

**The Windsor-Essex Parkway Project
Geotechnical Investigation and
Design Report –
Pedestrian Bridges**

July/2013

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1 Introduction

1.1 Preface

The Windsor Essex Parkway (the Parkway), was conceived to strengthen transportation and trade links between Canada and the United States, reduce road congestion, and foster economic growth. The Parkway will connect Highway 401 to a new Canadian inspection plaza and a new international crossing over the Detroit River to Interstate 75 in Michigan, USA. It will be a six-lane highway, 11 kilometres long with 15 bridges, 11 tunnels and a four-lane service road that will provide full access to schools, neighbourhoods, natural areas, and shopping. Other components of the project include community and environmental features, such as: 300+ acres of green space, 20 kilometres of recreational trails, extensive landscaping throughout the corridor, as well as noise and environmental mitigation measures. The environmental mitigation measures were based upon Permit AY-D-001-09 which was approved in February 2010.

The Parkway's strategic international importance, urban location, and unique ecological context necessitate strong design and planning principles to guide infrastructure development. The Parkway is to be a state-of-the-art facility within a contextually sensitive landscape setting that has ecological integrity, builds physical and cultural connections, and establishes a sustainable network of amenities that can be enjoyed by present and future generations.

The plans for the Parkway strive to build and strengthen linkages within and between both human and ecological communities. Over time, restored green space will evolve into a tall grass prairie and oak savannah landscape that will, through ecological succession, allow the roadway to become a 'Parkway in a Prairie'. All of the green space areas of the Parkway, (whether associated with the Roadway, the Stormwater Management Areas, the Ecological Landscape areas, or the Screening), are ecologically based areas that in their totality will represent an extensive habitat network consisting of existing, new and rehabilitated terrestrial and aquatic communities.

Natural and cultural history are proposed to be celebrated in the artful design of three Gateways and eleven Land Bridges that support the existing municipal road system and the inter-connected multi-use pathway system. The Gateways are conceived as bold and commanding landscapes that draw on sculpted landform, strong patterning, and public art to create strong visual elements for the driving experience within themes of 'Arrival, Settlement, and Flow'.

The Land Bridges draw on natural and cultural influences to create distinct and memorable places that serve as markers, urban respite areas, and focal points to the overall green space system. Other opportunities for artistic expression include the streetscapes and urban amenity areas, trail bridges; tunnel abutments, and noise walls. These structural elements offer opportunities for simple expression of the surrounding natural environment, area history and the 'prairie' landscape in particular, through color, form, materials, and the integration of public art.

The lasting legacy of the Parkway project will not only be its significant contribution as an international trade and transportation route, but rather include the establishment of a contiguous and sustainable green space system that contributes to the quality of life in the community and supports the re-establishment of an ecologically rich Carolinian landscape.

On December 17, 2010 Infrastructure Ontario and Ministry of Transportation of Ontario (MTO) announced that the Windsor Essex Mobility Group (WEMG) reached financial close and signed a fixed-price contract with the Province to design, build, finance, and maintain the Windsor-Essex Parkway. To build the initial works, WEMG has formed a Design-Build Joint Venture – Parkway Infrastructure Constructors (PIC). This team includes Dragados Canada, Inc., Acciona Infrastructure Canada Inc., and Fluor Canada Ltd. This combination brings a wide range of local and international experience to the project.

1.2 Report Introduction

This report presents the geotechnical investigation and design for Pedestrian Bridges TB-1, TB-2, TB-4, TB-5, TB-7, TB-7A and TB-8 at various locations in the Windsor and LaSalle sectors of the proposed Parkway project. Pedestrian Bridges / Tunnels TB-6, TB-8B and TB-9 were each addressed in separate reports and are not included here. Pedestrian Bridge TB-3 was deleted from the project prior to tender.

The 11.2 km long proposed Parkway will run generally east-west and connect the existing Highway 401 in Tecumseh to the proposed new international crossing bridge across Detroit River (near Zug Island). It will run sequentially along segments of Highway 3 and Huron Church Road and then adjacent to the E.C. Row Expressway to its intersection with Ojibway Parkway. It will be constructed mostly within a cut section until the intersection of Huron Church Road and E.C. Row Expressway, beyond which it will be mostly on embankments. The proposed Parkway includes 15 bridges (Bridges B-1 to B-15), 11 tunnels (T-1 to T-11), 9 trail bridges, approximately 5.5 km length of retaining walls, 2 submerged culverts, 5 box culverts, and other structures.

The trail bridges addressed by this report include the following structures:

- TB-1(Drawing 285380-03-060-WIP2-6101): The proposed one-span concrete deck structure of the bridge will pass over Bethlehem Avenue and will be used for pedestrian traffic along Bethlehem Trail.
- TB-2 (Drawing 285380-03-060-WIP2-6201): The proposed one-span concrete deck structure of the bridge will pass over Grand Marais Road/Lambton Road and will be used for pedestrian traffic along Grand Marais/Lambton Road Trail.
- TB-4 (Drawing 285380-03-060-WIP1-6401): The proposed one-span concrete deck structure of the bridge will pass over Cabana Road/Todd Lane and will be used for pedestrian traffic along Cabana Road/Todd Lane Trail.
- TB-5 (Drawing 285380-03-060-WIP1-6501): The proposed one-span concrete deck structure of the bridge will pass over Huron Church Line and will be used for pedestrian traffic along Trail 25.

- TB-7 (Drawing 285380-03-060-WIP1-6701): The proposed three-span concrete deck structure of the bridge will pass over Cousineau Road and will be used for pedestrian traffic along Cousineau Road Trail.
- TB-7A (Drawing 285380-03-060-WIP1-6751): The proposed one-span concrete deck structure of the bridge will pass over Wolfe Drain and will be used for pedestrian traffic along Wolfe Drain Trail.
- TB-8 (Drawing 285380-03-060-WIP1-6801): The proposed single-span concrete deck structure of the pedestrian bridge will pass over Hwy 3 and Cahill and Wolfe Drain.

The geotechnical design has been developed through interactive collaboration of the geotechnical, structural, and other design disciplines as well as the Parkway Infrastructure Constructors (PIC).

The report is organized in two parts. Part 1 is the factual information and is presented in Sections 1 to 4. Part 2 presents the geotechnical design and recommendations in Sections 5 and 6. Other information is presented in Sections 7 to 9.

The design complies with the requirements of the execution version of the Project Agreement (PA), Schedule 15-2 Part 2 Article 5.

2 Background Information

2.1 Geological Setting

The Parkway project site is located within the Essex Clay Plain (a part of the St. Clair Clay Plain physiographic region) (ref. R-12, R-13 and R-17). The Essex Clay Plain was deposited during the retreat of the late Pleistocene Era ice sheets, when a series of glacial lakes inundated the area. The ice sheets generally deposited materials with a glacial till like gradation in the Windsor area. Depending on the locations of the glacial ice sheets and depths of water in the ice-contact glacial lakes, the materials may have been directly deposited at the contact between the ice sheet and bedrock or, as the lake levels rose and the ice sheets retreated and floated, the soil and rock debris within and at the base of ice may have been deposited through the lake water (i.e., lacustrine environment). It is considered that unlike typical till deposits (that have undergone consolidation and densification under the weight of the ice sheet), the majority of the “glacial till” soils in the Windsor and Detroit area were deposited through water and have a soft to firm consistency below a surficial crust layer that has become stiff to hard due to weathering and desiccation. Geologically, the deposit in the project area is considered to be slightly over-consolidated, having experienced no major overburden stresses in excess of the existing stresses.

The overburden in the St. Clair Clay Plain has variously been described as clayey silt till, silty clay till and glaciolacustrine clay. P.P. Hudec (ref. R-17) summarized the overburden geology in Windsor as consisting of the following successive strata: desiccated lacustrine clay, normally consolidated lacustrine clay, silty Tavistock till, glaciolacustrine clay and coarse Catfish Creek till. A distinct change in overburden deposits occurs in the east-west direction along a boundary located generally along the Huron-Church Road. Whereas, the eastern part of Windsor is underlain by firm to stiff glaciolacustrine silts and clays with upper deposits of stiff sandy to silty weathered clay and hard to stiff lacustrine clay-silt crust, the western part of Windsor is characterized by a thin surficial granular deposit underlain by thin crust layer underlain by soft to firm glaciolacustrine silts and clays.

At the Parkway project area, the glacial till like deposit is typically 20 to 35 m thick and consists primarily of silty clay and clayey silt gradation with a random distribution of coarser particles. Random and apparently discontinuous seams / lenses of silt, sand and or gravel are present at various depths within the mass of the silty clay deposit. A firm to hard surficial crust layer has formed due to weathering and desiccation. Up to 2 m thick surficial layers of lacustrine silty clay or silt and sand are also encountered in the western sector of the project. A 1 m to 6 m thick very dense or hard basal glacial till or dense silty sand may be found directly overlying the bedrock surface. The bedrock at the project area comprises the Devonian Dundee Formation of the Hamilton Group and the underlying Devonian Lucas Formation of the Detroit River Group.

The Windsor area, referred to as the Essex Domain (with respect to bedrock geology), is located in the Grenville Front Tectonic Zone (GFTZ). The bedrock geology within the Essex Domain was formed as part of the midcontinent rift south-eastern extension. The midcontinent rift south-eastern extension is composed of Paleozoic cover rocks which form the bedrock foundation of the Essex Domain. The bedrock was deposited in the Paleozoic Era during the Middle Devonian period. Within the Essex Domain the following strata were deposited: the Hamilton Group; Dundee Formation; and Detroit River Group Onondaga Formation, all consisting of Limestone, Dolostone, and Shale.

2.2 Site Seismic Background

Windsor-Tecumseh area is described in CHBDC by a seismic hazard associated to a Velocity Zone $Z_v = 0$ and Acceleration seismic zone $Z_a = 0$. Zonal Velocity ratio, V , and Zonal Acceleration ratio, A , are both 0.

In accordance with the Canadian Highway Bridge Design Code (CHBDC) and based on a series of cross-hole tests (ref. R-14), the soil profile at the site of the project in general meets the description for Soil Profile Type III (soft to medium stiff clay and sands greater than 9 m in depth). The above noted cross-hole tests were carried out during the background investigation program at locations distributed along the project alignment between Howard Road (east end) and Matchette Road (west end). The measured velocities of the shear waves were consistently over 200 m/s, with the bulk of results ranging between 200 and 300 m/s.

2.3 Site Conditions

2.3.1 TB-1

Pedestrian Bridge TB-1 site is situated in the Windsor segment of the Parkway, just south-west of Tunnel T-2. The structures at this site are located within Phase 2 of Parkway. As shown on the Drawing 285380-03-060-WIP2-6101, the bridge is 40 m in length and the approach embankments are a maximum of 5 m in height above the surrounding grade, with 2:1 side slopes. The wing walls of the bridge will be constructed using reinforced soil structures (RSS).

The topography of the lands immediately adjacent to Pedestrian Bridge TB-1 is essentially flat with ground surface elevations from about elevation 181 to 182¹ m. Adjacent land use is typically urban residential, parkland and light commercial.

2.3.2 TB-2

Pedestrian Bridge TB-2 site is situated in the Windsor sector of the Parkway, just south of Tunnel T-3. The structures at this site are located within Phase II of Parkway. As shown on the Drawing 285380-03-060-WIP2-6201, the bridge is 40 m in length and the approach embankments are a maximum of 5 m in height above the surrounding grade, with 2:1 side slopes. The wing walls of the bridge will be constructed using RSS.

The topography of the lands immediately adjacent to Pedestrian Bridge TB-2 is essentially flat with ground surface elevations from about elevation 181.8 to 182.6 m. Adjacent land use is typically urban residential, parkland and light commercial.

2.3.3 TB-4

Pedestrian Bridge TB-4 site is situated near the north extent of the LaSalle sector of the Parkway, just north of Tunnel T-6. The structures at this site are located within Phase I of Parkway. As shown on the Drawing 285380-03-060-WIP1-6401, the bridge is 40 m in length and the approach embankments are a

¹ Elevations are in metres and are referred to geodetic datum.

maximum of 5 m in height above the surrounding grade, with 3:1 side slopes. The wing walls of the tunnel will be constructed using RSS.

The topography of the lands immediately adjacent to Pedestrian Bridge TB-4 is essentially flat with ground surface elevations from about elevation 180.5 to 181.6 m. Adjacent land use is typically urban residential, parkland and light commercial.

2.3.4 TB-5

Pedestrian Bridge TB-5 site is situated near the north extent of the LaSalle sector of the Parkway, just south of Tunnel T-7. The structures at this site are located within Phase I of Parkway. As shown on the Drawing 285380-03-060-WIP1-6501, the bridge is 40 m in length and the approach embankments are a maximum of 6.5 m in height above the surrounding grade, with 2:1 side slopes. The wing walls of the tunnel will be constructed using RSS.

The topography of the lands immediately adjacent to Pedestrian Bridge TB-5 is essentially flat with ground surface elevations from about elevation 180.6 to 181.7 m. Adjacent land use is typically urban residential and light commercial.

2.3.5 TB-7

Pedestrian Bridge TB-7 site is situated in the centre of the LaSalle sector of the Parkway, north of Tunnel T-9. The structures at this site are located within Phase I of Parkway. As shown on the Drawing 285380-03-060-WIP1-6701, the bridge is 60 m in length and the approach embankments are a maximum of 7 m in height above the surrounding grade, with 2:1 side slopes. The wing walls of the tunnel will be constructed using RSS.

The topography of the lands immediately adjacent to Pedestrian Bridge TB-7 is essentially flat with ground surface elevations from about elevation 183.4 to 184.9 m. Adjacent land use is typically urban residential, parkland and light commercial. The Wolfe Drain and Culvert CV-3 are located south of Trail Bridge TB-7.

2.3.6 TB-7A

Pedestrian Bridge TB-7A site is situated in the centre of the LaSalle sector of the Parkway, just north of Tunnel T-10A. The structures at this site are located within Phase I of Parkway. As shown on the Drawing 285380-03-060-WIP1-6751, the bridge is 20 m in length and the approach embankments will roughly match the existing grades.

The topography of the lands immediately adjacent to Pedestrian Bridge TB-7A is essentially flat with ground surface elevations from about elevation 184.2 to 185.4 m. Adjacent land use is typically urban residential, parkland and light commercial.

2.3.7 TB-8

Pedestrian Bridge TB-8 site is situated near the border of LaSalle and Tecumseh segments of the Parkway (i.e., the east segment of the Parkway). The structures at this site are located within Phase I of Parkway and will be used to carry pedestrian traffic over Hwy 3 and Cahill and Wolfe Drain. As shown on the

Drawing 285380-03-060-WIP1-6801, the bridge is 60 m in length. The approach embankments are a maximum of 6 m in height above the surrounding grade, with 2:1 and 5:1 side slopes. The method of construction of the wing walls is not known at this time.

The topography of the lands immediately adjacent to Pedestrian Bridge TB-8 is essentially flat with ground surface elevations from about elevation 185.7 to 186.2 m. Adjacent land use is typically urban residential, parkland and light commercial. Tunnel T-11 is located immediately west of the proposed west abutment of Trail Bridge TB-8.

2.4 Frost depth

In accordance with MTO–SDO-90-01 Pavement Design and Rehabilitation Manual (ref. R-23) and OPSD 3090.101, the frost depth below the ground surface in Windsor area is estimated to 1.0 m. This estimate is considered applicable for natural soils and/or conventional pavement materials where the ground surface is usually cleaned from the snow cover.

In the case of rip/rap, or otherwise coarse rockfill cover, the insulation effects of such materials are considered to be one half of the insulation offered by soil deposits /cover, and the depth of frost penetration will have to be increased proportionally.

3 Geotechnical Investigation

3.1 Scope and Procedures of Geotechnical Investigations

Geotechnical investigations involving boreholes, cone penetration tests (CPT), and Nilcon vane tests had been carried out between 2006 and 2009 by Golder Associates (ref. R-9 to R-16) as part of background information for development of the Parkway proposal designs. Additional geotechnical investigation was carried out to supplement the previously obtained (pre-bid) subsurface soil data, as required to support the detailed design development of the Parkway embankment and structures. Boreholes were advanced near the footprint area of each proposed bridge. The objective of these boreholes was to examine the site specific subsurface conditions and confirm the background information from the nearby tests and investigations. Furthermore, additional boreholes, CPT and Flat Blade Dilatometer (DMT) were carried out for the nearby bridge and tunnel structures and highway design components (slopes, retaining structures). Table 3.1 lists the test holes located at or in close proximity to the bridge sites during both the previous and the current geotechnical investigations.

Table 3-1: Test Holes at and around Pedestrian Bridge Sites

Bridge	Reference	Boreholes	Nilcon Vane Tests	CPT's	DMT's
TB-1	This Investigation (2011)	TB1-1	NIL T2-1	CPT T2-1	DMT T2-1
		TB1-2		CPT T2-2	
		T2-1		CPT19-RW	
		T2-2			
	Previous Studies (2007-09)	BH-144	BH/NIL-145	BH/CPT-144	
		BH-145		BH/CPT-145	
		BH-145A		BH/CPT-335	
		BH-334			
TB-2	This Investigation (2011)	TB2-1	NIL T3-1	CPT T3-1	DMT T3-1
		TB2-2	NIL T3-2	CPT23-RW	DMT04-RW
		T3-1		CPT24-RW	
				CPT25-RW	
	Previous Studies (2007-09)	BH-139/139A		BH/CPT-333	
		BH-140/140A			
TB-4	This Investigation (2011)	TB4-1	NIL T6-2	CPT35-RW	DMT T6-1
		TB4-2	NIL T6-3	CPT36-RW	
		T6-1	NIL12-RW	CPT37-RW	
		T6-2			
		T6-3			
		BH12-RW			
	Previous Studies (2007-09)	BH-129/129A	NIL BH-129	CPT-11	
		BH-323		BH/CPT-130	
TB-5	This Investigation (2011)	BH-325		BH/CPT-324	
		TB5-1		CPT T7-1	DMT T7-1
		TB5-2		CPT T7-2	
		TB5-3			
		TB5-4			
		T7-1			
		T7-2			
		T7-3			

Bridge	Reference	Boreholes	Nilcon Vane Tests	CPT's	DMT's
TB-7	Previous Studies (2007-09)	BH-122/122A		BH/CPT-124	
		BH-126		BH/CPT-322	
		BH-127			
	This Investigation (2011)	TB7-1	NIL T9-1	CPT45-RW	DMT T9-1
		TB7-2		CPT46-RW	
		TB7-3			
		TB7-4			
		T9-1			
		CV3-1			
		BH15-RW			
	Previous Studies (2007-09)	BH-115/115A		BH/CPT-114	
		BH-116			
TB-7A	This Investigation (2011)	TB7A-1		CPT T10-1	DMT T10-1
		T10-1		CPT T10-2	
		T10-2		CPT47-RW	
	Previous Studies (2007-09)	BH-112/112A	BH/NIL-112	CPT-5	
		BH-113/113A		BH/CPT-114	
TB-8	This Investigation (2011)	TB8-1	NIL T11-1		DMT T11-1
		TB8-2	NIL T11-2		
		TB8-3			
		T11-1			
		T11-2			
		T11-3			
	Previous Studies (2007-09)	BH-107/107A		CPT-3	
		BH-304		BH/CPT-106	
		BH-305		BH/CPT-303	
				BH/CPT-306	

The locations of boreholes, Nilcon tests, CPTs and DMTs executed during the pre-bid and additional investigations, and the inferred soil profile in the general area of each pedestrian bridge are shown on the drawings listed below.

- TB-1: Drawings 285380-04-090-WIP2-6102 and 285380-04-091-WIP2-6103
- TB-2: Drawings 285380-04-090-WIP2-6202 and 285380-04-091-WIP2-6203
- TB-4: Drawings 285380-04-090-WIP2-6402 and 285380-04-091-WIP2-6403
- TB-5: Drawings 285380-04-090-WIP2-6502 and 285380-04-091-WIP2-6503
- TB-7: Drawings 285380-04-090-WIP2-6702 and 285380-04-091-WIP2-6703
- TB-7A: Drawings 285380-04-090-WIP2-6752 and 285380-04-091-WIP2-6753
- TB-8: Drawings 285380-04-090-WIP2-6802 and 285380-04-091-WIP2-6803

Borehole, CPT, DMT and Nilcon logs from the additional investigation are included in Appendix A. Relevant borehole logs from the previous investigation are included in Appendix B.

3.2 Additional Investigation at the Bridge Sites

This section presents the exploration procedure and the results of the investigation. The interpreted soil and groundwater data from all the boreholes within the vicinity have been considered in the design of the pedestrian bridges.

3.2.1 Fieldwork at Bridge Sites

Boreholes at pedestrian bridge TB-1 were drilled on June 11, 2011 for this study. Boreholes at the other pedestrian bridges were drilled between July 5 and July 15, 2011. The boreholes were advanced using a track-mounted CME 55 auger rig owned and operated by Marathon Drilling Co. Ltd. under contract to AMICO and under full-time technical direction by AMEC engineers and technicians. The boreholes were advanced to a maximum depth of 10.1 m below grade using 200 mm diameter hollow stem augers.

Soil sampling was advanced using a 50 mm diameter split spoon sampler. Soil sampling was performed at 0.75 m to 1.5 m depth intervals to the depths explored. All samples were field identified, placed in airtight containers and transported to AMEC's Tecumseh (Windsor) laboratories for further examination and testing. Standard Penetration Tests (SPT, ASTM D1586) were carried out in conjunction with split spoon sampling. Field vane tests (using conventional vanes) were conducted at approximately 7 m below ground surface and at the termination of the boreholes. The boreholes were decommissioned using a bentonite-cement grout following completion of sampling and testing.

3.2.2 Laboratory and Analytical Testing

All recovered soil samples were examined in the field and the AMEC geotechnical laboratory. Natural moisture content measurements were performed on all of the recovered samples. The results are presented on the borehole logs (Appendix A).

Analytical testing consisting of pH, redox potential, resistivity, sulphide and sulphate contents were carried out on one sample collected from each borehole. The results from these chemical tests are presented in Appendix C and are summarized in Table 6-1.

3.2.3 Data Interpretation – General Discussion

Field Vane Test Data Correction: The chart shown in Figure 3.1,² initially developed by Bjerrum (1972) and updated subsequently by Ladd et al (1977) based on circular arc failure analyses of embankment failures, suggests correction by multiplying the field vane data by 1.05 to 1.10 for soils with plasticity index (PI) of about 15 (ref. R-3 and R-22 to R-24). However, based on re-evaluation of the Bjerrum chart by Aas et al. (1986), the Canadian Foundations Manual suggests that the vane test data for clays with $PI < 20$ should not be corrected (ref. R-1 and R-4). The field vane test data (from conventional and Nilcon vane tests) at this site were not corrected for PI.

Strength Profiles from Cone Penetration Tests: The undrained shear strength of the silty clay deposit was estimated using the CPT tip resistance, Q_t , as follows:

² All figures are included at the end of the report text.

$$S_{u\ CPT} = \frac{Q_t - \sigma_{vo}}{N_{kt}}$$

Where:

- $S_{u\ CPT}$ is the undrained shear strength estimated from the CPT test;
- Q_t is the corrected total cone tip resistance;
- σ_{vo} is the total vertical stress at the corresponding depth of measurement of the Q_t value; and
- N_{kt} is an empirical factor that varies, depending on soil type and test arrangement, typically between 8 and 20.

The CPT based S_u profiles were developed to achieve a general agreement with the nearby Nilcon vane test profiles by modifying the N_{kt} factor values used to calibrate the CPT strength profiles. The N_{kt} factor values varied for different segments of the Parkway and the soil strata. Thus, an N_{kt} factor of 14 was used to estimate the undrained shear strength of the clay crust and transition layers. The N_{kt} factors used for the underlying grey silty clay to clayey silt stratum and the lower clayey silt stratum were 15 and 12, respectively. Figures 3.3a through 3.3g present the undrained shear strength profiles for the trail bridge areas.

Pre-Consolidation Pressures from Cone Penetration Tests: The approach used for estimating the pre-consolidation pressures from the estimated S_u profiles follows the Stress History and Normalized Soil Engineering Properties (SHANSEP) method developed at MIT (Ladd and Foott, 1974). The following relationship was used to compute the pre-consolidation pressures:

$$OCR = \frac{\sigma'_p}{\sigma'_{vo}} = \left[\frac{S_u / \sigma'_{vo}}{S} \right]^{1/m}$$

Where:

- S_u is the undrained shear strength,
- σ'_{vo} is the vertical effective stress,
- σ'_p is the preconsolidation pressure (also referred as maximum past pressure),
- S is the normalized strength ratio, S_u / σ'_{vo} , of normally consolidated soil,
- OCR is the overconsolidation ratio, and
- m is an empirically determined exponent, typically varying between 0.7 and 1.0.

Based on plasticity index of the clayey silt to silty clay deposit, values of $S = 0.18$ and $m = 0.95$ were chosen to estimate the maximum past pressures from the inferred undrained shear strength profile. The maximum past pressure, σ'_p can then be estimated as:

$$\sigma'_p = \sigma'_{vo} \times \left[\frac{\frac{S_{u\ CPT}}{\sigma'_{vo}}}{0.18} \right]^{1.05}$$

Flat Blade Dilatometer (DMT) Test Data:

DMT tests along Parkway were conducted following ASTM D6635-01 (2007). The soil properties from the results of these tests were developed in general accordance with the guidelines in ref. R-16. The undrained shear strength values for the clay deposits were estimated using the relationship $S_u = 0.18 \sigma'_{vo} (0.5 K_d)^{1.25}$. K_d is the horizontal stress index obtained from DMT reading represented by:

$$K_d = (p_0 - u_0) / \sigma'_{vo}$$

Where:

p_0 is the corrected instrument lateral pressure reading at zero membrane deformation ('null method')

u_0 is the pore water pressure in the soil prior to the blade insertion

The undrained shear strength (S_u), pre-consolidation pressure (σ'_p), natural water content (w_N) and compression index (C_c) profiles based on field and laboratory testing from boreholes, CPTs and DMT carried out in the vicinity of each pedestrian bridge are presented on Figures 3.3a through 3.3g. Also included on the figures are $0.18\sigma'_{vo}$ curve (representing OCR=1) and simplified soil stratigraphic deposits to facilitate correlation of soil properties to the individual soil units. The constant 0.18 for S_u/σ'_{vo} for OCR=1 curve is based on average plasticity of the silty clay to clayey silt stratum and published relationships (refs. R-6 and R-20).

4 Subsurface Conditions

The subsurface conditions described below are based on data gathered in the historic investigations and the current investigation.

The general soil stratigraphy at all sites consists of the following successive strata: topsoil and/or fills over a relatively shallow (in general less than 5 m deep) and discontinuous upper granular deposit below an extensive (typically over 25 m thick) clayey silt to silty clay. A second discontinuous lower granular deposit (0 up to 5 m thick) below the clayey silt deposit overlies limestone and dolostone bedrock below about elevation 149 m. The bedrock was encountered at depths approximately 32 to 35 m below the ground surface.

At all sites, the design soil properties for the main clayey silt deposit have been determined on the bases of field and laboratory tests as follows.

The stress-strain properties and the effective shear strength properties of the silty clay to clayey silt soils were based on published correlations (ref. R-19, ref. R-21 and ref. R-22), the tests reported in Golder's Subsurface Condition Interpretation Report (ref. R-12) and the tests performed during the additional geotechnical investigation carried out as part of the detailed design development for the entire Parkway length.

The compressibility indexes are correlated to natural water content (w_N , expressed as percent) as illustrated in Figures 4.1 and 4.2 and summarized as follows:

$$C_c = 0.0086w_N - 0.0086$$

$$C_r = 0.11C_c$$

The effective shear strength properties applicable to the silty clay to clayey silt stratum were determined from triaxial and direct shear tests performed during the pre-bid and additional geotechnical investigations and supported by published PI versus ϕ' relationships (ref. R-19 and R-22, Figure 4.3 and Figure 4.4).

The modulus of elasticity has been correlated with the average undrained shear strength of the material, published information (ref R-22), and local experience (ref R-12). Empirical relationships were used based on average shear strength profiles for the material, as follows:

$$\text{Undrained Elastic Modulus } E_u = 300 S_u$$

$$\text{Drained Elastic Modulus } E' = 0.9E_u$$

4.1 TB-1

The general soil stratigraphy at the site consists of the following successive strata: topsoil and/or fills over upper granular deposit below the existing ground surface at about elevation 181 to 182, an extensive clayey silt to silty clay deposit below about elevation 180 to 181, and possibly a discontinuous lower granular deposit below about elevation 156.1 to 154.1, overlying limestone and dolostone bedrock below about elevation 149 m. The thickness of the clayey silt to sandy/silty clay deposit based on the available

nearby boreholes is about 24 to 31 m. The bedrock was encountered at depths approximately 32 to 33 m below the ground surface.

4.1.1 Topsoil, and Surficial Fills and Upper Granular Soils

A layer of topsoil was encountered at the ground surface in Boreholes CPT 19-RW and BH-335. The thickness of the topsoil was about 0.1 to 0.8 m at these locations.

Fill layers were encountered in all boreholes except Boreholes CPT 19-RW and BH-335. The fills were variable and consisted of silty clay to sand to silty sand and gravel. The fill thickness was about 0.6 to 1.5 m at the borehole locations. Portland cement concrete was observed at the ground surface in Borehole TB1-2. The concrete was about 0.1 m thick.

All of the boreholes except Boreholes TB1-1, TB1-2 and BH-144 encountered upper granular deposits below the soils described above. The upper granular deposits consisted of sandy silt, silty sand and sand. The thickness of the upper granular deposits was about 0.3 to 1.3 m at these locations.

4.1.2 Silty Clay to Clayey Silt Stratum

An extensive cohesive silty clay to clayey silt stratum was encountered directly underlying the topsoil, upper granular and/or fill deposit. The encountered depth below existing ground surface varied from 0.8 to 1.7 m corresponding to elevation 180.0 to 181.1 m. Based on the gradation, in-situ moisture content and strength characteristics, the stratum may be subdivided into four layers as follows: brown desiccated stiff to hard clay crust, transition zone, upper grey silty clay to clayey silt deposit (referred to hereafter as silty clay), and then a generally coarser lower grey clayey silt deposit (referred to as clayey silt). The natural water content, Atterberg limits, and total unit weights of the clay sub-strata are summarized in Table 4-1-1 and illustrated in Figure 3.3a.

Table 4-1-1: TB-1 Summary of Index Properties

Property ¹	Clay Crust	Transition	Upper Silty Clay	Lower Clayey Silt
Elevation Range (m)	182 ² to 177	177 to 175	175 to 160	160 to 151 ²
Natural Water Content, w_N , %	14.2 to 22.8	11.8 to 16.9	16.6 to 42.4	10.3 to 36.5
Liquid Limit, w_L , %	29 to 33	37	25.5 to 28	27
Plastic Limit, w_P , %	15 to 17	18	13.1 to 16	16
Plasticity Index, PI	12 to 18	19	12 to 14	11
Liquidity Index, LI	0 to 0.6	0	0.0 to 0.41	0
Unit Weight, γ , kN/m ³	21.4 to 25.9	21.0 to 26.3	19 to 23.5	21.3 to 22.5

1 – Index Properties are based on laboratory results from Boreholes: TB1-1, TB1-2, T2-1, T2-2, BH-144, BH-145, BH-334, and BH-335.

2 – Ground surface elevation and base of the lower silty clay varies at test locations.

As illustrated on Figure 3.3a, the measured undrained shear strength of the silty clay stratum varied with depth generally as follows:

- Crust layer: $> 100 \pm 20$ kPa
- Transition layer: ± 75 kPa to 70 ± 10 kPa

- Upper silty clay: 70±10 kPa to 50±10 kPa & then to 60±10 kPa
- Lower clayey silt: 75±15 kPa

The interpreted representative values used for the silty clay/ clayey silt substrata for the Pedestrian Bridge TB-1 site are summarized as follows:

Table 4-1-2: TB-1 Summary of Compressibility Properties

Property	Clay Crust	Transition	Grey Silty Clay ("Upper Clay")	Clayey Silt ("Lower Silt")
Average Natural Water Content, w_N , %	16	16	24	20
Virgin Compression Index, C_c	0.13	0.13	0.20	0.16
Recompression Index, C_r	0.014	0.014	0.022	0.018
Swelling Index, C_s	0.032	0.031	0.049	0.041
Secondary Compression Index, C_α	0.0036	0.0035	0.0055	0.0046

Table 4-1-3: TB-1 Summary of Interpreted Elastic Moduli Properties

Soils Stratigraphy	Elastic Modulus (Undrained), MPa	Poisson's Ratio (Undrained) *	Elastic Modulus (Drained), MPa	Poisson's Ratio (Drained)*
Clay Crust	35	0.49	31.5	0.35
Transition	21	0.49	18.9	0.35
Upper Silty Clay	13.5 to 15.8	0.49	12.2 to 14.2	0.35
Lower Clayey Silt	22.5	0.49	20.3	0.35

*-Assumed values (ref. R-22)

4.1.3 Lower Granular Deposit

Underlying the silty clay to clayey silt stratum and overlying the bedrock, a discontinuous deposit varying from clayey silt with extensive sand seams to silty sand was encountered. Based on SPT N-values ranging generally from 10 to greater than 100, this material is considered to be in a compact to very dense state. This layer was approximately 1 to 3 m thick where encountered within the site area.

4.1.4 Bedrock

Boreholes TB1-1, TB1-2, CPT 19-RW, CPT-144 and BH-335 were terminated within the overburden deposits. Boreholes T2-1, T2-2, BH-145 and BH-334 encountered bedrock beneath the lower granular deposit or below the silty clay to clayey silt stratum at about elevation 148.6 to 149.5. The bedrock was light grey, fairly porous, and fine grained limestone bedrock. The Rock Quality Designation (RQD) of the recovered rock cores ranged from 23 to 97 percent, indicating a very poor to excellent quality.

4.1.5 Groundwater Conditions

The shallower boreholes TB1-1 and TB1-2 were dry during the relatively short period of time until backfilling. This is consistent with the general low permeability overburden soils at this site.

Shallow and deep vibrating wire and standpipe piezometers were installed in selected boreholes to measure the water levels within overburden and bedrock, respectively (Table 4-1-4).

The piezometric levels measured in the clayey silt overburden and the limestone bedrock varied from 179.7 to 180.9 and around 177.3 and 180.9, respectively. The highest piezometric levels within the overburden and the bedrock were recorded at elevation 180.9 (Table 4-1-4). These observations suggest the piezometric levels between the overburden and the bedrock are essentially equal. Furthermore, the highest recorded piezometric levels are within 1 m of the ground surface; therefore occurrence of artesian condition in deeper excavations may be possible from the bedrock aquifer.

Table 4-1-4: TB-1 Summary of Measured Water Levels

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
T2-2	181.4	VWP	171.0	Silty Clay	2011-05-02	180.4
					2011-05-16	180.5
					2011-05-24	180.1
					2011-06-08	180.4
					2011-06-25	180.3
					2011-07-09	180.3
					2011-07-23	180.2
					2011-08-06	180.2
					2011-08-18	180.2
		VWP	161.8	Silty Clay	2011-05-02	179.9
					2011-05-16	180.0
					2011-05-24	179.7
					2011-06-08	179.9
					2011-06-25	179.8
					2011-07-09	179.8
					2011-07-23	179.7
					2011-08-06	179.7
					2011-08-18	179.7
		S-Piez	145.8	Limestone	2011-05-19	180.4
					2011-05-24	180.5
					2011-06-04	180.5
					2011-06-25	180.3
					2011-07-09	180.5
					2011-07-23	180.3
					2011-08-06	180.5
					2011-08-18	180.8
					2011-10-13	180.8
BH-145	182.3	S-Piez	146.7	Limestone	2008-07-31	179.1
					2008-08-11	179.2
					2008-09-19	180.3
					2008-11-11	177.3
					2009-01-28	178.2
					2011-07-09	180.9
					2011-07-23	180.9
BH-145A	182.3	S-Piez	173.1	Silty Clay	2008-09-19	180.2
					2008-09-22	180.3
					2009-01-28	180.6
					2011-07-09	180.2
					2011-07-23	180.2
BH-334	181.8	S-Piez	143.6	Limestone	2010-02-24	180.9
					2010-01-06	180.9

Legend: S-Piez Standpipe Piezometer
VWP Vibrating Wire Piezometer

Perched groundwater is known to accumulate seasonally within the upper deposits of fill, topsoil and granular layers, and within the fissures in the silty clay crust. In periods of wet weather, the perched groundwater levels can rise to near the ground surface.

4.2 TB-2

The general soil stratigraphy at the site consists of the following successive strata: surficial layers of occasional fills, topsoil and upper granular deposit below the existing ground surface at about elevation 181.8 to 182.6, an extensive clayey silt to silty clay deposit below about elevation 180.5 to 179.2, and a possibly discontinuous lower granular deposit below about elevation 149.3 to 151.1, overlying limestone and dolostone bedrock below about elevation 146.6 to 148.9 m. The thickness of the clayey silt to sandy/silty clay deposit based on the available nearby boreholes is about 29.1 to 31.2 m. The bedrock was encountered at depths approximately 33.1 to 35.7 m below the ground surface.

4.2.1 Topsoil, Surficial Fills and Upper Granular Soils

A layer of topsoil was encountered at the ground surface in Boreholes TB2-1, NIL T3-2, CPT23-RW and BH11-RW and below the surficial fills in Boreholes CPT 25-RW, DMT04-RW and BH-139. The thickness of the topsoil was about 0.2 to 0.6 m at these locations. The thickness of the topsoil is expected to vary in quality and thickness through the project area.

Fill layers were encountered at the ground surface in Boreholes TB2-2, T3-1, CPT T3-1, CPT24-RW, CPT25-RW, BH10-RW, DMT04-RW, CPT-333, BH-139 and BH-140. The fills were variable and consisted of silty clay, topsoil, silty sand, sand and gravel, crushed lime stone, concrete and asphalt. The fill thickness was about 0.3 to 2.4 m at the borehole locations.

Upper granular deposits were encountered at the ground surface or below the topsoil / fill layer described above in all boreholes with the exception of DMT T3-1. The upper granular deposits consisted of silt, silty sand and sand. The thickness of the upper granular deposits was about 0.7 m to 2.6 m at these locations. CPT23-RW was terminated within the upper granular deposit.

4.2.2 Silty Clay to Clayey Silt Stratum

An extensive cohesive silty clay to clayey silt stratum, was encountered directly underlying the topsoil, upper granular and/or fill deposit. The encountered depth below existing ground surface varied from 1.7 to 3.0 m corresponding to elevation 180.5 to 179.2 m. Based on the gradation, in-situ moisture content and strength characteristics, the stratum may be subdivided into four layers as follows: brown desiccated stiff to hard clay crust, transition zone, upper grey silty clay to clayey silt deposit (referred to hereafter as silty clay), and then a generally coarser lower grey clayey silt deposit (referred to as clayey silt). The natural water content, Atterberg limits, and total unit weights of the clay sub-strata are summarized in Table 4-2-1 and illustrated in Figure 3.3b.

Table 4-2-1: TB-2 Summary of Index Properties

Property ¹	Clay Crust	Transition	Upper Silty Clay	Lower Clayey Silt
Elevation Range (m)	181 ² to 177	177 to 175	175 to 163	163 to 151 ²
Natural Water Content, w_N , %	12 to 28	12 to 25	13 to 28	12 to 33
Liquid Limit, w_L , %	20 to 42	31 to 34	29 to 36	27 to 50
Plastic Limit, w_P , %	18	16 to 17	16 to 18	15 to 23
Plasticity Index, PI	21	14 to 17	13 to 21	12 to 27
Liquidity Index, LI	(-)0.01	0.09 to 0.34	0.24 to 0.39	(-)0.09 to 0.62
Unit Weight, γ , kN/m ³	N/A	20.6 to 20.9	18.6 to 20.6	18.8 to 21.6

1 – Index Properties are based on laboratory results from Boreholes: TB2-1, TB2-2, T3-1, NIL T3-2, BH10-RW, BH11-RW, BH-139, BH-140, and DMT04-RW.

2 – Ground surface elevation and base of the lower silty clay varies at test locations.

As illustrated on Figure 3.3b, the undrained shear strength of the silty clay stratum varied with depth generally as follows:

- Crust layer: $> 100 \pm 25$ kPa
- Transition layer: 100 ± 25 kPa to 60 ± 15 kPa
- Upper silty clay: 60 ± 15 kPa to 50 ± 10 kPa
- Lower clayey silt: 75 ± 15

The interpreted representative values used for the silty clay/ clayey silt substrata for the Pedestrian Bridge TB-2 site are summarized as follows:

Table 4-2-2: TB-2 Summary of Compressibility Properties

Property	Clay Crust	Transition	Grey Silty Clay ("Upper Clay")	Clayey Silt ("Lower Silt")
Average Natural Water Content, w_N , %	20	23	20 - 25	17 - 23
Virgin Compression Index, C_c	0.163	0.189	0.163-0.206	0.138-0.189
Recompression Index, C_r	0.0180	0.0205	0.0179-0.0227	0.0151-0.0208
Swelling Index, C_s	0.0409	0.0472	0.0407-0.0515	0.0342 -0.0472
Secondary Compression Index, C_α	0.00458	0.00529	0.00456-0.00577	0.00384 - 0.00529

A direct shear test was carried out on silty clay to clayey silt sample obtained from Borehole T3-1 at a depth of 18.3 m below the ground surface and the results are shown in Appendix C.

Table 4-2-3: TB-2 Summary of Interpreted Elastic Moduli Properties

Soils Stratigraphy	Elastic Modulus (Undrained), MPa	Poisson's Ratio (Undrained) *	Elastic Modulus (Drained), MPa	Poisson's Ratio (Drained)*
Clay Crust	22.5	0.49	20.3	0.35
Transition	16.5 to 22.5	0.49	14.9 to 20.3	0.35
Upper Silty Clay	12.0 to 16.5	0.49	10.8 to 14.9	0.35
Lower Clayey Silt	14 to 22.5	0.49	12.6 to 20.3	0.35

*-Assumed values (ref. R-22)

4.2.3 Lower Granular Deposit

Underlying the silty clay to clayey silt stratum and overlying the bedrock, a heterogeneous non-cohesive material deposit (varying from silt to sandy silt and sand and gravel) was encountered. Based on SPT N-values ranging generally from 10 to 76, this material is considered to be in a compact to very dense state. This layer was approximately 0.8 to 4.0 m thick within the site area.

4.2.4 Bedrock

Boreholes TB2-1, TB2-2, CPT T3-1, DMT R3-1, NIL T3-2, BH10-RW, BH11-RW, CPT23-RW, CPT24-RW, CPT25-RW, DMT04-RW and CPT-333 were terminated within the overburden deposits. Boreholes T3-1, BH-139 and BH-140 encountered bedrock beneath the lower granular deposit or below the silty clay to clayey silt stratum at about elevation 148.9 to 146.6. Where rock coring was undertaken, a white to grey, limestone bedrock was encountered. The bedrock was generally fresh, medium strong, laminated to thinly laminated, fine grained, faintly to highly porous and highly fractured. The RQD of the recovered rock varied between 31 to 100 per cent indicating a poor to excellent quality. The RQD values generally increased with depth. Rock core samples from Borehole BH-139 were tested and had unconfined compressive strengths of 78.3 MPa. The results of the compressive strength testing indicate that the limestone rock may be described as “strong” rock.

4.2.5 Groundwater Conditions

Free likely perched groundwater was observed near El. 180.5 in the TB2-1 and TB2-2 boreholes at completion which appears consistent with the presence of more pervious upper granular soil extending down to about 3 m below grade.

Shallow and deep vibrating wire and standpipe piezometers were installed in selected boreholes to measure the water levels within overburden and bedrock, respectively (Table 4-2-4).

The piezometric levels measured in the clayey silt overburden and the limestone bedrock varied from 173.5 to 181.9 and around 177.1 to 178.6, respectively. The highest piezometric levels within the overburden and the bedrock were recorded at about elevations 181.9 and 178.6, respectively (Table 4-2-4). These observations suggest a slight downward gradient between the overburden and the bedrock. Nevertheless, given the general information along the project area, occurrence of artesian condition in bedrock cannot be entirely ruled out.

Table 4-2-4: TB-2 Summary of Measured Water Levels

Borehole	Ground Surface EL, m	Piezometer Type	Screen EL, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
T3-1	182.3	VWP	173.1	Silty Clay	2011-07-29 2011-08-06	180.9 181.2
		VWP	163.9	Silty Clay	2011-07-29 2011-08-06	174.2 173.5
		VWP	147.2	Limestone	2011-07-29 2011-08-06	177.1 177.1
		S-Piez.	150.5	Silty Clay	2011-10-19	181.9
BH-139	182.3	S-Piez	143.3	Limestone	2008-09-19	178.6
					2008-09-22	178.6
					2008-11-11	177.6
					2009-01-28	177.6
BH-139A	182.3	VWP	173.4	Silty Clay	2008-09-19	177.9
					2008-09-22	178.6
					2009-01-28	180.3
BH-140	182.0	S-Piez	150.8 to 149.5	Lower Granular	2008-09-19	179.5
					2008-09-22	179.5
					2008-11-11	178.2
					2009-01-28	178.6
BH-140A	182.0	VWP	172.9	Silty Clay	2008-09-19	178.0
					2008-09-22	178.1
					2009-01-28	180.3
TB2-1	182.1	OB	182.1 to 180.3	Sand over Clayey Silt	2011-07-6 ^(*)	180.3
TB2-2	182.6	OB	182.6 to 179.6	Upper Fill over Sand/Silt over Clayey Silt	2011-07-06 ^(*)	180.3
CPT24-RW	181.7	OB	181.7 to 179.6	Upper fill over Sand over Clayey Silt	2011-08-11 ^(*)	180.5

Legend: S-Piez Standpipe Piezometer
VWP Vibrating Wire Piezometer
OB Open Borehole
(*) Date of Borehole Completion

Perched groundwater is known to accumulate seasonally within the upper deposits of fill, topsoil and granular layers, and within the fissures in the silty clay crust. In periods of wet weather, the perched groundwater levels can rise to near the ground surface.

4.3 TB-4

The general soil stratigraphy at the site consists of the following successive strata: surficial layers of occasional fills, topsoil and upper granular deposit below the existing ground surface at about elevation 180.5 to 181.6, an extensive clayey silt to silty clay deposit below about elevation 180.7 to 177.9, and a possibly discontinuous lower granular deposit below about elevation 149.2 to 151.7, overlying limestone and dolostone bedrock below about elevation 147.2 to 148.5 m. The thickness of the clayey silt to

sandy/silty clay deposit based on the available nearby boreholes is about 28.3 to 30.4 m. The bedrock was encountered at depths approximately 32.3 to 34.7 m below the ground surface.

4.3.1 Topsoil, Surficial Fills and Upper Granular Soils

A layer of topsoil was encountered at the ground surface in Boreholes TB4-1, T6-2, NIL12-RW, CPT36-RW, CPT-324 and BH-325 and below the surficial fills in Boreholes TB4-2, DMT T6-1 and CPT37-RW. The thickness of the topsoil was about 0.1 to 1.4 m at these locations. The thickness of the topsoil is expected to vary in quality and thickness through the project area.

Fill layers were encountered at the ground surface in Boreholes TB4-2, T6-1, T6-3, DMT T6-1, BH12-RW, CPT35-RW, CPT37-RW, BH-129, BH-323 and CPT-130. The fills were variable and consisted of silty clay, topsoil, sand and gravel, crushed lime stone, concrete and asphalt. The fill thickness was about 0.2 to 3.0 m at the borehole locations.

Upper granular deposits were encountered below the topsoil / fill layer described above in Boreholes T6-3, NIL12-RW, CPT36-RW and BH-325. The upper granular deposits consisted of sand and silty sand. The thickness of the upper granular deposits ranged from about 0.1 m to 0.7 m at these locations.

4.3.2 Silty Clay to Clayey Silt Stratum

An extensive cohesive silty clay to clayey silt stratum, was encountered directly underlying the topsoil, upper granular and/or fill deposit. The encountered depth below existing ground surface varied from 0.2 to 3.0 m corresponding to elevation 180.6 to 177.9 m. Based on the gradation, in-situ moisture content and strength characteristics, the stratum may be subdivided into six layers as follows: brown desiccated stiff to hard clay crust, transition zone, upper and lower grey silty clay to clayey silt deposit (referred to hereafter as silty clay), and then a generally coarser upper and lower grey clayey silt deposit (referred to as clayey silt). The natural water content, Atterberg limits, and total unit weights of the clay sub-strata are summarized in Table 4-3-1 and illustrated in Figure 3.3c.

Table 4-3-1: TB-4 Summary of Index Properties

Property ¹	Clay Crust	Transition	Upper Silty Clay	Lower Clayey Silt	Upper Clayey Silt	Lower Clayey Silt
Elevation Range (m)	181 ² to 177	177 to 175	175 to 166	166 to 163	163 to 160	160 to 150 ²
Natural Water Content, w_N , %	10 to 33	11 to 28	15 to 38	15 to 30	15 to 20	13 to 35
Liquid Limit, w_L , %	32 to 39	31 to 35	27 to 40	25 to 35	23 to 27	28 to 41
Plastic Limit, w_P , %	19 to 20	16 to 18	15 to 17	12 to 19	14 to 15	13 to 21
Plasticity Index, PI	12 to 20	15 to 17	10 to 23	13 to 18	9 to 13	11 to 20
Liquidity Index, LI	0.05 to 0.17	0.06 to 0.09	0.19 to 0.95	0.08 to 0.98	0.09 to 0.47	0.09 to 0.62
Unit Weight, γ , kN/m ³	-	-	18.6 to 20.3	21.4	21.4 to 21.8	20.8 to 21.1

1 – Index Properties are based on laboratory results from Boreholes: TB4-1, TB4-2, T6-1, T6-2, T6-3, CPT35-RW, CPT36-RW, CPT37-RW, NIL12-RW, DMT T6-1, BH-129 and BH-325.

2 – Ground surface elevation and base of the lower silty clay varies at test locations.

As illustrated on Figure 3.3c, the undrained shear strength of the silty clay stratum varied with depth generally as follows:

- Clay Crust layer: $> 80 \pm 20$ kPa
- Clay Transition layer: 80 ± 20 kPa to 60 ± 10 kPa
- Upper silty clay: 60 ± 10 kPa to 45 ± 10 kPa to 50 ± 10
- Lower clayey silt: 50 ± 10 kPa to 65 ± 20 kPa to > 65 kPa.

The interpreted representative values used for the silty clay/ clayey silt substrata for the Pedestrian Bridge TB-4 site are summarized as follows:

Table 4-3-2: TB-4 Summary of Compressibility Properties

Property	Clay Crust	Transition	Upper Silty Clay	Lower Silty Clay	Upper Clayey Silt	Lower Clayey Silt
Average Natural Water Content, w_N , %	19	23	25	20	17	22
Virgin Compression Index, C_c	0.16	0.19	0.20	0.16	0.14	0.18
Recompression Index, C_r	0.017	0.020	0.022	0.018	0.015	0.020
Swelling Index, C_s	0.039	0.046	0.051	0.041	0.034	0.045
Secondary Compression Index, C_{α}	0.0044	0.0052	0.0057	0.0046	0.0038	0.0051

An oedometer test carried out on grey clayey silt sample obtained from Boreholes T6-1 at a depth of 12.5 m below ground surface with $w_N = 20.3\%$ indicated the following compressibility indices: $C_c = 0.151$ and $C_r = 0.017$. These compression index values are in general agreement with the interpreted compressibility characteristics summarized in Table 4-3-2.

A direct shear test carried out on silty clay to clayey silt sample obtained from Borehole T6-3 at a depth of 17.1 m below the ground surface indicated a residual internal friction angle 30° . The results are shown in Appendix C.

Table 4-3-3: TB-4 Summary of Interpreted Elastic Moduli Properties

Soils Stratigraphy	Elastic Modulus (Undrained), MPa	Poisson's Ratio (Undrained) *	Elastic Modulus (Drained), MPa	Poisson's Ratio (Drained)*
Clay Crust	35	0.49	32	0.35
Transition	20	0.49	18	0.35
Upper Silty Clay	16	0.49	14	0.35
Lower Silty Clay	15	0.49	14	0.35
Upper Clayey Silt	17	0.49	15*	0.35
Lower Clayey Silt	20	0.49	18*	0.35

*-Assumed values (ref. R-22)

4.3.3 Lower Granular Deposit

Underlying the silty clay to clayey silt stratum and overlying the bedrock, a heterogeneous non-cohesive material deposit (varying from cobbles and boulders, silt to sandy silt and sand and gravel) was encountered. Based on SPT N-values ranging generally from 17 to greater than 100, this material is considered to be in a compact to very dense state. This layer was approximately 2.0 to 3.6 m thick within the site area.

4.3.4 Bedrock

Boreholes TB4-1, TB4-2, DMT T6-1, BH12-RW, CPT35-RW, CPT36-RW, CPT37-RW, NIL12-RW, CPT-130 and CPT-324 were terminated within the overburden deposits. Boreholes T6-1, T6-2, T6-3, BH-129, BH-323 and BH-325 encountered bedrock beneath the lower granular deposit or below the silty clay to clayey silt stratum at about elevation 147.2 to 148.5. Where rock coring was undertaken, a white to grey, limestone bedrock was encountered. The bedrock was generally fresh, medium strong, laminated to thinly laminated, fine grained, faintly to highly porous and highly fractured. The RQD of the recovered rock varied between 0 to 100 per cent indicating a very poor to excellent quality. The RQD values generally increased with depth. Rock core samples from Borehole BH-129 were tested and had unconfined compressive strengths of 79.6 MPa. The results of the compressive strength testing indicate that the limestone rock may be described as “strong” rock.

4.3.5 Groundwater Conditions

The shallower boreholes TB4-1 and TB4-2 were dry during the relatively short period of time until backfilling. This is consistent with the general low permeability overburden soils at this site.

Shallow and deep vibrating wire and standpipe piezometers were installed in selected boreholes to measure the water levels within overburden and bedrock, respectively (Table 4-3-4).

The piezometric levels measured in the clayey silt overburden and the limestone bedrock varied from 178.8 to 182.2 and around 177.5 to 179.4, respectively. The highest piezometric levels within the overburden and the bedrock were recorded at about elevations 182.2 and 179.4, respectively

(Table 4-3-4). These measurements indicate artesian conditions with piezometric head roughly 0.2 m to 1.3 m above the ground surface.

Table 4-3-4: TB-4 Summary of Measured Water Levels

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
T6-1	180.9	VWP	169.5	Silty Clay	2011-07-23	182.2
					2011-07-29	182.0
					2011-08-06	181.6
					2011-08-29	181.1
		VWP	148.9	Cobbles/ Boulders	2011-07-23	178.8
					2011-07-29	178.7
					2011-08-06	178.7
					2011-08-29	178.8
		S-Piez.	177.9	Fill	2011-07-23	dry
					2011-07-29	180.0
					2011-08-06	180.2
					2011-08-29	180.5
T6-2	180.8	VWP	169.5	Silty Clay	2011-07-23	180.8
					2011-08-06	180.5
					2011-08-29	180.6
		VWP	162.6	Silty Clay	2011-07-23	180.6
					2011-08-06	180.3
					2011-08-29	180.4
BH-129	180.8	S-Piez	147.9	Lower Granular	2008-07-22	178.5
					2008-08-11	177.9
					2008-09-19	177.6
					2009-01-28	177.5
BH-129A	180.8	S-Piez	171.7	Silty Clay	2008-07-22	179.0
					2008-08-11	178.9
					2008-09-19	179.0
					2009-01-28	178.8
BH-323	181.3	S-Piez	143	Limestone	2009-12-17 ^(*)	150.1
					2010-01-06	178.9
					2010-02-24	179.1
BH-325	180.8	S-Piez	143.3	Limestone	2009-12-17 ^(*)	dry
					2010-01-06	179.3
					2010-02-24	179.4

Legend: S-Piez Standpipe Piezometer
VWP Vibrating Wire Piezometer
(*) During Drilling

Perched groundwater is known to accumulate seasonally within the upper deposits of fill, topsoil and granular layers, and within the fissures in the silty clay crust. In periods of wet weather, the perched groundwater levels can rise to near the ground surface.

4.4 TB-5

The general soil stratigraphy at the site consists of the following successive strata: surficial layers of occasional fills, topsoil and upper granular deposit below the existing ground surface at about elevation

180.5 to 181.6, an extensive clayey silt to silty clay deposit below about elevation 179.1 to 181.5, and a possibly discontinuous lower granular deposit below about elevation 151.9 to 156.1, overlying limestone and dolostone bedrock below about elevation 146.6 to 149.7 m. The thickness of the clayey silt to sandy/silty clay deposit based on the available nearby boreholes is about 21.8 to 29.6 m. The bedrock was encountered at depths approximately 32.0 to 35.1 m below the ground surface.

4.4.1 Topsoil, Surficial Fills and Upper Granular Soils

A layer of topsoil was encountered at the ground surface in Boreholes TB5-2, TB5-3, TB5-4, T7-2, T7-3, CPT T7-1, CPT T7-2, CPT-124, and BH-122 and below the surficial fills in Boreholes TB5-1 and BH/CPT-322. The thickness of the topsoil was about 0.2 to 0.76 m at these locations. The thickness of the topsoil is expected to vary in quality and thickness through the project area.

Fill layers were encountered at the ground surface in Boreholes TB5-1, T7-1, DMT T7-1, BH-126, BH-127, and CPT-322. The fills were variable and consisted of silty clay, topsoil, sand and gravel, crushed lime stone, concrete and asphalt. The fill thickness was about 0.5 to 1.5 m at the borehole locations.

Upper granular deposits were encountered below the topsoil / fill layer described above in Boreholes TB5-2, TB5-3, T7-1, T7-3, CPT T7-1, CPT T7-2, CPT-124, and BH-127. The upper granular deposits consisted of sand and silty sand. The thickness of the upper granular deposits ranged from about 0.3 m to 1.1 m at these locations.

4.4.2 Silty Clay to Clayey Silt Stratum

An extensive cohesive silty clay to clayey silt stratum was encountered directly underlying the topsoil, upper granular and/or fill deposit. The encountered depth below existing ground surface varied from 0.2 to 2.1 m corresponding to elevation 179.1 to 181.5 m. Based on the gradation, in-situ moisture content and strength characteristics, the stratum may be subdivided into four layers as follows: brown desiccated stiff to hard clay crust, transition zone, upper grey silty clay to clayey silt deposit (referred to hereafter as silty clay), and then a generally coarser lower grey clayey silt deposit (referred to as clayey silt). The natural water content, Atterberg limits, and total unit weights of the clay sub-strata are summarized in Table 4-4-1 and illustrated in Figure 3.3d.

Table 4-4-1: TB-5 Summary of Index Properties

Property ¹	Clay Crust	Transition	Upper Silty Clay	Lower Clayey Silt
Elevation Range (m)	181 ² to 177	177 to 175	175 to 163	163 to 151
Natural Water Content, w_N , %	12 to 28	12 to 25	13 to 28	12 to 33
Liquid Limit, w_L , %	39	31 to 34	29 to 38	27 to 50
Plastic Limit, w_P , %	18	16 to 17	16 to 18	15 to 23
Plasticity Index, PI	21	14 to 17	13 to 21	12 to 27
Liquidity Index, LI	(-)0.01	0.09 to 0.34	0.24 to 0.39	(-)0.09 to 0.62
Unit Weight, γ , kN/m ³	N/A	20.6 to 20.9	18.6 to 20.6	18.8 to 21.6

1 – Index Properties are based on laboratory results from Boreholes: TB5-1, TB5-2, TB5-3, TB5-4, T7-1, T7-2, T7-3, CPT T7-1, CPT T7-2, DMT T7-1, BH-122, BH-126, BH-127, CPT-124, and CPT-322.

2 – Ground surface elevation and base of the lower silty clay varies at test locations.

As illustrated on Figure 3.3d, the undrained shear strength of the silty clay stratum varied with depth generally as follows:

- Crust layer: > 100 kPa
- Transition layer: 100±30 kPa to 75±20 kPa
- Upper silty clay: 75±25 kPa to 55±15 kPa
- Lower clayey silt: 80±15 kPa

The interpreted representative values used for the silty clay/ clayey silt substrata for the Pedestrian Bridge TB-1 site are summarized as follows:

Table 4-4-2: TB-5 Summary of Compressibility Properties

Property	Clay Crust	Transition	Upper Silty Clay	Lower Clayey Silt
Average Natural Water Content, w_N , %	20	20	15 - 23	18
Virgin Compression Index, C_c	0.163	0.163	0.120 – 0.189	0.146
Recompression Index, C_r	0.0180	0.0180	0.0132 – 0.0208	0.0161

Table 4-4-3: TB-5 Summary of Interpreted Elastic Moduli Properties

Soils Stratigraphy	Elastic Modulus (Undrained), MPa	Poisson's Ratio (Undrained) *	Elastic Modulus (Drained), MPa	Poisson's Ratio (Drained)*
Clay Crust	22.5	0.49	20.3	0.35
Transition	19.5 to 22.5	0.49	17.6 to 20.3	0.35
Upper Silty Clay	13.0 to 19.5	0.49	11.7 to 17.6	0.35
Lower Clayey Silt	15 to 19.5	0.49	13.5 to 17.5	0.35

*-Assumed values (ref. R-22)

4.4.3 Lower Granular Deposit

Underlying the silty clay to clayey silt stratum and overlying the bedrock, a heterogeneous non-cohesive material deposit (varying from cobbles and boulders, silt to sandy silt and sand and gravel) was encountered. Based on SPT N-values ranging generally from 13 to greater than 100, this material is considered to be in a compact to very dense state. This layer was approximately 2.4 to 7.6 m thick within the site area.

4.4.4 Bedrock

Boreholes TB5-1, TB5-2, TB5-3, TB5-4, CPT T7-1, CPT T7-2, DMT T7-1, BH-126, CPT-124 and CPT-322 were terminated within the overburden deposits. Boreholes T7-1, T7-2, T7-3, BH-122 and BH-127 refused on bedrock beneath the lower granular deposit or below the silty clay to clayey silt stratum at about elevation 146.6 to 149.7. Where rock coring was undertaken, a white to grey, limestone bedrock was encountered. The bedrock was generally fresh, medium strong, laminated to thinly laminated, fine grained, faintly to highly porous and highly fractured. The RQD of the recovered rock was 100 per cent indicating excellent quality. Rock core samples from Borehole BH-122, BH-127 and T7-1 were tested

and had unconfined compressive strengths of 14 to 100.1 MPa. The results of the compressive strength testing indicate that the limestone rock may be described as "weak" to "very strong" rock.

4.4.5 Groundwater Conditions

The shallower boreholes TB5-1 thru TB5-4 were dry during the relatively short period of time until backfilling. This is consistent with the general low permeability overburden soils at this site.

Shallow and deep vibrating wire and standpipe piezometers were installed in selected boreholes to measure the water levels within overburden and bedrock, respectively (Table 4-4-4).

The piezometric levels measured in the clayey silt overburden and the limestone bedrock varied from 179.5 to 181.0 and around 177.2 to 178.3, respectively. These observations suggest a slight downward gradient between the overburden and the bedrock. At Borehole T7-3, groundwater rose to roughly 2.4 m above the ground surface for a brief period after coring of the bedrock was completed, therefore occurrence of artesian condition in bedrock cannot be ruled out.

Table 4-4-4: TB-5 Summary of Measured Water Levels

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
T7-1	181.5	VWP	172.4	Silty Clay	2011-07-24	180.4
		VWP	161.7	Silty Clay	2011-08-06	180.5
T7-2	180.8	VWP	169.5	Silty Clay	2011-07-24	180.4
		VWP	162.6	Silty Clay	2011-08-06	180.4
T7-3	181.7	Borehole	n/a	Limestone	2011-07-10	179.5
CPT-124	181.5	Borehole	n/a	Silty Clay	2011-08-06	179.7
BH-122	181.7	S-Piez	143.8	Limestone	2011-07-24	180.3
					2011-08-06	181.0
					2011-07-10	181.3 ^(*)
					2008-09-11	180.5 ^(*)
					2008-07-22	178.0
BH-122A	181.7	S-Piez	172.5	Silty Clay	2008-08-11	178.3
					2008-09-19	178.3
					2008-11-11	177.5
BH-127	181.3	S-Piez	145.1	Limestone	2009-01-28	177.2
					2008-03-20	177.7
					2008-07-22	178.3
					2008-08-11	178.1
					2008-09-19	177.9
					2008-11-11	177.7
					2009-01-28	177.3

Legend: S-Piez Standpipe Piezometer
VWP Vibrating Wire Piezometer
(*) During Drilling

Perched groundwater is known to accumulate seasonally within the upper deposits of fill, topsoil and granular layers, and within the fissures in the silty clay crust. In periods of wet weather, the perched groundwater levels can rise to near the ground surface.

4.5 TB-7

The subsurface conditions described below are based on data gathered in the historic investigations and the current investigation.

The general soil stratigraphy at the site consists of the following successive strata: surficial layers of occasional fills, topsoil and upper granular deposit below the existing ground surface at about elevation 183.4 to 184.9, an extensive clayey silt to silty clay deposit below about elevation 182.6 to 184.6, and a possibly discontinuous lower granular deposit below about elevation 152.0 to 156.2, overlying limestone and dolostone bedrock below about elevation 151.5 to 151.7 m. The thickness of the clayey silt to sandy/silty clay deposit based on the available nearby boreholes is about 27.2 to 31.7 m. The bedrock was encountered at depths approximately 32.0 to 32.3 m below the ground surface.

4.5.1 Topsoil, Surficial Fills and Upper Granular Soils

A layer of topsoil was encountered at the ground surface in all Boreholes except for Boreholes TB7-3, CV3-1, T9-1 and BH15-RW. The thickness of the topsoil was about 0.2 to 0.5 m at these locations. The thickness of the topsoil is expected to vary in quality and thickness through the project area.

Fill layers were encountered in Boreholes TB7-3, CV3-1, T9-1 and BH15-RW. The fills were variable and consisted of silty clay, topsoil, asphalt, concrete and crushed limestone. The fill thickness was about 0.9 to 1.5 m at the borehole locations.

No distinct native granular deposits were observed in the boreholes at the site of this particular structure. However, based on the experience in the general project alignment, local occurrence of native silts and fine sands may be possible.

4.5.2 Silty Clay to Clayey Silt Stratum

An extensive cohesive silty clay to clayey silt stratum, was encountered directly underlying the surficial topsoil, and fill/granular deposit. The encountered depth below existing ground surface varied from 0.2 to 1.5 m corresponding to elevation 182.6 to 184.6 m. Based on the gradation, in-situ moisture content and strength characteristics, the stratum may be subdivided into five layers as follows: brown desiccated stiff to hard clay crust, transition zone, upper grey silty clay to clayey silt deposit (referred to hereafter as silty clay), middle grey silty clay, and then a generally coarser lower grey clayey silt deposit (referred to as clayey silt). The natural water content, Atterberg limits, and total unit weights of the clay sub-strata are summarized in Table 4-5-1 and illustrated in Figure 3.3e.

Table 4-5-1: TB-7 Summary of Index Properties

Property ¹	Clay Crust	Transition	Upper Silty Clay	Mid Silty Clay	Lower Clayey Silt
Elevation Range (m)	184 ² to 178	178 to 175	175 to 166	166 to 163	163 to 154 ²
Natural Water Content, w_N , %	2.3 – 22.9	10.0 – 18.0	11.3 – 37.5	14.3 – 34	9.9 – 26.0
Liquid Limit, w_L , %	22.6 – 25.9	23.0 – 25.0	24.5 ³ – 36.6	23.2	27.4 – 33.2
Plastic Limit, w_P , %	13.4 – 15.0	13.0	12.0 ³ – 19.4	14.0	15.4 – 17.2
Plasticity Index, PI	9.2 – 10.9	10.0 – 12.0	11.1 ³ – 17.2	9.2	12.0 – 16.0
Liquidity Index, LI	(-) 0.34 – 0.01	0.20 – 0.23	0.28 – 1.05	0.03	(-) 0.04 – 0.44
Unit Weight, γ , kN/m ³	N/A	21.6	21.0 – 21.5	N/A	21.8

1 – Index Properties are based on laboratory results from Boreholes: TB7-1, TB7-2, TB7-3, TB7-4, CV3-1, T9-1, BH15-RW, NIL T9-2, BH-115, BH-116, and DMT T9-1.

2 – Ground surface elevation and base of the lower clayey silt varies at test locations.

3 – Out of range measured property on a single sample has been excluded.

As illustrated on Figure 3.3e, the undrained shear strength of the silty clay stratum varied with depth generally as follows:

- Crust layer: > 100 kPa
- Transition layer: 80±20 kPa to 60±10 kPa
- Upper silty clay: 60±10 kPa
- Mid silty clay: 60±10 kPa to 70±10 kPa
- Lower clayey silt: >80±10 kPa.

The interpreted representative values used for the silty clay/ clayey silt substrata for the Pedestrian Bridge TB-7 site are summarized as follows:

Table 4-5-2: TB-7 Summary of Compressibility Properties

Property	Clay Crust	Transition	Grey Silty Clay ("Upper Clay")	Mid Silty Clay	Clayey Silt ("Lower Silt")
Average Natural Water Content, w_N , %	14	16	20	24	20
Virgin Compression Index, C_c	0.112	0.129	0.163	0.198	0.163
Recompression Index, C_r	0.0123	0.0142	0.0180	0.0218	0.0180
Swelling Index, C_s	0.0280	0.0322	0.0409	0.0495	0.0409
Secondary Compression Index, C_{α}	0.0031	0.0036	0.0046	0.0055	0.0046

An oedometer test was carried out on a grey clayey silt sample obtained from Borehole T9-1 at a depth of 15.2 m below ground surface (sample at elevation 168.8 with w_N , w_L and PI values of 20.0%, 29 and 17, respectively) indicated the following compressibility indices: $C_c = 0.116$ and $C_r = 0.036$.

A consolidated isotropic undrained triaxial compression (CIUC) test was carried out on a clayey silt sample from Borehole T9-1 at a depth of 15.2 m below ground surface indicates an effective friction angle of 32 degrees.

Table 4-5-3: TB-7 Summary of Interpreted Elastic Moduli Properties

Soils Stratigraphy	Elastic Modulus (Undrained), MPa	Poisson's Ratio (Undrained) *	Elastic Modulus (Drained), MPa	Poisson's Ratio (Drained)*
Clay Crust	35	0.49	31	0.35
Transition	20	0.49	18	0.35
Upper Silty Clay	16	0.49	14	0.35
Mid Silty Clay	17	0.49	15	0.35
Lower Clayey Silt	35	0.49	31	0.35

*-Assumed values (ref. R-22)

4.5.3 Lower Granular Deposit

Underlying the silty clay to clayey silt stratum and overlying the bedrock, a heterogeneous non-cohesive material deposit (varying from sand, to sand and gravel, and sandy silt) was encountered. Based on SPT N-values ranging generally from 30 to 48, this material is considered to be in a compact state of compactness. This layer was approximately 0 to 4.7 m thick. The thickness of the layer and state of compactness may vary significantly throughout the project area.

4.5.4 Bedrock

Boreholes TB7-1, TB7-2, TB7-3, TB7-4, CV3-1, NIL T9-2, DMT T9-1, BH15-RW, CPT45-RW, CPT46-RW and CPT-114 were terminated within the overburden deposits. Boreholes T9-1, BH-115 and BH-116 encountered bedrock beneath the lower granular deposit or below the silty clay to clayey silt stratum at about elevation 151.5 to 151.7. Where rock coring was undertaken, a white to grey, limestone bedrock was encountered. The bedrock was generally fresh, medium strong, laminated to thinly laminated, fine grained, faintly to highly porous and highly fractured. The RQD of the recovered rock varied between 33 to 100 per cent indicating poor to excellent quality. The RQD values generally increased with depth. Two samples of the rock core obtained from Borehole T9-1 were tested in compression to failure. The samples had unconfined compressive strengths of 61.0 and 63.3 MPa. Unconfined compressive strength of two rock cores taken from Borehole 115 at a depth of 37.5 m and Borehole 116 at a depth of 33.0 m was 26.5 MPa and 24.8 MPa, respectively. The results of the compressive strength testing indicate that the limestone rock may be described as "weak" to "strong" rock.

4.5.5 Groundwater Conditions

The shallower boreholes TB7-1 thru TB7-4 were dry during the relatively short period of time until backfilling. This is consistent with the general low permeability overburden soils at this site.

Shallow and deep vibrating wire and standpipe piezometers were installed in selected boreholes to measure the water levels within overburden and bedrock, respectively (Table 4-5-4).

The piezometric levels measured in the clayey silt overburden and the limestone bedrock varied from 182.2 to 184.0 and around 176.0 to 178.1, respectively. The highest piezometric levels within the

overburden and the bedrock were recorded at about elevations 184.0 and 178.1, respectively (Table 4-5-4). These observations suggest a slight downward gradient between the overburden and the bedrock. Nevertheless, given the general information along the project area, occurrence of artesian condition in bedrock cannot be entirely ruled out. The water levels inferred from the shallow piezometer at Borehole T9-1 are noted to be about equal to the ground surface.

Table 4-5-4: TB-7 Summary of Measured Water Levels

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
T9-1	184.0	VWP	174.9	Silty Clay	2011-08-06	183.9
					2011-08-29	184.0
		VWP	151.4	Limestone	2011-08-06	177.5
					2011-08-29	177.7
BH-115	183.8	S-Piez	146.2	Limestone	2008-02-21	178.0
					2008-03-20	178.1
					2008-07-24	177.7
					2008-09-19	176.0
					2008-11-14	177.2
					2009-01-28	177.4
BH-115A	183.8	VWP	173.0	Sand lens in Upper Silty Clay	2008-03-20	182.4
					2008-07-24	182.3
					2008-09-19	182.3
					2009-01-28	182.2
BH-116	183.6	S-Piez	152.0	Just above Limestone	2008-07-22	178.0
					2008-08-11	176.7
					2008-09-19	176.1
					2008-11-14	177.3
					2009-01-28	177.5
BH-116A	183.6	VWP	174.6	Silty Clay	2008-03-20	182.6
					2008-07-22	182.8
					2008-08-11	182.6
					2008-09-19	182.6
					2009-01-28	182.7

Legend: S-Piez Standpipe Piezometer
VWP Vibrating Wire Piezometer

Perched groundwater is known to accumulate seasonally within the upper deposits of fill, topsoil and granular layers, and within the fissures in the silty clay crust. In periods of wet weather, the perched groundwater levels can rise to near the ground surface.

4.6 TB-7A

The general soil stratigraphy at the site consists of the following successive strata: surficial layers of occasional fills, topsoil and upper granular deposit below the existing ground surface at about elevation 185 to 184, an extensive clayey silt to silty clay deposit below about elevation 183.5 to 184.9, and a possibly discontinuous lower granular deposit below about elevation 154.5 to 159.3, overlying limestone and dolostone bedrock below elevation 150.1 to 153.0 m. The thickness of the clayey silt to sandy/silty

clay deposit based on the available nearby boreholes is about 24.2 to 28.2 m. The bedrock was encountered at depths approximately 31.4 to 32.5 m below the ground surface.

4.6.1 Topsoil, Surficial Fills and Upper Granular Soils

A layer of topsoil was encountered at the ground surface in all Boreholes except for Boreholes T10-1 and CPT T10-2. The thickness of the topsoil was about 0.3 to 0.6 m at these locations. The thickness of the topsoil is expected to vary in quality and thickness through the project area.

Fill layers were encountered in Boreholes T10-1 and CPT T10-2. The fills were variable and consisted of silty clay, topsoil and gravel. The fill thickness was about 0.5 to 1.4 m at the borehole locations.

Borehole CPT T10-2 encountered upper granular deposits below the fill layer described above. The upper granular deposits consisted of sandy silt and sand. Soil sampling at CPT T10-2 was terminated within the upper granular deposit at a depth of 5.0 m.

4.6.2 Silty Clay to Clayey Silt Stratum

An extensive cohesive silty clay to clayey silt stratum, was encountered directly underlying the topsoil, upper granular and/or fill deposit. The encountered depth below existing ground surface varied from 0.3 to 1.4 m corresponding to elevation 183.5 to 184.9 m. Based on the gradation, in-situ moisture content and strength characteristics, the stratum may be subdivided into four layers as follows: brown desiccated stiff to hard clay crust, transition zone, upper grey silty clay to clayey silt deposit (referred to hereafter as silty clay), and then a generally coarser lower grey clayey silt deposit (referred to as clayey silt). The natural water content, Atterberg limits, and total unit weights of the clay sub-strata are summarized in Table 4-6-1 and illustrated in Figure 3.3f.

Table 4-6-1: TB-7A Summary of Index Properties

Property ¹	Clay Crust	Transition	Upper Silty Clay	Lower Clayey Silt
Elevation Range (m)	184.4 ² to 178.3	177.2 to 175.3	174.2 to 163.1	162.0 to 154.1 ²
Natural Water Content, w_N , %	12 to 21	13 to 16	12 to 44	10 to 27
Liquid Limit, w_L , %	19 to 26	20 to 24	28 to 41	22 to 36
Plastic Limit, w_P , %	12 to 15	12 to 13	15 to 20	14 to 17
Plasticity Index, PI	7 to 11	7 to 12	13 to 21	8 to 21
Liquidity Index, LI	<0.14	0.06 to 0.31	0.31 to 1.89	-0.43 to 0.44
Unit Weight, γ , kN/m ³	19.9 to 22.3	21.7	18.5 to 21.2	20.4 to 23.2

1 – Index Properties are based on laboratory results from Boreholes: TB7A-1, T10-1, T10-2, BH-112, BH-113, CPT T10-2, and DMT T10-1.

2 – Ground surface elevation and base of clayey silt layer varies at test locations.

As illustrated on Figure 3.3f, the undrained shear strength of the silty clay stratum varied with depth generally as follows:

- Crust layer: > 100±20 kPa

- Transition layer: 100±20 kPa to 65±10 kPa
- Upper silty clay: 65±10 kPa to 55±10 kPa
- Lower clayey silt: >75 kPa

The interpreted representative values used for the silty clay/ clayey silt substrata for the Pedestrian Bridge TB-7A site are summarized as follows:

Table 4-6-2: TB-7A Summary of Compressibility Properties

Property	Clay Crust	Transition	Grey Silty Clay ("Upper Clay")	Clayey Silt ("Lower Silt")
Average Natural Water Content, w_N , %	14	15	23	19
Virgin Compression Index, C_c	0.111	0.120	0.189	0.155
Recompression Index, C_r	0.0123	0.0132	0.0284	0.0170
Swelling Index, C_s	0.0280	0.0301	0.0473	0.0387
Secondary Compression Index, C_α	0.00313	0.00337	0.0053	0.00433

Oedometer tests carried out on grey clayey silt samples obtained from Boreholes T10-1 and T10-2 at depths of 17.1 m and 20.1 m below ground surface with $w_N = 19.1\%$ and 18% , respectively, indicated the following compressibility indices: $C_c = 0.130$ and 0.097 and $C_r = 0.018$ and 0.011 .

A consolidated isotropic undrained triaxial compression (CIUC) test was carried out on silty clay to clayey silt sample obtained from Borehole T10-2 at a depth of 20.1 m below ground surface. A direct shear test was also carried out on silty clay to clayey silt sample obtained from Borehole T10-1 at a depth of 16.7 m below the ground surface. The results of both tests are shown in Appendix C.

Table 4-6-3: TB-7A Summary of Interpreted Elastic Moduli Properties

Soils Stratigraphy	Elastic Modulus (Undrained), MPa	Poisson's Ratio (Undrained) *	Elastic Modulus (Drained), MPa	Poisson's Ratio (Drained)*
Clay Crust	35	0.49	31.5	0.35
Transition	19.5	0.49	17.5	0.35
Upper Silty Clay	14.4	0.49	12.9	0.35
Lower Clayey Silt	29	0.49	26	0.35

*-Assumed values (ref. R-22)

4.6.3 Lower Granular Deposit

Underlying the silty clay to clayey silt stratum and overlying the bedrock, a heterogeneous non-cohesive material deposit (varying from silty sand, to sand and gravel, and sandy silt) was encountered. Based on SPT N-values ranging generally from 12 to more than 100, this material is considered to be in a compact to very dense state. This layer was approximately 1.5 to 6.1 m thick within the site area.

4.6.4 Bedrock

Boreholes TB7A-1, CPT T10-1, CPT T10-2, CPT47-RW, DMT T10-1 and CPT-114 were terminated within the overburden deposits. Boreholes T10-1, T10-2, BH-112 and BH-113 encountered bedrock beneath the lower granular deposit or below the silty clay to clayey silt stratum at about elevation 153.0 to 152.1. Where rock coring was undertaken, a white to grey, limestone bedrock was encountered. The bedrock was generally fresh, medium strong, laminated to thinly laminated, fine grained, faintly to highly porous and highly fractured. The RQD of the recovered rock varied between 0 to 100 per cent indicating a very poor to excellent quality. The RQD values generally increased with depth. Rock core samples from Boreholes BH-112 and BH-113 were tested and had unconfined compressive strengths of 30.1 MPa and 16.6 MPa, respectively. The results of the compressive strength testing indicate that the limestone rock may be described as “medium strong to weak” rock.

4.6.5 Groundwater Conditions

The shallower borehole TB7-A1 was dry during the relatively short period of time until backfilling. This is consistent with the general low permeability overburden soils at this site.

Shallow and deep vibrating wire and standpipe piezometers were installed in selected boreholes to measure the water levels within overburden and bedrock, respectively (Table 4-6-4).

The piezometric levels measured in the clayey silt overburden and the limestone bedrock varied from 177.0 to 183.7 and around 177.7, respectively. The highest piezometric levels within the overburden and the bedrock were recorded at about elevations 183.7 and 177.7, respectively (Table 4-6-4). These observations suggest a slight downward gradient between the overburden and the bedrock. Nevertheless, given the general prevalence in the Windsor area, occurrence of artesian condition in bedrock cannot be entirely ruled out.

Table 4-6-4: TB-7A Summary of Measured Water Levels

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
T10-1	184.9	S-Piez.	181.9-183.4	Silty Clay	2011-07-29	183.7
		VWP	175.8	Silty Clay	2011-07-29	183.4
		VWP	163.3	Silty Clay	2011-07-29	182.4
T10-2	184.8	S-Piez	181.9-183.4	Silty Clay	2011-07-23	182.6
		VWP	178.3	Silty Clay	2011-07-23	182.4
		VWP	166.2	Silty Clay	2011-07-23	181.3
		VWP	153.8	Lower Granular	2011-07-23	177.0
BH-112	184.6	S-Piez	146.4-148.0	Limestone	2009-01-28	177.7
BH-112A	184.6	VWP	175.4	Silty Clay	2009-01-28	182.4
BH-113	184.4	S-Piez	153.0-154.5	Lower Granular	2009-01-28	177.4
BH-113A	184.4	VWP	174.8	Silty Clay	2009-01-28	182.5

Legend: S-Piez Standpipe Piezometer
VWP Vibrating Wire Piezometer

Perched groundwater is known to accumulate seasonally within the upper deposits of fill, topsoil and granular layers, and within the fissures in the silty clay crust. In periods of wet weather, the perched groundwater levels can rise to near the ground surface.

4.7 TB-8

The general soil stratigraphy at the site consists of the following successive strata: surficial layers of occasional fills, topsoil and upper granular deposit below the existing ground surface at about elevation 185.7 to 188, an extensive clayey silt to silty clay deposit below about elevation 181.8 to 185.8, and a possibly discontinuous lower granular deposit below about elevation 155.3 to 159.1, overlying limestone and dolostone bedrock below about elevation ranging from 154.3 to 156.0. The thickness of the clayey silt to sandy/silty clay deposit based on the available nearby boreholes is about 22.0 to 30.5 m. The bedrock was encountered at depths approximately 29.9 to 31.5 m below the ground surface. Lenses of up to 2 m thick of non-cohesive silty sand to sandy silt were encountered at a number of boreholes embedded within the silty clay stratum between elevations 171 to 178.

4.7.1 Topsoil, Surficial Fills and Upper Granular Soils

A layer of topsoil was encountered at the ground surface in all Boreholes except for Boreholes NIL T11-1, BH-304, CPT-106 and CPT306. The thickness of the topsoil was about 0.1 to 0.3 m at these locations. The thickness of the topsoil is expected to vary in quality and thickness through the project area.

Surficial fills were encountered and/or interpreted to exist at the ground surface in Boreholes BH-304, CPT-106 and CPT-306. The fills were variable and consisted of clayey topsoil and gravel to clayey silt. The fill thickness was about 0.2 to 2.9 m at the borehole locations.

A layer of upper granular deposit was encountered beneath the topsoil in Boreholes T11-2 and NIL T11-2. The upper granular deposit consisted of sandy silt to sand and gravel. The thickness of the upper granular deposit was up to 4.8 m at the borehole locations.

4.7.2 Silty Clay to Clayey Silt Stratum

An extensive cohesive silty clay to clayey silt stratum, was encountered directly underlying the surficial topsoil, and fill/granular deposit in all boreholes except NIL T11-1, where it was encountered at the ground surface. The encountered depth below existing ground surface varied from 0.0 m to 4.9 m corresponding to elevation 181.1 to 185.8. Based on the gradation, in-situ moisture content and strength characteristics, the stratum may be subdivided into four layers as follows: brown desiccated stiff to hard clay crust, transition zone, upper grey silty clay to clayey silt deposit (referred to hereafter as silty clay), and then a generally coarser lower grey clayey silt deposit (referred to as clayey silt). The natural water content, Atterberg limits, and total unit weights of the clay sub-strata are summarized in Table 4-7-1 and illustrated in Figure 3.3g.

Table 4-7-1: TB-8 Summary of Index Properties

Property ¹	Clay Crust	Transition	Upper Silty Clay	Lower Clayey Silt
Elevation Range (m)	186 ² to 181	181 – 176	176 – 163	163 - 160
Natural Water Content, w_N , %	9 – 45	11 - 17	13 – 35	12 - 36
Liquid Limit, w_L , %	25 - 37	13 – 26	15 – 36	27 – 38
Plastic Limit, w_P , %	11 – 16	11 – 14	11 – 19	13 – 17
Plasticity Index, PI	12 – 21	2 – 12	4 – 21	12 – 21
Liquidity Index, LI	(-)0.05 – (-)0.23	(-)0.09 – 0.27	(-)0.54 – 0.60	(-)0.18 – 1.64
Unit Weight, γ , kN/m ³	N/A	21.7-22.1	18.8 – 21.3	N/A

1 – Index Properties are based on laboratory results from Boreholes: TB8-1, TB8-2, TB8-3, T11-1, T11-2, T11-3, NIL T11-1, NIL T11-2, BH-107, BH-304 and BH-305

2 – Ground surface elevation and base of clayey silt layer varies at test locations.

As illustrated on Figure 3.3g, the undrained shear strength of the silty clay stratum varied with depth generally as follows:

- Crust layer: $> 80 \pm 20$ kPa
- Transition layer: 80 ± 20 kPa to 60 ± 10 kPa
- Upper silty clay: 60 ± 10 kPa to 80 ± 10 kPa
- Lower clayey silt: $> 90 \pm 10$ kPa

The interpreted representative values used for the silty clay/ clayey silt substrata for the Pedestrian Bridge TB-8A site are summarized as follows:

Table 4-7-2: TB-8 Summary of Compressibility Properties

Property	Clay Crust	Transition	Grey Silty Clay ("Upper Clay")	Clayey Silt ("Lower Silt")
Average Natural Water Content, w_N , %	13	16	18-25	17
Virgin Compression Index, C_c	0.103	0.129	0.146-0.206	0.138
Recompression Index, C_r	0.0114	0.0142	0.0161-0.0227	0.0151
Swelling Index, C_s	0.0258	0.0323	0.0366-0.0516	0.0344
Secondary Compression Index, C_α	0.00288	0.00361	0.00700- 0.00578	0.00385

An oedometer test carried out on a grey clayey silt sample obtained from Borehole T11-3 at a depth of 15.6 m below ground surface with a $w_N = 20.7\%$ indicated the following compressibility indices: $C_c =$ and 0.144 and $C_r = 0.026$.

Unconsolidated undrained triaxial compression (UUC) tests carried out on silty clay to clayey silt samples obtained from Boreholes T11-2 and T11-3 at the depths of 17.0 and 12.5 m, respectively, below ground surface and the results are shown in Appendix C.

Table 4-7-3: TB-8 Summary of Interpreted Elastic Moduli Properties

Soils Stratigraphy	Elastic Modulus (Undrained), MPa	Poisson's Ratio (Undrained) *	Elastic Modulus (Drained), MPa	Poisson's Ratio (Drained)*
Clay Crust	35	0.49	31	0.35
Transition	19.5	0.49	17.5	0.35
Upper Silty Clay	16.5	0.49	15	0.35
Lower Clayey Silt	30	0.49	27	0.35

*-Assumed values (ref. R-22)

4.7.3 Lower Granular Deposit

Underlying the silty clay to clayey silt stratum and overlying the bedrock, a heterogeneous non-cohesive material deposit (varying from silt and sand to sandy silt and gravel) was encountered. Based on SPT N-values ranging generally from 23 to greater than 100, this material is considered to be in a compact to very dense state of compactness. This layer was approximately 0 to 3.1 m thick. The thickness of the layer and state of compactness may vary significantly throughout the project area.

4.7.4 Bedrock

Boreholes TB8-1, TB8-2, TB8-3, NIL T11-1, NIL T11-2, BH-304, CPT-106, CPT-303 and CPT-306 were terminated within the overburden deposits. Boreholes T11-1, T11-2, BH-107 and BH-305 refused on material considered to be bedrock beneath the lower granular deposit or below the silty clay to clayey silt stratum at about elevation 154.3 to 156.0. Where rock coring was undertaken, a white to grey, limestone bedrock was encountered. The bedrock was generally fresh, medium strong, laminated to thinly laminated, fine grained, faintly to highly porous and highly fractured. The RQD of the recovered rock varied between 0 to 100 per cent indicating a very poor to excellent quality. The RQD values generally increased with depth. A sample of the rock core obtained from the Borehole T11-2 was tested in compression to failure. The sample had an unconfined compressive strength of 86.1 MPa. A Rock core sample from Borehole BH-107 was also tested and had unconfined compressive strengths of 44.1 MPa. The results of the compressive strength testing indicate that the limestone rock may be described as "medium to strong" rock.

4.7.5 Groundwater Conditions

The shallower boreholes TB8-1 thru TB8-3 were dry during the relatively short period of time until backfilling. This is consistent with the general low permeability overburden soils at this site

Shallow and deep vibrating wire and standpipe piezometers were installed in selected boreholes to measure the water levels within overburden and bedrock, respectively (Table 4-7-4).

The piezometric levels measured in the clayey silt overburden and the limestone bedrock varied from 182.2 to 184.5 and around 175.6 to 178.4, respectively. The highest piezometric levels within the overburden and the bedrock were recorded at about elevations 184.5 and 178.4, respectively (Table 4-7-4). These observations suggest a slight downward gradient between the overburden and the bedrock. Nevertheless, given the general information within the project area, occurrence of artesian condition in bedrock cannot be entirely ruled out.

Table 4-7-4: TB-8 Summary of Measured Water Levels

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
T11-2	186.0	VWP	178.4	Silty Clay	2011-05-16	184.5
		VWP	167.7	Silty Clay	2011-07-24	183.3
T11-2A	186.0	VWP	155.5	Limestone	2011-05-24	184.1
		VWP	167.7	Silty Clay	2011-08-06	182.4
T11-3A	186.0	VWP	178.4	Silty Clay	2011-05-12	177.2
		VWP	155.5	Limestone	2011-07-24	175.6
BH-107	185.9	S-Piez.	151.5-153	Limestone	2011-05-16	184.5
		S-Piez.	151.5-153	Limestone	2011-07-24	184.0
BH-305	185.9	VWP	150.0	Limestone	2011-05-16	184.0
		VWP	150.0	Limestone	2011-08-06	183.5

Legend: S-Piez Standpipe Piezometer
VWP Vibrating Wire Piezometer

Perched groundwater is known to accumulate seasonally within the upper deposits of fill, topsoil and granular layers, and within the fissures in the silty clay crust. In periods of wet weather, the perched groundwater levels can rise to near the ground surface.

4.8 Subsurface Gases

The groundwater in the project area, especially within the lower granular deposit and bedrock, is known to contain dissolved hydrogen sulphide (H₂S) and methane (CH₄) gases that are liberated from the water on exposure to atmospheric pressure.

The H₂S gas can frequently be detected by odour at concentrations on the order of 0.5 mg/L (ppm) and can be corrosive at concentrations of about 2 to 3 mg/L in the groundwater.

The presence of the gas was not noted by odour during the current drilling program at the pedestrian bridge locations. Although the H₂S and CH₄ gases were not detected during the 2011 geotechnical investigation at the pedestrian bridge sites, their presence cannot be entirely ruled out.

Pumping tests were conducted at three locations across the proposed parkway to determine concentration levels of hydrogen sulphide gas in the groundwater of the area. A summary of the results of these tests is provided in Table 4-8.

Table 4-8: Pumping Tests Data

Test #	Approximate Location	H ₂ S Gas Concentration (mg/L)
TOW-1	East of Tunnel T-10A	<0.2
TOW-2	North of Tunnel T-7	20.0
TOW-3	South of Tunnel T-4	7.0

Dissolved methane was also sampled by Golder (ref. R-13) with most samples below detection (<5 µg/L) with the largest values (up to 485 µg/L) generally measured where artesian conditions occurred. These data are consistent with general water chemistry sampling taken at the end of the pumping tests.

In the case of deep excavations air quality and subgrade pore pressure monitoring should be carried out during construction. The equipment operating in confined spaces should be selected to safely operate in a potentially gaseous environment. Excavation lifts should be decided in consideration of the pore pressure monitoring data and the potential ground softening.

5 Development of Geotechnical Design

It is understood that the pedestrian bridge structures will, in general be a single-span steel truss with concrete deck supported on abutments with shallow spread footing foundations. The south abutment of TB-8 will be located over the RSS fill for the north abutment wall of Tunnel T-11, and therefore will require deep foundations. The general arrangements are shown on the drawings listed below:

- TB-1 Drawing 285380-03-060-WIP2-6101
- TB-2 Drawing 285380-03-060-WIP2-6201
- TB-4 Drawing 285380-03-060-WIP1-6401
- TB-5 Drawing 285380-03-060-WIP1-6501
- TB-7 Drawing 285380-03-060-WIP1-6701
- TB-7A Drawing 285380-03-060-WIP1-6751
- TB-8 Drawing 285380-03-060-WIP1-6801

In most cases RSS wing walls will be constructed at both sides of each abutment. The walls will retain the backfill behind the abutment and will generally blend into the approach embankments, which will have side slopes ranging from 2H:1V to 5H:1V.

5.1 Geotechnical Design Criteria and Considerations

The geotechnical design has been completed in compliance with the requirements of the execution version of the Project Agreement Schedule 15-2 Part 2, Article 5 (PA) for the Parkway project. The foundations' design was carried out following the Limit States Design (LS method) based on Load and Resistance Factors (CHBDC and Canadian Foundation Engineering Manual).

Working Stress Design (WS Method) was employed for global stability of the earthworks, soil mass containing earth retaining structures and the external stability (bearing, sliding and overturning) of the RSS structures. The stability of the soil mass containing the wing-walls was checked for all potential surfaces of sliding to meet the PA requirements.

5.2 Design Soil Properties

The design undrained shear strengths for the silty clay to clayey silt deposit were interpreted from the CPT, DMT and Nilcon vane test profiles and the laboratory test results from the old and new investigations (Figures 3.3a to 3.3g).

Based on in-situ test results, the gradation, in-situ moisture content and strength characteristics, the stratum may be divided into 4 layers as follows: brown desiccated stiff to hard clay crust, transition zone, upper grey silty clay to clayey silt deposit (referred to hereafter as upper silty clay), and then a generally coarser lower grey clayey silt deposit (referred to as lower clayey silt).

The S_u profiles inferred from the CPT and DMT advanced around the pedestrian bridges are shown in Figures 3.3a to 3.3g. Selected typical design values obtained from these profiles and the trends in the subject portion of the Parkway project are summarized in Table 5-1.

Table 5-1: Summary of Interpreted Design Properties of Clay Strata

Structure	Clay Substratum	Elevation Range, m	Undrained Shear Strength (Su), kPa	Effective Strength Parameters	Preconsolidation Pressure (σ_p'), kPa	OCR Range
TB-1	Clay Crust	>177	75	Cohesion, $c' = 0$ Friction Angle, $\phi = 30^\circ$	700 to 525	>4
	Transition	177 to 175	75 to 65		525 to 350	2
	Upper Silty Clay	175 to 163 to 160	65 to 43 to 50		265 to 350	1.5
	Lower Clayey Silt	160 to <159	50 to 75		265 – 400	1.2
TB-2	Clay Crust	>177	75	Cohesion, $c' = 0$ Friction Angle, $\phi = 30^\circ$	500	>5
	Transition	177 to 175	75 to 55		325 to 500	>2.5
	Upper Silty Clay	175 to 161	55 to 40 to 47		225 to 325	1.1 to 2.8
	Lower Clayey Silt	161 to 150	47 to 75		260 to 400	1.2 to 1.3
TB-4	Clay Crust	>177	75	Cohesion, $c' = 0$ Friction Angle, $\phi = 30^\circ$	550	>9
	Transition	177 to 175	75 to 60		550 to 350	7
	Upper Silty Clay	175 to 166	60 to 45		350 to 230	2.8
	Lower Silty Clay	166 to 163	45 to 50		230 to 260	1.3
	Upper Clayey Silt	163 to 160	50 to 65		260 to 400	1.5
	Lower Clayey Silt	160 to 150	65		400	1.4
TB-5	Clay Crust	181 to 177	75	Cohesion, $c' = 0$ Friction Angle, $\phi = 30^\circ$	550	>5
	Transition	177 to 175	75 to 65		350 – 550	>3
	Upper Silty Clay	175 to 163	65 to 44 to 50		220 to 350	1.15 to 2.1
	Lower Clayey Silt	163 to 151	50 to 65		260	1.3 to 1.4
TB-7 (north side of Tunnel T-9)	Clay Crust	>178	75	Cohesion, $c' = 0$ Friction Angle, $\phi = 30^\circ$	600	>4
	Transition	178 to 175	75 to 50		600 to 300	3
	Upper Grey Silty Clay	175 to 166	50		300	1.5
	Mid Grey Silty Clay	166 to 163	50 to 60		300 to 335	1.2
	Lower Grey Clayey Silt	163 to 155	60 to 100		325 to 500	1.5
TB-7A	Clay Crust	>178	75	Cohesion, $c' = 0$ Friction Angle, $\phi = 30^\circ$	450 to 650	>4
	Transition	178 to 175	55 to 75		325 to 450	2
	Upper Silty Clay	175 to 163	52 to 55		325 to 240	1.5
	Lower Clayey Silt	163 to 155	55 to 100		400 to 500	1.2
TB-8	Clay Crust	186 to 181	75	Cohesion, $c' = 0$	600 to 650	>4
	Transition	181 to 176	75 to 50		600 to 300	2.5

Structure	Clay Substratum	Elevation Range, m	Undrained Shear Strength (S_u), kPa	Effective Strength Parameters	Preconsolidation Pressure (σ'_p), kPa	OCR Range
	Upper Silty Clay	176 to 163	50 to 57	Friction Angle, $\phi = 30^\circ$	300 to 325	1.2 to 1.5
	Lower Clayey Silt	163 - 160	100		550	1.5

5.3 Excavation and Temporary Cut Slopes

The discussion of the temporary slopes in this report relates only to the anticipated subsurface conditions to assist the designer of temporary works and as they affect the design of the tunnel foundation. The shapes and slopes of the temporary excavations shown in this report do not constitute the recommended design of the temporary slopes. The Contractors are fully responsible for the design, construction methods and performance (stability, deformability and deterioration) of the temporary slopes. The Contractors also must ensure that the temporary slopes meet the Project Agreement criteria and the needs to accommodate the construction of the structure as per design.

The excavations are expected to encounter surficial fills, topsoil and water bearing upper granular soils and will be extended into the native stiff clayey silt to silty clay. The anticipated bearing elevations will vary from elevation 179.2 to 185.8 m, with a maximum excavation depth of about 4 m.

5.4 Shallow Foundations

5.4.1 General

All topsoil, disturbed soils and other deleterious materials must be completely removed from the footprint area of the structure foundation. The exposed subgrade should be inspected and upon approval, a subgrade protection layer comprising at least 75 mm of lean concrete over the areas of cast-in-place foundation should be placed the same day as excavated.

In accordance with MTO-SDO-90-01 Pavement Design and Rehabilitation Manual (ref. R-23) and OPSD 3090.101, the frost depth below the ground surface in Windsor area is estimated to be 1.0 m. This estimate is considered applicable for natural soils and/or conventional pavement materials where the ground surface is usually cleaned from the snow cover. Foundation soils should be protected from frost penetration by a minimum 1.0 m of earth cover. In the case of rip/rap, or otherwise coarse rockfill cover, the insulation effects of such materials are considered to be one half of the insulation offered by soil deposits /cover, and the depth of frost penetration will have to be increased proportionally. Where sufficient soil cover for subgrade protection is not available, equivalent synthetic insulation may be used.

The excavations and foundation grades should be inspected in accordance with OPSS 902. Any low areas should be brought to grade with lean concrete fill, or approved soil backfill, as directed by the engineer. Depending on the site conditions, the use of geofabric may be required where soil backfilling is approved for subgrade corrections.

5.4.2 Bearing and Sliding Resistance

Preliminary load combinations and foundation sizes were outlined in a portable data format (.pdf) file received from HMM on 19 June 2013 and subsequent update for TB-7 East abutment of July 4, 2013. The foundation and load configurations provided are included in Appendix F. Based on the preliminary structural design information provided, AMEC calculated the factored foundation pressures for each load combination, from which the following were determined:

- Net factored geotechnical resistance at Ultimate Limit State (ULS) and associated stress ratio, r , of the geotechnical ULS resistance vs. applied factored loads (similar to a “factor of safety” relative to the design foundation pressures).
- Preliminary soil reaction at Serviceability Limit State (SLS) and associated stress ratio, r , of the geotechnical SLS reaction vs. applied unfactored loads.
- Factored undrained (short-term) geotechnical horizontal (sliding) resistance for the most severe load combination and associated stress ratio, r , of the geotechnical ULS resistance vs. applied factored loads.

Base Sliding:

The geotechnical horizontal resistance at ULS (H_{ULS}) can be determined in accordance to the following expression:

$$H_{ULS} = \Phi(A'c' + V\tan\delta) > H_f$$

Where:

Φ	= resistance factor of 0.8 per CHBDC
A' (m^2)	= effective contact area of the base;
c' (kPa)	= cohesion/adhesion at sliding interface;
δ ($^\circ$)	= friction angle at sliding interface (usually equal to ϕ defined in Table 5-1) ;
V (kN)	= unfactored vertical force (kN); and
H_f (kN)	= factored horizontal load.

The approximate locations, foundations sizes and bearing elevations are summarized in Table 5-2, with the findings of the above analyses. Table 5-3 presents AMEC's remarks on the findings for each structure.

In general, the preliminary structural foundation designs require adjustments to meet the geotechnical limitations of the site. In most cases acceptable solutions may be obtained by decreasing the loads (such as by using lightweight materials for the retained fill), increasing the footing length and/or width, or raising the bearing elevation. Alternatively deep foundations may be required. Recommendations for pile foundations are presented in Section 5.5.

In the case of the west abutment for TB-8, the foundation will be located above the reinforced soil structure (RSS) wall for the north abutment of Tunnel T-11; therefore deep foundations will be necessary in order to transfer structural loads below the tunnel abutment. Preliminary recommendations in this regard are presented in Section 5.5.

Table 5-2: Geotechnical Analysis for Trail Bridge Foundations

Structure	Structure Type	Preliminary Footing Size (W x L) (m) ⁽³⁾	H (m) ⁽¹⁾	PFE ⁽³⁾	Local BHs	GSE ⁽²⁾	GWE ⁽²⁾	Foundation Soils ⁽⁴⁾	Design S _u (kPa) ⁽⁴⁾	q _{SLS} (kPa) ⁽⁵⁾	Net Factored q _{ULS} (kPa) ⁽⁶⁾	r _{ULS} Bearing ⁽¹⁰⁾	H _{st} (kN) ⁽⁷⁾	r _{ULS} Sliding	r _{SLS} Bearing
TB-1	North Abutment ⁽⁹⁾	4.3 x 6.4	5.6	181.0	TB1-1, TB1-2	182.0	180.5	Fill over Stiff Clayey Silt	80	135	205	0.8 – 1.05	1260	>1	>1
	South Abutment ⁽⁸⁾	5.1 x 7.0	5.9	180.0	TB-1, TB-2	181.5	18.5	Fill over Stiff Clayey Silt	80	135	205	0.8 – 0.91	1700	<0.95	>1
TB-2	West Abutment ⁽⁹⁾	4.3 x 6.4	7.0	180.1	TB2-1, TB2-2	182.0	180.3	Loose wet Silt over Clayey Silt	73	125	190	0.65 – 0.82	1100	>1	0.88
	East Abutment ⁽⁸⁾	5.1 x 7.0	7.0	181.0	TB2-1, TB2-2	182.5	180.3	Loose wet Silt over Clayey Silt	73	125	190	0.56 – 0.65	1340	<0.55	1.05
TB-4	West Abutment ⁽⁸⁾	5.1 x 7.0	5.7	180.0	TB4-1, TB4-2	181.0	180.8	Firm to very stiff Clayey Silt	80	135	205	0.9 – 1.0	1790	≥1.00	>1
	East Abutment ⁽⁸⁾	5.1 x 7.0	5.0	179.2	TB4-1, TB4-2	181.0	180.8	Firm to very stiff Clayey Silt	80	135	205	0.99 – 1.06	1860	>1	>1
TB-5	West Abutment ⁽⁹⁾	4.3 x 6.4	7.6	180.9	TB5-1, TB5-2	181.0	181.0	Fill, topsoil, over stiff Clayey Silt	80	135	205	0.91 – 1.07	1260	>2	>1
	East Abutment ⁽⁹⁾	4.3 x 6.4	6.5	180.9	TB5-3, TB5-4	181.5	181.0	Topsoil, loose wet Sand over stiff Clayey Silt	80	170	205	0.94 – 1.25	1300	>2	>1
TB-7	West Abutment ⁽⁹⁾	5.9 x 7.8	6.5	182.0	TB7-1, TB7-2	184.0	183.9	Stiff Clayey Silt	90	155	230	>1	3030	>2	>1
	East Abutment ⁽⁸⁾ (Geometry II)	5.4 x 7.0	5.6	183.4	TB7-3, TB7-4	185.0	183.9	Fill over firm over very stiff Clayey Silt	90	155	230	> 1	2345	>1	>1
TB-7A	North Abutment ⁽⁸⁾	1.9 x 6.2	2.0	183.1	TB7A-1	184.8	183.8	Topsoil over firm over very stiff Clayey Silt	90	155	230	0.59 – 0.94	175	>1	~1
	South Abutment ⁽⁸⁾	1.9 x 6.2	2.0	183.1	TB7A-1	184.8	183.8	Topsoil over firm over very stiff Clayey Silt	90	155	230	0.59 – 0.94	175	>1	~1
TB-8	West Abutment	4.3 x 6.4	7.5	184.2	TB8-3	186.0	184.5	Backfill at T-11 North Abutment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TB-8	East Abutment ⁽⁸⁾	5.1 x 7.0	4.9	185.8	TB8-1	187.5	184.5	Topsoil over firm over very stiff Clayey Silt	110	170	280	>1	2460	>1	>1

Table Notes:

- 1) Approachway Height Above Existing Ground Surface Based on General Arrangement Drawings provided by HMM
- 2) Ground Surface Elevations (GSE) and Groundwater Elevation (GWE) Inferred from closest boreholes
- 3) Proposed Foundation Elevations (PFE) Based on information provided by HMM
- 4) Within zone of influence
- 5) Preliminary SLS soil resistance, calculated using the conventional factor of safety FS = 3 applied to the ultimate bearing capacity. SLS reaction for allowable post-construction settlement will differ and be established for final configuration and specified acceptable deformations.
- 6) Uncorrected Net Factored ULS resistance for undrained (short-term) conditions and vertical loads. ULS resistance increases with footing embedment with a rate of 20 kPa for each 1 m embedment. Must be corrected for load inclination, footing shape and embedment.
- 7) Factored undrained (short-term) geotechnical horizontal (sliding) resistance for most severe load combination. No allowance for embedment is included.
- 8) Preliminary foundation design loads provided by HMM considered use of soil backfill. In cases where the available geotechnical resistance has been exceeded, additional lightweight materials may be required within abutment and approachway backfill to reduce the design loads on the abutment. See remarks in Table 5-3.
- 9) Preliminary foundation design loads provided by HMM considered use of lightweight materials (EPS) within approachway backfill. In cases where the available geotechnical resistance has been exceeded, additional lightweight materials may be required within abutment and approachway backfill to reduce the design loads on the abutment. See remarks in Table 5-3.
- 10) r_{ULS} calculations considered corrections to bearing capacity for shape, depth and inclination.

Table 5-3: General Geotechnical Comments and Recommendations for Trail Bridge Foundations

Structure	Structure Type	Remarks
TB-1	North Abutment	<ol style="list-style-type: none"> Expanded polystyrene blocks (EPS)indicated for the approachway for global stability purposes Fill possible at PFE; if present, must be removed to exposed stiff to very stiff native soils. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill Conventional footings are feasible subject to increasing the footing size and decreasing the loads by the use of EPS or cellular concrete (CC) within abutment backfill For global stability requirements refer to Section 5.4.3. and Figures D.1
	South Abutment	<ol style="list-style-type: none"> Fill, possible at PFE; if present, must be removed and replaced by lean concrete/ grout fill/engineered granular fill Conventional footings are feasible subject to increasing the footing size and decreasing the loads For global stability requirements refer to Section 5.4.3 and Figures D.4 While no EPS is necessary in general approachway (see Fig. D.12), some EPS or CC will be required within abutment and approachway backfill to reduce the design loads on the abutment
TB-2	West Abutment	<ol style="list-style-type: none"> EPS indicated for the approachway for global stability purposes Shallow loose wet silt, possible PFE; if present, must be removed to expose stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/ engineered granular fill Conventional footings are only marginally feasible subject to increasing the footing size and decreasing the loads. The use of EPS and / or CC in the abutment backfill and approachway required to meet the bearing and sliding resistances For global stability requirements refer to Section 5.4.3 and Fig. D.16 that indicates that Global stability is NOT satisfied with the proposed configuration EPS or CC required within abutment backfill to limit the operation average bearing pressures to approx. 125 kPa.(Figure D.16A)
	East Abutment	<ol style="list-style-type: none"> Shallow loose silt, possible at PFE; if present, must be removed to expose stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill Conventional footings are only marginally feasible subject to increasing the footing size, and decreasing the loads. The use of EPS and / or CC in the abutment backfill and approachway required to meet the bearing and sliding resistances For global stability requirements refer to Section 5.4.3.and Figures D.13 that indicates that global stability is satisfied with the proposed configuration EPS required in approachway and backfill (Figures D.28 through D.31) for global stability purposes
TB-4	West Abutment	<ol style="list-style-type: none"> Topsoil/Fill or firm native possible at PFE; if present, must be removed to expose stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill Conventional footing likely feasible with some adjustments (footing size and weight)
	East Abutment	<ol style="list-style-type: none"> Topsoil/Fill or firm native possible at PFE; if present, must be removed to expose stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill Conventional footing likely feasible with adjustments (footing size and weight)
TB-5	West Abutment	<ol style="list-style-type: none"> EPS indicated for the approachway for global stability purposes Fill/topsoil, likely at PFE; if present, must be removed to expose stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill Conventional footings are feasible subject to increasing the footing size and/or decreasing the loads. The use of EPS and / or CC in the abutment backfill and approachway required to meet the bearing and sliding resistances. For global stability requirements refer to Section 5.4.3 and Figure D.39 that indicates that Global stability is NOT satisfied with the proposed configuration. EPS or CC most likely required within abutment backfill to limit the operation average bearing pressures to approx. 115 kPa (Figure D.40)
TB-5	East Abutment	<ol style="list-style-type: none"> EPS indicated for the approachway for global stability purposes Shallow loose wet sand, likely at foundation level; if present, must be must be removed to expose stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill Conventional footings are feasible subject to increasing the footing size and/or decreasing the loads. The use of EPS and / or CC in the abutment backfill and approachway required to meet the bearing and sliding resistances For global stability requirements refer to Section 5.4.3 and Figure D.38. Global stability will be highly dependent on final design grading of the spill slopes and side slopes. EPS or CC may be required within abutment backfill
TB-7	West Abutment	<ol style="list-style-type: none"> Stiff native soil at PFE (182) to be adequately protected Conventional footings feasible
	East Abutment	<ol style="list-style-type: none"> Topsoil/Fill or firm native possible at PFE; if present, must be removed to expose very stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill Conventional footings are feasible. For global stability refer to Section 5.4.3.
TB-7A	North Abutment	<ol style="list-style-type: none"> HWL in drain at 183.59 m. Scour protection required Topsoil/Fill or firm native possible at PFE; if present, must be removed to expose very stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill Conventional footing feasible with significant adjustments (footing size and weight)

Structure	Structure Type	Remarks
	South Abutment	<div><div>1. HWL in drain at 183.59 m. Scour protection required</div><div>2. Topsoil/Fill or firm native possible at PFE; if present, must be removed to expose very stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill</div><div>3. Conventional footing feasible with significant adjustments (footing size and weight)</div></div>
TB-8	West Abutment	<div><div>1. EPS indicated for the approachway</div><div>2. Foundation over RSS wall for north abutment of T-11, therefore deep foundations required</div></div>
	East Abutment	<div><div>1. HWL in drain at 184.64 m. Scour protection required.</div><div>2. Conventional footing feasible</div><div>3. Topsoil/Fill or firm native possible at PFE; if present, must be removed to expose very stiff native clayey silt. Subexcavations must be replaced by lean concrete/ grout fill/engineered granular fill</div></div>

5.4.3 Global Stability of Abutment Foundations

Slope stability analyses (Limit Equilibrium) were carried out using SLOPE/W Version 2007 and the Morgenstern-Price method of analysis.

The global stability analyses were carried out for short-term end of construction (EOC) and long-term steady state (LT) loading conditions using the design soil properties discussed in Section 5.2. Surcharge of 9 kPa for short term and long-term model was applied at the top of the ground surface to live load. A tension crack was assumed for the undrained condition only.

The calculated factor of safety (FS) exceed 1.3 against global instability of the abutment foundations in the longitudinal (direction of the approachways) and transverse (perpendicular to approachways) directions, as shown in Appendix D and are summarized in Table 5-4.

Table 5-4: Results of Global Stability Analyses

Structure	Direction of Analysis ⁽¹⁾	Factor of Safety ⁽²⁾		Figure No.	Remarks
		Short Term Undrained	Long Term Drained		
TB-1 North Abutment	transverse	1.3 (1.4)		D.1	
	longitudinal	3.6 (4.3)	2.1 (2.4)	D.2, D.3	
TB-1 South Abutment	transverse	1.4 (1.6)		D.4	
	longitudinal	2.4 (3.5)	1.6 (2.0)	D.5, D.6	
TB-2 East Abutment	transverse	1.4 (1.5)		D.13	
	longitudinal	2.4 (3.5)	1.9 (2.6)	D.14, D.15	
TB-2 West Abutment	transverse	1.1 (1.3)		D.16, D.16A	Global stability is NOT satisfied for the preliminary foundation design (see Fig. D.16). Footing pressure should be limited to operating average value of 125 kPa (see Fig. D.16A).
	longitudinal	4.6 (8.1)	3.1 (4.3)	D.17, D.18	
TB-4 East Abutment	longitudinal	2.7 (4.2)	1.6 (2.1)	D.32, D.33	
TB-4 West Abutment	transverse	1.9 (4.8)		D.34	
	longitudinal	2.1 (3.1)	1.5 (1.9)	D.35, D.36	
TB-5 East Abutment	transverse	1.3 (1.4)		D.38	
	longitudinal	2.5 (2.7)	1.6 (2.0)	D.43, D.44	

Structure	Direction of Analysis ⁽¹⁾	Factor of Safety ⁽²⁾		Figure No.	Remarks
		Short Term Undrained	Long Term Drained		
TB-5 West Abutment	transverse	1.2 (1.3)		D.39, D.40	Global stability is NOT satisfied for the preliminary foundation design (see Fig. D.39). Footing pressure should be limited to operating average value of 115 kPa (see Fig. D.40).
	longitudinal	4.7 (5.1)	3.0 (3.6)	D.41, D.42	Lightweight materials required for global stability of Trail 25 retaining wall (see Fig. D.49)
TB-7 East Abutment	transverse	2.2 (2.9)		D.56	
	longitudinal	2.6 (3.2)	1.8 (2.1)	D.57, D.58	
TB-7 West Abutment	longitudinal	1.7 (2.0)	1.4 (1.5)	D.59, D.60	
TB-7A South Abutment	transverse				not analyzed (longitudinal direction more critical due to Tunnel T-10 abutment)
	longitudinal	1.3 (1.4)		D.67	
TB-7A North Abutment	transverse				not analyzed (longitudinal direction more critical due to Wolfe Drain)
	longitudinal	4.2 (4.9)	1.5 (1.7)	D.68, D.69	
TB-8 East Abutment	transverse	2.0 (4.4)		D.71	
	longitudinal	1.5 (1.8)	1.5 (1.6)	D.72, D.73	east abutment to be founded on piles (see Section 5.5)

Table Notes

- 1) Transverse indicates the direction perpendicular to the approach embankment. Longitudinal is in the direction of the approach embankment.
- 2) Values in parentheses refer to factor of safety for circular failure surface.

5.4.4 Stress-Deformation Analysis of Abutment Foundations

Settlement at the abutment foundations was estimated using the “elastic” soil properties estimated from the correlations described in Section 4 and the preliminary structural design information provided by HMM.

Stress-deformation analyses (SDA) were also carried out for select sections of the approachway embankments using the finite element modeling (SIGMA/W software Version 2007). The main purpose

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of the SDA was to assess the deformations of the soil mass supporting and surrounding the bridge structures.

The calculation model assumed the following loading steps:

- a) Definition of the initial (in-situ) stress condition for level ground assuming an average bulk unit weight of 21 kN/m^3 and an at-rest earth pressure coefficient K_0 of 0.75 (based on published data [ref. R-3] and confirmed by DMT at the site) for the soil deposit; and
- b) Dissipation of excess pore pressure leading to long-term steady state condition.

The stratigraphy and selection of the soil properties was based on the design soil properties discussed in Section 5.2.

The SDA were carried out using an effective stress-based model. The phreatic surface was assumed to correspond to the initial groundwater level at elevation at each specific site and, where applicable, follows the permanent cut surfaces (as the bottom of the drain channels) Elastic-plastic Mohr-Coulomb models were used for all native soil layers except the unweathered firm to stiff silty clay, which was described by the Modified Cam-Clay model. Hydraulic conductivity properties described in the geotechnical reports for the permanent cuts Phase I and Phase II (Geocres #40J3-13 and #40J3-22) were assigned to the different soil layers.

The immediate and long-term post-construction settlements of the bridge abutments will be strongly influenced by the construction staging and timeline in relation with the timing and progress of the nearby approachway embankments and completion of the main nearby tunnels. The geotechnical design approach was based on the following assumed construction staging applicable to all the trail bridges with high approachway embankments:

- a) Before any trail load is placed, the nearby main tunnel structures are first substantially completed, including the base and subbase granular layers over the Hwy 401 subgrade. This condition is critical to ensure the undrained (short-term) global stability for the tunnel abutments.
- b) The trail embankments are substantially completed before the construction of the bridge abutments. This condition is intended to avoid immediate settlements of the abutments caused by the fill placement in the approachway embankments.
- c) Temporary surcharge with fill beyond the footprint of the future abutments is desirable to take place as long before the abutment construction as practical. The surcharge levels should be as large as possible without exceeding though the limits imposed by the global stability of the nearby tunnel abutments.
- d) The construction of the bridge abutments is scheduled after Stage c) above.

The examination of the settlement and SDA analyses in conjunction with the assumed construction staging discussed above led to the estimations regarding the settlements of the bridge abutments presented in Table 5-5, below.

Table 5-5: Estimated Immediate Settlement at Bridge Abutments

Structure	Abutment	SLS Foundation Average Bearing Pressure, kPa ⁽¹⁾	Average Elastic Modulus (E), MPa	Immediate Settlement, mm	Post-construction settlements (Consolidation Settlements) (mm)
TB-1	East	133	20.3	<30	< 50
	West	167	23.1	<25	<50
TB-2	East	145	21.2	<25	<50
	West	167	20.8	<25	<50
TB-4	East	123	19.0	<30	<30
	West	128	19.0	<30	<30
TB-5	East	143	23.0	<30	<50
	West	147	23.0	<25	<50
TB-7	East	141	24.3	<30	<20
	West	155	18.5	<35	<20
TB-7A	North	118	31.0	<15	Nominal
	South	118	31.0	<15	Nominal
TB-8 ⁽²⁾	East	124	23.7	<35	<20

1) Foundation bearing pressure is determined from foundation dimensions and SLS load combinations provided by HMM

2) South abutment for TB-8 will be on deep foundations and therefore is not included.

All the ground movement and deformations discussed above are estimates based on soil deformation/compressibility properties interpreted from laboratory tests and empirical correlations. Therefore, the reported values are approximate and should be considered only as an indication of the magnitude of the soil response. These estimates should be verified and refined with respect to the actual performance monitoring in the field.

5.5 Pile Foundations

The present discussion is limited to the specific case of TB-8 west abutment where the use of end bearing driven piles is anticipated due to overlapping on the footing in approved backfill behind the RSS abutment of Tunnel T-11. In the unlikely case that piles will be considered at other locations, additional recommendations can be developed on a case-by-case basis.

5.5.1 Resistance to Axial Loads

HP310x110 steel H piles have been used thus far at this project. Therefore, the same type of piles is anticipated for TB-8. Based on geotechnical investigation and confirmation from a limited number of static and dynamic tests, these piles driven to bedrock as per OPSS 903 are capable to mobilize an ultimate axial geotechnical resistance in excess of 4000 kN. Accordingly, a factored Ultimate Limit States (ULS) resistance of at least 2000 kN is anticipated. The appropriate pile driving equipment and installation procedure should be established in the field in conjunction with Pile Driving Analyzer (PDA) testing to determine the hammer performance and appropriate driving criteria (set).

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The Serviceability Limit State (SLS) resistance of the HP310x110 piles, based on the conventional 25 mm settlement, is estimated to exceed the ULS resistance due to the unyielding nature of the bearing surface. Hence, the SLS resistance is determined by the elastic characteristics of the pile shaft.

Based on the available borehole data at these structures, the bedrock surface elevation varies between 154.3 and 156.0, where the tips of piles are anticipated to be set. In cases where some of the piles cannot be driven to bedrock due to presence of dense till lying immediately above the bedrock and a perceived risk of damaging the piles by overdriving is apparent, consideration should be given to supplementing the field testing to prove the actual mobilized resistance. If lower mobilized pile resistances are proven, options based on the most economical approaches may be considered (e.g., changes to the driving method and equipment, or addition of more piles).

The following general pile installation recommendations should be considered:

- The location of the piles must be carefully determined to avoid disturbance to the RSS abutment and existing utilities.
- The steel H piles should be installed and monitored in accordance with OPSS 903 requirements. The piles should be reinforced with Type I shoe flanges as shown in OPSD 3000.100, or approved alternatives.
- Survey of all the pile head elevations should be completed at the end of driving and just prior to forming the pile cap. Re-tapping of the piles will be necessary where uplift exceeding 5 mm is noted, or as directed by engineer.
- While unlikely to occur at this site, considering the general geologic conditions in the region, indications of natural gas venting, water, and fines washout should be monitored during driving. Provision to mitigate such occurrences (by heavy mud, grouting of the cavities, etc.) should be in place. It is recommended that the pile splicing be completed by butt-welding (OPSD 3000.150, Section A-A) to minimize the pathways for upward flow of artesian water along the piles to the surface.
- Consideration should be given to potential driving difficulties due to the presence of dense to very dense lower granular soils and potential presence of cobbles and boulders above the bedrock.
- Adequate hammers should be used to ensure the mobilization of the design ultimate geotechnical resistance and prevent damages to the piles during driving.
- Vibrations generated by piling should be monitored. It is not expected that the vibrations during piling will have a significant impact on the stability of temporary slopes and nearby utilities and RSS abutment. Nonetheless, if the vibration intensities at the toe and top of the slopes exceed 10 mm/s, appropriate mitigation measures (slope flattening or vibration dampening by dumping sand around the piles) should be considered.
- Noise monitoring should be carried out during pile driving at the site.

5.5.2 ULS and SLS Resistance to Lateral Loads

The ULS and SLS geotechnical resistances to lateral loads should be determined on the basis of field load tests. Both the ULS and SLS lateral load resistances are strongly dependent on the soil properties, structural configuration of the pile and pile foundation, load configuration and deformations.

The SLS geotechnical resistance to lateral loads is dependent on the acceptable levels of the lateral pile deflections under the design loads and should be obtained on the basis of field load tests. In the absence of field tests, the preliminary design may be based on a reference SLS resistance of 70 kN along the strong axis, and 50 kN along the weak axis of the HP310x110. This reference SLS resistance represents the lateral shear force applied on a free-head pile that causes a lateral deflection of 10 mm measured at the ground surface.

The ULS lateral resistance is defined as the lateral force applied to the pile shaft causing unstabilised pile displacements due to soil failure or pile structural failure. In the absence of field tests, the ULS lateral resistance may be assumed as 220 kN, and 105 kN along the strong axis and weak axis, respectively.

The above estimates were based on a pile model assumed to be embedded within clay backfill from underside of pile cap at approximately elevation 184 and stiff silty clay below elevation 178. The above resistances were estimated using the “p-y” model (LPile 5.0 model Ensoft 2010). The “p-y” curves were generated using the Reese method described in the Technical manual for LPILE, using the Reese “Stiff-Clay without free water” model in conjunction with the following soil parameters described in Tables 5-6 and 5-7. As mentioned earlier, the SLS criterion was set to 10 mm lateral deflection at the assumed ground surface. The ULS criterion for the above modeling was set at the onset of the plastic yielding in the pile section subjected to an induced bending moment.

Table 5-6: Soil Parameters for Pile Interaction Assessment within Native Clayey Silt Soils

Soils Around the Piles	Elevation	Design Bulk Unit Weight (kN/m ³)	Undrained Shear Strength, S_u (kPa)	ϵ_{50} ⁽¹⁾
Clay Crust	186 to 181	22	75	0.005
Clay Transition	181 to 176	22	75 to 50	0.005 to 0.007
Upper Grey Silty Clay	175 to 166	20.5	50	0.010
Mid Grey Silty Clay	166 to 163	20.5	50 to 60	0.010 to 0.007
Lower Grey Silty Clay	163 to 152	20.5	60 to 100	0.007

Table Notes:

- 1) ϵ_{50} = Soil axial strain at 50% of the maximum deviatoric stress determined from undrained triaxial compression tests or estimated from correlations between S_u and ϵ_{50} .

Table 5-7: Fill Properties for Pile Interaction Assessment within Backfill

Material	Soil Model in L-Pile	Effective Unit Weight, kN/m ³	Undrained Shear Strength, kPa
Approved Fill	Reese "Stiff Clay without free water"	21	50

The actual SLS and ULS lateral resistances will increase in the case of piles with structural restraints at the pile head due to embedment within the pile caps. Both the ULS and SLS lateral loads resistances are also strongly dependent on the structural and load configuration and on the acceptable deformations.

It should be noted that during driving, significant soil disturbance and damage occur around the pile shaft forming sizeable gaps between the pile and the surrounding soils. These gaps cause significant reduction of the actual SLS and ULS resistances. Where the design relies on the lateral resistance provided by the soils, "repairs" to the disturbed soils must be undertaken (typically, the voids are grouted using non-shrink fills).

Significant lateral loads in excess of the preliminary values previously cited should be resisted fully or partially by the use of battered piles. For ease of constructability and to ensure hammer energy sufficient for pile driving, batters are usually limited to no steeper than 1H:5V.

The stress-deformation analysis of the piles to lateral loads may be carried out using one of the following methods.

Horizontal Subgrade Reaction Method:

The coefficient of horizontal subgrade reaction, k_h , may be based on the following equations:

$$k_h = n_h \left(\frac{z}{d} \right) \quad \text{for cohesionless soils, and}$$

$$= 67 \left(\frac{S_u}{d} \right) \quad \text{for cohesive soils.}$$

Where:

k_h (MPa/m) = Soil modulus of horizontal subgrade reaction

n_h (MPa/m) = Soil coefficient

S_u (MPa) = Undrained shear strength

z (m) = Depth below finished grade

d (m) = Pile diameter/width

The recommended overburden and fill soil parameters are tabulated in Tables 5-6 and 5-7.

Group action for lateral loading should be considered when the pile spacing in the direction of the loading is less than eight pile diameters. Group action may be evaluated by reducing the coefficient of lateral subgrade reaction in the direction of loading by a reduction factor indicated in Table 5-8. Subgrade reaction reduction factors for other pile spacing values may be interpolated for pile spacing in between those listed here.

Table 5-8: Lateral Load Capacity Reduction Factors for Pile Groups using the Horizontal Subgrade Reaction Method

Pile Spacing in Direction of Loading	Subgrade Reaction Reduction Factor
8d	1
6d	0.7
4d	0.4
3d	0.25

d = pile diameter

Reference: Foundations and Earth Structures – Design Manual 7.2, NAVFAC DM-7.2, Department of the Navy, Naval Facilities Engineering Command (1986).

Alternative Nonlinear ‘p-y’ Curve Method:

Alternative pile design methods may be considered using the nonlinear ‘p-y’ interaction method and elastic continuum theory as discussed in the Canadian Foundation Engineering Manual (ref. R-4).

The p-y curves describe the lateral soil resistance along the pile depth. For each soil layer along the pile shaft, the p-y curves describe lateral soil pressure ‘p’ (kPa) per unit length mobilized by the pile lateral deflection ‘y’ (m). Where only pile head loads are applied and there are no lateral movements of the surrounding soil mass, ‘y’ is the absolute lateral deflection. Where lateral ground movements occur, ‘y’ is the relative movement between the pile and the soil. The ‘p-y’ curves reflect the non-linear soil behaviour under moderate to high stress levels where the more traditional elastic modeling of the soil response is considered to be insufficient.

The general procedure for computing p-y curves is summarized in the Canadian Foundation Engineering Manual (ref. R-4). A detailed description for the generation of the ‘p-y’ curves can be found in the Technical Manual for the commercial software LPILE Plus by Ensoft Inc. (ref. R-8). For a given foundation configuration, pile size, and soil stratification, the soil properties required for the generation of the p-y curves are provided in Tables 5-6 and 5-7. “Stiff clay” ‘p-y’ curves as given in the LPILE manual should be developed appropriate for either static or cyclic loading conditions in absence of free water. For ‘p-y’ curves below the water table, submerged unit weights in the soil mass shall be used. The obtained ‘p-y’ curves may need to be scaled by a factor (“modifier”) to account for batter and for group effects. The modifier factor applies to the “p” values.

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In the case of group of piles, the modifier factors for the p-y curves are calculated as follows:

$$F_{mi} = \prod \beta_{ki}$$

where :

β_{ki} = the influence factor of pile 'k' in the group on pile 'i', with $k \neq i$, and is calculated with one of the following expressions depending on the relative position of pile 'k' in the group with respect to pile 'i' (Table 5-9).

Table 5-9: Lateral Load Capacity Reduction Factor For Pile Groups using Nonlinear 'p-y' Curve Method

Relative Pile Position	Pile Spacing Ratio, s/d	β_{ki}
In Row (perpendicular to the load direction)	< 3.75	$0.64(s/d)^{0.34} \leq 1$
Leading pile in Line (first pile in line parallel to the load direction)	≤ 4	$0.70(s/d)^{0.26} \leq 1$
Trailing piles in line (piles behind the leading pile)	≤ 7	$0.48(s/d)^{0.38} \leq 1$

The space between the piles under the abutments has not been determined at the time of issuance of this report.

LPILE software and other similar products provide automatic generation of the 'p-y' curves along with the stress-deformation calculation of a pile subjected to various lateral loads applied at the pile cap and/or along the pile shaft, and various boundary conditions at the pile head and / or along the pile shaft.

5.5.3 Soil Pile Interaction Assessment

Downdrag Loads (Negative Skin Friction – NSF):

Potential for downdrag loads on piles was considered in conjunction with the anticipated ground movements (rebound and settlements) that are assumed to occur during and following excavation of the overburden of up to 9 m to accommodate the future depressed highways, followed by partial re-placement of fills to construct the tunnel T-11 abutments. Piles for the west abutment of TB-8 will be driven through the backfill of the T-11 north abutment.

Soil stress-deformation analyses described in the T-11 geotechnical report (Doc. No. 285380-04-119-0014) were conducted using the SIGMA/W software.

The analyses indicated the following:

- Ground settlements is expected to occur along the pile shaft occur during construction of the RSS, tunnel and completion of the associated backfill and continue for long-term; and

- Ground rebound is expected to occur along Highway 401 after the substantial completion of the ground surface loading.

Considering that TB-8 foundations will be constructed following construction of the RSS, tunnel but before the placement of the final backfill above the abutment the design should consider a potential downdrag load of 640 kN.

In accordance with the Canadian Foundation Engineering Manual (ref. R-4), the service loads should not be reduced by any portion of the drag loads unless required by insufficient structural strength of the pile. Downdrag load and live load do not combine and two separate loading cases should be considered:

- Dead load plus downdrag load (but no transient live load); and
- Dead load and live load (but no downdrag load).

Pile Shaft Bending:

The approach to estimate the pile shaft bending caused by deforming soil mass surrounding the piles was as follows:

- The ground lateral movement along the pile shaft anticipated to occur after the installation of the piles was estimated in the design report for Tunnel T-11 using the stress-deformation analysis described above in Section 5.4.4.
- The pile head was assumed to be a free head.
- The above soil deformation field was imposed as “loads” along the pile shaft. The calculation was conducted using the “p-y” model (LPile 5.0 model Ensoft 2010). The “p-y” curves were generated using the Reese method described in the Technical manual for LPILE, using the soil parameters indicated in Tables 5-6 and 5-7.
- The shear force, bending moment and displacement along the pile shaft were calculated using the LPile software.

Based on the above approach and the anticipated lateral ground displacement, the estimated maximum unfactored bending moment in the shaft for the strong axis pile loadings were 40 kN-m and 110 kN-m for free head and fixed head conditions, respectively. The calculated maximum pile deflection was less than 10 mm. These bending moments, shear forces and deflections are in addition to those caused by bridge loads applied to the piles.

5.6 Retaining Walls and Embankments

5.6.1 General

The general configurations developed for the wing walls at the pedestrian bridges are shown in the general arrangement drawings.

The wing walls comprise RSS founded on a granular pad. These configurations and preliminary dimensions were checked at the maximum section along the wing wall to verify the geotechnical design requirements with respect to (a) the global stability of the soil mass containing the structure and (b) the foundation soil bearing resistances. The design assessments were based on (a) assumed strength and deformation properties of the proprietary components (RSS), which will have to be confirmed by proprietary suppliers, and (b) the assumed external loads and backfill properties. The final design of the abutment may require adjustments based on the proprietary components and structural design.

The properties of the proprietary products used in the geotechnical analyses are described in Table 5-10.

Table 5-10: Assumed Proprietary Product Properties

Backfill Material	Unit weight, kN/m ³	Limit Equilibrium Analyses (Drained)	
		Friction Angle, °	Apparent Cohesion, kPa
RSS with Approved Granular Fill	21	35	50(*)

(*) For global stability model only

The properties assumed for the backfill materials are given in Table 5-11.

Table 5-11: Assumed Backfill Material Properties

Backfill Material	Unit weight, kN/m ³	Limit Equilibrium Analyses	
		Undrained Shear Strength, kPa	Drained Friction Angle *, °
Compacted Clay Fill	21	50	30
Approved Granular Fill	21	N/A	32

* c' = 0 kPa

The design assessments were based on (a) assumed strength and deformation properties of the proprietary components (RSS, EPS and cellular concrete, CC), which will have to be confirmed by proprietary suppliers, and (b) the assumed external loads and backfill properties. The final design of the RSS walls may require adjustments based on the proprietary components and structural design. In general, the RSS walls are to be designed and constructed in accordance with MTO's RSS Design Guidelines and Special Provisions SP599S22 and SP599S23.

The following general recommendations are considered applicable:

- All topsoil and other deleterious materials are to be completely removed from the footprint area of the structure so that it is founded directly on the competent native soils.
- Any low areas should be brought to grade using approved compacted fill.

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- The base of each wall segment shall be stepped in a manner than ensure a minimum soil cover over native subgrade of 1 m along the length of each wall segment.

5.6.2 Global Stability

Slope stability analyses (Limit Equilibrium) were carried out using SLOPE/W Version 2007 and the Morgenstern-Price method of analysis. The methodology was as described in Section 5.4.3. The results of the analyses are presented in Table 5-12.

5.6.3 Stress-Deformation Analysis of Embankments

Stress-deformation analyses were carried out using Slope/W Version 2007 as described above in Section 5.4.4. The results of the analyses are summarized in Table 5-12.

Table 5-12: Results of Stability and Stress Deformation Analyses

Structure / Embankment	Station	Height of Wall / Embankment m	Global Stability			Stress Deformation			Remarks
			Factor of Safety (2)		Figures	Settlement (mm)		Figures	
			Short Term (Undrained)	Long Term (Drained)		Short Term (End of construction)	Post-construction		
TB-1									
North Abutment Wing Walls and Approach (Trail 2)	10+728	6.5	1.3 (1.4)	2.1 (2.8)	D.7, D.8	(3)	(3)	-	13 m³/m cellular concrete required between RSS wing walls (approx. 2 m deep)
	10+723	6	1.3 (1.3)	-	D.9	(3)	(3)	-	15 m³/m EPS required in embankment
	10+720	6	1.3 (1.4)	-	D.10	(3)	(3)	-	10 m³/m EPS required in embankment
	10+705	5	1.3 (1.3)	-	D.11	(3)	(3)	-	no light weight materials required for embankment
South Abutment	10+770	6	1.3 (1.4)	-	D.12	75 – 85	45-50	E.1, E.2, E.3	
TB-2									
West Abutment Wing Walls and Approach (Trail 6)	10+532	7.0	1.3 (1.4)	1.7 (1.8)	D.19, D.20	(3)	(3)	-	22.5 m³/m CC in RSS wing walls (approx. depth 3.5 m) Both embankments contain EPS as per design requirement for Tunnel T-3, therefore settlement will be nominal
	10+522	6.5	1.3 (1.3)	-	D.21	(3)	(3)	-	45.5 m³/m CC in core of embankment 16 m³/m EPS for each embankment slope
	10+515	6.5	1.3 (1.3)	-	D.22	(3)	(3)	-	60 m³/m EPS in embankment Highway 401 granular base and sub-base must be in place before completion of trail embankment above elevation 185
	10+495	5.0	1.3 (1.4)	-	D.23	(3)	(3)	-	32 m³/m EPS in embankment
	10+475	4	1.3 (1.4)	-	D.24	(3)	(3)	-	16 m³/m EPS in embankment
	10+465	3.5	1.3 (1.3)	-	D.25	(3)	(3)	-	no light weight materials required for embankment
East Abutment Wing Walls and Approach (Trail 6 and Trail 15)	10+577 (Trail 6)	7.5	1.3 (1.4)	2.5 (2.7)	D.26, D.27	(3)	(3)	-	no lightweight materials required between first RSS block behind abutment
	10+585 (Trail 6)	7.0	1.3 (1.4)		D.28	(3)	(3)	-	17.5 m³/m CC required between last RSS block behind abutment 30 m³/m EPS in embankment
	10+588 (Trail 6)	7.0	1.3 (1.3)		D.29	(3)	(3)	-	48 m³/m EPS in embankment
	10+019 (Trail 15)	5.5	1.3 (1.3)		D.30	(3)	(3)	-	6.5 m³/m EPS in embankment
	10+025 (Trail 15)	5	1.3 (1.3)		D.31	(3)	(3)	-	no light weight materials required for embankment
TB-4									
West Approach (Trail 31)	10+020	5.7	2.5 (2.9)		D.37	60 – 70	20-25	E.4, E.5, E.6	
East Approach		5.0	(3)	(3)	-	(3)	(3)		Not analyzed for stability or settlement due to lesser height than west approach

Structure / Embankment	Station	Height of Wall / Embankment m	Global Stability		Figures	Stress Deformation			Remarks
			Factor of Safety (2)			Settlement (mm)		Figures	
			Short Term (Undrained)	Long Term (Drained)		Short Term (End of construction)	Post-construction		
TB-5									
West Wing Walls and Approach (Trail 25)	10+547	8.0	1.3 (1.4)	1.7 (1.9)	D.45, D.46	(3)	(3)	-	28 m³/m CC in RSS wing walls (approx. depth 4.0 m) Both embankments contain EPS as per design requirement for Tunnel T-6, therefore settlement will be nominal
	10+544	8.0	1.3 (1.4)		D.47	(3)	(3)	-	28 m³/m CC in RSS wing walls (approx. depth 4.0 m)
	10+541	7.5	1.3 (1.4)		D.48	(3)	(3)	-	31.5 m³/m CC in RSS wing walls (approx. depth 4.5 m)
	10+535	7.5	1.3 (1.4)		D.49	(3)	(3)	-	42 m³/m CC in RSS wall (approx. depth 6.0 m) 6.5 m³/m EPS in south slope
	10+470	4.5	1.3 (1.4)		D.50	(3)	(3)	-	no light weight materials required for retaining wall and embankment
East Wing Walls and Approach (Trail 25)	10+593	7.0	1.3 (1.4)	1.7 (1.9)	D.51	(3)	(3)	-	6 m³/m CC in RSS wing walls (approx. depth 1.0 m). Global stability will be highly dependent on final design grading of the spillway and side slopes. EPS or CC may be required within abutment backfill
	10+596	6.5	1.3 (1.4)	-	D.52	(3)	(3)	-	6 m³/m CC in RSS wing walls (approx. depth 1.0 m)
	10+598	6.5	1.3 (1.4)	-	D.53	(3)	(3)	-	57.5 m3/m EPS in embankment
Retaining wall on south side of Trail 25	10+635	5.0	1.3 (1.3)	-	D.54	(3)	(3)	-	9 m³/m CC in RSS retaining wall (approx. depth 1.5 m)
	10+650	4.5	1.4 (1.4)	-	D.55	(3)	(3)		no light weight materials required for retaining wall and embankment
TB-7									
West Approach (Trail 41)	10+500	4.0	2.6 (2.9)	-	D.66A	(3)	(3)	-	
East Approach (Trail 44)	10+086	5.6	1.4 (1.5)	2.2 (2.4)	D.61, D.62	45 – 55	10 - 20	E.7, E.8, E.9	
	10+125	5.0	2.2 (2.3)	1.4 (1.4)	D.63, D.64	30-40	< 10	E.10. E.11, E.12	
	10+155	4.5	2.8 (3.2)	1.3 (1.4)	D.65, D.66	(3)	(3)	-	
TB-7A									
North Abutment		2.0	(3)	(3)	-	(3)	(3)	-	
South Abutment		2.0	1.3 (1.4)	-	D.70	(3)	(3)	-	
TB-8									
East Abutment (Trails 47 and 54)	Sta 10+000	4.9	1.6 (1.8)	1.6 (1.7)	D.72, D.73	55 – 65	15 - 20	E.13, E.14, E.15	

Table Notes:

- 1) ST indicates undrained conditions for external stability and end of construction for global stability and stress deformation analyses. LT indicates drained conditions for external stability and post-construction for global stability and stress deformation analyses.
- 2) Values in parentheses refer to factor of safety for circular failure surface.
- 3) Not analysed due to low level surcharge through the use of CC and EPS, or low height embankment

5.6.4 RSS External Stability

The external stability factors of safety against base sliding, overturning about the toe and bearing capacity failures were checked by means of the WS method in accordance with the CFEM guidelines in conjunction with the undrained and drained soils shear strength properties described in Section 5.2.

Bearing Capacity:

The net ultimate bearing capacity values (q_{uls}) were determined for the native subgrade soils consistent with the undrained shear strength values used for evaluation of the abutment foundations (as presented in Table 5-2). Long-term drained conditions were based on friction angle of 30°.

Wall tilt (angular distortion) resulting from differential settlement is expected to be less than 0.2% based on the deformation analysis completed for the south east RSS wall at TB-7, which is among the highest RSS walls associated with the trails. Deformation modeling of the RSS wall at Sta 10+125 (Trail 44) is shown on Figures E.10, E.11, and E.12. Figure E.12A shows the end of construction and long term lateral displacement of the face of the RSS wall.

All the ground movement and deformations discussed above are estimates based on soil deformation/compressibility properties interpreted from laboratory tests and empirical correlations. Therefore, the reported values are approximate and should be considered only as an indication of the magnitude of the soil response. These estimates should be verified and refined with respect to the actual performance monitoring in the field.

Base Sliding:

The ultimate geotechnical horizontal resistance (H_{ri}) can be determined in accordance to the following expression:

$$H_{ri} = A'c' + V \tan \delta > 1.5 H_f$$

Where:

A' (m ²)	= effective contact area of the base;
c' (kPa)	= cohesion/adhesion at sliding interface;
δ (°)	= friction angle at sliding interface (usually ϕ , as defined in Table 5-1);
V (kN)	= specified vertical force (kN); and
H_f (kN)	= specified horizontal load.

All RSS walls are assumed to be constructed over a minimum 200 mm thick compacted granular pad. Subgrade for the granular pad is assumed to be engineered fill (clay or granular) constructed on approved undisturbed native subgrade or directly on undisturbed native stiff silty clay or compact native silt or sand.

The results of the analyses are presented in Table 5-13.

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Table 5-13: Results of RSS External Stability Analyses

Structure / Embankment	Station	Height of Wall, m	Width of Reinforcement	Ultimate Bearing Capacity, kPa		Safety Factors (SLS)						Comments
				Short Term (Undrained)	Long Term (Drained)	Short Term (Undrained)			Long Term (Drained)			
						Bearing	Sliding	Over- turning	Bearing	Sliding	Over- turning	
TB-1												
North Abutment Wing Walls	10+728 (Trail 2)	3.0	1.6	105 ⁽¹⁾	40 ⁽¹⁾	5.2	NA	NA	2.1	NA	NA	13 m³/m cellular concrete required between RSS wing walls (approx. 2 m deep) based on global stability analysis (Figures D.7 and D.8)
South Abutment Wing Walls	10+774 (Trail 2)	7.0	5.0	205	180	2.6	-	-	4.1	-	-	
TB-2												
West Abutment Wing Walls	10+532 (Trail 6)	7.5	4	180	280	3.3	NA	NA	5.1	NA	NA	22.5 m³/m CC in RSS wing walls (approx depth 3.5 m) based on global stability analysis (Figures D.19 and D.20)
East Abutment Wing Walls	10+577 (Trail 6)	7.0	4.0	110	120	2.2	NA	NA	2.4	NA	NA	no lightweight materials required between first RSS block behind abutment; 17.5 m³/m CC and 30 m3/m EPS at RSS block behind abutment based on global stability analysis (Figures D.26, D.27 and D.28)
TB-4												
West Abutment	10+017 (Trail 31)	7.0	4.0	205	280	2.6	NA	NA	2.4	NA	NA	
East Abutment	10+063 (Trail 31)	6.0	3.5	205	255	3.1	NA	NA	3.8	NA	NA	
TB-5												
West Abutment and Approach (Trail 25)	10+547	9.0	4.0	180	275	2.7	15.3	59.1	4.1	19.3	87.4	
	10+535	8.5	4.5	180	265	2.0	1.8	4.4	3.2	3.2	5.8	
	10+470	5.5	2.5	180	180	2.2	3.3	4.3	2.1	2.7	3.6	
East Abutment	10+590 (Trail 25)	7.0	4.0	180	280	2.3	NA	NA	3.6	NA	NA	
TB-7												
South-east Retaining Wall (Trail 44) Block 1 (West End)	10+090	1.95	3.8	20	115	3.6	7.6	16.8	2.1	6.5	28.2	
South-east Retaining Wall (Trail 44) Block 2 (East End)	10+100	1.95	3.0	205	115	3.5	5.8	10.4	2.1	5.1	17.8	
South-east Retaining Wall (Trail 44) Block 3 (East End)	10+105	2.45	3.5	210	140	3.0	5.4	10.8	2.1	4.9	16.2	

Structure / Embankment	Station	Height of Wall, m	Width of Reinforcement	Ultimate Bearing Capacity, kPa		Safety Factors (SLS)						Comments
				Short Term (Undrained)	Long Term (Drained)	Short Term (Undrained)			Long Term (Drained)			
						Bearing	Sliding	Over- turning	Bearing	Sliding	Over- turning	
South-east Retaining Wall (Trail 44) Block 4 (East End)	10+110	3.5	5.0	205	185	2.2	5.5	14.5	2.0	5.1	17.4	
South-east Retaining Wall (Trail 44) Block 5 (East End)	10+120	3.65	5.5	310	190	3.3	8.9	16.8	2.1	5.4	19.5	
South-east Retaining Wall (Trail 44) Block 6 (East End)	10+123	4.6	6.3	310	235	2.7	8.1	17.0	2.0	5.1	16.8	
South-east Retaining Wall (Trail 44) Block 7 (East End)	10+150	3.2	4.5	315	170	3.7	8.1	13.1	2.0	5.0	16.6	
South-east Retaining Wall (Trail 44) Block 8 (West End)	10+165	2.05	2.8	320	120	5.1	7.5	8.6	2.0	4.6	14.3	
South-east Retaining Wall (Trail 44) Block 9 (West End)	10+170	1.65	2.2	210	100	3.9	4.8	6.9	2.0	4.4	13.0	
TB-7 West Wing Wall	10+009	6.7	4.5	460	600	3.0	NA	NA	3.9	NA	NA	
Trail 41 North Retaining Wall	10+455	3.3	1.8	460	315	2.9	2.1	2.0	2.4	2.0	2.8	

(1) Reduced capacities due to sloping ground surface at the toe of the walls

NA – Not Applicable

5.7 Backfilling

Behind the concrete abutment wall backfill materials should meet the requirements of OPSS 902 and the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (CHBDC).

The backfill should be compacted in maximum 200 mm thick loose lifts in accordance with SP 105S10. Longitudinal drains should be installed to provide positive drainage of the backfill. Other aspects of the abutment backfill requirements with respect to subdrains and frost taper should be in accordance with OPSD 3101.150.

Heavy compaction equipment should not be used immediately adjacent to the walls of the structure as per the CHBDC and OPSS 501. Effects of backfill compaction activities should be simulated as live load over and above the static lateral earth pressure for structural design in accordance with Section 6.9.3 in the CHBDC.

Earth pressures on wing walls may be calculated on the basis of the parameters given in Table 5-14.

In the case of sloping backfill surface, the coefficients in this table should be modified based on the following equations:

$$K_a = \left(\frac{\cos \phi}{1 + \sqrt{\frac{\sin \phi \cdot \sin(\phi - \beta)}{\cos \beta}}} \right)^2 \quad (\text{Eq. 5.7})$$

$$K_0 = (1 - \sin \phi)(1 + \sin \beta) \quad (\text{Eq. 5.8})$$

$$K_p = \left(\frac{\cos \phi}{1 - \sqrt{\frac{\sin \phi \cdot \sin(\phi + \beta)}{\cos \beta}}} \right)^2 \quad (\text{Eq. 5.9})$$

Where: ϕ = Friction angle of backfill material,

β = Slope of the backfill surface.

Table 5-14: Soil Parameters for Earth Pressure Calculations

Soil Parameter	Group I Soils	Group II Soils	Group III Soils
Fill Unit Weight, kN/m^3	22	21	20.5
Friction angle, $\phi(^{\circ})$	33-35	29-32	22-30
Coefficients of Static Lateral Earth Pressure:			
'Active' or Unrestrained, $K_a^{(*)}$	0.27 to 0.30	0.31 to 0.35	0.33 to 0.45
'At Rest' or Restrained, $K_o^{(*)}$	0.43 to 0.46	0.47 to 0.52	0.50 to 0.62
'Passive', $K_p^{(*)}$	3.3 to 3.7	2.9 to 3.2	2.2 to 3.0

(*)Values are given for level backfill and ground surface behind the wall. The coefficients of lateral earth pressure should be adjusted if there is sloping ground at the back of the wall.

Note: Compacted to > 95% Standard Proctor maximum dry density.

Legend:

- Group I Soils: Coarse grained soils (e.g., Granular A and B Type 2).
- Group II Soils: Finer grained than Group I non-cohesive soils (e.g., Granular B Type1, pit run, etc).
- Group III Soils: Finer grained soils (e.g., approved site generated silty clay)

Group III soils may be used as general backfill within approved areas.

5.8 Flood Events

Trail Bridges TB-1, TB-2, TB-4, and TB-5 are at or above existing ground surface and not in the vicinity of local watercourses, therefore the foundations of these structures are not considered susceptible to flood events. Trail Bridge TB-7 is located immediately north of the Wolfe/Cahill Drain, however the top of bank of the drains is assumed to be designed with sufficient freeboard to prevent inundation of the bridge foundations and lower portions of the embankments.

Trail Bridge TB-7A crosses over the realigned Wolfe Drain, which has a design high water level (HWL) of elevation 183.59. Scour protection of the foundations should be considered for both abutments.

The east span of TB-8 also crosses over the realigned Wolfe Drain, which at this location has a design HWL of 184.64 m. Scour protection of the foundations should be considered for the east abutment.

6 Other Geotechnical Recommendations

6.1 Construction Dewatering

The design of the dewatering system should comply with the OPSS 517 and 518 provisions.

Due to the relatively low permeability of the silty clay deposit, groundwater seepage is anticipated to be minor, which should be controllable by conventional temporary dewatering methods.

Runoff and seepage into the excavations from perched groundwater from the fill, existing and abandoned utility trenches, and upper granular layers should also be anticipated. In adverse conditions, the runoff and seepage from perched groundwater can be significant. Provision should be made to deal with the seepage by pumping from properly filtered sumps located within the excavation.

It is anticipated that piping of fine granular materials from embedded seams and at the granular/clay interface will occur. In this area, blanketing of the excavation slopes with a geotextile and free draining granular material may be required to prevent the loss of ground.

Accordingly, provision should be made to prevent runoff and piping erosion of the slope surface by cut-off drains and/or blanketing of the excavation slopes with a geotextile and free draining granular material. The seepage flow should be directed to collection sumps by temporary drainage ditches properly sized, filtered and lined to accommodate the flow rates.

All surface water should be directed away from all open excavations.

6.2 General Construction Requirements

The anticipated construction conditions in this report are discussed only to the extent of their potential influence on the design decisions. References to construction methods are not intended to be the suggestions or directions on the construction methodologies. Contractors should be aware that the data presented in this report and their interpretations may not be sufficient to assess all factors that may affect the construction.

The Contractor is fully responsible for the design, construction methods and performance (stability, deformability and deterioration) of the temporary slopes. The Contractor also must ensure that the temporary slopes meet the Project Agreement criteria and the needs to accommodate the construction of the structure as per design.

The following recommendations and comments are considered applicable:

- All excavation works should be carried out in accordance with the guidelines outlined in Occupational Health and Safety Act (OHSA) and Ontario Provincial Standard Specification (OPSS) 902. The native undisturbed soils may be classified as Type 3 soils. The excavations below the original ground levels may intersect water bearing backfill within trenches of active

and/or abandoned utilities. In these cases, Type 4 soil conditions may occur and should be addressed accordingly.

- The silty clay soils at the project site are highly susceptible to disturbance and rapid deterioration when exposed to elements, groundwater inflow, weathering and/ or subjected to direct construction traffic.
- Temporary slopes, permanent slopes, and subgrade areas must be appropriately protected at all times against surface erosion due to runoff, desiccation, freeze-thaw effects, etc.
- To protect the integrity of subgrade for foundations and pavements, the final excavation lift above the design elevation should not be less than 500 mm and should be carried out only when the contractor is ready to prepare and cover the subgrade with the materials specified in the design. The subgrade should be covered the same day the final excavation is exposed and approved. No construction traffic should be permitted over subgrade without approved protective covers.
- The excavation of the final soil layer above the design subgrade is to be carried out using buckets equipped with smooth lips. Once exposed, the subgrade must be immediately inspected. Upon approval, the subgrade should be immediately protected; depending on the type of construction, geofabrics, granular mats, a skim coat of lean concrete protection (mud mat), etc. should be used.
- Regular inspection of the condition of the temporary slopes should be carried out by qualified personnel for signs of distress or instability and appropriate mitigation measures should be implemented.

6.3 Corrosion Potential

A series of pH, Redox Potential, Resistivity, Sulphide, and Sulphate tests were carried out on samples from each borehole at the trail bridge locations. Table 6-1 provides the results of these analyses that could be used to assess the potential for corrosion on concrete. Additional test results from nearby boreholes at which shallow test samples were selected have been included to supplement that data from the trail bridge boreholes. These additional test results have not been included in the appendices.

Table 6-1: Results of Analytical Testing on Soils

Location of Soil Samples	Depth (Elevation) of Soil Sample m	pH	Redox Potential, mV	Resistivity, ohm.cm	Sulphide, mg/kg	Sulphate, mg/kg
Borehole TB1-1 (SA#8, L1044361-1)	2.3 (179.6)	7.85	165	2220	<0.2	501
Borehole TB1-2 (SA#6, L1044361-2)	4.5 (177.0)	7.84	188	1860	<0.2	689
Borehole BH 09-RW (SA#6, L1030747-2)	4.5 (177.2)	7.87	173	2870	<0.2	230
Borehole TB2-1 (SA#10, L1030695-1)	9.1 (173.0)	7.99	176	2490	<0.2	338
Borehole TB2-2 (SA#10, L1030695-2)	9.1 (173.5)	7.95	146	2690	<0.2	292

Location of Soil Samples	Depth (Elevation) of Soil Sample m	pH	Redox Potential, mV	Resistivity, ohm.cm	Sulphide, mg/kg	Sulphate, mg/kg
Borehole BH 10-RW (SA#6, L1030747-1)	4.5 (178.0)	7.98	163	3510	<0.2	126
Borehole BH 11-RW (SA#8, L1030747-4)	6.1 (176.3)	8.05	160	3230	<0.2	229
Borehole CV6-1 (SA#3, L1037961-1)	1.5 (171.5)	7.71	167	1960	<0.2	620
Borehole TB4-1 (SA#10, L1032538-1)	9.1 (171.6)	8.15	118	1850	<0.2	572
Borehole TB4-2 (SA#10, L1032538-2)	9.1 (171.9)	7.98	154	2340	<0.2	403
Borehole BH 12-RW (SA#4, L1035523-5)	3.0 (178.2)	7.62	131	5750	<0.2	69
Borehole TB5-1 (SA#10, L1030717-1)	9.1 (171.9)	7.80	152	2330	<0.2	370
Borehole TB5-2 (SA#10, L1044365-1)	9.1 (171.7)	7.98	164	2350	<0.2	609
Borehole TB5-3 (SA#10, L1032526-2)	9.1 (172.2)	8.01	114	2360	<0.2	347
Borehole TB5-4 (SA#10, L1032526-1)	9.1 (172.6)	8.09	116	2440	<0.2	301
Borehole TB7-1 (SA#10, L1032551-3)	9.1 (174.9)	7.99	106	5050	<0.2	45
Borehole TB7-2 (SA#10, L1032551-4)	9.1 (175.0)	8.01	112	4670	<0.2	53
Borehole TB7-3 (SA#10, L1032551-2)	9.1 (175.8)	7.97	108	4350	<0.2	48
Borehole TB7-4 (SA#10, L1035603-1)	9.1 (175.7)	7.94	90	6410	<0.2	56
Borehole BH 15-RW (SA#6, L1037978-2)	4.5 (179.6)	7.59	156	3770	<0.2	200
Borehole CV3-1 (SA#7, L1032540-1)	5.3 (181.2)	7.71	167	1960	<0.2	620
Borehole TB7A-1 (SA#10, L1032551-1)	9.1 (175.7)	7.98	105	4630	<0.2	65
Borehole TB8-1 (SA#10, L1032520-1)	9.1 (177.1)	7.97	124	1940	<0.2	92
Borehole TB8-2 (SA#10, L1032520-2)	9.1 (177.1)	7.95	115	4030	<0.2	86
Borehole TB8-3 (SA#10, L1044495-1)	2.3 (183.5)	7.85	180	5990	<0.2	69
Borehole CV2-1 (SA#5, L1037957-1)	3.0 (183.2)	7.75	151	2750	<0.2	174

The reported results of laboratory testing indicate that based on CSA A23.1, concrete in contact with the tested soil material would have a negligible degree of exposure to sulphate attack.

Based on the measured electrical resistivity, pH, redox potential, sulphide contents etc., the soil would be considered to have a potential for corrosion to buried metallic elements

A corrosion specialist should review the test results and provide recommendations to address corrosion concerns.

6.4 Construction Quality Control

To ensure that construction is carried out in a manner consistent with the intent of the recommendations set forth in this report, a construction quality control program, including geotechnical inspection, testing and instrument monitoring, should be developed and implemented throughout the construction phase. In addition, related laboratory testing should be carried out in conjunction with the fieldwork to monitor compliance with the various materials and project specifications.

6.5 Instrumentation and Monitoring

No geotechnical instrumentation specific to the pedestrian bridges was considered for the construction period due to the shallow depth of excavation. However, instrumentation has been installed as part of the main structures around the pedestrian tunnel which will be used to note any potential associated movements in the area. PIC and WEMG will be responsible to monitor the movements of the finished works for the duration of the contract with the Province.

7 Limitations of Report

The work performed in this report was carried out in accordance with the Standard Terms and Conditions made part of our contract. The conclusions and recommendations presented herein are based solely upon the scope of services and time and budgetary limitations described in our contract.

This report presents the subsurface soil and groundwater conditions inferred from geotechnical investigation and geotechnical design of the structures mentioned in the report. The report was prepared with the condition that the structural and other designs of the Parkway will be in accordance with applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practices. Further, the recommendations and opinions expressed in this report are only applicable to the proposed project as described within AMEC's report.

There should also be an ongoing liaison with AMEC during both the design and construction phases of the project to ensure that the recommendations in this report have been interpreted and implemented correctly. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of this project, AMEC should be contacted immediately.

The conclusions and recommendations given in this report are based on data presented in the pre-bid geotechnical investigation reports and information determined at the test hole locations during the additional investigation carried out for the geotechnical design work. The data obtained from the pre-bid investigations (carried out by others) was assumed to be valid and applicable.

The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated.

The soil boundaries indicated have been inferred from non-continuous sampling, observations of drilling resistance, Nilcon vane, CPT and DMT probing. The boundaries typically represent a transition from one soil type to another and are not intended to define exact planes of geological change. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. Thus, unsuitable foundation soils may be encountered at the foundation grade requiring extra sub-excavations, subgrade improvement, and/or changes to the design. It is important that the AMEC geotechnical design engineer be involved during construction throughout the Parkway project site to confirm that the subsurface conditions do not deviate materially from those encountered in test holes, and that any material deviations, if encountered, do not adversely affect the geotechnical design.

The stability analyses assumed a certain sequence of the construction; if different construction approaches are considered the geotechnical design will have to be reviewed. The calculated factors of safety assume strict adherence to good construction practices with respect to the protection of the exposed slopes.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that AMEC be engaged during the final design and construction stages to verify that the design and construction are consistent with AMEC's recommendations.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the structural and other designers and constructor. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of the surficial topsoil and the clay crust layer, the presence of artesian conditions and exsolved natural gases, and the strength of the silty clay stratum may vary markedly and unpredictably. The constructor should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. The work presented in this report has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

The benchmark and elevations mentioned in this report were surveyed and provided by AMICO. They should not be used by any other party for any other purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. AMEC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.


8 Closure

The geotechnical report for the pedestrian bridges was prepared by Mr. Matt Oldewening, P.Eng. and Mr. ElAlim Ahmed, PE (Az) and checked by Dr. Dan Dimitriu, P.Eng. The project was executed under the technical direction of Dr. Narendra S. Verma, P.Eng. Mr. Matt Oldewening, P.Eng., managed the geotechnical investigation and Mr. Brian Lapos, P.Eng., is the project manager.

The cooperation received from Ms. Biljana Rajlic, P.Eng. and Mr. Philip Murray, P.Eng. of Hatch Mott McDonald and Mr. Daniel Muñoz, P.Eng. of PIC during the design study is gratefully acknowledged.

Yours truly,


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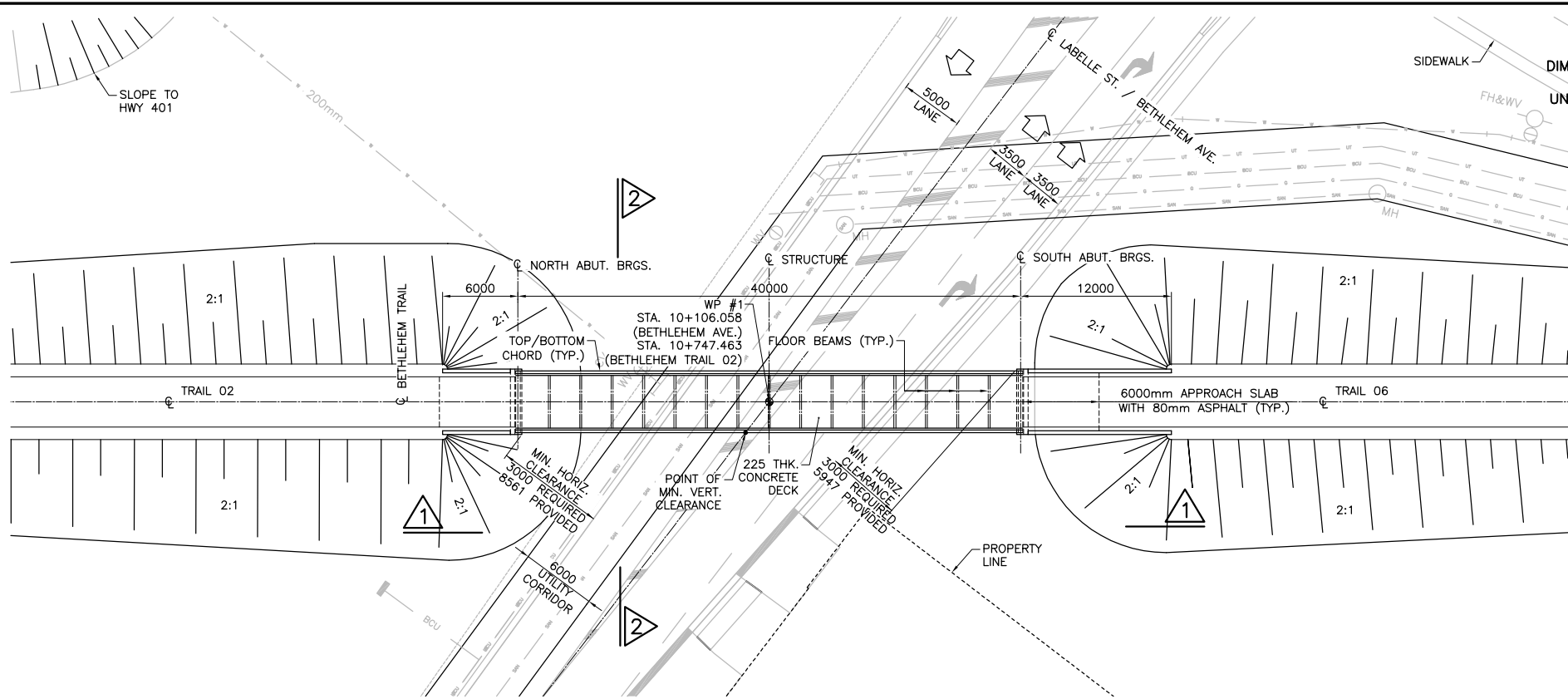
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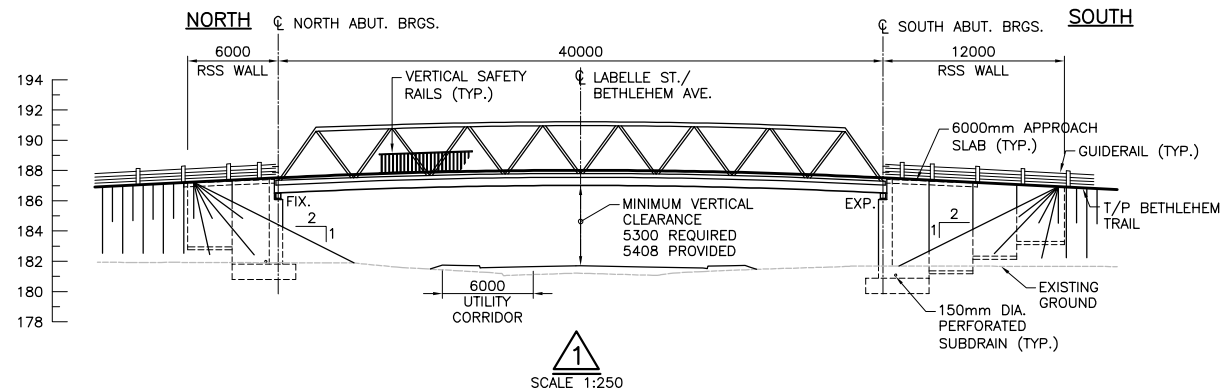
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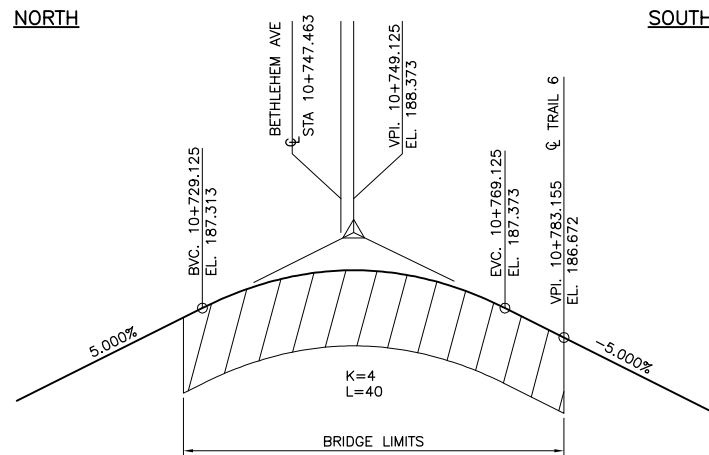
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PLAN
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PROFILE OF BETHLEHEM TRAIL BRIDGE
N.T.S.

METRIC

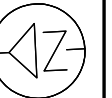
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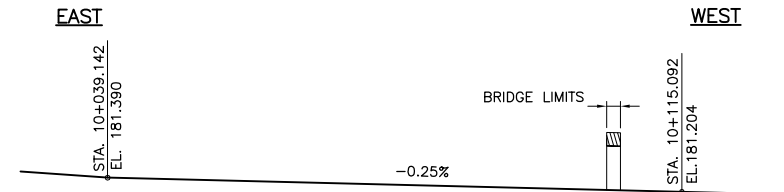
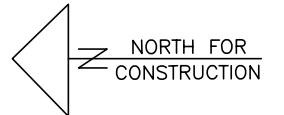
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Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER LABELLE ST-BETHLEHEM AVE. TB-1
GENERAL ARRANGEMENT

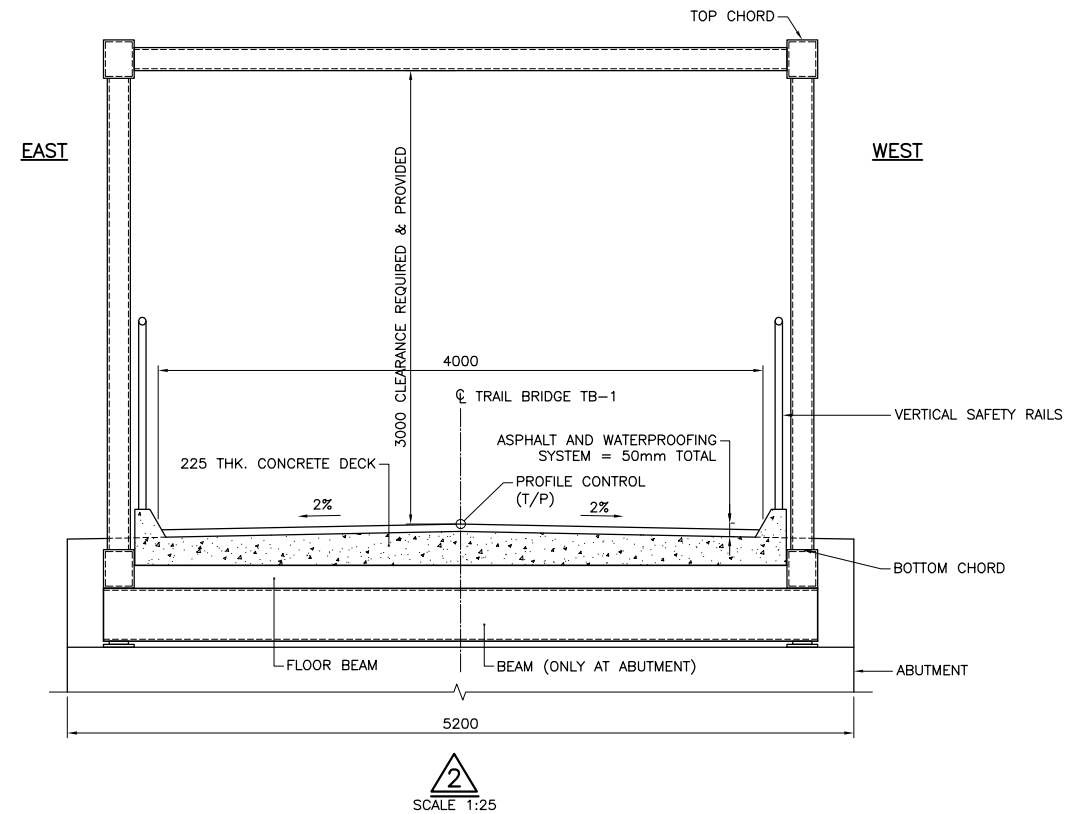


SHEET
S6101

Phase 2
60% Sub



PROFILE OF LABELLE ST./BETHLEHEM AVE.
N.T.S.



SCALE 1:25

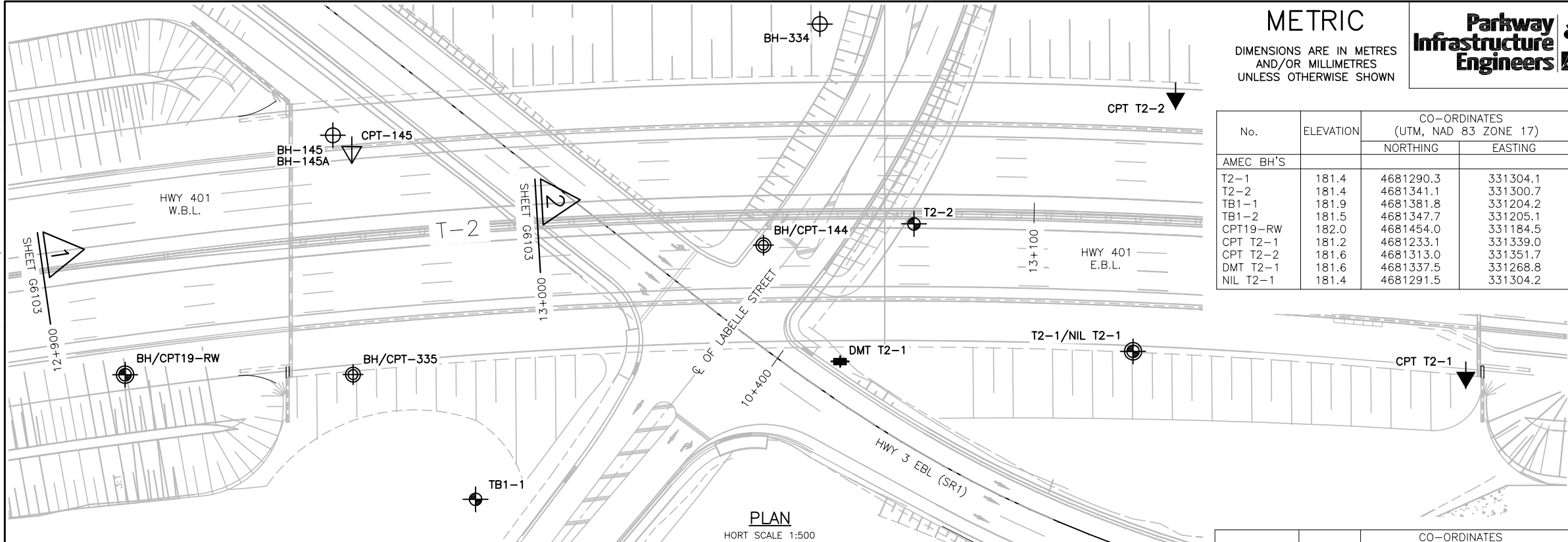
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION

REVISIONS	DATE				DESCRIPTION			
	DATE	REV.	BY		DATE	REV.	BY	
DESIGN	BR	CHK	PM	CODE CAN/CSA S6-06	LOAD	CL	625-ONT	
DRAWN	RD	CHK	MAS	SITE	6-616	DATE	JULY 2010	

DOC: 285380-03-060-MST2-6101

DATE PLOTTED: 5/28/2013 9:55:50 AM
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PR-D-707 BB-05
MINISTRY OF TRANSPORTATION, ONTARIO



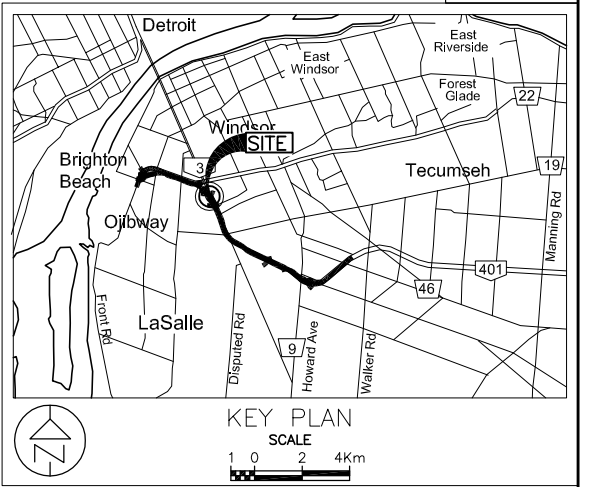
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

Parkway Infrastructure Engineers
amec
Hatch Mott MacDonald

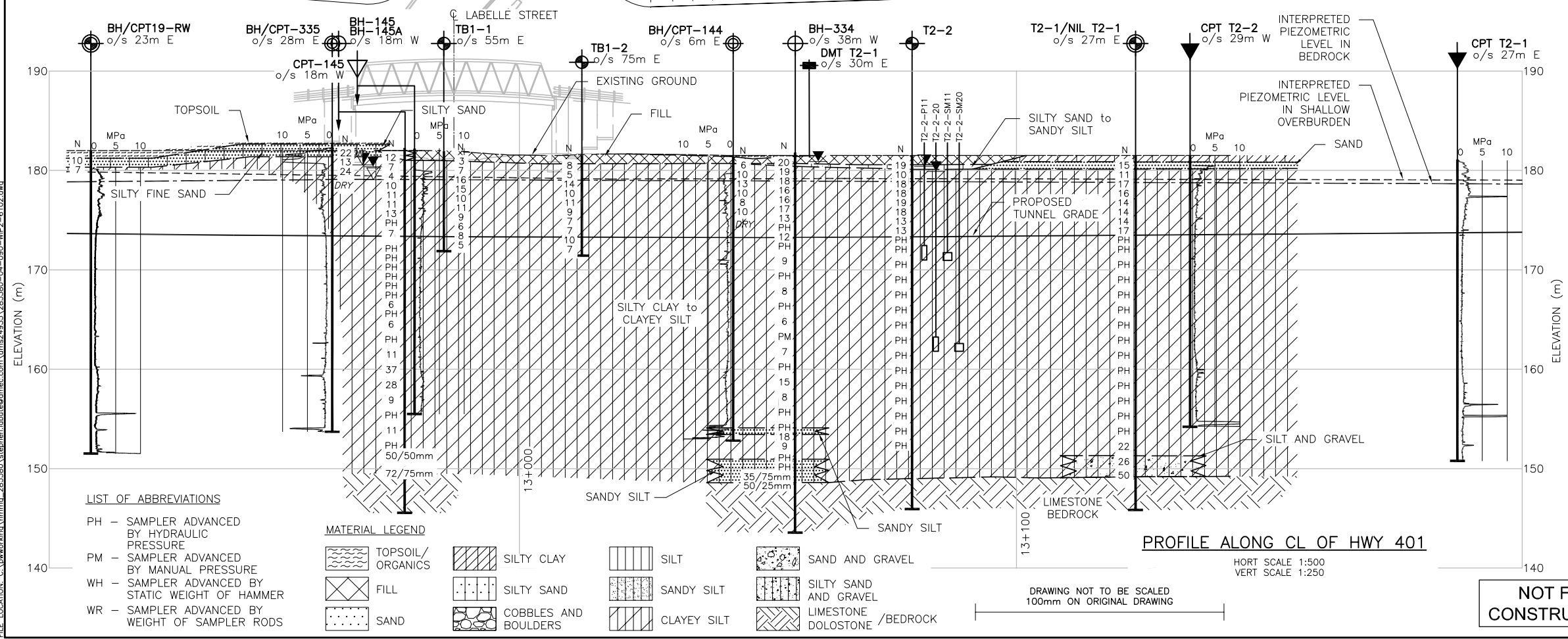
Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-1
BOREHOLE LOCATIONS & SOIL STRATA

SHEET
G6102
Phase 2
60% Sub



No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
PREVIOUS BH'S			
BH/CPT-144	181.3	4681363.6	331279.2
BH-145	182.3	4681447.2	331247.9
BH-145A	182.3	4681447.2	331247.9
BH-334	181.8	4681379.6	331322.2
BH/CPT-335	182.3	4681416.4	331210.7
CPT-145	182.3	4681442.8	331248.2



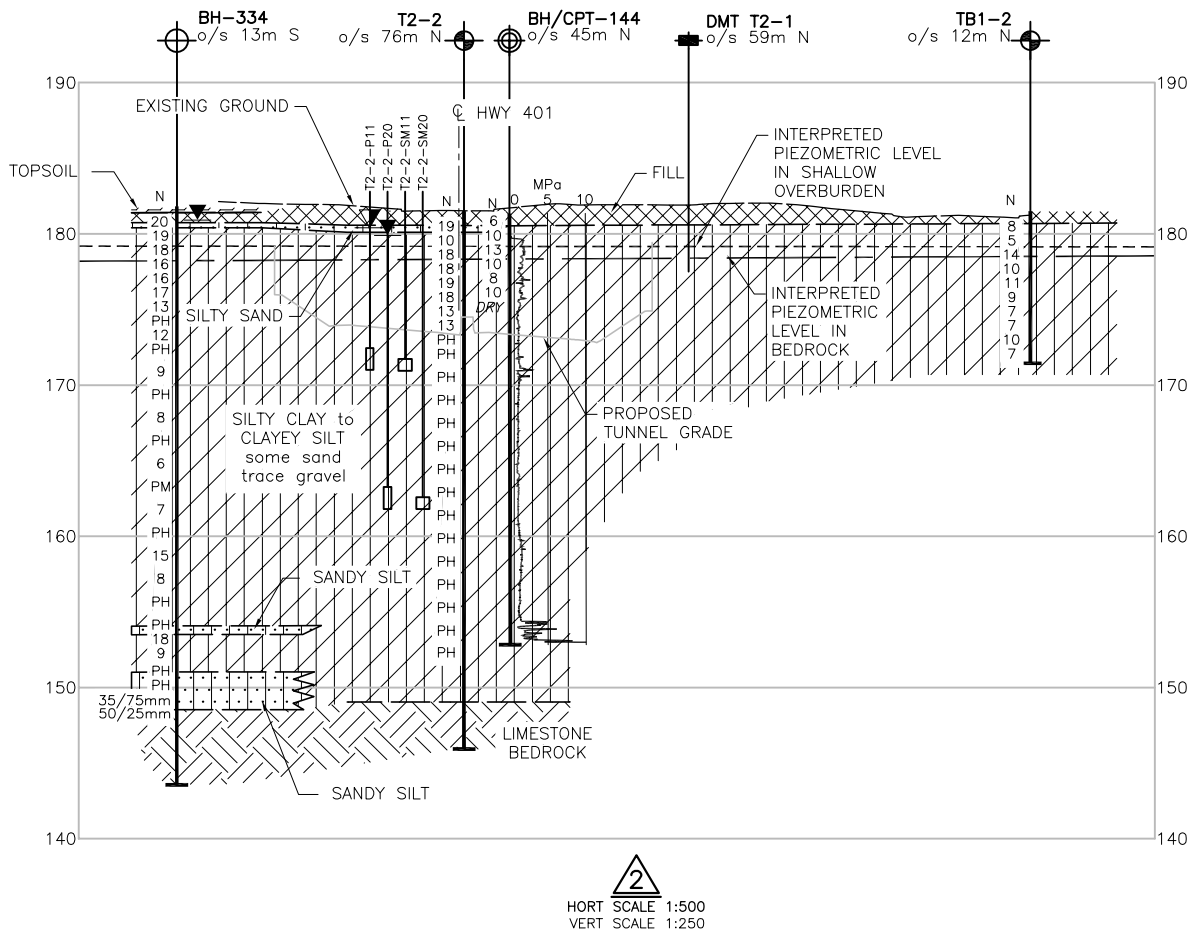
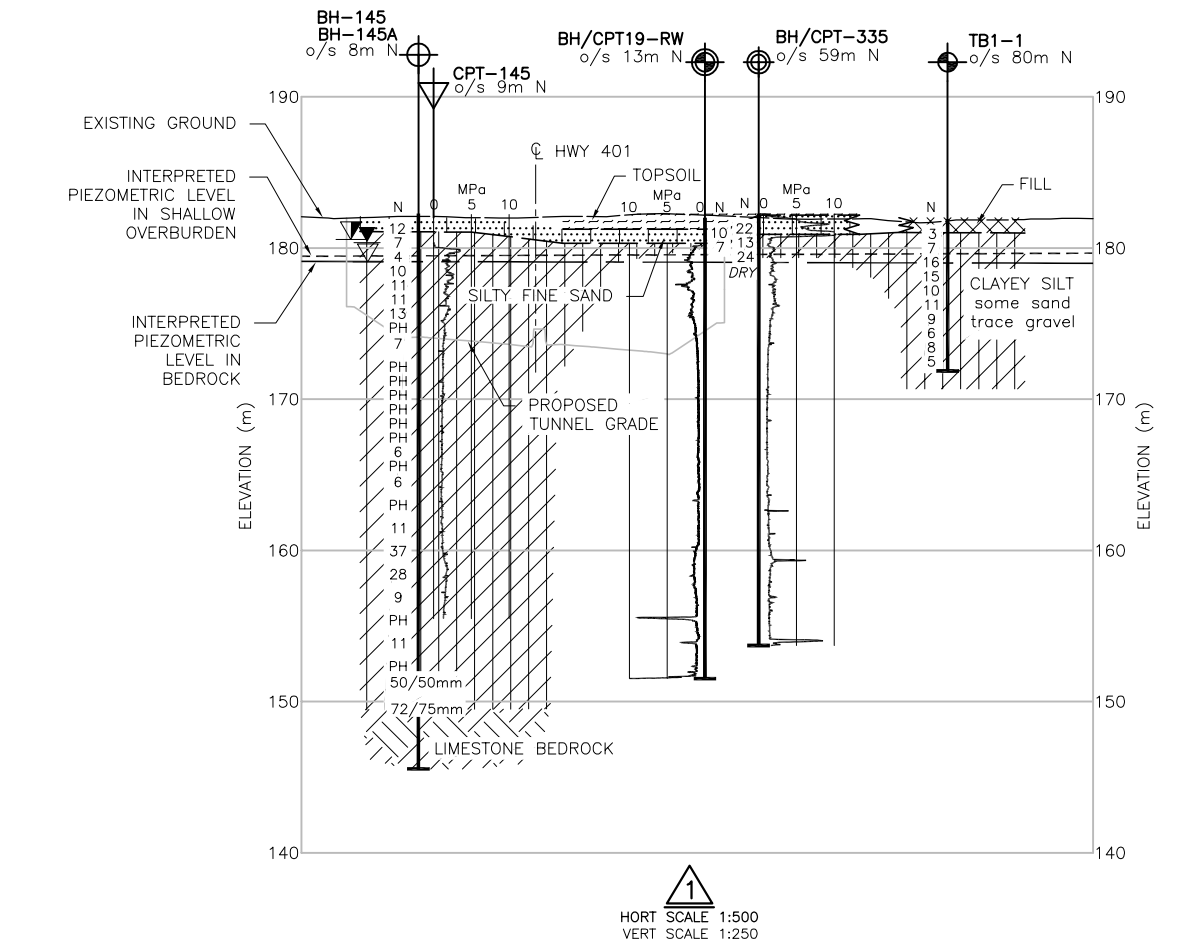
LEGEND

- BOREHOLE CURRENT INVESTIGATION
- BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
- NILCON VANE CURRENT INVESTIGATION
- CPT - CURRENT INVESTIGATION
- DMT - CURRENT INVESTIGATION
- BOREHOLE PREVIOUS INVESTIGATION
- BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
- CPT -PREVIOUS INVESTIGATION
- SPT N-VALUE
- BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- MHSG - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
- P - VIBRATING WIRE PIEZOMETER (VWP)
- DRY BOREHOLE DRY DURING DRILLING
- WATER LEVEL DURING DRILLING
- WATER LEVEL (SHALLOW PIEZO)
- WATER LEVEL (DEEP PIEZO)

- NOTES**
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN REPORT.
 - THE INTERPRETED STRATIGRAPHY REPRESENTS SIMPLIFIED SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DEFINED AT BOREHOLE LOCATIONS ONLY. CONDITIONS BETWEEN BOREHOLE LOCATIONS COULD DIFFER FROM ILLUSTRATED CONDITIONS.
 - ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

NOT FOR CONSTRUCTION

REVISIONS		DATE	REV.	BY	DESCRIPTION
13-MAY-13		A1	EA	60% INTERIM IDR SUBMISSION	
DESIGN	EA	CHK	DD	CODE	CAN/CSA
DRAWN	SJL	CHK	MO	SITE	6-616
		LOAD	CL-625-ONT	DATE	16-APR-13



METRIC

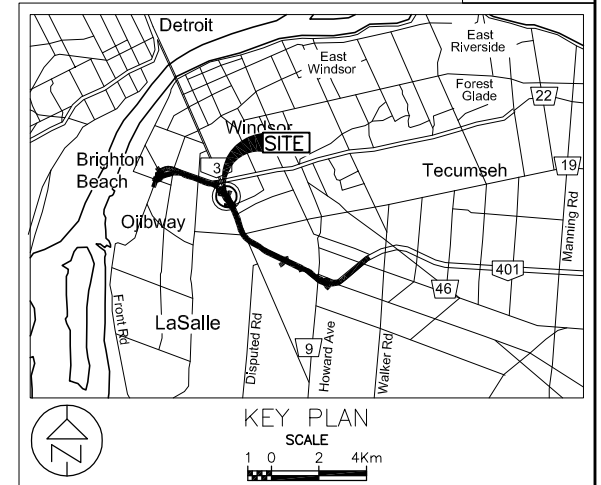
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-1
SOIL STRATIGRAPHY

SHEET
G6103
Phase 2
60% Sub



LIST OF ABBREVIATIONS

PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
PM - SAMPLER ADVANCED BY MANUAL PRESSURE
WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

	TOPSOIL/ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE /BEDROCK

LEGEND	
	BOREHOLE CURRENT INVESTIGATION
	BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
	NILCON VANE CURRENT INVESTIGATION
	CPT - CURRENT INVESTIGATION
	DMT - CURRENT INVESTIGATION
	BOREHOLE PREVIOUS INVESTIGATION
	BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
	CPT -PREVIOUS INVESTIGATION
N	SPT N-VALUE
16	BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
	P - VIBRATING WIRE PIEZOMETER (VWP)
DRY	BOREHOLE DRY DURING DRILLING
	WATER LEVEL DURING DRILLING
	WATER LEVEL (SHALLOW PIEZO)
	WATER LEVEL (DEEP PIEZO)
	CPT-qc

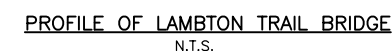
NOTES

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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

NOT FOR
CONSTRUCTION

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

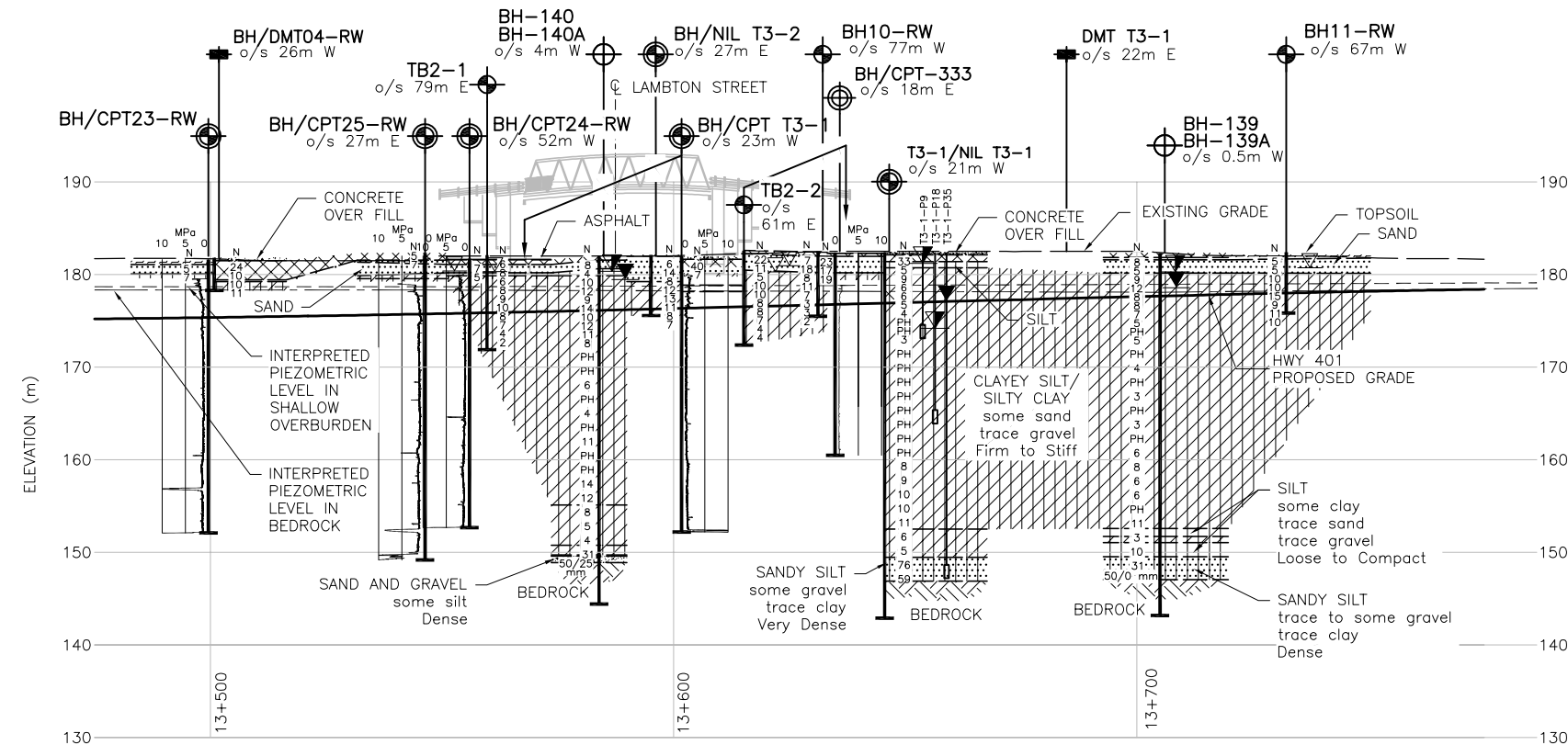
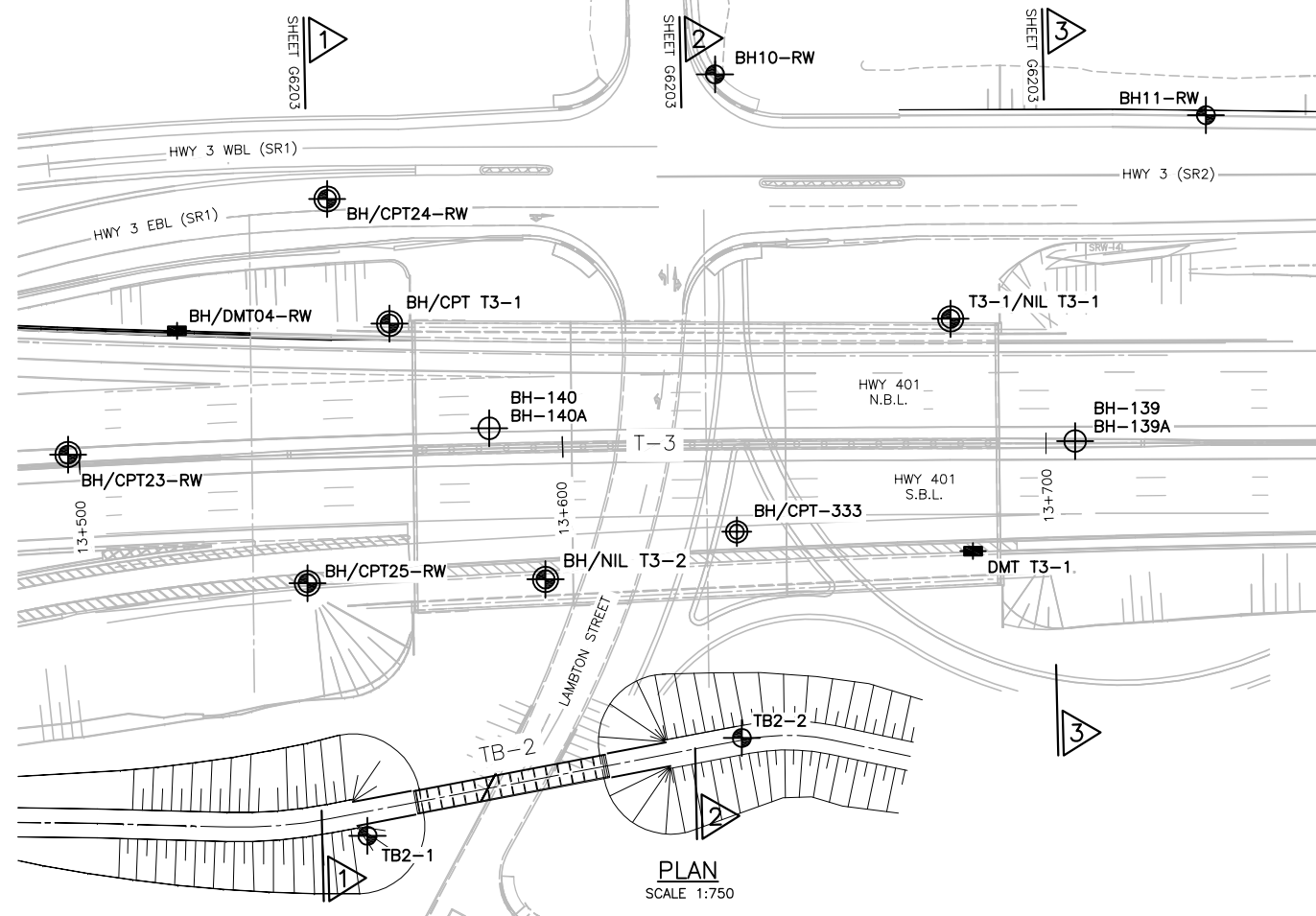
REVISIONS		DATE	REV.	BY	DESCRIPTION
13-MAY-13	A1	EA	60% INTERIM IDR SUBMISSION		
DESIGN	EA	CHK	DD	CODE	CAN/CSA
DRAWN	SJL	CHK	MO	SITE	6-616
				LOAD	CL-625-ONT
				DATE	16-APR-13



FOR PIC PROCUREMENT
PURPOSES ONLY

NOT FOR
CONSTRUCTION

REVISIONS									
	21-DEC-12		A1	MAS	ISSUED FOR PROCUREMENT PURPOSES				
	DATE		REV. BY		DESCRIPTION				
	DESIGN	BR	CHK	PM	CODE	CAN/CSA	S6-06	LOAD	CL 625-ONT
	DRAWN	RD	CHK	MAS	SITE	6-617		DATE	EC-12



PROFILE ALONG CL OF TUNNEL
HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION

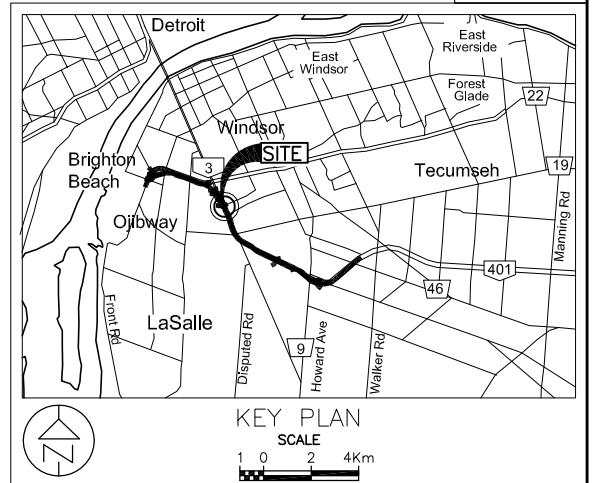
LIST OF ABBREVIATIONS

- PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
PM - SAMPLER ADVANCED BY MANUAL PRESSURE
WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

	TOPSOIL/ ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE /BEDROCK

No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC BOREHOLES			
BH10-RW	182.5	4680886.4	331638.3
BH11-RW	182.4	4680790.2	331671.9
BH/CPT23-RW	181.6	4680976.7	331512.0
BH/CPT24-RW	182.1	4680949.2	331582.1
BH/CPT25-RW	182.3	4680920.6	331507.8
BH/CPT T3-1	182.0	4680926.9	331563.8
BH/DMT04-RW	181.8	4680966.5	331544.6
BH/NIL T3-2	182.1	4680875.7	331528.6
DMT T3-1	182.6	4680797.9	331570.0
NIL T3-1	182.2	4680822.6	331611.7
T3-1	182.3	4680821.3	331611.9
TB2-1	182.1	4680888.0	330465.2
TB2-2	182.6	4680825.5	331515.2
PREVIOUS BOREHOLES			
BH-139	182.3	4680787.5	331599.3
BH-139A	182.3	4680787.5	331599.3
BH-140	182.0	4680899.3	331552.4
BH-140A	182.0	4680899.3	331552.4
BH/CPT-333	182.3	4680843.8	331553.7



LEGEND

- BOREHOLE CURRENT INVESTIGATION
- BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
- NILCON VANE CURRENT INVESTIGATION
- CPT - CURRENT INVESTIGATION
- DMT - CURRENT INVESTIGATION
- BOREHOLE PREVIOUS INVESTIGATION
- BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
- CPT -PREVIOUS INVESTIGATION
- N SPT N-VALUE
- BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- MHS - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
- P - VIBRATING WIRE PIEZOMETER (VWP)
- DRY BOREHOLE DRY DURING DRILLING
- WATER LEVEL DURING DRILLING
- WATER LEVEL (SHALLOW PIEZO)
- WATER LEVEL (DEEP PIEZO)

NOTES

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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

REVISIONS	13-MAY-13				60% INTERIM IDR SUBMISSION			
	DATE	REV.	BY	DESCRIPTION	DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK	DD	CODE	CAN/CSA	LOAD	CL-625-ONT	
DRAWN	SJL	CHK	MO	SITE	6-617	DATE	18-APR-13	

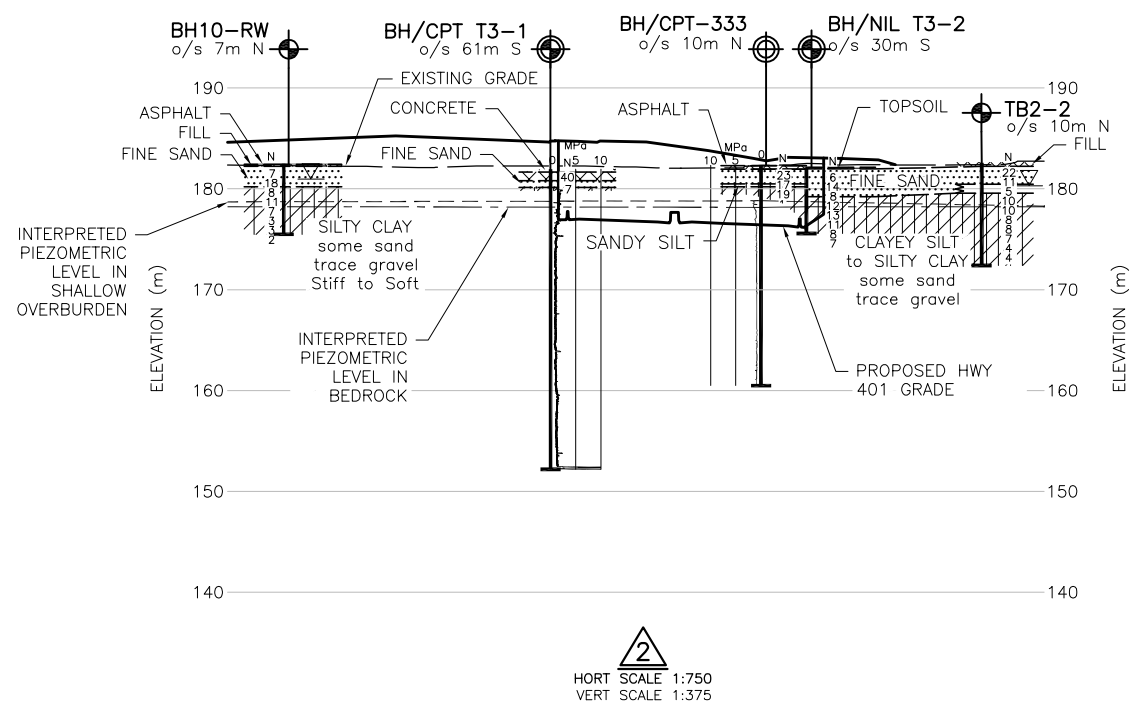
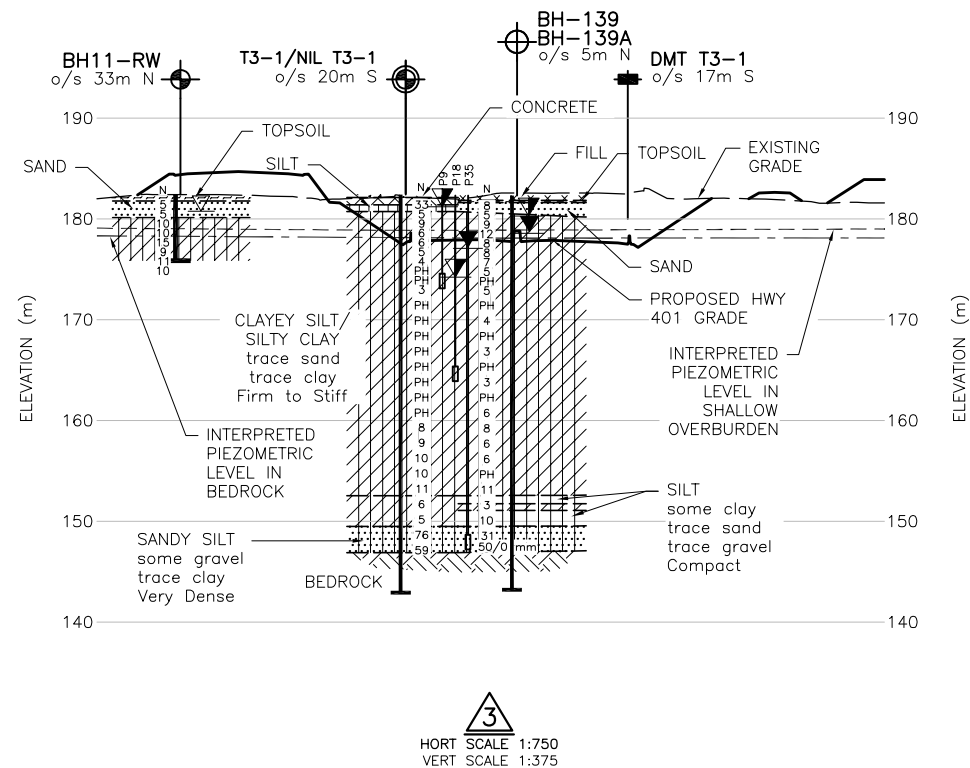
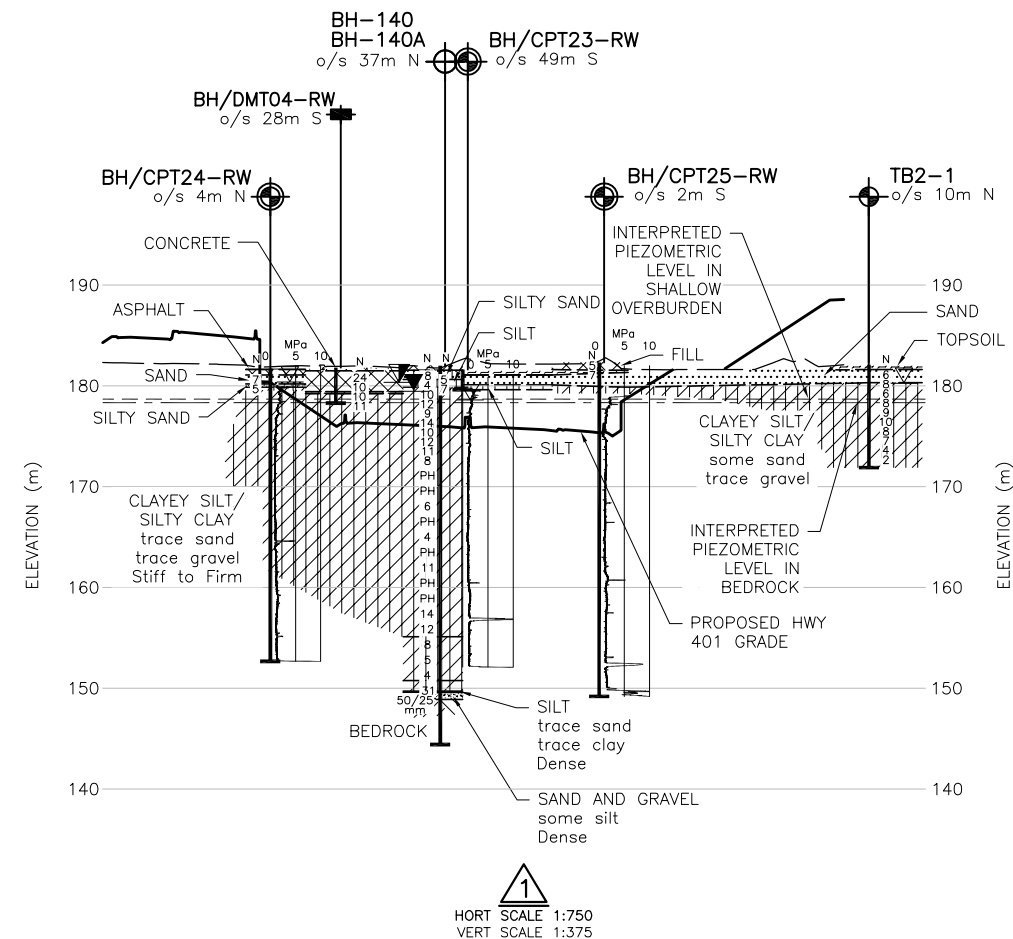
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-2
SOIL STRATIGRAPHY

SHEET
G6203
Phase 2
60% Sub

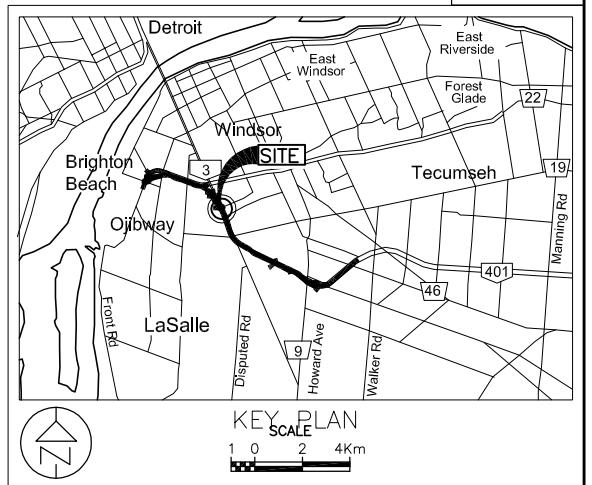


LIST OF ABBREVIATIONS

PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
PM - SAMPLER ADVANCED BY MANUAL PRESSURE
WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

TOPSOIL/ ORGANICS
FILL
SAND
SILTY CLAY
SILTY SAND
COBBLES AND BOULDERS
SILT
SANDY SILT
CLAYEY SILT
SAND AND GRAVEL
SILTY SAND AND GRAVEL
LIMESTONE /BEDROCK
DOLOSTONE



LEGEND

BOREHOLE CURRENT INVESTIGATION
BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
NILCON VANE CURRENT INVESTIGATION
CPT - CURRENT INVESTIGATION
DMT - CURRENT INVESTIGATION
BOREHOLE PREVIOUS INVESTIGATION
BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
CPT -PREVIOUS INVESTIGATION
N SPT N-VALUE
16 BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
P - VIBRATING WIRE PIEZOMETER (VWP)
DRY BOREHOLE DRY DURING DRILLING
WATER LEVEL DURING DRILLING
WATER LEVEL (SHALLOW PIEZO)
WATER LEVEL (DEEP PIEZO)
MMSG - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
CPT-qc

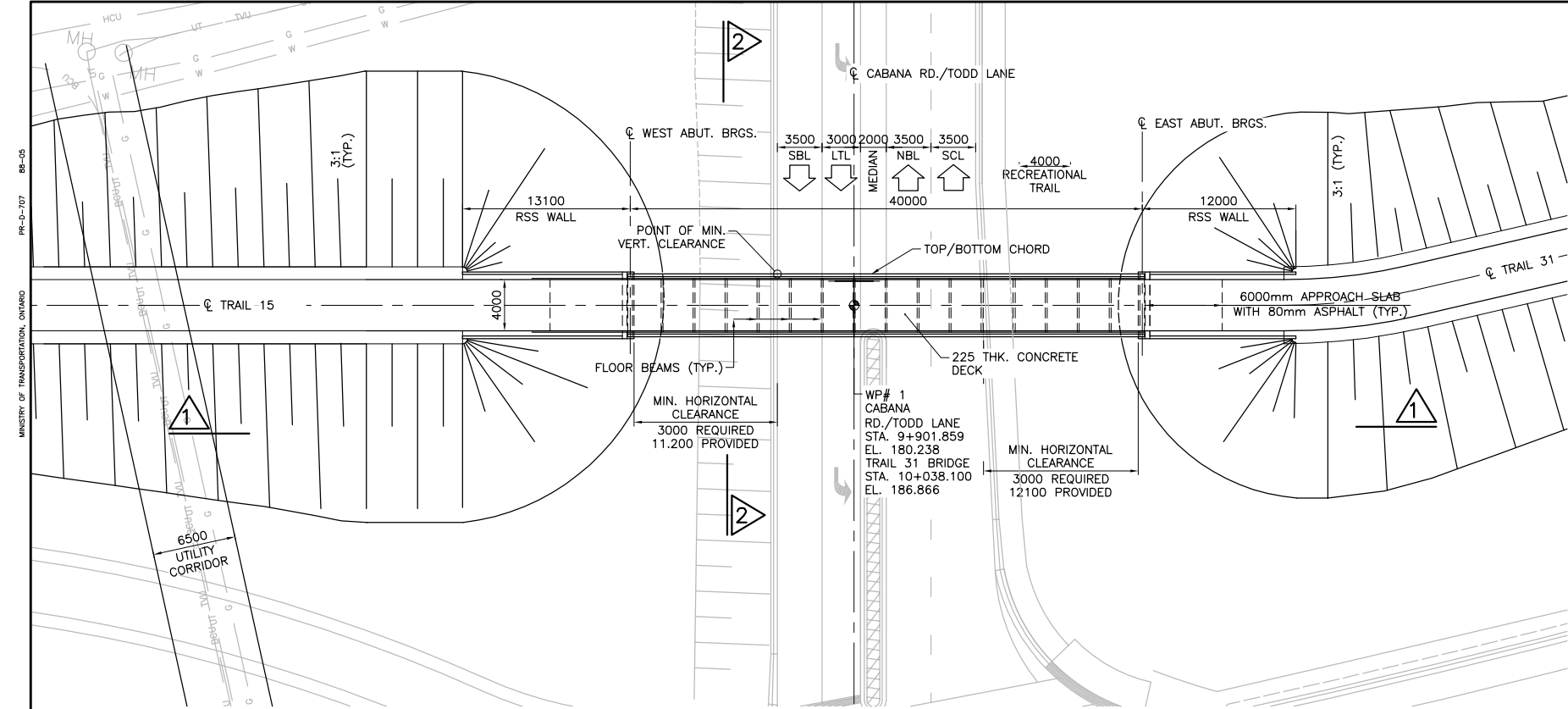
NOTES

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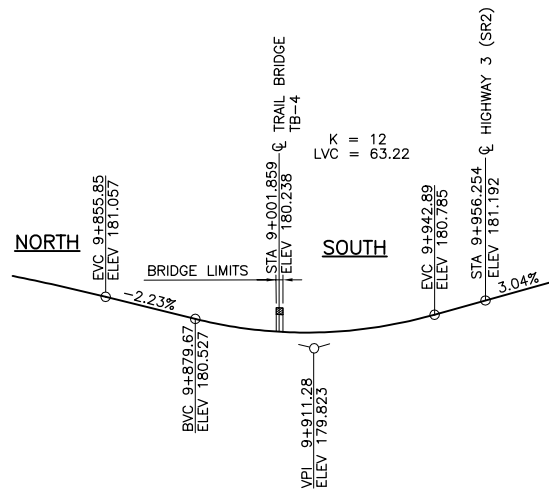
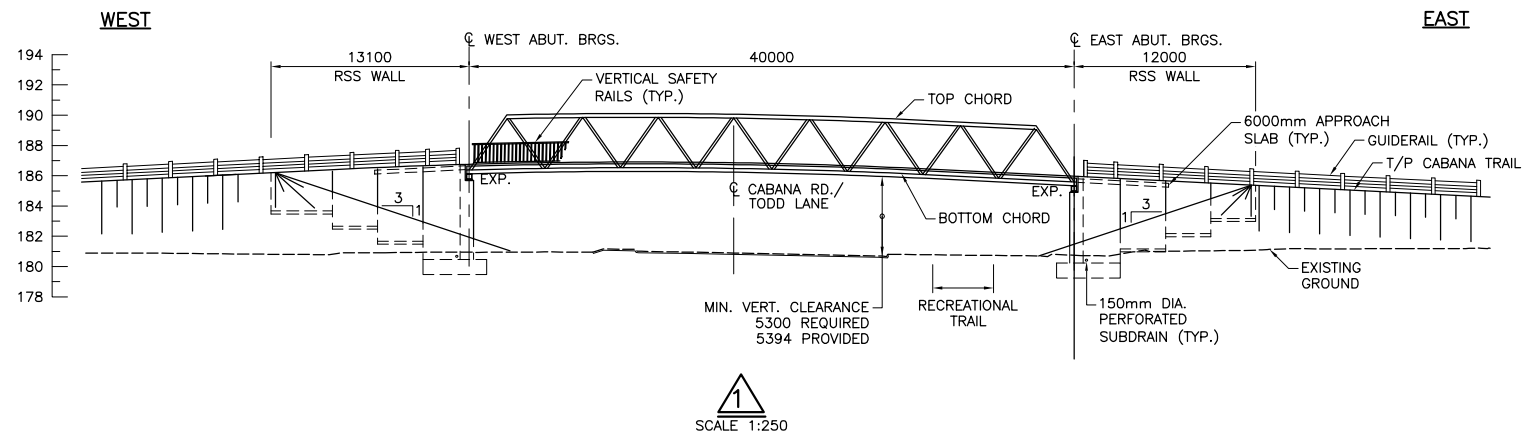
NOT FOR
CONSTRUCTION

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS	13-MAY-13				60% INTERIM IDR SUBMISSION			
	DATE	REV.	BY	DESCRIPTION	DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK	DD	CODE	CAN/CSA	LOAD	CL-625-ONT	
DRAWN	SJL	CHK	MO	SITE	6-617	DATE	18-APR-13	



PLAN
SCALE 1:250



PROFILE OF CABANA RD. / TODD LANE
N.T.S.

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

**Parkway
Infrastructure
Engineers**



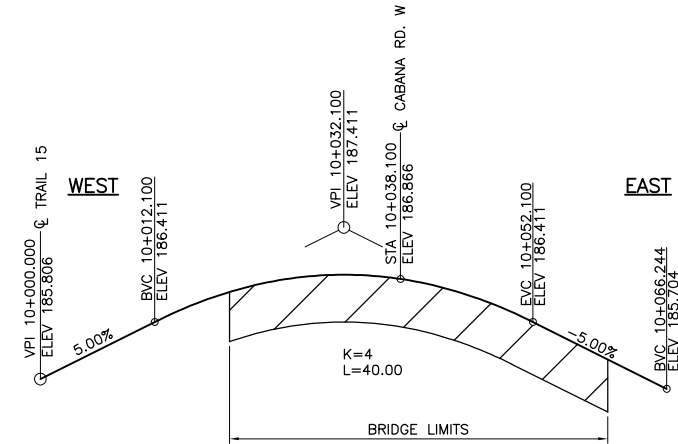
Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER CABANA RD.-TODD LN. TB-4
GENERAL ARRANGEMENT

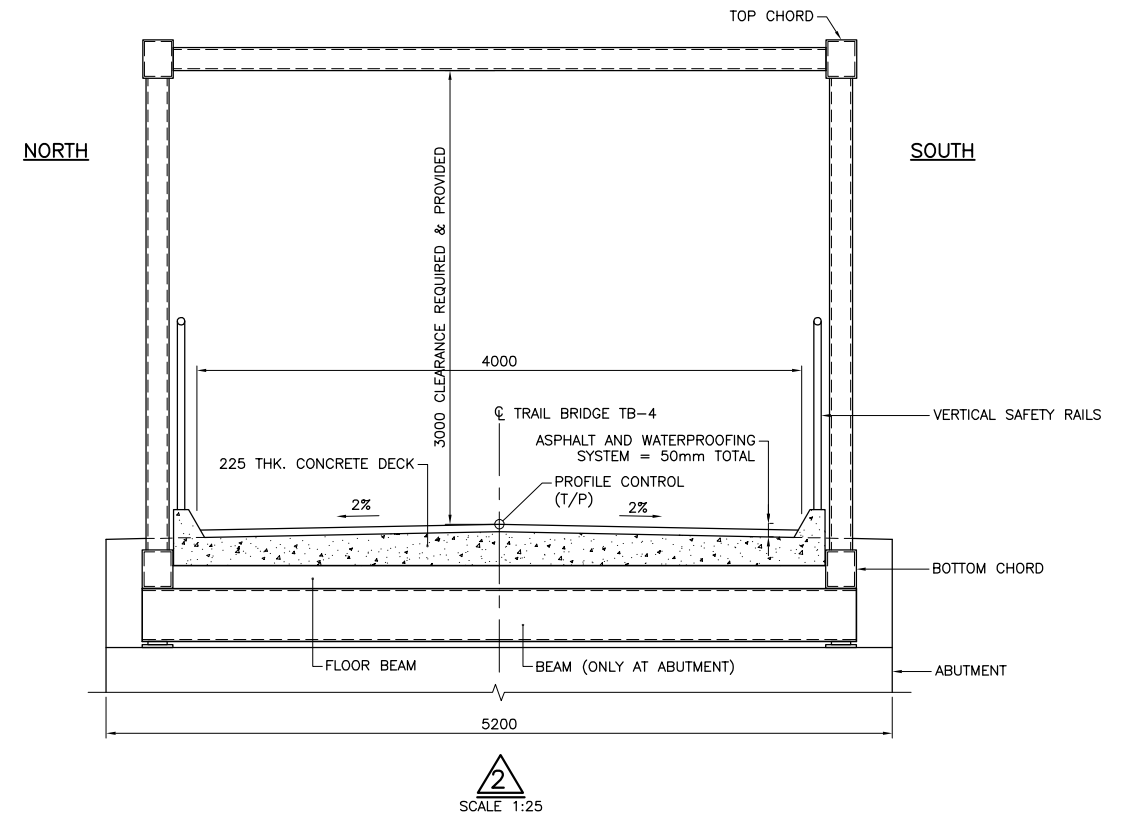


SHEET
S6401

Phase 1
60% Sub



PROFILE OF CABANA TRAIL BRIDGE
N.T.S.



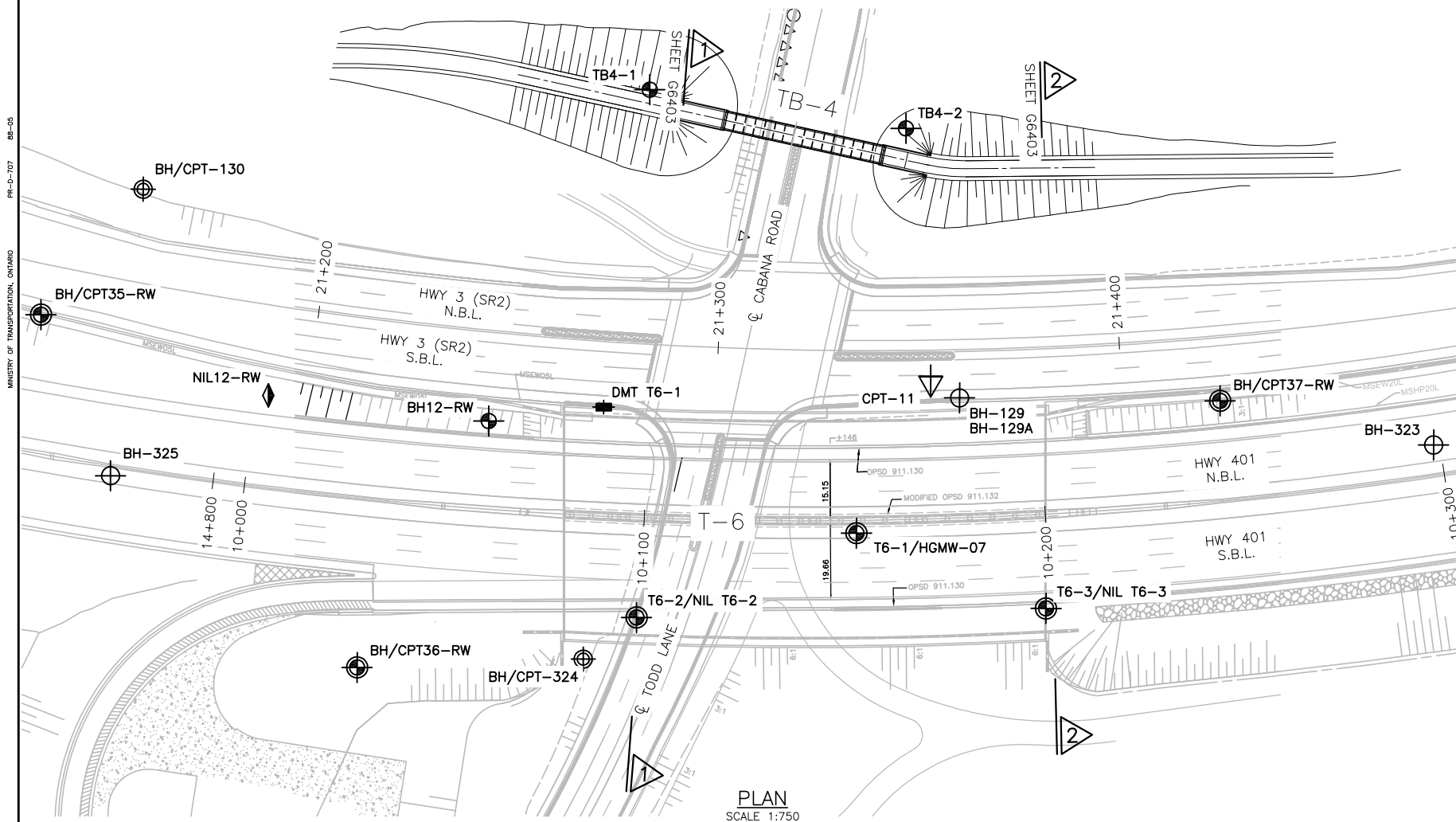
FOR PIC PROCUREMENT
PURPOSES ONLY

NOT FOR
CONSTRUCTION

REVISIONS	DATE	REV.	BY	DESCRIPTION
21-DEC-12	A1	MAS	ISSUED FOR PROCUREMENT PURPOSES	
DESIGN	BR	CHK	PM	CODE CAN/CSA S6-06 LOAD CL 625-ONT
DRAWN	RD	CHK	MAS	SITE 6-619 DATE JULY 2010

DOC: 285380-03-060-WIP1-6401

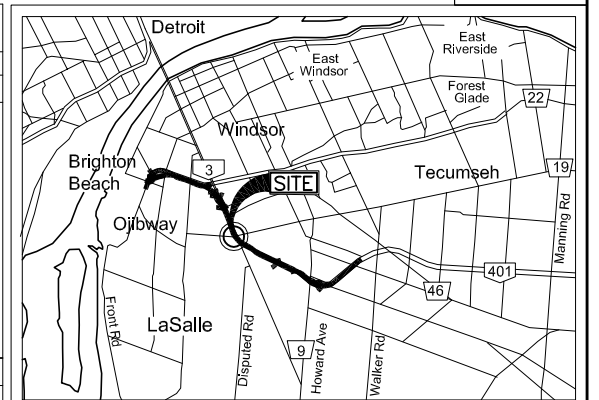
METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-4
BOREHOLE LOCATIONS & SOIL STRATASHEET
G6402Phase 1
60% Sub

No.	ELEVATION	CO—ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC BOREHOLES			
BH12—RW	181.2	4679718.1	332037.9
BH/CPT35—RW	181.0	4679825.8	331995.8
BH/CPT36—RW	180.5	4679710.0	331968.8
BH/CPT37—RW	180.9	4679571.4	332146.2
DMT T6—1	181.2	4679696.6	332057.3
NIL12—RW	181.2	4679767.0	332011.4
NIL T6—2	180.8	4679661.8	332020.5
NIL T6—3	181.7	4679574.1	332073.1
T6—1/HGMW—07	180.9	4679627.0	332067.4
T6—2	180.8	4679659.9	332018.8
T6—3	181.6	4679577.5	332079.1
TB4—1	180.7	4679732.3	332128.6
TB4—2	181.0	4679674.4	332157.2
PREVIOUS BOREHOLES			
BH—129	180.8	4679625.1	332109.7
BH—129A	180.8	4679625.1	332109.7
BH—323	181.3	4679521.4	332167.6
BH—325	180.8	4679787.7	331972.9
BH/CPT—130	180.8	4679821.8	332036.1
BH/CPT—324	180.9	4679664.9	332002.7
CPT—11	180.9	4679634.0	332110.0

MATERIAL LEGEND

	TOPSOIL/ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE /BEDROCK



KEY PLAN

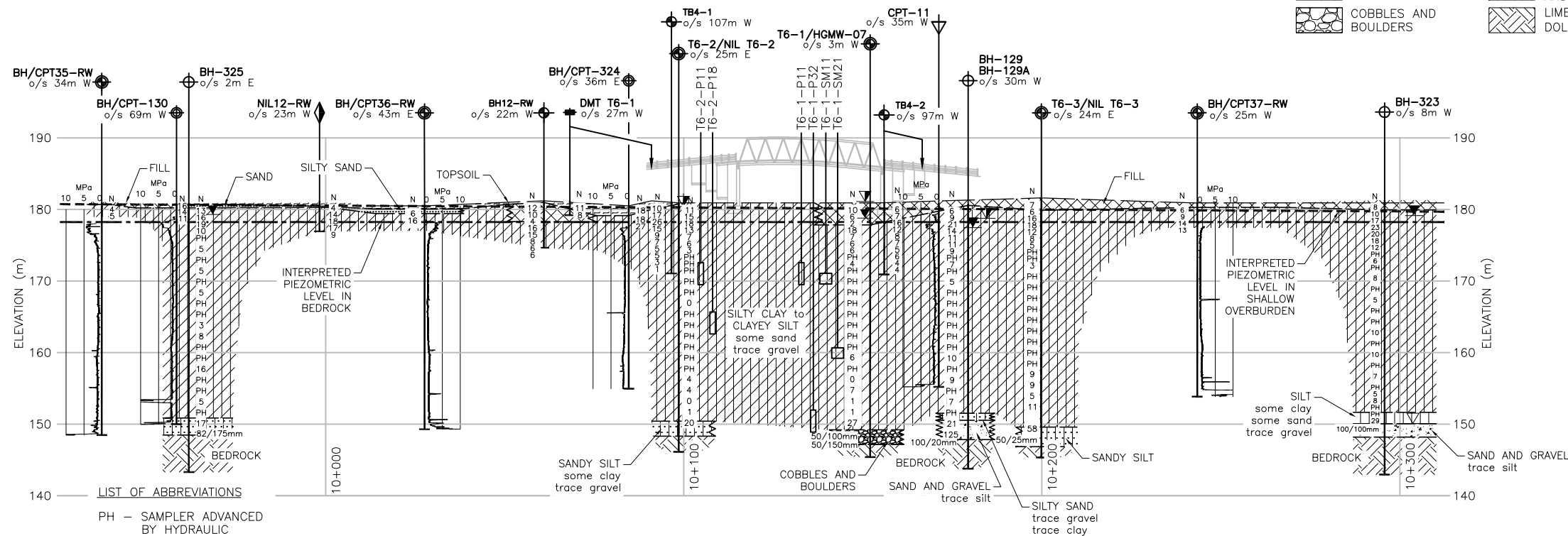
SCALE
0 2 4Km

LEGEND

- BOREHOLE CURRENT INVESTIGATION
- BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
- SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
- NILCON VANE CURRENT INVESTIGATION
- CPT - CURRENT INVESTIGATION
- DMT - CURRENT INVESTIGATION
- BOREHOLE PREVIOUS INVESTIGATION
- BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
- CPT -PREVIOUS INVESTIGATION
- N SPT N-VALUE
- BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- MHSG - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
- P - VIBRATING WIRE PIEZOMETER (VWP)
- SPZ - STANDPIPE PIEZOMETER
- DRY BOREHOLE DRY DURING DRILLING
- WATER LEVEL DURING DRILLING
- WATER LEVEL (SHALLOW PIEZO)
- WATER LEVEL (DEEP PIEZO)

NOTES

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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

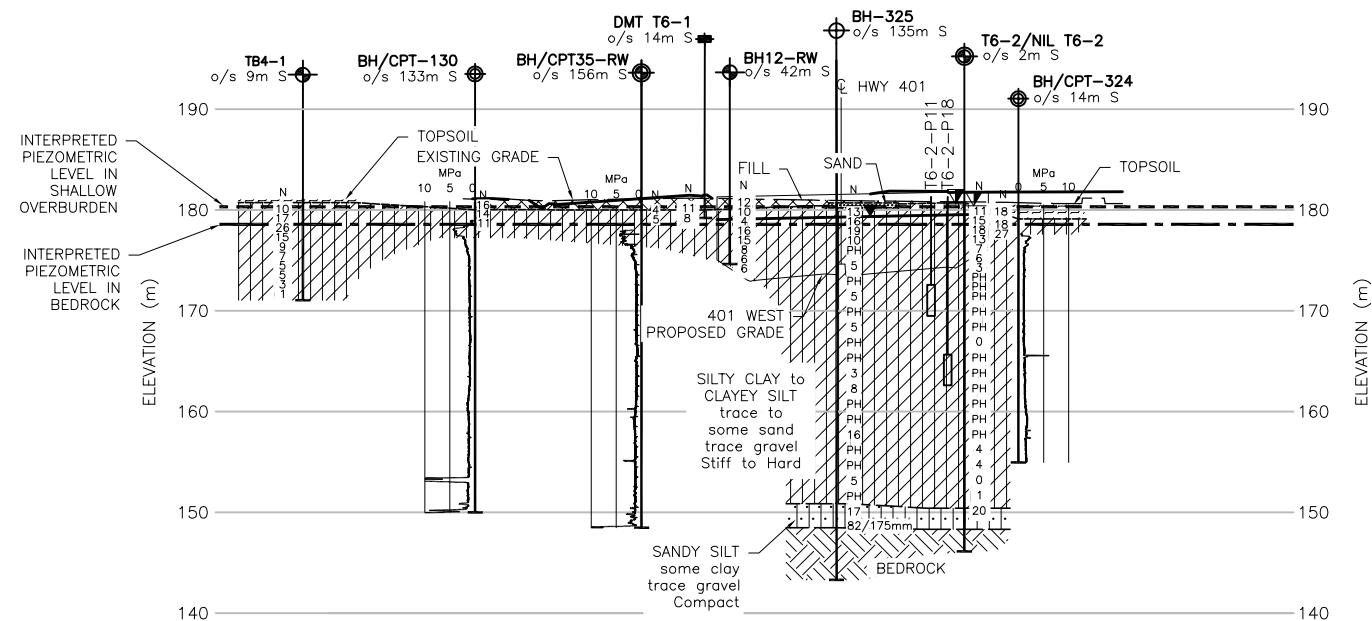
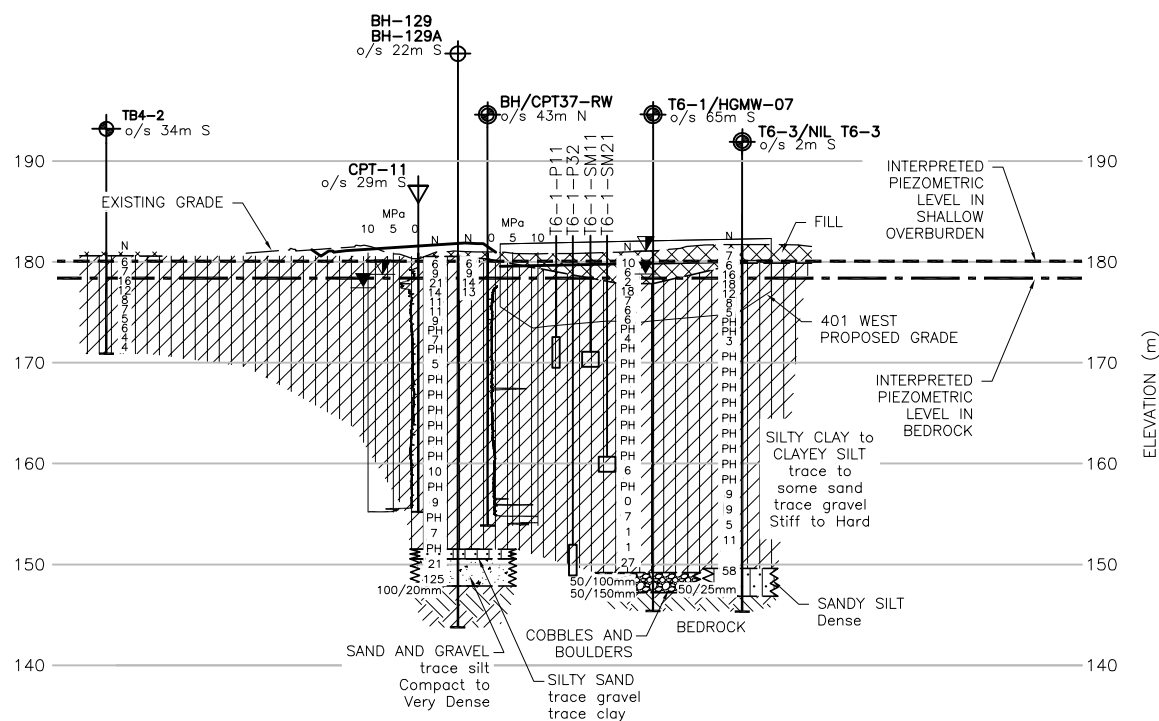


PROFILE ALONG CL OF HWY 401

HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWINGNOT FOR
CONSTRUCTION

REVISIONS	13-MAY-13				60% INTERIM IDR SUBMISSION			
	DATE	REV.	BY	DESCRIPTION	DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK	DD	CODE	CAN/CSA	LOAD	CL-625-ONT	
DRAWN	SJL	CHK	MO	SITE	6-619	DATE	19-APR-13	

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-4
SOIL STRATIGRAPHYSHEET
G6403Phase 1
60% SubHORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

LIST OF ABBREVIATIONS

PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
PM - SAMPLER ADVANCED BY MANUAL PRESSURE
WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

	TOPSOIL/ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE / BEDROCK

KEY PLAN
SCALE
1 0 2 4Km

LEGEND

	BOREHOLE CURRENT INVESTIGATION
	BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
	SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
	NILCON VANE CURRENT INVESTIGATION
	CPT - CURRENT INVESTIGATION
	DMT - CURRENT INVESTIGATION
	BOREHOLE PREVIOUS INVESTIGATION
	BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
	CPT - PREVIOUS INVESTIGATION
N	SPT N-VALUE
16	BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
	P - VIBRATING WIRE PIEZOMETER (VWP)
	SPz - STANDPIPE PIEZOMETER
DRY	BOREHOLE DRY DURING DRILLING
	WATER LEVEL DURING DRILLING
	WATER LEVEL (SHALLOW PIEZO)
	WATER LEVEL (DEEP PIEZO)
	CPT-qc

NOTES

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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWINGNOT FOR
CONSTRUCTION

REVISIONS	DATE	REV.	BY	DESCRIPTION
13-MAY-13	A1	EA		60% INTERIM IDR SUBMISSION
DESIGN	EA	CHK	DD	CODE CAN/CSA
DRAWN	SJL	CHK	MO	SITE 6-619
				LOAD CL-625-ONT
				DATE 19-APR-13

DOC: 285380-04-091-WP1-6403

DATE PLOTTED: 6/27/2013 3:04:11 PM
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MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707 08-05

Parkway Infrastructure Engineers

Hatch Mott MacDonald

Windsor-Essex Parkway Project

RFP No. 09-54-1007

NEW CONSTRUCTION

HWY 401

TRAIL BRIDGE OVER HURON CHURCH LN. TB-5

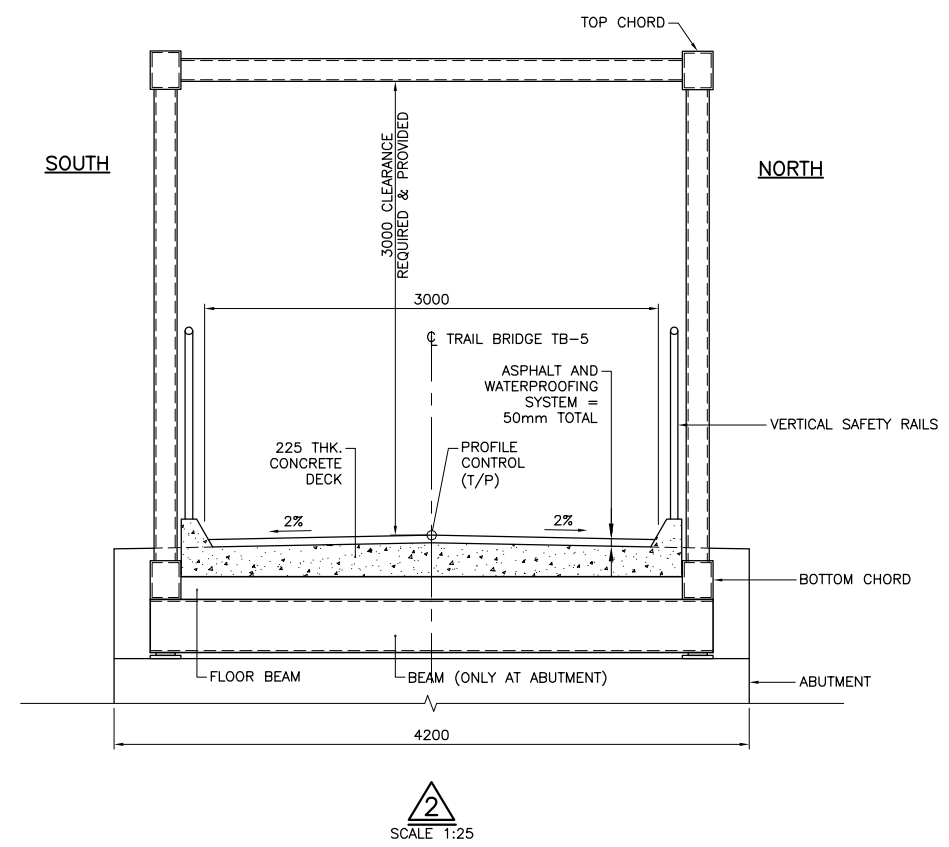
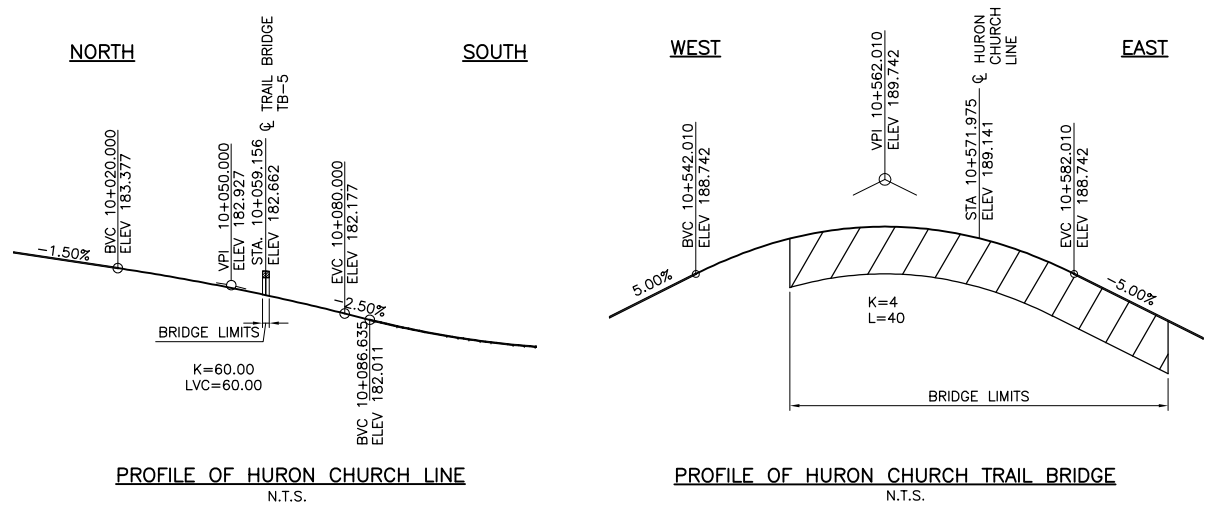
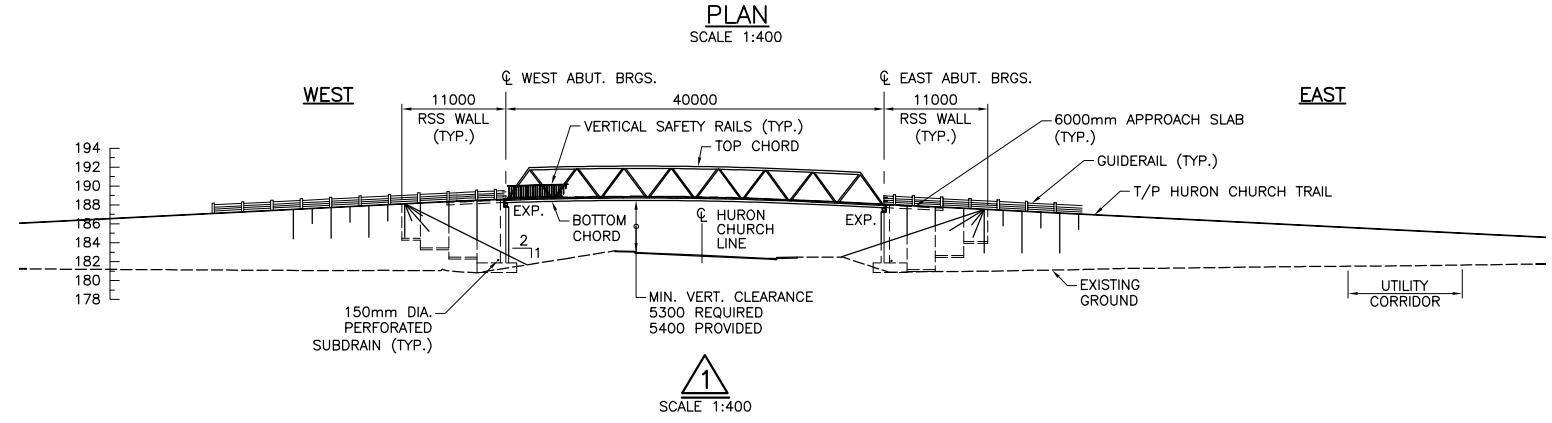
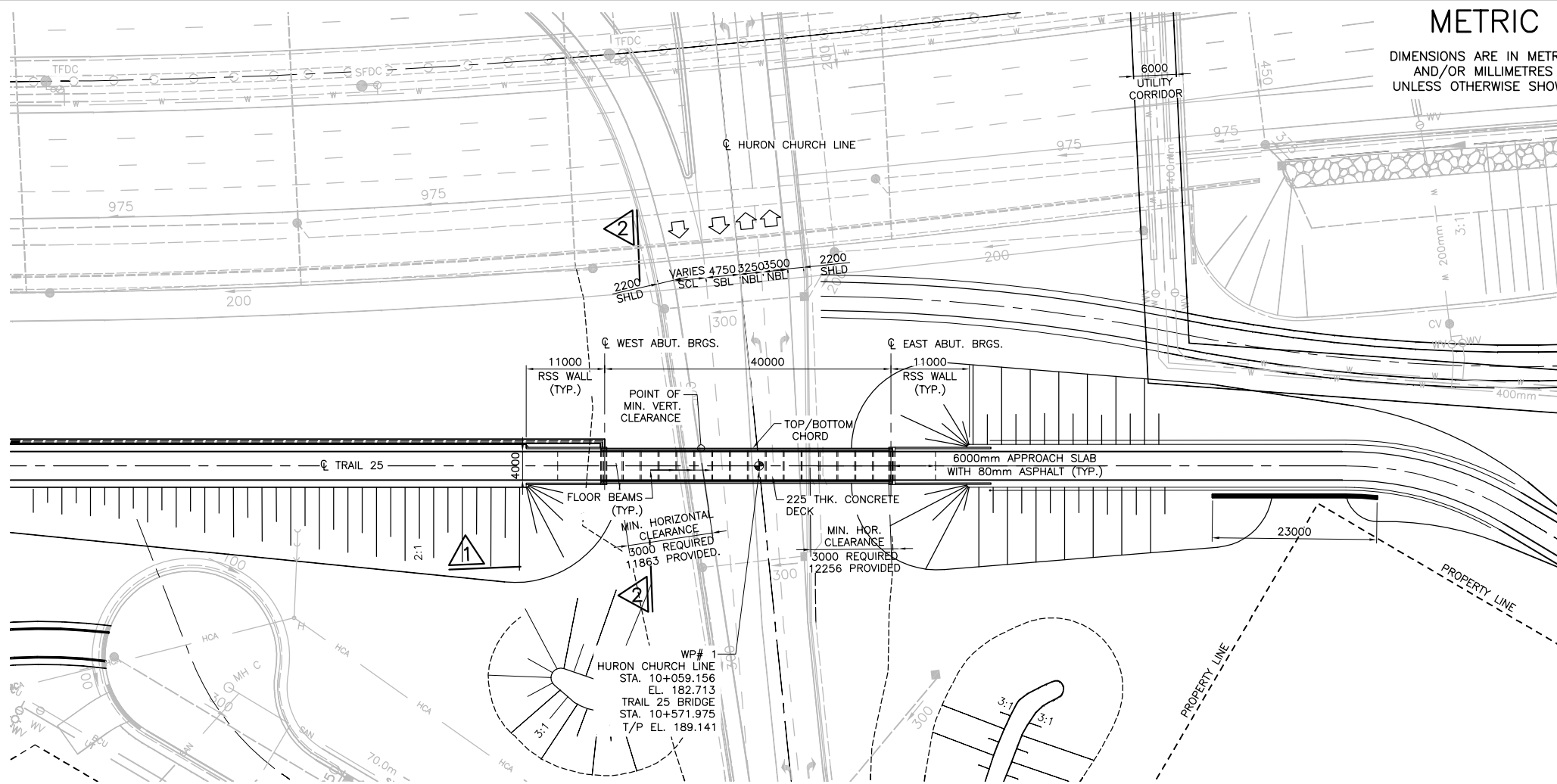
GENERAL ARRANGEMENT

SHEET

S6501

Phase 1

60% Sub

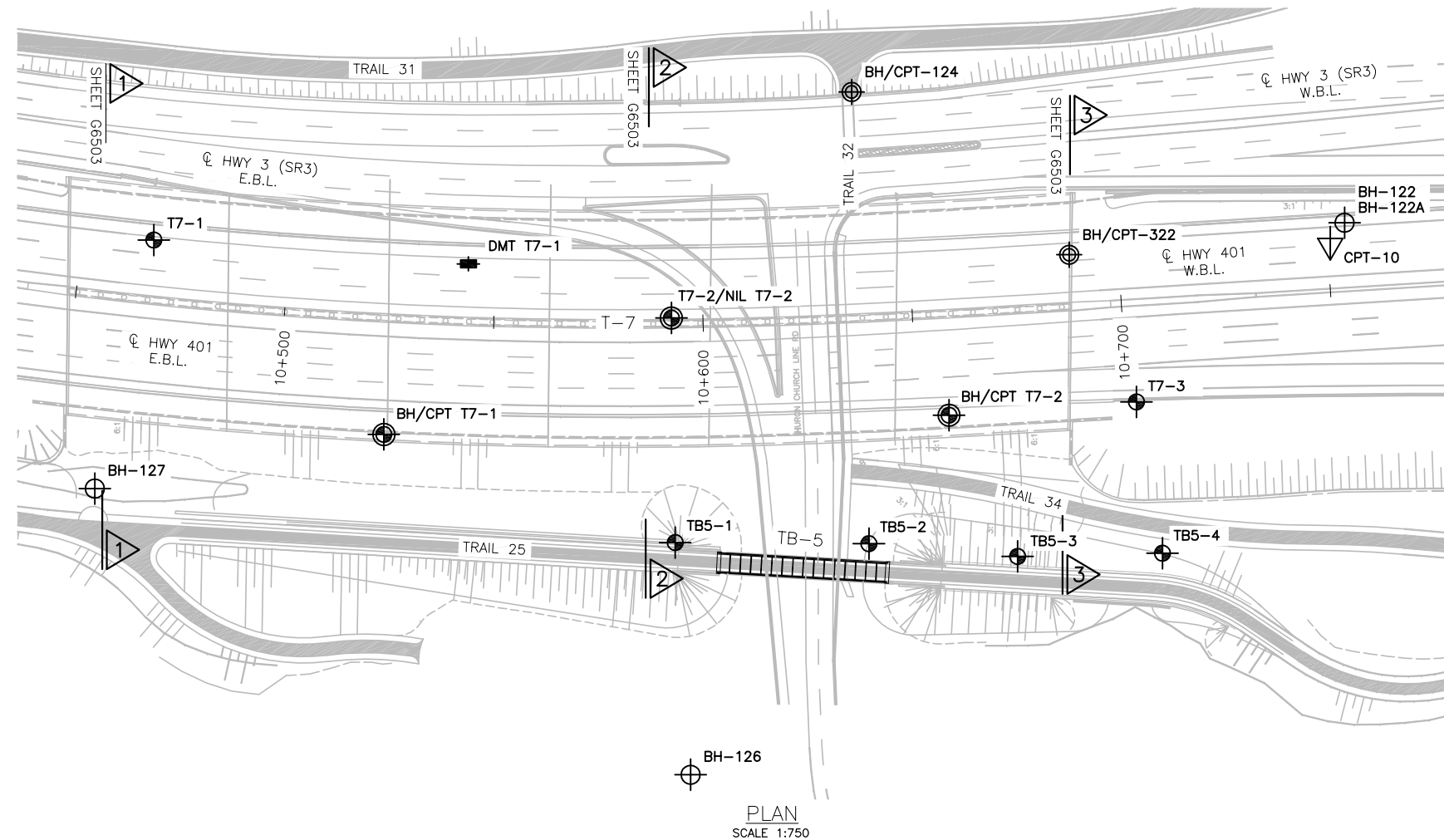


FOR PIC PROCUREMENT PURPOSES ONLY

NOT FOR CONSTRUCTION

REVISIONS		DATE	REV.	BY	DESCRIPTION
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DESIGN	BR	CHK	PM	CODE	CAN/CSA S6-06
DRAWN	RD	CHK	MAS	SITE	6-620

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-5
BOREHOLE LOCATIONS & SOIL STRATASHEET
G6502Phase 1
60% Sub

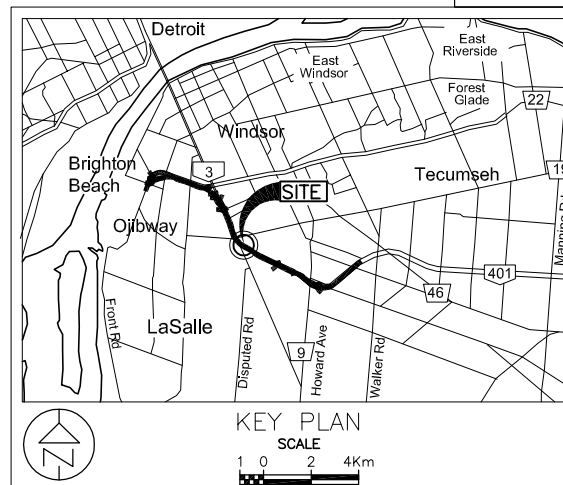
No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC TEST HOLES			
BH/CPT T7-1	181.2	4679345.0	332316.9
BH/CPT T7-2	181.2	4679276.9	332433.5
DMT T7-1	181.5	4679368.7	332355.7
NIL T7-2	181.0	4679332.1	332390.8
T7-1	181.5	4679413.6	332295.2
T7-2	181.2	4679331.1	332388.2
T7-3	181.7	4679255.7	332473.2
TB5-1	181.0	4679286.0	332362.0
TB5-2	180.8	4679261.2	332400.9
TB5-3	181.3	4679239.6	332429.4
TB5-4	181.7	4679221.9	332459.0
PREVIOUS TEST HOLES			
BH/CPT-124	181.5	4679354.6	332455.0
BH/CPT-322	181.5	4679294.0	332478.2
BH-122	181.7	4679265.4	332537.9
BH-122A	181.7	4679265.4	332537.9
BH-126	180.6	4679237.2	332335.5
BH-127	181.3	4679370.9	332251.6
CPT-10	181.8	4679264.0	332533.0

MATERIAL LEGEND

	TOPSOIL/ ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE DOLOSTONE /BEDROCK

LIST OF ABBREVIATIONS

PH	-	SAMPLER ADVANCED BY HYDRAULIC PRESSURE
PM	-	SAMPLER ADVANCED BY MANUAL PRESSURE
WH	-	SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR	-	SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

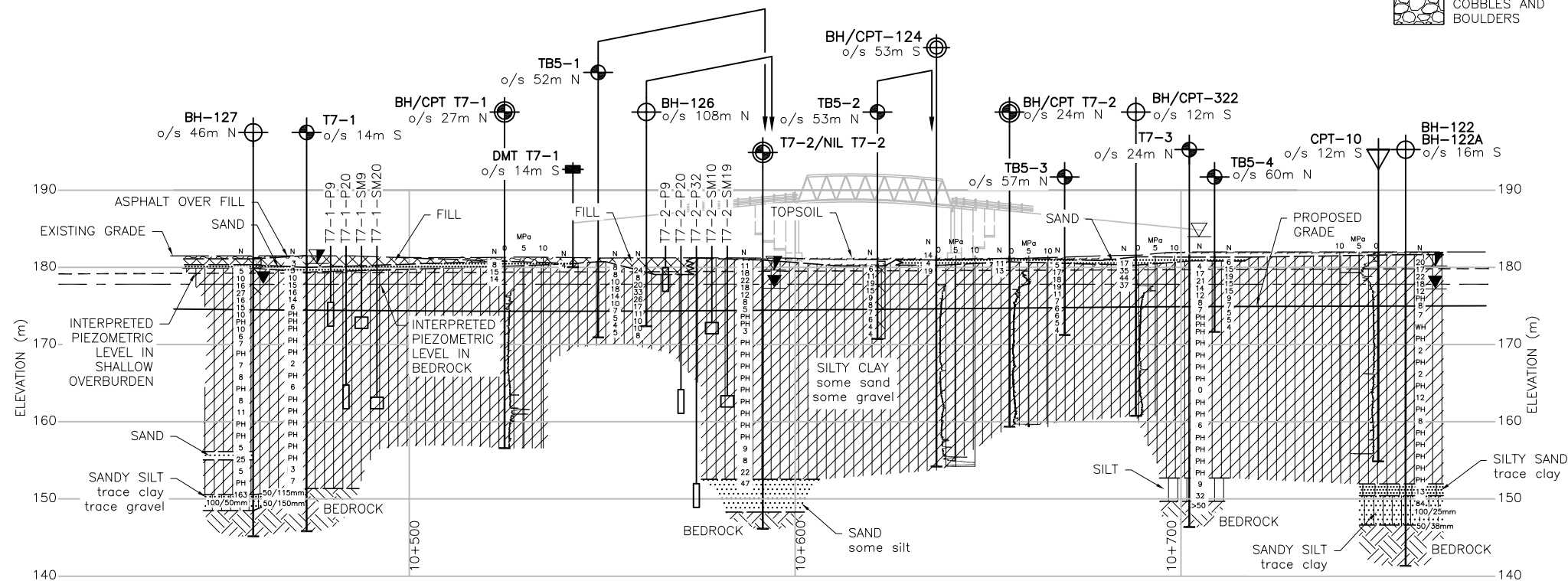


LEGEND

	BOREHOLE CURRENT INVESTIGATION		BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
	SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION		NILCON VANE CURRENT INVESTIGATION
	CPT - CURRENT INVESTIGATION		DMT - CURRENT INVESTIGATION
	BOREHOLE PREVIOUS INVESTIGATION		BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
	CPT -PREVIOUS INVESTIGATION		N SPT N-VALUE
	BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)		MHSg - MAGNETIC HEAVE/SETTLEMENT GAUGE
	P - VIBRATING WIRE PIEZOMETER		CPT-qc
	DRY BOREHOLE DRY DURING DRILLING		WATER LEVEL DURING DRILLING
	WATER LEVEL (SHALLOW PIEZO)		WATER LEVEL (DEEP PIEZO)

NOTES

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PROFILE ALONG CL OF TUNNEL

HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWINGNOT FOR
CONSTRUCTION

REVISIONS	13-MAY-13				60% INTERIM IDR SUBMISSION			
	DATE	REV.	BY	DESCRIPTION	DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK	DD	CODE	CAN/CSA	LOAD	CL-625-ONT	
DRAWN	SJL	CHK	MO	SITE	6-620	DATE	24-APR-13	

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

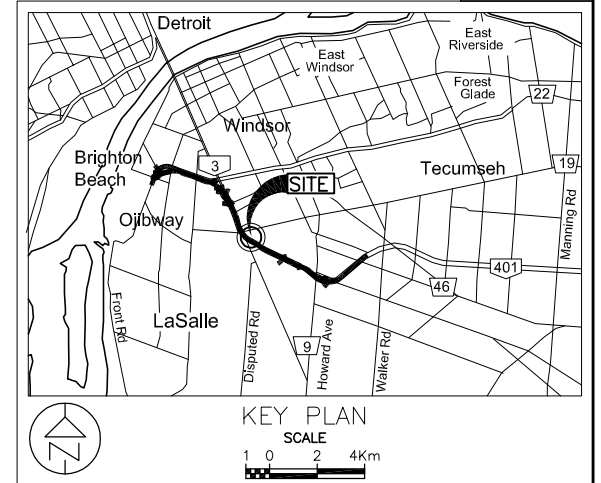
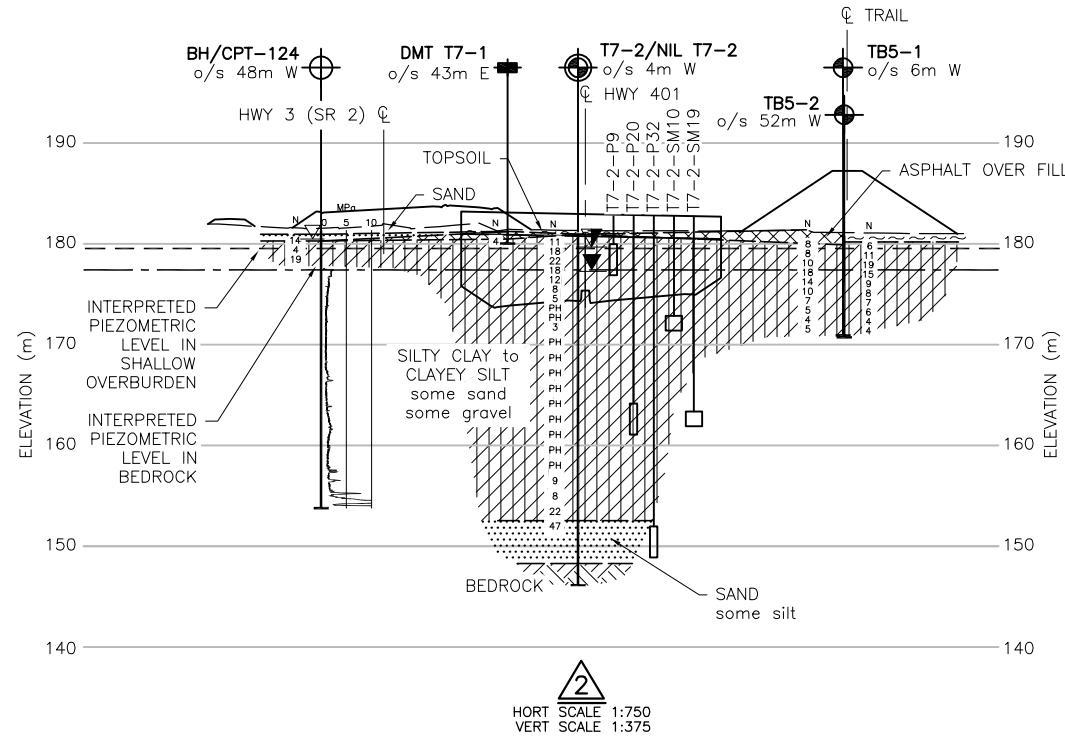
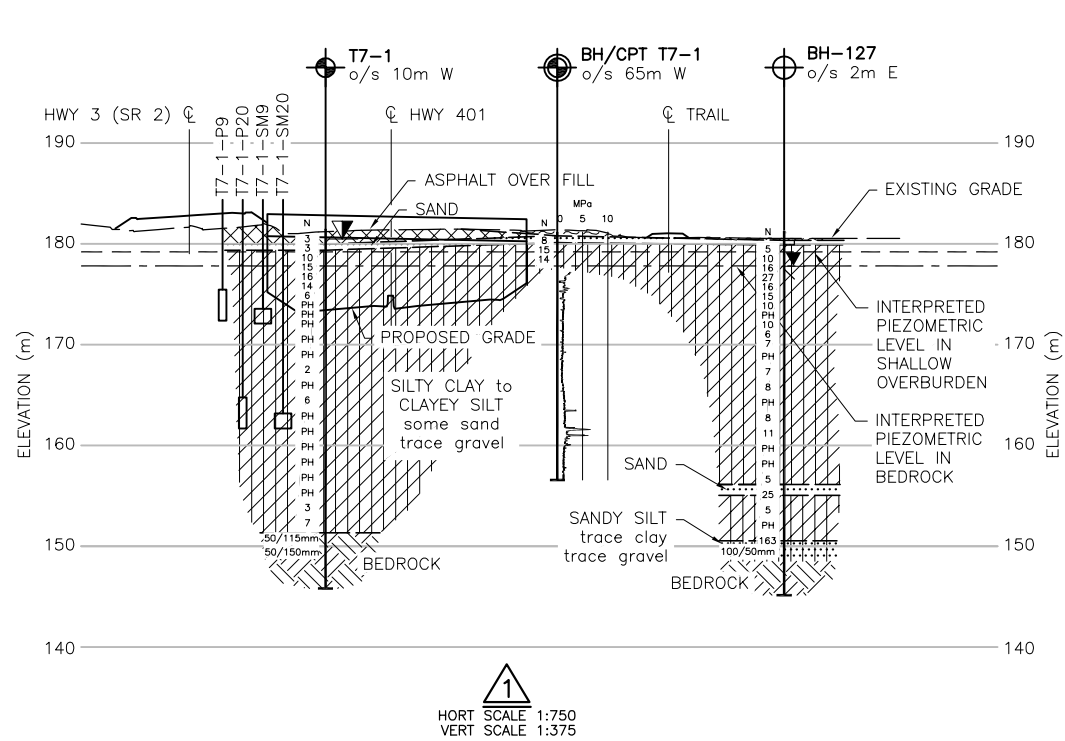


Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-5
SOIL STRATIGRAPHY

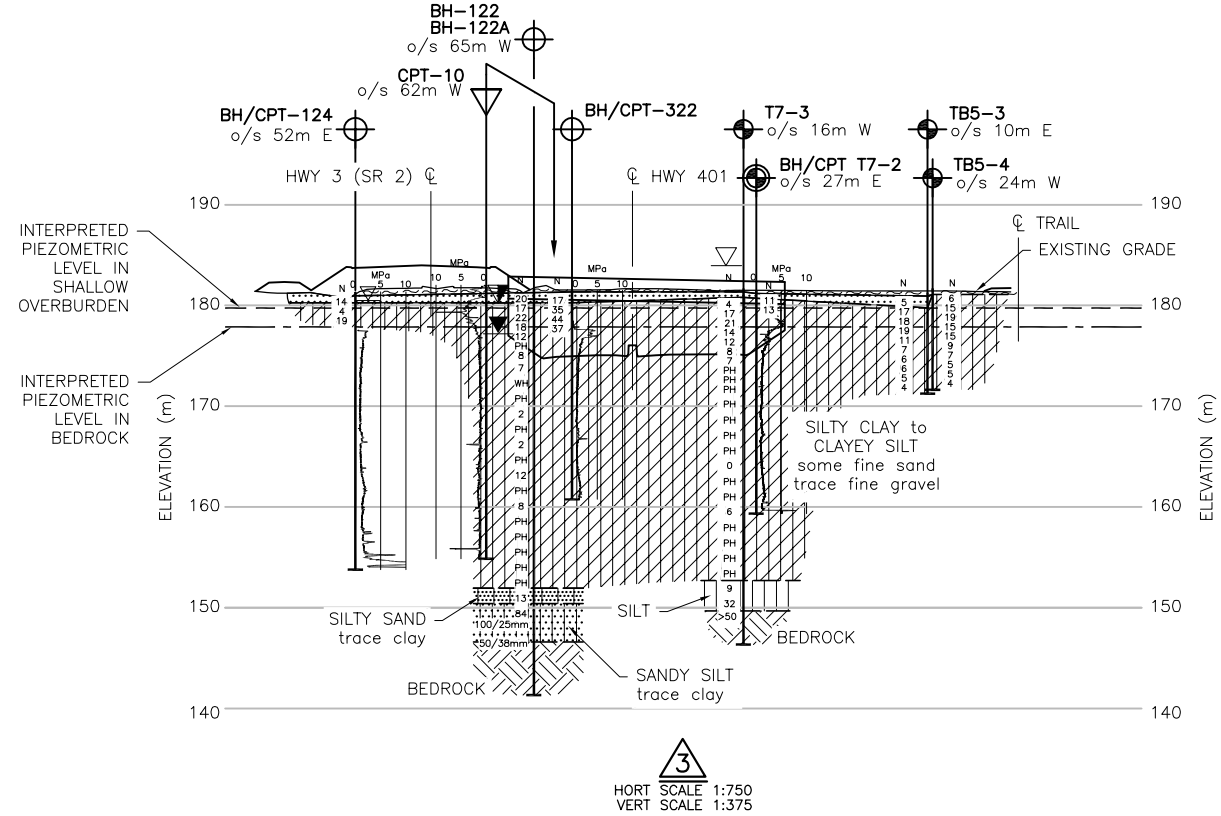
SHEET
G6503

Phase 1
60% Sub



- LIST OF ABBREVIATIONS
- PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
 - PM - SAMPLER ADVANCED BY MANUAL PRESSURE
 - WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
 - WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

- MATERIAL LEGEND
- TOPSOIL/ ORGANICS
 - FILL
 - SAND
 - SILTY CLAY
 - SILTY SAND
 - COBBLES AND BOULDERS
 - SILT
 - SANDY SILT
 - CLAYEY SILT
 - SAND AND GRAVEL
 - SILTY SAND AND GRAVEL
 - LIMESTONE /BEDROCK



- LEGEND
- BOREHOLE CURRENT INVESTIGATION
 - BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
 - SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
 - NILCON VANE CURRENT INVESTIGATION
 - CPT - CURRENT INVESTIGATION
 - DMT - CURRENT INVESTIGATION
 - BOREHOLE PREVIOUS INVESTIGATION
 - BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
 - CPT -PREVIOUS INVESTIGATION
 - N SPT N-VALUE
 - 16 BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
 - MHSG - MAGNETIC HEAVE/SETTLEMENT GAUGE
 - P - VIBRATING WIRE PIEZOMETER
 - DRY BOREHOLE DRY DURING DRILLING
 - WATER LEVEL DURING DRILLING
 - WATER LEVEL (SHALLOW PIEZO)
 - WATER LEVEL (DEEP PIEZO)

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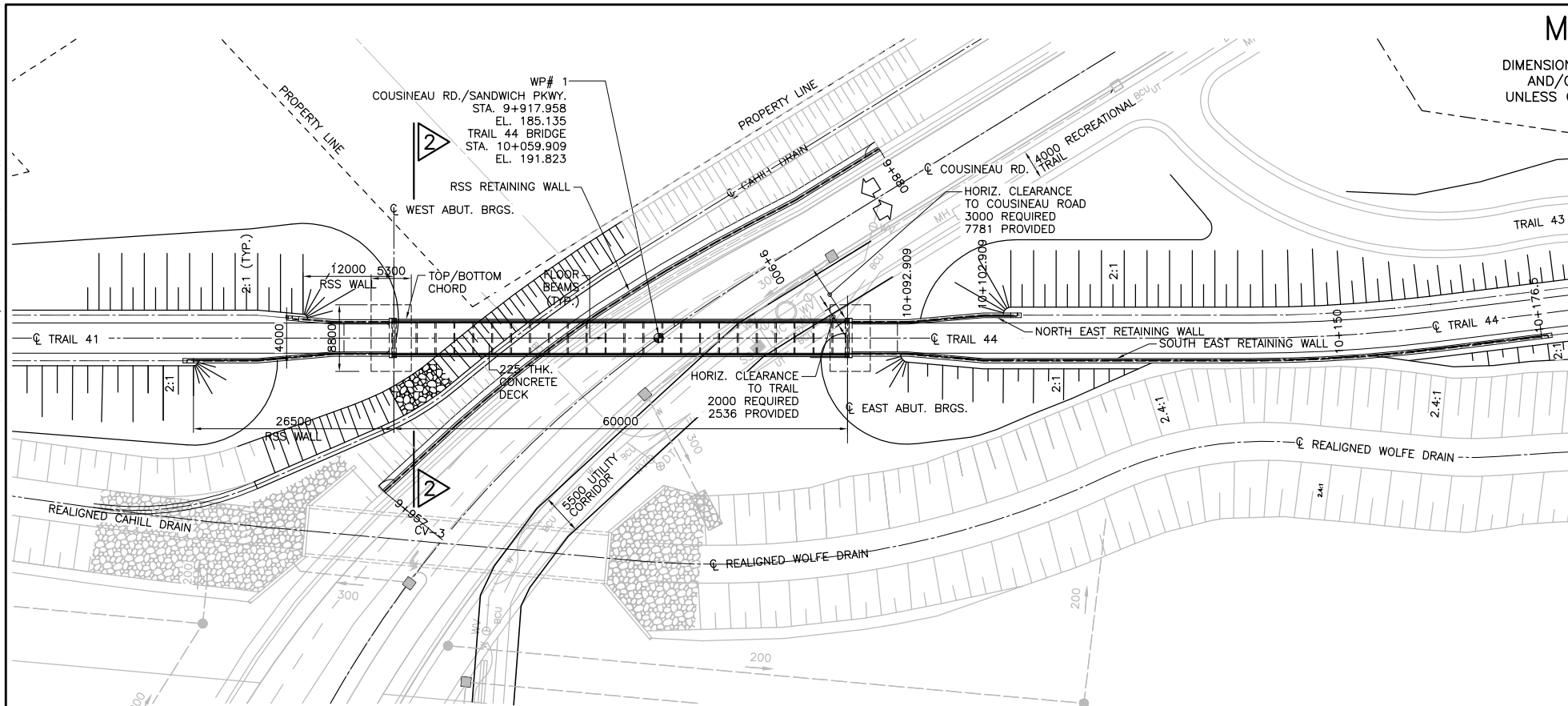
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NOT FOR
CONSTRUCTION

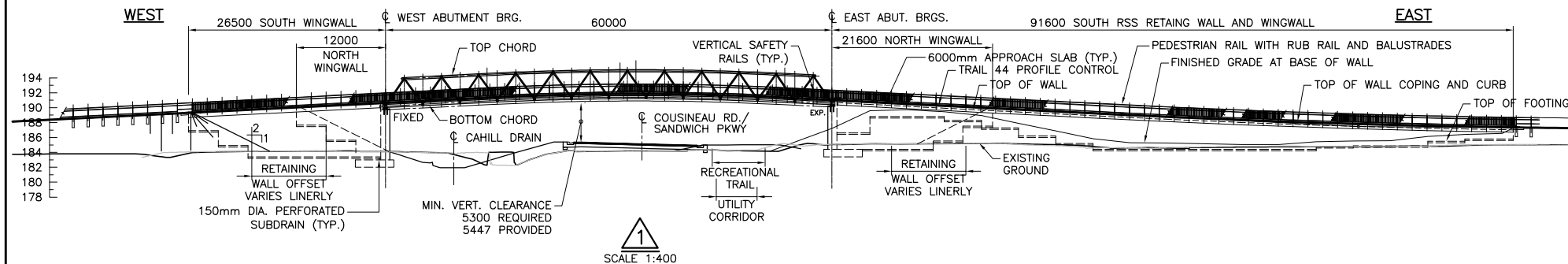
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DESIGN	EA	CHK	DD	CODE	CAN/CSA	LOAD	CL-625-ONT									
DRAWN	SJL	CHK	MO	SITE	6-620	DATE	24-APR-13									

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MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707 88-05



PLAN
SCALE 1:400



SCALE 1:400

NORTH

SOUTH

PROFILE OF COUSINEAU RD.
N.T.S.

WEST

EAST

PROFILE OF COUSINEAU TRAIL BRIDGE
N.T.S.

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

Parkway
Infrastructure
Engineers



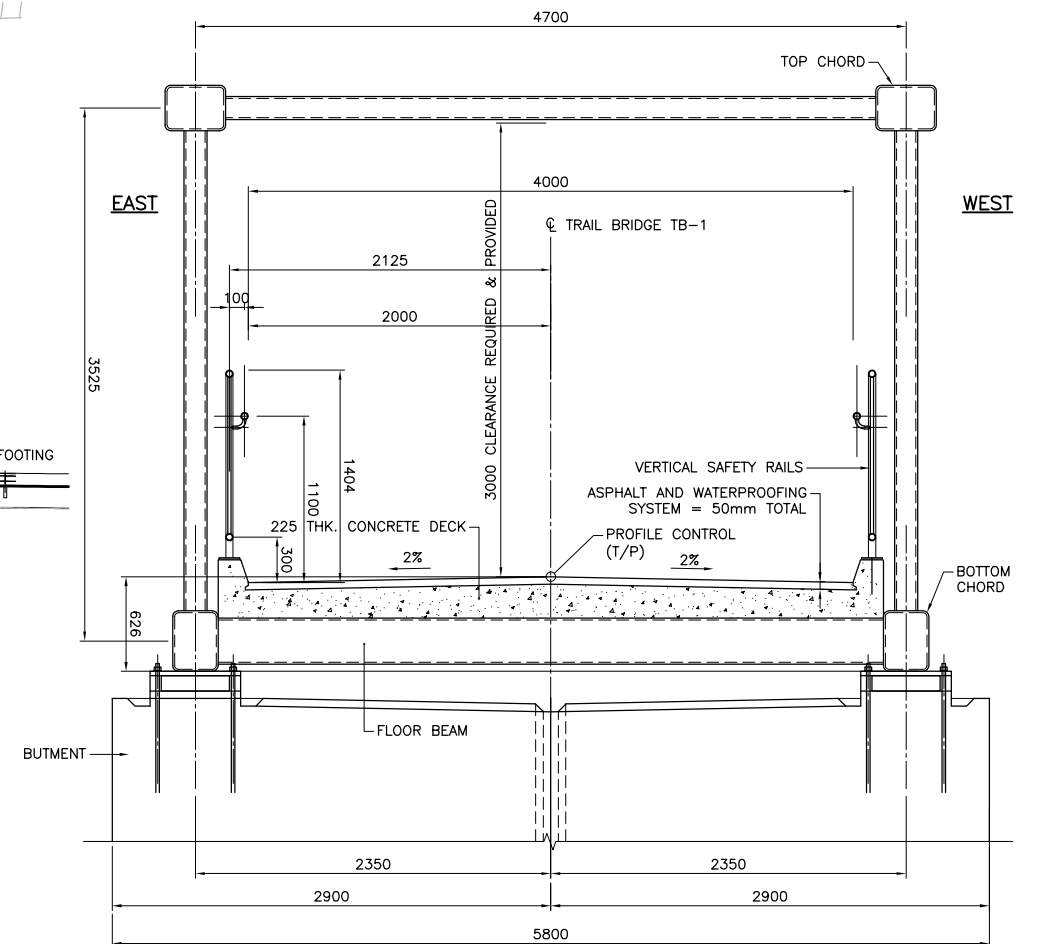
Windsor-Essex
Parkway Project
RFP No. 09-54-1007



NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER COUSINEAU RD. TB-7
GENERAL ARRANGEMENT

SHEET
S6701

Phase 1
60% Sub



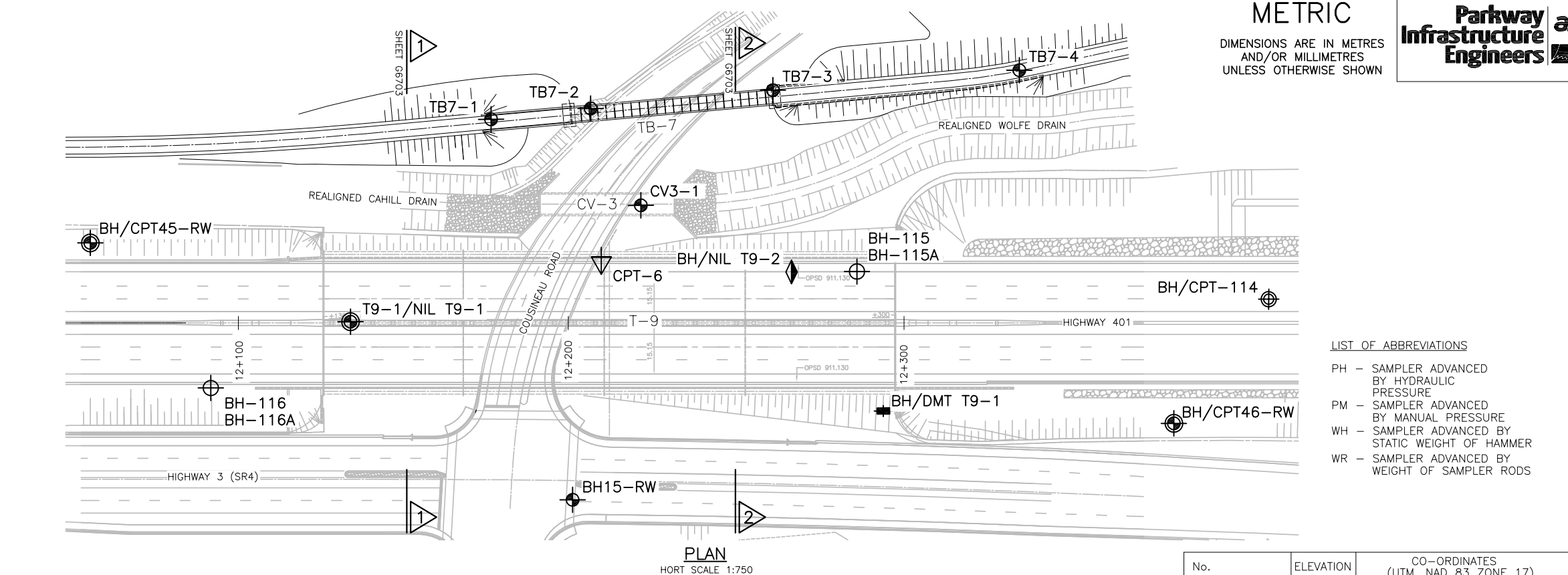
SCALE 1:25

NOT FOR
CONSTRUCTION

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

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21-DEC-12		A1	MAS	ISSUED FOR PROCUREMENT PURPOSES	
DESIGN		BR	CHK	PM	CODE CAN/CSA S6-06 LOAD CL 625-ONT
DRAWN		RD	CHK	MAS	SITE 6-622 DATE JULY 2010

DOC: 285380-03-060-WIP1-6701

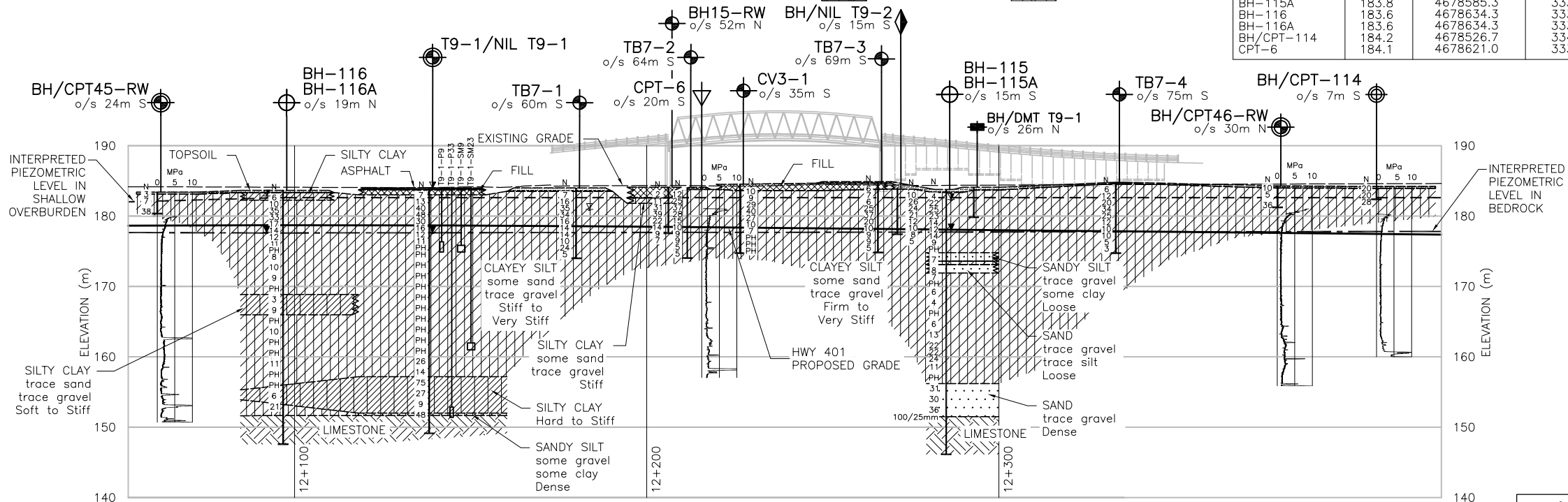


PLAN
HORIZONTAL SCALE 1:750

MATERIAL LEGEND

	TOPSOIL/ ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE DOLOSTONE /BEDROCK

No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC TESTHOLES			
BH15-RW	184.1	4678559.2	333806.1
BH/CPT45-RW	183.4	4678688.3	333708.0
BH/CPT46-RW	184.3	4678505.0	333977.6
CV3-1	184.5	4678630.0	333861.1
BH/DMT T9-1	184.1	4678544.5	333900.9
T9-1/NIL T9-1	184.0	4678634.9	333766.7
BH/NIL T9-2	184.0	4678636.5	333765.3
TB7-1	184.0	4678671.8	333831.4
TB7-2	184.1	4678662.3	333859.6
TB7-3	184.9	4678644.6	333911.0
TB7-4	184.8	4678619.4	333980.0
PREVIOUS TESTHOLES			
BH-115	183.8	4678585.3	333911.1
BH-115A	183.8	4678585.3	333911.1
BH-116	183.6	4678634.3	333722.5
BH-116A	183.6	4678634.3	333722.5
BH/CPT-114	184.2	4678526.7	334018.6
CPT-6	184.1	4678621.0	333844.0



PROFILE ALONG CL OF HWY 401

HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION

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



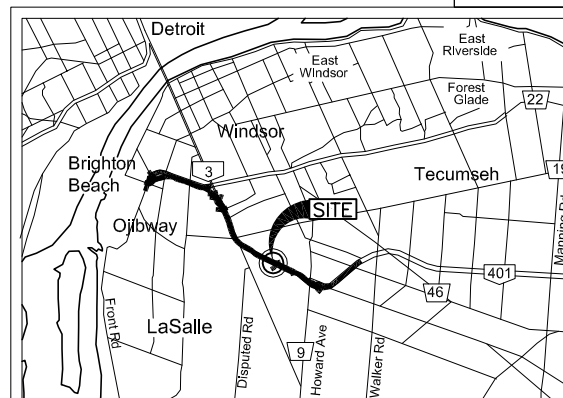
Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-7
BOREHOLE LOCATIONS & SOIL STRATA



SHEET
G6702

Phase 1
60% Sub



KEY PLAN

SCALE
1 0 2 4Km

LEGEND

- BOREHOLE
CURRENT INVESTIGATION
- BOREHOLE AND NILCON VANE
CURRENT INVESTIGATION
- SW/SP HOLE (HYDROGEOLOGY)
CURRENT INVESTIGATION
- NILCON VANE
CURRENT INVESTIGATION
- CPT - CURRENT INVESTIGATION
- DMT - CURRENT INVESTIGATION
- BOREHOLE
PREVIOUS INVESTIGATION
- BOREHOLE, CPT AND NILCON VANE
PREVIOUS INVESTIGATIONS
- CPT -PREVIOUS INVESTIGATION
- N SPT N-VALUE
- 16 BLOWS/0.3m UNLESS
OTHERWISE STATED
(STD. PEN. TEST, 475 J/BLOW)
- MHS - MAGNETIC
HEAVE/SETTLEMENT
GAUGE (SM)
- P - VIBRATING WIRE PIEZOMETER (VWP)
- DRY BOREHOLE DRY DURING DRILLING
- WATER LEVEL DURING DRILLING
- WATER LEVEL (SHALLOW PIEZO)
- WATER LEVEL (DEEP PIEZO)

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REVISIONS	DATE	REV.	BY	DESCRIPTION
13-MAY-13	A1	EA		60% INTERIM IDR SUBMISSION
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DRAWN	SJL	CHK	MO	SITE
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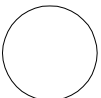
DOC: 285380-04-090-WIP1-6702

METRIC

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AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



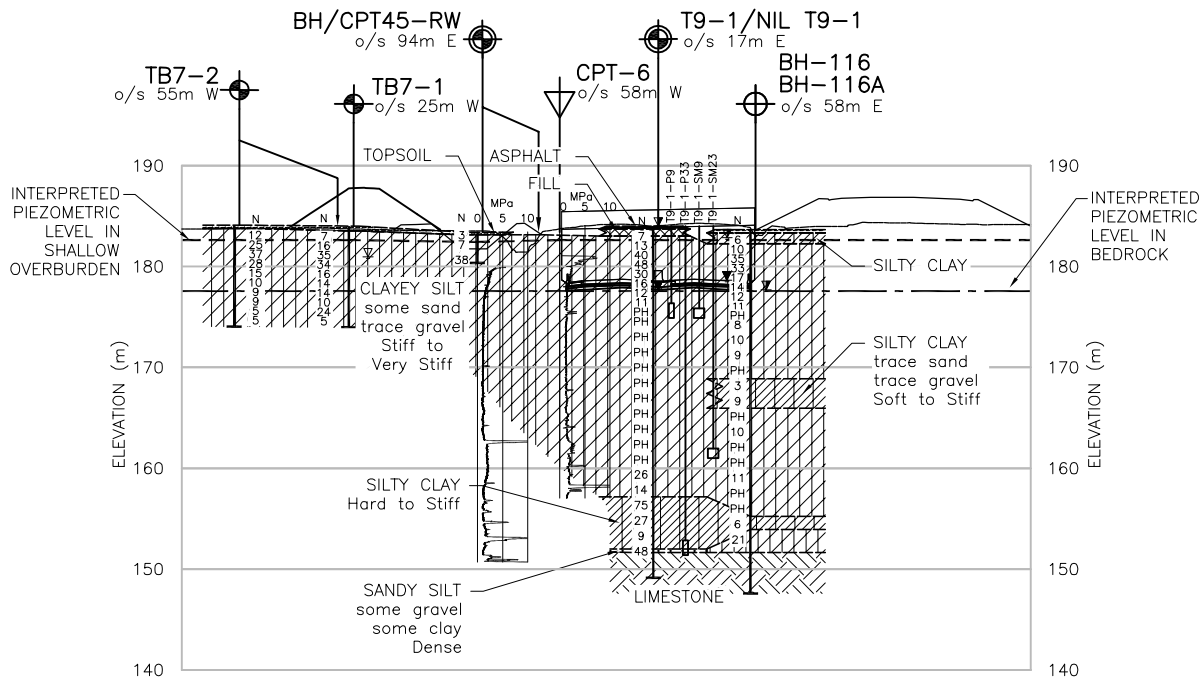
Windsor-Essex
Parkway Project
RFP No. 09-54-1007



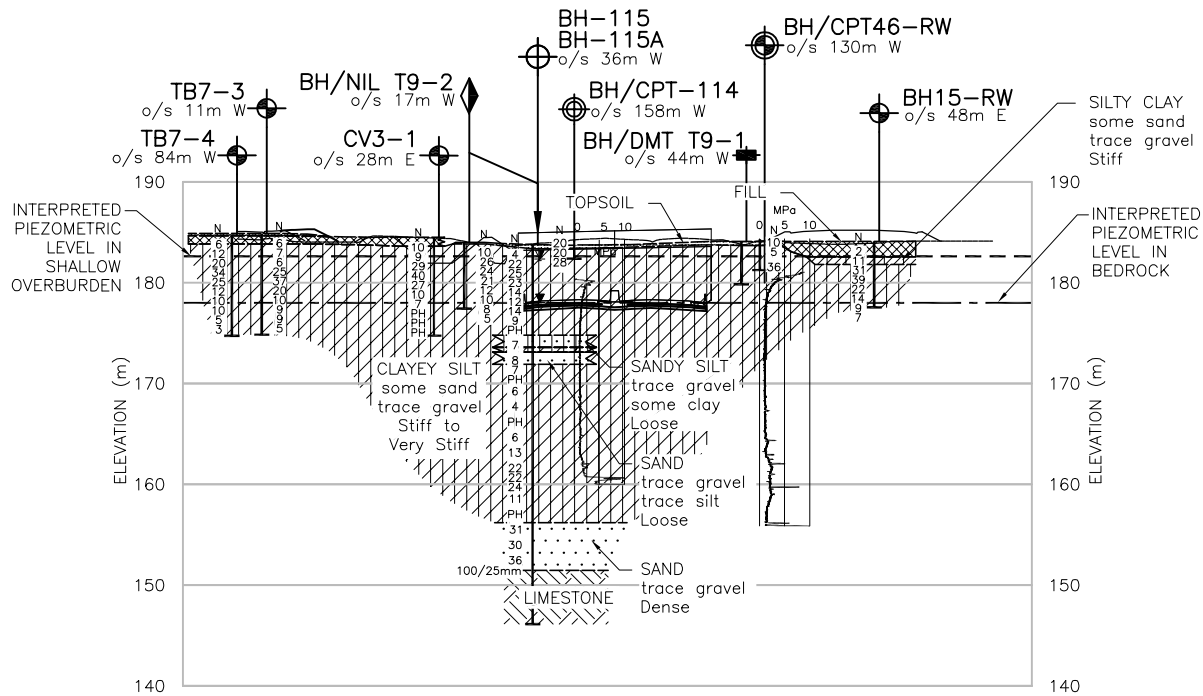
NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-7
SOIL STRATIGRAPHY

SHEET
G6703

Phase 1
60% Sub



HORT SCALE 1:750
VERT SCALE 1:375



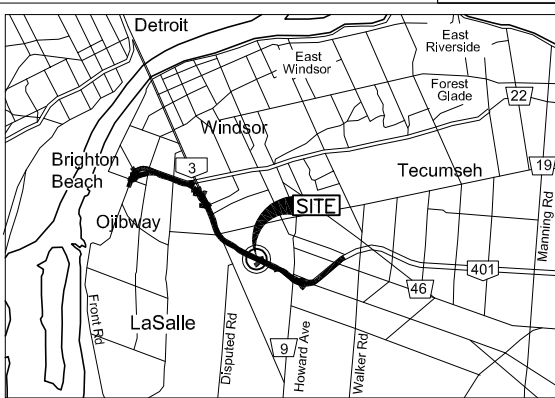
HORT SCALE 1:750
VERT SCALE 1:375

LIST OF ABBREVIATIONS

PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
PM - SAMPLER ADVANCED BY MANUAL PRESSURE
WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

	TOPSOIL/ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE DOLOSTONE /BEDROCK



KEY PLAN

SCALE
1:0 2:4Km

LEGEND

	BOREHOLE CURRENT INVESTIGATION
	BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
	SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
	NILCON VANE CURRENT INVESTIGATION
	CPT - CURRENT INVESTIGATION
	DMT - CURRENT INVESTIGATION
	BOREHOLE PREVIOUS INVESTIGATION
	BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
	CPT -PREVIOUS INVESTIGATION
	N SPT N-VALUE
	BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
	MHSG - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
	P - VIBRATING WIRE PIEZOMETER (VWP)
	DRY BOREHOLE DRY DURING DRILLING
	WATER LEVEL DURING DRILLING
	WATER LEVEL (SHALLOW PIEZO)
	WATER LEVEL (DEEP PIEZO)

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DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION

REVISIONS	DATE	REV.	BY	DESCRIPTION
13-MAY-13	A1	EA		60% INTERIM IDR SUBMISSION
DESIGN	EA	CHK	DD	CODE CAN/CSA
DRAWN	SJL	CHK	MO	SITE
				LOAD CL-625-ONT
				DATE 16-APR-13

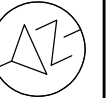
METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

**Parkway
Infrastructure
Engineers**



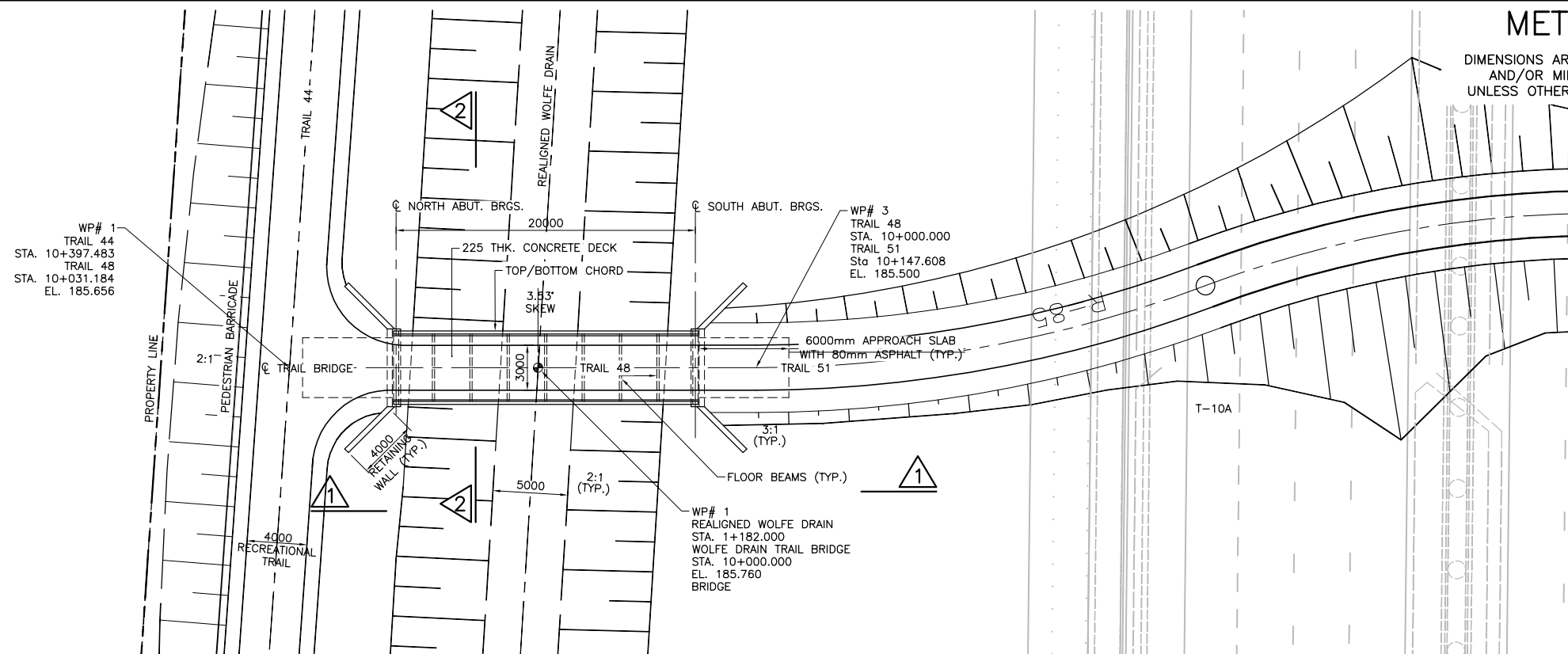
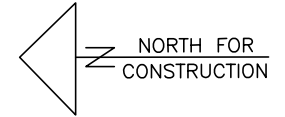
Windsor-Essex
Parkway Project
RFP No. 09-54-1007



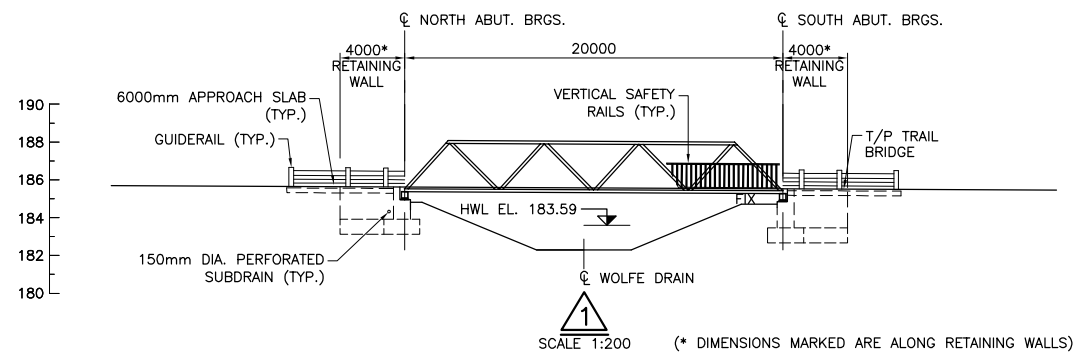
NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER WOLFE DRAIN TB-7A
GENERAL ARRANGEMENT

SHEET
S6751

Phase 1
60% Sub



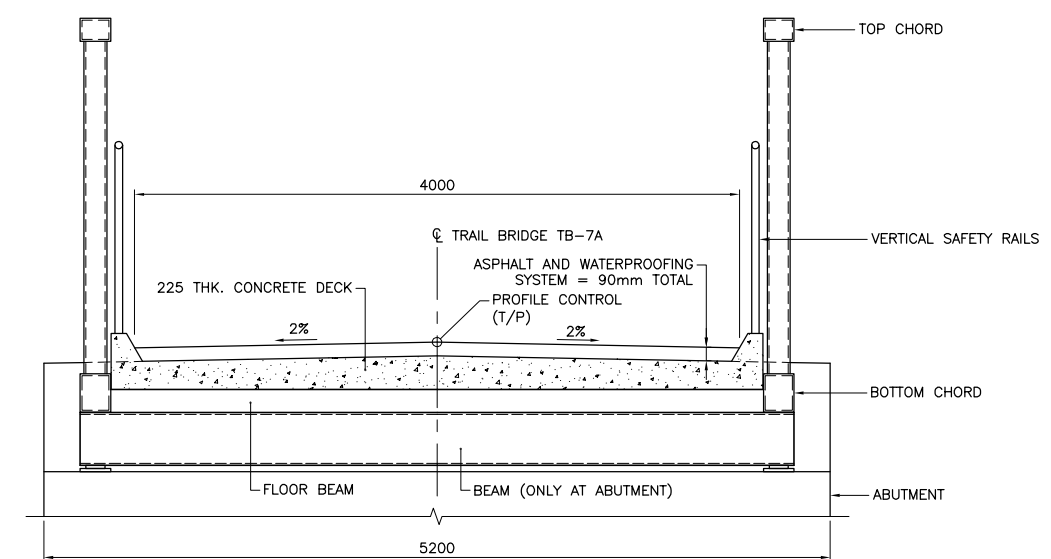
PLAN
SCALE 1:200



PROFILE OF TB-7A
N.T.S.

WEST

EAST



CROSS SECTION
SCALE 1:25

FOR PIC PROCUREMENT
PURPOSES ONLY

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CONSTRUCTION

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100mm ON ORIGINAL DRAWING

REVISIONS	DATE	REV.	BY	DESCRIPTION
	DATE	REV.	BY	DESCRIPTION
DESIGN	BR	CHK	PM	CODE CAN/CSA S6-06 LOAD CL 625-ONT
DRAWN	LG	CHK	MAS	SITE 6-623 DATE JULY 2010

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

**Parkway
Infrastructure
Engineers**

Windsor-Essex
Parkway Project
RFP No. 09-54-1007



NEW CONSTRUCTION

HWY 401
TRAIL BRIDGE TB-7A
BOREHOLE LOCATIONS & SOIL STRATA

SHEET

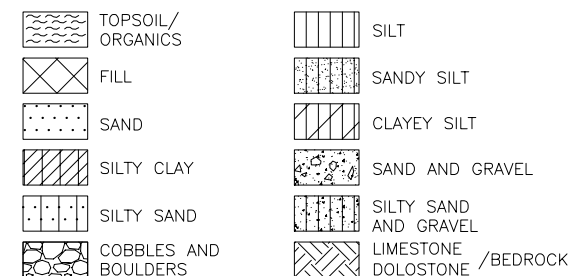
G6752

Phase 1

60% Sub

No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC BOREHOLES			
BH/CPT47-RW	185.4	4678440.3	334300.2
BH/CPT T10-1	184.9	4678450.6	334217.4
BH/CPT T10-2	185.2	4678403.2	334089.2
DMT T10-1	184.6	4678412.4	334151.5
T10-1/HGMW-04/SW-3	184.9	4678495.6	334122.3
T10-2/HGMW-09	184.8	4678358.2	334191.8
TB7A-1	184.8	4678506.6	334190.2
PREVIOUS BOREHOLES			
BH-112	184.6	4678413.3	334221.3
BH-112A	184.6	4678413.3	334221.3
BH-113	184.4	4678454.5	334070.3
BH-113A	184.4	4678454.5	334070.3
BH/CPT-114	184.2	4678526.7	334018.6
CPT-5	184.7	4678413.0	334220.0

MATERIAL LEGEND



LIST OF ABBREVIATIONS

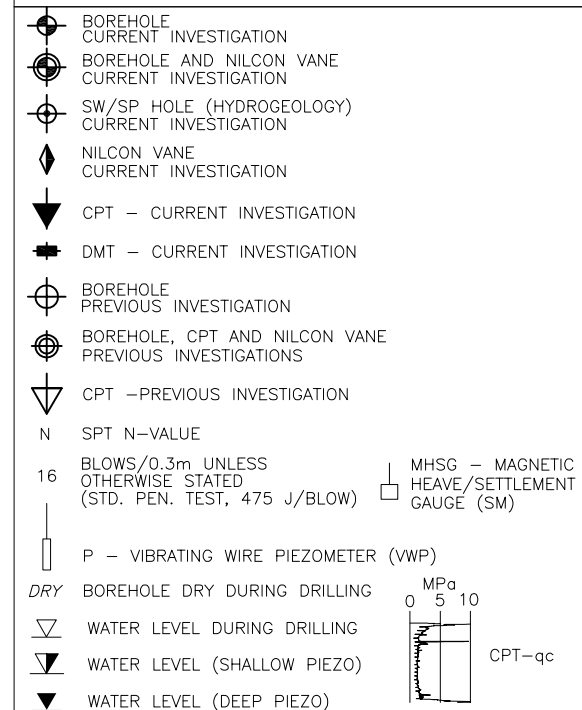
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BY HYDRAULIC
PRESSURE

PM - SAMPLER ADVANCED
BY MANUAL PRESSURE

WH - SAMPLER ADVANCED BY
STATIC WEIGHT OF HAMMER

WR - SAMPLER ADVANCED BY
WEIGHT OF SAMPLER RODS

LEGEND



NOTES

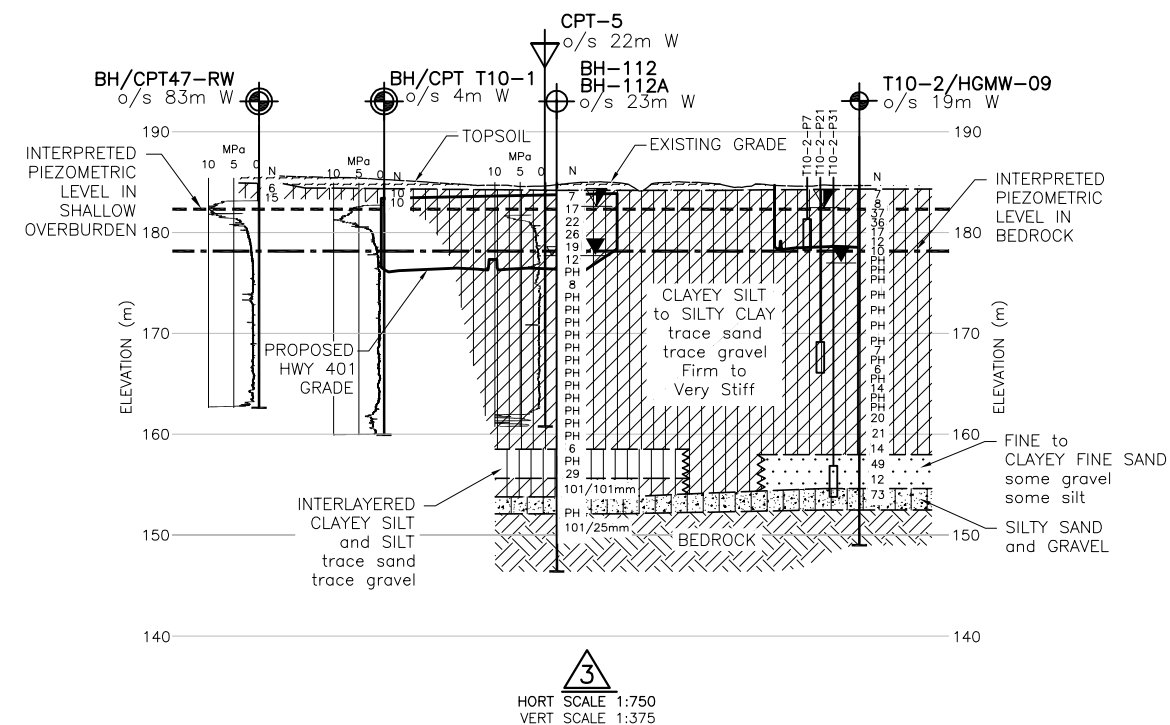
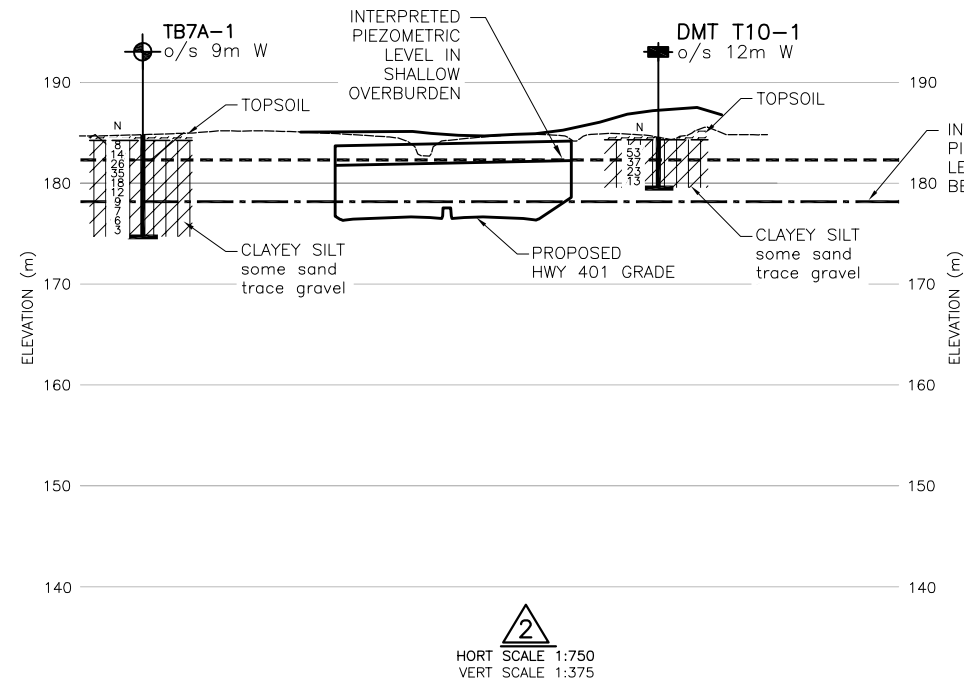
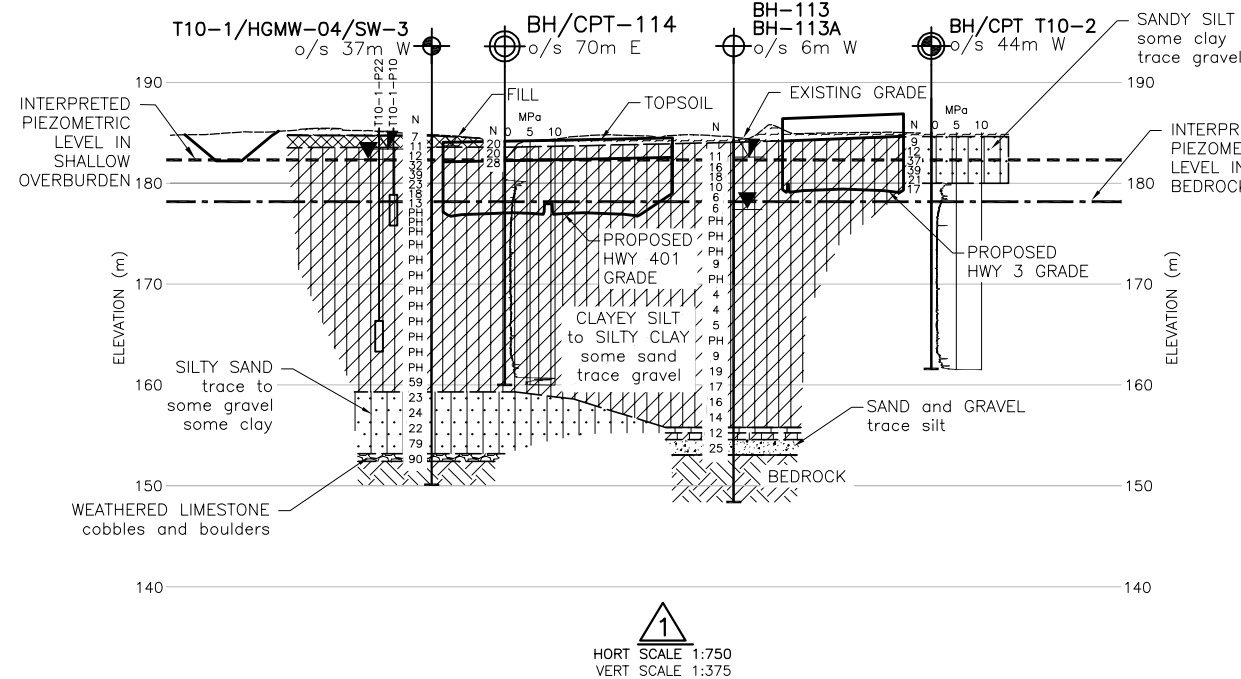
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2. THE INTERPRETED STRATIGRAPHY REPRESENTS SIMPLIFIED SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DEFINED AT BOREHOLE LOCATIONS ONLY. CONDITIONS BETWEEN BOREHOLE LOCATIONS COULD DIFFER FROM ILLUSTRATED CONDITIONS.
3. ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

NOT FOR
CONSTRUCTION

REVISIONS							
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	DATE	REV.	BY	DESCRIPTION			
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DRAWN	SJL	CHK	MO	SITE	6-623	DATE	23-APR-13

DOC: 285380-04-090-WIP1-6752

METRIC

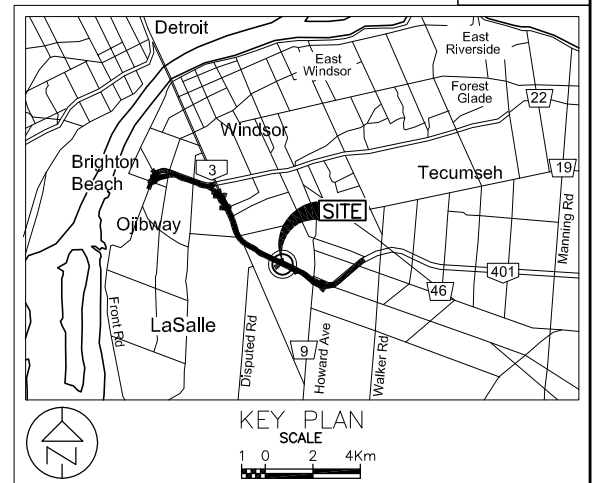
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AND/OR MILLIMETRES
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Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-7A
SOIL STRATIGRAPHYSHEET
G6753Phase 1
60% Sub

LIST OF ABBREVIATIONS

PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
PM - SAMPLER ADVANCED BY MANUAL PRESSURE
WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

TOPSOIL/ ORGANICS
FILL
SAND
SILTY CLAY
SILTY SAND
COBBLES AND BOULDERS
SILT
SANDY SILT
CLAYEY SILT
SAND AND GRAVEL
SILTY SAND AND GRAVEL
LIMESTONE DOLOSTONE /BEDROCK



LEGEND

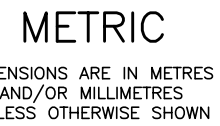
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BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
NILCON VANE CURRENT INVESTIGATION
CPT - CURRENT INVESTIGATION
DMT - CURRENT INVESTIGATION
BOREHOLE PREVIOUS INVESTIGATION
BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
CPT -PREVIOUS INVESTIGATION
N SPT N-VALUE
16 BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
P - VIBRATING WIRE PIEZOMETER (VWP)
DRY BOREHOLE DRY DURING DRILLING
WATER LEVEL DURING DRILLING
WATER LEVEL (SHALLOW PIEZO)
WATER LEVEL (DEEP PIEZO)
MHS - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
CPT-qc

NOTES

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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

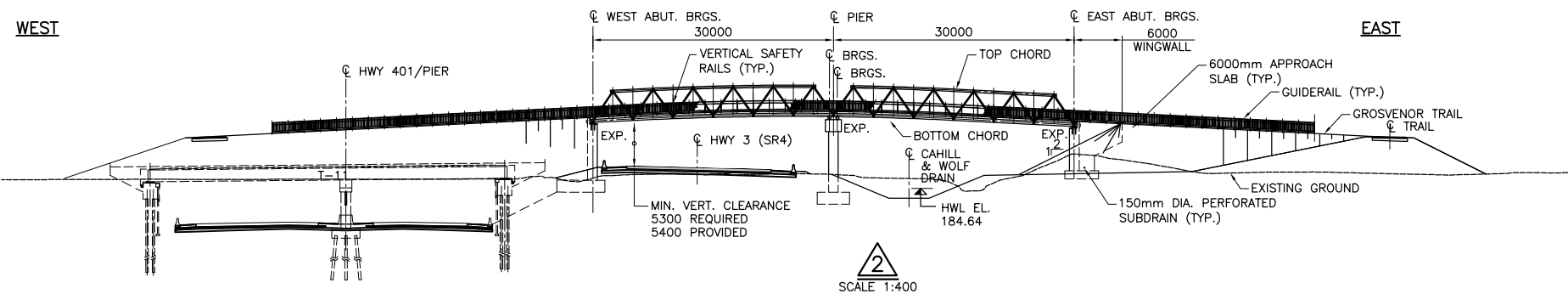
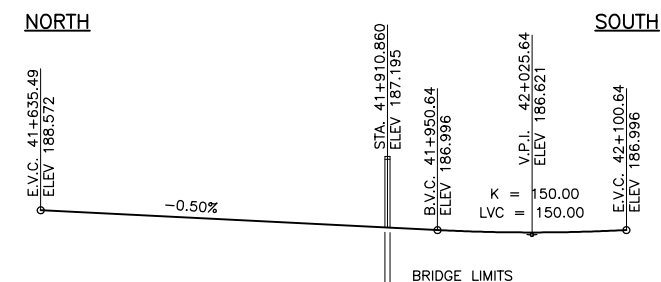
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CONSTRUCTIONDRAWING NOT TO BE SCALED
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DESIGN	EA	CHK	MO	CODE CAN/CSA
DRAWN	SJL	CHK	DD	SITE 6-623
				LOAD CL-625-ONT
				DATE 23-APR-13



Hatch Mott
MacDonald

SHEET
S6801

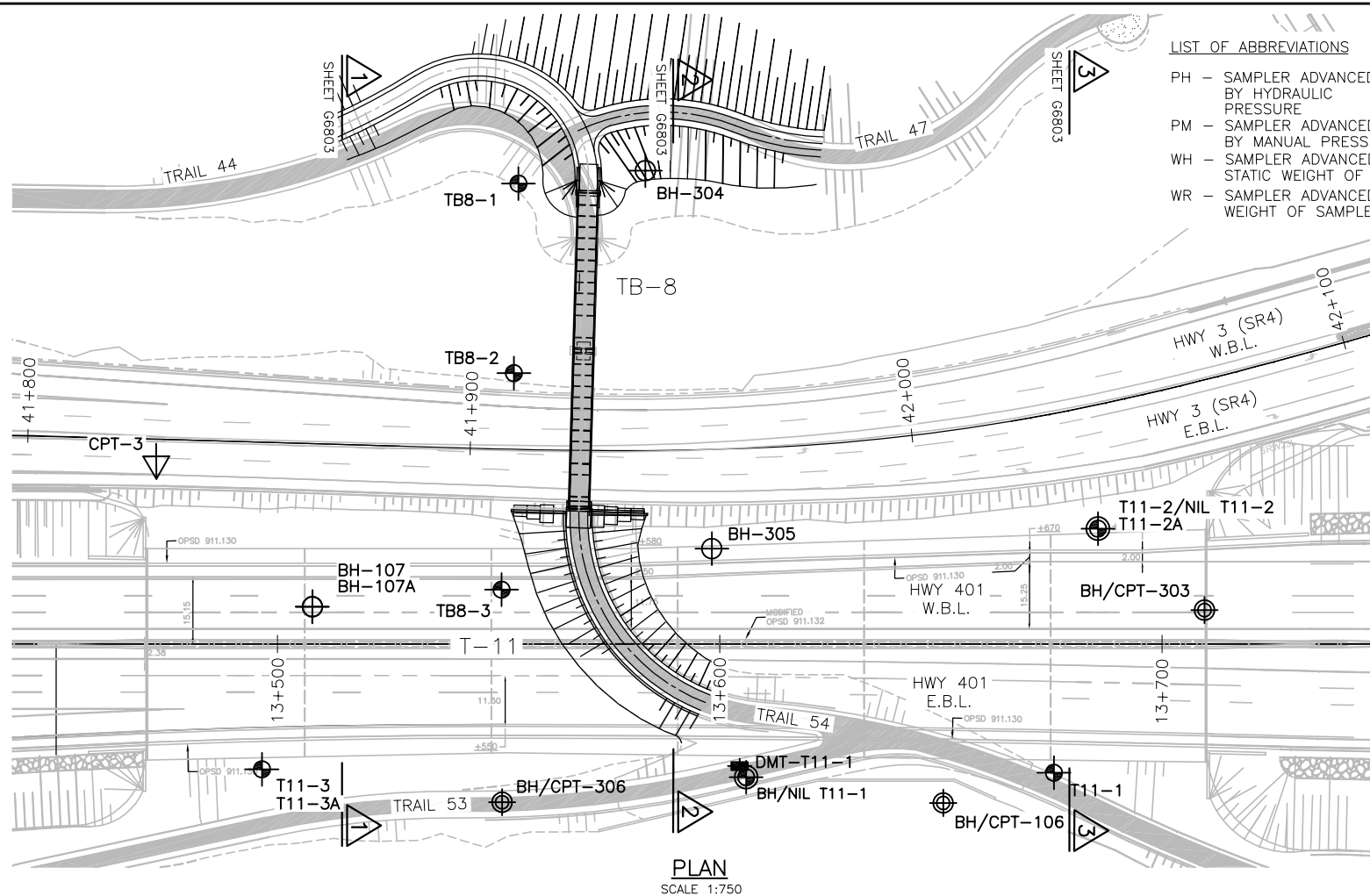


NOT FOR
CONSTRUCTION

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DRAWN	RD	CHK	MAS	SITE	6-624		DATE	JULY	2010

DOC: 285380-03-060-WIP1-6801

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING



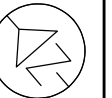
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- PH - SAMPLER ADVANCED BY HYDRAULIC PRESSURE
 - PM - SAMPLER ADVANCED BY MANUAL PRESSURE
 - WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
 - WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



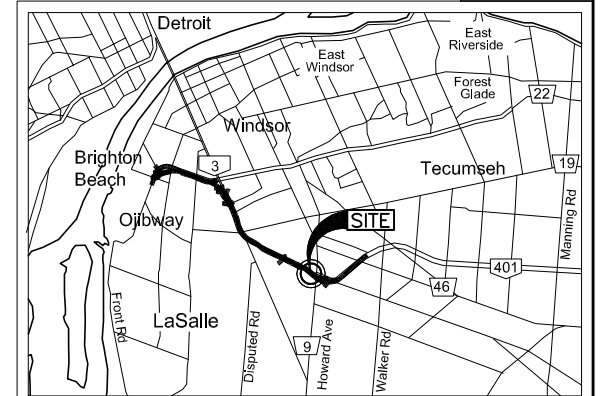
Windsor-Essex
Parkway Project
RFP No. 09-54-1007



NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-8
BOREHOLE LOCATIONS & SOIL STRATA

SHEET
G6802

Phase 1
60% Sub



KEY PLAN
SCALE
1 0 2 4Km

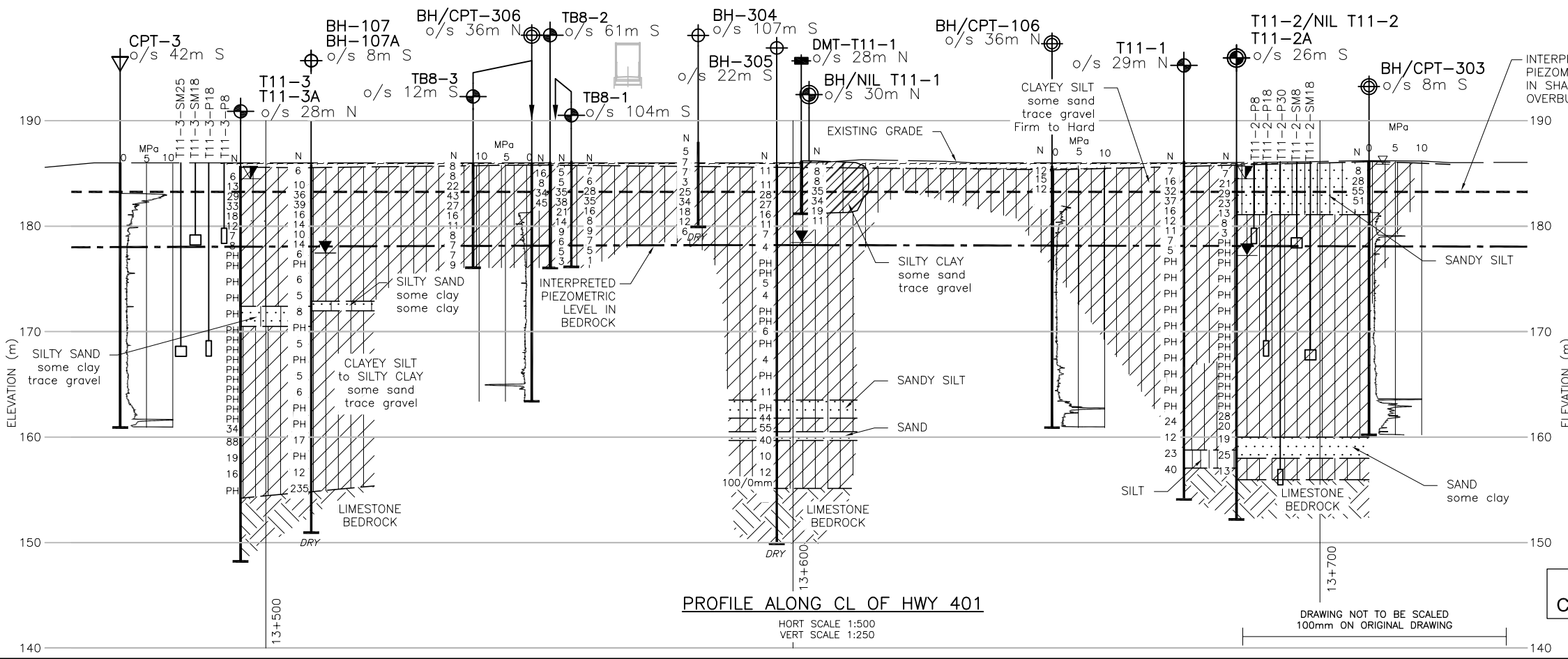
MATERIAL LEGEND

	TOPSOIL/ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE /BEDROCK
			DOLOSTONE /BEDROCK

- ### LEGEND
- BOREHOLE CURRENT INVESTIGATION
 - BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
 - SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
 - NILCON VANE CURRENT INVESTIGATION
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 - BOREHOLE PREVIOUS INVESTIGATION
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 - CPT -PREVIOUS INVESTIGATION
 - N SPT N-VALUE
 - BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
 - MHSG - MAGNETIC HEAVE/SETTLEMENT GAUGE (SM)
 - P - VIBRATING WIRE PIEZOMETER (VWP)
 - DRY BOREHOLE DRY DURING DRILLING
 - WATER LEVEL DURING DRILLING
 - WATER LEVEL (SHALLOW PIEZO)
 - WATER LEVEL (DEEP PIEZO)

NOTES

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PROFILE ALONG CL OF HWY 401

HORT SCALE 1:500
VERT SCALE 1:250

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100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION

REVISIONS	DATE	REV.	BY	DESCRIPTION
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DRAWN	SJL	CHK	MO	SITE 6-624
				LOAD CL-625-ONT
				DATE 01-MAY-13

METRIC

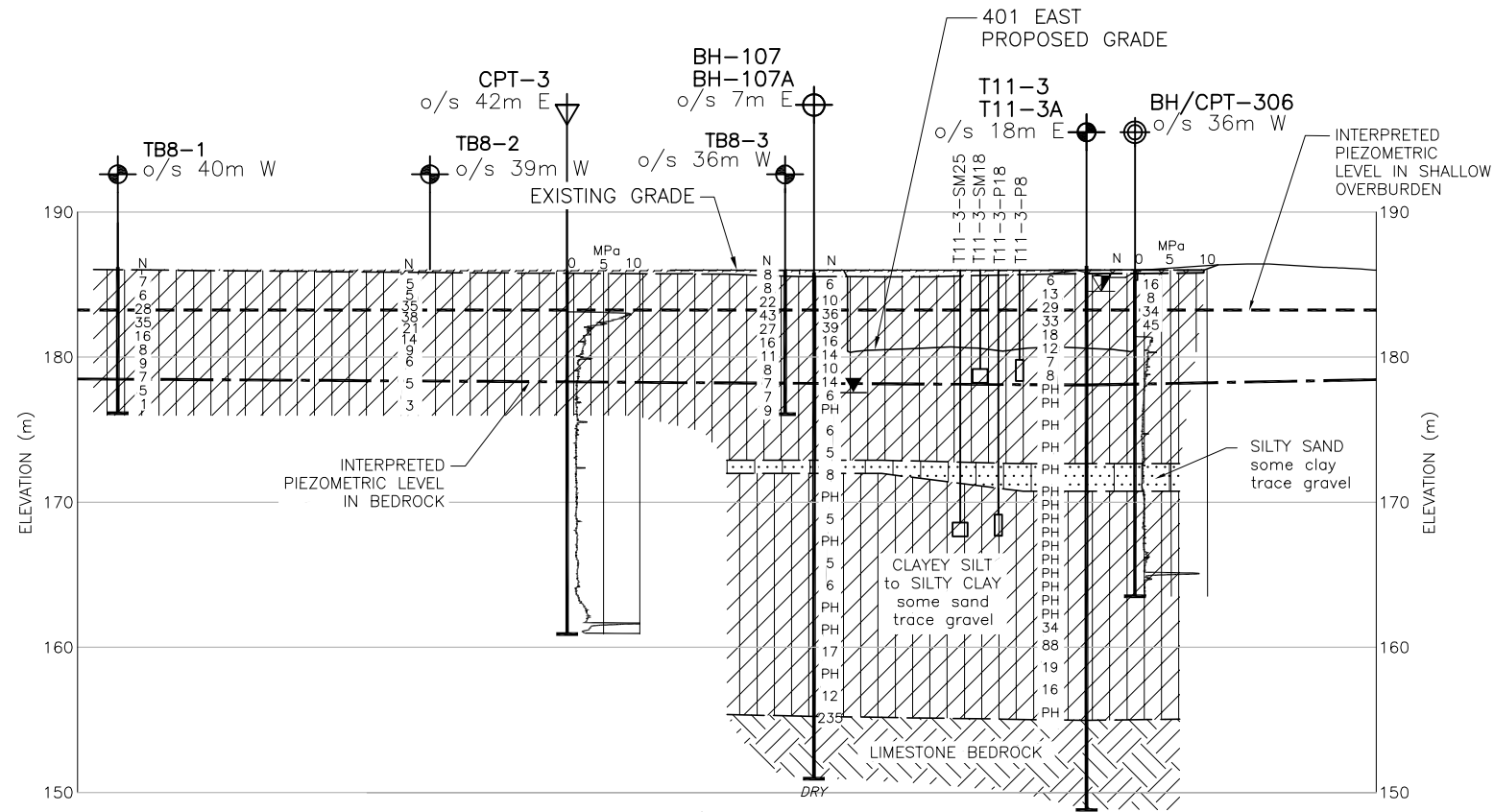
DIMENSIONS ARE IN METRES
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UNLESS OTHERWISE SHOWN



Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE TB-8
SOIL STRATIGRAPHY

SHEET
G6803
Phase 1
60% Sub



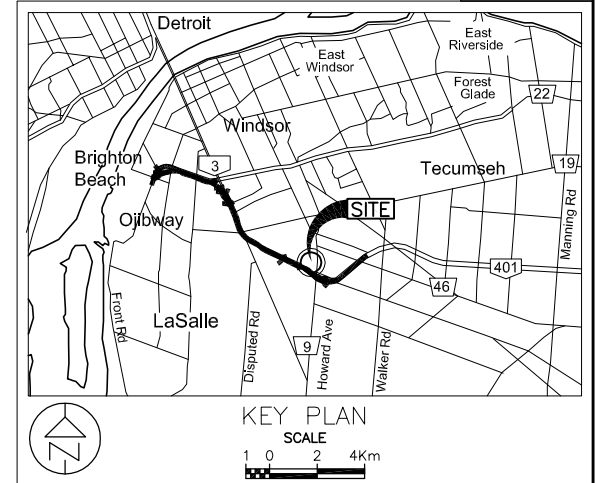
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VERT SCALE 1:250

MATERIAL LEGEND

	TOPSOIL/ ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
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STATIC WEIGHT OF HAMMER
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WEIGHT OF SAMPLER RODS

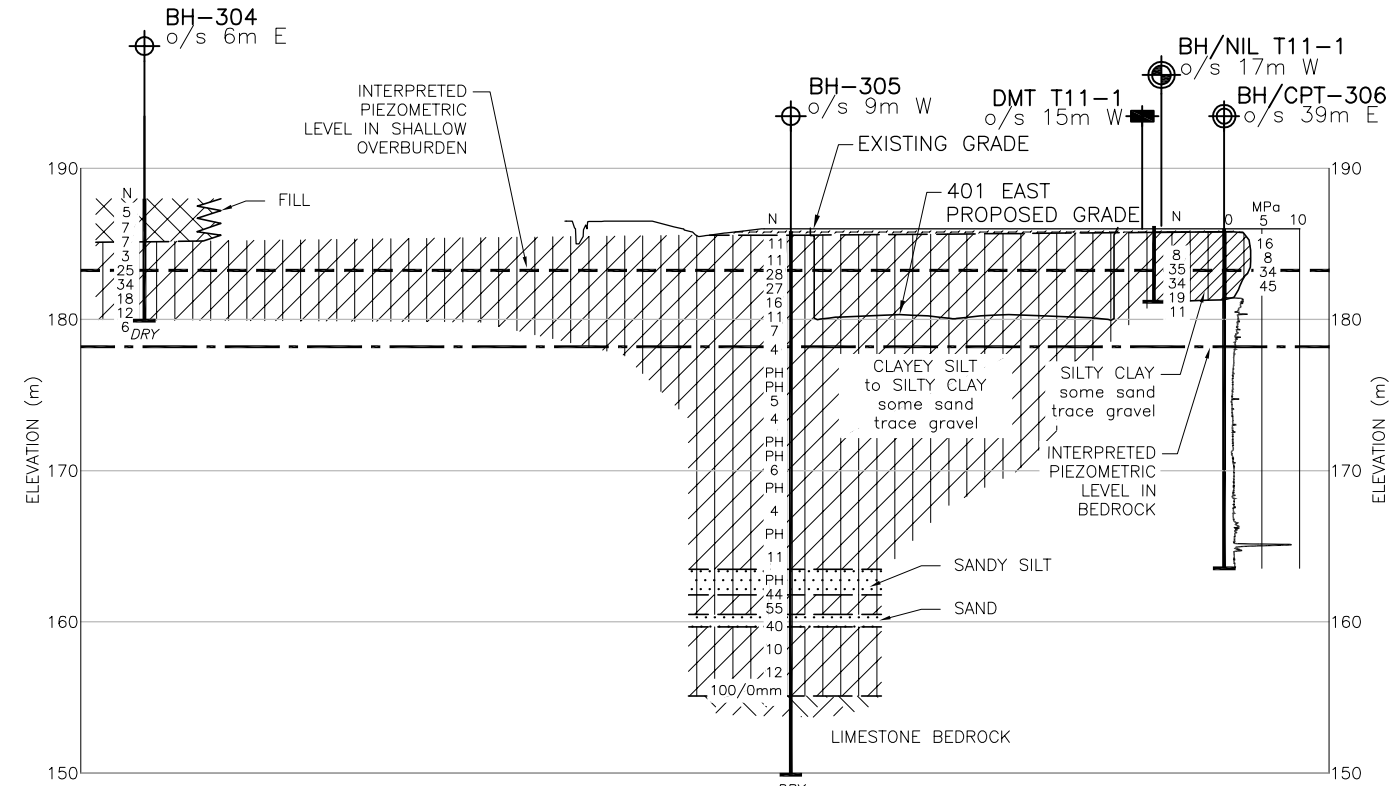


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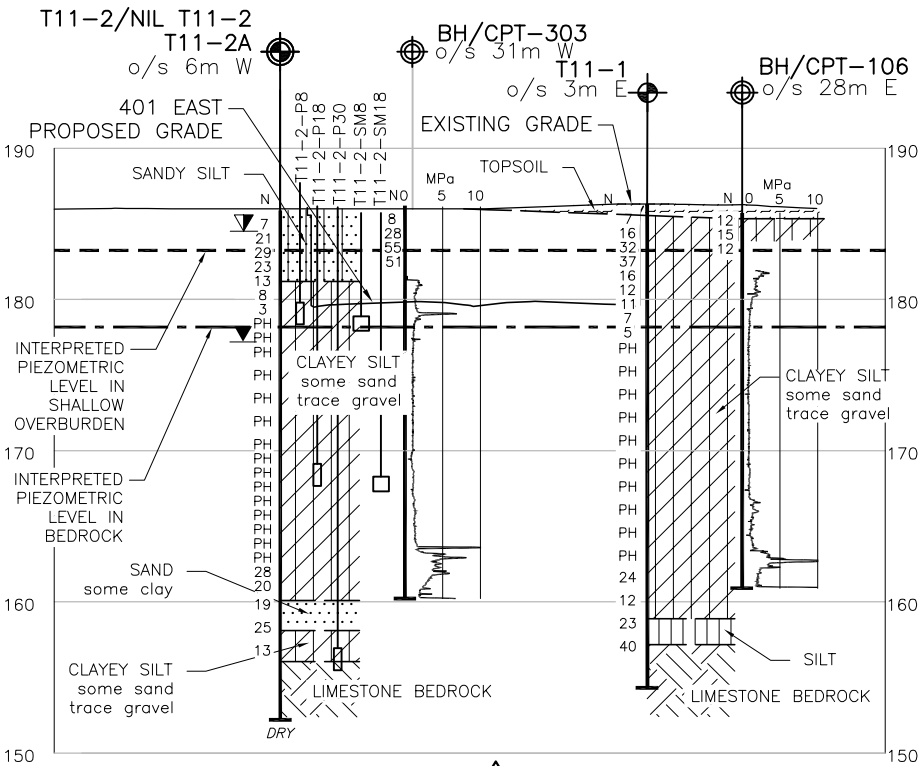
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CURRENT INVESTIGATION
- BOREHOLE AND NILCON VANE
CURRENT INVESTIGATION
- SW/SP HOLE (HYDROGEOLOGY)
CURRENT INVESTIGATION
- NILCON VANE
CURRENT INVESTIGATION
- CPT - CURRENT INVESTIGATION
- DMT - CURRENT INVESTIGATION
- BOREHOLE
PREVIOUS INVESTIGATION
- BOREHOLE, CPT AND NILCON VANE
PREVIOUS INVESTIGATIONS
- CPT -PREVIOUS INVESTIGATION
- N SPT N-VALUE
- BLOWS/0.3m UNLESS
OTHERWISE STATED
(STD. PEN. TEST, 475 J/BLOW)
- MHSG - MAGNETIC
HEAVE/SETTLEMENT
GAUGE (SM)
- P - VIBRATING WIRE PIEZOMETER (VWP)
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BETWEEN BOREHOLE LOCATIONS COULD DIFFER FROM
ILLUSTRATED CONDITIONS.
- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.



HORT SCALE 1:500
VERT SCALE 1:250



HORT SCALE 1:500
VERT SCALE 1:250

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION

REVISIONS	DATE	REV.	BY	DESCRIPTION
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DESIGN	EA	CHK	DD	CODE CAN/CSA
DRAWN	SJL	CHK	MO	SITE 6-624
				LOAD CL-625-ONT
				DATE 01-MAY-13

Figures

Figure 3-1: Field Vane Correction Factor vs. Plasticity Index Derived from Embankment Failures

(Figure 5.1, Ladd & DeGroot, 2004, ref. R-29)

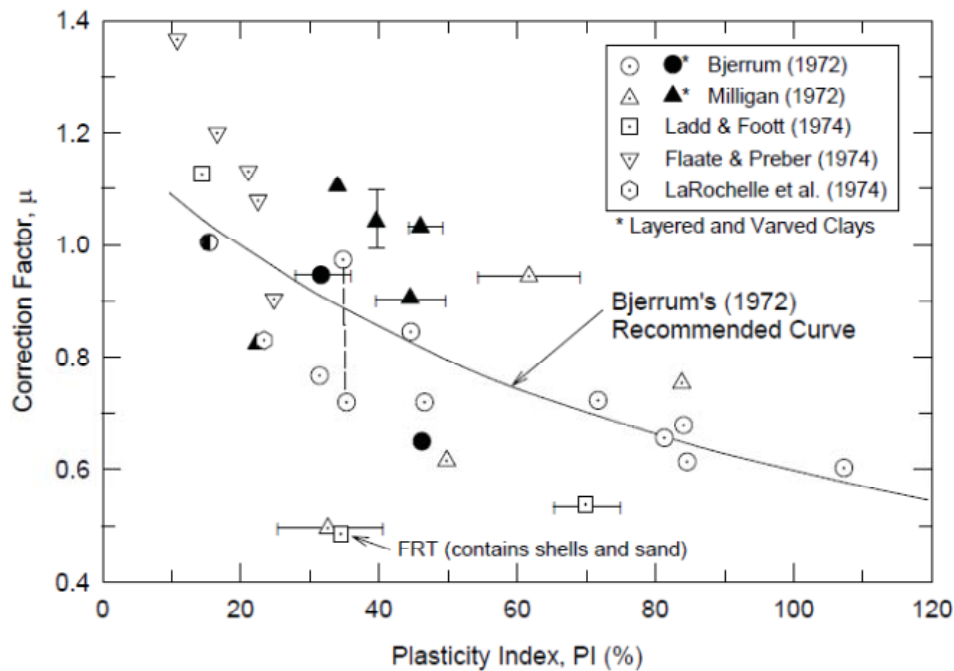
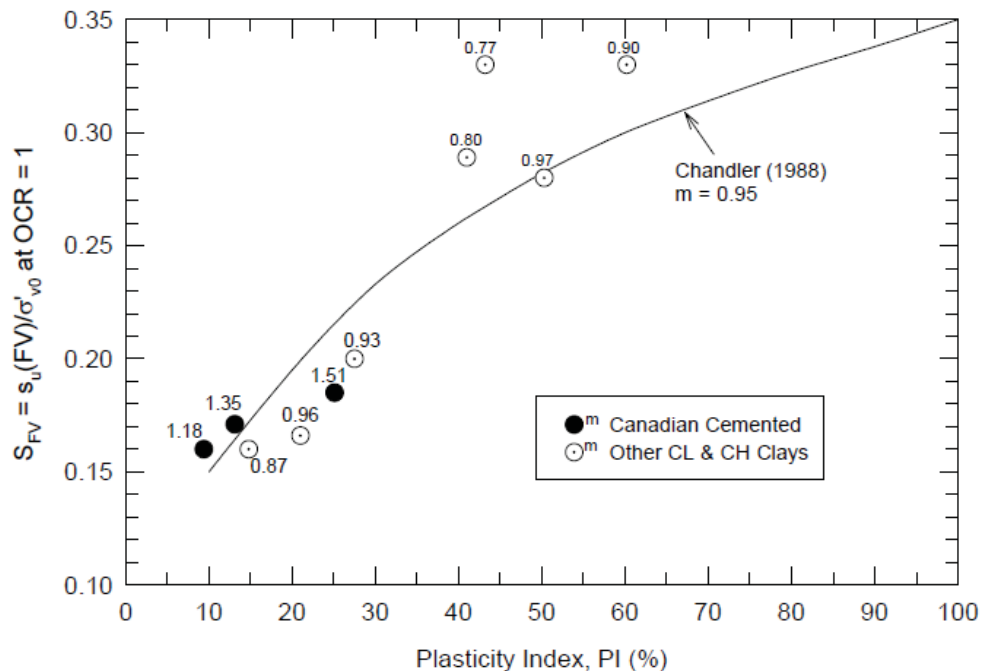
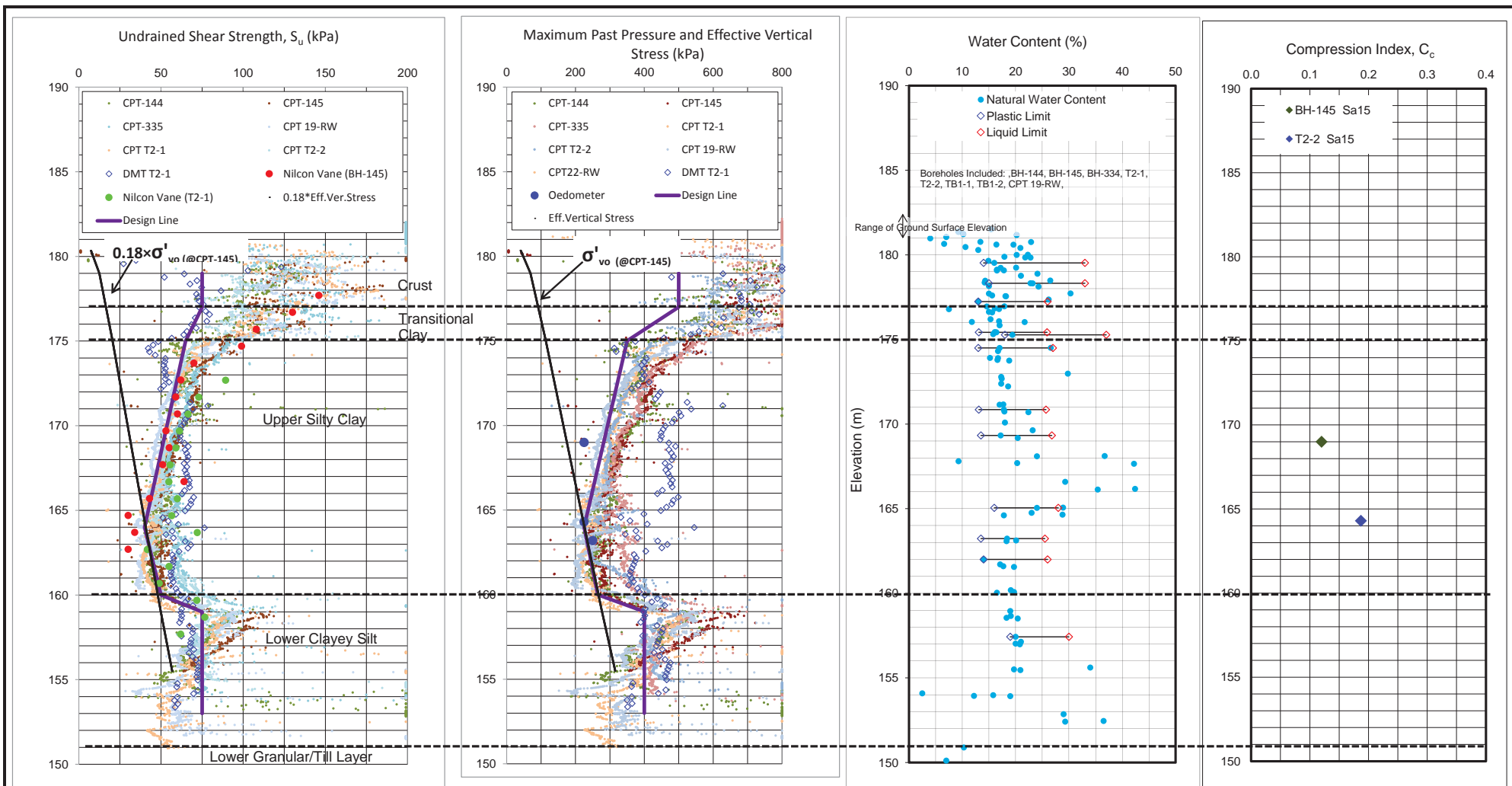



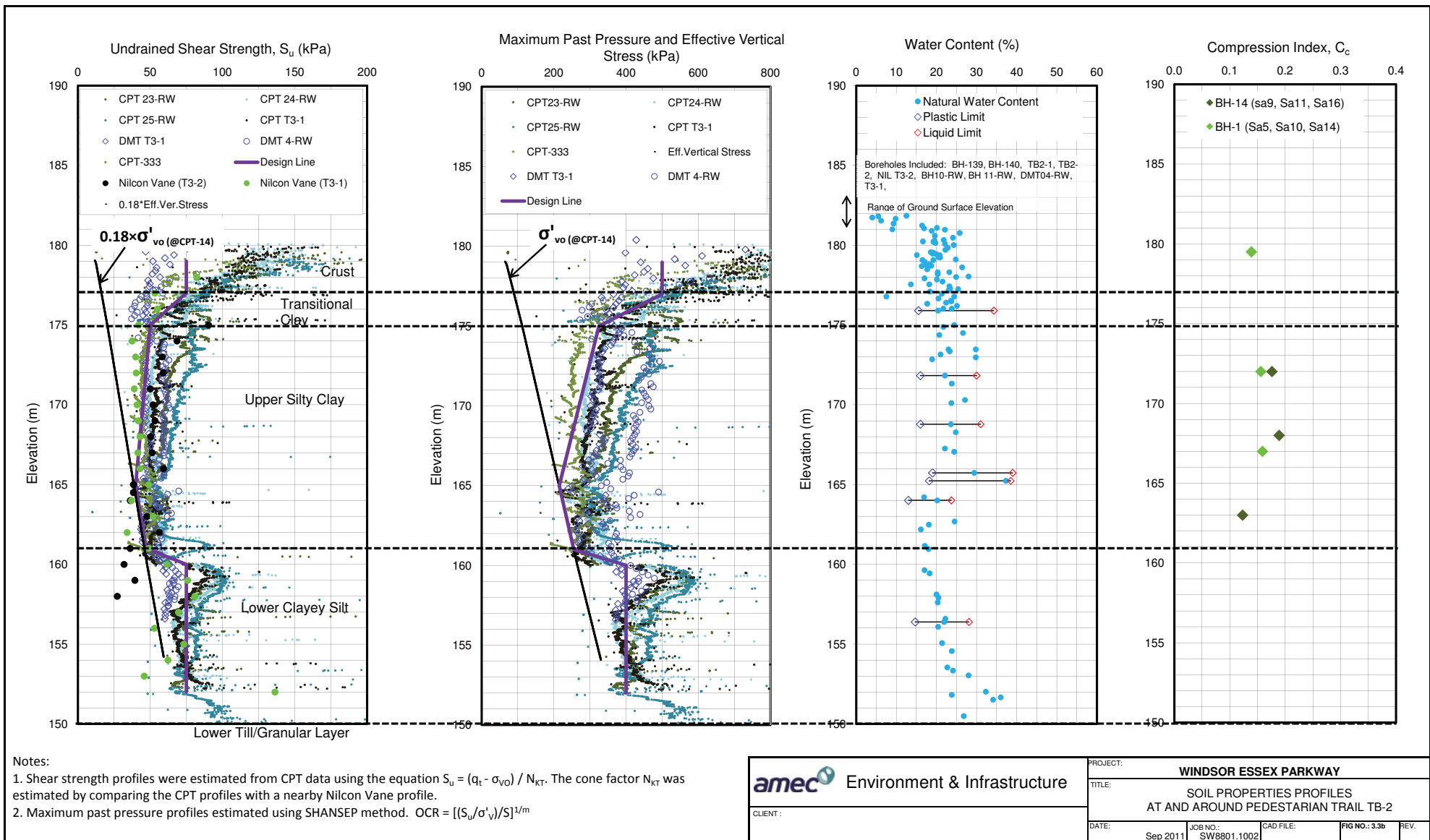
Figure 3-2: Field Vane Undrained Strength Ratio at OCR = 1 vs. Plasticity Index for Homogeneous Clays

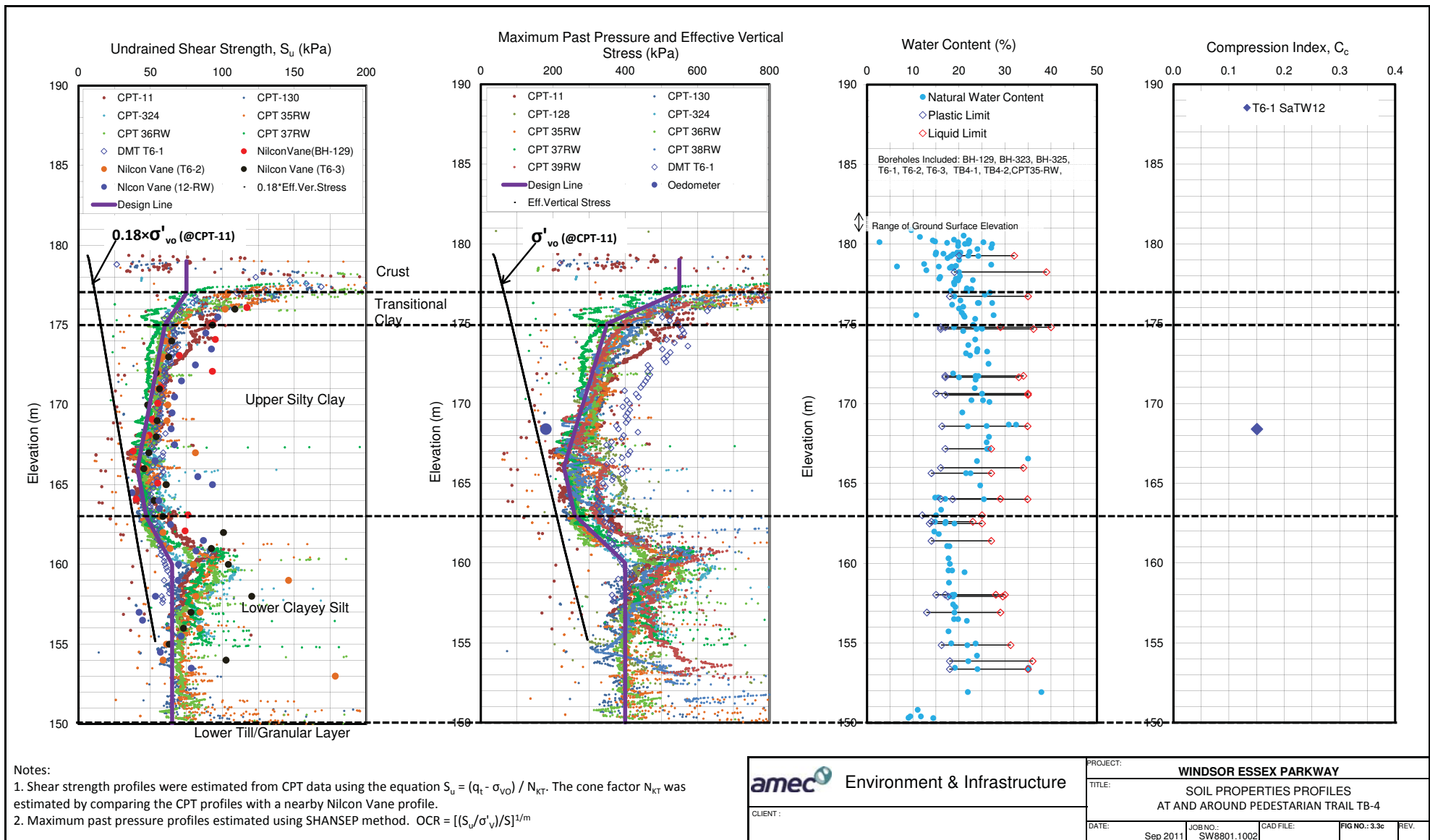
(Figure 5.2, Ladd & DeGroot, 2004, ref. R-29)

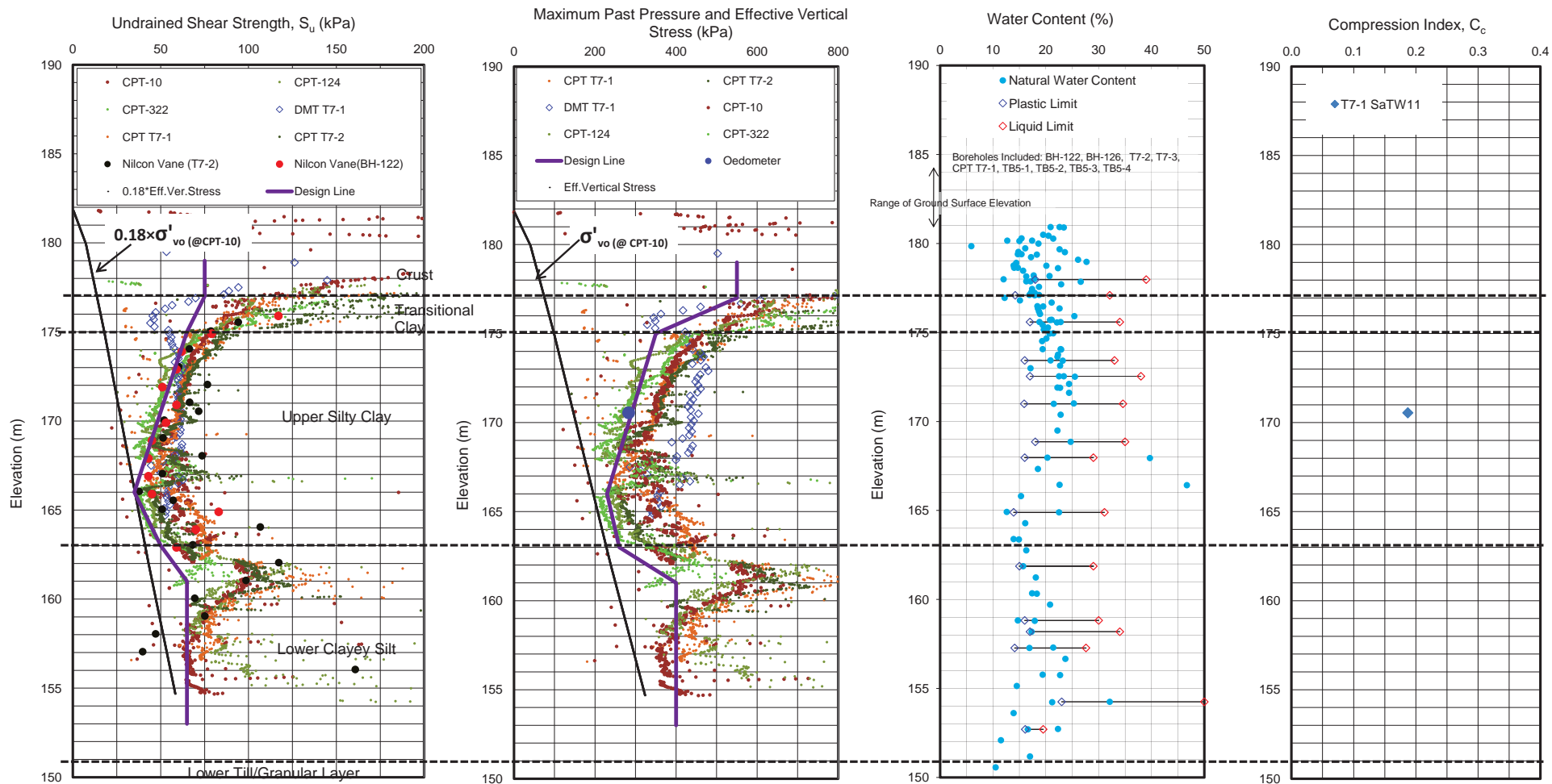




 Environment & Infrastructure		PROJECT: WINDSOR ESSEX PARKWAY				
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		DATE: Mar 2012		JOB NO.: SW8801.1002		CAD FILE:
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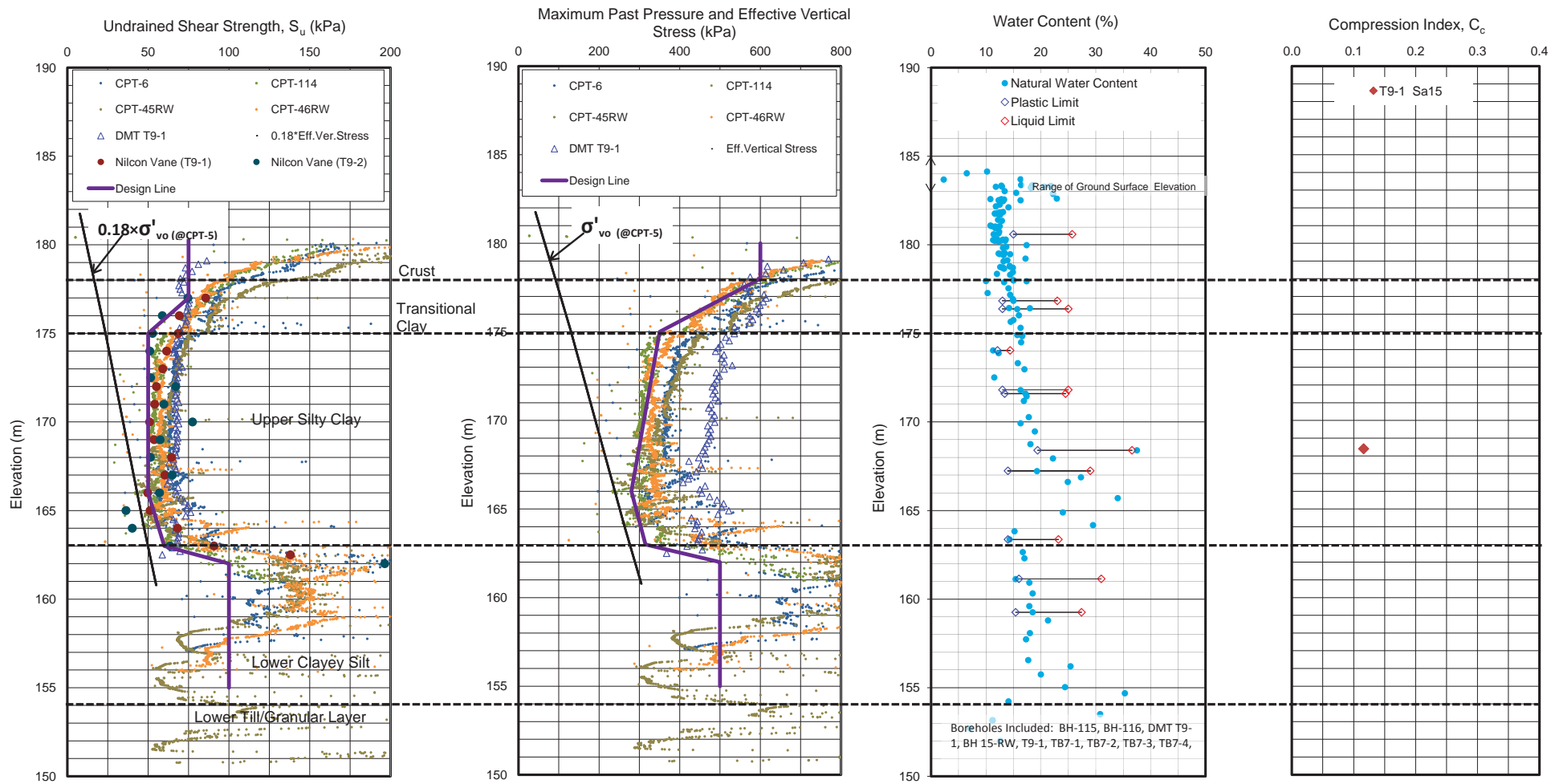
Notes:

1. Shear strength profiles were estimated from CPT data using the equation $S_u = (q_t - \sigma_{vo}) / N_{KT}$. The cone factor N_{KT} was estimated by comparing the CPT profiles with a nearby Nilcon Vane profile.
2. Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_v) / S]^{1/m}$

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PROJECT:	WINDSOR ESSEX PARKWAY			
TITLE:	SOIL PROPERTIES PROFILES AT AND AROUND PEDESTARIAN TRAIL TB-5			
DATE:	JOB NO.:	CAD FILE:	FIG NO.:	REV.
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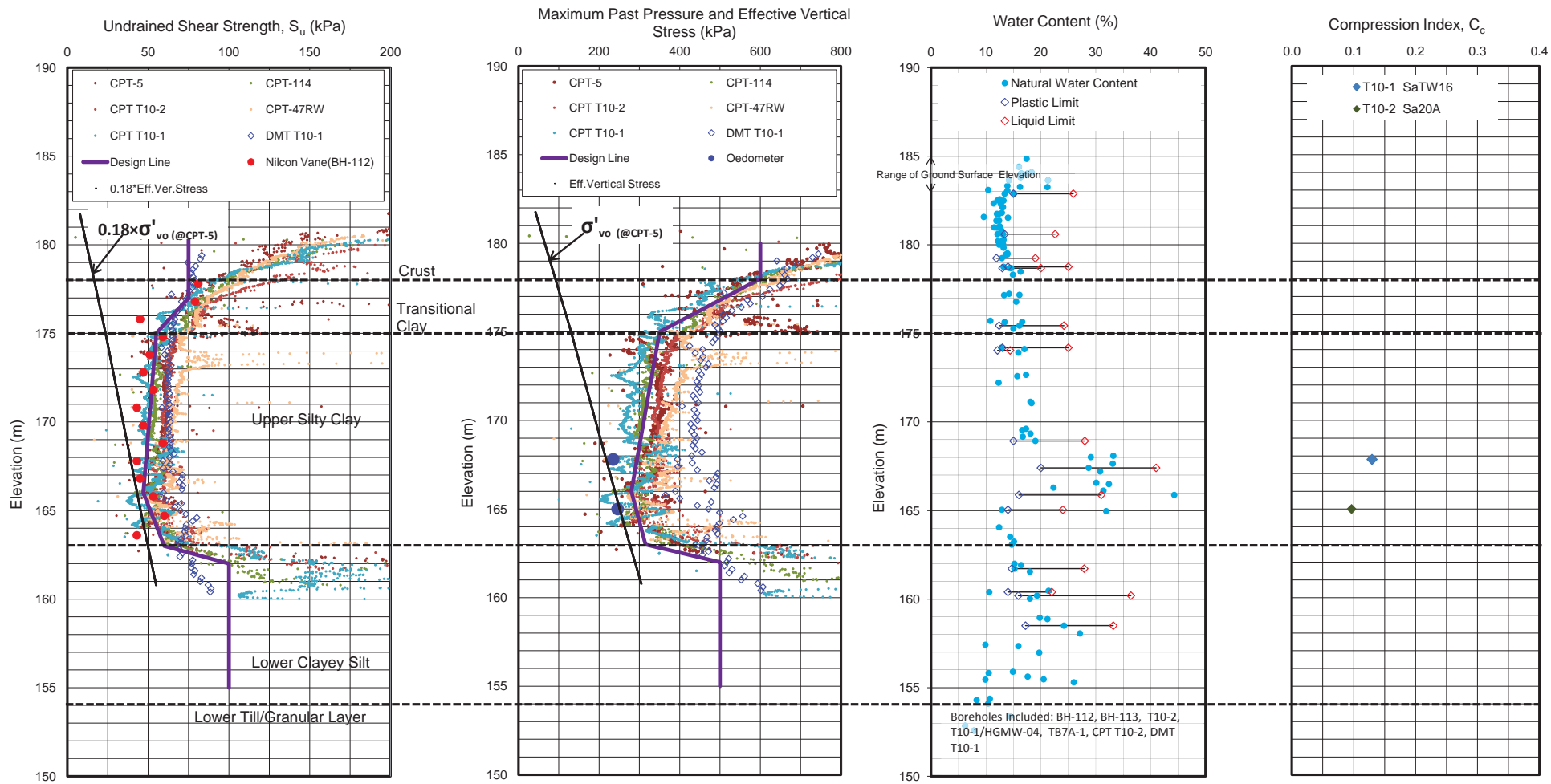
Notes:

1. Shear strength profiles were estimated from CPT data using the equation $S_u = (q_t - \sigma'_{vo}) / N_{KT}$. The cone factor N_{KT} was estimated by comparing the CPT profiles with a nearby Nilcon Vane profile.
2. Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_{vo}) / S]^{1/m}$

amec Environment & Infrastructure

CLIENT:

PROJECT:	WINDSOR ESSEX PARKWAY			
TITLE:	SOIL PROPERTIES PROFILES AT AND AROUND PEDESTARIAN TRAIL TB-7			
DATE:	JOB NO.:	CAD FILE:	FIG NO.:	REV.
Sep 2011	SW8801.1002		3.3e	



Notes:

1. Shear strength profiles were estimated from CPT data using the equation $S_u = (q_t - \sigma_{vo}) / N_{KT}$. The cone factor N_{KT} was estimated by comparing the CPT profiles with a nearby Nilcon Vane profile.
2. Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_{vo}) / S]^{1/m}$

amec Environment & Infrastructure

CLIENT:

PROJECT:

WINDSOR ESSEX PARKWAY

TITLE:

**SOIL PROPERTIES PROFILES
AT AND AROUND PEDESTARIAN TRAIL TB-7A**

DATE:

Sep 2011

JOB NO.:

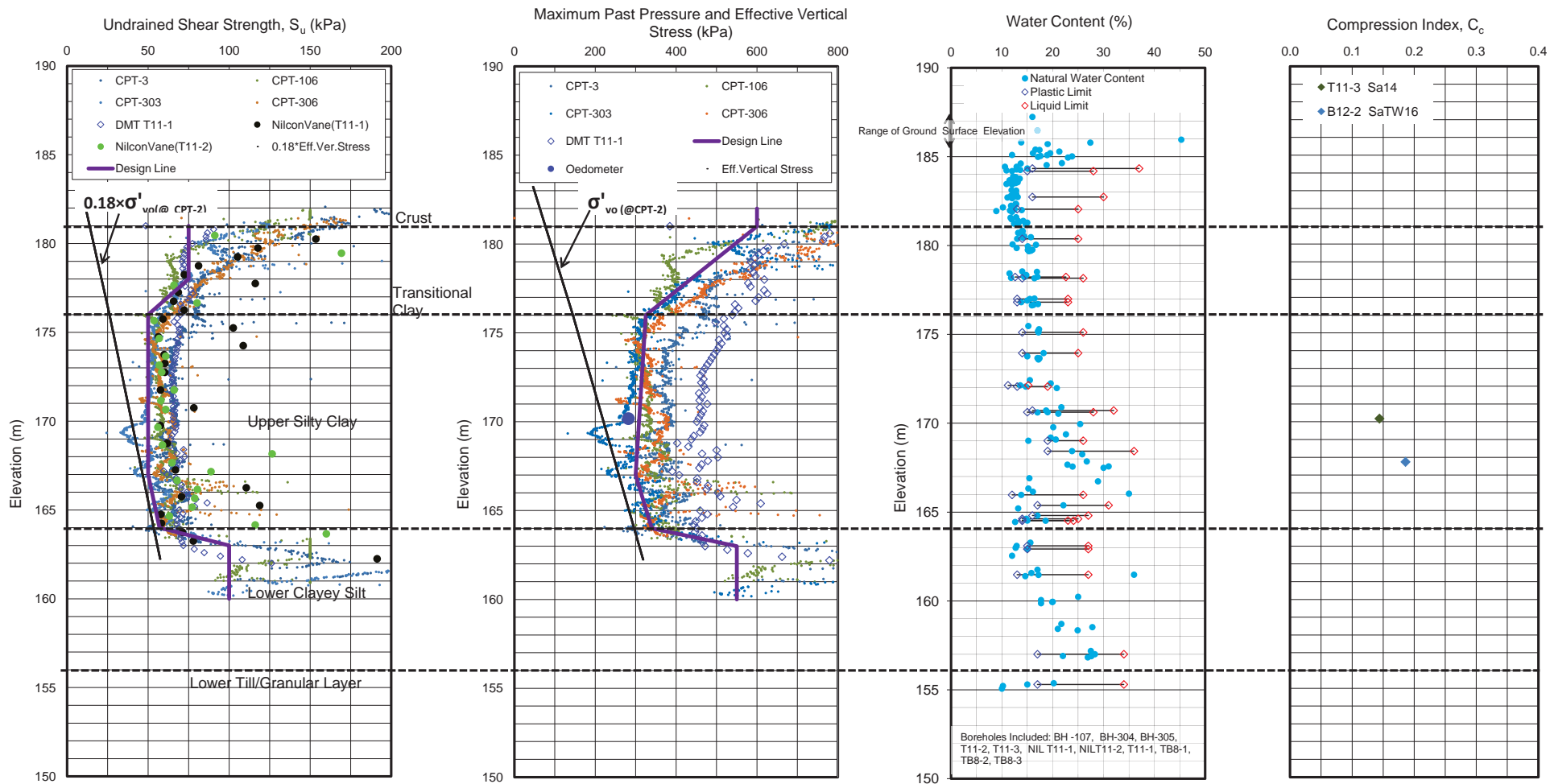
SW8801.1002

CAD FILE:

FIG NO.:

3.3f

REV.



amec Environment & Infrastructure

CLIENT:

PROJECT:	WINDSOR ESSEX PARKWAY			
TITLE:	SOIL PROPERTIES PROFILES AT AND AROUND PEDESTRIAN TRAIL TB-8			
DATE:	JOB NO.:	CAD FILE:	FIG NO.:	REV.
Sep 2011	SW8801.1002		3.3g	

Figure 4-1: Compressibility Parameters at Parkway

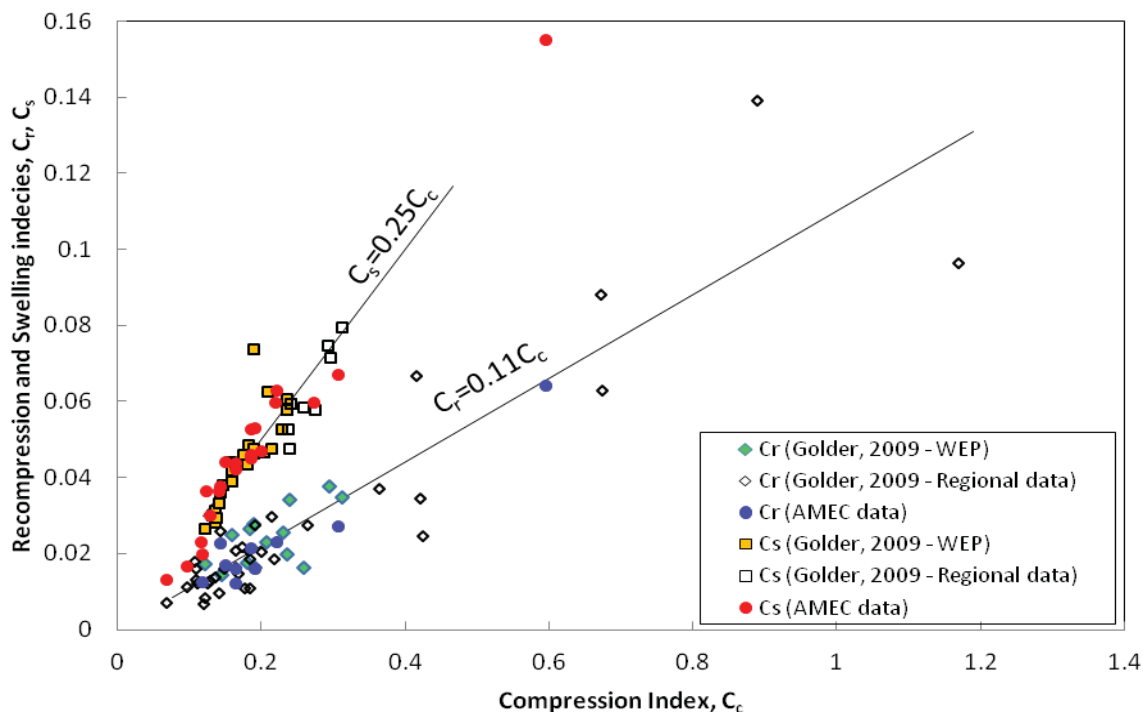
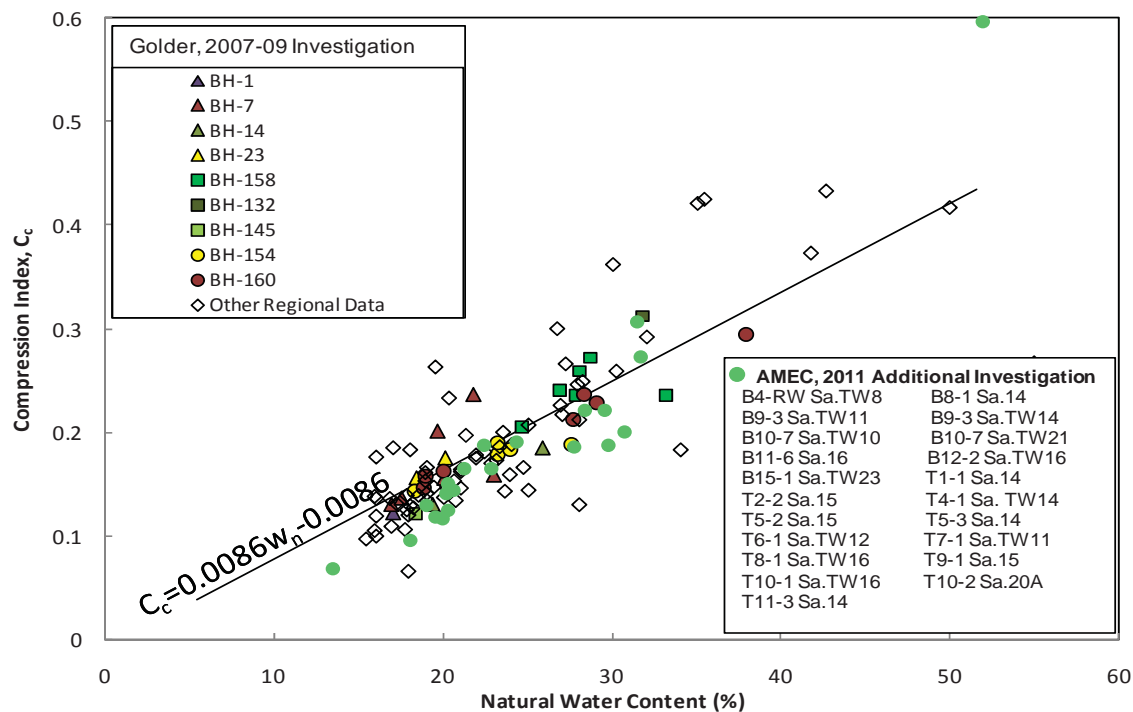


Figure 4-2: Cc versus Cα Relationship at Parkway

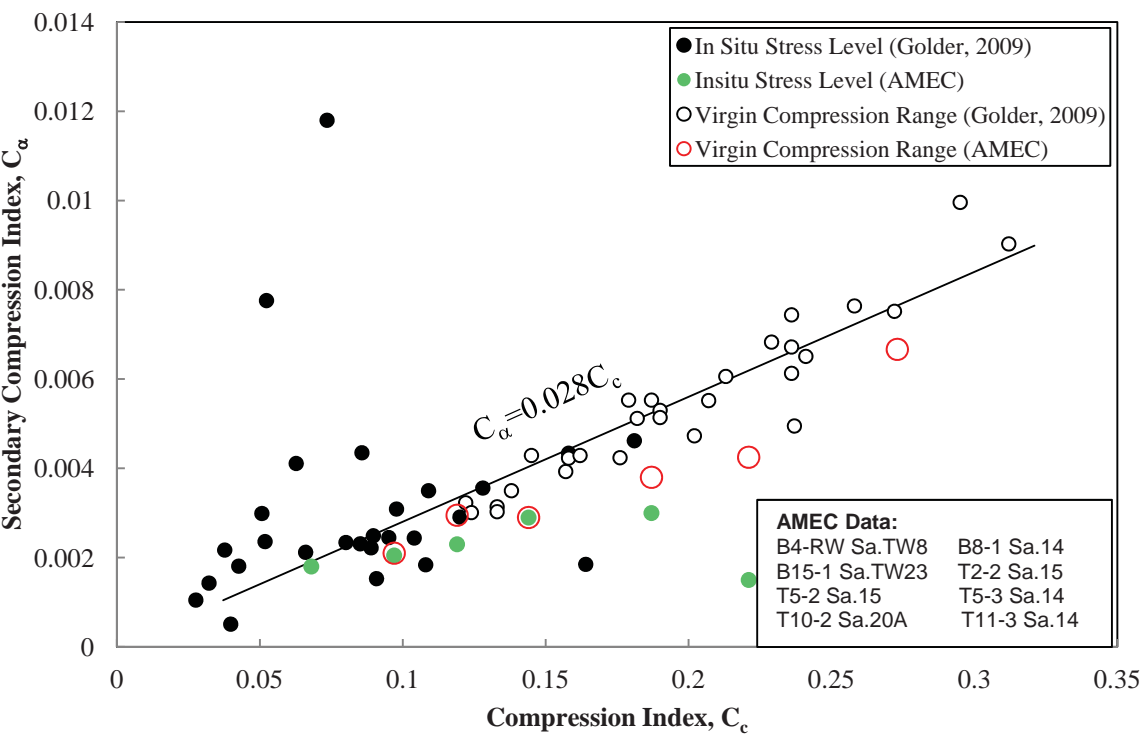


Figure 4-3: Effective Friction Angle (ϕ') for Silty Clay to Clayey Silt Stratum at Parkway

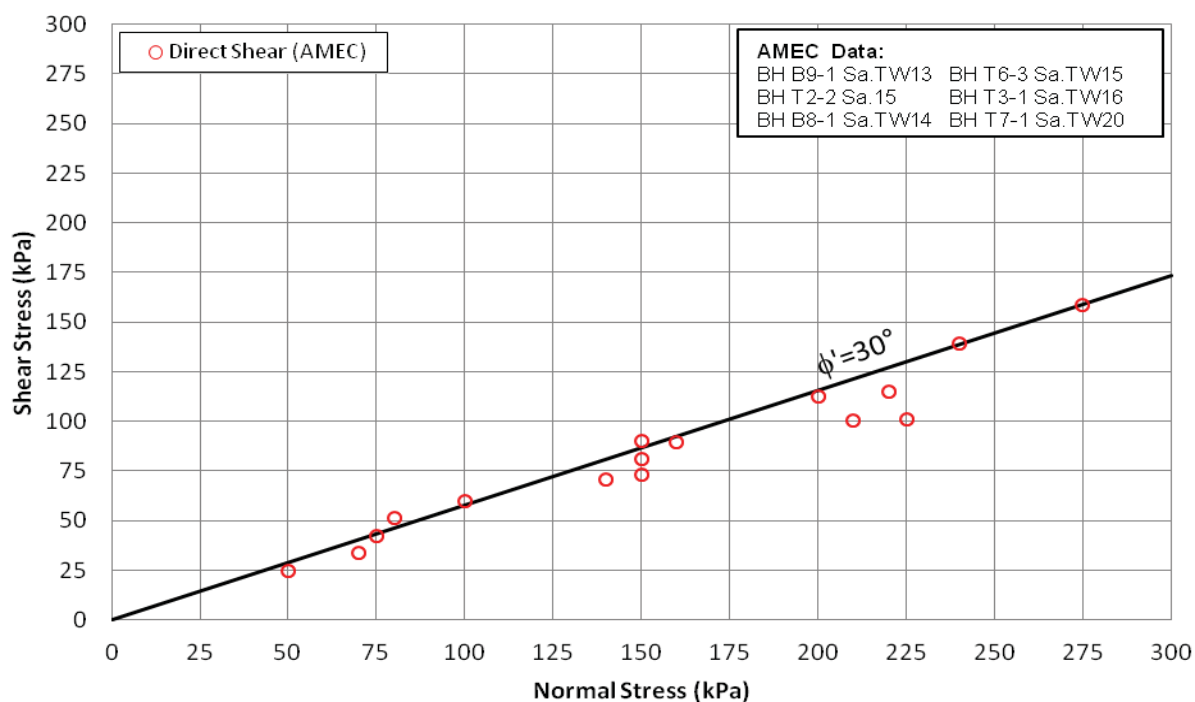
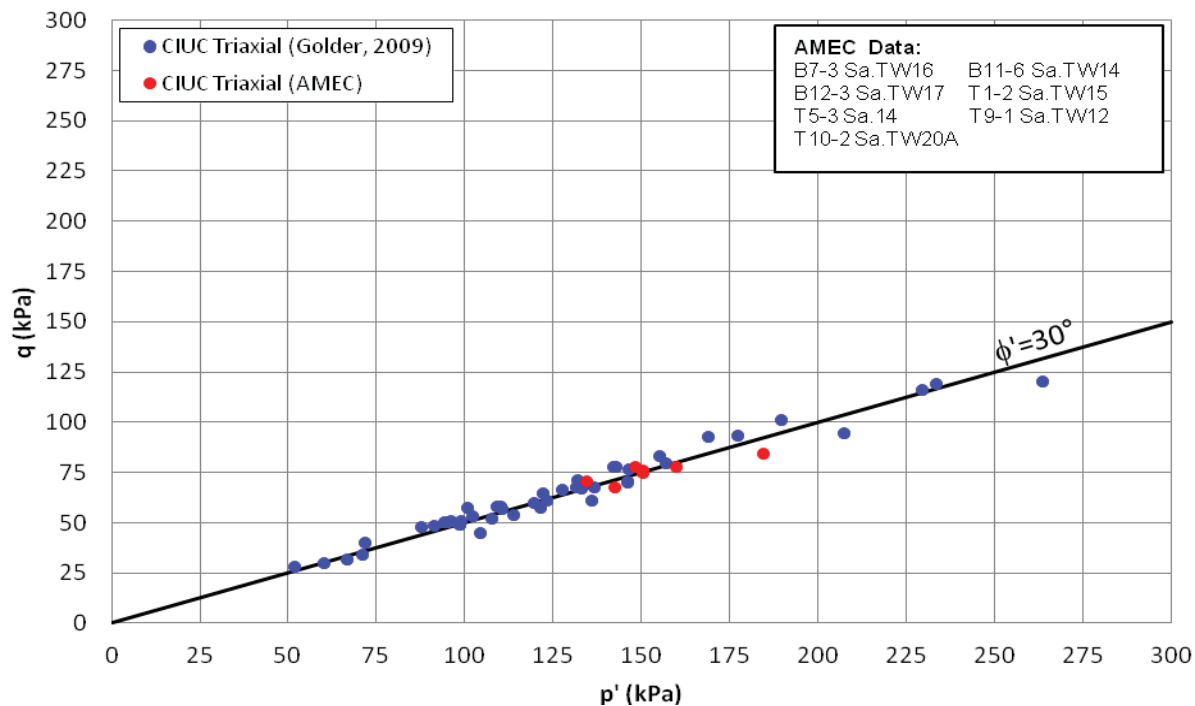
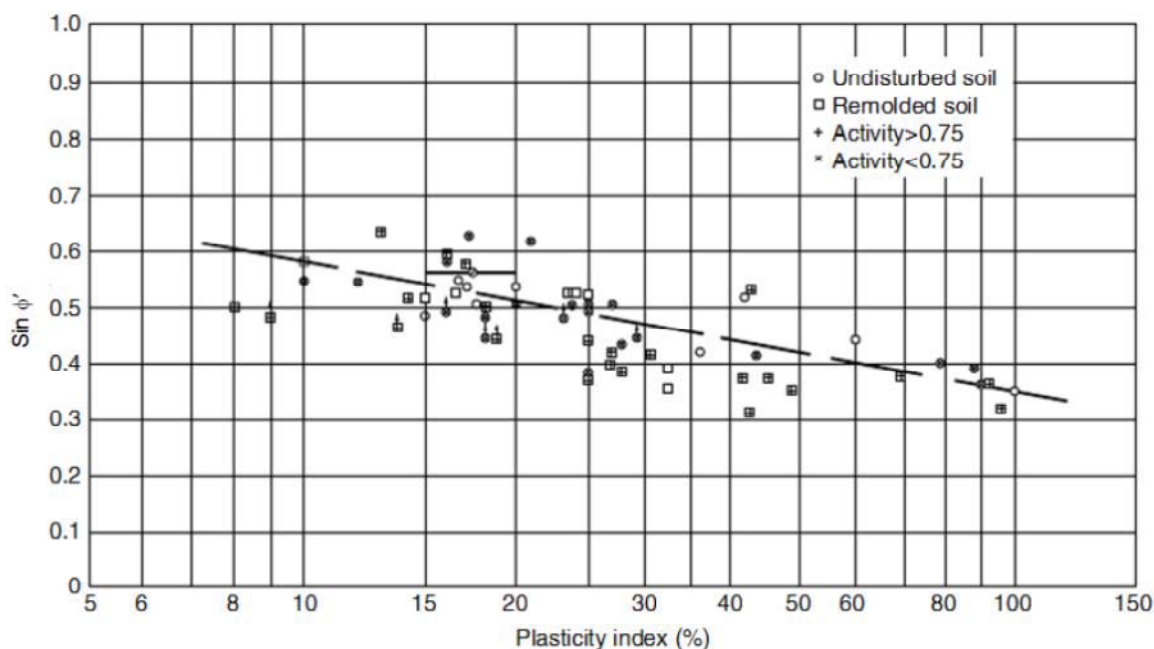


Figure 4-4: Relationship between $\sin \phi'$ and Plasticity Index for Normally Consolidated Soils

(Kenney, 1959)



Appendix A Borehole, CPT and DMT logs from Additional Geotechnical Investigation

RECORD OF BOREHOLE No TB1-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4681381.8, E331204.2 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 11 Jun 11 - 11 Jun 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.						
181.9	Ground Surface					20	40	60	80	100	10	20	30	GR SA SI CL		
0.0	<div><div></div><div>FILL Topsoil</div></div>	<div></div>													-borehole 1.5m from basement of former 2368 Bethlehem	
	<div><div></div><div>FILL Silty Sand and topsoil inclusions Brown Moist to wet</div></div>		1	SS	3											
180.4																
1.5	<div><div></div><div>CLAYEY SILT Some sand, trace gravel Stiff to very stiff Mottled brown and grey</div></div>	<div></div>	2	SS	7											
			3	SS	16											
	Grey		4	SS	15											
	-Trace pink clay inclusions, trace silt and fine sand inclusions															
			5	SS	10											
			6	SS	11											
		7	SS	9												
		8	SS	6												
			VT													
		9	SS	8												

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

RECORD OF BOREHOLE No TB1-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4681347.7, E331205.1 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 11 Jun 11 - 11 Jun 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE									
181.5	Pavement Surface																	
0.0	CONCRETE																	
	FILL																	
	Fine Sand																	
	Some silt and topsoil, pieces of wood																	
	Brown		1	SS	8													
180.0																		
1.5	CLAYEY SILT																	
	Some sand, trace gravel		2	SS	5													
	Firm to stiff																	
	Mottled brown and grey		3	SS	14													
	Grey																	
			4	SS	10													
			5	SS	11													
	-Trace pink clay and fine sand inclusions																	
	Wet		6	SS	9													
			7	SS	7													
			8	SS	7													
				VT														
			9	SS	10													
					</													

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

RECORD OF BOREHOLE No T2-1

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4681290.3, E331304.1 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 7 Apr 11 - 11 Apr 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
181.4	Fill Surface							20 40 60 80 100	20 40 60 80 100	10 20 30				GR SA SI CL
0.0	FILL Silty Clay Some sand, trace gravel, occasional broken brick Brown						181							
180.8	SAND Well-Graded Trace silt, trace gravel Compact Brown		1	SS	15		180							
0.6	SILTY CLAY Some sand, trace gravel, trace pink clay nodules Stiff to very stiff Grey		2	SS	11		179							
180.0							178							6 15 36 43
1.4							177							
							176							
							175							
							174							-Switched to wash boring at a depth of 6.6m (Elevation 174.8m)
							173							
							172						21.1	
							171							
							170							
							169						20.0	
							168							
							167							
									</					

-Trace sand seams at about elevation 172m

-Switched to wash boring at a depth of 6.6m (Elevation 174.8m)

21.1

20.0

42.2

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

METRIC

SOIL PROFILE						SAMPLES			<div>DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100</div>	<div>SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE</div>	<div>PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w_p w w_L WATER CONTENT (%)</div>	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES	GROUNDED WATER CONDITIONS	ELEVATION SCALE											
165.6 15.8	SILTY CLAY Some sand, trace gravel, trace pink clay nodules (<i>continued</i>)		14	TW	PH		166										22.2	-end of drilling April 7; continue April 11
	SILTY CLAY Some pink and black clay nodules Grey				VT			165						5.1				
			15	TW	PH		164											
	-Some sand and gravel at about elevation 163.1m		16	TW	PH		163											19.0
162.2 19.2	CLAYEY SILT Some embedded sand and gravel Stiff Grey		17	TW	PH		162											
			18	TW	PH		160						21.8					
			19	TW	PH		158											
			20	TW	PH		157						21.3					
156.1 25.3	CLAYEY SILT Some gravel Grey		21	SS	PH		156							-no recovery with shelly tube; sample retrieved by pushing split spoon				
154.6 26.8	CLAYEY SILT Some sand, trace gravel Grey	22	SS	PH		154							-no recovery with shelly tube; sample retrieved by pushing split spoon					
153.1 28.3	SILTY CLAY with Compact to Dense Silt and Fine Sand Interbeds Soft to firm Grey	23	SS	22		153												

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

RECORD OF BOREHOLE No T2-2

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4681341.1, E331300.7 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Auger COMPILED BY SS
 DATUM Geodetic DATE 4 Apr 11 - 5 Apr 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE									
181.4	Fill Surface																	
0.0	FILL Silty Clay, some sand, trace gravel Trace topsoil Brown														-2 vibrating wire piezometers (VWPs) installed in adjacent borehole, drilled without sampling (4681339.9N, 331302.9E)			
180.9																		
0.5																		
180.5	FILL Sand and Gravel Grey		1	SS	19													
0.9																		
180.0	SILTY SAND/SANDY SILT Trace organics Brown Moist		2	SS	10													
1.4																		
	CLAYEY SILT Some sand, trace gravel Stiff to very stiff Grey -Some oxidized inclusions		3	SS	18													
			4	SS	18													
			5	SS	19													
			6	SS	18													
			7	SS	13													
			8	SS	13													
			9	TW	PH													
			10	TW	PH													
				VT														
			11	TW	PH													
	50mm diameter stone in sample																	
				VT														
			12	TW	PH													
				VT														
			13	TW	PH													
				VT														

Continued Next Page

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



ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

RECORD OF BOREHOLE No T2-2

2 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4681341.1, E331300.7 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Auger COMPILED BY SS
 DATUM Geodetic DATE 4 Apr 11 - 5 Apr 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL LIQUID LIMIT MOISTURE CONTENT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED		+ FIELD VANE			○				
								● POCKET PEN.		× LAB VANE			○				
14.9	CLAYEY SILT Pink and black clay inclusions Grey (continued)		14	TW	PH										42.4	-wash rotary drilling below 15m	
	-Trace sand and gravel			15	TW	PH											
	-Trace interbedded sand layers from 18m to 19m -Fractures filled with white-grey silt		16	TW	PH										20.4	-VWP #P20 and MG installed at 19.66m below ground surface	
162.2	CLAYEY SILT Some sand, trace gravel Grey																
19.2																	
				17	TW	PH											
				18	TW	PH											21.3
				19	TW	PH											
				20	TW	PH										21.1	
	-Interbedded silt layers from 18 m to 20 m																
			21	TW	PH												
			22	TW	PH										22.5		
	-50mm diameter stone in sample																
			23	SS	PH												
	-Inferred boulders and cobbles																

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

METRIC

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



ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

RECORD OF BOREHOLE No CPT T2-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4681233.1, E331339.0 ORIGINATED BY KH
 DIST HWY WEP BOREHOLE TYPE Track Mounted Drill - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 27 Sep 11 - 27 Sep 11 CHECKED BY MSO

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa												
						○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE			20	40	60	80	100					
									20	40	60	80	100					
181.2 0.0	SAND Oxidation, trace organics and gravel Dark Brown to Light Brown Moist-wet		A	SA														
180.6 0.6	SAND Trace gravel and organics Mottled Brown Wet		B	SA														
180.0 1.2	SILTY CLAY Trace gravel, trace organics Brown Moist																	
178.8 2.4	CLAYEY SILT Oxidation and trace gravel Grey Moist-wet		C	SA														
178.2 3.0	END OF BOREHOLE																	
		</																




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

RECORD OF BOREHOLE No CPT19-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4681454.0, E331184.5 ORIGINATED BY TA
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 13 Jun 11 - 13 Jun 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE							
182.0 0.0	Ground Surface TOPSOIL														
181.2 0.8	SILTY SAND Compact Brown		1	SS	10										
180.3 1.7	SILTY CLAY to CLAYEY SILT Some sand, trace gravel Firm Grey		2	SS	7										
180.0 2.0	END OF SAMPLED BOREHOLE (Continued with CPT to refusal) Borehole dry on completion														
						</									

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

RECORD OF NILCON VANE TEST NIL T2-1

Project : Windsor-Essex Parkway

Test Date: 4/12/2011

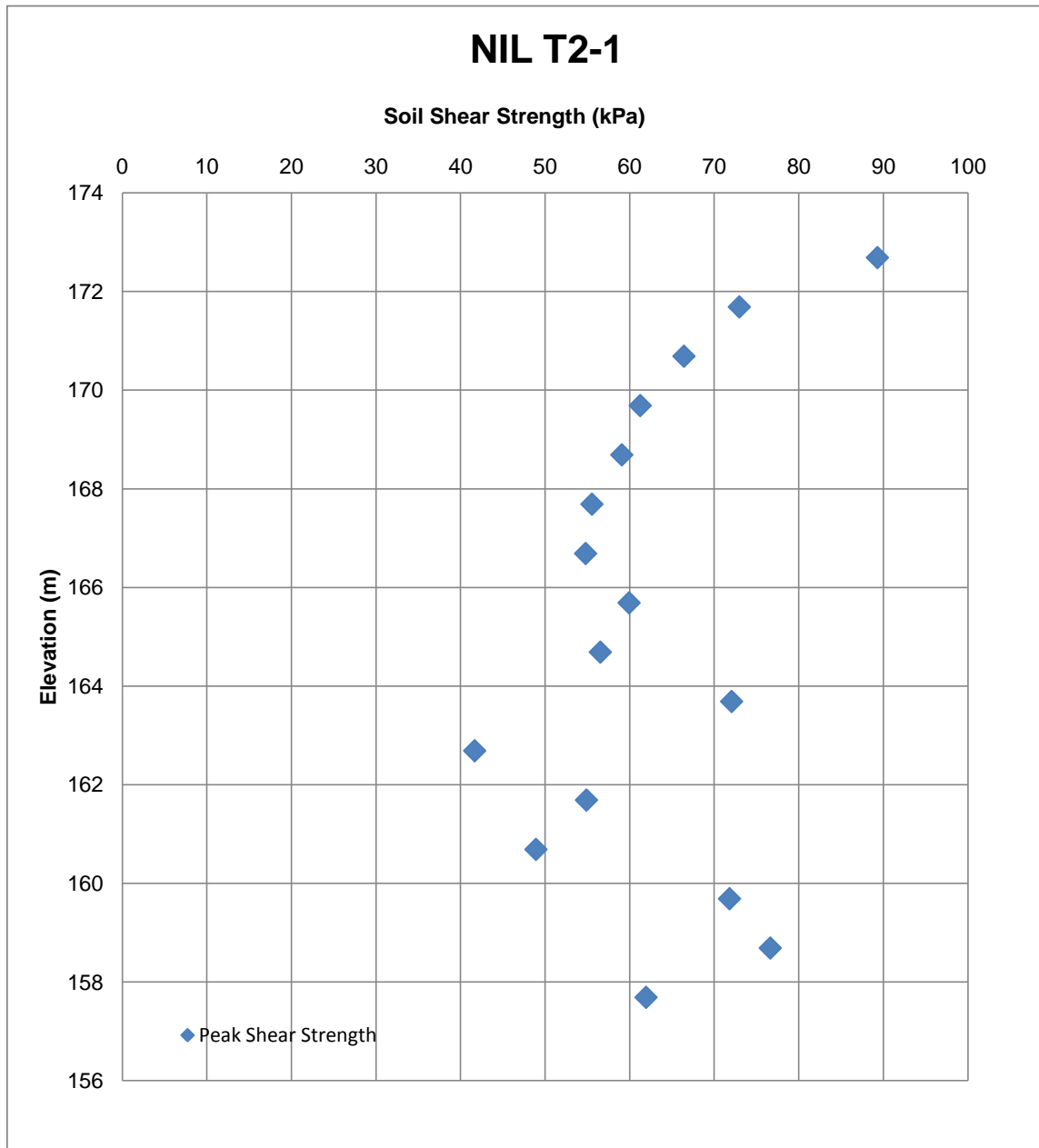
Sheet 1 of 1

Location: N4681291.5; E331304.2

Predrill Depth : 5.93 m

Datum Geodetic

Ground Surface Elevation: 181.4 m



Operator: TA

Checked: DD

RECORD OF CONE PENETRATION TEST CPT T2-1

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 4/14/2011 - 4/14/2011

SHEET 1 OF 3

LOCATION N4681233.1; E331339.0

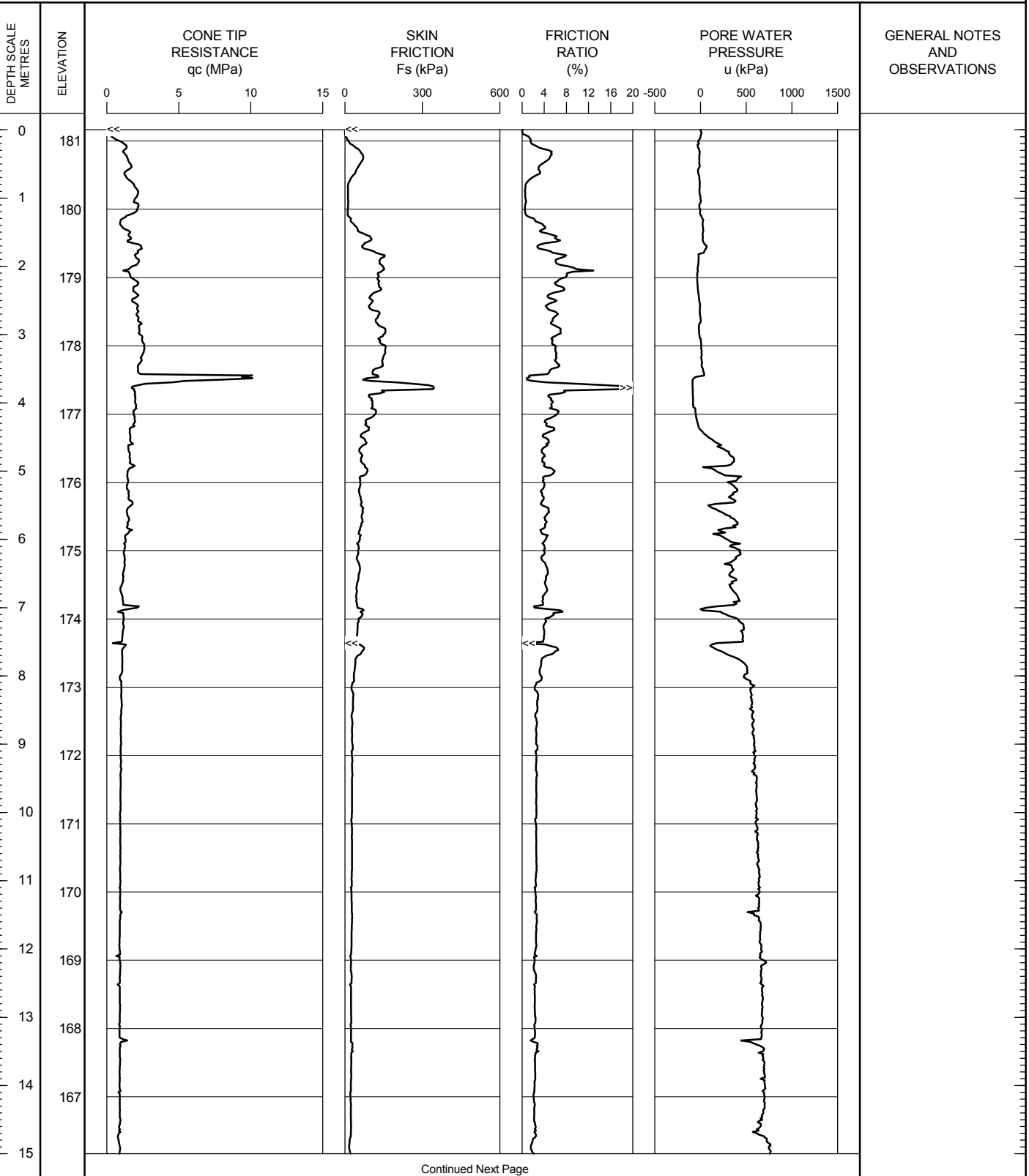
DATUM Geodetic

GROUND SURFACE ELEVATION: 181.2

PREDRILL DEPTH: 0

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T2-1

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 4/14/2011 - 4/14/2011

SHEET 2 OF 3

LOCATION N4681233.1; E331339.0

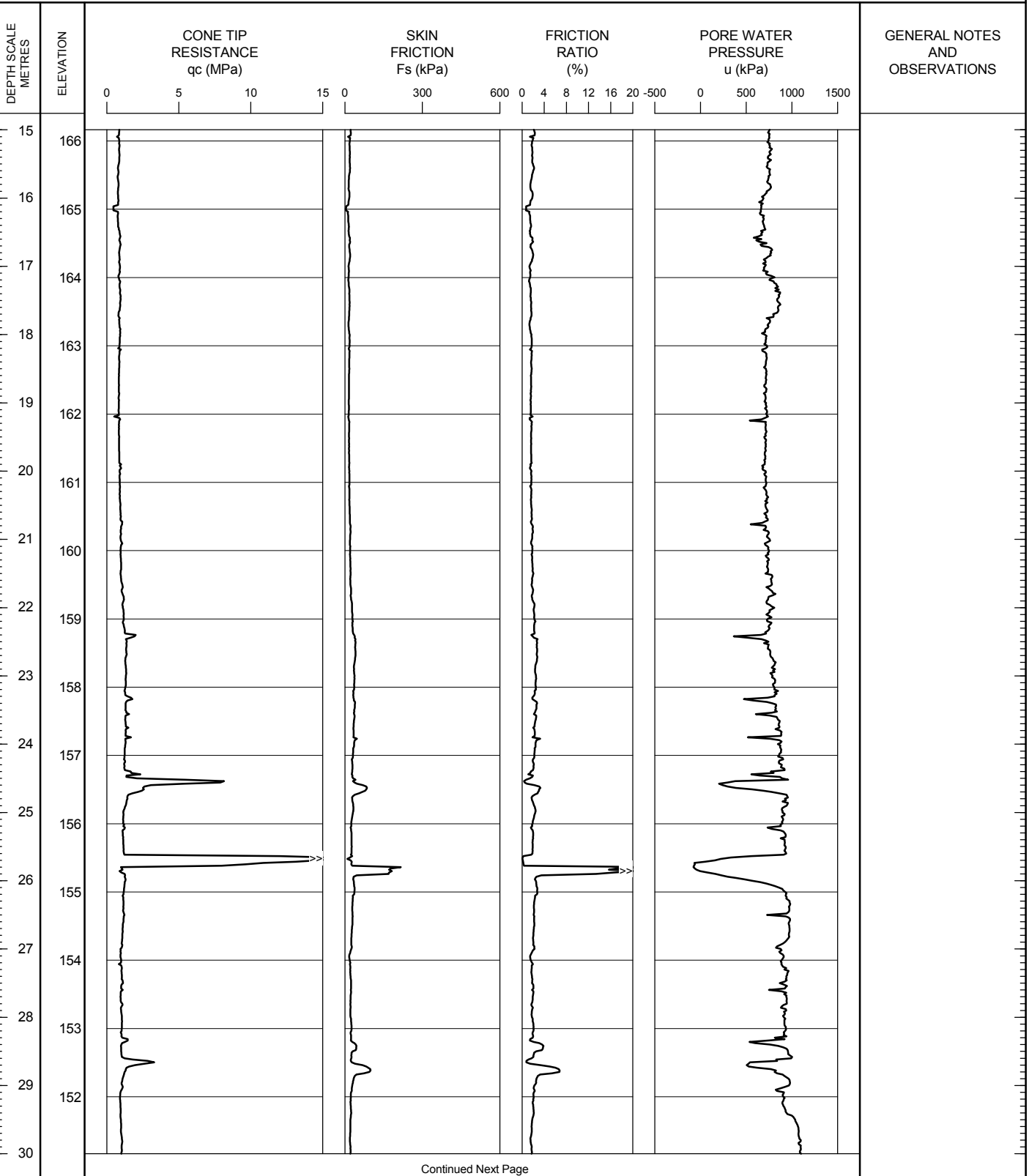
DATUM Geodetic

GROUND SURFACE ELEVATION: 181.2

PREDRILL DEPTH: 0

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

METRIC

SHEET 3 OF 3

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.2 PREDRILL DEPTH: 0 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0

RECORD OF CONE PENETRATION TEST CPT T2-2

METRIC

PROJECT Windsor-Essex Parkway

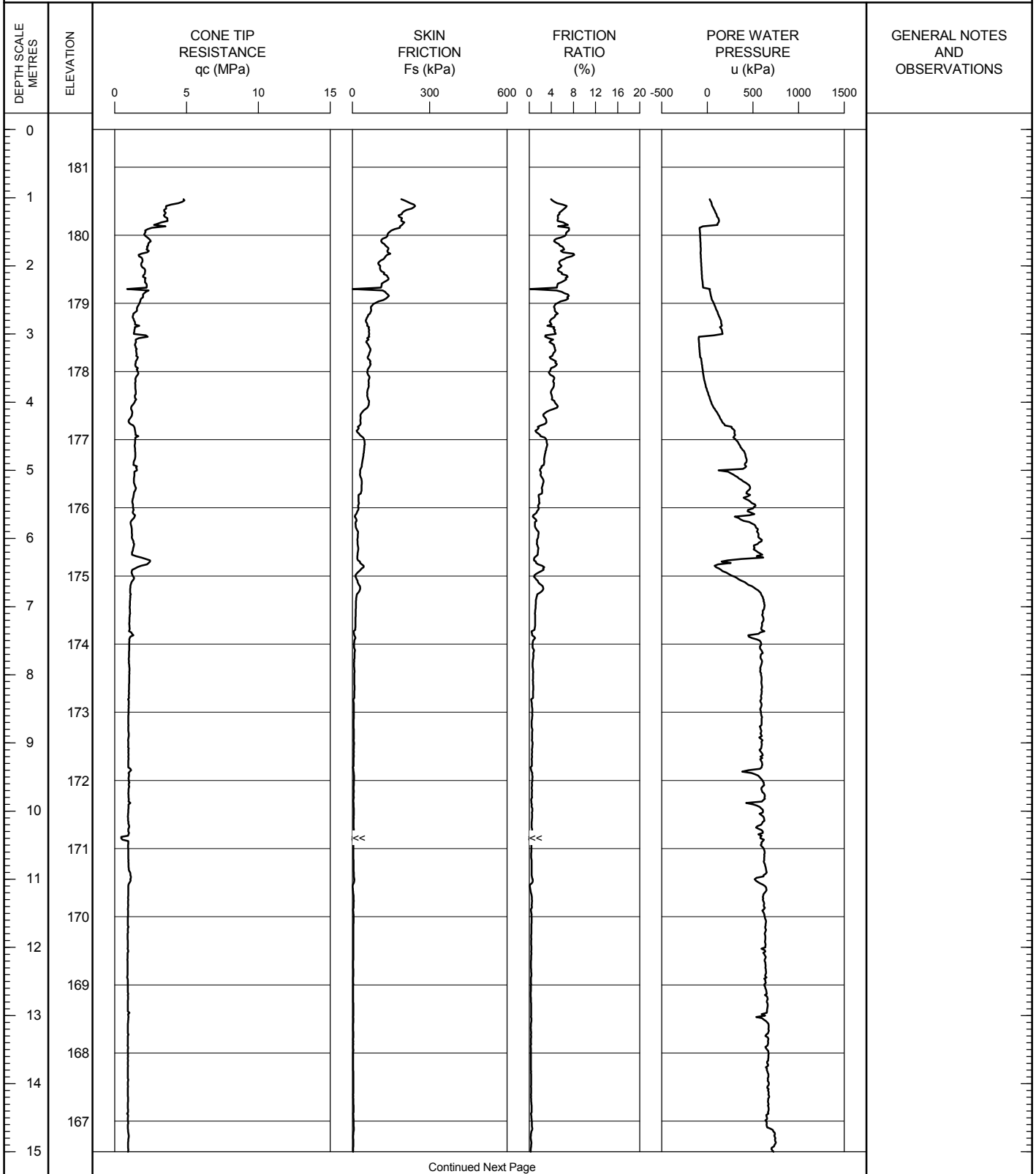
TEST DATE 4/13/2011 - 4/13/2011

SHEET 1 OF 2

LOCATION N4681313.0; E331351.7

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.6 PREDRILL DEPTH: 0.99 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T2-2

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 4/13/2011 - 4/13/2011

SHEET 2 OF 2

LOCATION N4681313.0; E331351.7

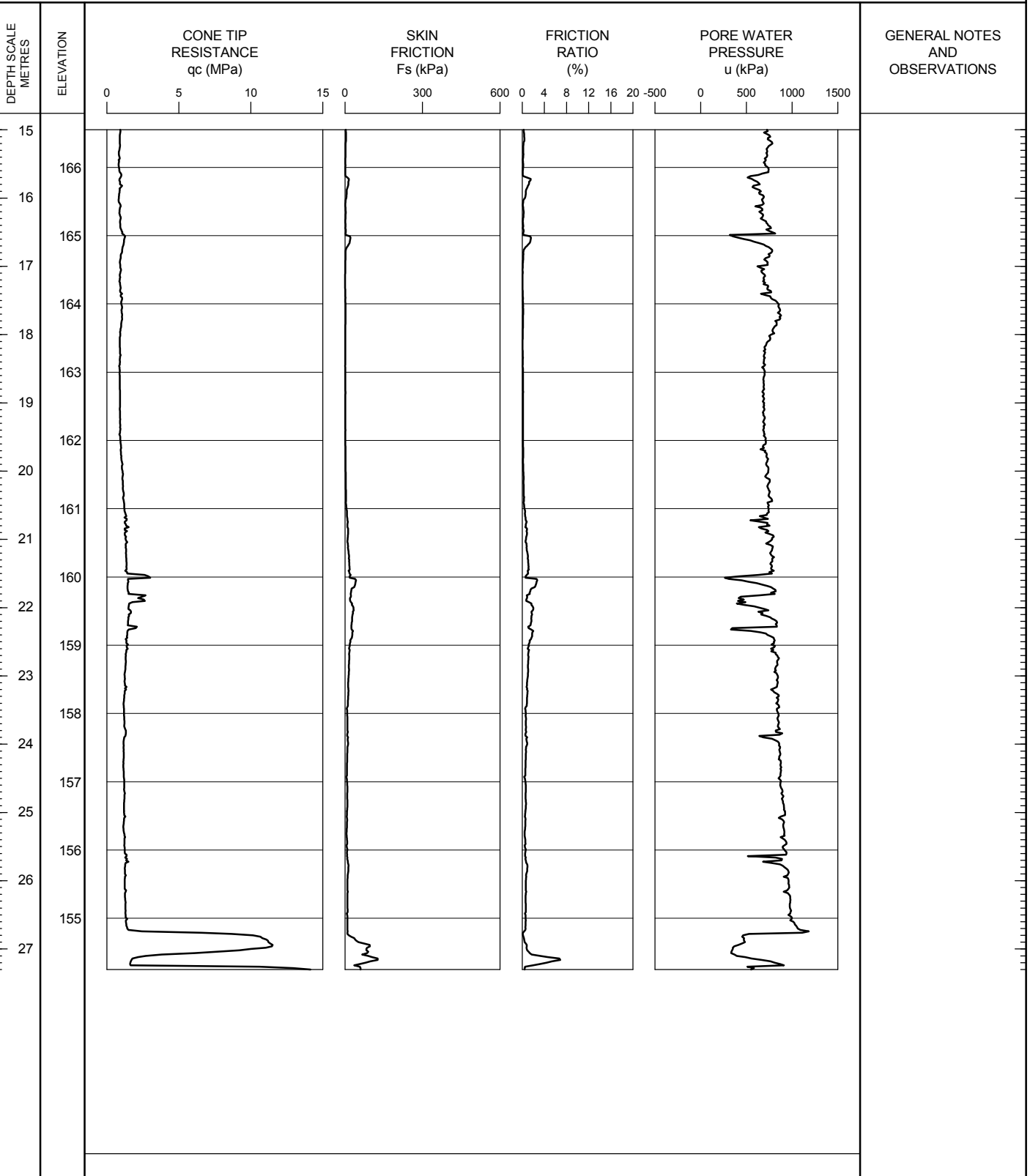
DATUM Geodetic

GROUND SURFACE ELEVATION: 181.6

PREDRILL DEPTH: 0.99

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



WEP CPT LOG CPT T2-2.GPJ ONTARIO MOT. GDT 21/12/11

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 19-RW

METRIC

PROJECT Windsor-Essex Parkway

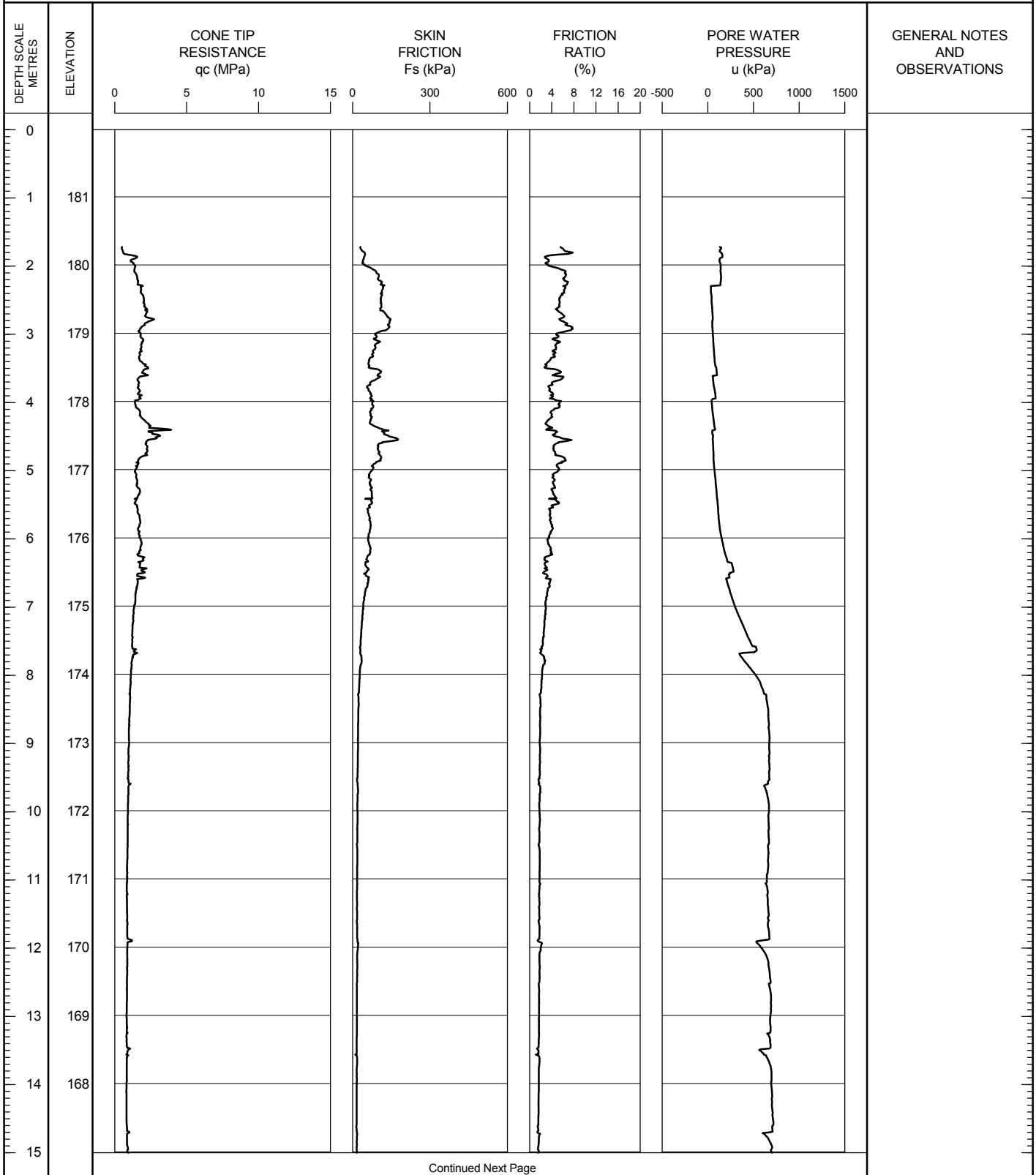
TEST DATE 6/13/2011 - 6/13/2011

SHEET 1 OF 3

LOCATION N4681454.0; E331184.5

DATUM Geodetic

GROUND SURFACE ELEVATION: 182.0 PREDRILL DEPTH: 1.57 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 19-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 6/13/2011 - 6/13/2011

SHEET 2 OF 3

LOCATION N4681454.0; E331184.5

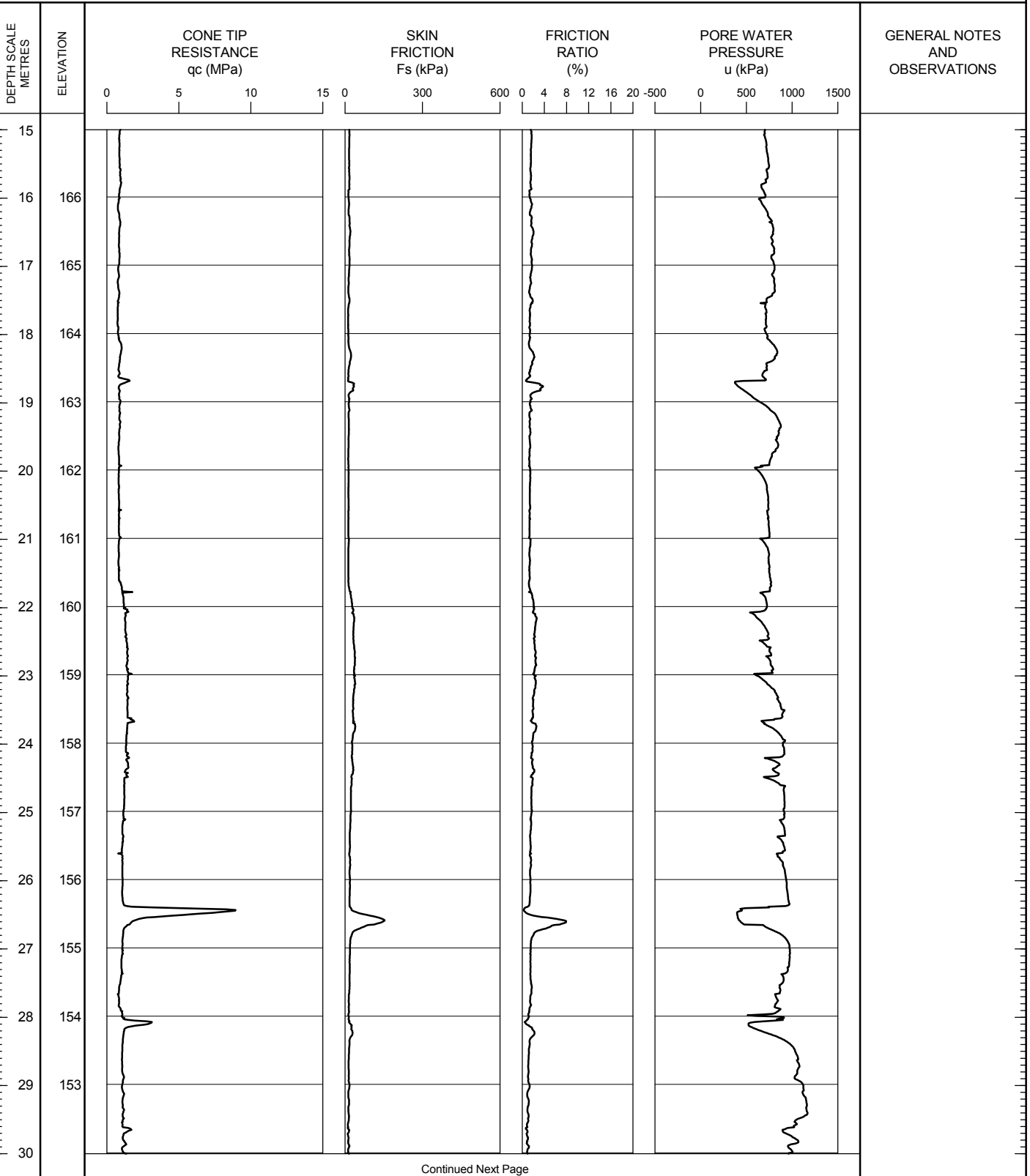
DATUM Geodetic

GROUND SURFACE ELEVATION: 182.0

PREDRILL DEPTH: 1.57

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

METRIC

SHEET 3 OF 3

DATUM Geodetic

GROUND SURFACE ELEVATION: 182.0 PREDRILL DEPTH: 1.57 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0

WEP CPT LOG CPT-RW.GPJ ONTARIO MOT.GDT 23/12/11

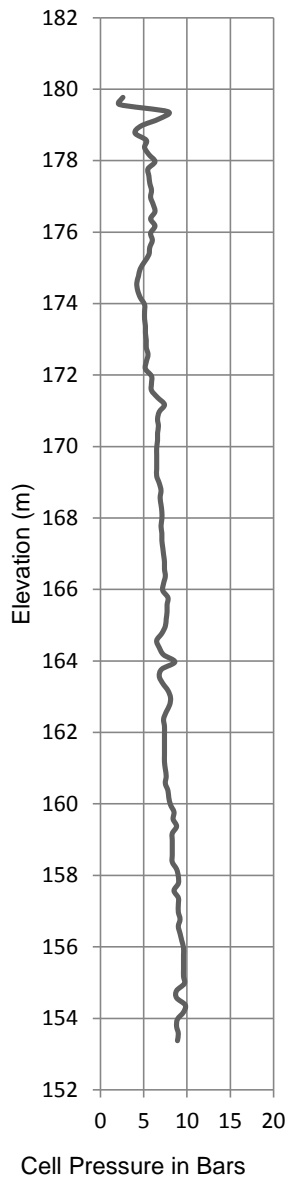
RECORD OF DILATOMETER TEST DMT T2-1

Project : Windsor-Essex Parkway
Location: N4681337.5; E331268.8
Ground Surface Elevation : 181.6

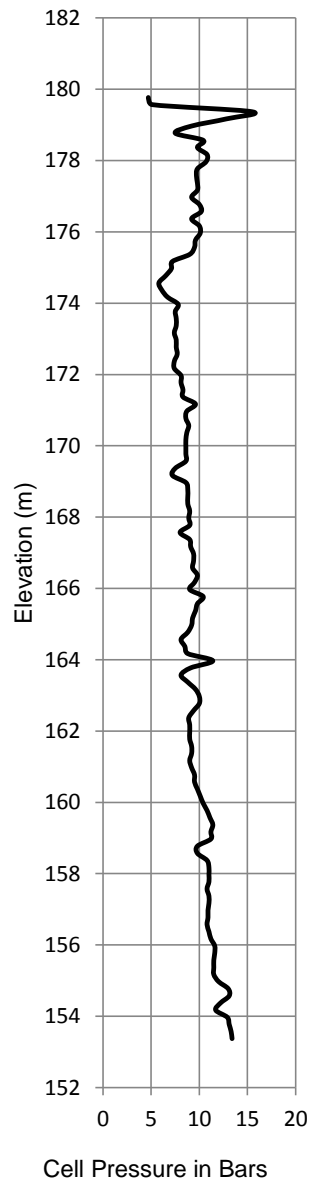
Test Date: 4/15/2011
Predrill Depth : 1.8 m
Delta A: 0.19 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.37 Bar

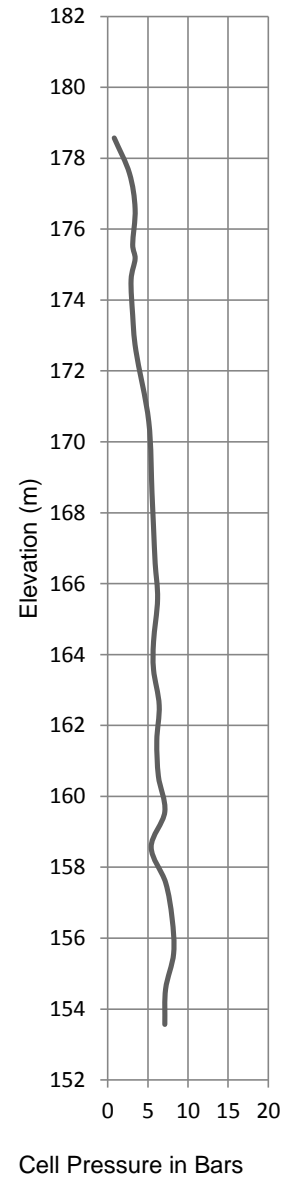
Reading A



Reading B



Reading C



Operator: LC

Checked: DD

RECORD OF BOREHOLE No TB2-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680888.0, E330465.2 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 6 Jul 11 - 6 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE										
								20 40 60 80 100											
182.1	Ground Surface																		
0.0	TOPSOIL																		
181.6																			
0.5	FINE SAND Poorly graded Trace gravel, trace silt Loose Brown		1	SS	6														
180.3			2A, B	SS	8														
1.8	CLAYEY SILT with embedded fine sand Laminated Firm Grey																		
179.5			3	SS	6														
2.6	CLAYEY SILT Some sand, trace gravel Firm to stiff Grey -Trace pink nodules		4	SS	8														
			5	SS	9														
			6	SS	10														
			7	SS	8														
			8	SS	7														
			VT																
			9	SS	4														
			VT																
			10	SS	2														
			VT																
171.9																			
10.2	END OF BOREHOLE																		
	Groundwater encountered at elevation 180.3m during drilling																		
			</																

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

RECORD OF BOREHOLE No TB2-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680825.5, E331515.2 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 5 Jul 11 - 6 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)			
								○ UNCONFINED	+	FIELD VANE											
								● POCKET PEN.	×	LAB VANE											
182.6	Ground Surface						20	40	60	80	100		10	20	30						
0.0	FILL Silty Clay Some sand, trace gravel, trace topsoil Brown																				
182.2																					
0.4	FINE SAND Poorly graded Trace silt Brown		1	SS	22																
			2	SS	11																
180.5																					
2.1	SILT Some clay, trace to some sand Loose Grey Wet		3	SS	5																
179.6																					
3.0	CLAYEY SILT Some sand, trace gravel Firm to Stiff Grey -Trace oxidation		4	SS	10																
			5	SS	10																
			6	SS	8																
			7	SS	8																
			8	SS	7																
				VT																	
			9	SS	4																
				VT																	
			10	SS	4																
				VT																	
172.4																					
10.2	END OF BOREHOLE Groundwater encountered at elevation 180.3m during drilling																				
												</									

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 14/08/12

RECORD OF BOREHOLE No T3-1

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680821.3, E331611.9 ORIGINATED BY RL
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 13 Jul 11 - 15 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
182.3	Ground Surface													
0.0	CONCRETE													
182.0														
0.3	FILL													
	Silty sand and gravel													
181.2	Crushed Limestone on woven geotextile													
1.0	Grey		1	SS	33									
	SILT													
	Some fine sand, trace clay													
180.6	Compact		2	SS	5									
1.7	Brown													
	Moist to wet													
	CLAYEY SILT													
	Some sand, trace gravel													
	Firm to stiff													
	Grey													

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

METRIC

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No T3-1

3 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680821.3, E331611.9 ORIGINATED BY RL
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 13 Jul 11 - 15 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE									
								20 40 60 80 100										
29.9	SILTY CLAY And interbeds of SILT and SAND Soft/Compact Grey (continued)																	
			24	SS	6													
			25	SS	5													
149.3																		
32.9	SANDY SILT Some gravel, trace clay Very dense Grey																	
			26	SS	76													
146.7	-Limestone fragments at about elevation 147.1m		27	SS	59													
35.5																		
35.6	BOULDER LIMESTONE Fine grained, laminated, pitted, porous with fractures (micro) running parallel to the core length. Fractures are filled with calcite mineralization, stylolites present. Brown		28	RC														
			29	RC														
144.0																		
38.3	LIMESTONE Fine grained, dense limestone having stylolitic contact with the upper unit. Facies looks like cherty limestone, laminated Grey to white		30	RC														
143.1																		
39.2																		
142.8																		
39.5	LIMESTONE Fine grained, laminated, porous, turbid and pitted with black inclusions, stylolites present. Dark grey END OF BOREHOLE No groundwater observed during auger drilling Water level measured in deep observation well at elevation 181.9m on October 19, 2011 Water level measured in Piezometer VWP T3-1-P9 at elevation 180.9m on July 29, 2011 Water level measured in Piezometer VWP T3-1-P9 at elevation 181.2m on August 6, 2011 Water level measured in Piezometer VWP T3-1-P18 at elevation 174.2m on July 29, 2011 Water level measured in Piezometer VWP T3-1-P18 at elevation 173.5m August 6, 2011 Water level measured in Piezometer VWP T3-1-P35 at elevation 177.1m on July 29, 2011 Water level measured in Piezometer VWP T3-1-P35 at elevation 177.1m August 6, 2011																	
											</							

-end of drilling July 14; continue July 15
-VWP T3-1-P35 installed at 35.1m below ground surface (EL. 147.2m)
-hit rock at 35.05m
RQD = 75%
TCR = 100%
SCR = 83%
RQD = 97%
TCR = 100%
SCR = 100%

RQD = 78%
TCR = 100%
SCR = 90%

RECORD OF BOREHOLE No NIL T3-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680875.7, E331528.6 ORIGINATED BY SO
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 5 Aug 11 - 5 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
								20 40 60 80 100					
182.1	Ground Surface												
180.0	TOPSOIL												
0.2	FINE SAND Some silt Loose to compact Brown		1	SS	6								
180.0	Grey Wet		2	SS	14								
2.1	CLAYEY SILT Stiff Grey Wet		3	SS	8								
179.2	SILTY CLAY Some embedded sand and gravel Trace pink nodules Stiff Grey		4	SS	12								
2.9			5	SS	13								
			6	SS	11								
			7	SS	8								
			8	SS	7								
175.5	END OF SAMPLED BOREHOLE (Continued with Nilcon Vane from 7.0m to refusal at 24.0m) (EL. 175.1m to EL. 158.1m) Borehole dry on completion												
6.6													

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

1 OF 1

METRIC




+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No DMT T3-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680797.9, E331570.0 ORIGINATED BY KH
 DIST HWY WEP BOREHOLE TYPE Track Mounted Drill - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 28 Sep 11 - 28 Sep 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.	× LAB VANE									
182.6							20	40	60	80	100									
0.0	SAND Trace organics and gravel Brown Moist		A	SA																
182.0																				
0.6	SAND Trace oxidation, trace gravel Light brown Moist		B	SA																
181.4																				
1.2	Grey SILTY CLAY Trace gravel and oxidation Moist																			
179.6			C	SA																
3.0	END OF BOREHOLE																			

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

METRIC

[illegible]

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

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

RECORD OF BOREHOLE No BH11-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680790.2, E331671.9 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 8 Jul 11 - 8 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				
								○ UNCONFINED		+ FIELD VANE										
								● POCKET PEN.		× LAB VANE										
182.4	Ground Surface						20	40	60	80	100	10	20	30						
0.0	TOPSOIL																			
181.8																				
0.6	FINE SAND Poorly graded Trace silt Brown -Some sandy silt pockets		1	SS	5															
			2	SS	5															
180.1																				
2.3	CLAYEY SILT to SILTY CLAY Stiff Varved Grey		3	SS	10															
179.4																				
3.0	SILTY CLAY Some sand, trace gravel Stiff to very stiff Grey		4	SS	10															
			5	SS	15															
			6	SS	9															
			7	SS	11															
			8	SS	10															
175.8	END OF BOREHOLE																			
6.6	Groundwater encountered at elevation 180.9m during drilling																			

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

RECORD OF BOREHOLE No CPT23-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680976.7, E331512.0 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 10 Aug 11 - 10 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20 40 60 80 100										10 20 30		
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE												
181.6	Ground Surface																			
0.0	TOPSOIL																			
181.1																				
0.5	SAND Fine-medium coarse, poorly graded Trace to some silt Brown		1	SS	5		181													
180.1																				
1.5	SILT Some sand, some clay Brown to grey		2	SS	7		180													
179.6	END OF SAMPLED BOREHOLE (Continued with CPT to refusal)																			
2.0	Borehole dry on completion																			
							179													
							178													
							177													
							176													
							175													
							174													
							173													
							172													
							171													
							170													
							169													
							168													
							167													

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

1 OF 1

METRIC

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

RECORD OF BOREHOLE No CPT25-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680920.6, E331507.8 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 11 Aug 11 - 11 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE										
182.3	Ground Surface							20	40	60	80	100	10	20	30	kN/m ³	GR SA SI CL		
0.0	FILL Topsoil		1	SS	5														
181.8	FILL Silty Clay																		
0.5	Some sand, trace gravel																		
181.5	Trace topsoil		2	SS	7														
0.8	Brown																		
1.0	TOPSOIL SAND Fine, poorly graded Brown																		
179.9																			
2.4	CLAYEY SILT																		
179.6	Some sand		3	SS													-N-Values not recorded		
2.7	Grey																		
179.3	SILTY CLAY Some sand, trace gravel Grey																		
3.0	END OF SAMPLED BOREHOLE (Continued with CPT to refusal) Groundwater encountered at elevation 181.1m during drilling																		

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

RECORD OF BOREHOLE No DMT04-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680966.5, E331544.6 ORIGINATED BY LC
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 11 Jul 11 - 12 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
								○ UNCONFINED	+ FIELD VANE										
								● POCKET PEN.	× LAB VANE										
181.8	Ground Surface																		
0.0 181.5	CONCRETE																		
0.3	FILL Crushed Limestone		A	AS															
180.9 0.9	FILL Well-graded sand		1	SS	24														
180.1 1.7	FILL Silty Clay Grey		2A, B	SS	10														
179.4 2.4	TOPSOIL Organic Clay Black		3A, B, C, D	SS	10														
2.6	CLAYEY SILT Some sand, trace gravel Stiff Grey		4	SS	11														
178.3 3.5	END OF BOREHOLE (continued with DMT to refusal) Borehole dry on completion														end of drilling July 11, 2011; continue with DMT July 12, 2011				
							178												
							177												
							176												
							175												
							174												
							173												
							172												
							171												
							170												
							169												
							168												
							167												

end of drilling
July 11, 2011;
continue with
DMT July 12,
2011

RECORD OF NILCON VANE TEST NIL T3-1

Project : Windsor-Essex Parkway

Test Date: 8/6/2011

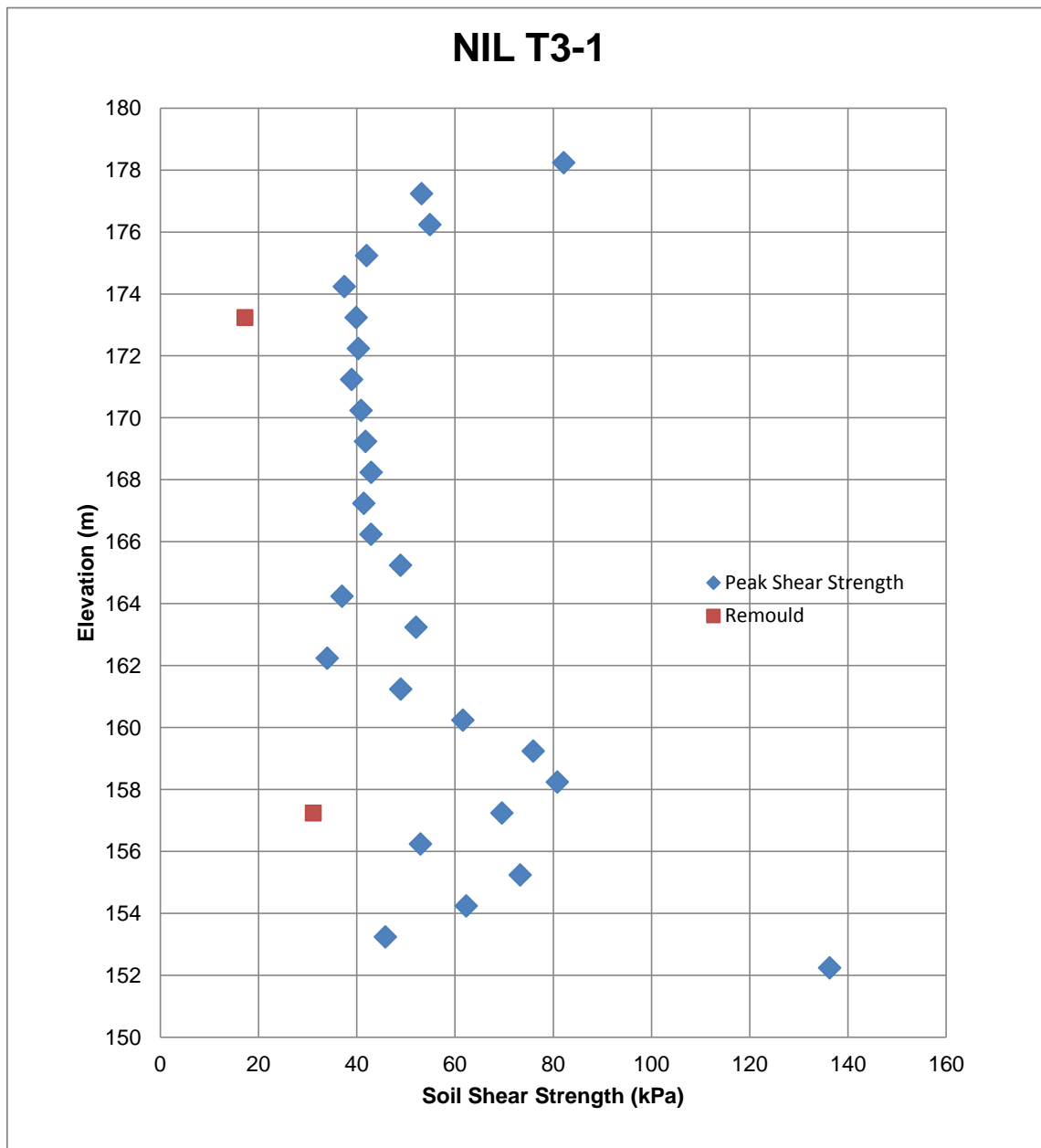
Sheet 1 of 1

Location: N4680822.6; E331611.7

Predrill Depth : 3.0 m

Datum Geodetic

Ground Surface Elevation: 182.2 m



Operator: SD

Checked: DD

RECORD OF NILCON VANE TEST NIL T3-2

Project : Windsor-Essex Parkway

Test Date: 8/5/2011

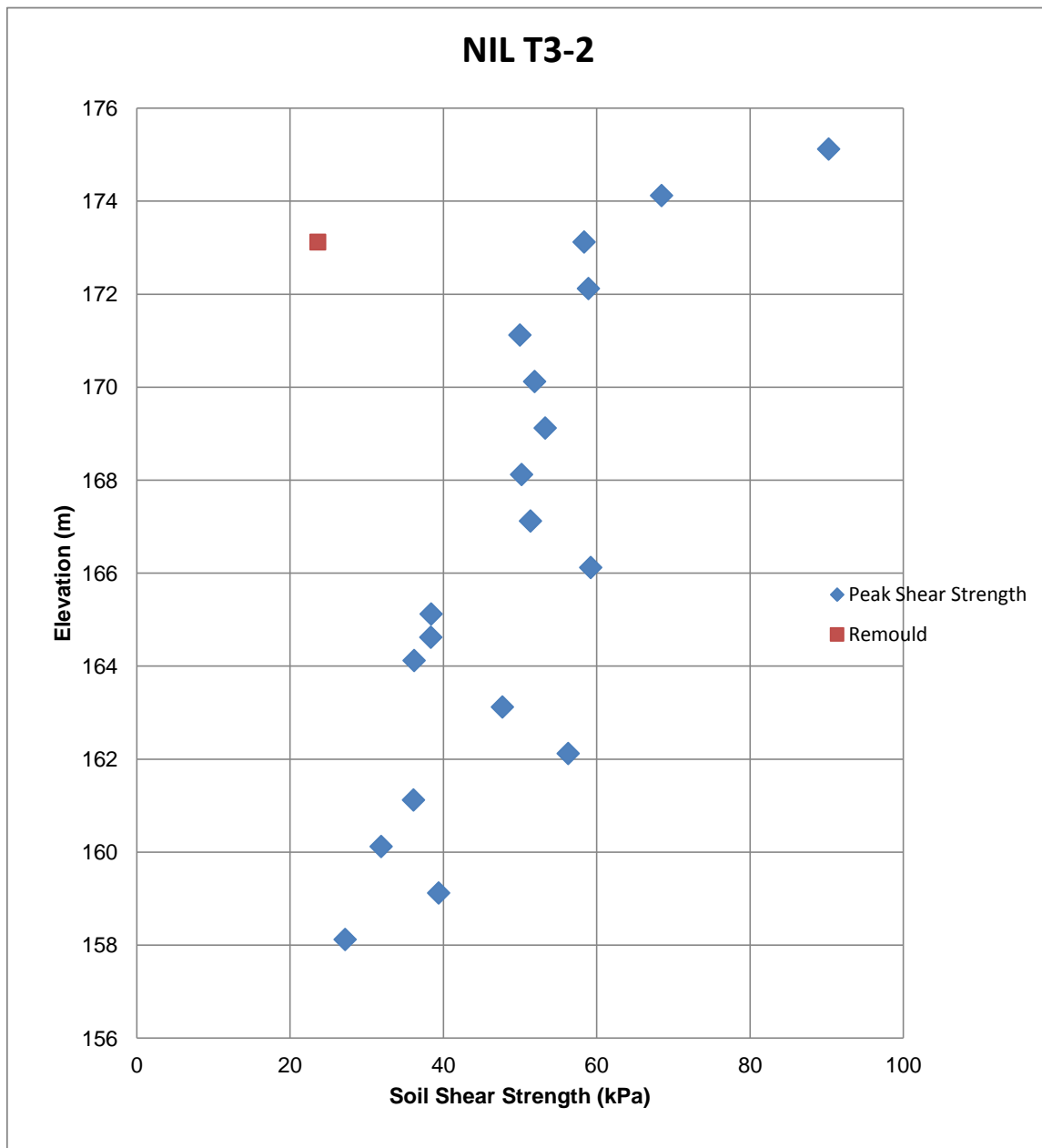
Sheet 1 of 1

Location: N4680875.7; E331528.6

Predrill Depth : 6.6 m

Datum Geodetic

Ground Surface Elevation: 182.1 m



Operator: SD

Checked: DD

RECORD OF CONE PENETRATION TEST CPT T3-1

METRIC

PROJECT Windsor-Essex Parkway

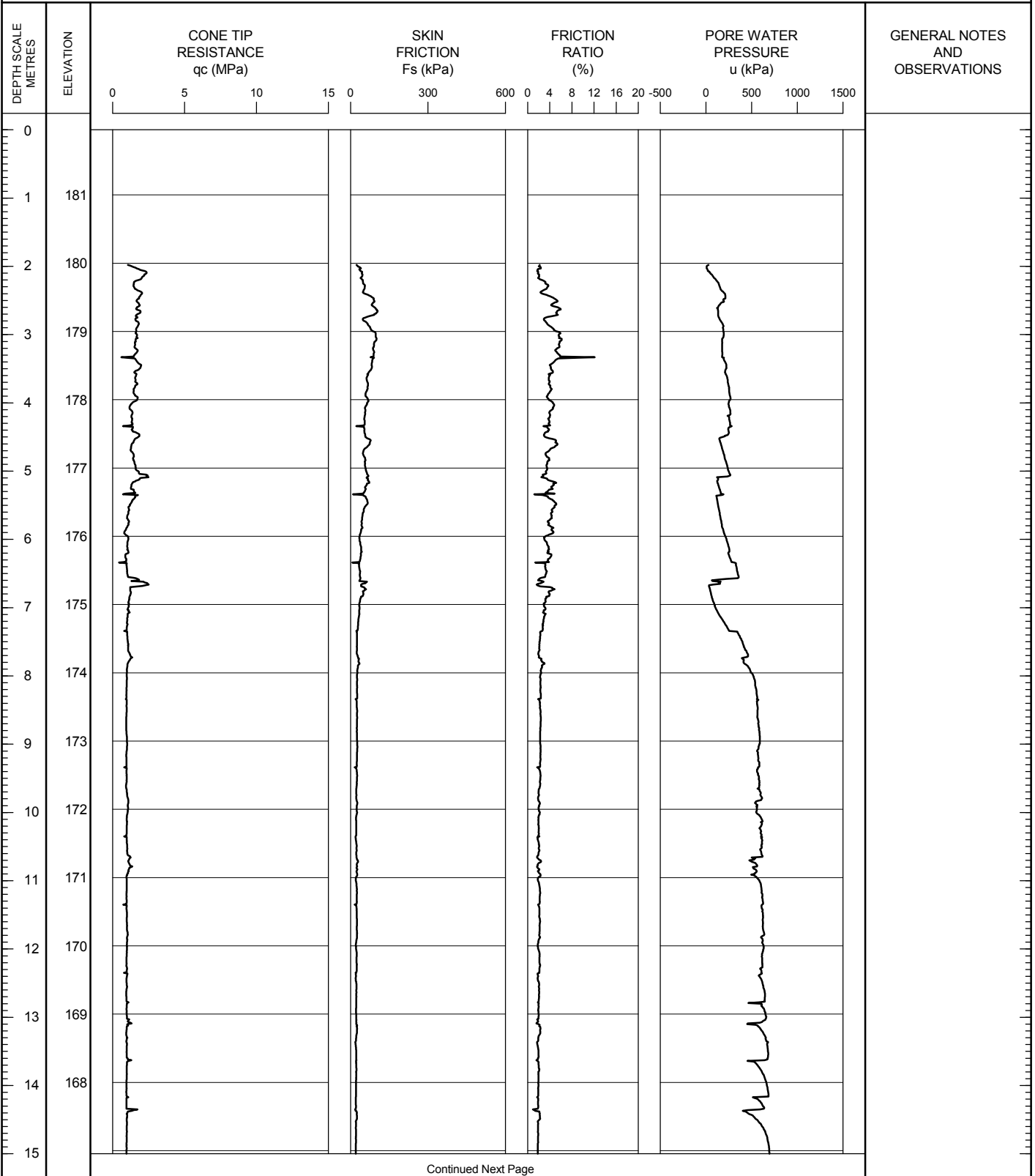
TEST DATE 8/5/2011 - 8/5/2011

SHEET 1 OF 2

LOCATION N4680926.9; E331563.8

DATUM Geodetic

GROUND SURFACE ELEVATION: 182.0 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T3-1

METRIC

PROJECT Windsor-Essex Parkway

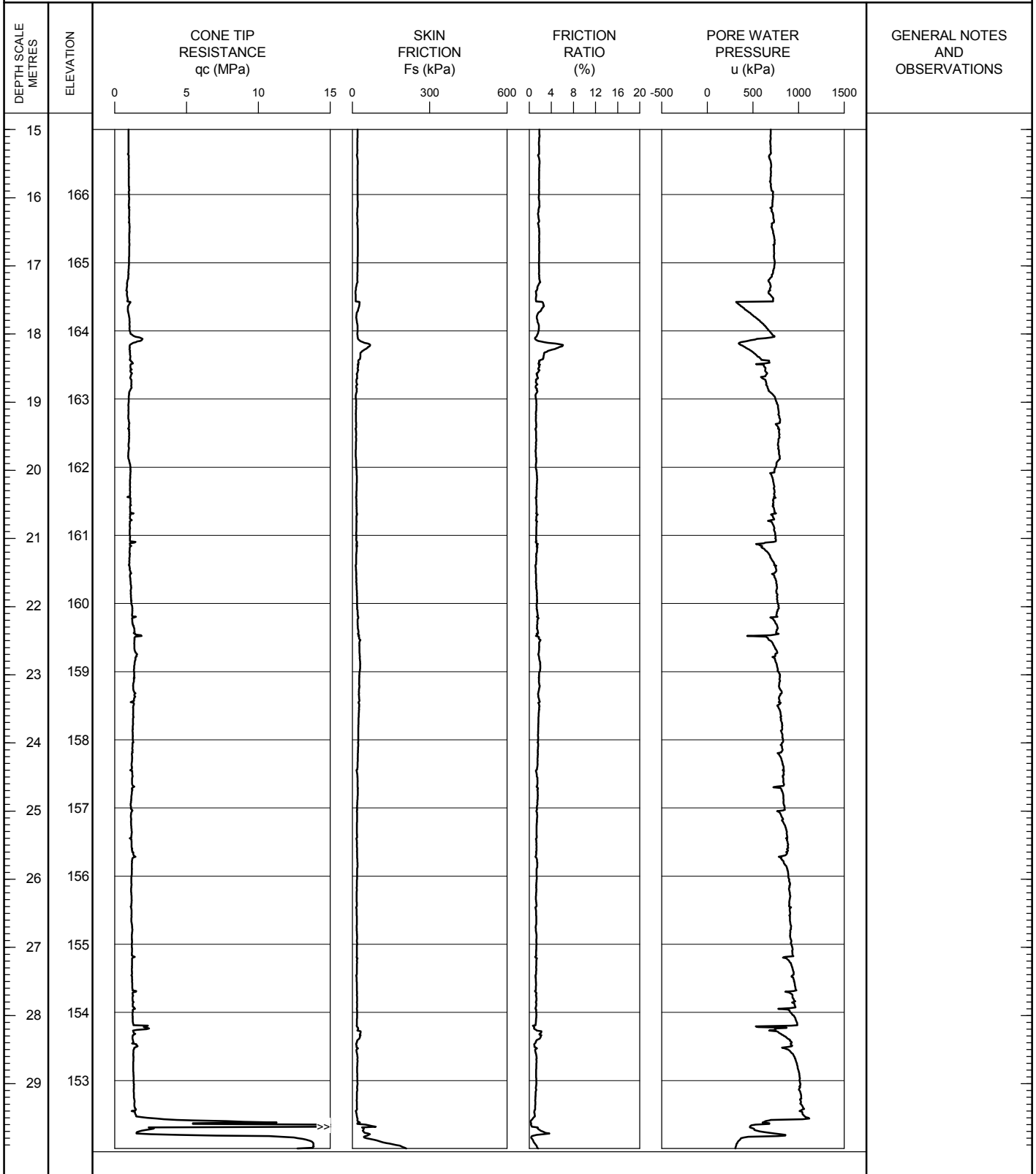
TEST DATE 8/5/2011 - 8/5/2011

SHEET 2 OF 2

LOCATION N4680926.9; E331563.8

DATUM Geodetic

GROUND SURFACE ELEVATION: 182.0 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



WEF CPT LOG CPT T3-1.GPJ ONTARIO.MOT.GDT 22/12/11

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 23-RW

METRIC

PROJECT Windsor-Essex Parkway

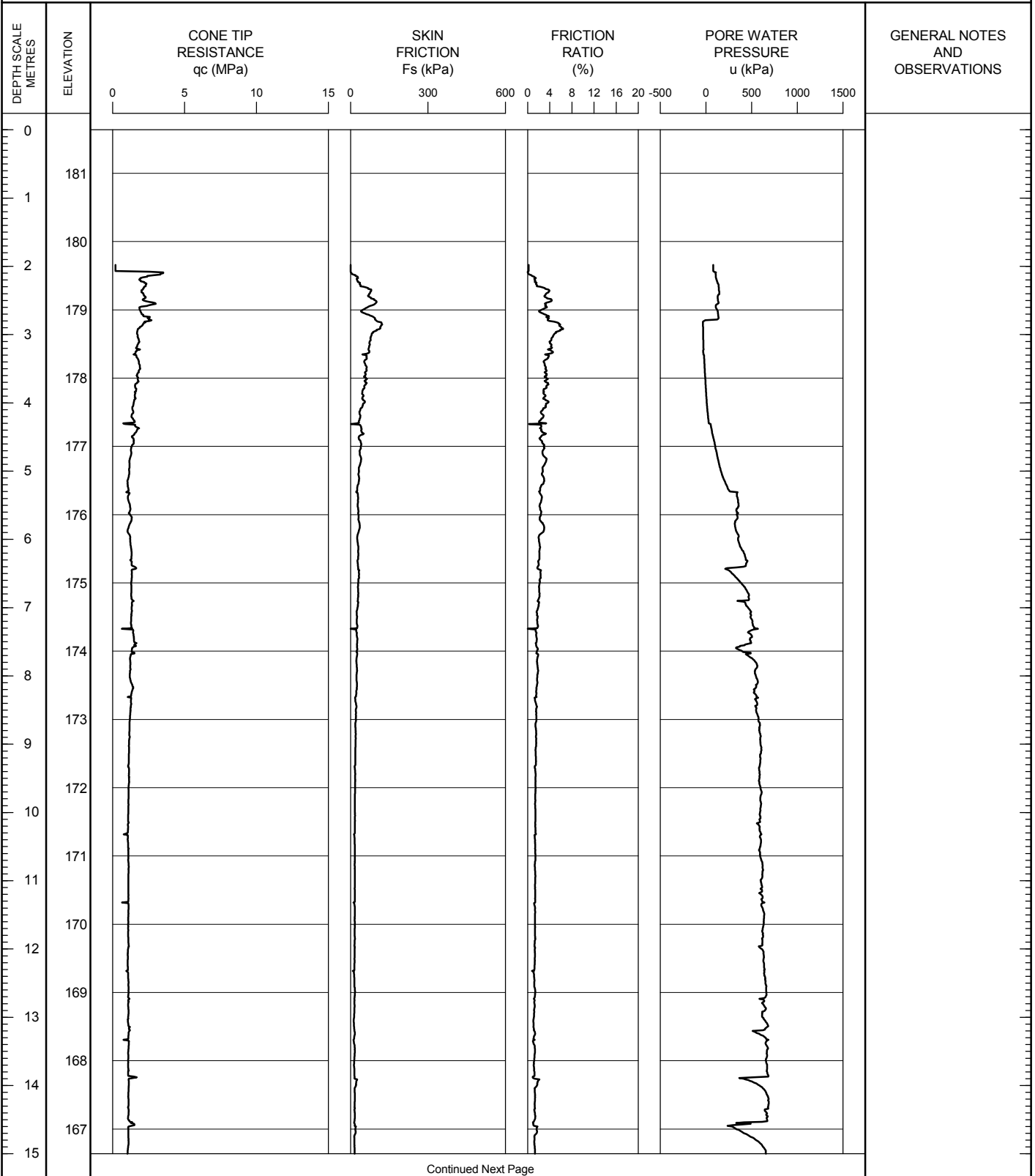
TEST DATE 8/10/2011 - 8/10/2011

SHEET 1 OF 2

LOCATION N4680976.7; E331512.0

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.6 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 23-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/10/2011 - 8/10/2011

SHEET 2 OF 2

LOCATION N4680976.7; E331512.0

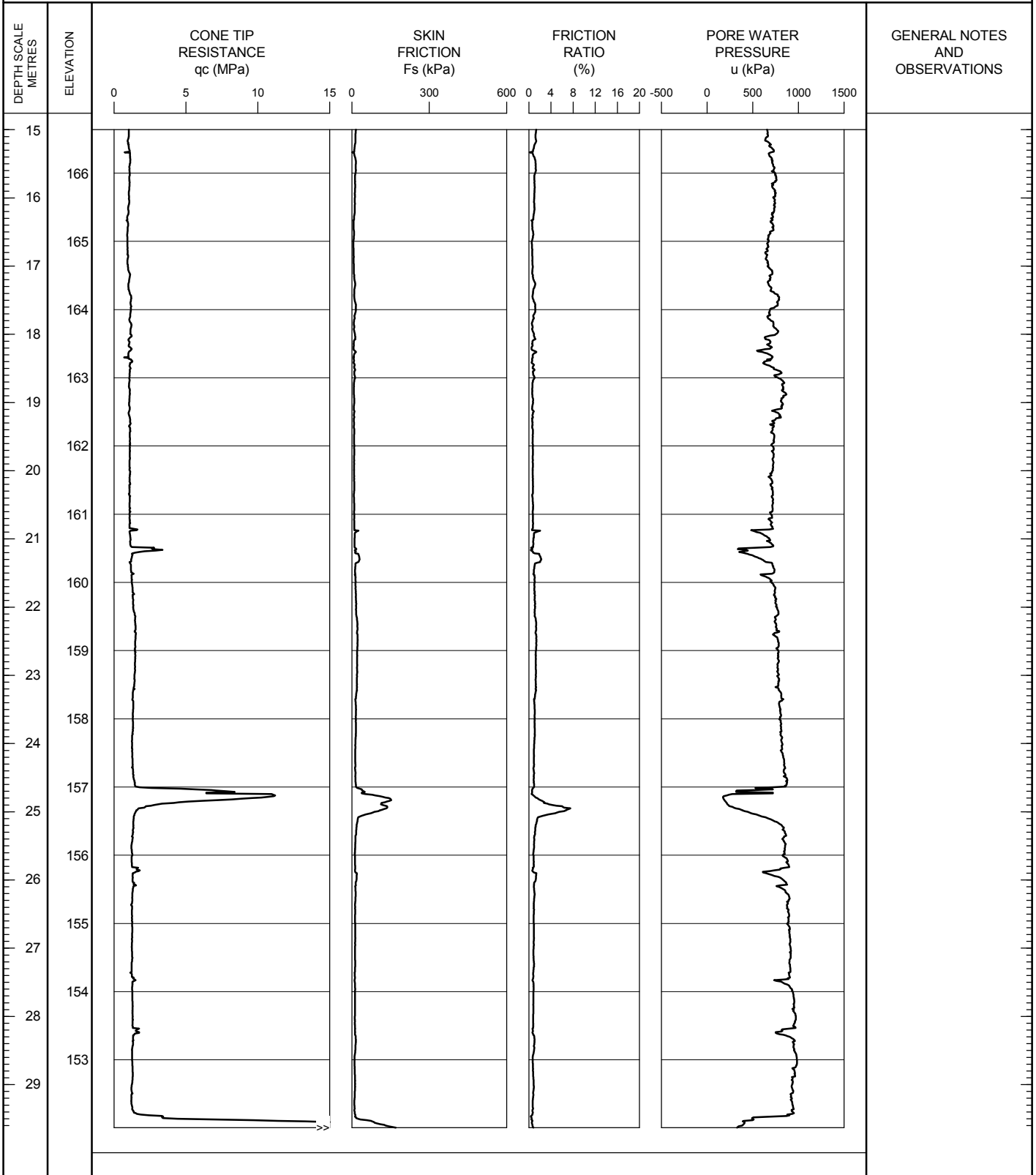
DATUM Geodetic

GROUND SURFACE ELEVATION: 181.6

PREDRILL DEPTH: 1.98

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



WEF CPT LOG CPT-RW/GPJ ONTARIO MOT GDT 23/12/11

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 24-RW

METRIC

PROJECT Windsor-Essex Parkway

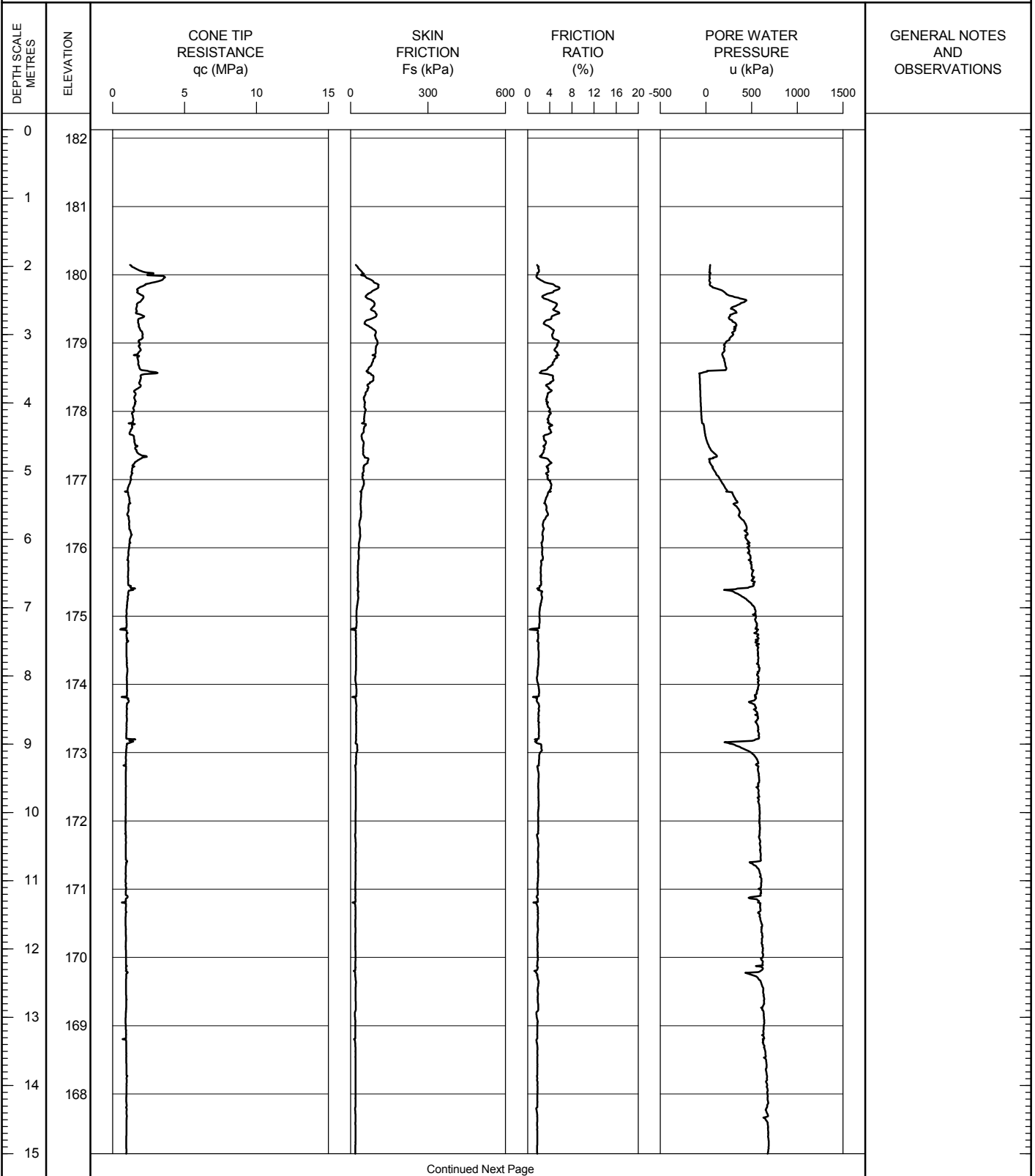
TEST DATE 8/11/2011 - 8/11/2011

SHEET 1 OF 2

LOCATION N4680949.2; E331582.1

DATUM Geodetic

GROUND SURFACE ELEVATION: 182.1 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 24-RW

METRIC

PROJECT Windsor-Essex Parkway

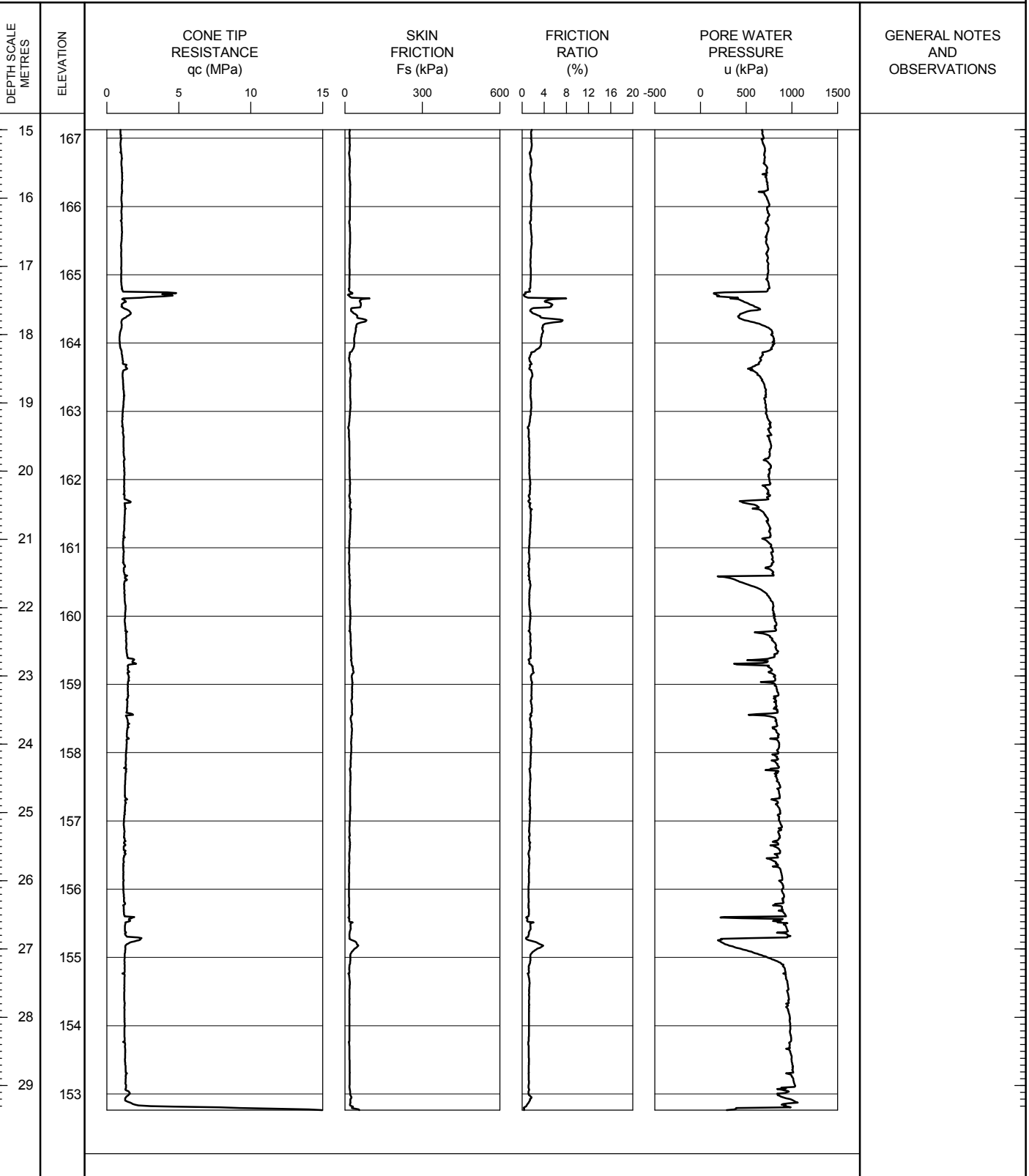
TEST DATE 8/11/2011 - 8/11/2011

SHEET 2 OF 2

LOCATION N4680949.2; E331582.1

DATUM Geodetic

GROUND SURFACE ELEVATION: 182.1 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



WEF CPT LOG CPT-RW/GPJ ONTARIO MOT GDT 23/12/11

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 25-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/11/2011 - 8/11/2011

SHEET 1 OF 3

LOCATION N4680920.6; E331507.8

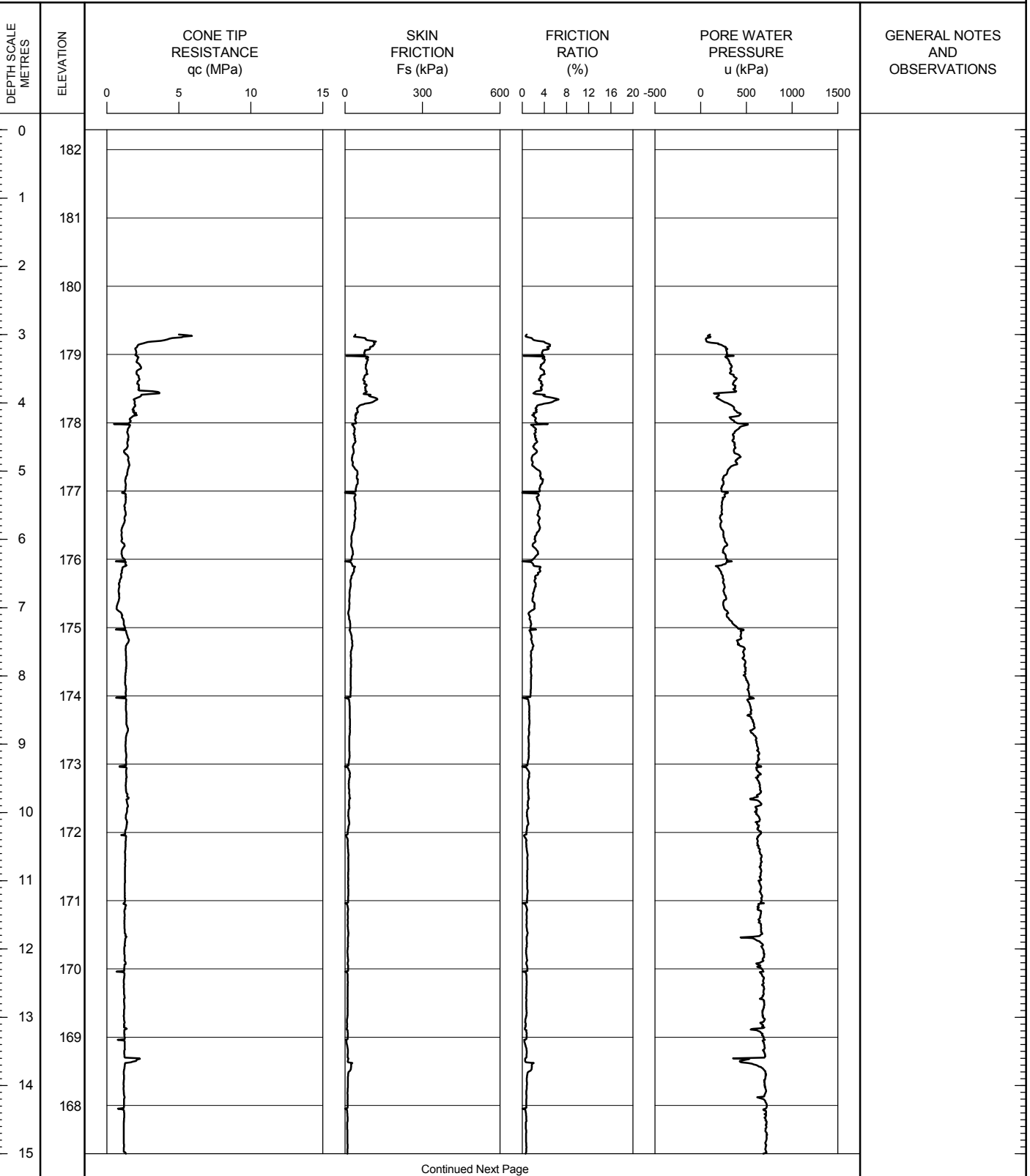
DATUM Geodetic

GROUND SURFACE ELEVATION: 182.3

PREDRILL DEPTH: 3

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 25-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/11/2011 - 8/11/2011

SHEET 2 OF 3

LOCATION N4680920.6; E331507.8

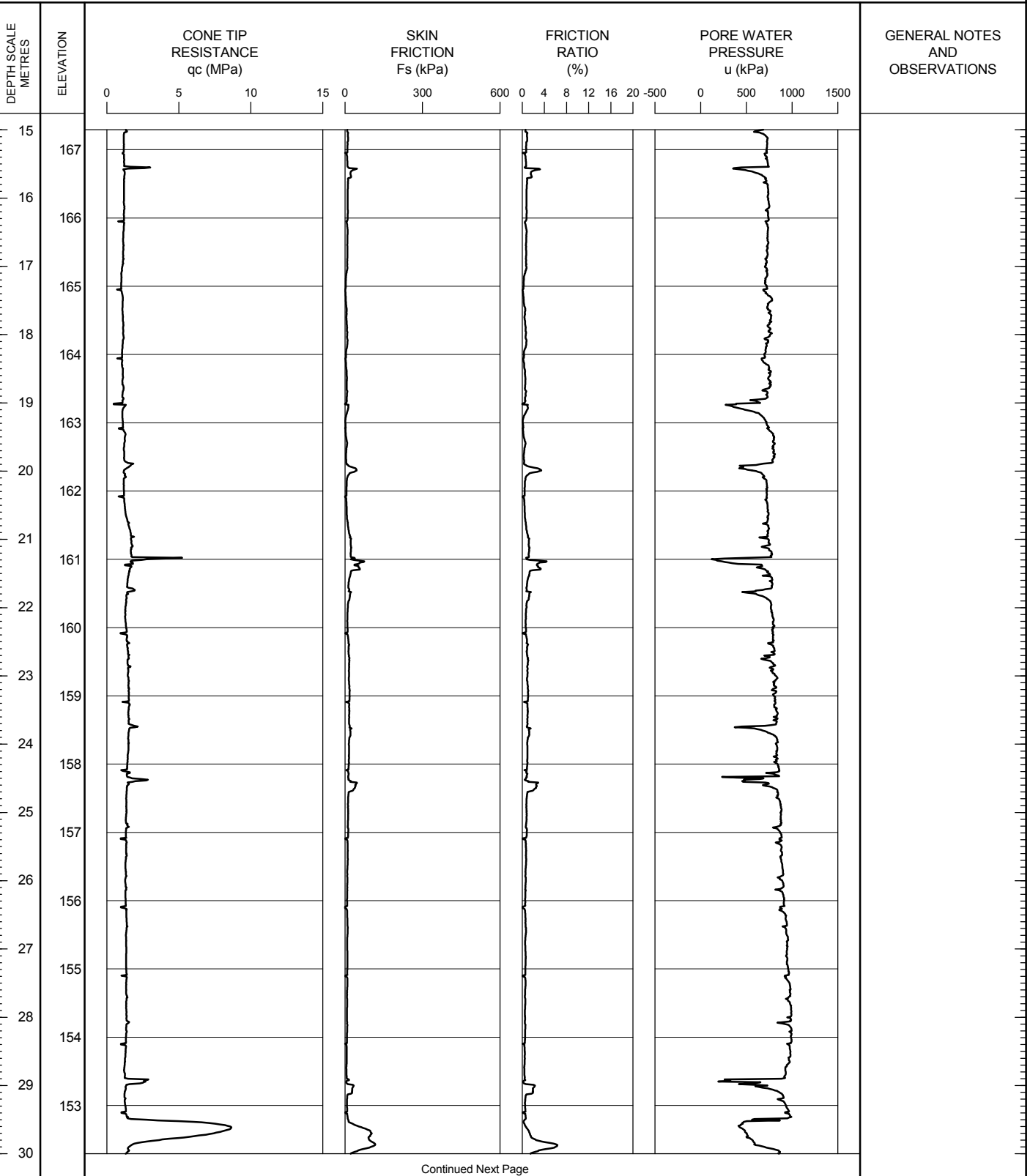
DATUM Geodetic

GROUND SURFACE ELEVATION: 182.3

PREDRILL DEPTH: 3

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 25-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/11/2011 - 8/11/2011

SHEET 3 OF 3

LOCATION N4680920.6; E331507.8

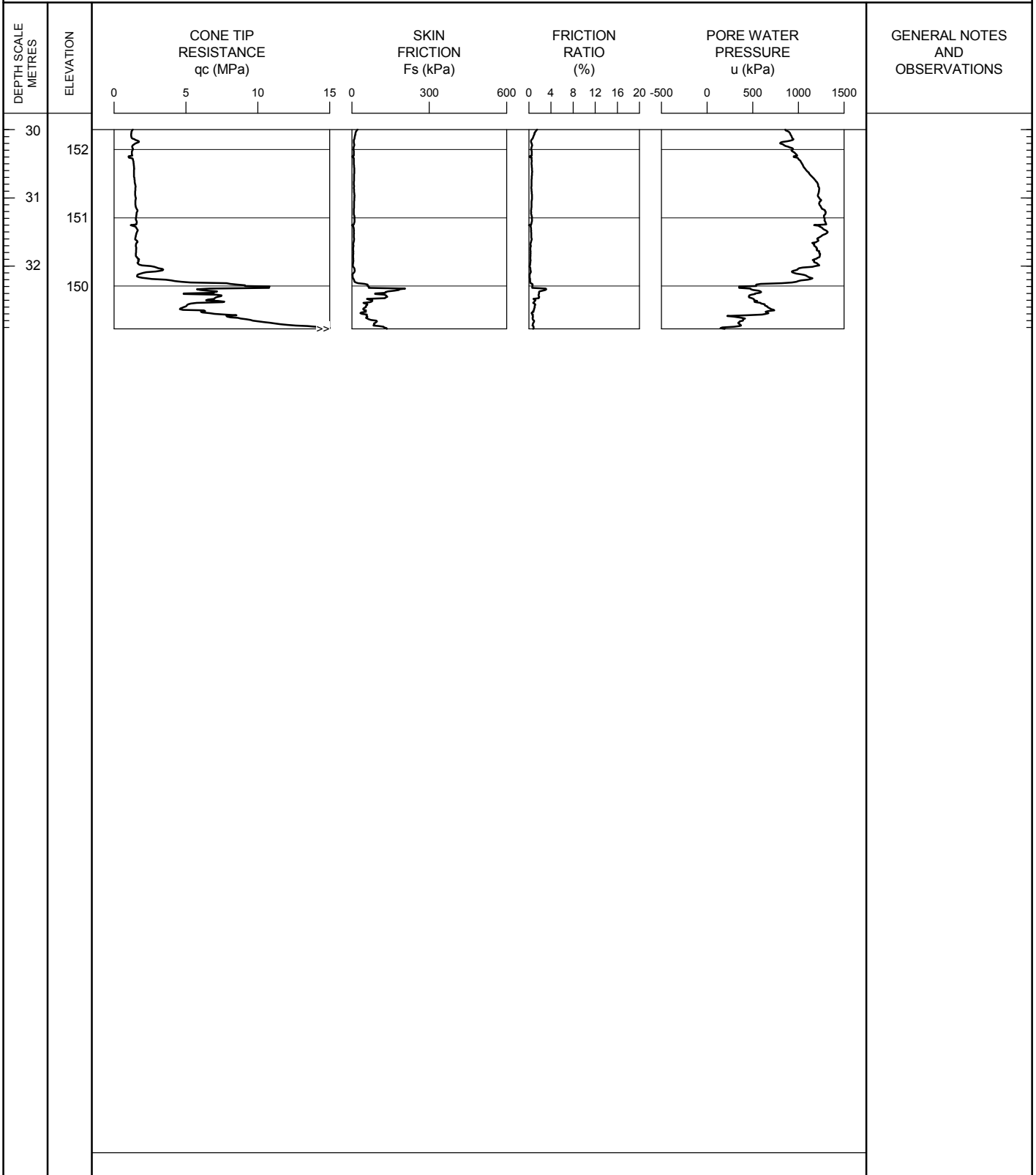
DATUM Geodetic

GROUND SURFACE ELEVATION: 182.3

PREDRILL DEPTH: 3

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

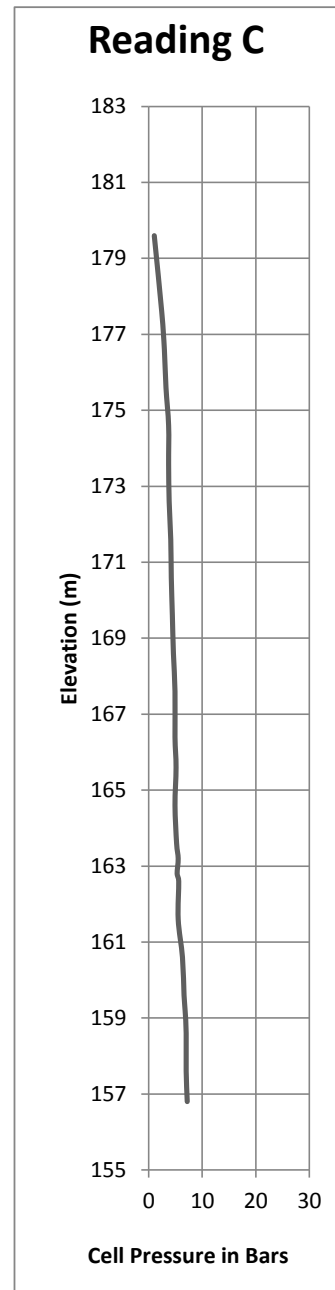
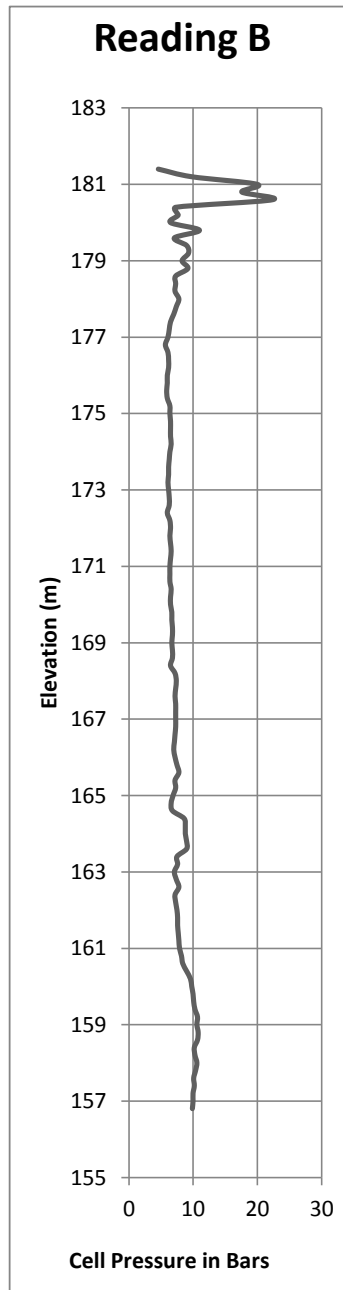
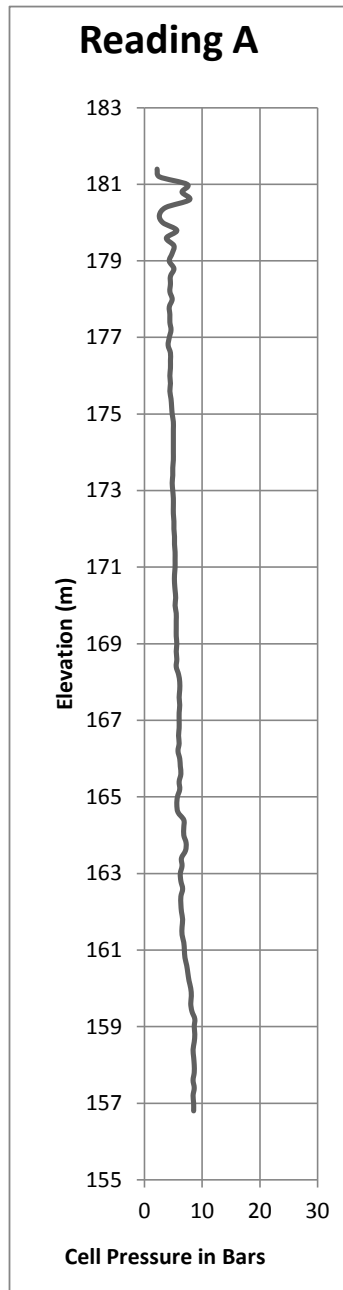
CHECKED: DD

RECORD OF DILATOMETER TEST DMT T3-1

Project : Windsor-Essex Parkway
Location: N 4680797.9; E 331570.0
Ground Surface Elevation : 182.6

Test Date: 7/12/2011
Predrill Depth : 1.2 m
Delta A: 0.19 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.22 Bar



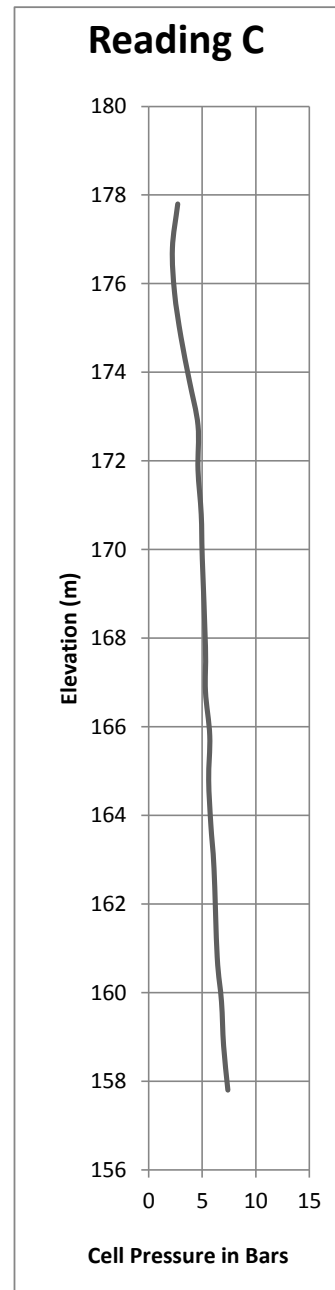
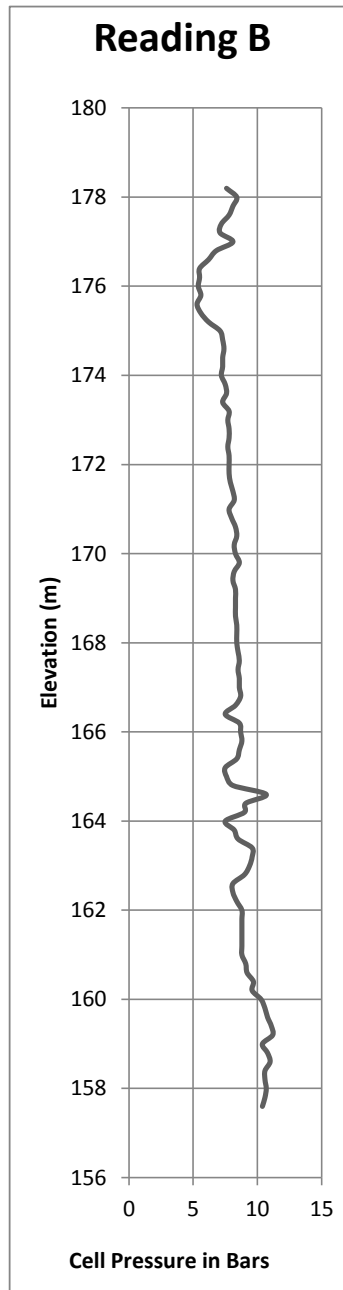
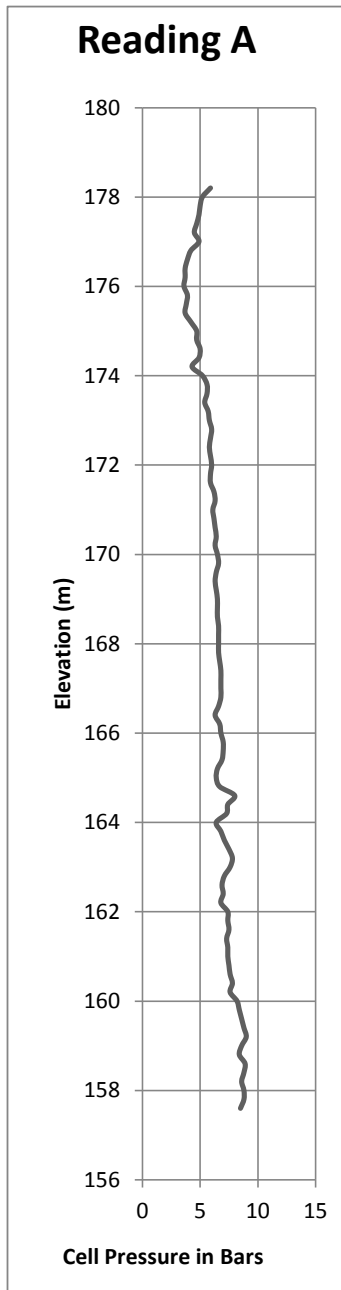
Operator: LC
Checked: DD

RECORD OF DILATOMETER TEST DMT04-RW

Project : Windsor-Essex Parkway
Location: N 4680966.5; E 331544.6
Ground Surface Elevation : 181.8

Test Date: 7/12/2011
Predrill Depth : 3.5 m
Delta A: 0.19 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.23 Bar





Operator: LC
Checked: DD

RECORD OF BOREHOLE No TB4-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679732.3, E332128.6 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 12 Jul 11 - 12 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
								○ UNCONFINED	+ FIELD VANE										
								● POCKET PEN.	× LAB VANE										
180.7	Ground Surface																		
0.0	TOPSOIL																		
180.3																			
0.4	CLAYEY SILT Some sand, trace gravel Firm to very stiff Mottled brown and grey		1	SS	10														
	-Some fissures, occasional silt seams Brown		2	SS	17														
	-Some sand pockets		3	SS	26														
	Grey		4	SS	15														
			5	SS	9														
			6	SS	7														
			7	SS	5														
			8	SS	5														
					VT														
			9	SS	3														
					VT														
			10	SS	1														
					VT														
170.6	END OF BOREHOLE																		
10.1	Borehole dry on completion																		

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No BH12-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679718.1, E332037.9 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE Truck Mounted Drill - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 16 Jul 11 - 16 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED	+ FIELD VANE							
								● POCKET PEN.	× LAB VANE							
181.2	Fill Surface															
0.0																
0.2	<div><div></div><div>FILL Topsoil Black FILL Silty clay, some topsoil, brown-black to grey</div></div>		1	SS	12											
			2	SS	10											
			3	SS	4											
178.3			4	SS	16											
2.9	CLAYEY SILT Some sand, trace gravel Firm to very stiff Brown to grey		5	SS	15											
			6	SS	8											
			7	SS	6											
			8	SS	6											
174.6	END OF BOREHOLE (no refusal) Borehole dry on completion															
6.6																
							174									
							173									
							172									
							171									
							170									
							169									
							168									
							167									

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

RECORD OF BOREHOLE No NIL12-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679767.0, E332011.4 ORIGINATED BY TR
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 24 Aug 11 - 24 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p W W _L							
								20 40 60 80 100	20 40 60 80 100			10 20 30					
181.2	Ground Surface						181										
0.0	TOPSOIL Sandy Black																
180.4																	
0.8	SILTY SAND Trace rootlets Brown		1	SS	4		180										
0.9	CLAYEY SILT Some sand, trace gravel, trace rootlets Mottled brown and grey		2	SS	14												
	Brown		3	SS	18		179										
			4	SS	17		178										
			5	SS	9		177										
176.9	END OF SAMPLED BOREHOLE Continued with Nilcon Vane from 5.0 m to refusal																
4.3	Borehole dry on completion						176										
							175										
							174										
							173										
							172										
							171										
							170										
							169										
							168										
							167										

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

RECORD OF BOREHOLE No T6-1/HG-MW-07

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679627.0, E332067.4 ORIGINATED BY DG
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 14 Jul 11 - 15 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
								○ UNCONFINED	+	FIELD VANE									
								● POCKET PEN.	×	LAB VANE									
180.9	Ground Surface						20	40	60	80	100								
0.0	FILL Sand and gravel, some silty clay clumps Brown		1	SS	10										-Vibrating Wire Piezometers (VWP) installed in sampled borehole -Observation Well installed in adjacent boring at (coordinates) -Spider magnets (MG) installed in adjacent boring at (coordinates)				
			2	SS	6														
			3	SS	2														
177.9																			
3.0	CLAYEY SILT Trace sand, trace fine-medium gravel Very stiff to very soft trace pink nodules Grey		4	SS	18										20.2				
			5	SS	7														
			6	SS	6														
			7	SS	6														
			8	TW	PH			×							19.8				
				VT					2.1										
			9	SS	4														
			10	TW	PH			×											
				VT					1.4						-switched to wash boring at 9.6m below ground surface (EL. 171.3m) -MG T6-1-SM11 installed at 11.28m below ground surface (El. 169.6 m) -VWP T6-1-P11 installed at 11.43m (El. 169.5 m)				
			11	TW	PH														
			12	TW	PH														
				VT					2										
			13	TW	PH			×							19.6				

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

2 OF 3

METRIC

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

3 OF 3

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE						
149.2 31.7	CLAYEY SILT Trace sand, trace fine-medium gravel Very stiff to very soft trace pink nodules Grey (continued)		24	SS	27		150								
147.2 33.7	COBBLES AND BOULDERS Weathered Limestone (inferred from rock fragments retrieved by split spoon)		25	SS	50/ 100mm		149							-installed VWP T6-1-P32 at 32m (El. El. 148.9 m)	
147.2 33.7	LIMESTONE Fine Grained, laminated Non-calcareous black colour inclusions, calcite mineralization is visible, stylolites present Fractured at location between 32.7m-32.9m and 35.3m-35.5m. Fractures are running parallel to the core length Brown		26	SS	50/ 150mm		147								
145.4 35.5	END OF BOREHOLE No groundwater observed during drilling due to wash boring Observation Well was dry on July 23, 2011 Water level measured in Observation Well at elevation 180.0m on July 29, 2011 Water level measured in Observation Well at elevation 180.2m on August 6, 2011 Water level measured in Observation Well at elevation 180.5m on August. 29, 2011 Water level measured in Piezometer VWP T6-1-P11 at elevation 182.2m on July 23, 2011 Water level measured in Piezometer VWP T6-1-P11 at elevation 182.0m on July 29, 2011 Water level measured in Piezometer VWP T6-1-P11 at elevation 181.6m on August 6, 2011 Water level measured in Piezometer VWP T6-1-P11 at elevation 181.1m on August 29, 2011 Water level measured in Piezometer VWP T6-1-P32 at elevation 178.8m on July 23, 2011 Water level measured in Piezometer VWP T6-1-P32 at elevation 178.7m on July 29, 2011 Water level measured in Piezometer VWP T6-1-P32 at elevation 178.7m on August 6, 2011 Water level measured in Piezometer VWP T6-1-P32 at elevation 178.8m on August 29, 2011						145								
							144								
							143								
							142								
							141								
							140								
							139								
							138								
							137								
							136								

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No T6-2

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679659.9, E332018.8 ORIGINATED BY DG
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 18 Jul 11 - 19 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _P W W _L				
180.8	Ground Surface							20 40 60 80 100						GR SA SI CL
0.0	152mm TOPSOIL							○ UNCONFINED + FIELD VANE						
0.2	CLAYEY SILT Trace sand, trace fine-medium gravel, trace pink nodules Soft to very stiff Mottled brown and grey							● POCKET PEN. × LAB VANE						
			1	SS	11		180							
			2	SS	15		179							
			3	SS	18		178							
			4	SS	13		177							
	Grey		5	SS	7		176							
			6	SS	6		175							
			7	SS	3		174							
			8	TW	PH		173		×					
				VT			172							
			9	TW	PH		171							
				VT			170							
			10	TW	PH		169							
				VT			168							
			11	TW	PH		167							
				VT			166							
169.3			12	TW	PH									
11.6	CLAYEY SILT Soft to firm Grey			VT										
			13	SS	0									
166.2														
14.6														

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No T6-2

2 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679659.9, E332018.8 ORIGINATED BY DG
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 18 Jul 11 - 19 Jul 11 CHECKED BY MSO

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

-VWP T6-2-P18
installed at 18.3m
below ground
surface (El. 162.6
m)

-sampler sank
0.45m under
weight of rods

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No T6-2

3 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679659.9, E332018.8 ORIGINATED BY DG
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 18 Jul 11 - 19 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE							
								● POCKET PEN.	× LAB VANE							
						20 40 60 80 100				10 20 30						
150.4																
30.5	SANDY SILT Trace fine-medium gravel, some clay Compact Grey Saturated		24	SS	20		150							end of drilling July 18; continued July 19		
							149									
148.3																
32.6	LIMESTONE Fine Grained, rubble, dense, grey -Rock/boulder fragments and pieces		25	RC			148									
147.4																
33.5	LIMESTONE Fine Grained, laminated, porous, stylolites, grey		26	RC			147							RQD = 87% TCR = 100% SCR = 90%		
146.1																
34.8	END OF BOREHOLE No groundwater observed during drilling due to wash boring Water level measured in Piezometer VWP T6-2-P11 at elevation 180.8m on July 23, 2011 Water level measured in Piezometer VWP T6-2-P11 at elevation 180.5m on August 6, 2011 Water level measured in Piezometer VWP T6-2-P11 at elevation 180.6m on August 29, 2011 Water level measured in Piezometer VWP T6-2-P18 at elevation 180.6 on July 23, 2011 Water level measured in Piezometer VWP T6-2-P18 at elevation 180.3m on August 6, 2011 Water level measured in Piezometer VWP T6-2-P18 at elevation 180.4 on August 29, 2011					146										
							145									
							144									
							143									
							142									
							141									
							140									
							139									
							138									
							137									
							136									

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

RECORD OF BOREHOLE No T6-3

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679577.5, E332079.1 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 14 Jul 11 - 19 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				
181.6	Ground Surface							20	40	60	80	100					GR	SA	SI	CL
0.0	FILL Topsoil/sand/silt mixture, trace gravel and bricks, brown to black						181										Nilcon vane advnced o adjacent o sampled borehole from 5 m to 27 m depth (El. 176.6 m to El. 154.6 m)			
180.4			1	SS	7															
180.1	CONCRETE						180													
1.5	FINE SAND Trace gravel Brown		2	SS	6															
1.7	CLAYEY SILT Some sand, trace gravel Soft to stiff Mottled brown and grey Trace pink nodules and moist to wet below approx. 4 m Brown						179													
			3	SS	16															
			4	SS	18		178													
	Grey		5	SS	12		177													
			6	SS	8		176													
			7	SS	5		175													
			8	TW	PH		174													
				VT																
			9	TW	PH		173													
	-Sandy pocket						172													
			10	SS	3		171													
				VT			170													
			11	TW	PH		169													
							168													
			12	TW	PH		167													
				VT																
			13	TW	PH															
168.6	CLAYEY SILT Soft Trace black and pink inclusions, varved Grey																			
13.0																				

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

METRIC[illegible]

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

METRIC

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No DMT T6-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679696.6, E332057.3 ORIGINATED BY LC
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 14 Jul 11 - 14 Jul 11 CHECKED BY MSO

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)											
						○ UNCONFINED			○ POCKET PEN.	+ FIELD VANE	× LAB VANE											
181.2	Ground Surface																					
0.0	FILL Silty clay and topsoil Some sand, trace gravel																					
180.2			1A, B	SS	11																	
1.4	ORGANIC CLAY Black																					
1.2	SILTY CLAY Some sand, trace gravel Trace organic inclusion, weathered Mottled brown and grey		2	SS	8																	
179.2	END OF SAMPLED BOREHOLE Continued with DMT from 2.4 m to refusal at 23.4 m (El. 178.8 m to El. 157.8 m)																					
2.0	Borehole dry on completion																					
										</												

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

1 OF 1

METRIC




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

RECORD OF BOREHOLE No CPT36-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679710.0, E331968.8 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 15 Aug 11 - 15 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)			
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE												
180.5	Ground Surface							20	40	60	80	100								
0.0	TOPSOIL																			
180.1																				
0.4	SILTY SAND Brown																			
179.4			1A, B	SS	6		180													
1.1	SILTY CLAY Some sand, trace gravel, trace fissures Mottled brown and grey Brown						179													
178.4			2	SS	16															
2.1	END OF SAMPLED BOREHOLE Continued with CPT to refusal Borehole dry on completion																			
							178													
							177													
							176													
							175													
							174													
							173													
							172													
							171													
							170													
							169													
							168													
							167													
							166													

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No CPT37-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679571.4, E332146.2 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 15 Jul 11 - 15 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								○ UNCONFINED	+ FIELD VANE										
								● POCKET PEN.	× LAB VANE										
180.9	Ground Surface																		
0.0	FILL Crushed Limestone Grey																		
180.4	TOPSOIL SILTY CLAY Some sand, trace gravel Mottled brown and grey		1	SS	6														
0.5																			
0.6			2	SS	9														
			3	SS	14														
			4	SS	13														
177.4	END OF SAMPLED BOREHOLE Continued with CPT from 3.3 m to refusal																		
3.5	Borehole dry on completion																		
							177												
							176												
							175												
							174												
							173												
							172												
							171												
							170												
							169												
							168												
							167												
							166												

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

RECORD OF NILCON VANE TEST NIL 12-RW

Project : Windsor-Essex Parkway

Test Date: 8/24/2011

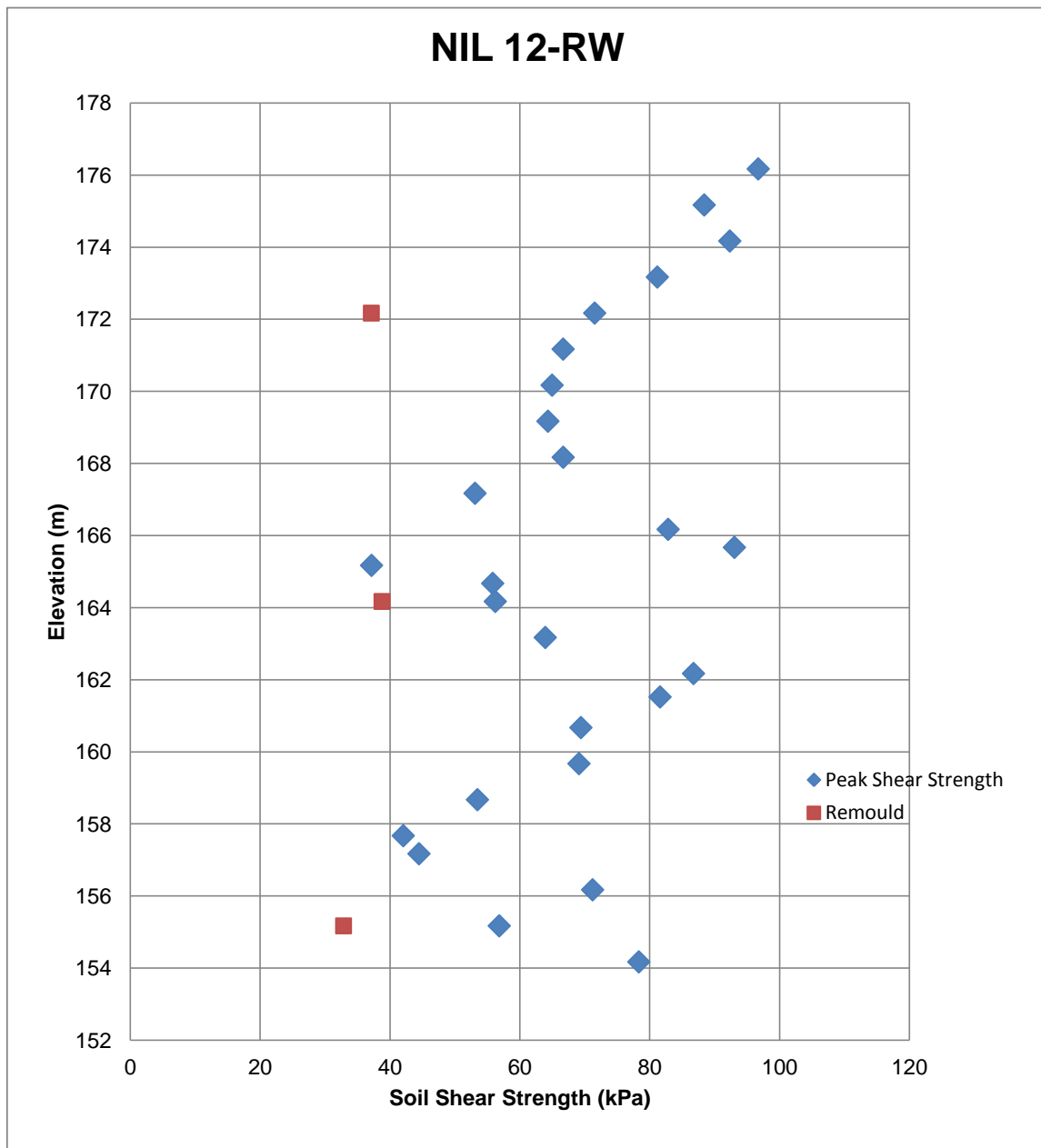
Sheet 1 of 1

Location: N4679767.0; E332011.4

Predrill Depth : 4.3 m

Datum Geodetic

Ground Surface Elevation: 181.2 m



Operator: TR

Checked: DD

RECORD OF NILCON VANE TEST NIL T6-2

Project : Windsor-Essex Parkway

Test Date: 8/12/2011

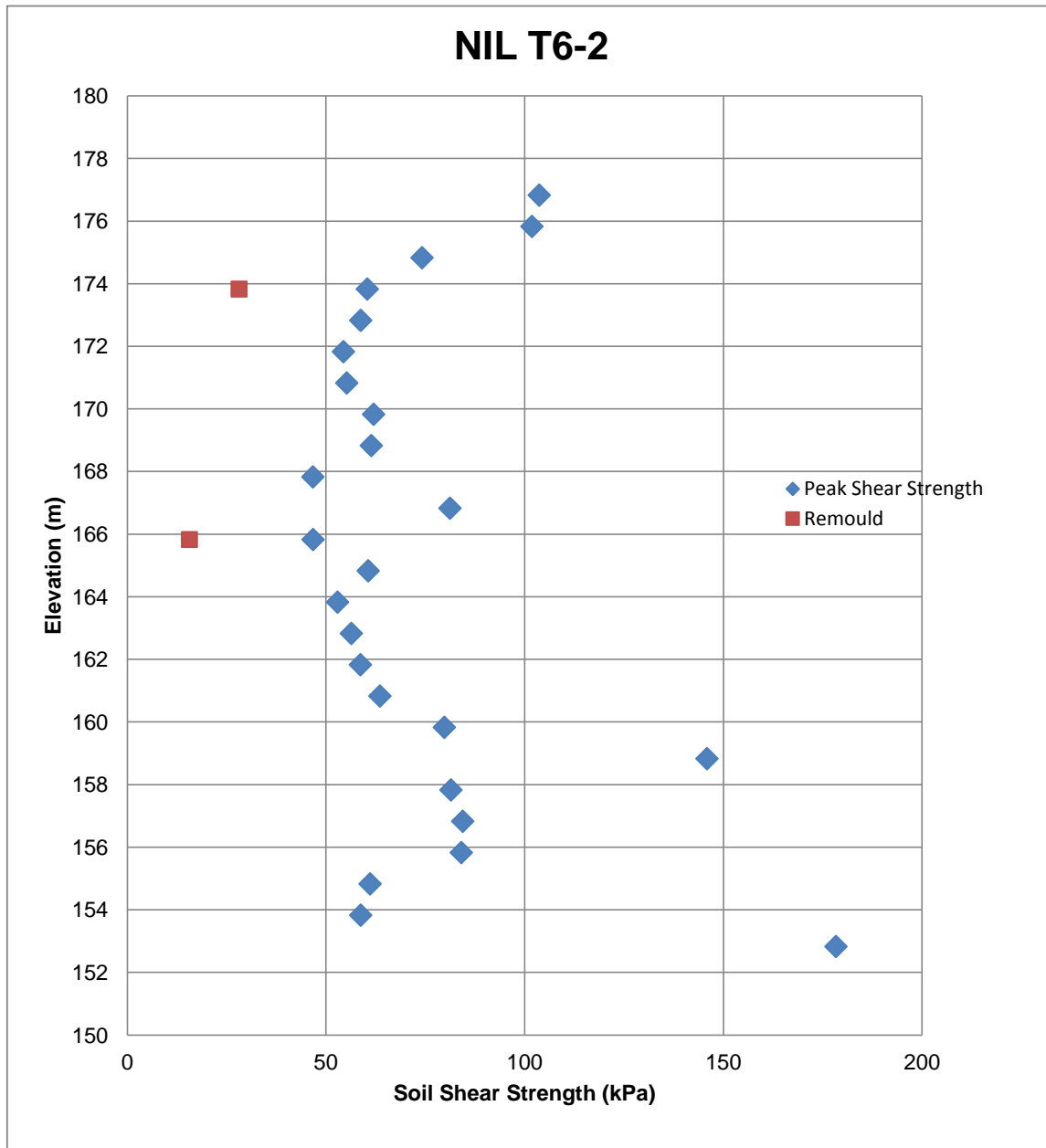
Sheet 1 of 1

Location: N4679661.8; E332020.5

Predrill Depth : 3.0 m

Datum Geodetic

Ground Surface Elevation: 180.8 m



Operator: SD

Checked: DD

RECORD OF NILCON VANE TEST NIL T6-3

Project : Windsor-Essex Parkway

Test Date: 8/13/2011

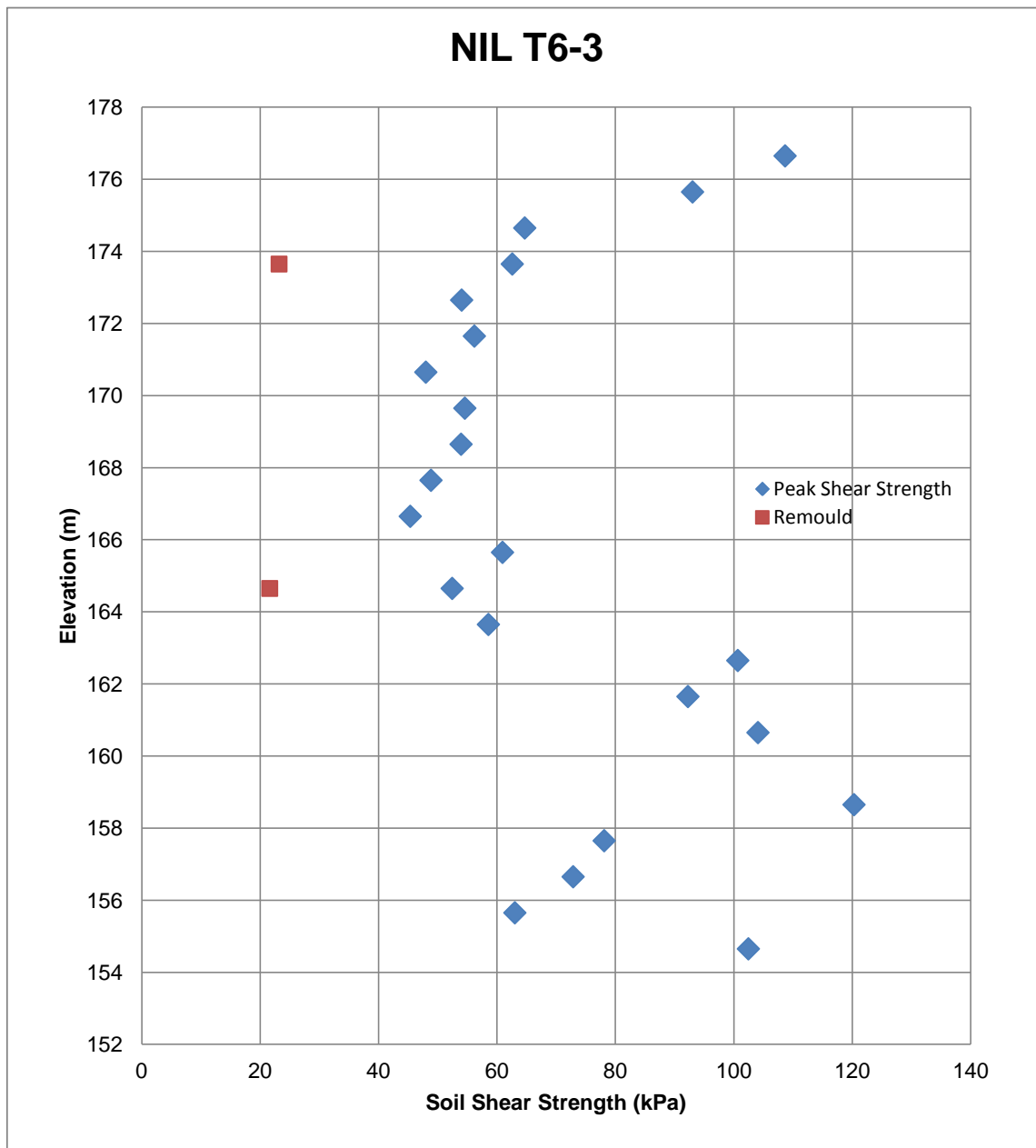
Sheet 1 of 1

Location: N4679574.1; E332073.1

Predrill Depth : 4.6 m

Datum Geodetic

Ground Surface Elevation: 181.7 m



Operator: SD

Checked: DD

RECORD OF CONE PENETRATION TEST CPT 35-RW

METRIC

PROJECT Windsor-Essex Parkway

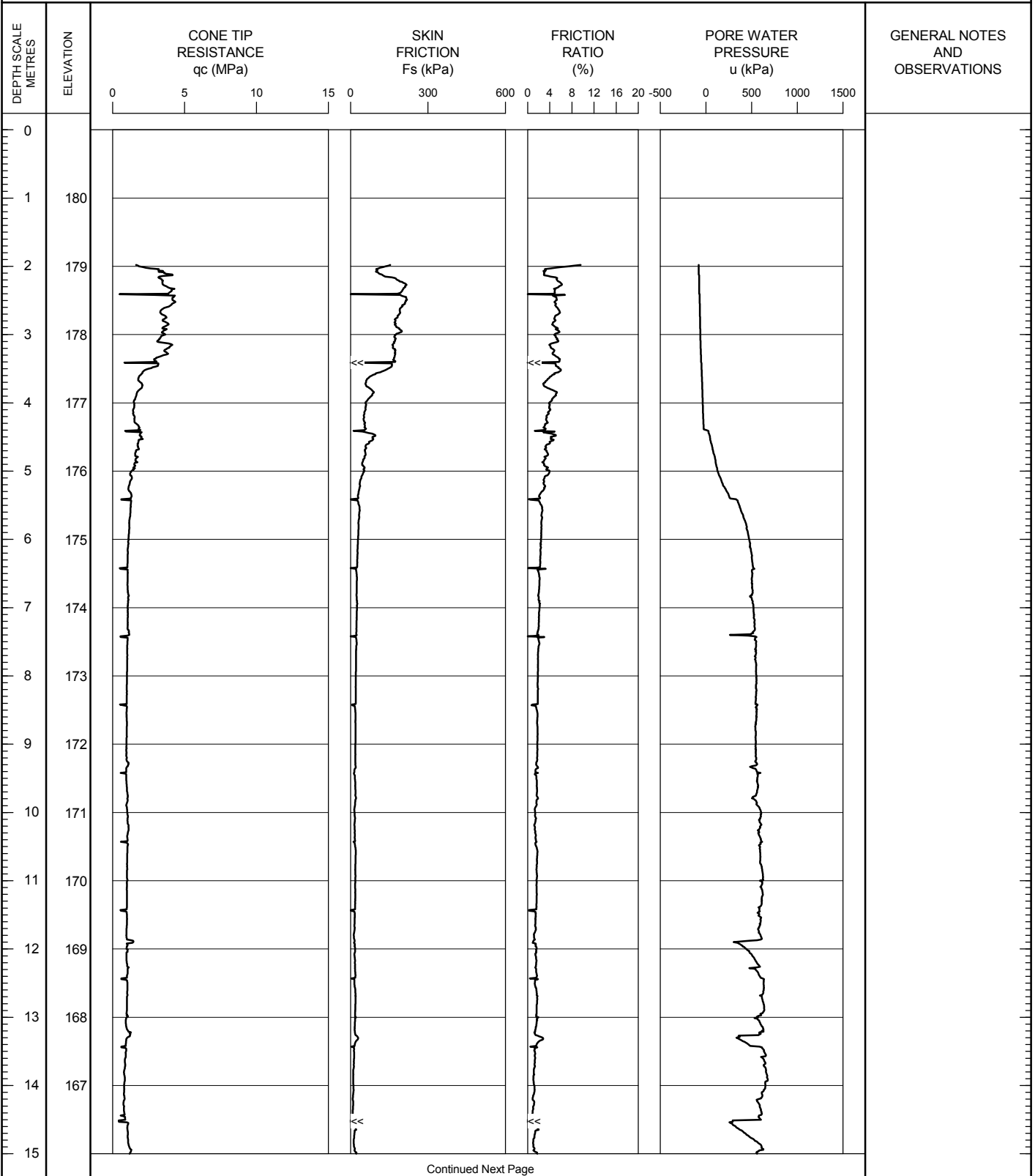
TEST DATE 8/24/2011 - 8/24/2011

SHEET 1 OF 3

LOCATION N4679825.8; E331995.8

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.0 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 35-RW

METRIC

PROJECT Windsor-Essex Parkway

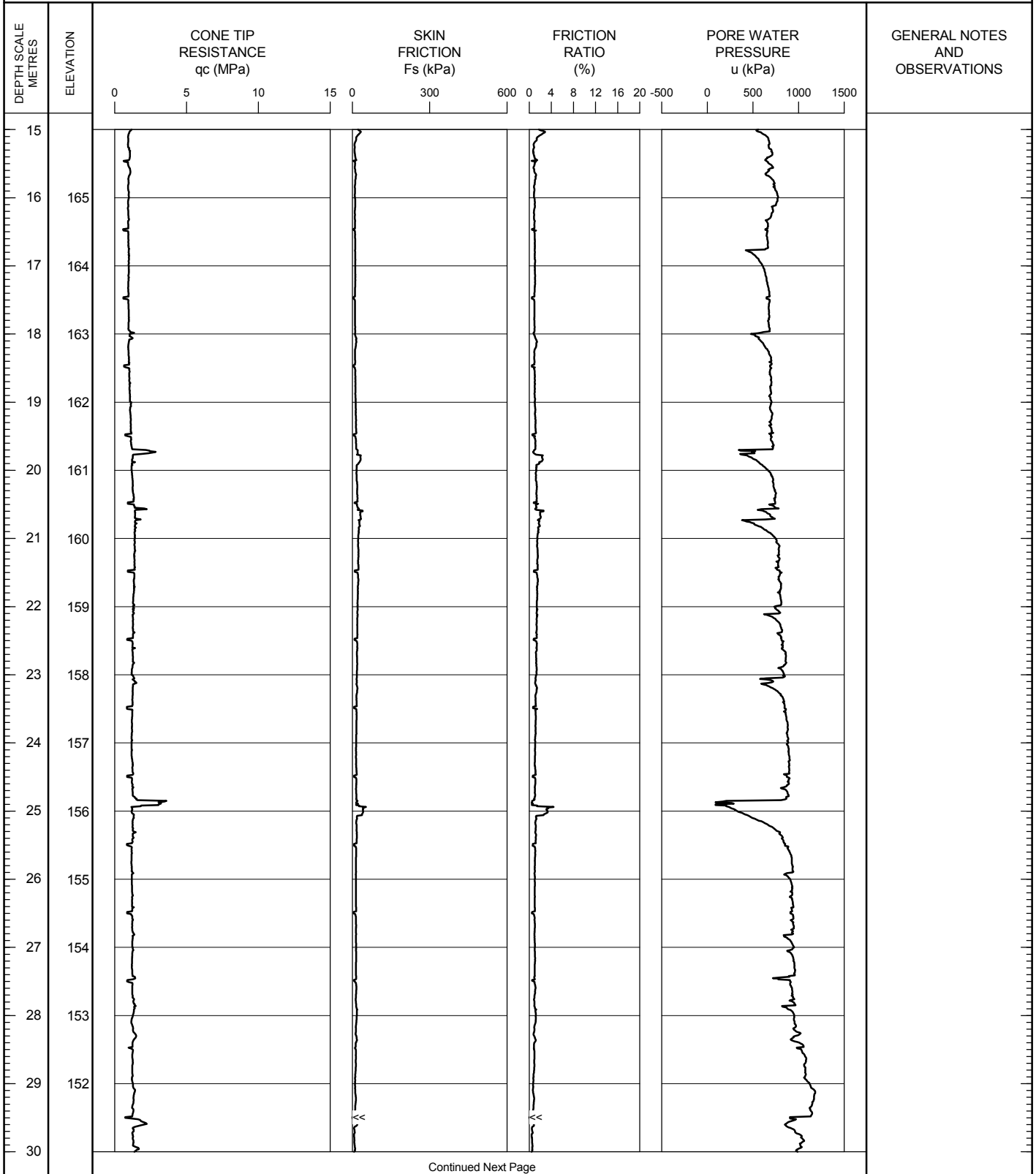
TEST DATE 8/24/2011 - 8/24/2011

SHEET 2 OF 3

LOCATION N4679825.8; E331995.8

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.0 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 35-RW

METRIC

PROJECT Windsor-Essex Parkway

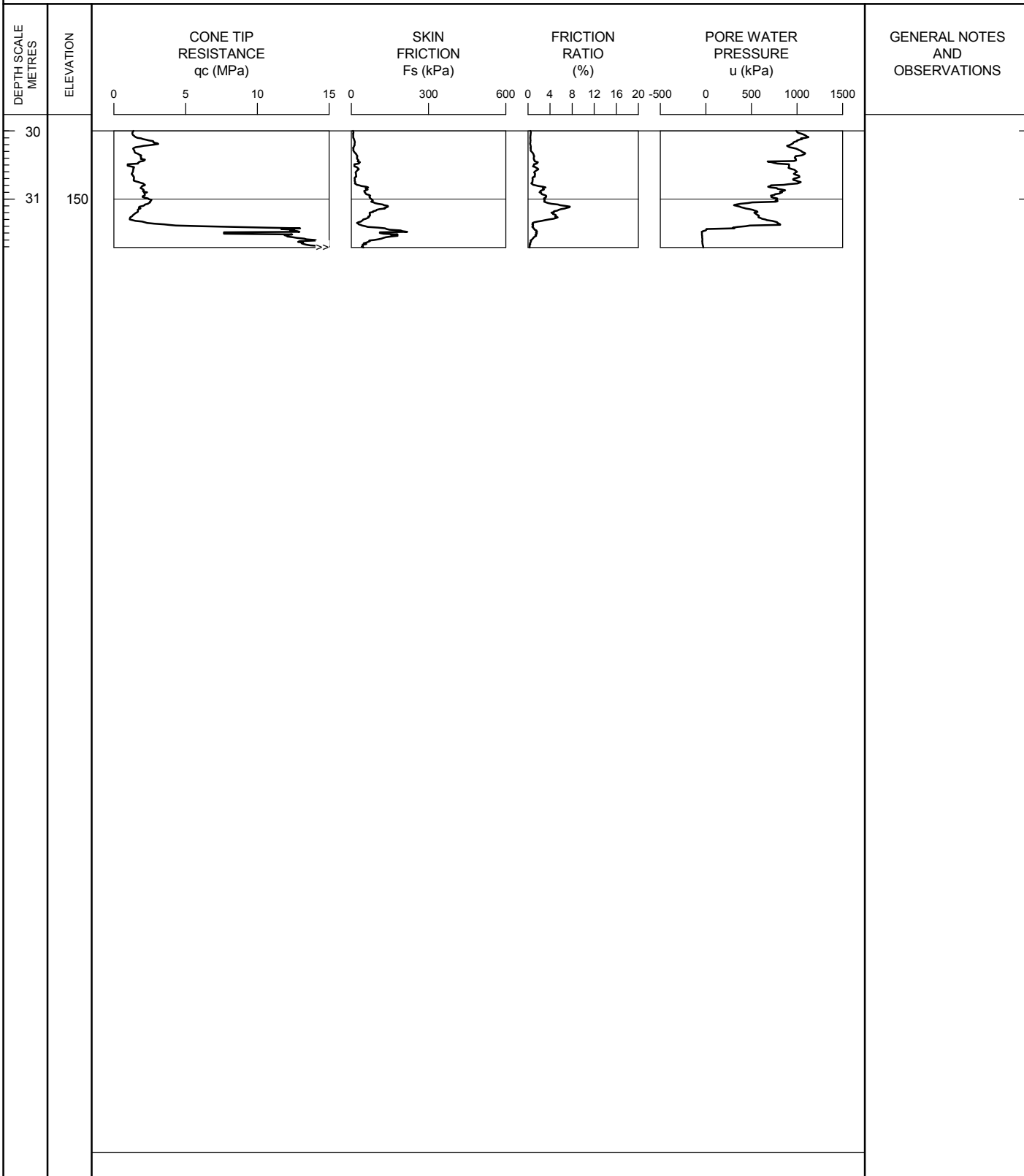
TEST DATE 8/24/2011 - 8/24/2011

SHEET 3 OF 3

LOCATION N4679825.8; E331995.8

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.0 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 36-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/15/2011 - 8/15/2011

SHEET 1 OF 3

LOCATION N4679710.0; E331968.8

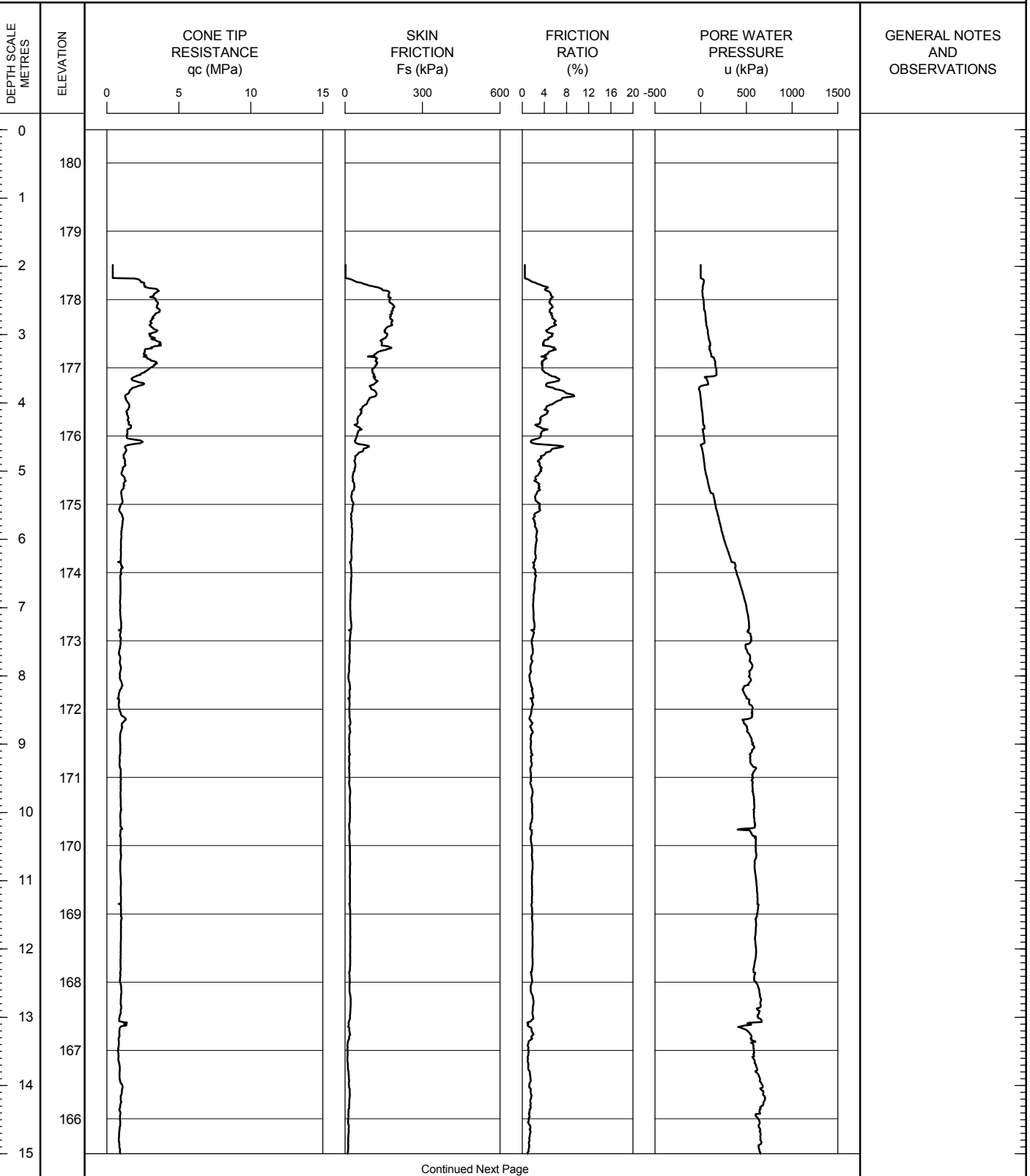
DATUM Geodetic

GROUND SURFACE ELEVATION: 180.5

PREDRILL DEPTH: 2.17

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 36-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/15/2011 - 8/15/2011

SHEET 2 OF 3

LOCATION N4679710.0; E331968.8

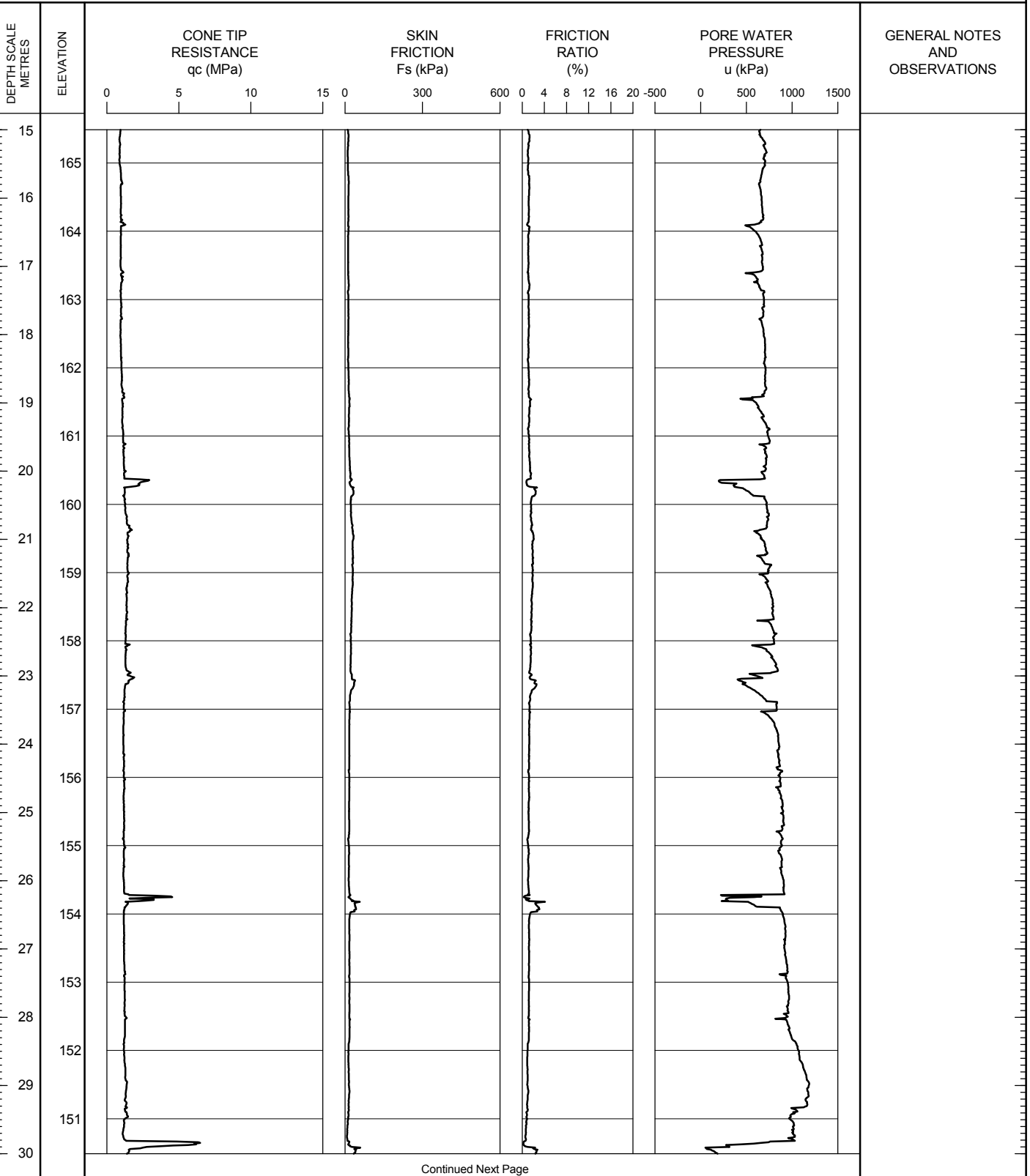
DATUM Geodetic

GROUND SURFACE ELEVATION: 180.5

PREDRILL DEPTH: 2.17

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 36-RW

METRIC

PROJECT Windsor-Essex Parkway

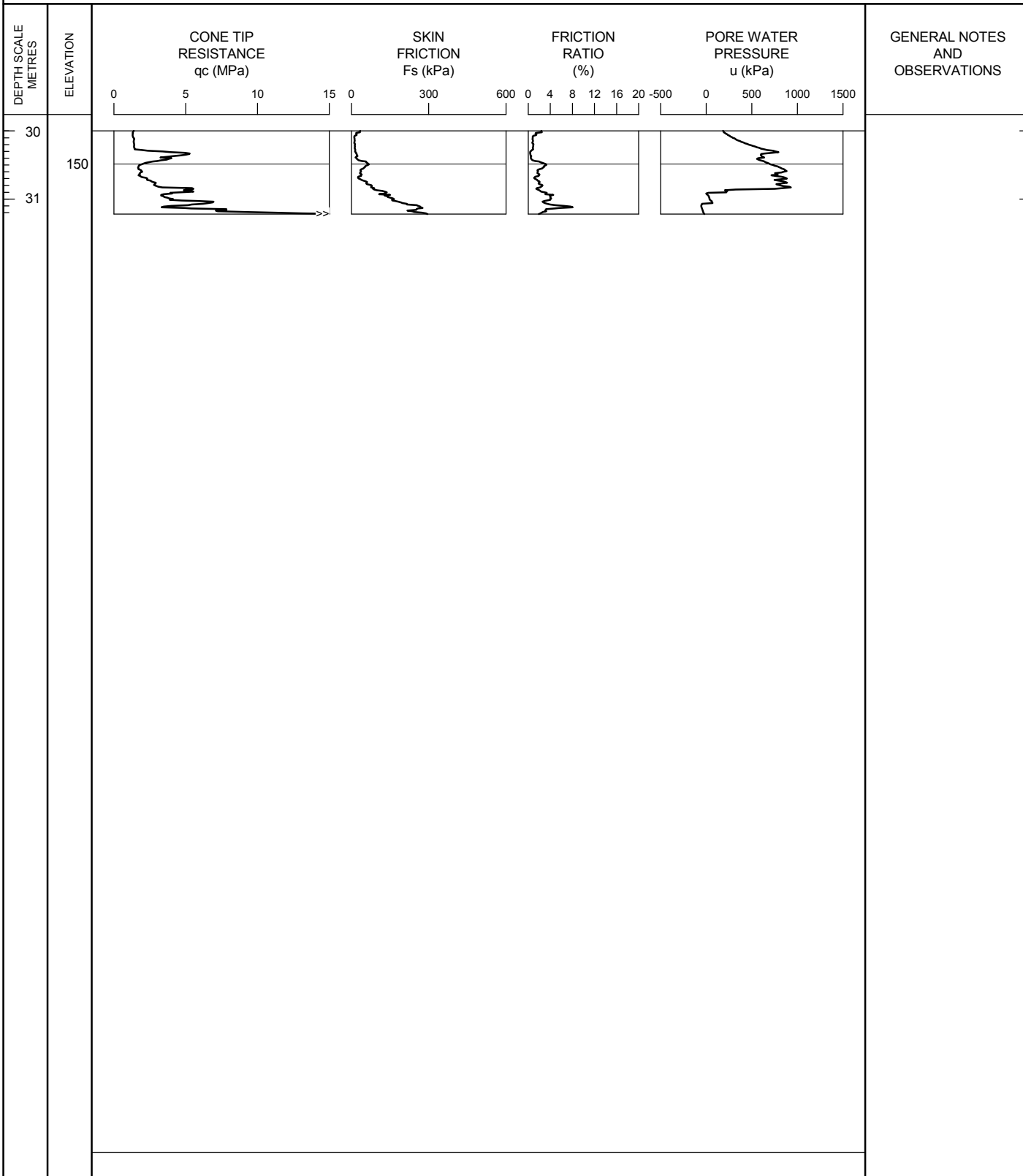
TEST DATE 8/15/2011 - 8/15/2011

SHEET 3 OF 3

LOCATION N4679710.0; E331968.8

DATUM Geodetic

GROUND SURFACE ELEVATION: 180.5 PREDRILL DEPTH: 2.17 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



WEP CPT LOG CPT-RW.GPJ ONTARIO MOT.GDT 06/01/12

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 37-RW

METRIC

PROJECT Windsor-Essex Parkway

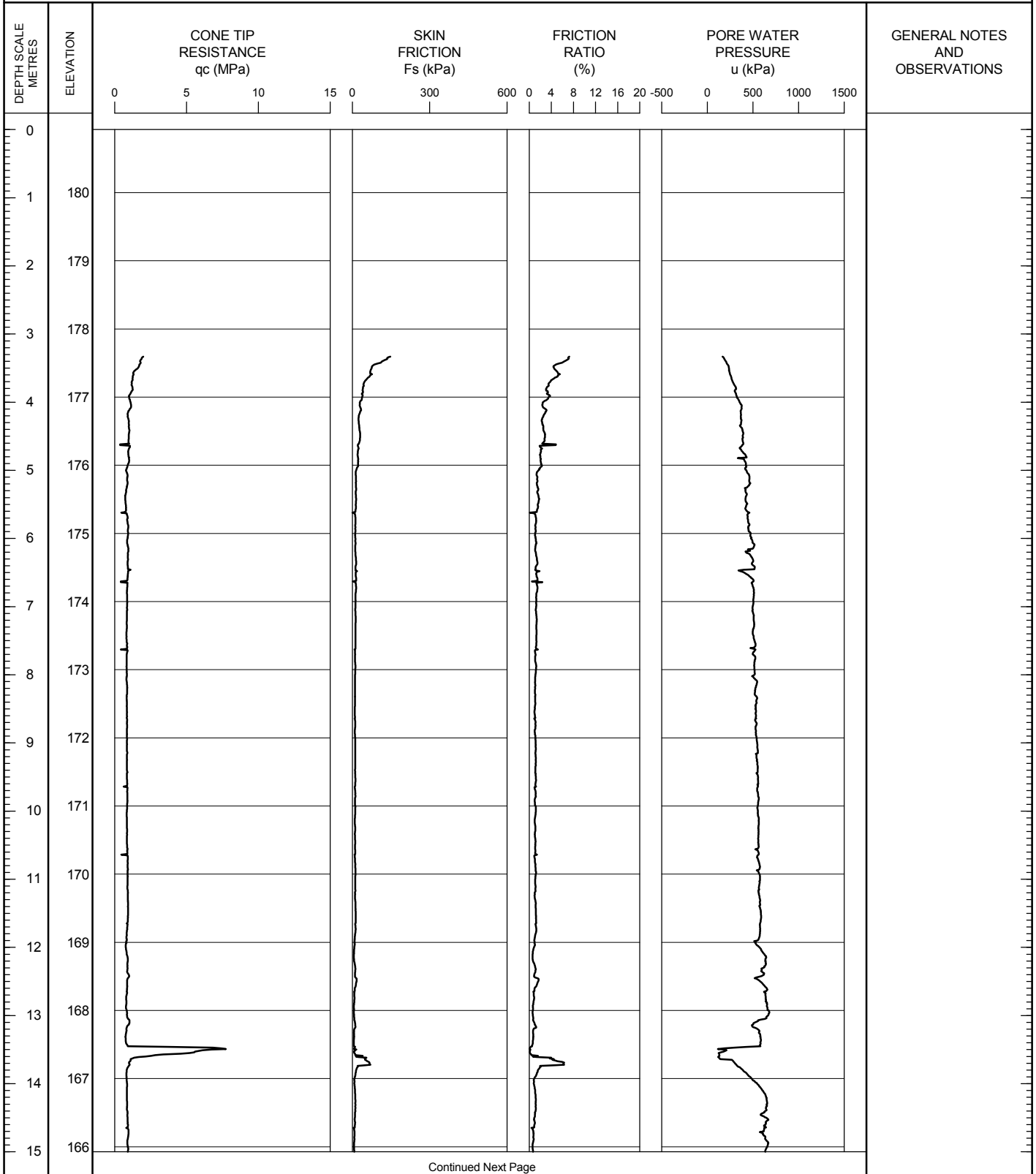
TEST DATE 7/27/2011 - 7/27/2011

SHEET 1 OF 2

LOCATION N4679571.4; E332146.2

DATUM Geodetic

GROUND SURFACE ELEVATION: 180.9 PREDRILL DEPTH: 2.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 37-RW

METRIC

PROJECT Windsor-Essex Parkway

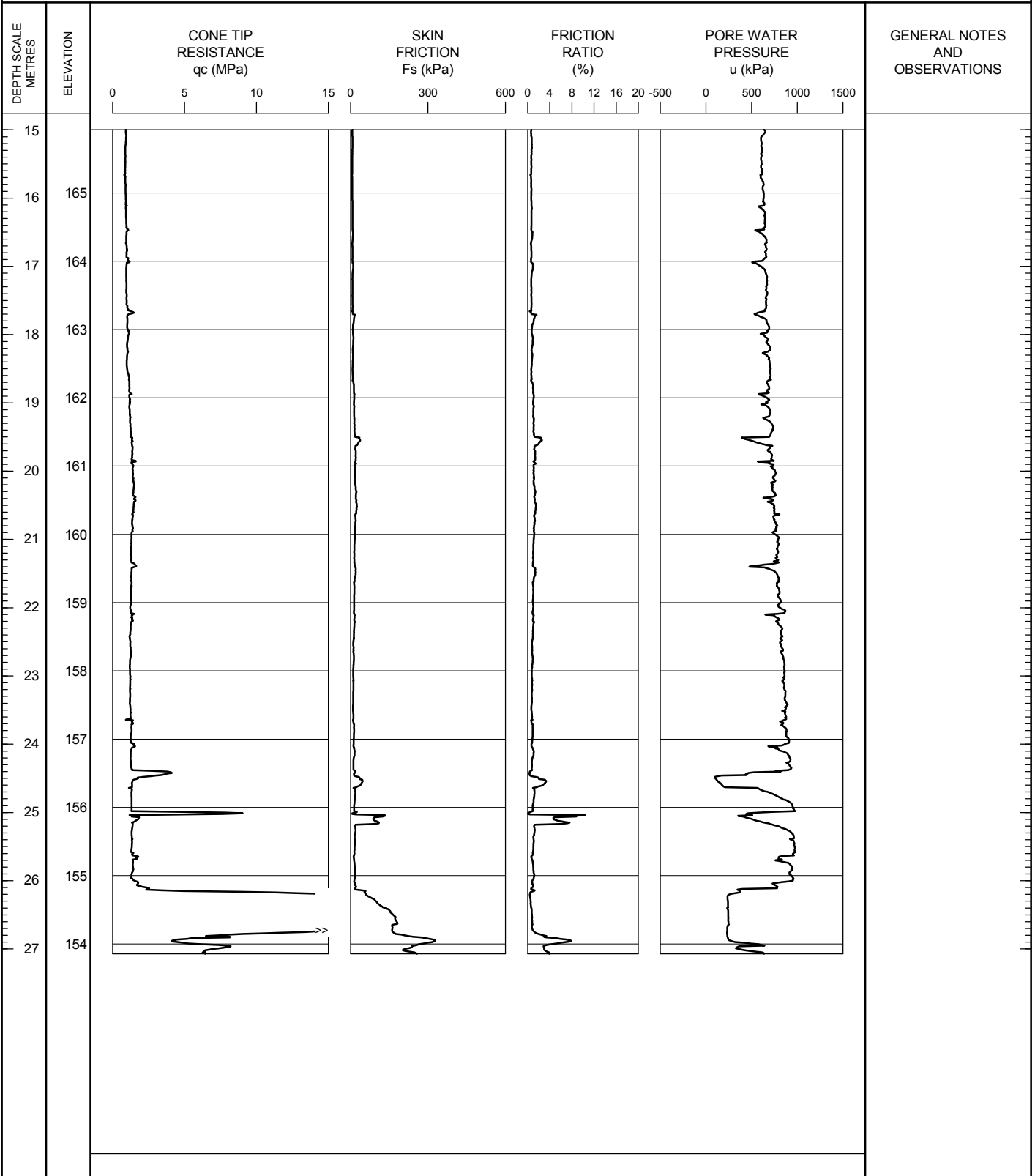
TEST DATE 7/27/2011 - 7/27/2011

SHEET 2 OF 2

LOCATION N4679571.4; E332146.2

DATUM Geodetic

GROUND SURFACE ELEVATION: 180.9 PREDRILL DEPTH: 2.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



WEP CPT LOG CPT-RW.GPJ ONTARIO MOT.GDT 06/01/12

OPERATOR: TA

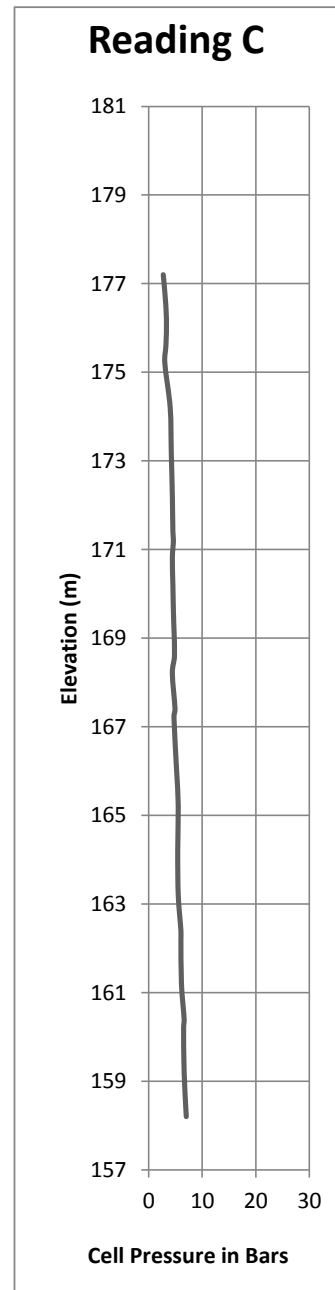
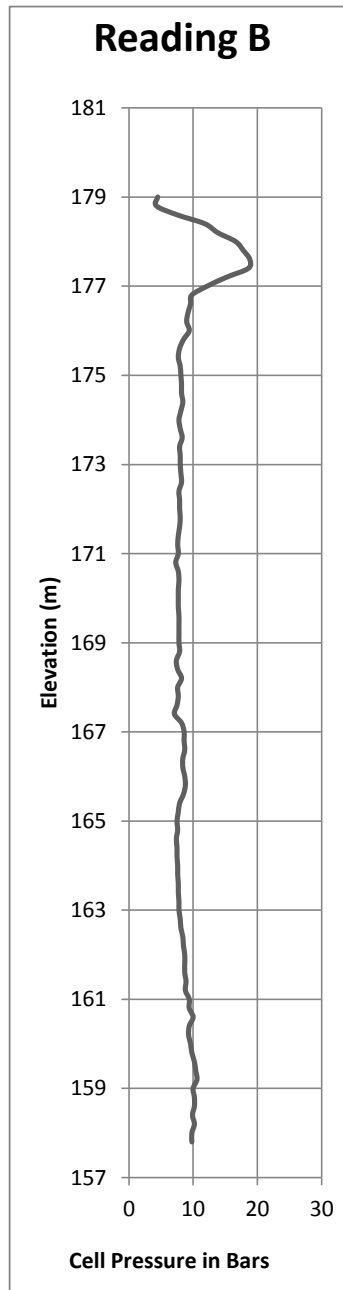
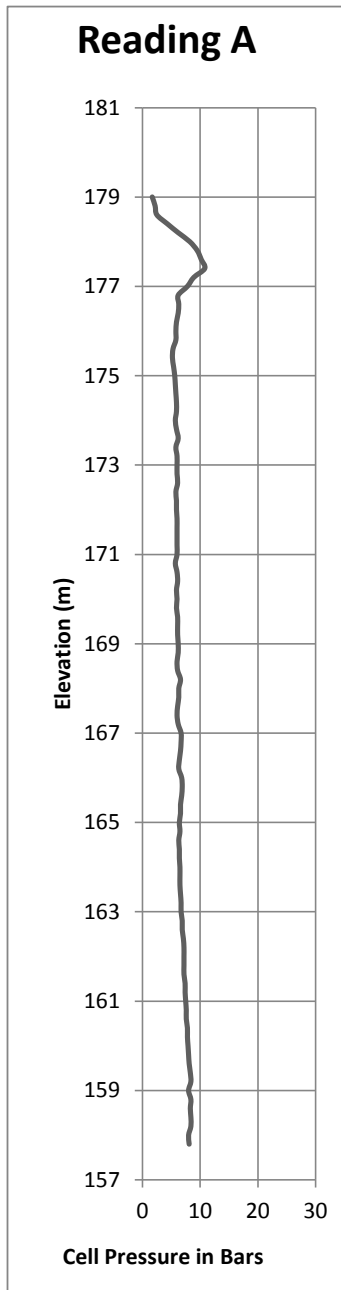
CHECKED: DD

RECORD OF DILATOMETER TEST DMT T6-1

Project : Windsor-Essex Parkway
Location: N 4679696.6; E 332057.3
Ground Surface Elevation : 181.2

Test Date: 7/14/2011
Predrill Depth : 2.0 m
Delta A: 0.18 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.22 Bar



Operator: LC
Checked: DD

RECORD OF BOREHOLE No TB5-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679286.0, E332362.0 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 6 Jul 11 - 6 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.						× LAB VANE		
181.0	Ground Surface						20	40	60	80	100							
180.9	ASPHALT																	
180.7	FILL																	
180.3	Crushed Limestone Grey																	
180.2	FILL																	
179.9	Silty clay some sand, trace gravel Trace topsoil Greenish-brown		1A, B	SS	8													
179.8	TOPSOIL																	
179.1	CLAYEY SILT Some sand, trace gravel Firm to stiff Mottled brown and grey trace to some pink nodules		2	SS	8													
			3	SS	10													
	Brown		4	SS	18													
	Grey		5	SS	14													
			6	SS	10													
			7	SS	7													
			8	SS	5													
			VT															
			9	SS	4													
			VT															
			10	SS	5													
			VT															
170.9	END OF BOREHOLE																	
10.1	Borehole dry on completion																	

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

METRIC

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No TB5-3

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679239.6, E332429.4 ORIGINATED BY LC
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 10 Jul 11 - 10 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED	+	FIELD VANE									
								● POCKET PEN.	×	LAB VANE									
181.3	Ground Surface						20	40	60	80	100								
0.0	TOPSOIL																		
180.9	Sandy Black		A	AS															
0.4	FINE SAND																		
	Trace to some silt		1	SS	5														
	Brown-yellow																		
179.8																			
1.5	CLAYEY SILT		2	SS	17														
	Some sand, trace gravel, fissured																		
	Firm to very stiff																		
	Brown to grey																		
	Trace pink nodules below approx.																		
	5.5 m (El. 175.8 m)		3	SS	18														
	Fissured																		
	Hairline sand/silt lenses																		
			4	SS	19														
	Vertical fissures		5	SS	11														
			6	SS	7														
			7	SS	6														
			8	SS	6														
				VT															
			9	SS	5														
			10	SS	4														

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No TB5-4

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679221.9, E332459.0 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 10 Jul 11 - 10 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.	× LAB VANE					
181.7	Ground Surface						20	40	60	80	100	10	20	30		
0.0	TOPSOIL															
181.4	some sand															
0.3	Black															
181.1	SAND															
0.6	Some silt															
	Brown		1	SS	6								○			
	CLAYEY SILT															
	Some sand, trace gravel												○			
	Firm to very stiff		2	SS	15											
	Mottled brown and grey												○			
	Brown															
	-Fissured with sandy silt hairline lenses		3	SS	19								○			
	Grey		4	SS	15								○			
	-Fissured															
			5	SS	15								○			
			6	SS	9								○			
			7	SS	7									○		
			8	SS	5								○			
				VT												
			9	SS	5									○		
			10	SS	4									○		
				VT												
171.6	END OF BOREHOLE															
10.1	Borehole dry on completion															

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No T7-1

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION 4679413.6N, 332295.2E ORIGINATED BY DG
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 7 Jul 11 - 7 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
181.5	Ground Surface													
0.0	50mm ASPHALT													
0.2	Over 200mm Crushed Limestone Sand and Gravel fill													
	FILL Silty Clay and Topsoil Green and black		1	SS	3									
180.0														
1.5	SAND Poorly Graded (Fine) Trace organics, saturated Green grey to brown		2	SS	3									
179.4														
2.1	CLAYEY SILT Some sand, trace gravel Very soft to very stiff Grey -Trace medium-coarse gravel Trace fine-medium gravel, pink clay nodules		3	SS	10									
			4	SS	15									
			5	SS	16									
	-Trace fissures		6	SS	14									
	-Trace pink clay nodules		7	SS	6									
	Fine sand nodules Trace fine gravel, pink clay nodules		8	TW	PH								20.6	2 17 49 32
			9	TW	PH									
			10	TW	PH									
			VT											
	-Trace fine-coarse gravel		11	TW	PH								4 22 38 36	
			12	TW	PH									
			VT											
	-Trace fine-medium gravel		13	SS	2								20.6	3 22 40 35

Continued Next Page

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 25/04/13

METRIC

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 25/04/13

RECORD OF BOREHOLE No T7-1

3 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION 4679413.6N, 332295.2E ORIGINATED BY DG
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 7 Jul 11 - 7 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE									
151.3								20	40	60	80	100						
30.2	SAND And weathered LIMESTONE Cobbles and boulders (inferred) Very dense		24	SS	50/ 115mm												-no recovery, spoon bouncing continued to drill to 32m	
			25	SS	50/ 150mm													
148.9																		
32.6	LIMESTONE Medium to coarse grained Porous, vuggy, fractured at location between 33.07m and 33.22m Clacite crystallization is visible Brown		26	RC													RQD = 100%	
146.7																		
34.8	LIMESTONE Laminated, medium to fine grained, porous Pitted at location between 34.78m and 35.14m Brown to Grey		27	RC														
146.4																		
35.1																		
35.5	LIMESTONE Fine Grained Vuggy, calcite crystals visible Grey																	
35.7	LIMESTONE Fine Grained Laminated, porous and dense Grey																	
	END OF BOREHOLE No groundwater observed prior to starting wash boring below approx. 9.6 m on July 7, 2011 Water Level measured in Piezometer VWP T7-1-P9 at elevation 180.4m on July 24, 2011 Water Level measured in Piezometer VWP T7-1-P9 at elevation 180.5m on August 6, 2011 Water Level measured in Piezometer VWP T7-1-P20 at elevation 180.4m July 24, 2011 Water Level measured in Piezometer VWP T7-1-P20 at elevation 180.4m on August 6, 2011																	
										</								

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

METRIC

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

METRIC

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No T7-2

3 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679331.1, E332388.2 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 5 Jul 11 - 7 Jul 11 CHECKED BY MSO

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

-NW Casing refusal
-VWP #T7-2-P32 installed at 32.31m below ground surface (EL. 148.9m)
-continue with NQ Core, no bedrock
-only 15" recovery 1 solid piece, the rest possibly lost in BH
RQD = 25%

METRIC

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

METRIC





+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No CPT T7-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679345.0, E332316.9 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 11 Jul 11 - 11 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE												
								● POCKET PEN. × LAB VANE												
181.2	Ground Surface						20	40	60	80	100	10	20	30	kn/m ³	GR SA SI CL				
0.0	TOPSOIL																			
180.8	SAND Poorly graded Trace to some silt Brown																			
0.4																				
180.1			1A, B	SS	8															
1.1																				
	SILTY CLAY Some sand, trace gravel Mottled brown and grey Brown -Trace fissures		2	SS	15															
	Grey -Trace oxidation		3	SS	14															
177.7	END OF BOREHOLE (continued with CPT to refusal) Borehole dry upon completion																			
3.5																				

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

RECORD OF BOREHOLE No CPT T7-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679276.9, E332433.5 ORIGINATED BY TA
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 23 Jul 11 - 23 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	W _p W W _L	20 40 60 80 100	10 20 30	GR SA SI CL						
181.2	Ground Surface																	
0.0	TOPSOIL																	
180.9																		
0.3	SAND																	
	Poorly graded, trace silt																	
180.4	Brown																	
0.8	SILTY CLAY		1	SS	11													
	Some sand, trace gravel																	
	Mottled brown-grey to brown																	
179.2			2	SS	13													
2.0	END OF SAMPLED BOREHOLE																	
	Continued with CPT from 2.0 m to refusal at 22.1 m (El. 179.2 m to El. 157.1 m)																	
	Borehole dry upon completion																	

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

RECORD OF BOREHOLE No DMT T7-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4679368.7, E332355.7 ORIGINATED BY LC
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 15 Jul 11 - 15 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE												
181.5	Pavement Surface							20	40	60	80	100								
0.0	25mm Asphalt						181													
	152mm Crushed Limestone, Silty																			
	254mm Brown Silty Sand with gravel																			
	to																			
180.7	304mm Weathered Brown Sandy																			
0.8	Clay with Topsoil		1	SS	4															
180.3	FILL																			
1.2	SILTY CLAY						180													
	Some sand, trace gravel																			
	Trace organics, weathered brown																			
	END OF SAMPLED BOREHOLE						179													
	Continued with DMT from 2.0 m to																			
	refusal at 16.8 m (El. 179.5 m o El.																			
	164.7 m)						178													
	Borehole dry upon completion																			
							177													
							176													
							175													
							174													
							173													
							172													
							171													
							170													
							169													
							168													
							167													

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

RECORD OF NILCON VANE TEST NIL T7-2

Project : Windsor-Essex Parkway

Test Date: 7/8/2011

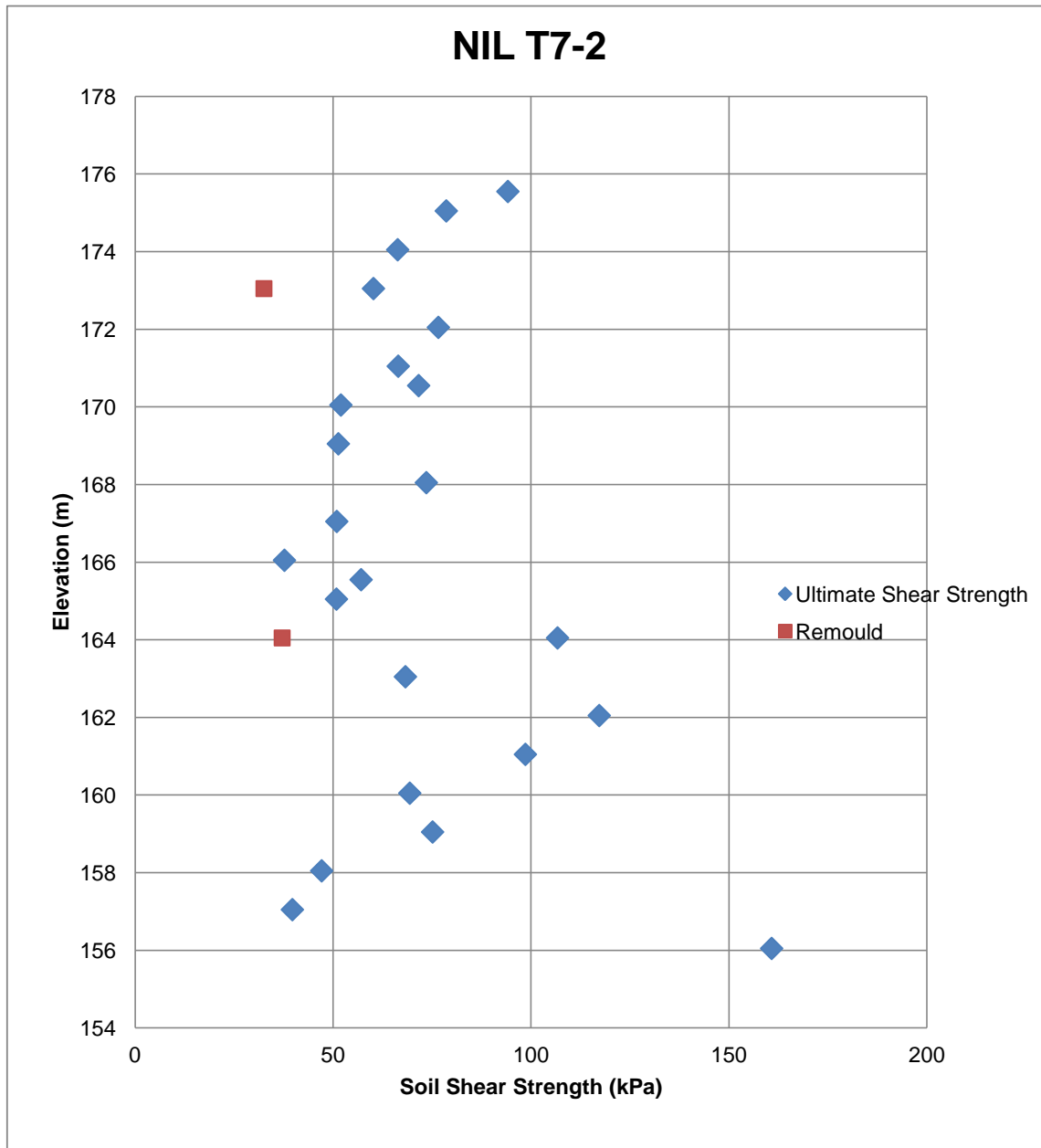
Sheet 1 of 1

Location: N4679332.1; E332390.8

Predrill Depth : 4.6 m

Datum Geodetic

Ground Surface Elevation: 181.0 m



Operator: SD

Checked: DD

RECORD OF CONE PENETRATION TEST CPT T7-1

METRIC

PROJECT Windsor-Essex Parkway

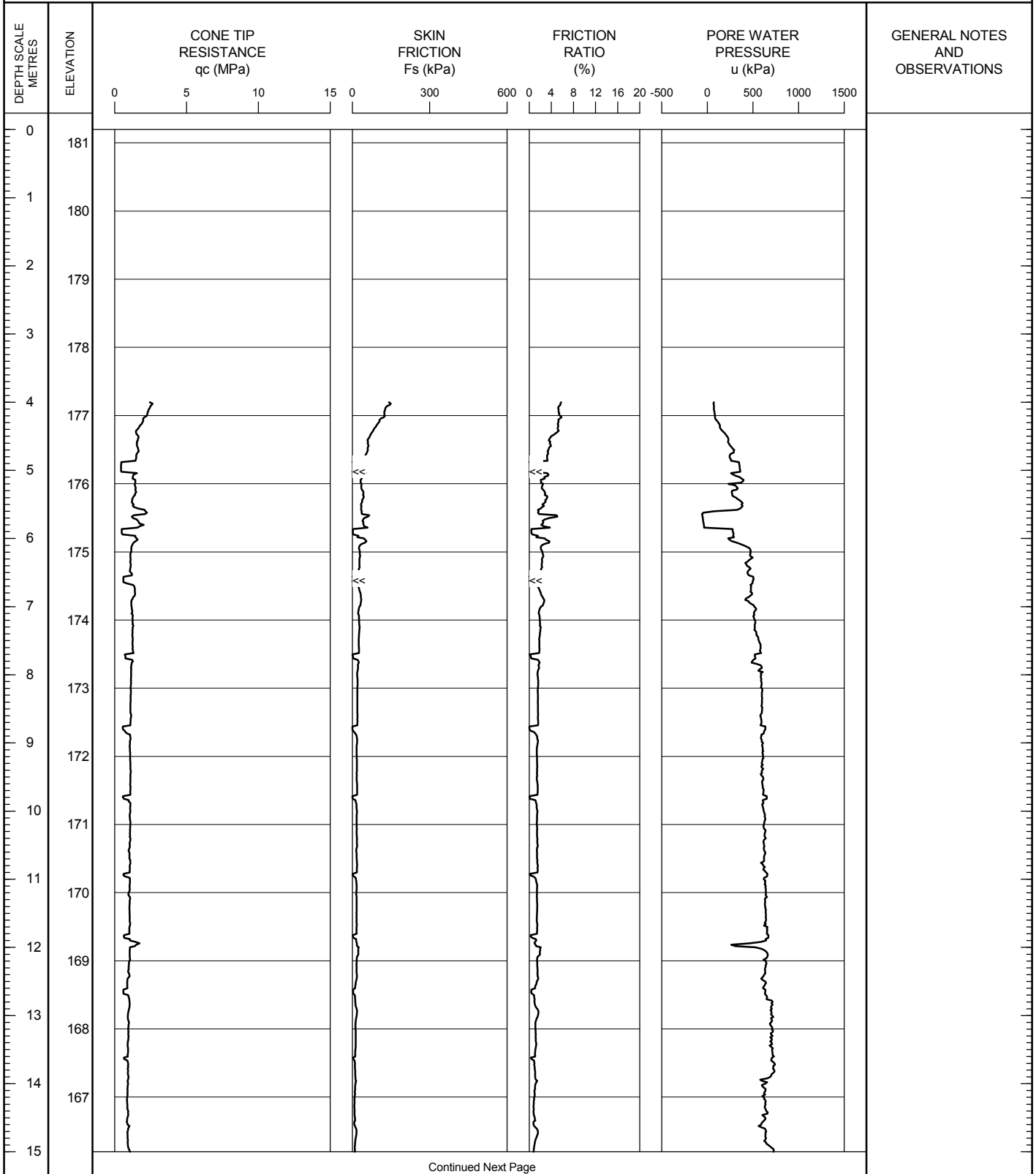
TEST DATE 7/22/2011 - 7/22/2011

SHEET 1 OF 2

LOCATION N4679345.0; E332316.9

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.2 PREDRILL DEPTH: 3.37 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T7-1

METRIC

PROJECT Windsor-Essex Parkway

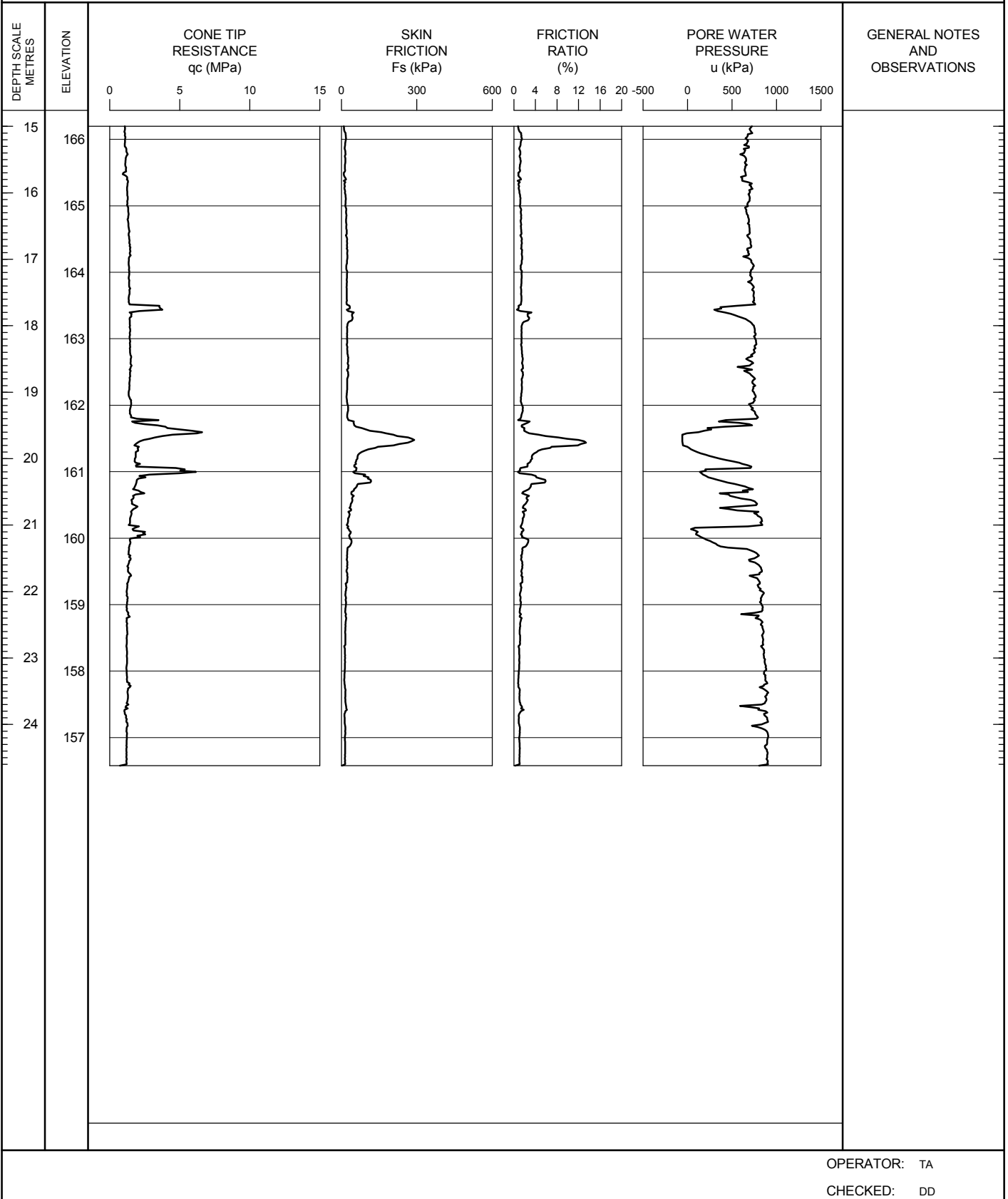
TEST DATE 7/22/2011 - 7/22/2011

SHEET 2 OF 2

LOCATION N4679345.0; E332316.9

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.2 PREDRILL DEPTH: 3.37 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



RECORD OF CONE PENETRATION TEST CPT T7-2

METRIC

PROJECT Windsor-Essex Parkway

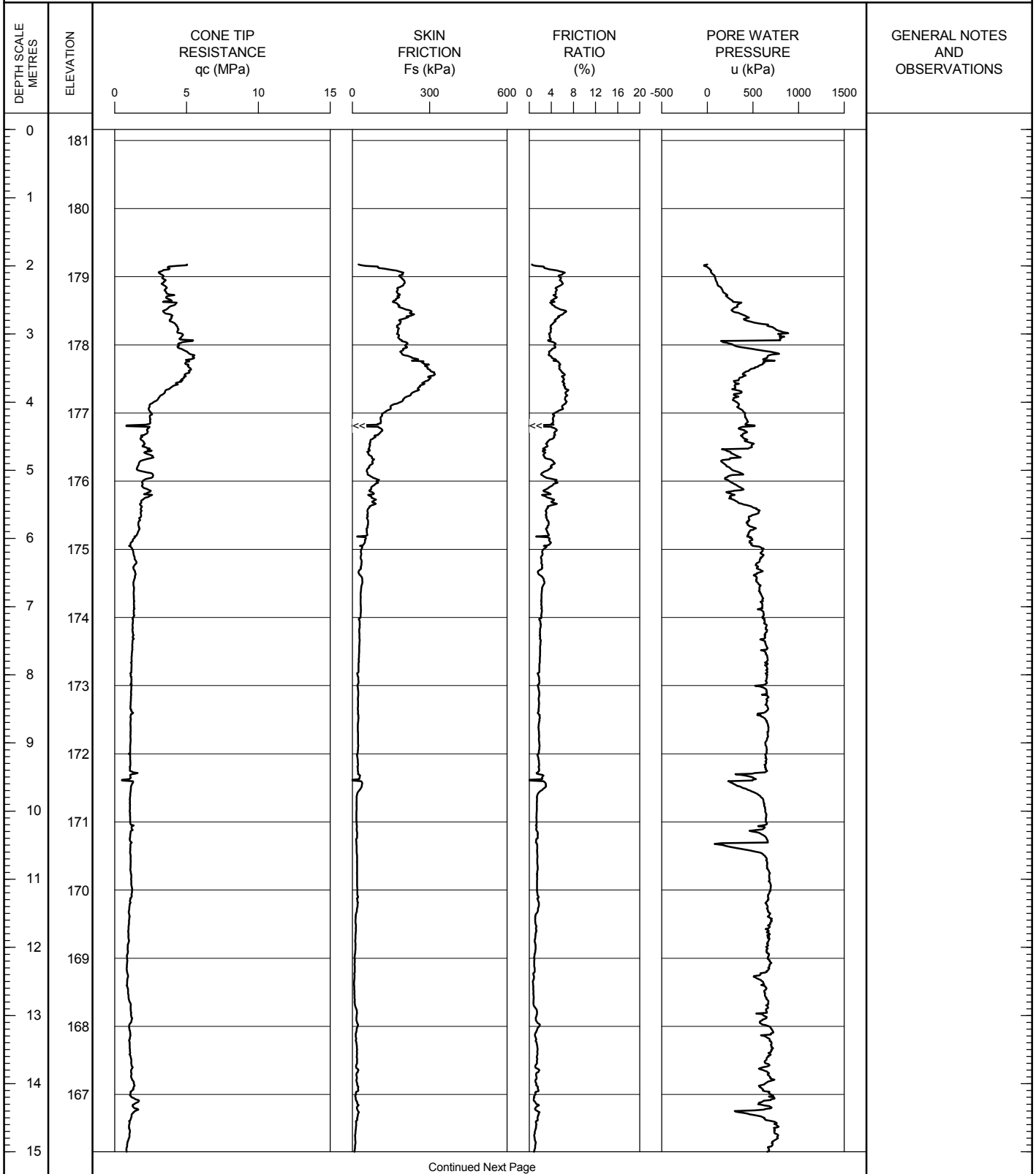
TEST DATE 7/23/2011 - 7/23/2011

SHEET 1 OF 2

LOCATION N4679276.9; E332433.5

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.2 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T7-2

METRIC

PROJECT Windsor-Essex Parkway

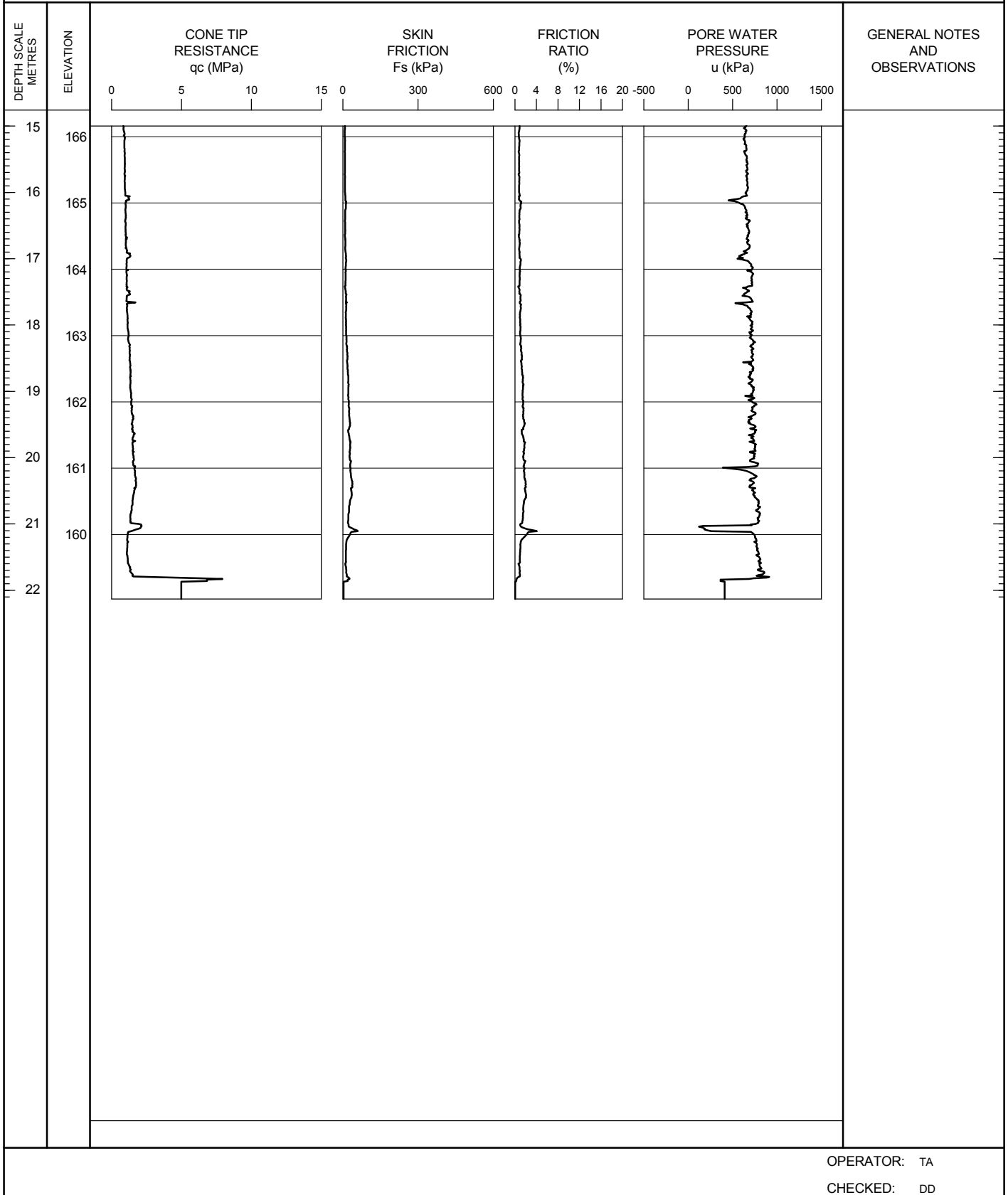
TEST DATE 7/23/2011 - 7/23/2011

SHEET 2 OF 2

LOCATION N4679276.9; E332433.5

DATUM Geodetic

GROUND SURFACE ELEVATION: 181.2 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0

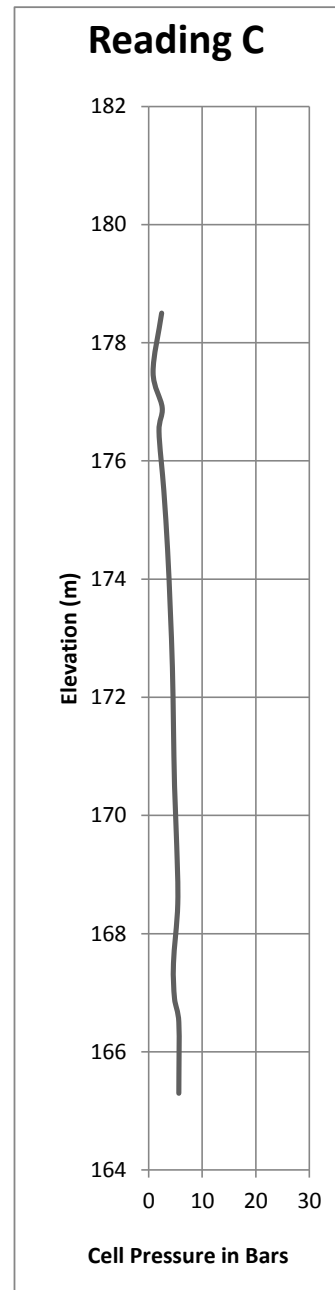
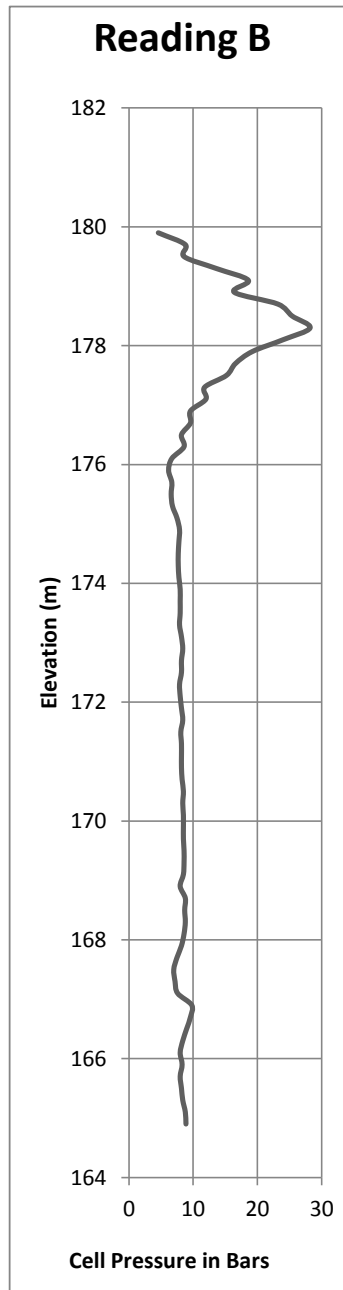
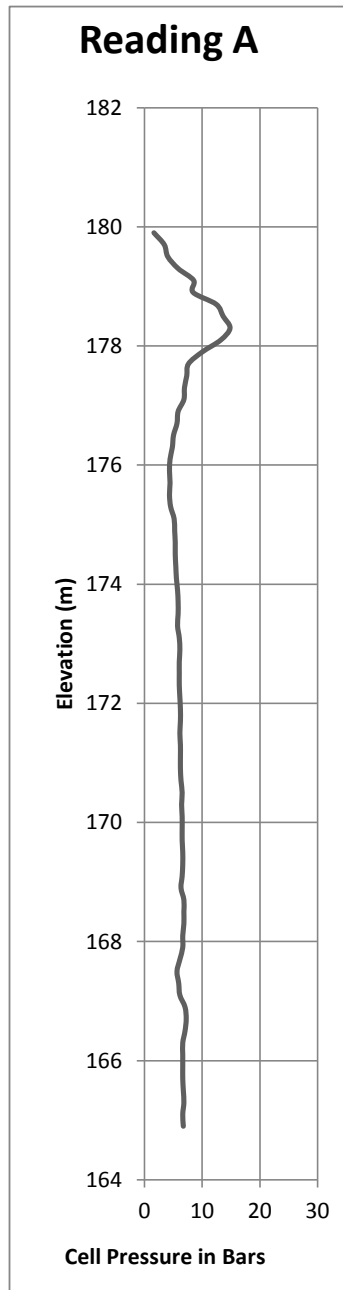


RECORD OF DILATOMETER TEST DMT T7-1

Project : Windsor-Essex Parkway
Location: N 4679368.7; E 332355.7
Ground Surface Elevation : 181.5

Test Date: 7/15/2011
Predrill Depth : 1.5 m
Delta A: 0.14 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.22 Bar





Operator: LC
Checked: DD

RECORD OF BOREHOLE No TB7-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678671.8, E333831.4 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 9 Jul 11 - 10 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	○ POCKET PEN.	+ FIELD VANE	× LAB VANE						
184.0	Ground Surface						20	40	60	80	100						
0.0	TOPSOIL																
183.5	CLAYEY SILT Some sand, trace gravel, trace cobbles Firm to hard Mottled brown and Grey Brown -Trace fissures Grey		1	SS	7	▽	183										
								182									
								181									
								180									
								179									
								178									
								177									
								176									
								175									
								174									
173.9	END OF BOREHOLE			VT			174										
10.1	Groundwater encountered at elevation 181.0m during drilling on July 10, 2011						173										
							172										
							171										
							170										

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF BOREHOLE No TB7-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678662.3, E333859.6 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 10 Jul 11 - 10 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				w _p	w	w _L		WATER CONTENT (%)	GR	SA	SI	CL
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.	× LAB VANE									
184.1	Ground Surface							20	40	60	80	100								
0.0	TOPSOIL						184													
183.8	CLAYEY SILT																			
0.3	Some sand, trace gravel		1	SS	12		183													
	Firm to hard																			
	Mottled brown and grey		2	SS	25		182													
	Trace fissures																			
	Brown		3	SS	37		181													
	Trace to some oxidized fissures		4	SS	28															
	Grey		5	SS	15		180													
			6	SS	10		179													
			7	SS	9		178													
			8	SS	9		177													
			9	SS	5		176													
				VT																
			10	SS	5		175													
				VT																
174.0	END OF BOREHOLE						174													
10.1	Borehole dry on completion																			
							173													
							172													
							171													
							170													

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF BOREHOLE No TB7-3

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678644.6, E333911.0 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 12 Jul 11 - 12 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)			
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE												
184.9	Fill Surface						20	40	60	80	100									
184.0	<div>FILL Topsoil</div>																			
0.2	<div>FILL Silty clay and topsoil Brown</div>																			
183.8	<div>CLAYEY SILT Firm to hard Mottled brown and grey</div> <div>Brown Moist to wet Trace fissures</div> <div>Grey</div>		1	SS	6															
1.1			2	SS	7															
			3A, B	SS	6															
			4	SS	25															
			5	SS	37															
			6	SS	20															
			7	SS	10															
			8	SS	9															
			9	SS	9															
			10	SS	5															
174.8	END OF BOREHOLE		VT																	
10.1	Borehole dry on completion																			

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 16/08/12

METRIC

[illegible]

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 16/08/12

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No CV3-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678630.0, E333861.1 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 12 Jul 11 - 12 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED ● POCKET PEN.	+	FIELD VANE ×	LAB VANE									
								20 40 60 80 100												
184.5	Ground Surface																			
0.0	FILL Silty clay Some sand, trace gravel Trace to some topsoil Brown						184													
183.6	CLAYEY SILT Some sand, trace gravel Stiff to hard Mottled brown and grey		1	SS	10		183													
0.9			2	SS	9															
	Trace fissures, trace silt seams Brown		3	SS	29		182													
			4	SS	40		181													
			5	SS	27															
							180													
	Grey		6	SS	10															
			7	SS	7		179													
			8	TW	PH		178													
	Numerous Sand Layers at Elevation 176.9 m		9	TW	PH		177										1 32 42 25			
							176													
			10	TW	PH		175													
174.7	END OF BOREHOLE Borehole dry on completion																			
9.8							174													
							173													
							172													
							171													
							170													

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 16/08/12

METRIC

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

METRIC

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

RECORD OF BOREHOLE No NIL T9-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678636.5, E333765.3 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE CME 850 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 15 Aug 11 - 15 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE							○		
								● POCKET PEN.		× LAB VANE									
184.0							20	40	60	80	100								
180.8	TOPSOIL																		
0.2	CLAYEY SILT Some sand, trace gravel Stiff to very stiff Mottled brown and grey		1	SS	10		183							○					
														○					
	Brown		2	SS	26		182							○					
														○					
			3	SS	24		181							○					
														○					
			4	SS	21		180							○					
														○					
	Grey		5	SS	12		179							○					
														○					
			6	SS	10		178							○					
														○					
			7	SS	8									○					
														○					
			8	SS	5									○					
177.4	END OF BOREHOLE Continued with Nilcon vane from 7.0 m to refusal at 22.0 m (El. 177.0 to El. 162.0 m) Borehole dry on completion						177												
6.6							176												
							175												
							174												
							173												
							172												
							171												
							170												



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

RECORD OF BOREHOLE No DMT T9-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678544.5, E333900.9 ORIGINATED BY LC
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 19 Jul 11 - 19 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80						100
								○ UNCONFINED	+	FIELD VANE	×						LAB VANE
184.1	Ground Surface																
0.0	Clayey TOPSOIL						184										
183.7																	
0.4	CLAYEY SILT Some sand, trace gravel Stiff to hard Mottled brown and grey		1	AS			183										
	-Weathered fissures -Some sand, trace gravel with topsoil/organics in fissures		2	SS			182										
	Brown fissures		3	SS			181										
	Oxidized		4	SS			180										
	Silty fissures		5	SS													
179.8	Grey																
4.3	END OF SAMPLED BOREHOLE DMT advanced from 0.2 m to refusal at 21.6 m (El. 183.9 m to El. 162.5 m)						179										
	Borehole dry on completion						178										
							177										
							176										
							175										
							174										
							173										
							172										
							171										
							170										

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

RECORD OF BOREHOLE No BH15-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678559.2, E333806.1 ORIGINATED BY LC
DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 15 Jul 11 - 15 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.	× LAB VANE					
184.1	Fill Surface						20	40	60	80	100	10	20	30		
184.0	<div><div><div>FILL</div><div>Silty Topsoil to Mixed Clay/Silt/Sand/Roots/concrete</div><div>FILL</div><div>Soft Clay/Topsoil</div></div></div>	<div></div>														
			1	SS	2											
182.6																
1.5	<div><div><div>SILTY CLAY</div><div>Weathered, fissures Some sand, trace gravel</div><div>Stiff Brown</div></div></div>	<div></div>	2	SS	11											
181.8																
2.3	<div><div><div>CLAYEY SILT</div><div>Hard to firm Brown</div><div>Some sand, trace gravel Moist Fissured occasionally</div><div>Grey</div></div></div>	<div></div>	3	SS	31											
			4	SS	39											
			5	SS	22											
			6	SS	14											
			7	SS	9											
			8	SS	7											
177.5	<div><div><div>END OF BOREHOLE</div><div>Borehole dry on completion</div></div></div>															
6.6																
														</		


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

RECORD OF BOREHOLE No CPT45-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678688.3, E333708.0 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 9 Aug 11 - 9 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE												
183.4	Ground Surface							20	40	60	80	100								
0.0	TOPSOIL																			
183.1	CLAYEY SILT Some sand, trace gravel, trace fissures Firm to hard Mottled brown and grey		1	SS	3		183													
0.3			2	SS	7		182													
							181													
180.4	Brown		3	SS	38															
3.0	END OF SAMPLED BOREHOLE Continued with CPT from 3.5 m to refusal at 32.8 m (El. 179.9 m to El. 150.6 m) Borehole dry on completion						180													
							179													
							178													
							177													
							176													
							175													
							174													
							173													
							172													
							171													
							170													
							169													

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

RECORD OF BOREHOLE No CPT46-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678505.0, E333977.6 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 5 Aug 11 - 5 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE												
184.3	Ground Surface							20	40	60	80	100								
0.0	TOPSOIL		1	SS	10		184													
184.0	CLAYEY SILT Some sand, trace gravel Firm to hard Mottled brown and grey		2	SS	5															
0.3								183												
								182												
	Brown Trace fissures		3	SS	36															
181.3	END OF SAMPLED BOREHOLE (continued with CPT to refusal)						181													
3.0	Borehole dry on completion						180													
							179													
							178													
							177													
							176													
							175													
							174													
							173													
							172													
							171													
							170													

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

RECORD OF NILCON VANE TEST NIL T9-1

Project : Windsor-Essex Parkway

Test Date: 8/16/2001

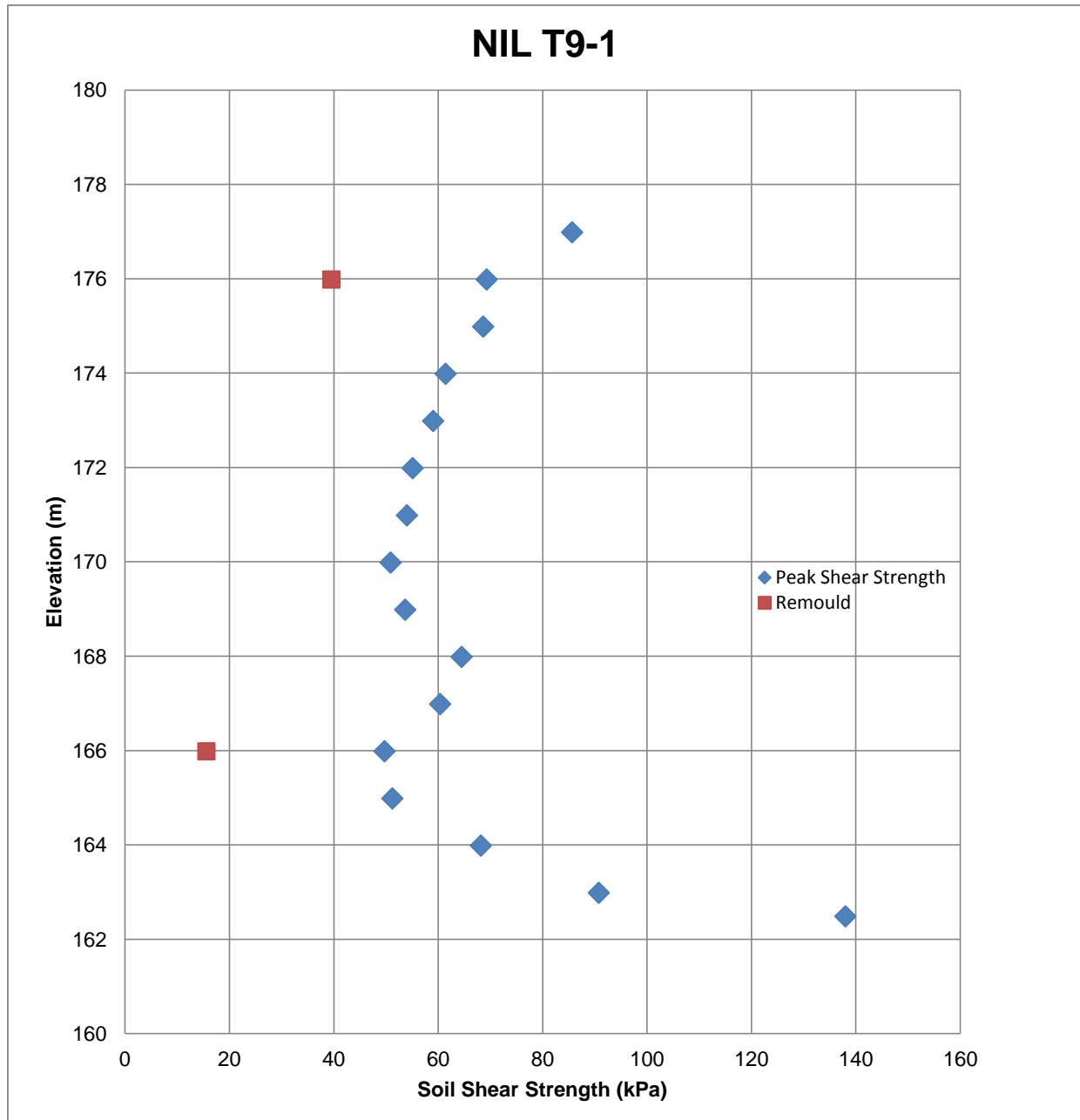
Sheet 1 of 1

Location: N4678636.5; E333765.3

Predrill Depth : 6.1 m

Datum Geodetic

Ground Surface Elevation: 184.0 m



Operator: SD

Checked: DD

RECORD OF NILCON VANE TEST NIL T9-2

Project : Windsor-Essex Parkway

Test Date: 8/15/2001

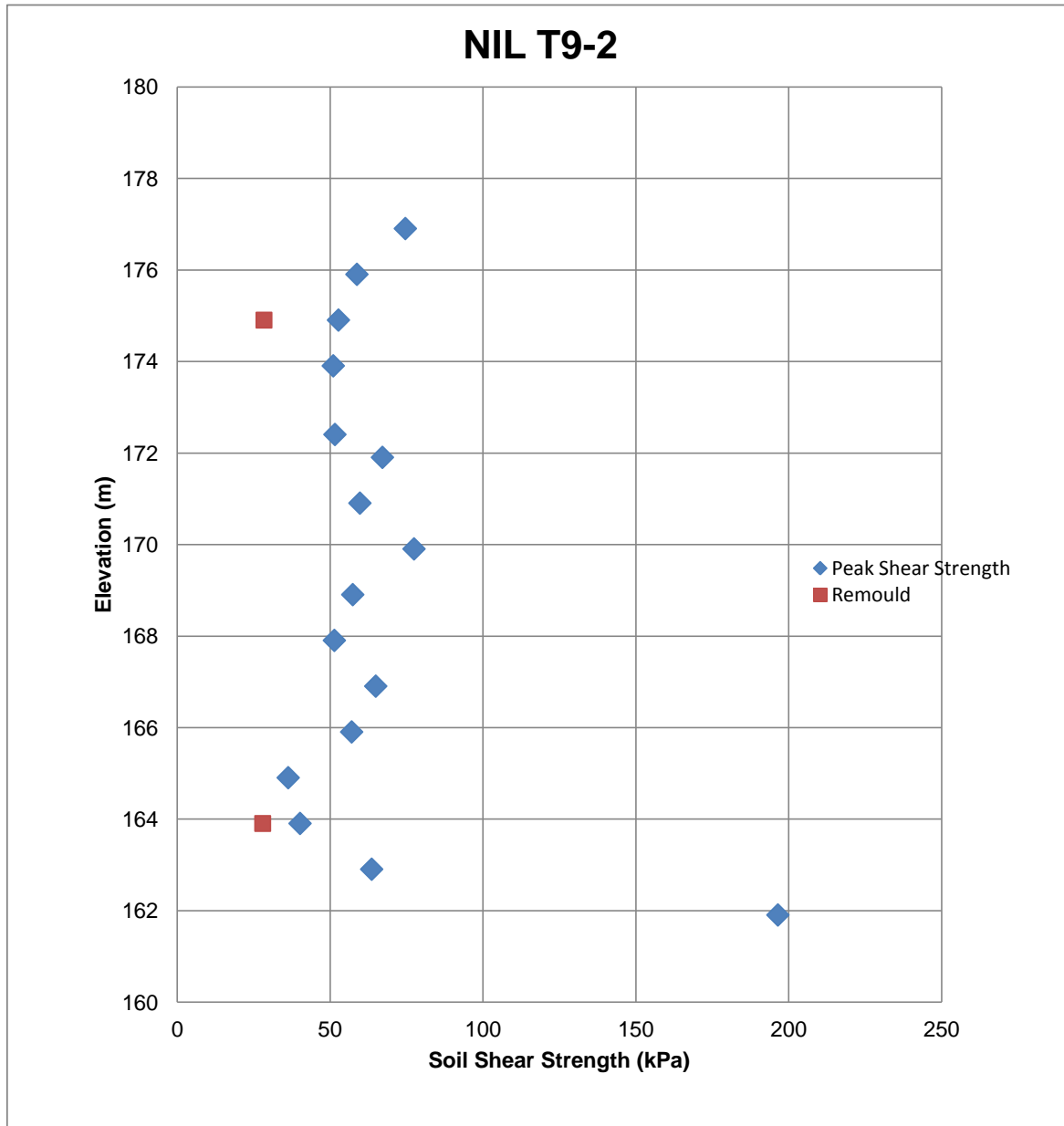
Sheet 1 of 1

Location: N4678593.7; E333893.5

Predrill Depth : 6.6 m

Datum Geodetic

Ground Surface Elevation: 183.9 m



Operator: SD

Checked: DD

RECORD OF CONE PENETRATION TEST CPT 45-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/9/2011 - 8/9/2011

SHEET 1 OF 3

LOCATION N4678688.3; E333708.0

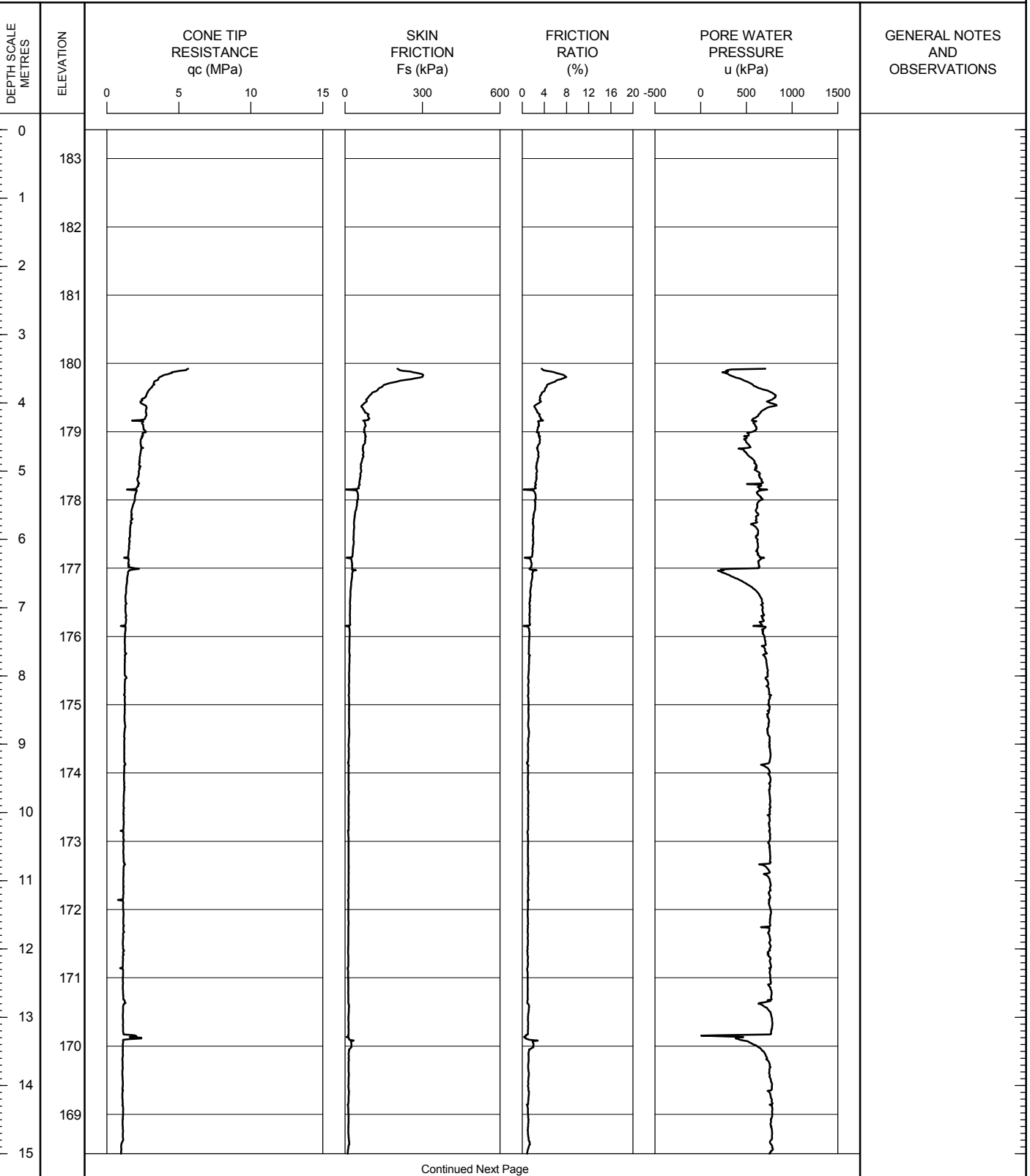
DATUM Geodetic

GROUND SURFACE ELEVATION: 183.4

PREDRILL DEPTH: 3

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 45-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/9/2011 - 8/9/2011

SHEET 2 OF 3

LOCATION N4678688.3; E333708.0

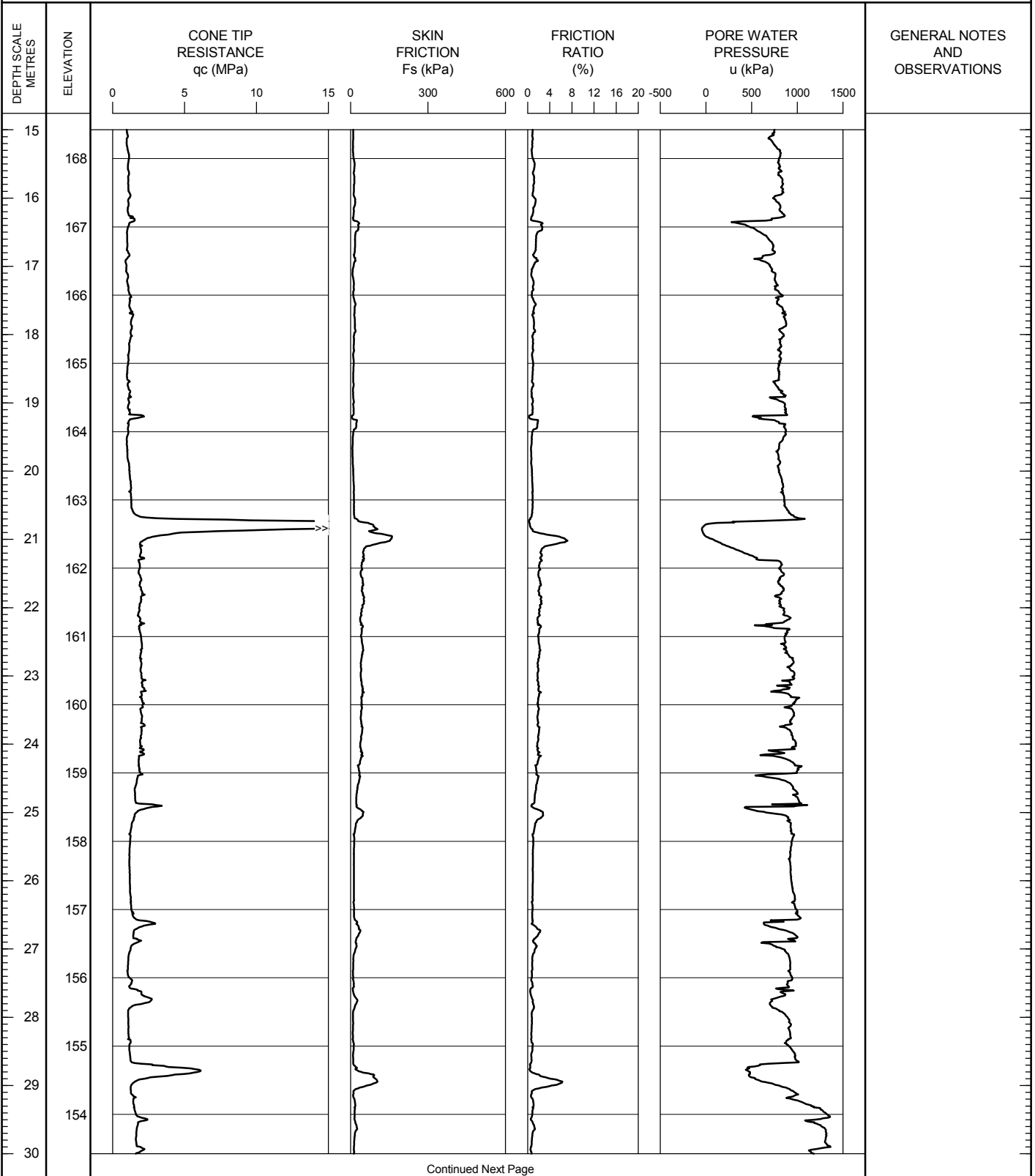
DATUM Geodetic

GROUND SURFACE ELEVATION: 183.4

PREDRILL DEPTH: 3

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



WEF CPT LOG CPT-RW/GPJ ONTARIO MOT GDT 06/01/12

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 45-RW

METRIC

PROJECT Windsor-Essex Parkway

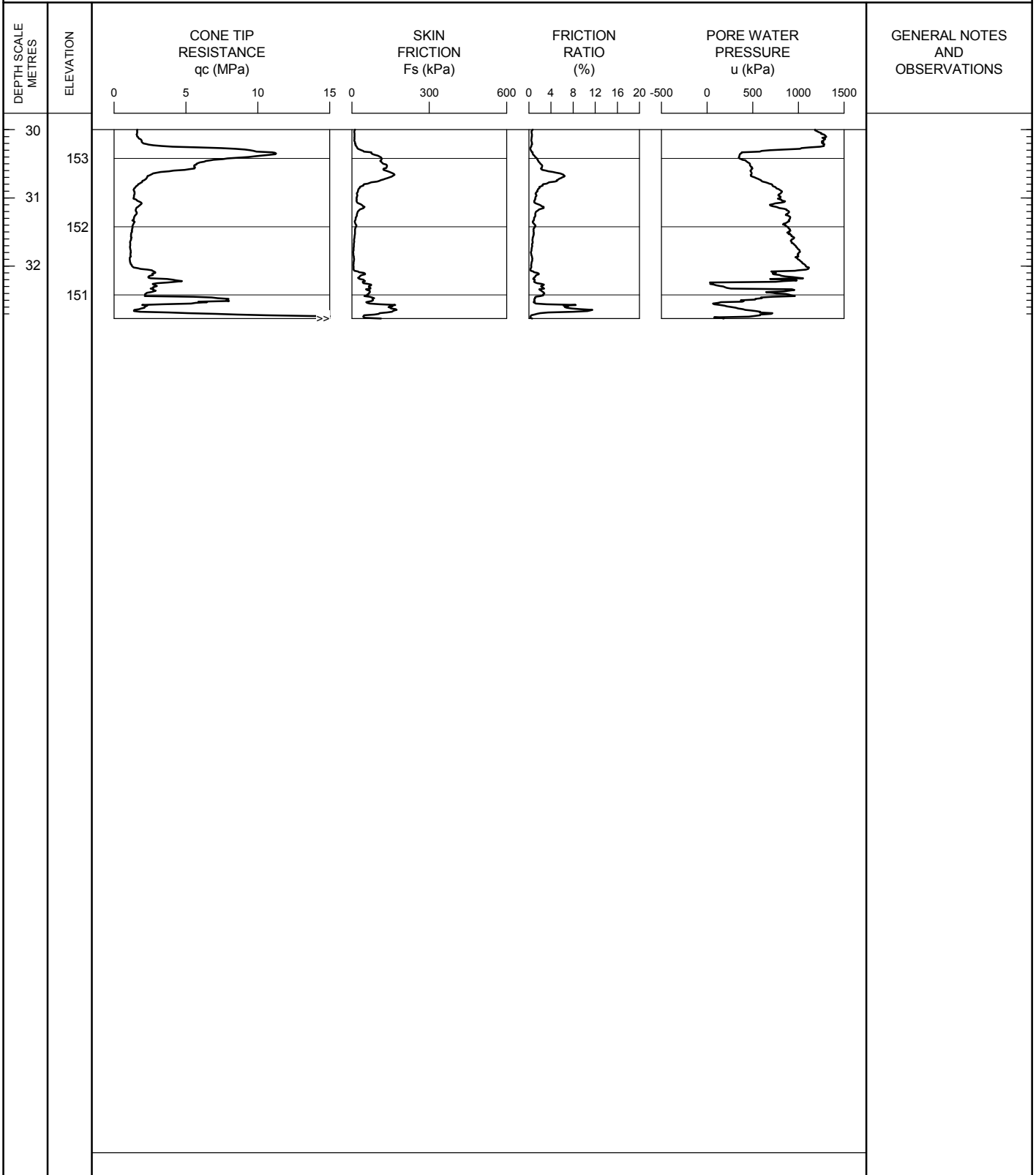
TEST DATE 8/9/2011 - 8/9/2011

SHEET 3 OF 3

LOCATION N4678688.3; E333708.0

DATUM Geodetic

GROUND SURFACE ELEVATION: 183.4 PREDRILL DEPTH: 3 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 46-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/5/2011 - 8/5/2011

SHEET 1 OF 2

LOCATION N4678505.0; E333977.6

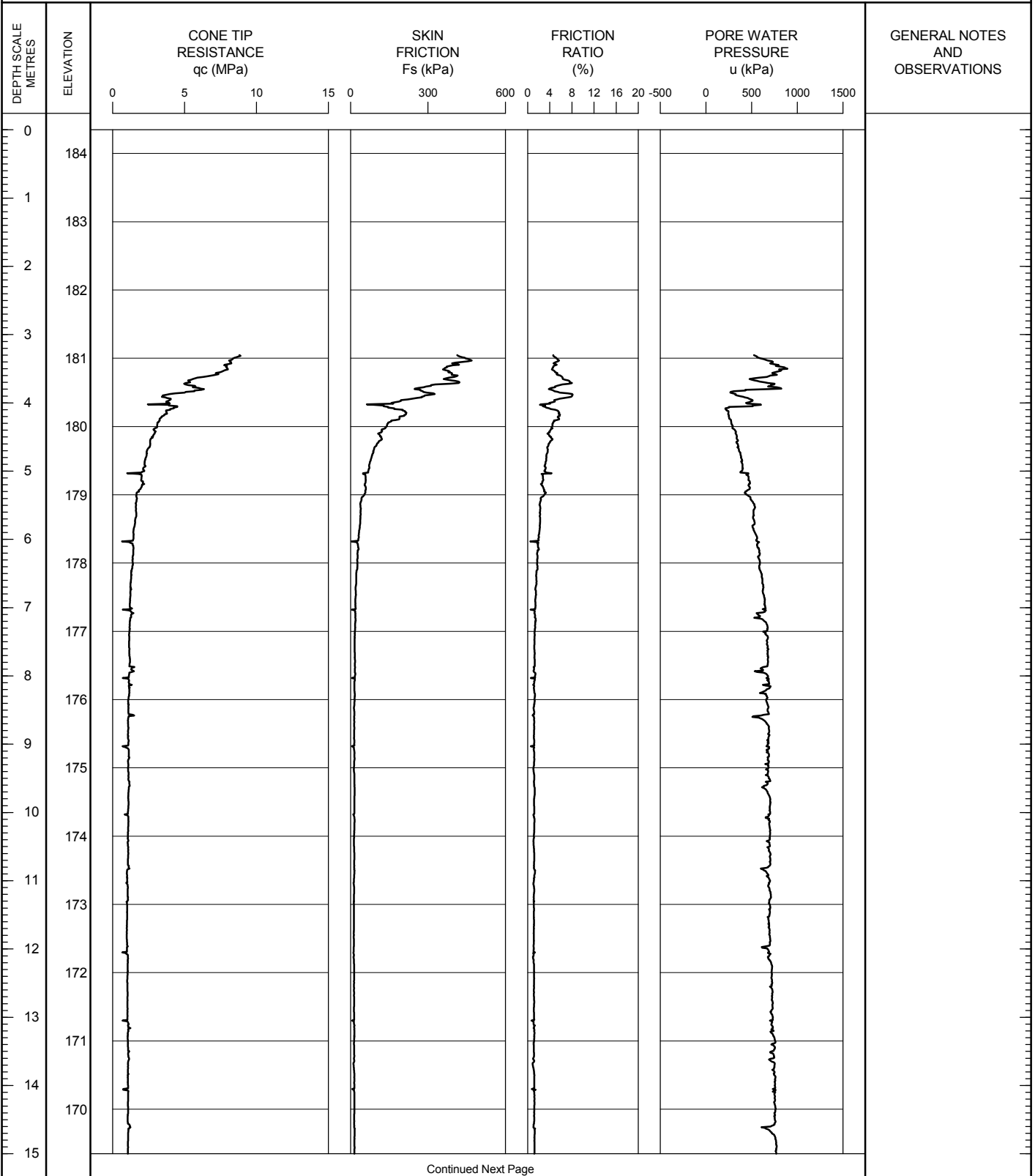
DATUM Geodetic

GROUND SURFACE ELEVATION: 184.3

PREDRILL DEPTH: 3

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



WEF CPT LOG CPT-RW.GPJ ONTARIO MOT.GDT 06/01/12

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 46-RW

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/5/2011 - 8/5/2011

SHEET 2 OF 2

LOCATION N4678505.0; E333977.6

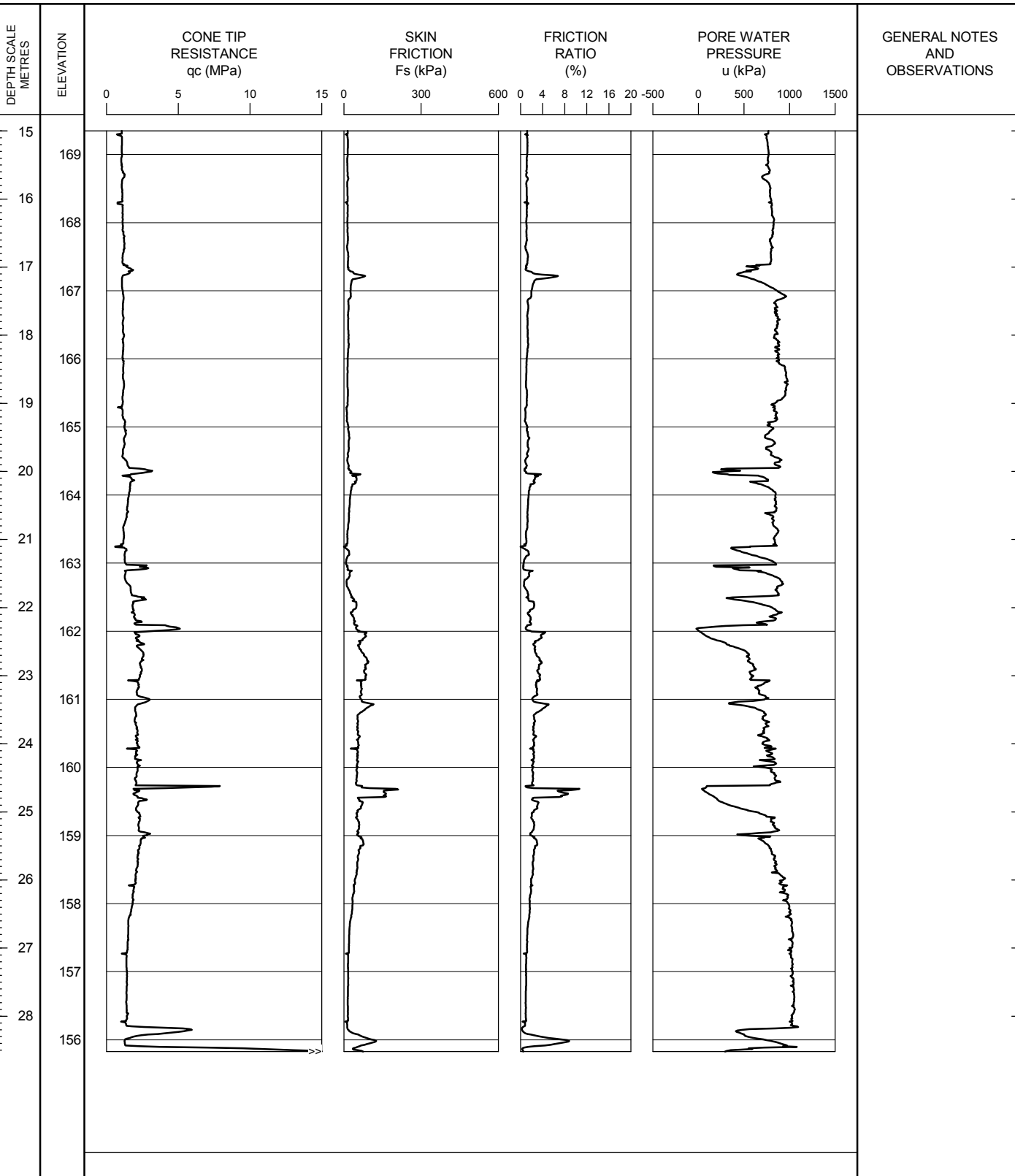
DATUM Geodetic

GROUND SURFACE ELEVATION: 184.3

PREDRILL DEPTH: 3

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



WEP CPT LOG CPT-RW.GPJ ONTARIO MOT GDT 06/01/12

OPERATOR: TA

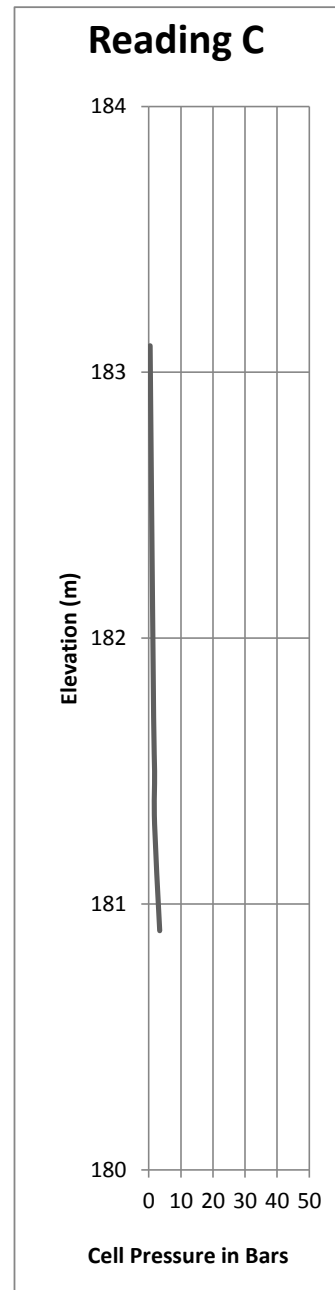
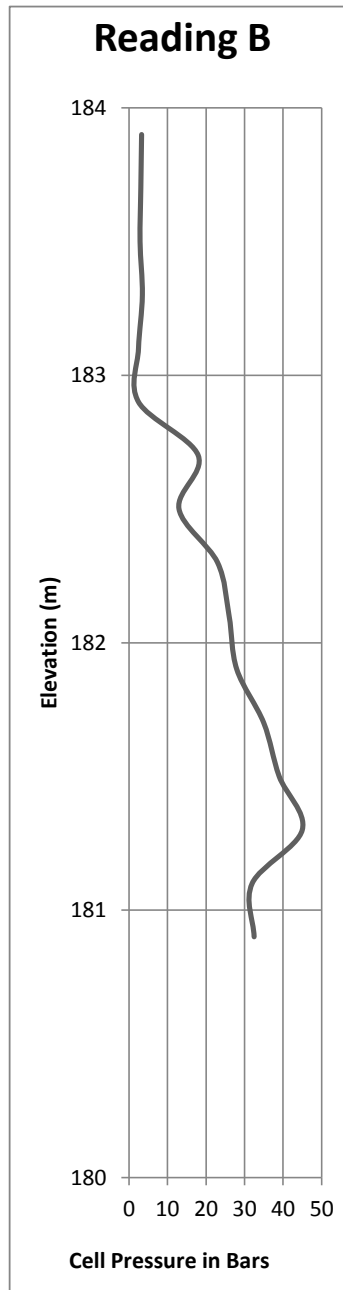
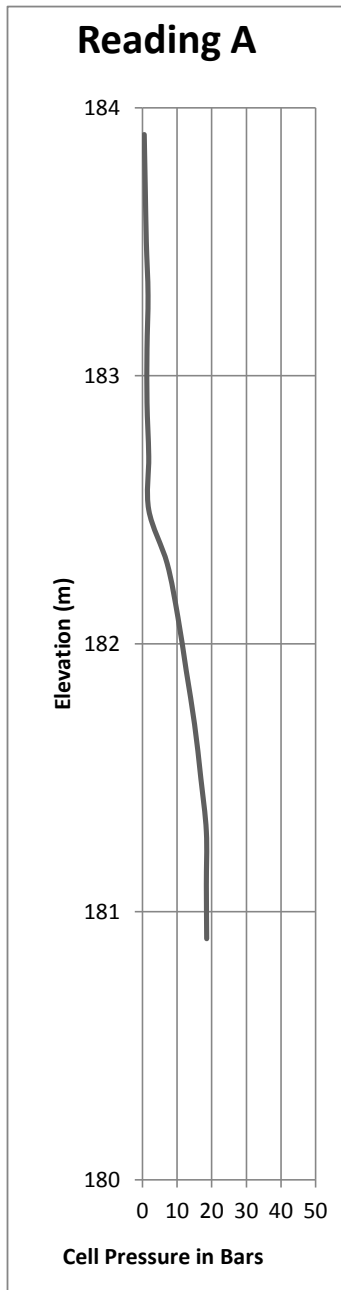
CHECKED: DD

RECORD OF DILATOMETER TEST DMT T9-1-SHALLOW

Project : Windsor-Essex Parkway
Location: N 4678544.5; E 333900.9
Ground Surface Elevation : 184.1

Test Date: 7/19/2011
Predrill Depth : 0.2 m
Delta A: 0.14 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.22 Bar



Note: DMT refusal at elevation 180.9m .Redrill to elevation 179.5m
Resumed DMT to elevation 162.5m

Operator: LC

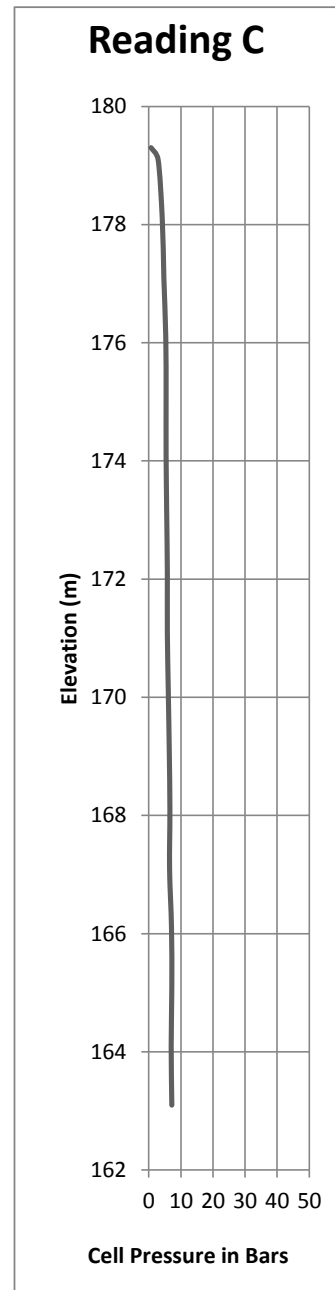
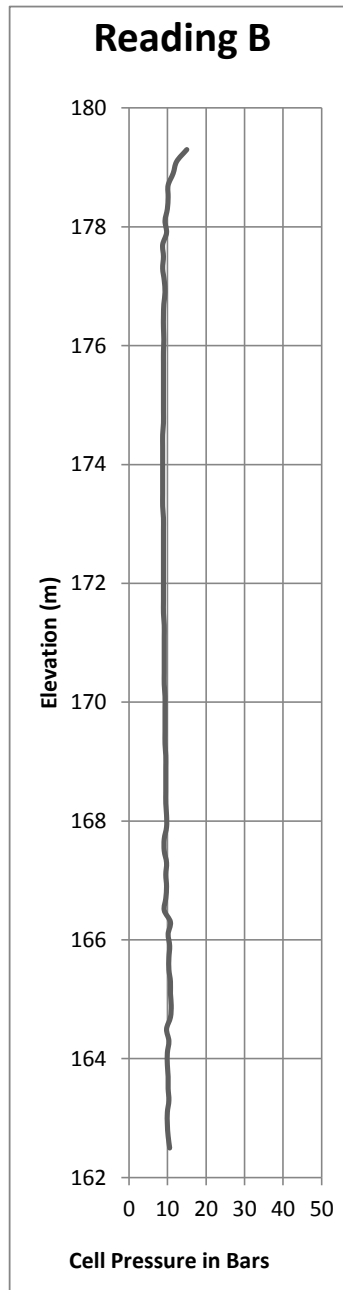
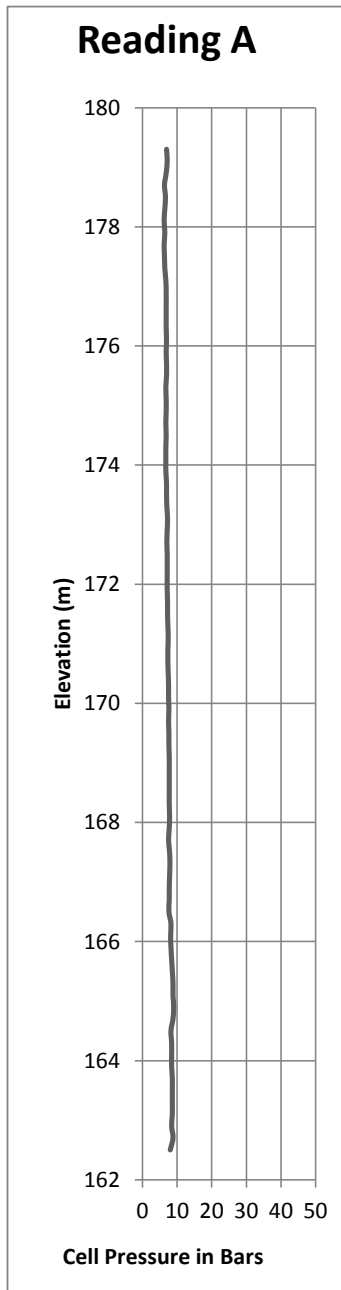
Checked: DD

RECORD OF DILATOMETER TEST DMT T9-1-DEEP

Project : Windsor-Essex Parkway
 Location: N 4678544.5; E 333900.9
 Ground Surface Elevation : 184.1

Test Date: 7/19/2011
 Predrill Depth : 4.6 m
 Delta A: 0.10 Bar

Sheet 1 of 1
 Datum Geodetic
 Delta B: 0.37 Bar



Operator: LC
 Checked: DD

METRIC

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

RECORD OF BOREHOLE No T10-1/HGMW-04 1 OF 3 METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678495.6, E334122.3 ORIGINATED BY NB
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 13 Jul 11 - 15 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _P	W	W _L		
184.9	Fill Surface													
184.7	<div>FILL</div> <div>150mm Topsoil</div> <div>FILL</div> <div>Silty Clay and Topsoil</div> <div>Brown-Grey</div>		1	SS	7									-Vibrating Wire Piezometers (VWP) installed in sampled borehole observation well (OW) installed in adjacent boring at N4678497.2, E334122.3
184.0			2	SS	11									
183.5														
183.5	<div>CLAYEY SILT</div> <div>Sandy to some sand, trace gravel</div> <div>Stiff</div>		3	SS	12									
183.0														
182.5	Brown		4	SS	32									
182.0			5	SS	39									
181.5														
181.0	Grey		6	SS	23									
180.5														
180.0			7	SS	18									
179.5														
179.0			8	SS	13									
178.5														
178.0			9	TW	PH			×					22.0	
177.5				VT						1.6				
177.0			10	TW	PH									
176.5														
176.0														
175.5			11	TW	PH									
175.0				VT						1.5				
174.5														
174.0			12	TW	PH			×					21.5	
173.5														
173.0														
172.5			13	TW	PH									
172.0				VT										
171.5														
171.0			14	TW	PH									
170.5														
170.0														

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

2 OF 3

METRIC

[illegible]

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No T10-2/HGMW-09

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION 4678358.2N, 334191.8E ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 2 May 11 - 4 May 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
184.8	Ground Surface							○ UNCONFINED	+ FIELD VANE										
0.0	TOPSOIL							● POCKET PEN.	× LAB VANE										
184.3	Organic Clay Black																		
0.5	CLAYEY SILT																		
	Some sand, trace gravel Firm to Stiff Mottled brown and grey		1	SS	7														
			2	SS	8														
	Brown		3	SS	37														
			4	SS	36														
	Grey		5	SS	17														
			6	SS	12														
			7	SS	10														
			8	TW	PH				×										
	Layers of clayey sand below approximately 7m		9	TW	PH														
			10	TW	PH				×										
				VT					+ 1.64										
			11	TW	PH														
			12	TW	PH														
				VT					+ 2.38										
			13	TW	PH														

Continued Next Page

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

2 OF 3

METRIC[illegible]

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No T10-2/HGMW-09

3 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION 4678358.2N, 334191.8E ORIGINATED BY TA
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 2 May 11 - 4 May 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE							
								● POCKET PEN. × LAB VANE							
							20 40 60 80 100								
154.6															
30.2															
153.7															
31.1															
153.3															
31.5															
152.5															
32.3															
149.0															
35.8															

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



ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

RECORD OF BOREHOLE No CPT T10-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678450.6, E334217.4 ORIGINATED BY TA
DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
DATUM Geodetic DATE 9 Aug 11 - 9 Aug 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p W W _L					
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE					WATER CONTENT (%)					
184.9	Ground Surface							20	40	60	80	100						
0.0	TOPSOIL																	
184.4																		
0.5	CLAYEY SILT Some sand, trace gravel Stiff Mottled brown and grey		1	SS	10		184											
			2	SS	10													
182.9	END OF SAMPLED BOREHOLE (Continued with CPT to refusal)						183											
2.0	Borehole dry on completion																	
							182											
							181											
							180											
							179											
							178											
							177											
							176											
							175											
							174											
							173											
							172											
							171											
							170											

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

RECORD OF BOREHOLE No CPT T10-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N46783403.2, E334089.2 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 2 May 11 - 2 May 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE									
185.2	Fill Surface																	
0.0	FILL 75mm rounded gravel over 400mm silty clay																	
184.7																		
0.5	SAND Poorly graded Black																	
184.2																		
0.8	SANDY SILT Some clay, trace gravel Stiff to hard Mottled brown and grey Dry to wet -Disturbed soil to approx. 1.2m Brown		1	SS	9													
			2	SS	12													
			3	SS	37													
			4	SS	39													
	Grey		5	SS	21													
			6	SS	17													
180.2	END OF SAMPLED BOREHOLE (continued with CPT to refusal) Borehole dry on completion																	
5.0																		

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

RECORD OF BOREHOLE No DMT T10-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678412.4, E334151.5 ORIGINATED BY LC
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 21 Jul 11 - 21 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
								○ UNCONFINED	+	FIELD VANE									
								● POCKET PEN.	×	LAB VANE									
184.6	Ground Surface																		
0.0	<div>TOPSOIL</div> <div>Clayey, with roots</div> <div>To weathered brown-grey silty clay</div> <div>Some sand, trace gravel</div> <div>SILTY CLAY</div> <div>Some sand, trace gravel</div> <div>Dry</div> <div>-Brown fissures</div> <div>Stiff to hard</div> <div>Mottled brown and grey</div>																		
184.3																			
0.3																			

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

RECORD OF CONE PENETRATION TEST CPT T10-1

METRIC

PROJECT Windsor-Essex Parkway

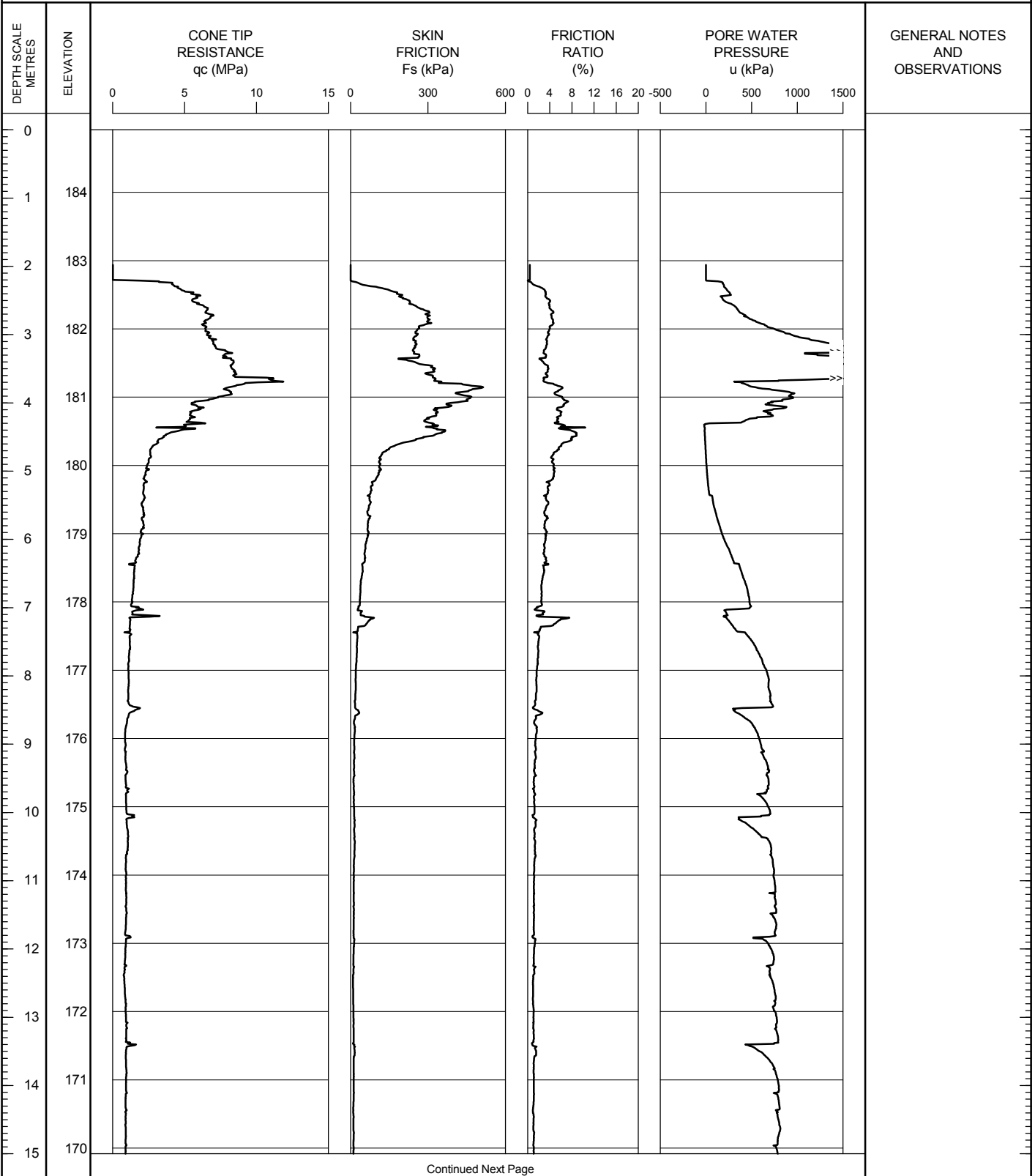
TEST DATE 8/9/2011 - 8/9/2011

SHEET 1 OF 2

LOCATION N4678450.6; E334217.4

DATUM Geodetic

GROUND SURFACE ELEVATION: 184.9 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T10-1

METRIC

PROJECT Windsor-Essex Parkway

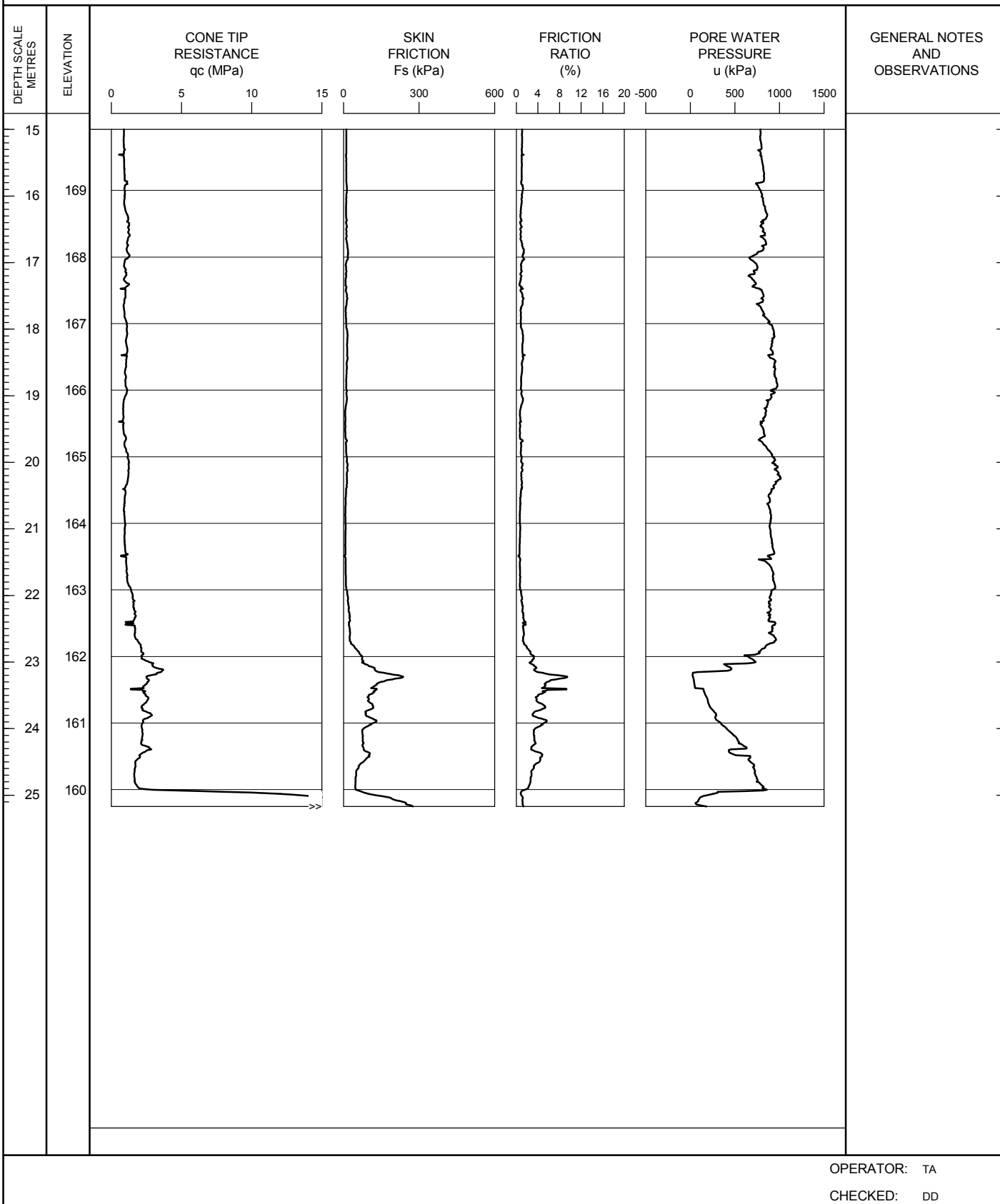
TEST DATE 8/9/2011 - 8/9/2011

SHEET 2 OF 2

LOCATION N4678450.6; E334217.4

DATUM Geodetic

GROUND SURFACE ELEVATION: 184.9 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T10-2

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 02/05/2011 - 02/05/2011

SHEET 1 OF 2

LOCATION 4678403.2N; 334089.2E

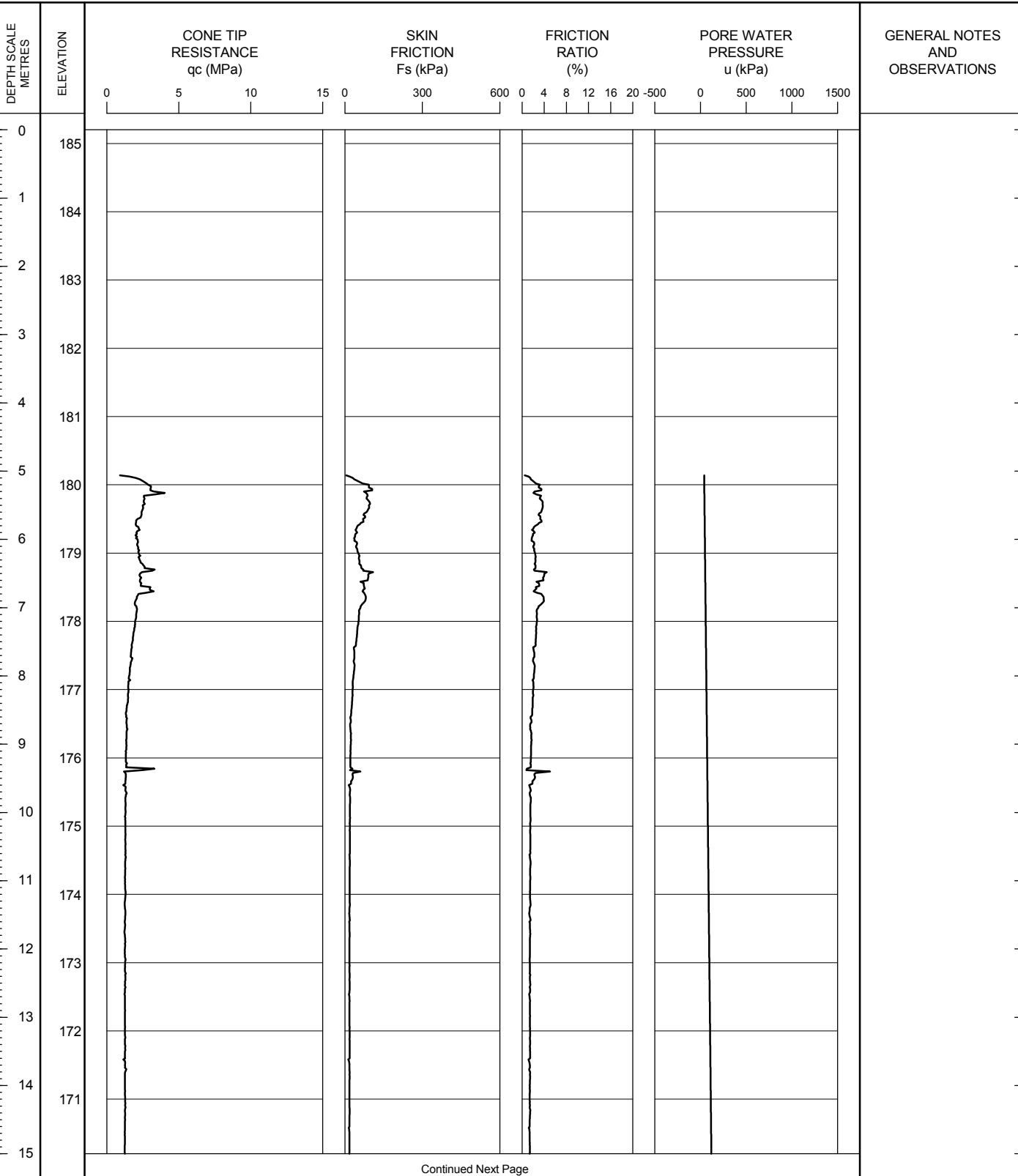
DATUM Geodetic

GROUND SURFACE ELEVATION: 185.2

PREDRILL DEPTH: 5

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: MSO

RECORD OF CONE PENETRATION TEST CPT T10-2

METRIC

PROJECT Windsor-Essex Parkway

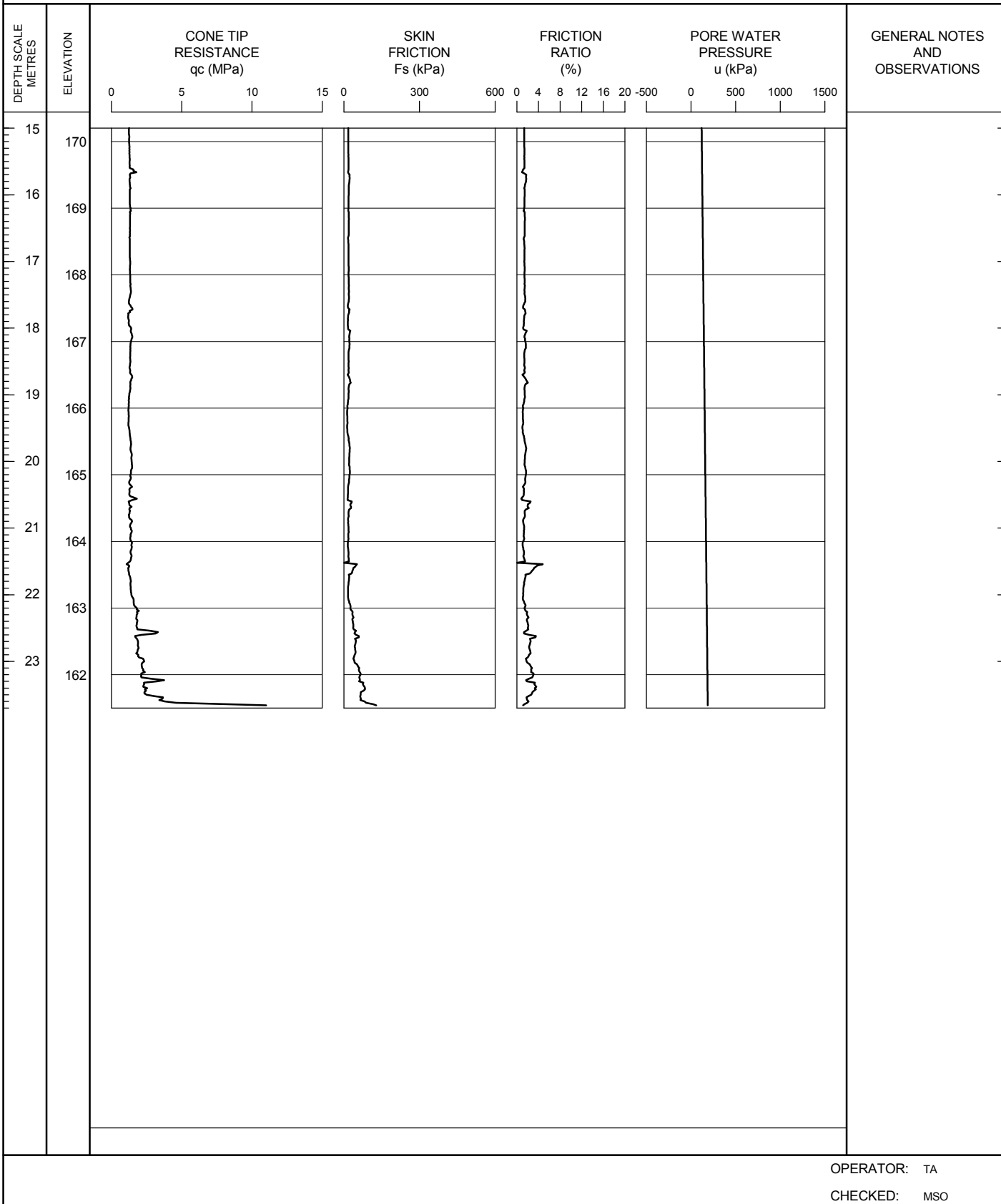
TEST DATE 02/05/2011 - 02/05/2011

SHEET 2 OF 2

LOCATION 4678403.2N; 334089.2E

DATUM Geodetic

GROUND SURFACE ELEVATION: 185.2 PREDRILL DEPTH: 5 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0

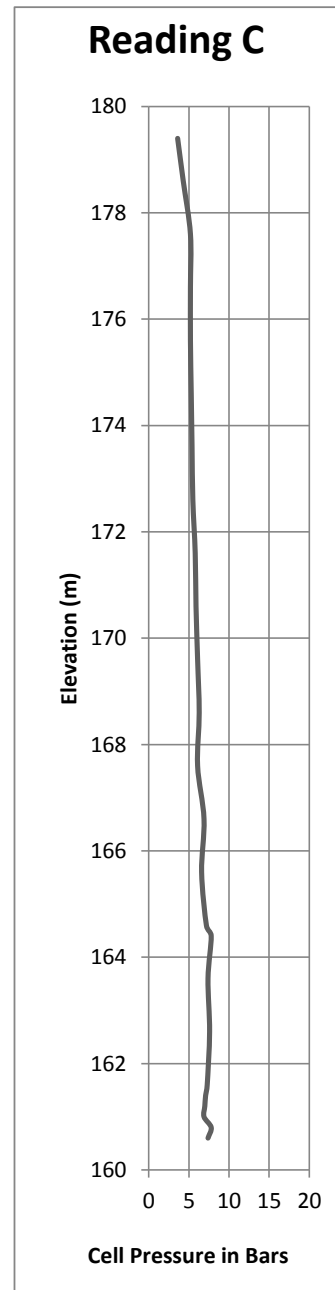
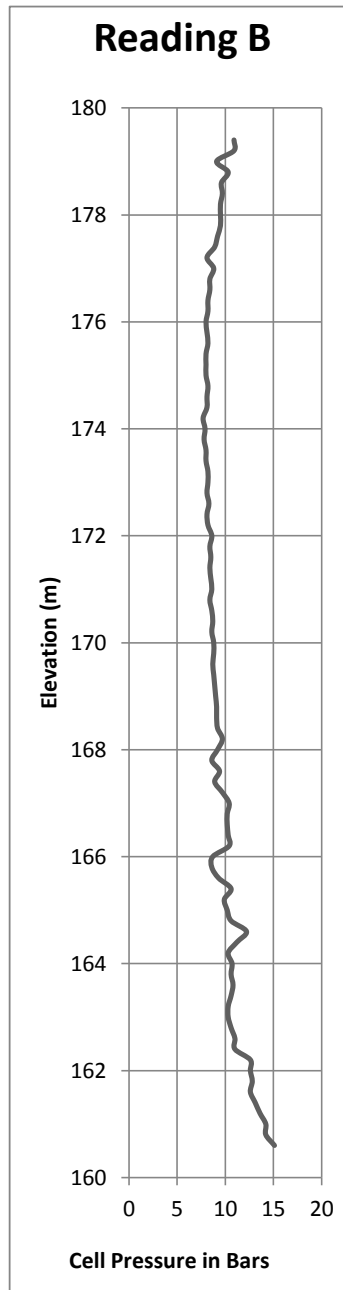
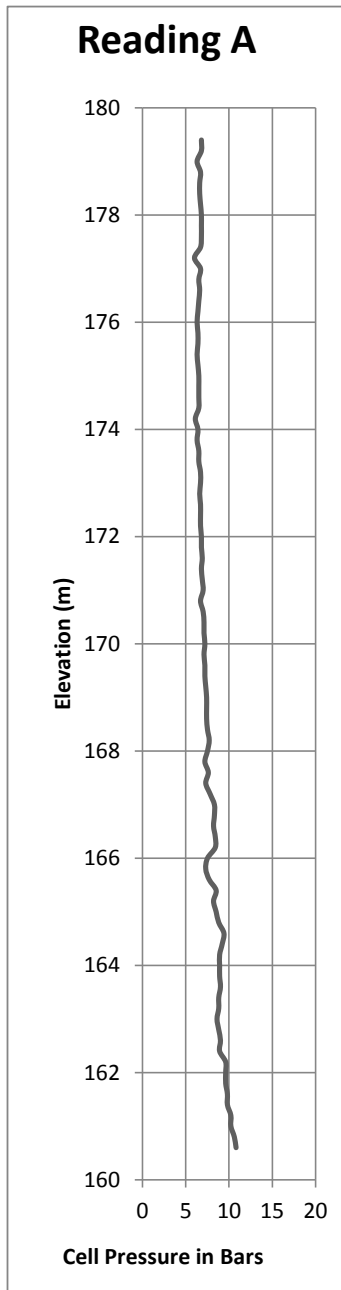


RECORD OF DILATOMETER TEST DMT T10-1

Project : Windsor-Essex Parkway
Location: N 4678412.4; E 334151.5
Ground Surface Elevation : 184.6

Test Date: 7/21/2011
Predrill Depth : 5.0 m
Delta A: 0.10 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.33 Bar



Operator: LC
Checked: DD

RECORD OF BOREHOLE No TB8-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678014.8, E335059.2 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 13 Jul 11 - 13 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE								
								● POCKET PEN.	× LAB VANE								
186.2	Ground Surface						20	40	60	80	100						
0.0	TOPSOIL																
0.2	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel Firm to hard Mottled brown and grey Brown Trace fissures at about elevations 183.74m Grey Trace to some oxidation at about elevation 182.21m Trace oxidation at about elevation 181.68m																
		1	SS	7													
		2	SS	6													
		3	SS	28													
		4	SS	35													
		5	SS	16													
		6	SS	8													
		7	SS	9													
		8	SS	7													
			VT														
9	SS	5															
	VT																
10	SS	1															
		VT															
176.1	END OF BOREHOLE																
10.1	Borehole dry during drilling on July 13, 2011																

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

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 13/06/13

RECORD OF BOREHOLE No TB8-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677983.1, E335030.3 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 12 Jul 11 - 12 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
186.1	Ground Surface							○ UNCONFINED	+	FIELD VANE							
0.0	TOPSOIL							● POCKET PEN.	×	LAB VANE							
0.2	SILTY CLAY TO CLAYEY SILT Some sand trace gravel, trace to some topsoil Firm to hard Mottled brown and grey		1	SS	5												
	Brown		2A, B	SS	5												
	Some fissures at about elevation 183.71m		3	SS	35												
			4	SS	38												
	Grey Some oxidation at about elevation 181.96m		5	SS	21												
	Trace oxidation at about elevation 181.43m		6	SS	14												
			7	SS	9												
			8	SS	6												
			VT														
			9	SS	5												
		10	SS	3													
176.0	END OF BOREHOLE		VT														
10.1	Borehole dry during drilling on July 12, 2011																
				</													

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 13/06/13

RECORD OF BOREHOLE No TB8-3

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677948, E334996.1 ORIGINATED BY NB
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 13 Jul 11 - 13 Jul 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										○		
								● POCKET PEN. × LAB VANE												
185.8	Ground Surface						20	40	60	80	100									
0.0	TOPSOIL																			
185.5	SILTY CLAY TO CLAYEY SILT , trace sand and gravel, trace rootlets and organics Stiff to hard Mottled brown and grey -Grey inclusions at about elevation 183.96m Brown Oxidized at about elevation 183.20m Grey		1	SS	8															
0.3																				
			2	SS	8															
			3	SS	22															
			4	SS	43															
			5	SS	27															
			6	SS	16															

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 13/06/13

RECORD OF BOREHOLE No T11-1

1 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677834.8, E335063.3 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 4 Jun 11 - 5 Jun 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
186.1	Ground Surface																
0.0	TOPSOIL																
185.9	Black																
0.3	SILTY CLAY TO CLAYEY SILT																
	Some sand, trace gravel		1	SS	7												
	Stiff to very stiff																
	Mottled brown and grey		2	SS	16												
183.9	SILTY CLAY TO CLAYEY SILT																
2.3	Some sand, trace gravel		3	SS	32												
	Hard																
	Brown		4	SS	37												
182.3	CLAYEY SILT																
3.8	Some sand, trace gravel		5	SS	16												
	Very stiff to stiff																
	Grey		6	SS	12												
			7	SS	11												
	-free water, inferred sand/gravel layout at about elevation 179.96 m 50mm of Silty Clay, some gravel at about elevation 179.65 m		8	SS	7												
			9	SS	5												
			10	TW	PH												

Continued Next Page

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

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

METRIC

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

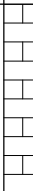

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF BOREHOLE No T11-1

3 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677834.8, E335063.3 ORIGINATED BY SD
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 4 Jun 11 - 5 Jun 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE	20 40 60 80 100	20 40 60 80 100	10 20 30							
29.9	LIMESTONE Coarse to fine grained, laminated Grey to Brown (<i>continued</i>) clay seam at about elevation 155.27m		24	RC			156									SCR = 100%		
			25	RC			155									RQD = 78% TCR = 97% SCR = 85%		
154.1	END OF BOREHOLE Borehole dry during drilling between June 4 and 5, 2011						154											
32.0							153											
							152											
							151											
							150											
							149											
							148											
							147											
							146											
							145											
							144											
							143											
							142											

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF BOREHOLE No T11-2

2 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677869.1, E335106.5 ORIGINATED BY TP
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 29 Apr 11 - 6 May 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	+	FIELD VANE										
						● POCKET PEN.	×	LAB VANE												
						20	40	60	80	100				10	20	30				
169.4	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel (<i>continued</i>)		14	TW	PH		170										1 22 38 39			
16.6			15	TW	PH		170											switched to wash boring at elevation 170.12m		
with trace pink clay nodules at about elevation 165.48 m			16	TW	PH		169												UUC	
			17	TW	PH		168												2 12 46 38	
			18	TW	PH		168												VWP T11-2-P18 installed at elevation 167.68m	
			19	TW	PH		167												T11-2-SM18 installed at N4677867.5, E335102.9 at elevation 167.32m	
			20	TW	PH		166												-increased resistance to drilling	
			21	TW	PH		165												1 16 46 37	
			22	TW	PH		164												4 27 42 21	
			163.1	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel Very Stiff Grey	23		SS	28	163											-end of drilling May 2; continued May 3
22.9	24	SS	20		162											-shelby tube lost down hole; end of drilling May 3				
159.1	FINE SAND Some clay, silt Compact Grey	25	SS		19	160														
26.8		26	SS		25	159														
157.9	CLAYEY SILT Stiff Grey						158													
28.0				157																
156.0			27	SS	13															

Continued Next Page

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

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	SHEAR STRENGTH kPa		W _p	W		W _L	GR SA SI C	
									○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE							
29.9	LIMESTONE Faintly laminated to bedded, fine grained, stylolitic; porous, pitted between elevations 154.23m and 153.86m and elevations 152.74m and 152.33m Light grey (<i>continued</i>)	[Stratigraphic Column Diagram]	28	RC			155						RQD = 21% TCR = 92% SCR = 31%			
			29	RC			154						RQD = 97% TCR = 100% SCR = 97%			
			30	RC			153						RQD = 85% TCR = 100% SCR = 87%			
152.4 33.6	END OF BOREHOLE No groundwater observed during drilling between April 29 and May 6, 2011 due to wash boring Water level measured in Piezometer T11-2-P8 at elevation 184.49 m on May 16, 2011 Water level measured in Piezometer T11-2-P8 at elevation 184.31 m on May 24, 2011 Water level measured in Piezometer T11-2-P8 at elevation 184.12 m on June 25, 2011 Water level measured in Piezometer T11-2-P8 at elevation 183.87 m on July 10, 2011 Water level measured in Piezometer T11-2-P8 at elevation 183.26 m on July 24, 2011 Water level measured in Piezometer T11-2-P8 at elevation 183.84 m on July 29, 2011 Water level measured in Piezometer T11-2-P8 at elevation 183.43 m on August 6, 2011 Water level measured in Piezometer T11-2-P18 at elevation 183.23 m on May 12, 2011 Water level measured in Piezometer T11-2-P18 at elevation 183.35 m on May 16, 2011 Water level measured in Piezometer T11-2-P18 at elevation 184.12 m on May 24, 2011 Water level measured in Piezometer T11-2-P18 at elevation 182.94 m on June 25, 2011 Water level measured in Piezometer T11-2-P18 at elevation 182.76 m on July 10, 2011 Water level measured in Piezometer T11-2-P18 at elevation 182.4 m on July 24, 2011 Water level measured in Piezometer T11-2-P18 at elevation 182.64 m on July 29, 2011 Water level measured in Piezometer T11-2-P18 at elevation 182.40 m on August 6, 2011						152									
							151									
							150									
							149									
							148									
							147									
							146									
							145									
							144									
							143									
							142									

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

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

METRIC

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No T11-2A

2 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677868.8, E335104.6 ORIGINATED BY NB
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 29 Apr 11 - 6 May 11 CHECKED BY MSO

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
	Borehole drilled without sampling (continued)																
170																	
169																	
168																	
167																	
166																	
165																	
164																	
163																	
162																	
161																	
160																	
159																	
158																	
157																	

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF BOREHOLE No T11-2A

3 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677868.8, E335104.6 ORIGINATED BY NB
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 29 Apr 11 - 6 May 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)									
						20 40 60 80 100					10 20 30									
						○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE														
155.5	Borehole drilled without sampling (continued)																			
30.5	END OF BOREHOLE																VWP T11-2-P30 installed at elevavtion 155.48m			
	Water level measured in Piezometer T11-2-P30 at elevation 177.19 m on May 12, 2011						155													
	Water level measured in Piezometer T11-2-P30 at elevation 177.24 m on May 16, 2011						154													
	Water level measured in Piezometer T11-2-P30 at elevation 177.01 m on May 24, 2011						153													
	Water level measured in Piezometer T11-2-P30 at elevation 176.44 m on June 25, 2011						152													
	Water level measured in Piezometer T11-2-P30 at elevation 176.55 m on July 10, 2011						151													
	Water level measured in Piezometer T11-2-P30 at elevation 175.61 m on July 24, 2011						150													
	Water level measured in Piezometer T11-2-P30 at elevation 176.08 m on July 29, 2011						149													
	Water level measured in Piezometer T11-2-P30 at elevation 176.08 m on August 6, 2011						148													
							147													
							146													
							145													
							144													
							143													
							142													

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF BOREHOLE No T11-3

2 OF 3

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677952.8, E334928.6 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 19 Apr 11 - 21 Apr 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE							
170.5																
15.2	CLAYEY SILT Some sand, trace gravel Stiff Grey Occasional Sand Layers Between Elevations 168.73m and 165.68m		14	TW	PH									Oedometer 1 26 42 31		
			15	TW	PH											
			16	TW	PH			×						2 26 36 35		
			17	TW	PH											
			18	TW	PH											
			19	TW	PH									T11-3-SM25 installed at N4677953.6, E334927.3 at elevation 167.17m		
			20	TW	PH			×						1 28 44 27		
			21	TW	PH											
			22	TW	PH									continued by wash boring with casing below elevation 164.44m		
			23	TW	PH									4 18 47 29		
		24	SS	34									unable to push shelby tube at elevation 161.39m			
159.6			25AB	SS	88											
26.2	SANDY SILT Dense Grey															
159.1																
26.7	CLAYEY SILT Some sand, trace gravel Very Stiff Grey		26	SS	19											
			27	SS	16											

Continued Next Page

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

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								○ UNCONFINED	+ FIELD VANE							● POCKET PEN.	× LAB VANE	
154.3 31.5	CLAYEY SILT Some sand, trace gravel Very Stiff Grey (<i>continued</i>) trace pink nodules, possible sand, seams, trace shale fragments at about elevation 155.30 m		28	TW	PH		155							1 11 44 43				
153.2 32.6	LIMESTONE Fine grained, stylolitic, dark grey inclusions, vuggy between elevations 153.68 m and 153.37 m, faintly porous, laminated, fractured Light grey		29	NQ			154							end of drilling April 20, 2011; continued April 21, 2011 RQD = 10% TCR = 100% SCR = 31%				
152.2 33.6	LIMESTONE Fine grained, porous, fractured Light brown		30	NQ			153							RQD = 0% TCR = 100% SCR = 30%				
151.5 34.3	LIMESTONE Fine grained, highly laminated, thick sandstone seam between elevations 152.19 m to 152.15 m Light brown		31	NQ			152							RQD = 27% TCR = 100% SCR = 35%				
148.3 37.5	LIMESTONE Fine grained, porous, vuggy with calcite crystals between elevations 149.05 m and 148.75 m, fossiliferous, stylolitic Brown		32	NQ			151							RQD = 40% TCR = 100% SCR = 40%				
			33	NQ			150							RQD=35% TCR = 100% SCR = 35%				
	END OF BOREHOLE No groundwater observed during drilling between April 19 and 21, 2011 due to wash boring						149											
							148											
							147											
							146											
							145											
							144											
							143											
							142											
							141											

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

2 OF 2

METRIC

				DYNAMIC CONE PENETRATION			
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+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF BOREHOLE No NIL T11-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677879.7, E335010.1 ORIGINATED BY NB
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 7 May 11 - 7 May 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								20 40 60 80 100									10 20 30		
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE											
185.8	Ground Surface															ground surface in vicinity of borehole stripped of topsoil			
0.0	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel Stiff Mottled brown and grey		1	SS	8														
			2	SS	8														
	trace organic matters (rootlets) at about elevation 184.07 m																		
183.5																			
2.3	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel Hard Brown		3	SS	35														
182.6																			
3.2	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel Hard to stiff Grey prominent oxidized vertical and horizontal fissures at elevation 182.25 m		4	SS	34														
			5	SS	19														
			6	SS	11														
180.7																			
5.0	END OF BOREHOLE Continued with Nilcon Vane Borehole dry during drilling on May 7, 2011																		

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

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF BOREHOLE No NIL T11-2

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4677870, E335107 ORIGINATED BY NB
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE 5 May 11 - 5 May 11 CHECKED BY MSO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.	× LAB VANE								
186.0	Ground Surface																		
0.0	TOPSOIL Organic clay Black															-installed slope inclinometer casing (T11-2-SI)			
0.2	SANDY SILT Some clay, trace gravel Loose to compact Mottled brown and grey		1	SS	7														
	vertical fissures with rootlets at about elevation 184.25 m		2	SS	21														
183.7																			
2.3	SANDY SILT Some clay, trace gravel Dense Brown		3	SS	32														
182.9																			
3.0	SANDY SILT Some clay, trace gravel Dense to compact Grey		4	SS	31														
			5	SS	16														
			6	SS	12														
180.9	END OF BOREHOLE Continued with Nilcon Vane																		
5.0	Borehole dry during drilling on May 5, 2011																		

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

ONTARIO MOT TUNNEL T11 BOREHOLES-MODIFIED.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF NILCON VANE TEST NIL T11-1

Project : Windsor-Essex Parkway

Test Date: 5/7/2011

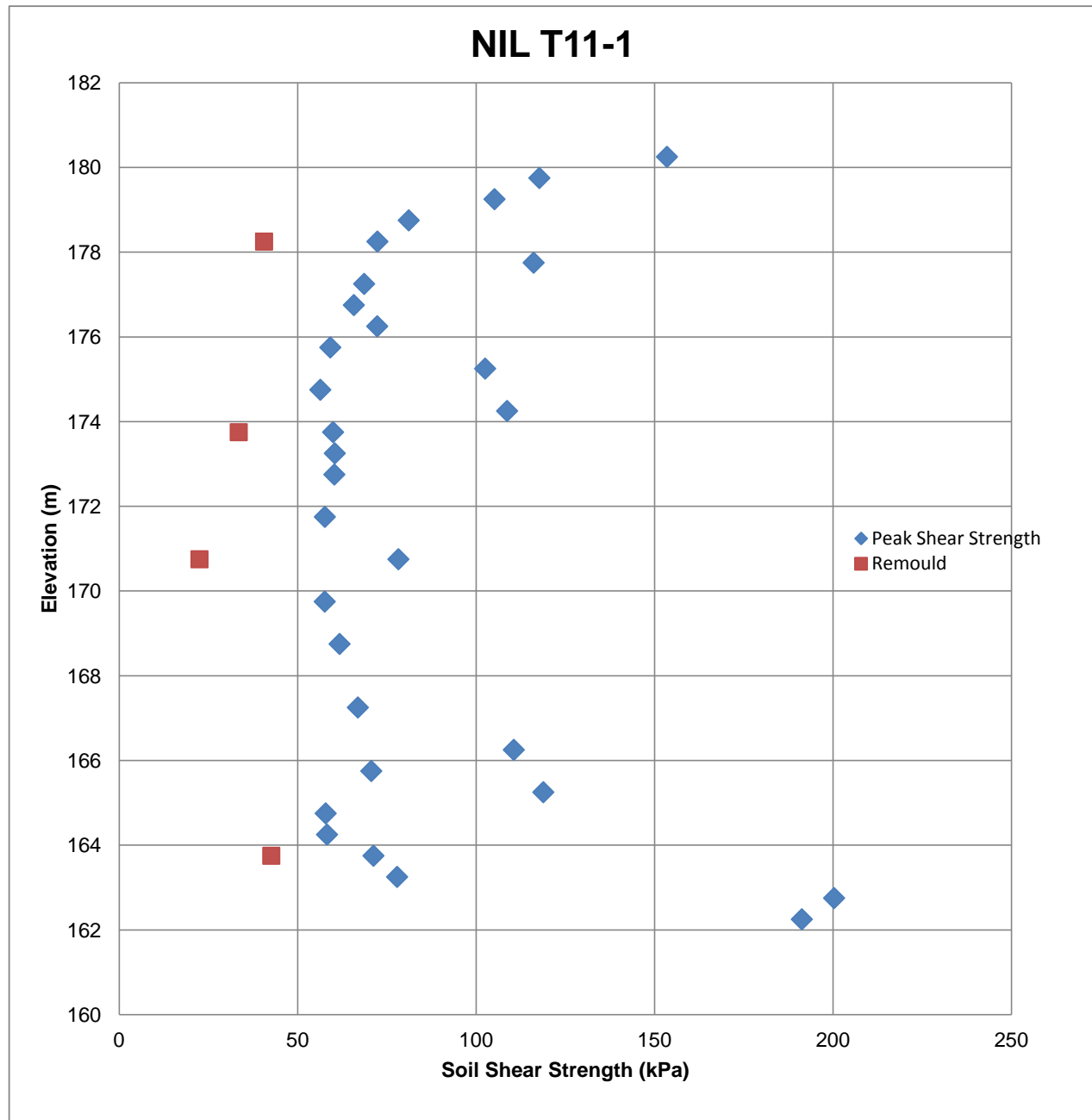
Sheet 1 of 1

Location: N4677879.7; E335010.1

Predrill Depth : 5 m

Datum Geodetic

Ground Surface Elevation: 185.8 m



Operator: NB

Checked: DD

RECORD OF NILCON VANE TEST NIL T11-2

Project : Windsor-Essex Parkway

Test Date: 5/5/2011

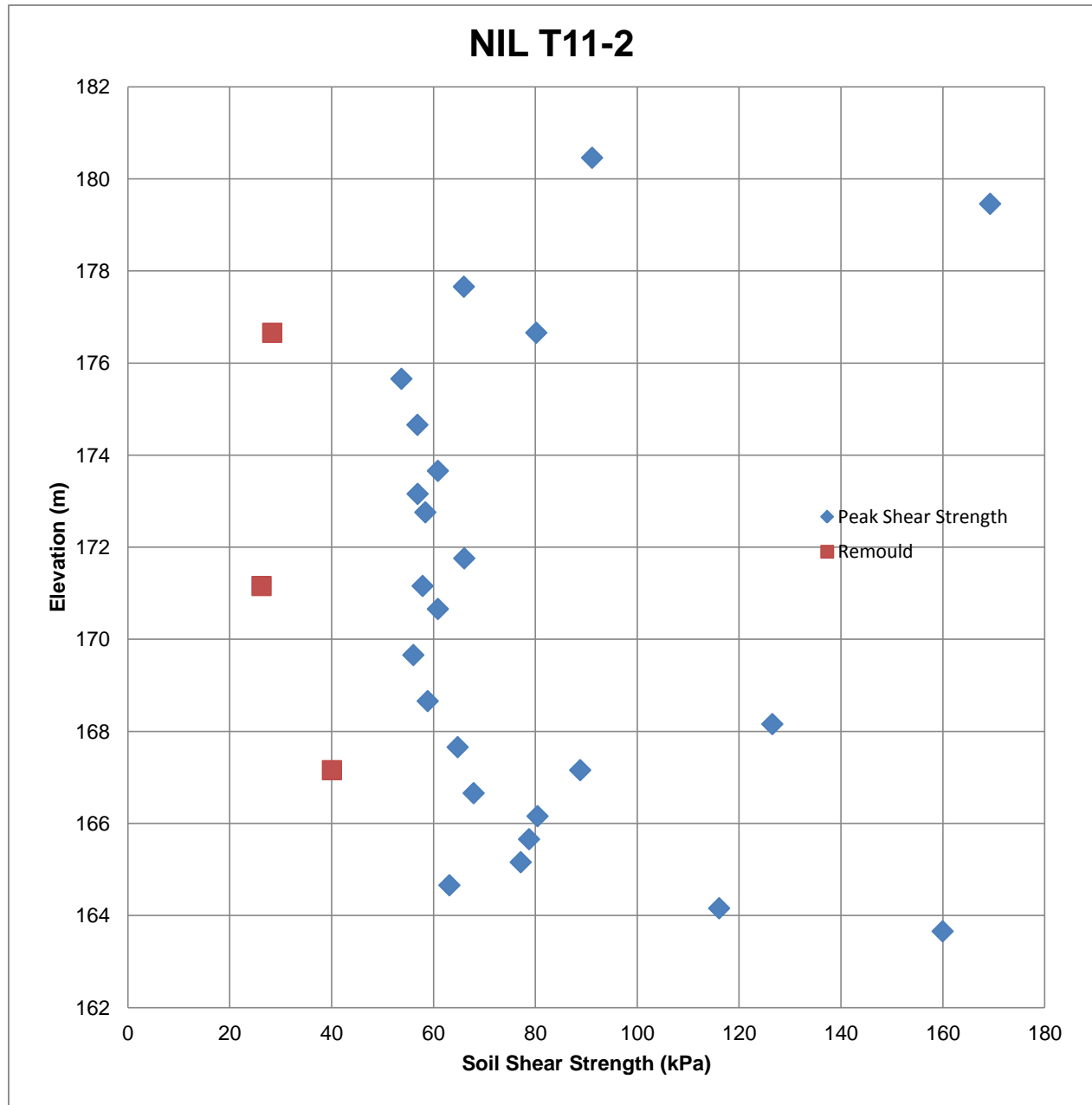
Sheet 1 of 1

Location: N4677870; E335107

Predrill Depth : 5 m

Datum Geodetic

Ground Surface Elevation: 186.0 m



Operator: NB

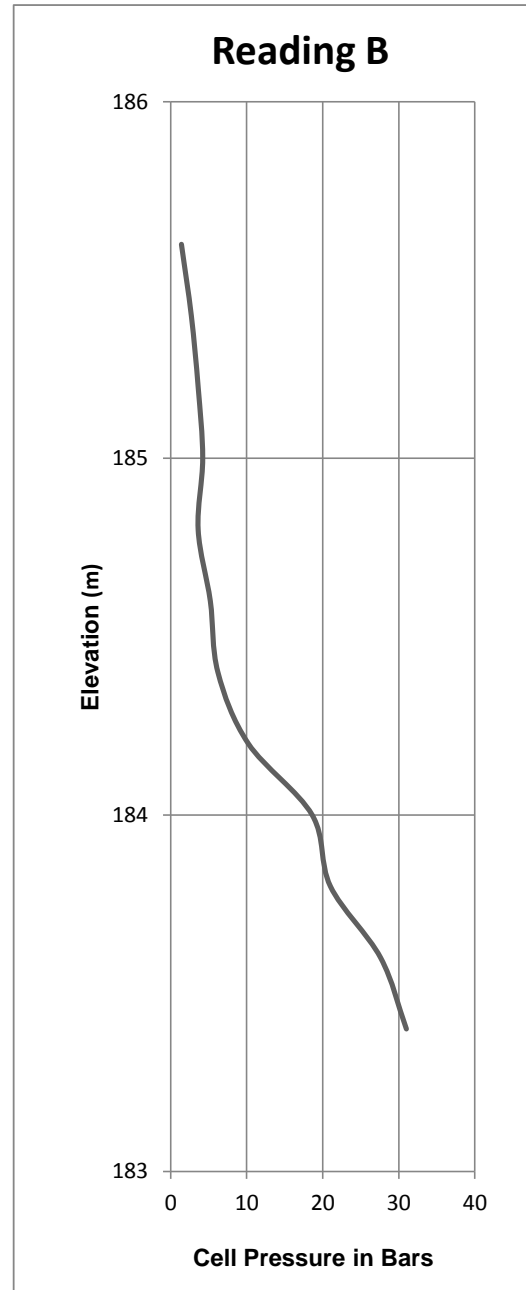
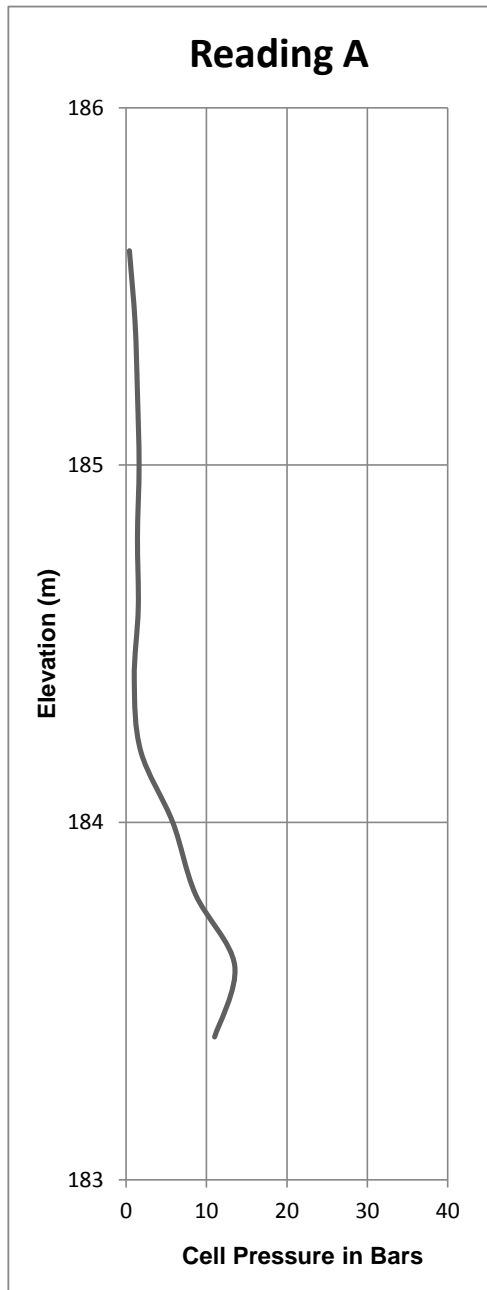
Checked: DD

RECORD OF DILATOMETER TEST DMT T11-1 Shallow

Project : Windsor-Essex Parkway
Location: N4677882.6; E335010.7
Ground Surface Elevation : 185.8

Test Date: 4/27/2001
Predrill Depth : 0.2 m
Delta A: 0.19 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.37 Bar



Note DMT refusal at elevation 183.2m. Redrilled to elevation 181.2m.
Resumed DMT at elevation 181.0 m.

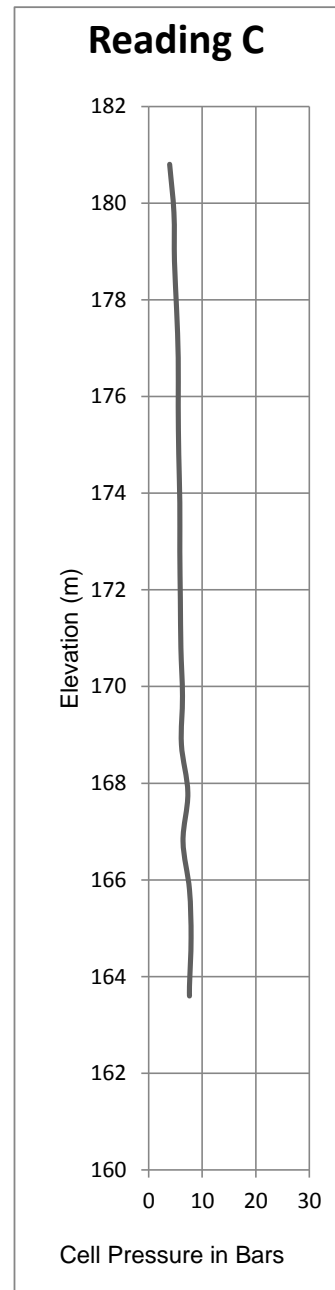
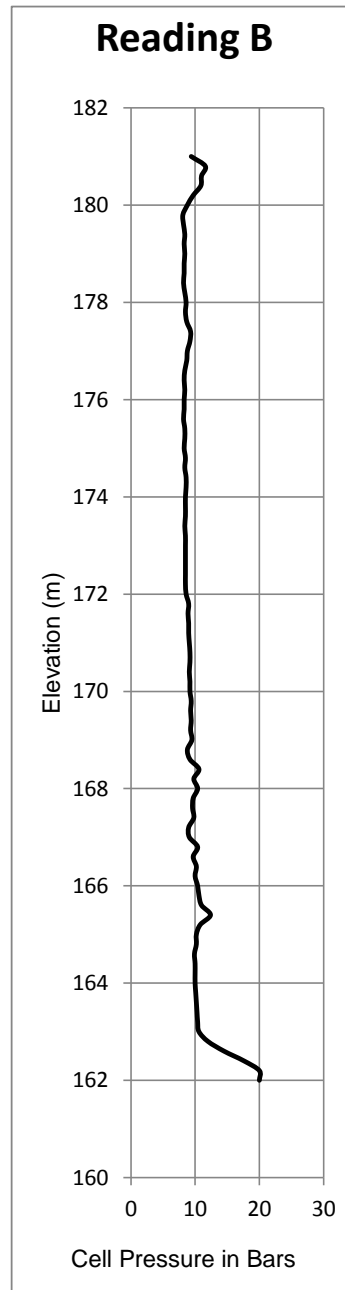
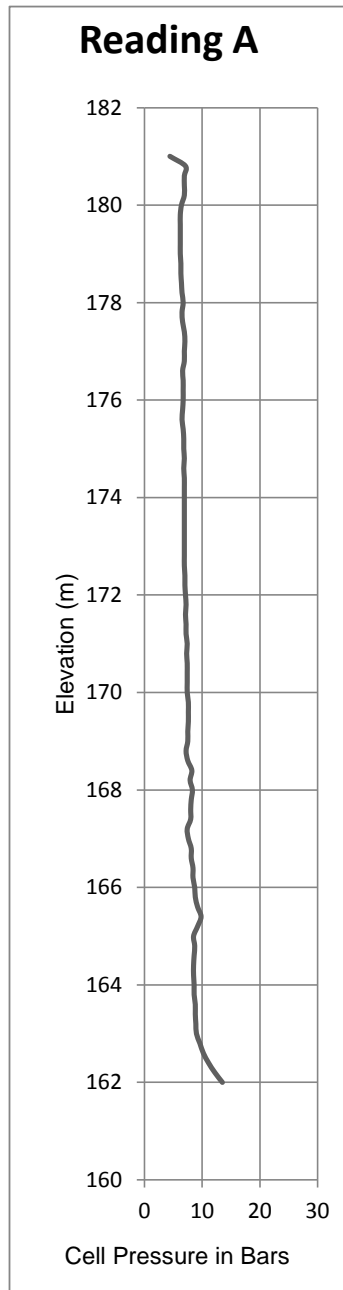
Operator: LC
Checked: DD

RECORD OF DILATOMETER TEST DMT T11-1 Deep

Project : Windsor-Essex Parkway
Location: N4677882.6; E335010.7
Ground Surface Elevation : 185.8

Test Date: 4/27/2001
Predrill Depth : 4.6 m
Delta A: 0.19 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.37 Bar



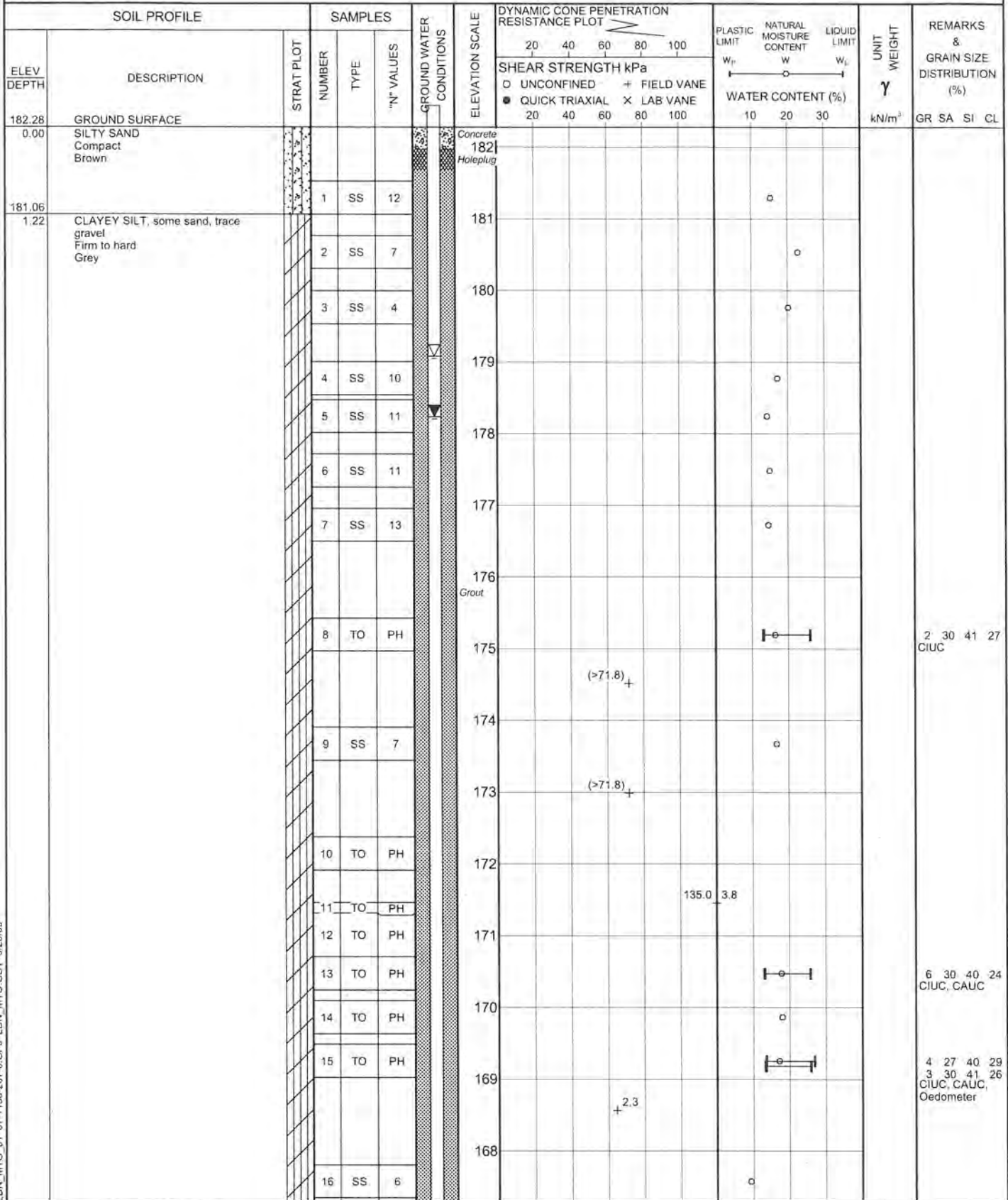
Note: DMT resumed at elevation 181.0 m

Operator: LC

Checked: DD

Appendix B Borehole Logs from Previous Investigations

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 145		1 OF 4	METRIC
W.P.	LOCATION	N 4681447.2, E 331247.9		ORIGINATED BY SM	
DIST WEST HWY 401/3	BOREHOLE TYPE	POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC	DATE	July 28, 2008 - July 30, 2008		CHECKED BY <i>SJB</i>	



LDN MTO.01 07-1130-207-0.GPJ LDN MTO.GDT 8/29/09

Continued Next Page

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

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No 145		2 OF 4 METRIC	
W.P. _____		LOCATION <u>N 4681447 2 E 331247 9</u>		ORIGINATED BY <u>SM</u>	
DIST <u>WEST</u> HWY <u>401/3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>BRS</u>	
DATUM <u>GEODETIC</u>		DATE <u>July 28, 2008 - July 30, 2008</u>		CHECKED BY <u>SJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES									
	CLAYEY SILT, some sand, trace gravel Firm to hard Grey						167		+ 1.4					
			17	TO	PH		166							
									+ 2.0					
			18	SS	6		165							
							164							
			19	TO	PH		163		+ 1.7					
									+ 3.1					
			20	SS	11		162							
							161		+ 1.4					
			21	SS	37		160							
							159							
			22	SS	28		158							
							157							
			23	SS	9		156		+ 1.5					
							155							
			24	TO	PH		154		+ 2.8					
			25	SS	11		153							

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

Continued Next Page

+³, X³: Numbers refer to Sensitivity ○³% STRAIN AT FAILURE

RECORD OF BOREHOLE No 145

3 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4681447.2 ; E 331247.9

ORIGINATED BY SM

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

DATUM GEODETIC

DATE July 28, 2008 - July 30, 2008

CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100					
	CLAYEY SILT, some sand, trace gravel Firm to hard Grey		26	TO	PH		152								
			27	SS	50/50mm		151								
							150								
149.51			28	SS	72/75m		149								
32.77	LIMESTONE, fresh, medium strong, weakly laminated to laminated, very fine to fine grained, faintly porous Grey to brown (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		29	NQ			148	100	85	86					
			30	NQ			147	100	74	70					
			31	NQ			146	100	63	63					
145.55	END OF BOREHOLE														
36.73	Water level in borehole at about elev. 179.08m during drilling on July 28, 2008. Water level measured in deep piezometer at elev. 179.08m on July 31, 2008. Water level measured in deep piezometer at elev. 179.24m on August 11, 2008. Water level measured in deep piezometer at elev. 180.30m on September 19, 2008. Water level measured in deep piezometer at elev. 180.35m on September 22, 2008. Water level measured in deep piezometer at elev. 177.31m on November 11, 2008. Water level measured in deep piezometer at elev. 178.23m on January 28, 2009.														

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 145

SHEET 4 OF 4

LOCATION: N 4681447.2 ,E 331247.9

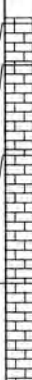
DRILLING DATE: July 28, 2008 - July 30, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No	PENETRATION RATE (m/min)	COLOUR FLUSH % RETURN	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols										DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
				DEPTH (m)					RECOVERY		R Q D %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec					
									TOTAL CORE %	SOLID CORE %			DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION						
									80 60 40 20	80 60 40 20			80 60 40 20			0 20 40 60				
		ROCK SURFACE		149.51 32.77																
33	MUD ROTARY NQ ROCK CORE	LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous, light grey		33.11	1			149										Broken Core		
		LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous, grey		148.76 33.52												JN,CU,SM CI				
34		LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous, grey														JN,PL,SM CI				
		LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous with occasional stylolites, whitish grey		147.86 34.42	2											JN,CU,Ro CI				
35		LIMESTONE, fresh, medium strong, laminated, very fine grained, faintly porous, light tan to grey														Broken Core				
		LIMESTONE, fresh, medium strong, weakly laminated, fine grained, faintly porous, brown, zone of hydrocarbon staining at 36.06m (150mm thick)		146.59 35.69	3											Broken Core				
36		END OF DRILLHOLE		145.55 36.73				146												
37																				
38																				
39																				
40																				
41																				
42																				
43																				
44																				
45																				
46																				
47																				

DEPTH SCALE

1 : 75



LOGGED: SG

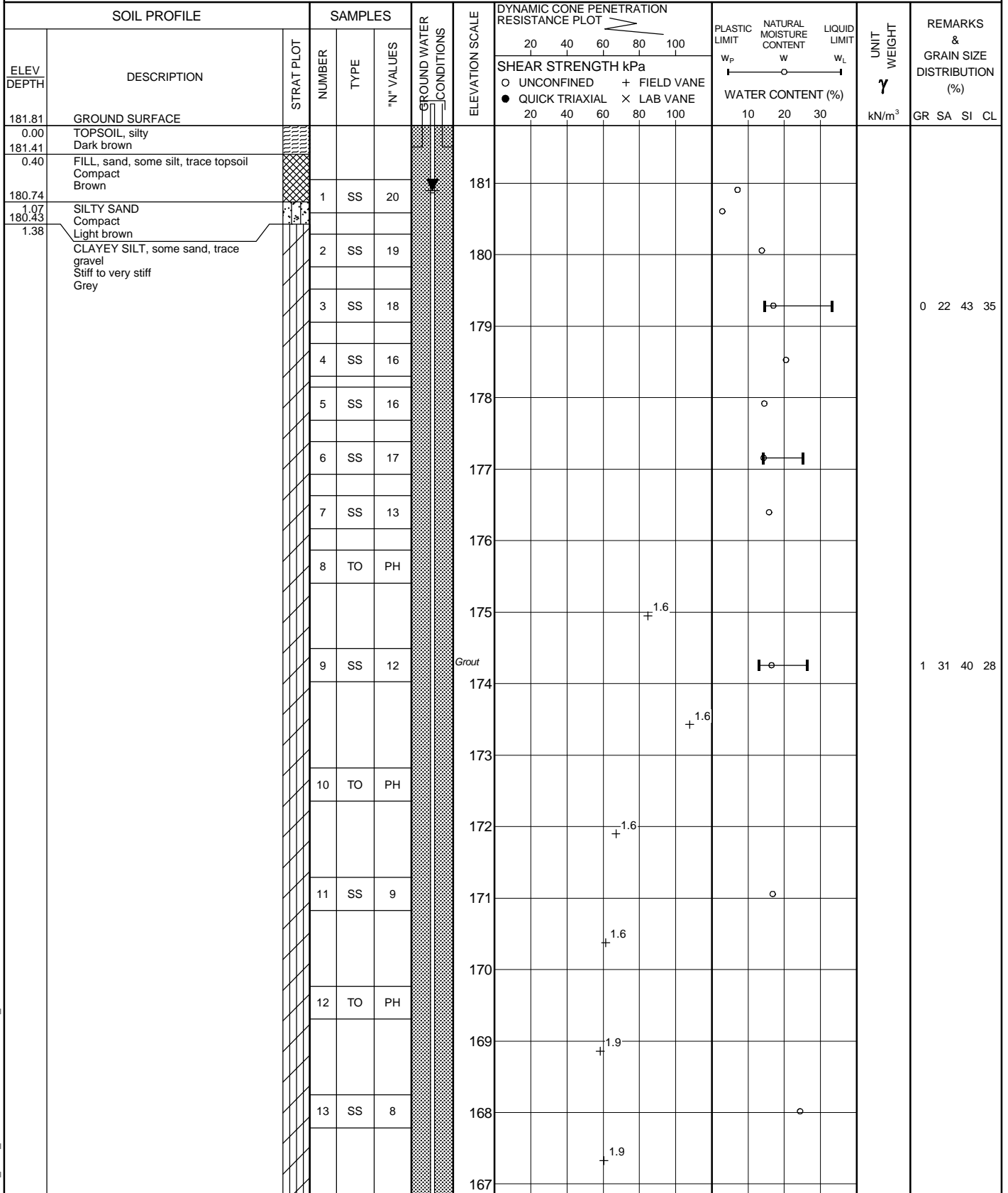
CHECKED: SJB

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 145A		1 OF 1	METRIC
W.P. _____		LOCATION N 4681447.2 :E 331247.9		ORIGINATED BY SM	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, HOLLOW STEM		COMPILED BY BRS	
DATUM GEODETIC		DATE July 30, 2008		CHECKED BY <i>SJB</i>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	"N" VALUES								
182.28 0.00	SOIL CONDITIONS INFERRED FROM BOREHOLE No. 145 GROUND SURFACE SILTY SAND Compact Brown					Concrete	182						
181.06 1.22	CLAYEY SILT, some sand, trace gravel Firm to hard Grey					Cuttings	181						
							180						
							179						
							178						
							177						
							176						
							175						
							174						
173.14 9.14	END OF BOREHOLE Water level measured in shallow piezometer at elev. 180.15m on September 19, 2008. Water level measured in shallow piezometer at elev. 180.28m on September 22, 2008. Water level measured in shallow piezometer at elev. 180.56m on January 28, 2009.					Sand Piezometer							

LDN MTO_01 07-1130-207-0.GPJ LDN MTO.GDT 5/29/09

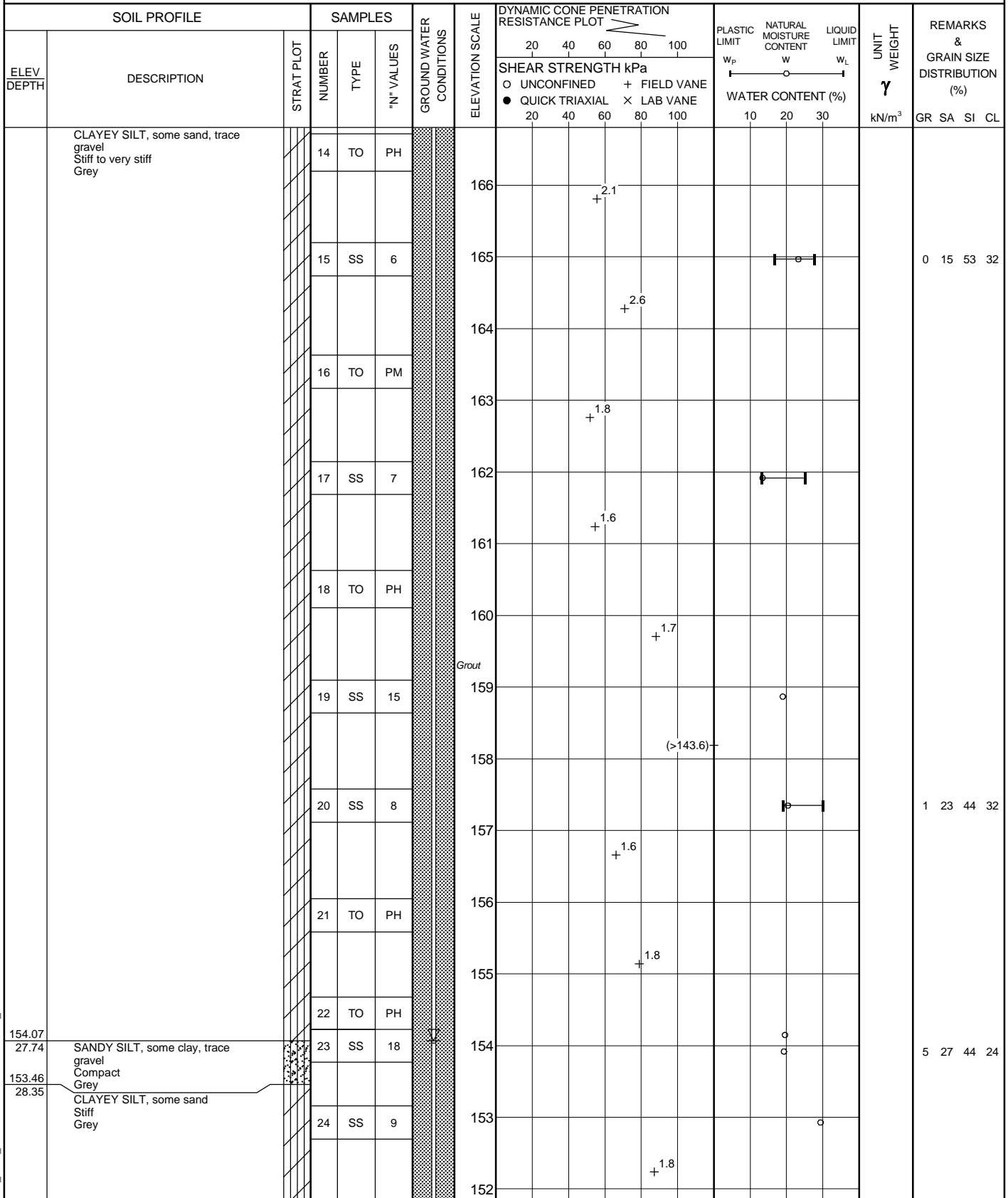
PROJECT 09-1132-0080 **RECORD OF BOREHOLE No 334** 1 OF 4 **METRIC**
W.P. _____ LOCATION N 4681379.6 ; E 331322.2 ORIGINATED BY MR
DIST WEST HWY 401 / 3 BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC COMPILED BY LMK/DMB
DATUM GEODETIC DATE December 18, 2009 - December 21, 2009 CHECKED BY _____



Continued Next Page

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

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 334		2 OF 4		METRIC	
W.P. _____		LOCATION <u>N 4681379.6 ; E 331322.2</u>		ORIGINATED BY <u>MR</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 18, 2009 - December 21, 2009</u>		CHECKED BY _____			



LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

Continued Next Page

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

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 334		3 OF 4		METRIC	
W.P. _____		LOCATION <u>N 4681379.6 ; E 331322.2</u>		ORIGINATED BY <u>MR</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 18, 2009 - December 21, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
							20	40	60	80	100									
151.02	CLAYEY SILT, some sand Stiff Grey		25	TO	PH															
30.79	SANDY SILT, some gravel, trace clay Very dense Grey		26	TO	PH															
			27	SS	35/ 75mm															
148.58	LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous Light grey to brown (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		28	SS	50/ 25mm															
33.23			29	NQ RC	-		89	58	26											
			30	NQ RC	-		98	96	94											
			31	NQ RC	-		T.C.R. (%) 100	S.C.R. (%) 92	R.Q.D. (%) 92											
			32	NQ RC	-		100	97	97											
143.56	END OF BOREHOLE																			
38.25	Groundwater encountered at about elev. 154.1m during drilling between December 18 and 21, 2009. Water level measured at elev. 180.90 on February 24, 2010. Water level measured at elev. 180.90 on January 6, 2010.																			

PROJECT: 09-1132-0080

RECORD OF DRILLHOLE: 334

SHEET 4 OF 4

LOCATION: N 4681379.6 ;E 331322.2

DRILLING DATE: December 18, 2009 - December 21, 2009

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: LANTECH

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN	FLUSH	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.										HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)		NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION	10 ⁻⁸	10 ⁻⁶	10 ⁻⁴	10 ⁻²	2	4	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
				TOTAL CORE % 80 60 40 20						SOLID CORE % 80 60 40 20	DIP w.r.t. CORE AXIS 0 30 60 90																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
		ROCK SURFACE		148.59																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		</

DEPTH SCALE

1 : 75



LOGGED: SG

CHECKED:

LDN_ROCK_03 09-1132-0080-ROCK.GPJ GLDR LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>07-1130-207-0</u>			RECORD OF BOREHOLE No CPT-144			1 OF 1			METRIC		
W.P. _____			LOCATION <u>N 4681363.6 E 331279.2</u>			ORIGINATED BY <u>CC</u>					
DIST <u>WEST</u> HWY <u>401/3</u>			BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>			COMPILED BY <u>BRS</u>					
DATUM <u>GEODETIC</u>			DATE <u>August 1, 2008</u>			CHECKED BY <u>SJB</u>					

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT <div style="text-align: center;"> </div>	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES								
181.34	GROUND SURFACE												
0.00	FILL, silty fine sand and crushed gravel Brown						181						
180.58	SILTY CLAY, trace sand, trace gravel Firm to stiff Grey		1	SS	6		180						
0.76			2	SS	10		179						
			3	SS	13		178						
			4	SS	10		177						
			5	SS	8								
			6	SS	10								
176.31	END OF BOREHOLE												
5.03	Borehole dry during drilling on August 1, 2008.												

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-335		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4681416.4 ; E 331210.7</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 16, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w _p	w	w _L		GR	SA	SI	CL
182.27	GROUND SURFACE																			
0.10	TOPSOIL, sandy Black																			
	SILTY FINE SAND Compact Brown to grey		1	SS	22															
180.90																				
1.37	CLAYEY SILT, some sand, trace gravel, with occasional silt partings																			
	Stiff to very stiff Grey		2	SS	13															
179.37			3	SS	24															
2.90	END OF BOREHOLE																			
	Borehole dry during drilling on December 16, 2009.																			

LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-144

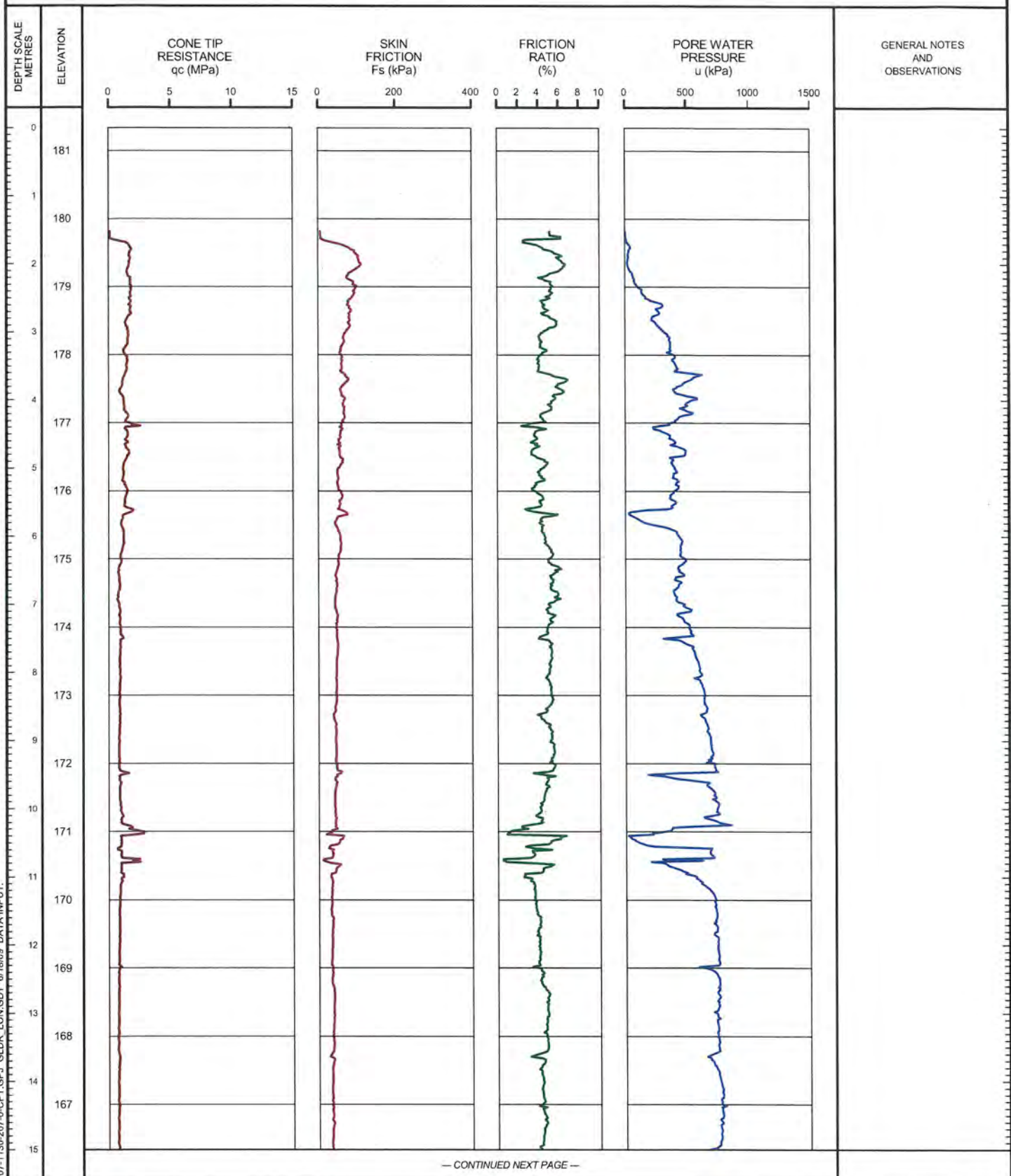
SHEET 1 OF 2

LOCATION: N 4681363.6 ; E 331279.2

TEST DATE: August 1, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.53m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1: 75



OPERATOR: CC

CHECKED: *SS*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-144

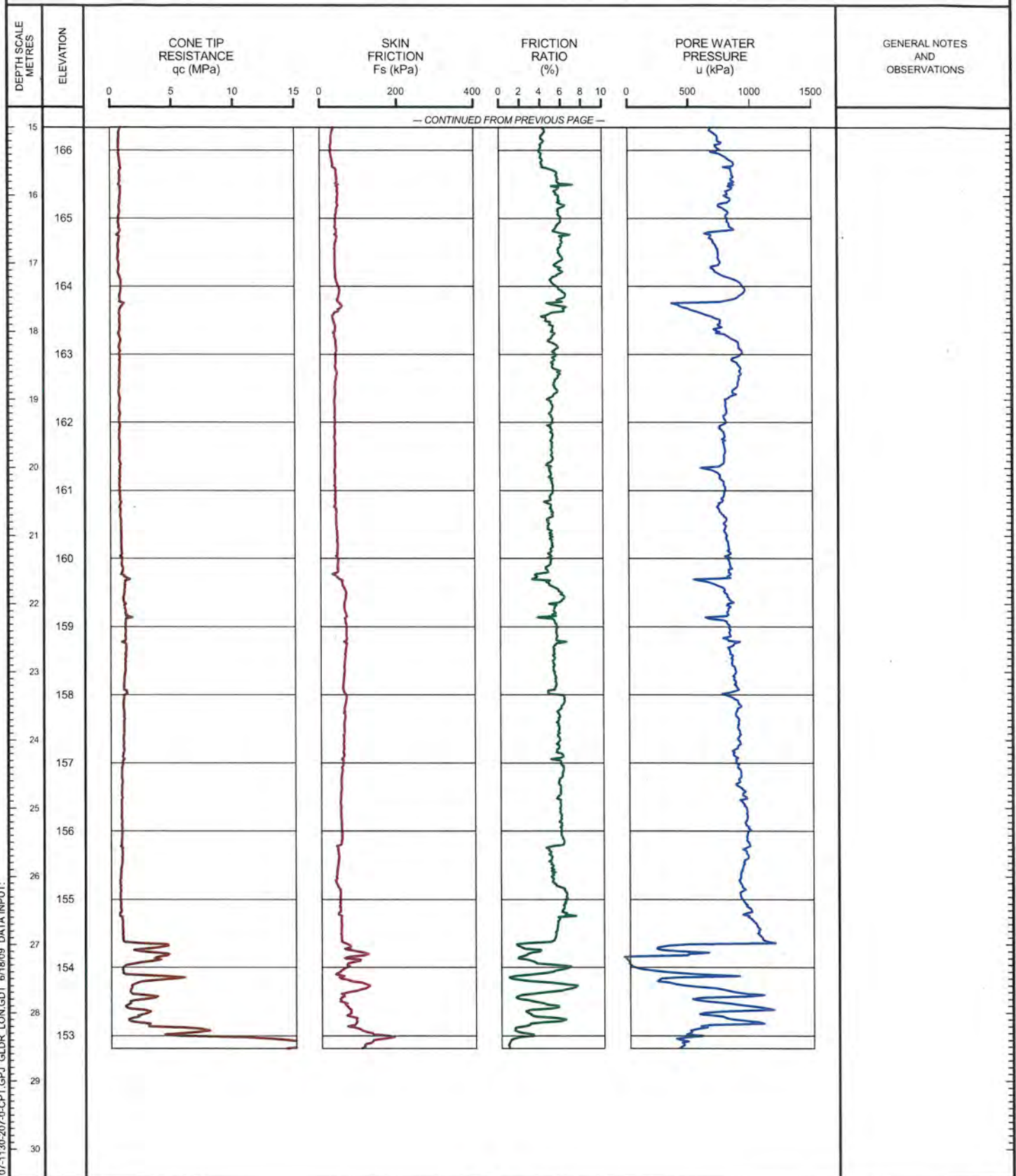
SHEET 2 OF 2

LOCATION: N 4681363.6 ; E 331279.2

TEST DATE: August 1, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.53m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SSB*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-145

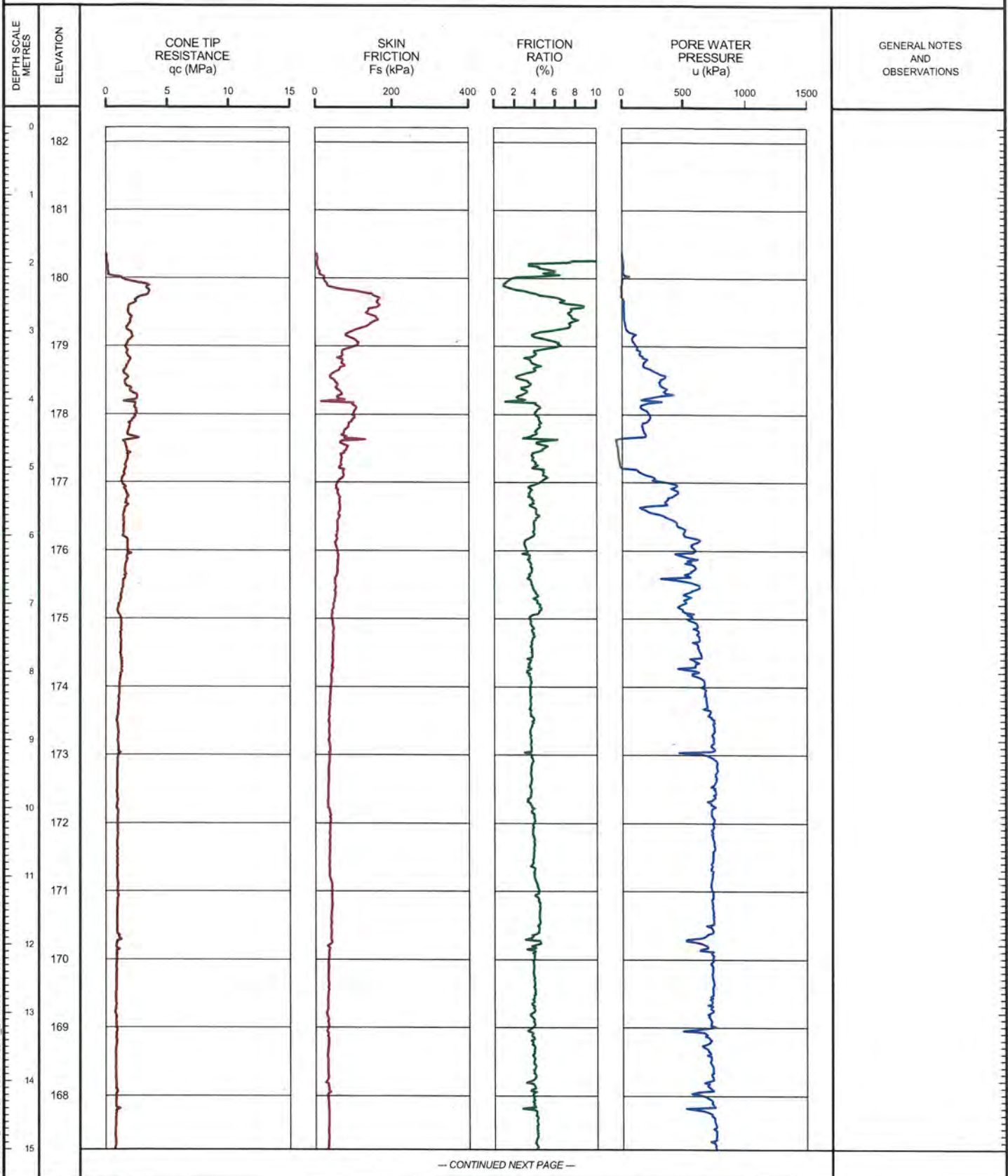
SHEET 1 OF 2

LOCATION: N 4681442.8 E 331248.2

TEST DATE: September 3, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.88m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LON_CPT_01_07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE
1 : 75OPERATOR: CC
CHECKED: *SJS*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-145

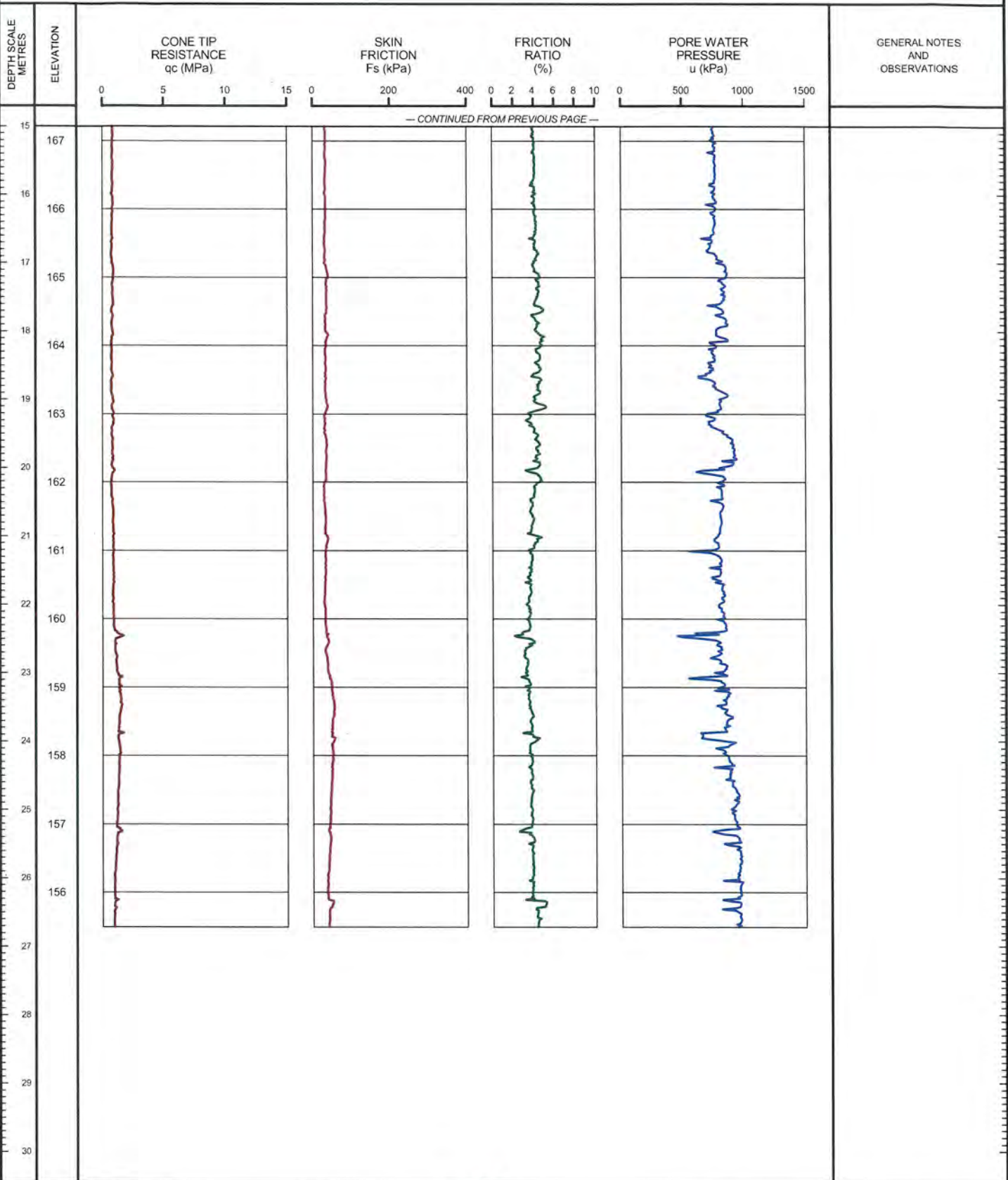
SHEET 2 OF 2

LOCATION: N 4681442.8 ; E 331248.2

TEST DATE: September 3, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.88m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: SSB

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-335

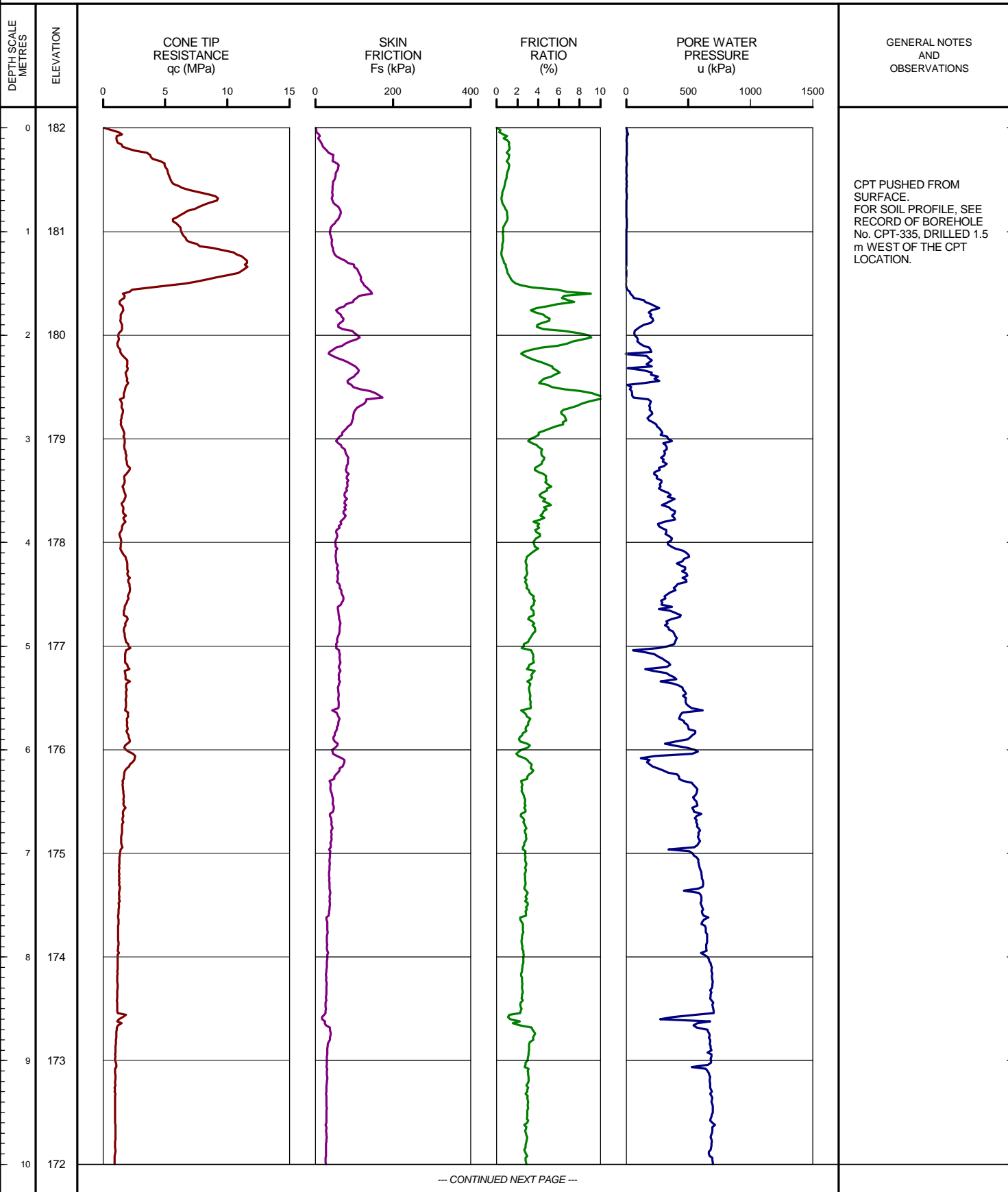
SHEET 1 OF 3

LOCATION: N 4681416.4 ;E 331210.7

TEST DATE: December 16, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 182.27m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-335

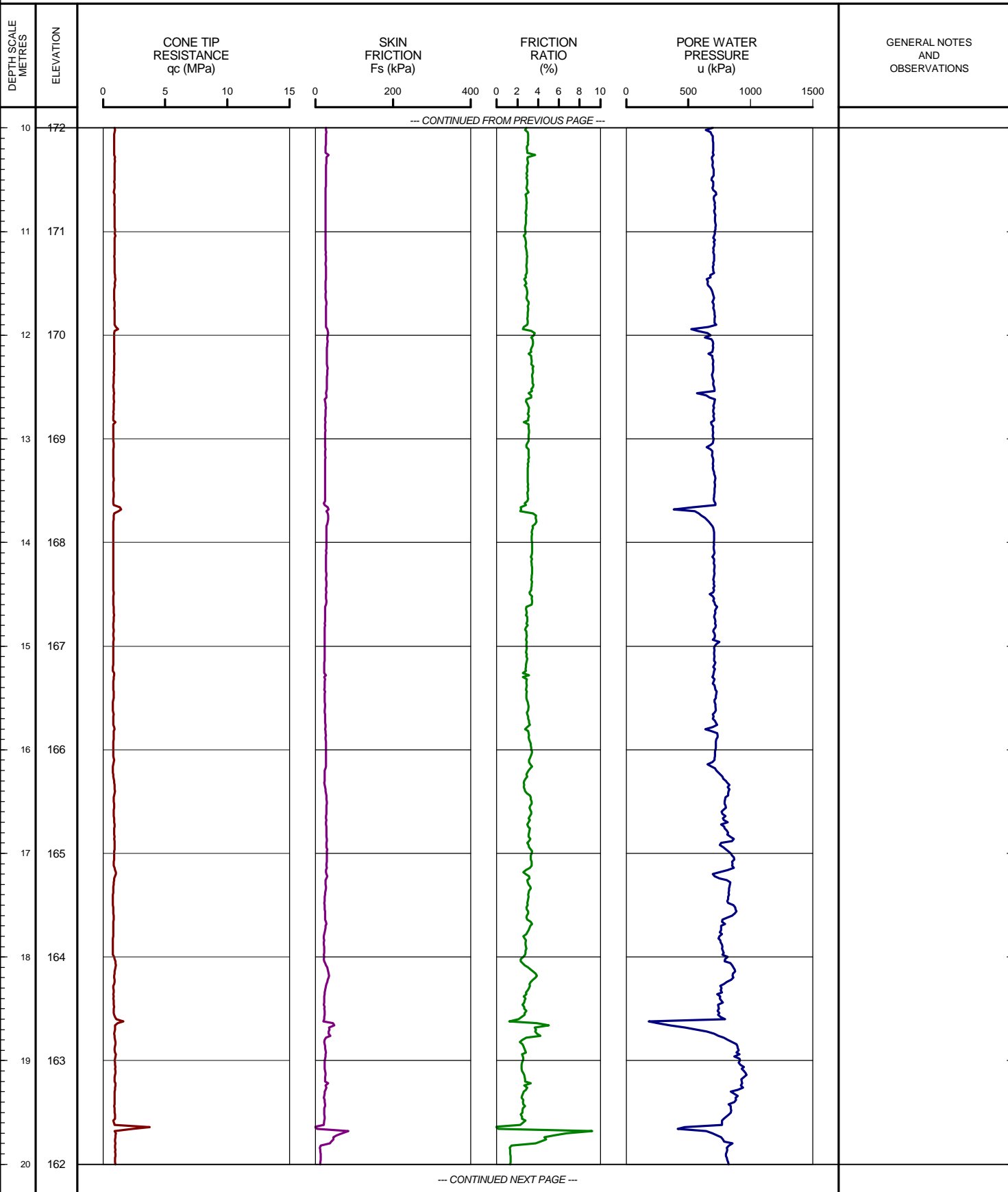
SHEET 2 OF 3

LOCATION: N 4681416.4 ;E 331210.7

TEST DATE: December 16, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 182.27m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-335

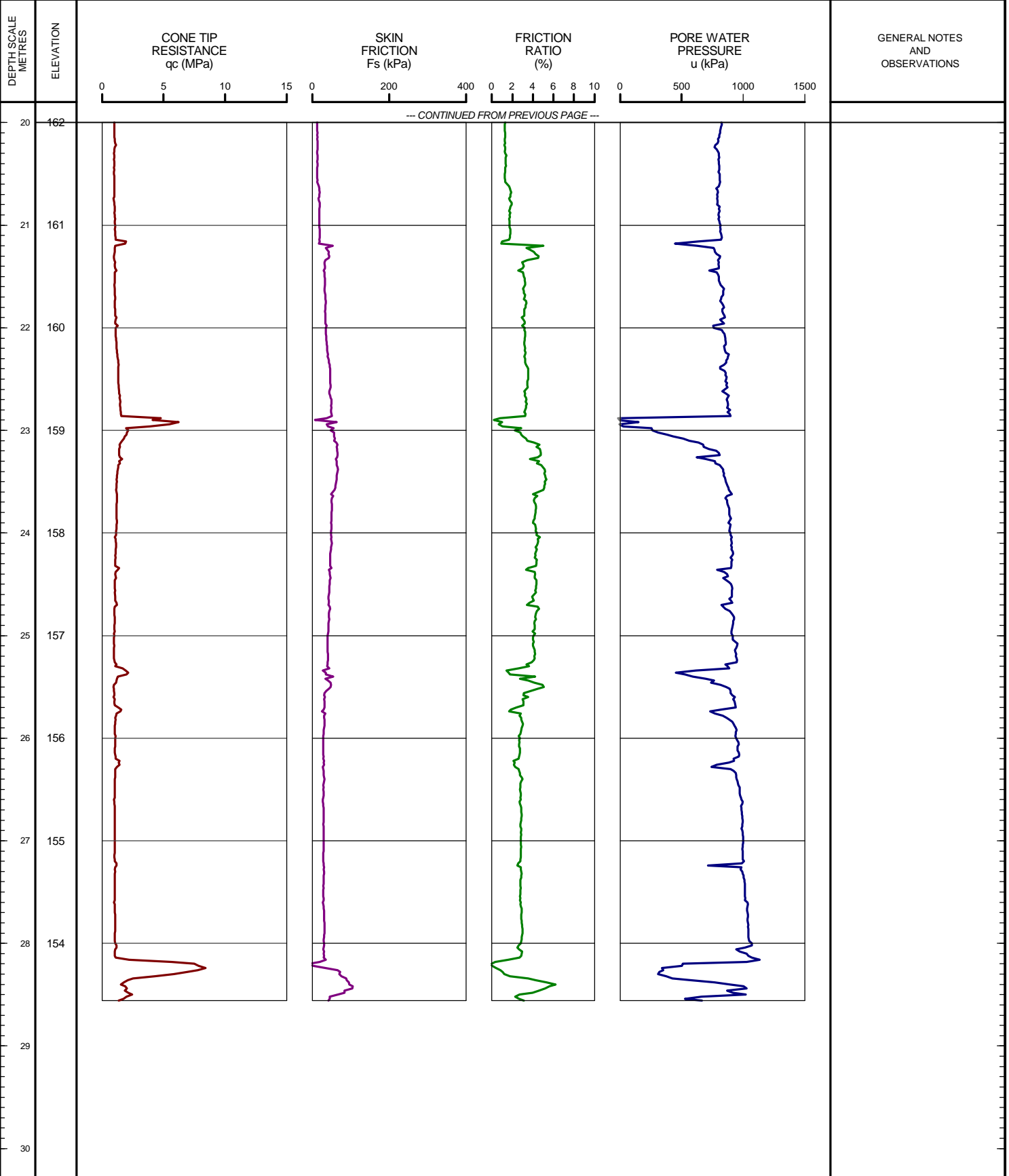
SHEET 3 OF 3

LOCATION: N 4681416.4 ;E 331210.7

TEST DATE: December 16, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 182.27m PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT 07-1130-207-0

RECORD OF BOREHOLE No 139

1 OF 4

METRIC

W.P. LOCATION N 4680787.5 :E 331599.3

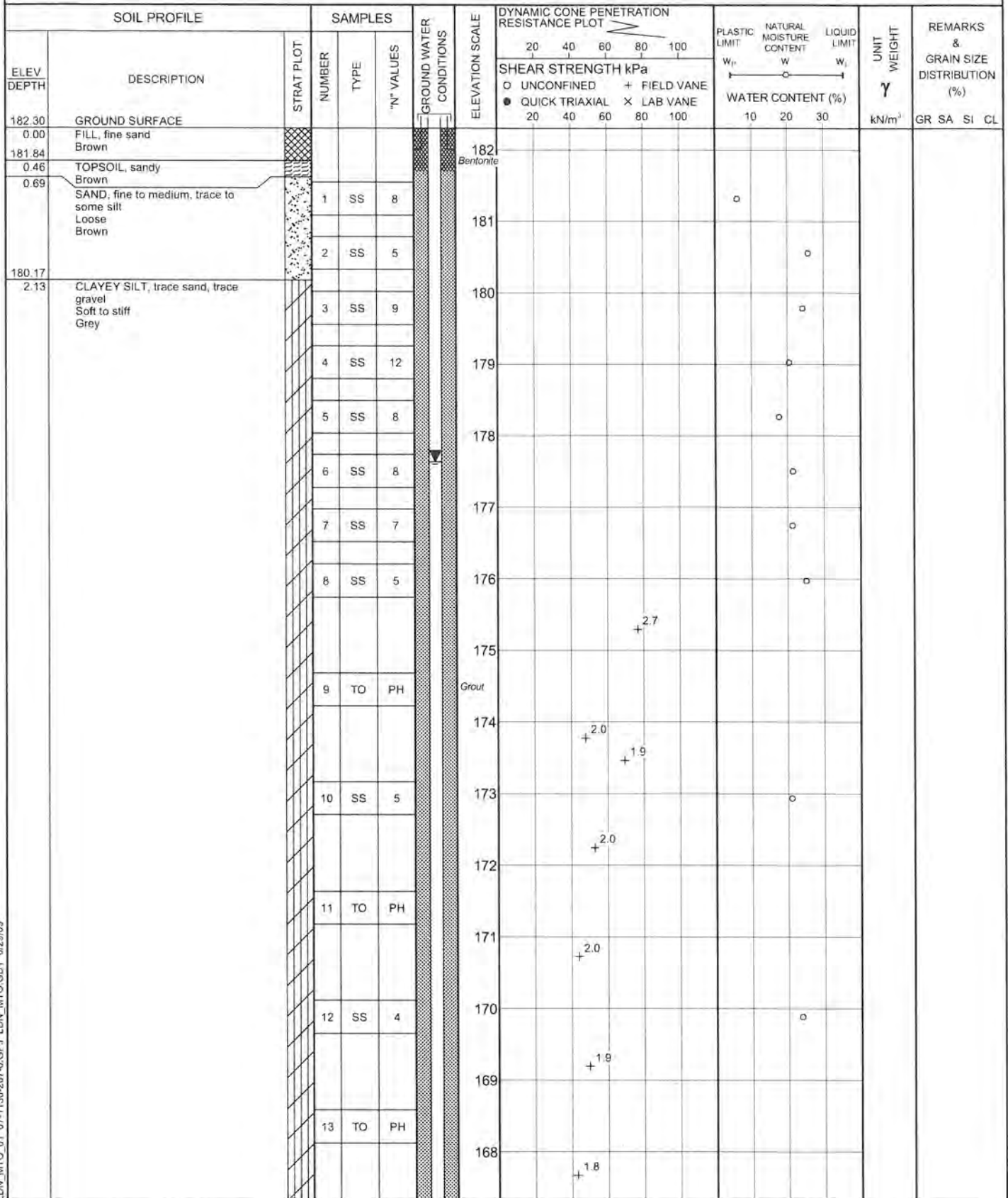
ORIGINATED BY SM

DIST WEST HWY 401/3 BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

DATUM GEODETIC DATE August 26, 2008 - August 27, 2008

CHECKED BY *SSB*



Continued Next Page

+3, X3, Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 07-1130-207-0

RECORD OF BOREHOLE No 139

2 OF 4

METRIC

W.P. _____

LOCATION N 4680787 5:E 331599.3

ORIGINATED BY SM

DIST WEST HWY 401/3

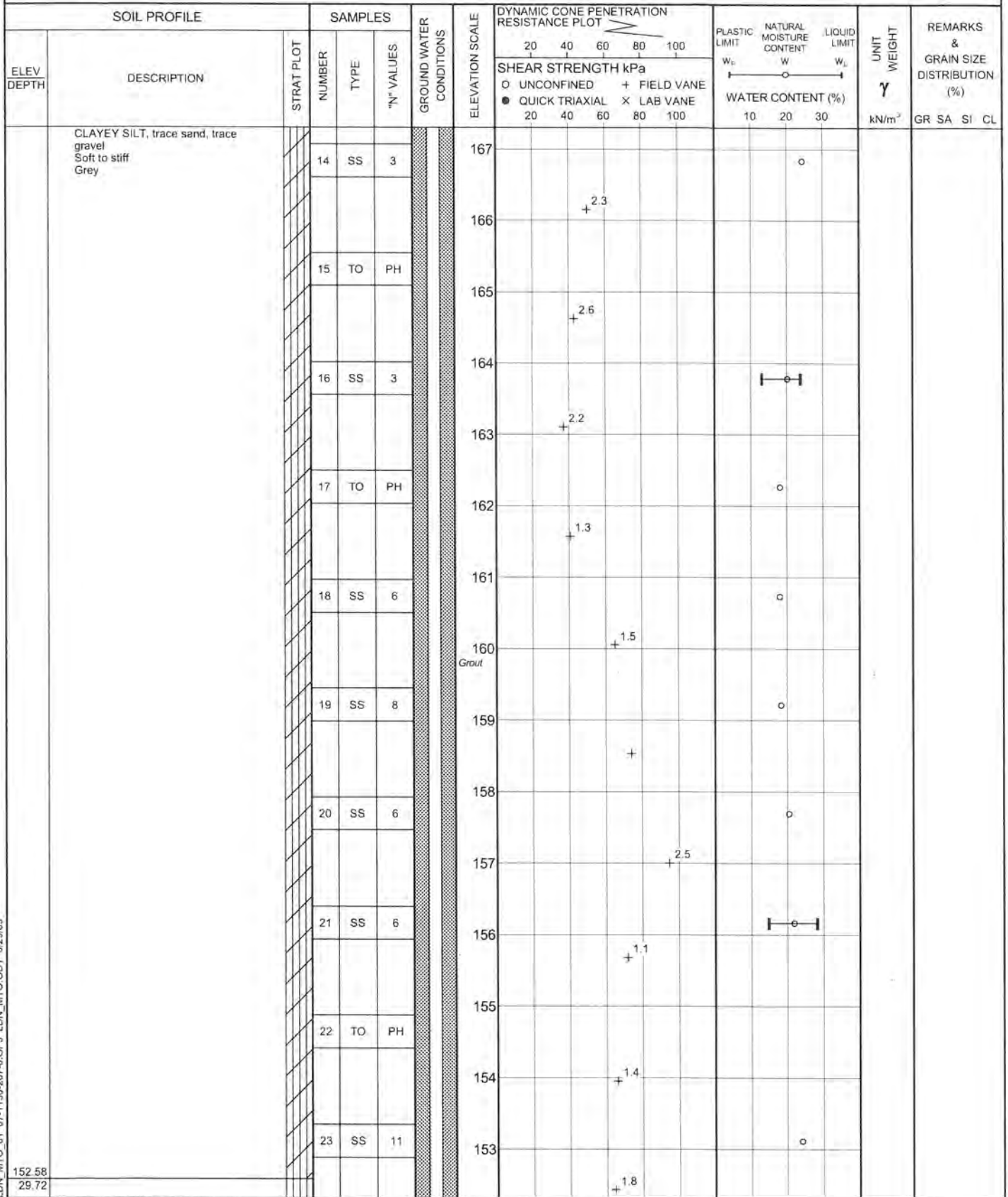
BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

DATUM GEODETIC

DATE August 26, 2008 - August 27, 2008

CHECKED BY **SJB**



Continued Next Page

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

LDN MTO 01 07-1130-207-0.GPJ LDN MTO.GDT 6/29/09

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 139		3 OF 4	METRIC
W.P. _____		LOCATION N 4680787.5 ; E 331599.3		ORIGINATED BY SM	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC		DATE August 26, 2008 - August 27, 2008		CHECKED BY <i>SB</i>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE							
							20 40 60 80 100	20 40 60 80 100	10 20 30							
151.72	SILT, some clay Loose Grey															
30.58	SILTY CLAY Soft Grey		24	SS	3									0 0 40 60		
151.06	SILT, some clay to CLAYEY SILT, trace sand, trace gravel Compact Grey							2.2 +								
31.24			25	SS	10											
149.53																
32.77	SANDY SILT, trace to some gravel, trace clay Dense Grey							1.5 +								
			26	SS	31											
			27	SS	50/ 0mm											
147.04																
35.26	LIMESTONE, fresh, medium strong, weakly to thinly laminated, very fine to fine grained, faintly to strongly porous Light brown and grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		28	NQ RC												
			29	NQ RC												
			30	NQ RC										UC		
143.19	END OF BOREHOLE															
39.11	Borehole dry during drilling on August 26 and 27, 2008. Water level measured in deep piezometer at elev. 178.57m on September 19, 2008. Water level measured in deep piezometer at elev. 178.57m on September 22, 2008. Water level measured in deep piezometer at elev. 177.60m on November 11, 2008. Water level measured in deep piezometer at elev. 177.63m on January 28, 2009.															

LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/20/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 139

SHEET 4 OF 4

LOCATION: N 4680787.5 E 331599.3

DRILLING DATE: August 26, 2008 - August 27, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: --

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.		RUN No.	PENETRATION RATE (min/m)	COLOUR % RETURN	FLUSH	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.										DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
				DEPTH (m)	FRACT INDEX PER 0.3						RECOVERY		R.Q.D. %	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
											TOTAL CORE %	SOLID CORE %		DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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DEPTH SCALE

1:75



LOGGED: SG

CHECKED: *SG*

○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 140

1 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4680899.3; E 331552.4

ORIGINATED BY SM

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

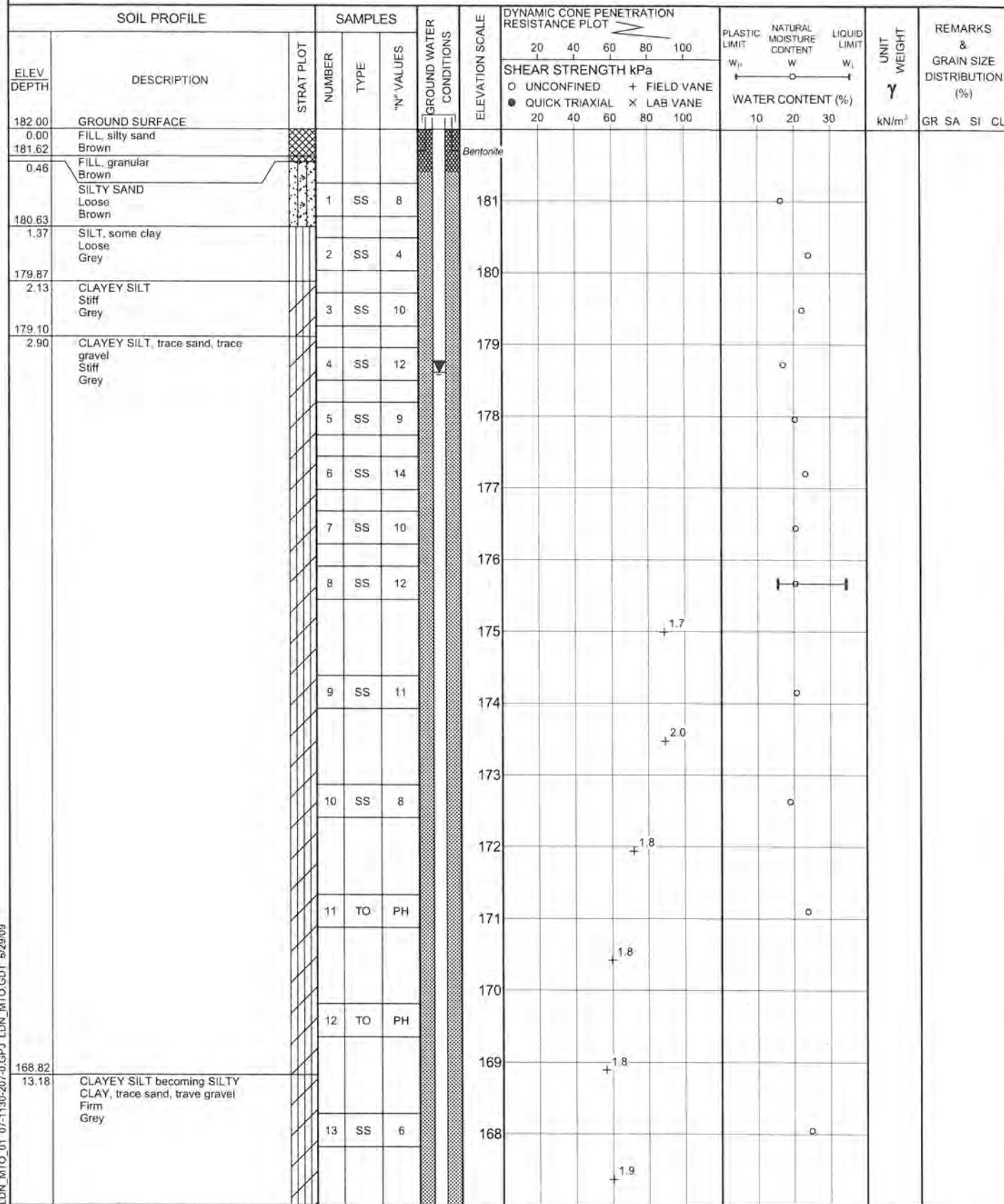
COMPILED BY BRS

DATUM GEODETIC

DATE

August 21, 2008 - August 25, 2008

CHECKED BY *SLB*

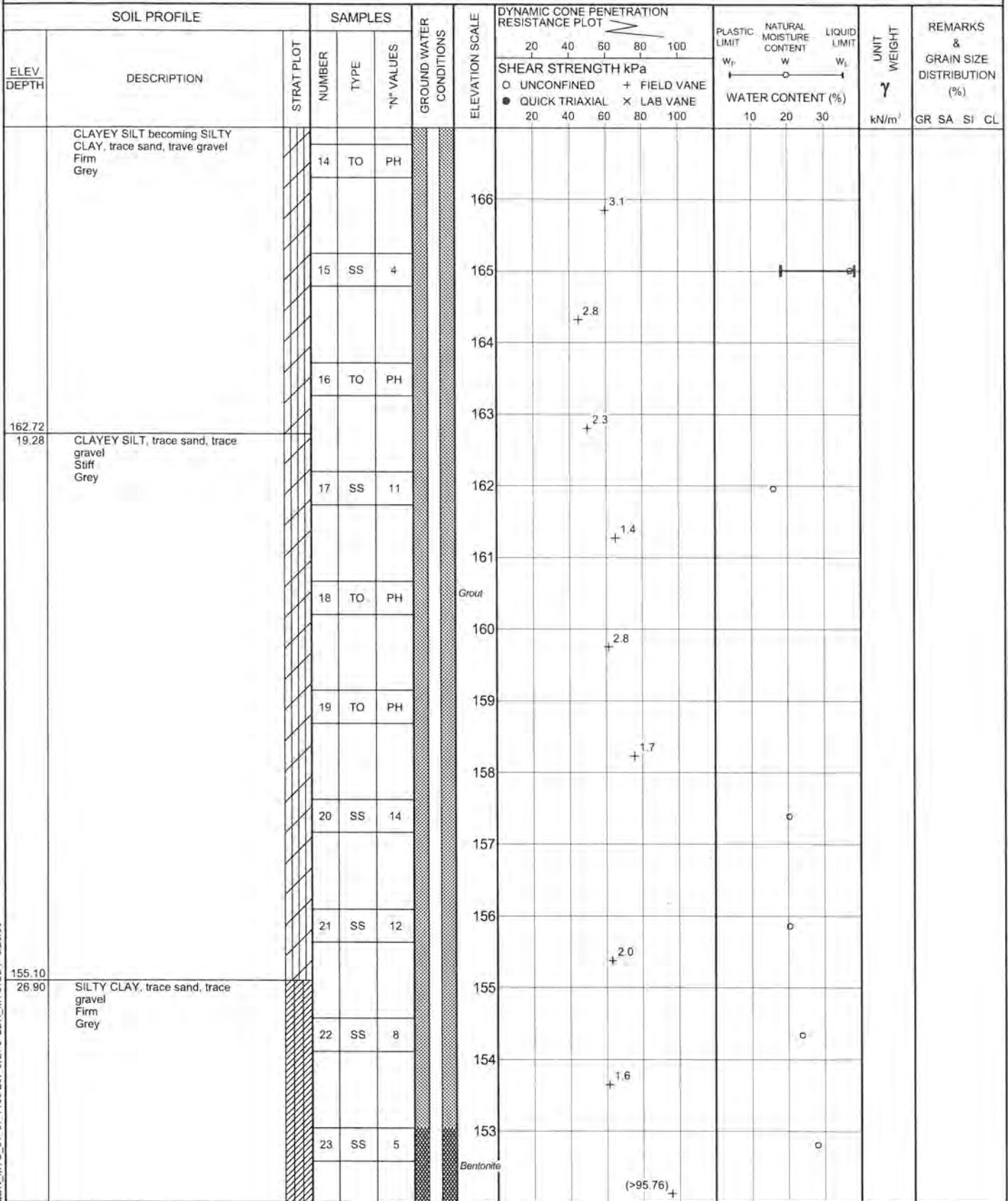


Continued Next Page

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

LDN MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 5/29/09

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 140		2 OF 4	METRIC
W.P. _____		LOCATION N 4680899 3 :E 331552.4		ORIGINATED BY SM	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC		DATE August 21, 2008 - August 25, 2008		CHECKED BY <u>SJB</u>	



LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 8/29/09

Continued Next Page

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

RECORD OF BOREHOLE No 140

3 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4680899.3 :E 331552.4

ORIGINATED BY SM

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

DATUM GEODETIC

DATE

August 21, 2008 - August 25, 2008

CHECKED BY SJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
150.80	SILTY CLAY, trace sand, trace gravel Firm Grey		24	SS	4		151							
31.20	CLAYEY SILT, layered with silt Hard to dense Grey						150		2.7					
149.70	SILT, trace sand, trace clay Dense Grey		25	SS	31		150							
32.40	SAND AND GRAVEL, some silt Dense Brown						148							
148.88	LIMESTONE, fresh, medium strong, very fine to fine grained, faintly porous Light brown and grey		26	SS	50/25mm		148							
33.12	(FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		27	NQ RC			147							
			28	NQ RC			146							
			29	NQ RC			145							
144.41	END OF BOREHOLE													
37.59	Borehole dry during drilling between August 21 and 25, 2008. Water level measured in deep piezometer at elev. 179.46m on September 19, 2008. Water level measured in deep piezometer at elev. 179.46m on September 22, 2008. Water level measured in deep piezometer at elev. 178.21m on November 11, 2008. Water level measured in deep piezometer at elev. 178.61m on January 28, 2009.													

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 140

SHEET 4 OF 4

LOCATION: N 4680899.3 E 331552.4

DRILLING DATE: August 21, 2008 - August 25, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: --

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (min/m)	COLOUR % RETURN	FLUSH	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate				BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage				PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular				PO - Polished K - Slickensided SM - Smooth Ro - Rough				Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols	HYDRAULIC CONDUCTIVITY k, cm/sec				DIAMETRAL PUMP LOAD INDEX (MPa)				NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		DIPWELL CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁴ 10 ⁻³ 10 ⁻² 10 ⁻¹				2 4 6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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DEPTH SCALE

1:75

LOGGED: SG

CHECKED: SYB

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 140A		1 OF 1	METRIC
W.P. _____		LOCATION N 4680899.3 ; E 331552.4		ORIGINATED BY SM	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, HOLLOW STEM		COMPILED BY BRS	
DATUM GEODETIC		DATE August 25, 2008		CHECKED BY <i>SB</i>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	10 20 30					
182.00	SOIL CONDITIONS INFERRED FROM BOREHOLE No. 140														
0.00	GROUND SURFACE														
181.62	FILL, silty sand Brown														
0.46	FILL, granular Brown														
180.63	SILTY SAND Loose Brown														
1.37	SILT, some clay Loose Grey														
179.87	CLAYEY SILT Stiff Grey														
2.13															
179.10	CLAYEY SILT, trace sand, trace gravel Stiff Grey														
2.90															
172.86	END OF BOREHOLE														
9.14	Water level measured in shallow piezometer at elev. 177.96m on September 19, 2008.														
	Water level measured in shallow piezometer at elev. 178.09m on September 22, 2008.														
	Water level measured in shallow piezometer at elev. 180.33m on January 28, 2009.														

LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 8/29/09

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-333		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4680843.8 ; E 331553.7</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 16, 2019</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								20	40	60	80	100	w _p	w	w _L						
182.33	ROAD SURFACE																				
0.05	ASPHALT PAVEMENT																				
181.95	FILL, limestone gravel, crushed																				
0.38	Grey																				
	SAND, fine, some silt		1	SS	23																
	Compact																				
	Brown																				
180.50			2	SS	17																
1.83	SANDY SILT, some clay, trace																				
180.19	gravel																				
2.14	Compact																				
	Grey																				
	CLAYEY SILT, some sand, trace		3	SS	19																
	gravel, with occasional silt partings																				
179.43	Very stiff																				
2.90	Grey																				
	END OF BOREHOLE																				
	Borehole dry during drilling on December 16, 2009.																				

LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-333

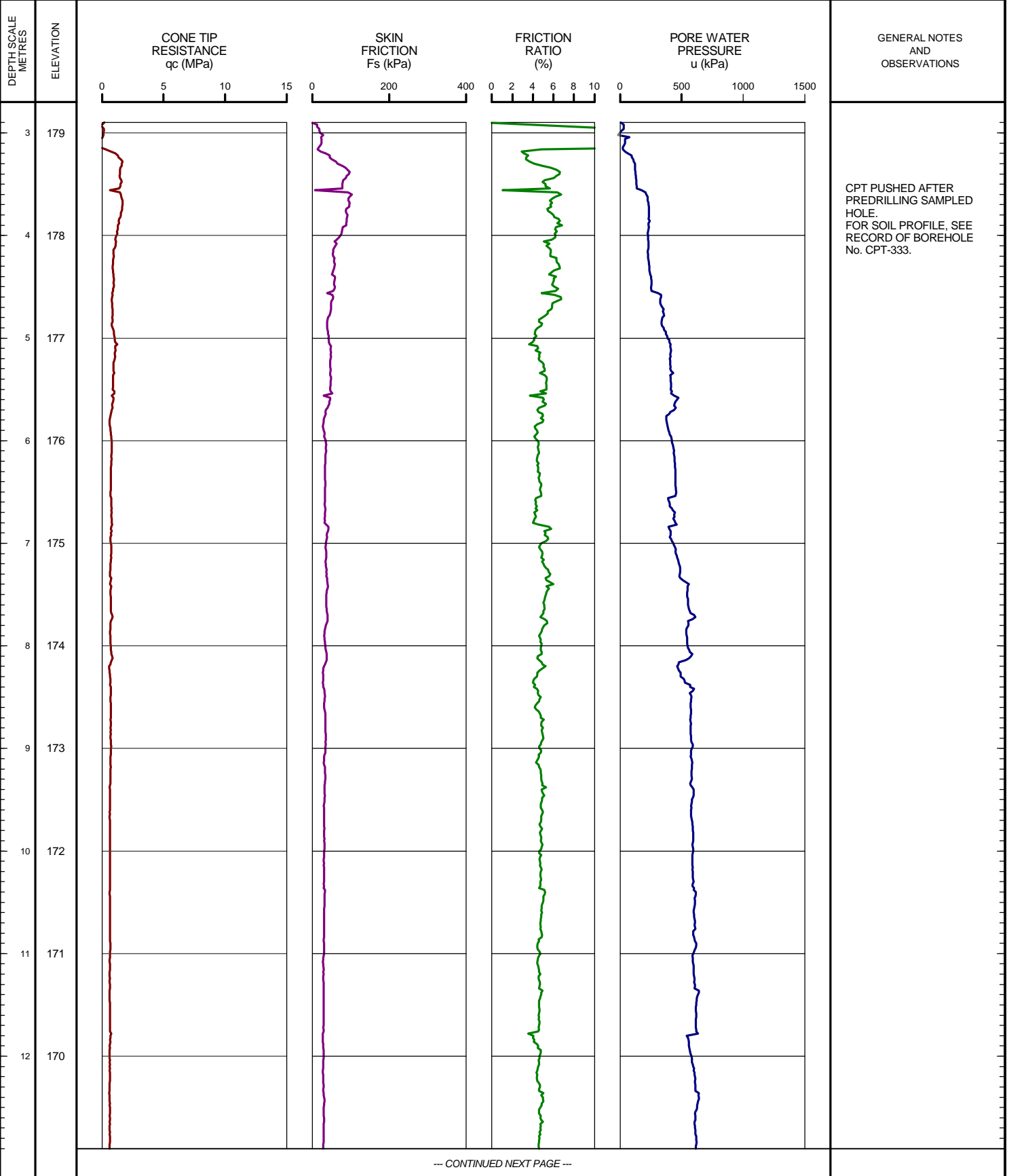
SHEET 1 OF 2

LOCATION: N 4680843.8 ;E 331553.7

TEST DATE: December 16, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 182.33m PREDRILL DEPTH: 2.90m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-333

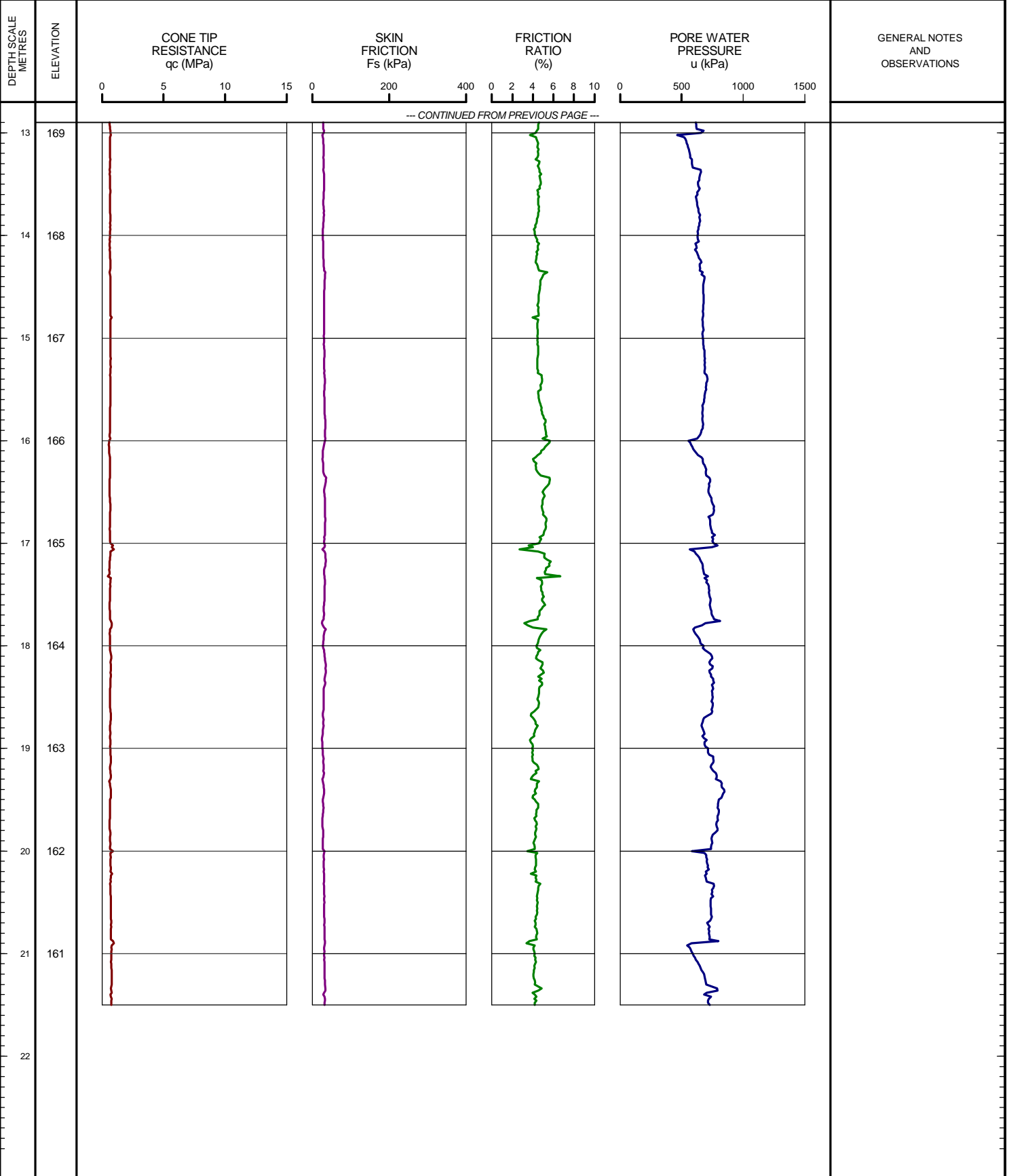
SHEET 2 OF 2

LOCATION: N 4680843.8 ;E 331553.7

TEST DATE: December 16, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 182.33m PREDRILL DEPTH: 2.90m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

RECORD OF BOREHOLE No 129

1 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4679625.1 E 332109.7

ORIGINATED BY LZ/CC/MA/SM

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

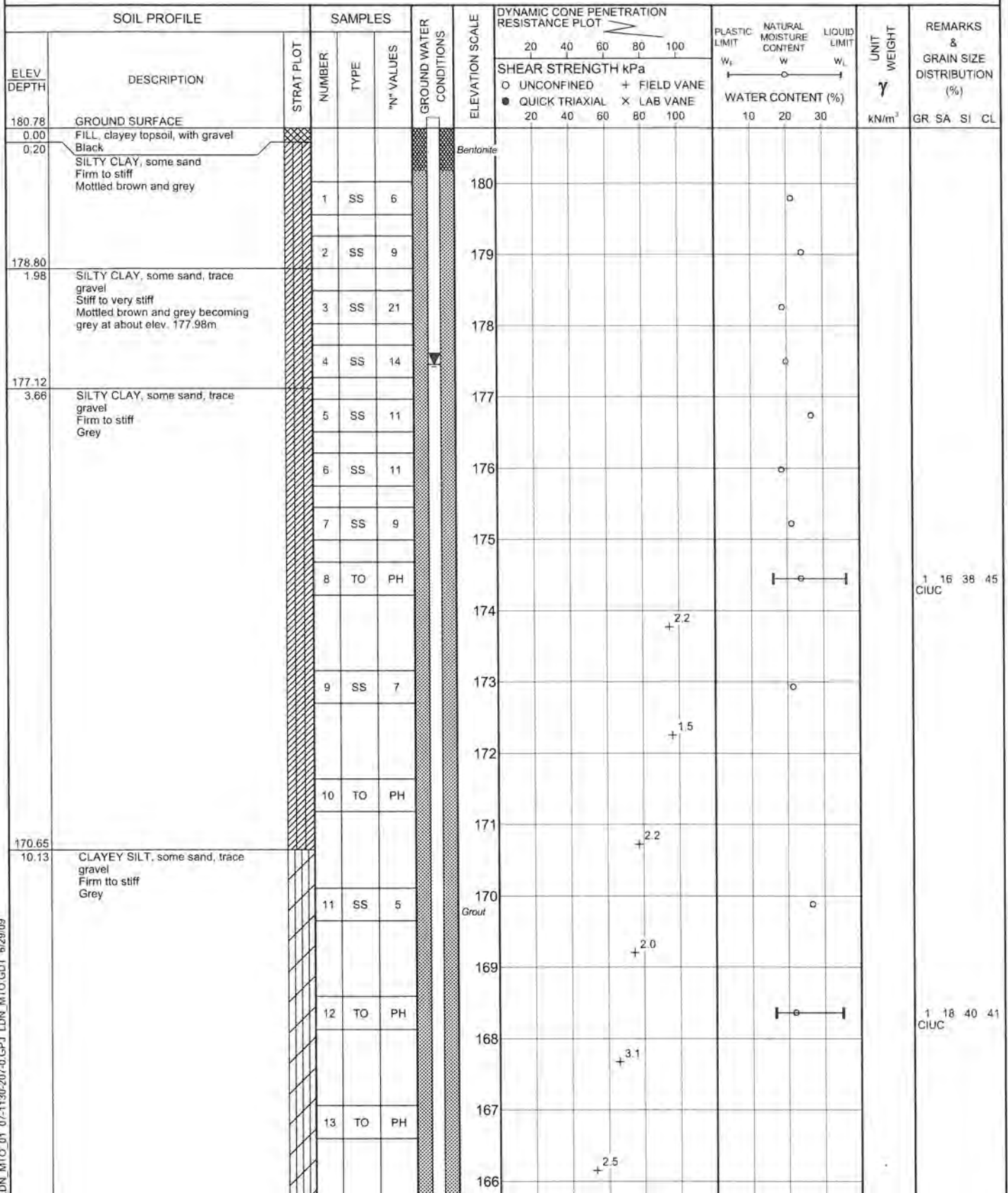
COMPILED BY BRS

DATUM GEODETIC

DATE

March 4, 2008 - March 10, 2008

CHECKED BY SJB



Continued Next Page

+ 3, x 3. Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO_GDT 6/29/09

RECORD OF BOREHOLE No 129

2 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4679625.1, E 332109.7

ORIGINATED BY LZ/CC/MA/SM

DIST

WEST

HWY 401/3

BOREHOLE TYPE

POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

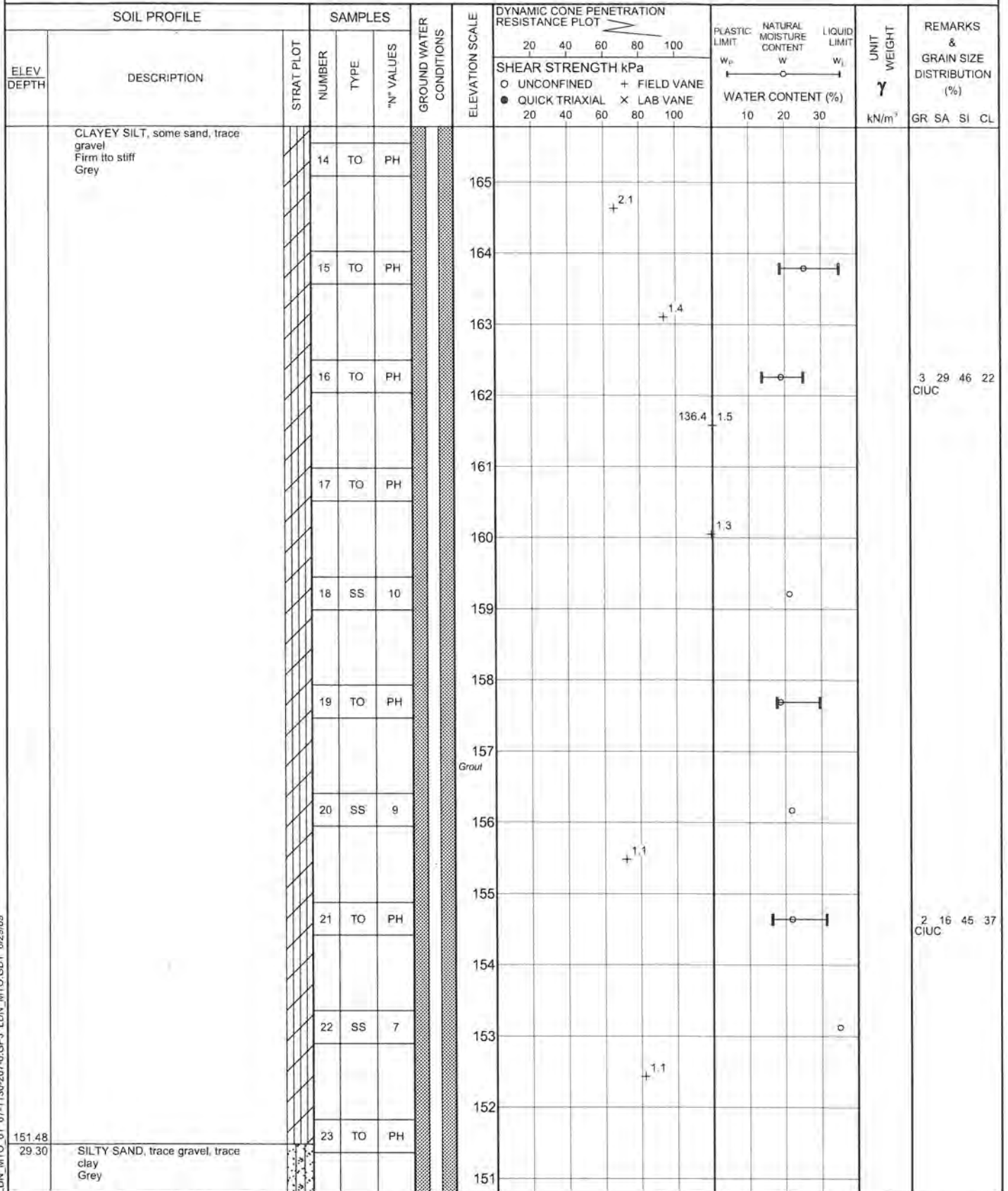
COMPILED BY BRS

DATUM GEODETIC

DATE

March 4, 2008 - March 10, 2008

CHECKED BY *SSB*



Continued Next Page

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

LDN MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/25/09

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 129		3 OF 4 METRIC	
W.P. _____		LOCATION N 4679625.1 :E 332109.7		ORIGINATED BY LZ/CC/MA/SM	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC		DATE March 4, 2008 - March 10, 2008		CHECKED BY SJB	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE							
150.55							20 40 60 80 100		10 20 30							
30.23	SAND AND GRAVEL, medium to coarse, trace silt Compact to very dense Grey		24	SS	21											
			25	SS	125											
147.88	DOLOSTONE/LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous Grey to brown (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)															
32.90																
					26	SS	100/120mm									
					27	NQ RC										
					28	NQ RC										
			29	NQ RC												
			30	NQ RC												
143.78	END OF BOREHOLE Borehole dry during drilling between March 4 and 10, 2008. Water level measured in deep piezometer at elev. 178.50m on July 22, 2008. Water level measured in deep piezometer at elev. 177.88m on August 11, 2008. Water level measured in deep piezometer at elev. 177.48m on September 19, 2008. Water level measured in deep piezometer at elev. 177.57m on November 11, 2008. Water level measured in deep piezometer at elev. 177.46m on January 28, 2009.															
37.00																

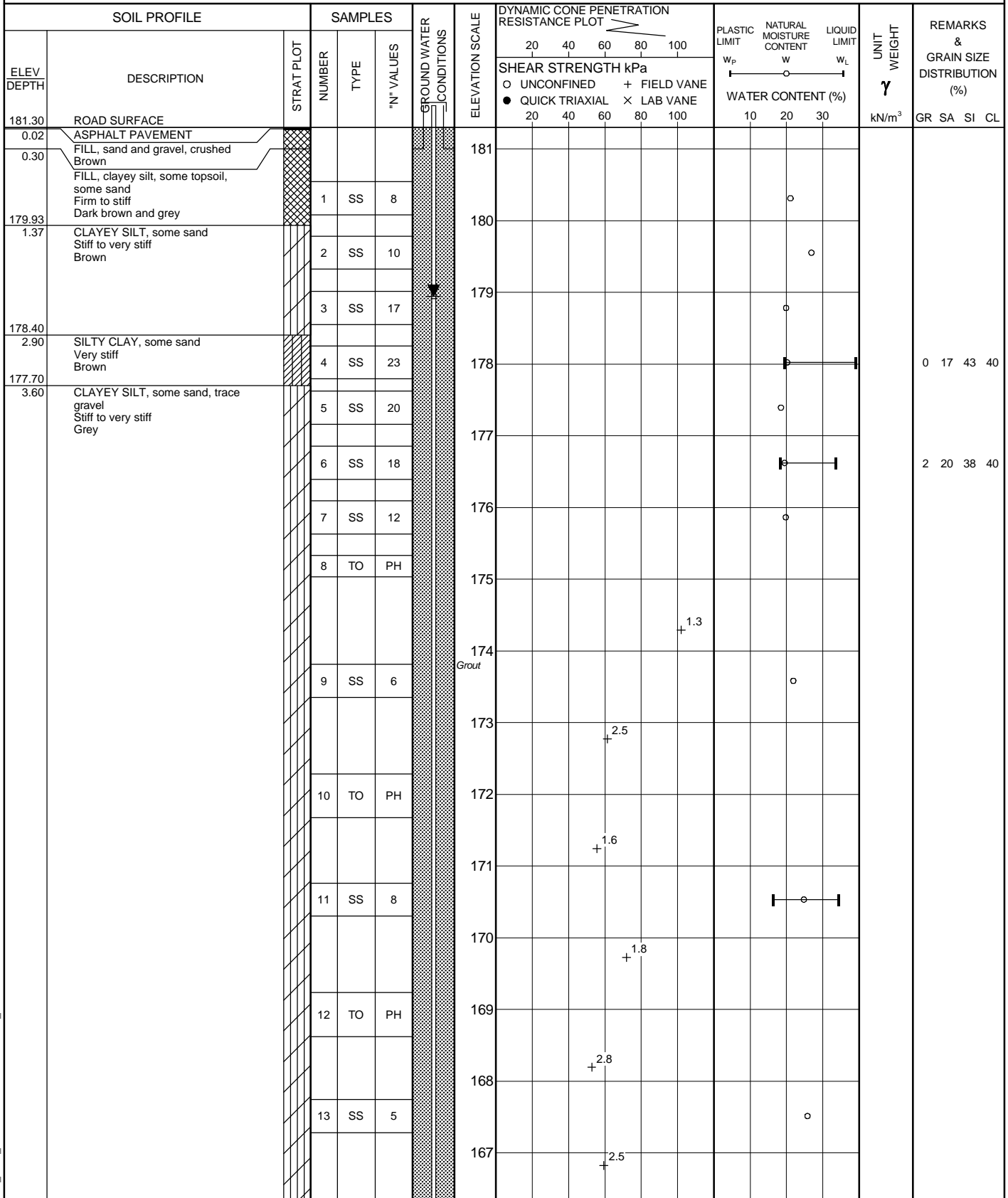
LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT 07-1130-207-0 RECORD OF BOREHOLE No 129A 1 OF 1 METRIC
W.P. LOCATION N 4679625.1 , E 332109.7 ORIGINATED BY SM
DIST WEST HWY 401/3 BOREHOLE TYPE POWER AUGER, HOLLOW STEM COMPILED BY BRS
DATUM GEODETIC DATE March 4, 2008 CHECKED BY SJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
180.78	SOIL CONDITIONS INFERRED FROM BOREHOLE No. 129 GROUND SURFACE							20 40 60 80 100						
0.00	FILL, clayey topsoil, with gravel							0 UNCONFINED + FIELD VANE						
0.20	Black							● QUICK TRIAXIAL × LAB VANE						
	SILTY CLAY, some sand							20 40 60 80 100						
	Firm to stiff													
	Mottled brown and grey													
178.60														
1.98	SILTY CLAY, some sand, trace gravel													
	Stiff to very stiff													
	Mottled brown and grey to grey at about elev. 177.98m													
177.12														
3.66	SILTY CLAY, some sand, trace gravel													
	Firm to stiff													
	Grey													
171.18														
9.60	END OF BOREHOLE													
	Water level measured in shallow piezometer at elev. 178.95m on July 22, 2008.3													
	Water level measured in shallow piezometer at elev. 178.93m on August 11, 2008.													
	Water level measured in shallow piezometer at elev. 178.95m on September 19, 2008.													
	Water level measured in shallow piezometer at elev. 178.84m on January 28, 2009.													

LDN MTO 01 07-1130-207-0.GPJ LDN MTO GDT 6/29/09

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 323		1 OF 4	METRIC
W.P. _____		LOCATION <u>N 4679521.4 ; E 332167.6</u>		ORIGINATED BY <u>MK/MR</u>	
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>	
DATUM <u>GEODETIC</u>		DATE <u>December 15, 2009 - December 17, 2009</u>		CHECKED BY _____	

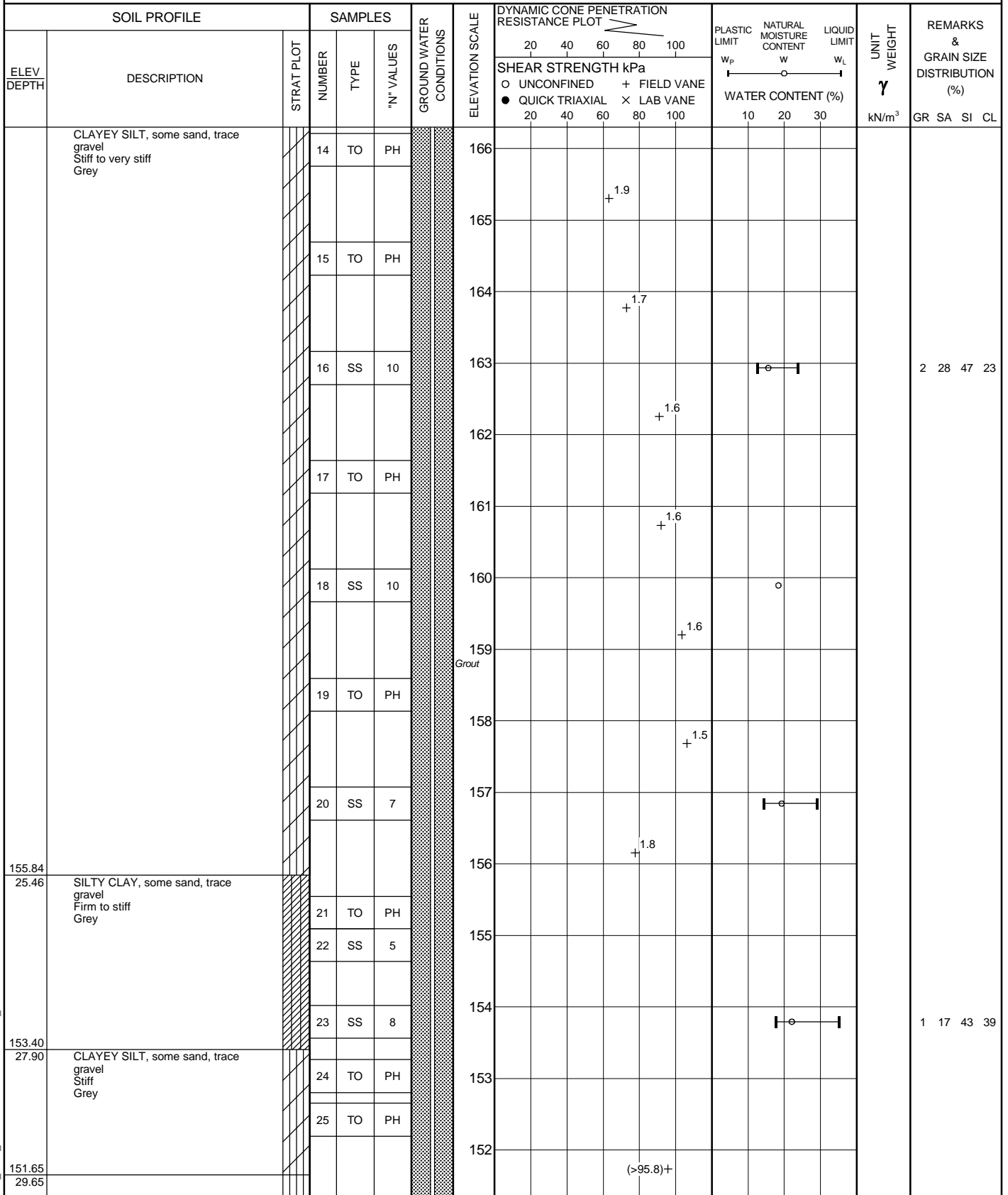


LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

Continued Next Page

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

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 323		2 OF 4		METRIC	
W.P. _____		LOCATION <u>N 4679521.4 ; E 332167.6</u>		ORIGINATED BY <u>MK/MR</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 15, 2009 - December 17, 2009</u>		CHECKED BY _____			



LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

Continued Next Page

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

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 323		3 OF 4	METRIC
W.P. _____		LOCATION <u>N 4679521.4 ; E 332167.6</u>		ORIGINATED BY <u>MK/MR</u>	
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>	
DATUM <u>GEODETIC</u>		DATE <u>December 15, 2009 - December 17, 2009</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	SILT, some clay, some sand, trace gravel Compact Grey		26	SS	29												
150.05																	
31.25	SAND AND GRAVEL, trace silt Very dense Brown		27	SS	100/ 100mm												
148.19																	
33.11	LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous Light brown to grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		28	NQ RC	-		73	30	33								
			29	NQ RC	-		100	92	92								
			30	NQ RC	-		T.C.R. (%) 95	S.C.R. (%) 95	R.Q.D. (%) 95								
			31	NQ RC	-		100	100	100								
142.96																	
38.34	END OF BOREHOLE																
	Groundwater encountered at about elev. 150.1m during drilling between December 15 and 17, 2009. Water level measured at elev. 179.12 on February 24, 2010. Water level measured at elev. 178.94 on January 6, 2010.																

PROJECT: 09-1132-0080

RECORD OF DRILLHOLE: 323

SHEET 4 OF 4

LOCATION: N 4679521.4 ;E 332167.6

DRILLING DATE: December 15, 2009 - December 17, 2009

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: LANTECH

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.												HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)		NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁸	10 ⁻⁶	10 ⁻⁴	10 ⁻²	2	4	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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DEPTH SCALE

1 : 75

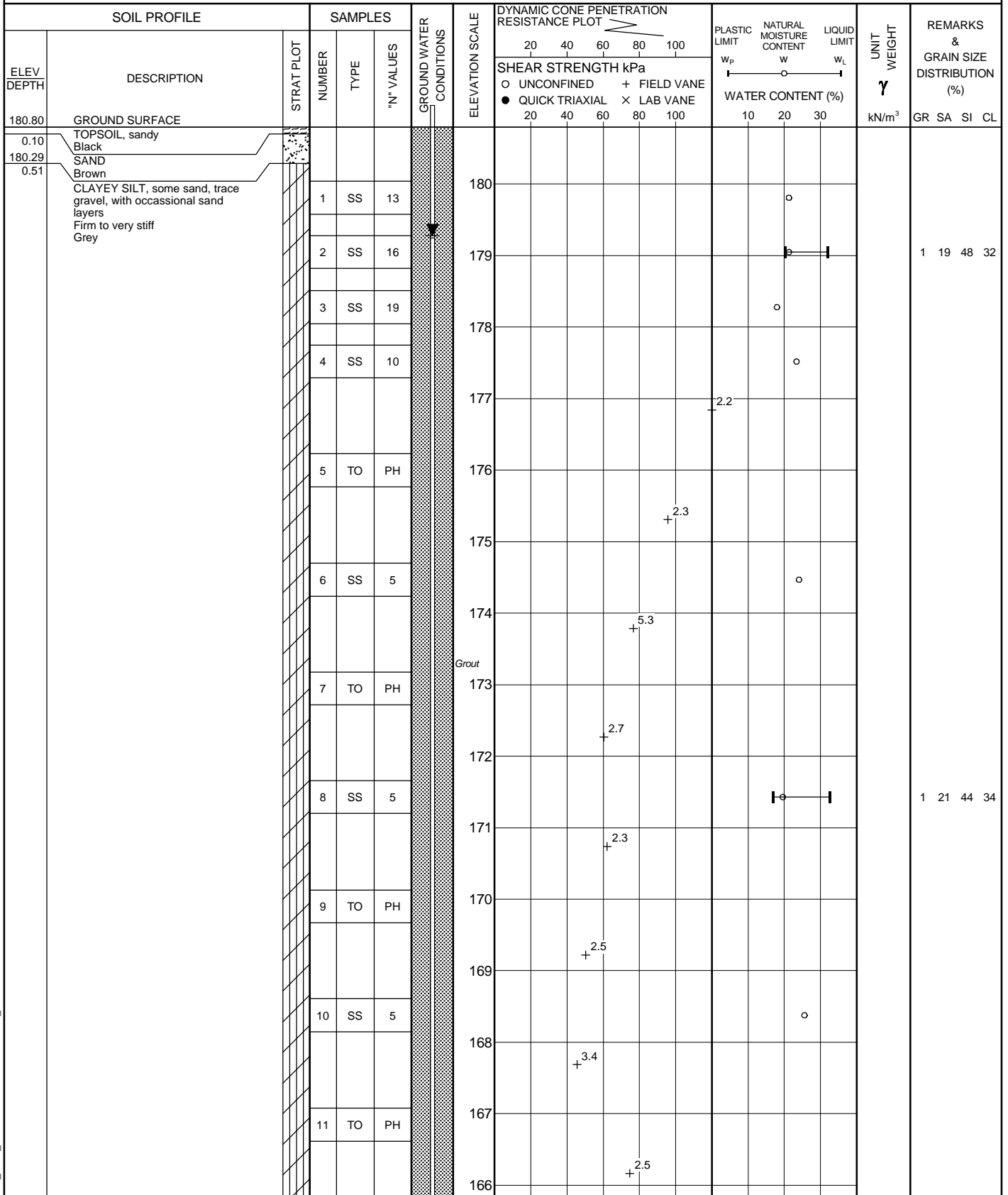


LOGGED: SG

CHECKED:

LDN_ROCK_03 09-1132-0080-ROCK.GPJ GLDR_LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 325		1 OF 4		METRIC	
W.P. _____		LOCATION <u>N 4679787.7 ; E 331972.9</u>		ORIGINATED BY <u>SM</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 16, 2009 - December 17, 2009</u>		CHECKED BY _____			

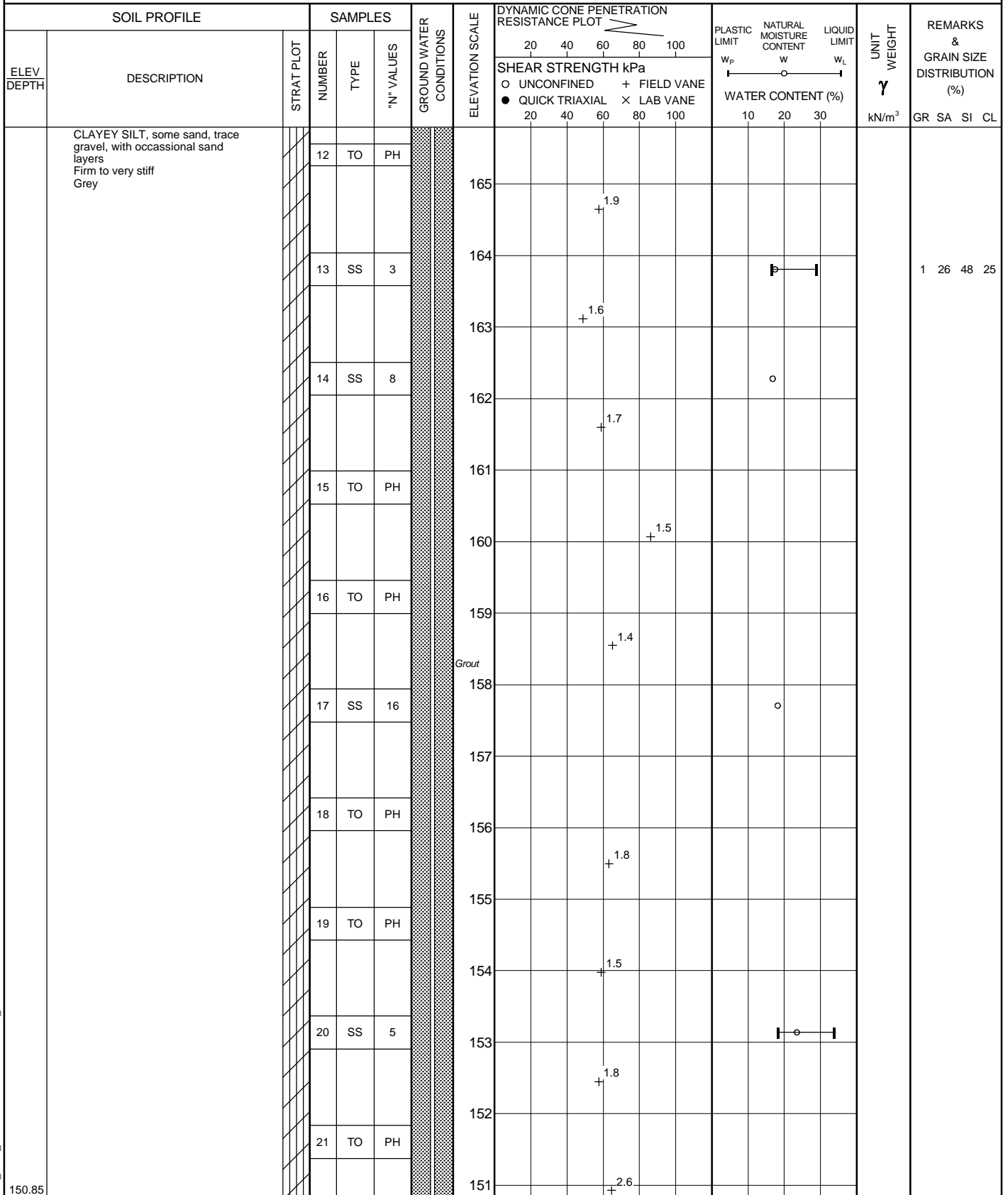


LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

Continued Next Page

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

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 325		2 OF 4		METRIC	
W.P. _____		LOCATION <u>N 4679787.7 ; E 331972.9</u>		ORIGINATED BY <u>SM</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 16, 2009 - December 17, 2009</u>		CHECKED BY _____			



LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

Continued Next Page

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

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 325		3 OF 4		METRIC	
W.P. _____		LOCATION <u>N 4679787.7 ; E 331972.9</u>		ORIGINATED BY <u>SM</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 16, 2009 - December 17, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						
29.95	SANDY SILT, some clay, trace to some gravel Compact to very dense Grey		22	SS	17		150										10 40 38 12	
148.48	LIMESTONE, fresh, medium strong, weakly laminated to laminated, very fine to fine grained, faintly porous Light grey to brown (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		23	SS	82/ 175mm		149											
32.32																		
			24	NQ RC	-		148	88	78	78								
			25	NQ RC	-		147	97	95	94								
			26	NQ RC	-		146	T.C.R. (%) 100	S.C.R. (%) 98	R.Q.D. (%) 86								
			27	NQ RC	-		145											
							144	100	95	88								
143.31	END OF BOREHOLE Borehole dry during drilling between December 14 and 17, 2009. Water level measured at elev. 179.35 on February 24, 2010. Water level measured at elev. 179.28 on January 6, 2010.																	
37.49																		

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DATUM: GEODETIC



**Golder
Associates**

CHECKED:

_LDN_ROCK_03 09-1132-0080-ROCK.GPJ GLDR_LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT 07-1130-207-0 **RECORD OF BOREHOLE No CPT-130** 1 OF 1 **METRIC**
W.P. _____ LOCATION N 4679821.8 :E 332036.1 ORIGINATED BY CC
DIST WEST HWY 401/3 BOREHOLE TYPE POWER AUGER, SOLID STEM COMPILED BY SJL
DATUM GEODETIC DATE September 4, 2008 CHECKED BY SJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
180.82	GROUND SURFACE													
0.00	FILL, crushed sand and gravel, trace silt		1	SS	16									
180.29	Compact Brown													
0.61	FILL, sand with slag		2	SS	14		180							
	Compact Black													
	CLAYEY SILT, trace sand, trace gravel		3	SS	11									
178.99	Stiff						179							
1.83	Mottled brown and grey													
	END OF BOREHOLE													
	Borehole dry during drilling on September 4, 2008.													

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-324		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4679664.9 ; E 332002.7</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>January 25, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × LAB VANE											
180.85	GROUND SURFACE																			
0.00	TOPSOIL, clayey Very stiff Black		1	SS	18															
179.48																				
1.37	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Very stiff Brown		2	SS	18															
177.95			3	SS	27															
2.90	END OF BOREHOLE																			
	Borehole dry during drilling on January 25, 2010.																			

LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-11

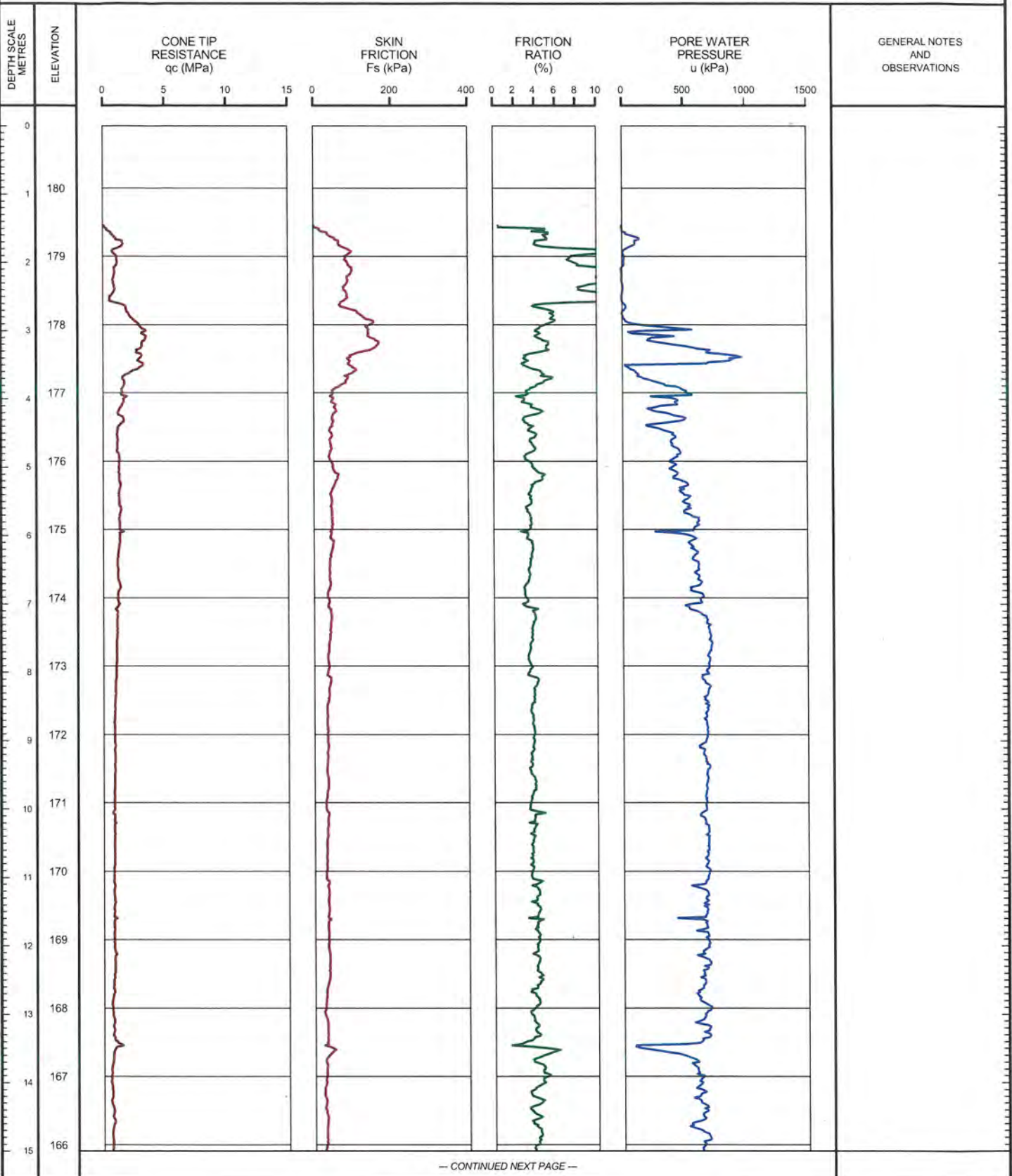
SHEET 1 OF 2

LOCATION: N 4679634.0 ; E 332110.0

TEST DATE: November 10, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.46m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: SJB

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-11

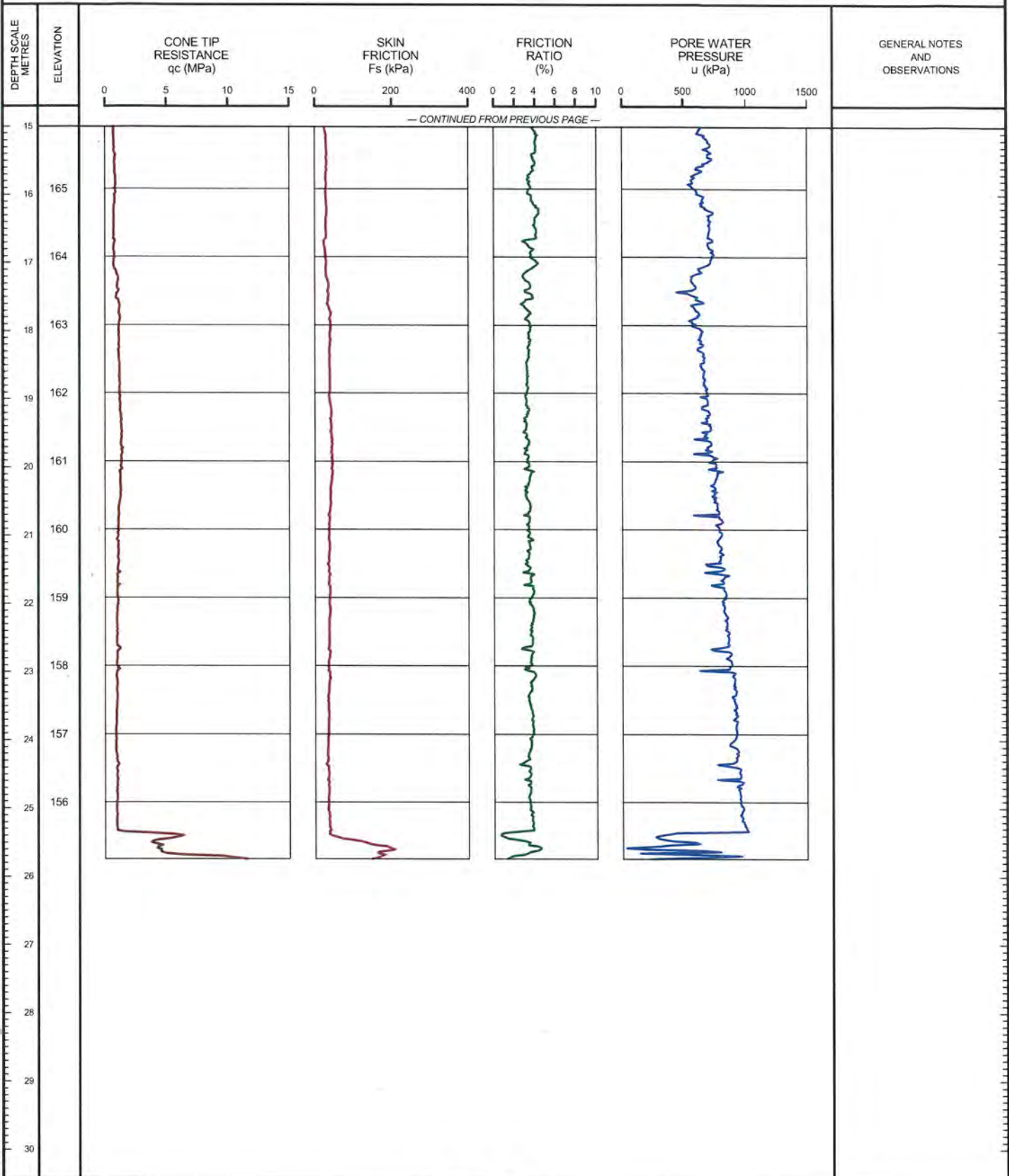
SHEET 2 OF 2

LOCATION: N 4679634.0 :E 332110.0

TEST DATE: November 10, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.46m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SSB*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-130

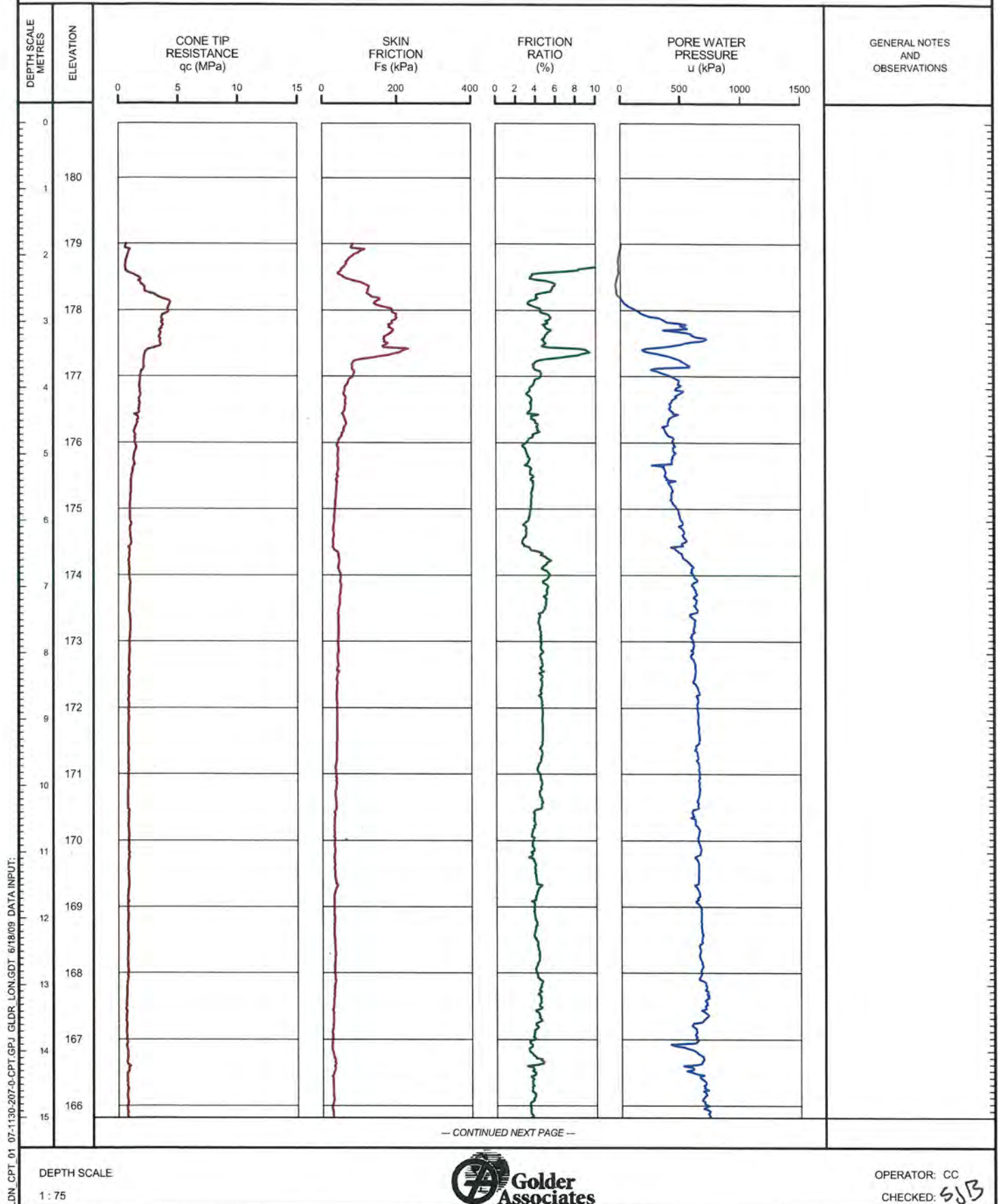
SHEET 1 OF 3

LOCATION: N 4679821.8 :E 332036.1

TEST DATE: September 4, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.83m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-130

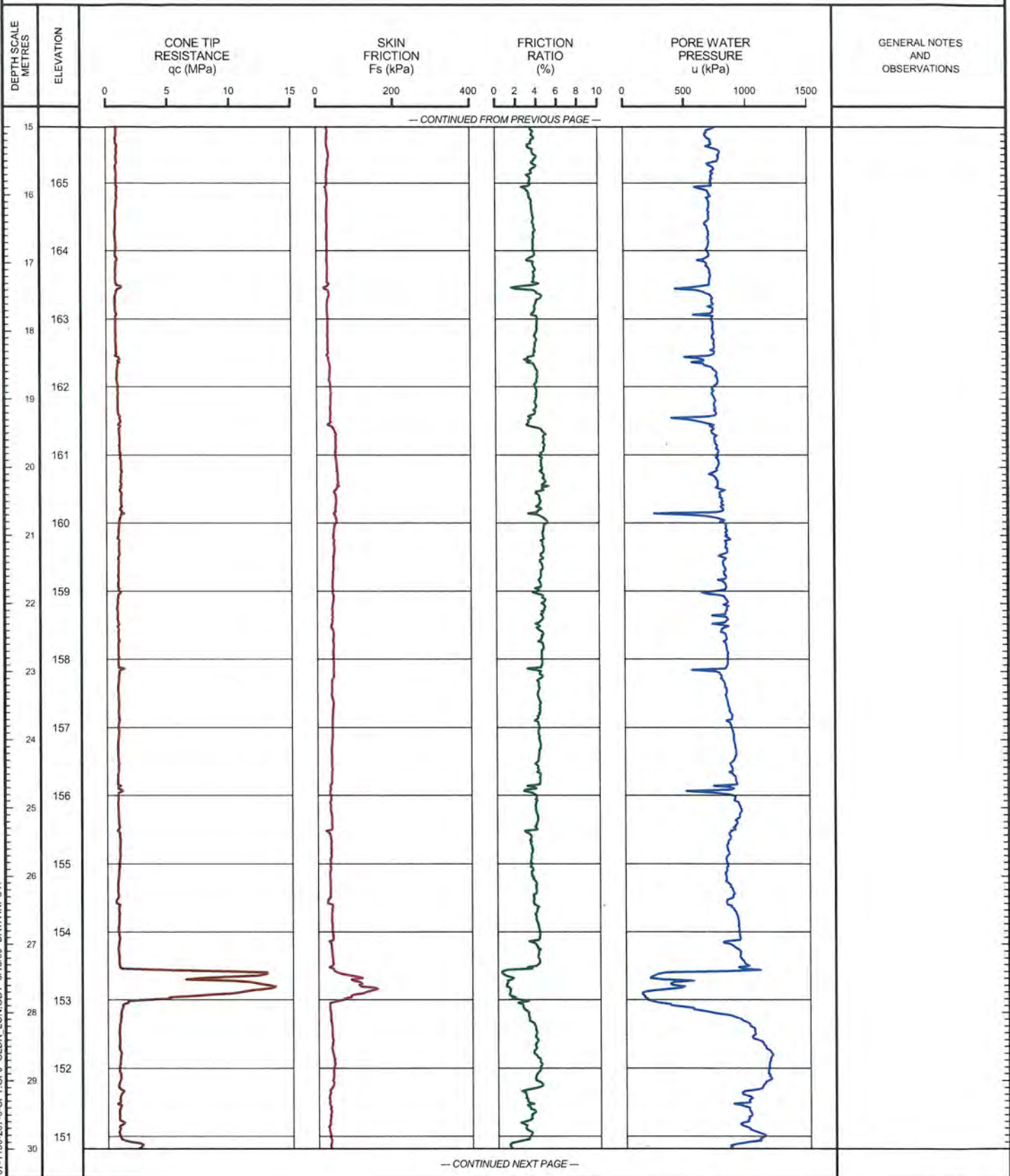
SHEET 2 OF 3

LOCATION: N 4679821.8 ; E 332036.1

TEST DATE: September 4, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.83m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: SJB

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-130

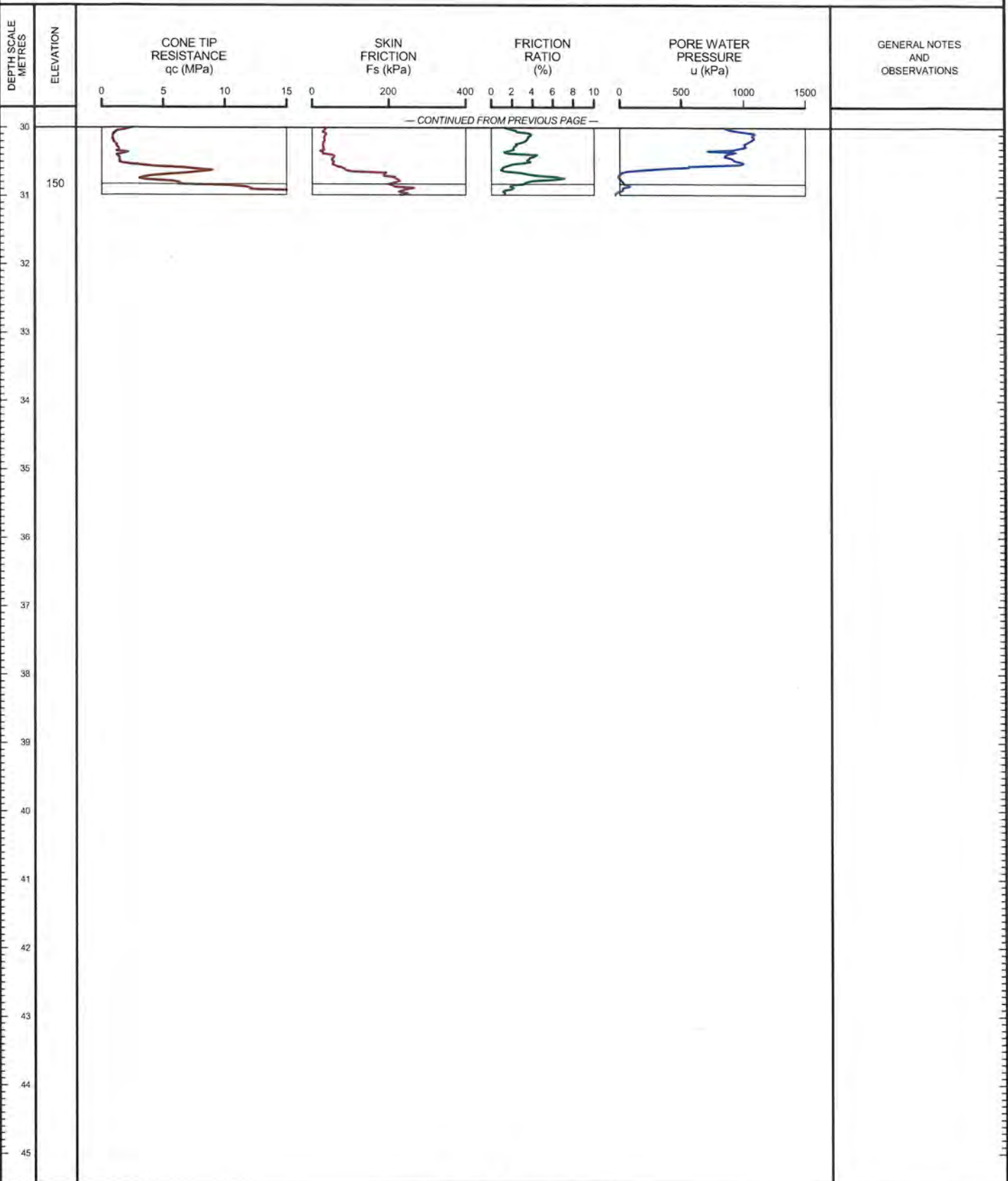
SHEET 3 OF 3

LOCATION: N 4679821.8 :E 332036.1

TEST DATE: September 4, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 1.83m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013




LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: 

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-324

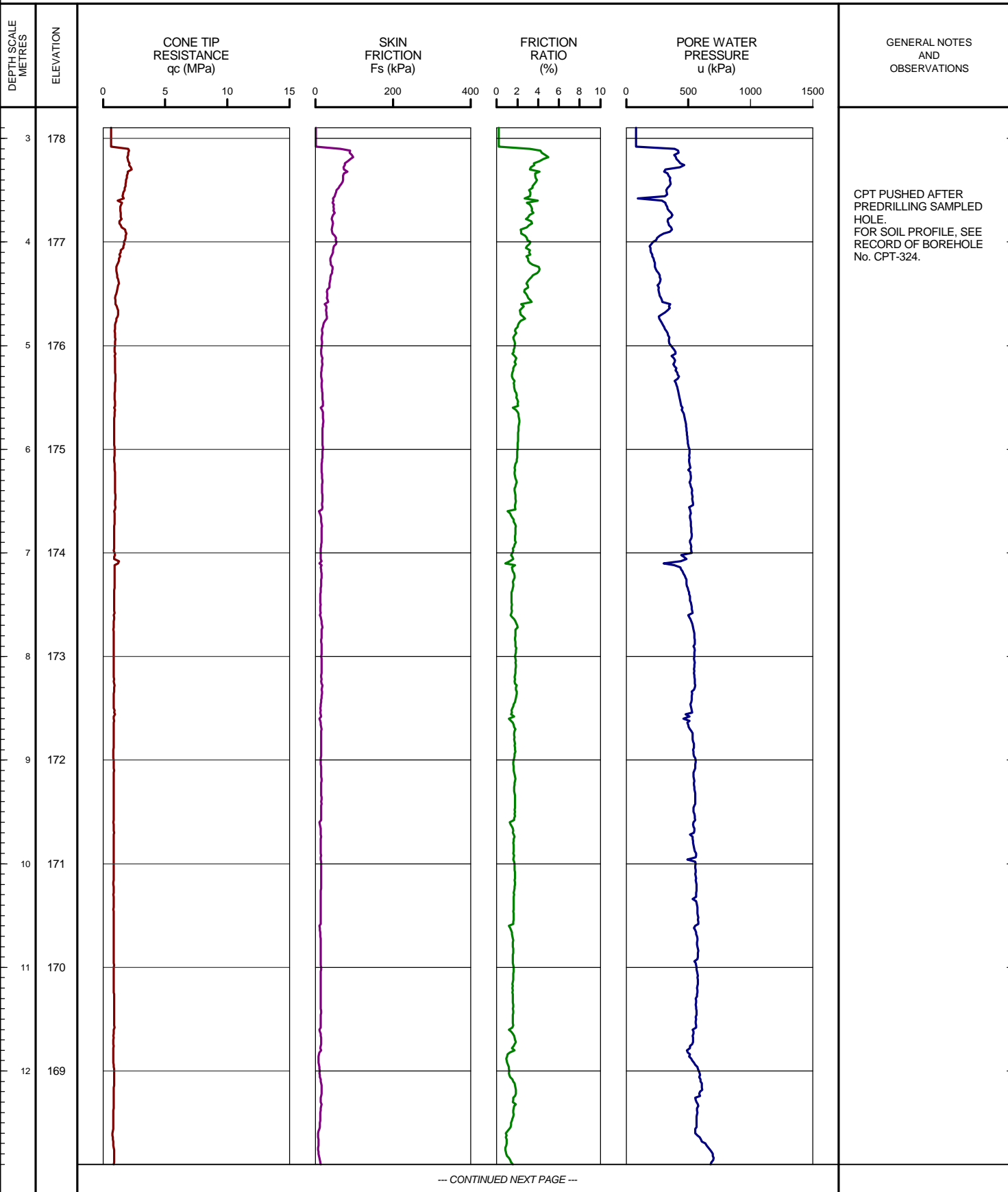
SHEET 1 OF 3

LOCATION: N 4679664.9 ;E 332002.7

TEST DATE: January 25, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.85m PREDRILL DEPTH: 2.90m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-324

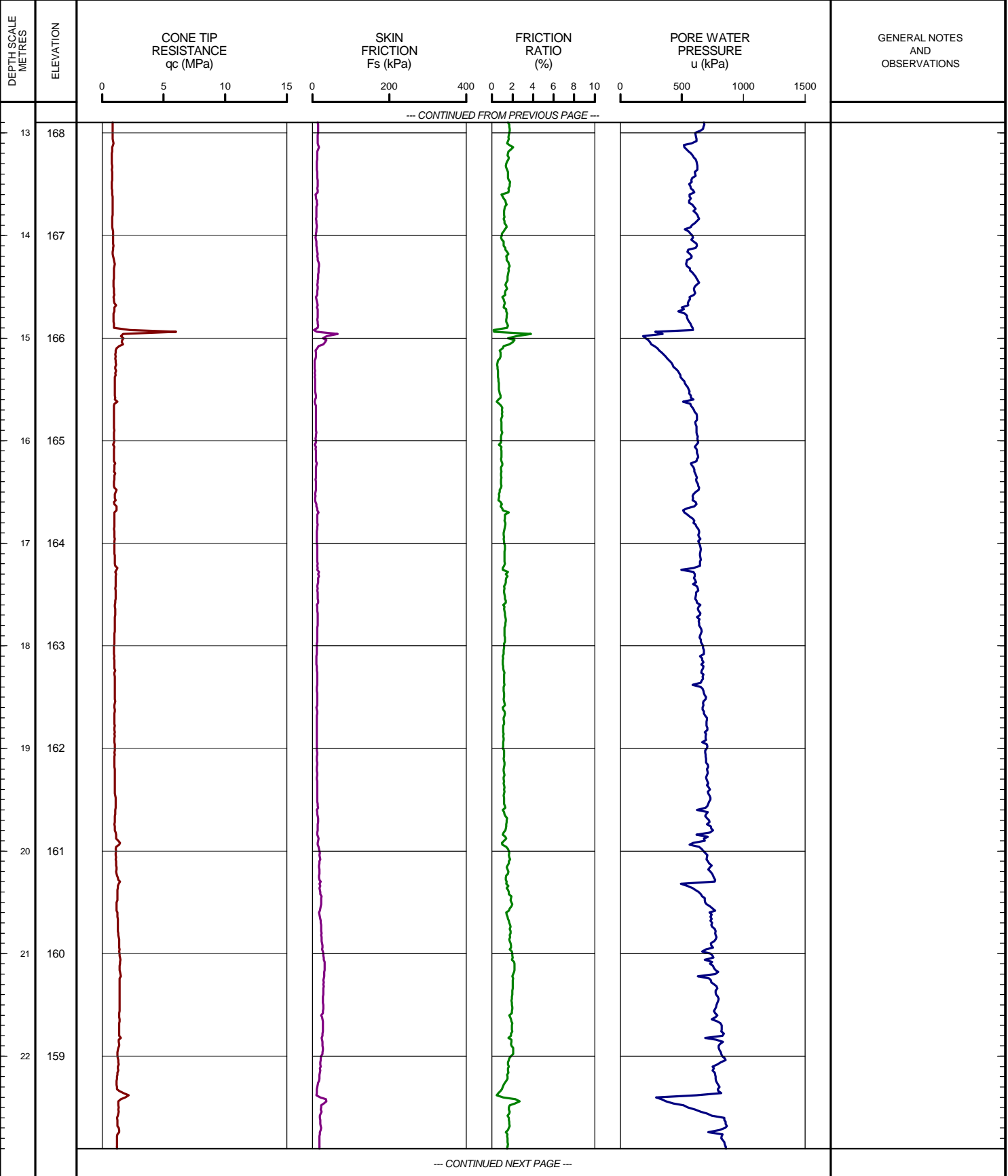
SHEET 2 OF 3

LOCATION: N 4679664.9 ;E 332002.7

TEST DATE: January 25, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.85m PREDRILL DEPTH: 2.90m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-324

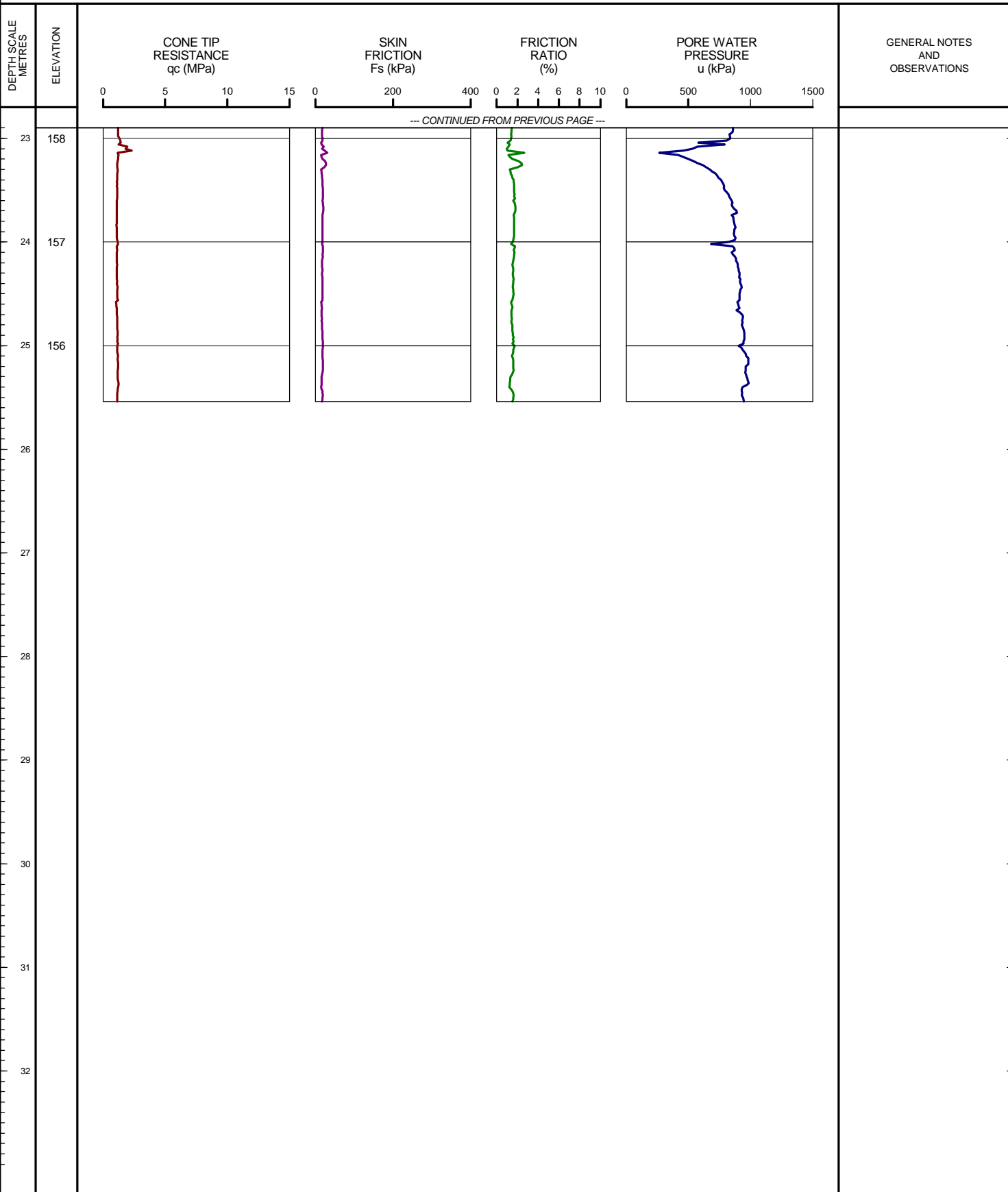
SHEET 3 OF 3

LOCATION: N 4679664.9 ;E 332002.7

TEST DATE: January 25, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.85m PREDRILL DEPTH: 2.90m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

RECORD OF BOREHOLE No 122

1 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4679265.4 :E 332537.9

ORIGINATED BY SM

DIST WEST HWY 401/3

BOREHOLE TYPE

POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

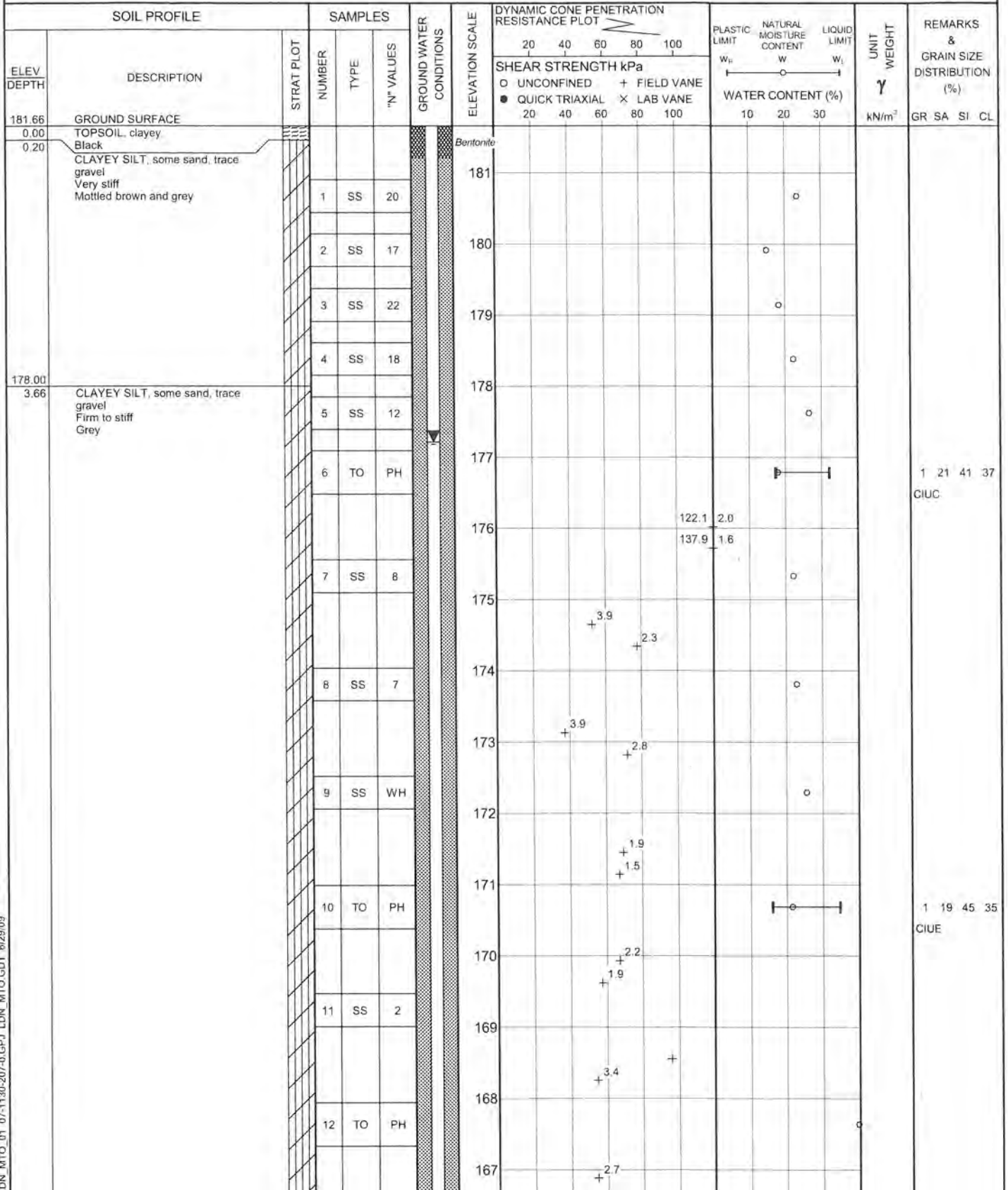
COMPILED BY BRS

DATUM GEODETIC

DATE

January 24, 2008 - January 29, 2008

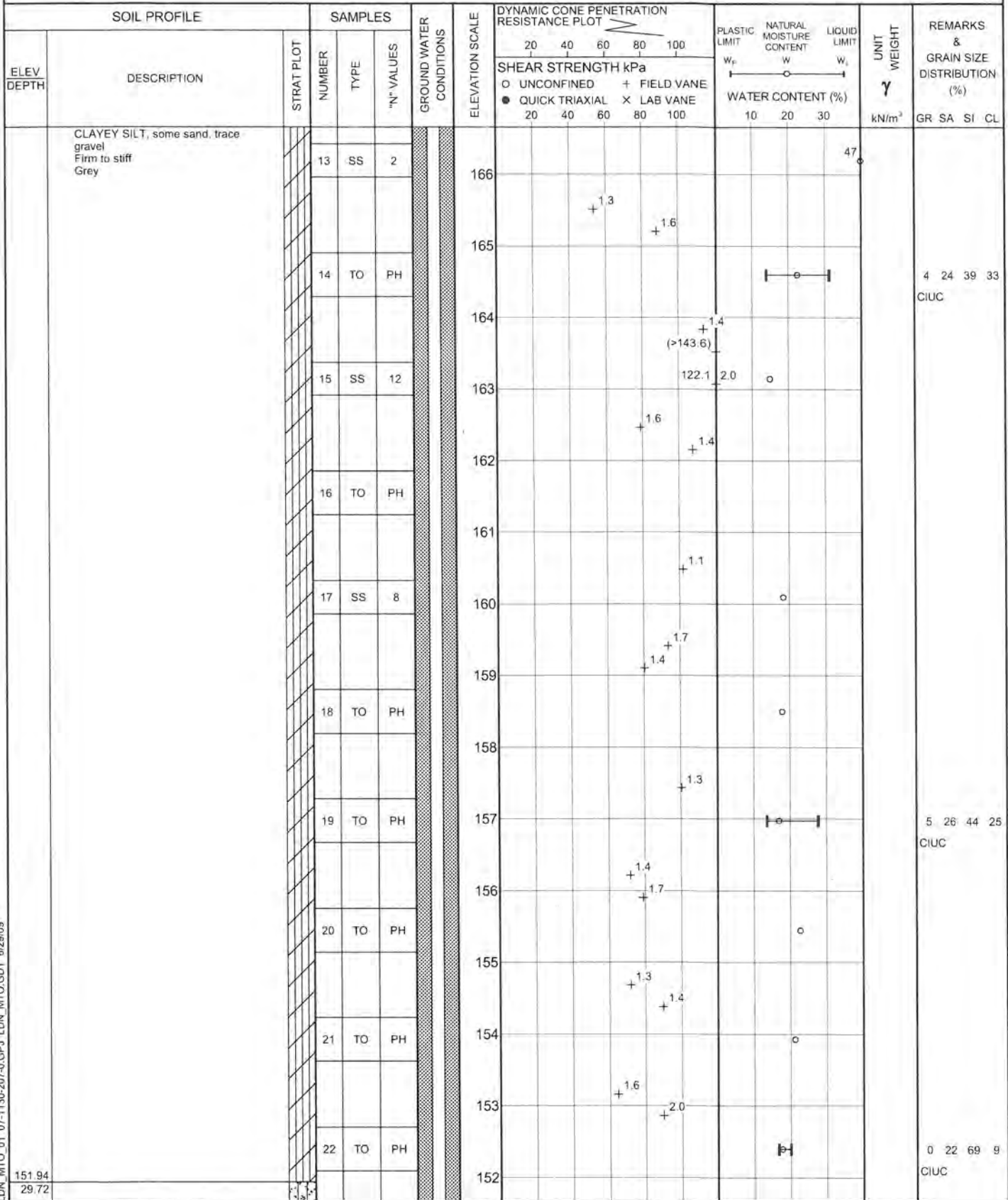
CHECKED BY *SSS*



Continued Next Page

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

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 122		2 OF 4		METRIC	
W.P. _____		LOCATION N 4679265.4 E 332537.9		ORIGINATED BY SM			
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS			
DATUM GEODETIC		DATE January 24, 2008 - January 29, 2008		CHECKED BY SJB			



LDN MTO_01 07-1130-207-0.GPJ LDN MTO.GDT 6/29/09

Continued Next Page

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

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 122		3 OF 4	METRIC
W.P. _____		LOCATION N 4679265.4 : E 332537.9		ORIGINATED BY SM	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC		DATE January 24, 2008 - January 29, 2008		CHECKED BY <i>SJS</i>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
							20 40 60 80 100								
							(>143.6)								
150.42	SILTY SAND, fine to medium, trace clay Compact Grey		23	SS	13									(29)	
31.24	SANDY SILT, trace clay, with clayey silt intrusions Very dense Grey		24	SS	84										
			25	SS	100/ 2.5mm										
146.61	LIMESTONE, fresh, medium strong, thinly laminated to laminated, very fine to fine grained, faintly to strongly porous Brown to grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		26	SS	50/ 3.8mm									UC	
35.05			27	NQ RC											
			28	NQ RC											
			29	NQ RC											
			30	NQ RC											
141.33	END OF BOREHOLE														
40.33	Borehole dry during drilling between January 24 and 29, 2008. Water level measured in deep piezometer at elev. 178.01m on July 22, 2008 Water level measured in deep piezometer at elev. 178.26m on August 11, 2008. Water level measured in deep piezometer at elev. 178.26m on September 19, 2008. Water level measured in deep piezometer at elev. 177.54m on November 11, 2008. Water level measured in deep piezometer at elev. 177.21m on January 28, 2009.														

LDN MTO_01 07-1130-207-0.GPJ LDN MTO GDT 8/29/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 122

SHEET 4 OF 4

LOCATION: N 4679265.4 E 332537.9

DRILLING DATE: January 24, 2008 - January 29, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (mm/min)	COLOUR % RETURN	FLUSH	ELEVATION											DIAMETRAL POW. LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
				TOTAL CORE %						SOLID CORE %	DIP w.r.t. CORE AXIS			TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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		ROCK SURFACE		146.61																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									

LDN ROCK 03 07-1130-207-0-ROCK GP, GLDR LDN GDT 5/29/09 DATA INPUT: WDF

DEPTH SCALE

1:75



LOGGED: SG

CHECKED: *SSB*

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

RECORD OF BOREHOLE No 126

1 OF 1

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4679237.2 :E 332335.5

ORIGINATED BY DM

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, HOLLOW STEM

COMPILED BY BRS

DATUM GEODETIC

DATE

March 26, 2008

CHECKED BY *SSB*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						20 40 60 80 100	10 20 30
180.61	GROUND SURFACE															
0.00	FILL, sand and gravel, trace silt Compact Brown		1	SS	24											
179.09																
1.52	CLAYEY SILT, some sand, trace gravel Stiff to hard Brown, becoming grey at about elev. 177.0m		2	SS	8											
			3	SS	20											
			4	SS	33											
			5	SS	26											
			6	SS	17											
			7	SS	11											
			8	SS	10											
			9	SS	10											
			10	SS	8											
172.38	END OF BOREHOLE															
8.23	Borehole dry during drilling on March 26, 2008.															

DN_M10_01 07-11-30-207-0.GPJ LUN_M10.GDT 6/23/09

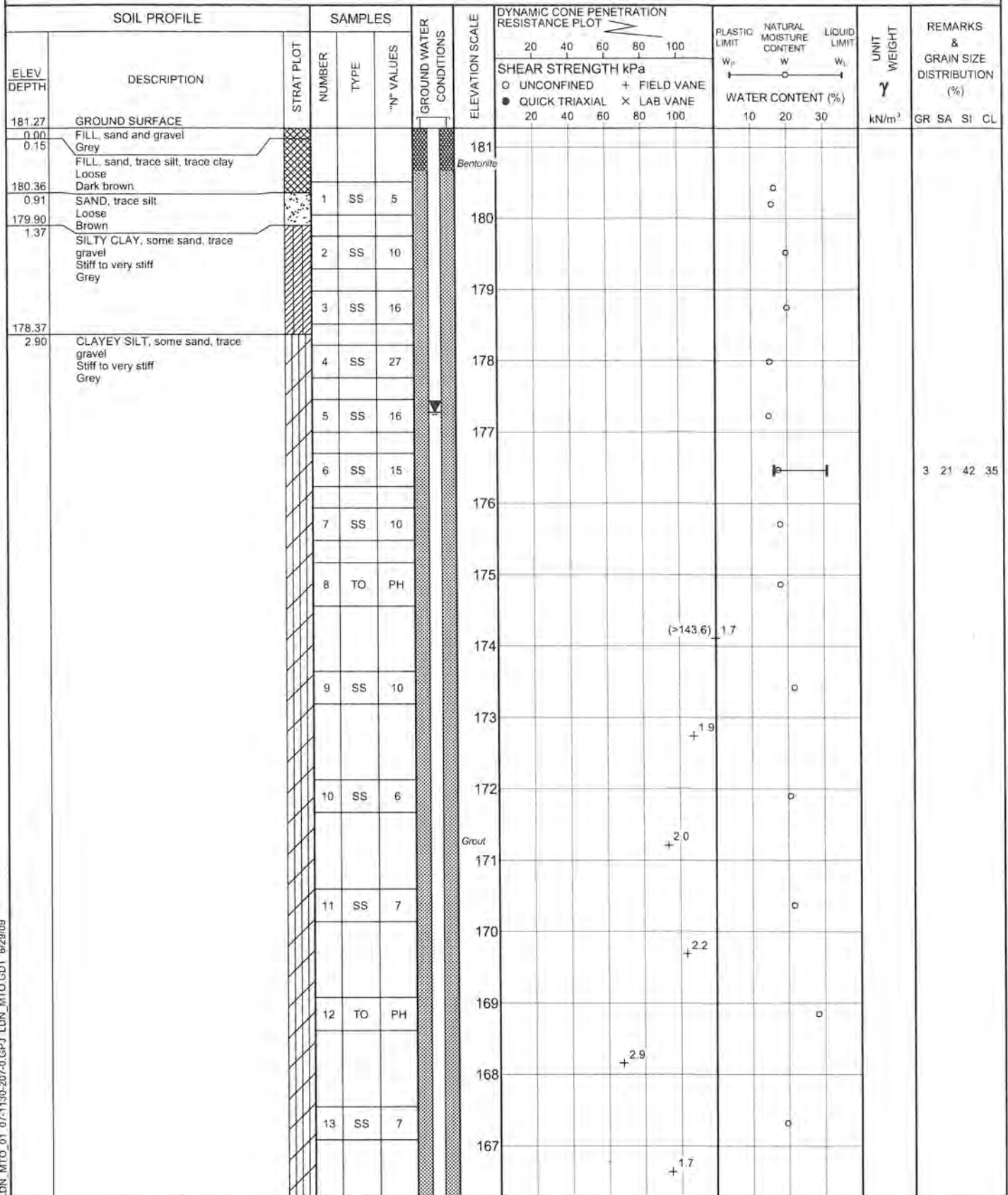
LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT 07-1130-207-0 **RECORD OF BOREHOLE No 127** 1 OF 4 **METRIC**

W.P. LOCATION N 4679370.9 , E 332251.6 ORIGINATED BY SM

DIST WEST HWY 401/3 BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC COMPILED BY BRS

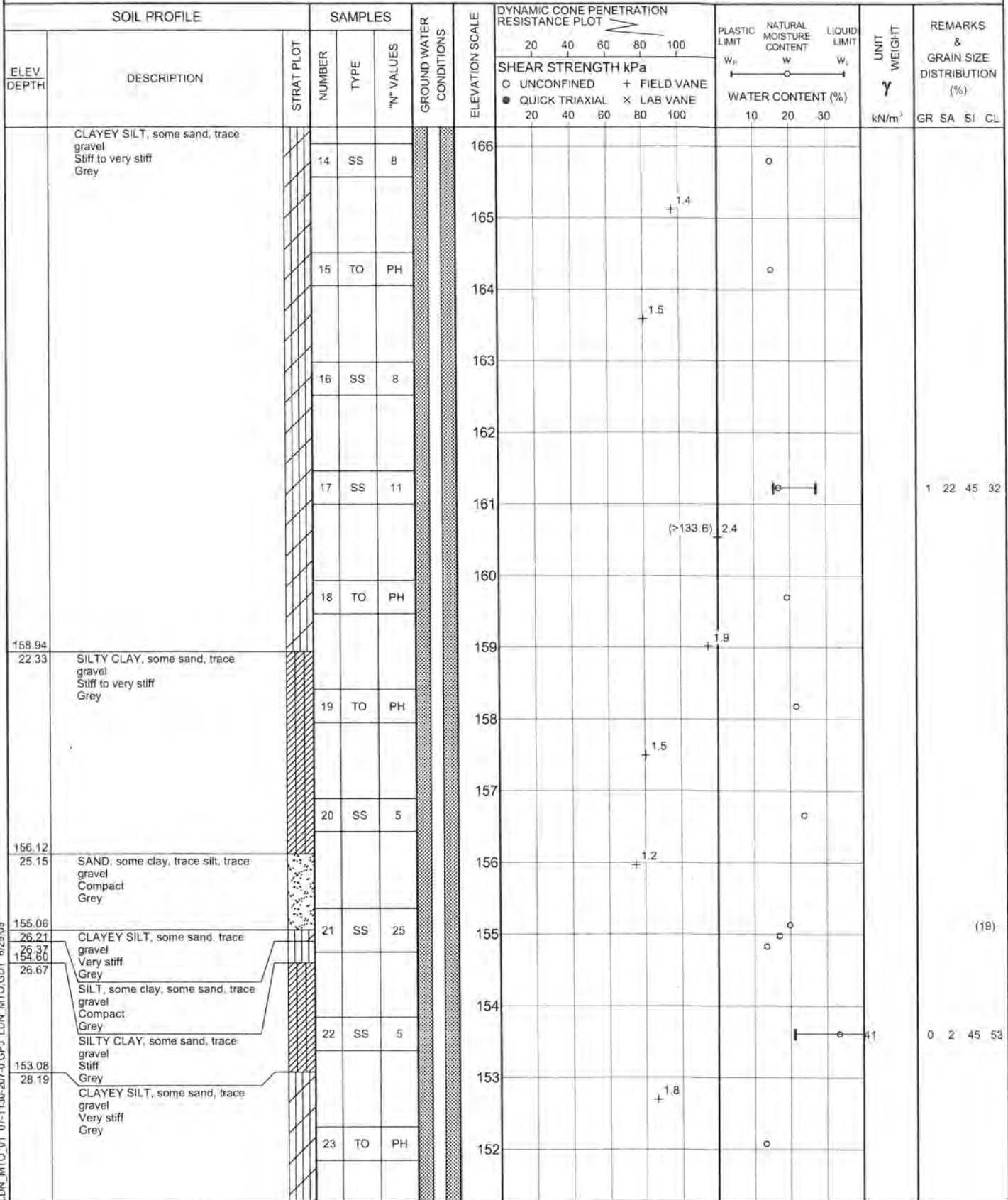
DATUM GEODETIC DATE March 11, 2008 - March 13, 2008 CHECKED BY *SLF*



Continued Next Page

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

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 127		2 OF 4	METRIC
W.P.	LOCATION	N 4679370.9, E 332251.6		ORIGINATED BY SM	
DIST WEST HWY 401/3	BOREHOLE TYPE	POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC	DATE	March 11, 2008 - March 13, 2008		CHECKED BY <i>SJB</i>	



LDN MTO 01 07-1130-207-0.GPJ LDN MTO.GDT 6/29/09

Continued Next Page

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

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 127		3 OF 4		METRIC						
W.P. _____		LOCATION N 4679370.9 E 332251.6		ORIGINATED BY SM								
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS								
DATUM GEODETIC		DATE March 11, 2008 - March 13, 2008		CHECKED BY <i>SJB</i>								
SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _l	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
150.54	CLAYEY SILT, some sand, trace gravel Very stiff Grey		24	SS	163							(39)
30.73	SANDY SILT, trace clay, trace gravel, with cobbles Very dense Grey		25	SS	100/50mm							
148.47	DOLOSTONE/LIMESTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous Brown to grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		26	NQ RC								
32.80			27	NQ RC								
145.16			28	NQ RC								UC
36.11	END OF BOREHOLE											
<p>Borehole dry during drilling between March 11 and 13, 2008.</p> <p>Water level measured in deep piezometer at elev. 177.74m on March 20, 2008.</p> <p>Water level measured in deep piezometer at elev. 178.27m on July 22, 2008.</p> <p>Water level measured in deep piezometer at elev. 178.12m on August 11, 2008.</p> <p>Water level measured in deep piezometer at elev. 177.87m on September 19, 2008.</p> <p>Water level measured in deep piezometer at elev. 177.74m on November 11, 2008.</p> <p>Water level measured in deep piezometer at elev. 177.28m on January 28, 2009.</p>												

LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 127

SHEET 4 OF 4

LOCATION: N 4679370.9 ; E 332251.6

DRILLING DATE: March 11, 2008 - March 13, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (mm/min)	COLOUR % RETURN	FLUSH	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols										DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
				DEPTH (m)						RECOVERY		R Q D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec					
										TOTAL CORE %	SOLID CORE %			DIP w/11 CORE AXIS	TYPE AND SURFACE DESCRIPTION						
		ROCK SURFACE		148.47																	
33	MUD ROTARY NO ROCK CORE	LIMESTONE/BASALT - broken core, likely cobbles from till		32.80 148.20	1																
		DOLOSTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous with localized vugs, dark brown		33.07					148												
34					2																
					146.89					147											
		LIMESTONE, fresh, medium strong, thinly laminated, medium grained, faintly porous, grey to brown		34.38 146.47																	
35			DOLOSTONE/LIMESTONE, fresh, medium strong, thinly laminated to bedded, very fine grained to fine grained, faintly porous, light grey to grey		34.80										JN, PL, SM Ci JN, C, Ro Ca						
		DOLOSTONE/LIMESTONE, fresh, medium strong, laminated, fine grained, faintly porous, light grey to grey		145.55	3				146					JN, PL, SM Ca JN, PL, SM Ca							
36		DOLOSTONE/LIMESTONE, fresh, medium strong, laminated, fine grained, faintly porous, brown		35.72 145.16																	
		END OF DRILLHOLE		36.11										JN, PL, SM Ci							
37																					
38																					
39																					
40																					
41																					
42																					
43																					
44																					
45																					
46																					
47																					

LDN-ROCK-03 07-1130-207-0-ROCK-GPJ GLDR LDN-GDT 6/29/09 DATA INPUT: WDF

DEPTH SCALE

1:75



LOGGED: SG

CHECKED: SJB

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No CPT-124		1 OF 1	METRIC
W.P. _____		LOCATION <u>N 4679354.6 :E 332455.0</u>		ORIGINATED BY <u>CC</u>	
DIST <u>WEST</u> HWY <u>401/3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>LMK</u>	
DATUM <u>GEODETIC</u>		DATE <u>September 11, 2008</u>		CHECKED BY <u>SJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p — w — w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
181.51	GROUND SURFACE										
0.00	TOPSOIL, silty, some sand, trace clay, trace organics, trace gravel		1	SS	14		181				
180.90	Compact Brown										
0.61	SAND, fine to medium, some silt		2	SS	4						
0.91	Loose Brown										
	CLAYEY SILT, trace sand, trace gravel		3	SS	19		180				
179.68	Firm to very stiff										
1.83	Mottled brown and grey										
	END OF BOREHOLE										
	Water level in borehole at about elev. 180.5m during drilling on September 11, 2008.										

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-322		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4679294.0 ; E 332478.2</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>January 7, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w _p	w	w _L					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE												
181.50	ROAD SURFACE						20	40	60	80	100									
0.05	ASPHALT PAVEMENT																			
181.04	FILL, limestone gravel, crushed																			
0.46	Grey TOPSOIL, clayey Very stiff Black		1	SS	17															
180.28																				
1.22	CLAYEY SILT, some sand, trace gravel, with occasional fissures, silt partings and seams Hard Brown becoming grey below about elev. 177.5m		2	SS	35															
			3	SS	44															
			4	SS	37															
177.84																				
3.66	END OF BOREHOLE																			
	Borehole dry during drilling on January 7, 2010.																			

LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-10

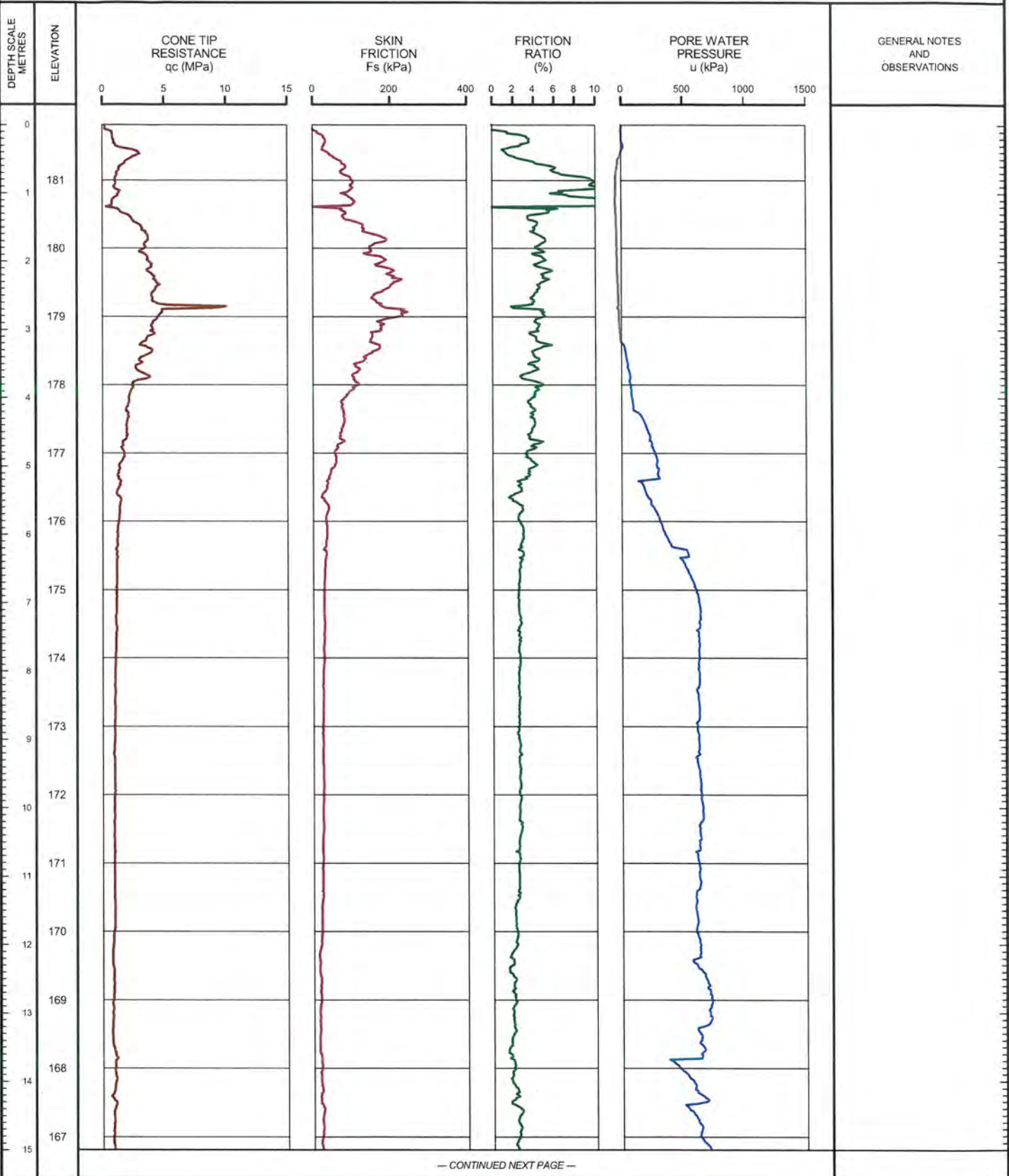
SHEET 1 OF 2

LOCATION: N 4679264.0 ; E 332533.0

TEST DATE: November 10, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SSB*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-10

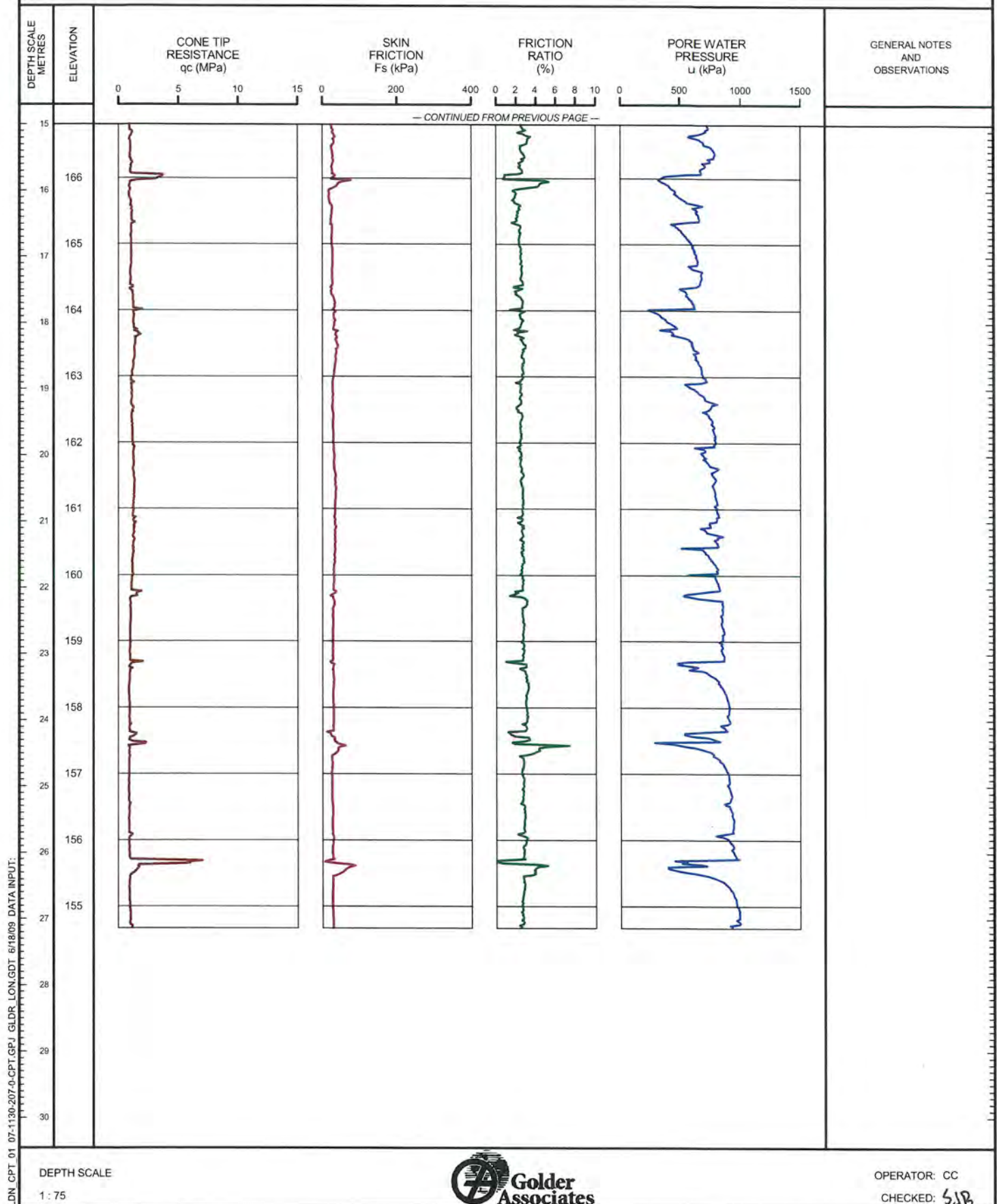
SHEET 2 OF 2

LOCATION: N 4679264.0 :E 332533.0

TEST DATE: November 10, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 0.00m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-124

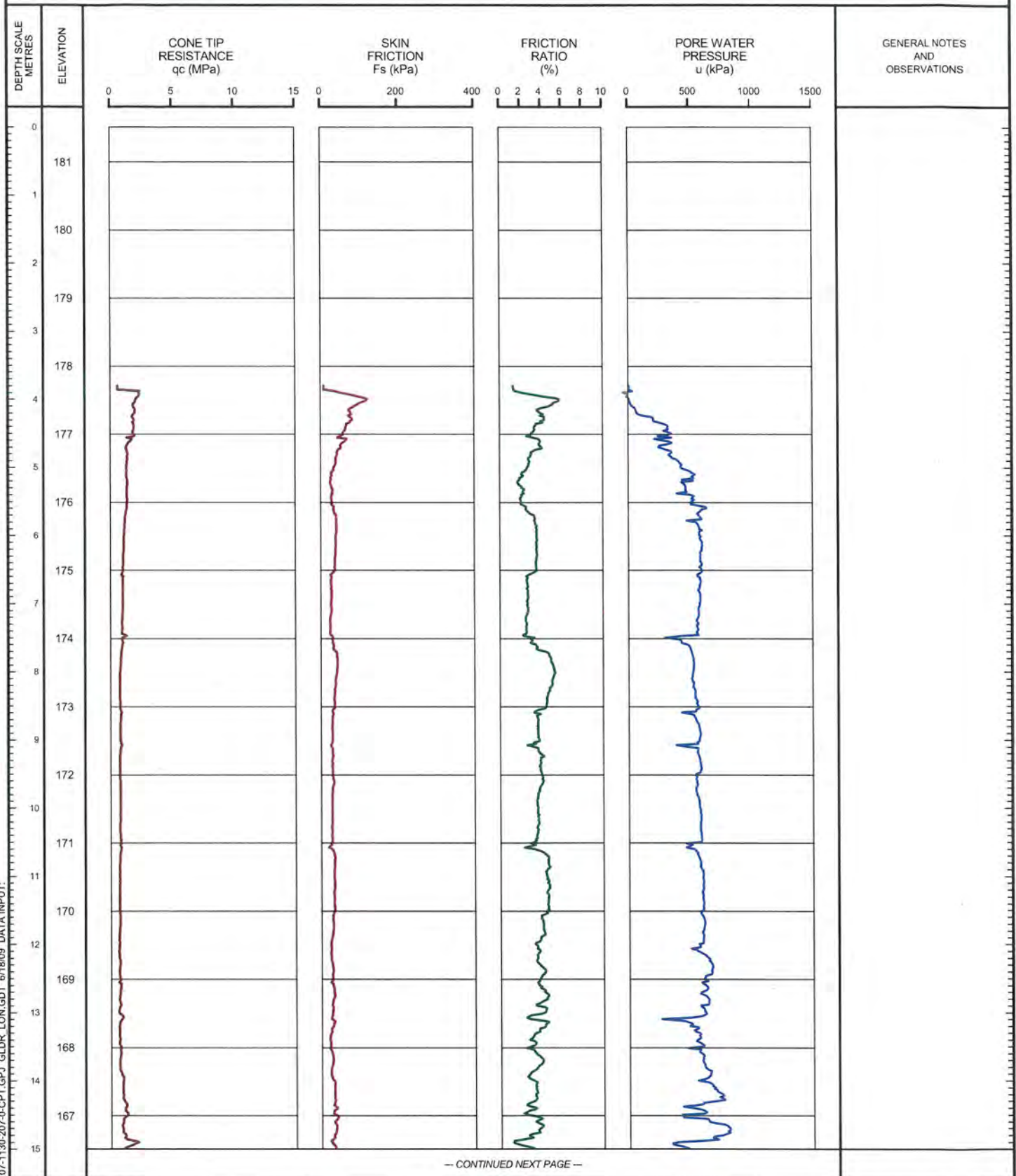
SHEET 1 OF 2

LOCATION: N 4679354.6 :E 332455.0

TEST DATE: September 29, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.81m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SB*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-124

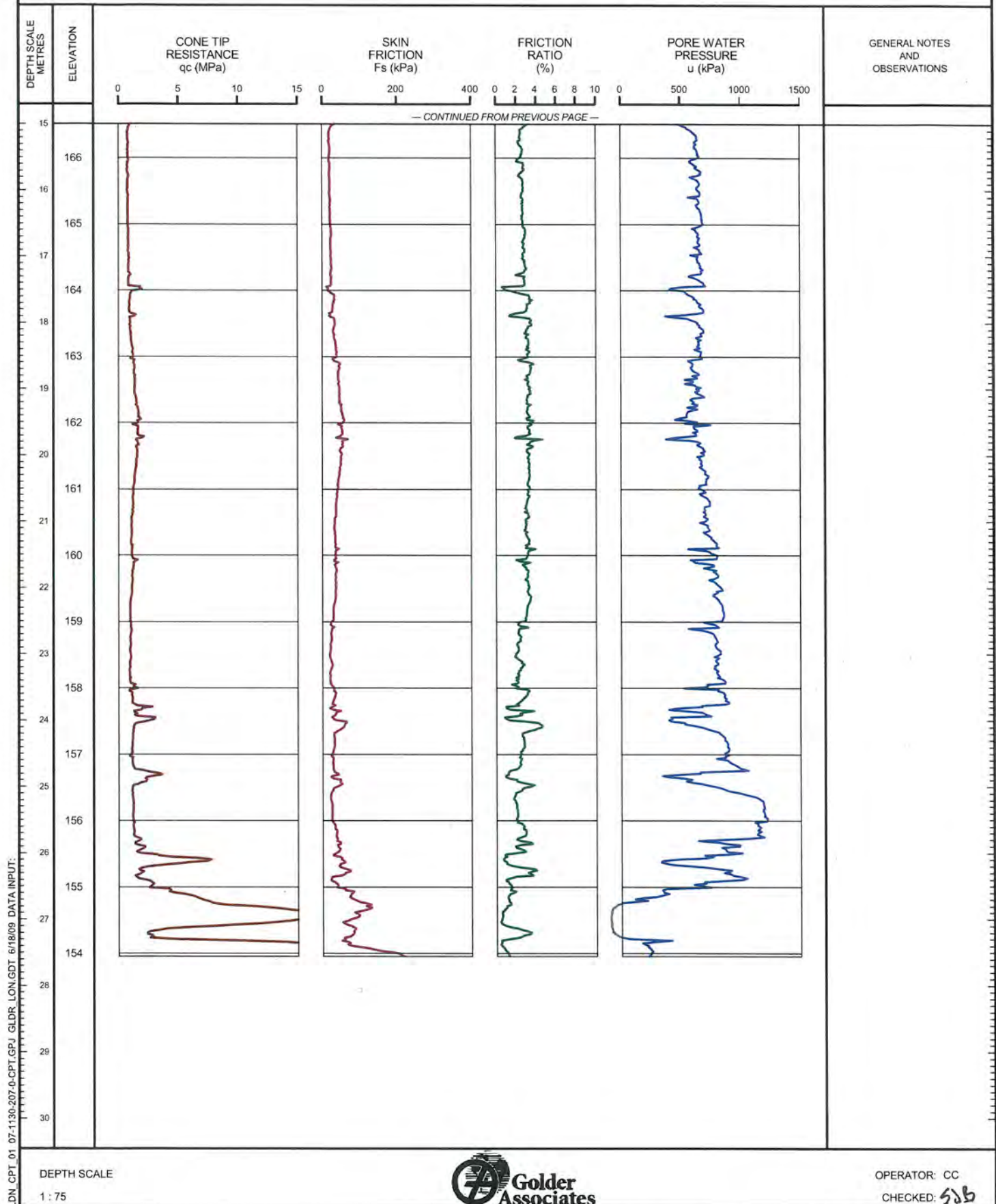
SHEET 2 OF 2

LOCATION: N 4679354.6 :E 332455.0

TEST DATE: September 29, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.81m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-322

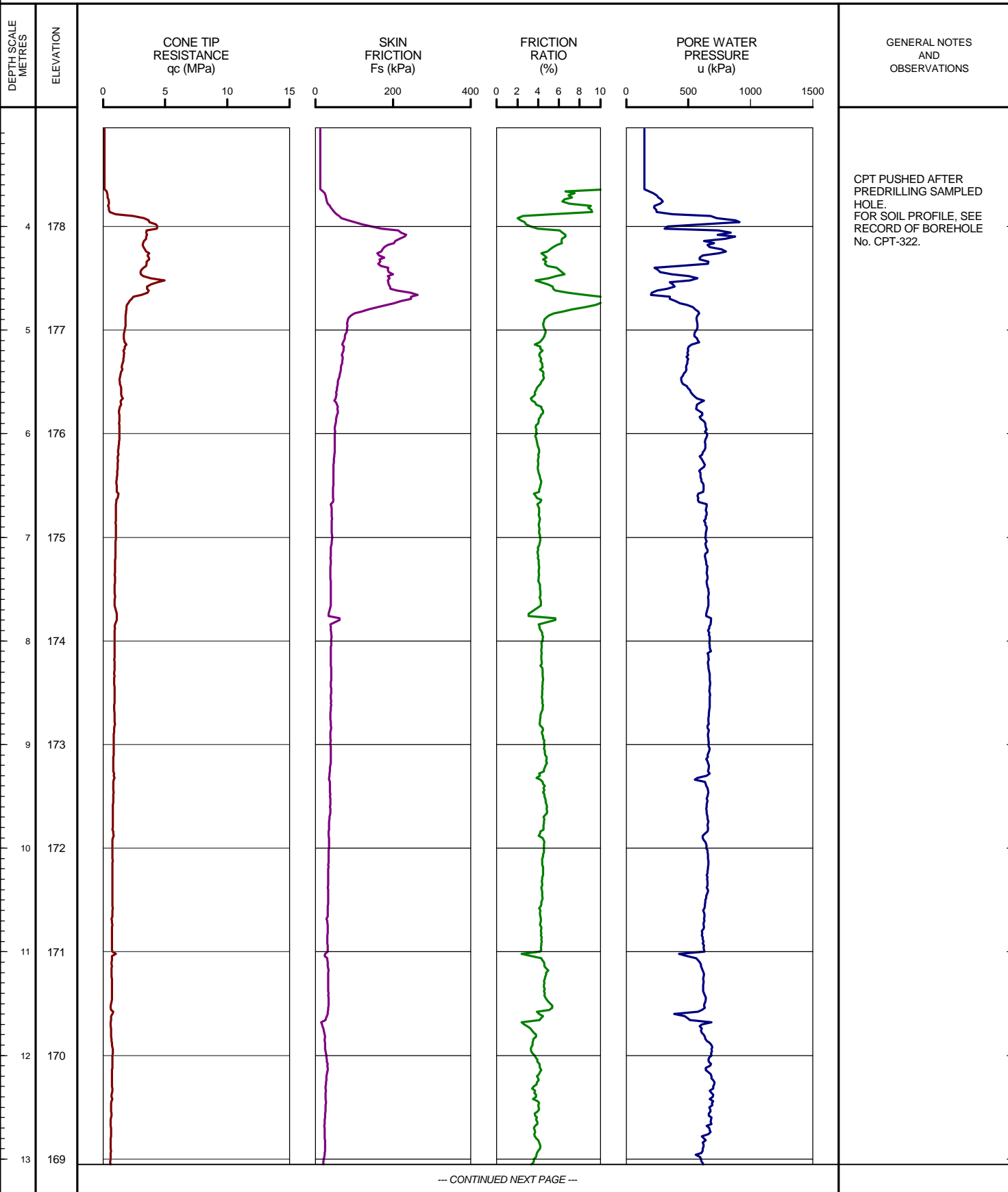
SHEET 1 OF 2

LOCATION: N 4679294.0 ;E 332478.2

TEST DATE: January 8, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 181.50m PREDRILL DEPTH: 3.05m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-322

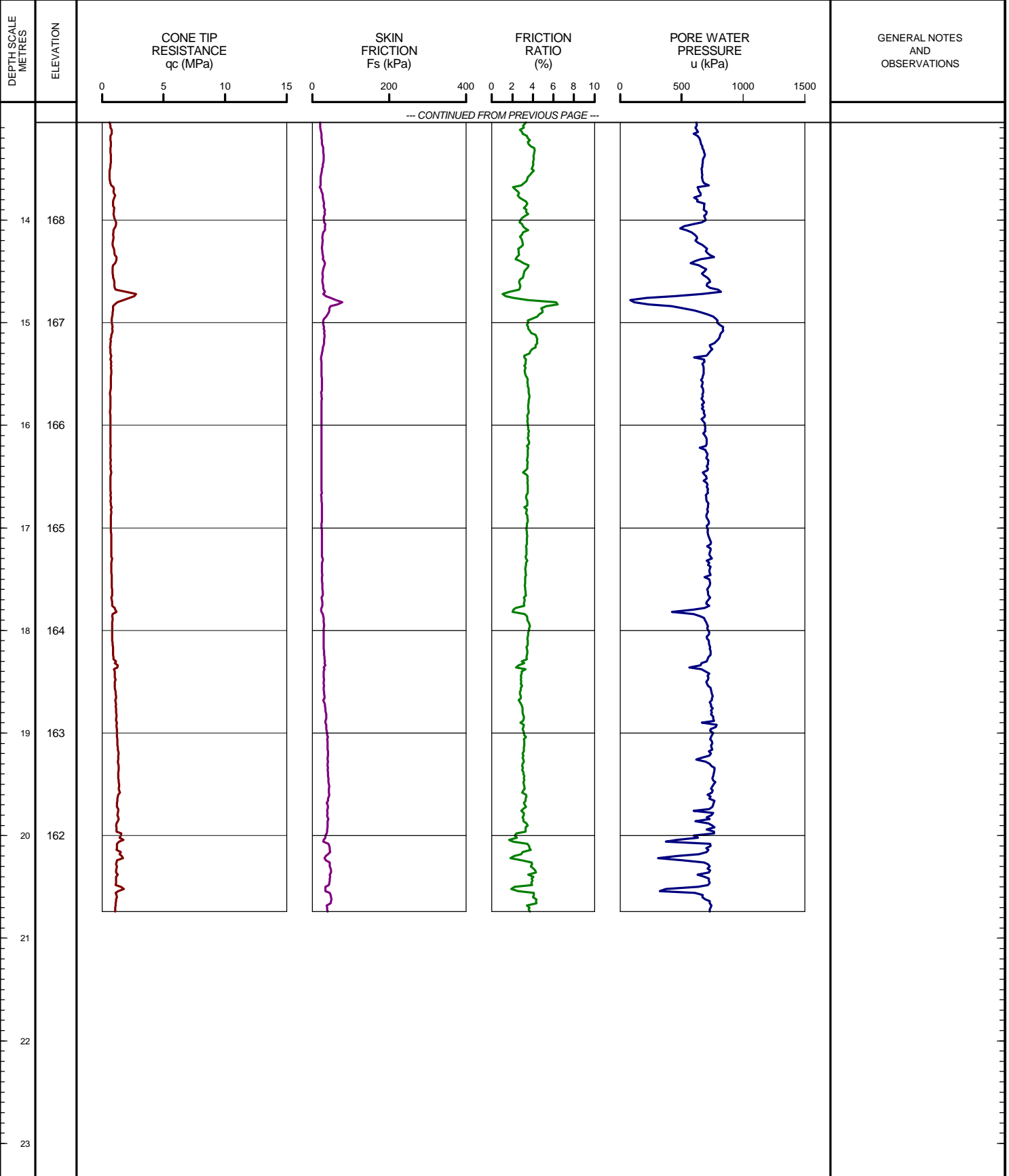
SHEET 2 OF 2

LOCATION: N 4679294.0 ;E 332478.2

TEST DATE: January 8, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 181.50m PREDRILL DEPTH: 3.05m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 115		1 OF 4	METRIC
W.P.	LOCATION	N 4678585.3 E 333911.1		ORIGINATED BY MA	
DIST WEST HWY 401/3	BOREHOLE TYPE	POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC	DATE	February 15, 2008 - February 21, 2008		CHECKED BY <i>SJB</i>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								○ UNCONFINED	+ FIELD VANE							● QUICK TRIAXIAL	x LAB VANE	
183.79	GROUND SURFACE						20	40	60	80	100	10	20	30	GR SA SI CL			
0.00	TOPSOIL, silty Brown																	
183.36																		
0.43	CLAYEY SILT, some sand, trace gravel Soft to very stiff Brown		1	SS	4													
			2	SS	22													
			3	SS	25													
			4	SS	23													
180.44																		
3.35	CLAYEY SILT, some sand, trace gravel Stiff Grey		5	SS	14													
			6	SS	12													
			7	SS	14													
			8	SS	9													
			9	TO	PH													
174.80																		
8.99	SANDY SILT, some clay, trace gravel Loose Grey																	
			10	SS	7													
173.58																		
10.21	CLAYEY SILT, some sand, trace gravel Firm Grey																	
173.12																		
10.67	SAND, trace gravel, trace silt Loose Grey		11	SS	8													
171.90																		
11.89	CLAYEY SILT, some sand, trace gravel Soft to very stiff Grey		12	SS	7													
			13	TO	PH													
			14	SS	6													

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 8/29/09

Continued Next Page

+3, x3. Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 115

2 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678585.3 :E 333911.1

ORIGINATED BY MA

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

DATUM GEODETIC

DATE

February 15, 2008 - February 21, 2008

CHECKED BY **SB**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
	CLAYEY SILT, some sand, trace gravel Soft to very stiff Grey													
			15	SS	4		168		1.5					
							167		2.0					
			16	TO	PH		166							
							165		1.5					
			17	SS	6		164							
							163							4 25 47 24
			18	SS	13		162							
							161							
			19	SS	22		160							
							159							
			20	SS	22		158							
							157							
			21	SS	24		156							
							155							
			22	SS	11		154							
			23	TO	PH									
156.21 27.58	SAND, trace sand, trace gravel, trace clay Dense Grey		24	SS	31									1 86 8 5
154.83 28.96	SAND, trace gravel Compact to dense Grey													
			25	SS	30									

Continued Next Page

+ 3, x 3.

Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

LDN MTO 01 07-1130-207-0.GPJ LDN MTO.GDT 6/29/09

RECORD OF BOREHOLE No 115

3 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678585.3 : E 333911.1

ORIGINATED BY MA

DIST WEST

HWY 401/3

BOREHOLE TYPE

POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

DATUM GEODETIC

DATE

February 15, 2008 - February 21, 2008

CHECKED BY **SJB**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
							20 40 60 80 100		10 20 30						
153.31	SAND AND GRAVEL, trace silt Dense Grey					Grout								25 66 6 3	
30.48			26	SS	36										
151.48	LIMESTONE, fresh, medium strong, laminated, fine grained Light grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		27	SS	100/ 25mm	Bentonite									
32.31				28	NQ RC				96	90	86				
				29	NQ RC				100	100	100				
				30	NQ RC				100	97	86				
146.15	END OF BOREHOLE													UC	
37.64	Water level in borehole at about elev. 156.19m during drilling on February 21, 2008. Water level measured in deep piezometer at elev. 178.00m on February 21, 2008. Water level measured in deep piezometer at elev. 178.10m on March 20, 2008. Water level measured in deep piezometer at elev. 177.69m on July 24, 2008. Water level measured in deep piezometer at elev. 175.99m on September 19, 2008. Water level measured in deep piezometer at elev. 177.25m on November 14, 2008. Water level measured in deep piezometer at elev. 177.35m on January 28, 2009.														

DRW_MTO_01 07-11-30-20740.GPJ LON_MTO.GDT 9/23/03

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 8/29/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 115

SHEET 4 OF 4

LOCATION: N 4678585.3 ; E 333911.1

DRILLING DATE: February 15, 2008 - February 21, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.		RUN No.	PENETRATION RATE (m/min)	COLOUR (m/min)	FLUSH % RETURN	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols										HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETERAL POINT LOAD INDEX (MPa)		NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
				DEPTH (m)	RECOVERY						R.Q.D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION	10 ⁻⁶	10 ⁻⁴	10 ⁻²	2	4	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
													TOTAL CORE %	SOLID CORE %								DIP w.r.t. CORE AXIS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
		ROCK SURFACE		151.48 32.31																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

DEPTH SCALE

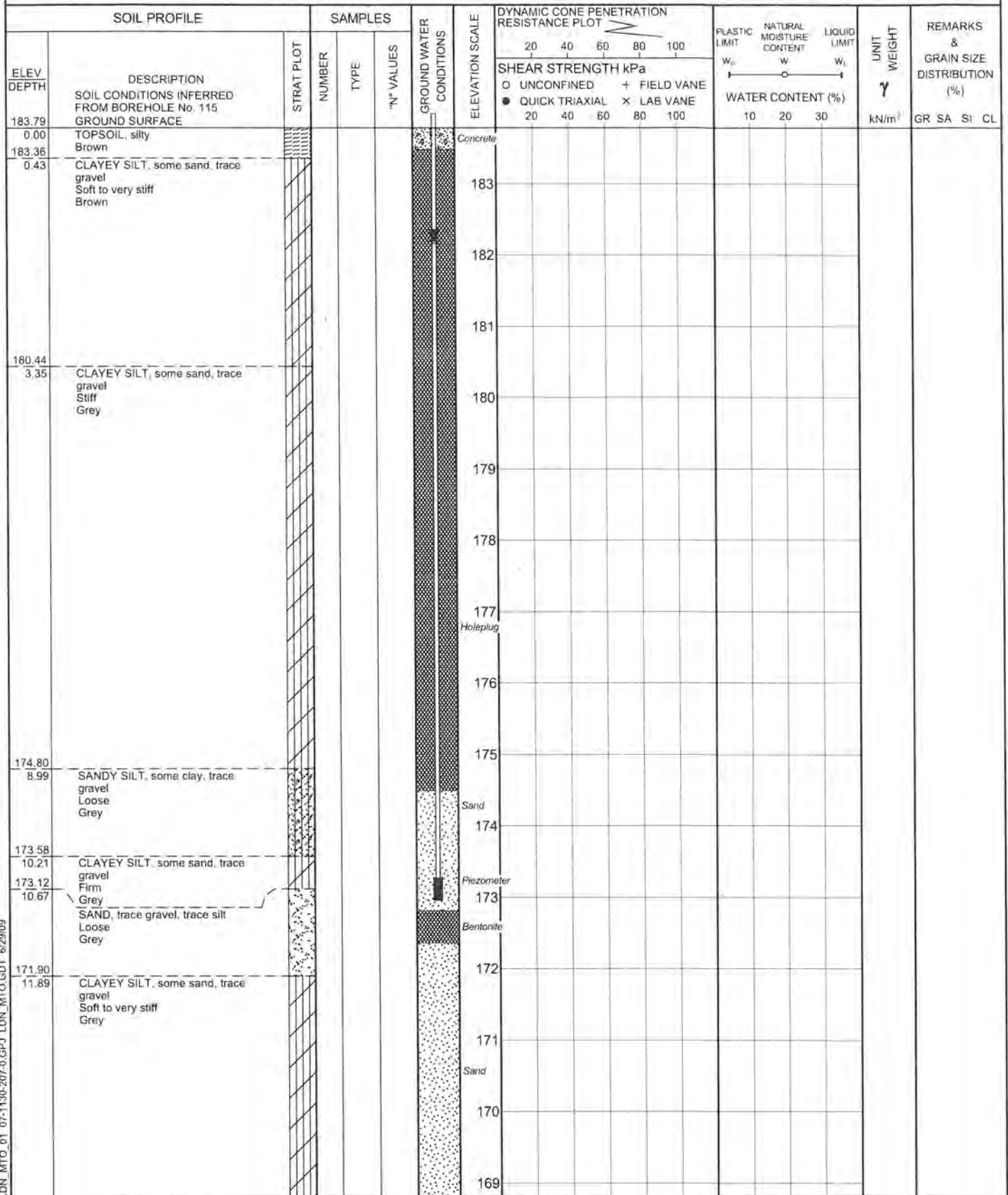
1 : 75



LOGGED: SG

CHECKED: SUB

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No 115A		1 OF 2	METRIC
W.P. _____		LOCATION <u>N 4678585.3 ; E 333911.1</u>		ORIGINATED BY <u>MA</u>	
DIST <u>WEST</u> HWY <u>401/3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>BRS</u>	
DATUM <u>GEODETIC</u>		DATE <u>February 20, 2008 - February 21, 2008</u>		CHECKED BY <u>SJB</u>	



LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

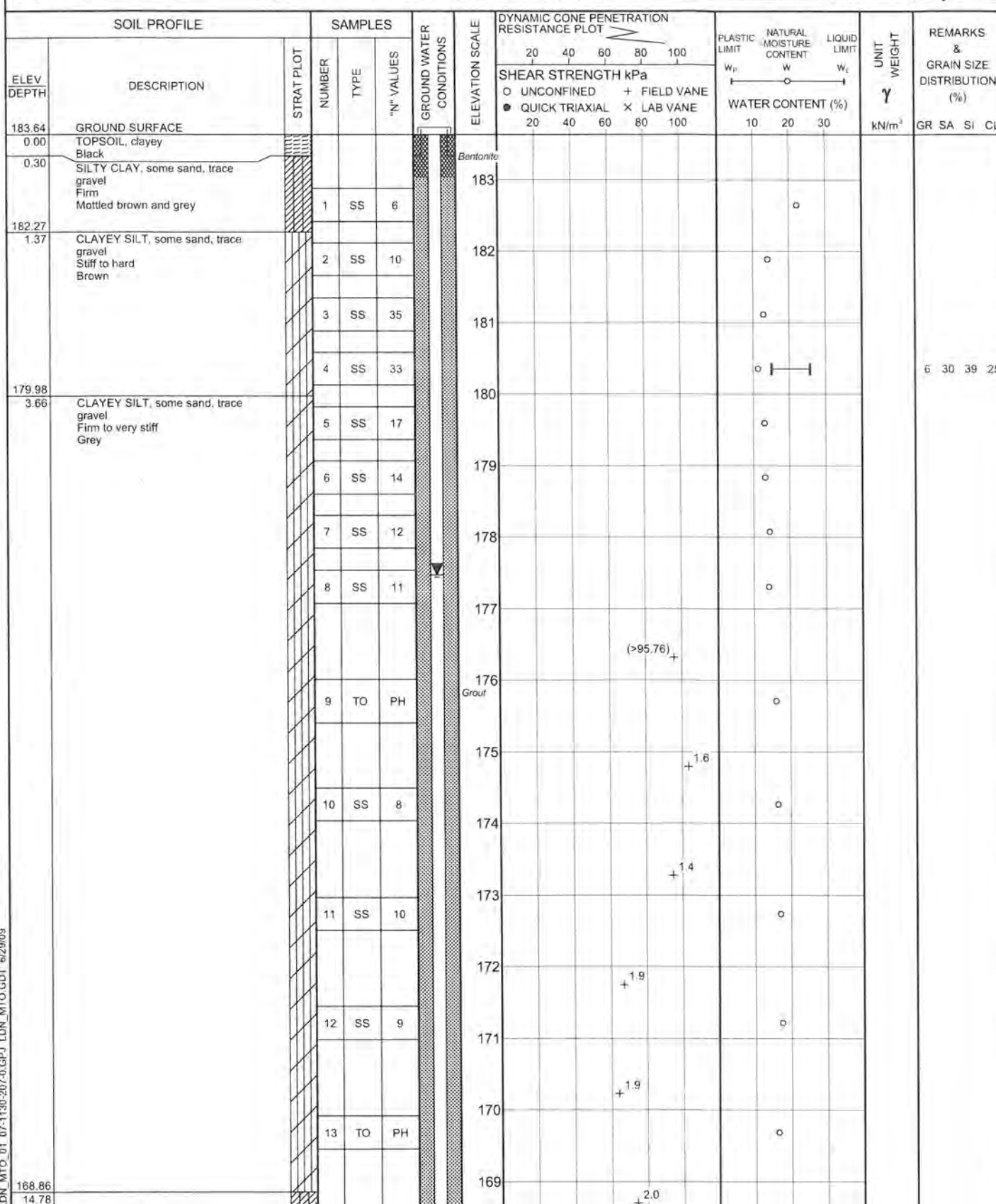
Continued Next Page

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

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 115A				2 OF 2		METRIC					
W.P. _____		LOCATION N 4678585.3 E 333911.1				ORIGINATED BY MA							
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC				COMPILED BY BRS							
DATUM GEODETIC		DATE February 20, 2008 - February 21, 2008				CHECKED BY SJB							
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT		UNIT WEIGHT		REMARKS & GRAIN SIZE DISTRIBUTION	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)	γ	GR SA SI CL	
	CLAYEY SILT, some sand, trace gravel Soft to very stiff Grey						168						
							167						
							166						
							165						
163.98	END OF BOREHOLE						164						
19.81	Water level measured in shallow piezometer at elev. 182.36m on March 20, 2008.												
	Water level measured in shallow piezometer at elev. 182.34m on July 24, 2008.												
	Water level measured in shallow piezometer at elev. 182.26m on September 19, 2008.												
	Water level measured in shallow piezometer at elev. 182.20m on January 28, 2009.												

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 116		1 OF 4	METRIC
W.P.	LOCATION	N 4678634.3 :E 333722.5		ORIGINATED BY SM	
DIST WEST HWY 401/3	BOREHOLE TYPE	POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC	DATE	February 20, 2008 - February 25, 2008		CHECKED BY <i>SB</i>	



LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

Continued Next Page

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

RECORD OF BOREHOLE No 116

2 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678634.3 E 333722.5

ORIGINATED BY SM

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

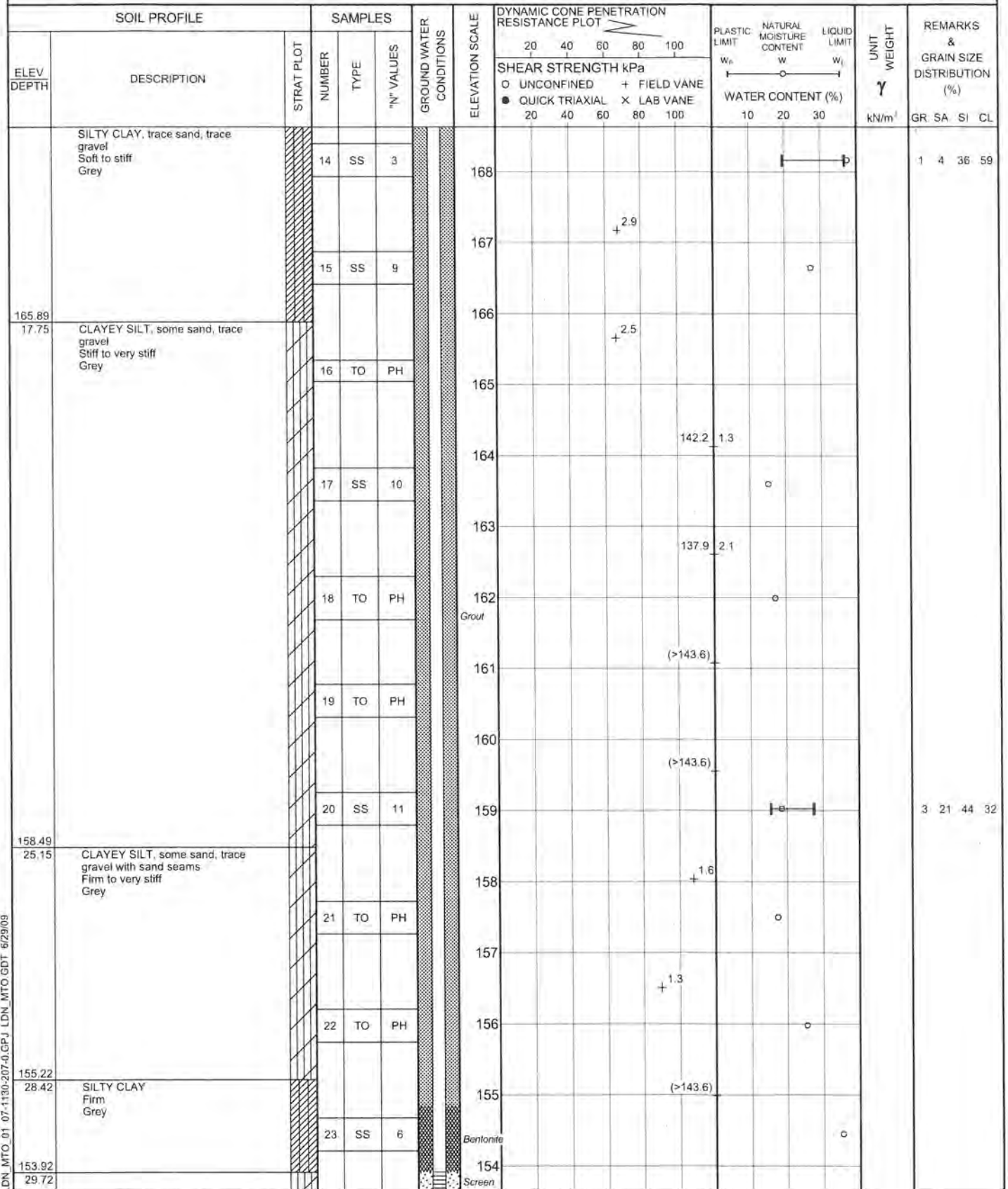
COMPILED BY BRS

DATUM GEODETIC

DATE

February 20, 2008 - February 25, 2008

CHECKED BY **SJB**



Continued Next Page

+ 3, X 3

Numbers refer to Sensitivity

O 3% STRAIN AT FAILURE

LDN MTO.01 07-1130-207-0.GPJ LDN MTO.GDT 6/29/09

PROJECT 07-1130-207-0 **RECORD OF BOREHOLE No 116** 3 OF 4 **METRIC**
W.P. LOCATION N 4678634.3 E 333722.5 ORIGINATED BY SM
DIST WEST HWY 401/3 BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC COMPILED BY BRS
DATUM GEODETIC DATE February 20, 2008 - February 25, 2008 CHECKED BY *SYB*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE											
							20	40	60	80	100	10	20	30					
	CLAYEY SILT, some sand, some gravel, with cobbles and boulders Very stiff Brown		24	SS	21											(49)			
151.66																			
31.98	LIMESTONE AND DOLOSTONE, fresh, medium strong, laminated, fine grained, faintly porous Light brown to grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		25	NQ RC												UC			
			26	NQ RC															
			27	NQ RC															
147.58																			
36.06	END OF BOREHOLE Borehole dry during drilling between February 20 and 25, 2008. Water level measured in deep piezometer at elev. 180.79m on March 20, 2008. Water level measured in deep piezometer at elev. 177.95m on July 22, 2008. Water level measured in deep piezometer at elev. 176.69m on August 11, 2008. Water level measured in deep piezometer at elev. 176.09m on September 19, 2008. Water level measured in deep piezometer at elev. 177.26m on November 11, 2008. Water level measured in deep piezometer at elev. 177.48m on January 28, 2009.																		

LDN_MTO_01 07-1130-207-0-GPJ LDN_MTO.GDT 6/29/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 116

SHEET 4 OF 4

LOCATION: N 4678634.3 ; E 333722.5

DRILLING DATE: February 20, 2008 - February 25, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (mm/min)	COLOUR % RETURN	FLUSH	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Stickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.										DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
										TOTAL CORE %	SOLID CORE %			DIP w/1 CORE AXIS	TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

LDN ROCK 03 07-1130-207-0-ROCK.GPJ GLDR LDN GDT 8/29/09 DATA INPUT: WDF

DEPTH SCALE

1:75



LOGGED: SG

CHECKED: *SG*

RECORD OF BOREHOLE No 116A

1 OF 1

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678634.3 E 333722.5

ORIGINATED BY SM

DIST

WEST

HWY 401/3

BOREHOLE TYPE

POWER AUGER, SOLID STEM

COMPILED BY BRS

DATUM GEODETIC

DATE

February 25, 2008

CHECKED BY SJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
183.64	GROUND SURFACE						20 40 60 80 100	20 40 60 80 100	10 20 30						
0.00	TOPSOIL, clayey Black														
0.30	SILTY CLAY, some sand, trace gravel Firm Mottled brown and grey														
182.27															
1.37	CLAYEY SILT, some sand, trace gravel Stiff to hard Brown														
179.98															
3.66	CLAYEY SILT, some sand, trace gravel Firm to very stiff Grey														
174.50															
9.14	END OF BOREHOLE														
	Water level measured in shallow piezometer at elev. 182.55m on March 20, 2008.														
	Water level measured in shallow piezometer at elev. 182.80m on July 22, 2008.														
	Water level measured in shallow piezometer at elev. 182.59m on August 11, 2008.														
	Water level measured in shallow piezometer at elev. 182.57m on September 19, 2008.														
	Water level measured in shallow piezometer at elev. 182.72m on January 28, 2009.														

LDN_MTO 01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No CPT-114		1 OF 1	METRIC
W.P. _____		LOCATION <u>N 4678526.7 :E 334018.6</u>		ORIGINATED BY <u>CC</u>	
DIST <u>WEST</u> HWY <u>401/3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>SJL</u>	
DATUM <u>GEODETIC</u>		DATE <u>September 10, 2008</u>		CHECKED BY <u>SJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80
184.21	GROUND SURFACE															
0.00	TOPSOIL, silty, trace to some sand Compact Black		1	SS	20											
0.28	CLAYEY SILT, trace to some sand, trace gravel Very stiff Mottled brown and grey becoming brown at about elev. 183.0m		2	SS	20											
182.38			3	SS	28											
1.83	END OF BOREHOLE Borehole dry during drilling on September 10, 2008.															

LDN MTO_01 07-1130-207-0.GPJ LDN MTO.GDT 6/29/09

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-6

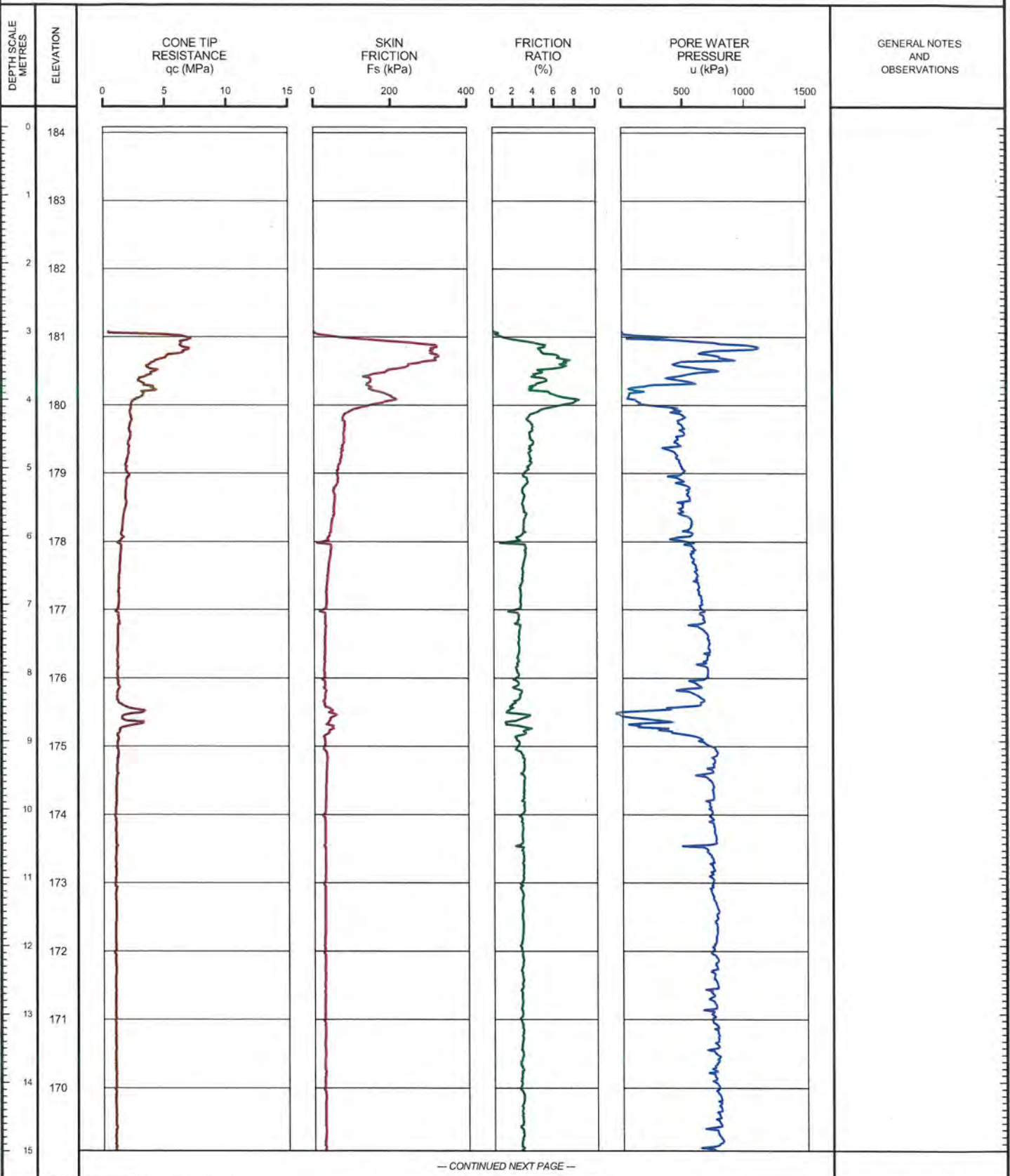
SHEET 1 OF 2

LOCATION: N 4678621.0 ; E 333844.0

TEST DATE: November 13, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.00m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *536*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-6

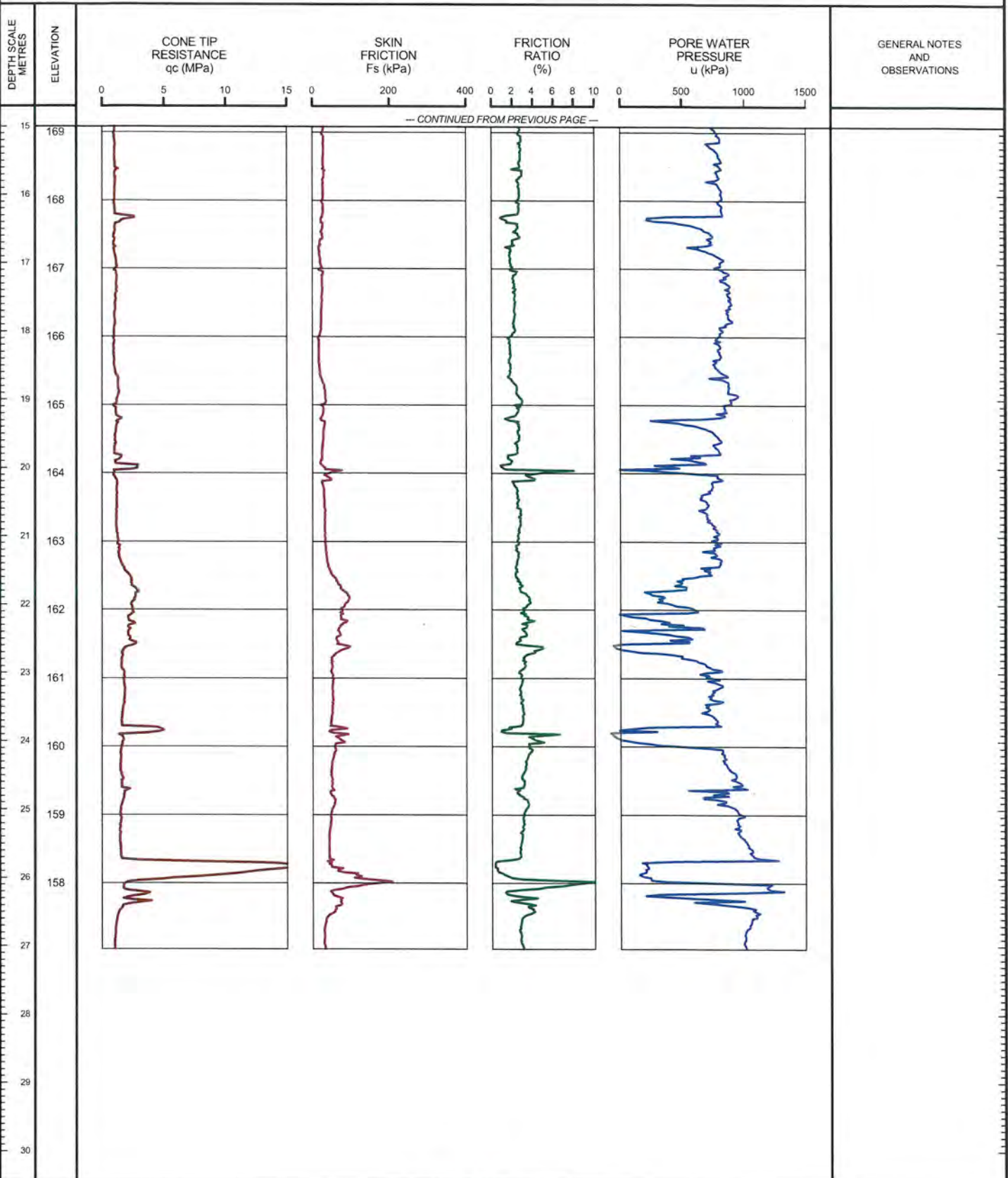
SHEET 2 OF 2

LOCATION: N 4678621.0; E 333844.0

TEST DATE: November 13, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.00m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SVB*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-114

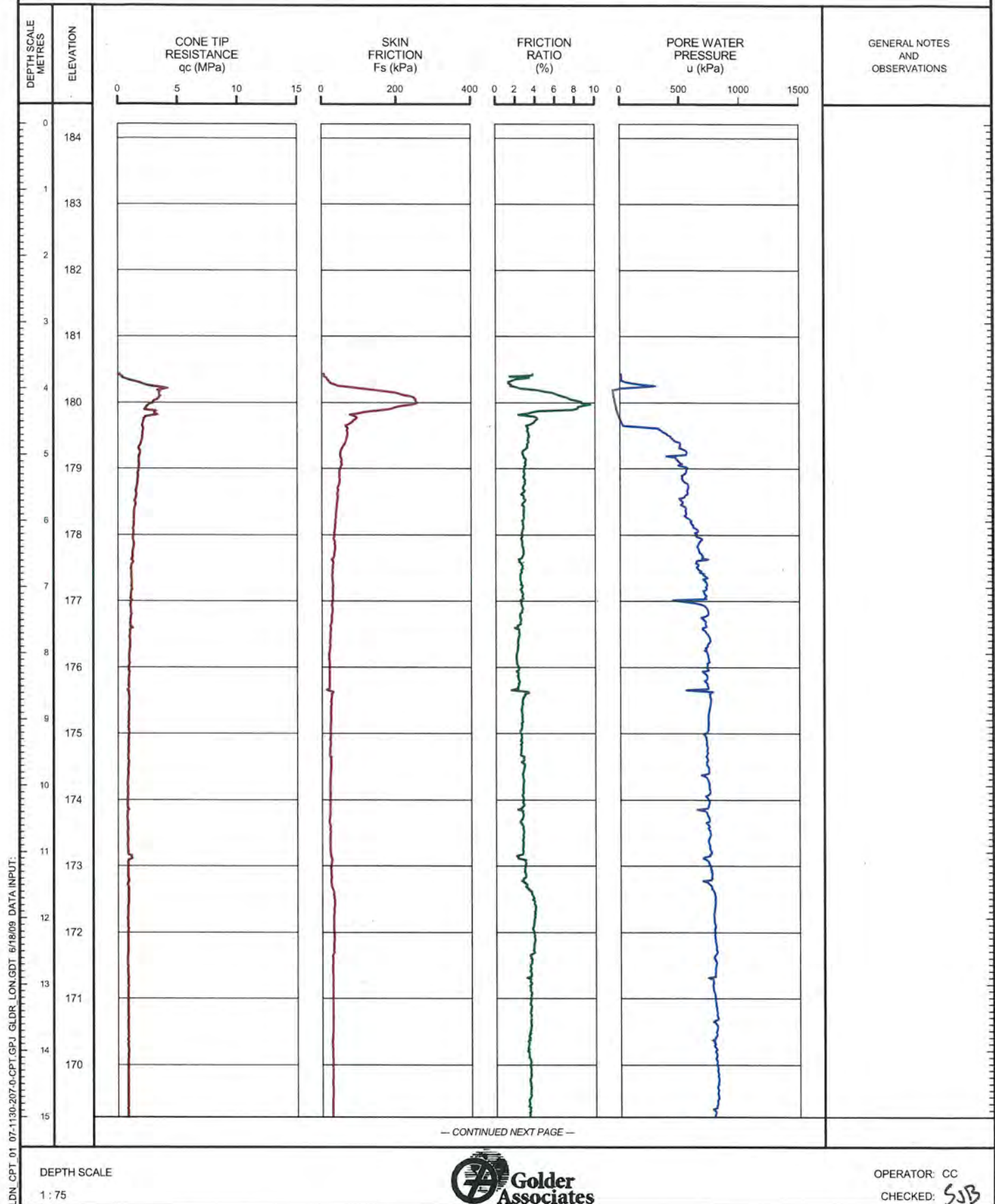
SHEET 1 OF 2

LOCATION: N 4678526.7 ,E 334018.6

TEST DATE: September 10, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.80m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-114

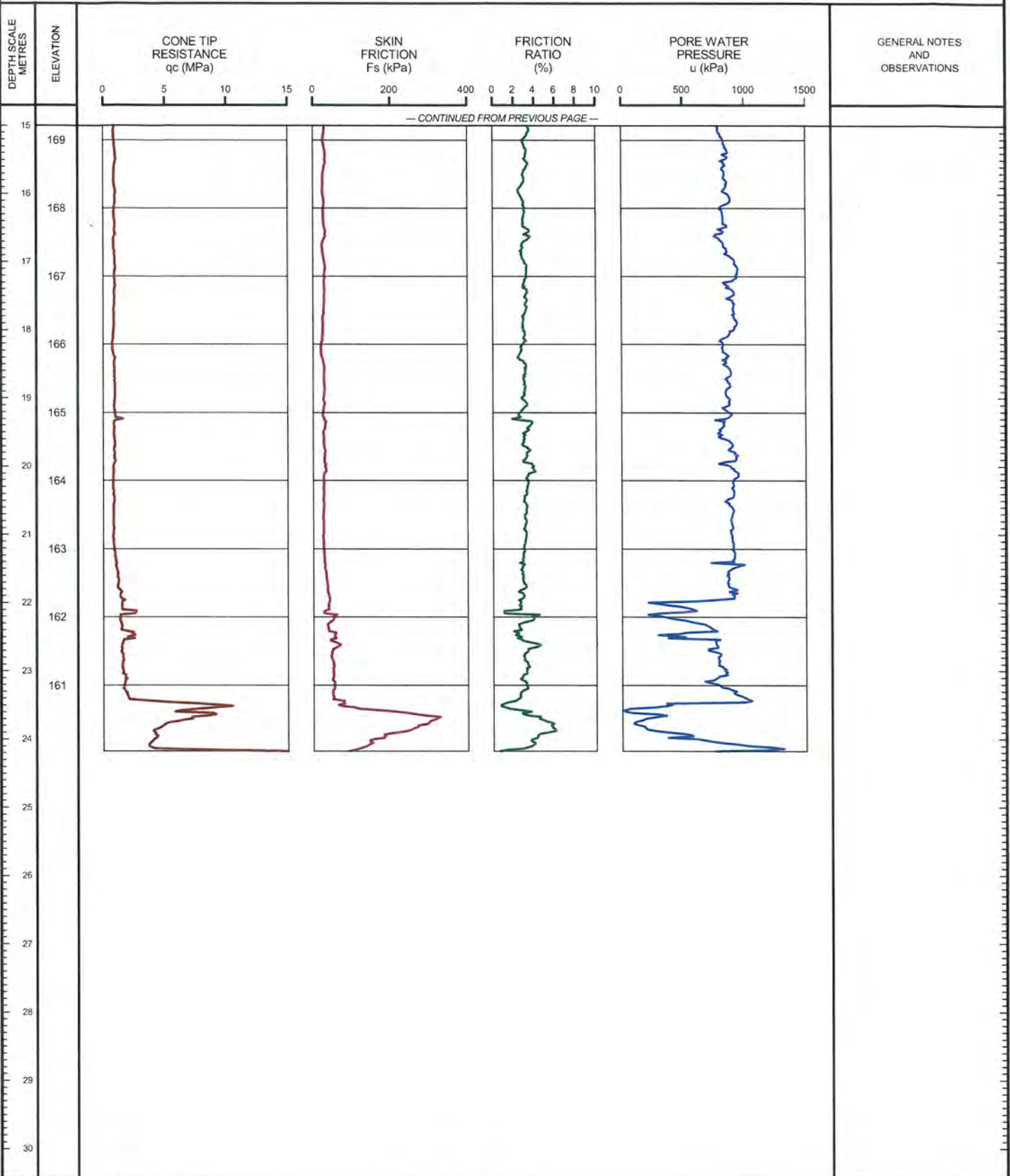
SHEET 2 OF 2

LOCATION: N 4678526.7 ; E 334018.6

TEST DATE: September 10, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.80m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

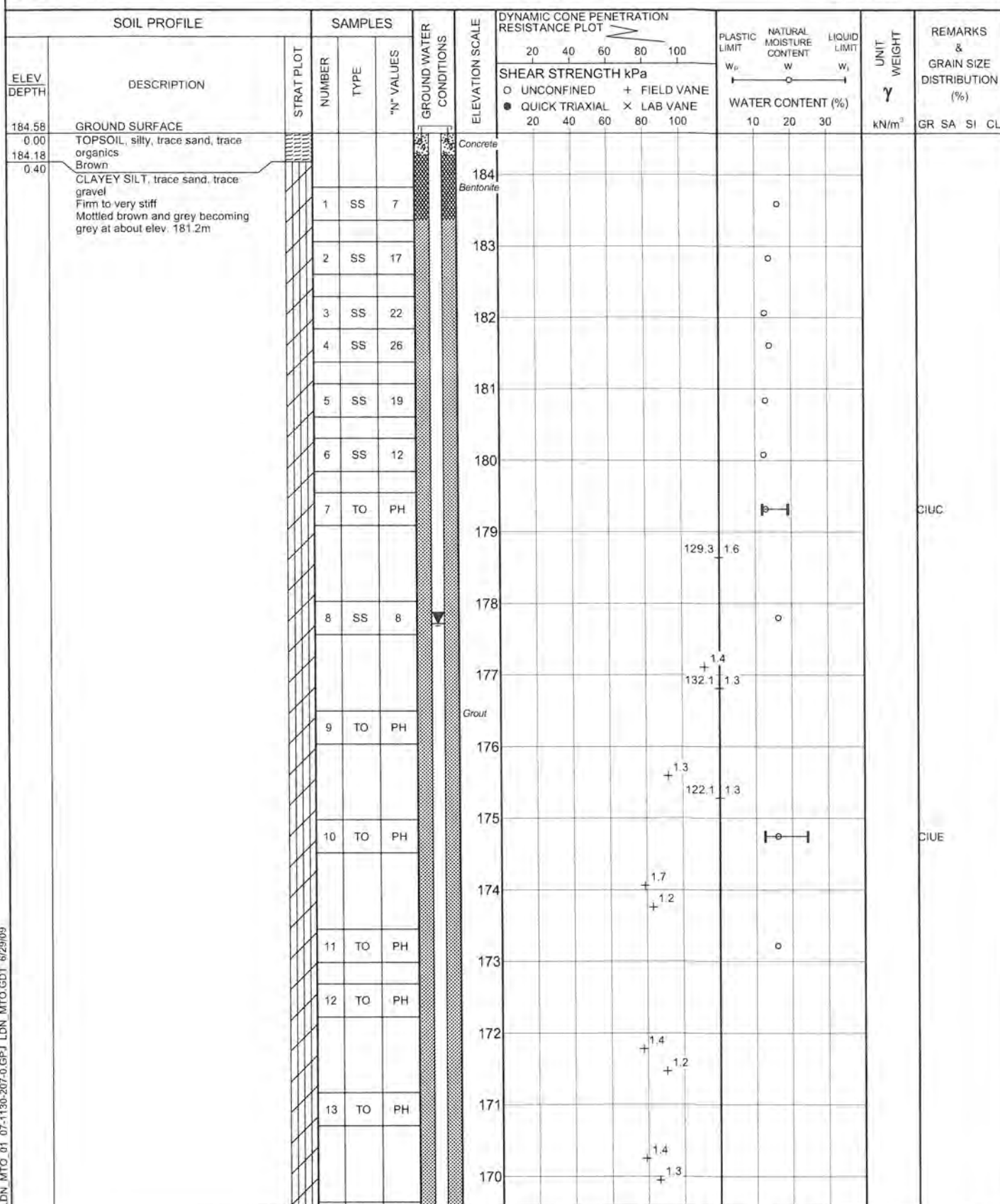
1 : 75



OPERATOR: CC

CHECKED: *SJB*

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 112		1 OF 4	METRIC
W.P.		LOCATION N 4678413.3 :E 334221.3		ORIGINATED BY SM	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC		DATE January 29, 2008 - February 12, 2008		CHECKED BY <i>SJB</i>	



LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

Continued Next Page

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

PROJECT 07-1130-207-0

RECORD OF BOREHOLE No 112

2 OF 4

METRIC

W.P. LOCATION N 4678413.3, E 334221.3

ORIGINATED BY SM

DIST WEST HWY 401/3 BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE NQRC

COMPILED BY BRS

DATUM GEODETTIC DATE January 29, 2008 - February 12, 2008

CHECKED BY **SJB**

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
	CLAYEY SILT, trace sand, trace gravel Firm to very stiff Mottled brown and grey becoming grey at about elev. 181.2m		14	TO	PH		169							
			15	TO	PH		168							
			16	TO	PH		167							
			17	TO	PH		166							
			18	TO	PH		165							
			19	TO	PH		164							
			20	TO	PH		163							
			21	SS	6		162							
161.64	SILTY CLAY, trace sand, trace gravel Firm Grey		22	TO	PH		161							
22.94			23	SS	29		160							
158.52	SILT, trace clay Grey						159							
26.06	CLAYEY SILT, trace sand, trace gravel Grey						158							
158.21	SANDY SILT, trace gravel Grey						157							
26.37	CLAYEY SILT, trace sand, trace gravel Grey						156							
157.76	CLAYEY SILT, trace sand, trace gravel Very stiff Grey						155							
26.82	SILT, some sand Compact Grey													
157.00	CLAYEY SILT, some sand, trace gravel Very stiff Grey													
27.58														
156.36														
28.22														
155.62														
28.96														

Continued Next Page

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

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 112		3 OF 4	METRIC
W.P.	LOCATION	N 4678413.3 : E 334221.3		ORIGINATED BY SM	
DIST WEST HWY 401/3	BOREHOLE TYPE	POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC	DATE	January 29, 2008 - February 12, 2008		CHECKED BY <i>SSB</i>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	×						
						20	40	60	80	100	10	20	30			
153.80	CLAYEY SILT, some sand, trace gravel Very stiff Grey		24	SS	28											
30.78	SILTY SAND AND GRAVEL, with cobbles and boulders Very dense Grey		25	SS	101/ 101mm											
			26	TO	PH											
152.12	LIMESTONE, fresh, medium strong, thinly laminated to laminated, very fine to medium grained, faintly to moderately porous Light greyish brown		27	SS	101/ 25mm											
32.46	(FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		28	NQ RC			100	67	20							
			29	NQ RC			100	72	58							
			30	NQ RC			100	100	100							
			31	NQ RC			100	100	100							
146.39	END OF BOREHOLE															
38.19	Water level in borehole at about elev. 158.52m during drilling on February 5, 2008. Water level measured in deep piezometer at elev. 178.28m on February 12, 2008. Water level measured in deep piezometer at elev. 178.38m on March 20, 2008. Water level measured in deep piezometer at elev. 177.93m on July 24, 2008. Water level measured in deep piezometer at elev. 176.25m on September 19, 2008. Water level measured in deep piezometer at elev. 177.54m on November 14, 2008. Water level measured in deep piezometer at elev. 177.72m on January 28, 2009.															

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 112

SHEET 4 OF 4

LOCATION: N 4678413.3 ; E 334221.3






DRILLING DATE: January 29, 2008 - February 12, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN	ELEVATION	RECOVERY		R.Q.D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA					HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POWER LOG INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
				DEPTH (m)					TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	DIP w.r.t. CORE AXIS	Br - Broken Rock	NOTE: For occasional abbreviations refer to list of abbreviations & symbols				
		ROCK SURFACE		152.12 32.46																
33	MUD ROTARY NO ROCK CORE	LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous, light grey		150.75 33.83	1			151	40	60	20									
34																				
35		LIMESTONE, fresh, medium strong, laminated, fine grained, vuggy to faintly porous with depth, light greyish brown, fossils present		149.28 35.30	2			150	40	60	20									
36																				
37		LIMESTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous, light greyish brown		148.34 36.24	3			149	40	60	20									
38																				
39		LIMESTONE, fresh, medium strong, laminated, medium grained, moderately porous, light greyish brown		147.18 37.40	4			148	40	60	20									
40																				
41		LIMESTONE, fresh, medium strong, laminated, fine grained, faintly porous, very light greyish brown		146.66 37.92				147	40	60	20									
42																				
43		END OF DRILLHOLE		146.39 38.19																
44																				
45																				
46																				
47																				

DEPTH SCALE

1:75



LOGGED: SG

CHECKED: SJB

RECORD OF BOREHOLE No 113

1 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678454.5 : E 334070.3

ORIGINATED BY DJM/MA

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

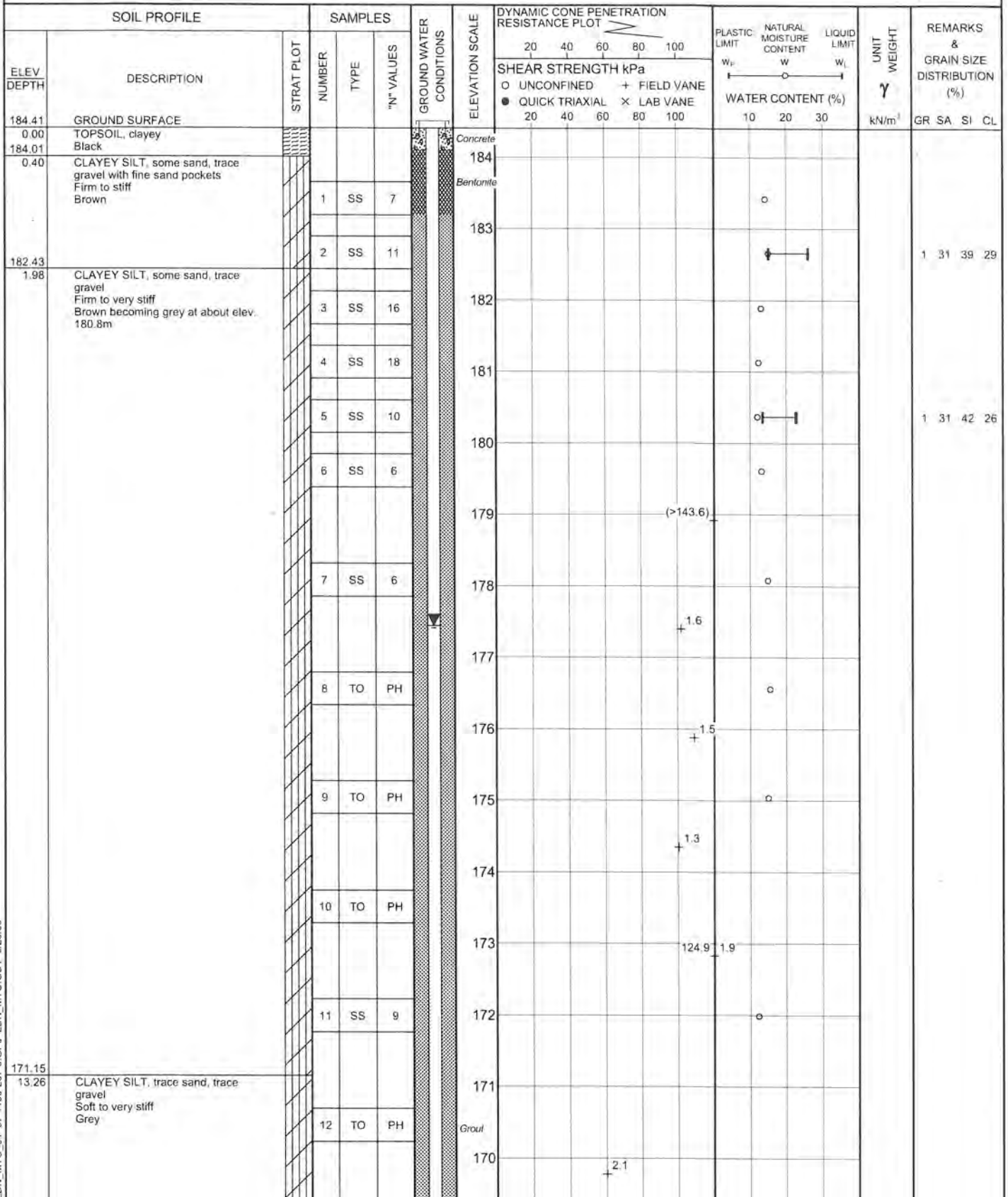
COMPILED BY BRS

DATUM GEODETTIC

DATE

February 22, 2008 - February 28, 2008

CHECKED BY *SB*



PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 113		2 OF 4	METRIC
W.P. _____		LOCATION N 4678454.5 ; E 334070.3		ORIGINATED BY DJM/MA	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC		DATE February 22, 2008 - February 28, 2008		CHECKED BY <i>SB</i>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								○ UNCONFINED	+ FIELD VANE							● QUICK TRIAXIAL	× LAB VANE	20
167.95	CLAYEY SILT, trace sand, trace gravel Soft to very stiff Grey		13	SS	4													
166.46	SILTY CLAY, trace sand Soft to stiff Grey		14	SS	4													
			15	SS	5													
165.13	CLAYEY SILT, trace sand, trace gravel Stiff to very stiff Grey		16	TO	PH													
19.28			17	SS	9													
			18	SS	19													
			19	SS	17													
			20	SS	16													
155.76	SILTY SAND, trace gravel, trace clay Compact Grey		21	SS	14													
28.65	CLAYEY SILT, with silt lenses Stiff Grey		22	SS	12													
154.54																		

LDN MTO 01 07-1130-207-0.GPJ LDN MTO GDT 6/29/09

Continued Next Page

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

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No 113		3 OF 4	METRIC
W.P. _____		LOCATION <u>N 4678454.5 :E 334070.3</u>		ORIGINATED BY <u>DJM/MA</u>	
DIST <u>WEST</u> HWY <u>401/3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>BRS</u>	
DATUM <u>GEODETIC</u>		DATE <u>February 22, 2008 - February 28, 2008</u>		CHECKED BY <u>SJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
29.87	SAND AND GRAVEL, trace silt Compact Grey		23	SS	25		154											
153.01	LIMESTONE, fresh, medium strong, thinly laminated to laminated, very fine to fine grained, faintly porous to porous Light grey to brown (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		24	NQ	RC		153	33	0	0								
31.40			25	NQ	RC		152	27	10	0								
			26	NQ	RC		151	73	38	12								
			27	NQ	RC		150	TCR (%)	SCR (%)	RQD (%)								
			28	NQ	RC		149	94	92	78								
148.36	END OF BOREHOLE																	
36.05	Water level in borehole at about elev. 154.54m during drilling between February 22 and 28, 2008 Water level measured in deep piezometer at elev. 178.13m on February 28, 2008. Water level measured in deep piezometer at elev. 182.91m on March 20, 2008. Water level measured in deep piezometer at elev. 177.75m on July 22, 2008. Water level measured in deep piezometer at elev. 175.87m on September 19, 2008. Water level measured in deep piezometer at elev. 177.18m on November 11, 2008. Water level measured in deep piezometer at elev. 177.44m on January 28, 2009.																	

LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 5/29/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 113

SHEET 4 OF 4

LOCATION: N 4678454.5 E 334070.3

DRILLING DATE: February 22, 2008 - February 28, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein C.J. - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations A symbols										DIAMETRAL CORE LOG INDEX (MFA)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
									RECOVERY		R.Q.D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
									TOTAL CORE %	SOLID CORE %			DP WITH CORE AXIS	TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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DEPTH SCALE

1 : 75



LOGGED: SG

CHECKED: SJB

+3 × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No CPT-114		1 OF 1	METRIC
W.P. _____		LOCATION <u>N 4678526.7 :E 334018.6</u>		ORIGINATED BY <u>CC</u>	
DIST <u>WEST</u> HWY <u>401/3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>SJL</u>	
DATUM <u>GEODETIC</u>		DATE <u>September 10, 2008</u>		CHECKED BY <u>SJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	W _P W W _L					
184.21	GROUND SURFACE													
0.00	TOPSOIL, silty, trace to some sand Compact Black		1	SS	20	184								
0.28	CLAYEY SILT, trace to some sand, trace gravel Very stiff Mottled brown and grey becoming brown at about elev. 183.0m		2	SS	20	183								
182.38			3	SS	28									
1.83	END OF BOREHOLE Borehole dry during drilling on September 10, 2008.													

LDN MTO_01 07-1130-207-0.GPJ LDN MTO.GDT 6/29/09

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-5

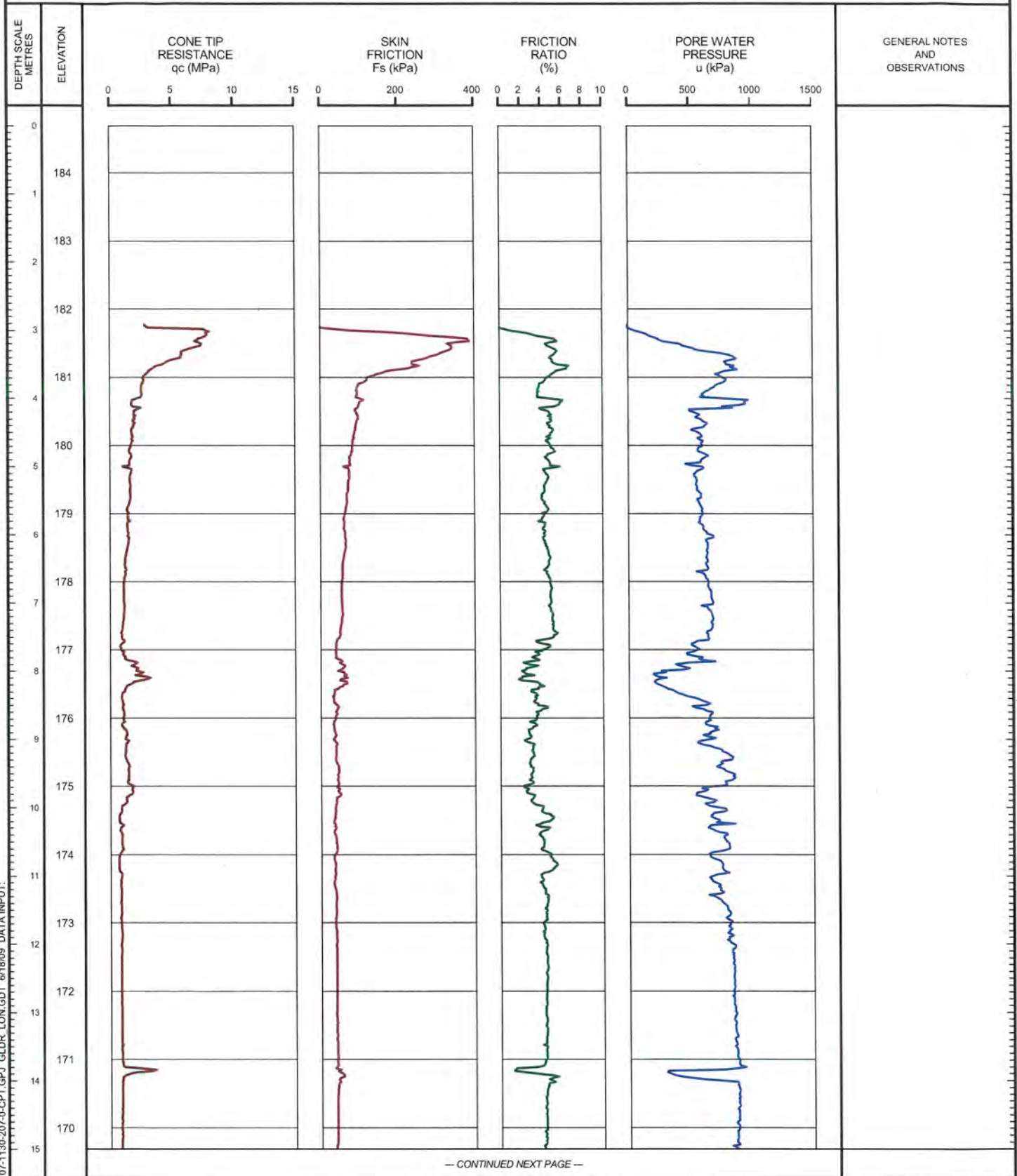
SHEET 1 OF 2

LOCATION: N 4678413.0 ; E 334220.0

TEST DATE: November 13, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 2.94m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



— CONTINUED NEXT PAGE —

LON CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SB*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-5

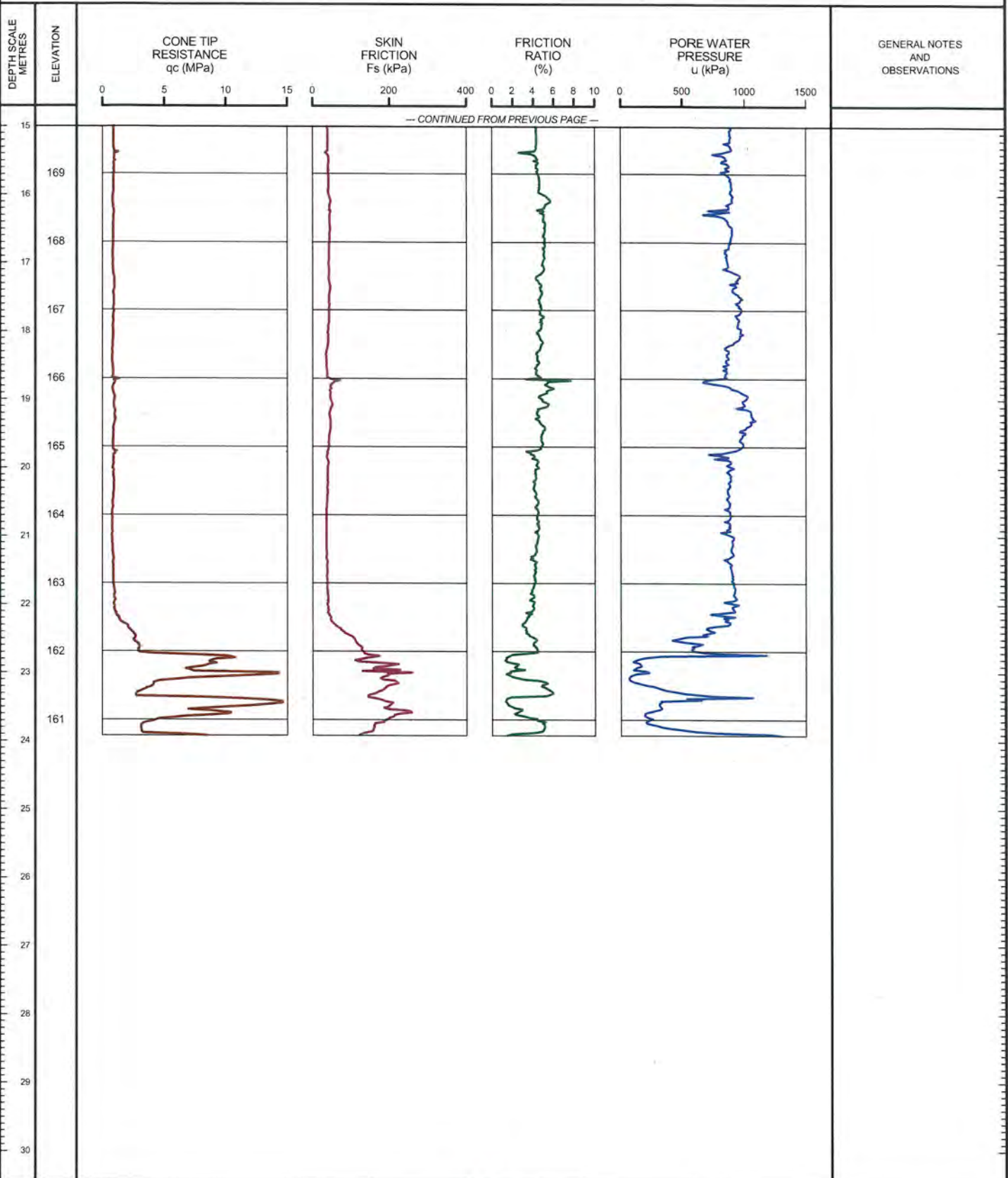
SHEET 2 OF 2

LOCATION: N 4678413.0, E 334220.0

TEST DATE: November 13, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 2.94m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN_CPT_01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/19/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SSS*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-114

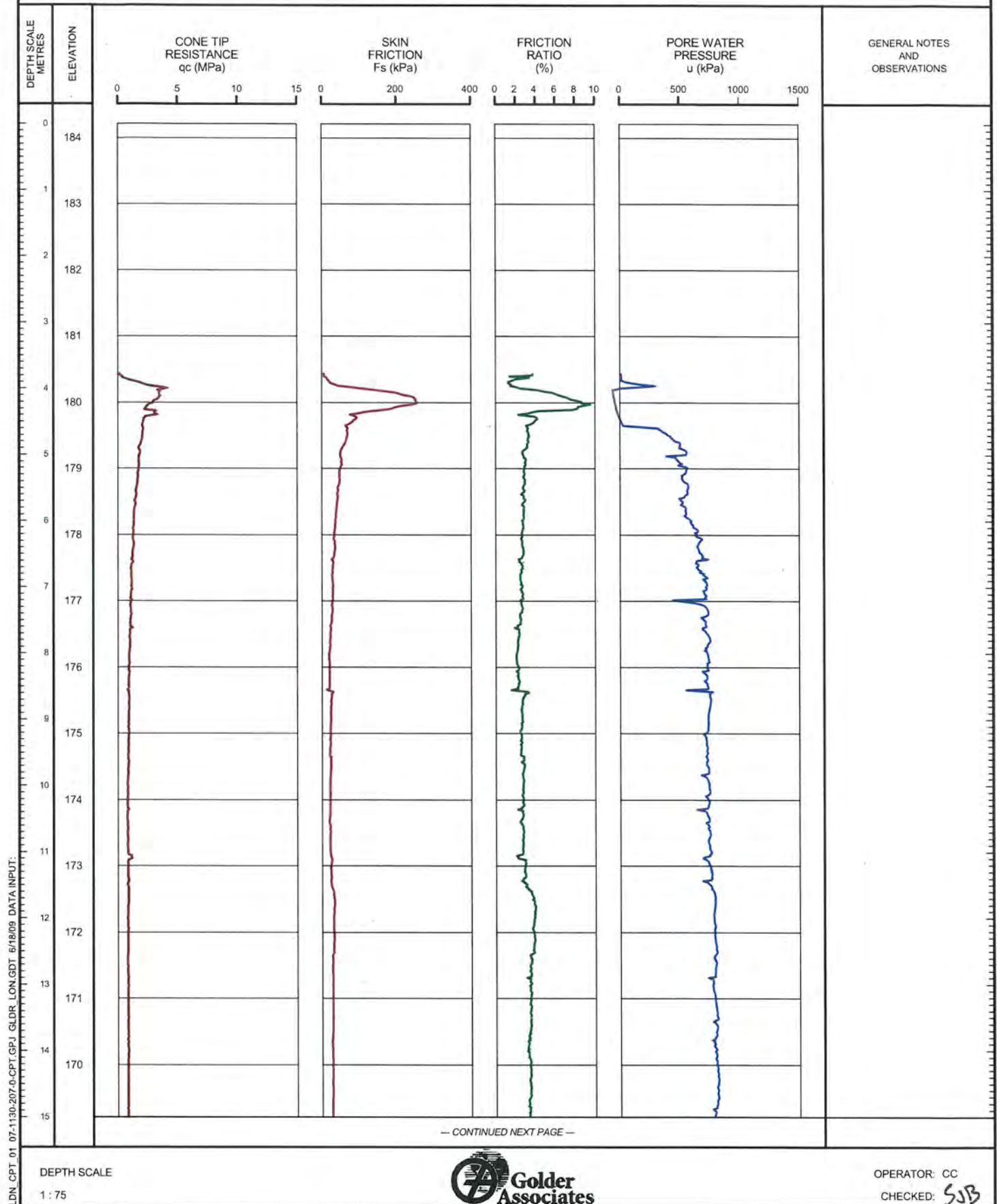
SHEET 1 OF 2

LOCATION: N 4678526.7 ,E 334018.6

TEST DATE: September 10, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.80m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-114

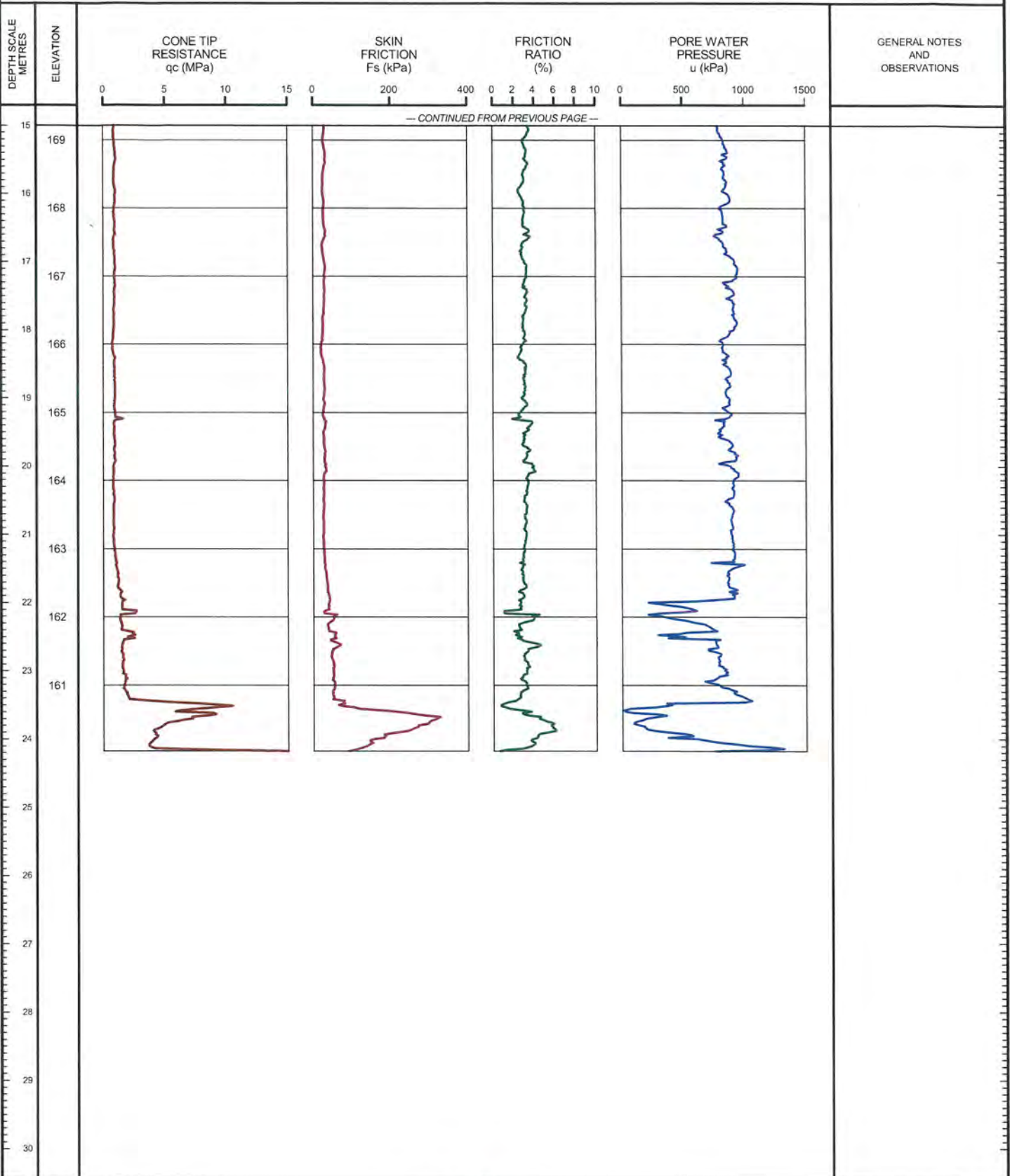
SHEET 2 OF 2

LOCATION: N 4678526.7 ;E 334018.6

TEST DATE: September 10, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.80m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SJB*

RECORD OF BOREHOLE No 107

1 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4677973.1 : E 334961.3

ORIGINATED BY MA

DIST WEST

HWY 401/3

BOREHOLE TYPE

POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

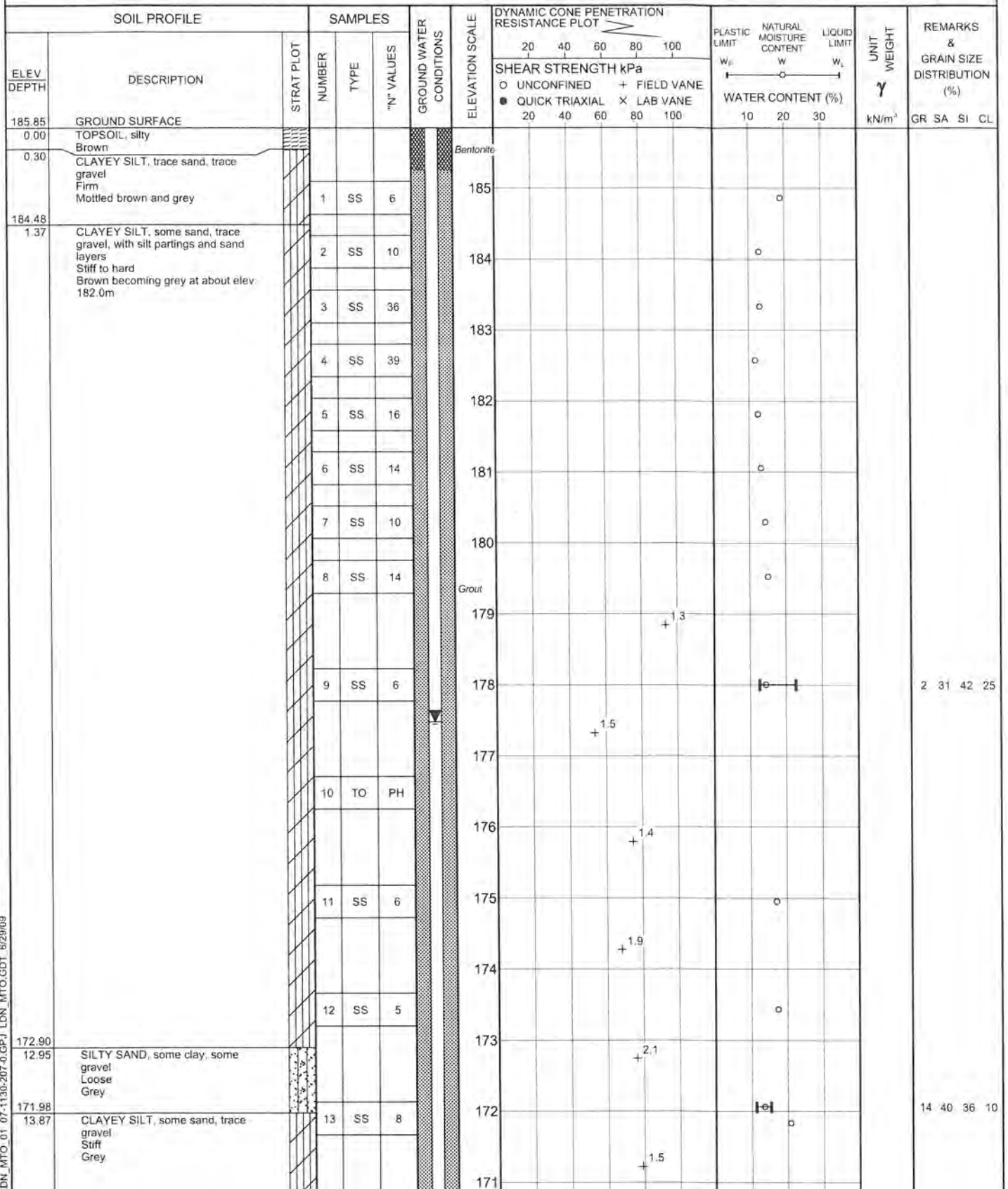
COMPILED BY BRS

DATUM GEODETIC

DATE

March 14, 2008 - March 19, 2008

CHECKED BY *SSB*

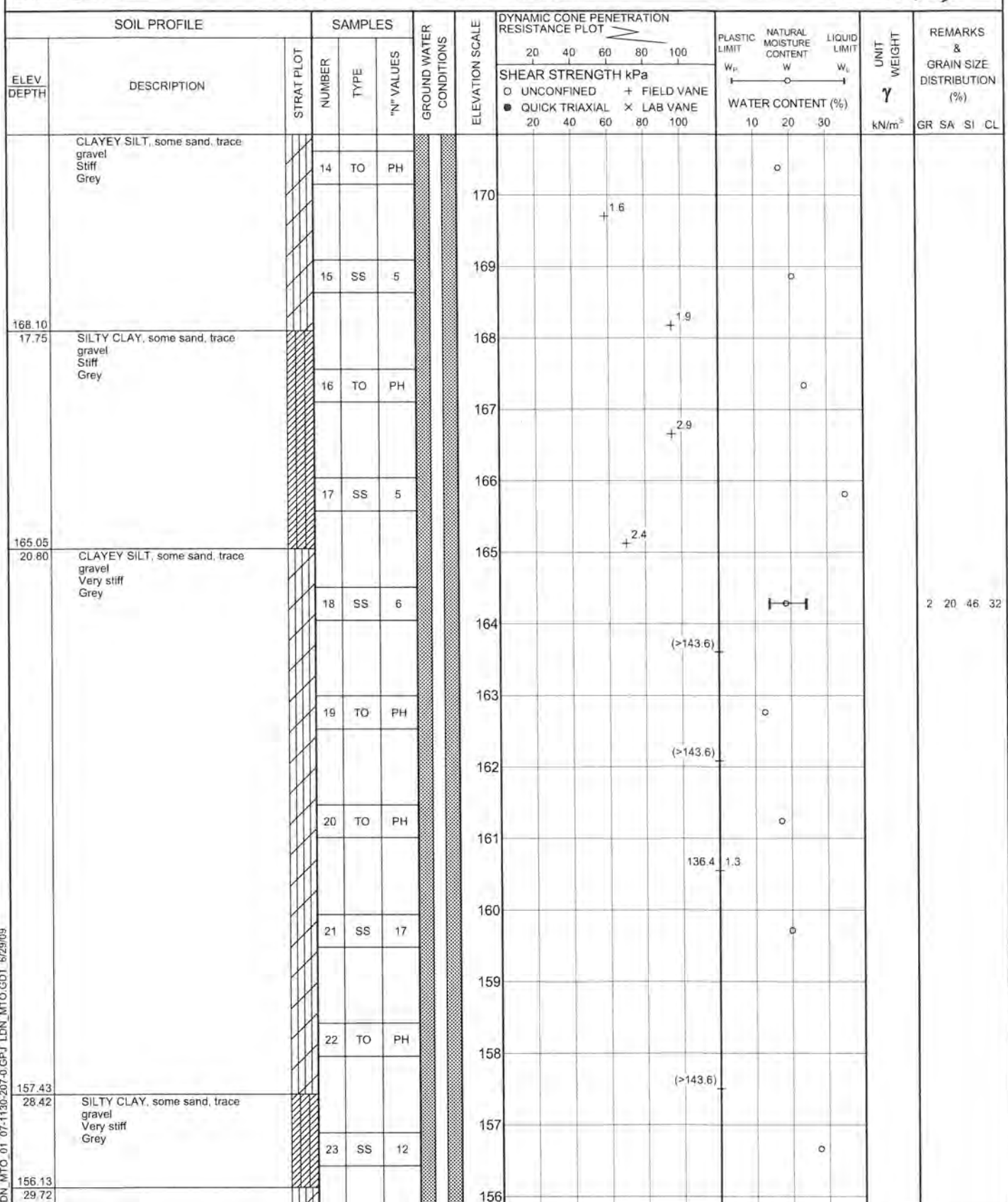


Continued Next Page

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

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 8/29/09

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 107		2 OF 4	METRIC
W.P.	LOCATION	N 4677973.1 ; E 334961.3		ORIGINATED BY MA	
DIST WEST HWY 401/3	BOREHOLE TYPE	POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC	DATE	March 14, 2008 - March 19, 2008		CHECKED BY <i>SJB</i>	



LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

Continued Next Page

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

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 107		3 OF 4	METRIC
W.P. _____		LOCATION N 4677973.1 E 334961.3		ORIGINATED BY MA	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		COMPILED BY BRS	
DATUM GEODETIC		DATE March 14, 2008 - March 19, 2008		CHECKED BY <i>SLB</i>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60
155.25	CLAYEY SILT, some sand, trace gravel Very stiff Grey		24	SS	235										
30.68	SILTY SAND, trace clay, trace gravel														
154.61	LIMESTONE, weathered Tan and grey		25	NQ											
31.24	LIMESTONE, fresh, medium strong, thinly laminated, fine to medium grained, faintly porous Brown and grey			RC											
	(FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		26	NQ											
				RC											
			27	NQ											
				RC											
			28	NQ											
				RC											
			29	NQ											
			RC												
		30	NQ											UC	
			RC												
150.95		31	NQ												
			RC												
150.95	END OF BOREHOLE														
34.90	Borehole dry during drilling between March 14 and 19, 2008. Water level measured in deep piezometer at elev. 177.30m on November 14, 2008. Water level measured in deep piezometer at elev. 177.48m on January 28, 2009.														

LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 107

SHEET 4 OF 4

LOCATION: N 4677973.1;E 334961.3

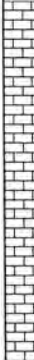
DRILLING DATE: March 14, 2008 - March 19, 2008

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: —

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (mm/min)	COLOUR % RETURN	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols										DIAMETRAL INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
				DEPTH (m)					FLUSH	RECOVERY	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec					
										TOTAL CORE %	SOLID CORE %		DIP w / l CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻¹	10 ⁻²	10 ⁻³	10 ⁻⁴		
										80 60 40 20	80 60 40 20	80 60 40 20	5 10 15 20	0 30 60 90						
31	MUD ROTARY NO ROCK CORE	ROCK SURFACE		155.17 30.68				155												
32		Core retriever malfunctioning - most of core broken LIMESTONE, fresh, medium strong, thinly laminated to laminated, fine to medium grained, faintly porous, brown and grey		1																
33				2																
34				3																
35				4																
36				5																
37				6																
38		END OF DRILLHOLE		150.95 34.90	7			151												
39																				
40																				
41																				
42																				
43																				
44																				
45																				

LDN ROCK 03 07-1130-207-0-ROCK.GPJ GLDR LDN GDT 6/29/09 DATA INPUT: WDF

DEPTH SCALE

1:75



LOGGED: SG

CHECKED: SSB

RECORD OF BOREHOLE No 107A

1 OF 1

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4677973.1 E 334961.3

ORIGINATED BY MA

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, SOLID STEM

COMPILED BY BRS

DATUM GEODETTIC

DATE










March 14, 2008

CHECKED BY *SB*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
185.85	SOIL CONDITIONS INFERRED FROM BOREHOLE No. 107 GROUND SURFACE													
0.00	TOPSOIL, silty Brown						Concrete							
0.30	CLAYEY SILT, trace sand, trace gravel Firm Mottled brown and grey						185							
184.48							184							
1.37	CLAYEY SILT, some sand, trace gravel, with silt partings and sand layers Stiff to hard Brown becoming grey at about elev 182.0m						183							
							182							
							181							
							180							
							179 Bentonite							
							178 Sand							
							177 Piezometer							
176.25														
9.60	END OF BOREHOLE													

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 5/29/09

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 304		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4677998.2 ; E 335082.8</u>		ORIGINATED BY <u>SM</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, HOLLOW STEM</u>		COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>November 27, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N VALUES			SHEAR STRENGTH kPa					w _p	w	w _L		GR	SA	SI	CL	
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE													
188.00	GROUND SURFACE							20	40	60	80	100									
0.00	FILL, clayey silt, some sand, trace gravel, trace bricks, with topsoil pockets Firm Brown		1	SS	5		187								○						
			2	SS	7		186								○						
			3	SS	7										○						
185.10	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Very stiff Brown becoming grey below about elev. 182.8m		4	SS	3		185									○					
2.90			5	SS	25		184								○						
			6	SS	34		183								○						
			7	SS	18		182								○						
			8	SS	12		181								○						
			9	SS	6		180								○						
179.92	END OF BOREHOLE																				
8.08	Borehole dry during drilling on November 27, 2009.																				

PROJECT 09-1132-0080 **RECORD OF BOREHOLE NO 305** 1 OF 4 **METRIC**

W.P. _____ LOCATION N 4677923.8 ;E 335038.1 ORIGINATED BY SM

DIST WEST HWY 401 / 3 BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC COMPILED BY LMK/DMB

DATUM GEODETIC DATE November 30, 2009 - December 1, 2009 CHECKED BY _____

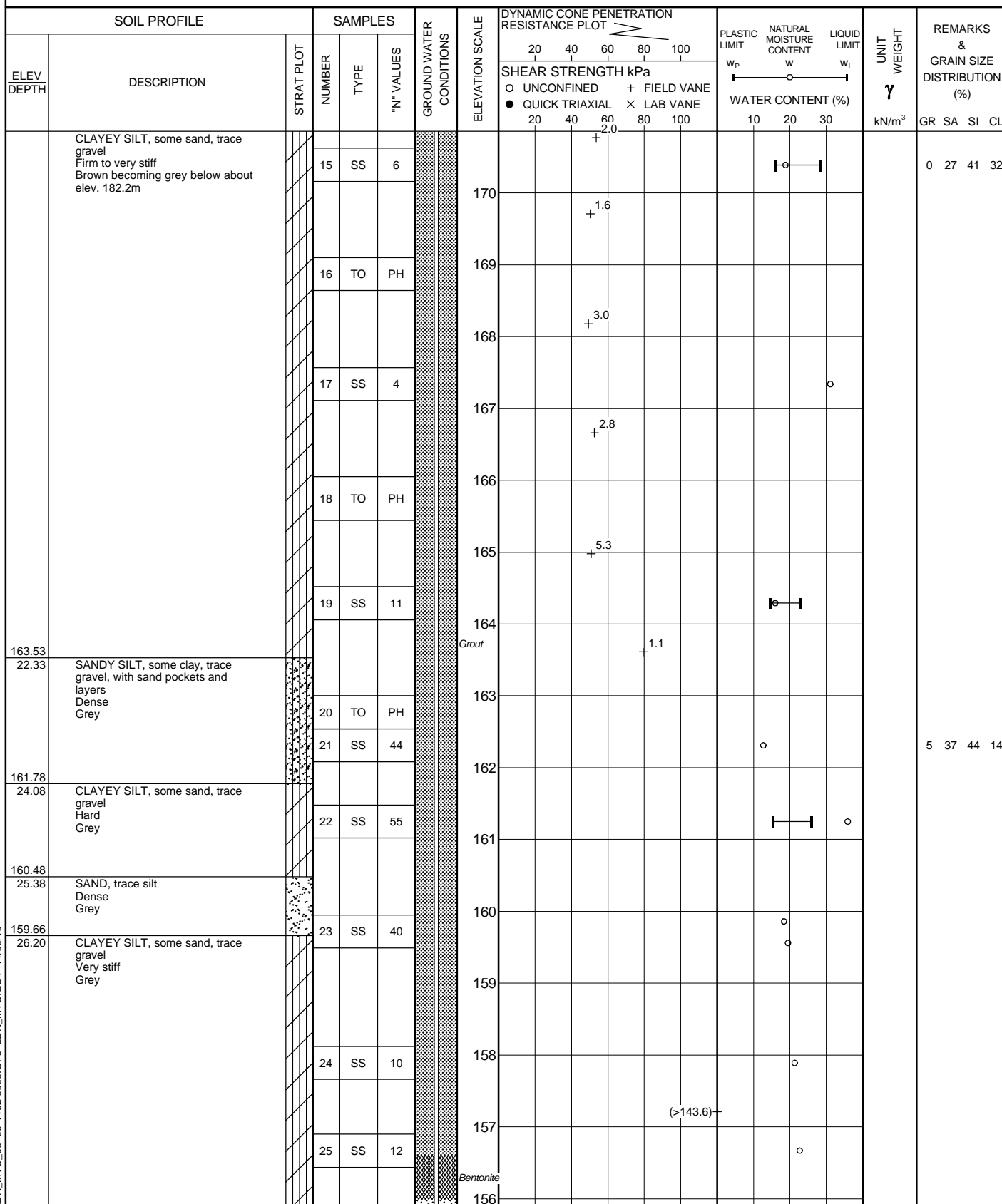
[illegible]

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 305		2 OF 4	METRIC
W.P. _____	LOCATION <u>N 4677923.8 ;E 335038.1</u>	ORIGINATED BY <u>SM</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>	BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>	COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>	DATE <u>November 30, 2009 - December 1, 2009</u>	CHECKED BY _____			



Continued Next Page

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

DN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 305		3 OF 4		METRIC	
W.P. _____		LOCATION <u>N 4677923.8 ; E 335038.1</u>		ORIGINATED BY <u>SM</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>November 30, 2009 - December 1, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		
155.09	CLAYEY SILT, some sand, trace gravel Very stiff Grey		26	SS	100/0mm															
30.77	LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous Light brown to grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		27	NQ RC	-		100	38	17											
			28	NQ RC	-		98	74	64											
			29	NQ RC	-		T.C.R. (%) 98	S.C.R. (%) 79	R.Q.D. (%) 75											
			30	NQ RC	-		100	71	83											
149.99																				
35.87	END OF BOREHOLE Borehole dry during drilling on November 30, 2009 to December 1, 2009. Water level measured at elev. 178.39 on February 24, 2010. Water level measured at elev. 178.14 on January 6, 2010.																			

PROJECT: 09-1132-0080

RECORD OF DRILLHOLE: 305

SHEET 4 OF 4

LOCATION: N 4677923.8 ;E 335038.1

DRILLING DATE: November 30, 2009 - December 1, 2009

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: AARDVARK

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	COLOUR FLUSH % RETURN	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.																HYDRAULIC CONDUCTIVITY k, cm/sec				DIAMETRAL POINT LOAD INDEX (MPa)			NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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31	MUD ROTARY NO ROCK CORE	ROCK SURFACE		155.10	1			155																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

DEPTH SCALE

1 : 75



LOGGED: SG

CHECKED:

LDN_ROCK_03 09-1132-0080-ROCK.GPJ GLDR_LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No CPT-106		1 OF 1	METRIC
W.P. _____		LOCATION <u>N 4677846.1 :E 335039.9</u>		ORIGINATED BY <u>CC</u>	
DIST <u>WEST</u> HWY <u>401/3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>SJL</u>	
DATUM <u>GEODETIC</u>		DATE <u>September 8, 2008</u>		CHECKED BY <u>SJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
185.72	GROUND SURFACE												
0.00	FILL, clayey topsoil with crushed gravel		1	SS	12								
185.36	Stiff Brown		2	SS	15								
0.36	CLAYEY SILT, trace to some sand, trace gravel		3	SS	12								
183.89	Mottled brown and grey becoming brown at about elev. 184.5m												
184.5	END OF BOREHOLE												
1.83	Borehole dry during drilling on September 8, 2008.												

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-303		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4677840.3 ; E 335113.1</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>January 11, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) w _p w w _L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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186.02	GROUND SURFACE					▽	185									184																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-306		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4677911.6 ; E 334964.7</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>January 8, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w _p	w	w _L		GR	SA	SI	CL
								20	40	60	80	100								
186.02	GROUND SURFACE																			
0.00	FILL, limestone gravel, crushed Grey																			
0.22	CLAYEY SILT, some sand, trace gravel, with occasional silt partings and seams Firm to hard Brown		1	SS	16															
			2	SS	8															
			3	SS	34															
			4	SS	45															
182.36	END OF BOREHOLE																			
3.66	Borehole dry during drilling on January 8, 2010.																			

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-3

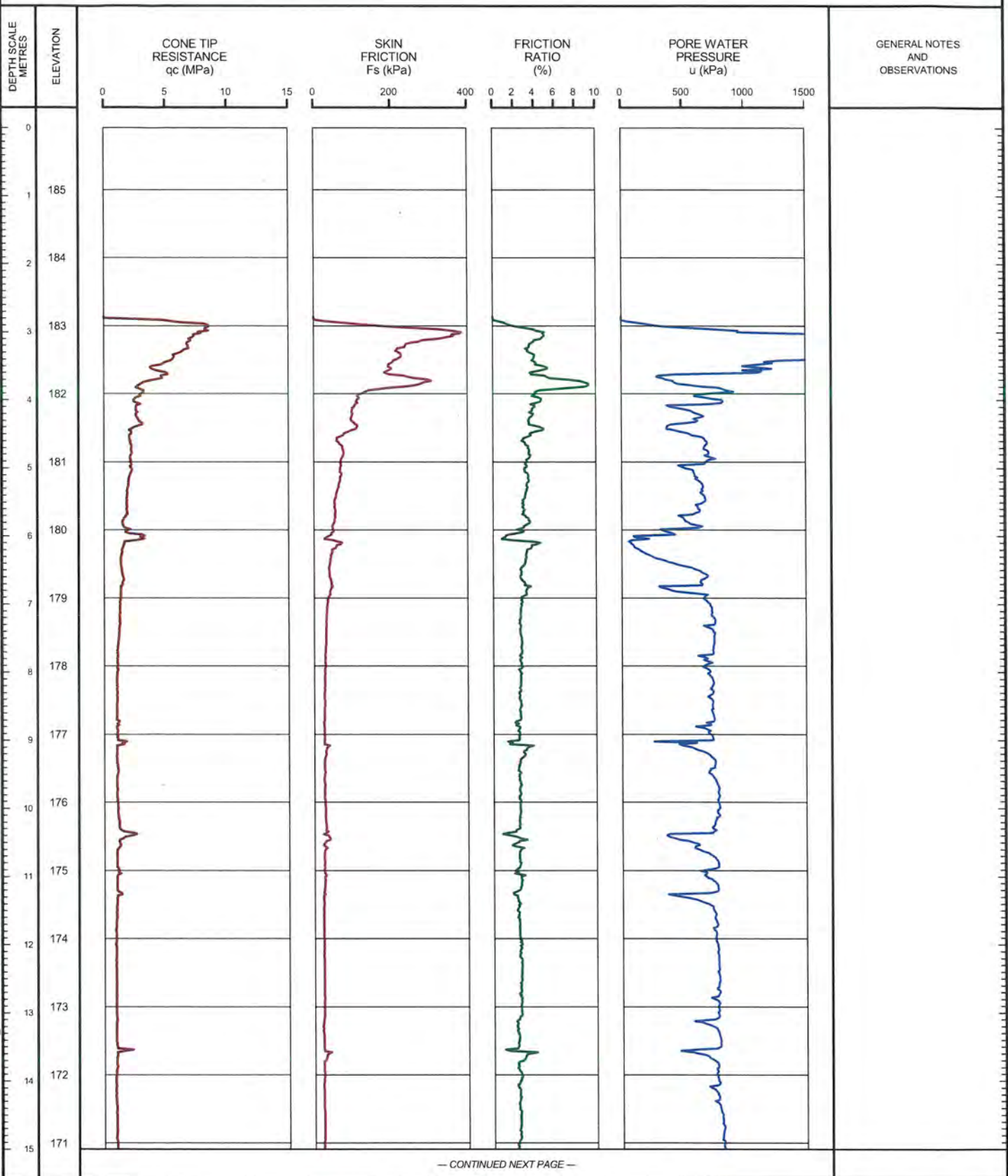
SHEET 1 OF 2

LOCATION: N 4678022.0 E 334957.0

TEST DATE: November 13, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 2.80m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75

OPERATOR: CC
CHECKED: SSB

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-3

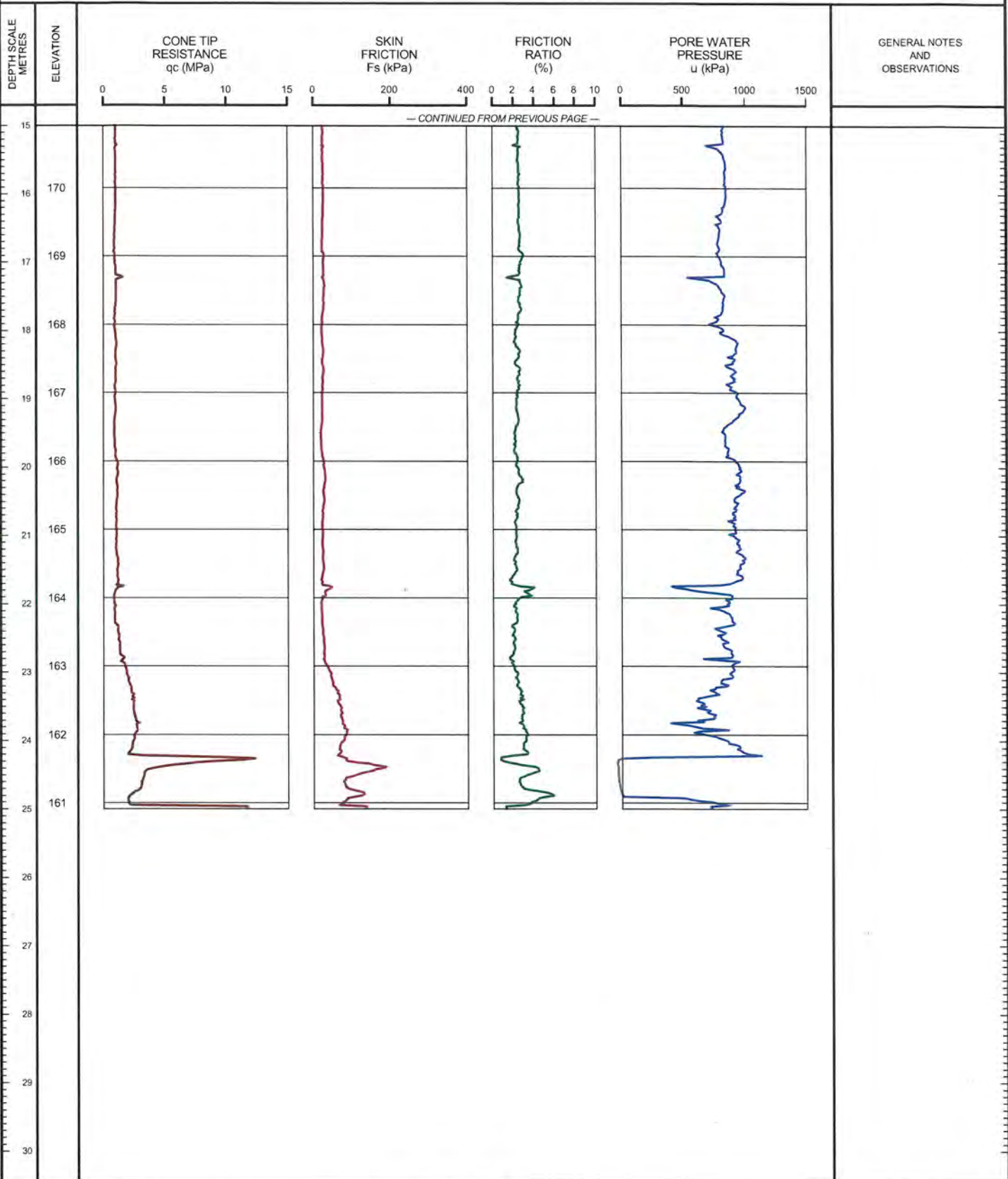
SHEET 2 OF 2

LOCATION: N 4678022.0 ; E 334957.0

TEST DATE: November 13, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 2.80m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN_CPT_01 07-1130-207-0-CPT.GPJ GILDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SSB*

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-106

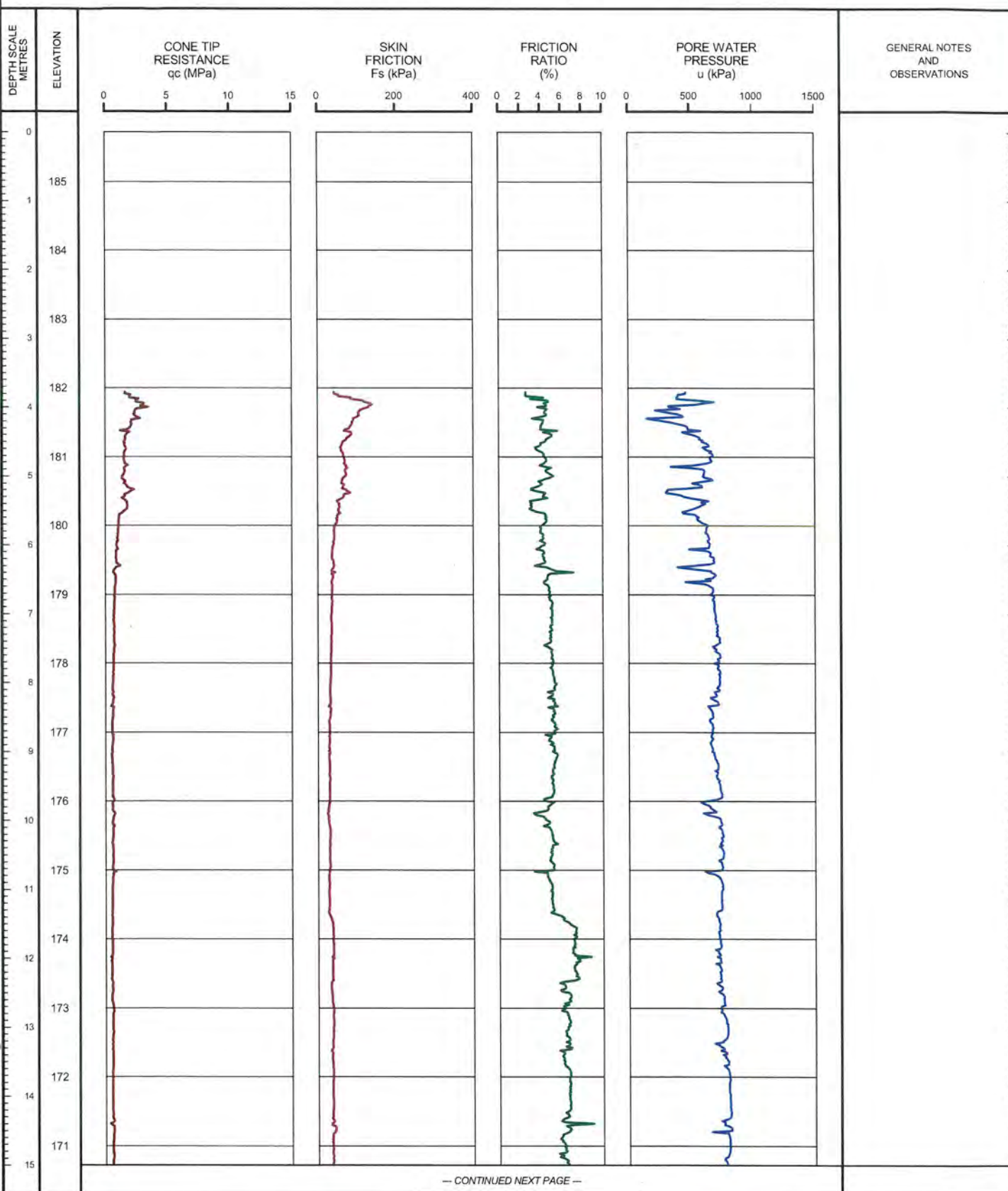
SHEET 1 OF 2

LOCATION: N 4677846.1 E 335039.9

TEST DATE: September 9, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.80m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/18/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: SJB

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-106

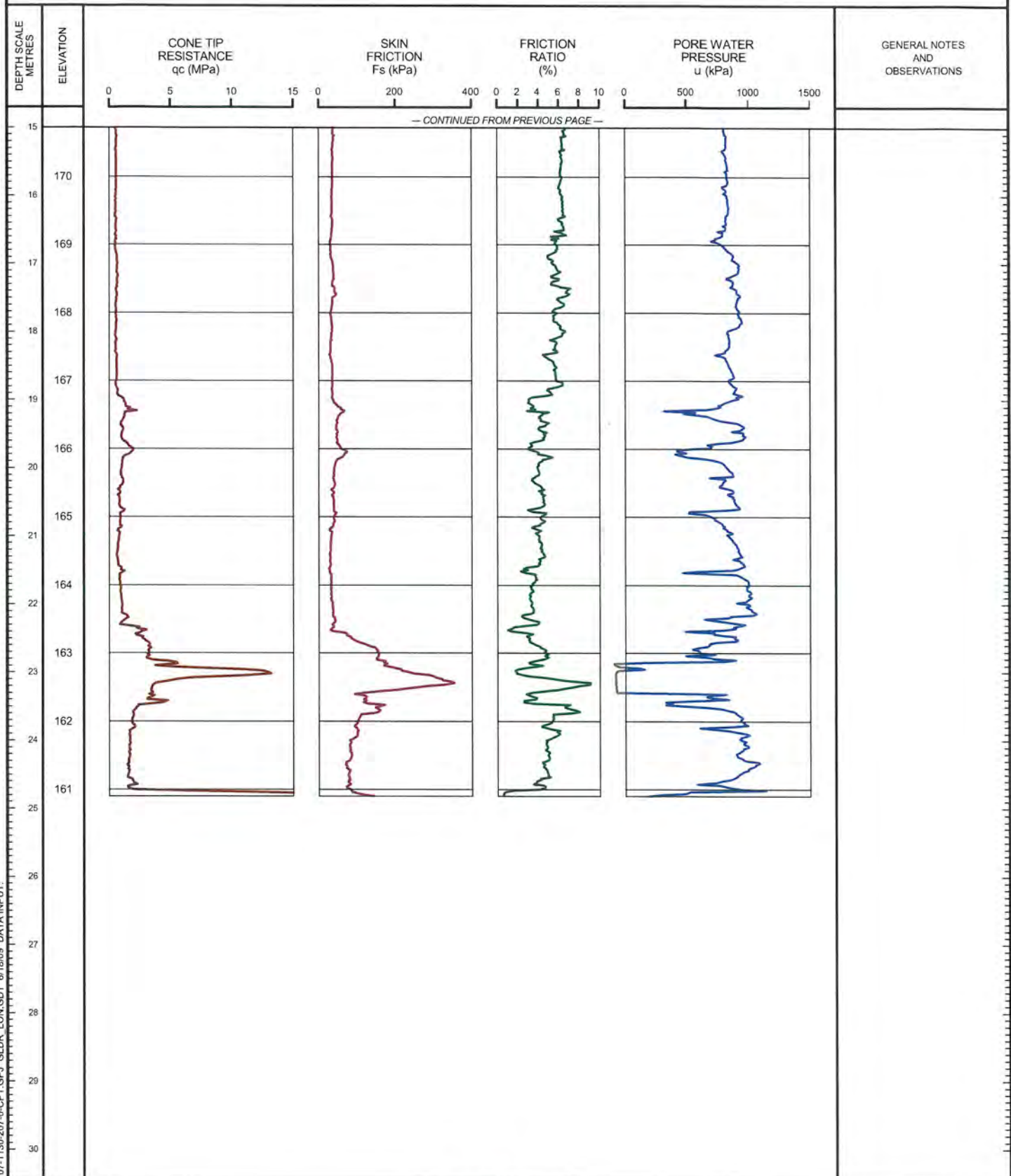
SHEET 2 OF 2

LOCATION: N 4677846.1 :E 335039.9

TEST DATE: September 9, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.80m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/19/09 DATA INPUT:

DEPTH SCALE

1 : 75



OPERATOR: CC

CHECKED: *SD*

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-303

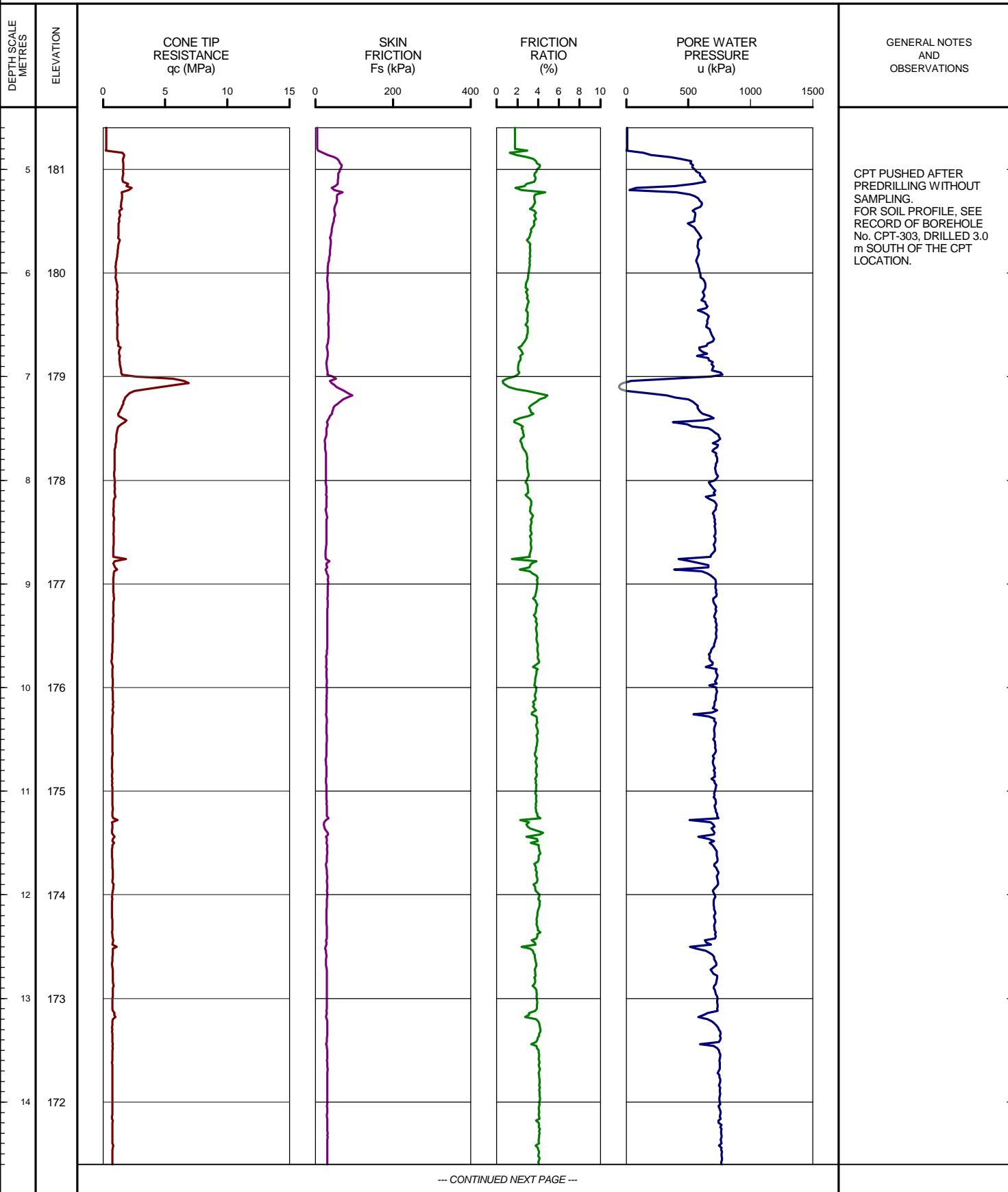
SHEET 1 OF 3

LOCATION: N 4677840.3 ;E 335113.1

TEST DATE: January 25, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 186.02m PREDRILL DEPTH: 4.60m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-303

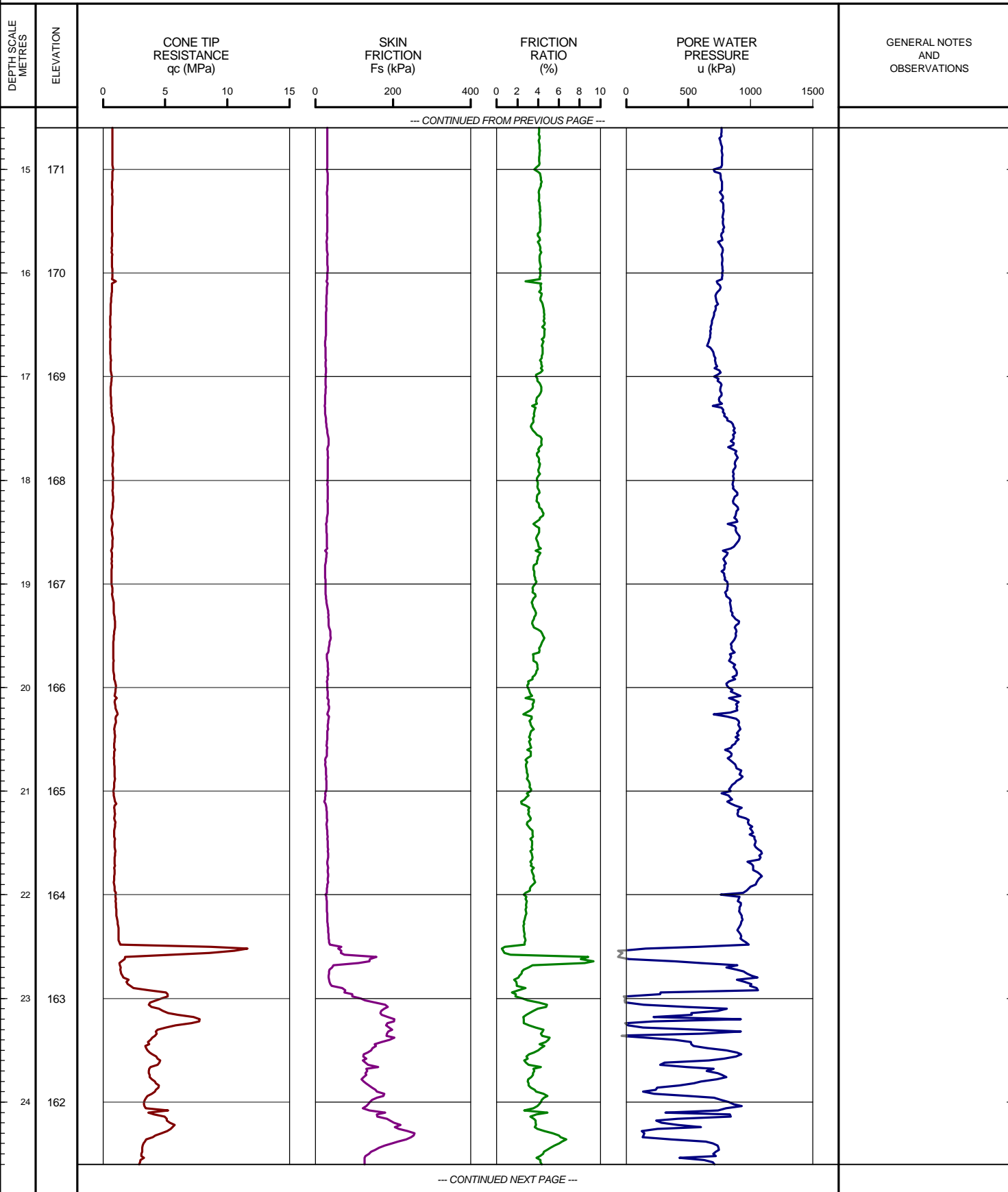
SHEET 2 OF 3

LOCATION: N 4677840.3 ;E 335113.1

TEST DATE: January 25, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 186.02m PREDRILL DEPTH: 4.60m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-303

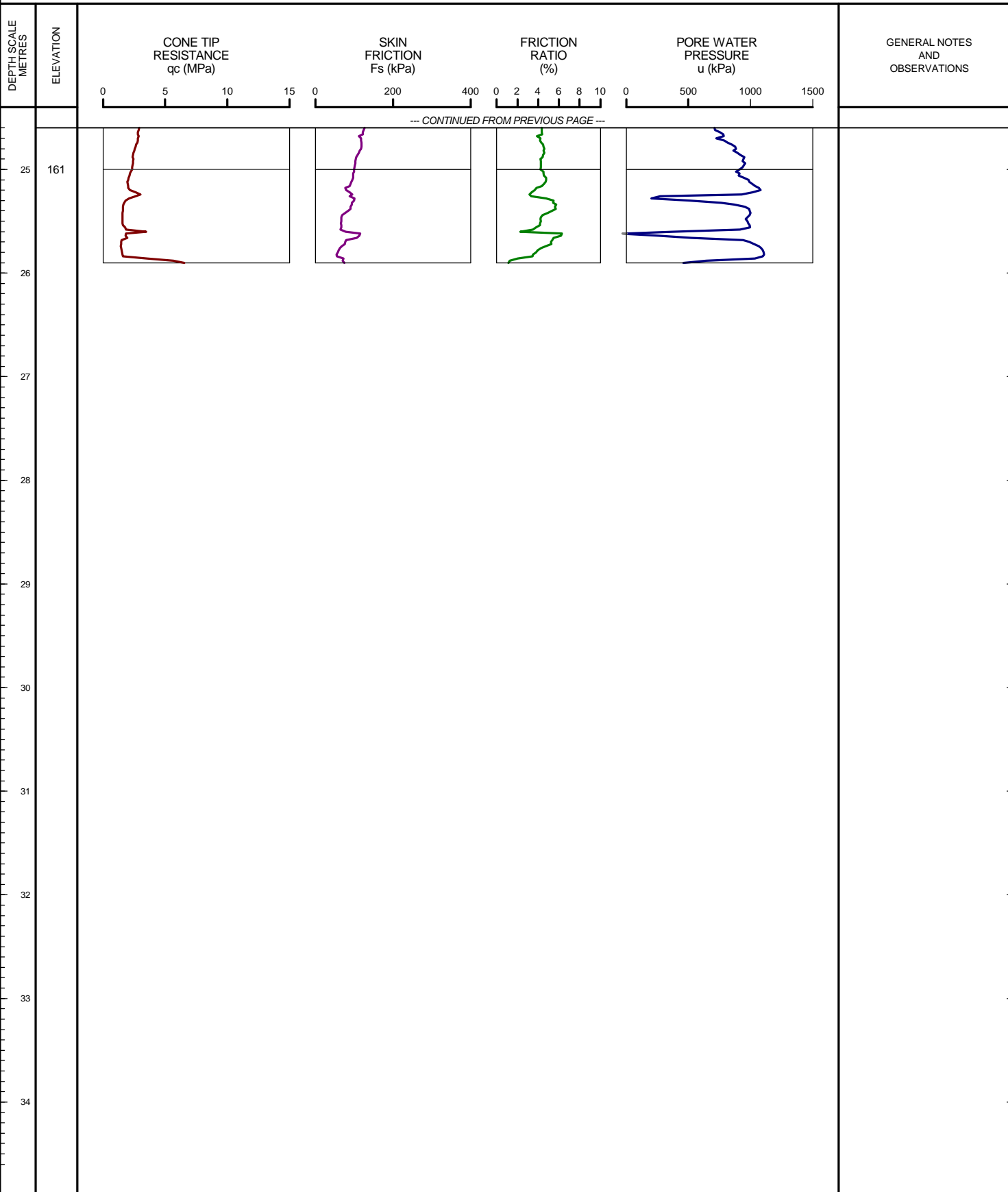
SHEET 3 OF 3

LOCATION: N 4677840.3 ;E 335113.1

TEST DATE: January 25, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 186.02m PREDRILL DEPTH: 4.60m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-306

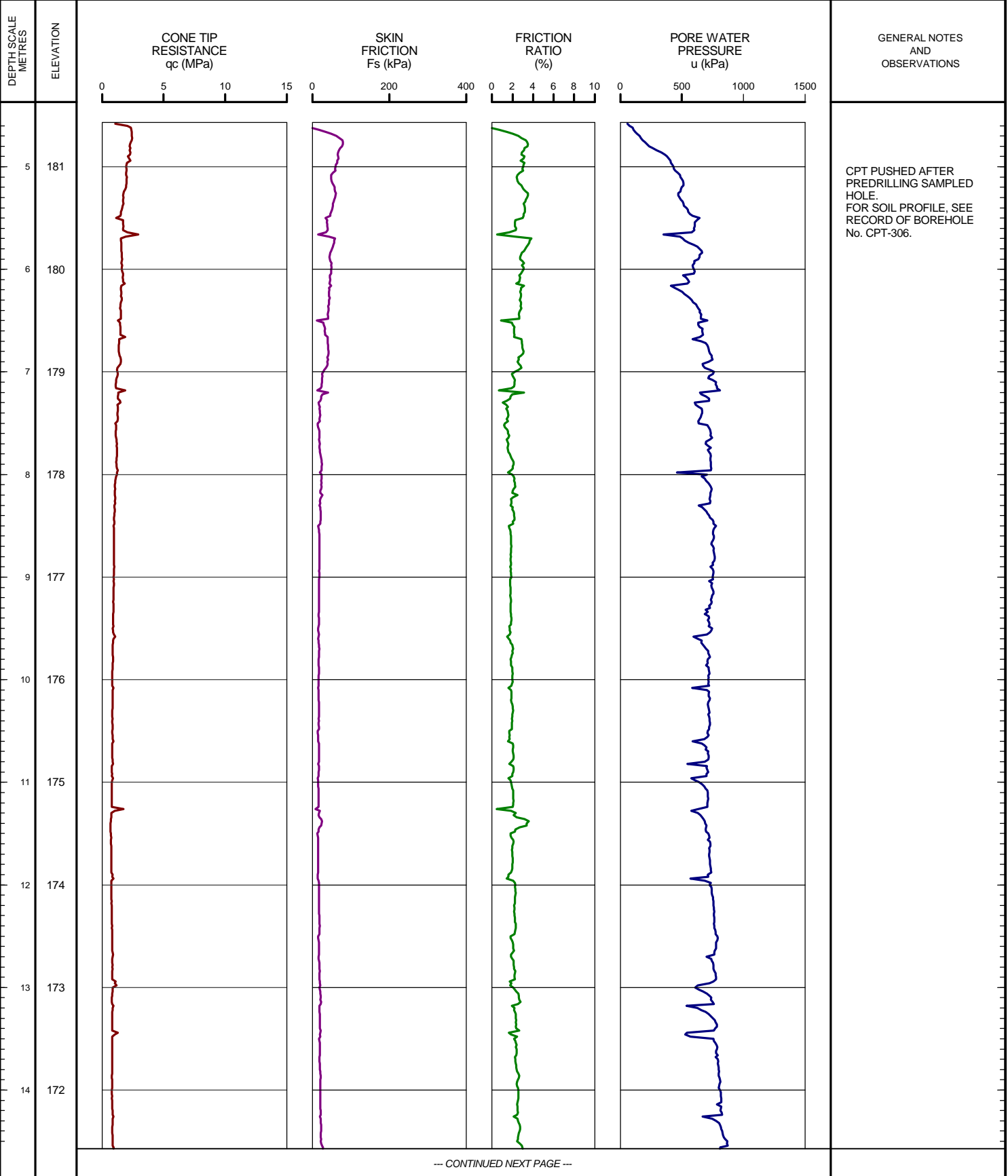
SHEET 1 OF 2

LOCATION: N 4677911.6 ;E 334964.7

TEST DATE: January 11, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 186.02m PREDRILL DEPTH: 4.57m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-306

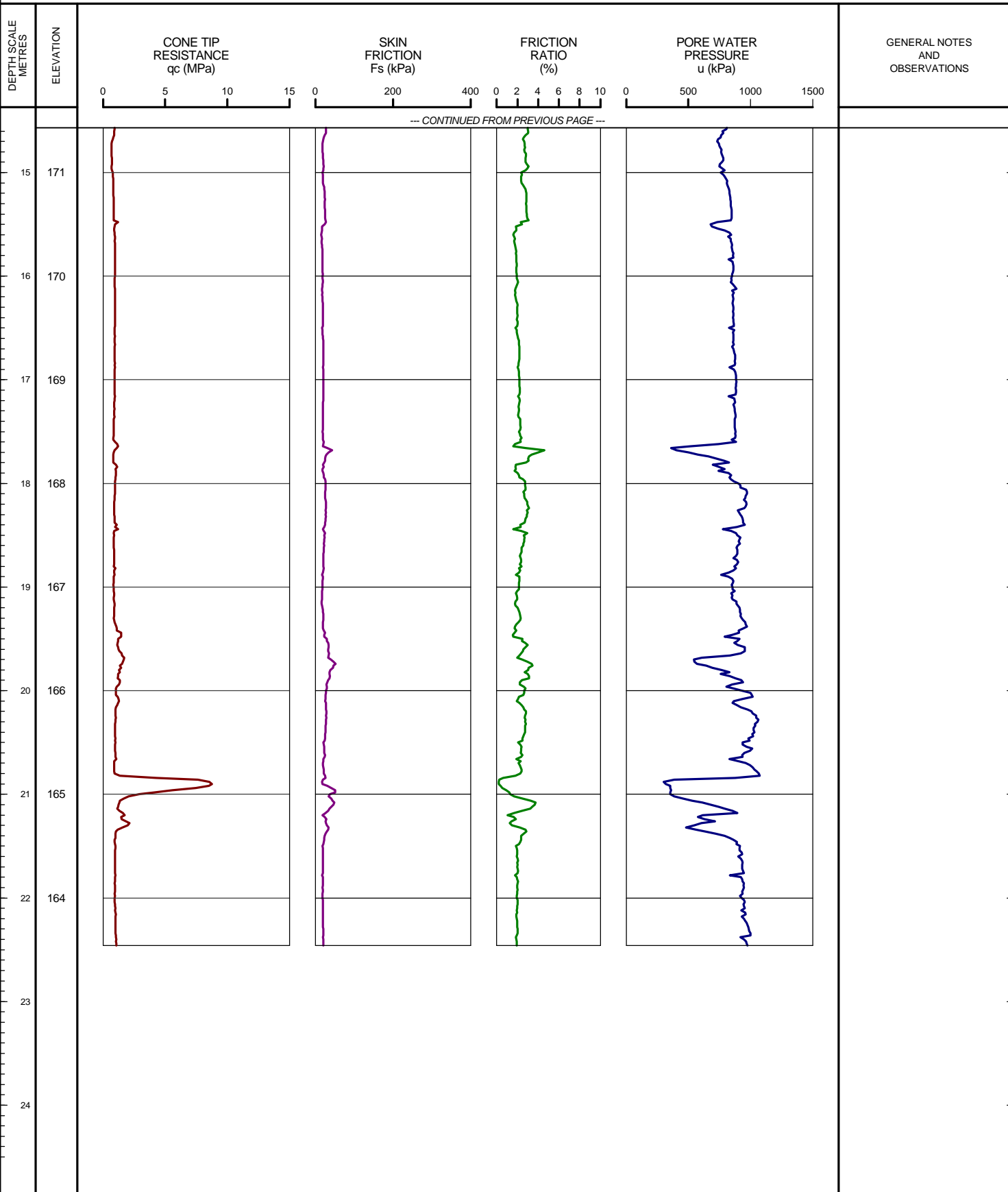
SHEET 2 OF 2

LOCATION: N 4677911.6 ;E 334964.7

TEST DATE: January 11, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 186.02m PREDRILL DEPTH: 4.57m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

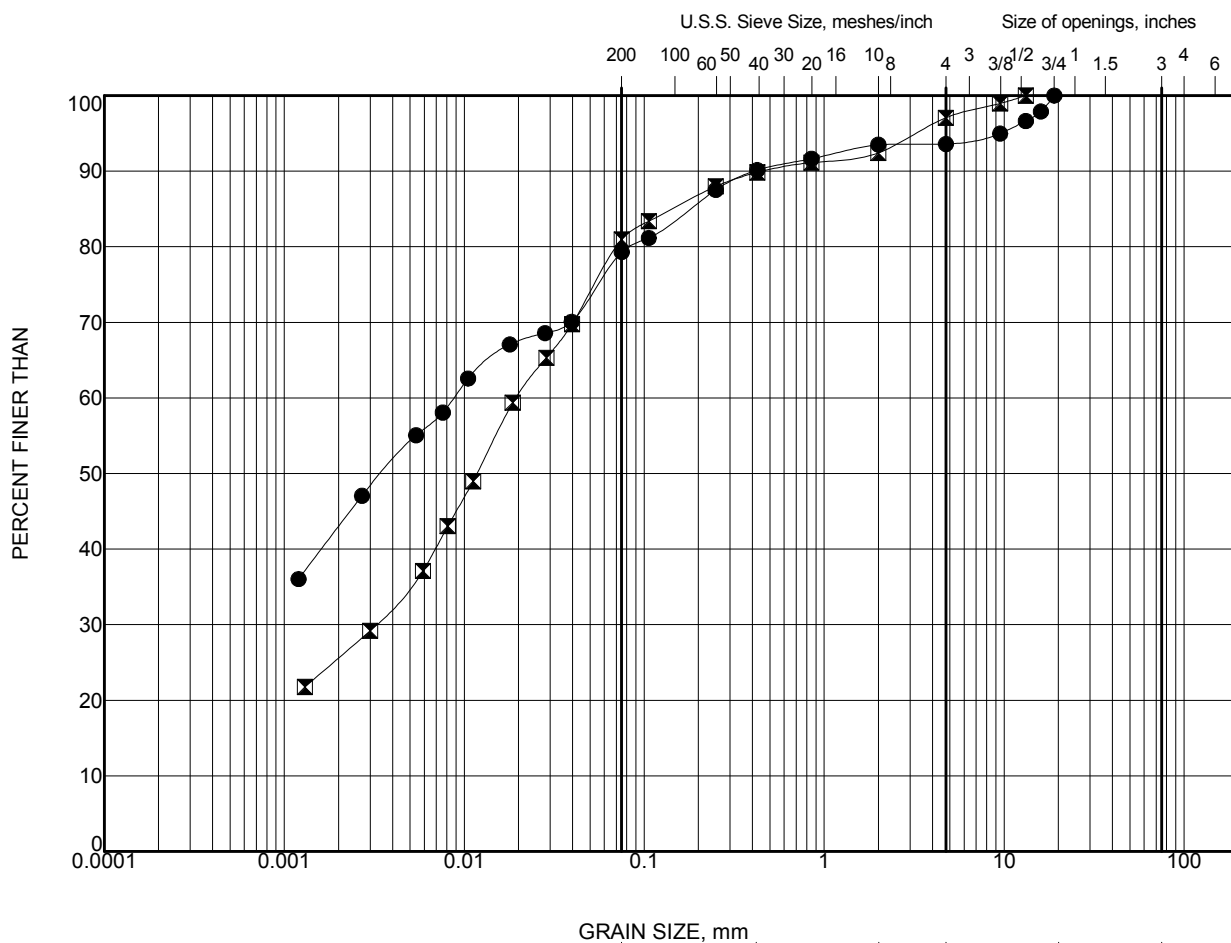
1 : 50



OPERATOR: TA

CHECKED:

Appendix C Analytical Laboratory Results

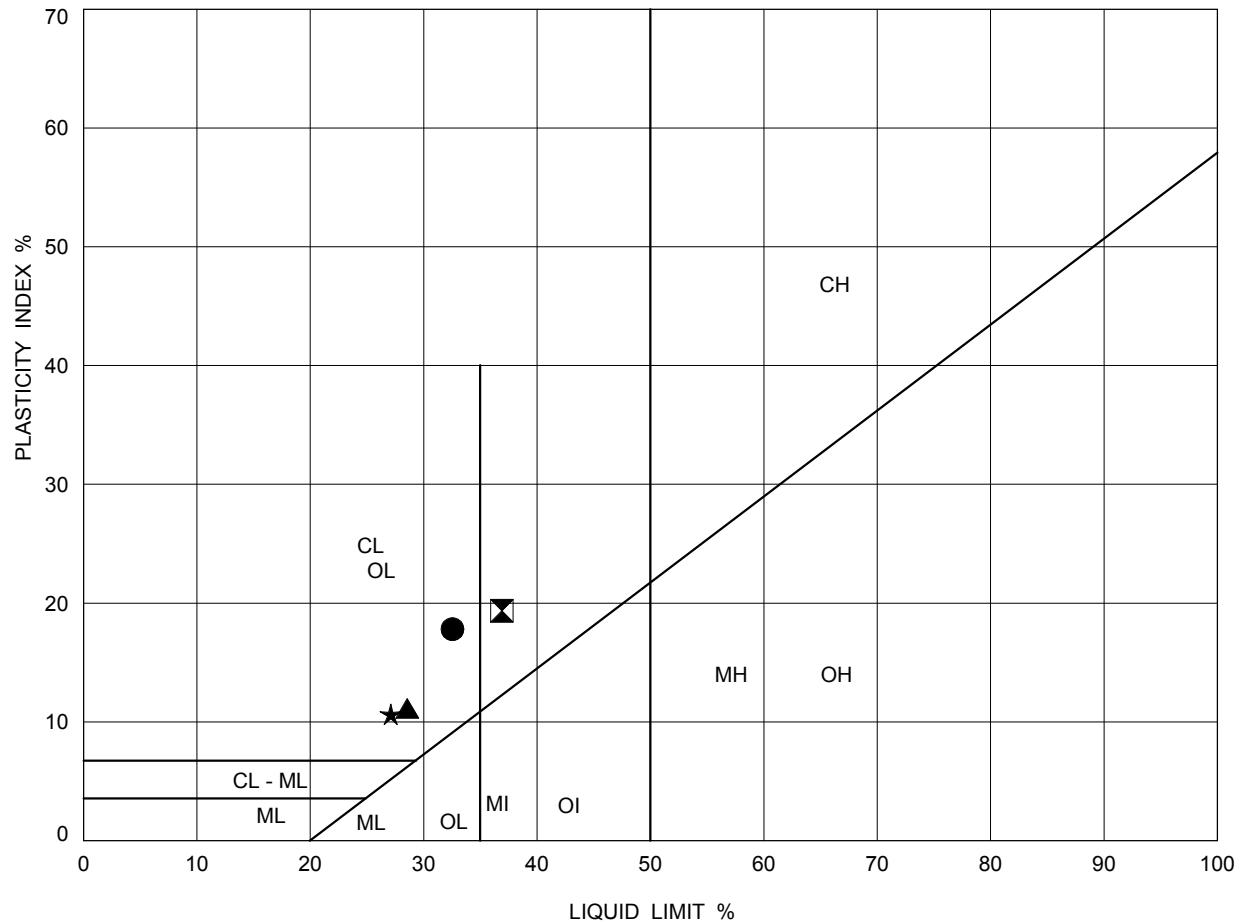


CLAY AND SILT	SAND SIZE			GRAVEL SIZE		Cobble Size
	fine	medium	coarse	fine	coarse	

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T2-1	4	3
⊠	T2-2	3	2.3

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
		PROJECT No. SW8801.1004.101	FILE No.
DRAWN		EA	SCALE
CHECK		MSO	REV.
		FIGURE C.1	



LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T2-1	4	3	33	15	18
⊠	T2-1	8	6.1	37	18	19
▲	T2-2	3	2.3	29	17	12
★	T2-2	18	21.3	27	16	11

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
PROJECT No. SW8801.1004.101		FILE No.	
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.2	

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D 2435)

Project: **WEP**
 Client: **Hatch Mott MacDonald Limited**
 Date: **20-Apr-11**

Job N **SW8801**

Sample ID: **T2-2_Sa15**

Depth(m): **16.8 to 17.4**

Test Data

Ring # :	A	Ring Height (in) =	0.750	Wt of dry filter paper (g)	0.61
Wet soil + Ring Wt (g)			194.55	Wt of ring (g)	76.58
Wet soil + Wet Paper + Ring (g)			189.96	Wet Paper (g)	1.65
Dry Soil + Dry Paper + Ring (g)			168.12	Ring Dia (in)	2.498
Initial moisture Content (%)			29.74	Final moisture Content (%)	22.87
Area of Ring (in ²)			4.90	Initial Volume (in ³)	3.6757
Initial Bulk Density (kg/m ³)			1959	Initial Dry Density (kg/m ³)	1510
Specific Gravity of Soil			2.75	Equiv. Thick. of solids (mm)	10.465
Final Bulk Density (kg/m ³)			2069	Final Dry Density (kg/m ³)	1595
Initial gauge reading for Load 1			0.2701	Gauge reading for last Loading	0.1924
Initial Voids Ratio			0.820	Final Void Ratio	0.632
Initial Degree of Saturation (%)			100	Final Degree of Saturation (%)	100

Trial #	1	2	3	4	5	6	7
Load (kPa)	5.0	7.5	11.5	17.0	25.0	38.0	55.0
Load (tsf)	0.052	0.078	0.120	0.177	0.260	0.395	0.572
Gauge Reading (in)	0.2675	0.2668	0.2640	0.2598	0.2550	0.2491	0.2423
(H-Hs) mm	8.519	8.500	8.430	8.323	8.201	8.051	7.877
Voids ratio	0.814	0.812	0.805	0.795	0.784	0.769	0.753
t90 (min)		5.29	12.25	11.22	12.25	8.41	9.00
Cv (m ² /day)		0.021	0.009	0.010	0.009	0.013	0.012
k' (MPa)		2.560	1.074	0.972	1.238	1.614	1.814
Mv (mm ² / N)		0.3907	0.9308	1.0290	0.8078	0.6197	0.5511

Trial #	8	9	10	11	12	13	14
Load (kPa)	85	130.0	190.0	130.0	85.0	55.0	38.0
Load (tsf)	0.884	1.352	1.976	1.352	0.884	0.572	0.395
Gauge Reading (in)	0.23292	0.2234	0.2142	0.2149	0.2158	0.2175	0.2196
(H-Hs) mm	7.640	7.398	7.164	7.181	7.206	7.249	7.301
Voids ratio	0.730	0.707	0.685	0.686	0.689	0.693	0.698
t90 (min)	4.84	6.25	4.84				
Cv (m ² /day)	0.021	0.016	0.020				
k' (MPa)	2.322	3.355	4.591				
Mv (mm ² / N)	0.4307	0.2980	0.2178				

Trial #	15	16	17	18	19	20	21
Load (kPa)	25.0	17.0	11.5	17.0	25.0	38.0	55.0
Load (tsf)	0.26	0.177	0.120	0.177	0.260	0.395	0.572
Gauge Reading (in)	0.22155	0.2241	0.2272	0.2266	0.2257	0.2239	0.2216
(H-Hs) mm	7.352	7.415	7.495	7.479	7.457	7.412	7.353
Voids ratio	0.702	0.709	0.716	0.715	0.713	0.708	0.703
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-2 (T2-2_SA15)**

Date

Aug 2012

JOB NO

SW8801.1004.101

FIGURE NO.
C.3-A

REV

Trial #	22	23	24	25	26	27	28
Load (kPa)	85	130.0	190.0	275.0	430.0	650.0	975.0
Load (tsf)	0.884	1.352	1.976	2.860	4.472	6.760	10.140
Gauge Reading (in)	0.21845	0.2151	0.2107	0.2033	0.1915	0.1796	0.1662
(H-Hs) mm	7.273	7.188	7.076	6.889	6.587	6.286	5.946
Voids ratio	0.695	0.687	0.676	0.658	0.629	0.601	0.568
t90 (min)				3.06	3.80	2.56	2.72
Cv (m ² /day)				0.030	0.024	0.034	0.031
k' (MPa)				7.943	8.922	12.443	16.019
Mv (mm ² / N)				0.1259	0.1121	0.0804	0.0624

Trial #	29	30	31	32	33	34	35
Load (kPa)	1450	725.0	360.0	180.0	90.0	45.0	22.5
Load (tsf)	15.08	7.540	3.744	1.872	0.936	0.468	0.234
Gauge Reading (in)	0.15372	0.1560	0.1593	0.1638	0.1682	0.1759	0.1840
(H-Hs) mm	5.629	5.687	5.770	5.885	5.997	6.193	6.397
Voids ratio	0.538	0.543	0.551	0.562	0.573	0.592	0.611
t90 (min)	2.56						
Cv (m ² /day)	0.031						
k' (MPa)	24.591						
Mv (mm ² / N)	0.0407						

Trial #	36						
Load (kPa)	11.5						
Load (tsf)	0.1196						
Gauge Reading (in)	0.1924						
(H-Hs) mm	6.610						
Voids ratio	0.632						
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project

WINDSOR ESSEX PARKWAY

TITLE

CONSOLIDATION TEST
TUNNEL T-2 (T2-2_SA15)

Date

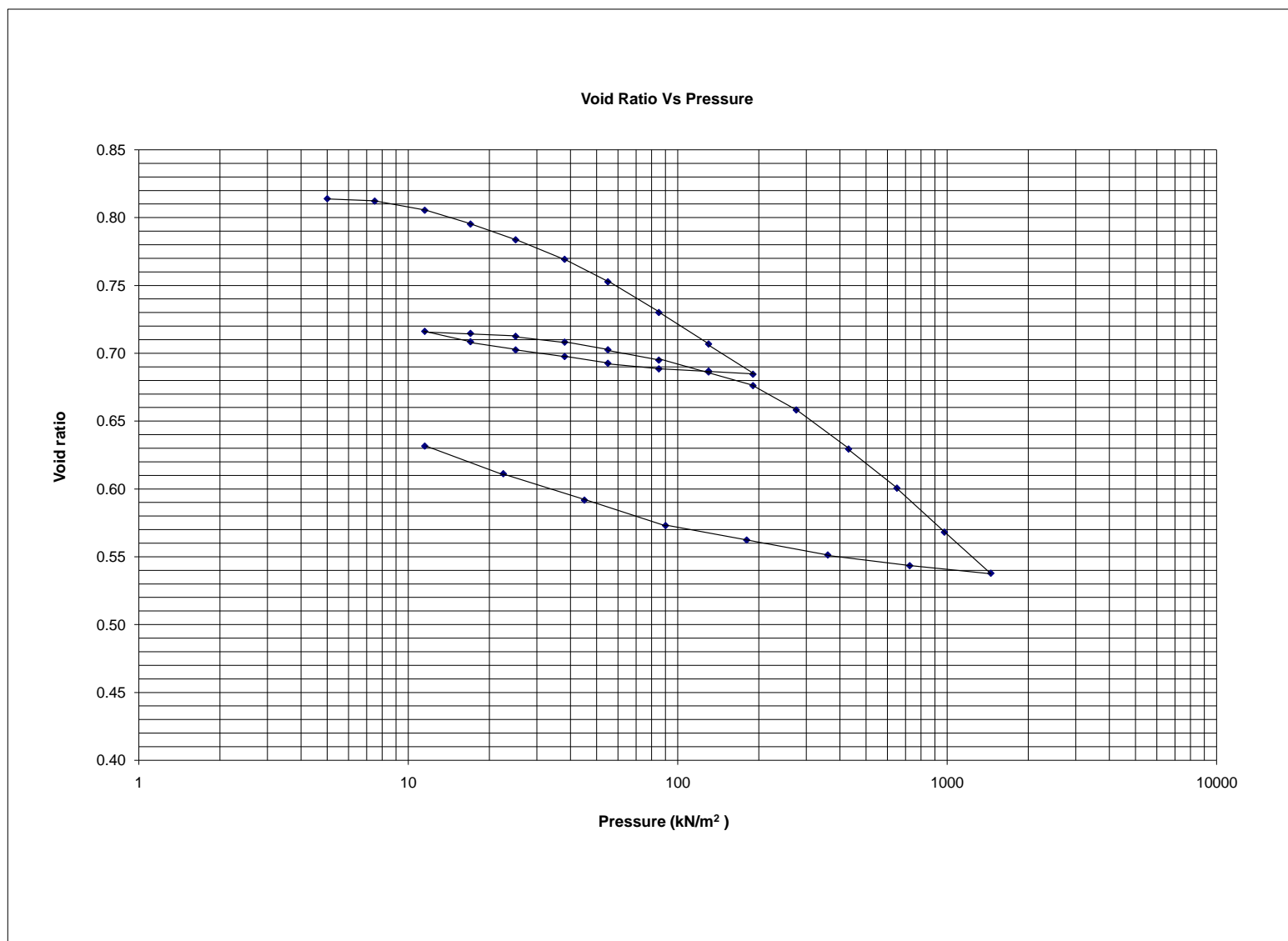
Aug 2012

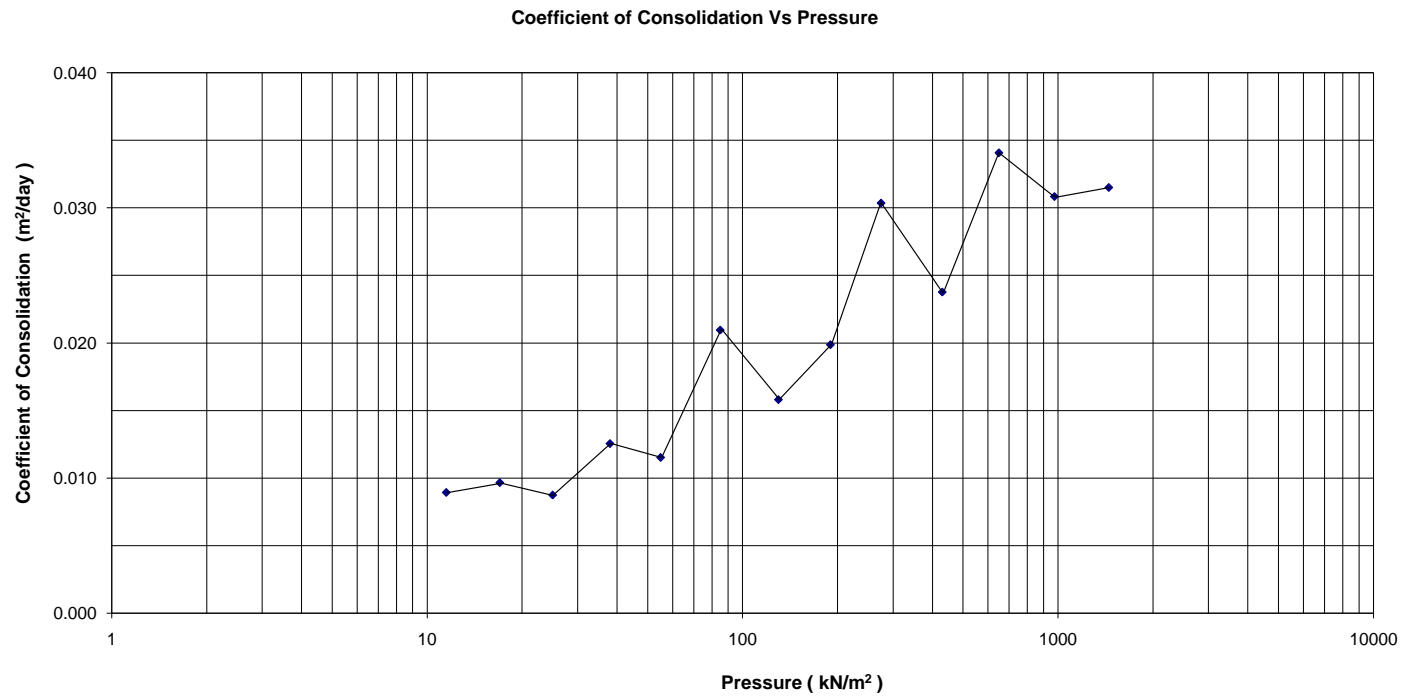
JOB NO

SW8801.1004.101

FIGURE NO.
C.3-B

REV





Strain Energy Data

Presssure (kN/m ²)	cv (m ² /day)	Void ratio
5.0		0.814
7.5		0.812
11.5	0.009	0.805
17.0	0.010	0.795
25.0	0.009	0.784
38.0	0.013	0.769
55.0	0.012	0.753
85.0	0.021	0.730
130.0	0.016	0.707
190.0	0.020	0.685
130.0		0.686
85.0		0.689
55.0		0.693
38.0		0.698
25.0		0.702
17.0		0.709
11.5		0.716
17.0		0.715
25.0		0.713
38.0		0.708
55.0		0.703
85.0		0.695
130.0		0.687
190.0		0.676
275.0	0.030	0.658
430.0	0.024	0.629
650.0	0.034	0.601
975.0	0.031	0.568
1450.0	0.031	0.538
725.0		0.543
360.0		0.551
180.0		0.562
90.0		0.573
45.0		0.592
22.5		0.611
11.5		0.632

Presssure (KN/m ²)	Height mm	Total Work (KJ/m ³)
5.0	19.050	0.000
7.5	19.031	0.006
11.5	18.961	0.041
17.0	18.854	0.122
25.0	18.733	0.257
38.0	18.582	0.510
55.0	18.409	0.944
85.0	18.166	1.867
130.0	17.923	3.304
190.0	17.690	5.388
130.0	17.707	5.232
85.0	17.731	5.085
55.0	17.774	4.915
38.0	17.826	4.779
25.0	17.929	4.597
17.0	17.993	4.522
11.5	18.073	4.459
17.0	18.057	4.472
25.0	18.034	4.498
38.0	17.989	4.576
55.0	17.930	4.729
85.0	17.850	5.041
130.0	17.766	5.550
190.0	17.654	6.559
275.0	17.466	9.031
430.0	17.165	15.116
650.0	16.863	24.601
975.0	16.523	40.976
1450.0	16.206	64.238
725.0	16.265	60.317
360.0	16.347	57.555
180.0	16.462	55.659
90.0	16.574	54.743
45.0	16.770	53.943
22.5	16.974	53.533
11.5	17.187	53.319

Project

WINDSOR ESSEX PARKWAY

TITLE

CONSOLIDATION TEST
TUNNEL T-2 (T2-2_SA15)

Date

Aug 2012

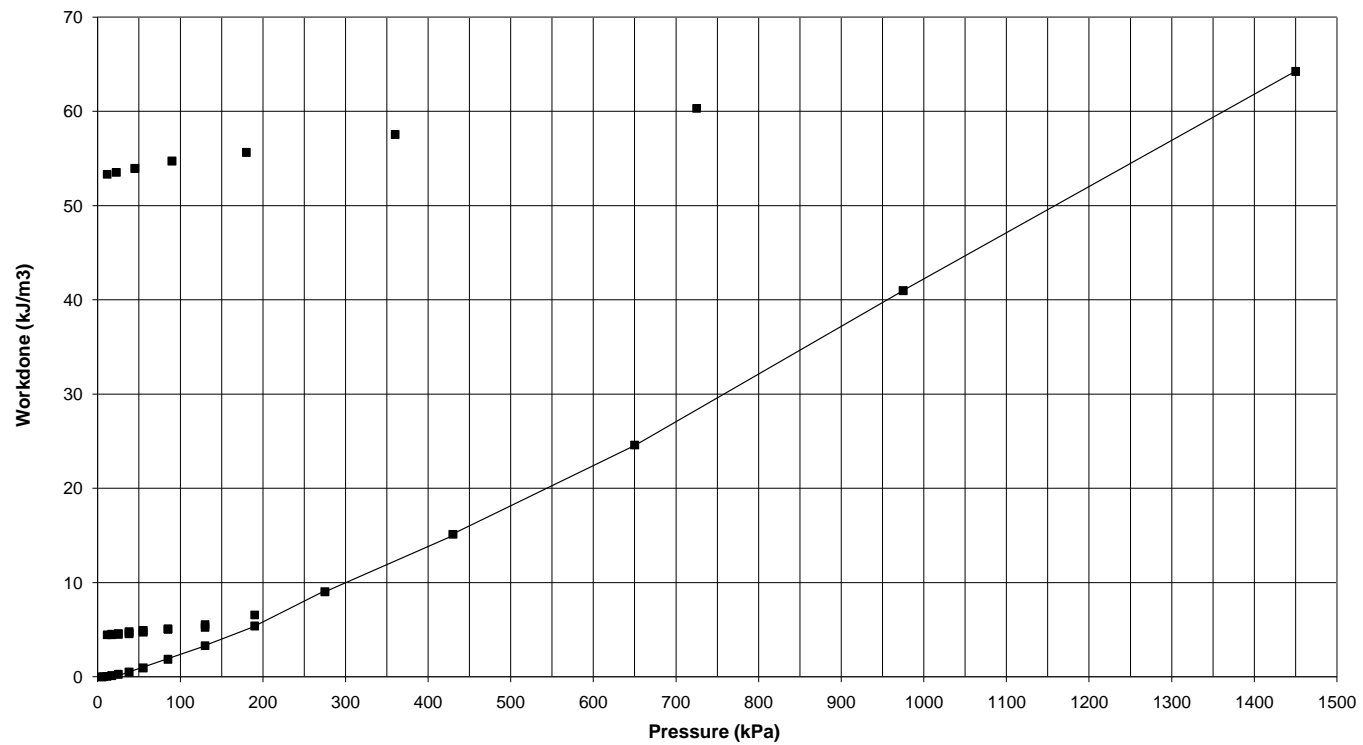
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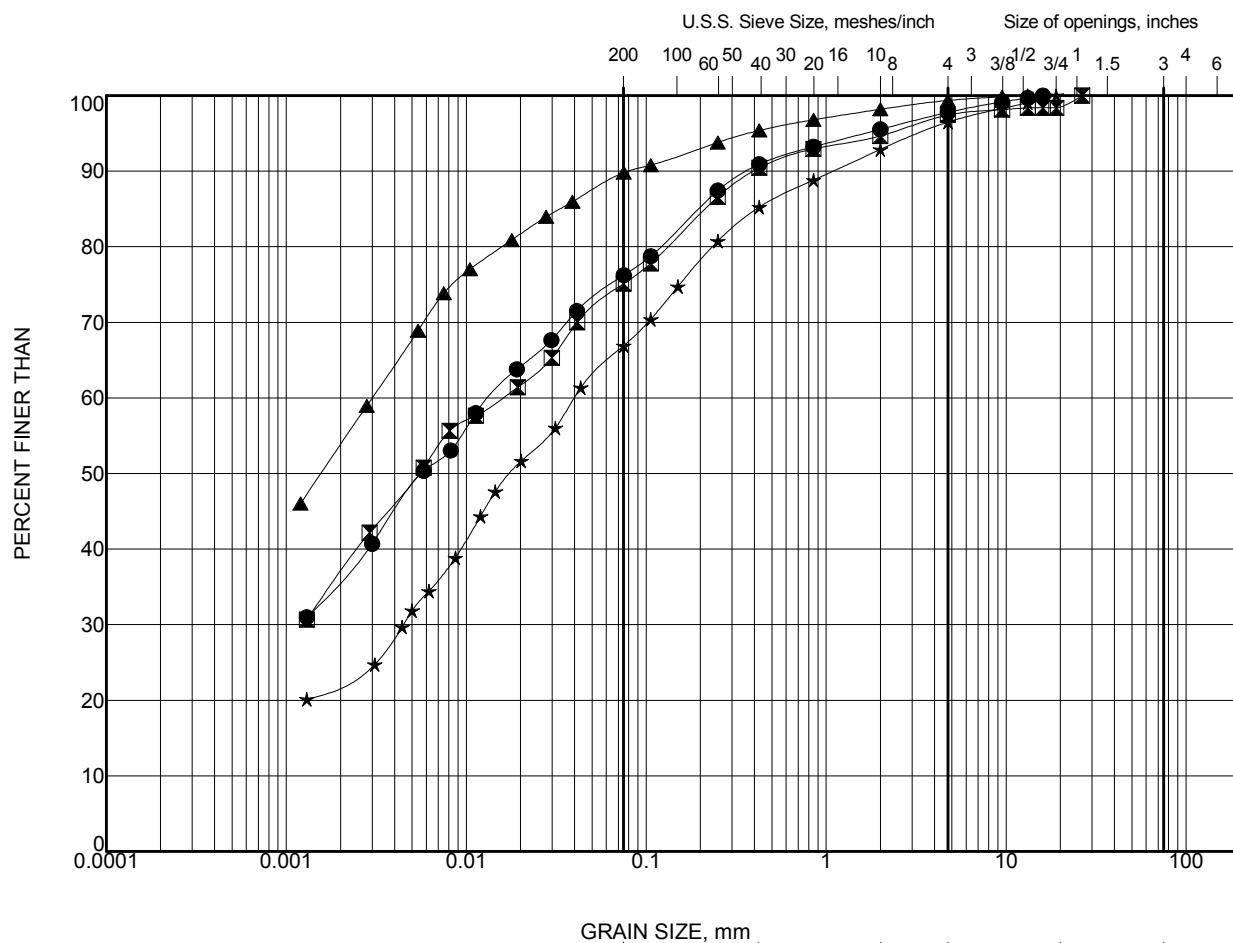
SW8801.1004.101

FIGURE NO.
C.3-E

REV

Strain Energy Method for Preconsolidation Pressure





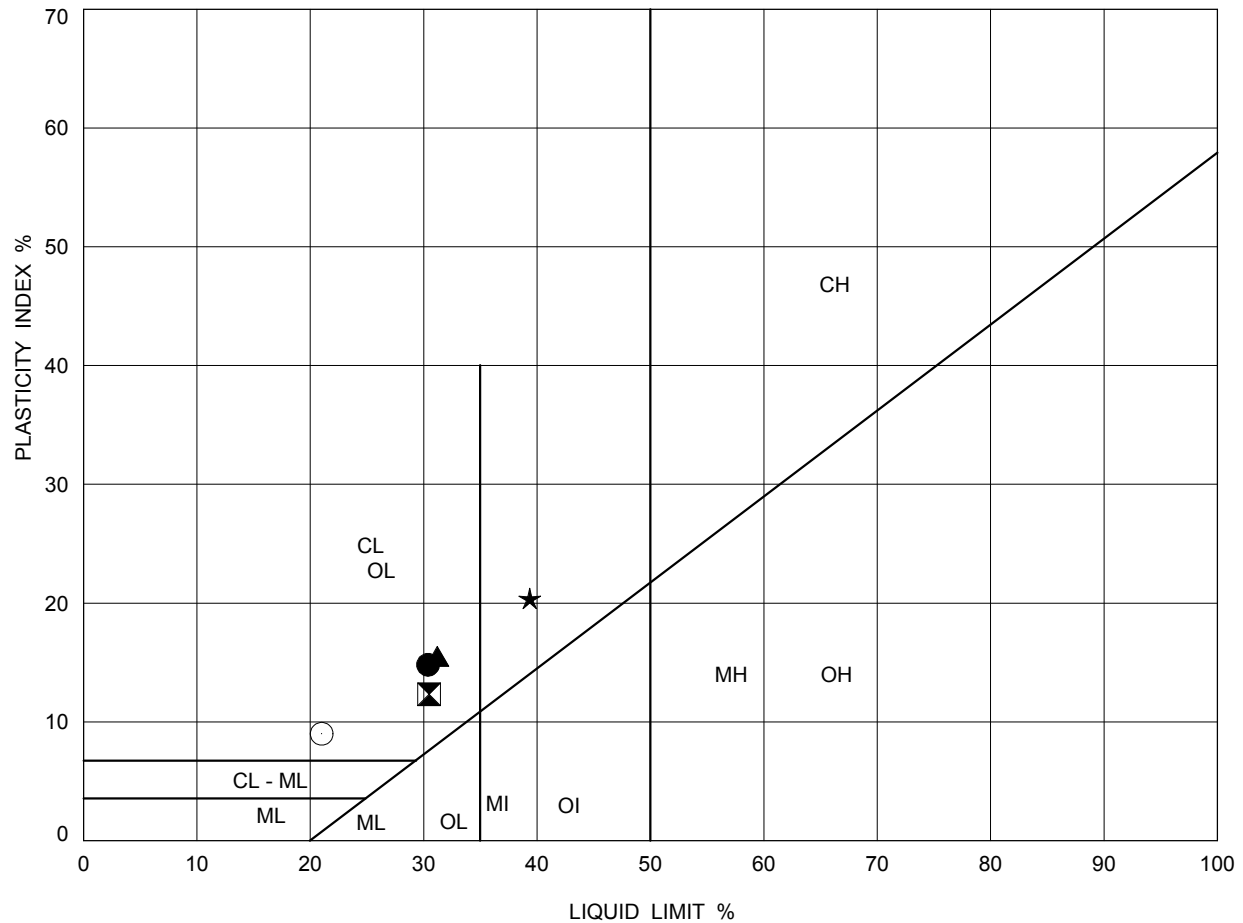


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T3-1	11	10.7
◻	T3-1	13	13.7
▲	T3-1	15	16.8
★	T3-1	16	18.3

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN EA		SCALE	REV.
CHECK MSO		FIGURE C.1	





SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T3-1	11	10.7	30	16	14
⊠	T3-1	12	12.2	30	18	12
▲	T3-1	13	13.7	31	16	15
★	T3-1	15	16.8	39	19	20
○	T3-1	16	18.3	21	12	9

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA		SCALE
CHECK	MSO		REV.
		FIGURE C.2	

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS (ASTM D 3080)

Page 1 of 5

Project:- WEP
Client:- Hatch Mott MacDonald Limited
Sample ID.: T3-1_TW16
Lab No.: AdS091_2011

Job#: SW8801.1004.101
Date: 23 November 2011
Tested By: CZ/SB
Checked By: SB

Specimen ID	1	2	3
Date of Test	30-Nov-11	27-Nov-11	29-Nov-11
Normal Stress (kPa)	150	220	350
Rate of displacement (mm/min)	0.04	0.04	0.04
Initial thickness of specimen (mm)	24.10	24.10	24.10
Initial diameter of specimen (mm)	63.30	63.30	63.30
Initial moisture content (%)	23.9	19.1	26.3
Density (kN/m ³)	5.2	5.8	4.8
Final moisture (%)	23.5	18.8	21.6

Specimen ID	Normal Stress	Peak Shear Stress	Residual Shear Stress
	kPa	kPa	kPa
1	150.0	73.0	68.8
2	220.0	114.8	111.7
3	350.0	173.8	169.0

Note: Test specimens were inundated with water.



Project

WINDSOR ESSEX PARKWAY

TITLE

CONSOLIDATION TEST
TUNNEL T-3 (T3-1_TW16)

Date

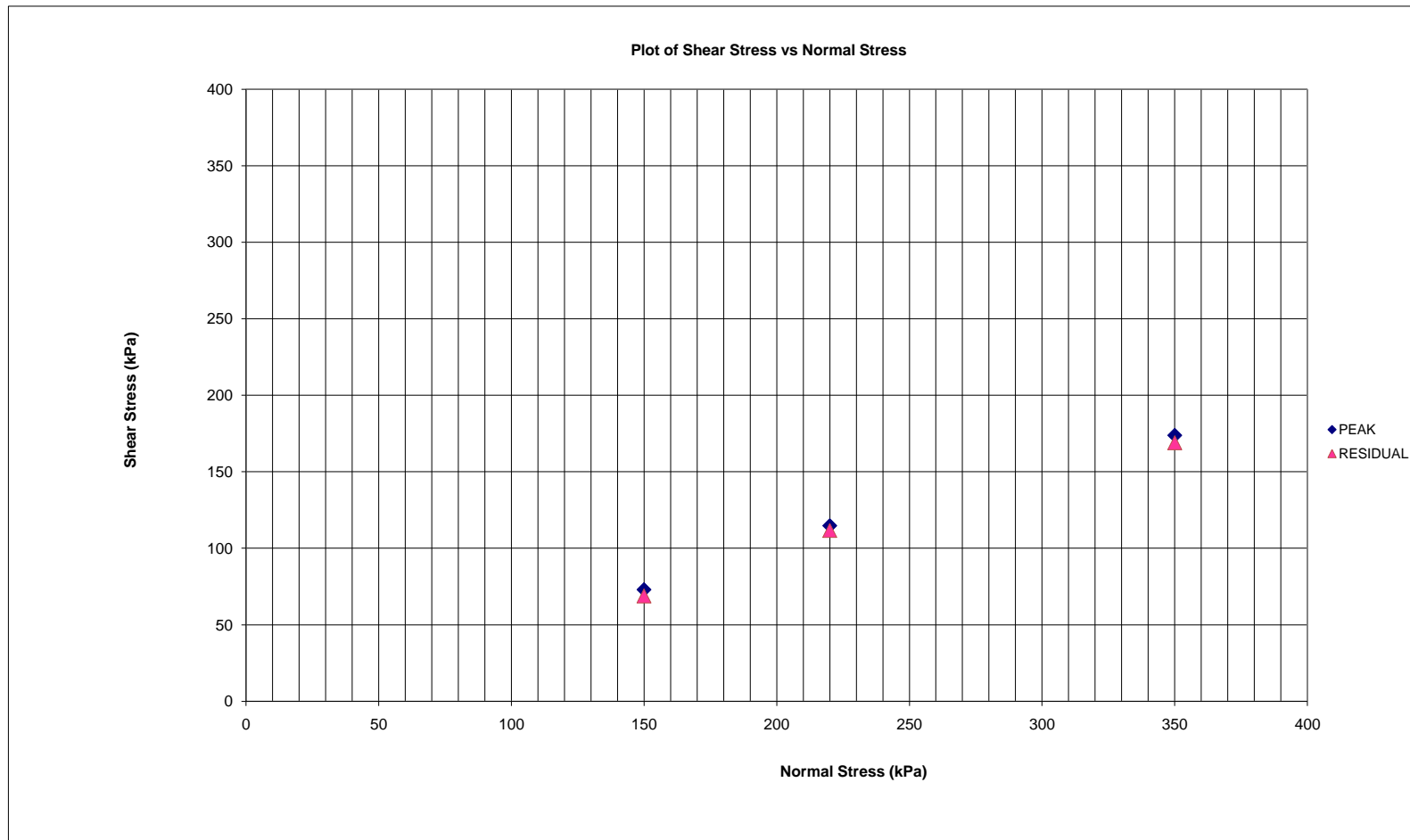
Aug 2012

JOB NO

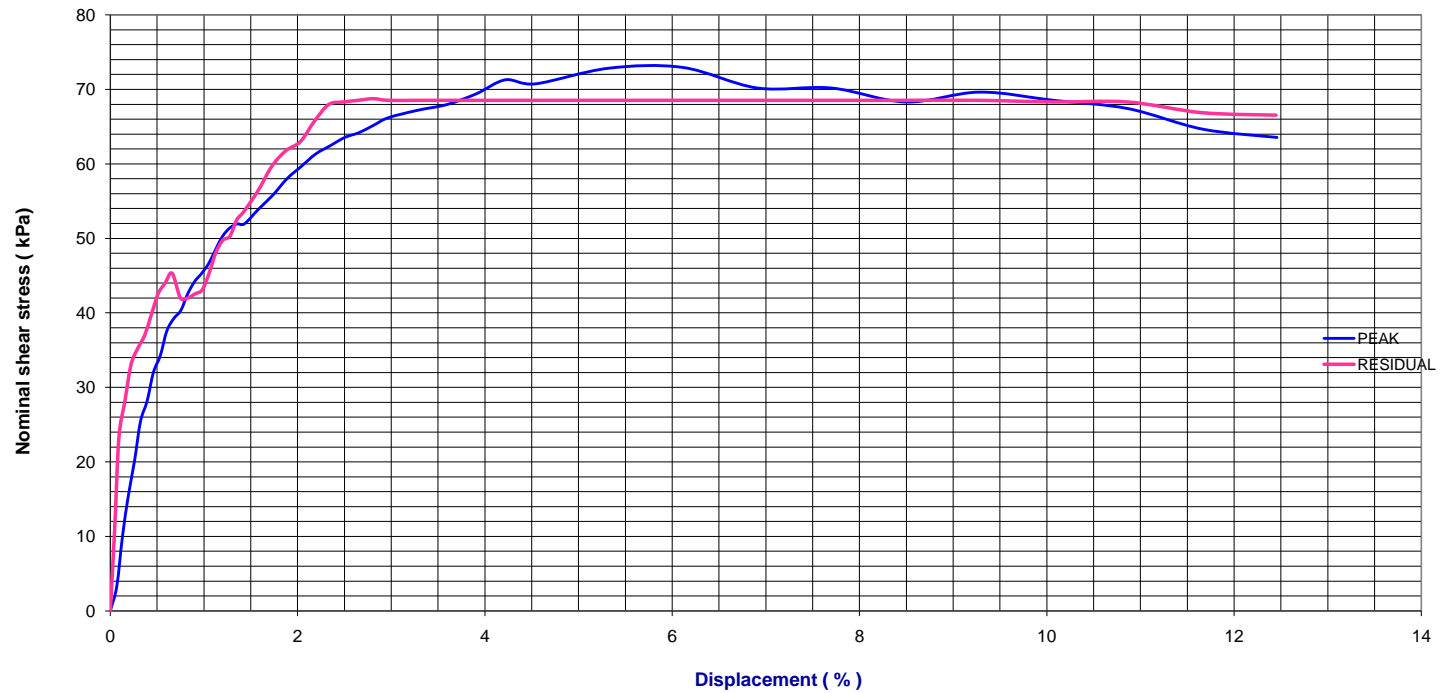
SW8801.1004.101

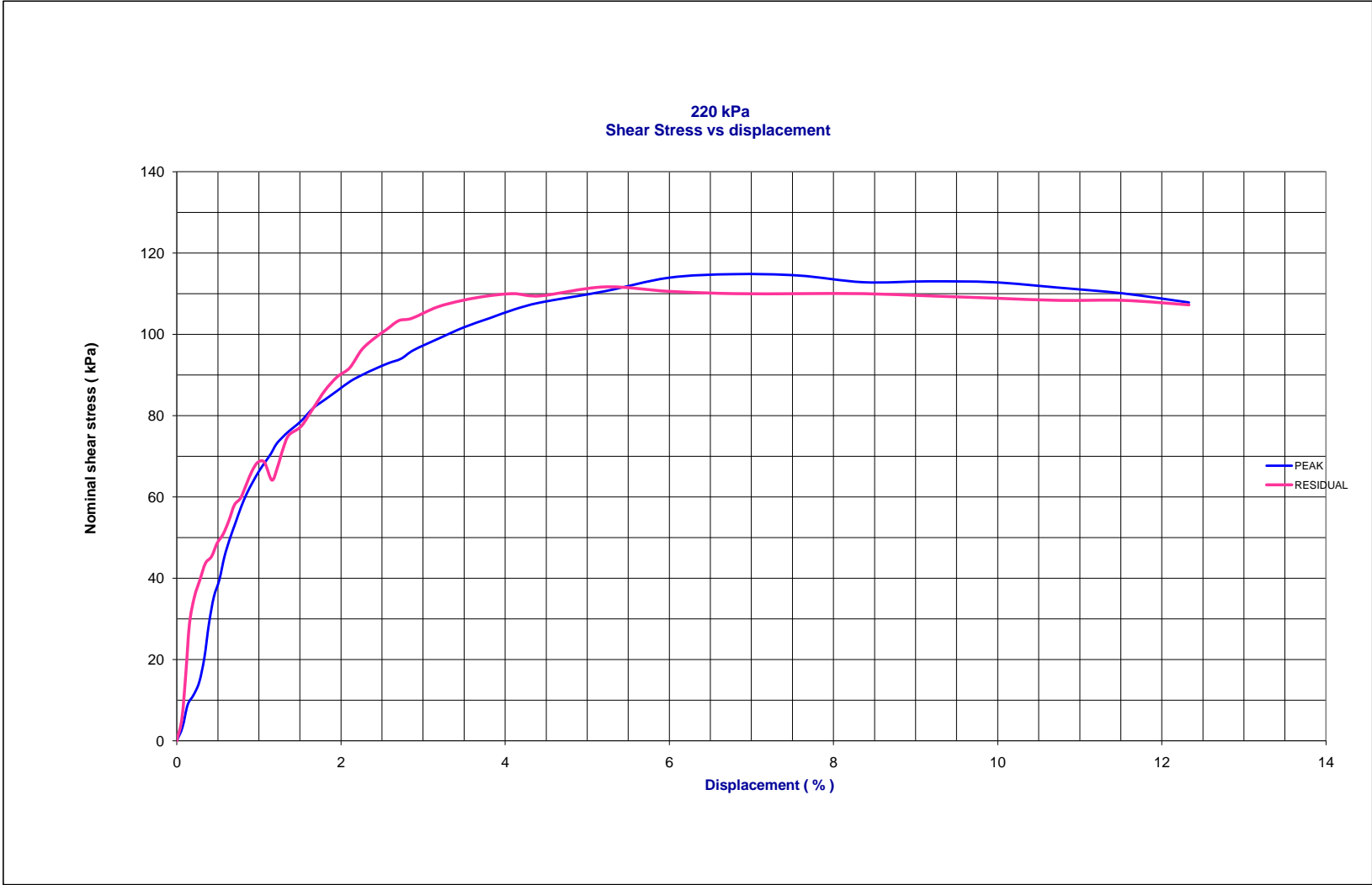
FIGURE NO.
C.3-A

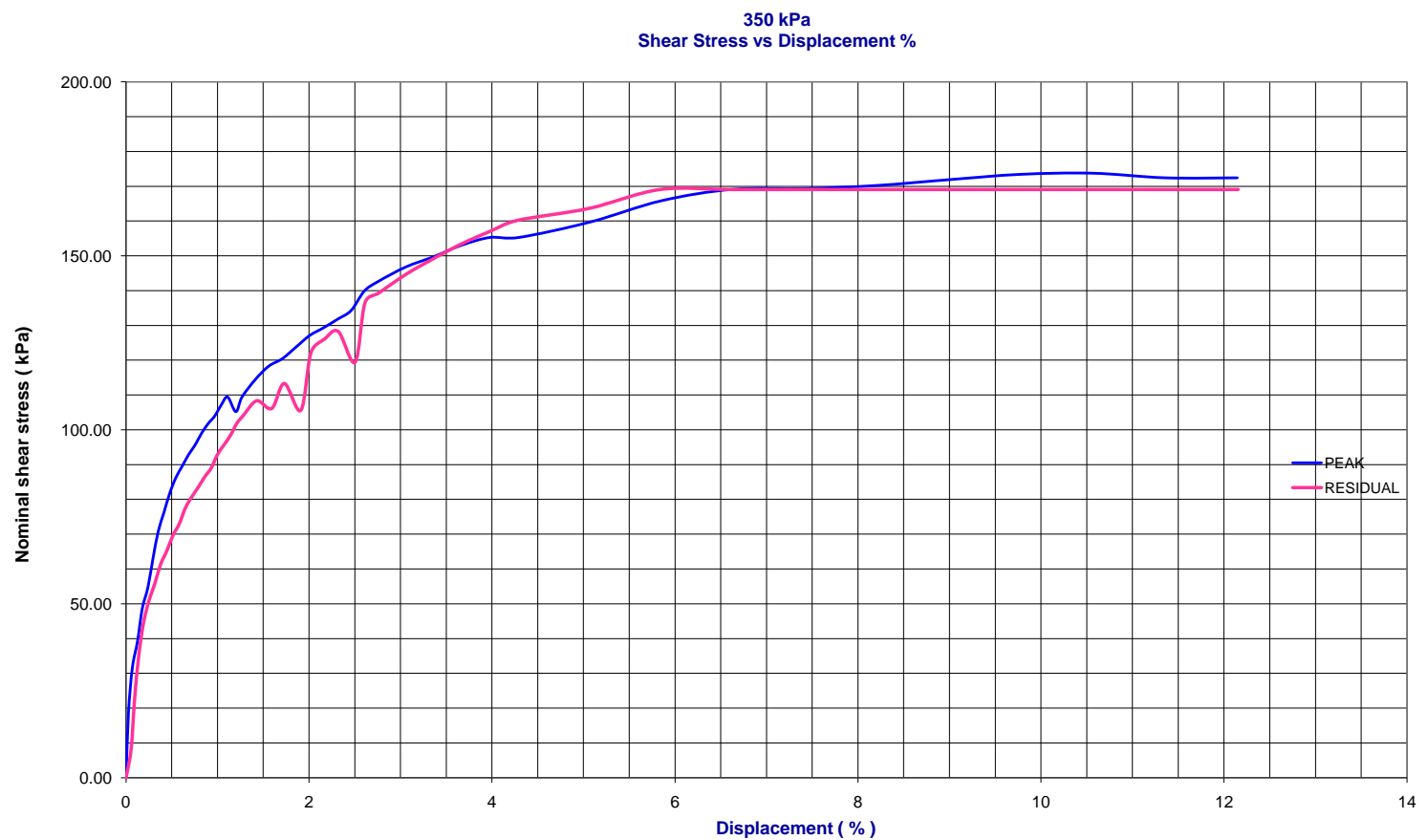
REV

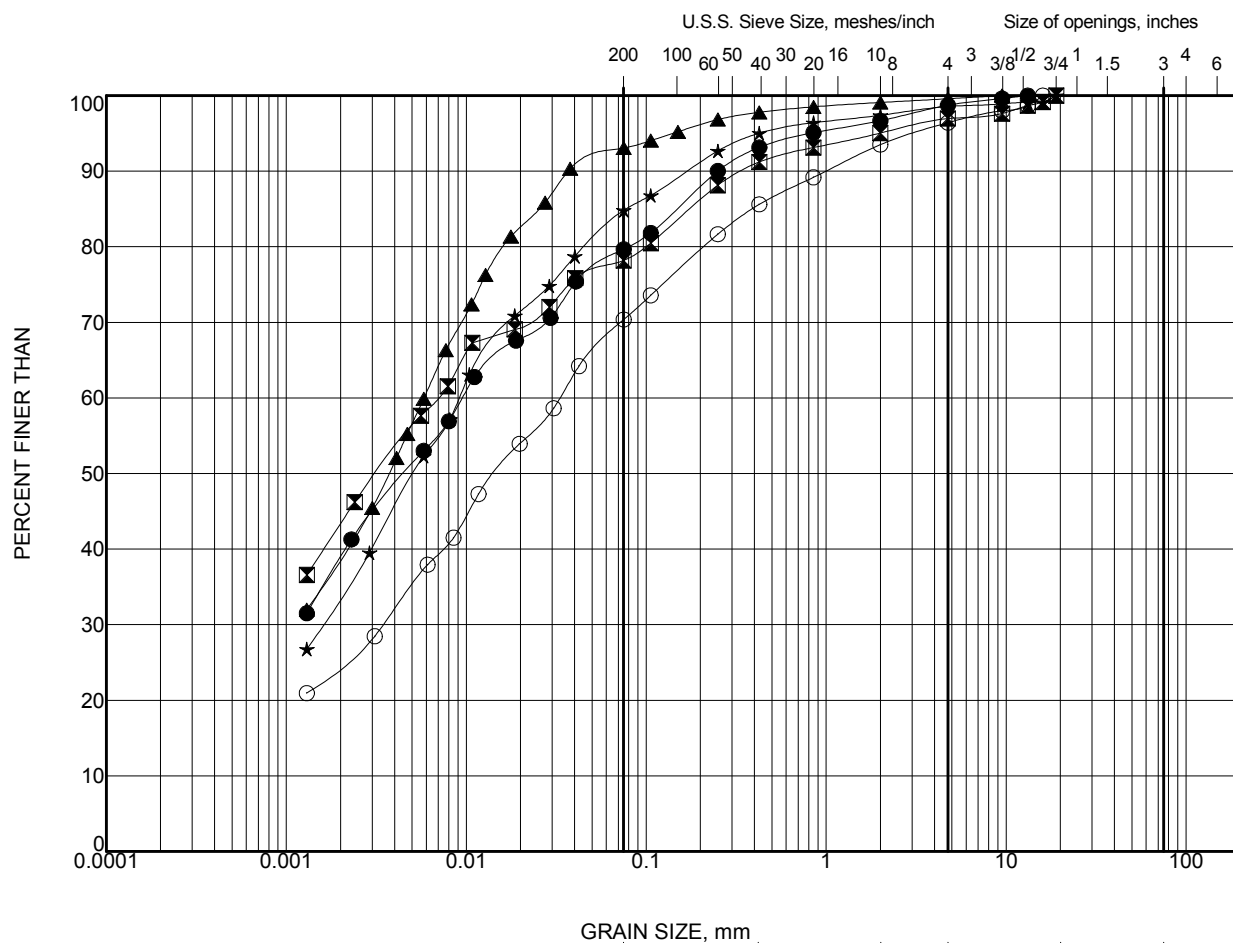


150 kPa
Shear Stress vs Strain







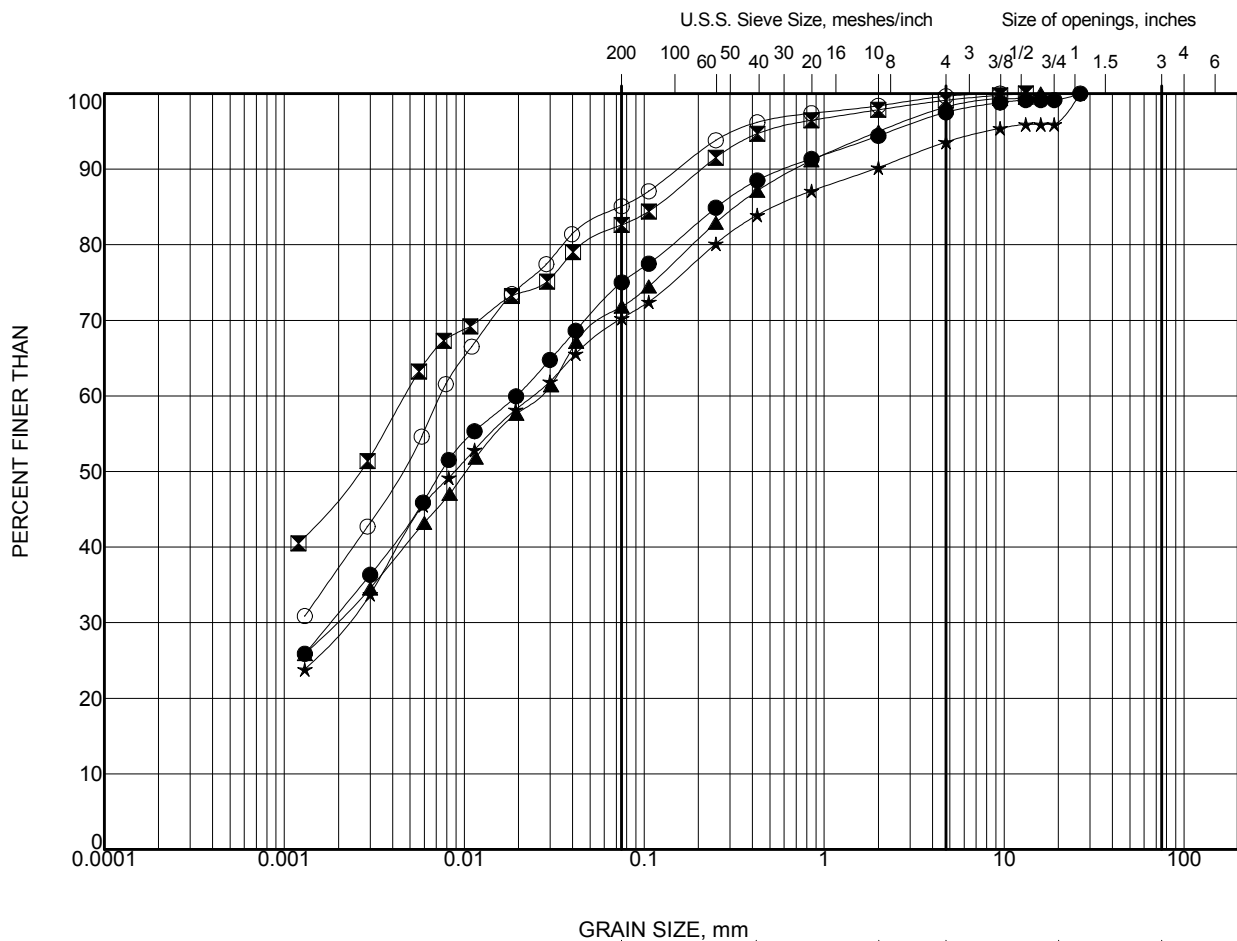


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T6-1/HG-MW-07	8	6.1
◩	T6-1/HG-MW-07	10	9.1
▲	T6-1/HG-MW-07	12	12.2
★	T6-1/HG-MW-07	13	13.7
○	T6-1/HG-MW-07	16	18.3

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
	PROJECT No. SW8801.1004.101		FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
FIGURE C.1			

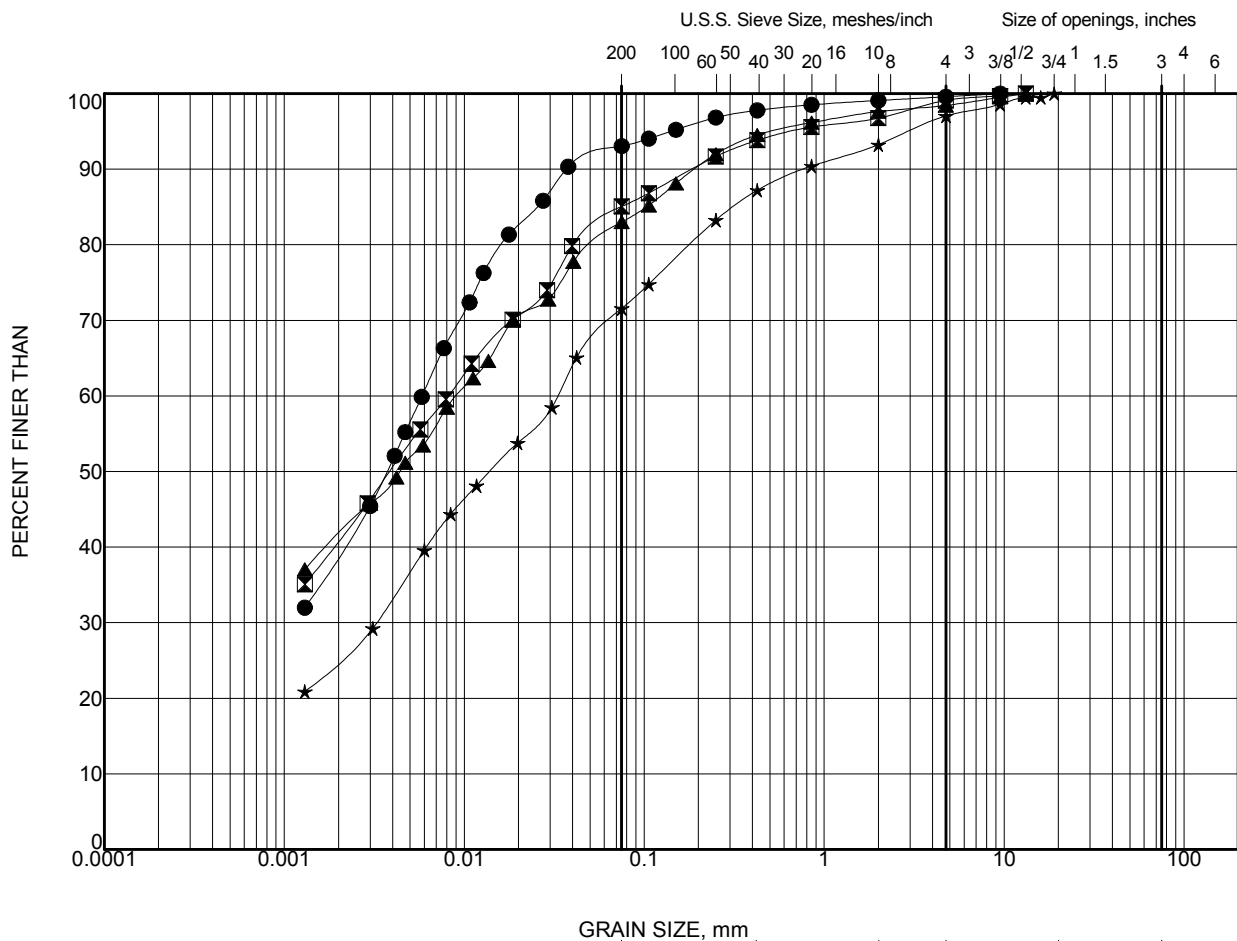


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T6-1/HG-MW-07	19	22.9
⊠	T6-2	8	6.1
▲	T6-2	14	15.2
★	T6-2	19	22.9
○	T6-3	11	10.7

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
	PROJECT No. SW8801.1004.101		FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
FIGURE C.2			

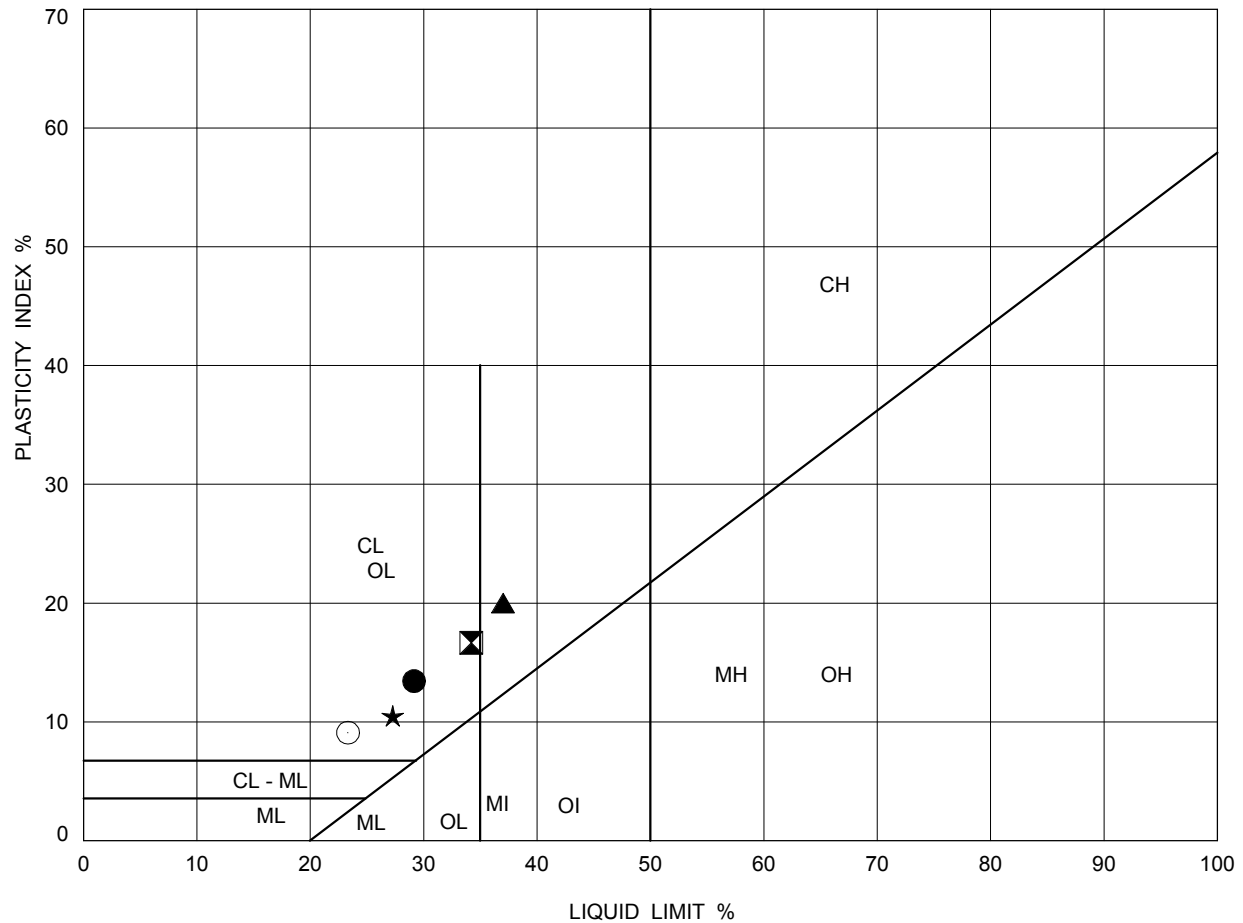


CLAY AND SILT	GRAIN SIZE, mm					Cobble Size
	fine	medium	coarse	fine	coarse	
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T6-3	12	12.2
◻	T6-3	14	15.2
▲	T6-3	15	16.8
★	T6-3	17	19.8

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
		PROJECT No. SW8801.1004.101	FILE No.
		DRAWN EA	SCALE
		CHECK MSO	REV.
		FIGURE C.3	





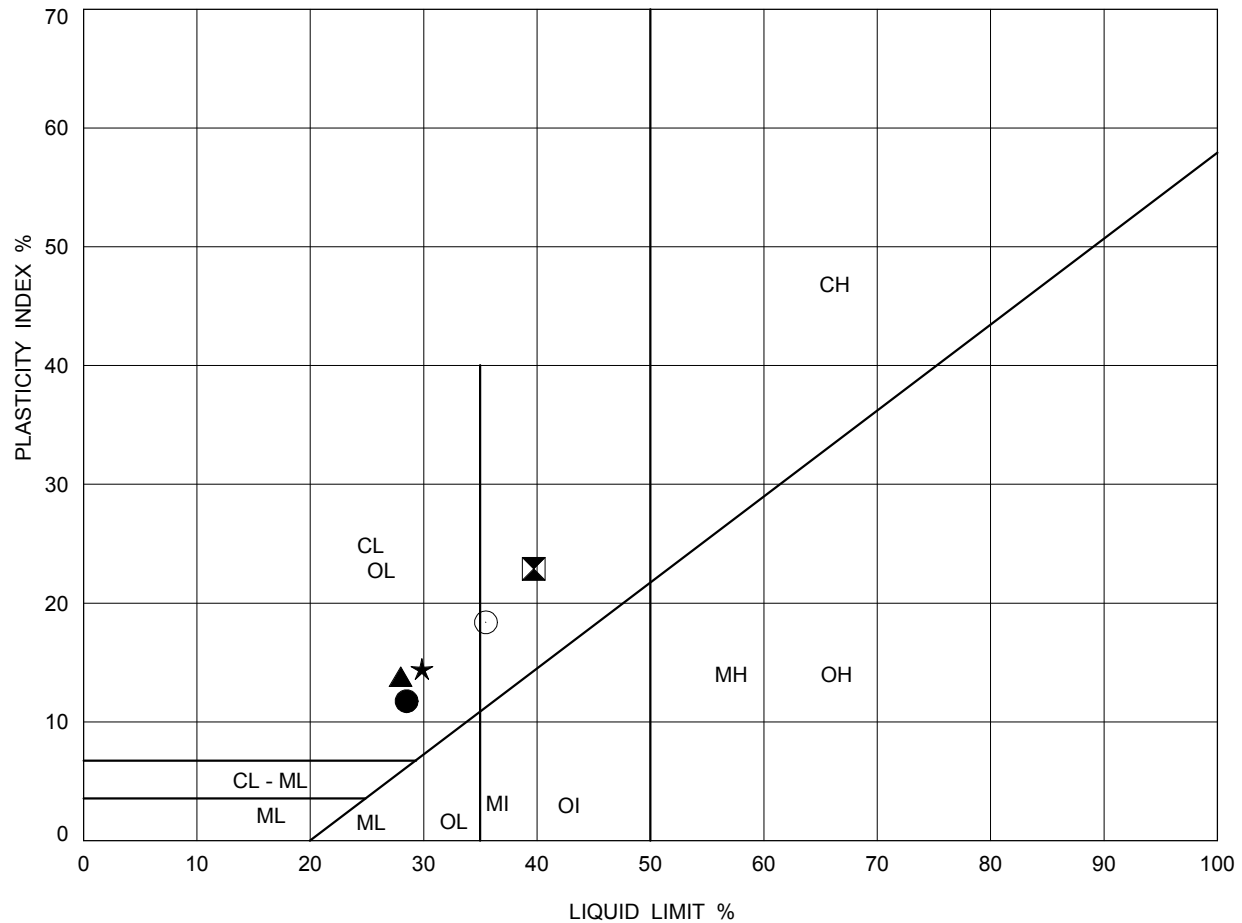
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:



SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T6-1/HG-MW-07	8	6.1	29	16	13
⊠	T6-1/HG-MW-07	10	9.1	34	18	16
▲	T6-1/HG-MW-07	12	12.2	37	17	20
★	T6-1/HG-MW-07	13	13.7	27	17	10
○	T6-1/HG-MW-07	16	18.3	23	14	9

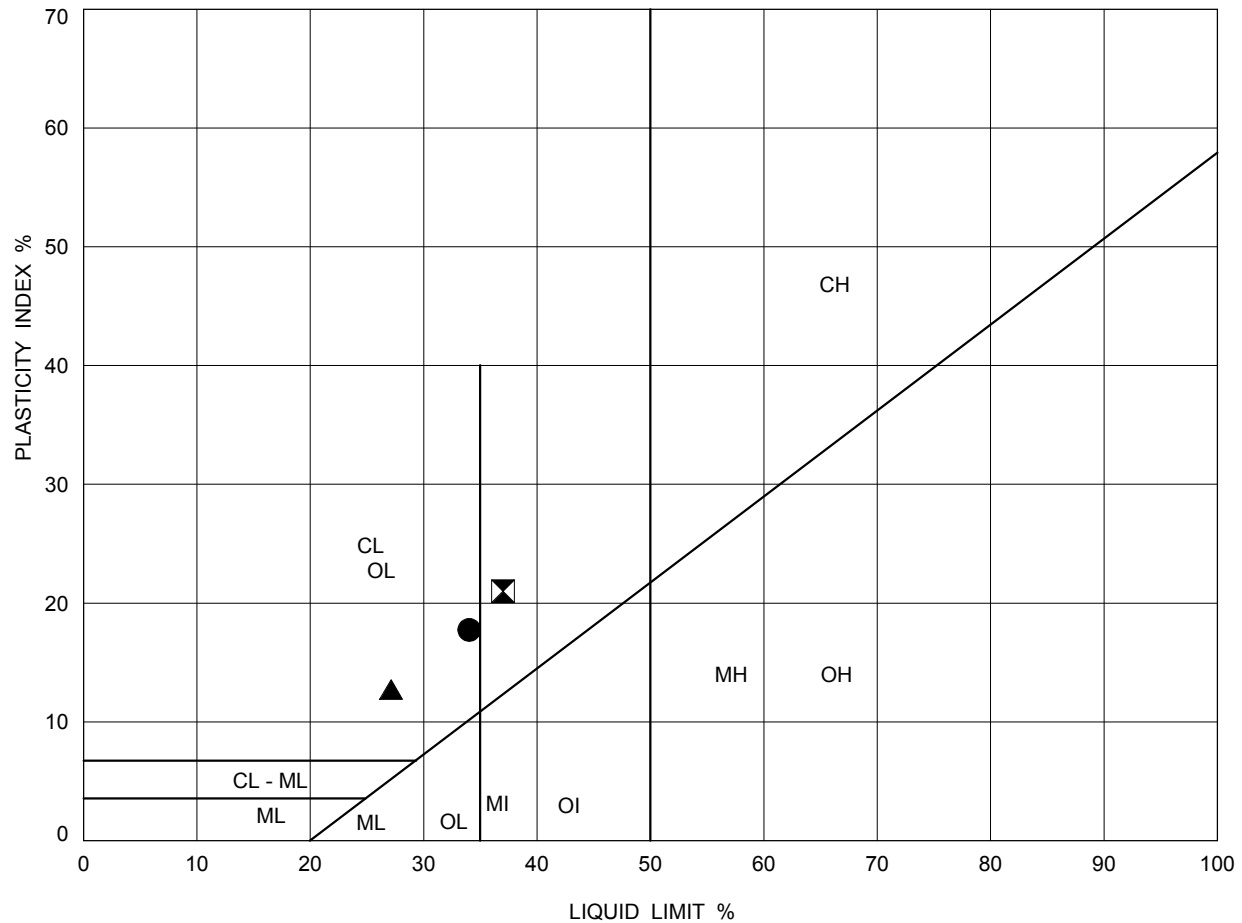
PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	CHECK	MSO
SCALE		REV.	
FIGURE C.4			



LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T6-1/HG-MW-07	19	22.9	28	17	11
⊠	T6-2	8	6.1	40	17	23
▲	T6-2	14	15.2	28	14	14
★	T6-2	19	22.9	30	15	15
○	T6-3	11	10.7	35	17	18

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA		SCALE
CHECK	MSO		REV.
		FIGURE C.5	



LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T6-3	14	15.2	34	16	18
⊠	T6-3	15	16.8	37	16	21
▲	T6-3	17	19.8	27	14	13

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
PROJECT No. SW8801.1004.101		FILE No.	
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.6	

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D 2435)

Project: **WEP**
 Client: **Hatch Mott MacDonald**
 Date: **14-Nov-11**

Job No.: **SW8801.1004.101**
 Sample ID: **T6-1_TW12**
 Depth(m): **12.2**

Test Data

Ring # :	A	Ring Height (in) =	0.758	Wt of dry filter paper (g)	0.8
Wet soil + Ring Wt (g)			205.34	Wt of ring (g)	76.58
Wet soil + Wet Paper + Ring (g)			204.00	Wet Paper (g)	2.28
Dry Soil + Dry Paper + Ring (g)			184.44	Ring Dia (in)	2.498
Initial moisture Content (%)			20.27	Final moisture Content (%)	16.89
Area of Ring (in ²)			4.90	Initial Volume (in ³)	3.7149
Initial Bulk Density (kg/m ³)			2115	Initial Dry Density (kg/m ³)	1759
Specific Gravity of Soil			2.73	Equiv. Thick. of solids (mm)	12.389
Final Bulk Density (kg/m ³)			2186	Final Dry Density (kg/m ³)	1870
Initial gauge reading for Load 1			0.2558	Gauge reading for last Loading	0.2106
Initial Voids Ratio			0.554	Final Void Ratio	0.461
Initial Degree of Saturation (%)			100	Final Degree of Saturation (%)	100

Trial #	1	2	3	4	5	6	7
Load (kPa)	4.75	7.0	10.5	15.75	23.75	35.5	53.5
Load (tsf)	0.0494	0.0728	0.109	0.164	0.247	0.369	0.556
Gauge Reading (in)	0.2558	0.2554	0.2548	0.2517	0.2496	0.2468	0.2434
(H-Hs) mm	6.864	6.854	6.838	6.760	6.706	6.636	6.549
Voids ratio	0.554	0.553	0.552	0.546	0.541	0.536	0.529
t ₉₀ (min)			5.71	6.76	11.56	9.00	7.56
C _v (m ² /day)			0.020	0.017	0.010	0.012	0.015
k' (MPa)			4.209	1.299	2.872	3.201	3.919
M _v (mm ² / N)			0.2376	0.7700	0.3482	0.3124	0.2551

Trial #	8	9	10	11	12	13	14
Load (kPa)	80.0	120.0	80.0	53.5	80.0	120.0	180.0
Load (tsf)	0.832	1.248	0.832	0.556	0.832	1.248	1.872
Gauge Reading (in)	0.2393	0.2347	0.2352	0.2357	0.2352	0.2340	0.2282
(H-Hs) mm	6.445	6.328	6.341	6.353	6.341	6.310	6.163
Voids ratio	0.520	0.511	0.512	0.513	0.512	0.509	0.497
t ₉₀ (min)	7.02	6.76					6.25
C _v (m ² /day)	0.016	0.016					0.017
k' (MPa)	4.819	6.448					7.616
M _v (mm ² / N)	0.2075	0.1551					0.1313



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-6 (T6-1-SA12)**

Date

Aug 2012

JOB NO

SW8801.1004.101

FIGURE NO.
C.7-A

REV

Trial #	15	16	17	18	19	20	21
Load (kPa)	270.0	405.0	607.5	910.0	1375.0	685.0	340.0
Load (tsf)	2.808	4.212	6.318	9.464	14.300	7.124	3.536
Gauge Reading (in)	0.21968	0.2094	0.1986	0.1863	0.1733	0.1751	0.1775
(H-Hs) mm	5.946	5.686	5.410	5.099	4.769	4.814	4.874
Voids ratio	0.480	0.459	0.437	0.412	0.385	0.389	0.393
t90 (min)	7.02	6.25	6.25	6.25	6.25		
Cv (m ² /day)	0.015	0.016	0.016	0.015	0.015		
k' (MPa)	7.715	9.508	13.245	17.304	24.665		
Mv (mm ² / N)	0.1296	0.1052	0.0755	0.0578	0.0405		

Trial #	22	23	24	25	26	27	
Load (kPa)	170.0	85.0	42.5	21.5	10.75	5.25	
Load (tsf)	1.768	0.884	0.442	0.224	0.112	0.055	
Gauge Reading (in)	0.1818	0.1870	0.1922	0.1986	0.2050	0.2106	
(H-Hs) mm	4.983	5.116	5.248	5.411	5.574	5.715	
Voids ratio	0.402	0.413	0.424	0.437	0.450	0.461	
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-6 (T6-1-SA12)**

Date

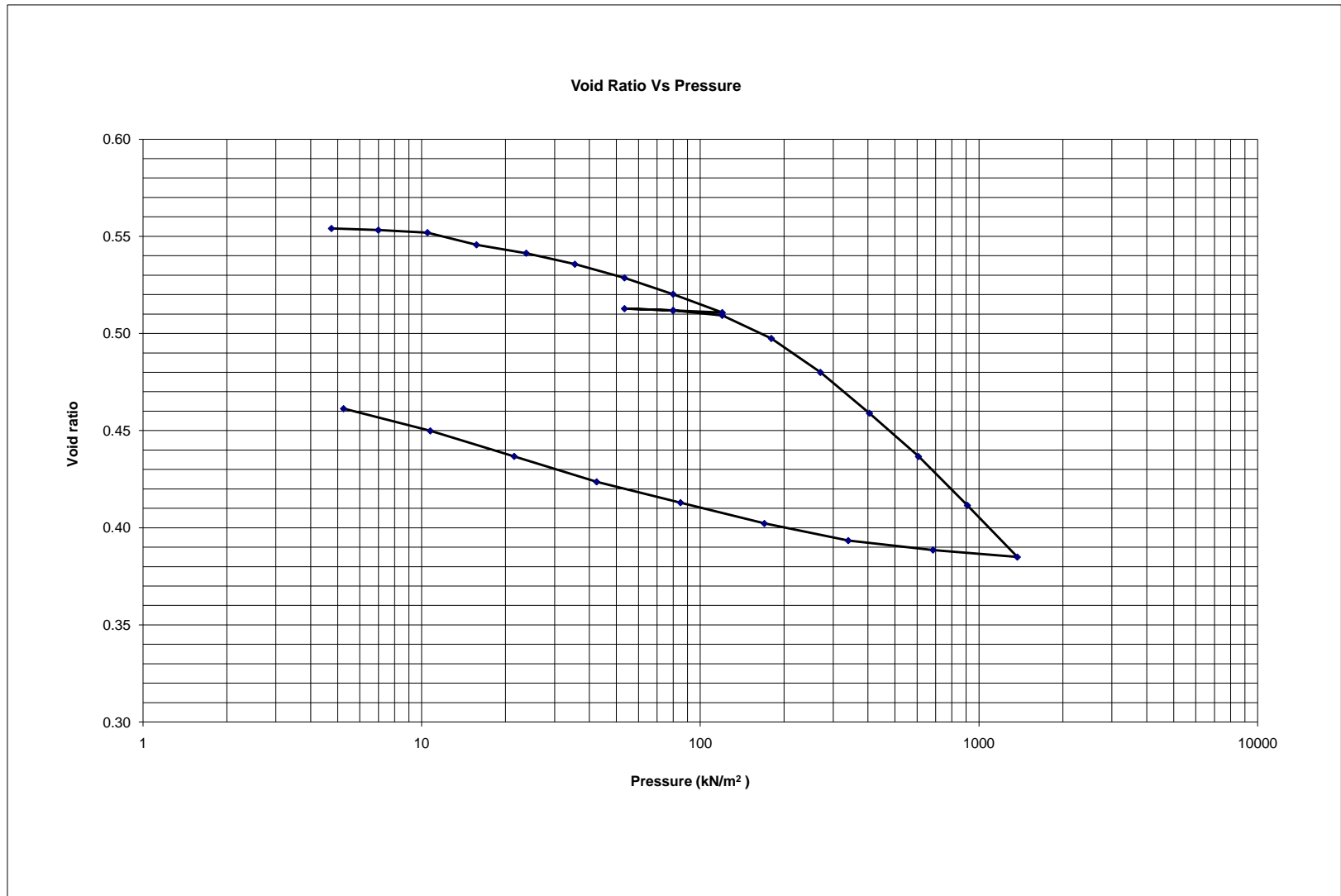
Aug 2012

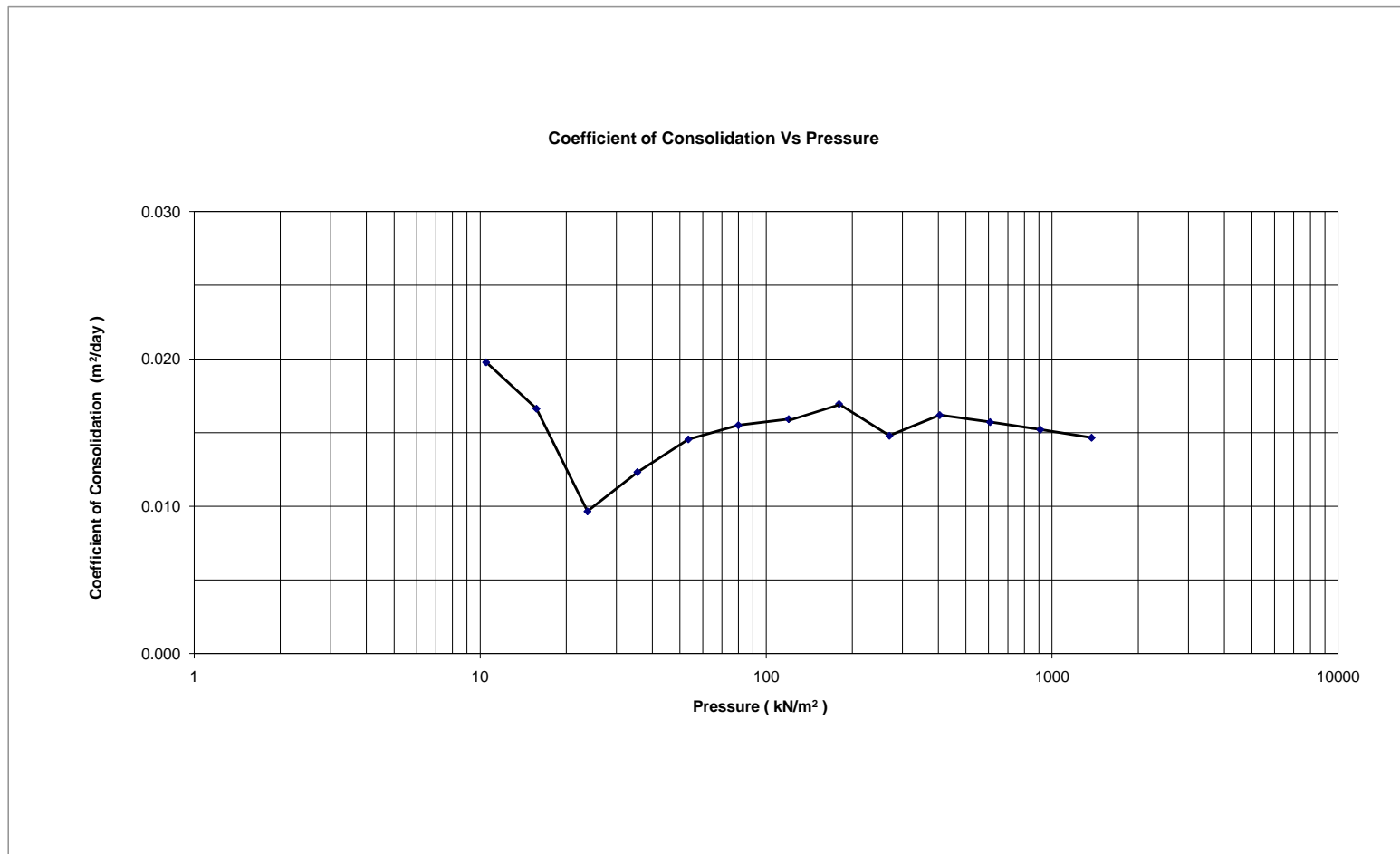
JOB NO

SW8801.1004.101

FIGURE NO.
C.7-B

REV





Strain Energy Data

Presssure (kN/m ²)	c _v (m ² /day)	Void ratio
4.75		0.554
7.0		0.553
10.5	0.020	0.552
15.8	0.017	0.546
23.75	0.010	0.541
35.5	0.012	0.536
53.5	0.015	0.529
80.0	0.016	0.520
120.0	0.016	0.511
80.0		0.512
53.5		0.513
80.0		0.512
120.0		0.509
180.0	0.0169	0.497
270.0	0.0148	0.480
405.0	0.0162	0.459
607.5	0.0157	0.437
910.0	0.0152	0.412
1375.0	0.0147	0.385
685.0		0.389
340.0		0.393
170.0		0.402
85.0		0.413
42.5		0.424
21.5		0.437
10.75		0.450
5.25		0.461

Presssure (kN/m ²)	Height mm	Total Work (kJ/m ³)
4.75	19.253	0.000
7.0	19.243	0.003
10.5	19.227	0.010
15.75	19.149	0.064
23.75	19.096	0.119
35.5	19.026	0.227
53.5	18.938	0.432
80.0	18.834	0.799
120.0	18.717	1.419
80.0	18.731	1.347
53.5	18.742	1.306
80.0	18.730	1.349
120.0	18.699	1.513
180.0	18.552	2.695
270.0	18.188	7.106
405.0	17.928	11.937
607.5	17.652	19.741
910.0	17.341	33.115
1375.0	17.011	54.837
685.0	17.056	52.100
340.0	17.116	50.306
170.0	17.225	48.679
85.0	17.358	47.696
42.5	17.490	47.209
21.5	17.653	46.911
10.75	17.816	46.763
5.25	17.957	46.699



Project

WINDSOR ESSEX PARKWAY

TITLE

CONSOLIDATION TEST
TUNNEL T-6 (T6-1-SA12)

Date

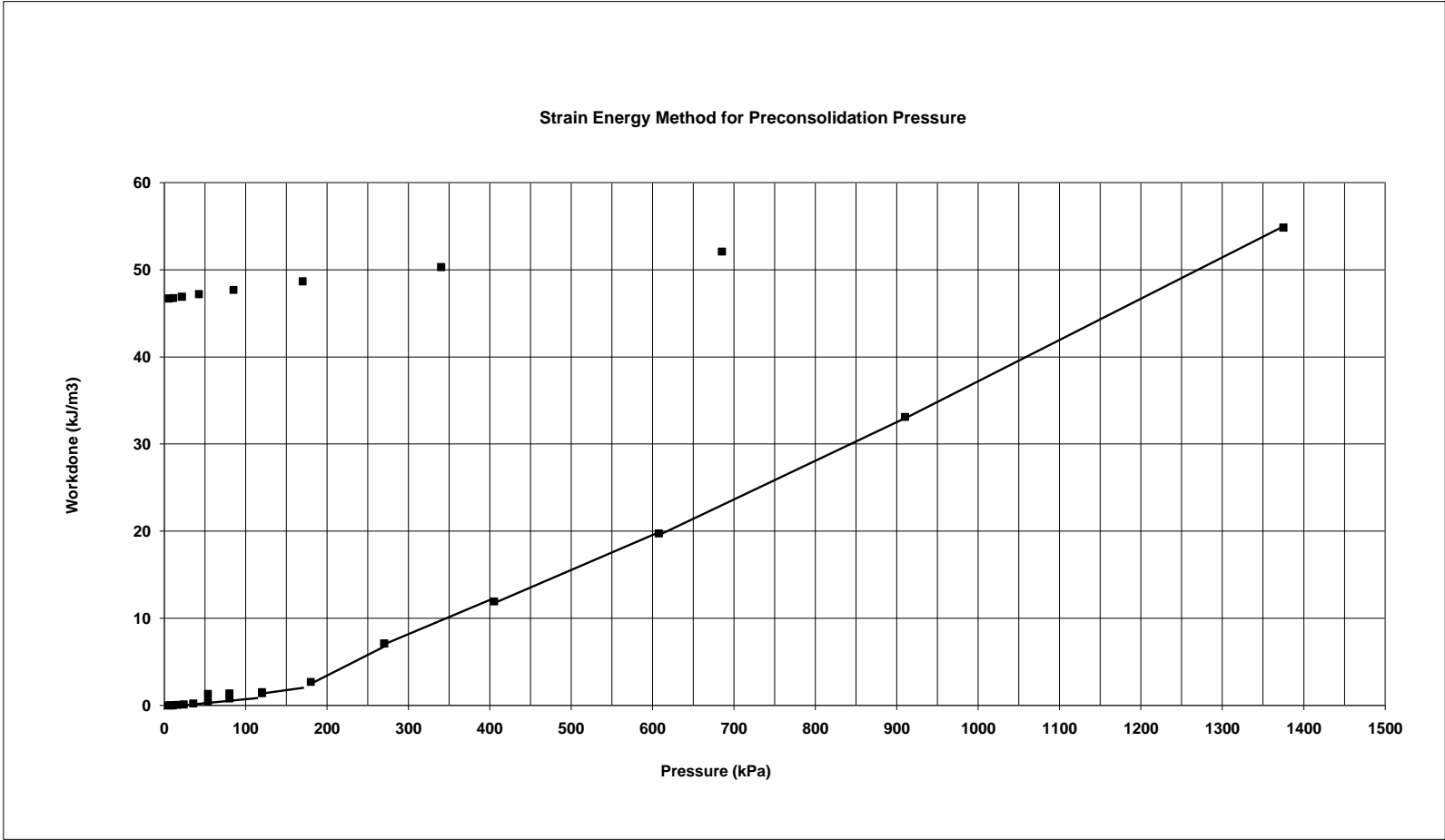
Aug 2012

JOB NO

SW8801.1004.101

FIGURE NO.
C.7-E

REV



DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS (ASTM D 3080)

Page 1 of 5

Project:- WEP
Client:- Hatch Mott MacDonald
Sample ID.: T6-3_TW15
Lab No.: AdS090_2011

Job#: SW8801.1004.101
Date: 14 November 2011
Tested By: CZ/SB
Checked By: SB

Specimen ID	1	2	3
Date of Test	15-Nov-11	16-Nov-11	17-Nov-11
Normal Stress (kPa)	80	160	240
Rate of displacement (mm/min)	0.05	0.06	0.06
Initial thickness of specimen (mm)	24.10	24.10	24.10
Initial diameter of specimen (mm)	63.30	63.30	63.30
Initial moisture content (%)	16.0	15.2	15.2
Density (kN/m ³)	8.4	7.9	8.1
Final moisture (%)	15.3	15.3	13.1

Specimen ID	Normal Stress	Peak Shear Stress	Residual Shear Stress
	kPa	kPa	kPa
1	80.0	51.4	49.8
2	160.0	89.5	86.6
3	240.0	139.3	137.0

Note: Test specimens were inundated with water.



Project

WINDSOR ESSEX PARKWAY

TITLE

DIRECT SHEAR TEST
TUNNEL T-6 (T6-3-SA15)

Date

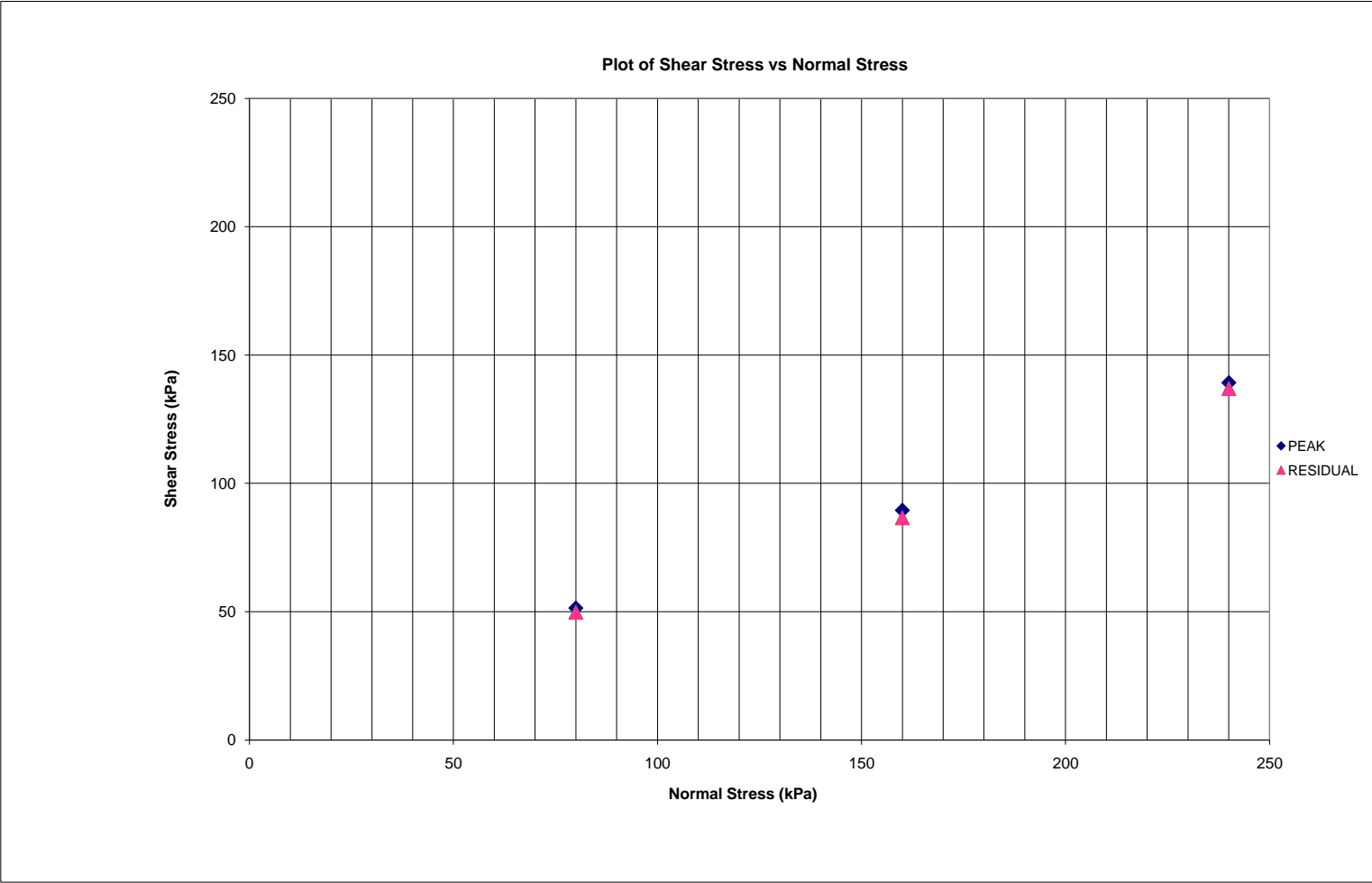
Aug 2012

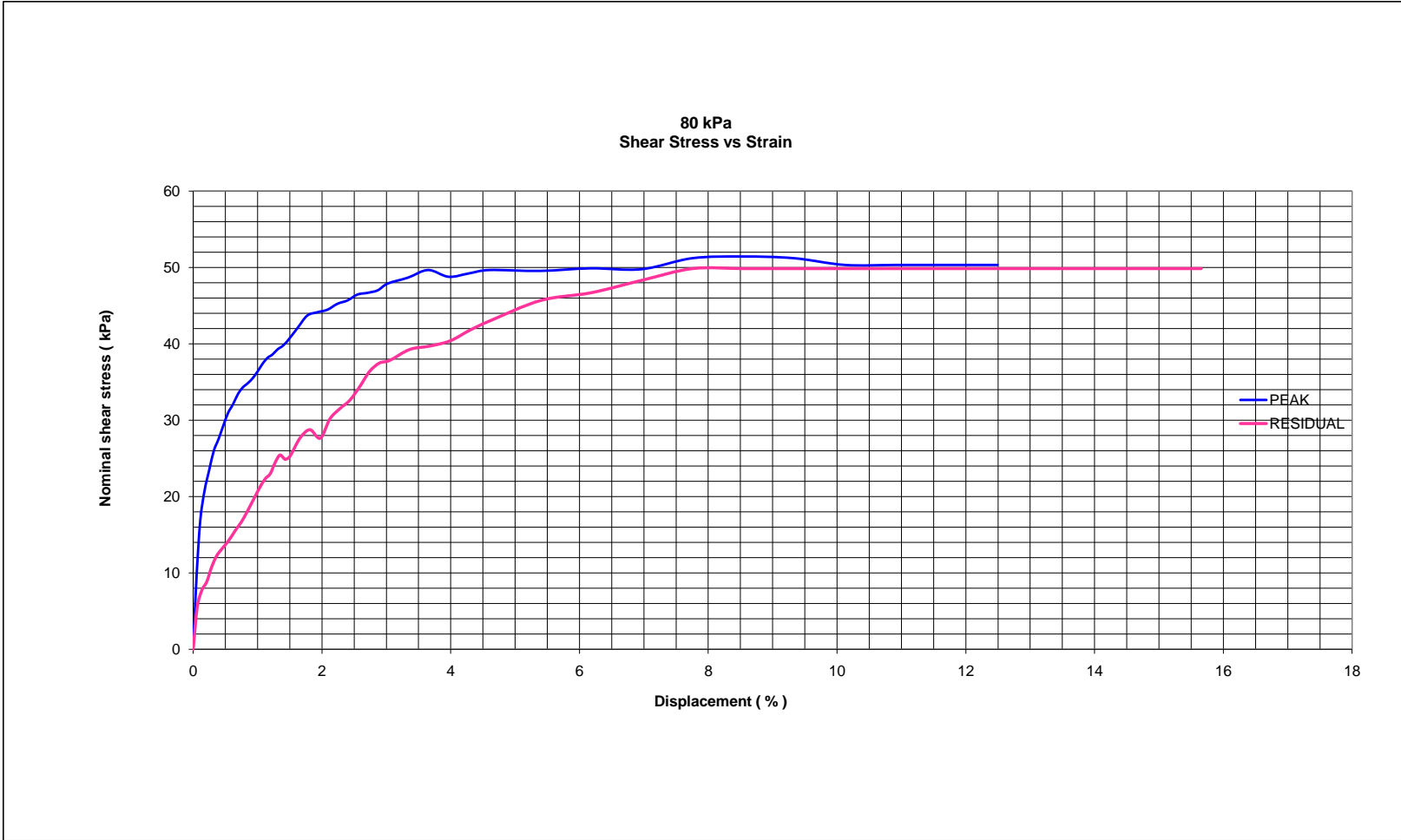
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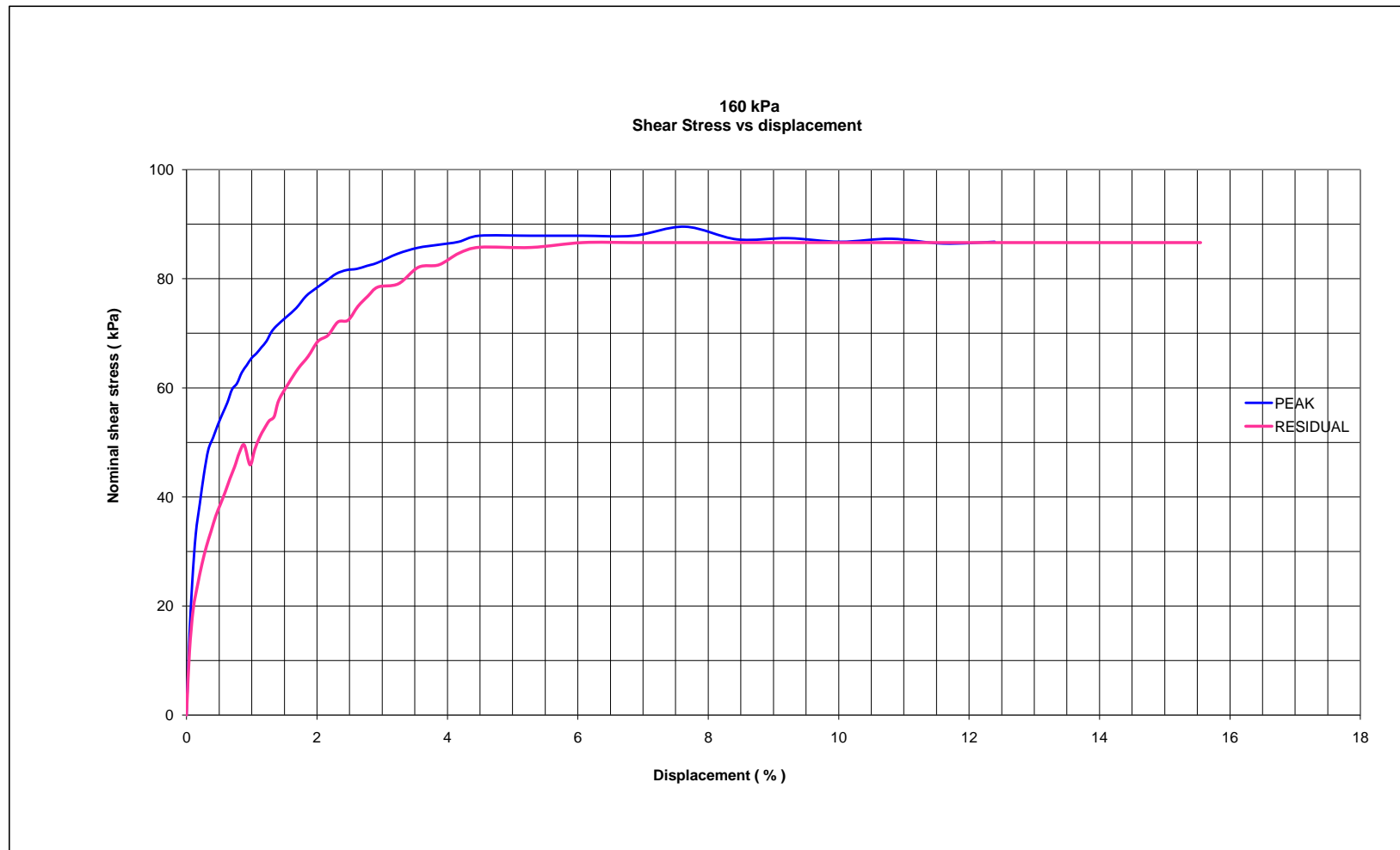
SW8801.1004.101

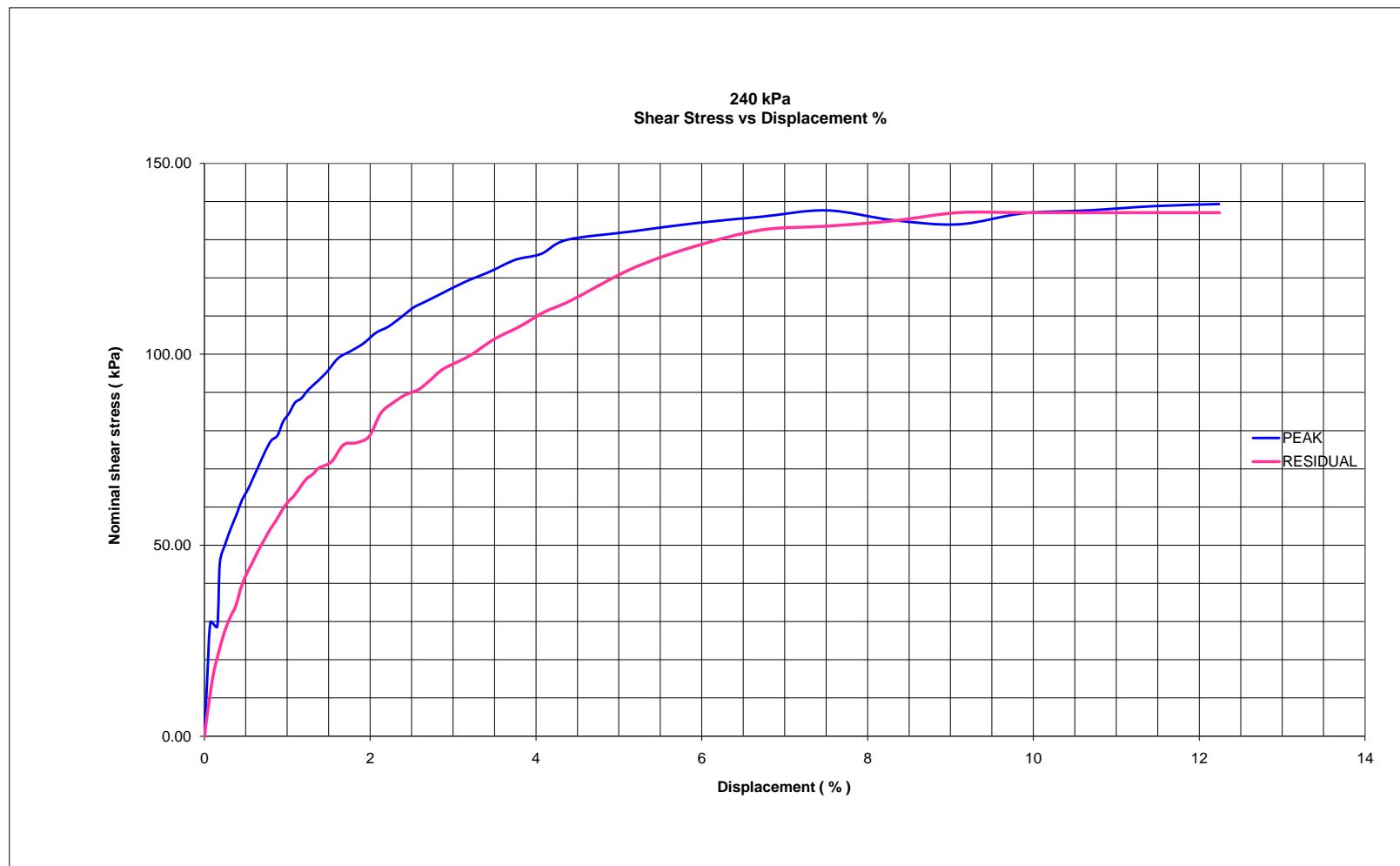
FIGURE NO.
C.8-A

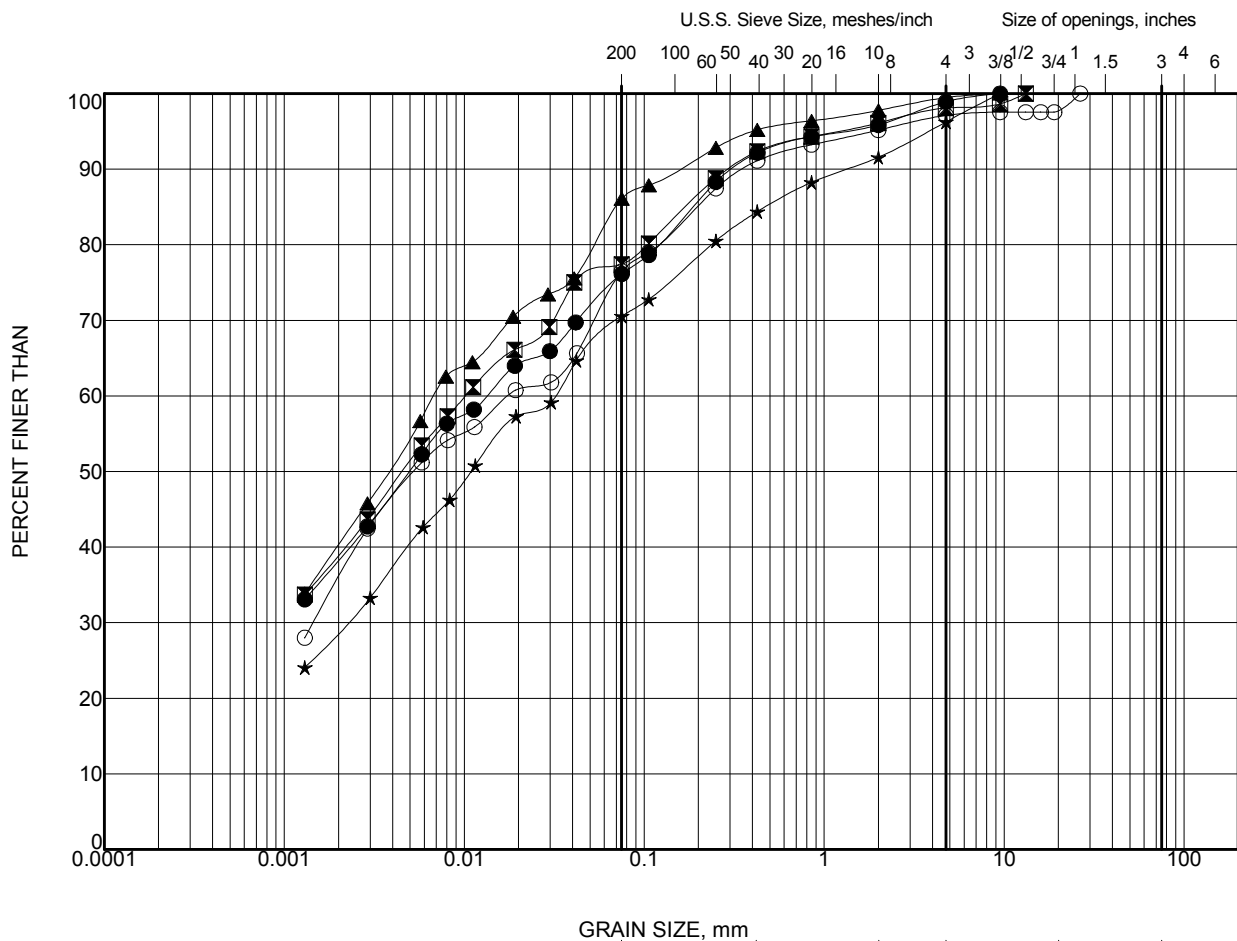
REV









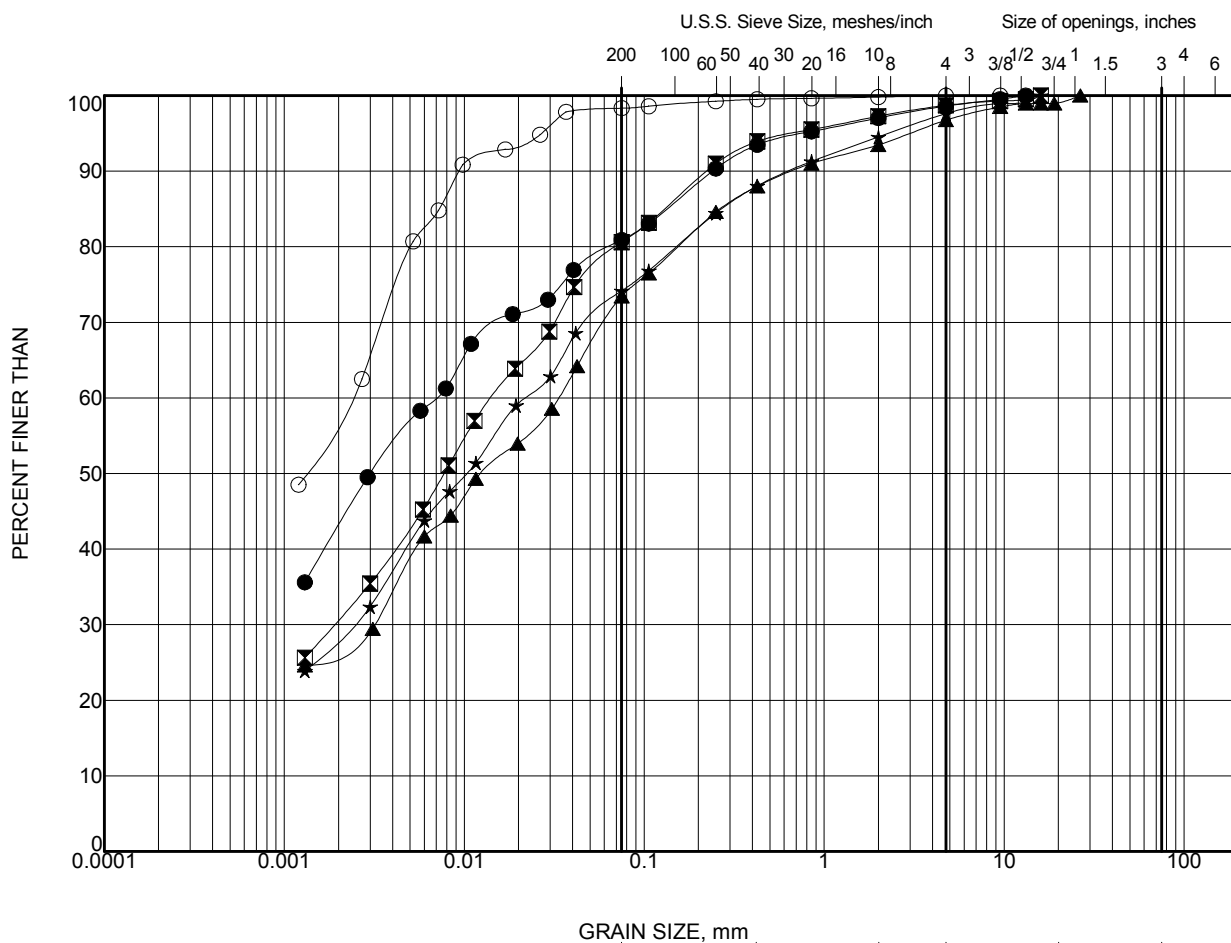


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T7-2	5	3.8
▣	T7-2	10	9.1
▲	T7-2	12	12.2
★	T7-2	18	21.3
○	T7-3	8	6.1




PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.1	

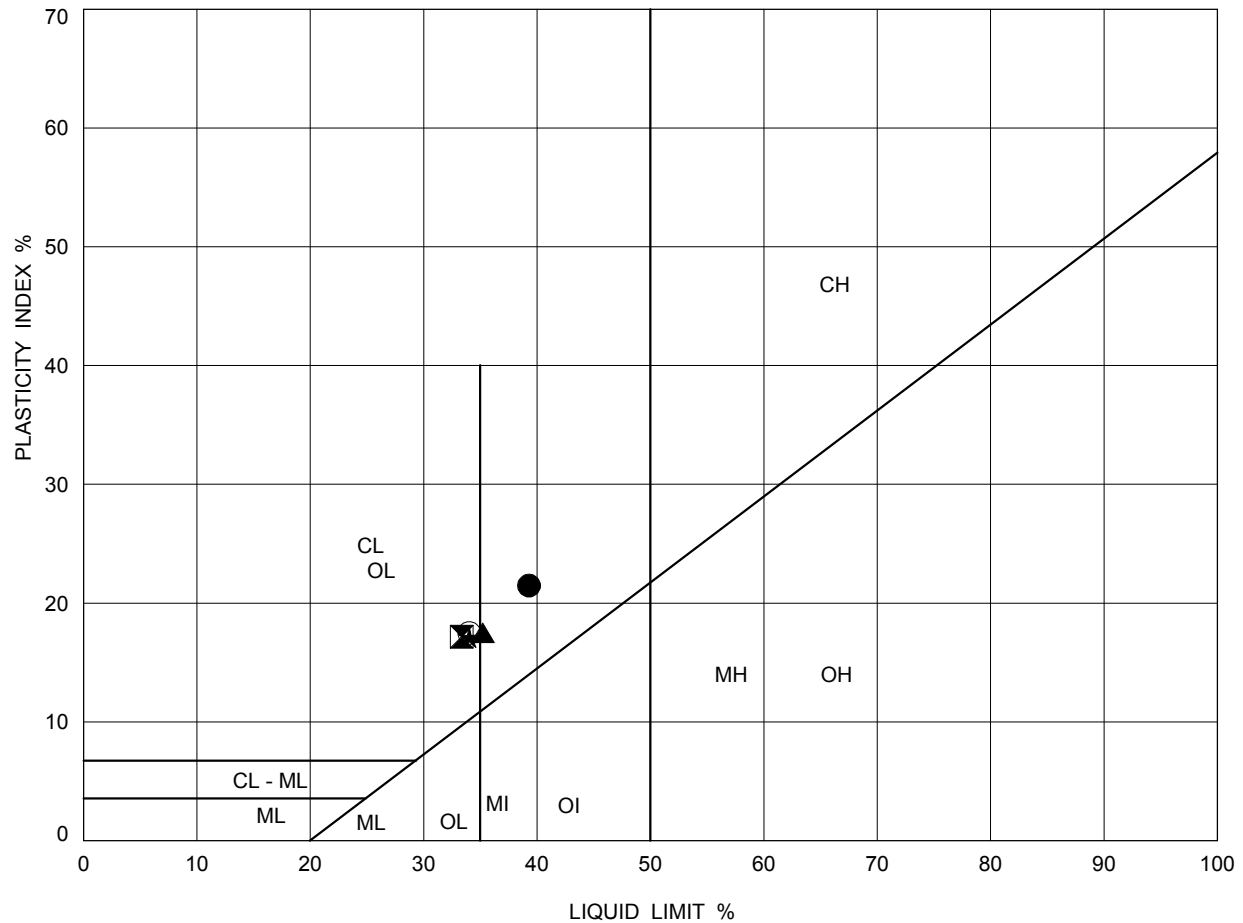


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:



SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T7-3	10	9.1
▣	T7-3	13	13.7
▲	T7-3	17	19.8
★	T7-3	19	22.9
○	T7-3	22	27.4

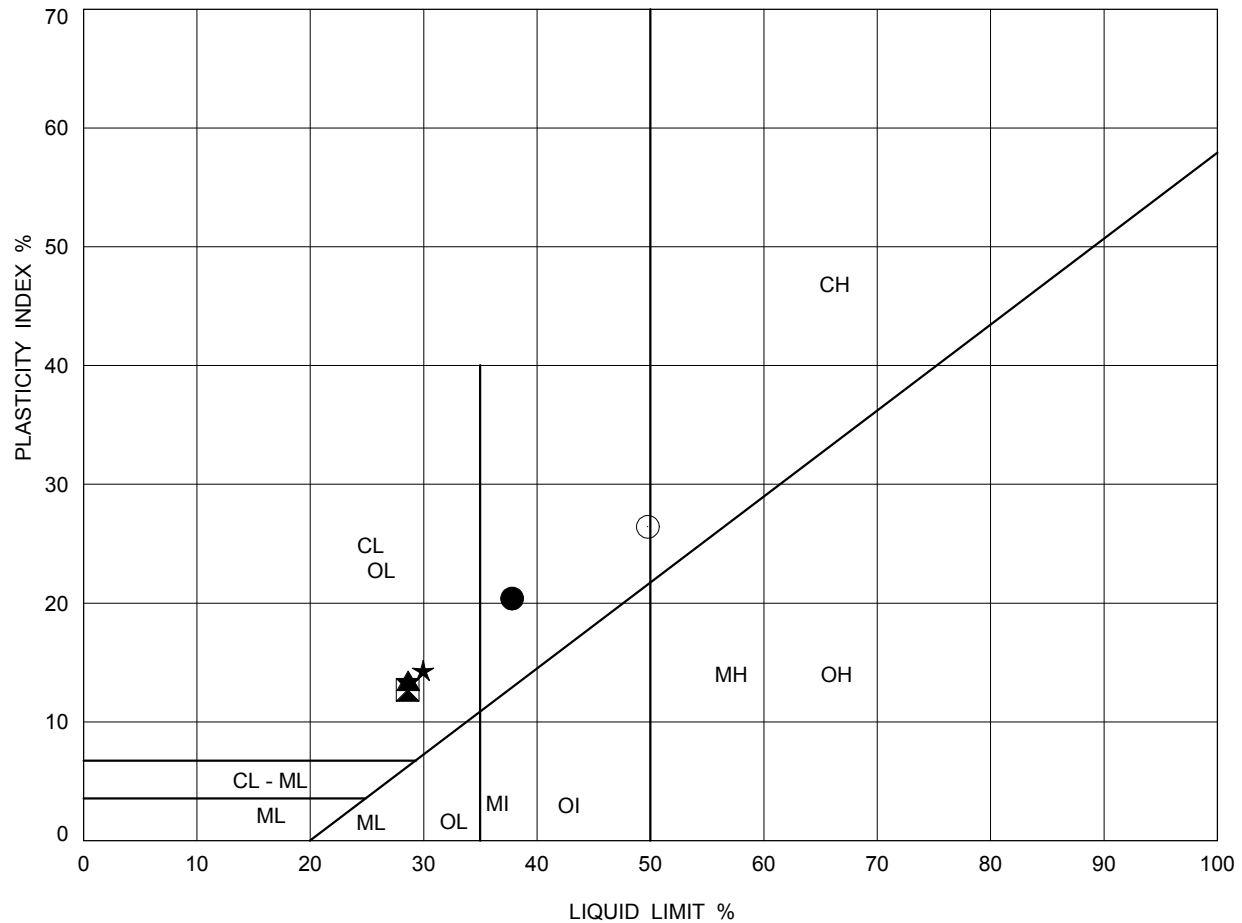
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TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
  		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA		SCALE
CHECK	MSO		REV.
		FIGURE C.2	



LEGEND:



SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T7-2	4	3	39	18	21
⊠	T7-2	9	7.6	33	16	17
▲	T7-2	12	12.2	35	18	17
★	T7-2	19	22.9	34	17	17
○	T7-3	8	6.1	34	17	17

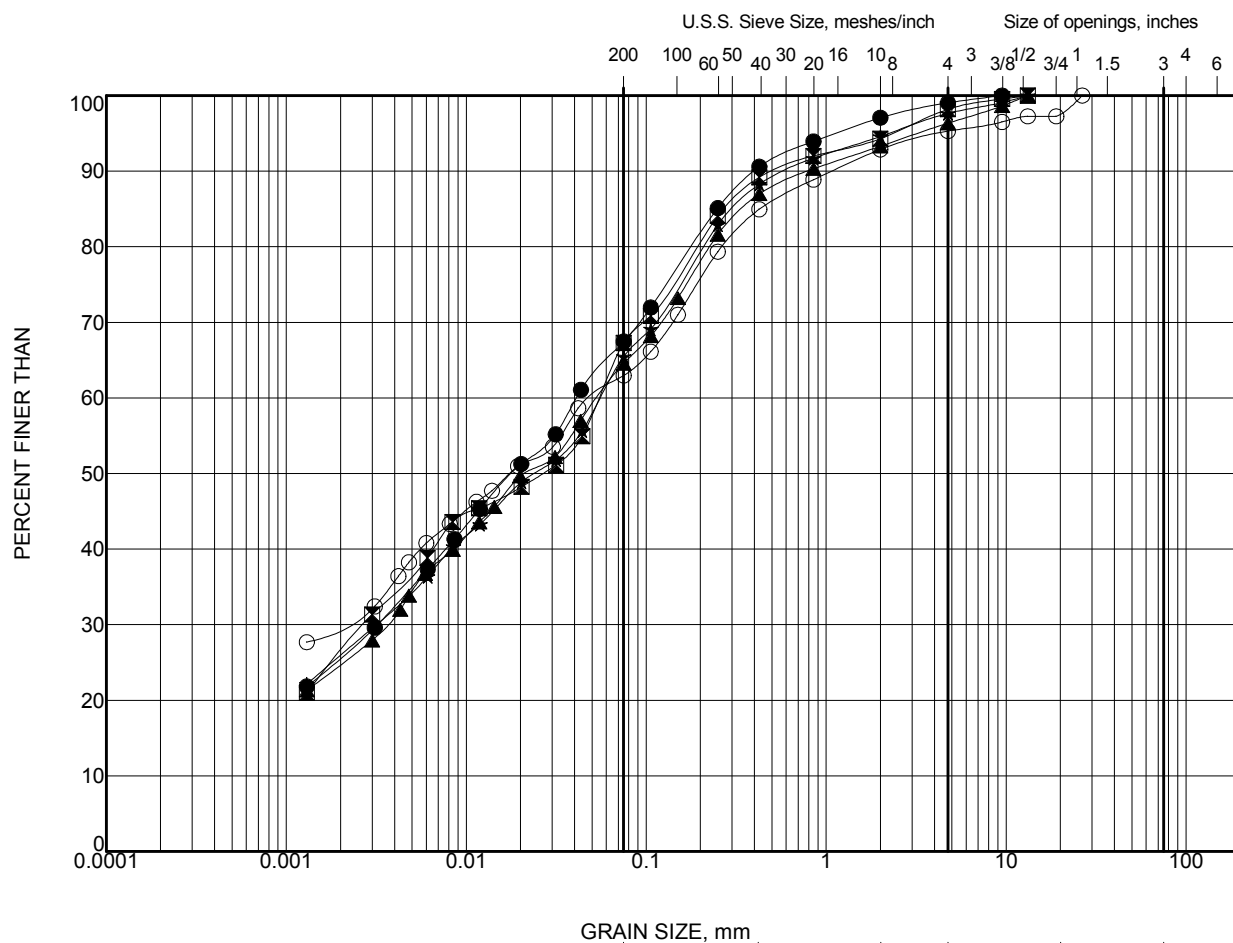
PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.3	



LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T7-3	10	9.1	38	17	21
⊠	T7-3	13	13.7	29	16	13
▲	T7-3	17	19.8	29	15	14
★	T7-3	19	22.9	30	16	14
○	T7-3	22	27.4	50	23	27

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.4	

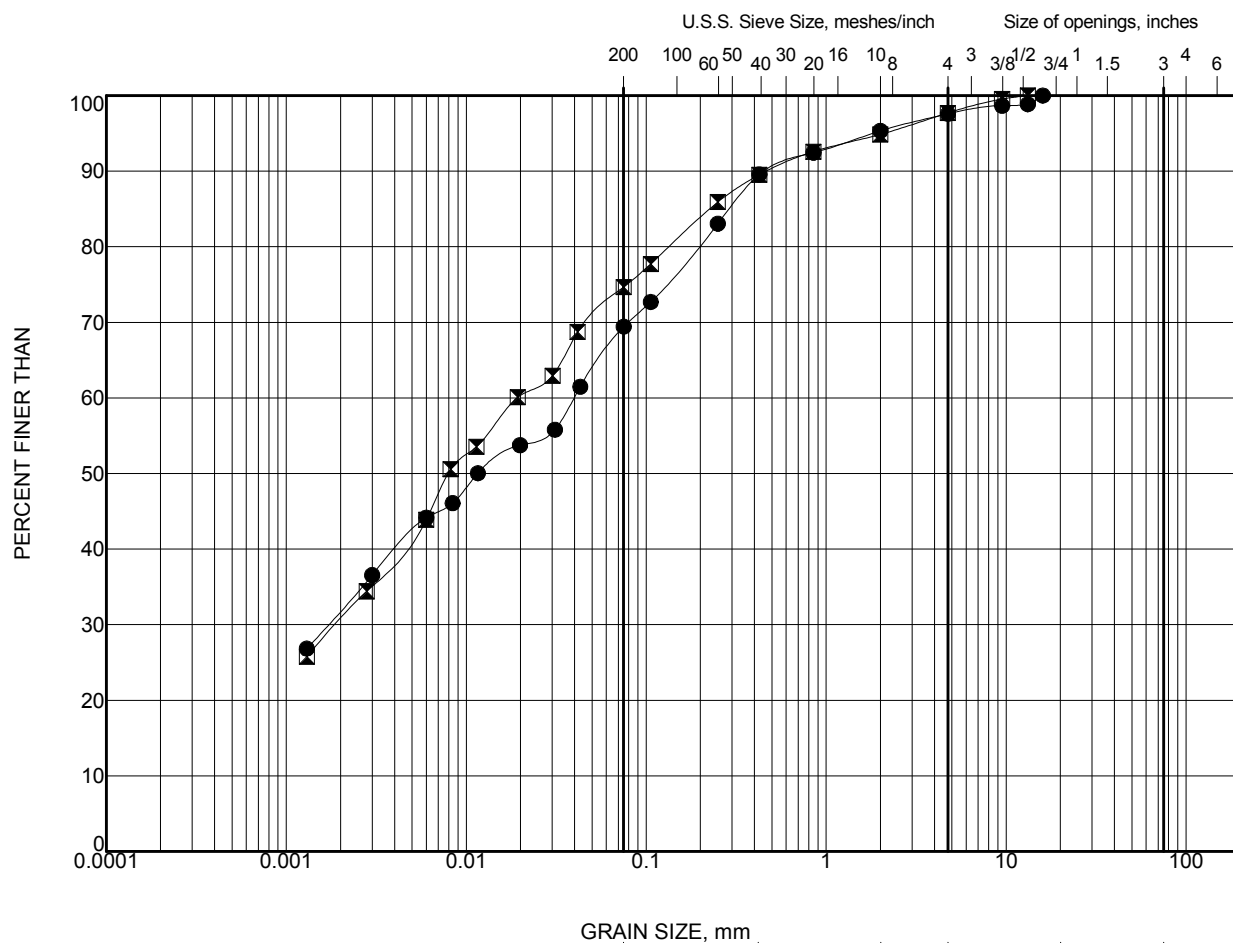


CLAY AND SILT	GRAIN SIZE, mm					Cobble Size
	fine	medium	coarse	fine	coarse	
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	CV3-1	9	7.6
■	T9-1	10	7.6
▲	T9-1	12	10.7
★	T9-1	13	12.2
○	T9-1	15	15.2

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
	PROJECT No.	SW8801.1004.101	FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
FIGURE C.1			

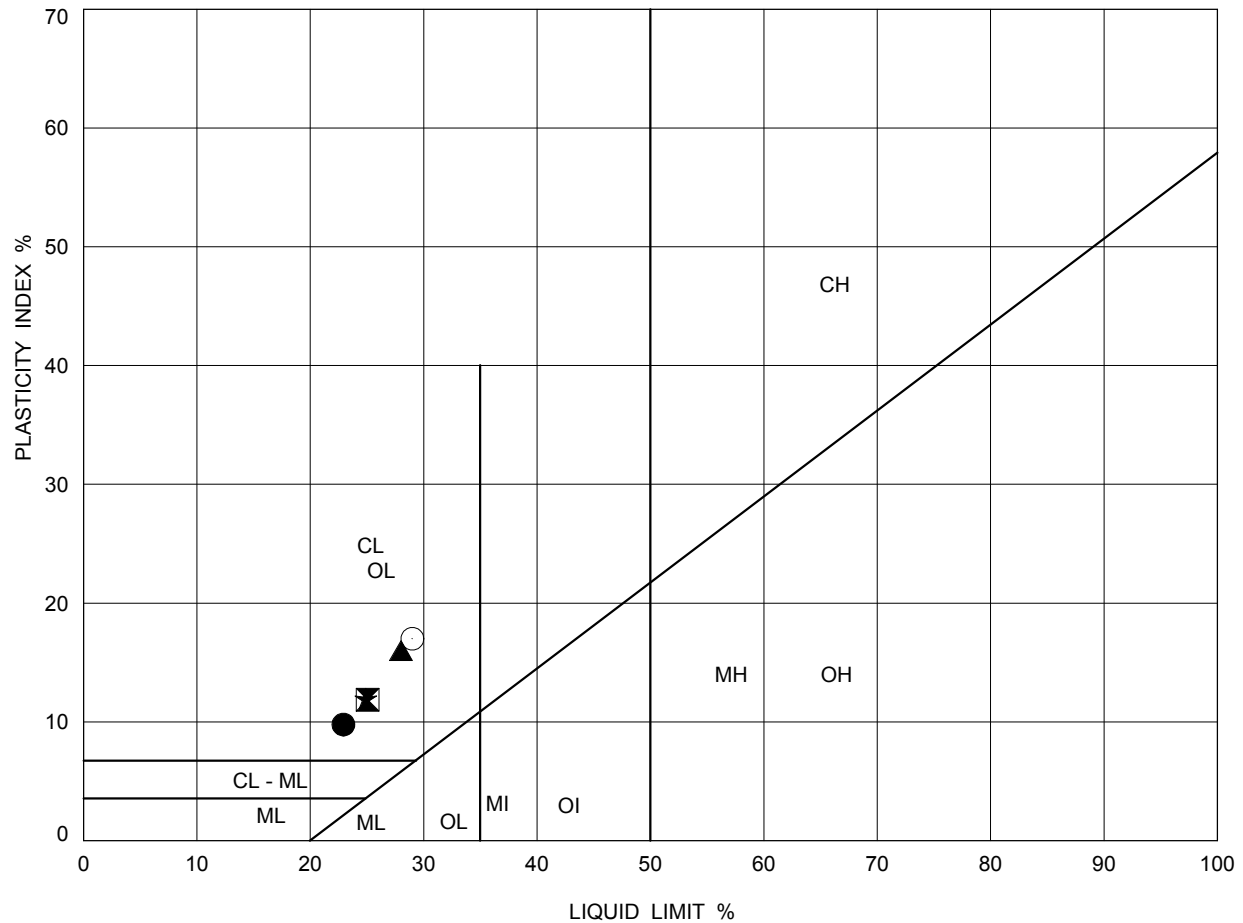


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T9-1	16	16.8
◻	T9-1	20	22.9

PROJECT		Windsor Essex Parkway (WEP)	
		Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION	
		SILTY CLAY TO CLAYEY SILT	
	PROJECT No. SW8801.1004.101		FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
			FIGURE C.2





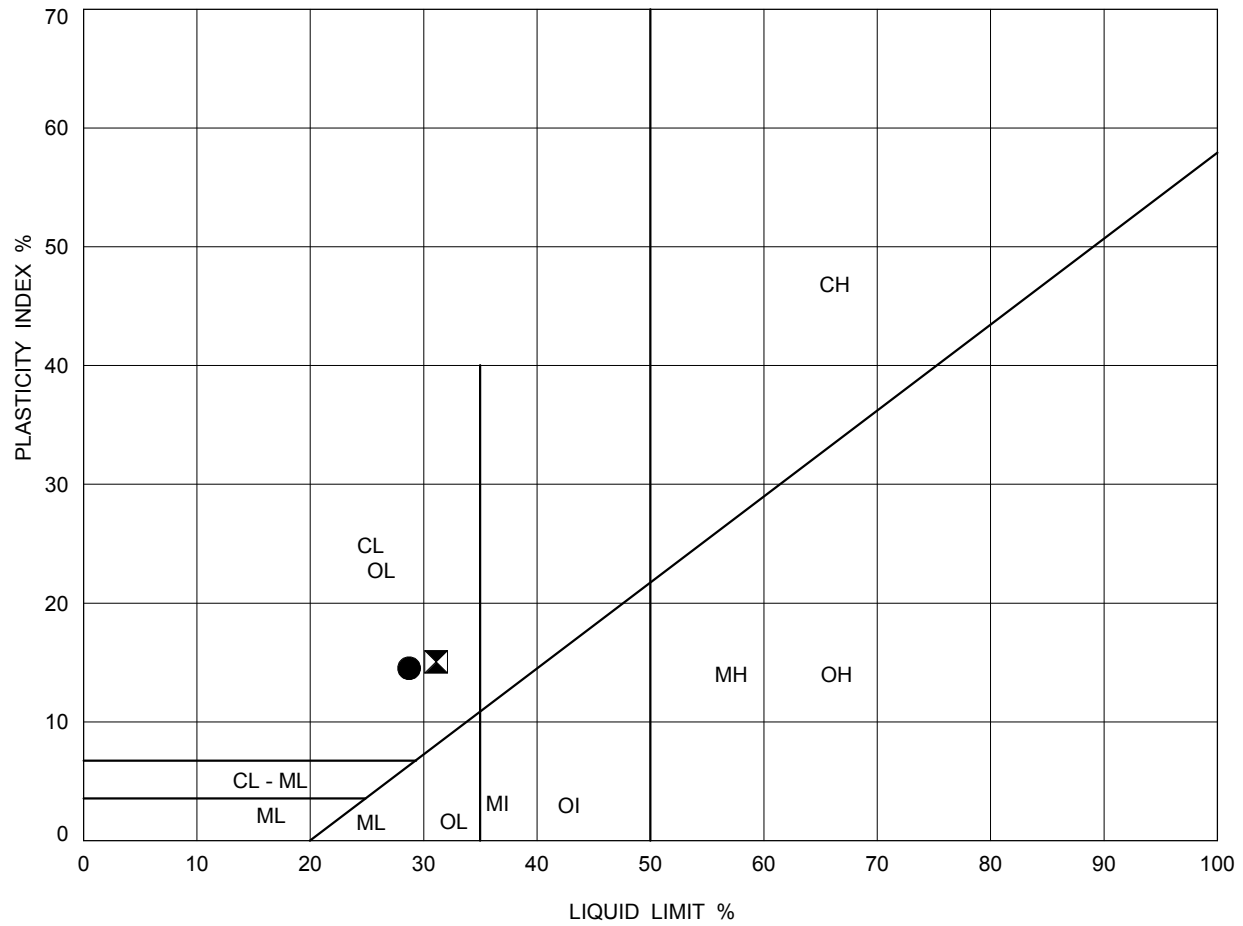
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	CV3-1	9	7.6	23	13	10
⊠	T9-1	10	7.6	25	13	12
▲	T9-1	12	10.7	28	12	16
★	T9-1	13	12.2	25	13	12
○	T9-1	15	15.2	29	12	17

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.3	





SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T9-1	16	16.8	29	14	15
⊠	T9-1	20	22.9	31	16	15

PROJECT				Windsor Essex Parkway (WEP) Windsor, Ontario			
TITLE				PLASTICITY CHART SILTY CLAY TO CLAYEY SILT			
 				PROJECT No. SW8801.1004.101		FILE No.	
DRAWN		EA		SCALE		REV.	
CHECK		MSO		FIGURE C.4			

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D 2435)

Project: **WEP**
 Client: **Hatch Mott MacDonald Limited**
 Date: **21-Oct-11**

Job No.: **SW8801.1004.101**
 Sample ID: **T9-1_Sa15**
 Depth(m): **15.25 to 15.86**

Test Data

Ring # :	A	Ring Height (in) =	0.758	Wt of dry filter paper (g)	0.67
Wet soil + Ring Wt (g)			205.82	Wt of ring (g)	76.59
Wet soil + Wet Paper + Ring (g)			201.90	Wet Paper (g)	2.00
Dry Soil + Dry Paper + Ring (g)			184.96	Ring Dia (in)	2.498
Initial moisture Content (%)			19.99	Final moisture Content (%)	14.49
Area of Ring (in ²)			4.90	Initial Volume (in ³)	3.7149
Initial Bulk Density (kg/m ³)			2123	Initial Dry Density (kg/m ³)	1769
Specific Gravity of Soil			2.74	Equiv. Thick. of solids (mm)	12.441
Final Bulk Density (kg/m ³)			2245	Final Dry Density (kg/m ³)	1871
Initial gauge reading for Load 1			0.2566	Gauge reading for last Loading	0.1824
Initial Voids Ratio			0.548	Final Void Ratio	0.396
Initial Degree of Saturation (%)			100	Final Degree of Saturation (%)	100

Trial #	1	2	3	4	5	6	7
Load (kPa)	5.0	7.5	11.5	17.0	25.0	37.5	55.0
Load (tsf)	0.052	0.078	0.120	0.177	0.260	0.390	0.572
Gauge Reading (in)	0.2533	0.2511	0.2484	0.2446	0.2418	0.2359	0.2295
(H-Hs) mm	6.730	6.672	6.604	6.508	6.437	6.287	6.124
Voids ratio	0.541	0.536	0.531	0.523	0.517	0.505	0.492
t90 (min)		60.06	51.84	46.24	59.29	36.00	30.25
Cv (m ² /day)		0.002	0.002	0.002	0.002	0.003	0.004
k' (MPa)		0.824	1.136	1.085	2.131	1.580	2.010
Mv (mm ² / N)		1.2137	0.8805	0.9215	0.4692	0.6329	0.4976

Trial #	8	9	10	11	12	13	14
Load (kPa)	85.0	130.0	195.0	130.0	85.0	55.0	37.5
Load (tsf)	0.884	1.352	2.028	1.352	0.884	0.572	0.390
Gauge Reading (in)	0.22115	0.2122	0.2031	0.2035	0.2045	0.2055	0.2069
(H-Hs) mm	5.912	5.684	5.454	5.465	5.490	5.515	5.550
Voids ratio	0.475	0.457	0.438	0.439	0.441	0.443	0.446
t90 (min)	26.52	18.49	16.40				
Cv (m ² /day)	0.004	0.005	0.006				
k' (MPa)	2.626	3.613	5.136				
Mv (mm ² / N)	0.3808	0.2768	0.1947				

Trial #	15	16	17	18	19	20	21
Load (kPa)	25.0	17.0	11.5	7.5	11.5	17.0	25.0
Load (tsf)	0.26	0.177	0.120	0.078	0.120	0.177	0.260
Gauge Reading (in)	0.2072	0.2085	0.2097	0.2113	0.2111	0.2107	0.2098
(H-Hs) mm	5.558	5.590	5.621	5.661	5.657	5.647	5.624
Voids ratio	0.447	0.449	0.452	0.455	0.455	0.454	0.452
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-9 (T9-1-SA15)**

Date

Aug 2012

JOB NO

SW8801.1004.101

FIGURE NO.
C.5-A

REV

Trial #	22	23	24	25	26	27	28
Load (kPa)	37.5	55.0	85.0	130.0	195.0	290.0	440.0
Load (tsf)	0.390	0.572	0.884	1.352	2.028	3.016	4.576
Gauge Reading (in)	0.2088	0.2074	0.2058	0.2042	0.2007	0.1937	0.1841
(H-Hs) mm	5.597	5.563	5.522	5.482	5.393	5.214	4.971
Voids ratio	0.450	0.447	0.444	0.441	0.433	0.419	0.400
t90 (min)						9.30	9.30
Cv (m ² /day)						0.010	0.010
k' (MPa)						9.461	10.917
Mv (mm ² / N)						0.1057	0.0916

Trial #	29	30	31	32	33	34	35
Load (kPa)	660.0	990.0	1500	750.0	370.0	185.0	90.0
Load (tsf)	6.864	10.296	15.6	7.800	3.848	1.924	0.936
Gauge Reading (in)	0.1747	0.1652	0.15485	0.1560	0.1571	0.1606	0.1648
(H-Hs) mm	4.732	4.491	4.228	4.257	4.285	4.374	4.481
Voids ratio	0.380	0.361	0.340	0.342	0.344	0.352	0.360
t90 (min)	8.70	6.25	4.84				
Cv (m ² /day)	0.010	0.014	0.018				
k' (MPa)	16.044	23.486	32.847				
Mv (mm ² / N)	0.0623	0.0426	0.0304				

Trial #	36	37	38	39			
Load (kPa)	45.0	22.5	11.5	5.5			
Load (tsf)	0.468	0.234	0.1196	0.0572			
Gauge Reading (in)	0.1679	0.1728	0.1778	0.1824			
(H-Hs) mm	4.560	4.684	4.811	4.928			
Voids ratio	0.367	0.376	0.387	0.396			
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-9 (T9-1-SA15)**

Date

Aug 2012

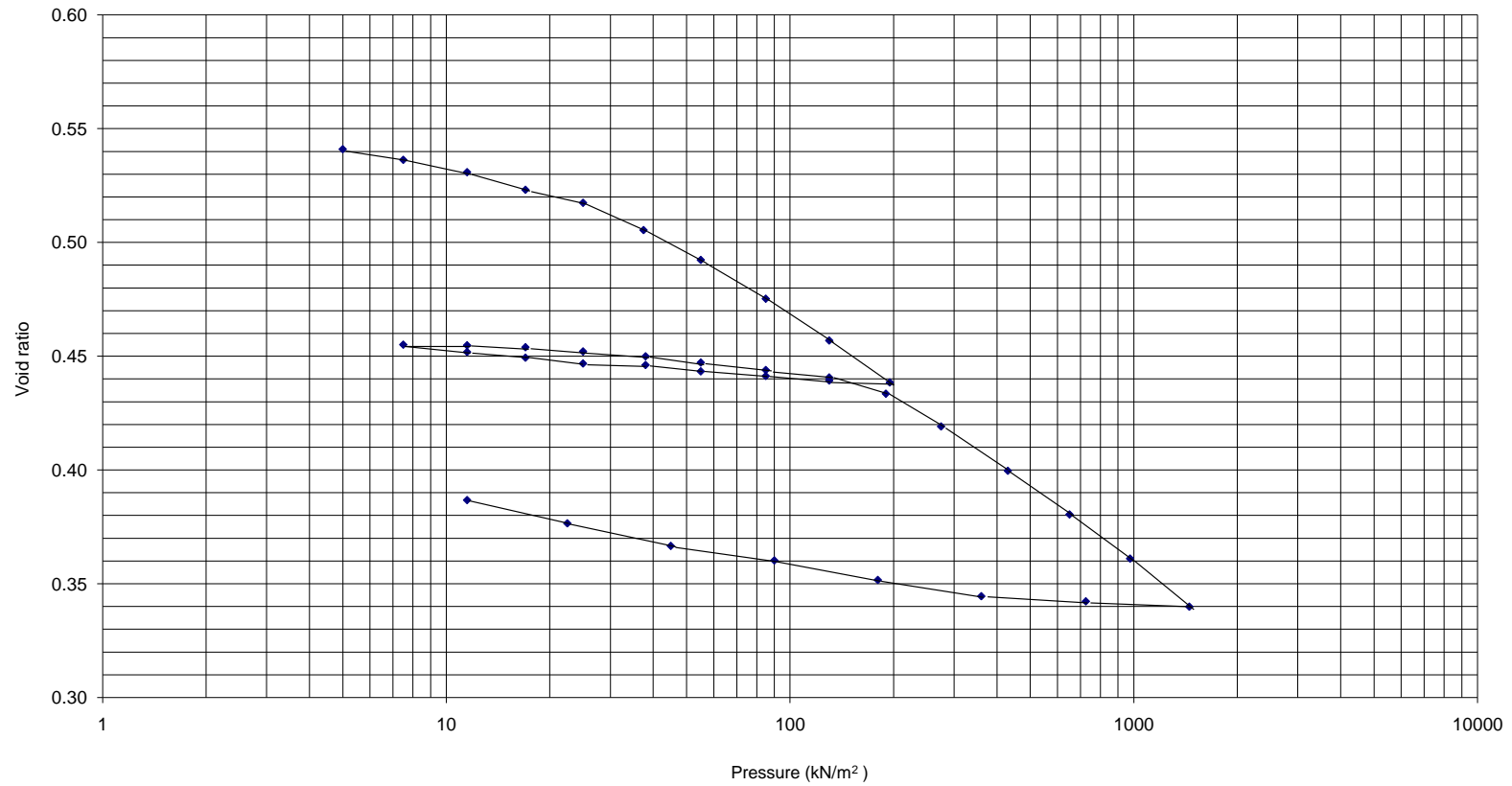
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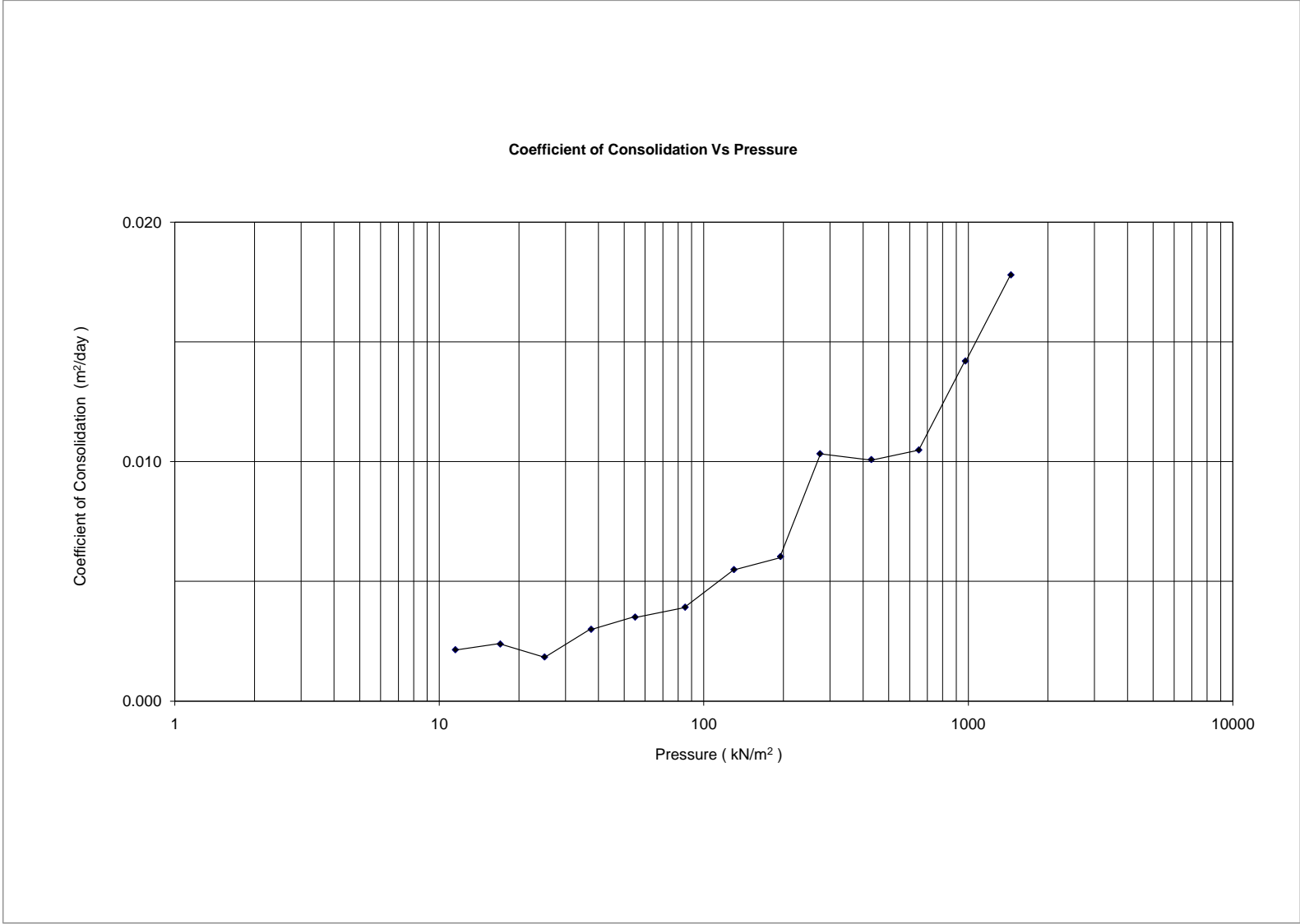
SW8801.1004.101

FIGURE NO.
C.5-B

REV

Void Ratio Vs Pressure



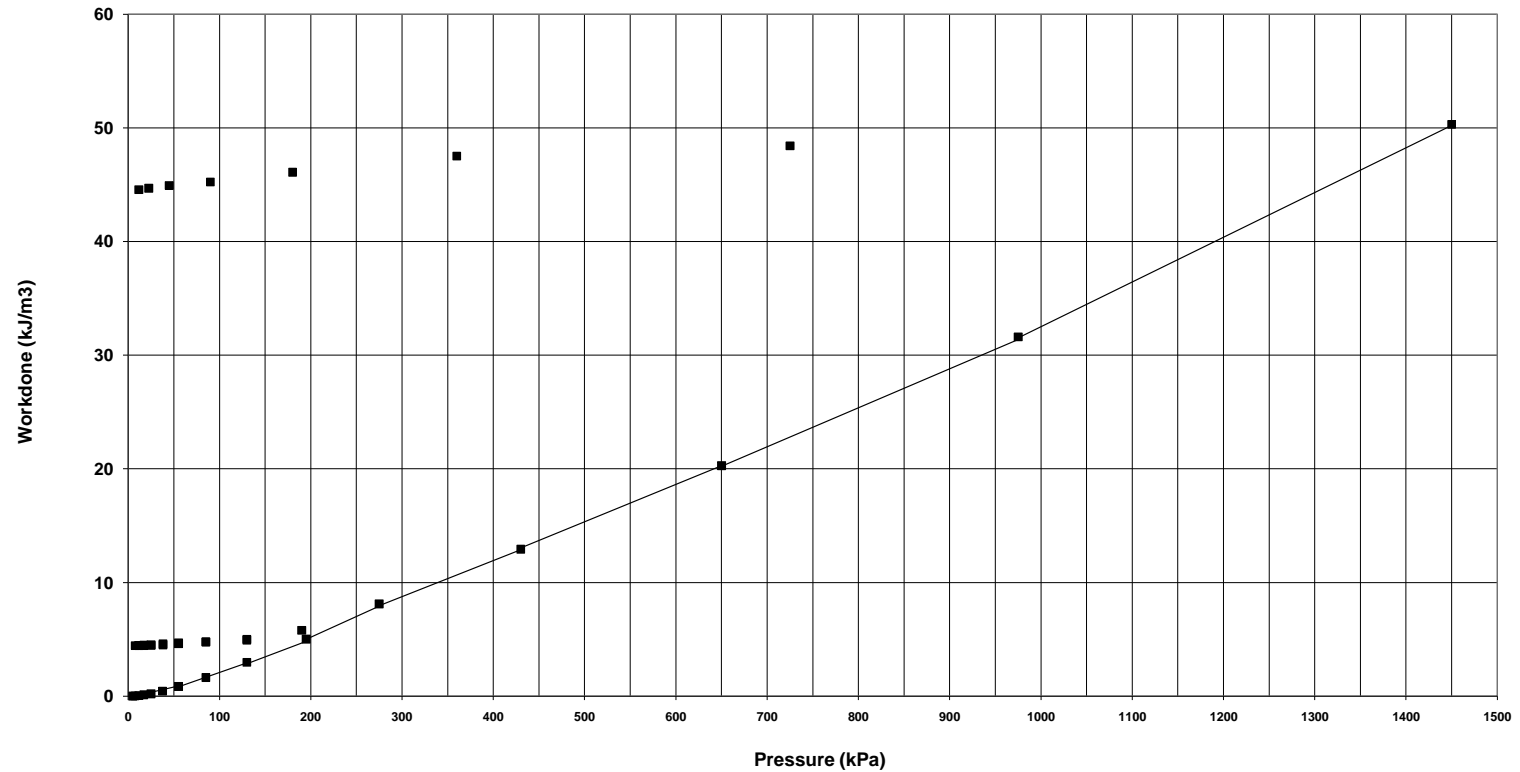


Strain Energy Data

Presssure (kN/m ²)	c _v (m ² /day)	Void ratio
5.0		0.541
7.5		0.536
11.5	0.002	0.531
17.0	0.002	0.523
25.0	0.002	0.517
37.5	0.003	0.505
55.0	0.004	0.492
85.0	0.004	0.475
130.0	0.005	0.457
195.0	0.006	0.438
130.0		0.439
85.0		0.441
55.0		0.443
38.0		0.446
25.0		0.447
17.0		0.449
11.5		0.452
7.5		0.455
11.5		0.455
17.0		0.454
25.0		0.452
38.0		0.450
55.0		0.447
85.0		0.444
130.0		0.441
190.0		0.433
275.0	0.010	0.419
430.0	0.010	0.400
650.0	0.010	0.380
975.0	0.014	0.361
1450.0	0.018	0.340
725.0		0.342
360.0		0.344
180.0		0.352
90.0		0.360
45.0		0.367
22.5		0.376
11.5		0.387
5.5		0.396

Presssure (kN/m ²)	Height mm	Total Work (kJ/m ³)
5.0	19.253	0.000
7.5	19.195	0.019
11.5	19.128	0.052
17.0	19.031	0.124
25.0	18.960	0.203
37.5	18.811	0.449
55.0	18.648	0.850
85.0	18.436	1.646
130.0	18.207	2.979
195.0	17.978	5.026
130.0	17.988	4.932
85.0	18.013	4.783
55.0	18.038	4.684
38.0	18.073	4.595
25.0	18.116	4.520
17.0	18.148	4.483
11.5	18.179	4.458
7.5	18.219	4.437
11.5	18.216	4.439
17.0	18.205	4.448
25.0	18.182	4.474
38.0	18.155	4.520
55.0	18.121	4.608
85.0	18.080	4.765
130.0	18.040	5.007
190.0	17.951	5.795
275.0	17.772	8.114
430.0	17.529	12.926
650.0	17.291	20.281
975.0	17.049	31.620
1450.0	16.786	50.316
725.0	16.816	48.424
360.0	16.844	47.522
180.0	16.932	46.097
90.0	17.039	45.247
45.0	17.119	44.932
22.5	17.242	44.688
11.5	17.369	44.563
5.5	17.486	44.506

Strain Energy Method for Preconsolidation Pressure



**CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
FOR COHESIVE SOILS (ASTM D-4767)**

Project: WEP
Client: Hatch Mott MacDonald Limited
Location: Windsor, ON.

Sample ID: T9-1_TW12

Project No.: SW8801.1004.101
Date: 01-Nov-11
Depth(m): 10.7 to 11.3

Sample Description: Sandy Silty Clay trace gravel

Sample Parameters				
Initial		Specimen 1	Specimen 2	Specimen 3
Diameter	cm	7.256		
Height	cm	14.625		
Volume	cm ³	604.756		
Wet Mass	g	1322.80		
Dry Density	kg/m ³	1874		
Water Content	%	16.7		
Specific Gravity	Actual	2.740		
Void Ratio		0.46		
Degree of Saturation		99.1		
Before Shear (after consolidation)				
Volume	cm ³	589.656		
B - Value		0.98		
After Shear				
Wet Mass	g	1316.64		
Dry Density	kg/m ³	1920		
Water Content	%	16.3		
Void Ratio		0.43		
Degree of Saturation		100.0		
Stress - Strain				
Cell Pressure	kPa	420.00		
Back Pressure	kPa	300.00		
Consolidation Stress	kPa	120.00		
Rate of Strain	mm/min	0.0200		
Vertical Strain at Failure	%	9.22		
Deviator Stress at Failure	kPa	156.00		
Pore Pressure at Failure	kPa	49.70		
Total Stress				
Minor Principal Stress, σ_3	kPa	120.00		
Major Principal Stress, σ_1	kPa	276.00		
Radius, $(\sigma_1 - \sigma_3)/2$	kPa	78.00		
Intersection Point, $(\sigma_1 + \sigma_3)/2$	kPa	198.00		
Effective Stress				
Minor Principal Stress, σ_3'	kPa	70.30		
Major Principal Stress, σ_1'	kPa	226.30		
Radius, $(\sigma_1' - \sigma_3')/2$	kPa	78.00		
Intersection Point, $(\sigma_1' + \sigma_3')/2$	kPa	148.30		



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
TUNNEL T-9 (T9-1-TW12)**

Date

Aug 2012

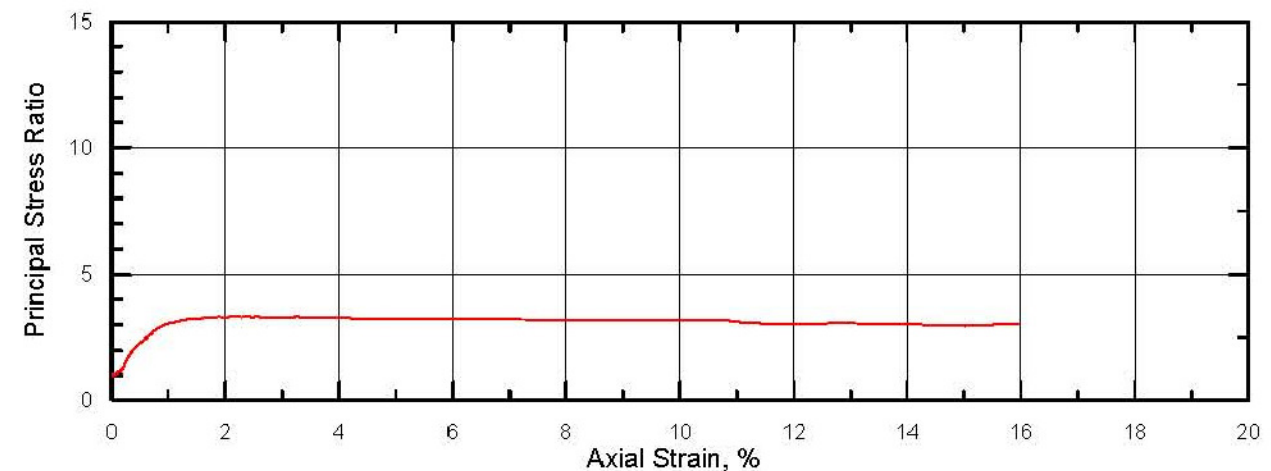
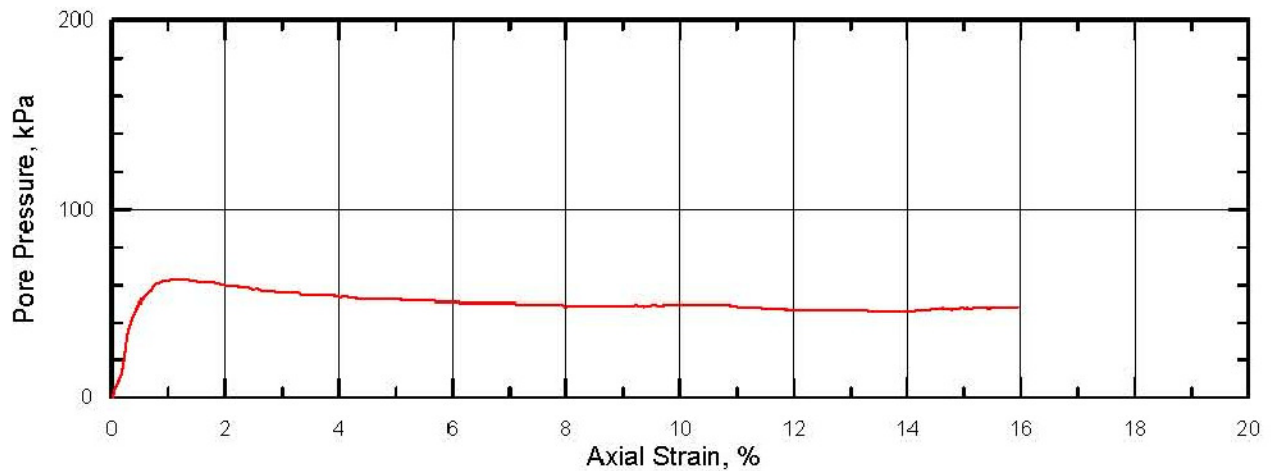
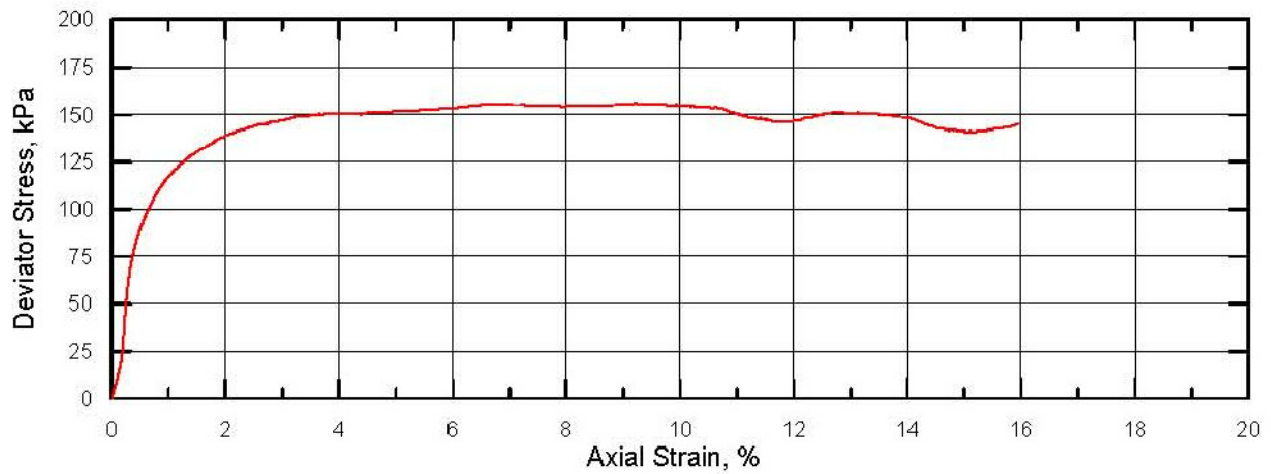
JOB NO

SW8801.1004.101

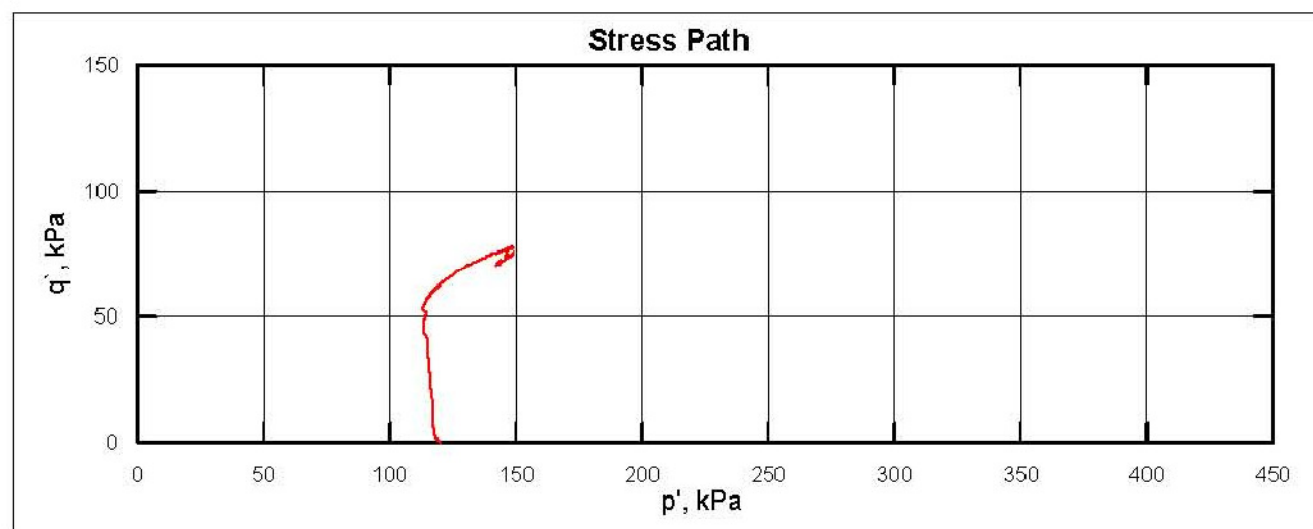
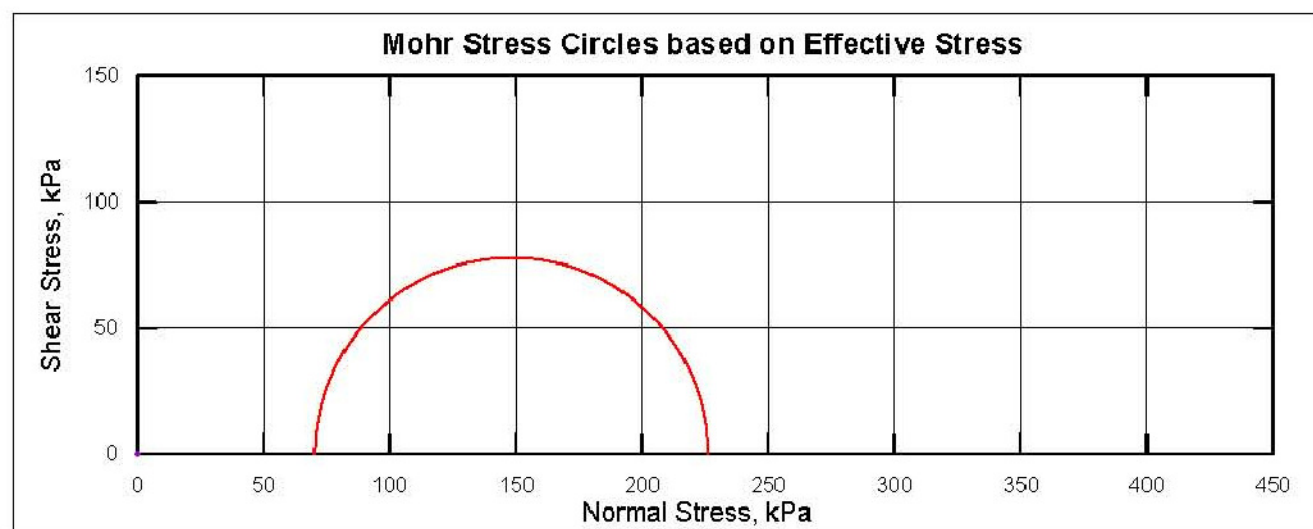
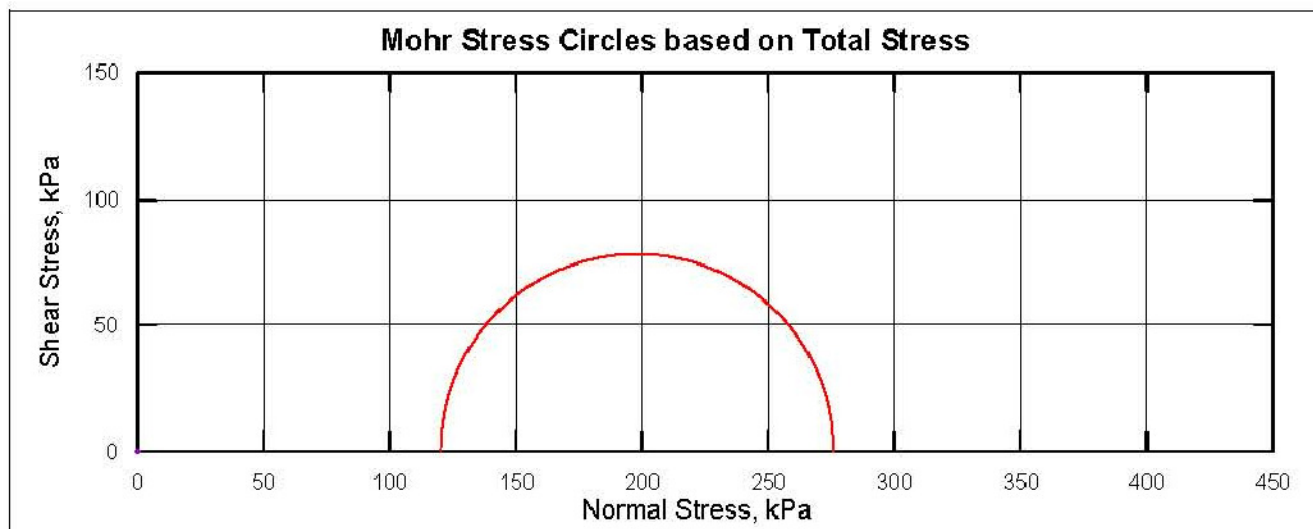
FIGURE NO.

C.6-A

REV

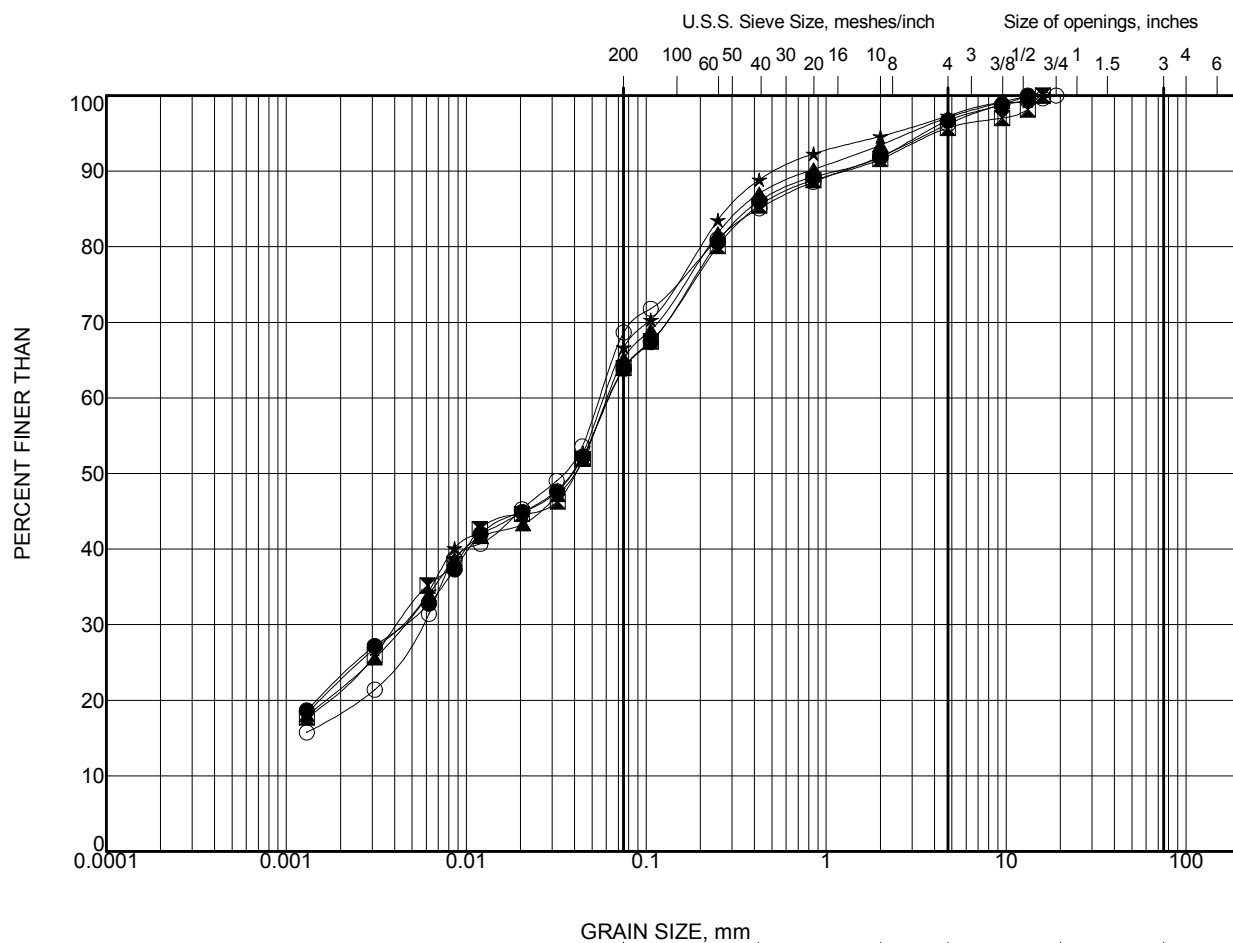


— 120 kPa



— 120 kPa

Note:
Failure based on maximum deviator stress

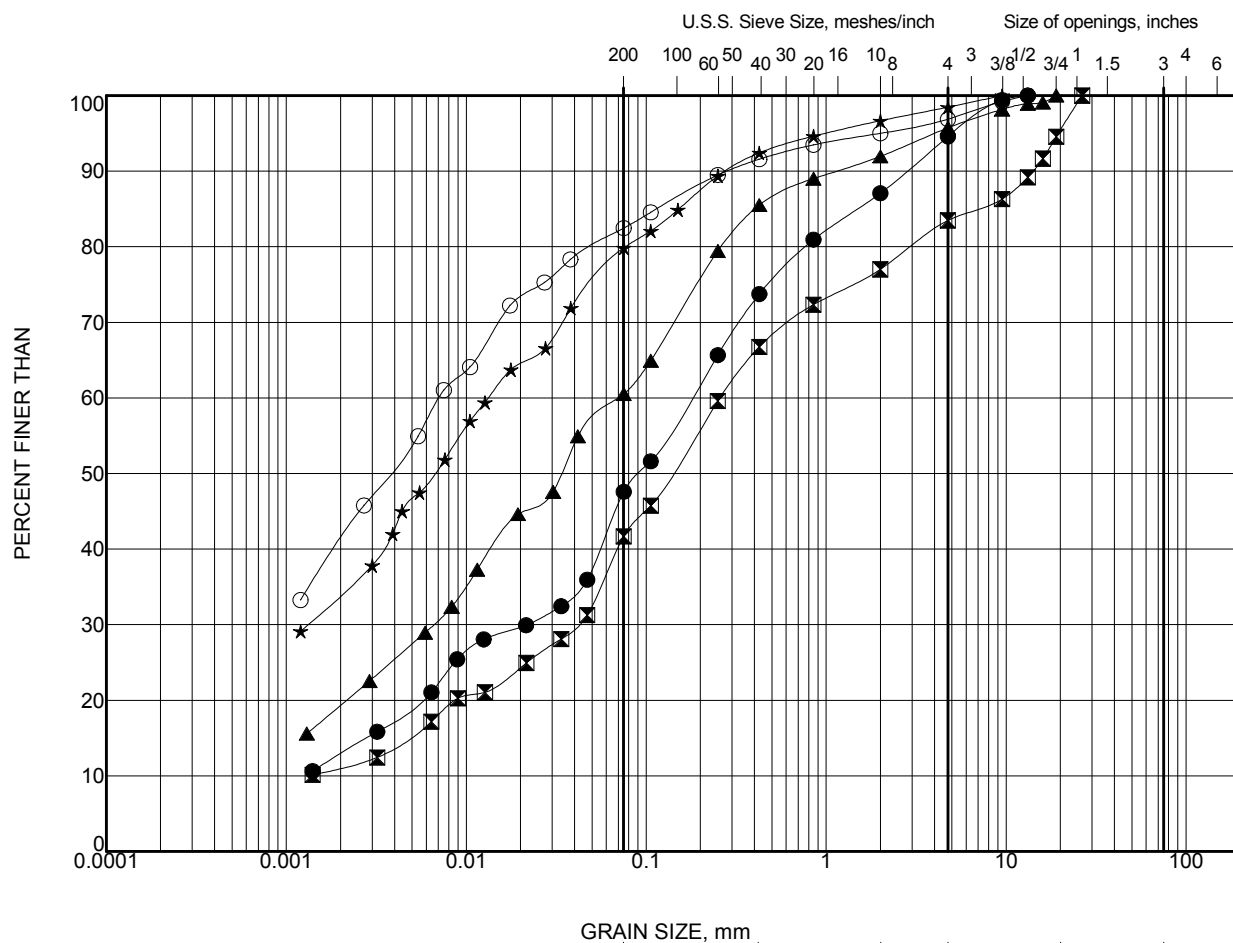


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T10-1/HGMW-04	5	3
▣	T10-1/HGMW-04	7	4.6
▲	T10-1/HGMW-04	9	6.1
★	T10-1/HGMW-04	12	10.7
○	T10-1/HGMW-04	18	19.8

PROJECT		Windsor Essex Parkway (WEP)	
		Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION	
		SILTY CLAY TO CLAYEY SILT	
	PROJECT No. SW8801.1004.101		FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
			FIGURE C.1

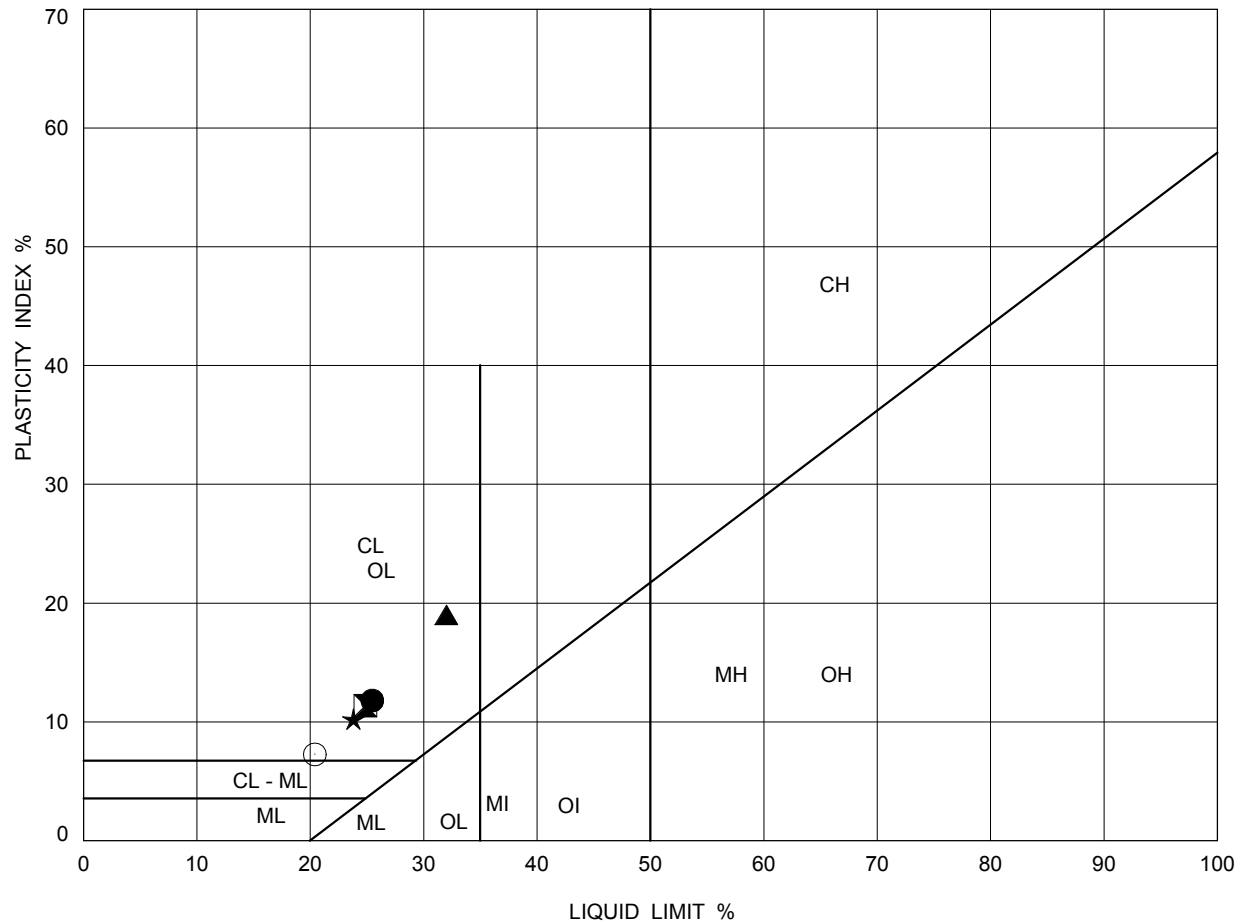


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T10-1/HGMW-04	23	27.4
■	T10-1/HGMW-04	24	29
▲	T10-2/HGMW-09	8	6.1
★	T10-2/HGMW-09	20.1	19.8
○	T10-2/HGMW-09	24	25.9

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.2	



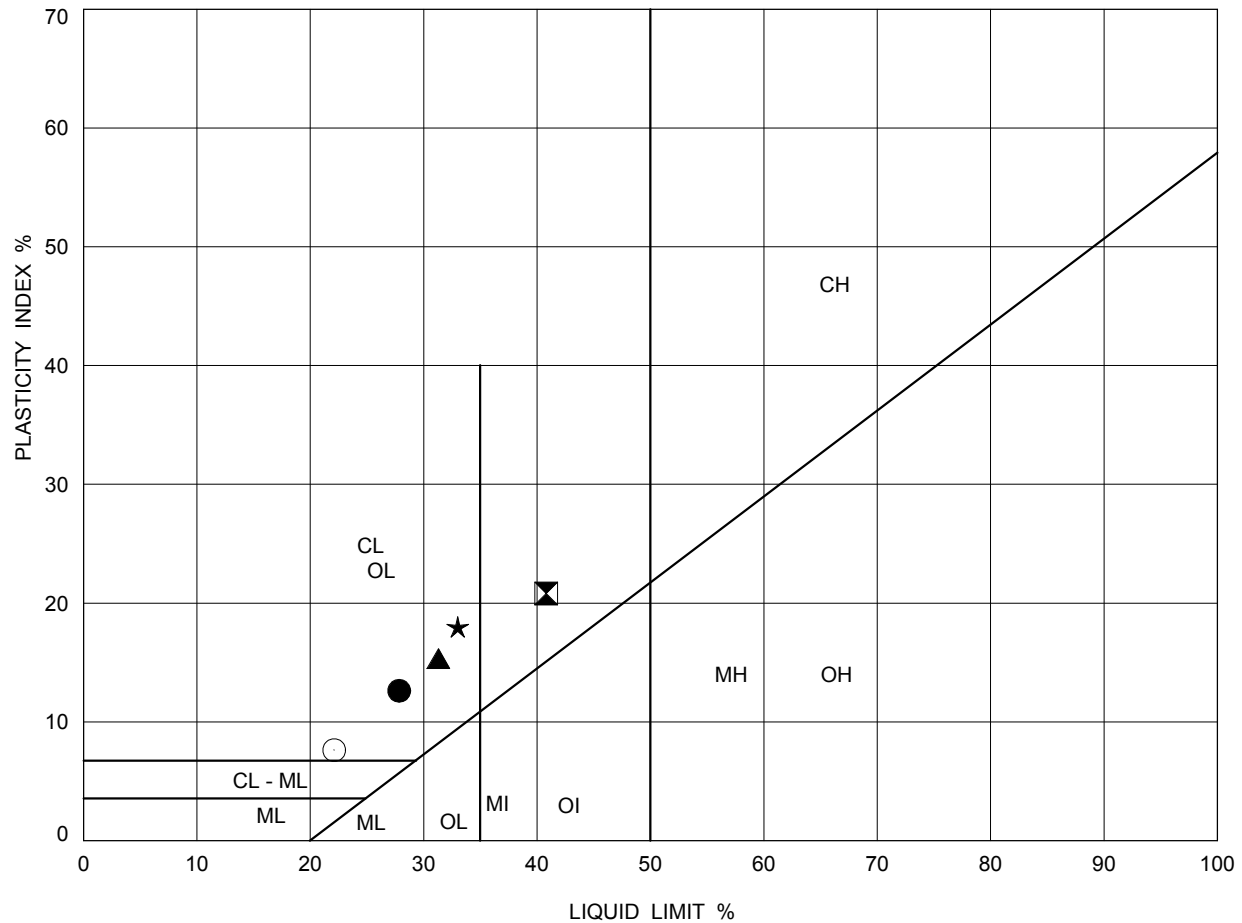
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T10-1/HGMW-04	9	6.1	25	14	11
⊠	T10-1/HGMW-04	12	10.7	25	13	12
▲	T10-1/HGMW-04	16		32	13	19
★	T10-1/HGMW-04	18	19.8	24	14	10
○	T10-2/HGMW-09	8	6.1	20	13	7

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
PROJECT No. SW8801.1004.101		FILE No.	
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.3	



SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T10-2/HGMW-09	15	15.8	28	15	13
⊠	T10-2/HGMW-09	17	17.4	41	20	21
▲	T10-2/HGMW-09	19	18.9	31	16	15
★	T10-2/HGMW-09	20		33	15	18
○	T10-2/HGMW-09	23	24.4	22	14	8

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
PROJECT No. SW8801.1004.101		FILE No.	
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.4	

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D 2435)

Project: **WEP**
 Client: **Hatch Mott MacDonald**
 Date: **12-Jul-11**

Job No.: **SW8801.1004.101**

Sample ID: **T10-2_Sa20A** Depth(m): **19.8 to 20.4**

Test Data

Ring # :	A	Ring Height (in) =	0.755	Wt of dry filter paper (g)	0.69
Wet soil + Ring Wt (g)			208.30	Wt of ring (g)	76.58
Wet soil + Wet Paper + Ring (g)			204.96	Wet Paper (g)	2.15
Dry Soil + Dry Paper + Ring (g)			188.87	Ring Dia (in)	2.498
Initial moisture Content (%)			18.03	Final moisture Content (%)	13.11
Area of Ring (in ²)			4.90	Initial Volume (in ³)	3.7002
Initial Bulk Density (kg/m ³)			2172	Initial Dry Density (kg/m ³)	1841
Specific Gravity of Soil			2.75	Equiv. Thick. of solids (mm)	12.844
Final Bulk Density (kg/m ³)			2230	Final Dry Density (kg/m ³)	1889
Initial gauge reading for Load 1			0.2506	Gauge reading for last Loading	0.1829
Initial Voids Ratio			0.493	Final Void Ratio	0.359
Initial Degree of Saturation (%)			100	Final Degree of Saturation (%)	100

Trial #	1	2	3	4	5	6	7
Load (kPa)	4.0	5.5	8.5	13.0	20.0	30.0	45.0
Load (tsf)	0.0416	0.0572	0.088	0.135	0.208	0.312	0.468
Gauge Reading (in)	0.2475	0.2471	0.2450	0.2418	0.2380	0.2333	0.2276
(H-Hs) mm	6.254	6.244	6.191	6.110	6.013	5.893	5.749
Voids ratio	0.487	0.486	0.482	0.476	0.468	0.459	0.448
t90 (min)			47.61	44.89	36.00	21.16	20.25
Cv (m ² /day)			0.002	0.002	0.003	0.005	0.005
k' (MPa)			1.089	1.047	1.371	1.580	1.941
Mv (mm ² / N)			0.9182	0.9548	0.7294	0.6331	0.5151

Trial #	8	9	10	11	12	13	14
Load (kPa)	65	100.0	150.0	220.0	150.0	100.0	65.0
Load (tsf)	0.676	1.040	1.560	2.288	1.560	1.040	0.676
Gauge Reading (in)	0.22462	0.2175	0.2108	0.2043	0.2045	0.2050	0.2055
(H-Hs) mm	5.673	5.492	5.322	5.157	5.162	5.175	5.188
Voids ratio	0.442	0.428	0.414	0.401	0.402	0.403	0.404
t90 (min)	19.36	12.25	12.25	7.29			
Cv (m ² /day)	0.005	0.008	0.008	0.014			
k' (MPa)	4.913	3.584	5.379	7.714			
Mv (mm ² / N)	0.2036	0.2790	0.1859	0.1296			

Trial #	15	16	17	18	19	20	21
Load (kPa)	45.0	30.0	20.0	13.0	20.0	30.0	45.0
Load (tsf)	0.468	0.312	0.208	0.135	0.208	0.312	0.468
Gauge Reading (in)	0.20621	0.2069	0.2078	0.2088	0.2088	0.2085	0.2078
(H-Hs) mm	5.205	5.222	5.246	5.271	5.271	5.264	5.246
Voids ratio	0.405	0.407	0.408	0.410	0.410	0.410	0.408
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-10 (T10-2-SA20A)**

Date

Aug 2012

JOB NO

SW8801.1004.101

FIGURE NO.
C.5-A

REV

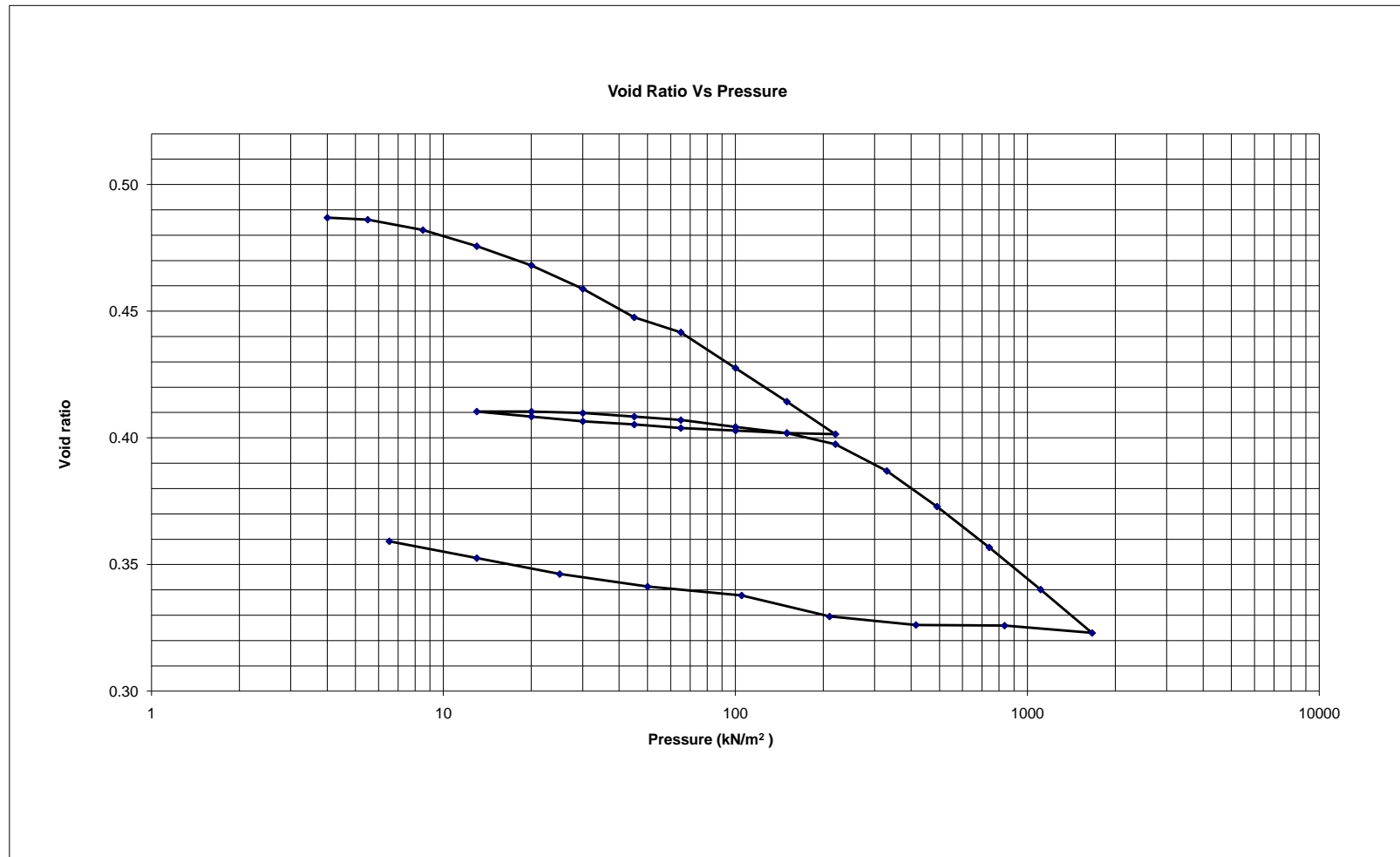
Trial #	22	23	24	25	26	27	28
Load (kPa)	65	100.0	150.0	220.0	330.0	490.0	740.0
Load (tsf)	0.676	1.040	1.560	2.288	3.432	5.096	7.696
Gauge Reading (in)	0.2071	0.2058	0.2045	0.2023	0.1970	0.1899	0.1817
(H-Hs) mm	5.228	5.194	5.163	5.106	4.970	4.790	4.582
Voids ratio	0.407	0.404	0.402	0.398	0.387	0.373	0.357
t90 (min)					4.84	4.62	4.41
Cv (m ² /day)					0.020	0.021	0.021
k' (MPa)					14.530	15.805	21.244
Mv (mm ² / N)					0.0688	0.0633	0.0471

Trial #	29	30	31	32	33	34	35
Load (kPa)	1110	1665.0	835.0	415.0	210.0	105.0	50.0
Load (tsf)	11.544	17.316	8.684	4.316	2.184	1.092	0.520
Gauge Reading (in)	0.17328	0.1646	0.1661	0.1662	0.1679	0.1721	0.1739
(H-Hs) mm	4.369	4.149	4.186	4.189	4.232	4.339	4.384
Voids ratio	0.340	0.323	0.326	0.326	0.330	0.338	0.341
t90 (min)	4.00	2.89					
Cv (m ² /day)	0.023	0.031					
k' (MPa)	30.220	43.431					
Mv (mm ² / N)	0.0331	0.0230					

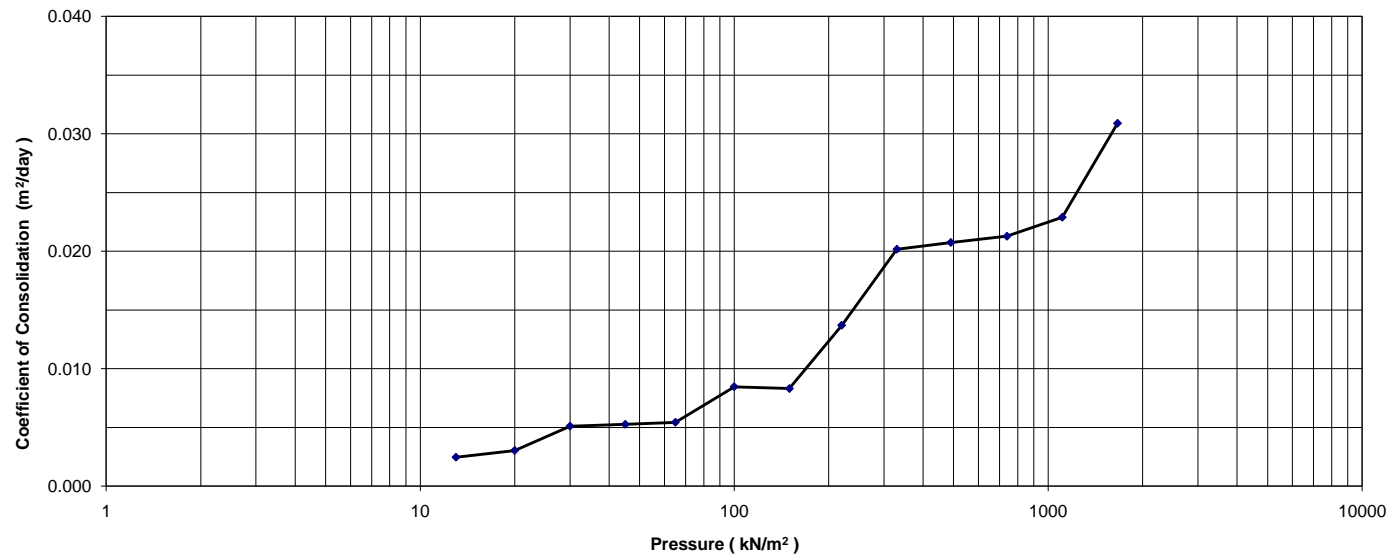
Trial #	36	37	38				
Load (kPa)	25	13.0	6.5				
Load (tsf)	0.26	0.135	0.068				
Gauge Reading (in)	0.1764	0.1796	0.1829				
(H-Hs) mm	4.448	4.528	4.614				
Voids ratio	0.346	0.353	0.359				
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project WINDSOR ESSEX PARKWAY			
TITLE CONSOLIDATION TEST TUNNEL T-10 (T10-2-SA20A)			
Date Aug 2012	JOB NO SW8801.1004.101	FIGURE NO. C.5-B	REV



Coefficient of Consolidation Vs Pressure

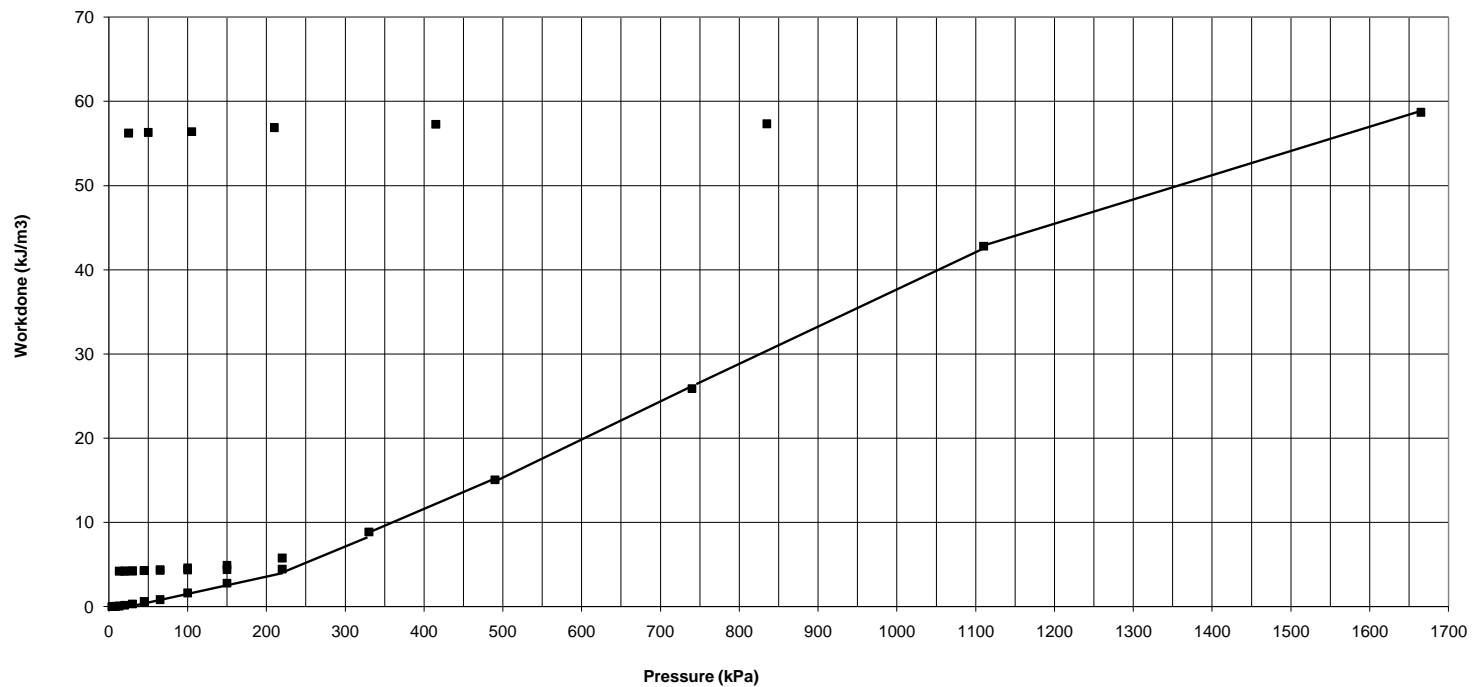


Strain Energy Data

Presssure (kN/m ²)	c _v (m ² /day)	Void ratio
4.0		0.487
5.5		0.486
8.5		0.482
13.0	0.002	0.476
20.0	0.003	0.468
30.0	0.005	0.459
45.0	0.005	0.448
65.0	0.005	0.442
100.0	0.008	0.428
150.0	0.008	0.414
220.0	0.014	0.401
150.0		0.402
100.0		0.403
65.0		0.404
45.0		0.405
30.0		0.407
20.0		0.408
13.0		0.410
20.0		0.410
30.0		0.410
45.0		0.408
65.0		0.407
100.0		0.404
150.0		0.402
220.0		0.398
330.0	0.020	0.387
490.0	0.021	0.373
740.0	0.021	0.357
1110.0	0.023	0.340
1665.0	0.031	0.323
835.0		0.326
415.0		0.326
210.0		0.330
105.0		0.338
50.0		0.341
25.0		0.346
13.0		0.353
6.5		0.359

Presssure (kN/m ²)	Height mm	Total Work (kJ/m ³)
4.0	19.177	0.000
5.5	19.167	0.003
8.5	19.114	0.022
13.0	19.032	0.068
20.0	18.936	0.152
30.0	18.816	0.309
45.0	18.672	0.598
65.0	18.596	0.821
100.0	18.415	1.623
150.0	18.245	2.780
220.0	18.080	4.451
150.0	18.085	4.404
100.0	18.098	4.346
65.0	18.110	4.308
45.0	18.128	4.271
30.0	18.145	4.248
20.0	18.169	4.226
13.0	18.194	4.203
20.0	18.194	4.203
30.0	18.186	4.219
45.0	18.169	4.273
65.0	18.151	4.354
100.0	18.117	4.590
150.0	18.086	4.906
220.0	18.029	5.767
330.0	17.893	8.858
490.0	17.713	15.056
740.0	17.505	25.893
1110.0	17.292	42.805
1665.0	17.072	58.706
835.0	17.109	57.348
415.0	17.112	57.288
210.0	17.155	56.893
105.0	17.262	56.411
50.0	17.307	56.313
25.0	17.371	56.243
13.0	17.451	56.198
6.5	17.537	56.182

Strain Energy Method for Preconsolidation Pressure



DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS (ASTM D 3080)

Page 1 of 5

Project:- **WEP**
Client:- **Hatch Mott MacDonald**
Sample ID.: **T10-1_Sa16**
Lab No.: **AdS056_2011**

Job#: **SW8801.1004.101**
Date: **24 August 2011**
Tested By: **FC/SB**
Checked By: **SB**

Specimen ID	1	2	3
Date of Test	15-Aug-11	18-Aug-11	23-Aug-11
Normal Stress (kPa)	60	110	210
Rate of displacement (mm/min)	0.02	0.02	0.03
Initial thickness of specimen (mm)	24.10	24.10	24.10
Initial diameter of specimen (mm)	63.30	63.30	63.30
Initial moisture content (%)	18.9	19.6	18.7
Density (kN/m ³)	20.8	20.7	21.1
Final moisture (%)	19.4	18.4	16.8

Specimen ID	Normal Stress	Peak Shear Stress	Residual Shear Stress
	kPa	kPa	kPa
1	60.0	25.6	30.4
2	110.0	39.6	54.4
3	210.0	89.5	107.0

Note: Test specimens were inundated with water.



Project

WINDSOR ESSEX PARKWAY

TITLE

DIRECT SHEAR TEST
TUNNEL T-10 (T10-1-SA16)

Date

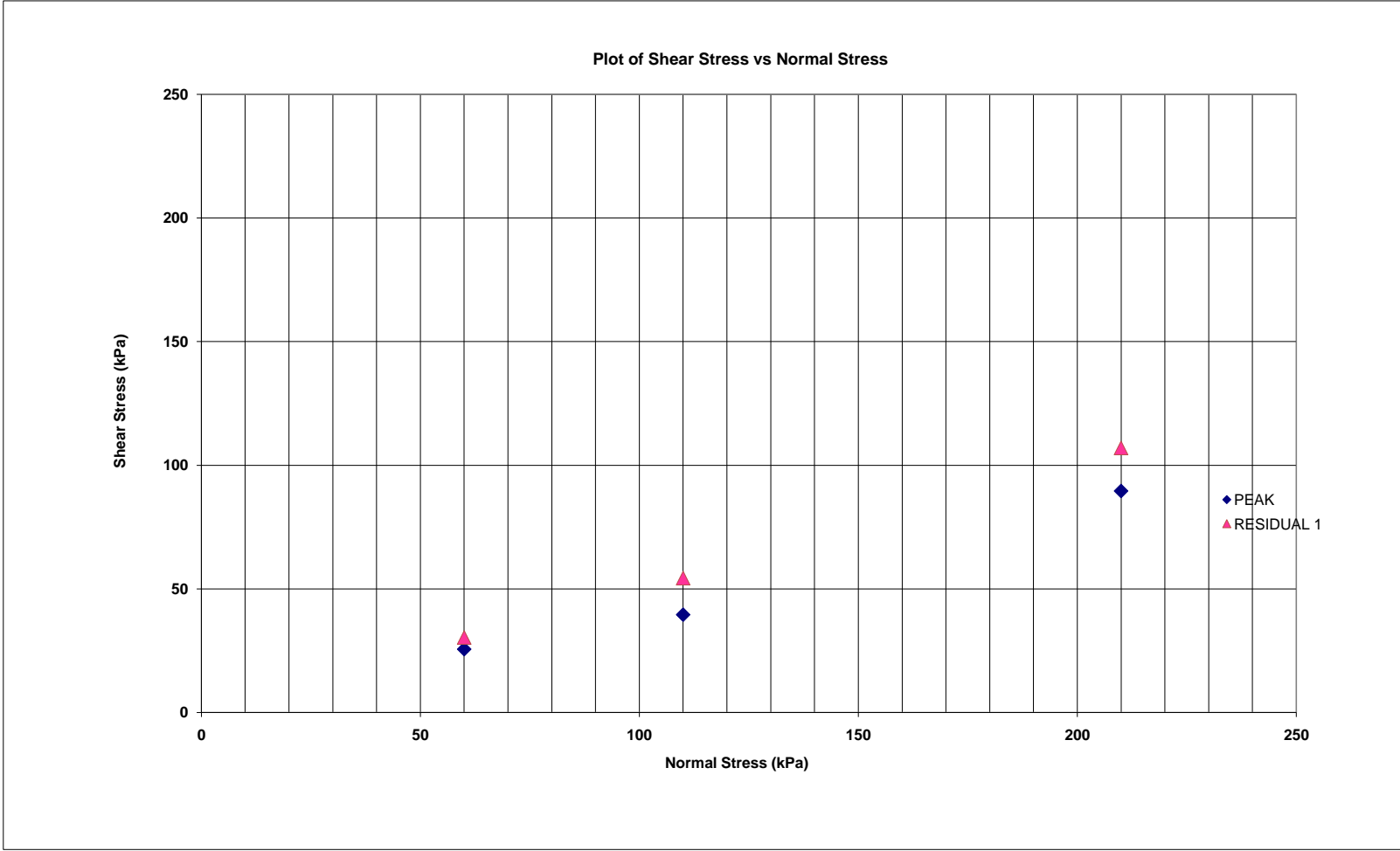
Aug 2012

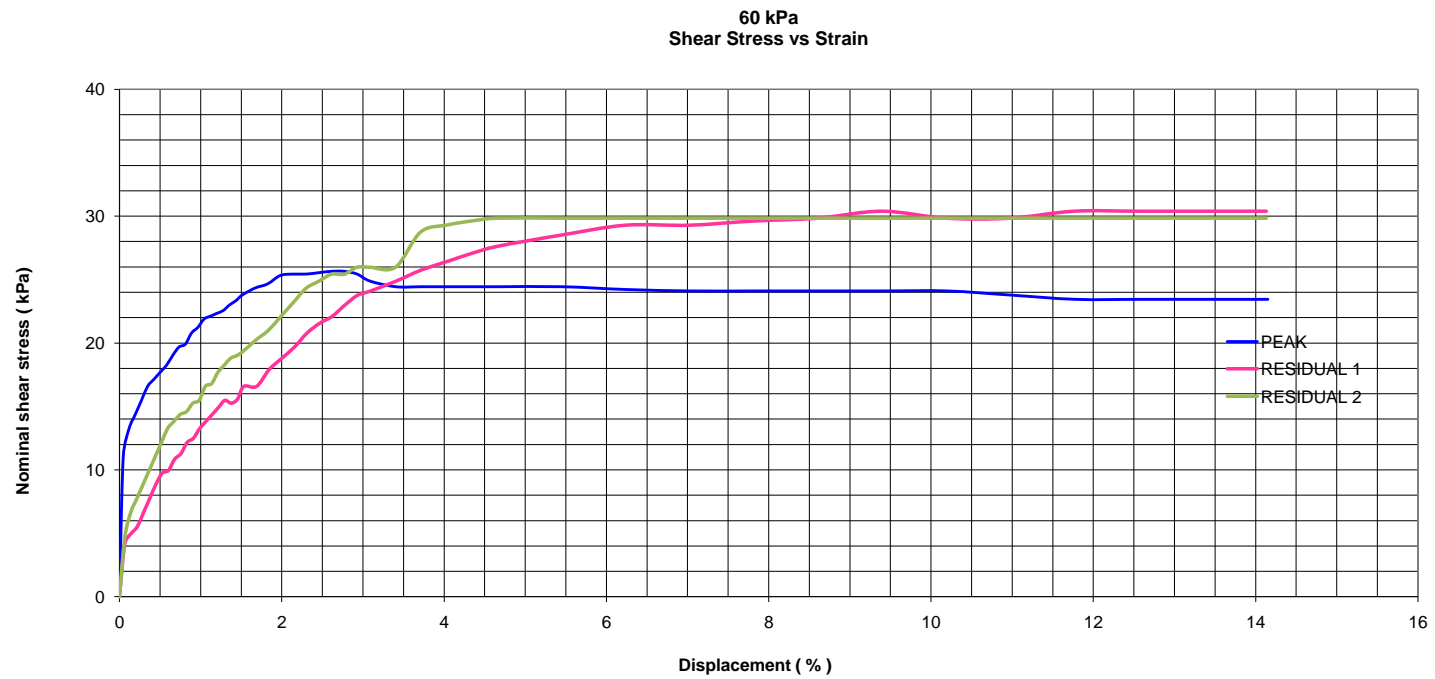
JOB NO

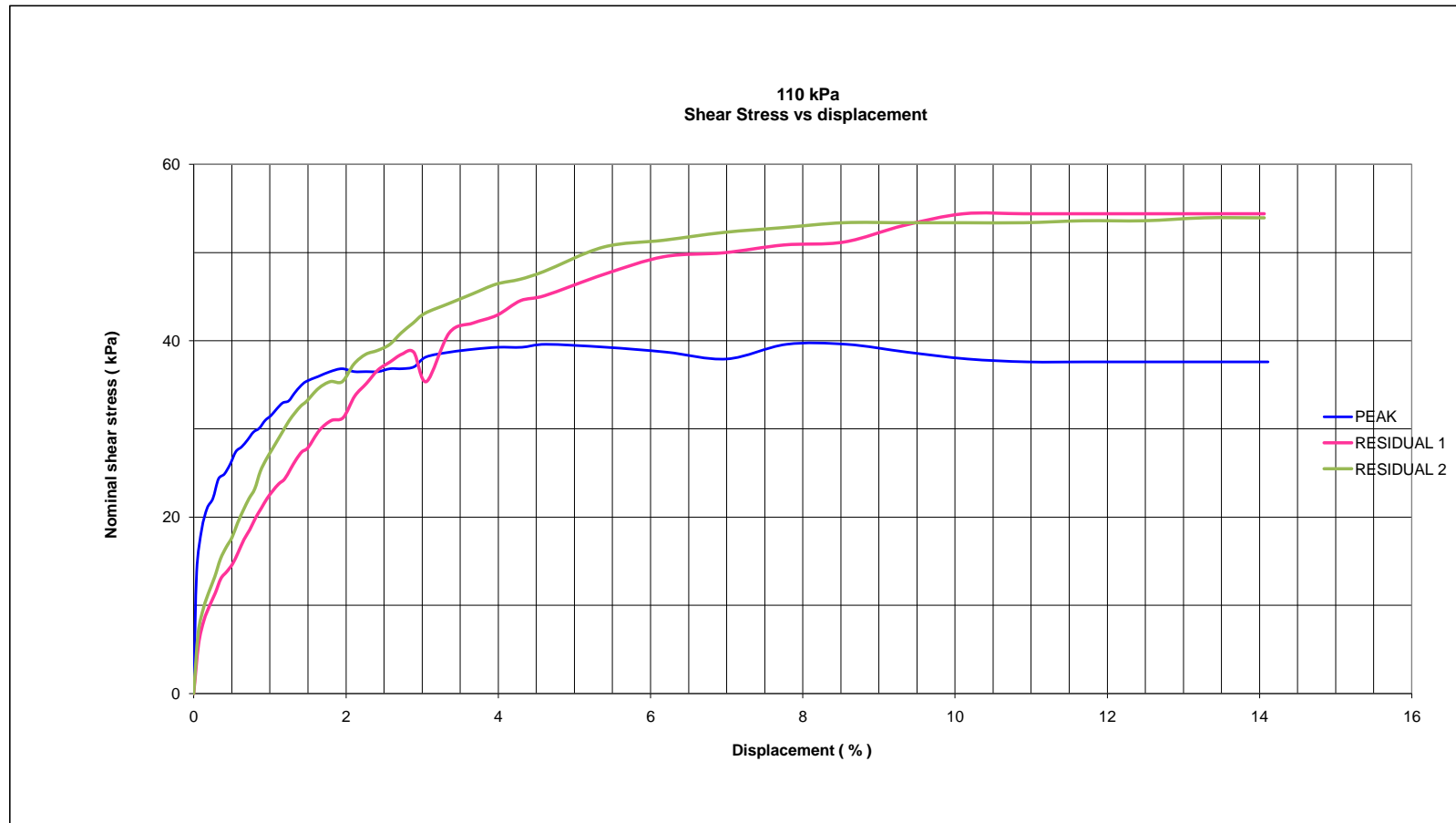
SW8801.1004.101

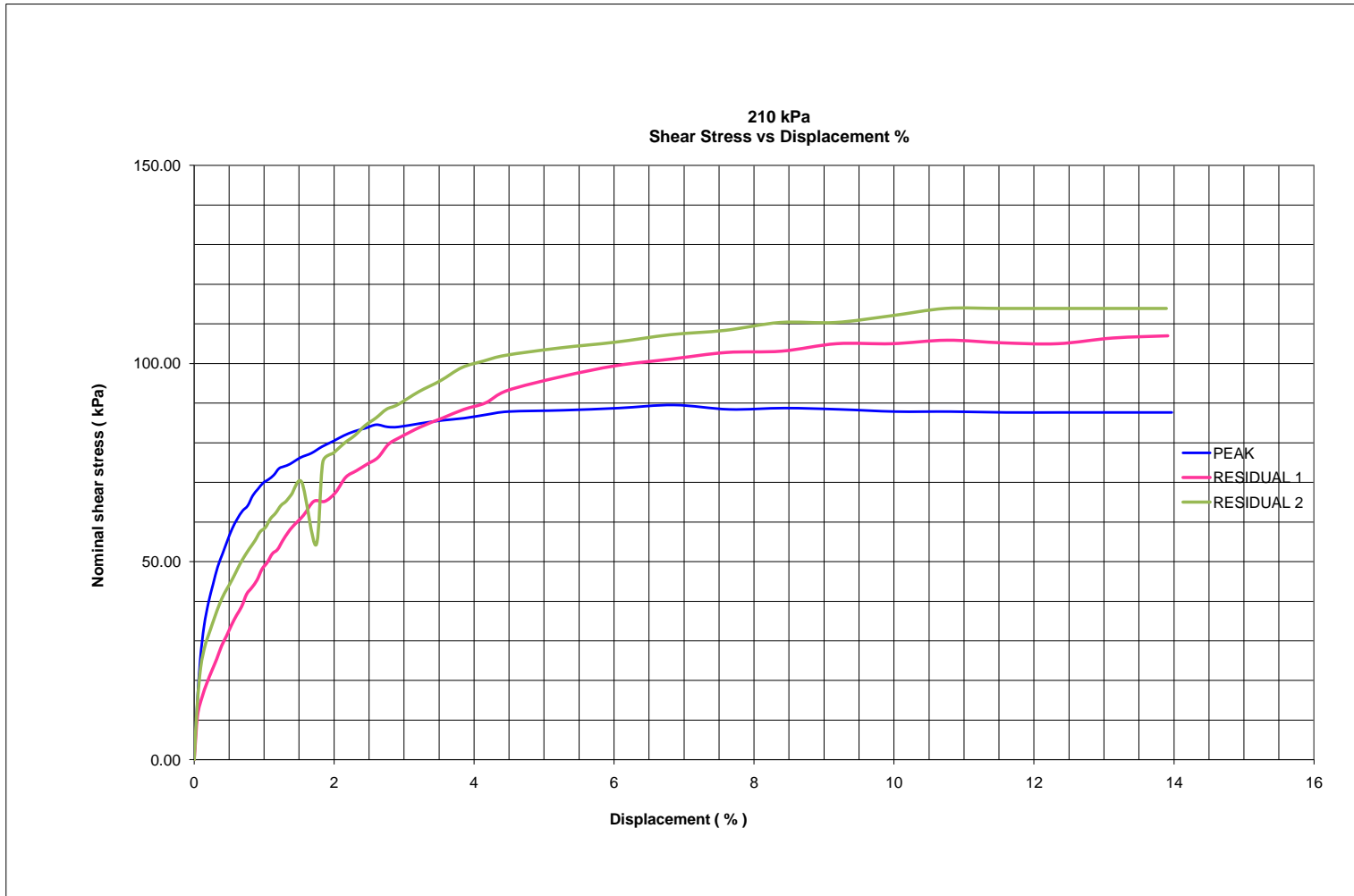
FIGURE NO.
C.6-A

REV









**CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
FOR COHESIVE SOILS (ASTM D-4767)**

Project: WEP
Client: Hatch Mott MacDonald
Location: Windsor, ON.

Sample ID: T10-2_TW20A

Project No.: SW8801.1004.101
Date: 18-Jul-11
Depth(m): 19.8 to 20.4

Sample Description: Clayey Silt/Silty Clay, some sand, trace gravel

		Sample Parameters		
Initial		Specimen 1	Specimen 2	Specimen 3
Diameter	cm	7.040		
Height	cm	14.070		
Volume	cm ³	547.683		
Wet Mass	g	1076.40		
Dry Density	kg/m ³	1622		
Water Content	%	21.2		
Specific Gravity	Actual	2.748		
Void Ratio		0.69		
Degree of Saturation		83.9		
Before Shear (after consolidation)				
Volume	cm ³	508.393		
B - Value		0.99		
After Shear				
Wet Mass	g	1039.18		
Dry Density	kg/m ³	1678		
Water Content	%	21.8		
Void Ratio		0.64		
Degree of Saturation		94.0		
Stress - Strain				
Cell Pressure	kPa	304.00		
Back Pressure	kPa	150.00		
Consolidation Stress	kPa	154.00		
Rate of Strain	mm/min	0.0140		
Vertical Strain at Failure	%	8.39		
Deviator Stress at Failure	kPa	168.16		
Pore Pressure at Failure	kPa	53.50		
Total Stress				
Minor Principal Stress, σ_3	kPa	154.00		
Major Principal Stress, σ_1	kPa	322.16		
Radius, $(\sigma_1 - \sigma_3)/2$	kPa	84.08		
Intersection Point, $(\sigma_1 + \sigma_3)/2$	kPa	238.08		
Effective Stress				
Minor Principal Stress, σ_3'	kPa	100.50		
Major Principal Stress, σ_1'	kPa	268.66		
Radius, $(\sigma_1' - \sigma_3')/2$	kPa	84.08		
Intersection Point, $(\sigma_1' + \sigma_3')/2$	kPa	184.58		



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
TUNNEL T-10 (T10-2-SA20A)**

Date

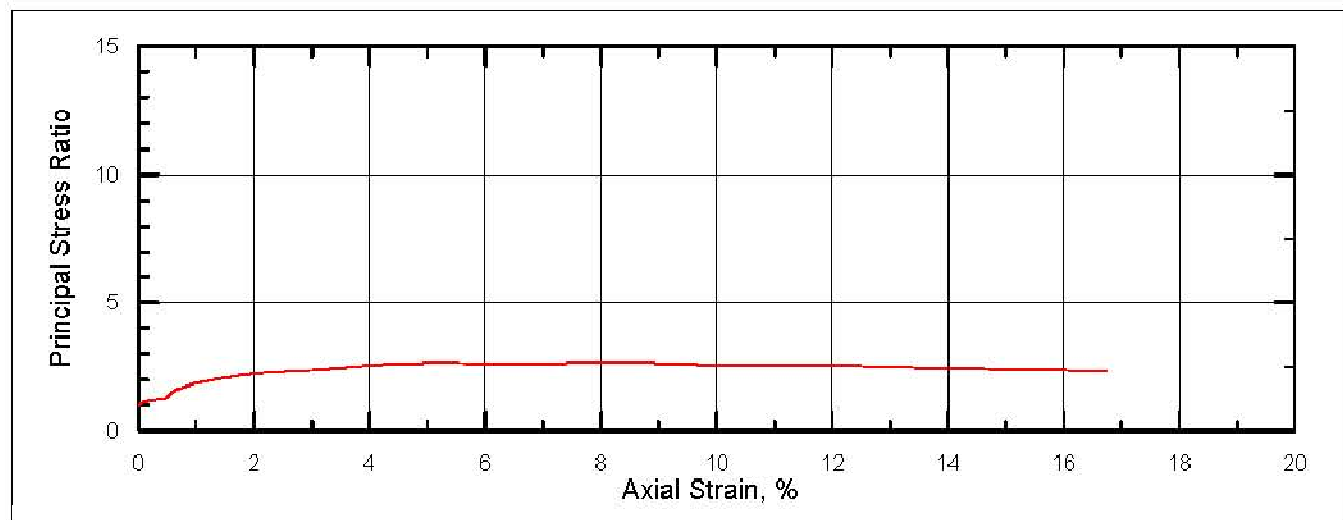
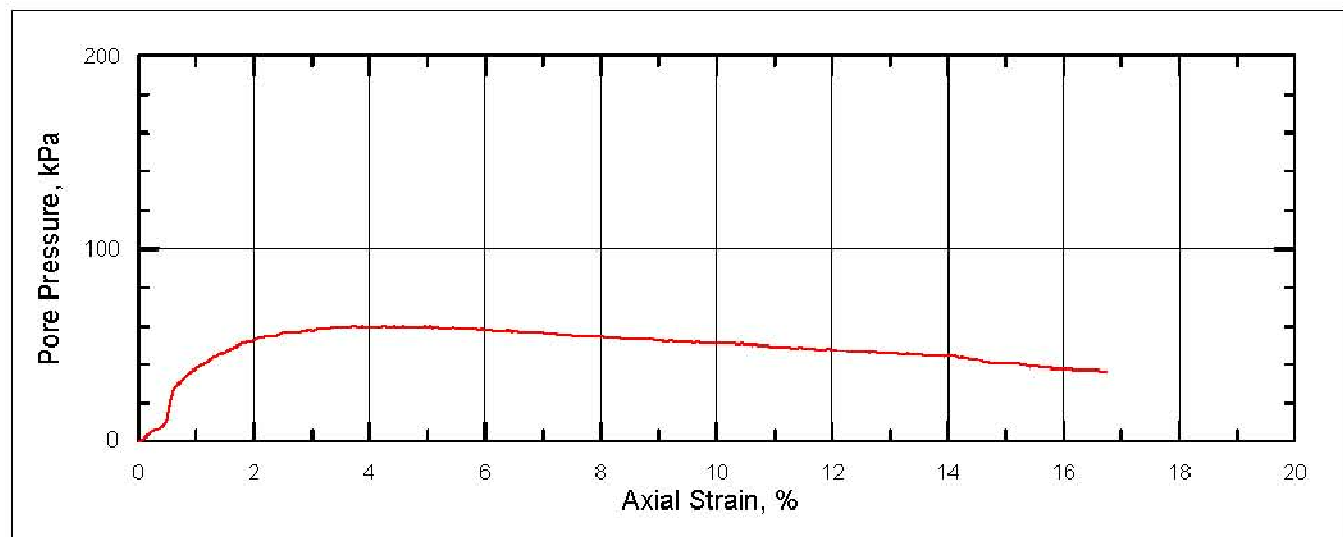
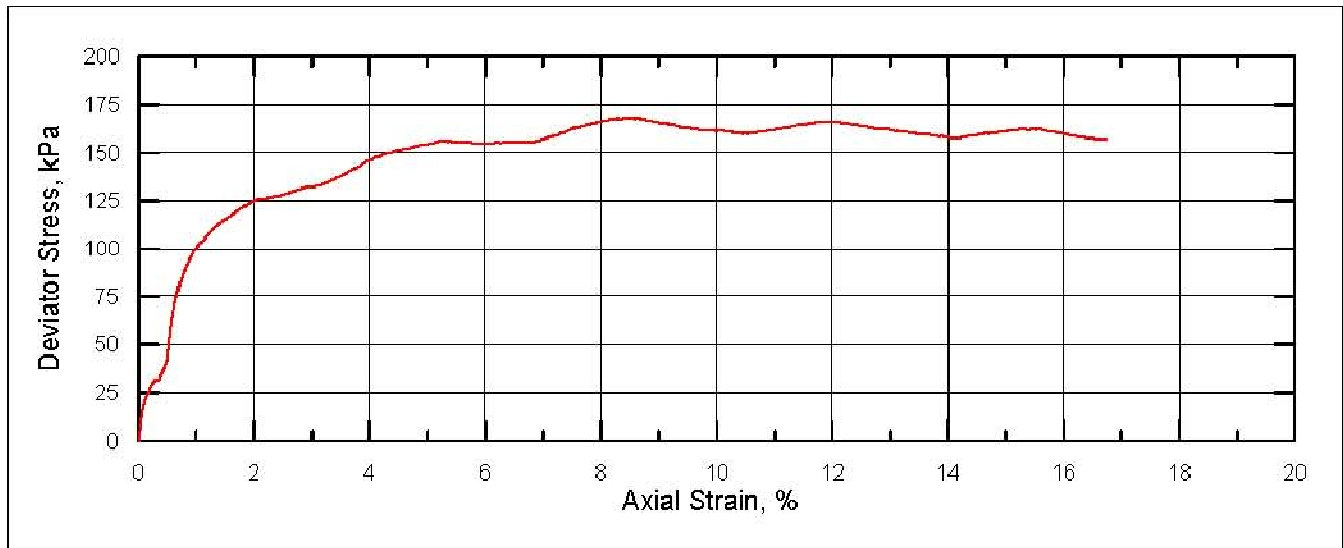
Aug 2012

JOB NO

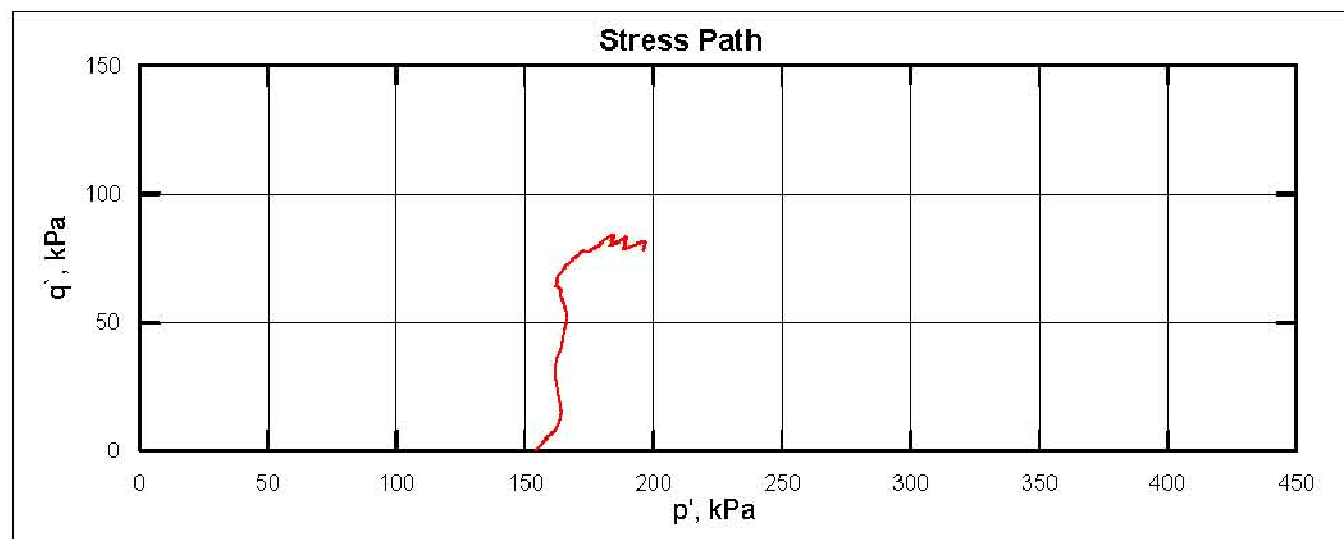
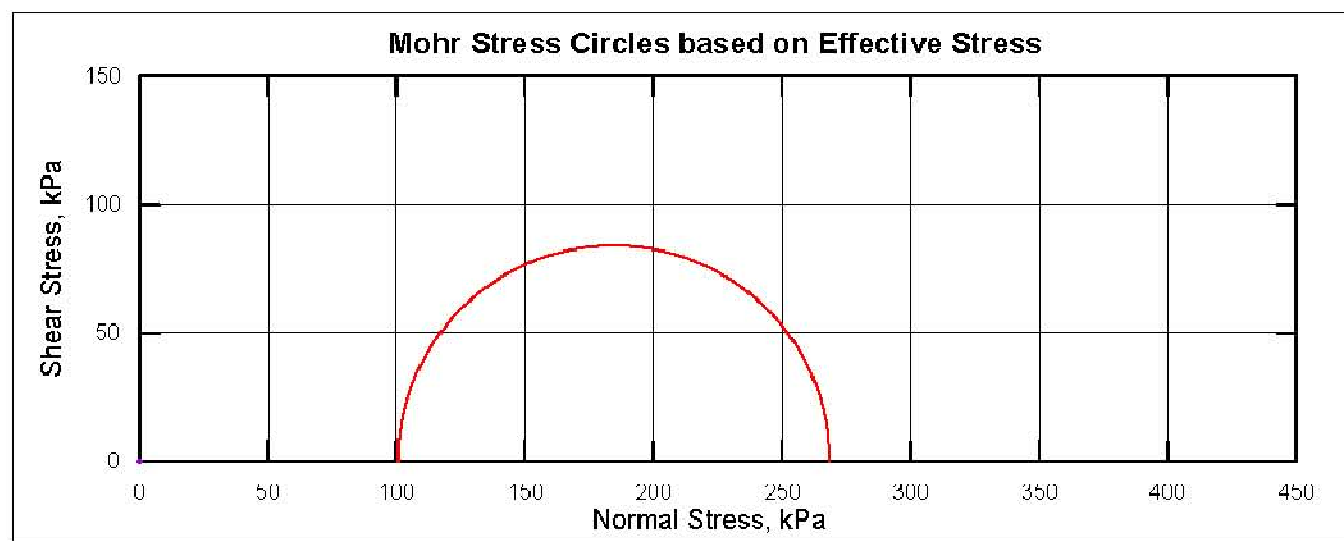
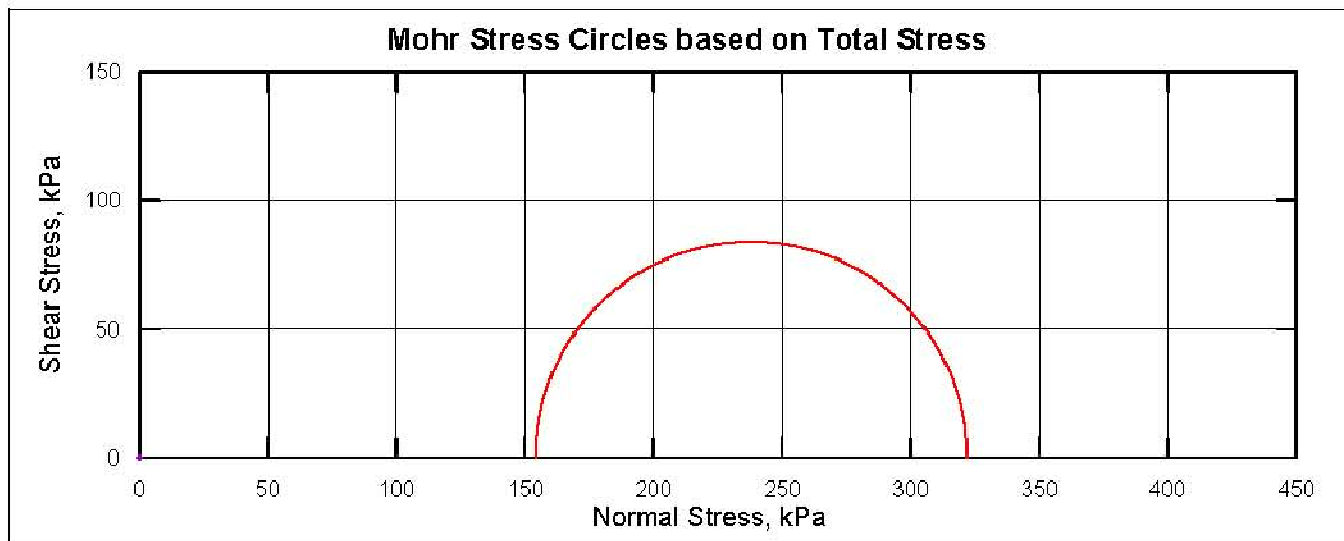
SW8801.1004.101

**FIGURE NO.
C.7-A**

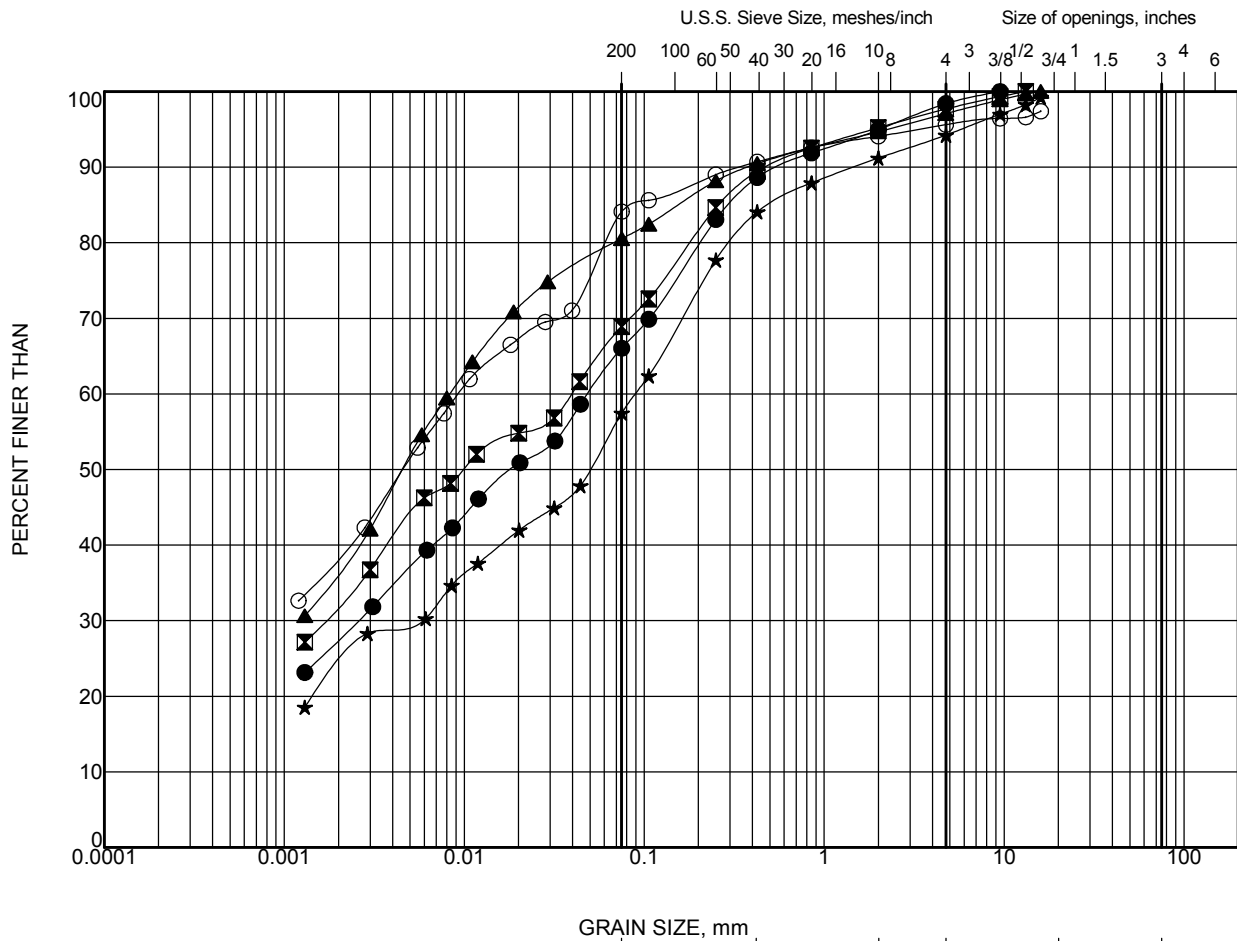
REV



— 150 kPa



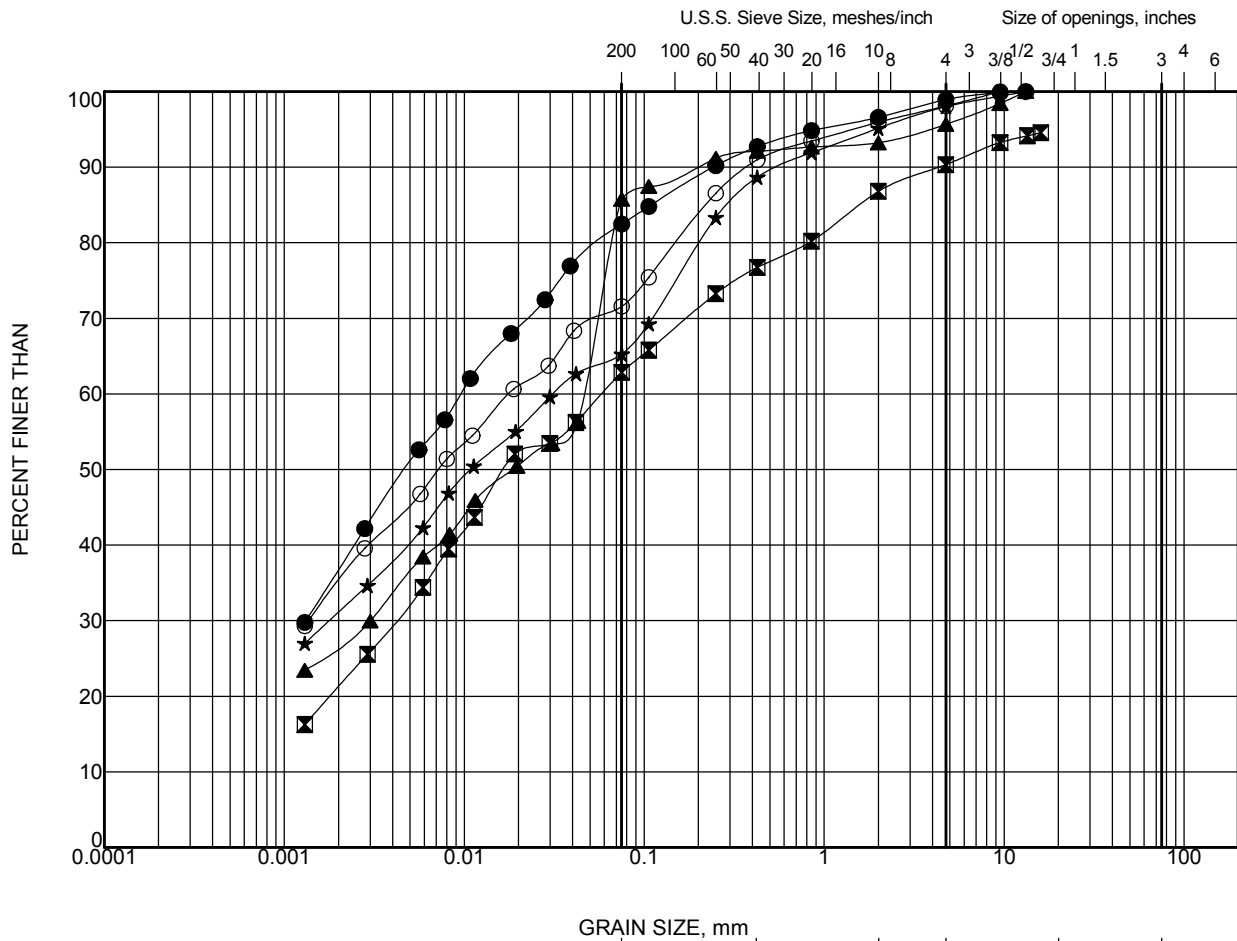
— 150 kPa



LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T11-1	10	9.1
■	T11-1	12	12.2
▲	T11-1	18	21.3
★	T11-2	10	9.1
○	T11-2	17	17.5

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION CLAYEY SILT	
Parkway Infrastructure Engineers 	PROJECT No. SW6801.1004.101	FILE No.	
	DRAWN	SCALE	REV.
	CHECK		
			FIGURE C.1

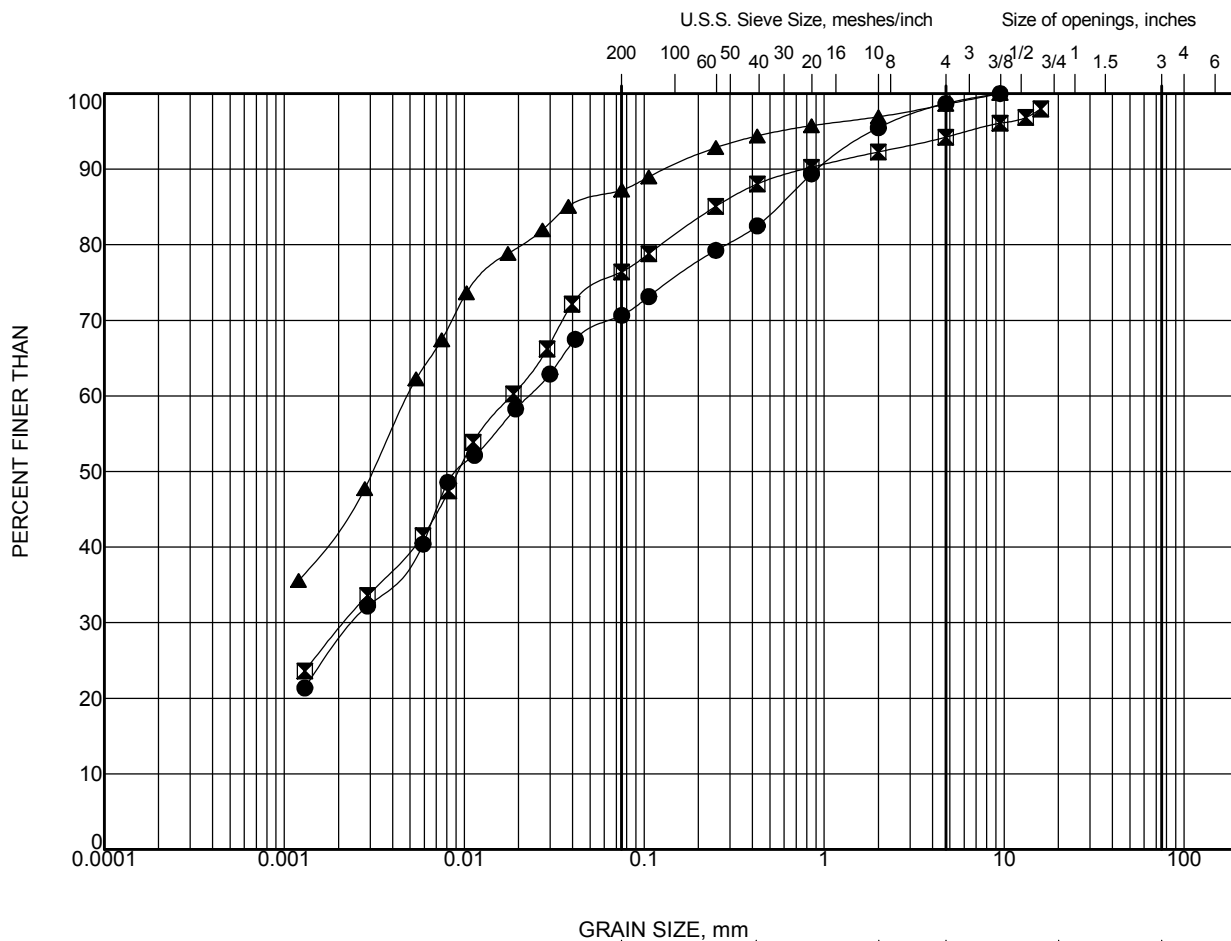


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T11-2	21	20.6
■	T11-2	22	21.3
▲	T11-3	9	7.6
★	T11-3	11	10.7
○	T11-3	16	16.8

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION CLAYEY SILT	
	PROJECT No. SW8801.1004.101	FILE No.	
	DRAWN	SCALE	REV.
	CHECK	FIGURE C.2	

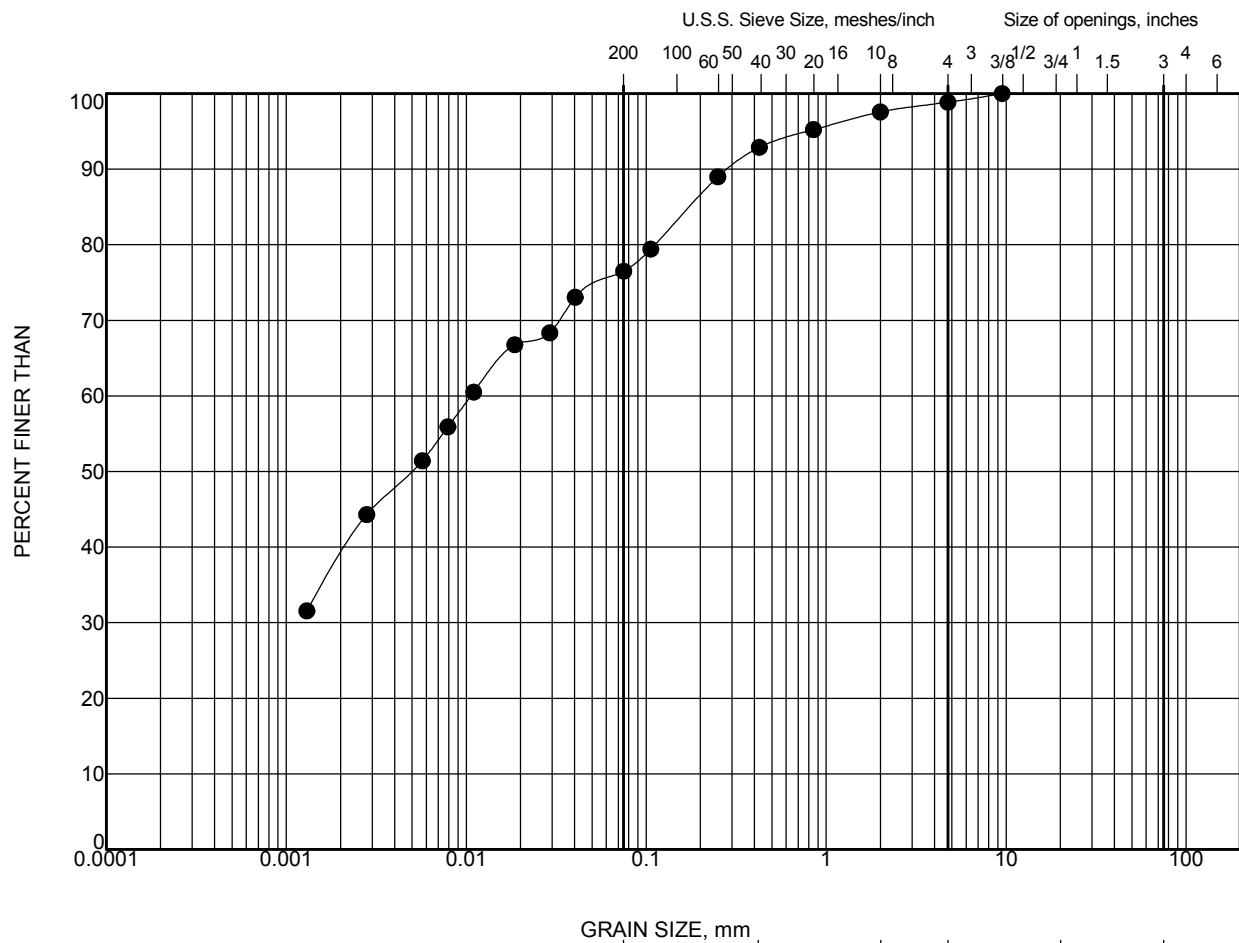


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T11-3	20	19.8
■	T11-3	23	22.9
▲	T11-3	28	30.5

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION CLAYEY SILT	
	PROJECT No. SW8801.1004.101	FILE No.	
	DRAWN	SCALE	REV.
	CHECK	FIGURE C.3	

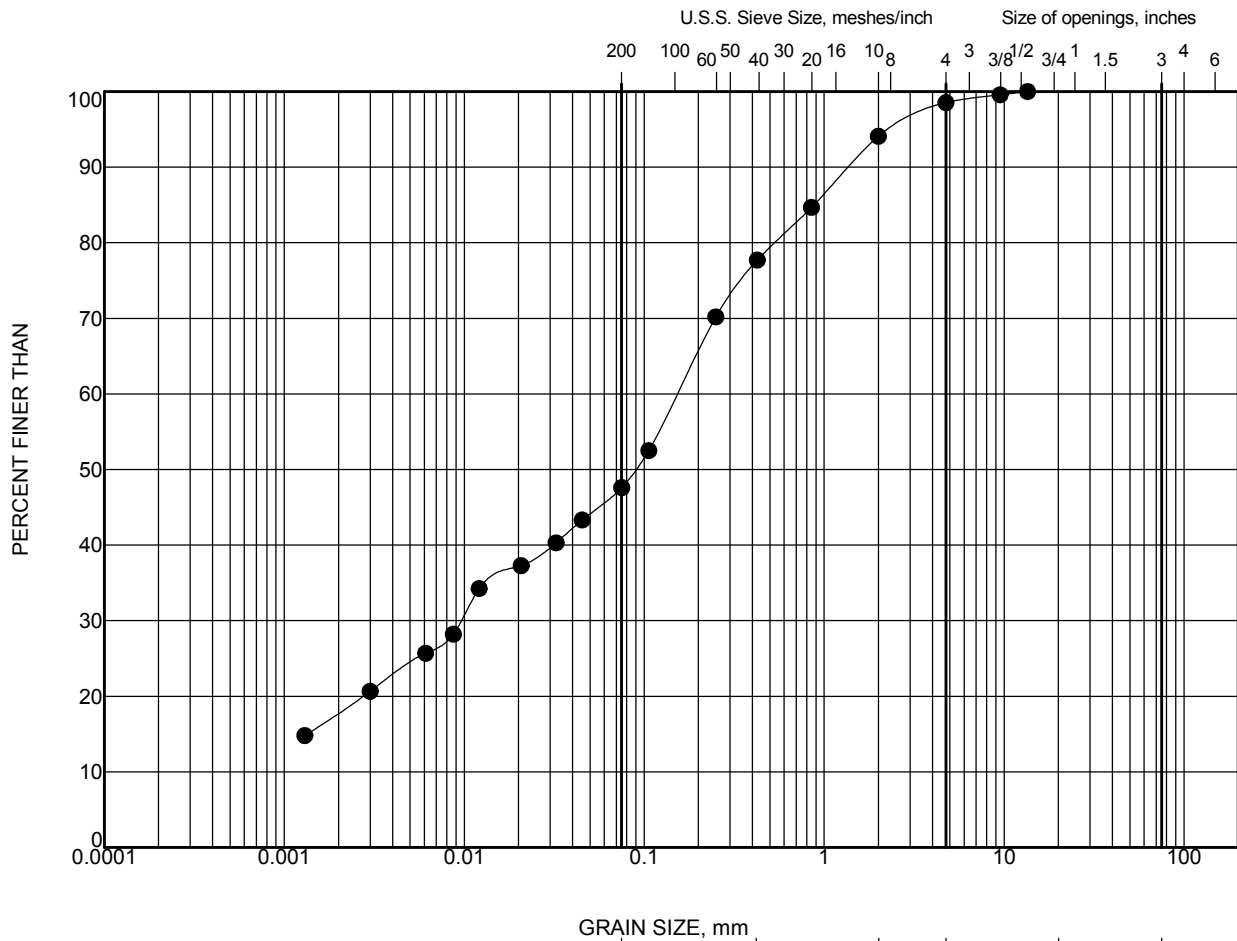


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T11-2	14	15.2

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY	
<div> <div> Parkway Infrastructure Engineers </div> <div> amec </div> <div> Hatch Mott MacDonald </div> </div>	PROJECT No. SW6801.1004.101		FILE No.
	DRAWN		SCALE
	CHECK		REV.
FIGURE C.4			

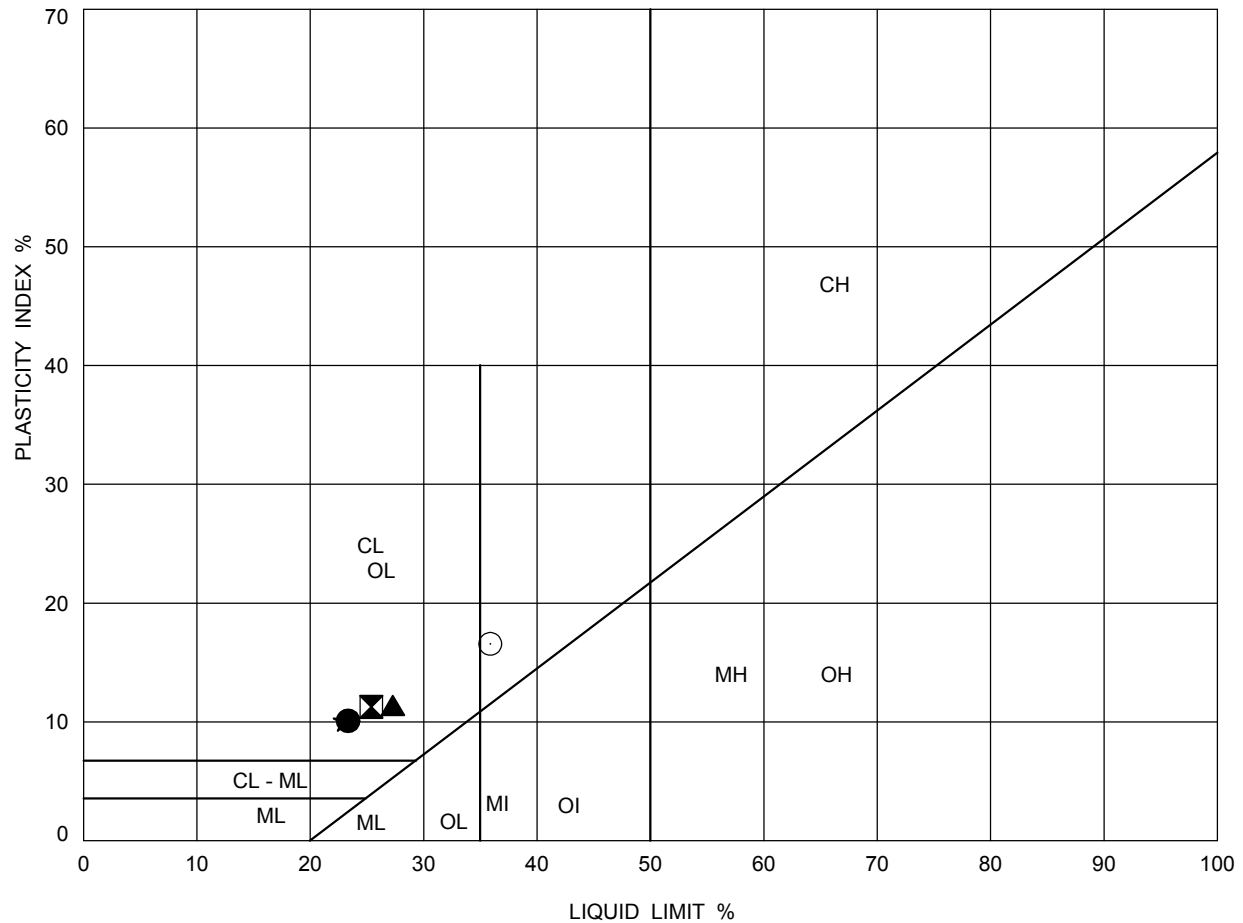


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T11-3	13	13.7

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY SAND	
	PROJECT No.	SW6801.1004.101	FILE No.
	DRAWN		SCALE
	CHECK		REV.
FIGURE C.5			



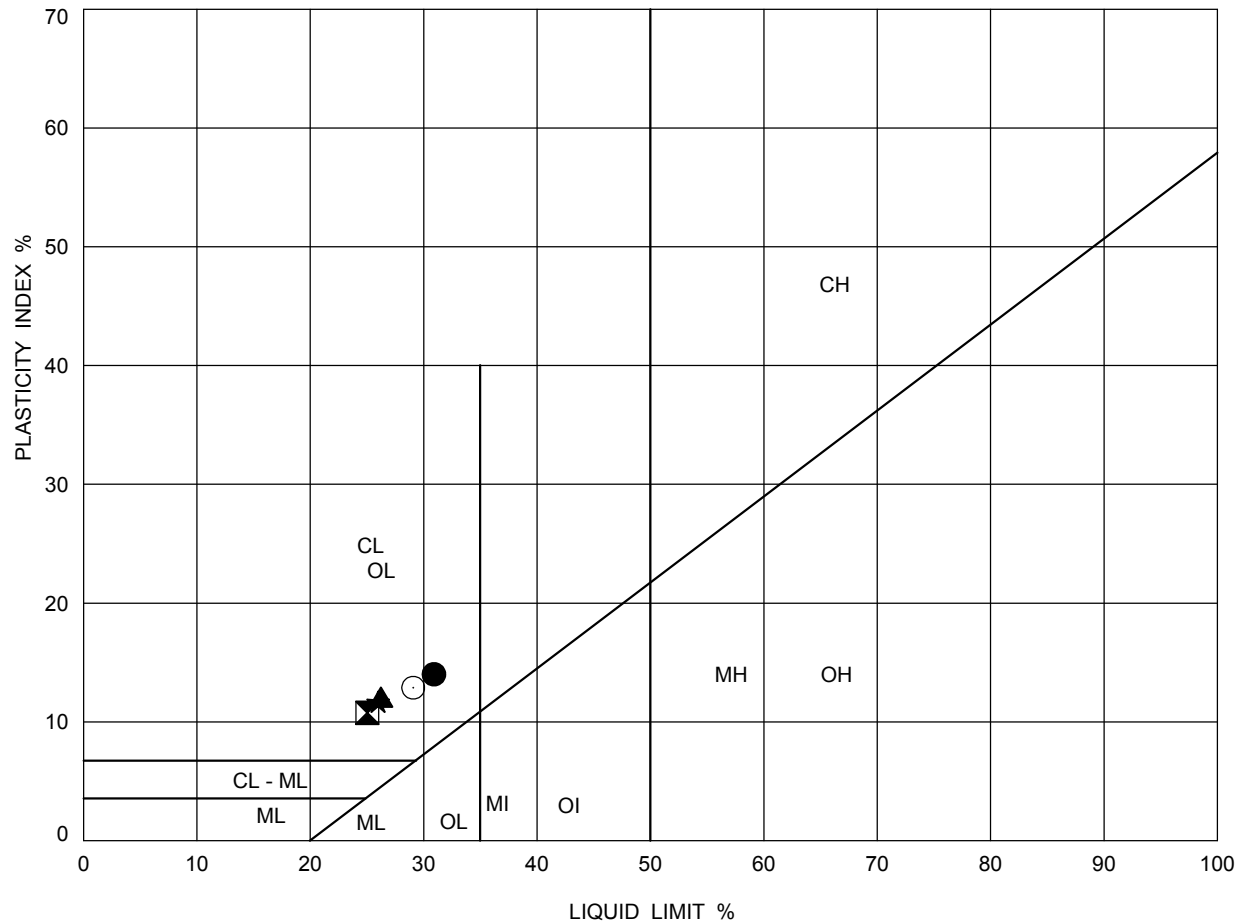
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T11-1	10	9.1	23	13	10
⊠	T11-1	12	12.2	25	14	11
▲	T11-1	18	21.3	27	16	11
★	T11-2	10	9.1	23	13	10
○	T11-2	17	17.5	36	19	17

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART CLAYEY SILT	
	PROJECT No. SW8801.1004.101		
	FILE No.		
DRAWN	SCALE	REV.	
CHECK	FIGURE C.6		






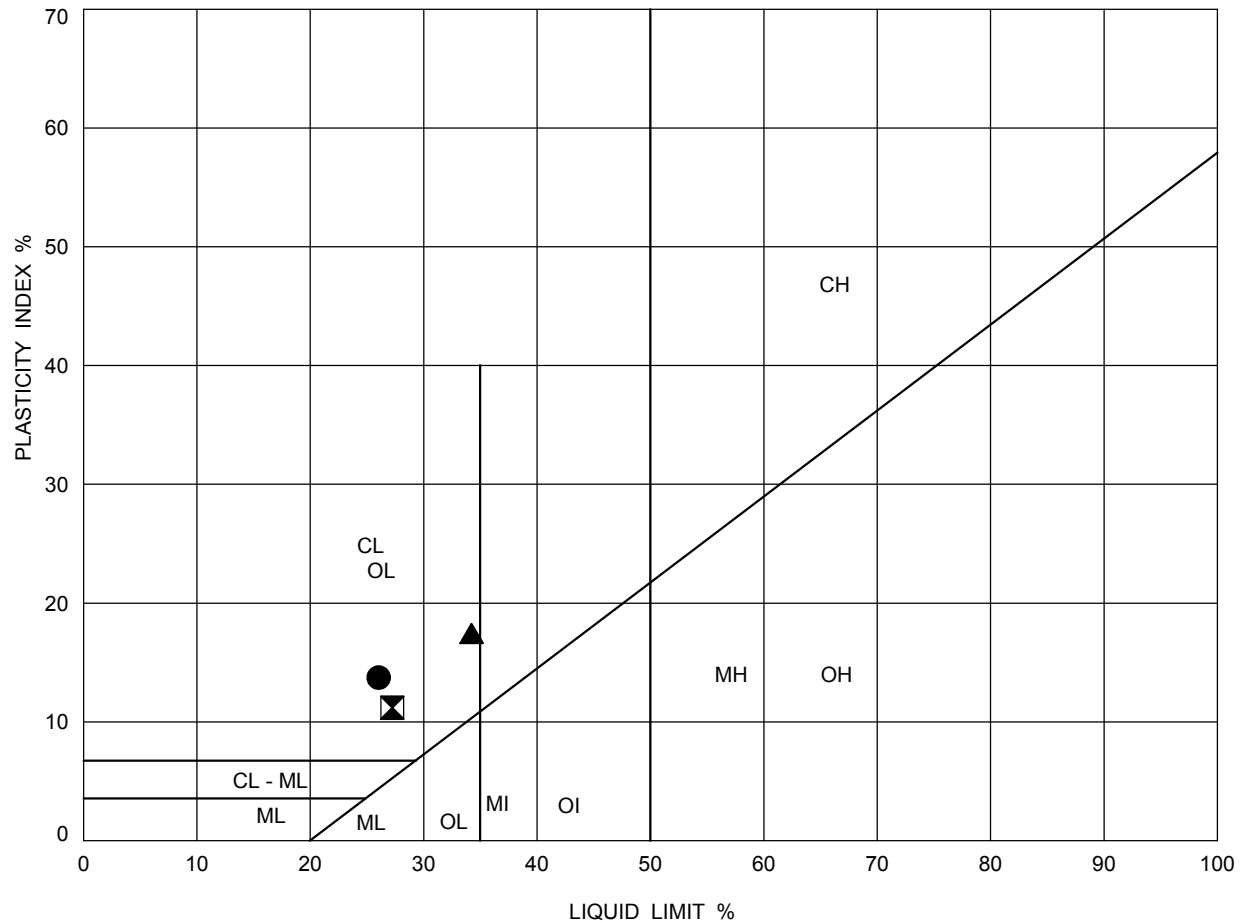
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T11-2	21	20.6	31	17	14
⊠	T11-2	22	21.3	25	14	11
▲	T11-3	9	7.6	26	14	12
★	T11-3	11	10.7	26	14	12
○	T11-3	16	16.8	29	16	13

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
		DRAWN	SCALE
		CHECK	REV.
		FIGURE C.7	



SOIL TYPE

C = Clay
M = Silt
O = Organic

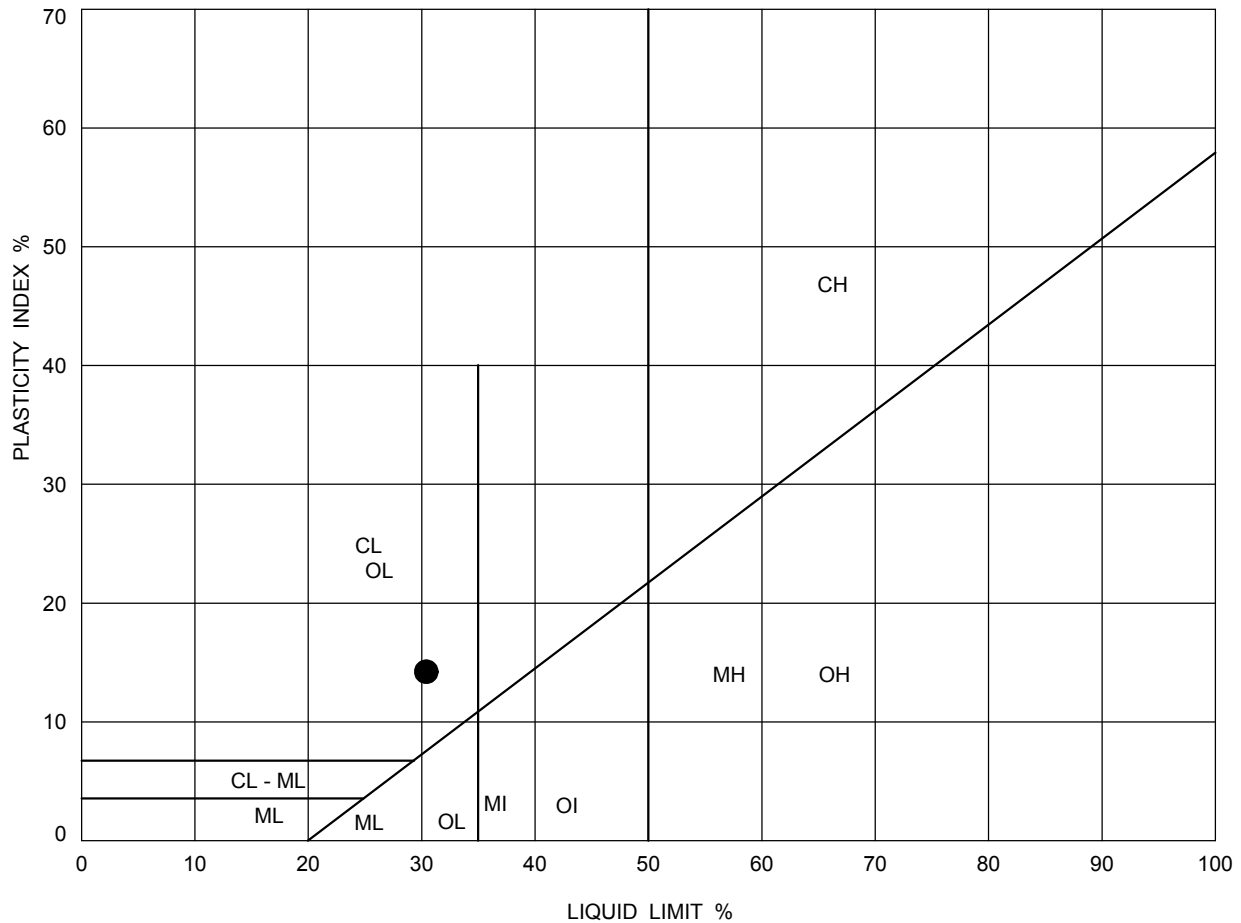
PLASTICITY

L = Low
I = Intermediate
H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T11-3	20	19.8	26	12	14
⊠	T11-3	23	22.9	27	16	11
▲	T11-3	28	30.5	34	17	17

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART CLAYEY SILT	
	PROJECT No. SW8801.1004.101	FILE No.	
	DRAWN	SCALE	REV.
CHECK	FIGURE C.8		



SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	T11-2	14	15.2	30	16	14

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY	
	PROJECT No. SW8801.1004.101		
	FILE No.		
DRAWN	SCALE	REV.	
CHECK	FIGURE C.9		

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D 2435)

Project: **WEP**
 Client: **Hatch Mott MacDonald Limited**
 Date: **20-May-11**

Job No.: **SW8801.1004.101**
 Sample ID: **T11-3_Sa14**
 Depth(m): **15.25 to 16.00**

Test Data

Ring # :	A	Ring Height (in) =	0.762	Wt of dry filter paper (g)	0.69
Wet soil + Ring Wt (g)			205.51	Wt of ring (g)	76.58
Wet soil + Wet Paper + Ring (g)			203.03	Wet Paper (g)	1.81
Dry Soil + Dry Paper + Ring (g)			184.11	Ring Dia (in)	2.500
Initial moisture Content (%)			20.68	Final moisture Content (%)	16.66
Area of Ring (in ²)			4.91	Initial Volume (in ³)	3.7405
Initial Bulk Density (kg/m ³)			2103	Initial Dry Density (kg/m ³)	1743
Specific Gravity of Soil			2.72	Equiv. Thick. of solids (mm)	12.403
Final Bulk Density (kg/m ³)			2537	Final Dry Density (kg/m ³)	2102
Initial gauge reading for Load 1			0.2578	Gauge reading for last Loading	0.2048
Initial Voids Ratio			0.560	Final Void Ratio	0.452
Initial Degree of Saturation (%)			100	Final Degree of Saturation (%)	100

Trial #	1	2	3	4	5	6	7
Load (kPa)	4.0	6.0	9.0	13.5	20.0	30.0	45.0
Load (tsf)	0.0416	0.0624	0.094	0.140	0.208	0.312	0.468
Gauge Reading (in)	0.2536	0.2532	0.2520	0.2497	0.2477	0.2448	0.2418
(H-Hs) mm	6.846	6.834	6.804	6.746	6.696	6.620	6.545
Voids ratio	0.552	0.551	0.549	0.544	0.540	0.534	0.528
t90 (min)		1.96	12.25	7.84	9.00	19.36	15.60
Cv (m ² /day)		0.058	0.009	0.014	0.012	0.006	0.007
k' (MPa)		3.158	1.976	1.480	2.475	2.532	3.808
Mv (mm ² / N)		0.3167	0.5062	0.6759	0.4041	0.3950	0.2626

Trial #	8	9	10	11	12	13	14
Load (kPa)	70	105.0	155.0	230.0	155.0	105.0	70.0
Load (tsf)	0.728	1.092	1.612	2.392	1.612	1.092	0.728
Gauge Reading (in)	0.2374	0.2326	0.2277	0.2212	0.2219	0.2225	0.2238
(H-Hs) mm	6.434	6.312	6.186	6.022	6.040	6.056	6.087
Voids ratio	0.519	0.509	0.499	0.486	0.487	0.488	0.491
t90 (min)	12.96	10.24	10.56	8.70			
Cv (m ² /day)	0.008	0.011	0.010	0.012			
k' (MPa)	4.239	5.407	7.442	8.510			
Mv (mm ² / N)	0.2359	0.1849	0.1344	0.1175			

Trial #	15	16	17	18	19	20	21
Load (kPa)	45.0	30.0	20.0	13.5	9.0	13.5	20.0
Load (tsf)	0.468	0.312	0.208	0.140	0.094	0.140	0.208
Gauge Reading (in)	0.2257	0.2272	0.2290	0.2308	0.2329	0.2324	0.2315
(H-Hs) mm	6.136	6.174	6.221	6.266	6.318	6.306	6.284
Voids ratio	0.495	0.498	0.502	0.505	0.509	0.508	0.507
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-11**

Date

Aug 2012

JOB NO

SW8801.1004.101

FIGURE NO.
C.10-A

REV

Trial #	22	23	24	25	26	27	28
Load (kPa)	30	45.0	70.0	105.0	155.0	230.0	345.0
Load (tsf)	0.312	0.468	0.728	1.092	1.612	2.392	3.588
Gauge Reading (in)	0.2302	0.2286	0.2265	0.2245	0.2224	0.2188	0.2123
(H-Hs) mm	6.251	6.209	6.157	6.105	6.051	5.961	5.796
Voids ratio	0.504	0.501	0.496	0.492	0.488	0.481	0.467
t90 (min)							6.25
Cv (m ² /day)							0.016
k' (MPa)							12.792
Mv (mm ² / N)							0.0782

Trial #	29	30	31	32	33	34	35
Load (kPa)	525	775.0	1175.0	1750.0	875.0	440.0	220.0
Load (tsf)	5.46	8.060	12.220	18.200	9.100	4.576	2.288
Gauge Reading (in)	0.2025	0.1916	0.1789	0.1664	0.1682	0.1706	0.1748
(H-Hs) mm	5.547	5.269	4.948	4.629	4.676	4.737	4.844
Voids ratio	0.447	0.425	0.399	0.373	0.377	0.382	0.391
t90 (min)	8.70	8.70	6.25	5.76			
Cv (m ² /day)	0.011	0.011	0.015	0.016			
k' (MPa)	13.160	16.135	22.000	31.297			
Mv (mm ² / N)	0.0760	0.0620	0.0455	0.0320			

Trial #	36	37	38	39	40		
Load (kPa)	110	55.0	27.5	14.0	7.00		
Load (tsf)	1.144	0.572	0.286	0.146	0.073		
Gauge Reading (in)	0.1809	0.1863	0.1926	0.1978	0.2048		
(H-Hs) mm	4.997	5.134	5.296	5.428	5.606		
Voids ratio	0.403	0.414	0.427	0.438	0.452		
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-11**

Date

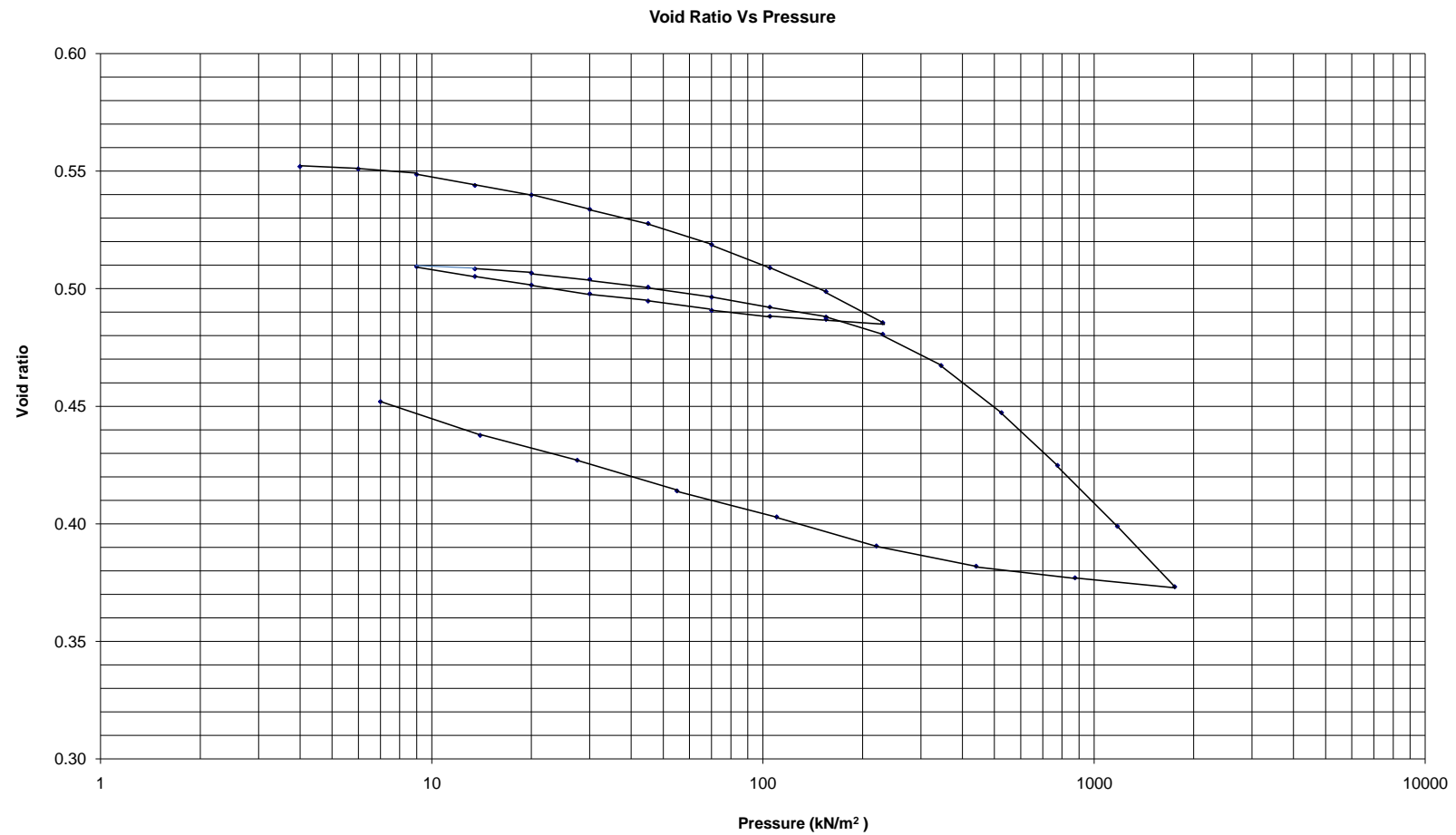
Aug 2012

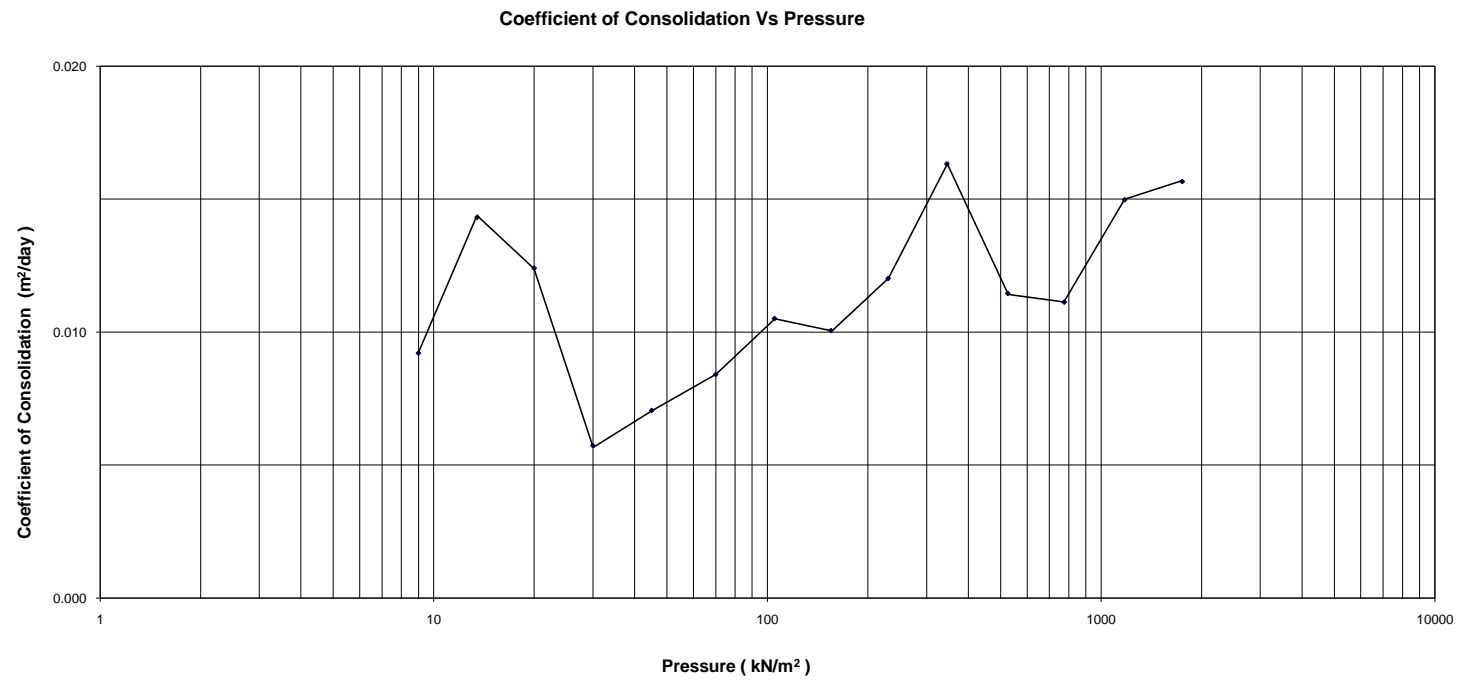
JOB NO

SW8801.1004.101

FIGURE NO.
C.10-B

REV





Strain Energy Data

Presssure Kn/m ²	C _v m ² /day	Void ratio
4.0		0.552
6.0		0.551
9.0	0.009	0.549
13.5	0.014	0.544
20.0	0.012	0.540
30.0	0.006	0.534
45.0	0.007	0.528
70.0	0.008	0.519
105.0	0.011	0.509
155.0	0.010	0.499
230.0	0.012	0.486
155.0		0.487
105.0		0.488
70.0		0.491
45.0		0.495
30.0		0.498
20.0		0.502
13.5		0.505
9.0		0.509
13.5		0.508
20.0		0.507
30.0		0.504
45.0		0.501
70.0		0.496
105.0		0.492
155.0		0.488
230.0		0.481
345.0	0.016	0.467
525.0	0.011	0.447
775.0	0.011	0.425
1175.0	0.015	0.399
1750.0	0.016	0.373
875.0		0.377
440.0		0.382
220.0		0.391
110.0		0.403
55.0		0.414
27.5		0.427
14.0		0.438
7.0		0.452

Presssure kN/m ²	Height mm	Total Work kJ/m ³
4.0	19.355	0.000
6.0	19.343	0.003
9.0	19.313	0.014
13.5	19.255	0.049
20.0	19.205	0.092
30.0	19.129	0.190
45.0	19.054	0.337
70.0	18.943	0.675
105.0	18.821	1.238
155.0	18.695	2.106
230.0	18.531	3.793
155.0	18.549	3.632
105.0	18.565	3.558
70.0	18.596	3.461
45.0	18.645	3.362
30.0	18.683	3.311
20.0	18.729	3.269
13.5	18.775	3.242
9.0	18.827	3.211
13.5	18.815	3.222
20.0	18.793	3.251
30.0	18.760	3.317
45.0	18.718	3.445
70.0	18.666	3.689
105.0	18.614	4.052
155.0	18.560	4.603
230.0	18.470	6.000
345.0	18.305	9.889
525.0	18.056	18.728
775.0	17.778	33.746
1175.0	17.457	60.179
1750.0	17.138	84.146
875.0	17.185	82.343
440.0	17.246	81.167
220.0	17.353	80.144
110.0	17.506	79.416
55.0	17.643	79.093
27.5	17.805	78.903
14.0	18.099	78.730
7.0	18.570	78.639

Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-11**

Date

Aug 2012

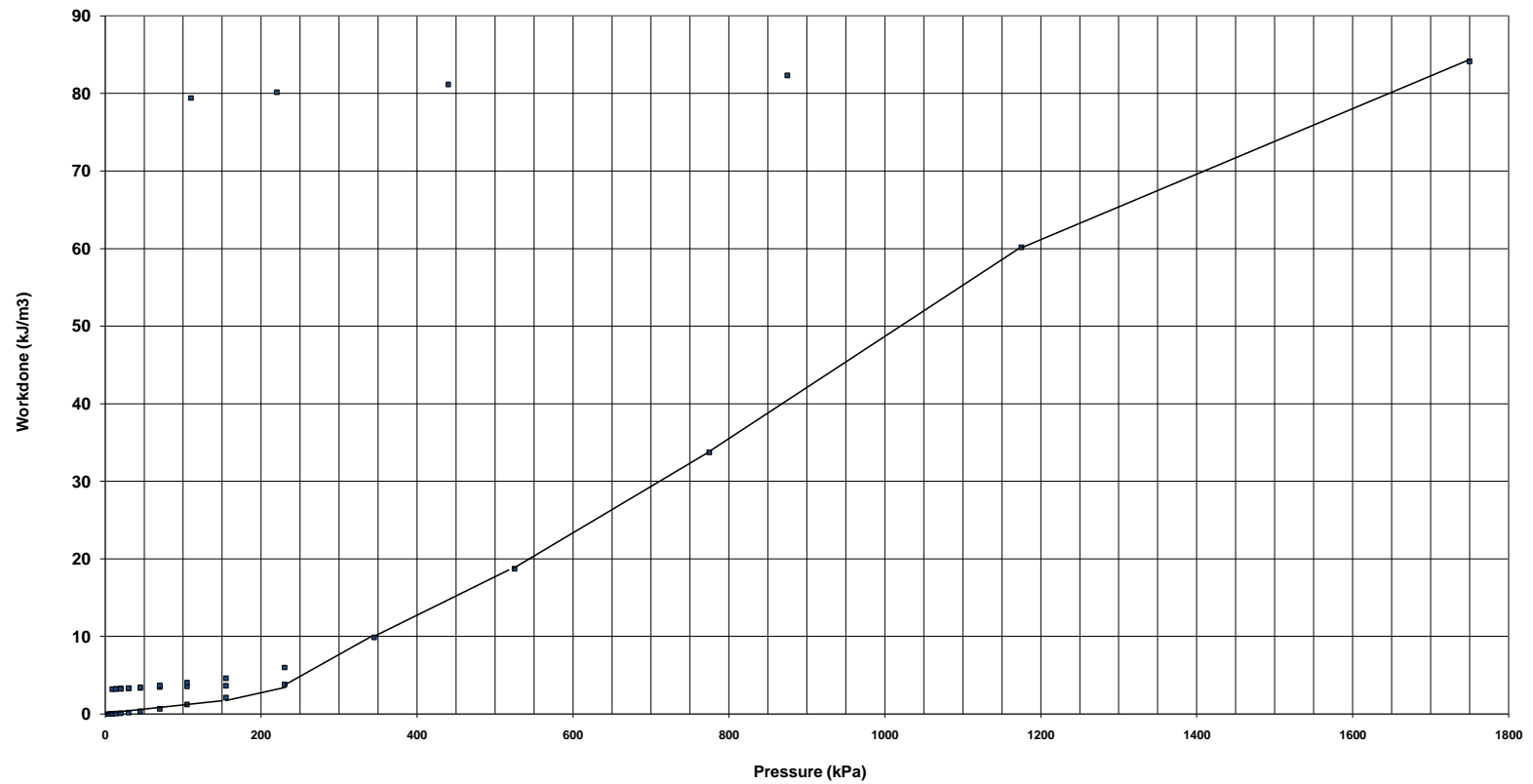
JOB NO

SW8801.1004.101

FIGURE NO.
C.10-E

REV

Strain Energy Method for Preconsolidation Pressure



**UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
ON COHESIVE SOILS (ASTM D-2850)**

Project: WEP
Client: Hatch Mott MacDonald Limited
Location: Windsor, ON.

Project No.: SW8801
Date: 20-May-11
Depth(m): 16.7 to 17.3

Sample ID: T11-2_Sa16

Sample Description: Silty Clay trace sand and gravel

Sample Parameters				
Initial		Specimen 1	Specimen 2	Specimen 3
Diameter	cm	6.970		
Height	cm	14.110		
Volume	cm ³	538.372		
Wet Mass	g	1108.10		
Dry Density	kg/m ³	1641		
Water Content	%	25.4		
Specific Gravity	Assumed	2.720		
Void Ratio		0.66		
Degree of Saturation		105.1		
Before Shear (after consolidation)				
Volume	cm ³	538.372		
B - Value		0.98		
After Shear				
Wet Mass	g	1108.10		
Dry Density	kg/m ³	1645		
Water Content	%	25.1		
Void Ratio		0.65		
Degree of Saturation		100.0		
Stress - Strain				
Cell Pressure	kPa	465.00		
Back Pressure	kPa	190.00		
Consolidation Stress	kPa	275.00		
Rate of Strain	mm/min	0.2000		
Vertical Strain at Failure	%	14.89		
Deviator Stress at Failure	kPa	59.14		
Pore Pressure at Failure	kPa	250.40		
Total Stress				
Minor Principal Stress, σ_3	kPa	275.00		
Major Principal Stress, σ_1	kPa	334.14		
Radius, $(\sigma_1 - \sigma_3)/2$	kPa	29.57		
Intersection Point, $(\sigma_1 + \sigma_3)/2$	kPa	304.57		
Effective Stress				
Minor Principal Stress, σ_3'	kPa	24.60		
Major Principal Stress, σ_1'	kPa	83.74		
Radius, $(\sigma_1' - \sigma_3')/2$	kPa	29.57		
Intersection Point, $(\sigma_1' + \sigma_3')/2$	kPa	54.17		



Project

WINDSOR ESSEX PARKWAY

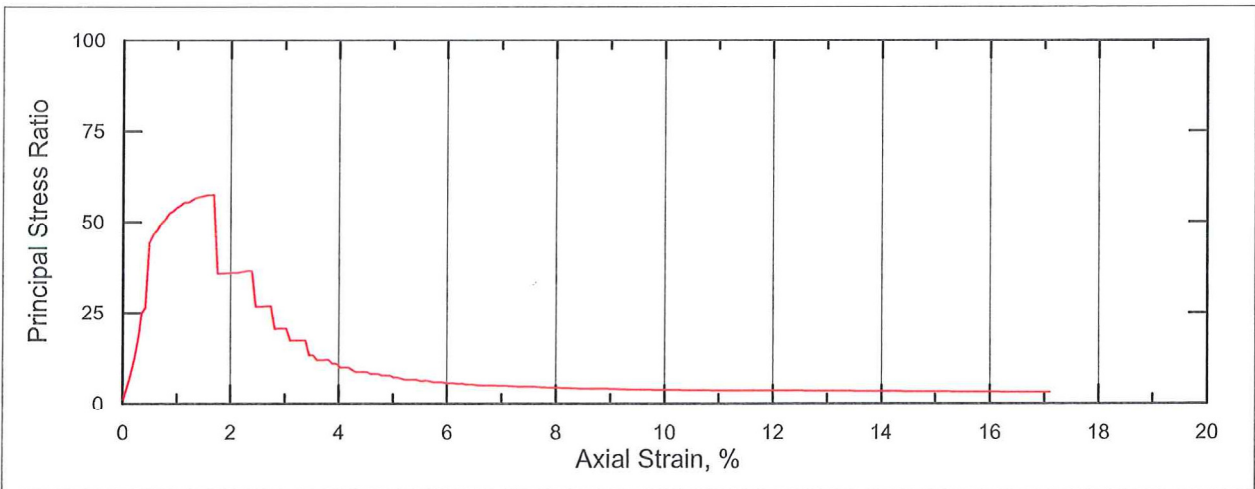
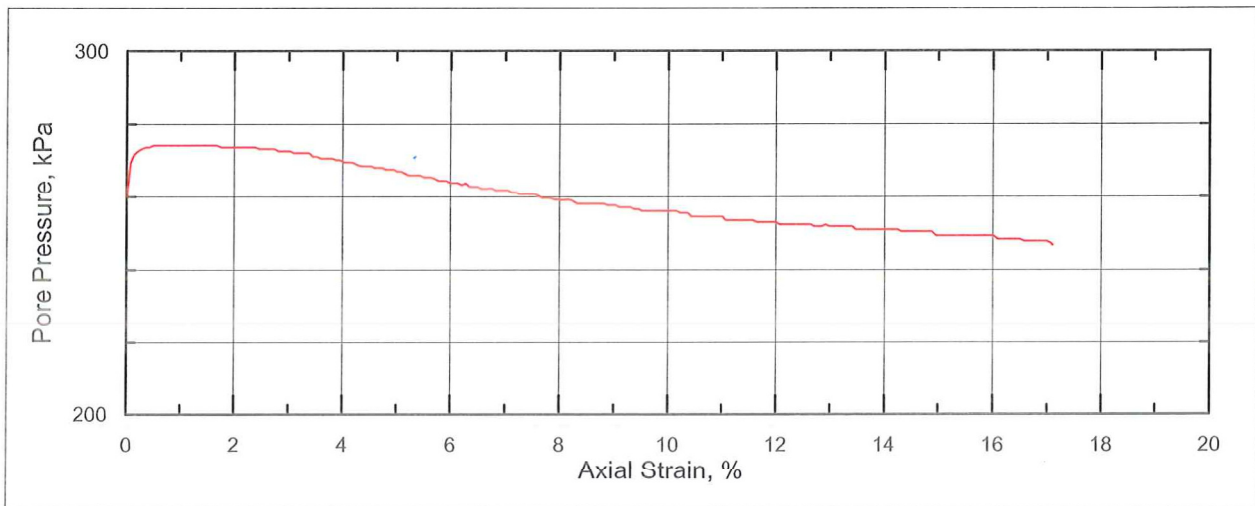
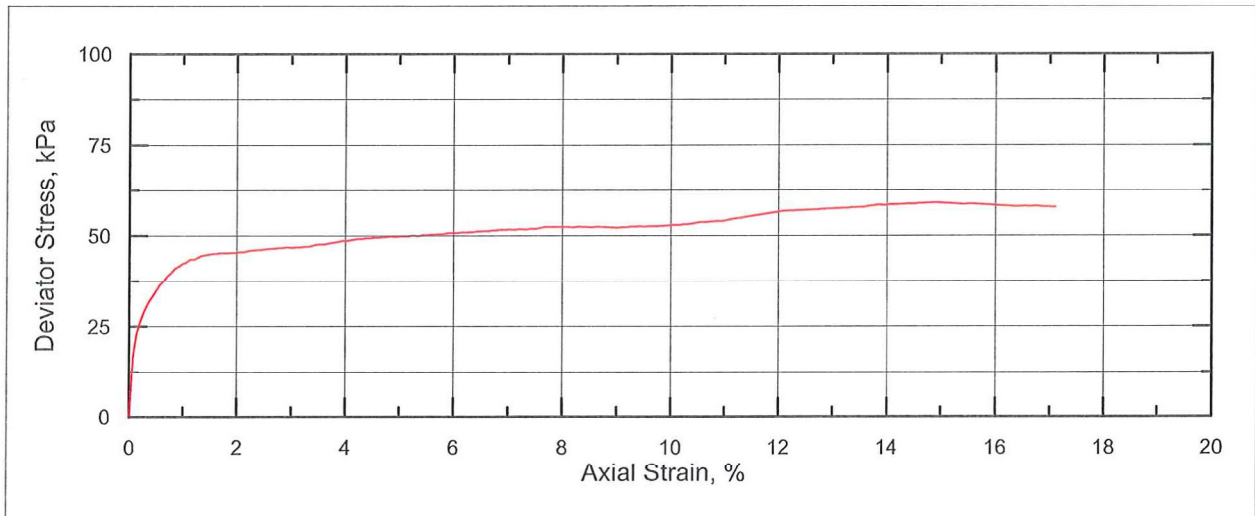
TITLE UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
TUNNEL T-11

Date
Aug 2012

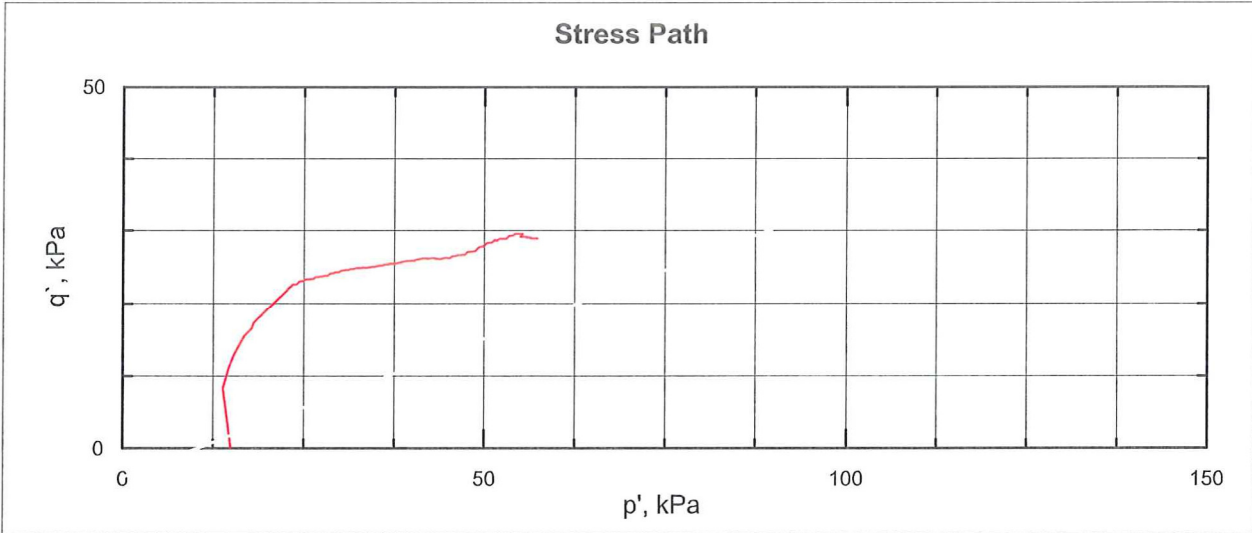
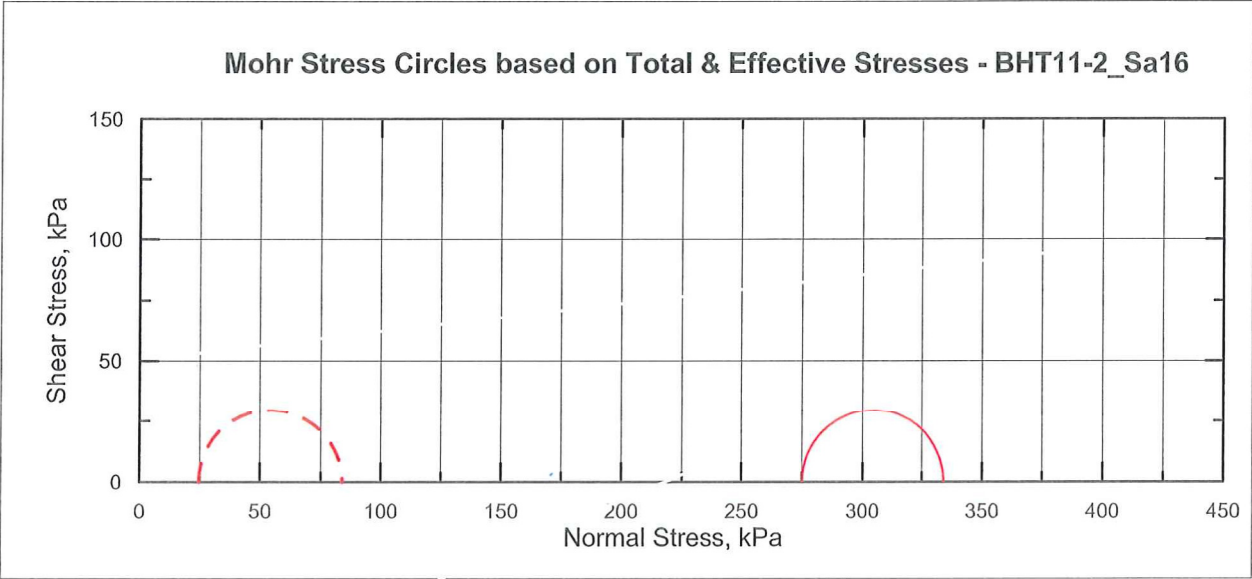
JOB NO
SW8801.1004.101

FIGURE NO.
C.11-A

REV



— BH T11-2_Sa16 (275 kPa)



— BHT11-2_Sa16 (275 kPa)

NOTE:
Failure based on maximum deviator stress

**UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
ON COHESIVE SOILS (ASTM D-2850)**

Project: WEP
Client: Hatch Mott MacDonald Limited
Location: Windsor, ON.

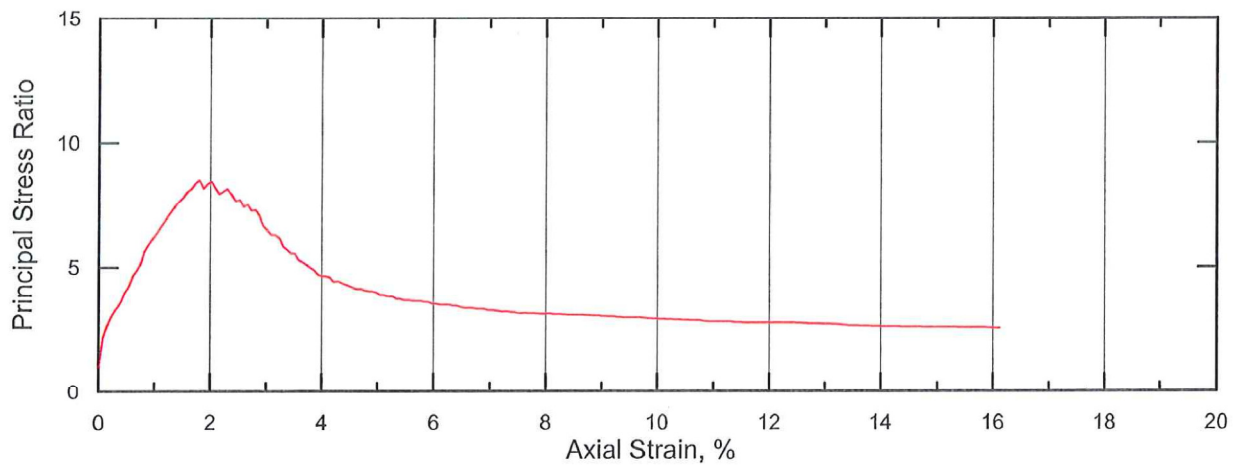
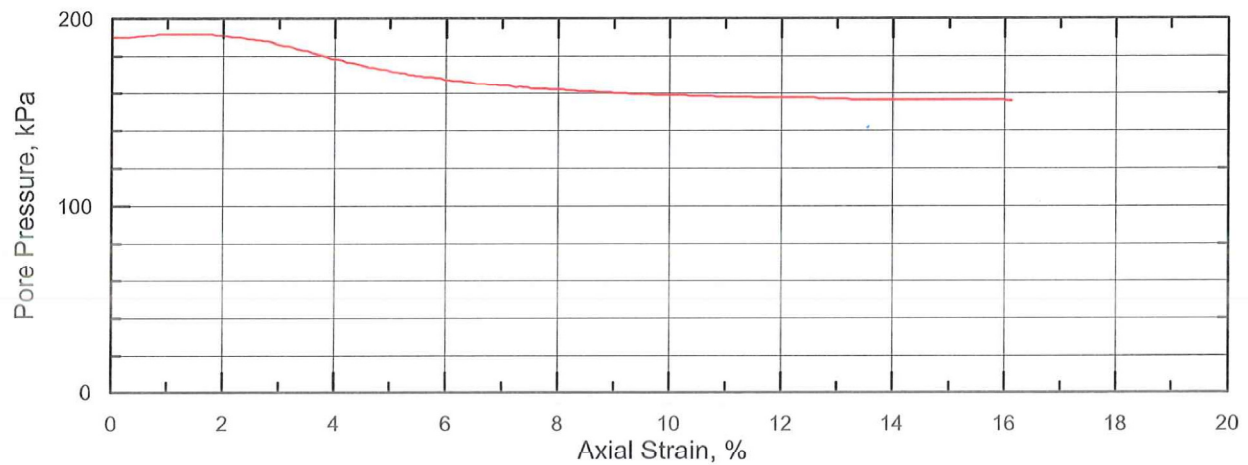
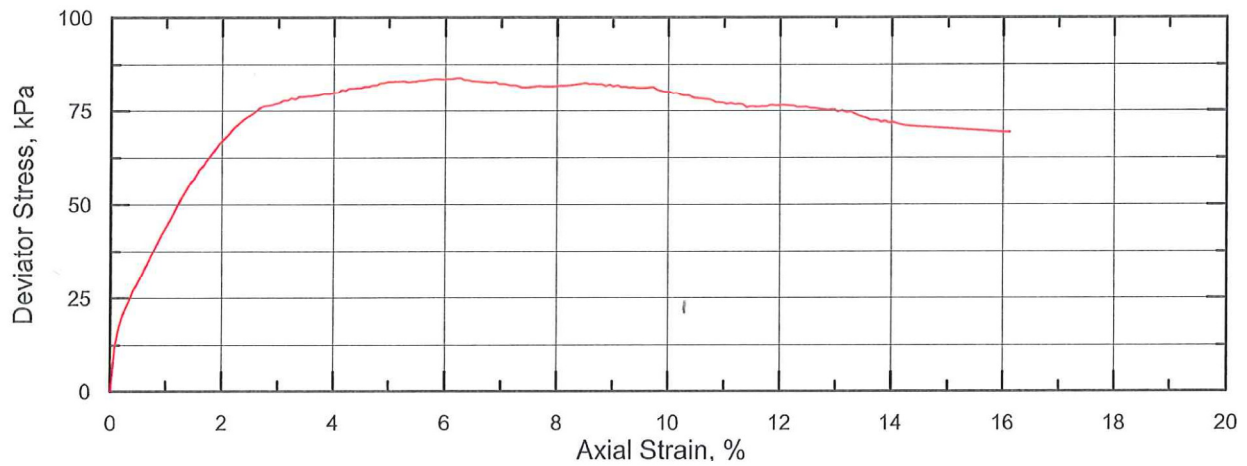
Project No. SW8801
Date: 23-May-11
Depth(m): 12.2 to 12.8
Sample ID: T11-3_Sa12

Sample Description: Silty Clay trace sand and gravel

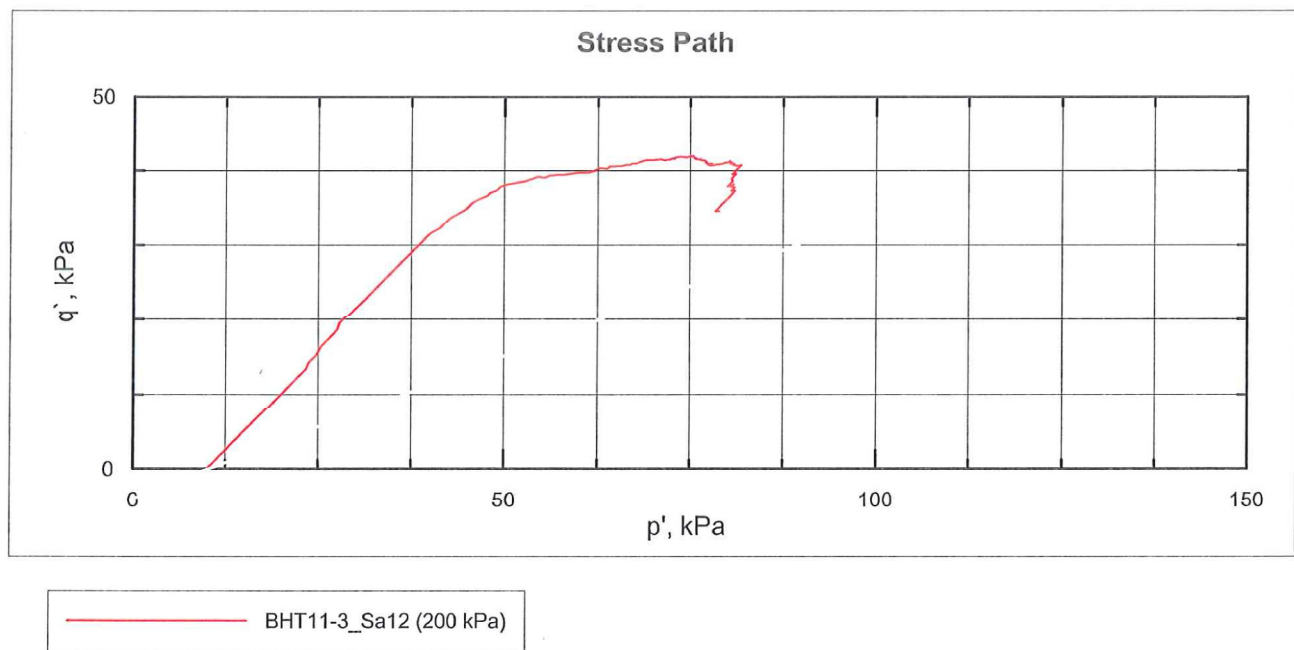
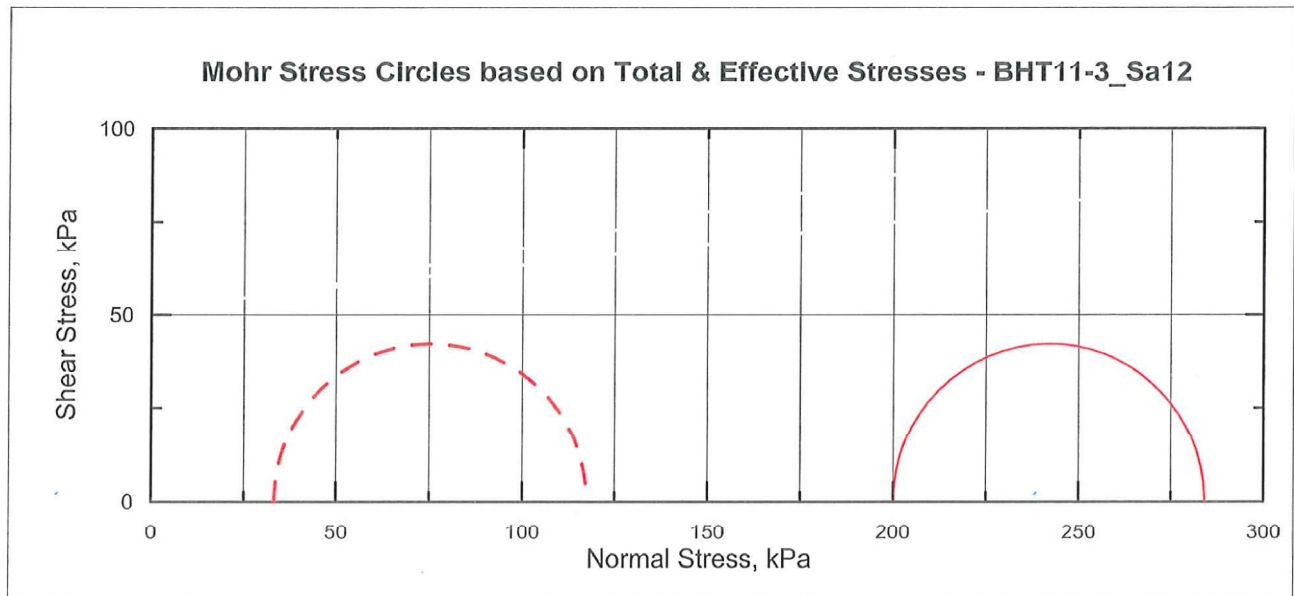
Sample Parameters				
Initial		Specimen 1	Specimen 2	Specimen 3
Diameter	cm	6.989		
Height	cm	14.105		
Volume	cm ³	541.119		
Wet Mass	g	1166.35		
Dry Density	kg/m ³	1820		
Water Content	%	18.4		
Specific Gravity	Assumed	2.720		
Void Ratio		0.49		
Degree of Saturation		101.3		
Before Shear (after consolidation)				
Volume	cm ³	541.119		
B - Value		N/A		
After Shear				
Wet Mass	g	1194.00		
Dry Density	kg/m ³	1857		
Water Content	%	18.8		
Void Ratio		0.46		
Degree of Saturation		100.0		
Stress - Strain				
Cell Pressure	kPa	440.00		
Back Pressure	kPa	240.00		
Consolidation Stress	kPa	200.00		
Rate of Strain	mm/min	0.1000		
Vertical Strain at Failure	%	6.27		
Deviator Stress at Failure	kPa	83.99		
Pore Pressure at Failure	kPa	166.70		
Total Stress				
Minor Principal Stress, σ_3	kPa	200.00		
Major Principal Stress, σ_1	kPa	283.99		
Radius, $(\sigma_1 - \sigma_3)/2$	kPa	41.99		
Intersection Point, $(\sigma_1 + \sigma_3)/2$	kPa	241.99		
Effective Stress				
Minor Principal Stress, σ_3'	kPa	33.30		
Major Principal Stress, σ_1'	kPa	117.29		
Radius, $(\sigma_1' - \sigma_3')/2$	kPa	41.99		
Intersection Point, $(\sigma_1' + \sigma_3')/2$	kPa	75.29		



Project WINDSOR ESSEX PARKWAY			
TITLE UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST TUNNEL T-11			
Date Aug 2012	JOB NO SW8801.1004.101	FIGURE NO. C.12-A	REV



— BH T11-3_Sa12 (200 kPa)



NOTE:
Failure based on maximum deviator stress



AMEC EARTH & ENVIRONMENTAL-
WINDSOR
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 15-AUG-11
Report Date: 22-AUG-11 08:21 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #: L1044361
Project P.O. #: NOT SUBMITTED
Job Reference: SW8801.1004.101
C of C Numbers: 112846
Legal Site Desc:

Gayle Braun
Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1044361-1	L1044361-2			
		Description	SOIL	SOIL			
		Sampled Date	12-AUG-11	12-AUG-11			
		Sampled Time					
		Client ID	TB1-1, SS8@20', GREY, SILTY CLAY	TB1-2, SS6@15', GREY, SILTY CLAY			
Grouping	Analyte						
SOIL							
Physical Tests	% Moisture (%)	13.8	19.9				
	pH (pH units)	7.85	7.84				
	Redox Potential (mV)	165	188				
	Resistivity (ohm cm)	2220	1860				
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20	<0.20				
Anions and Nutrients	Sulphate (mg/kg)	501	689				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
EXTEMP	Samples Received with temperature >15 Degrees C

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

112846

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1044361

Report Date: 22-AUG-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL-WINDSOR

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
Soil								
Batch	R2234766							
WG1330199-2	LCS							
% Moisture			94		%		70-130	15-AUG-11
Batch	R2234766							
WG1330199-1	MB							
% Moisture			<0.10		%		0.1	15-AUG-11
PH-WT								
Soil								
Batch	R2235381							
WG1331381-1	CVS							
pH			100		%		80-120	16-AUG-11
REDOX-POTENTIAL-WT								
Soil								
Batch	R2238000							
WG1334285-1	DUP	L1044361-1						
Redox Potential		165	162		mV	1.8	25	19-AUG-11
RESISTIVITY-WT								
Soil								
Batch	R2238001							
WG1334286-1	CVS							
Resistivity			99		%		70-130	19-AUG-11
Batch	R2238001							
WG1334286-2	DUP	L1044361-1						
Resistivity		2220	2210		ohm cm	0.44	25	19-AUG-11
SO4-WT								
Soil								
Batch	R2236478							
WG1332024-3	LCS							
Sulphate			101		%		60-140	17-AUG-11
Batch	R2236478							
WG1332024-1	MB							
Sulphate			<20		mg/kg		20	17-AUG-11
SULPHIDE-WT								
Soil								
Batch	R2236612							
WG1332830-1	CVS							
Sulphide			106		%		50-120	18-AUG-11
Batch	R2236612							
WG1332826-2	DUP	L1044361-1						
Sulphide		<0.20	<0.20	RPD-NA	mg/kg	N/A	20	18-AUG-11
Batch	R2236612							
WG1332826-1	MB							
Sulphide			<0.20		mg/kg		0.2	18-AUG-11

Quality Control Report

Workorder: L1044361

Report Date: 22-AUG-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1044361

Report Date: 22-AUG-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	12-AUG-11	19-AUG-11 20:23	24	176	hours	EHTR
	2	12-AUG-11	19-AUG-11 20:25	24	176	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1044361 were received on 15-AUG-11 09:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



ALS

112846
C of C # 00000

Notes

1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 13-JUL-11
Report Date: 19-JUL-11 13:47 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #:	L1030695
Project P.O. #:	NOT SUBMITTED
Job Reference:	SW8801.1004.101
Legal Site Desc:	
C of C Numbers:	092959

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1030695-1	L1030695-2			
		Description	SOIL	SOIL			
		Sampled Date	06-JUL-11	06-JUL-11			
		Sampled Time					
		Client ID	TB2-1 SA#10	TB2-2 SA#10			
Grouping	Analyte						
SOIL							
Physical Tests	% Moisture (%)		20.5	19.5			
	pH (pH units)		7.99	7.95			
	Redox Potential (mV)		176	146			
	Resistivity (ohm cm)		2490	2690			
Leachable Anions & Nutrients	Sulphide (mg/kg)		<0.20	<0.20			
Anions and Nutrients	Sulphate (mg/kg)		338	292			

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092959

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

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Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1030695

Report Date: 19-JUL-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
Soil								
Batch	R2218341							
WG1311854-2	LCS							
% Moisture			93		%		70-130	13-JUL-11
WG1311854-1	MB							
% Moisture			<0.10		%		0.1	13-JUL-11
PH-WT								
Soil								
Batch	R2220797							
WG1315023-1	CVS							
pH			99		%		80-120	19-JUL-11
WG1315023-2	DUP	L1030695-1						
pH		7.99	8.07		pH units	1.0	20	19-JUL-11
REDOX-POTENTIAL-WT								
Soil								
Batch	R2220849							
WG1315031-1	DUP	L1030695-1						
Redox Potential		176	170		mV	3.5	25	19-JUL-11
RESISTIVITY-WT								
Soil								
Batch	R2220855							
WG1315028-1	CVS							
Resistivity			99		%		70-130	19-JUL-11
WG1315028-2	DUP	L1030695-1						
Resistivity		2490	2510		ohm cm	1.0	25	19-JUL-11
SO4-WT								
Soil								
Batch	R2219765							
WG1312668-2	DUP	L1030695-1						
Sulphate		338	338		mg/kg	0.11	30	15-JUL-11
WG1312668-3	LCS							
Sulphate			103		%		60-140	15-JUL-11
WG1312668-1	MB							
Sulphate			<20		mg/kg		20	15-JUL-11
SULPHIDE-WT								
Soil								
Batch	R2218729							
WG1312664-1	CVS							
Sulphide			106		%		50-120	14-JUL-11
WG1312662-2	DUP	L1030695-1						
Sulphide		<0.20	<0.20	RPD-NA	mg/kg	N/A	20	14-JUL-11
WG1312662-1	MB							
Sulphide			<0.20		mg/kg		0.2	14-JUL-11

Quality Control Report

Workorder: L1030695

Report Date: 19-JUL-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1030695

Report Date: 19-JUL-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	06-JUL-11	19-JUL-11 14:04	24	314	hours	EHTR
	2	06-JUL-11	19-JUL-11 14:06	24	314	hours	EHTR
Resistivity	1	06-JUL-11	19-JUL-11 14:24	7	13	days	EHTL
	2	06-JUL-11	19-JUL-11 14:26	7	13	days	EHTL
Leachable Anions & Nutrients							
Sulphide	1	06-JUL-11	14-JUL-11 15:45	7	8	days	EHTL
	2	06-JUL-11	14-JUL-11 15:47	7	8	days	EHTL

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.

Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1030695 were received on 13-JUL-11 10:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-5047
CANADA TOLL FREE: 1-800-668-9878



ALS Environmental

COMPANY NAME: Amel Exl

OFFICE: Windsor

PROJECT MANAGER: Shane Morland

PROJECT: Shore Morland

PHONE: 519 735-2199 FAX: 519 735-9669

ACCOUNT: 028643 POB

QUOTATION: 028643

SAMPLE DATE/TIME

DATE (dd-mm-yy)

TIME (hh:mm)

TYPE

MATRIX

OTHER

SOIL

WATER

COMB

DATE

TIME

TYPE

MATRIX

OTHER

SOIL

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DATE

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CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

C of C # 092959 PAGE OF

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Criteria on report Yes ☐ No ☐

Reg 153/04

Table 1 2 3

TCLP MISA PWOC

ODWS OTHER

REPORT FORMAT / DISTRIBUTION

EMAIL FAX BOTH

SELECT: PDF DIGITAL BOTH

EMAIL 1 Shane Morland@Amel.com

EMAIL 2

SAMPLE DESCRIPTION TO APPEAR ON REPORT

TB 2-1 Sa#10

TB 2-2 Sa#10

Specify date required

Service requested

5 day (Frigidifier)

3-4 day TAT (25%)

2 day TAT (50%)

Next day TAT (100%)

Same day TAT (200%)

PLEASE INDICATE FILTERED, PRESERVED OR BOTH

☐ (F, P, F/C)

SUBMISSION #

L1030695

ENTERED BY

BB

DATE/TIME ENTERED:

13 July 11

BIN #

NUMBER OF CONTAINERS

1

1

CRITERIA

Reg 153/04

Table 1

2

3

TCLP

MISA

PWOC

ODWS

OTHER

REPORT FORMAT / DISTRIBUTION

EMAIL

FAX

BOTH

SELECT: PDF

DIGITAL

BOTH

EMAIL 1

Shane Morland@Amel.com

EMAIL 2

SAMPLE DESCRIPTION TO APPEAR ON REPORT

TB 2-1 Sa#10

TB 2-2 Sa#10

THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)

Are any samples taken from a regulated DW System?

Yes ☒ No ☐

If yes, an authorized drinking water COC MUST be used for this submission.

Is the water sampled intended to be potable for human consumption?

Yes ☒ No ☐

MEAN TEMP

10.3

COOLING INITIATED

AMBIENT

OBSERVATIONS

Yes ☐ No ☐

Yes add SIF

13-Jul-11 10:30

DATE & TIME

RECEIVED BY:

DATE & TIME

13-Jul-11 10:30

RECEIVED AT LAB BY:

DATE & TIME

13-Jul-11 10:30

NOTES AND CONDITIONS:

1. Quote number must be provided to ensure proper pricing.

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.

3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

White - Report copy

YELLOW - File copy

PINK - Customer copy

07/13/2011 14:29

To: London Office

07/13/2011 13:27

Fax Station: ALS LABORATORY GROUP-LONDON

Received Fax: 13 Jul 2011 13:27

Page 1



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 18-JUL-11
Report Date: 25-JUL-11 15:02 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #:	L1032538
Project P.O. #:	NOT SUBMITTED
Job Reference:	SW8801.1004.101
Legal Site Desc:	
C of C Numbers:	092959-F

Gayle Braun
Senior Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1032538-1	BHTB4-1,SS10@30' GREY SILTY CLAY							
Sampled By:	CLIENT on 15-JUL-11							
Matrix:	SOIL							
Physical Tests								
% Moisture		23.0		0.10	%	18-JUL-11	18-JUL-11	R2220531
pH		8.15		0.10	pH units	22-JUL-11	22-JUL-11	R2223567
Redox Potential		118		-1000	mV	22-JUL-11	22-JUL-11	R2223536
Resistivity		1850		100	ohm cm	22-JUL-11	22-JUL-11	R2223537
Leachable Anions & Nutrients								
Sulphide		<0.20		0.20	mg/kg	21-JUL-11	21-JUL-11	R2222299
Anions and Nutrients								
Sulphate		572		20	mg/kg	20-JUL-11	20-JUL-11	R2222247

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092959-F

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

#052 P.005/009

07/18/2011 11:05

To: London Office

From:

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
CANADA TOLL FREE: 1-800-668-9878



CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

C of C # 092959-F
PAGE 1 OF 1

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required	Service requested	2 day TAT (50%)
	5 day (Regular)	<input checked="" type="checkbox"/> Next day TAT (100%)
	3-4 day TAT (25%)	<input type="checkbox"/> Same day TAT (200%)

COMPANY NAME **Amel E+I**

OFFICE **Windsor**

PROJECT MANAGER

Shane MacLeod

PROJECT # **SW8601:1004,101**

PHONE **519 735-2499** FAX **519 735-9669**

ACCOUNT #

QUOTATION # **Q28643** POS

SAMPLING INFORMATION

Sample Date/Time	TYPE	MATRIX
Date (dd-mm-yy)	Time (24 hr) (hh:mm)	COMP GRAB WATER SOIL OTHER
5/07/11		X

CRITERIA

Criteria on report: Yes ☐ No ☐

Reg 153/04

Table 1 2 3

TCLP MISA PWOO

ODWS OTHER

REPORT FORMAT / DISTRIBUTION

EMAIL ☒ FAX BOTH

SELECT: PDF DIGITAL BOTH

EMAIL1 **Shane.MacLeod@Amel.com**

EMAIL2

SAMPLE DESCRIPTION TO APPEAR ON REPORT

B1 TB4-1, 5010@50' grey silty clay

NUMBER OF CONTAINERS

Corrosion Package

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH
☐ (F, P, F/P)

SUBMISSION #

L1032538

ENTERED BY:

PStaShay

DATE/TIME ENTERED:

15-July 11

BIN #

COMMENTS

LAB ID

-1

SPECIAL INSTRUCTIONS/COMMENTS

THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)

Are any samples taken from a regulated DW System? Yes ☐ No ☒
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ☐ No ☒

SAMPLE CONDITION

FROZEN <input type="checkbox"/>	MEAN TEMP
COLD <input type="checkbox"/>	
COOLING INITIATED <input checked="" type="checkbox"/>	22.90°C
AMBIENT <input checked="" type="checkbox"/>	

SAMPLED BY:

DATE & TIME

RECEIVED BY:

DATE & TIME

RELINQUISHED BY:

DATE & TIME

RECEIVED AT LAB BY: **AKP**

DATE & TIME

OBSERVATIONS
Yes ☐ No ☐
If yes add SIF

INIT

DSF

NOTES AND CONDITIONS:

1. Quote number must be provided to ensure proper pricing.

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.

3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

White - Report copy

YELLOW - File copy

PINK - Customer copy

See COC Form 4.00



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 13-JUL-11
Report Date: 19-JUL-11 13:49 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #:	L1030720
Project P.O. #:	NOT SUBMITTED
Job Reference:	SW8801.1004.101
Legal Site Desc:	
C of C Numbers:	092959

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1030720-1 SOIL 07-JUL-11 TB4-2 SA#10				
Grouping	Analyte					
SOIL						
Physical Tests	% Moisture (%)	20.1				
	pH (pH units)	7.98				
	Redox Potential (mV)	154				
	Resistivity (ohm cm)	2340				
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20				
Anions and Nutrients	Sulphate (mg/kg)	403				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092959

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1030720

Report Date: 19-JUL-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
	Soil							
Batch	R2218341							
WG1311854-2	LCS							
% Moisture			93		%		70-130	13-JUL-11
WG1311854-1	MB							
% Moisture			<0.10		%		0.1	13-JUL-11
PH-WT								
	Soil							
Batch	R2220797							
WG1315023-1	CVS							
pH			99		%		80-120	19-JUL-11
RESISTIVITY-WT								
	Soil							
Batch	R2220855							
WG1315028-1	CVS							
Resistivity			99		%		70-130	19-JUL-11
SO4-WT								
	Soil							
Batch	R2219765							
WG1312668-3	LCS							
Sulphate			103		%		60-140	15-JUL-11
WG1312668-1	MB							
Sulphate			<20		mg/kg		20	15-JUL-11
SULPHIDE-WT								
	Soil							
Batch	R2218729							
WG1312664-1	CVS							
Sulphide			106		%		50-120	14-JUL-11
WG1312662-1	MB							
Sulphide			<0.20		mg/kg		0.2	14-JUL-11

Quality Control Report

Workorder: L1030720

Report Date: 19-JUL-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1030720

Report Date: 19-JUL-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	07-JUL-11	19-JUL-11 14:09	24	290	hours	EHTR
Resistivity	1	07-JUL-11	19-JUL-11 14:29	7	12	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.

Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1030720 were received on 13-JUL-11 10:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM



60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B3
Phone: (519) 886-6910
Fax: (519) 886-8047
CANADA TOLL FREE: 1-800-669-8878

ALS Environmental

COMPANY NAME Amel E+I		CRITERIA Reg 15304 Table 1 2 3		Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.		Specify date required 5 day (Regular) <input checked="" type="checkbox"/> 3-4 day TAT (25%) <input type="checkbox"/> 2 day TAT (50%) <input type="checkbox"/> Next day TAT (100%) <input type="checkbox"/> Same day TAT (200%) <input type="checkbox"/>	
OFFICE Shore Macleod		PROJECT Shore Macleod		ANALYSIS REQUEST		PLEASE INDICATE FILTERED, PRESERVED OR BOTH <input type="checkbox"/> (F, P, F/P)	
PROJECT # 506801004101		TCLP MISA		SUBMISSION # L1030720		ENTERED BY: BB	
PHONE 519 735-2449		ODWS OTHER		DATE/TIME ENTERED 13 July 11		GIN #	
ACCOUNT # 228643		REPORT FORMAT / DISTRIBUTION EMAIL <input checked="" type="checkbox"/> FAX <input type="checkbox"/> BOTH <input type="checkbox"/> SELECT: PDF <input type="checkbox"/> DIGITAL <input type="checkbox"/> BOTH <input type="checkbox"/> EMAIL1 Shore.Macleod@Amel.com EMAIL2		NUMBER OF CONTAINERS		COMMENTS	
QUOTATION # 228643		SAMPLE DESCRIPTION TO APPEAR ON REPORT TB 4-2 50410		LAB ID		LAB ID	
SAMPLING INFORMATION		SPECIAL INSTRUCTIONS/COMMENTS		THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)		SAMPLE CONDITION	
Sample Date/Time	TYPE	MATRIX		Are any samples taken from a regulated DW System? If yes, an authorized drinking water COC MUST be used for this submission.	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	FROZEN <input type="checkbox"/>	MEAN TEMP
Date (dd-mm-yy)	Time (24 hr) (hh-mm)	WATER		Is the water sampled intended to be potable for human consumption?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	COLD <input type="checkbox"/>	18.30C
July 7		SOIL				COOLING INITIATED <input type="checkbox"/>	
		OTHER				AMBIENT <input type="checkbox"/>	
						OBSERVATIONS	
						Yes <input type="checkbox"/> No <input type="checkbox"/>	
						If Yes add SIF	
SAMPLER BY: TA		DATE & TIME 3 July 11		RECEIVED BY: Shore Macleod		DATE & TIME 13 July 11 10:30	
RELINQUISHED BY:		DATE & TIME		DATE & TIME		DATE & TIME	
NOTES AND CONDITIONS:							
1. Quota number: must be provided to ensure proper pricing.							
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TAT's.							
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.							

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DATE FOR BENCH



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 13-JUL-11
Report Date: 19-JUL-11 13:48 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #:	L1030717
Project P.O. #:	NOT SUBMITTED
Job Reference:	SW8801.1004.101
Legal Site Desc:	
C of C Numbers:	092959

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L1030717-1 SOIL 06-JUL-11 TB5-1 SA#10				
Grouping	Analyte						
SOIL							
Physical Tests	% Moisture (%)	17.2					
	pH (pH units)	7.80					
	Redox Potential (mV)	152					
	Resistivity (ohm cm)	2330					
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20					
Anions and Nutrients	Sulphate (mg/kg)	370					

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092959

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1030717

Report Date: 19-JUL-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
	Soil							
Batch	R2218341							
WG1311854-2	LCS							
% Moisture			93		%		70-130	13-JUL-11
WG1311854-1	MB							
% Moisture			<0.10		%		0.1	13-JUL-11
PH-WT								
	Soil							
Batch	R2220797							
WG1315023-1	CVS							
pH			99		%		80-120	19-JUL-11
RESISTIVITY-WT								
	Soil							
Batch	R2220855							
WG1315028-1	CVS							
Resistivity			99		%		70-130	19-JUL-11
SO4-WT								
	Soil							
Batch	R2219765							
WG1312668-3	LCS							
Sulphate			103		%		60-140	15-JUL-11
WG1312668-1	MB							
Sulphate			<20		mg/kg		20	15-JUL-11
SULPHIDE-WT								
	Soil							
Batch	R2218729							
WG1312664-1	CVS							
Sulphide			106		%		50-120	14-JUL-11
WG1312662-1	MB							
Sulphide			<0.20		mg/kg		0.2	14-JUL-11

Quality Control Report

Workorder: L1030717

Report Date: 19-JUL-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1030717

Report Date: 19-JUL-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	06-JUL-11	19-JUL-11 14:08	24	314	hours	EHTR
Resistivity	1	06-JUL-11	19-JUL-11 14:28	7	13	days	EHTL
Leachable Anions & Nutrients							
Sulphide	1	06-JUL-11	14-JUL-11 15:49	7	8	days	EHTL

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1030717 were received on 13-JUL-11 10:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

#036 P.003/010

07/13/2011 14:31

To: London Office

From:

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-8047
CANADA TOLL FREE: 1-800-663-9878



CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

C of C # 092959
PAGE 1 OF 1

Note: all TAT Quoted material is in business days which exclude
statutory holidays and weekends. TAT samples received past
3:00 pm or Saturday/Sunday begin the next day.

Specify date required	Service requested	2 day TAT (50%)
	5 day (Regular)	<input checked="" type="checkbox"/> Next day TAT (100%)
	3-4 day TAT (25%)	Same day TAT (200%)

COMPANY NAME		CRITERIA		ANALYSIS REQUEST	PLEASE INDICATE FILTERED, PRESERVED OR BOTH (F, P, F/P)
Amel E+I		Criteria on report Yes <input type="checkbox"/> No <input type="checkbox"/>			
OFFICE Windsor		Reg 153/04		SUBMISSION # L1030717 ENTERED BY [Signature] DATE/TIME ENTERED: 13 July 11 BIN #	
PROJECT MANAGER Shane Macleod		Table 1 2 3			
PROJECT # SW8801.1004.101		TCLP MISA PWQO			
PHONE 519-735-2499 FAX 519-735-9669		ODWS OTHER			
ACCOUNT		REPORT FORMAT / DISTRIBUTION			
QUOTATION: Q28643 PO:		EMAIL <input checked="" type="checkbox"/> FAX BOTH			
		SELECT: PDF DIGITAL BOTH			
		EMAIL1 Shane.Macleod@Amel.com			
		EMAIL2			
		SAMPLE DESCRIPTION TO APPEAR ON REPORT			
SAMPLING INFORMATION		NUMBER OF CONTAINERS		COMMENTS LAB ID	
Sample Date/Time	TYPE	MATRIX			
Date (dd-mm-yy)	Time (24 hr) (hh:mm)	CONP GRAB WATER SOIL OTHER			
July 6, 11		X	TB 5-1 S#10		
SPECIAL INSTRUCTIONS/COMMENTS		THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)		SAMPLE CONDITION	
		Are any samples taken from a regulated DW System? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		FROZEN <input type="checkbox"/> MEAN TEMP	
		If yes, an authorized drinking water COC MUST be used for this submission.		COLD <input type="checkbox"/>	
		Is the water sampled intended to be potable for human consumption? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		COOLING INITIATED <input type="checkbox"/>	
				AMBIENT <input type="checkbox"/>	
SAMPLED BY:		DATE & TIME	RECEIVED BY:	DATE & TIME	OBSERVATIONS
RELINQUISHED BY:		DATE & TIME	RECEIVED AT LAB BY:	DATE & TIME	Yes <input type="checkbox"/> No <input type="checkbox"/> If yes add SIF
NOTES AND CONDITIONS:		1. Quote number must be provided to ensure proper pricing.		2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.	
		3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.			

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BAC COC Rev 4.00



AMEC EARTH & ENVIRONMENTAL-
WINDSOR

ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 15-AUG-11
Report Date: 22-AUG-11 08:21 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #: L1044365
Project P.O. #: NOT SUBMITTED
Job Reference: SW8801.1004.101
C of C Numbers: 112848
Legal Site Desc:

Gayle Braun
Senior Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1044365-1 SOIL 12-AUG-11 TB5-2, SA#10@30' GREY, SILTY CLAY				
Grouping	Analyte					
SOIL						
Physical Tests	% Moisture (%)	17.8				
	pH (pH units)	7.98				
	Redox Potential (mV)	164				
	Resistivity (ohm cm)	2350				
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20				
Anions and Nutrients	Sulphate (mg/kg)	609				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
EXTEMP	Samples Received with temperature >15 Degrees C

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

112848

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1044365

Report Date: 22-AUG-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL-WINDSOR

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT	Soil							
Batch	R2234766							
WG1330199-2	LCS							
% Moisture			94		%		70-130	15-AUG-11
WG1330199-1	MB							
% Moisture			<0.10		%		0.1	15-AUG-11
PH-WT	Soil							
Batch	R2235381							
WG1331381-1	CVS							
pH			100		%		80-120	16-AUG-11
RESISTIVITY-WT	Soil							
Batch	R2238001							
WG1334286-1	CVS							
Resistivity			99		%		70-130	19-AUG-11
SO4-WT	Soil							
Batch	R2236478							
WG1332024-3	LCS							
Sulphate			101		%		60-140	17-AUG-11
WG1332024-1	MB							
Sulphate			<20		mg/kg		20	17-AUG-11
SULPHIDE-WT	Soil							
Batch	R2236612							
WG1332830-1	CVS							
Sulphide			106		%		50-120	18-AUG-11
WG1332826-1	MB							
Sulphide			<0.20		mg/kg		0.2	18-AUG-11

Quality Control Report

Workorder: L1044365

Report Date: 22-AUG-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1044365

Report Date: 22-AUG-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	12-AUG-11	19-AUG-11 20:26	24	176	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1044365 were received on 15-AUG-11 09:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM Page ____ of ____

660 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878



WATERLOG, ON NZV 286 Phone: (519) 886-6910 Fax: (519) 886-9047 Toll Free: 1-800-668-9878		COMPANY NAME Anec E+I		CRITERIA Reg 153/04 <input type="checkbox"/> Criteria on report YES <input type="checkbox"/> NO <input type="checkbox"/> Table 1 2 3 4 5 6 7 8 9 TCLP <input type="checkbox"/> MISA <input type="checkbox"/> PWQO <input type="checkbox"/> ODWS <input type="checkbox"/> OTHER <input type="checkbox"/>										Service requested 2 day TAT (50%) <input checked="" type="checkbox"/> 5 day (regular) <input type="checkbox"/> 3-4 day (25%) <input type="checkbox"/>		Specify date required Next day TAT (100%) <input type="checkbox"/> Same day TAT (200%) <input type="checkbox"/>	
		REPORT FORMAT/DISTRIBUTION EMAIL <input checked="" type="checkbox"/> FAX <input type="checkbox"/> DIGITAL <input type="checkbox"/> BOTH <input type="checkbox"/> SELECT: PDF <input type="checkbox"/> DIGITAL <input type="checkbox"/> BOTH <input type="checkbox"/> EMAIL 1 <u>Shane.Macleod@Anec.com</u> EMAIL 2 _____										ANALYSIS REQUEST Please indicate filtered, preserved or both ← (F, P, F/P)		Submission # L1644365 ENTERED BY AL DATE/TIME ENTERED 15/18/11 9:58 BIN # 8543			
QUOTATION # 78643 PO # _____ ACCOUNT # _____ PHONE 519-735-2499 FAX 519-735-9669		SAMPLING INFORMATION Sample Date/Time _____ TYPE _____ MATRIX _____ Date (dd-mm-yy) 12/06/11 Time (24hr) (hh:mm) _____ OTHER _____ SOIL <input checked="" type="checkbox"/> WATER _____ GRAB _____ COMP _____		NUMBER OF CONTAINERS Corrosion Package										Comments LAB ID _____			
SPECIAL INSTRUCTIONS/COMMENTS		THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK YES OR NO) Are any samples taken from a regulated DW System? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, an authorized drinking water COC MUST be used for this submission. Is the water sampled intended to be potable for human consumption? Yes <input type="checkbox"/> No <input type="checkbox"/>										DATE & TIME DATE 12/06/11 TIME 9:30 RECEIVED BY _____ RECEIVED AT LAB BY _____		DATE & TIME DATE 12/06/11 TIME 9:30 RECEIVED BY _____ RECEIVED AT LAB BY _____			
SAMPLED BY: _____ RELINQUISHED BY: _____		OBSERVATIONS If you add SIF										INIT ML					

Notes

1. Quote number must be provided to ensure proper pricing

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. 3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section. Please contact the lab to confirm TATs.



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 18-JUL-11
Report Date: 25-JUL-11 15:07 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #:	L1032526
Project P.O. #:	NOT SUBMITTED
Job Reference:	SW8801.1004.101
Legal Site Desc:	
C of C Numbers:	092959-C

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1032526-1 SOIL 15-JUL-11 TB5-4,SS10@30-31.5' GREY SILTY CLAY	L1032526-2 SOIL 15-JUL-11 TB5-3,SS10@30-31.5' GREY SILTY CLAY			
Grouping	Analyte					
SOIL						
Physical Tests	% Moisture (%)	19.5	19.4			
	pH (pH units)	8.09	8.01			
	Redox Potential (mV)	116	114			
	Resistivity (ohm cm)	2440	2360			
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20	<0.20			
Anions and Nutrients	Sulphate (mg/kg)	301	347			

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092959-C

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1032526

Report Date: 25-JUL-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
	Soil							
Batch	R2220531							
WG1314260-2	LCS							
% Moisture			84		%		70-130	18-JUL-11
WG1314260-1	MB							
% Moisture			<0.10		%		0.1	18-JUL-11
PH-WT								
	Soil							
Batch	R2223567							
WG1318107-1	CVS							
pH			100		%		80-120	22-JUL-11
RESISTIVITY-WT								
	Soil							
Batch	R2223537							
WG1318094-1	CVS							
Resistivity			98		%		70-130	22-JUL-11
SO4-WT								
	Soil							
Batch	R2222247							
WG1315561-3	LCS							
Sulphate			101		%		60-140	20-JUL-11
WG1315561-1	MB							
Sulphate			<20		mg/kg		20	20-JUL-11
SULPHIDE-WT								
	Soil							
Batch	R2222299							
WG1316784-1	CVS							
Sulphide			107		%		50-120	21-JUL-11
WG1316782-1	MB							
Sulphide			<0.20		mg/kg		0.2	21-JUL-11

Quality Control Report

Workorder: L1032526

Report Date: 25-JUL-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1032526

Report Date: 25-JUL-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	15-JUL-11	22-JUL-11 13:48	24	170	hours	EHTR
	2	15-JUL-11	22-JUL-11 13:49	24	170	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1032526 were received on 18-JUL-11 10:35.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 18-JUL-11
Report Date: 25-JUL-11 14:58 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #:	L1032551
Project P.O. #:	NOT SUBMITTED
Job Reference:	SW8801.1004.101
Legal Site Desc:	
C of C Numbers:	092959-I

Gayle Braun
Senior Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1032551-1 SOIL 15-JUL-11 BHTB7A- 1,SS10@30', GREY SILTY CLAY	L1032551-2 SOIL 15-JUL-11 BHTB7- 3,SS10@30', GREY SILTY CLAY	L1032551-3 SOIL 15-JUL-11 BHTB7- 1,SS10@30', GREY SILTY CLAY	L1032551-4 SOIL 15-JUL-11 BHTB7- 2,SS10@30', GREY SILTY CLAY	
Grouping	Analyte					
SOIL						
Physical Tests	% Moisture (%)	13.5	12.2	13.8	14.2	
	pH (pH units)	7.98	7.97	7.99	8.01	
	Redox Potential (mV)	105	108	106	112	
	Resistivity (ohm cm)	4630	4350	5050	4670	
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20	<0.20	<0.20	<0.20	
Anions and Nutrients	Sulphate (mg/kg)	65	48	45	53	

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092959-I

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

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Quality Control Report

Workorder: L1032551

Report Date: 25-JUL-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
Soil								
Batch	R2220531							
WG1314260-2	LCS							
% Moisture			84		%		70-130	18-JUL-11
Batch	R2220574							
WG1314260-1	MB							
% Moisture			<0.10		%		0.1	18-JUL-11
Batch	R2220574							
WG1314544-2	LCS							
% Moisture			98		%		70-130	18-JUL-11
Batch	R2220574							
WG1314544-1	MB							
% Moisture			<0.10		%		0.1	18-JUL-11
PH-WT								
Soil								
Batch	R2223567							
WG1318107-1	CVS							
pH			100		%		80-120	22-JUL-11
RESISTIVITY-WT								
Soil								
Batch	R2223537							
WG1318094-1	CVS							
Resistivity			98		%		70-130	22-JUL-11
SO4-WT								
Soil								
Batch	R2222247							
WG1315561-3	LCS							
Sulphate			101		%		60-140	20-JUL-11
Batch	R2222247							
WG1315561-1	MB							
Sulphate			<20		mg/kg		20	20-JUL-11
SULPHIDE-WT								
Soil								
Batch	R2222299							
WG1316784-1	CVS							
Sulphide			107		%		50-120	21-JUL-11
Batch	R2222299							
WG1316782-1	MB							
Sulphide			<0.20		mg/kg		0.2	21-JUL-11

Quality Control Report

Workorder: L1032551

Report Date: 25-JUL-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1032551

Report Date: 25-JUL-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	15-JUL-11	22-JUL-11 13:59	24	170	hours	EHTR
	2	15-JUL-11	22-JUL-11 14:00	24	170	hours	EHTR
	3	15-JUL-11	22-JUL-11 14:01	24	170	hours	EHTR
	4	15-JUL-11	22-JUL-11 14:02	24	170	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

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Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1032551 were received on 18-JUL-11 10:35.

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The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 25-JUL-11
Report Date: 29-JUL-11 20:53 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #:	L1035603
Project P.O. #:	NOT SUBMITTED
Job Reference:	SW8801.1004.101
Legal Site Desc:	
C of C Numbers:	112830

Gayle Braun
Senior Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1035603-1 SOIL 22-JUL-11 TB7- 4,SS10@30',SILTY CLAY,GREY				
Grouping	Analyte					
SOIL						
Physical Tests	% Moisture (%)	12.9				
	pH (pH units)	7.94				
	Redox Potential (mV)	90.0				
	Resistivity (ohm cm)	6410				
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20				
Anions and Nutrients	Sulphate (mg/kg)	56				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

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The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

112830

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1035603

Report Date: 29-JUL-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
	Soil							
Batch	R2224277							
WG1318502-2	LCS							
% Moisture			92		%		70-130	25-JUL-11
WG1318502-1	MB							
% Moisture			<0.10		%		0.1	25-JUL-11
PH-WT								
	Soil							
Batch	R2226613							
WG1321682-1	CVS							
pH			100		%		80-120	27-JUL-11
RESISTIVITY-WT								
	Soil							
Batch	R2226581							
WG1319414-2	CVS							
Resistivity			99		%		70-130	27-JUL-11
SO4-WT								
	Soil							
Batch	R2225769							
WG1319770-3	LCS							
Sulphate			101		%		60-140	27-JUL-11
WG1319770-1	MB							
Sulphate			<20		mg/kg		20	27-JUL-11
SULPHIDE-WT								
	Soil							
Batch	R2224730							
WG1319337-1	CVS							
Sulphide			96		%		50-120	26-JUL-11
WG1319332-1	MB							
Sulphide			<0.20		mg/kg		0.2	26-JUL-11

Quality Control Report

Workorder: L1035603

Report Date: 29-JUL-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1035603

Report Date: 29-JUL-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	22-JUL-11	27-JUL-11 14:14	24	122	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1035603 were received on 25-JUL-11 10:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



AMEC EARTH & ENVIRONMENTAL
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 18-JUL-11
Report Date: 25-JUL-11 15:08 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #:	L1032520
Project P.O. #:	NOT SUBMITTED
Job Reference:	SW8801.1004.101
Legal Site Desc:	
C of C Numbers:	092959-B

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1032520-1 SOIL 15-JUL-11 BHTB8- 1,SS10@30' GREY SILTY CLAY	L1032520-2 SOIL 15-JUL-11 BHTB8- 2,SS10@30' GREY SILTY CLAY			
Grouping	Analyte					
SOIL						
Physical Tests	% Moisture (%)	14.3	10.7			
	pH (pH units)	7.97	7.95			
	Redox Potential (mV)	124	115			
	Resistivity (ohm cm)	1940	4030			
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20	<0.20			
Anions and Nutrients	Sulphate (mg/kg)	92	86			

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

092959-B

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1032520

Report Date: 25-JUL-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
	Soil							
Batch	R2220531							
WG1314260-2	LCS							
% Moisture			84		%		70-130	18-JUL-11
WG1314260-1	MB							
% Moisture			<0.10		%		0.1	18-JUL-11
PH-WT								
	Soil							
Batch	R2223567							
WG1318107-1	CVS							
pH			100		%		80-120	22-JUL-11
RESISTIVITY-WT								
	Soil							
Batch	R2223537							
WG1318094-1	CVS							
Resistivity			98		%		70-130	22-JUL-11
SO4-WT								
	Soil							
Batch	R2222247							
WG1315561-3	LCS							
Sulphate			101		%		60-140	20-JUL-11
WG1315561-1	MB							
Sulphate			<20		mg/kg		20	20-JUL-11
SULPHIDE-WT								
	Soil							
Batch	R2222299							
WG1316784-1	CVS							
Sulphide			107		%		50-120	21-JUL-11
WG1316782-1	MB							
Sulphide			<0.20		mg/kg		0.2	21-JUL-11

Quality Control Report

Workorder: L1032520

Report Date: 25-JUL-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1032520

Report Date: 25-JUL-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	15-JUL-11	22-JUL-11 13:46	24	170	hours	EHTR
	2	15-JUL-11	22-JUL-11 13:47	24	170	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1032520 were received on 18-JUL-11 10:35.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

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AMEC EARTH & ENVIRONMENTAL-
WINDSOR
ATTN: SHANE MACLEOD
11865 County Road 42
TECUMSEH ON N8N 2M1

Date Received: 15-AUG-11
Report Date: 22-AUG-11 08:24 (MT)
Version: FINAL

Client Phone: 519-735-2499

Certificate of Analysis

Lab Work Order #: L1044495
Project P.O. #: NOT SUBMITTED
Job Reference: SW8801.1004.101
C of C Numbers: 1128949
Legal Site Desc:

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L1044495-1 SOIL 12-AUG-11 12:00 TB8-3,SS4@7.5', BROWN,SILTY CLAY				
Grouping	Analyte						
SOIL							
Physical Tests	% Moisture (%)	10.4					
	pH (pH units)	7.85					
	Redox Potential (mV)	180					
	Resistivity (ohm cm)	5990					
Leachable Anions & Nutrients	Sulphide (mg/kg)	<0.20					
Anions and Nutrients	Sulphate (mg/kg)	69					

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A
Soil samples are mixed in the deionized water and the supernatant is analyzed directly by the pH meter.			
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580
RESISTIVITY-WT	Soil	Resistivity	MOEE E3137A
SO4-WT	Soil	Sulphate	EPA 300.0
SULPHIDE-WT	Soil	Sulphide	APHA 4500S2D

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

1128949

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

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Quality Control Report

Workorder: L1044495

Report Date: 22-AUG-11

Page 1 of 3

Client: AMEC EARTH & ENVIRONMENTAL-WINDSOR

11865 County Road 42

TECUMSEH ON N8N 2M1

Contact: SHANE MACLEOD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT								
	Soil							
Batch	R2234818							
WG1330422-2	LCS							
% Moisture			90		%		70-130	15-AUG-11
WG1330422-1	MB							
% Moisture			<0.10		%		0.1	15-AUG-11
PH-WT								
	Soil							
Batch	R2235381							
WG1331381-1	CVS							
pH			100		%		80-120	16-AUG-11
RESISTIVITY-WT								
	Soil							
Batch	R2238001							
WG1334286-1	CVS							
Resistivity			99		%		70-130	19-AUG-11
SO4-WT								
	Soil							
Batch	R2236478							
WG1332024-3	LCS							
Sulphate			101		%		60-140	17-AUG-11
WG1332024-1	MB							
Sulphate			<20		mg/kg		20	17-AUG-11
SULPHIDE-WT								
	Soil							
Batch	R2236612							
WG1332830-1	CVS							
Sulphide			106		%		50-120	18-AUG-11
WG1332826-1	MB							
Sulphide			<0.20		mg/kg		0.2	18-AUG-11

Quality Control Report

Workorder: L1044495

Report Date: 22-AUG-11

Page 2 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1044495

Report Date: 22-AUG-11

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential	1	12-AUG-11 12:00	19-AUG-11 20:28	24	176	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

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Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1044495 were received on 15-AUG-11 09:30.

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ALS

C of C # 00000

112849

[illegible]

Notes

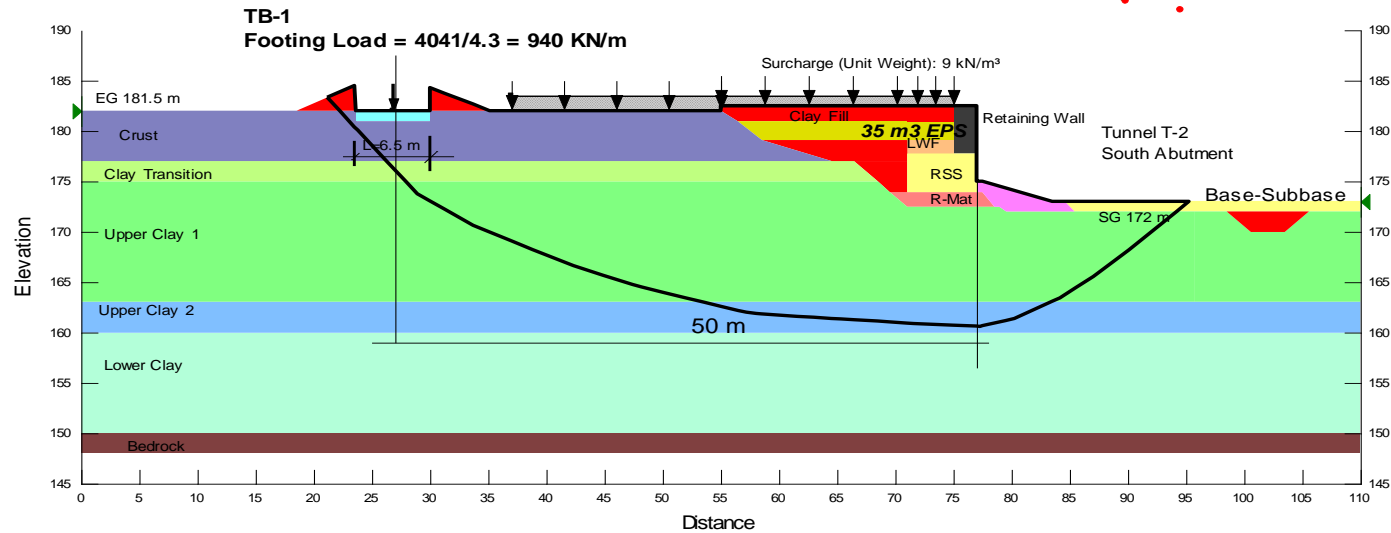
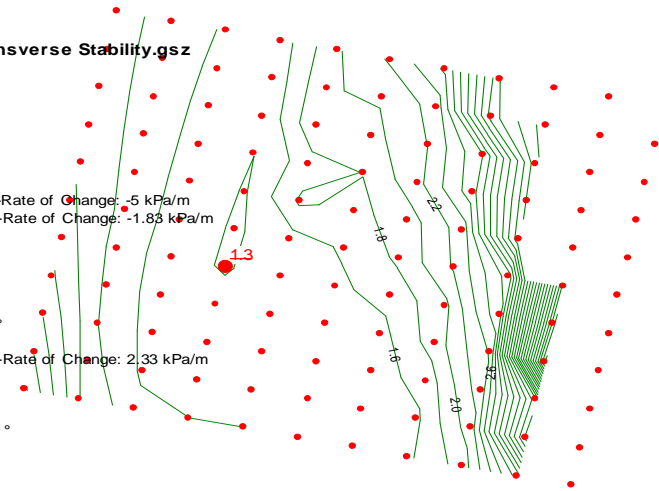
- 1. Quote number must be provided to ensure proper pricing**

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. 3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

Appendix D Slope Stability Analyses

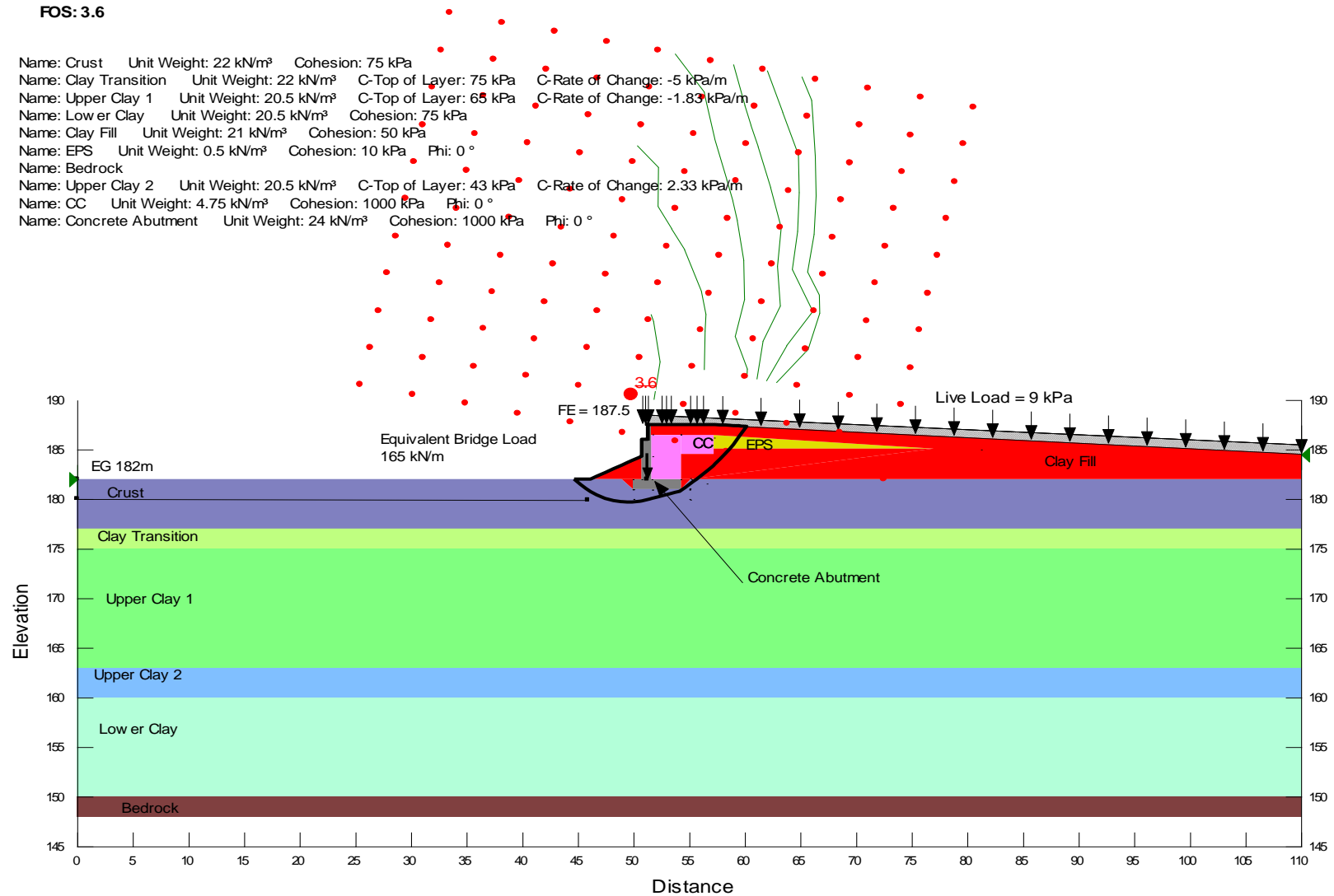
File Name: TB-1 North Abutment-St. 10+731 - Bridge Footing Transverse Stability.gsz
 Last Solved Date: 27/06/2013
 Current Analysis: Short-term
 FOS: 1.3

Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Clay Transition Unit Weight: 22 kN/m³ C-Top of Layer: 75 kPa C-Rate of Change: -5 kPa/m
 Name: Upper Clay 1 Unit Weight: 20.5 kN/m³ C-Top of Layer: 65 kPa C-Rate of Change: -1.83 kPa/m
 Name: Lower Clay Unit Weight: 20.5 kN/m³ Cohesion: 75 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: R-Mat Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 33 °
 Name: RSS Unit Weight: 21 kN/m³ Cohesion: 200 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Retaining Wall Unit Weight: 0.1 kN/m³ Cohesion: 500 kPa Phi: 0 °
 Name: Bedrock
 Name: Upper Clay 2 Unit Weight: 20.5 kN/m³ C-Top of Layer: 43 kPa C-Rate of Change: 2.33 kPa/m
 Name: LWF Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °
 Name: Bridge Footing Unit Weight: 0.1 kN/m³ Cohesion: 1000 kPa Phi: 0 °



File Name: TB-1 North Abutment (CC & EPS)-Longitudinal Stability-Corrected.gsz
 Date: 11/07/2013
 Name: Undrained Conditions
 FOS: 3.6

Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Clay Transition Unit Weight: 22 kN/m³ C-Top of Layer: 75 kPa C-Rate of Change: -5 kPa/m
 Name: Upper Clay 1 Unit Weight: 20.5 kN/m³ C-Top of Layer: 65 kPa C-Rate of Change: -1.83 kPa/m
 Name: Lower Clay Unit Weight: 20.5 kN/m³ Cohesion: 75 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Bedrock
 Name: Upper Clay 2 Unit Weight: 20.5 kN/m³ C-Top of Layer: 43 kPa C-Rate of Change: 2.33 kPa/m
 Name: CC Unit Weight: 4.75 kN/m³ Cohesion: 1000 kPa Phi: 0 °
 Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °



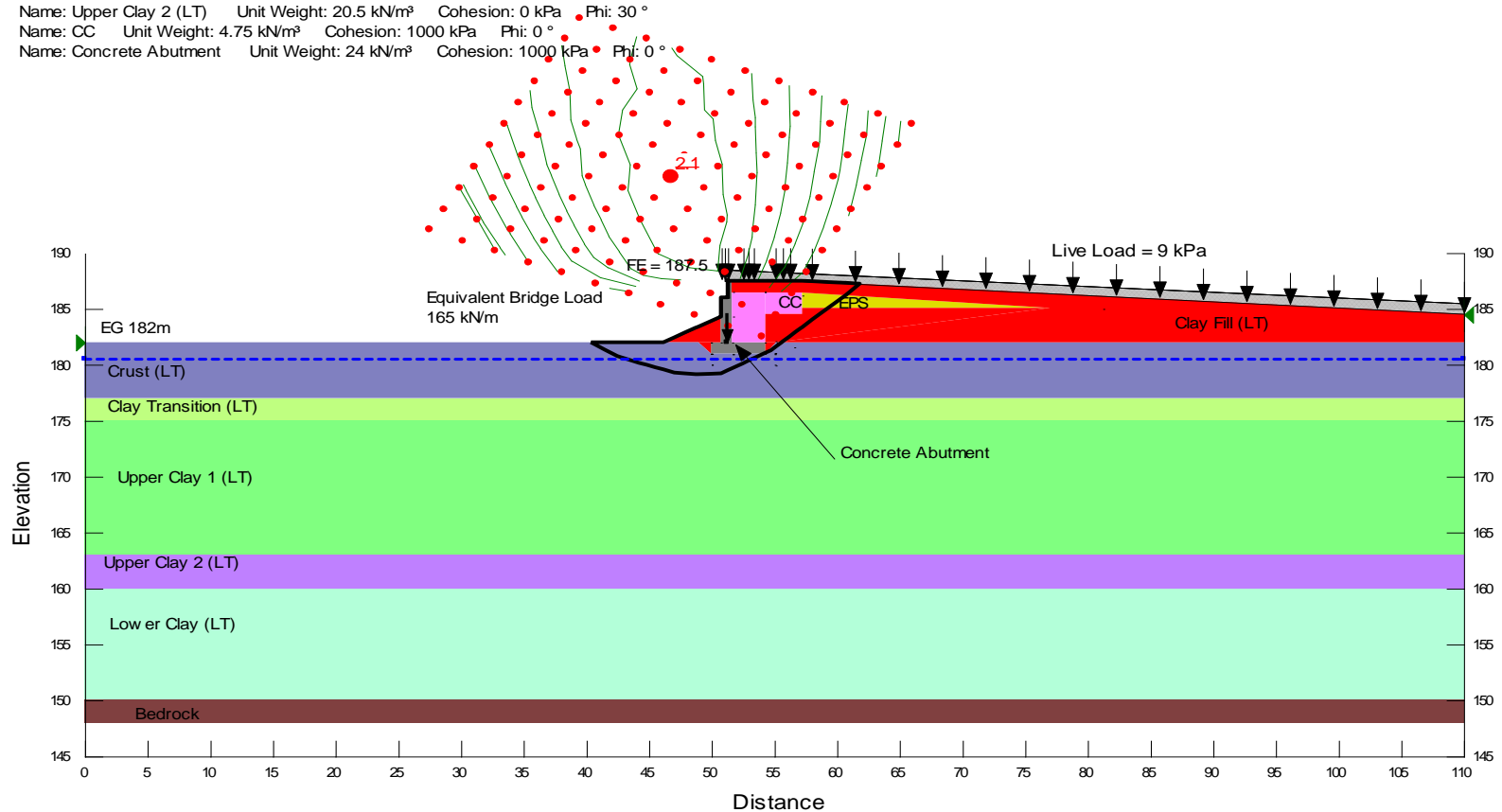
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Date: 11/07/2013

Name: Drained Conditions

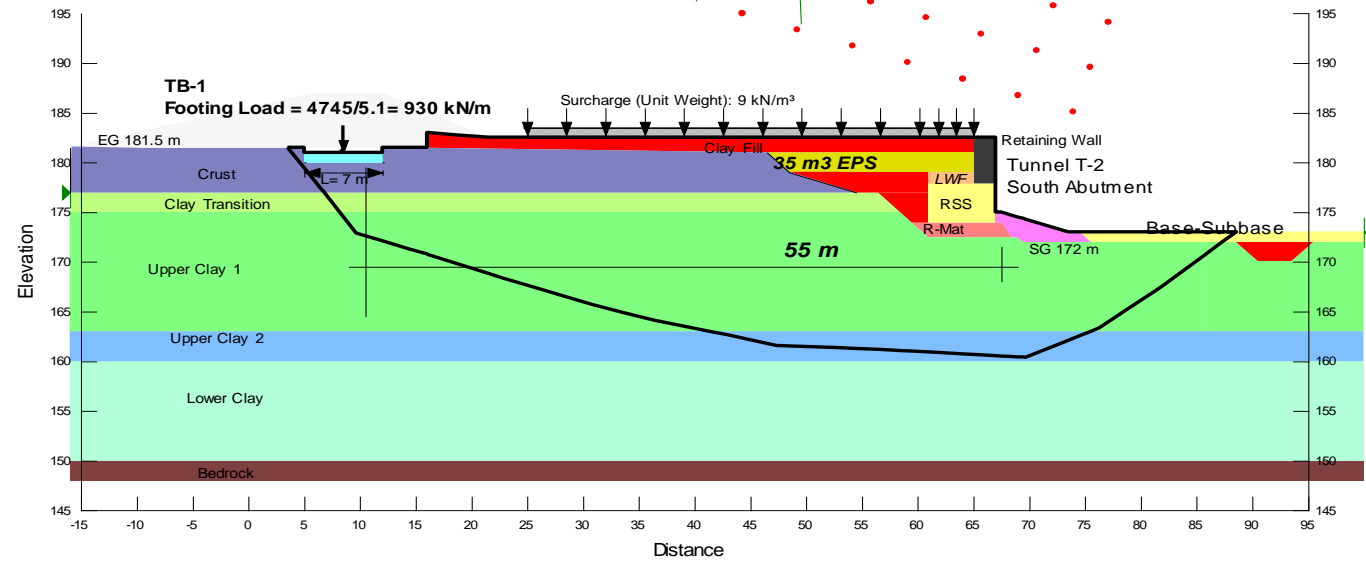
FOS: 2.1

Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
Name: Crust (LT) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Clay Transition (LT) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Upper Clay 1 (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Lower Clay (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Clay Fill (LT) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Bedrock
Name: Upper Clay 2 (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: CC Unit Weight: 4.75 kN/m³ Cohesion: 1000 kPa Phi: 0 °
Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °

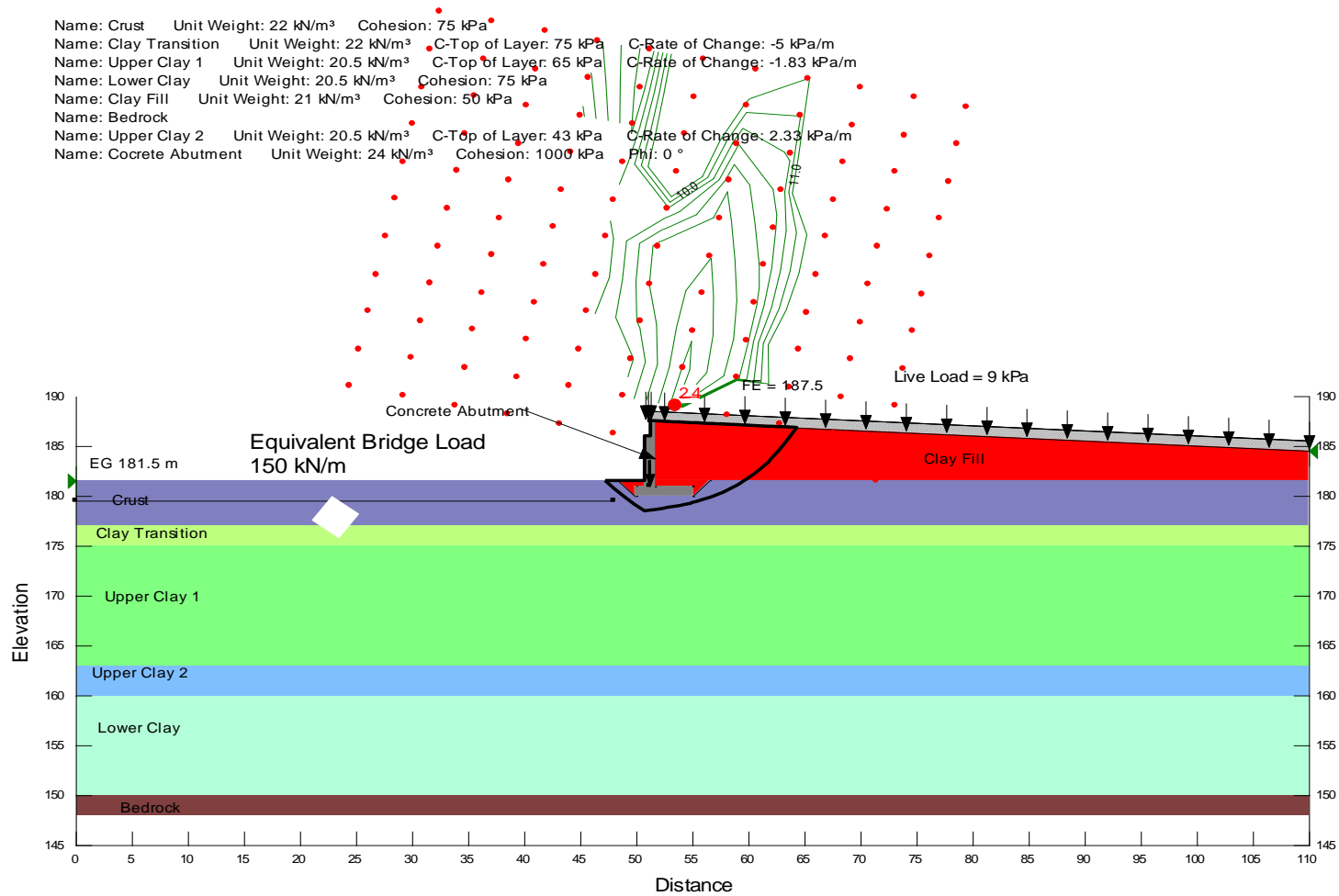


File Name:TB-1 South Abutment- St. 10+770-Bridge Footing TS.gsz
 Last Solved Date: 29/06/2013
 Current Analysis: Short-term
 FOS: 1.4

Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Clay Transition Unit Weight: 22 kN/m³ C-Top of Layer: 75 kPa C-Rate of Change: -5 kPa/m
 Name: Upper Clay 1 Unit Weight: 20.5 kN/m³ C-Top of Layer: 65 kPa C-Rate of Change: -1.83 kPa/m
 Name: Lower Clay Unit Weight: 20.5 kN/m³ Cohesion: 75 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: R-Mat Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 33 °
 Name: RSS Unit Weight: 21 kN/m³ Cohesion: 200 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Retaining Wall Unit Weight: 0.1 kN/m³ Cohesion: 500 kPa Phi: 0 °
 Name: Bedrock
 Name: Upper Clay 2 Unit Weight: 20.5 kN/m³ C-Top of Layer: 43 kPa C-Rate of Change: 2.33 kPa/m
 Name: LWF Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °
 Name: Concrete Footing Unit Weight: 0.1 kN/m³ Cohesion: 1000 kPa Phi: 0 °



TB-1 South Abutment-Longitudinal Stability.gsz
Name: Undrained Conditions
Date: 11/07/2013
FOS: 2.4



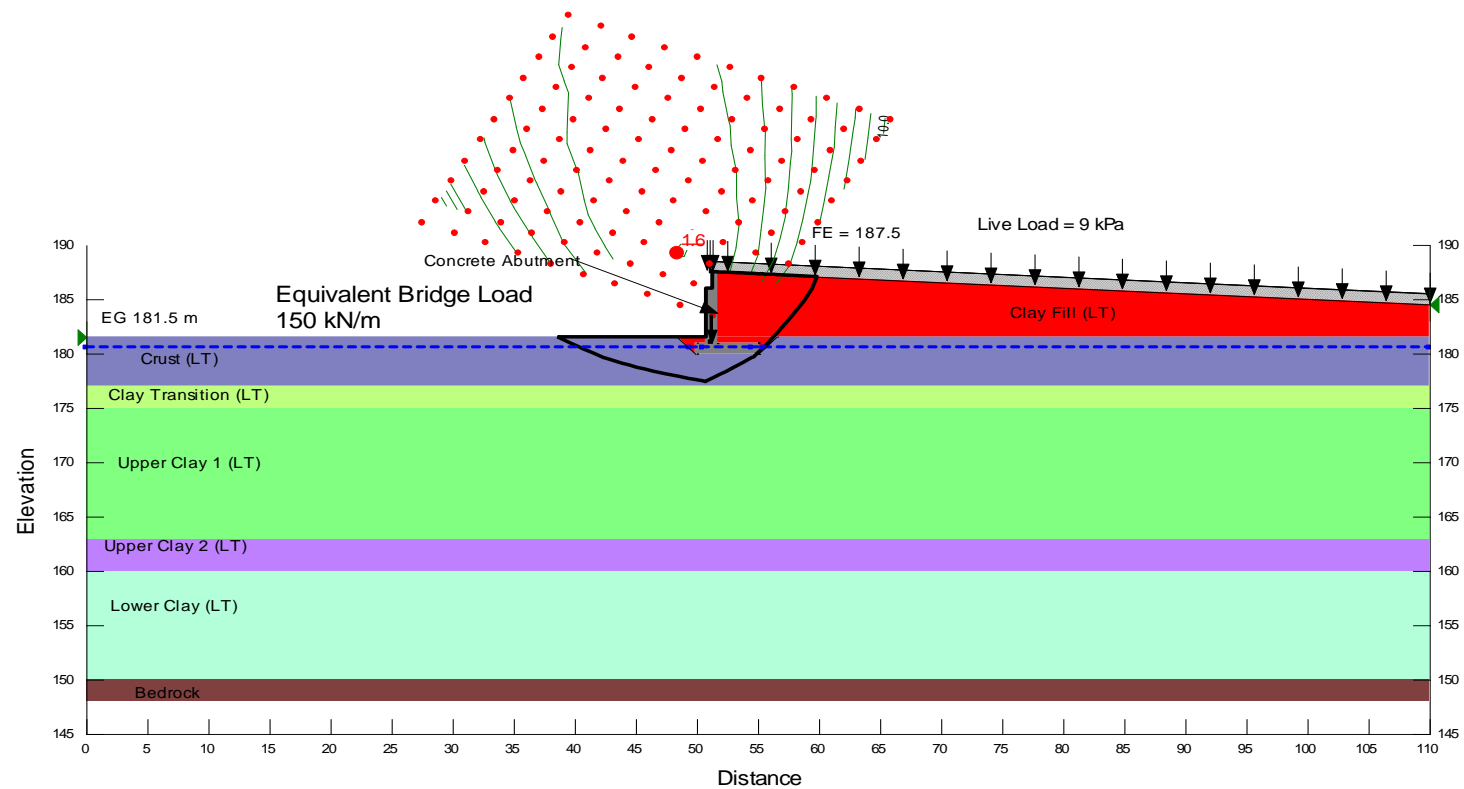
TB-1 South Abutment-Longitudinal Stability.gsz

Name: Drained Conditions

Date: 11/07/2013

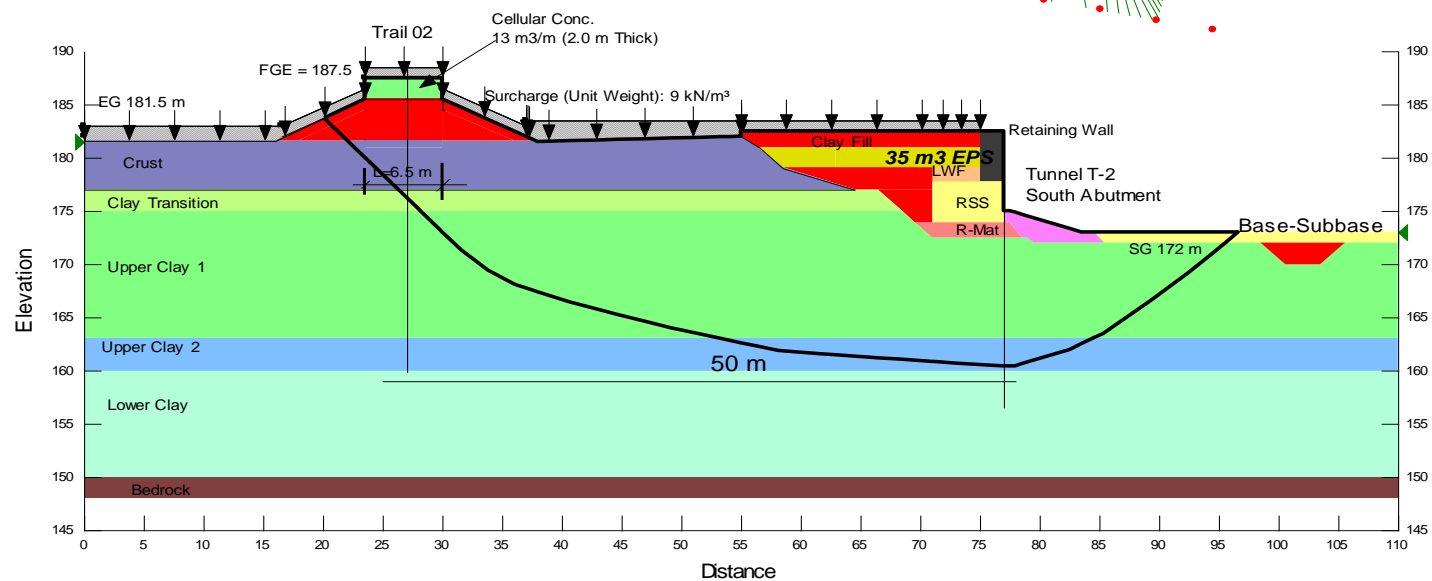
FOS: 1.6

Name: Crust (LT) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Transition (LT) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Upper Clay 1 (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Lower Clay (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Fill (LT) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Bedrock
 Name: Upper Clay 2 (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °



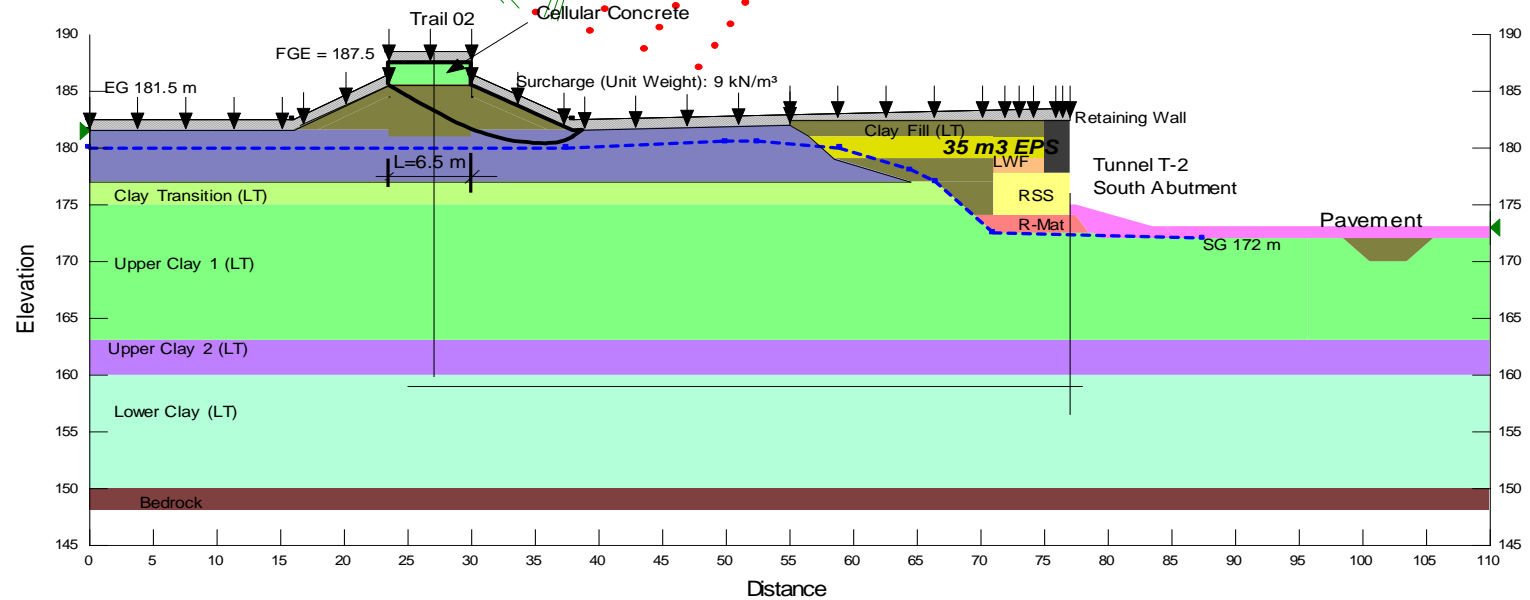
File Name:TB-1 North RSS-St. 10+728 - Cellular Concrete.gsz
 Last Solved Date: 28/06/2013
 Current Analysis: Short-term
 FOS: 1.3

Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Clay Transition Unit Weight: 22 kN/m³ C-Top of Layer: 75 kPa C-Rate of Change: -5 kPa/m
 Name: Upper Clay 1 Unit Weight: 20.5 kN/m³ C-Top of Layer: 65 kPa C-Rate of Change: -1.83 kPa/m
 Name: Lower Clay Unit Weight: 20.5 kN/m³ Cohesion: 75 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: R-Mat Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 33 °
 Name: RSS Unit Weight: 21 kN/m³ Cohesion: 200 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Retaining Wall Unit Weight: 0.1 kN/m³ Cohesion: 500 kPa Phi: 0 °
 Name: Bedrock
 Name: Upper Clay 2 Unit Weight: 20.5 kN/m³ C-Top of Layer: 43 kPa C-Rate of Change: 2.33 kPa/m
 Name: LWF Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °
 Name: CC Unit Weight: 4.75 kN/m³ Cohesion: 1000 kPa Phi: 0 °



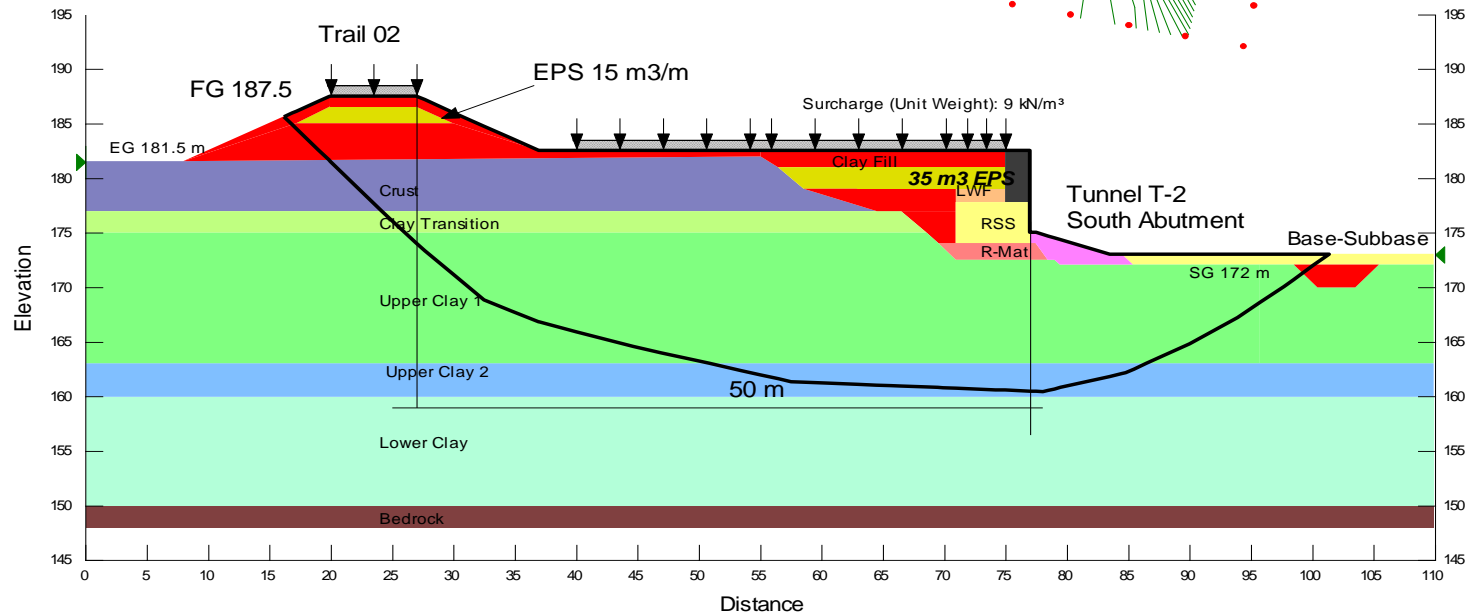
File Name:TB-1 North RSS-St. 10+728 - Cellular Concrete.gsz
 Last Solved Date: 08/07/2013
 Current Analysis: Long-term (drained)
 FOS: 2.1

Name: R-Mat Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 33 °
 Name: RSS Unit Weight: 21 kN/m³ Cohesion: 200 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Retaining Wall Unit Weight: 0.1 kN/m³ Cohesion: 500 kPa Phi: 0 °
 Name: Crust (LT) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Transition (LT) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Upper Clay 1 (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Lower Clay (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Fill (LT) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Bedrock
 Name: Upper Clay 2 (LT) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: LWF Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: CC Unit Weight: 4.75 kN/m³ Cohesion: 1000 kPa Phi: 0 °



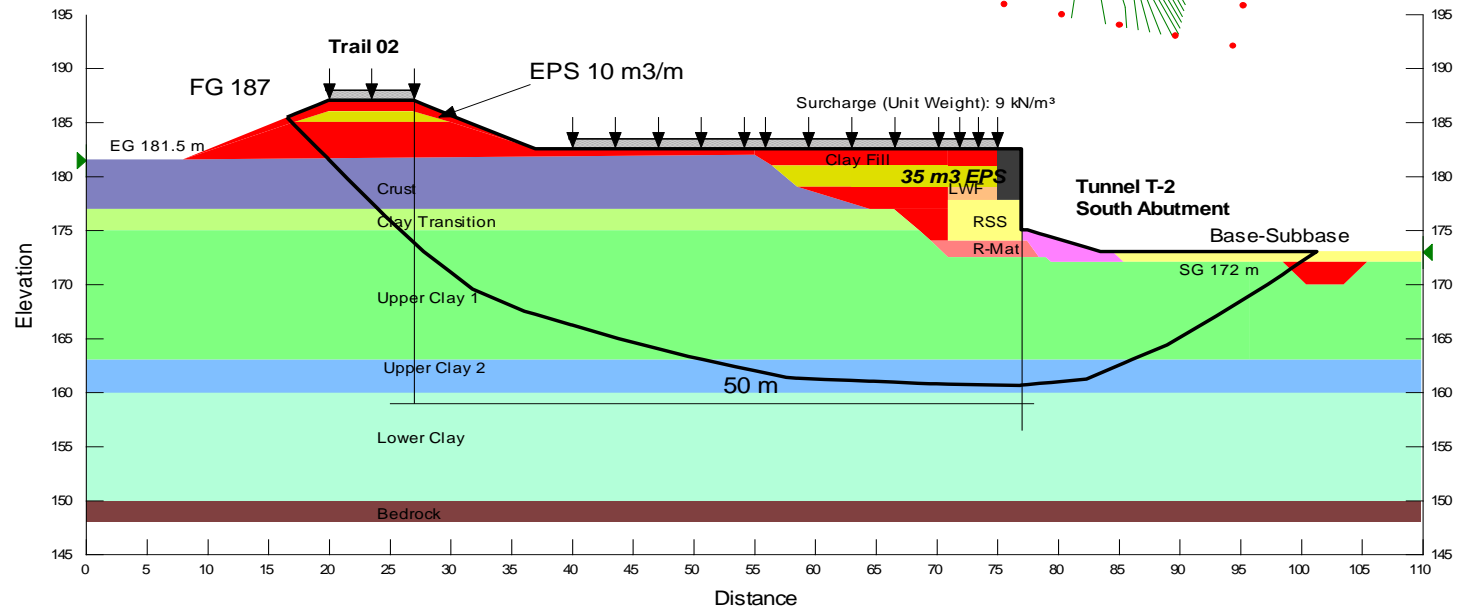
File Name:TB-1 North Embankment-St. 10+723-dd.gsz
 Last Solved Date: 27/06/2013
 Current Analysis: Short-term
 FOS: 1.3

Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Clay Transition Unit Weight: 22 kN/m³ C-Top of Layer: 75 kPa C-Rate of Change: -5 kPa/m
 Name: Upper Clay 1 Unit Weight: 20.5 kN/m³ C-Top of Layer: 65 kPa C-Rate of Change: -1.83 kPa/m
 Name: Lower Clay Unit Weight: 20.5 kN/m³ Cohesion: 75 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: R-Mat Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 33 °
 Name: RSS Unit Weight: 21 kN/m³ Cohesion: 200 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Retaining Wall Unit Weight: 0.1 kN/m³ Cohesion: 500 kPa Phi: 0 °
 Name: Bedrock
 Name: Upper Clay 2 Unit Weight: 20.5 kN/m³ C-Top of Layer: 43 kPa C-Rate of Change: 2.33 kPa/m
 Name: LWF Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °



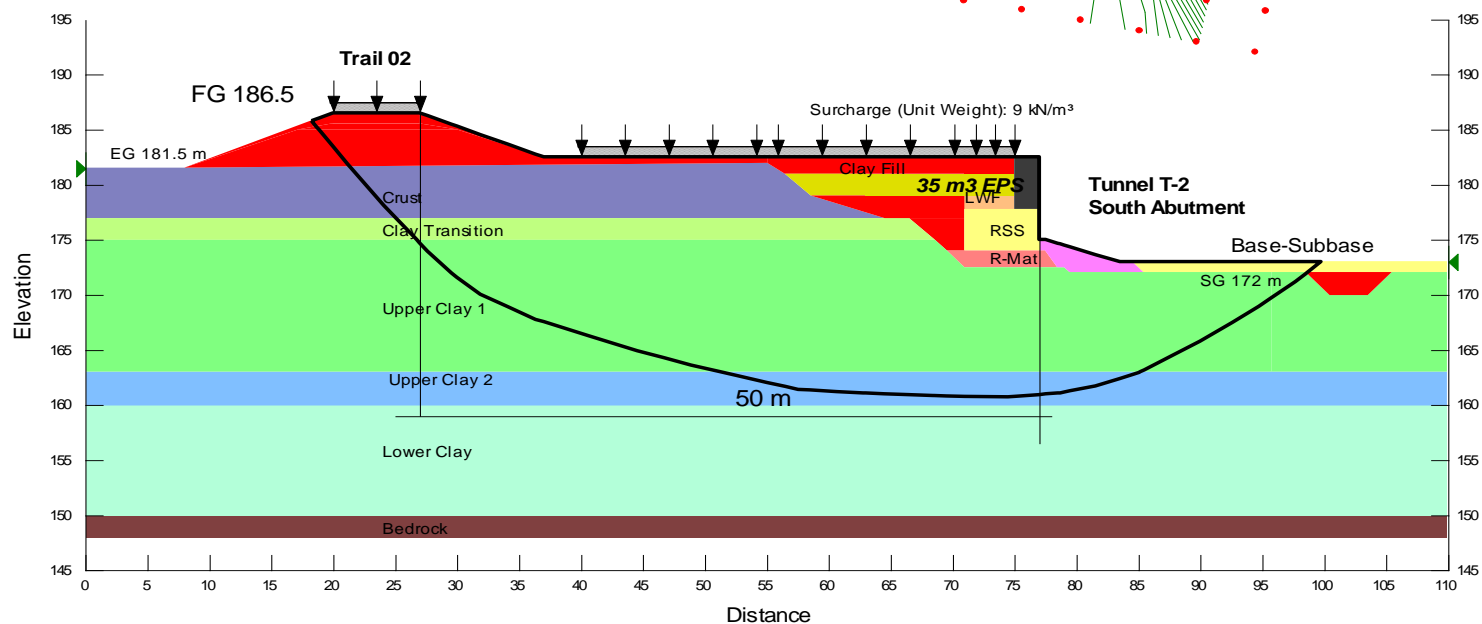
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 Last Solved Date: 27/06/2013
 Current Analysis: Short-term
 FOS: 1.3

Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Clay Transition Unit Weight: 22 kN/m³ C-Top of Layer: 75 kPa C-Rate of Change: -5 kPa/m
 Name: Upper Clay 1 Unit Weight: 20.5 kN/m³ C-Top of Layer: 65 kPa C-Rate of Change: -1.83 kPa/m
 Name: Lower Clay Unit Weight: 20.5 kN/m³ Cohesion: 75 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: R-Mat Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 33 °
 Name: RSS Unit Weight: 21 kN/m³ Cohesion: 200 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Retaining Wall Unit Weight: 0.1 kN/m³ Cohesion: 500 kPa Phi: 0 °
 Name: Bedrock
 Name: Upper Clay 2 Unit Weight: 20.5 kN/m³ C-Top of Layer: 43 kPa C-Rate of Change: 2.33 kPa/m
 Name: LWF Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °



File Name:TB-1 North Embankment-St. 10+705.gsz
 Last Solved Date: 28/06/2013
 Current Analysis: Short-term-No EPS
 FOS: 1.3

Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Clay Transition Unit Weight: 22 kN/m³ C-Top of Layer: 75 kPa C-Rate of Change: -5 kPa/m
 Name: Upper Clay 1 Unit Weight: 20.5 kN/m³ C-Top of Layer: 65 kPa C-Rate of Change: -1.83 kPa/m
 Name: Lower Clay Unit Weight: 20.5 kN/m³ Cohesion: 75 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: R-Mat Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 33 °
 Name: RSS Unit Weight: 21 kN/m³ Cohesion: 200 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Retaining Wall Unit Weight: 0.1 kN/m³ Cohesion: 500 kPa Phi: 0 °
 Name: Bedrock
 Name: Upper Clay 2 Unit Weight: 20.5 kN/m³ C-Top of Layer: 43 kPa C-Rate of Change: 2.33 kPa/m
 Name: LWF Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °

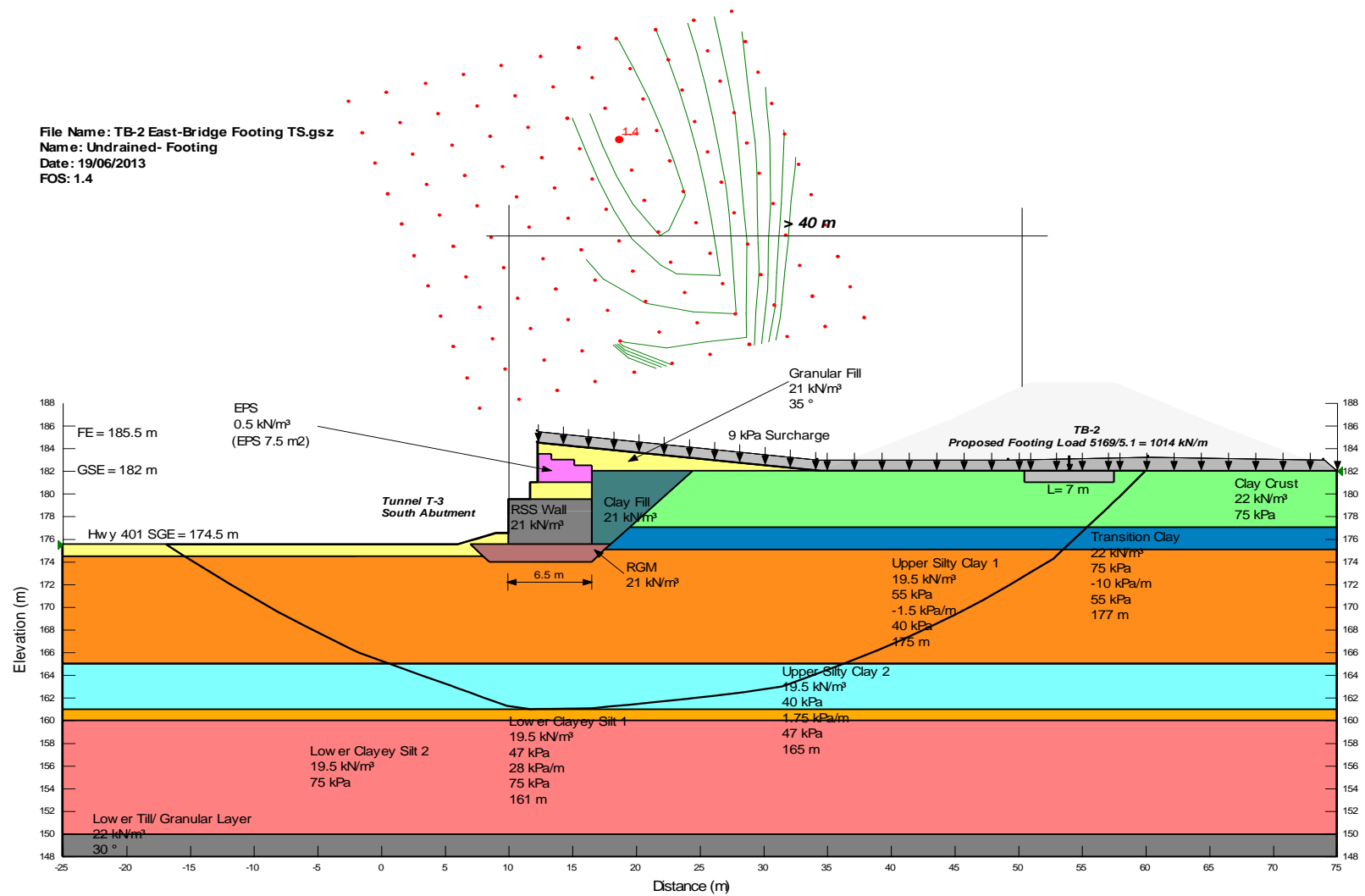


Name	Unit Weight	Cohesion	C-Top of Layer	C-Rate of Change
Crust	22 kN/m ³	75 kPa		
Play Transition	22 kN/m ³	75 kPa	75 kPa	-5 kPa/m
Upper Clay 1	20.5 kN/m ³	65 kPa	65 kPa	-1.83 kPa/m
Lower Clay	20.5 kN/m ³	75 kPa		
Clay Fill	21 kN/m ³	50 kPa		
R-Mat	21 kN/m ³	50 kPa	Phi: 33 °	
RSS	21 kN/m ³	200 kPa	Phi: 35 °	
EPS	0.5 kN/m ³	10 kPa	Phi: 0 °	
Retaining Wall	0.1 kN/m ³	500 kPa	Phi: 0 °	
Bedrock				
Upper Clay 2	20.5 kN/m ³	43 kPa	43 kPa	2.33 kPa/m
LWF	12 kN/m ³	0 kPa	Phi: 35 °	
Pavement	22 kN/m ³	0 kPa	Phi: 35 °	
Base-Subbase	12 kN/m ³	0 kPa	Phi: 33 °	



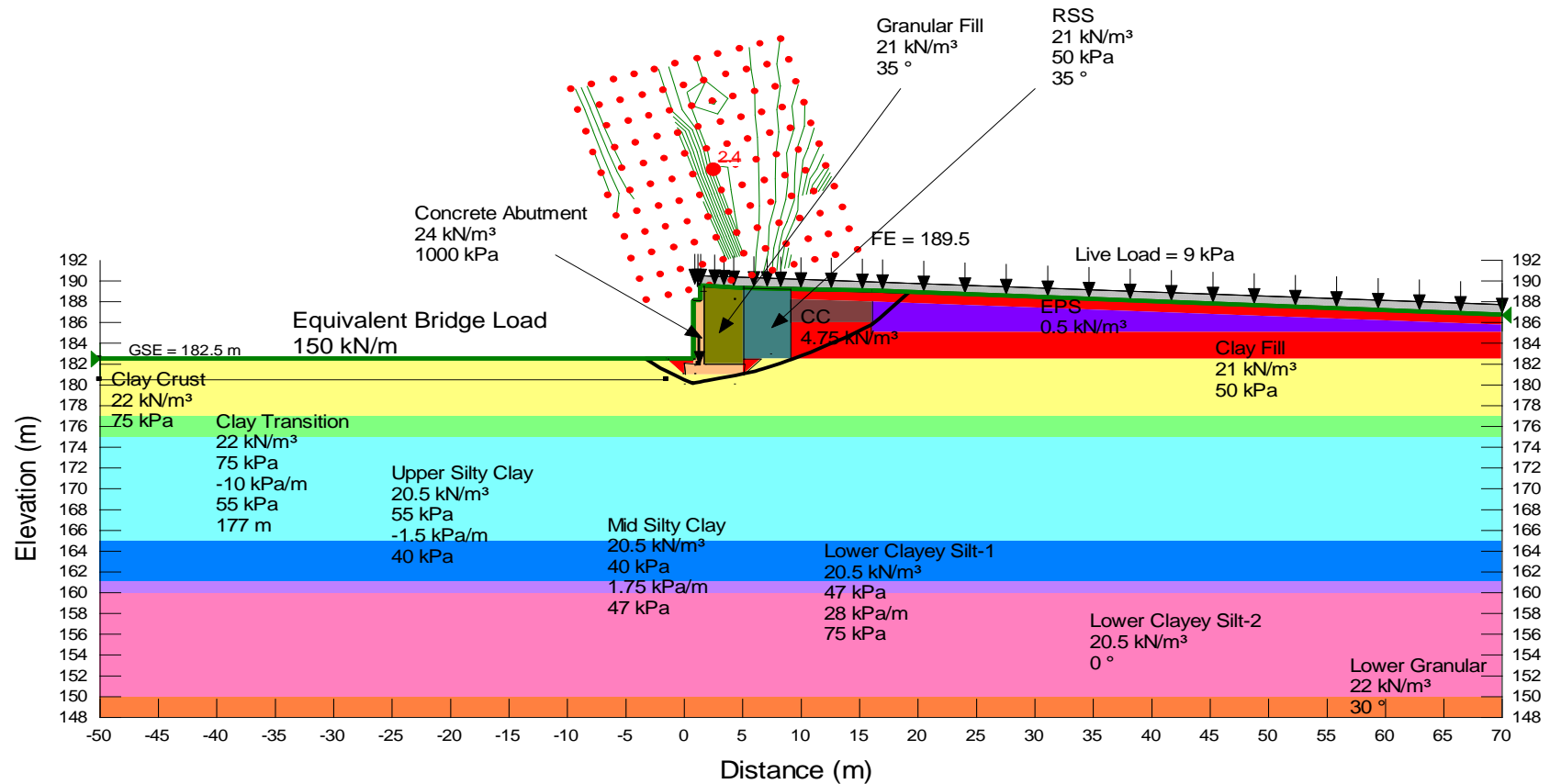
PROJECT: WINDSOR ESSEX PARKWAY				
TITLE: TB-1 SOUTH EMBANKMENT-STATION 10+770 SHORT-TERM				
DATE: Jun 2013	JOB NO.:	CAD FILE:	FIGURE NO.: D.12	REV.

File Name: TB-2 East-Bridge Footing TS.gsz
 Name: Undrained- Footing
 Date: 19/06/2013
 FOS: 1.4



File Name: TB-2- East Abutment (CC & EPS)-Longitudinal Stability.gsz
 Name: Undrained-Short-Term
 Date: 11/07/2013
 FOS: 2.4

WEP SW8801.1002.101



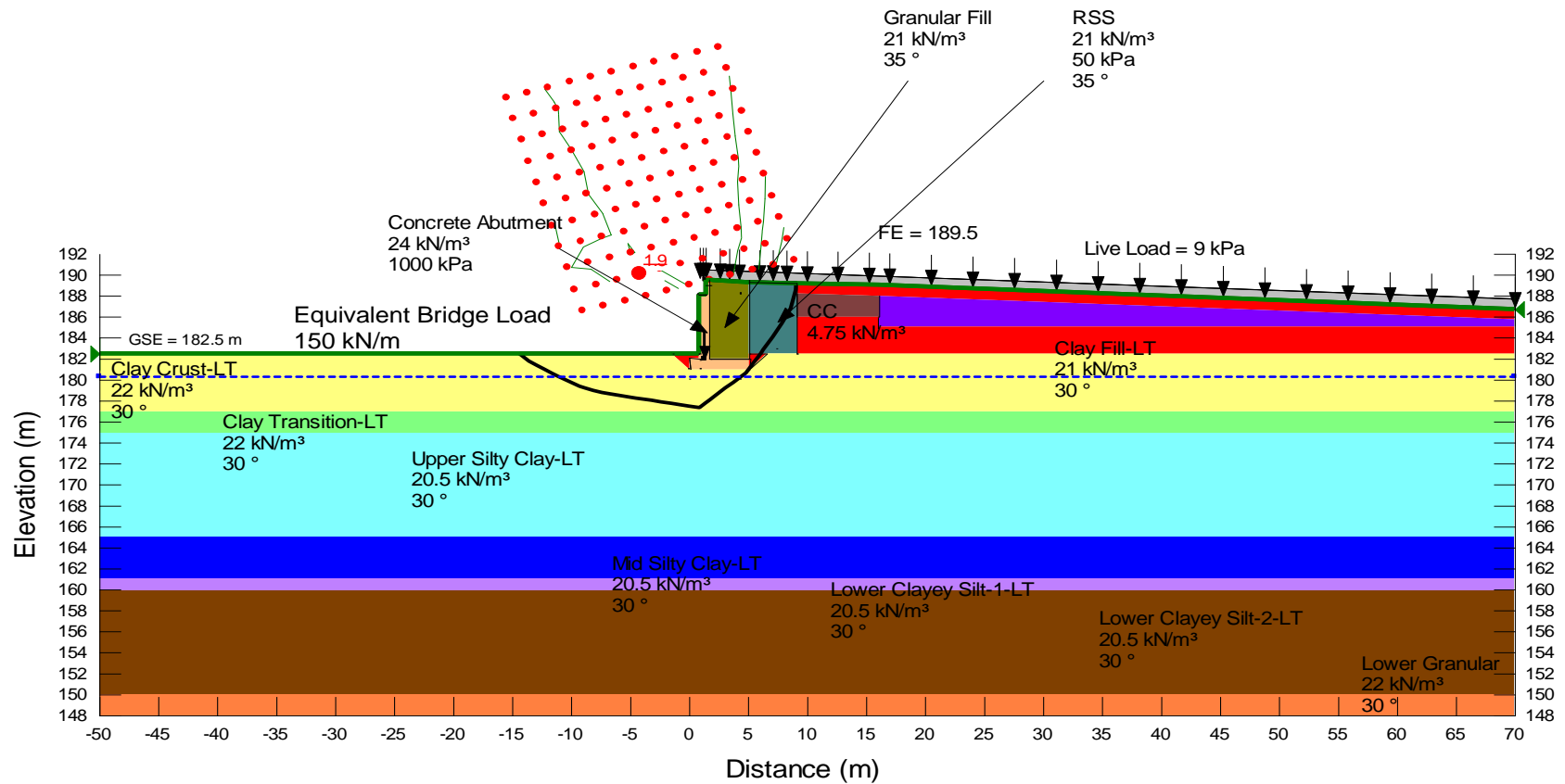
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Name: Drained - Long-Term

Date: 11/07/2013

FOS: 1.9

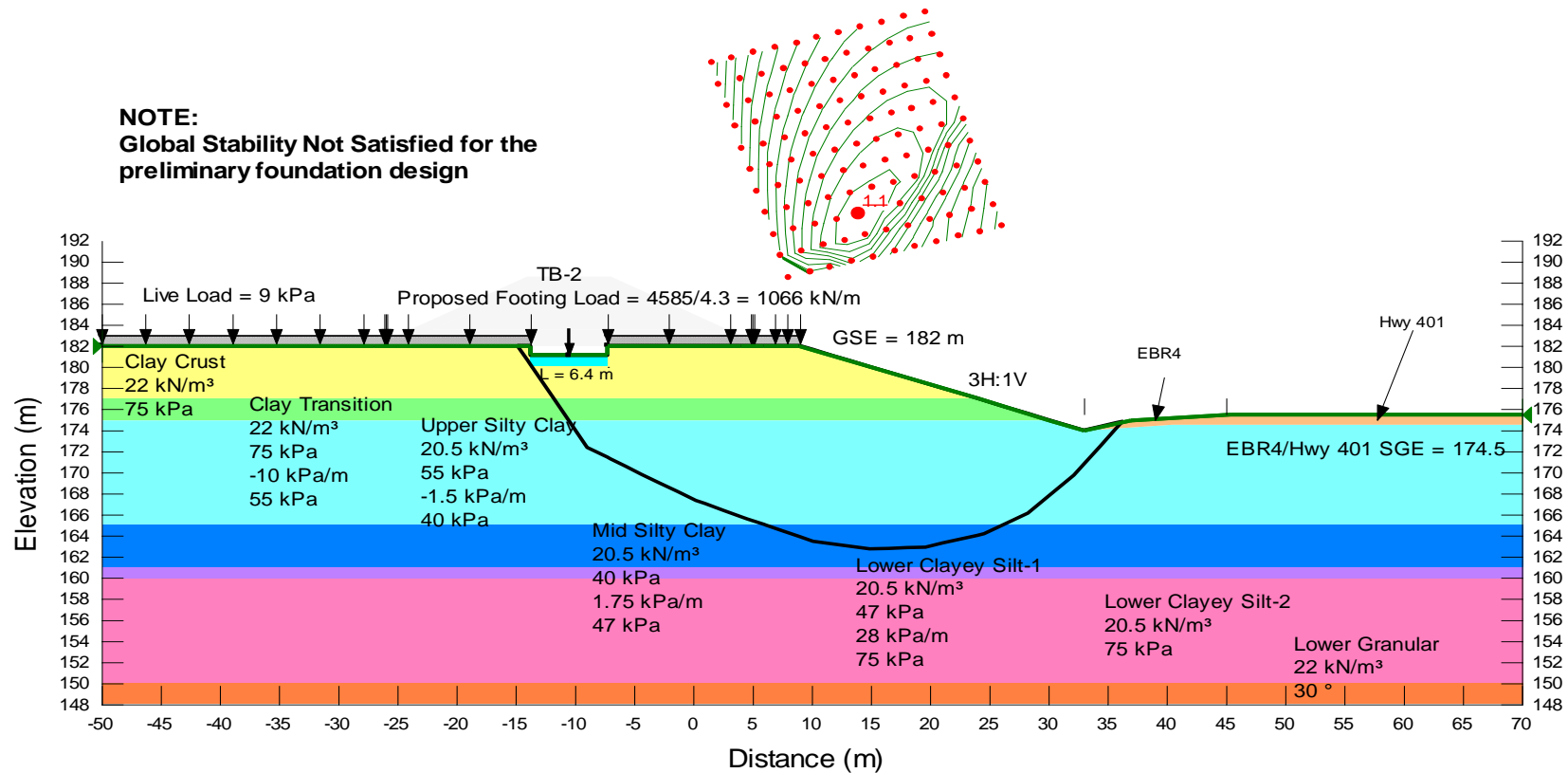
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File Name: TB-2- West -Bridge Footing TS.gsz
 Name: Undrained-Footing
 Date: 20/06/2013
 FOS: 1.1

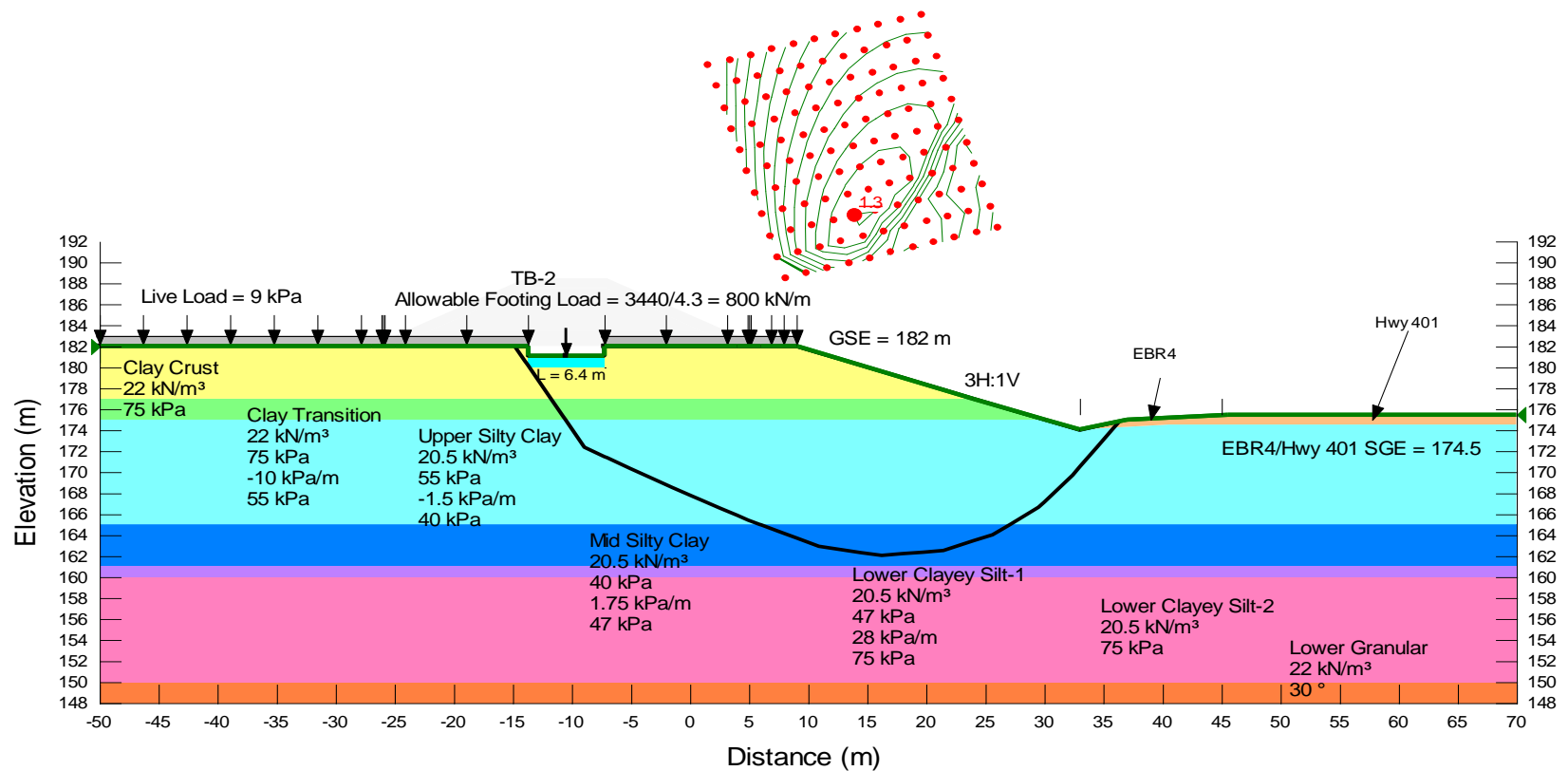
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NOTE:
 Global Stability Not Satisfied for the
 preliminary foundation design



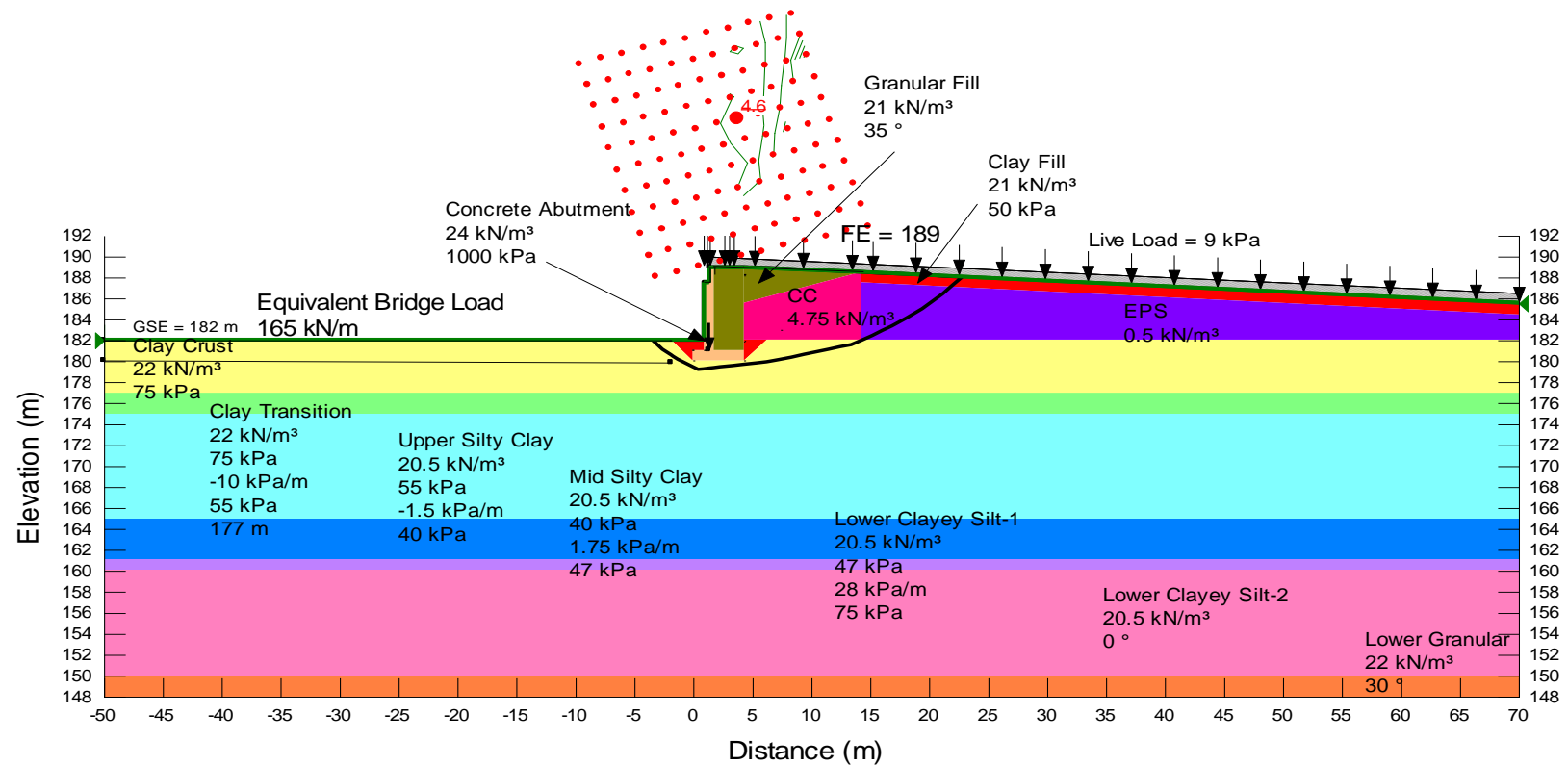
File Name: TB-2- West -Bridge Footing TS-Allowable SLS=3440 kN.gsz
Name: Undrained-Footing
Date: 08/07/2013
FOS: 1.3

WEP SW8801.1002.101



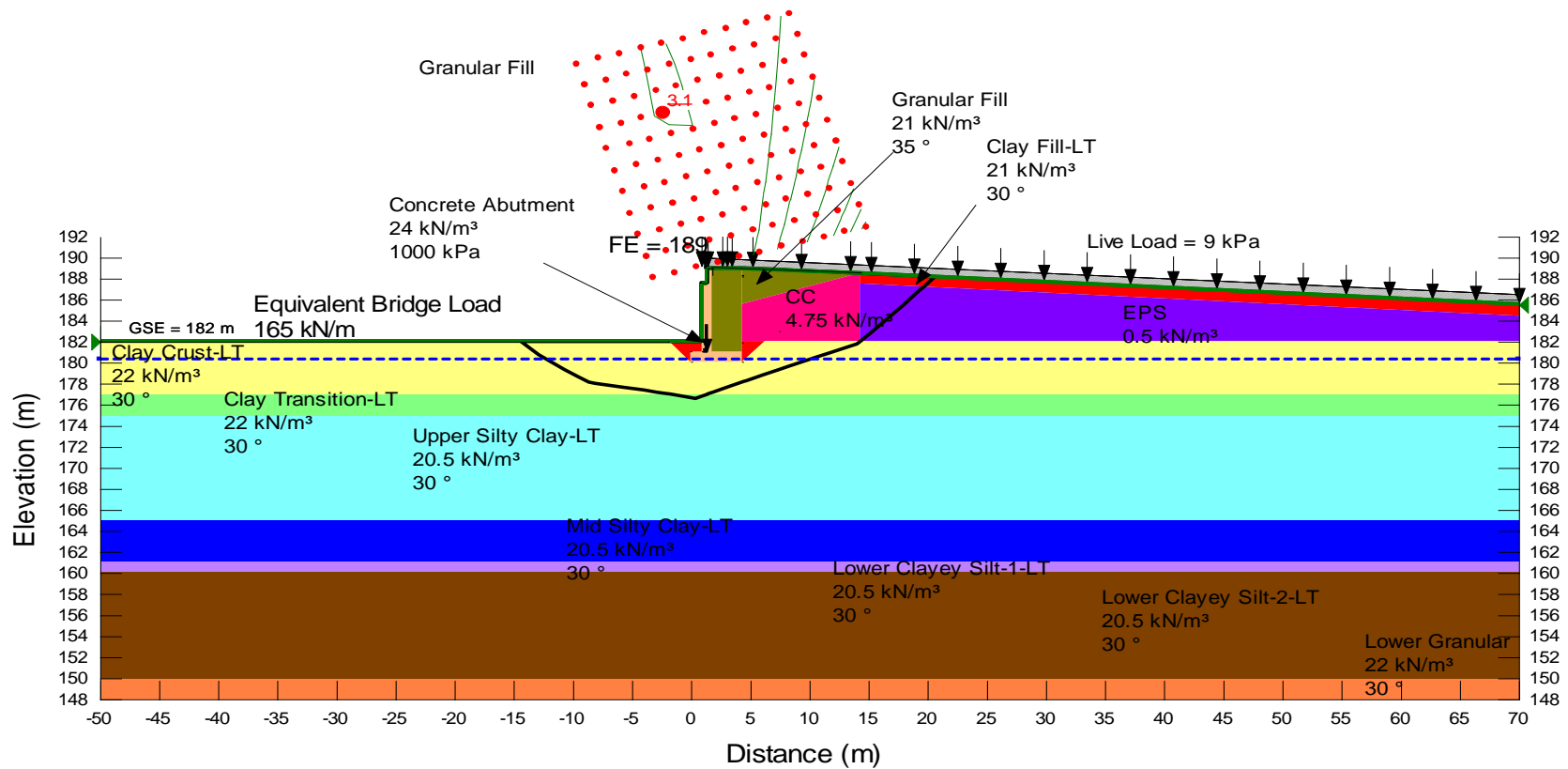
File Name: TB-2- West Abutment (CC & EPS)-Longitudinal Stability.gsz
 Name: Undrained-Short-Term
 Date: 11/07/2013
 FOS: 4.6

WEP SW8801.1002.101



File Name: TB-2- West Abutment (CC & EPS)-Longitudinal Stability.gsz
 Name: Drained - Long-Term
 Date: 11/07/2013
 FOS: 3.1

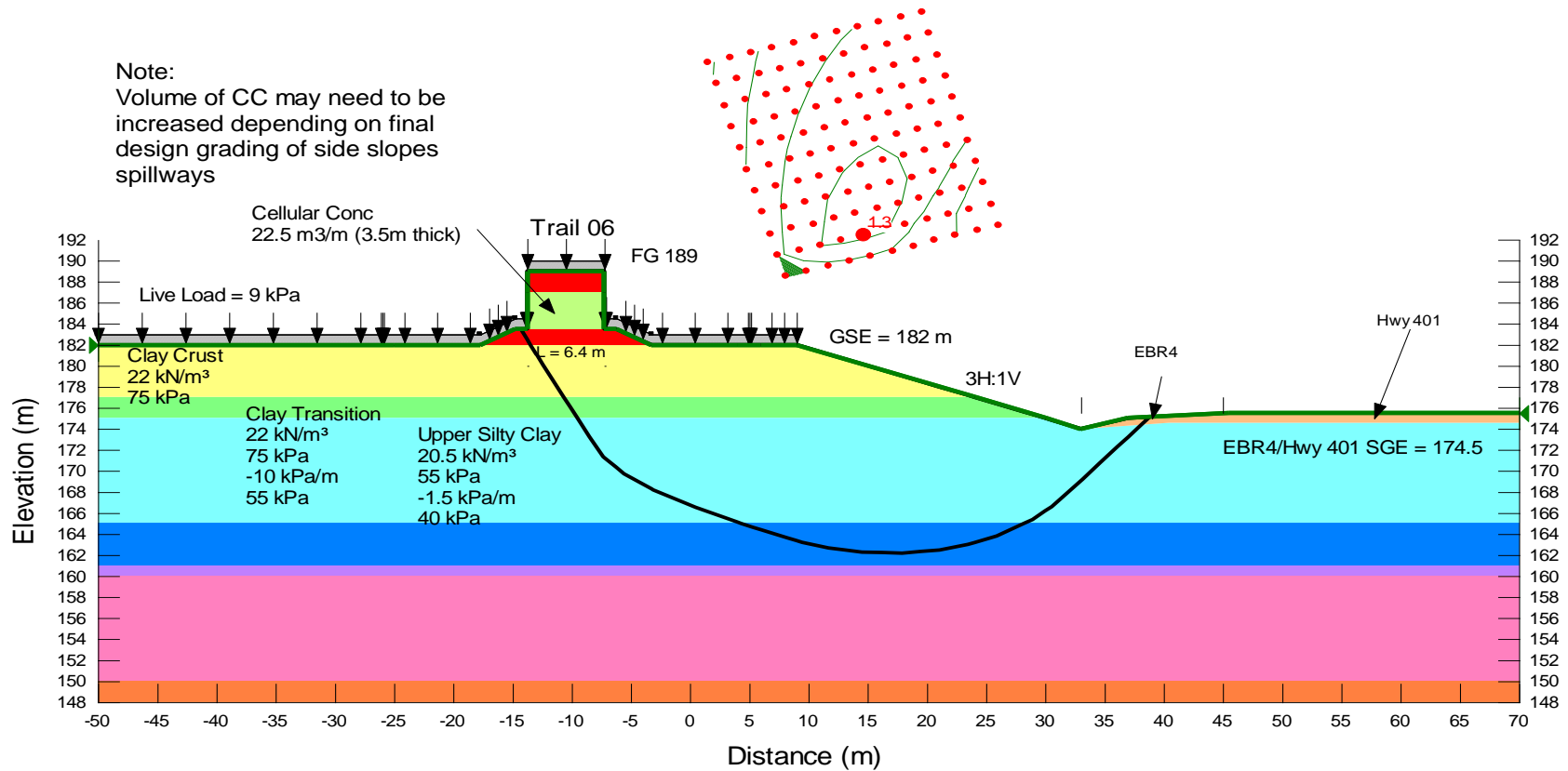
WEP SW8801.1002.101



File Name: TB-2- West -St.10+532-RSS Walls-cellular.gsz
 Name: Undrained-Behind Footing
 Date: 27/06/2013
 FOS: 1.3

WEP SW8801.1002.101

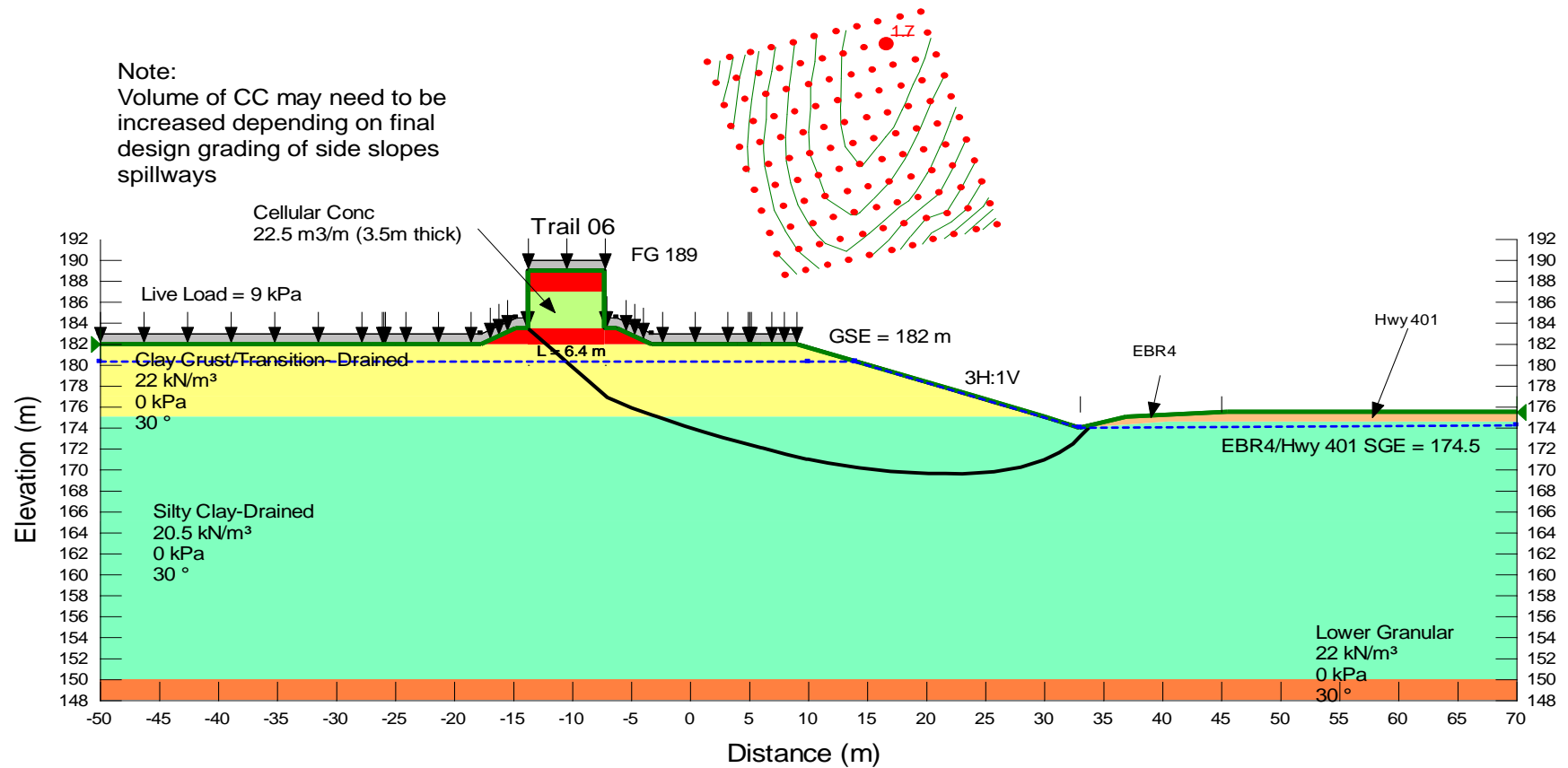
Note:
 Volume of CC may need to be
 increased depending on final
 design grading of side slopes
 spillways



File Name: TB-2- West -St.10+532-RSS Walls-cellular.gsz
 Name: Drained-Long-term
 Date: 29/06/2013
 FOS: 1.7

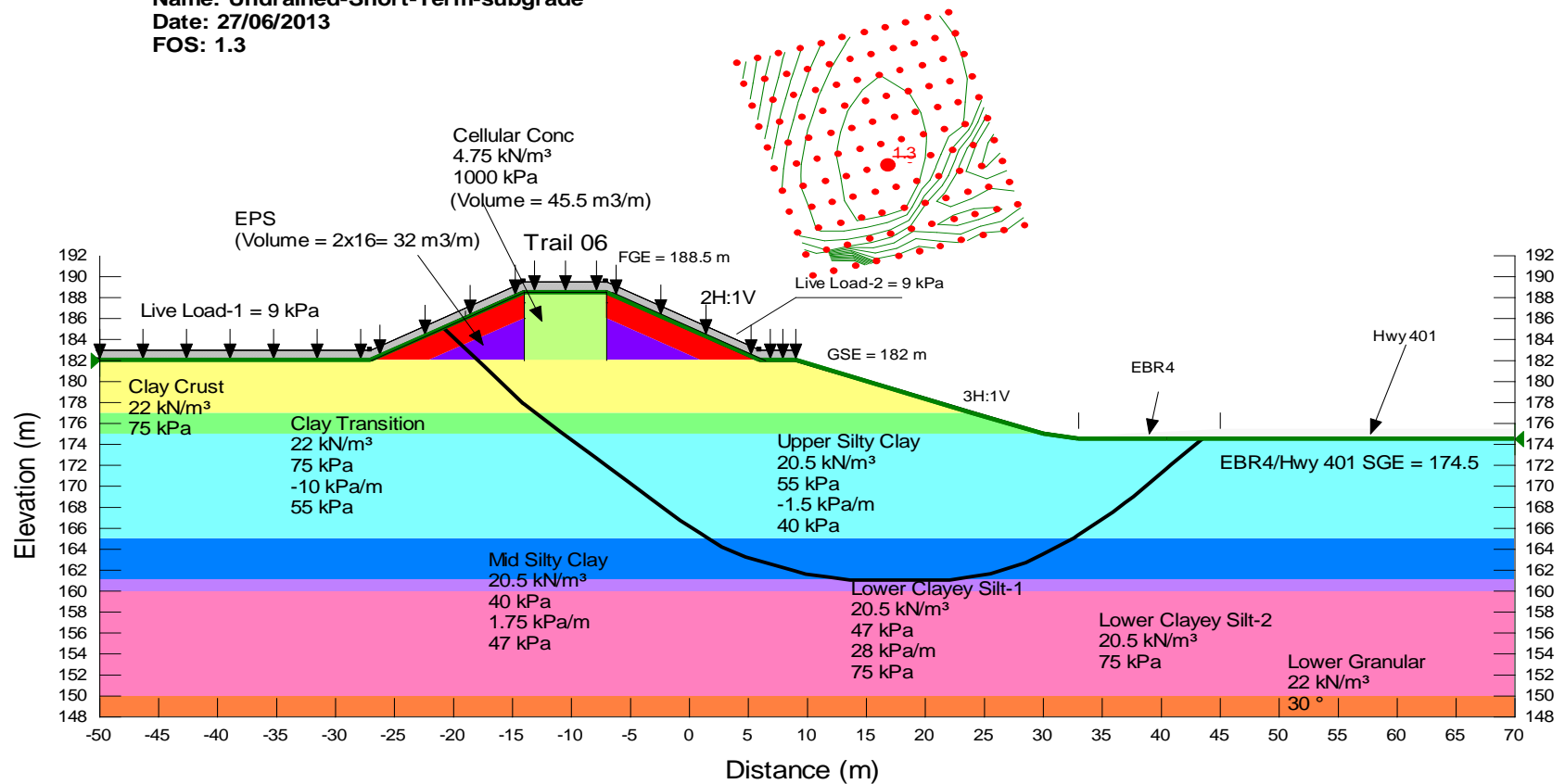
WEP SW8801.1002.101

Note:
 Volume of CC may need to be
 increased depending on final
 design grading of side slopes
 spillways



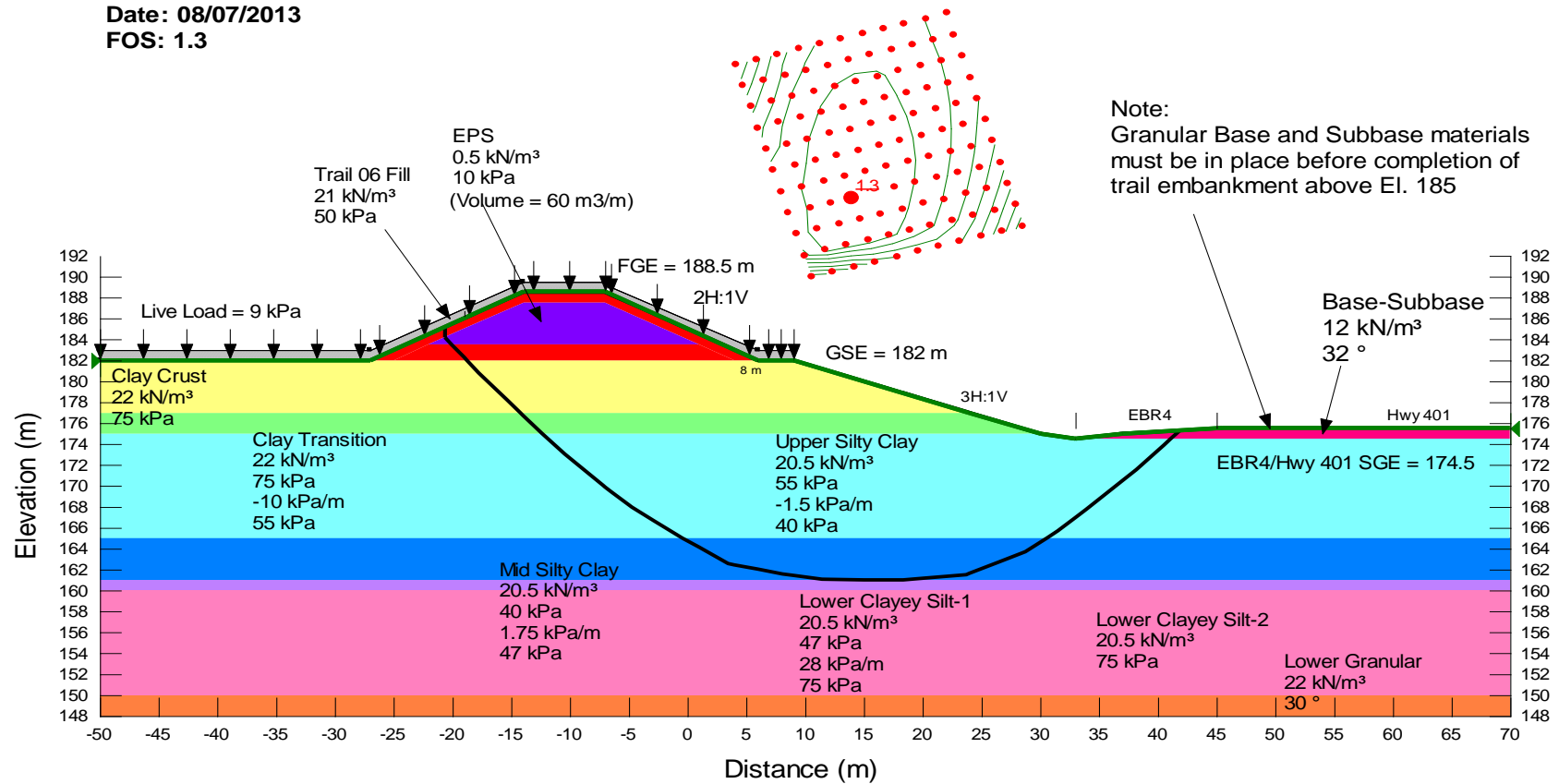
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 Name: Undrained-Short-Term-subgrade
 Date: 27/06/2013
 FOS: 1.3

WEP SW8801.1002.101



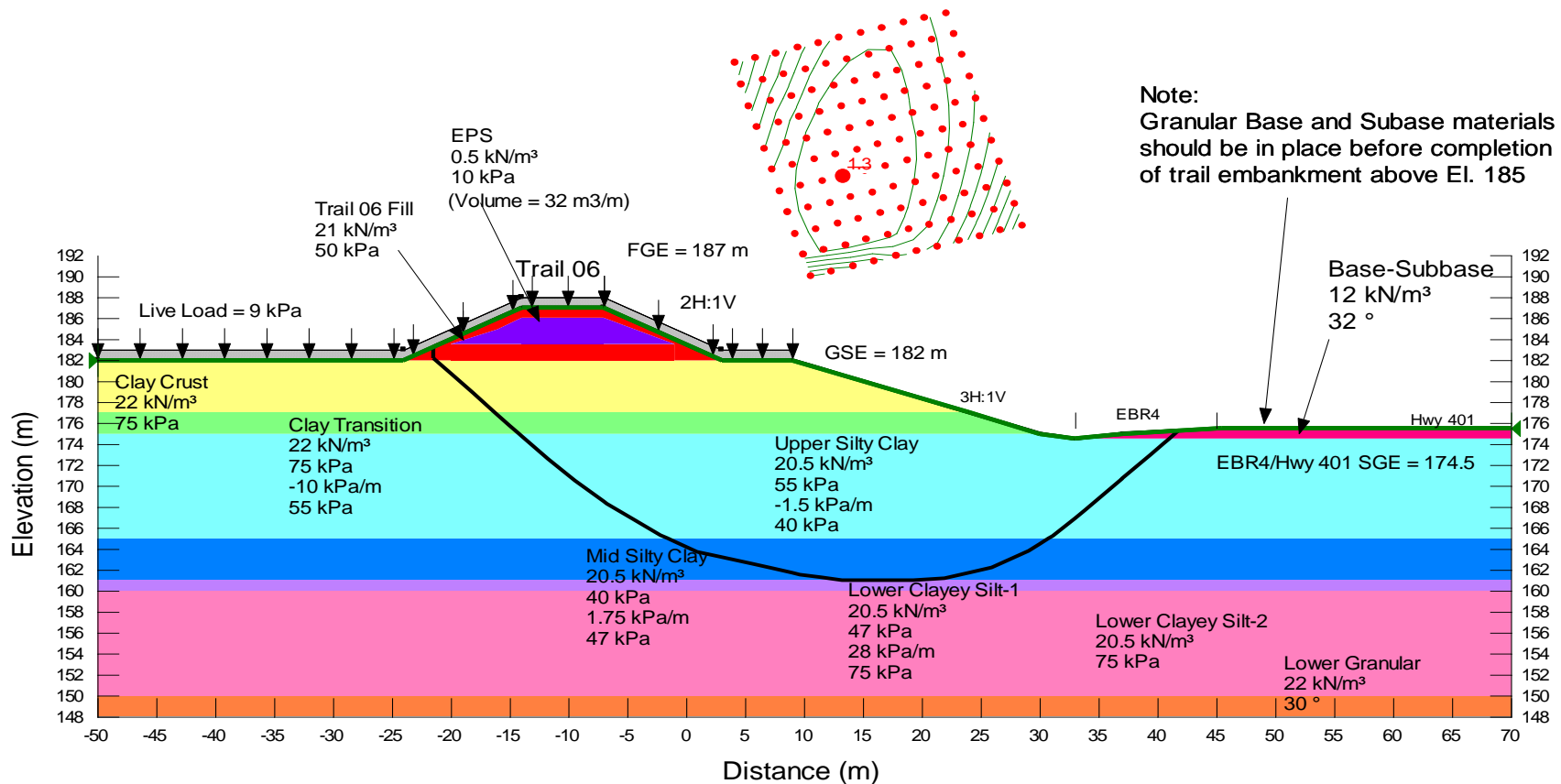
File Name: TB-2- West -St.10+515.gsz
 Name: Undrained-Short-Term-Base-Subbase
 Date: 08/07/2013
 FOS: 1.3

WEP SW8801.1002.101



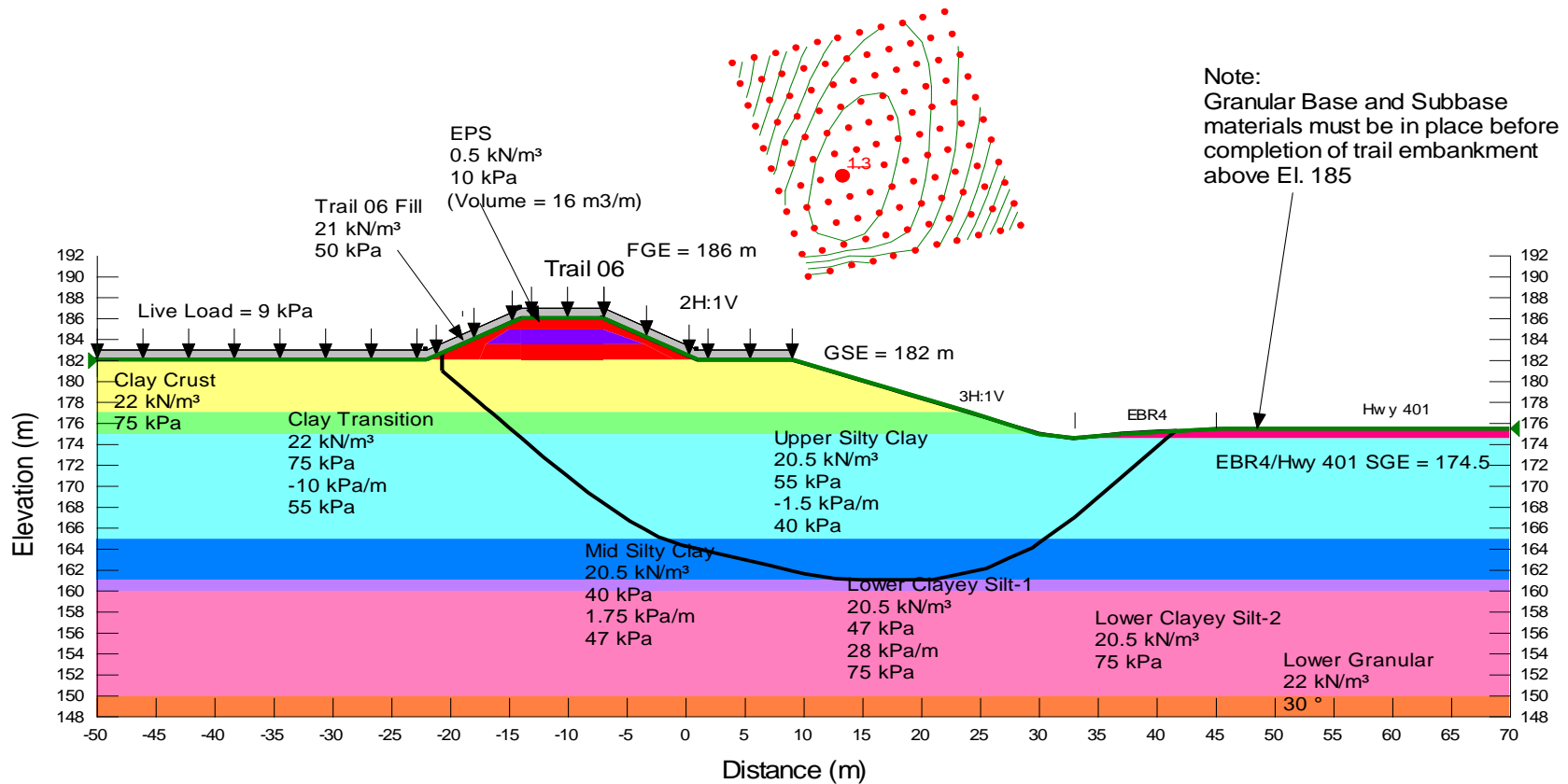
TB-2- West -St.10+495-Tr6-EPS.gsz
Name: Undrained-Short-Term-Base-Subbase
Date: 27/06/2013
FOS: 1.3

WEP SW8801.1002.101



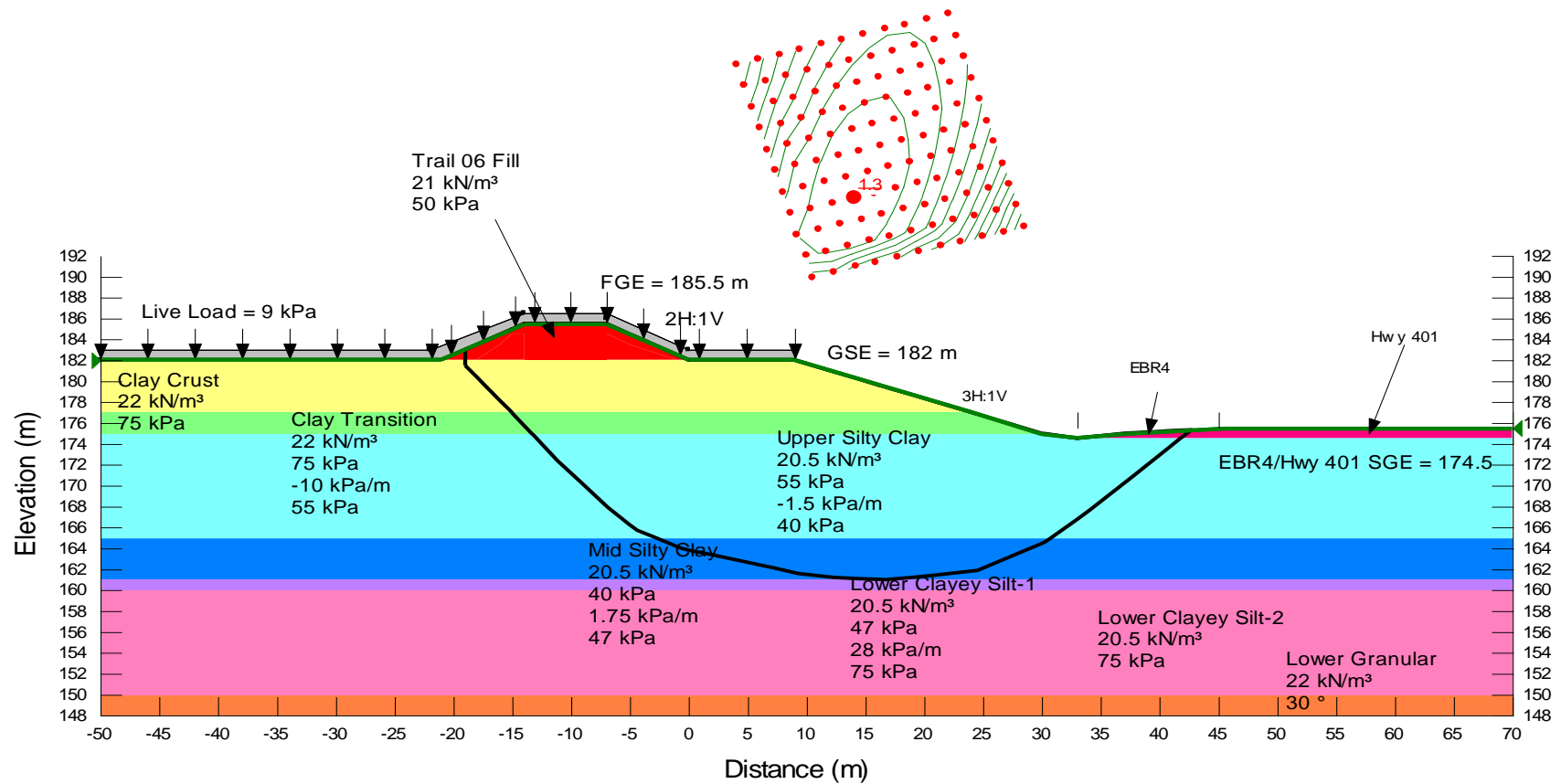
TB-2- West -St.10+475-Tr6-EPS.gsz
 Name: Undrained-Short-Term-Base-Subbase
 Date: 27/06/2013
 FOS: 1.3

WEP SW8801.1002.101

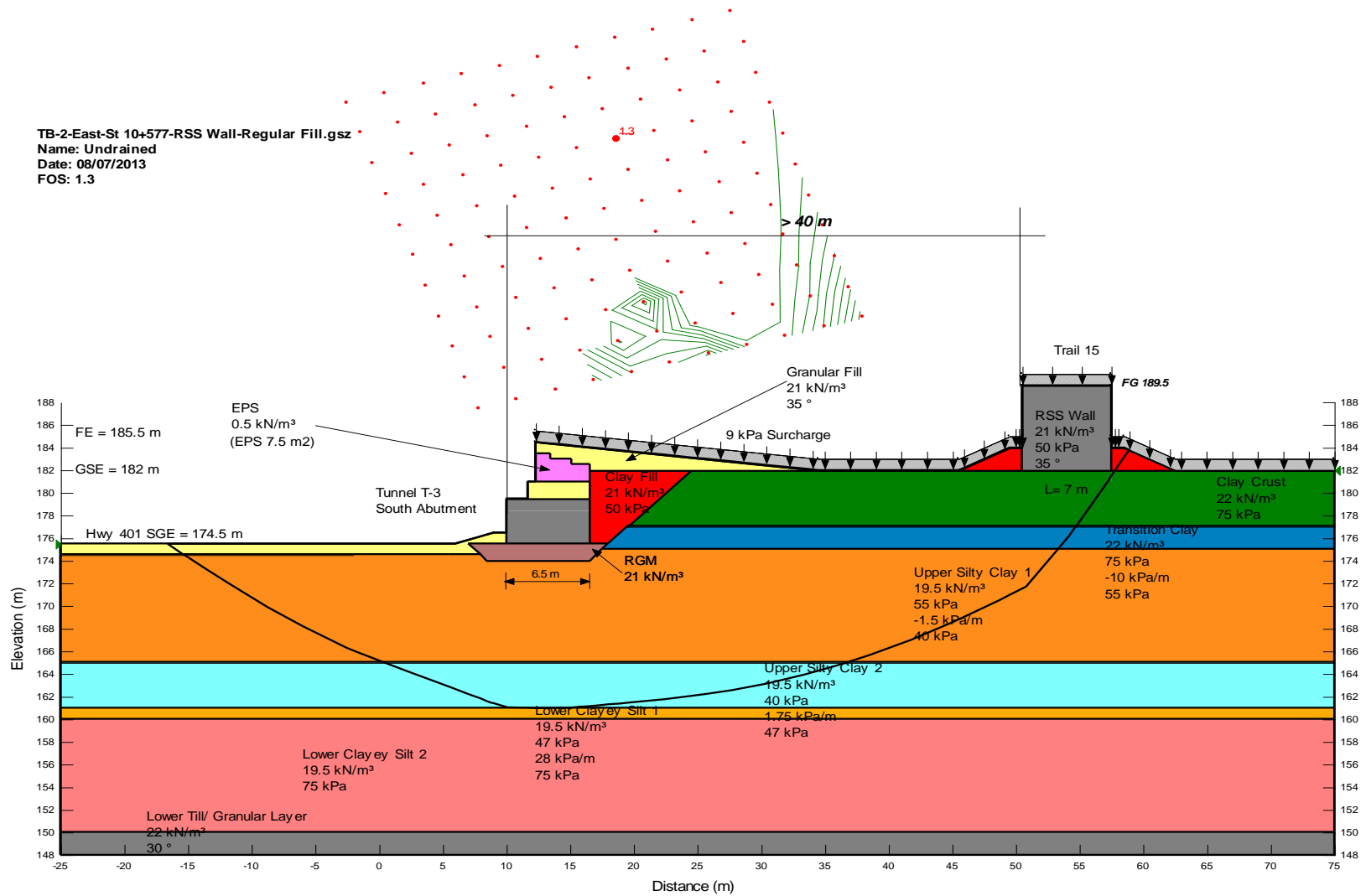


TB-2- West -St.10+465-Tr6-no EPS.gsz
 Name: Undrained-Short-Term-Base-Subbase
 Date: 26/06/2013
 FOS: 1.3

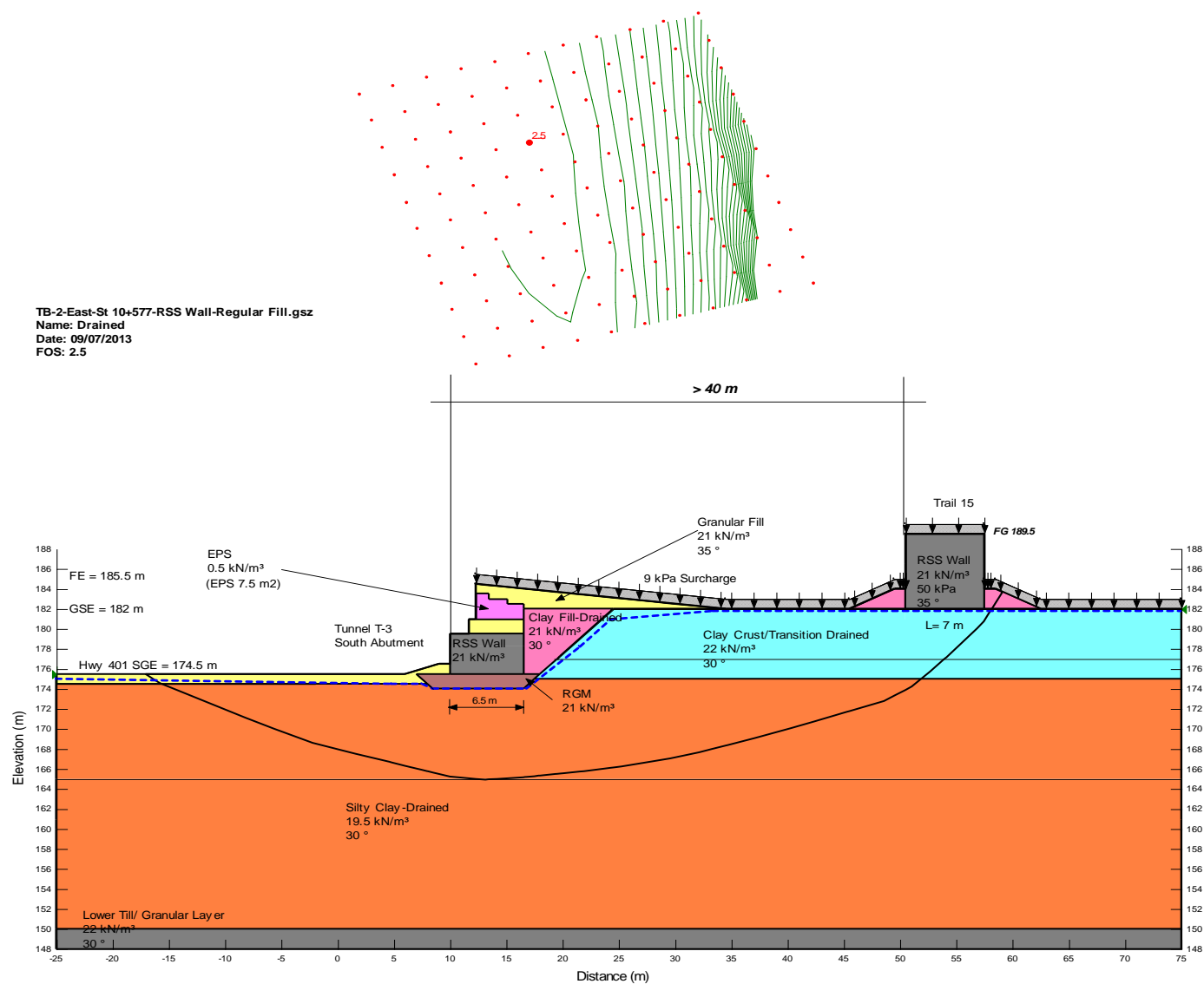
WEP SW8801.1002.101



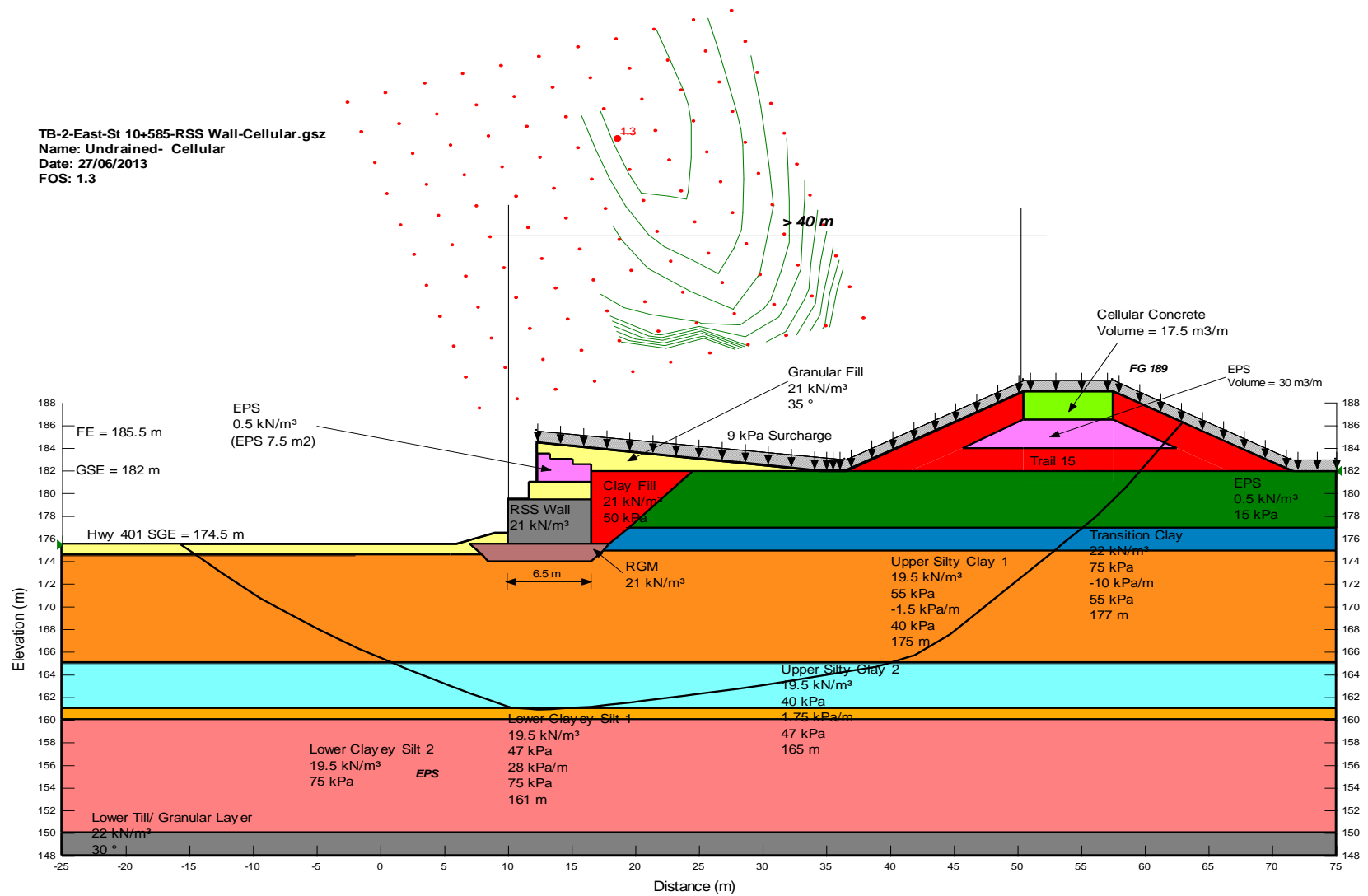
TB-2-East-St 10+577-RSS Wall-Regular Fill.gsz
 Name: Undrained
 Date: 08/07/2013
 FOS: 1.3



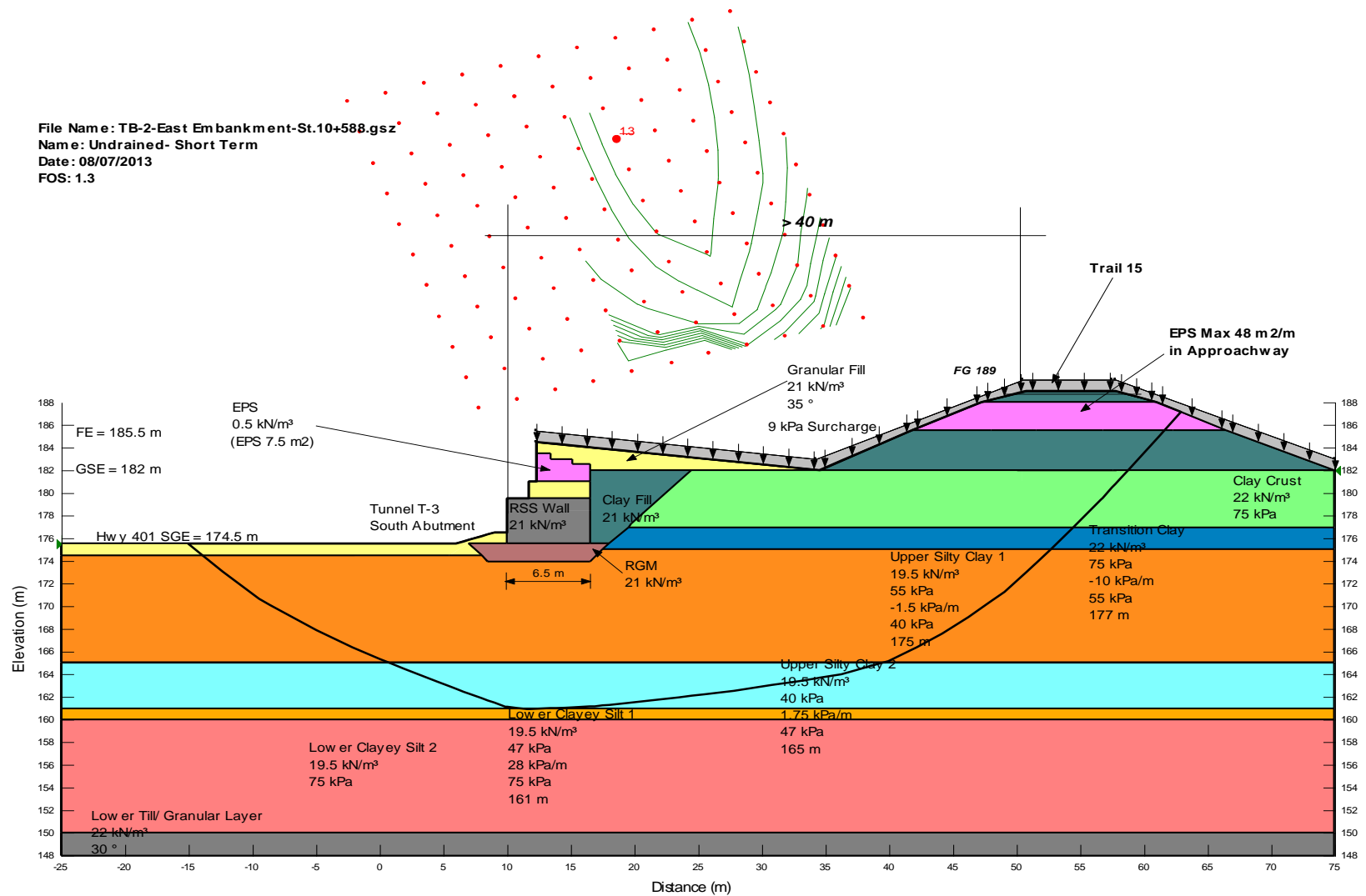
TB-2-East-St 10+577-RSS Wall-Regular Fill.gsz
 Name: Drained
 Date: 09/07/2013
 FOS: 2.5



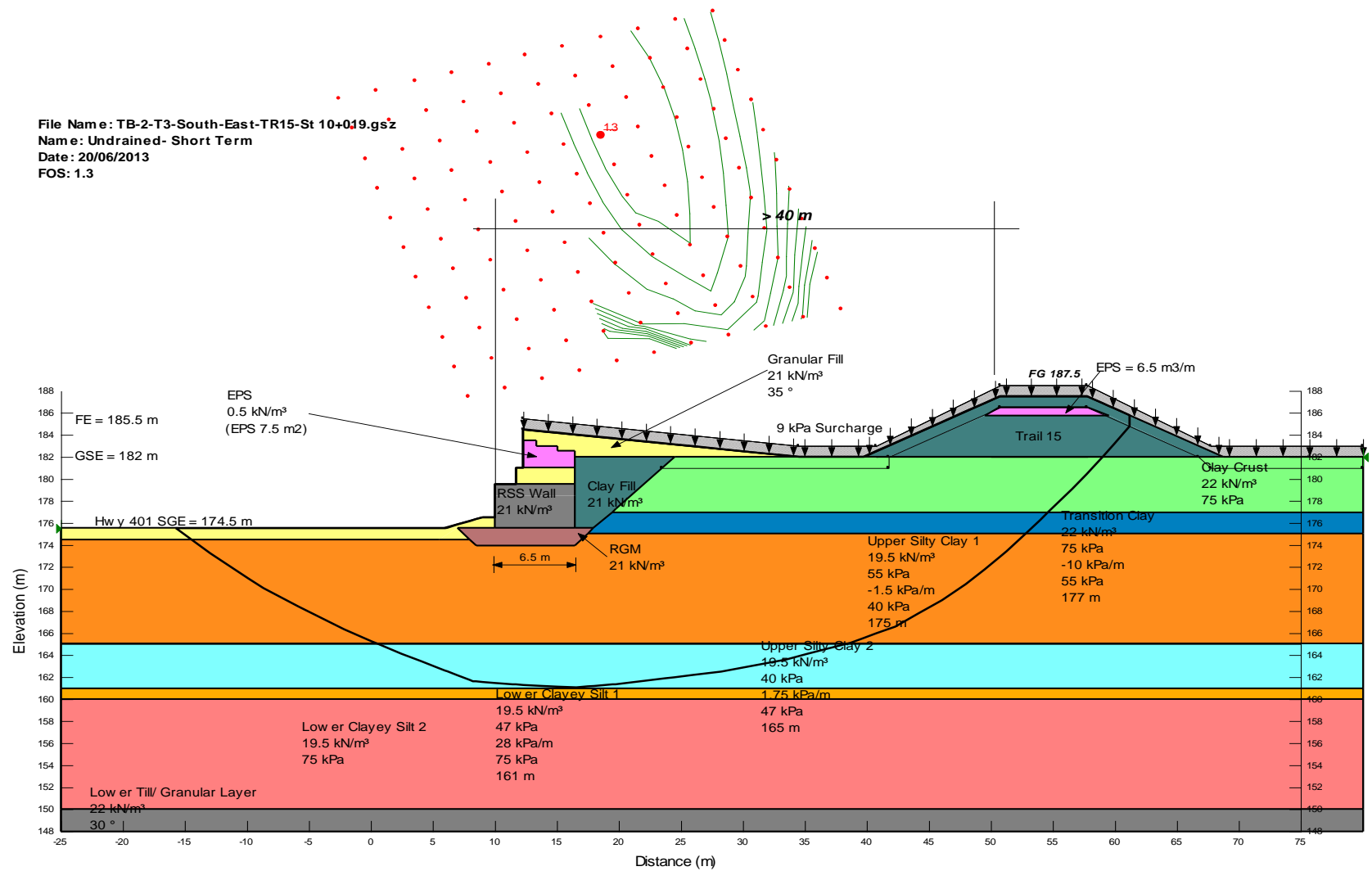
TB-2-East-St 10+585-RSS Wall-Cellular.gsz
 Name: Undrained- Cellular
 Date: 27/06/2013
 FOS: 1.3



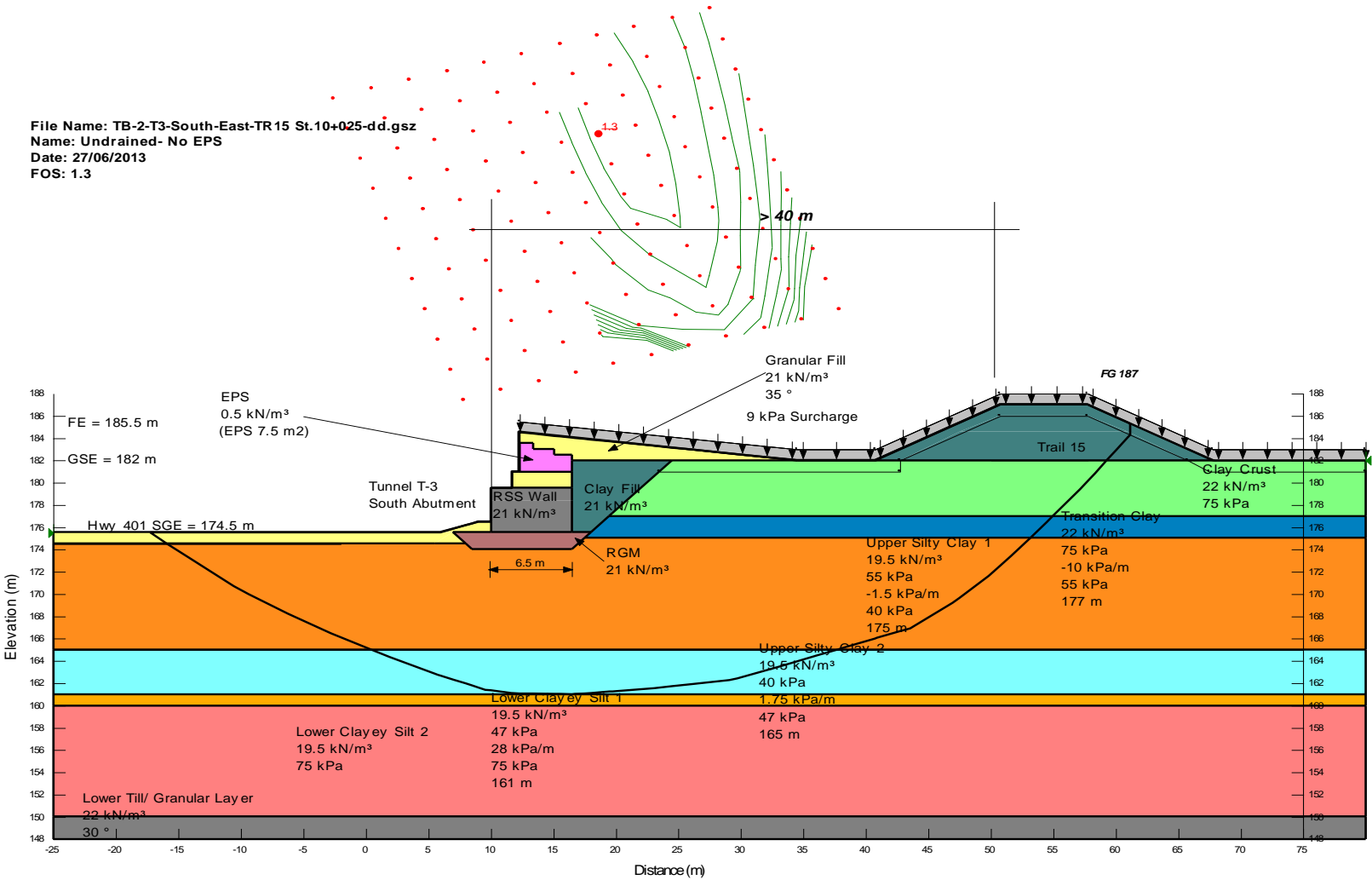
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 Name: Undrained- Short Term
 Date: 08/07/2013
 FOS: 1.3



File Name: TB-2-T3-South-East-TR15-St 10+019.gsz
 Name: Undrained- Short Term
 Date: 20/06/2013
 FOS: 1.3



File Name: TB-2-T3-South-East-TR15 St.10+025-dd.gsz
Name: Undrained- No EPS
Date: 27/06/2013
FOS: 1.3



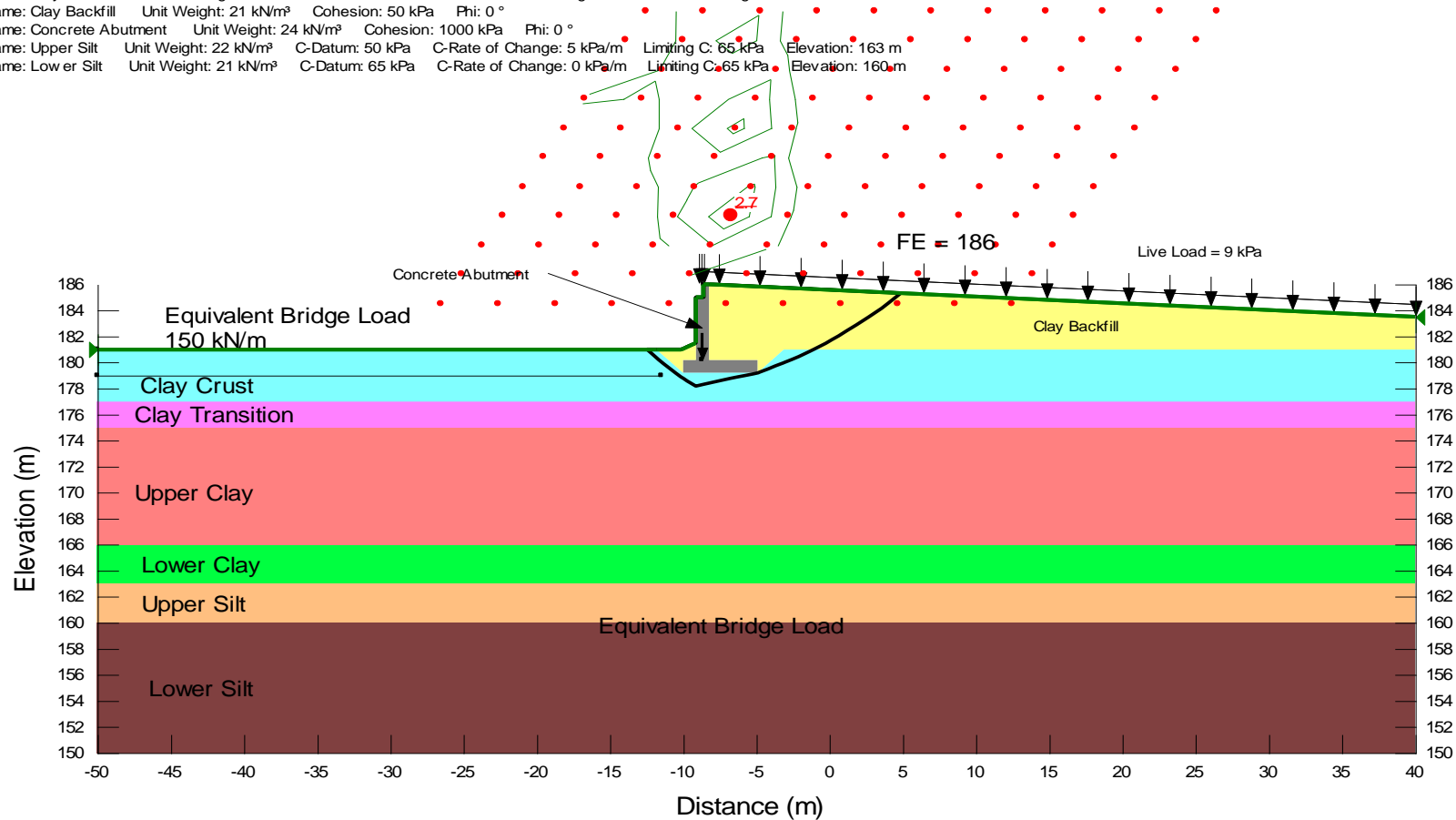
File Name: TB-4 East Abutment.gsz
Name: Undrained - Short-Term

Last Saved: 11/07/2013 - 1:13:04 PM
Analysis Method: Morgenstern-Price

Properties:

Name: Upper Clay	Unit Weight: 20 kN/m³	C-Datum: 60 kPa	C-Rate of Change: -1.67 kPa/m	Limiting C: 45 kPa	Elevation: 175 m
Name: Lower Clay	Unit Weight: 21 kN/m³	C-Datum: 45 kPa	C-Rate of Change: 1.67 kPa/m	Limiting C: 50 kPa	Elevation: 166 m
Name: Clay Crust	Unit Weight: 22 kN/m³	Cohesion: 75 kPa	Phi: 0 °		
Name: Clay Transition	Unit Weight: 22 kN/m³	C-Datum: 75 kPa	C-Rate of Change: -7.5 kPa/m	Limiting C: 60 kPa	Elevation: 177 m
Name: Clay Backfill	Unit Weight: 21 kN/m³	Cohesion: 50 kPa	Phi: 0 °		
Name: Concrete Abutment	Unit Weight: 24 kN/m³	Cohesion: 1000 kPa	Phi: 0 °		
Name: Upper Silt	Unit Weight: 22 kN/m³	C-Datum: 50 kPa	C-Rate of Change: 5 kPa/m	Limiting C: 65 kPa	Elevation: 163 m
Name: Lower Silt	Unit Weight: 21 kN/m³	C-Datum: 65 kPa	C-Rate of Change: 0 kPa/m	Limiting C: 65 kPa	Elevation: 160 m

FOS: 2.7



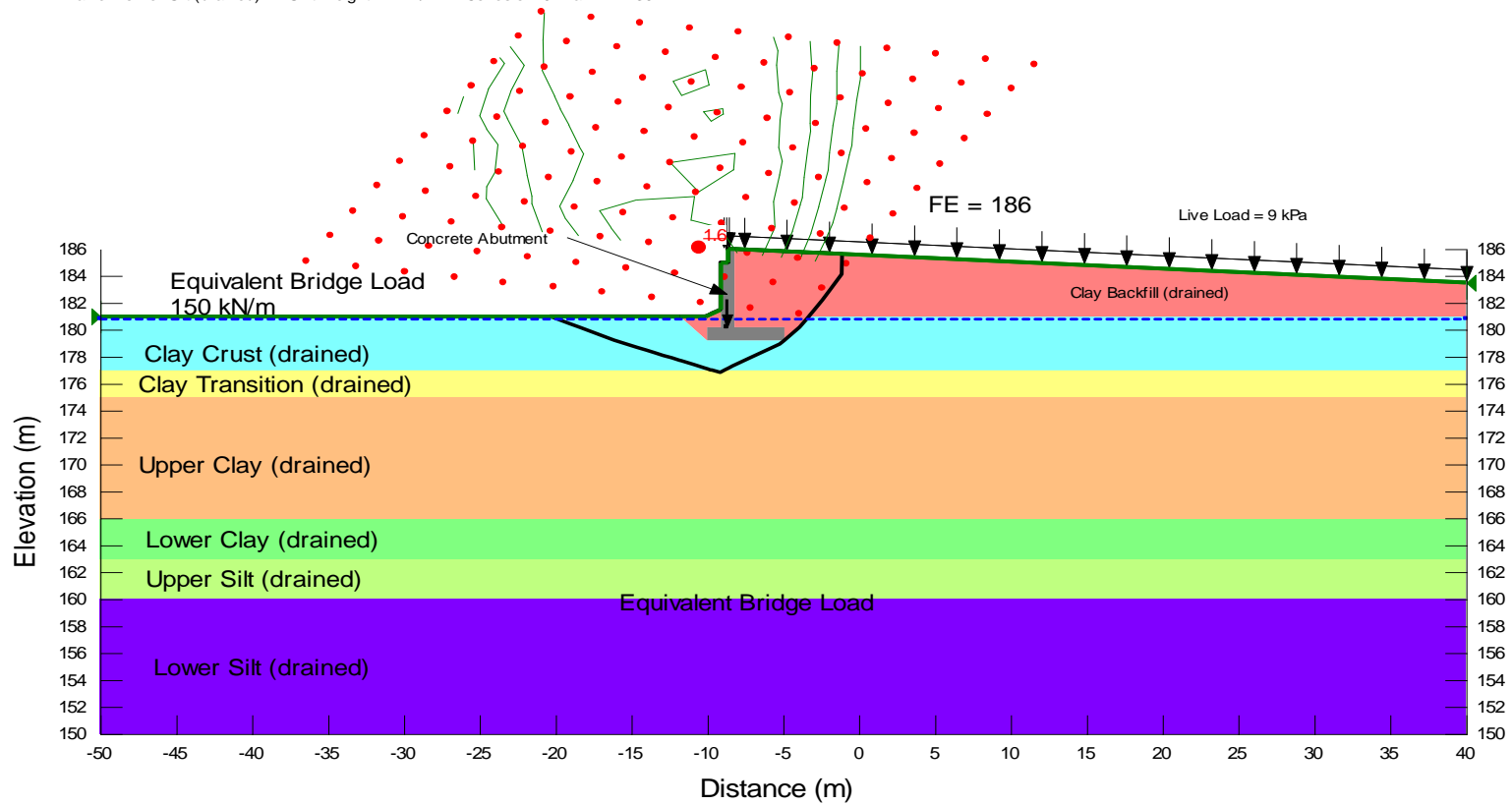
File Name: TB-4 East Abutment.gsz
Name: Drained - Long-Term

Last Saved: 11/07/2013 - 1:13:04 PM
Analysis Method: Morgenstern-Price

Properties:

Name: Upper Clay (drained)	Unit Weight: 20 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Transition (drained)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Backfill (drained)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Lower Clay (drained)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Crust (drained)	Unit Weight: 22 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Concrete Abutment	Unit Weight: 24 kN/m ³	Cohesion: 1000 kPa	Phi: 0 °
Name: Upper Silt (drained)	Unit Weight: 22 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Lower Silt (drained)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °

FOS: 1.6



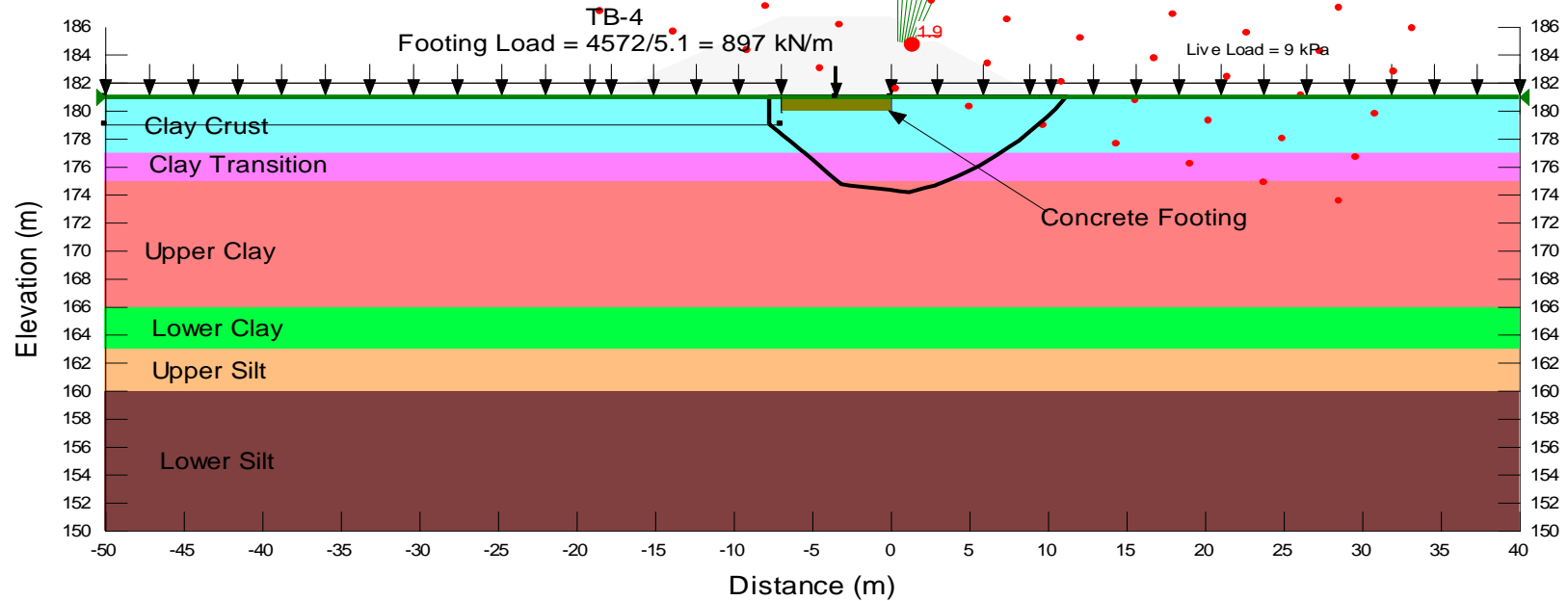
FOS: 1.9

File Name: TB-4-West Abutment -St 10+020-Bridge Footing Transverse Stability .gsz
Name: Short-Term-Concrete Footing

Last Saved: 27/06/2013 - 2:04:35 PM
Analysis Method: Morgenstern-Price

Properties:

Name: Upper Clay	Unit Weight: 20 kN/m ³	C-Datum: 60 kPa	C-Rate of Change: -1.67 kPa/m	Limiting C: 45 kPa	Elevation: 175 m
Name: Lower Clay	Unit Weight: 21 kN/m ³	C-Datum: 45 kPa	C-Rate of Change: 1.67 kPa/m	Limiting C: 50 kPa	Elevation: 166 m
Name: Clay Crust	Unit Weight: 22 kN/m ³	Cohesion: 75 kPa	Phi: 0 °		
Name: Clay Transition	Unit Weight: 21 kN/m ³	C-Datum: 75 kPa	C-Rate of Change: -7.5 kPa/m	Limiting C: 60 kPa	Elevation: 177 m
Name: Upper Silt	Unit Weight: 22 kN/m ³	C-Datum: 50 kPa	C-Rate of Change: 5 kPa/m	Limiting C: 65 kPa	Elevation: 163 m
Name: Lower Silt	Unit Weight: 21 kN/m ³	C-Datum: 65 kPa	C-Rate of Change: 0 kPa/m	Limiting C: 65 kPa	Elevation: 160 m
Name: Concrete Footing	Unit Weight: 0.1 kN/m ³	Cohesion: 1000 kPa	Phi: 0 °		



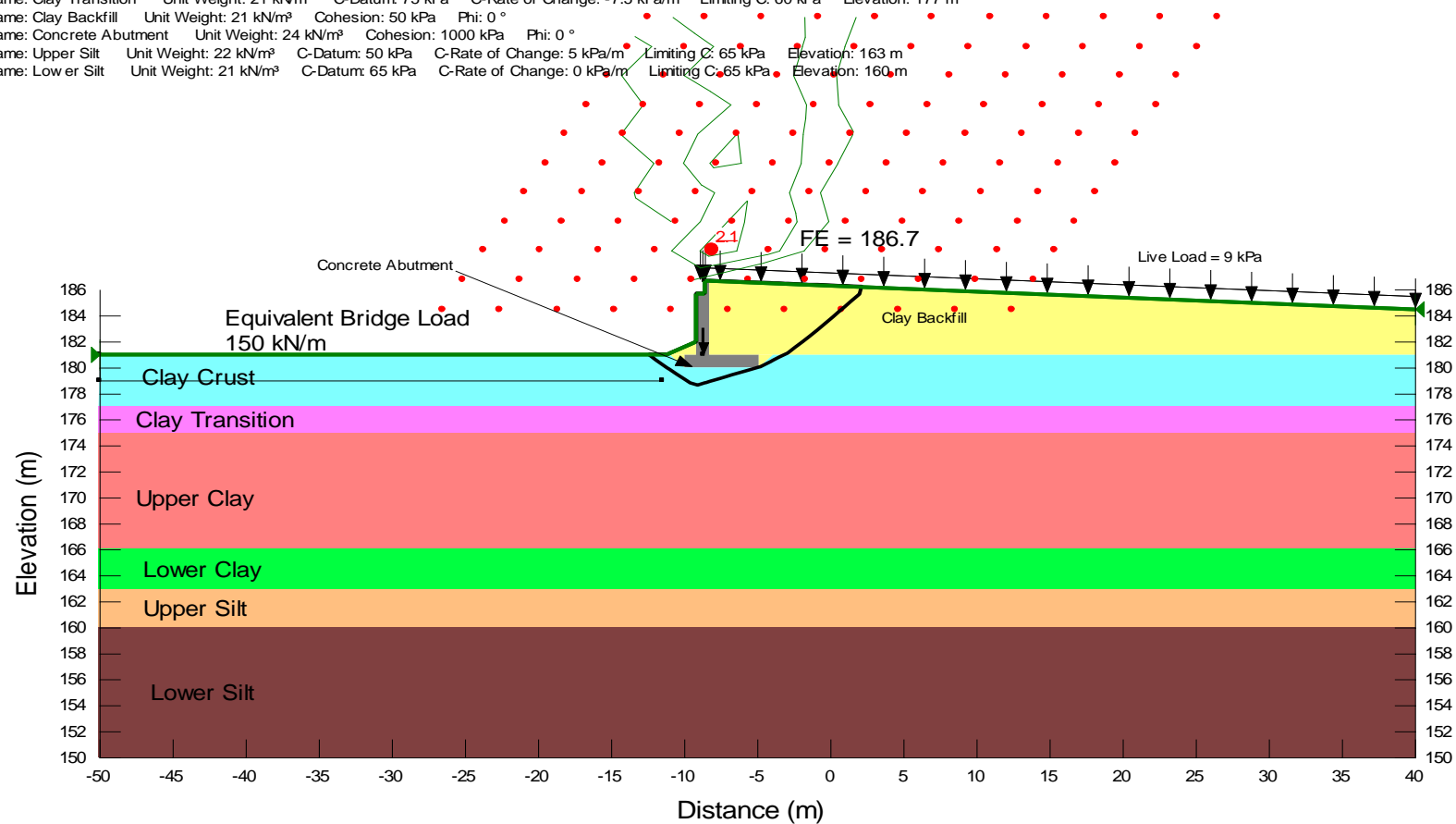
File Name: TB-4 West Abutment.gsz
Name: Undrained - Short-Term

FOS: 2.1

Last Saved: 11/07/2013 - 1:05:39 PM
Analysis Method: Morgenstern-Price

Properties:

Name: Upper Clay	Unit Weight: 20 kN/m ³	C-Datum: 60 kPa	C-Rate of Change: -1.67 kPa/m	Limiting C: 45 kPa	Elevation: 175 m
Name: Lower Clay	Unit Weight: 21 kN/m ³	C-Datum: 45 kPa	C-Rate of Change: 1.67 kPa/m	Limiting C: 50 kPa	Elevation: 166 m
Name: Clay Crust	Unit Weight: 22 kN/m ³	Cohesion: 75 kPa	Phi: 0 °		
Name: Clay Transition	Unit Weight: 21 kN/m ³	C-Datum: 75 kPa	C-Rate of Change: -7.5 kPa/m	Limiting C: 60 kPa	Elevation: 177 m
Name: Clay Backfill	Unit Weight: 21 kN/m ³	Cohesion: 50 kPa	Phi: 0 °		
Name: Concrete Abutment	Unit Weight: 24 kN/m ³	Cohesion: 1000 kPa	Phi: 0 °		
Name: Upper Silt	Unit Weight: 22 kN/m ³	C-Datum: 50 kPa	C-Rate of Change: 5 kPa/m	Limiting C: 65 kPa	Elevation: 163 m
Name: Lower Silt	Unit Weight: 21 kN/m ³	C-Datum: 65 kPa	C-Rate of Change: 0 kPa/m	Limiting C: 65 kPa	Elevation: 160 m



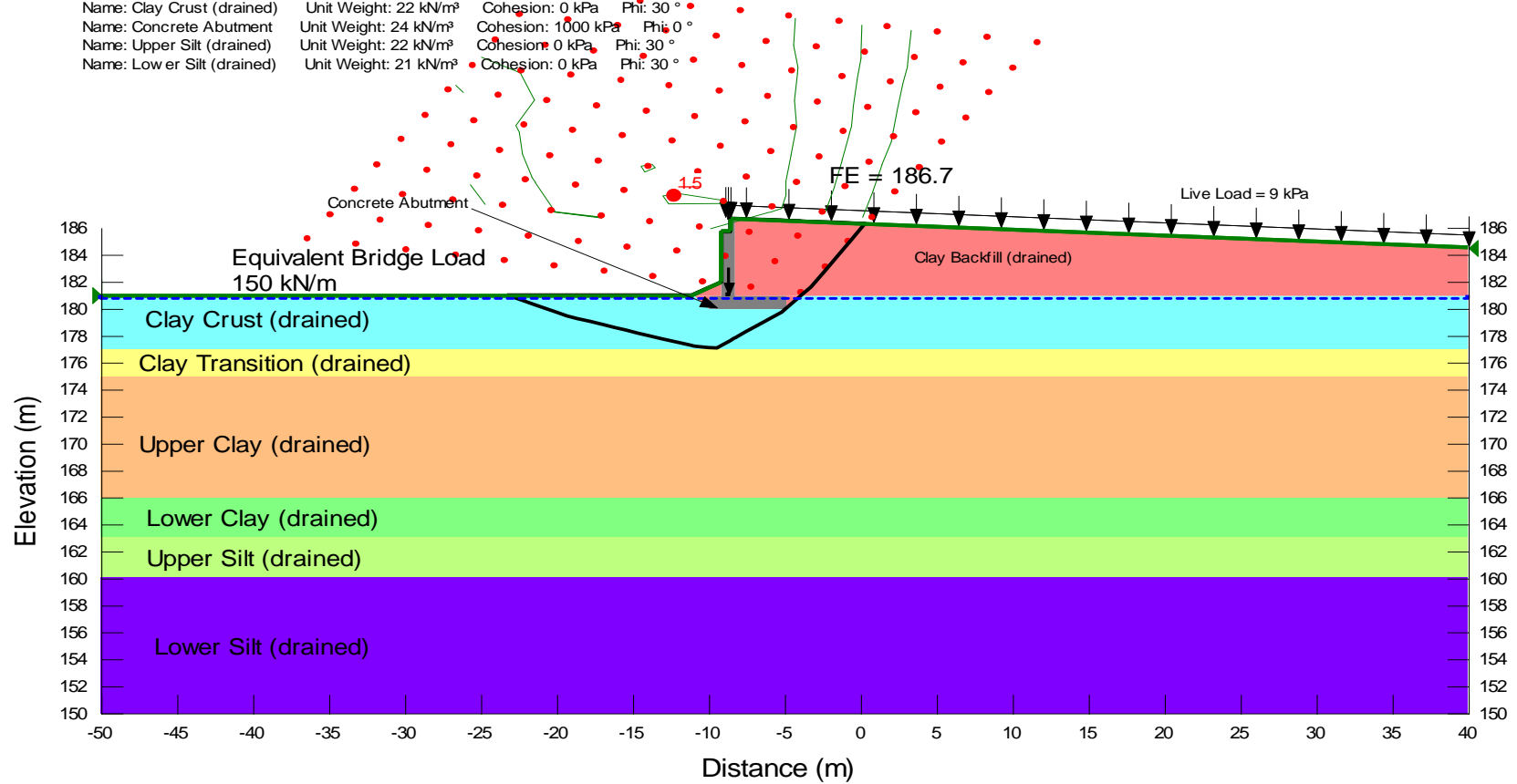
FOS: 1.5

File Name: TB-4 West Abutment.gsz
Name: Drained - Long-Term

Last Saved: 11/07/2013 - 1:05:39 PM
Analysis Method: Morgenstern-Price

Properties:

Name: Upper Clay (drained)	Unit Weight: 20 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Transition (drained)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Backfill (drained)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Lower Clay (drained)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Crust (drained)	Unit Weight: 22 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Concrete Abutment	Unit Weight: 24 kN/m ³	Cohesion: 1000 kPa	Phi: 0 °
Name: Upper Silt (drained)	Unit Weight: 22 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Lower Silt (drained)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °



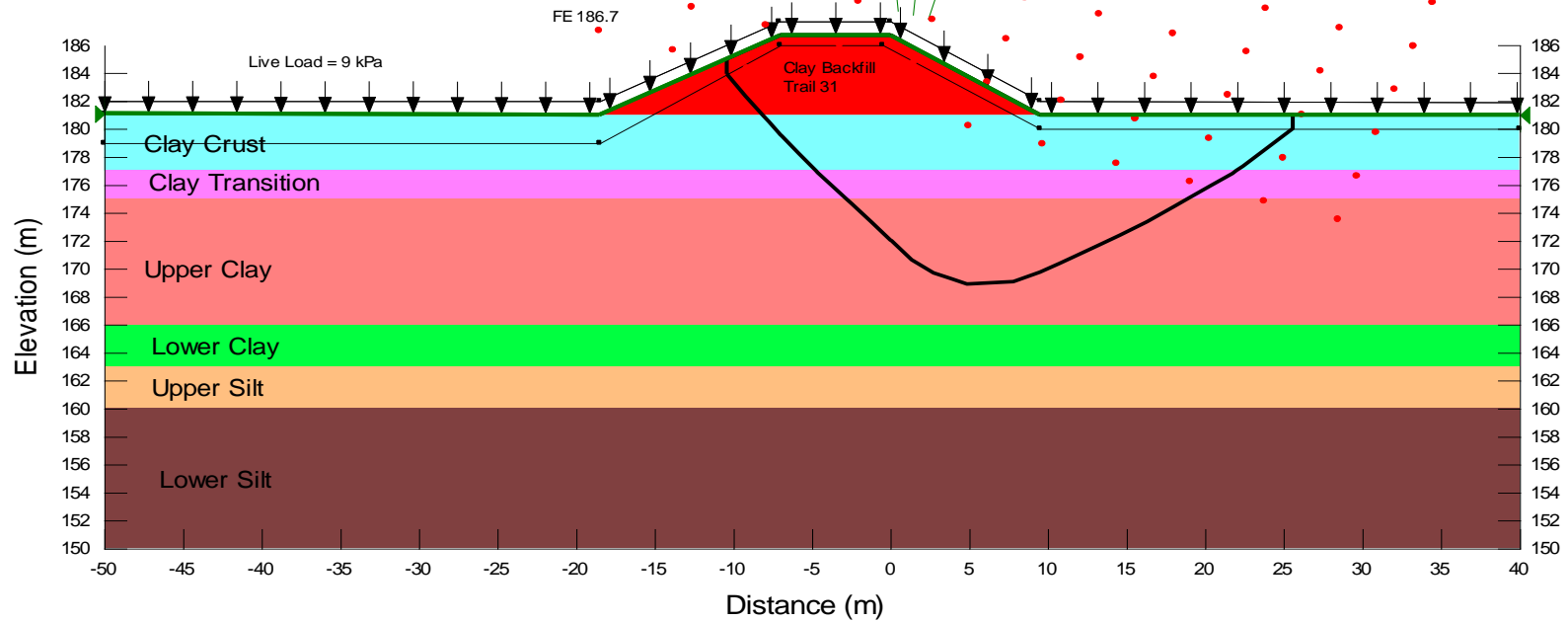
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File Name: TB-4-West Embankment -St 10+020.gsz
Name: Short-Term

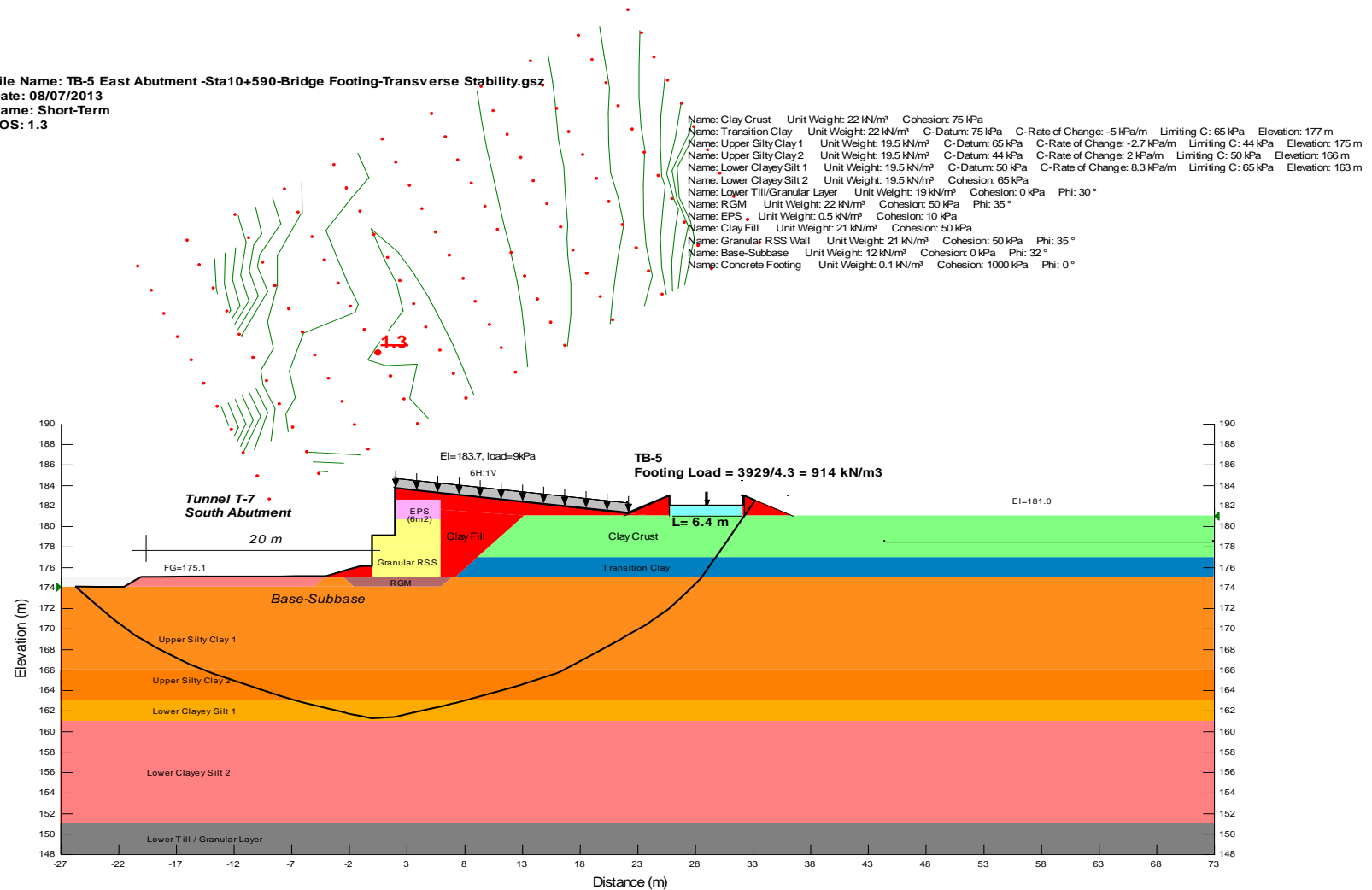
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Analysis Method: Morgenstern-Price

Properties:

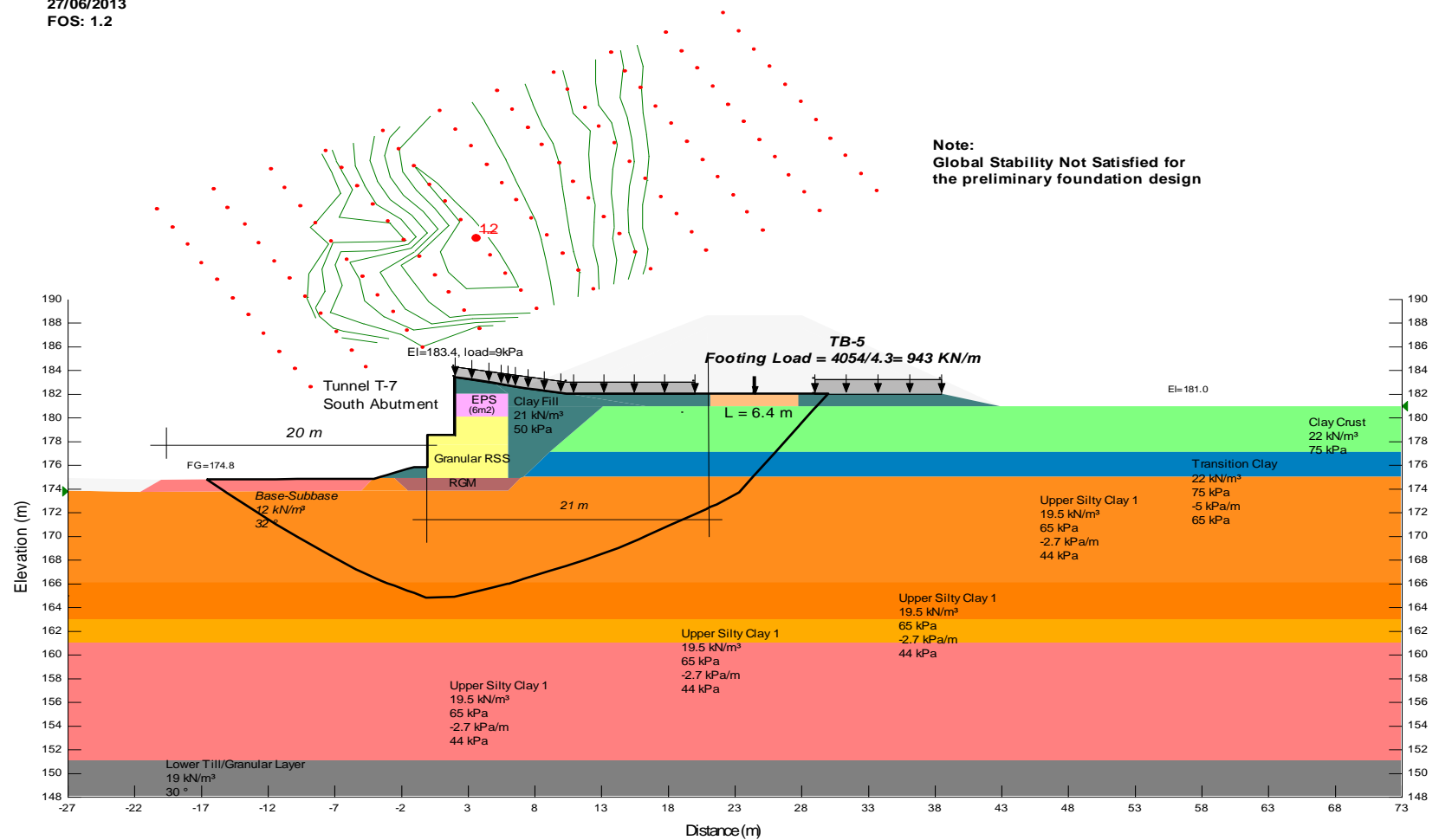
Name: Upper Clay	Unit Weight: 20 kN/m³	C-Datum: 60 kPa	C-Rate of Change: -1.67 kPa/m	Limiting C: 45 kPa	Elevation: 175 m
Name: Lower Clay	Unit Weight: 21 kN/m³	C-Datum: 45 kPa	C-Rate of Change: 1.67 kPa/m	Limiting C: 50 kPa	Elevation: 166 m
Name: Clay Crust	Unit Weight: 22 kN/m³	Cohesion: 75 kPa	Phi: 0°		
Name: Clay Transition	Unit Weight: 21 kN/m³	C-Datum: 75 kPa	C-Rate of Change: -7.5 kPa/m	Limiting C: 60 kPa	Elevation: 177 m
Name: Clay Backfill	Unit Weight: 21 kN/m³	Cohesion: 50 kPa	Phi: 0°		
Name: Upper Silt	Unit Weight: 22 kN/m³	C-Datum: 50 kPa	C-Rate of Change: 5 kPa/m	Limiting C: 65 kPa	Elevation: 163 m
Name: Lower Silt	Unit Weight: 21 kN/m³	C-Datum: 65 kPa	C-Rate of Change: 0 kPa/m	Limiting C: 65 kPa	Elevation: 160 m



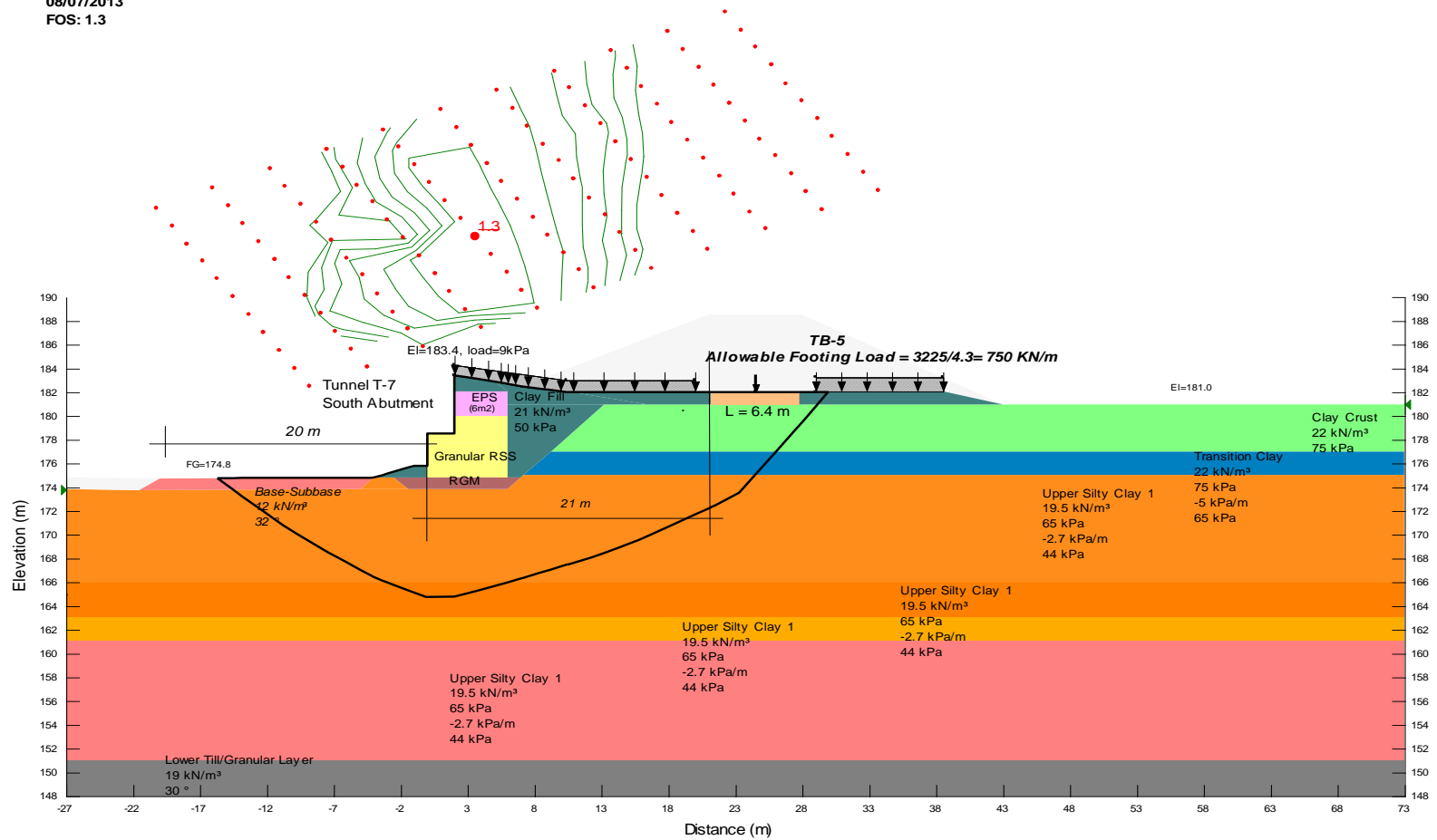
File Name: TB-5 East Abutment -Sta10+590-Bridge Footing-Transverse Stability.gsz
 Date: 08/07/2013
 Name: Short-Term
 FOS: 1.3



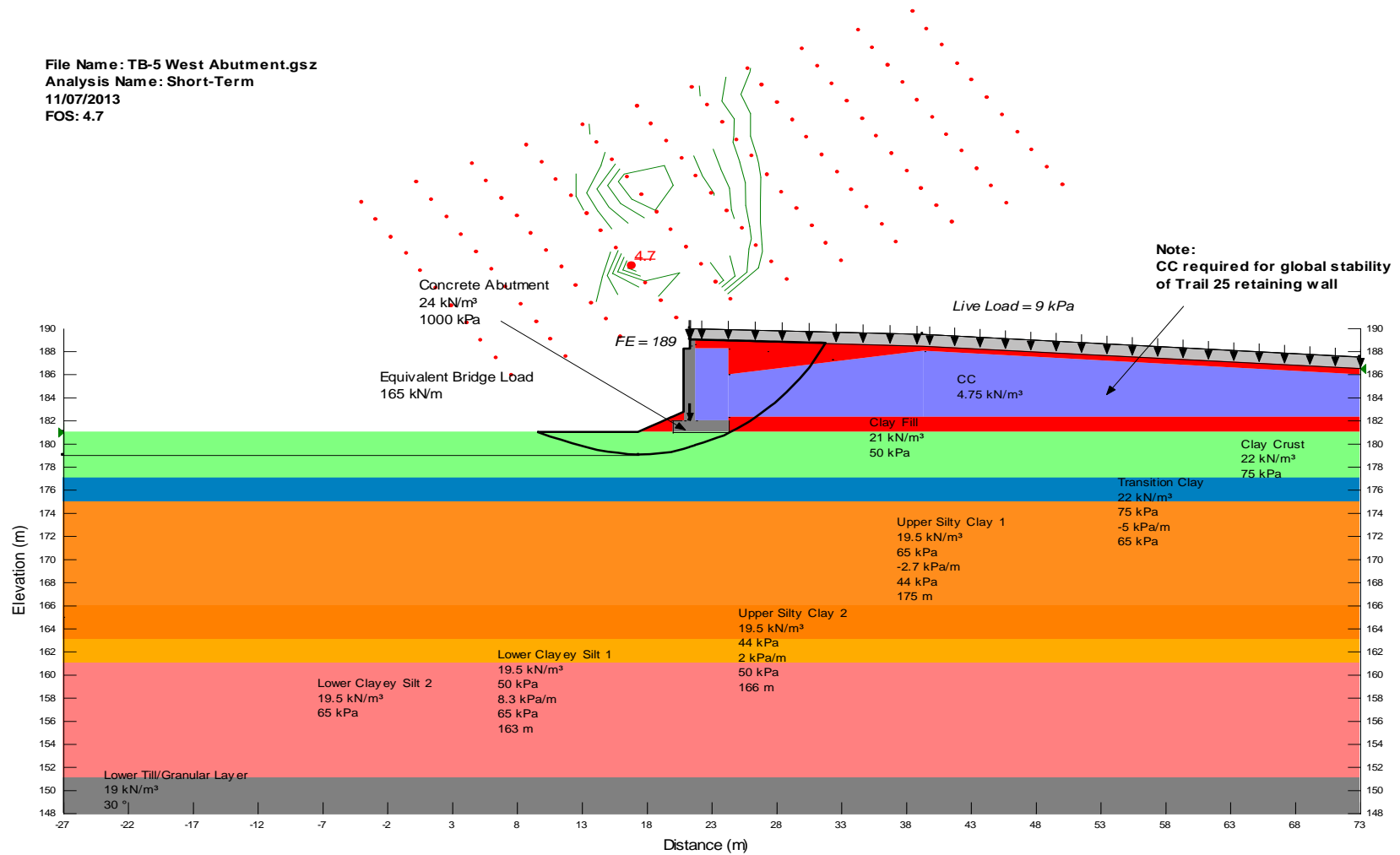
File Name: TB-5 West Bridge Footing-Transverse Stability.gsz
 Analysis Name: Short-Term
 27/06/2013
 FOS: 1.2



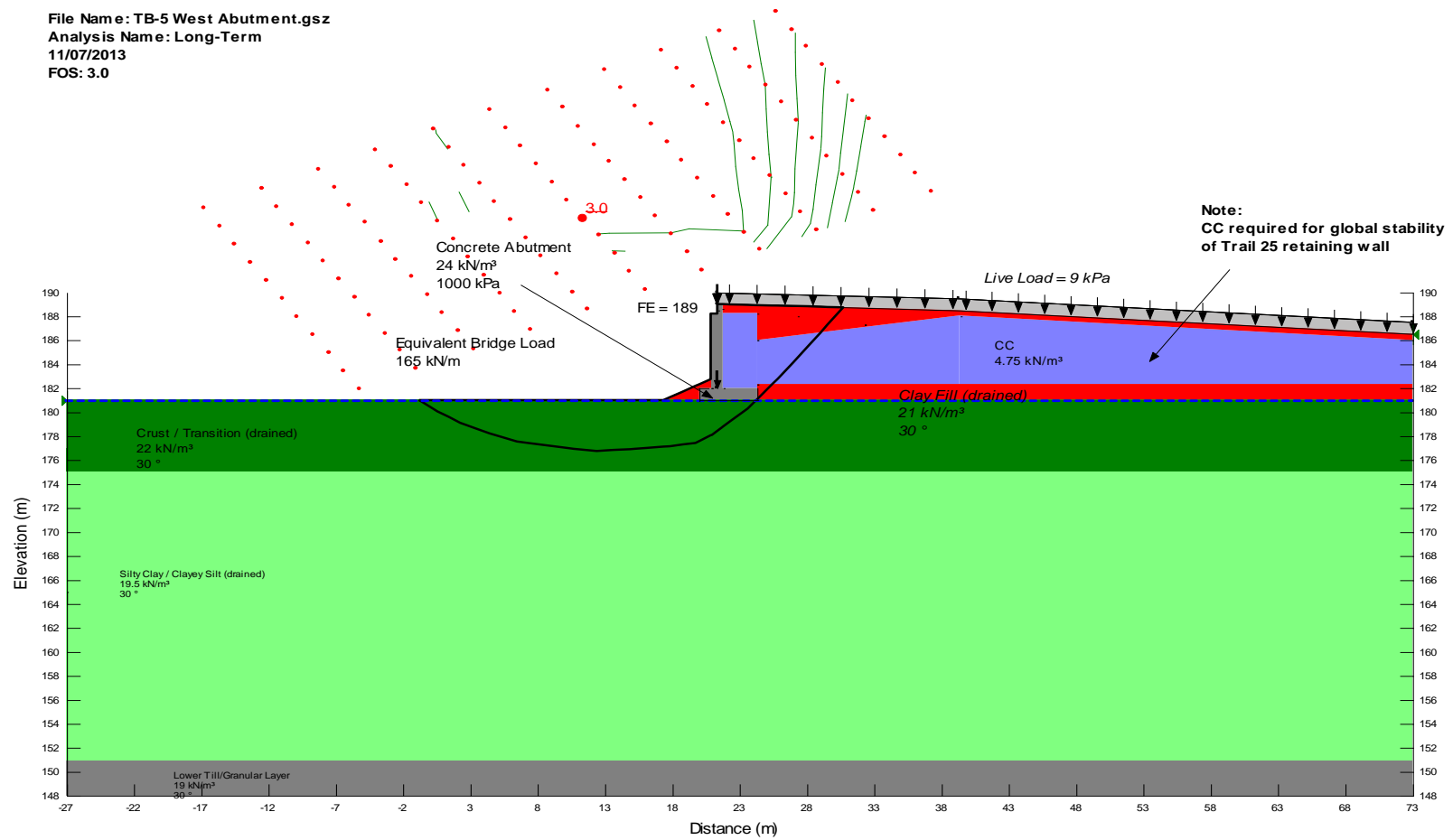
File Name: TB-5 West Bridge Footing-Transverse Stability-Allowable SLS 3225 kN.gsz
 Analysis Name: Short-Term
 08/07/2013
 FOS: 1.3



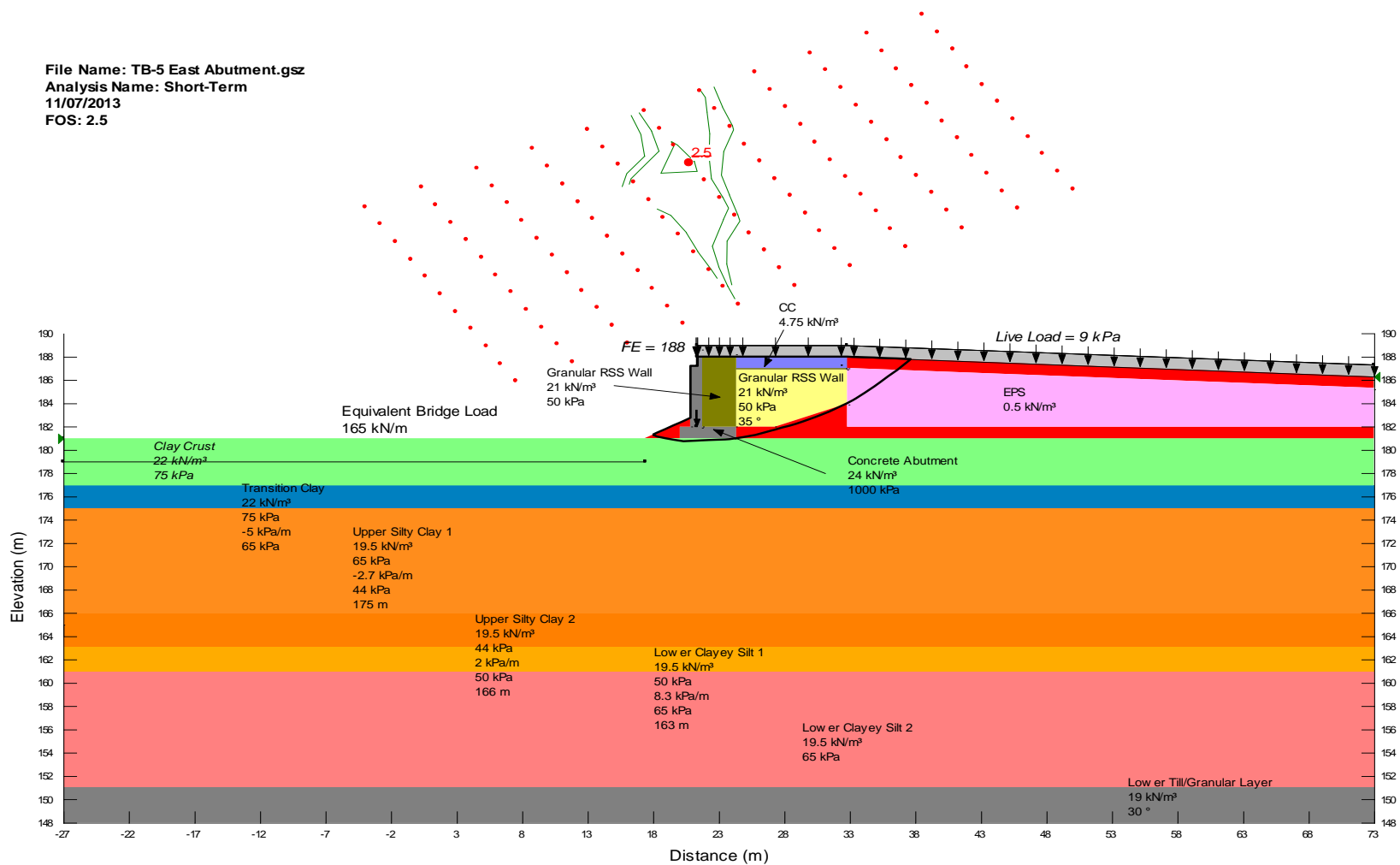
File Name: TB-5 West Abutment.gsz
 Analysis Name: Short-Term
 11/07/2013
 FOS: 4.7



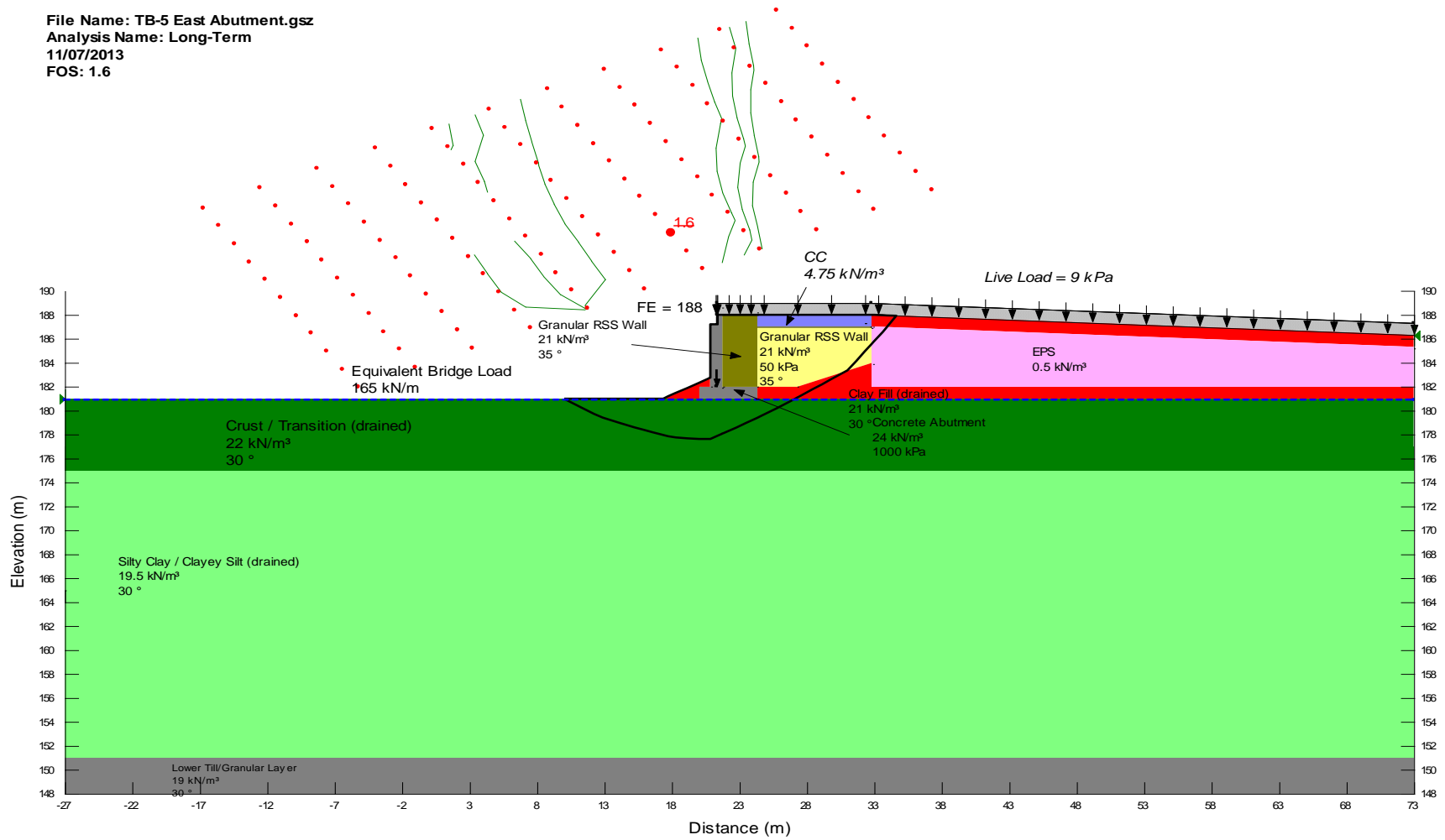
File Name: TB-5 West Abutment.gsz
 Analysis Name: Long-Term
 11/07/2013
 FOS: 3.0



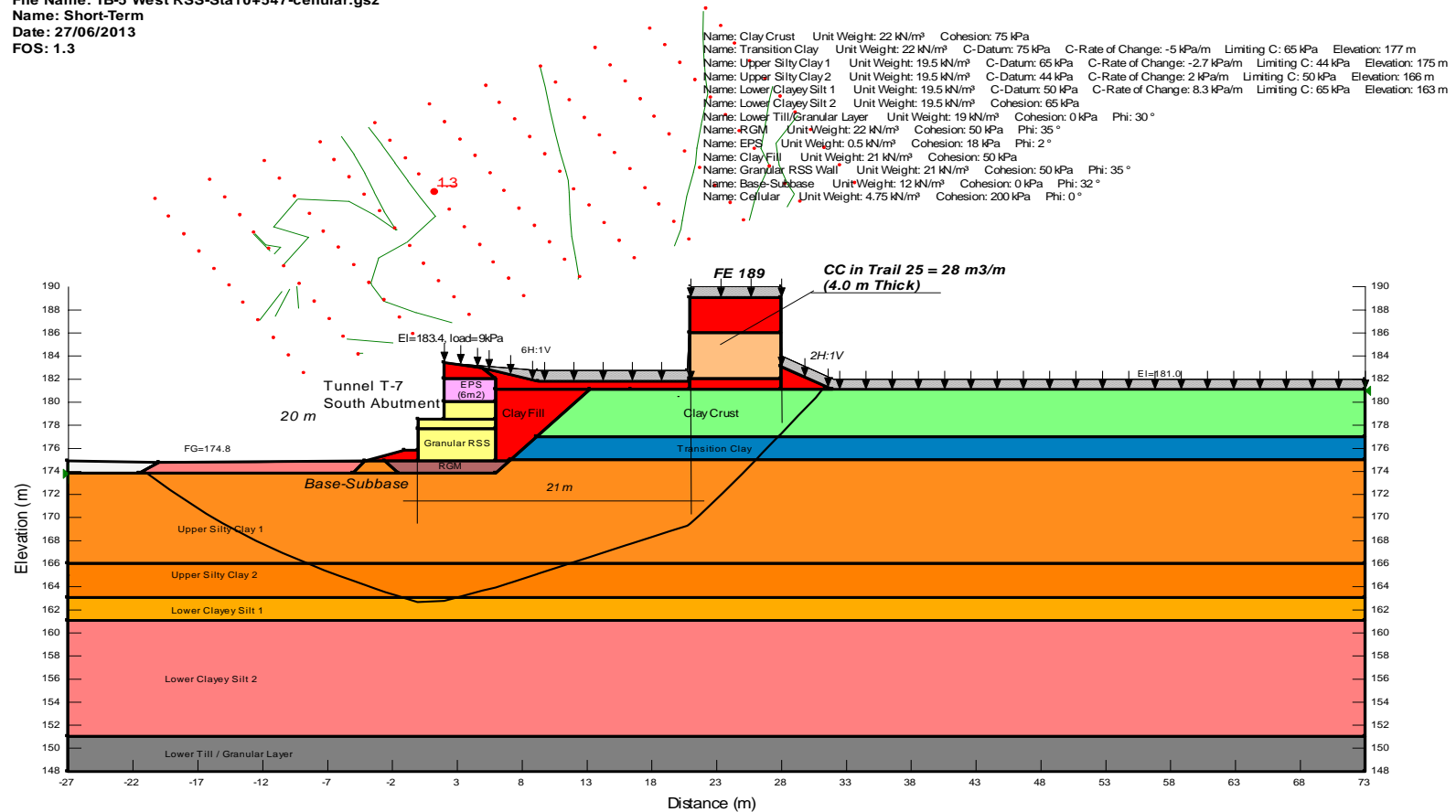
File Name: TB-5 East Abutment.gsz
 Analysis Name: Short-Term
 11/07/2013
 FOS: 2.5



File Name: TB-5 East Abutment.gsz
 Analysis Name: Long-Term
 11/07/2013
 FOS: 1.6



File Name: TB-5 West RSS-Sta10+547-cellular.gsz
 Name: Short-Term
 Date: 27/06/2013
 FOS: 1.3



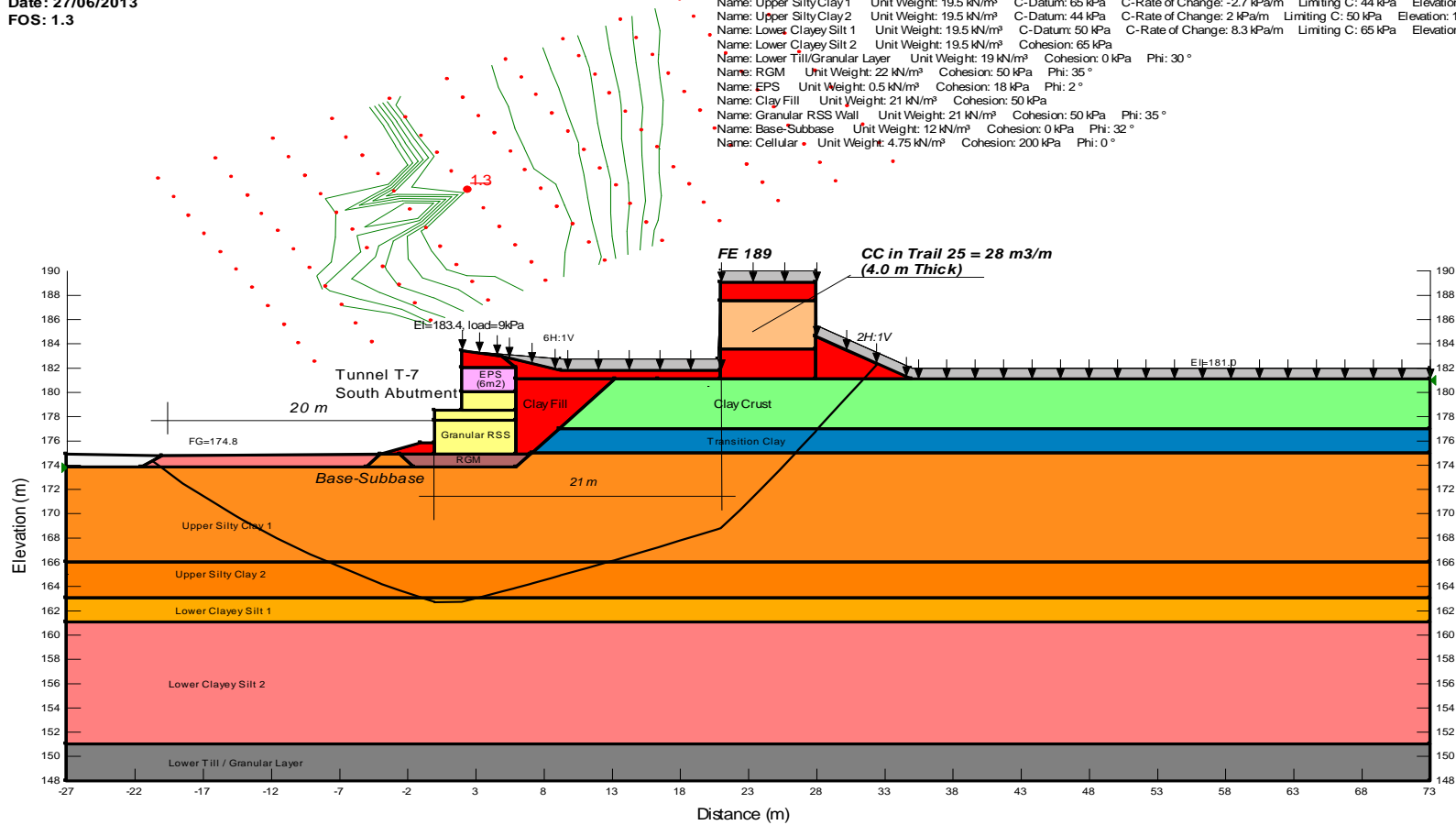
Name: Lower Till/Granular Layer Unit Weight: 19 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 18 kPa Phi: 2 °
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: Granular RSS Wall Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: Clay Fill (drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Silt/Clay or Clay/Silt (drained) Unit Weight: 19.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Crust / Transition (drained) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Cellular Unit Weight: 4.75 kN/m³ Cohesion: 200 kPa Phi: 0 °



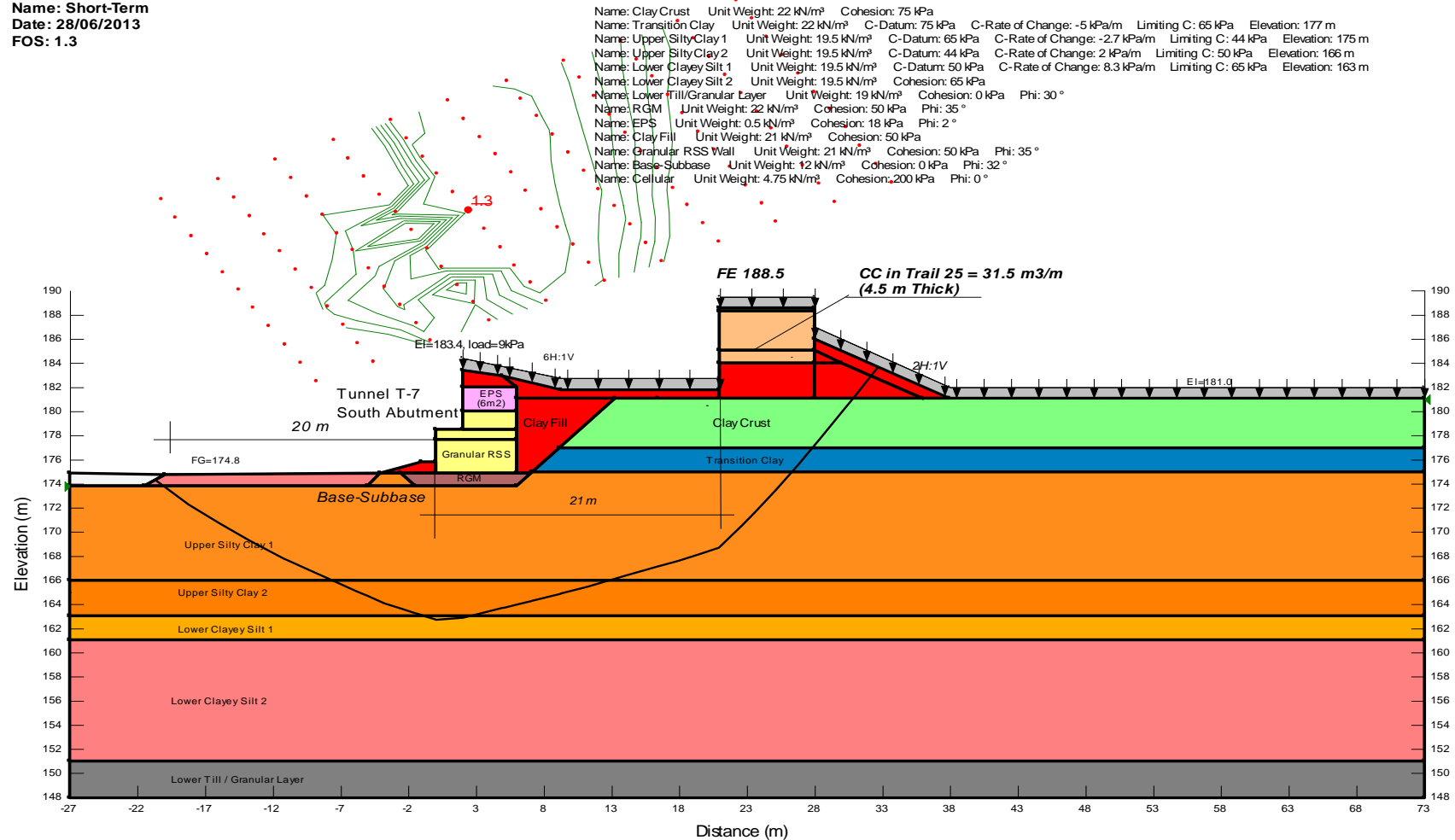
PROJECT: WINDSOR ESSEX PARKWAY				
TITLE: TB-5 WEST RSS WALL-STATION 10+547 LONG-TERM				
DATE: Jun 2013	JOB NO.:	CAD FILE:	FIGURE NO.: D.46	REV.

FOS: 1.3

Name:	Clay Crust	Unit Weight:	22 kN/m ³	Cohesion:	75 kPa		
Name:	Transition Clay	Unit Weight:	22 kN/m ³	C-Datum:	75 kPa	C-Rate of Change:	-5 kPa/m Limiting C: 65 kPa Elevation: 177 m
Name:	Upper Silty Clay1	Unit Weight:	19.5 kN/m ³	C-Datum:	65 kPa	C-Rate of Change:	-2.7 kPa/m Limiting C: 44 kPa Elevation: 175 m
Name:	Upper Silty Clay2	Unit Weight:	19.5 kN/m ³	C-Datum:	44 kPa	C-Rate of Change:	2 kPa/m Limiting C: 50 kPa Elevation: 166 m
Name:	Lower Clay Silt1	Unit Weight:	19.5 kN/m ³	C-Datum:	50 kPa	C-Rate of Change:	8.3 kPa/m Limiting C: 65 kPa Elevation: 163 m
Name:	Lower Clay Silt2	Unit Weight:	19.5 kN/m ³	Cohesion:	65 kPa		
Name:	Lower Till/Gravel Layer	Unit Weight:	19 kN/m ³	Cohesion:	0 kPa	Phi:	30 °
Name:	RGM	Unit Weight:	22 kN/m ³	Cohesion:	50 kPa	Phi:	35 °
Name:	EPS	Unit Weight:	0.5 kN/m ³	Cohesion:	18 kPa	Phi:	2 °
Name:	Clay Fill	Unit Weight:	21 kN/m ³	Cohesion:	50 kPa		
Name:	Granular RSS Wall	Unit Weight:	21 kN/m ³	Cohesion:	50 kPa	Phi:	35 °
Name:	Base Subbase	Unit Weight:	12 kN/m ³	Cohesion:	0 kPa	Phi:	32 °
Name:	Cellular	Unit Weight:	4.75 kN/m ³	Cohesion:	200 kPa	Phi:	0 °

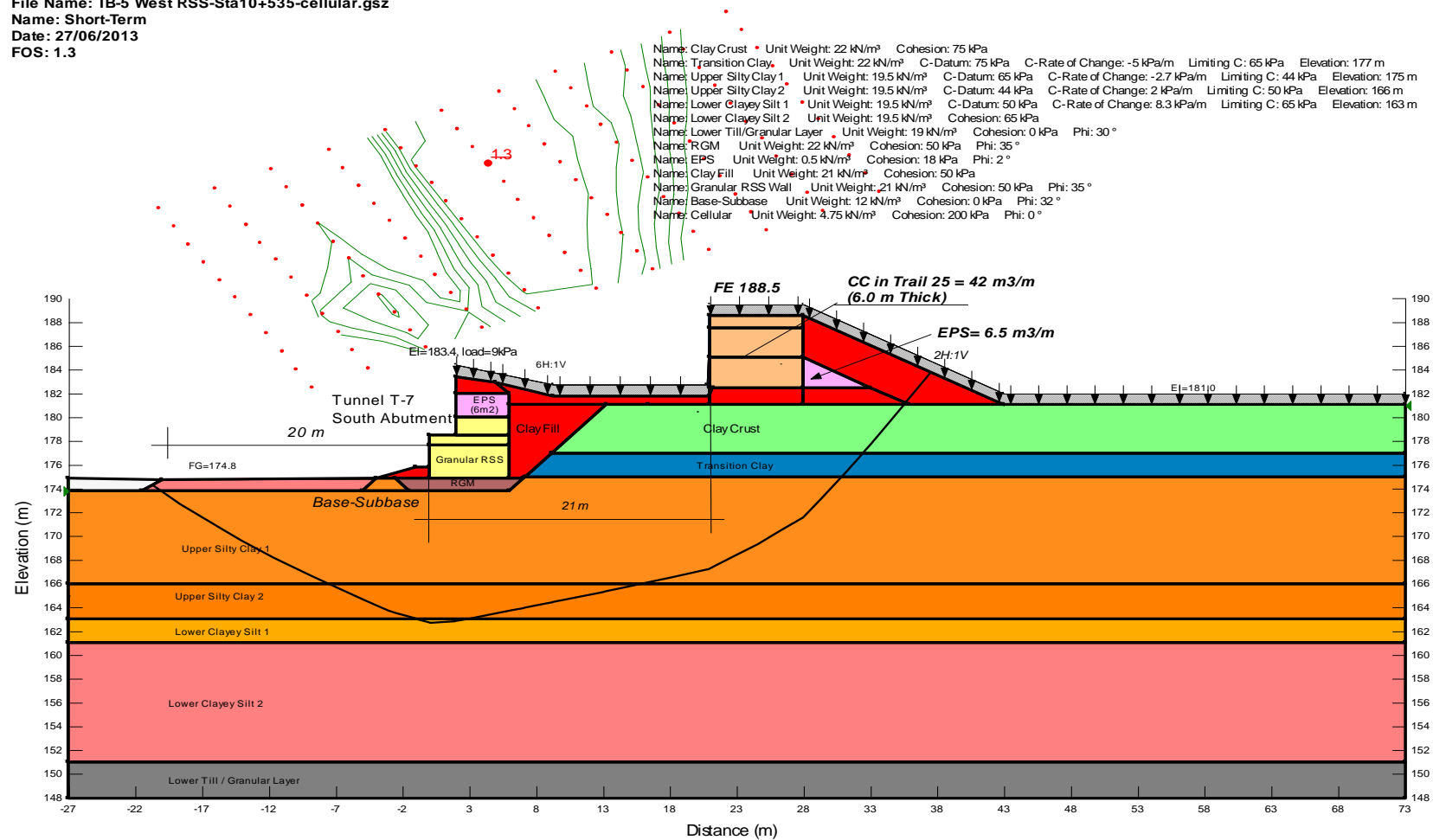


File Name: TB-5 West RSS-Sta10+541-cellular.gsz
 Name: Short-Term
 Date: 28/06/2013
 FOS: 1.3



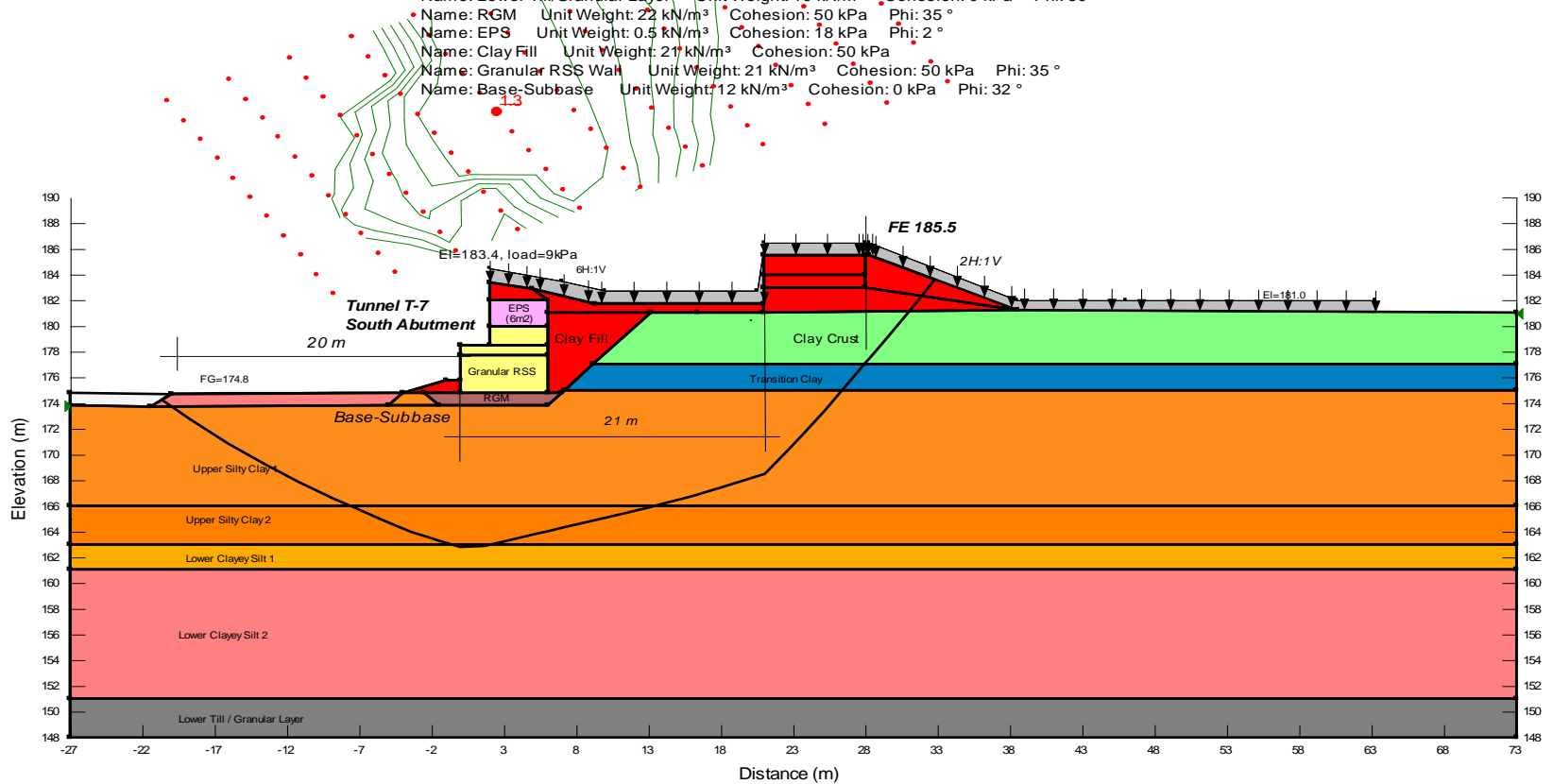
Name: Clay Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 175 m
 Name: Upper Silty Clay 2 Unit Weight: 19.5 kN/m³ C-Datum: 44 kPa C-Rate of Change: 2 kPa/m Limiting C: 50 kPa Elevation: 166 m
 Name: Lower Clayey Silt 1 Unit Weight: 19.5 kN/m³ C-Datum: 50 kPa C-Rate of Change: 8.3 kPa/m Limiting C: 65 kPa Elevation: 163 m
 Name: Lower Clayey Silt 2 Unit Weight: 19.5 kN/m³ Cohesion: 65 kPa
 Name: Lower Till / Granular Layer Unit Weight: 19 kN/m³ Cohesion: 0 kPa Phi: 30°
 Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35°
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 18 kPa Phi: 2°
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: Granular RSS Wall Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35°
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32°
 Name: Cellular Unit Weight: 4.75 kN/m³ Cohesion: 200 kPa Phi: 0°

File Name: TB-5 West RSS-Sta10+535-cellular.gsz
 Name: Short-Term
 Date: 27/06/2013
 FOS: 1.3

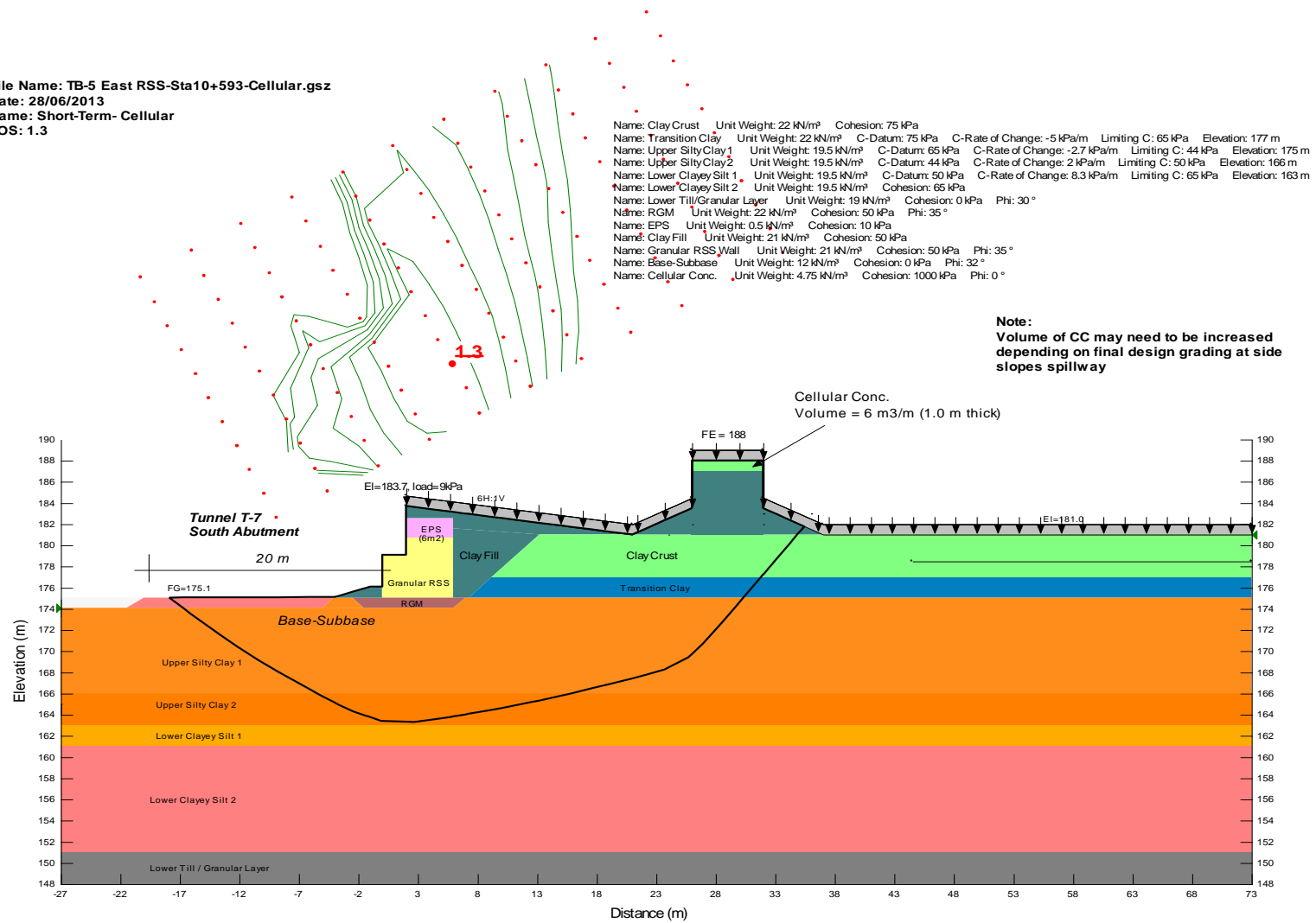


File Name: TB-5 West RSS-Sta10+470-no cellular.gsz
 Date: 27/06/2013
 Name: Short-Term
 FOS: 1.3

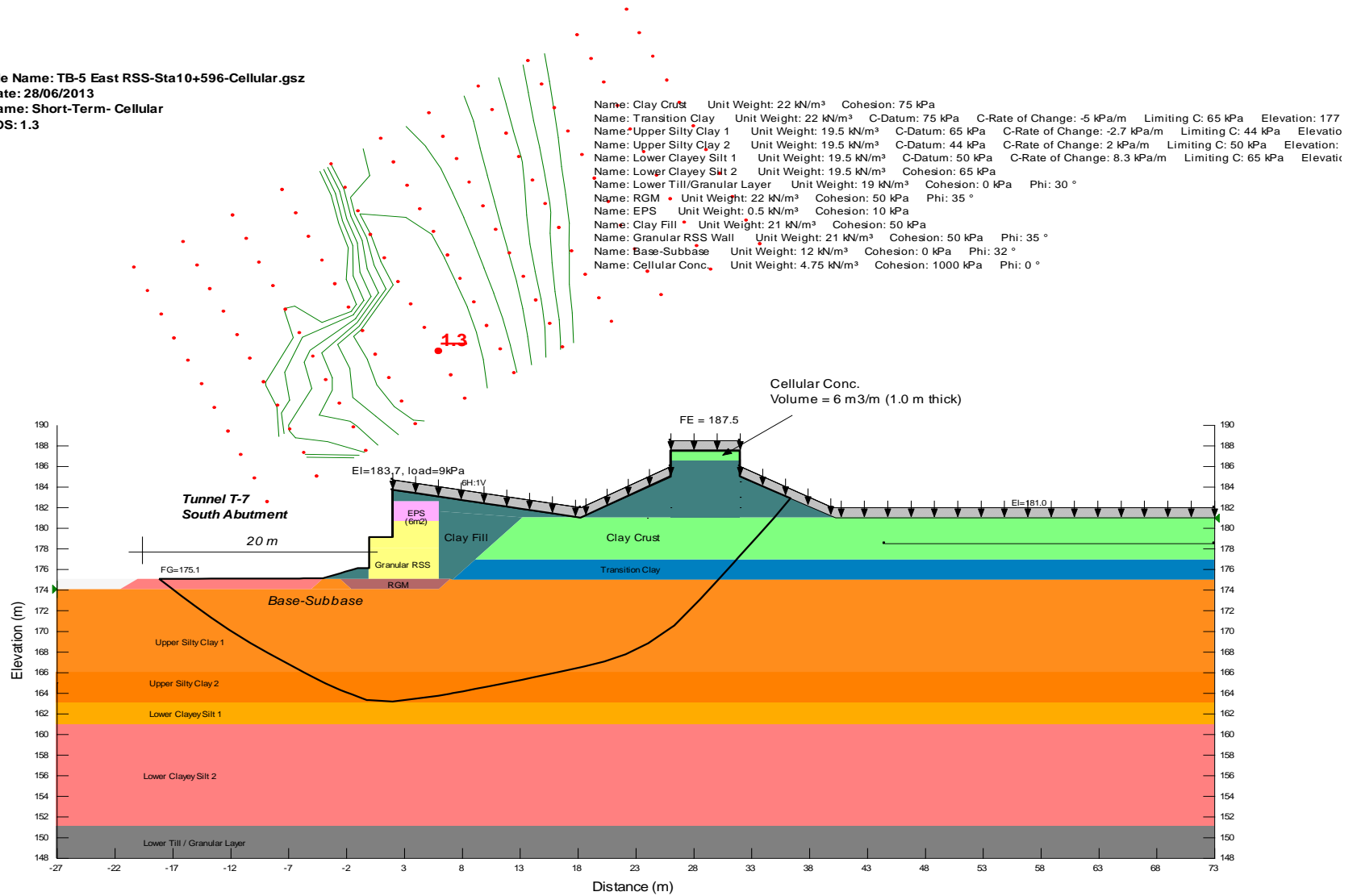
Name: Clay Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 175 m
 Name: Upper Silty Clay 2 Unit Weight: 19.5 kN/m³ C-Datum: 44 kPa C-Rate of Change: 2 kPa/m Limiting C: 50 kPa Elevation: 166 m
 Name: Lower Clayey Silt 1 Unit Weight: 19.5 kN/m³ C-Datum: 50 kPa C-Rate of Change: 8.3 kPa/m Limiting C: 65 kPa Elevation: 163 m
 Name: Lower Clayey Silt 2 Unit Weight: 19.5 kN/m³ Cohesion: 65 kPa
 Name: Lower Till / Granular Layer Unit Weight: 19 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 18 kPa Phi: 2 °
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: Granular RSS Wall Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32 °



File Name: TB-5 East RSS-Sta10+593-Cellular.gsz
 Date: 28/06/2013
 Name: Short-Term- Cellular
 FOS: 1.3

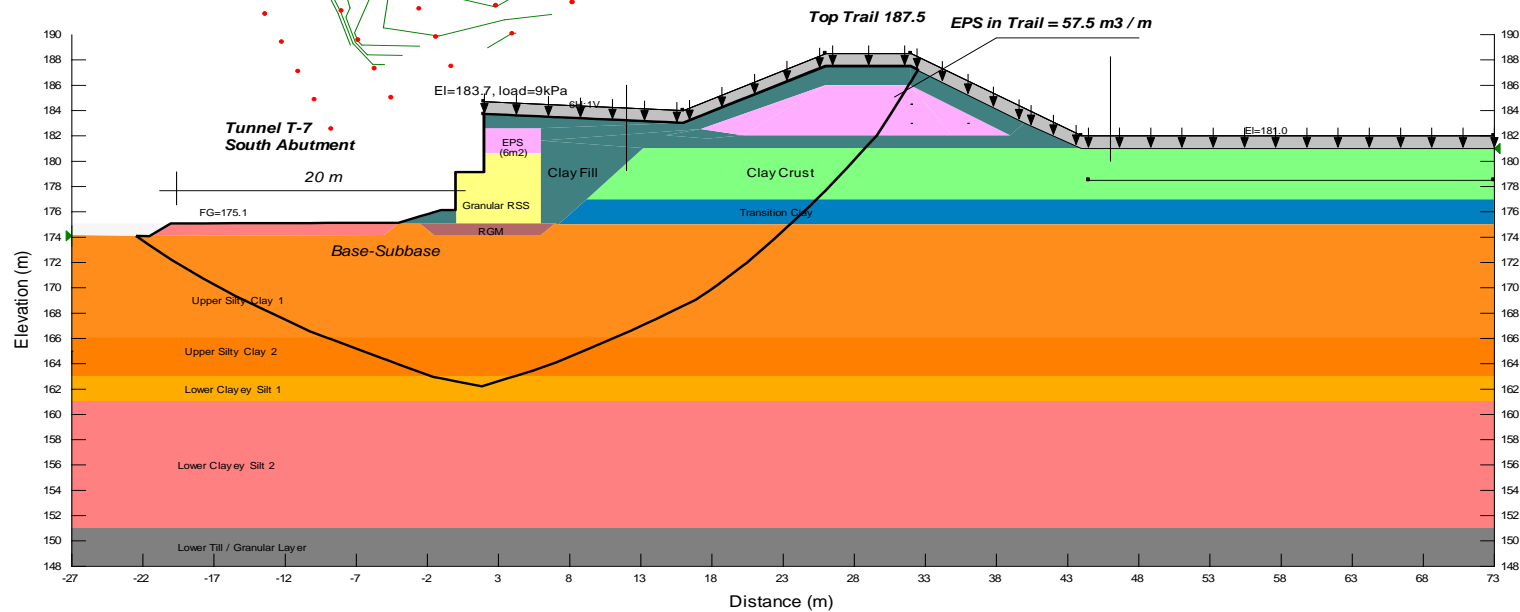


File Name: TB-5 East RSS-Sta10+596-Cellular.gsz
 Date: 28/06/2013
 Name: Short-Term- Cellular
 FOS: 1.3



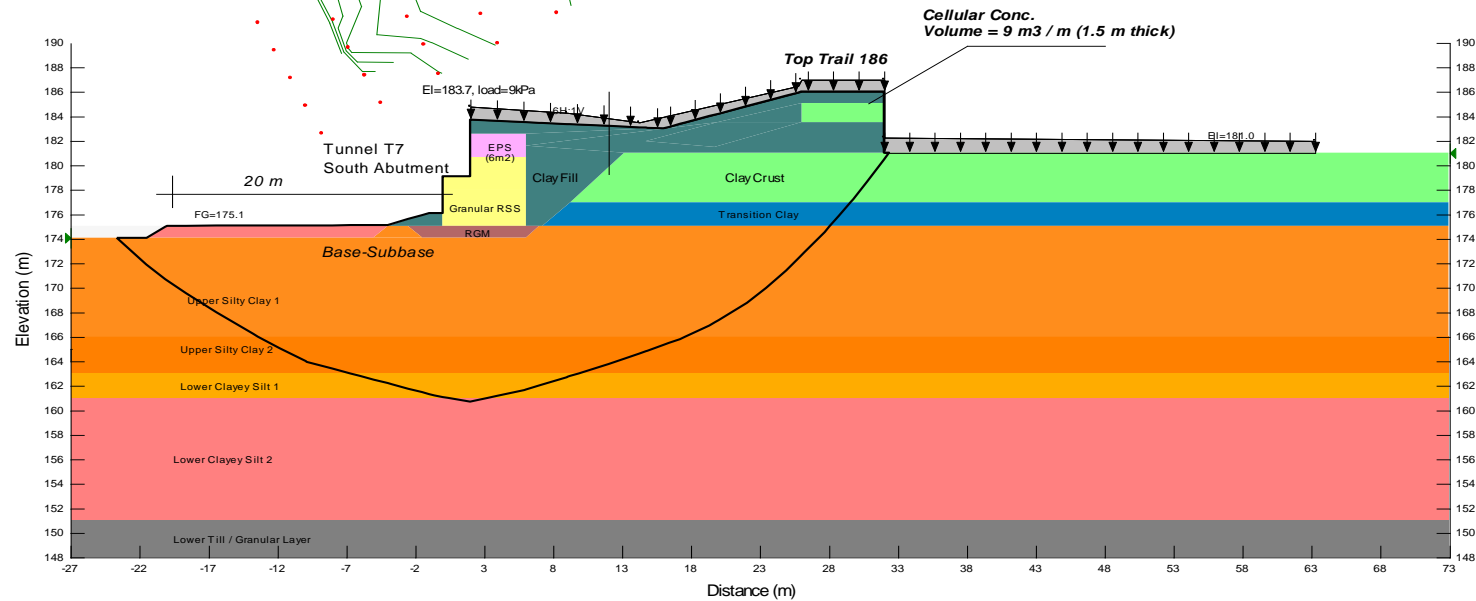
File Name: TB-5 East Embankment -Sta10+598.gsz
 Date: 28/06/2013
 Name: Short-Term-EPS
 FOS: 1.3

Name: Clay Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 175 m
 Name: Upper Silty Clay 2 Unit Weight: 19.5 kN/m³ C-Datum: 44 kPa C-Rate of Change: 2 kPa/m Limiting C: 50 kPa Elevation: 166 m
 Name: Lower Clayey Silt 1 Unit Weight: 19.5 kN/m³ C-Datum: 50 kPa C-Rate of Change: 8.3 kPa/m Limiting C: 65 kPa Elevation: 163 m
 Name: Lower Clayey Silt 2 Unit Weight: 19.5 kN/m³ Cohesion: 65 kPa
 Name: Lower Till/Granular Layer Unit Weight: 19 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: Granular RSS Wall Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32 °

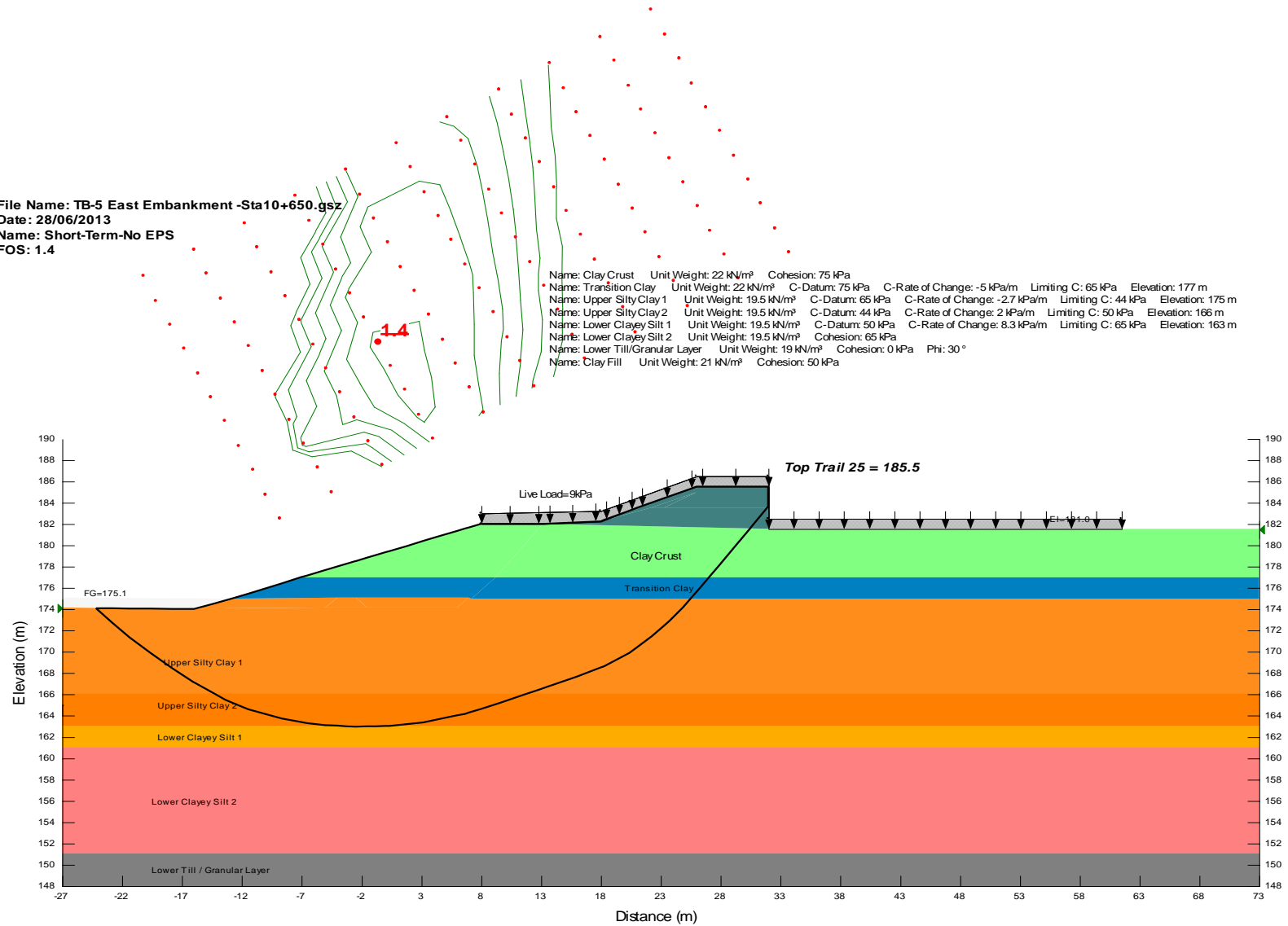


File Name: TB-5 East Embankment-Station10+635.gsz
 Date: 28/06/2013
 Name: Short-Term-Cellular Conc.
 FOS: 1.3

Name: Clay Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 175 m
 Name: Upper Silty Clay 2 Unit Weight: 19.5 kN/m³ C-Datum: 44 kPa C-Rate of Change: 2 kPa/m Limiting C: 50 kPa Elevation: 166 m
 Name: Lower Clayey Silt 1 Unit Weight: 19.5 kN/m³ C-Datum: 50 kPa C-Rate of Change: 8.3 kPa/m Limiting C: 65 kPa Elevation: 163 m
 Name: Lower Clayey Silt 2 Unit Weight: 19.5 kN/m³ Cohesion: 65 kPa
 Name: Lower Till/Granular Layer Unit Weight: 19 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa
 Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: Granular RSS Wall Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32 °
 Name: CC Unit Weight: 4.75 kN/m³ Cohesion: 1000 kPa Phi: 0 °

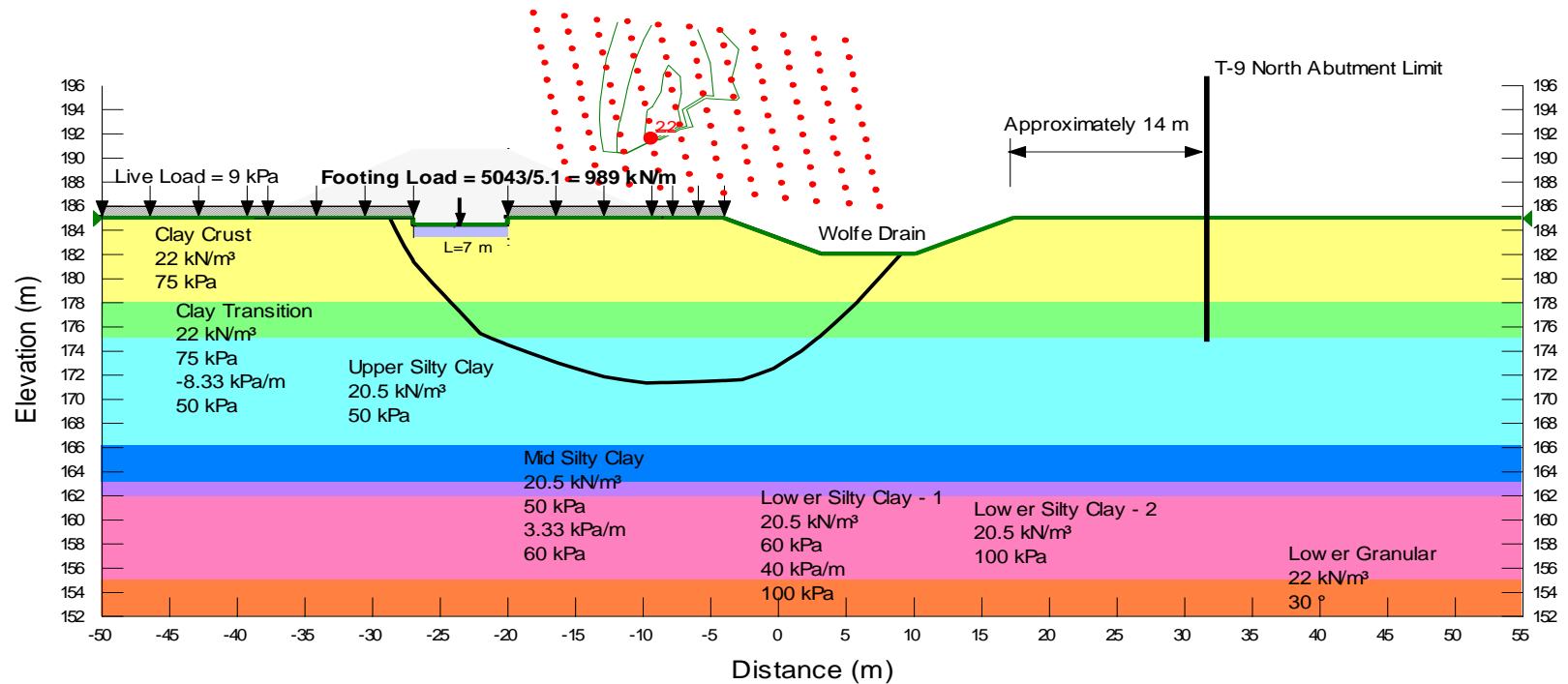


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 Date: 28/06/2013
 Name: Short-Term-No EPS
 FOS: 1.4



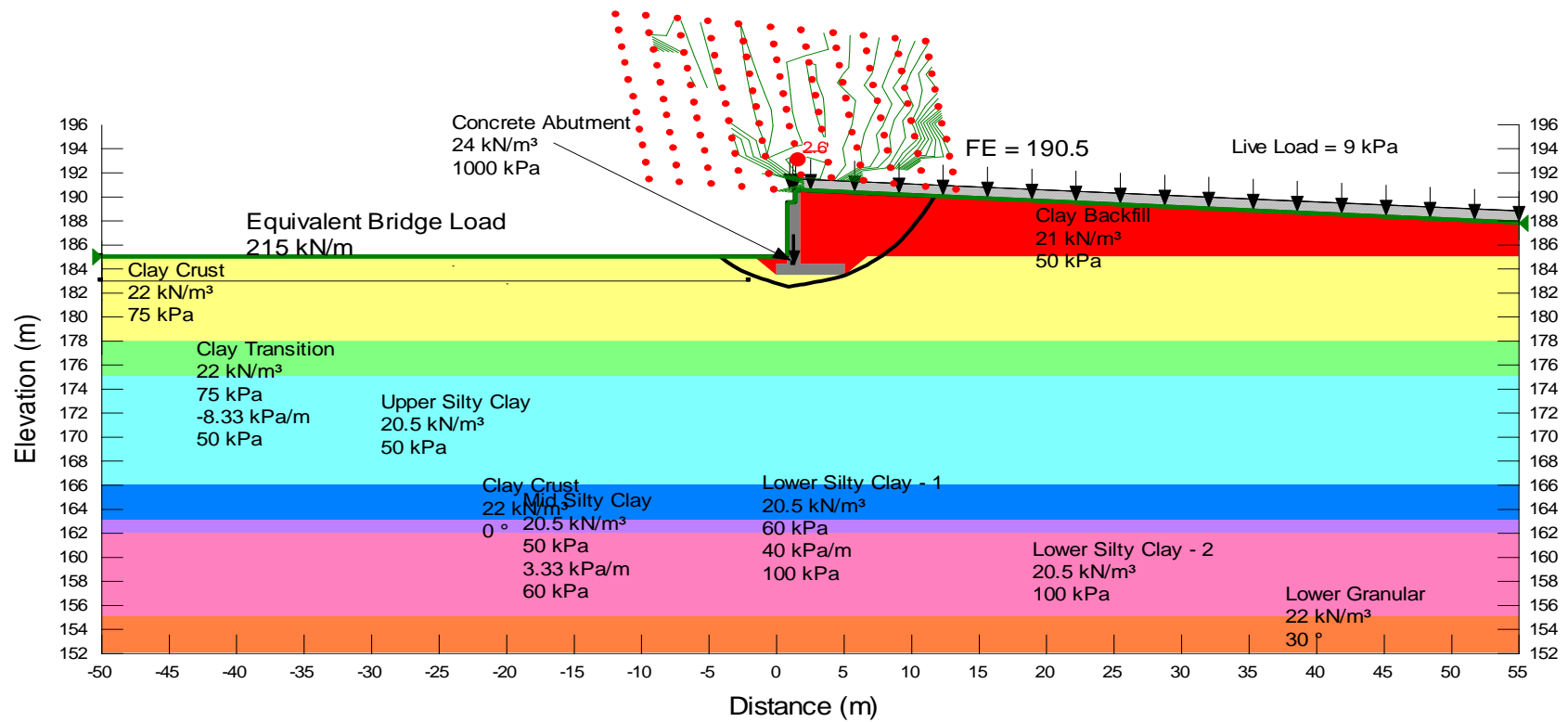
File Name: TB-7-East Abutment Sta. 10+085-Bridge Footing Transverse Stability.gsz
 Date: 28/06/2013
 Name: Short-Term
 FOS: 2.2

WEP SW8801.1002.101



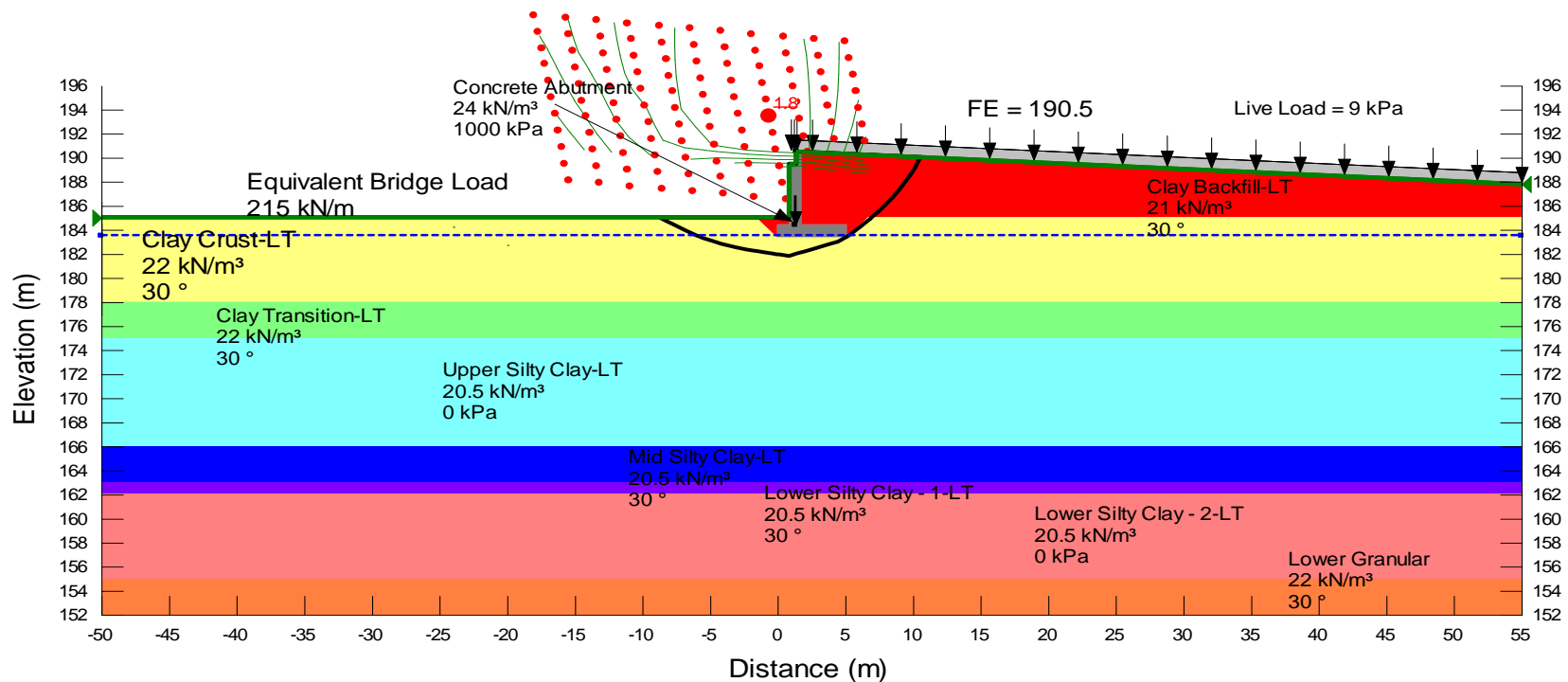
File Name: TB-7-East Abutment.gsz
 Name: Undrained-Short-Term
 Date: 11/07/2013
 FOS: 2.6

WEP SW8801.1002.101



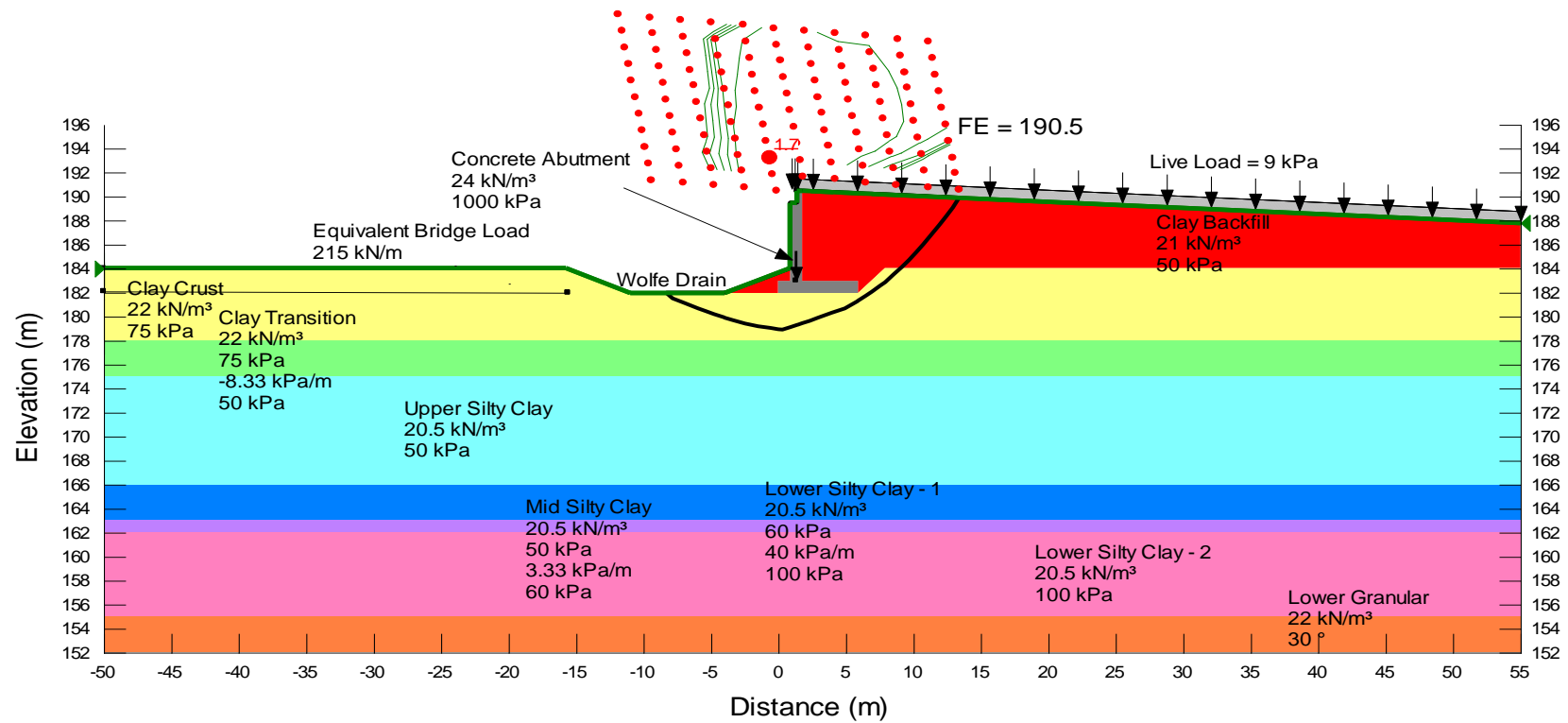
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 Name: Drained-Long-Term
 Date: 11/07/2013
 FOS: 1.8

WEP SW8801.1002.101



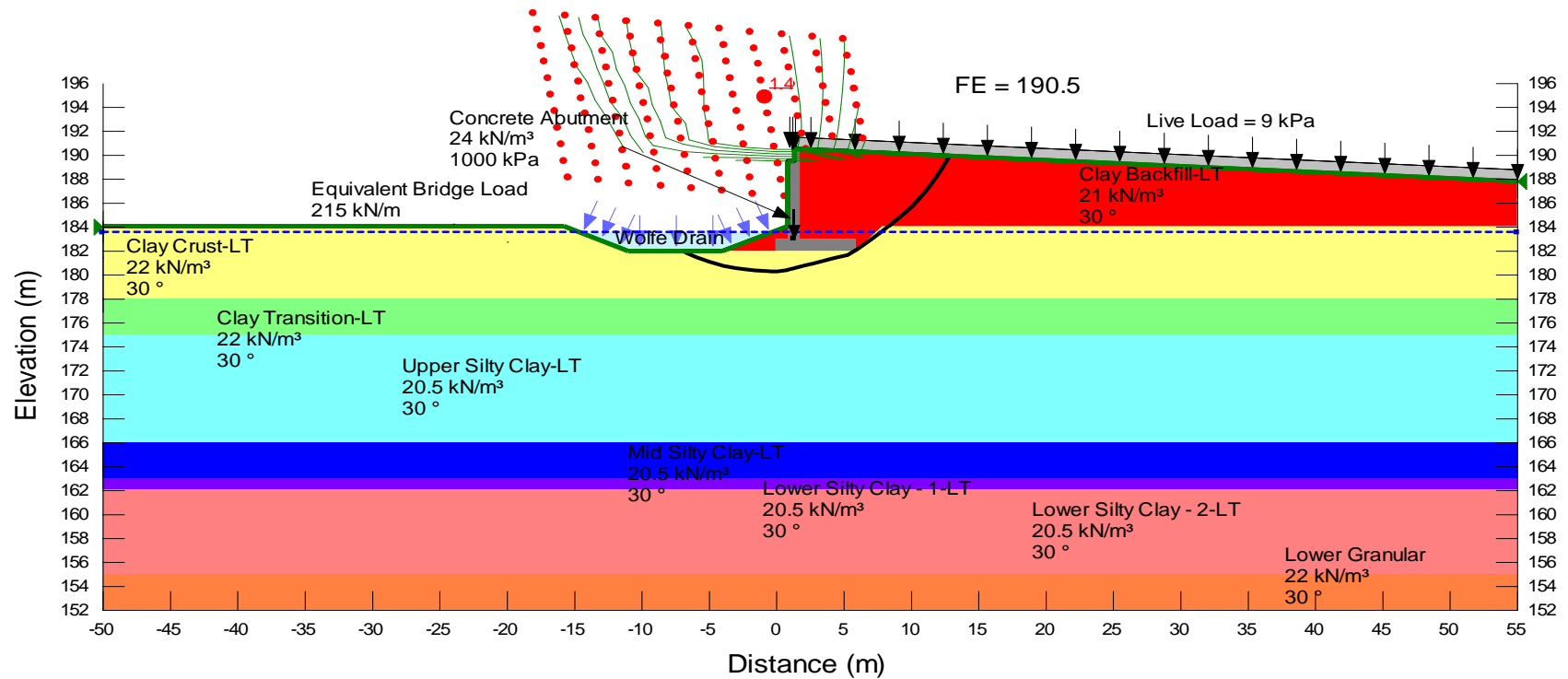
File Name: TB-7-West Abutment.gsz
 Name: Undrained-Short-Term
 Date: 11/07/2013
 FOS: 1.7

WEP SW8801.1002.101



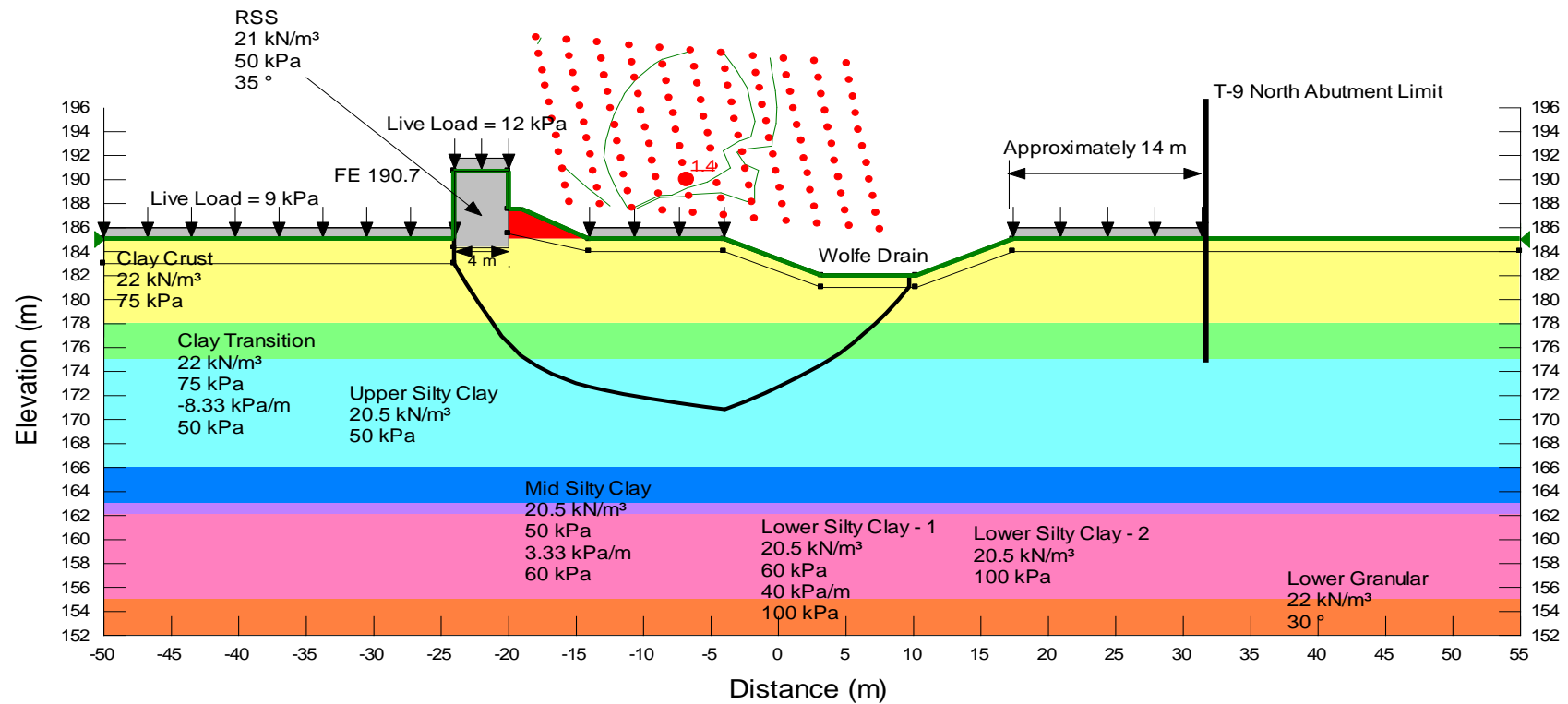
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Name: Drained-Long-Term
Date: 11/07/2013
FOS: 1.4

WEP SW8801.1002.101



File Name: TB-7-NE RSS Wall-Sta. 10+085.56-Undrained-dd.gsz
 Date: 09/07/2013
 Name: EOC-Undrained
 FOS: 1.4

WEP SW8801.1002.101

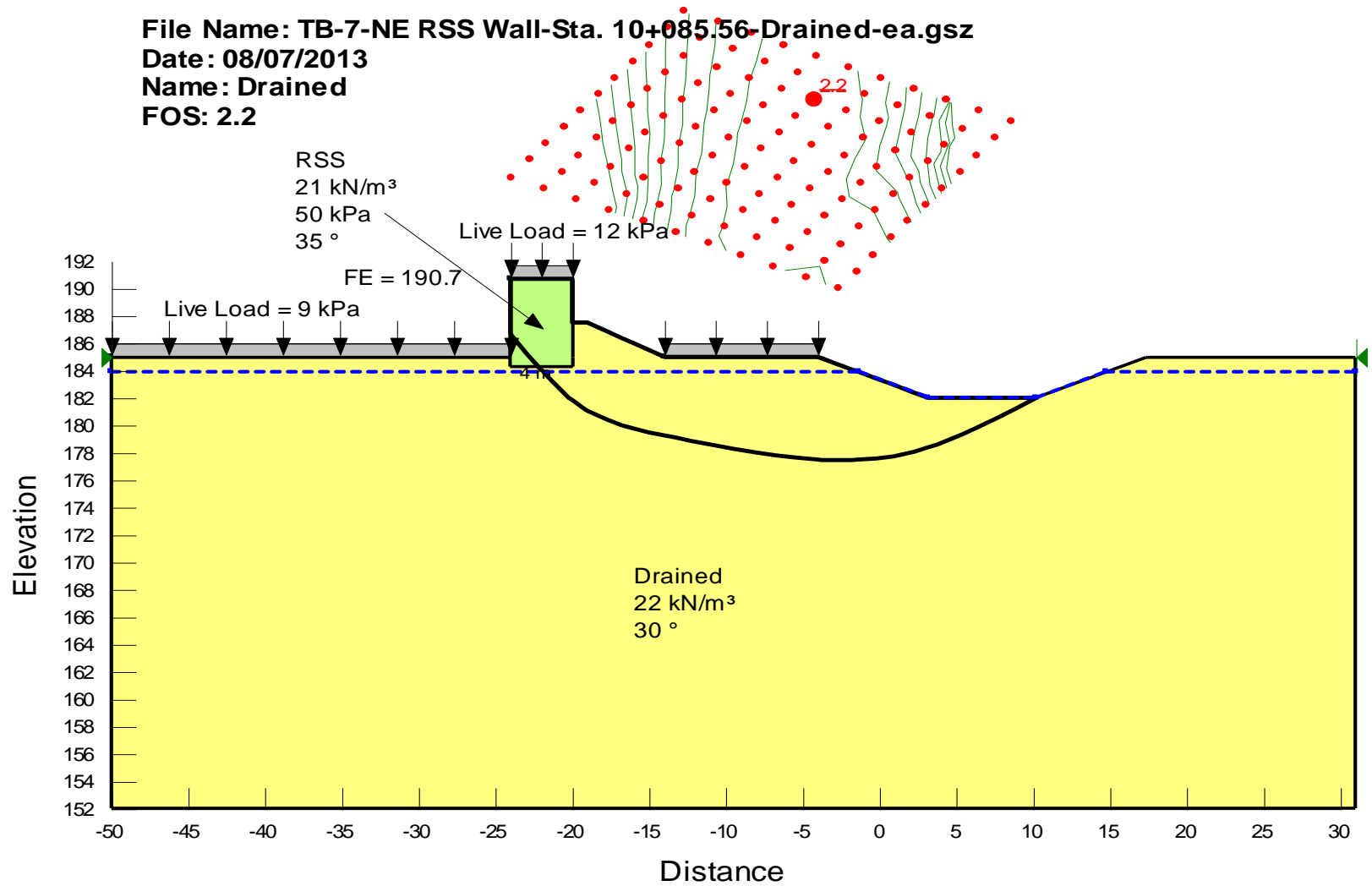


File Name: TB-7-NE RSS Wall-Sta. 10+085.56-Drained-ea.gsz

Date: 08/07/2013

Name: Drained

FOS: 2.2



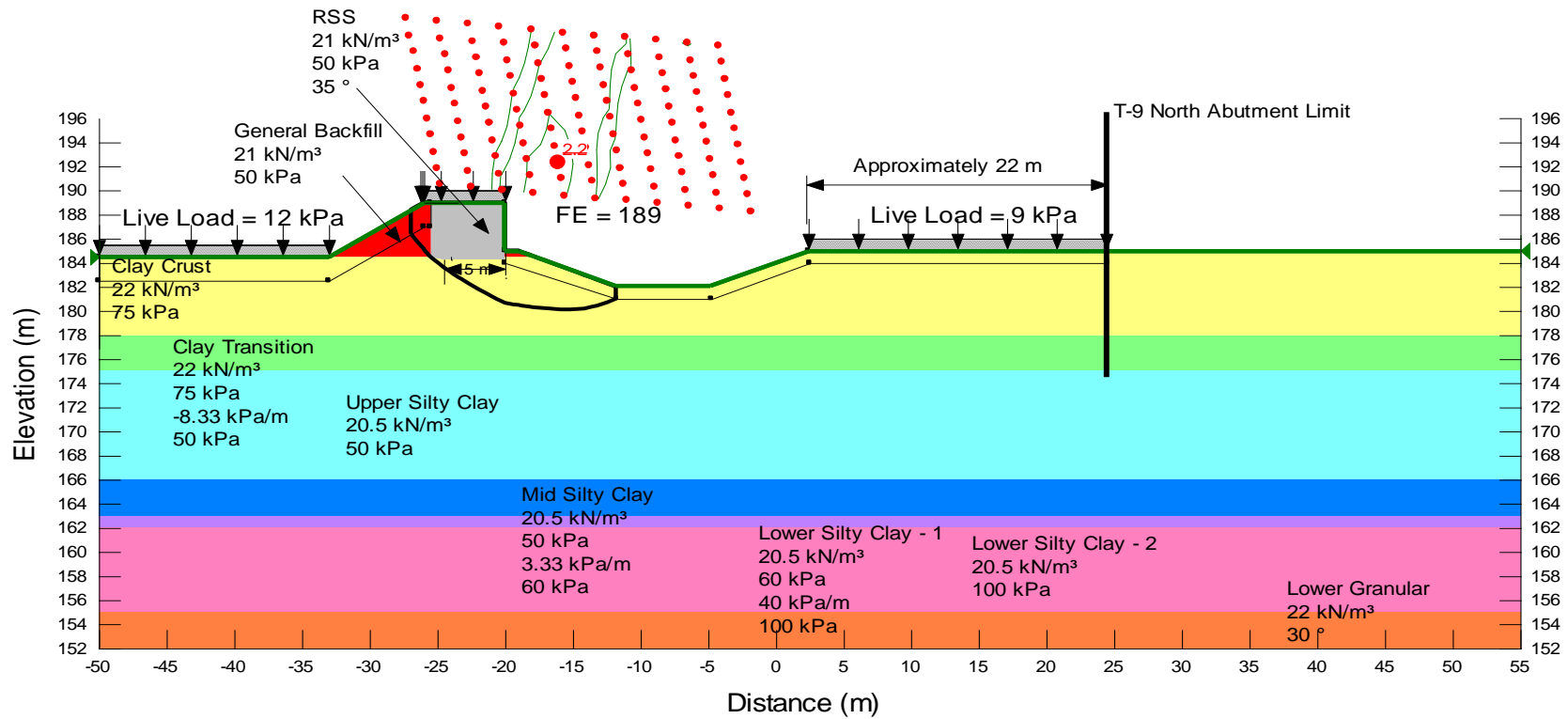
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Date: 08/07/2013

Name: ST-Undrained

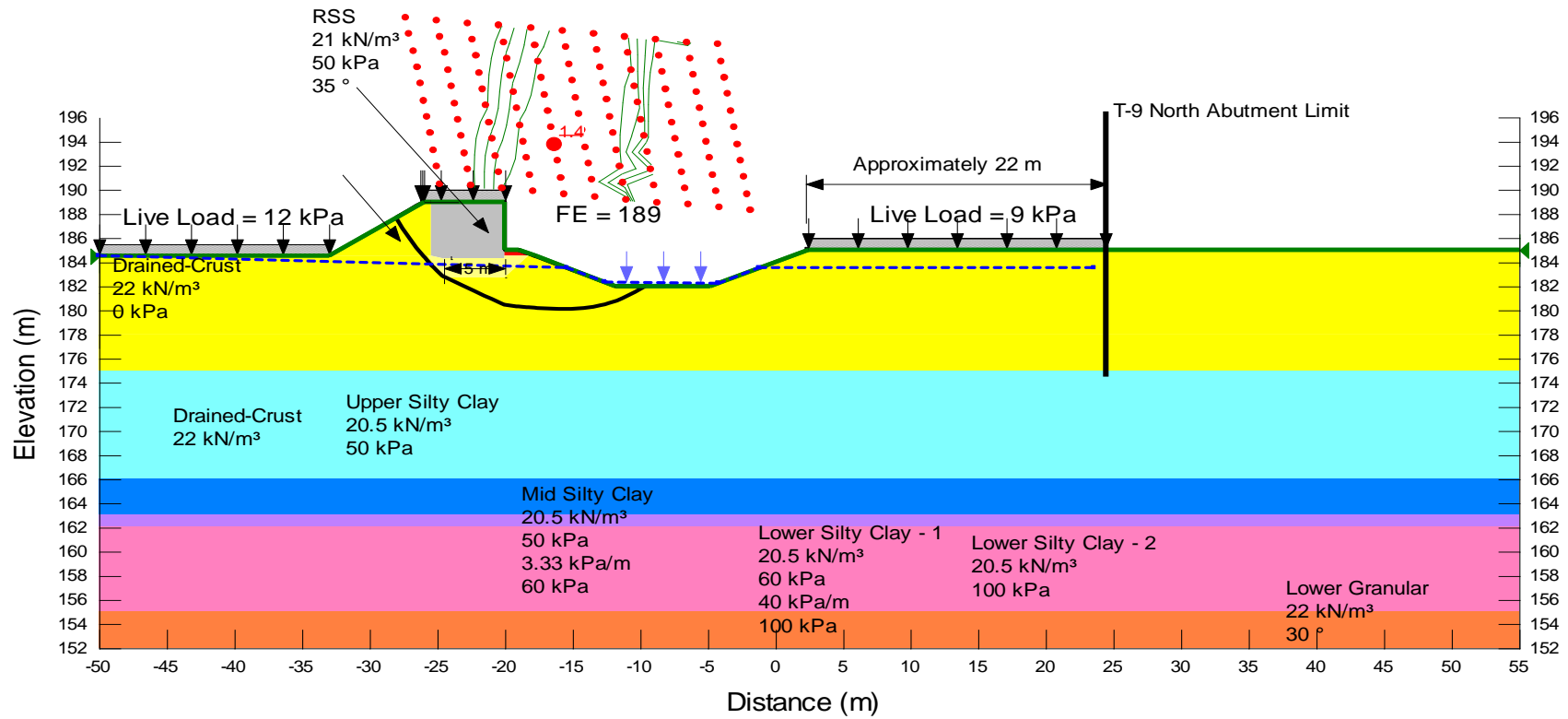
FOS: 2.2

WEP SW8801.1002.101



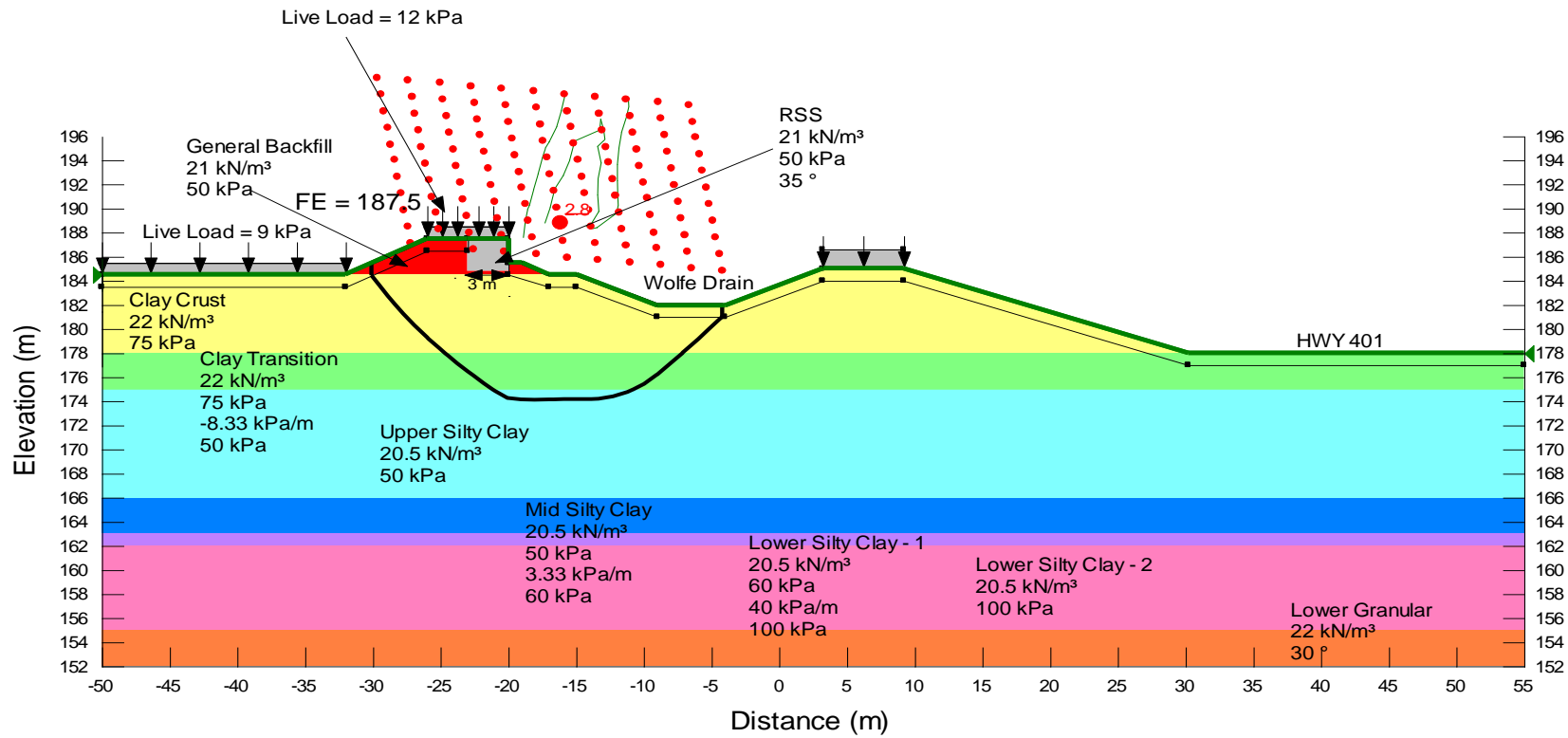
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 Date: 08/07/2013
 Name: Drained
 FOS: 1.4

WEP SW8801.1002.101

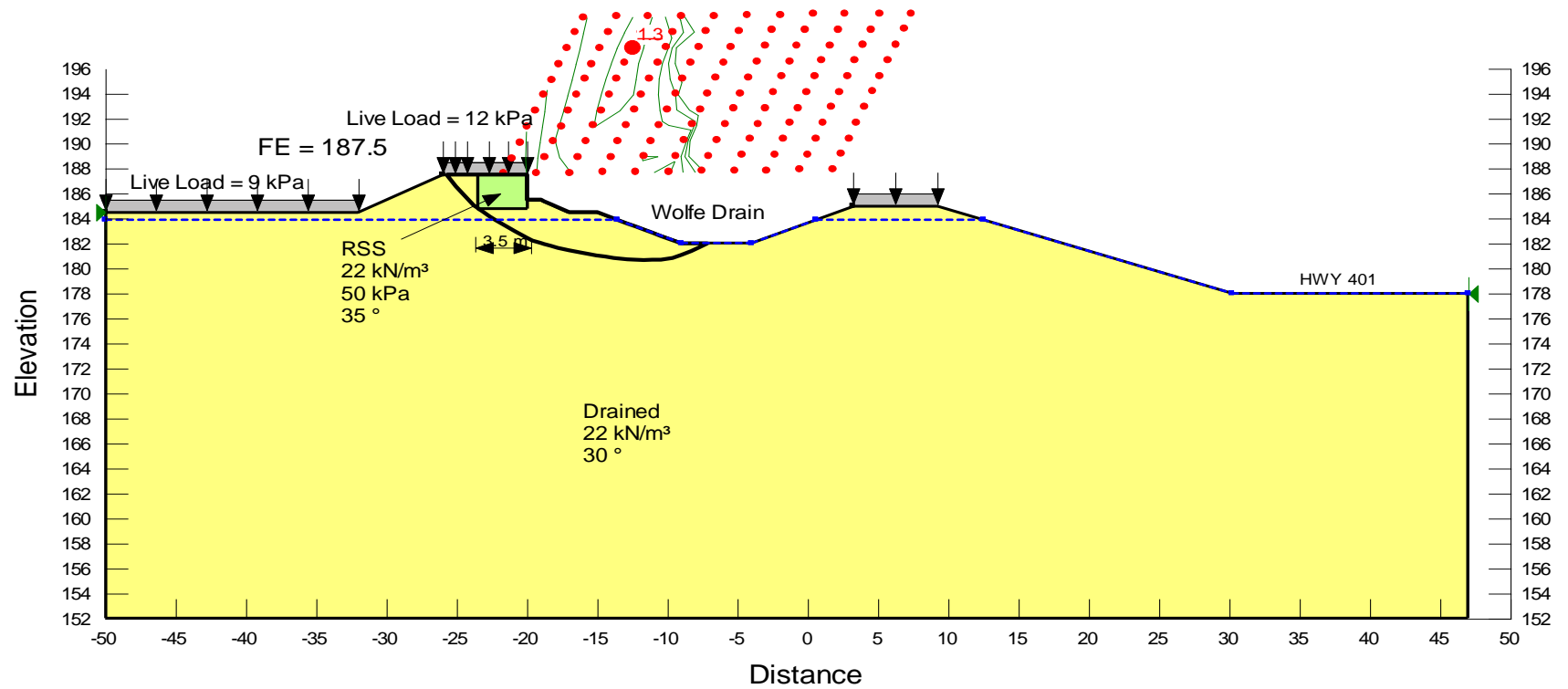


File Name: TB-7-NE RSS Wall-Sta. 10+155-Undrained.gsz
Date: 08/07/2013
Name: EOC-Undrained
FOS: 2.8

WEP SW8801.1002.101

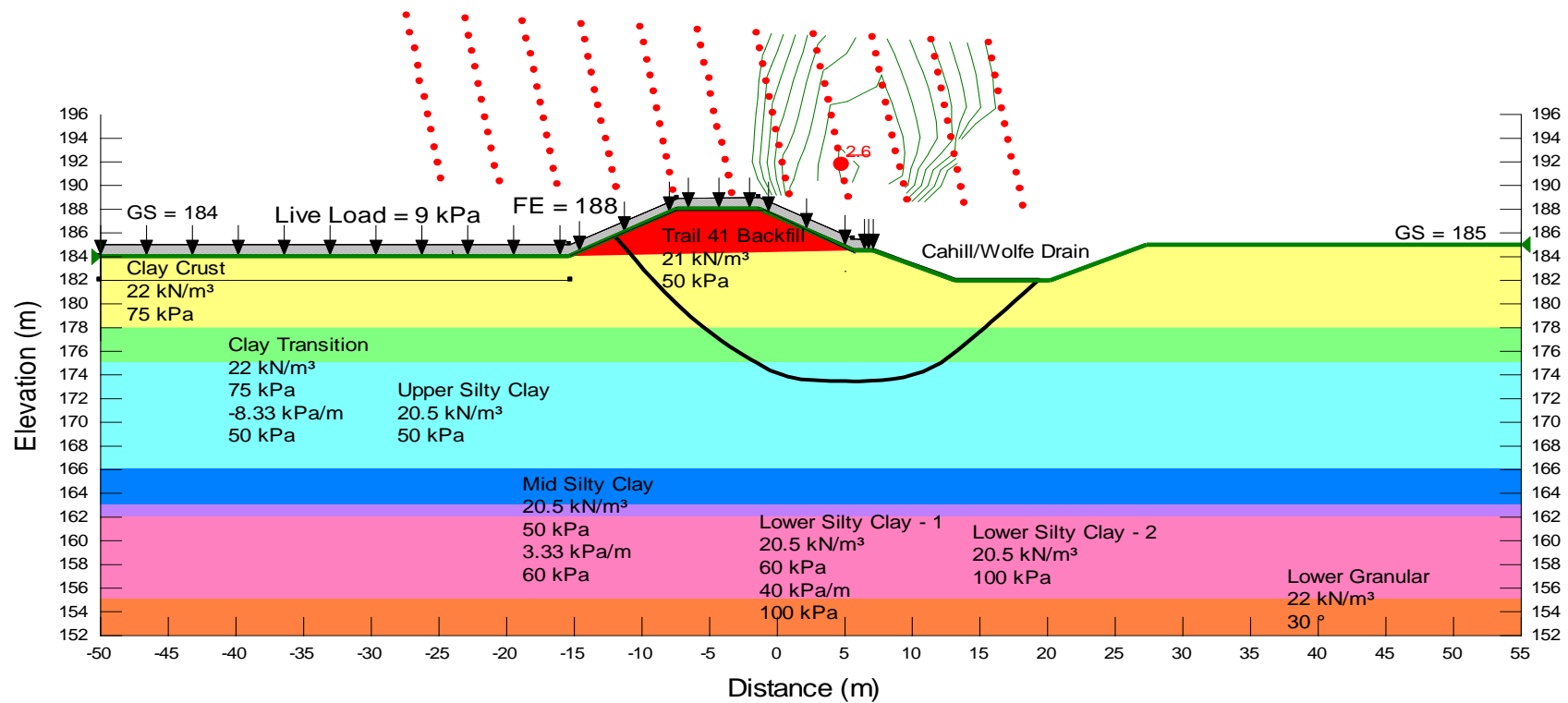


File Name: TB-7-NE RSS Wall-Sta. 10+155-Drained-ea.gsz
 Date: 09/07/2013
 Name: Drained
 FOS: 1.3



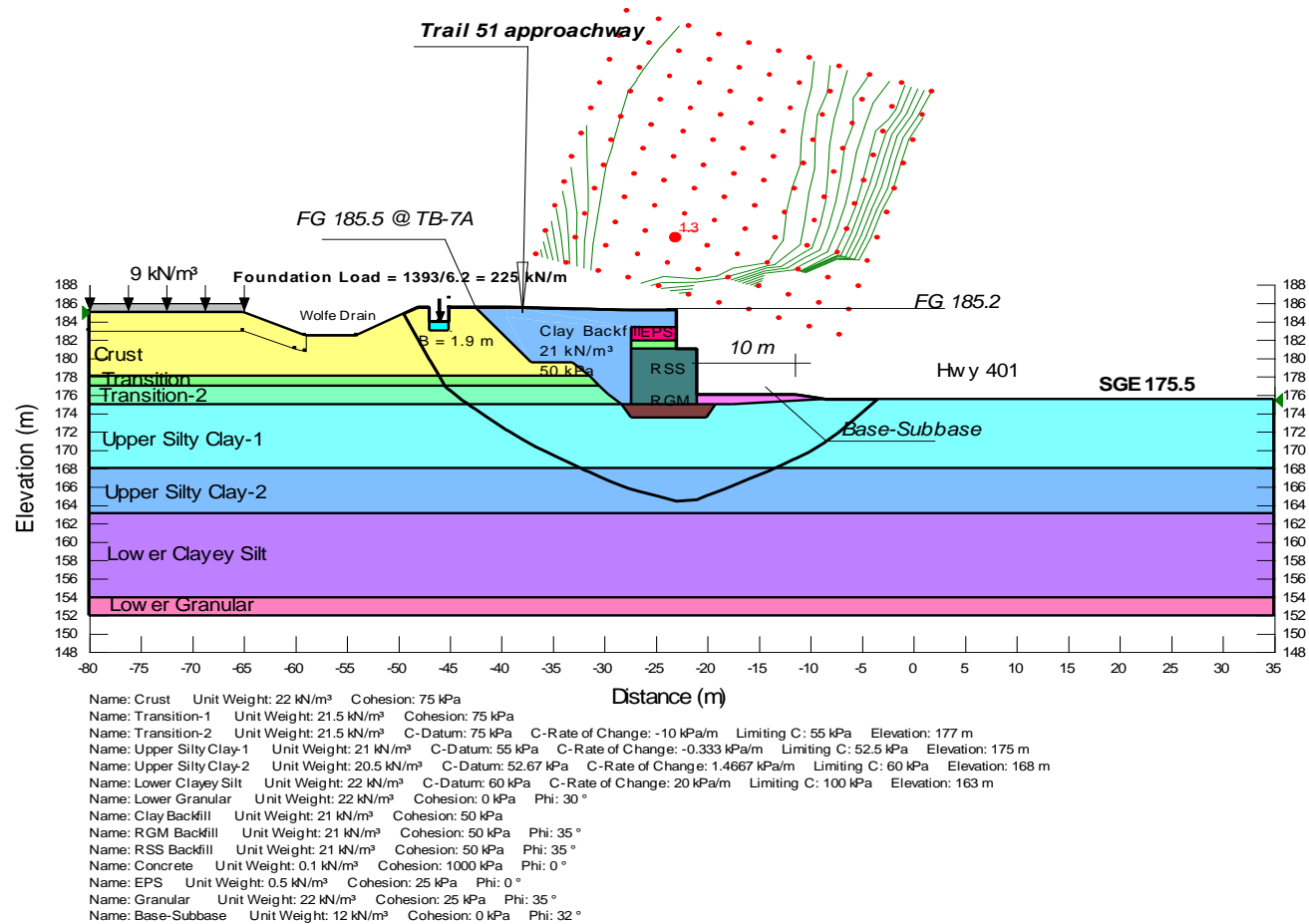
File Name: TB-7-West Embankment-Sta. 10+500-Trail 41.gsz
 Date: 09/07/2013
 Name: ST-Undrained
 FOS: 2.6

WEP SW8801.1002.101



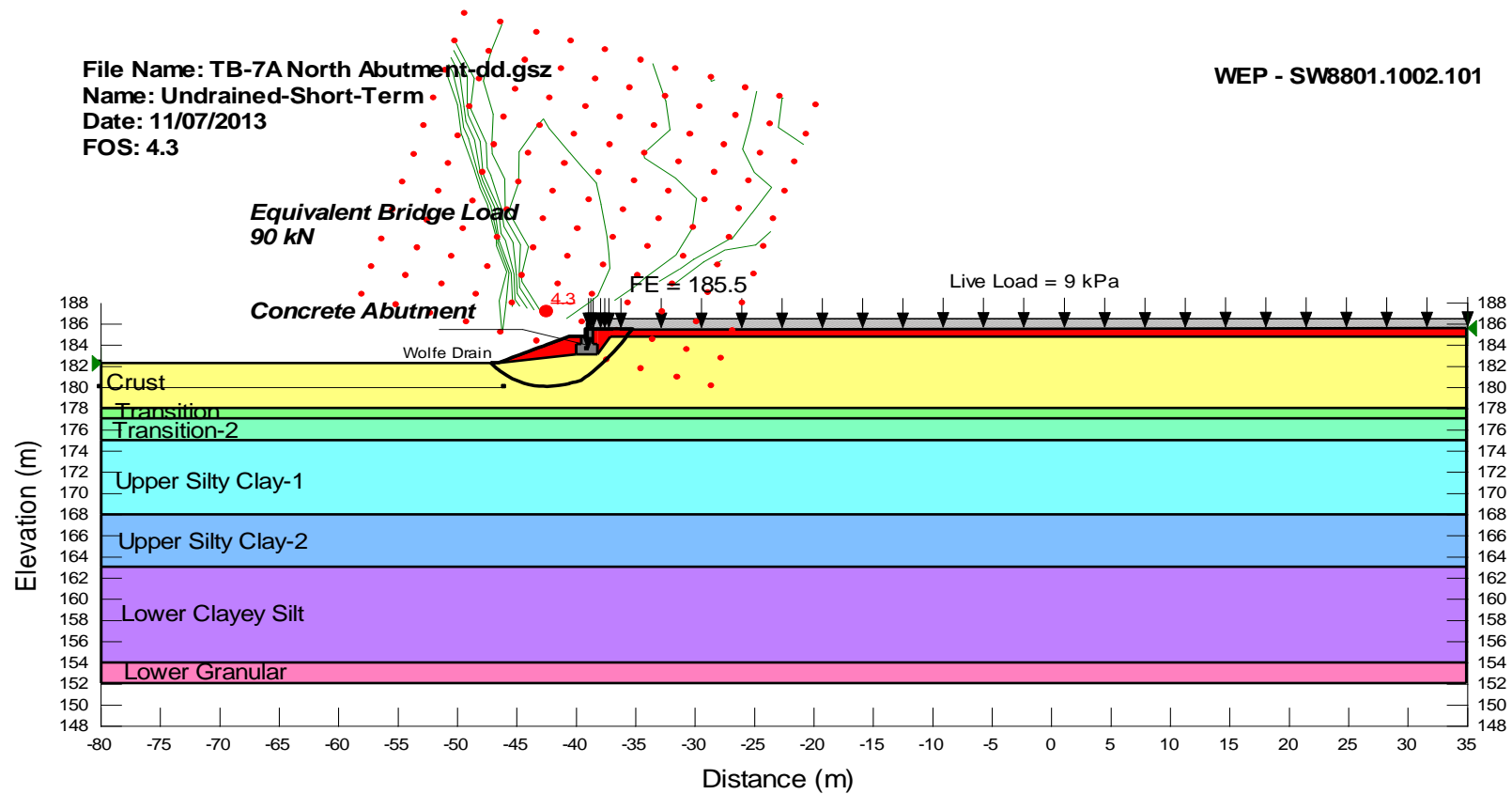
File Name: TB-7A South Abutment-Bridge Footing Longitudinal Stability.gsz
Date: 29/06/2013
Name: Short-Term
FOS: 1.3

WEP - SW8801.1002.101



File Name: TB-7A North Abutment-dd.gsz
 Name: Undrained-Short-Term
 Date: 11/07/2013
 FOS: 4.3

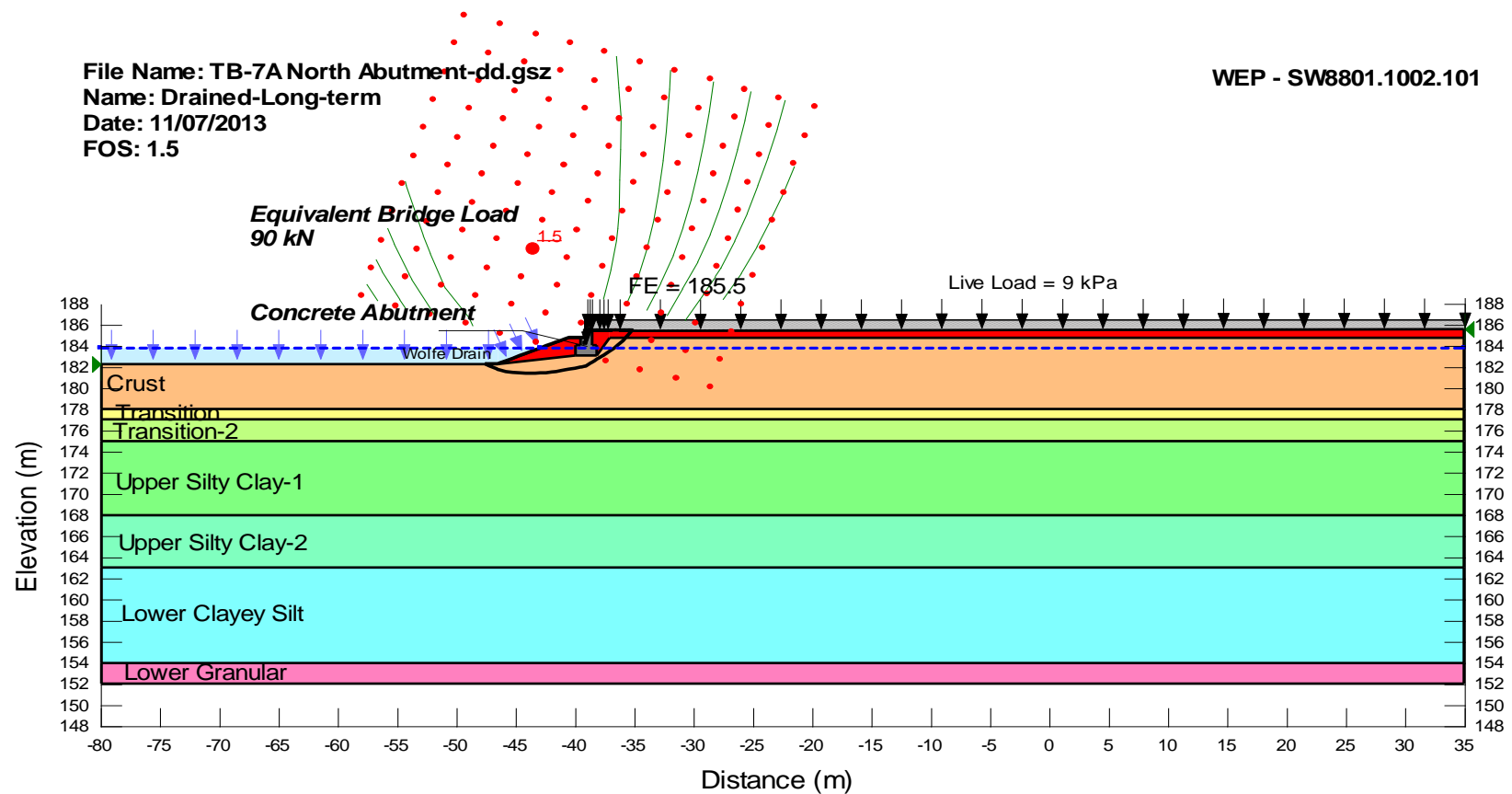
WEP - SW8801.1002.101



Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Transition-1 Unit Weight: 21.5 kN/m³ Cohesion: 75 kPa
 Name: Transition-2 Unit Weight: 21.5 kN/m³ C-Datum: 75 kPa C-Rate of Change: -10 kPa/m Limiting C: 55 kPa Elevation: 177 m
 Name: Upper Silty Clay-1 Unit Weight: 21 kN/m³ C-Datum: 55 kPa C-Rate of Change: -0.333 kPa/m Limiting C: 52.5 kPa Elevation: 175 m
 Name: Upper Silty Clay-2 Unit Weight: 20.5 kN/m³ C-Datum: 52.67 kPa C-Rate of Change: 1.4667 kPa/m Limiting C: 60 kPa Elevation: 168 m
 Name: Lower Clayey Silt Unit Weight: 22 kN/m³ C-Datum: 60 kPa C-Rate of Change: 20 kPa/m Limiting C: 100 kPa Elevation: 163 m
 Name: Lower Granular Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Backfill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °

File Name: TB-7A North Abutment-dd.gsz
 Name: Drained-Long-term
 Date: 11/07/2013
 FOS: 1.5

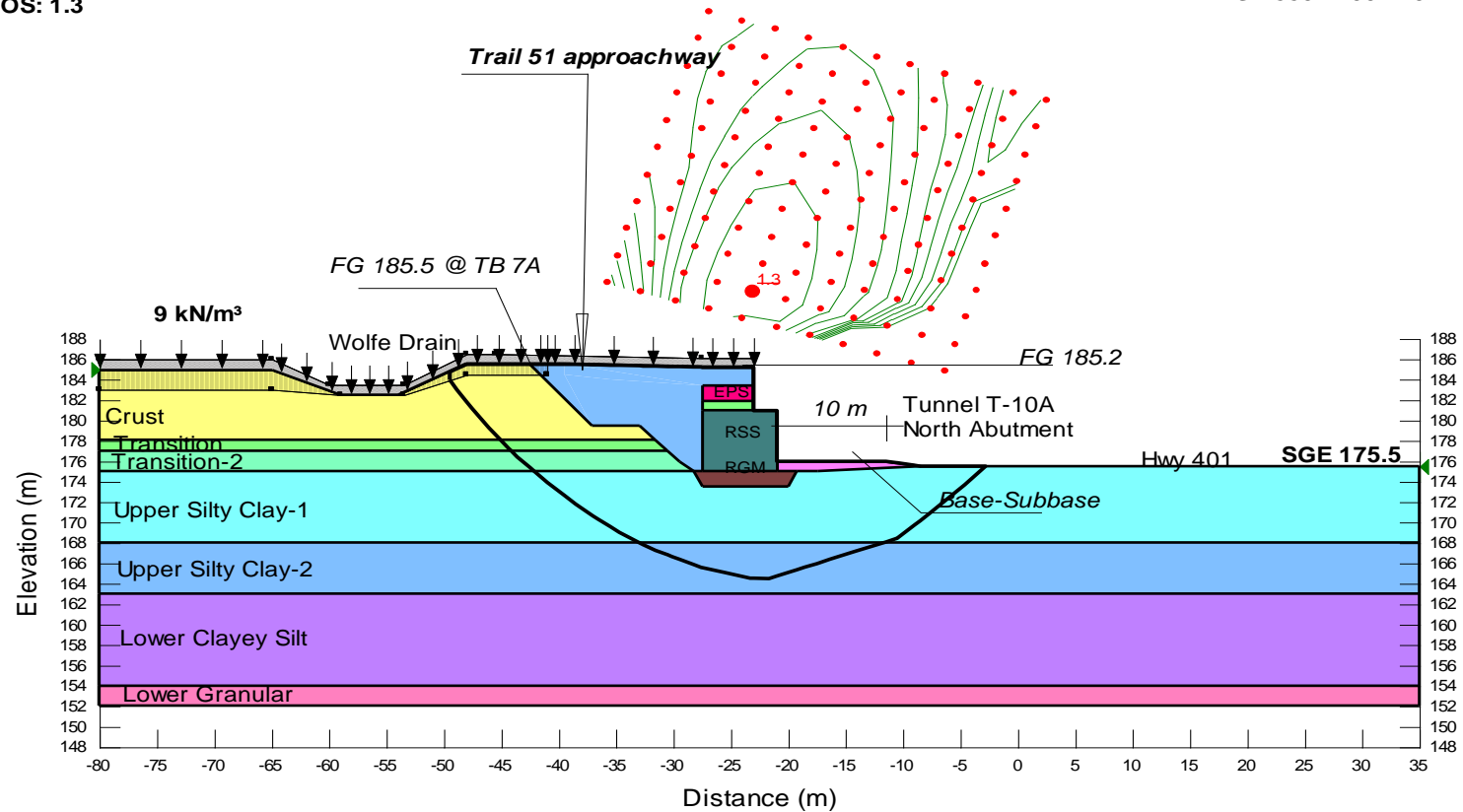
WEP - SW8801.1002.101



Name: Lower Granular Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Crust (Drained) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Transition-1 (Drained) Unit Weight: 21.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Transition-2 (Drained) Unit Weight: 21.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Upper Silty Clay-1 (Drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Upper Silty Clay-2 (Drained) Unit Weight: 20.5 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Lower Clayey Silt (Drained) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Backfill (Drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °

File Name: TB-7A South Embankment-1-No-EPS.gsz
 28/06/2013
 Short-Term No-EPS in Trail 51
 FOS: 1.3

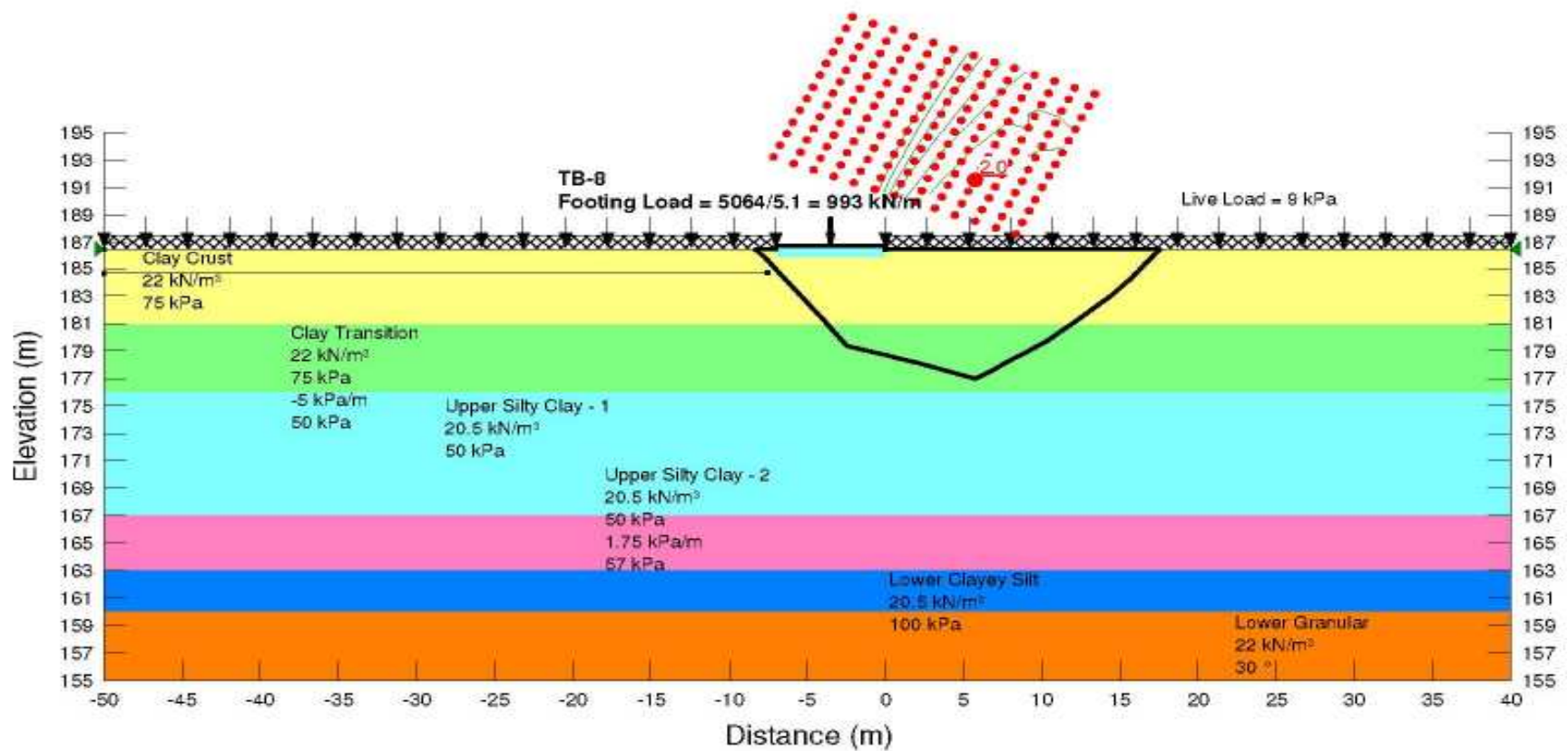
WEP - SW8801.1002.101



Name: Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Transition-1 Unit Weight: 21.5 kN/m³ Cohesion: 75 kPa
 Name: Transition-2 Unit Weight: 21.5 kN/m³ C-Datum: 75 kPa C-Rate of Change: -10 kPa/m Limiting C: 55 kPa Elevation: 177 m
 Name: Upper Silty Clay-1 Unit Weight: 21 kN/m³ C-Datum: 55 kPa C-Rate of Change: -0.333 kPa/m Limiting C: 52.5 kPa Elevation: 175 m
 Name: Upper Silty Clay-2 Unit Weight: 20.5 kN/m³ C-Datum: 52.67 kPa C-Rate of Change: 1.4667 kPa/m Limiting C: 60 kPa Elevation: 168 m
 Name: Lower Clayey Silt Unit Weight: 22 kN/m³ C-Datum: 60 kPa C-Rate of Change: 20 kPa/m Limiting C: 100 kPa Elevation: 163 m
 Name: Lower Granular Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Backfill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 Name: RGM Backfill Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: RSS Backfill Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 25 kPa Phi: 0 °
 Name: Granular Unit Weight: 22 kN/m³ Cohesion: 25 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32 °

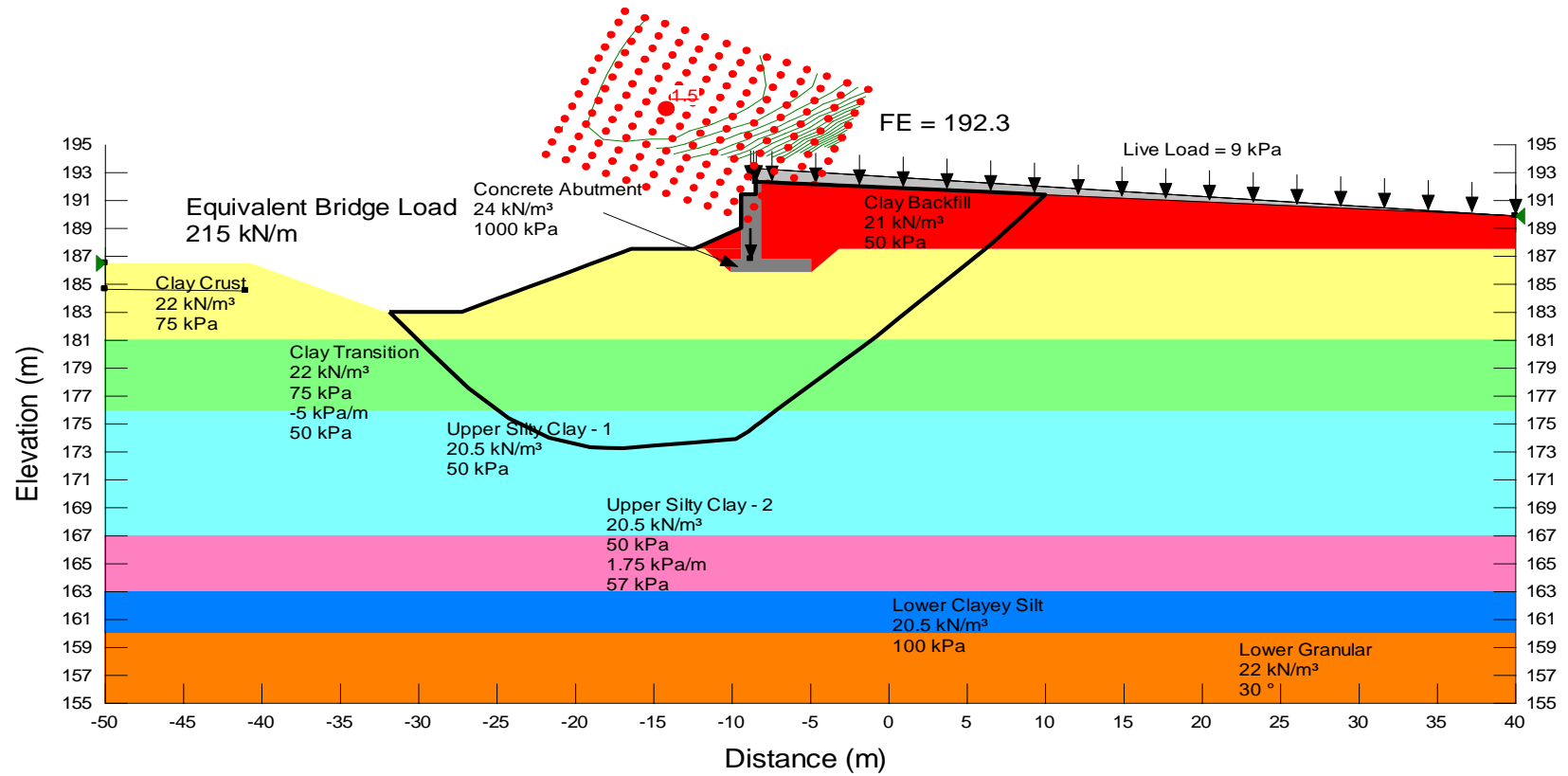
File Name: TB-8- East Abutment-Bridge Footing Transverse Stability.gsz
 Name: Undrained-Short-Term
 Date: 28/06/2013
 FOS: 2.0

WEP SW8801.1002.101



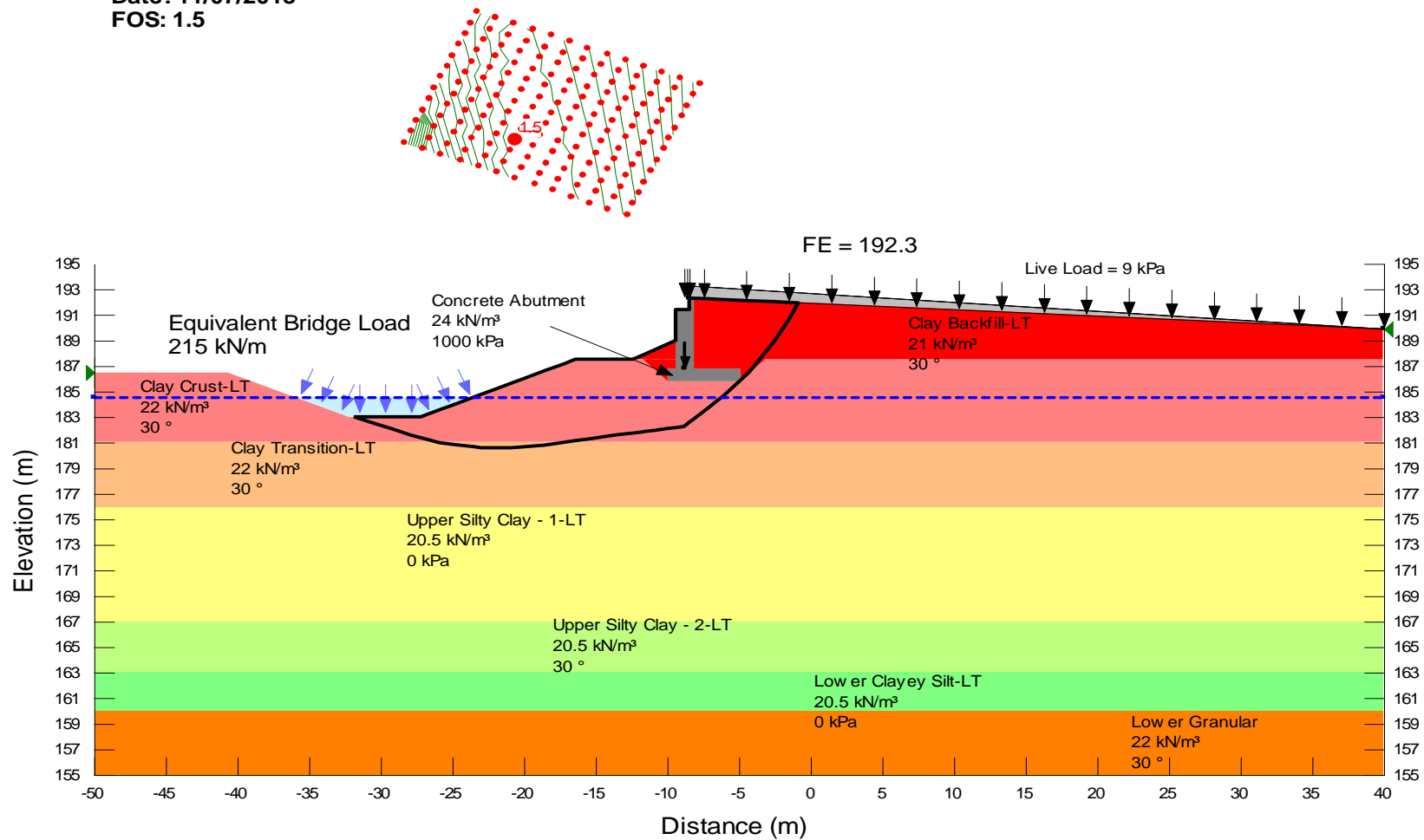
File Name: TB-8- East Abutment.gsz
 Name: Undrained-Short-Term
 Date: 11/07/2013
 FOS: 1.5

WEP SW8801.1002.101



File Name: TB-8- East Abutment.gsz
 Name: Drained-Long-Term
 Date: 11/07/2013
 FOS: 1.5

WEP SW8801.1002.101



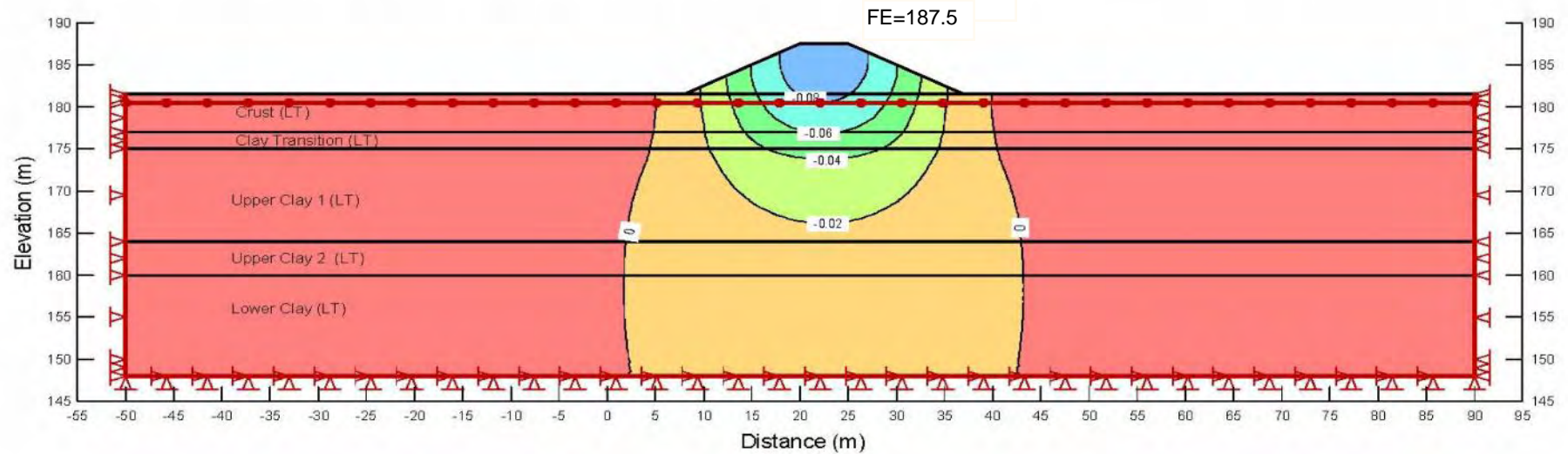
Appendix E Stress-Deformation Analyses of Embankments

File Name: TB-1 South Embankment.gsz

Name: Embankment - Coupled

Sta. 10+770 (Trail 2)

Name: Crust (LT) Model: Elastic-Plastic Effective Young's Modulus (E): 31500 kPa Poisson's Ratio: 0.35 Unit Weight: 22 kN/m³ K-Ratio: 1 K-Function: Conductivity Crust
Name: Clay Transition (LT) Model: Elastic-Plastic Effective Young's Modulus (E): 18900 kPa Poisson's Ratio: 0.35 Unit Weight: 22 kN/m³ K-Ratio: 0.5 K-Function: Conductivity Transition
Name: Upper Clay 1 (LT) Model: Soft Clay (MCC) Poisson's Ratio: 0.35 Unit Weight: 20.5 kN/m³ K-Ratio: 0.5 K-Function: Conductivity Upper Clay
Name: Lower Clay (LT) Model: Elastic-Plastic Effective Young's Modulus (E): 20250 kPa Poisson's Ratio: 0.35 Unit Weight: 20.5 kN/m³ K-Ratio: 0.5 K-Function: Conductivity Lower Clay
Name: Clay Fill (LT) Model: Linear Elastic Young's Modulus (E): 25000 kPa Unit Weight: 21 kN/m³ Poisson's Ratio: 0.35
Name: Upper Clay 2 (LT) Model: Soft Clay (MCC) Poisson's Ratio: 0.35 Unit Weight: 20.5 kN/m³ K-Ratio: 0.5 K-Function: Conductivity Upper Clay



Legend:

End of Construction (Day 30 in analysis)

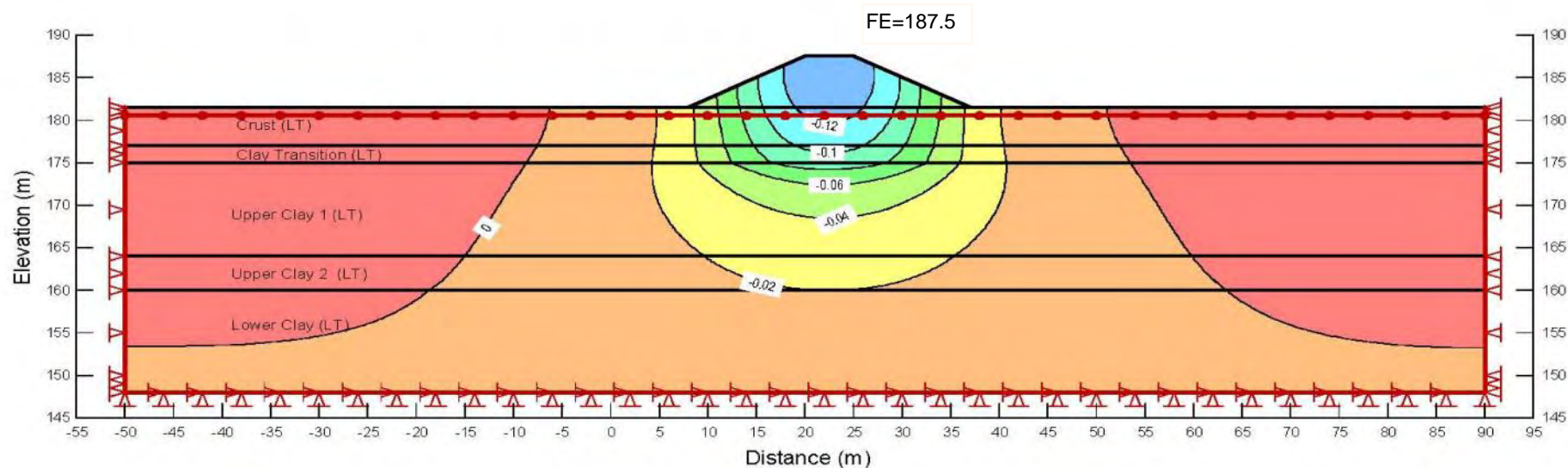
Value shown on contour line is in metre (m), negative is downward movement.

File Name: TB-1 South Embankment.gsz

Name: Dissipation - Coupled

Sta. 10+770 (Trail 2)

Name: Crust (LT) Model: Elastic-Plastic Effective Young's Modulus (E): 31500 kPa Poisson's Ratio: 0.35 Unit Weight: 22 kN/m³ K-Ratio: 1 K-Function: Conductivity Crust
Name: Clay Transition (LT) Model: Elastic-Plastic Effective Young's Modulus (E): 18900 kPa Poisson's Ratio: 0.35 Unit Weight: 22 kN/m³ K-Ratio: 0.5 K-Function: Conductivity Transition
Name: Upper Clay 1 (LT) Model: Soft Clay (MCC) Poisson's Ratio: 0.35 Unit Weight: 20.5 kN/m³ K-Ratio: 0.5 K-Function: Conductivity Upper Clay
Name: Lower Clay (LT) Model: Elastic-Plastic Effective Young's Modulus (E): 20250 kPa Poisson's Ratio: 0.35 Unit Weight: 20.5 kN/m³ K-Ratio: 0.5 K-Function: Conductivity Lower Clay
Name: Clay Fill (LT) Model: Linear Elastic Young's Modulus (E): 25000 kPa Unit Weight: 21 kN/m³ Poisson's Ratio: 0.35
Name: Upper Clay 2 (LT) Model: Soft Clay (MCC) Poisson's Ratio: 0.35 Unit Weight: 20.5 kN/m³ K-Ratio: 0.5 K-Function: Conductivity Upper Clay

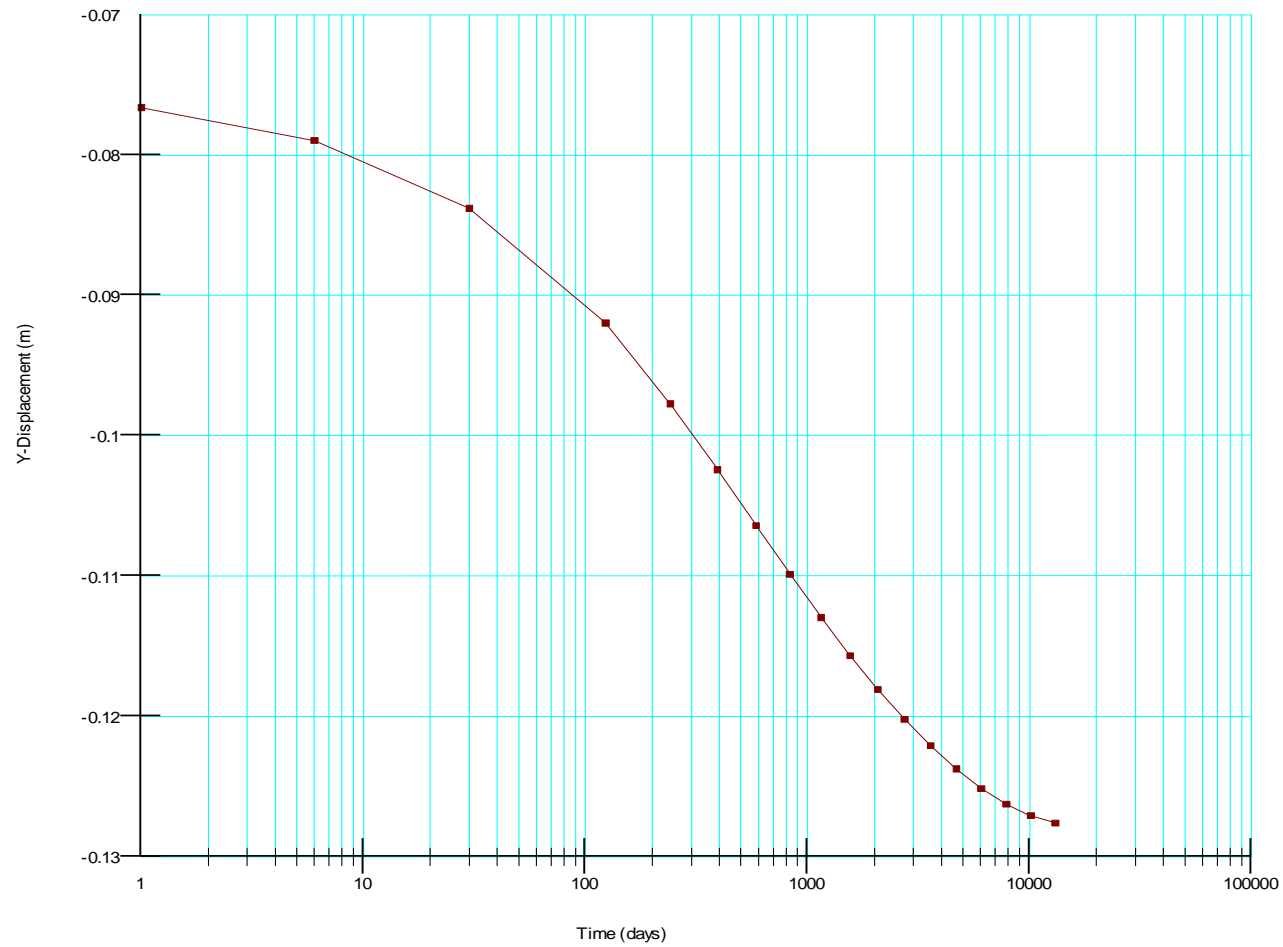


Legend:

LONG-TERM (Day 13030 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.

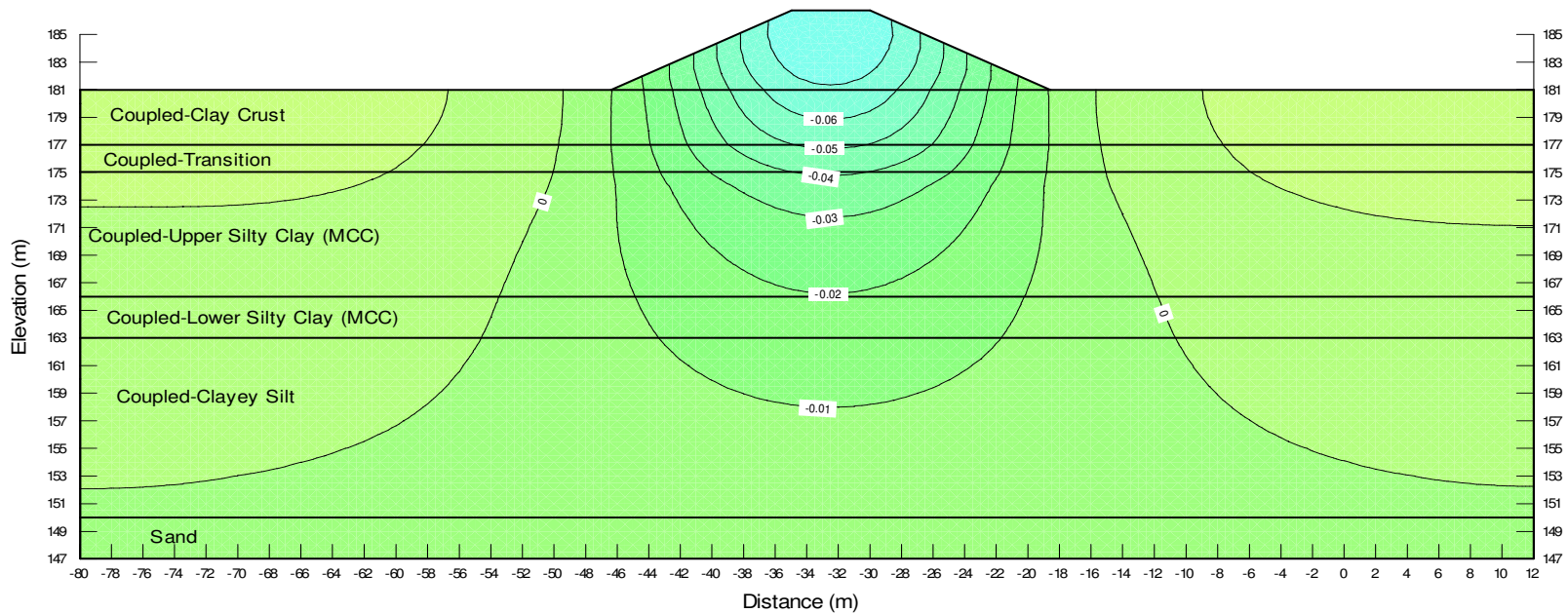
TB-1 South Embankment - Consolidation



End of Construction (Day 30 in analysis)
LONG-TERM (Day 13030 in analysis)

File Name: TB-4 West Embankment.gsz
Name: Embankment - Coupled
Sta. 10+020 (Trail 31)

Name: Sand Model: Elastic-Plastic Effective Young's Modulus (E'): 40000 kPa Poisson's Ratio: 0.35 Cohesion': 0 kPa Phi': 30 ° Unit Weight: 22 kN/m³
Name: Backfill (Drained) Model: Elastic-Plastic Young's Modulus (E): 20000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 21 kN/m³
Name: Coupled-Clay Crust Model: Elastic-Plastic Effective Young's Modulus (E'): 32000 kPa Poisson's Ratio: 0.35 Cohesion': 0 kPa Phi': 30 ° Unit Weight: 22 kN/m³ K-Ratio: 1 K-Function: Conductivity _Crust
Name: Coupled-Transition Model: Elastic-Plastic Effective Young's Modulus (E'): 18000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi': 30 ° Unit Weight: 21 kN/m³ K-Ratio: 0.5 K-Function: Conductivity _Transition
Name: Coupled-Upper Silty Clay (MCC) Model: Soft Clay (MCC) O.C. Ratio: 2.8 Poisson's Ratio: 0.35 Lambda: 0.0882 Kappa: 0.009699 Initial Void Ratio: 0.69 Unit Weight: 20 kN/m³ Phi': 25 ° K-Ratio: 0.5 K-Fu
Name: Coupled-Lower Silty Clay (MCC) Model: Soft Clay (MCC) O.C. Ratio: 1.3 Poisson's Ratio: 0.35 Lambda: 0.0713 Kappa: 0.007839 Initial Void Ratio: 0.56 Unit Weight: 21 kN/m³ Phi': 26 ° K-Ratio: 0.5 K-Fu
Name: Coupled-Clayey Silt Model: Elastic-Plastic Effective Young's Modulus (E'): 23000 kPa Poisson's Ratio: 0.35 Cohesion': 0 kPa Phi': 30 ° Unit Weight: 21.5 kN/m³ K-Ratio: 0.5 K-Function: Conductivity _Upper Silt



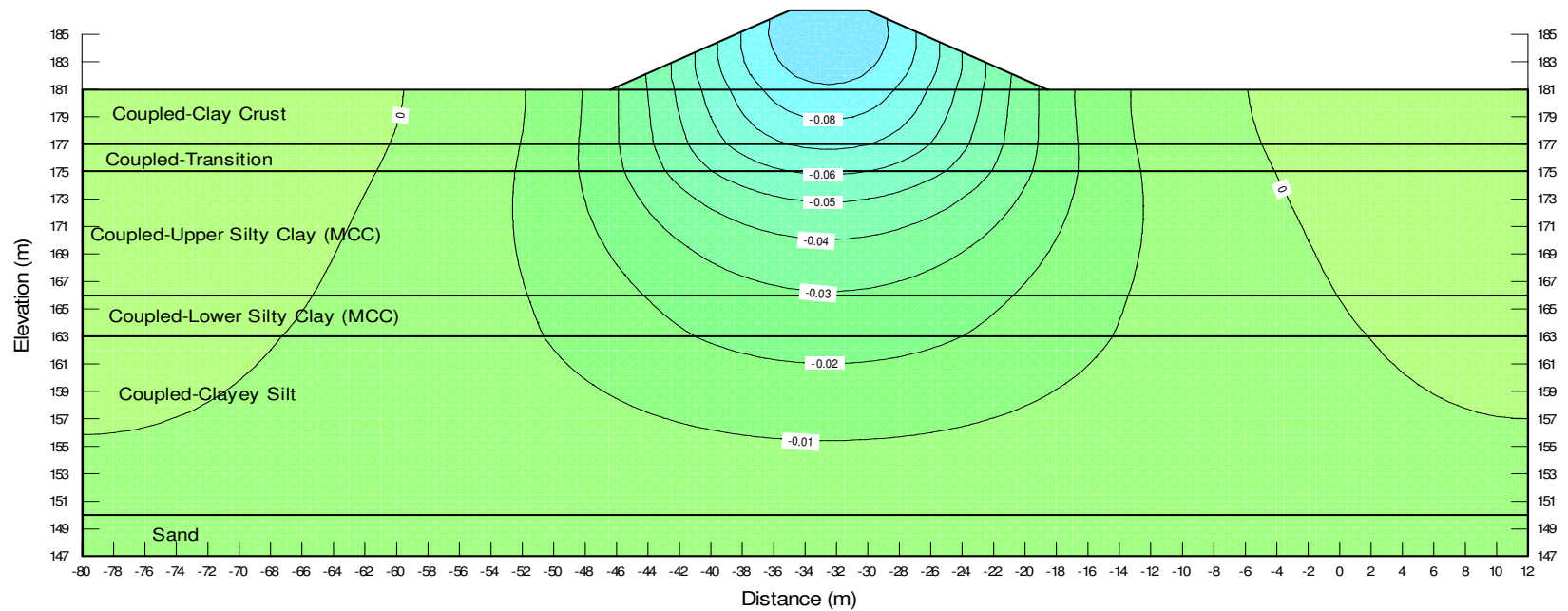
Legend:
End of Construction (Day 30 in analysis)
Value shown on contour line is in metre (m), negative is downward movement.

File Name: TB-4 West Embankment.gsz

Name: Dissipation - Coupled

Sta. 10+020 (Trail 31)

Name: Sand Model: Elastic-Plastic Effective Young's Modulus (E'): 40000 kPa Poisson's Ratio: 0.35 Cohesion': 0 kPa Phi': 30 ° Unit Weight: 22 kN/m³
Name: Backfill (Drained) Model: Elastic-Plastic Young's Modulus (E): 20000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 21 kN/m³
Name: Coupled-Clay Crust Model: Elastic-Plastic Effective Young's Modulus (E'): 32000 kPa Poisson's Ratio: 0.35 Cohesion': 0 kPa Phi': 30 ° Unit Weight: 22 kN/m³ K-Ratio: 1 K-Function: Conductivity_Crust
Name: Coupled-Transition Model: Elastic-Plastic Effective Young's Modulus (E'): 18000 kPa Poisson's Ratio: 0.35 Cohesion': 0 kPa Phi': 30 ° Unit Weight: 21 kN/m³ K-Ratio: 0.5 K-Function: Conductivity_Transition
Name: Coupled-Upper Silty Clay (MCC) Model: Soft Clay (MCC) O.C. Ratio: 2.8 Poisson's Ratio: 0.35 Lambda: 0.0882 Kappa: 0.009699 Initial Void Ratio: 0.69 Unit Weight: 20 kN/m³ Phi': 25 ° K-Ratio: 0.5 K-Fu
Name: Coupled-Lower Silty Clay (MCC) Model: Soft Clay (MCC) O.C. Ratio: 1.3 Poisson's Ratio: 0.35 Lambda: 0.0713 Kappa: 0.007839 Initial Void Ratio: 0.56 Unit Weight: 21 kN/m³ Phi': 26 ° K-Ratio: 0.5 K-Fu
Name: Coupled-Clayey Silt Model: Elastic-Plastic Effective Young's Modulus (E'): 23000 kPa Poisson's Ratio: 0.35 Cohesion': 0 kPa Phi': 30 ° Unit Weight: 21.5 kN/m³ K-Ratio: 0.5 K-Function: Conductivity_Upper Silt

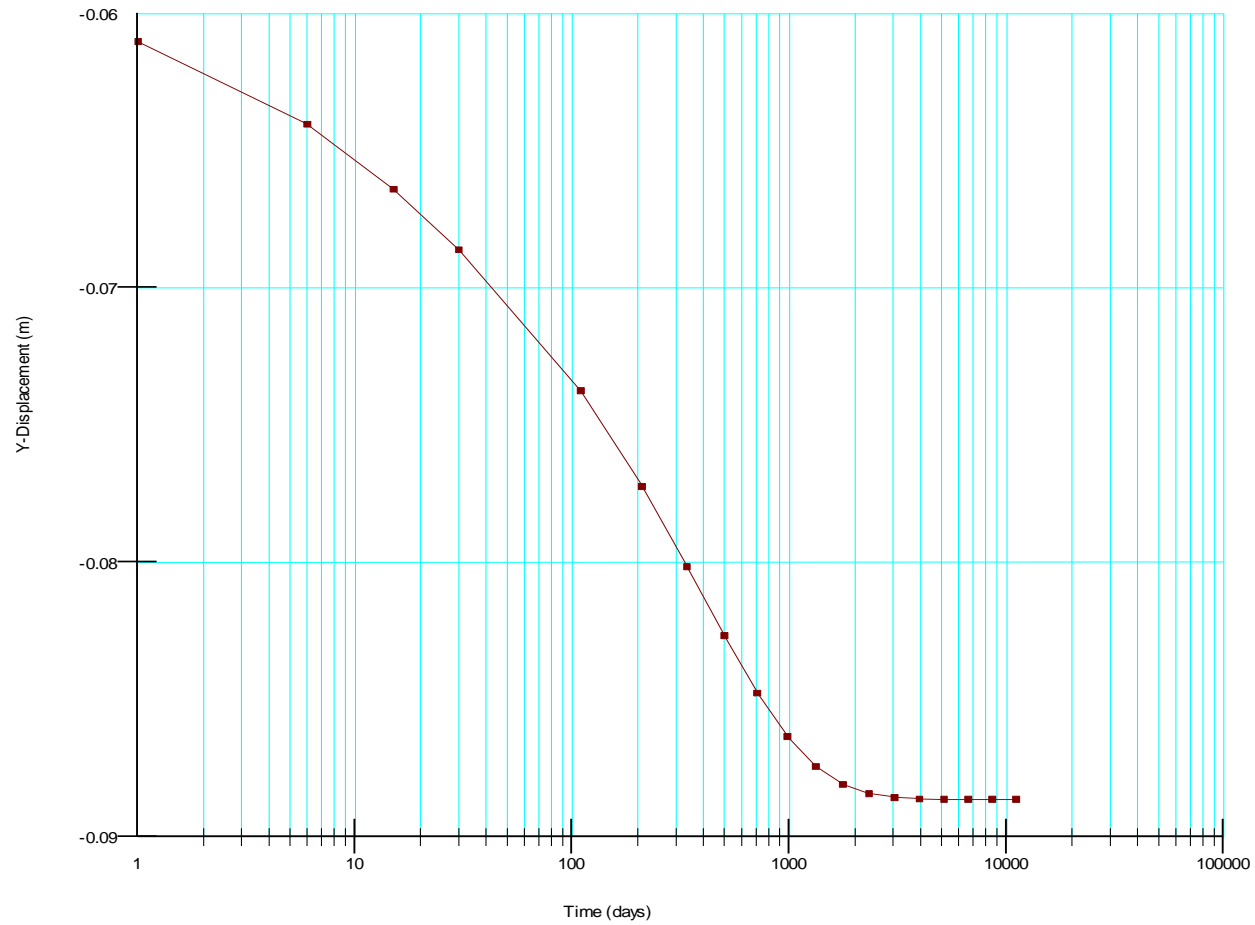


Legend:

LONG-TERM (Day 13030 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.

TB-4 West Embankment - Consolidation



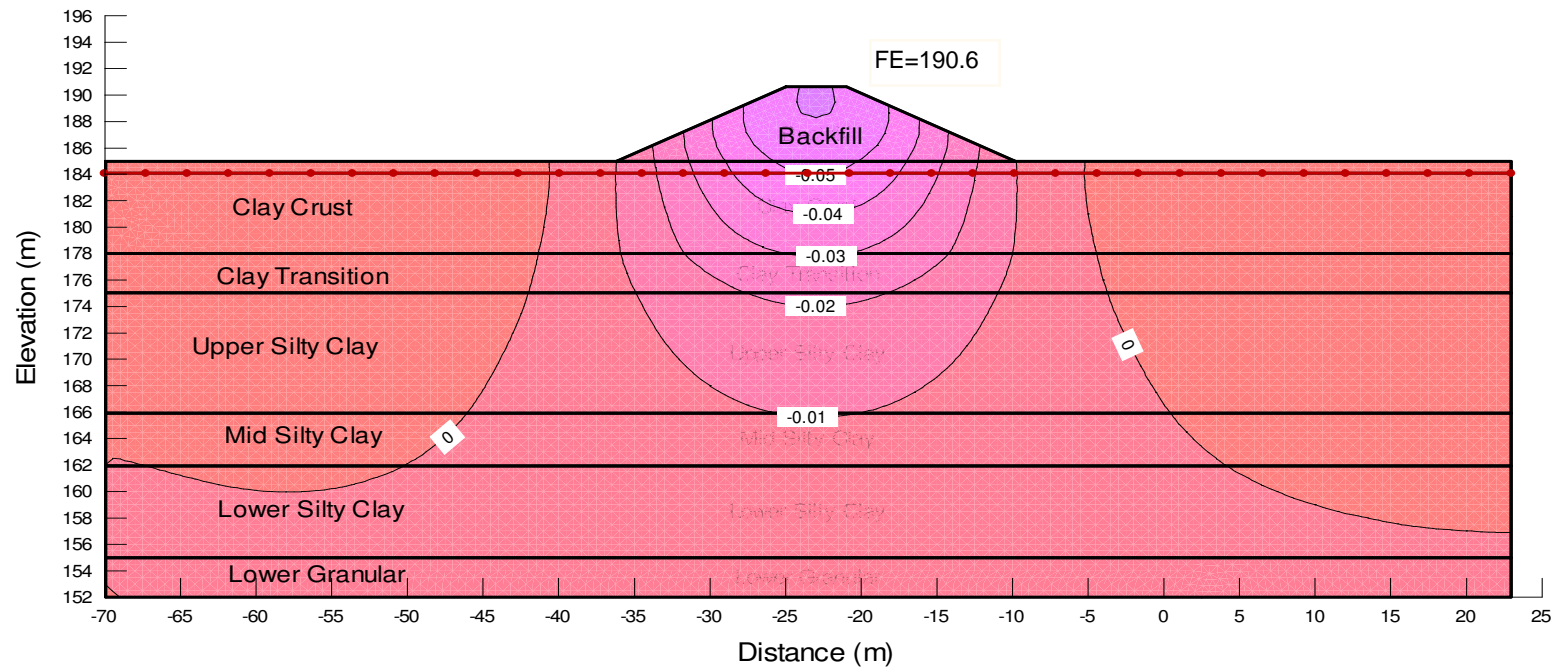
End of Construction (Day 30 in analysis)
LONG-TERM (Day 13030 in analysis)

File Name: TB-7 East Embankment Deformation.gsz

Name: Embankment-Coupled

Sta. 10+086 (Trail 44)

Name: Clay Crust Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Clay Transition Effective Young's Modulus (E'): 18000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Upper Silty Clay O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.071 Kappa: 0.0078 Initial Void Ratio: 0.54 Unit Weight: 20.5 kN/m³ Phi': 25 °
Name: Mid Silty Clay O.C. Ratio: 1.2 Poisson's Ratio: 0.35 Lambda: 0.086 Kappa: 0.0094 Initial Void Ratio: 0.65 Unit Weight: 20.5 kN/m³ Phi': 26 °
Name: Lower Silty Clay Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 20.5 kN/m³
Name: Lower Granular Effective Young's Modulus (E'): 40000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 21 kN/m³



Legend:

End of Construction (Day 30 in analysis)

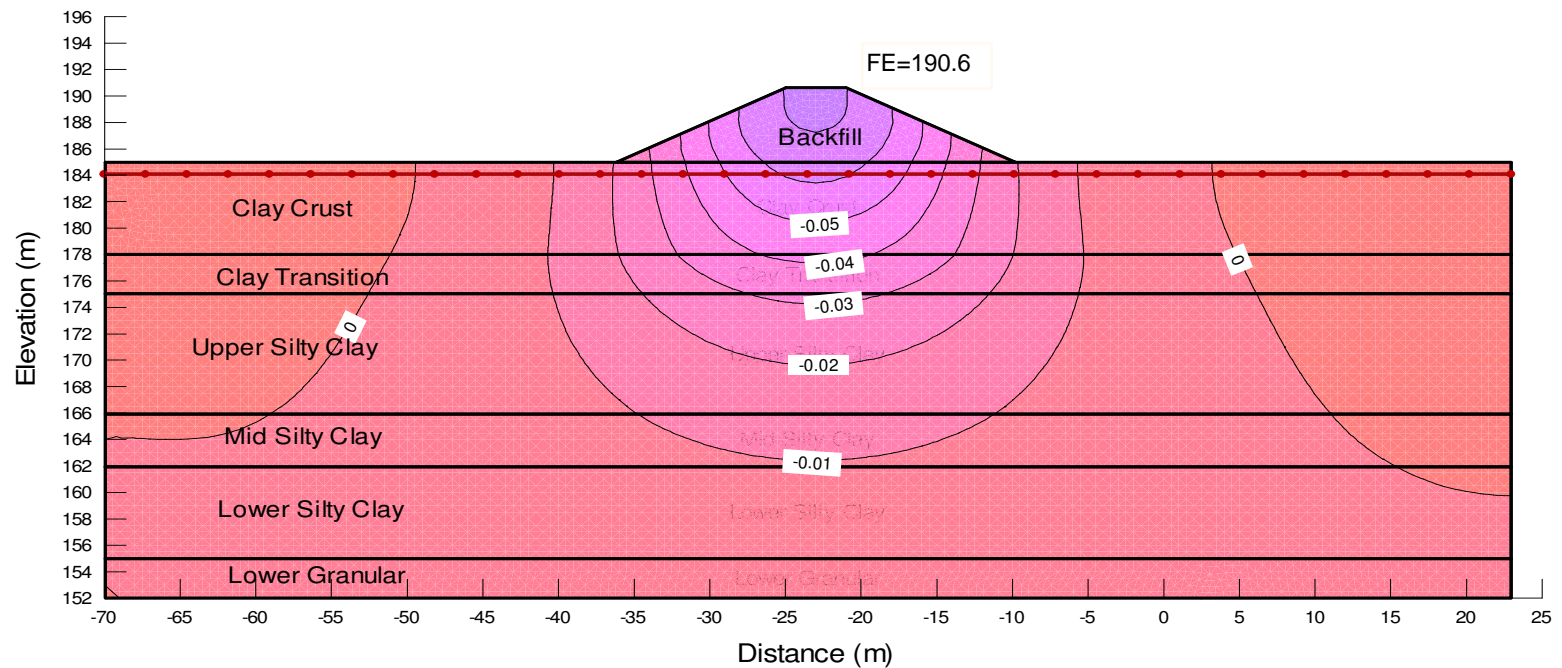
Value shown on contour line is in metre (m), negative is downward movement.

File Name: TB-7 East Embankment Deformation.gsz

Name: Dissipation-Coupled

Sta. 10+086 (Trail 44)

Name: Clay Crust Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Clay Transition Effective Young's Modulus (E'): 18000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Upper Silty Clay O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.071 Kappa: 0.0078 Initial Void Ratio: 0.54 Unit Weight: 20.5 kN/m³ Phi': 26 °
Name: Mid Silty Clay O.C. Ratio: 1.2 Poisson's Ratio: 0.35 Lambda: 0.086 Kappa: 0.0094 Initial Void Ratio: 0.65 Unit Weight: 20.5 kN/m³ Phi': 26 °
Name: Lower Silty Clay Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 20.5 kN/m³
Name: Lower Granular Effective Young's Modulus (E'): 40000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 21 kN/m³

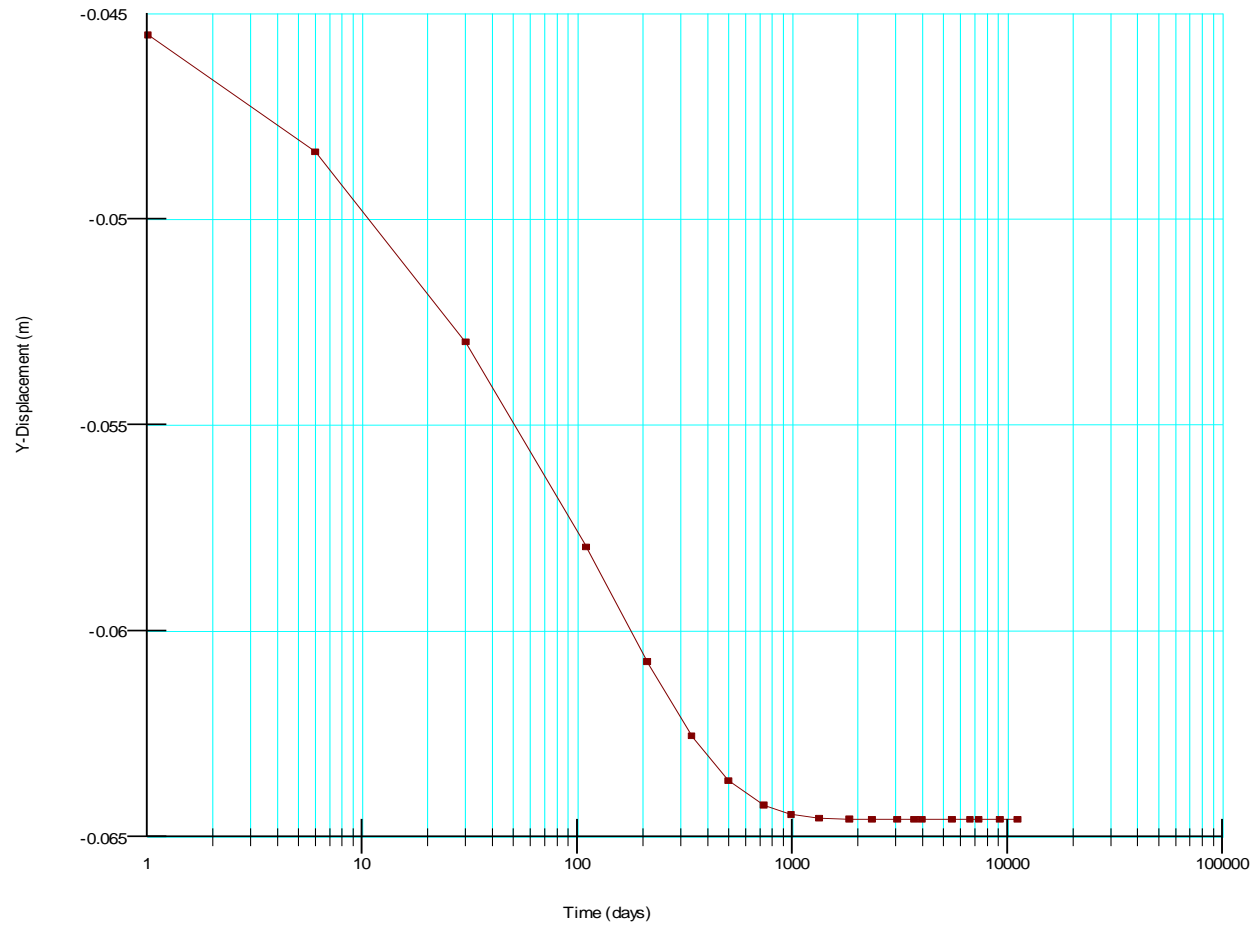


Legend:

LONG-TERM (Day 13030 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.

TB-7 East Embankment - Consolidation



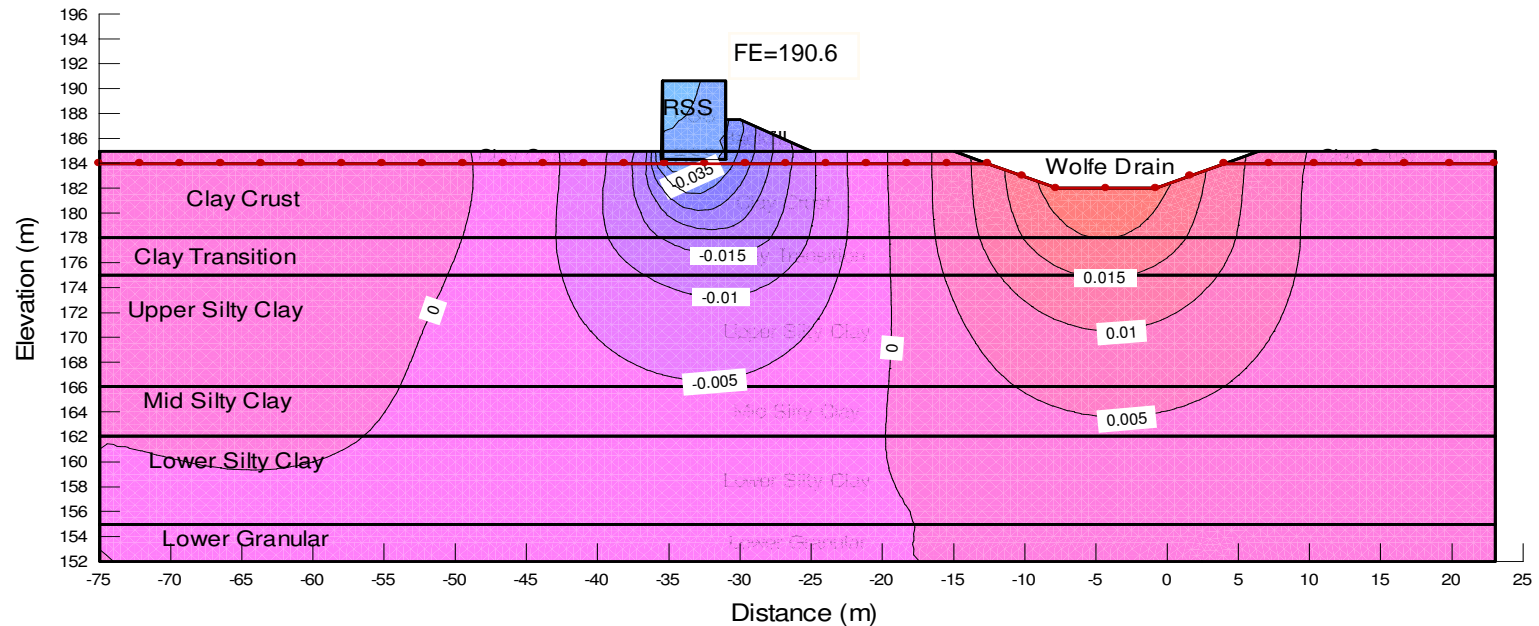
End of Construction (Day 30 in analysis)
LONG-TERM (Day 13030 in analysis)

File Name: TB-7 East Embankment Deformation-RSS Wall-ea.gsz

Name: RSS Construction

Sta. 10+125 (Trail 44)

Name: Clay Crust Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Clay Transition Effective Young's Modulus (E'): 18000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Upper Silty Clay O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.071 Kappa: 0.0078 Initial Void Ratio: 0.54 Unit Weight: 20.5 kN/m³ Phi': 25 °
Name: Mid Silty Clay O.C. Ratio: 1.2 Poisson's Ratio: 0.35 Lambda: 0.086 Kappa: 0.0094 Initial Void Ratio: 0.65 Unit Weight: 20.5 kN/m³ Phi': 26 °
Name: Lower Silty Clay Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 20.5 kN/m³
Name: Lower Granular Effective Young's Modulus (E'): 40000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: RSS Young's Modulus (E): 60000 kPa Unit Weight: 21 kN/m³ Poisson's Ratio: 0.35
Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 21 kN/m³



Legend:

End of Construction (Day 415 in analysis)

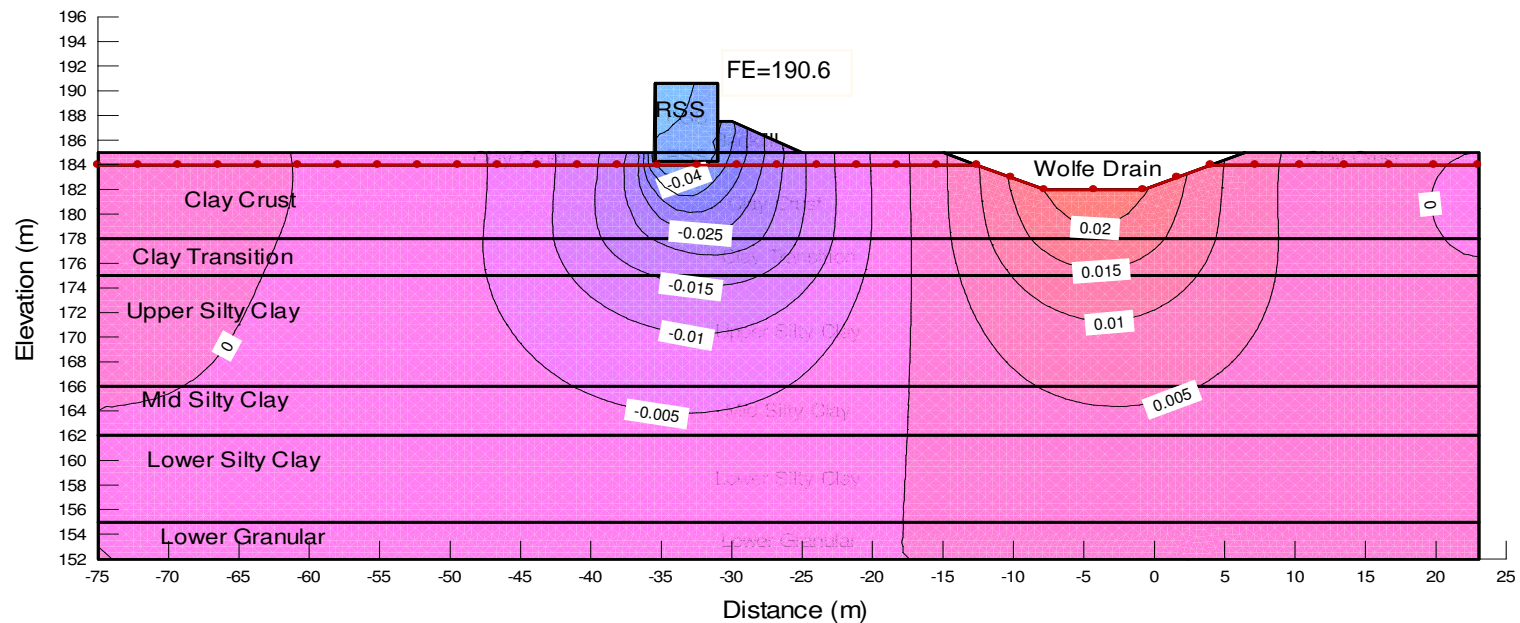
Value shown on contour line is in metre (m), negative is downward movement.

File Name: TB-7 East Embankment Deformation-RSS Wall-ea.gsz

Name: Dissipation

Sta. 10+125 (Trail 44)

Name: Clay Crust Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Clay Transition Effective Young's Modulus (E'): 18000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Upper Silty Clay O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.071 Kappa: 0.0078 Initial Void Ratio: 0.54 Unit Weight: 20.5 kN/m³ Phi': 25 °
Name: Mid Silty Clay O.C. Ratio: 1.2 Poisson's Ratio: 0.35 Lambda: 0.086 Kappa: 0.0094 Initial Void Ratio: 0.65 Unit Weight: 20.5 kN/m³ Phi': 26 °
Name: Lower Silty Clay Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 20.5 kN/m³
Name: Lower Granular Effective Young's Modulus (E'): 40000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: RSS Young's Modulus (E): 60000 kPa Unit Weight: 21 kN/m³ Poisson's Ratio: 0.35
Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 21 kN/m³

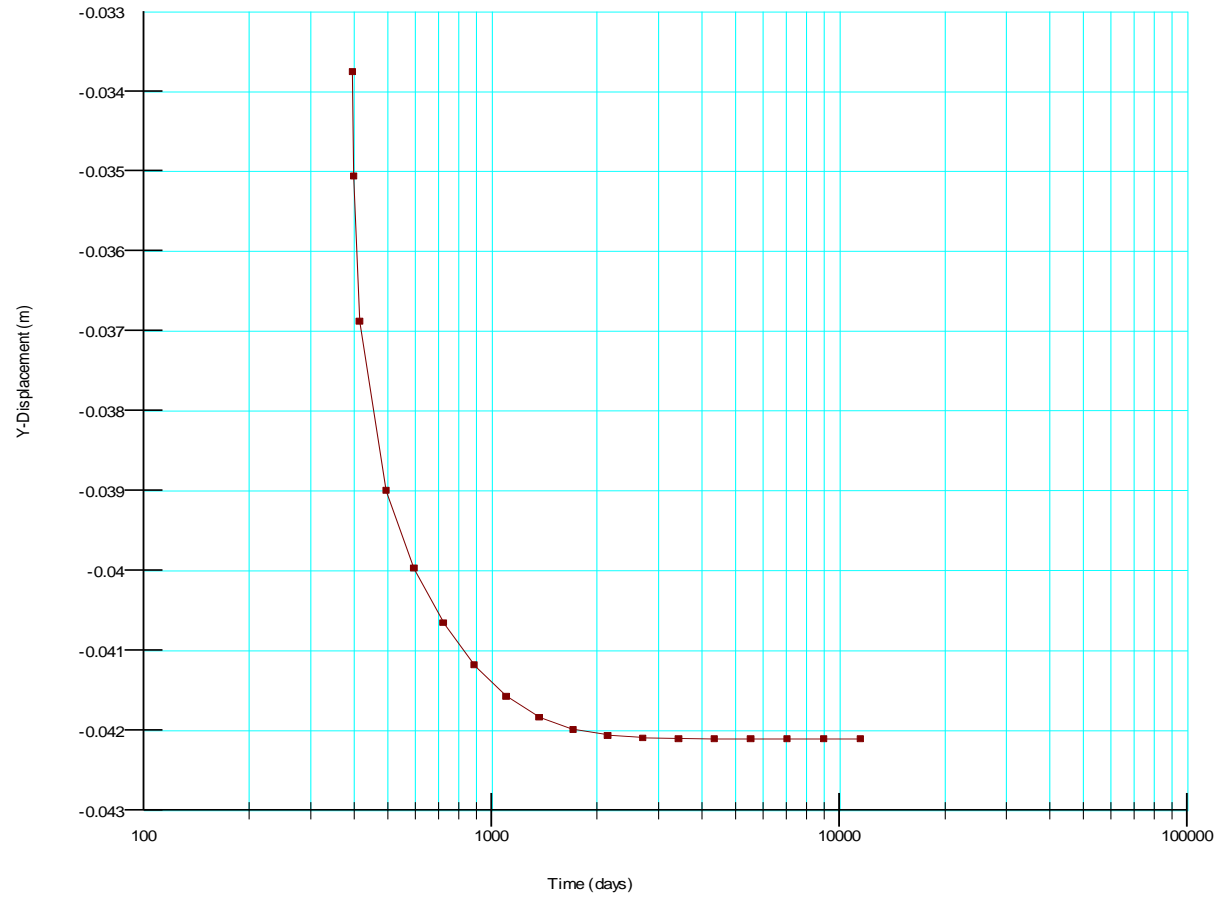


Legend:

LONG-TERM (Day 11415 in analysis)

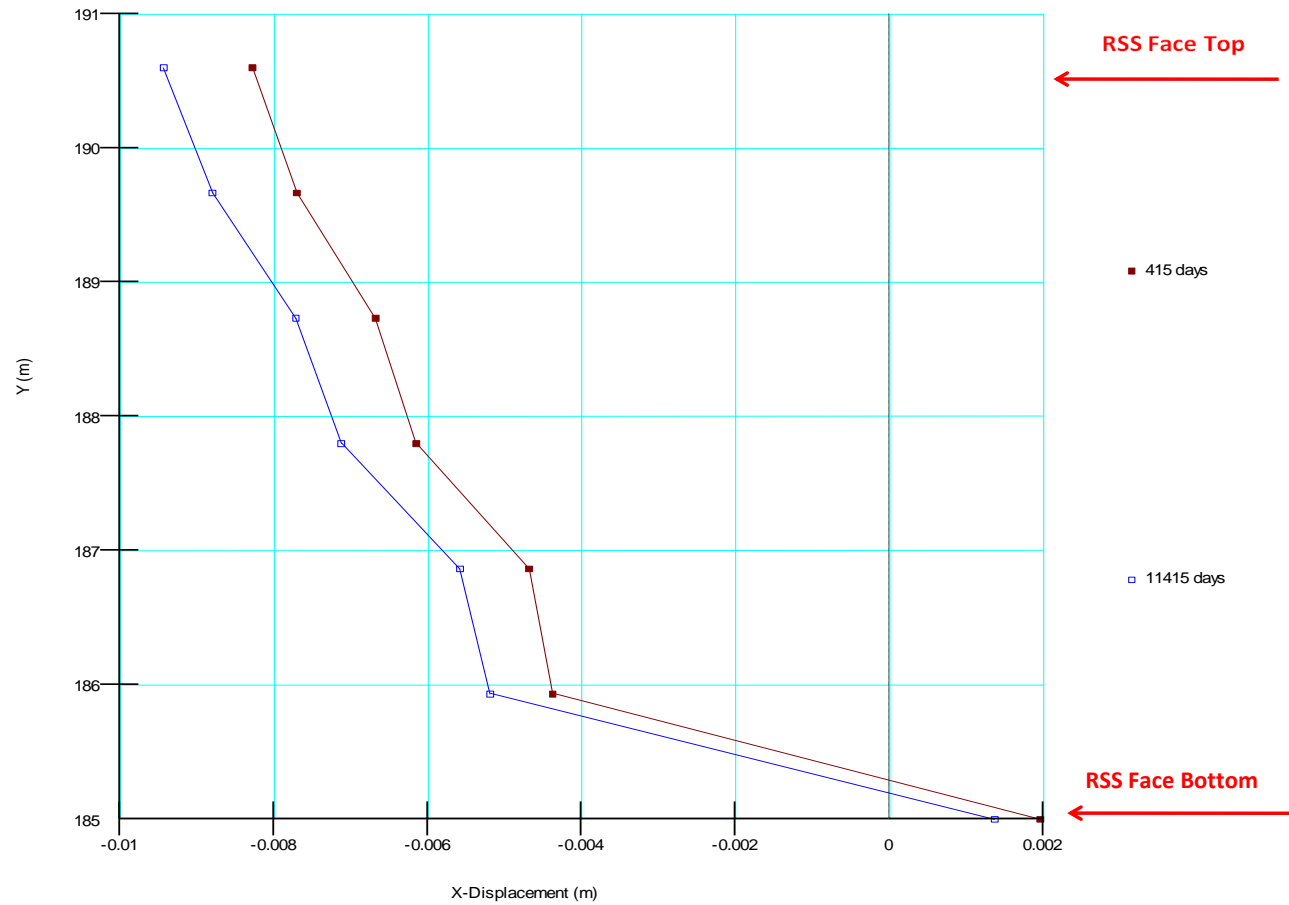
Value shown on contour line is in metre (m), negative is downward movement.

TB-7 SE RSS Wall-Consolidation



End of Construction (Day 415 in analysis)
LONG-TERM (Day 11415 in analysis)

Lateral Displacement at RSS Face



Legend:

415 days = End of Construction (Day 415 in analysis)

11415 days = Long-term Condition (11000 days after End of Construction)

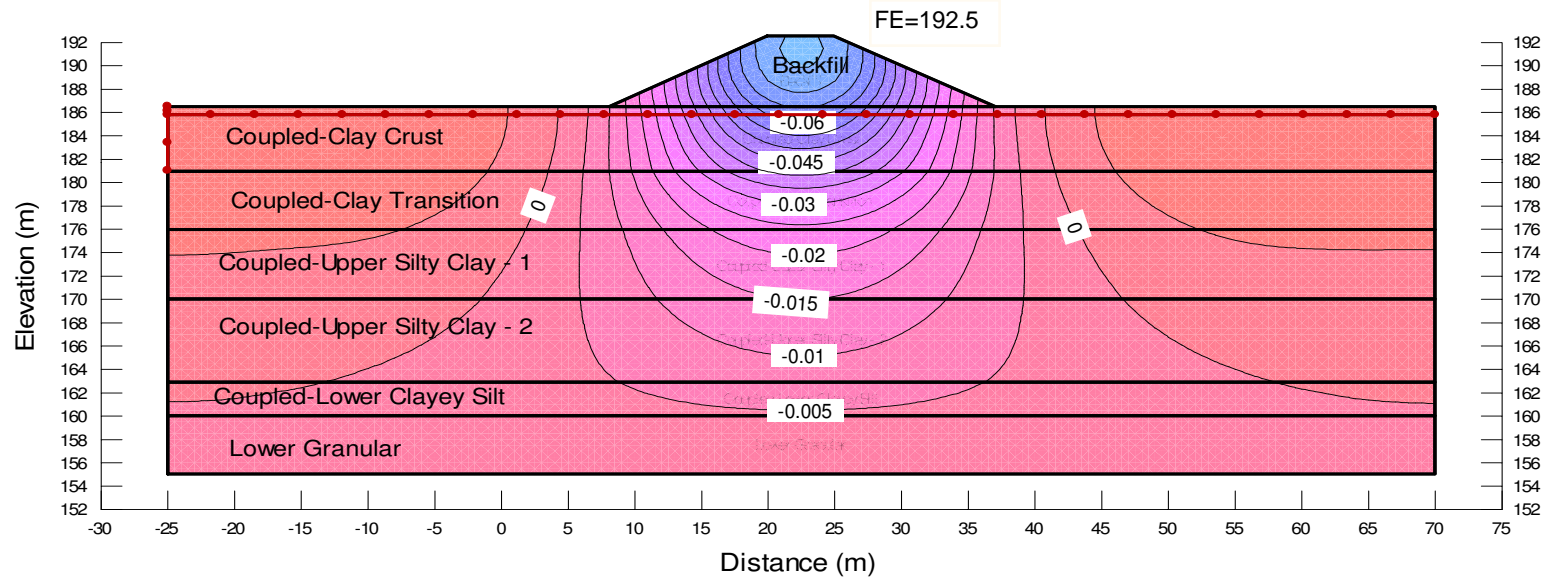
Positive X-Displacement means movement away from wall face.

TB-8 East Embankment -Stress Deformation.gsz

Name: Embankment - Coupled

Sta. 10+000 (Trails 47 & 54)

Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 21 kN/m³
Name: Coupled-Clay Crust Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 22 kN/m³
Name: Coupled-Clay Transition Effective Young's Modulus (E'): 17500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 22 kN/m³
Name: Coupled-Upper Silty Clay - 1 O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.063482 Kappa: 0.006983 Initial Void Ratio: 0.49 Unit Weight: 20.5 kN/m³
Name: Coupled-Lower Clayey Silt Effective Young's Modulus (E'): 27000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 20.5 kN/m³
Name: Lower Granular Effective Young's Modulus (E'): 40000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 22 kN/m³
Name: Coupled-Upper Silty Clay - 2 O.C. Ratio: 1.2 Poisson's Ratio: 0.35 Lambda: 0.089622 Kappa: 0.009858 Initial Void Ratio: 0.68 Unit Weight: 20.5 kN/m³



Legend:

End of Construction (Day 30 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.



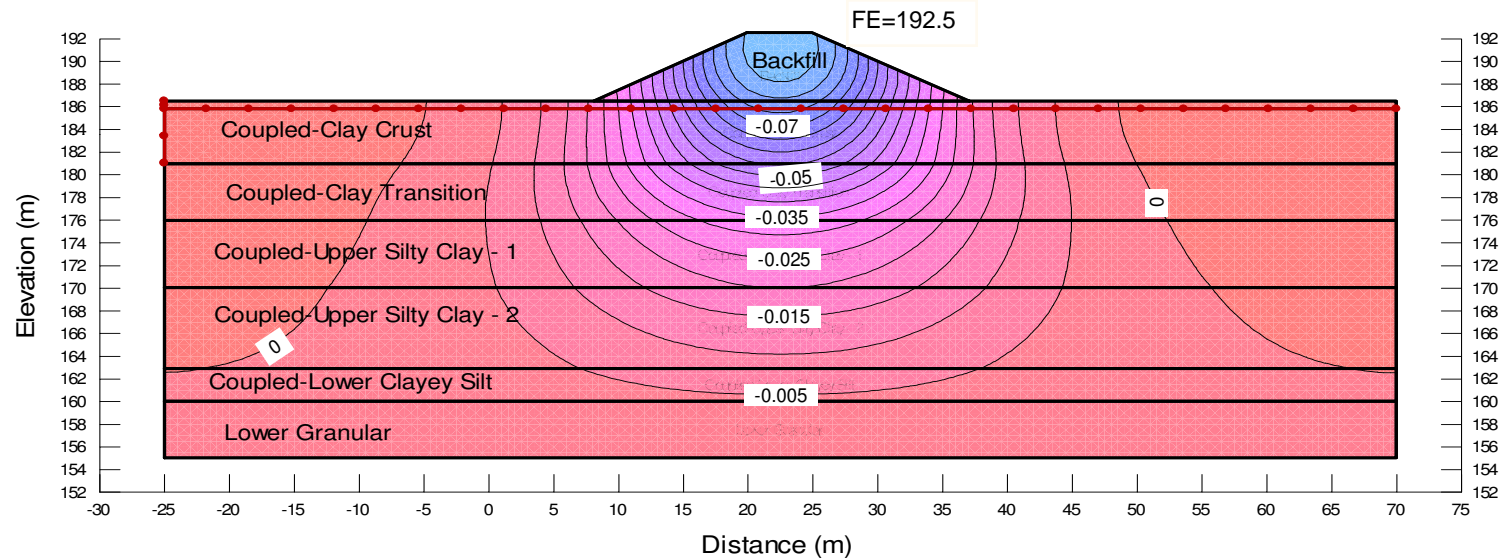
PROJECT:	WINDSOR ESSEX PARKWAY			
TITLE:	TB-8 NORTH EMBANKMENT AT END OF CONSTRUCTION CUMULATIVE SETTLEMENT CONTOURS			
DATE:	JUN 2013	JOB NO.:	CAD FILE:	FIGURE NO.: E.13
				REV.

TB-8 East Embankment -Stress Deformation.gsz

Name: Dissipatipn - Coupled

Sta. 10+000 (Trails 47 & 54)

Name: Backfill Young's Modulus (E): 22500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 21 kN/m³
Name: Coupled-Clay Crust Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 22 kN/m³
Name: Coupled-Clay Transition Effective Young's Modulus (E'): 17500 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 22 kN/m³
Name: Coupled-Upper Silty Clay - 1 O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 0.063482 Kappa: 0.006983 Initial Void Ratio: 0.49 Unit Weight: 20.5 kN/m³
Name: Coupled-Lower Clayey Silt Effective Young's Modulus (E'): 27000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 20.5 kN/m³
Name: Lower Granular Effective Young's Modulus (E'): 40000 kPa Poisson's Ratio: 0.35 Cohesion: 0 kPa Phi: 30 ° Unit Weight: 22 kN/m³
Name: Coupled-Upper Silty Clay - 2 O.C. Ratio: 1.2 Poisson's Ratio: 0.35 Lambda: 0.089622 Kappa: 0.009858 Initial Void Ratio: 0.68 Unit Weight: 20.5 kN/m³

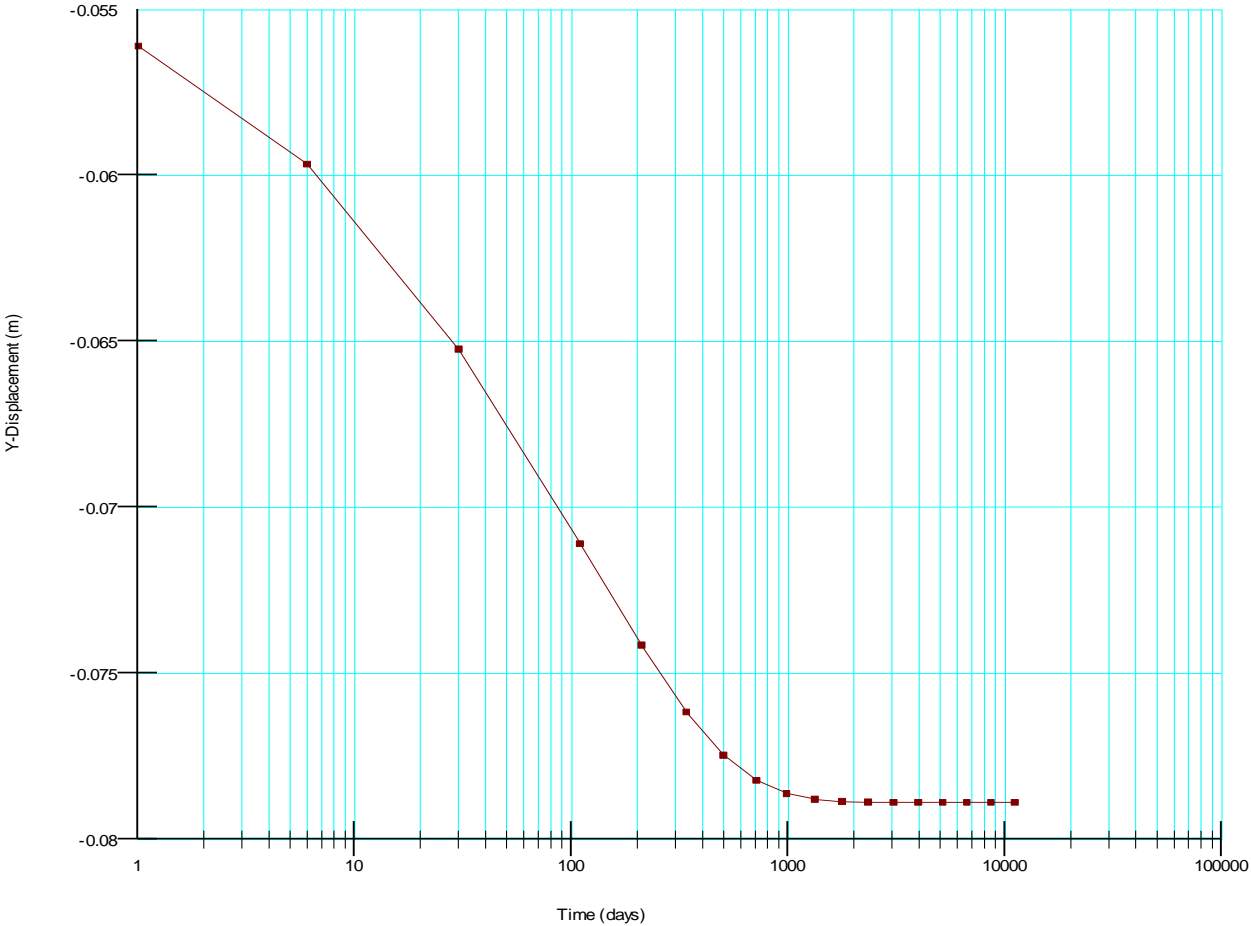


Legend:

LONG-TERM (Day 13030 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.

TB-8 East Embankment - Consolidation



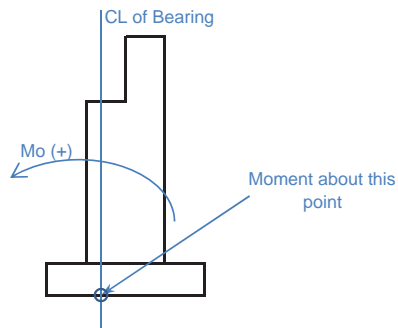
End of Construction (Day 30 in analysis)
LONG-TERM (Day 13030 in analysis)

Appendix F Trail Bridge Footing Design Forces-Moment Summary

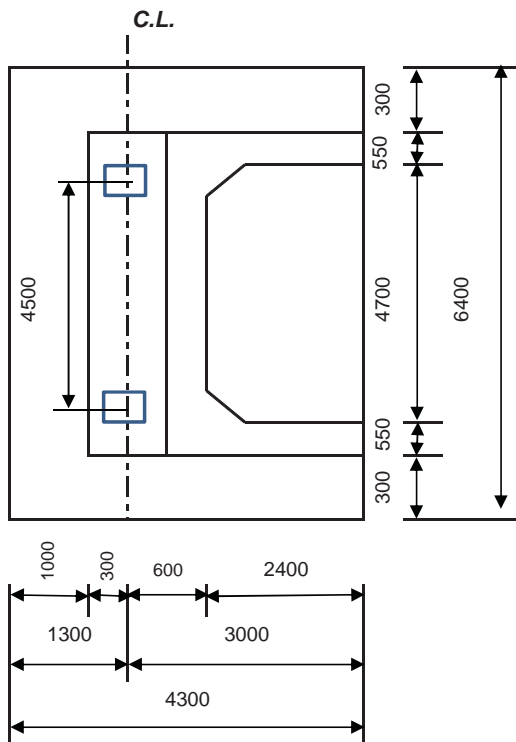
Spreadsheet Information:

This spreadsheet provides a summary of the different reactions on the soil due to the SLS and ULS loads on the bridge, as well as from the foundation itself. The locations of where the loads are acting through are shown on the diagram below. There are two general types of foundation layouts and three special layouts used.

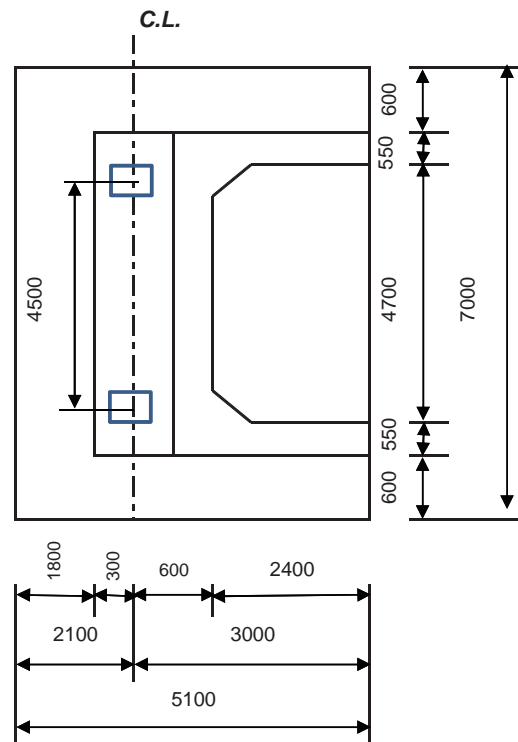
Forces Diagram:



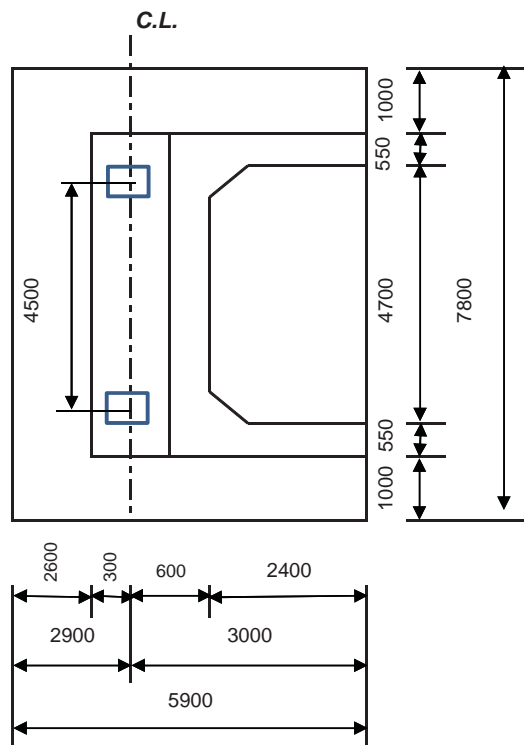
Layout 1: EPS and Soil Backfill



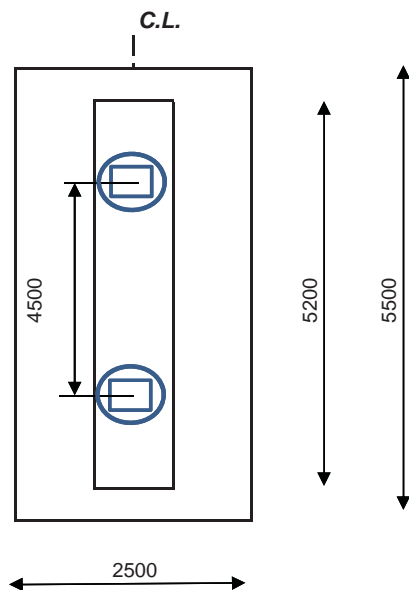
Layout 2: Soil Backfill



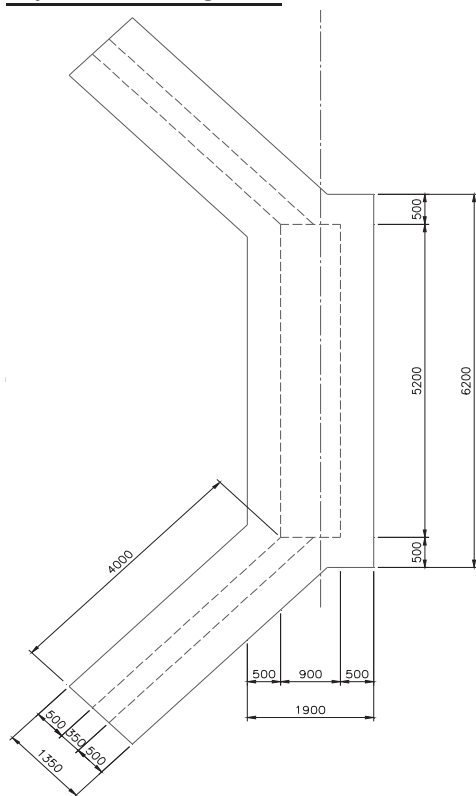
Layout 3: Trail Bridge 7 - spread footing



Layout 4: Trail Bridge 8 - Pier



Layout 5: Trail Bridge 7A





Trail Bridge 1 - West Abutment

Foundation Type: Layout 1

Footing bottom elevation: 181.0 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces		912	945	941	948	751
Vertical Forces		5150	5114	5044	4551	4041
Bending Moment	max	-1267	-1249	-1252	-1248	-1735
	min	-2351	-2368	-2366	-2370	-2162

Trail Bridge 2 - West Abutment

Foundation Type: Layout 1

Footing bottom elevation: 180.1 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces		1039	1072	1068	1075	852
Vertical Forces		5807	5772	5702	5209	4585
Bending Moment	max	-1011	-997	-999	-995	-1528
	min	-2177	-2192	-2190	-2193	-2161

Trail Bridge 4 - West Abutment

Foundation Type: Layout 2

Footing bottom elevation: 180.0 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces		1757	1791	1786	1794	1426
Vertical Forces		5798	5763	5692	5199	4572
Bending Moment	max	536	546	545	547	339
	min	-38	-49	-47	-50	26

Trail Bridge 5 - West Abutment

Foundation Type: Layout 1

Footing bottom elevation: 180.9 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces		524	558	553	561	441
Vertical Forces		5149	5114	5043	4550	4054
Bending Moment	max	-1248	-1232	-1234	-1231	-1746
	min	-2394	-2409	-2407	-2410	-2246

Trail Bridge 7 - West Abutment

Foundation Type: Layout 1

Option: Deep foundation

Footing bottom elevation: 181.0 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces						
Vertical Forces						
Bending Moment	max					
	min					

Trail Bridge 1 - East Abutment

Foundation Type: Layout 2

Footing bottom elevation: 180.0 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1	
Horizontal Forces		1956	1989	1985	1992	1585	kN
Vertical Forces		6009	5974	5904	5411	4745	kN
Bending Moment	max	1060	1071	1069	1072	731	kN.m
	min	290	280	281	279	399	kN.m

Trail Bridge 2 - East Abutment

Foundation Type: Layout 2

Footing bottom elevation: 181.0 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1	
Horizontal Forces		2490	2523	2519	2526	2012	kN
Vertical Forces		6531	6496	6425	5933	5169	kN
Bending Moment	max	2714	2724	2723	2725	1984	kN.m
	min	1331	1321	1322	1320	1596	kN.m

Trail Bridge 4 - East Abutment

Foundation Type: Layout 2

Footing bottom elevation: 179.2 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1	
Horizontal Forces		1573	1606	1602	1609	1279	kN
Vertical Forces		5590	5555	5485	4992	4403	kN
Bending Moment	max	98	108	107	109	13	kN.m
	min	-311	-322	-321	-323	-281	kN.m

Trail Bridge 5 - East Abutment

Foundation Type: Layout 1

Footing bottom elevation: 180.9 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1	
Horizontal Forces		513	546	542	549	432	kN
Vertical Forces		4997	4962	4892	4399	3929	kN
Bending Moment	max	-1285	-1269	-1271	-1268	-1767	kN.m
	min	-2400	-2416	-2414	-2418	-2219	kN.m

Trail Bridge 7 - West Abutment

Foundation Type: Layout 3

**Option: Spread footing* 4.0m of EPS assumed.*

Footing bottom elevation: 182.0 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1	
Horizontal Forces		881	930	924	935	737	kN
Vertical Forces		6990	6940	6839	6133	5489	kN
Bending Moment	max	-663	-650	-652	-649	-1204	kN.m
	min	-1848	-1860	-1859	-1861	-1786	kN.m

Trail Bridge 7 - East Abutment

Foundation Type: Layout 2

Footing bottom elevation: 183.4 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces		1807	1854	1848	1858	1476
Vertical Forces		6467	6417	6316	5611	5043
Bending Moment	max	661	677	675	678	433
	min	41	26	27	24	115

Trail Bridge 7A - West and East Abutment

Foundation Type: Layout 5

Footing bottom elevation: 183.1 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1	
Horizontal Forces		74	92	89	93	71	kN
Vertical Forces		1818	1797	1755	1464	1393	kN
Bending Moment	max	-856	-836	-839	-835	-845	kN.m
	min	-1227	-1246	-1244	-1248	-1013	kN.m

Trail Bridge 8 - West Abutment

Foundation Type: Layout 1

Deep foundation

Footing bottom elevation: 184.2 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces		308	358	351	362	280
Vertical Forces		5363	5313	5212	4507	4162
Bending Moment	max	-1162	-1138	-1141	-1136	-1586
	min	-2167	-2191	-2188	-2193	-2009

Trail Bridge 8 - East Abutment

Foundation Type: Layout 2

Footing bottom elevation: 185.8 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1	
Horizontal Forces		1767	1817	1811	1822	1446	kN
Vertical Forces		6486	6436	6335	5630	5064	kN
Bending Moment	max	561	577	575	578	358	kN.m
	min	-22	-38	-36	-40	44	kN.m

Trail Bridge 8 - Pier

Foundation Type: Pier Layout 4

Footing bottom elevation: 184.4 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1	
Horizontal Forces							kN
Vertical Forces							kN
Bending Moment	max						kN.m
	min						kN.m



Reactions from superstructure

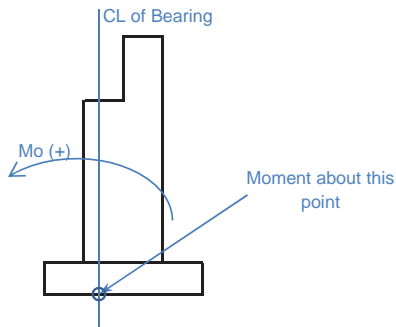
		Concrete slab	Asphalt	Steel	LL	Total	Forces per Abutment		Point of application of horizontal force above footing bottom [mm]
		[kN]	[kN]	[kN]	[kN]	[kN]	Vertical [kN]	Horiz. [kN]	
TB - 1	ULS 1	977	268	432	1197	2873	1437	0	North 5200
	ULS 2	977	268	432	1126	2803	1401	33	
	ULS 3	977	268	432	986	2662	1331	29	South 6200
	ULS 4	977	268	432	0	1676	838	36	
	SLS 1	814	179	392	634	2019	1009	23	
TB - 2	ULS 1	977	268	432	1197	2873	1437	0	West 7600
	ULS 2	977	268	432	1126	2803	1401	33	
	ULS 3	977	268	432	986	2662	1331	29	East 7200
	ULS 4	977	268	432	0	1676	838	36	
	SLS 1	814	179	392	634	2019	1009	23	
TB - 4	ULS 1	977	268	432	1197	2873	1437	0	West 5800
	ULS 2	977	268	432	1126	2803	1401	33	
	ULS 3	977	268	432	986	2662	1331	29	East 5800
	ULS 4	977	268	432	0	1676	838	36	
	SLS 1	814	179	392	634	2019	1009	23	
TB - 5	ULS 1	977	268	432	1197	2873	1437	0	West 7000
	ULS 2	977	268	432	1126	2803	1401	33	
	ULS 3	977	268	432	986	2662	1331	29	East 6400
	ULS 4	977	268	432	0	1676	838	36	
	SLS 1	814	179	392	634	2019	1009	23	
TB - 7	ULS 1	1465	402	648	1714	4228	2114	0	West 7900
	ULS 2	1465	402	648	1613	4127	2064	50	
	ULS 3	1465	402	648	1411	3926	1963	43	East 6850
	ULS 4	1465	402	648	0	2514	1257	54	
	SLS 1	1221	268	589	907	2985	1492	35	
TB - 7A	ULS 1	507	141	247	707	1603	801	0	West 2000
	ULS 2	507	141	247	666	1561	780	18	
	ULS 3	507	141	247	582	1478	739	15	East 2000
	ULS 4	507	141	247	0	895	448	19	
	SLS 1	422	94	225	374	1116	558	12	
TB - 8	ULS 1	1465	402	648	1714	4228	2114	0	West 8450
	ULS 2	1465	402	648	1613	4127	2064	50	
	ULS 3	1465	402	648	1411	3926	1963	43	East 6400
	ULS 4	1465	402	648	0	2514	1257	54	
	SLS 1	1221	268	589	907	2985	1492	35	

Trail Bridge 7 - East Abutment

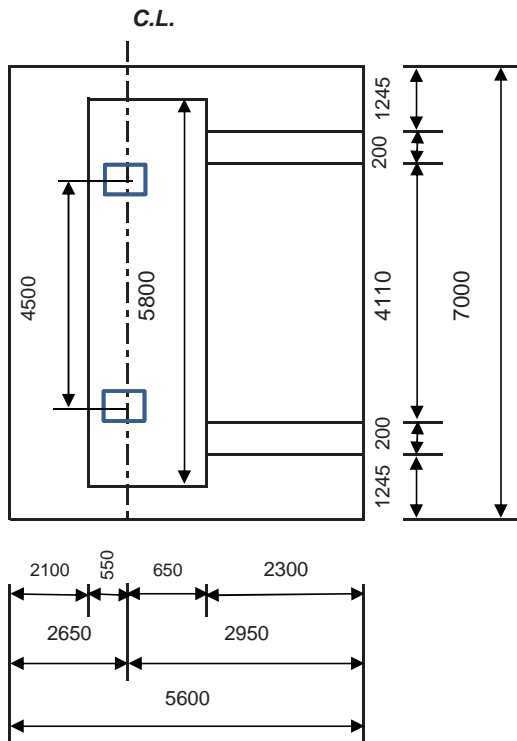
Spreadsheet Information:

This spreadsheet provides a summary of the different reactions on the soil due to the SLS and ULS loads on the bridge, as well as from the foundation itself. The locations of where the loads are acting through are shown on the diagram below.

Forces Diagram:



Geometry I



Forces

Foundation Type: Spread footing

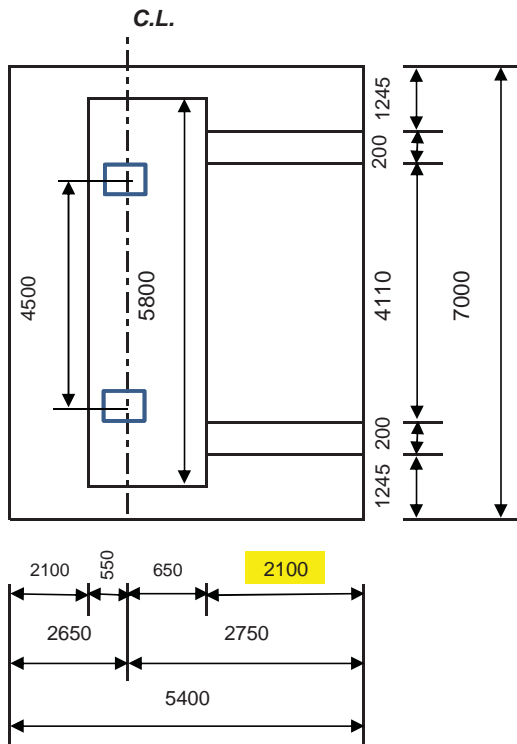
Regular backfill behind abutment

Footing bottom elevation: 183.4 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces		1599	1649	1643	1654	1312
Vertical Forces		6274	6224	6123	5418	4897
Bending Moment	max	1167	1457	1419	1482	1068
	min	613	324	362	299	618



Geometry II



Forces

Foundation Type: Spread footing, optimized

Regular backfill behind abutment

Footing bottom elevation: 183.4 m

		ULS 1	ULS 2	ULS 3	ULS 4	SLS 1
Horizontal Forces		1599	1649	1643	1654	1312
Vertical Forces		6071	6021	5920	5214	4733
Bending Moment	max	1657	1947	1909	1972	1486
	min	987	697	735	672	1018