

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

**Geocres Nos. 40J6-60, 40J6-61, 40J6-59, 40J6-62,
40J3-27, 40J3-29, 40J2-129, 40J3-30**

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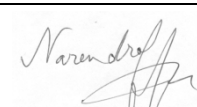

Hatch Mott MacDonald
2800 Speakman Drive
Mississauga, Ontario L5K 2R7
Canada
Tel: 905 855 2010
Fax: 905 855 2607

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	Name, Title	Signature	Date
Prepared By	Ashley Verge, M.A.Sc. Engineer-in-Training		07/15/2014
Reviewed By	Narendra S. Verma, Ph.D., P.Eng. Principal Geotechnical Engineer (Designated MTO RAQS Contact)		07/15/2014
Approved By	Brian Lapos, P.Eng. Geotechnical Engineer (Project Manager, AMEC)		07/15/2014

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List of Contents and Appendices Page

1	Introduction	1
1.1	Preface	1
1.2	Report Introduction	2
2	Background Information	4
2.1	Geological Setting	4
2.2	Site Seismic Background	5
2.3	Site Conditions	5
2.3.1	TB-1	5
2.3.2	TB-2	5
2.3.3	TB-4	5
2.3.4	TB-5	6
2.3.5	TB-7	6
2.3.6	TB-7A	6
2.3.7	TB-8	6
2.4	Frost depth	7
3	Geotechnical Investigation	8
3.1	Scope and Procedures of Geotechnical Investigations	8
3.2	Additional Investigation at the Bridge Sites	11
3.2.1	Fieldwork at Bridge Sites	11
3.2.2	Laboratory and Analytical Testing	11
3.2.3	Data Interpretation – General Discussion	11
4	Subsurface Conditions	14
4.1	TB-1	14
4.1.1	Topsoil, Surficial Fills and Upper Granular Soils	15
4.1.2	Silty Clay to Clayey Silt Stratum	15
4.1.3	Lower Granular Deposit	16
4.1.4	Bedrock	16
4.1.5	Groundwater Conditions	16
4.2	TB-2	18
4.2.1	Topsoil, Surficial Fills, and Upper Granular Soils	18
4.2.2	Silty Clay to Clayey Silt Stratum	18
4.2.3	Lower Granular Deposit	20
4.2.4	Bedrock	20
4.2.5	Groundwater Conditions	20
4.3	TB-4	21
4.3.1	Topsoil, Surficial Fills, and Upper Granular Soils	22
4.3.2	Silty Clay to Clayey Silt Stratum	22
4.3.3	Lower Granular Deposit	23
4.3.4	Bedrock	24

4.3.5	Groundwater Conditions	24
4.4	TB-5	25
4.4.1	Topsoil, Surficial Fills, and Upper Granular Soils	25
4.4.2	Silty Clay to Clayey Silt Stratum	26
4.4.3	Lower Granular Deposit	27
4.4.4	Bedrock	27
4.4.5	Groundwater Conditions	27
4.5	TB-7	28
4.5.1	Topsoil, Surficial Fills, and Upper Granular Soils	29
4.5.2	Silty Clay to Clayey Silt Stratum	29
4.5.3	Lower Granular Deposit	30
4.5.4	Bedrock	31
4.5.5	Groundwater Conditions	31
4.6	TB-7A	32
4.6.1	Topsoil, Surficial Fills, and Upper Granular Soils	32
4.6.2	Silty Clay to Clayey Silt Stratum	33
4.6.3	Lower Granular Deposit	34
4.6.4	Bedrock	34
4.6.5	Groundwater Conditions	34
4.7	TB-8	35
4.7.1	Topsoil, Surficial Fills, and Upper Granular Soils	35
4.7.2	Silty Clay to Clayey Silt Stratum	36
4.7.3	Lower Granular Deposit	37
4.7.4	Bedrock	37
4.7.5	Groundwater Conditions	38
4.8	Subsurface Gases.....	39
5	Development of Geotechnical Design	40
5.1	Geotechnical Design Criteria and Considerations.....	40
5.2	Design Soil Properties.....	40
5.3	Excavation and Temporary Cut Slopes	42
5.4	Shallow Foundations.....	42
5.4.1	General	42
5.4.2	Bearing and Sliding Resistance	43
5.4.3	Global Stability of Abutment Foundations.....	46
5.4.4	Stress-Deformation Analysis of Abutment Foundations.....	47
5.5	Pile Foundations.....	50
5.5.1	Resistance to Axial Loads	50
5.5.2	ULS and SLS Resistance to Lateral Loads.....	51
5.5.3	Soil-Pile Interaction Assessment.....	54
5.6	Retaining Walls and Embankments	56
5.6.1	General	56
5.6.2	Global Stability.....	57
5.6.3	Stress-Deformation Analysis of Embankments.....	57
5.6.4	RSS External Stability.....	60

5.6.5	Toe Walls	64
5.7	Backfilling.....	67
5.8	Flood Events.....	68
6	Other Geotechnical Recommendations.....	69
6.1	Construction Dewatering.....	69
6.2	General Construction Requirements	69
6.3	Corrosion Potential.....	70
6.4	Construction Quality Control	72
6.5	Instrumentation and Monitoring.....	72
7	Limitations of Report	73
8	Closure	75
9	References	76

List of Tables

Table 3-1: Test Holes at and around Trail Bridge Sites.....	8
Table 3-2: Test Holes around Toe Retaining Wall Sites.....	10
Table 4-1-1: TB-1 Summary of Index Properties	15
Table 4-1-2: TB-1 Summary of Compressibility Properties.....	16
Table 4-1-3: TB-1 Summary of Interpreted Elastic Moduli Properties	16
Table 4-1-4: TB-1 Summary of Measured Water Levels	17
Table 4-2-1: TB-2 Summary of Index Properties	19
Table 4-2-2: TB-2 Summary of Compressibility Properties.....	19
Table 4-2-3: TB-2 Summary of Interpreted Elastic Moduli Properties	20
Table 4-2-4: TB-2 Summary of Measured Water Levels	21
Table 4-3-1: TB-4 Summary of Index Properties	22
Table 4-3-2: TB-4 Summary of Compressibility Properties.....	23
Table 4-3-3: TB-4 Summary of Interpreted Elastic Moduli Properties	23
Table 4-3-4: TB-4 Summary of Measured Water Levels	24
Table 4-4-1: TB-5 Summary of Index Properties	26
Table 4-4-2: TB-5 Summary of Compressibility Properties.....	27
Table 4-4-3: TB-5 Summary of Interpreted Elastic Moduli Properties	27
Table 4-4-4: TB-5 Summary of Measured Water Levels	28
Table 4-5-1: TB-7 Summary of Index Properties	29
Table 4-5-2: TB-7 Summary of Compressibility Properties.....	30
Table 4-5-3: TB-7 Summary of Interpreted Elastic Moduli Properties	30
Table 4-5-4: TB-7 Summary of Measured Water Levels	31
Table 4-6-1: TB-7A Summary of Index Properties	33
Table 4-6-2: TB-7A Summary of Compressibility Properties.....	33
Table 4-6-3: TB-7A Summary of Interpreted Elastic Moduli Properties	34
Table 4-6-4: TB-7A Summary of Measured Water Levels	35
Table 4-7-1: TB-8 Summary of Index Properties	36
Table 4-7-2: TB-8 Summary of Compressibility Properties.....	37
Table 4-7-3: TB-8 Summary of Interpreted Elastic Moduli Properties	37
Table 4-7-4: TB-8 Summary of Measured Water Levels	38
Table 4-8: Pumping Test Data	39
Table 5-1: Summary of Interpreted Design Properties of Clay Strata	41
Table 5-2: Geotechnical Analysis for Trail Bridge Foundations	44
Table 5-3: General Geotechnical Comments and Recommendations for Trail Bridge Foundations.....	45
Table 5-4: Results of Global Stability Analyses	46
Table 5-5: Estimated Settlement of Bridge Abutments	49
Table 5-6: Soil Parameters for Pile Interaction Assessment within Native Clayey Silt Soils	52
Table 5-7: Fill Properties for Pile Interaction Assessment within Backfill	52
Table 5-8: Lateral Load Capacity Reduction Factors for Pile Groups using the Horizontal Subgrade Reaction Method (ref. R-7)	53
Table 5-9: Lateral Load Capacity Reduction Factor For Pile Groups using Nonlinear “p-y” Curve Method.....	54
Table 5-10: Assumed Proprietary Product Properties.....	56
Table 5-11: Assumed Backfill Material Properties.....	56
Table 5-12: Results of Stability and Stress Deformation Analyses	58
Table 5-13: Results of RSS External Stability Analyses	62
Table 5-14: Summary of Phase 1 Toe Retaining Walls Configuration.....	64
Table 5-15: Static Soil Parameters for Retaining Walls Design	64

Table 5-16: Assumed Backfill Material Properties.....	64
Table 5-17: Geotechnical Analysis for Toe Retaining Walls Foundations.....	66
Table 5-18: Soil Parameters for Earth Pressure Calculations	68
Table 6-1: Results of Analytical Testing on Soils	70

Drawings

285380-03-060-WIP2-6101	Hwy 401 Trail Bridge over Labelle St-Bethlehem Ave. TB-1 General Arrangement
285380-03-060-WIP2-6201	Hwy 401 Trail Bridge over Grand Marais-Lambton Rd. TB-2 General Arrangement
285380-03-060- WIP1-6401	Hwy 401 Trail Bridge over Cabana Rd.-Todd Ln. TB-4 General Arrangement
285380-03-060- WIP1-6501	Hwy 401 Trail Bridge over Huron Church Ln. TB-5 General Arrangement
285380-03-060-WIP1-6701	Hwy 401 Trail Bridge over Cousineau Rd. TB-7 General Arrangement
285380-03-060-WIP1-6751	Hwy 401 Trail Bridge over Wolfe Drain TB-7A General Arrangement
285380-03-060-WIP1-6801	Hwy 401 Trail Bridge over Hwy 3 (SR4) TB-8 General Arrangement
285380-03-061-WIP1-8701	Trail 31 – Sta 11+310 to 11+325 Toe Retaining Wall “A” General Arrangement
285380-03-061-WIP1-8703	Trail 31 – Sta 11+405 to 11+415 Toe Retaining Wall “B” General Arrangement
285380-03-061-WIP1-8705	Trail 41 – Sta 10+430 to 10+455 Toe Retaining Wall “C” General Arrangement
285380-03-061-WIP1-8707	Trail 44 – Sta 10+370 to 10+420 Toe Retaining Wall “D” General Arrangement
285380-03-061-WIP1-6819	Hwy 401 Trail Bridge over Hwy 3 (SR4) TB-8 Chelsea Dr. RSS Wall – Plan and Profile
285380-04-090-WIP2-6103	Hwy 401 Trail Bridge over Labelle St.-Bethlehem Ave. TB-1 Borehole Locations & Soil Strata
285380-04-091-WIP2-6104	Hwy 401 Trail Bridge over Labelle St.-Bethlehem Ave. TB-1 Soil Stratigraphy
285380-04-090-WIP2-6203	Hwy 401 Trail Bridge over Grand Marais-Lambton Rd. TB-2 Borehole Locations & Soil Strata
285380-04-091-WIP2-6204	Hwy 401 Trail Bridge over Grand Marais-Lambton Rd. TB-2 Soil Stratigraphy
285380-04-090-WIP1-6403	Hwy 401 Trail Bridge over Cabana Rd.-Todd Ln. TB-4 Borehole Locations & Soil Strata
285380-04-091-WIP1-6404	Hwy 401 Trail Bridge over Cabana Rd.-Todd Ln. TB-4 Soil Stratigraphy
285380-04-090-WIP1-6503	Hwy 401 Trail Bridge over Huron Church Ln. TB-5 Borehole Locations & Soil Strata
285380-04-091-WIP1-6504	Hwy 401 Trail Bridge over Huron Church Ln. TB-5 Soil Stratigraphy
285380-04-090-WIP1-6703	Hwy 401 Trail Bridge over Cousineau Rd. TB-7 Borehole Locations & Soil Strata

285380-04-091-WIP1-6704	Hwy 401 Trail Bridge over Cousineau Rd. TB-7 Soil Stratigraphy
285380-04-090-WIP1-6753	Hwy 401 Trail Bridge over Wolfe Drain TB-7A Borehole Locations & Soil Strata
285380-04-091-WIP1-6754	Hwy 401 Trail Bridge over Wolfe Drain TB-7A Soil Stratigraphy
285380-04-090-WIP1-6803	Hwy 401 Trail Bridge over Hwy 3 (SR4) TB-8 Borehole Locations & Soil Strata
285380-04-091-WIP1-6804	Hwy 401 Trail Bridge over Hwy 3 (SR4) TB-8 Soil Stratigraphy
285380-04-090-WIP1-0151	Trail 31 – Sta 11+310 to 11+325 Toe Retaining Wall “A” Borehole Locations & Soil Strata
285380-04-090-WIP1-0152	Trail 31 – Sta 11+405 to 11+415 Toe Retaining Wall “B” Borehole Locations & Soil Strata
285380-04-090-WIP1-0153	Trail 41 – Sta 10+430 to 10+455 Toe Retaining Wall “C” Borehole Locations & Soil Strata
285380-04-090-WIP1-0154	Trail 44 – Sta 10+370 to 10+420 Toe Retaining Wall “D” Borehole Locations & Soil Strata

List of Figures

- Figure 3.1: Field Vane Correction Factor vs. Plasticity Index Derived from Embankment Failures (Figure 5.1, Ladd & DeGroot, 2004, ref. R-20)
- 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-20)
- Figure 3.3a: Soil Property Profiles at and around Trail Bridge TB-1
- Figure 3.3b: Soil Property Profiles at and around Trail Bridge TB-2
- Figure 3.3c: Soil Property Profiles at and around Trail Bridge TB-4
- Figure 3.3d: Soil Property Profiles at and around Trail Bridge TB-5
- Figure 3.3e: Soil Property Profiles at and around Trail Bridge TB-7
- Figure 3.3f: Soil Property Profiles at and around Trail Bridge TB-7A
- Figure 3.3g: Soil Property Profiles at and around Trail Bridge TB-8
- Figure 4-1: Compressibility Parameters at Parkway
- Figure 4-2: Cc versus C α 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, ref. R-2)

List of Appendices

- Appendix A: Borehole, CPT, DMT and Nilcon Logs from Additional Geotechnical Investigation
- Appendix B: Borehole and CPT Logs from Previous Investigations
- Appendix C: Analytical Laboratory Results
- Appendix D: Slope Stability Analyses
- Appendix E: Stress-Deformation Analyses of Embankments
- Appendix F: Trail Bridge Footing Design Forces-Moment Summary

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 colour, 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 Trail 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, retaining walls along the different sections of the trails, approachway embankments to trail bridges, as well as toe retaining walls A, B, C and D. Trail Bridges TB-6, TB-8B and TB-9 were each addressed in separate reports and are not included here. Trail Bridge TB-3 was deleted from the project prior to tender. The design updates for the aforementioned bridges presented in this Rev-0 report correspond to the latest design and loading configurations provided by HMM.

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), 10 trail bridges, approximately 5.5 km length of retaining walls, 2 submerged culverts, 5 box culverts, and other structures.

The trail bridges and associated retaining walls 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 one-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 trail bridge will pass over Highway 3 and Cahill and Wolfe Drains.
- Toe Retaining Wall “A” (Drawing 285380-03-061-WIP1-8701): The proposed toe retaining wall will be built on Trail 31 from Stations 11+310 to 11+325.
- Toe Retaining Wall “B” (Drawing 285380-03-061-WIP1-8703): The proposed toe retaining wall will be built on Trail 31 from Stations 11+405 to 11+415.
- Toe Retaining Wall “C” (Drawing 285380-03-061-WIP1-8705): The proposed toe retaining wall will be built on Trail 41 from Stations 10+430 to 10+455.
- Toe Retaining Wall “D” (Drawing 285380-03-061-WIP1-8707): The proposed toe retaining wall will be built on Trail 44 from Stations 10+370 to 10+420.
- Chelsea Dr. reinforced soil structure (RSS) Wall (Drawing 285380-03-061-WIP1-6819): The proposed Chelsea Dr. retaining wall will be built on Trails 53 and 54 from Stations 10+196 to 10+584.

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).

Sections 1 to 4 of this report present the factual information. Sections 5 and 6 present the geotechnical design and recommendations. Sections 7 to 9 provide closing information.

The design complies with the applicable 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 overconsolidated, 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 a 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 m 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

The Windsor-Tecumseh area is described in the Canadian Highway Bridge Design Code (CHBDC, ref. R-5) 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 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

Trail Bridge TB-1 is situated in the Windsor segment of the Parkway, just southwest of Tunnel T-2. The structures at this site are located within Phase 2 of Parkway. As shown on Drawing 285380-03-060-WIP2-6101, the bridge is 40 m in length and the approach embankments are a maximum of 6.0 m in height above the surrounding grade, with 2H:1V side slopes. The wing walls of the trail bridge will be constructed using RSS.

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

2.3.2 TB-2

Trail Bridge TB-2 is situated in the Windsor sector of the Parkway, just south of Tunnel T-3. The structures at this site are located within Phase 2 of Parkway. As shown on Drawing 285380-03-060-WIP2-6201, the bridge is 40 m in length and the approach embankments are a maximum of 7.2 m in height above the surrounding grade, with 2H:1V side slopes. The wing walls of the trail bridge will be constructed using RSS.

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

2.3.3 TB-4

Trail Bridge TB-4 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 1 of Parkway. As shown on Drawing 285380-03-060-WIP1-6401, the bridge is 40 m in length and the approach embankments are a maximum of 5.7 m in height above the surrounding grade, with 3H:1V side slopes. The wing walls of the trail bridge will be constructed using RSS.

¹ All elevations are in metres and are referred to geodetic datum.

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

2.3.4 TB-5

Trail Bridge TB-5 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 1 of Parkway. As shown on Drawing 285380-03-060-WIP1-6501, the bridge is 40 m in length and the approach embankments are a maximum of 8.0 m in height above the surrounding grade, with 2H:1V side slopes. The wing walls of the trail bridge will be constructed using RSS.

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

2.3.5 TB-7

Trail Bridge TB-7 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 1 of Parkway. As shown on Drawing 285380-03-060-WIP1-6701, the bridge is 60 m in length and the approach embankments are a maximum of 6.6 m in height above the surrounding grade, with 2H:1V side slopes. The wing walls of the trail bridge will be constructed using RSS.

The topography of the lands immediately adjacent to Trail Bridge TB-7 is essentially flat with ground surface elevations from about elevation 183.4 to 184.9. 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

Trail Bridge TB-7A 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 1 of Parkway. As shown on 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 Trail Bridge TB-7A is essentially flat with ground surface elevations from about elevation 184.2 to 185.4. Adjacent land use is typically urban residential, parkland and light commercial.

2.3.7 TB-8

Trail Bridge TB-8 is situated near the border of the LaSalle and Tecumseh segments of the Parkway (i.e., the east segment of the Parkway). The structures at this site are located within Phase 1 of Parkway and will be used to carry pedestrian traffic over Highway 3 and Cahill and Wolfe Drains. As shown on Drawing 285380-03-060-WIP1-6801, the bridge is 60 m in length. The approach embankments are a maximum of 8.5 m in height above the surrounding grade, with 2H:1V and 5H:1V side slopes. The wing walls of the trail bridge will be constructed using RSS.

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

2.4 Frost depth

In accordance with MTO-SDO-90-01 Pavement Design and Rehabilitation Manual (ref. R-25) and OPSD 3090.101 (ref. R-37), the frost depth below the ground surface in the 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 cleared of the snow cover.

In the case of riprap, 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. An 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 and retaining structures). Table 3-1 lists the test holes located at or in close proximity to the trail bridge sites during both the previous and current geotechnical investigations.

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

Bridge	Reference	Boreholes	Nilcon Vane Tests	CPTs	DMTs
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 (2006-2009)	BH-145/145A	NIL-145	BH/CPT-144	
		BH-334		BH/CPT-145	
TB-2	This Investigation (2011)			BH/CPT-335	
		TB2-1	NIL T3-1	BH/CPT T3-1	BH/DMT T3-1
		TB2-2	BH/NIL T3-2	BH/CPT23-RW	BH/DMT04-RW
		T3-1		BH/CPT24-RW	
		BH10-RW		BH/CPT25-RW	
		BH11-RW			
TB-4	This Investigation (2011)	BH-139/139A		BH/CPT-333	
		BH-140/140A			
		TB4-1	NIL T6-2	BH/CPT35-RW	DMT T6-1
		TB4-2	NIL T6-3	BH/CPT36-RW	
		T6-1/HGMW-07	NIL12-RW	BH/CPT37-RW	
		T6-2			
TB-5	This Investigation (2011)	T6-3			
		BH12-RW			
		BH-129/129A		CPT-11	
		BH-323		BH/CPT-130	
		BH-325		BH/CPT-324	
	Previous Studies	BH-122/122A		BH/CPT-124	

Bridge	Reference	Boreholes	Nilcon Vane Tests	CPTs	DMTs
	(2006-2009)	BH-126		BH/CPT-322	
		BH-127		CPT-10	
TB-7	This Investigation (2011)	TB7-1	NIL T9-1	CPT45-RW	BH/DMT T9-1
		TB7-2	BH/NIL T9-2	CPT46-RW	
		TB7-3			
		TB7-4			
		T9-1			
		CV3-1			
		BH15-RW			
	Previous Studies (2006-2009)	BH-115/115A		BH/CPT-114	
		BH-116/116A		CPT-6	
TB-7A	This Investigation (2011)	TB7A-1		BH/CPT T10-1	DMT T10-1
		T10-1/HGMW-04		BH/CPT T10-2	
		T10-2/HGMW-09		BH/CPT47-RW	
	Previous Studies (2006-2009)	BH-112/112A		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			
		T11-2/2A			
		T11-3/3A			
	Previous Studies (2006-2009)	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 trail bridge are shown on the drawings listed below.

- TB-1: Drawings 285380-04-090-WIP2-6103 and 285380-04-091-WIP2-6104
- TB-2: Drawings 285380-04-090-WIP2-6203 and 285380-04-091-WIP2-6204
- TB-4: Drawings 285380-04-090-WIP1-6403 and 285380-04-091-WIP1-6404
- TB-5: Drawings 285380-04-090-WIP1-6503 and 285380-04-091-WIP1-6504
- TB-7: Drawings 285380-04-090-WIP1-6703 and 285380-04-091-WIP1-6704
- TB-7A: Drawings 285380-04-090-WIP1-6753 and 285380-04-091-WIP1-6754
- TB-8: Drawings 285380-04-090-WIP1-6803 and 285380-04-091-WIP1-6804

Table 3-2 lists the test holes located in close proximity to the toe retaining wall sites during both the previous and the additional geotechnical investigations.

Table 3-2: Test Holes around Toe Retaining Wall Sites

Wall	Reference	Boreholes	Nilcon Vane Tests	CPTs	DMTs
Toe Retaining Wall “A”	This Investigation (2011)	TB6-1			
		BH/CPT43-RW		CPT43-RW	
		HGMW-2			
		BH/CPT T8-1		CPT8-1	
	Previous Investigations (2006-2009)	BH-118			
		BH-119	BH-119	CPT-8	
BH/CPT-121			CPT-121		
Toe Retaining Wall “B”	This Investigation (2011)	TB6-1			
		BH/CPT43-RW			
		BH/CPT T8-1		CPT T8-1	
		CV4-1			
	Previous Investigations (2006-2009)	BH-118			
		BH-7		CPT-7	
Toe Retaining Wall “C”	This Investigation (2011)	BH/CPT45-RW		CPT-45-RW	
		T9-1	NILT9-1		
		TB7-1			
		TB7-2			
		TB7-3			
		CV3-1			
	Previous Investigations (2006-2009)	BH-116			
		BH/CPT-117		CPT-117	
		BH/CPT-313		CPT-313	
				CPT-6	
		CPT-7			
Toe Retaining Wall “D”	This Investigation (2011)	TB7A-1			
		T10-1			
		BH/CPT T10-1		CPT T10-1	
		BH/CPT T10-2		CPT T10-2	
		BH/DMT T10-1			DMT T10-1
		BH/CPT47-RW		CPT47-RW	
	Previous Investigations (2006-2009)	BH-112			
		BH-113			
		BH/CPT-114		CPT-114	
			CPT-5		

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 toe retaining wall are shown on the drawings listed below:

- Toe Retaining Wall "A": Drawing 285380-04-090-WIP1-0151
- Toe Retaining Wall "B": Drawing 285380-04-090-WIP1-0152
- Toe Retaining Wall "C": Drawing 285380-04-090-WIP1-0153
- Toe Retaining Wall "D": Drawing 285380-04-090-WIP1-0154

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

3.2.1 Fieldwork at Bridge Sites

Boreholes listed in Table 5-2 at Trail Bridge TB-1 were drilled on June 11, 2011 for this study. Boreholes at the other trail bridges were drilled between July 5, 2011 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, ref. R-27) 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 3.1² initially developed by Bjerrum (1972, ref. R-3) 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-22 to R-24). However, based on re-evaluation of the Bjerrum chart by Aas et al. (1986, ref. R-1), the Canadian Foundation Engineering Manual (CFEM, ref. R-4) suggests that the vane test data for clays with PI < 20 should not be corrected. 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.

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

Where:

- $S_{u\text{CPT}}$ 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 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.

Preconsolidation Pressures from Cone Penetration Tests: The approach used for estimating the preconsolidation pressures from the estimated S_u profiles follows the Stress History and Normalized Soil Engineering Properties (SHANSEP) method developed at MIT (ref. R-21). The following relationship was used to compute the preconsolidation 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 to 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 the 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:

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

Flat Blade Dilatometer (DMT) Test Data:

DMT tests along Parkway were conducted following ASTM D6635 (ref. R-28). The soil properties from the results of these tests were developed in general accordance with the guidelines in ref. R-18. 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); and

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

The undrained shear strength (S_u), preconsolidation pressure (σ'_p), natural water content (w_N) and compression index (C_c) profiles based on field and laboratory testing from boreholes, CPTs and DMTs carried out in the vicinity of each trail bridge are presented on Figures 3.3a through 3.3g. Also included on the figures are the $0.18 \sigma'_{vo}$ 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 the OCR=1 curve is based on average plasticity of the silty clay to clayey silt stratum and published relationships (ref. 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 deposit. A second discontinuous lower granular deposit (0 m up to 5 m thick) below the clayey silt deposit overlies limestone and dolostone bedrock below about elevation 149. The bedrock was encountered at depths approximately 32 m 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 basis 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, R-21, and 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 index is 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 σ' relationships (ref. R-19 and R-22 and Figures 4.3 and 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. The thickness of the clayey silt to sandy/silty clay deposit, based on the available

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

4.1.1 Topsoil, 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 m 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 m 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 m 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 m to 1.7 m corresponding to elevation 180.0 to 181.1. 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 substrata 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	-	-	19 to 23.5	21.1 to 22.5

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

2 – Ground surface elevation and base of the lower clayey silt vary 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:

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

- Upper Silty Clay: 70±10 kPa to 50±10 kPa, and 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 Trail 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

Soil 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 m 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 fine grained limestone bedrock was light grey and fairly porous. The rock quality designation (RQD) of the recovered rock cores ranged from 23% to 97%, 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 until backfilling. This is consistent with the general low permeability overburden soils at this site.

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

The piezometric levels measured in the clayey silt overburden varied from 179.7 m to 180.9 m and those in the limestone bedrock were around 177.3 to 180.9 m. 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 in the overburden and the bedrock are essentially equal. Furthermore, the highest recorded piezometric levels are within 1 m of the ground surface; therefore the 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

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
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. The thickness of the clayey silt to sandy/silty clay deposit, based on nearby boreholes, is about 29.1 m to 31.2 m. The bedrock was encountered at depths of approximately 33.1 m 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 m to 0.6 m at these locations. The topsoil is expected to vary in quality and thickness throughout 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 limestone, concrete, and asphalt. The fill thickness was about 0.3 m 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 m to 3.0 m corresponding to elevation 180.5 to 179.2. 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 substrata 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	-	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 BH/DMT04-RW.

2 – Ground surface elevation and base of the lower clayey silt vary 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 Crust: $> 100 \pm 25$ kPa
- Clay Transition: 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 Trail 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 to 25	17 to 23
Virgin Compression Index, C_c	0.163	0.189	0.163 to 0.206	0.138 to 0.189
Recompression Index, C_r	0.0180	0.0205	0.0179 to 0.0227	0.0151 to 0.0208
Swelling Index, C_s	0.0409	0.0472	0.0407 to 0.0515	0.0342 to 0.0472
Secondary Compression Index, C_α	0.00458	0.00529	0.00456 to 0.00577	0.00384 to 0.00529

A direct shear test was carried out on a 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

Soil 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 m 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, 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% and 100%, indicating poor to excellent quality. The RQD values generally increased with depth. Rock core samples from Borehole BH-139 were tested and had unconfined compressive strength 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 m 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 piezometers were installed in selected boreholes to measure the water levels within overburden and standpipe piezometers were installed to measure water levels in bedrock (Table 4-2-4).

The piezometric levels measured in the clayey silt overburden varied from 173.5 m to 181.9 m and water levels in the limestone bedrock were around 177.1 to 178.6. 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, the occurrence of artesian conditions 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 2008-09-22 2008-11-11 2009-01-28	178.6 178.6 177.6 177.6
BH-139A	182.3	VWP	173.4	Silty Clay	2008-09-19 2008-09-22 2009-01-28	177.9 178.6 180.3
BH-140	182.0	S-Piez	150.8 to 149.5	Lower Granular	2008-09-19 2008-09-22 2008-11-11 2009-01-28	179.5 179.5 178.2 178.6
BH-140A	182.0	VWP	172.9	Silty Clay	2008-09-19 2008-09-22 2009-01-28	178.0 178.1 180.3
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. The thickness of the clayey silt to sandy/silty clay deposit, based on nearby boreholes, is about 28.3 m to 30.4 m. The bedrock was encountered at depths of approximately 32.3 m 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 m to 1.4 m at these locations. The topsoil is expected to vary in quality and thickness throughout 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 limestone, concrete, and asphalt. The fill thickness was about 0.2 m 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 m to 3.0 m corresponding to elevations 180.6 to 177.9. 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 substrata 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 Silty Clay	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/HGMW-07, T6-2, T6-3, BH/CPT35-RW, BH/CPT36-RW, BH/CPT37-RW, NIL12-RW, DMT T6-1, BH-129, and BH-325.

2 – Ground surface elevation and base of the lower clayey silt vary 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: $> 80 \pm 20$ kPa
- Clay Transition: 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 Trail 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 a grey clayey silt sample obtained from Borehole T6-1 at a depth of 12.5 m below ground surface with $w_N = 20.3\%$ indicated $C_c = 0.151$ 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 a 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

Soil 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 m 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% and 100% indicating 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 strength of 79.6 MPa. The results of 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 until backfilling. This is consistent with the general low permeability overburden soils at this site.

To measure water levels in overburden, shallow and deep vibrating wire piezometers were installed in selected boreholes. Standpipe piezometers were installed to measure water levels in bedrock (Table 4-3-4).

The piezometric levels measured in the clayey silt overburden varied from 178.8 to 182.2 and water levels in the limestone bedrock varied from around 177.5 m to 179.4 m. The highest piezometric levels within the overburden and 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

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water level	
					Date	El, m
		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. The thickness of the clayey silt to sandy/silty clay deposit, based on nearby boreholes, is about 21.8 m to 29.6 m. The bedrock was encountered at depths approximately 32.0 m 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 m to 0.76 m at these locations. The topsoil is expected to vary in quality and thickness throughout 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 limestone, concrete and asphalt. The fill thickness was about 0.5 m 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 m to 2.1 m corresponding to elevations 179.1 to 181.5. 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 substrata 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 ²
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	-	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, BH/CPT T7-1, BH/CPT T7-2, DMT T7-1, BH-122, BH-126, BH-127, BH/CPT-124, and BH/CPT-322.

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

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

- Clay Crust: > 100 kPa
- Clay Transition: 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 Trail Bridge TB-5 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 to 23	18
Virgin Compression Index, C_c	0.163	0.163	0.120 to 0.189	0.146
Recompression Index, C_r	0.0180	0.0180	0.0132 to 0.0208	0.0161

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

Soil 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 m 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, 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% indicating excellent quality. Rock core samples from Boreholes BH-122, BH-127, and T7-1 were tested and had unconfined compressive strengths of 14 MPa 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 to TB5-4 were dry during the relatively short period until backfilling. This is consistent with the general low permeability overburden soils at this site.

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

The piezometric levels measured in the clayey silt overburden varied from 179.5 m to 181.0 m and the water levels in the limestone bedrock varied from 177.2 m to 178.3 m. These observations suggest a slight downward gradient from the overburden to 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 the occurrence of artesian conditions 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 2011-08-06	180.4 180.5
		VWP	161.7	Silty Clay	2011-07-24 2011-08-06	180.4 180.4
T7-2	180.8	VWP	169.5	Silty Clay	2011-07-24 2011-08-06	179.5 179.7
		VWP	162.6	Silty Clay	2011-07-24 2011-08-06	180.3 181.0
T7-3	181.7	Borehole	n/a	Limestone	2011-07-10	181.3 ^(*)
CPT-124	181.5	Borehole	n/a	Silty Clay	2008-09-11	180.5 ^(*)
BH-122	181.7	S-Piez	143.8	Limestone	2008-07-22	178.0
					2008-08-11	178.3
					2008-09-19	178.3
					2008-11-11	177.5
					2009-01-28	177.2
BH-122A	181.7	S-Piez	172.5	Silty Clay	2008-08-11	179.8
					2008-09-19	179.5
					2009-01-28	180.2
BH-127	181.3	S-Piez	145.1	Limestone	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. The thickness of the clayey silt to sandy/silty clay deposit based on the available nearby boreholes is about 27.2 m to 31.7 m. The bedrock was encountered at depths approximately 32.0 m 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 m to 0.5 m at these locations. The topsoil is expected to vary in quality and thickness throughout 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 m 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 m to 1.5 m corresponding to elevations 182.6 to 184.6. 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 substrata 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 to 22.9	10.0 to 18.0	11.3 to 37.5	14.3 to 34	9.9 to 26.0
Liquid Limit, w_L , %	22.6 to 25.9	23.0 to 25.0	24.5 ³ to 36.6	23.2	27.4 to 33.2
Plastic Limit, w_P , %	13.4 to 15.0	13.0	12.0 ³ to 19.4	14.0	15.4 to 17.2
Plasticity Index, PI	9.2 to 10.9	10.0 to 12.0	11.1 ³ to 17.2	9.2	12.0 to 16.0
Liquidity Index, LI	(-) 0.34 to 0.01	0.20 to 0.23	0.28 to 1.05	0.03	(-) 0.04 to 0.44
Unit Weight, γ , kN/m ³	-	21.6	21.0 to 21.5	-	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, BH/NIL T9-2, BH-115, BH-116, and BH/DMT T9-1.

2 – Ground surface elevation and base of the lower clayey silt vary 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:

- Clay Crust: > 100 kPa
- Clay Transition: 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 Trail 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 $C_c = 0.116$ and $C_r = 0.036$.

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

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

Soil 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 compact. This layer was approximately 0 m 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 elevations 151.5 to 151.7. Where rock coring was undertaken, 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% and 100%, 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 MPa and 63.3 MPa. Unconfined compressive strengths of two rock cores taken from Borehole BH-115 at a depth of 37.5 m and Borehole BH-116 at a depth of 33.0 m were 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 to TB7-4 were dry during the relatively short period until backfilling. This is consistent with the general low permeability overburden soils at this site.

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

The piezometric levels measured in the clayey silt overburden varied from 182.2 to 184.0 and those in the limestone bedrock varied from around 176.0 m to 178.1 m. The highest piezometric levels within the overburden and bedrock were recorded at about elevations 184.0 and 178.1, respectively (Table 4-5-4). These observations suggest a slight downward gradient from the overburden to the bedrock. Nevertheless, given the general information along the project area, the occurrence of artesian conditions in the 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

Borehole	Ground Surface El, m	Piezometer Type	Screen El, m	Strata Type at Screen Depth	Measured Water Level	
					Date	El, m
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
BH-116A	183.6	VWP	174.6	Silty Clay	2009-01-28	177.5
					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. The thickness of the clayey silt to sandy/silty clay deposit, based on nearby boreholes, is about 24.2 m to 28.2 m. The bedrock was encountered at depths of approximately 31.4 m 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 m to 0.6 m at these locations. The quality and thickness of the topsoil is expected to vary throughout 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 m 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 m to 1.4 m corresponding to elevations 183.5 to 184.9. 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 substrata 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)	182.3 ² to 178	178 to 175	175 to 163	163 to 154 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	22	21.7	19.6 to 21.9	-

1 – Index properties are based on laboratory results from Boreholes TB7A-1, T10-1/HGMW-04, T10-2/HGMW-09, BH-112, BH-113, BH/CPT T10-2, and DMT T10-1.

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

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

- Clay Crust: > 100±20 kPa
- Clay Transition: 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 Trail 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 $C_c = 0.130$ and 0.097 and $C_r = 0.018$ and 0.011 .

A consolidated isotropic undrained triaxial compression (CIUC) test was carried out on a 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

Soil 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 m 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, 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% and 100%, indicating 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 until backfilling. This is consistent with the general low permeability overburden soils at this site.

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

The piezometric levels measured in the clayey silt overburden varied from 177.0 to 183.7 and those in the limestone bedrock were around 177.7. The highest piezometric levels within the overburden and bedrock were recorded at about elevations 183.7 and 177.7, respectively (Table 4-6-4). These observations suggest a slight downward gradient from overburden to bedrock. Nevertheless, given the general prevalence in the Windsor area, the occurrence of artesian conditions 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 to 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 to 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 to 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 to 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 m to 159.1 m, overlying limestone and dolostone bedrock below about elevation 154.3 to 156.0. The thickness of the clayey silt to sandy/silty clay deposit, based on nearby boreholes, is about 22.0 m to 30.5 m. The bedrock was encountered at depths of approximately 29.9 m to 31.5 m below the ground surface. Lenses 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 m to 0.3 m at these locations. The topsoil is expected to vary in quality and thickness throughout 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 m 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 elevations 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 substrata 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 to 176	176 to 163	163 to 160 ²
Natural Water Content, w_N , %	9 to 45	11 to 17	13 to 35	12 to 36
Liquid Limit, w_L , %	25 to 37	13 to 26	15 to 36	27 to 38
Plastic Limit, w_P , %	11 to 16	11 to 14	11 to 19	13 to 17
Plasticity Index, PI	12 to 21	2 to 12	4 to 21	12 to 21
Liquidity Index, LI	(-)0.05 to (-)0.23	(-)0.09 to 0.27	(-)0.54 to 0.60	(-)0.18 to 1.64
Unit Weight, γ , kN/m ³	-	21.7 to 22.1	18.8 to 21.3	-

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 lower clayey silt vary at test locations.

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

- Clay Crust: $> 80 \pm 20$ kPa
- Clay Transition: 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 Trail Bridge TB-8 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 to 25	17
Virgin Compression Index, C_c	0.103	0.129	0.146 to 0.206	0.138
Recompression Index, C_r	0.0114	0.0142	0.0161 to 0.0227	0.0151
Swelling Index, C_s	0.0258	0.0323	0.0366 to 0.0516	0.0344
Secondary Compression Index, C_α	0.00288	0.00361	0.00700 to 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 $w_N = 20.7\%$ indicated $C_c =$ and 0.144 and $C_r = 0.026$.

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

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

Soil 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 compact to very dense. This layer was approximately 0 m 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, 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% and 100% indicating very poor to excellent quality. The RQD values generally increased with depth. A sample of the rock core obtained from 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 strength 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 to TB8-3 were dry during the relatively short period until backfilling. This is consistent with the general low permeability overburden soils at this site.

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

The piezometric levels measured in the clayey silt overburden varied from 182.2 to 184.5, while those in the limestone bedrock were around 175.6 to 178.4. The highest piezometric levels within the overburden and bedrock were recorded at about elevations 184.5 and 178.4, respectively (Table 4-7-4). These observations suggest a slight downward gradient from the overburden to the bedrock. Nevertheless, given the general information within the project area, the occurrence of artesian conditions in the 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 2011-07-24	184.5 183.3
		VWP	167.7	Silty Clay	2011-05-24 2011-08-06	184.1 182.4
T11-2A	186.0	VWP	155.5	Limestone	2011-05-12 2011-07-24	177.2 175.6
T11-3A	186.0	VWP	178.4	Silty Clay	2011-05-16 2011-07-24	184.5 184.0
		VWP	167.7	Silty Clay	2011-05-16 2011-08-06	184.0 183.5
BH-107	185.9	S-Piez.	151.5 to 153	Limestone	2008-11-14 2009-01-28	177.3 177.5
BH-305	185.9	VWP	150.0	Limestone	2010-01-06 2010-02-24	178.1 178.4

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 (H_2S) and methane (CH_4) gases that are liberated from the water on exposure to atmospheric pressure.

The H_2S 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.

Although the H_2S and CH_4 gases were not detected during the 2011 geotechnical investigation at the trail 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 Test Data

Test #	Approximate Location	H_2S 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 $\mu g/L$) with the largest values (up to 485 $\mu g/L$) 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. Equipment used 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 potential ground softening.

5 Development of Geotechnical Design

It is understood that all trail bridge structure will consist of a single-span steel truss with concrete deck supported on abutments with shallow spread footing foundations. The west 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 of the trail bridges are shown on the drawings included in this report. As noted in Section 1, this Rev-0 report presents updates of designs presented previously in Rev-A report dated July 2013. The updates correspond to the latest design and loading configurations provided by HMM.

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 applicable requirements of the execution version of the Project Agreement (PA) Schedule 15-2 Part 2, Article 5 for the Parkway project. The foundation design for the abutments was carried out following the Limit States Design (LS Method) based on Load and Resistance Factors (CHBDC and CFEM).

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 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 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 trail bridges are shown in Figures 3.3a to 3.3g. Selected typical design values obtained from these profiles and the trends in the portions of the Parkway project relevant to the trail bridges 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 (S_u), 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 to 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 to 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	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
TB-8	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 to 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 foundations. 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 need 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 179.2 to 185.8, 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-25) and OPSD 3090.101 (ref. R-37), the frost depth below the ground surface in the 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 cleared of snow cover. Foundation soils should be protected from frost penetration by a minimum 1.0 m of earth cover. In the case of riprap, or other 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 Ontario Provincial Standard Specification (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

Load combinations and foundation sizes were outlined in a portable data format (.pdf) file received from HMM in May/June 2014. The foundation and load configurations provided are included in Appendix F. Based on the 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) (bearing capacity of foundation soil without the effect of footing embedment) 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).
- Soil reaction at Serviceability Limit State (SLS) calculated on assumed 25 mm post-construction settlement 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 (°)	= friction angle at concrete-soil sliding interface (equal to $\frac{3}{4}$ times 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 analysis. Table 5-3 presents AMEC's remarks on the findings for each structure.

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 to transfer structural loads below the tunnel abutment. Recommendations in this regard are presented in Section 5.5.

Table 5-2: Geotechnical Analysis for Trail Bridge Foundations

Structure	Abutment	Footing Size (W x L) (m)	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 ⁽⁸⁾	H_{st} (kN) ⁽⁷⁾	r_{ULS} Sliding	r_{SLS} Bearing
TB-1	North	4.2 x 7.0	5.5	181.0	TB1-1, TB1-2	182.0	180.5	Fill over Stiff Clayey Silt	80	185	205	>1	1535	>3	>1
	South	5.4 x 7.0	6.0	180.0	TB-1, TB-2	181.5	18.5	Fill over Stiff Clayey Silt	80	120	205	>1	2165	>2	>1
TB-2	West	5.2 x 7.8	7.0	179.3	TB2-1, TB2-2	182.0	180.3	Loose wet Silt over Clayey Silt	73	110	190	≥1	1795	≥7	≥1
	East	4.3 x 7.0	7.2	181.0	TB2-1, TB2-2	182.5	180.3	Loose wet Silt over Clayey Silt	73	165	190	>1	1485	>4	≥1
TB-4	West	4.6 x 7.0	5.7	180.0	TB4-1, TB4-2	181.0	180.0	Firm to very stiff Clayey Silt	80	135	205	>1	1795	>2	>1
	East	4.6 x 7.0	5.0	179.2	TB4-1, TB4-2	181.0	180.0	Firm to very stiff Clayey Silt	80	130	205	>1	1795	>2	>1
TB-5	West	4.6 x 7.0	8.0	180.9	TB5-1, TB5-2	181.0	181.0	Fill, topsoil, over stiff Clayey Silt	80	150	205	>1	1765	>2	>1
	East	4.8 x 7.0	7.3	180.9	TB5-3, TB5-4	181.5	181.0	Topsoil, loose wet Sand over stiff Clayey Silt	80	145	205	>1	1880	>3	>1
TB-7	West	5.6 x 8.8	6.6	182.0	TB7-1, TB7-2	184.0	183.9	Stiff Clayey Silt	90	100	230	>1	2085	>5	>1
	East	5.4 x 7.0	5.5	183.4	TB7-3, TB7-4	185.0	183.9	Fill over firm over very stiff Clayey Silt	90	130	230	>1	2220	>2	>1
TB-7A	North	3.0 x 7.0	0.8	182.7	TB7A-1	184.8	183.8	Topsoil over firm over very stiff Clayey Silt	90	270	230	>1	1135	>2	>1
	South	3.0 x 7.0	0.7	182.6	TB7A-1	184.8	183.8	Topsoil over firm over very stiff Clayey Silt	90	270	230	>1	1135	>2	>1
TB-8	West	N/A	8.5	185.2	TB8-3	187.0	184.5	Backfill at T-11 North Abutment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	East	4.6 x 7.0	3.9	185.8	TB8-1	187.5	184.5	Topsoil over firm over very stiff Clayey Silt	110	165	280	>1	2280	>2	>1

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 – SLS soil reaction for 25 mm settlement.

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 – 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	Abutment	Remarks
TB-1	North	EPS indicated for the approachway for global stability purposes. Fill possible at PFE; if present, must be removed to expose stiff to very stiff native soils. Subexcavations must be replaced by lean concrete/grout fill/engineered granular fill. Conventional footing is feasible subject to the use of LWF within abutment backfill.
	South	Fill possible at PFE; if present, must be removed and replaced by lean concrete/grout fill/engineered granular fill. Conventional footing is feasible.
TB-2	West	EPS indicated for the approachway for global stability purposes. Shallow loose wet 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 footing is feasible subject to the use of lightweight cellular concrete (CC) in the abutment backfill.
	East	EPS indicated for the approachway for global stability purposes. 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 footing is feasible subject to the use of CC in the abutment backfill.
TB-4	West	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 is feasible.
	East	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 is feasible.
TB-5	West	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 footing is feasible subject to the use of LWF in the abutment backfill.
	East	EPS indicated for the approachway for global stability purposes. Shallow loose wet sand likely at foundation level; 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 is feasible subject to the use of LWF in the abutment backfill.
TB-7	West	Stiff native soil at PFE (182) to be adequately protected. Conventional footing is feasible subject to the use of CC in the abutment backfill.
	East	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 is feasible.
TB-7A	North	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 is feasible.
	South	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 is feasible.
TB-8	West	EPS indicated for the approachway for global stability purposes. Foundation over RSS wall for north abutment of T-11, therefore deep foundations are required.
	East	HWL in drain at 184.64 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 is feasible.

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 models was applied at the top of the ground surface to represent a live load. A tension crack was assumed for the undrained condition only.

The calculated factors of safety (FS) exceed 1.3 for undrained conditions (short-term) and 1.5 for drained conditions (long-term) 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 ^a	Factor of Safety ^b		Figure	Remarks
		Short-Term (Undrained)	Long-Term (Drained)		
TB-1 North Abutment	Transverse	1.3 (1.4)	c	D.1	
	Longitudinal	3.1 (3.9)	1.7 (2.1)	D.2, D.3	
TB-1 South Abutment	Transverse	1.4 (1.6)	c	D.10	
	Longitudinal	2.2 (2.8)	1.6 (1.8)	D.11, D.12	
TB-2 West Abutment	Transverse	1.4 (1.5)	c	D.14	
	Longitudinal	4.8 (7.4)	2.4 (2.8)	D.15, D.16	
TB-2 East Abutment	Transverse	1.5 (1.6)	c	D.24	
	Longitudinal	3.7 (4.6)	2.3 (2.8)	D.25, D.26	
TB-4 West Abutment	Transverse	3.6 (5.1)	3.5 (4.4)	D.33, D.34	Checks in transversal direction for the record only.
	Longitudinal	2.3 (2.9)	1.5 (1.7)	D.35, D.36	
TB-4 East Abutment	Longitudinal	3.3 (3.8)	1.6 (1.9)	D.38, D.39	
TB-5 West Abutment	Transverse	1.3 (1.4)	c	D.40	
	Longitudinal	2.1 (2.4)	1.5 (1.7)	D.41, D.42	
TB-5 East Abutment	Transverse	1.3 (1.4)	1.5 (1.5)	D.49, D.50	Check for long-term stability along transversal for the record only.
	Longitudinal	2.2 (2.4)	1.7 (1.9)	D.51, D.52	
TB-7 West Abutment	Transverse	3.9 (4.7)	c	D.59	Design governed by longitudinal stability.
	Longitudinal	2.0 (2.1)	1.5 (1.6)	D.60, D.61	
TB-7 East Abutment	Transverse	2.4 (2.7)	c	D.63	
	Longitudinal	2.1 (3.0)	2.0 (2.3)	D.64, D.65	
TB-7A North Abutment	Transverse	c	c	-	
	Longitudinal	3.6 (4.2)	1.5 (1.7)	D.72, D.73	Across Wolfe Drain
TB-7A South Abutment	Transverse	c	c	-	
	Longitudinal	1.3 (1.4)	1.5 (1.6)	D.74, D.75	Across Tunnel T-10A abutment

Structure	Direction of Analysis ^a	Factor of Safety ^b		Figure	Remarks
		Short-Term (Undrained)	Long-Term (Drained)		
TB-8 West Abutment	Transverse	-	-	-	Not analyzed (to be founded on piles; see Section 5.5)
	Longitudinal	1.7 (1.9)	1.8 (1.9)	D.77, D.78	
TB-8 East Abutment	Transverse	3.1 (3.9)	2.8 (3.2)	D.81, D.82	
	Longitudinal	1.6 (1.9)	1.5 (1.6)	D.83, D.84	

a – Transverse indicates the direction perpendicular to the approach embankment. Longitudinal is in the direction of the approach embankment.

b – Values in parentheses refer to factor of safety for circular failure surface.

c – No global stability concerns in this direction.

5.4.4 Stress-Deformation Analysis of Abutment Foundations

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

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

- Definition of the initial (in-situ) stress condition for level ground assuming an average bulk unit weight of 21 kN/m³ 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
- 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 the 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 to 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, particularly with respect to the installation of the base and subbase granular layers over the Highway 401 subgrade. This condition is critical to ensure the undrained (short-term) global stability for the tunnel abutments due to the additional surcharges from the trail embankments.
- b) The trail approachway embankments comprising regular soil fill should be substantially completed and extended beyond the abutment footprint before the construction of the bridge abutments. This condition is intended to avoid sizeable 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 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 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.

Differential settlement between the abutments and the embankments were estimated by comparison between the post-construction settlements given in Table 5-5 for the abutments and those reported in Table 5-12 for the embankments. Based on these results, the embankments fully built-up with regular soil fill are expected to experience greater settlements than the abutments. It is anticipated that the approachway embankment will require periodic monitoring and maintenance until the stabilization of the settlement process. To minimize the differential settlement and required repairs, it is critical that the construction staging described above is followed and that the excess surcharge fill is left in place for as long as feasible.

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 calculation results are approximate and should be considered only as initial estimates of the magnitude of the soil response. The observed field performance over a relatively limited period time of some of the partially and fully built structures in the vicinity of the trails bridges seems to indicate that no changes are warranted at this time to the interpreted soil model interpreted from the historical geotechnical investigation program. Nevertheless, the settlement estimates should be verified and refined with respect to the actual performance monitoring in the field.

Table 5-5: Estimated Settlement of Bridge Abutments

Structure	Abutment	Footing Size (W x L) (m)	Embedment (m)	Average Compressibility Properties			Net SLS Foundation Average Bearing Pressure, kPa ⁽¹⁾	Average Elastic Modulus, E (MPa)	Long-Term Settlement (mm)	Immediate Settlement (mm)	Post-Construction Settlement (mm)
				e_o	$C_c^{(5)}$	C_r					
TB-1	North	4.2 x 7.0	1.0	0.572	-	0.0182	110	25.3	28.5	15	<14
	South	5.4 x 7.0	1.5	0.602	-	0.0195	95	20.0	27.3	20	<8
TB-2	West	5.2 x 7.8	2.7	0.664 ⁽³⁾ , 0.711 ⁽⁴⁾	0.1845	0.0200	70	18.5	18.4	16	<3
	East	4.3 x 7.0	1.5	0.629	-	0.0196	95	23.3	26.0	14	<12
TB-4	West	4.6 x 7.0	1.0	0.665	-	0.0206	114	20.2	30.9	21	<11
	East	4.6 x 7.0	1.8	0.648	-	0.0207	95	19.3	25.6	19	7
TB-5	West	4.6 x 7.0	1.0	0.603	-	0.0174	105	22.4	27.2	17	<11
	East	4.8 x 7.0	1.0	0.605	-	0.0174	110	22.4	27.3	19	<9
TB-7	West	5.6 x 8.8	2.0	0.518	-	0.0160	70	18.5	21.1	17	<5
	East	5.4 x 7.0	1.6	0.510	-	0.0154	115	21.5	22.2	22	<1
TB-7A	North	3.0 x 7.0	2.1	0.491	-	0.0149	50	28.2	16.7	5	<13
	South	3.0 x 7.0	2.2	0.493	-	0.0151	50	28.0	17.2	5	<13
TB-8 ⁽²⁾	East	4.6 x 7.0	1.7	0.526	-	0.0147	125	24.5	20.1	19	<2

1 – Foundation bearing pressure is determined from foundation dimensions and SLS load combinations provided by HMM. Values shown are corrected for the effect of embedment depth.

2 – The west abutment of TB-8 will be on deep foundations and is not included.

3 – Average void ratio for overconsolidated soil region.

4 – Average void ratio for normally consolidated soil region.

5 – Compression index, C_c , provided where zone of influence extends into normally consolidated soil.

5.5 Pile Foundations

The present discussion is limited to the specific case of the 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.

5.5.1 Resistance to Axial Loads

HP310x110 steel H piles have been used for highway bridge and tunnel structures at this project and are anticipated to be the choice for TB-8, which requires deep foundations. Based on geotechnical investigation and confirmation from a limited number of static and dynamic tests, these piles driven to bedrock as per OPSS 903 (ref. R-33) are capable of mobilizing 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).

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 the piles are expected to be set. In cases where some of the piles cannot be driven to bedrock due to the 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 (ref. R-33) requirements. The piles should be reinforced with Type I shoe flanges as shown in OPSD 3000.100 (ref. R-34), 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 the 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, ref. R-35) 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 abutments. 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 resistances may be assumed to be 220 kN and 105 kN along the strong and weak axes, respectively.

The above estimates were based on a pile model assumed to be embedded within clay backfill from the underside of the pile cap at approximate 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 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

Soil Around the Piles	Elevation (m)	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

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 LPILE	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 load 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 construction and to ensure sufficient hammer energy 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:

$$\begin{aligned}
 k_h &= n_h \left(\frac{z}{d} \right) && \text{for cohesionless soils, and} \\
 &= 67 \left(\frac{S_u}{d} \right) && \text{for cohesive soils.}
 \end{aligned}$$

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 between those listed here.

Table 5-8: Lateral Load Capacity Reduction Factors for Pile Groups using the Horizontal Subgrade Reaction Method (ref. R-7)

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

d = pile diameter

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 CFEM (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 nonlinear 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 CFEM (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.

In the case of a 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)

The 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 replacement of fills to construct the Tunnel T-11 abutments. 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 settlement is expected to occur along the pile shaft during construction of the RSS, tunnel, and completion of the associated backfill and will continue in the long-term; and
- Ground rebound is expected to occur along Highway 401 after the substantial completion of the ground surface loading.

Considering that the TB-8 foundation will be constructed following construction of the RSS and 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 CFEM (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 lateral ground 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 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 (ref. R-8), 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 kNm and 110 kNm 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 trail bridges are shown in the general arrangement drawings. The wing walls comprise RSS founded on a granular pad. These configurations and 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, LWF, 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 abutment 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 (ref. R-38 and R-39).

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(*)
Light Weight Fill (LWF)	12.5	35	50(*)
Cellular Concrete (CC)	4.75	0	1000(*)
Expanded Polystyrene (EPS)	0.5	0	10

*For the purpose of global and external 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 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 competent native soils.

- Any low areas should be brought to grade using approved compacted fill.
- The base of each wall segment shall be stepped in a manner to 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 SIGMA/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		Figure	Stress Deformation			Remarks
			Factor of Safety*			Settlement (mm)		Figure	
			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	6.0	1.3 (1.4)	1.7 (2.3)	D.4, D.5	b	b	-	2.1 m thickness LWF required in RSS wing walls
	10+725	6.0	1.3 (1.4)	a	D.6	b	b	-	28 m³/m EPS required below granular RSS wing walls
	10+723	6.0	1.3 (1.3)	a	D.97	b	b	-	15 m³/m EPS required in embankment
	10+720	5.5	1.3 (1.3)	a	D.8	b	b	-	10 m³/m EPS required in embankment
	10+705	5.0	1.3 (1.3)	a	D.9	b	b	-	No light weight materials required for embankment
South Abutment (Trail 6)	10+770	5.5	1.3 (1.4)	a	D.13	75 to 85	45 to 50	E.1, E.2, E.3	No light weight materials required for embankment
TB-2									
West Abutment Wing Walls and Approach (Trail 6)	10+532	7.0	1.3 (1.3)	1.6 (1.8)	D.17, D.18	b	b	-	19 m³/m CC in RSS wing walls (approx. depth 3 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)	a	D.19	b	b	-	7 m³/m CC in core of embankment 63 m³/m EPS below RSS and in embankment slopes
	10+515	6.5	1.3 (1.3)	a	D.20	b	b	-	72 m³/m EPS in embankment
	10+495	5.0	1.3 (1.3)	a	D.21	b	b	-	30 m³/m EPS in embankment
	10+475	4.0	1.3 (1.3)	a	D.22	b	b	-	16 m³/m EPS in embankment
	10+465	3.5	1.3 (1.3)	a	D.23	b	b	-	No light weight materials required for embankment
East Abutment Wing Walls and Approach (Trail 15)	10+577	7.5	1.5 (1.6)	2.6 (2.9)	D.27, D.28	b	b	-	37 m³/m CC in RSS wing walls for external stability
	10+585	7.0	1.3 (1.3)	a	D.29	b	b	-	10.3 m³/m CC required between last RSS block behind abutment 26 m³/m EPS beneath RSS wall
	10+588	7.0	1.3 (1.3)	a	D.30	b	b	-	42 m³/m EPS in embankment
	10+019	5.5	1.3 (1.3)	a	D.31	b	b	-	6.5 m³/m EPS in embankment
	10+025	5.0	1.3 (1.3)	a	D.32	b	b	-	No light weight materials required for embankment
	TB-4								
West Approach (Trail 15)	10+020	5.7	2.5 (2.8)	a	D.37	60 to 70	20 to 25	E.4, E.5, E.6	No light weight materials required for embankment
East Approach (Trail 31)		5.0	a	a	-	b	b	-	No light weight materials required for embankment
TB-5									
West Wing Walls and Approach (Trail 25)	10+547	8.0	1.3 (1.3)	1.5 (1.6)	D.43, D.44	b	b	-	5.15 m thick LWF in RSS wing walls 7.1 m³/m EPS in embankment slopes Both embankments contain EPS as per design requirement for Tunnel T-6, therefore settlement will be nominal
	10+544	8.0	1.3 (1.3)	a	D.45	b	b	-	3.25 m thick LWF in RSS wing walls 37 m³/m EPS below RSS wall and in embankment slopes

Structure/Embankment	Station	Height of Wall/Embankment, m	Global Stability		Figure	Stress Deformation			Remarks
			Factor of Safety*			Settlement (mm)		Figure	
			Short-Term (Undrained)	Long-Term (Drained)		Short-Term (End of Construction)	Post-Construction		
TB-5									
West Wing Walls and Approach (Trail 25)	10+541	7.5	1.3 (1.4)	a	D.46	b	b	-	1.5 m thick LWF in RSS wing walls 55 m³/m EPS below RSS wall and in embankment slopes
	10+535	7.5	1.3 (1.3)	a	D.47	b	b	-	71 m³/m EPS in embankment slopes
	10+470	4.5	1.3 (1.4)	a	D.48	b	b	-	7 m³/m EPS in embankment
East Wing Walls and Approach (Trail 25)	10+593	7.3	1.3 (1.4)	a	D.53	b	b	-	3.3 m thick LWF in RSS wing walls
	10+595.99	7.0	1.3 (1.4)	a	D.54	b	b	-	2.8 m thick LWF in RSS wing walls 11.5 m³/m EPS in embankment slopes
	10+596	7.0	1.3 (1.4)	a	D.55	b	b	-	2 m thick LWF in RSS wing walls 12.5 m3/m EPS in embankment slopes
	10+600.99	7.0	1.3 (1.4)	a	D.56	b	b	-	50 m³/m EPS below RSS wall
Retaining wall on north side of Trail 25	10+635	4.5	1.3 (1.3)	a	D.57	b	b	-	No light weight materials required for retaining wall and embankment
	10+650	4.0	1.4 (1.4)	a	D.58	b	b	-	No light weight materials required for retaining wall and embankment
TB-7									
West Approach (Trail 41)	10+500	4.0	2.6 (2.9)	a	D.62	b	b	-	No light weight materials required for embankment
East Approach (Trail 44)	10+086	5.7	1.4 (1.5)	2.2 (2.4)	D.66, D.67	45 to 55	10 to 20	E.7, E.8, E.9	No light weight materials required for retaining wall
	10+125	4.2	2.3 (2.4)	1.3 (1.4)	D.68, D.69	30 to 40	< 10	E.10, E.11, E.12, E.13	No light weight materials required for retaining wall
	10+155	3.0	2.8 (3.2)	1.3 (1.4)	D.70, D.71	b	b	-	No light weight materials required for retaining wall
TB-7A									
North Abutment		2.0	a	a	-	b	b	-	No light weight materials required
South Abutment		2.0	1.3 (1.4)	a	D.76	b	b	-	No light weight materials required
TB-8									
West Abutment (Trail 54)	10+080	4.4	4.7 (4.8)	6.9 (15.1)	D.79, D.80	b	b	b	Cellular concrete backfill above T-11 South Abutment required for external stability
East Abutment (Trails 47 and 54)	10+000	6.0	2.8 (2.9)	1.4 (1.4)	D.85, D.86	55 to 65	15 to 20	E.14, E.15, E.16	No light weight materials required for embankment

* – Values in parentheses refer to factor of safety for circular failure surface.

a – No global stability concerns due to low level surcharge through the use of CC and EPS, or low height embankment.

b – Short and long-term settlement was not analyzed for these non-critical sections 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 (ref. R-4) in conjunction with the undrained and drained soil shear strength properties described in Section 5.2. The checked sections were those that met the safety requirement from global safety standpoint.

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 southeast 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.13 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 according to the following expression:

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

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; 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.

A wind load of 2.35 kN/m^2 was applied to fully exposed cofferdam-style approachway embankment between RSS wing walls based on calculations provided by HMM (Appendix F). The results of the analyses are presented in Table 5-13.

Table 5-13: Results of RSS External Stability Analyses

Structure/ Embankment	Station	Height of Wall (m)	Width of Reinforcement (m)	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)	3.1	4.0	105 ⁽¹⁾	75 ⁽¹⁾	3.7	19.7	33.9	2.7	13.2	33.9	2.1 m thick LWF required based on global stability analysis (Figures D.4 and D.5)
South Abutment Wing Walls	10+774 (Trail 2)	7.0	5.0	205	215	2.6	23.4	33.5	2.6	27.1	33.5	No light weight materials required
TB-2												
West Abutment Wing Walls (Trail 6)	10+532	7.5	4.0	180	160	3.0	14.5	13.1	2.7	14.2	13.1	19 m³/m CC in RSS wing walls (approx. depth 3 m) based on global stability analysis (Figures D.20 and D.21)
East Abutment Wing Walls (Trail 6)	10+577	6.7	4.0	105 ⁽¹⁾	70 ⁽¹⁾	3.1	11.3	9.3	2.0	8.9	9.3	37 m³/m CC required in RSS wing walls (Figures D.27 and D.28)
TB-4												
West Abutment (Trail 31)	10+017	4.5	4.0	130	170	2.4	18.0	34.2	3.2	22.4	34.2	No light weight materials required
East Abutment (Trail 31)	10+063	4.8	3.5	130	145	2.3	14.9	24.9	2.6	19.5	24.9	No light weight materials required
TB-5												
West Abutment and Approach (Trail 25)	10+547	5.8	4.0	105 ⁽¹⁾	95 ⁽¹⁾	2.3	13.7	17.4	2.1	14.6	17.4	5.15 m thick LWF required based on global stability analysis (Figures D.44 and D.45)
	10+535	7.5	7.0	205	245	3.5	2.6	5.1	4.2	2.2	5.1	3.5 m thick EPS required in embankment for global stability (Figure D.47)
	10+470	4.5	3.5	205	120	3.9	3.3	4.7	2.3	2.5	4.7	1 m thick EPS required for global stability (Figure D.48)
East Abutment (Trail 25)	10+590	6.4	4.0	205	165	4.0	19.8	16.0	3.2	14.8	16.0	5.4 m thick LWF required
TB-7												
Southeast Retaining Wall (Trail 44)	10+090	3.8	4.0	385 ⁽¹⁾	190 ⁽¹⁾	4.2	38.5	41.0	2.1	22.7	41.0	No light weight materials required
	10+100	1.6	2.5	210 ⁽¹⁾	150 ⁽¹⁾	4.8	31.6	42.8	3.4	16.1	42.8	No light weight materials required
	10+110	2.1	3.0	210 ⁽¹⁾	125 ⁽¹⁾	3.7	8.0	16.8	2.2	6.4	20.8	No light weight materials required
	10+115	3.0	3.5	205 ⁽¹⁾	135 ⁽¹⁾	3.0	5.0	10.9	2.0	4.8	13.7	No light weight materials required
	10+120	3.7	4.5	385 ⁽¹⁾	180 ⁽¹⁾	4.1	7.9	13.7	2.0	5.8	17.0	No light weight materials required
	10+123	4.3	5.0	380 ⁽¹⁾	215 ⁽¹⁾	3.6	6.8	13.1	2.0	5.7	16.3	No light weight materials required
	10+150	2.9	3.5	385 ⁽¹⁾	150 ⁽¹⁾	5.2	9.9	13.5	2.0	5.7	16.7	No light weight materials required
	10+165	1.7	2.0	215 ⁽¹⁾	100 ⁽¹⁾	4.2	7.2	10.7	2.0	5.1	13.4	No light weight materials required
	10+170	1.3	1.5	215 ⁽¹⁾	80 ⁽¹⁾	5.2	8.2	9.6	2.0	4.8	12.0	No light weight materials required
Northeast Retaining Wall (Trail 44)	10+090	7.0	4.0	465	420	2.3	2.3	4.8	2.1	2.9	4.8	No light weight materials required
Southwest Retaining Wall	10+009	6.5	4.5	465	345	2.5	2.4	4.8	2.0	3.5	6.2	No light weight materials required
North Retaining Wall (Trail 41)	10+455	3.3	1.8	465	315	3.2	1.8	2.2	2.6	2.1	2.9	No light weight materials required

5.6.5 Toe Walls

Based on the information provided by HMM, it is understood that concrete toe retaining walls are to be designed and constructed along sections of Trails 31, 41, and 44 as part of the construction of the Windsor-Essex Parkway. Foundation bearing resistance, sliding resistance and overturning of the Phase 1 toe retaining walls were analyzed. Table 5-14 outlines the toe retaining wall locations and dimensions.

Table 5-14: Summary of Phase 1 Toe Retaining Walls Configuration

Wall	Trail	Station Range	Approximate Total Height of Wall (m)	Approximate Length of Wall (m)
Toe Retaining Wall "A"	Trail 31	11+310 to 11+325	2.33	15
Toe Retaining Wall "B"	Trail 31	11+405 to 11+415	2.63	10
Toe Retaining Wall "C"	Trail 41	10+430 to 10+455	2.69	25
Toe Retaining Wall "D"	Trail 44	10+370 to 10+420	1.88	50

The geotechnical assessment of the toe retaining walls is based on the geotechnical information (subsurface soil and groundwater conditions and soil property interpretations) obtained from investigations carried out for the Windsor-Essex Parkway project. A summary of various soil parameters used in retaining wall design is given in Table 5-15 derived from the CPT and Nilcon vane test profiles, available laboratory and field test data, typical published data, and local experience.

Table 5-15: Static Soil Parameters for Retaining Walls Design

Retaining Wall	Toe Retaining Wall "A"	Toe Retaining Wall "B"	Toe Retaining Wall "C"	Toe Retaining Wall "D"
Soil within Foundation Zone	Stiff to Very Stiff Silty Clay	Stiff to Very Stiff Silty Clay	Stiff to Very Stiff Silty Clay	Stiff to Very Stiff Silty Clay
Approximate Elevation Range within Foundation Zone, m	181 to 176.5	181 to 176	182.5 to 177.5	184 to 180
Bulk Unit Weight, γ , kN/m ³ ⁽¹⁾	22.0	22.0	22.0	22.0
Undrained Shear Strength, S_u , kPa ⁽²⁾	60 to 75	60 to 75	65 to 75	65 to 75
Drained Angle of Internal Friction, Φ , ° ⁽³⁾	30	30	30	30
Elastic Modulus E , MPa ⁽⁴⁾	24 to 30	24 to 30	26 to 30	26 to 30
Poisson's Ratio	0.35 to 0.49	0.35 to 0.49	0.35 to 0.49	0.35 to 0.49

1 – For submerged soil, 9.81 kN/m³ is subtracted from the corresponding bulk unit weight.

2 – Applicable for undrained conditions.

3 – Applicable for drained conditions.

4 – Estimated based on undrained shear strength, where $E = 400S_u$ for cohesive soils.

The properties assumed for the backfill materials are given in Table 5-16.

Table 5-16: Assumed Backfill Material Properties

Backfill Material	Unit Weight (kN/m ³)	Angle of Internal Friction Φ^0	Earth Pressure Coefficients ⁽¹⁾		
			Active, K_a	At Rest, K_0	Passive, K_p
Granular Backfill	21.5	32	0.31	0.47	3.25

1 - These are Rankine coefficients for information only. The external design was conducted using Coulomb active earth pressure method.

The geotechnical design for the toe retaining walls has been completed in compliance with the requirements of the executed version of the Project Agreement Schedule 15-2 Part 2, Article 5 (PA) for the Windsor-Essex Parkway Project. The foundation designs were as per the principles of Limit States Design (LS Method) based on Load and Resistance Factors (CHBDC and CFEM).

The net ultimate bearing capacity values (q_{uls}) were determined for the native subgrade soils based on the undrained shear strength values presented in Table 5-17. Long-term drained conditions were based on friction angle of 30°.

All retaining walls have been analyzed for stability in terms of ULS bearing and sliding resistances and overturning. Results are summarized in Table 5-17.

Heavy compaction equipment should not be used adjacent to the walls of the structure, where the backfill should be placed in maximum 100 mm thick loose lifts and compacted with small compactors. Earth pressures on retaining walls may be calculated on the basis of the soil parameters given in Table 5-17.

5.7 Backfilling

Behind the concrete abutment wall backfill materials should meet the requirements of OPSS 902 (ref. R-32) and the CHBDC (ref R-5).

The backfill should be compacted in maximum 200 mm thick loose lifts in accordance with SP105S10 (ref. R-40). 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 (ref. R-36).

Heavy compaction equipment should not be used immediately adjacent to the walls of the structure as per the CHBDC and OPSS 501 (ref. R-5 and R-29). 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 the wing walls may be calculated on the basis of the parameters given in Table 5-18.

In the case of a 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; and

β = Slope of the backfill surface.

Table 5-18: 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, ϕ ($^\circ$)	33 to 35	29 to 32	22 to 30
Coefficients of Static Lateral Earth Pressure (Rankine):			
“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 Type 1, 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 (ref. R-30 and R-31).

Due to the relatively low permeability of the silty clay deposit, groundwater seepage is anticipated to be minor and 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. Provisions 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 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 need 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, ref. R-23) and OPSS 902 (ref. R-32). 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 the 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 the 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 the subgrade without approved protective cover.
- 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 of concrete. Additional test results from nearby boreholes at which shallow test samples were selected have been included to supplement the 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 (ref. R-26), 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.

Project: Windsor-Essex Parkway
Document: Geotechnical Investigation and Design Report – Pedestrian Bridges
Doc No.: 285380-04-119-0150

Date: July/2014
Rev: 0
Page No.: 71

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 trail 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 trail bridges 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 as 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

This geotechnical report for the trail bridges, embankments and associated retaining walls was prepared by Ms. Ashley Verge with the participation of Mr. Matt Oldewening, P.Eng. and Elalim Ahmed, P.Eng. The technical direction and checkup was by Dr. Dan Dimitriu, P.Eng., the Lead Geotechnical Engineer. The review was completed by Dr. Narendra Verma, P.Eng., Principal Engineer and Designated MTO RAQS Contact. 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., Mr. Boris Malac, P.Eng., and Mr. Jeffrey Luckai of Hatch Mott MacDonald and Mr. Daniel Muñoz, P.Eng. of PIC during the design study is gratefully acknowledged.

Yours truly,
AMEC Environment & Infrastructure
a Division of AMEC Americas Limited

Ashley Verge

Ashley Verge, M.A.Sc.
Engineer-in-Training



Dan Dimitriu, Ph.D., P.Eng.,
Associate Geotechnical Engineer
(Project Lead Designer)



Narendra S. Verma, Ph.D., P.Eng., F.ASCE, D.G.E.
Principal Geotechnical Engineer
(Designated MTO RAQS Contact)

Project: Windsor-Essex Parkway
Document: Geotechnical Investigation and Design Report – Pedestrian Bridges
Doc No.: 285380-04-119-0150

Date: July/2014
Rev: 0
Page No.: 75

9 References

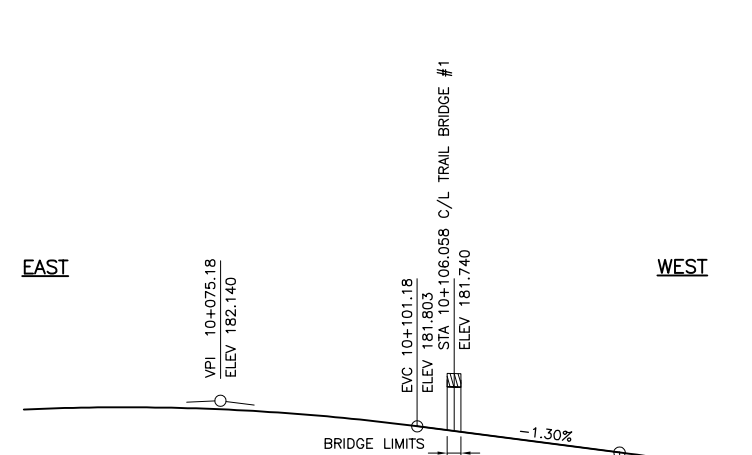
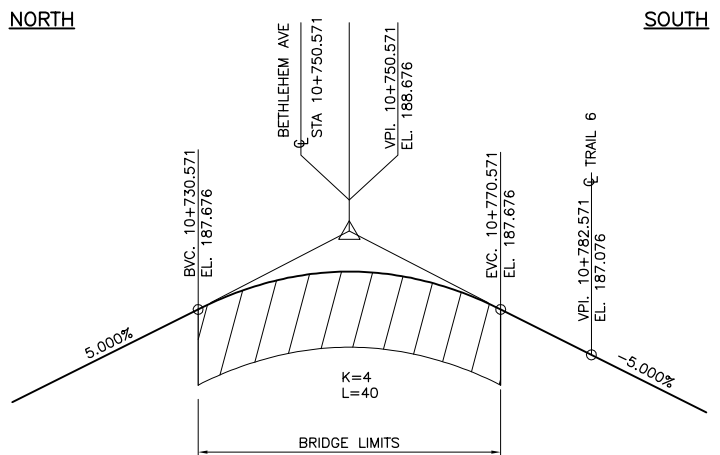
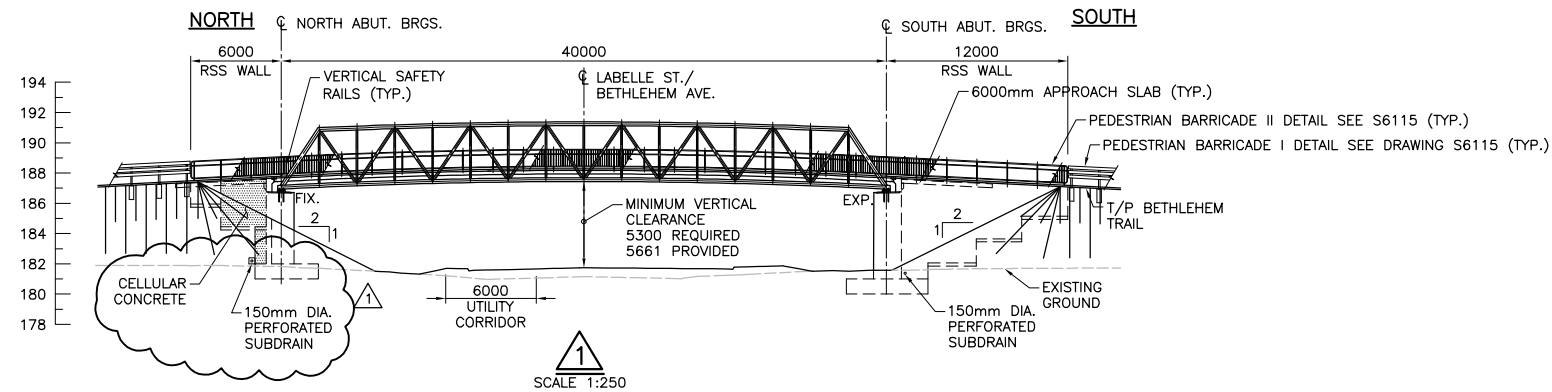
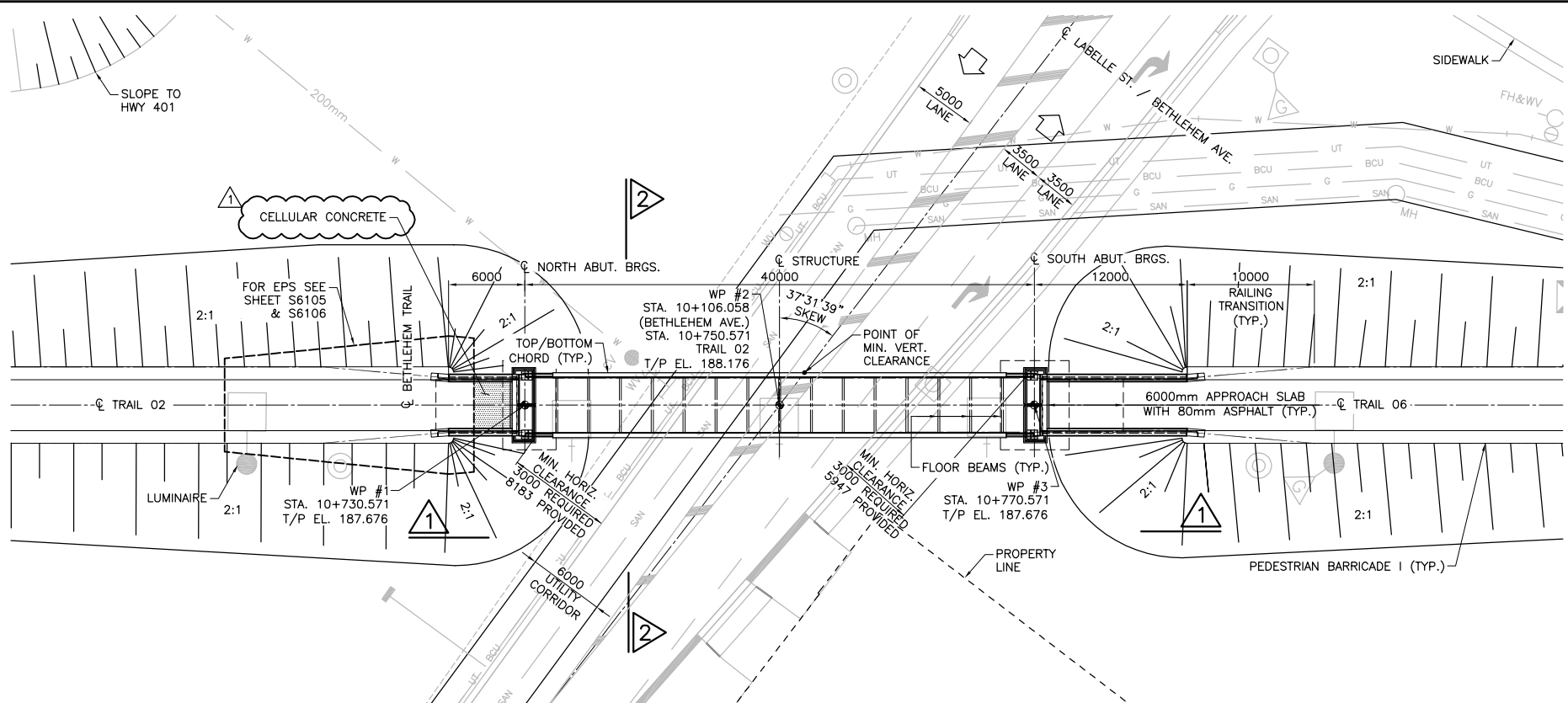
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Drawings

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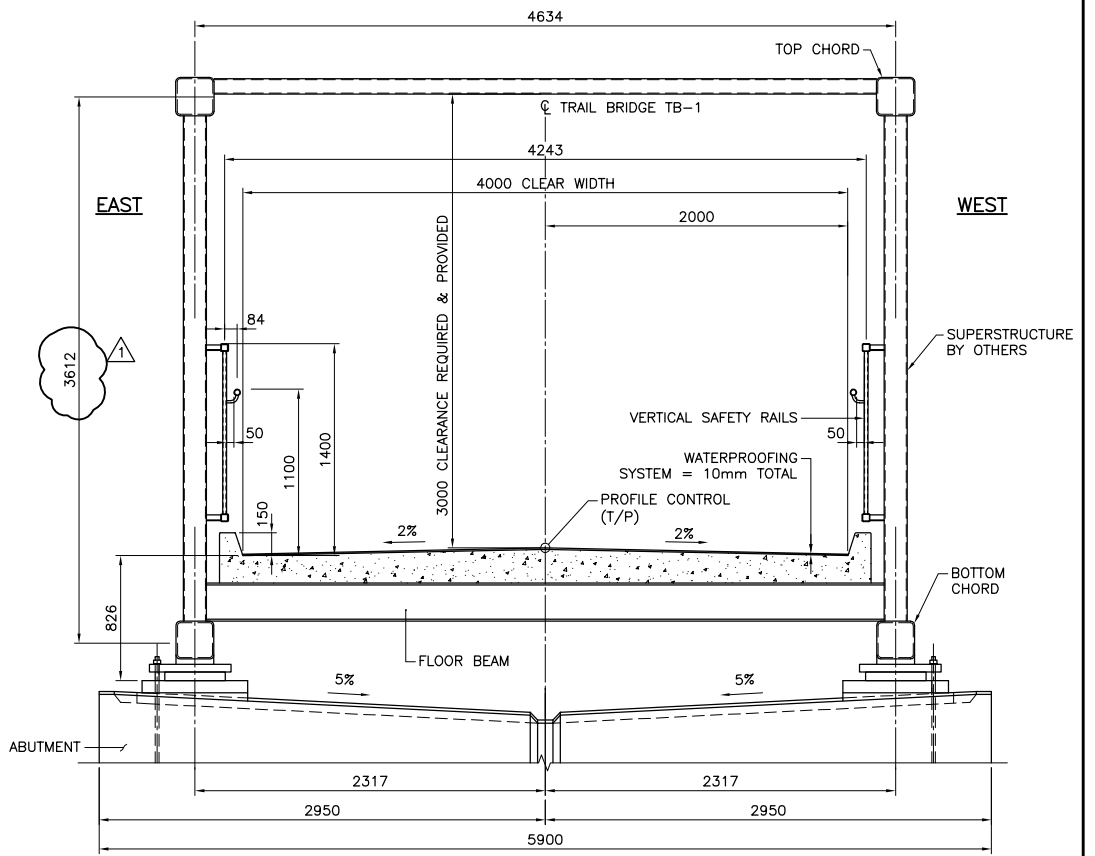
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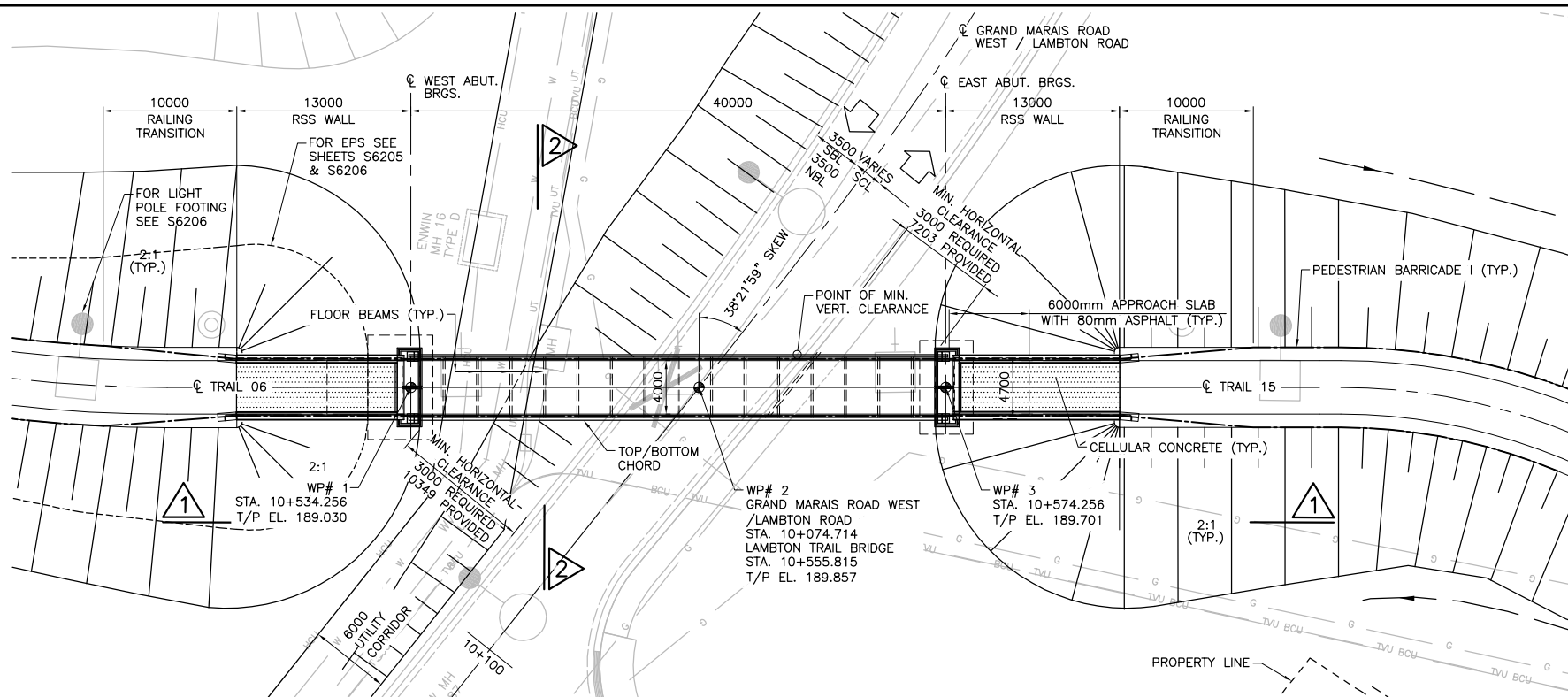
Windsor-Essex
Parkway Project
RFP No. 09-54-1007

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TRAIL BRIDGE OVER LABELLE ST-BETHLEHEM AVE. TB-1
GENERAL ARRANGEMENT

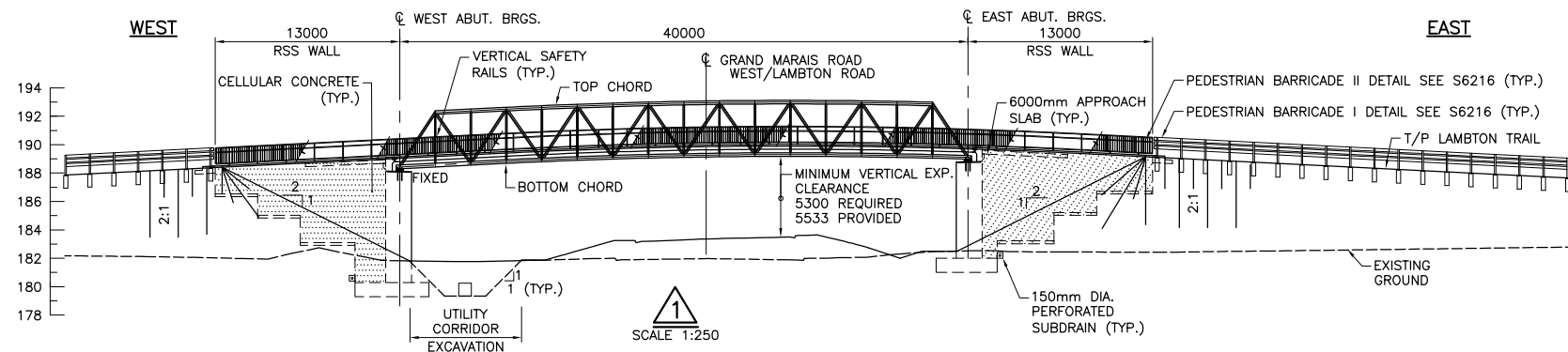
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Phase 2
IFC



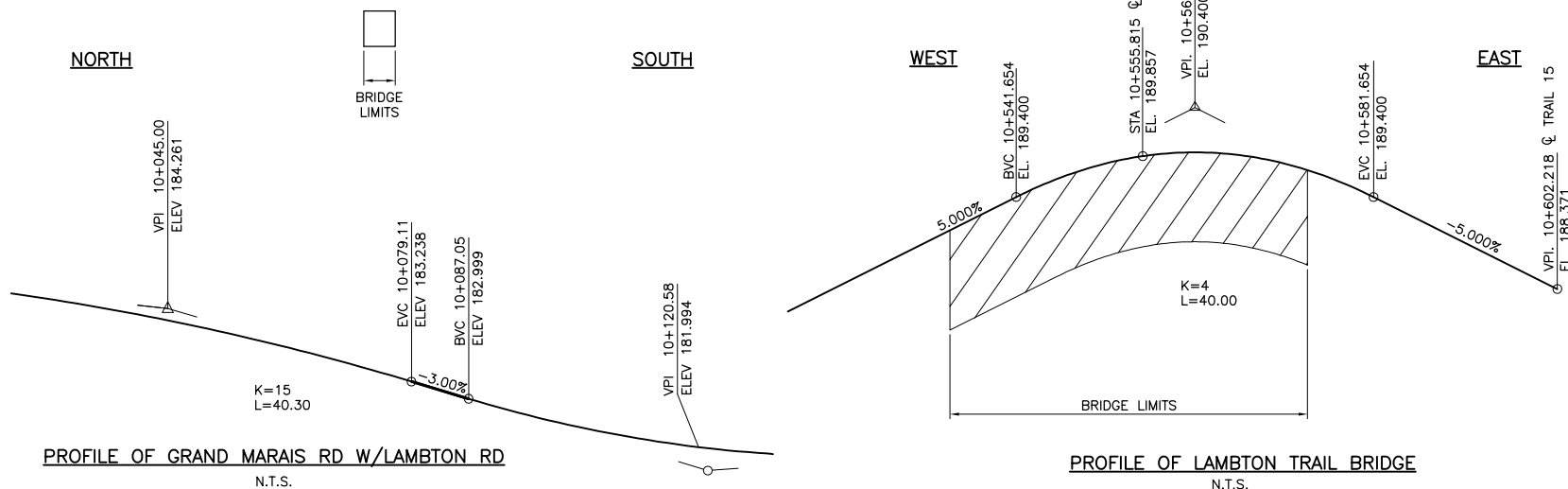
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PLAN
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SCALE 1:250



PROFILE OF GRAND MARAIS RD W/LAMBTON RD
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PROFILE OF LAMBTON TRAIL BRIDGE
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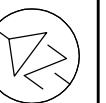


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RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER GRAND MARAIS-LAMBTON RD. TB-2
GENERAL ARRANGEMENT

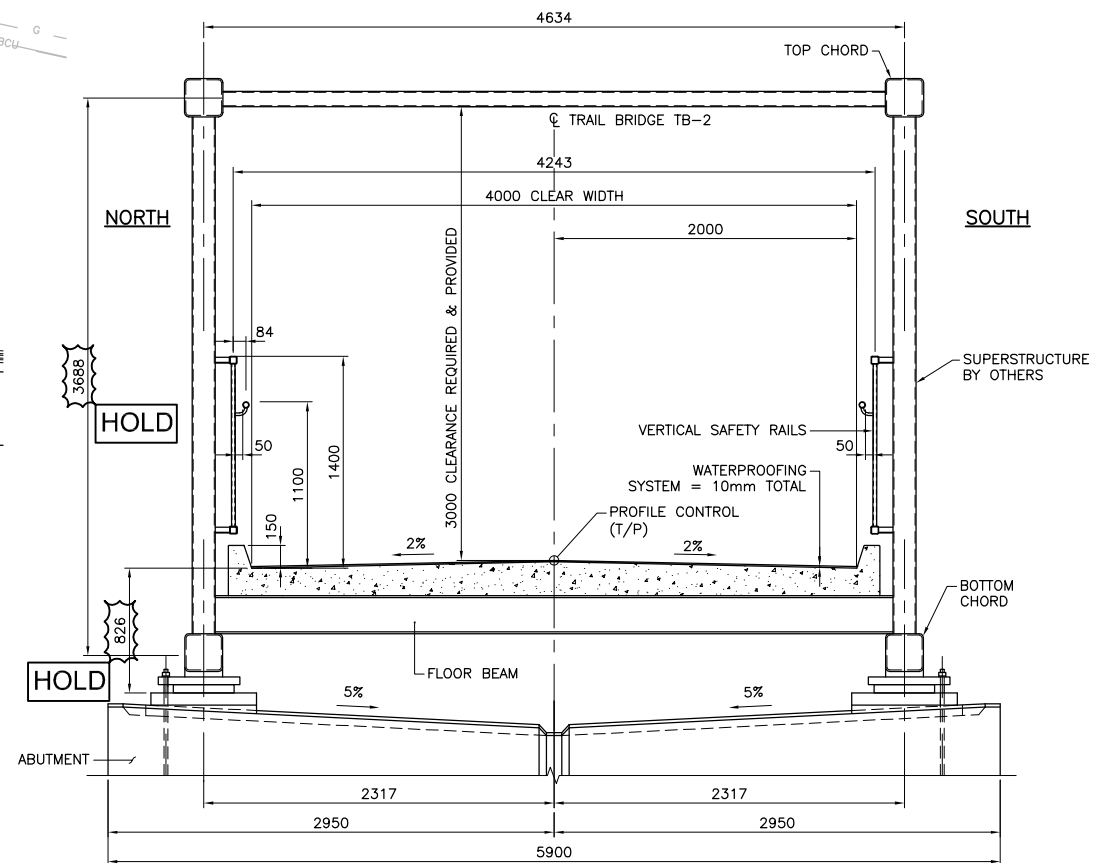


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Phase 2
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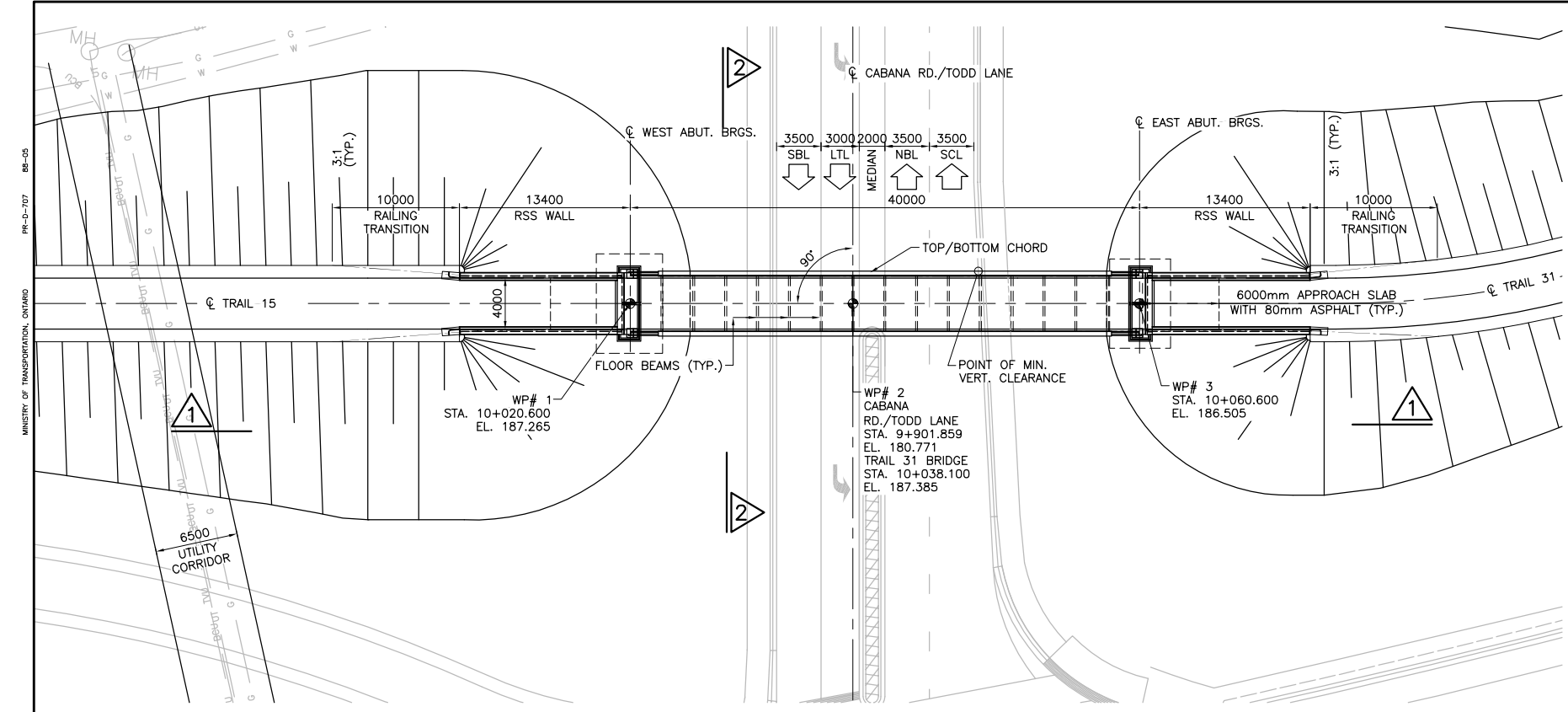
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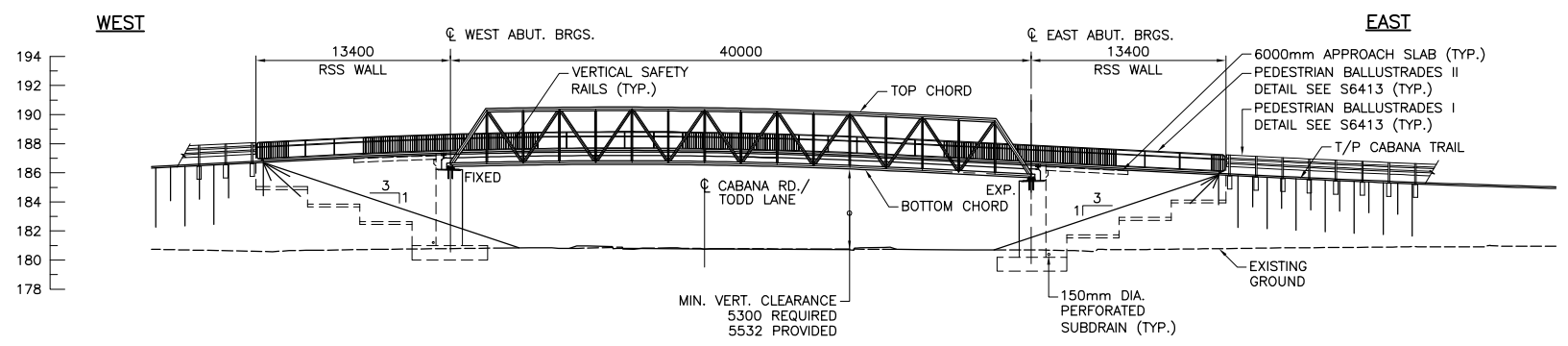
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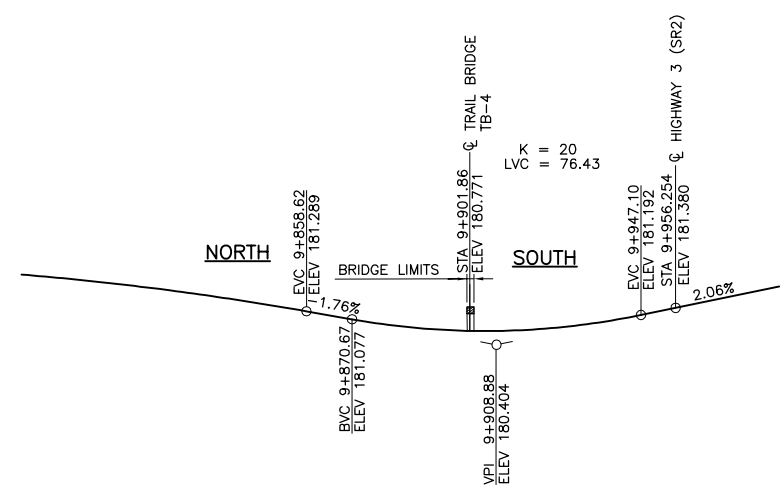
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PLAN
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SCALE 1:250



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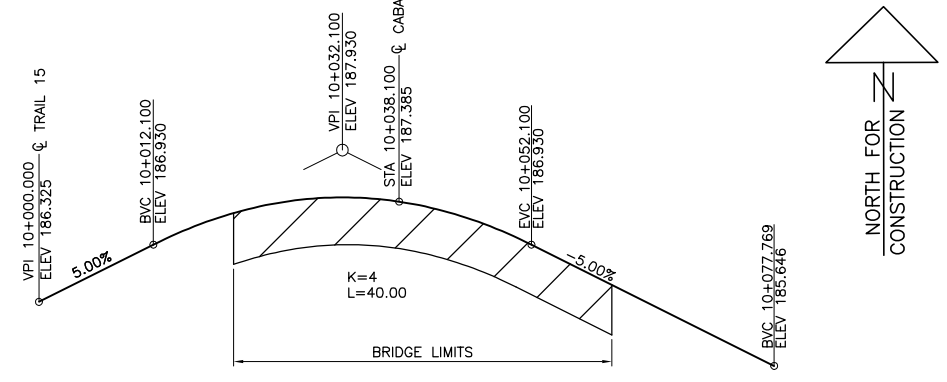
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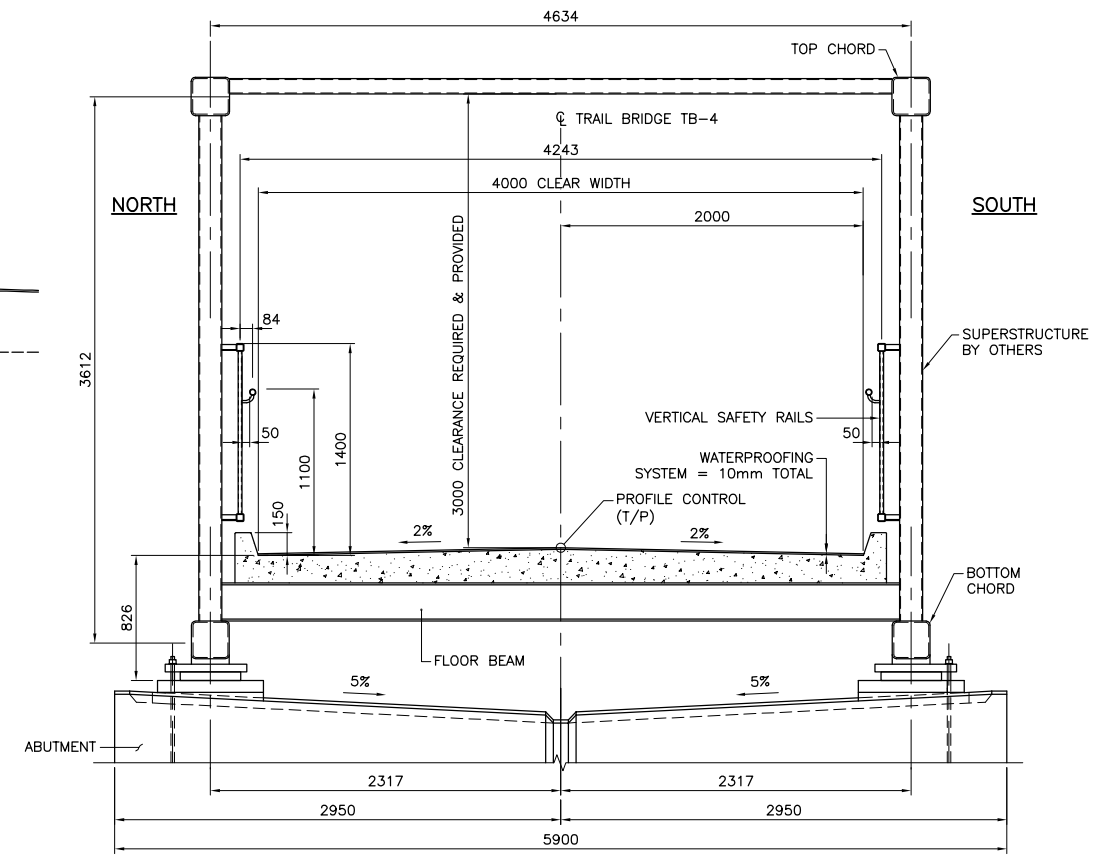
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RFP No. 09-54-1007

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TRAIL BRIDGE OVER CABANA RD.-TODD LN. TB-4
GENERAL ARRANGEMENT

SHEET
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Phase 1
IFC



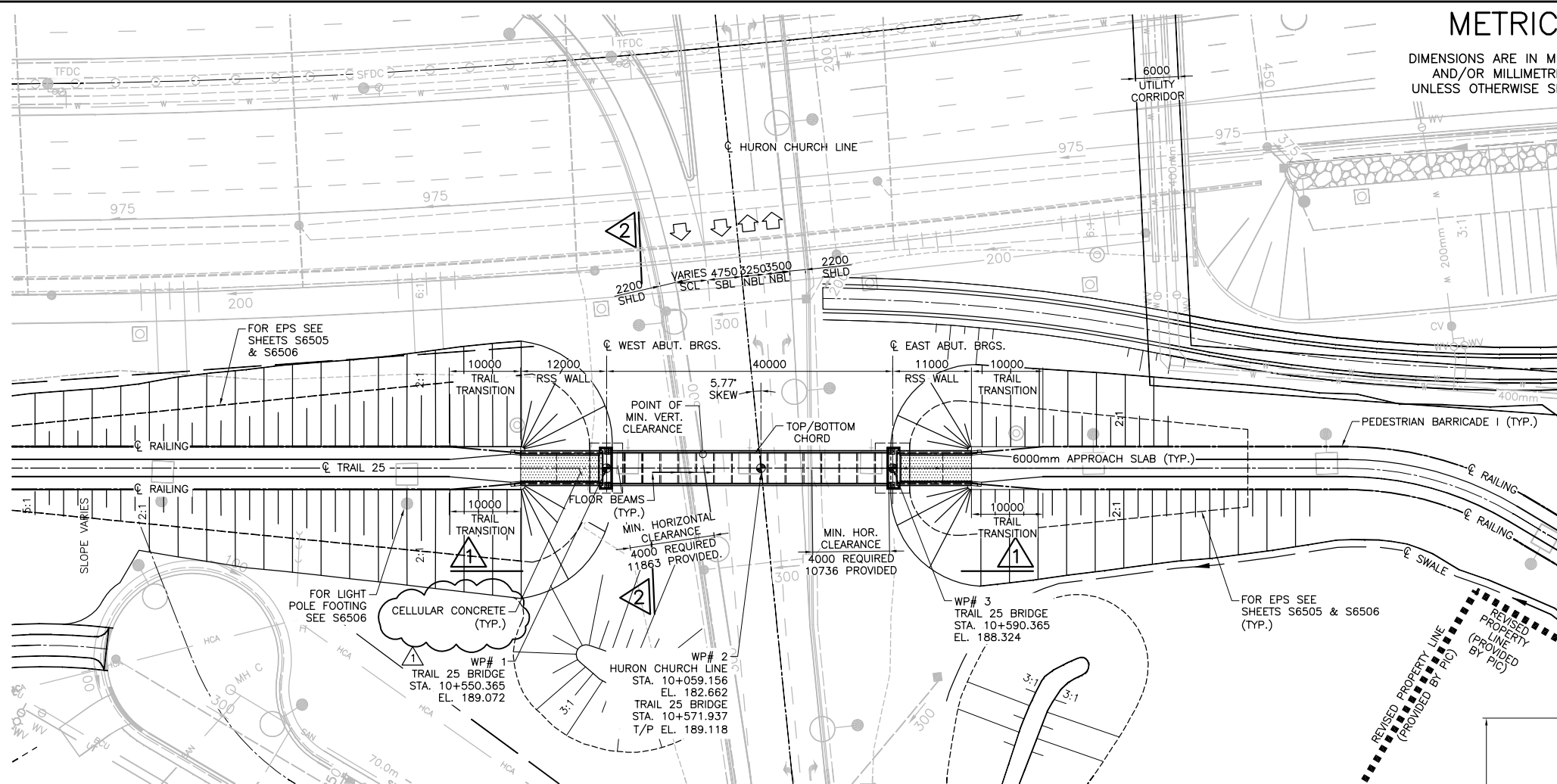
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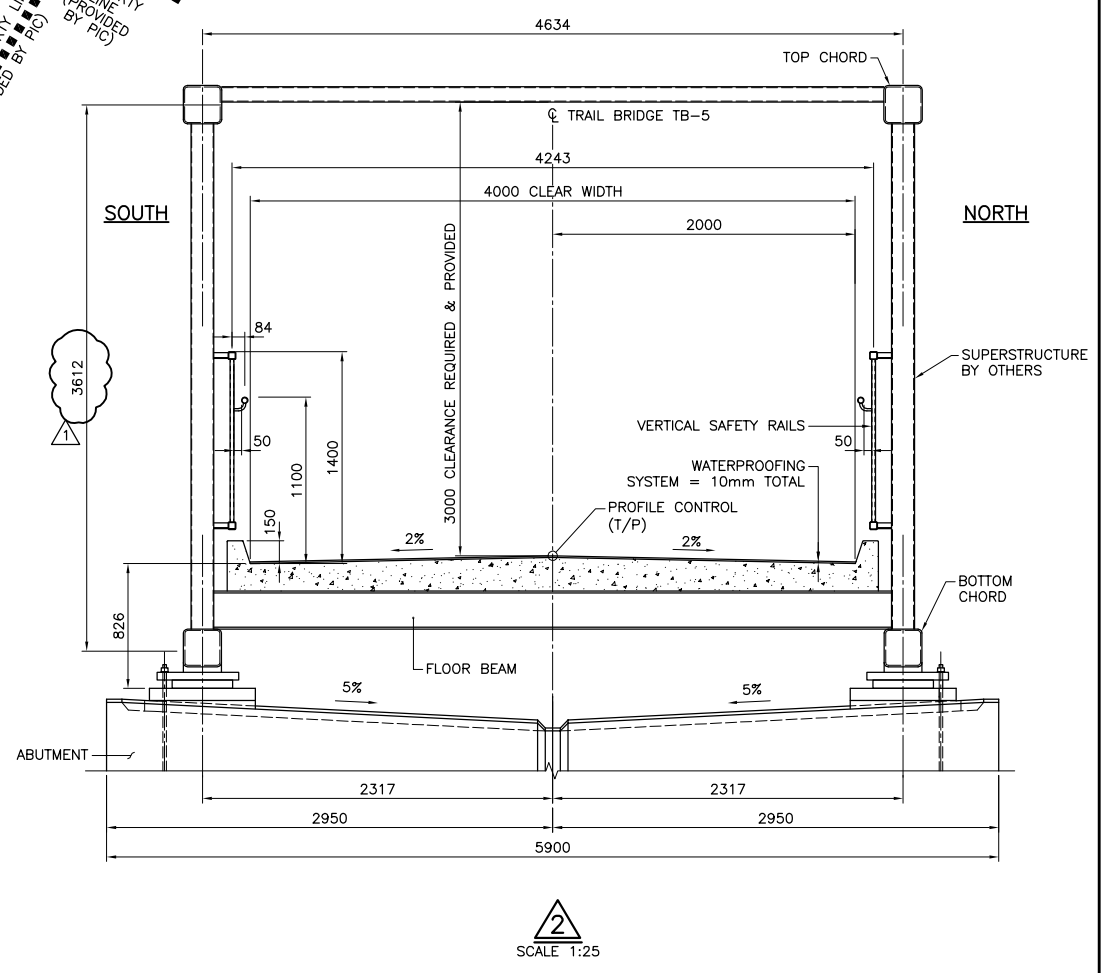
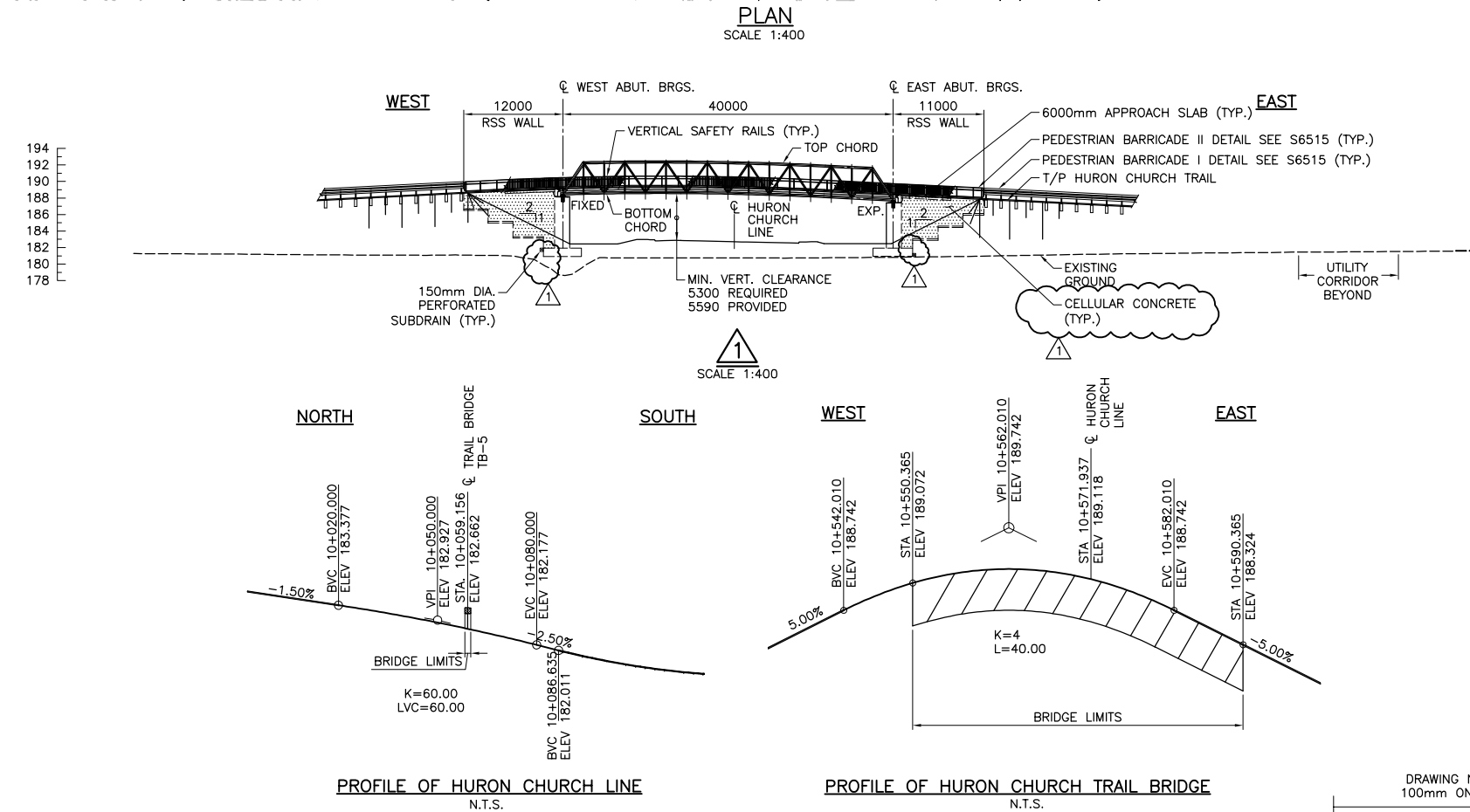
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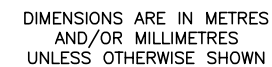
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GENERAL ARRANGEMENT

SHEET
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Phase 1
IFC



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Windsor-Essex
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Phase 1
IFC



PROFILE OF COUSINEAU RD.
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PROFILE OF COUSINEAU TRAIL BRIDGE
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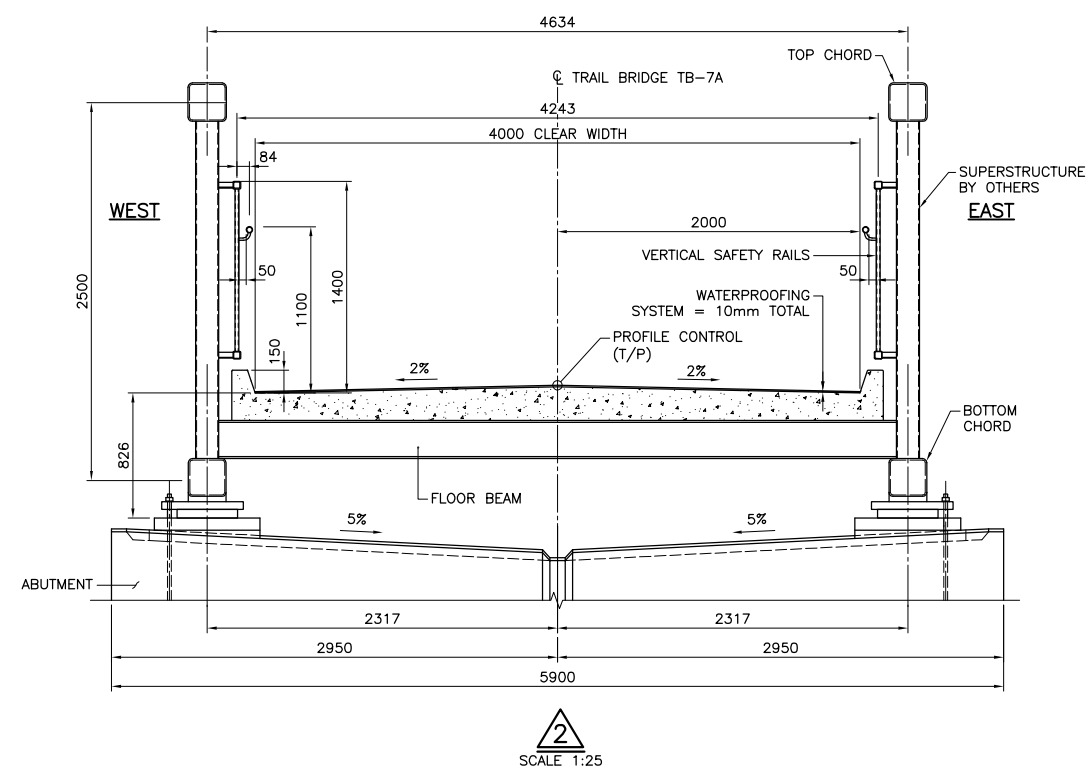
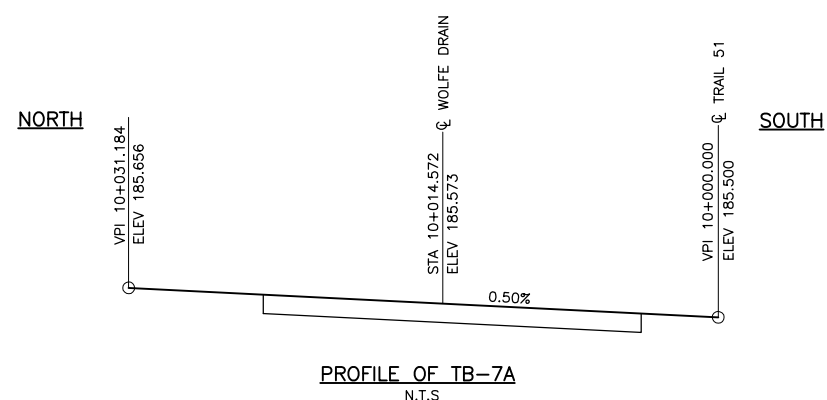
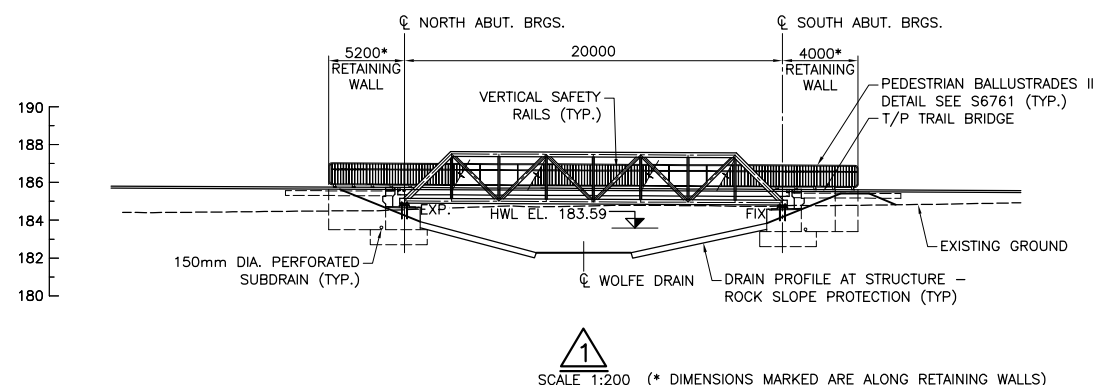
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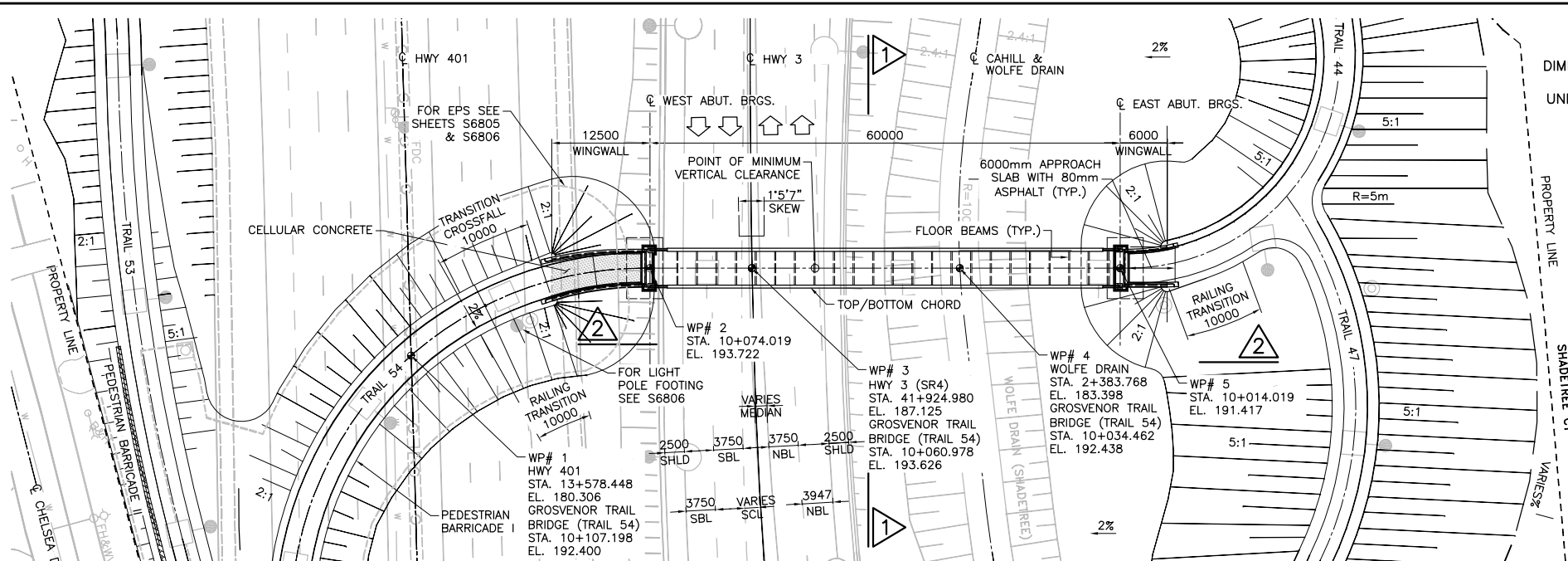


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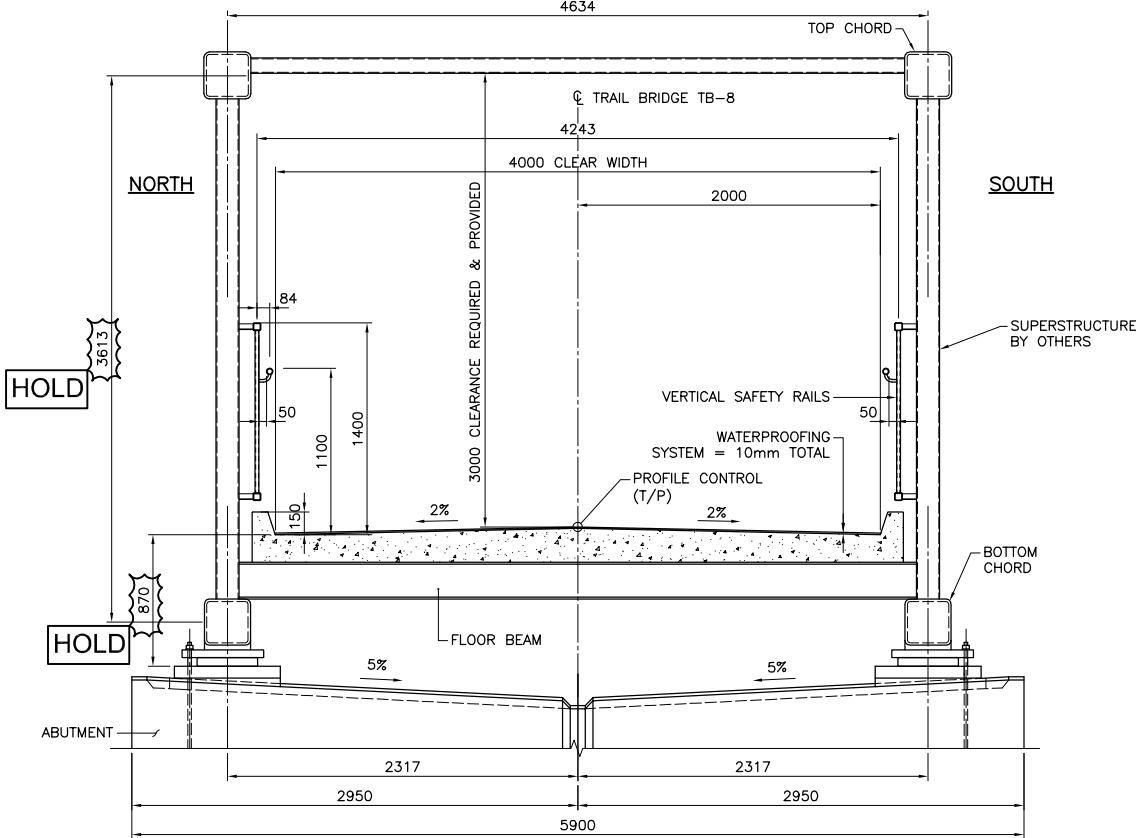
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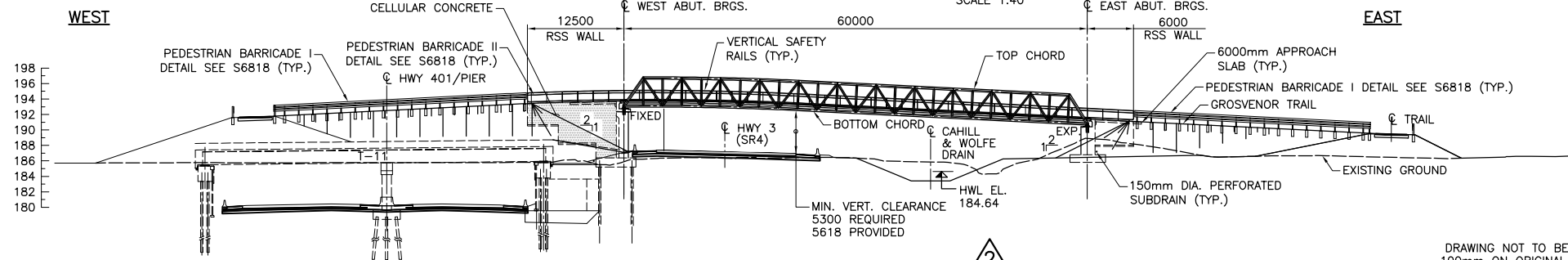
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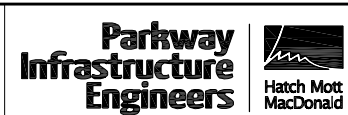


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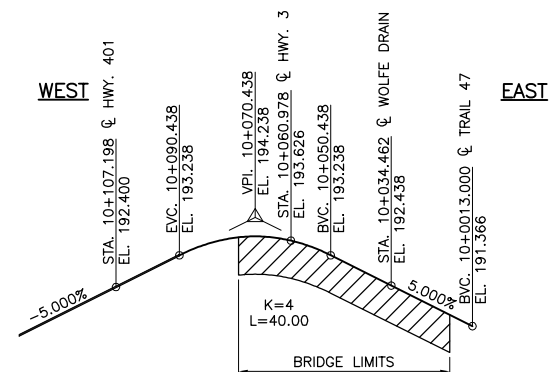
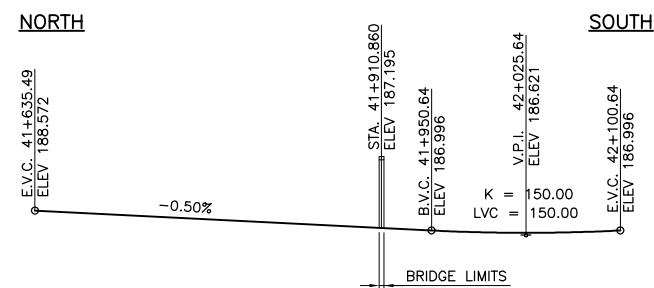
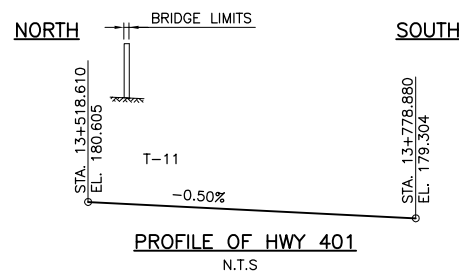


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Parkway Project
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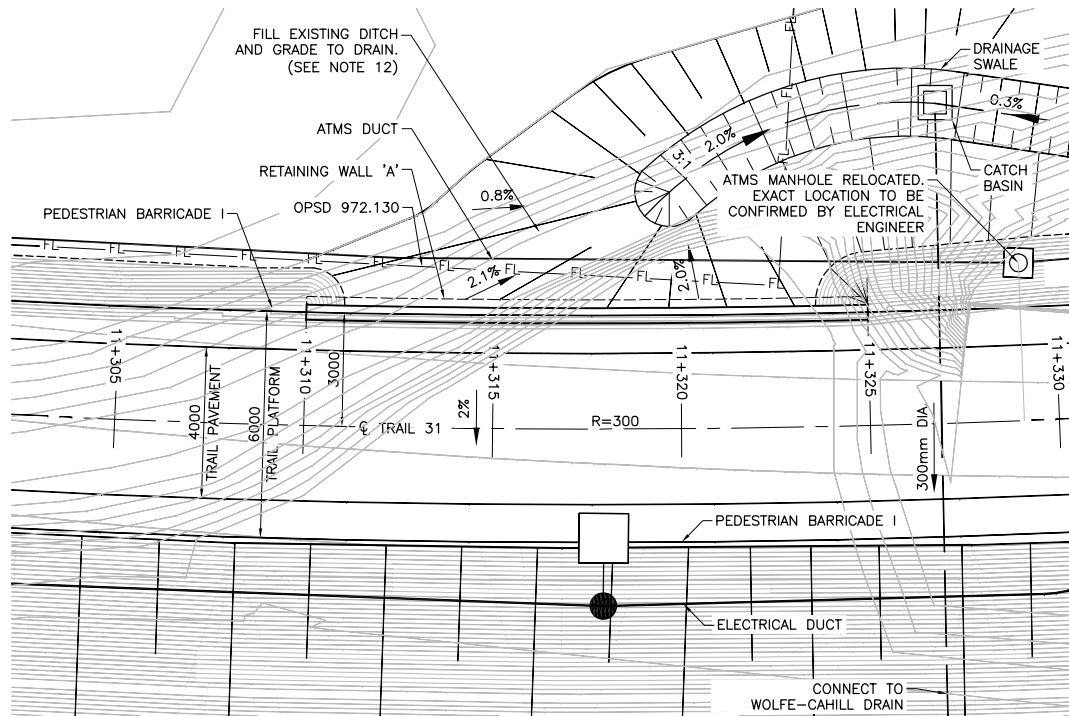
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TRAIL BRIDGE OVER HWY 3 (SR4) TB-8
GENERAL ARRANGEMENT

SHEET
S6801

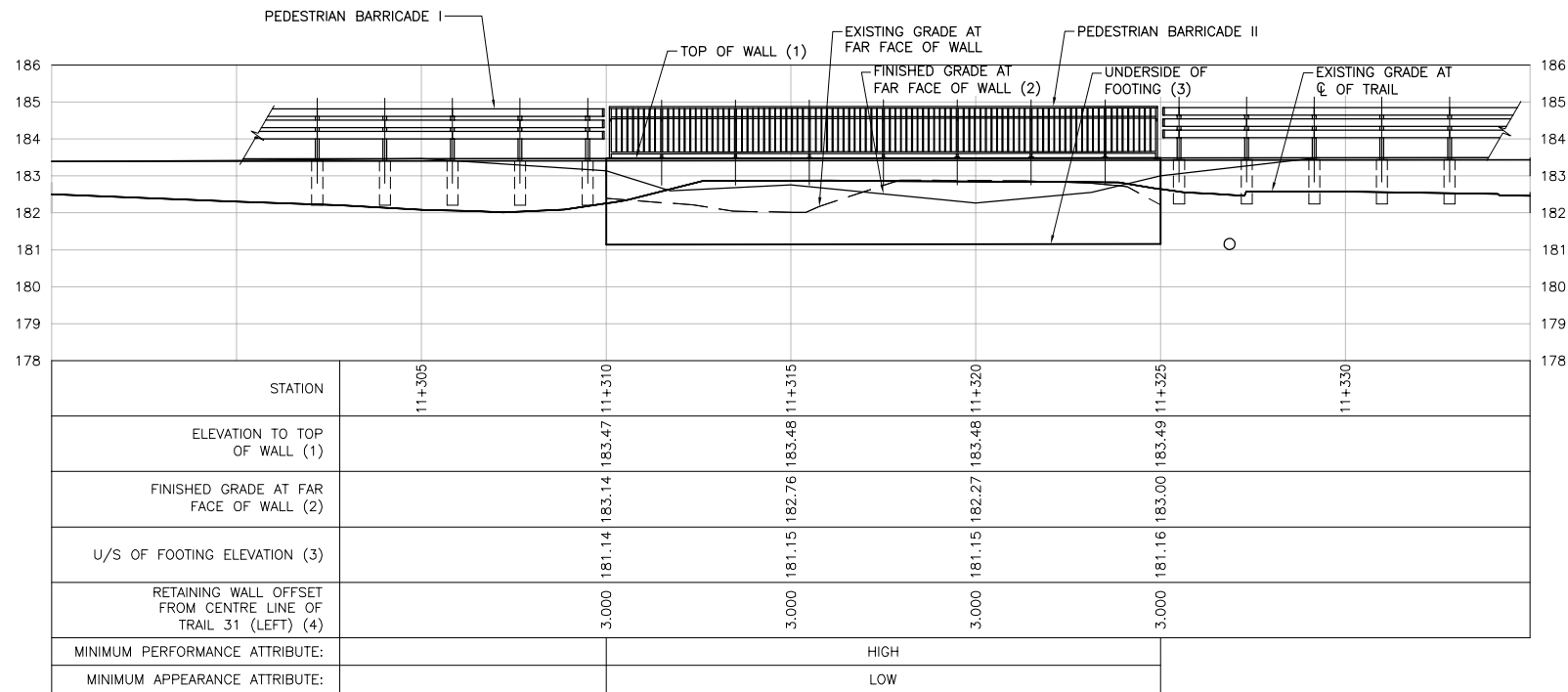
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DRAWN	RD	CHK	MAS	SITE	6-624	DATE	JULY 2010



PLAN
SCALE 1:100



WALL "A" PROFILE
SCALE 1:100

METRIC

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



NEW CONSTRUCTION
TRAIL 31 - STA 11+310 TO 11+325
TOE RETAINING WALL "A"
GENERAL ARRANGEMENT

SHEET
S8701

Phase 1
90% Sub

GENERAL NOTES:

- CLASS OF CONCRETE 30MPa, EXCEPT AS NOTED.
BLIND CONCRETE TO BE TYPE GU CLASS, 20MPa.
- ABBREVIATIONS
ALT ALTERNATE
OF OUTSIDE FACE
IF INSIDE FACE
EF EACH FACE
TOC TOP OF CONCRETE
EOP EDGE OF PAVEMENT
TYP TYPICAL
- FOUNDATION SOILS:
- UNDISTURBED STIFF NATIVE CLAYEY SILT/SILTY CLAY OR
ENGINEERED FILL
BEARING CAPACITY: FACTORED ULS 150kPa (MIN.); (ESTIMATED MAX. SETTLEMENT 25mm CORRESPONDING SLS REACTION 360kPa.)
- REFER TO LANDSCAPE CONSTRUCTION DRAWINGS AND HIGHWAY NEW CONSTRUCTION DRAWINGS FOR FENCING DETAILS AND LAYOUT, INCLUDING RIGHT OF WAY FENCE, SECURITY FENCE, NOISE WALLS, LANDSCAPE AND TRAIL BARRIERS.
- FOR ALL HIGHWAY WORKS REFER TO HIGHWAY NEW CONSTRUCTION DRAWINGS.
- FOR ALL ELECTRICAL WORKS REFER TO ELECTRICAL NEW CONSTRUCTION DRAWINGS.
- FOR ALL UTILITY WORKS REFER TO UTILITY NEW CONSTRUCTION DRAWINGS.
- REFER TO TRAIL DRAWINGS FOR ASPHALT THICKNESSES AND GRANULAR BASE DETAILS.
- 10mm PREFORMED JOINT FILLER, TYPE A, NON-EXTRUDING AND RESILIENT BITUMINOUS AS SPECIFIED.
- COLD APPLIED RUBBER ASPHALT JOINT SEALING COMPOUND.
- TOE WALLS SHALL BE BACKFILLED WITH WELL-GRADED FREE DRAINING GRANULAR MATERIAL (GROUP I SOIL) COMPACTED TO MIN. 95% STANDARD PROCTOR MAX. DRY DENSITY.
- STRIP TOPSOIL, MUD, ETC AND FILL EXISTING DITCH AND LOW POINTS ON THE NORTH SIDE ADJACENT TO THE TRAIL FROM APPROX. 11+320 TO 11+410. GRADE THE SURFACE TO DRAIN TO THE TWO CATCH BASINS FROM A HIGH POINT ELEV. OF 182.70 AT 11+355 WITH APPROVED COMPACTED FILL.
- DESIGN SOIL PARAMETERS (GROUP I SOIL):
FILL UNIT WEIGHT = 22kN/m³
FRICTION ANGLE = 33°
K_a = 0.30

HOLD

CONSTRUCTION NOTES:

- CONTRACTOR IS FULLY RESPONSIBLE FOR THE DESIGN, CONSTRUCTION METHODS AND PERFORMANCE OF THE TEMPORARY SLOPES AND WORKS. EXCAVATED CLAY SURFACES ARE SUSCEPTIBLE TO DETERIORATION AND EXPERIENCE DEFORMATIONS AND INSTABILITY. THEY ARE TO BE APPROPRIATELY PROTECTED, REGULARLY INSPECTED, AND TREATED AS REQUIRED.
- 20MPa CONCRETE MUD SLAB FOR SUBGRADE PROTECTION TO BE PLACED AFTER APPROVAL OF SUBGRADE BY GEOTECHNICAL ENGINEER.
- ALL TOPSOIL, DISTURBED SOILS, SEEPAGE AND OTHER DELETERIOUS MATERIALS MUST BE COMPLETELY REMOVED FROM THE FOOTPRINT AREA OF THE STRUCTURE FOUNDATION. CORRECT DEFICIENT SUBGRADE AS DIRECTED BY GEOTECHNICAL ENGINEER WITH APPROVED GRANULAR MATERIAL AND COMPACT TO MIN. 98% PROCTOR DENSITY PRIOR TO PLACEMENT OF TOE RETAINING WALL.
- SUBGRADE MUST BE PROTECTED AGAINST FREEZING AT ALL TIMES UNTIL COMPLETION OF BACKFILLING.
- BACKFILLING BEHIND THE WALL SHALL NOT EXCEED AT ANY TIME BY MORE THAN 1m THE GRADE IN FRONT OF THE WALL.

APPLICABLE STANDARD DRAWINGS:

OPSD-705.030 PRECAST CONCRETE DITCH INLET 600x600mm
OPSD-972.130 FENCE, CHAIN-LINK INSTALLATION - ROADWAY
OPSD-3120.100 WALLS - RETAINING - CONCRETE TOE WALL
OPSD-3121.150 WALLS, RETAINING, BACKFILL, MINIMUM GRANULAR REQUIREMENT
OPSD-3190.100 WALLS - RETAINING AND ABUTMENT - WALL DRAIN
OPSD-3941.200 FIGURES IN CONCRETE SITE NUMBER AND DATE LAYOUT

PEDESTRIAN RAILING NOTES:

- FOR PEDESTRIAN BARRICADE NOTES, SEE SHEET S8709.

NOT FOR
CONSTRUCTION

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS	DATE		REV.		BY		DESCRIPTION	
	DATE		REV.		BY		DESCRIPTION	
	04-JUN-14	B1	MY	90%	FINAL	IDR	SUBMISSION	
	04-NOV-13	A	MAS	60%	MTD	SUBMISSION		
DESIGN	BM	CHK	JL	CODE	CAN/CSA	S6-06	LOAD	SEE NOTES
DRAWN	MAS	CHK	JL	SITE	N.A.		DATE	SEPT 2013

DATE PLOTTED: 7/16/2014 2:22:49 PM
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MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707
BB-05

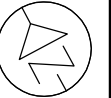
METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

**Parkway
Infrastructure
Engineers**



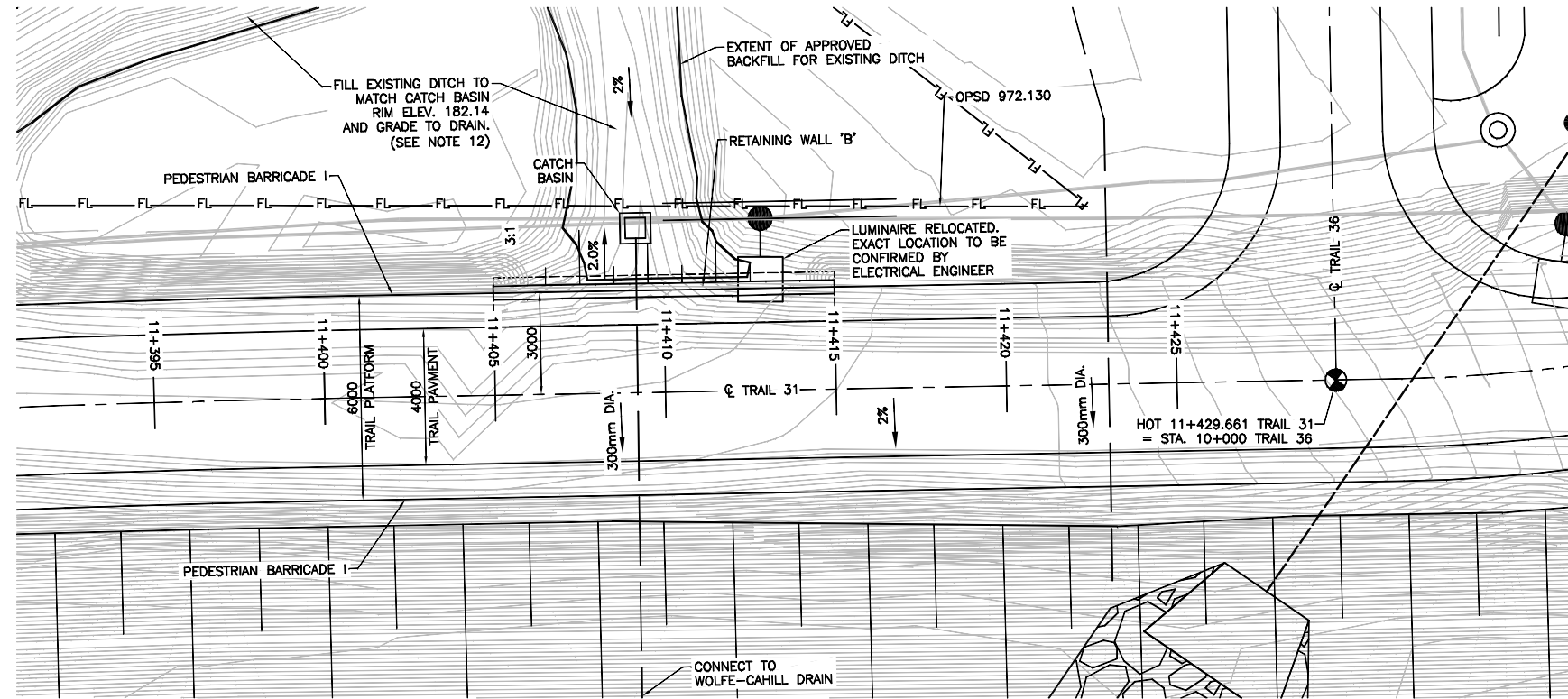
Windsor-Essex
Parkway Project
RFP No. 09-54-1007



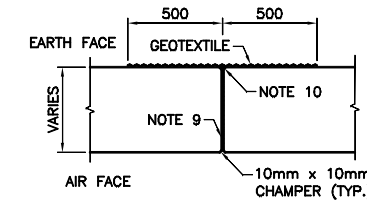
NEW CONSTRUCTION
TRAIL 31 - STA 11+405 TO 11+415
TOE RETAINING WALL "B"
GENERAL ARRANGEMENT

SHEET
S8703

Phase 1
90% Sub



PLAN
SCALE 1:200



PLAN OF JOINT DETAIL IN
CONCRETE TOE WALLS AT
3.0m SPACING (MAX.)
SCALE 1:20

GENERAL NOTES:

- CLASS OF CONCRETE 30MPa, EXCEPT AS NOTED. BLIND CONCRETE TO BE TYPE GU CLASS, 20MPa.
- ABBREVIATIONS
ALT ALTERNATE
OF OUTSIDE FACE
IF INSIDE FACE
EF EACH FACE
TOC TOP OF CONCRETE
EOP EDGE OF PAVEMENT
TYP TYPICAL
HOT HUB ON TANGENT
- FOUNDATION SOILS:
- UNDISTURBED STIFF NATIVE CLAYEY SILT/SILTY CLAY OR ENGINEERED FILL
BEARING CAPACITY: FACTORED ULS 150KPa (MIN.); (ESTIMATED MAX SETTLEMENT 25mm CORRESPONDING SLS REACTION 360KPa).
- REFER TO LANDSCAPE CONSTRUCTION DRAWINGS AND HIGHWAY NEW CONSTRUCTION DRAWINGS FOR FENCING DETAILS AND LAYOUT, INCLUDING RIGHT OF WAY FENCE, SECURITY FENCE, NOISE WALLS, LANDSCAPE AND TRAIL BARRIERS.
- FOR ALL HIGHWAY WORKS REFER TO HIGHWAY NEW CONSTRUCTION DRAWINGS.
- FOR ALL ELECTRICAL WORKS REFER TO ELECTRICAL NEW CONSTRUCTION DRAWINGS.
- FOR ALL UTILITY WORKS REFER TO UTILITY NEW CONSTRUCTION DRAWINGS.
- REFER TO TRAIL DRAWINGS FOR ASPHALT THICKNESSES AND GRANULAR BASE DETAILS.
- 10MM PREFORMED JOINT FILLER, TYPE A, NON-EXTRUDING AND RESILIENT BITUMINOUS AS SPECIFIED.
- COLD APPLIED RUBBER ASPHALT JOINT SEALING COMPOUND.
- TOE WALLS SHALL BE BACKFILLED WITH WELL GRADED FREE DRAINING GRANULAR MATERIAL (GROUP 1 SOIL) COMPACTED TO MIN. 95% STANDARD PROCTOR MAX. DRY DENSITY.
- STRIP TOPSOIL, MUD, ETC AND FILL EXISTING DITCH AND LOW POINTS ON THE NORTH SIDE ADJACENT TO THE TRAIL FROM APPROX. 11+320 TO 11+410. GRADE THE SURFACE TO DRAIN TO THE TWO CATCH BASINS FROM A HIGH POINT ELEV. OF 182.70 AT 11+355 WITH APPROVED COMPACTED FILL.
- DESIGN SOIL PARAMETERS (GROUP 1 SOIL):
FILL UNIT WEIGHT = 22KN/M³
FRICTION ANGLE = 3°
K_o = 0.30

HOLD

CONSTRUCTION NOTES:

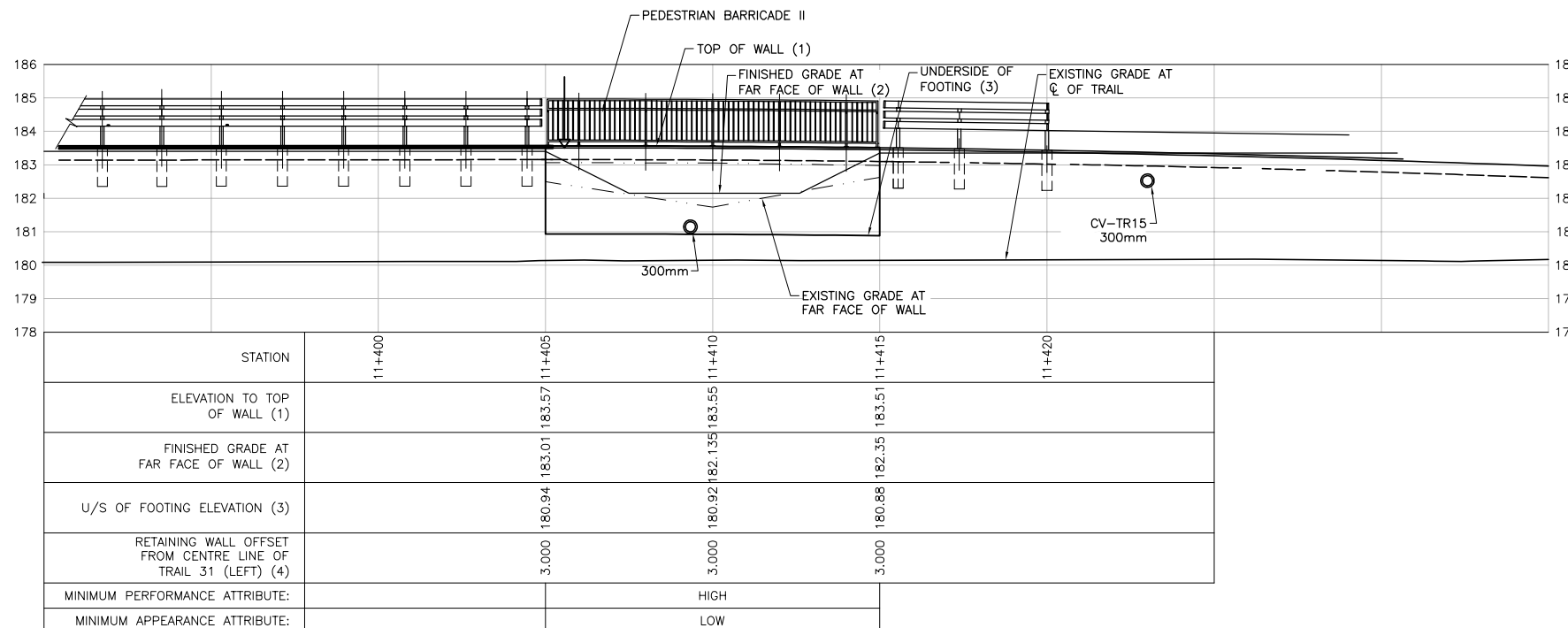
- CONTRACTOR IS FULLY RESPONSIBLE FOR THE DESIGN, CONSTRUCTION METHODS AND PERFORMANCE OF THE TEMPORARY SLOPES AND WORKS. EXCAVATED CLAY SURFACES ARE SUSCEPTIBLE TO DETERIORATION AND EXPERIENCE DEFORMATIONS AND INSTABILITY. THEY ARE TO BE APPROPRIATELY PROTECTED, REGULARLY INSPECTED, AND TREATED AS REQUIRED.
- 20MPa CONCRETE MUD SLAB FOR SUBGRADE PROTECTION TO BE PLACED AFTER APPROVAL OF SUBGRADE BY GEOTECHNICAL ENGINEER.
- ALL TOPSOIL, DISTURBED SOILS, SEEPAGE AND OTHER DELETERIOUS MATERIALS MUST BE COMPLETELY REMOVED FROM THE FOOTPRINT AREA OF THE STRUCTURE FOUNDATION. CORRECT DEFICIENT SUBGRADE AS DIRECTED BY GEOTECHNICAL ENGINEER WITH APPROVED GRANULAR MATERIAL AND COMPACT TO MIN. 98% PROCTOR DENSITY PRIOR TO PLACEMENT OF CONCRETE BASE SLAB.
- SUBGRADE MUST BE PROTECTED AGAINST FREEZING AT ALL TIMES UNTIL COMPLETION OF BACKFILLING.
- BACKFILLING BEHIND THE WALL SHALL NOT EXCEED AT ANY TIME BY MORE THAN 1.3m THE GRADE IN FRONT OF THE WALL.

APPLICABLE STANDARD DRAWINGS:

OPSD-705.030 PRECAST CONCRETE DITCH INLET 600x600mm
OPSD-972.130 FENCE, CHAIN-LINK INSTALLATION - ROADWAY
OPSD-3120.100 WALLS - RETAINING - CONCRETE TOE WALL
OPSD-3121.150 WALLS, RETAINING, BACKFILL. MINIMUM GRANULAR REQUIREMENT
OPSD-3190.100 WALLS - RETAINING AND ABUTMENT - WALL DRAIN
OPSD-3941.200 FIGURES IN CONCRETE SITE NUMBER AND DATE LAYOUT

PEDESTRIAN RAILING NOTES:

- FOR PEDESTRIAN BARRICADE NOTES, SEE SHEET S8709.



WALL "B" PROFILE
SCALE 1:100

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION

REVISIONS	DATE	REV.	BY	DESCRIPTION
	DATE	REV.	BY	DESCRIPTION
	04-JUN-14	B1	MY	90% FINAL IDR SUBMISSION
	11-NOV-13	A	JL	60% MTO SUBMISSION
DESIGN	BM	CHK	JL	CODE CAN/CSA S6-06 LOAD CL 625-ONT
DRAWN	MAS	CHK	JL	SITE xxx-xxxx DATE SEPT 2013

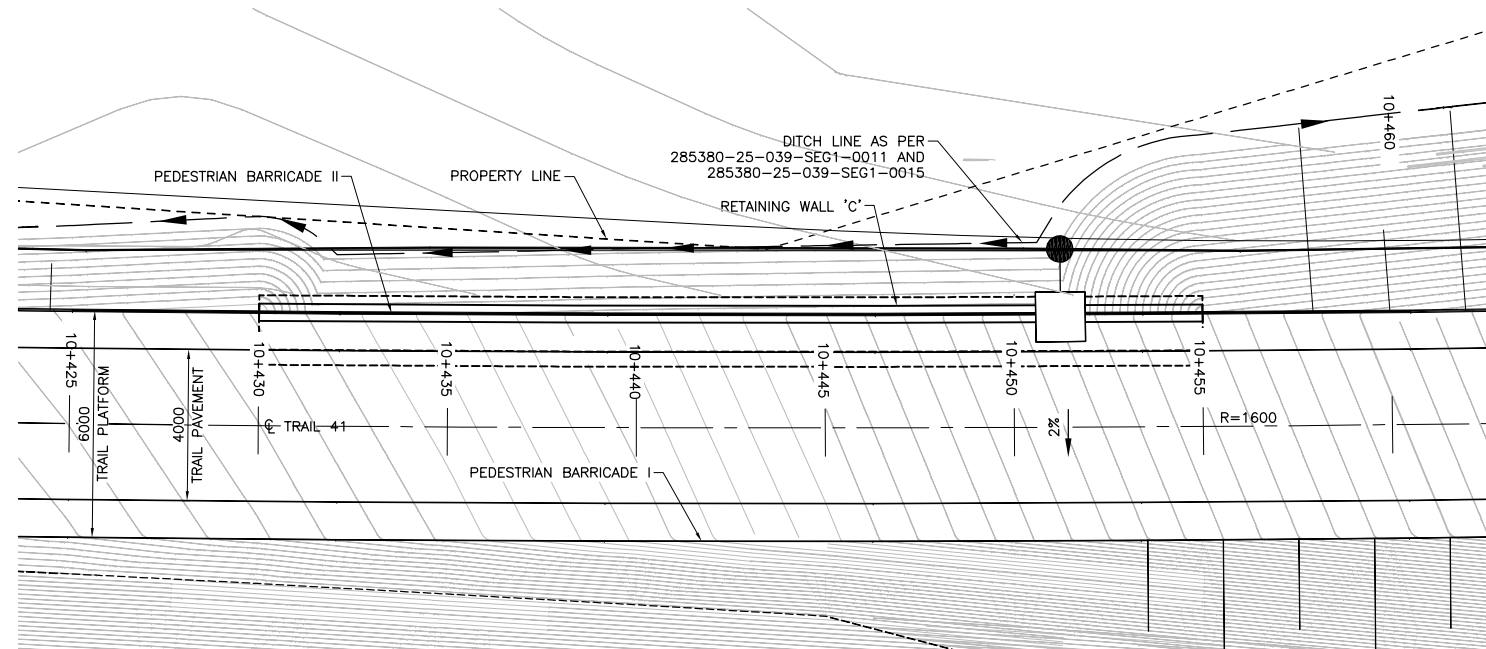
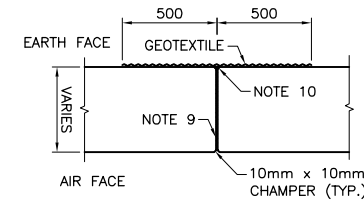
DOC: 285380-03-061-WP1-8703

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNParkway
Infrastructure
EngineersWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
TRAIL 41 - STA 10+430 TO 10+455
TOE RETAINING WALL "C"
GENERAL ARRANGEMENTSHEET
S8705

Phase 1

90% Sub

PLAN
SCALE 1:100PLAN OF JOINT DETAIL IN
CONCRETE TOE WALLS AT
3.0m SPACING (MAX.)
SCALE 1:20

GENERAL NOTES:

- CLASS OF CONCRETE 30MPa, EXCEPT AS NOTED. BLIND CONCRETE TO BE TYPE GU CLASS, 20MPa.
- ABBREVIATIONS
ALT ALTERNATE
OF OUTSIDE FACE
IF INSIDE FACE
EF EACH FACE
TOC TOP OF CONCRETE
EOP EDGE OF PAVEMENT
TYP TYPICAL
- FOUNDATION SOILS:
- UNDISTURBED STIFF NATIVE CLAYEY SILT/SILTY CLAY OR ENGINEERED FILL
BEARING CAPACITY: FACTORED ULS 150KPa (MIN.); (ESTIMATED MAX SETTLEMENT 25mm CORRESPONDING SLS REACTION 360KPa).
- REFER TO LANDSCAPE CONSTRUCTION DRAWINGS AND HIGHWAY NEW CONSTRUCTION DRAWINGS FOR FENCING DETAILS AND LAYOUT, INCLUDING RIGHT OF WAY FENCE, SECURITY FENCE, NOISE WALLS, LANDSCAPE AND TRAIL BARRIERS.
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- FOR ALL ELECTRICAL WORKS REFER TO ELECTRICAL NEW CONSTRUCTION DRAWINGS.
- FOR ALL UTILITY WORKS REFER TO UTILITY NEW CONSTRUCTION DRAWINGS.
- REFER TO TRAIL DRAWINGS FOR ASPHALT THICKNESSES AND GRANULAR BASE DETAILS.
- 10MM PREFORMED JOINT FILLER, TYPE A, NON-EXTRUDING AND RESILIENT BITUMINOUS AS SPECIFIED.
- COLD APPLIED RUBBER ASPHALT JOINT SEALING COMPOUND.
- TOE WALLS SHALL BE BACKFILLED WITH WELL GRADED FREE DRAINING GRANULAR MATERIAL (GROUP 1 SOIL) COMPACTED TO 95% STANDARD PROCTOR MAX. DRY DENSITY.
- DESIGN SOIL PARAMETERS (GROUP 1 SOIL):
FILL UNIT WEIGHT = 22KN/M³
FRICTION ANGLE = 33°
K_a = 0.30

HOLD

CONSTRUCTION NOTES:

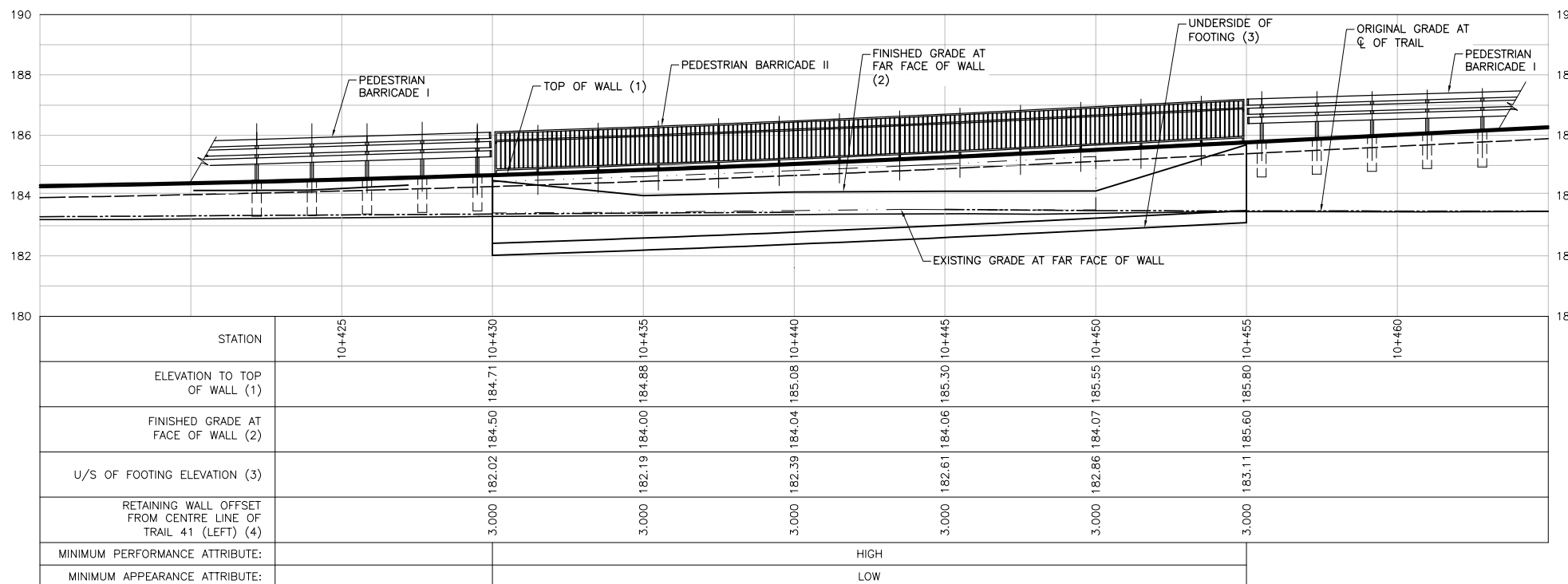
- CONTRACTOR IS FULLY RESPONSIBLE FOR THE DESIGN, CONSTRUCTION METHODS AND PERFORMANCE OF THE TEMPORARY SLOPES AND WORKS. EXCAVATED CLAY SURFACES ARE SUSCEPTIBLE TO DETERIORATION AND EXPERIENCE DEFORMATIONS AND INSTABILITY. THEY ARE TO BE APPROPRIATELY PROTECTED, REGULARLY INSPECTED, AND TREATED AS REQUIRED.
- 20MPa CONCRETE MUB SLAB FOR SUBGRADE PROTECTION TO BE PLACED AFTER APPROVAL OF SUBGRADE BY GEOTECHNICAL ENGINEER.
- ALL TOPSOIL, DISTURBED SOILS, SEEPAGE AND OTHER DELETERIOUS MATERIALS MUST BE COMPLETELY REMOVED FROM THE FOOTPRINT AREA OF THE STRUCTURE FOUNDATION. CORRECT DEFICIENT SUBGRADE AS DIRECTED BY GEOTECHNICAL ENGINEER WITH APPROVED GRANULAR MATERIAL AND COMPACT TO MIN. 98% PROCTOR DENSITY PRIOR TO PLACEMENT OF CONCRETE BASE SLAB.
- SUBGRADE MUST BE PROTECTED AGAINST FREEZING AT ALL TIMES UNTIL COMPLETION OF BACKFILLING.
- BACKFILLING BEHIND THE WALL SHALL NOT EXCEED AT ANY TIME BY MORE THAN 1.5m THE GRADE IN FRONT OF THE WALL.
- WALL DRAIN SHALL BE INSTALLED AS PER OPSD-3506.000

APPLICABLE STANDARD DRAWINGS:

OPSD-3120.100	WALLS - RETAINING - CONCRETE TOE WALL
OPSD-3121.150	WALLS, RETAINING, BACKFILL. MINIMUM GRANULAR REQUIREMENT
OPSD-3190.100	WALLS - RETAINING AND ABUTMENT - WALL DRAIN
OPSD-3506.000	RETAINING WALL AND ABUTMENT WALL DRAIN DETAIL
OPSD-3941.200	FIGURES IN CONCRETE SITE NUMBER AND DATE LAYOUT

PEDESTRIAN RAILING NOTES:

- FOR PEDESTRIAN BARRICADE NOTES, SEE SHEET S8709.

WALL "C" PROFILE
SCALE 1:100DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWINGNOT FOR
CONSTRUCTION

REVISIONS	DATE		REV.		BY		DESCRIPTION	
	DATE	REV.	DATE	REV.	DATE	REV.	DATE	REV.
	04-JUN-14	B1	MY					
	11-NOV-13	A	JL					
DESIGN	BM	CHK	JL		CODE	CAN/CSA	S6-06	LOAD SEE NOTES
DRAWN	MAS	CHK	JL		SITE	N.A.		DATE SEPT 2013

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

**Parkway
Infrastructure
Engineers**



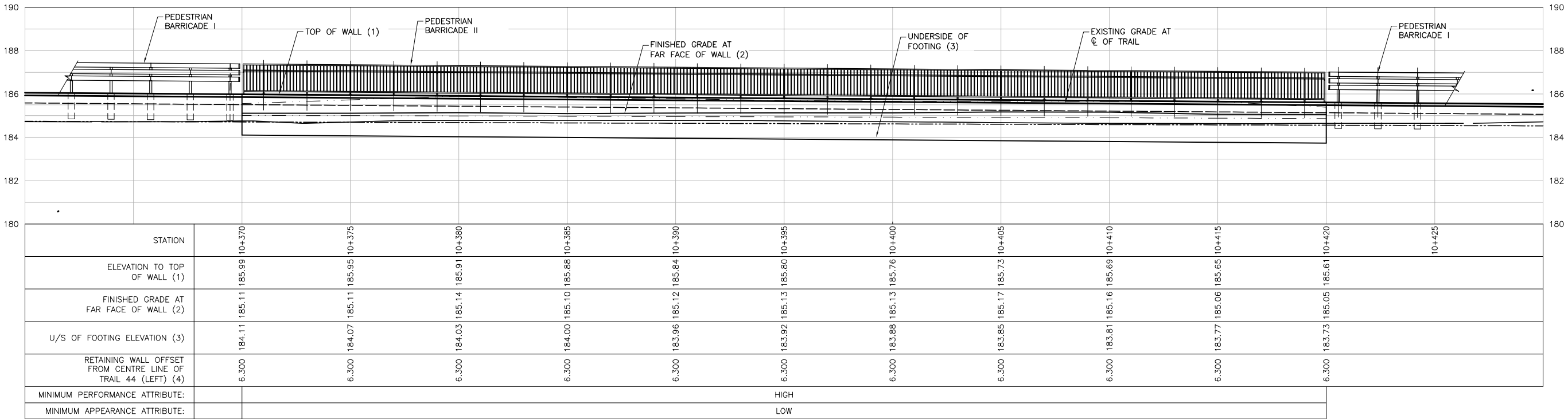
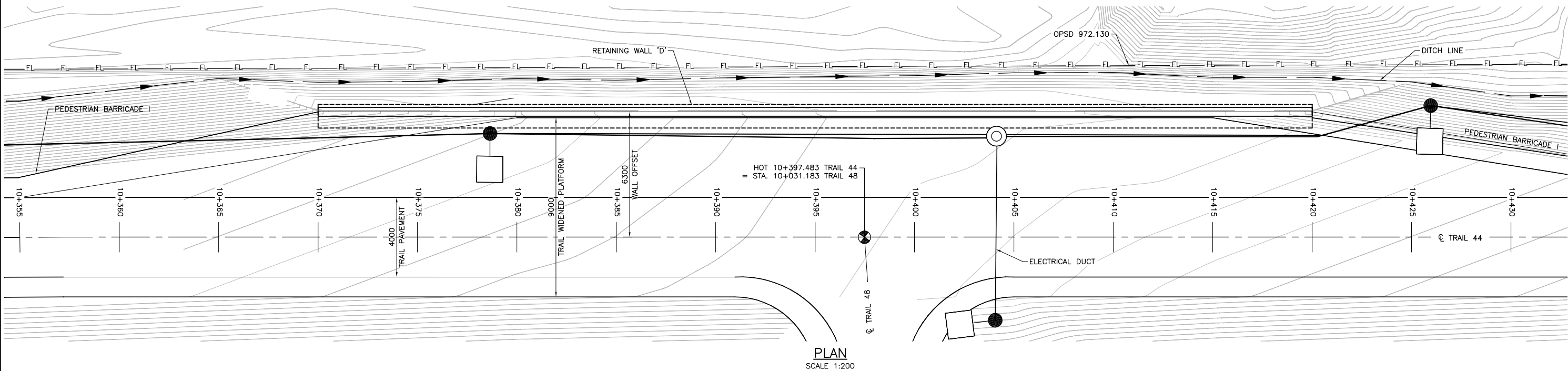
Windsor-Essex
Parkway Project
RFP No. 09-54-1007



NEW CONSTRUCTION
TRAIL 44 - STA 10+370 TO 10+420
TOE RETAINING WALL "D"
GENERAL ARRANGEMENT

SHEET
S8707

Phase 1
90% Sub



WALL "D" PROFILE
SCALE 1:200

PEDESTRIAN RAILING NOTES:

1. FOR PEDESTRIAN BARRICADE NOTES, SEE SHEET S8709.

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

NOT FOR
CONSTRUCTION

GENERAL NOTES:

1. FOR GENERAL NOTES PLEASE SEE SHEET S8708.

CONSTRUCTION NOTES:

1. FOR CONSTRUCTION NOTES PLEASE SEE SHEET S8708.

APPLICABLE STANDARD DRAWINGS:

OPSD-972.130 FENCE, CHAIN-LINK INSTALLATION - ROADWAY
OPSD-3120.100 WALLS - RETAINING - CONCRETE TOE WALL
OPSD-3121.150 WALLS, RETAINING, BACKFILL, MINIMUM GRANULAR REQUIREMENT
OPSD-3190.100 WALLS - RETAINING AND ABUTMENT - WALL DRAIN
OPSD-3506.000 RETAINING WALL AND ABUTMENT WALL DRAIN DETAIL
OPSD-3941.200 FIGURES IN CONCRETE SITE NUMBER AND DATE LAYOUT

REVISIONS		DATE	REV.	BY	DESCRIPTION
04-JUN-14	B1	MY	90% FINAL IDR SUBMISSION		
	11-NOV-13	A	JL	60% MTO SUBMISSION	
DESIGN	BM	CHK	JL	CODE CAN/CSA S6-06	LOAD SEE NOTES
DRAWN	MAS	CHK	JL	SITE N.A.	DATE SEPT 2013

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



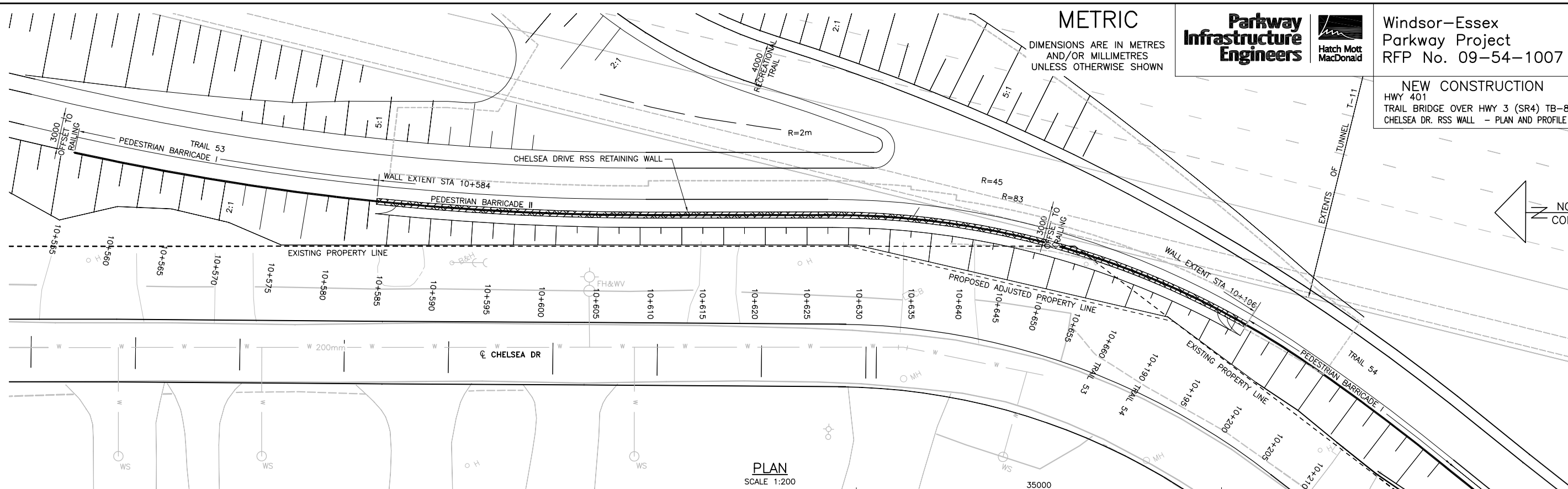
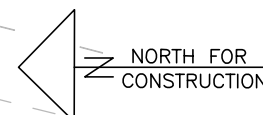
Windsor-Essex
Parkway Project
RFP No. 09-54-1007



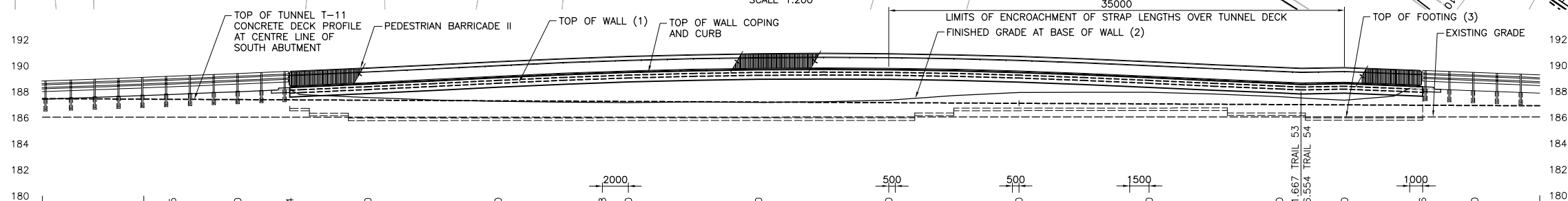
SHEET
S6815

Phase 1
IFC

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER HWY 3 (SR4) TB-8
CHELSEA DR. RSS WALL - PLAN AND PROFILE



PLAN
SCALE 1:200



	STATION	10+575	10+580	10+584	10+590	10+600	10+608	10+610	10+620	10+630	10+640	10+650	10+660	10+661.667	10+665.54	10+190	10+196	10+200
RETAINING WALL OFFSET FROM CENTRE LINE OF TRAILS 53 OR 54 (RIGHT) (4)				3.070	3.070	3.070	3.070	3.070	3.070	3.112	4.012	4.590	4.507	4.175	4.008	3.649	3.283	
ELEVATION TO TOP OF WALL (1)				187.95	188.17	188.41	188.88	189.06	189.26	189.26	189.04	188.64	188.41	188.20	188.12	188.18	187.98	
FINISHED GRADE AT BASE OF WALL (2)				187.46	187.15	186.95	186.87	186.73	186.77	186.85	187.67	187.73	187.44	187.22	187.12	187.10	186.78	
TOP OF FOOTING ELEVATION (3)				186.736 186.736 186.361 186.361 185.986	187.15 188.17	186.95 188.41	186.87 188.88	186.73 189.06	186.77 189.26	186.85 189.28	187.67 189.04	187.73 188.66	187.44 188.41	187.22 188.20	187.12 188.12	187.10 188.18	186.78 187.98	
MINIMUM PERFORMANCE ATTRIBUTE:										HIGH								
MINIMUM APPEARANCE ATTRIBUTE:										HIGH								
MINIMUM RSS WALL STRAP LENGTHS:						2.5m			3.0m	2.8m	2.5m	2.0m		1.7m				

PROFILE
SCALE 1:200

NOTES:

1. THE DRAWINGS SHOULD BE READ IN CONJUNCTION WITH THE GEOTECHNICAL REPORTS
(285380-04-119-0150)
2. THE MINIMUM REINFORCING STRIP WIDTH SHALL BE EQUAL TO THE TOTAL RSS WALL DESIGN HEIGHT.
3. THE SLOPE IN FRONT OF THE RSS WALL SHALL BE MAINTAINED WITHOUT ANY SLOUGHING/EROSION
AT ALL TIMES.
4. REFER TO HWY DRAWINGS FOR ALL HIGHWAY INFORMATION INCLUDING THE LOCATION OF DRAINS AND
CATCH BASINS.
5. THE FACTOR OF SAFETY AGAINST EXTERNAL MODES OF FAILURE FOR RSS WALLS SHALL BE AS PER
CANADIAN FOUNDATION ENGINEERING MANUAL (CFEM).
6. APPROVED RSS WALL SUPPLIER TO REFER TO UTILITIES NEW CONSTRUCTION DRAWINGS AND CONFIRM
LOCATION OF ALL UTILITIES. RSS WALL DESIGN SHALL ACCOUNT FOR ALL INTERFERENCE WITH
UTILITIES.

-RETAINED SOIL SYSTEM;

1. RSS WALL SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE 'MTO RSS DESIGN GUIDELINES' AND SPECIAL PROVISIONS SP599S22 AND SP599S23.
2. REFER TO RSS CONSTRUCTION NOTES--BACKFILL AT STRUCTURES (SHEET S6807).

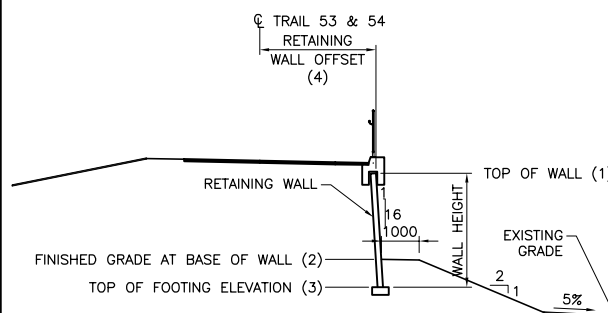
4. EPOXY COATED REINFORCEMENT SHALL BE USED IN THE FRONT SURFACE OF RSS PANELS AND ALL RSS COPING FOR ANY WALL WITHIN THE SPLASH ZONE. THIS INCLUDES PANEL SURFACES AND COPING WITHIN 10M OF AN EXISTING OR FUTURE ROADWAY, MEASURED HORIZONTAL FROM THE EDGE OF PAVEMENT UNLESS THE SURFACE IS MORE THAN 5M ABOVE THE ROADWAY.
4. LIMIT OF EXCAVATION AND TEMPORARY WORK TO BE CONFIRMED AND DESIGNED BY THE CONTRACTOR.
5. BENCHING OF EARTH SLOPES TO BE AS PER OPSD 208.010.
6. UNLESS REGULAR BACKFILL IS FILTER GRADE WITH RESPECT TO THE ADJACENT NATIVE CLAY DEPOSIT. A GEOTEXTILE LAYER (TERRAFIX 360R OR EQUIVALENT) SHALL BE PLACED ALONG THE BENCHED INTERFACE.
7. WITHIN THE RSS REINFORCING STRIPS, GRANULAR FILL IS TO BE SPECIFIED BY THE RSS SUPPLIER, UNLESS NOTED OTHERWISE.
8. FOR BACKFILL OUTSIDE OF RSS REINFORCING STRIPS, REGULAR FILL INDICATES APPROVED MATERIAL, INCLUDING SILTY CLAY, THAT MEETS THE PARAMETERS SPECIFIED IN THE GEOTECHNICAL REPORT, TO BE CONFIRMED BY THE RSS SUPPLIER AND SPECIFIED ON THE RSS SHOP DRAWINGS.

DRAINAGE:

1. CONNECT RSS SUBDRAIN(S) AND PROVIDE A POSITIVE OUTLET TO THE DRAIN IN FRONT OF THE WALL

UTILITIES:

1. REFER TO ELECTRICAL AND ATMS DRAWINGS FOR LOCATION, SITE & CONNECTION DETAILS FOR LIGHTING, POWER AND TRAFFIC MANAGEMENT.
2. INSTALLATION OF ELECTRICAL MANHOLE TO BE COORDINATED WITH THE WALL MANUFACTURE AND TO BE INSTALLED DURING THE WALL INSTALLATION NOT EXCAVATED AFTERWARD.



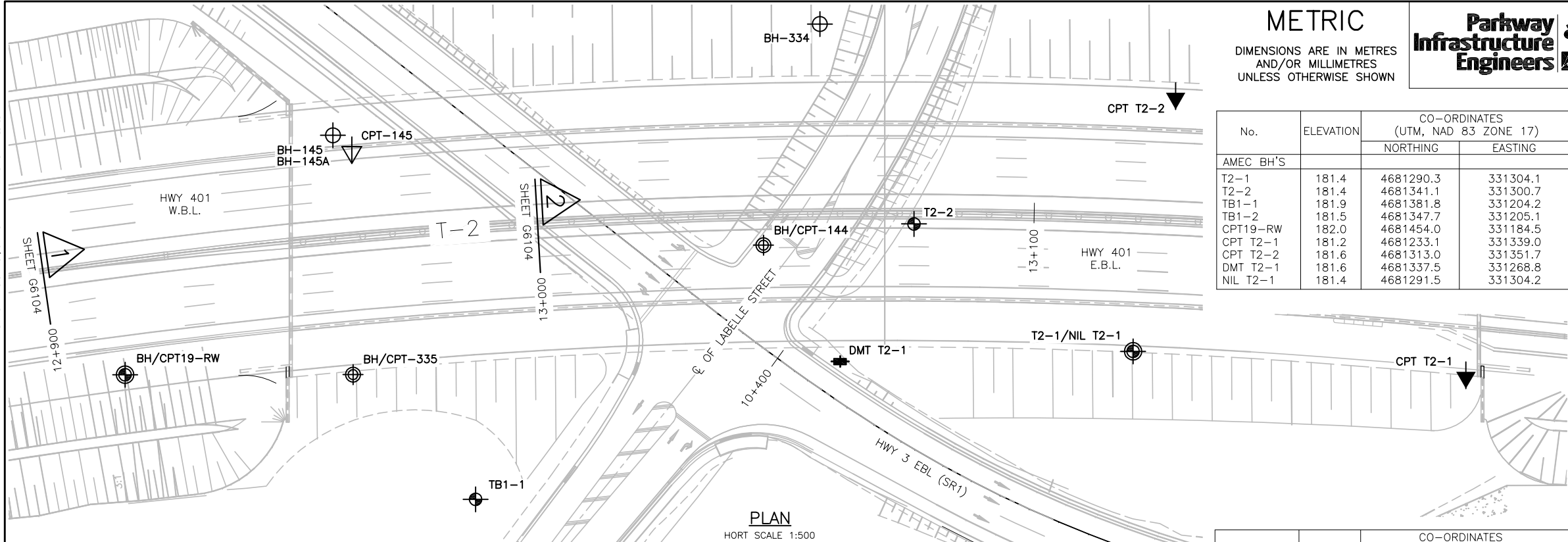
WALL LAYOUT KEY PLAN
SCALE 1:100

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

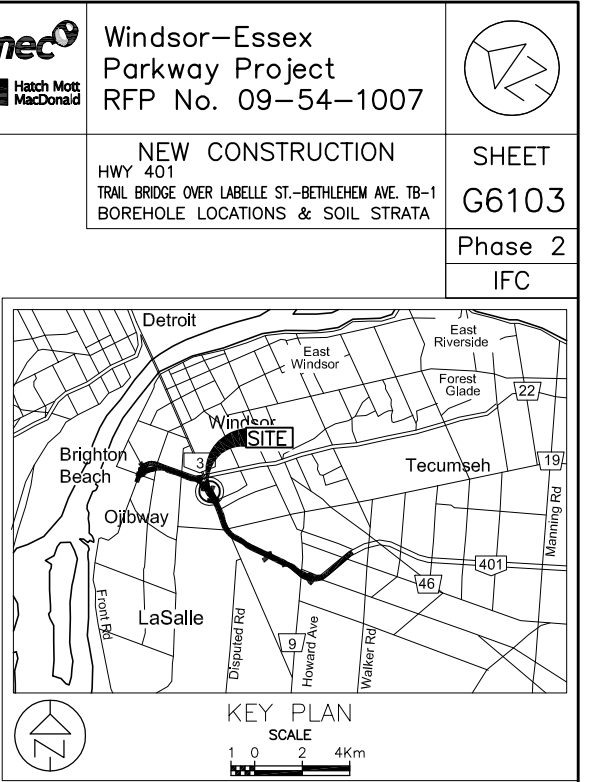
REVISIONS									
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	DATE	REV.	BY	DESCRIPTION					
	DESIGN	BM	CHK	JL	CODE	CAN/CSA	S6-06	LOAD	SEE T.A.F. DOC
	DRAWN	YZ	CHK	MAS	SITE	6-624		DATE	JUN 2013

DOC: 285380-03-061-WIP1-6819

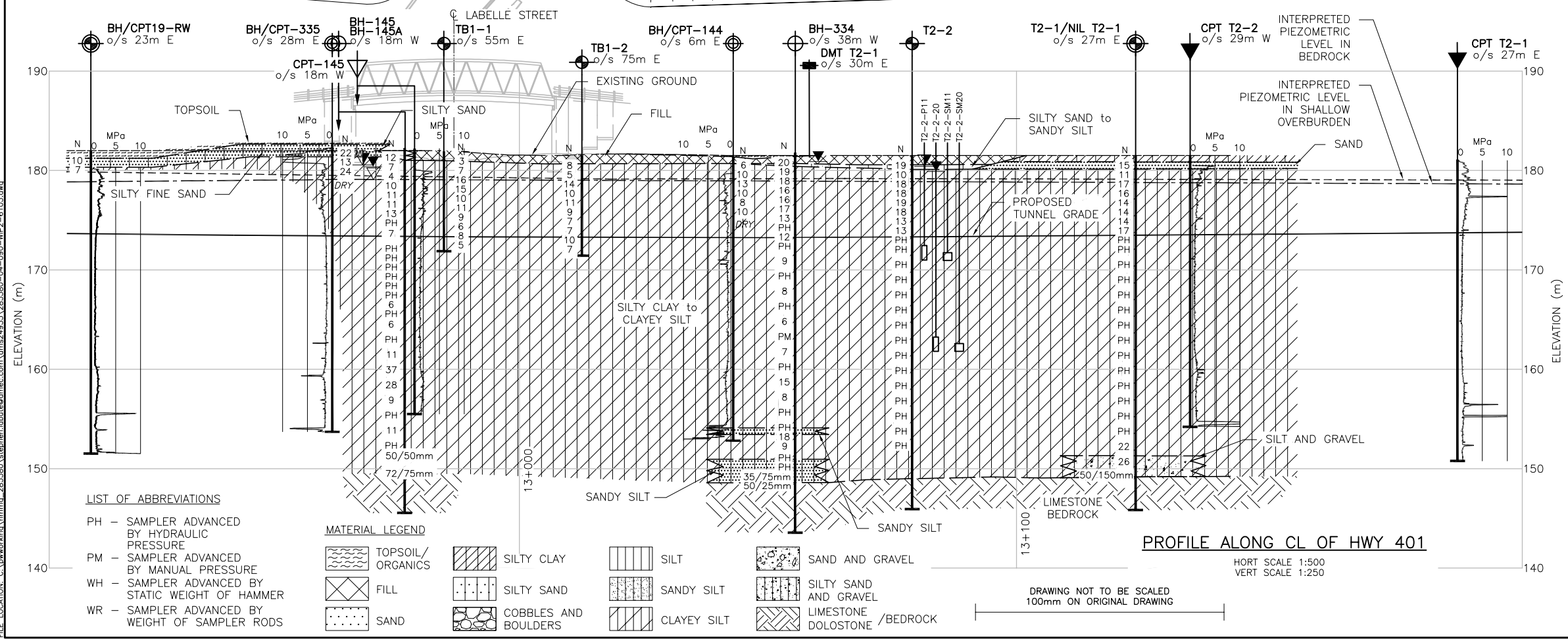
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PR-D-707 BB-05



METRIC			
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN			
No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC BH'S			
T2-1	181.4	4681290.3	331304.1
T2-2	181.4	4681341.1	331300.7
TB1-1	181.9	4681381.8	331204.2
TB1-2	181.5	4681347.7	331205.1
CPT19-RW	182.0	4681454.0	331184.5
CPT T2-1	181.2	4681233.1	331339.0
CPT T2-2	181.6	4681313.0	331351.7
DMT T2-1	181.6	4681337.5	331268.8
NIL T2-1	181.4	4681291.5	331304.2



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.

REVISIONS			
09-JUN-14	0	EA	ISSUED FOR CONSTRUCTION
DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK DD	CODE CAN/CSA
DRAWN	SJL	CHK MO	SITE 6-616
			LOAD SEE T.A.F. DOC.
			DATE 16-APR-13

METRIC

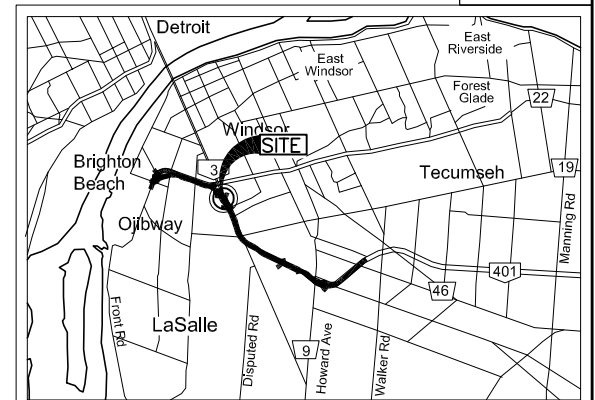
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER LABELLE ST.-BETHLEHEM AVE. TB-1
SOIL STRATIGRAPHY

SHEET

G6104

Phase 2

IFC



KEY PLAN

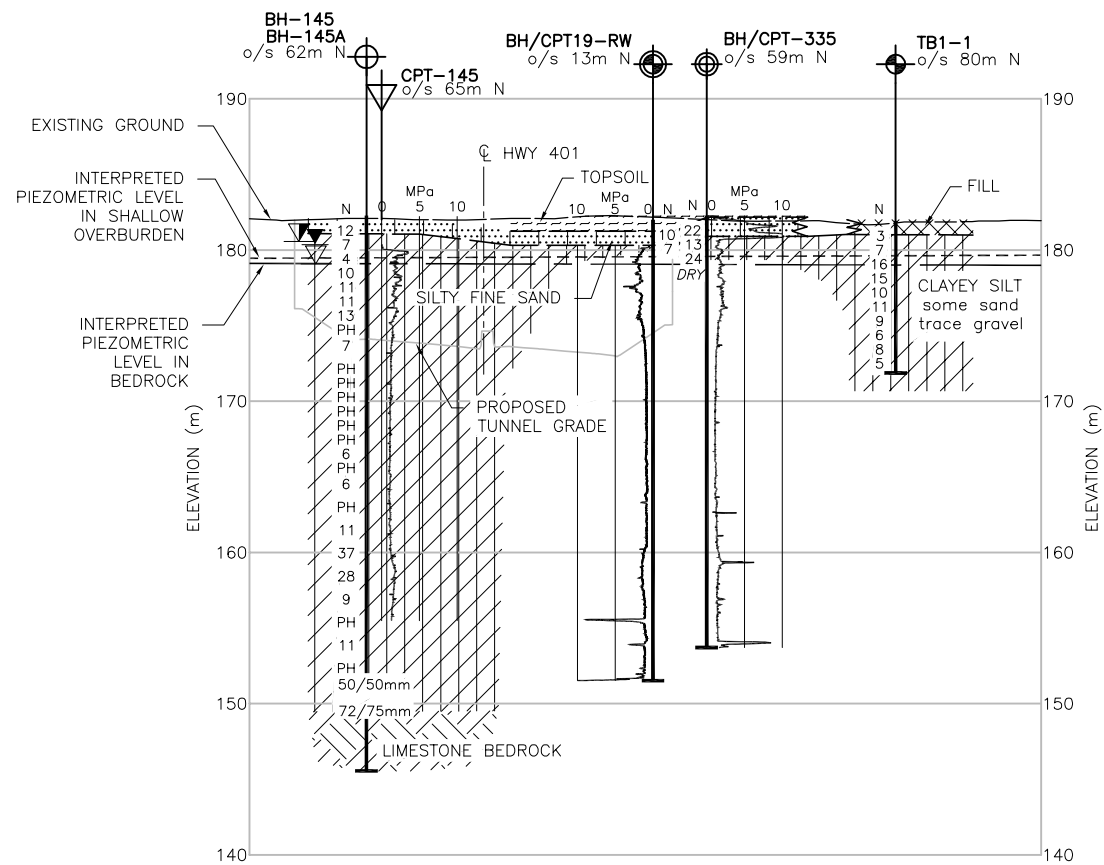
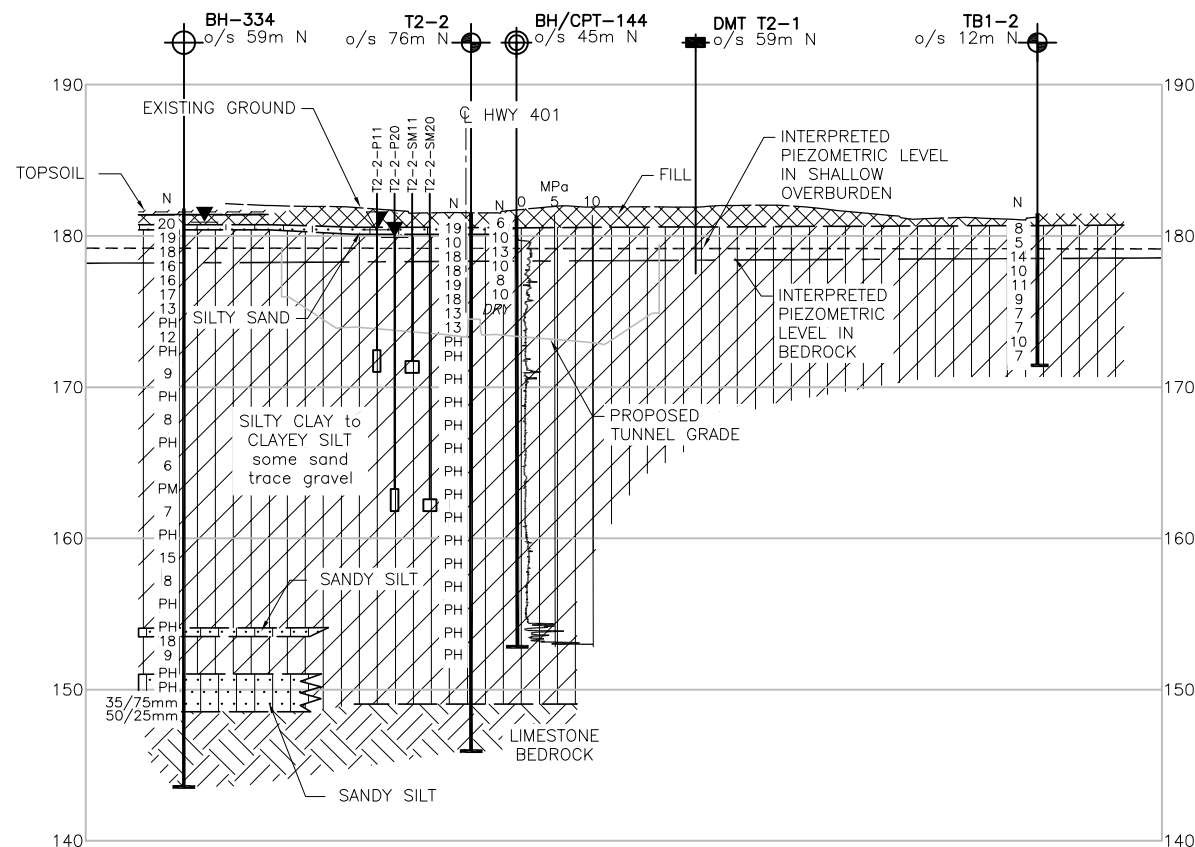
SCALE
1 0 2 4Km

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)
- 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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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250

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

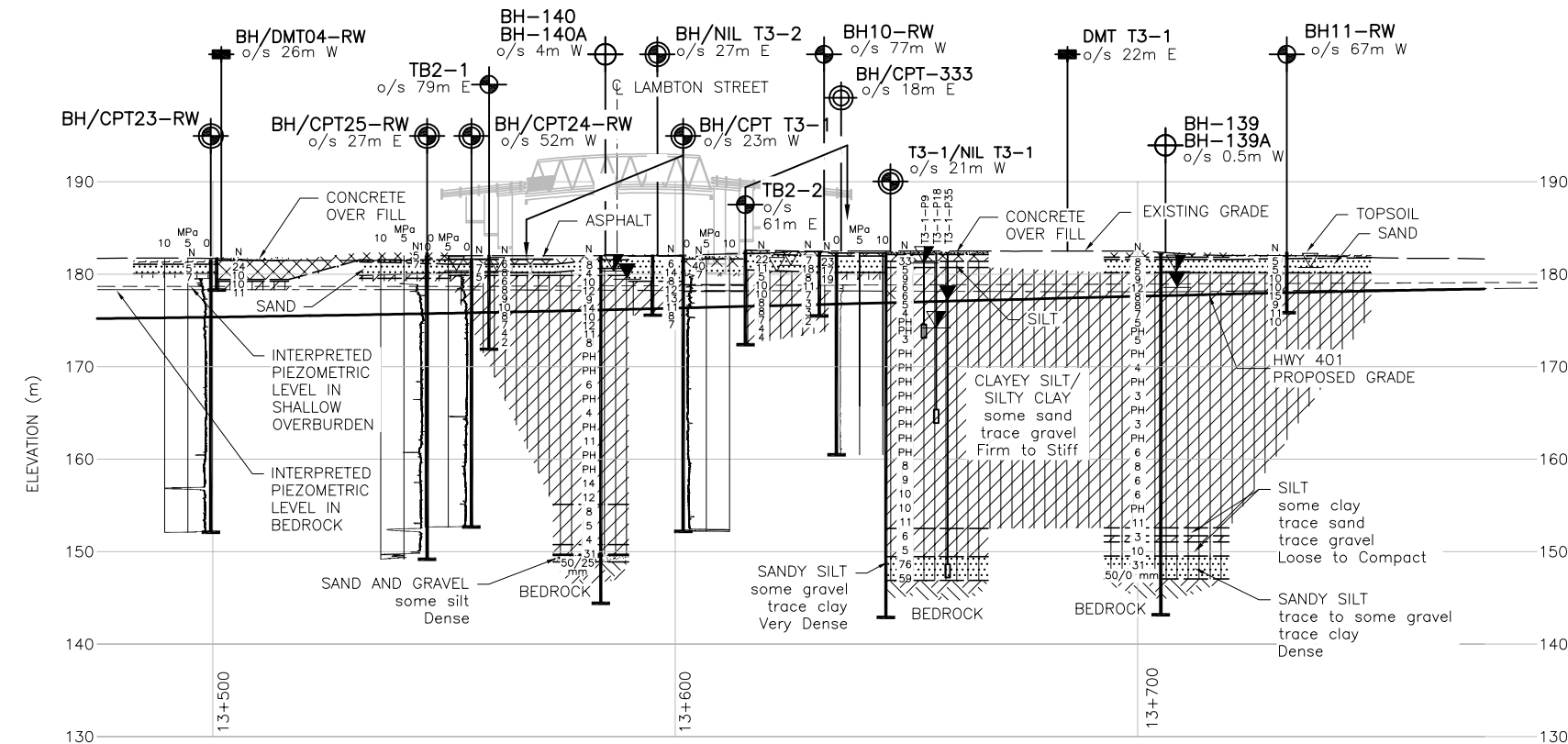
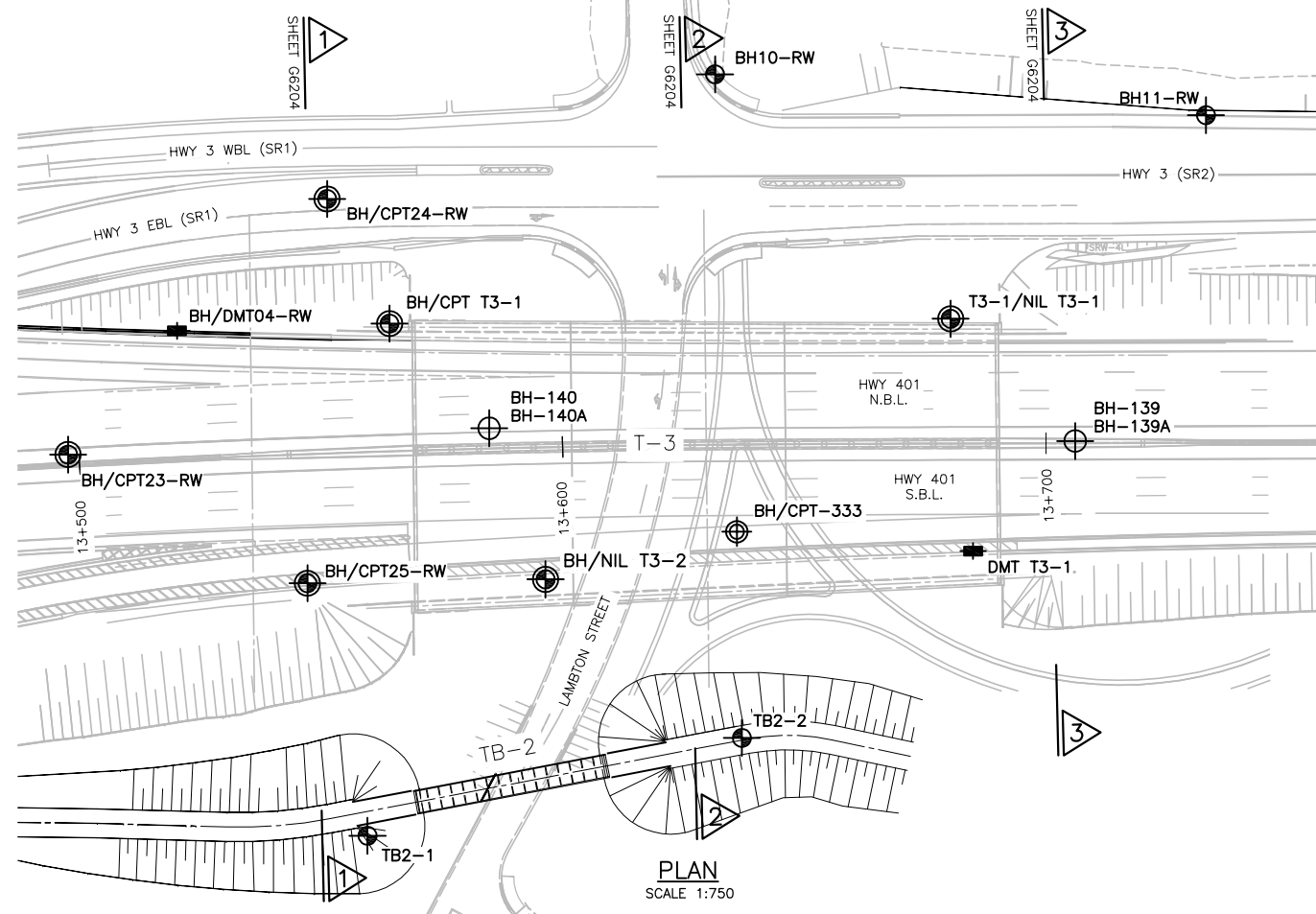
MATERIAL LEGEND

- 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

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS	DATE	REV.	BY	DESCRIPTION
09-JUN-14	0	EA		ISSUED FOR CONSTRUCTION
DESIGN	EA	CHK	DD	CODE CAN/CSA
DRAWN	SJL	CHK	MO	SITE 6-616
				LOAD SEE T.A.F. DOC.
				DATE 16-APR-13

DOC: 285380-04-091-WIP2-6104



PROFILE ALONG CL OF TUNNEL
HORT SCALE 1:750
VERT SCALE 1:375

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 OVER GRAND MARAIS-LAMBTON RD. TB-2
BOREHOLE LOCATIONS & SOIL STRATA

SHEET
G6203
Phase 2
IFC

READY FOR ISSUE		
SUBMISSION: ISSUED FOR CONSTRUCTION		
NAME (PRINT) DATE		
ORIGINATOR	E. AHMED	02-JUN-14
CHECKER	M. OLDEWENING	11-JUN-14
REVIEWER	D. DIMITRIU	

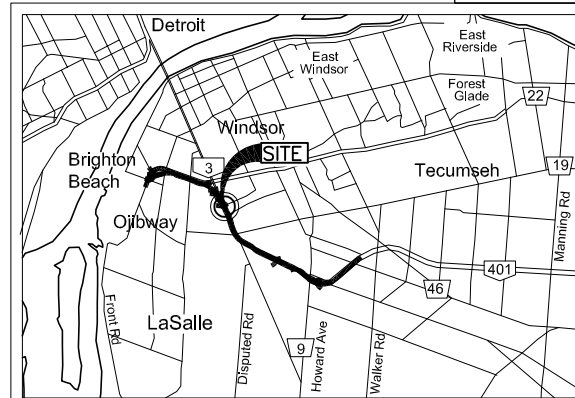
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WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

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

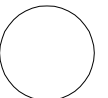
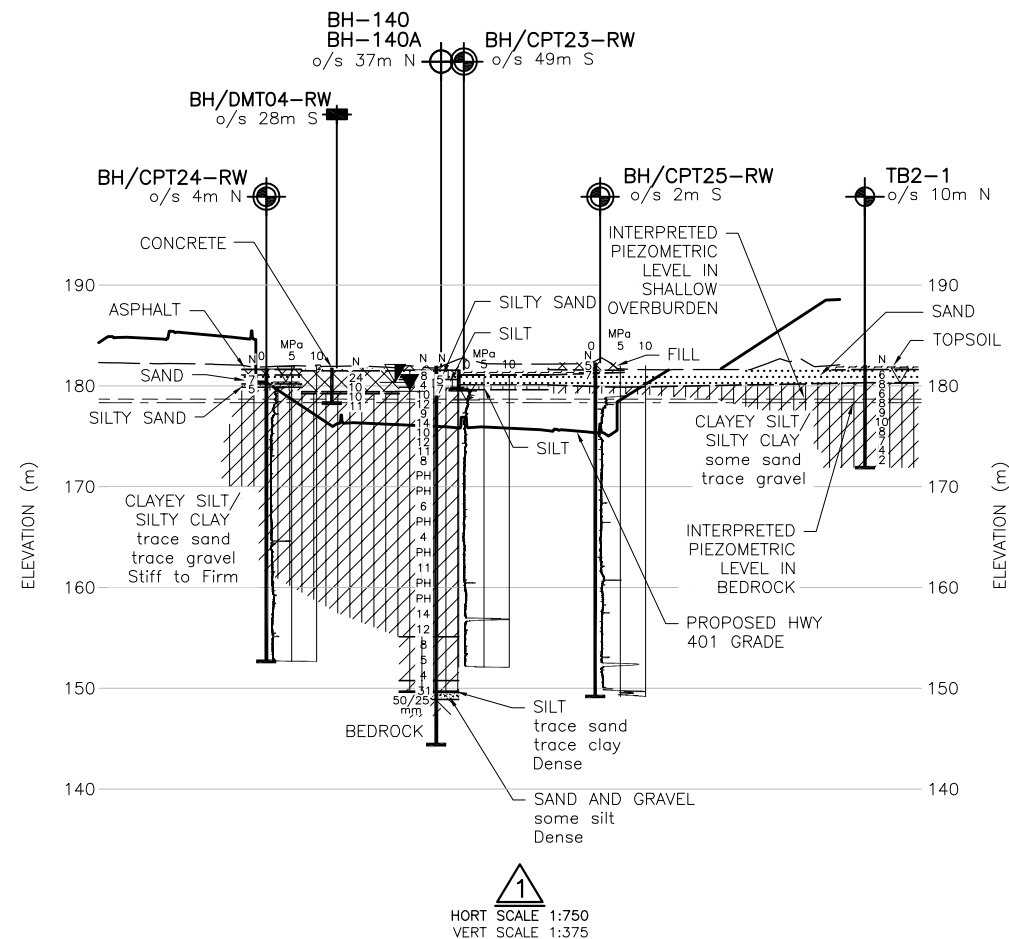
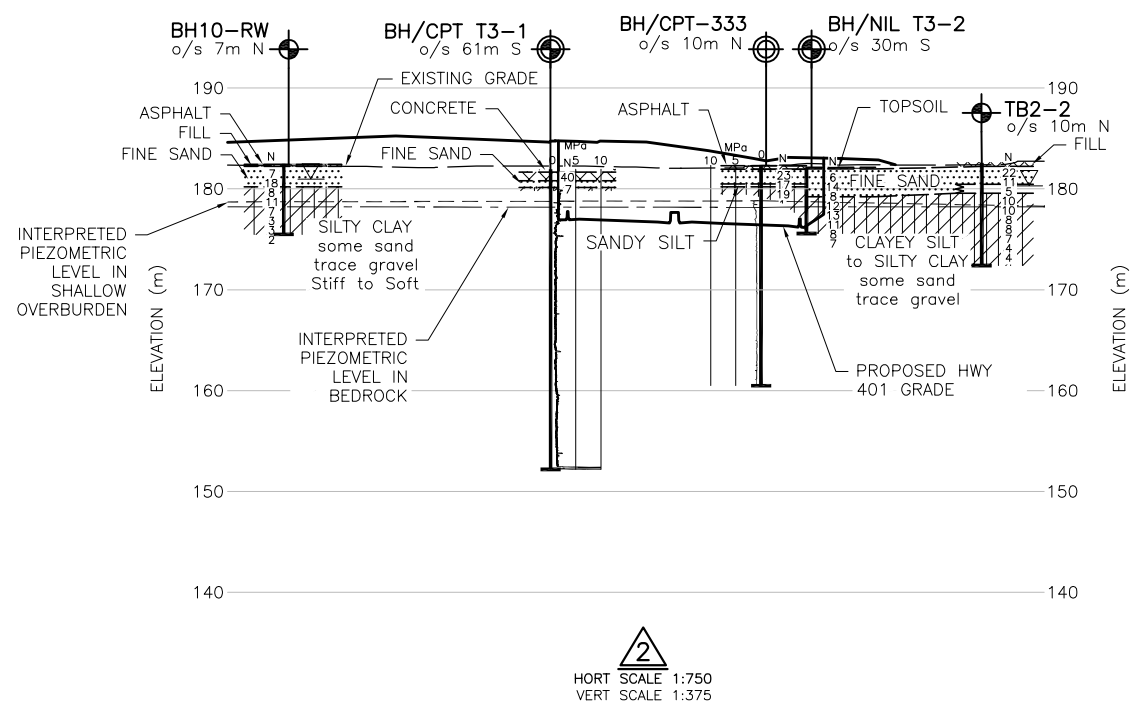
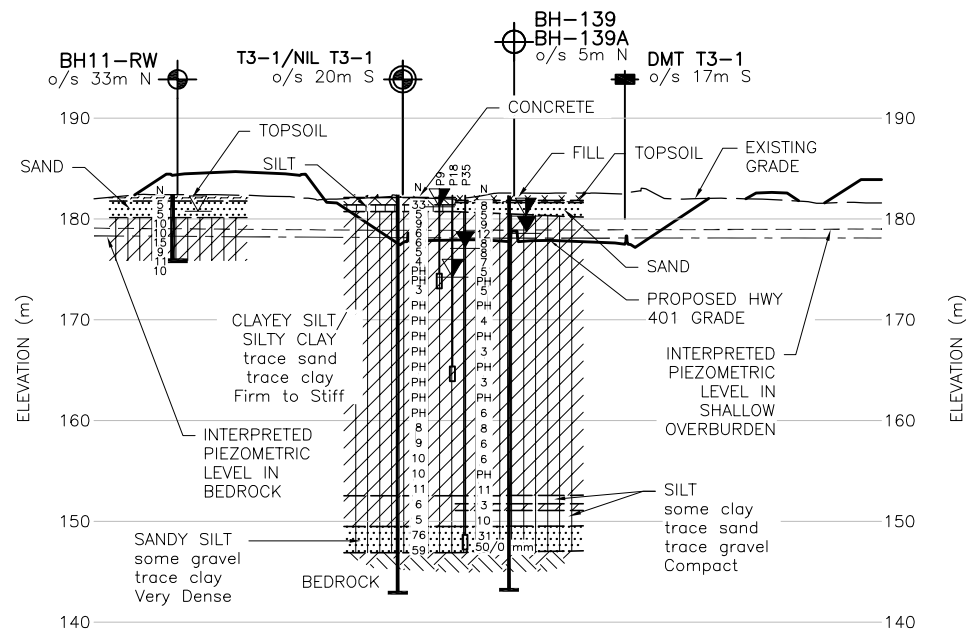
- BOREHOLE CURRENT INVESTIGATION
- BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
- NILCON VANE CURRENT INVESTIGATION
- CPT - CURRENT INVESTIGATION
- DMT - CURRENT INVESTIGATION
- BOREHOLE PREVIOUS INVESTIGATION
- BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
- CPT -PREVIOUS INVESTIGATION
- N 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)

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REVISIONS	13-JUN-14 0 EA ISSUED FOR CONSTRUCTION			
	DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK	DD	CODE CAN/CSA
DRAWN	SJL	CHK	MO	SITE 6-617
				LOAD SEE T.A.F. DOC.
				DATE 18-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 OVER GRAND MARAIS-LAMBTON RD. TB-2
SOIL STRATIGRAPHYSHEET
G6204Phase 2
IFCHORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

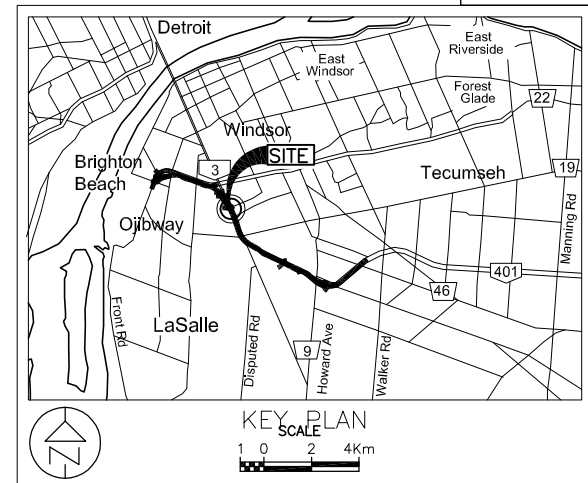
LIST OF ABBREVIATIONS

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WR - SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS

MATERIAL LEGEND

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

READY FOR ISSUE		
SUBMISSION: ISSUED FOR CONSTRUCTION		
ORIGINATOR	NAME (PRINT)	DATE
E. AHMED		02-JUN-14
CHECKER	M. OLDEWENING	11-JUN-14
REVIEWER	D. DIMITRIU	

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

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)
- 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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REVISIONS		DATE	REV.	BY	DESCRIPTION
13-JUN-14	0	EA			ISSUED FOR CONSTRUCTION
DESIGN	EA	CHK	DD	CODE	CAN/CSA
DRAWN	SJL	CHK	MO	SITE	6-617
				LOAD	SEE T.A.F. DOC.
				DATE	18-APR-13

DOC: 285380-04-091-WIP2-6204

METRIC

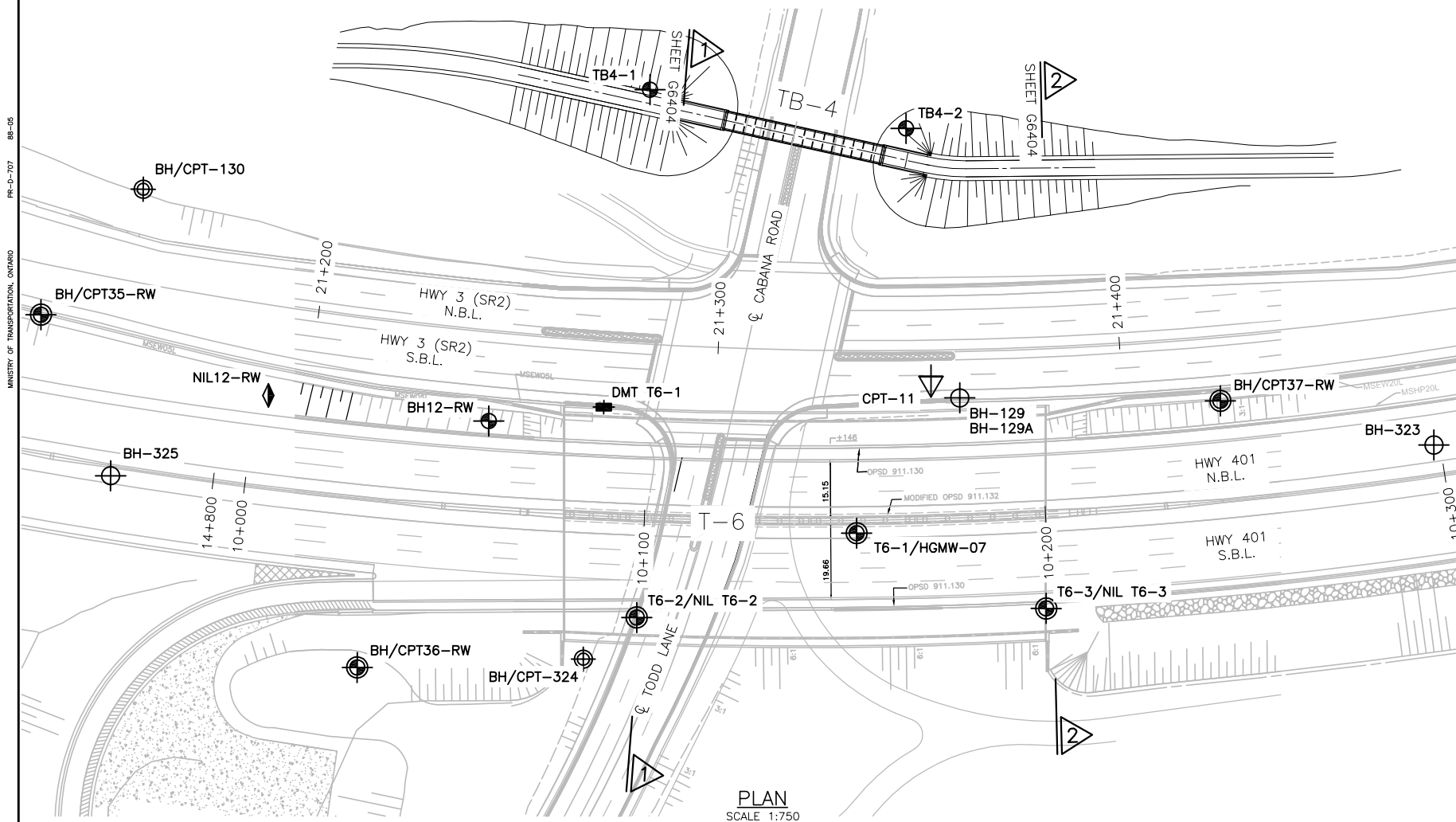
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER CABANA RD.-TODD LN. TB-4
BOREHOLE LOCATIONS & SOIL STRATA

SHEET

G6403

Phase 1

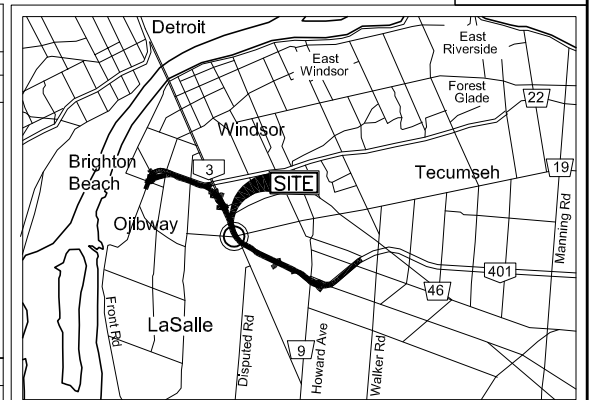
IFC

PLAN
SCALE 1:750

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

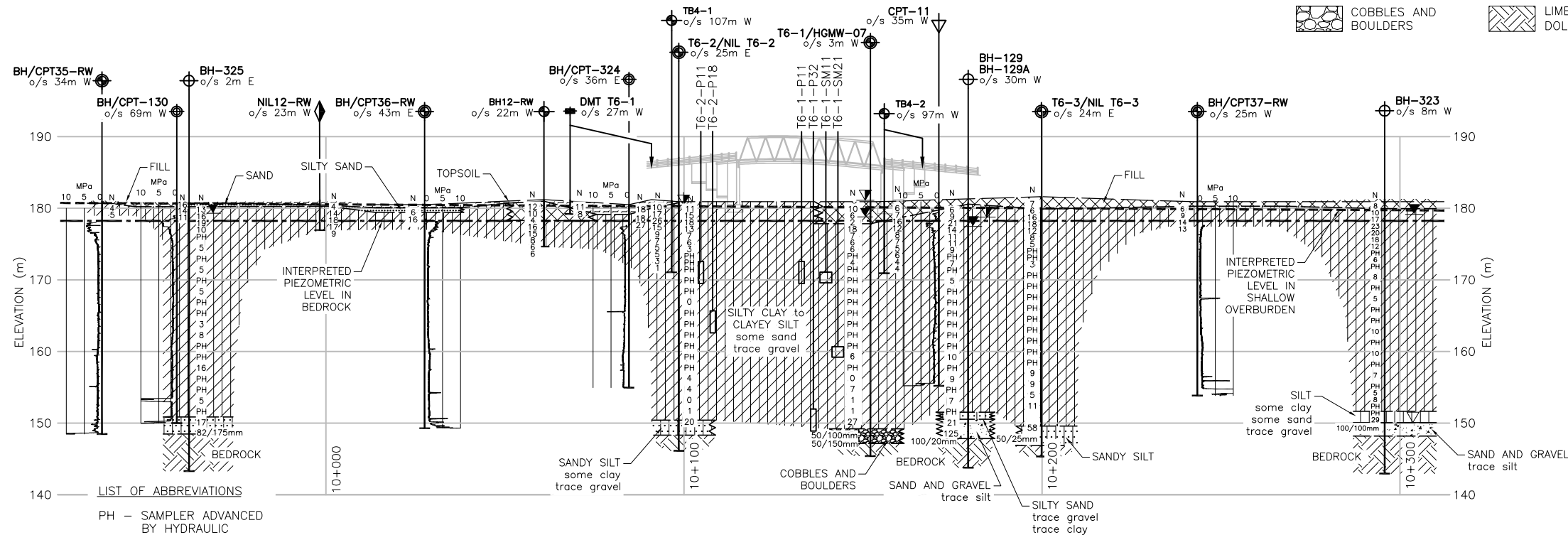
SCALE
1 0 2 4Km

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)
- MPa 0 5 10
- CPT-qc

NOTES

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PROFILE ALONG CL OF HWY 401

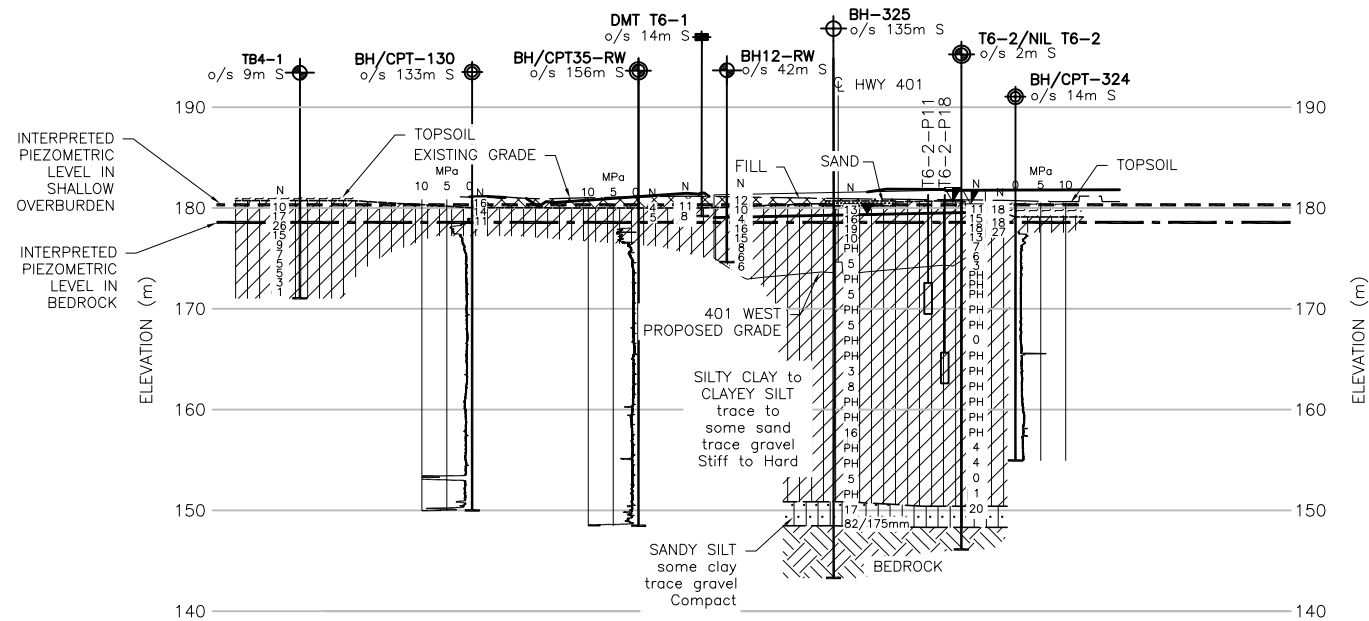
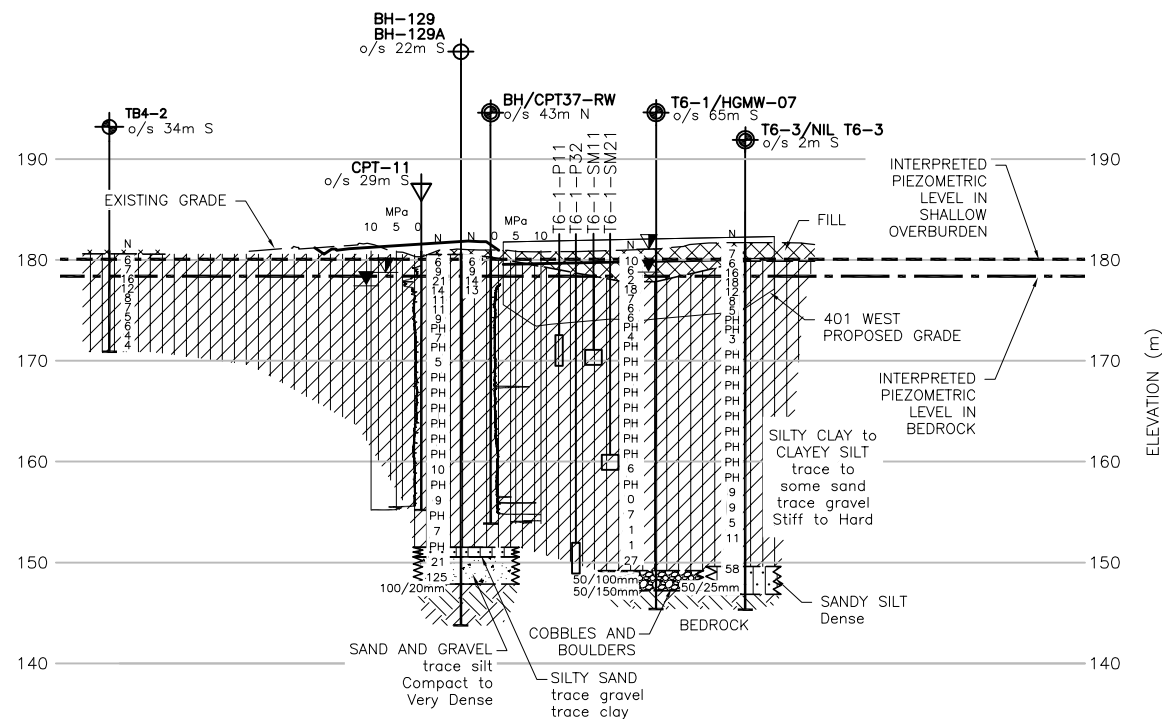
HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

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- WH - SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
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REVISIONS	25-JUN-14				ISSUED FOR CONSTRUCTION			
	DATE	REV.	BY		DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK	DD		CODE	CAN/CSA		LOAD SEE T.A.F. DOC.
DRAWN	SJL	CHK	MO		SITE	6-619		DATE 19-APR-13

METRIC

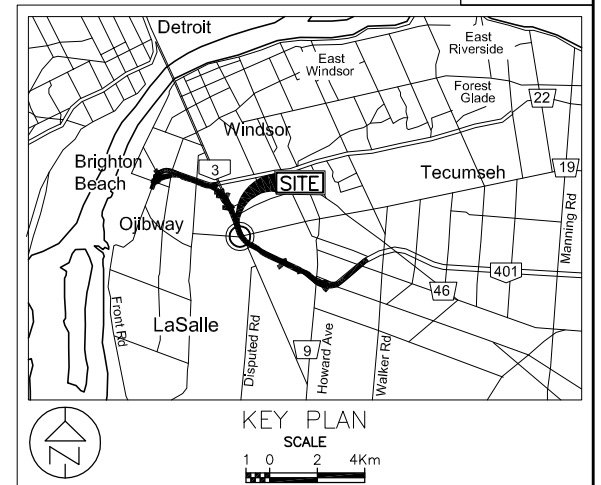
DIMENSIONS ARE IN METRES
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Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER CABANA RD.-TODD LN. TB-4
SOIL STRATIGRAPHYSHEET
G6404Phase 1
IFCHORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

LIST OF ABBREVIATIONS

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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
	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
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	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

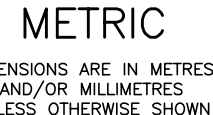
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DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS	DATE	REV.	BY	DESCRIPTION
1	25-JUN-14	0	EA	ISSUED FOR CONSTRUCTION
DESIGN	EA	CHK	DD	CODE CAN/CSA
DRAWN	SJL	CHK	MO	SITE 6-619
				LOAD SEE T.A.F. DOC.
				DATE 19-APR-13


DOC: 285380-04-091-WP1-6404

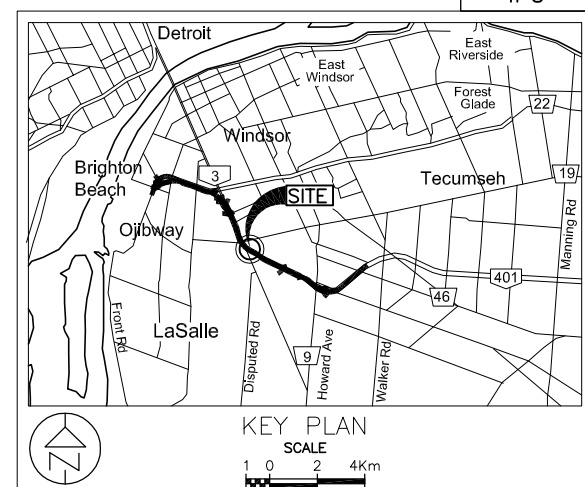


**Parkway
Infrastructure
Engineers**

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

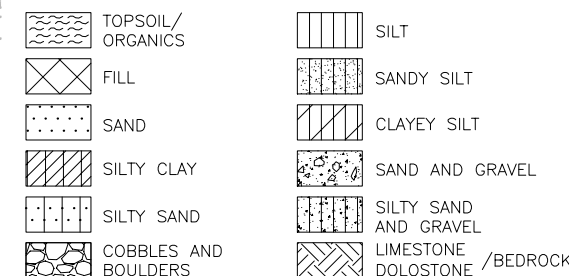
NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER HURON CHURCH LN. TB-5
BOREHOLE LOCATIONS & SOIL STRATA

	
5 A	SHEET G6503
	Phase 1
	IFC



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



LIST OF ABBREVIATIONS

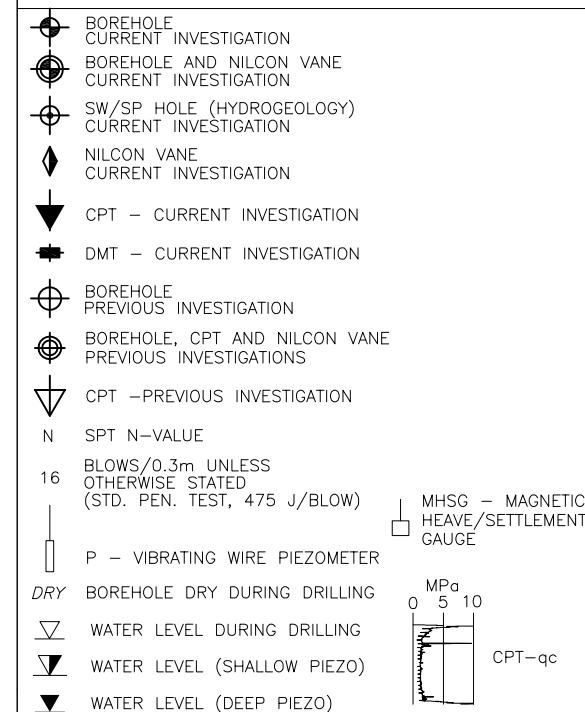
PH - SAMPLER ADVANCED
BY HYDRAULIC
PRESSURE

PM - SAMPLER ADVANCED
BY MANUAL PRESSURE

WH - SAMPLER ADVANCED BY
STATIC WEIGHT OF HAMMER

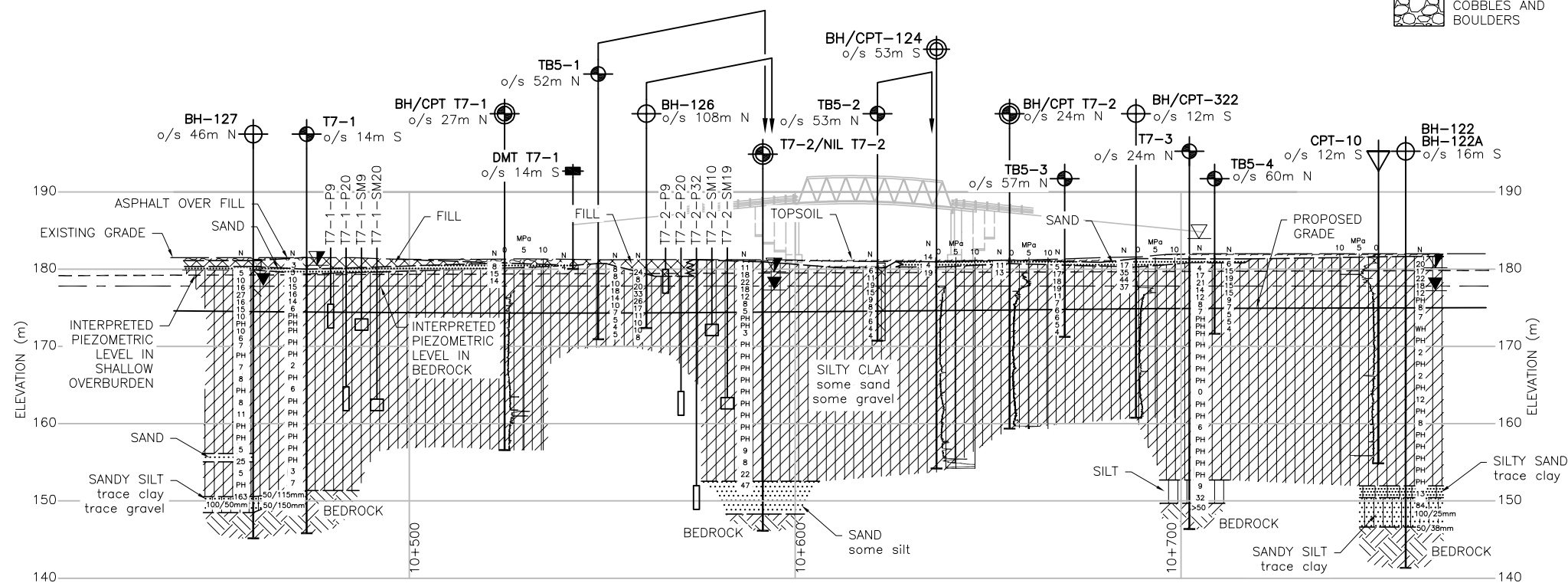
WR - SAMPLER ADVANCED BY
WEIGHT OF SAMPLER RODS

LEGEND



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PROFILE ALONG CL OF TUNNEL

HORT SCALE 1:750
VERT SCALE 1:375

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS									
	06-JUN-14	0	EA	ISSUED FOR CONSTRUCTION					
	DATE	REV.	BY	DESCRIPTION					
DESIGN	EA	CHK	DD	CODE	CAN/CSA	LOAD	SEE T.A.F.	DO	
DRAWN	SJL	CHK	MO	SITE	6-620	DATE	24-APR-13		

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

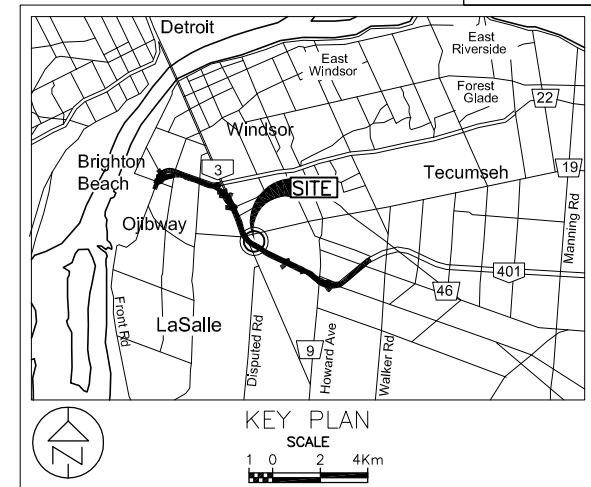
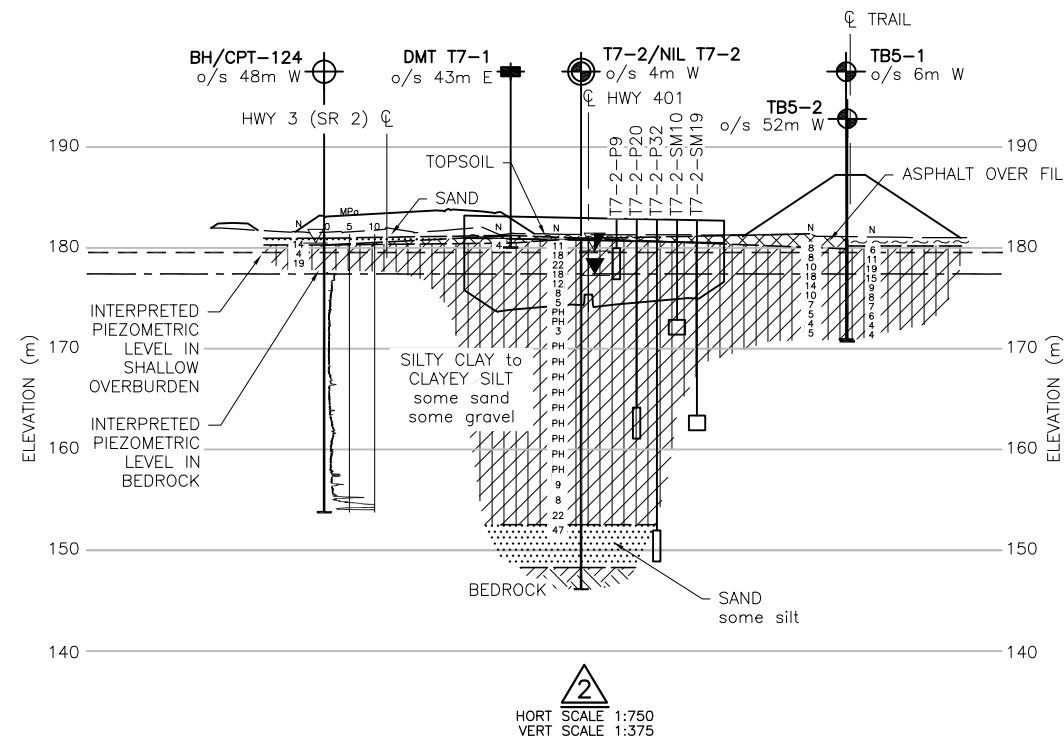
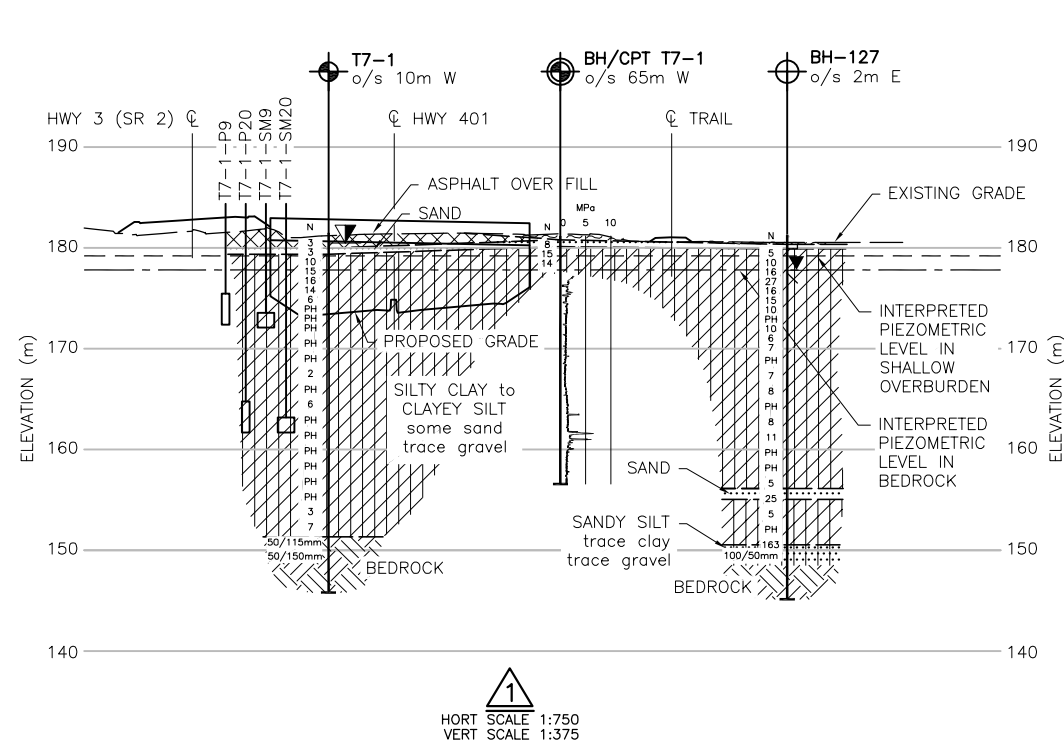


Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER HURON CHURCH LN. TB-5
SOIL STRATIGRAPHY

SHEET
G6504

Phase 1
IFC



LEGEND

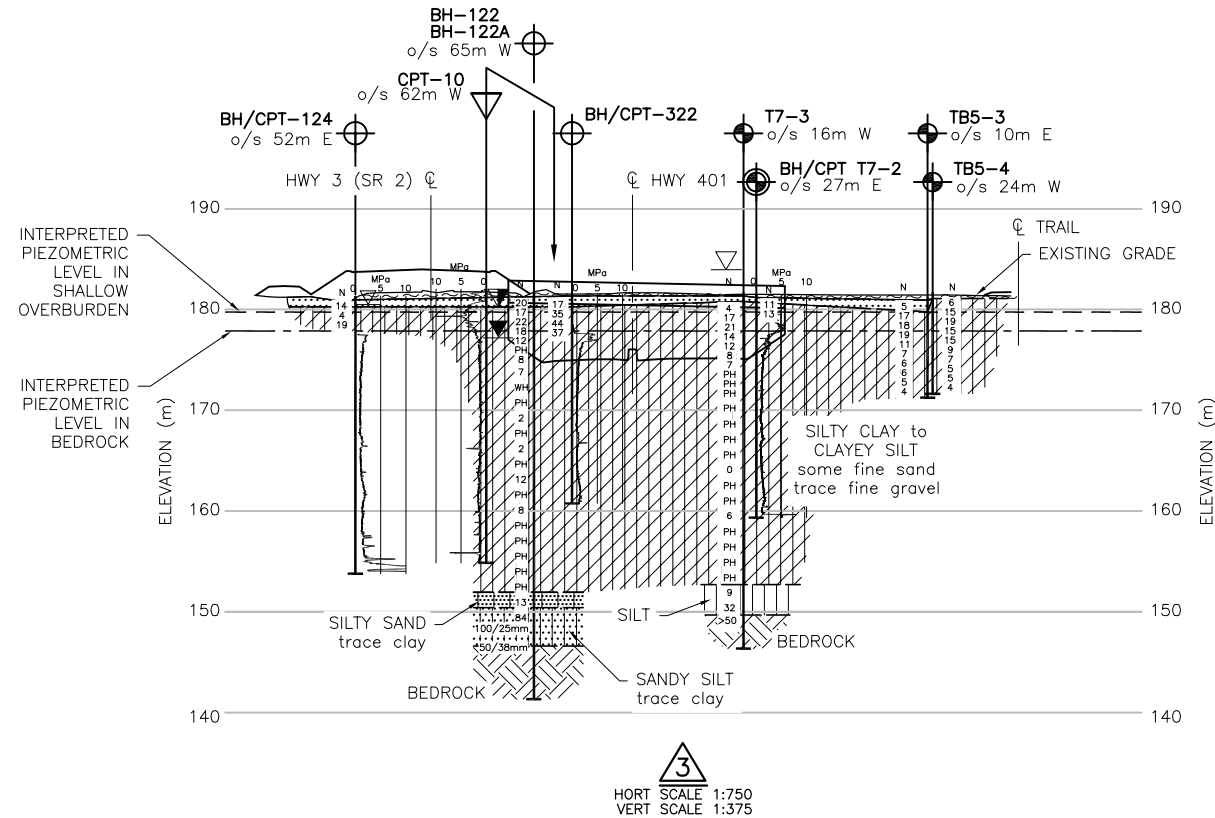
- BOREHOLE CURRENT INVESTIGATION
- BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
- SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
- NILCON VANE CURRENT INVESTIGATION
- CPT - CURRENT INVESTIGATION
- DMT - CURRENT INVESTIGATION
- BOREHOLE PREVIOUS INVESTIGATION
- BOREHOLE, CPT AND NILCON VANE PREVIOUS 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
- DRY BOREHOLE DRY DURING DRILLING
- WATER LEVEL DURING DRILLING
- WATER LEVEL (SHALLOW PIEZO)
- WATER LEVEL (DEEP PIEZO)
- MHSG - MAGNETIC HEAVE/SETTLEMENT GAUGE
- CPT-qc

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



READY FOR ISSUE		
SUBMISSION: ISSUED FOR CONSTRUCTION		
ORIGINATOR	NAME (PRINT)	DATE
E. AHMED		02-JUN-14
CHECKER		
M. OLDEWENING		05-JUN-14
REVIEWER		
D. DIMITRIU		

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS		DATE	REV.	BY	DESCRIPTION
06-JUN-14		0	EA		ISSUED FOR CONSTRUCTION
DESIGN	EA	CHK	DD	CODE	CAN/CSA
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		LOAD	DATE	24-APR-13	DOC.

SHEET
G6703

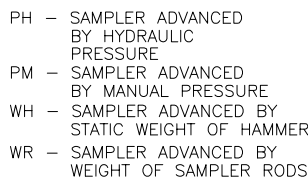
KEY PLAN

SCALE

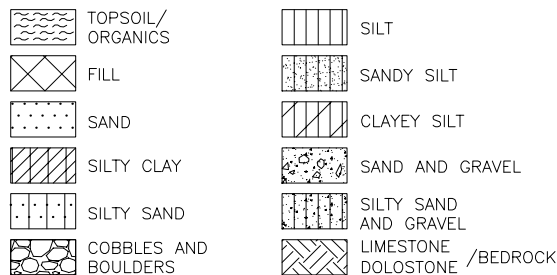
1 0 2 4Km

BOREHOLE CURRENT INVESTIGATION
 BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
 SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
 NILCON VANE CURRENT INVESTIGATION
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 WATER LEVEL (SHALLOW PIEZO)
 WATER LEVEL (DEEP PIEZO)
 CPT-qc

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN REPORT.
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.

DOC: 285380-04-090-WIP1-6703

MATERIAL LEGEND



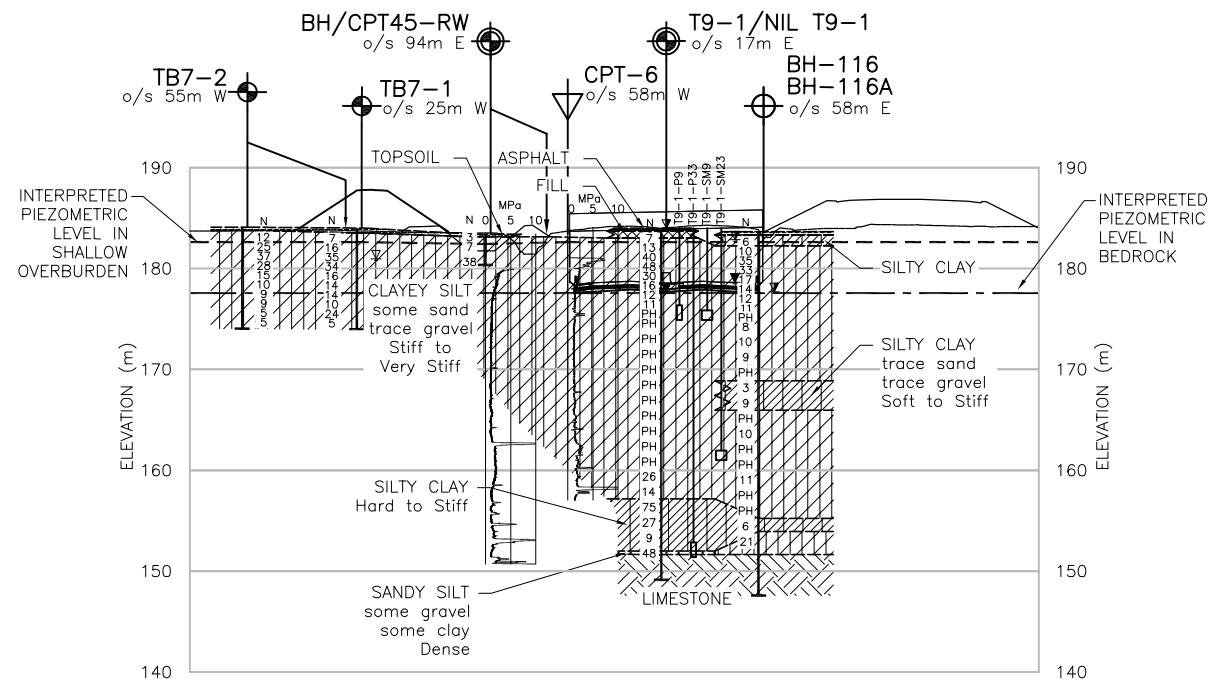
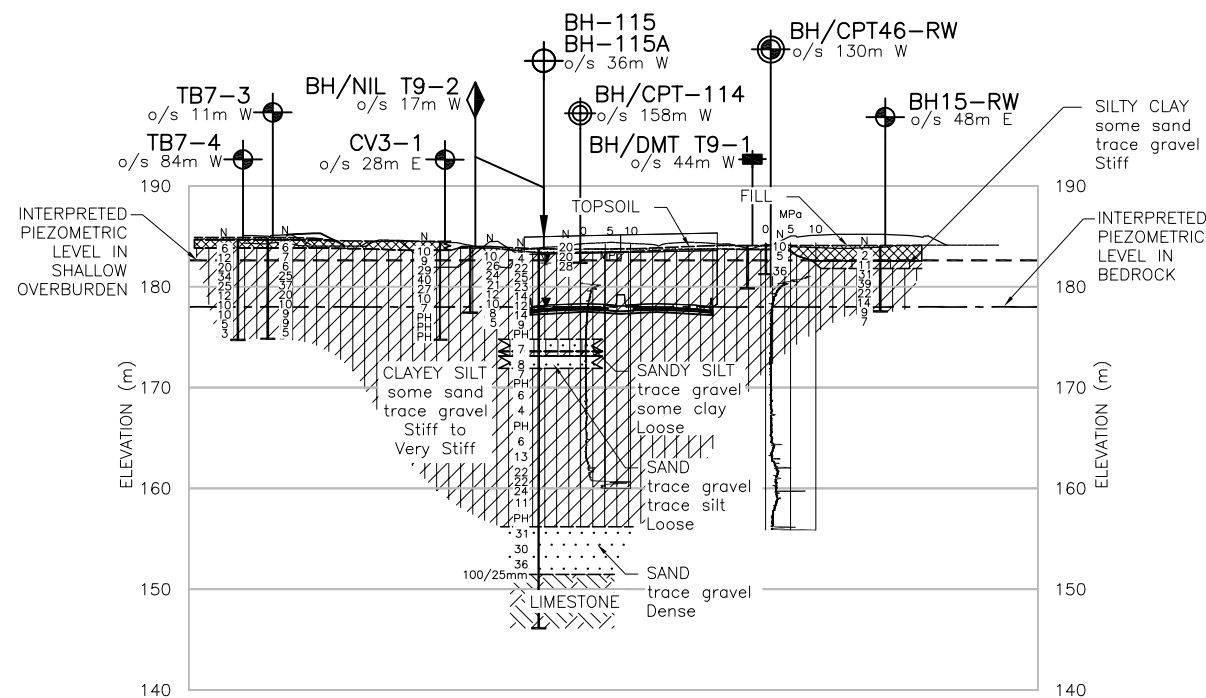
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		NORTHING	EASTING
AMEC TESTHOLES			
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BH/CPT45-RW	183.4	4678688.3	333708.0
BH/CPT46-RW	184.3	4678505.0	333977.6
CV3-1	184.5	4678635.0	333861.1
BH/DMT T9-1	184.1	4678544.5	333909.9
T9-1/NIL T9-1	184.0	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



HORT SCALE 1:750
VERT SCALE 1:375

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER COUSINEAU RD. TB-7
SOIL STRATIGRAPHYSHEET
G6704
Phase 1
IFCHORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

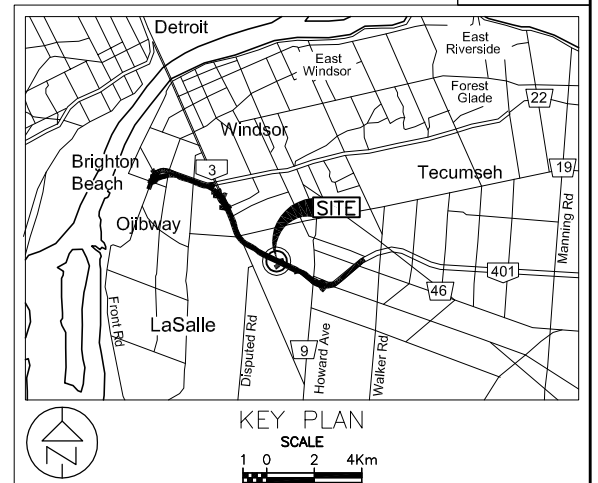
READY FOR ISSUE		
SUBMISSION: ISSUED FOR CONSTRUCTION		
	NAME (PRINT)	DATE
ORIGINATOR	E. AHMED	26-MAY-14
CHECKER	M. OLDEWENING	27-MAY-14
REVIEWER	D. DIMITRIU	

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)

NOTES

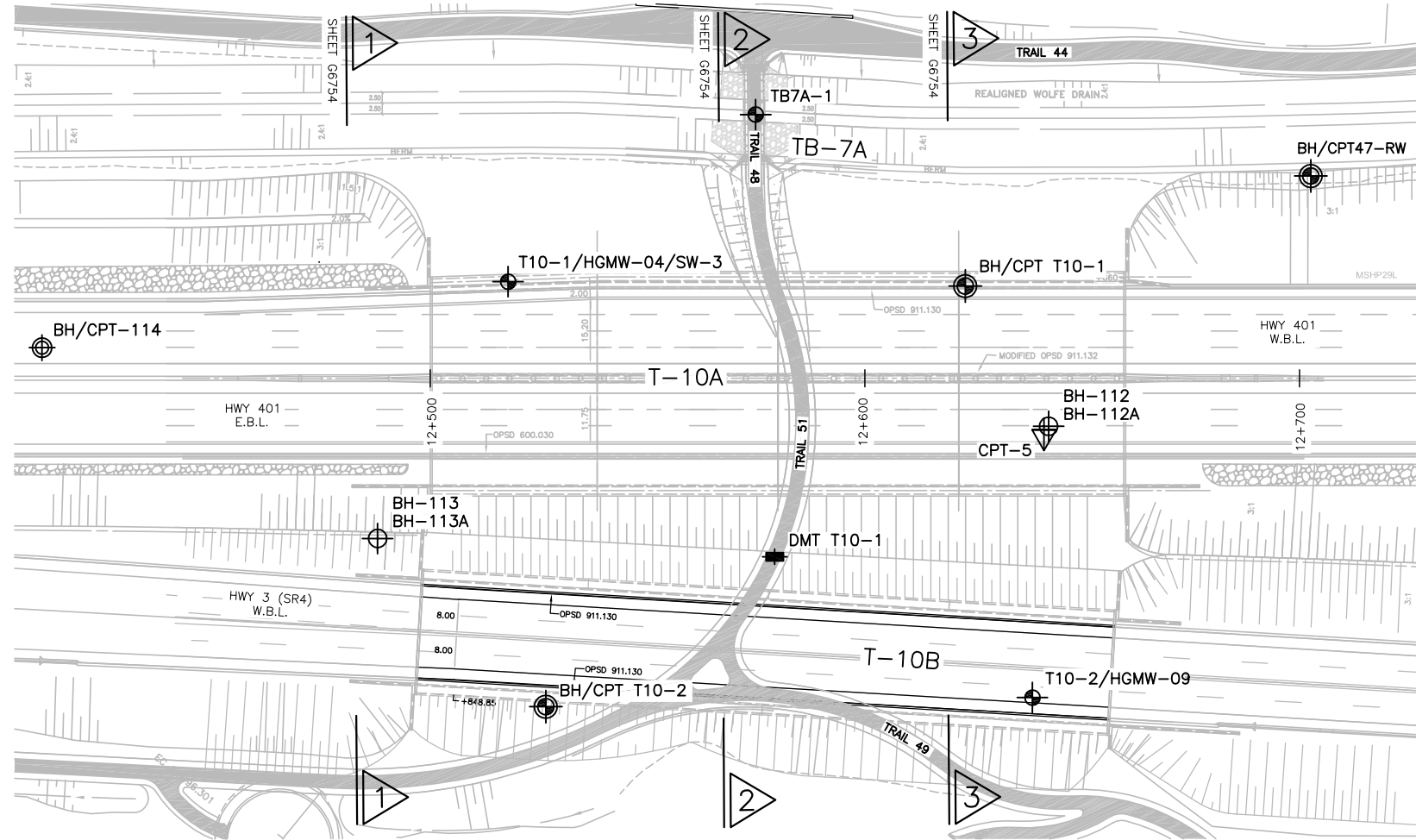
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN REPORT.
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DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

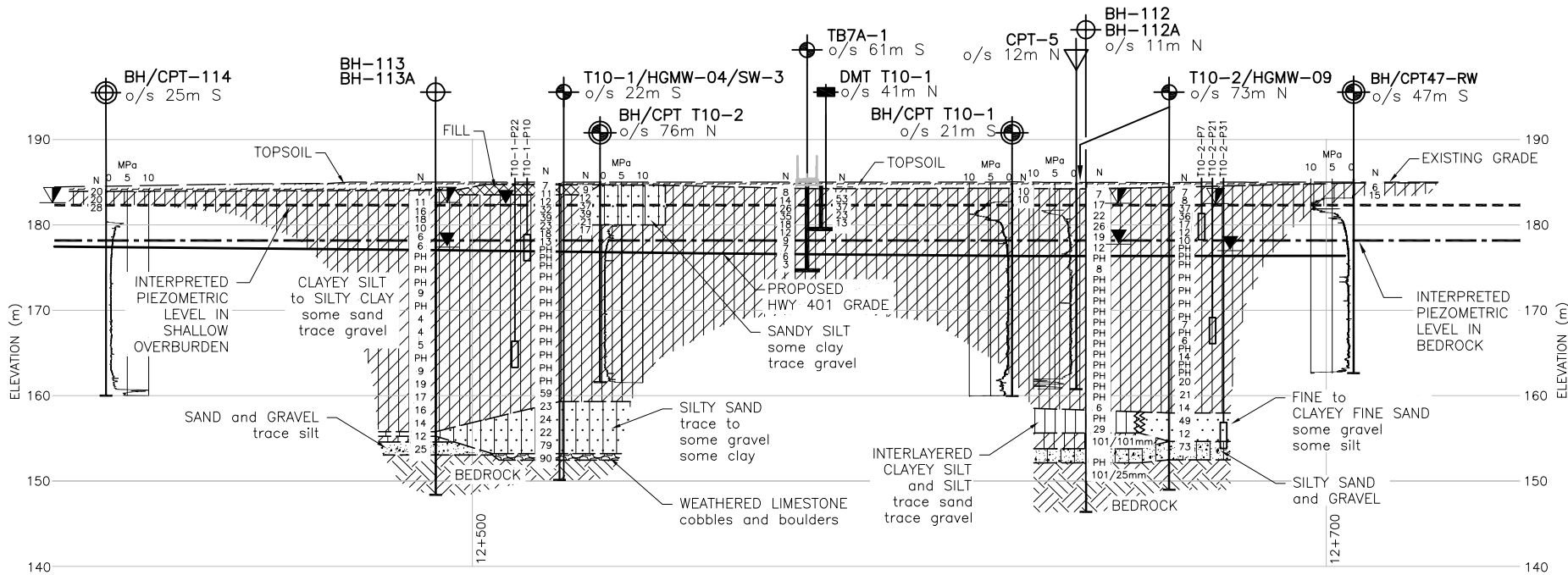
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DRAWN	SJL	CHK	MO	SITE	6-622
		DATE	16-APR-13		

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



PLAN
HORIZONTAL SCALE 1:750



PROFILE ALONG CL OF HWY 401

HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

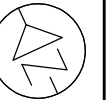
METRIC

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 OVER WOLFE DRAIN TB-7A
BOREHOLE LOCATIONS & SOIL STRATA



SHEET
G6753

Phase 1
IFC

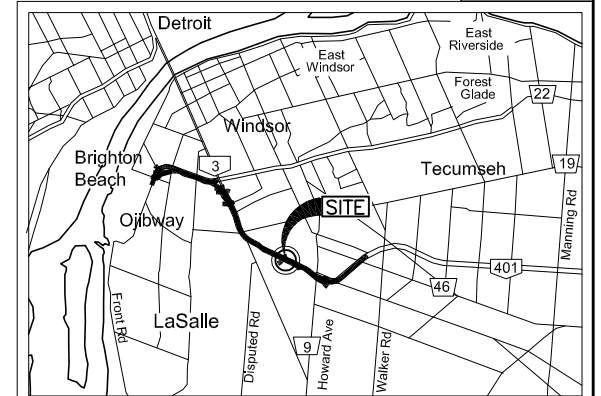
No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC BOREHOLES			
BH/CPT47-RW	185.4	4678440.3	334300.2
BH/CPT T10-1	184.9	4678450.6	334217.4
BH/CPT T10-2	185.2	4678403.2	334089.2
DMT T10-1	184.6	4678412.4	334151.5
T10-1/HGMW-04/SW-3	184.9	4678495.6	334122.3
T10-2/HGMW-09	184.8	4678358.2	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

	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
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WH	-	SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER
WR	-	SAMPLER ADVANCED BY WEIGHT OF SAMPLER RODS



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)

NOTES

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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

READY FOR ISSUE		
SUBMISSION: ISSUED FOR CONSTRUCTION		
ORIGINATOR	E. AHMED	07-JUL-14
CHECKER	M. OLDEWENING	08-JUL-14
REVIEWER	N. S. VERMA	

REVISIONS	DATE	REV.	BY	DESCRIPTION
08-JUL-14	0	EA		ISSUED FOR CONSTRUCTION
DESIGN	EA	CHK	DD	CODE CAN/CSA
DRAWN	SJL	CHK	MO	SITE 6-623
LOAD	SEE T.A.F. DOC.			
DATE	23-APR-13			

DOC: 285380-04-090-WP1-6753

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

Parkway Infrastructure Engineers | **amec** 
 **Hatch Macdonald**

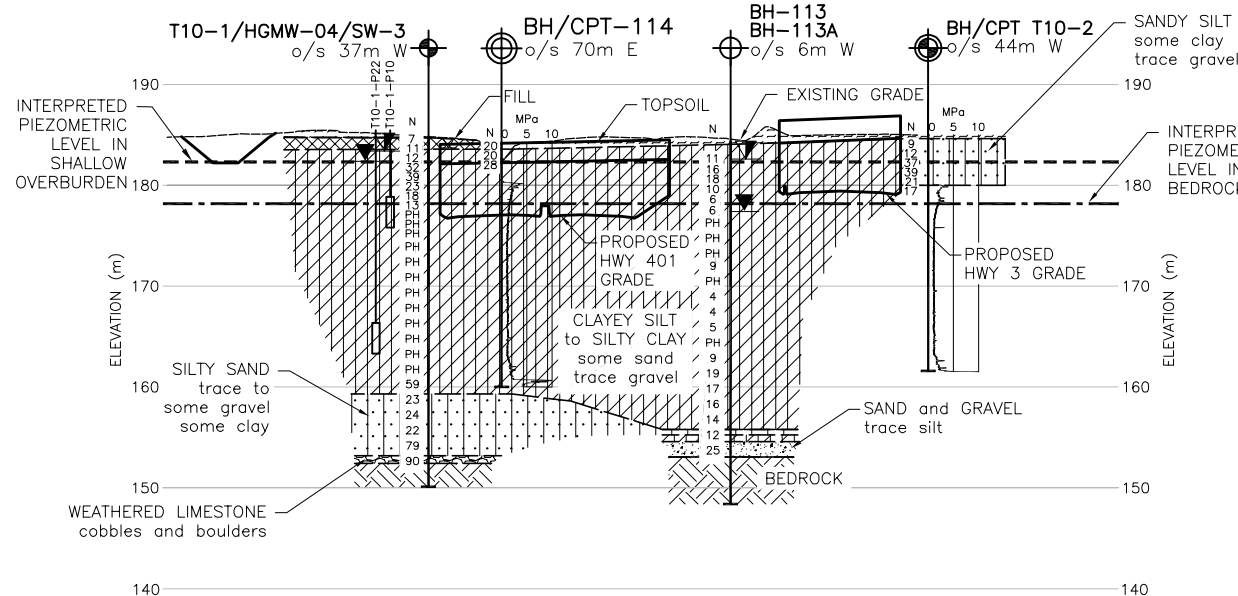
Windsor-Essex
Parkway Project
RFP No. 09-54-1007

SHEET

G6754

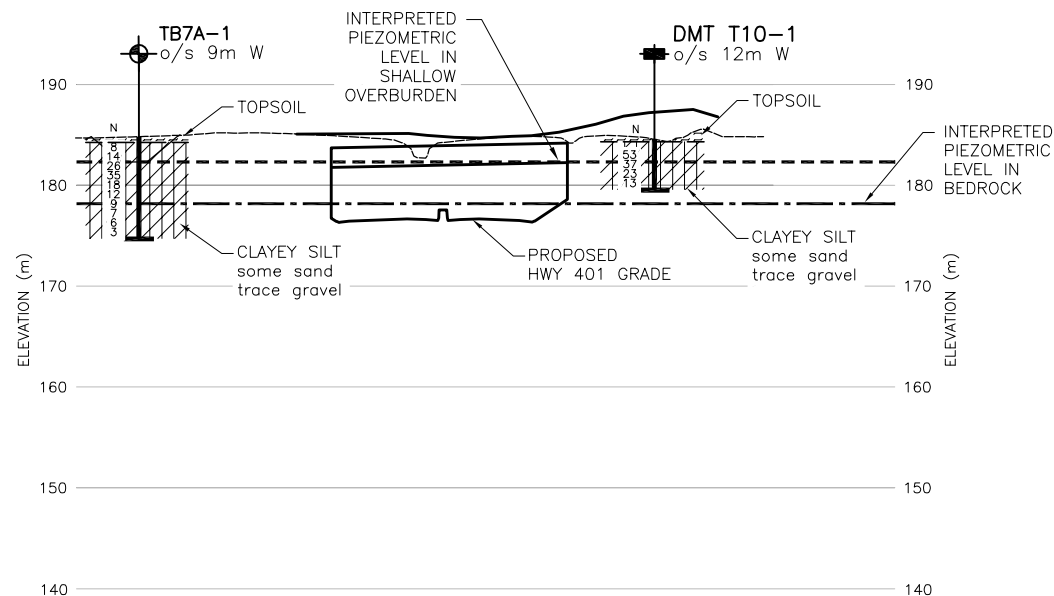
Phase 1

IFC

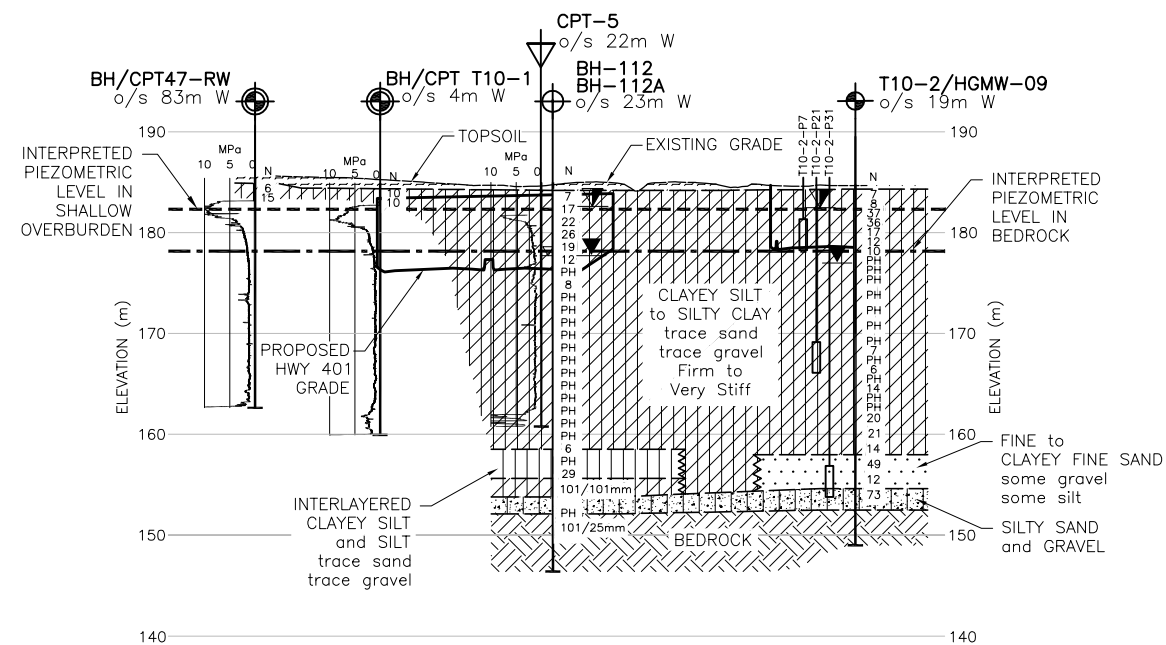




HORT SCALE 1:750
VERT SCALE 1:375




 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 4K

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 (SM) |
| | P - VIBRATING WIRE PIEZOMETER (VWP) | |
| DRY | BOREHOLE DRY DURING DRILLING | |
| | WATER LEVEL DURING DRILLING | |
| | WATER LEVEL (SHALLOW PIEZO) | |
| | WATER LEVEL (DEEP PIEZO) | |
| | | |

NOTES

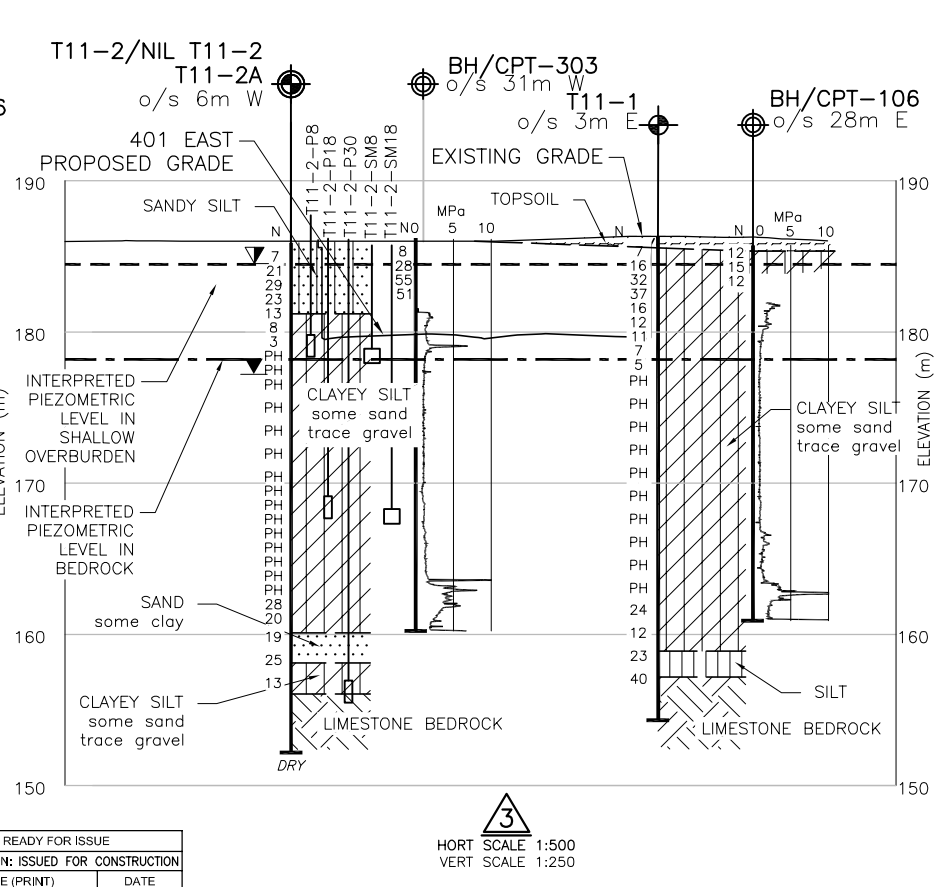
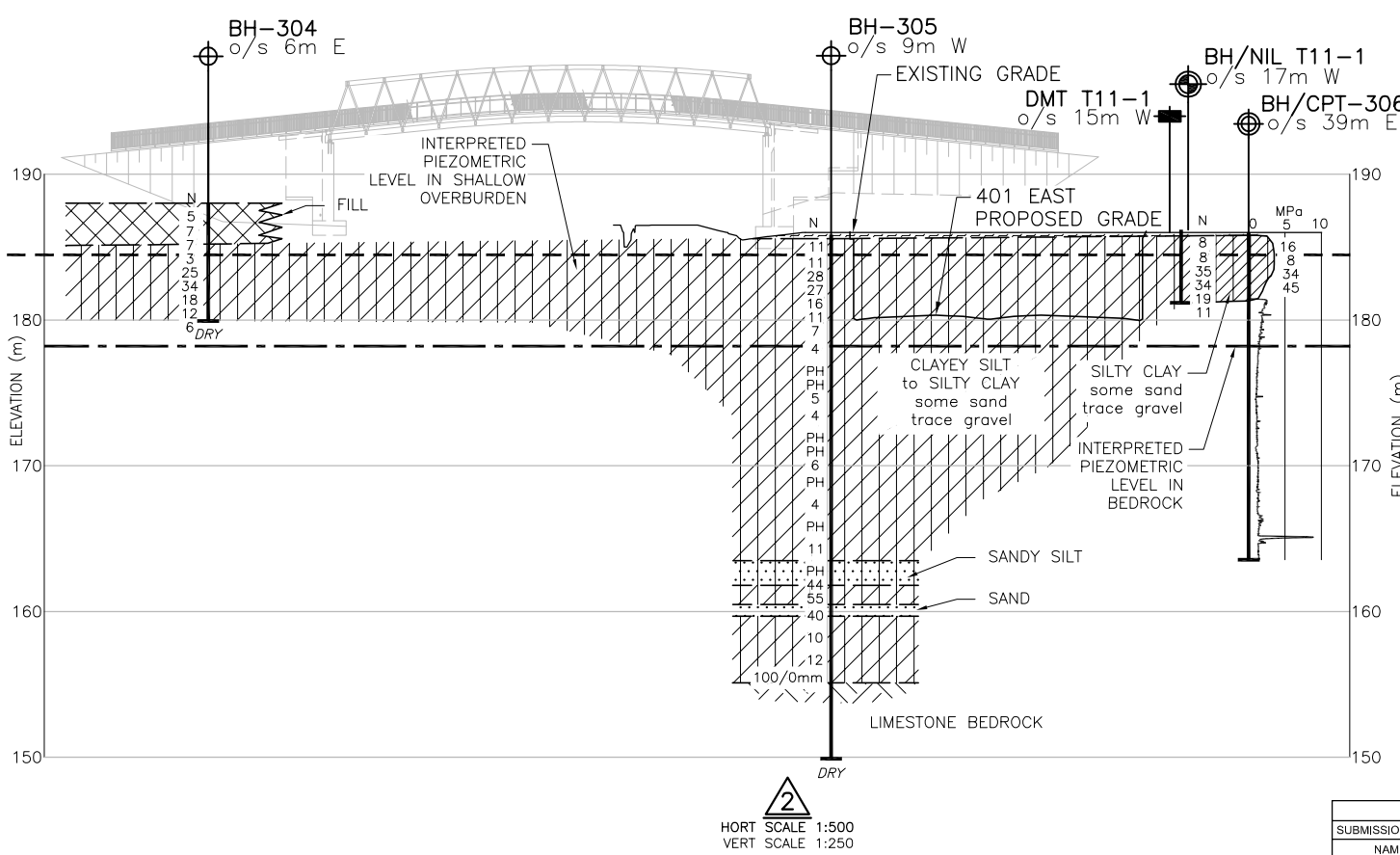
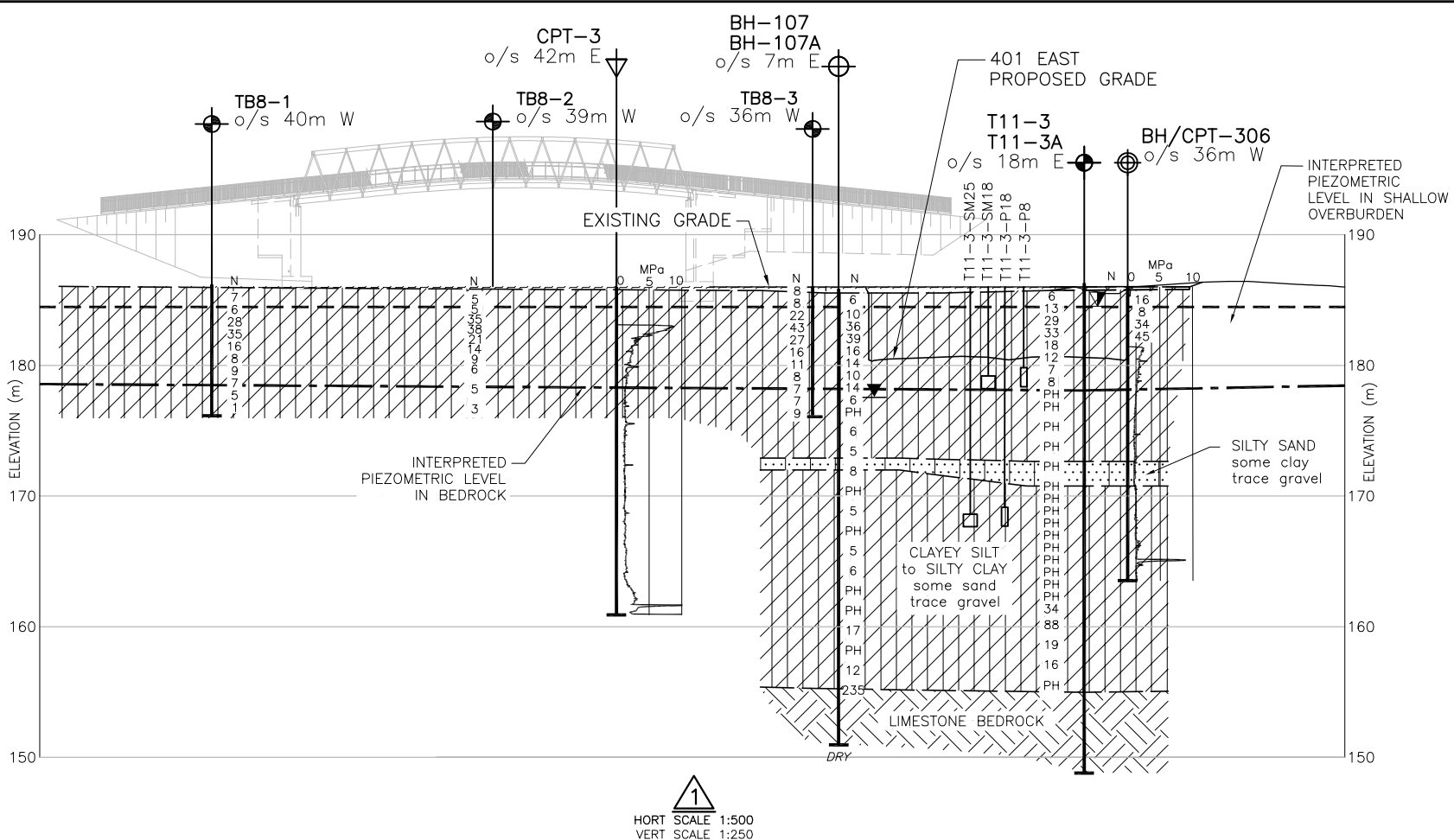
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN REPORT.
2. THE INTERPRETED STRATIGRAPHY REPRESENTS SIMPLIFIED SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DEFINED AT BOREHOLE LOCATIONS ONLY. CONDITIONS BETWEEN BOREHOLE LOCATIONS COULD DIFFER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

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

REVISIONS									
	08-JUL-14		0	EA	ISSUED FOR CONSTRUCTION				
	DATE		REV.		BY	DESCRIPTION			
	DESIGN	EA	CHK	MO	CODE	CAN/CSA	LOAD	SEE T.A.F.	DOC
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DATE PLOTTED: 5/30/2014 9:55:32 AM
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PR-D-707 88-05



READY FOR ISSUE			
SUBMISSION: ISSUED FOR CONSTRUCTION			
NAME (PRINT)		DATE	
ORIGINATOR	E. AHMED	28-MAY-14	
CHECKER	M. OLDEWENING	29-MAY-14	
REVIEWER	D. DIMITRIU		

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

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

Parkway Infrastructure Engineers

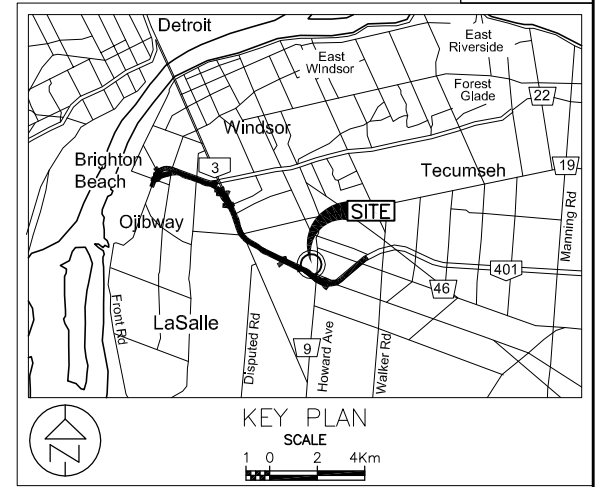
amtec
Hatch Mott MacDonald

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

NEW CONSTRUCTION
HWY 401
TRAIL BRIDGE OVER HWY 3 (SR4) TB-8
SOIL STRATIGRAPHY

SHEET
G6804

Phase 1
IFC

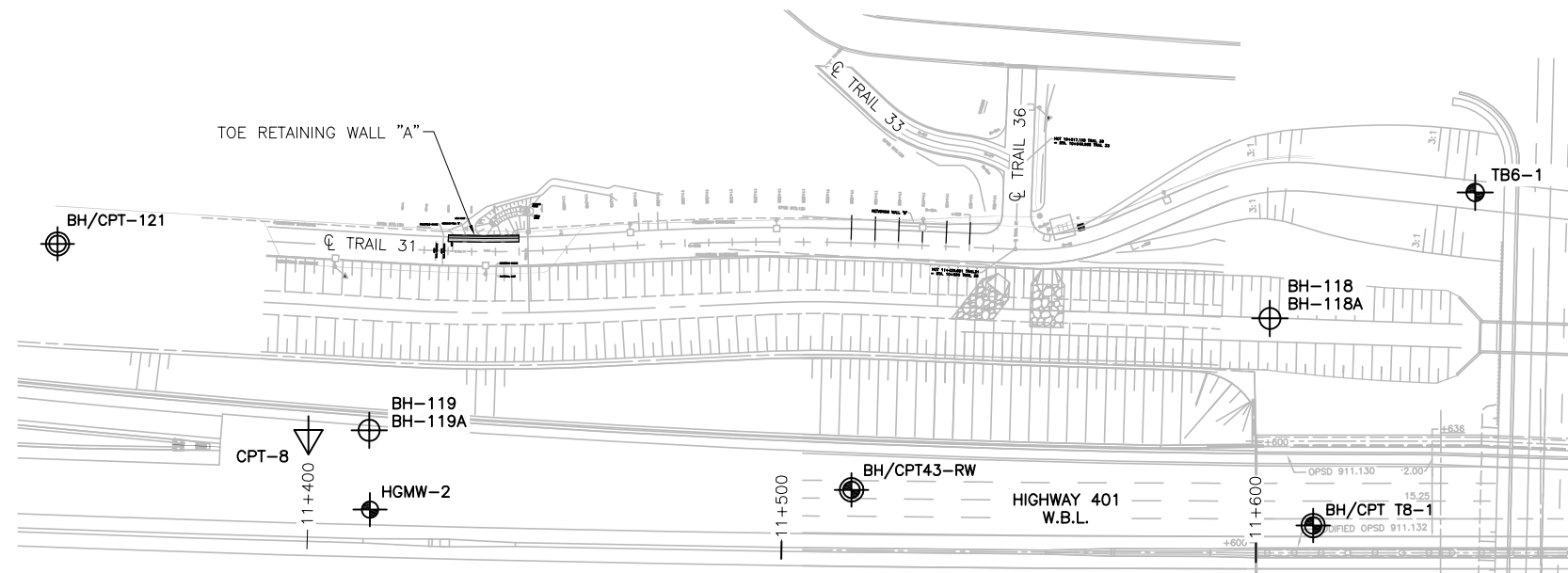


- LEGEND
- BOREHOLE CURRENT INVESTIGATION
 - BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
 - SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
 - NILCON VANE CURRENT INVESTIGATION
 - CPT - CURRENT INVESTIGATION
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 - BOREHOLE PREVIOUS INVESTIGATION
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 - N SPT N-VALUE
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REVISIONS		29-MAY-14		0	EA	ISSUED FOR CONSTRUCTION	
DESIGN	EA	CHK	DD	CODE	CAN/CSA	LOAD	SEE T.A.F. DOC.
DRAWN	SJL	CHK	MO	SITE	6-624	DATE	01-MAY-13

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWNWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
TRAIL 31 - STA 11+310 TO 11+325
TOE RETAINING WALL "A"
BOREHOLE LOCATIONS & SOIL STRATASHEET
G0151Phase 1
60% SubPLAN
SCALE 1:750

No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC BOREHOLES			
BH/CPT43-RW	182.6	4678907.6	333207.7
BH/CPT T8-1	183.2	4678860.0	333292.9
HGMW-2	182.3	4678946.3	333113.8
TB6-1	183.0	4678909.5	333353.3
PREVIOUS BOREHOLES			
BH-118	182.7	4678903.5	333302.9
BH-118A	182.7	4678903.5	333302.9
BH-119	182.5	4678961.6	333120.6
BH-119A	182.5	4678961.6	333120.6
BH/CPT-121	182.0	4679024.8	333077.4
CPT-8	182.5	4678967.0	333109.0

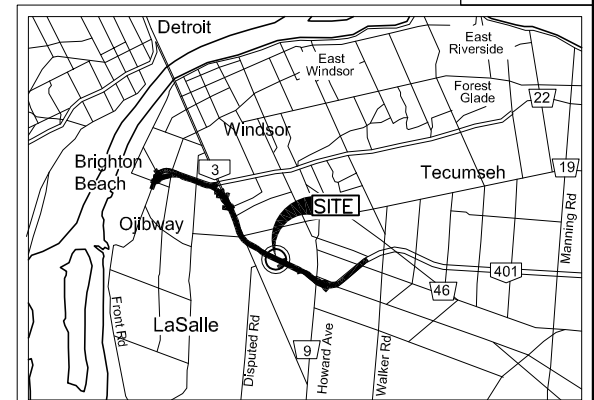
MATERIAL LEGEND

	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

READY FOR ISSUE		
SUBMISSION: 60% INTERIM IDR SUBMISSION		
ORIGINATOR	S. LABUTE	DATE
CHECKER	E. AHMED	21-MAY-14
REVIEWER	D. DIMITRIU	



KEY PLAN

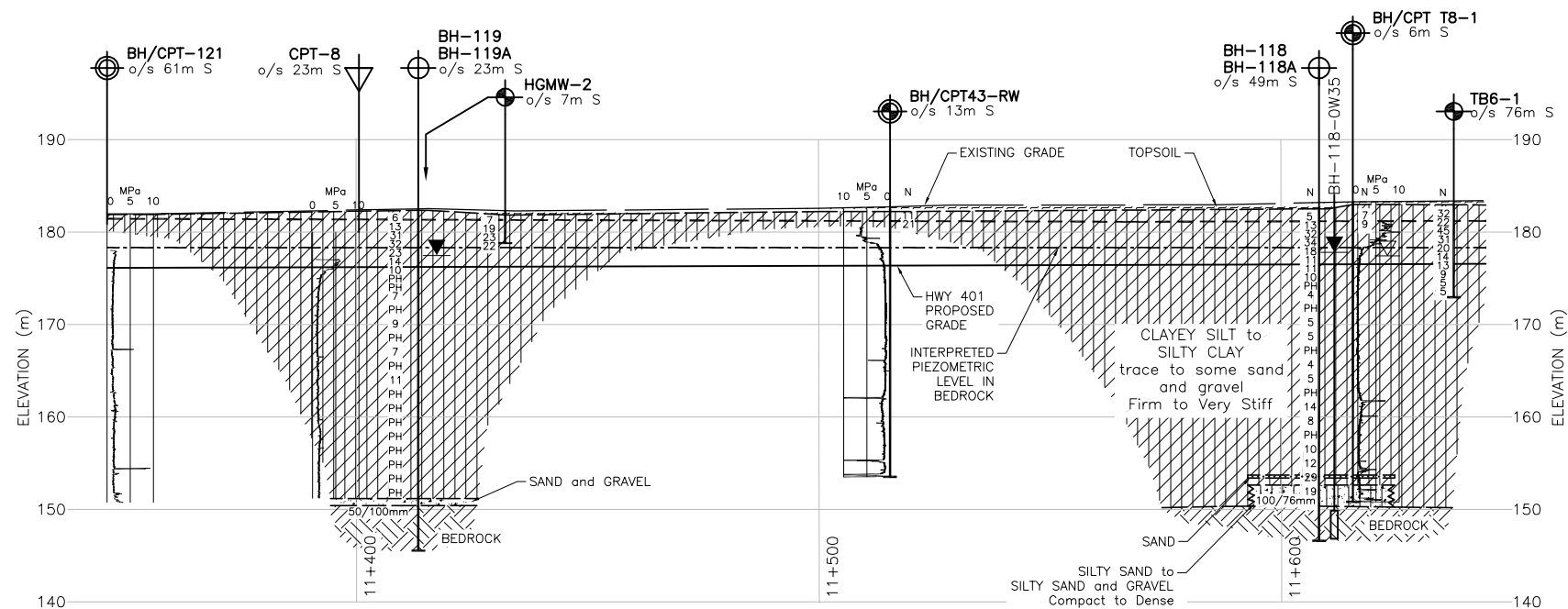
SCALE
1 0 2 4Km

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)
	OW - OBSERVATION WELL
DRY	BOREHOLE DRY DURING DRILLING
	WATER LEVEL DURING DRILLING
	WATER LEVEL (SHALLOW PIEZO)
	WATER LEVEL (DEEP PIEZO)
	CPT-qc

NOTES

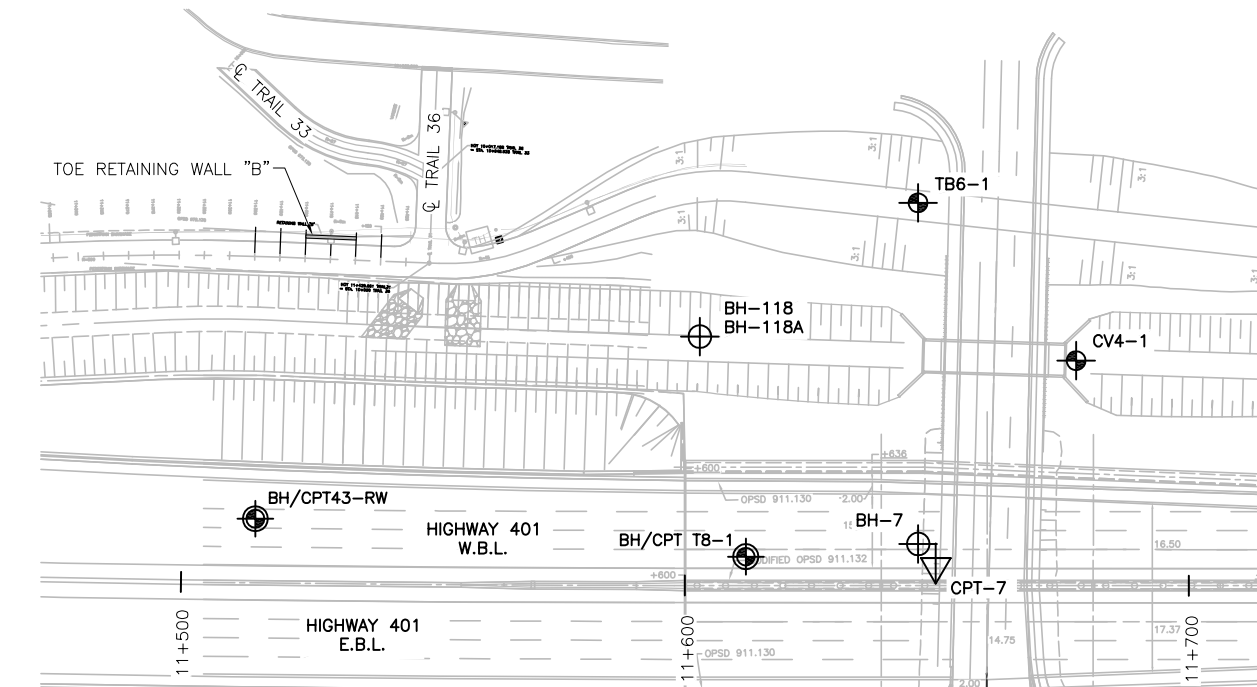
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GEOTECHNICAL DESIGN REPORT.
- THE INTERPRETED STRATIGRAPHY REPRESENTS SIMPLIFIED SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DEFINED AT BOREHOLE LOCATIONS ONLY. CONDITIONS BETWEEN BOREHOLE LOCATIONS COULD DIFFER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



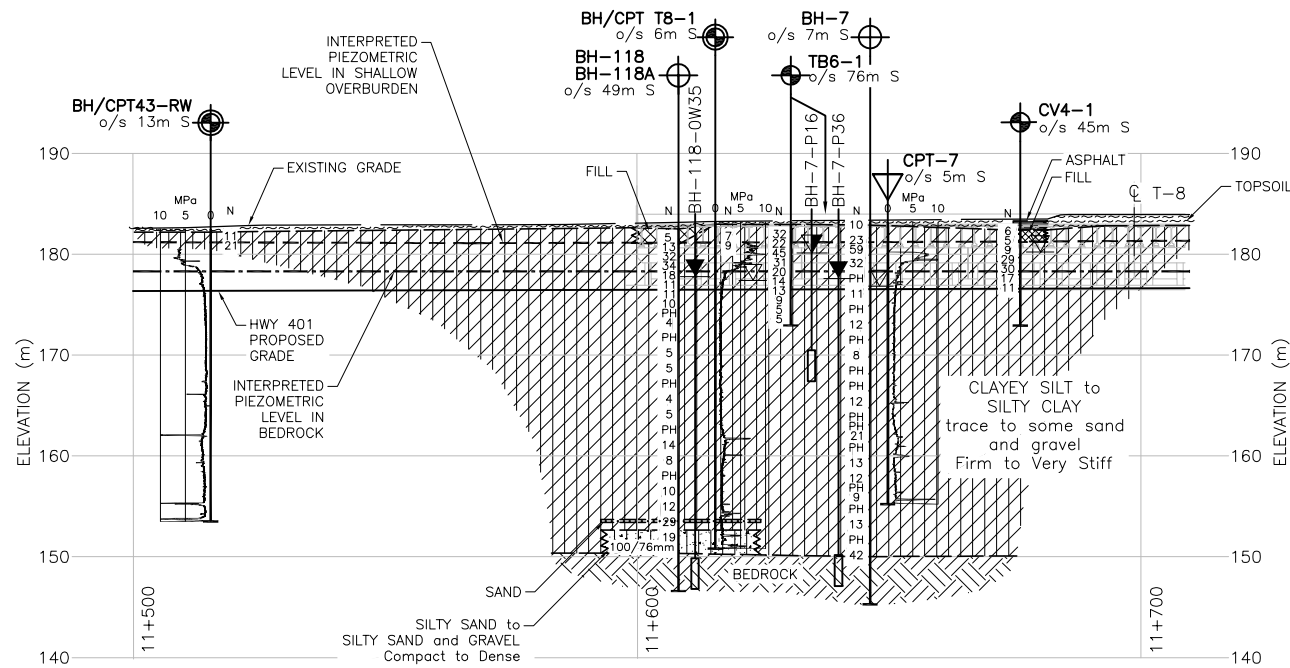
PROFILE ALONG CL OF HIGHWAY 401

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

REVISIONS			
21-MAY-14	A	EA	60% INTERIM IDR SUBMISSION
DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK DD	CODE CAN/CSA S6-06 LOAD CL-625-ONT
DRAWN	SJL	CHK NSV	SITE TOE WALL "A" DATE 21-APR-14



PLAN
SCALE 1:750



PROFILE ALONG CL OF HIGHWAY 401
HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



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



NEW CONSTRUCTION
TRAIL 31 - STA 11+405 TO 11+415
TOE RETAINING WALL "B"
BOREHOLE LOCATIONS & SOIL STRATA

SHEET
G0152

Phase 1
60% Sub

No.	ELEVATION	CO-ORDINATES (UTM, NAD 83 ZONE 17)	
		NORTHING	EASTING
AMEC BOREHOLES			
BH/CPT43-RW	182.6	4678907.6	333207.7
BH/CPT T8-1	183.2	4678860.0	333292.9
CV4-1	183.3	4678867.9	333368.7
TB6-1	183.0	4678909.5	333353.3
PREVIOUS BOREHOLES			
BH-7	183.2	4678848.0	333325.0
BH-118	182.7	4678903.5	333302.9
BH-118A	182.7	4678903.5	333302.9
CPT-7	183.2	4678844.0	333327.0

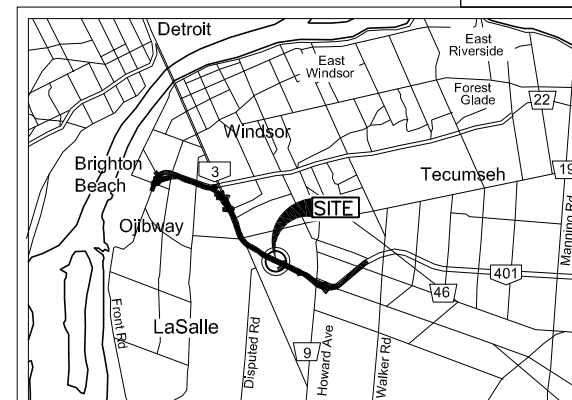
MATERIAL LEGEND

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

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

READY FOR ISSUE		
SUBMISSION: 60% INTERIM IDR SUBMISSION		
ORIGINATOR	S. LABUTE	21-MAY-14
CHECKER	E. AHMED	
REVIEWER	D. DIMITRIU	



KEY PLAN
SCALE
1 0 2 4Km

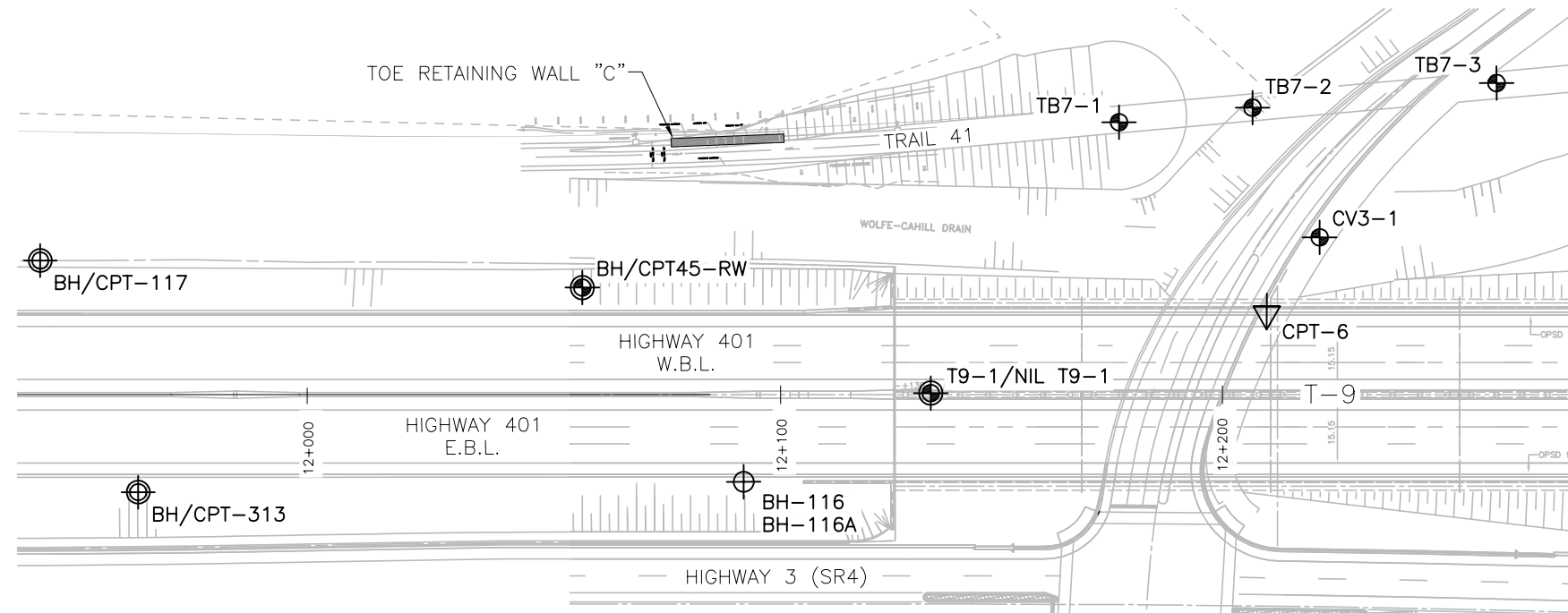
LEGEND

	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)
	OW - OBSERVATION WELL
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	21-MAY-14	A	EA	60% INTERIM IDR SUBMISSION
	DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK	DD	CODE CAN/CSA S6-06 LOAD CL-625-ONT
DRAWN	SJL	CHK	NSV	SITE TOE WALL "B" DATE 22-APR-14



PLAN
HORIZONTAL SCALE 1:750

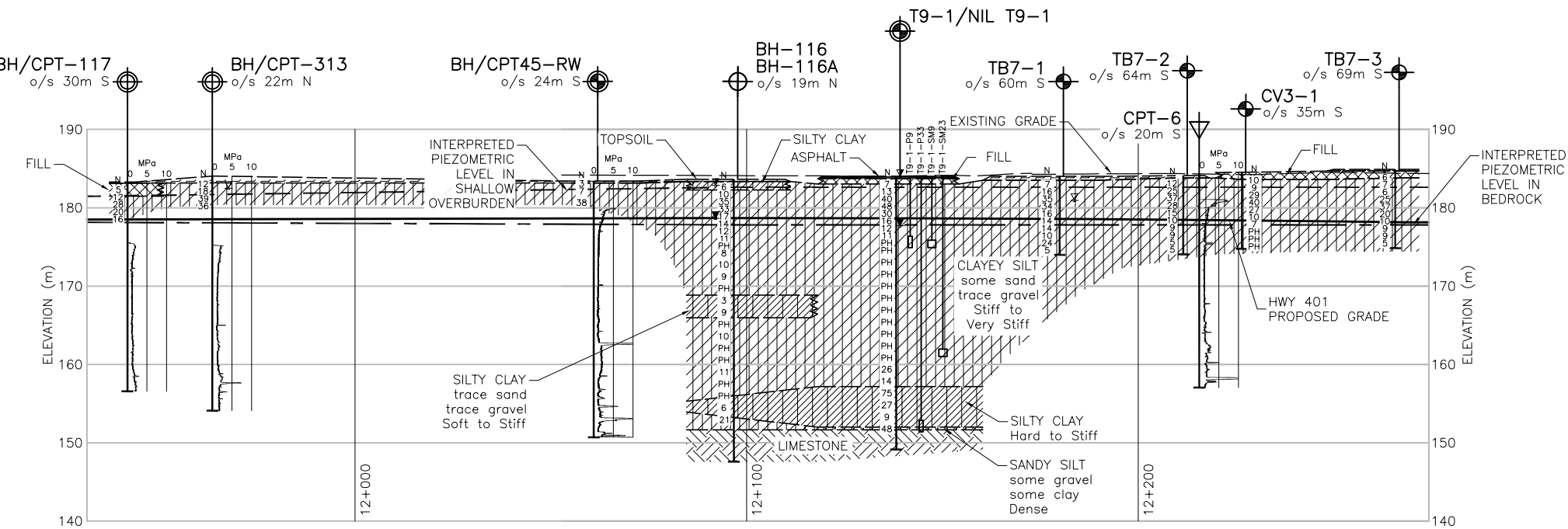
READY FOR ISSUE		
SUBMISSION: 60% INTERIM IDR SUBMISSION		
	NAME (PRINT)	DATE
ORIGINATOR	S. LABUTE	21-MAY-14
CHECKER	E. AHMED	
REVIEWER	D. DIMITRIU	

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



PROFILE ALONG CL OF HWY 401

HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



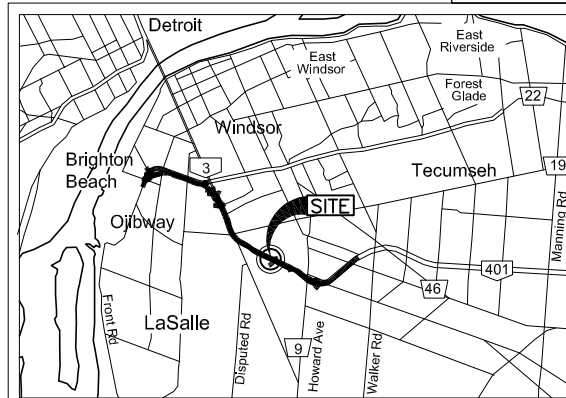
Windsor-Essex
Parkway Project
RFP No. 09-54-1007

NEW CONSTRUCTION
TRAIL 41 - STA 10+430 TO 10+455
TOE RETAINING WALL "C"
BOREHOLE LOCATIONS & SOIL STRATA



SHEET
G0153

Phase 1
60% Sub



KEY PLAN
SCALE
1 0 2 4Km

LEGEND

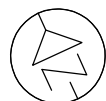
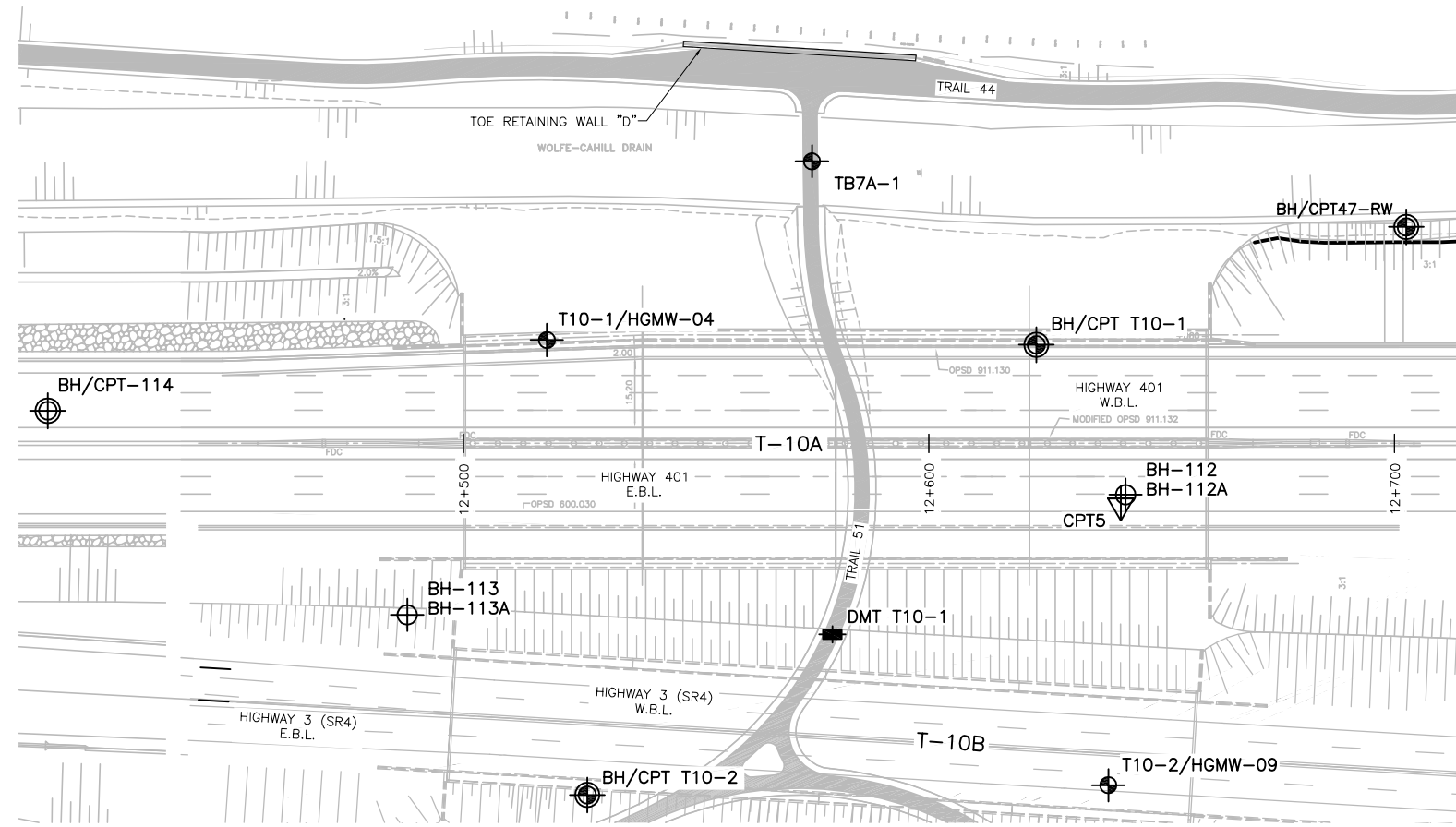
- BOREHOLE CURRENT INVESTIGATION
BOREHOLE AND NILCON VANE CURRENT INVESTIGATION
SW/SP HOLE (HYDROGEOLOGY) CURRENT INVESTIGATION
NILCON VANE CURRENT INVESTIGATION
CPT - CURRENT INVESTIGATION
DMT - CURRENT INVESTIGATION
BOREHOLE PREVIOUS INVESTIGATION
BOREHOLE, CPT AND NILCON VANE PREVIOUS INVESTIGATIONS
CPT -PREVIOUS INVESTIGATION
N SPT N-VALUE
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.
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- ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

REVISIONS	21-MAY-14	A	EA	60% INTERIM IDR SUBMISSION
	DATE	REV.	BY	DESCRIPTION
DESIGN	EA	CHK	NSV	CODE CAN/CSA
DRAWN	SJL	CHK	DD	SITE TOE WALL "C" DATE 24-APR-14

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN**Parkway
Infrastructure
Engineers****amec**
Hatch Mott
MacDonaldWindsor-Essex
Parkway Project
RFP No. 09-54-1007NEW CONSTRUCTION
TRAIL 44 - STA 10+370 TO 10+420
TOE RETAINING WALL "D"
BOREHOLE LOCATIONS & SOIL STRATASHEET
G0154Phase 1
60% SubPLAN
HORIZONTAL SCALE 1:750

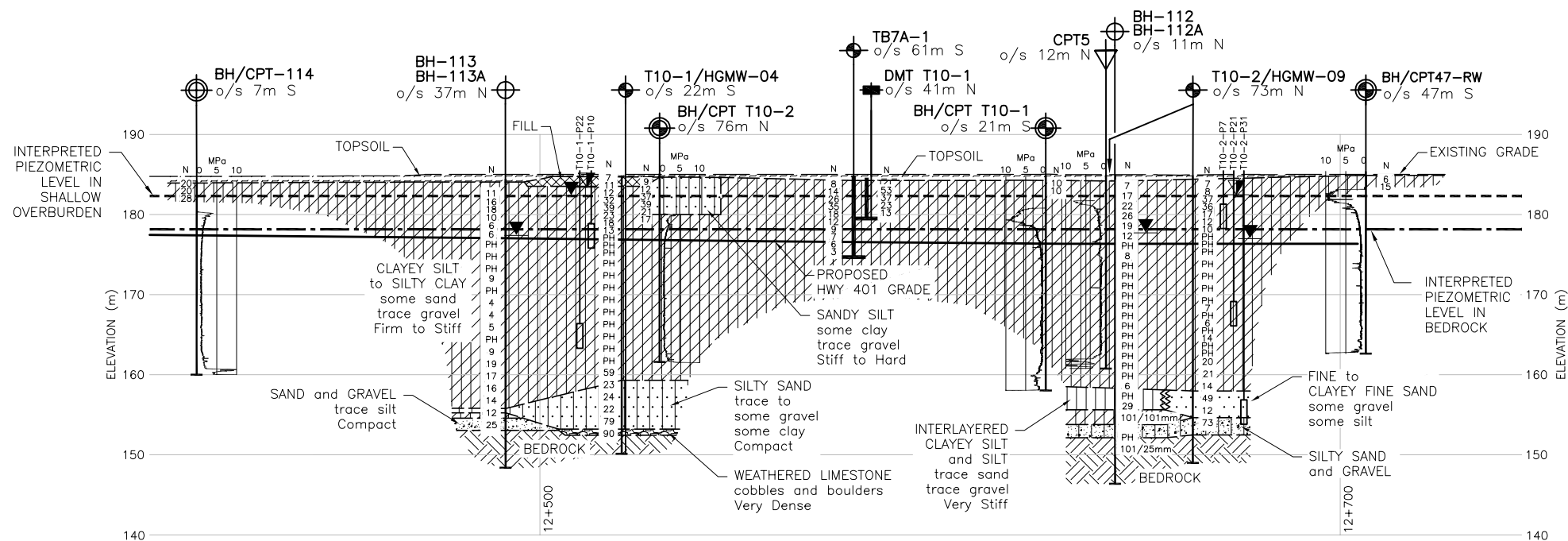
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		NORTHING	EASTING
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BH/CPT T10-1	184.9	4678450.6	334217.4
BH/CPT T10-2	185.2	4678403.2	334089.2
DMT T10-1	184.6	4678412.4	334151.5
T10-1/HGMW-04	184.9	4678495.6	334122.3
T10-2/HGMW-09	184.8	4678358.2	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
CPT5	184.7	4678413.0	334220.0

MATERIAL LEGEND

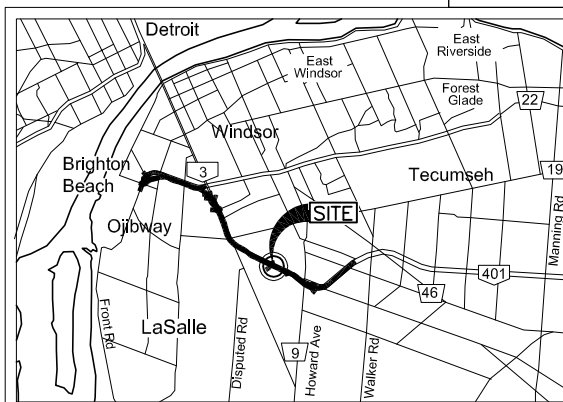
	TOPSOIL/ ORGANICS		SILT
	FILL		SANDY SILT
	SAND		CLAYEY SILT
	SILTY CLAY		SAND AND GRAVEL
	SILTY SAND		SILTY SAND AND GRAVEL
	COBBLES AND BOULDERS		LIMESTONE DOLOSTONE /BEDROCK

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



PROFILE ALONG CL OF HWY 401

HORIZONTAL SCALE 1:750
VERTICAL SCALE 1:375DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWINGKEY 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)
- MHS - MAGNETIC
HEAVE/SETTLEMENT
GAUGE (SM)
- V - 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.

READY FOR ISSUE		
SUBMISSION: 60% INTERIM IDR SUBMISSION		
NAME (PRINT)	DATE	
ORIGINATOR S. LABUTE	21-MAY-14	
CHECKER E. AHMED		
REVIEWER D. DIMITRIU		

REVISIONS	DATE	REV.	BY	DESCRIPTION
21-MAY-14	A	EA		60% INTERIM IDR SUBMISSION
DESIGN	EA	CHK	NSV	CODE CAN/CSA S6-06 LOAD CL-625-ONT
DRAWN	SJL	CHK	DD	SITE TOE WALL "D" DATE 24-APR-14

Figures

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

(Figure 5.1, Ladd & DeGroot, 2004, ref. R-20)

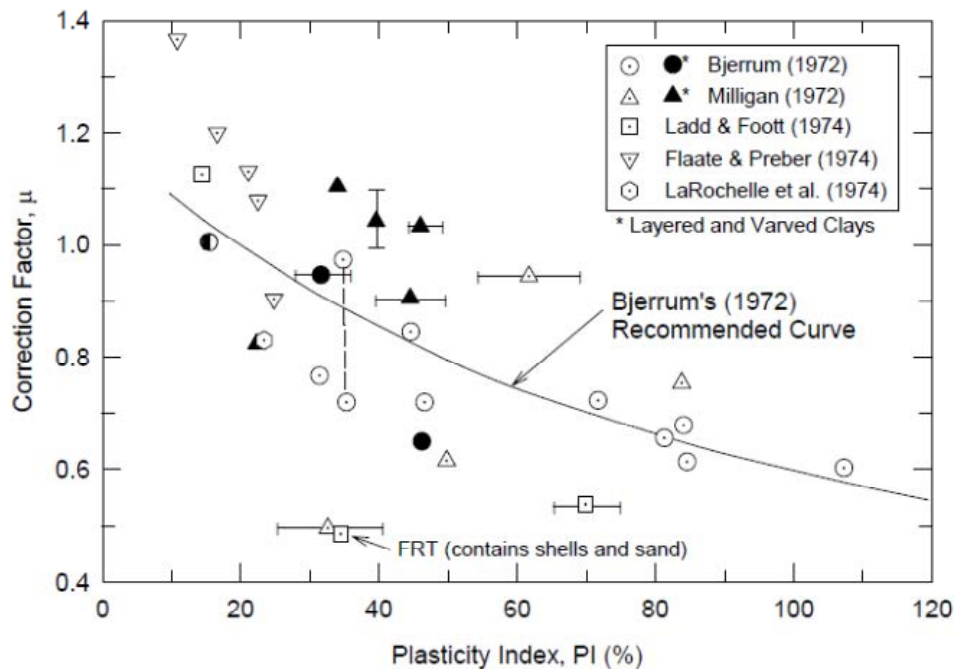
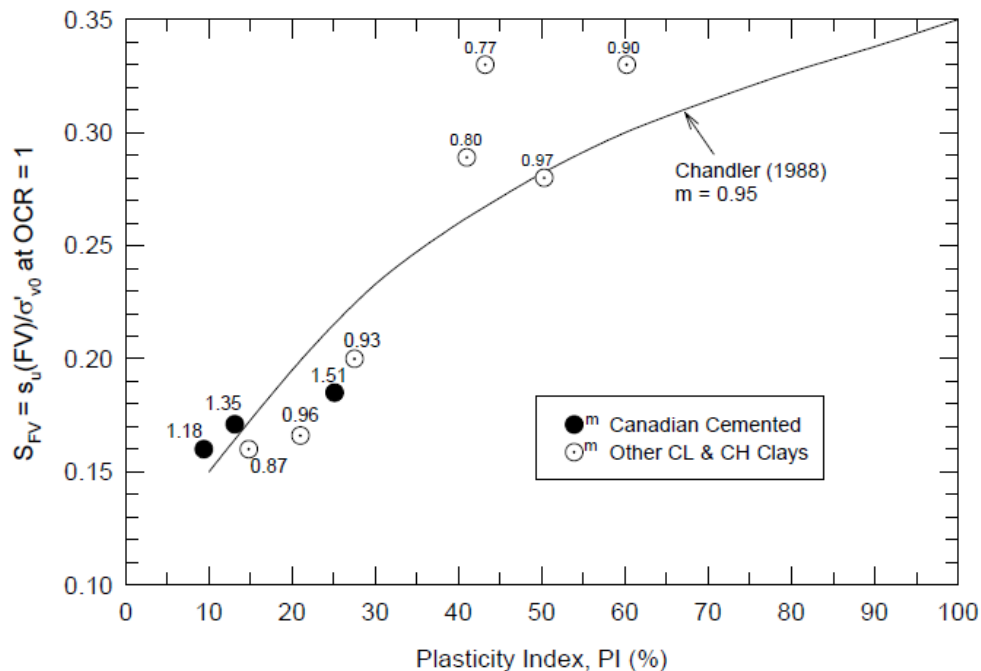
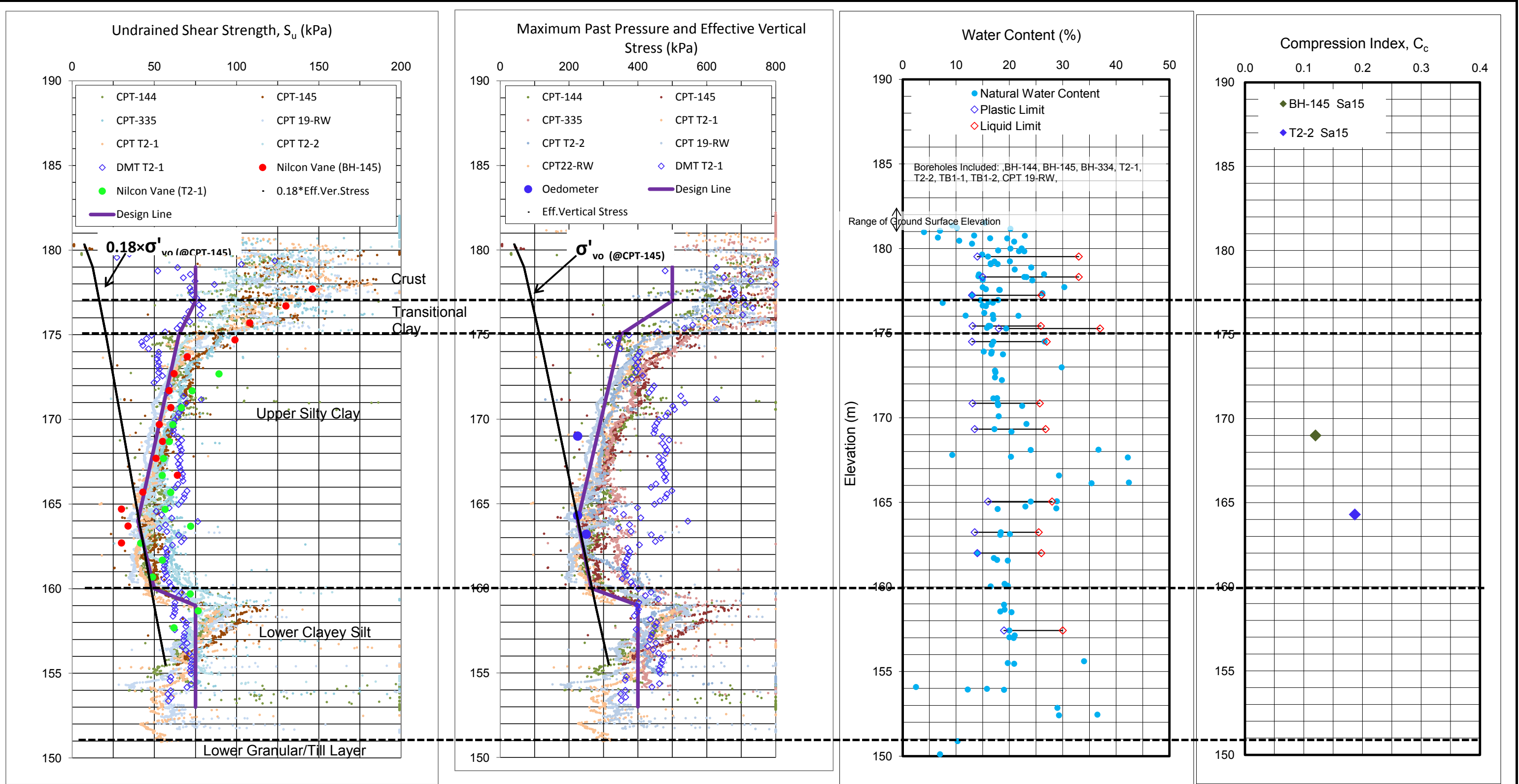


Figure 3-2: Field Vane Undrained Strength Ratio at OCR = 1 vs. Plasticity Index for Homogeneous Clays

(Figure 5.2, Ladd & DeGroot, 2004, ref. R-20)





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.

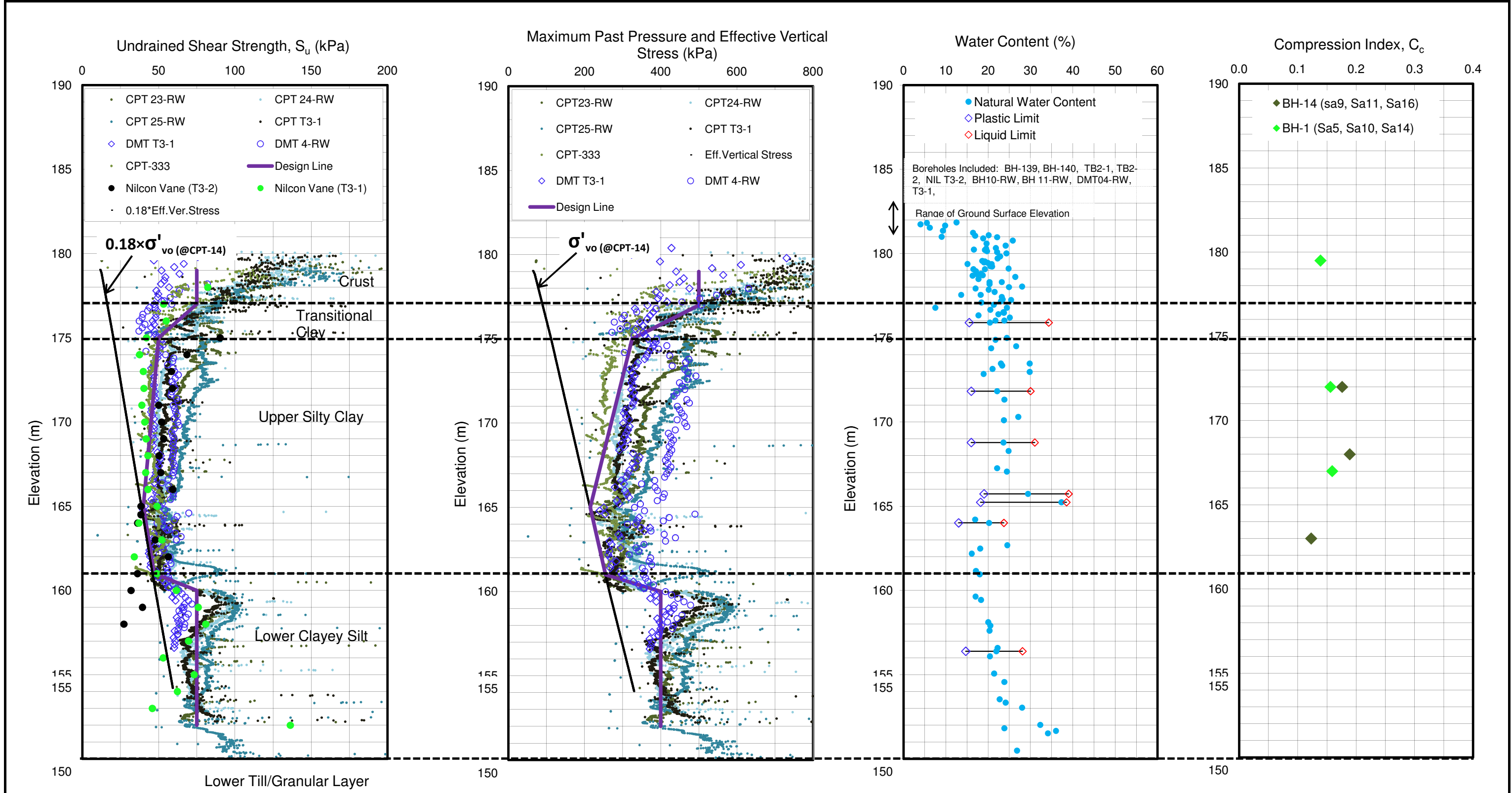
2. Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_{vo}) / S]^{1/m}$



Environment & Infrastructure

CLIENT :

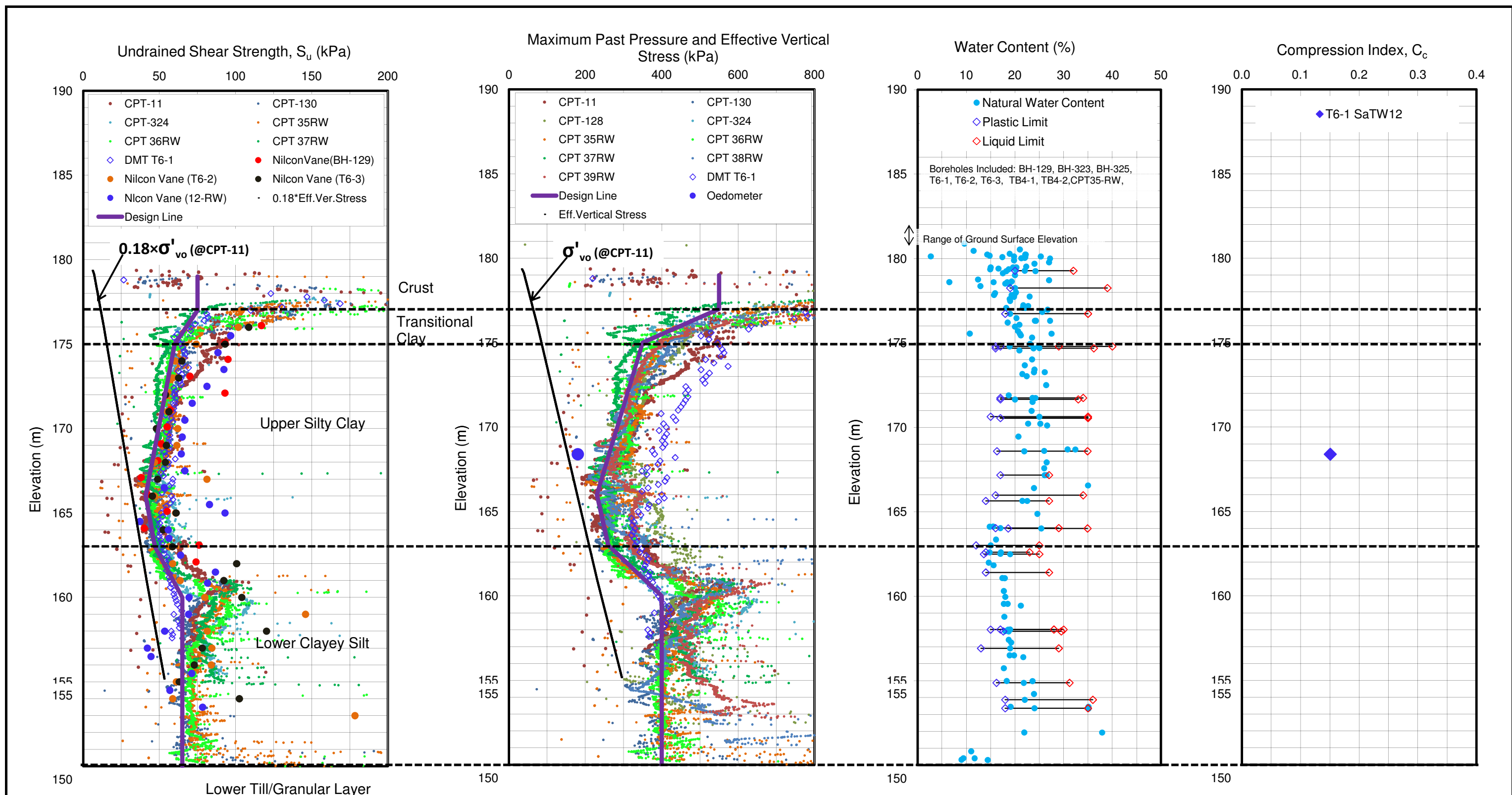
PROJECT: WINDSOR ESSEX PARKWAY				
TITLE: SOIL PROPERTY PROFILES AT AND AROUND TRAIL BRIDGE TB-1				
DATE: Jul 2014	JOB NO.:	CAD FILE:	FIG NO.: 3.3a	REV.



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. $OCR = [(S_u / \sigma'_v) / S]^{1/m}$



Notes:

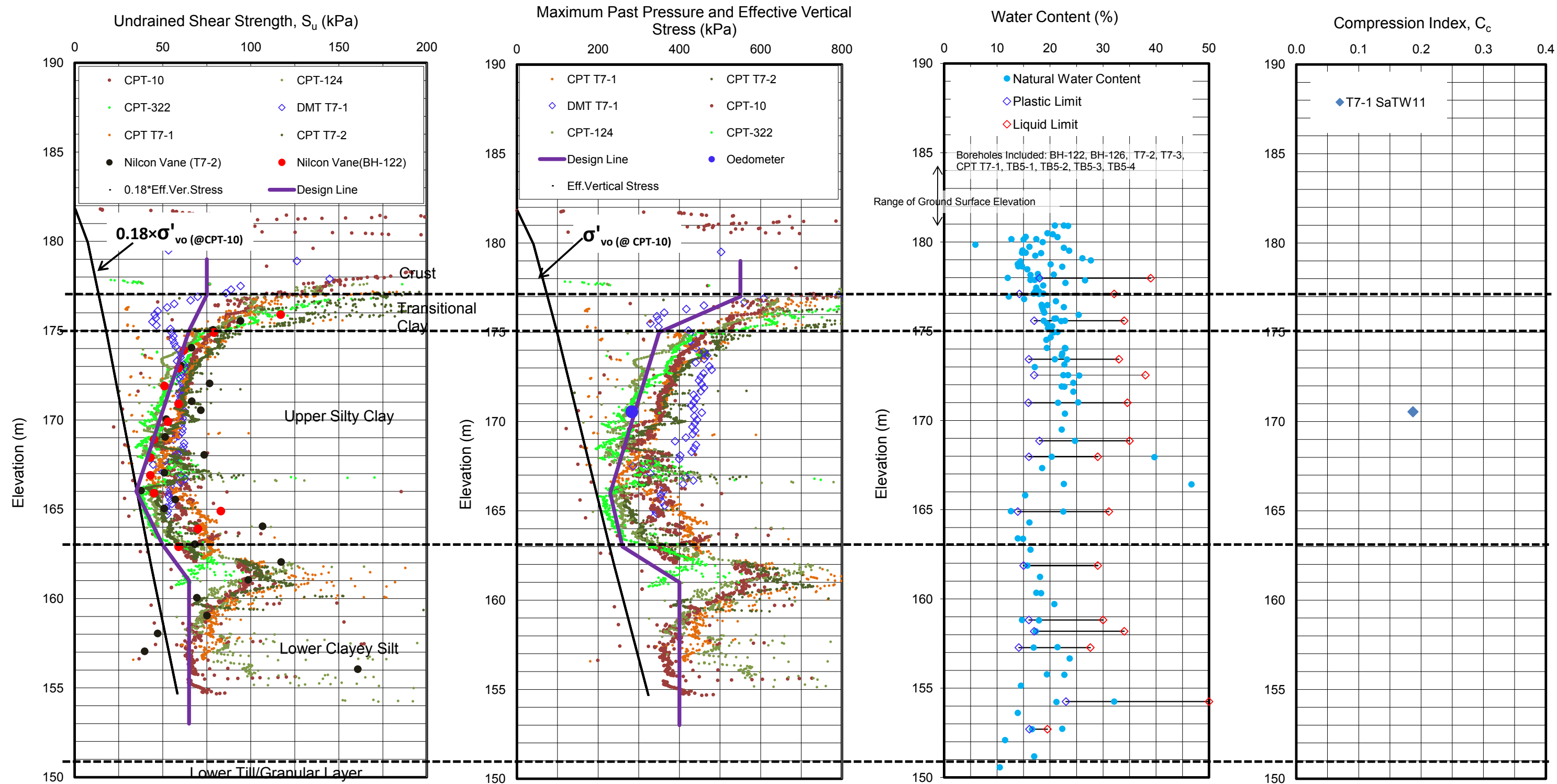
1. Shear strength profiles were estimated from CPT data using the equation $S_u = (q_t - \sigma_{VO}) / N_{KT}$. The cone factor N_{KT} was estimated by comparing the CPT profiles with a nearby Nilcon Vane profile.
2. Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_v)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



Environment & Infrastructure

CLIENT :

PROJECT: WINDSOR ESSEX PARKWAY				
TITLE: SOIL PROPERTY PROFILES				
AT AND AROUND TRAIL BRIDGE TB-4				
DATE: Jul 2014	JOB NO.:	CAD FILE:	FIG NO.: 3.3c	REV.



Notes:

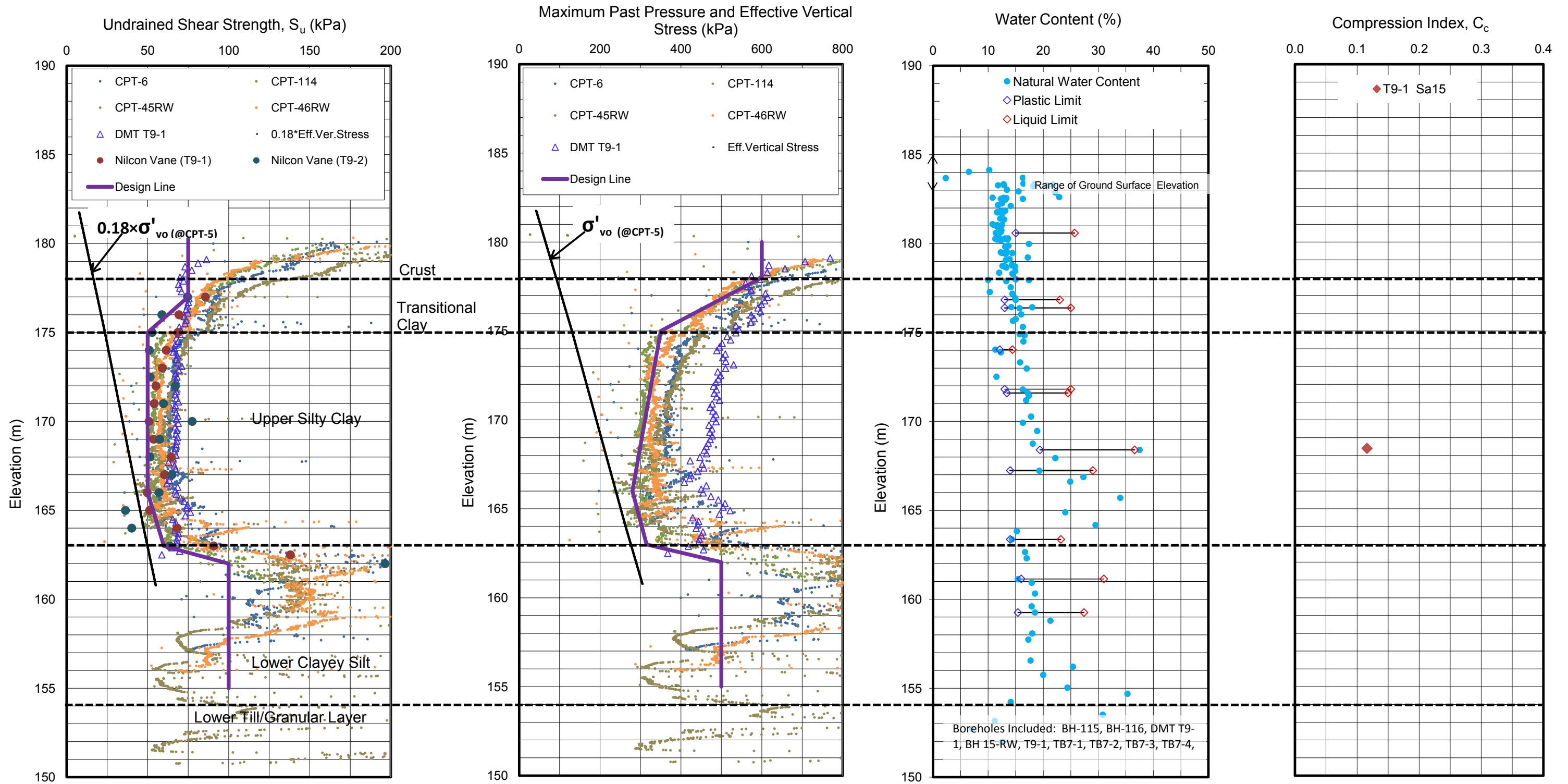
1. Shear strength profiles were estimated from CPT data using the equation $S_u = (q_t - \sigma_{vo}) / N_{KT}$. The cone factor N_{KT} was estimated by comparing the CPT profiles with a nearby Nilcon Vane profile.

2. Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_v) / S]^{1/m}$

amec Environment & Infrastructure

CLIENT :

PROJECT:	WINDSOR ESSEX PARKWAY				
TITLE:	SOIL PROPERTY PROFILES AT AND AROUND TRAIL BRIDGE TB-5				
DATE:	JUL 2014	JOB NO.:	CAD FILE:	FIG NO.: 3.3d	REV.



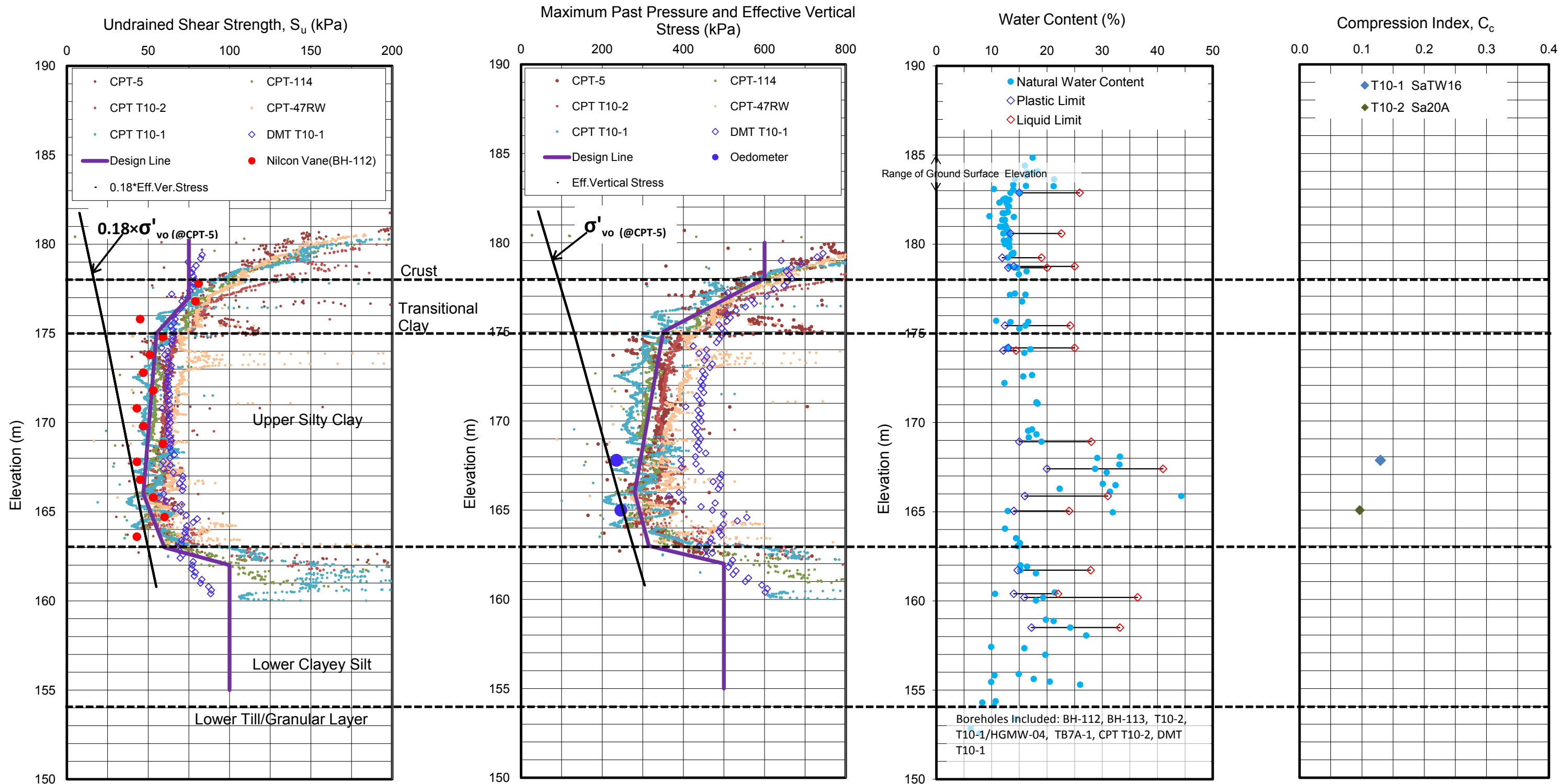
Notes:

- 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.
- Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_v) / S]^{1/m}$

amec Environment & Infrastructure

CLIENT :

PROJECT:	WINDSOR ESSEX PARKWAY			
TITLE:	SOIL PROPERTY PROFILES AT AND AROUND TRAIL BRIDGE TB-7			
DATE:	JUL 2014	JOB NO.:	CAD FILE:	FIG NO.: 3.3e REV.



Notes:

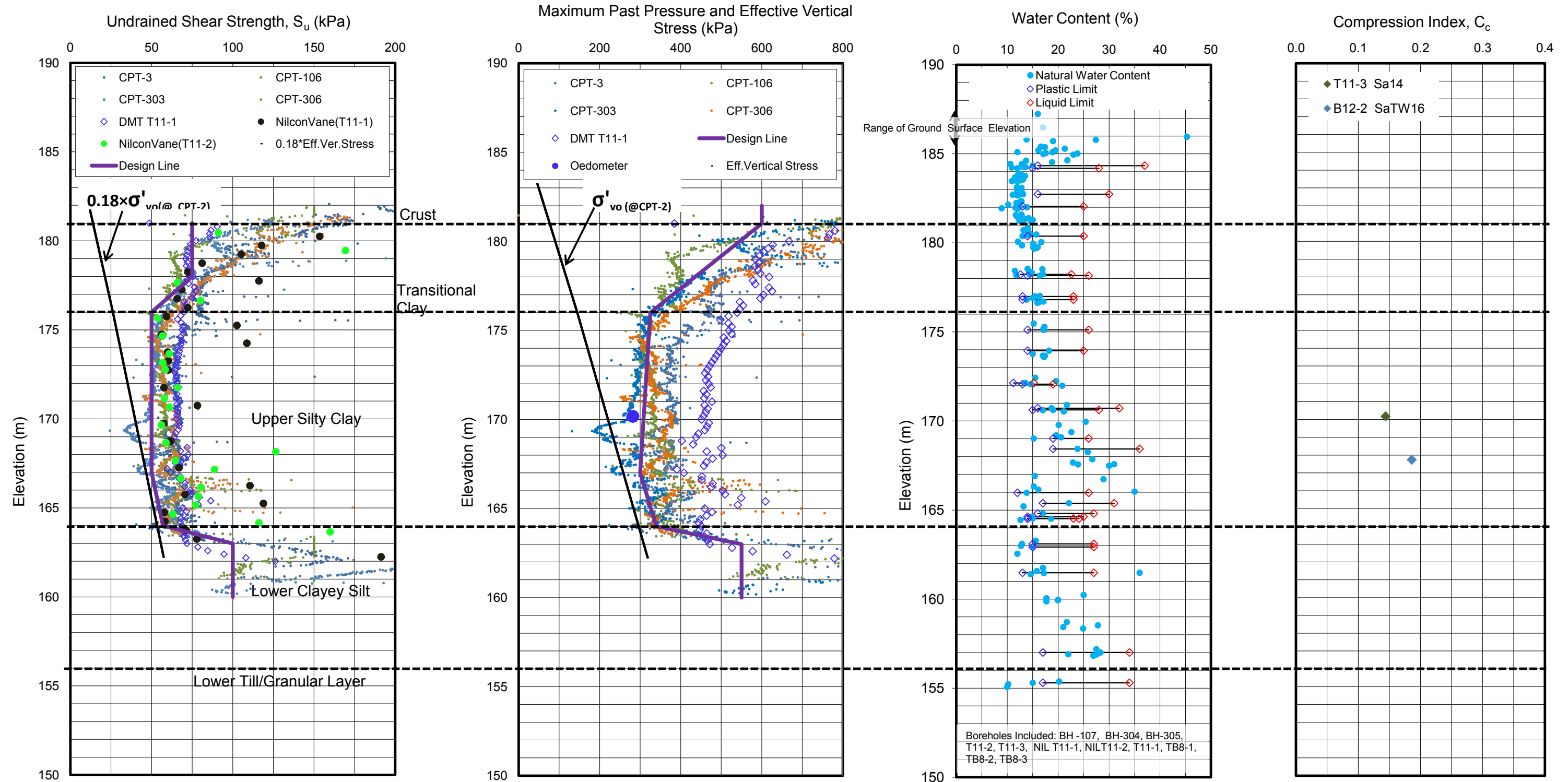
1. Shear strength profiles were estimated from CPT data using the equation $S_u = (q_t - \sigma_{vo}) / N_{KT}$. The cone factor N_{KT} was estimated by comparing the CPT profiles with a nearby Nilcon Vane profile.
2. Maximum past pressure profiles estimated using SHANSEP method. $OCR = [(S_u / \sigma'_v)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



Environment & Infrastructure

CLIENT :

PROJECT:	WINDSOR ESSEX PARKWAY			
TITLE:	SOIL PROPERTY PROFILES AT AND AROUND TRAIL BRIDGE TB-7A			
DATE:	JUL 2014	JOB NO.:	CAD FILE:	FIG NO.: 3.3f REV.



Notes:

1. Shear strength profiles were estimated from CPT data using the equation $S_u = (q_t - \sigma_{v0}) / N_{KT}$. 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. $OCR = [(S_u / \sigma'_v) / S]^{1/m}$

amec Environment & Infrastructure

CLIENT :

PROJECT:	WINDSOR ESSEX PARKWAY			
TITLE:	SOIL PROPERTY PROFILES AT AND AROUND TRAIL BRIDGE TB-8			
DATE:	JUL 2014	JOB NO.:	CAD FILE:	FIG NO.: 3.3g REV.

Figure 4-1: Compressibility Parameters at WEP

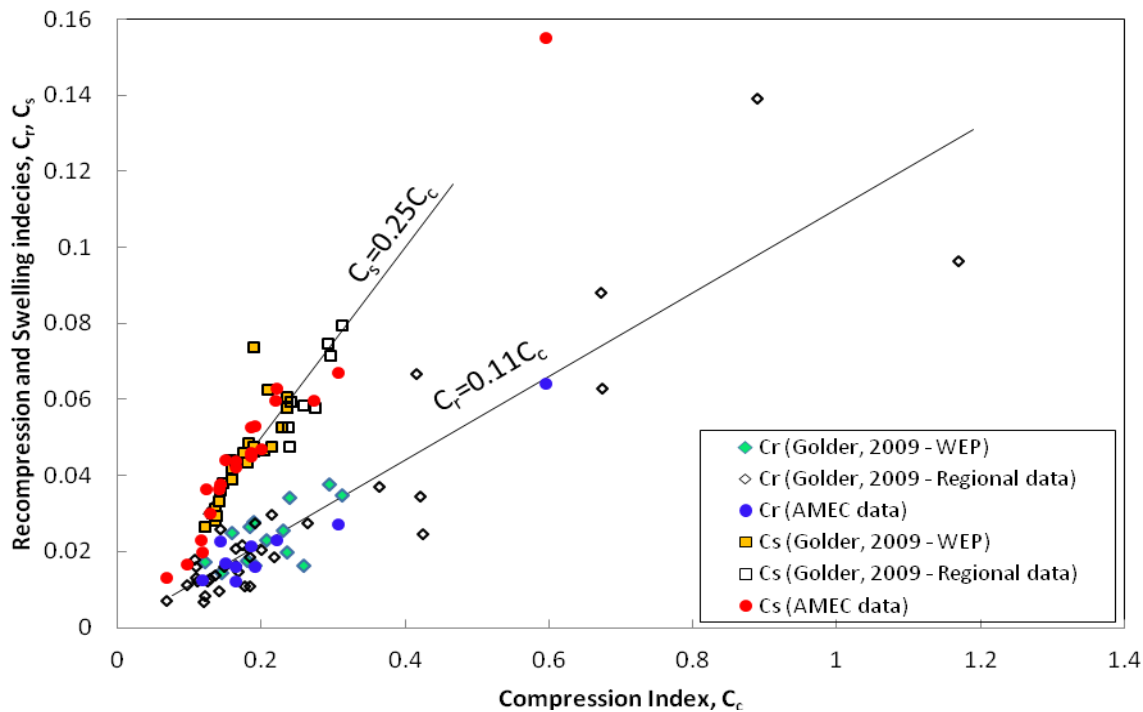
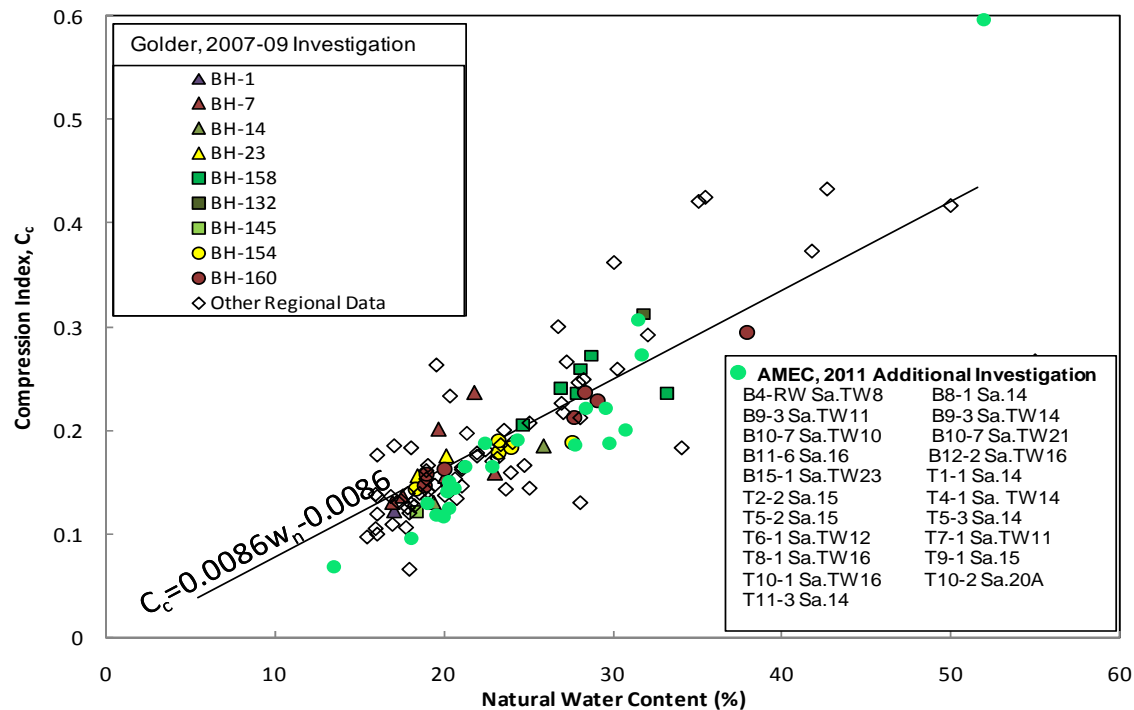


Figure 4-2: C_c versus C_α Relationship at WEP

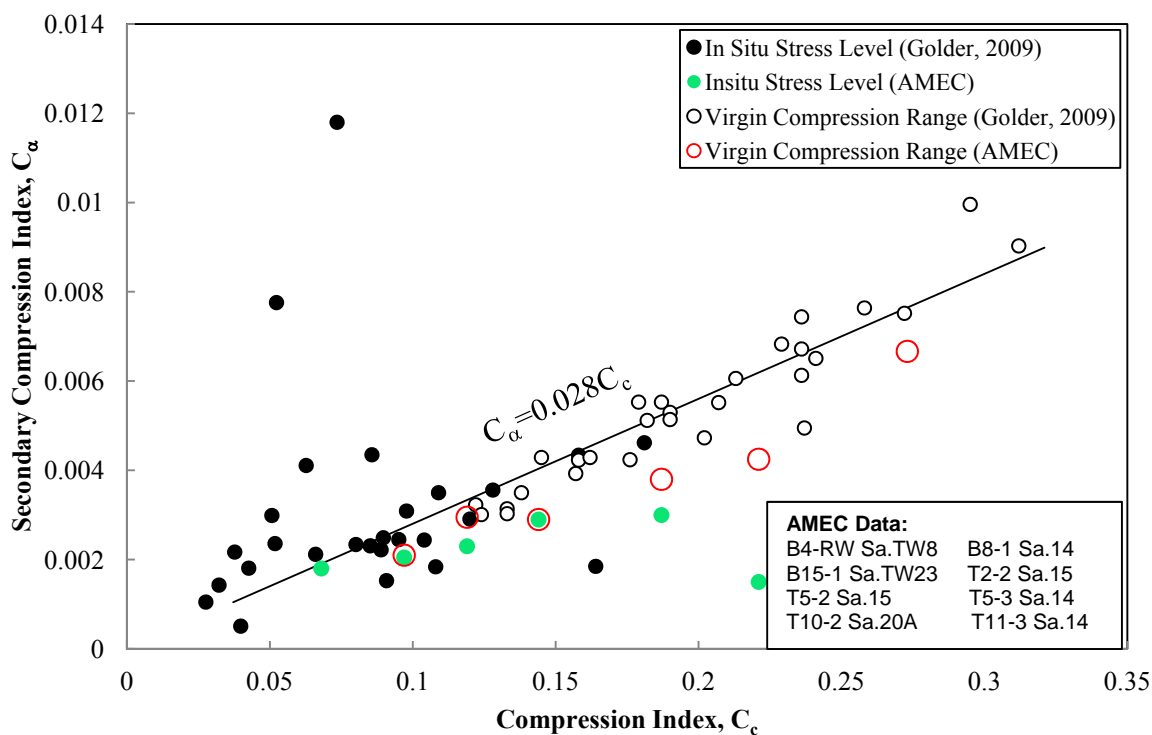


Figure 4-3: Effective Friction Angle (ϕ') for Silty Clay to Clayey Silt Stratum at WEP

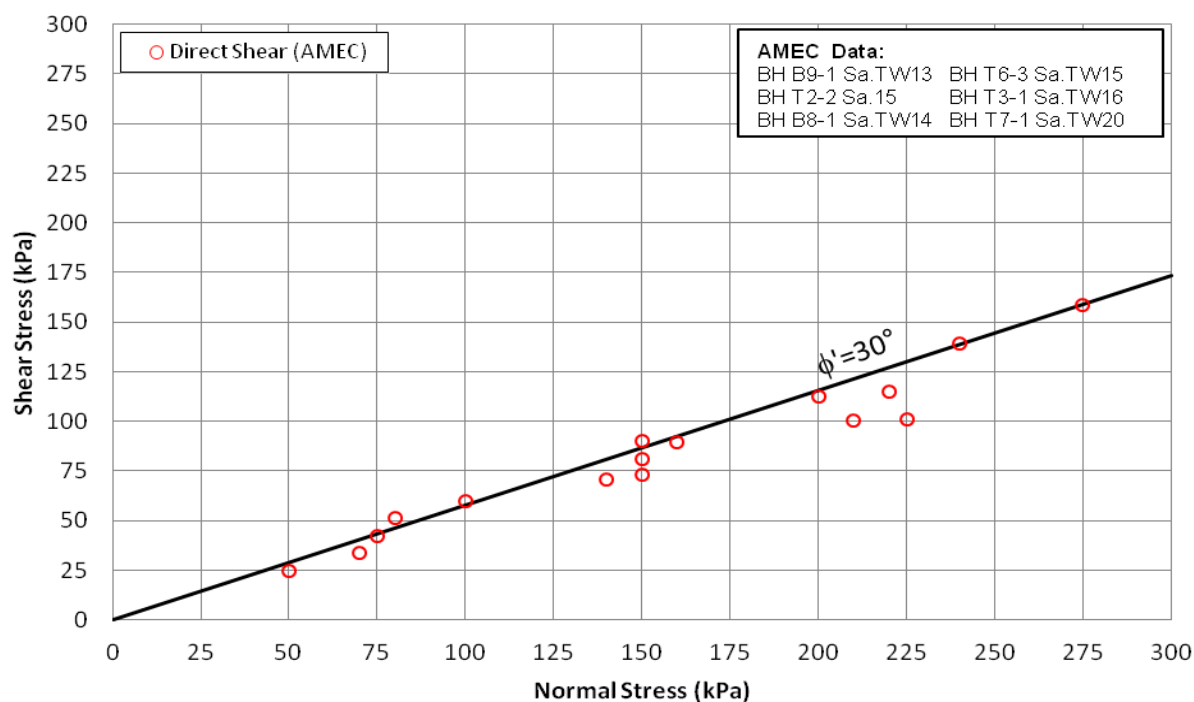
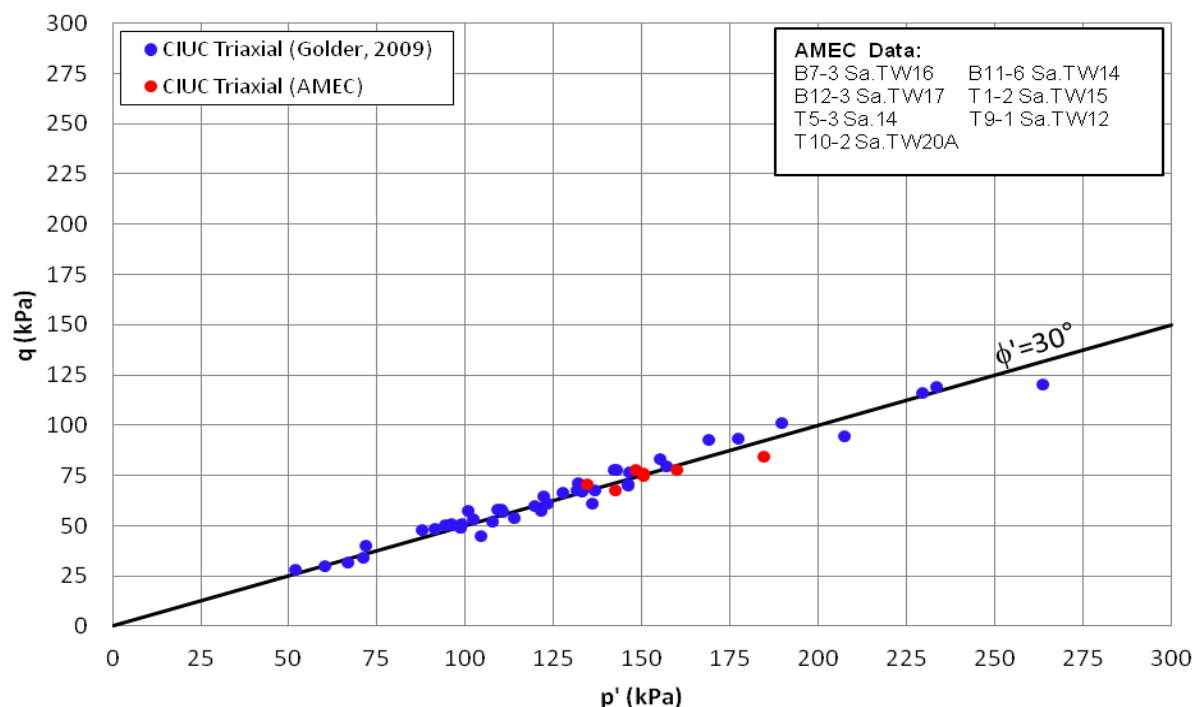
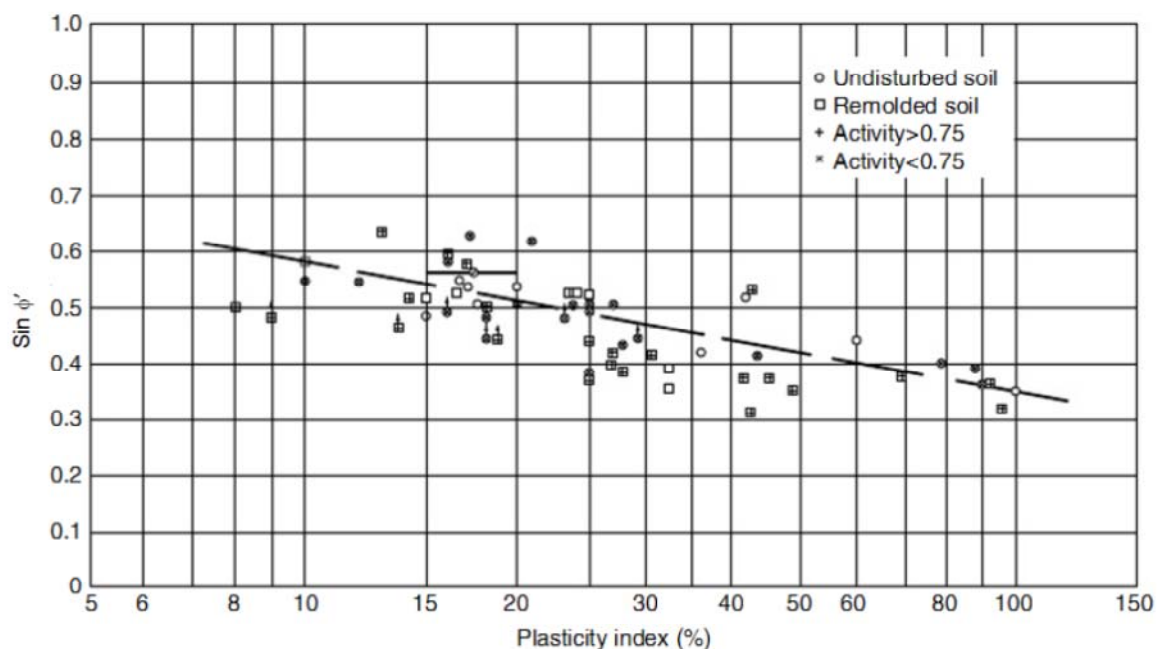


Figure 4-4: Relationship between $\sin \phi'$ and Plasticity Index for Normally Consolidated Soils

(Kenney, 1959, ref. R-2)



Appendix A Borehole, CPT, DMT and Nilcon 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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
181.9	Ground Surface							20 40 60 80 100	○ UNCONFINED + FIELD VANE					-borehole 1.5m from basement of former 2368 Bethlehem
0.0	<div><div>FILL</div><div>Topsoil</div></div>								● POCKET PEN. × LAB VANE					
	<div><div>FILL</div><div>Silty Sand and topsoil inclusions</div><div>Brown</div><div>Moist to wet</div></div>		1	SS	3		181							
180.4														
1.5	<div><div>CLAYEY SILT</div><div>Some sand, trace gravel</div><div>Stiff to very stiff</div><div>Mottled brown and grey</div></div>		2	SS	7		180							
			3	SS	16									
			4	SS	15		179							
	Grey		5	SS	10		178							
	-Trace pink clay inclusions, trace silt and fine sand inclusions		6	SS	11		177							
			7	SS	9		176							
			8	SS	6									
			VT				175							
			9	SS	8		174							
							173							
			10	SS	5									
			VT				172							
171.9	END OF BOREHOLE													
10.1	Borehole dry on completion on June 11, 2011						171							
							170							
							169							
							168							

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

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METRIC






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

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 + FIELD VANE										
								● POCKET PEN. × LAB VANE										
182.1	Ground Surface						182											
0.0	TOPSOIL						181											
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			179										
			5	SS	9			178										
			6	SS	10													
			7	SS	8			177										
			8	SS	7			176										
			VT					175										
			9	SS	4			174										
			VT															
			10	SS	2			173										
			VT															
171.9								172										
10.2	END OF BOREHOLE																	
	Groundwater encountered at elevation 180.3m during drilling																	
							171											
							170											
							169											
							168											

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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																	
0.0	FILL Silty Clay																	
182.2	Some sand, trace gravel, trace topsoil																	
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	END OF BOREHOLE																	
10.2	Groundwater encountered at elevation 180.3m during drilling																	

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



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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 ● POCKET PEN.	+ FIELD VANE × LAB VANE										
								20 40 60 80 100											
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														
			4	SS	15														
	Grey		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																		

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METRIC

[illegible]

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

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 NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE			WATER CONTENT (%) w _p w w _L					
181.0	Ground Surface							20	40	60	80	100				
180.9	ASPHALT															
180.7	FILL Crushed Limestone Grey															
180.2	FILL Silty clay some sand, trace gravel Trace topsoil Greenish-brown		1A, B	SS	8		180									
179.9	TOPSOIL CLAYEY SILT Some sand, trace gravel Firm to stiff Mottled brown and grey trace to some pink nodules		2	SS	8		179									
1.1			3	SS	10		178									
	Brown		4	SS	18		177									
	Grey		5	SS	14		176									
			6	SS	10		175									
			7	SS	7		174									
			8	SS	5		173									
				VT			172									
			9	SS	4		171									
				VT			170									
			10	SS	5		169									
				VT			168									
				VT			167									
170.9	END OF BOREHOLE															
10.1	Borehole dry on completion															

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METRIC

+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	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	20						40	60	80	100	10
181.3	Ground Surface																			
0.0	TOPSOIL Sandy Black																			
180.9																				
0.4	FINE SAND Trace to some silt Brown-yellow		A	AS																
			1	SS	5															
179.8	CLAYEY SILT Some sand, trace gravel, fissured Firm to very stiff Brown to grey Trace pink nodules below approx. 5.5 m (El. 175.8 m) Fissured Hairline sand/silt lenses <																			

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

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RECORD OF BOREHOLE No TB6-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678909.5, E333353.3 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE Jul 9, 11 - Jul 9, 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	10	20
183.0	Ground Surface																		
0.0	TOPSOIL																		
0.1	CLAYEY SILT Some sand, trace gravel Stiff to hard Mottled brown and grey Sandy, dry		1	SS	32							○							
	-Trace fissures		2	SS	22							○				-hit a stone which may have skewed blow counts			
	-Trace inferred cobbles, trace fissures		3	SS	45							○							
			4	SS	31							○				-sample very disturbed due to inferred cobbles			
			5	SS	20							○							
			6	SS	14							○							
			7	SS	13							○							
			8	SS	9							○							
			9	SS	5							○							
				VT															
			10	SS	5							○							
				VT												-corrosivity sample			
172.9	END OF BOREHOLE																		
10.1	Borehole dry on completion																		

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



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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									WATER CONTENT (%)		
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE										
184.0	Ground Surface																		
0.0	TOPSOIL																		
183.5																			
0.5	CLAYEY SILT Some sand, trace gravel, trace cobbles Firm to hard Mottled brown and Grey Brown -Trace fissures Grey		1	SS	7														
			2	SS	16														
			3	SS	35														
			4	SS	34														
			5	SS	16														
			6	SS	14														
			7	SS	14														
			8	SS	10														
			9	SS	24														
			10	SS	5														
173.9	END OF BOREHOLE			VT															
10.1	Groundwater encountered at elevation 181.0m during drilling on July 10, 2011																		
												</							

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

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 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								
184.1	Ground Surface							○ UNCONFINED	○ FIELD VANE							
0.0	TOPSOIL							● POCKET PEN.	× LAB VANE							
183.8						20	40	60	80	100	10	20	30			
0.3	CLAYEY SILT Some sand, trace gravel Firm to hard Mottled brown and grey		1	SS	12							○				
	Trace fissures Brown		2	SS	25							○				
			3	SS	37							○				
	Trace to some oxidized fissures		4	SS	28							○				
	Grey		5	SS	15							○				
			6	SS	10							○				
			7	SS	9							○				
			8	SS	9							○				
			9	SS	5							○				
			VT													
			10	SS	5							○				
			VT													
174.0	END OF BOREHOLE															
10.1	Borehole dry on completion															

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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 ● POCKET PEN.	+ FIELD VANE × LAB VANE										
								20 40 60 80 100											
184.9	Fill Surface																		
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>		1	SS	6														
1.1			2	SS	7														
	<div>Brown Moist to wet Trace fissures</div>		3A, B	SS	6														
			4	SS	25														
			5	SS	37														
	<div>Grey</div>		6	SS	20														
			7	SS	10														
			8	SS	9														
			9	SS	9														
			10	SS	5														
174.8	<div>END OF BOREHOLE</div>			VT															
10.1	<div>Borehole dry on completion</div>																		

+ 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 TB7A-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678506.6, E334190.2 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 75 - 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										
184.8 0.0	Ground Surface TOPSOIL																		
184.2 0.6	CLAYEY SILT Some sand, trace gravel Firm to hard Mottled brown and grey Brown - Trace fissures Grey		1	SS	8														
			2	SS	14														
			3	SS	26														
			4	SS	35														
			5	SS	18														
			6	SS	12														
			7	SS	9														
			8	SS	7														
				VT															
			9	SS	6														
			10	SS	3														
174.7 10.1	END OF BOREHOLE Borehole dry on completion			VT															
	</																		

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

METRIC

[illegible]

0.0	Ground Surface		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																																																														

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 13/06/13

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

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									WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.	× LAB VANE							
								20	40	60	80						100	10
186.1	Ground Surface																	
0.0	TOPSOIL																	
0.2	SILTY CLAY TO CLAYEY SILT Some sand trace gravel, trace to some topsoil Firm to hard Mottled brown and grey Brown Some fissures at about elevation 183.71m Grey Some oxidation at about elevation 181.96m Trace oxidation at about elevation 181.43m																	
			1	SS	5	185												
			2A, B	SS	5	184												
			3	SS	35	183												
			4	SS	38	182												
			5	SS	21	181												
			6	SS	14	180												
			7	SS	9	179												
			8	SS	6	178												
			9	SS	5	177												
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																		
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		185												
0.3																			
				2	SS			8											
				3	SS			22		184									
				4	SS			43		183									
				5	SS			27		182									
				6	SS			16		181									
		7	SS	11		180													
		8	SS	8		179													
		9	SS	7		178													
			VT			177													
</																			

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 13/06/13

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							WATER CONTENT (%)	
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE							
181.4 0.0	Fill Surface							20 40 60 80 100	10 20 30					GR SA SI CL		
180.8 0.6	FILL Silty Clay Some sand, trace gravel, occasional broken brick Brown															
180.0 1.4	SAND Well-Graded Trace silt, trace gravel Compact Brown		1	SS	15											
	SILTY CLAY Some sand, trace gravel, trace pink clay nodules Stiff to very stiff Grey		2	SS	11											
			3	SS	17											
			4	SS	16									6 15 36 43		
			5	SS	14											
			6	SS	14											
			7	SS	14											
			8	SS	17											
			9	TW	PH											
				VT												
			10	TW	PH											
				VT												
			11	TW	PH											
				VT												
			12	TW	PH											
				VT												
				VT												
			13	TW	PH											
				VT												
				VT												

-Trace sand seams at about elevation 172m

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

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

[illegible]

+ 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

3 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 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					
151.2																				
30.2	CLAYEY SILT Some sand, some gravel very stiff Grey		24	SS	26								○							
149.1			25	SS	50/ 0.5mm								○							
32.3	LIMESTONE Fine grained, fairly porous, 20-40mm thick SHALE layer present at depth of approximately 33.60m; laminated to bedded, stylolites and calcite crystals present; soft to semi-hard Light grey to tan brown		26	RC																





-split spoon
refusal at 32.3m
Rock Core Cu =
94.3 MPa
RQD = 39%
TCR = 85%
SCR = 46%
RQD = 89%
TCR = 100%
SCR = 94%
RQD = 89%
TCR = 100%
SCR = 89%

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								WATER CONTENT (%)			
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE										
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																		
							178												
							177												
							176												
							175												
							174												
							173												
							172												
							171												
							170												
							169												
							168												
							167												

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

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

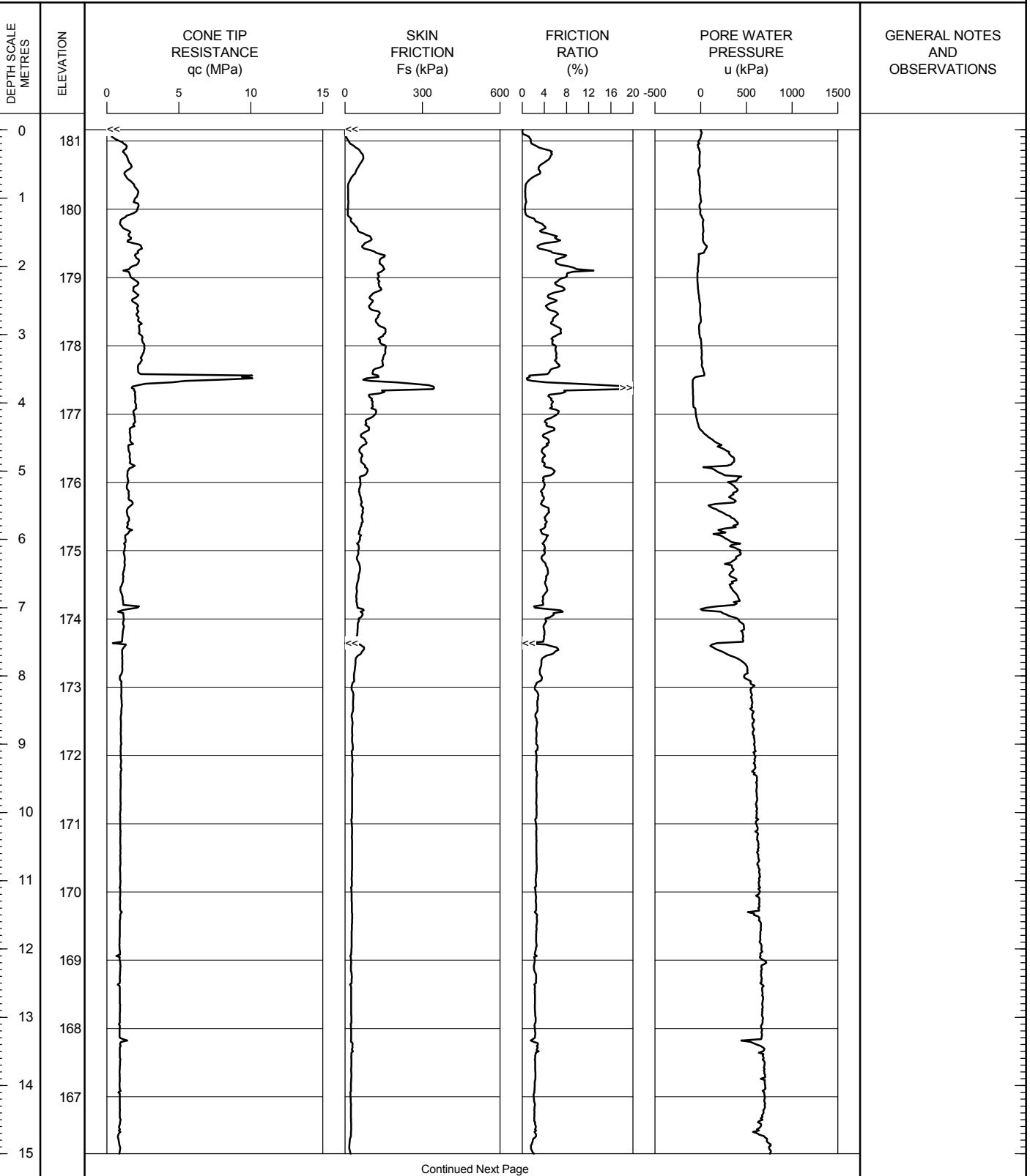
DATUM Geodetic

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

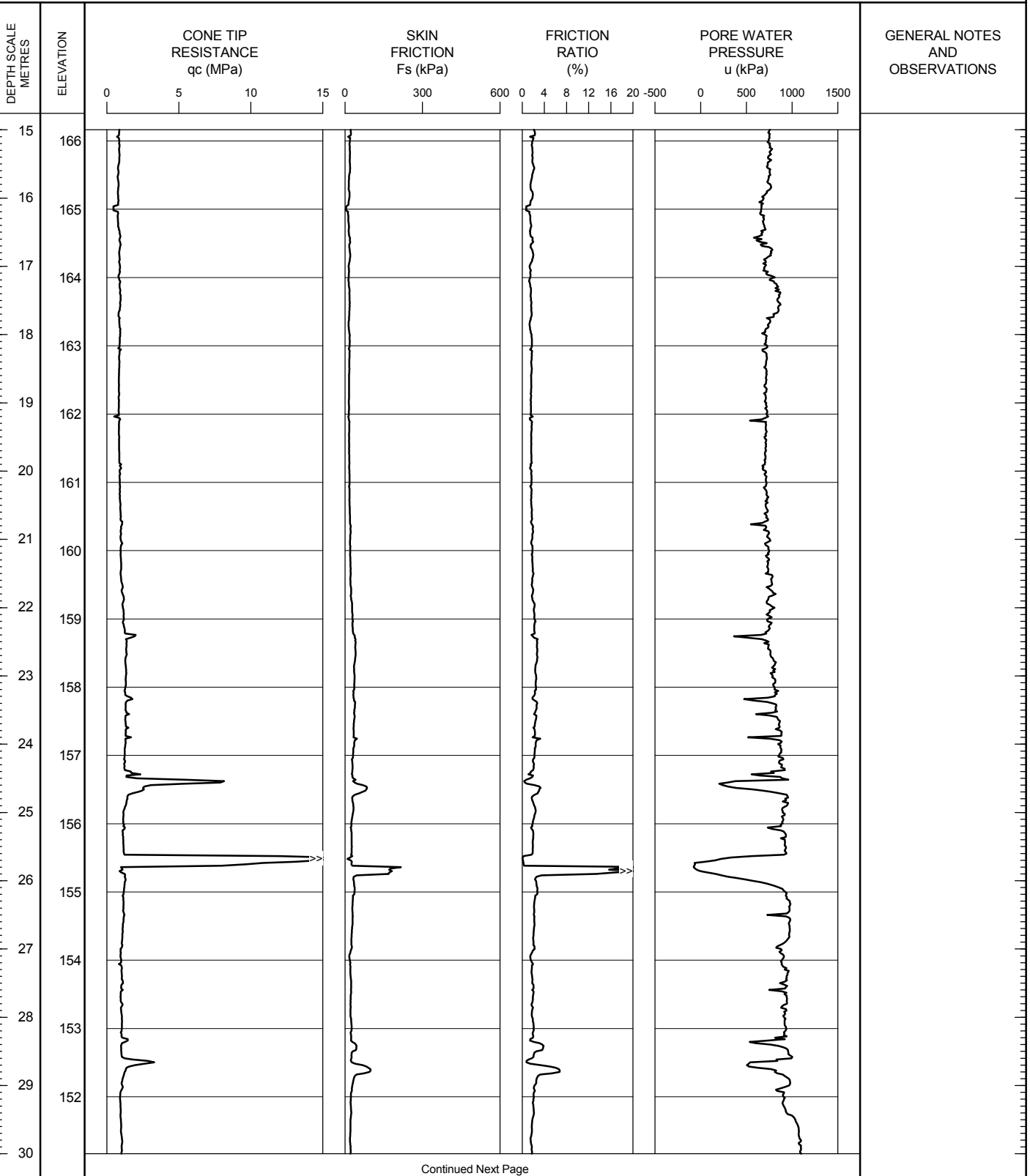
DATUM Geodetic

GROUND SURFACE ELEVATION: 181.2

PREDRILL DEPTH: 0

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T2-1

METRIC

PROJECT Windsor-Essex Parkway

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

SHEET 3 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

DEPTH SCALE METRES	ELEVATION	CONE TIP RESISTANCE qc (MPa)	SKIN FRICTION Fs (kPa)	FRICTION RATIO (%)	PORE WATER PRESSURE u (kPa)	GENERAL NOTES AND OBSERVATIONS
		0 5 10 15	0 300 600	0 4 8 12 16 20	-500 0 500 1000 1500	
30	151					

OPERATOR: TA

CHECKED: DD

RECORD OF NILCON VANE TEST NIL T2-1

Project : Windsor-Essex Parkway

Test Date: 4/12/2011

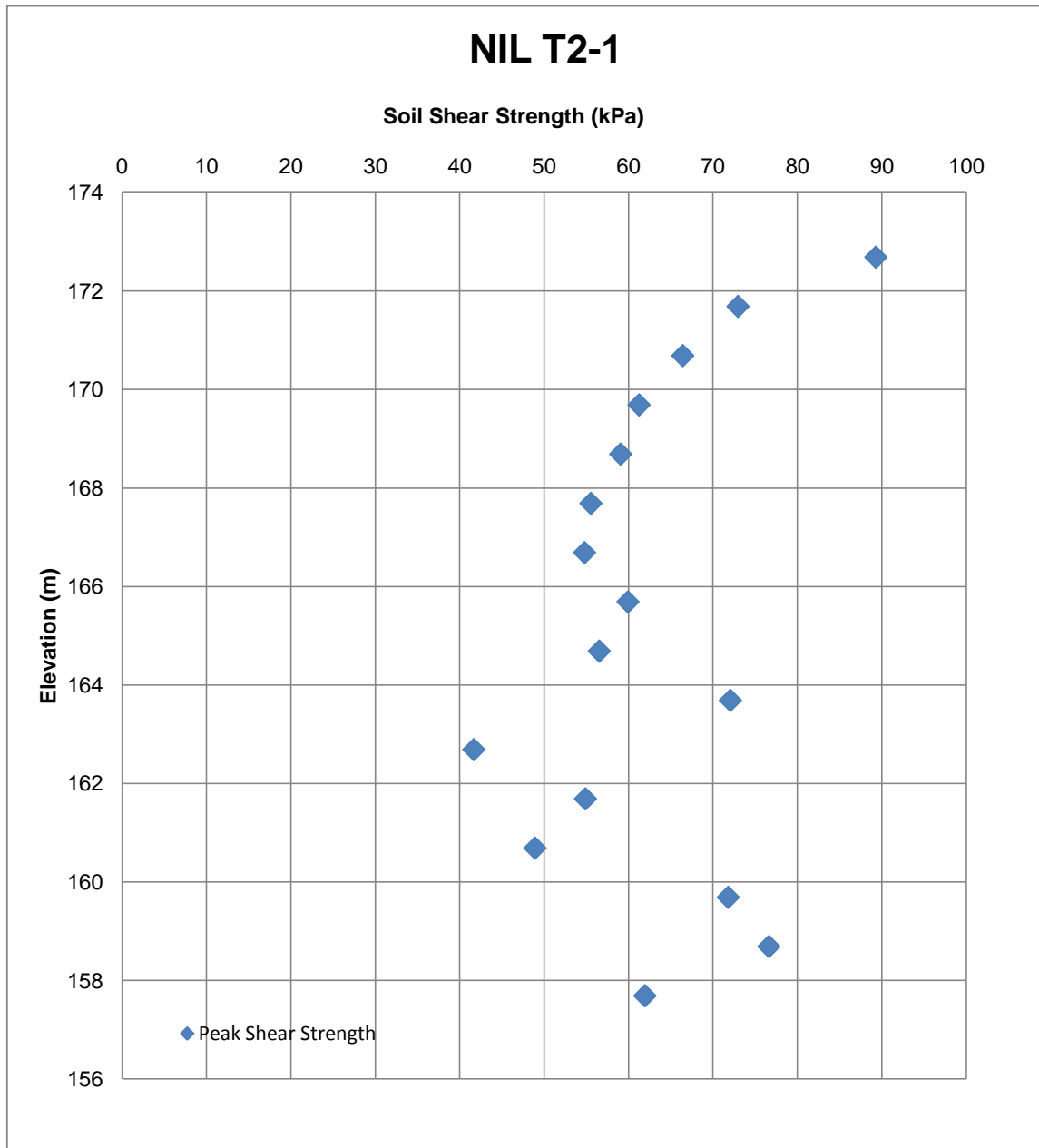
Sheet 1 of 1

Location: N4681291.5; E331304.2

Predrill Depth : 5.93 m

Datum Geodetic

Ground Surface Elevation: 181.4 m



Operator: TA

Checked: DD

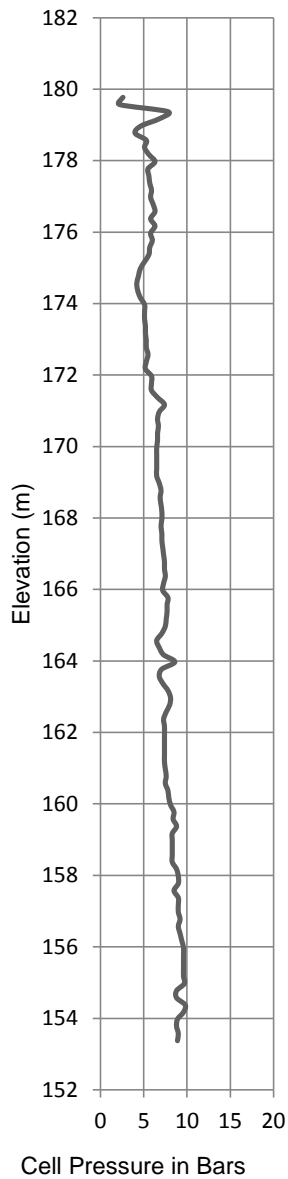
RECORD OF DILATOMETER TEST DMT T2-1

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

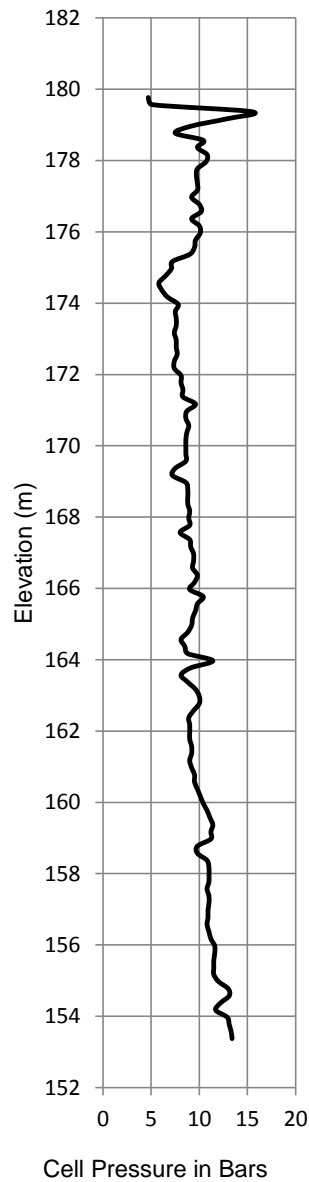
Test Date: 4/15/2011
Predrill Depth : 1.8 m
Delta A: 0.19 Bar

Sheet 1 of 1
Datum Geodetic
Delta B: 0.37 Bar

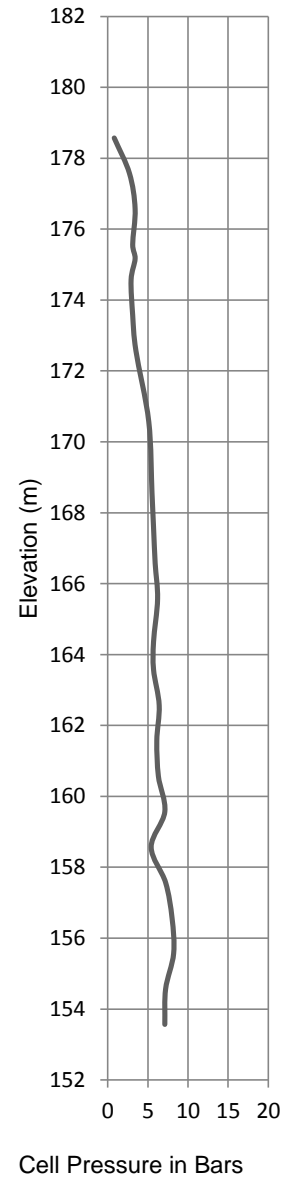
Reading A



Reading B



Reading C



Operator: LC

Checked: DD

RECORD OF BOREHOLE No 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 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 (%)							
181.4	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													
	50mm diameter stone in sample		11	TW	PH												
				VT													
			12	TW	PH												
				VT													
	-Trace pink clay inclusions at about elevation 168.3m			VT													
			13	TW	PH												
				VT													
166.5																	

Continued Next Page

+ 3, X 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

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 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.						
14.9	CLAYEY SILT Pink and black clay inclusions Grey (continued)		14	TW	PH								42.4	-wash rotary drilling below 15m		
					VT											
	-Trace sand and gravel		15	TW	PH											
	-Trace interbedded sand layers from 18m to 19m -Fractures filled with white-grey silt		16	TW	PH											
162.2																
19.2	CLAYEY SILT Some sand, trace gravel Grey		17	TW	PH											
				18	TW	PH										
				19	TW	PH										
				20	TW	PH										
	-Interbedded silt layers from 18 m to 20 m															
			21	TW	PH											
	-50mm diameter stone in sample		22	TW	PH											
	-Inferred boulders and cobbles		23	SS	PH											

166

165

164

163

162

161

160

159

158

157

156

155

154

153

152

4.4

×

×

×

42.4

20.4

21.3

21.1

22.5

-wash rotary
drilling below
15m

-VWP #P20 and
MG installed at
19.66m below
ground surface

-no recovery with
shelby tube,
sample retrieved
by pushing split
spoon

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

RECORD OF CONE PENETRATION TEST CPT T2-2

METRIC

PROJECT Windsor-Essex Parkway

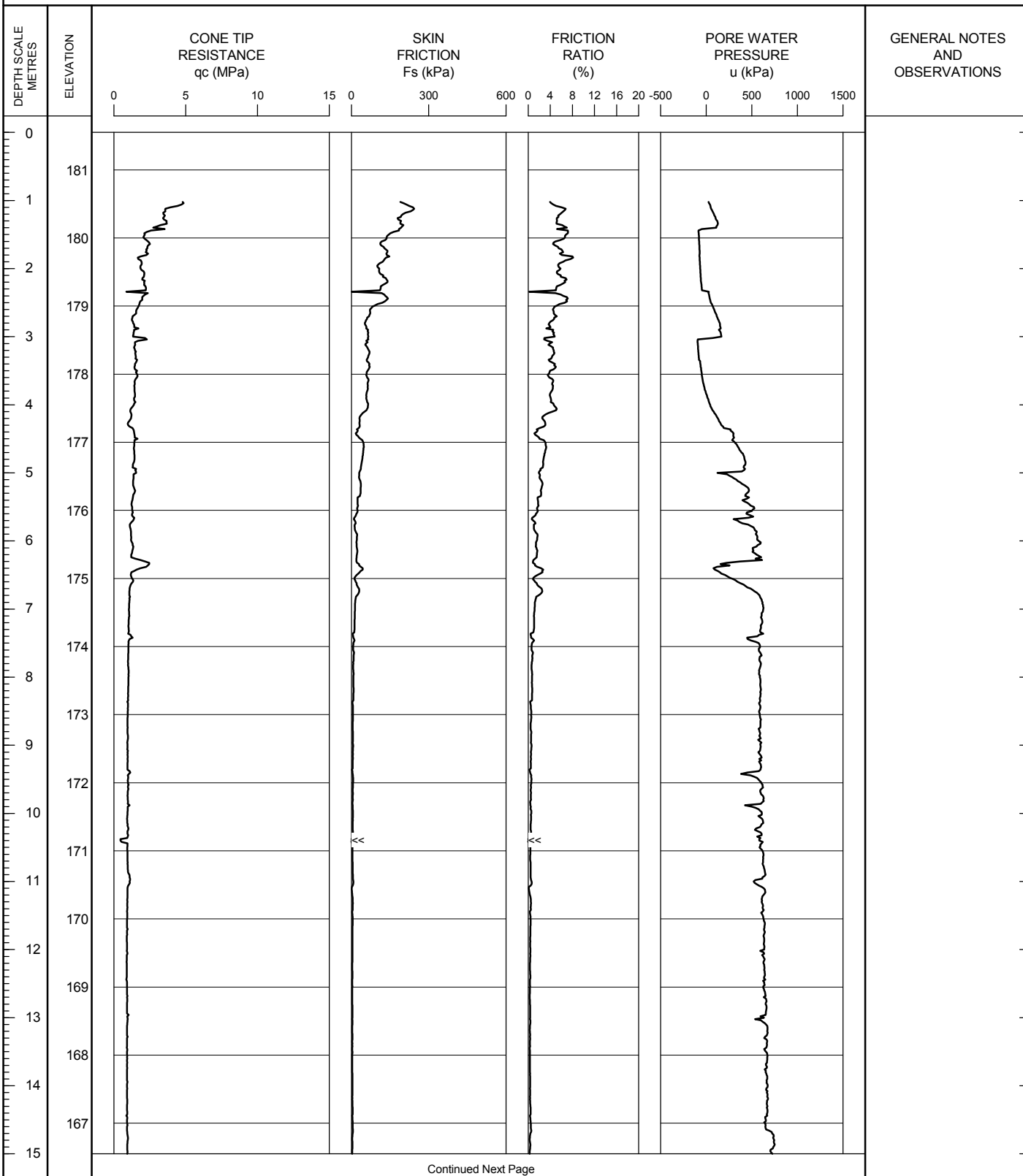
TEST DATE 4/13/2011 - 4/13/2011

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



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

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

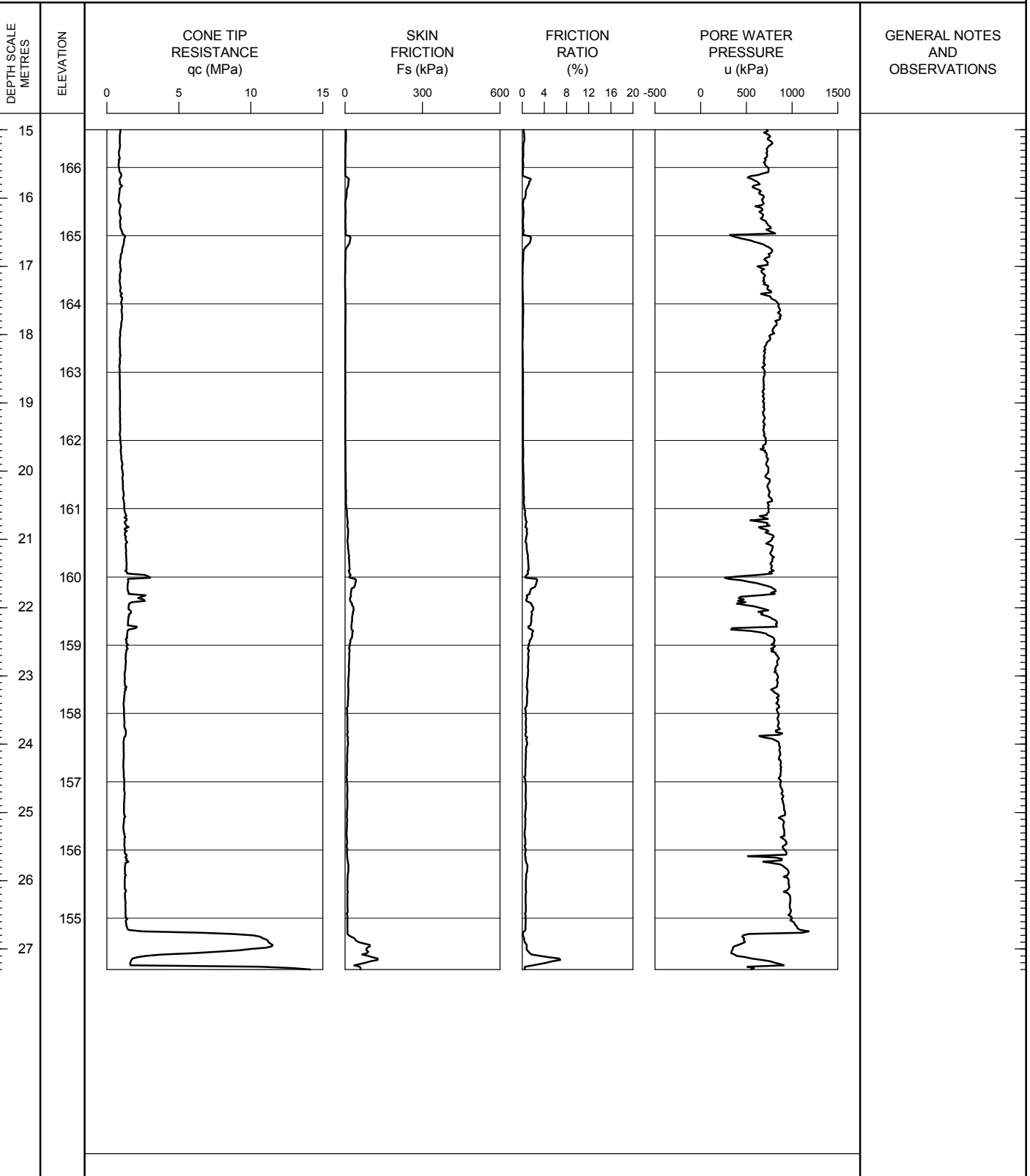
DATUM Geodetic

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

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 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 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									
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE	WATER CONTENT (%)										
							20 40 60 80 100	20 40 60 80 100			10 20 30			GR	SA	SI	CL		
29.9	SILTY CLAY And interbeds of SILT and SAND Soft/Compact Grey (continued)		24	SS	6		152												
								151											
					25		SS	5	150										
149.3	SANDY SILT Some gravel, trace clay Very dense Grey						149												
32.9								148											
					26		SS	76	147										
146.7	-Limestone fragments at about elevation 147.1m		27	SS	59		147												
35.5	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			146												
35.6								145											
					29	RC		144											
144.0	LIMESTONE Fine grained, dense limestone having stylolitic contact with the upper unit. Facies looks like cherty limestone, laminated Grey to white		30	RC			144												
38.3								143											
143.1																			
39.2	LIMESTONE Fine grained, laminated, porous, turbid and pitted with black inclusions, stylolites present. Dark grey						142												
142.8								141											
39.5								140											
	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						139												
								138											

-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%

+ 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 T3-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4680926.9, E331563.8 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 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							
182.0	Ground Surface																	
0.0	CONCRETE																	
181.7																		
0.3	FILL Crushed Limestone Grey																	
180.9			1A, B	SS	40													
1.1	FINE SAND Poorly Graded Trace silt Brown																	
180.2																		
1.8	CLAYEY SILT Some sand Grey		2A, B	SS	7													
179.9																		
2.1	END OF SAMPLED BOREHOLE (continued with CPT from 2.1m to refusal at 30.0m) EL. 179.9m to EL. 152.0m Borehole dry on completion																	

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

RECORD OF CONE PENETRATION TEST CPT T3-1

METRIC

PROJECT Windsor-Essex Parkway

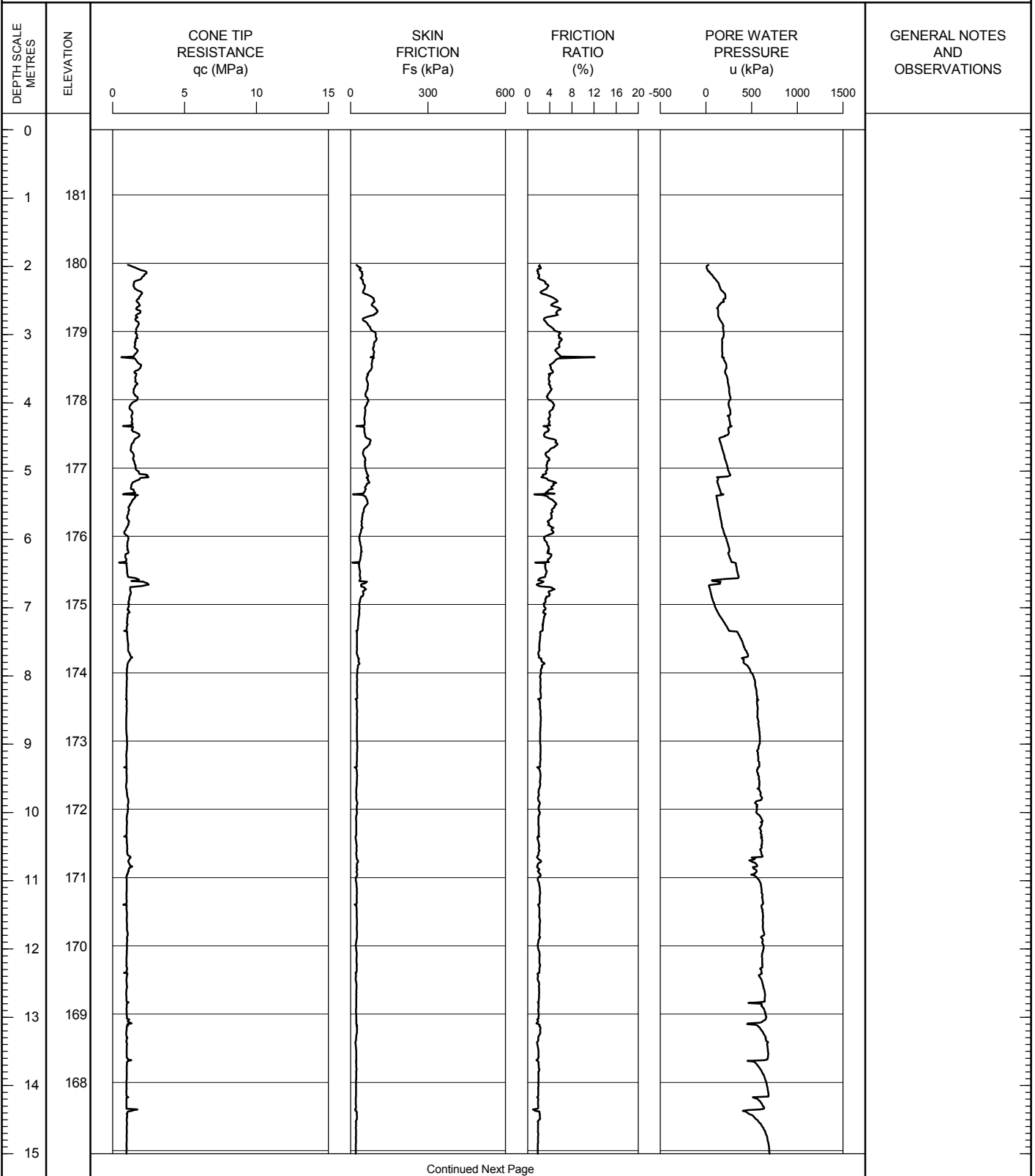
TEST DATE 8/5/2011 - 8/5/2011

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

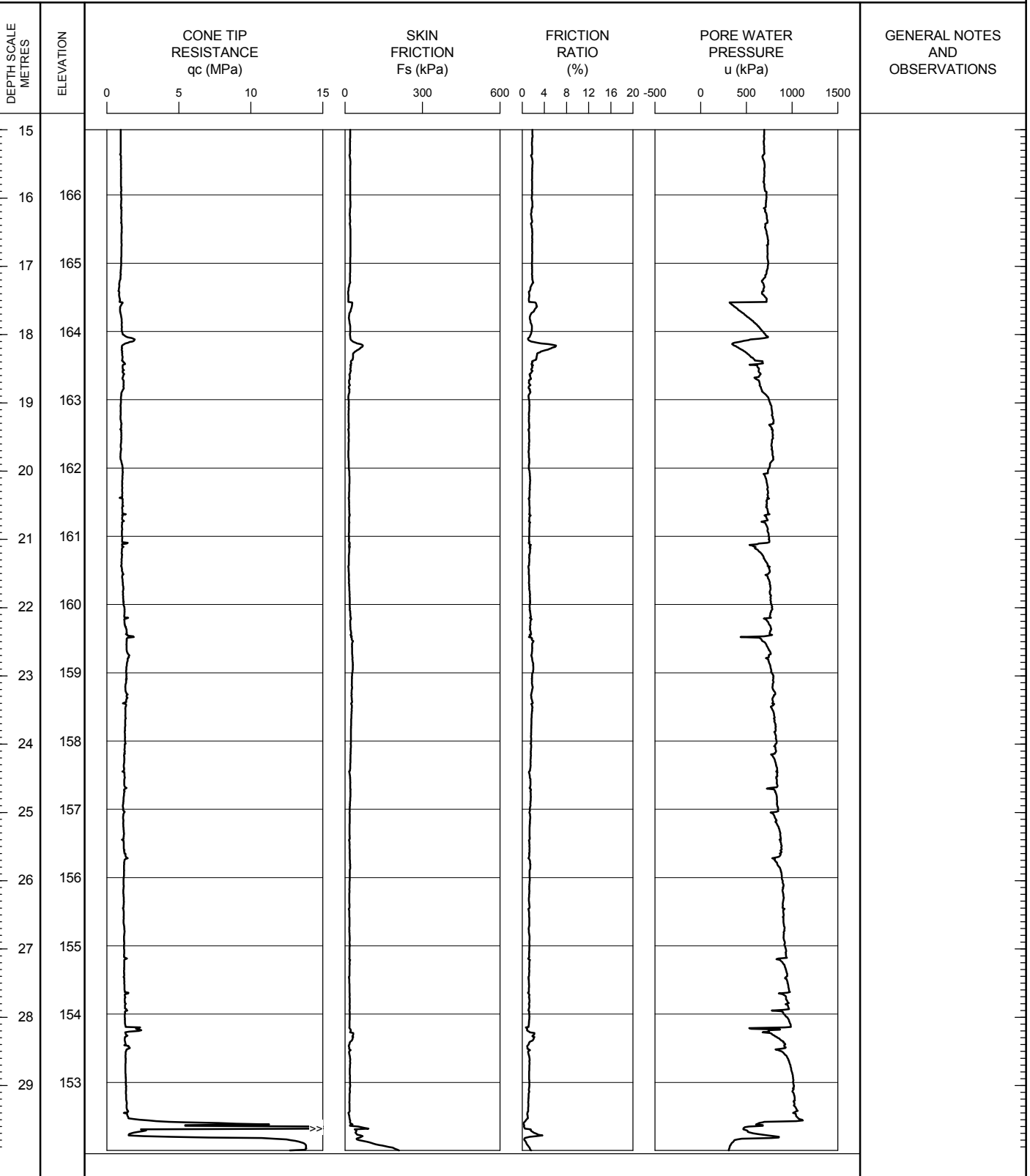
DATUM Geodetic

GROUND SURFACE ELEVATION: 182.0

PREDRILL DEPTH: 1.98

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF NILCON VANE TEST NIL T3-1

Project : Windsor-Essex Parkway

Test Date: 8/6/2011

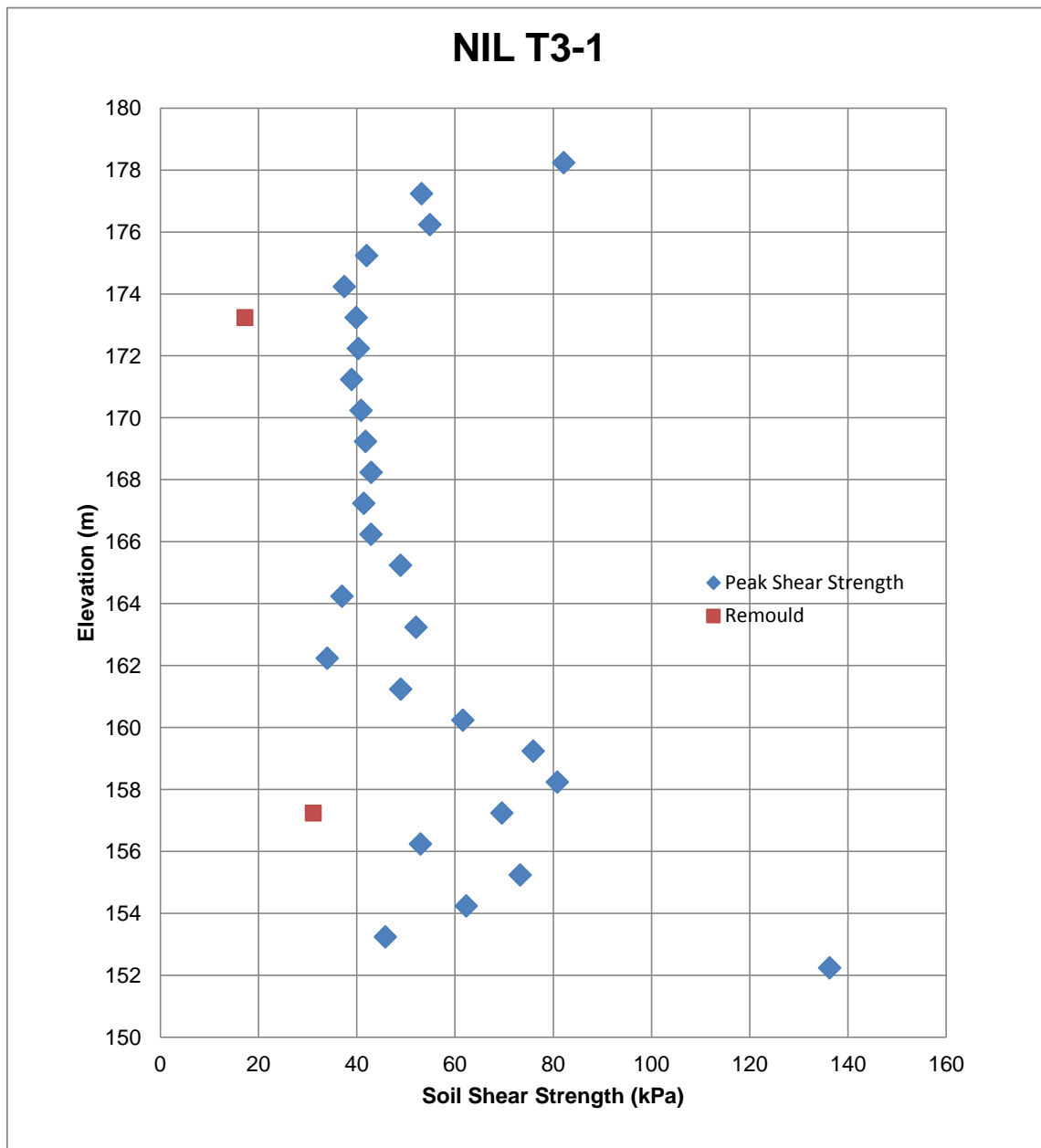
Sheet 1 of 1

Location: N4680822.6; E331611.7

Predrill Depth : 3.0 m

Datum Geodetic

Ground Surface Elevation: 182.2 m



Operator: SD



Checked: DD

RECORD OF 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 NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	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											
182.6 0.0	SAND Trace organics and gravel Brown Moist		A	SA			182	20	40	60	80	100	10	20	30	GR	SA	SI	CL
182.0 0.6	SAND Trace oxidation, trace gravel Light brown Moist		B	SA															
181.4 1.2	SILTY CLAY Grey Trace gravel and oxidation Moist								181										
179.6 3.0	END OF BOREHOLE		C	SA			180												
							179												
							178												
							177												
							176												
							175												
							174												
							173												
							172												
							171												
							170												
							169												
							168												

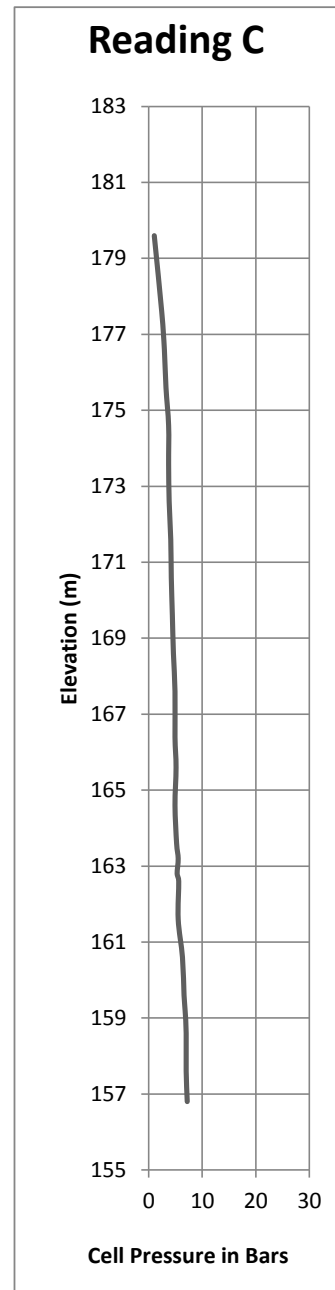
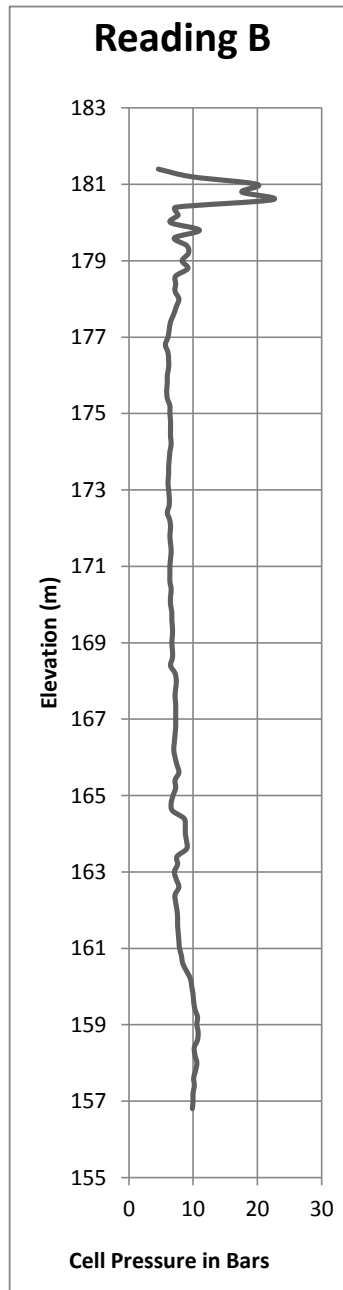
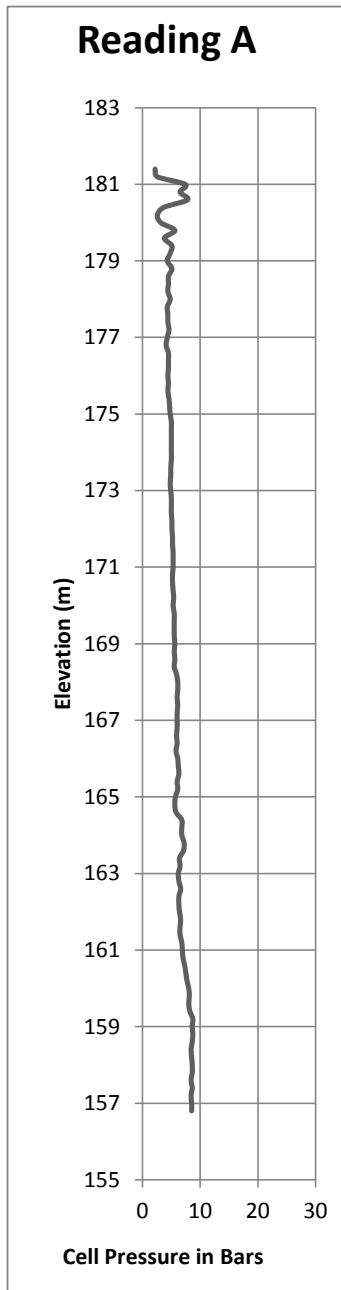
ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 13/06/13

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 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				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								20 40 60 80 100								
								20 40 60 80 100								
182.1	Ground Surface															
180.0	TOPSOIL															
0.2	FINE SAND Some silt Loose to compact Brown		1	SS	6											
			2	SS	14											
180.0	Grey Wet															
2.1	CLAYEY SILT Stiff Grey Wet		3	SS	8											
179.2																
2.9	SILTY CLAY Some embedded sand and gravel Trace pink nodules Stiff Grey		4	SS	12											
			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

RECORD OF NILCON VANE TEST NIL T3-2

Project : Windsor-Essex Parkway

Test Date: 8/5/2011

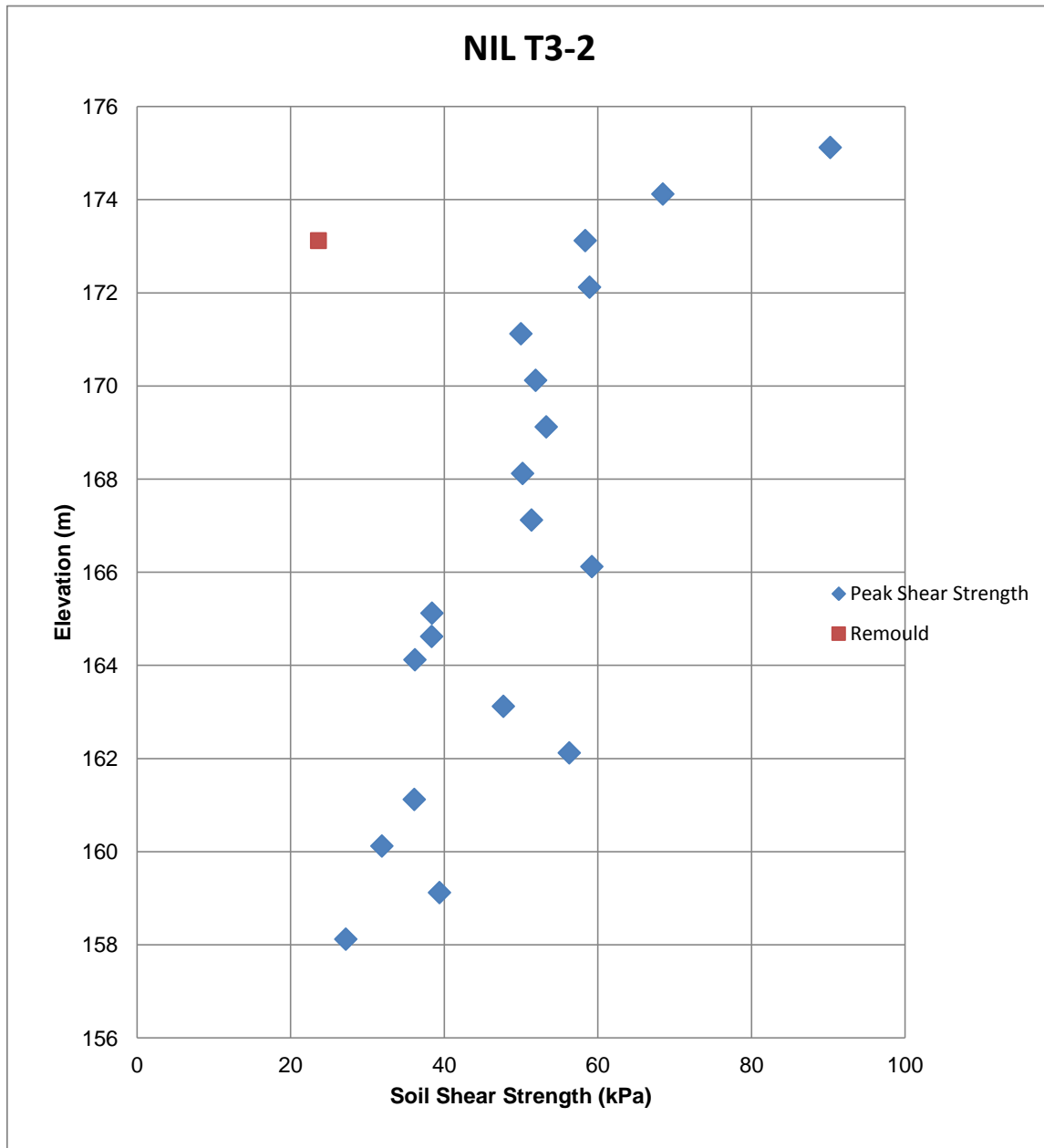
Sheet 1 of 1

Location: N4680875.7; E331528.6

Predrill Depth : 6.6 m

Datum Geodetic

Ground Surface Elevation: 182.1 m



Operator: SD

Checked: DD

amec

LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing ○ SPT ● DCPT MTO Vane* Nilcon Vane* △ Intact ◇ Intact ▲ Remould ◆ Remould	Atterberg Limits W _p — W — W _L Plastic Liquid * Combustible Soil Vapours (ppm) ◆ Combustible Soil Vapours (%LEL) ○ Total Organic Vapour (ppm)		
Lithology Plot	Geodetic Ground Surface Elevation: 182.3 m										
	TOPSOIL										
	181.8						182				-Observation Well installed in sampled borehole
	0.5										
Lithology Plot	Mottled Brown CLAYEY SILT Some sand, trace gravel Stiff		SS	1	100	7	1	○	○14		
							181				
	Brown, very stiff -Grey fissures, trace rootlets		SS	2	100	19	2	○	○13		
							180				
			SS	3	100	23	3	○	○14		
							179				
	-Multiple thin silt seams		SS	4	100	22	4	○	○14		
178.8											
3.5											
END OF BOREHOLE (no refusal)											
Water levels in observation well measured at elevation 179.8m on July 29, 2011 Water levels in observation well measured at elevation 181.8m on October 13, 2011											

Page: 1 of 1

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 (%)					
180.9	Ground Surface							○ UNCONFINED	+ FIELD VANE	● POCKET PEN.						×	LAB VANE				
0.0	FILL Sand and gravel, some silty clay clumps Brown																				
			1	SS	10																
			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																
			5	SS	7																
			6	SS	6																
			7	SS	6																
			8	TW	PH																
				VT																	
			9	SS	4																
			10	TW	PH																
				VT																	
			11	TW	PH																
			12	TW	PH																
				VT																	
			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

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					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								20	40						60	80
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									
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 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 NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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					
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE	WATER CONTENT (%)							
181.2	Ground Surface							20 40 60 80 100	10 20 30					GR	SA	SI	CL
0.0	FILL Silty clay and topsoil Some sand, trace gravel																
180.2			1A, B	SS	11												
1.1	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																

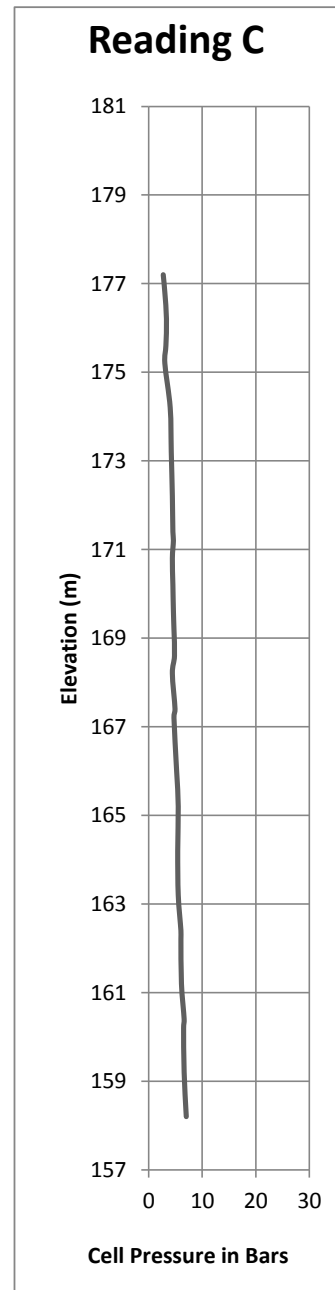
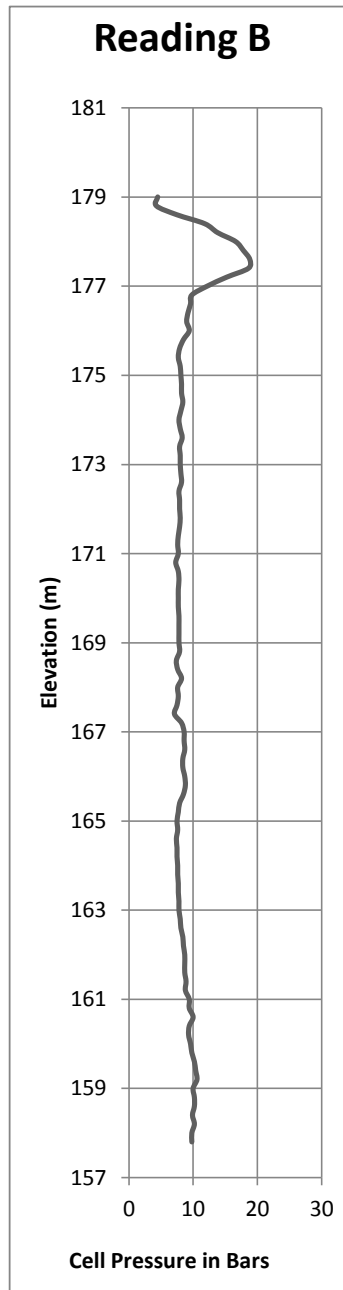
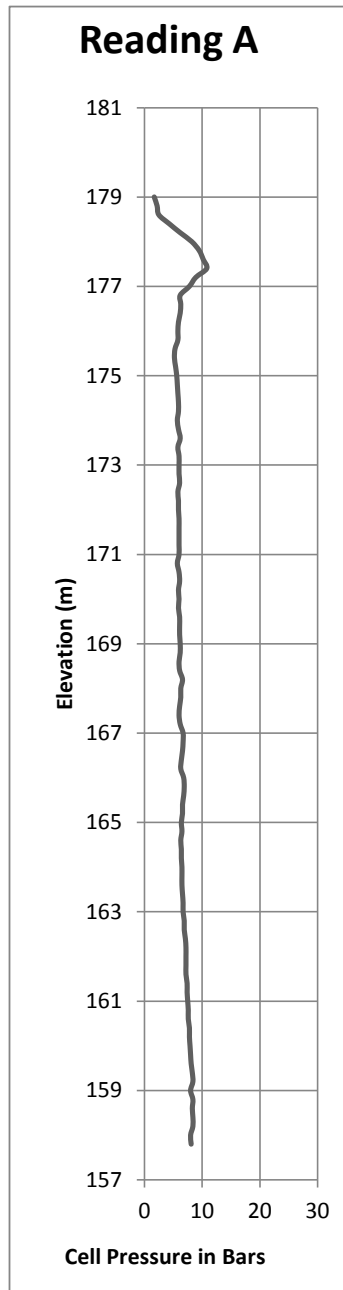
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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 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 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	
180.8	Ground Surface																	
0.0	152mm TOPSOIL																	
0.2	CLAYEY SILT Trace sand, trace fine-medium gravel, trace pink nodules Soft to very stiff Mottled brown and grey																	
			1	SS	11													
			2	SS	15													
			3	SS	18													
			4	SS	13													
	Grey		5	SS	7													
			6	SS	6													
			7	SS	3													
			8	TW	PH			×										
				VT														
			9	TW	PH													
			10	TW	PH													
				VT														
			11	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

METRIC

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

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					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								<div><div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● POCKET PEN. × LAB VANE</div></div></div>							
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, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF NILCON VANE TEST NIL T6-2

Project : Windsor-Essex Parkway

Test Date: 8/12/2011

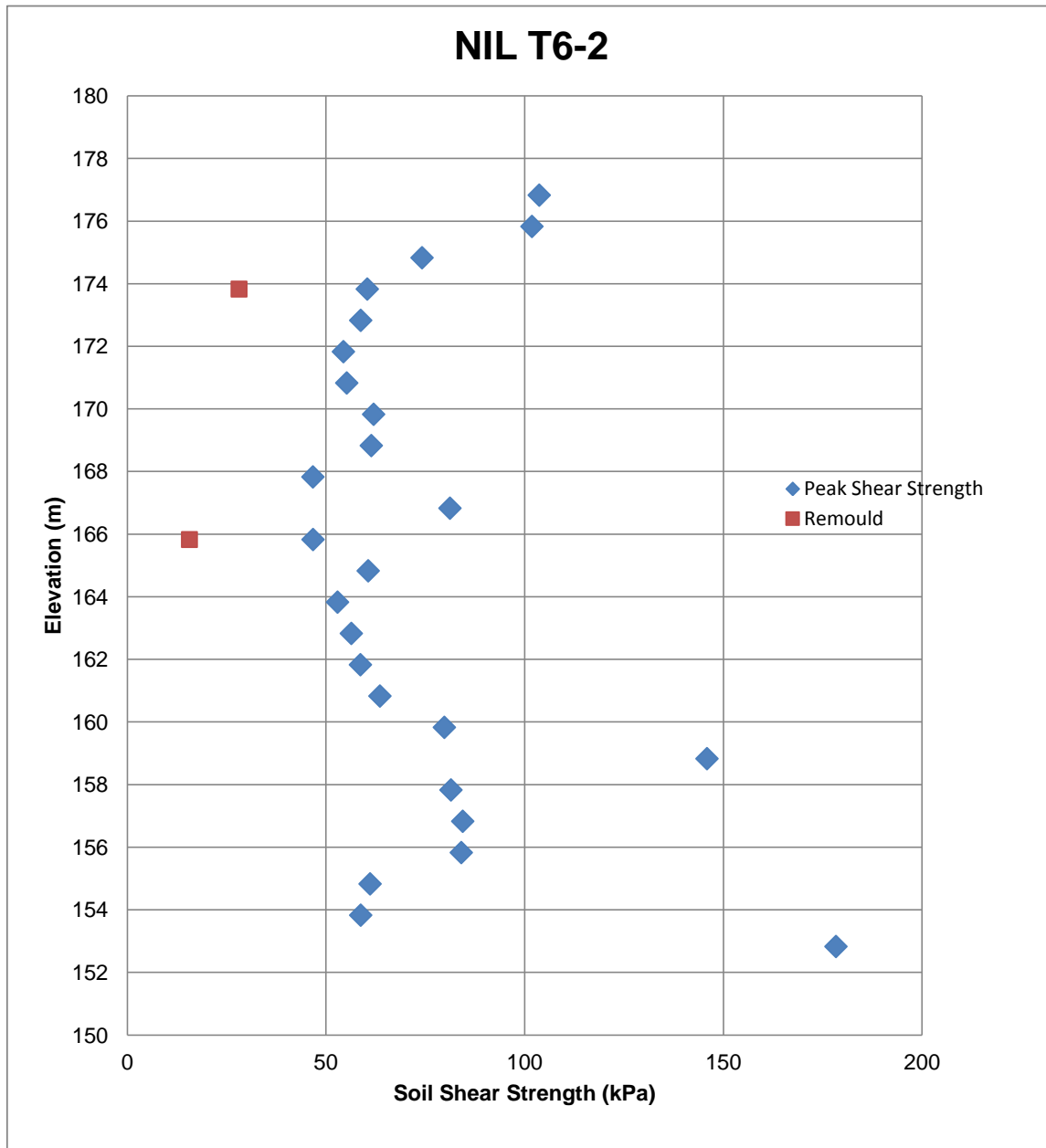
Sheet 1 of 1

Location: N4679661.8; E332020.5

Predrill Depth : 3.0 m

Datum Geodetic

Ground Surface Elevation: 180.8 m



Operator: SD

Checked: DD

RECORD OF 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 (%)		
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE									
181.6	Ground Surface														GR SA SI CL			
0.0	FILL Topsoil/sand/silt mixture, trace gravel and bricks, brown to black														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																	
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																	
			3	SS	16													
			4	SS	18													
	Grey		5	SS	12													
			6	SS	8													
			7	SS	5													
			8	TW	PH													
				VT														
			9	TW	PH													
	-Sandy pocket																	
			10	SS	3													
				VT														
			11	TW	PH													
			12	TW	PH													
				VT														
168.6	CLAYEY SILT Soft Trace black and pink inclusions, varved Grey																	
13.0				VT														

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 T6-3

2 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 NATURAL MOISTURE LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)				
								20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	W _P	W	W _L		
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × LAB VANE						
								20 40 60 80 100				10 20 30	kN/m ³	GR SA SI CL	

Continued Next Page

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

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

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		NATURAL MOISTURE CONTENT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	SHEAR STRENGTH kPa	PLASTIC LIMIT W _P			LIQUID LIMIT W _L
								20 40 60 80 100	○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE	WATER CONTENT (%)			
	CLAYEY SILT Some sand, trace gravel Soft to stiff Grey Moist to wet (<i>continued</i>)		24	SS			151					-N-Values not recorded	
149.6 32.0	SANDY GRAVELLY SILT Dense Grey Moist		25	SS	58		150					-spoon blocked with gravel	
	-Inferred cobbles		26	SS	50/ 25mm		149					-SPT refusal at 33.4m; Augers advanced to refusal at 34.7m	
146.9 34.7 146.5 35.1	LIMESTONE Fine Grained, well crystallized and dense Grey-Brown		27	RC			148					RQD = 100% TCR = 100% SCR = 71%	
	LIMESTONE Well crystallized and dense Grey		28	RC			147					RQD = 100% TCR = 100% SCR = 82%	
145.3 36.3	LIMESTONE Fine Grained, microfractures throughout filled with solution activity Brown						146						
	END OF BOREHOLE No groundwater observed during drilling due to wash boring						145						
							144						
							143						
							142						
							141						
							140						
							139						
							138						
							137						

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

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

RECORD OF NILCON VANE TEST NIL T6-3

Project : Windsor-Essex Parkway

Test Date: 8/13/2011

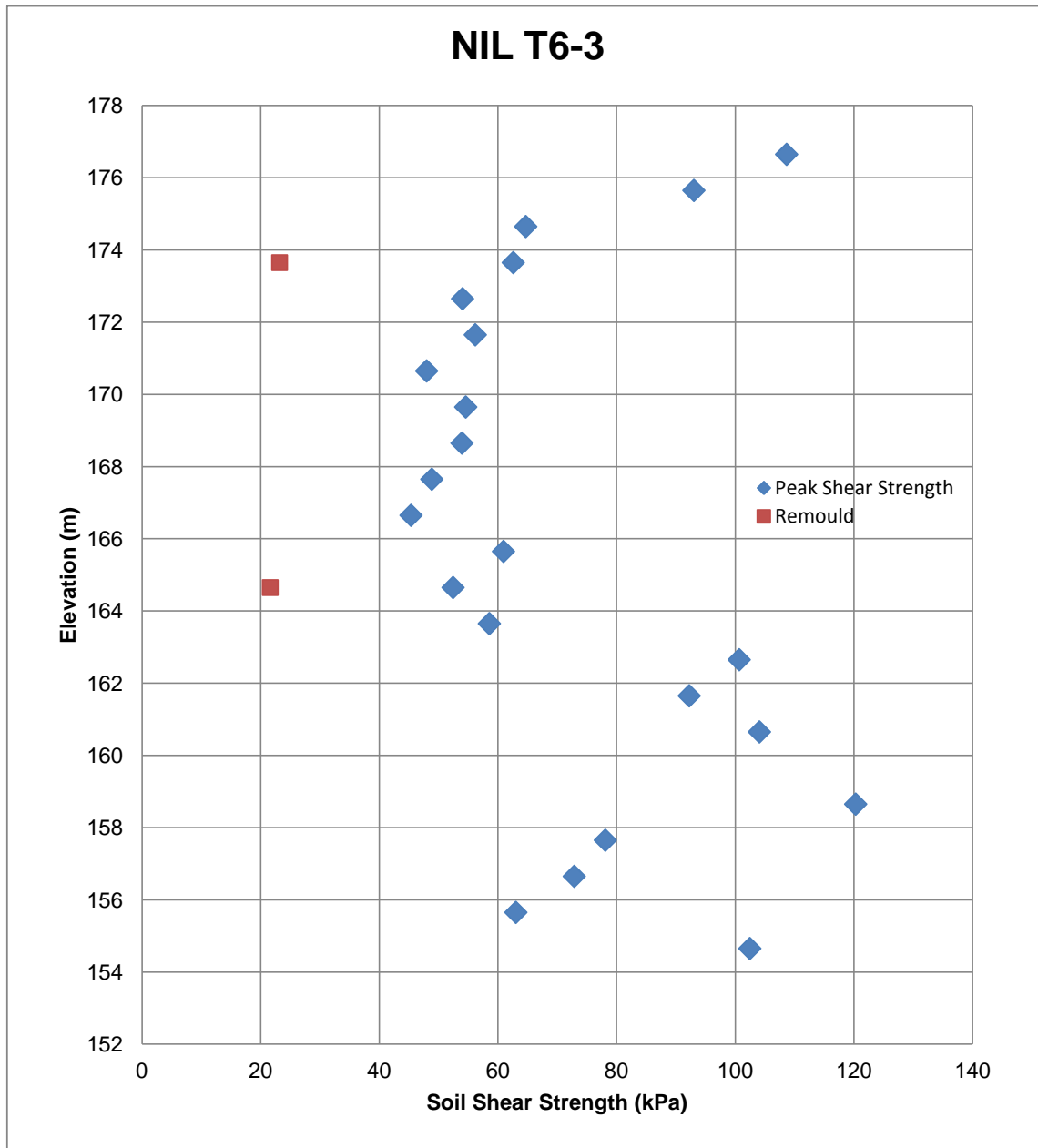
Sheet 1 of 1

Location: N4679574.1; E332073.1

Predrill Depth : 4.6 m

Datum Geodetic

Ground Surface Elevation: 181.7 m



Operator: SD

Checked: DD

RECORD OF 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 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									
181.5	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													
			6	SS	14													
	-Trace fissures																	
	-Trace pink clay nodules		7	SS	6													
			8	TW	PH													
	Fine sand nodules Trace fine gravel, pink clay nodules																	
			9	TW	PH													
			10	TW	PH													
				VT														
	-Trace fine-coarse gravel		11	TW	PH													
			12	TW	PH													
				VT														
	-Trace fine-medium gravel		13	SS	2													

Continued Next Page

+ 3, X 3: 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

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	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%	
32.6																		
146.7	LIMESTONE Laminated, medium to fine grained, porous Pitted at location between 34.78m and 35.14m Brown to Grey		27	RC													RQD = 100%	
34.8																		
146.4																		
35.1																		
35.5	LIMESTONE Fine Grained Vuggy, calcite crystals visible Grey 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																	
35.7																		





+ 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 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	Ground Surface						20	40	60	80	100					
0.0	TOPSOIL															
180.8																
0.4	SAND Poorly graded Trace to some silt Brown		1A, B	SS	8											
180.1																
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)															
3.5	Borehole dry upon completion															

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

RECORD OF CONE PENETRATION TEST CPT T7-1

METRIC

PROJECT Windsor-Essex Parkway

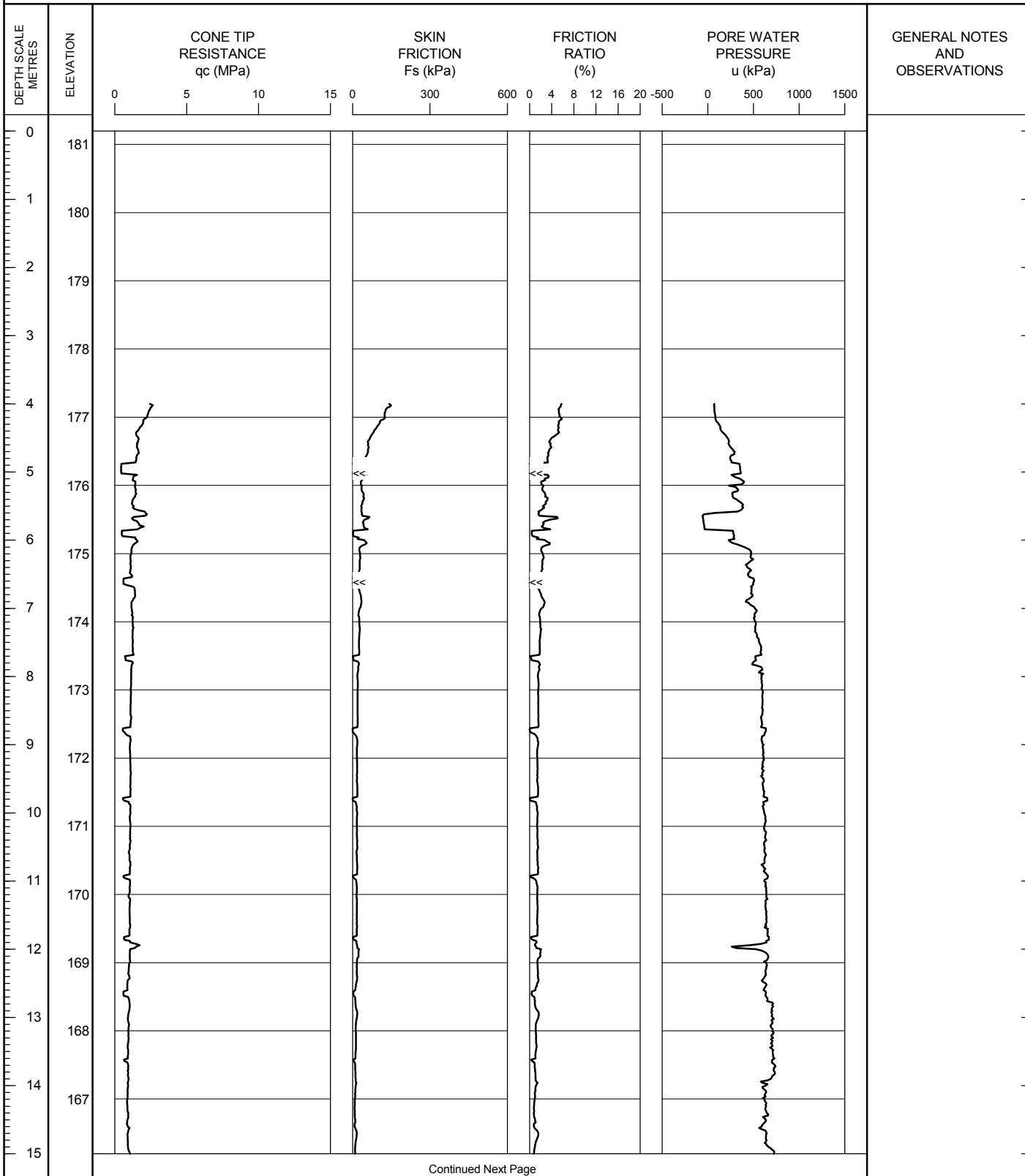
TEST DATE 7/22/2011 - 7/22/2011

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

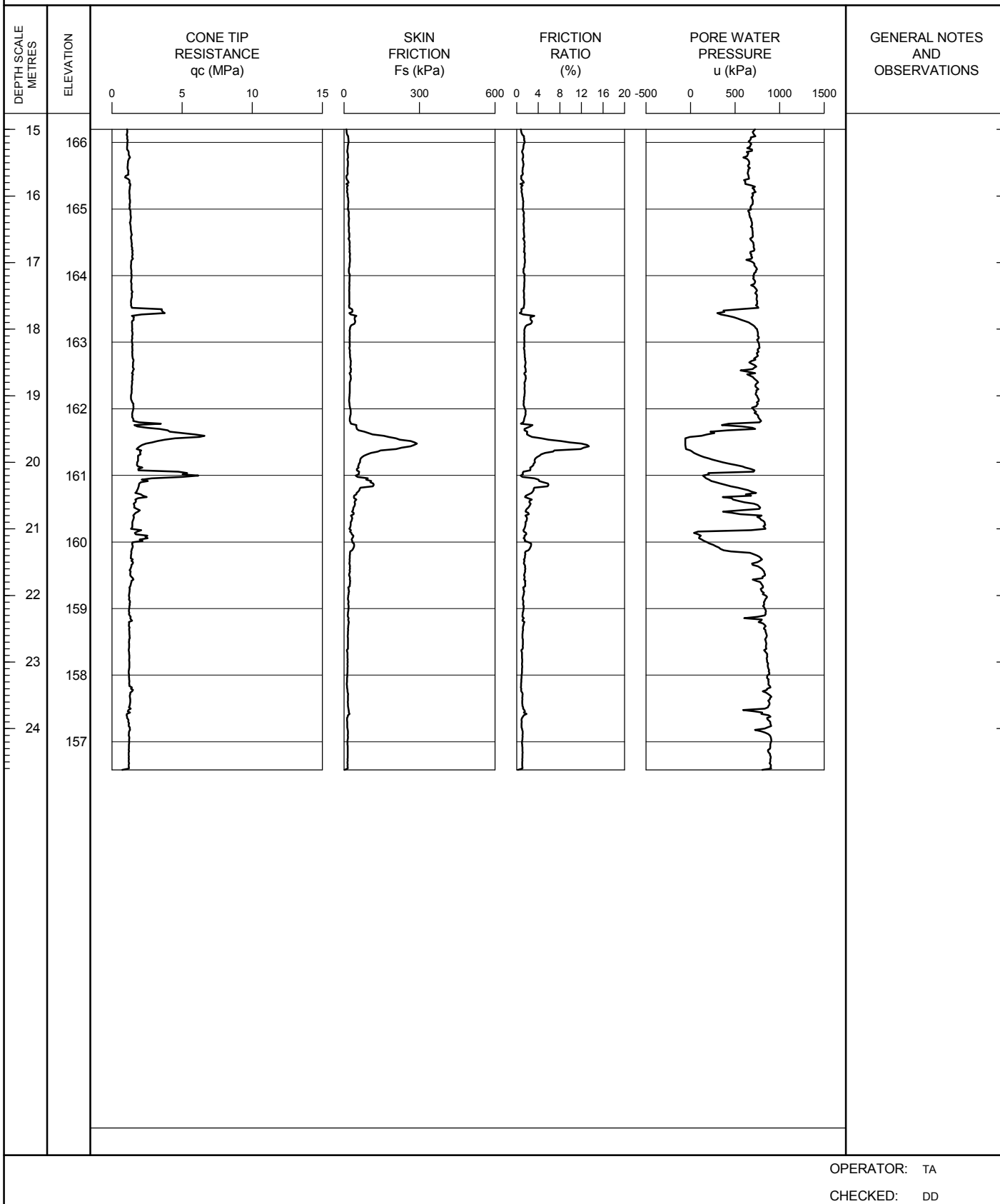
TEST DATE 7/22/2011 - 7/22/2011

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 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

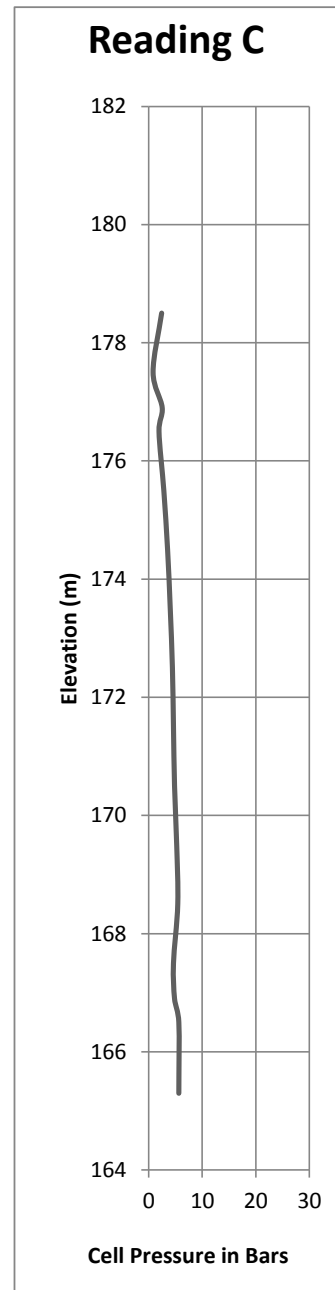
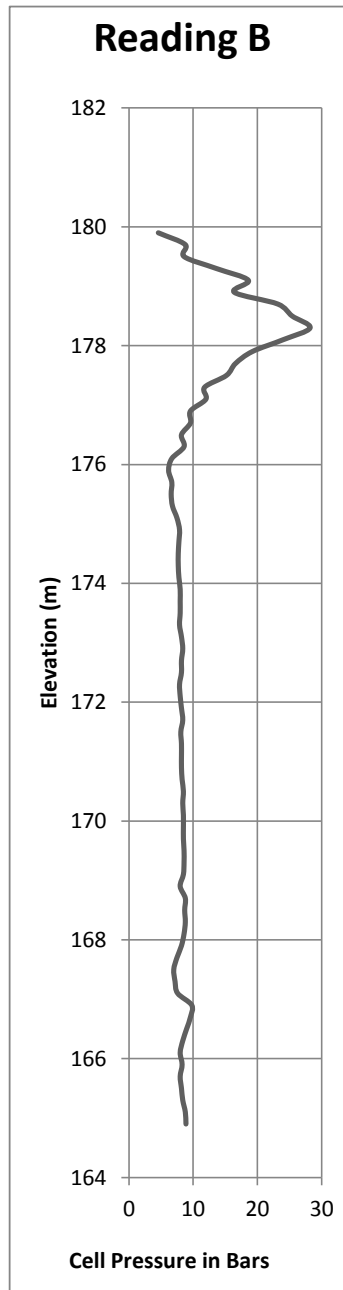
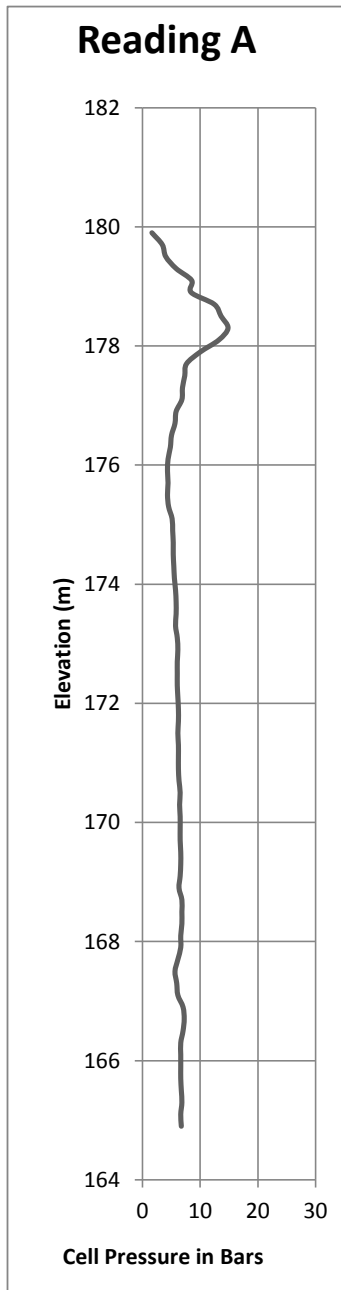
SOIL PROFILE						SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)									
181.5	Pavement Surface																			
0.0	25mm Asphalt																			
	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																			
	Some sand, trace gravel																			
	Trace organics, weathered brown																			
	END OF SAMPLED BOREHOLE																			
	Continued with DMT from 2.0 m to																			
	refusal at 16.8 m (El. 179.5 m o El.																			
	164.7 m)																			
	Borehole dry upon completion																			

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 T7-2

1 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 NATURAL MOISTURE CONTENT LIQUID LIMIT			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
								○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE							WATER CONTENT (%)		
							20 40 60 80 100					10 20 30			GR SA SI CL		
181.2	Ground Surface						181								-Vibrating Wire Piezometers (VWP) installed in sampled borehole -Spider Magnets (mg) installed in adjacent boring at 4679332.1N, 332390.8E -Nilcon vane advanced to sampled borehole from 5.5m to 25m (EL. 175.7m to EL. 156.2m)		
0.0	TOPSOIL																
180.9	Black																
0.3	CLAYEY SILT																
	Some sand and gravel		1	SS	11												
	Soft to very stiff																
	Mottled grey and brown to grey																
	Moist																
	Brown with Grey seams		2	SS	18												
	Brown																
	-Becoming grey		3	SS	22												
	Grey																
			4	SS	18												
		5	SS	12													
		6	SS	8													
	Moist to wet	7	SS	5													
		8	TW	PH													
	Some sand, trace gravel	9	SS	PH													
	Moist to wet																

Continued Next Page

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

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METRIC[illegible]

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


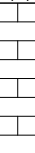
ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 15/08/12

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				10 20 30						
147.7 33.5	Gravelly SAND Well-Graded Some silt Very dense Grey (continued)		24	SS												
			25	SS												
		-Cobbles		26	RC											
146.1 35.1	Bedrock LIMESTONE -Not weathered		27	RC												
	END OF BOREHOLE						146									
	No groundwater observed prior to starting wash boring below 15 m on July 6, 2011						145									
	Water Level measured in Piezometer VWP T7-2-P9 at elevation 179.5m on July 24, 2011						144									
	Water Level measured in Piezometer VWP T7-2-P9 at elevation 179.7m on August 6, 2011						143									
	Water Level measured in Piezometer VWP T7-2-P20 at elevation 180.3m on July 24, 2011						142									
	Water Level measured in Piezometer VWP T7-2-P20 at elevation 181.0m on August 6, 2011						141									
	Water Level measured in Piezometer VWP T7-2-P32 at elevation 177.3m on July 24, 2011						140									
	Water Level measured in Piezometer VWP T7-2-P32 at elevation 177.7m on August 6, 2011						139									
							138									
							137									

-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%

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 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									
181.2	Ground Surface																
0.0 180.9	TOPSOIL																
0.3	SAND																
180.4	Poorly graded, trace silt 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																
							179										
							178										
							177										
							176										
							175										
							174										
							173										
							172										
							171										
							170										
							169										
							168										
							167										

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

RECORD OF CONE PENETRATION TEST CPT T7-2

METRIC

PROJECT Windsor-Essex Parkway

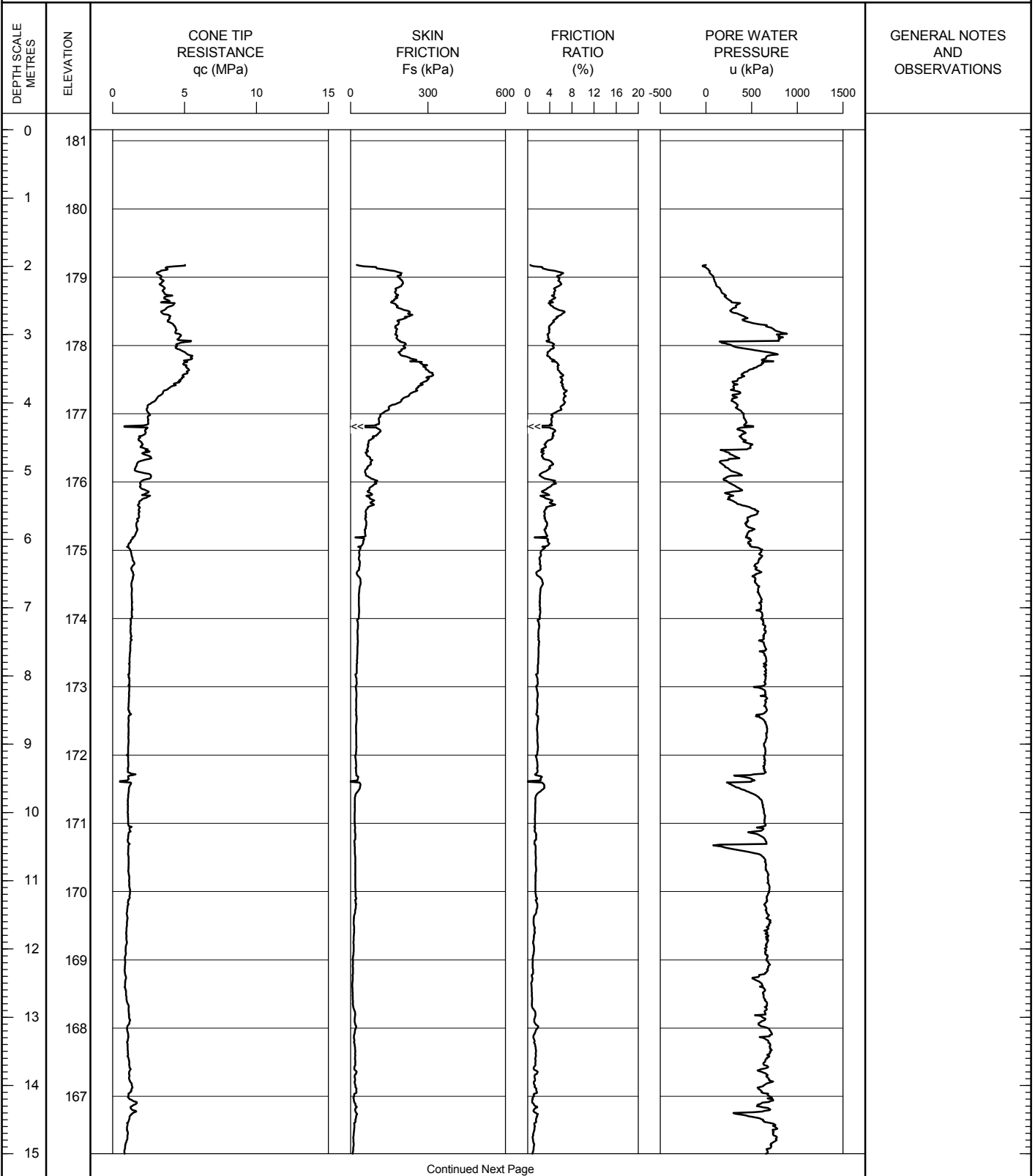
TEST DATE 7/23/2011 - 7/23/2011

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

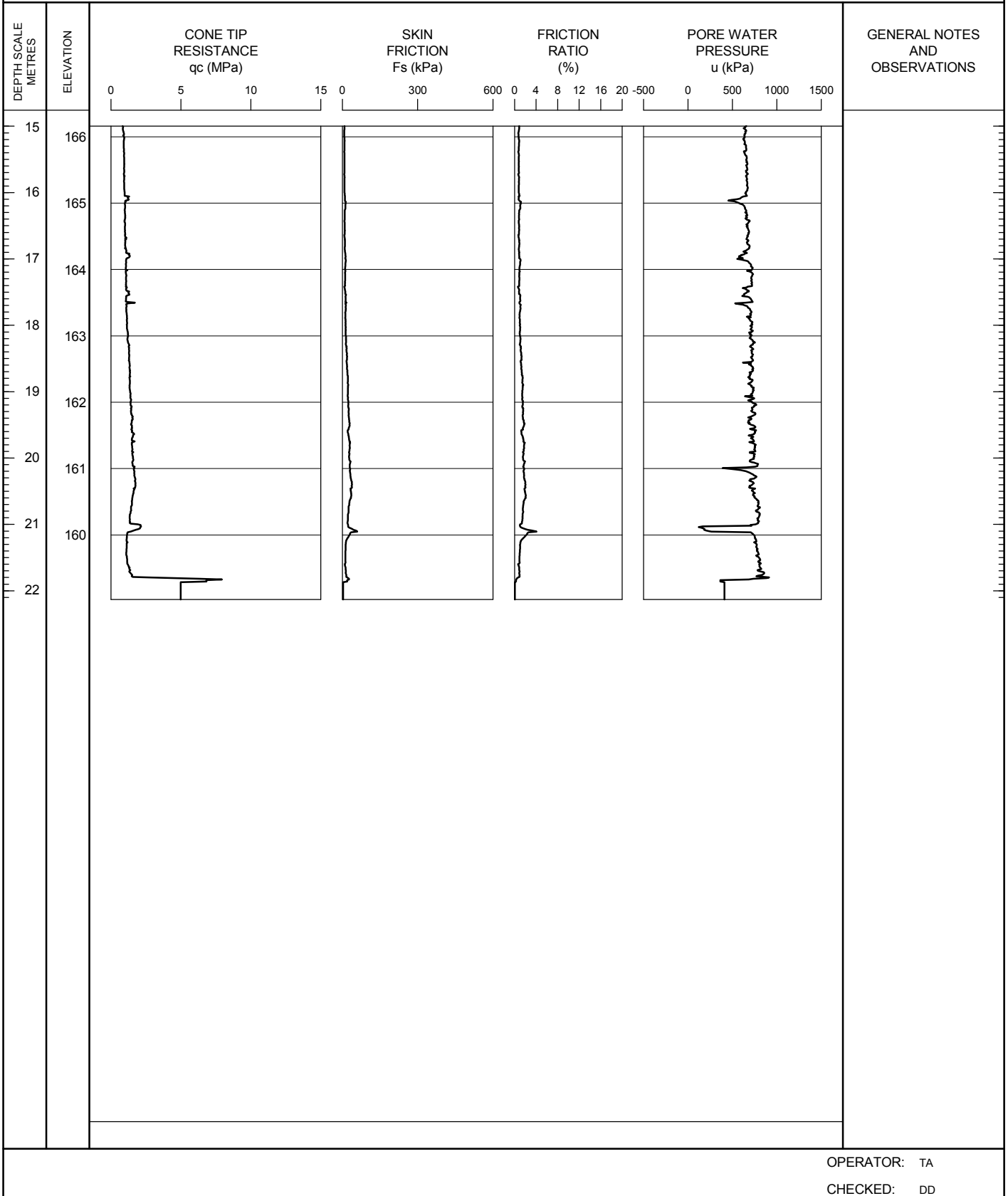
TEST DATE 7/23/2011 - 7/23/2011

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 NILCON VANE TEST NIL T7-2

Project : Windsor-Essex Parkway

Test Date: 7/8/2011

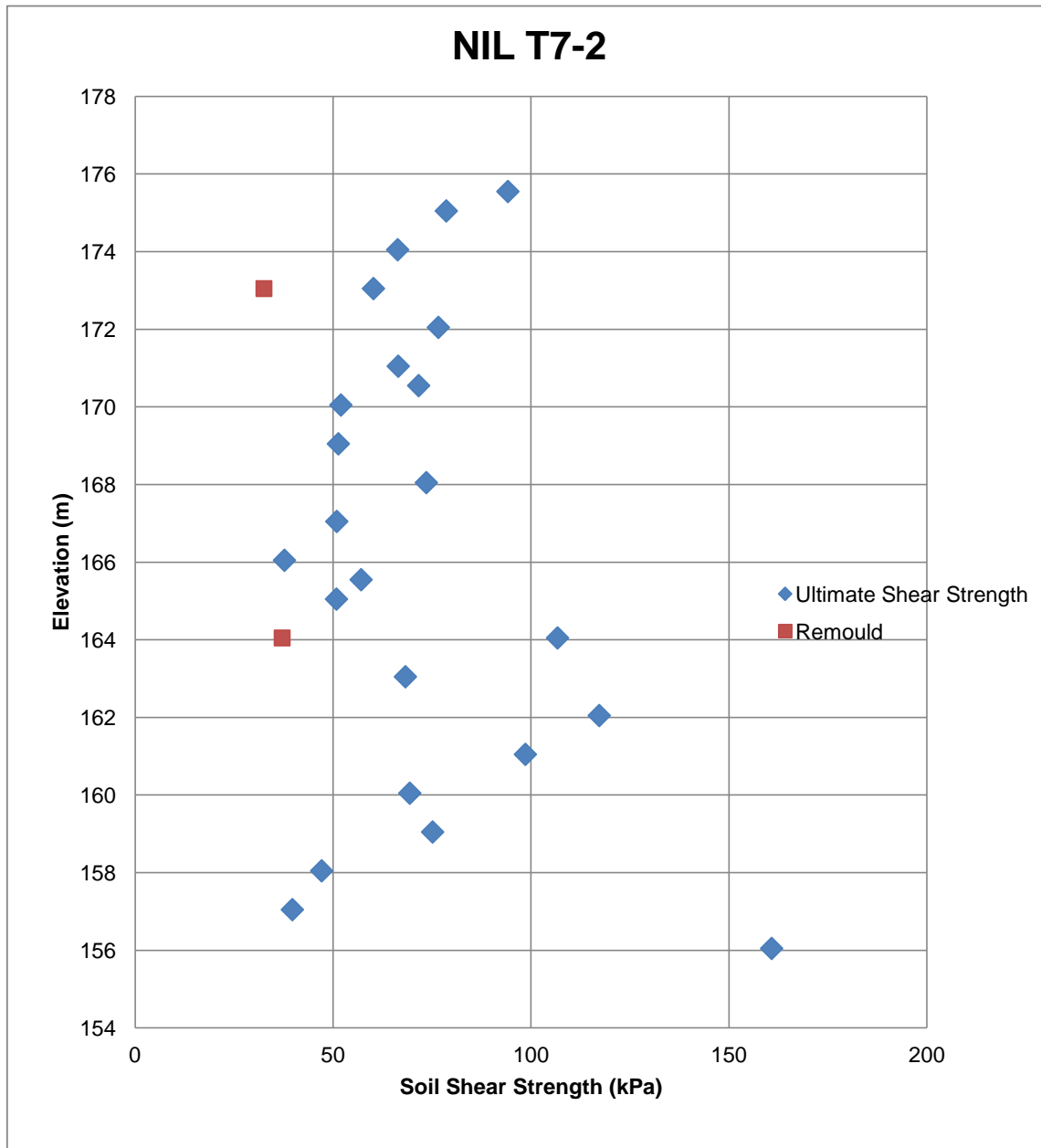
Sheet 1 of 1

Location: N4679332.1; E332390.8

Predrill Depth : 4.6 m

Datum Geodetic

Ground Surface Elevation: 181.0 m



Operator: SD

Checked: DD

METRIC

Continued Next Page

+ 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

RECORD OF BOREHOLE No CPT T8-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678860.0, E333292.9 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE Aug 4, 11 - Aug 4, 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											
183.2	Ground Surface							20	40	60	80	100								
0.0	FILL Crushed Limestone Grey																			
0.2																				
182.4	FILL Clayey silt, some gravel Brown																			
0.8	SANDY SILT Some clay, trace gravel Mottled brown and grey Brown		1	SS	7															
			2	SS	9															
181.2	END OF SAMPLED BOREHOLE Continued with CPT from 2 m to refusal at 32.4 m (El. 181.2 m to El. 150.8 m) Borehole dry on completion																			
2.0																				
								181												
								180												
								179												
								178												
								177												
								176												
								175												
								174												
								173												
								172												
								171												
								170												
								169												

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

RECORD OF CONE PENETRATION TEST CPT T8-1

METRIC

PROJECT Windsor-Essex Parkway

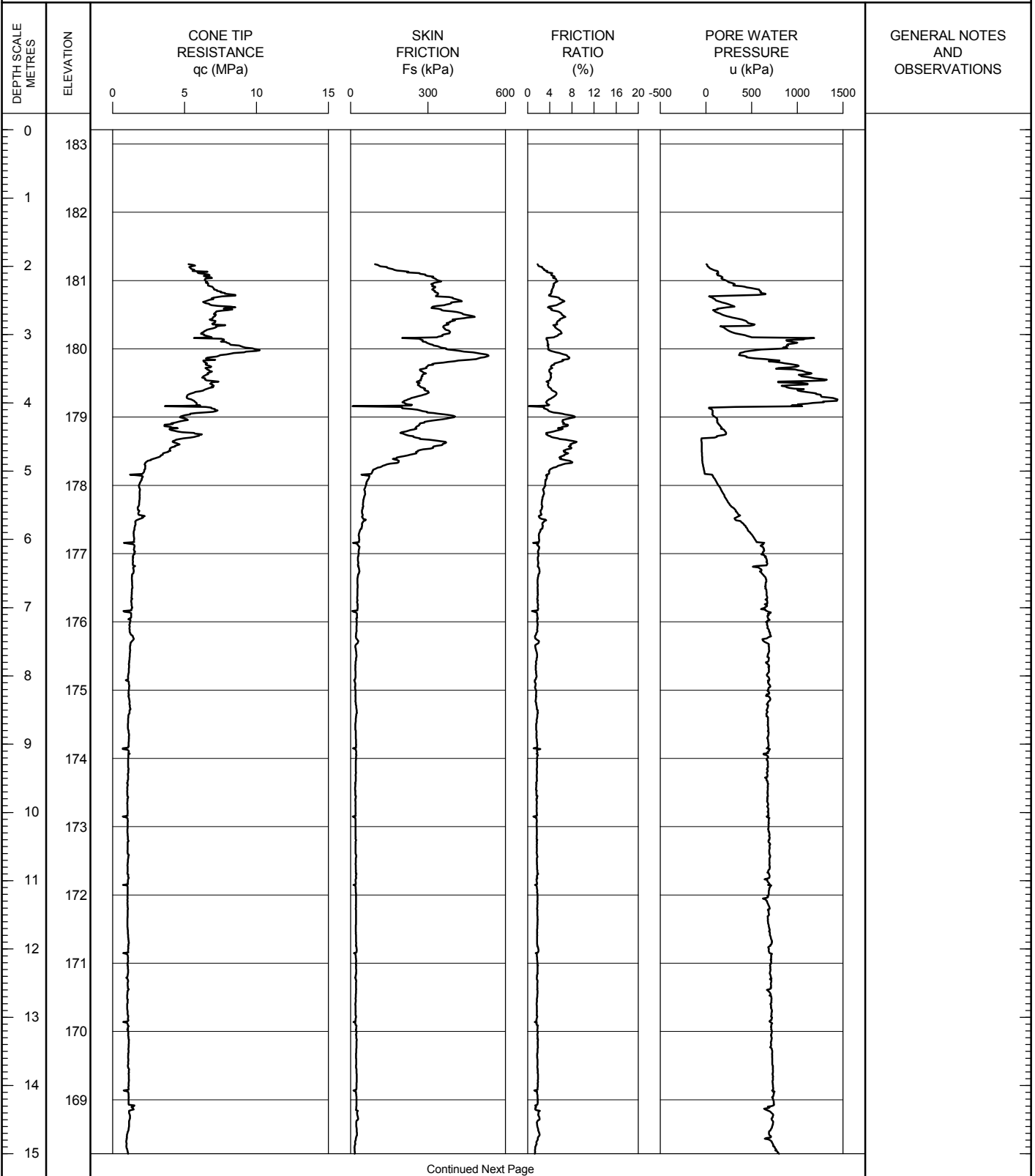
TEST DATE 8/4/2011 - 8/4/2011

SHEET 1 OF 3

LOCATION N4678860.0; E333292.9

DATUM Geodetic

GROUND SURFACE ELEVATION: 183.2 PREDRILL DEPTH: 1.82 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T8-1

METRIC

PROJECT Windsor-Essex Parkway

TEST DATE 8/4/2011 - 8/4/2011

SHEET 2 OF 3

LOCATION N4678860.0; E333292.9

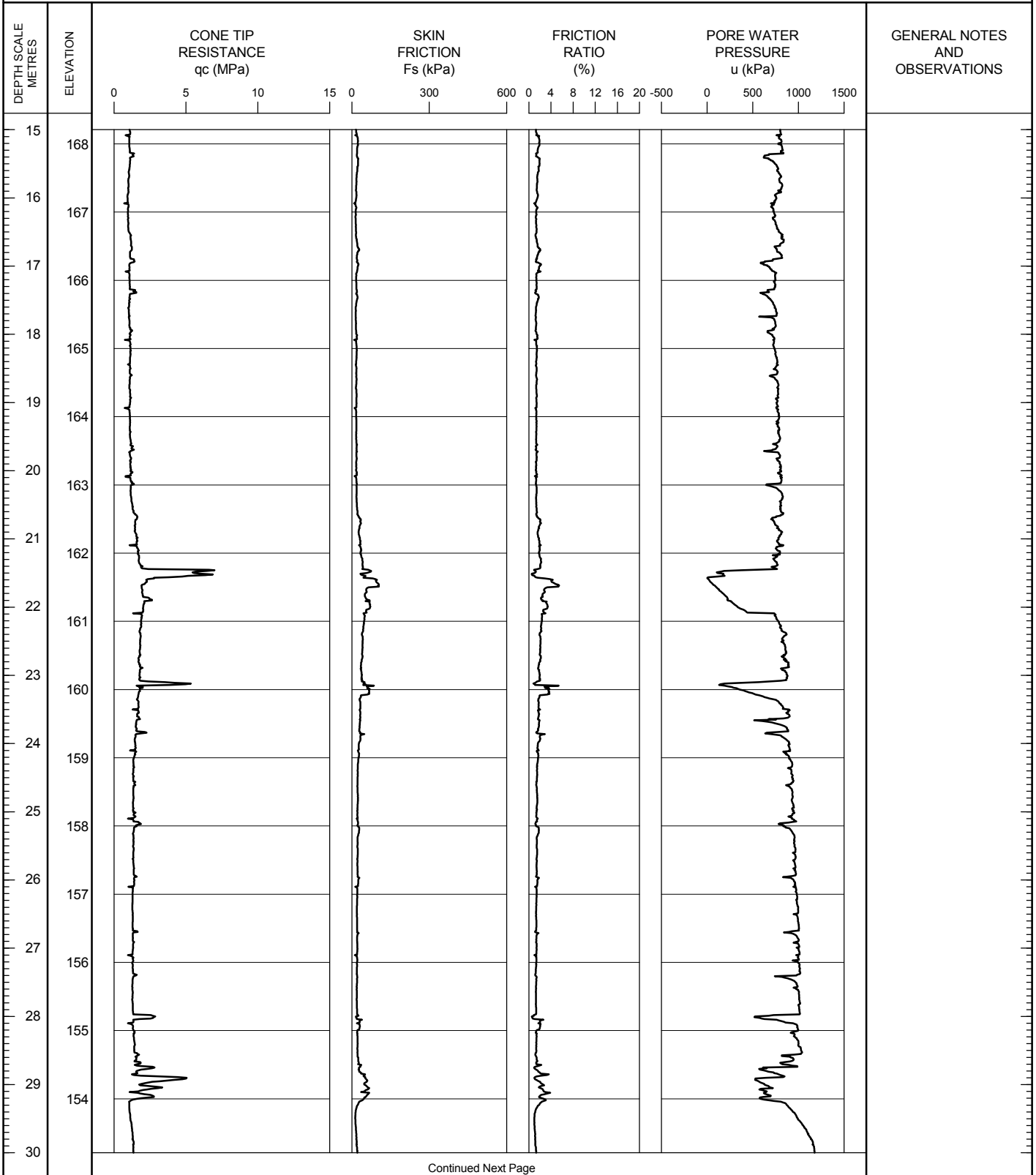
DATUM Geodetic

GROUND SURFACE ELEVATION: 183.2

PREDRILL DEPTH: 1.82

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT T8-1

METRIC

PROJECT Windsor-Essex Parkway

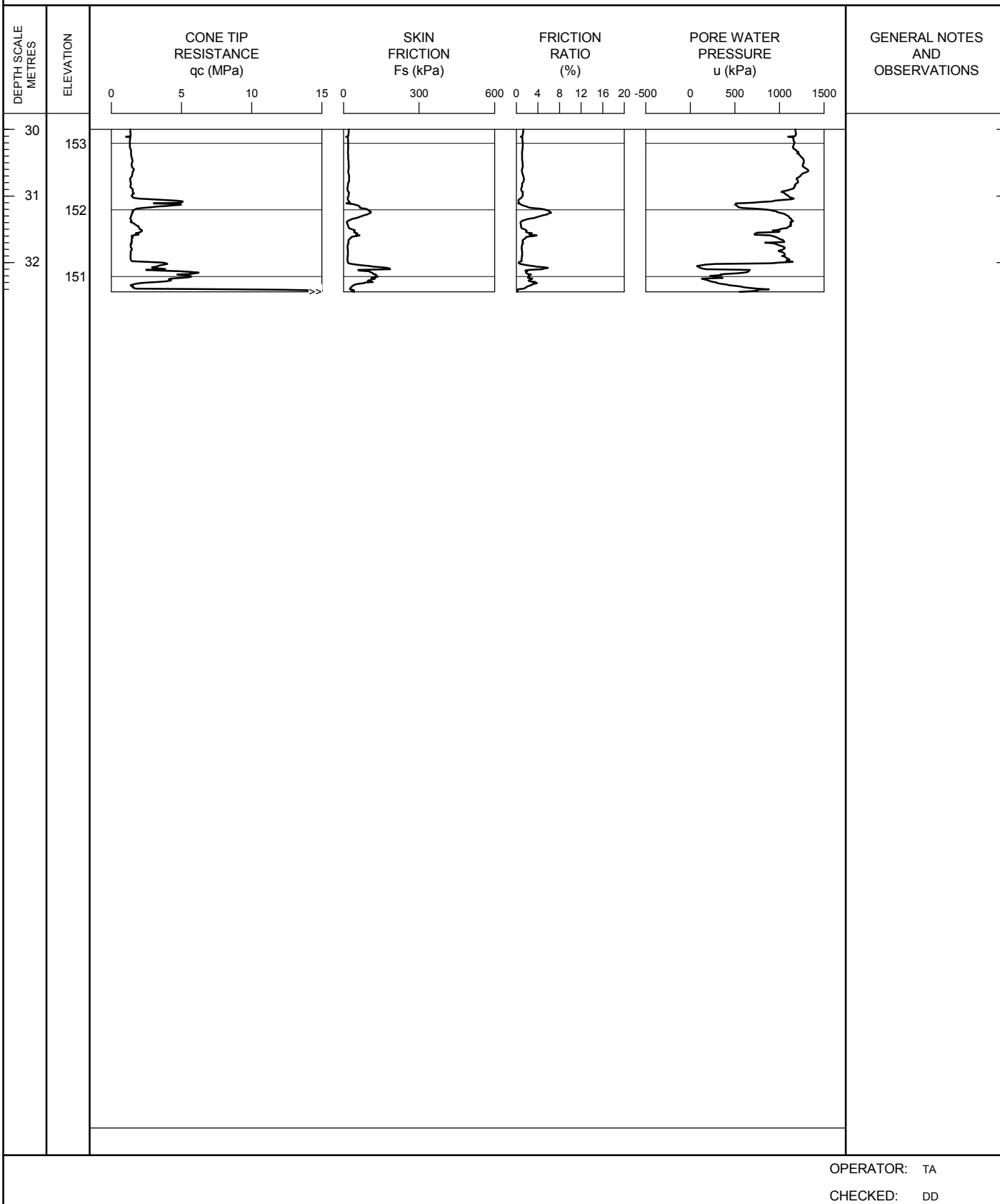
TEST DATE 8/4/2011 - 8/4/2011

SHEET 3 OF 3

LOCATION N4678860.0; E333292.9

DATUM Geodetic

GROUND SURFACE ELEVATION: 183.2 PREDRILL DEPTH: 1.82 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

METRIC

[illegible]

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

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

METRIC

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

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

METRIC

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

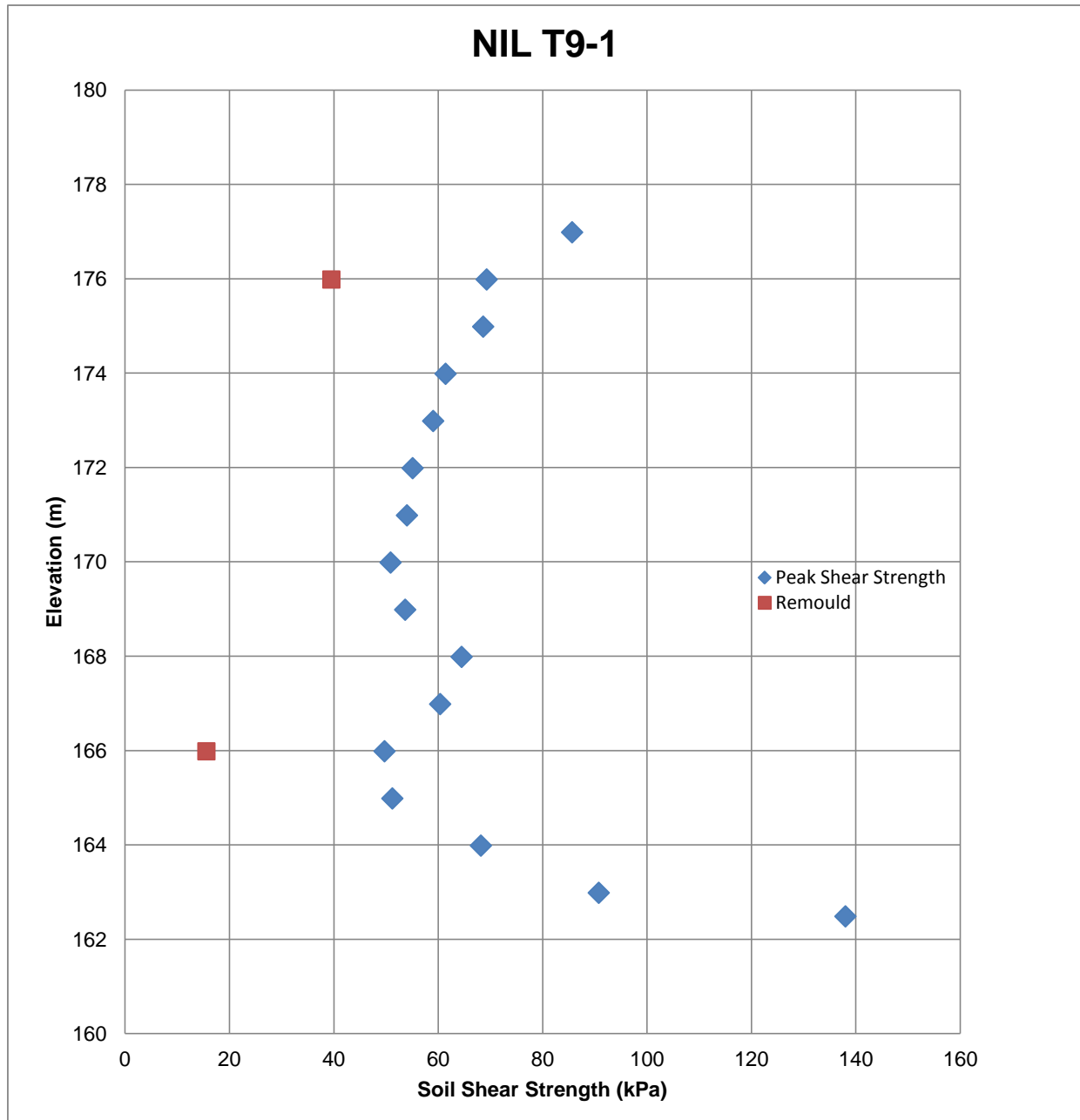
ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 16/08/12

RECORD OF NILCON VANE TEST NIL T9-1

Project : Windsor-Essex Parkway
 Location: N4678636.5; E333765.3
 Ground Surface Elevation: 184.0 m

Test Date: 8/16/2001
 Predrill Depth : 6.1 m

Sheet 1 of 1
 Datum Geodetic



Operator: SD

Checked: DD

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									WATER CONTENT (%)			
								○ UNCONFINED	○ POCKET PEN.	+	×						FIELD VANE	LAB VANE		
								20	40	60	80						100	10	20	30
184.1	Ground Surface																			
0.0	Clayey TOPSOIL																			
183.7																				
0.4	CLAYEY SILT Some sand, trace gravel Stiff to hard Mottled brown and grey		1	AS																
	-Weathered fissures -Some sand, trace gravel with topsoil/organics in fissures		2	SS																
	Brown fissures		3	SS																
	Oxidized		4	SS																
	Silty fissures Grey		5	SS																
179.8	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)																			
4.3	Borehole dry on completion																			

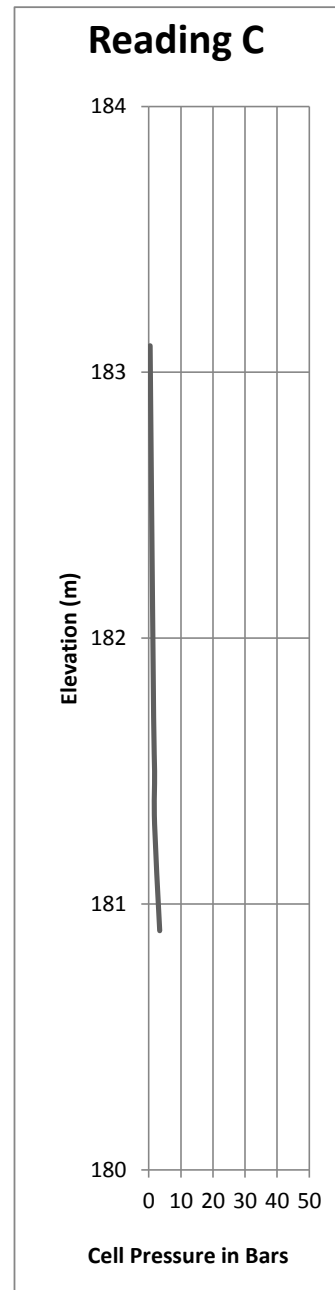
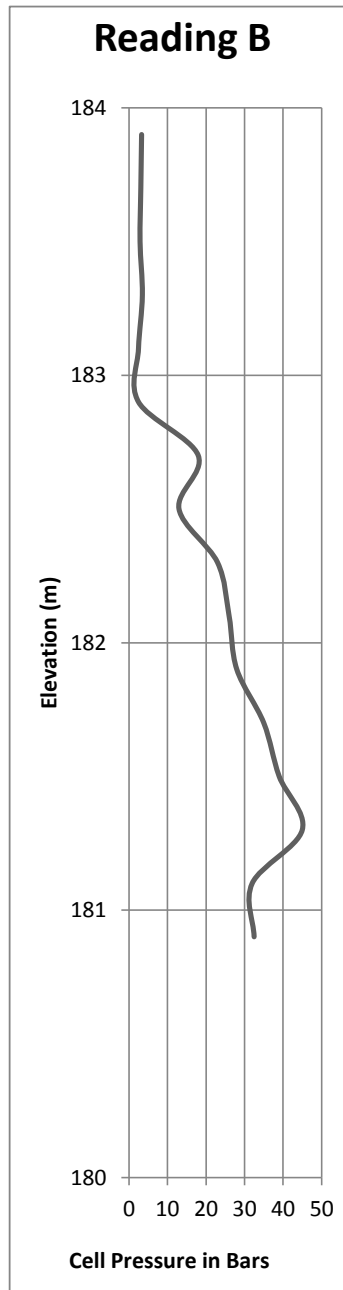
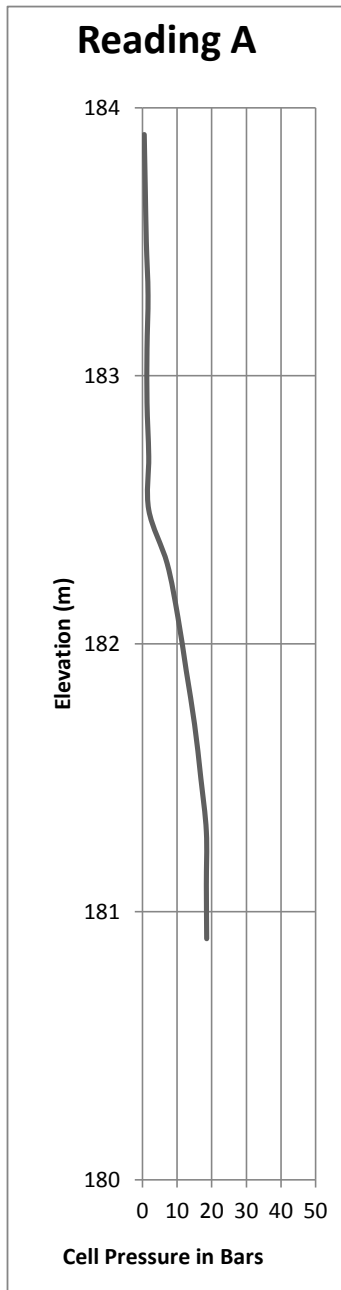
+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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

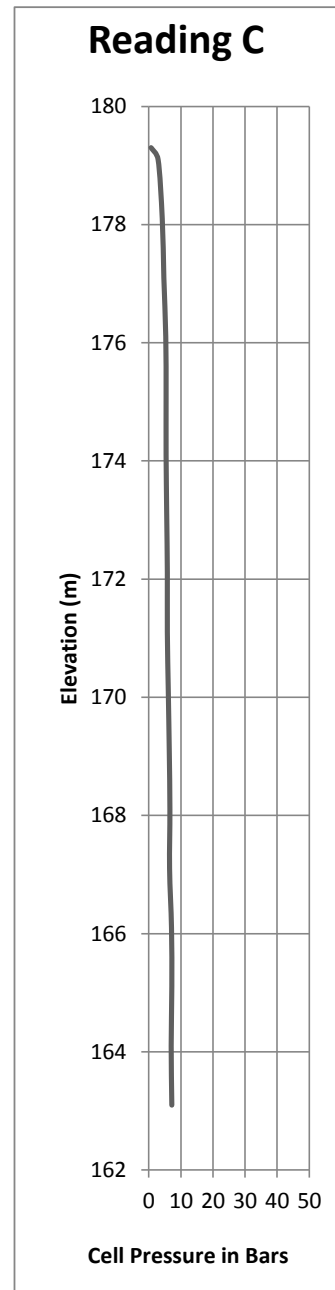
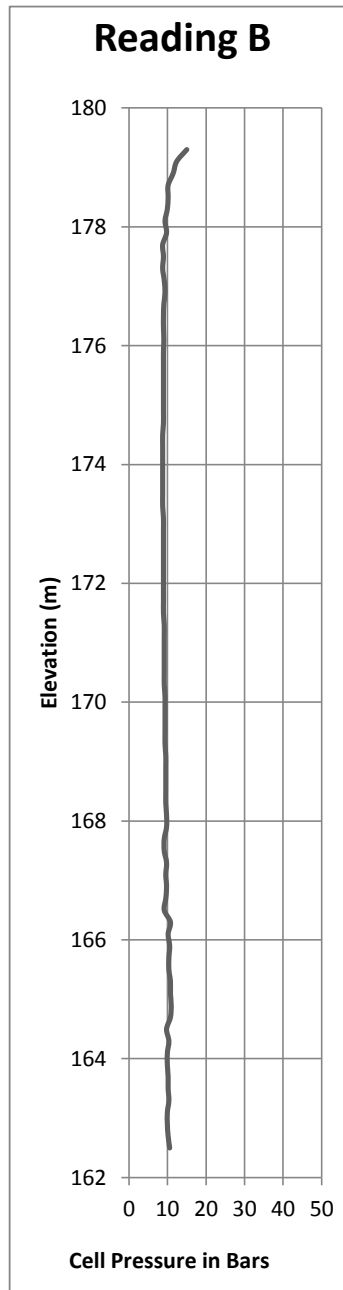
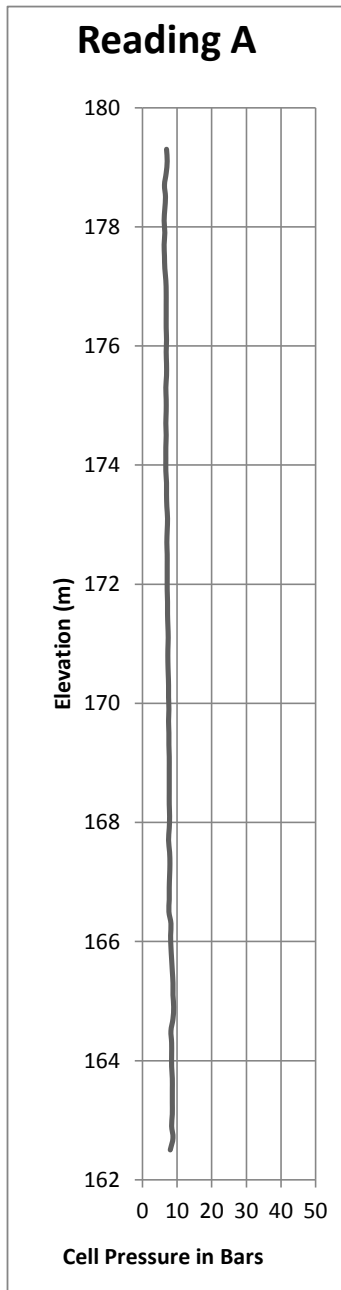
Checked: DD

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

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 ● POCKET PEN.	+ FIELD VANE × LAB VANE										
184.0								20	40	60	80	100							
180.8																			
0.2																			

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

RECORD OF NILCON VANE TEST NIL T9-2

Project : Windsor-Essex Parkway

Test Date: 8/15/2001

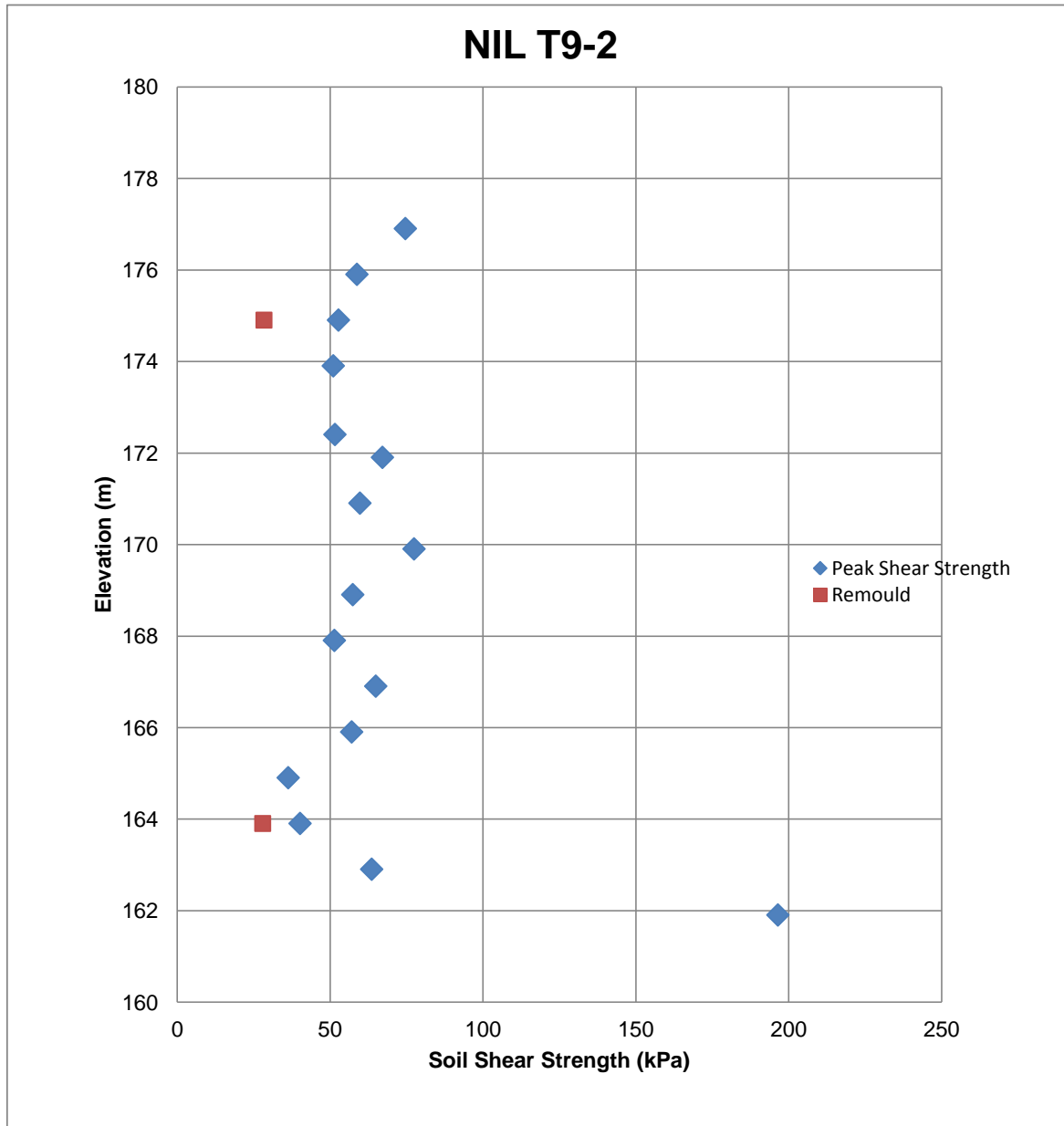
Sheet 1 of 1

Location: N4678593.7; E333893.5

Predrill Depth : 6.6 m

Datum Geodetic

Ground Surface Elevation: 183.9 m



Operator: SD

Checked: DD

RECORD OF 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					
								○ UNCONFINED + FIELD VANE	WATER CONTENT (%)								
						● POCKET PEN. × LAB VANE											
184.9	Fill Surface							20	40	60	80	100	10	20	30		
184.0	FILL 150mm Topsoil		1	SS	7									○			
0.2	FILL Silty Clay and Topsoil Brown-Grey		2	SS	11									○			
183.5														○			
1.4	CLAYEY SILT Sandy to some sand, trace gravel Stiff		3	SS	12									○			
														○			
	Brown		4	SS	32									○			
														○			
			5	SS	39									○			
														○			
	Grey		6	SS	23									○			
														○			
			7	SS	18									○			
														○			
			8	SS	13									○			
														○			
			9	TW	PH					×				□	—		22.0
				VT										1.6			
			10	TW	PH									○			
			11	TW	PH									○			
				VT													
			12	TW	PH					×				□	—		21.5
			13	TW	PH									○			
				VT													
			14	TW	PH									○			
											</						

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

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 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									
184.9	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									○			
														○			
182.9			2	SS	10												
2.0	END OF SAMPLED BOREHOLE (Continued with CPT to refusal) Borehole dry on completion																
															</		

RECORD OF CONE PENETRATION TEST CPT T10-1

METRIC

PROJECT Windsor-Essex Parkway

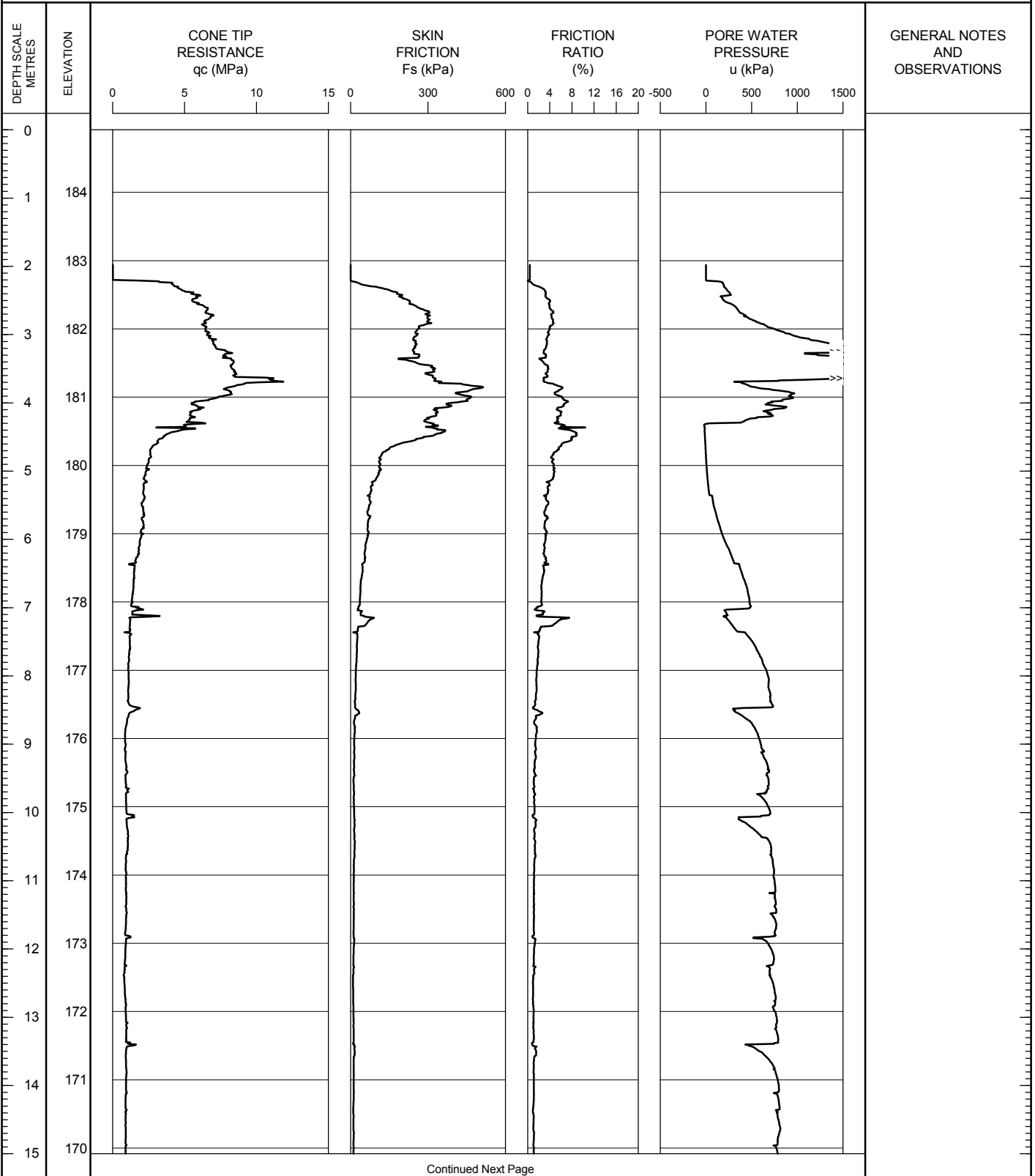
TEST DATE 8/9/2011 - 8/9/2011

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

WEF CPT LOG CPT T10-1 GPJ ONTARIO MOT.GDT 02/12/11

RECORD OF CONE PENETRATION TEST CPT T10-1

METRIC

PROJECT Windsor-Essex Parkway

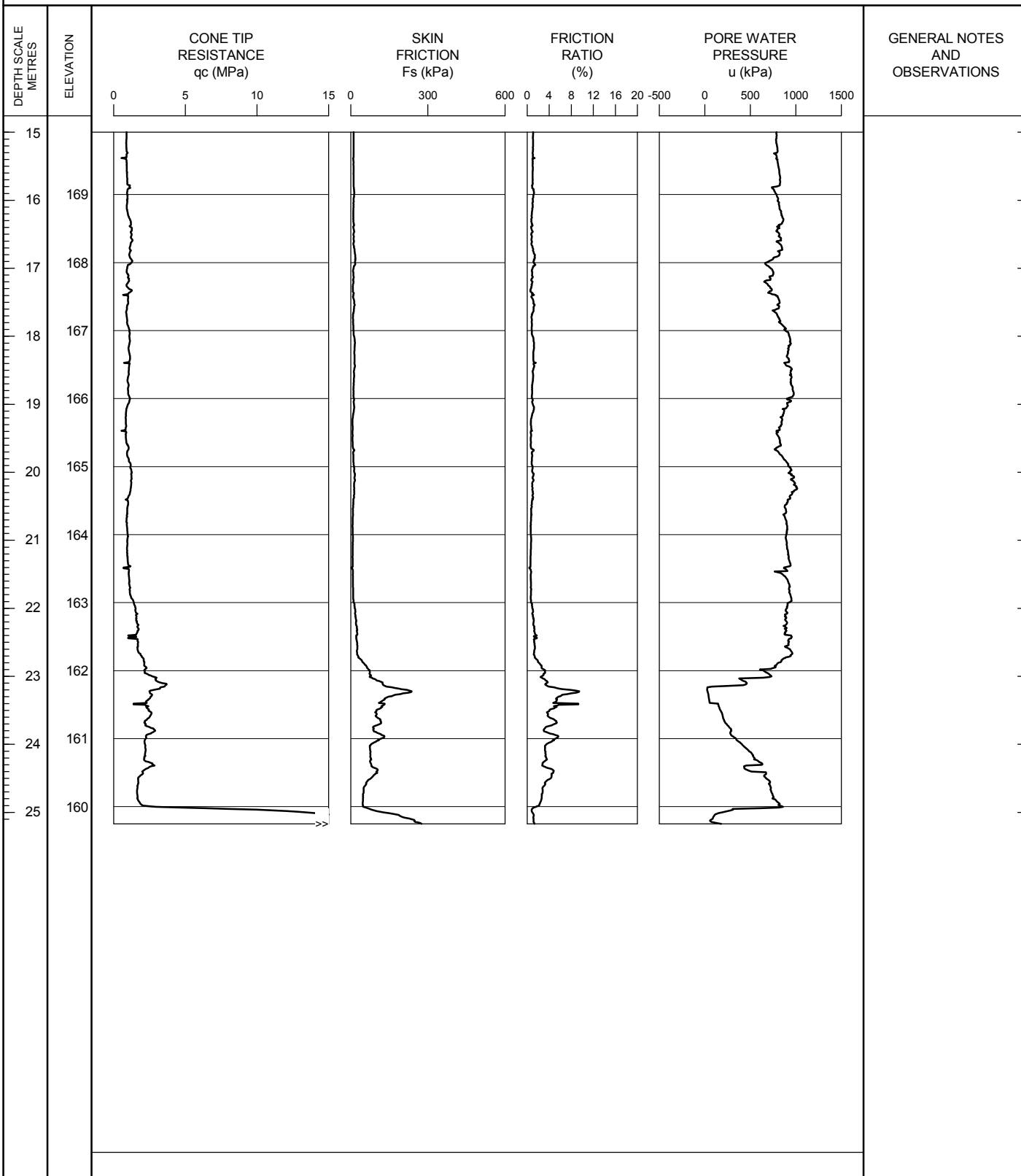
TEST DATE 8/9/2011 - 8/9/2011

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



WEP CPT LOG CPT T10-1.GPJ ONTARIO MOT.GDT 02/12/11

OPERATOR: TA

CHECKED: DD

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 (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			GR	SA
184.6	Ground Surface							20	40	60	80	100							
0.0	TOPSOIL							○ UNCONFINED											
184.3	Clayey, with roots							● POCKET PEN.											
0.3	To weathered brown-grey silty clay								+	FIELD VANE									
	Some sand, trace gravel								×	LAB VANE									
	SILTY CLAY																		
	Some sand, trace gravel																		
	Dry																		
	-Brown fissures																		
	Stiff to hard		1	AS			184												
	Mottled brown and grey		2	SS	53		183												
							182												
			3	SS	37		181												
							180												
			4	SS	23														
			5	SS	13														
179.6	END OF SAMPLED BOREHOLE																		
5.0	(continued with DMT to refusal)																		
	Borehole dry on completion																		
							179												
							178												
							177												
							176												
							175												
							174												
							173												
							172												
							171												
							170												

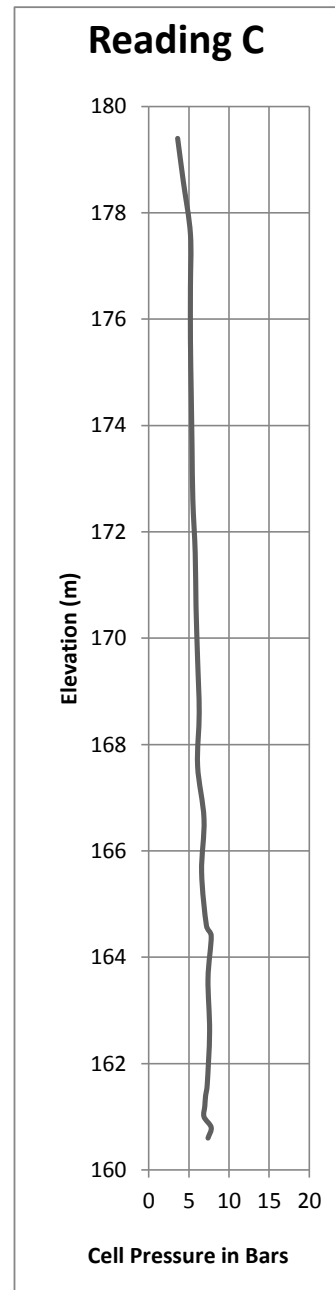
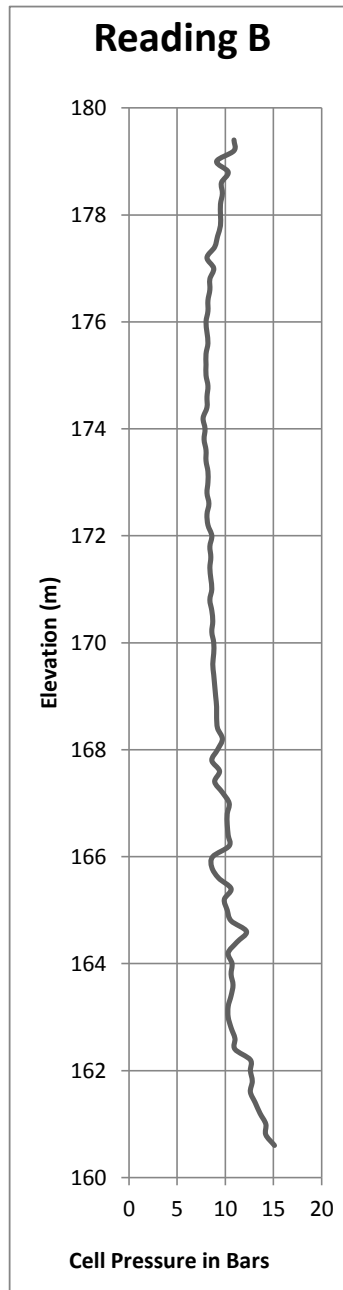
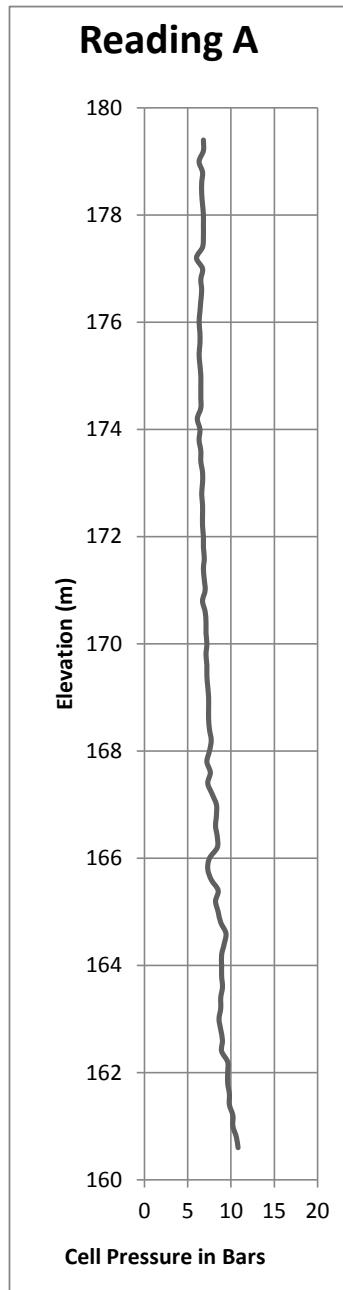
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

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 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 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							
184.8	Ground Surface																	
0.0	TOPSOIL Organic Clay Black															-shallow and mid-depth vibrating wire piezometers (VWP) installed in adjacent boring at (4678361.9N, 334192.4E) and observation well OW installed in adjacent boring at (4678365.8N, 334193.3E). -bedrock VWP installed in sampled borehole.		
184.3	CLAYEY SILT Some sand, trace gravel Firm to Stiff Mottled brown and grey		1	SS	7													
0.5			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			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											
154.6																			
30.2	SANDY SILT Some gravel, trace clay Very dense Grey		27	SS	73														
153.7																			
31.1	SAND AND GRAVEL Very dense Grey																		
153.3																			
31.5	SANDY SILT Some gravel Very dense Grey		28A, B	SS															
152.5																			
32.3	LIMESTONE Fine grained, cherty, bedded, highly fractured with numerous stylolites throughout, faintly to moderately porous. Pitted between 34.35m to 34.85m, light blue-grey inclusions. Light grey		29	RC															
			30	RC															
			31	RC															
			32	RC															
149.0																			
35.8	END OF BOREHOLE																		
	Water levels in observation well measured at elevation 184.1m on May 24, 2011																		
	Water levels in observation well measured at elevation 183.9m on June 4, 2011																		
	Water levels in observation well measured at elevation 183.3m on June 25, 2011																		
	Water levels in observation well measured at elevation 182.6m on July 23, 2011																		
	Water levels in Piezometer VWP T10-2-P7 measured at elevation 183.5m on May 24, 2011																		
	Water levels in Piezometer VWP T10-2-P7 measured at elevation 183.8m on June 4, 2011																		
	Water levels in Piezometer VWP T10-2-P7 measured at elevation 183.1m on June 25, 2011																		
	Water levels in Piezometer VWP T10-2-P7 measured at elevation 182.4m on July 23, 2011																		
	Water levels in Piezometer VWP T10-2-P21 measured at elevation 182.4m on May 24, 2011																		
	Water levels in Piezometer VWP T10-2-P21 measured at elevation 182.7m on June 4, 2011																		
	Water levels in Piezometer VWP T10-2-P21 measured at elevation 182.0m on June 25, 2011																		
	Water levels in Piezometer VWP T10-2-P21 measured at elevation 181.3m on July 23, 2011																		
	Water levels in Piezometer VWP T10-2-P31 measured at elevation 178.5m on May 24, 2011																		
	Water levels in Piezometer VWP T10-2-P31 measured at elevation 178.5m on June 4, 2011																		
	Water levels in Piezometer VWP T10-2-P31 measured at elevation 177.7m on June 25, 2011																		
	Water levels in Piezometer VWP T10-2-P31 measured at elevation 177.0m on July 23, 2011																		

+ 3, x 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 T10-2

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		+ FIELD VANE							○		
								● POCKET PEN.		× LAB VANE									
185.2	Fill Surface						20	40	60	80	100								
0.0	FILL 75mm rounded gravel over 400mm silty clay						185												
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		184												
			2	SS	12		183												
			3	SS	37		182												
			4	SS	39		181												
	Grey		5	SS	21														
			6	SS	17														
180.2	END OF SAMPLED BOREHOLE (continued with CPT to refusal) Borehole dry on completion						180												
5.0							179												
							178												
							177												
							176												
							175												
							174												
							173												
							172												
							171												

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

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

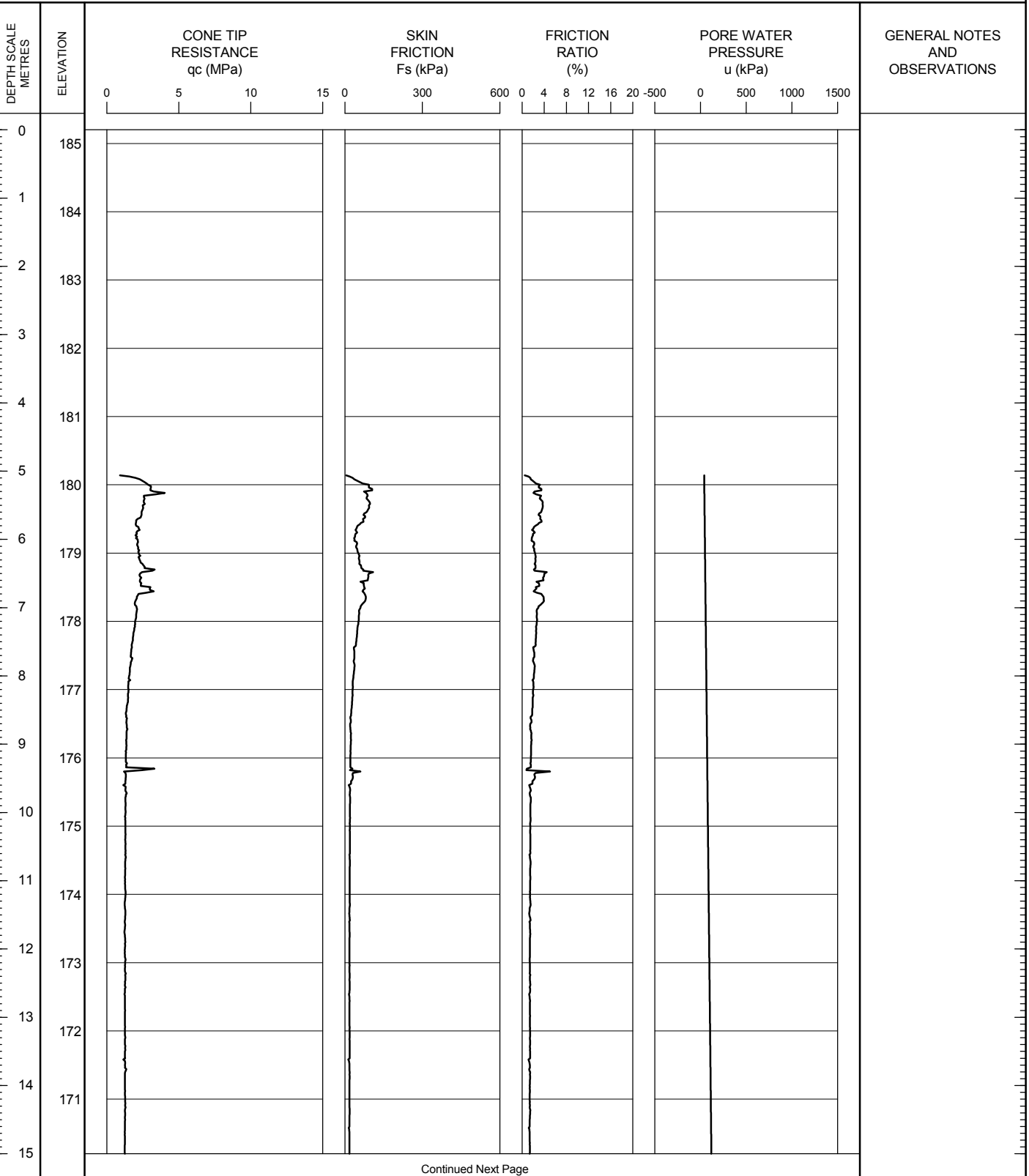
DATUM Geodetic

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

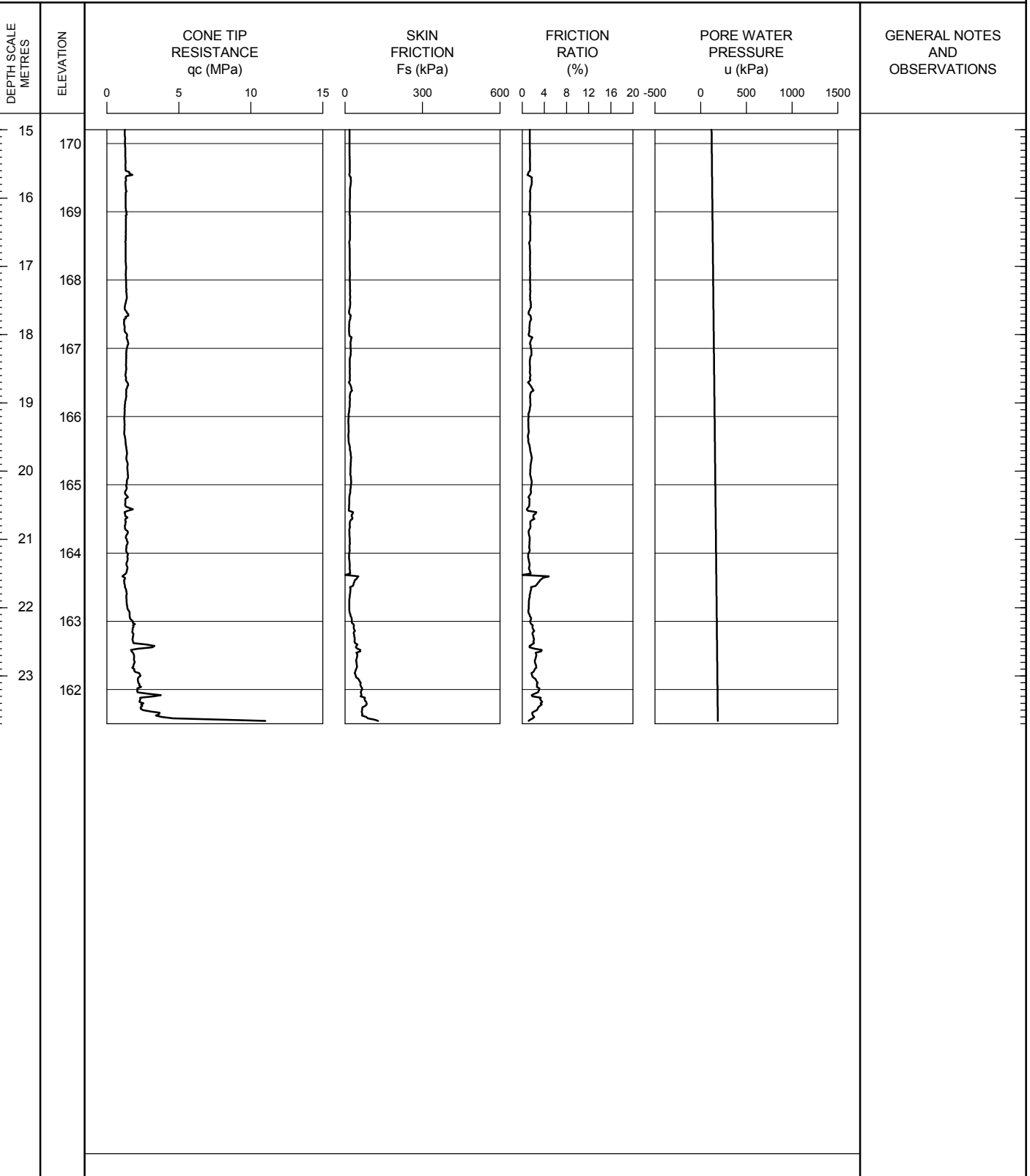
DATUM Geodetic

GROUND SURFACE ELEVATION: 185.2

PREDRILL DEPTH: 5

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: MSO

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 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
																				● POCKET PEN.	× LAB VANE
								WATER CONTENT (%)													
186.1	Ground Surface						186														
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						184														
2.3	Some sand, trace gravel		3	SS	32																
	Hard																				
	Brown		4	SS	37		183														
182.3	CLAYEY SILT						182														
3.8	Some sand, trace gravel		5	SS	16																
	Very stiff to stiff																				
	Grey		6	SS	12																
							181														
			7	SS	11																
	-free water, inferred sand/gravel layout at about elevation 179.96 m		8	SS	7		180														
	50mm of Silty Clay, some gravel at about elevation 179.65 m																				
							179														
			9	SS	5																
							178														
							177														
	Numerous Sand Layers Between Elevations 176.96m and 173.91m		10	TW	PH																
							176														
							175														
							174														
			12	TW	PH																
							173														
							172														
			13	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

RECORD OF BOREHOLE No T11-1

2 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 ● POCKET PEN.	+ FIELD VANE × LAB VANE									
	CLAYEY SILT Some sand, trace gravel <i>(continued)</i>		14	SS	PH										-no recovery with shelby tube; retrieved sample by pushing split spoon			
					VT													
					15	TW	PH											
					16	SS	PH											
						VT												
					17	SS	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

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					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
								20 40 60 80 100						
	</													

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 (%)		
								○ UNCONFINED	+	FIELD VANE									
								● POCKET PEN.	×	LAB VANE									
185.8	Ground Surface						20	40	60	80	100								
0.0	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel Stiff Mottled brown and grey		1	SS	8											ground surface in vicinity of borehole stripped of topsoil			
	trace organic matters (rootlets) at about elevation 184.07 m		2	SS	8														
183.5	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel Hard Brown		3	SS	35														
182.6	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														
3.2																			
			5	SS	19														
			6	SS	11														
180.7	END OF BOREHOLE Continued with Nilcon Vane Borehole dry during drilling on May 7, 2011																		
5.0																			
							180												
							179												
							178												
							177												
							176												
							175												
							174												
							173												
							172												
							171												

+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

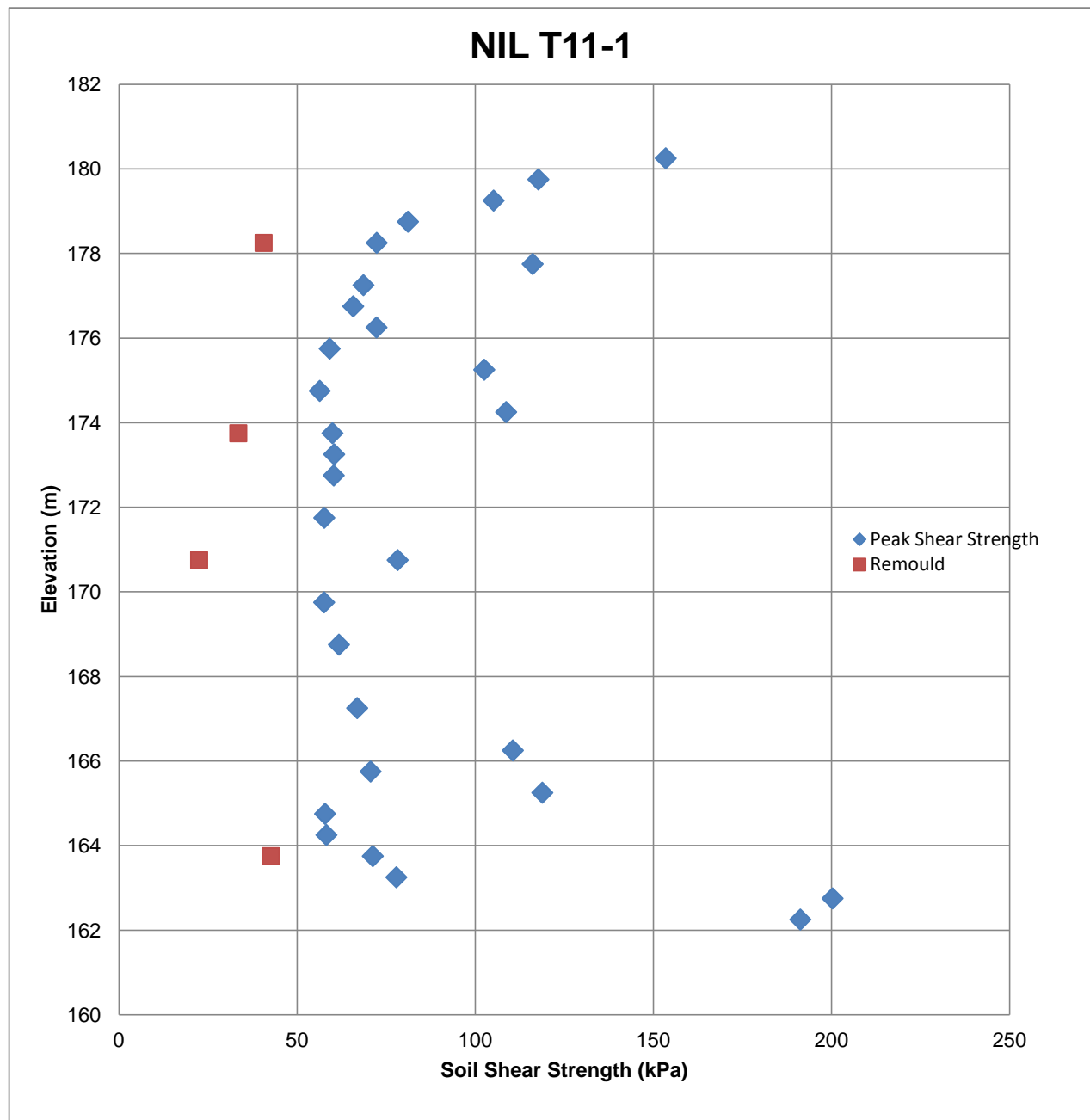
Sheet 1 of 1

Location: N4677879.7; E335010.1

Predrill Depth : 5 m

Datum Geodetic

Ground Surface Elevation: 185.8 m



Operator: NB

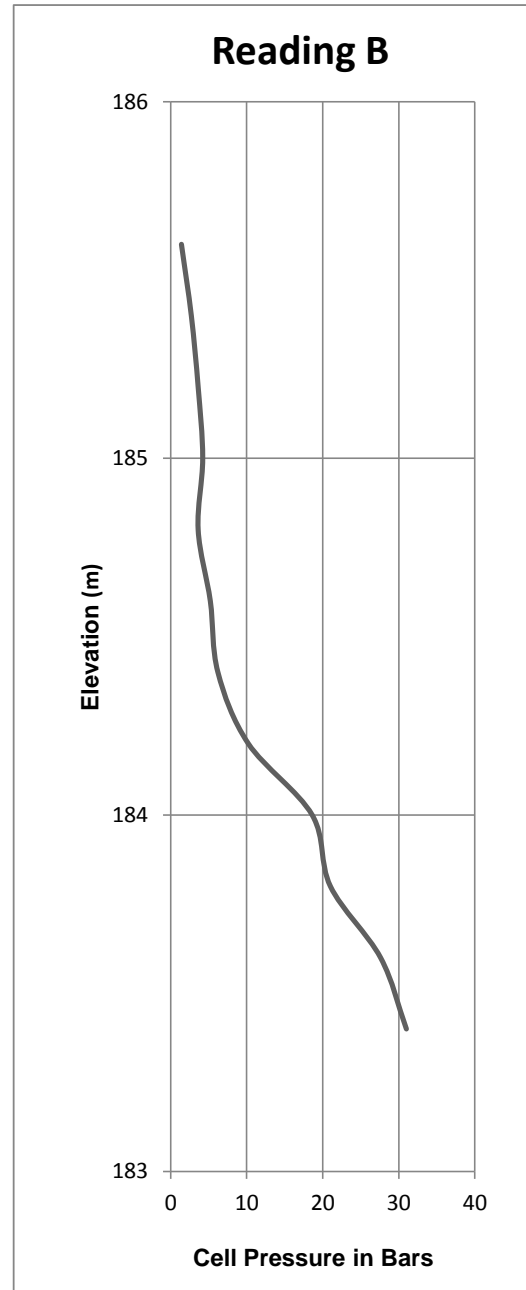
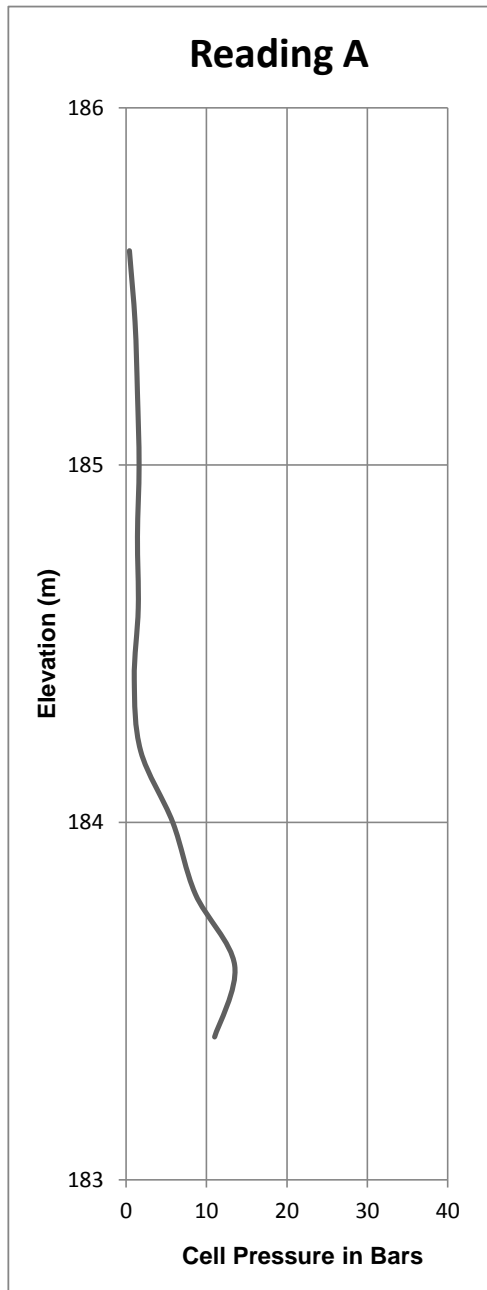
Checked: DD

RECORD OF 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.

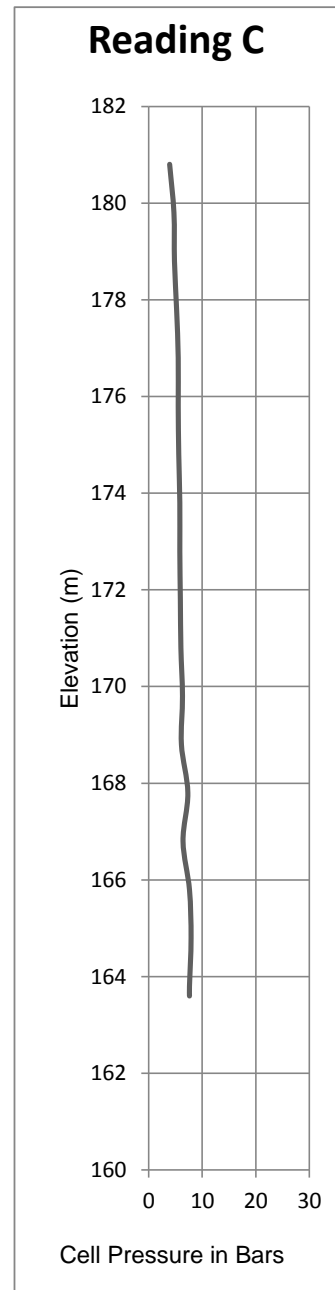
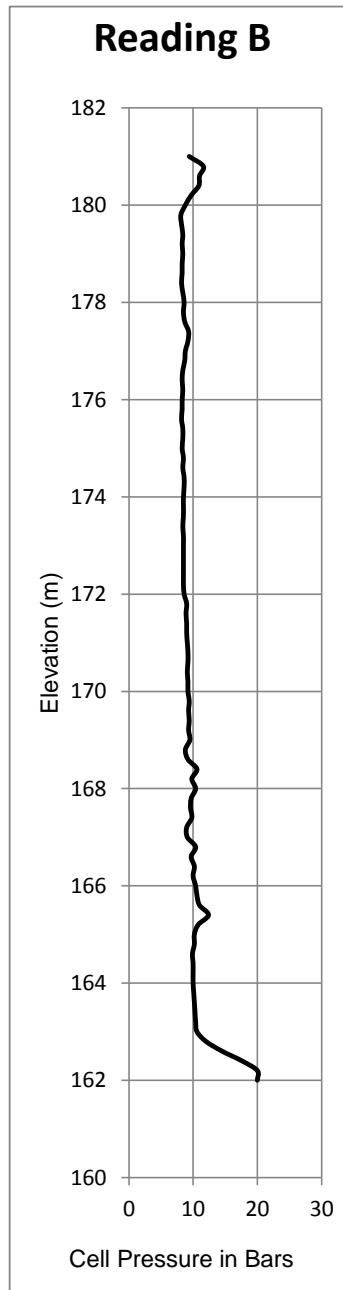
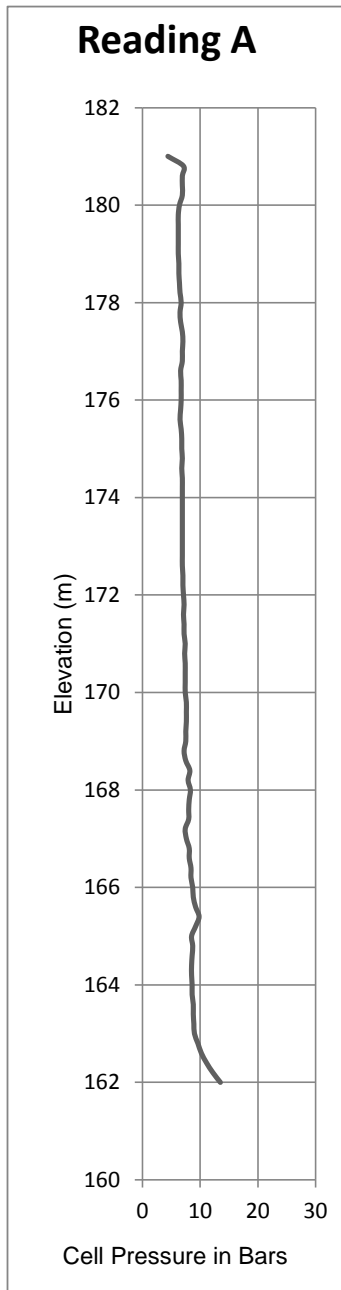
Operator: LC
Checked: DD

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

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT	LQUID LIMIT W _L	UNIT WEIGHT γ KN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100		SHEAR STRENGTH kPa	W		
										○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE			
											WATER CONTENT (%)		
186.0	Ground Surface												
0.0	175 mm TOPSOIL		1	TP									
0.2	Black organic sandy clay		2	TP									
	SANDY SILT												
	With silty clay layers, trace rootlets												
	Loose												
	Mottled brown and grey		1	SS	7								
184.4													
1.5	SANDY SILT		2	SS	21								
	With silty clay layers, trace rootlets												
	Compact												
	Brown		3	SS	29								
	oxidized fissures at about elevation 183.06 m		4	SS	23								
182.2													
3.8	SANDY SILT		5	SS	13								
	With silty clay layers, trace rootlets												
	Compact												
	Grey												
	horizontal silt fissure at about elevation 181.39 m		6	SS	8								
181.1													
4.9	CLAYEY SILT		7	SS	3								
	Some sand, trace gravel												
	Stiff												
	Grey		8	TW	PH								
				HV									
			9A,9B	TW	PH								
				HV									
	Numerous Sand Layers At Elevation 176.51m		10	TW	PH								
				HV									
175.6													
10.4	SILTY CLAY TO CLAYEY SILT		11	TW	PH								
	Some sand, trace gravel												
	Stiff												
	Grey												
				HV									
			12	TW	PH								

+ 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 T11-2

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		GR SA SI CL			
169.4 16.6	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel (continued) CLAYEY SILT Some sand, trace gravel Stiff Grey with trace pink clay nodules at about elevation 165.48 m Occasional Sand Seams At About Elevation 164.62 m		14	TW	PH		170								1 22 38 39	
																switched to wash boring at elevation 170.12m
			15	TW	PH											UUC
			16	TW	PH											
			17	TW	PH											18.8 2 12 46 38
																VWP T11-2-P18 installed at elevavtion 167.68m
			18	TW	PH											
			19	TW	PH											19.1
																T11-2-SM18 installed at N4677867.5, E335102.9 at elevation 167.32m
			20	TW	PH											
																-increased resistance to drilling
			21	TW	PH											19.9 1 16 46 37
22	TW	PH											4 27 42 21			
163.1 22.9	SILTY CLAY TO CLAYEY SILT Some sand, trace gravel Very Stiff Grey		23	SS	28		163							-end of drilling May 2; continued May 3 -shelby tube lost down hole; end of drilling May 3		
159.1 26.8	FINE SAND Some clay, silt Compact Grey		24	SS	20		162									
			25	SS	19		161									
			26	SS	25		160									
157.9 28.0	CLAYEY SILT Stiff Grey					159										
							158									
156.0			27	SS	13		157									

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

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						20	40	60	80	100		10	20	30		GR SA SI CL -installed slope inclinometer casing (T11-2-SI)					
0.0	TOPSOIL Organic clay Black																					
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 Borehole dry during drilling on May 5, 2011																					
5.0																						

+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 T11-2

Project : Windsor-Essex Parkway

Test Date: 5/5/2011

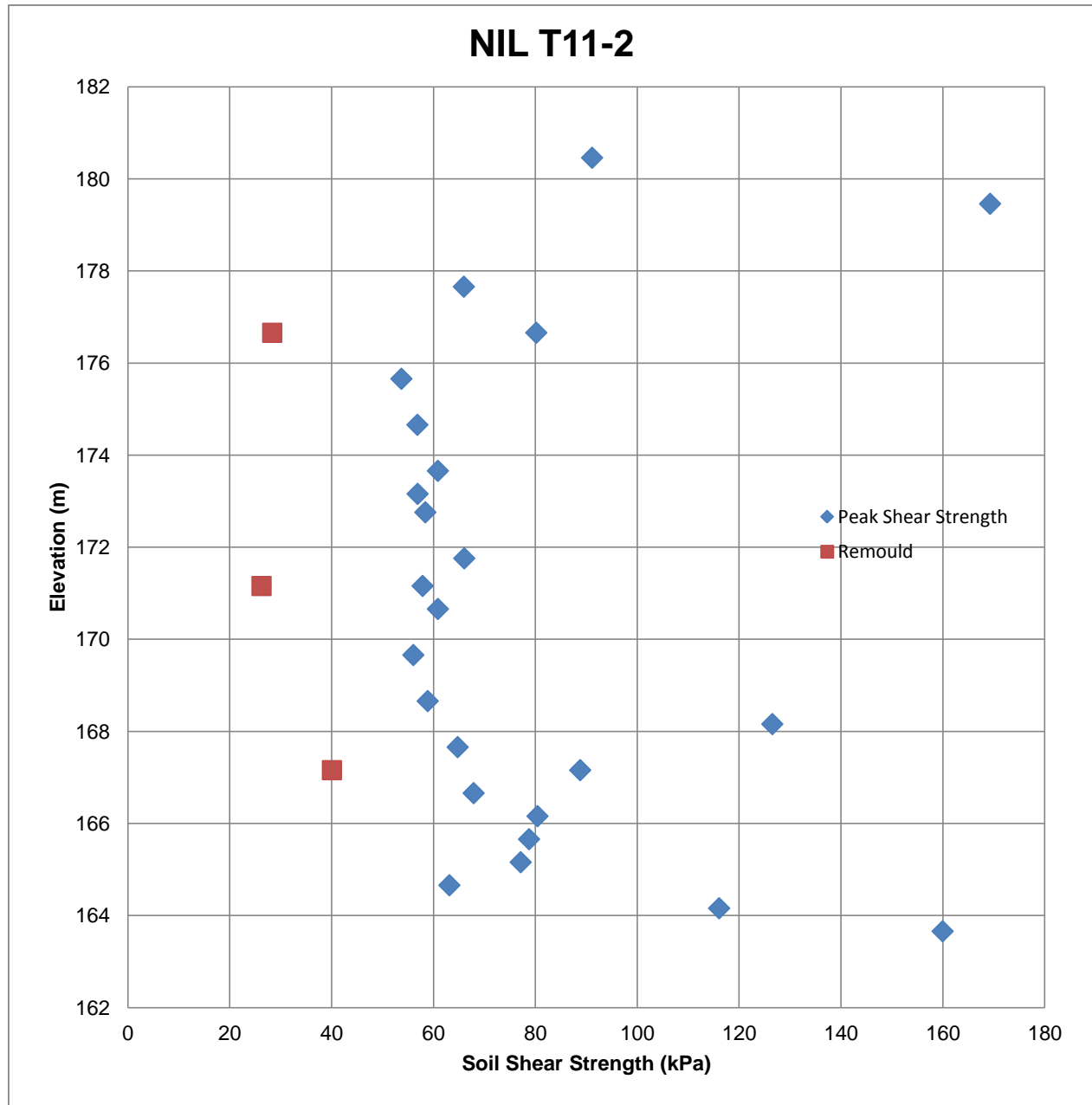
Sheet 1 of 1

Location: N4677870; E335107

Predrill Depth : 5 m

Datum Geodetic

Ground Surface Elevation: 186.0 m



Operator: NB

Checked: DD

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 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
	Borehole drilled without sampling (continued)																		
170																			
169																			
168																			
167																			
166																			
165																			
164																			
163																			
162																			
161																			
160																			
159																			
158																			
157																			

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

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												
						○ UNCONFINED + FIELD VANE												
						● POCKET PEN. × LAB VANE												
					WATER CONTENT (%)													
						20	40	60	80	100	10	20	30					
155.5	Borehole drilled without sampling (continued)																	
30.5	END OF BOREHOLE																	
	Water level measured in Piezometer T11-2-P30 at elevation 177.19 m on May 12, 2011																	
	Water level measured in Piezometer T11-2-P30 at elevation 177.24 m on May 16, 2011																	
	Water level measured in Piezometer T11-2-P30 at elevation 177.01 m on May 24, 2011																	
	Water level measured in Piezometer T11-2-P30 at elevation 176.44 m on June 25, 2011																	
	Water level measured in Piezometer T11-2-P30 at elevation 176.55 m on July 10, 2011																	
	Water level measured in Piezometer T11-2-P30 at elevation 175.61 m on July 24, 2011																	
	Water level measured in Piezometer T11-2-P30 at elevation 176.08 m on July 29, 2011																	
	Water level measured in Piezometer T11-2-P30 at elevation 176.08 m on August 6, 2011																	

VWP T11-2-P30 installed at elevation 155.48m

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 T11-3

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




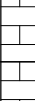

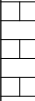

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _P	W	W _L			
								○ UNCONFINED + FIELD VANE	● POCKET PEN. × LAB VANE						
170.5								20 40 60 80 100							
15.2	CLAYEY SILT Some sand, trace gravel Stiff Grey Occasional Sand Layers Between Elevations 168.73m and 165.68m		14	TW	PH		170							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		

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 (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● POCKET PEN.	+ FIELD VANE × 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%	
	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								
148.3 37.5	END OF BOREHOLE No groundwater observed during drilling between April 19 and 21, 2011 due to wash boring						149							RQD=35% TCR = 100% SCR = 35%	
							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

[illegible]

+ 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 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 (%)		
								20	40	60	80						100	10	20
182.4	Ground Surface																		
0.0	TOPSOIL						182												
181.8																			
0.6	FINE SAND Poorly graded Trace silt Brown -Some sandy silt pockets		1	SS	5														
			2	SS	5														
180.1							181												
2.3	CLAYEY SILT to SILTY CLAY Stiff Varved Grey		3	SS	10		180												
179.4																			
3.0	SILTY CLAY Some sand, trace gravel Stiff to very stiff Grey		4	SS	10		179												
			5	SS	15														
			6	SS	9		178												
			7	SS	11		177												
			8	SS	10		176												
175.8	END OF BOREHOLE						175												
6.6	Groundwater encountered at elevation 180.9m during drilling						174												
							173												
							172												
							171												
							170												
							169												
							168												

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

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								
								20	40	60	80					
181.2	Fill Surface															
0.0																
0.2	<div><div></div><div>FILL Topsoil Black</div><div>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 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	Ground Surface														
0.0	TOPSOIL Sandy Black														
180.4	SILTY SAND Trace rootlets Brown		1	SS	4										
0.8	CLAYEY SILT Some sand, trace gravel, trace rootlets Mottled brown and grey		2	SS	14										
0.9															
			3	SS	18										
			4	SS	17										
			5	SS	9										
176.9	END OF SAMPLED BOREHOLE Continued with Nilcon Vane from 5.0 m to refusal														
4.3	Borehole dry on completion														

+ 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

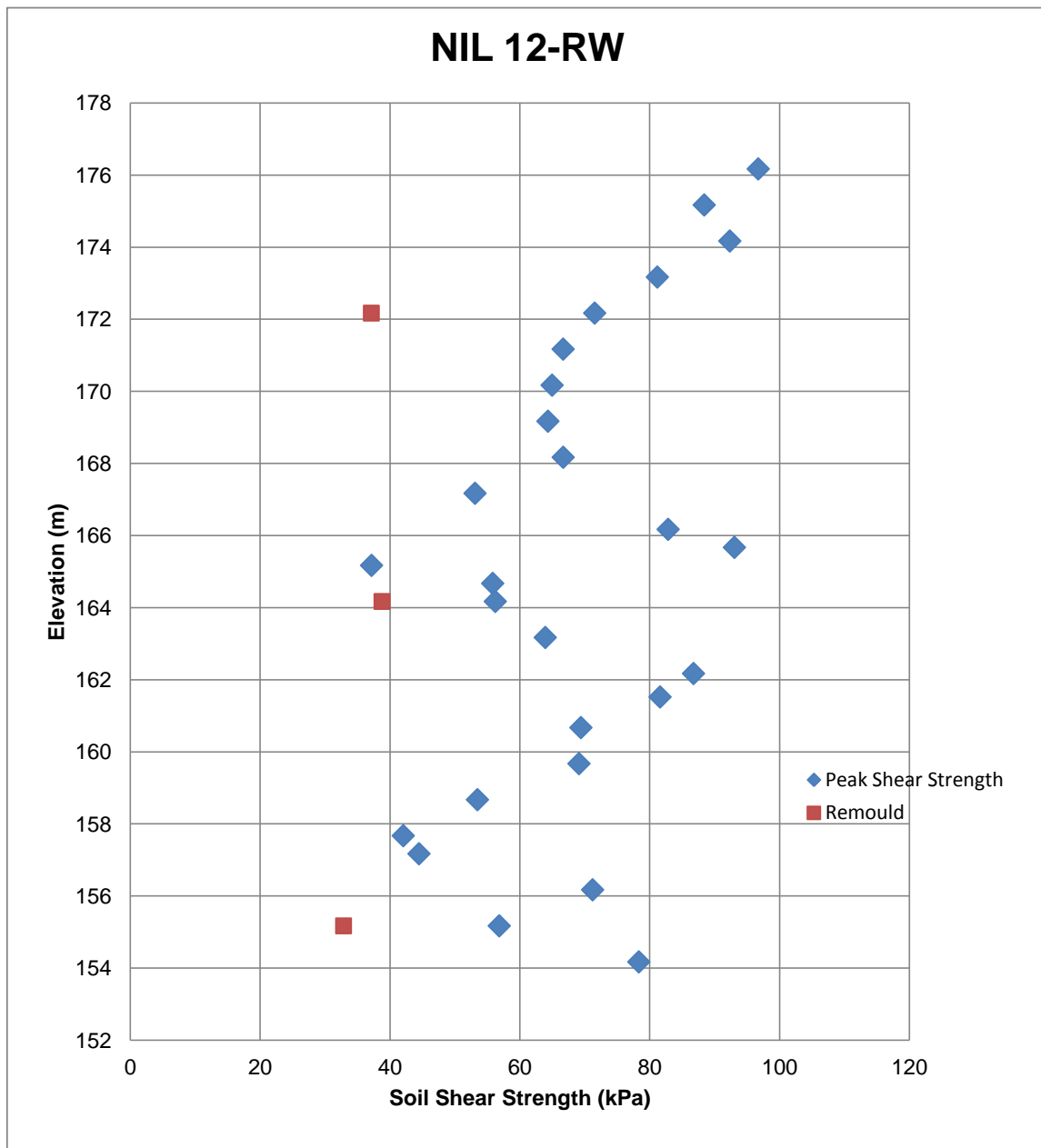
Sheet 1 of 1

Location: N4679767.0; E332011.4

Predrill Depth : 4.3 m

Datum Geodetic

Ground Surface Elevation: 181.2 m



Operator: TR

Checked: DD

RECORD OF 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	×					
184.1	Fill Surface						20	40	60	80	100					
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>															
			1	SS	2											
182.6																
1.5	<div><div><div>SILTY CLAY</div><div>Weathered, fissures</div><div>Some sand, trace gravel</div><div>Stiff</div><div>Brown</div></div></div>		2	SS	11											
181.8																
2.3	<div><div><div>CLAYEY SILT</div><div>Hard to firm</div><div>Brown</div><div>Some sand, trace gravel</div><div>Moist</div><div>Fissured occasionally</div><div>Grey</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																
							177									
							176									
							175									
							174									
							173									
							172									
							171									
							170									

+ 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		2	SS	7												
180.0 2.0	Some sand, trace gravel Firm Grey 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 CONE PENETRATION TEST CPT 19-RW

METRIC

PROJECT Windsor-Essex Parkway

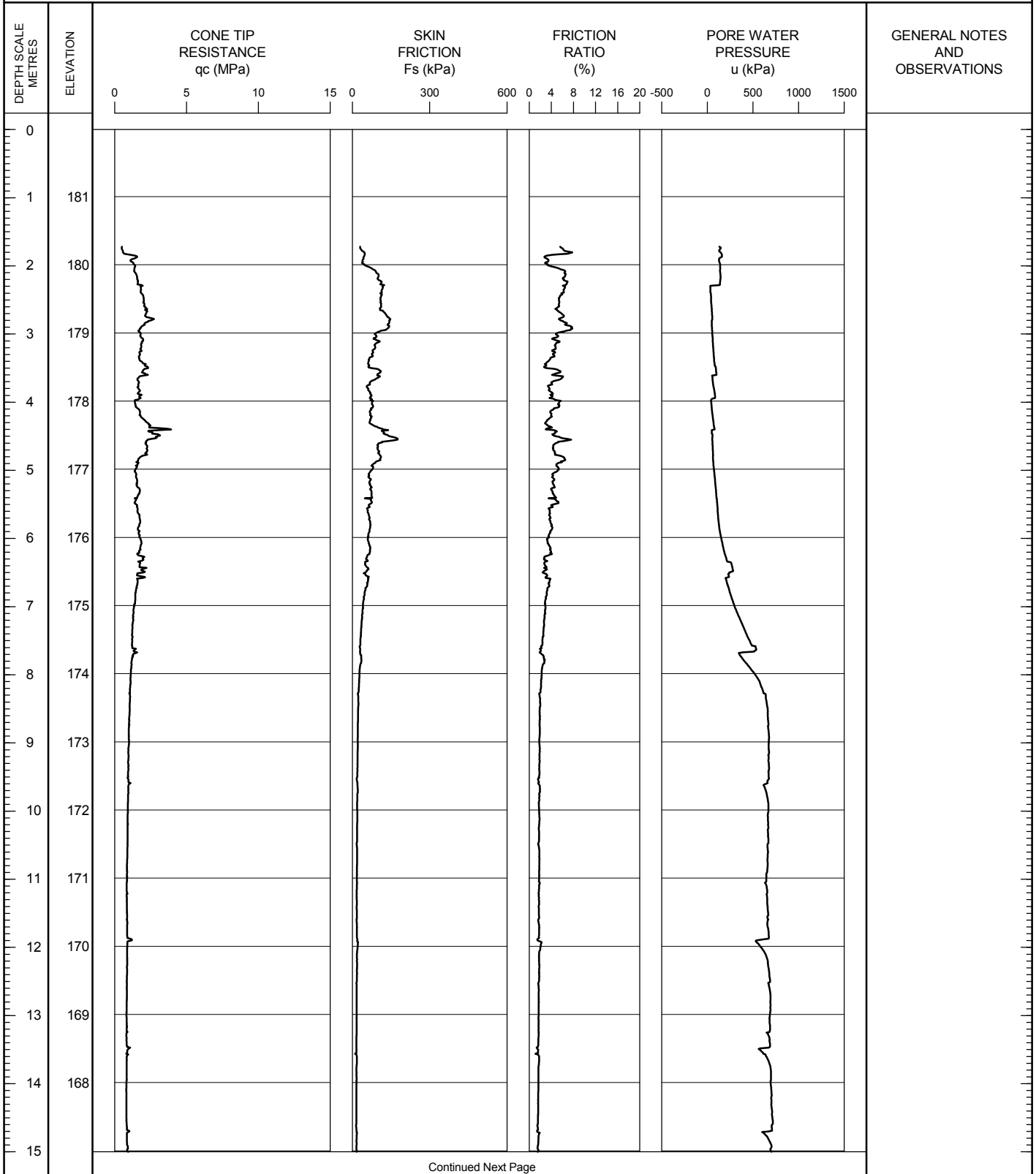
TEST DATE 6/13/2011 - 6/13/2011

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

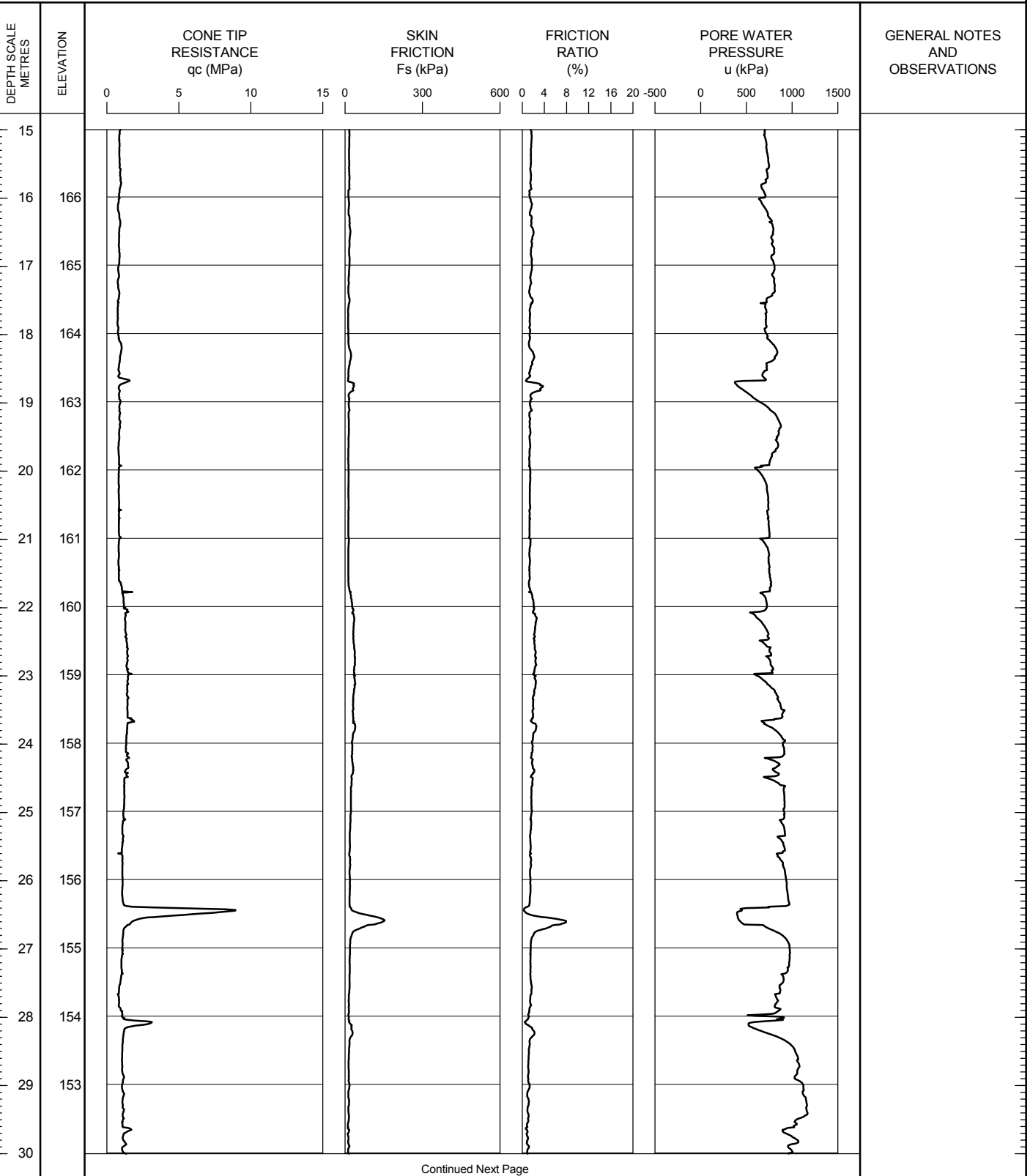
DATUM Geodetic

GROUND SURFACE ELEVATION: 182.0

PREDRILL DEPTH: 1.57

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 19-RW

METRIC

PROJECT Windsor-Essex Parkway

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

SHEET 3 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

DEPTH SCALE METRES	ELEVATION	CONE TIP RESISTANCE qc (MPa)	SKIN FRICTION Fs (kPa)	FRICTION RATIO (%)	PORE WATER PRESSURE u (kPa)	GENERAL NOTES AND OBSERVATIONS
		0 5 10 15	0 300 600	0 4 8 12 16 20 -500	0 500 1000 1500	
30						

OPERATOR: TA

CHECKED: DD

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											
								○ UNCONFINED	+	FIELD VANE									
								● POCKET PEN.	×	LAB VANE									
181.6	Ground Surface						20	40	60	80	100								
0.0	TOPSOIL																		
181.1																			
0.5	SAND Fine-medium coarse, poorly graded Trace to some silt Brown		1	SS	5								○						
180.1																			
1.5	SILT Some sand, some clay Brown to grey		2	SS	7								○						
179.6																			
2.0	END OF SAMPLED BOREHOLE (Continued with CPT to refusal)																		
	Borehole dry on completion																		

RECORD OF CONE PENETRATION TEST CPT 23-RW

METRIC

PROJECT Windsor-Essex Parkway

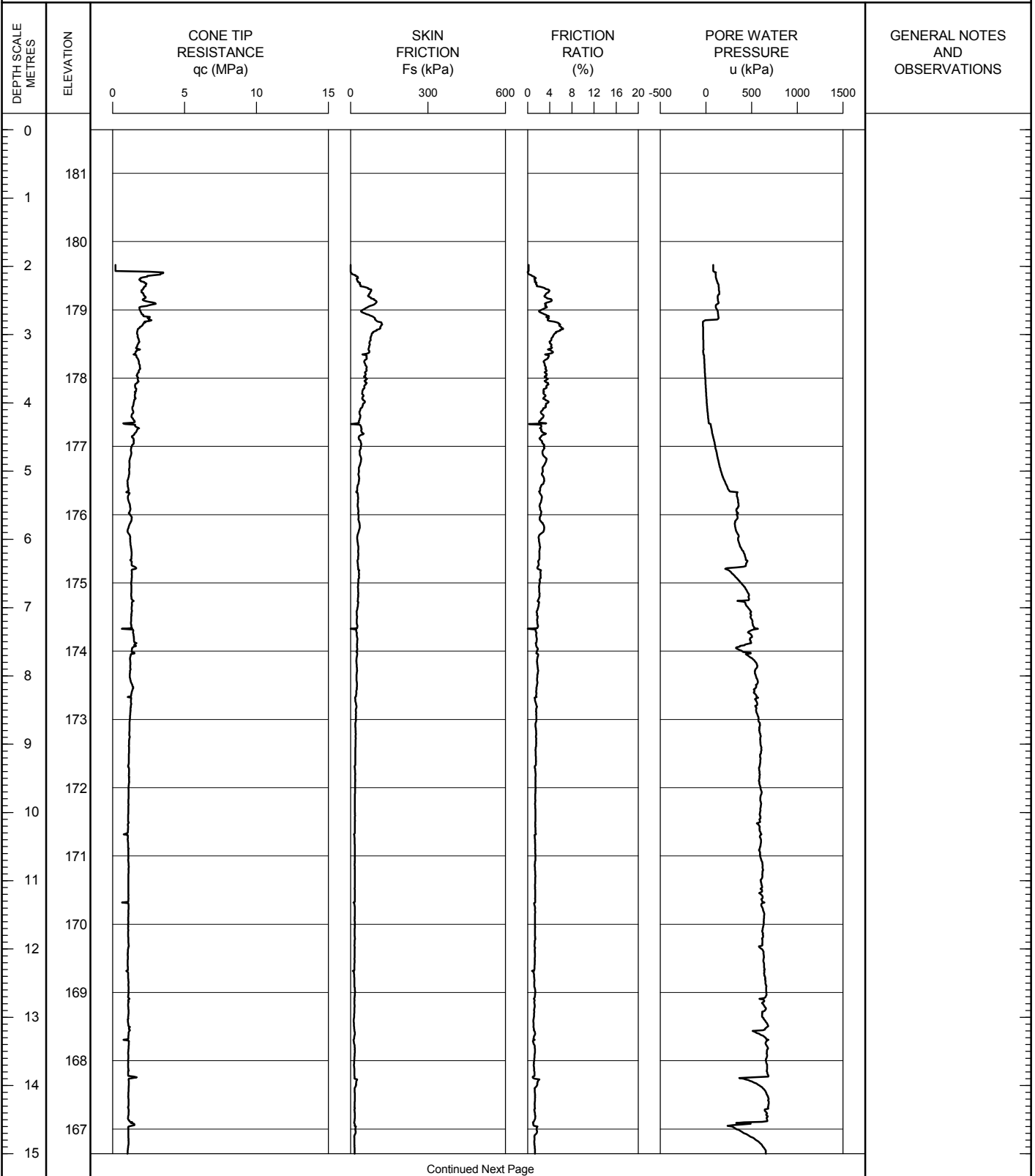
TEST DATE 8/10/2011 - 8/10/2011

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

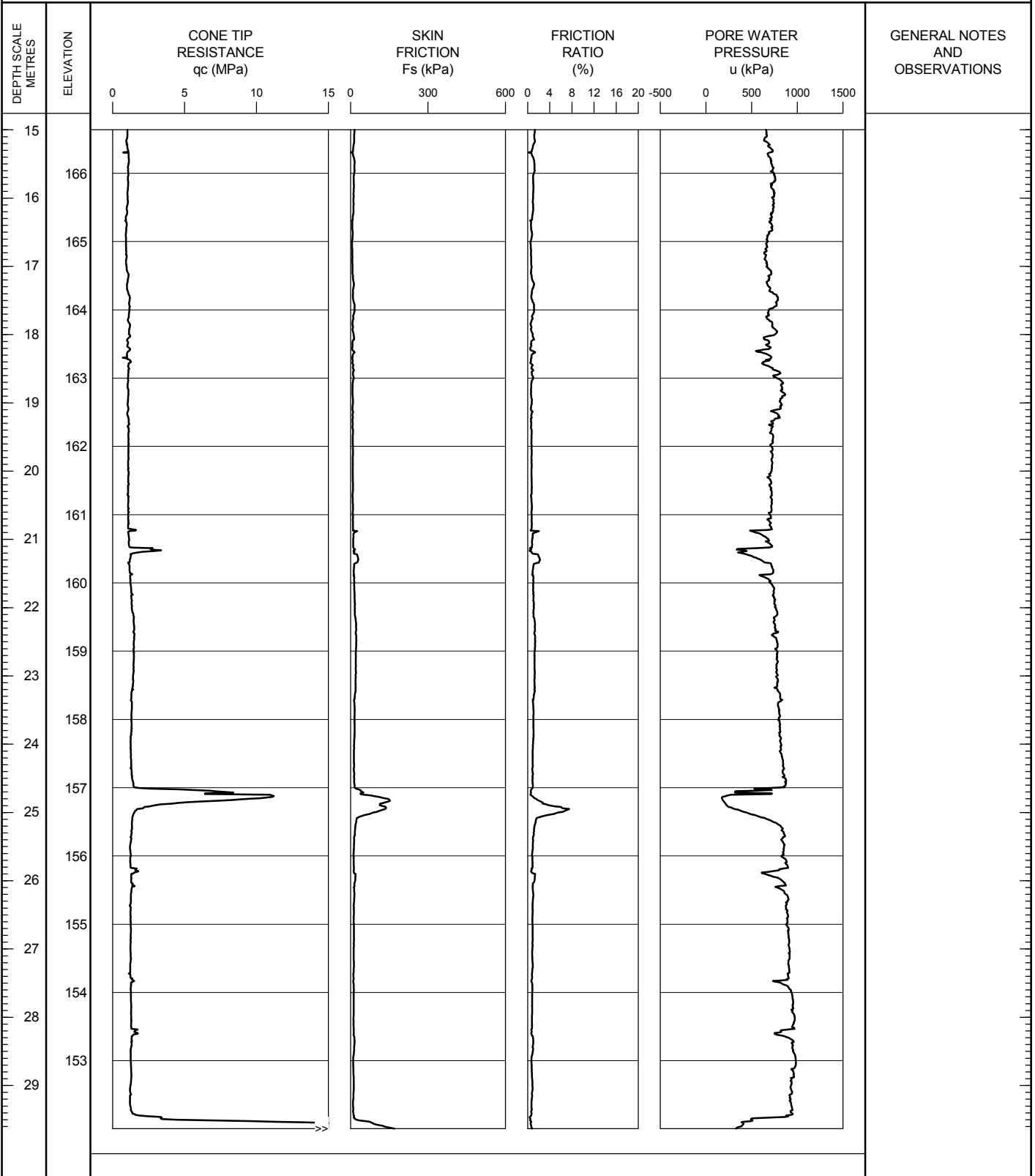
TEST DATE 8/10/2011 - 8/10/2011

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

1 OF 1

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 CONE PENETRATION TEST CPT 24-RW

METRIC

PROJECT Windsor-Essex Parkway

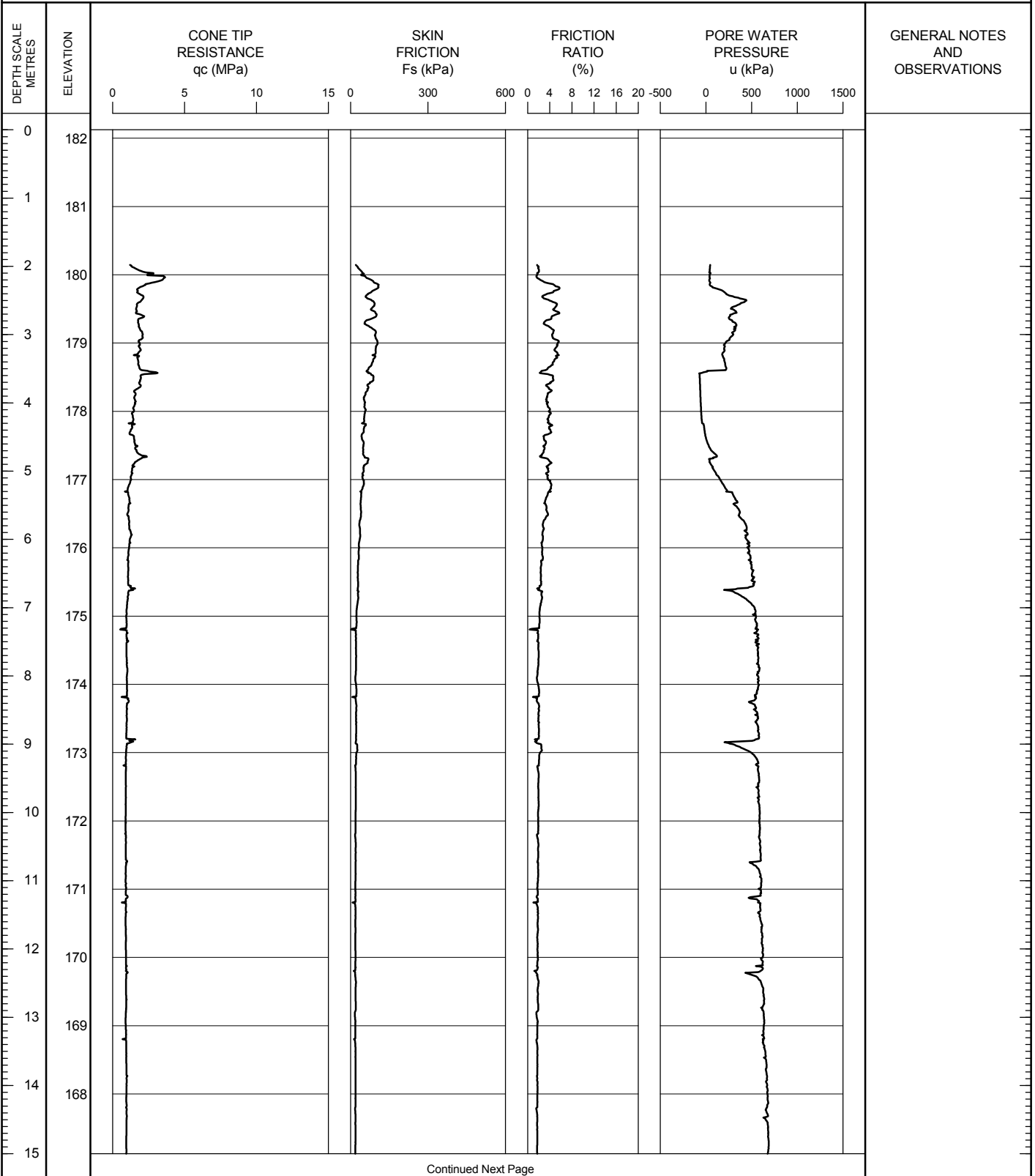
TEST DATE 8/11/2011 - 8/11/2011

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

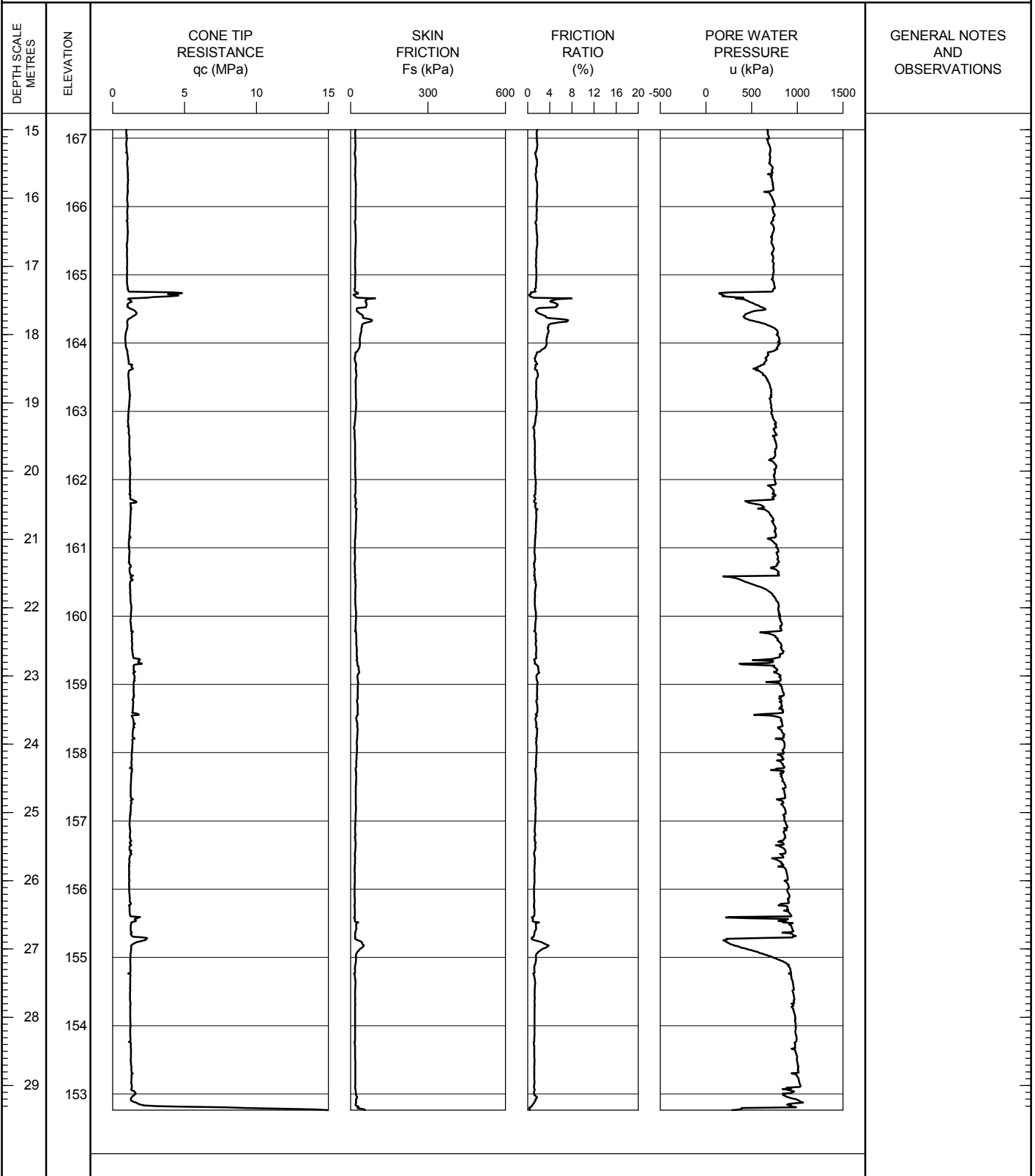
TEST DATE 8/11/2011 - 8/11/2011

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 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 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				
								20	40	60	80	100				
								20	40	60	80	100				

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

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

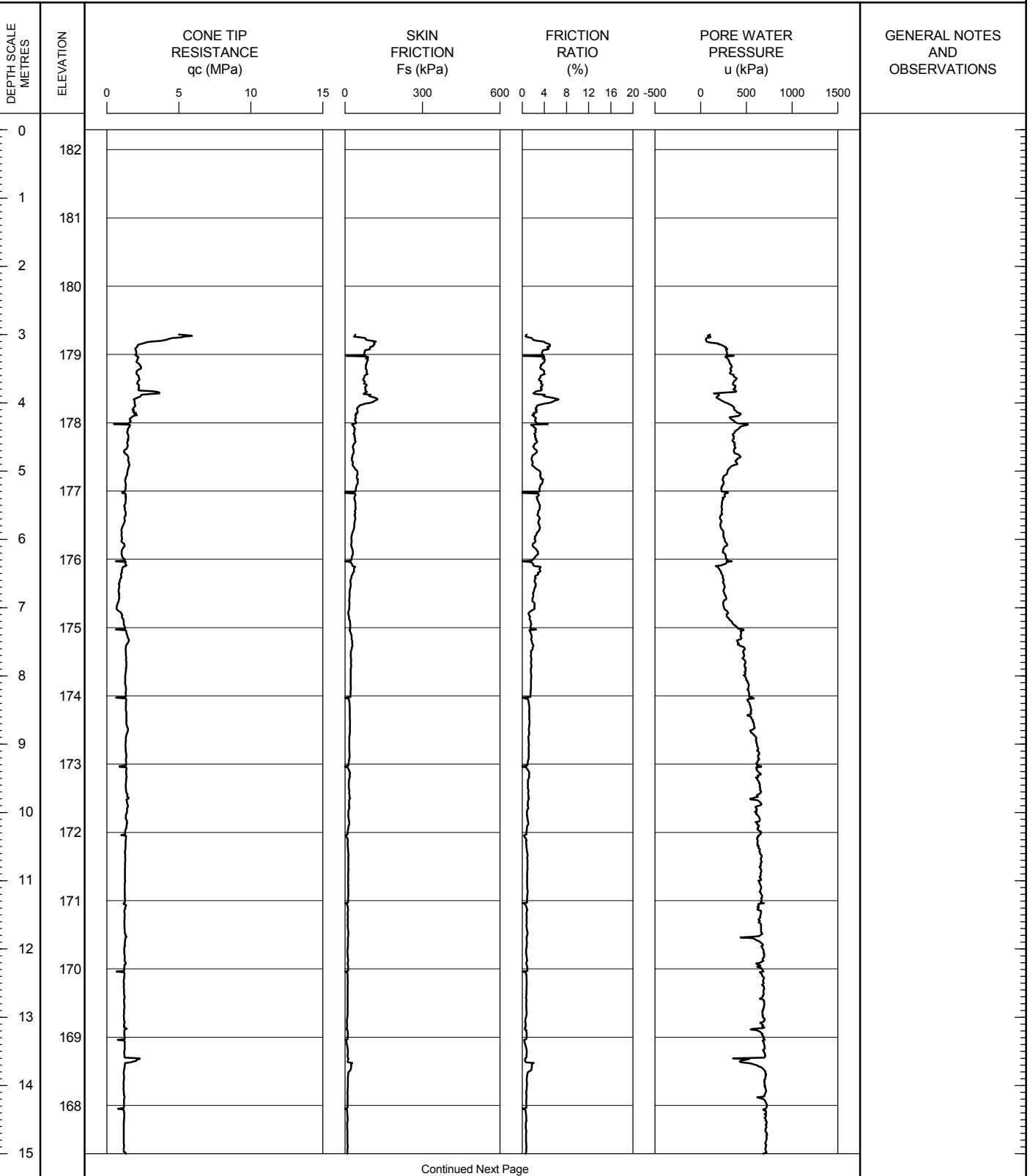
DATUM Geodetic

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

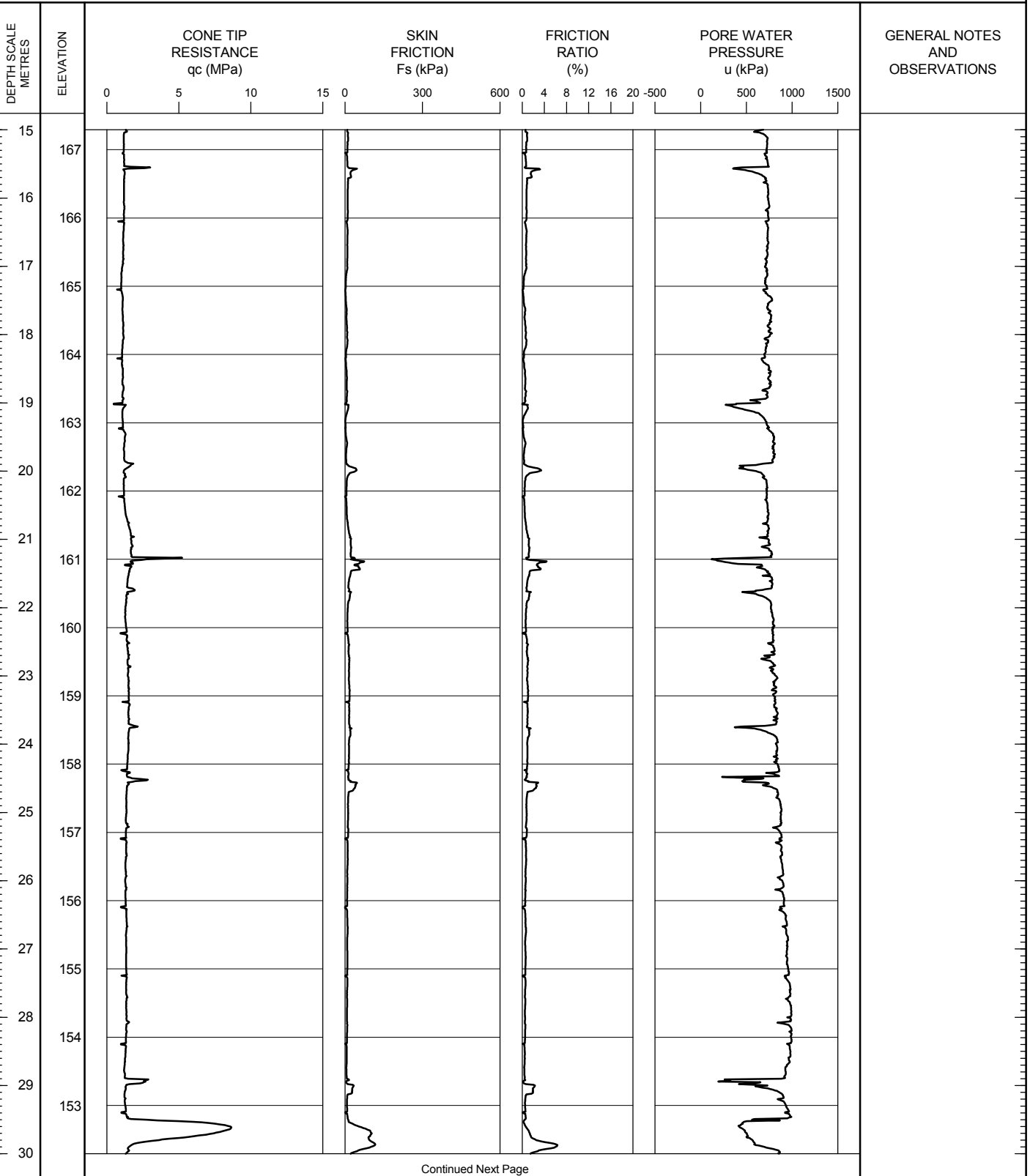
DATUM Geodetic

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

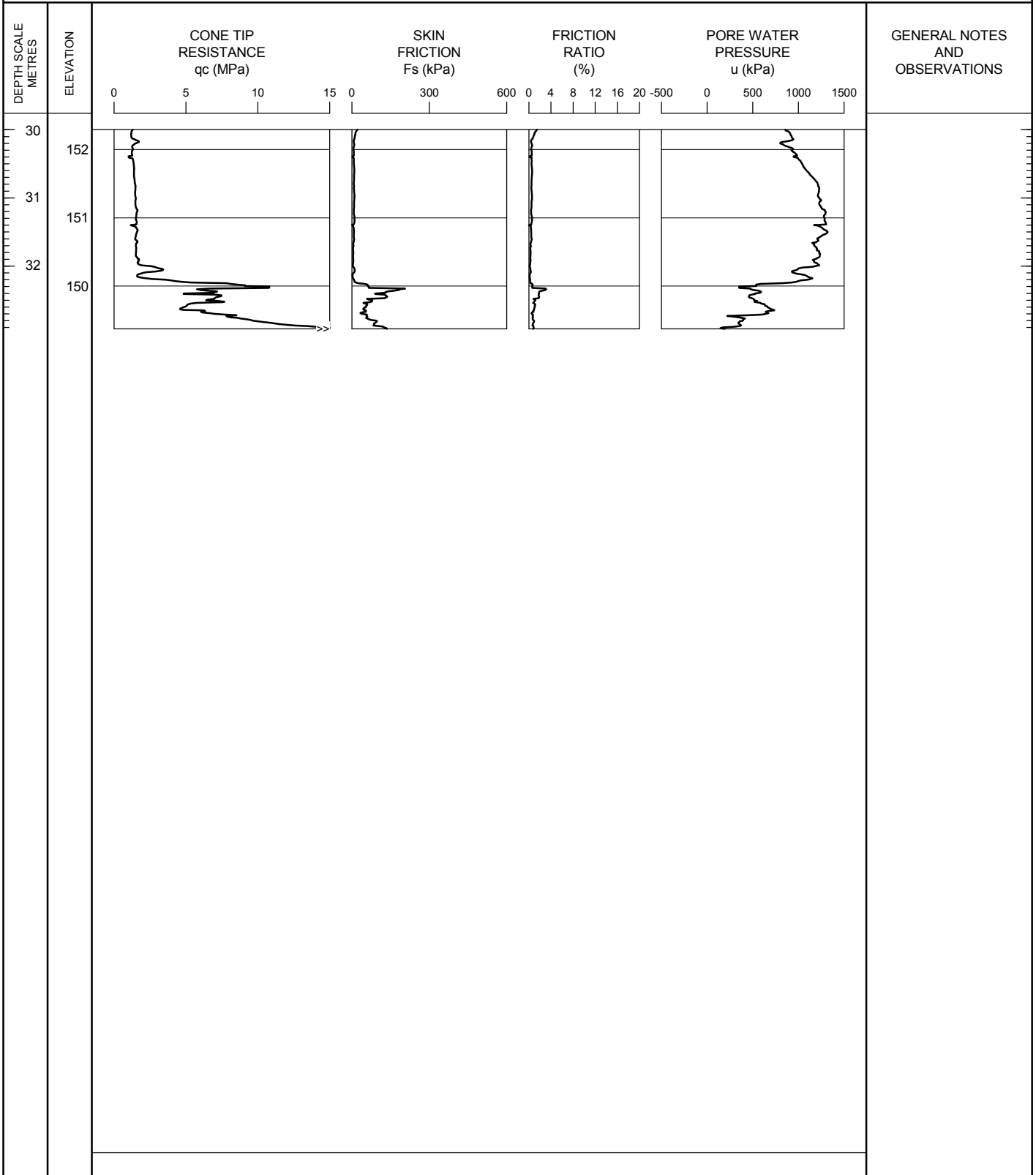
TEST DATE 8/11/2011 - 8/11/2011

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



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

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 35-RW

METRIC

PROJECT Windsor-Essex Parkway

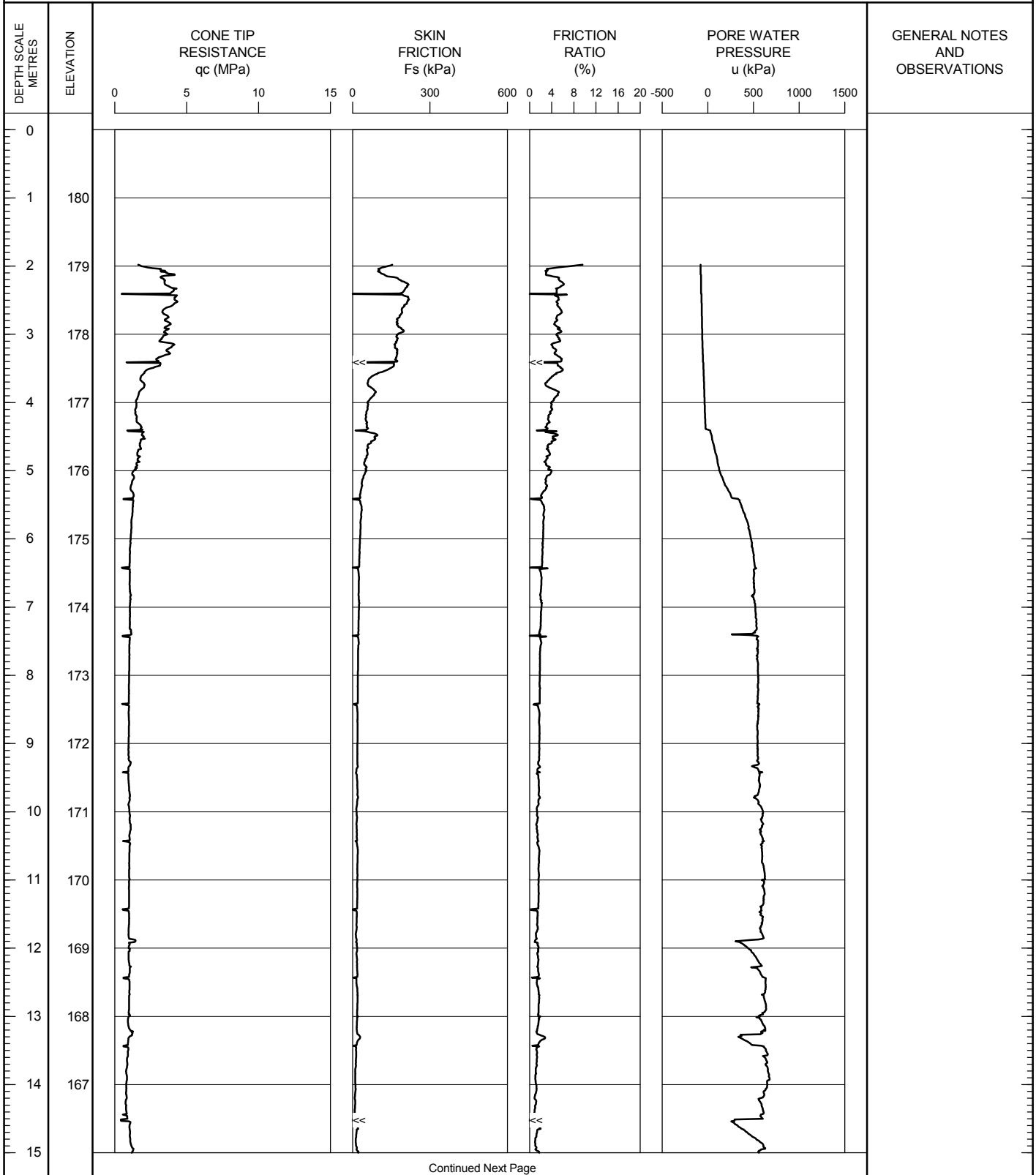
TEST DATE 8/24/2011 - 8/24/2011

SHEET 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



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

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 35-RW

METRIC

PROJECT Windsor-Essex Parkway

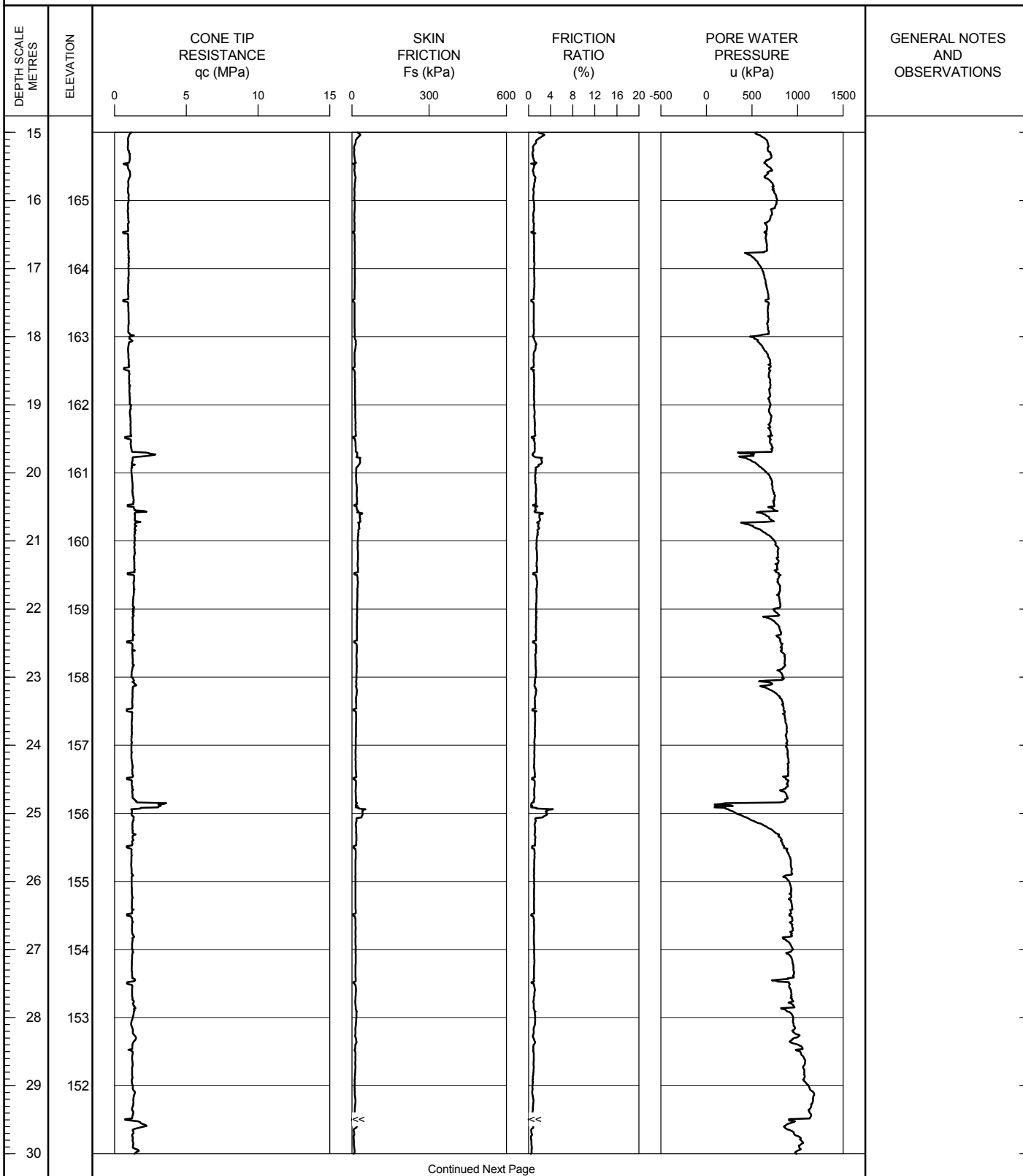
TEST DATE 8/24/2011 - 8/24/2011

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



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

OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 35-RW

METRIC

PROJECT Windsor-Essex Parkway

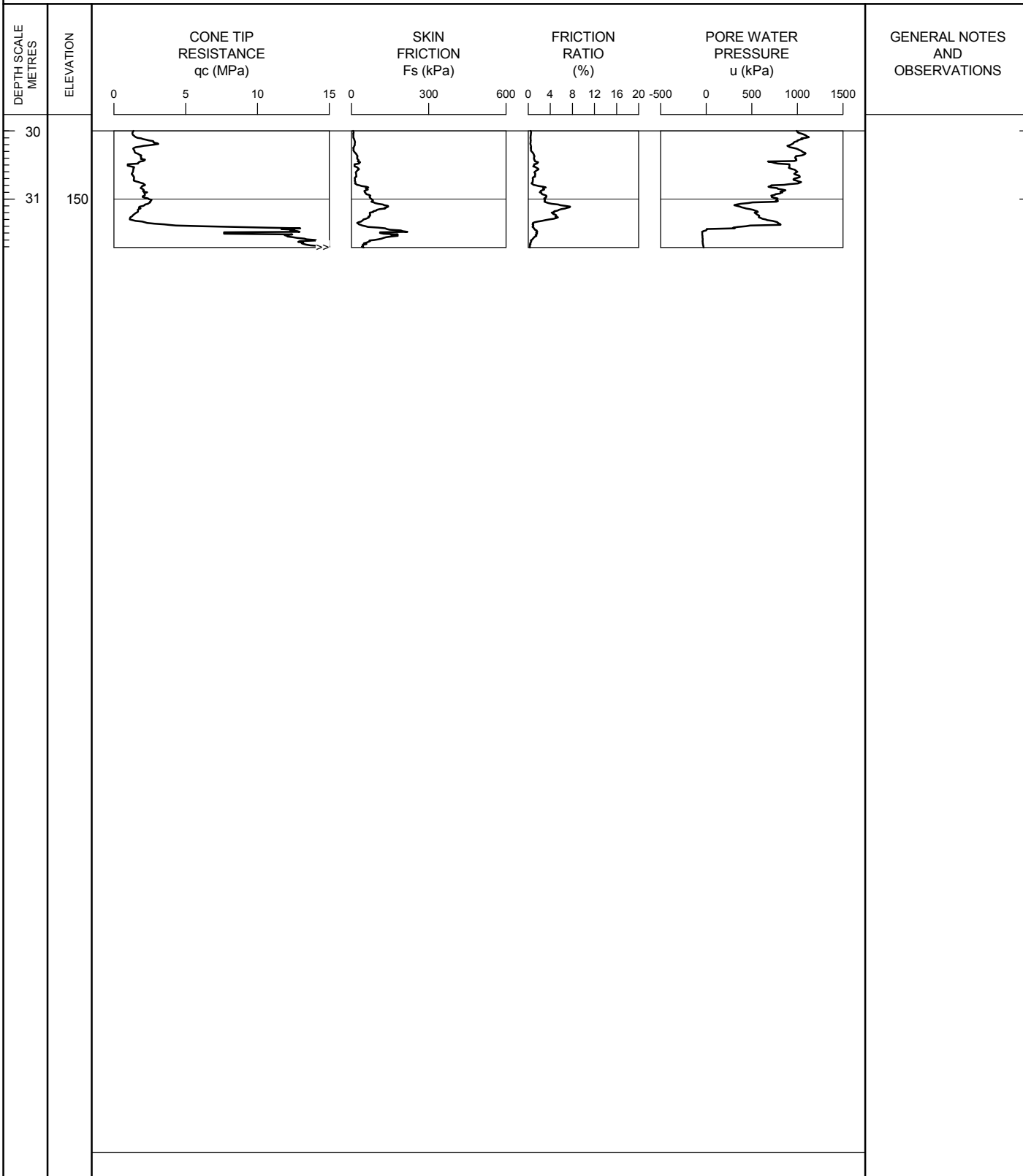
TEST DATE 8/24/2011 - 8/24/2011

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 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 (%) 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									
180.5	Ground Surface																			
0.0	TOPSOIL																			
180.1																				
0.4	SILTY SAND Brown																			
179.4			1A, B	SS	6															
1.1	SILTY CLAY Some sand, trace gravel, trace fissures Mottled brown and grey Brown																			
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													

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

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

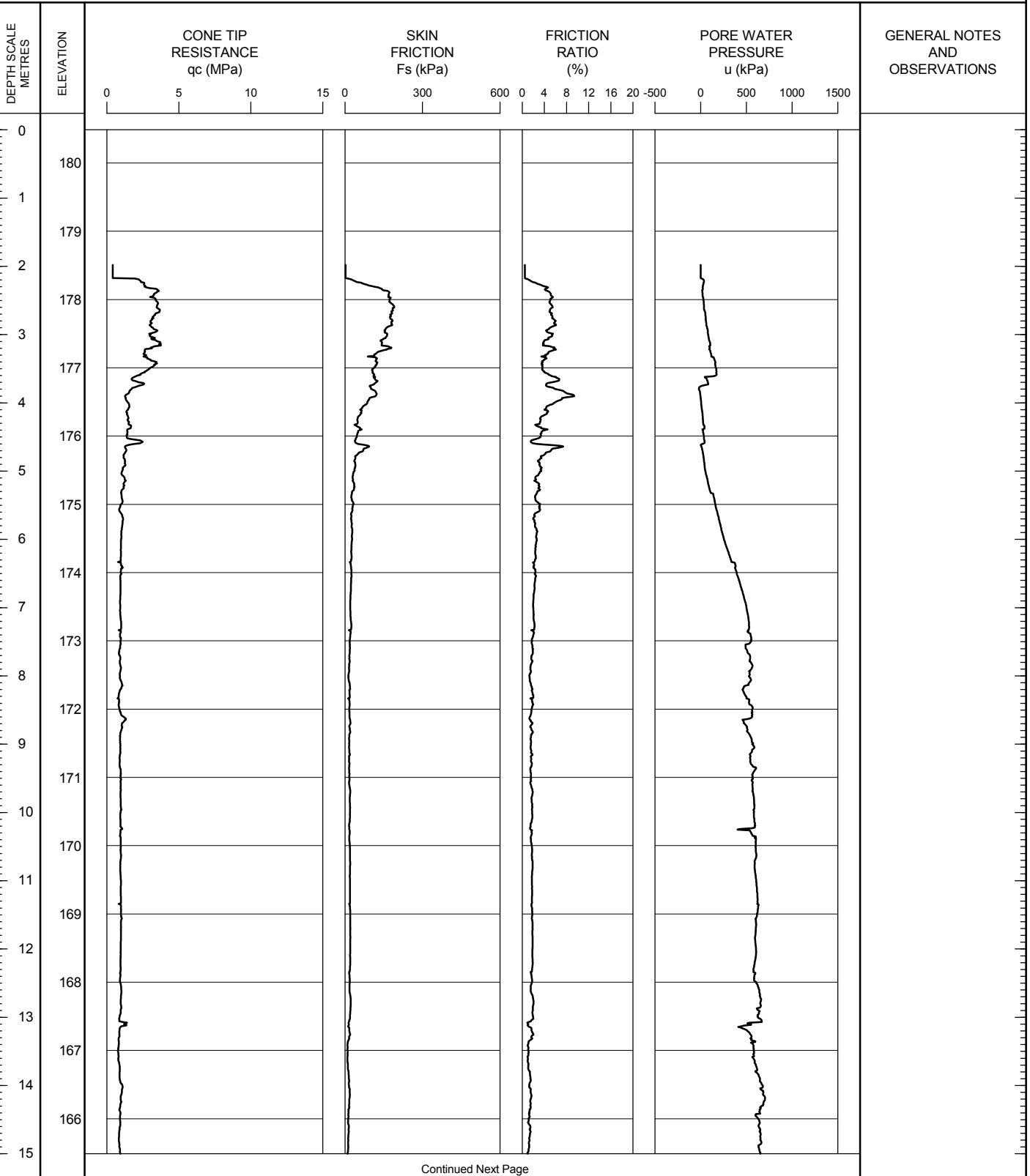
DATUM Geodetic

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

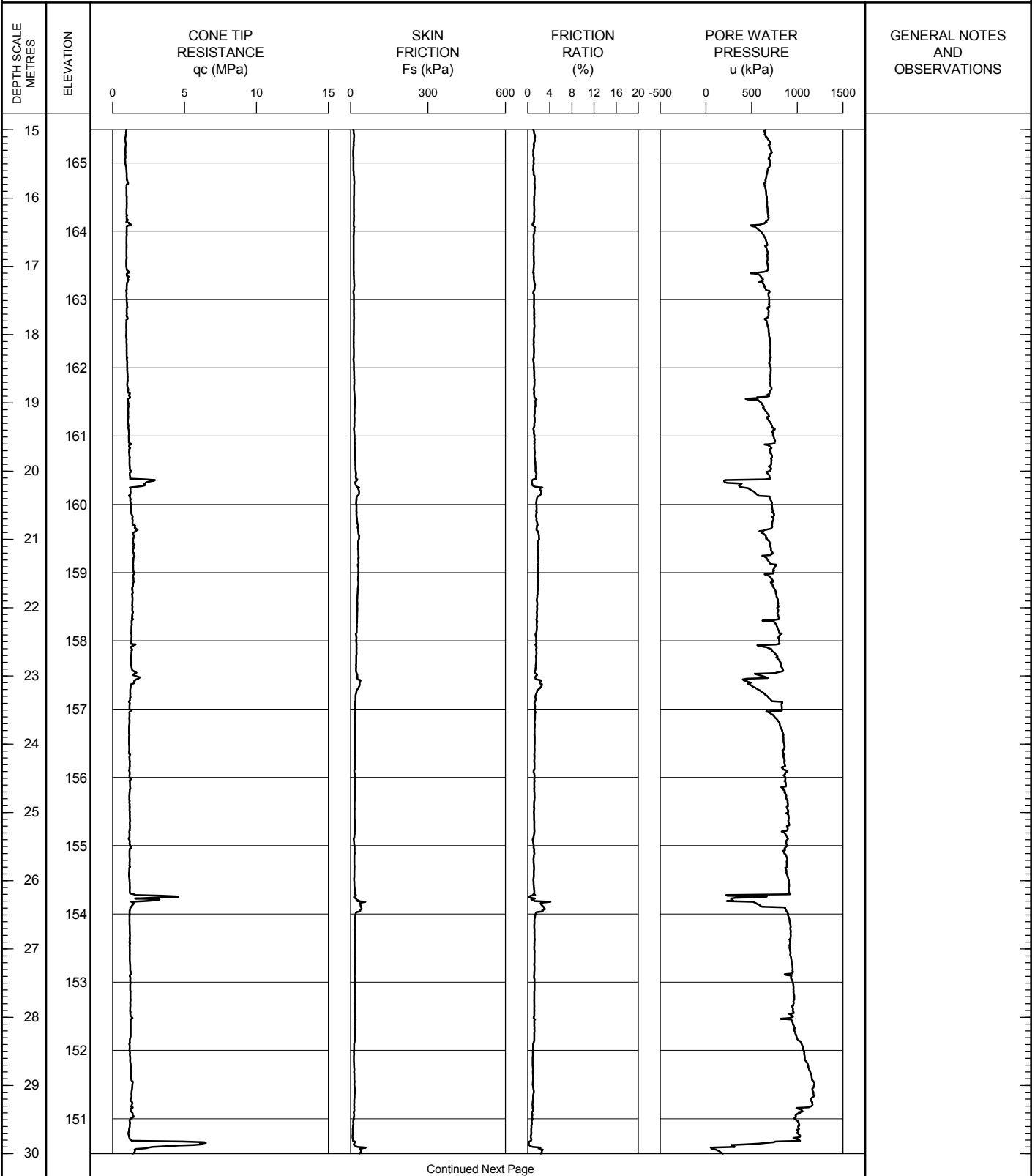
DATUM Geodetic

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

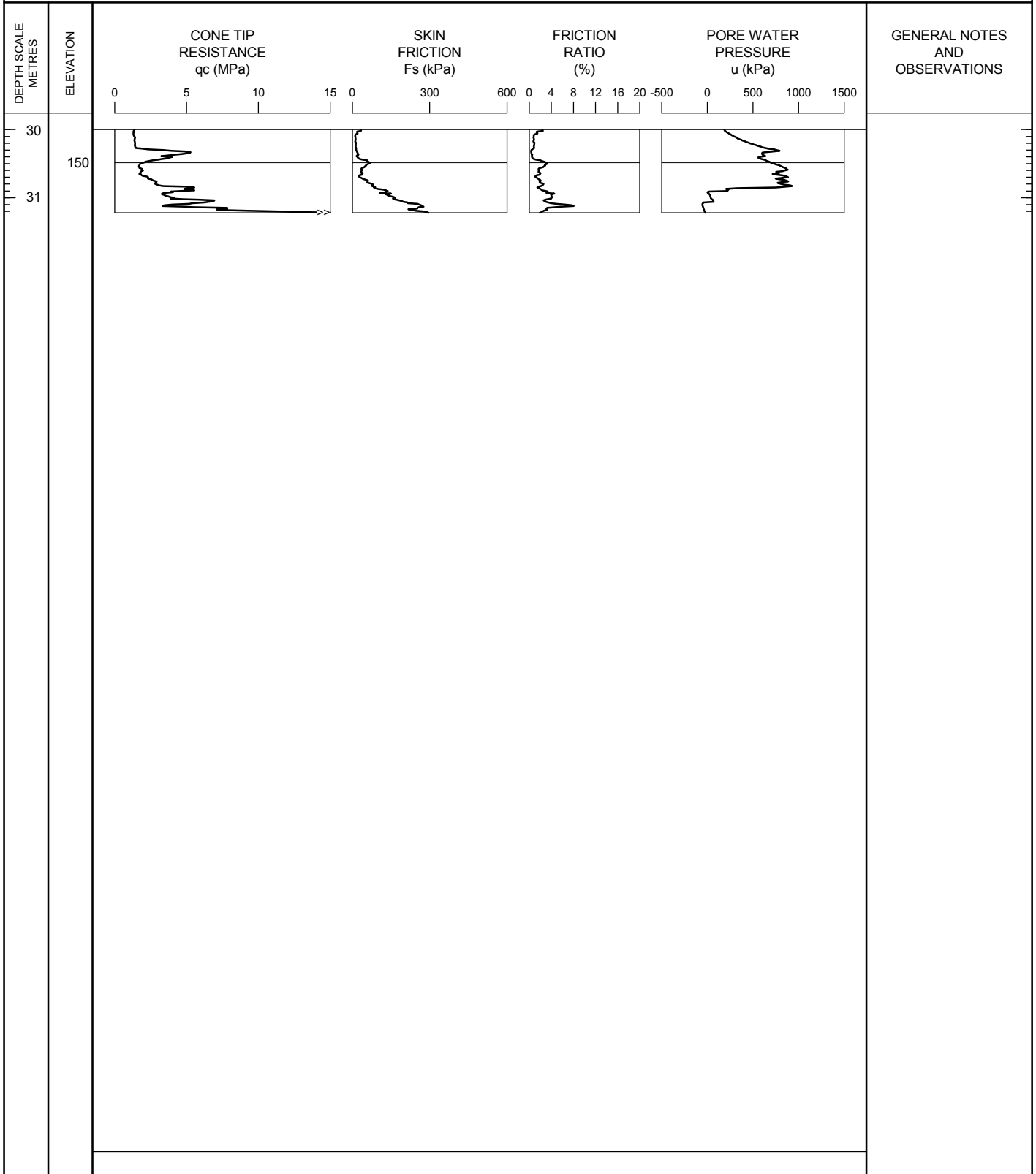
TEST DATE 8/15/2011 - 8/15/2011

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



OPERATOR: TA

CHECKED: DD

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								
180.9	Ground Surface							○ UNCONFINED	+	FIELD VANE						
0.0	FILL Crushed Limestone Grey							● POCKET PEN.	×	LAB VANE						
180.4	TOPSOIL SILTY CLAY Some sand, trace gravel Mottled brown and grey		1	SS	6											
0.5																
0.6																
	Brown		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 CONE PENETRATION TEST CPT 37-RW

METRIC

PROJECT Windsor-Essex Parkway

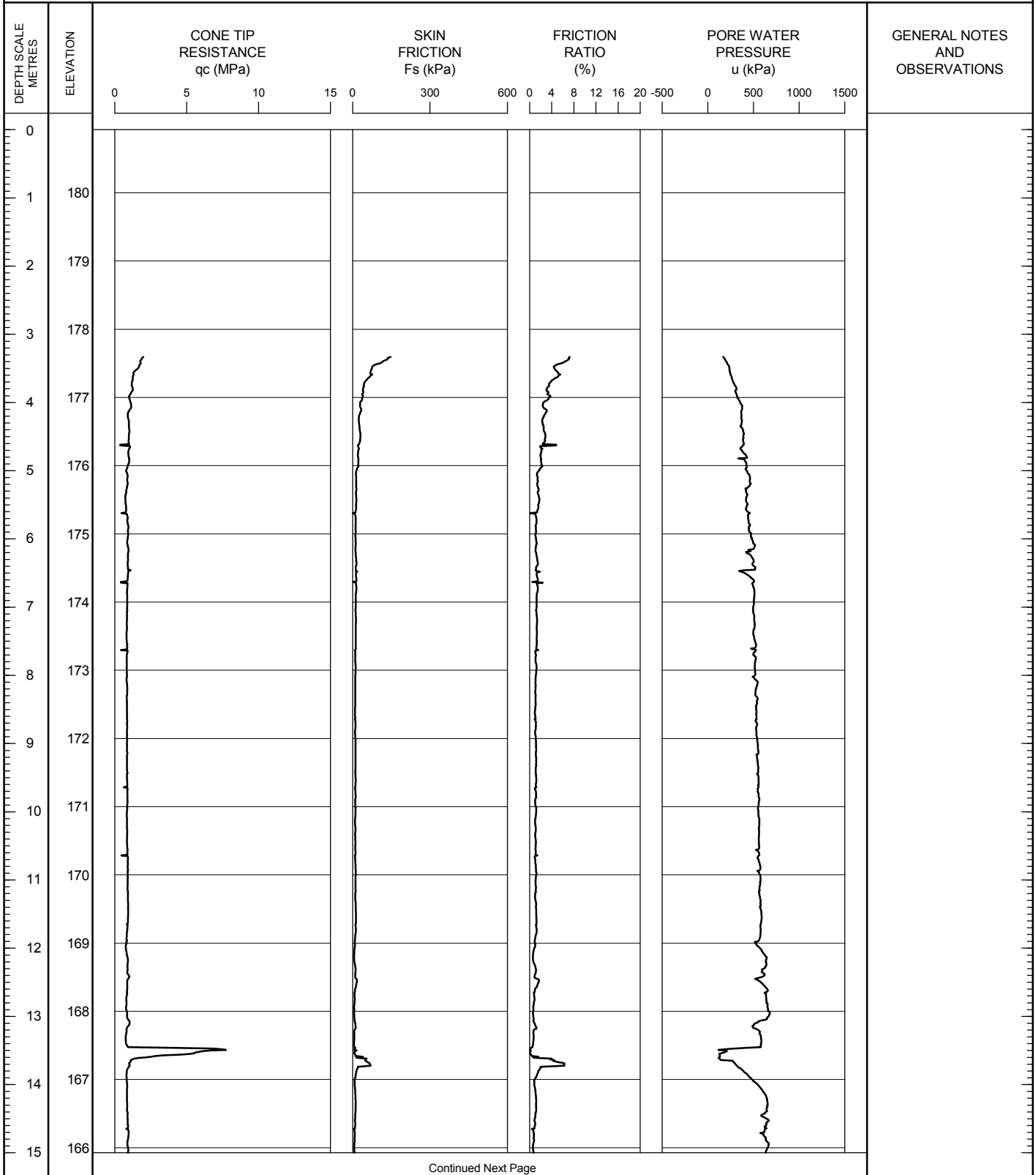
TEST DATE 7/27/2011 - 7/27/2011

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

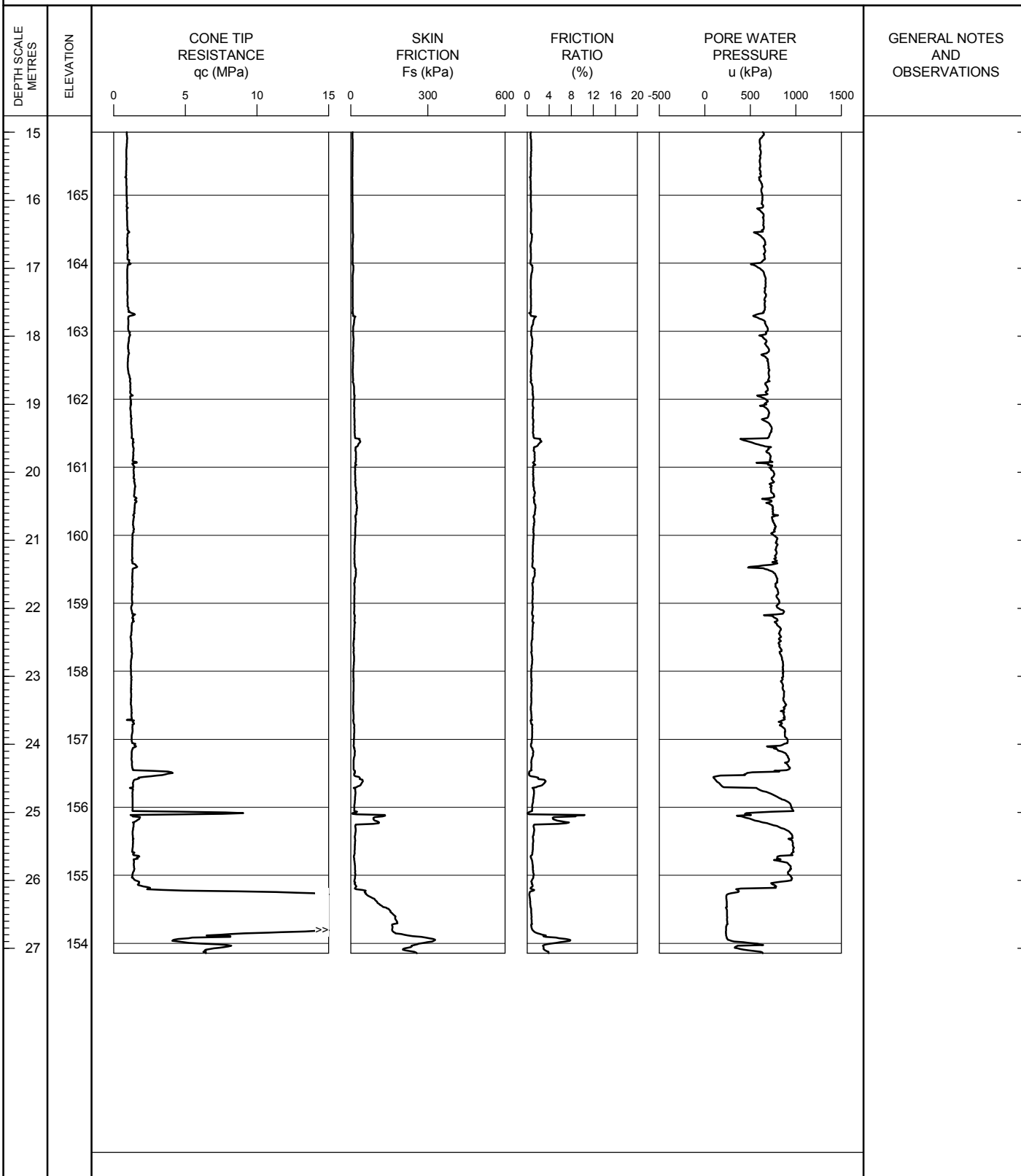
TEST DATE 7/27/2011 - 7/27/2011

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

amec

[illegible]

Page: 1 of 1

RECORD OF CONE PENETRATION TEST CPT 43-RW

METRIC

PROJECT Windsor-Essex Parkway

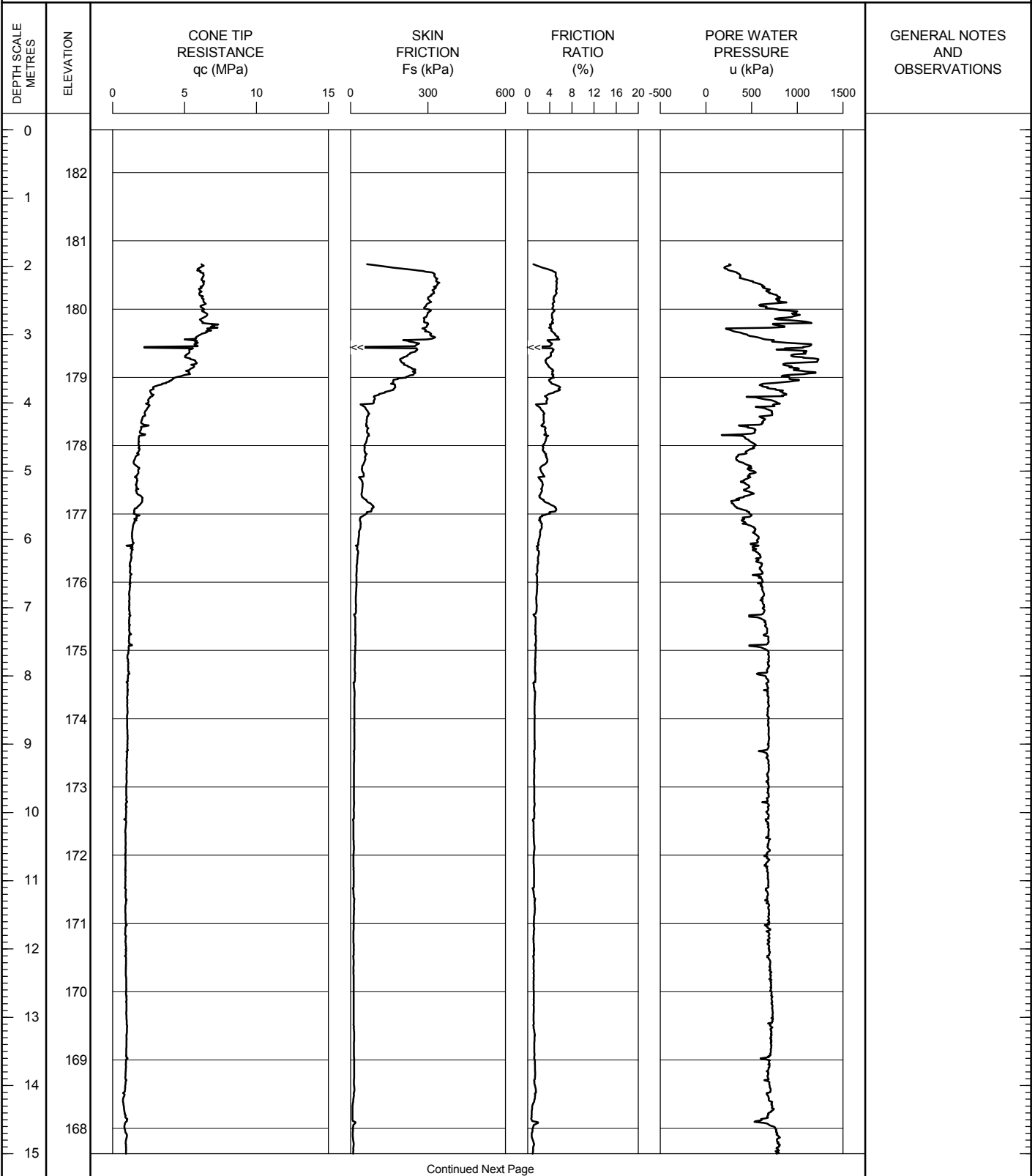
TEST DATE 8/3/2011 - 8/3/2011

SHEET 1 OF 2

LOCATION N4678907.6; E333207.7

DATUM Geodetic

GROUND SURFACE ELEVATION: 182.6 PREDRILL DEPTH: 1.97 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 43-RW

METRIC

PROJECT Windsor-Essex Parkway

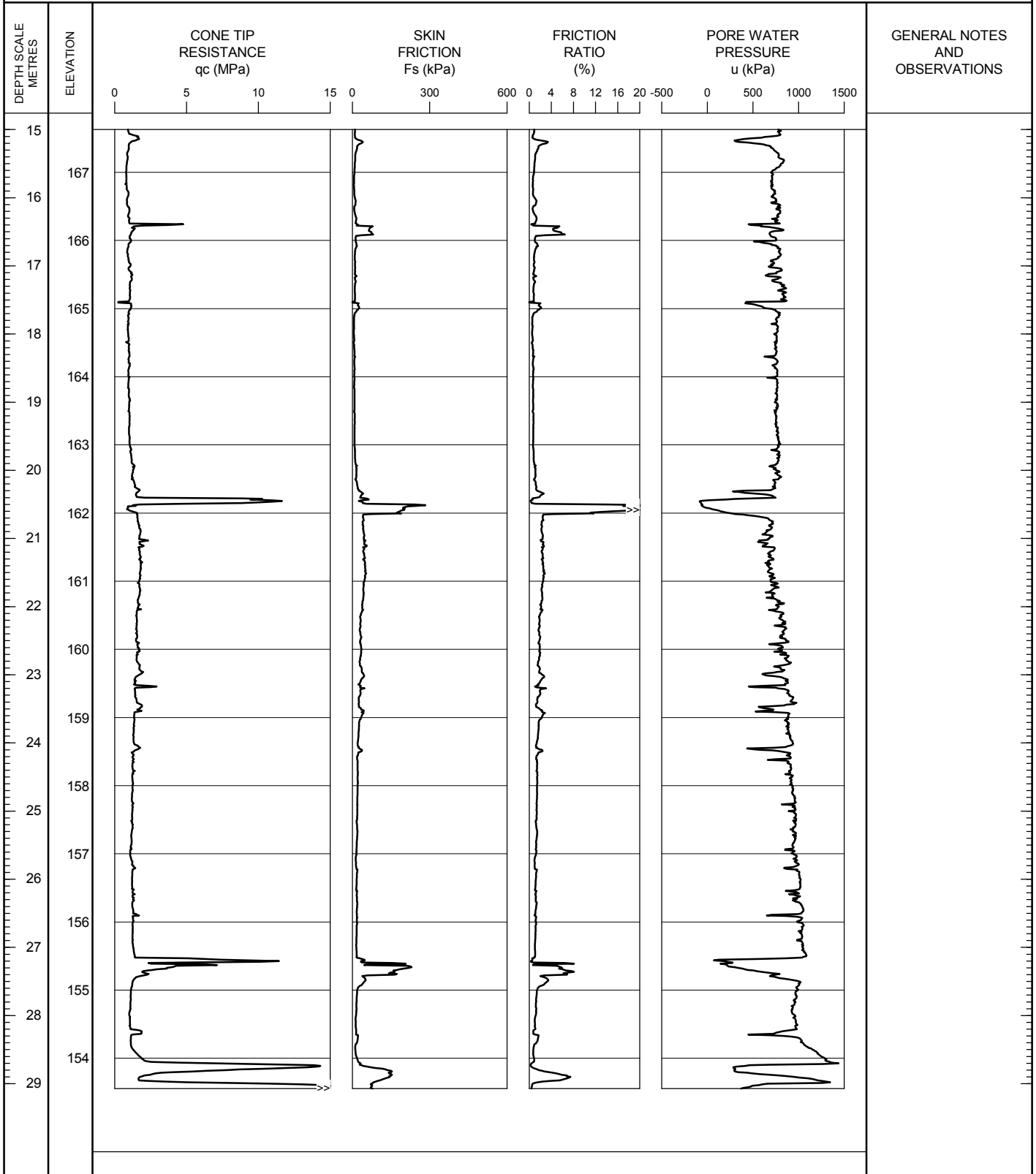
TEST DATE 8/3/2011 - 8/3/2011

SHEET 2 OF 2

LOCATION N4678907.6; E333207.7

DATUM Geodetic

GROUND SURFACE ELEVATION: 182.6 PREDRILL DEPTH: 1.97 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 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 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									
183.4	Ground Surface																
0.0	TOPSOIL																
183.1	CLAYEY SILT		1	SS	3		183										
0.3	Some sand, trace gravel, trace fissures		2	SS	7		182										
	Firm to hard						181										
	Mottled brown and grey																
	Brown		3	SS	38												
180.4	END OF SAMPLED BOREHOLE						180										
3.0	Continued with CPT from 3.5 m to refusal at 32.8 m (El. 179.9 m to El. 150.6 m)						179										
	Borehole dry on completion						178										
							177										
							176										
							175										
							174										
							173										
							172										
							171										
							170										
							169										

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

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

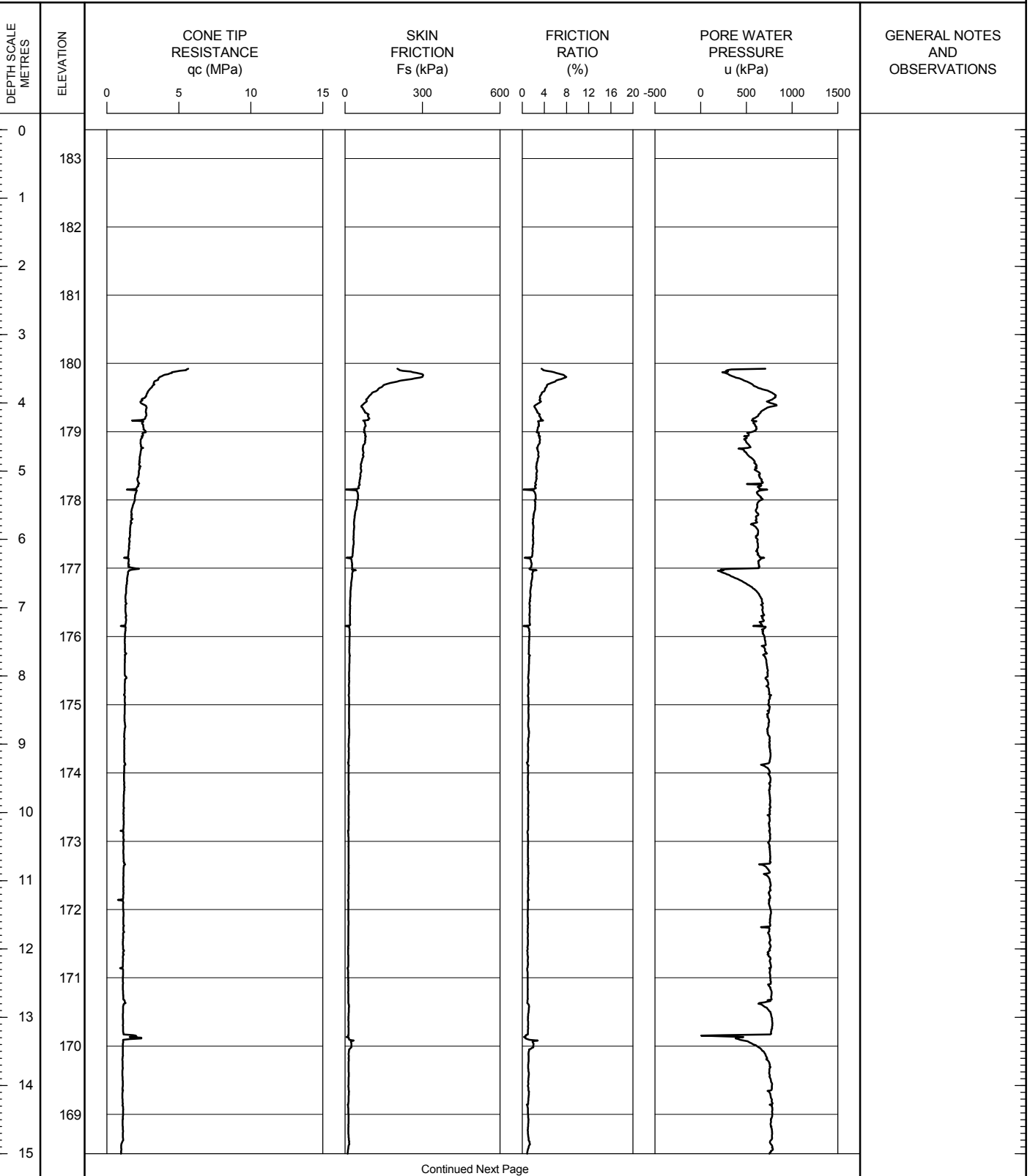
DATUM Geodetic

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

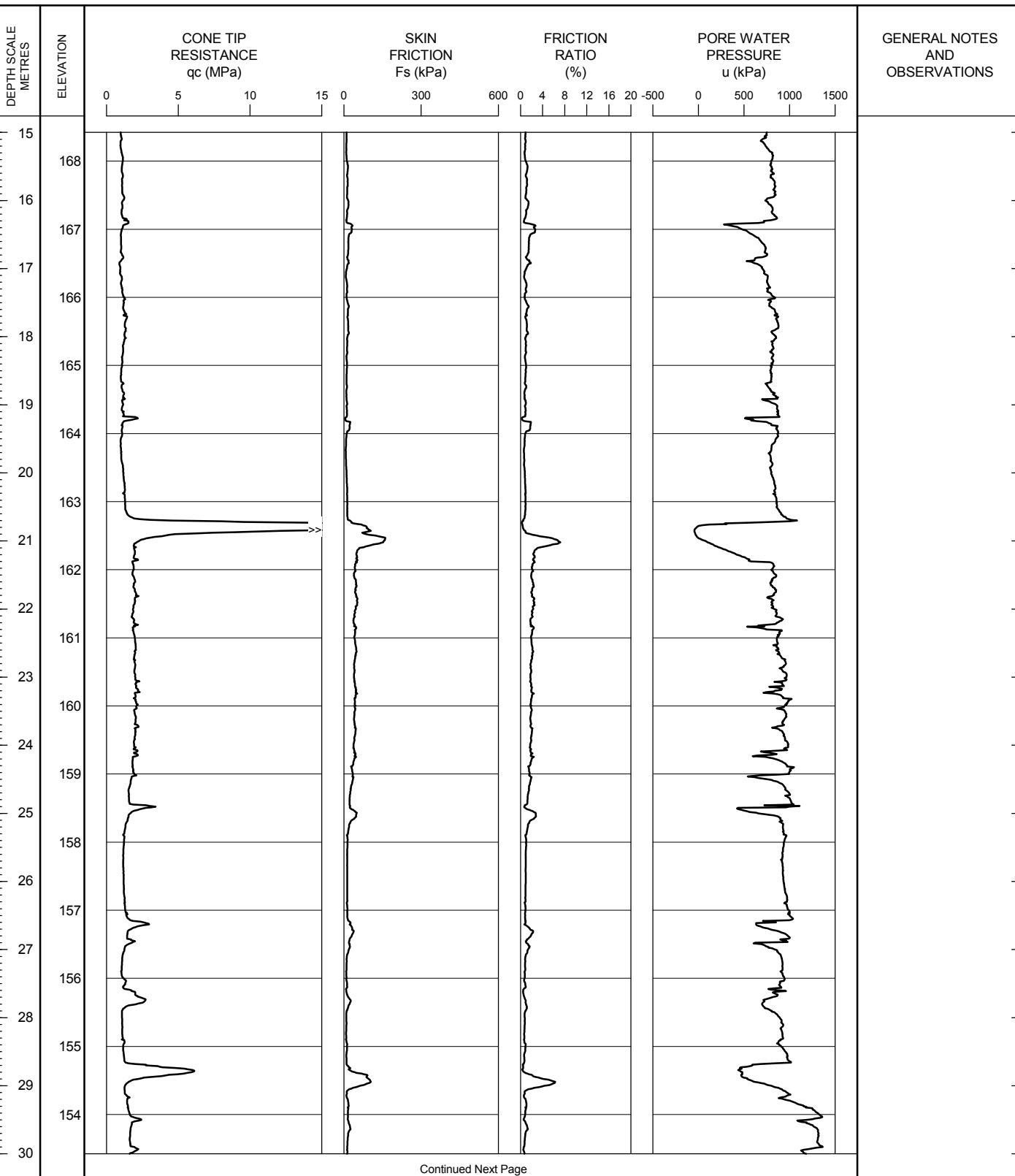
DATUM Geodetic

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

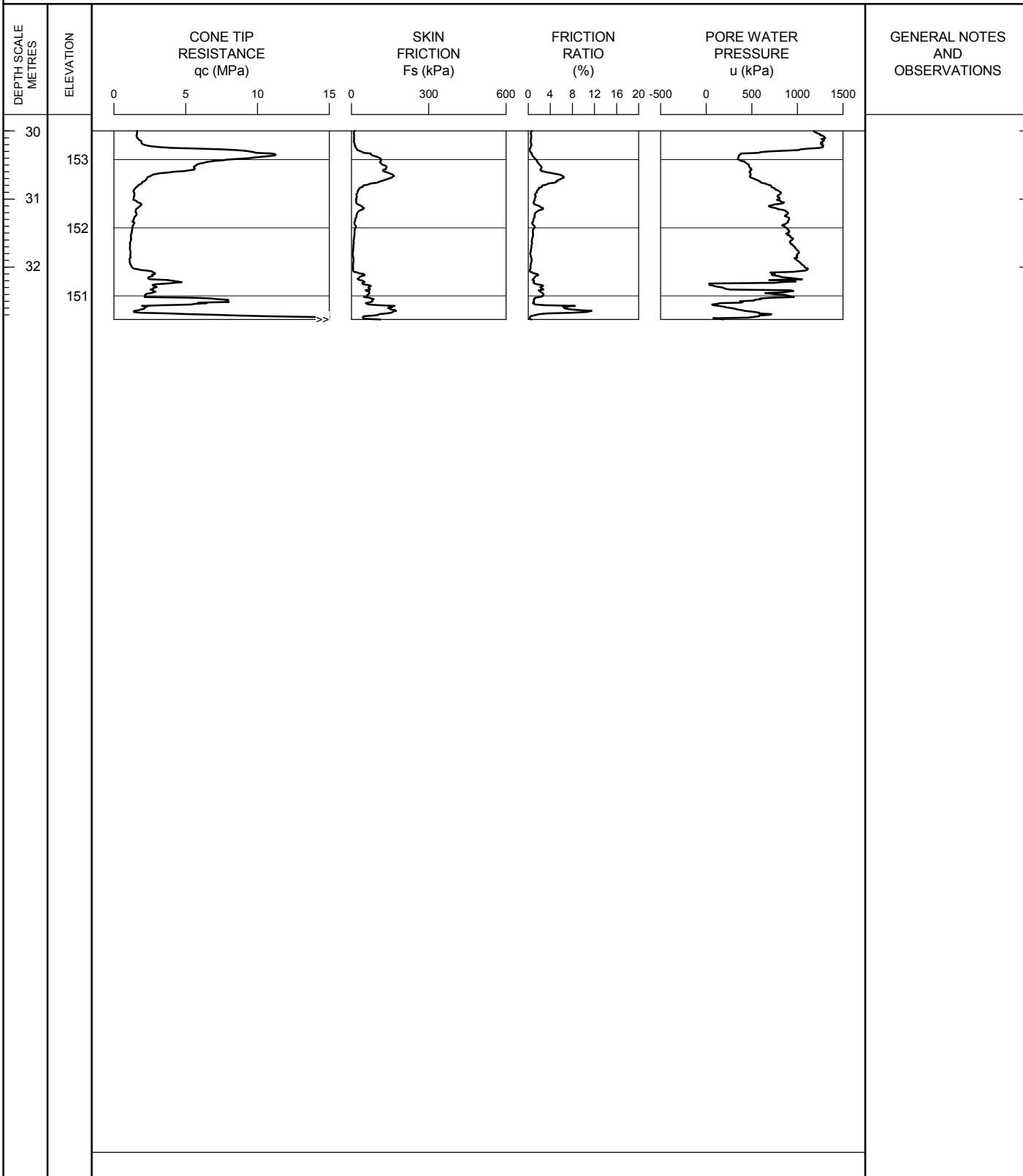
TEST DATE 8/9/2011 - 8/9/2011

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 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									
								○ UNCONFINED	+ FIELD VANE	● POCKET PEN.	× LAB VANE						
184.3	Ground Surface						20	40	60	80	100						
0.0	TOPSOIL		1	SS	10												
184.0	CLAYEY SILT Some sand, trace gravel Firm to hard Mottled brown and grey		2	SS	5												
0.3																	
	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 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

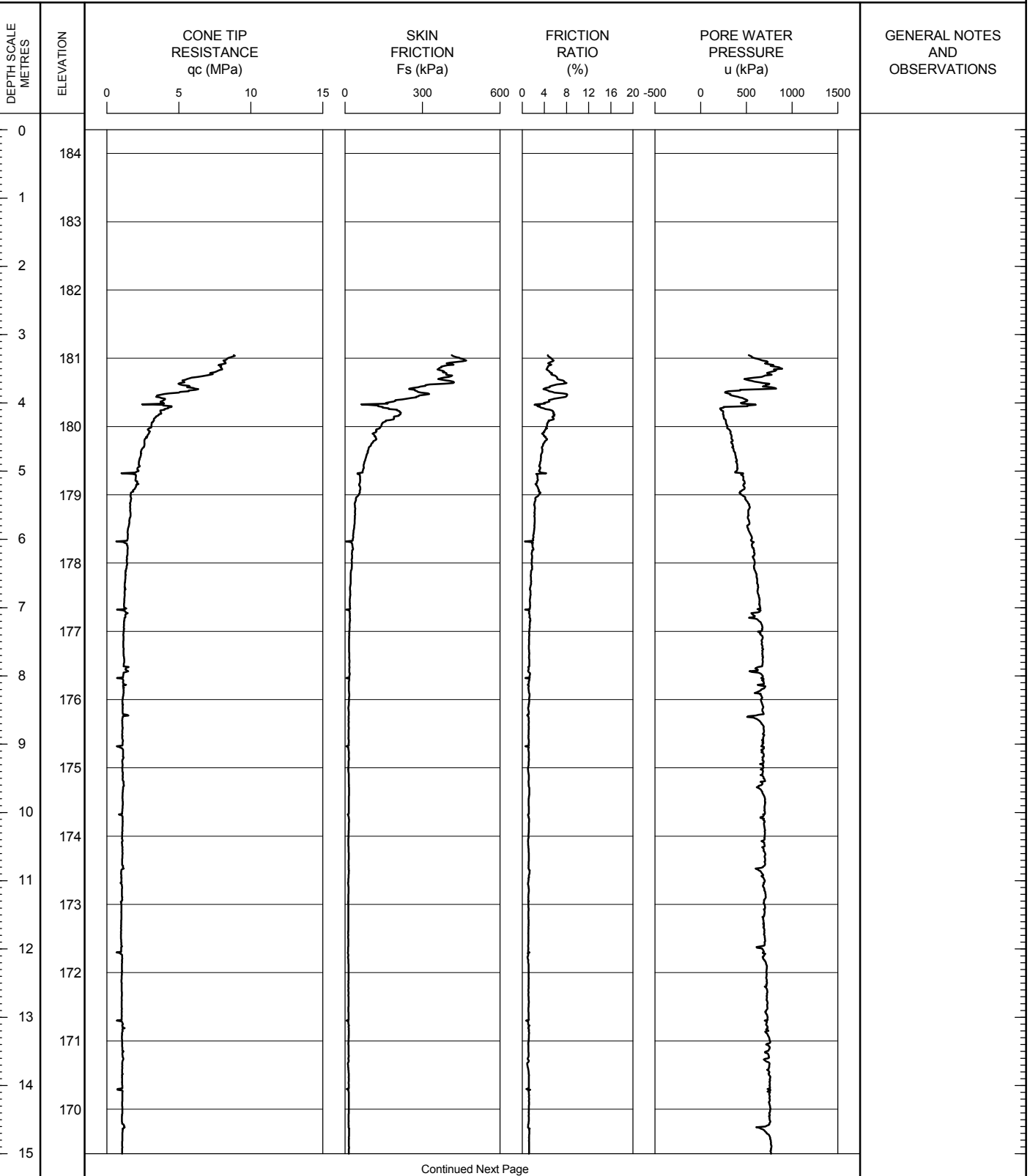
DATUM Geodetic

GROUND SURFACE ELEVATION: 184.3

PREDRILL DEPTH: 3

CORRECTION FACTOR A: 0.8

CORRECTION FACTOR B: 0



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

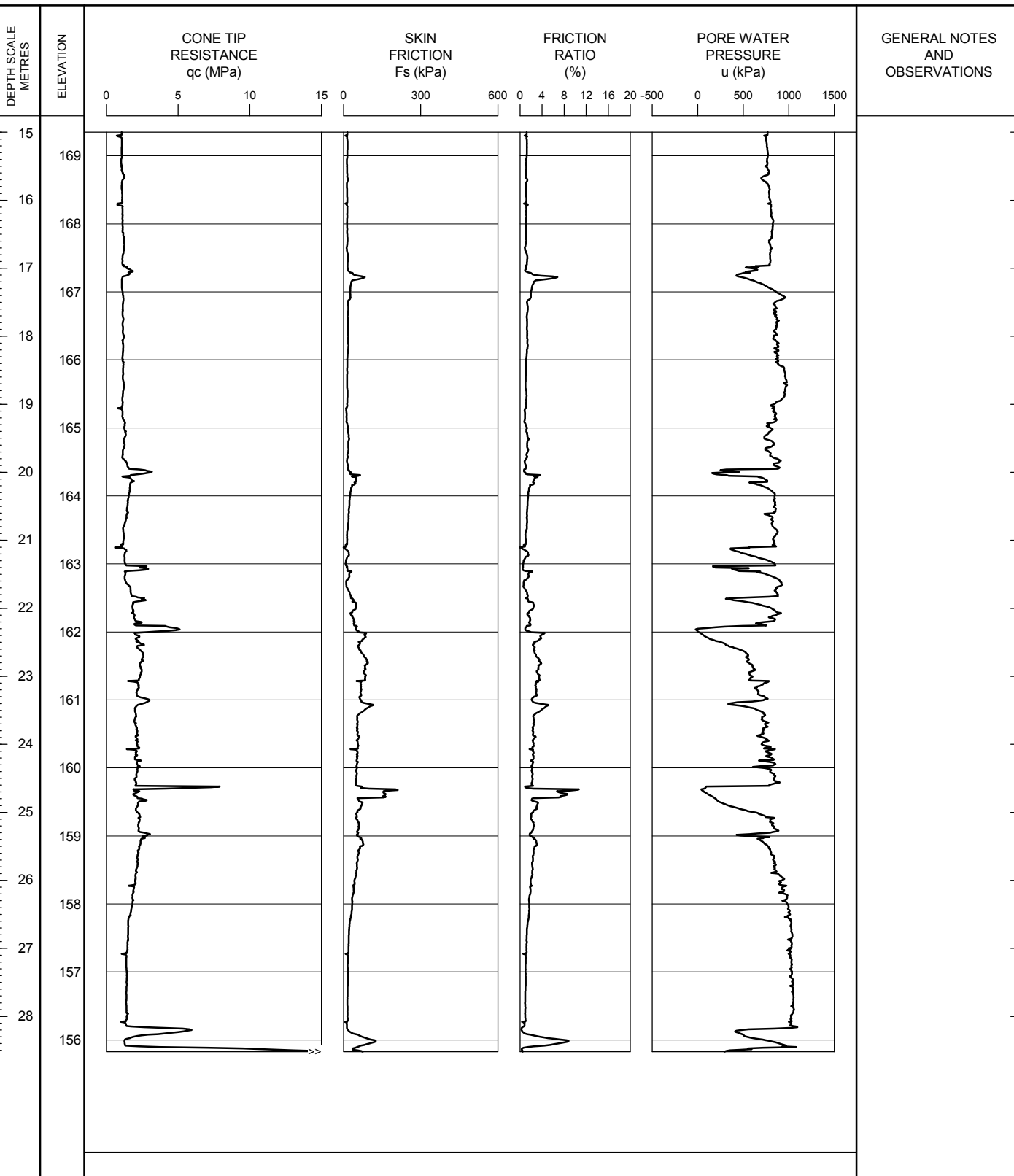
DATUM Geodetic

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 BOREHOLE No CPT47-RW

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678440.3, E334300.2 ORIGINATED BY TA
 DIST HWY WEP BOREHOLE TYPE CME 55 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE Aug 10, 11 - Aug 10, 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	10
185.4	Ground Surface																			
0.0	TOPSOIL						185													
184.9	CLAYEY SILT Some sand, trace gravel Firm to stiff Mottled brown and grey Dry Brown -Trace fissures		1	SS	6		184													
0.5																				
183.4			2	SS	15															
2.0	END OF SAMPLED BOREHOLE (continued with CPT to refusal) Borehole dry on completion						183													
							182													
							181													
							180													
							179													
							178													
							177													
							176													
							175													
							174													
							173													
							172													
							171													

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

RECORD OF CONE PENETRATION TEST CPT 47-RW

METRIC

PROJECT Windsor-Essex Parkway

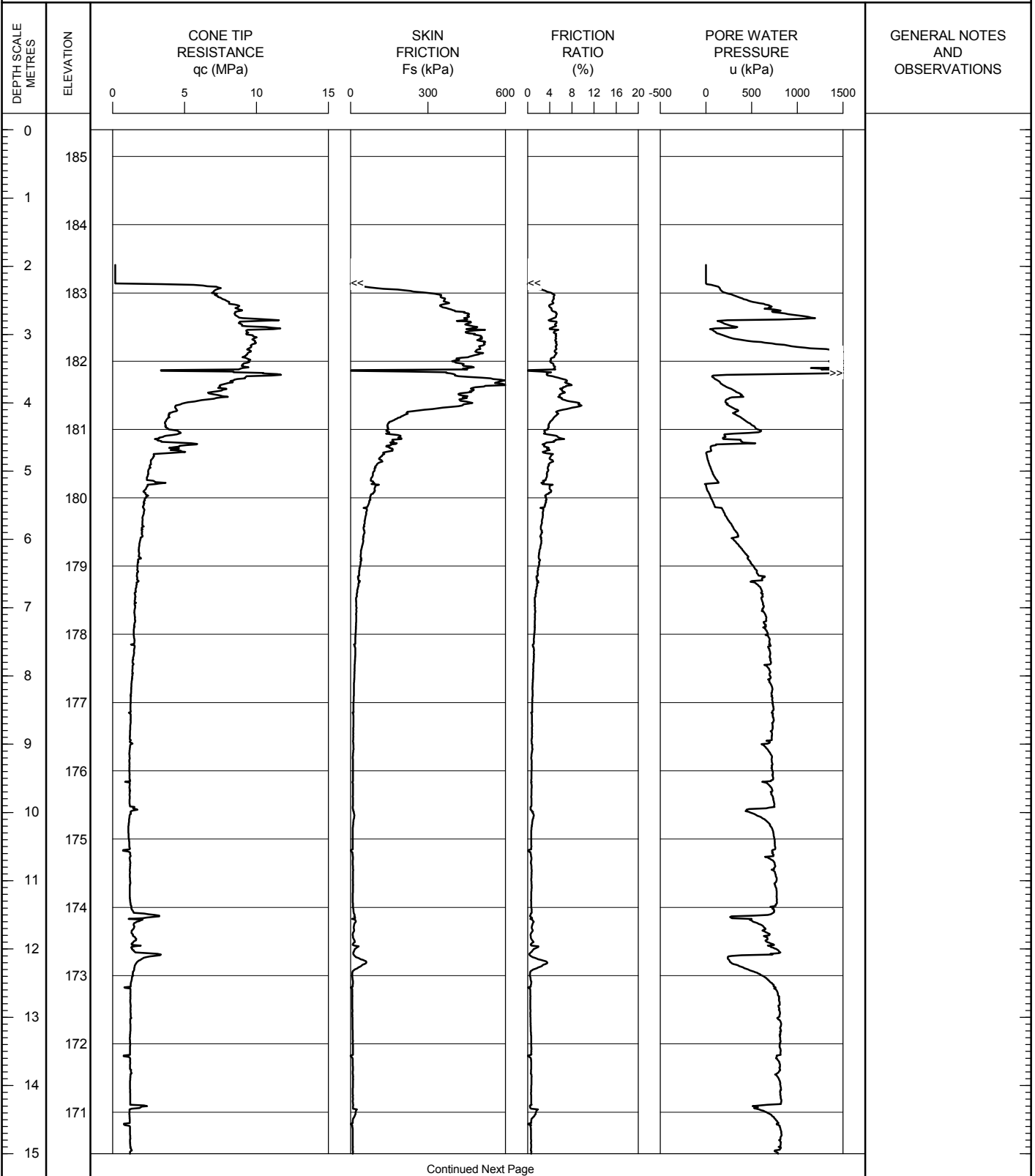
TEST DATE 8/10/2011 - 8/10/2011

SHEET 1 OF 2

LOCATION N4678440.3; E334300.2

DATUM Geodetic

GROUND SURFACE ELEVATION: 185.4 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



OPERATOR: TA

CHECKED: DD

RECORD OF CONE PENETRATION TEST CPT 47-RW

METRIC

PROJECT Windsor-Essex Parkway

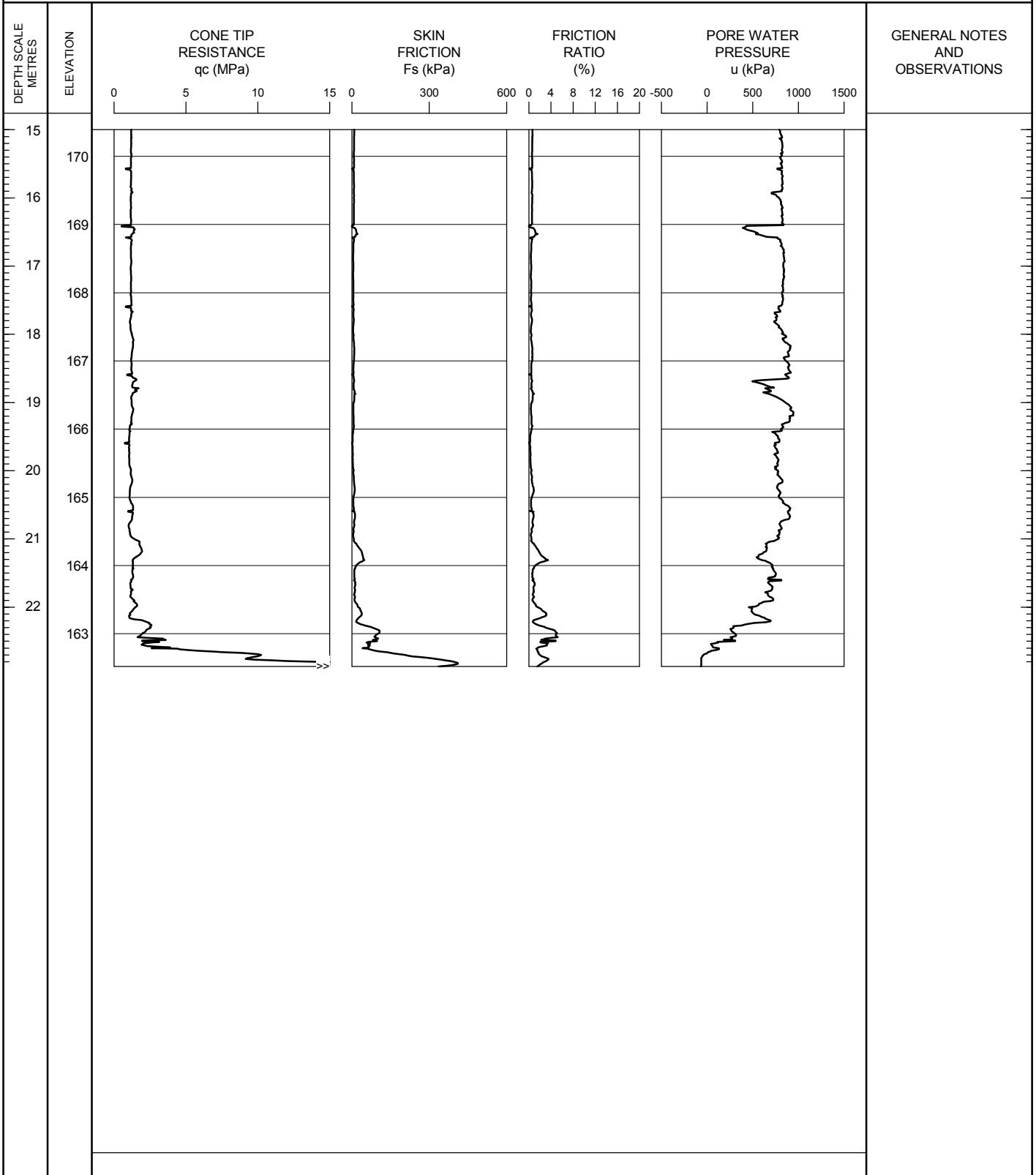
TEST DATE 8/10/2011 - 8/10/2011

SHEET 2 OF 2

LOCATION N4678440.3; E334300.2

DATUM Geodetic

GROUND SURFACE ELEVATION: 185.4 PREDRILL DEPTH: 1.98 CORRECTION FACTOR A: 0.8 CORRECTION FACTOR B: 0



WEP CPT LOG CPT 47-RW.GPJ ONTARIO MOT.GDT 02/12/11

OPERATOR: TA

CHECKED: DD

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															
0.9			2	SS	9		183													
	Trace fissures, trace silt seams Brown		3	SS	29		182													
			4	SS	40		181													
			5	SS	27		180													
	Grey		6	SS	10		179													
			7	SS	7		178													
			8	TW	PH		177													
			9	TW	PH		176													
	Numerous Sand Layers at Elevation 176.9 m																			
			10	TW	PH		175													
174.7	END OF BOREHOLE Borehole dry on completion						174													
9.8							173													
							172													
							171													
							170													

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

RECORD OF BOREHOLE No CV4-1

1 OF 1

METRIC

W.P. RFP No. 09-54-1007 LOCATION N4678867.9, E333368.7 ORIGINATED BY DG
 DIST HWY WEP BOREHOLE TYPE CME 850 - 200mm Dia. Continuous Flight Hollow Stem Augers COMPILED BY SS
 DATUM Geodetic DATE Aug 27, 11 - Aug 27, 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 (%)		
								20	40	60						80	100	20
183.3	Ground Surface																	
0.0	75mm ASPHALT Over FILL, sand and gravel						183											
182.4			1	SS	6		182											
0.9	FILL Silty Clay/Clayey Silt Some topsoil, trace fine gravel, trace sand, brown		2	SS	5													
181.2							181											
2.1	CLAYEY SILT Some sand, trace fine-coarse gravel Stiff to hard Mottled brown-grey		3	SS	9													
			4	SS	29		180											
			5	SS	30		179											
	Grey		6	SS	17		178											
			7	SS	11		177											
			8	TW	PH		176											
			VT				175											
			9	TW	PH		174											
			10	TW	PH		173											
			VT				172											
172.9							171											
10.4	END OF BOREHOLE (no refusal)						170											
	Groundwater observed at 3.0 m (El. 180.3 m) during drilling on Aug. 27, 2011						169											

ONTARIO MOT SW8801.1004.101.GPJ ONTARIO MOT.GDT 30/04/12

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									
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		181										
180.1 1.7	FILL Silty Clay Grey		2A, B	SS	10		180										
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		179										
178.3 3.5	END OF BOREHOLE (continued with DMT to refusal) Borehole dry on completion						178										
							177										
							176										
							175										
							174										
							173										
							172										
							171										
							170										
							169										
							168										
							167										

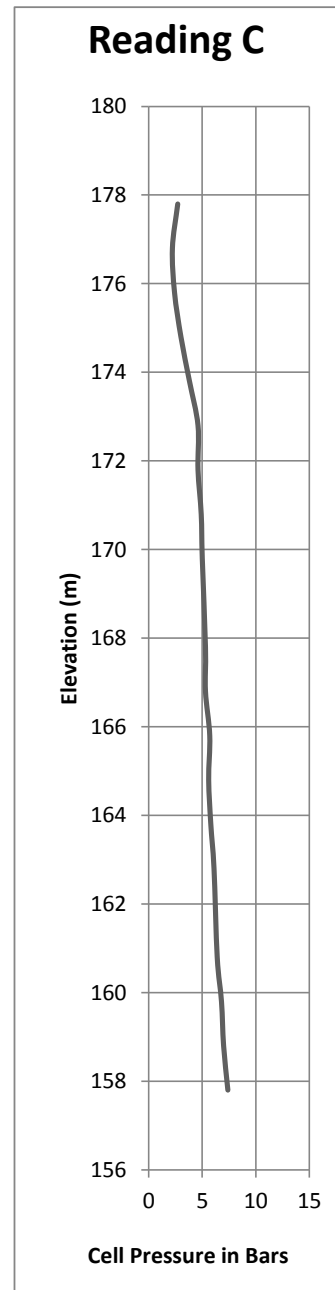
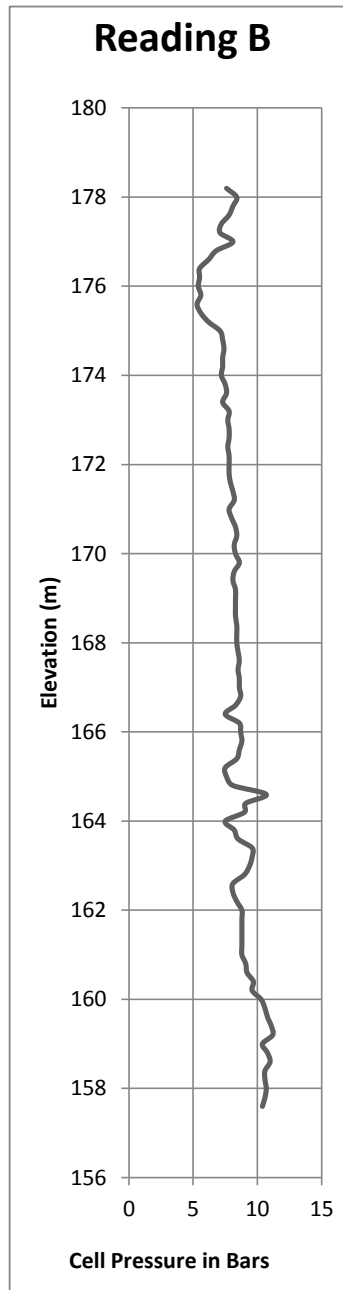
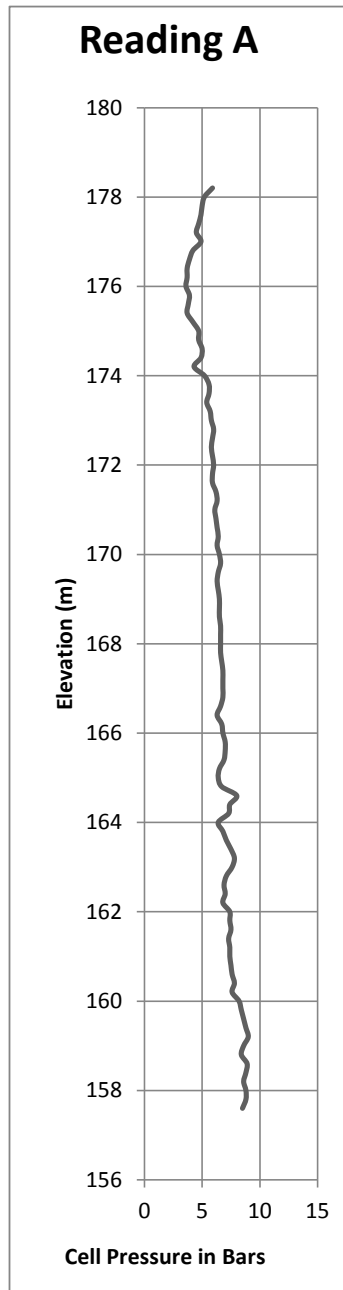
end of drilling
July 11, 2011;
continue with
DMT July 12,
2011

RECORD OF 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

Appendix B Borehole and CPT Logs from Previous Investigations

RECORD OF BOREHOLE No 7

1 OF 4

METRIC

PROJECT 04-1111-060

W.P.

LOCATION

N 4678848.0 :E 333325.0

ORIGINATED BY C.C.

DIST WEST HWY 401 / 3

BOREHOLE TYPE POWER AUGER, HOLLOW STEM

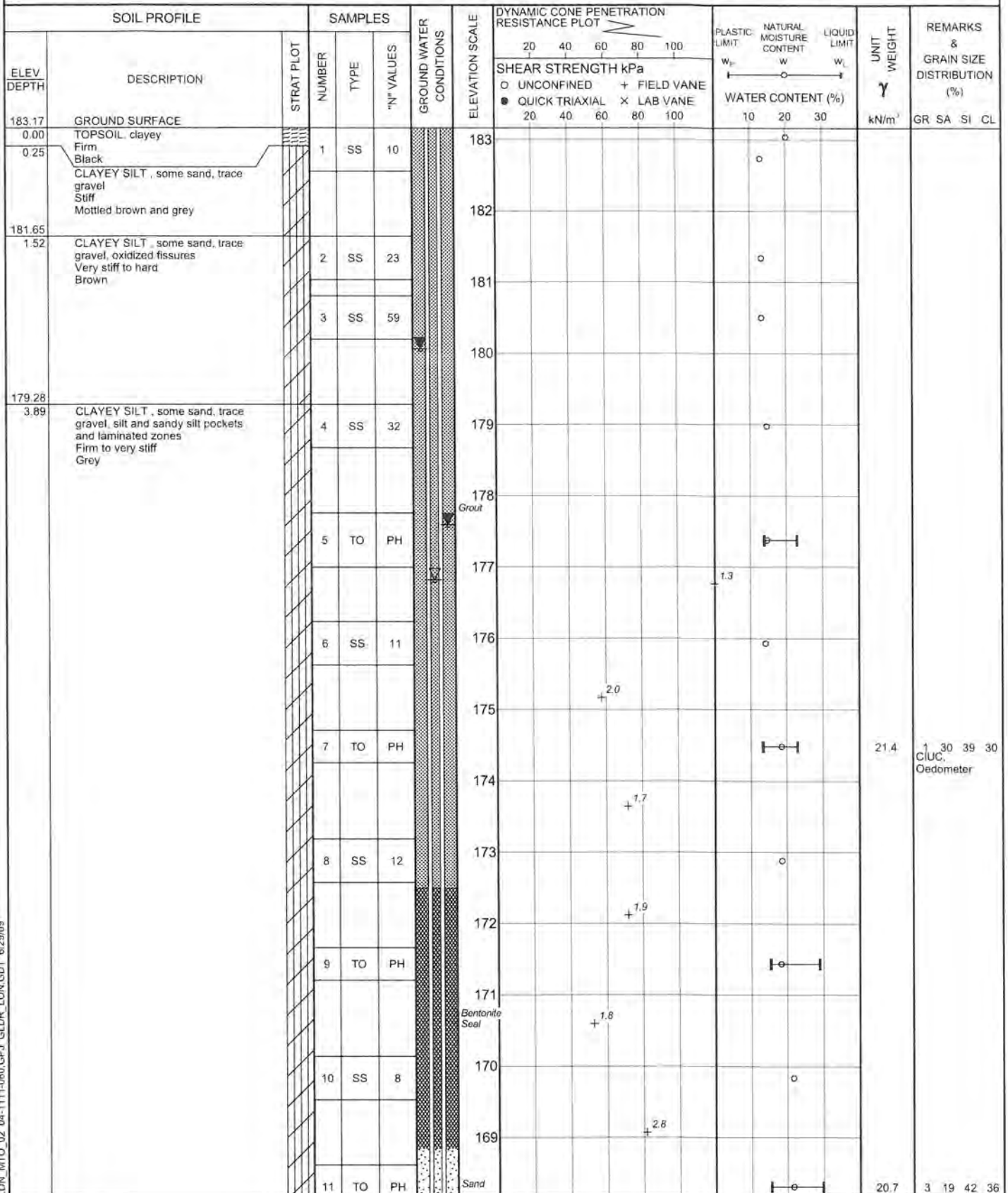
COMPILED BY T.M.

DATUM Geodetic

DATE

November 10, 2006 - November 16, 2006

CHECKED BY *SB*



LON_MTO_02 04-1111-060.GPJ GLDR_LON.GDT 6/29/09

Continued Next Page

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

PROJECT 04-1111-060		RECORD OF BOREHOLE No 7		2 OF 4	METRIC
W.P.	LOCATION	N 4678848.0 : E 333325.0		ORIGINATED BY C.C.	
DIST WEST HWY 401/3	BOREHOLE TYPE	POWER AUGER/HOLLOW STEM		COMPILED BY T.M.	
DATUM Geodetic	DATE	November 10, 2006 - November 16, 2006		CHECKED BY SJS	

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						
	CLAYEY SILT , some sand, trace gravel, silt and sandy silt pockets and laminated zones Firm to very stiff Grey						20 40 60 80 100	20 40 60 80 100	10 20 30						
				12	TO	PH									
				13	SS	12									
				14	TO	PH									
				15	TO	PH									
				16	SS	21									
				17	SS	PH									
				18	SS	13									
				19	SS	12									
				20	TO	PH									
				21	SS	9									
				22	SS	PH									

LDN_MTO_02 04-1111-060.GPJ GLDR LON.GDT 6/29/03

Continued Next Page

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

RECORD OF BOREHOLE No 7

3 OF 4

METRIC

PROJECT 04-1111-060

W.P.

LOCATION

N 4678848.0 ; E 333325.0

ORIGINATED BY C.C.

DIST WEST HWY 401 / 3

BOREHOLE TYPE POWER AUGER, HOLLOW STEM

COMPILED BY T.M.

DATUM Geodetic

DATE

November 10, 2006 - November 16, 2006

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	× LAB VANE						
						20 40 60 80 100	20 40 60 80 100	10 20 30							
150.02	CLAYEY SILT , some sand, trace gravel, silt and sandy silt pockets and laminated zones Firm to very stiff Grey		23	SS	13		153								
							152								
			24	SS	PH										
							151								
			25	SS	42										
33.15	LIMESTONE, fresh, medium strong, laminated, very fine grained, moderately porous, light grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		26	NQ RC			150								
			27	NQ RC			149								
							148								
			28	NQ RC			147								
							146								
145.28	END OF BOREHOLE		29	NQ RC										UC	
37.89	Water level in borehole at about elevation 176.82m on October 16, 2006 Lower piezometer 32mm PVC screen and riser pipe. Second (Upper) piezometer 13mm porous tip and CPVC riser pipe. Water level in Upper Piezometer at about elevation 180.06m on November 14, 2006. Water level in Lower Piezometer at about elevation 177.59m on November 14, 2006.														

LDN_MTD_02_04-1111-060.GPJ GLDR_LON.GDT 6/30/09

PROJECT: 04-1111-060

RECORD OF DRILLHOLE: 7

SHEET 4 OF 4

LOCATION: N 4678848.0 ; E 333325.0

DRILLING DATE: November 10, 2006 - November 16, 2006

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG:

DRILLING CONTRACTOR:

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.		PENETRATION RATE (m/min)	COLOUR FLUSH % RETURN	ELEVATION											NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
				DEPTH (m)	RUN No.				RECOVERY		R.Q.D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA			ROCK STRENGTH INDEX		WEATH- ERING INDEX																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
									TOTAL CORE %	SOLID CORE %			DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	R1	R2	R3	W1	W2	W3	W4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		ROCK SURFACE		150.04				150																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

DEPTH SCALE

1 : 75



LOGGED: C.C.

CHECKED: SB

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

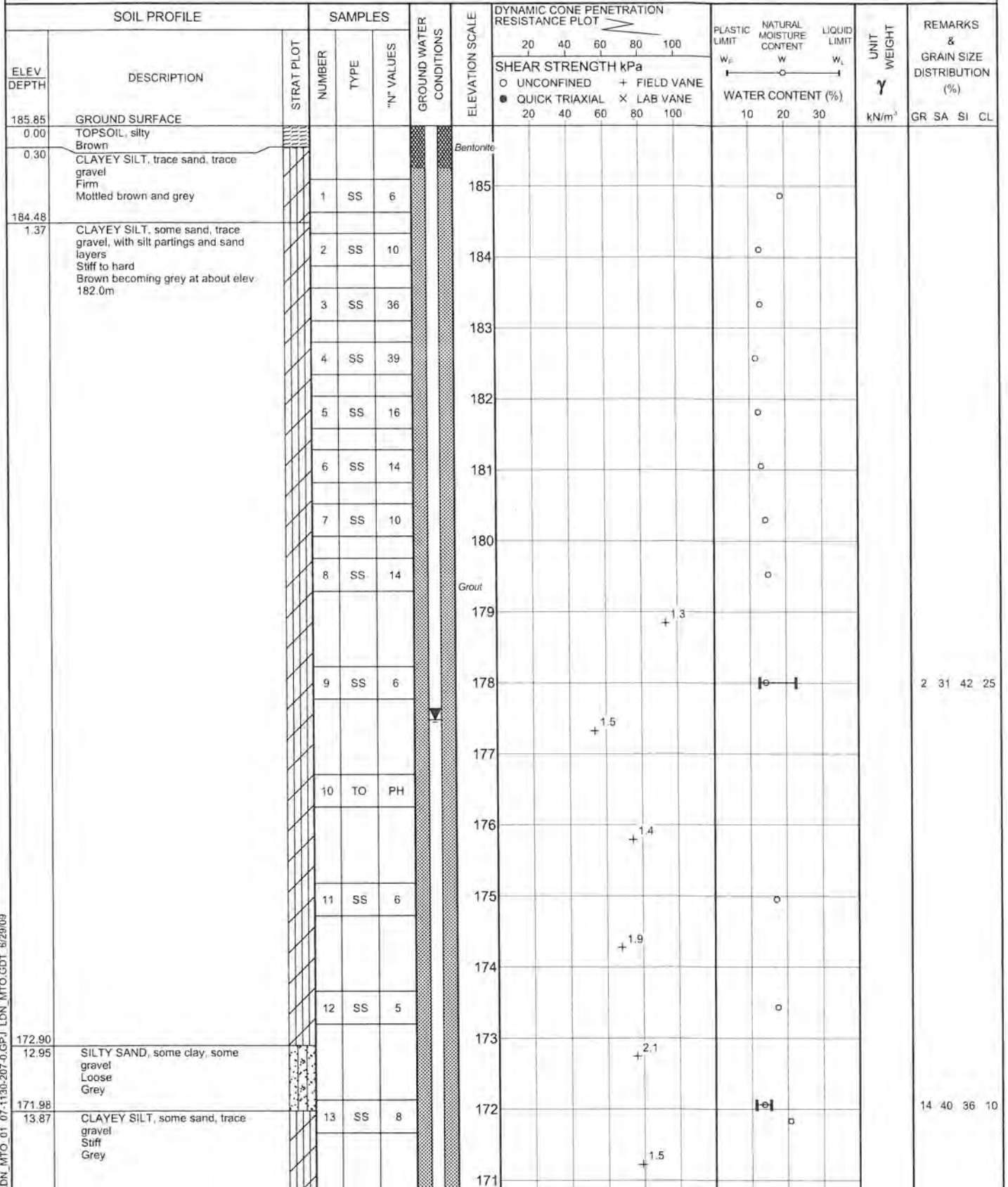
COMPILED BY BRS

DATUM GEODETIC

DATE

March 14, 2008 - March 19, 2008

CHECKED BY *SSB*

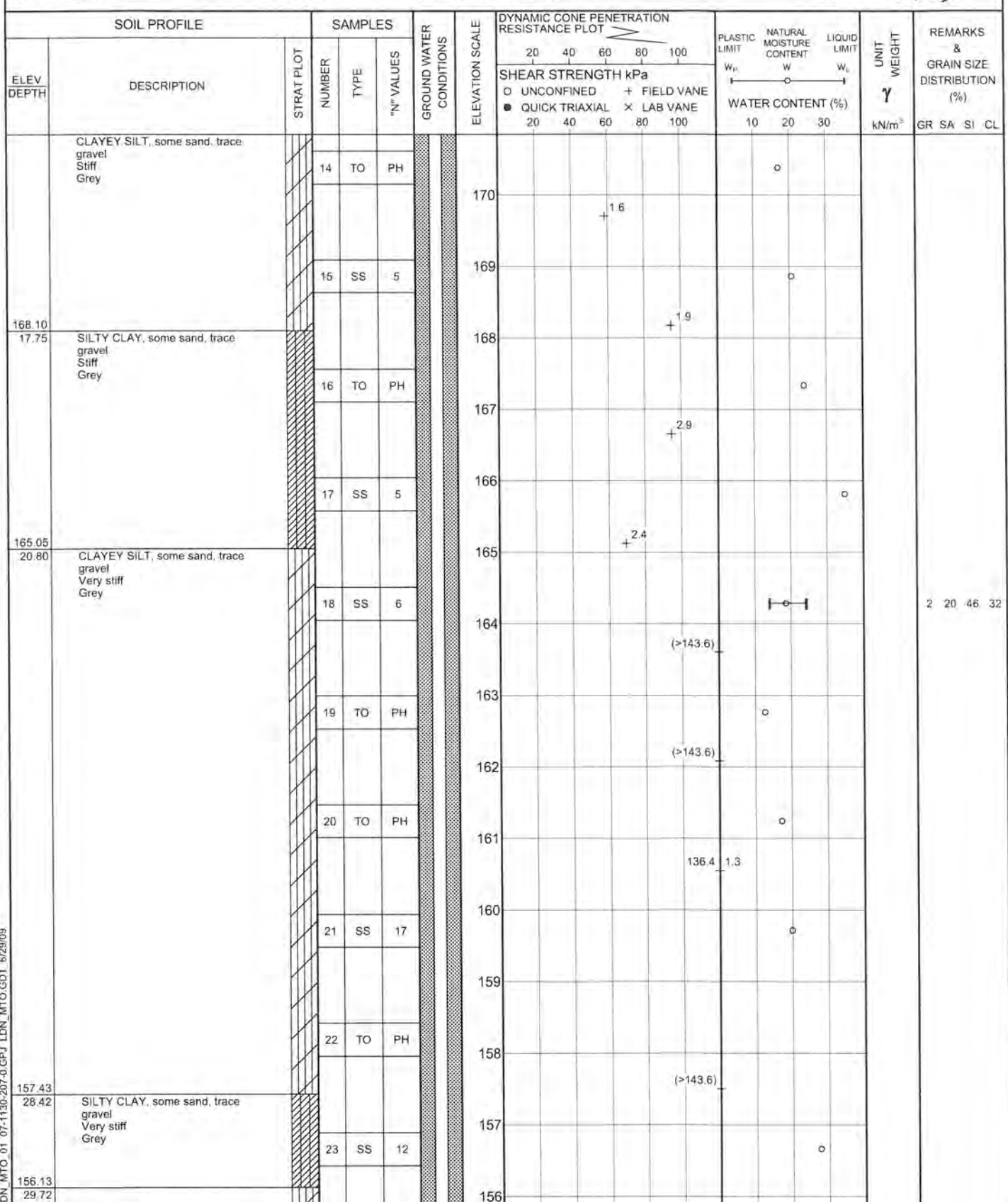


Continued Next Page

+ 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 O 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
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										
			28	NQ										
				RC										
			29	NQ										
				RC										
			30	NQ										
				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

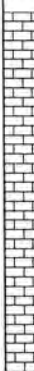
DRILLING DATE: March 14, 2008 - March 19, 2008

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	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 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 / l CORE AXIS									
										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												
		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																
32					2																
33					3																
				4																	
34					5																
				6																	
35		END OF DRILLHOLE		150.95 34.90	7				151												
36																					
37																					
38																					
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

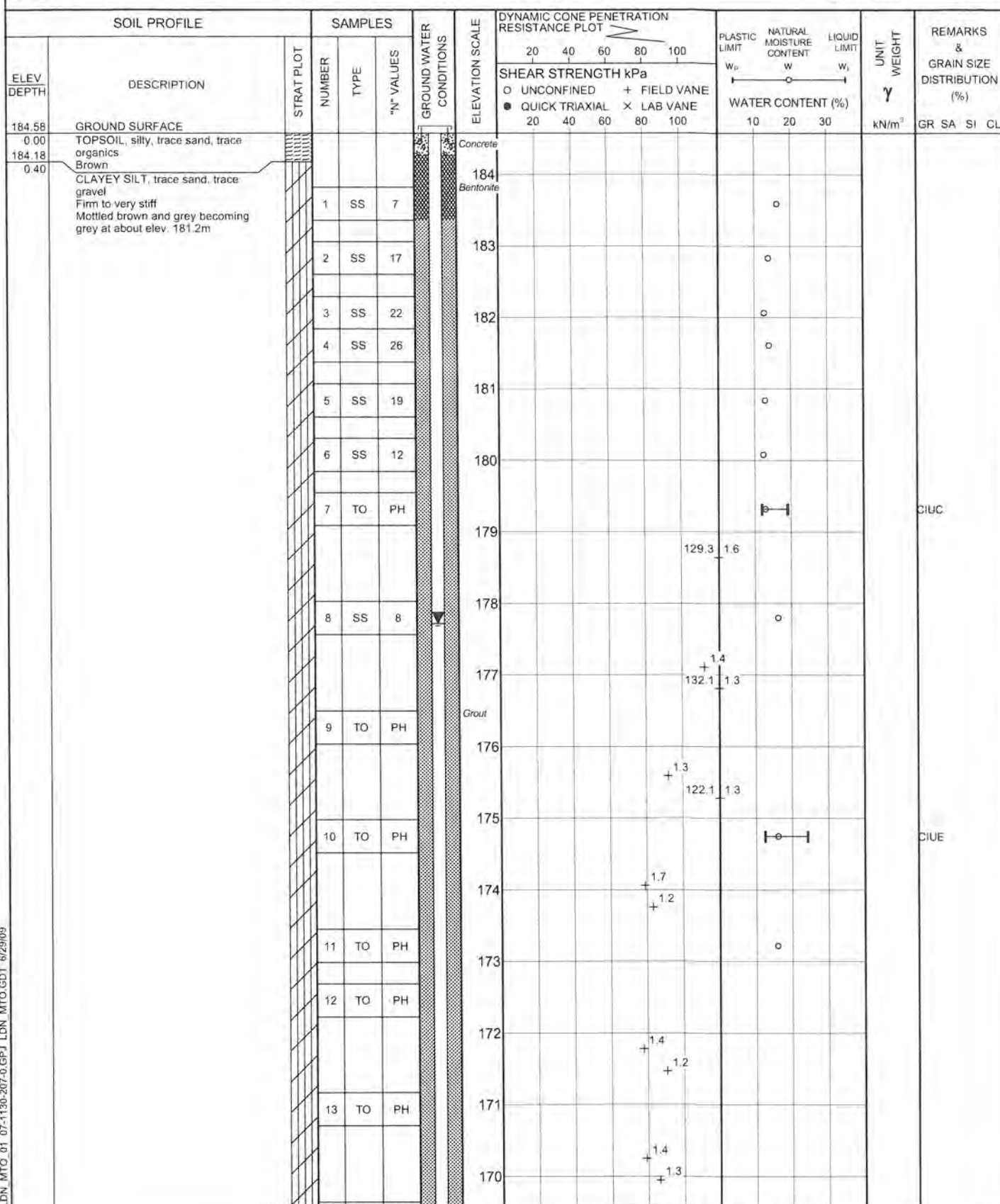
March 14, 2008

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			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	CLAYEY SILT, some sand, trace gravel, with silt partings and sand layers Stiff to hard Brown becoming grey at about elev 182.0m					184							
1.37						183							
						182							
						181							
						180							
						179							
						Bentonite							
						178							
						Sand							
						177							
						Piezometer							
176.25	END OF BOREHOLE												
9.60													

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 5/29/09

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 O 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 (54)			
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					
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														
			29	NQ RC														
			30	NQ RC														
			31	NQ RC														
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.																	

LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 112

SHEET 4 OF 4

LOCATION: N 4678413.3 ; E 334221.3

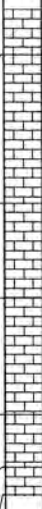
DRILLING DATE: January 29, 2008 - February 12, 2008

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	FLUSH	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						
				TOTAL CORE %						SOLID CORE %	TYPE AND SURFACE DESCRIPTION																
				DEPTH (m)																							
		ROCK SURFACE		152.12 32.46					152																		
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																		
34		LIMESTONE, fresh, medium strong, laminated, fine grained, vuggy to faintly porous with depth, light greyish brown, fossils present								150							Zone of broken material										
35		LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous, light grey		149.28 35.30	2						149							JN, PL, Ro CI									
36		LIMESTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous, light greyish brown		148.34 36.24	3						148							JN, CU, Ro CI									
37		LIMESTONE, fresh, medium strong, laminated, medium grained, moderately porous, light greyish brown		147.18 37.40							147																
38		LIMESTONE, fresh, medium strong, laminated, fine grained, faintly porous, very light greyish brown		146.66 37.92	4																						
				END OF DRILLHOLE		146.39 38.19																					
39																											
40																											
41																											
42																											
43																											
44																											
45																											
46																											
47																											

DEPTH SCALE

1:75



LOGGED: SG

CHECKED: SJB

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

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

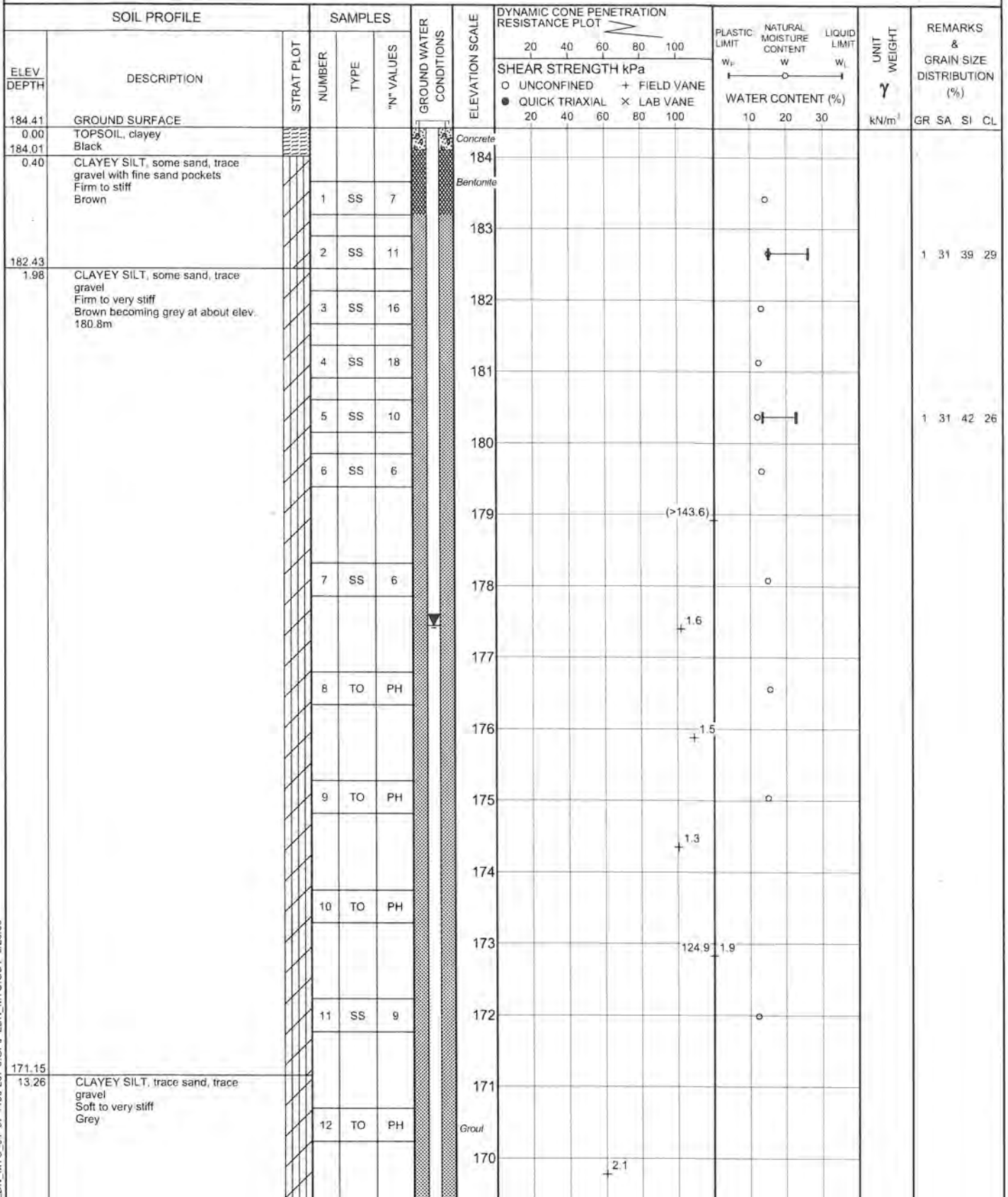
COMPILED BY BRS

DATUM GEODETIC

DATE

February 22, 2008 - February 28, 2008

CHECKED BY *SB*



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 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 20 40 60 80 100	+ FIELD VANE 20 40 60 80 100						
	CLAYEY SILT, trace sand, trace gravel Soft to very stiff Grey		13	SS	4										
167.95															
16.46	SILTY CLAY, trace sand Soft to stiff Grey		14	SS	4										
			15	SS	5										
165.13															
19.28	CLAYEY SILT, trace sand, trace gravel Stiff to very stiff Grey		16	TO	PH										
			17	SS	9										
			18	SS	19										
			19	SS	17										
			20	SS	16										
			21	SS	14										

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 113

3 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 GEODETIC

DATE

February 22, 2008 - February 28, 2008

CHECKED BY *SJB*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
								20 40 60 80 100				W _p W W _L				
								○ UNCONFINED + FIELD VANE								
								● QUICK TRIAXIAL × LAB VANE								
								20 40 60 80 100				10 20 30		GR SA SI CL		
29.87	SAND AND GRAVEL, trace silt Compact Grey		23	SS	25		154									
							Screen									
153.01			24	NQ RC			153	33	0	0						
31.40	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)		25	NQ RC			Bentonite	27	10	0						
			26	NQ RC			152	73	38	12						
			27	NQ RC			151	T.C.R. (%) 0 S.C.R. (%) 0 R.Q.D. (%) 0								
							Sand									
			28	NQ RC			150									
							149	94	92	78					UC	
148.36																
36.05	END OF BOREHOLE															
	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.															

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.		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										HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)		NOTES WATER LEVELS INSTRUMENTATION
				DEPTH (m)	RUN No.				RECOVERY		R Q D %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)					
									TOTAL CORE %	SOLID CORE %			DIP to CORE AXIS	TYPE AND SURFACE DESCRIPTION		HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)					
																10 ⁻⁸	10 ⁻⁶	10 ⁻⁴	10 ⁻²	10 ⁻¹				
		ROCK SURFACE		153.01				153																
32	MUD ROTARY NO ROCK CORE	LIMESTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous, light grey No recovery from 32.00m to 32.31m		31.40	1																			
				2																				
					3																			
33		LIMESTONE, fresh, medium strong, thinly laminated, fine grained to very fine grained, porous, light grey		151.40																				
				33.01																				
34		LIMESTONE, fresh, medium strong, laminated, fine grained, faintly porous, grey - brown		150.70	4																			
				33.71																				
35		LIMESTONE, fresh, medium strong, thinly laminated, fine grained, porous, light grey		149.60																				
				34.81																				
		LIMESTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous, light grey to brown		149.18	5																			
				35.23																				
36		END OF DRILLHOLE		148.35																				
				36.06																				
37																								
38																								
39																								
40																								
41																								
42																								
43																								
44																								
45																								
46																								

DEPTH SCALE

1 : 75



LOGGED: SG

CHECKED: SJB

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

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	
20	40	60	80	100	10	20	30											
183.79	GROUND SURFACE																	
0.00	TOPSOIL, silty Brown						Concrete											
183.36							Bentonite											
0.43	CLAYEY SILT, some sand, trace gravel Soft to very stiff Brown		1	SS	4		183				○							
			2	SS	22		182				○							
			3	SS	25		181				○							
			4	SS	23						○							
180.44																		
3.35	CLAYEY SILT, some sand, trace gravel Stiff Grey		5	SS	14		180				○							
			6	SS	12		179				○							
			7	SS	14						○							
							178											
			8	SS	9		177				○							
			9	TO	PH		176											
							Grout											
							175											
174.80																		
8.99	SANDY SILT, some clay, trace gravel Loose Grey																	
			10	SS	7		174				○			3 43 39 14				
173.58																		
10.21	CLAYEY SILT, some sand, trace gravel Firm Grey																	
173.12							173											
10.67	SAND, trace gravel, trace silt Loose Grey		11	SS	8		172				○			(9)				
171.90																		
11.89	CLAYEY SILT, some sand, trace gravel Soft to very stiff Grey		12	SS	7		171				○			2 30 40 28				
			13	TO	PH													
							170											
			14	SS	6		169				○							

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		
	CLAYEY SILT, some sand, trace gravel Soft to very stiff Grey													
			15	SS	4		168							
							167							
			16	TO	PH		166							
							165							
			17	SS	6		164							
							163							
			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						
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE					
							20 40 60 80 100							
153.31														
30.48	SAND AND GRAVEL, trace silt Dense Grey		26	SS	36		153							25 66 6 3
							152							
151.48														
32.31	LIMESTONE, fresh, medium strong, laminated, fine grained Light grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		27	SS	100/ 25mm		151							
							150	96	90	86				
			28	NQ RC			149							
			29	NQ RC			148	100	100	100				
			30	NQ RC			147	100	97	86				
146.15														UC
37.64	END OF BOREHOLE 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.													

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 8/29/09

+ 3 . X 3

Numbers refer to
Sensitivity

○ 3% STRAIN AT FAILURE

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				DISCONTINUITY DATA				DIAMETER POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
				DEPTH (m)	RECOVERY						R.Q.D. %	FRACT INDEX PER 0.3	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³	2	4	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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DEPTH SCALE

1:75



LOGGED: SG

CHECKED: SUB

RECORD OF BOREHOLE No 115A

1 OF 2

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

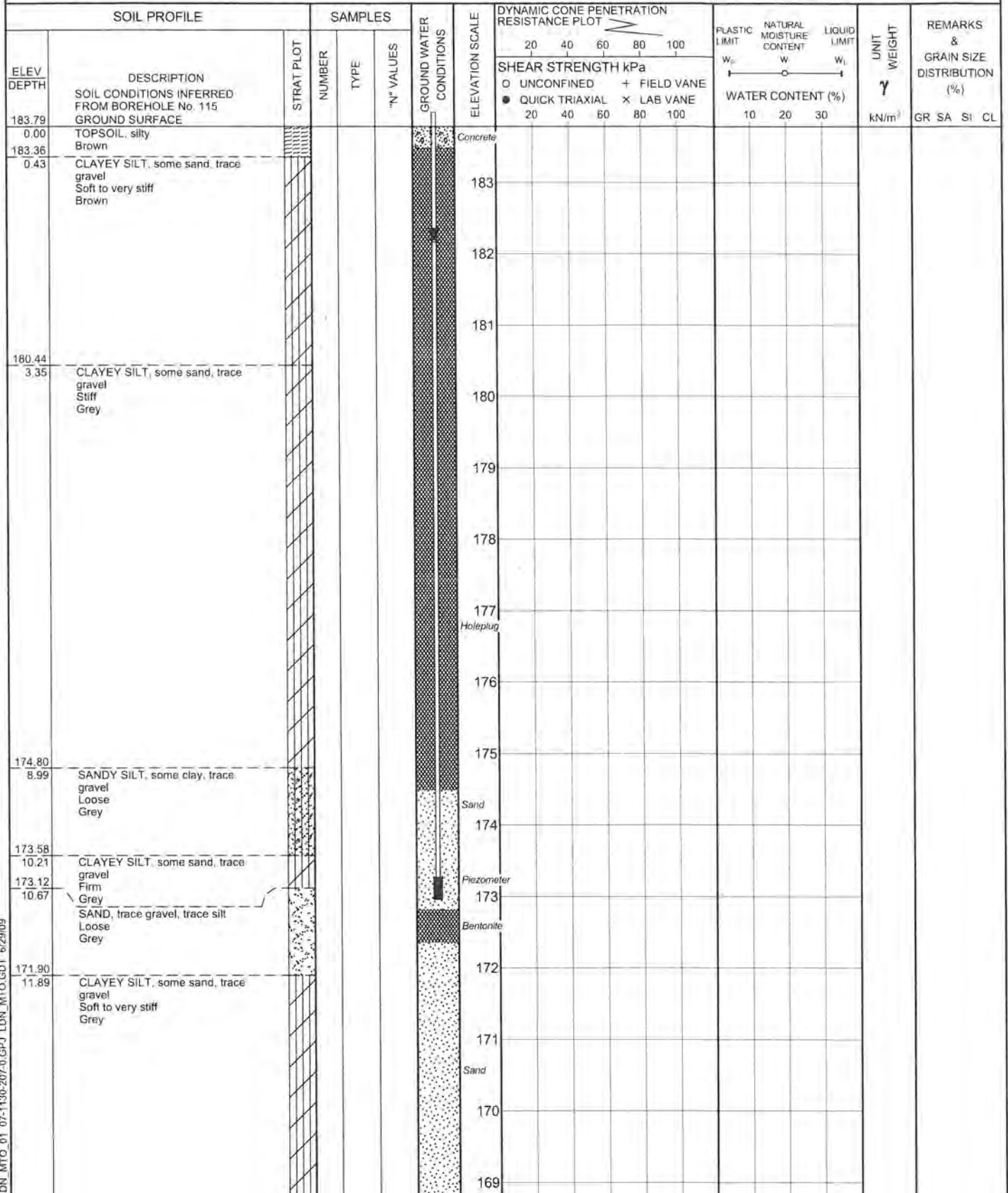
COMPILED BY BRS

DATUM GEODETIC

DATE

February 20, 2008 - February 21, 2008

CHECKED BY SJB



Continued Next Page

+ 3 × 3

Numbers refer to Sensitivity

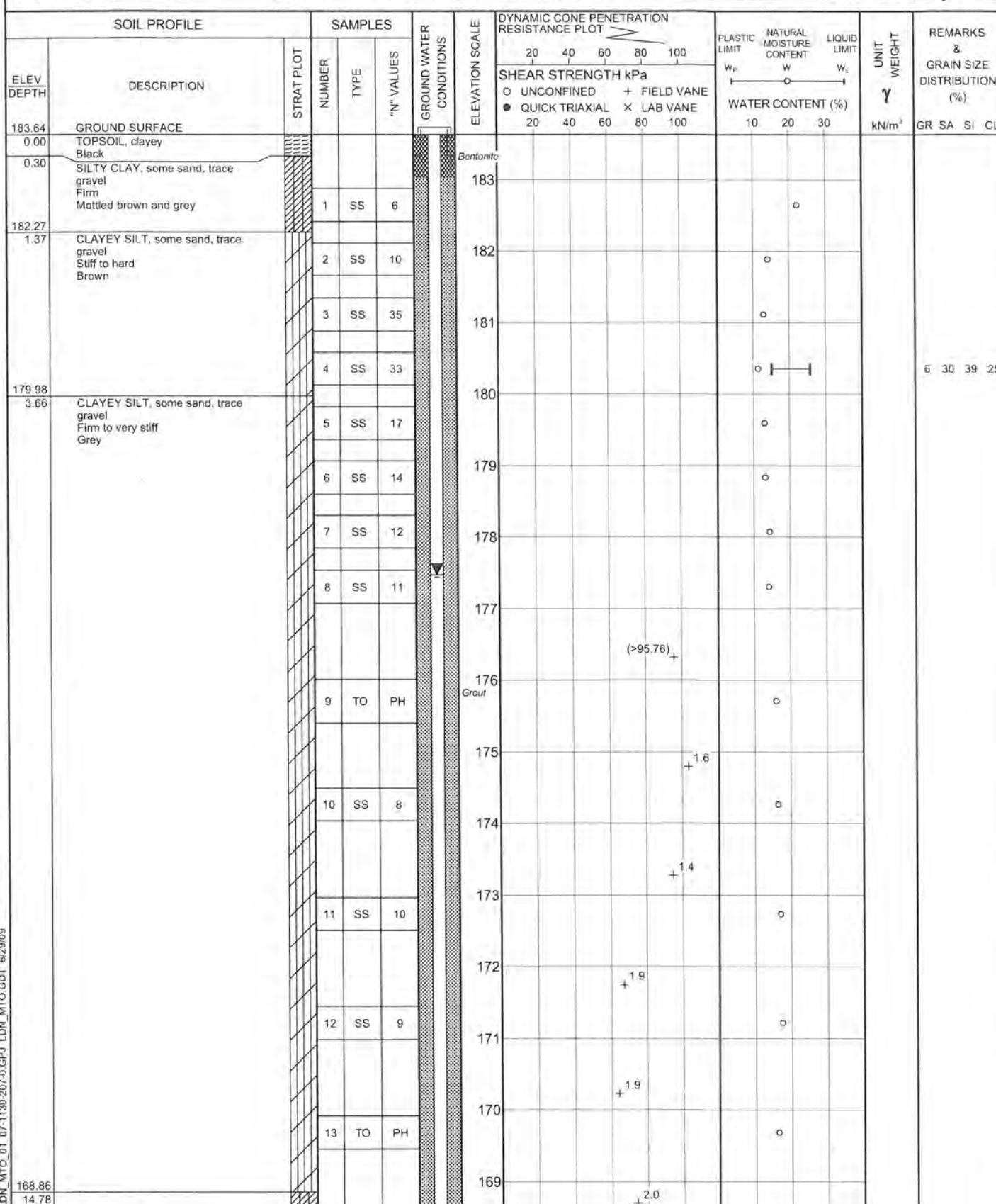
○ 3% STRAIN AT FAILURE

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No 115A		2 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>			

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



LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

Continued Next Page

+ 3, X 3, Numbers refer to Sensitivity O 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

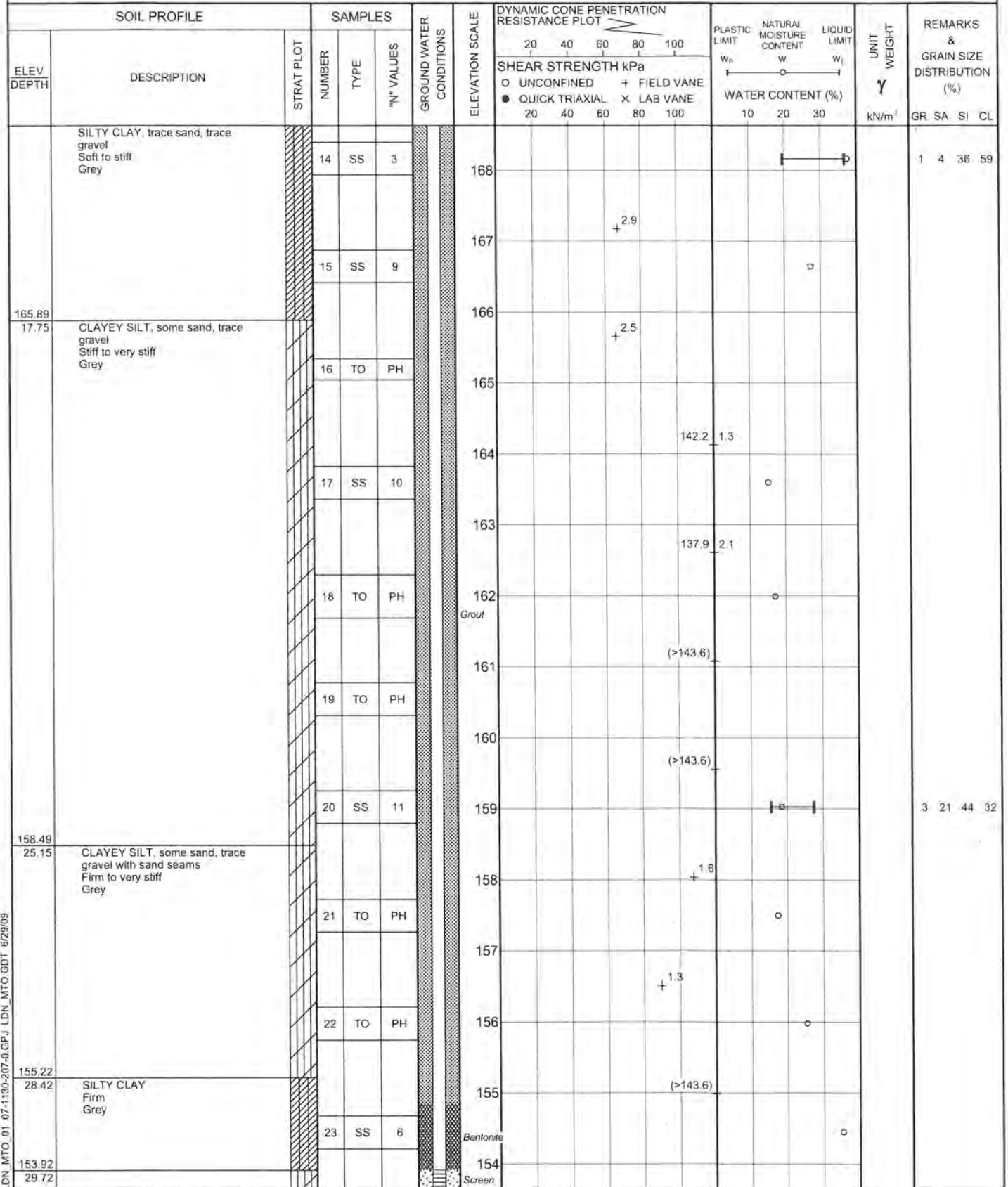
COMPILED BY BRS

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 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:	HYDRAULIC CONDUCTIVITY k, cm/sec				DIAMETRAL POINT LOAD INDEX (MPa)				NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
				DEPTH (m)	CORRECTION						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DIP w/1 CORE AXIS		TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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32	MUD ROTARY NO ROCK CORE	ROCK SURFACE		151.66																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
183.64	SOIL CONDITIONS INFERRED FROM BOREHOLE No. 116 GROUND SURFACE							20 40 60 80 100						
0.00	TOPSOIL, clayey Black							0 UNCONFINED + FIELD VANE						
0.30	SILTY CLAY, some sand, trace gravel Firm Mottled brown and grey							● QUICK TRIAXIAL × LAB VANE						
182.27								20 40 60 80 100						
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													
175.00														
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

RECORD OF BOREHOLE No 118

1 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678903 5 :E 333302.9

ORIGINATED BY MA

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

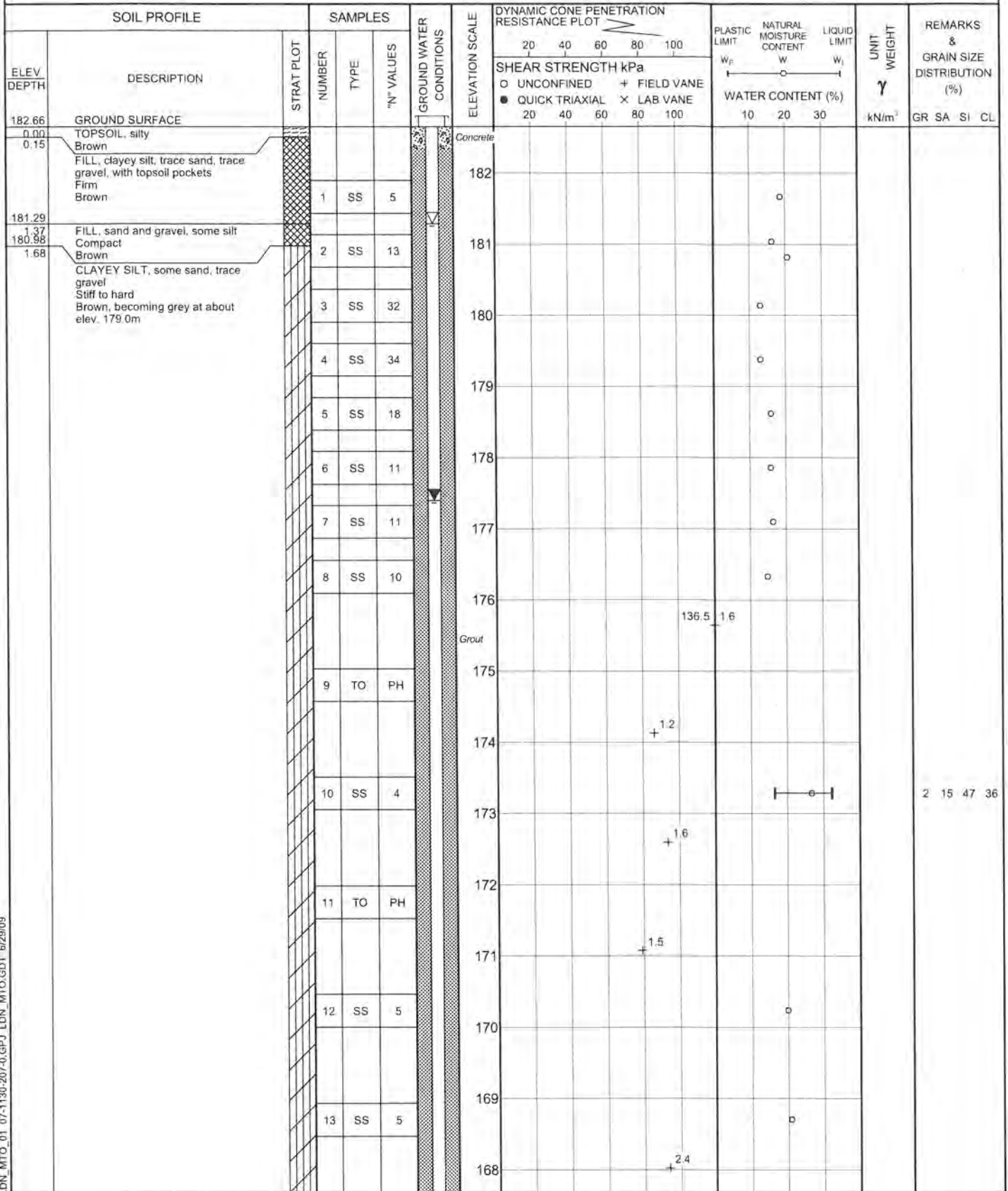
COMPILED BY BRS

DATUM GEODETIC

DATE

February 28, 2008 - March 4, 2008

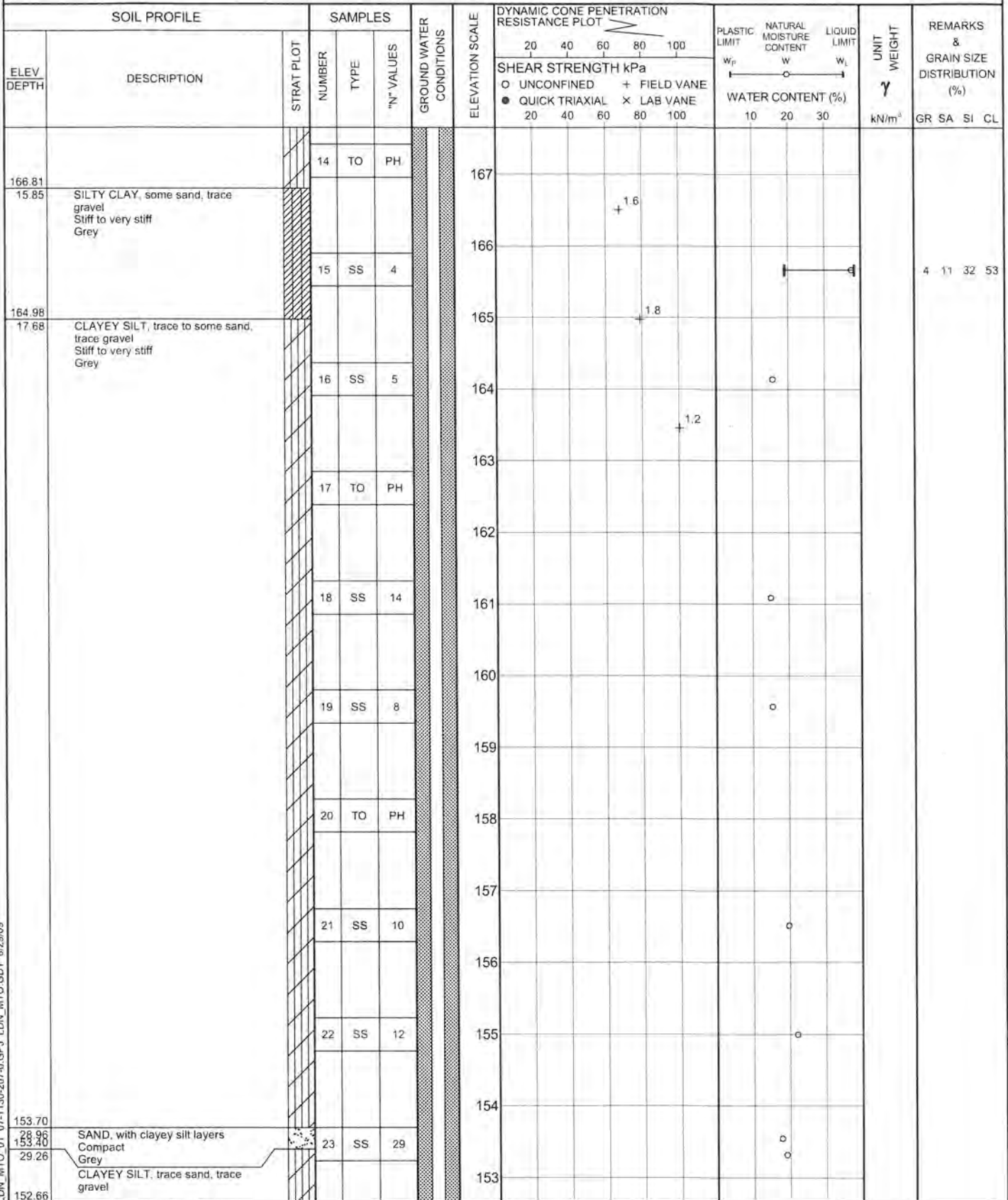
CHECKED BY SSB



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 118		2 OF 4	METRIC
W.P. _____	LOCATION <u>N 4678903.5 :E 333302.9</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 28, 2008 - March 4, 2008</u>	CHECKED BY <u>SB</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 DRILLHOLE: 118

SHEET 4 OF 4

LOCATION: N 4678903.5 ;E 333302.9


DRILLING DATE: February 28, 2008 - March 4, 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 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	
									RECOVERY		FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec							
									TOTAL CORE %	SOLID CORE %		TYPE AND SURFACE DESCRIPTION									
									80 60 40 20	80 60 40 20		DIP w.r.t. CORE AXIS	10 ⁻² 10 ⁻¹ 10 ⁰								
		ROCK SURFACE		150.32																	
	MUD ROTARY NO ROCK CORE	LIMESTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous, whitish grey		32.34	1			150													
33																					
		LIMESTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous, grey		149.56	2																
				33.10																	
				149.22																	
		LIMESTONE, fresh, medium strong, thinly laminated, fine to very fine grained, pitted, whitish grey		33.44					149												
34																					
					147.97	3															
		LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, moderately porous, light grey		34.69																	
					147.61																
		LIMESTONE, fresh, medium strong, thinly laminated, fine grained, pitted to vuggy, light brown to grey		35.05				147													
35																					
		END OF DRILLHOLE		146.60																	
				36.06																	
36																					
37																					
38																					
39																					
40																					
41																					
42																					
43																					
44																					
45																					
46																					
47																					

DEPTH SCALE

1:75



LOGGED: SG

CHECKED: SSB

RECORD OF BOREHOLE No 119

1 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678961.6 ; E 333120.6

ORIGINATED BY SM

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

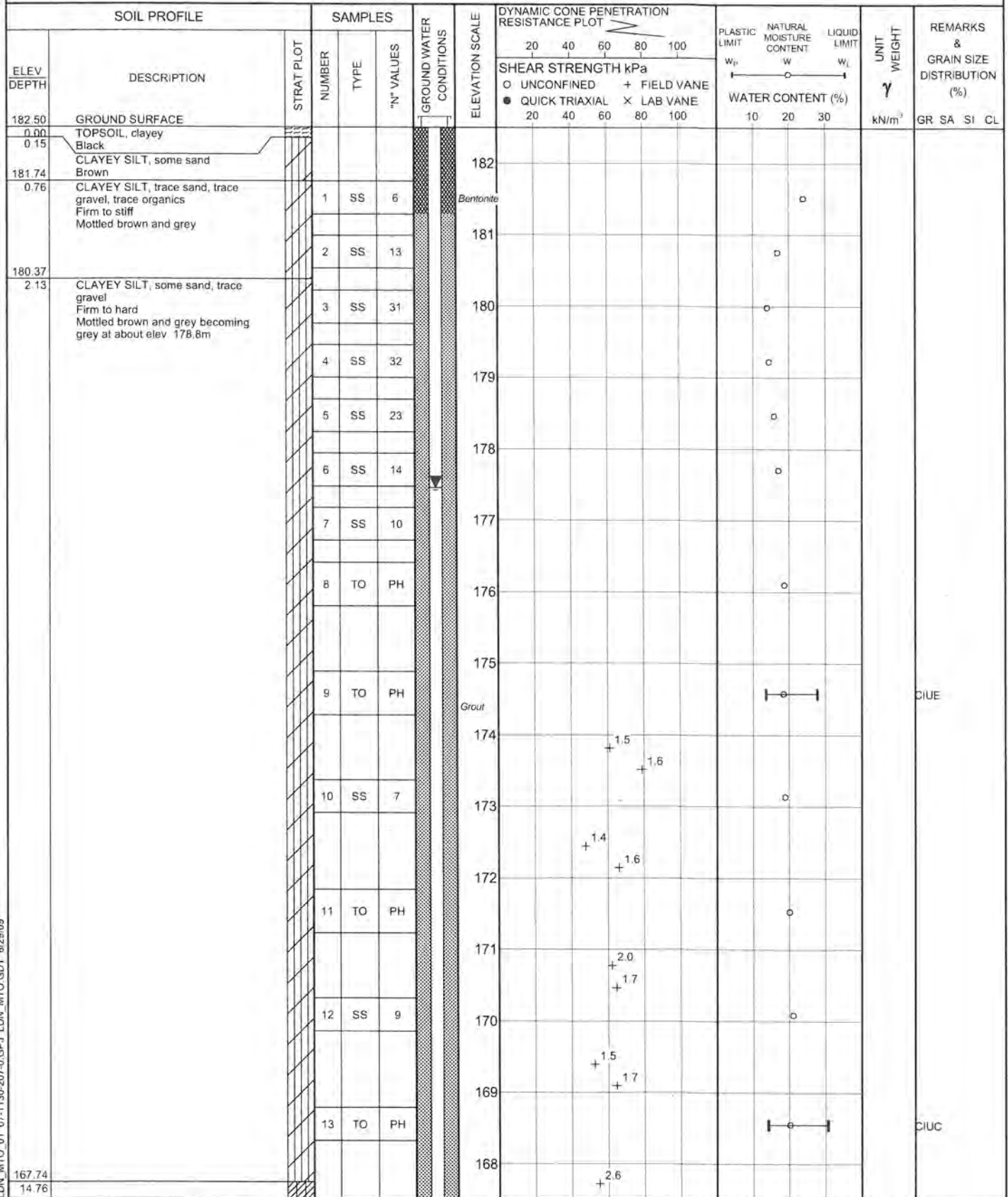
COMPILED BY BRS

DATUM GEODETIC

DATE

February 12, 2008 - February 20, 2008

CHECKED BY SJS



LDN_MTO_01_07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

Continued Next Page

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

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

RECORD OF BOREHOLE No 119

3 OF 4

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678961.6 : E 333120.6

ORIGINATED BY SM

DIST WEST HWY 401/3

BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC

COMPILED BY BRS

DATUM GEODETIC

DATE

February 12, 2008 - February 20, 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					
151.18	CLAYEY SILT, trace sand, trace gravel Stiff Grey		24	TO	PH		152								
31.32	SAND AND GRAVEL (Possible glacial till or weathered rock)		25	SS	50/0mm		151								
150.40	LIMESTONE, fresh, medium strong, thinly laminated to laminated, very fine to fine grained, faintly porous to porous, light grey (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		26	NQ RC			150	48	44	44					
32.10			27	NQ RC			149	95	91	89					
			28	NQ RC			147	100	100	100					
			29	NQ RC			146	67	53	55					
145.54	END OF BOREHOLE														
36.96	Borehole dry during drilling on February 19, 2008. Water level measured in deep piezometer at elev. 178.18m on March 20, 2008. Water level measured in deep piezometer at elev. 177.78m on July 22, 2008. Water level measured in deep piezometer at elev. 178.85m on August 11, 2008. Water level measured in deep piezometer at elev. 176.03m on September 19, 2008. Water level measured in deep piezometer at elev. 177.16m on November 11, 2008. Water level measured in deep piezometer at elev. 177.45m on January 28, 2009.														

+ 3, X 3

Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 119

SHEET 4 OF 4

LOCATION: N 4678961.6 :E 333120.6

DRILLING DATE: February 12, 2008 - February 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 (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.										DIAMETRAL INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
				DEPTH (m)	RECOVERY						R.Q.D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k. cm/sec.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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DEPTH SCALE

1:75



LOGGED: SG

CHECKED: SJB

LDN ROCK 03 07-1130-207-0-ROCK.GPJ GLDR LDN.GDT 6/29/09 DATA INPUT: WDF

METRIC

PROJECT 07-1130-207-0

W.P.

LOCATION

N 4678961.6 E 333120.6

ORIGINATED BY SM

DIST

WEST

HWY 401/3

BOREHOLE TYPE

POWER AUGER, HOLLOW STEM

COMPILED BY BRS

DATUM GEODETIC

DATE _____

February 20, 2008

CHECKED BY SSB

[illegible]

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

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

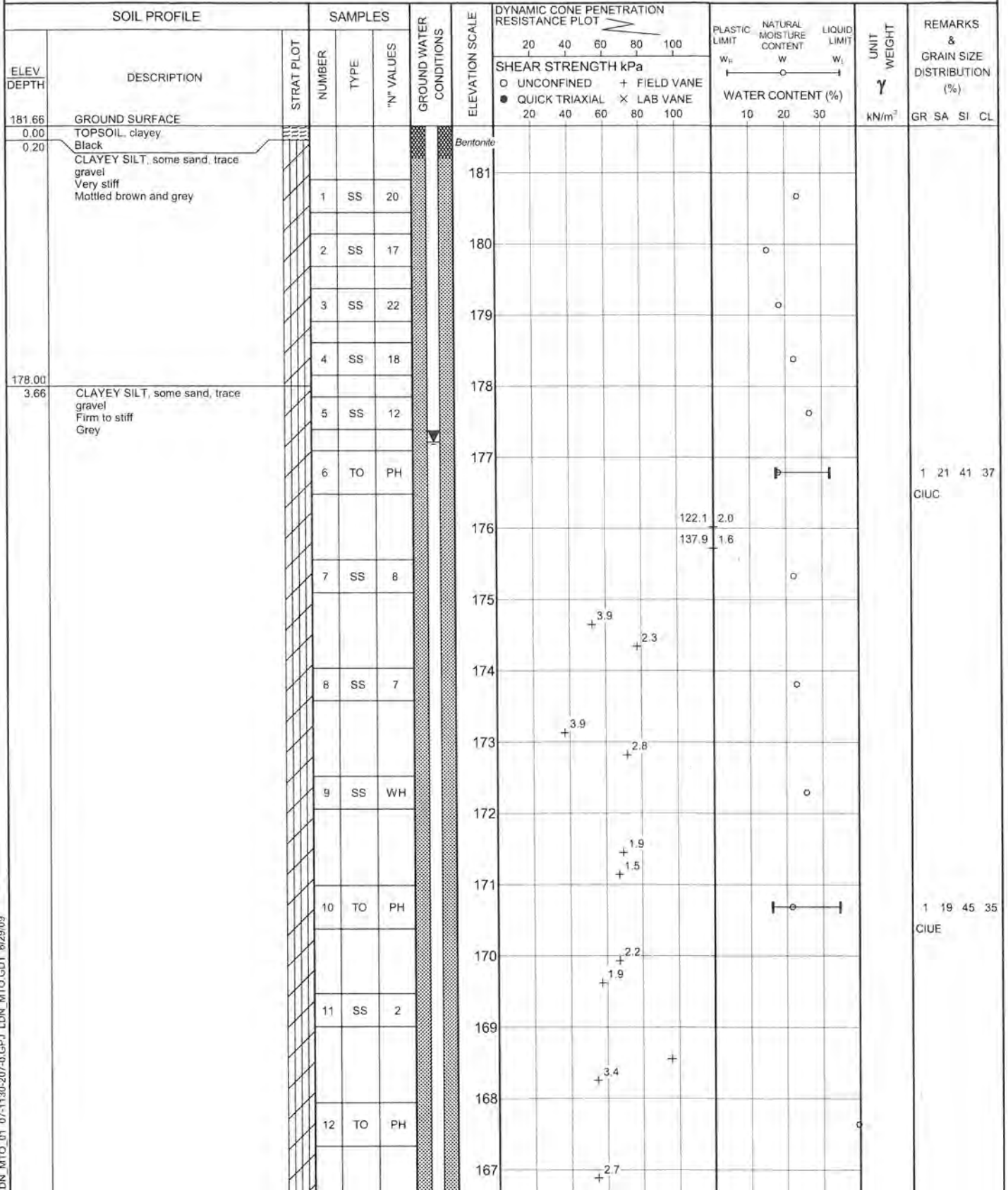
COMPILED BY BRS

DATUM GEODETIC

DATE

January 24, 2008 - January 29, 2008

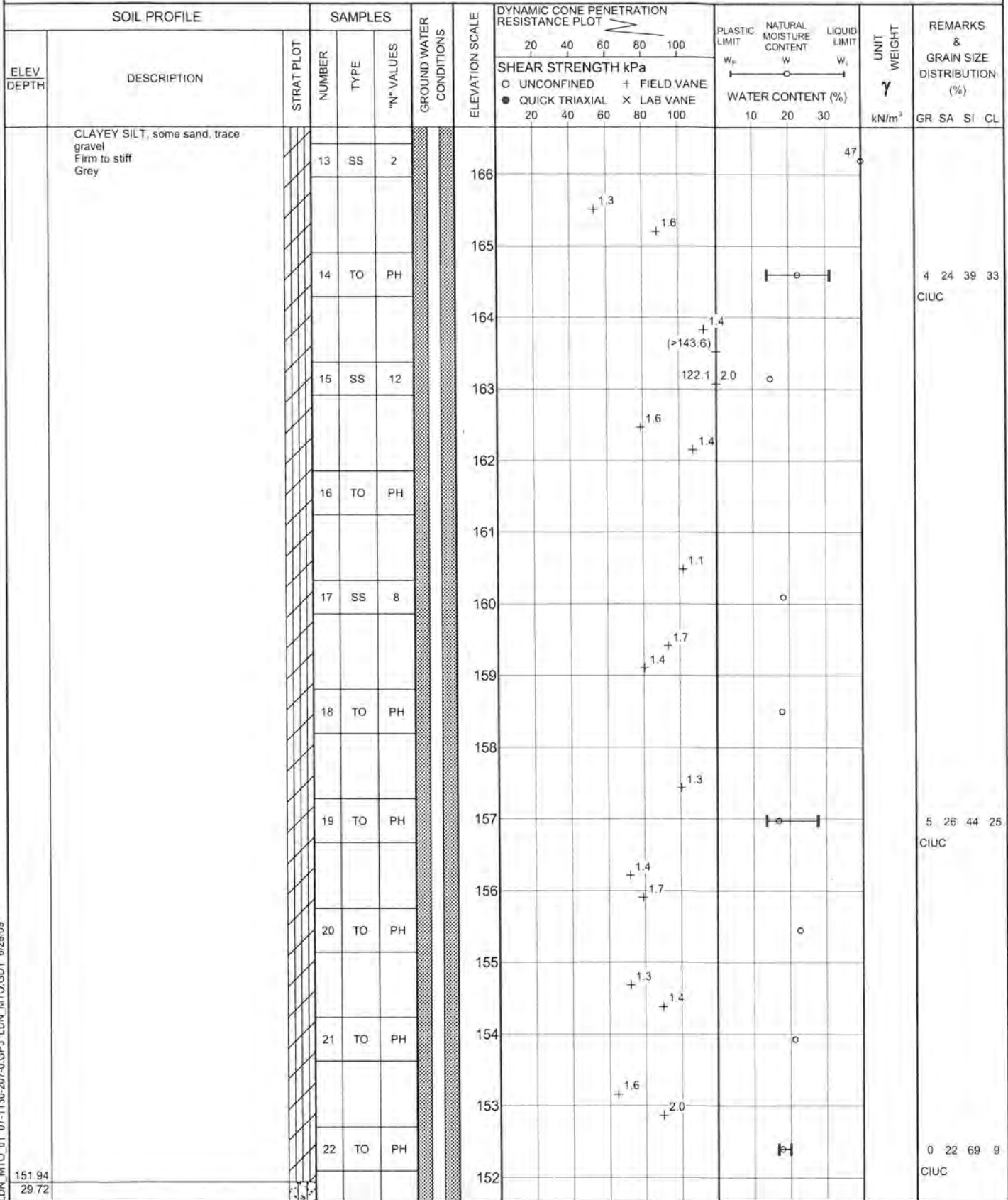
CHECKED BY *SS*



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

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No 122		2 OF 4	METRIC
W.P. _____		LOCATION <u>N 4679265.4 : E 332537.9</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>January 24, 2008 - January 29, 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 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 (%)					
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									
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)		25	SS	100/ 2.5mm									
35.05			26	SS	50/ 3.8mm									
			27	NQ RC										
			28	NQ RC										
			29	NQ RC										
			30	NQ RC										UC
141.33	END OF BOREHOLE													
40.33	<p>Borehole dry during drilling between January 24 and 29, 2008.</p> <p>Water level measured in deep piezometer at elev. 178.01m on July 22, 2008</p> <p>Water level measured in deep piezometer at elev. 178.26m on August 11, 2008.</p> <p>Water level measured in deep piezometer at elev. 178.26m on September 19, 2008.</p> <p>Water level measured in deep piezometer at elev. 177.54m on November 11, 2008.</p> <p>Water level measured in deep piezometer at elev. 177.21m on January 28, 2009.</p>													

LDN MTO_01 07-1130-207-0.GPJ LDN MTO GDT 8/29/09

SHEET 4 OF 4

DATUM: GEODETIC

DRILLING CONTRACTOR: AARDVARK DRILLING INC

[illegible]

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, HOLLOW STEM

COMPILED BY BRS

DATUM GEODETIC

DATE _____

January 24, 2008

CHECKED BY SS

[illegible]

+ 3 × 3: Numbers refer to Sensitivity ○ 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

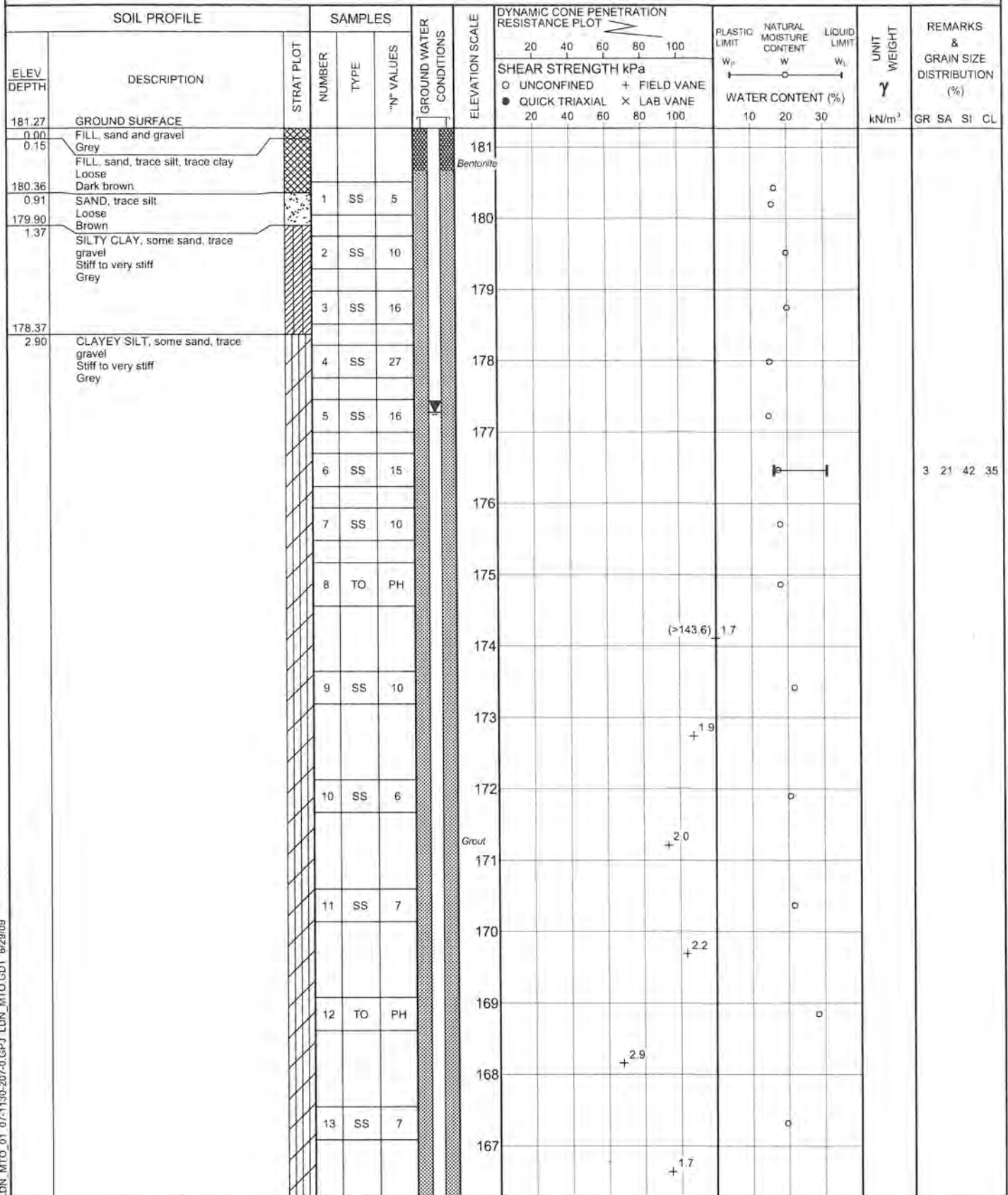
CHECKED BY *SSB*

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								20 40 60 80 100	20 40 60 80 100						10 20 30	
180.61	GROUND SURFACE															
0.00	FILL, sand and gravel, trace silt Compact Brown		1	SS	24		180									
179.09																
1.52	CLAYEY SILT, some sand, trace gravel Stiff to hard Brown, becoming grey at about elev. 177.0m		2	SS	8		179									
			3	SS	20		178									
			4	SS	33		177									
			5	SS	26		176									
			6	SS	17		175									
			7	SS	11		174									
			8	SS	10		173									
			9	SS	10											
			10	SS	8											
172.38																
8.23	END OF BOREHOLE Borehole dry during drilling on March 26, 2008.															

DN_MTO_01 07-11-30-207-0.GPJ LUN_MTO.GDT 6/23/09

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

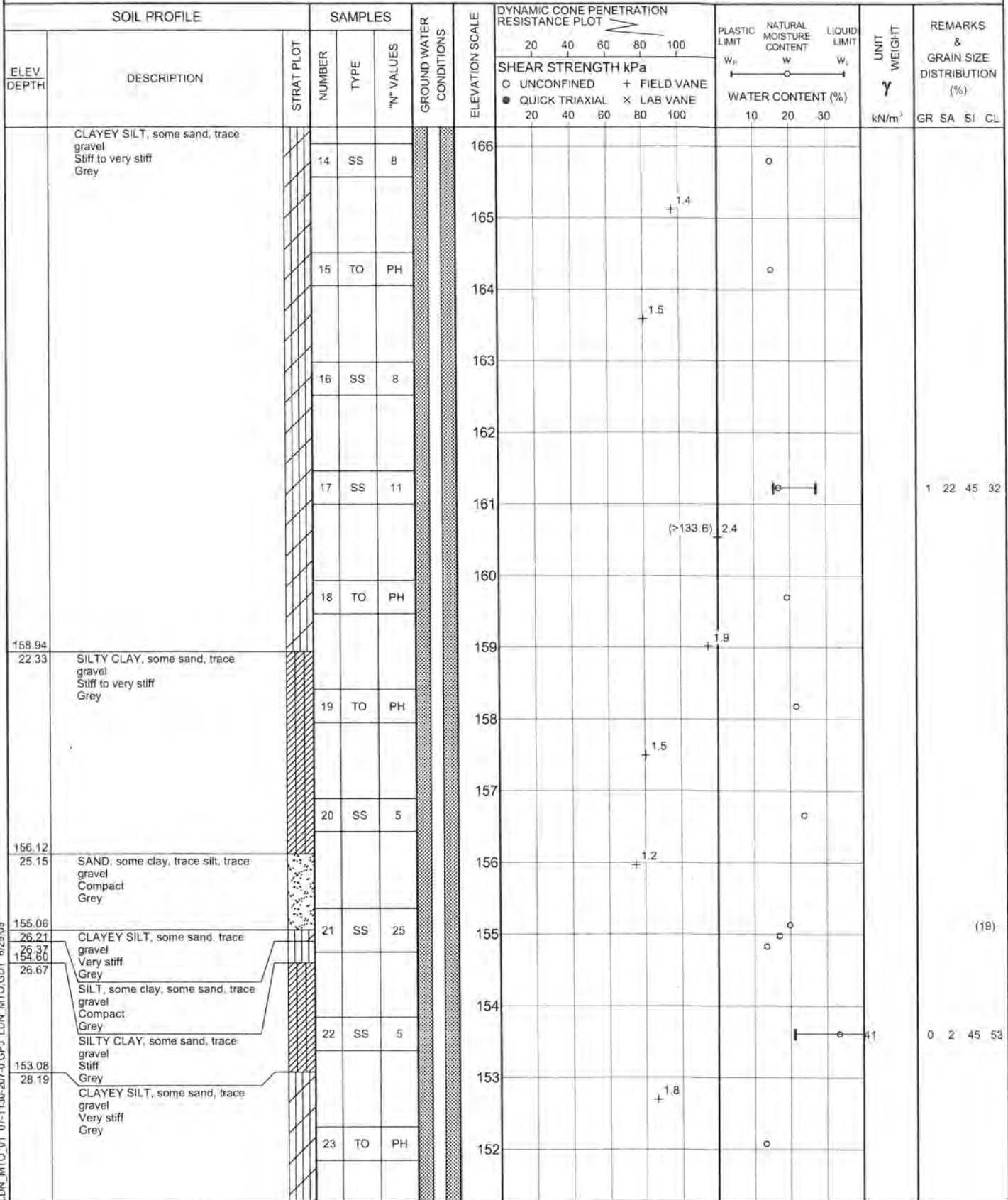
PROJECT 07-1130-207-0 **RECORD OF BOREHOLE No 127** 1 OF 4 **METRIC**
W.P. LOCATION N 4679370.9, E 332251.6 ORIGINATED BY SM
DIST WEST HWY 401/3 BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC COMPILED BY BRS
DATUM GEODETIC DATE March 11, 2008 - March 13, 2008 CHECKED BY *SLF*



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, × 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		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _l	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
							20 40 60 80 100						
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													
32.80	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									UC
			27	NQ RC									
			28	NQ RC									
145.16													
36.11	END OF BOREHOLE Borehole dry during drilling between March 11 and 13, 2008. Water level measured in deep piezometer at elev. 177.74m on March 20, 2008. Water level measured in deep piezometer at elev. 178.27m on July 22, 2008. Water level measured in deep piezometer at elev. 178.12m on August 11, 2008. Water level measured in deep piezometer at elev. 177.87m on September 19, 2008. Water level measured in deep piezometer at elev. 177.74m on November 11, 2008. Water level measured in deep piezometer at elev. 177.28m 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: 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)	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										DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
				ELEV.	DEPTH						RECOVERY		R Q D. %	FRACT INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec					
				(m)	(m)						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	1																	
				148.20																		
		DOLOSTONE, fresh, medium strong, thinly laminated, fine grained, faintly porous with localized vugs, dark brown		33.07																		
34					2																	
		LIMESTONE, fresh, medium strong, thinly laminated, medium grained, faintly porous, grey to brown		146.89																		
				34.38																		
35		DOLOSTONE/LIMESTONE, fresh, medium strong, thinly laminated to bedded, very fine grained to fine grained, faintly porous, light grey to grey		146.47																		
				34.80																		
		DOLOSTONE/LIMESTONE, fresh, medium strong, laminated, fine grained, faintly porous, brown		145.55	3																	
36		END OF DRILLHOLE		35.72																		
				145.16																		
				36.11																		
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

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

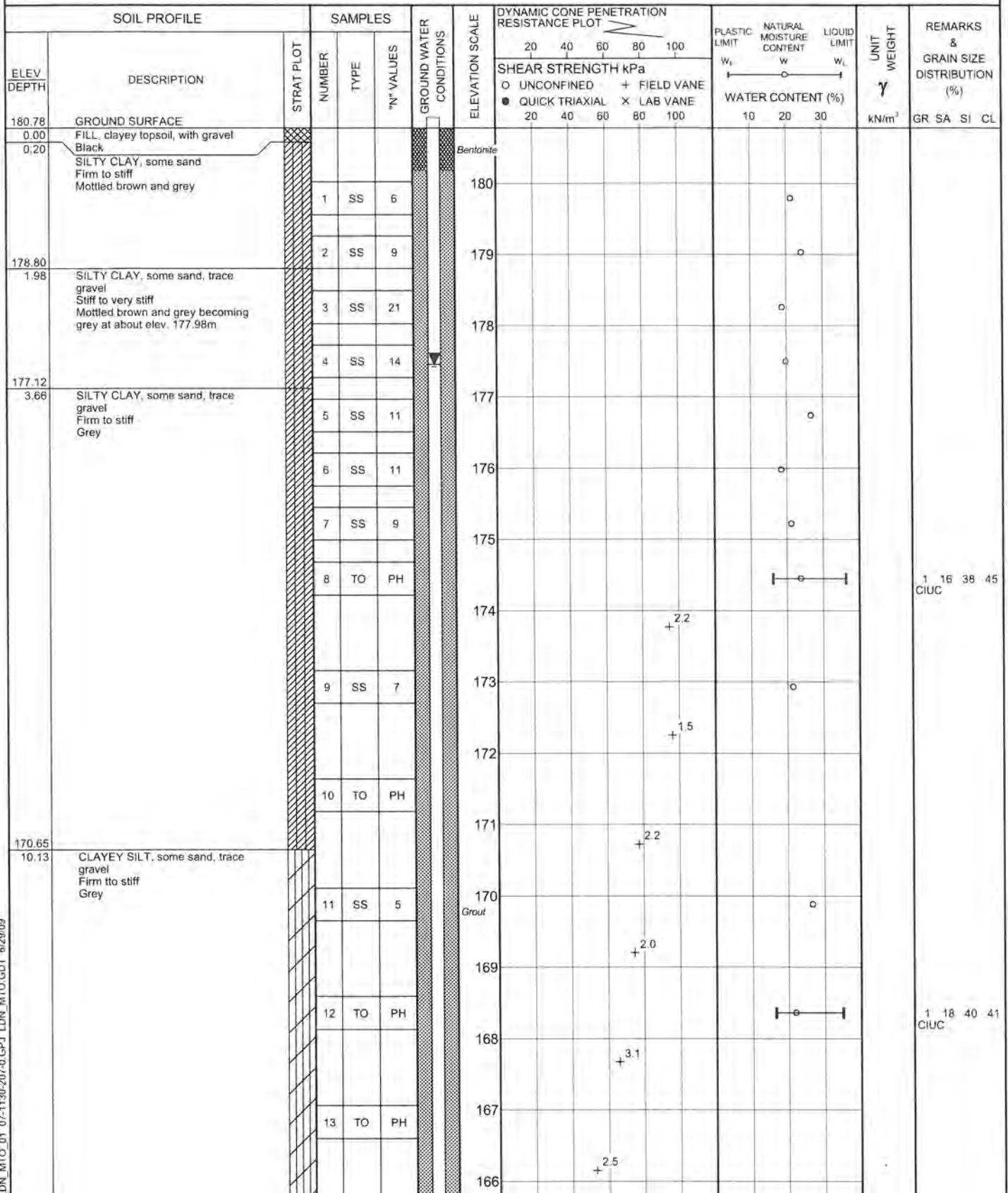
COMPILED BY BRS

DATUM GEODETIC

DATE

March 4, 2008 - March 10, 2008

CHECKED BY SJB



Continued Next Page

+ 3, x 3. Numbers refer to Sensitivity O 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

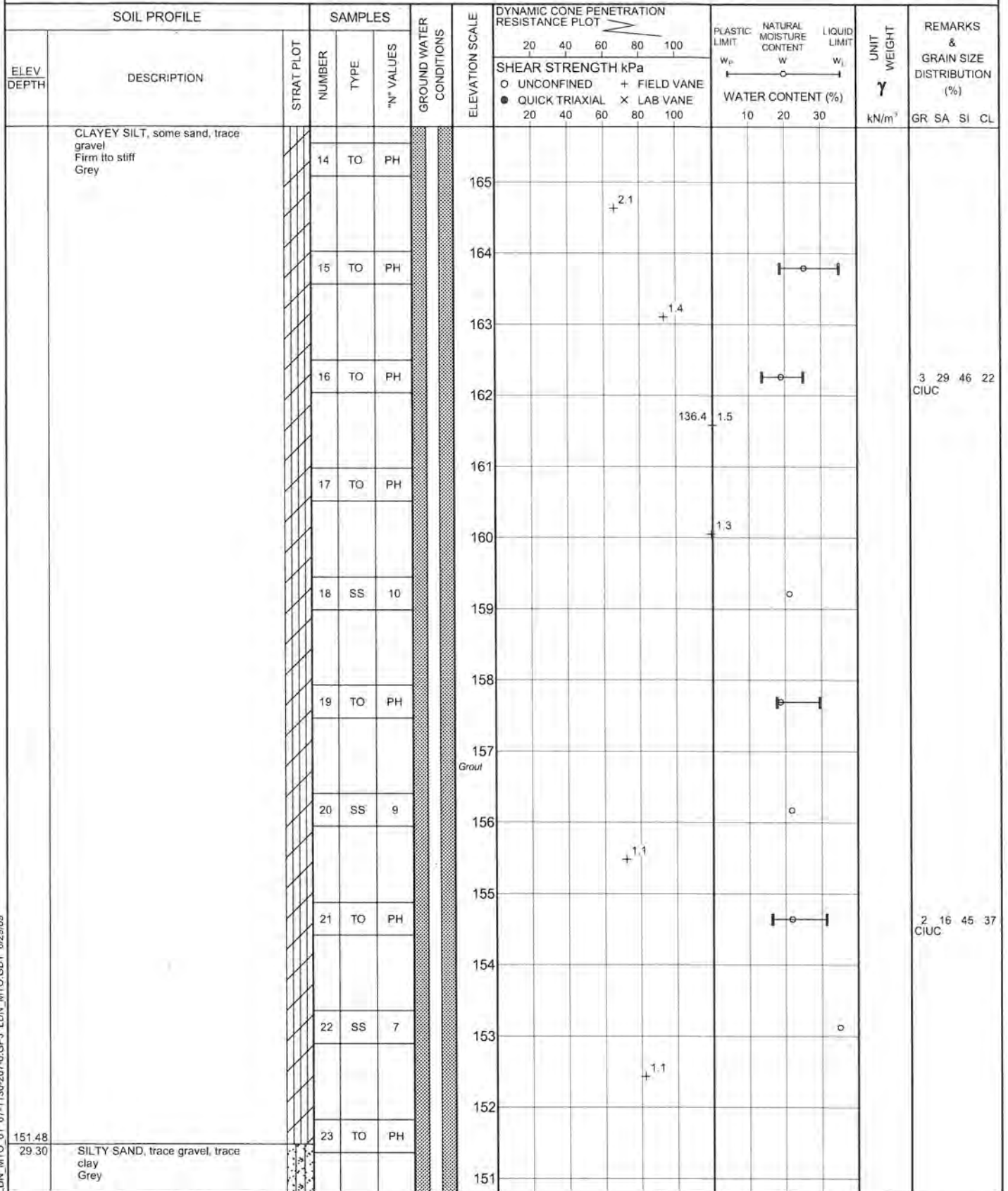
COMPILED BY BRS

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														
37.00															

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 6/29/09

PROJECT: 07-1130-207-0

RECORD OF DRILLHOLE: 129

SHEET 4 OF 4

LOCATION: N 4679625.1 E 332109.7




DRILLING DATE: March 4, 2008 - March 10, 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	ELEVATION											DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
				DEPTH (m)	RETURN					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	10 ⁻¹	10 ⁻²	10 ⁻³				
																			0 5 10 15 20			0 5 10 15 20
33		ROCK SURFACE		147.88																		
	MUD ROTARY NO ROCK CORE	DOLOSTONE/LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous, interbedded light and dark grey		32.90																		
34					1			147														
35		DOLOSTONE/LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous, interbedded medium and dark brown, stylolites at 35.64 m		146.21 34.57											JN, PL, SM	CI						
36					2				146													
37		DOLOSTONE/LIMESTONE, fresh, medium strong, thinly laminated, very fine grained, faintly porous, stylolitic, interbedded light and dark grey		144.56 36.22																		
		END OF DRILLHOLE		143.78 37.00										JN, IR, Ro	CI							
38																						
39																						
40																						
41																						
42																						
43																						
44																						
45																						
46																						
47																						

DEPTH SCALE

1:75



LOGGED: SG

CHECKED: *SG*

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							○ UNCONFINED + FIELD VANE						
0.00	FILL, clayey topsoil, with gravel							● QUICK TRIAXIAL × LAB VANE	20 40 60 80 100	10 20 30				
0.20	Black													
	SILTY CLAY, some sand													
	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 07-1130-207-0

RECORD OF BOREHOLE No 139

1 OF 4

METRIC

W.P. LOCATION N 4680787.5 :E 331599.3

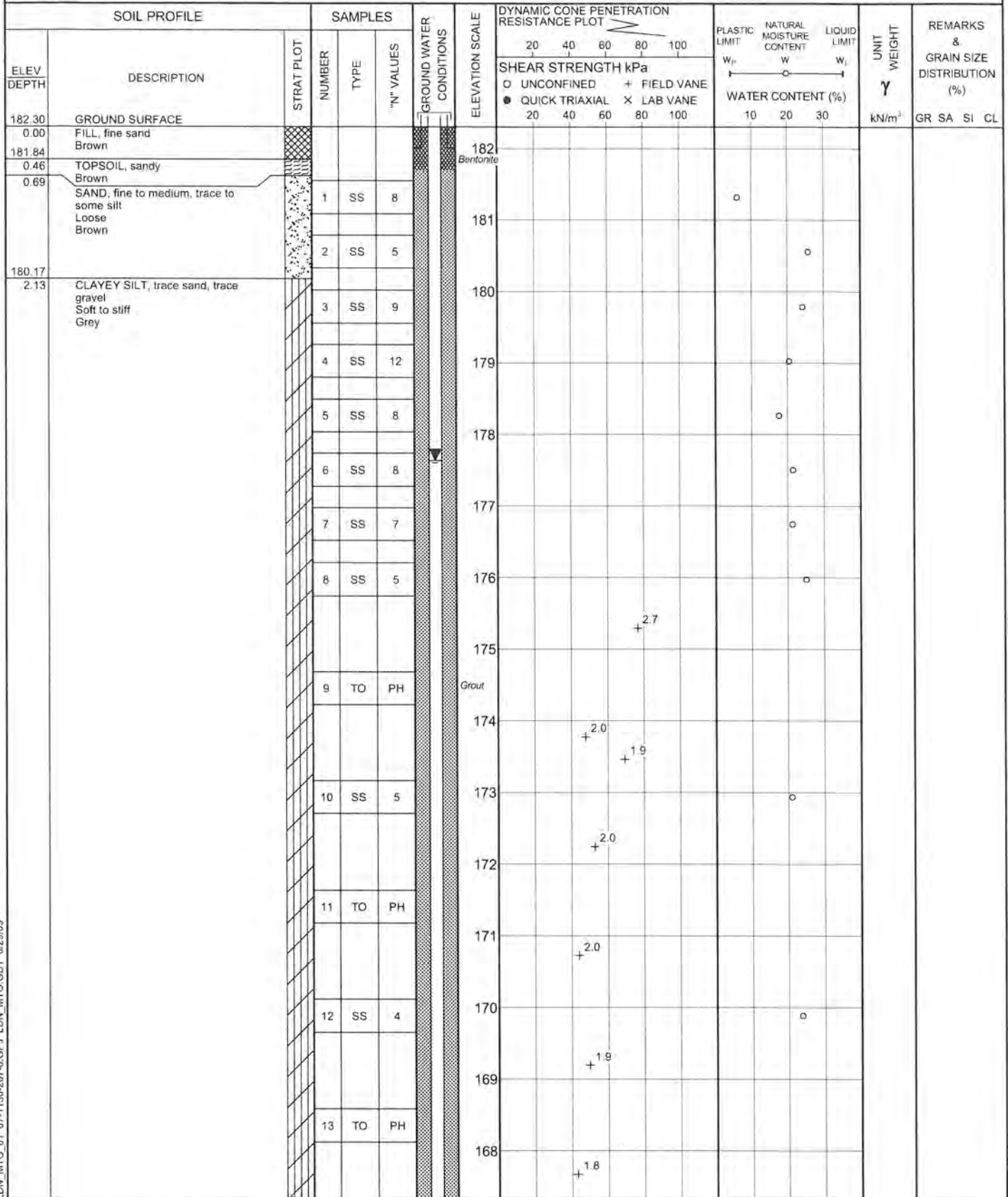
ORIGINATED BY SM

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

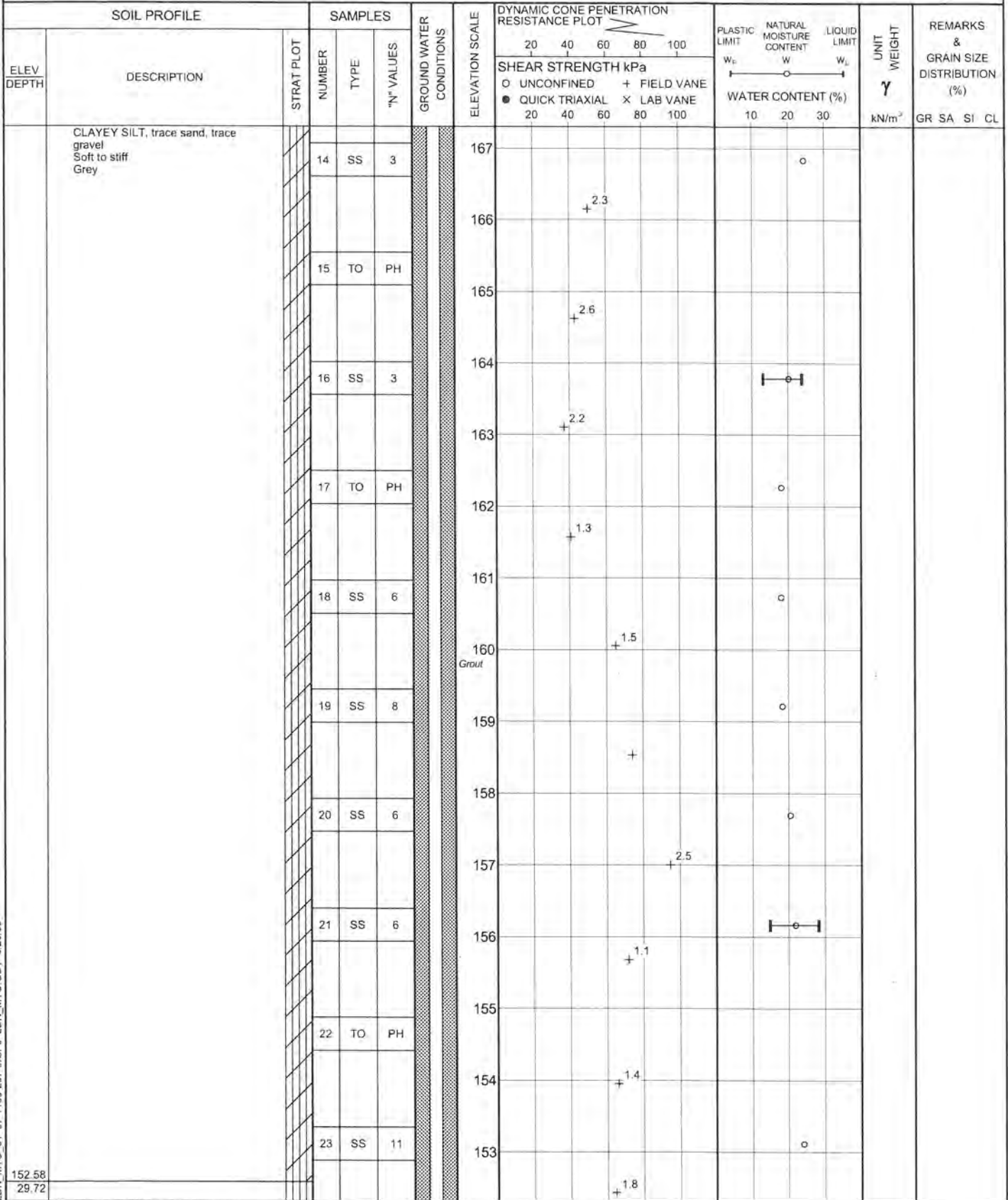
CHECKED BY *SSB*



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

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No 139		2 OF 4	METRIC
W.P. _____		LOCATION <u>N 4680787 5:E 331599.3</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>August 26, 2008 - August 27, 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 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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60 80 100						WATER CONTENT (%) 10 20 30
151.72	SILT, some clay Loose Grey						152								
30.58	SILTY CLAY Soft Grey		24	SS	3			Grout							0 0 40 60
151.06	SILT, some clay to CLAYEY SILT, trace sand, trace gravel Compact Grey							151							
31.24			25	SS	10		Bentonite								
149.53							150								
32.77	SANDY SILT, trace to some gravel, trace clay Dense Grey														
			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			Sand								
			29	NQ RC											
			30	NQ RC											
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 <small>NOTE: For additional abbreviations refer to list of abbreviations & symbols.</small>										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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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DEPTH SCALE

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LOGGED: SG

CHECKED: *SG*

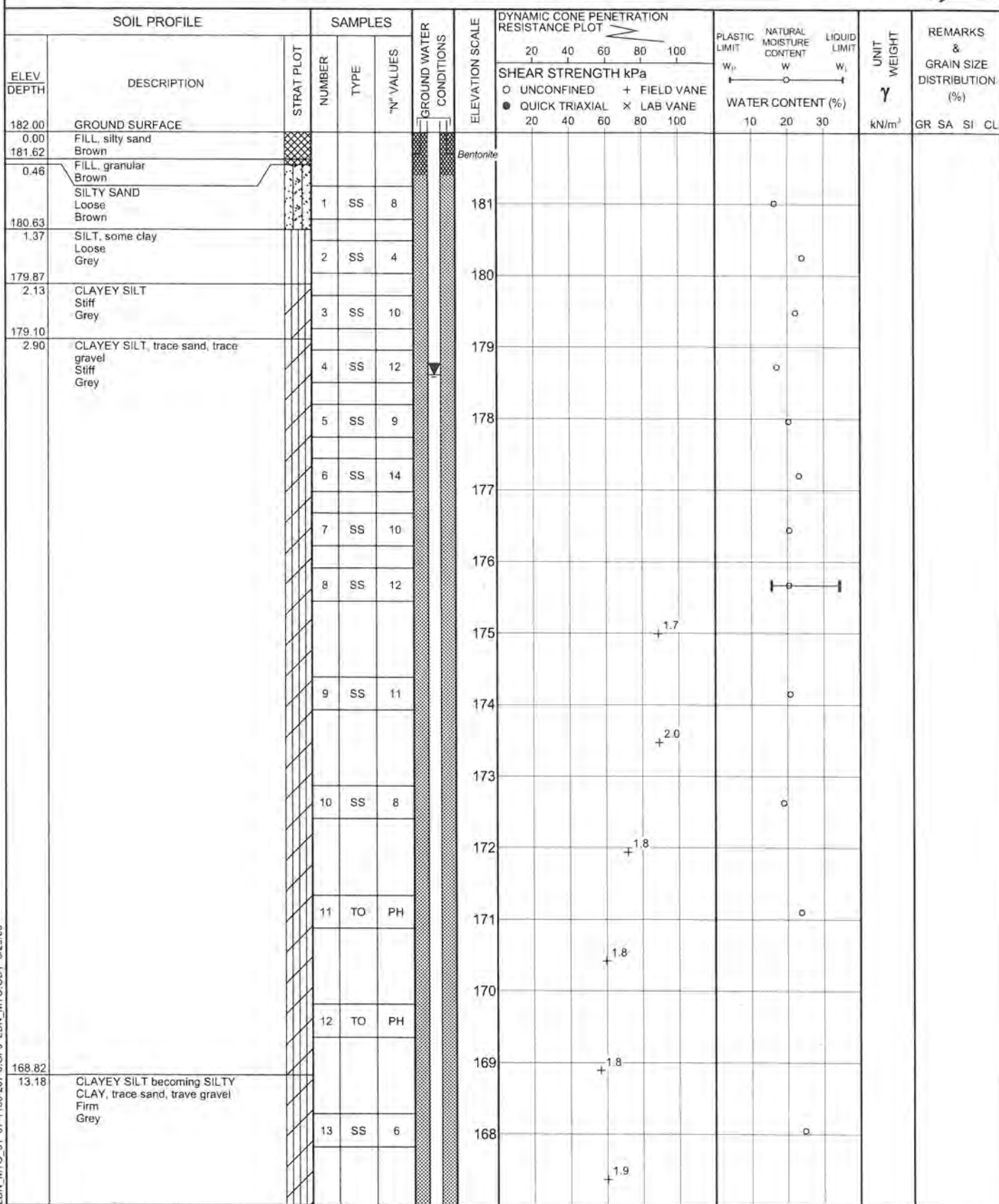
LDN ROCK 03 07-1130-207-0-ROCK GPJ GLDR LDN GDT 6/29/09 DATA INPUT: WDF

PROJECT 07-1130-207-0		RECORD OF BOREHOLE No 139A		1 OF 1	METRIC
W.P. _____		LOCATION N 4680787.5 ; E 331599.3		ORIGINATED BY SM	
DIST WEST HWY 401/3		BOREHOLE TYPE POWER AUGER, HOLLOW STEM		COMPILED BY BRS	
DATUM GEODETIC		DATE August 27, 2008		CHECKED BY <i>SJB</i>	

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									
182.30	FILL, fine sand Brown													
181.84	TOPSOIL, sandy Brown													
0.46														
0.69	SAND, fine to medium, trace to some silt. Loose Brown													
180.17	CLAYEY SILT, trace sand, trace gravel Soft to stiff Grey													
2.13														
173.00	END OF BOREHOLE													
9.30	Water level measured in shallow piezometer at elev. 177.94m on September 19, 2008.													
	Water level measured in shallow piezometer at elev. 178.62m on September 22, 2008.													
	Water level measured in shallow piezometer at elev. 180.31m 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 BOREHOLE No 140		1 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 <i>SLB</i>	

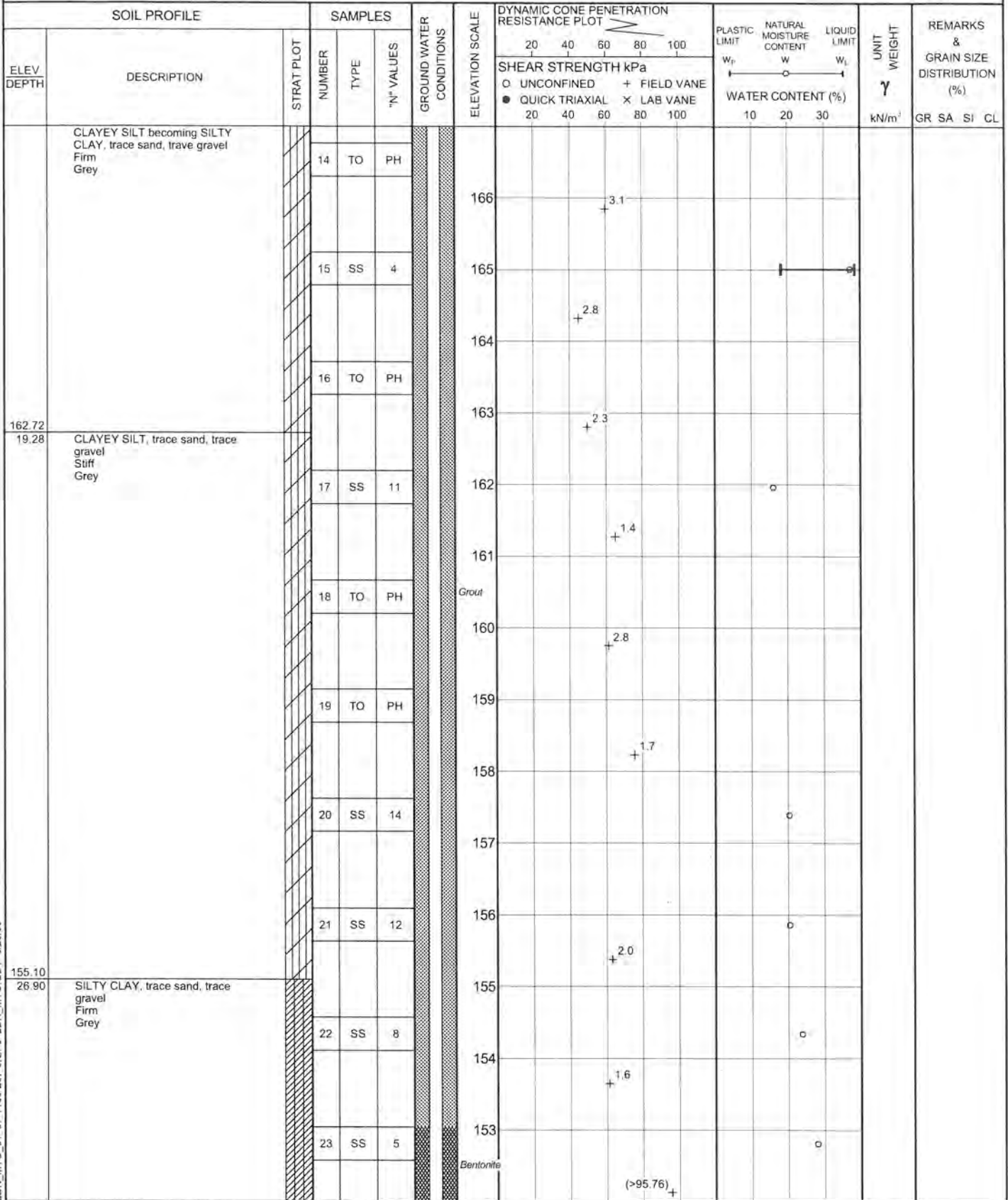


LDN MTO_01 07-1130-207-0.GPJ LDN_MTO.GDT 5/29/09

Continued Next Page

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

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 INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		DIPWILL CORE AXIS	TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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DEPTH SCALE

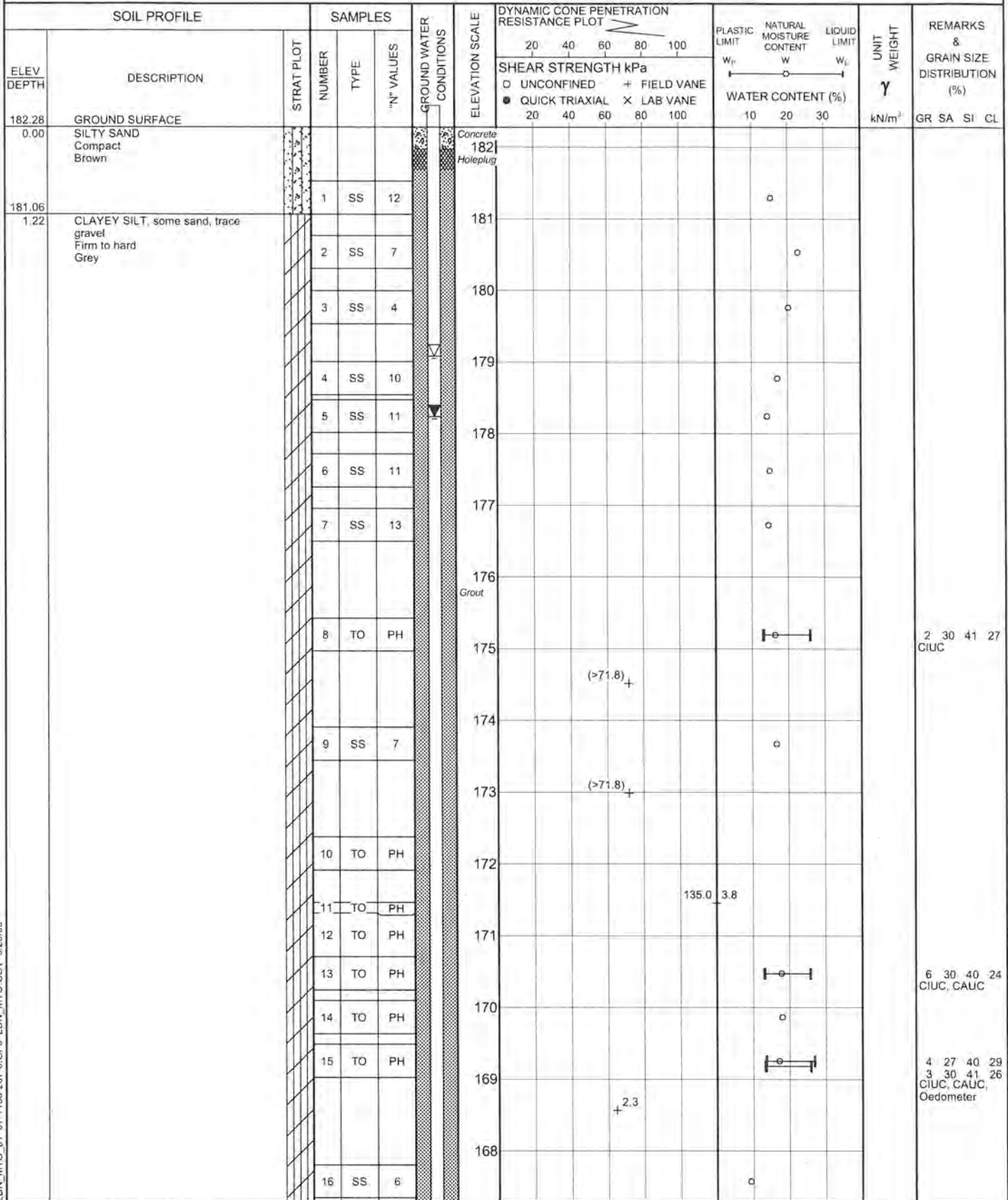
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LOGGED: SG

CHECKED: SYB

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							
							163		+ 1.7					
			19	TO	PH		162							
									+ 3.1					
			20	SS	11		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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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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 SJB	

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	"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						
							Bentonite 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 <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													WATER CONTENT (%)
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																
			2	SS	7																
			3	SS	7																
185.10																					
2.90	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Very stiff Brown becoming grey below about elev. 182.8m																				
			4	SS	3																
			5	SS	25																
			6	SS	34																
			7	SS	18																
			8	SS	12																
			9	SS	6																
179.92																					
8.08	END OF BOREHOLE																				
	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

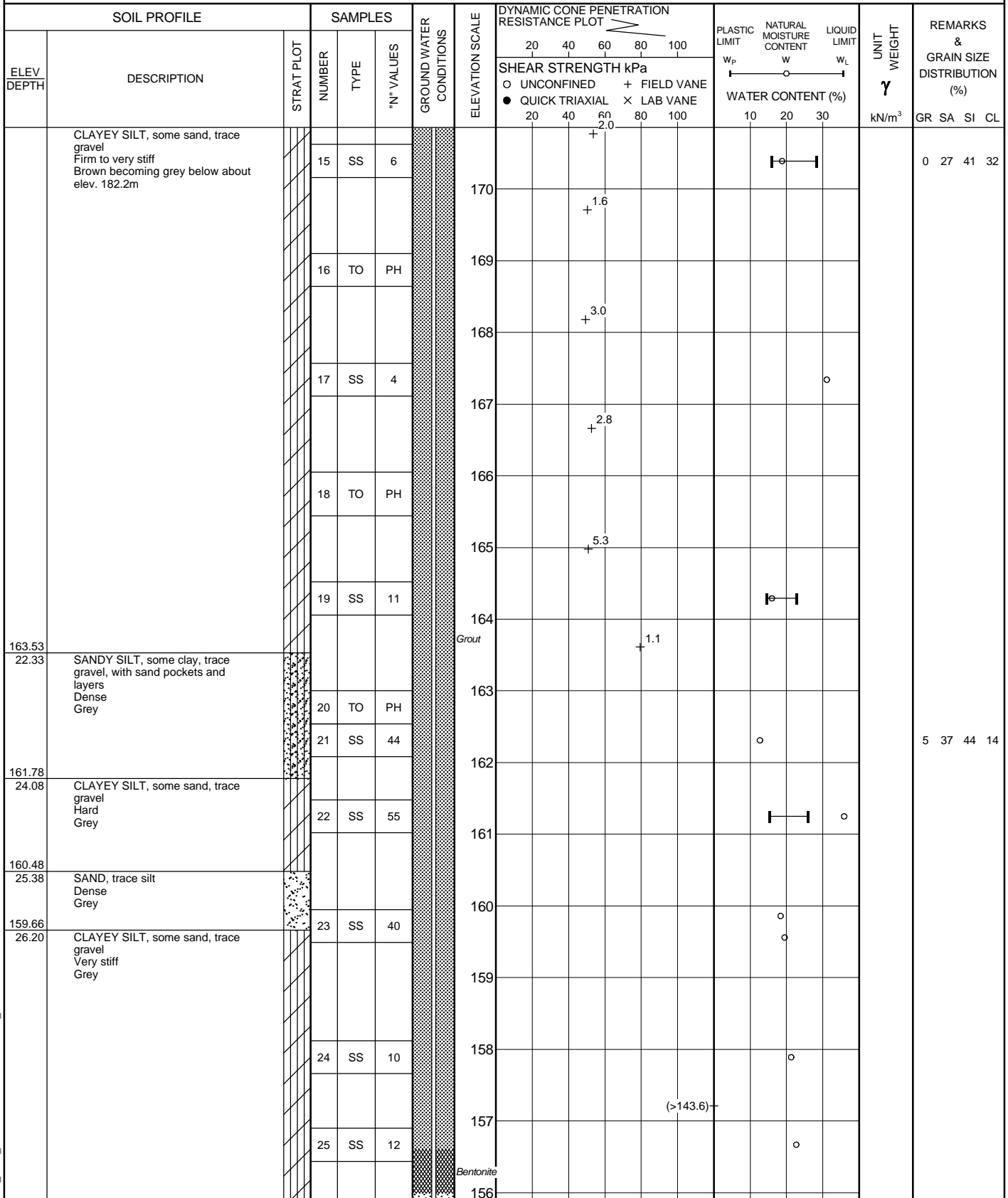
DATUM GEODETIC DATE November 30, 2009 - December 1, 2009 CHECKED BY _____

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Continued Next Page

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

PROJECT 09-1132-0080		RECORD OF BOREHOLE No 305		2 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 _____	



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 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	-		98	79	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.		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.												HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
				DEPTH (m)	FLUSH					RECOVERY			R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA			TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
										TOTAL CORE %	SOLID CORE %	DIP w.r.t CORE AXIS			TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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31	MUD ROTARY NO ROCK CORE	ROCK SURFACE		155.10					155																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

DEPTH SCALE

1 : 75

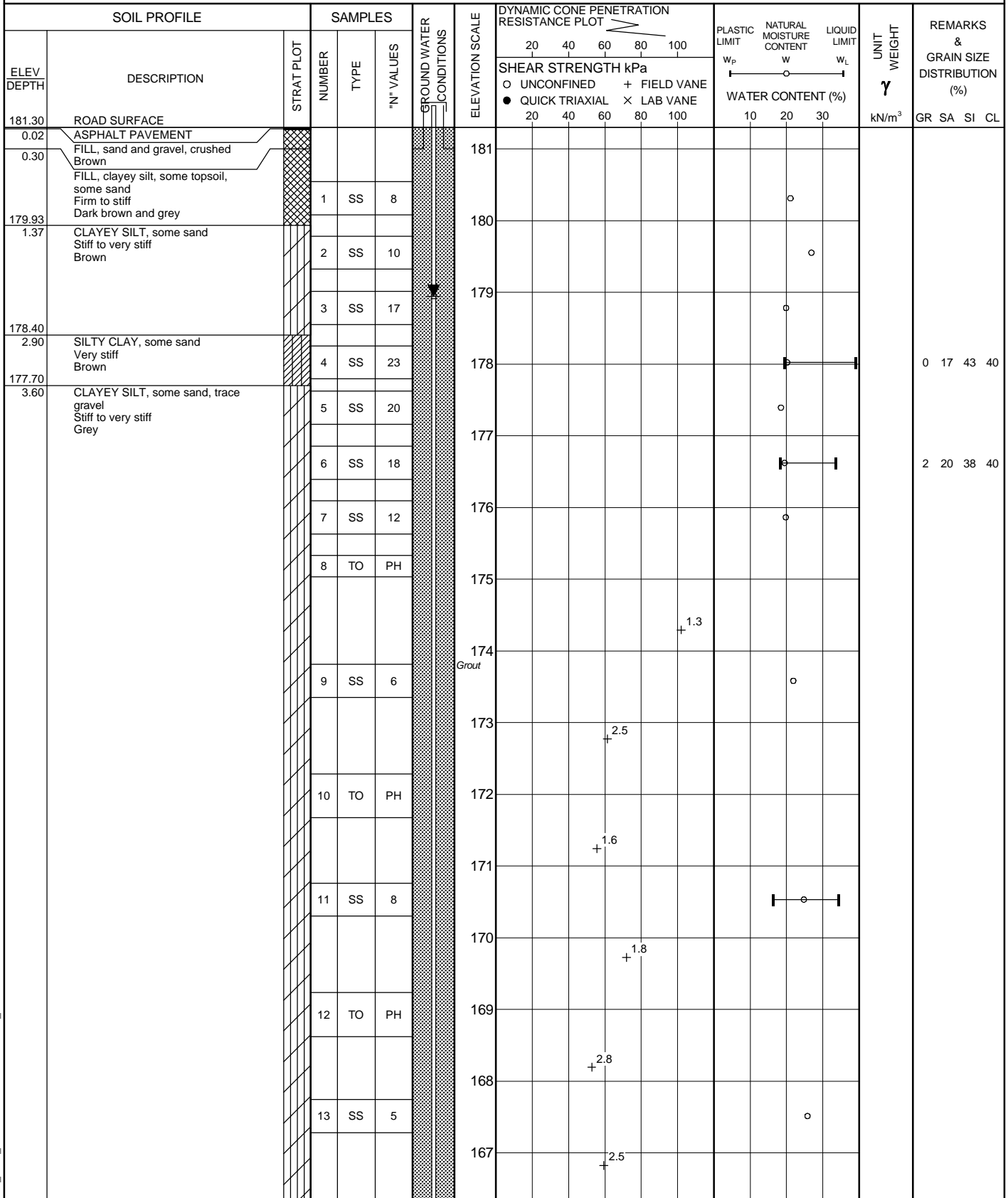


LOGGED: SG

CHECKED:

LDN_ROCK_03 09-1132-0080-ROCK.GPJ GLDR_LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>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 _____	

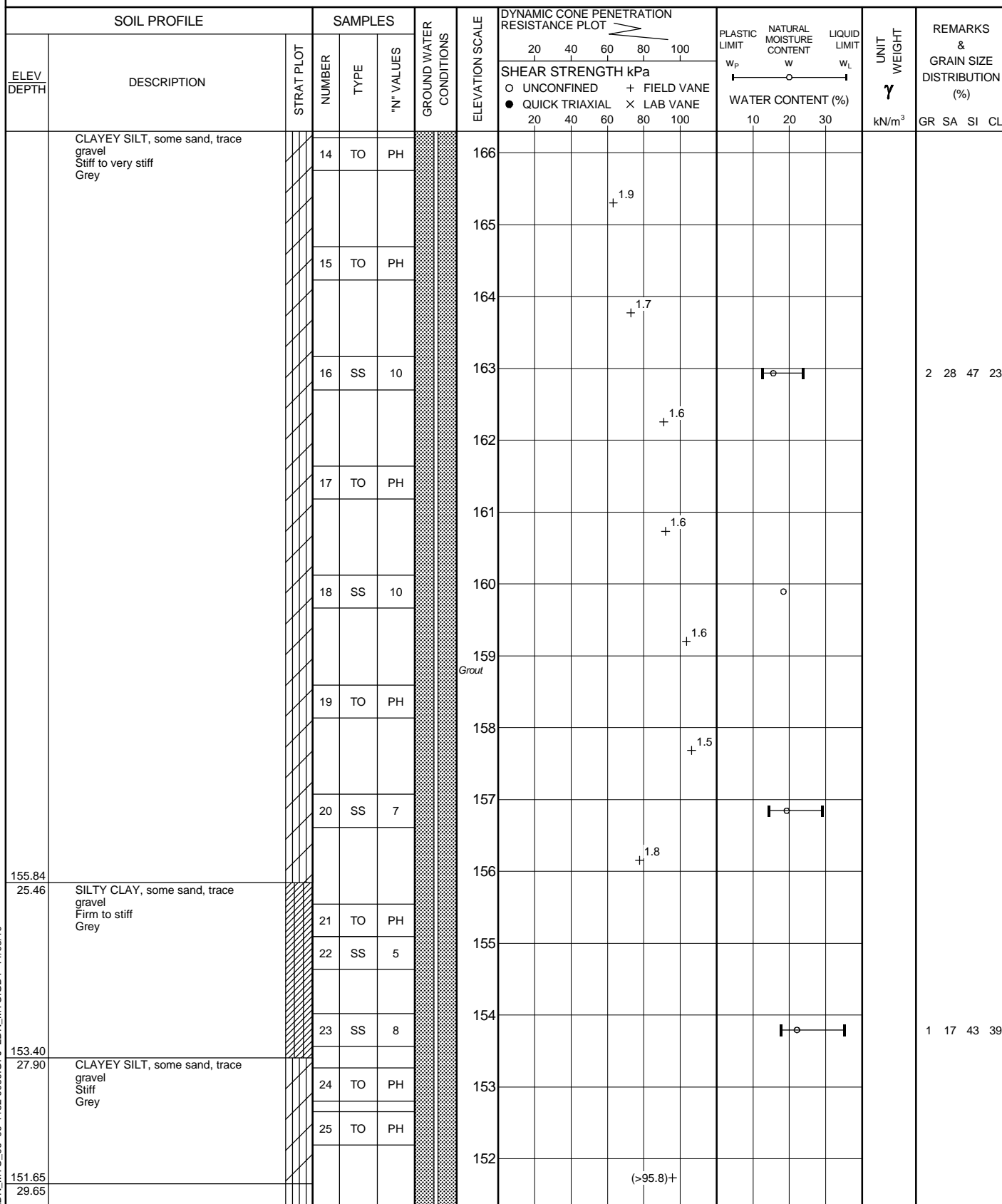


LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

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 _____			



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 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						SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		
150.05	SILT, some clay, some sand, trace gravel Compact Grey		26	SS	29															
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		TYPE AND SURFACE DESCRIPTION				2	4	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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DEPTH SCALE

1 : 75

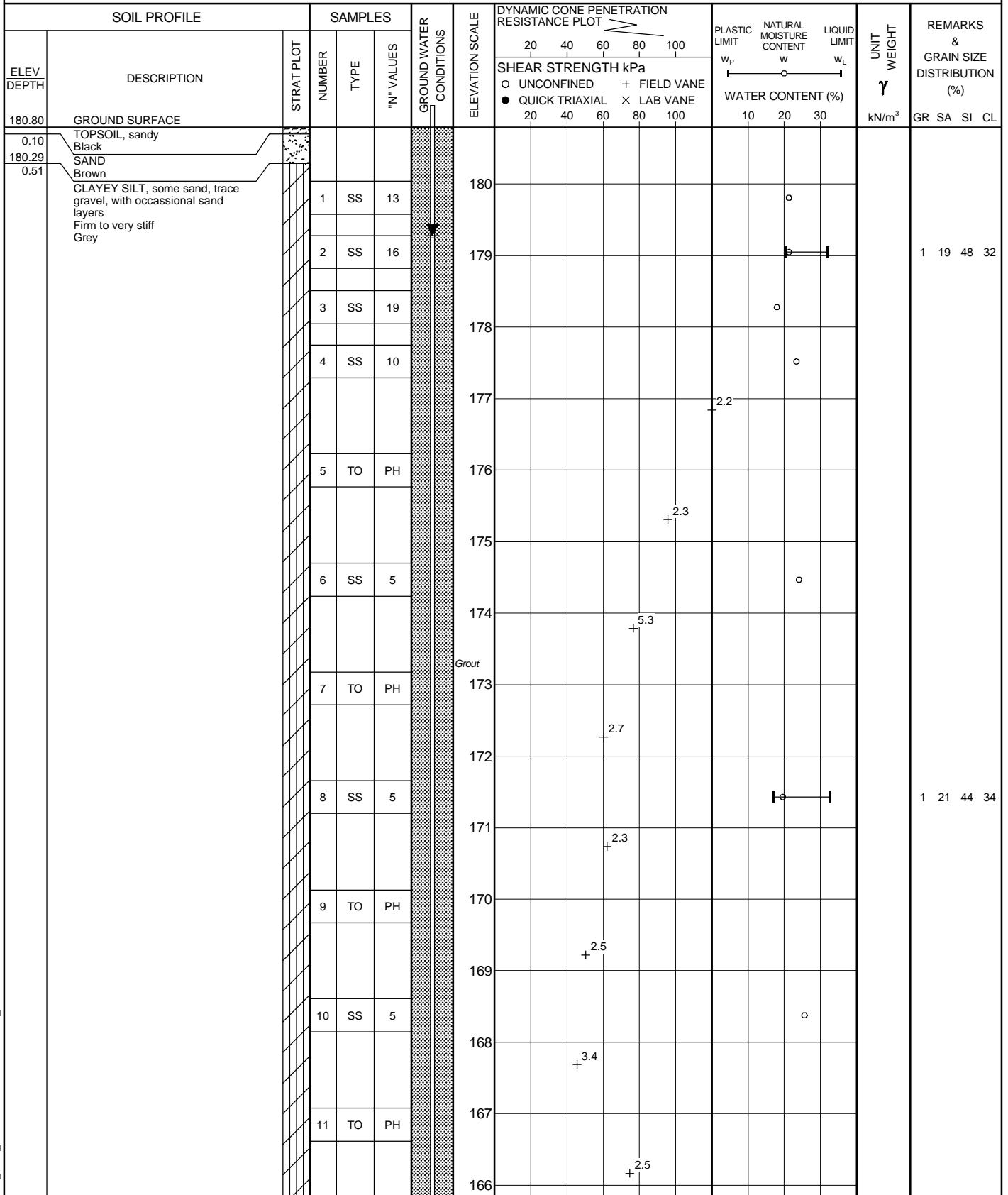


LOGGED: SG

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 _____			

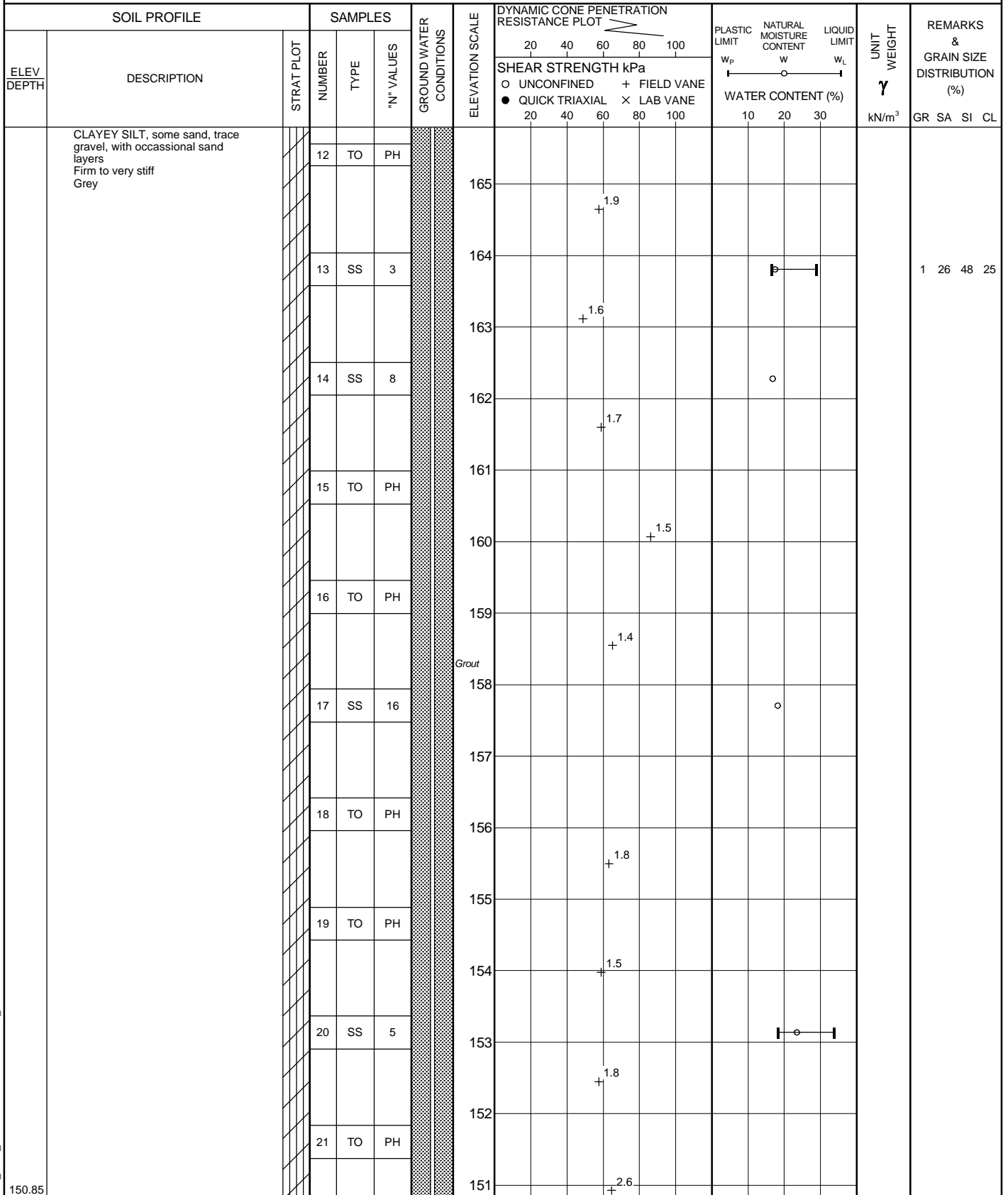


LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

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						× LAB VANE			
29.95	SANDY SILT, some clay, trace to some gravel Compact to very dense Grey		22	SS	17		Grout	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		Sand	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.						Piezometer														
37.49																					

PROJECT: 09-1132-0080

RECORD OF DRILLHOLE: 325

SHEET 4 OF 4

LOCATION: N 4679787.7 ;E 331972.9

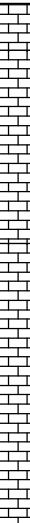

DRILLING DATE: December 16, 2009 - December 17, 2009

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.	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.	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
										TOTAL CORE %	SOLID CORE %			DIP w.r.t. CORE AXIS					
										80 60 40 20	80 60 40 20	80 60 40 20	5 10 15 20	0 30 60 90					
		ROCK SURFACE		148.49															
33	MUD ROTARY NO. ROCK CORE	LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous, grey		32.31	1				148						Broken core from 33.31m to 33.37m JN, CU, SM				
		148.03																	
		32.77																	
34		LIMESTONE, fresh, medium strong, laminated, fine grained, faintly porous, with occasional pits, brown			2				147										
35		LIMESTONE, fresh, medium strong, weakly laminated, fine to very fine grained, faintly porous, light grey to grey-brown, lower 0.3m fossiliferous		146.11 34.69	3				146										
36					4				145						SHR, , Ro Go				
37									144										
38		END OF DRILLHOLE		143.31 37.49															
39																			
40																			
41																			
42																			
43																			
44																			
45																			
46																			
47																			

DEPTH SCALE

1 : 75

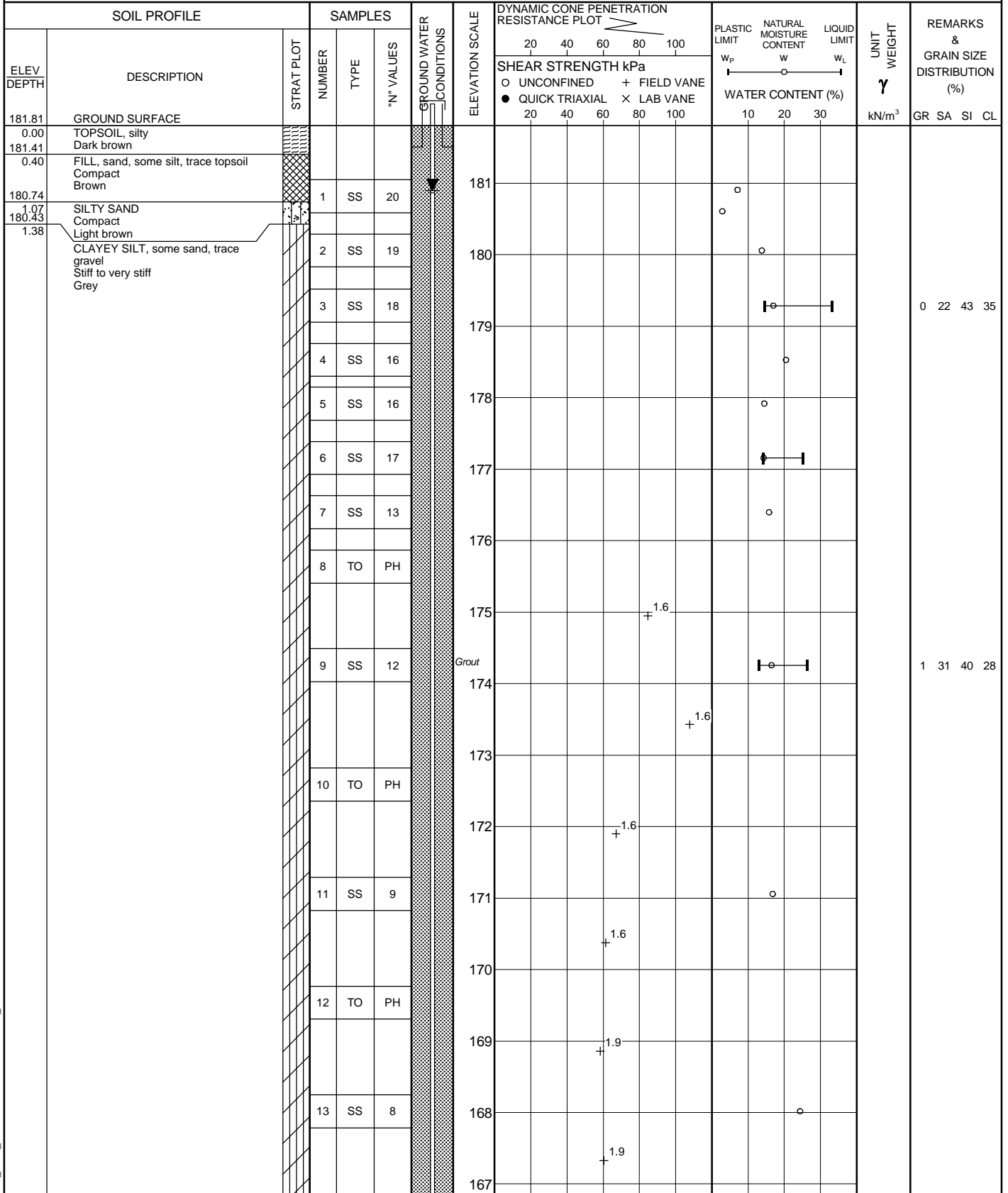


LOGGED: SG

CHECKED:

LDN_ROCK_03 09-1132-0080-ROCK.GPJ GLDR LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT 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 _____

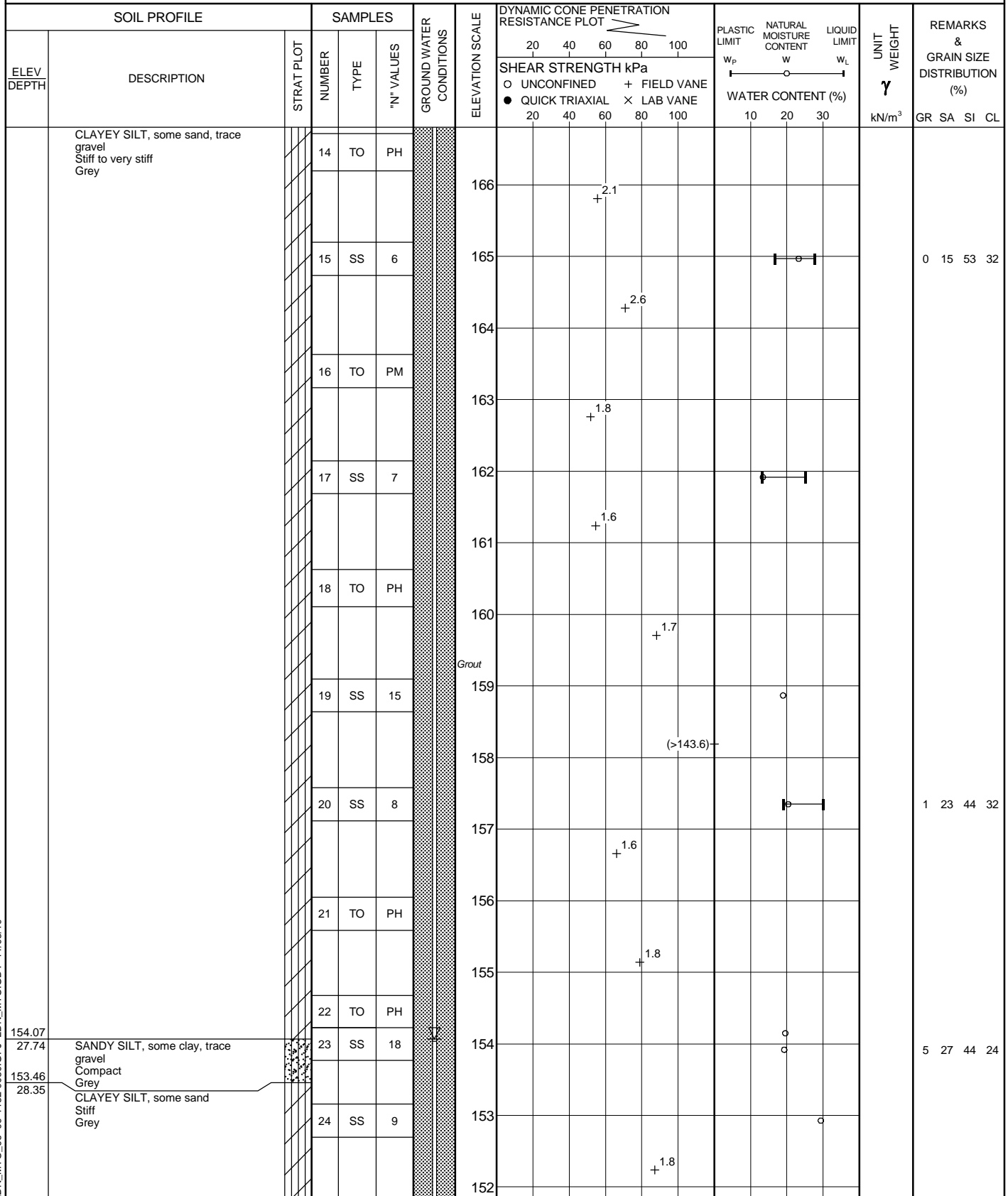


LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

Continued Next Page

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

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 334		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 NATURAL LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
								20 40 60 80 100	○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × LAB VANE	W _p W W _L					
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		28	SS	50/ 25mm											
33.23	(FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		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		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: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-3

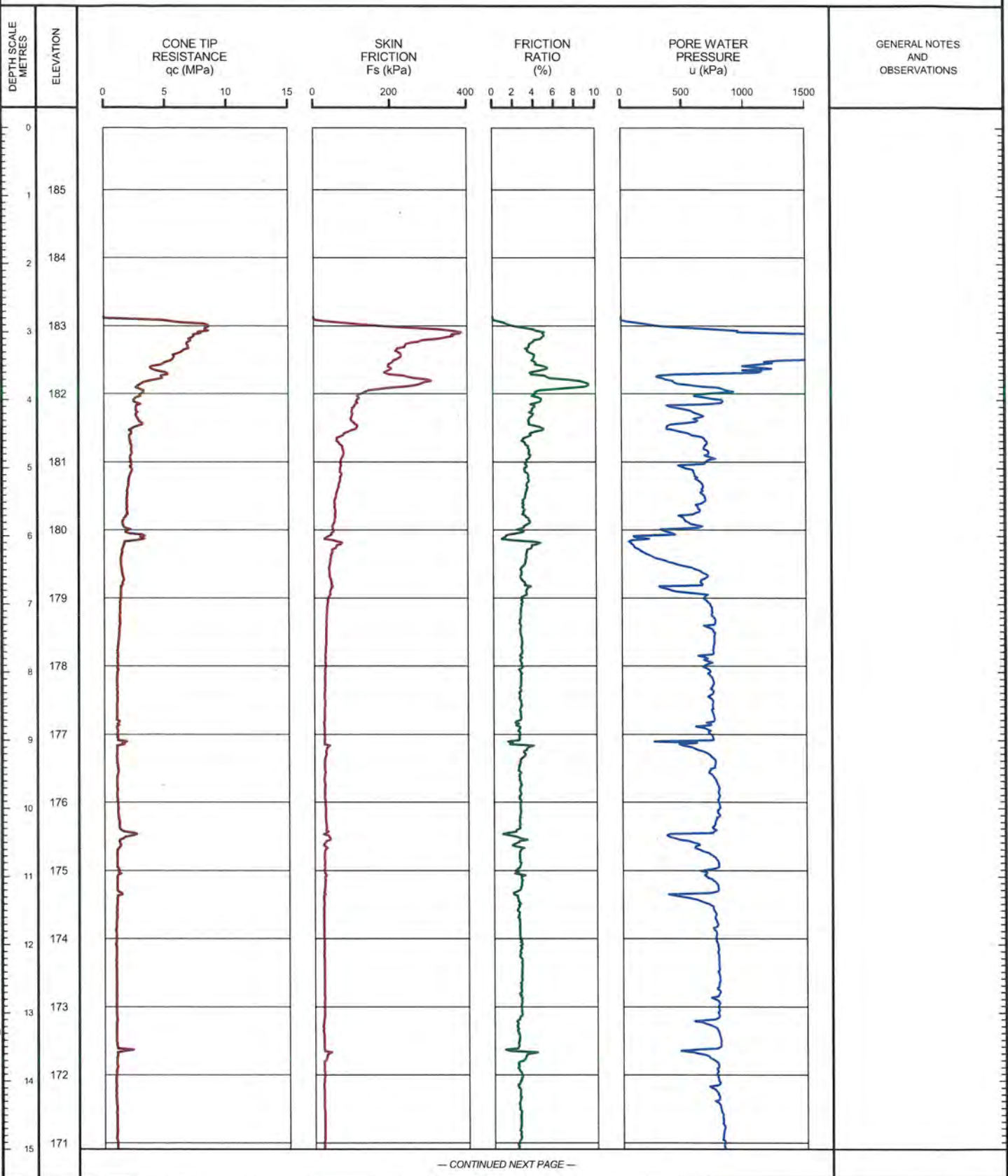
SHEET 1 OF 2

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

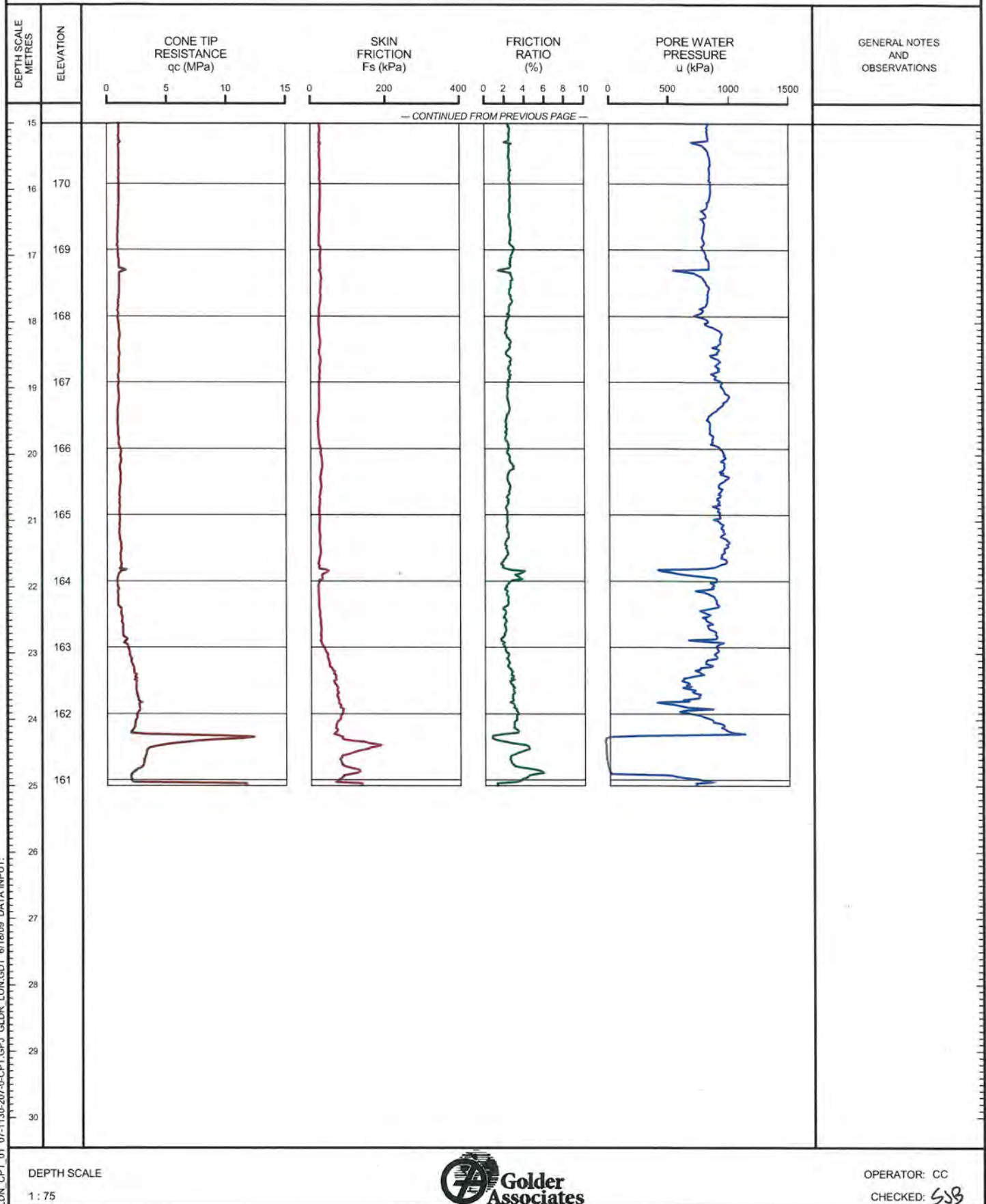
SHEET 2 OF 2

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



PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-5

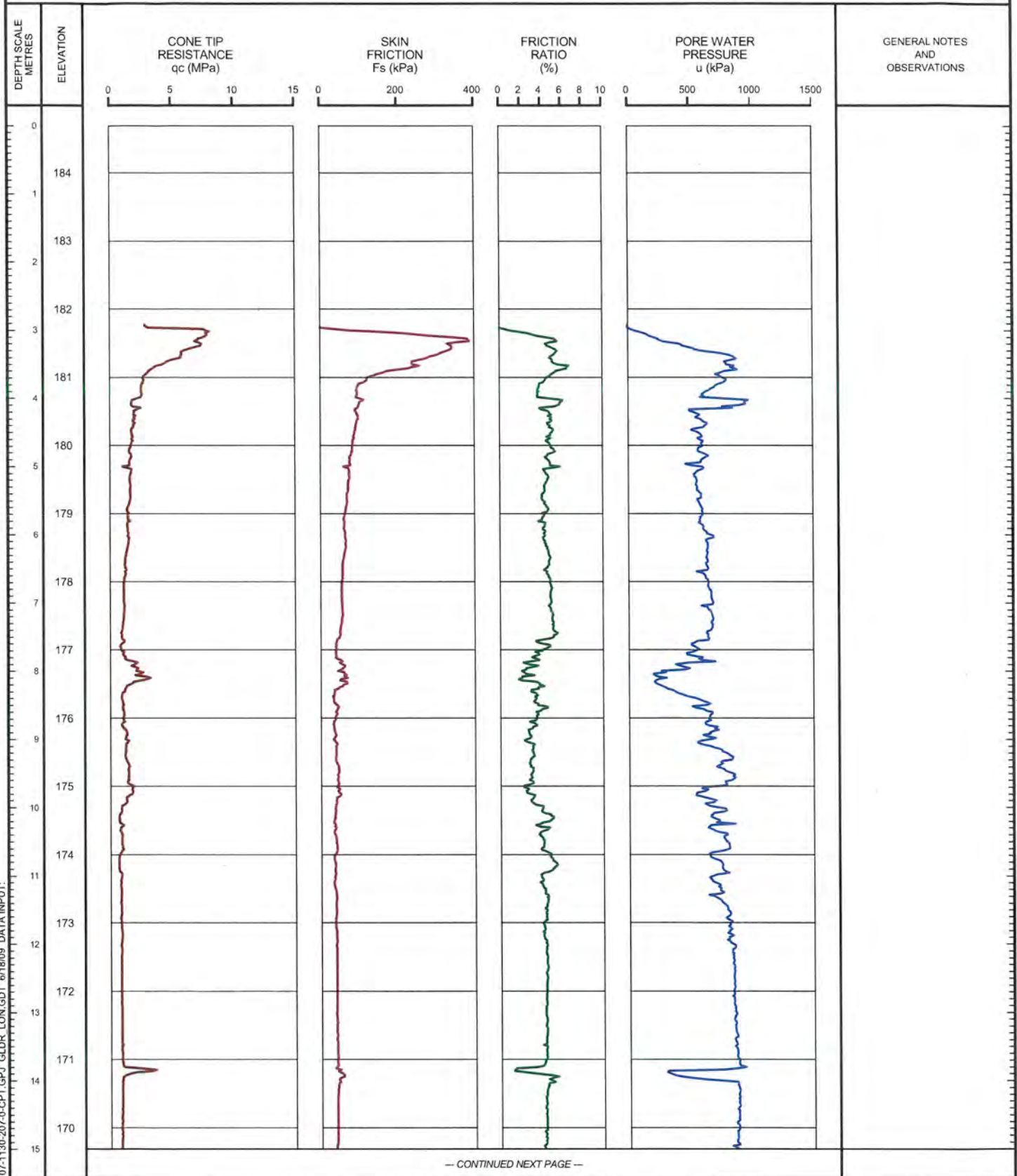
SHEET 1 OF 2

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

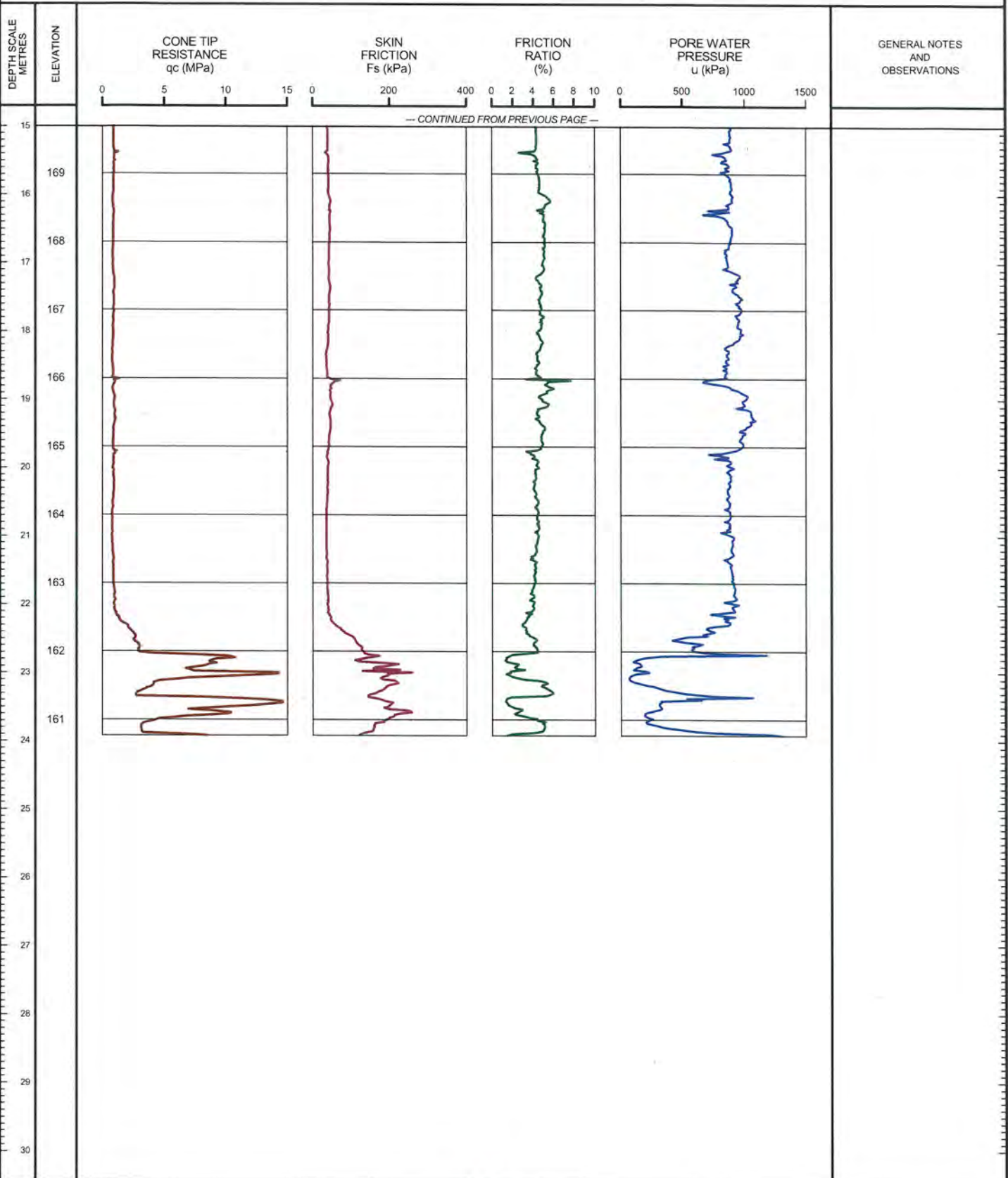
SHEET 2 OF 2

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-6

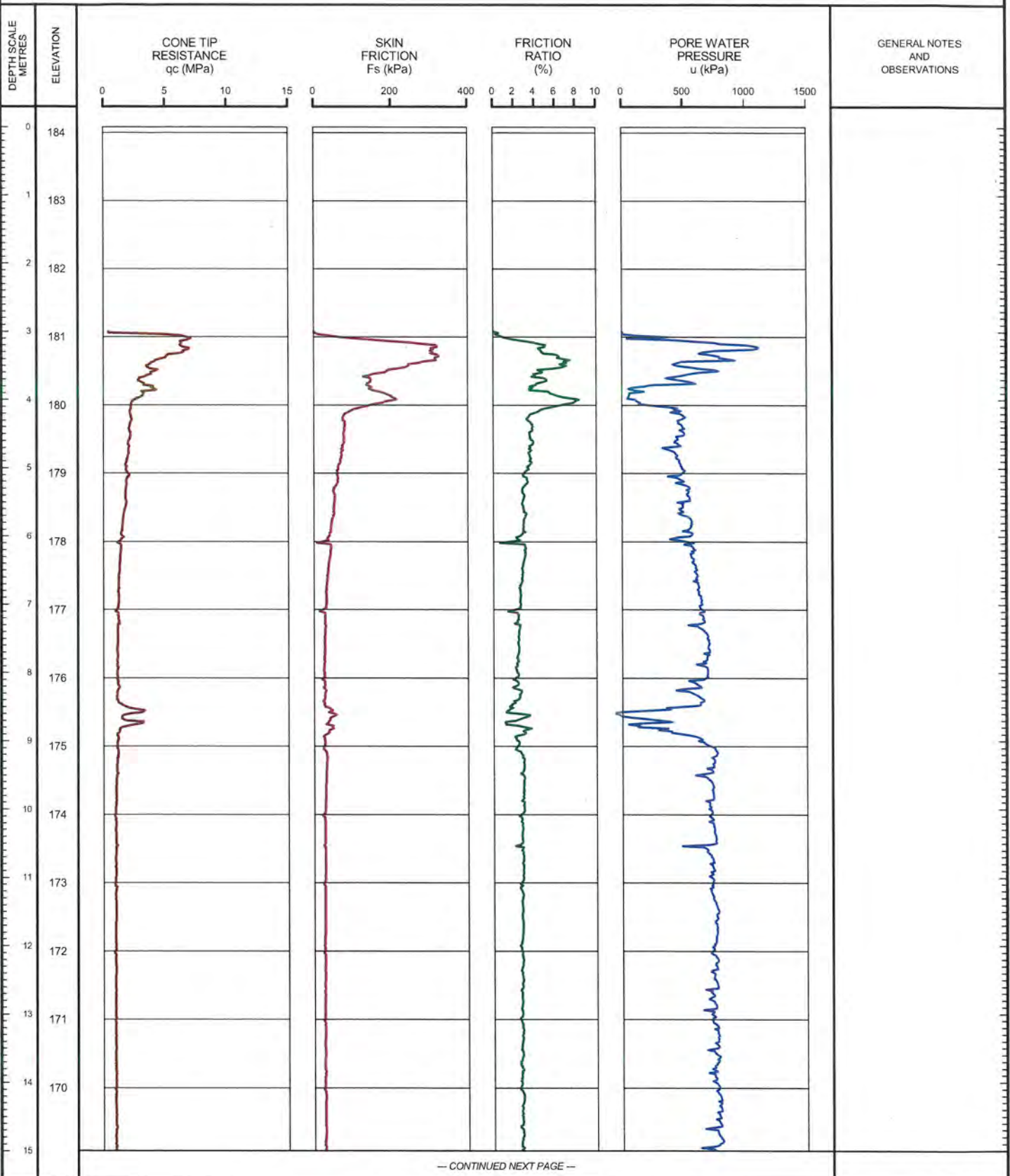
SHEET 1 OF 2

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

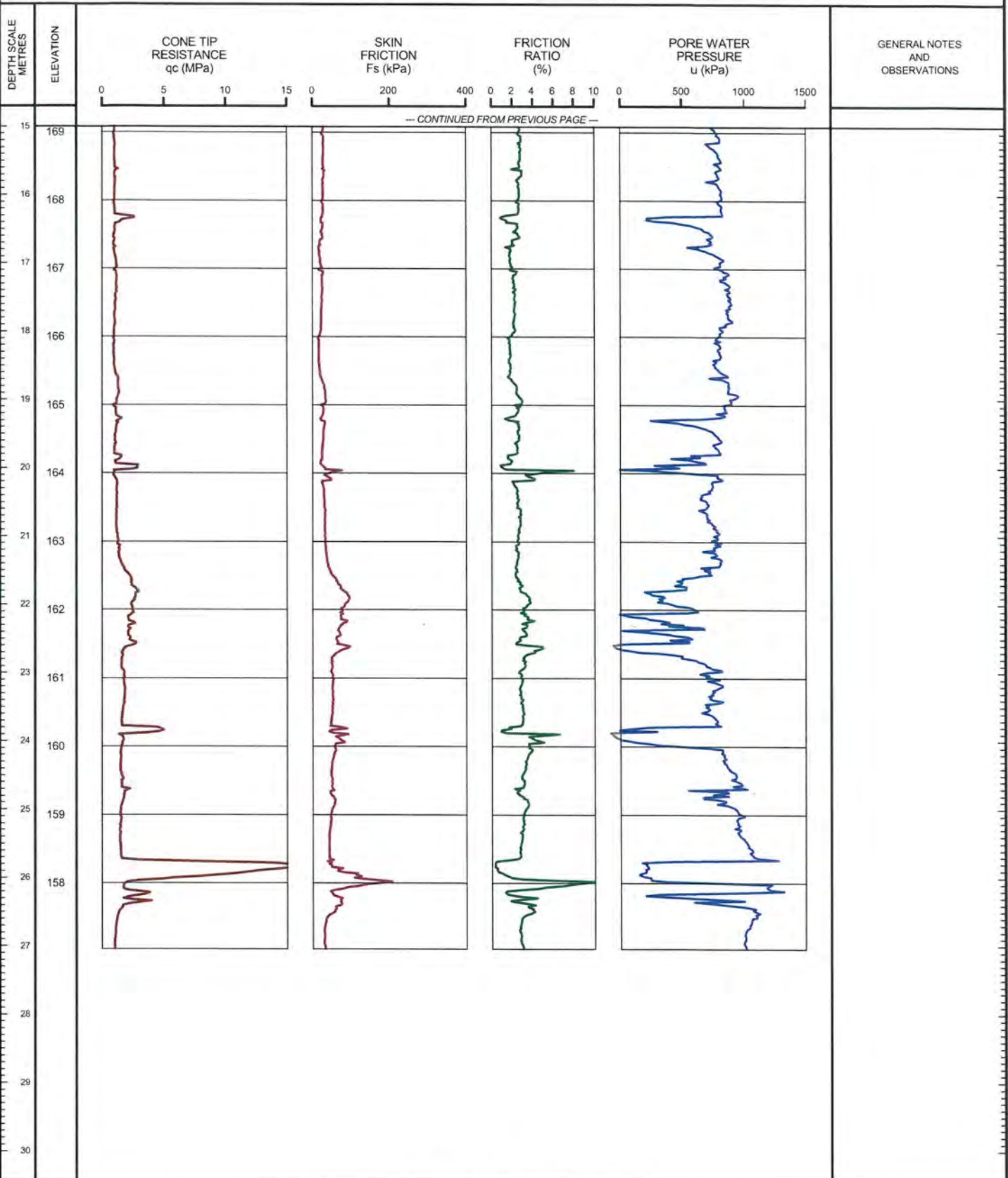
SHEET 2 OF 2

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-7

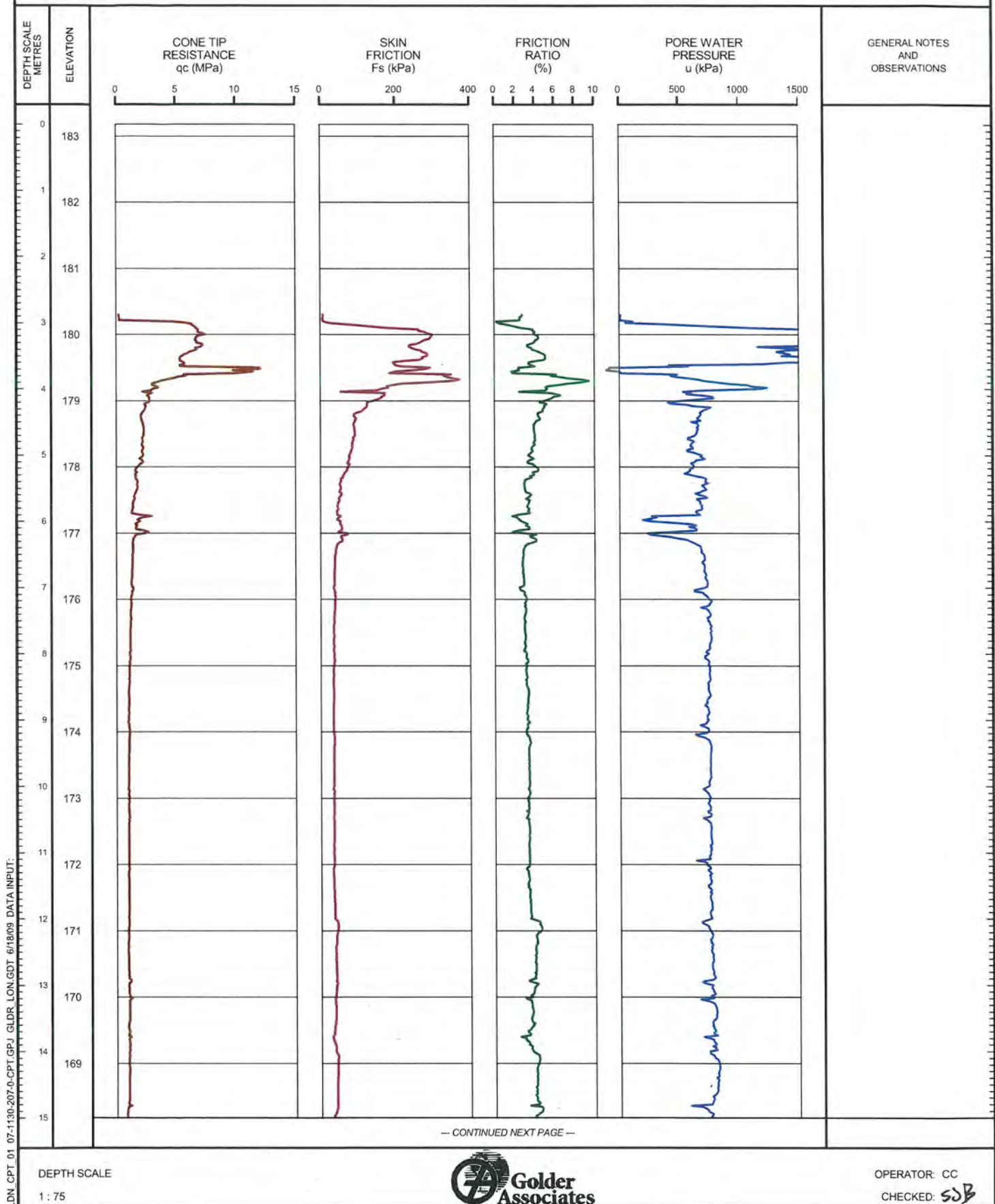
SHEET 1 OF 2

LOCATION: N 4678844.0 ;E 333327.0

TEST DATE: November 12, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 2.90m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-7

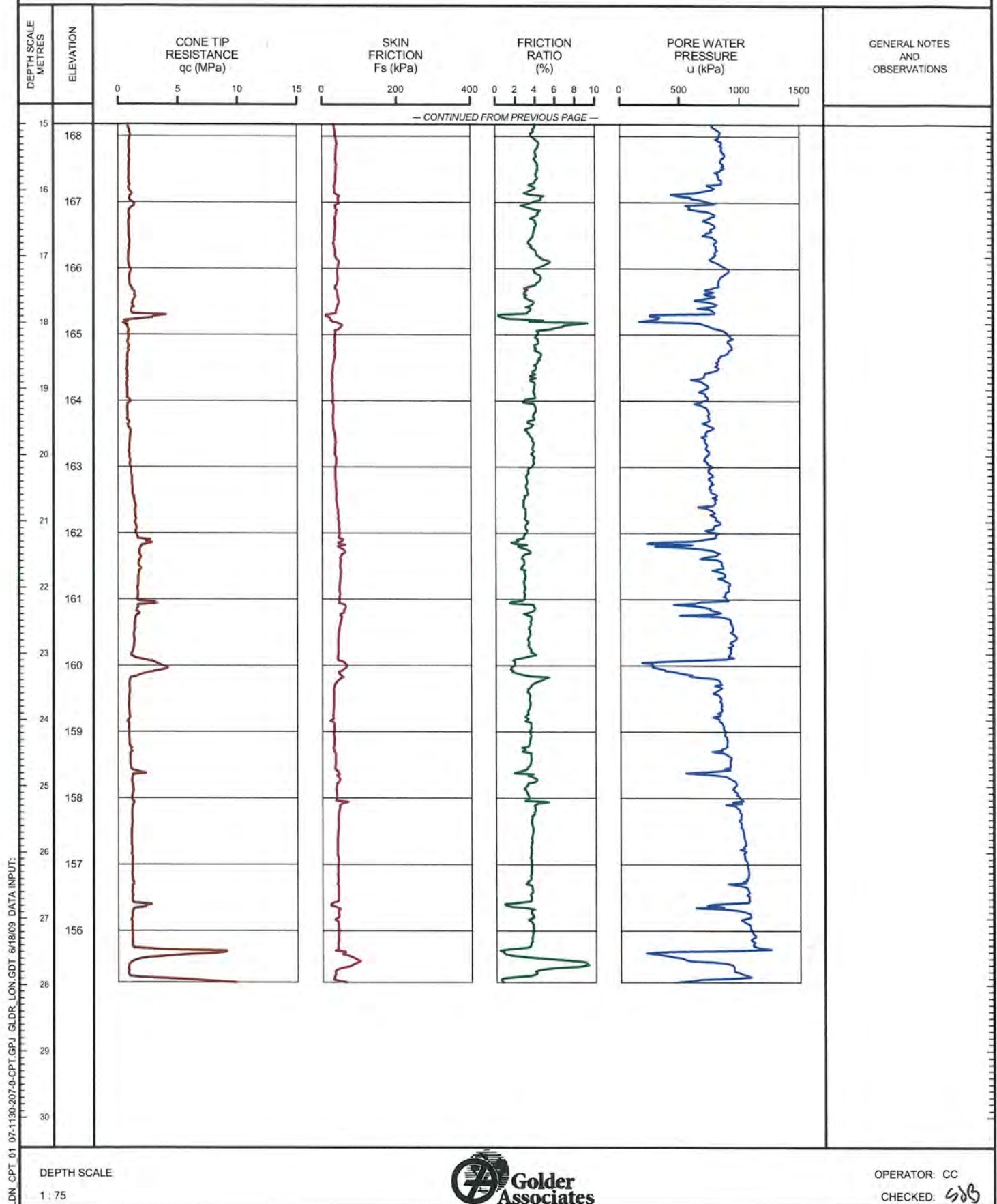
SHEET 2 OF 2

LOCATION: N 4678844.0 :E 333327.0

TEST DATE: November 12, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 2.90m 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: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-8

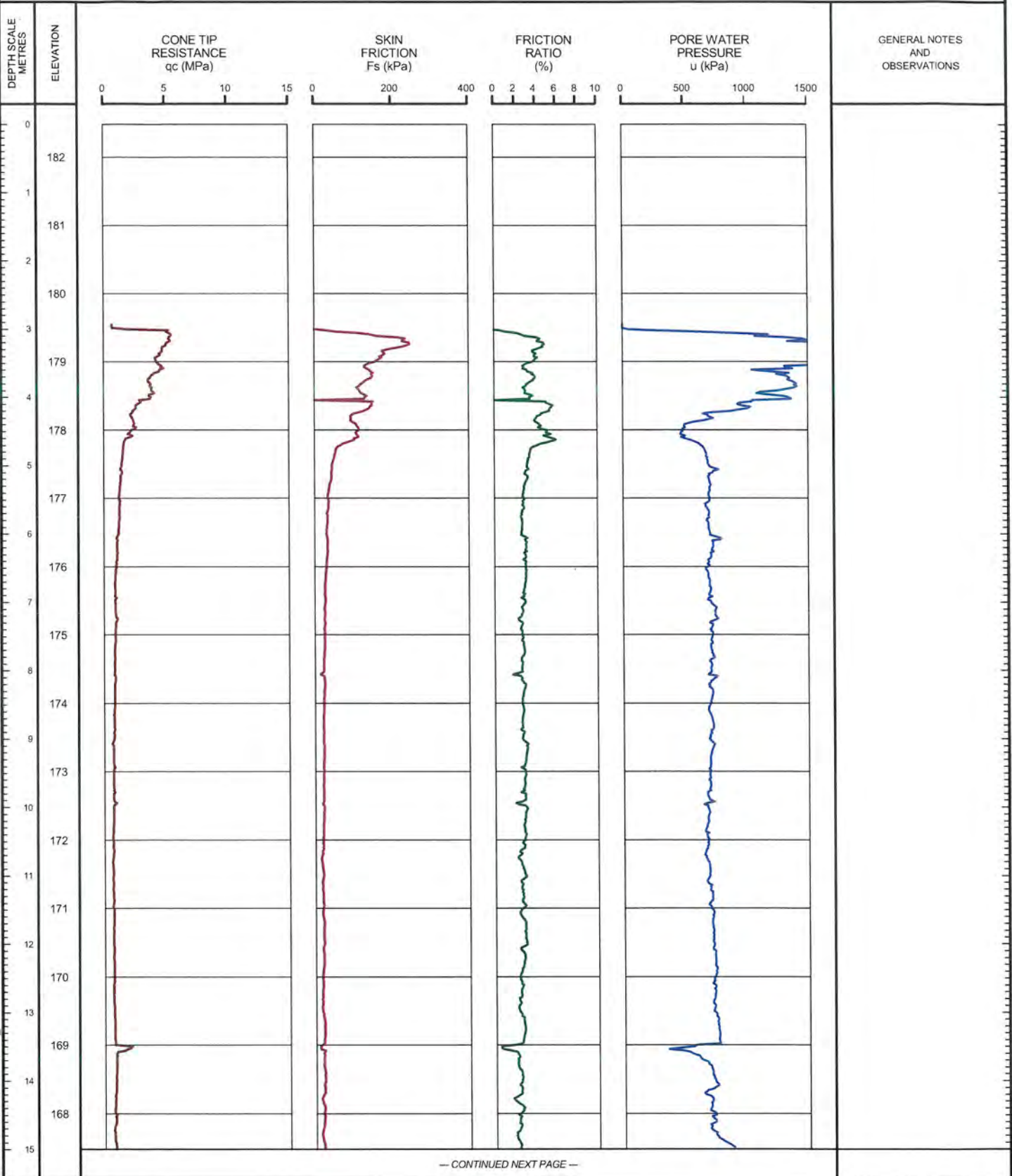
SHEET 1 OF 2

LOCATION: N 4678967.0 :E 333109.0

TEST DATE: November 11, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 2.95m 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 CONE PENETRATION TEST CPT-8

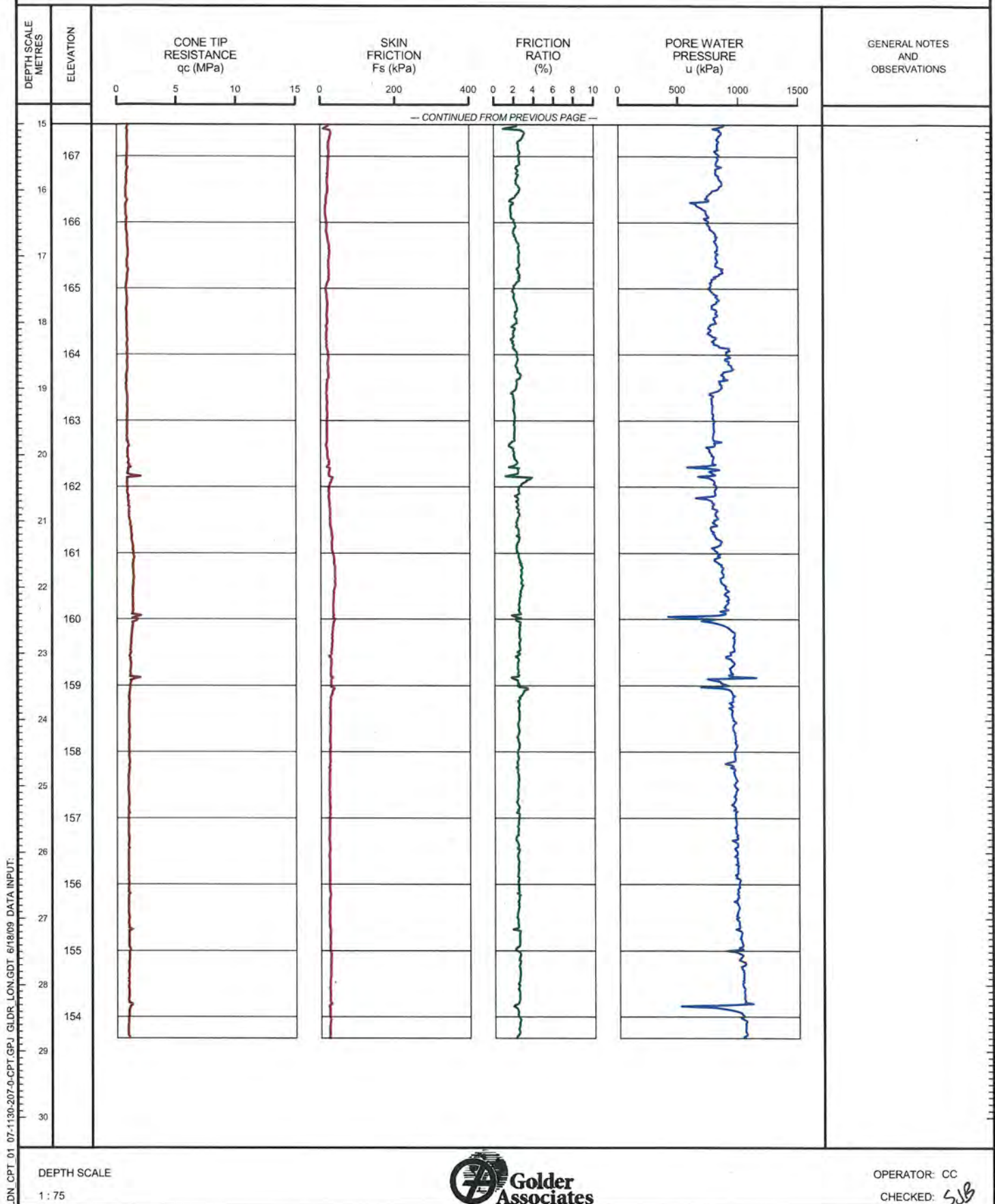
SHEET 2 OF 2

LOCATION: N 4678967.0 ; E 333109.0

TEST DATE: November 11, 2006

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 2.95m 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: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-10

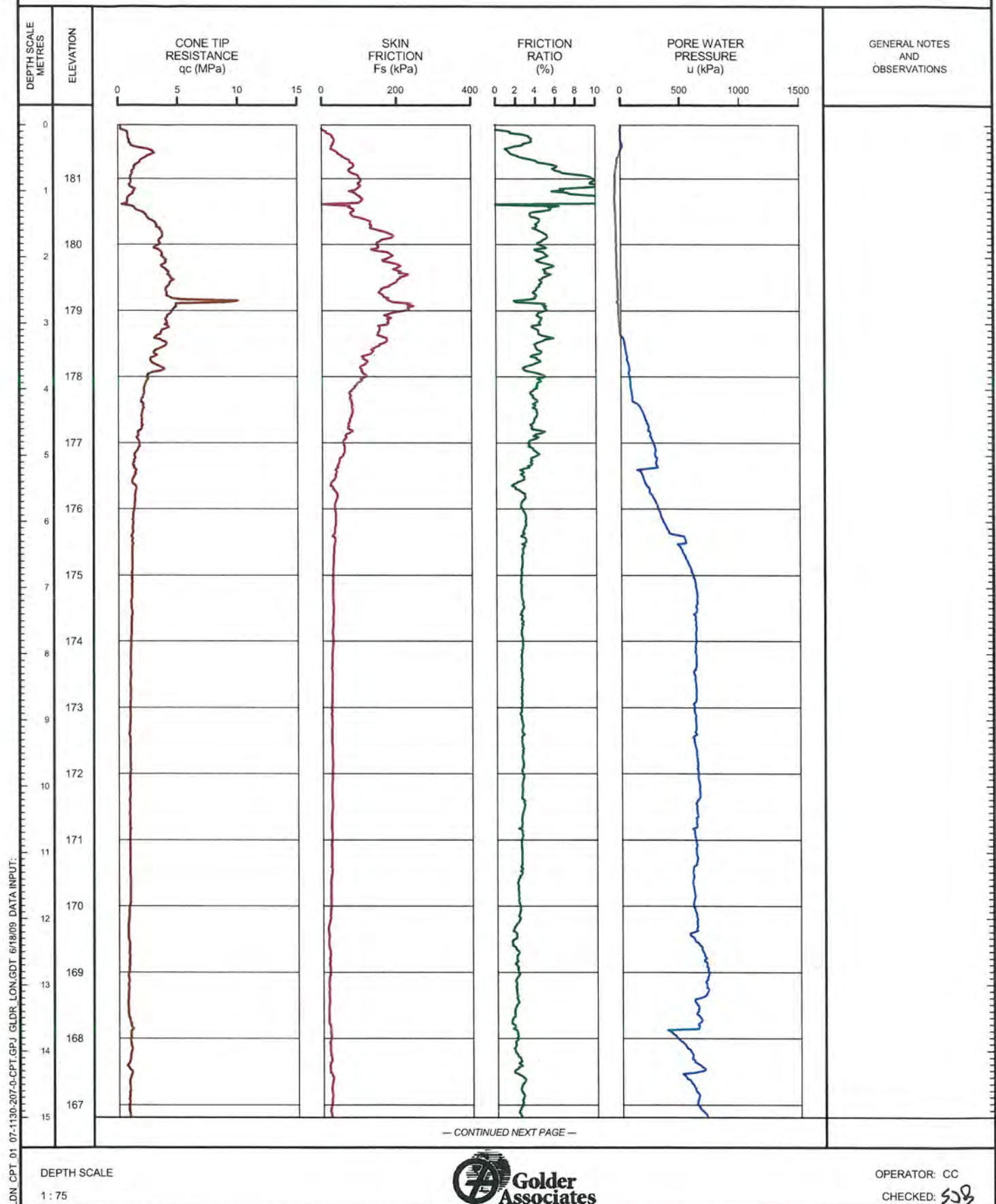
SHEET 1 OF 2

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



PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-10

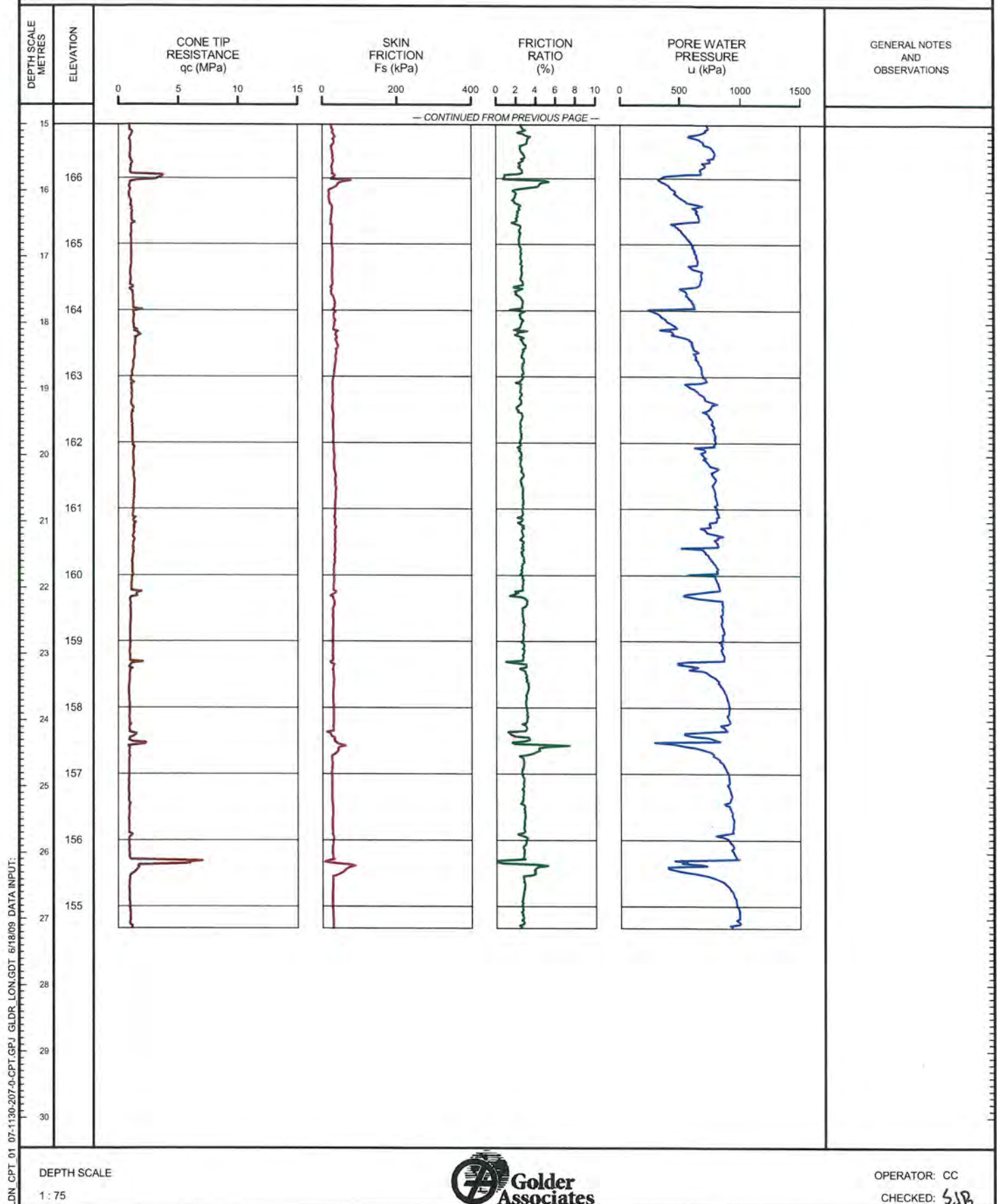
SHEET 2 OF 2

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-11

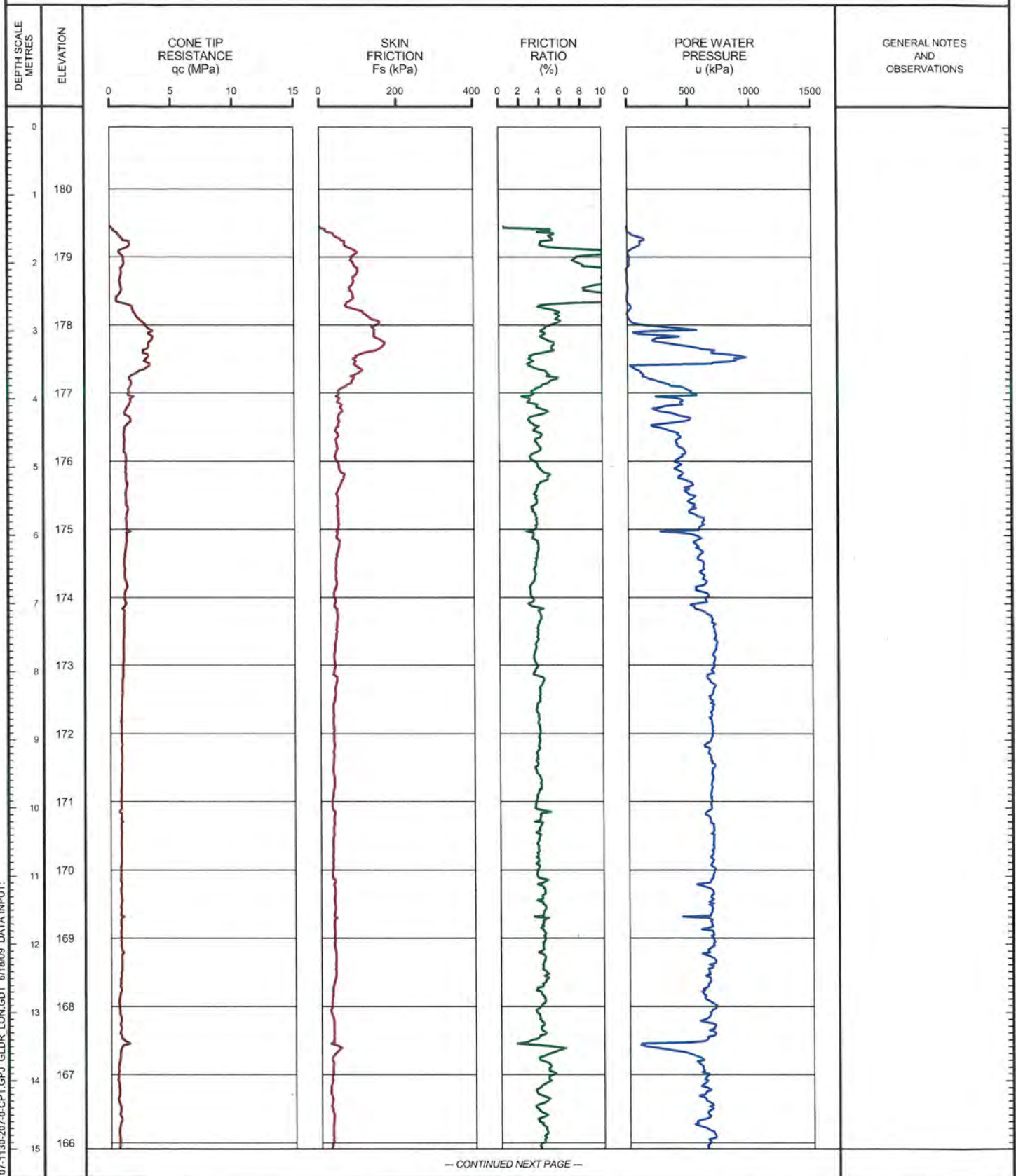
SHEET 1 OF 2

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

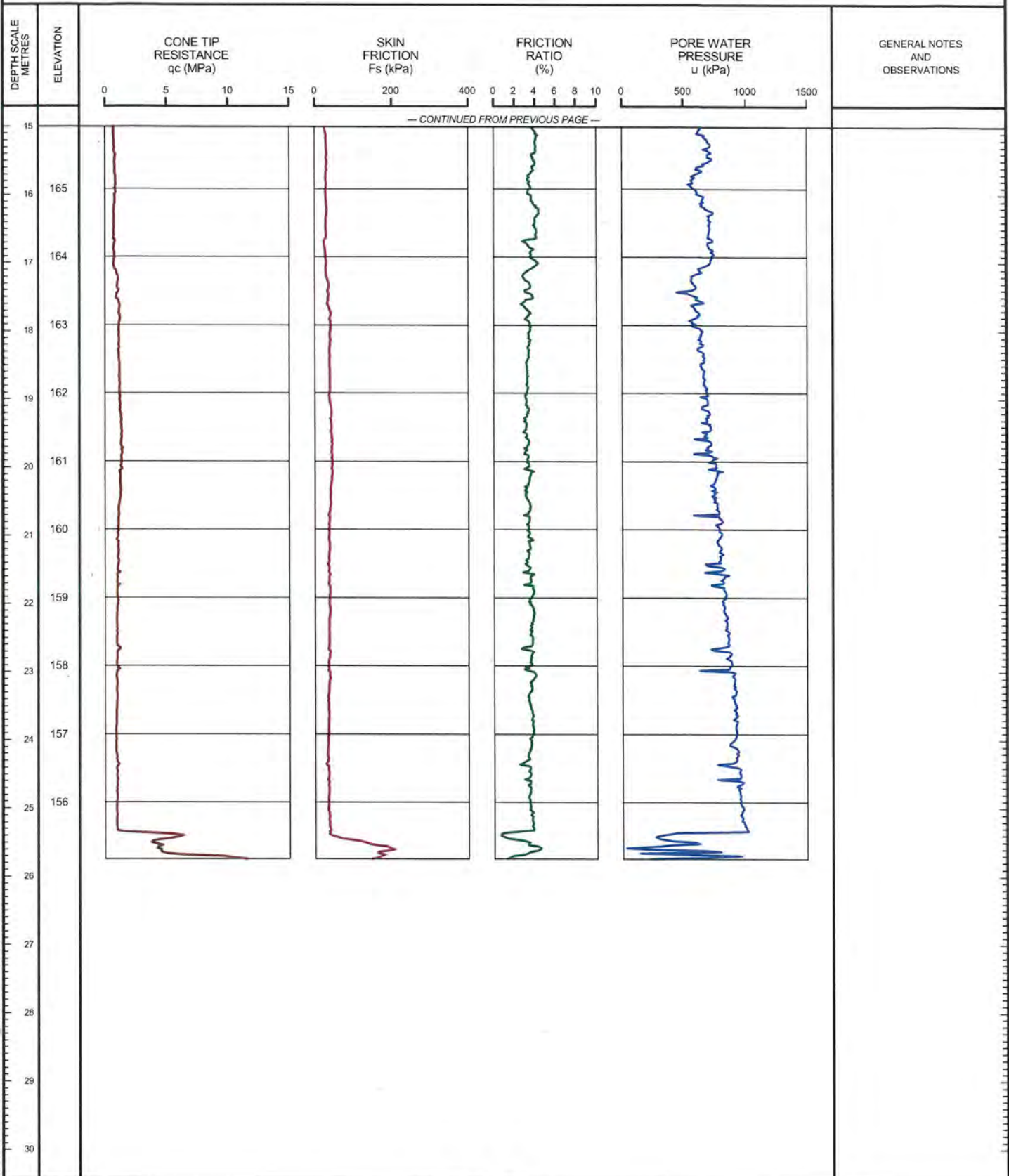
SHEET 2 OF 2

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 <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 <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 (%) 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						185						
							184						
1.83	END OF BOREHOLE												
	Borehole dry during drilling on September 8, 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-106

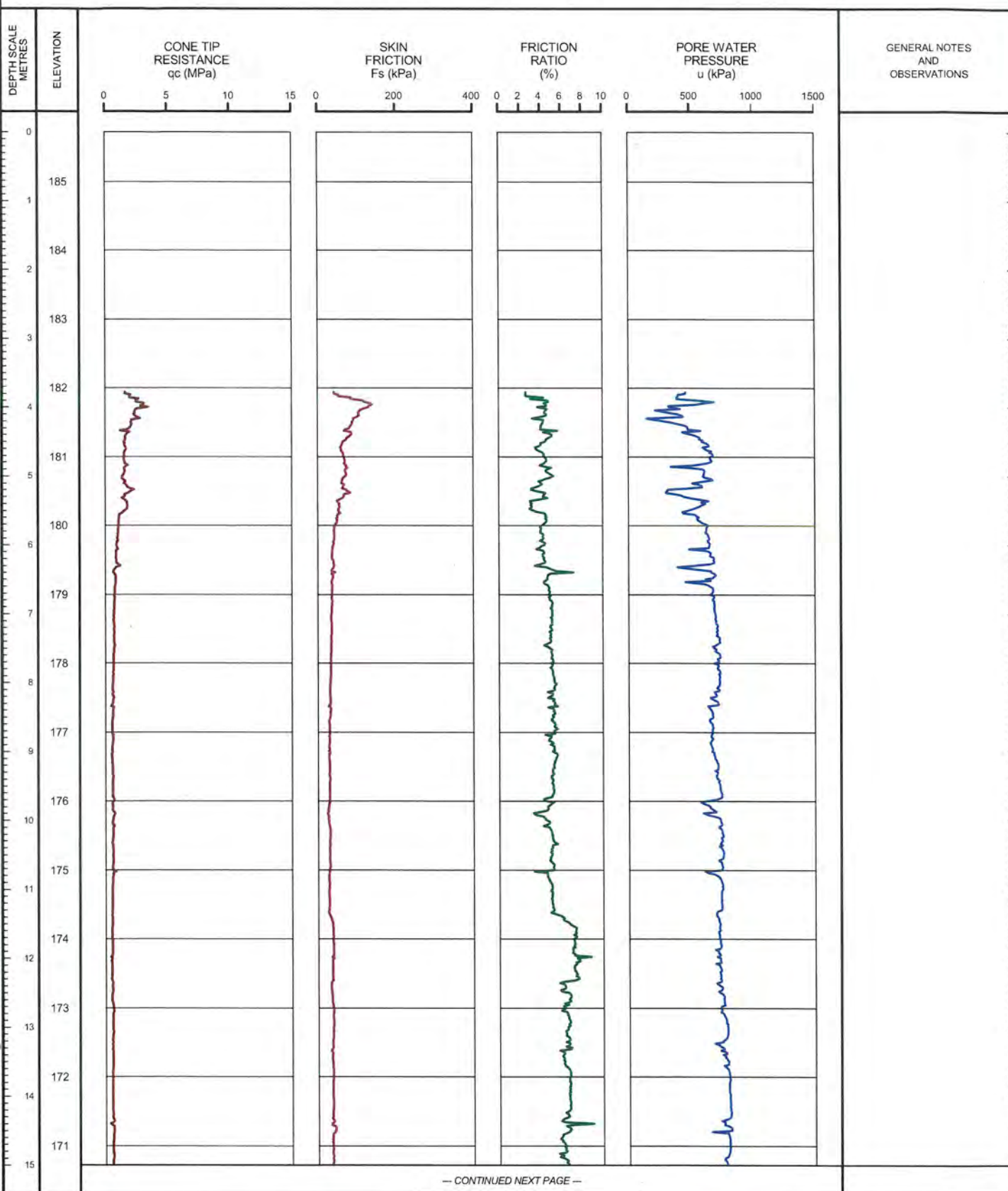
SHEET 1 OF 2

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

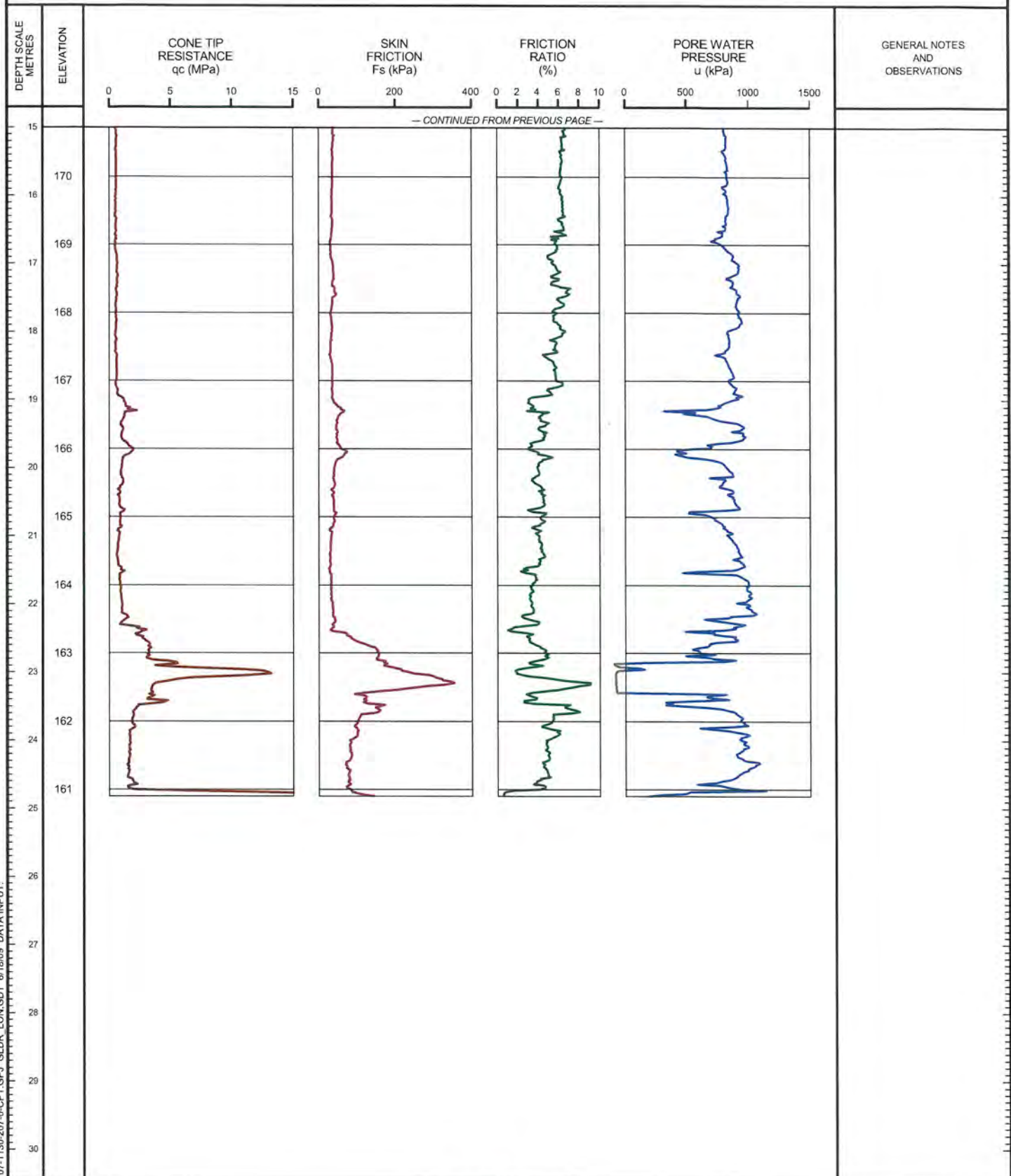
SHEET 2 OF 2

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: SDB

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>SJS</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									
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-114

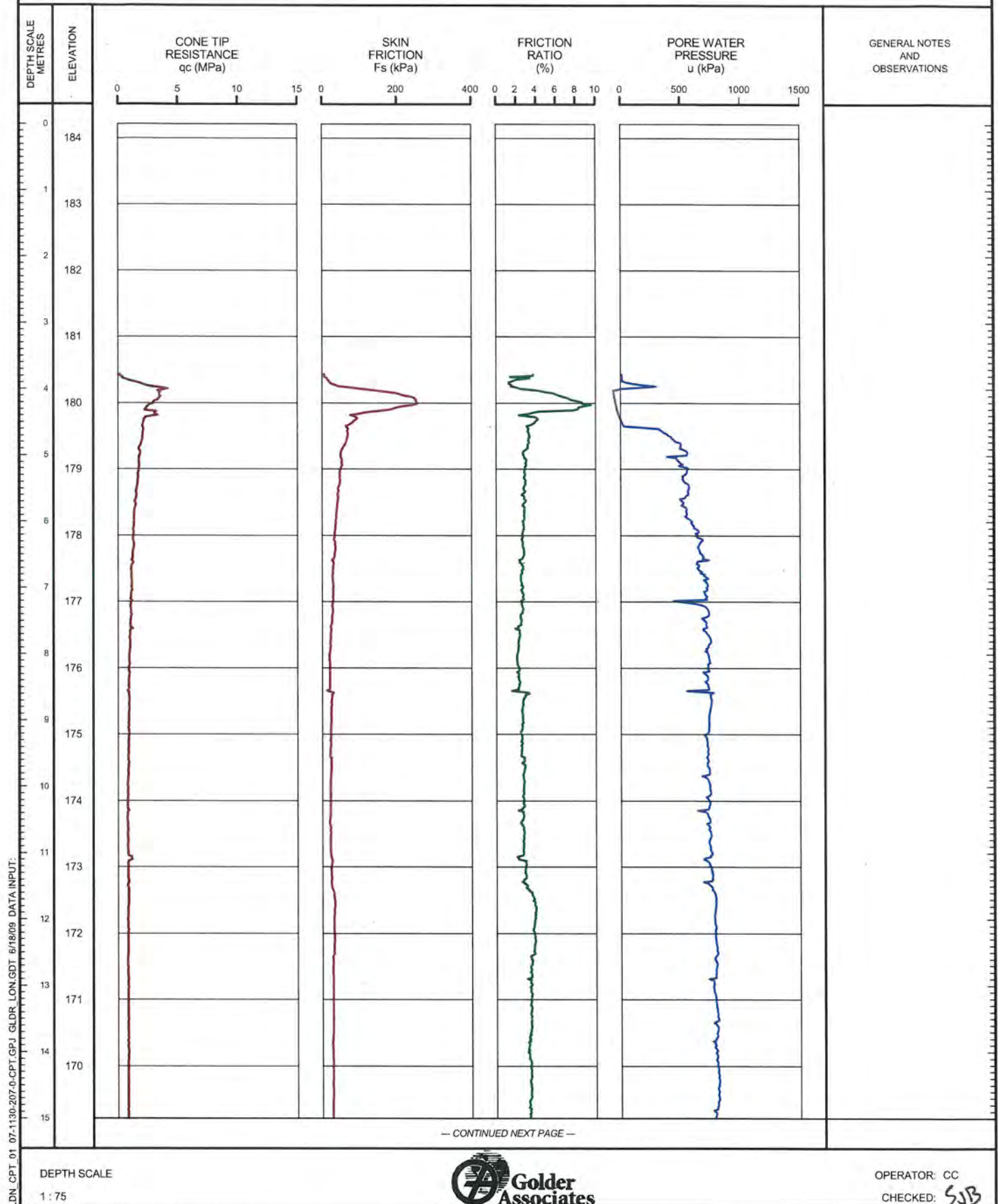
SHEET 1 OF 2

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

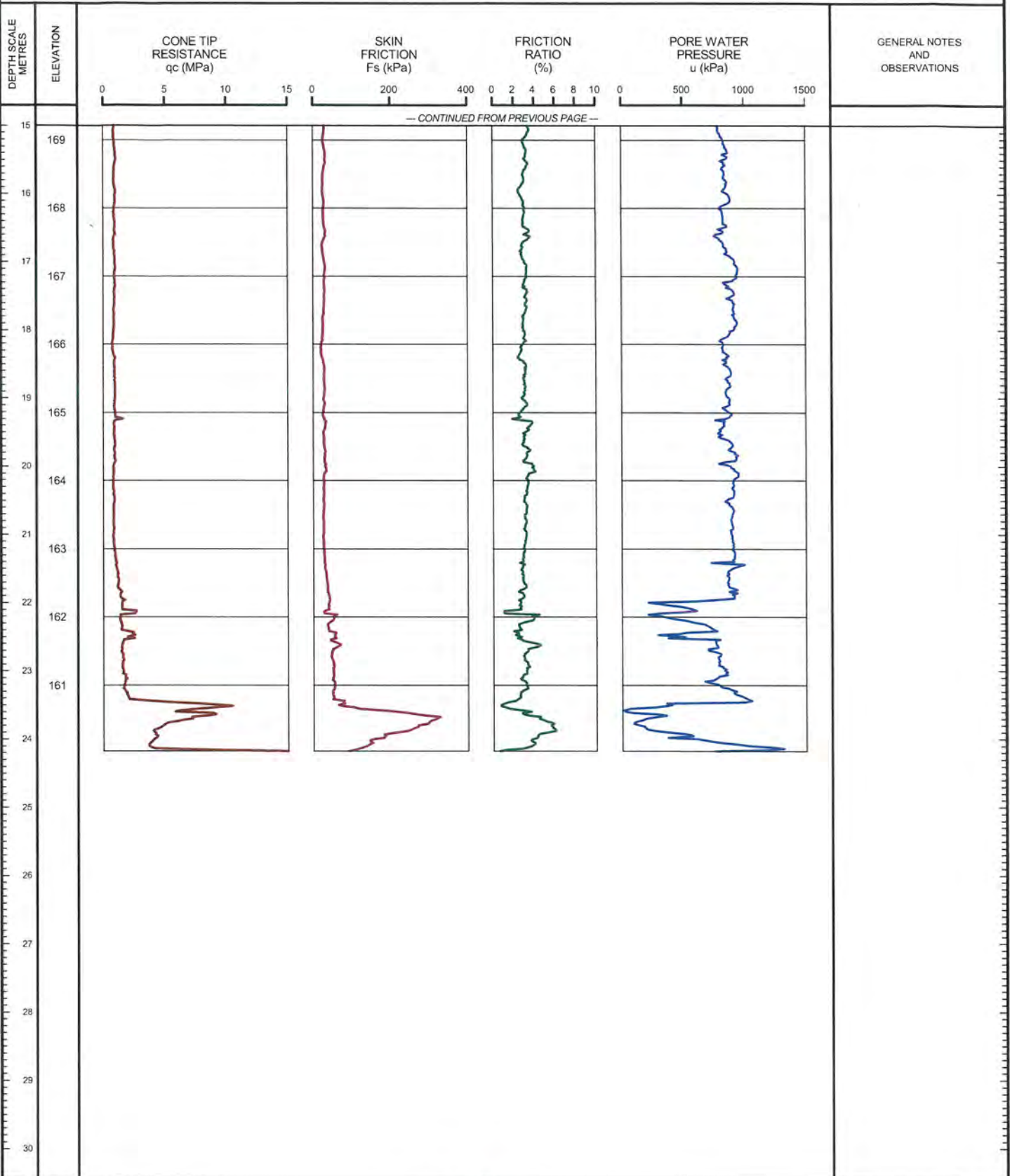
SHEET 2 OF 2

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: SDB

PROJECT 07-1130-207-0 **RECORD OF BOREHOLE No CPT-117** 1 OF 1 **METRIC**
W.P. _____ LOCATION N 4678744.1 :E 333601.5 ORIGINATED BY MA
DIST WEST HWY 401/3 BOREHOLE TYPE POWER AUGER, SOLID STEM COMPILED BY BRS
DATUM GEODETIC DATE March 27, 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
183.29	GROUND SURFACE							20 40 60 80 100						
0.00	TOPSOIL, silty Brown													
0.15	FILL, clayey silt, some sand, trace gravel Firm to stiff Brown		1	SS	5									
181.46			2	SS	12									
1.83	CLAYEY SILT, some sand, trace gravel Stiff to very stiff Brown becoming grey at about elev. 179.9m		3	SS	28									
			4	SS	20									
			5	SS	16									
178.72	END OF BOREHOLE													
4.57	Borehole dry during drilling on March 27, 2008.													

LDN_MTO_01 07-1130-207-0.GPJ LDN_MTO_GDT 5/29/09

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-117

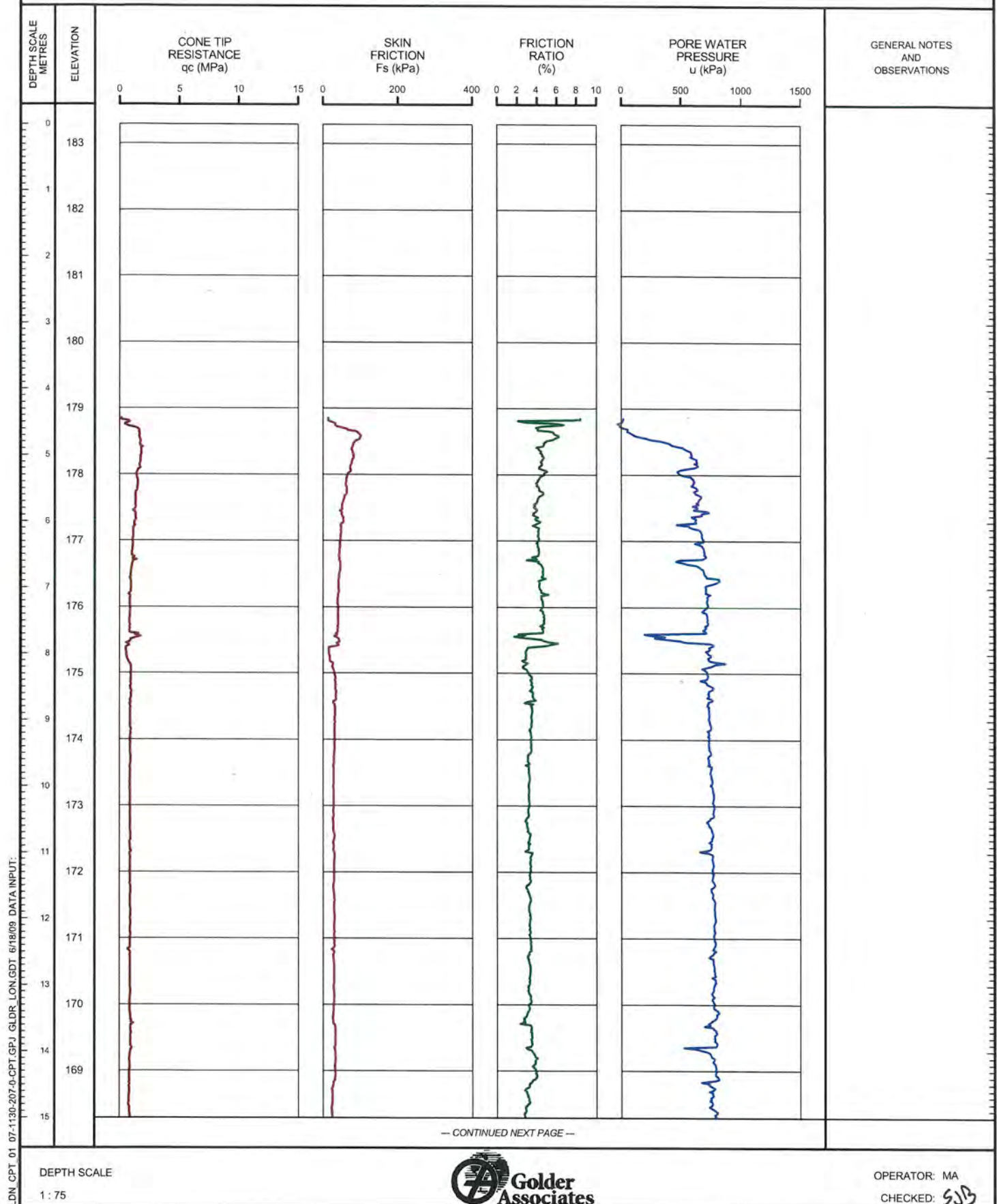
SHEET 1 OF 2

LOCATION: N 4678744.1 ; E 333601.5

TEST DATE: March 27, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 4.45m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



LON CPT 01 07-1130-207-0-CPT.GPJ GLDR LON.GDT 6/19/09 DATA INPUT:

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-117

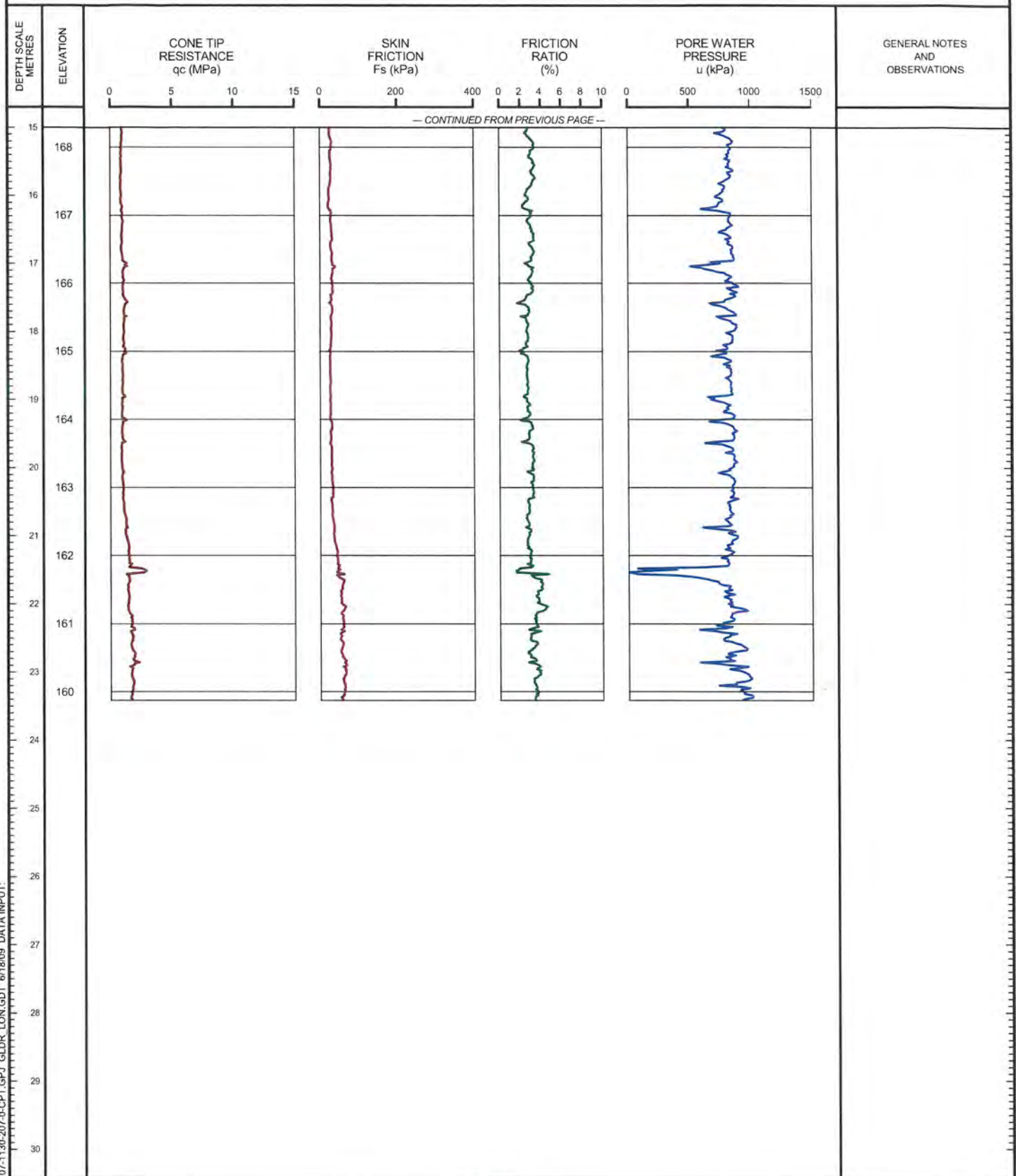
SHEET 2 OF 2

LOCATION: N 4678744.1 ; E 333601.5

TEST DATE: March 27, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 4.45m 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: MA

CHECKED: *SJB*

PROJECT <u>07-1130-207-0</u>		RECORD OF BOREHOLE No CPT-121		1 OF 1	METRIC
W.P. _____		LOCATION <u>N 4679024.8 :E 333077.4</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 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								
181.97	GROUND SURFACE												
0.08	TOPSOIL, clayey Very soft Brown CLAYEY SILT, trace to some sand, trace gravel Stiff to very stiff Mottled brown and grey becoming grey at about elev. 180.8m		1	SS	8		181						
			2	SS	11								
180.14			3	SS	26								
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-121

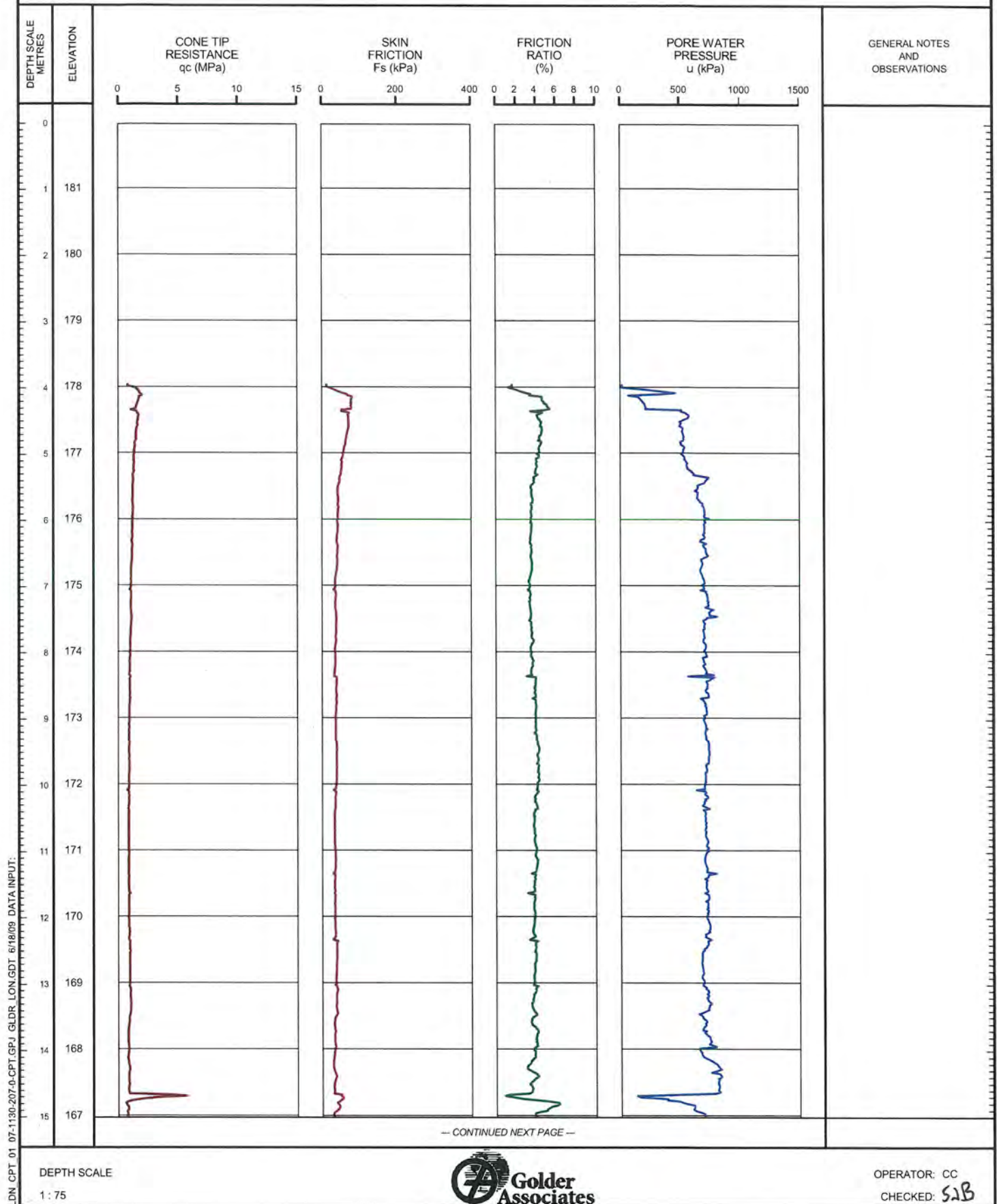
SHEET 1 OF 3

LOCATION: N 4679024.8 :E 333077.4

TEST DATE: September 10, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.96m 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:

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-121

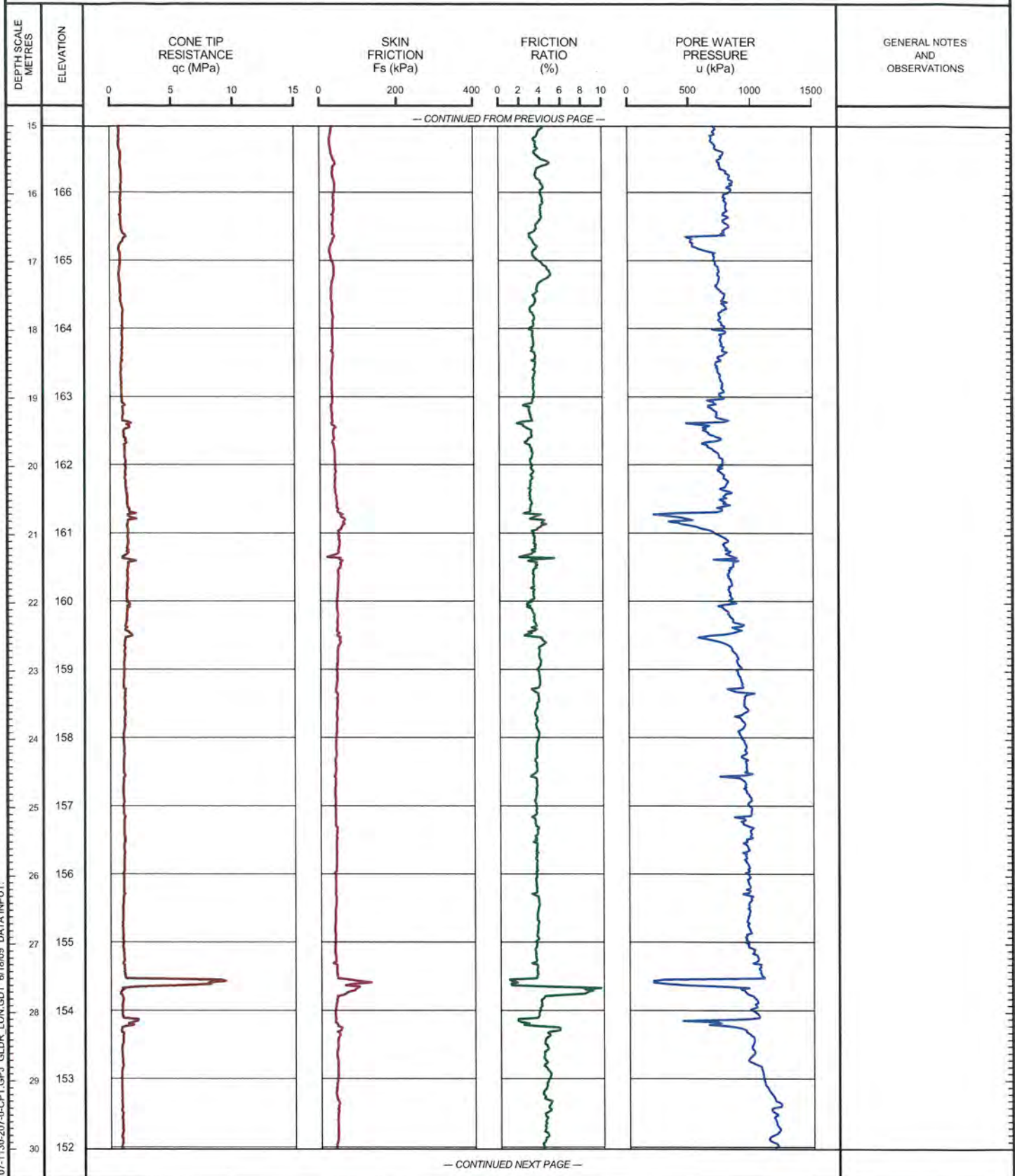
SHEET 2 OF 3

LOCATION: N 4679024.8 :E 333077.4

TEST DATE: September 10, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.96m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



LON 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-121

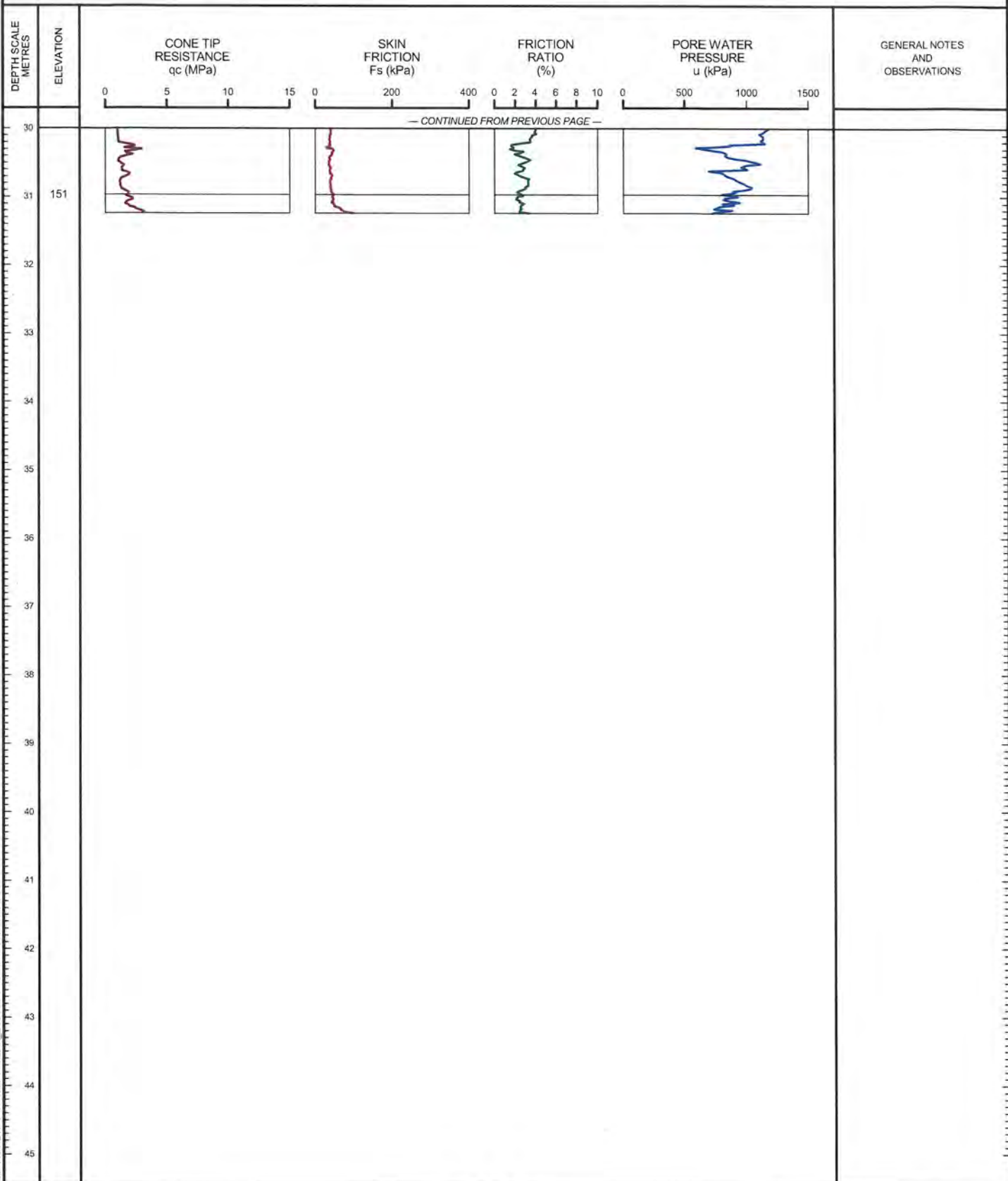
SHEET 3 OF 3

LOCATION: N 4679024.8 :E 333077.4

TEST DATE: September 10, 2008

DATUM: GEODETIC

GROUND SURFACE ELEVATION: PREDRILL DEPTH: 3.96m 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 <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: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-124

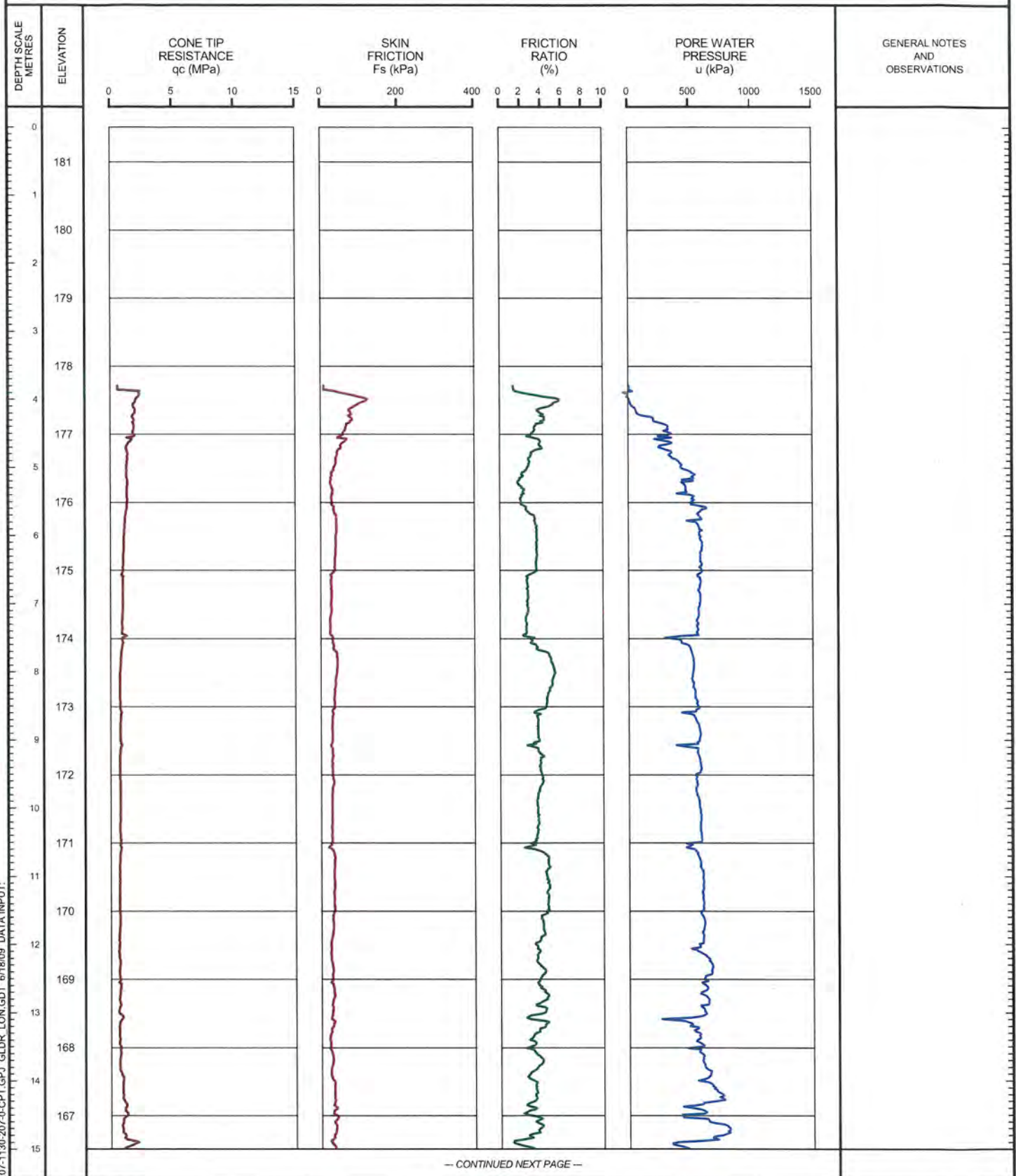
SHEET 1 OF 2

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

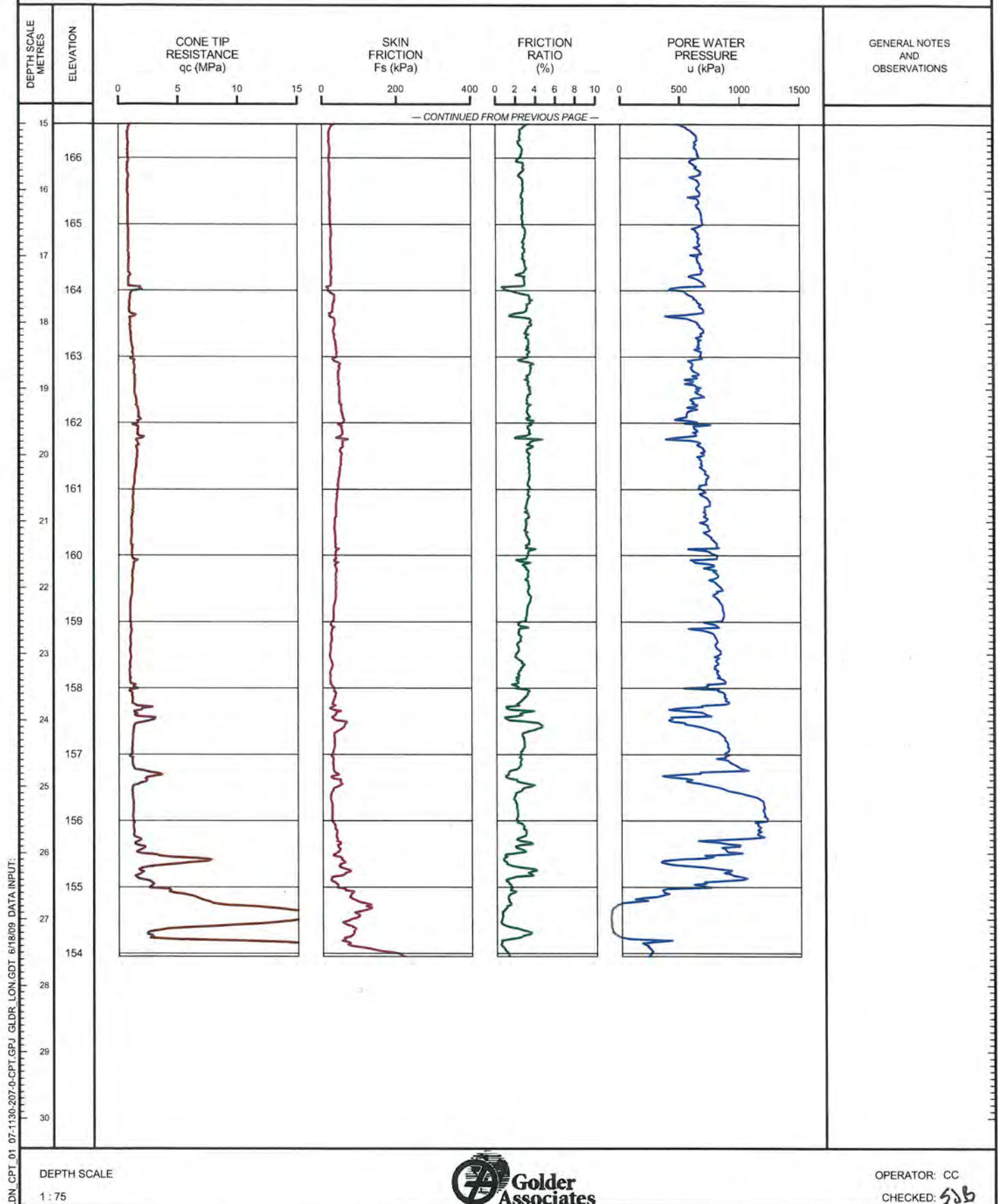
SHEET 2 OF 2

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



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 Compact Brown		1	SS	16									
180.29														
0.61	FILL, sand with slag Compact Black		2	SS	14		180							
	CLAYEY SILT, trace sand, trace gravel Stiff		3	SS	11									
178.99	Mottled brown and grey						179							
1.83	END OF BOREHOLE													
	Borehole dry during drilling on September 4, 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-130

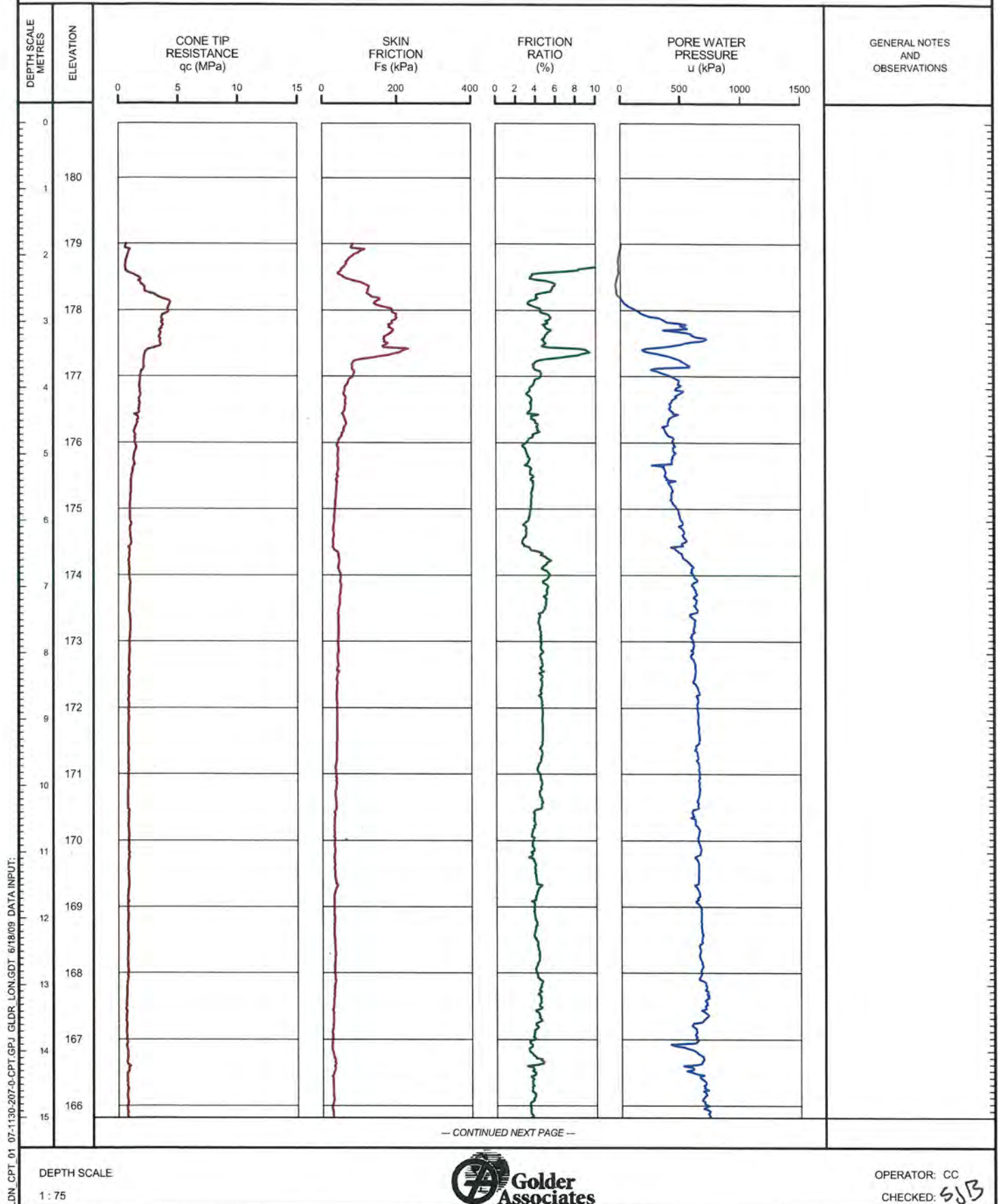
SHEET 1 OF 3

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

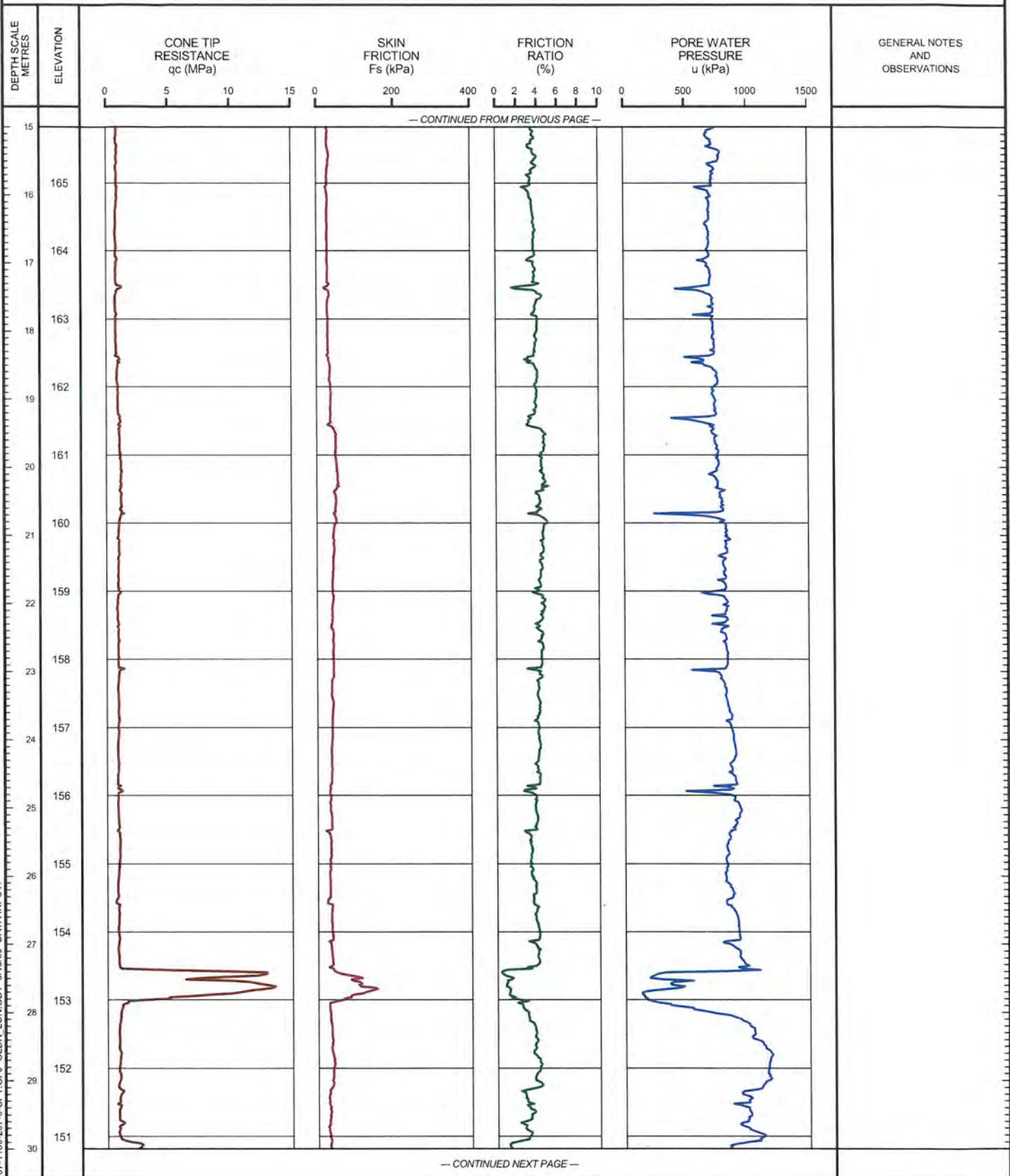
SHEET 2 OF 3

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

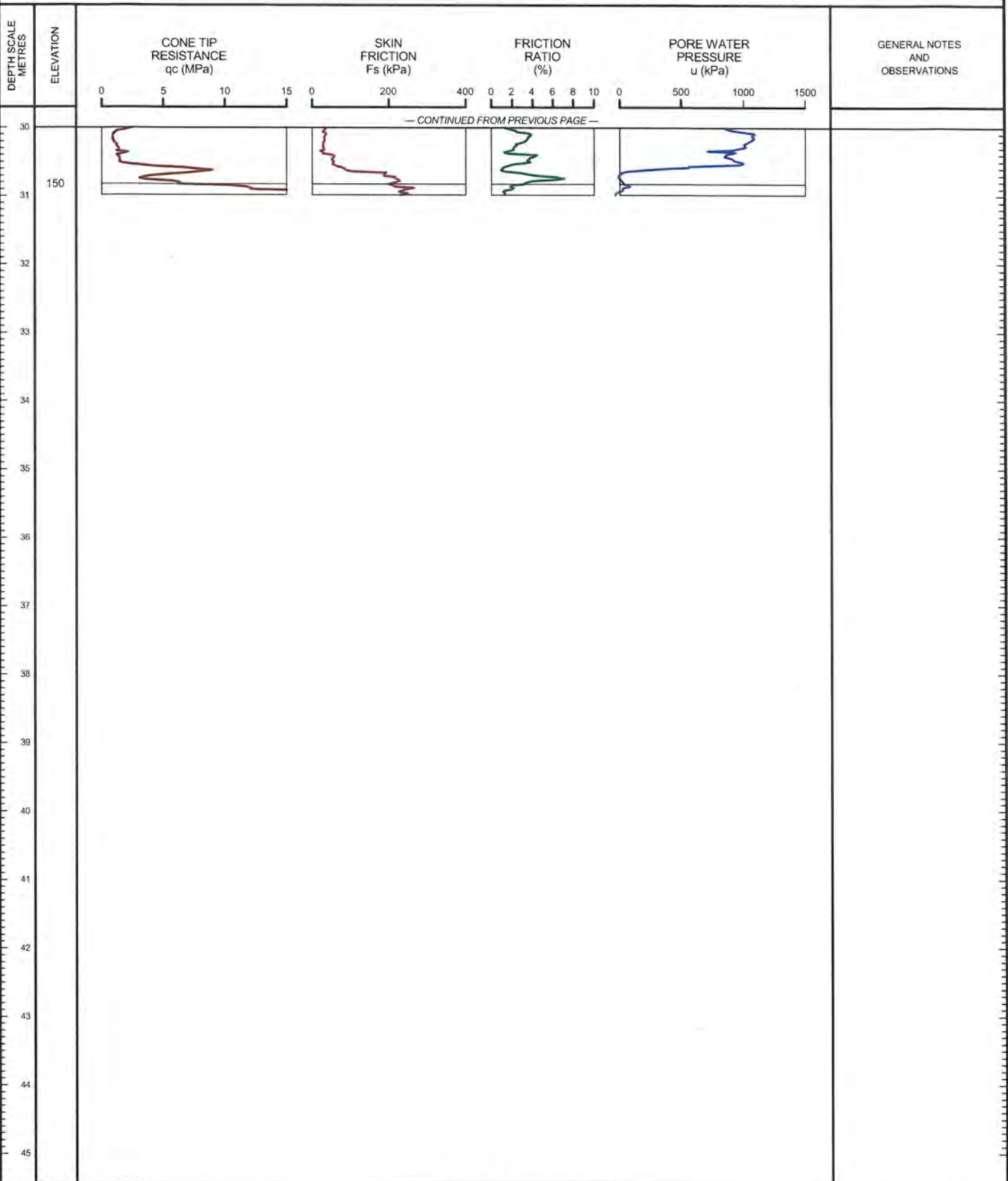
SHEET 3 OF 3

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: *SSB*

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: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-144

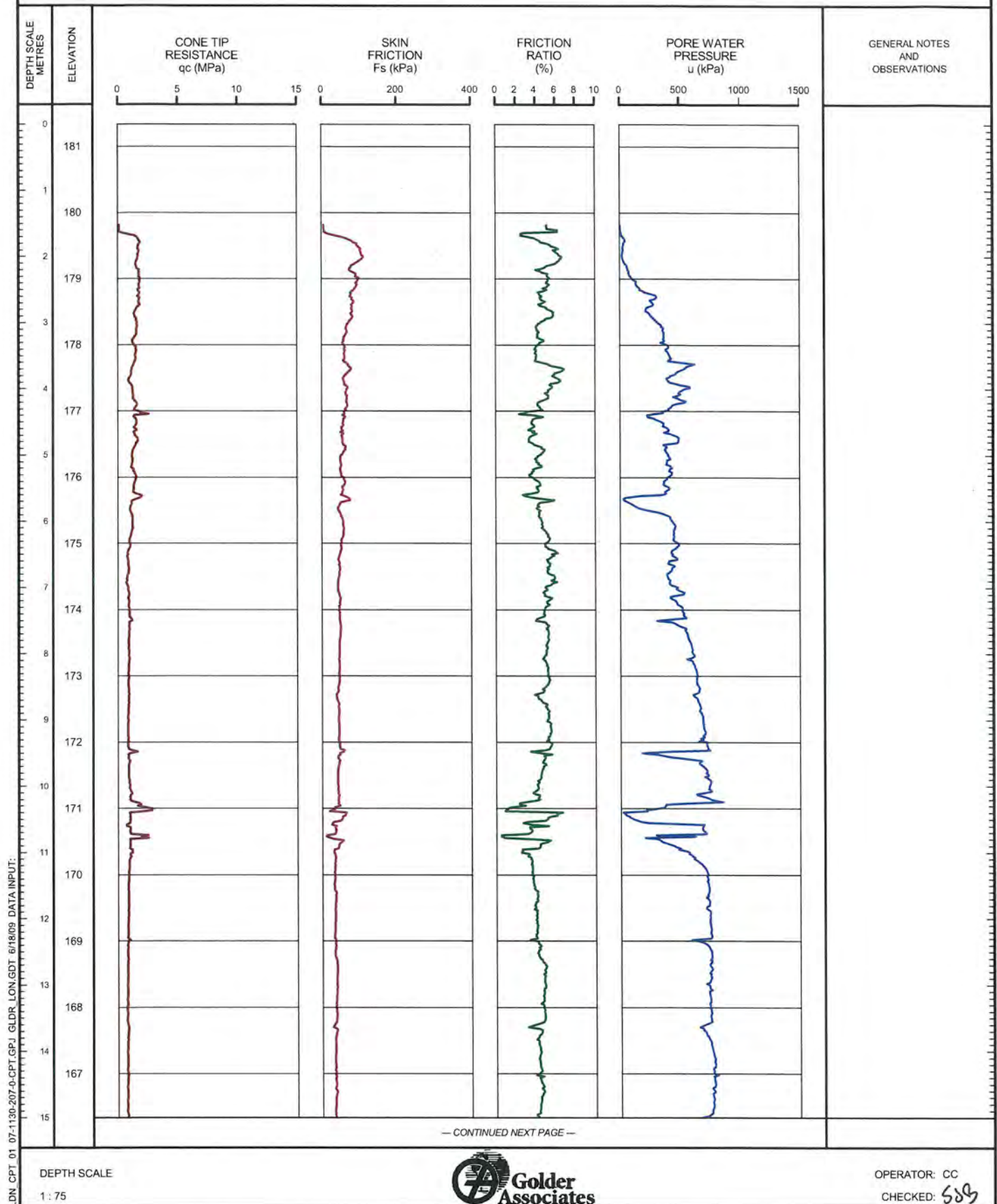
SHEET 1 OF 2

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:

PROJECT: 07-1130-207-0

RECORD OF CONE PENETRATION TEST CPT-144

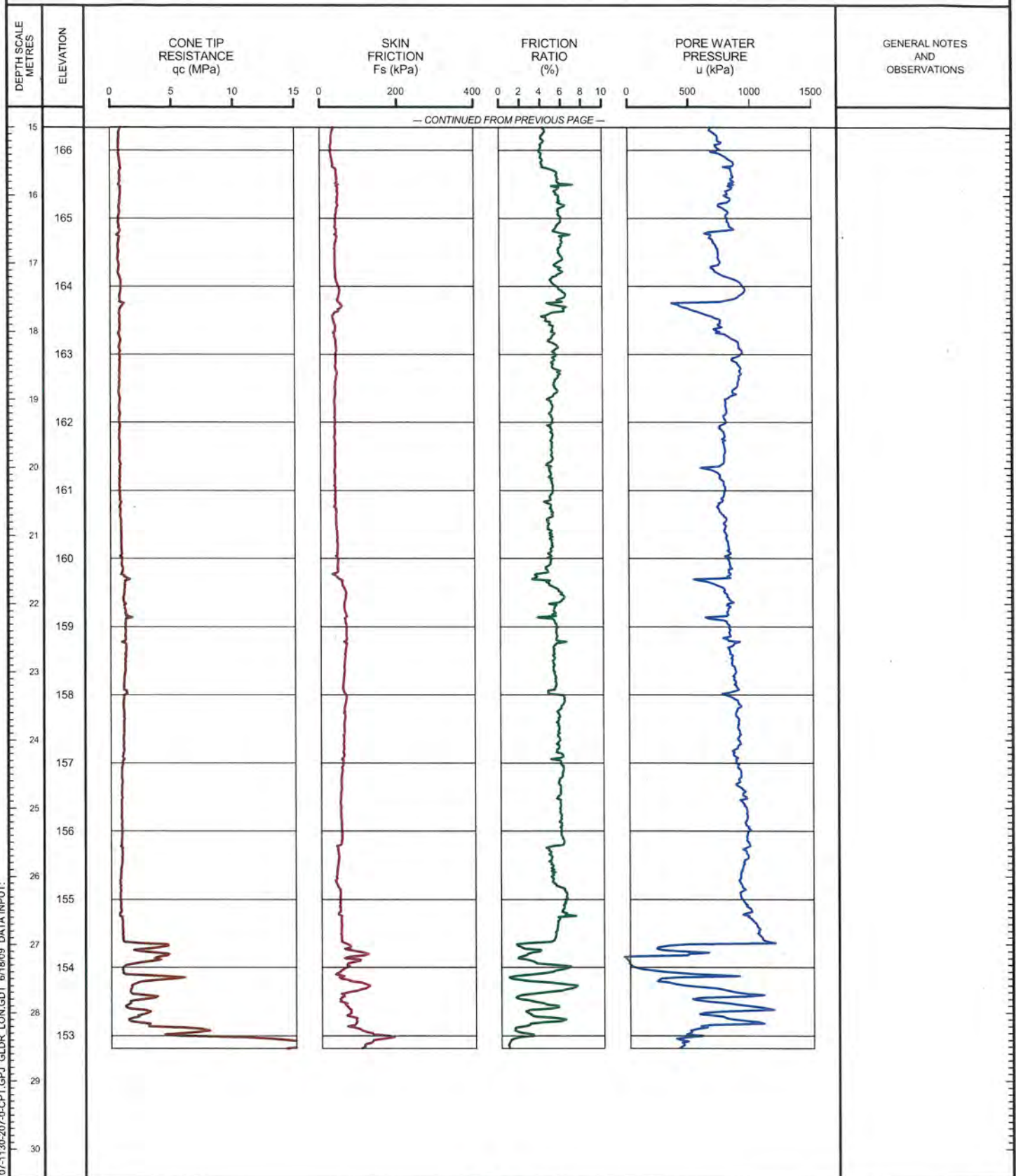
SHEET 2 OF 2

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

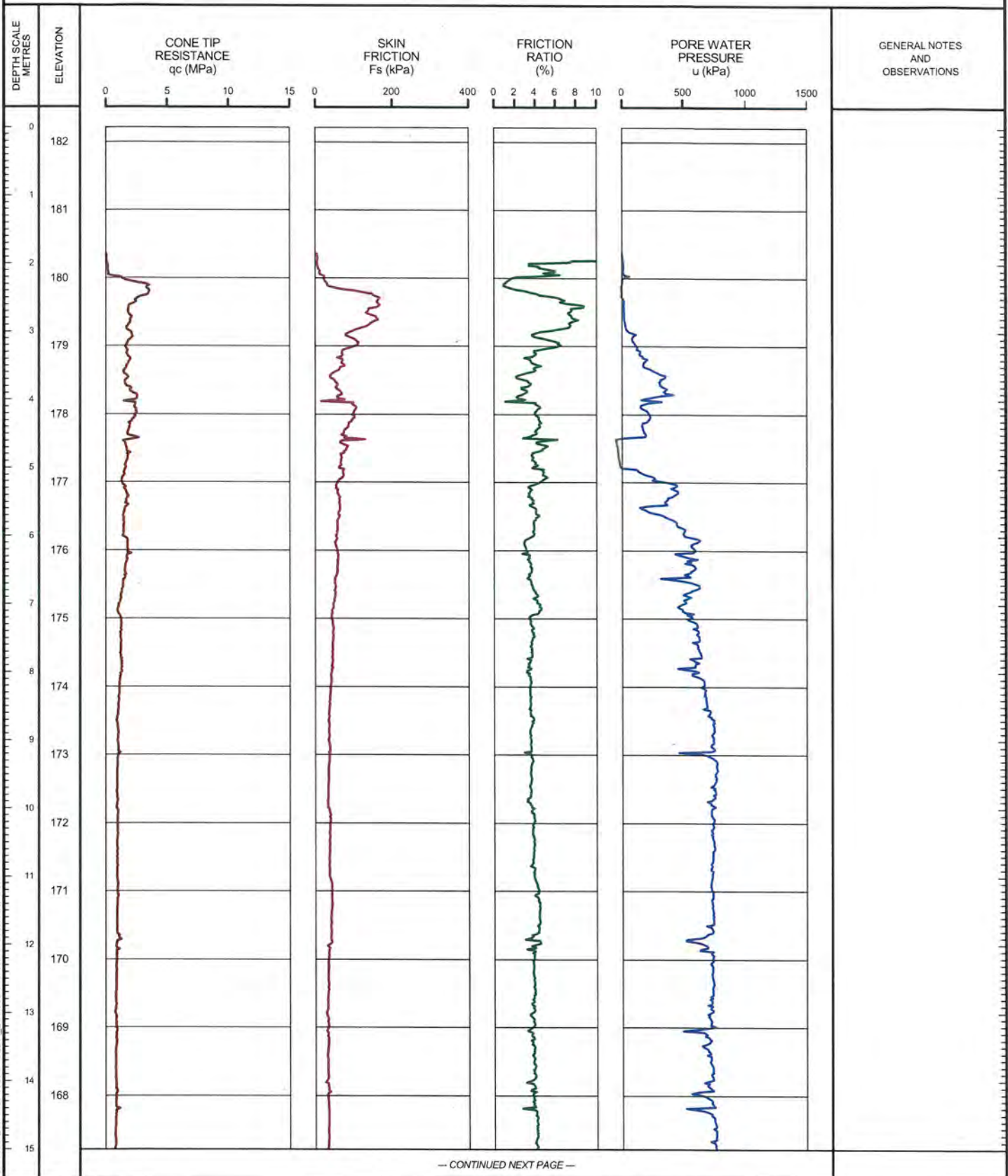
SHEET 1 OF 2

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

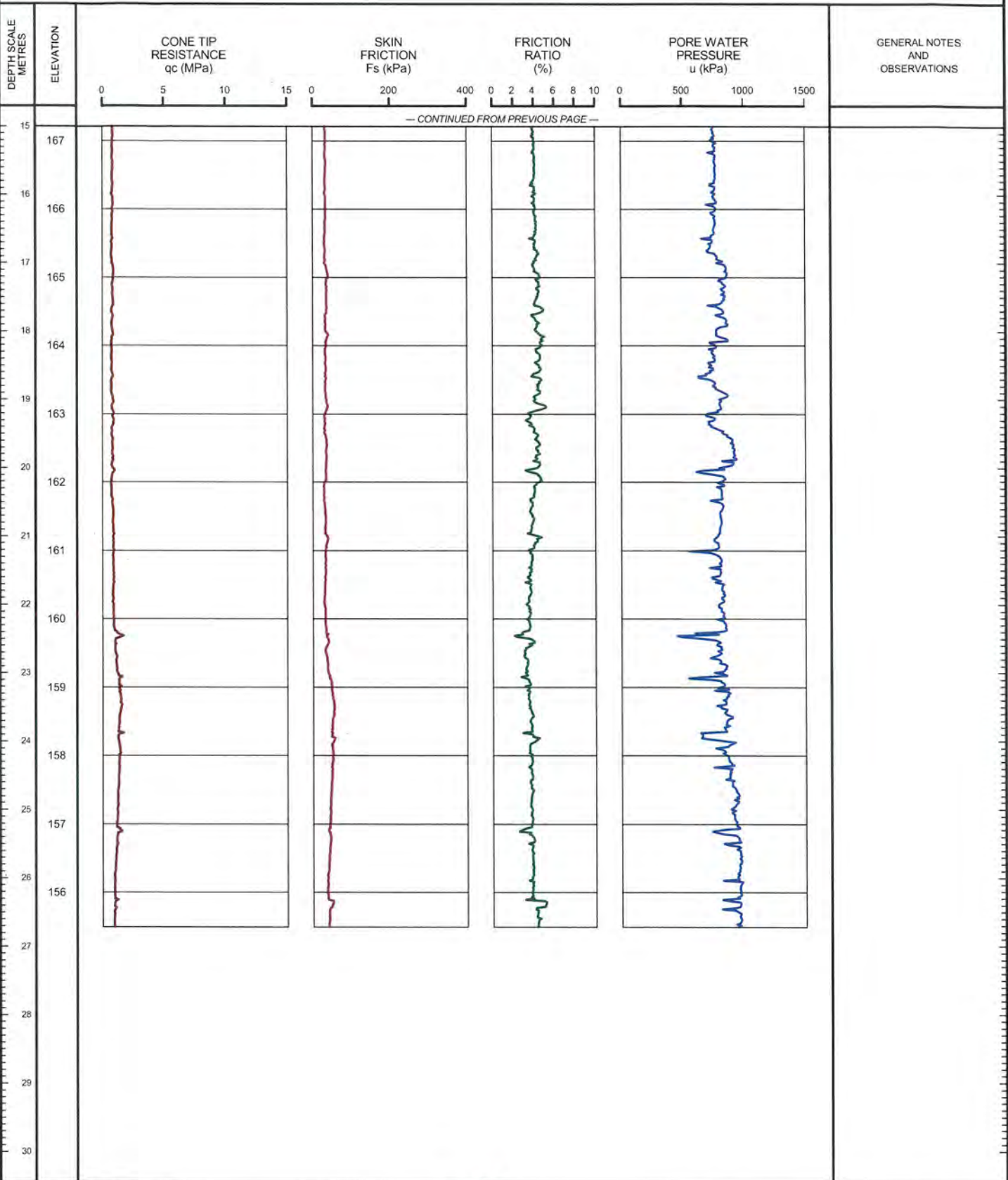
SHEET 2 OF 2

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 <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/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)							
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					w _p w w _L							
186.02	GROUND SURFACE							20	40	60	80	100								
0.10	TOPSOIL, clayey Black CLAYEY SILT, some sand, trace gravel, with occasional silt partings and seams Firm to hard Brown becoming grey below about elev. 183.1m					▽														
			1	SS	8		185													
			2	SS	28		184							○						
			3	SS	55															
							183													
			4	SS	51									○						
182.36	END OF BOREHOLE																			
3.66	Groundwater encountered at about elev. 185.7m during drilling on January 11, 2010.																			

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-303

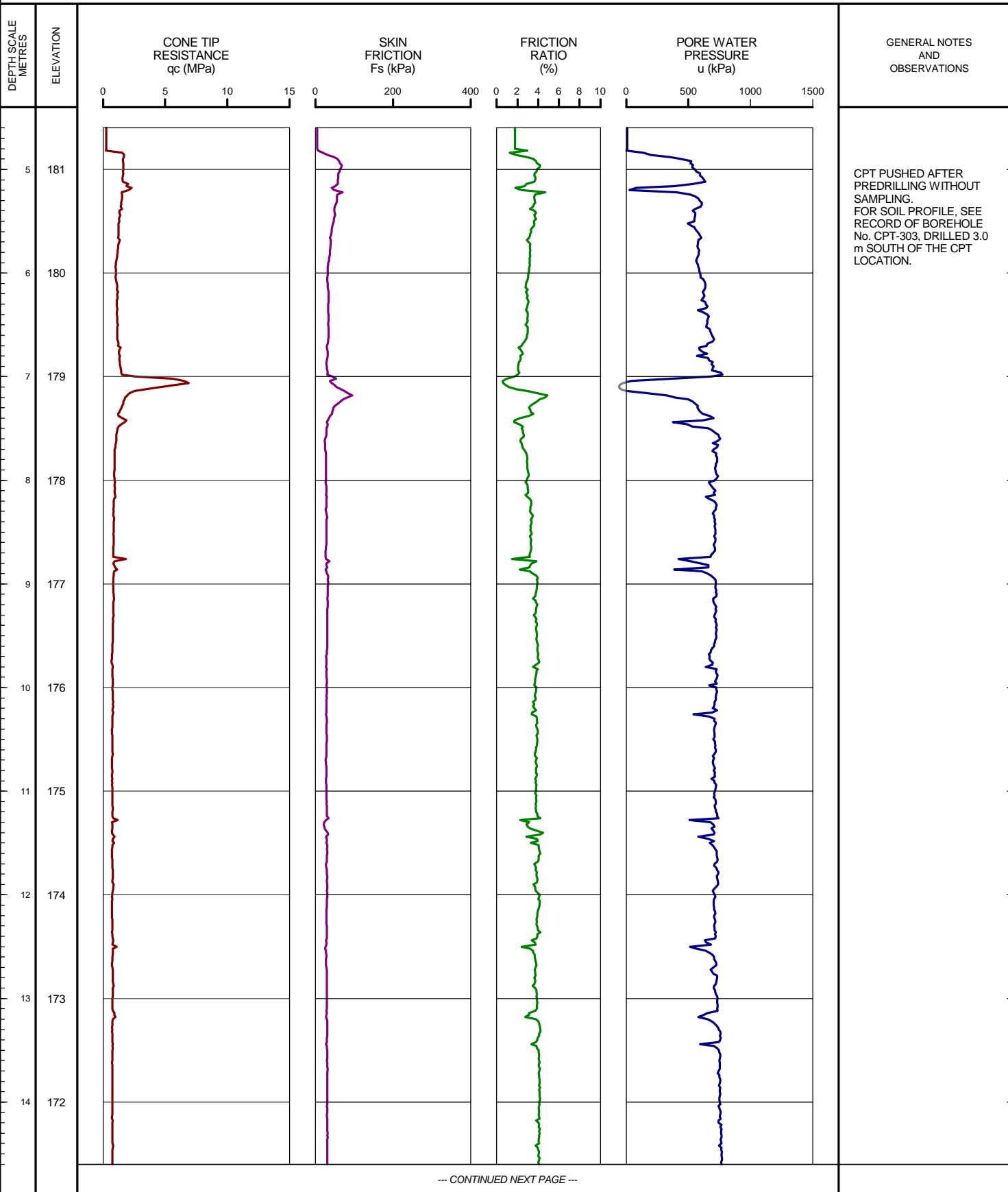
SHEET 1 OF 3

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

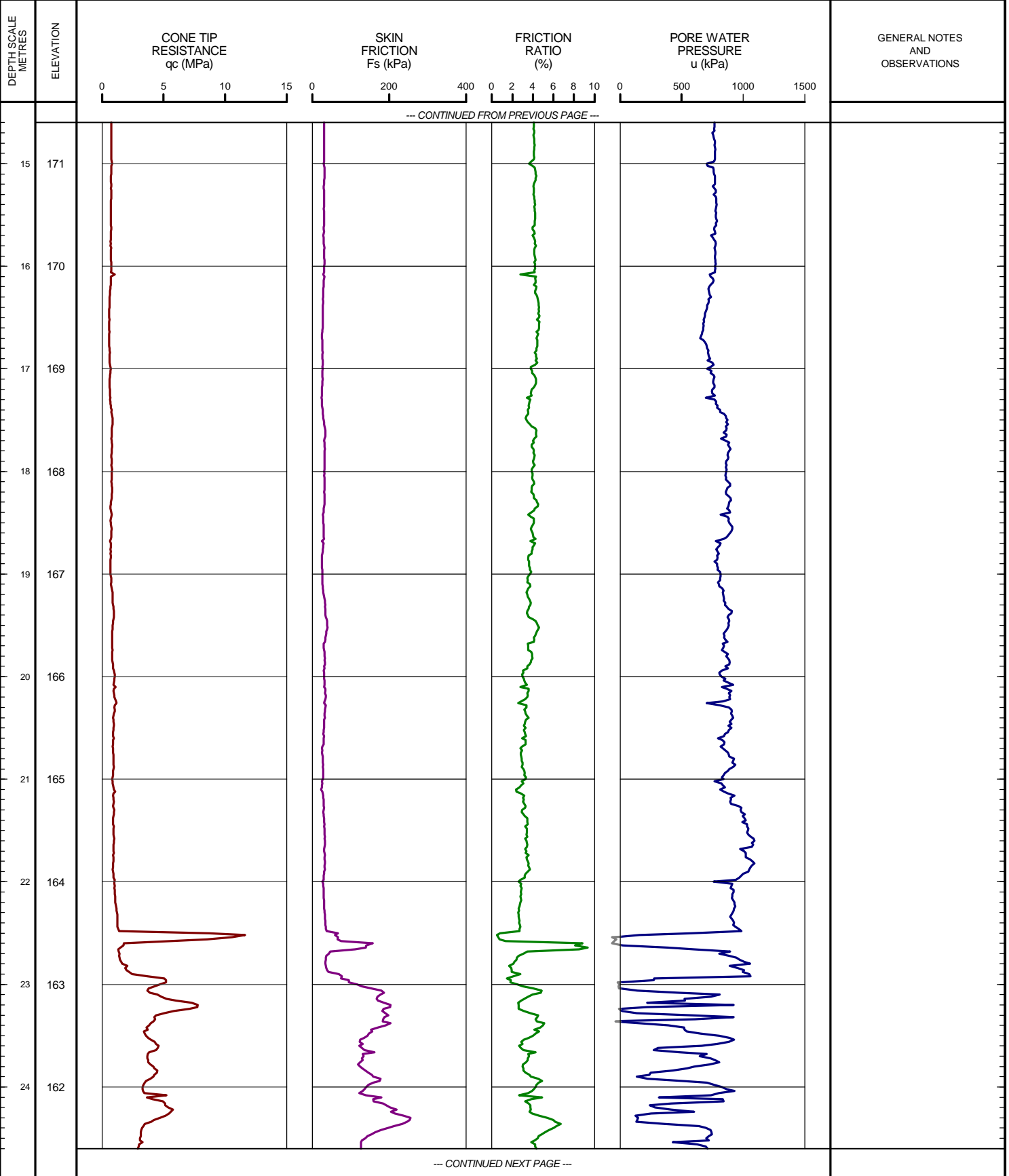
SHEET 2 OF 3

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

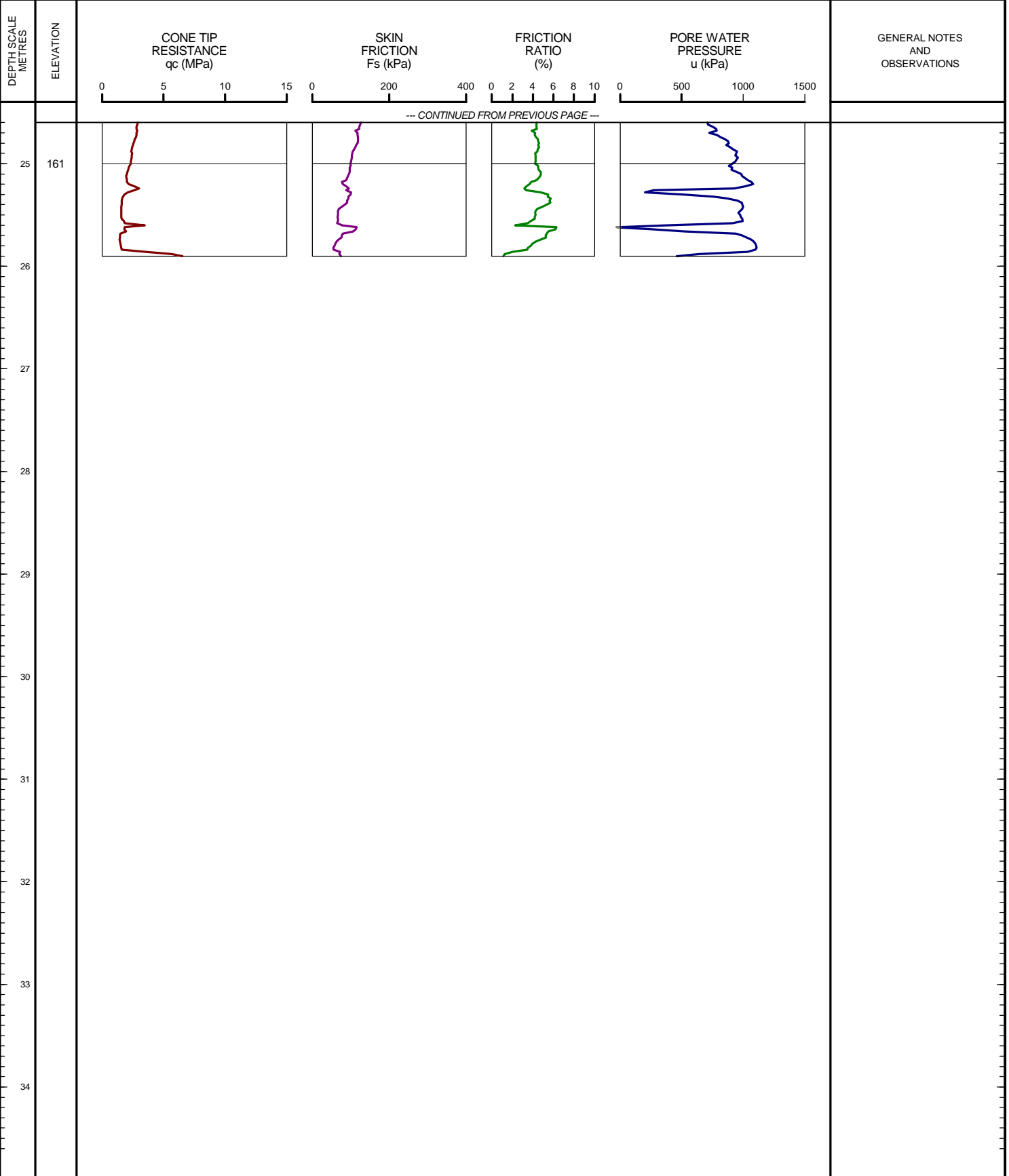
SHEET 3 OF 3

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



LON_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

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/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
								○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × LAB VANE						WATER CONTENT (%)					
186.02	GROUND SURFACE							20	40	60	80	100								
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: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-306

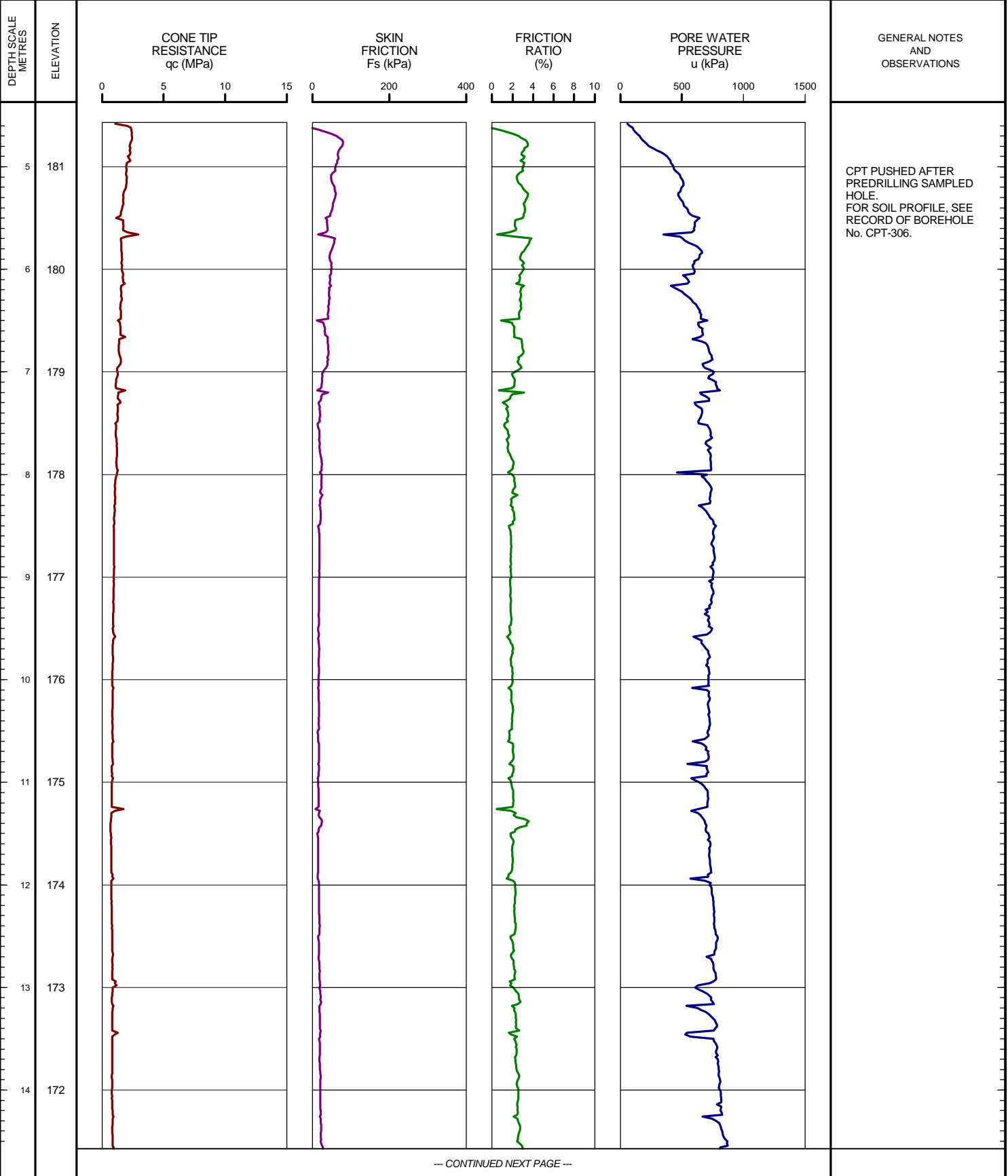
SHEET 1 OF 2

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

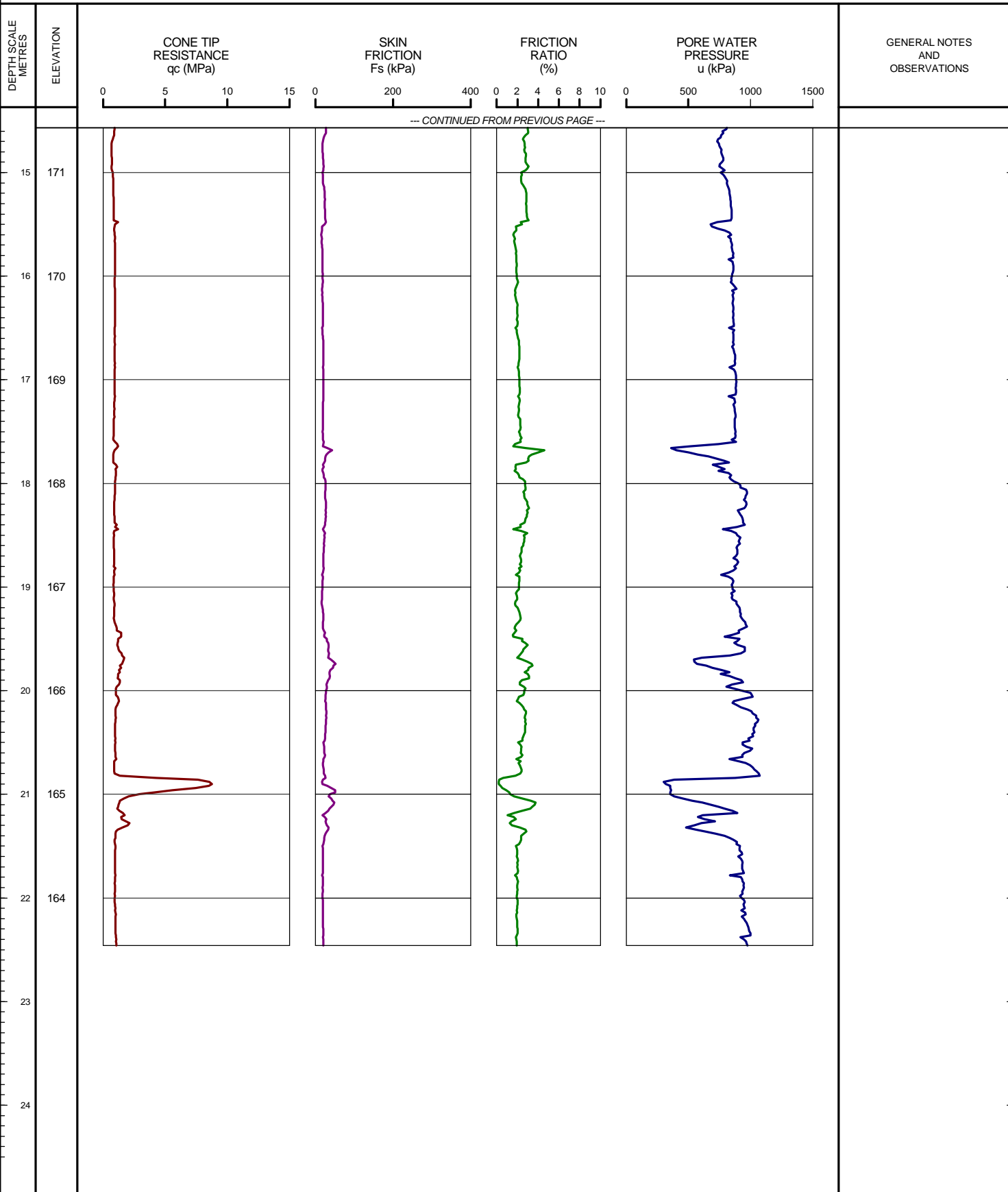
SHEET 2 OF 2

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:

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 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								
181.50	ROAD SURFACE															
0.05	ASPHALT PAVEMENT															
181.04	FILL, limestone gravel, crushed Grey															
0.46	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.															

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-322

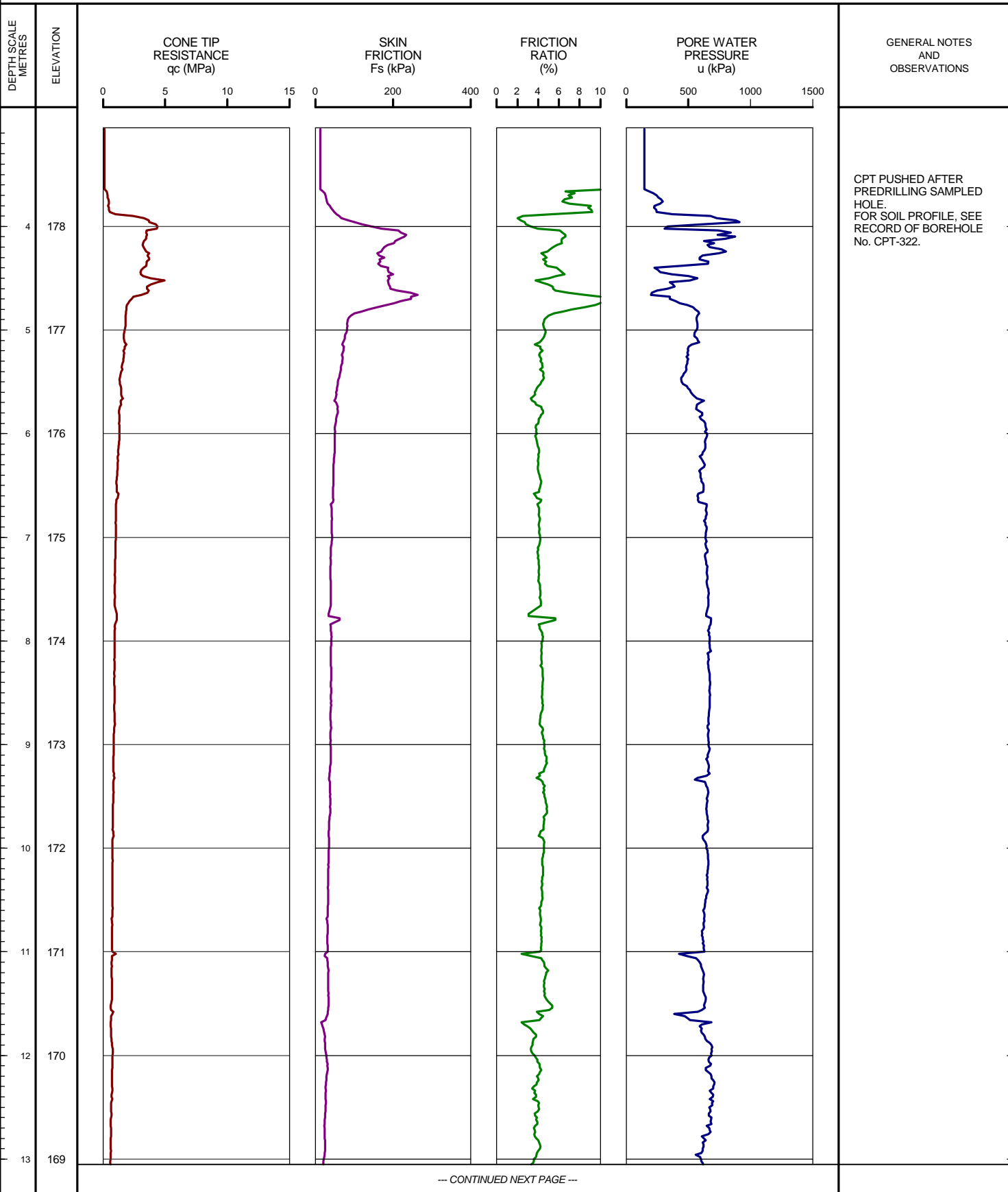
SHEET 1 OF 2

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

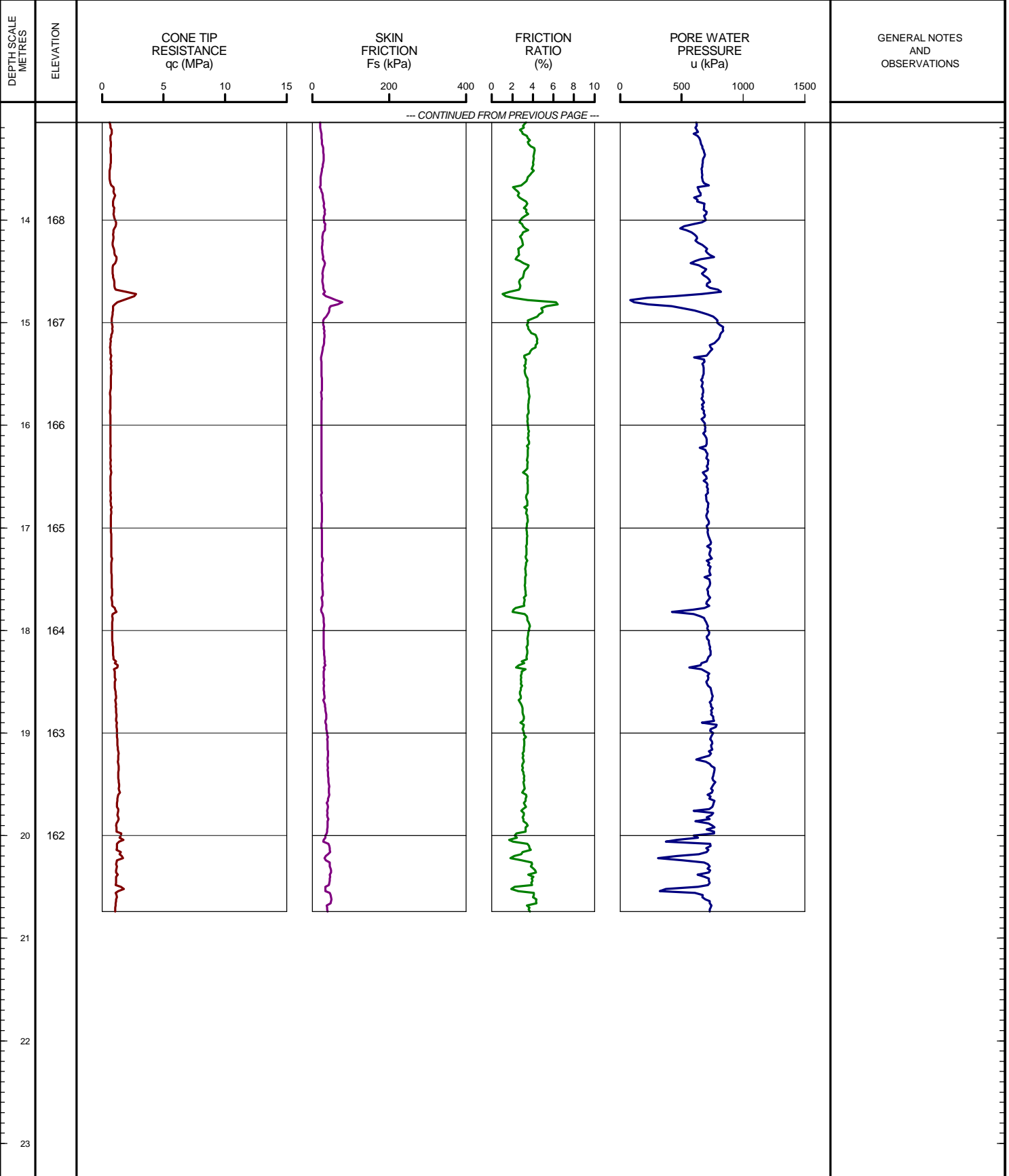
SHEET 2 OF 2

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 <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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
180.85	GROUND SURFACE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											</

LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No CPT-313		1 OF 1		METRIC	
W.P. _____		LOCATION <u>N 4678688.4 ; E 333599.7</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 21, 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					WATER CONTENT (%)								
								20	40	60	80	100	w _p	w	w _L						
184.04	GROUND SURFACE																				
0.00	TOPSOIL, clayey Stiff Black					▽	183														
183.18	CLAYEY SILT, some sand, trace gravel, with occasional fissures, silt partings and seams Stiff to hard Brown		1	SS	12			182													
0.86			2	SS	18																
			3	SS	39																
			4	SS	36																
180.38	END OF BOREHOLE																				
3.66	Groundwater encountered at about elev. 182.5m during drilling on January 21, 2010.																				

LDN_MTO_06 09-1132-0080.GPJ LDN_MTO.GDT 11/03/10

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-313

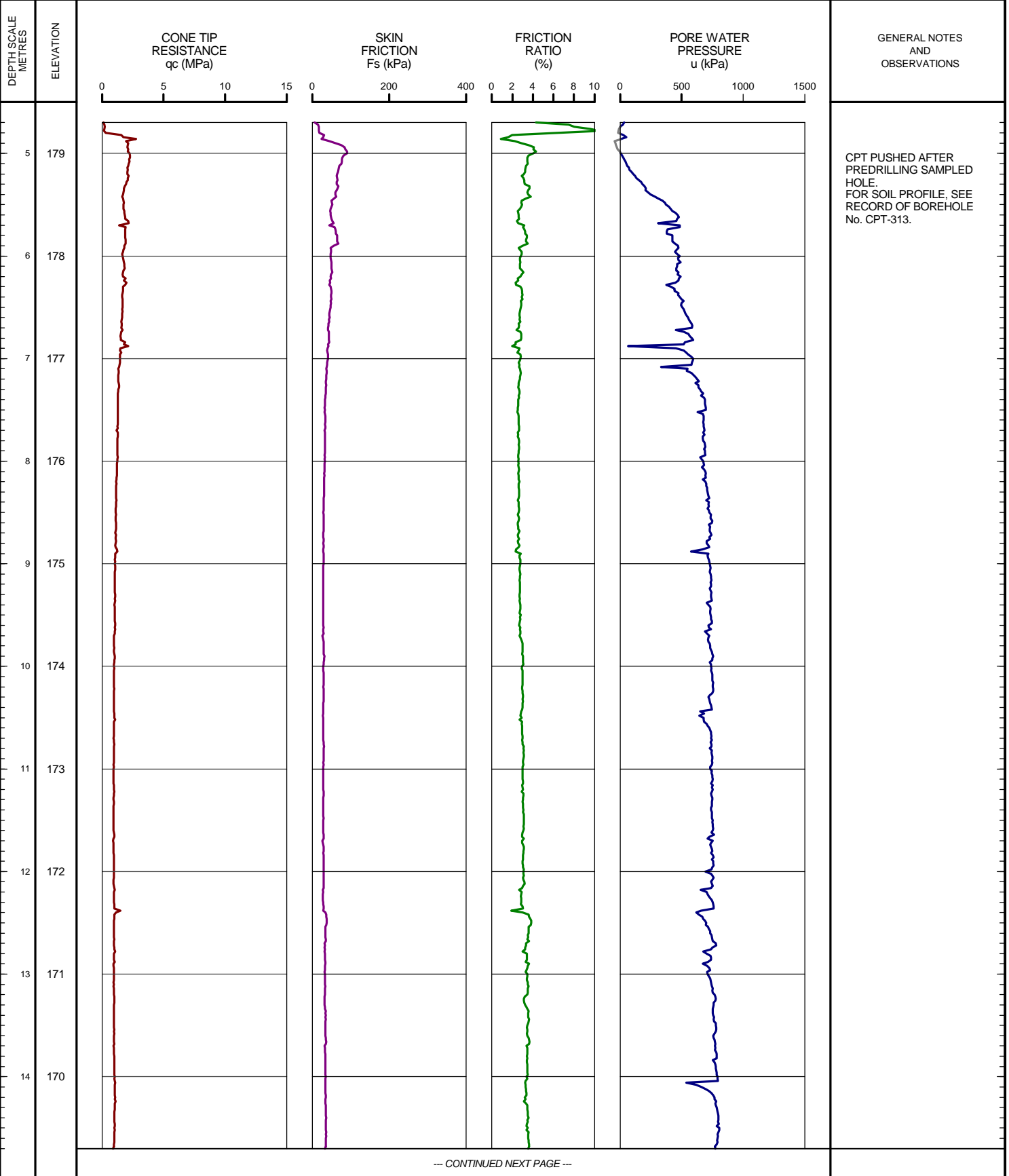
SHEET 1 OF 3

LOCATION: N 4678688.4 ;E 333599.7

TEST DATE: January 22, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 184.04m PREDRILL DEPTH: 4.70m 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-313

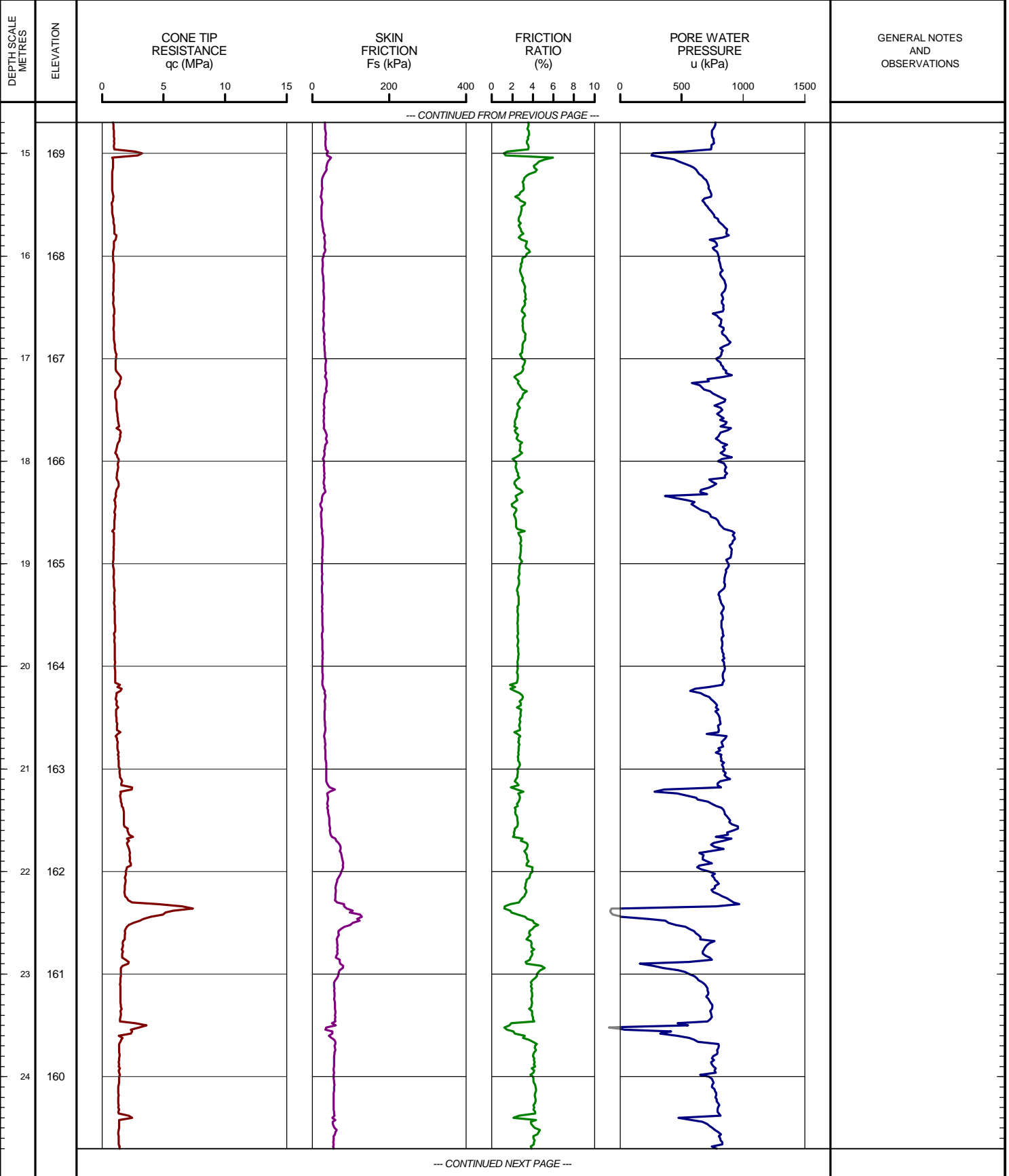
SHEET 2 OF 3

LOCATION: N 4678688.4 ;E 333599.7

TEST DATE: January 22, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 184.04m PREDRILL DEPTH: 4.70m 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-313

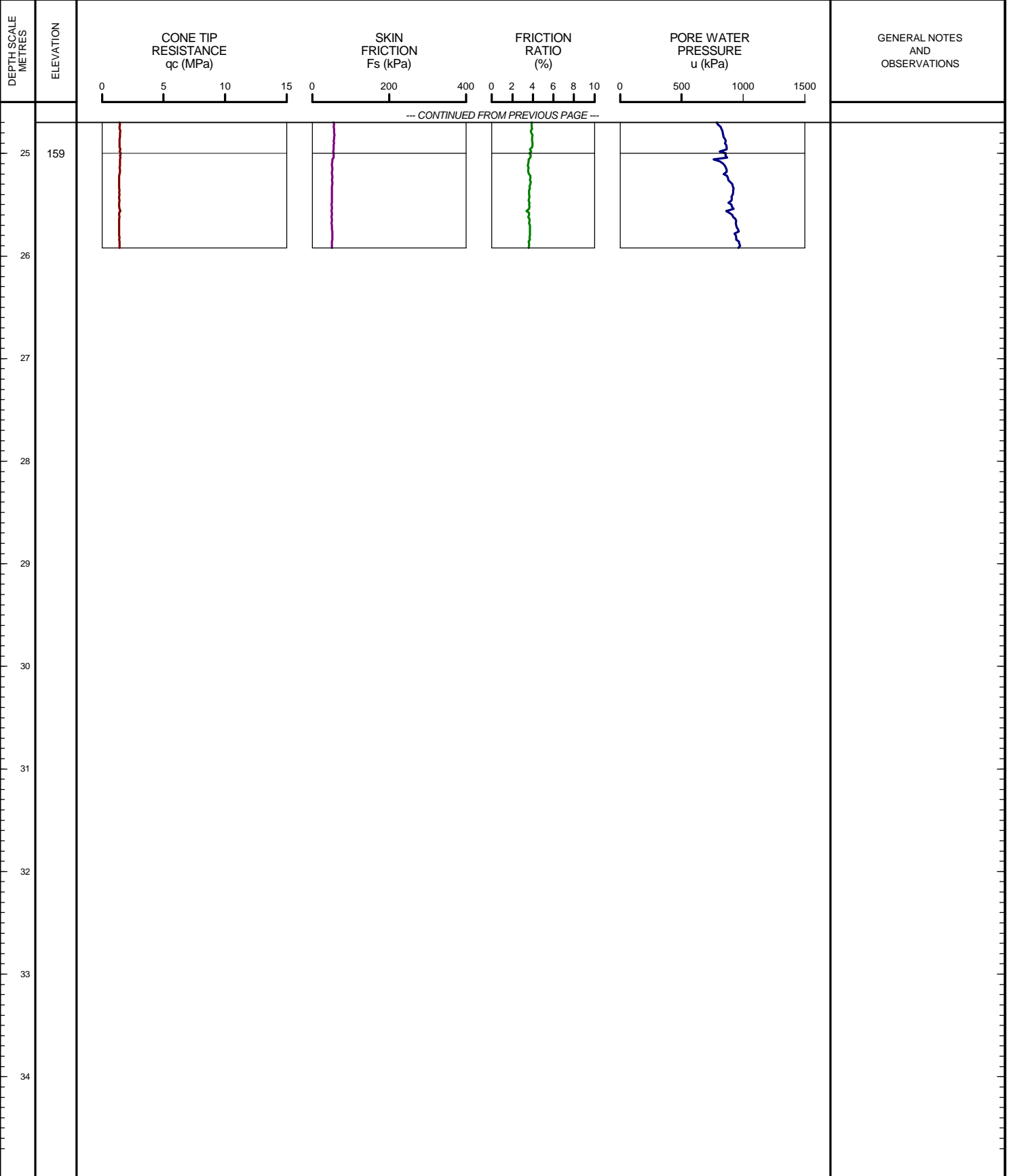
SHEET 3 OF 3

LOCATION: N 4678688.4 ;E 333599.7

TEST DATE: January 22, 2010

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 184.04m PREDRILL DEPTH: 4.70m 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-324

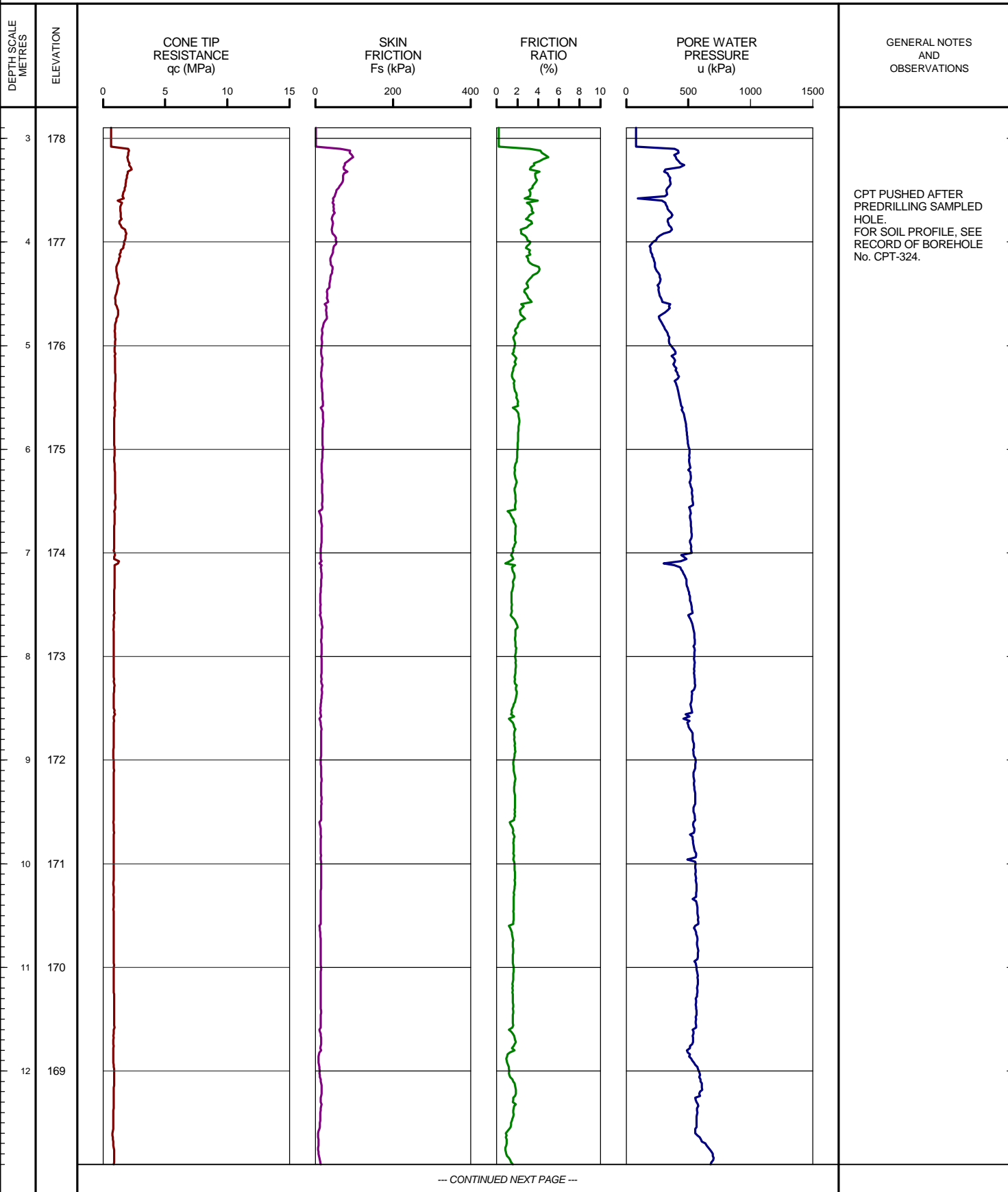
SHEET 1 OF 3

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

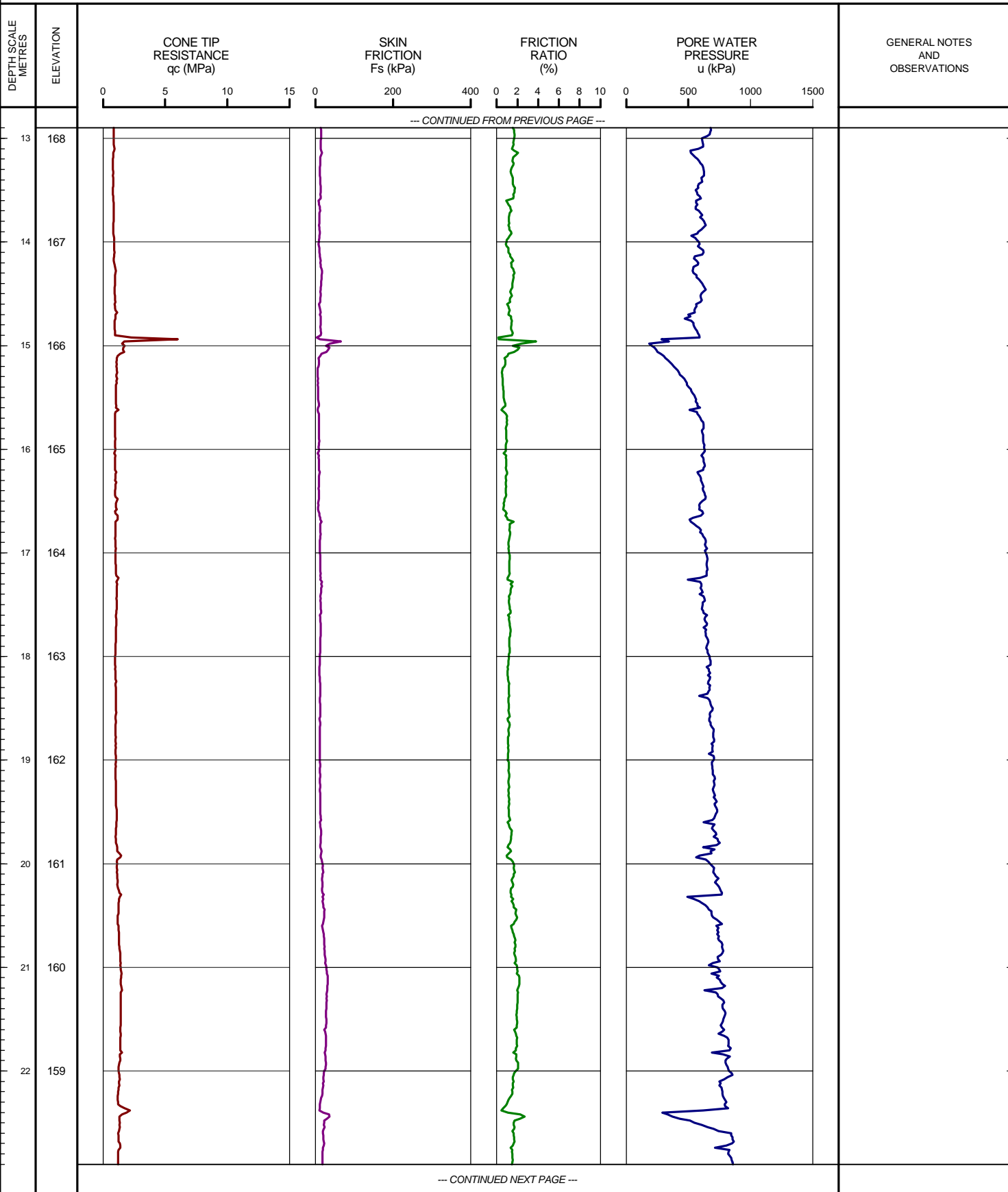
SHEET 2 OF 3

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



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-324

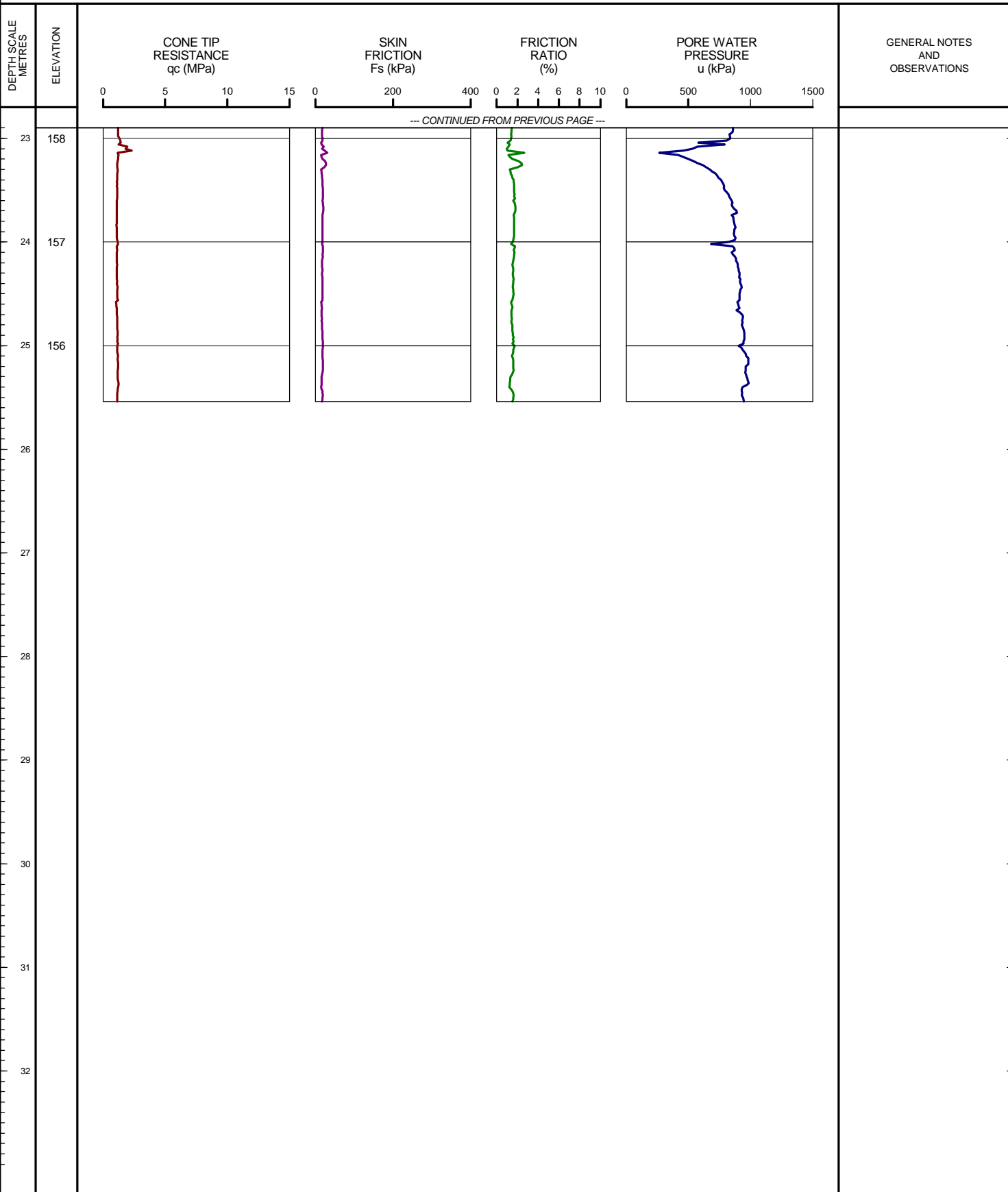
SHEET 3 OF 3

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:

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 LIMIT 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					WATER CONTENT (%)				
								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 Compact Brown		1	SS	23												
180.50			2	SS	17												
1.83	SANDY SILT, some clay, trace																
180.19	gravel Compact Grey																
2.14	CLAYEY SILT, some sand, trace		3	SS	19												
179.43	gravel, with occasional silt partings																
2.90	Very stiff Grey END OF BOREHOLE																
	Borehole dry during drilling on December 16, 2009.																

PROJECT: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-333

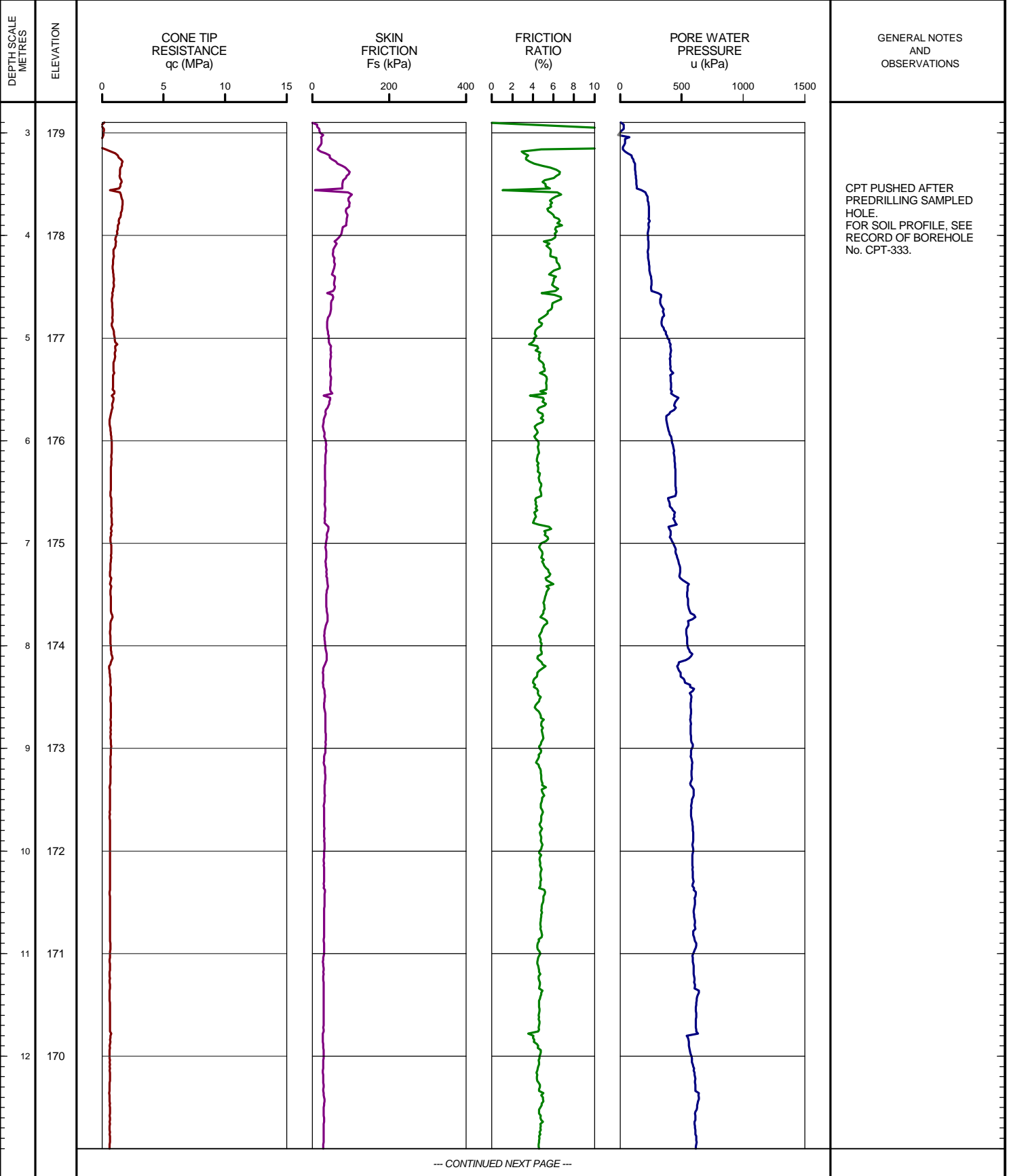
SHEET 1 OF 2

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

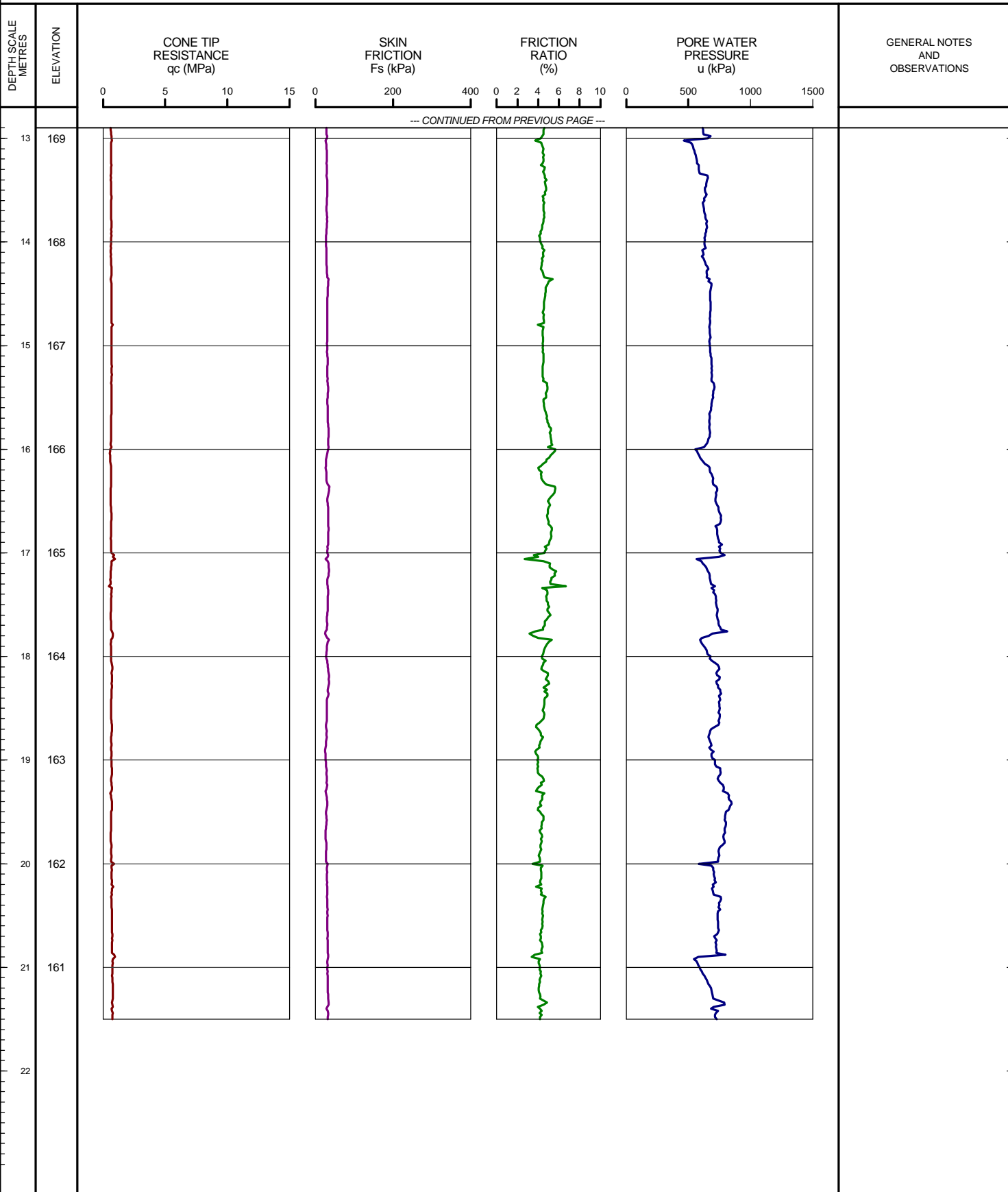
SHEET 2 OF 2

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



LDN_CPT_01 09-1132-0080-CPT.GPJ GLDR_LON.GDT 02/23/10 DATA INPUT:

DEPTH SCALE

1 : 50



OPERATOR: TA

CHECKED:

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 LIMIT 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					
182.27	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: 09-1132-0080

RECORD OF CONE PENETRATION TEST CPT-335

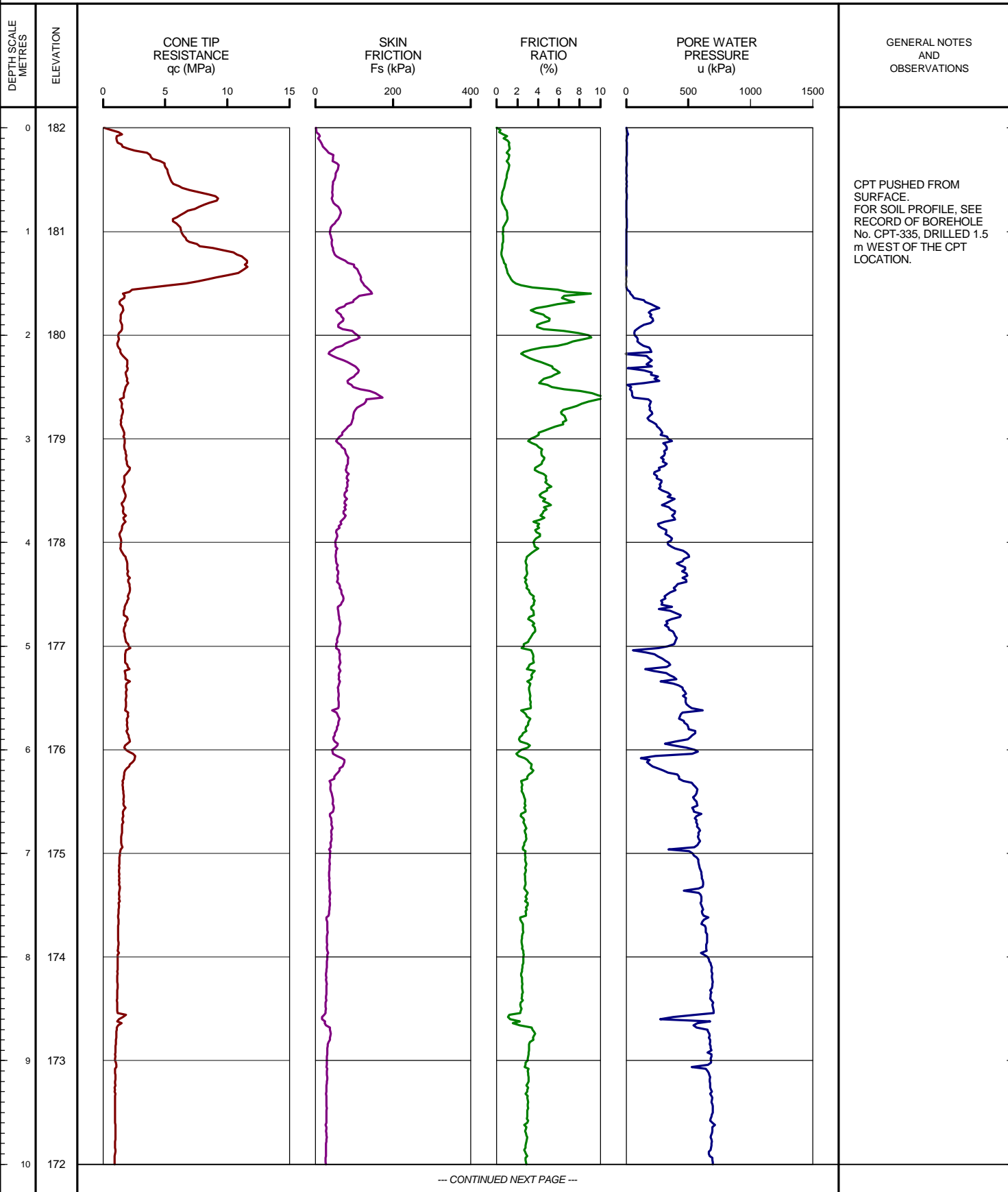
SHEET 1 OF 3

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

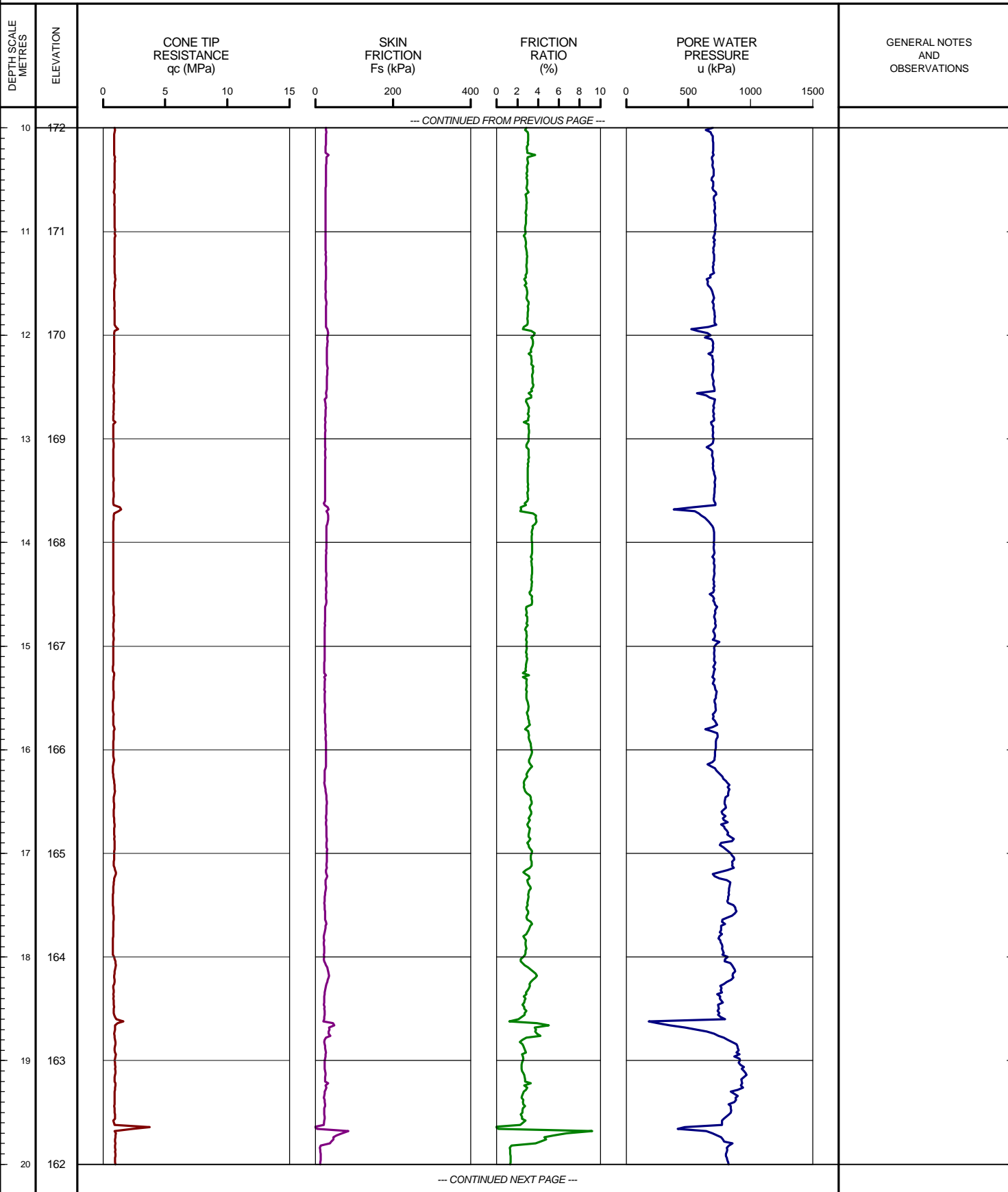
SHEET 2 OF 3

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

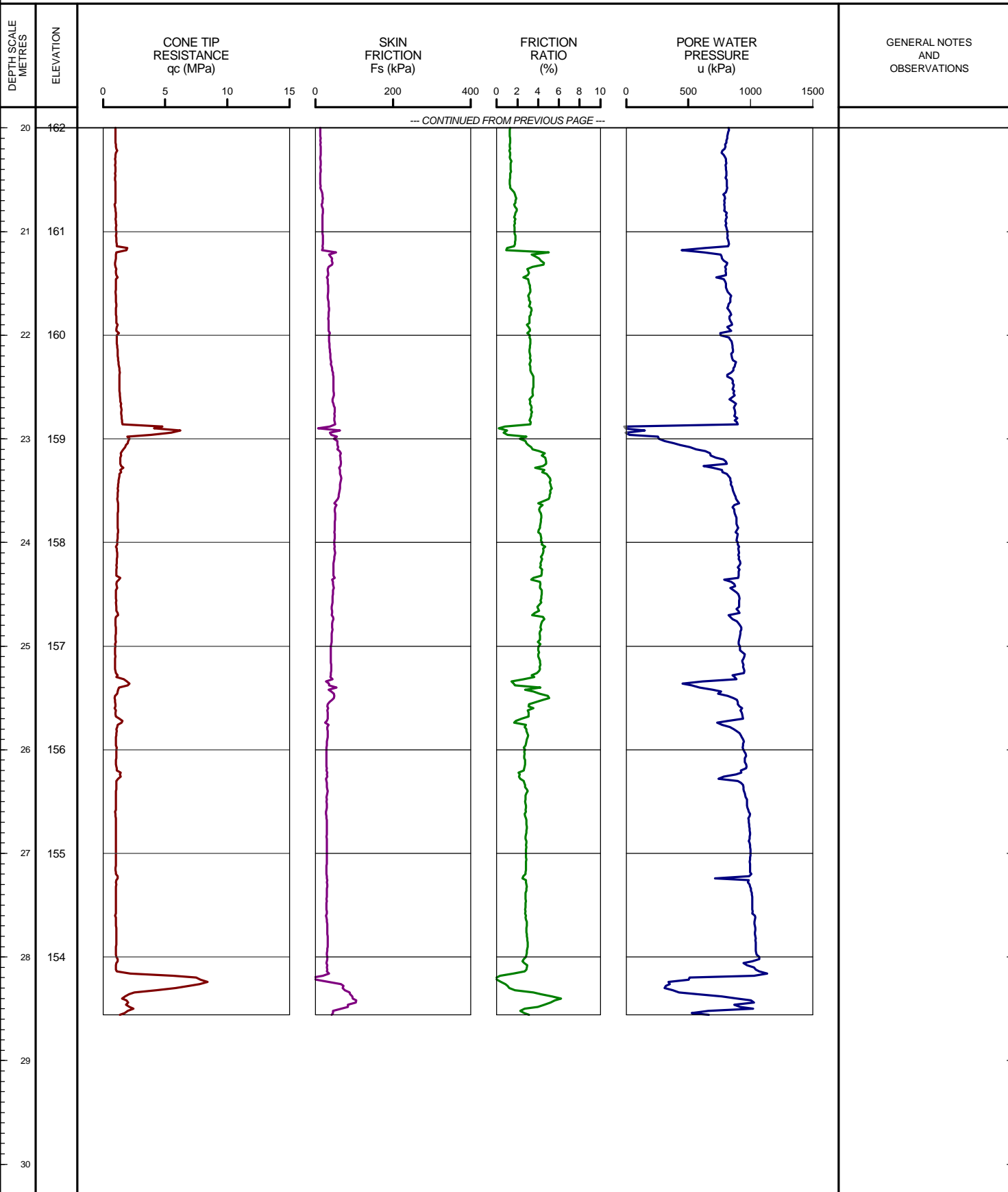
SHEET 3 OF 3

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

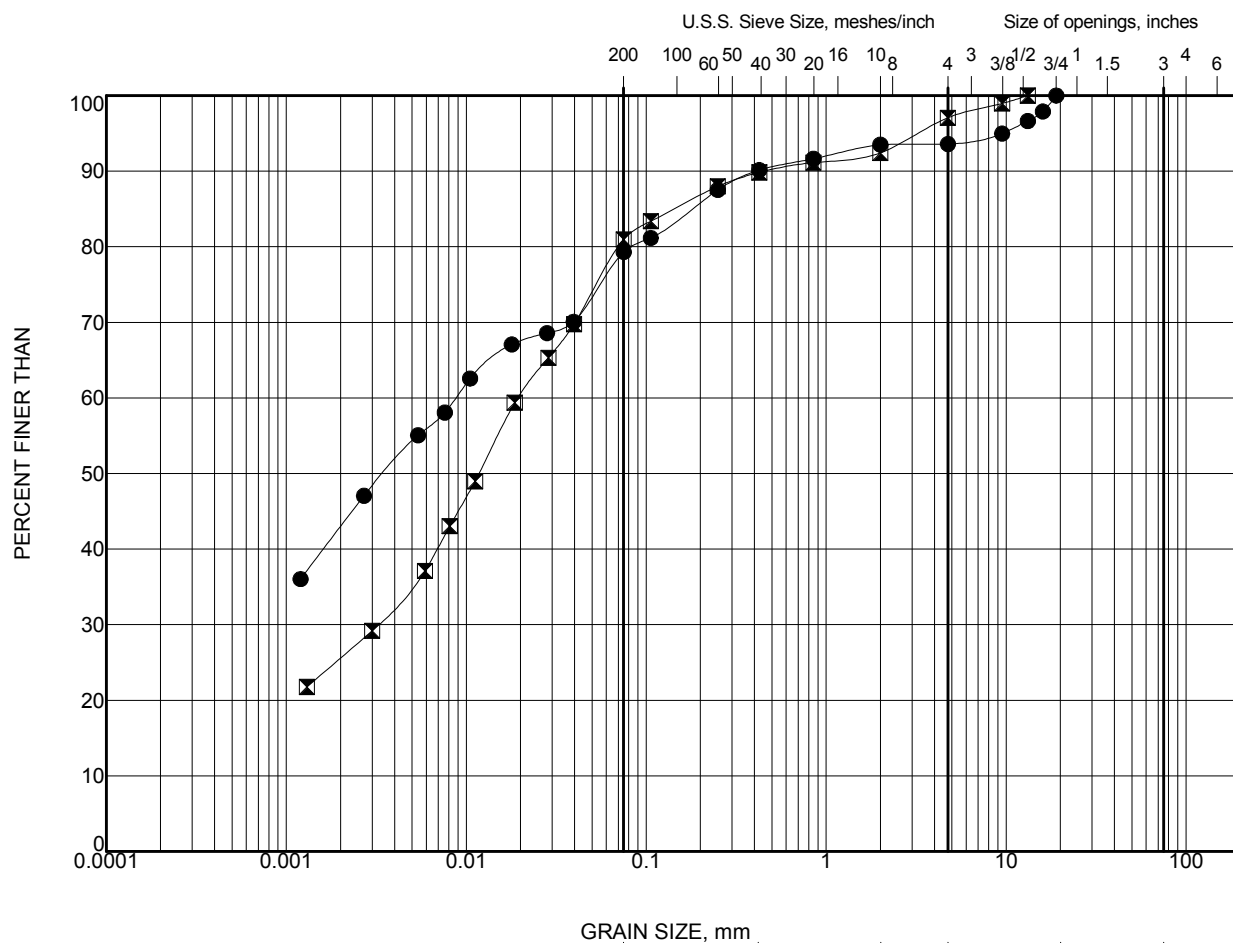
1 : 50



OPERATOR: TA

CHECKED:

Appendix C Analytical Laboratory Results

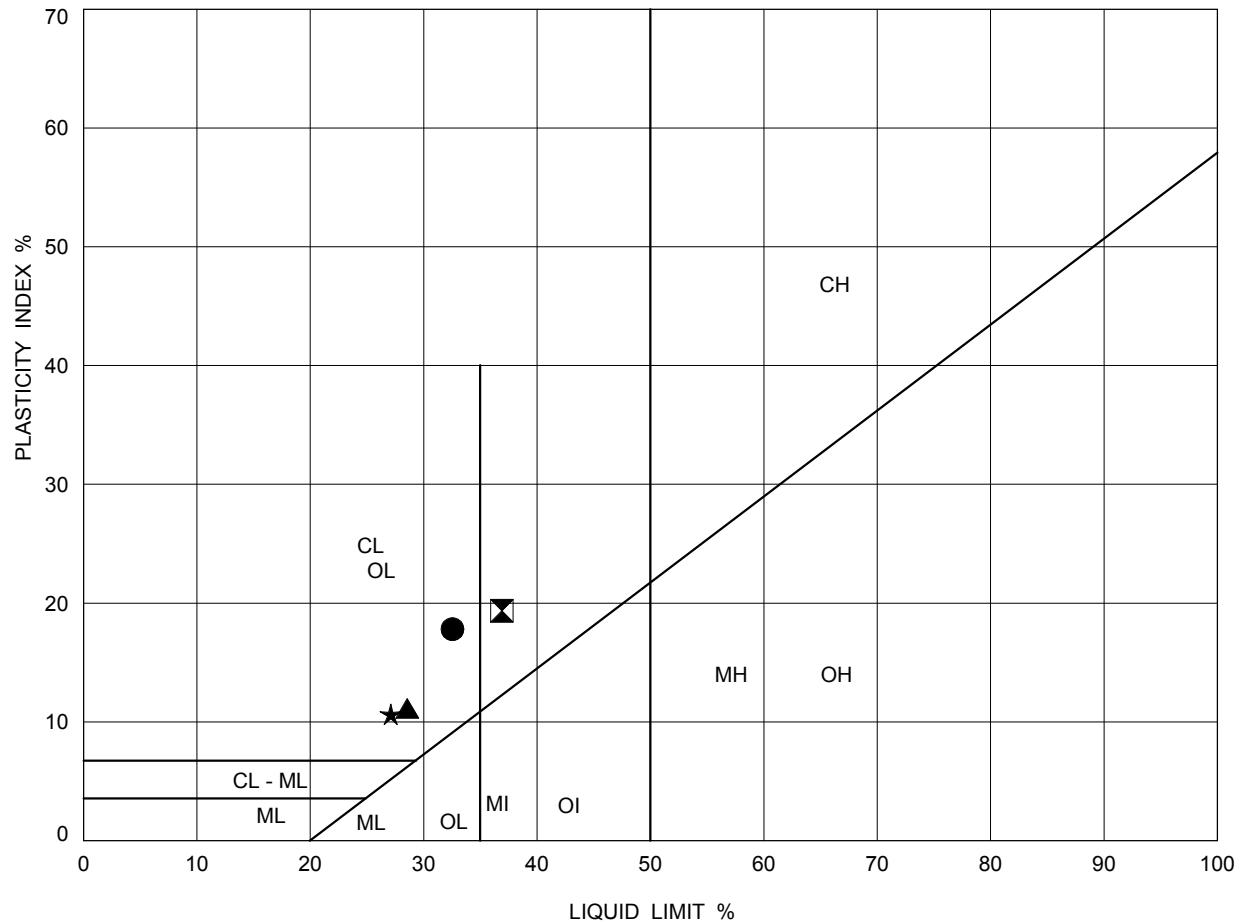


CLAY AND SILT	GRAIN SIZE, mm					Cobble Size
	fine	medium	coarse	fine	coarse	
	SAND SIZE			GRAVEL SIZE		

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

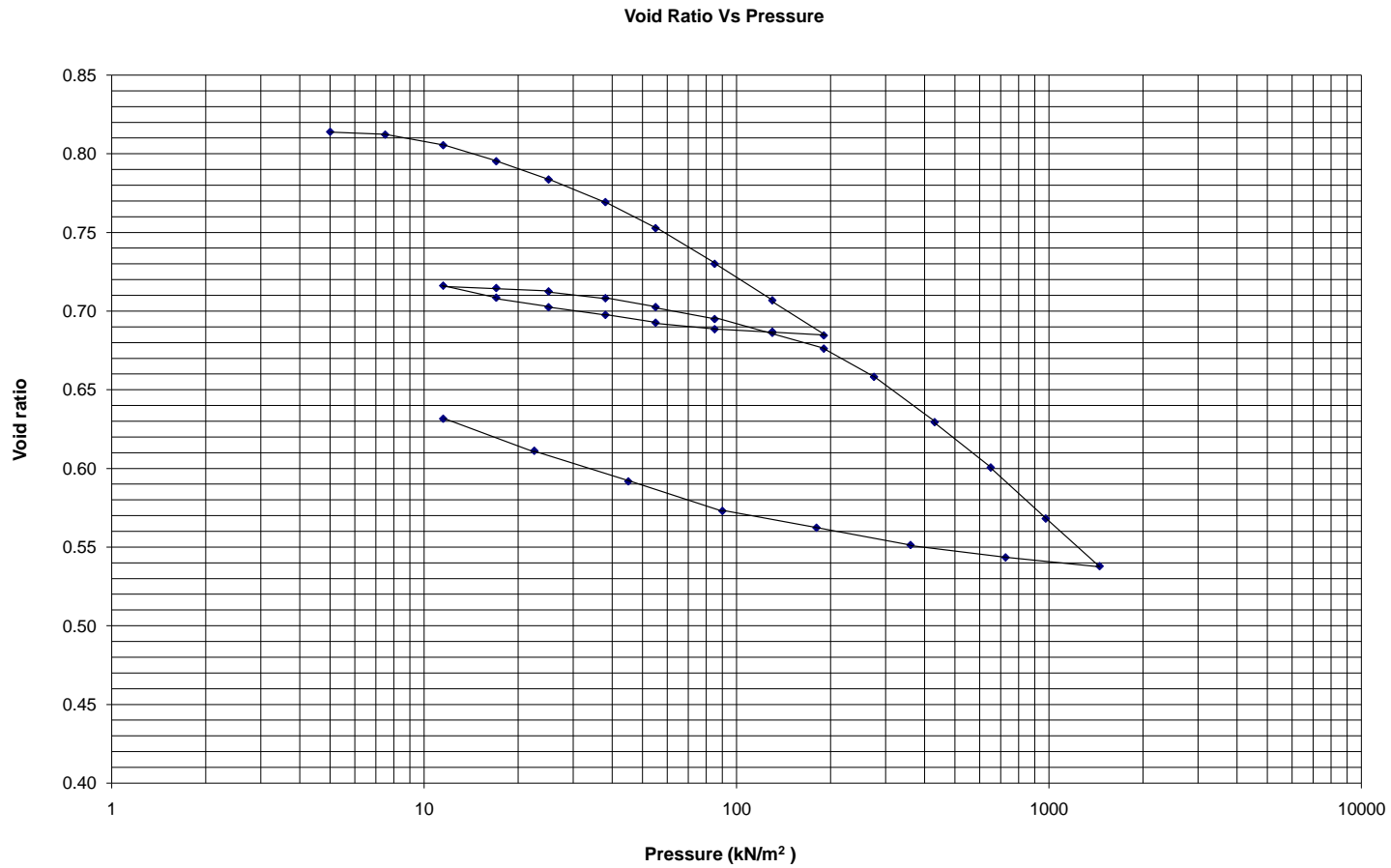
Aug 2012

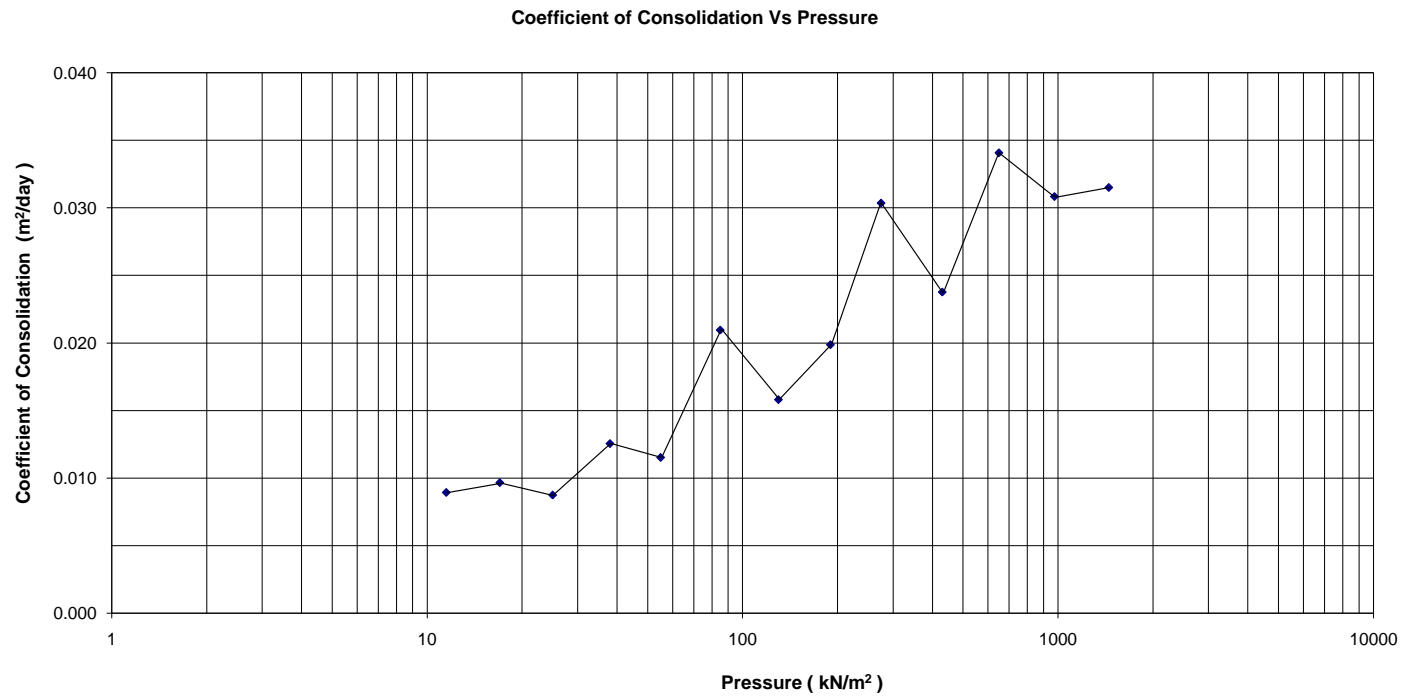
JOB NO

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

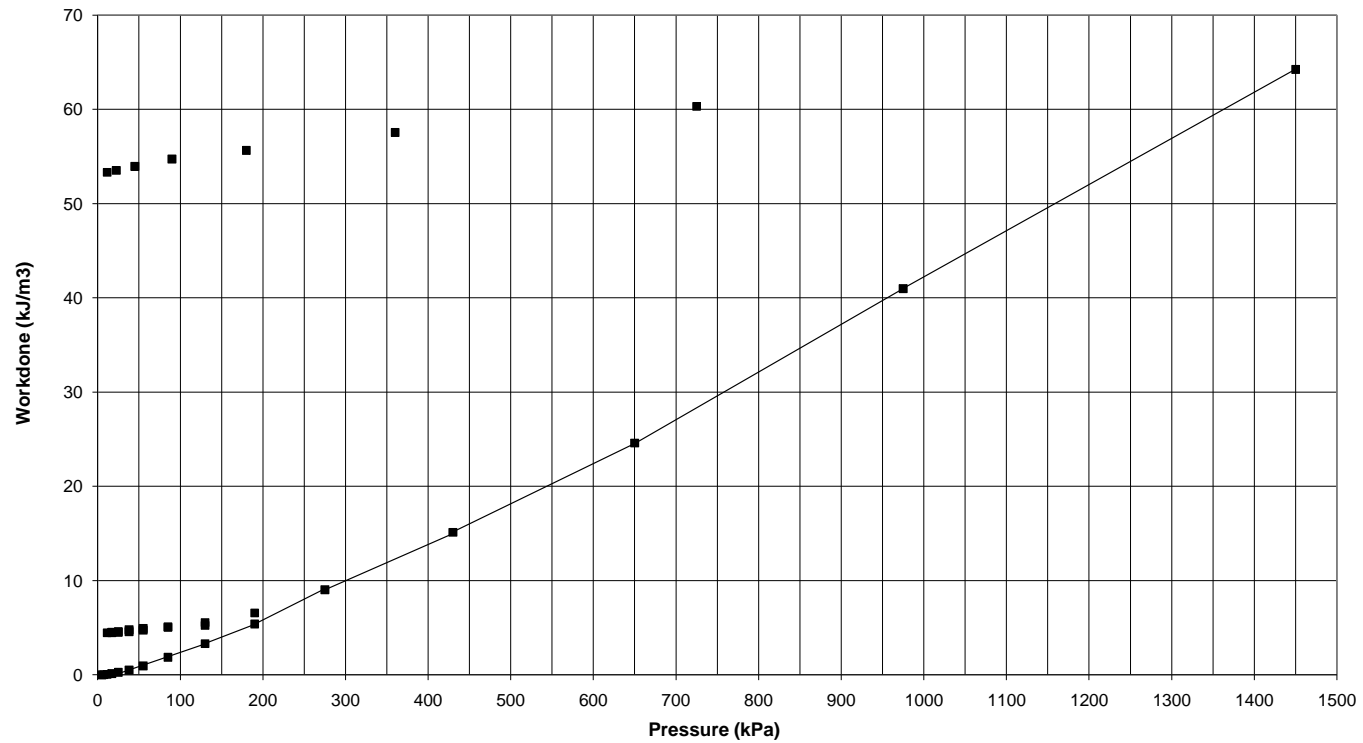
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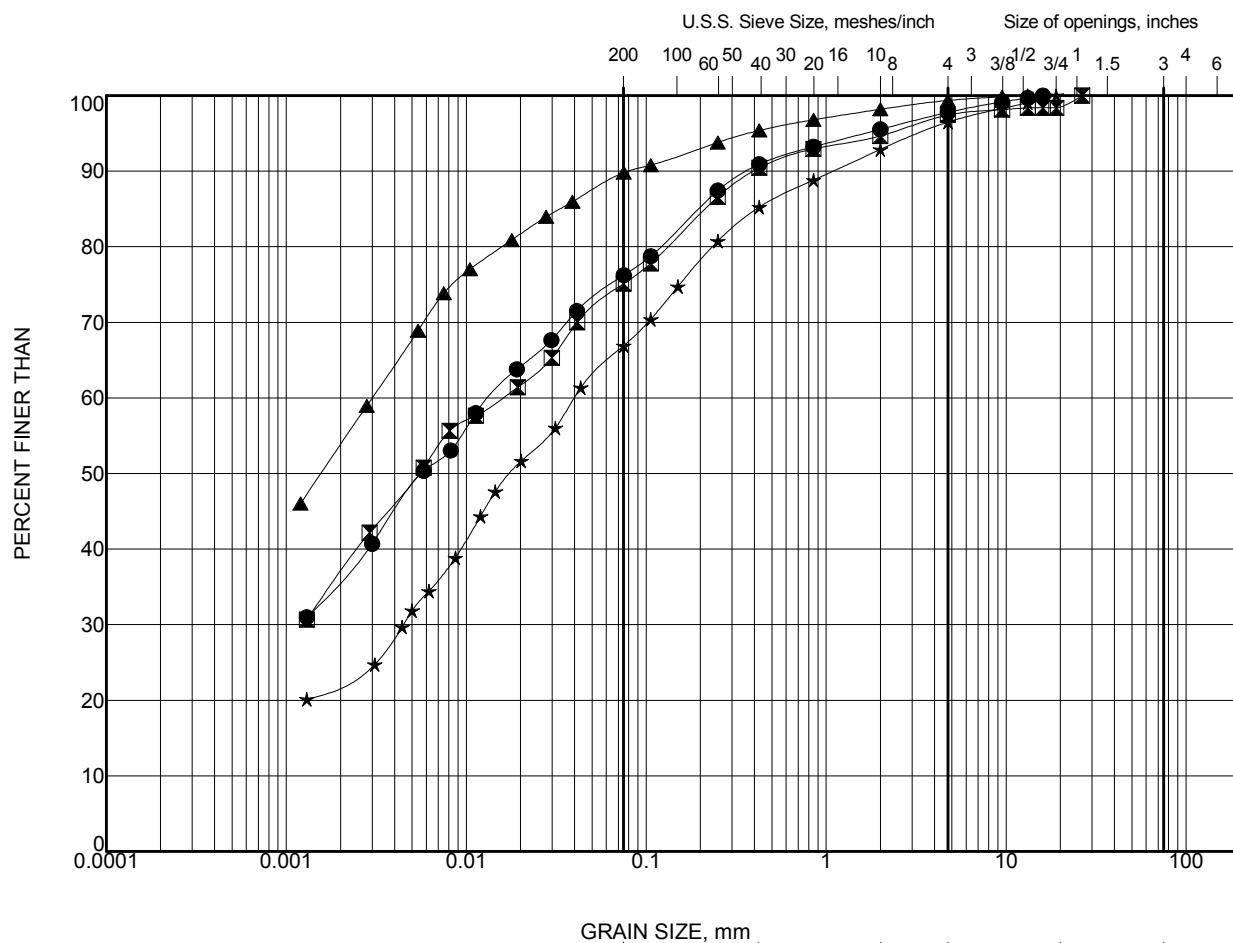
SW8801.1004.101

FIGURE NO.
C.3-E

REV

Strain Energy Method for Preconsolidation Pressure



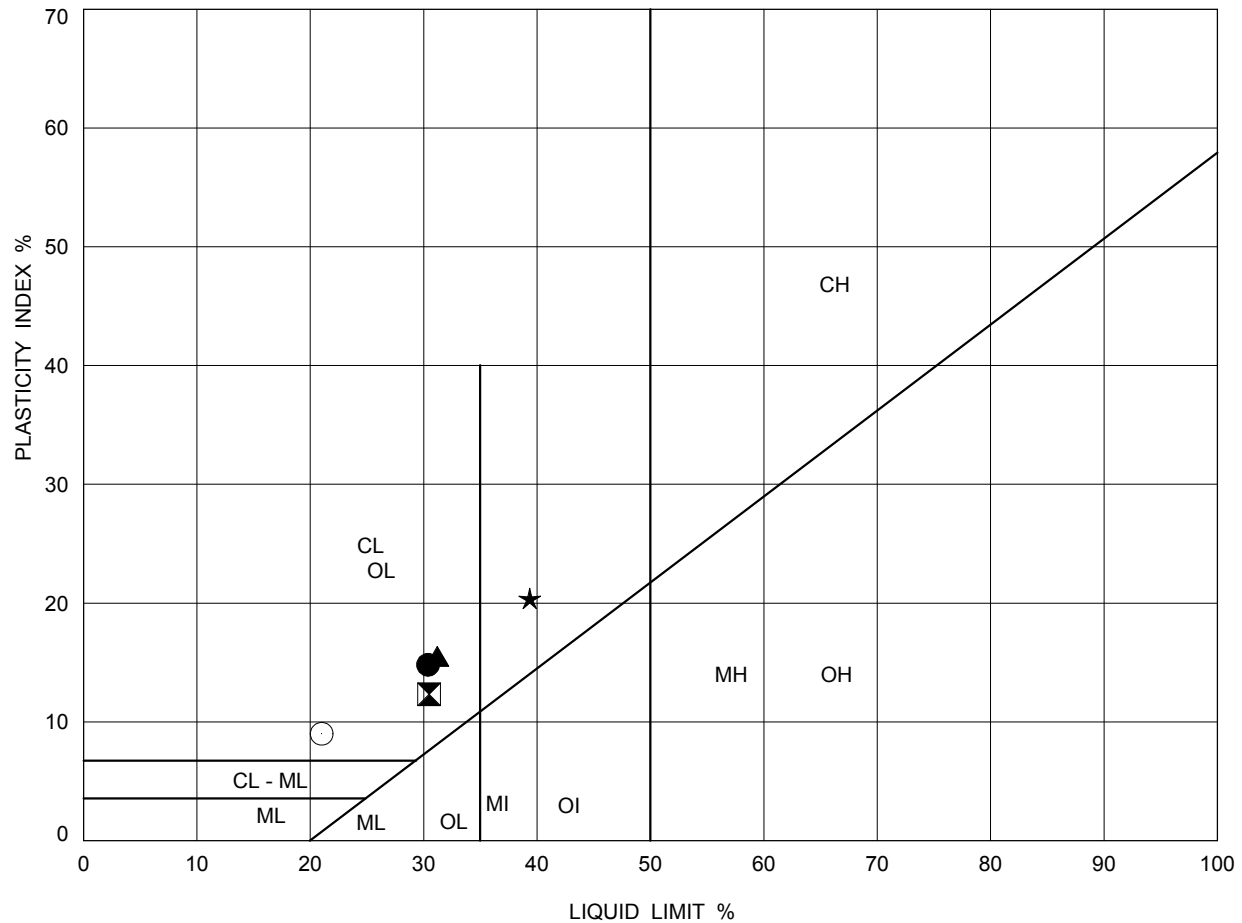


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

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
	CHECK	MSO	REV.
FIGURE C.1			



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

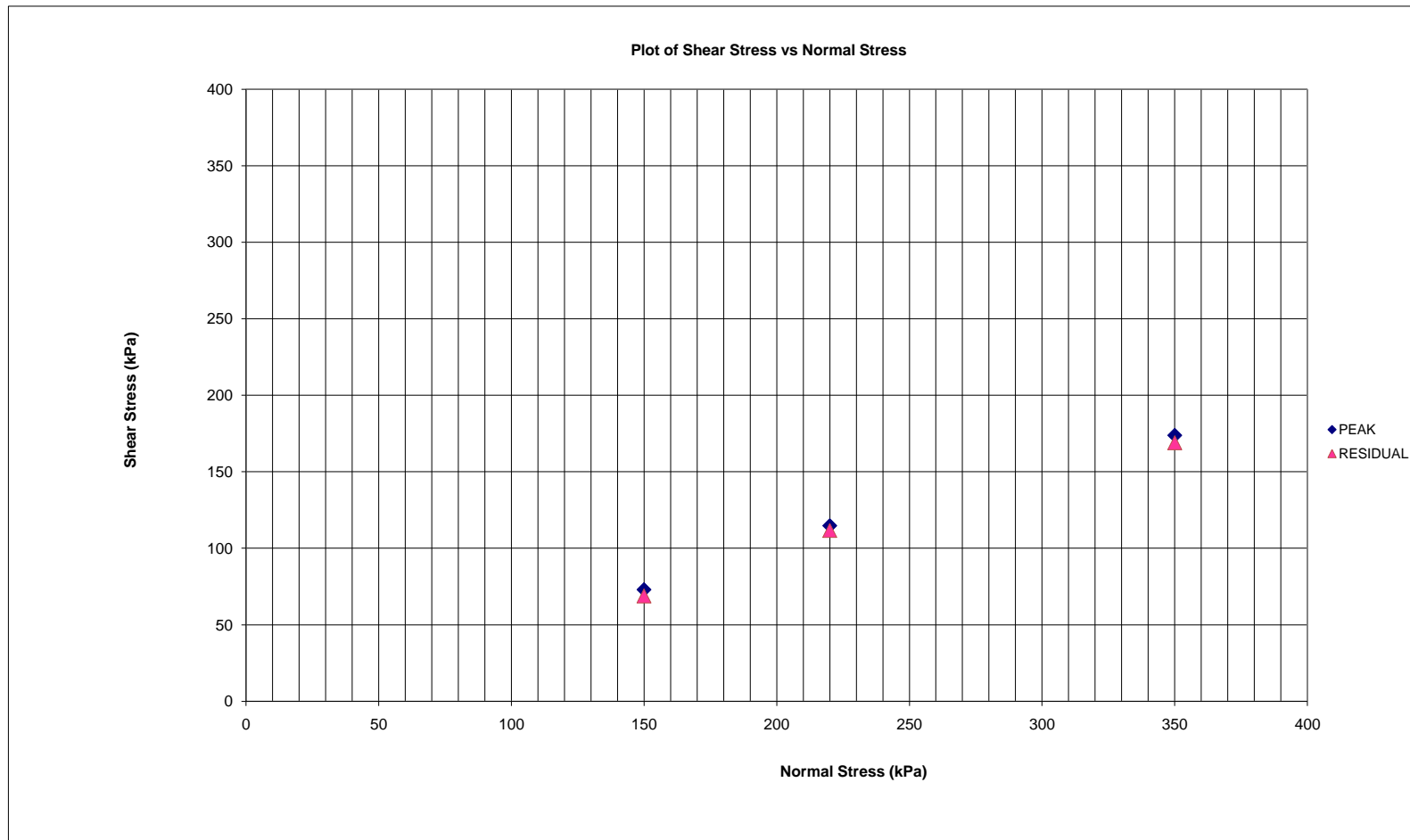
Aug 2012

JOB NO

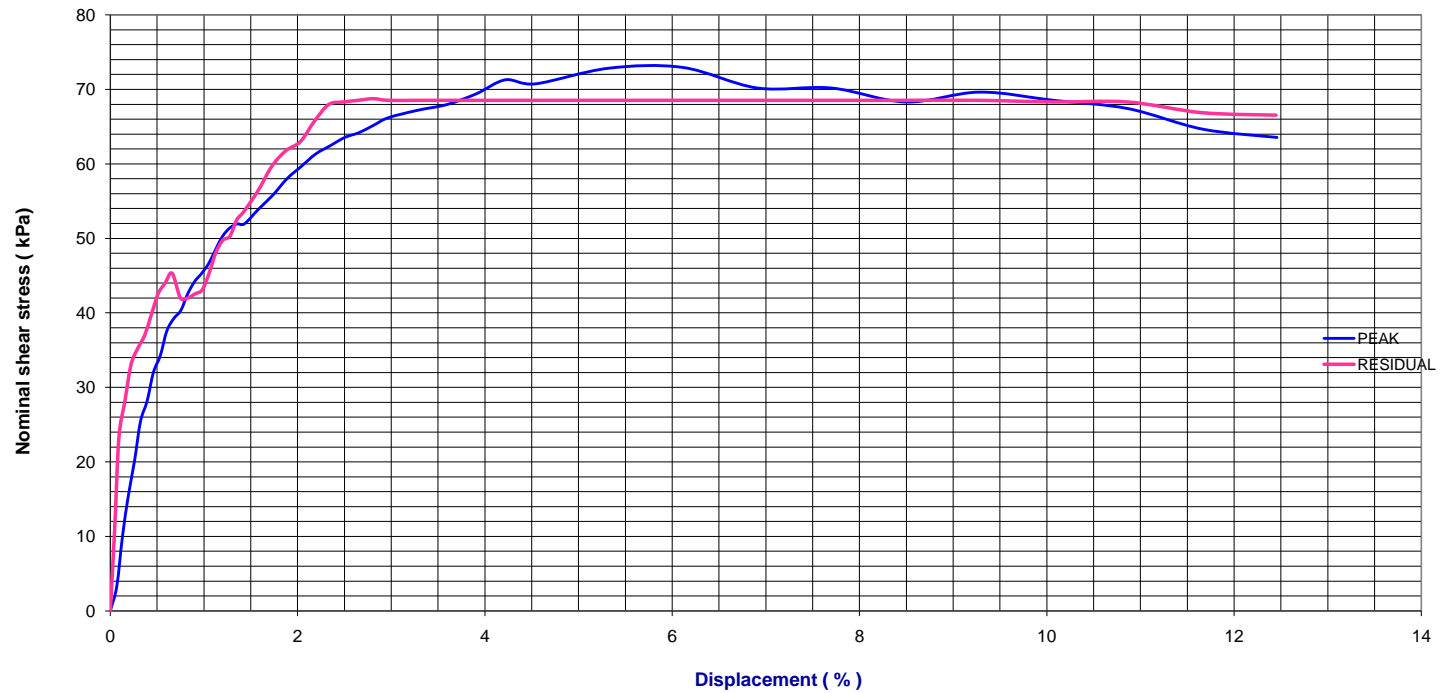
SW8801.1004.101

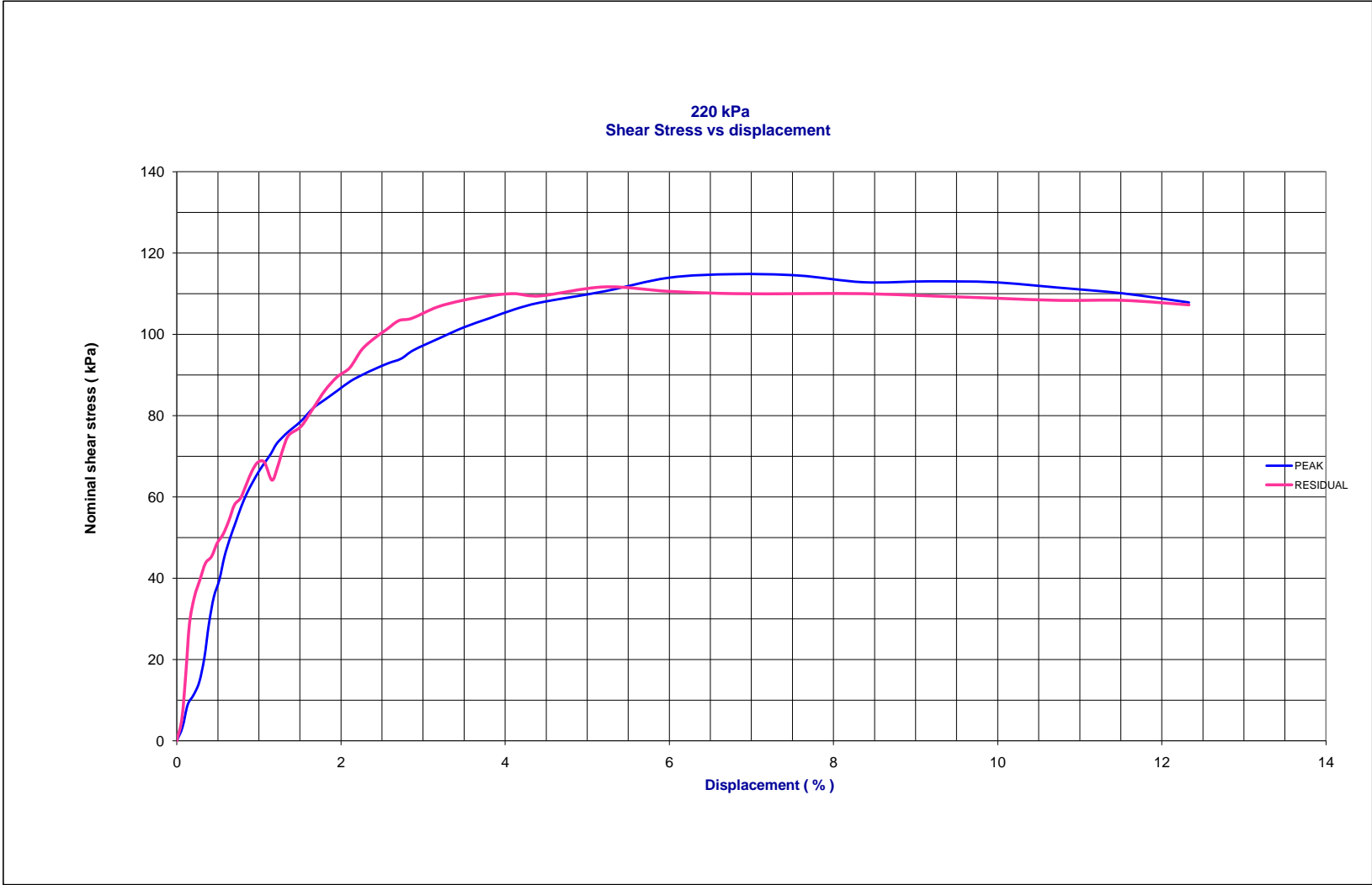
FIGURE NO.
 C.3-A

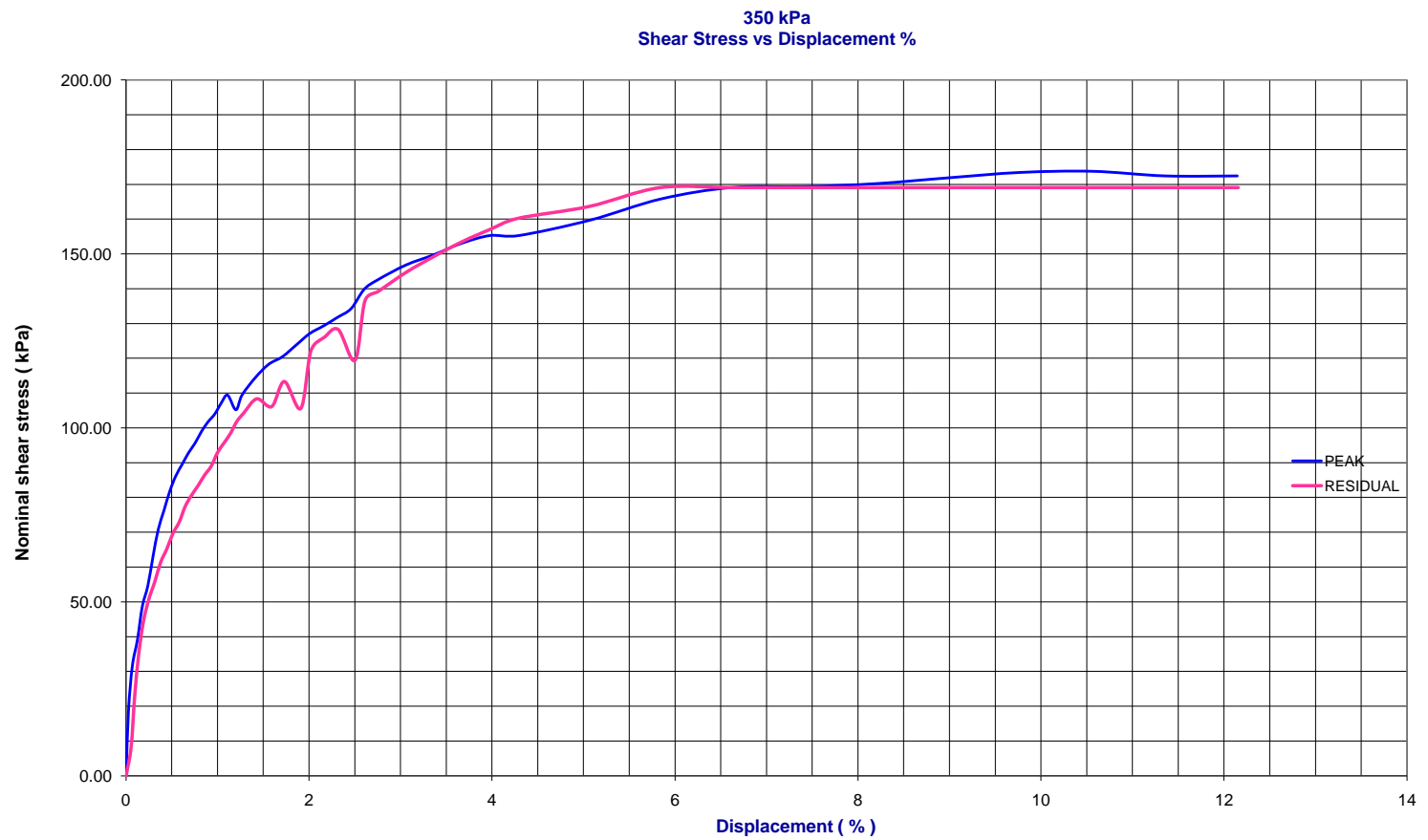
REV

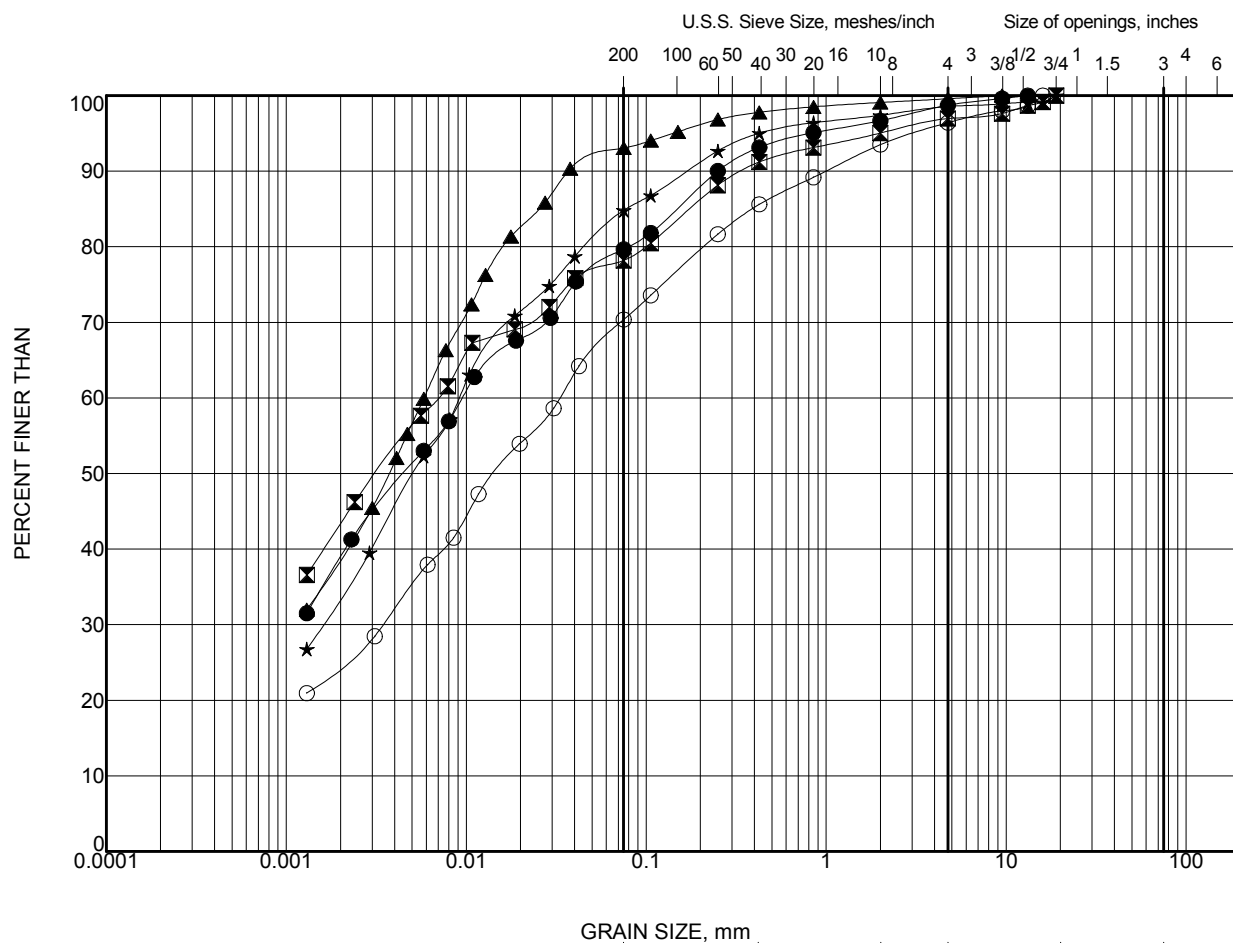


150 kPa
Shear Stress vs Strain







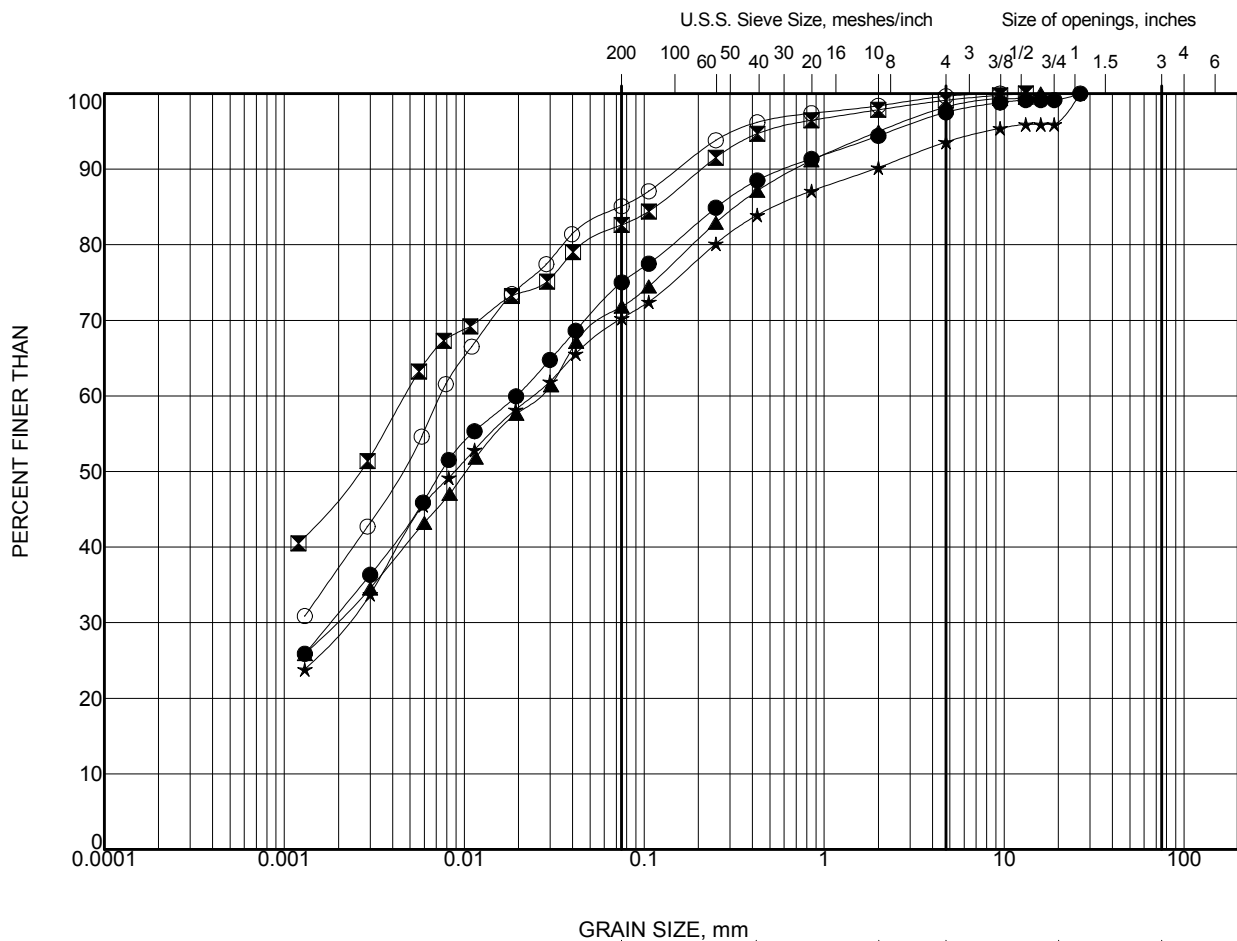


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

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			

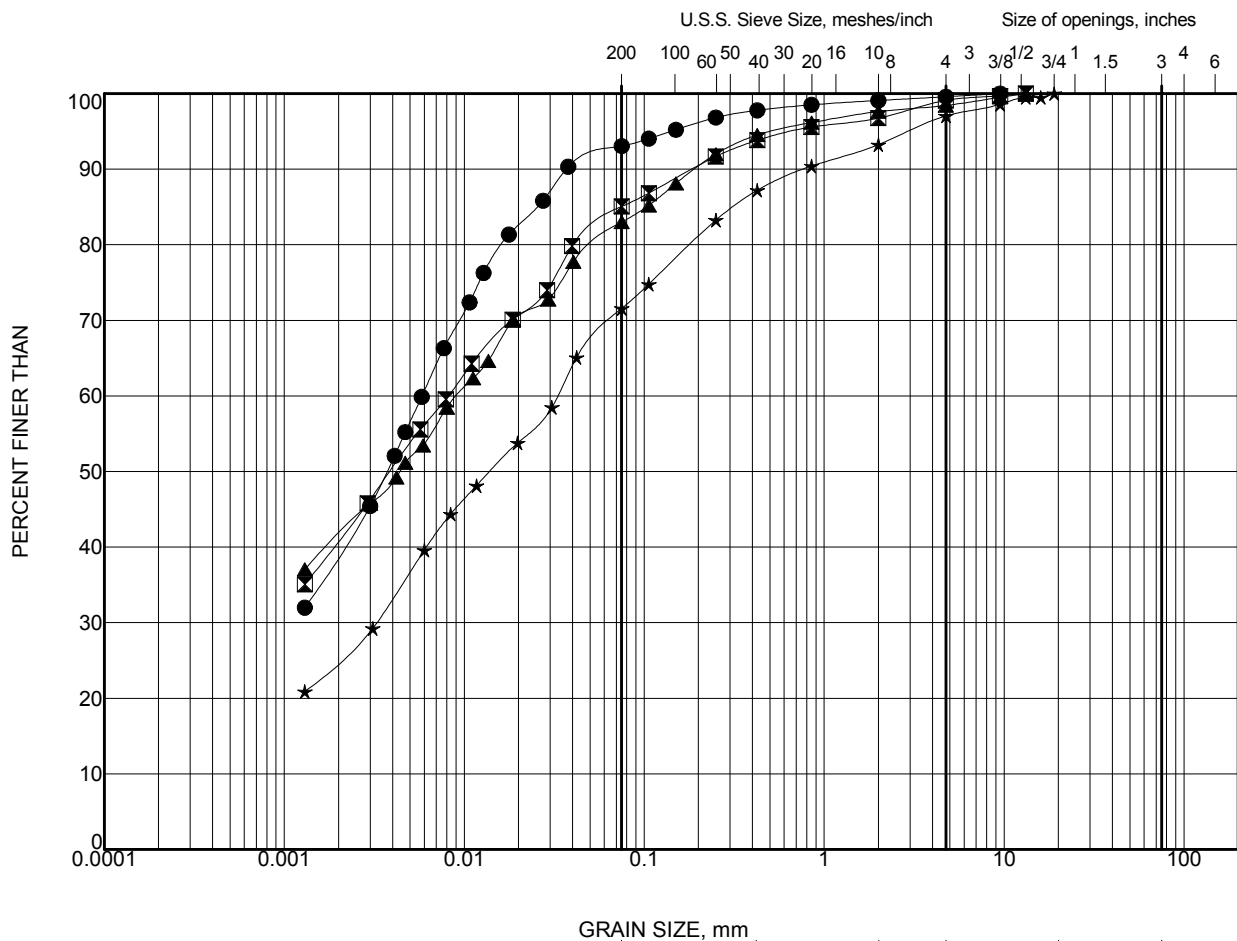


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

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			

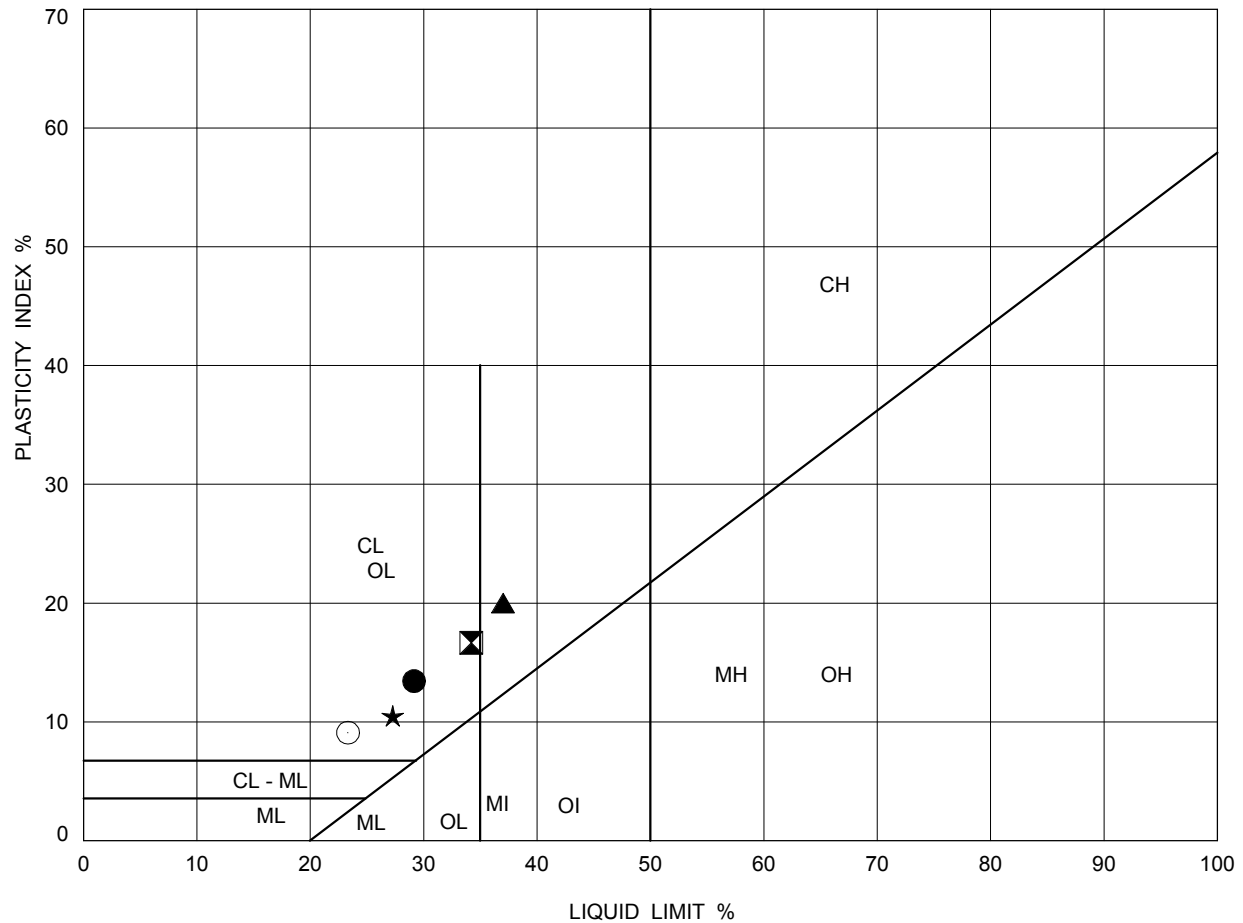


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

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

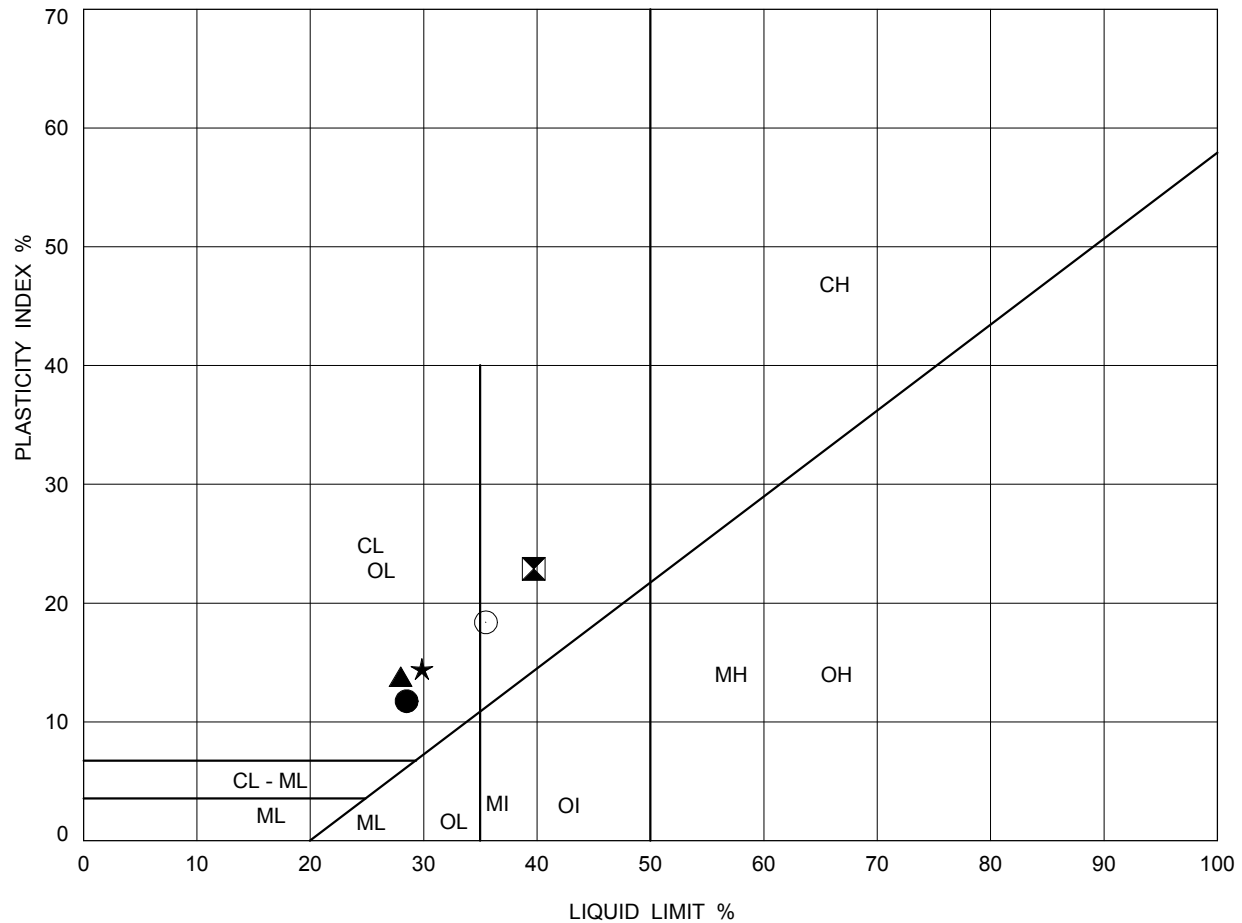
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TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY TO CLAYEY SILT	
		PROJECT No. SW8801.1004.101	FILE No.
		DRAWN EA	SCALE
		CHECK MSO	REV.
		FIGURE C.3	



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

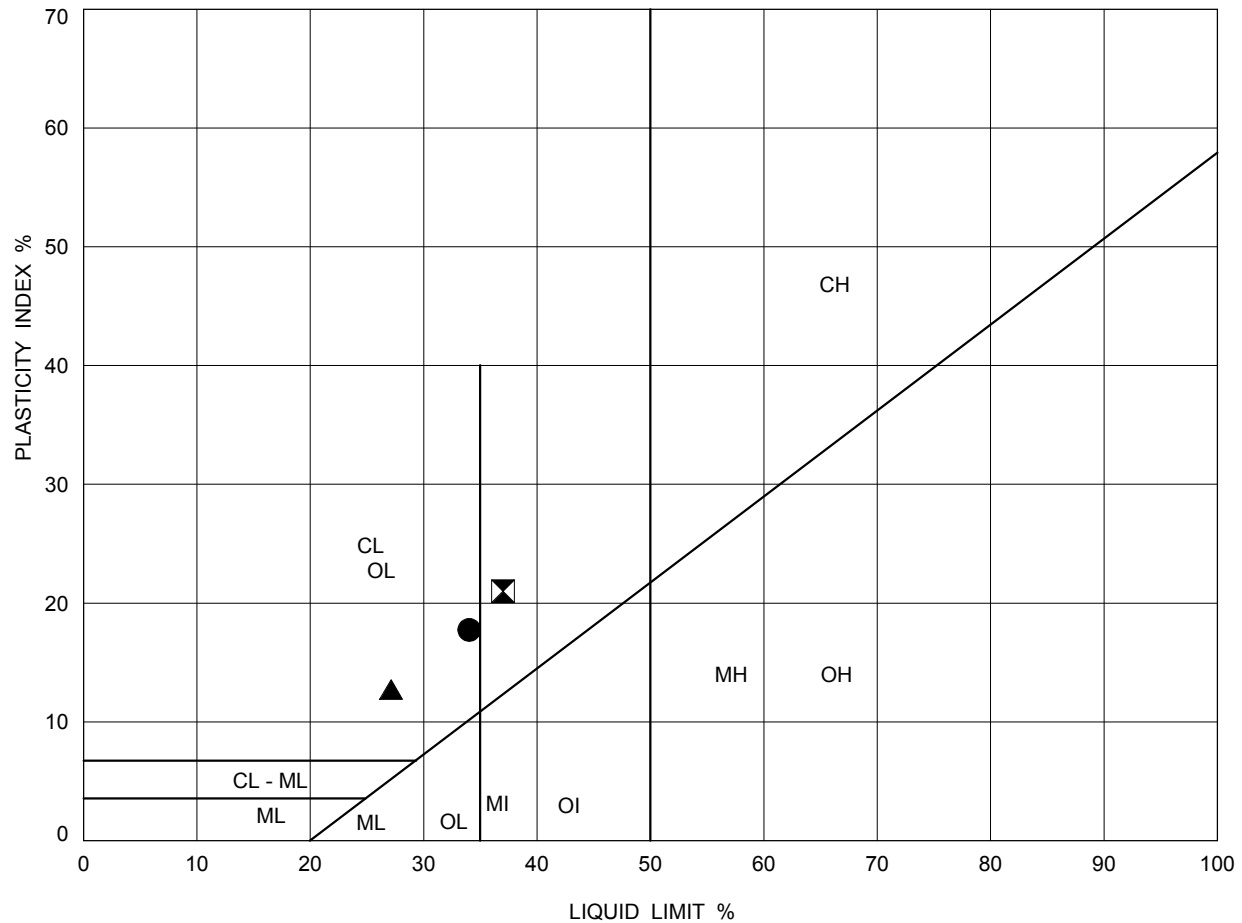
PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.4	



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

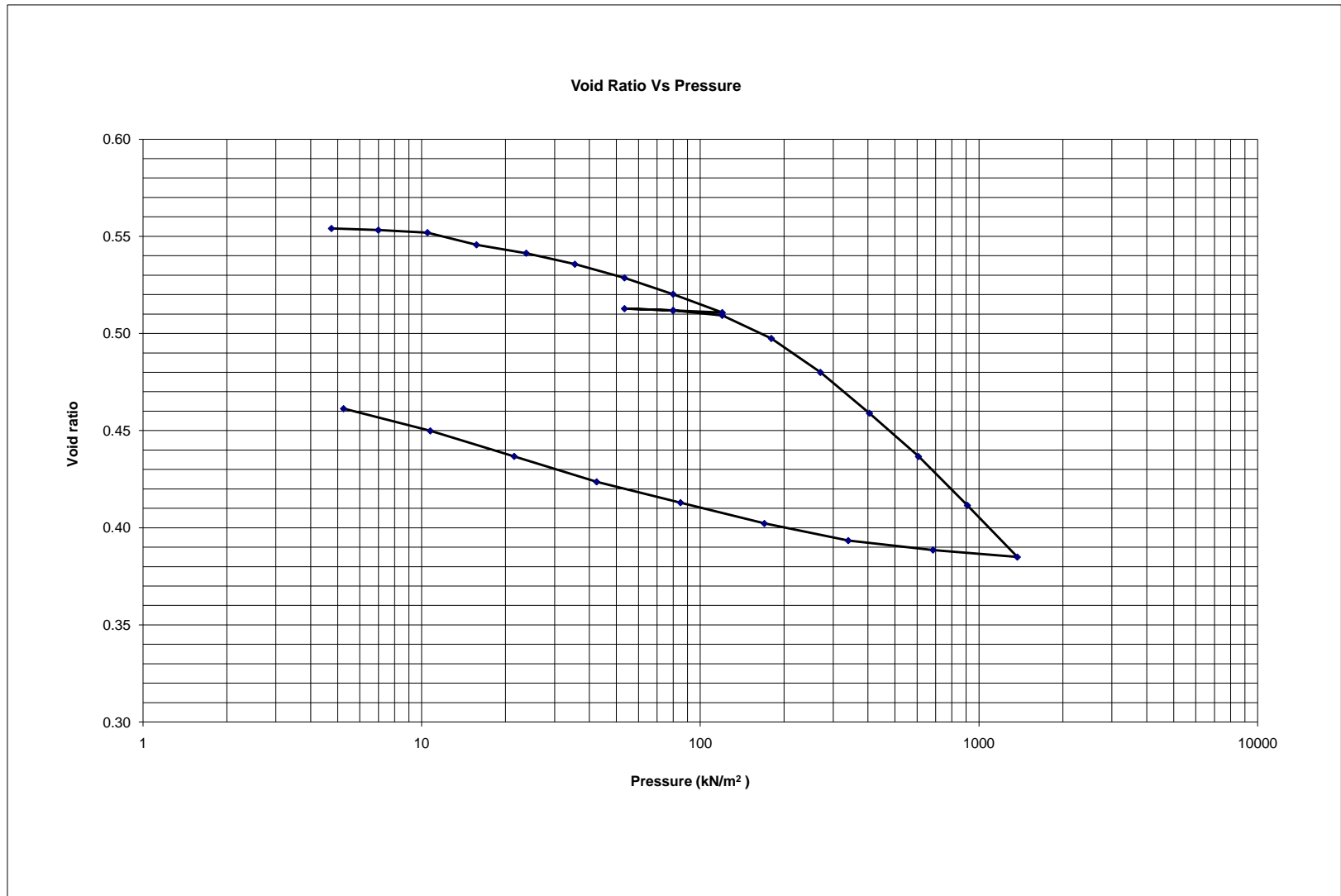
Aug 2012

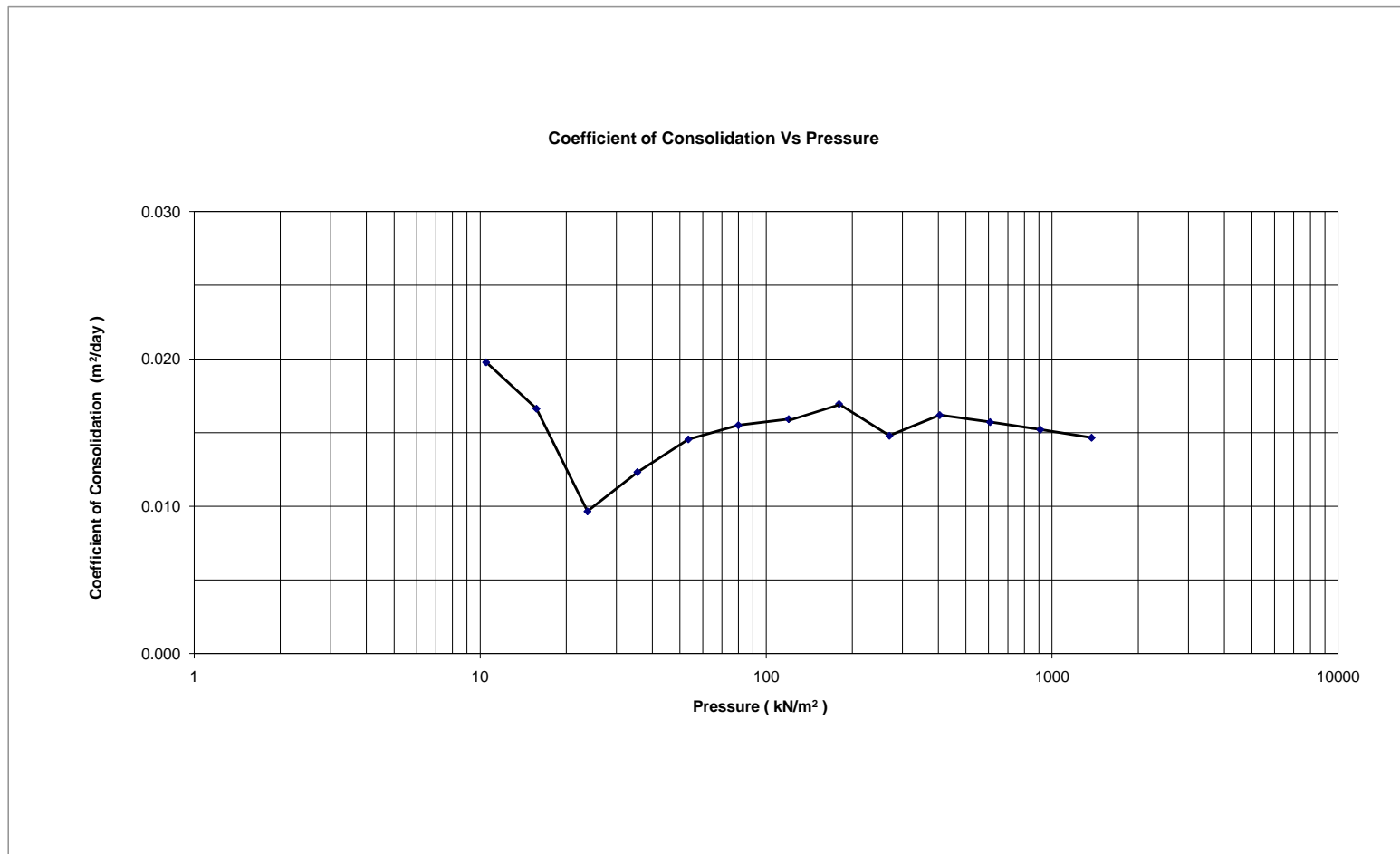
JOB NO

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

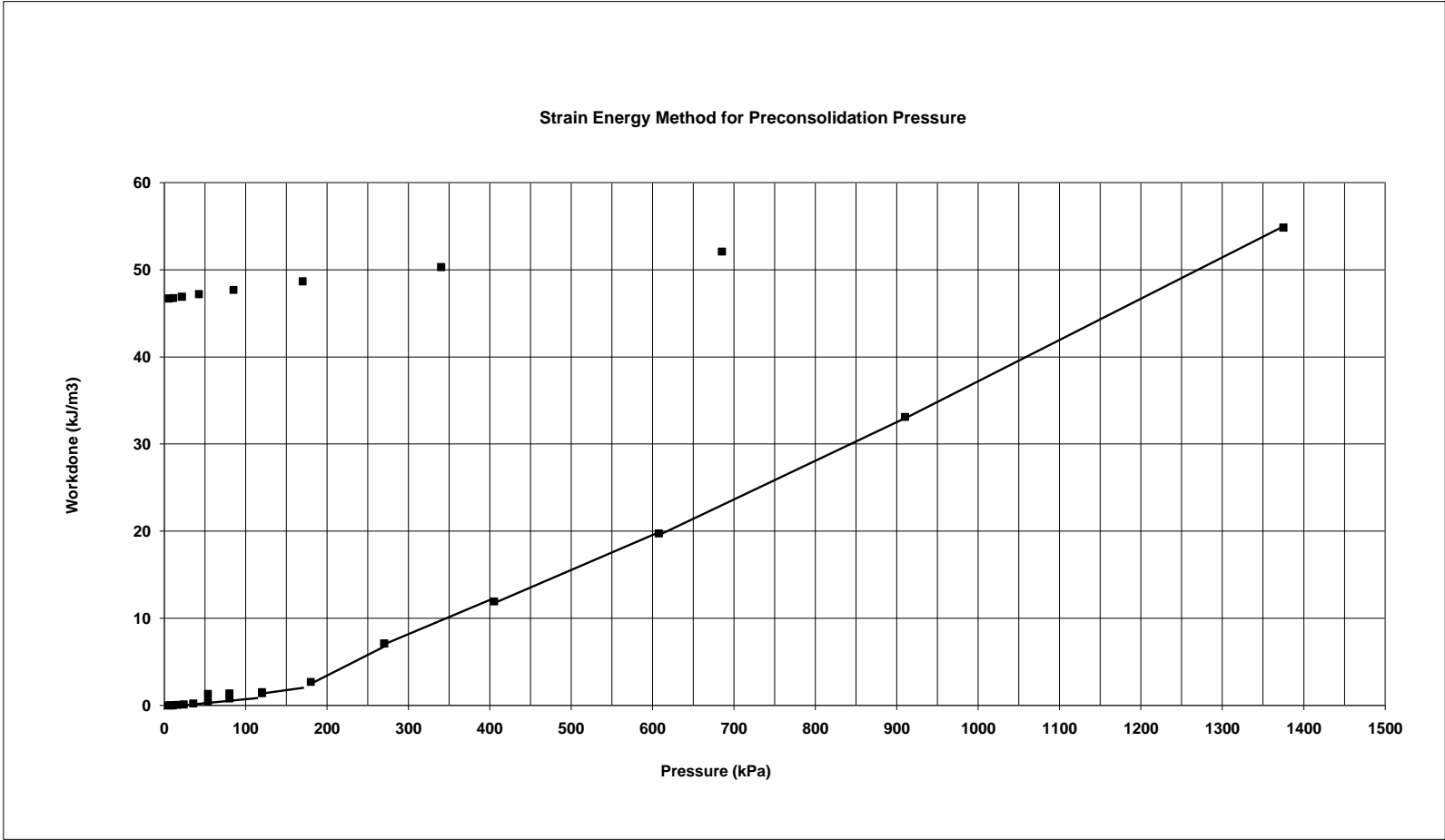
Aug 2012

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

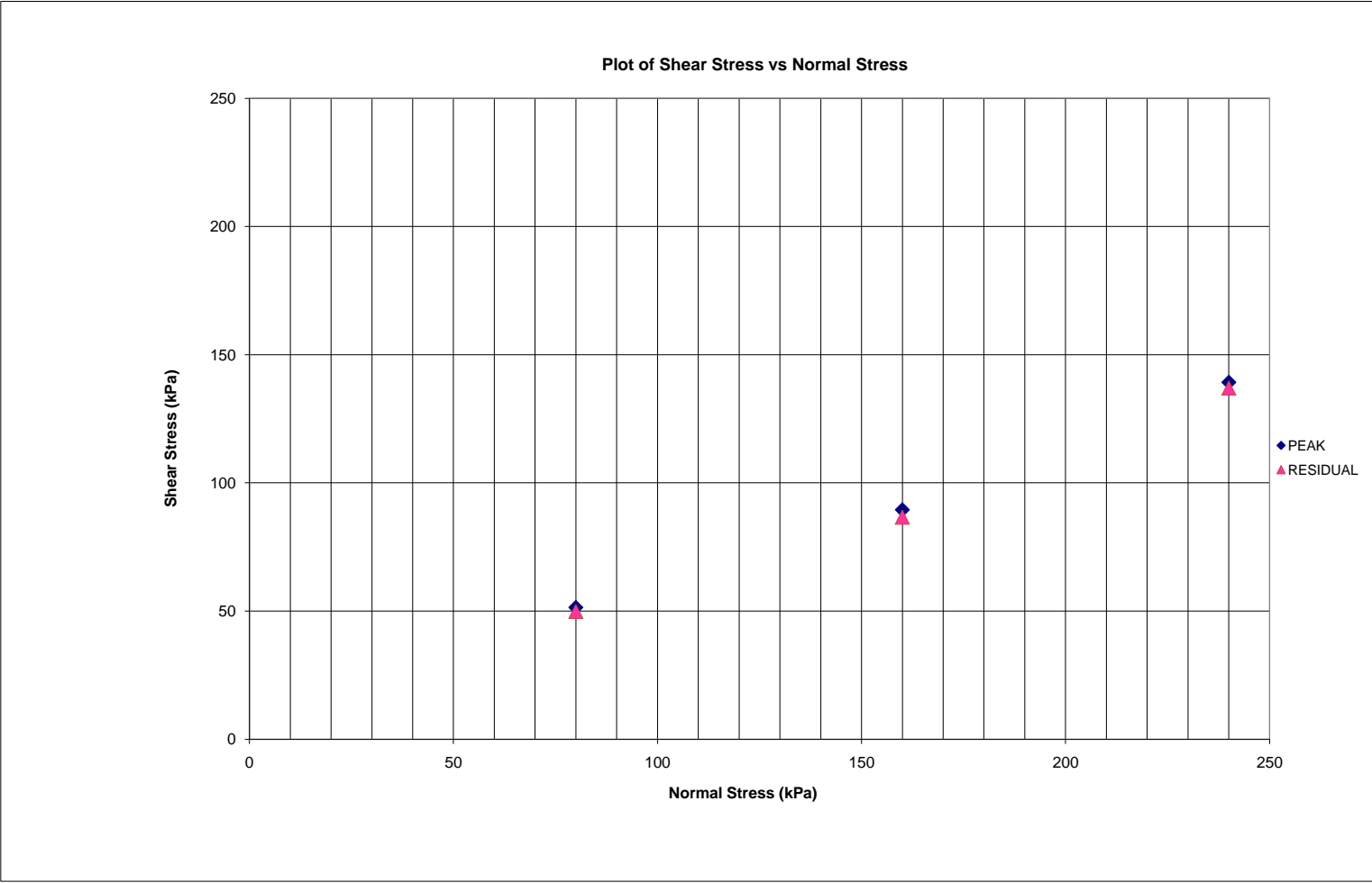
Aug 2012

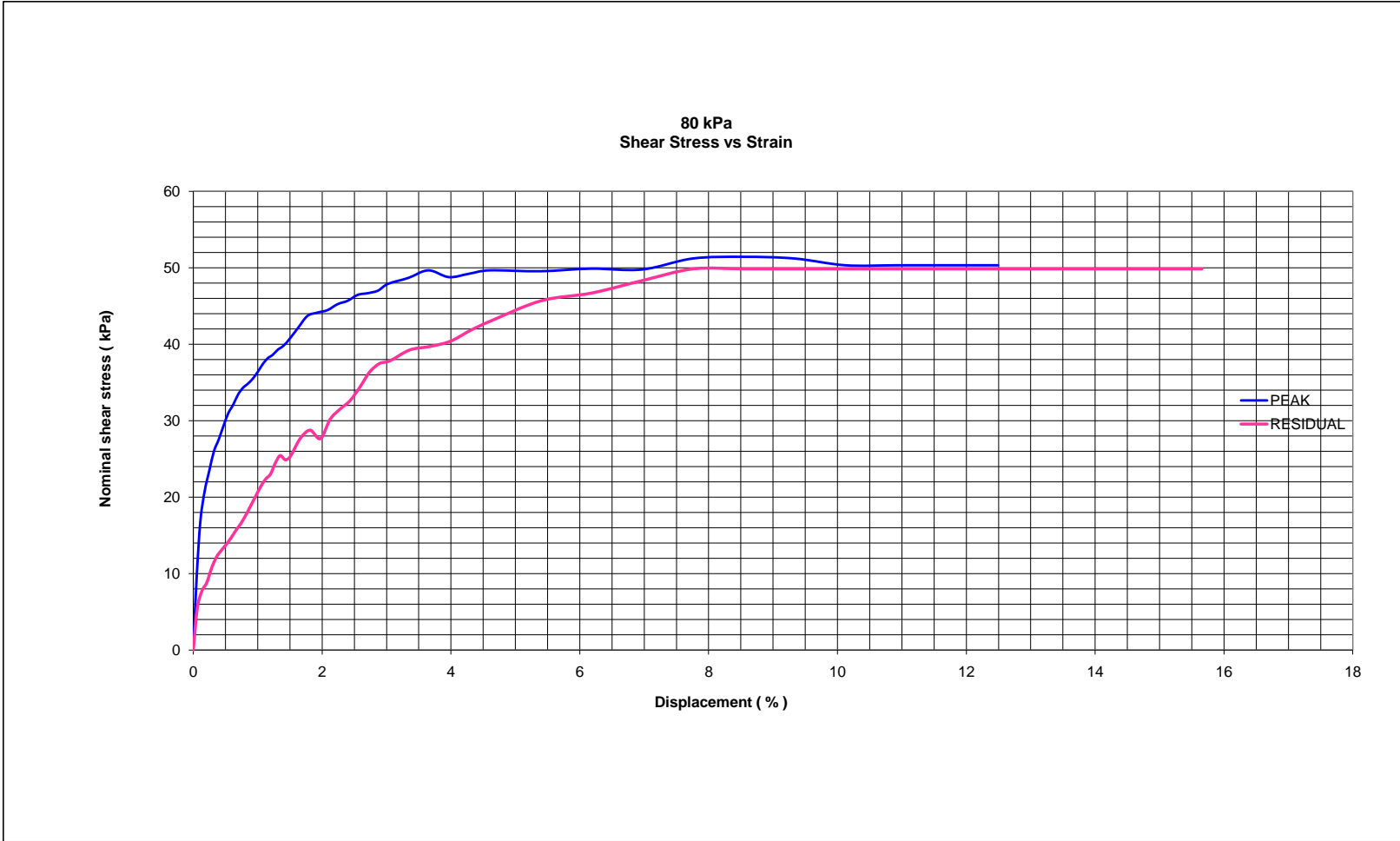
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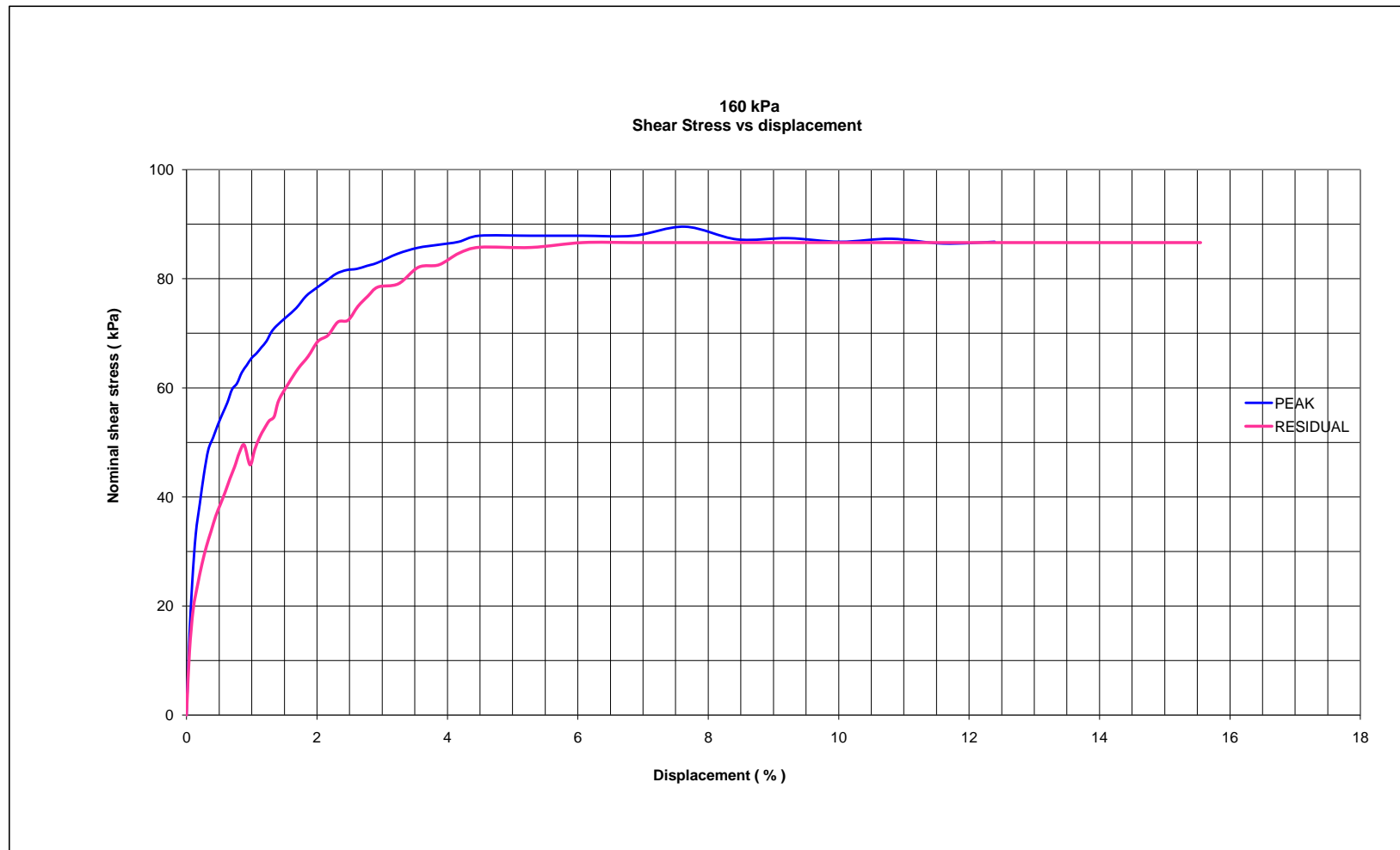
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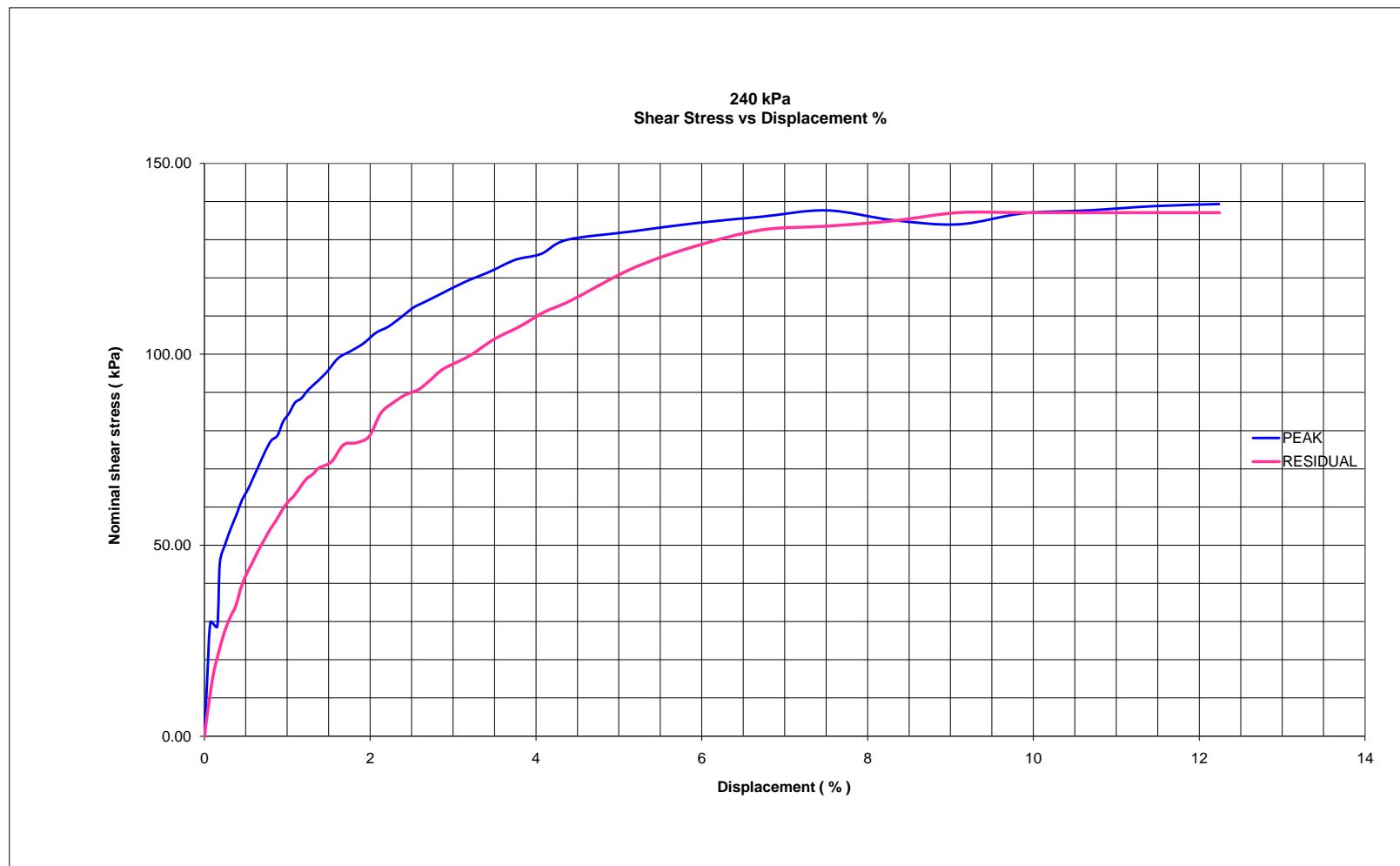
FIGURE NO.
C.8-A

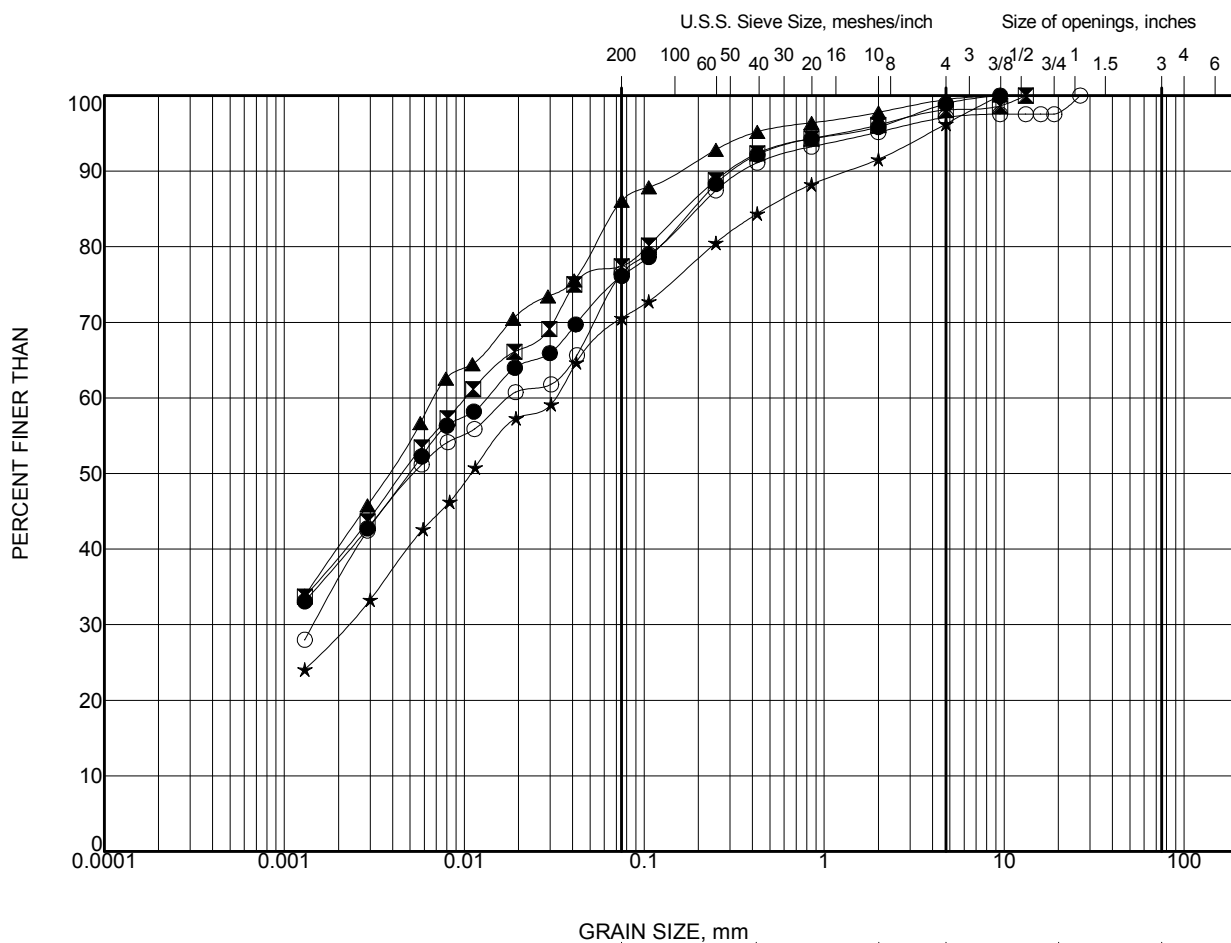
REV









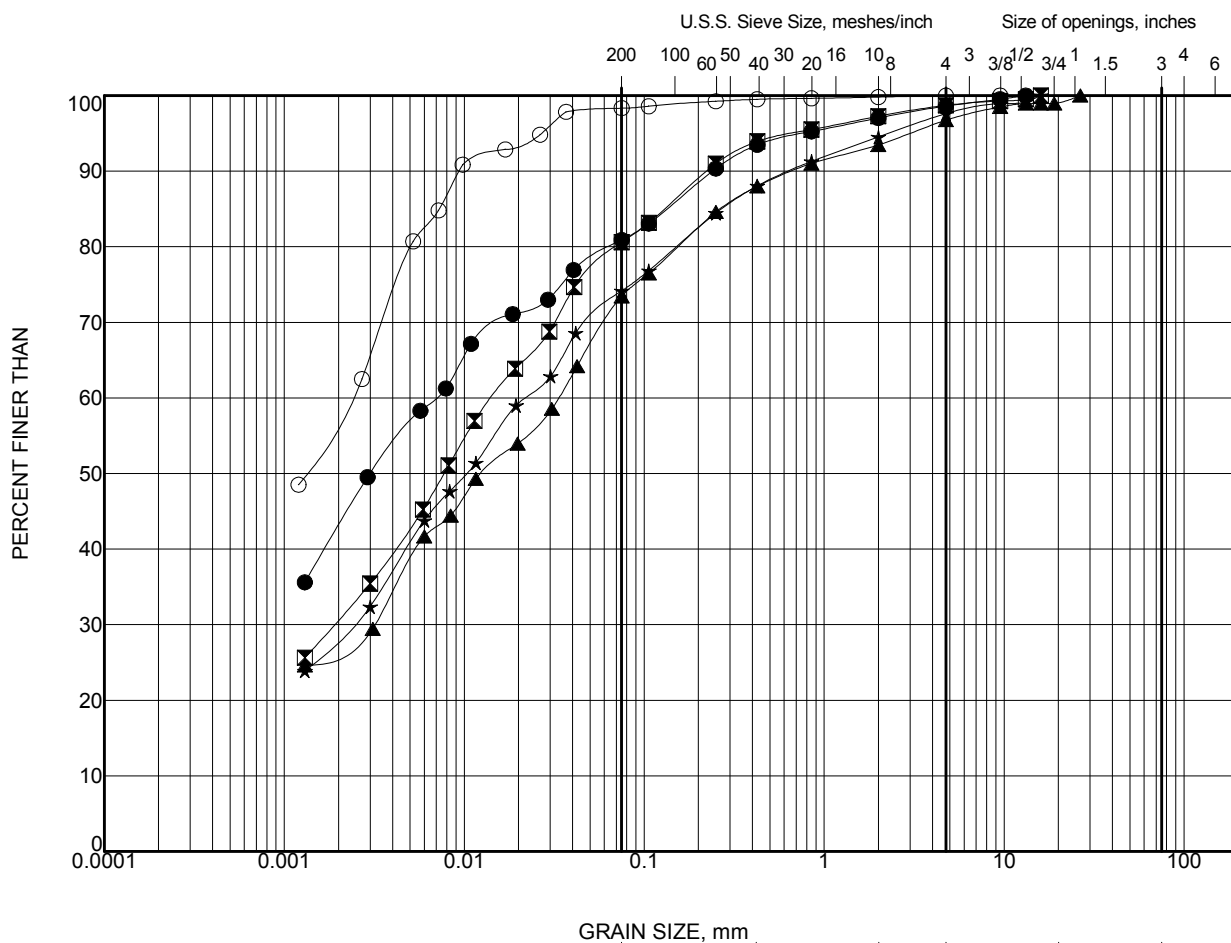


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

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
	CHECK	MSO	REV.
FIGURE C.1			

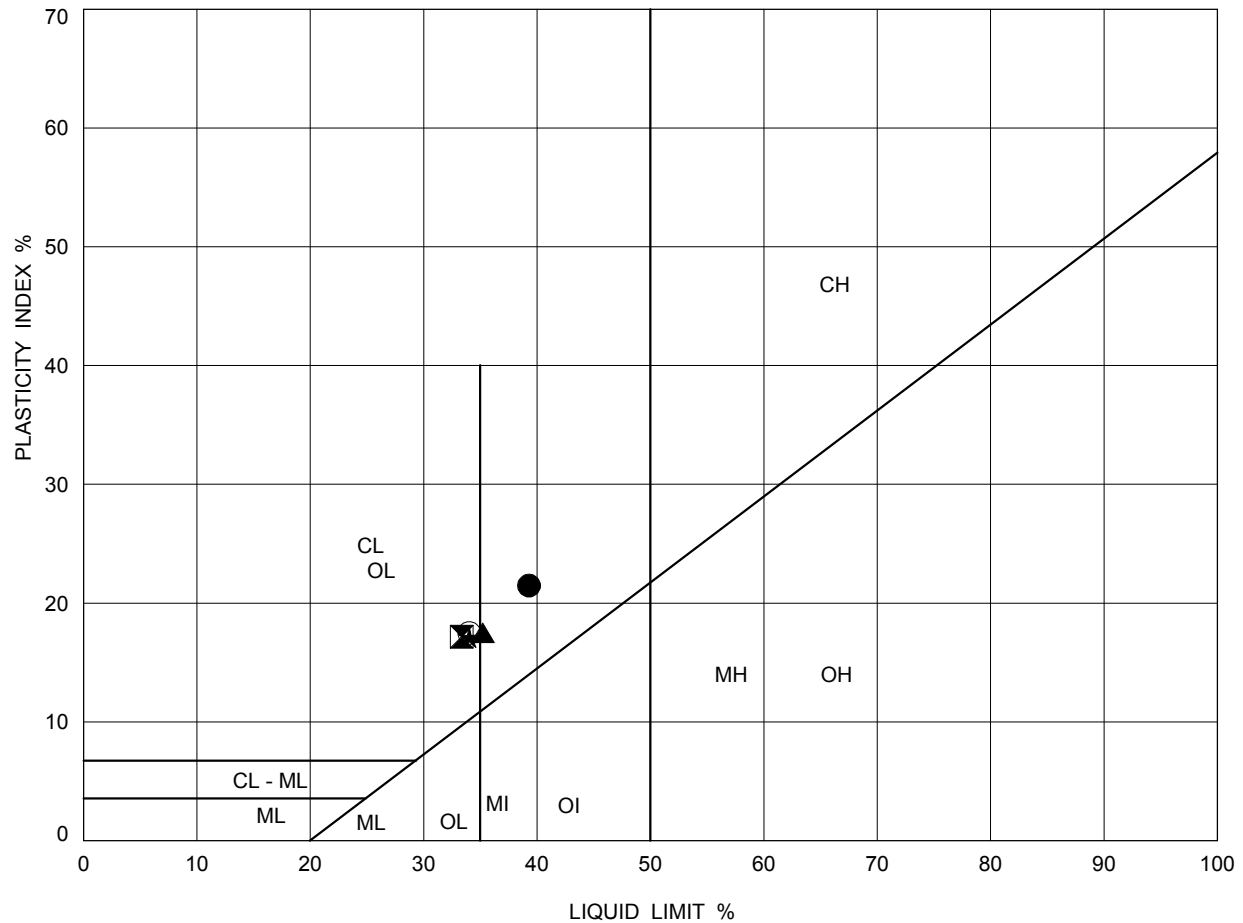


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	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

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	





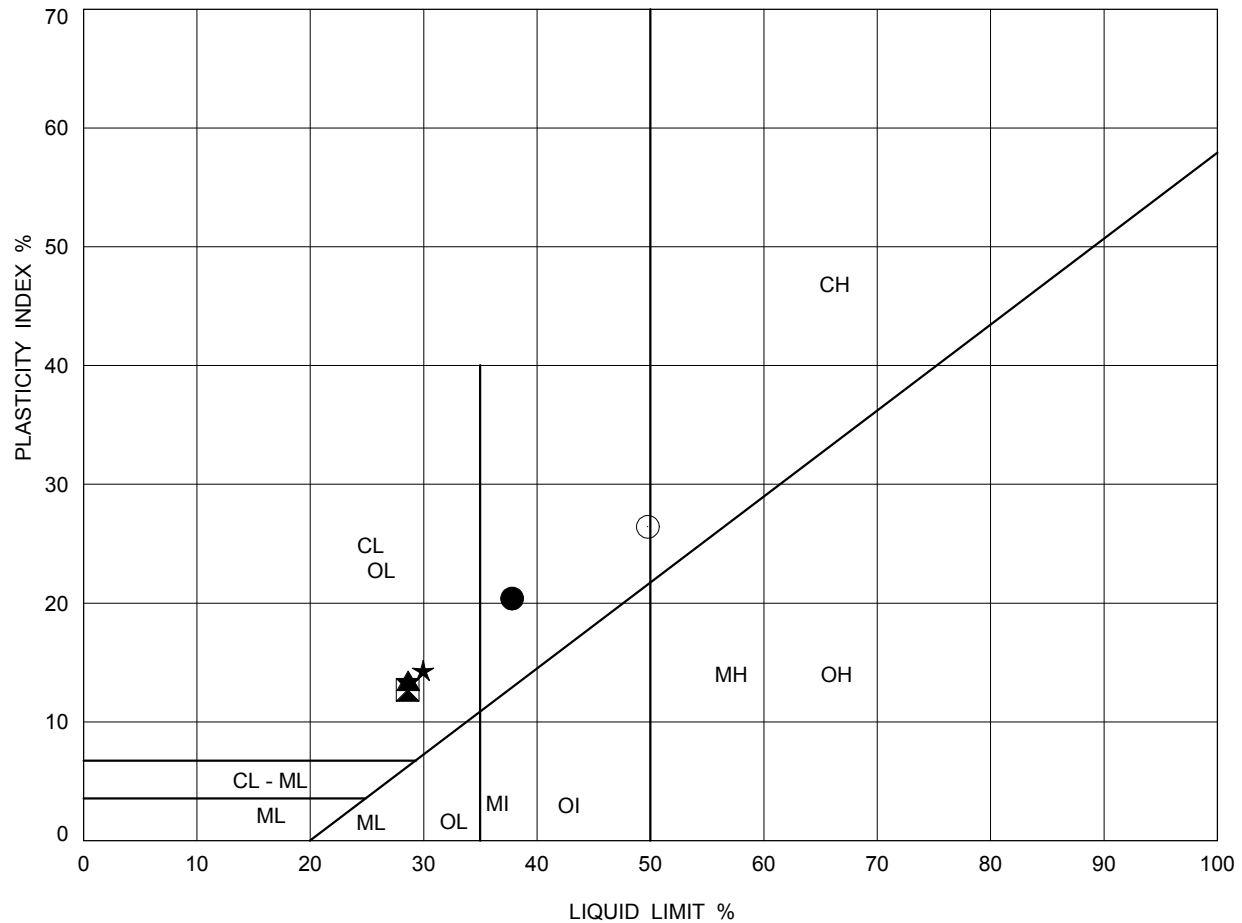
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND:



SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	LL(%)	PL(%)	PI
●	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

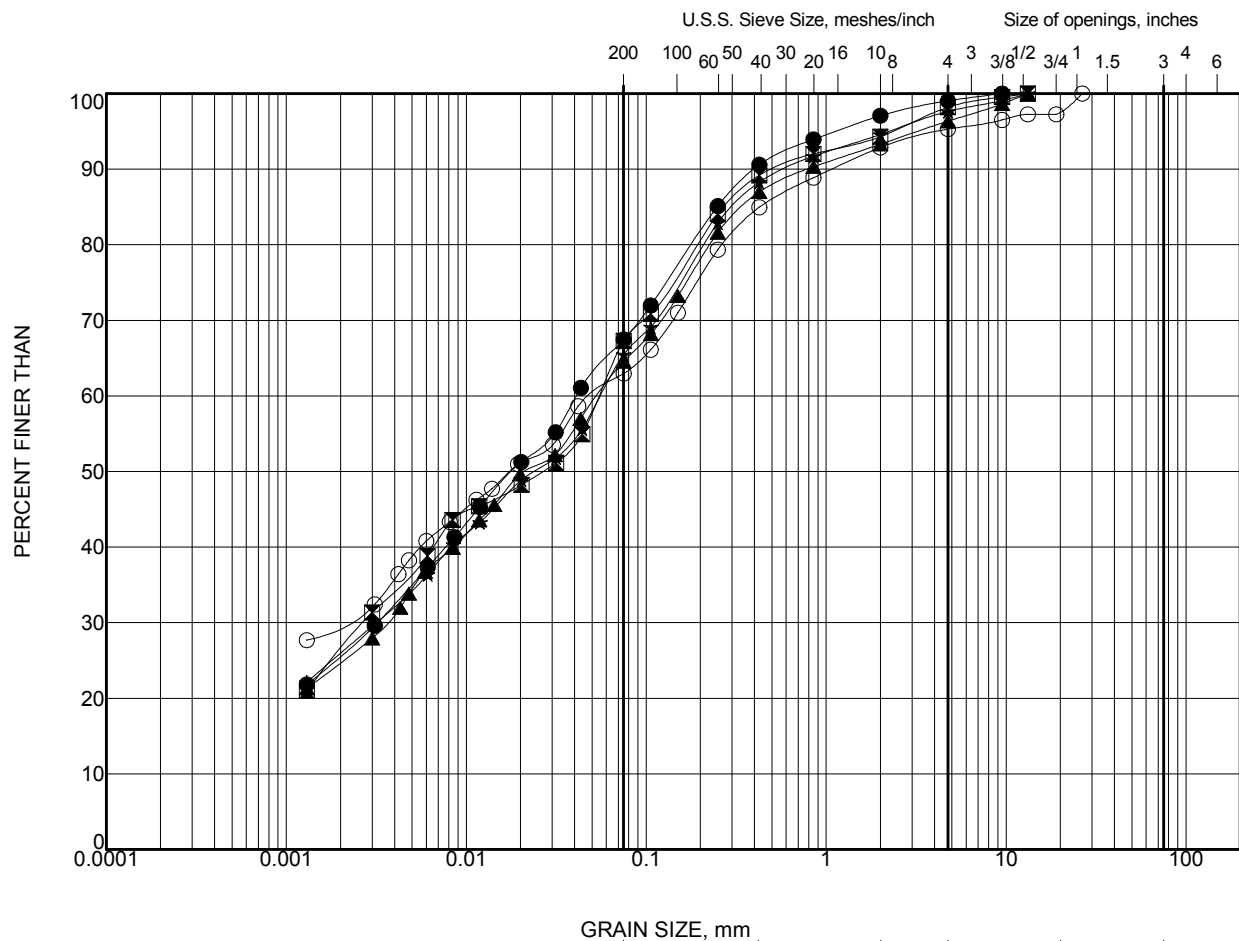
PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		PLASTICITY CHART SILTY CLAY TO CLAYEY SILT	
 		PROJECT No. SW8801.1004.101	FILE No.
DRAWN	EA	SCALE	REV.
CHECK	MSO	FIGURE C.3	



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
CHECK	MSO		REV.
		FIGURE C.4	

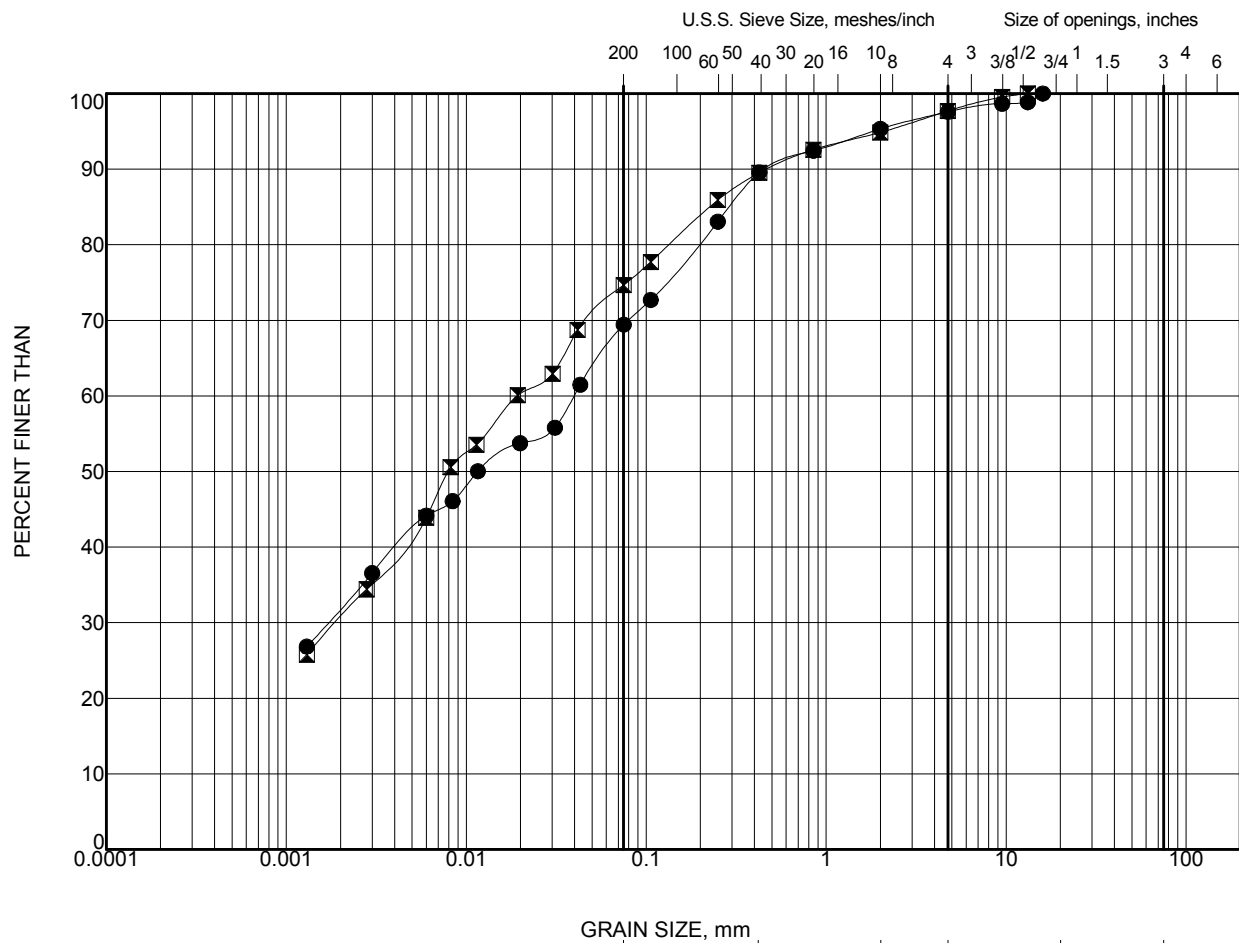


CLAY AND SILT	SAND SIZE			GRAVEL SIZE		Cobble Size
	fine	medium	coarse	fine	coarse	

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			

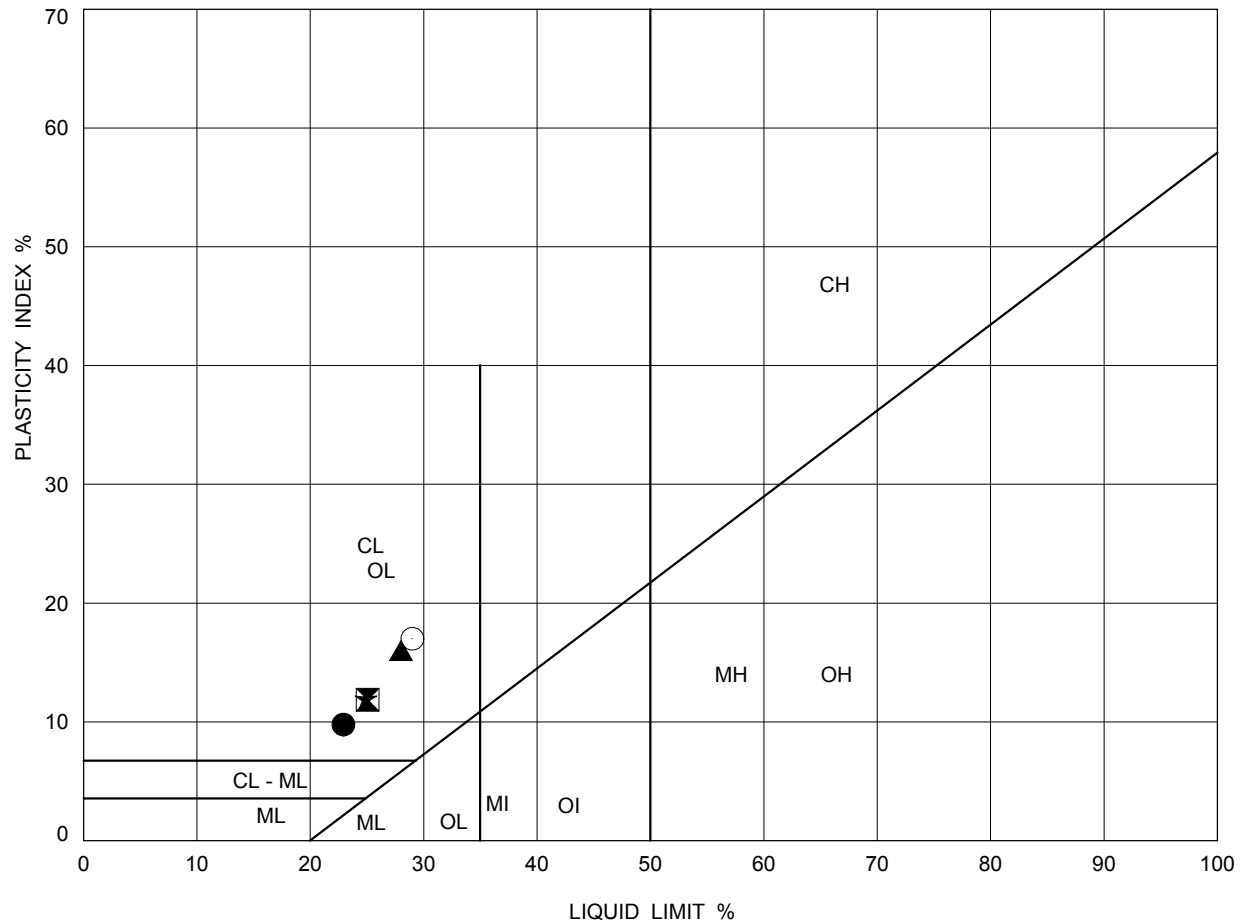


CLAY AND SILT	SAND SIZE			GRAVEL SIZE		Cobble Size
	fine	medium	coarse	fine	coarse	

LEGEND:



SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T9-1	16	16.8
◻	T9-1	20	22.9

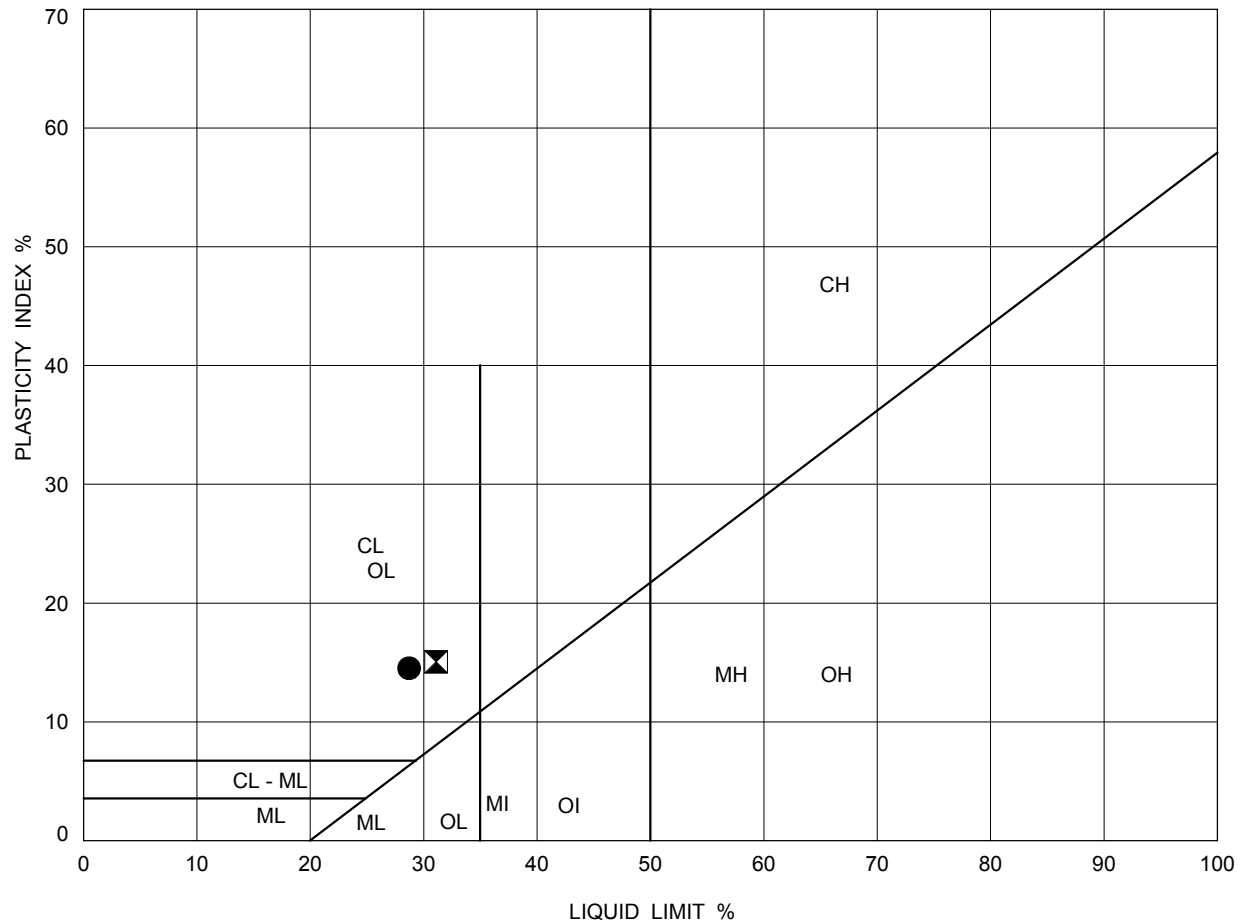
PROJECT		Windsor Essex Parkway (WEP)	
		Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION	
		SILTY CLAY TO CLAYEY SILT	
	PROJECT No. SW8801.1004.101		FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
			FIGURE C.2



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
CHECK	MSO		REV.
		FIGURE C.3	



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

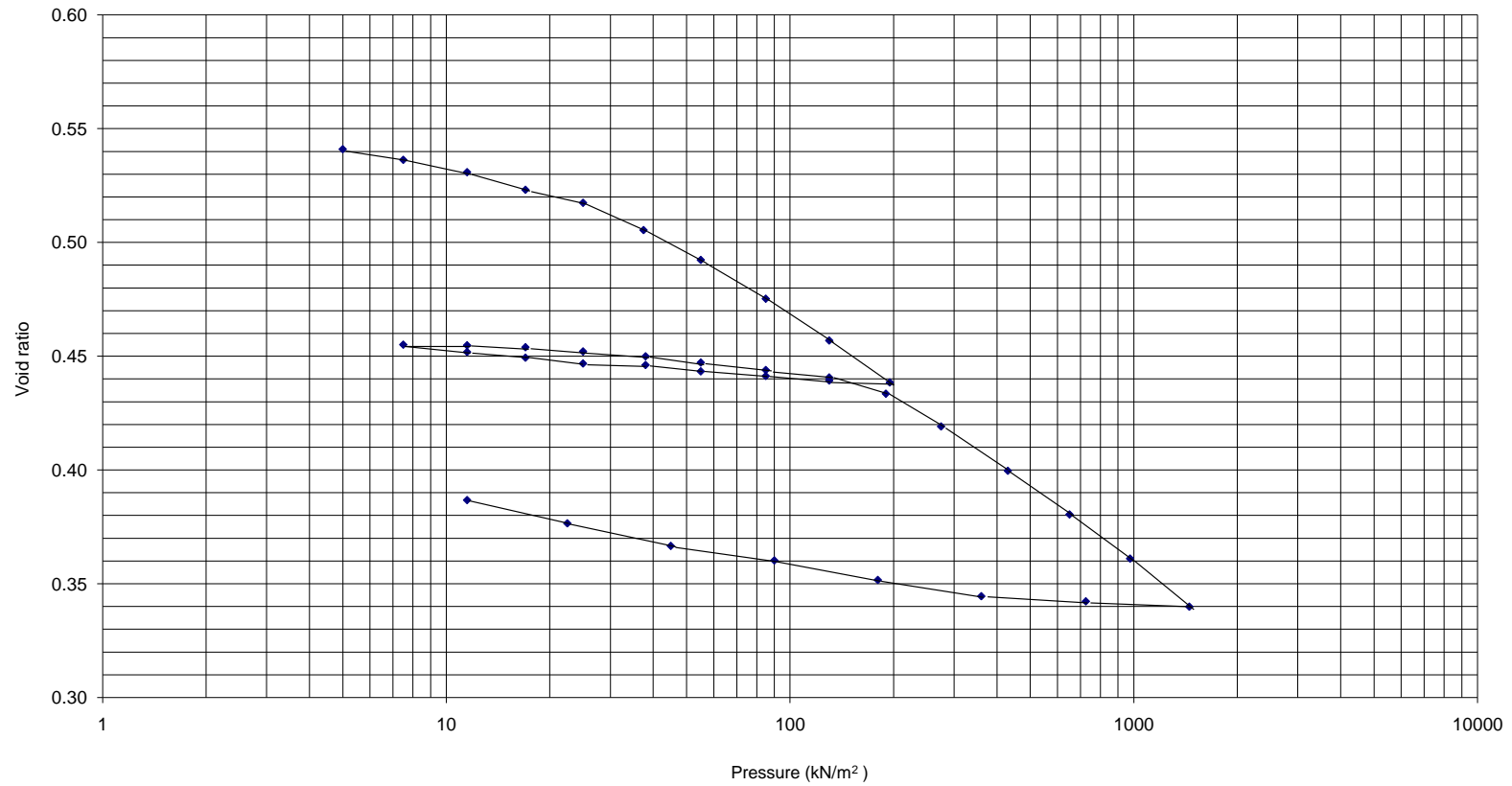
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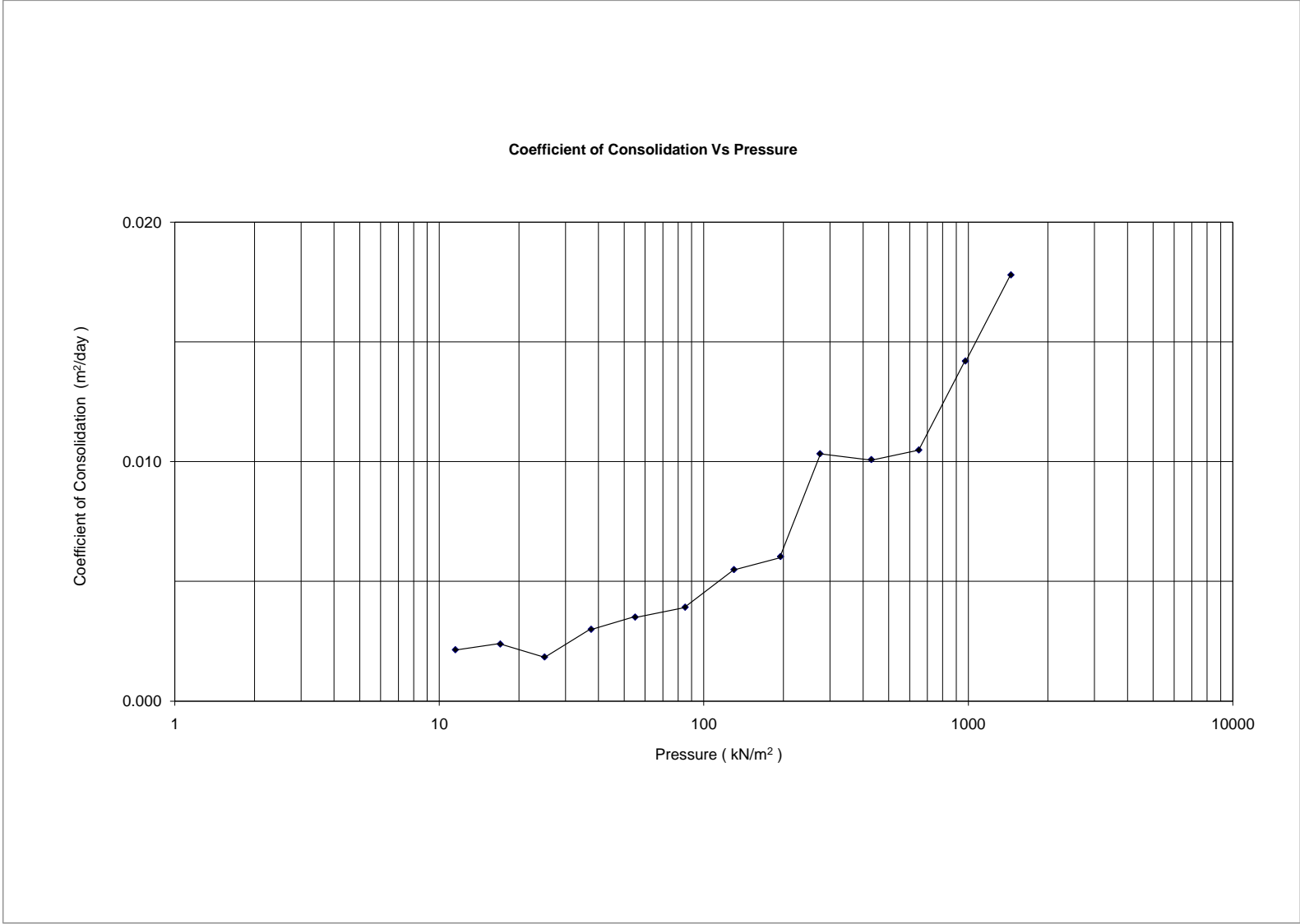
SW8801.1004.101

FIGURE NO.
C.5-B

REV

Void Ratio Vs Pressure



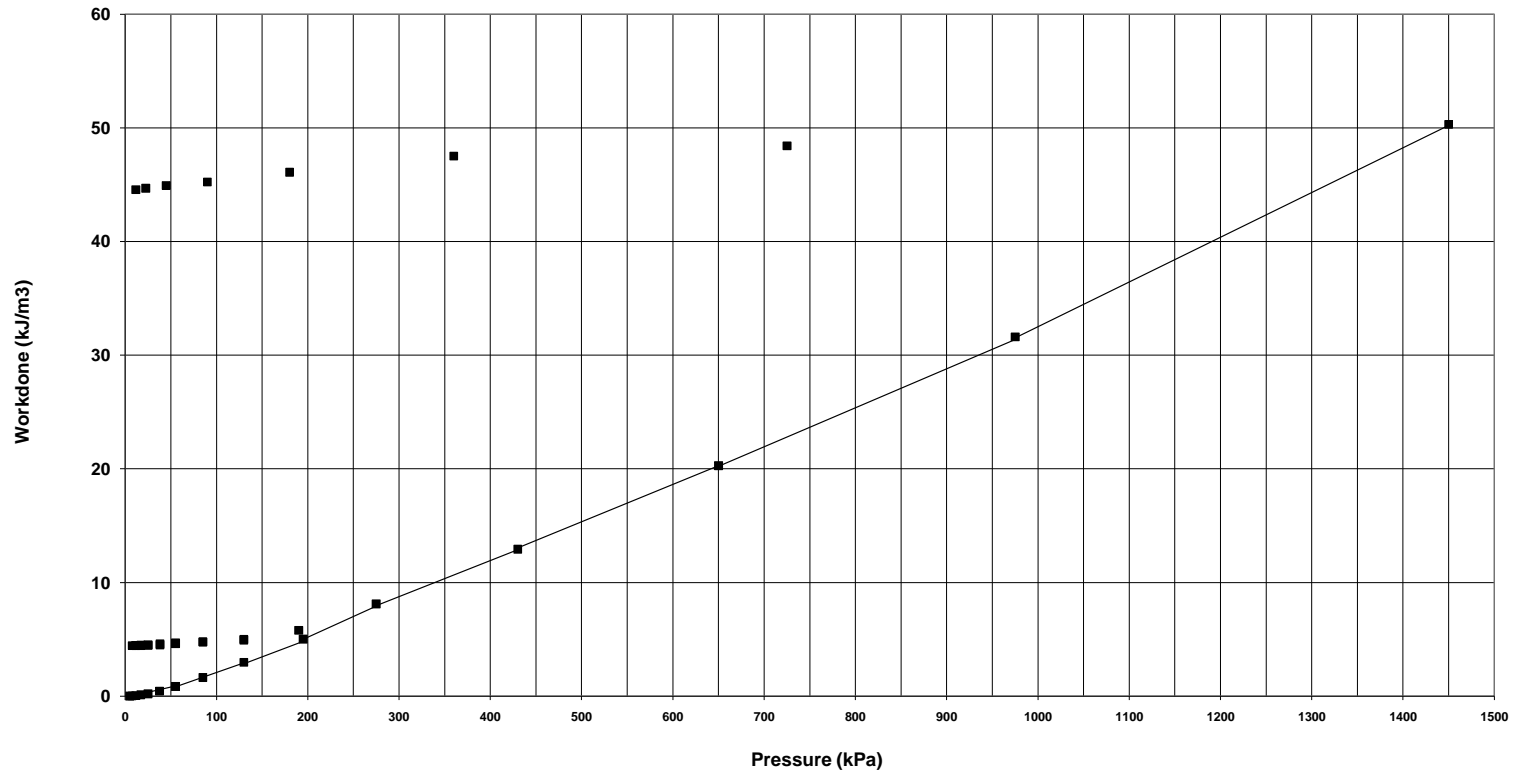


Strain Energy Data

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

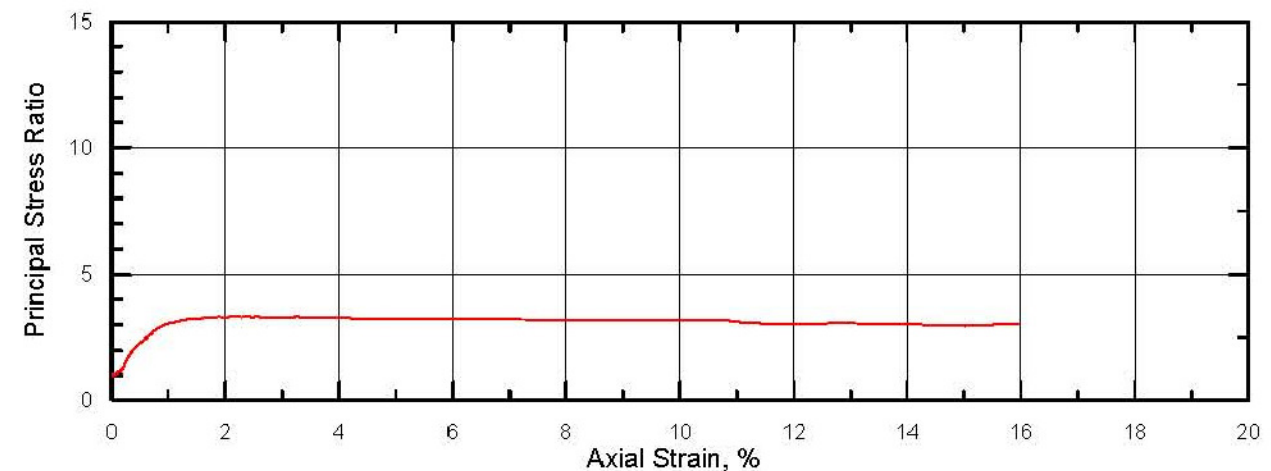
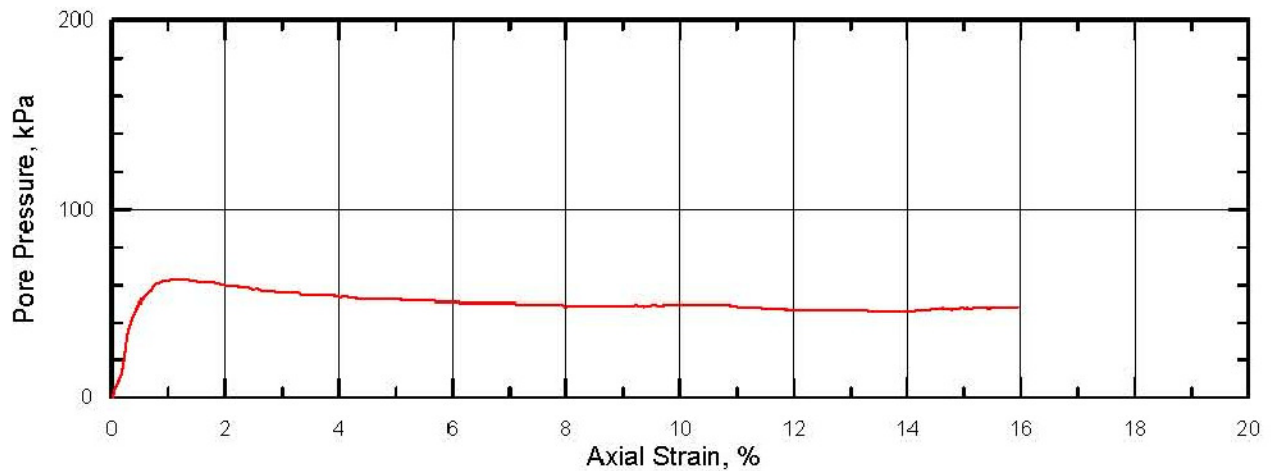
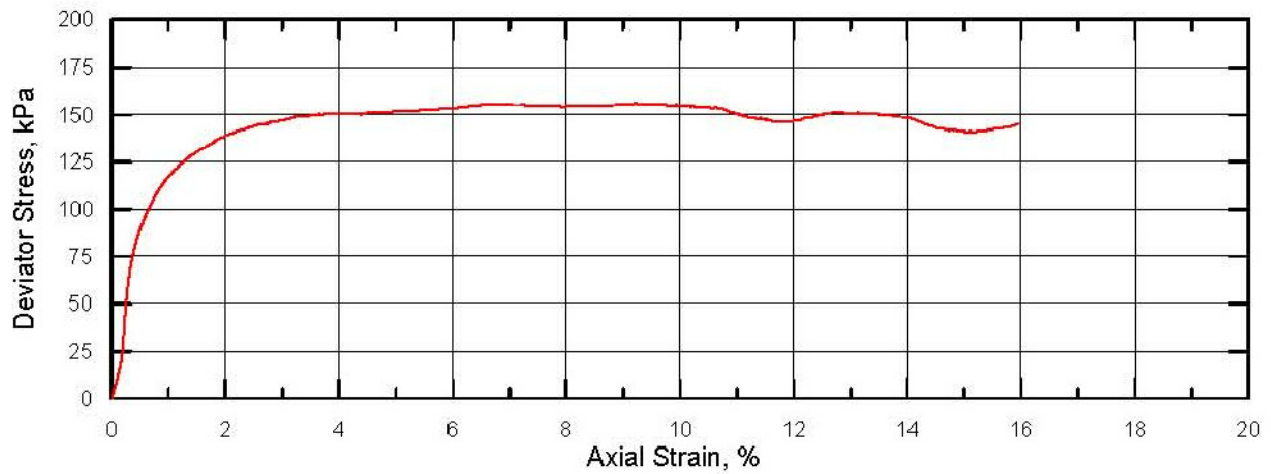
JOB NO

SW8801.1004.101

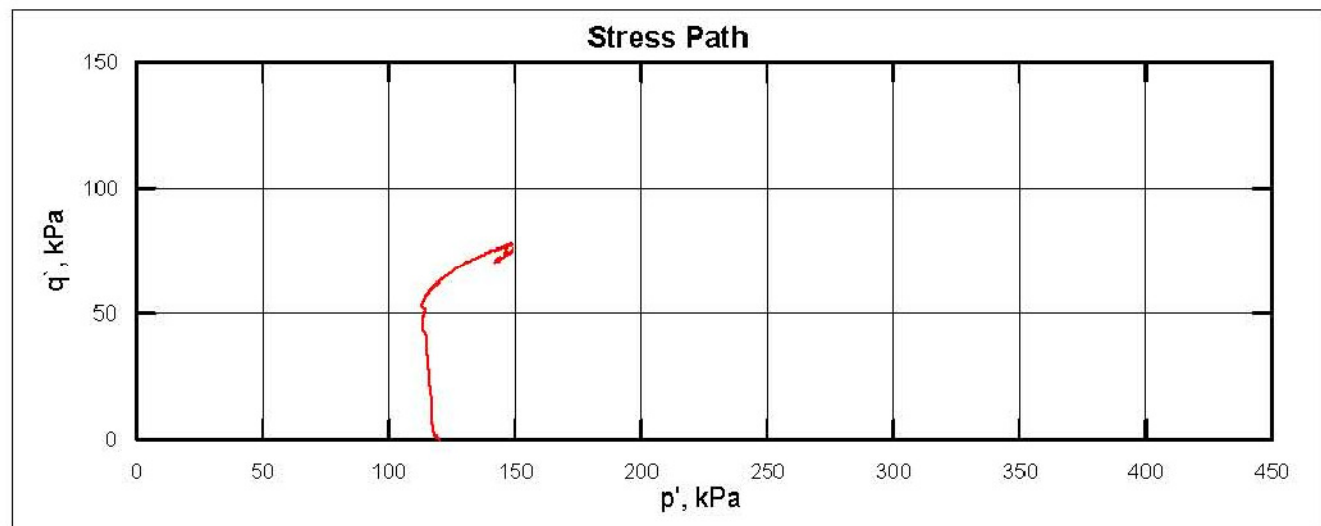
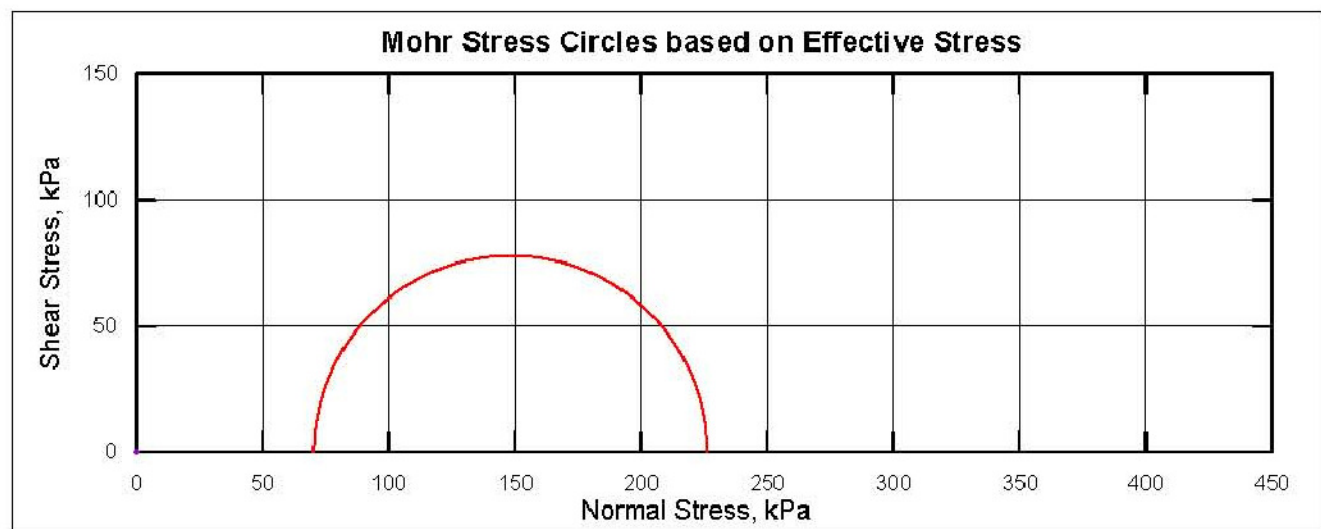
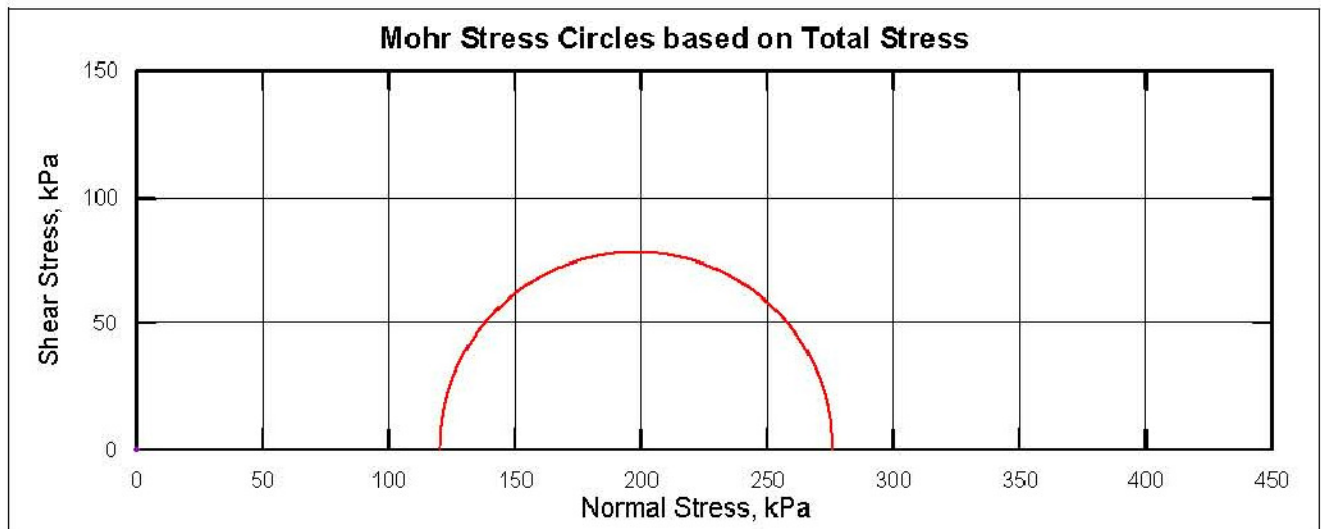
FIGURE NO.

C.6-A

REV

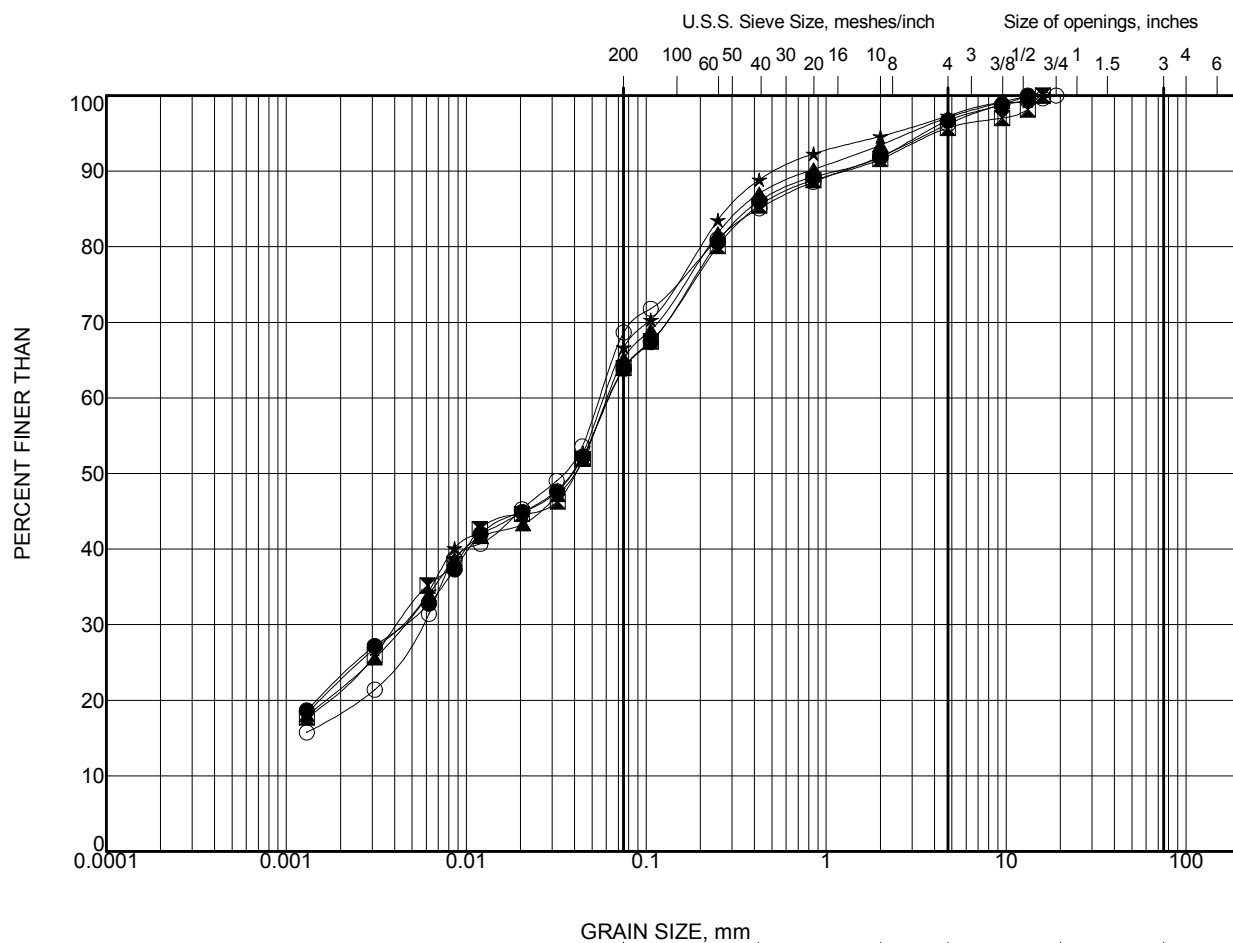


— 120 kPa



— 120 kPa

Note:
Failure based on maximum deviator stress

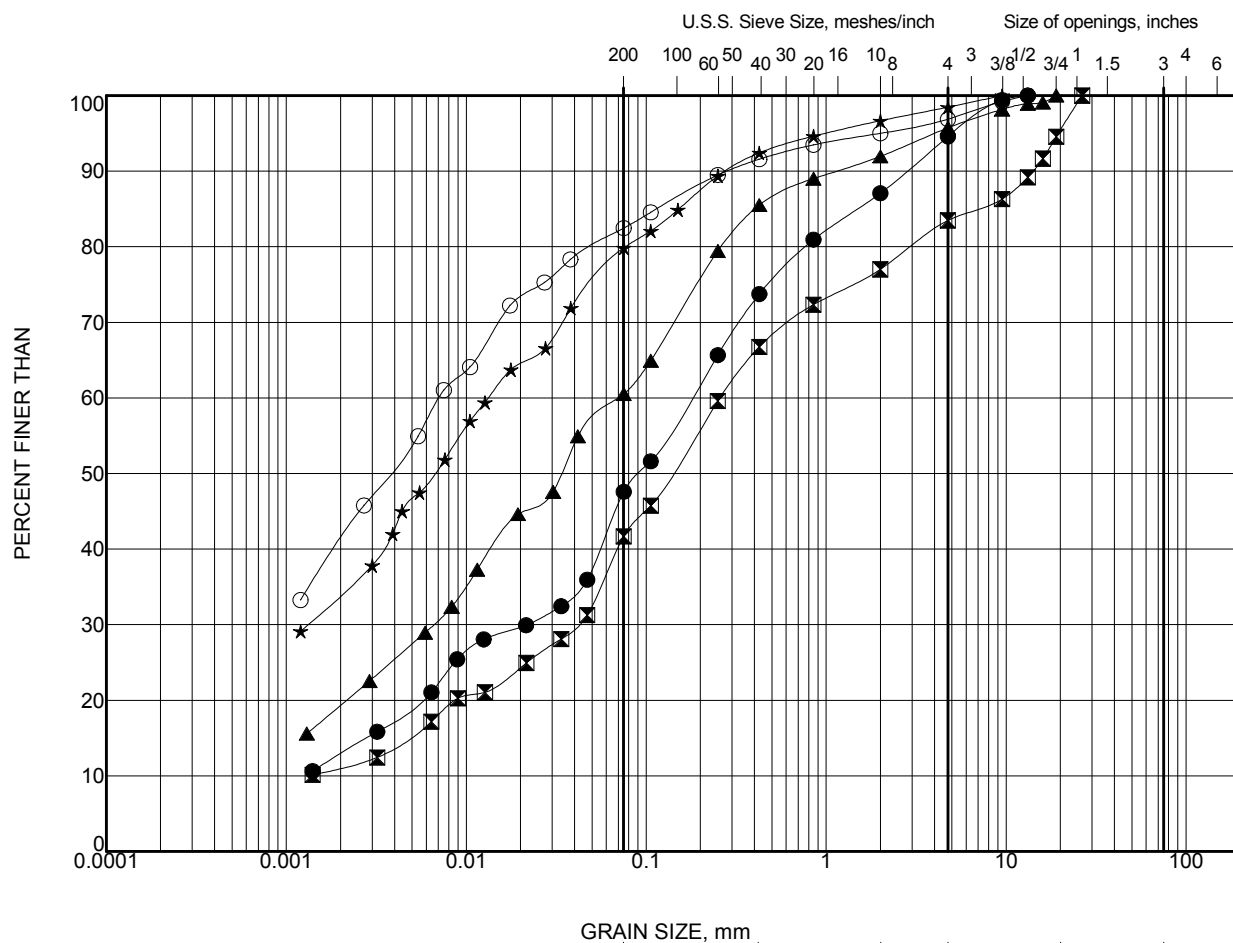


CLAY AND SILT	GRAIN SIZE, mm					Cobble Size
	fine	medium	coarse	fine	coarse	
	SAND SIZE			GRAVEL SIZE		

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			

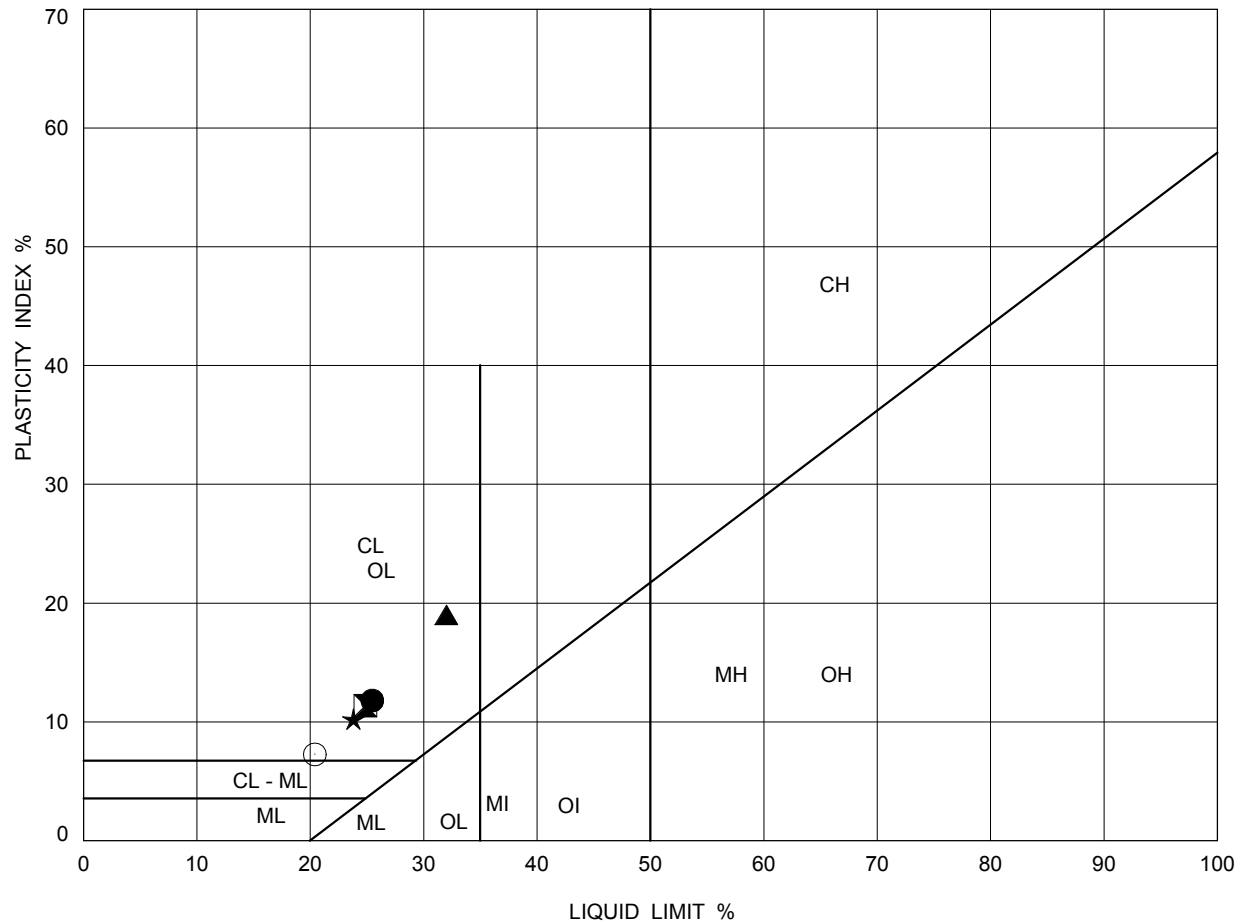


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

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

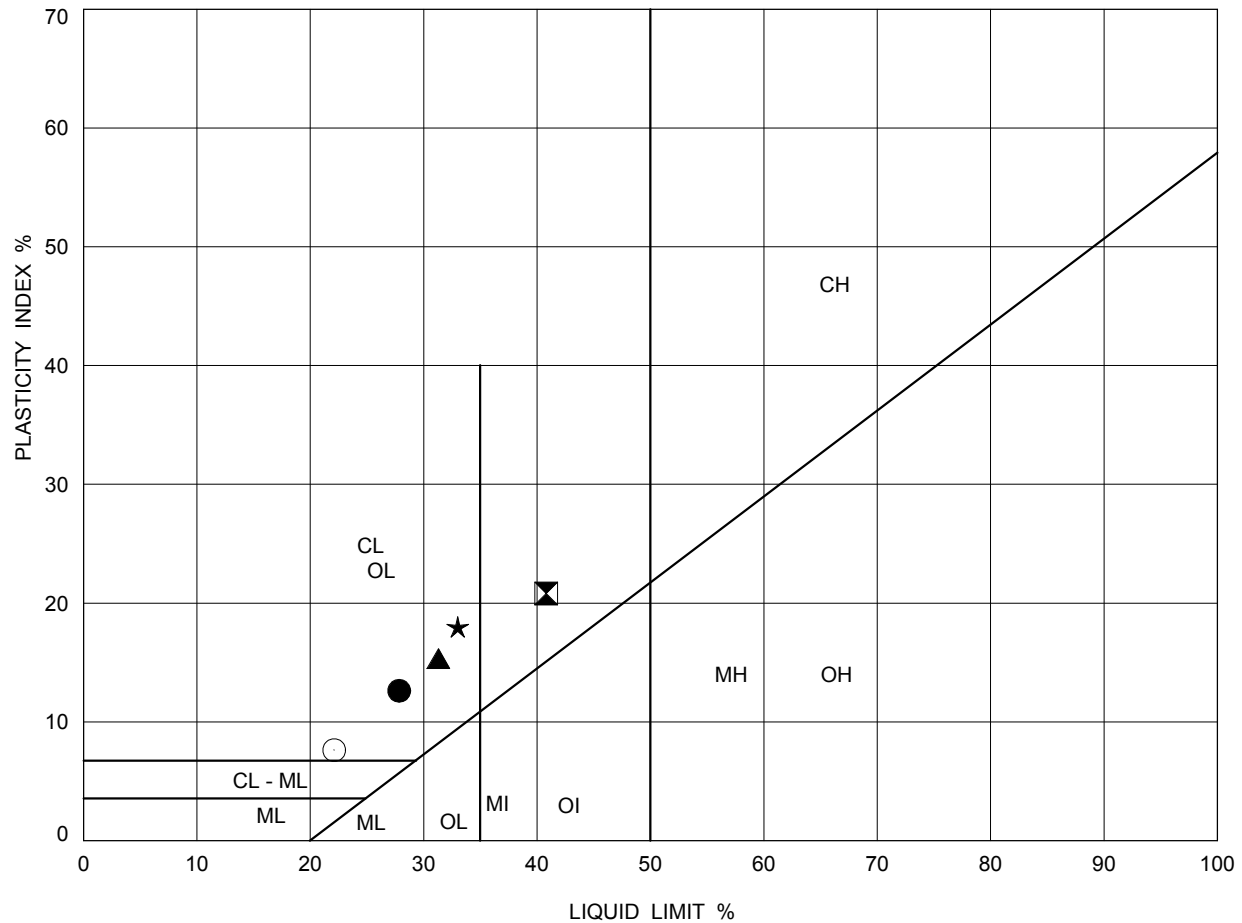
PROJECT		Windsor Essex Parkway (WEP)	
		Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION	
		SILTY CLAY TO CLAYEY SILT	
	PROJECT No. SW8801.1004.101		FILE No.
	DRAWN	EA	SCALE
	CHECK	MSO	REV.
FIGURE C.2			



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	



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
CHECK	MSO		REV.
		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

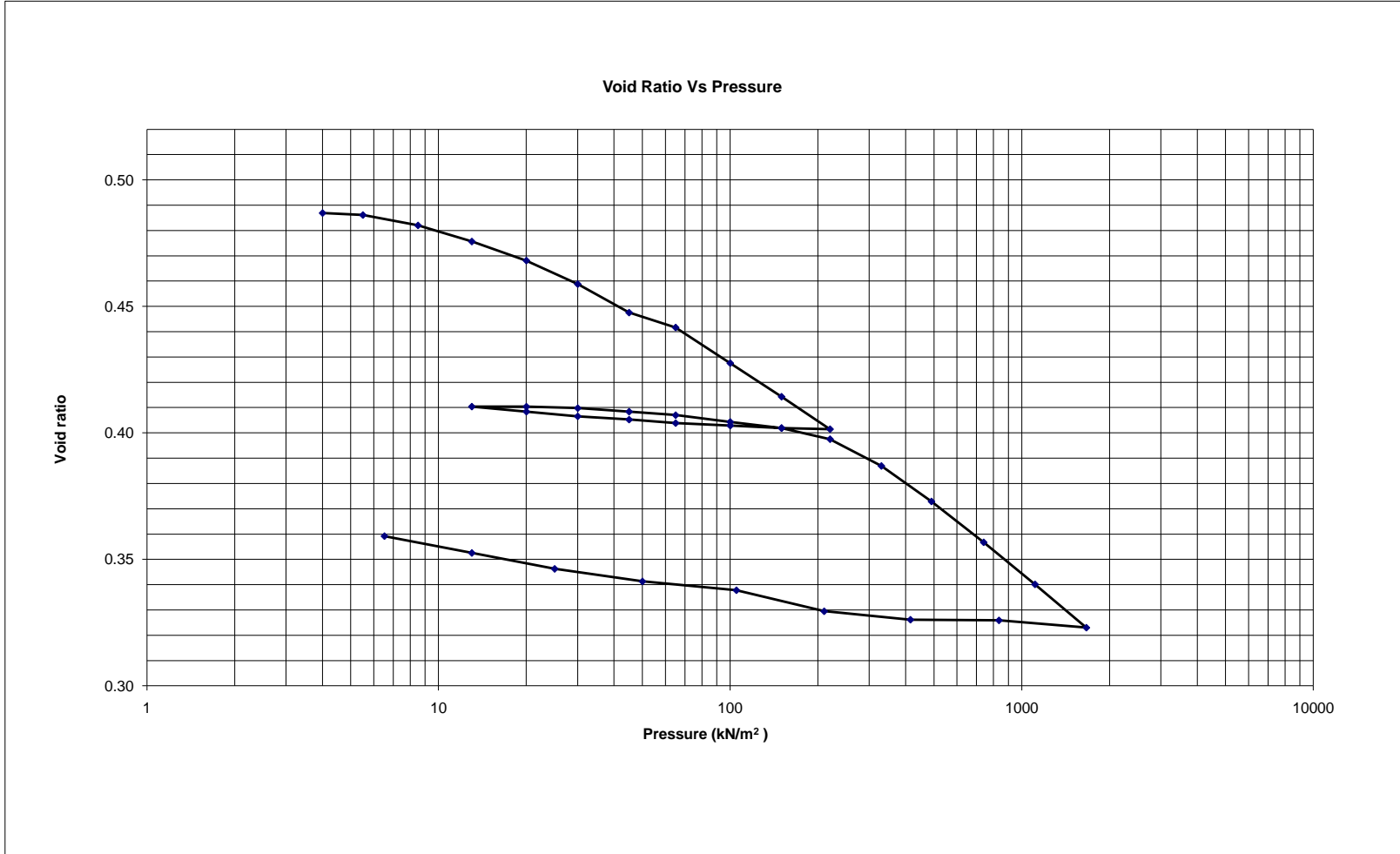
Trial #	22	23	24	25	26	27	28
Load (kPa)	65	100.0	150.0	220.0	330.0	490.0	740.0
Load (tsf)	0.676	1.040	1.560	2.288	3.432	5.096	7.696
Gauge Reading (in)	0.2071	0.2058	0.2045	0.2023	0.1970	0.1899	0.1817
(H-Hs) mm	5.228	5.194	5.163	5.106	4.970	4.790	4.582
Voids ratio	0.407	0.404	0.402	0.398	0.387	0.373	0.357
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					

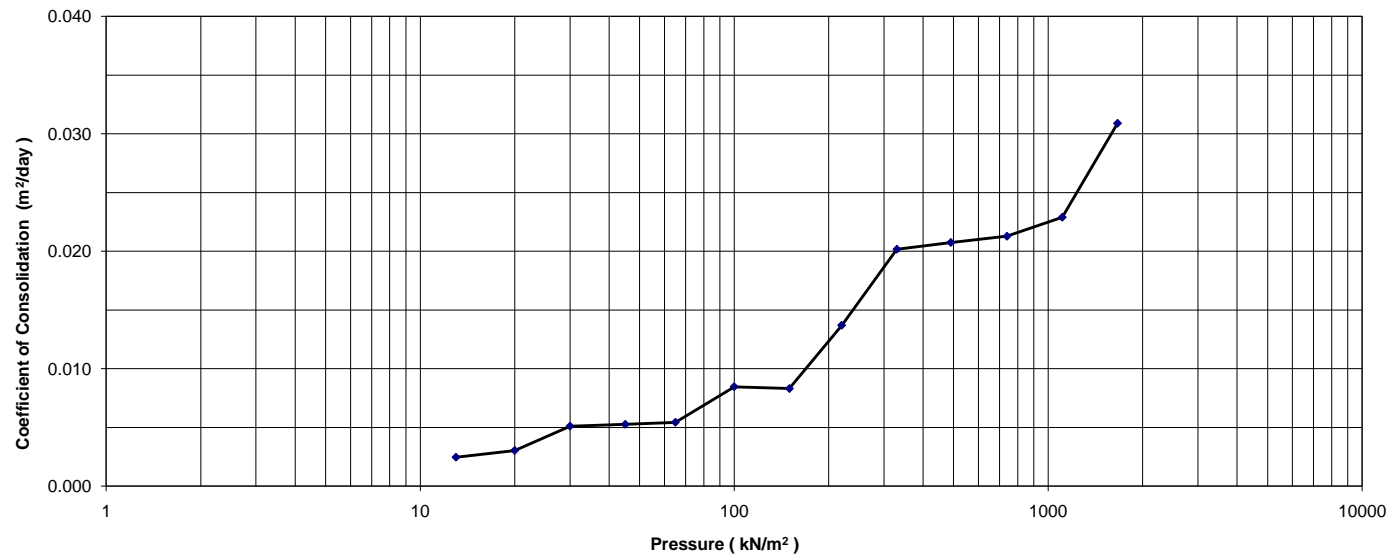
Trial #	36	37	38				
Load (kPa)	25	13.0	6.5				
Load (tsf)	0.26	0.135	0.068				
Gauge Reading (in)	0.1764	0.1796	0.1829				
(H-Hs) mm	4.448	4.528	4.614				
Voids ratio	0.346	0.353	0.359				
t90 (min)							
Cv (m ² /day)							
k' (MPa)							
Mv (mm ² / N)							



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

Project

WINDSOR ESSEX PARKWAY

TITLE

**CONSOLIDATION TEST
TUNNEL T-10 (T10-2-SA20A)**

Date

Aug 2012

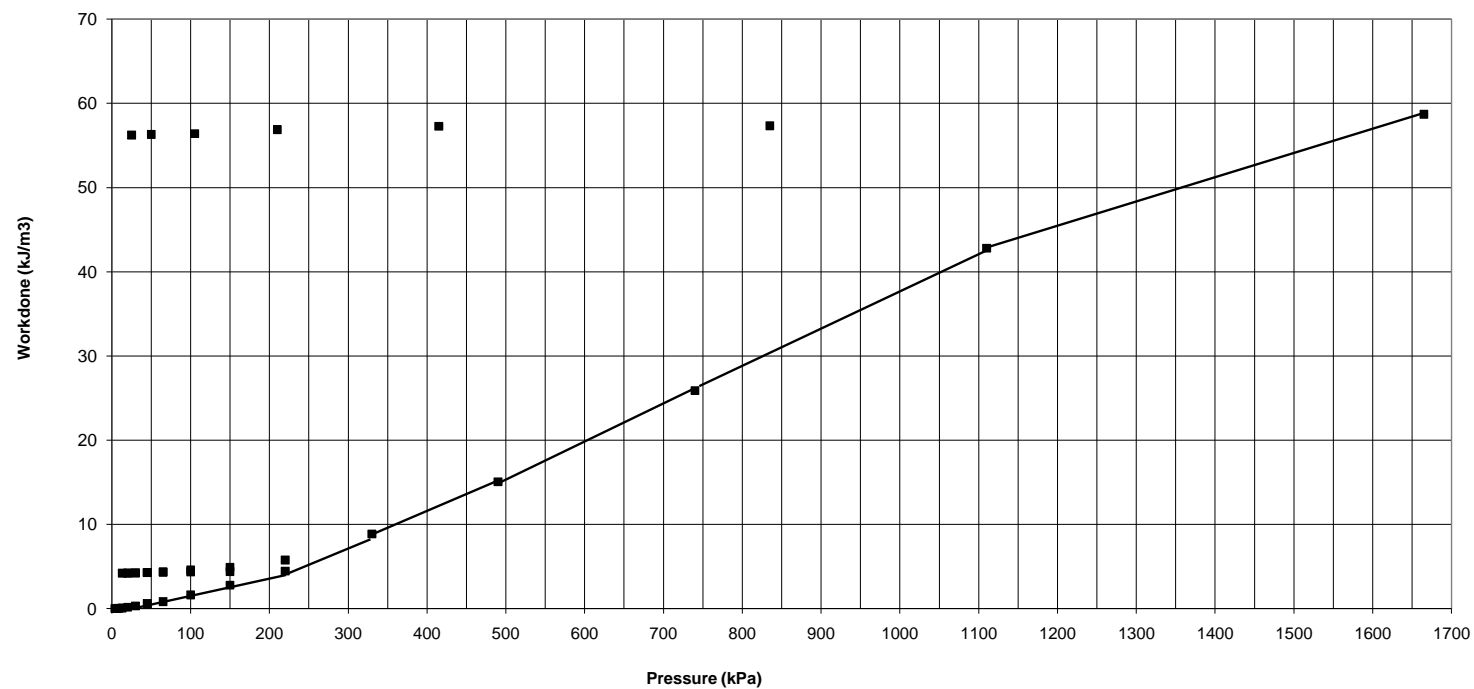
JOB NO

SW8801.1004.101

**FIGURE NO.
C.5-E**

REV

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

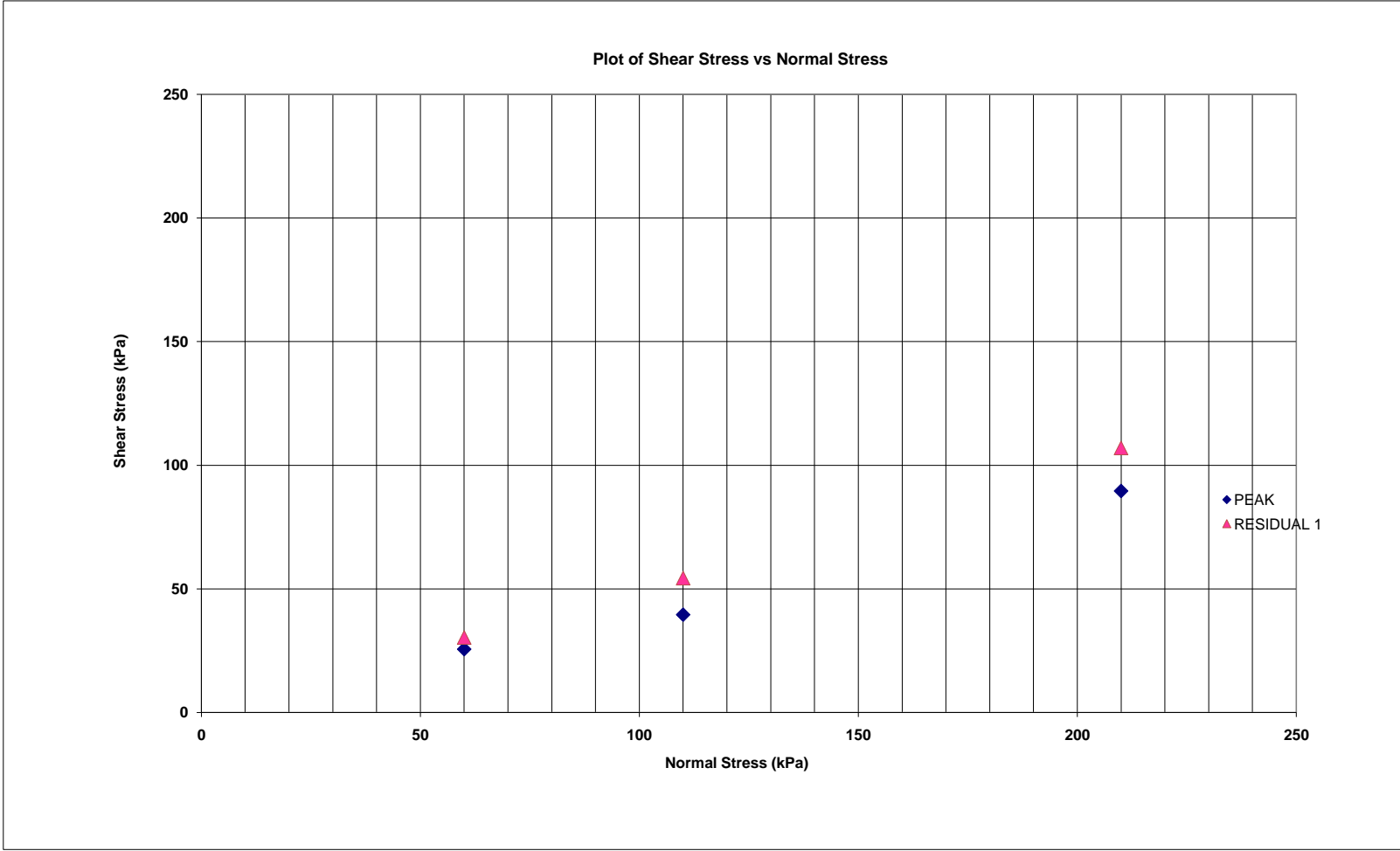
Aug 2012

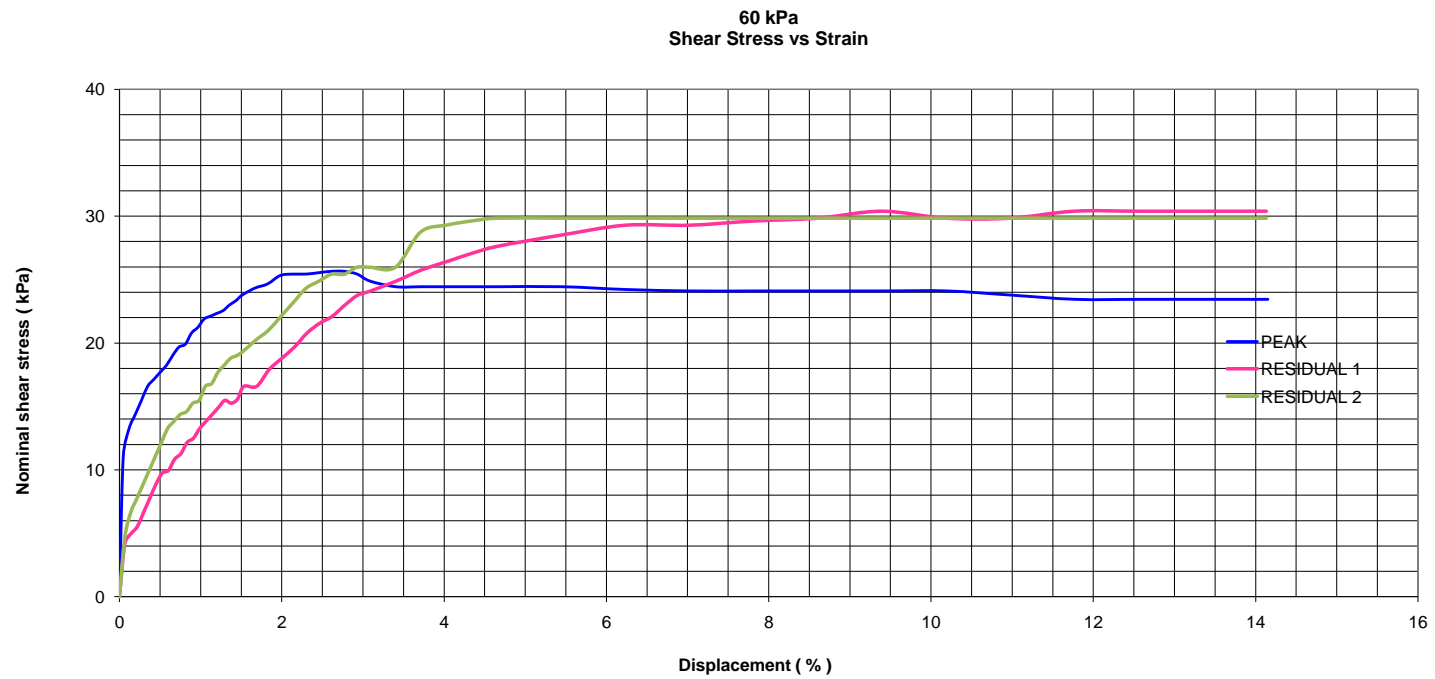
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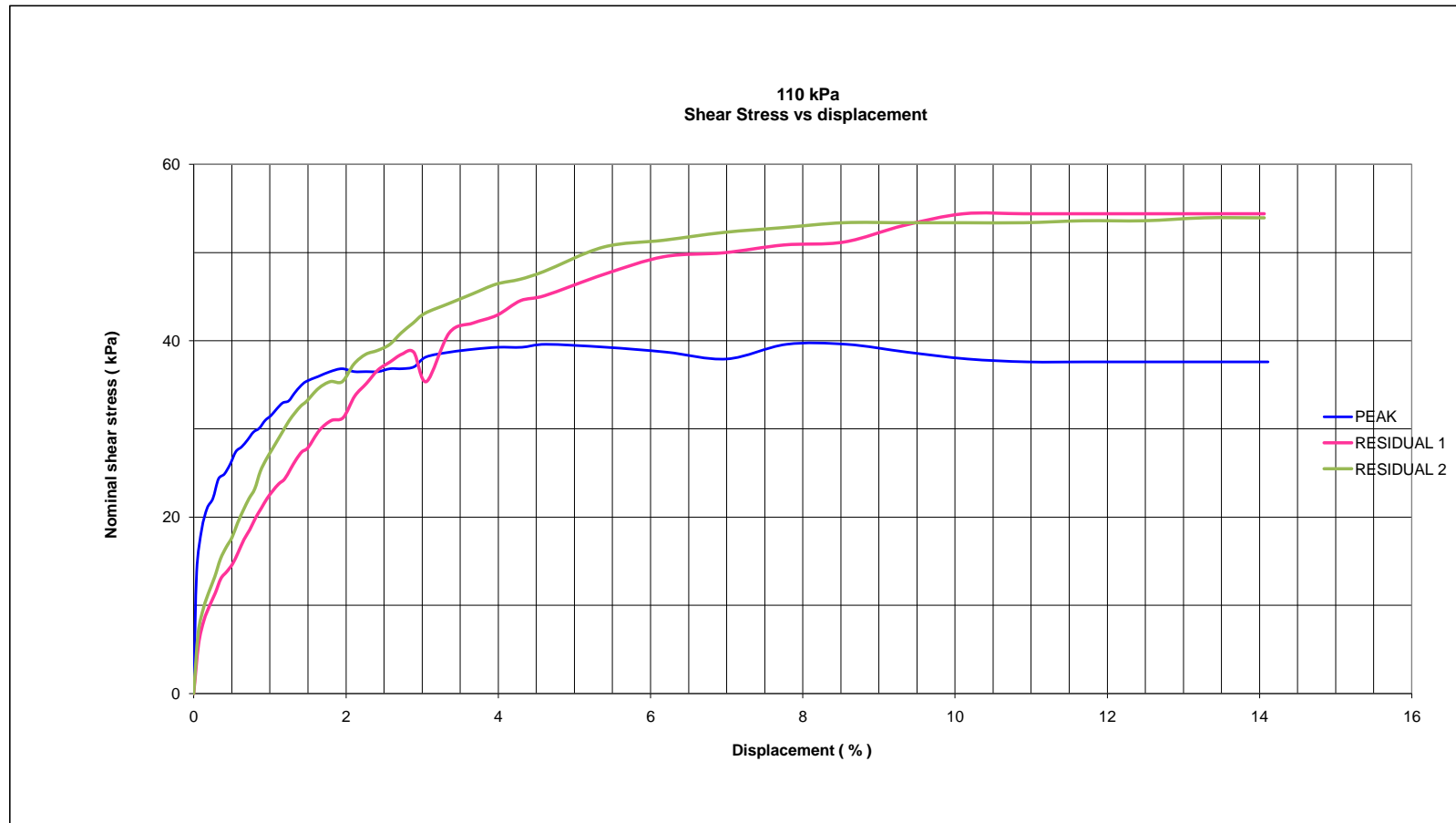
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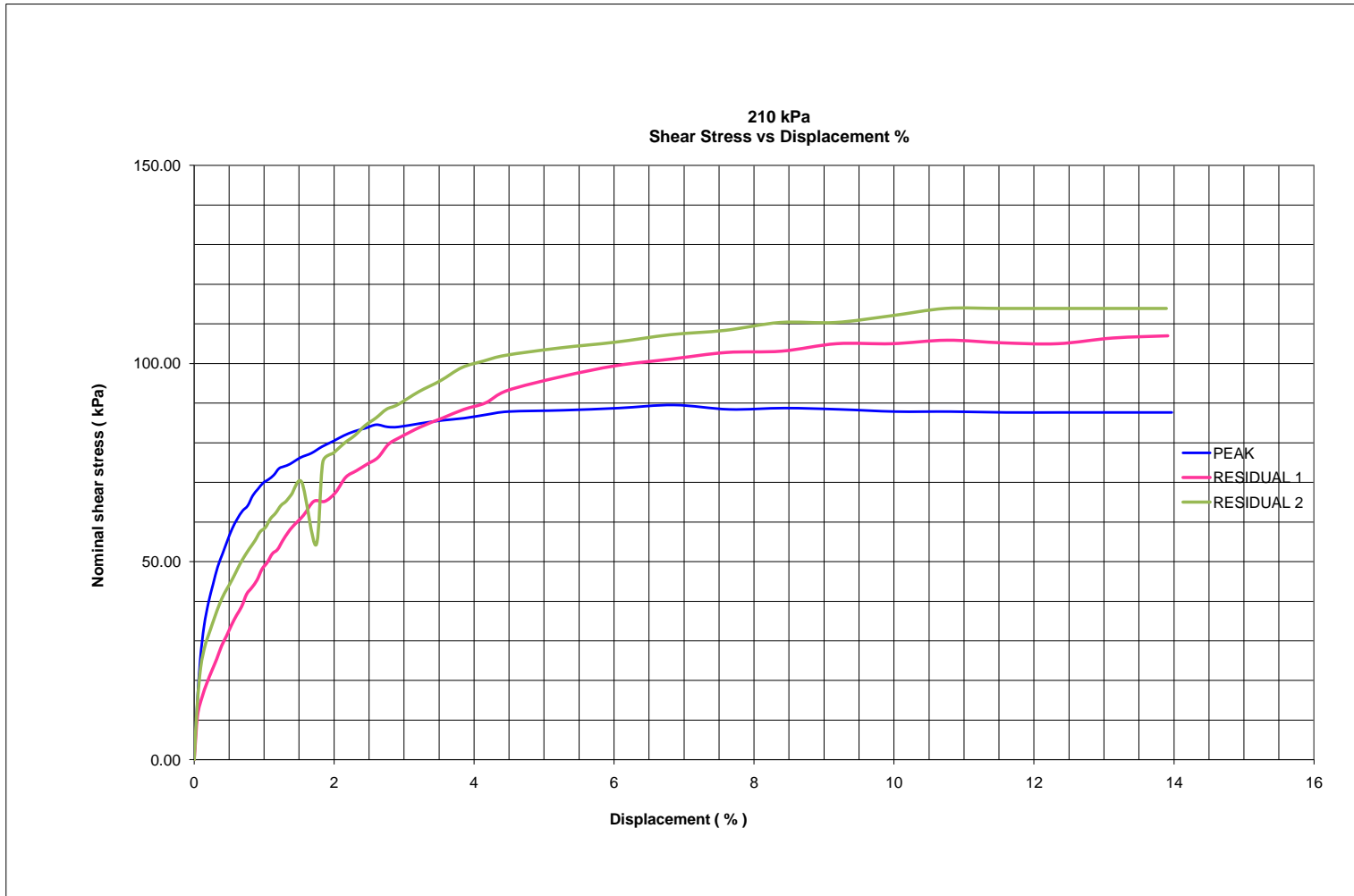
FIGURE NO.
C.6-A

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

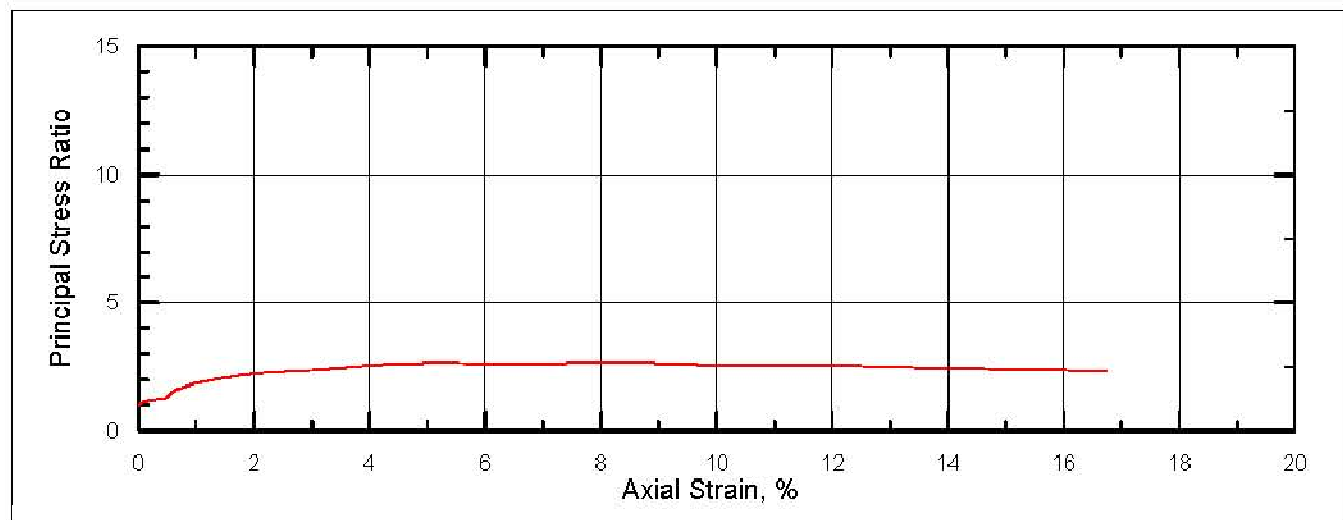
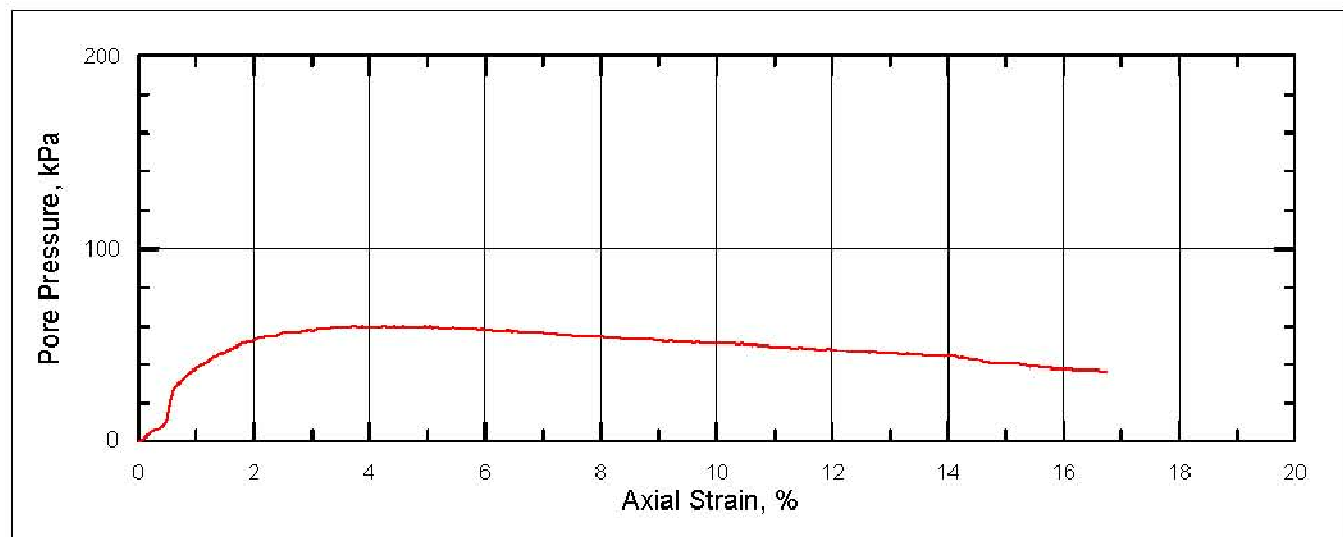
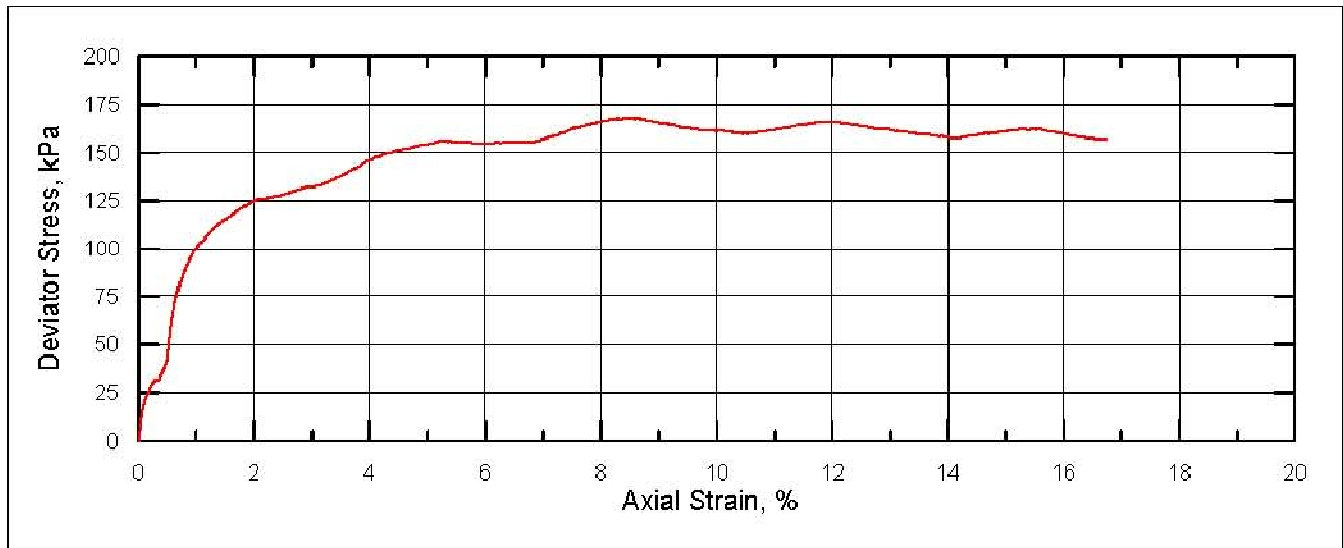
Aug 2012

JOB NO

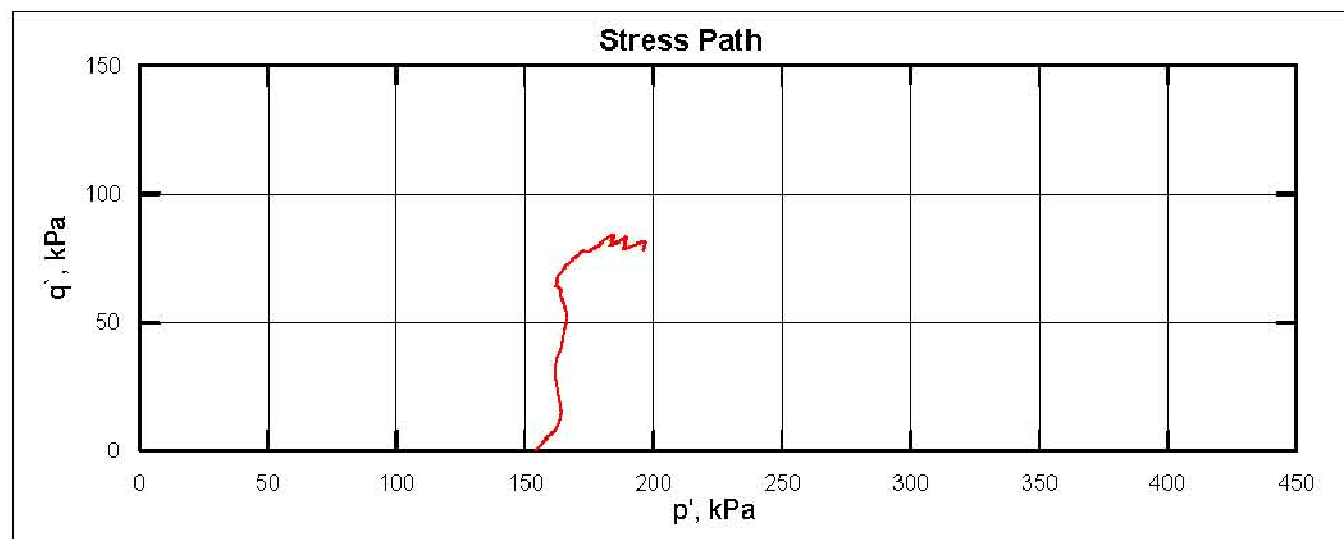
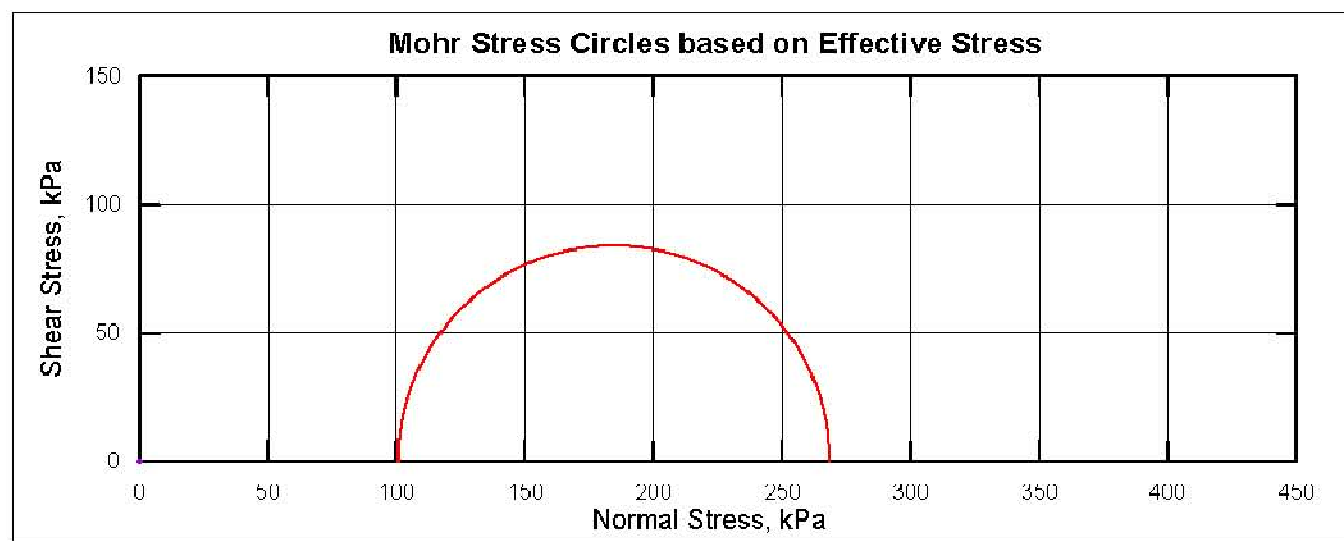
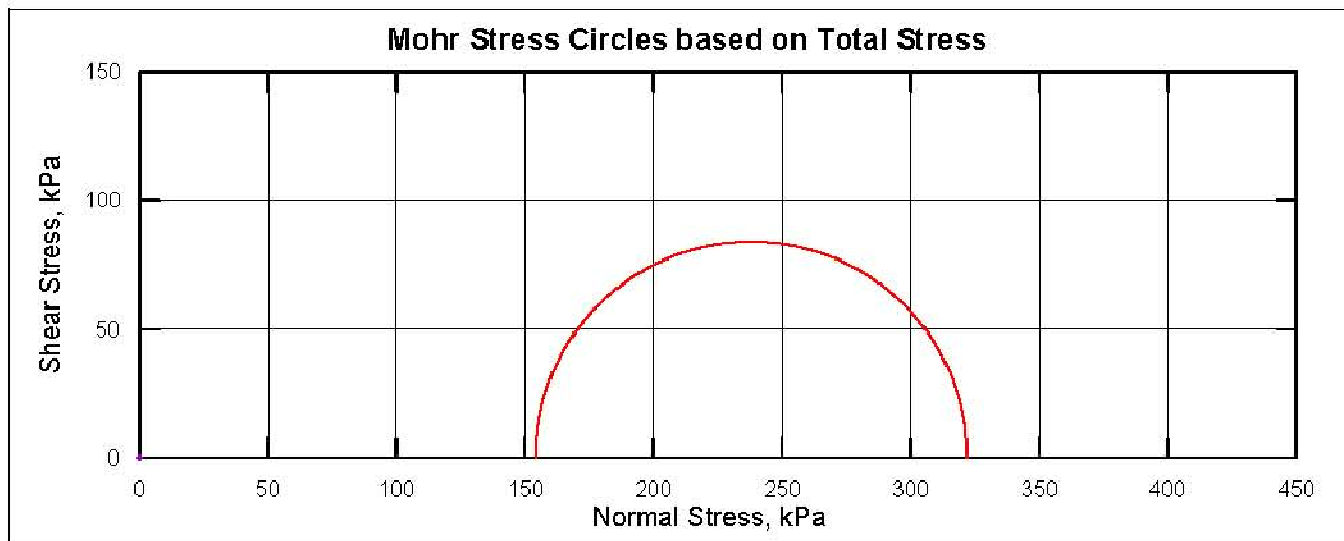
SW8801.1004.101

**FIGURE NO.
C.7-A**

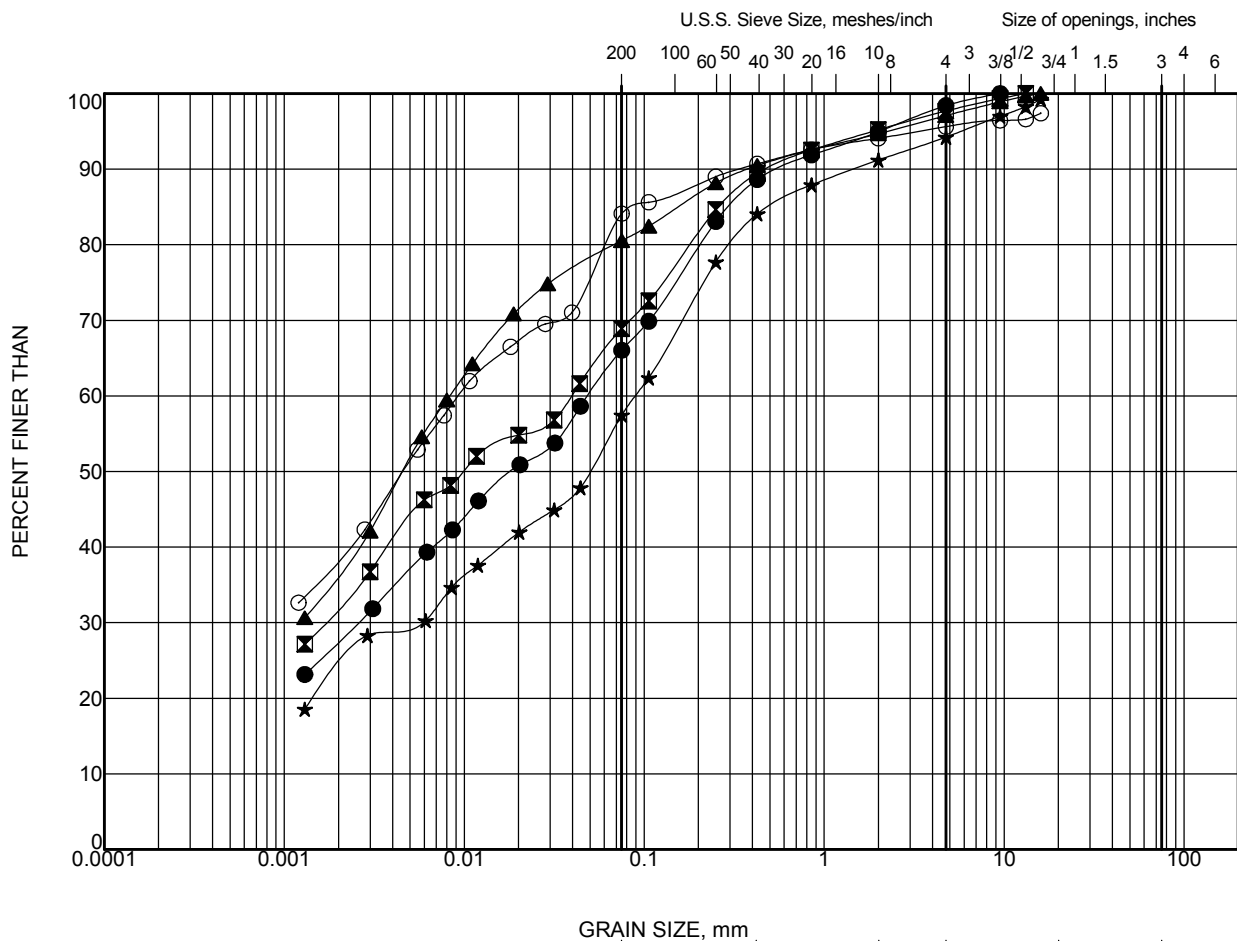
REV



— 150 kPa



— 150 kPa

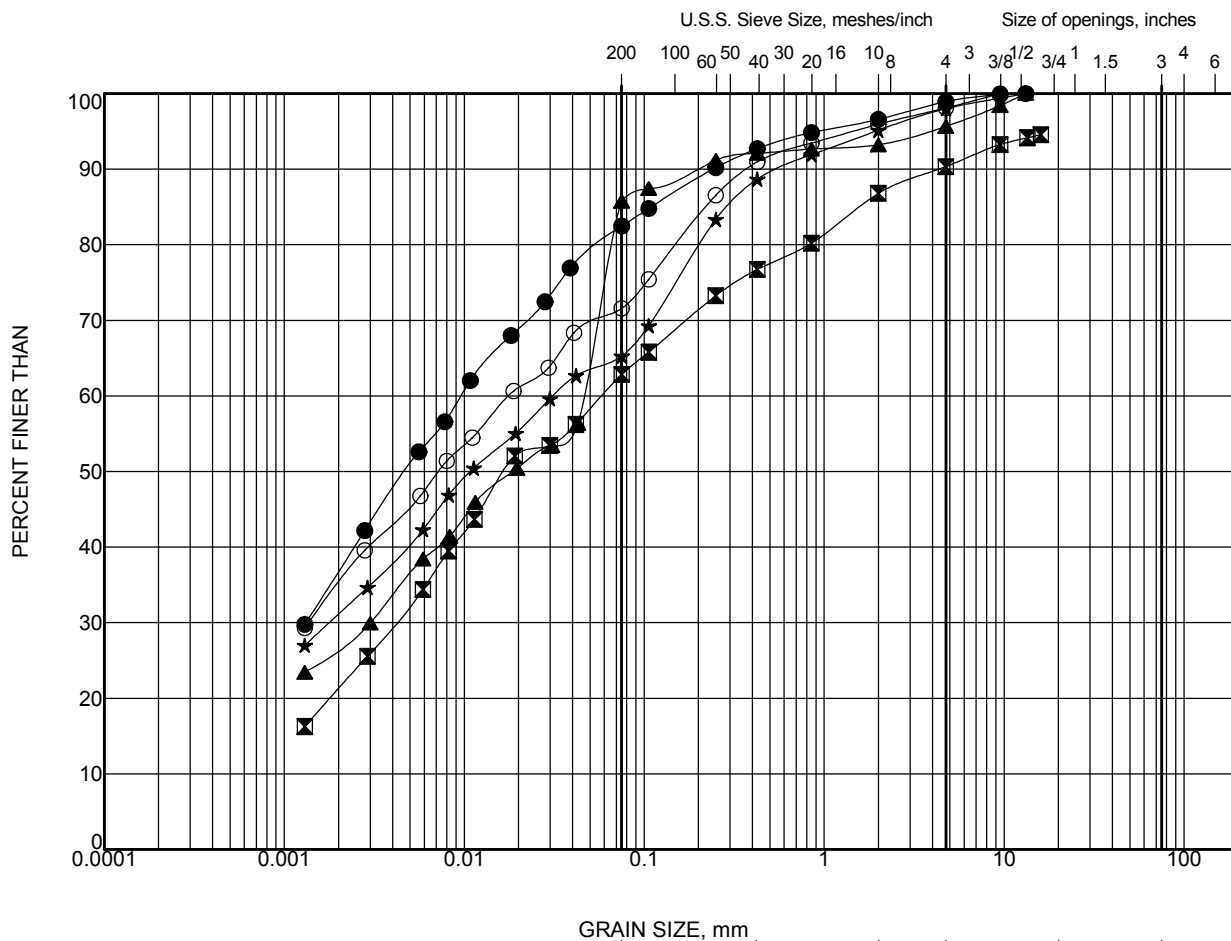


CLAY AND SILT	SAND SIZE			GRAVEL SIZE		Cobble Size
	fine	medium	coarse	fine	coarse	

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	
	PROJECT No. SW6801.1004.101	FILE No.	
	DRAWN	SCALE	REV.
	CHECK	FIGURE C.1	

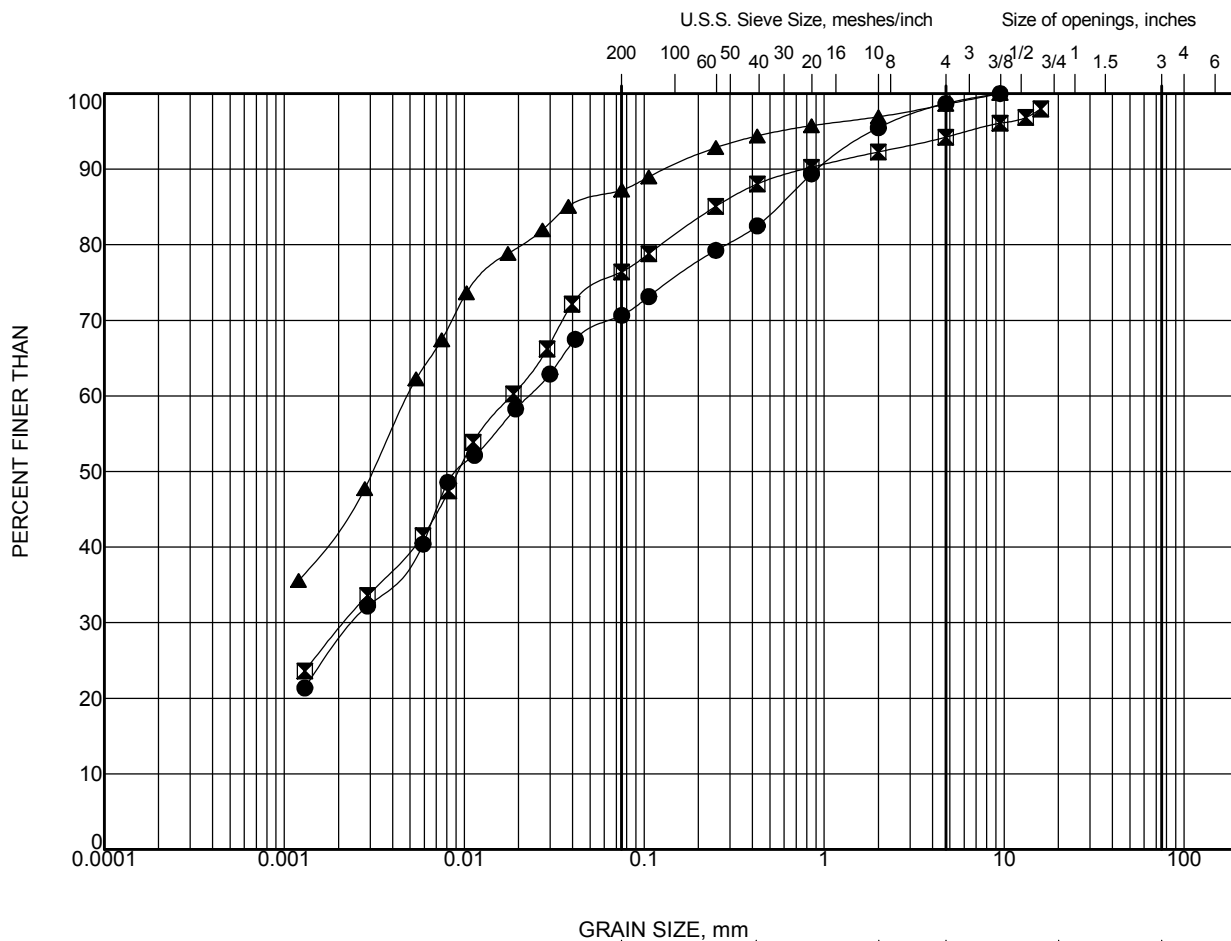


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

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	

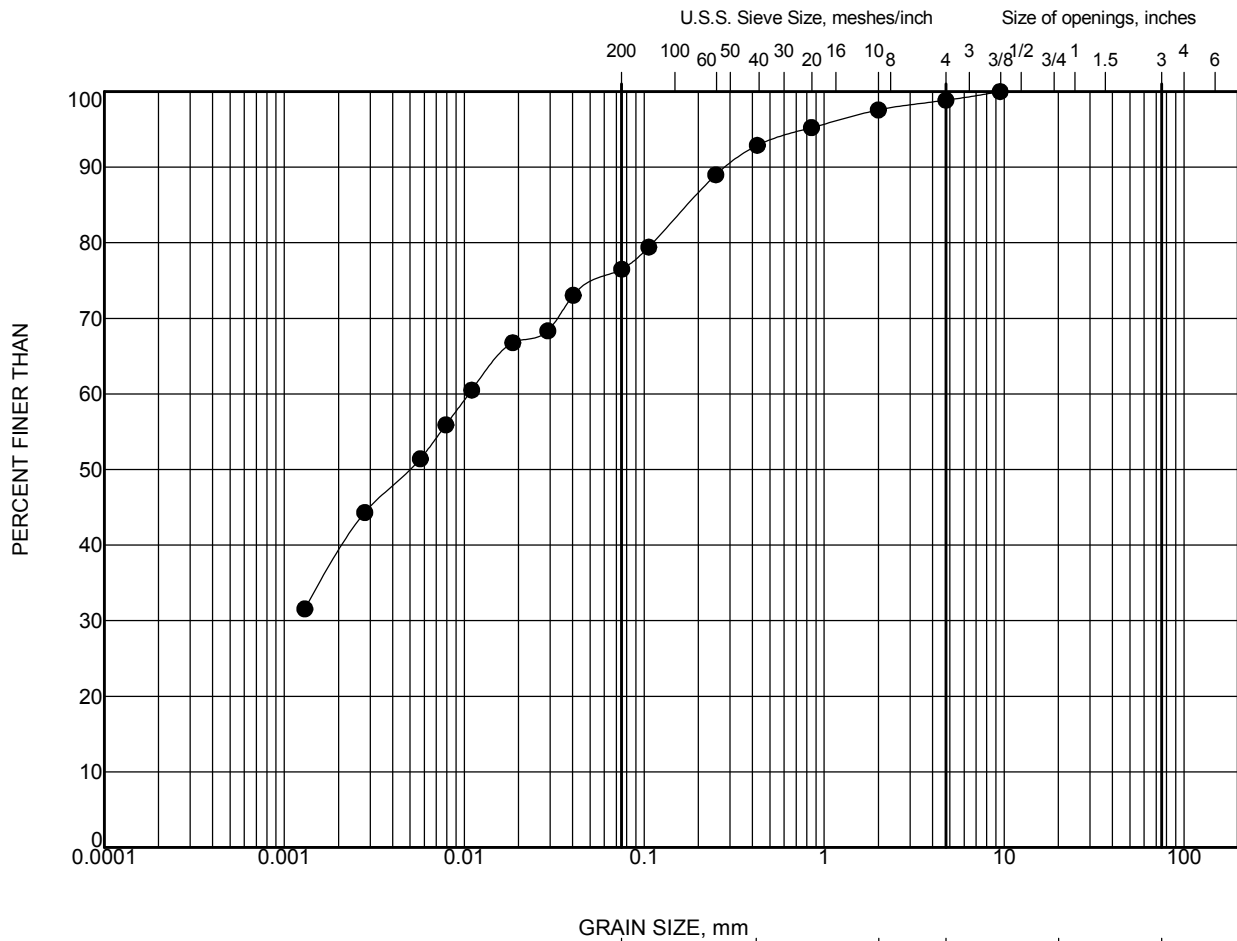


CLAY AND SILT	GRAIN SIZE, mm					Cobble Size
	fine	medium	coarse	fine	coarse	
	SAND SIZE			GRAVEL SIZE		

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	

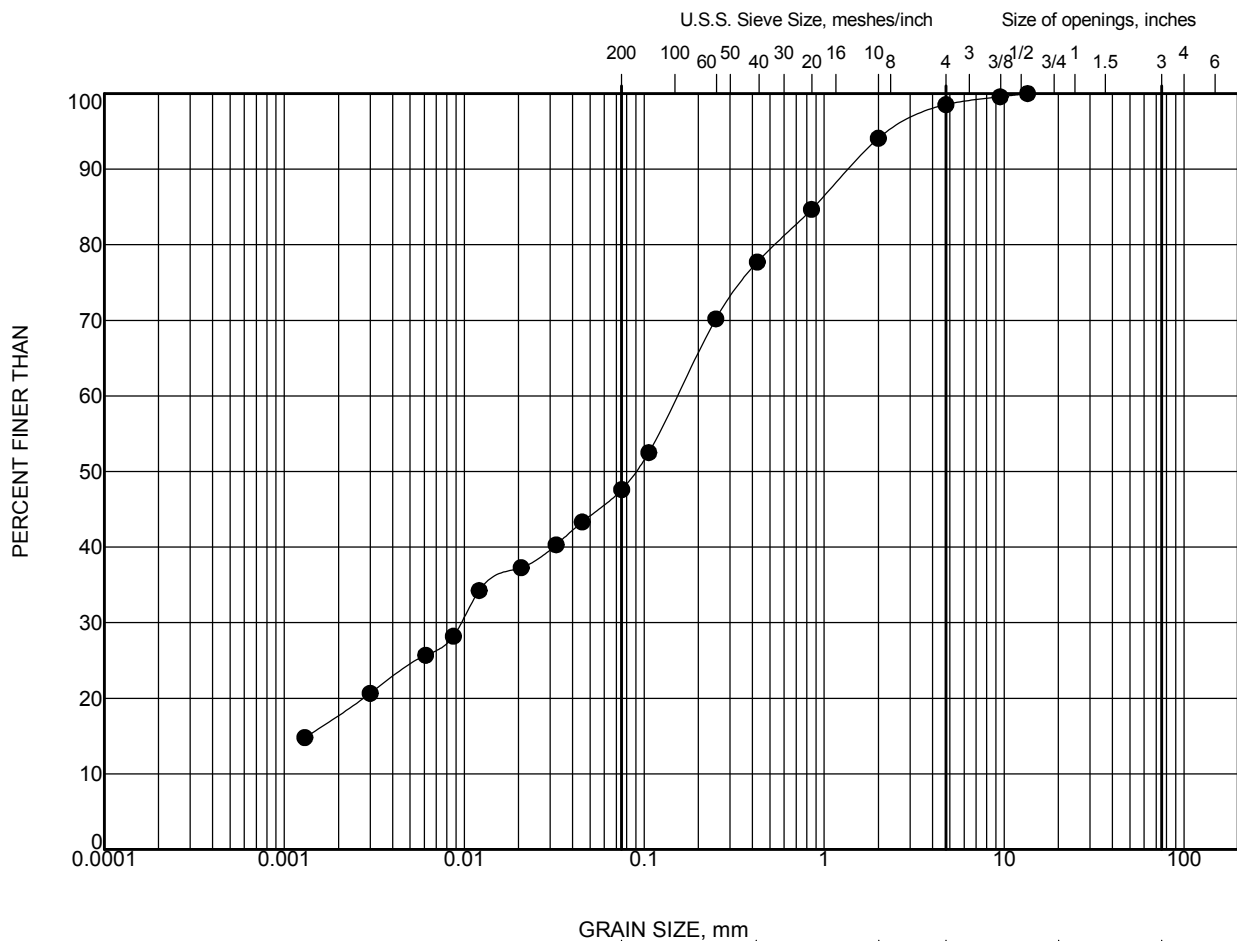


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T11-2	14	15.2

PROJECT		Windsor Essex Parkway (WEP) Windsor, Ontario	
TITLE		GRAIN SIZE DISTRIBUTION SILTY CLAY	
	PROJECT No.	SW6801.1004.101	FILE No.
	DRAWN		SCALE
	CHECK		REV.
FIGURE C.4			

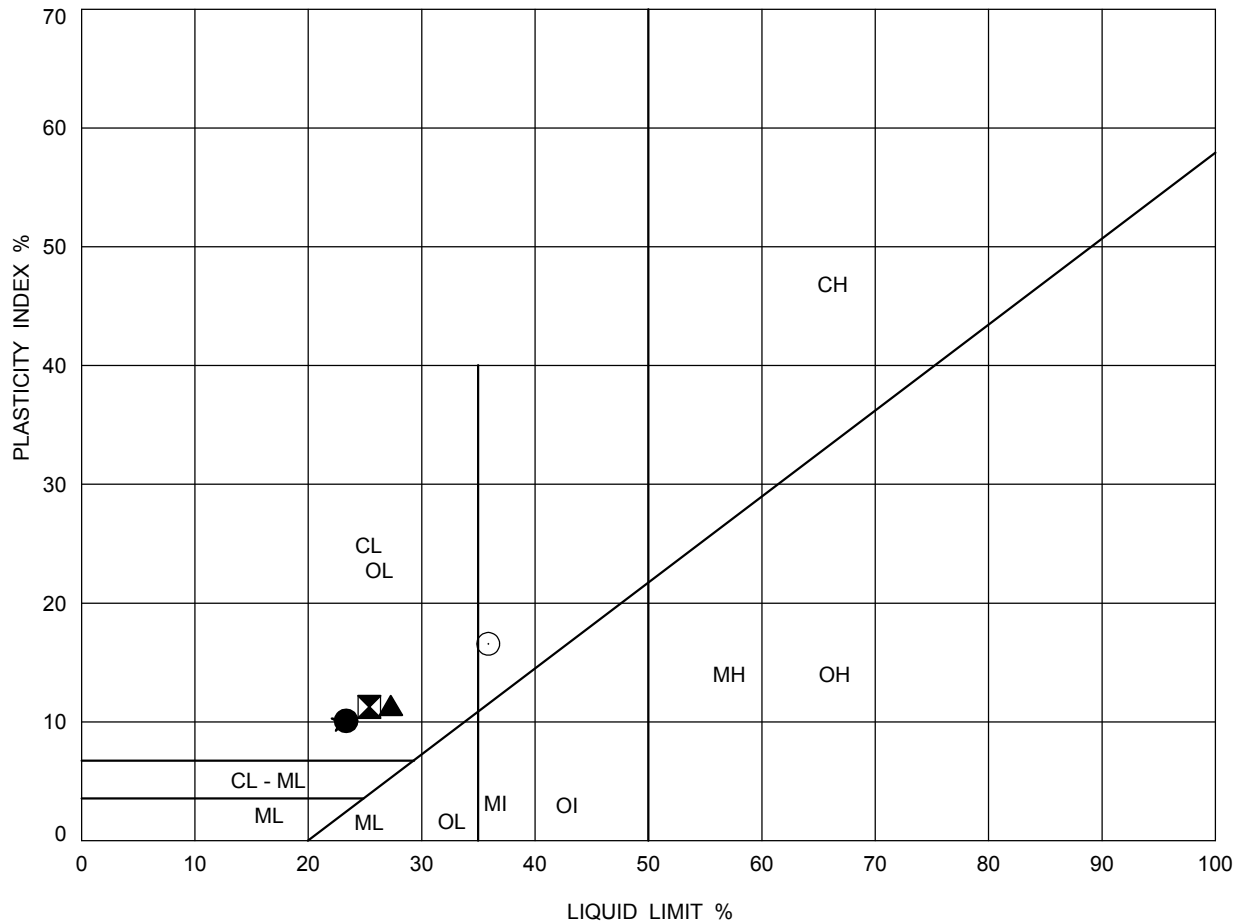


GRAIN SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND:

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)
●	T11-3	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			





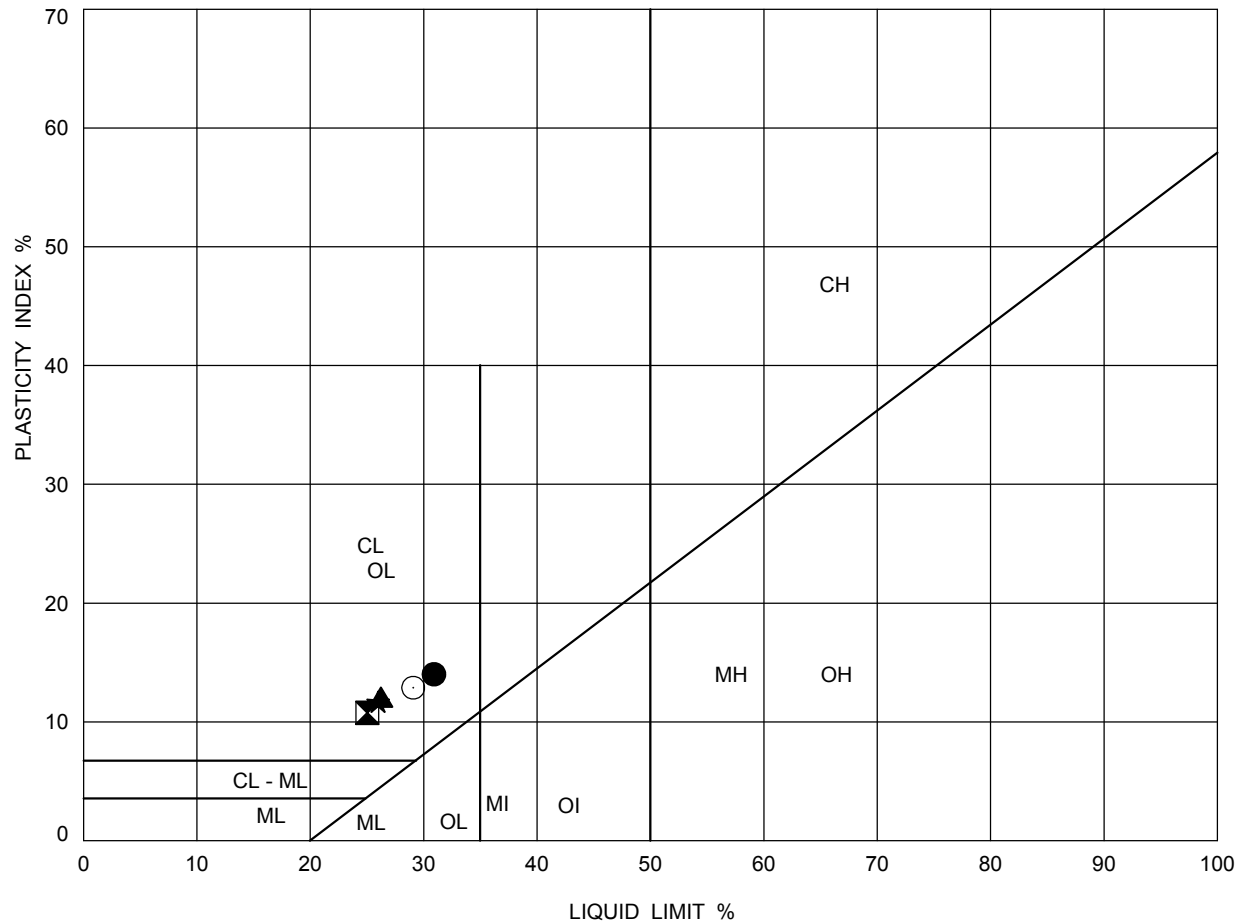
SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

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

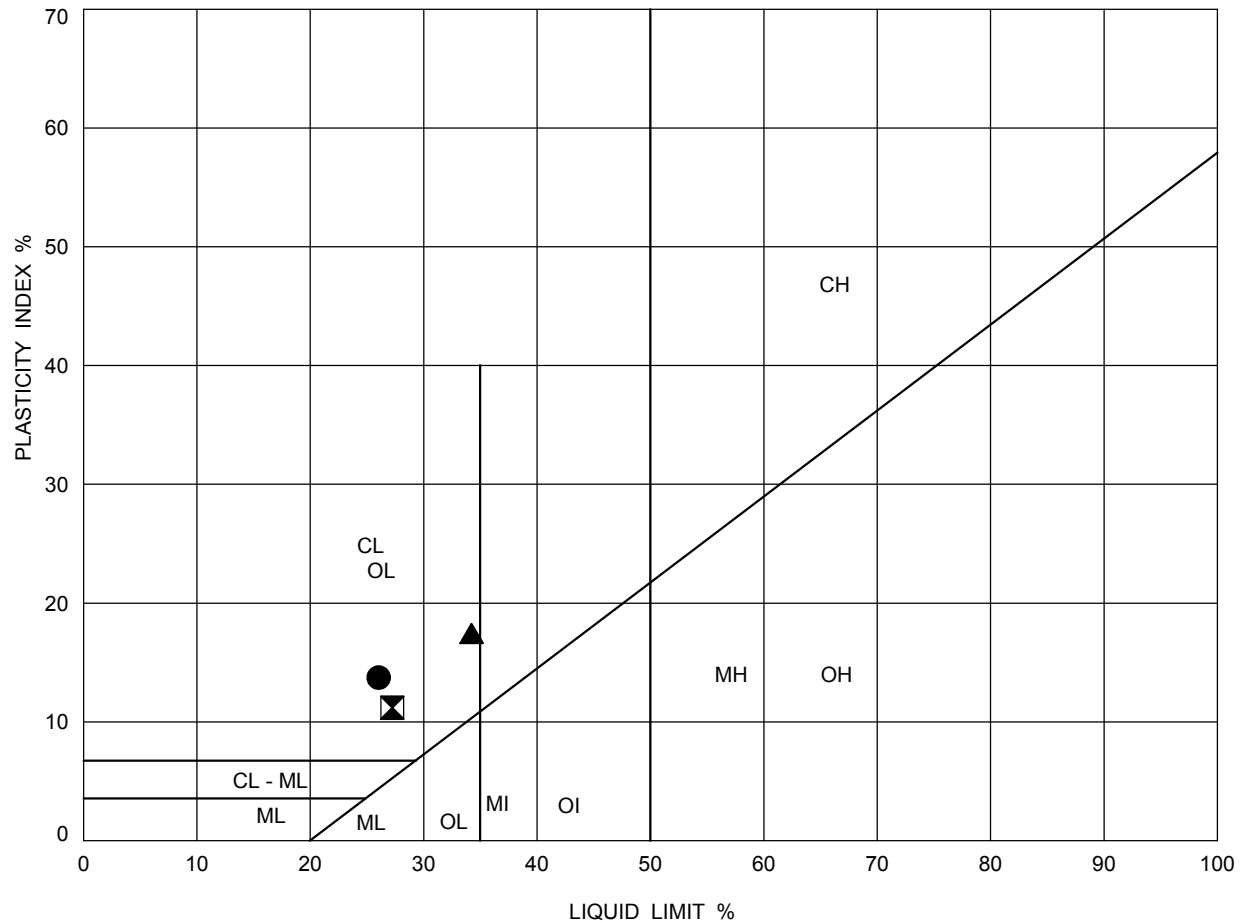
PLASTICITY

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	REV.
	CHECK		FIGURE C.7	



SOIL TYPE



C = Clay
M = Silt
O = Organic

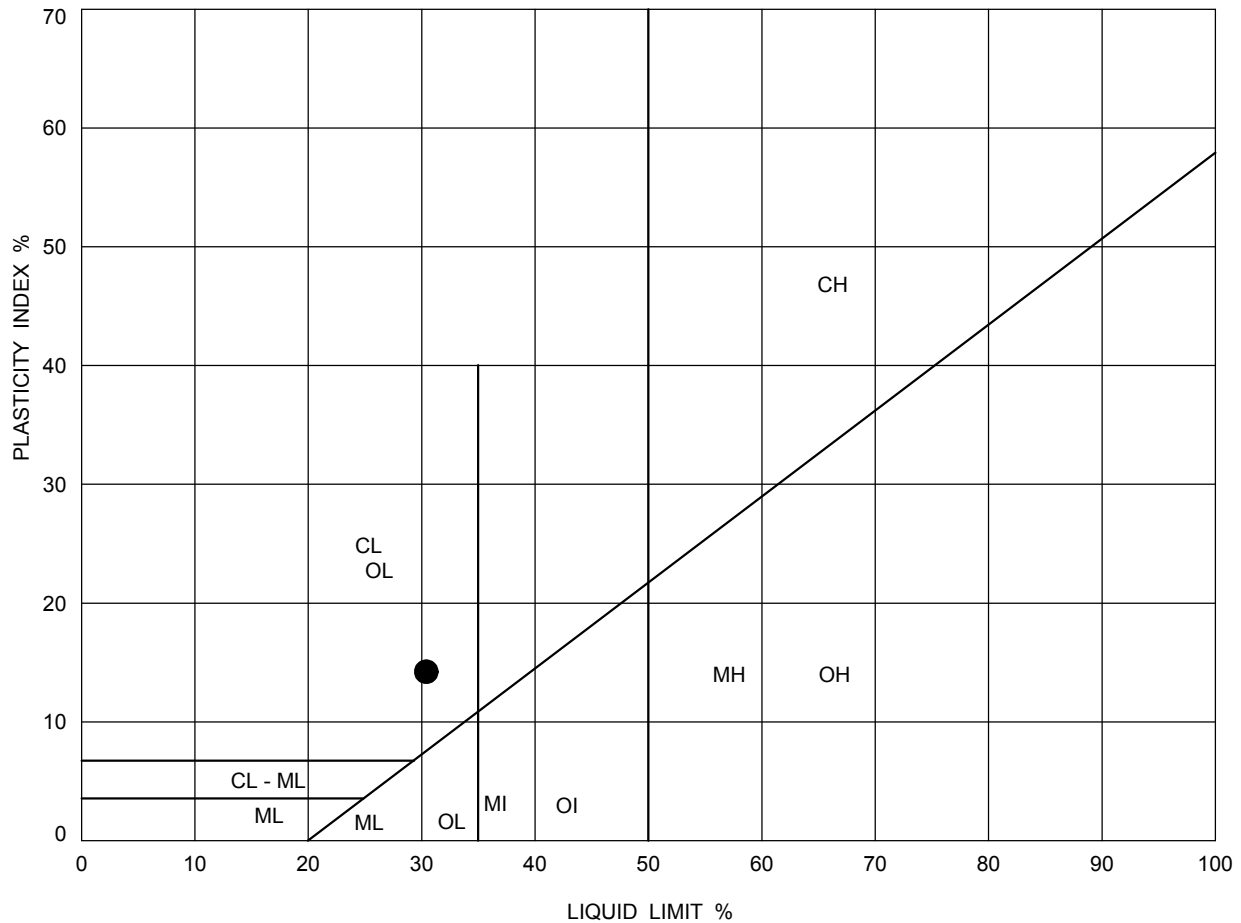
PLASTICITY

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.		SCALE		REV.	
DRAWN		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

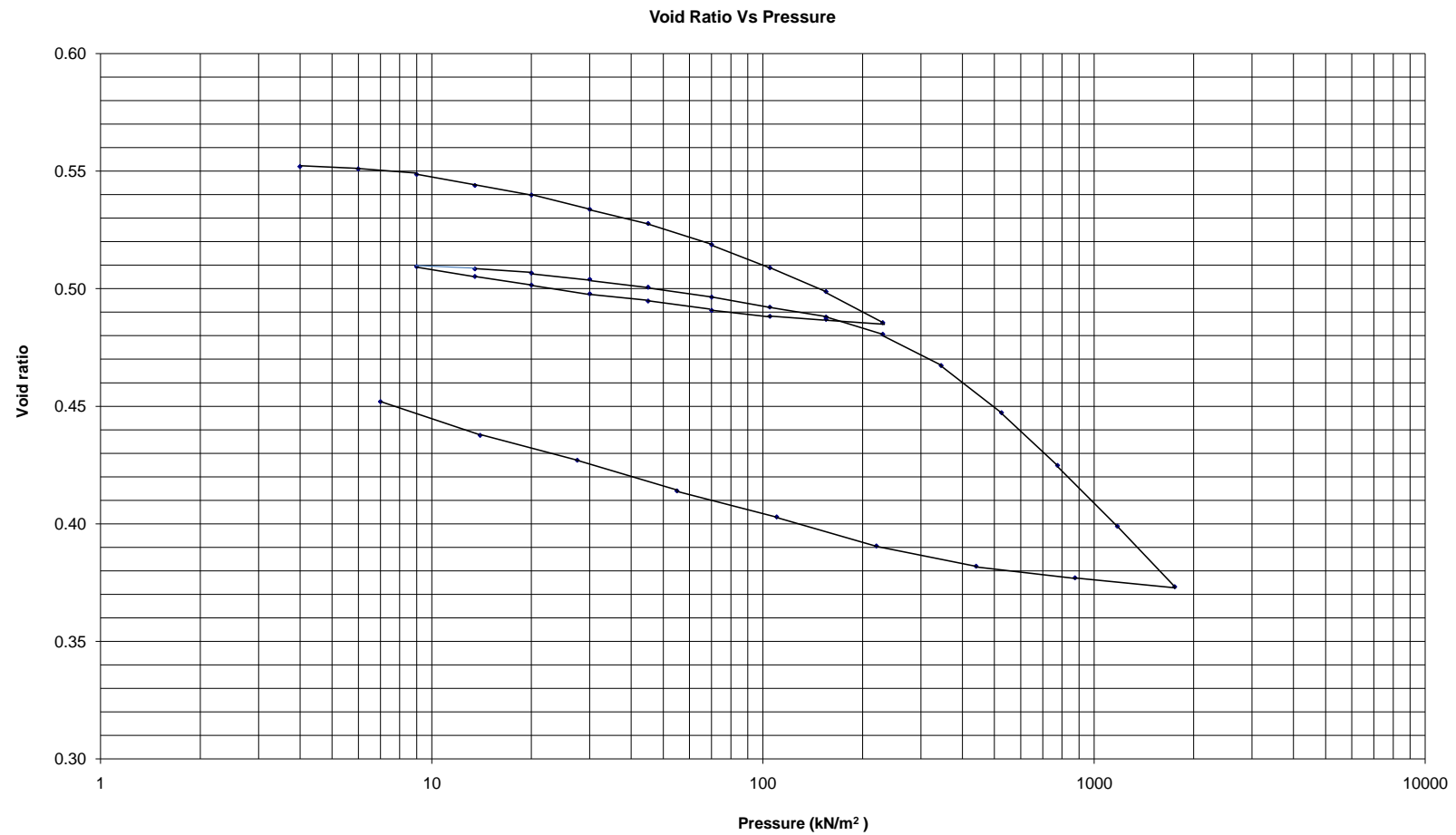
Aug 2012

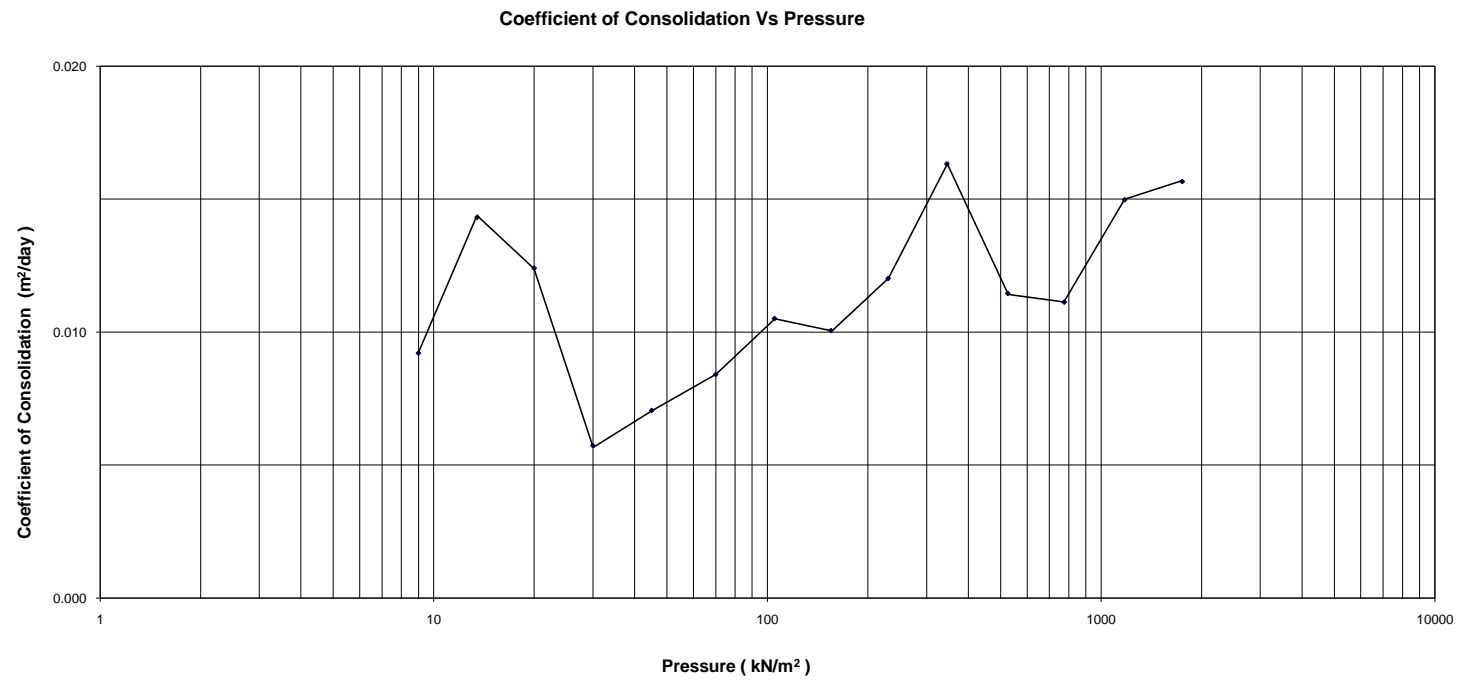
JOB NO

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

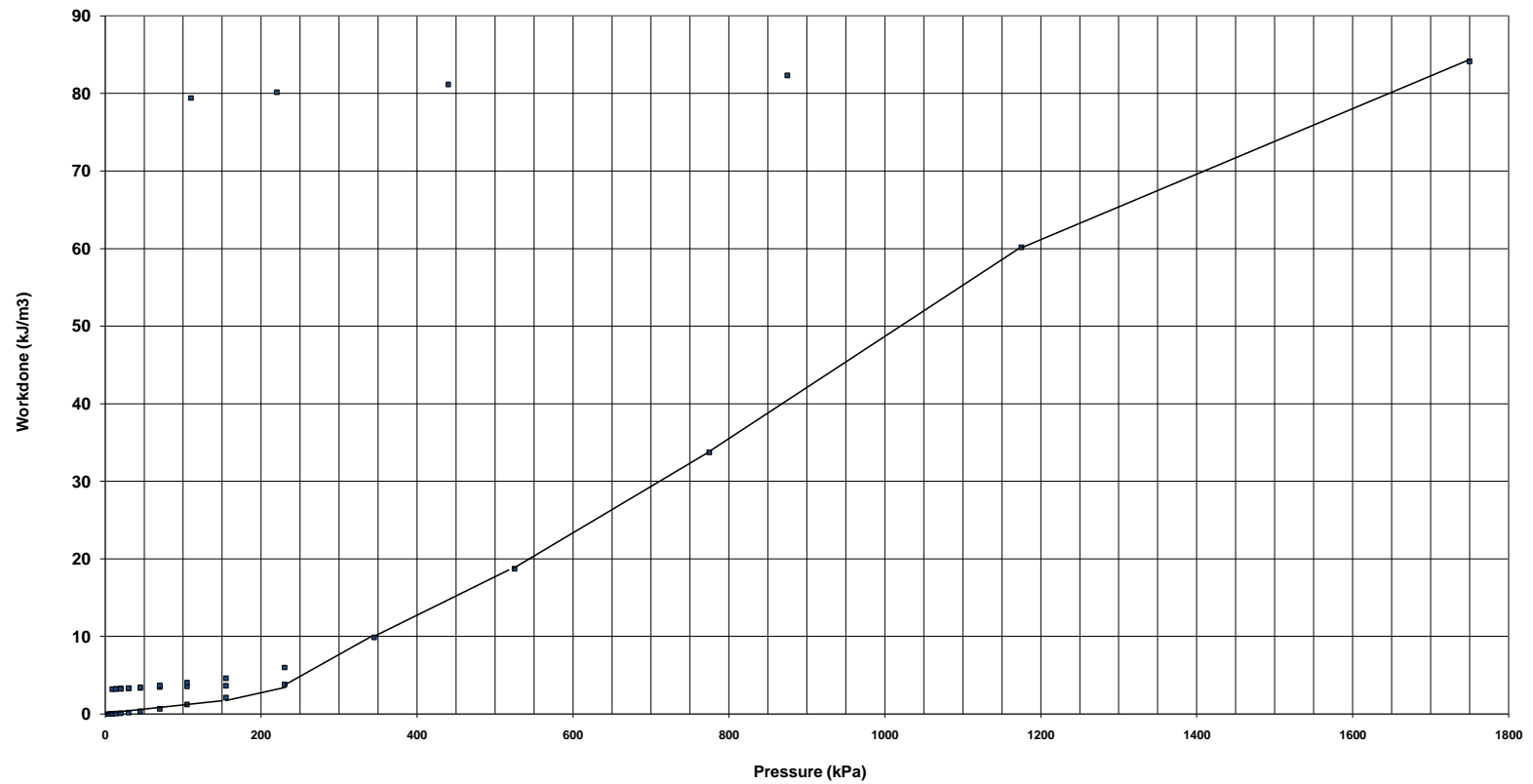
JOB NO

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

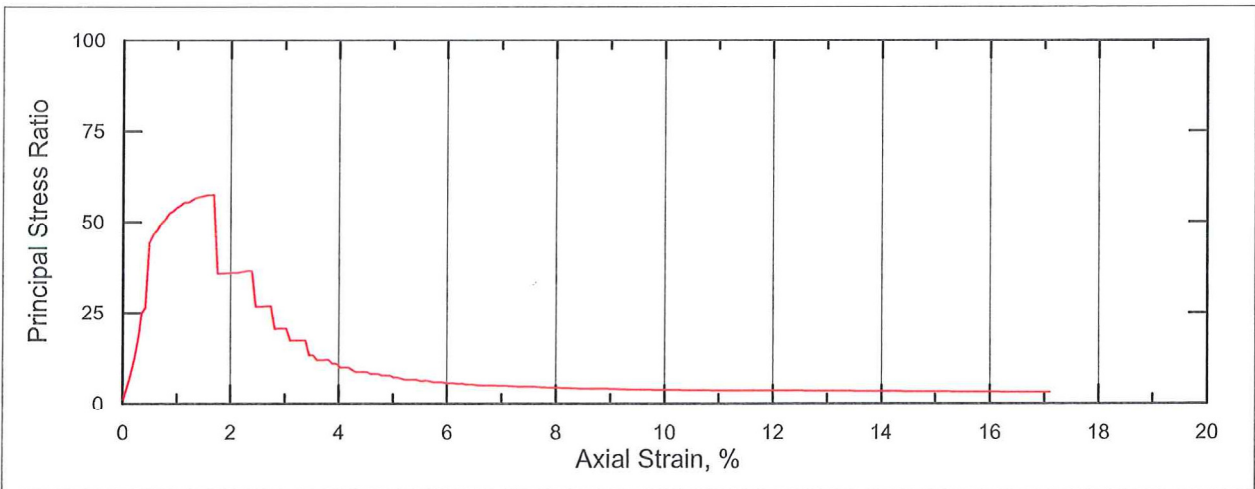
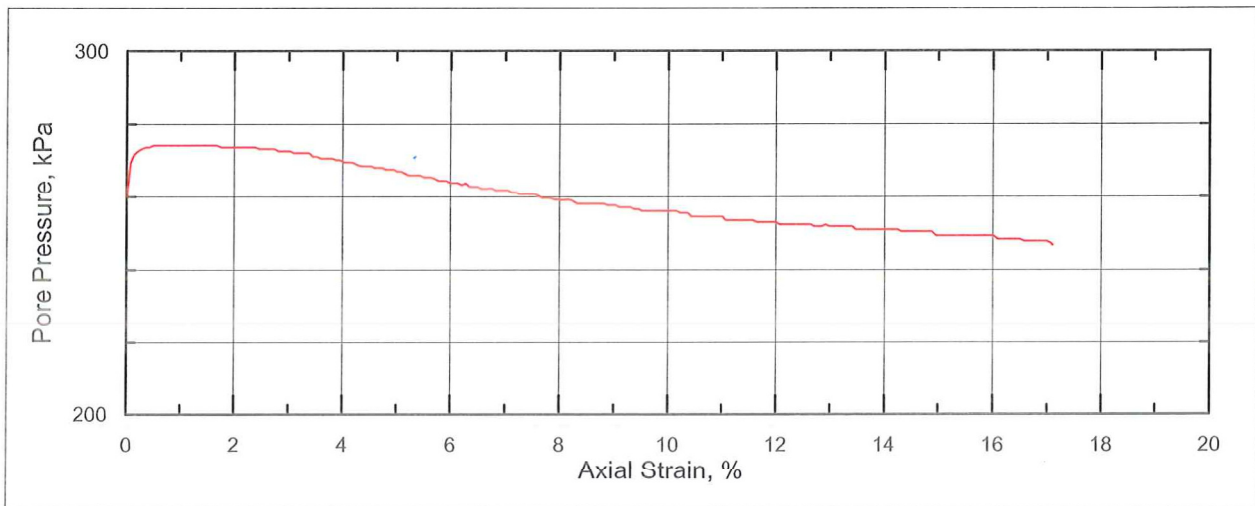
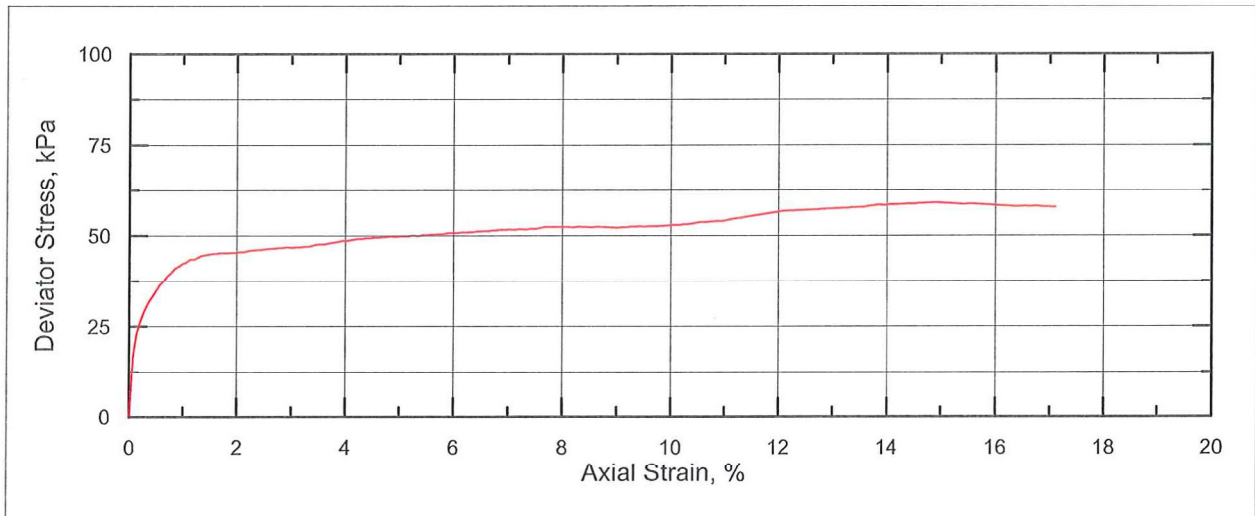
Sample ID: T11-2_Sa16

Sample Description: Silty Clay trace sand and gravel

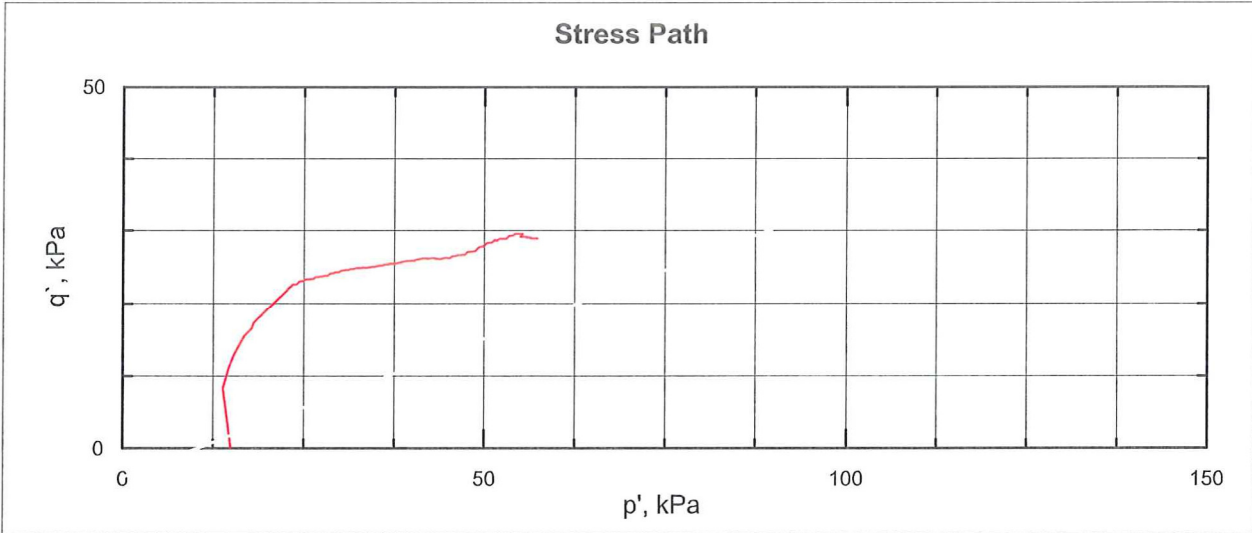
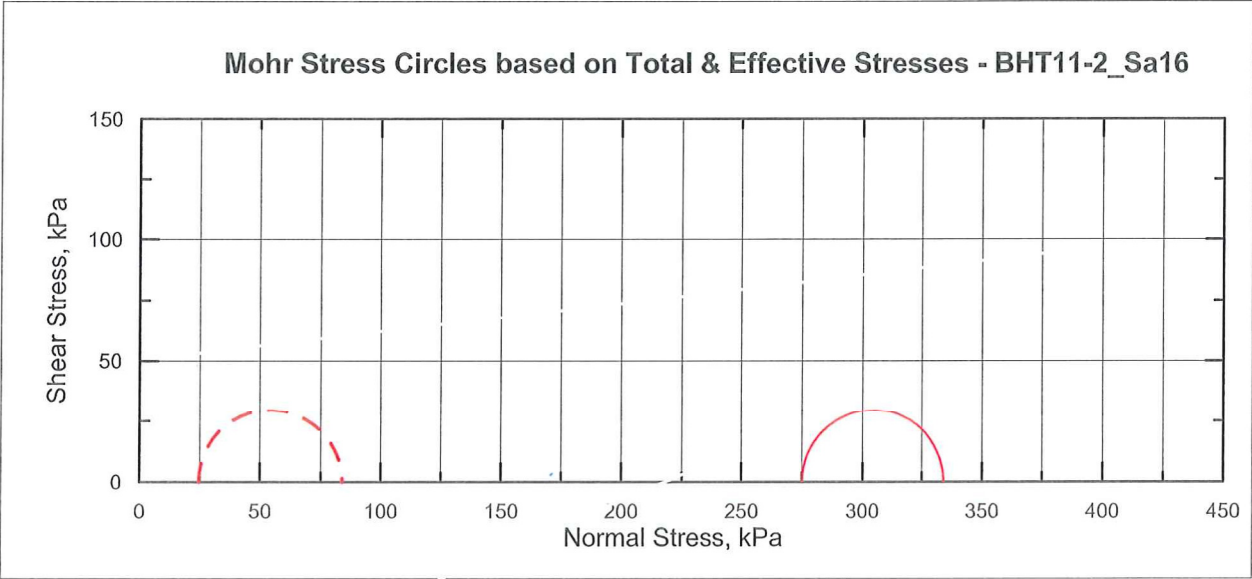
Sample Parameters				
Initial		Specimen 1	Specimen 2	Specimen 3
Diameter	cm	6.970		
Height	cm	14.110		
Volume	cm ³	538.372		
Wet Mass	g	1108.10		
Dry Density	kg/m ³	1641		
Water Content	%	25.4		
Specific Gravity	Assumed	2.720		
Void Ratio		0.66		
Degree of Saturation		105.1		
Before Shear (after consolidation)				
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.

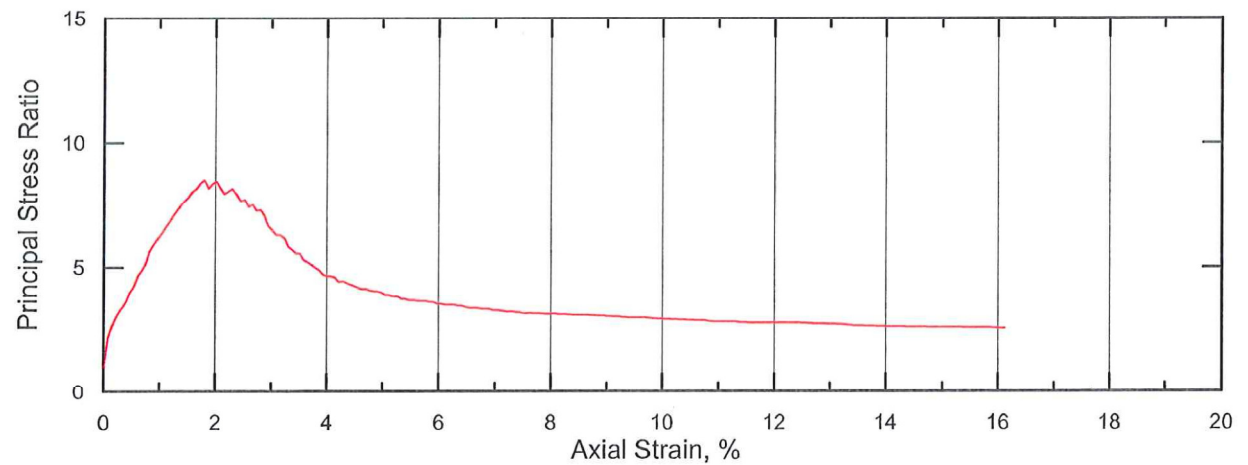
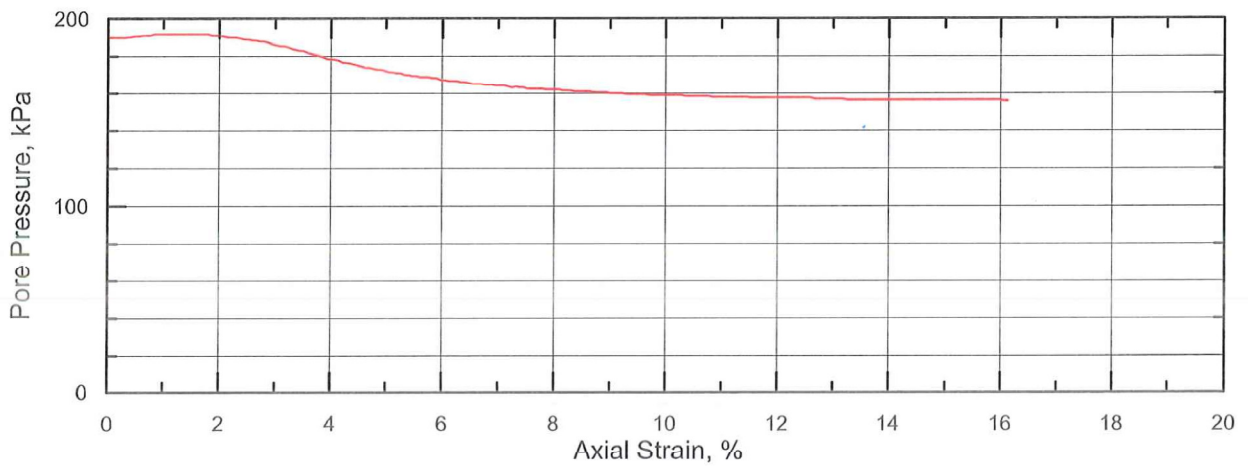
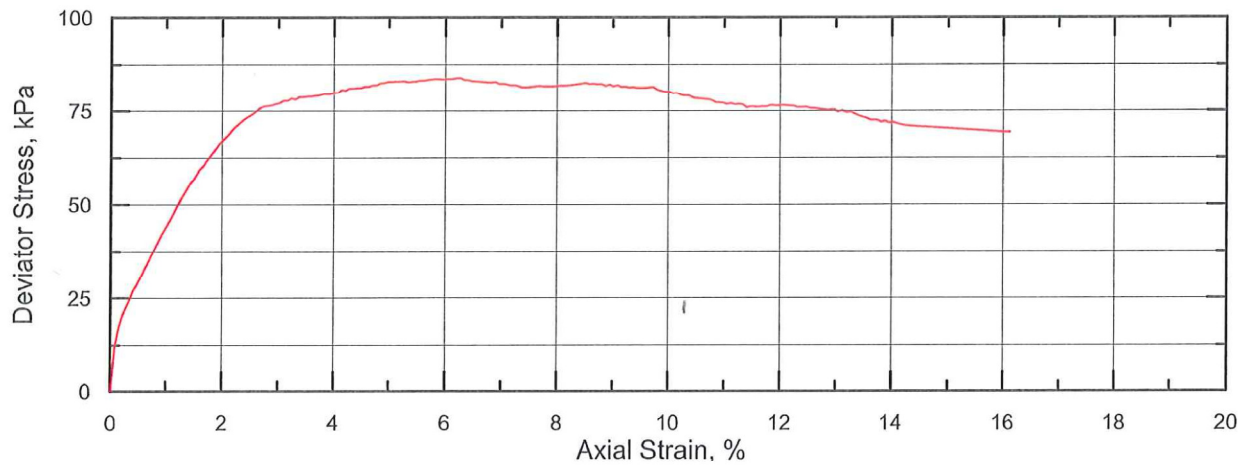
Project No.: SW8801
Date: 23-May-11
Depth(m): 12.2 to 12.8
Sample ID: T11-3_Sa12

Sample Description: Silty Clay trace sand and gravel

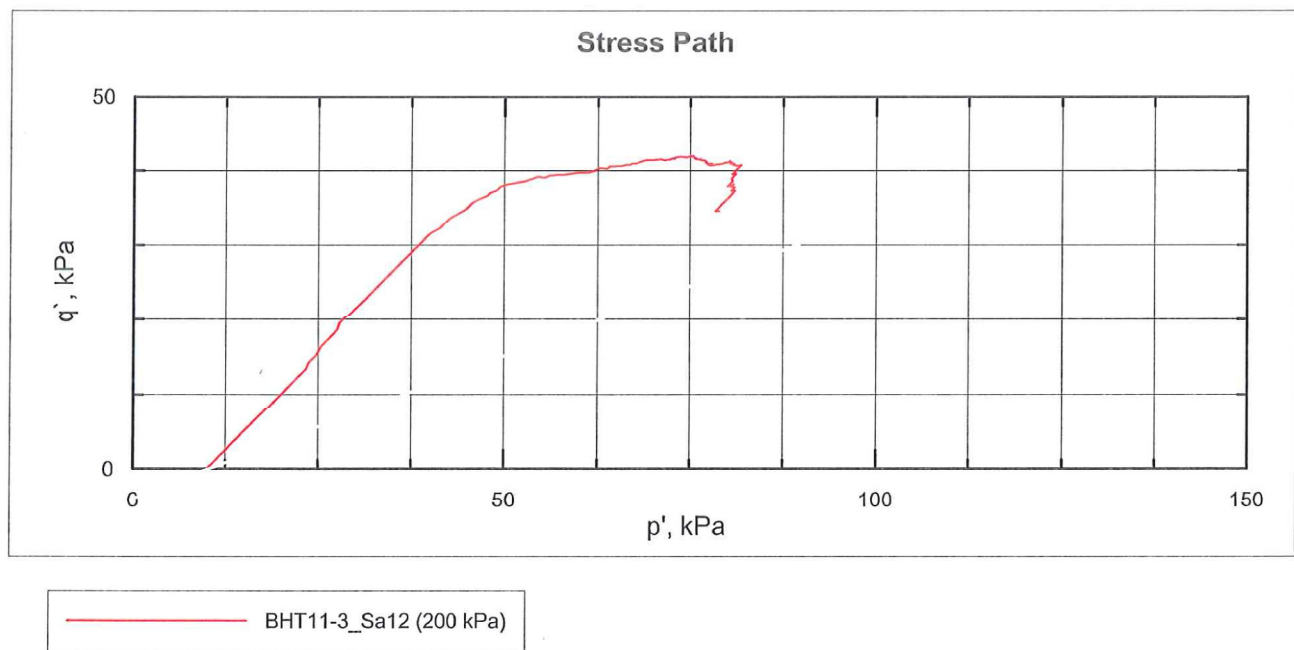
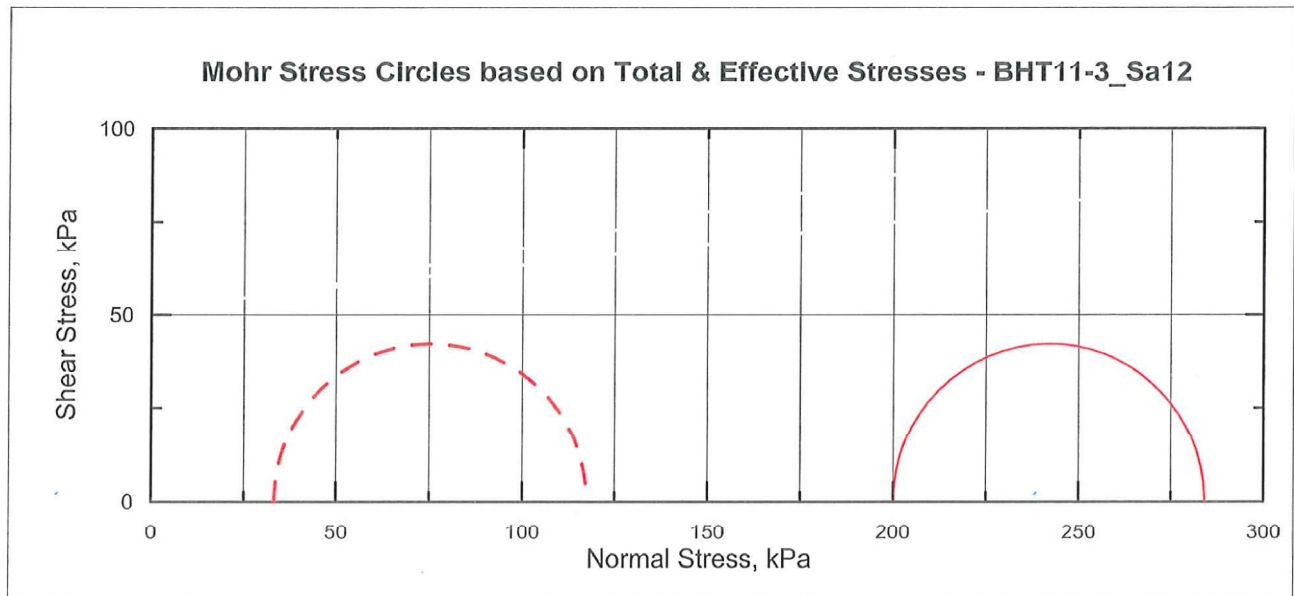
Sample Parameters				
Initial		Specimen 1	Specimen 2	Specimen 3
Diameter	cm	6.989		
Height	cm	14.105		
Volume	cm ³	541.119		
Wet Mass	g	1166.35		
Dry Density	kg/m ³	1820		
Water Content	%	18.4		
Specific Gravity	Assumed	2.720		
Void Ratio		0.49		
Degree of Saturation		101.3		
Before Shear (after consolidation)				
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	Description	Sampled Date	Sampled Time	Client ID
		L1044361-1	SOIL	12-AUG-11		
		L1044361-2	SOIL	12-AUG-11		
		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
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
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
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
WG1332826-2	DUP	L1044361-1						
Sulphide		<0.20	<0.20	RPD-NA	mg/kg	N/A	20	18-AUG-11
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.



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.

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: 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
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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.
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EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:

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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 PO#

QUOTATION: 028643

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

DATE (dd-mm-yy)

TIME (24 hr)

TYPE

MATRIX

OTHER

SOIL

WATER

COMB

DATE

TIME

TYPE

MATRIX

OTHER

SOIL

WATER

COMB

DATE

TIME

TYPE

MATRIX

OTHER

SOIL

WATER

COMB

DATE

TIME

TYPE

MATRIX

OTHER

SOIL

WATER

COMB

DATE

TIME

TYPE

MATRIX

OTHER

SOIL

WATER

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.

Specify date required Service requested
5 day (Frigidifier) 100%
3-4 day TAT (25%)
Same day TAT (200%)

ANALYSIS REQUEST
PLEASE INDICATE FILTERED, PRESERVED OR BOTH
☐ (F, P, F, P)

SUBMISSION # L1030695

ENTERED BY BB

DATE/TIME ENTERED: 13 July 11

BIN #

COMMENTS

LAB ID

-1

-2

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 ☒

DATE & TIME

RECEIVED BY: BB

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



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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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 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%)	Same day TAT (200%)

COMPANY NAME **Amel E+I**

CRITERIA

Criteria on report: Yes ☐ No ☐

OFFICE **Windsor**

Reg 153/04

PROJECT MANAGER

Table 1 2 3

Shane MacLeod

TCLP MISA PWOC

PROJECT # **SW8601:1004,101**

ODWS OTHER

PHONE **519 735-2499** FAX **519 735-9669**

REPORT FORMAT / DISTRIBUTION

ACCOUNT #

EMAIL ☒ FAX BOTH

QUOTATION # **Q28643** POS

SELECT: PDF DIGITAL BOTH

SAMPLING INFORMATION

EMAIL1 **Shane.MacLeod@Amel.com**

Sample Date/Time TYPE MATRIX

EMAIL2

Date (dd-mm-yy)	Time (24 hr) (hh:mm)	COMP	GRAB	WATER	SOIL	OTHER
5/07/11				X		

SAMPLE DESCRIPTION TO APPEAR ON REPORT

BT 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 ☐ MEAN TEMP
COLD ☐
COOLING INITIATED ☒ **22.90°C**
AMBIENT ☒

SAMPLED BY:

DATE & TIME

RECEIVED BY:

DATE & TIME

RELINQUISHED BY:

DATE & TIME

RECEIVED AT LAB BY:

DATE & TIME

OBSERVATIONS
Yes ☐ No ☐
If yes add SIF

INIT

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

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Chain of Custody Numbers:

092959

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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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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
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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:

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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.

Phone: (519) 286-6910 Fax: (519) 886-9047 CANADA TOLL FREE: 1-800-688-9878		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 data required Service requested 2 day TAT (50%) Next day TAT (100%) Same day TAT (200%) PLEASE INDICATE FILTERED, PRESERVED OR BOTH <input type="checkbox"/> (F, P, FP)	
COMPANY NAME Amei E+I		CRITERIA Reg 15304 Table 1 2 3 TCLP MISA PWQO ODWS OTHER 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 Shone, Maclead@Amei.com EMAIL2		ANALYSIS REQUEST SUBMISSION # L1030720 ENTERED BY: BB DATE/TIME ENTERED 13 July 11 BIN # COMMENTS LAB ID -1	
OFFICE Windsor PROJECT MANAGER Shone Maclead PROJECT # 5068011004101 PHONE 519 735-2499 FAX 519 735-9669 ACCOUNT #		QUOTATION # 12286423 PO#		NUMBER OF CONTAINERS Corrosion Package	
SAMPLE INFORMATION Sample Date/Time July 7 Date (dd-mm-yy) Time (24 hr) (hr:mm)		TYPE X MATRIX TB 4-2 5010		SAMPLE DESCRIPTION TO APPEAR ON REPORT Corrosion Package	
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 checked="" type="checkbox"/>		SAMPLE CONDITION FROZEN <input type="checkbox"/> MEAN TEMP COOL <input type="checkbox"/> COOLING INITIATED <input type="checkbox"/>	
Is the water sampled intended to be potable for human consumption? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		DATE & TIME 3 July 11		RECEIVED BY: Shone Maclead	
DATE & TIME 3 July 11		RECEIVED BY: Shone Maclead		DATE & TIME 13 July 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 TAT's.		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 13:48 (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.



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.

Specify data required

Service requested

2 day TAT (50%)

5 day (Regular)

Next day TAT (100%)

3-4 day TAT (25%)

Same day TAT (200%)

COMPANY NAME Amer E+I		CRITERIA Criteria on report Yes <input type="checkbox"/> No <input type="checkbox"/>		ANALYSIS REQUEST								PLEASE INDICATE FILTERED, PRESERVED OR BOTH ☐ (F, P, F/P)				
OFFICE Windsor		Reg 15304		<div style="writing-mode: vertical-rl; transform: rotate(180deg);">NUMBER OF CONTAINERS</div> <div style="font-size: 2em;">Corrosion Package</div>								SUBMISSION # L1030717				
PROJECT MANAGER Shone Macleod		Table 1 2 3										ENTERED BY: [Signature]				
PROJECT # SW 5801, 1004, 101		TCLP _____ MISA _____ PWQD _____										DATE/TIME ENTERED: 13 July 11				
PHONE 919 735-2499		ODWS _____ OTHER _____										BIN # [Signature]				
FAX 919 735-9669		REPORT FORMAT / DISTRIBUTION														
ACCOUNT #		EMAIL <input checked="" type="checkbox"/> FAX _____ BOTH _____														
QUOTATION# Q28643 PO#		SELECT: PDF _____ DIGITAL _____ BOTH _____														
SAMPLING INFORMATION		EMAIL1 Shone.Macleod@Amer.com														
Sample Date/Time		EMAIL2 _____														
TYPE		SAMPLE DESCRIPTION TO APPEAR ON REPORT														
MATRIX																
Date (dd-mm-yy)	Time (24 hr) (hh:mm)	COP	GRAB	WATER	SOIL	OTHER										
July 6, 11				X			TB S-1 SW #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 TEM
							If yes, an authorized drinking water COC MUST be used for this submission.							COLD	<input type="checkbox"/>	B.
							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"/>	
SAMPLED BY:		DATE & TIME		RECEIVED BY:		DATE & TIME		OBSERVATIONS Yes <input type="checkbox"/> No <input type="checkbox"/> If yes add SIF		INIT						
RELINQUISHED BY:		DATE & TIME		RECEIVED AT LAB BY:		DATE & TIME										
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

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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 08:21 (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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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		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.

112848

C of C # 00000

60 NORTHLAND ROAD, UNIT 1

WATERLOO, ON N2V 2B8

Phone: (519) 886-6910

Fax: (519) 886-9047

Toll Free: 1-800-668-9878



CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page ____ of ____

COMPANY NAME Anne E+I		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 (25%)		Service requested 2 day TAT (50%) <input checked="" type="checkbox"/> Next day TAT (100%)		2 day TAT (50%) Next day TAT (100%) Same day TAT (200%)	
OFFICE Winchester		CRITERIA Reg 153/04 <input type="checkbox"/> Reg 511/09 <input type="checkbox"/>		ANALYSIS REQUEST		PLEASE INDICATE FILTERED, PRESERVED OR BOTH ← (F, P, F/P)		SUBMISSION # L1644365	
PROJECT MANAGER Shane Macleod		TCLP <input type="checkbox"/> MISA <input type="checkbox"/> PWQO <input type="checkbox"/>		NUMBER OF CONTAINERS Corrosion Package		ENTERED BY AL		LAB ID	
PROJECT # 5188011004.101		ODWS <input type="checkbox"/> OTHER <input type="checkbox"/>		REPORT FORMAT/DISTRIBUTION		DATE/TIME ENTERED 15/11/11 9:50		COMMENTS 6543	
PHONE 519-735-2499		REPORT FORMAT/DISTRIBUTION		EMAIL <input checked="" type="checkbox"/> FAX <input type="checkbox"/> BOTH <input type="checkbox"/>		BIN #		LAB ID	
ACCOUNT # 519-735-2499		SELECT: PDF <input type="checkbox"/> DIGITAL <input type="checkbox"/> BOTH <input type="checkbox"/>		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
QUOTATION # 078643		EMAIL 1 Shane.Macleod@AEC.com		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
PO #		EMAIL 2		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
SAMPLING INFORMATION		MATRIX		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
Sample Date/Time		TYPE		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
Date (dd-mm-yy) 12/06/11		Time (24hr) (hh:mm)		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
OTHER		WATER		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
SOIL		GRAB		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
COMP		COMP		SAMPLE DESCRIPTION TO APPEAR ON REPORT		COMMENTS		LAB ID	
SPECIAL INSTRUCTIONS/COMMENTS		THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)		SAMPLE CONDITION		COMMENTS		LAB ID	
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 type="checkbox"/>		FROZEN <input type="checkbox"/>		MEAN TEMP 22.0		LAB ID	
Is the water sampled intended to be potable for human consumption?		Yes <input type="checkbox"/> No <input type="checkbox"/>		COOLING INITIATED <input checked="" type="checkbox"/>		OBSERVATIONS		LAB ID	
DATE & TIME		RECEIVED BY:		DATE & TIME		OBSERVATIONS		LAB ID	
DATE & TIME		RECEIVED AT LAB BY:		DATE & TIME		OBSERVATIONS		LAB ID	
SAMPLED BY:		RECEIVED AT LAB BY:		DATE & TIME		OBSERVATIONS		LAB ID	
RELINQUISHED BY:		RECEIVED AT LAB BY:		DATE & TIME		OBSERVATIONS		LAB ID	

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.



COMPANY NAME Amel E & J		CRITERIA Reg 153/04 Table 1 2 3		Criteria on report Yes <input type="checkbox"/> No <input type="checkbox"/>		ANALYSIS REQUEST Specify date required Service requested 5 day (Regular) 3-4 day TAT (25%) 2 day TAT (50%) Next day TAT (100%) Same day TAT (200%)		PLEASE INDICATE FILTERED, PRESERVED OR BOTH <input type="checkbox"/> (F, P, F/P)	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PHONE 319 735-2499		PHONE 319 735-2499		PHONE 319 735-2499		PHONE 319 735-2499		PHONE 319 735-2499	
FAX 319 735-2499		FAX 319 735-2499		FAX 319 735-2499		FAX 319 735-2499		FAX 319 735-2499	
ACCOUNT # 228642		ACCOUNT # 228642		ACCOUNT # 228642		ACCOUNT # 228642		ACCOUNT # 228642	
QUOTATION # 228642		QUOTATION # 228642		QUOTATION # 228642		QUOTATION # 228642		QUOTATION # 228642	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2004-101	
PROJECT # 2004-101		PROJECT # 2004-101		PROJECT # 2					



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 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: 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*:

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 L1032551 were received on 18-JUL-11 10:35.

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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.

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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.

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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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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.



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

[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

		<div>Sample ID Description Sampled Date Sampled Time Client ID</div>	<div>L1044495-1 SOIL 12-AUG-11 12:00 TB8-3,SS4@7.5', BROWN,SILTY CLAY</div>				
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 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: 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*:

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 L1044495 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

C of C # 00000

112849

[illegible]

Notes

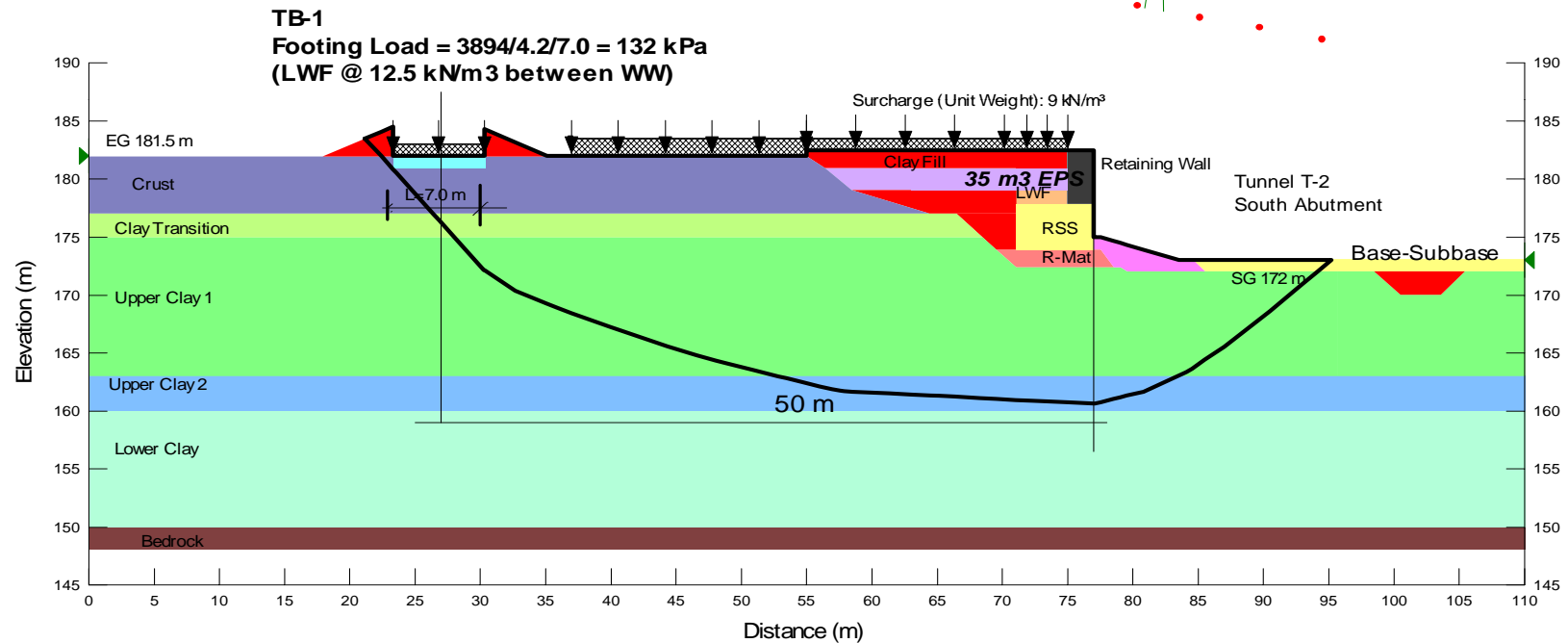
- 1. Quote number must be provided to ensure proper pricing**

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-Sta. 10+731-Transverse Stability.gsz
 Last Solved Date: 20/05/2014
 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: 12.5 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 °



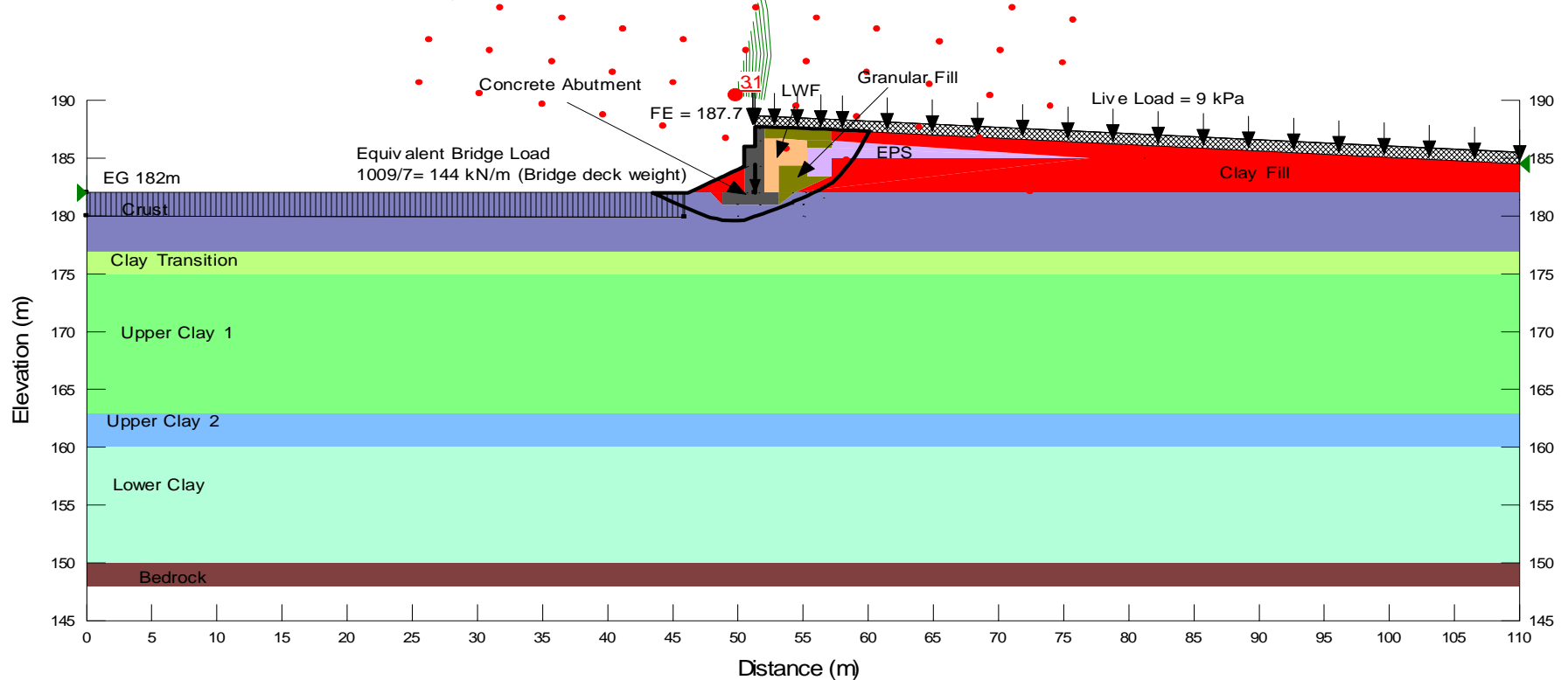
File Name: TB-1 North Abutment-Longitudinal Stability.gsz

Date: 10/06/2014

Name: Short-Term

FOS: 3.1

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: LWF Unit Weight: 12.5 kN/m³ Cohesion: 0 kPa Phi: 35 °
Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °



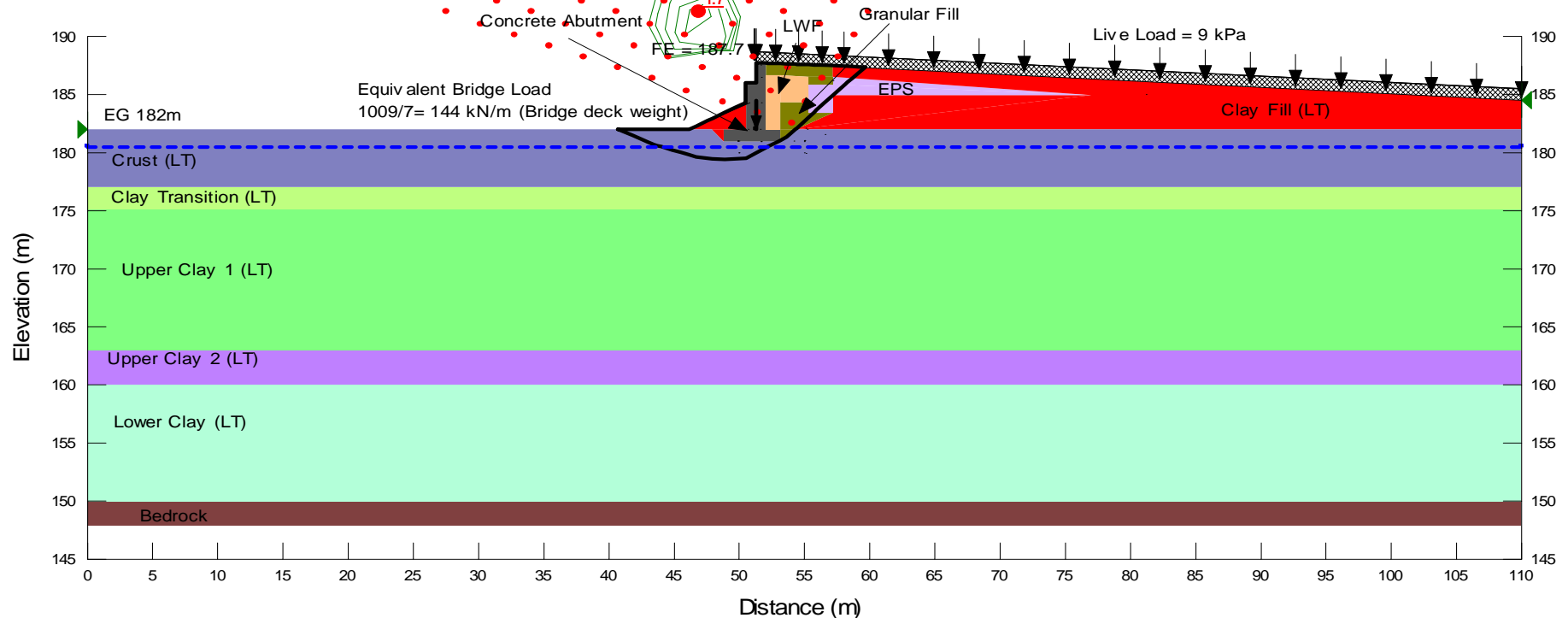
File Name: TB-1 North Abutment-Longitudinal Stability.gsz

Date: 10/06/2014

Name: Long-Term

FOS: 1.7

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: LWF Unit Weight: 12.5 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °



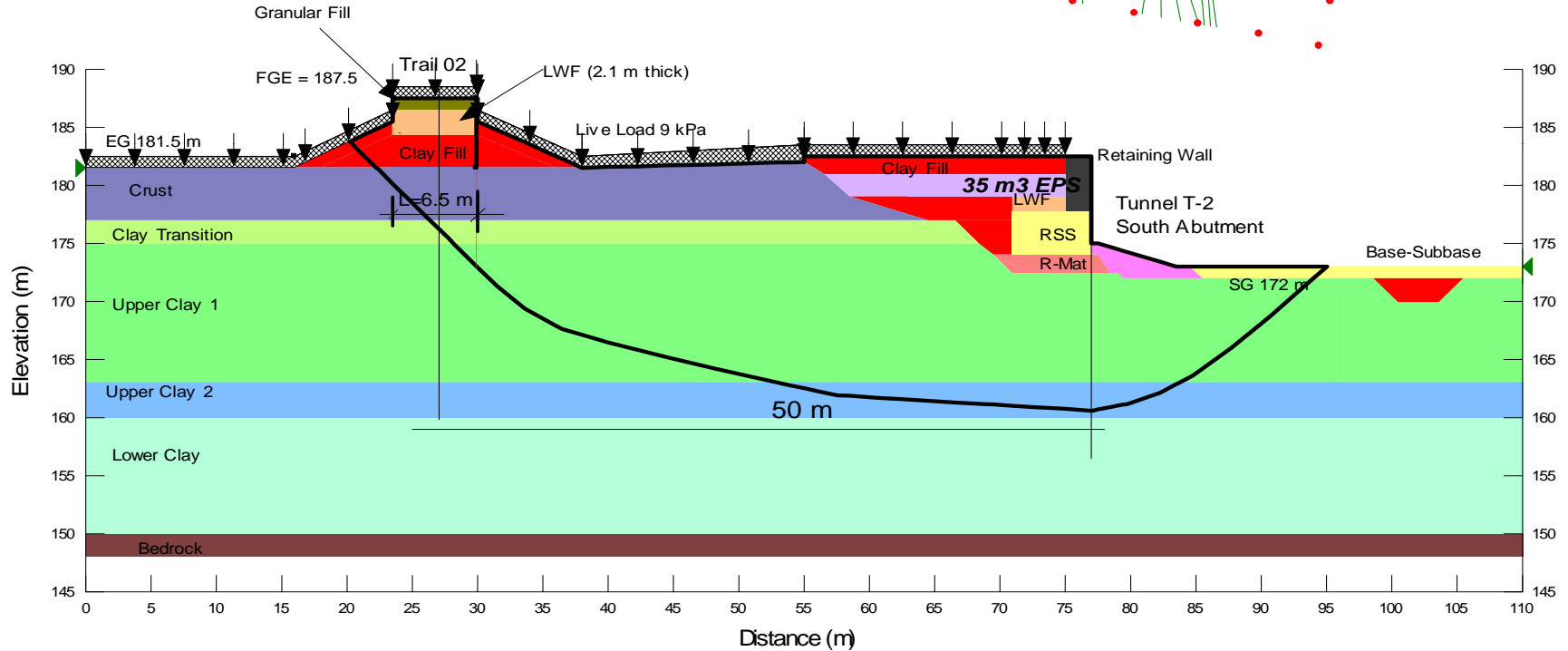
File Name:TB-1 North RSS Wall-Sta. 10+728.gsz

Last Solved Date: 10/06/2014

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: 12.5 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: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °



FOS: 1.7

Name: R-Mat	Unit Weight: 21 kN/m ³	Cohesion: 50 kPa	Phi: 33 °
Name: RSS	Unit Weight: 21 kN/m ³	Cohesion: 200 kPa	Phi: 35 °
Name: EPS	Unit Weight: 0.5 kN/m ³	Cohesion: 10 kPa	Phi: 0 °
Name: Retaining Wall	Unit Weight: 0.1 kN/m ³	Cohesion: 500 kPa	Phi: 0 °
Name: Crust (LT)	Unit Weight: 22 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Transition (LT)	Unit Weight: 22 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Upper Clay 1 (LT)	Unit Weight: 20.5 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Lower Clay (LT)	Unit Weight: 20.5 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Fill (LT)	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: Bedrock			
Name: Upper Clay 2 (LT)	Unit Weight: 20.5 kN/m ³	Cohesion: 0 kPa	Phi: 30 °
Name: LWF	Unit Weight: 12.5 kN/m ³	Cohesion: 0 kPa	Phi: 35 °
Name: Pavement	Unit Weight: 22 kN/m ³	Cohesion: 0 kPa	Phi: 35 °
Name: Granular Fill	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 32 °

FIGURE
NO.: D.5

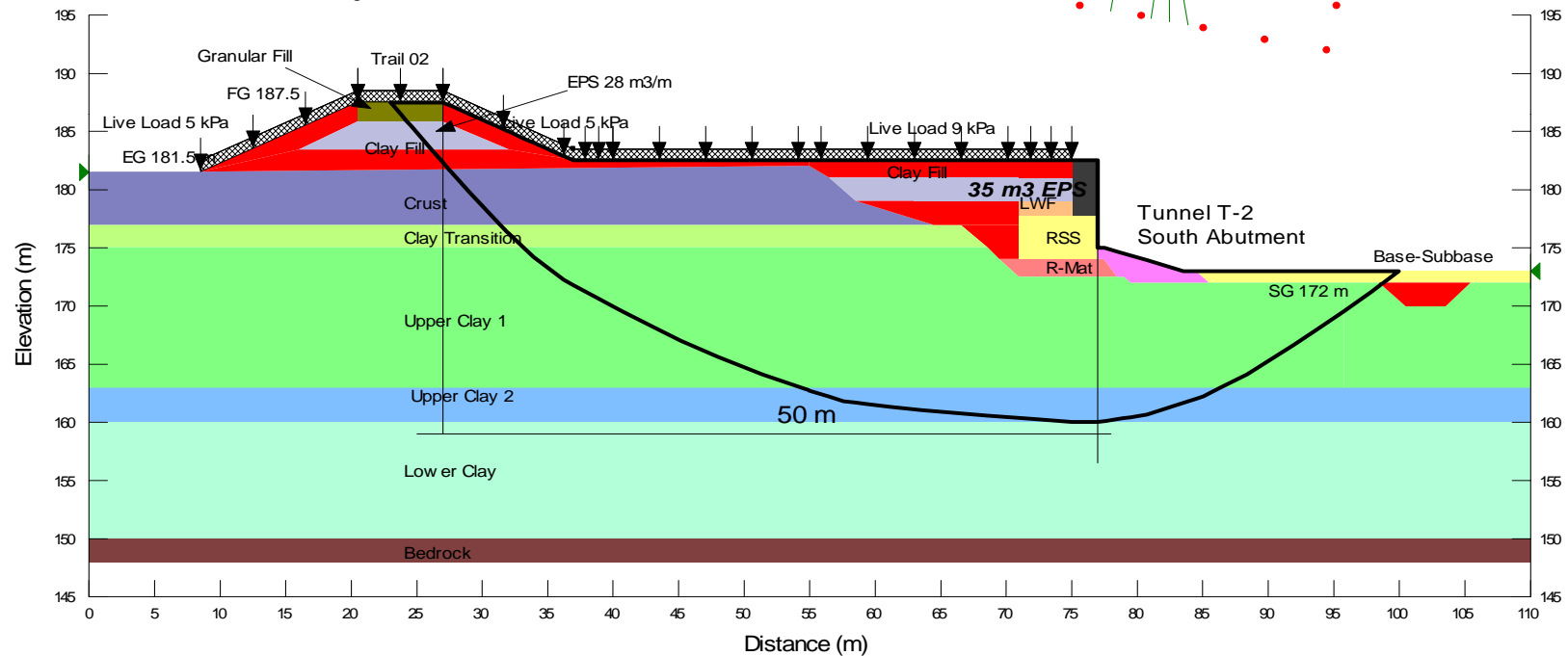
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Last Solved Date: 10/06/2014

Current Analysis: Short-term

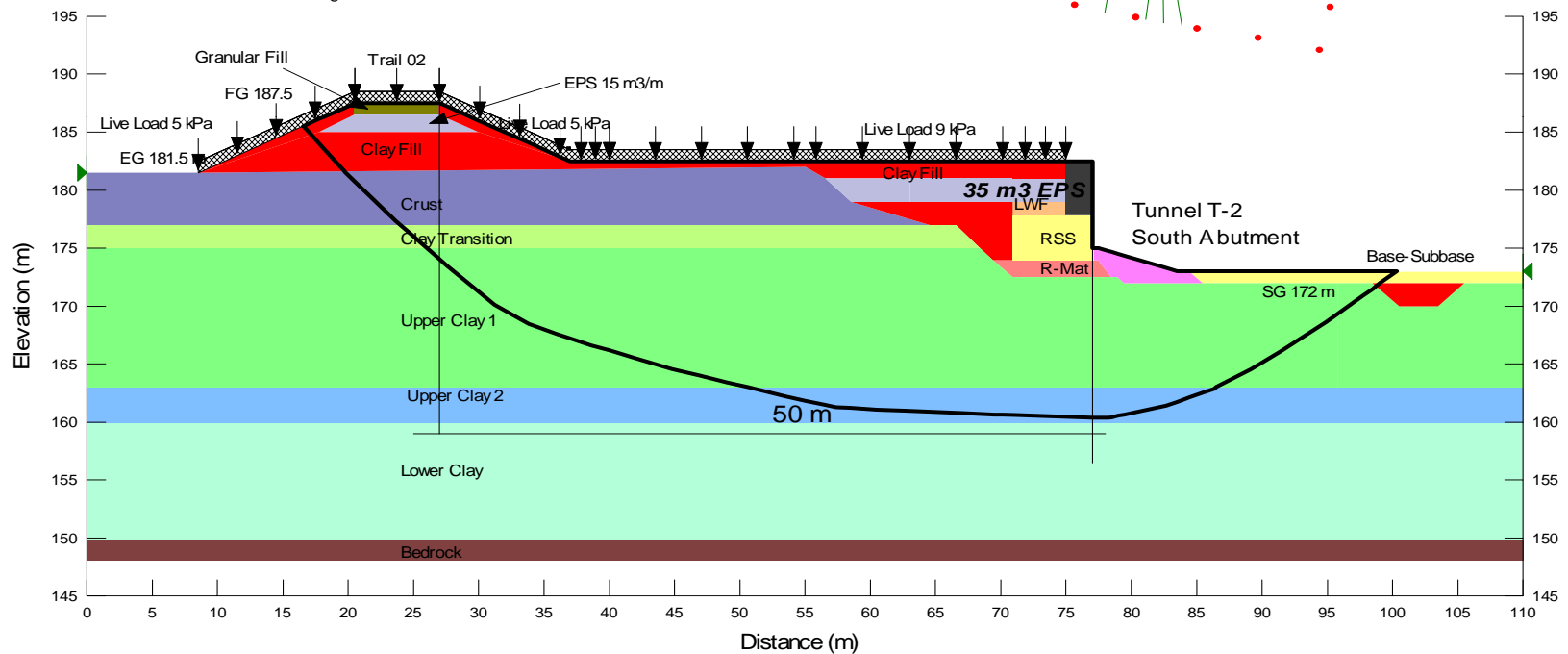
FOS: 1.3

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: 12.5 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °



File Name: TB-1 North Embankment-Sta. 10+723.gsz
Last Solved Date: 27/05/2014
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: 12.5 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °



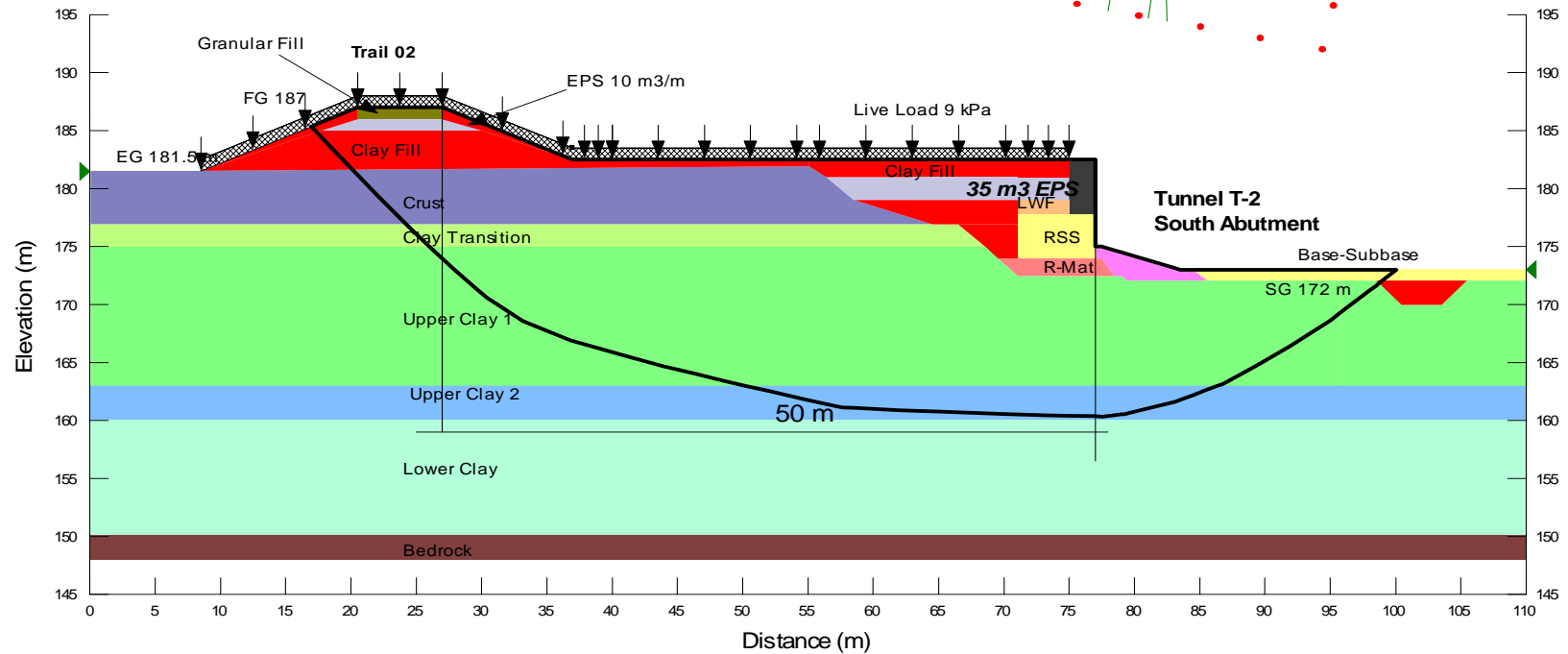
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Last Solved Date: 27/05/2014

Current Analysis: Short-term

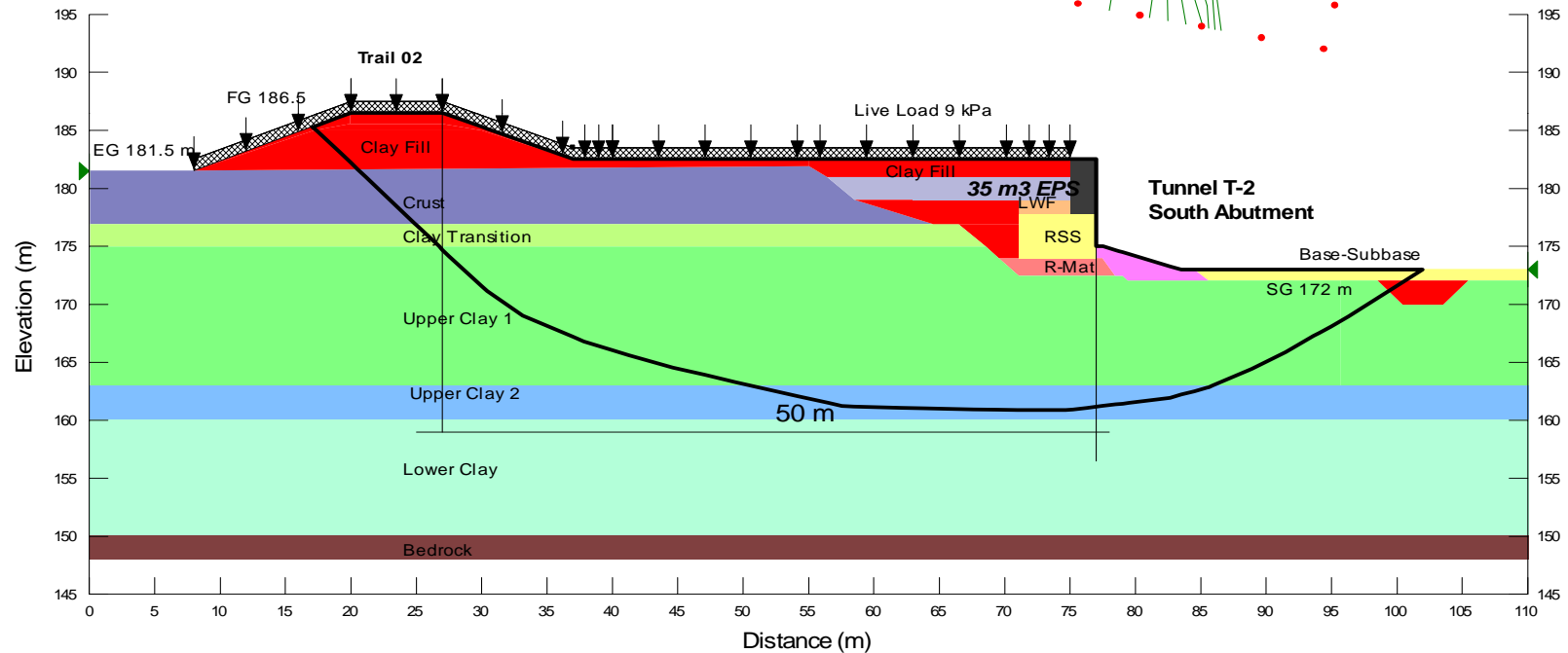
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Name: Clay Transition Unit Weight: 22 kN/m³ C-Top of Layer: 75 kPa C-Rate of Change: -5 kPa/m
Name: Upper Clay 1 Unit Weight: 20.5 kN/m³ C-Top of Layer: 65 kPa C-Rate of Change: -1.83 kPa/m
Name: Lower Clay Unit Weight: 20.5 kN/m³ Cohesion: 75 kPa
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: 12.5 kN/m³ Cohesion: 0 kPa Phi: 35 °
Name: Pavement Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 35 °
Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 33 °



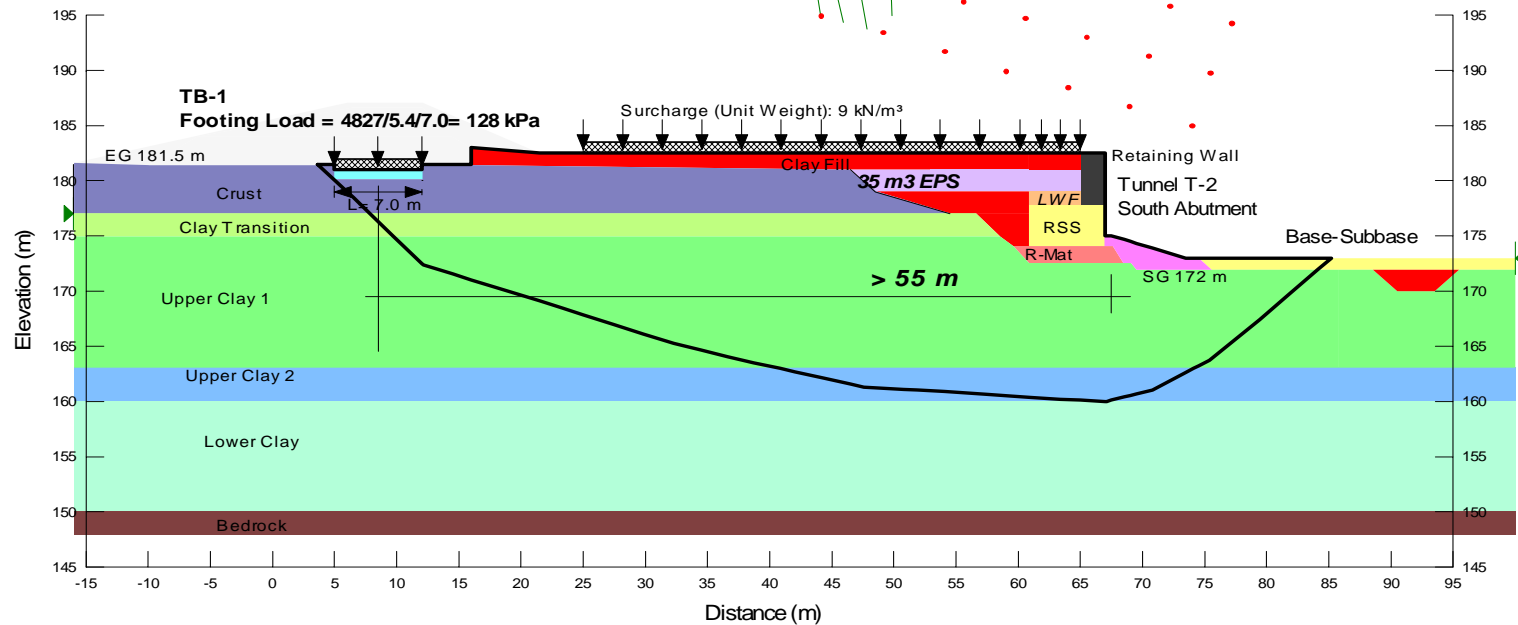
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Last Solved Date: 22/05/2014
Current Analysis: Short-term
FOS: 1.3

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: 12.5 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 South Abutment- Sta. 10+770-Transverse Stability.gsz
 Last Solved Date: 20/05/2014
 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 °



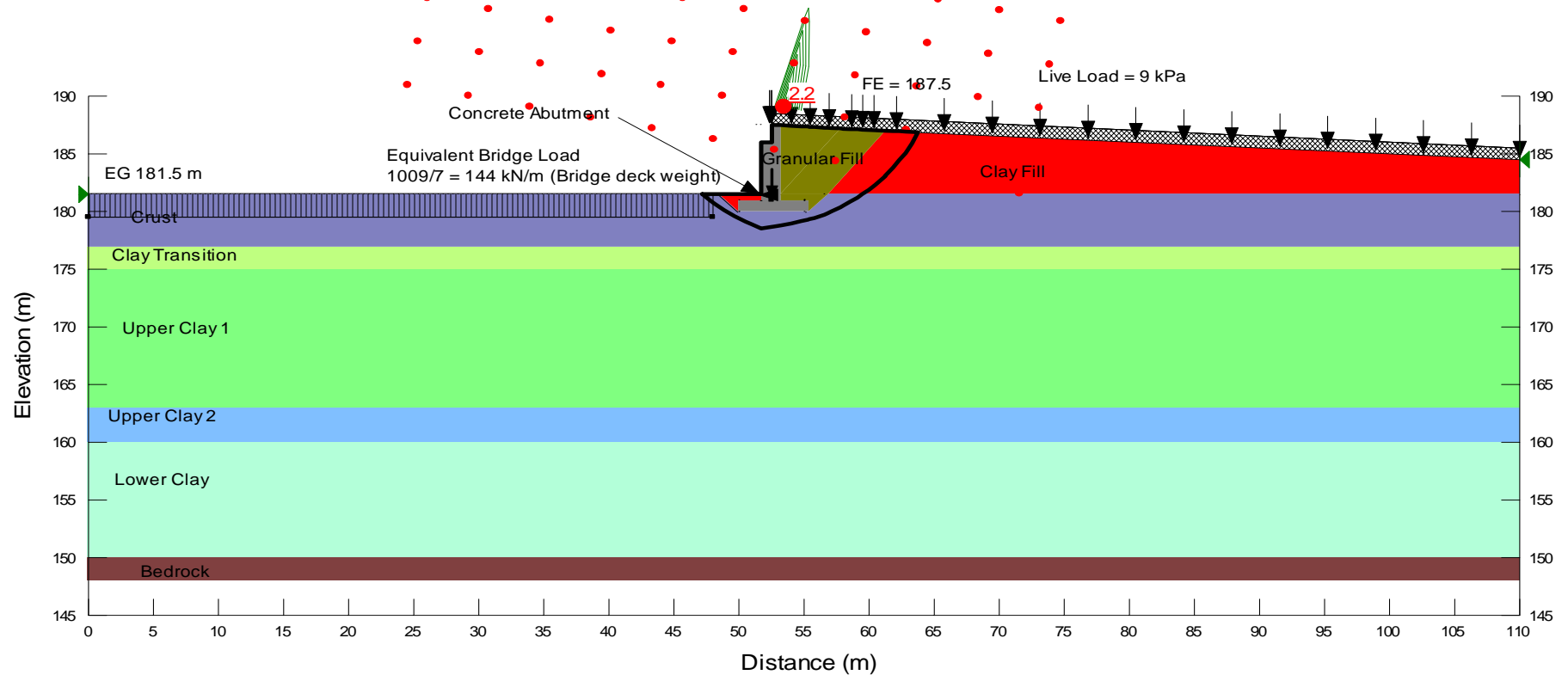
TB-1 South Abutment-Longitudinal Stability.gsz

Name: Undrained Conditions

Date: 20/05/2014

FOS: 2.2

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: Clay Fill (LT) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 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: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °



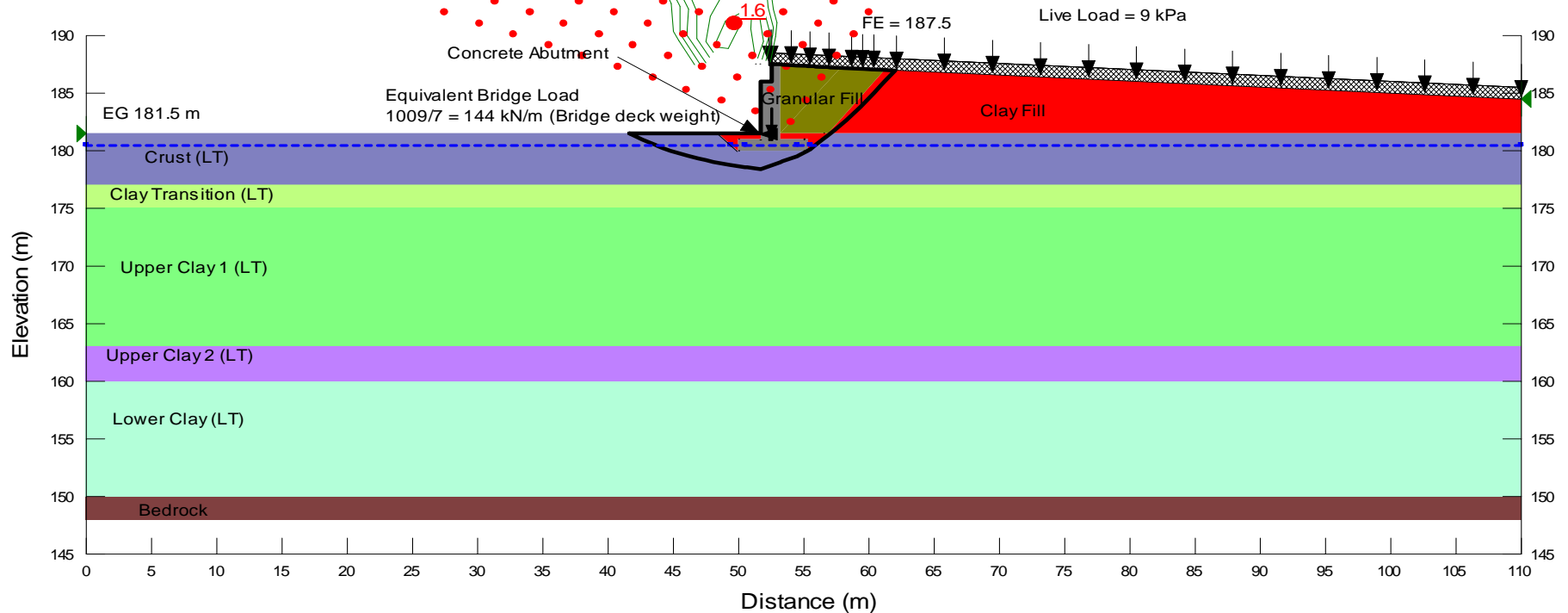
TB-1 South Abutment-Longitudinal Stability.gsz

Name: Drained Conditions

Date: 20/05/2014

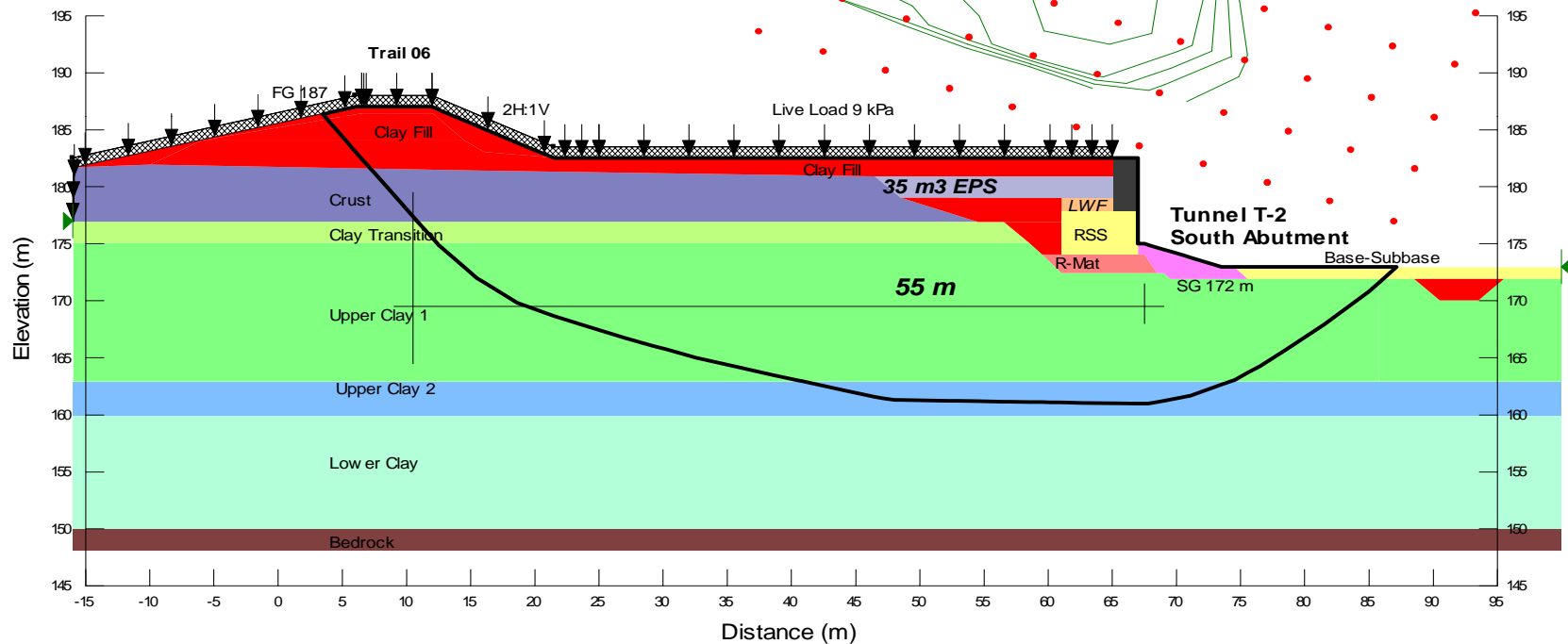
FOS: 1.6

Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
 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: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °

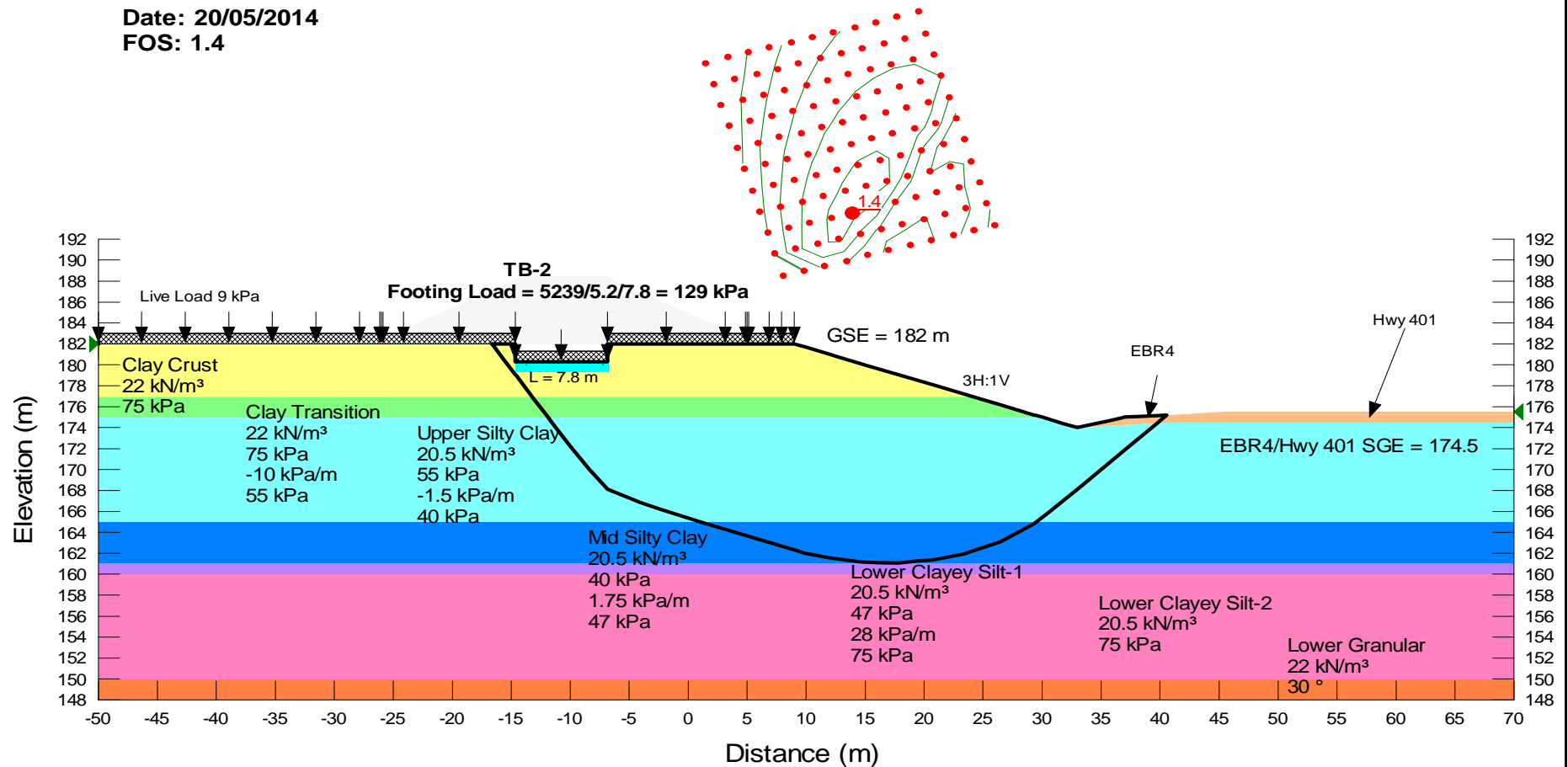


File Name: TB-1 South Embankment-Sta. 10+770.gsz
Last Solved Date: 22/05/2014
Current Analysis: Short-term
FOS: 1.3

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: 12.5 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-2 West -Sta.10+534-Transverse Stability.gsz
 Name: Short-term
 Date: 20/05/2014
 FOS: 1.4

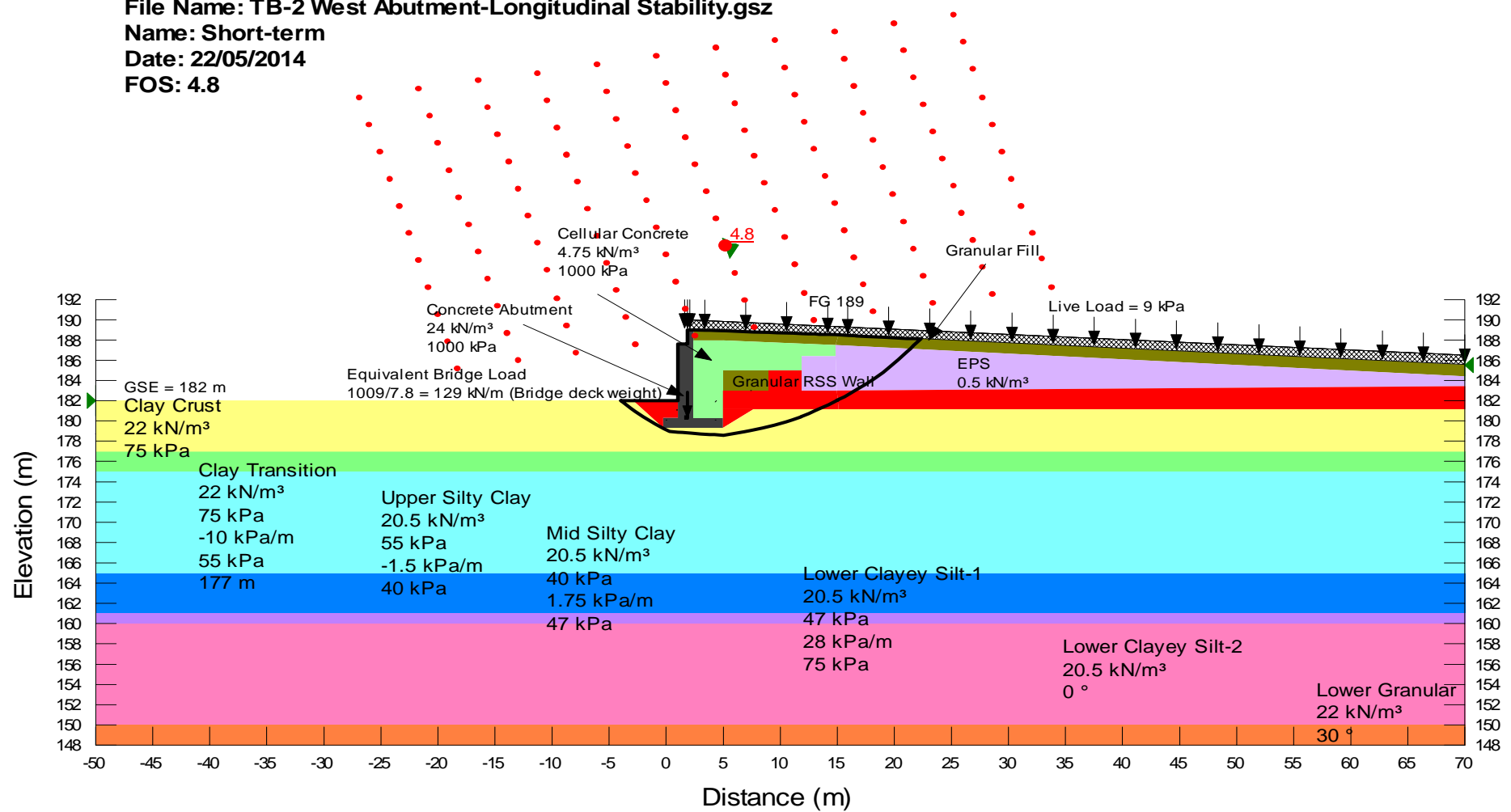


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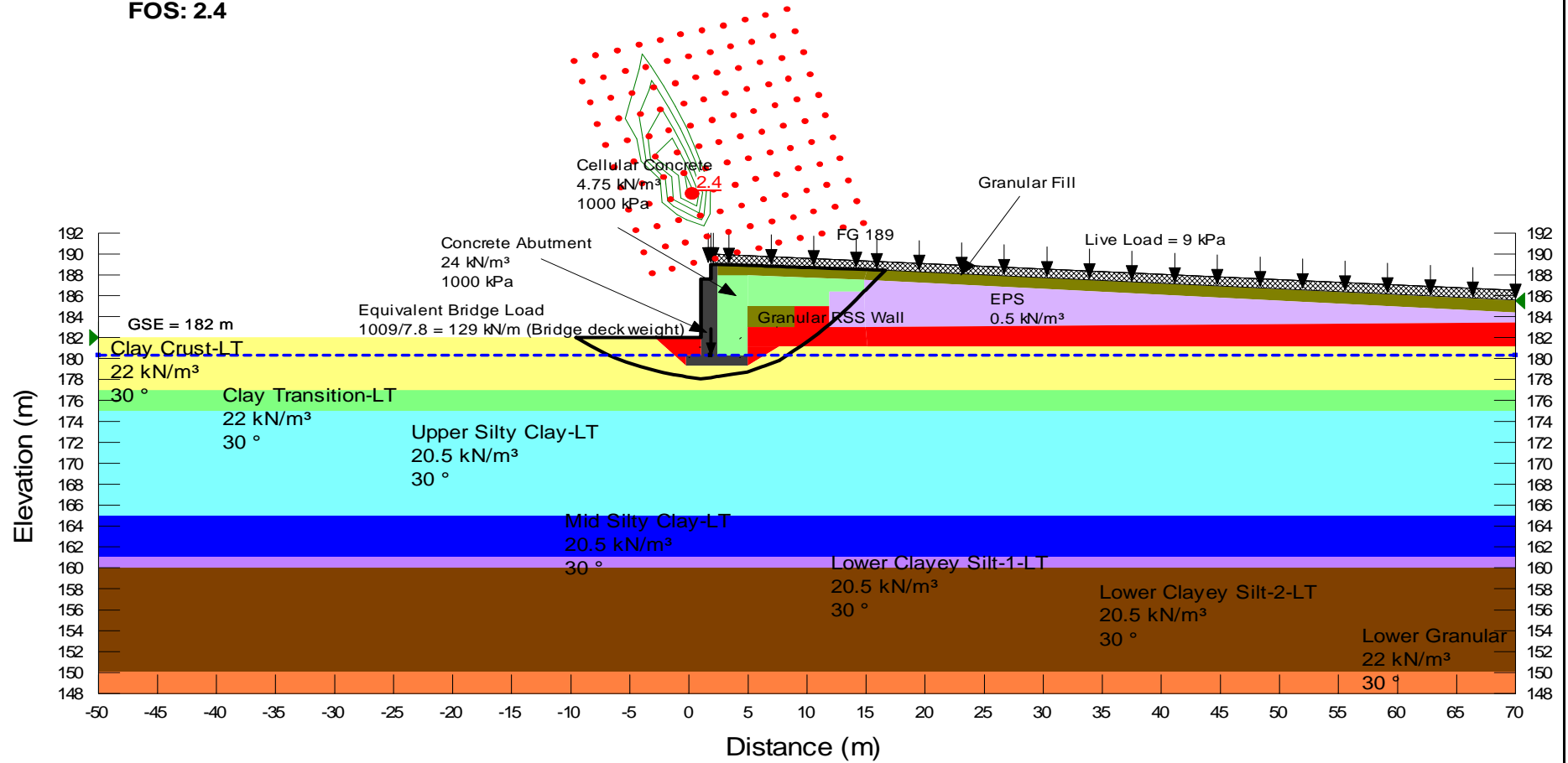
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Date: 22/05/2014

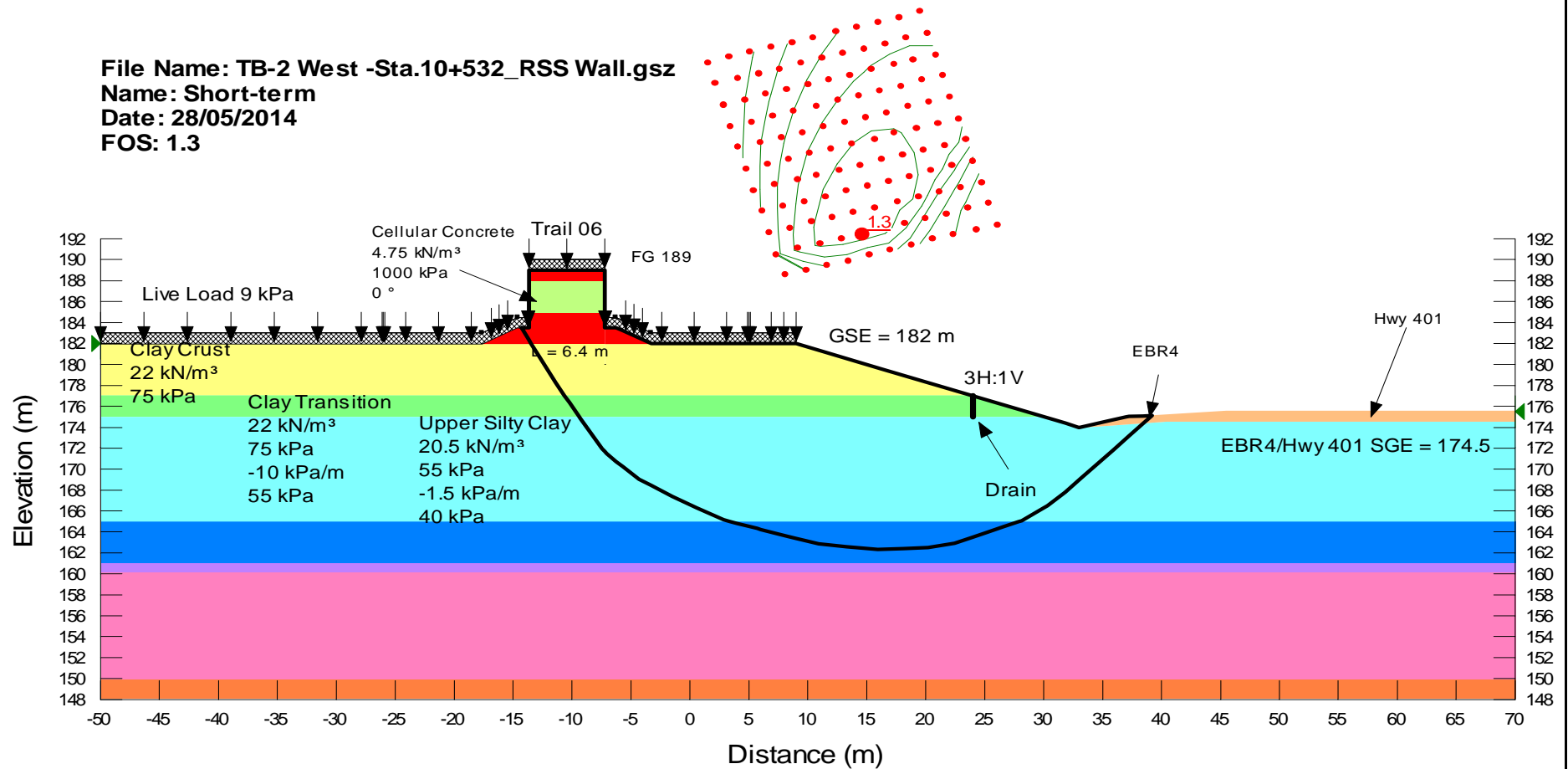
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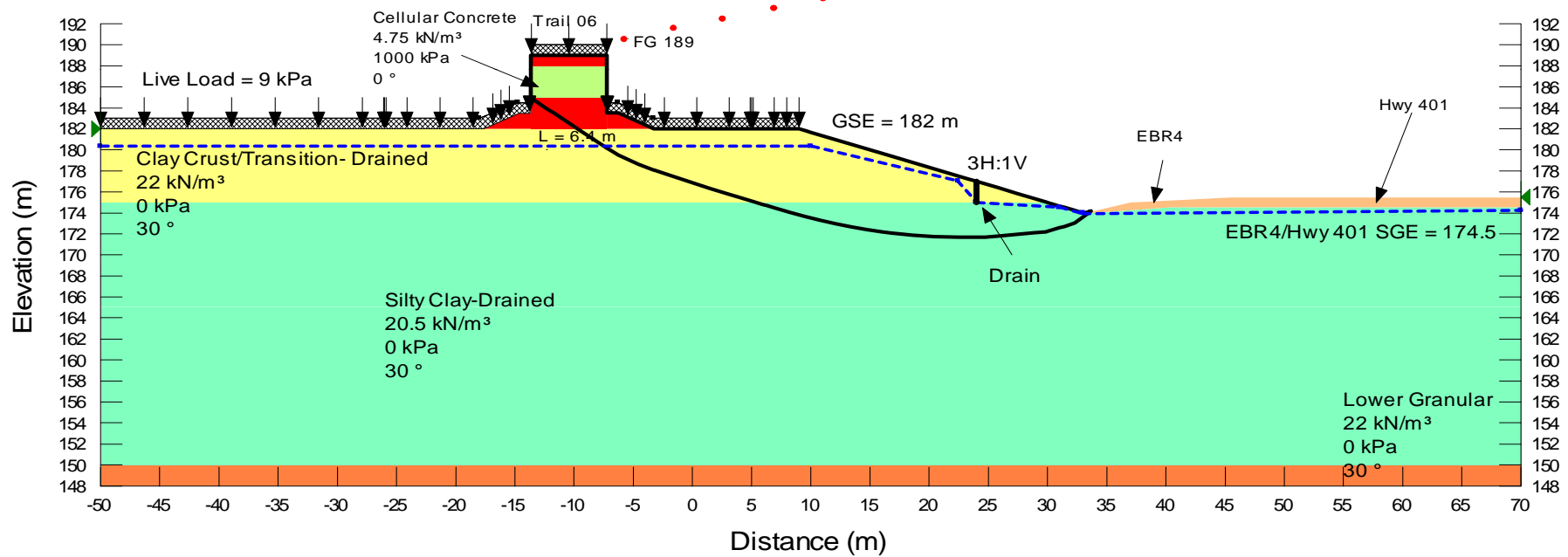
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 Date: 22/05/2014
 FOS: 2.4



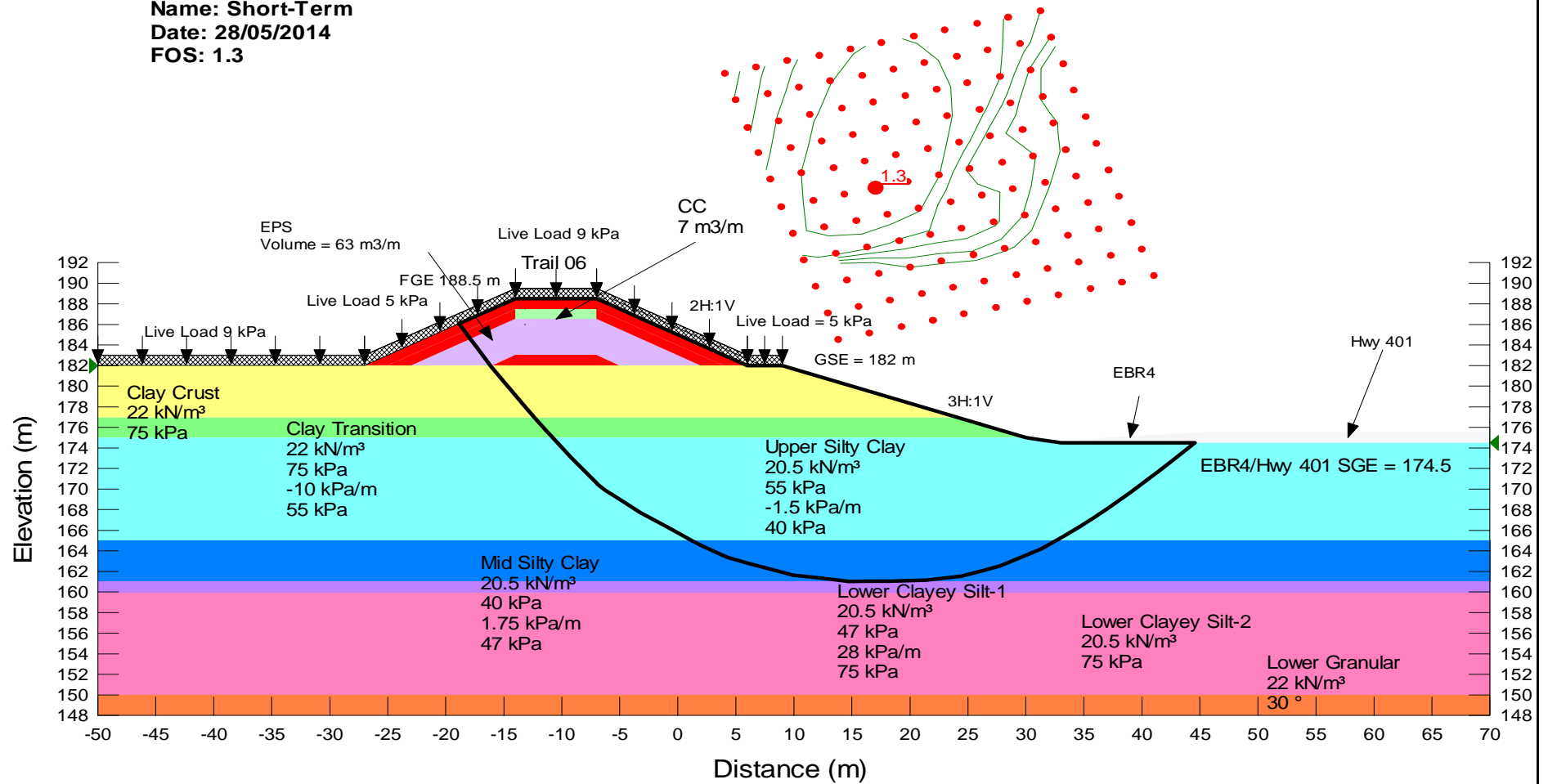
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 Date: 28/05/2014
 FOS: 1.3



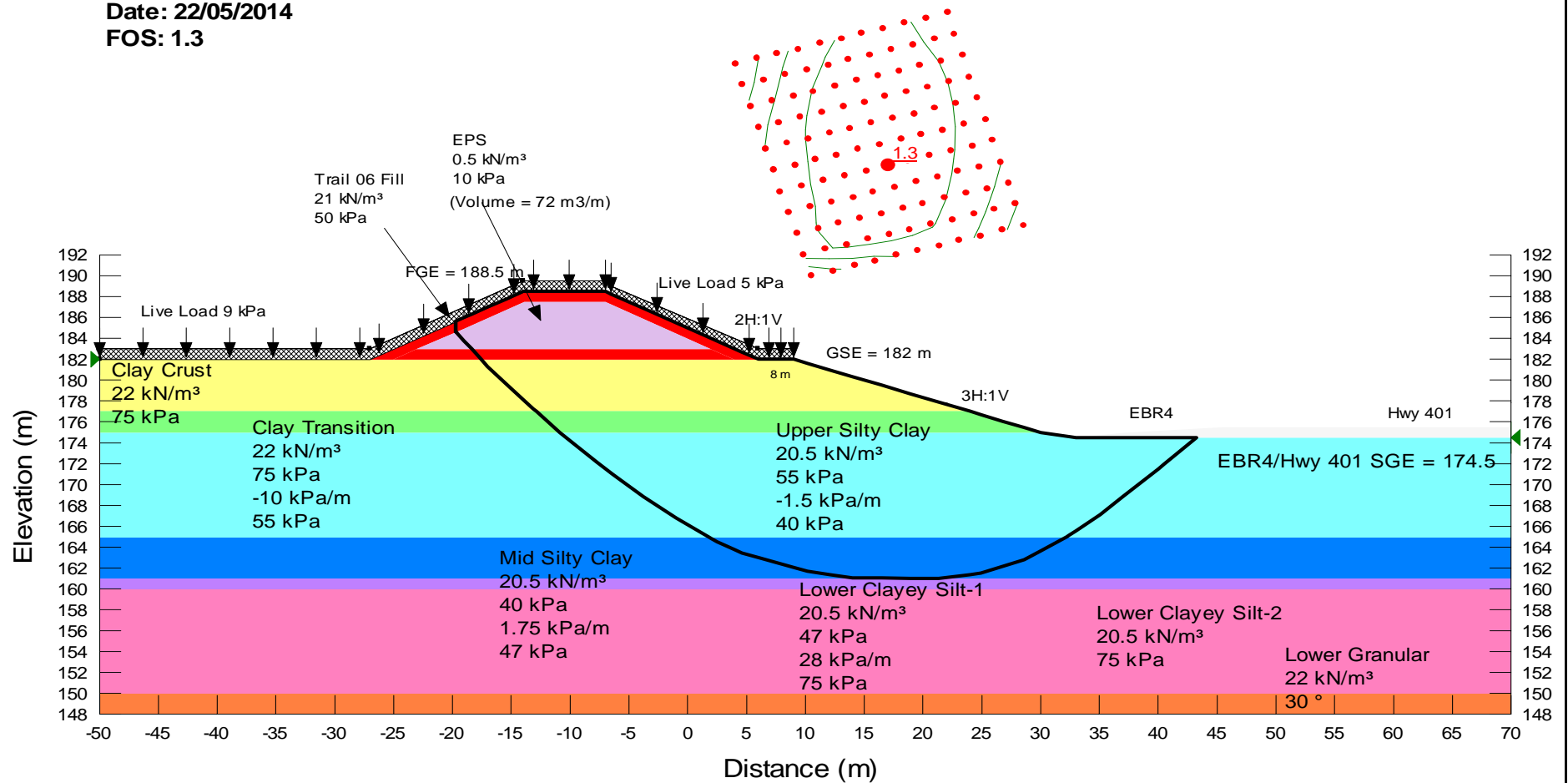
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 Date: 28/05/2014
 FOS: 1.6



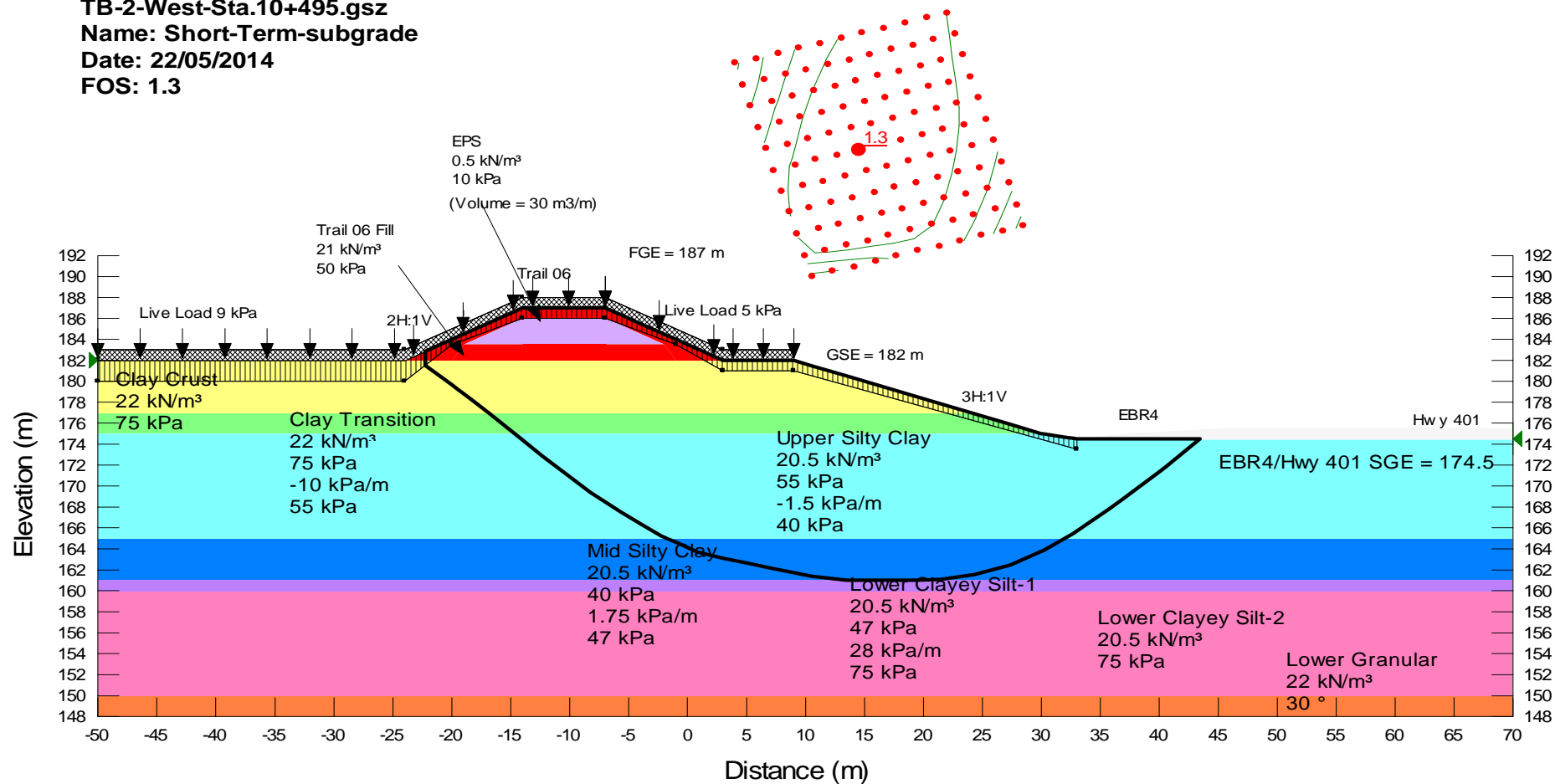
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 Date: 28/05/2014
 FOS: 1.3



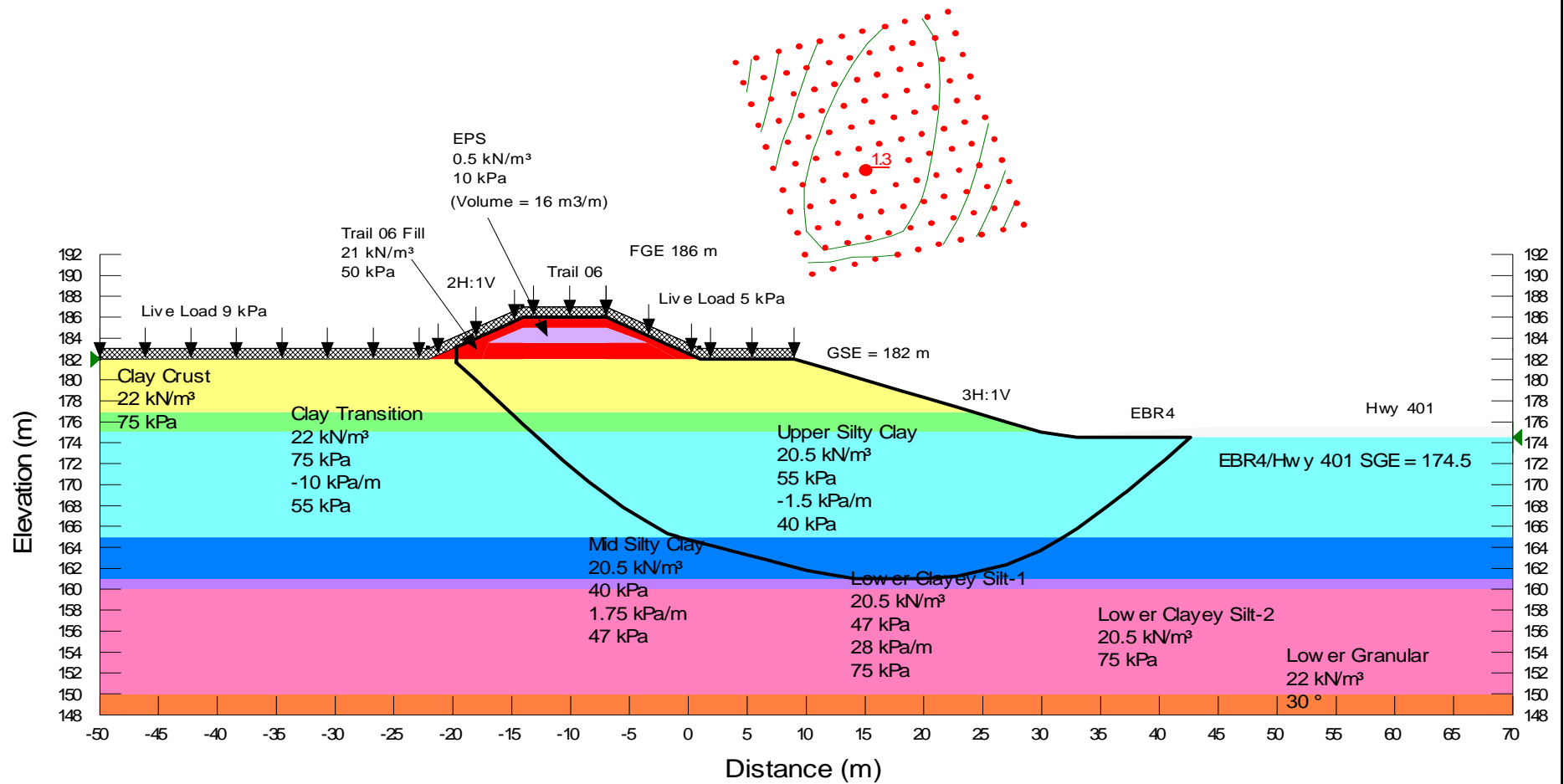
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 Date: 22/05/2014
 FOS: 1.3



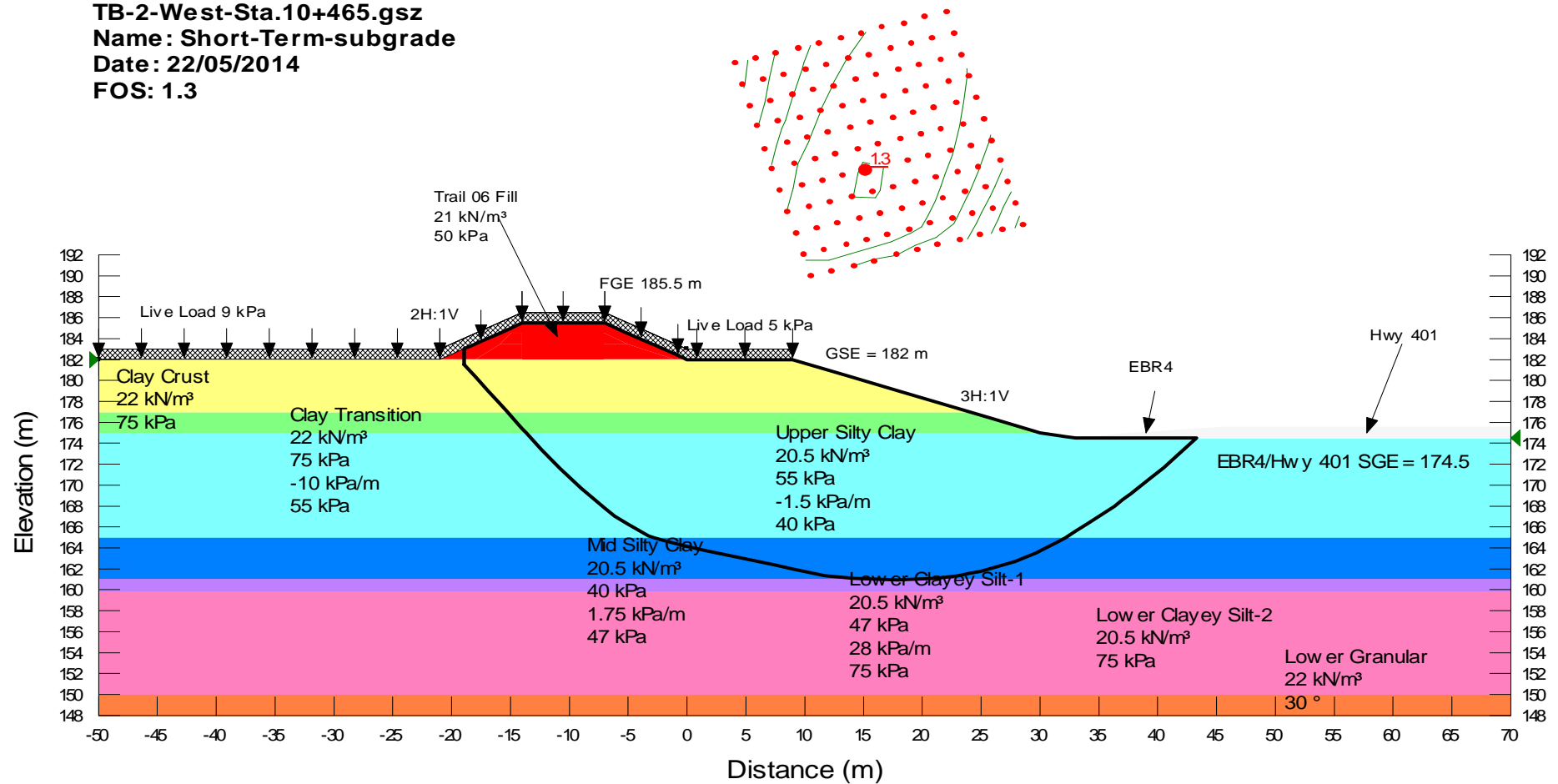
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Name: Short-Term-subgrade
Date: 22/05/2014
FOS: 1.3



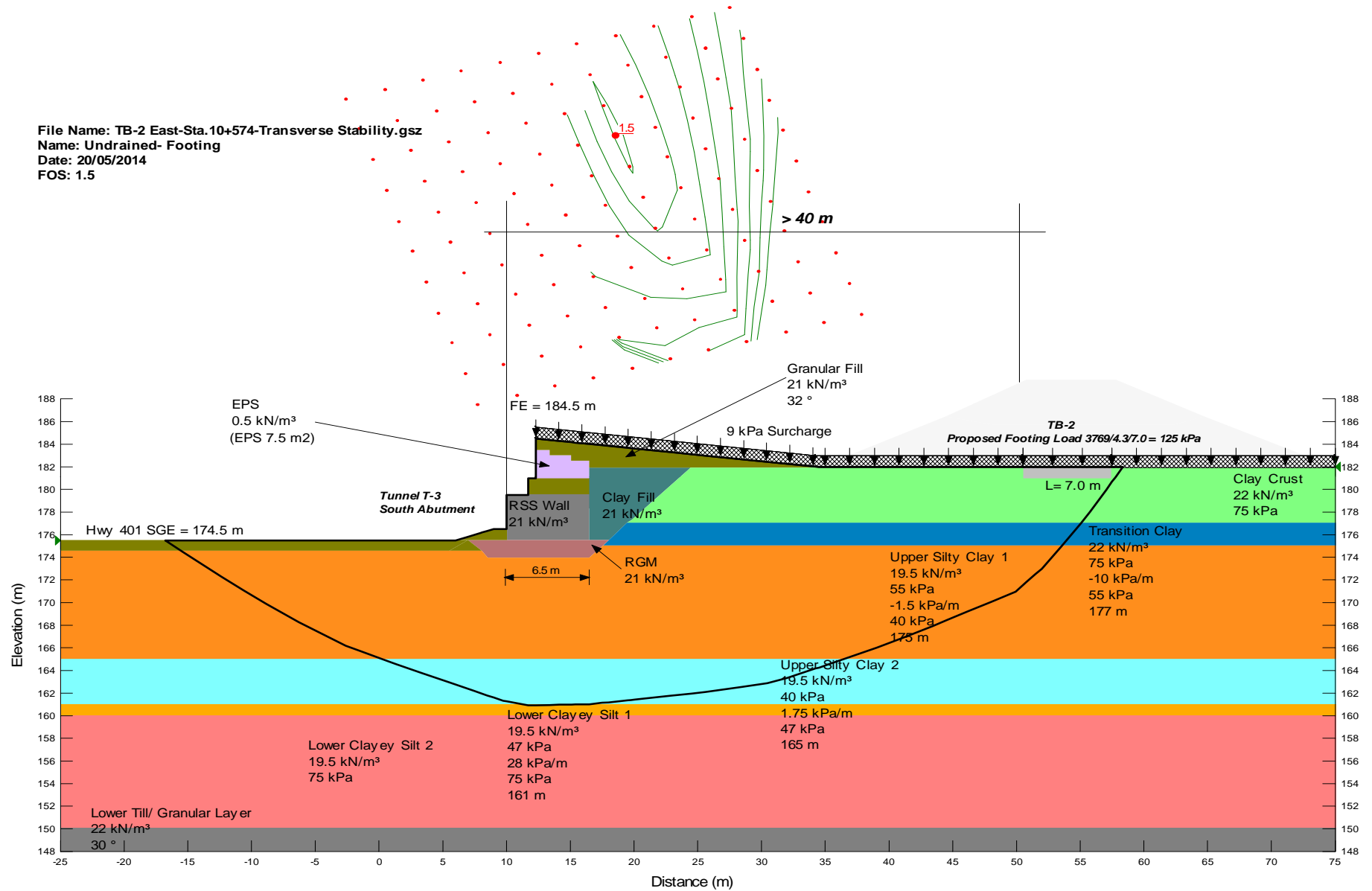
TB-2-West-Sta.10+475.gsz
Name: Short-Term-subgrade
Date: 22/05/2014
FOS: 1.3



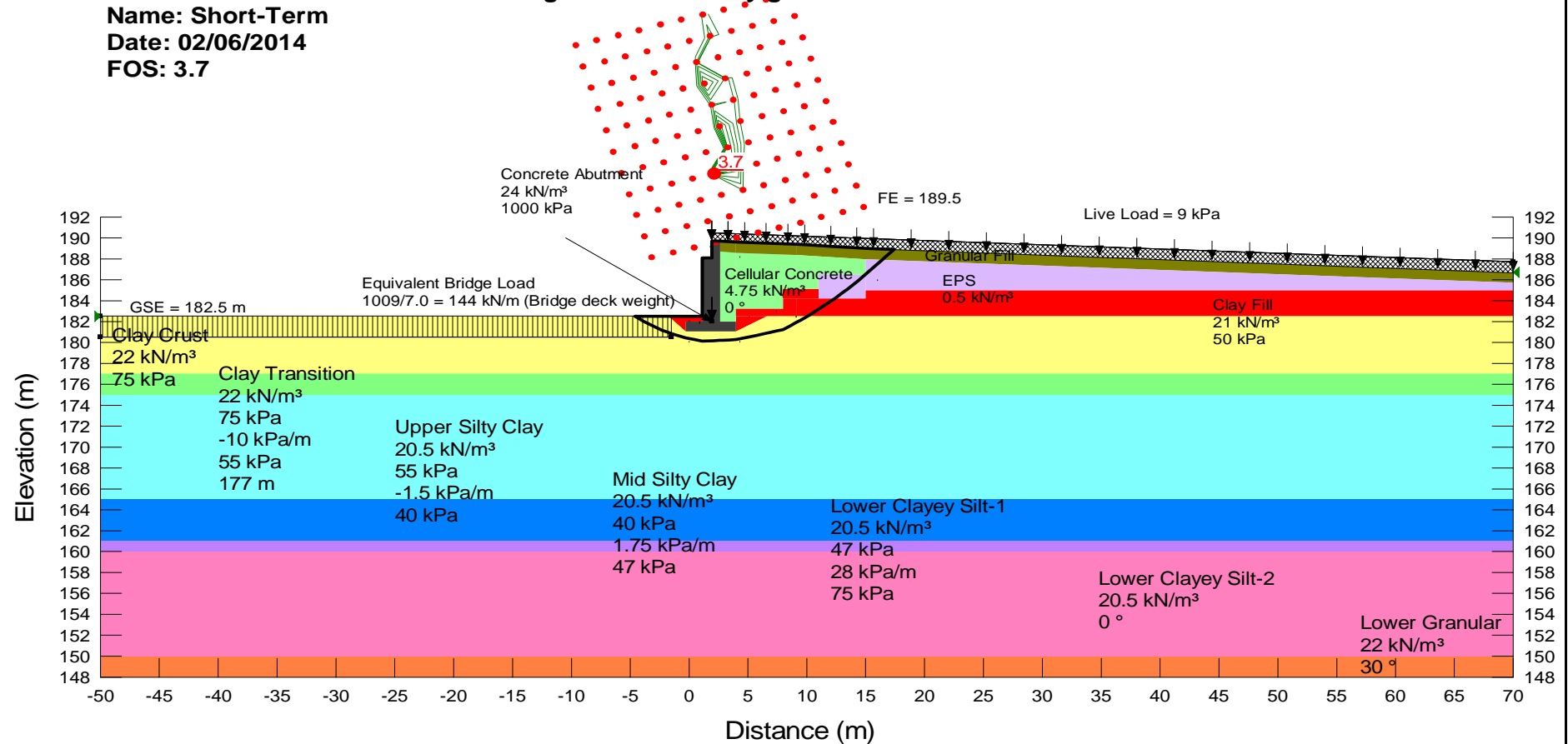
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Name: Short-Term-subgrade
Date: 22/05/2014
FOS: 1.3



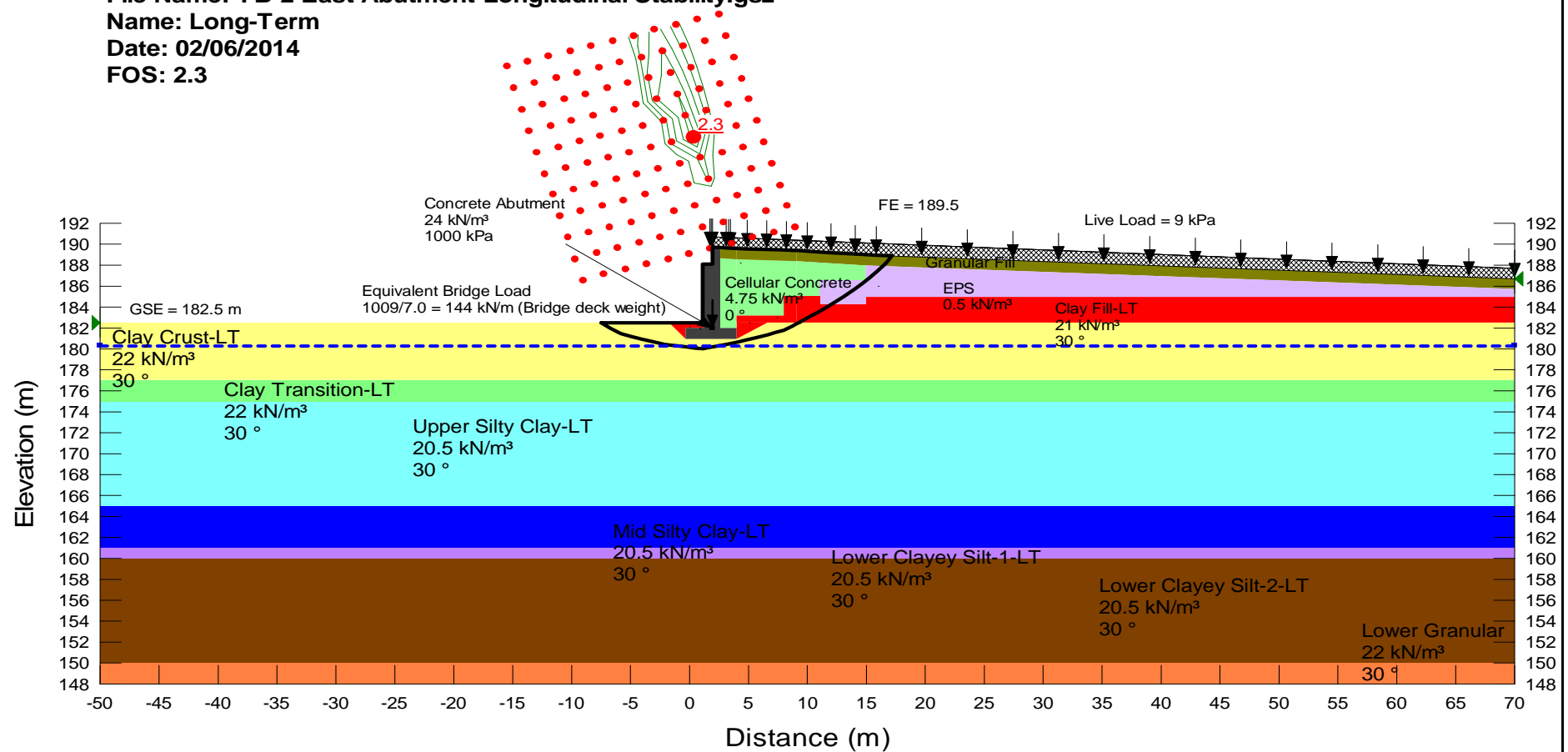
File Name: TB-2 East-Sta.10+574-Transverse Stability.gsz
 Name: Undrained- Footing
 Date: 20/05/2014
 FOS: 1.5



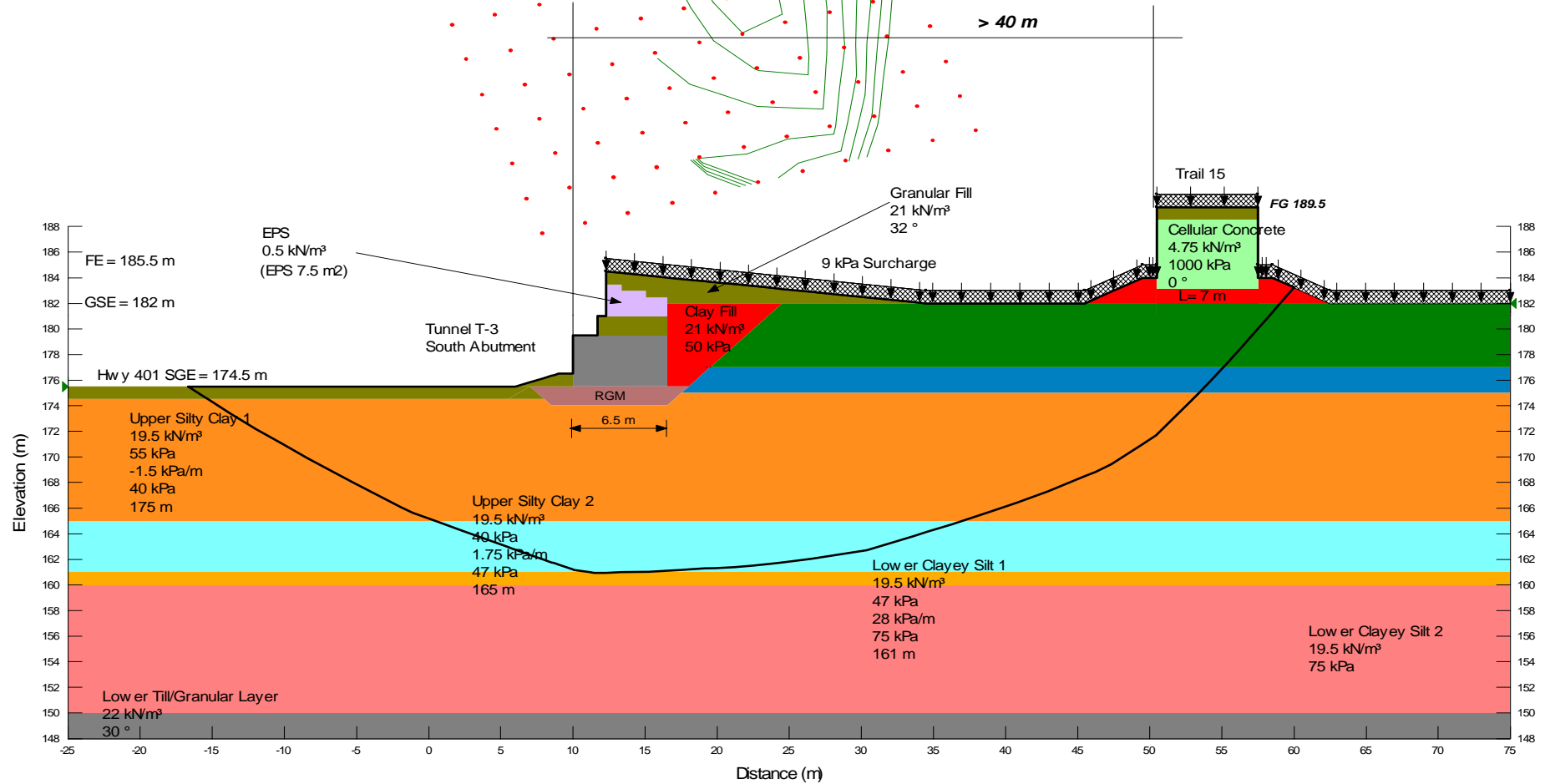
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 Name: Short-Term
 Date: 02/06/2014
 FOS: 3.7



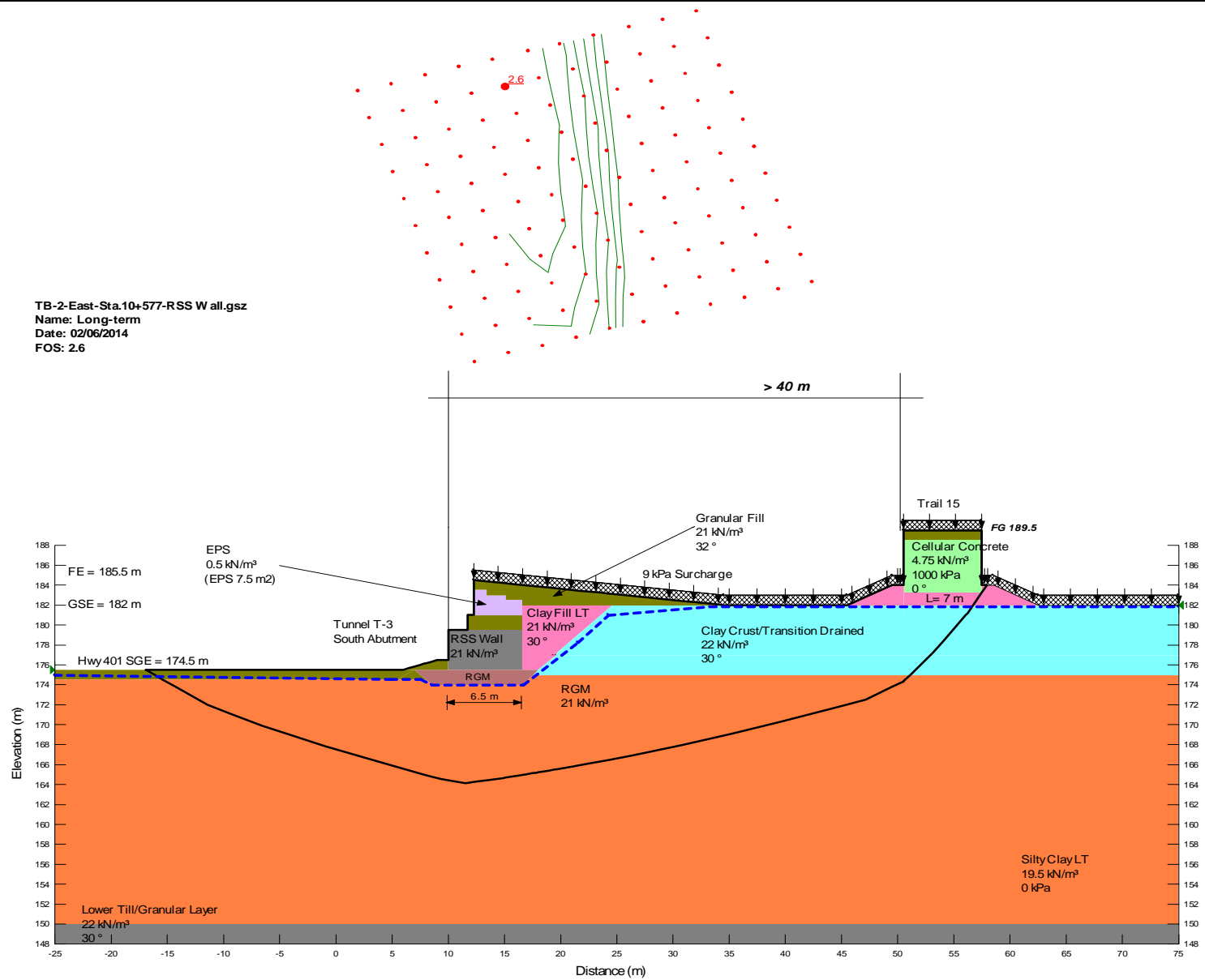
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 Date: 02/06/2014
 FOS: 2.3



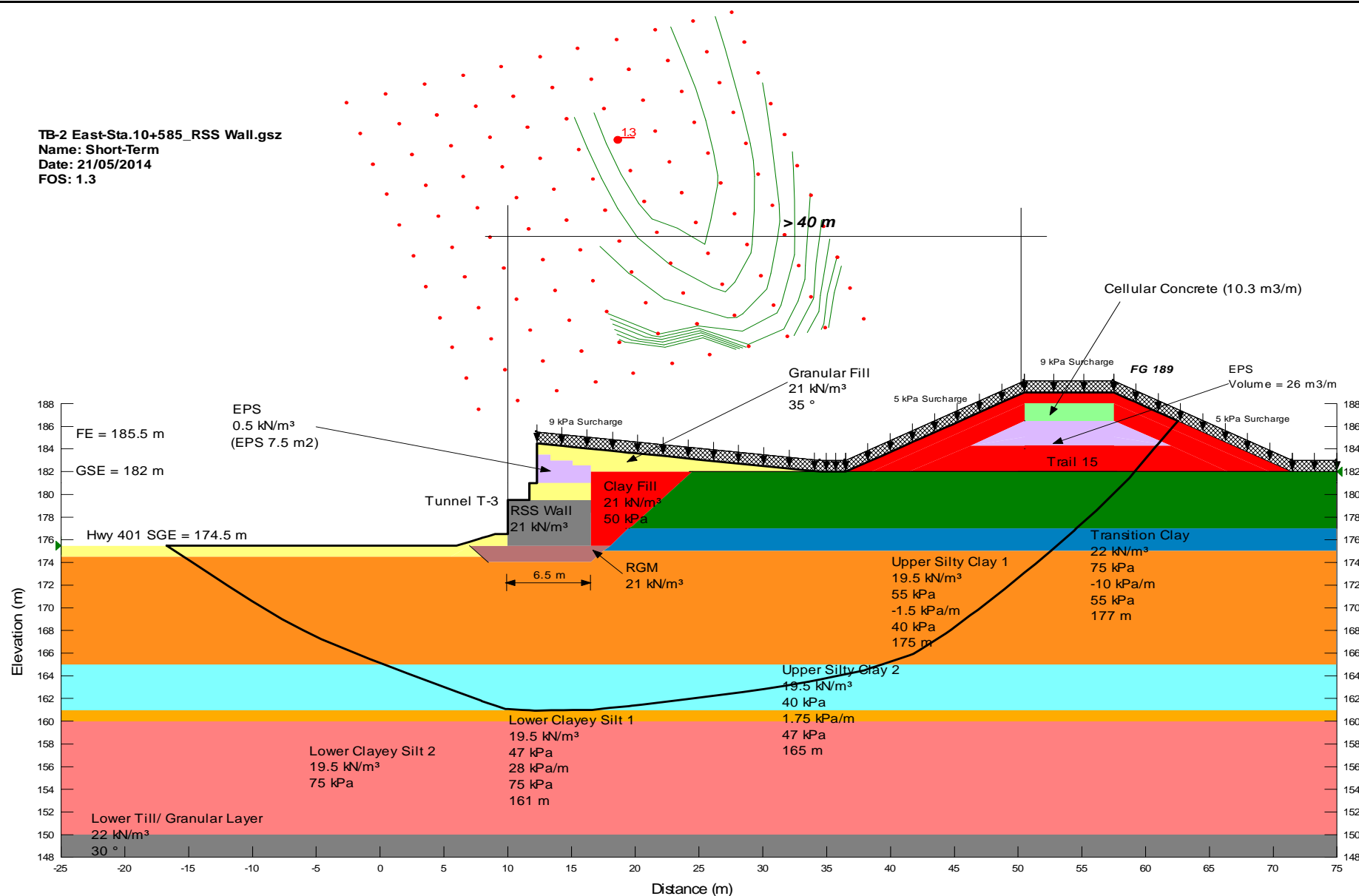
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 Name: Short-term
 Date: 02/06/2014
 FOS: 1.5



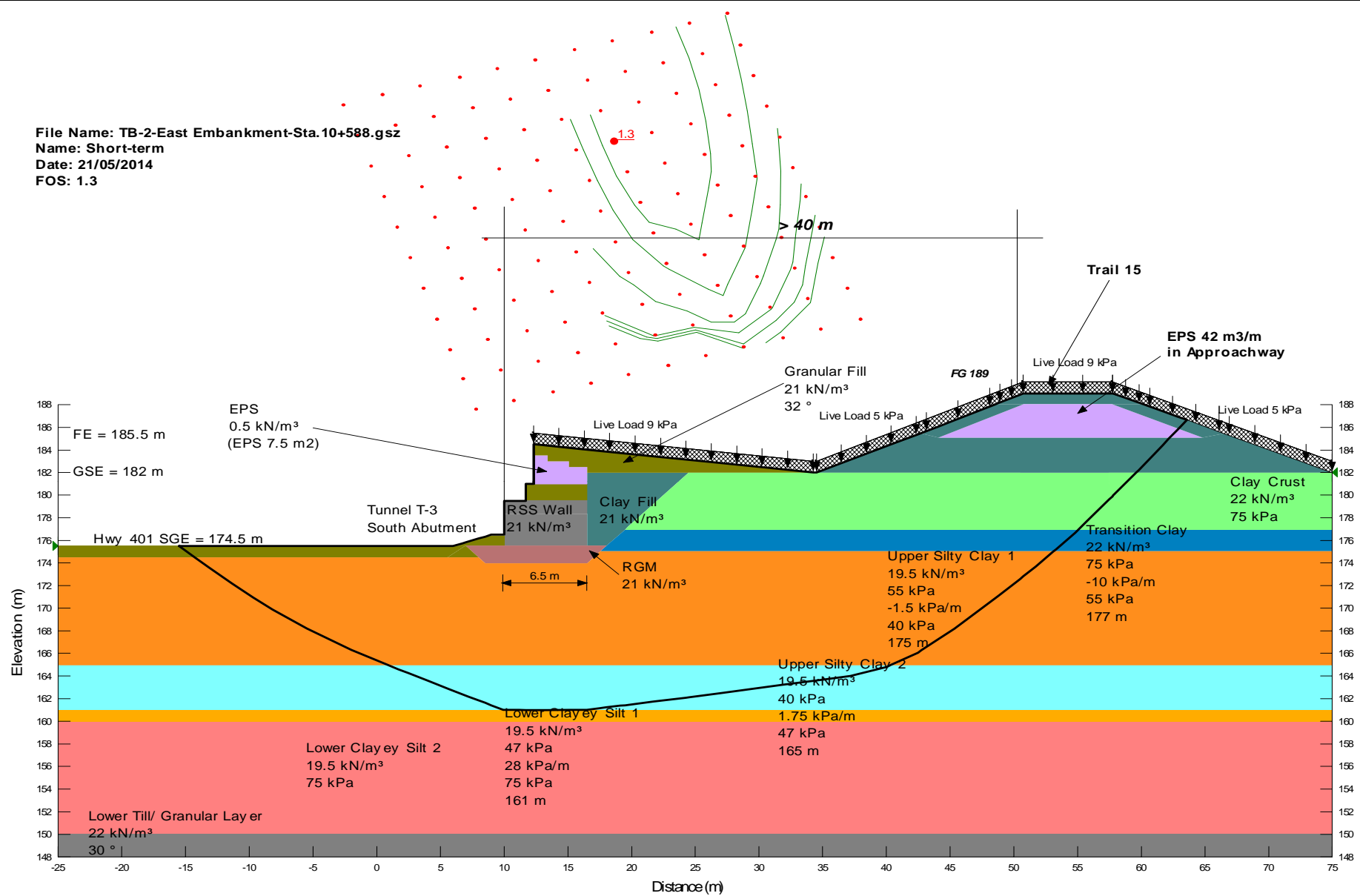
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 FOS: 2.6



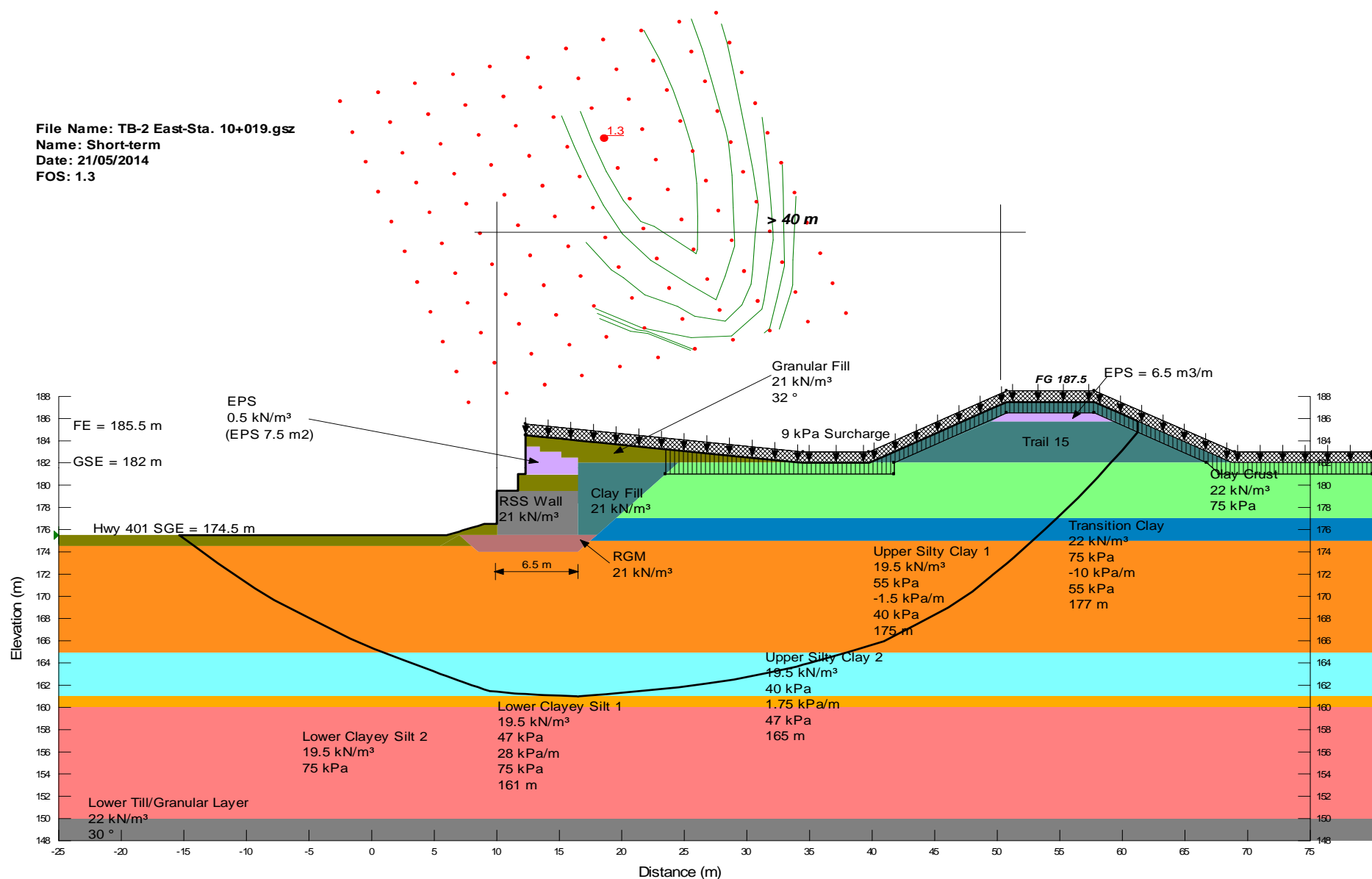
TB-2 East-Sta.10+585_RSS Wall.gsz
 Name: Short-Term
 Date: 21/05/2014
 FOS: 1.3



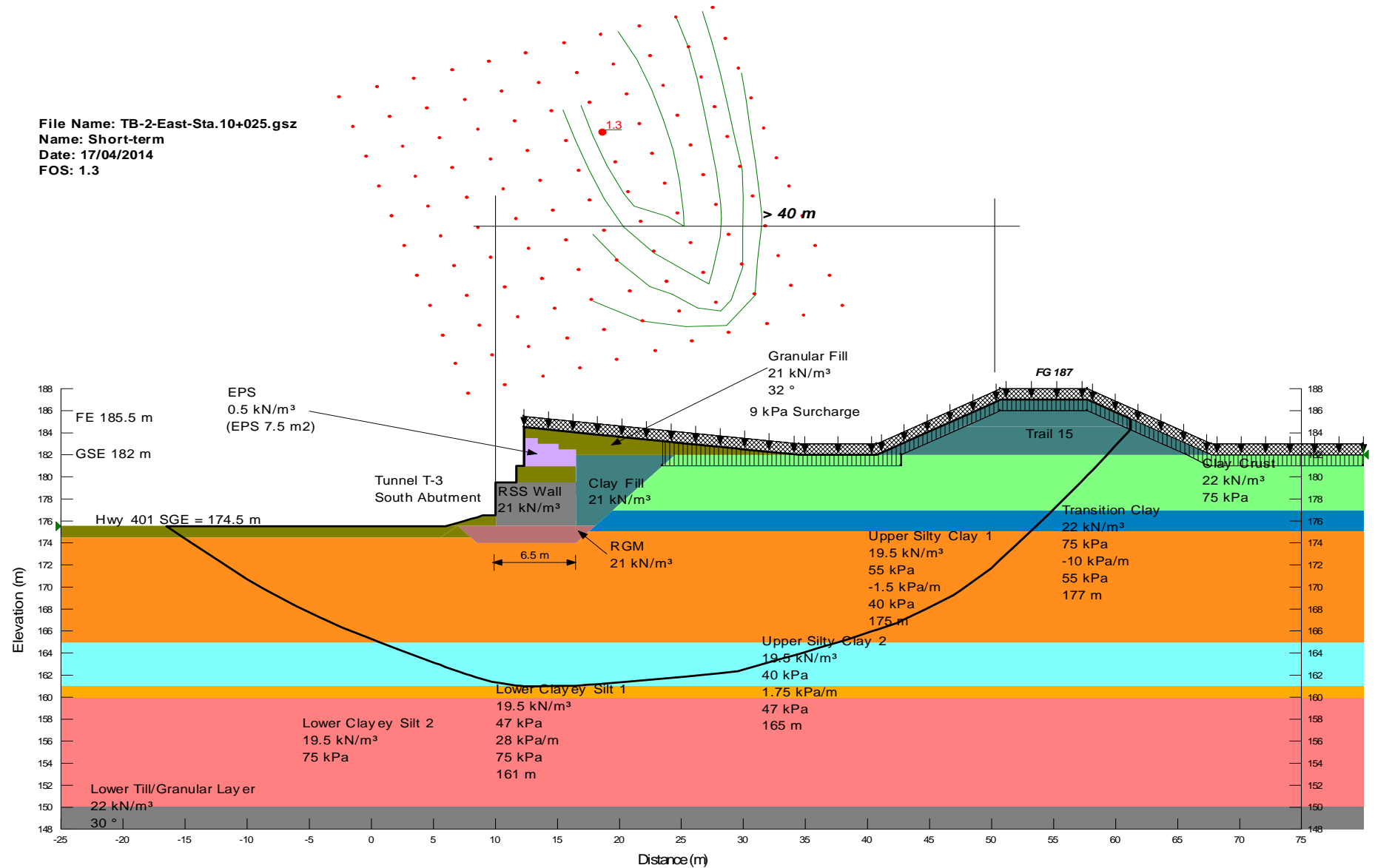
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 Date: 21/05/2014
 FOS: 1.3



File Name: TB-2 East-Sta. 10+019.gsz
 Name: Short-term
 Date: 21/05/2014
 FOS: 1.3



File Name: TB-2-East-Sta.10+025.gsz
 Name: Short-term
 Date: 17/04/2014
 FOS: 1.3

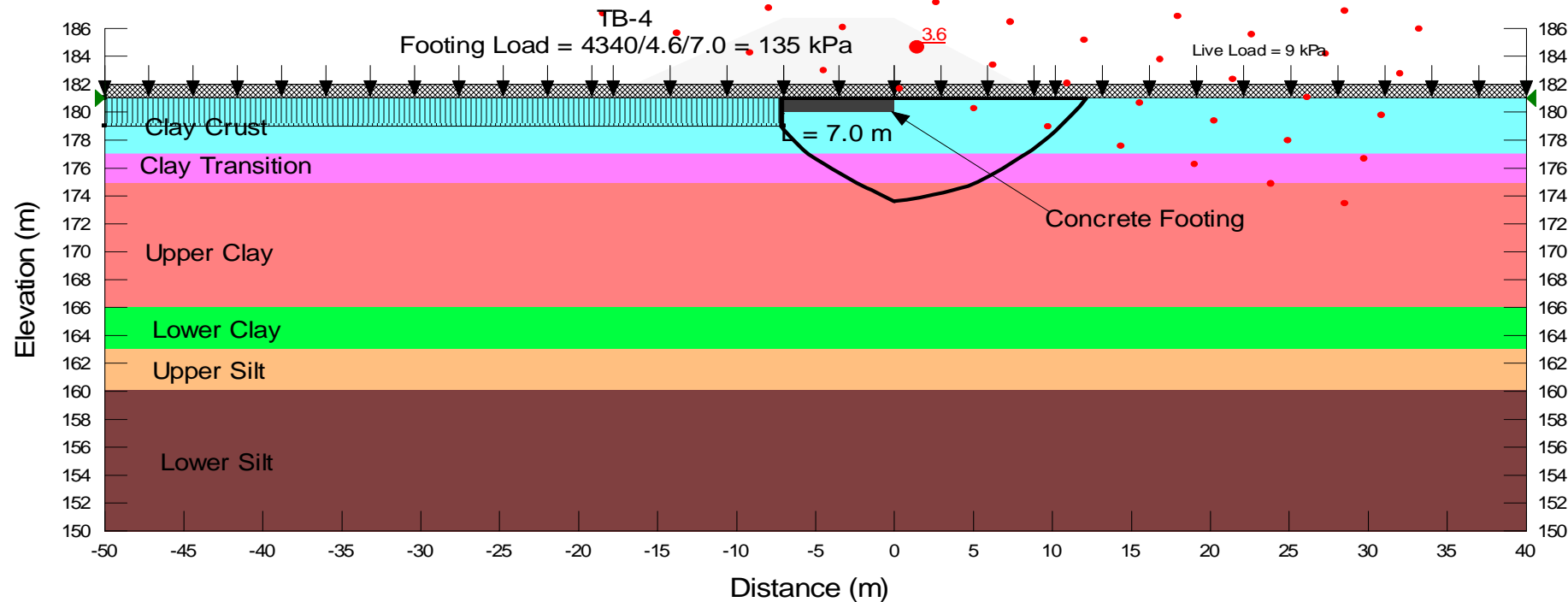


FOS: 3.6

TB-4-West Abutment-Sta. 10+020-Transverse Stability.gs; Short-term
12/06/2014

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: 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
Name: Concrete Footing	Unit Weight: 0.1 kN/m³	Cohesion: 1000 kPa	Phi: 0 °		

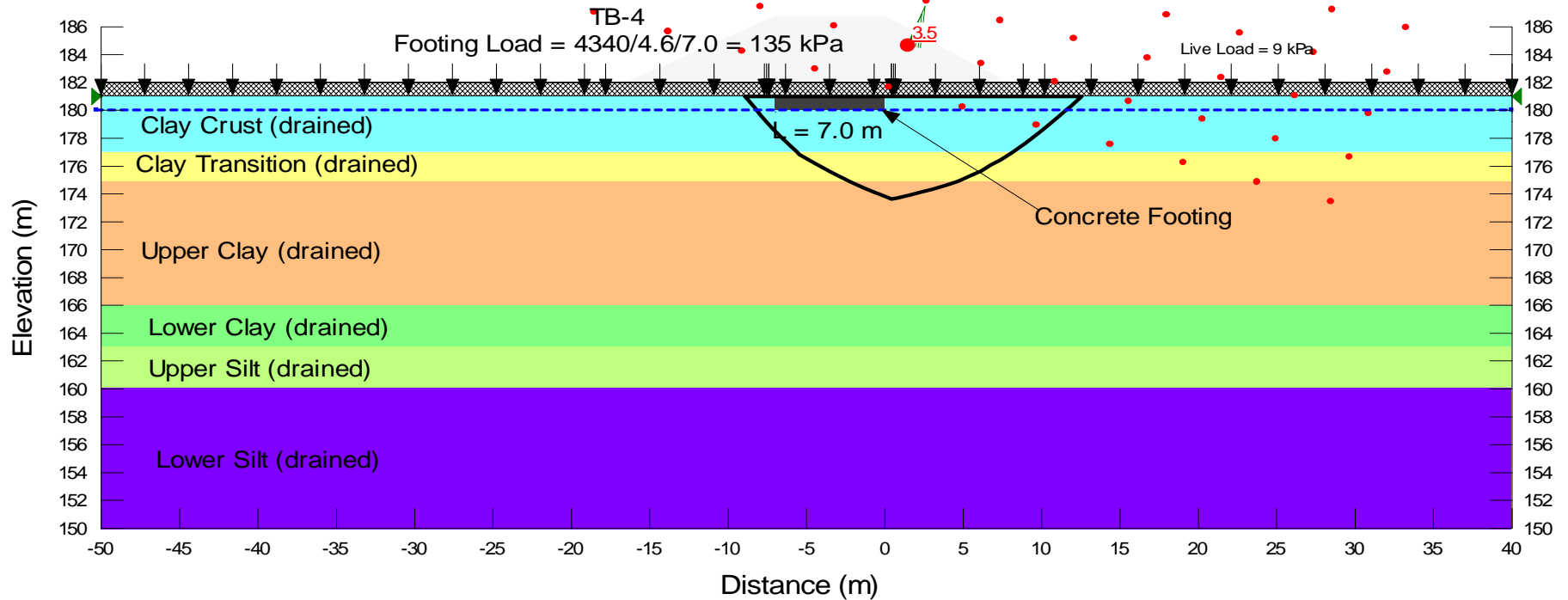


FOS: 3.5

TB-4-West Abutment-Sta. 10+020-Transverse Stability.gsz; Long-term
12/06/2014

Properties:

Name: Upper Clay (drained)	Unit Weight: 20 kN/m³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Transition (drained)	Unit Weight: 21 kN/m³	Cohesion: 0 kPa	Phi: 30 °
Name: Lower Clay (drained)	Unit Weight: 21 kN/m³	Cohesion: 0 kPa	Phi: 30 °
Name: Clay Crust (drained)	Unit Weight: 22 kN/m³	Cohesion: 0 kPa	Phi: 30 °
Name: Upper Silt (drained)	Unit Weight: 22 kN/m³	Cohesion: 0 kPa	Phi: 30 °
Name: Lower Silt (drained)	Unit Weight: 21 kN/m³	Cohesion: 0 kPa	Phi: 30 °
Name: Concrete Footing	Unit Weight: 0.1 kN/m³	Cohesion: 1000 kPa	Phi: 0 °

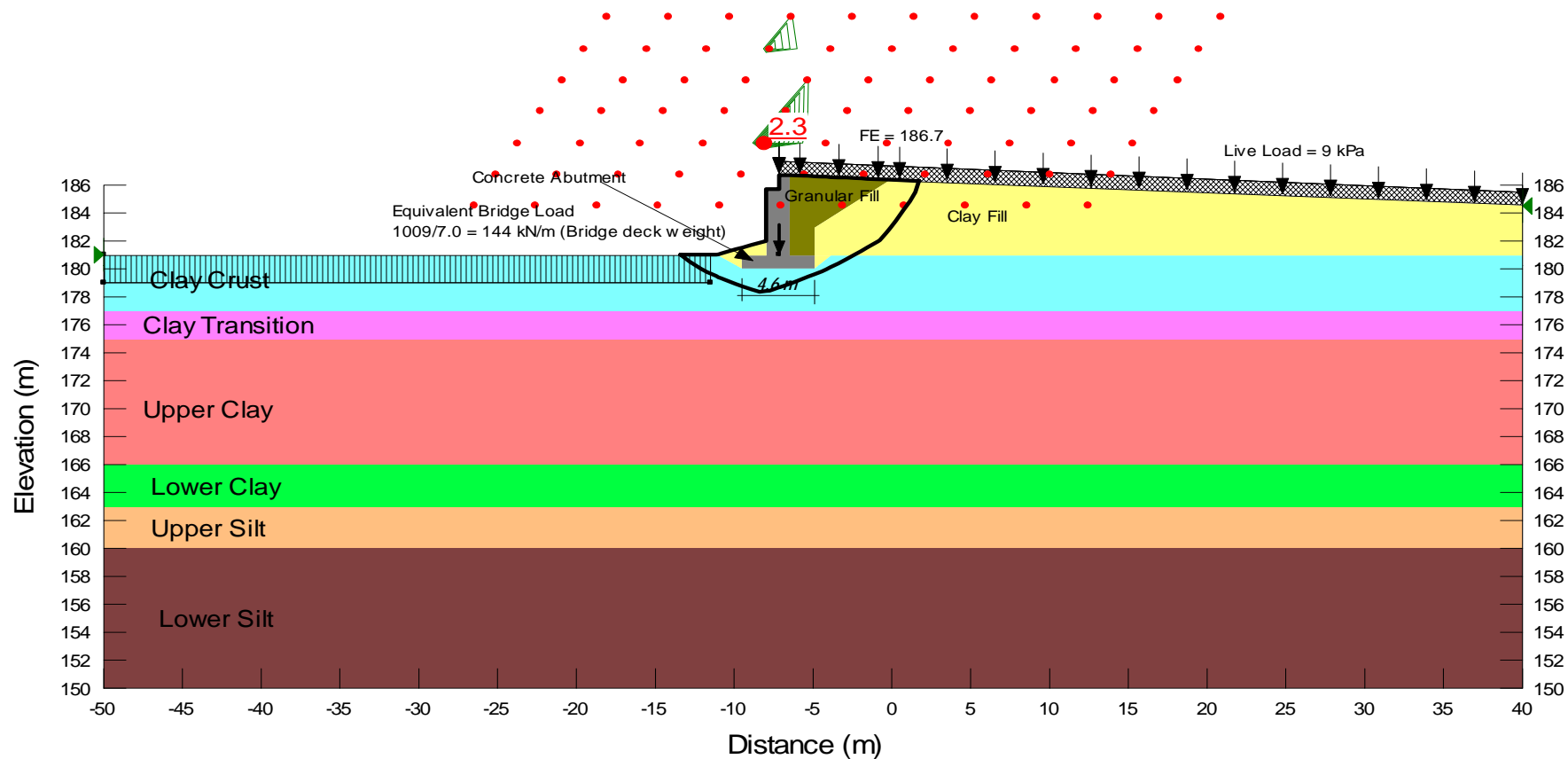


FOS: 2.3

TB-4 West Abutment.gsz; Short-term
12/06/2014

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 Fill	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
Name: Granular Fill	Unit Weight: 21 kN/m³	Cohesion: 0 kPa	Phi: 32 °		



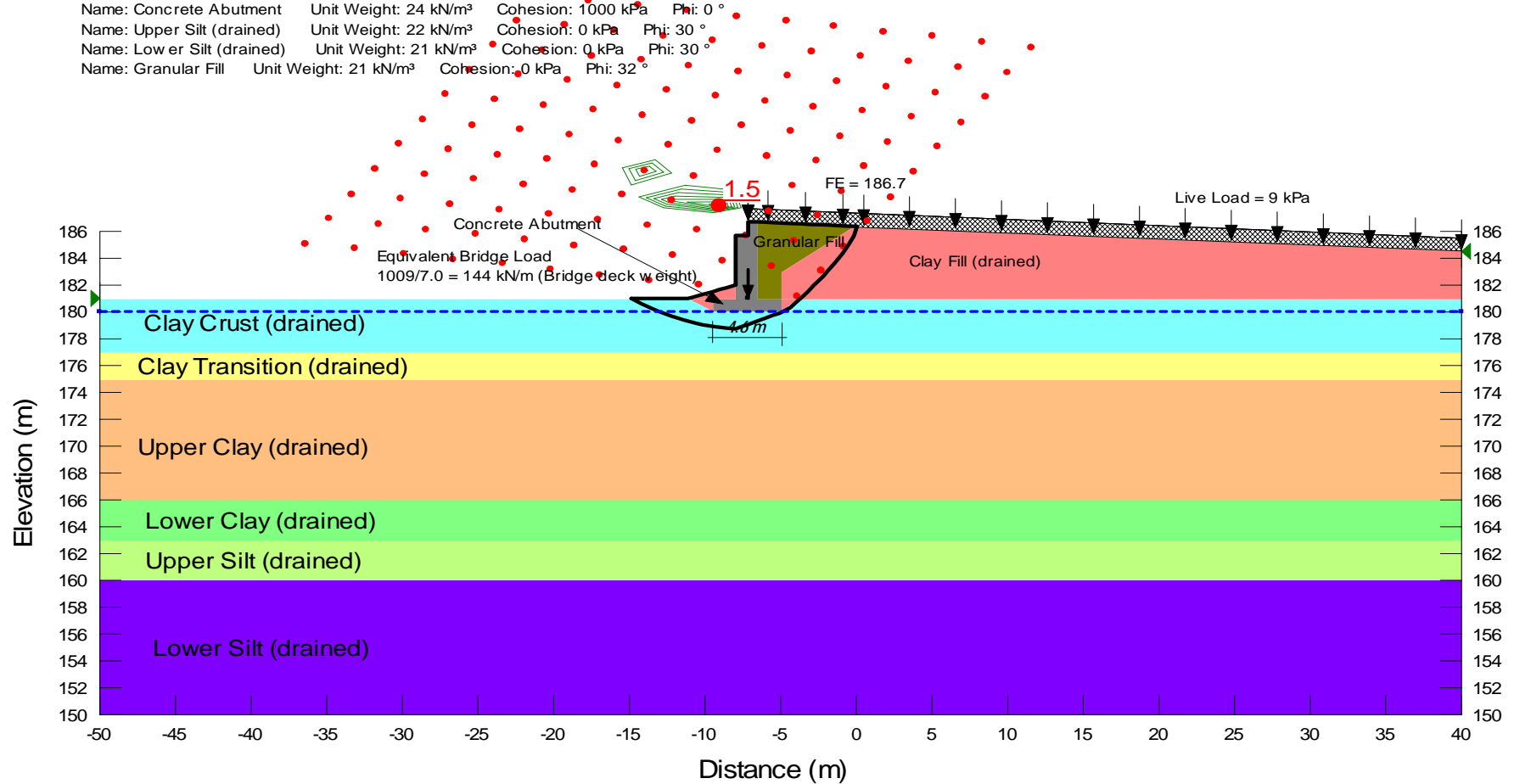
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Name: Long-term

FOS: 1.5

Last Saved: 12/06/2014 - 3:09:29 PM
Analysis Method: Morgenstern-Price

Properties:

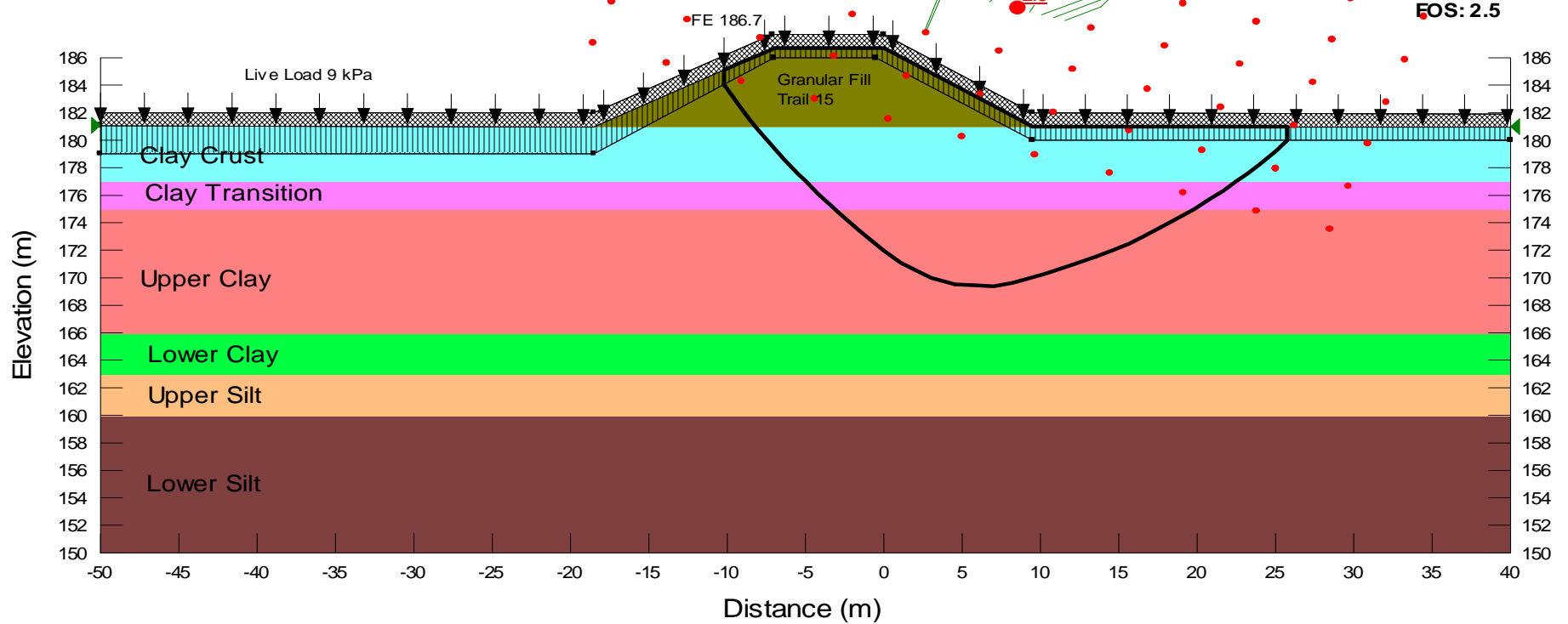
Name: Upper Clay (drained) Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Clay Transition (drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Clay Fill (drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Lower Clay (drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Clay Crust (drained) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °
Name: Upper Silt (drained) Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Lower Silt (drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °



TB-4-West Embankment-Sta. 10+020.gsz; Short-term
17/04/2014

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: Granular Fill	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 32 °		

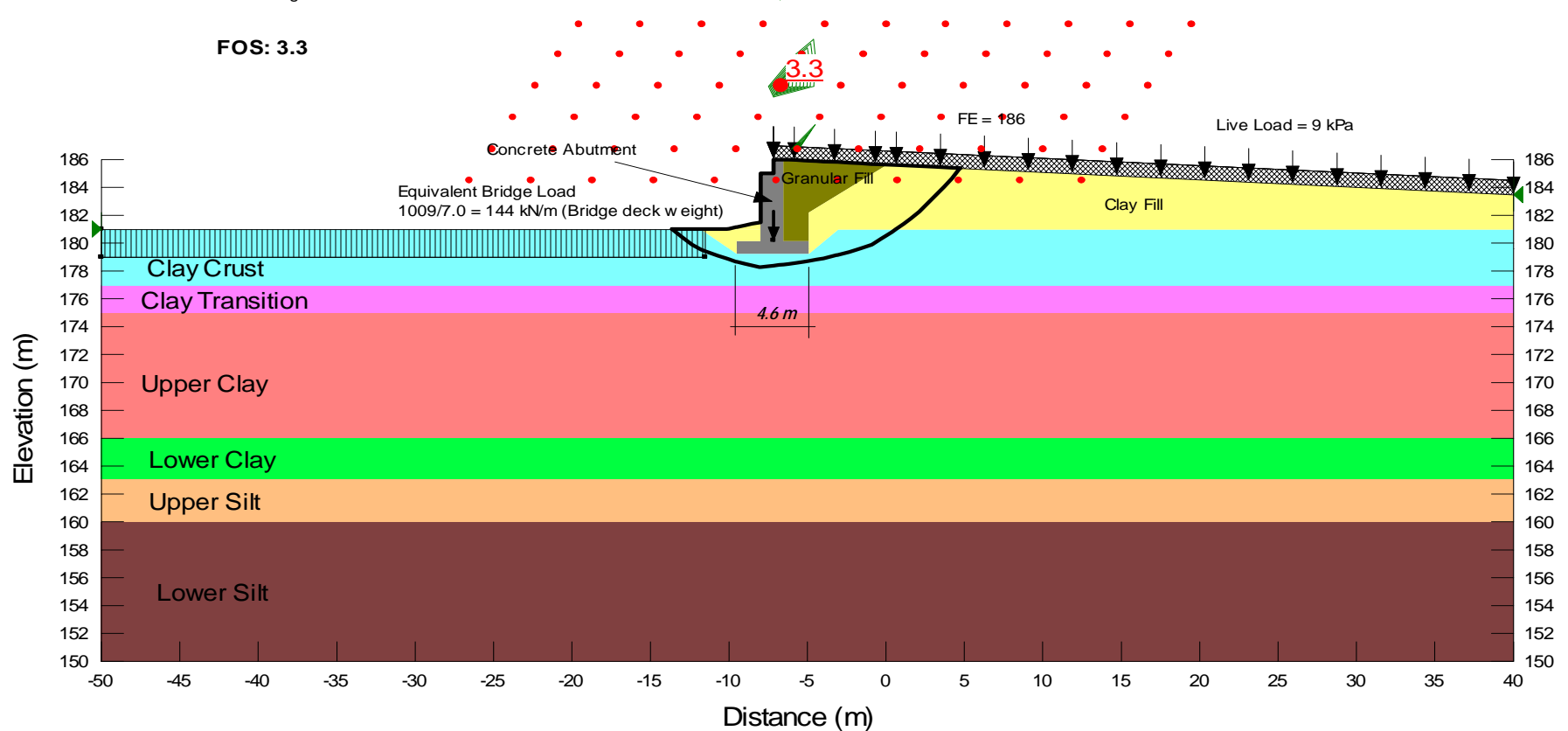


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Analysis Method: Morgenstern-Price

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: Low er 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 Fill	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: Low er Silt	Unit Weight: 21 kN/m³	C-Datum: 65 kPa	C-Rate of Change: 0 kPa/m	Limiting C: 65 kPa	Elevation: 160 m
Name: Granular Fill	Unit Weight: 21 kN/m³	Cohesion: 0 kPa	Phi: 32 °		

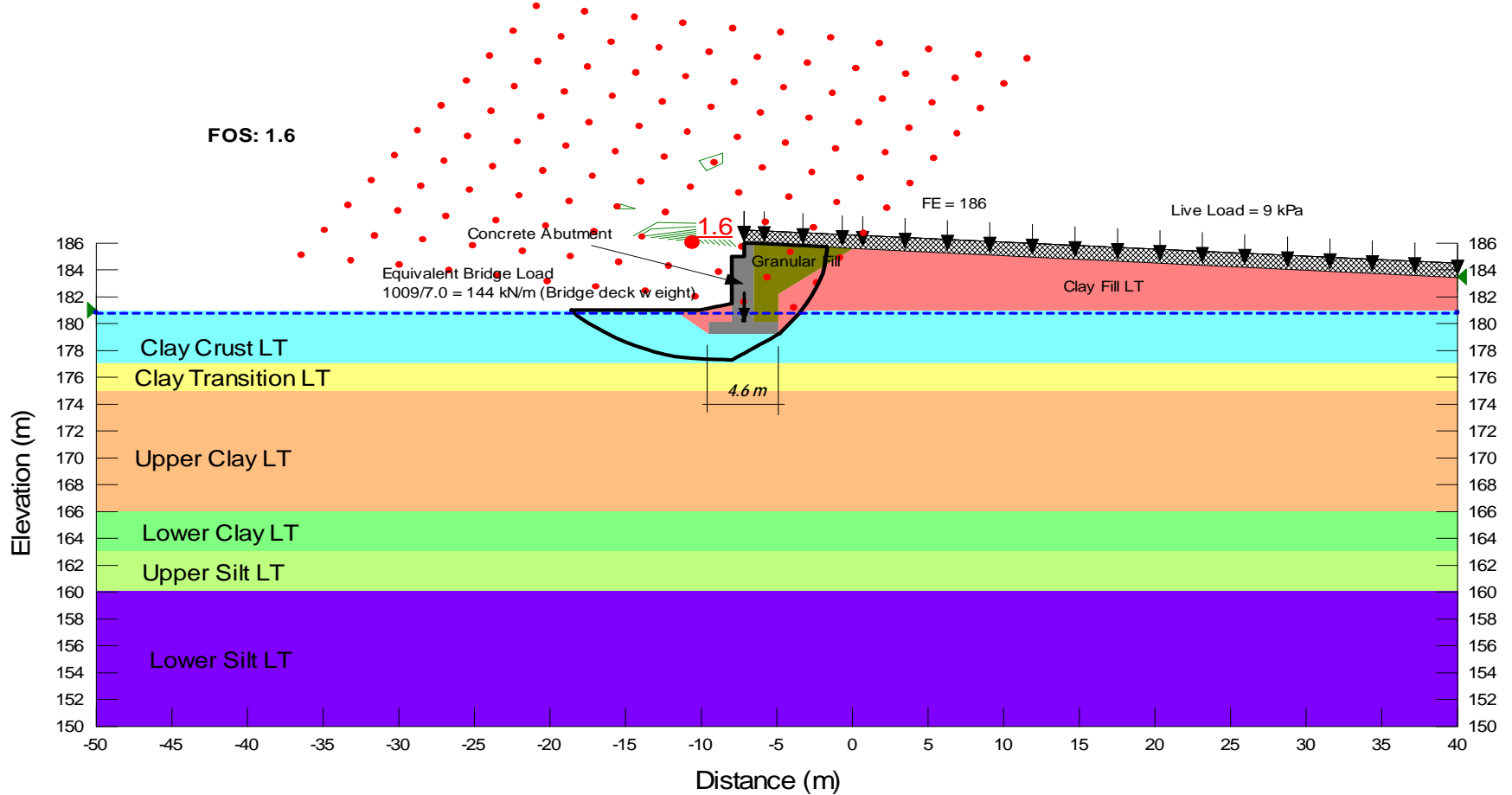
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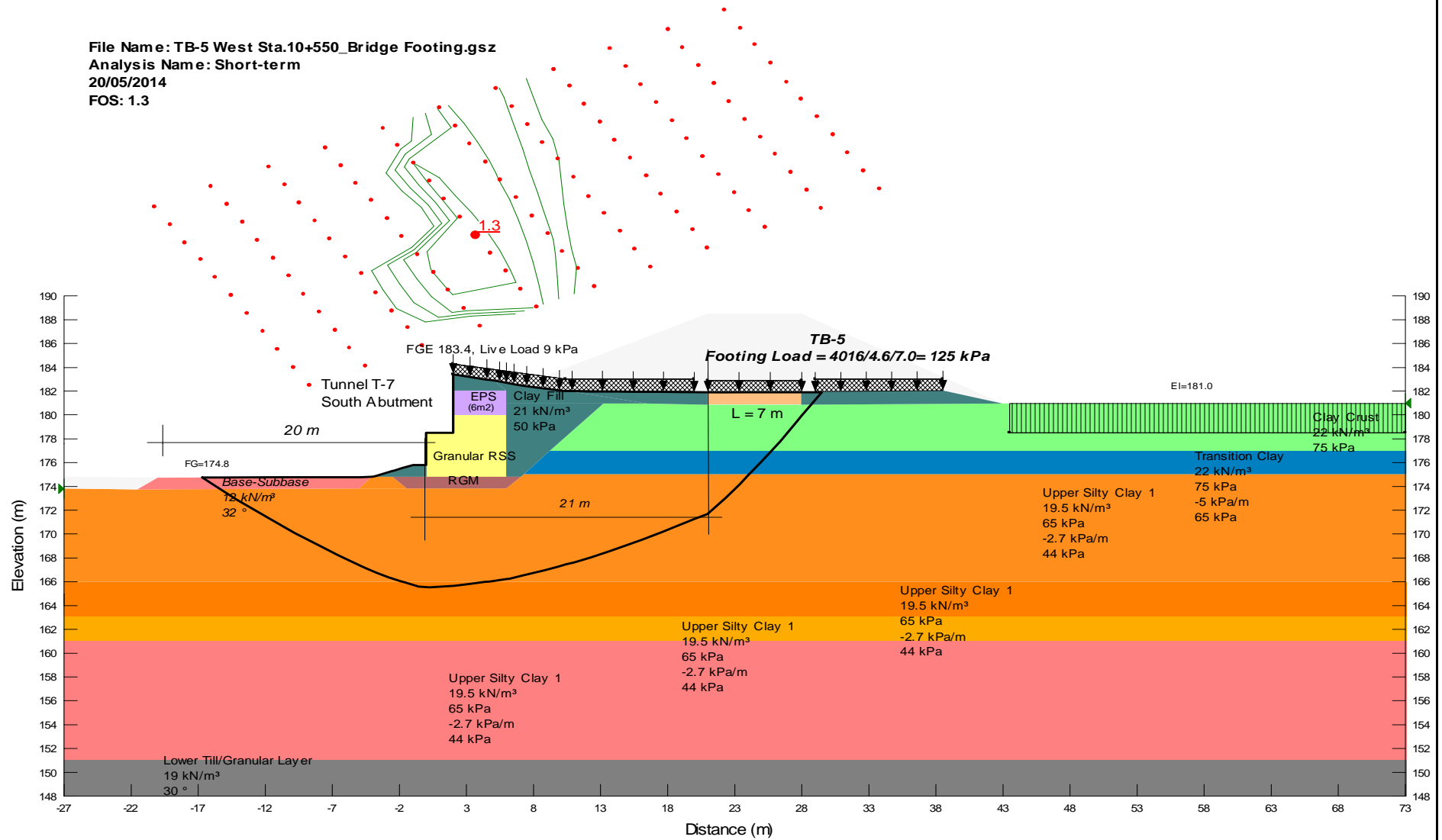
TB-4 East Abutment.gsz; Long-term
12/06/2014

Properties:

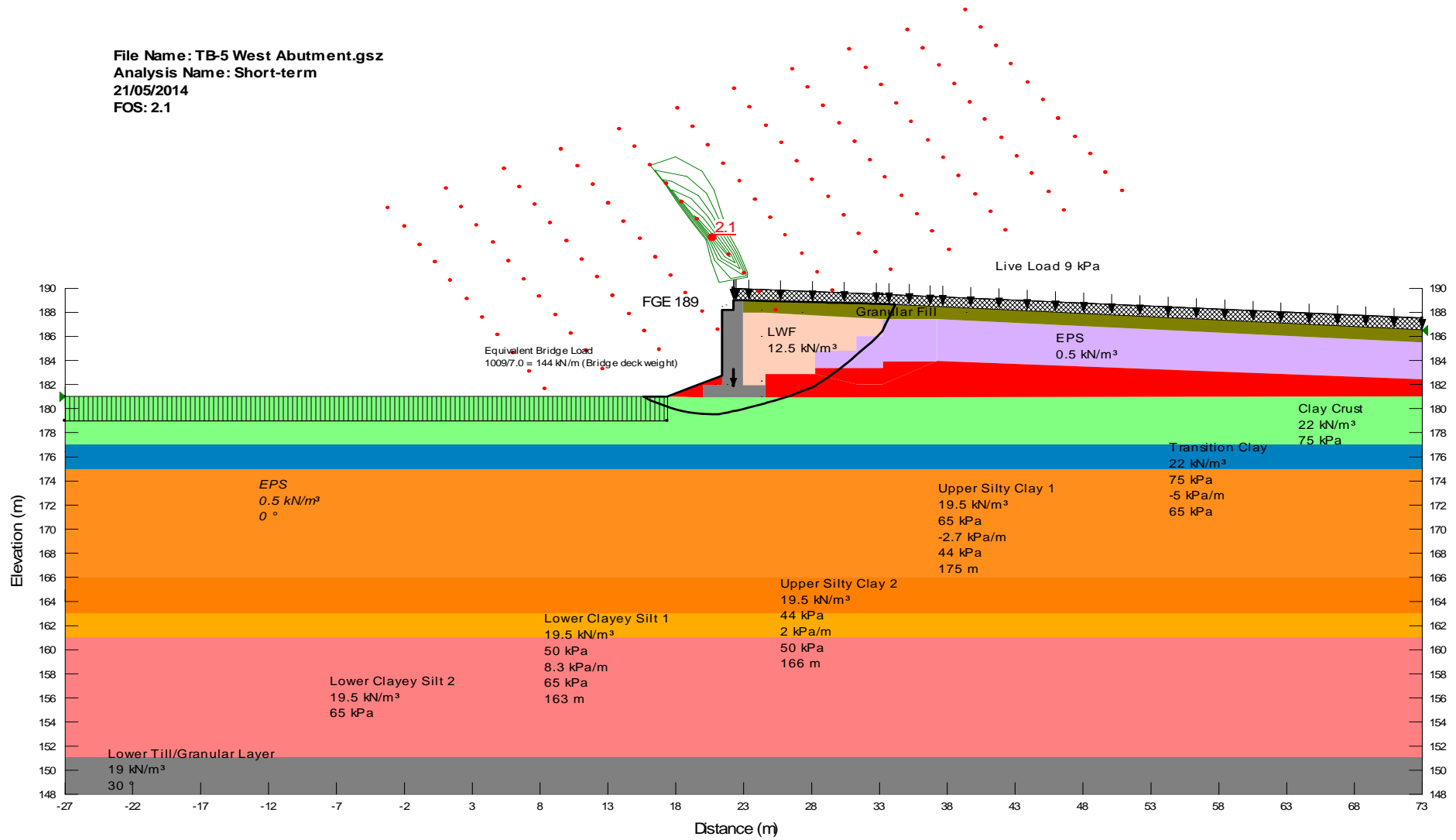
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 Name: Clay Transition LT Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Fill LT Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Lower Clay LT Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Clay Crust LT Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Concrete Abutment Unit Weight: 24 kN/m³ Cohesion: 1000 kPa Phi: 0 °
 Name: Upper Silt LT Unit Weight: 22 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Lower Silt LT Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °



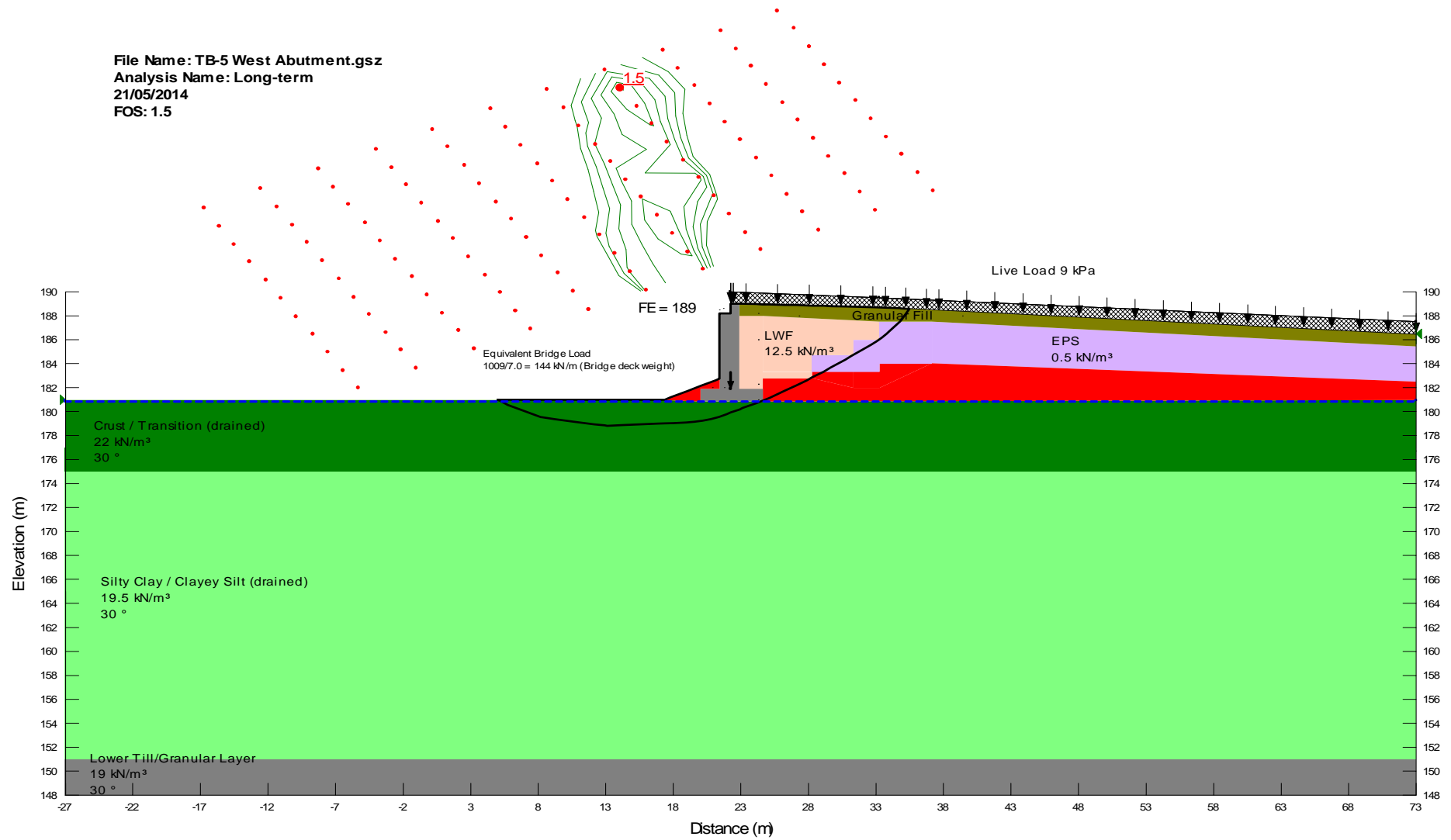
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 20/05/2014
 FOS: 1.3



File Name: TB-5 West Abutment.gsz
 Analysis Name: Short-term
 21/05/2014
 FOS: 2.1



File Name: TB-5 West Abutment.gsz
 Analysis Name: Long-term
 21/05/2014
 FOS: 1.5



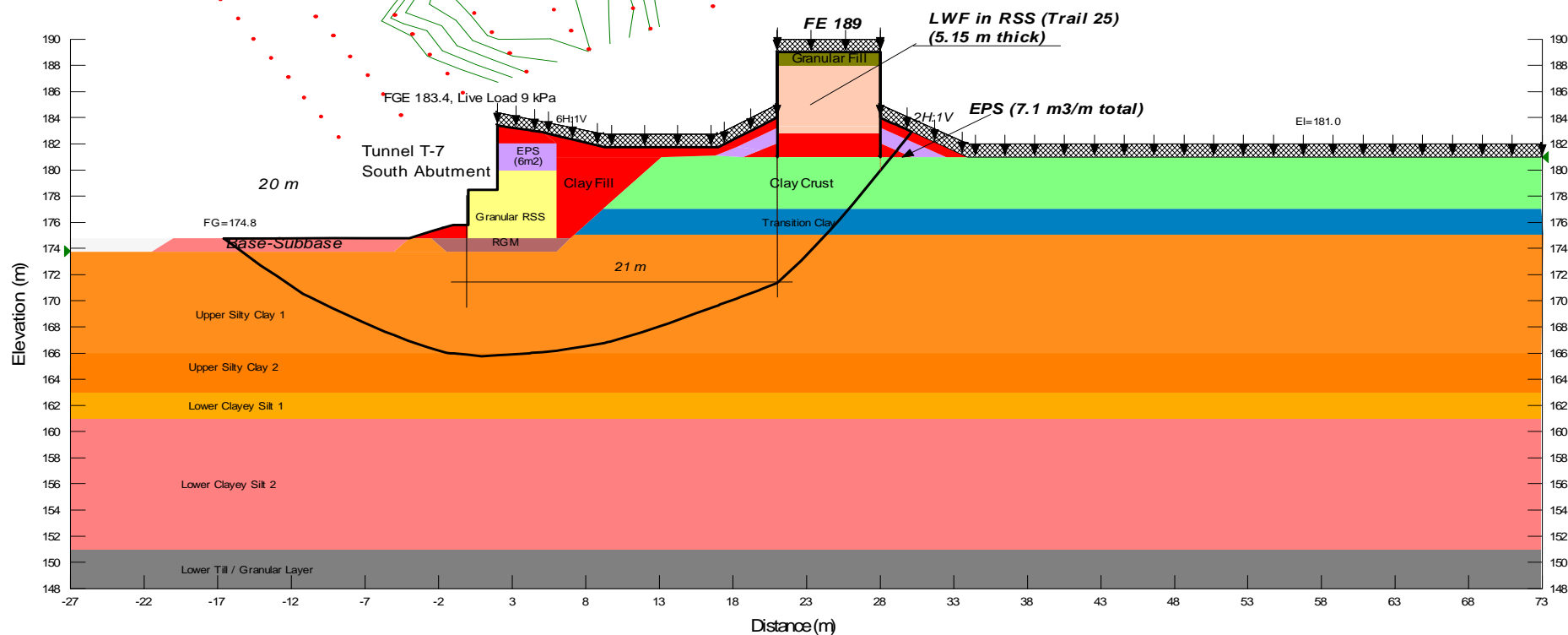
File Name: TB-5 West RSS-Sta10+547.gsz

Name: Short-term

Date: 24/04/2014

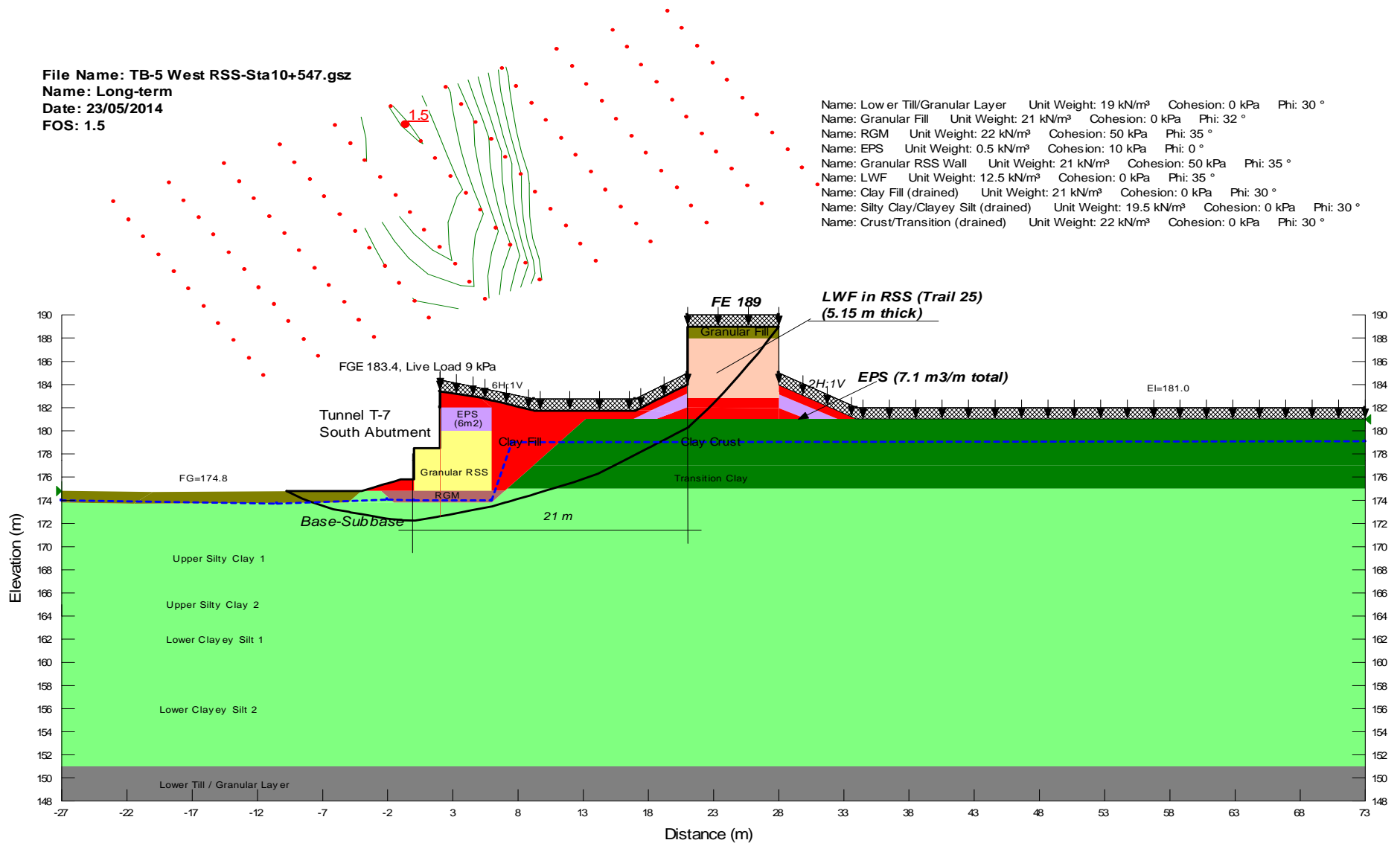
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Name: Clay Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate 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: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35 °
Name: ERS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
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: LWF Unit Weight: 12.5 kN/m³ Cohesion: 0 kPa Phi: 35 °
Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32 °



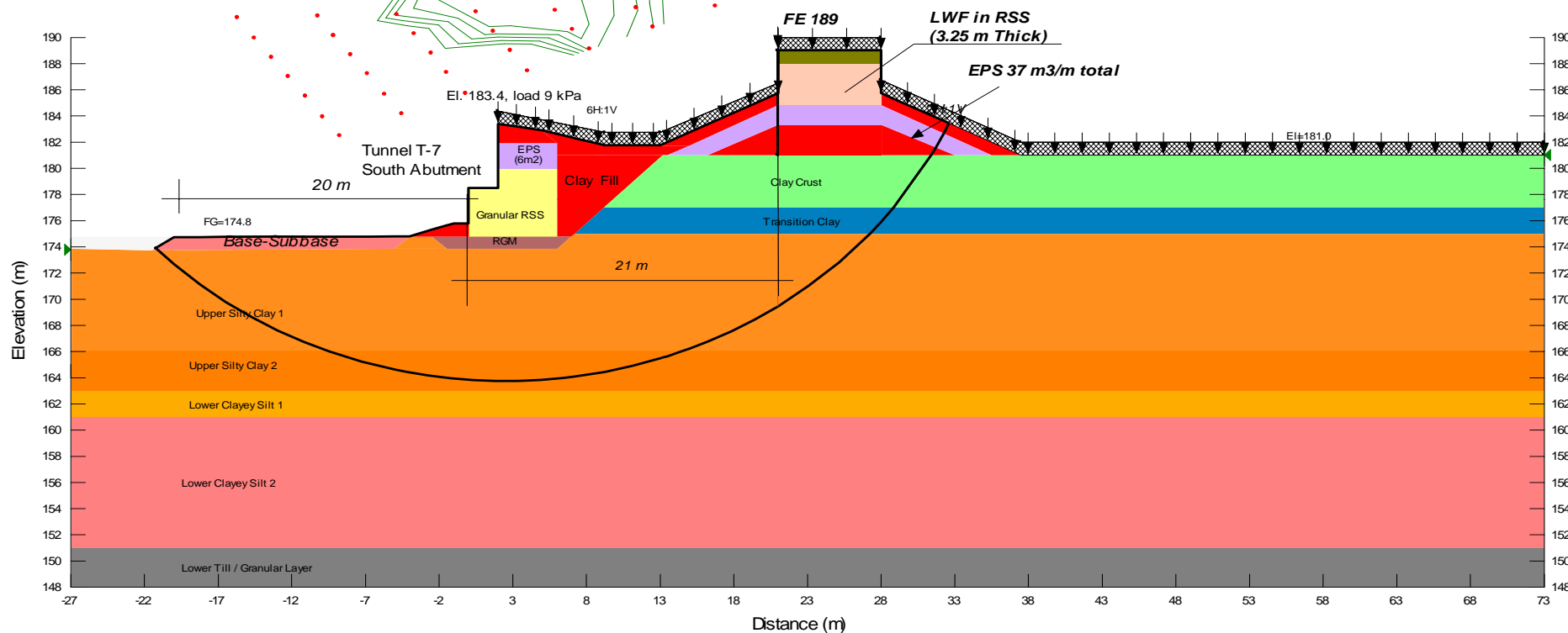
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Name: Lower Till/Granular Layer Unit Weight: 19 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0 °
 Name: Granular RSS Wall Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: LWF Unit Weight: 12.5 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Clay Fill (drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
 Name: Silty Clay/Clayey 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 °



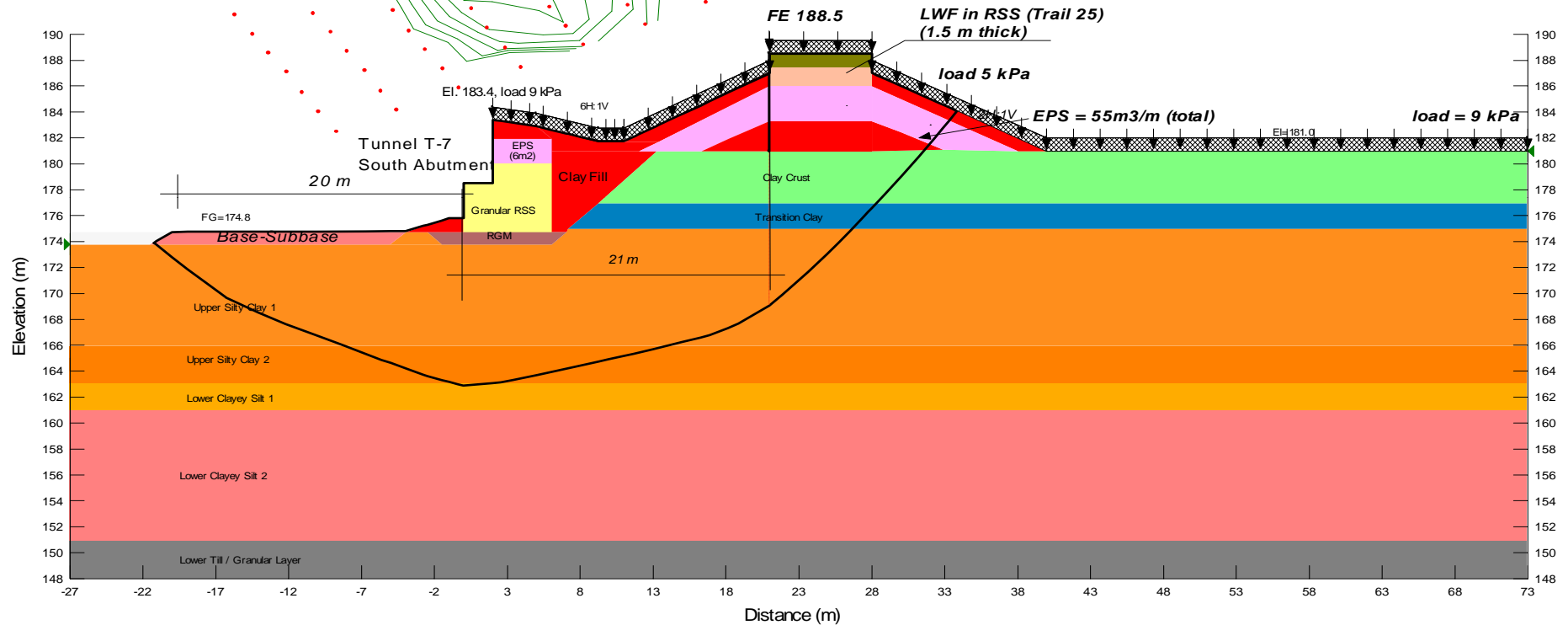
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Name: Clay Crust	Unit Weight: 22 kN/m ³	Cohesion: 75 kPa			
Name: Transition Clay	Unit Weight: 22 kN/m ³	C-Datum: 75 kPa	C-Rate of Change: -5 kPa/m	Limiting C: 65 kPa	Elevation: 177 m
Name: Upper Silty Clay 1	Unit Weight: 19.5 kN/m ³	C-Datum: 65 kPa	C-Rate of Change: -2.7 kPa/m	Limiting C: 44 kPa	Elevation: 175 m
Name: Upper Silty Clay 2	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 Clayey Silt 1	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 Clayey Silt 2	Unit Weight: 19.5 kN/m ³	Cohesion: 65 kPa			
Name: Lower Till/Granular Layer	Unit Weight: 19 kN/m ³	Cohesion: 0 kPa	Phi: 30 °		
Name: Granular Fill	Unit Weight: 21 kN/m ³	Cohesion: 0 kPa	Phi: 32 °		
Name: RCM	Unit Weight: 22 kN/m ³	Cohesion: 50 kPa	Phi: 35 °		
Name: EPS	Unit Weight: 0.5 kN/m ³	Cohesion: 10 kPa	Phi: 0 °		
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: LWF	Unit Weight: 12.5 kN/m ³	Cohesion: 0 kPa	Phi: 35 °		
Name: Base Subbase	Unit Weight: 12 kN/m ³	Cohesion: 0 kPa	Phi: 32 °		



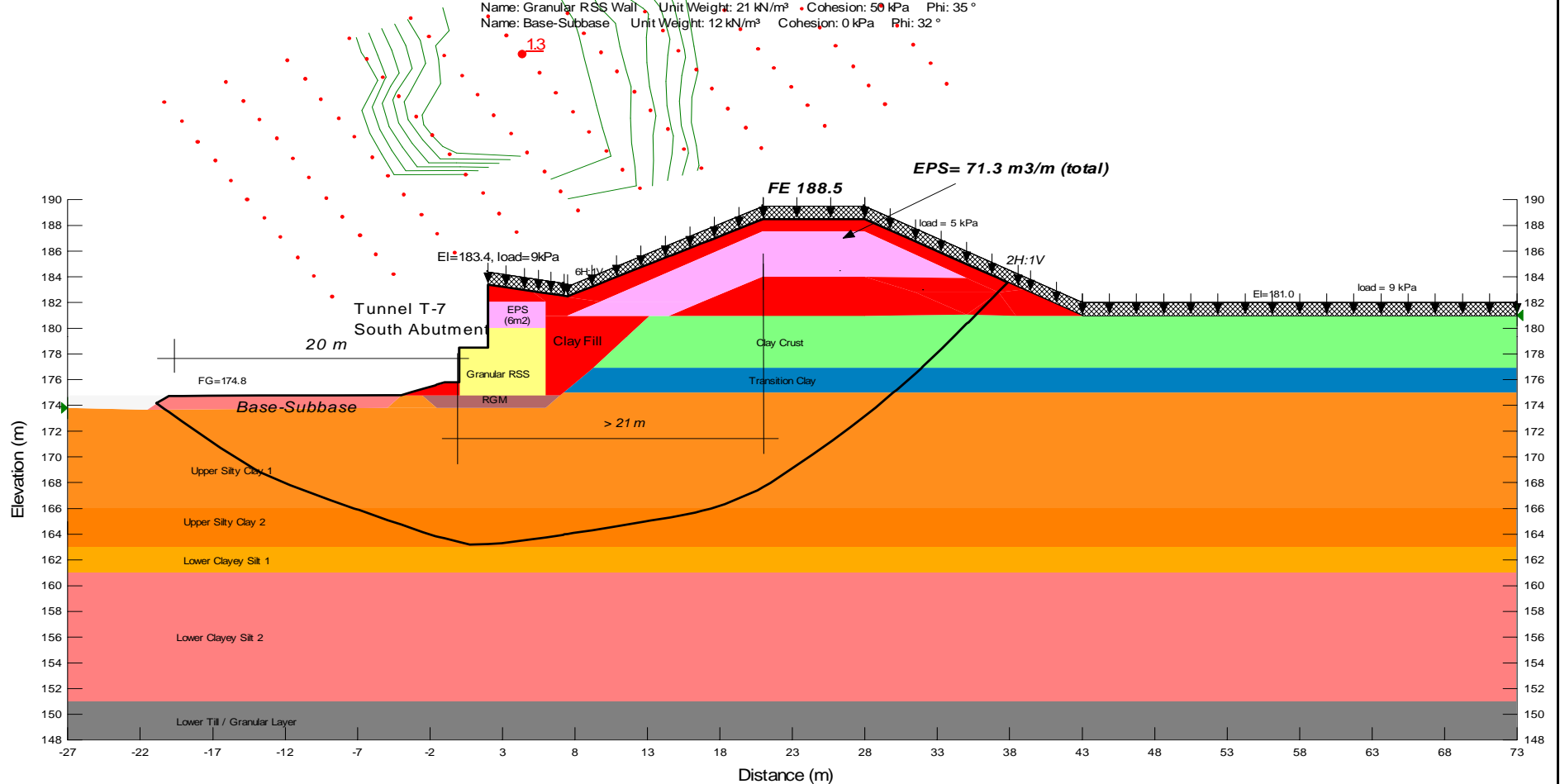
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 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 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: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32°
 Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35°
 Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa Phi: 0°
 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: LWF Unit Weight: 12.5 kN/m³ Cohesion: 50 kPa Phi: 35°
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32°



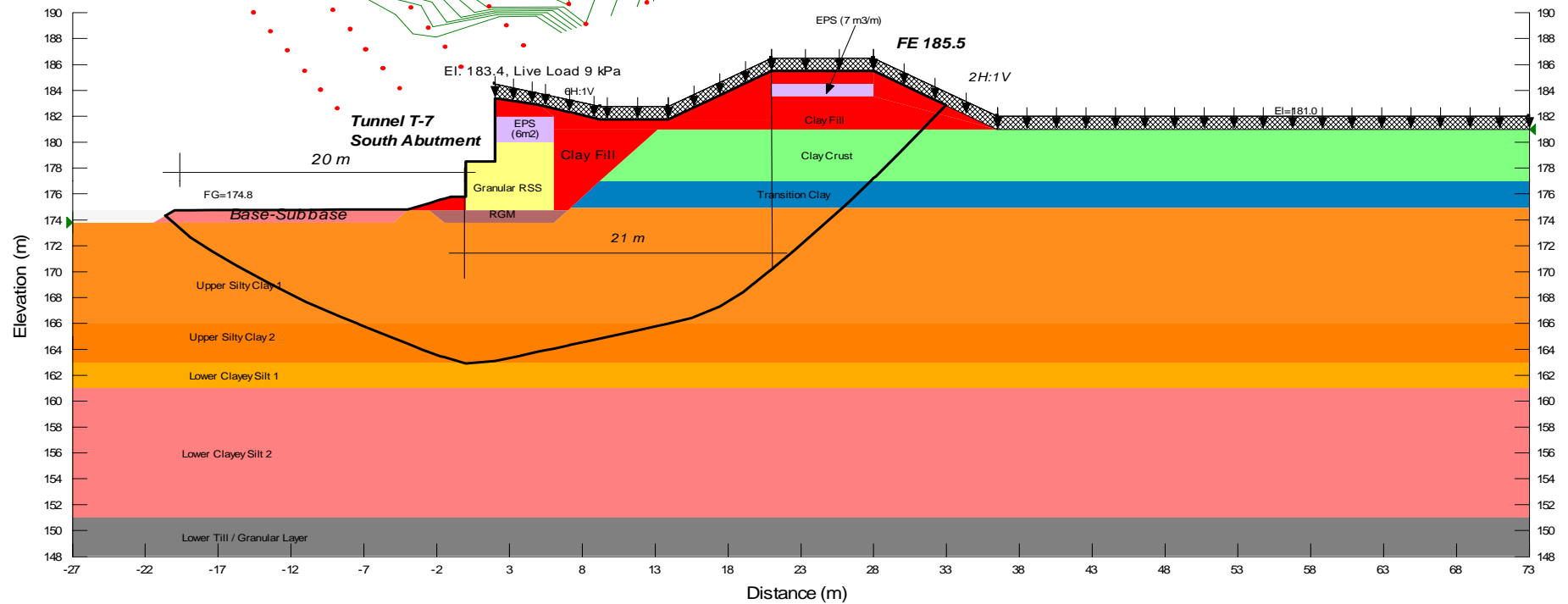
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 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 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: 15 kPa Phi: 0°
 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°



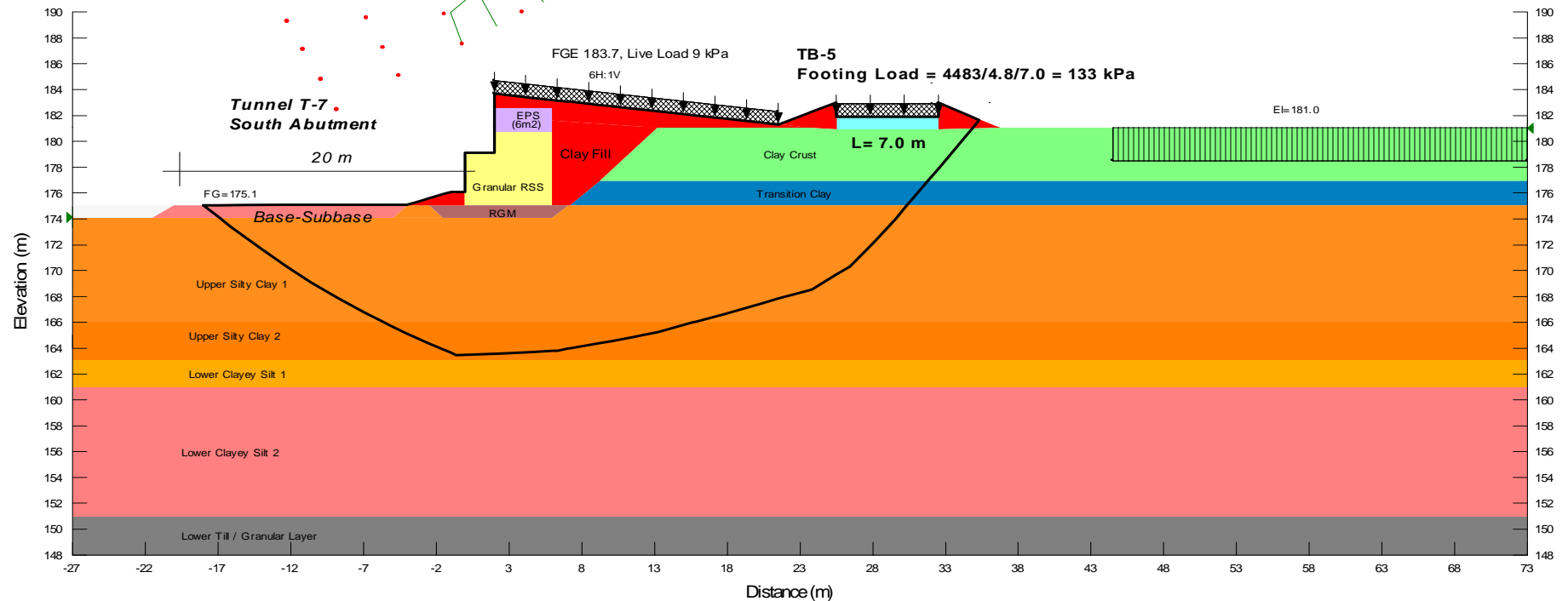
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Name: Clay Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate 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 Phi: 0 °
 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 °



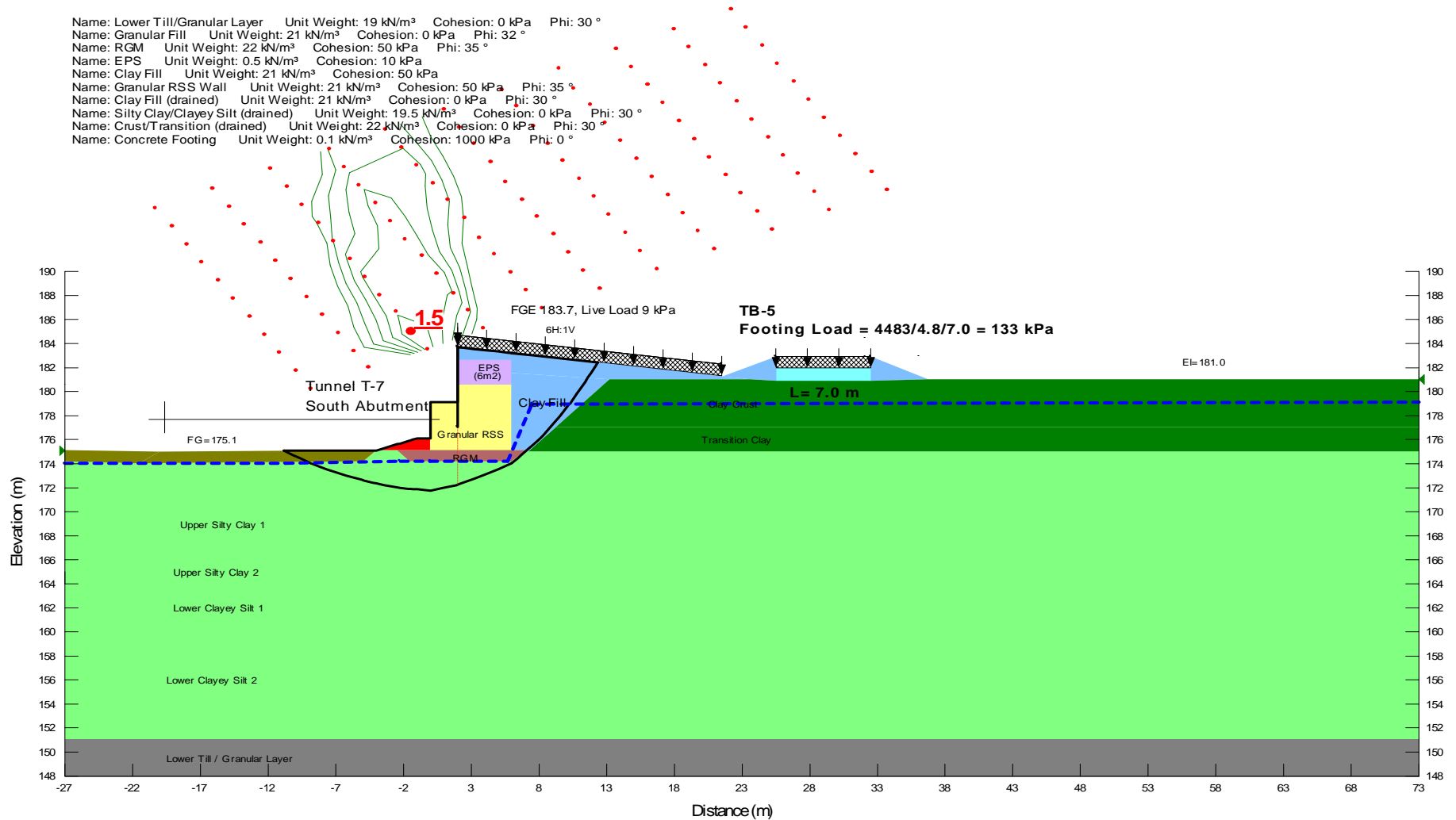
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Name	Unit Weight	Cohesion	C-Datum	C-Rate of Change	Limiting C	Elevation
Name: Clay Crust	Unit Weight: 22 kN/m ³	Cohesion: 75 kPa				
Name: Transition Clay	Unit Weight: 22 kN/m ³	Cohesion: 75 kPa		C-Rate of Change: -5 kPa/m	Limiting C: 65 kPa	Elevation: 177 m
Name: Upper Silty Clay 1	Unit Weight: 19.5 kN/m ³	Cohesion: 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/m ³	Cohesion: 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/m ³	Cohesion: 50 kPa		C-Rate of Change: 6.3 kPa/m	Limiting C: 65 kPa	Elevation: 163 m
Name: Lower Clayey Silt 2	Unit Weight: 19.5 kN/m ³	Cohesion: 65 kPa				
Name: Lower Till/Granular Layer	Unit Weight: 19 kN/m ³	Cohesion: 0 kPa				
Name: RGM	Unit Weight: 22 kN/m ³	Cohesion: 50 kPa				
Name: EPS	Unit Weight: 0.5 kN/m ³	Cohesion: 10 kPa				
Name: Clay Fill	Unit Weight: 21 kN/m ³	Cohesion: 50 kPa				
Name: Granular RSS Wall	Unit Weight: 21 kN/m ³	Cohesion: 60 kPa				
Name: Base-Subbase	Unit Weight: 12 kN/m ³	Cohesion: 0 kPa				
Name: Concrete Footing	Unit Weight: 0.1 kN/m ³	Cohesion: 1000 kPa				

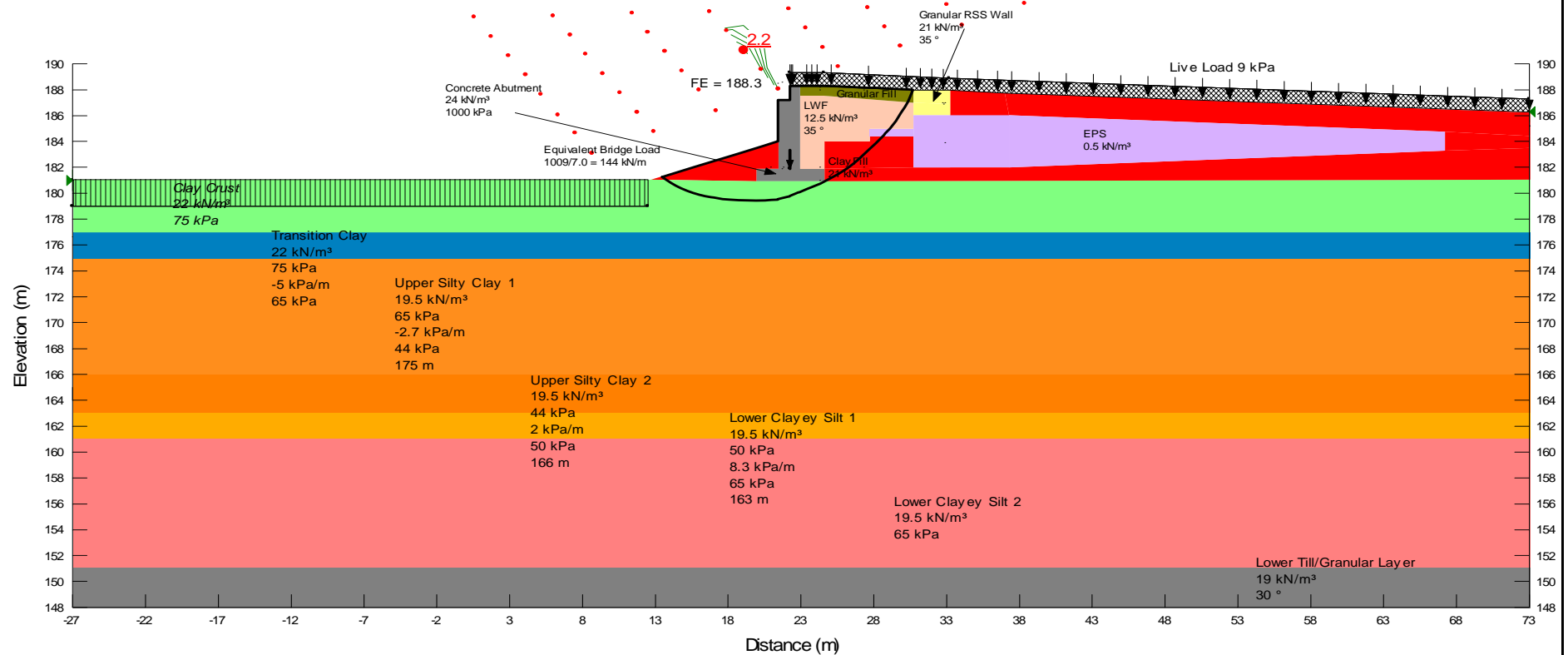


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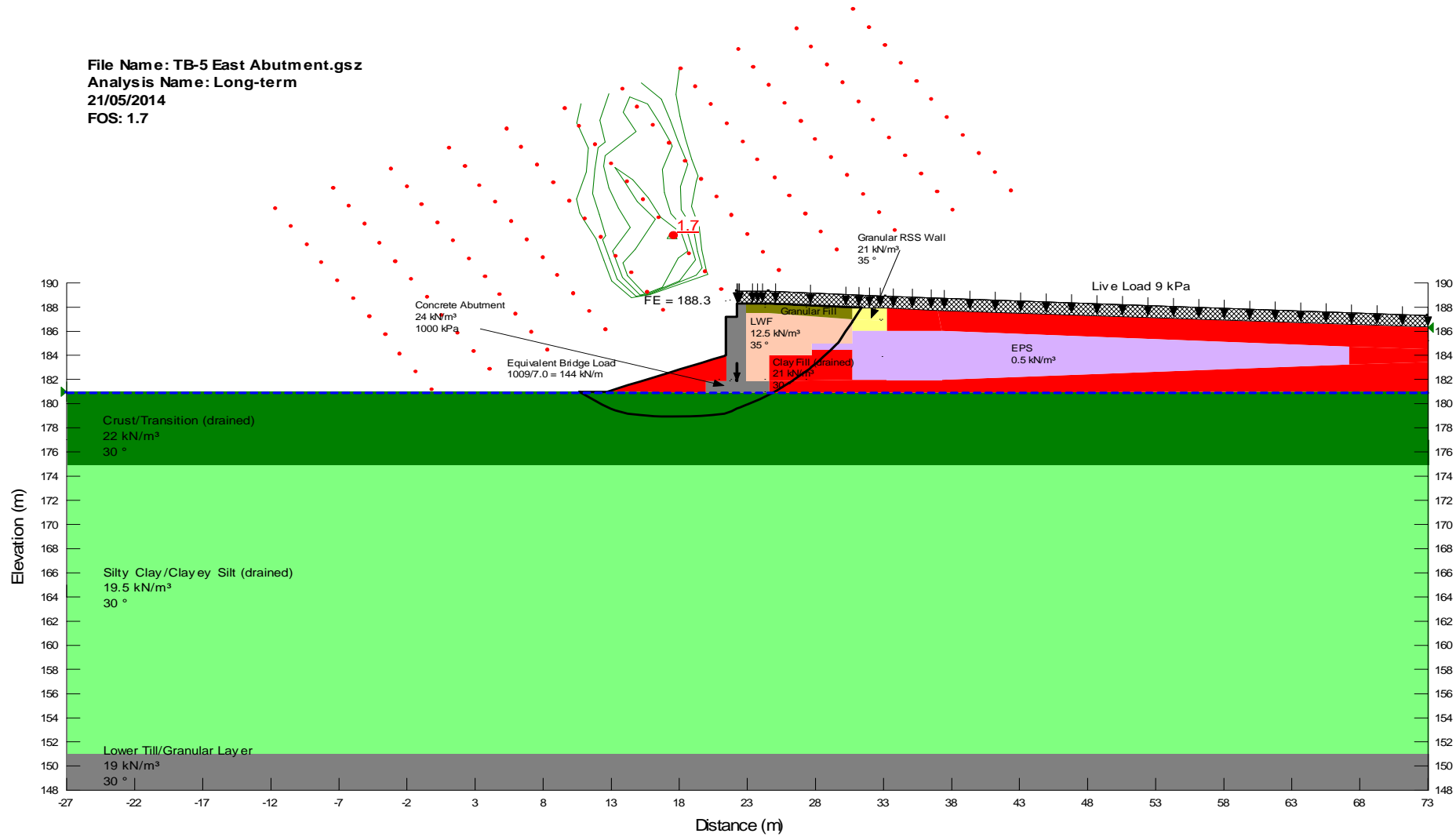
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Name: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
Name: RGM Unit Weight: 22 kN/m³ Cohesion: 50 kPa Phi: 35 °
Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 10 kPa
Name: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa
Name: Granular RSS Wall Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
Name: Clay Fill (drained) Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 30 °
Name: Silty Clay/Clayey 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: Concrete Footing Unit Weight: 0.1 kN/m³ Cohesion: 1000 kPa Phi: 0 °



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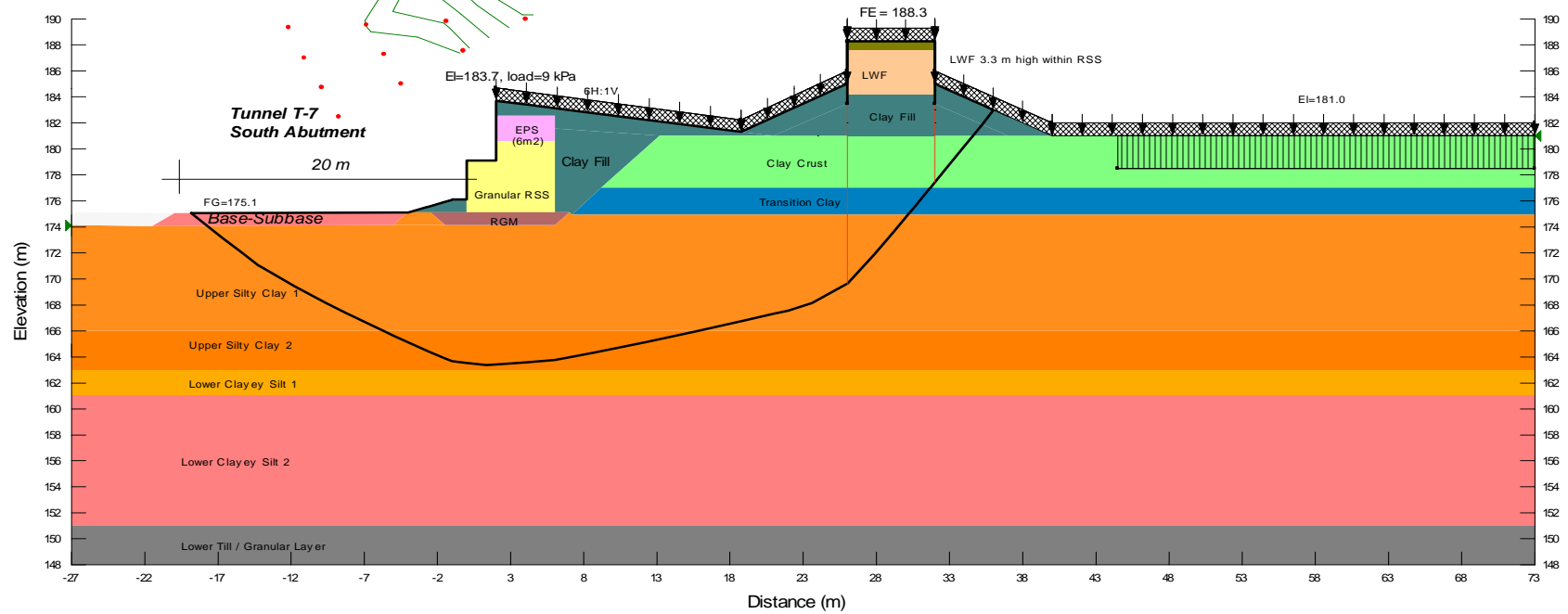


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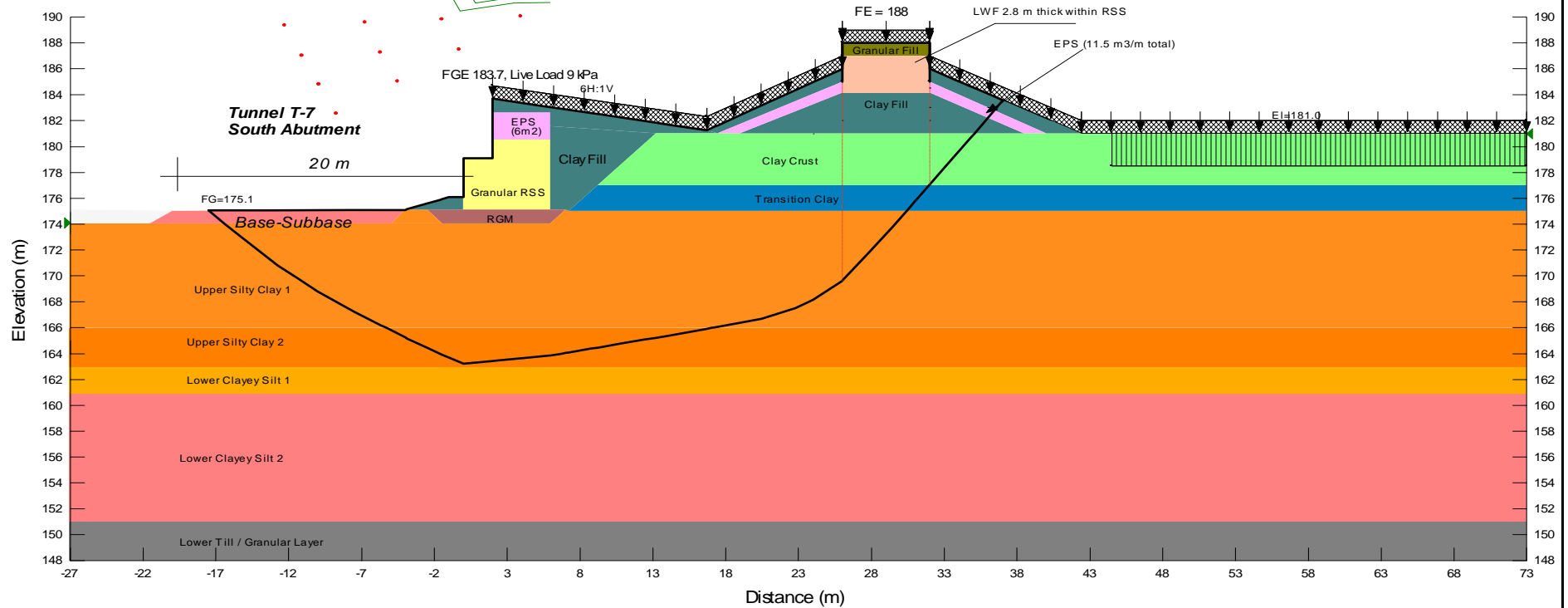
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Name: Clay Crust Unit Weight: 22 kN/m³ Cohesion: 75 kPa
 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate 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: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 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: 60 kPa
 Name: Granular RSS Wall Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °
 Name: LWF Unit Weight: 12.5 kN/m³ Cohesion: 0 kPa Phi: 35 °
 Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32 °



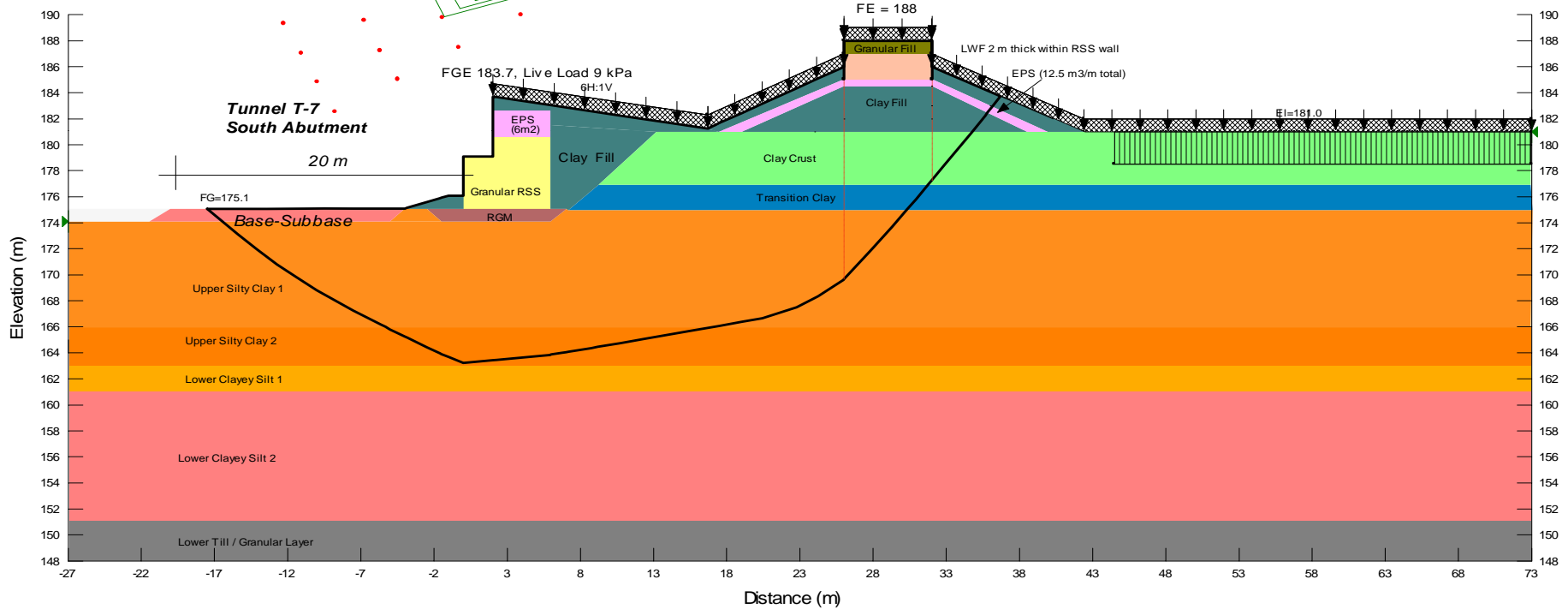
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 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 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: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 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 °
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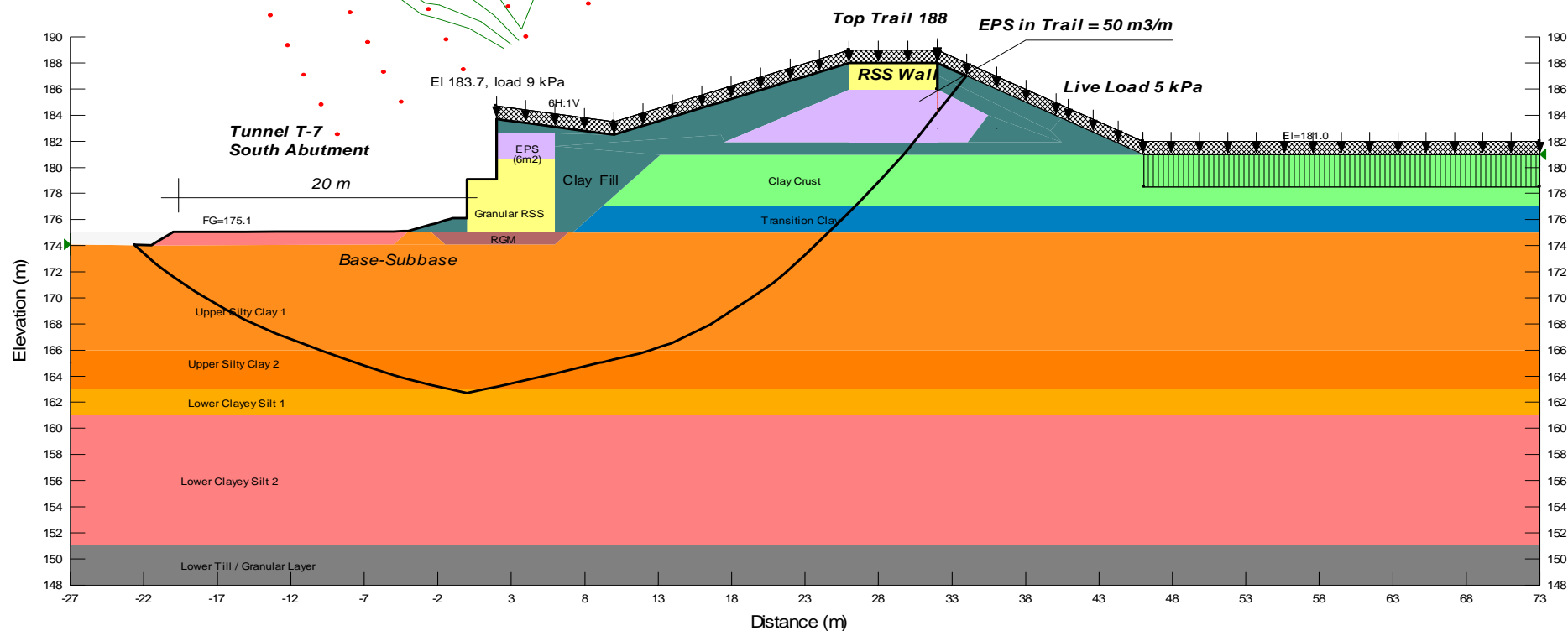
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 Name: Transition Clay Unit Weight: 22 kN/m³ C-Datum: 75 kPa C-Rate of Change: -5 kPa/m Limiting C: 65 kPa Elevation: 177 m
 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 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: Granular Fill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 32 °
 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 °
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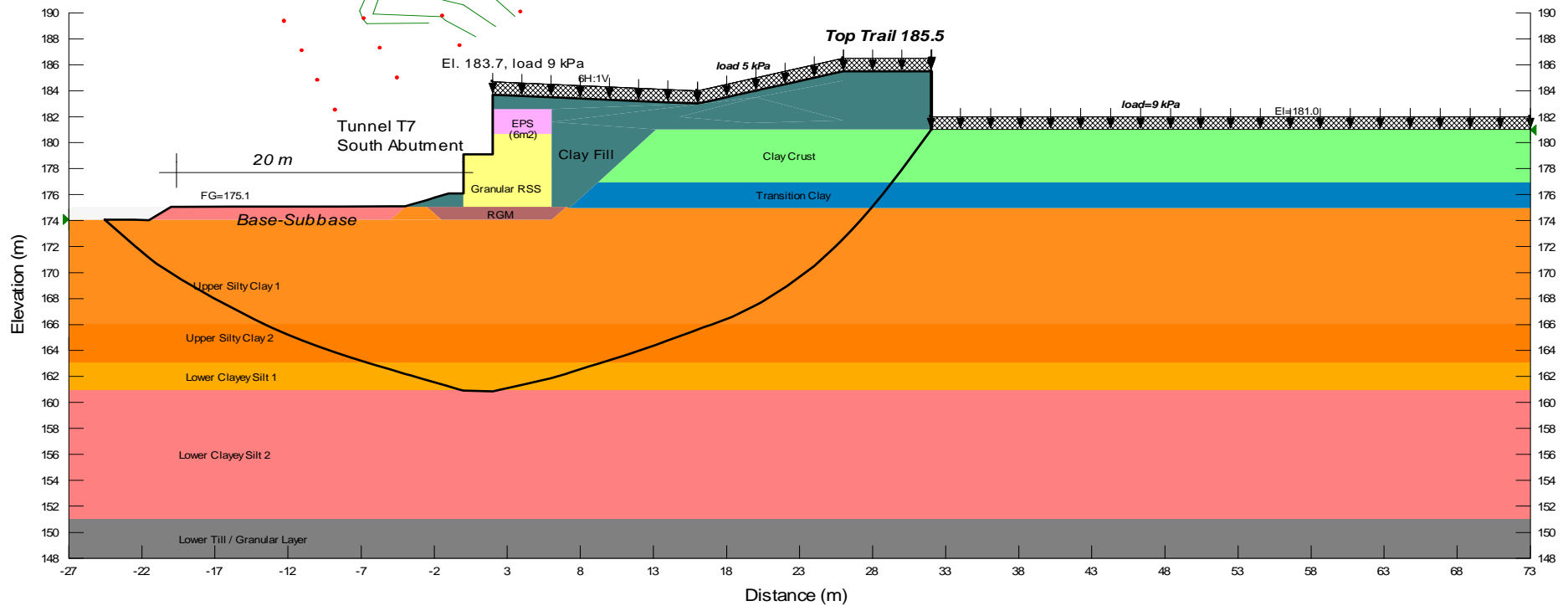
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Name: Transition Clay	Unit Weight: 22 kN/m ³	C-Datum: 75 kPa	C-Rate of Change: -5 kPa/m	Limiting C: 65 kPa	Elevation: 177 m	
Name: Upper Silty Clay 1	Unit Weight: 19.5 kN/m ³	C-Datum: 65 kPa	C-Rate of Change: -2.7 kPa/m	Limiting C: 44 kPa	Elevation: 175 m	
Name: Upper Silty Clay 2	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 Clayey Silt 1	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 Clayey Silt 2	Unit Weight: 19.5 kN/m ³	Cohesion: 65 kPa				
Name: Lower Till/Granular 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: 15 kPa				
Name: Clay Fill	Unit Weight: 21 kN/m ³	Cohesion: 50 kPa				
Name: Granular RSS Wall	Unit Weight: 21 kN/m ³	Cohesion: 200 kPa	Phi: 35 °			
Name: Base Subbase	Unit Weight: 12 kN/m ³	Cohesion: 0 kPa	Phi: 32 °			



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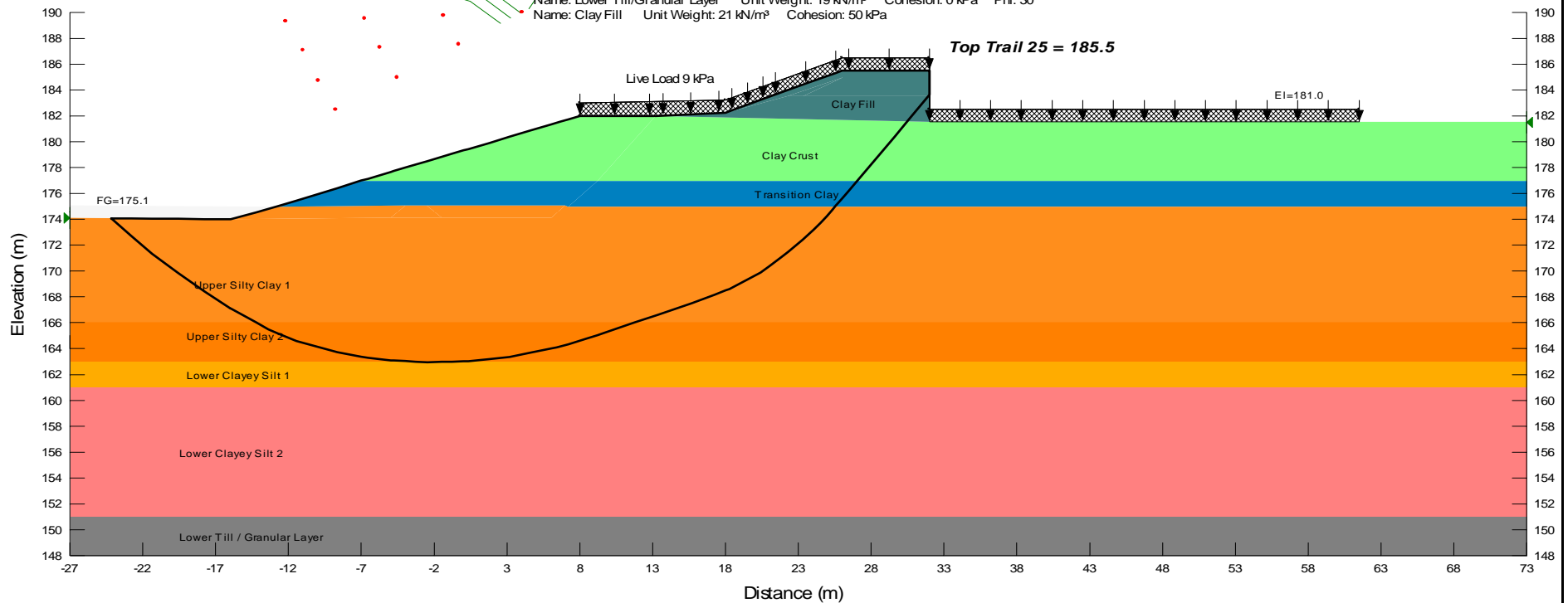
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 Name: Upper Silty Clay 1 Unit Weight: 19.5 kN/m³ C-Datum: 65 kPa C-Rate of Change: -2.7 kPa/m Limiting C: 44 kPa Elevation: 175 m
 Name: Upper Silty Clay 2 Unit Weight: 19.5 kN/m³ C-Datum: 44 kPa C-Rate of Change: 2 kPa/m Limiting C: 50 kPa Elevation: 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 °
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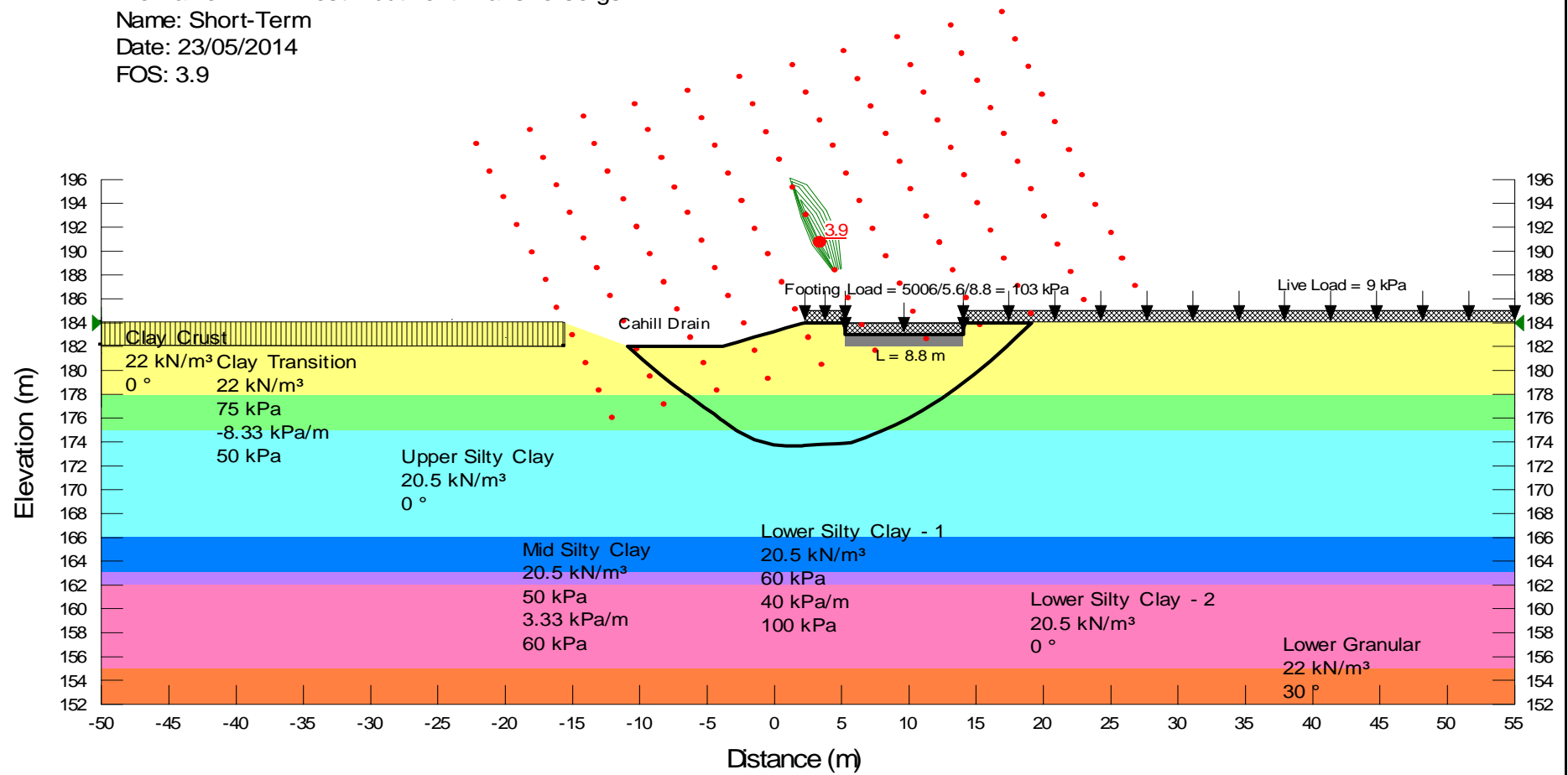
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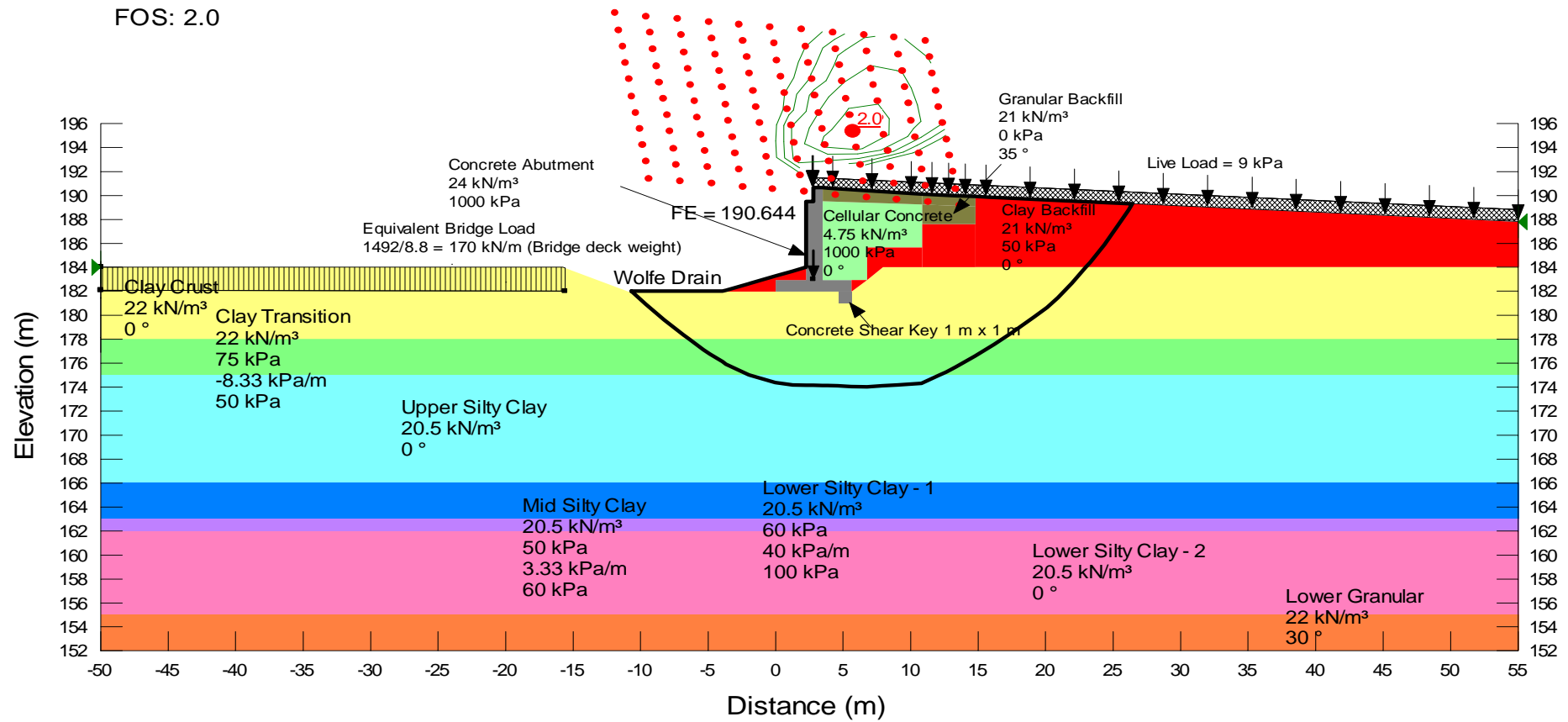
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 Name: Upper Silty Clay 2 Unit Weight: 19.5 kN/m³ C-Datum: 44 kPa C-Rate of Change: 2 kPa/m Limiting C: 50 kPa Elevation: 166 m
 Name: Lower Clayey Silt 1 Unit Weight: 19.5 kN/m³ C-Datum: 50 kPa C-Rate of Change: 8.3 kPa/m Limiting C: 65 kPa Elevation: 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: Clay Fill Unit Weight: 21 kN/m³ Cohesion: 50 kPa



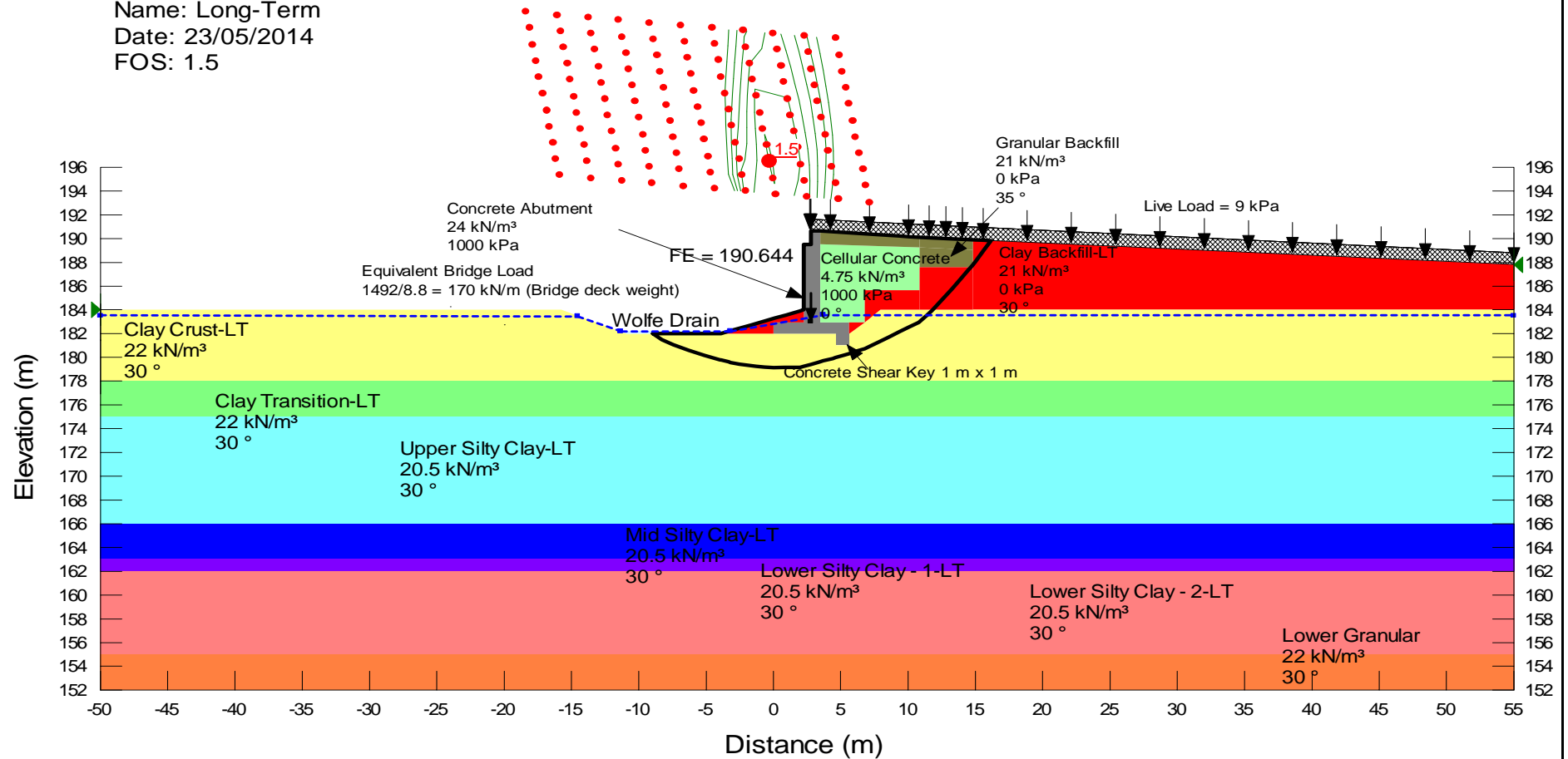
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 Date: 23/05/2014
 FOS: 3.9



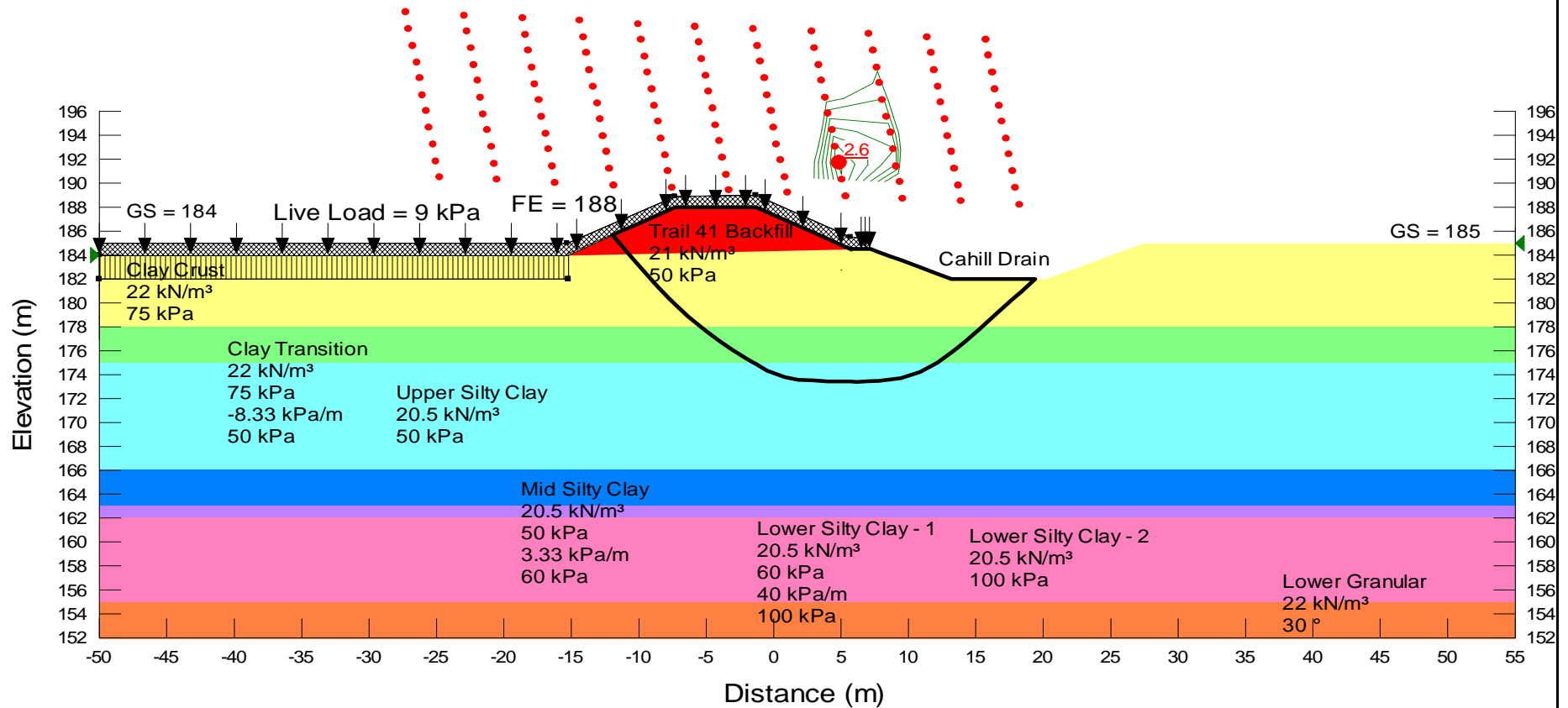
File Name: TB-7-West Abutment-Longitudinal.gsz
 Name: Short-Term
 Date: 23/05/2014
 FOS: 2.0



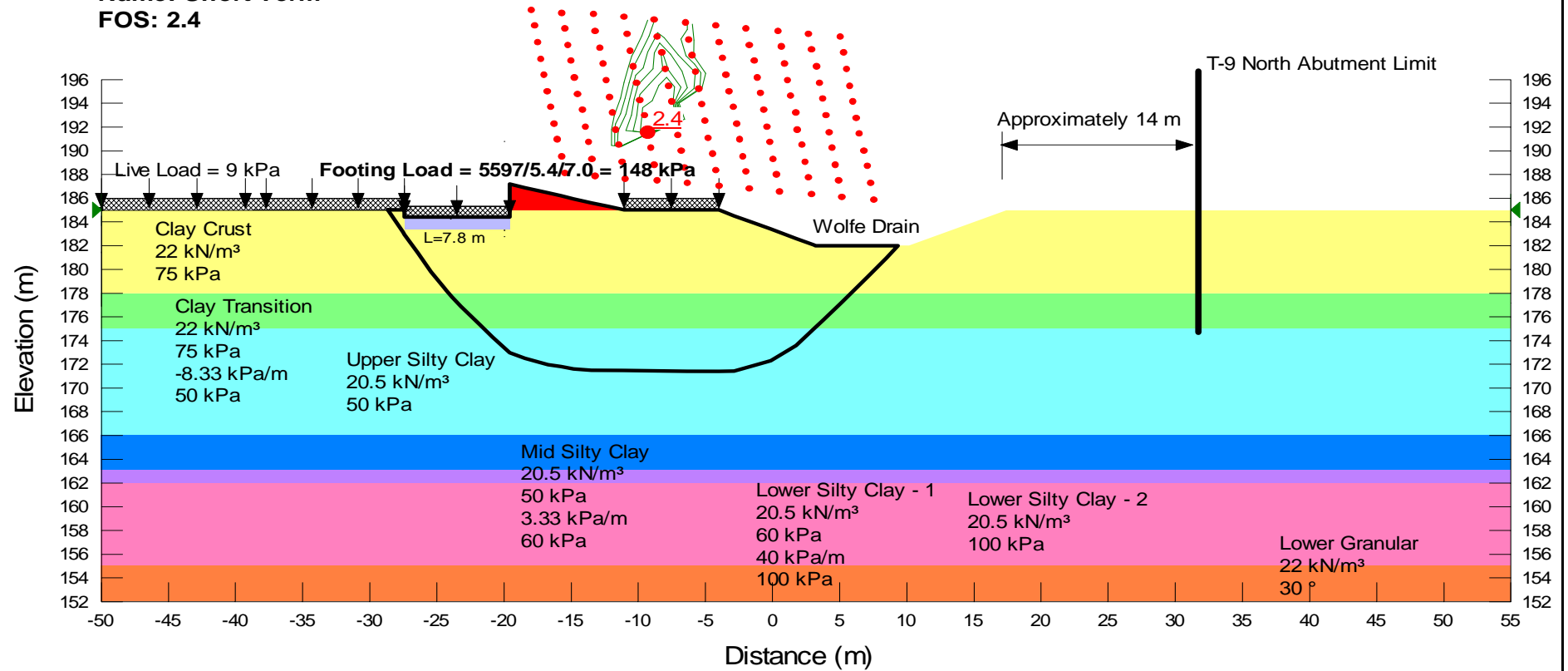
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 Name: Long-Term
 Date: 23/05/2014
 FOS: 1.5



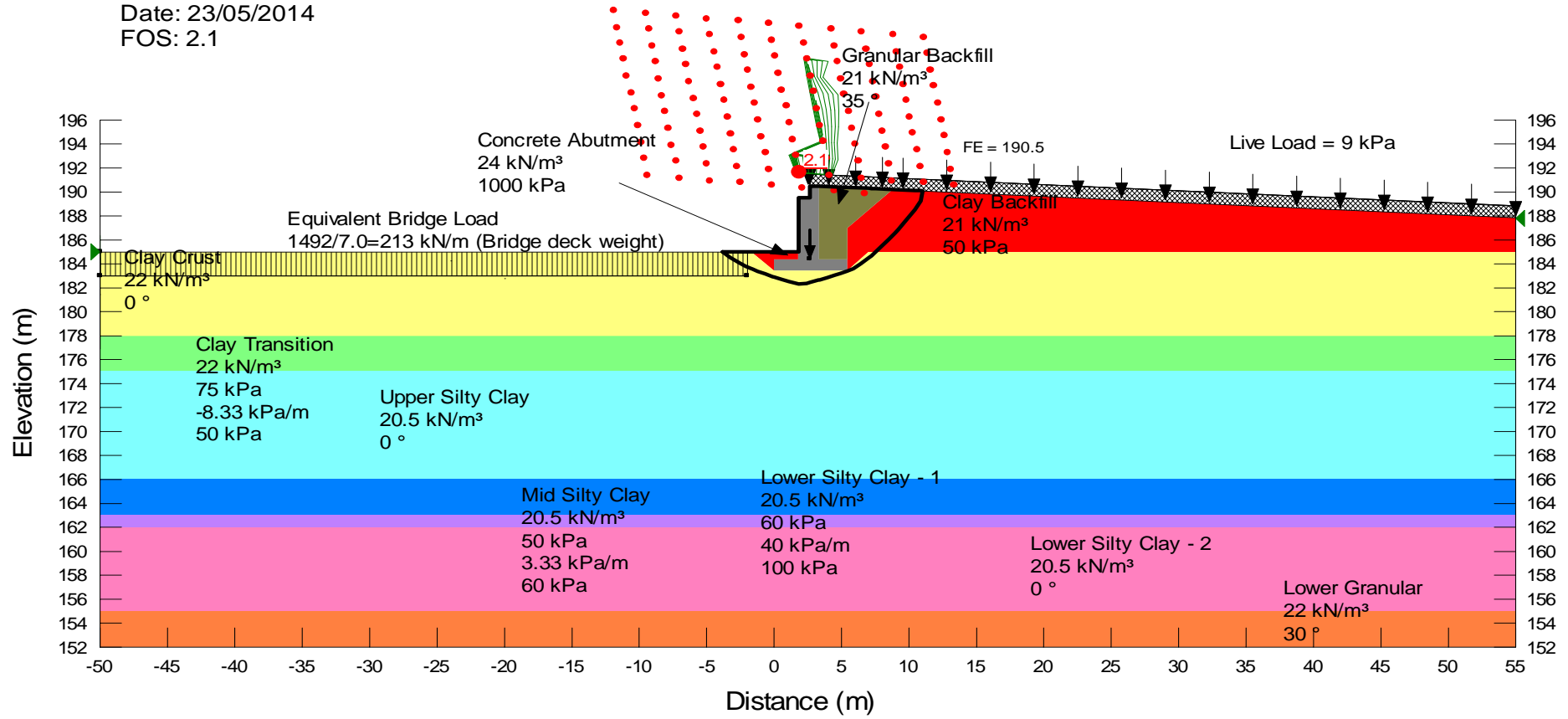
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Date: 23/05/2014
Name: Short-Term
FOS: 2.6



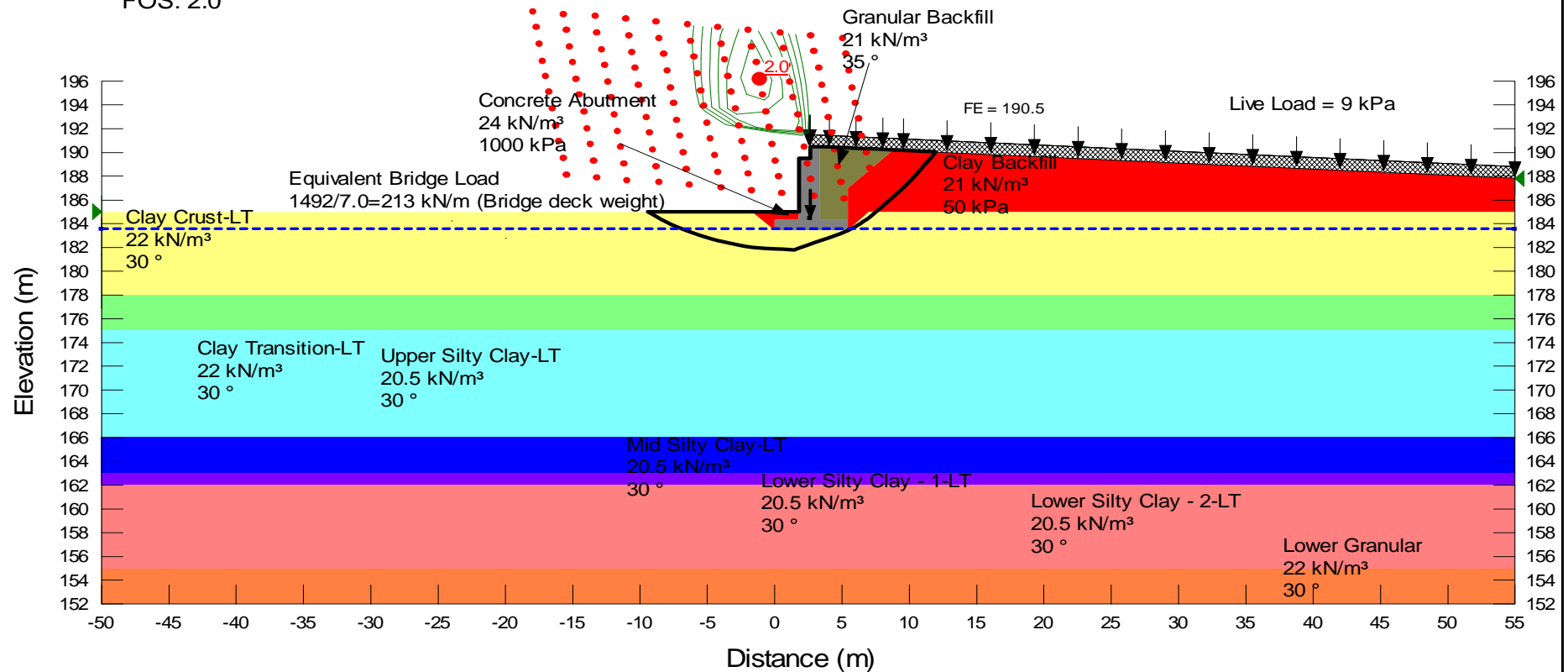
File Name: TB-7-East Abutment Sta. 10+085-Bridge Footing.gsz
Date: 23/05/2014
Name: Short-Term
FOS: 2.4



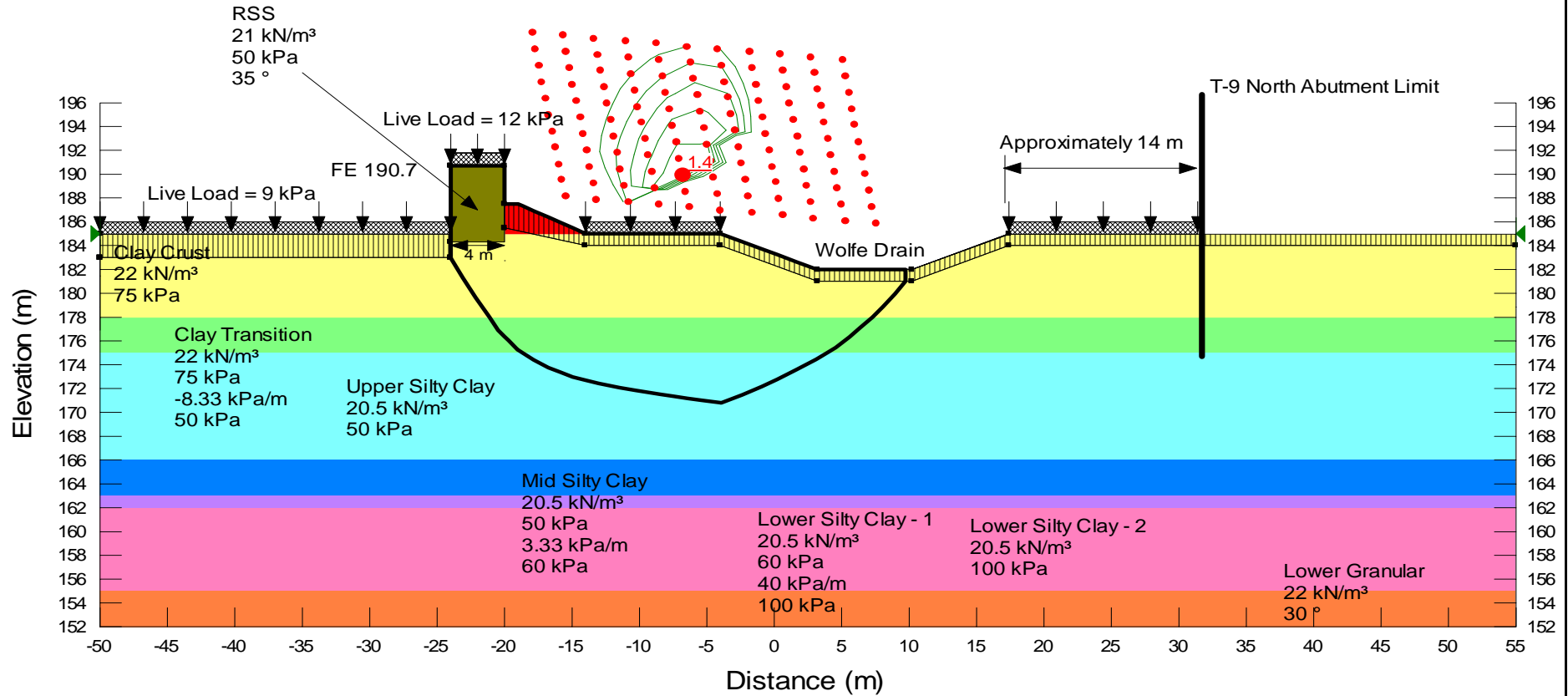
File Name: TB-7-East Abutment.gsz
 Name: Short-Term
 Date: 23/05/2014
 FOS: 2.1



File Name: TB-7-East Abutment.gsz
 Name: Long-Term
 Date: 23/05/2014
 FOS: 2.0



File Name: TB-7-SE RSS Wall-Sta. 10+086-Short-Term.gsz
 Date: 23/05/2014
 Name: Short-Term
 FOS: 1.4

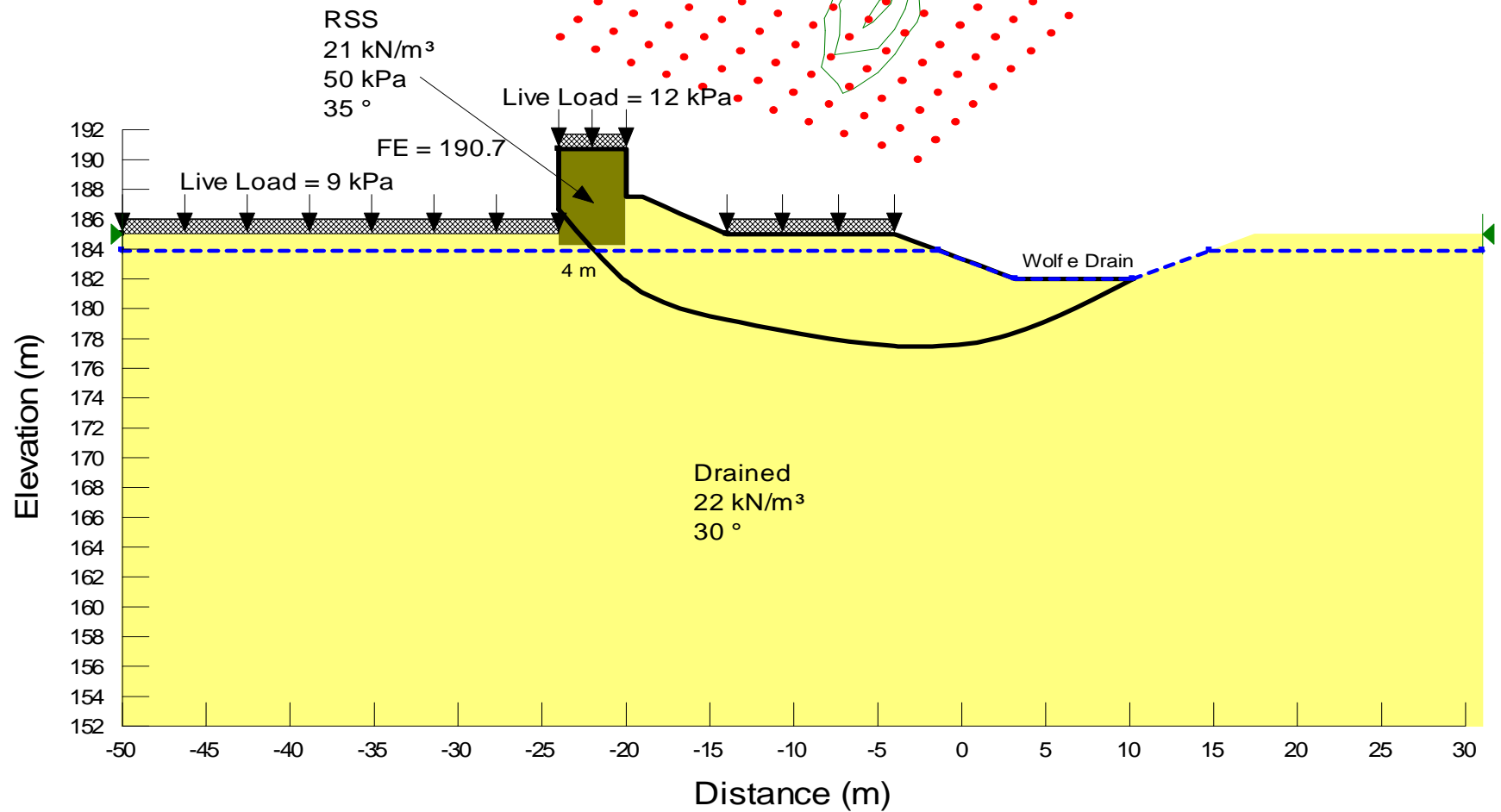


File Name: TB-7-SE RSS Wall-Sta. 10+086-Long-Term.gsz

Date: 23/05/2014

Name: Long-Term

FOS: 2.2

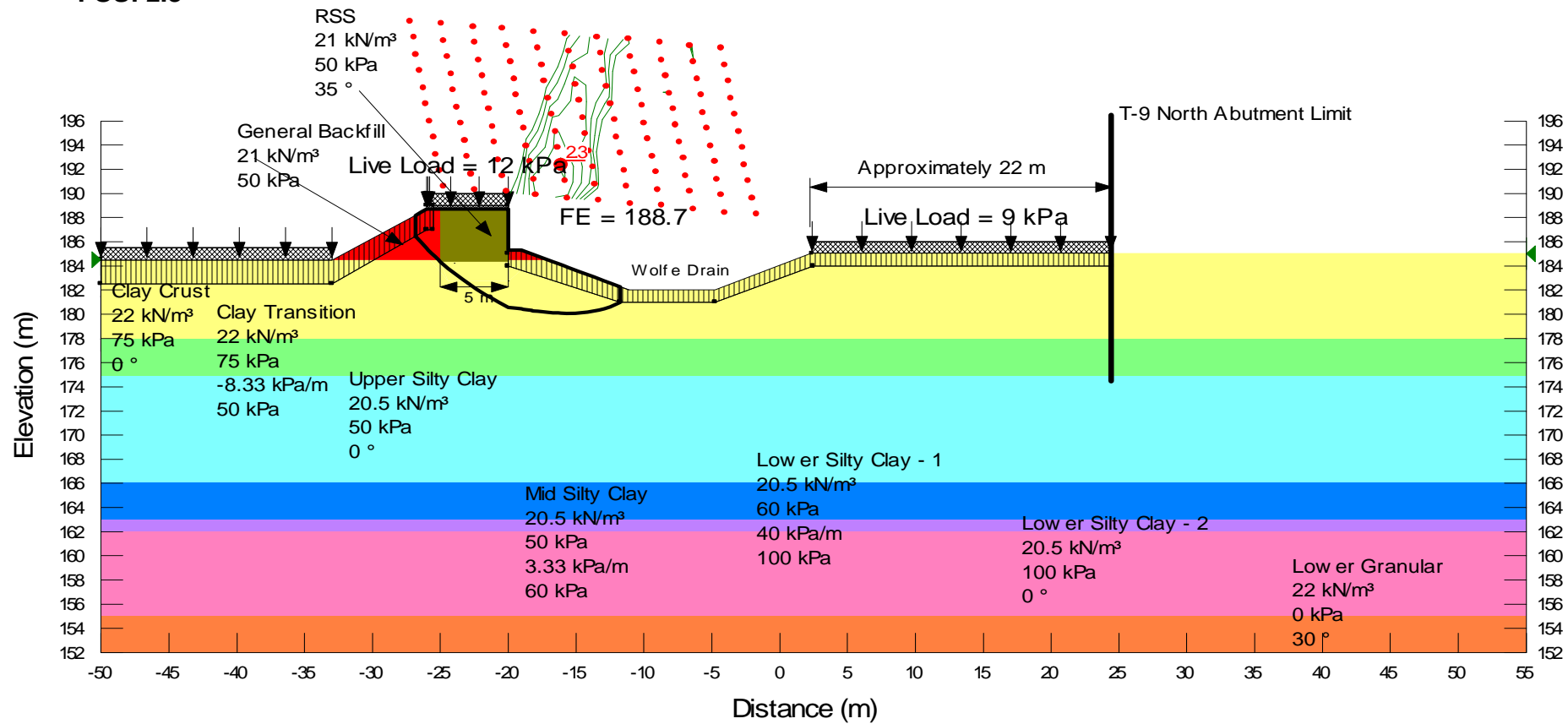


File Name: TB-7-SE RSS Sta. 10+125.gsz

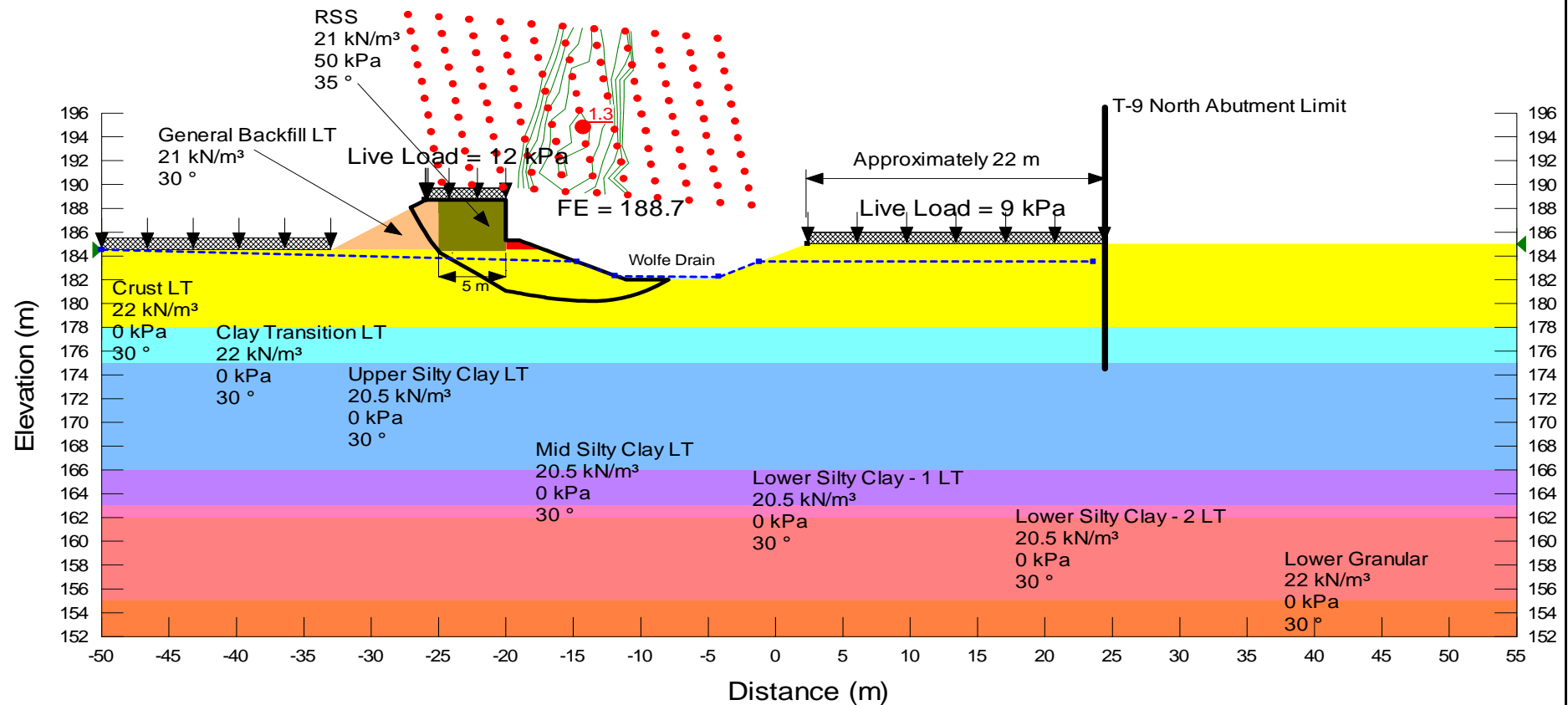
Date: 23/05/2014

Name: Short-Term

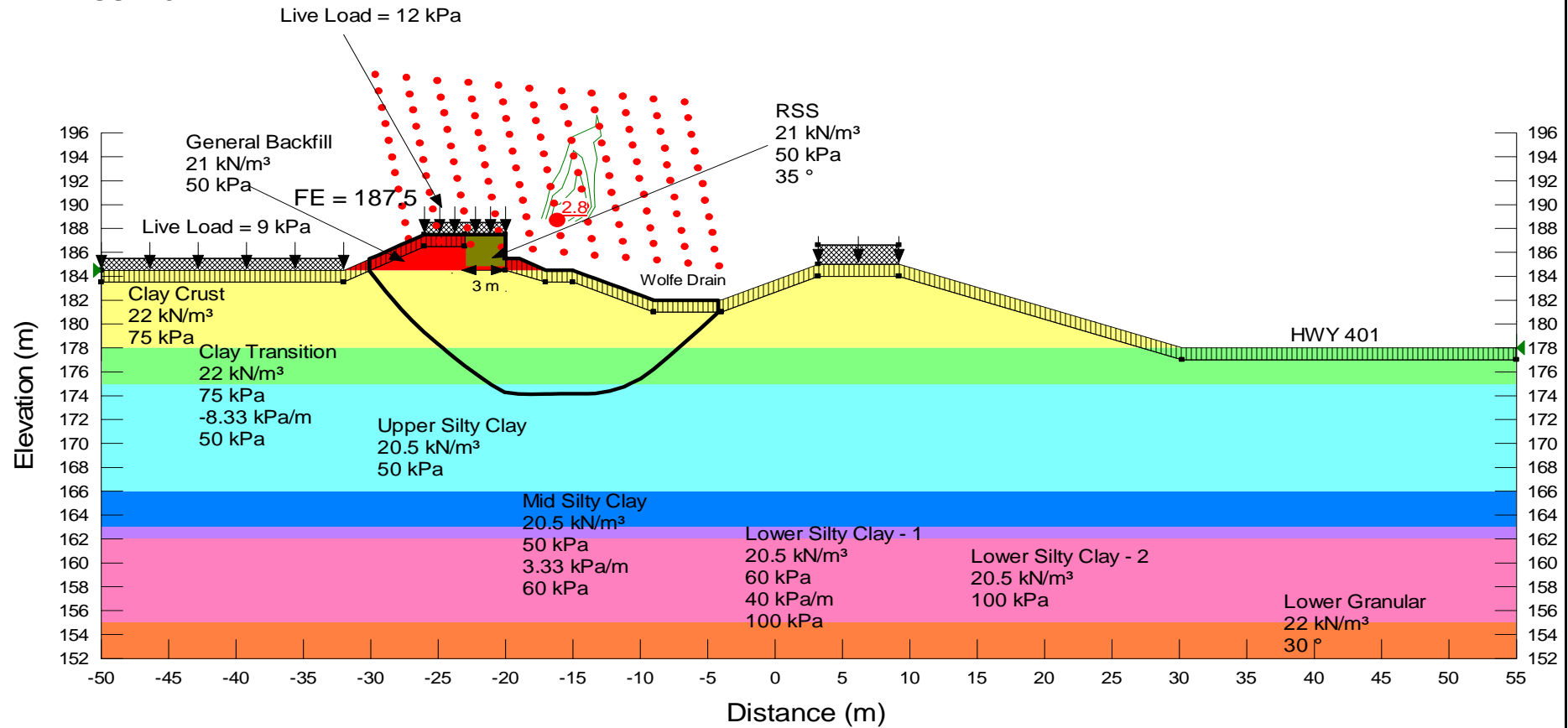
FOS: 2.3



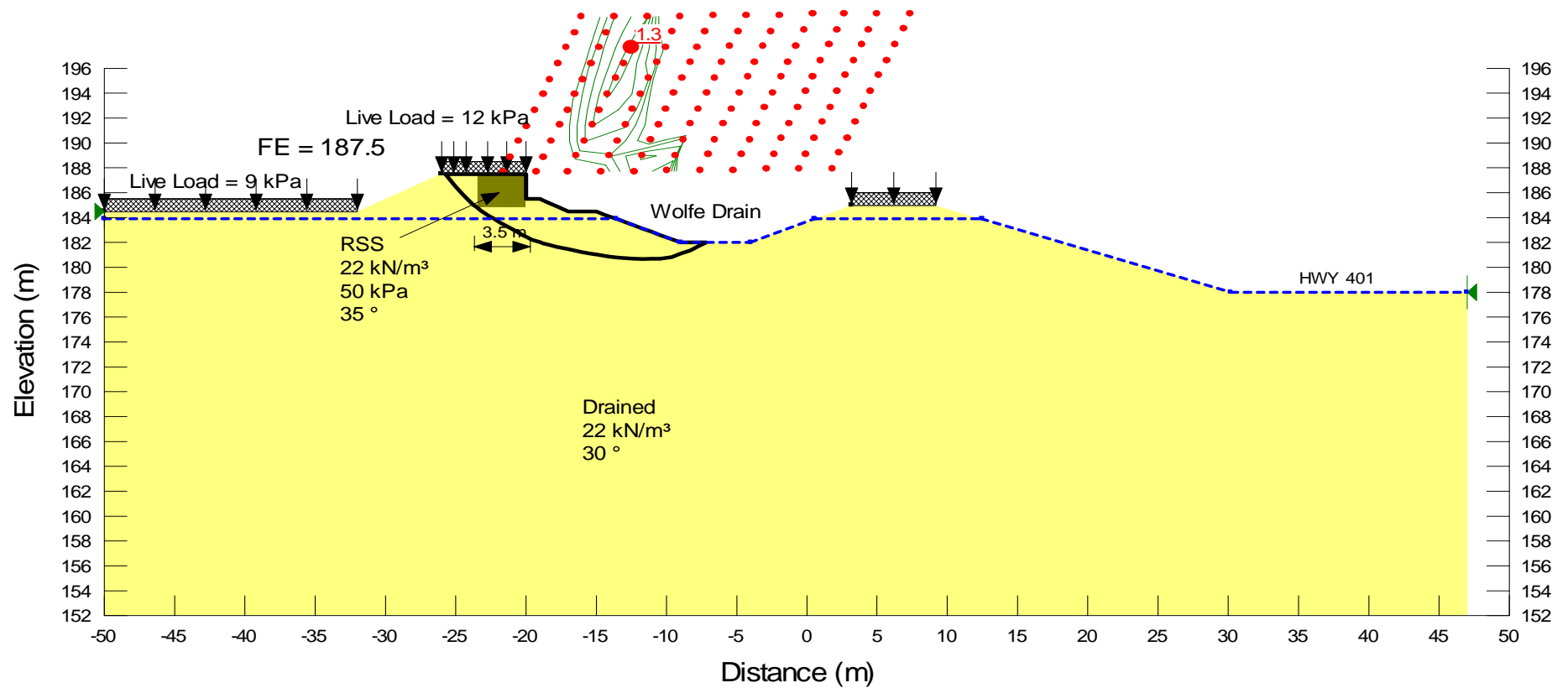
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 Date: 23/05/2014
 Name: Long-Term
 FOS: 1.3



File Name: TB-7-SE RSS Wall-Sta. 10+155-Short-Term.gsz
Date: 23/05/2014
Name: Short-Term
FOS: 2.8

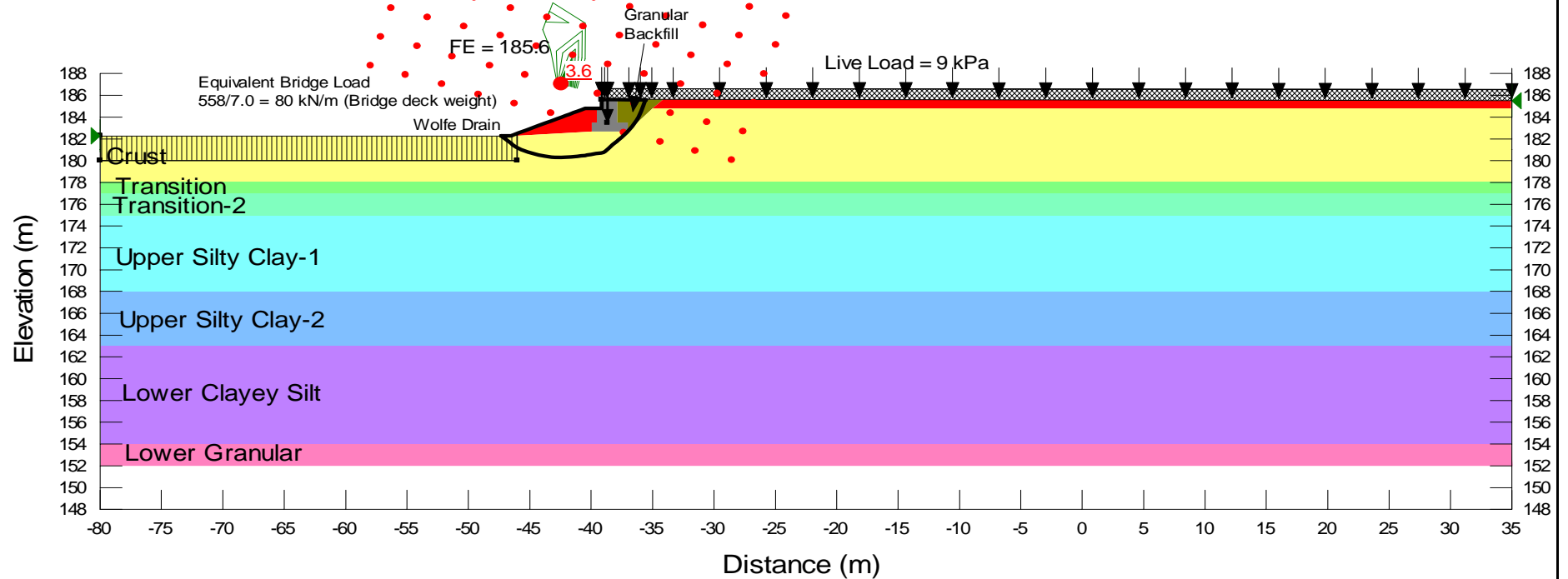


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 Date: 23/05/2014
 Name: Long-Term
 FOS: 1.3



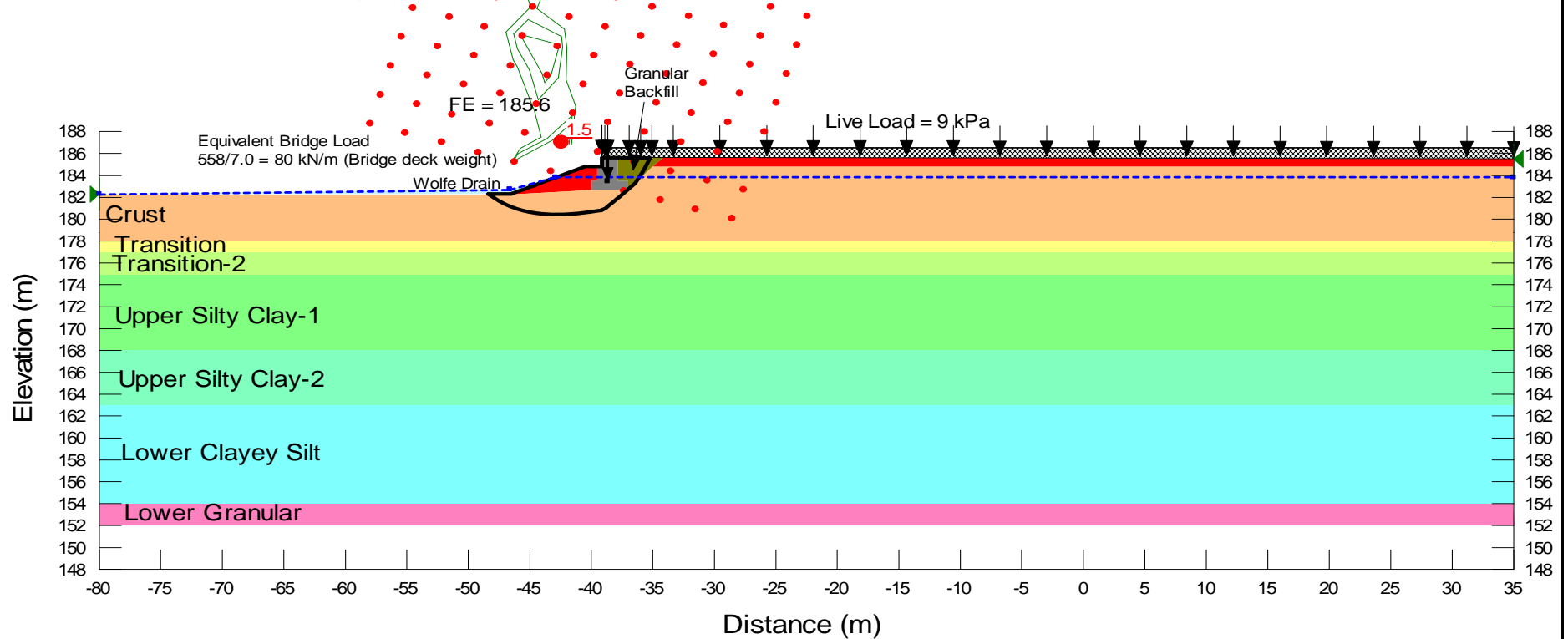
**TB-7A North Abutment.gsz; Short-Term
25/06/2014**

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: 52.5 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 °
 Name: Granular Backfill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 35 °



TB-7A North Abutment.gsz; Long-Term
25/06/2014

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 °
 Name: Granular Backfill Unit Weight: 21 kN/m³ Cohesion: 0 kPa Phi: 35 °



File Name: TB-7A South Abutment-Bridge Footing.gsz

Date: 25/06/2014

Name: Short-Term

FOS: 1.3

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°

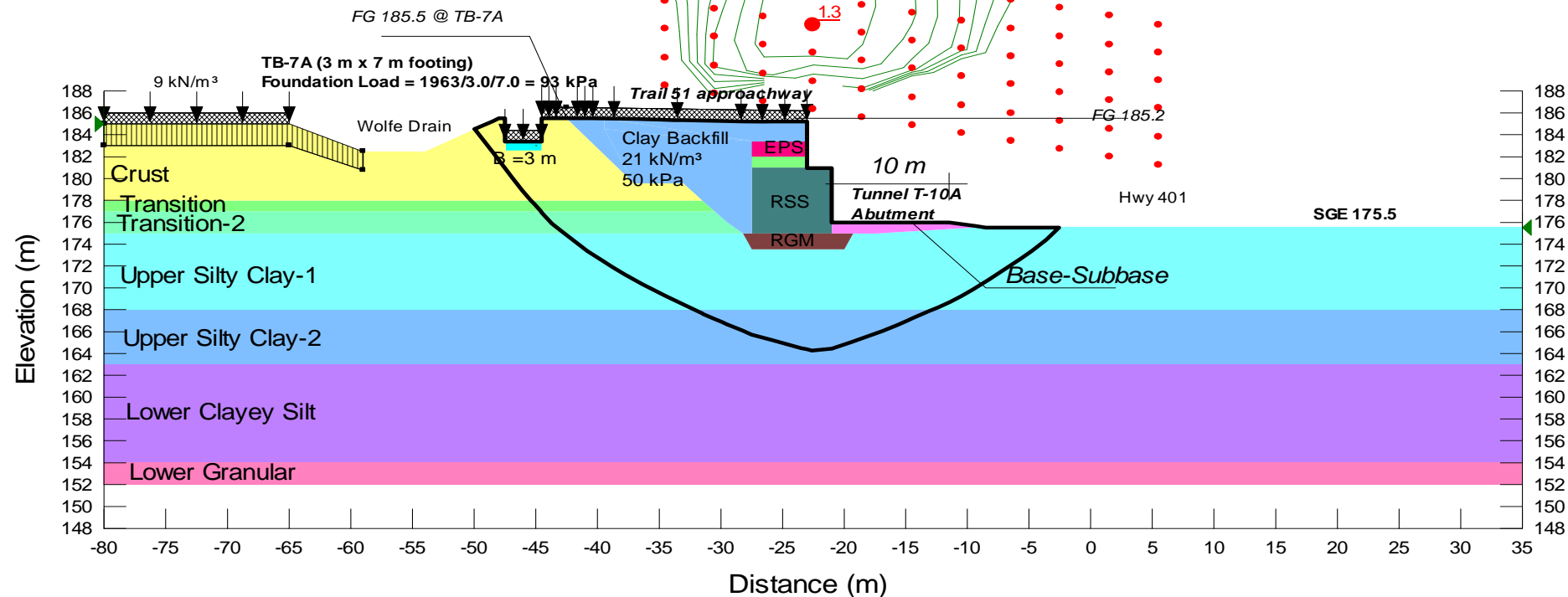
Name: RSS Backfill Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35°

Name: Concrete Unit Weight: 0.1 kN/m³ Cohesion: 1000 kPa Phi: 0°

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°



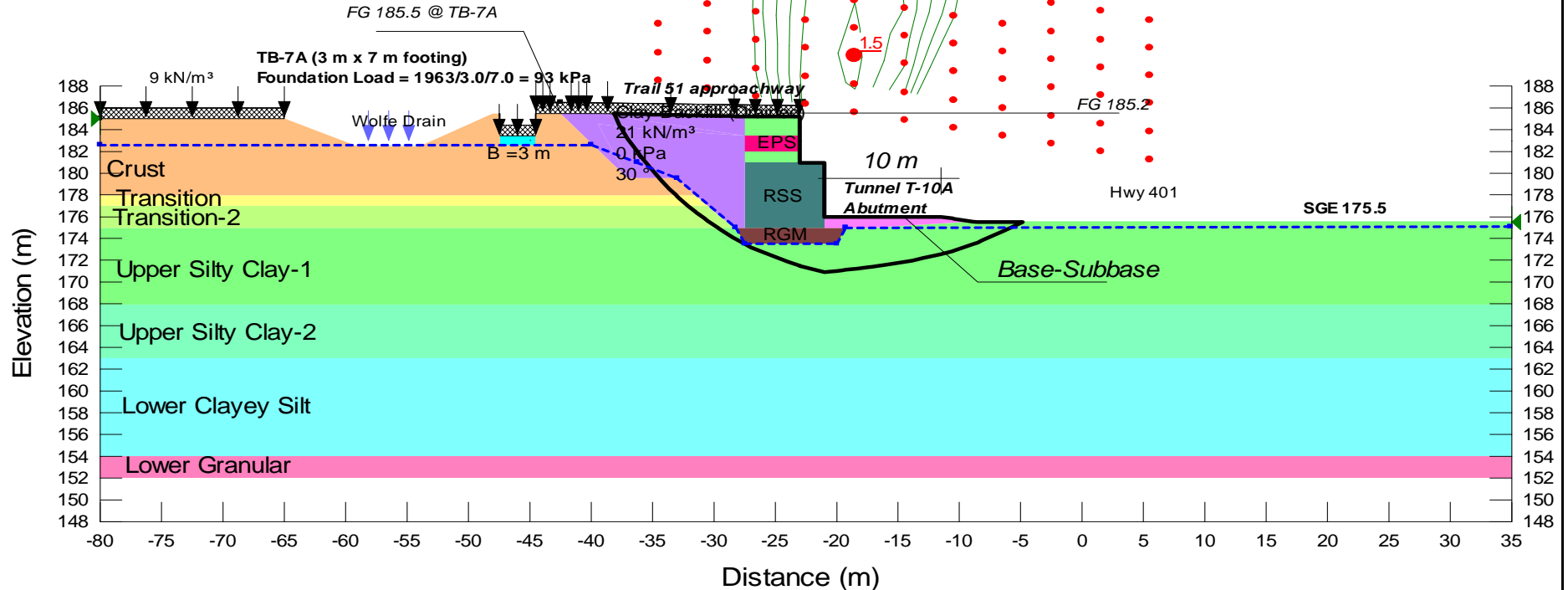
File Name: TB-7A South Abutment-Bridge Footing.gsz

Date: 25/06/2014

Name: Long-Term

FOS: 1.5

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: 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: Concrete Unit Weight: 0.1 kN/m³ Cohesion: 1000 kPa Phi: 0 °
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-7A South Embankment.gsz

11/06/2014

Short-Term

FOS: 1.3

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

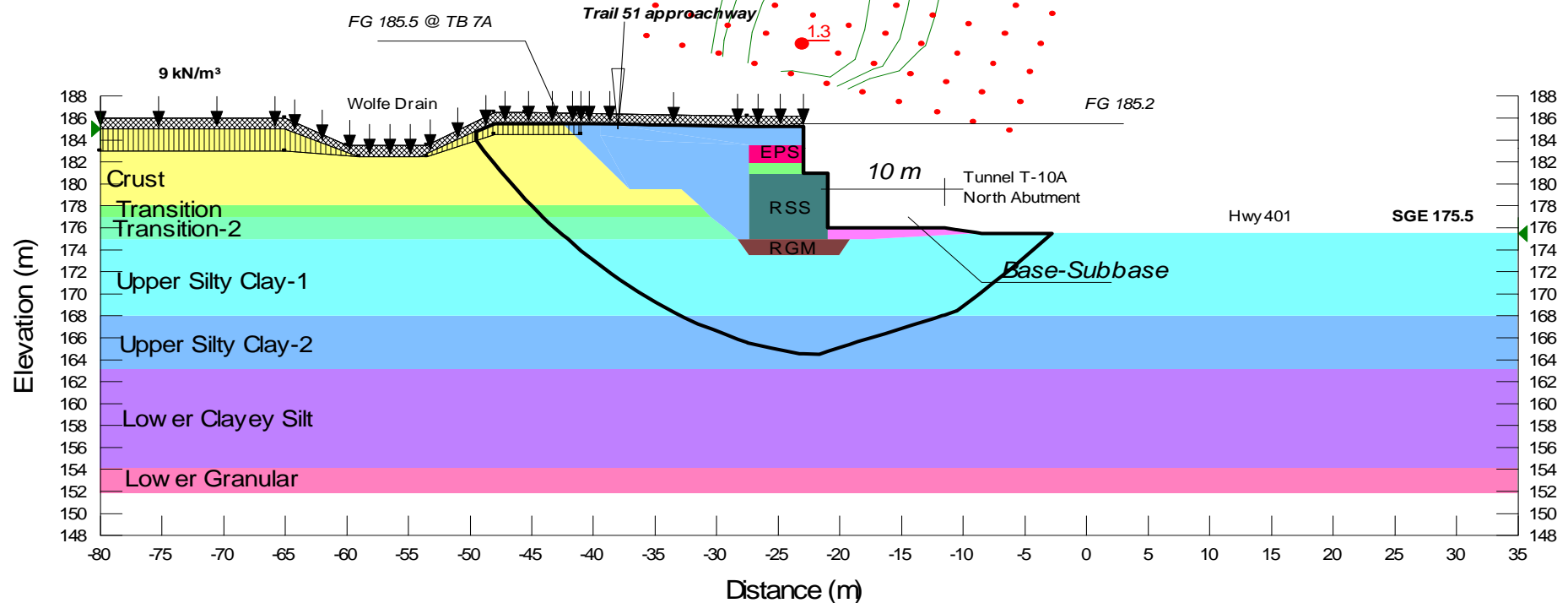
Name: RGM Backfill Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °

Name: RSS Backfill Unit Weight: 21 kN/m³ Cohesion: 50 kPa Phi: 35 °

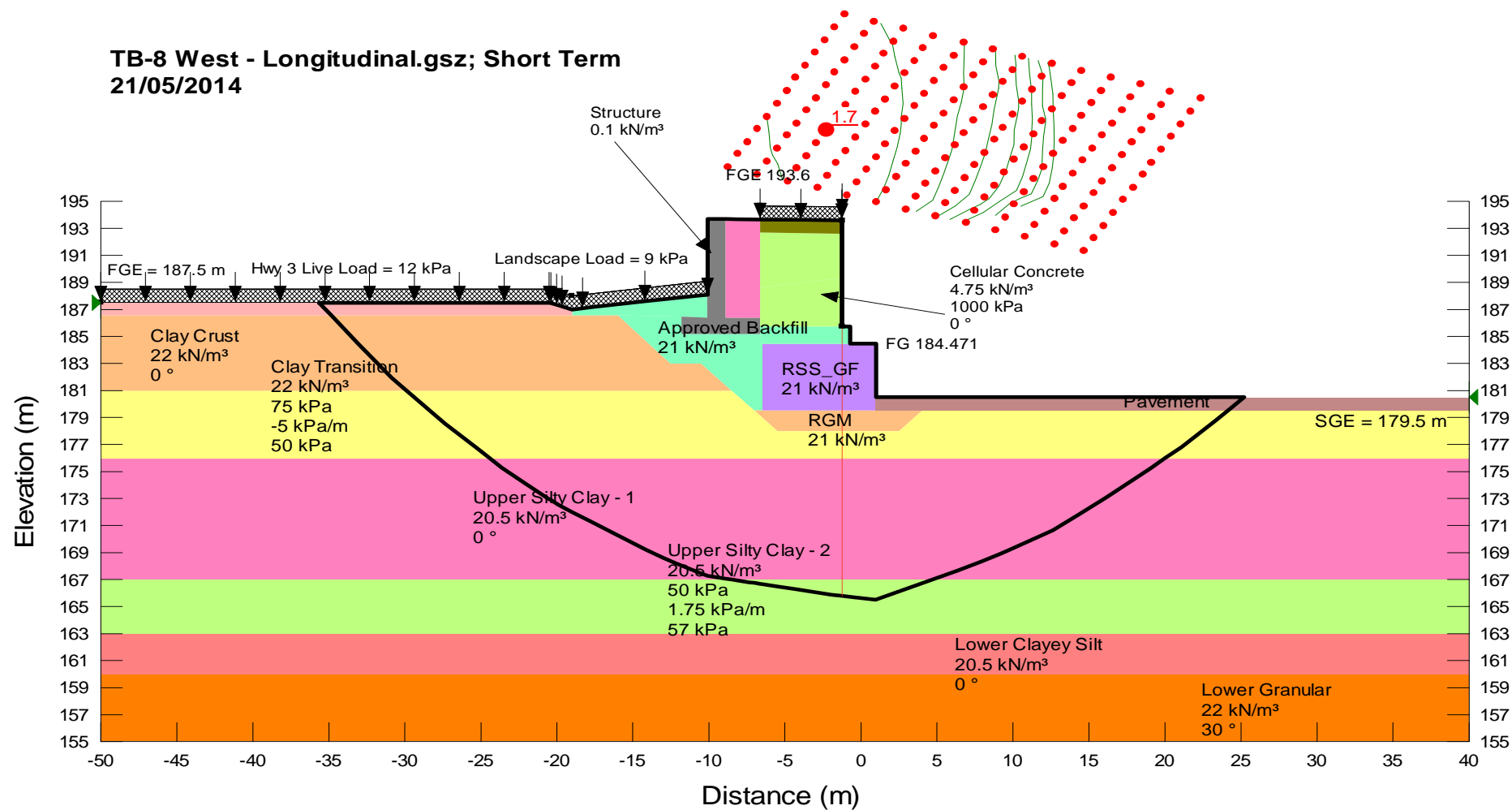
Name: EPS Unit Weight: 0.5 kN/m³ Cohesion: 25 kPa Phi: 0 °

Name: Granular Unit Weight: 22 kN/m³ Cohesion: 25 kPa Phi: 35 °

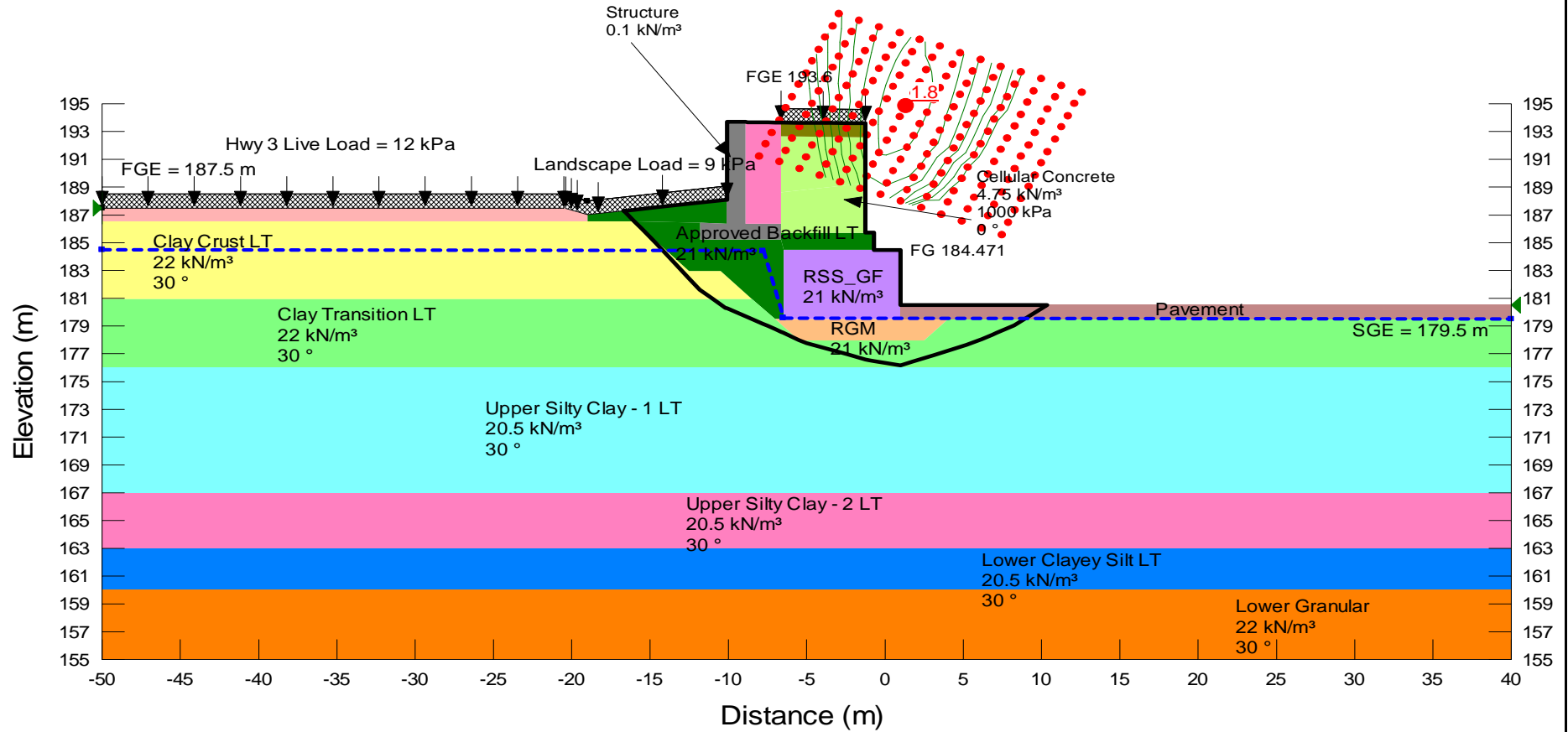
Name: Base-Subbase Unit Weight: 12 kN/m³ Cohesion: 0 kPa Phi: 32 °



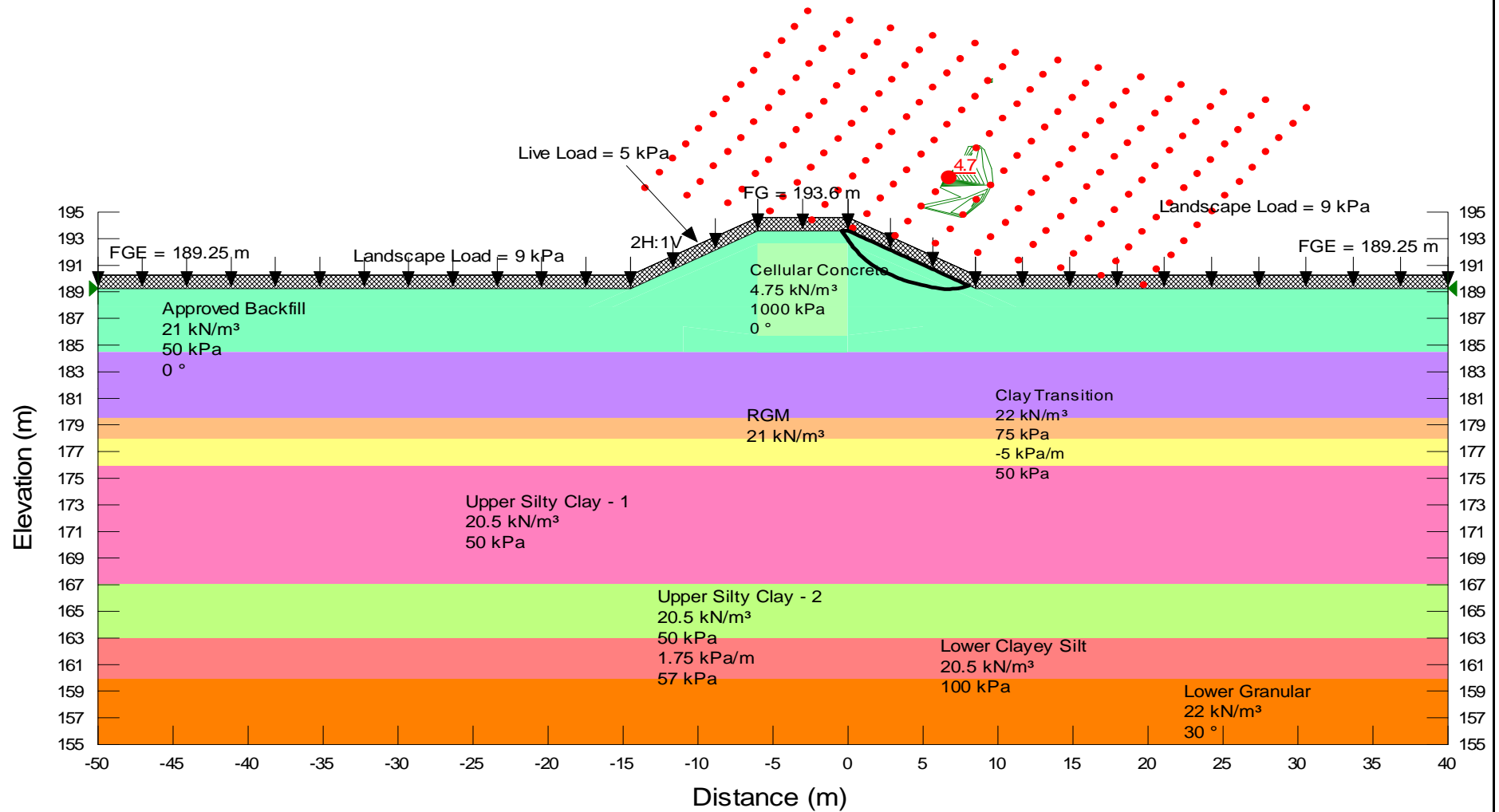
**TB-8 West - Longitudinal.gsz; Short Term
21/05/2014**



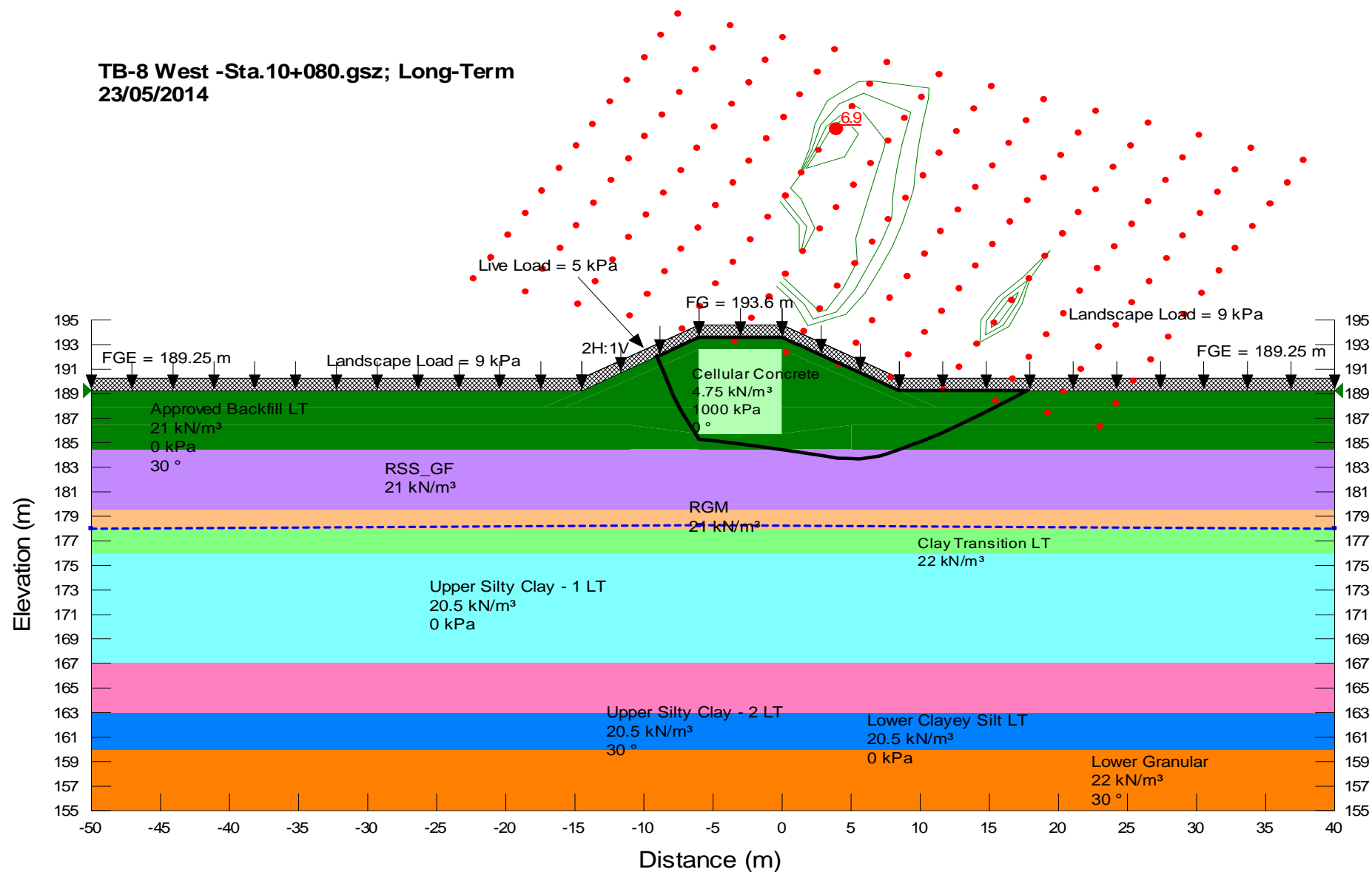
TB-8 West - Longitudinal.gsz; Long Term
21/05/2014



TB-8 West -Sta.10+080.gsz; Short-Term
23/05/2014



TB-8 West -Sta.10+080.gsz; Long-Term
23/05/2014

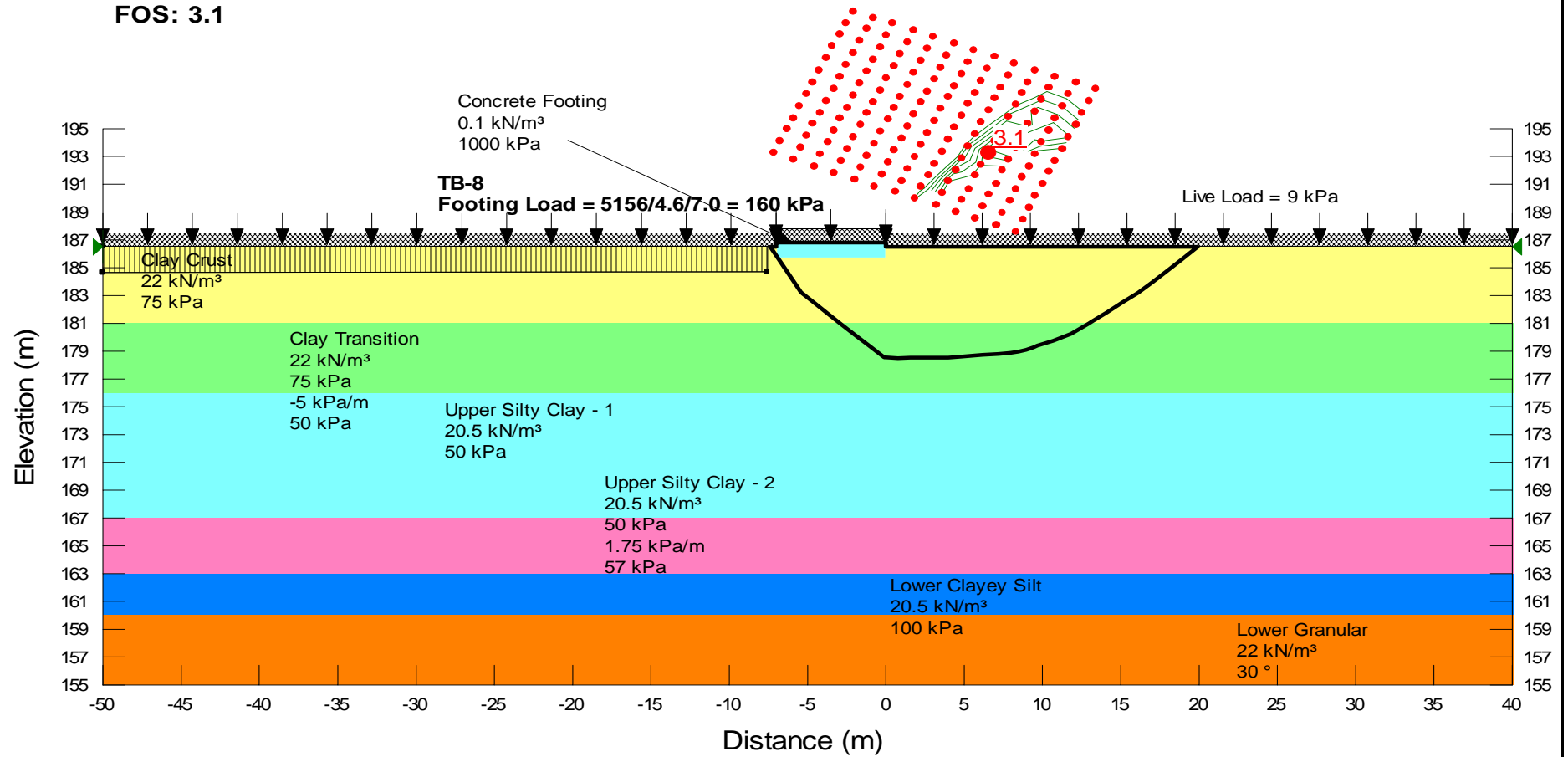


File Name: TB-8- East Abutment-Sta.10+014_Bridge Footing.gsz

Name: Short-Term

Date: 21/05/2014

FOS: 3.1

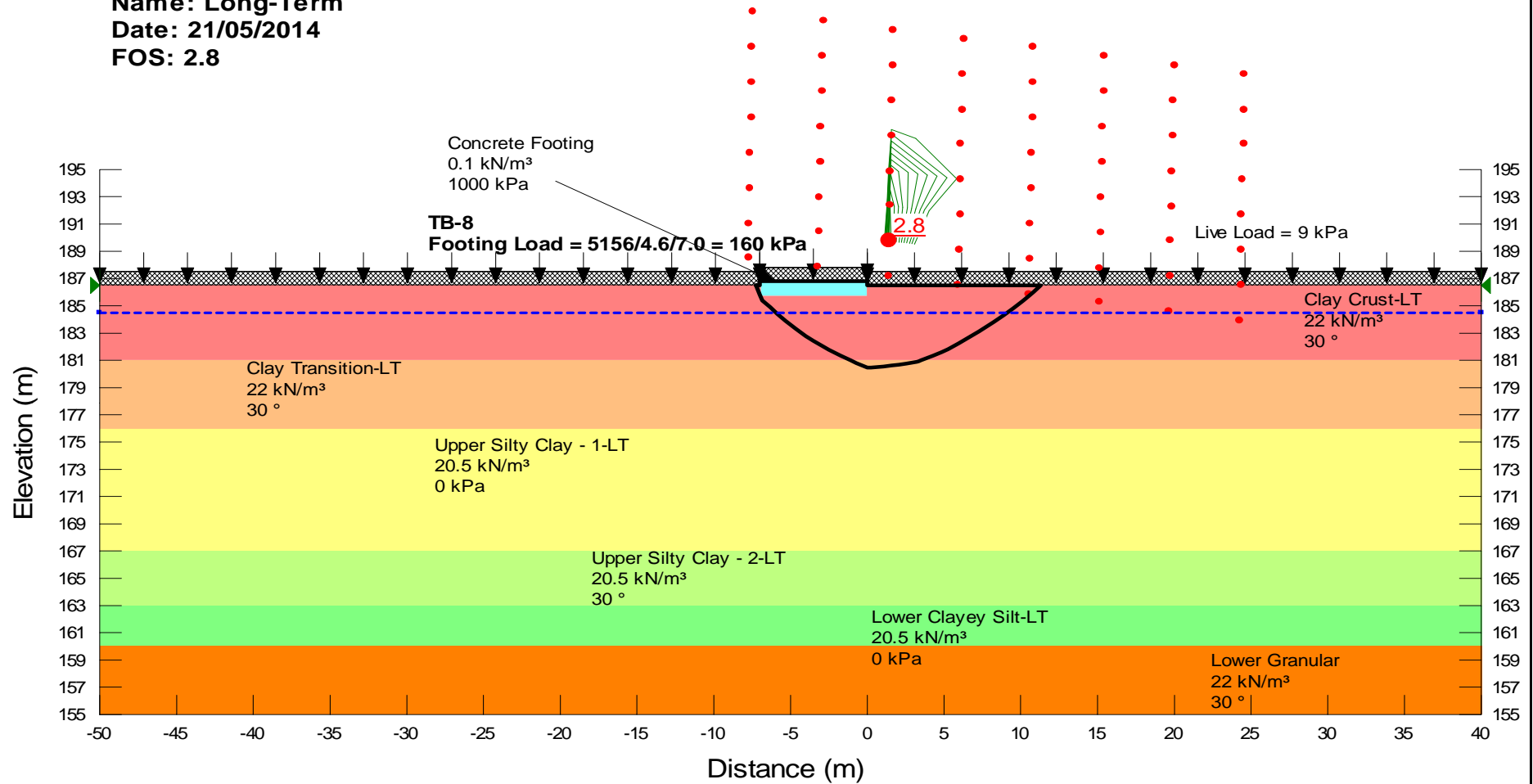


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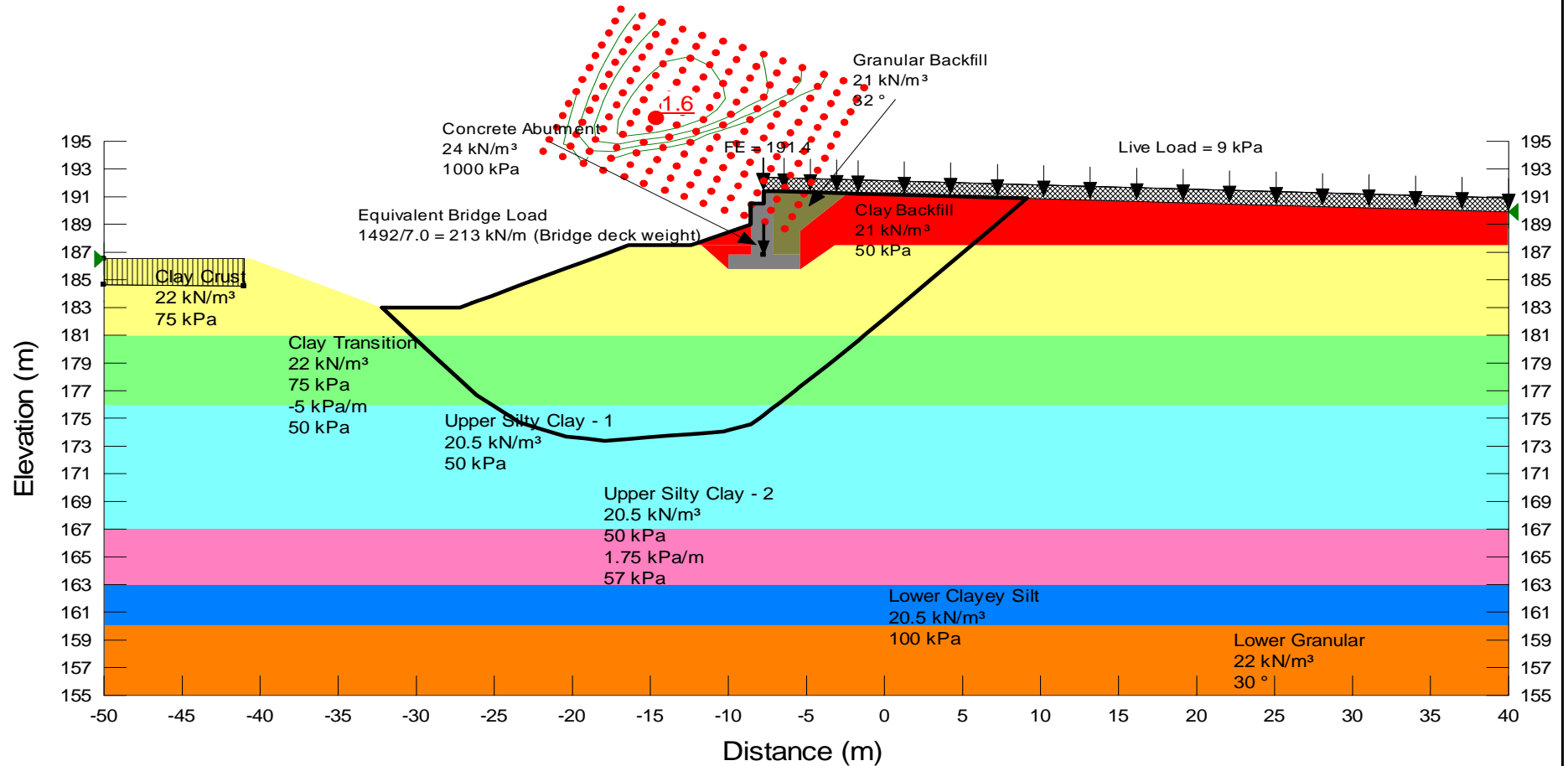
Name: Long-Term

Date: 21/05/2014

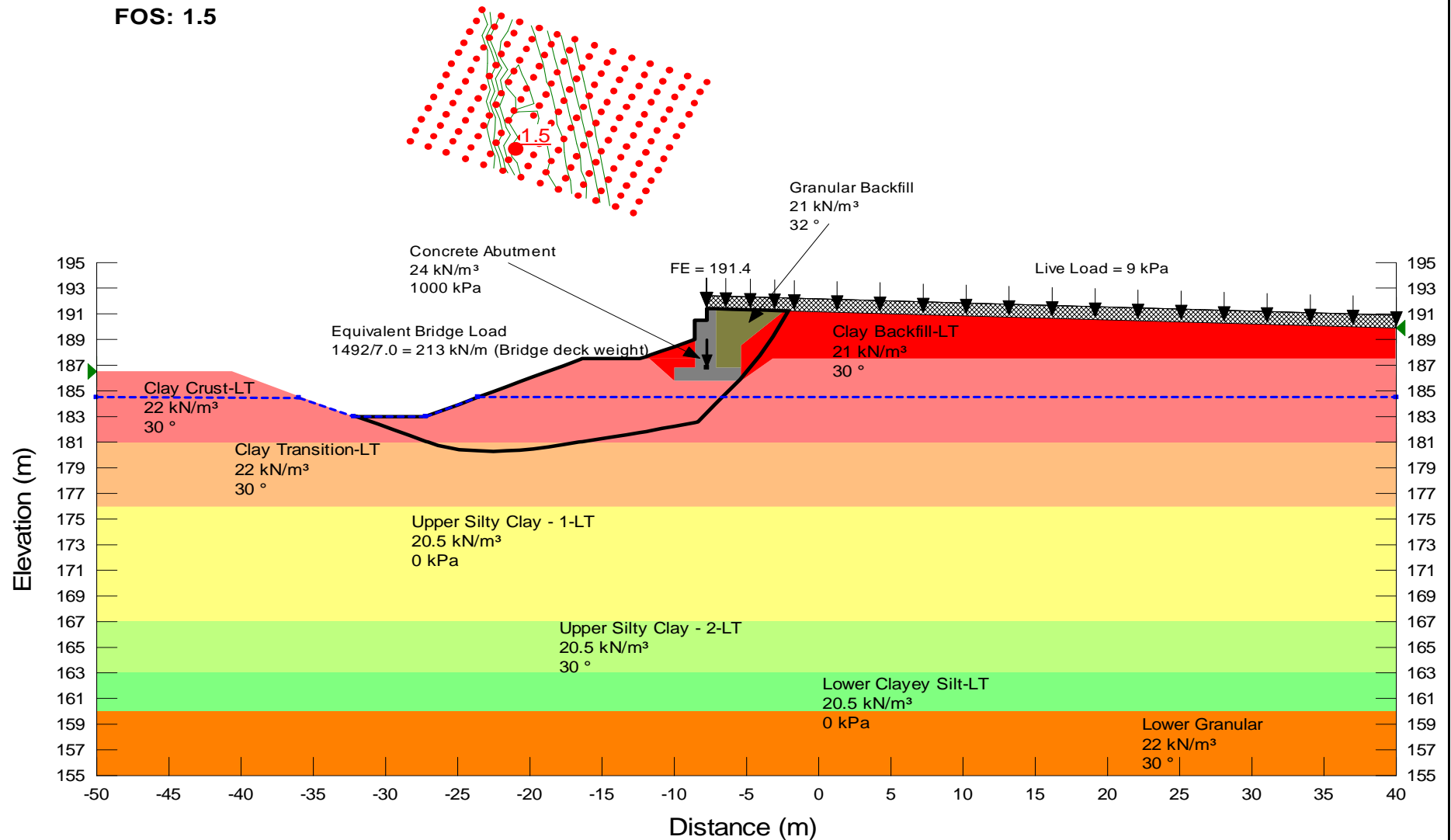
FOS: 2.8



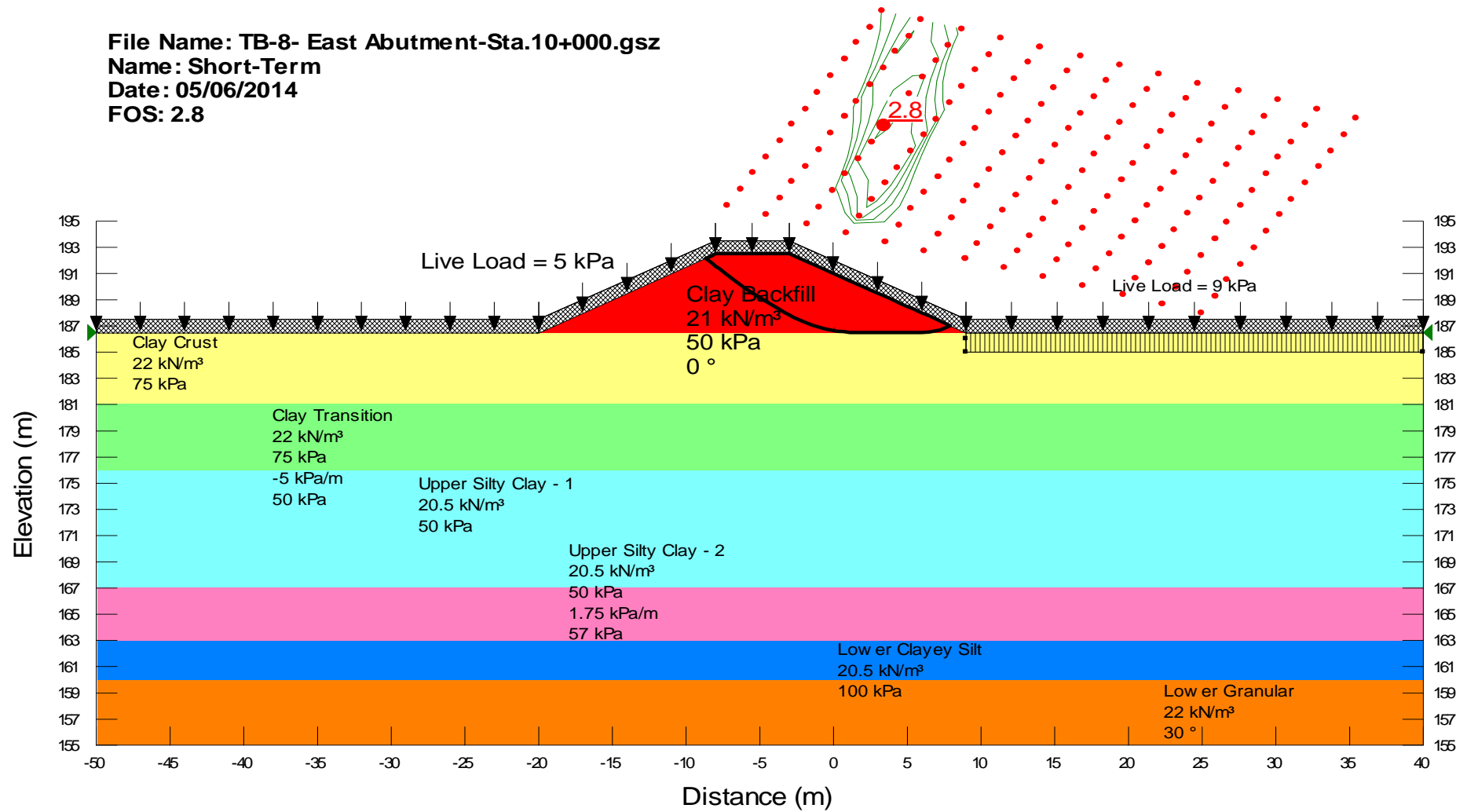
File Name: TB-8- East Abutment.gsz
 Name: Short-Term
 Date: 21/05/2014
 FOS: 1.6



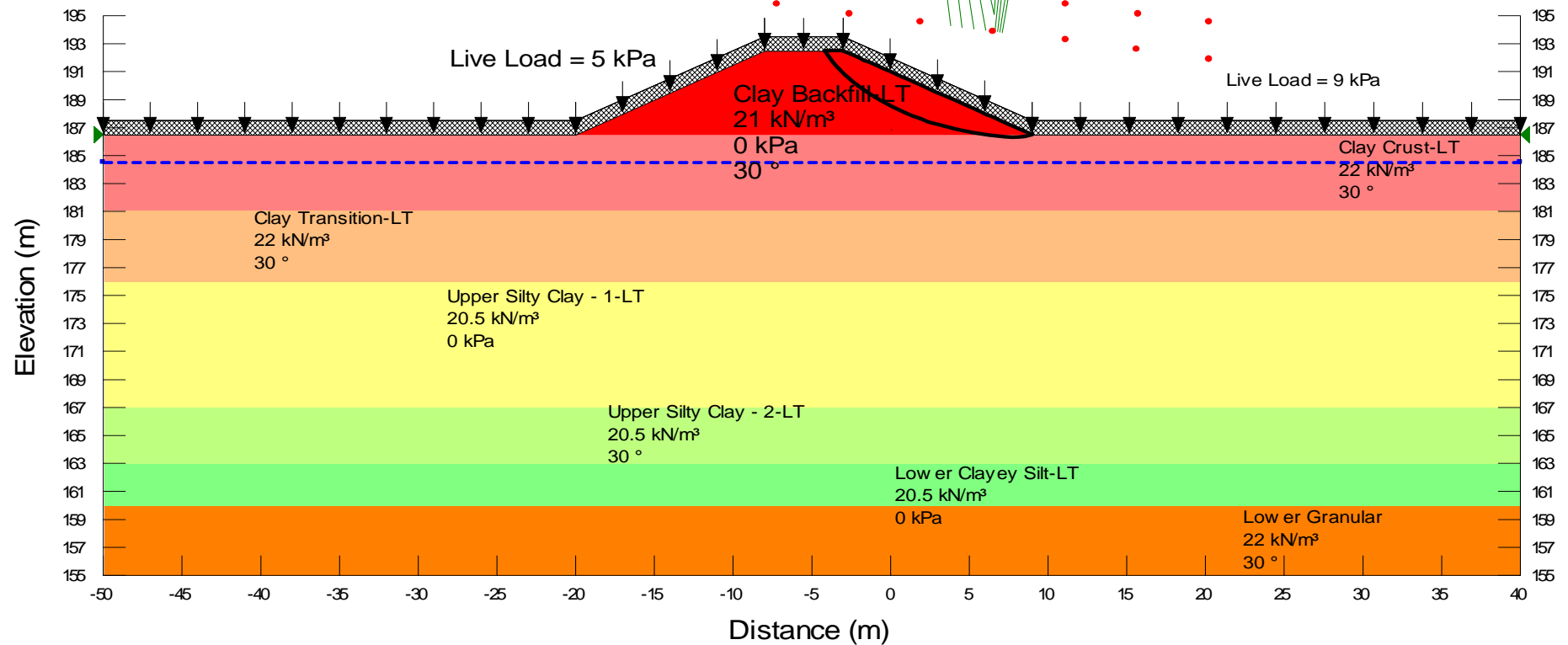
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 Name: Long-Term
 Date: 21/05/2014
 FOS: 1.5



File Name: TB-8- East Abutment-Sta.10+000.gsz
 Name: Short-Term
 Date: 05/06/2014
 FOS: 2.8



File Name: TB-8- East Abutment-Sta.10+000.gsz
 Name: Long-Term
 Date: 05/06/2014
 FOS: 1.4



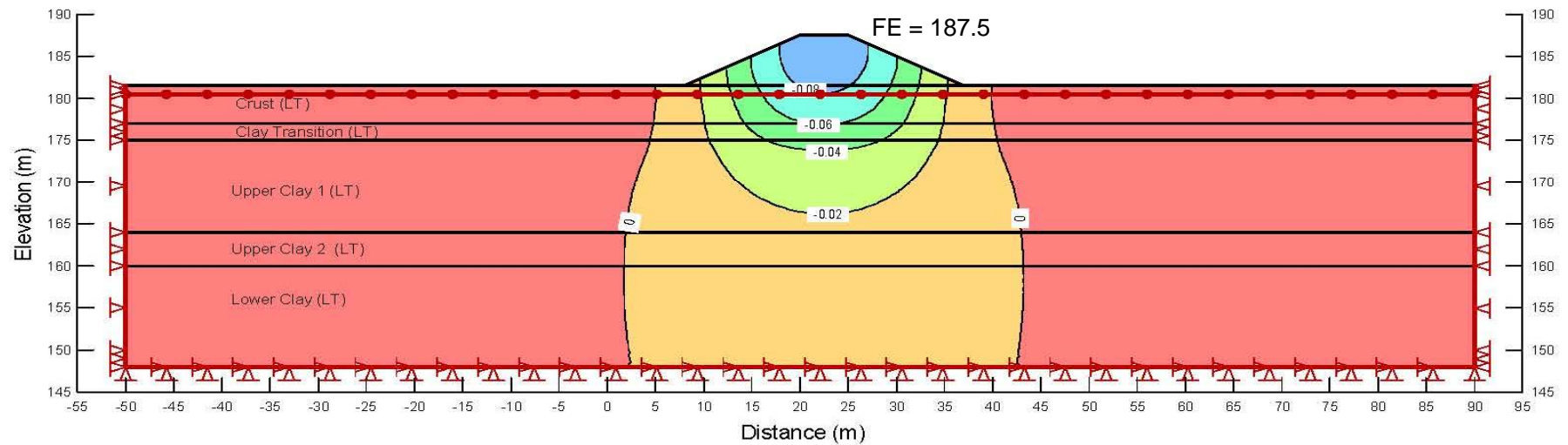
Appendix E Stress-Deformation Analyses of Embankments

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)

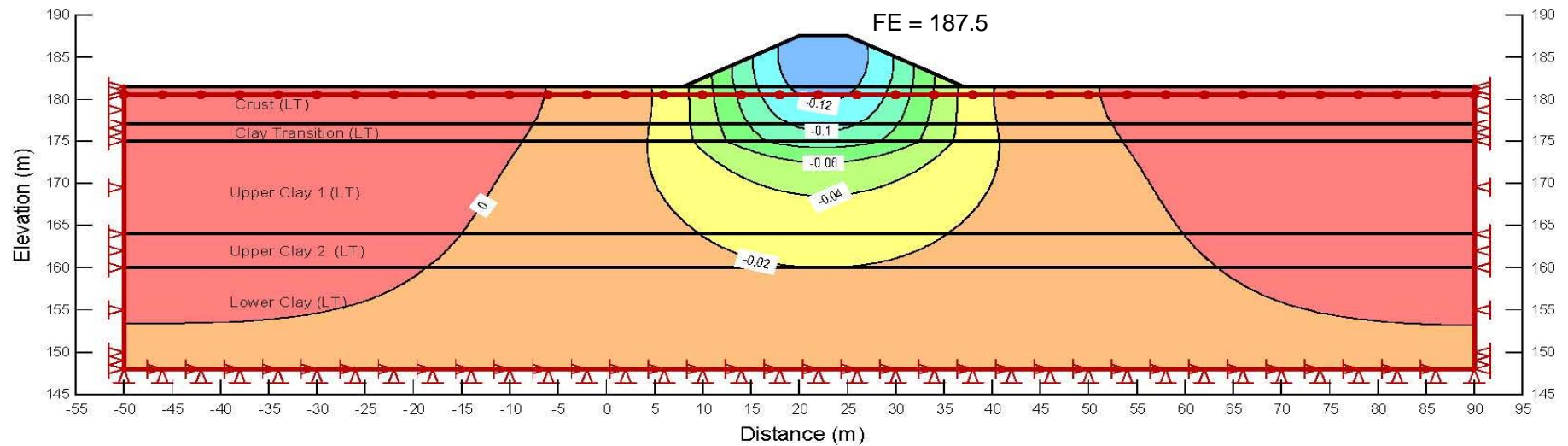
Value shown on contour line is in metre (m), negative is downward movement.

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

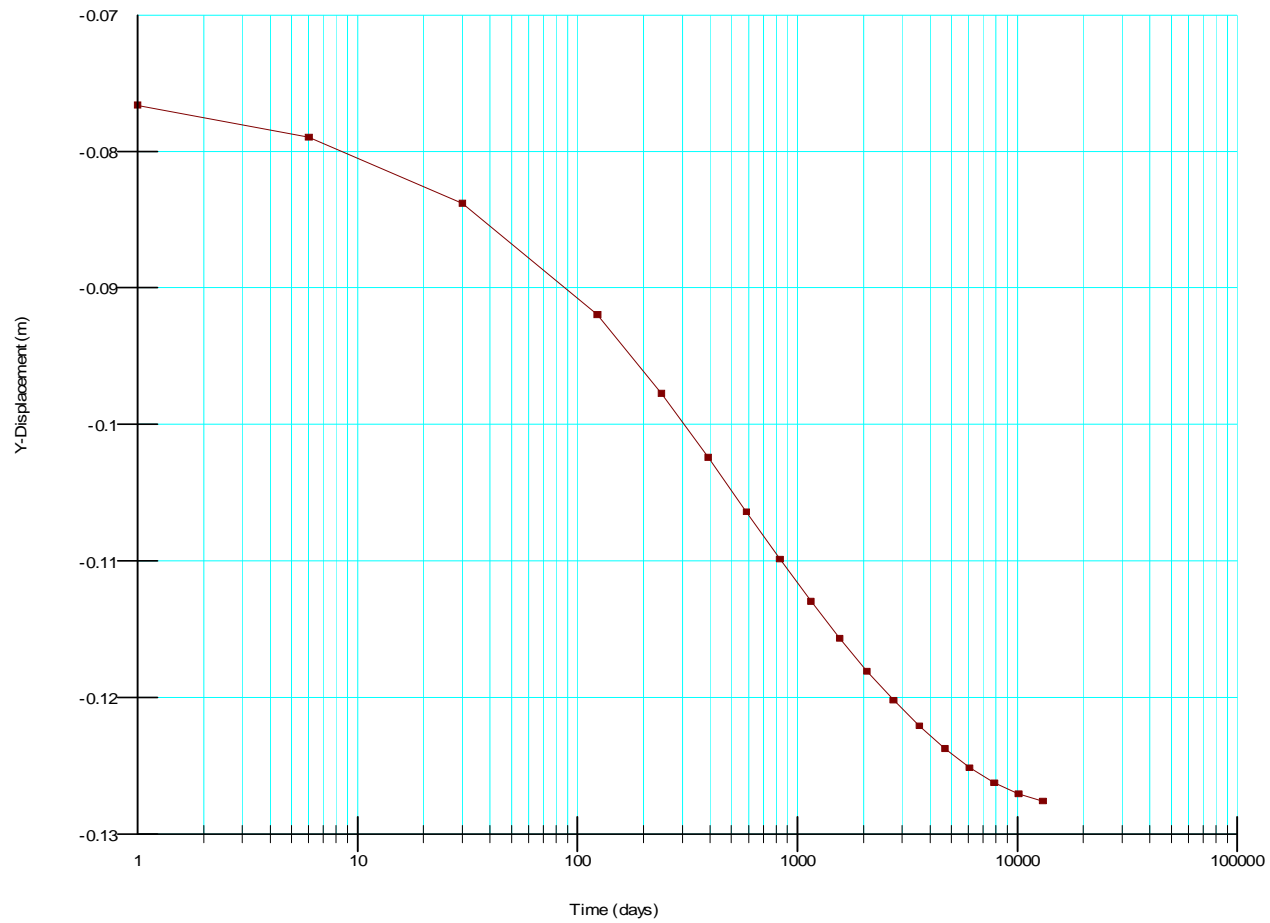


Legend:

LONG-TERM (Day 13030 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.

TB-1 South Embankment - Consolidation



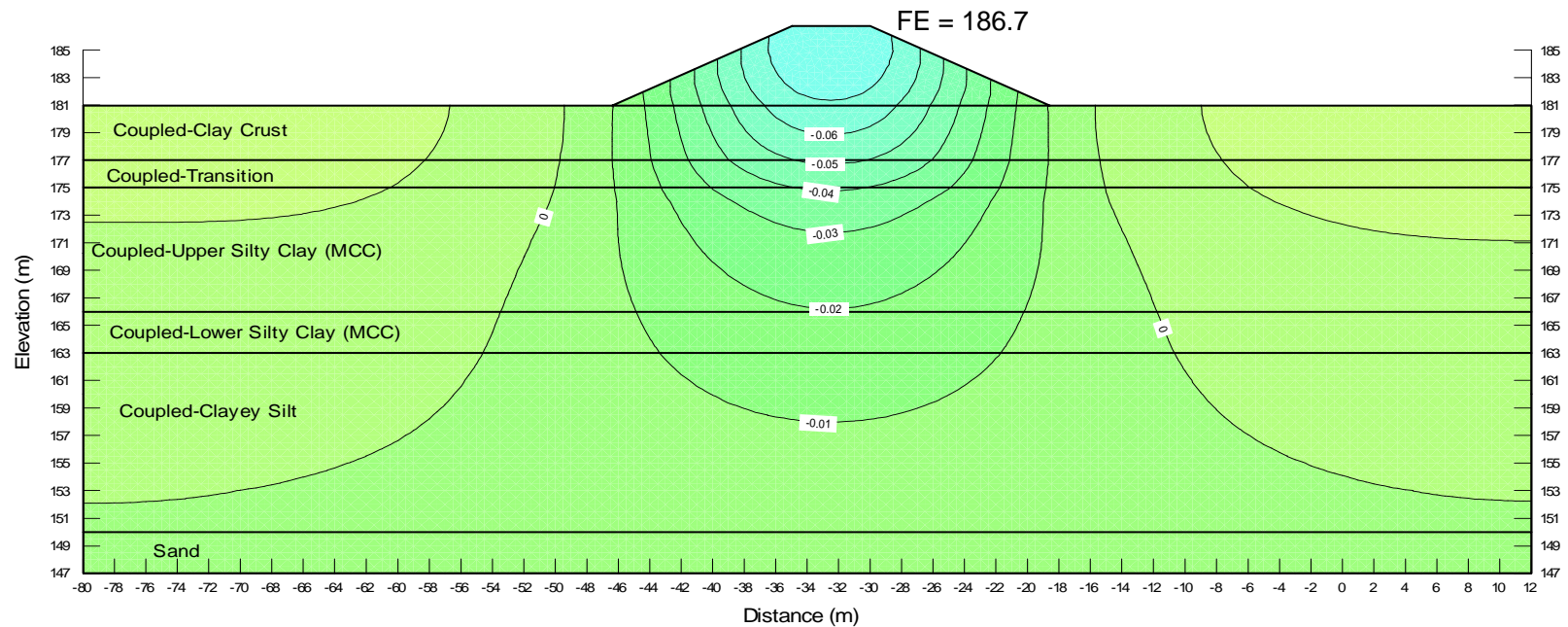
End of Construction (Day 30 in analysis)
LONG-TERM (Day 13030 in analysis)

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



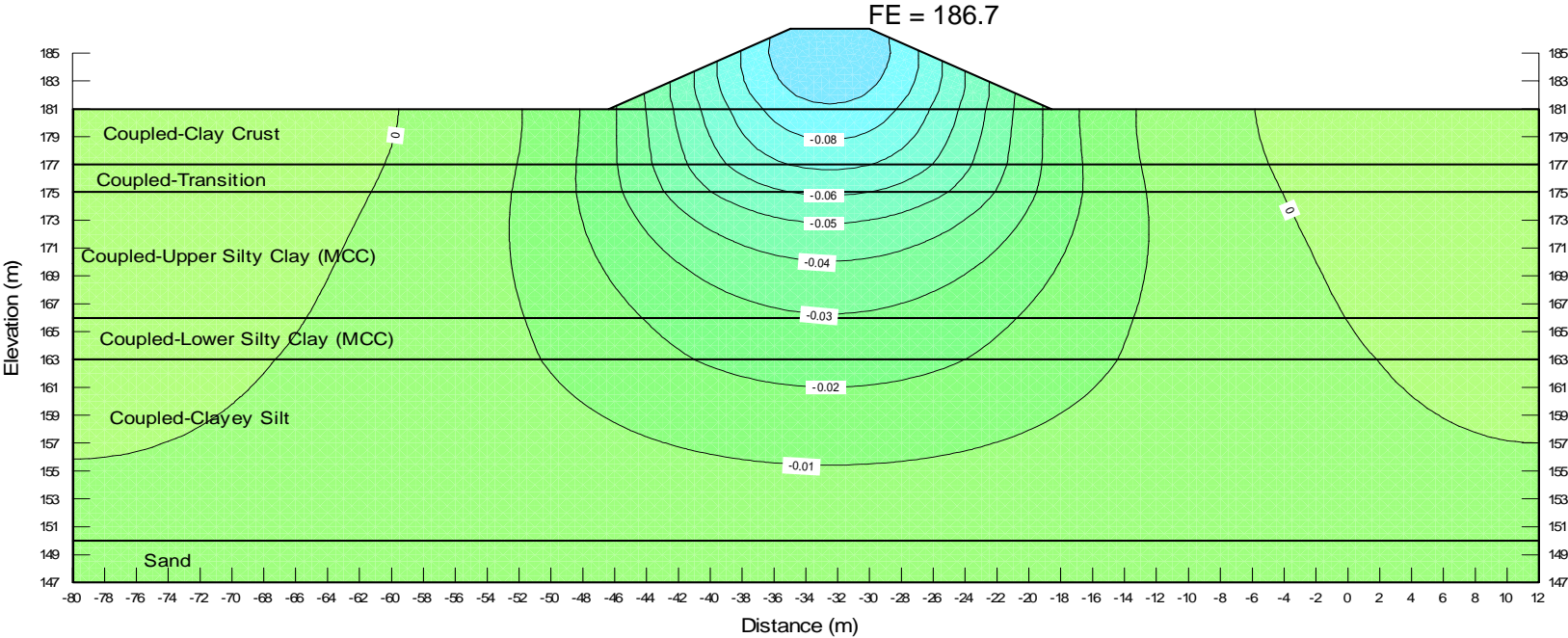
Legend:

End of Construction (Day 30 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.

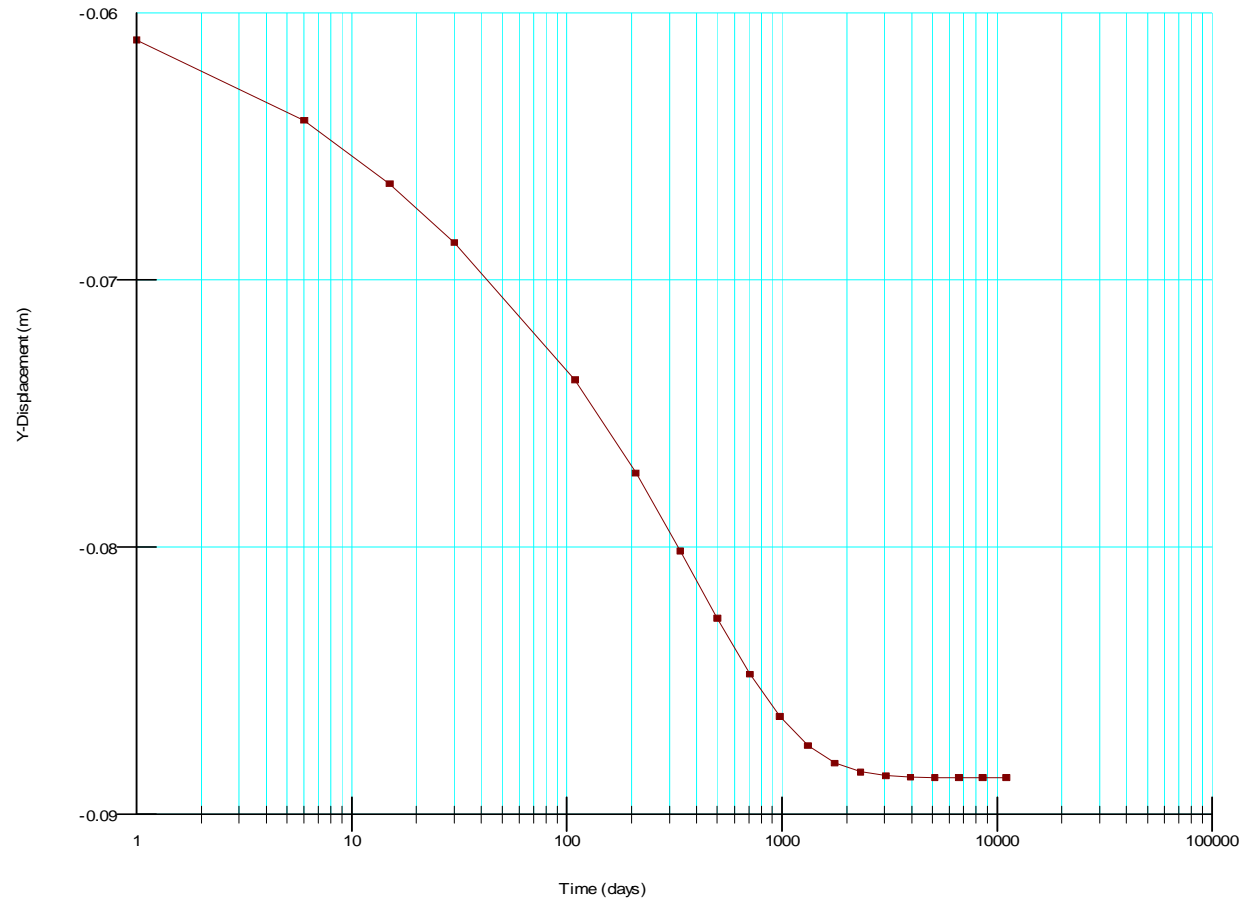
File Name: TB-4 West Embankment.gsz
Name: Dissipation - Coupled
Sta. 10+020 (Trail 31)

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



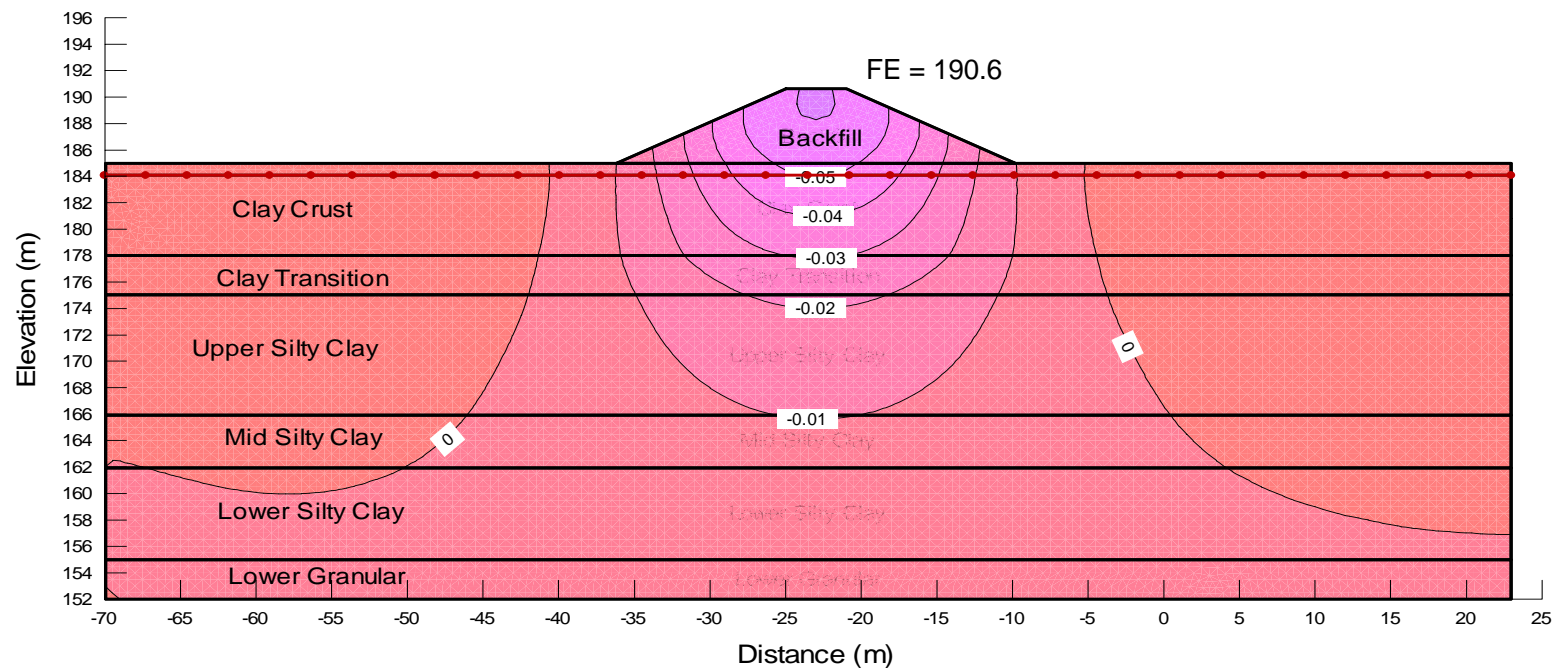
End of Construction (Day 30 in analysis)
LONG-TERM (Day 13030 in analysis)

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)

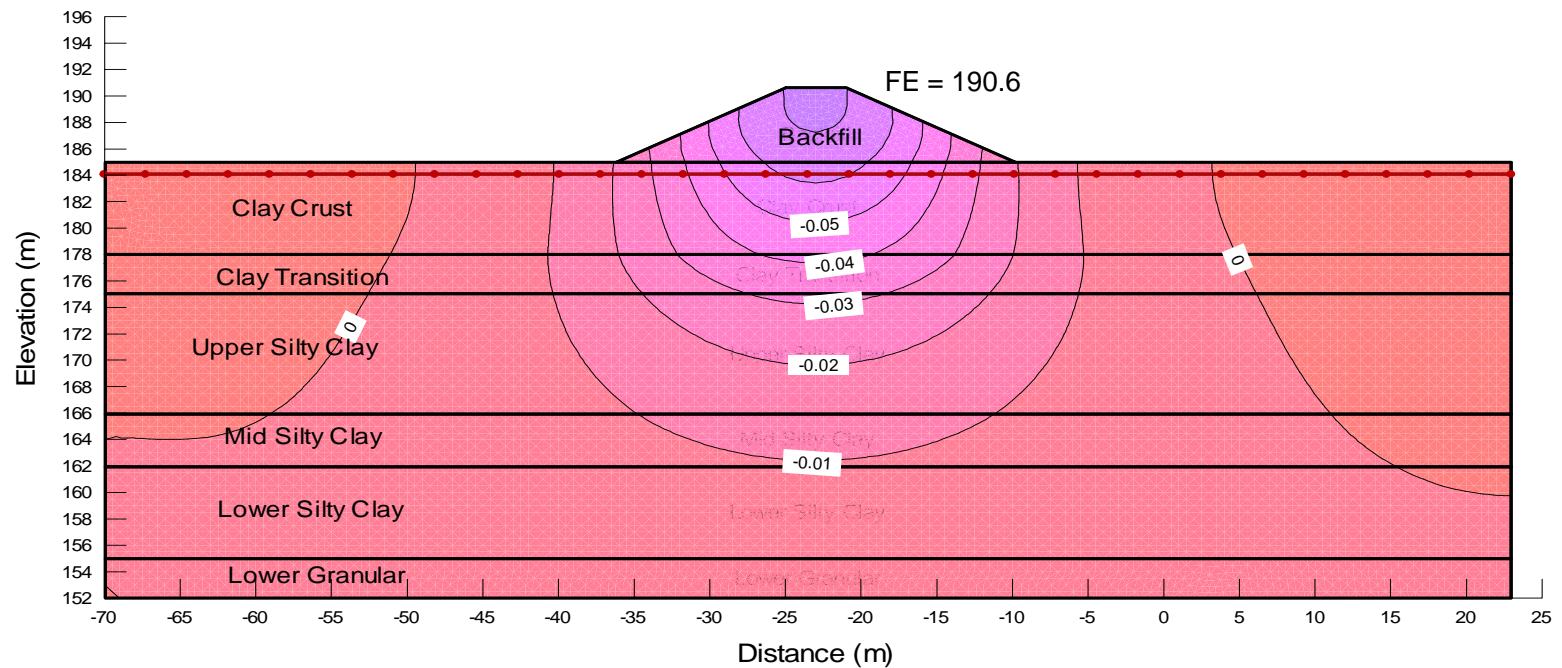
Value shown on contour line is in metre (m), negative is downward movement.

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': 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

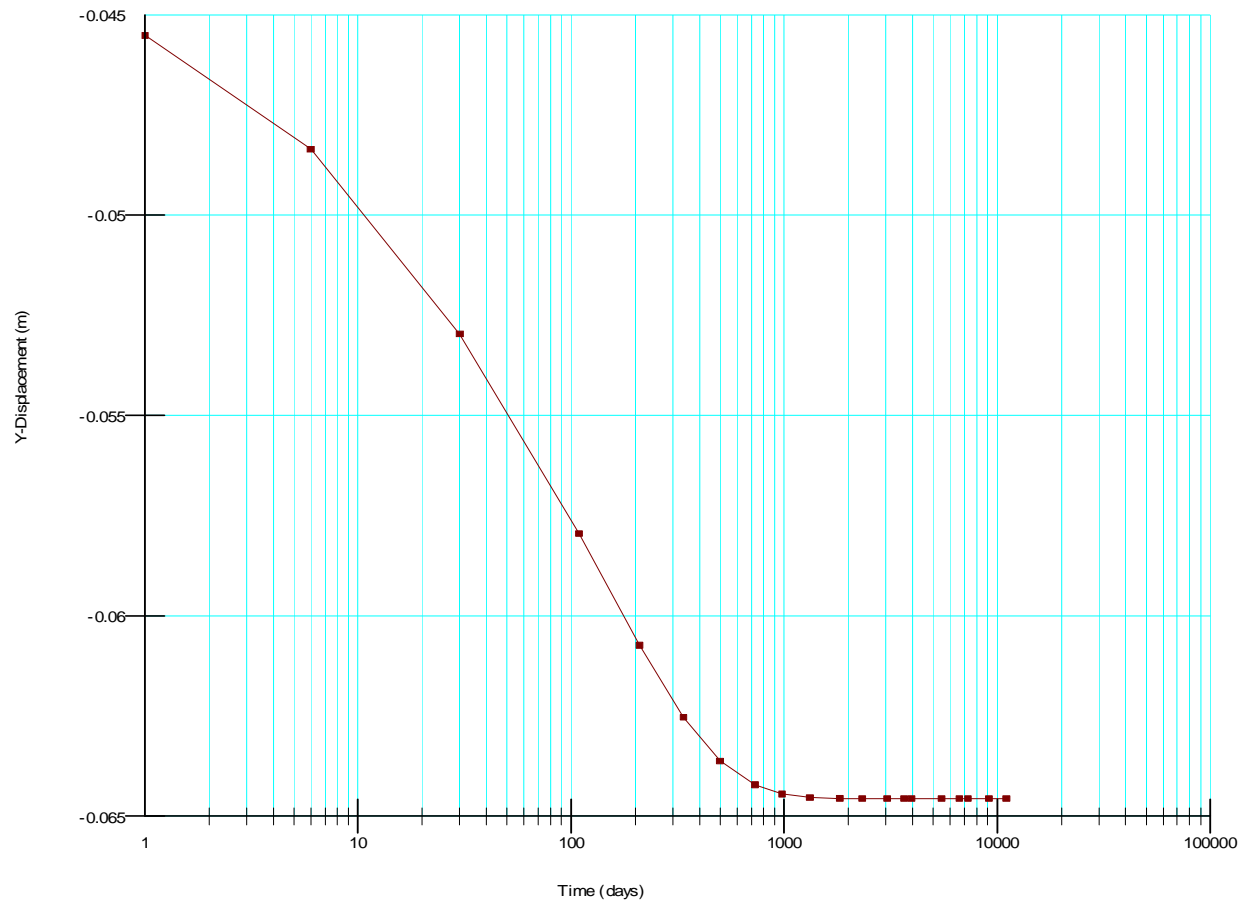


Legend:

LONG-TERM (Day 13030 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.

TB-7 East Embankment - Consolidation



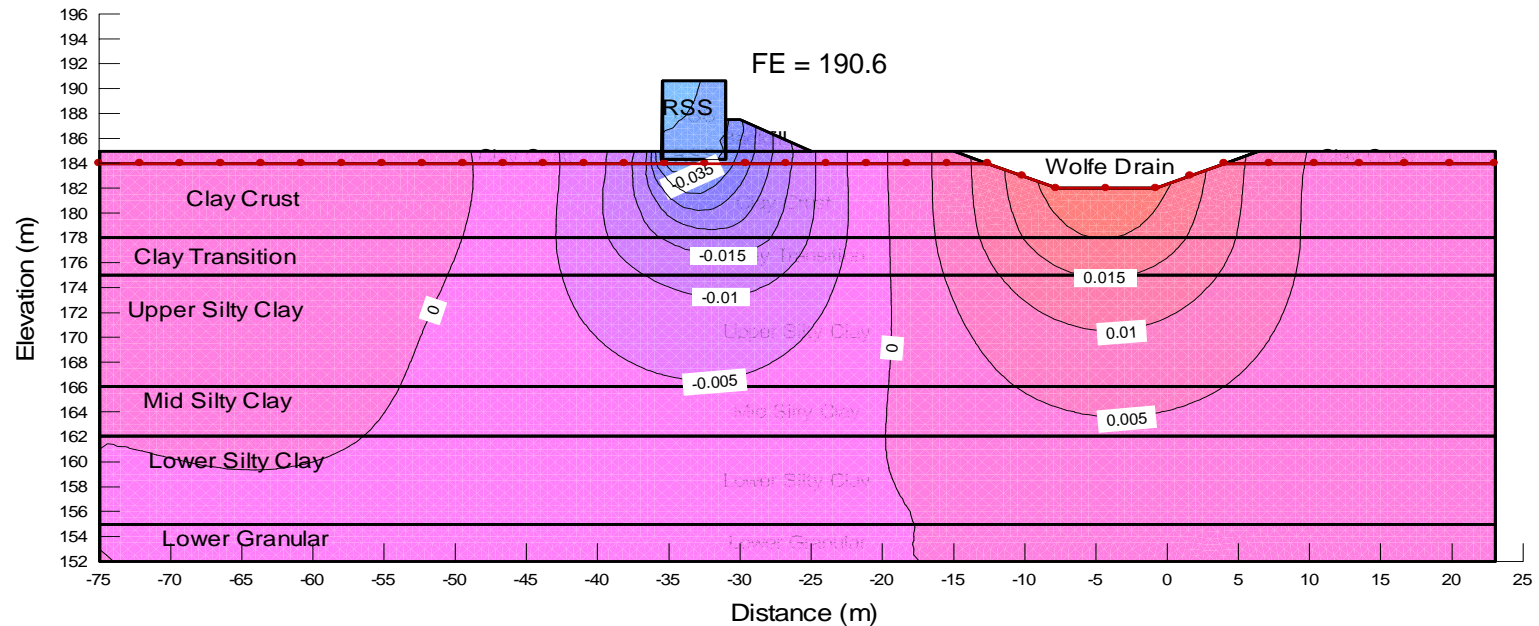
End of Construction (Day 30 in analysis)
LONG-TERM (Day 13030 in analysis)

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)

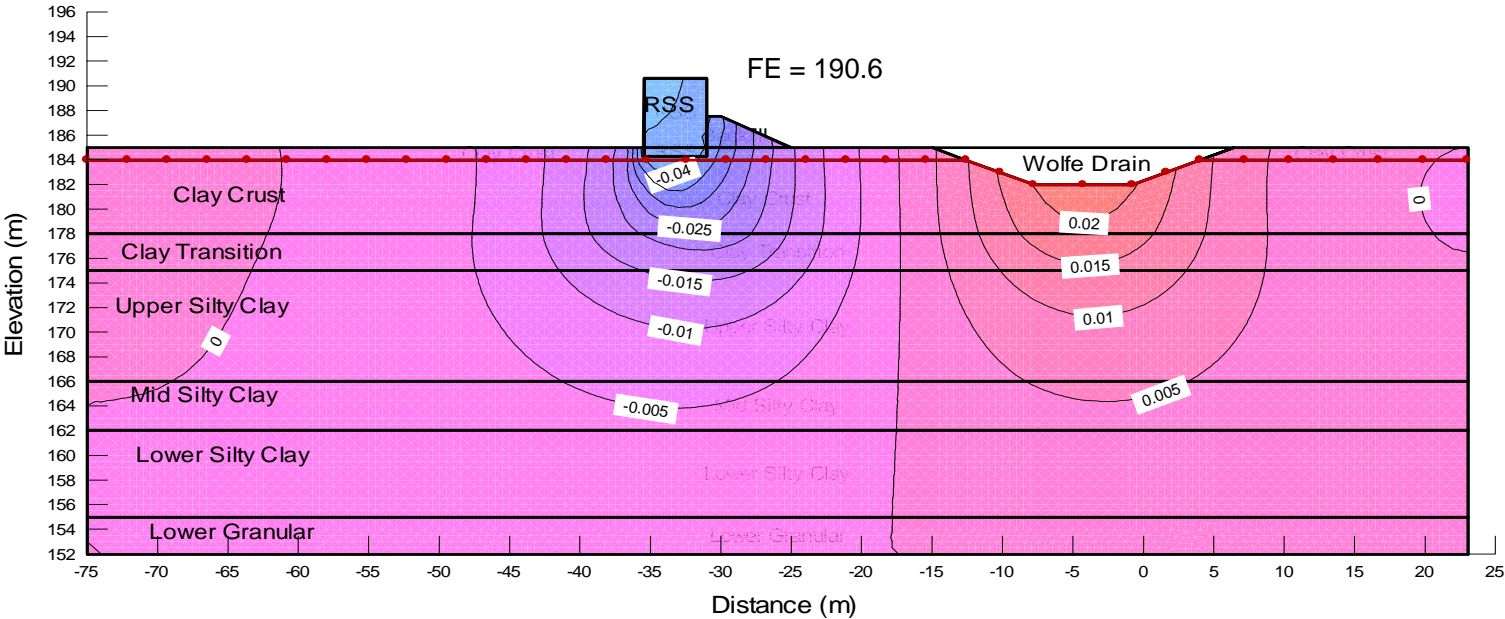
Value shown on contour line is in metre (m), negative is downward movement.

File Name: TB-7 East Embankment Deformation-RSS Wall-ea.gsz

Name: Dissipation

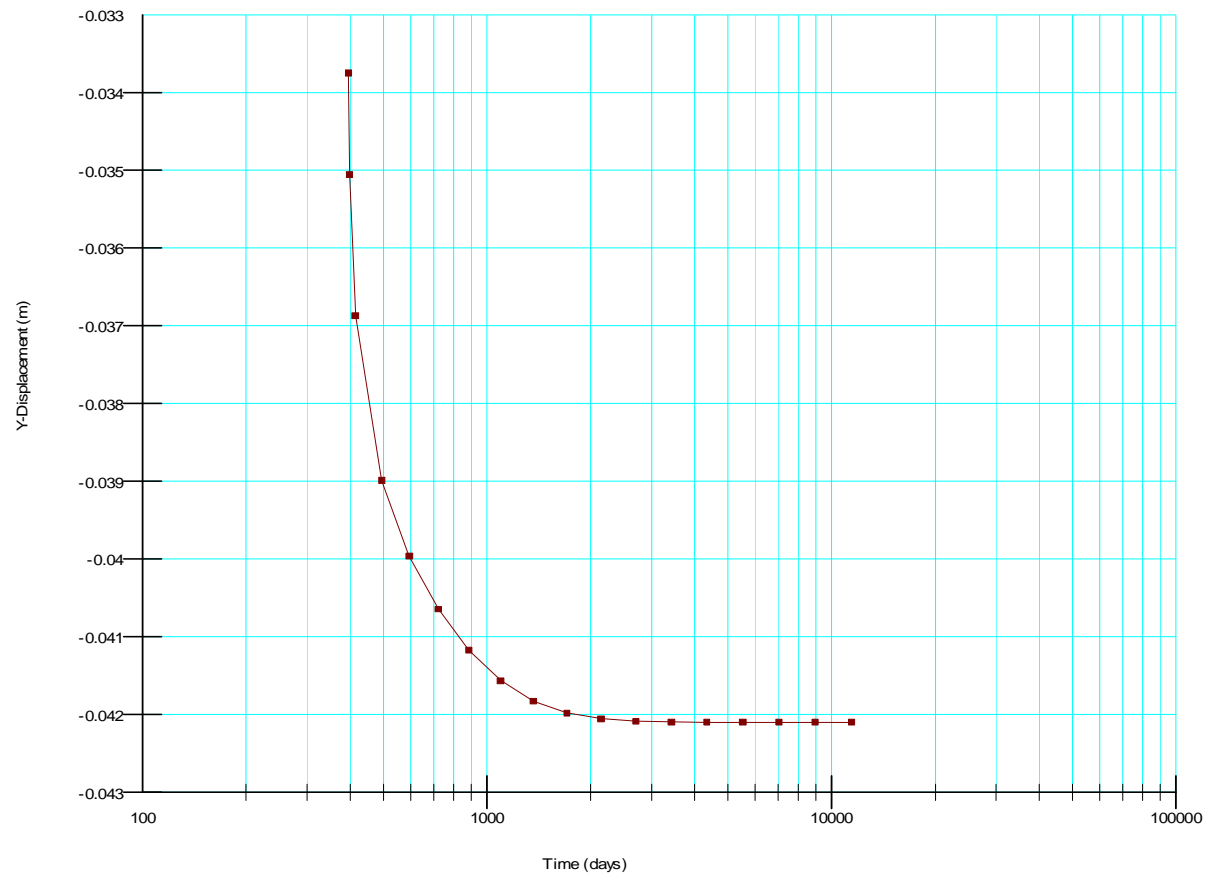
Sta. 10+125 (Trail 44)

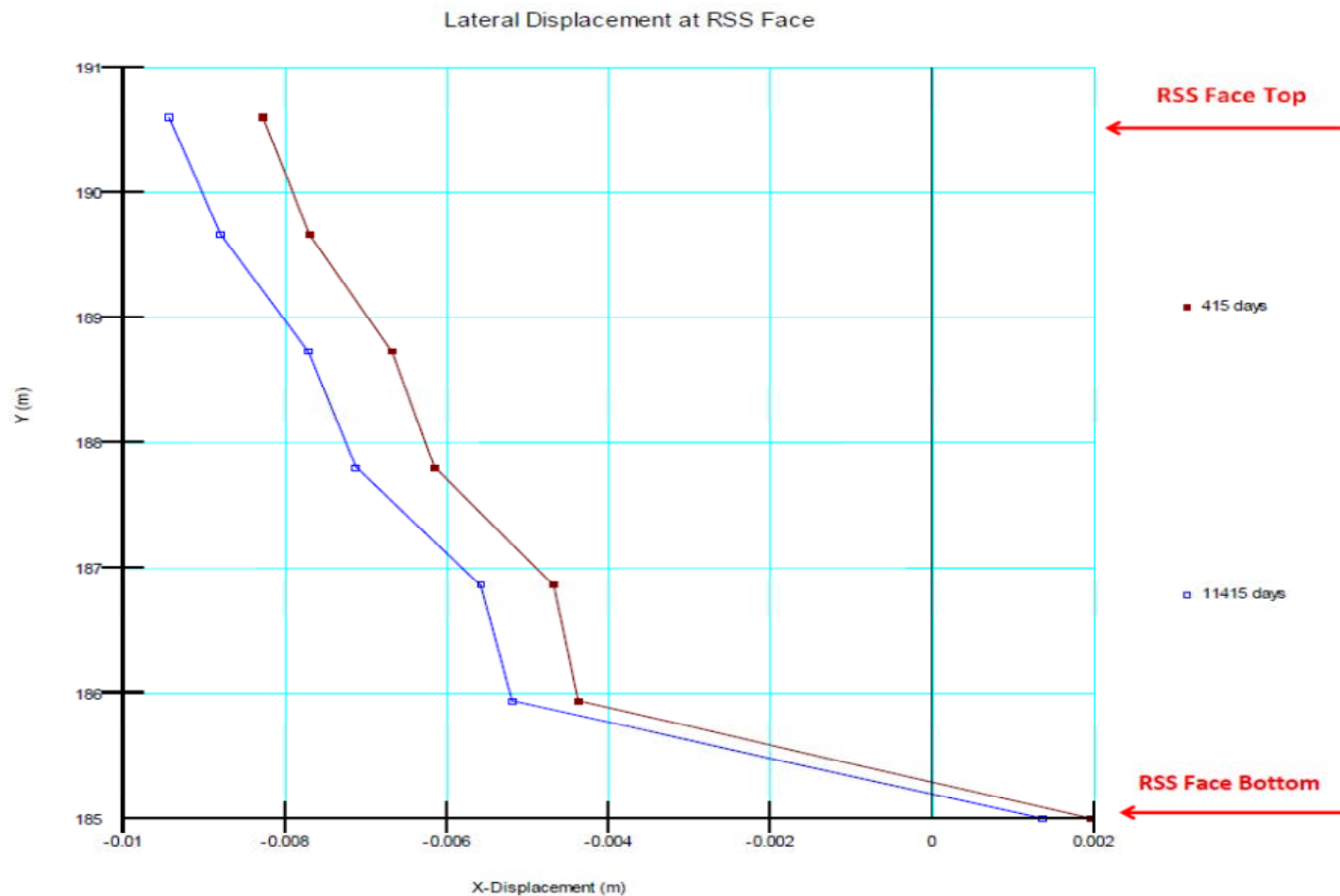
Name: Clay Crust Effective Young's Modulus (E'): 31000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Clay Transition Effective Young's Modulus (E'): 18000 kPa Poisson's Ratio: 0.35 Phi': 30 ° Unit Weight: 22 kN/m³
Name: Upper Silty Clay O.C. Ratio: 1.5 Poisson's Ratio: 0.35 Lambda: 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



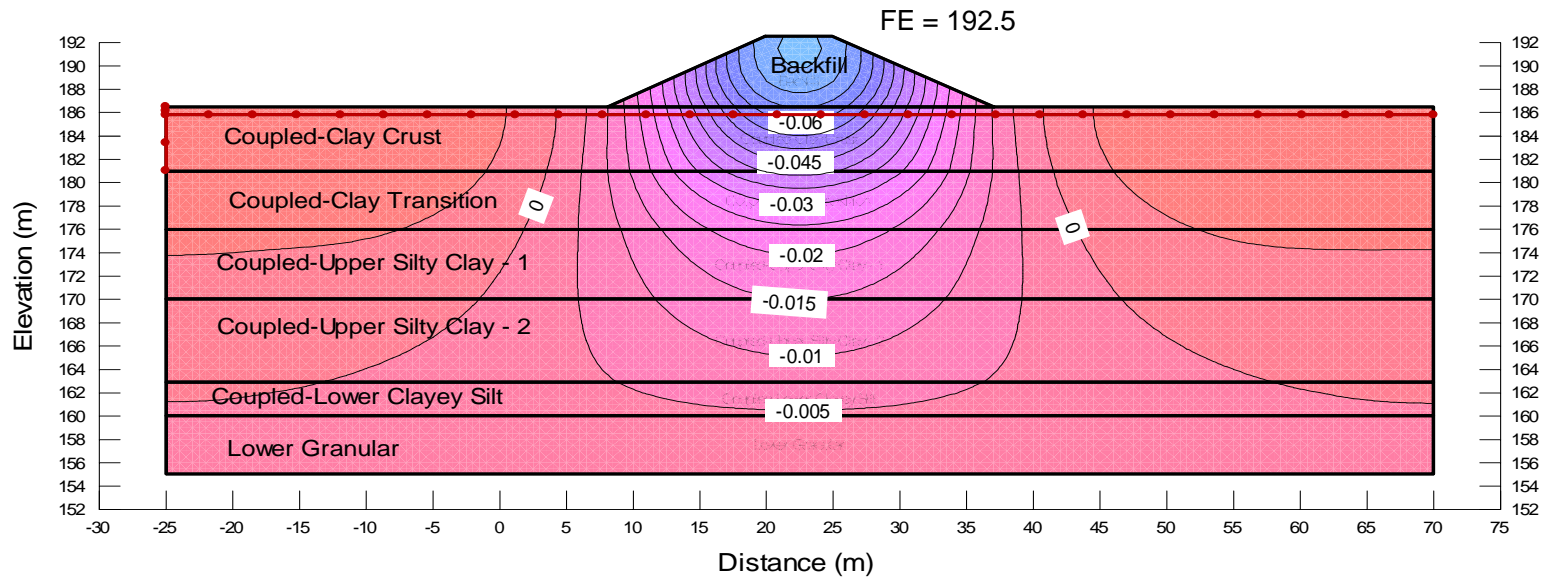


TB-8 East Embankment - Stress Deformation.gsz

Name: Embankment - Coupled

Station 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:

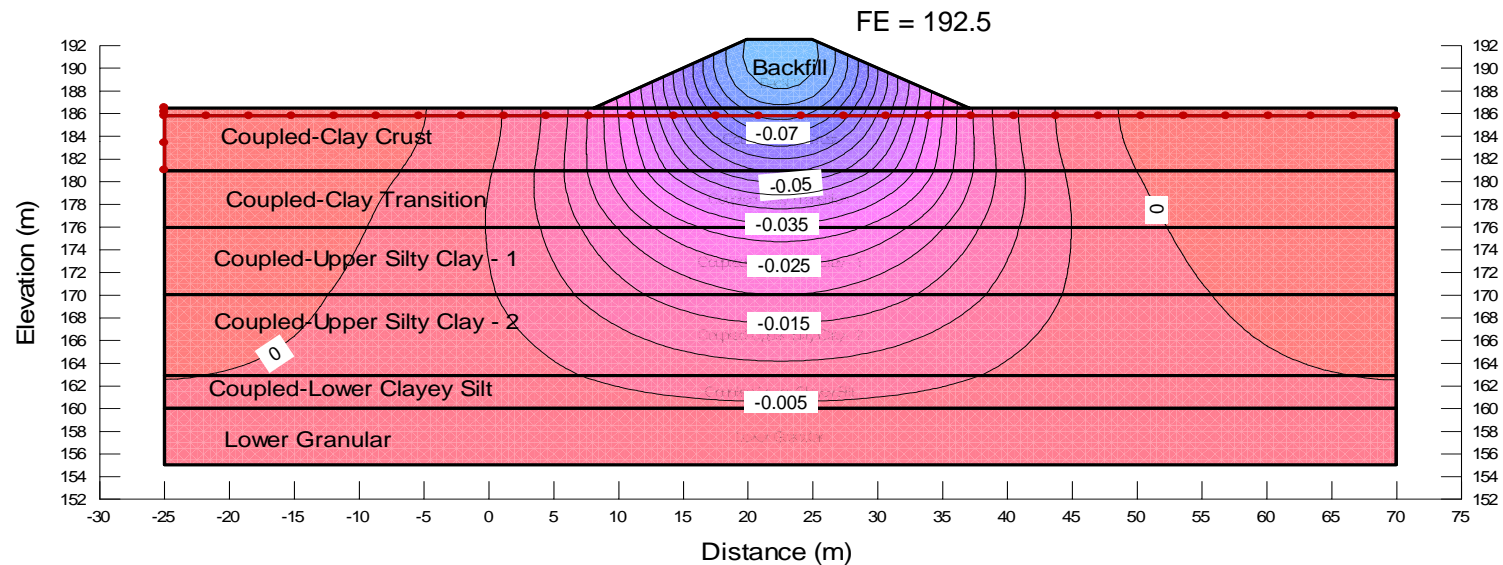
End of Construction (Day 30 in analysis)

Value shown on contour line is in metre (m), negative is downward movement.

TB-8 East Embankment - Stress Deformation.gs2
Name: Dissipation - Coupled

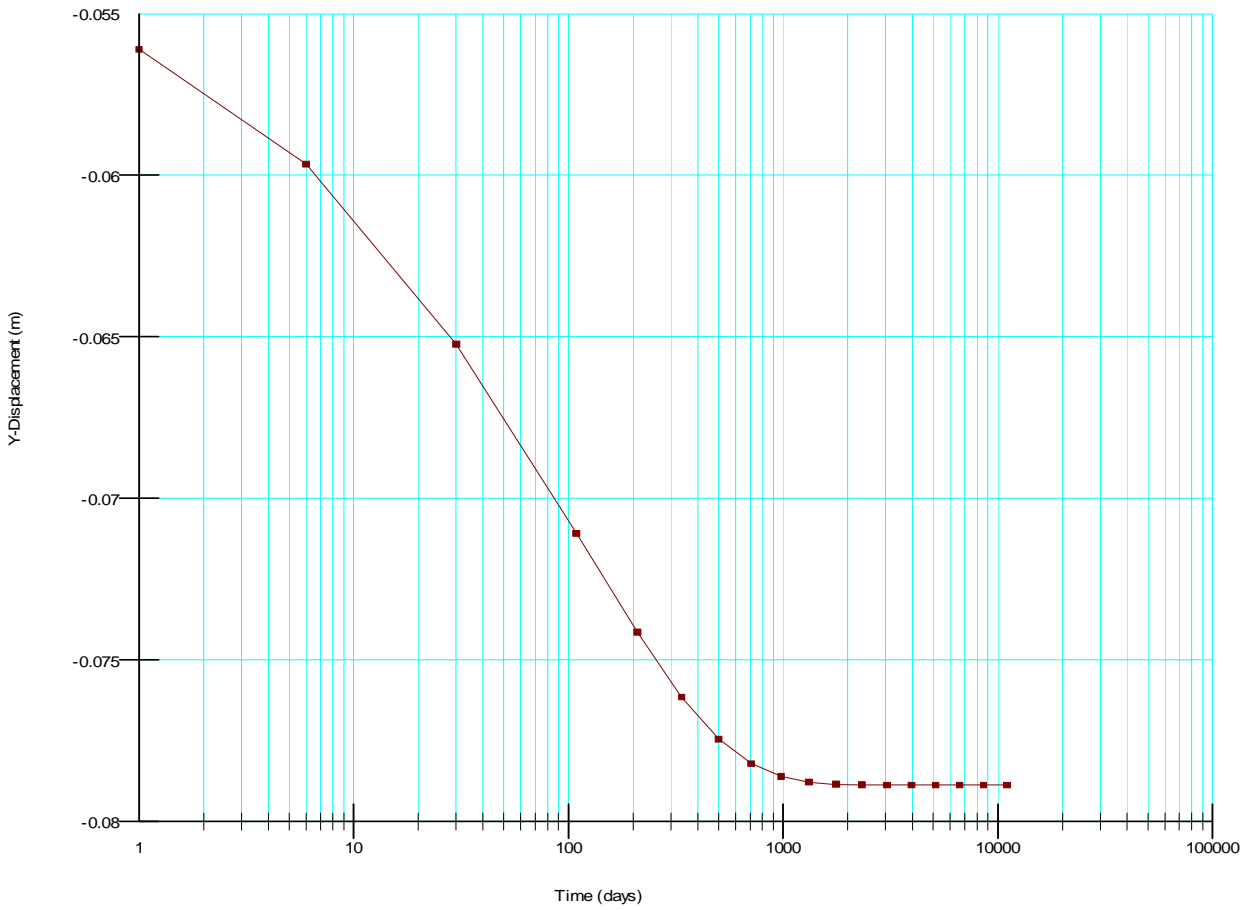
Station 10+000 (Trails 47 & 54)

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

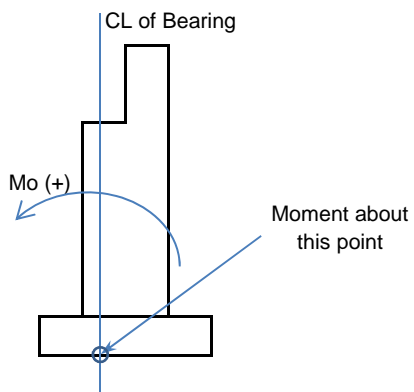
Trail Bridge 1 - North Abutment

Status: In progress

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.

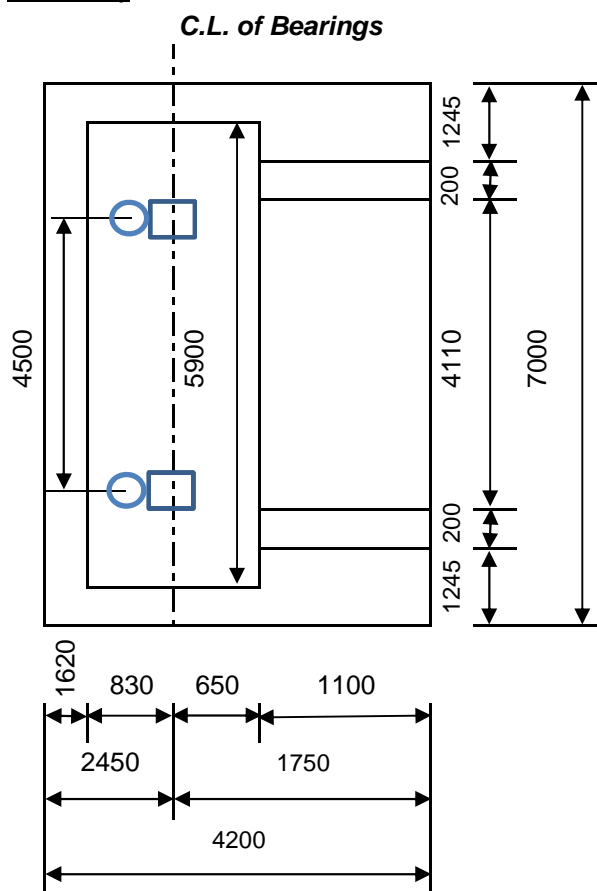
Forces Diagram:



Forces

	ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces	383	455	446	462	385	357
Vertical Forces	4956	4922	4913	4573	4733	3894
Longitudinal Bending Moments	max	1327	1737	1684	1773	1755
	min	758	348	401	312	1278
Lateral Forces	0	0	50	165	0	0
Lateral Bending Moments	0	0	285	941	0	0

Geometry



Notes

Foundation Type: Spread footing

Backfill: LWF

Footing bottom elevation: 181.0 m

Thickness of footing 1000 mm

Units: forces in [kN]
bending moments in [kNm]

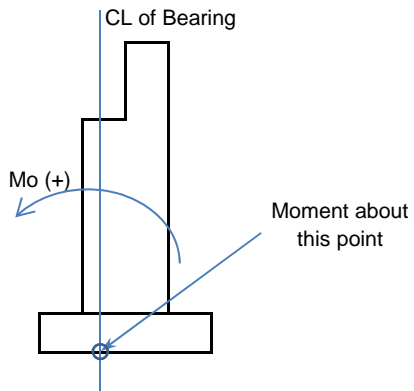
Trail Bridge 1 - South Abutment

Status: In progress

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.

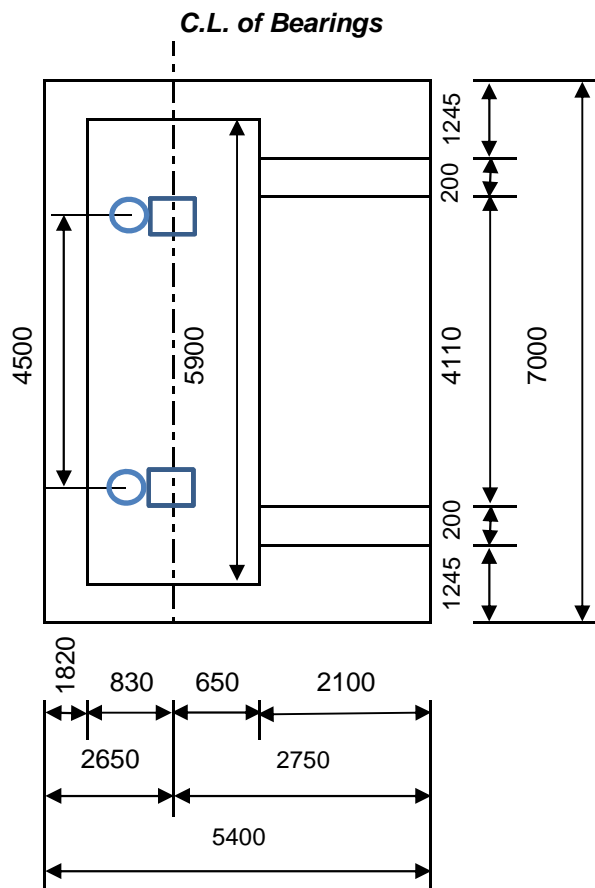
Forces Diagram:



Forces

	ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces	783	855	845	861	787	675
Vertical Forces	6100	6066	6058	5717	5951	4827
Longitudinal Bending Moments	max	-21	461	398	503	377
	min	-572	-1054	-991	-1095	-115
Lateral Forces	0	0	50	165	0	0
Lateral Bending Moments	0	0	335	1106	0	0

Geometry



Notes

Foundation Type: Spread footing
Backfill: Regular Backfill

Footing bottom elevation: 180.0 m
Thickness of footing: 1000 mm

Units: forces in [kN]
bending moments in [kNm]

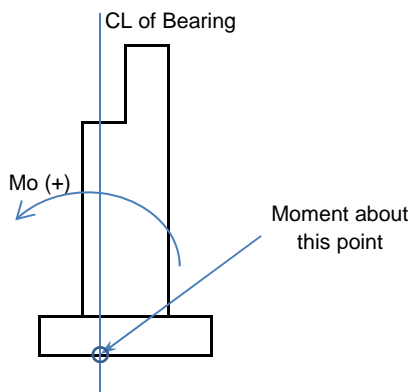
Trail Bridge 2 - West Abutment

Status: In progress

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.

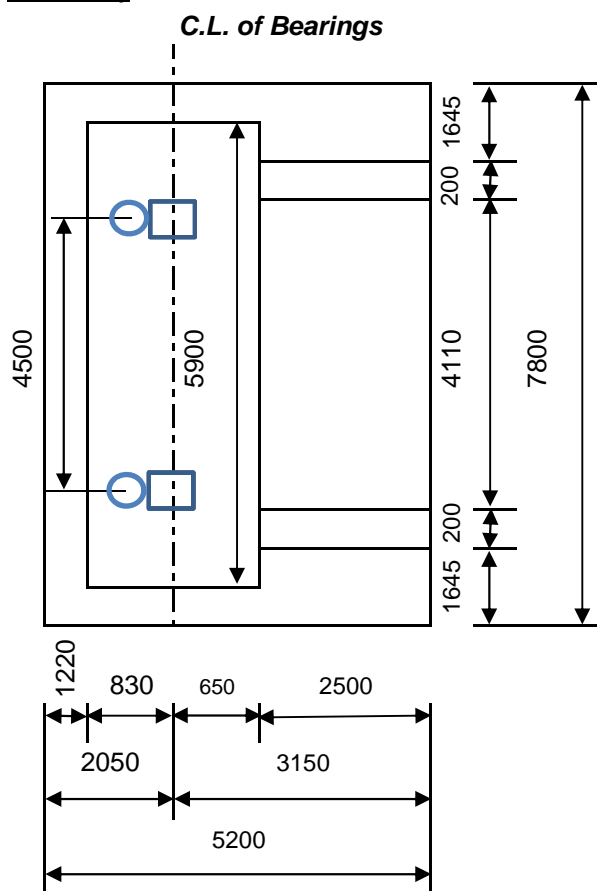
Forces Diagram:



Forces

		ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces		117	189	180	196	120	188
Vertical Forces		6584	6550	6542	6202	6528	5239
Longitudinal Bending Moments	max	-979	-339	-422	-283	-785	-833
	min	-1993	-2634	-2550	-2689	-1667	-1885
Lateral Forces		0	0	50	165	0	0
Lateral Bending Moments		0	0	445	1469	0	0

Geometry



Notes

Foundation Type: Spread footing

Backfill: CC

Hydrostatic pressure of fluid CC added, assuming 1.5m pours.

Footing bottom elevation: 179.3 m

Thickness of footing 1000 mm

Units: forces in [kN]
bending moments in [kNm]

Utility corridor in front of the abutment.

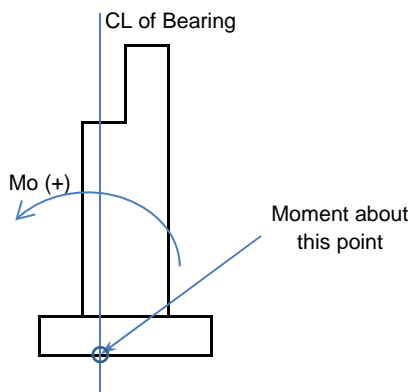
Trail Bridge 2 - East Abutment

Status: In progress

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.

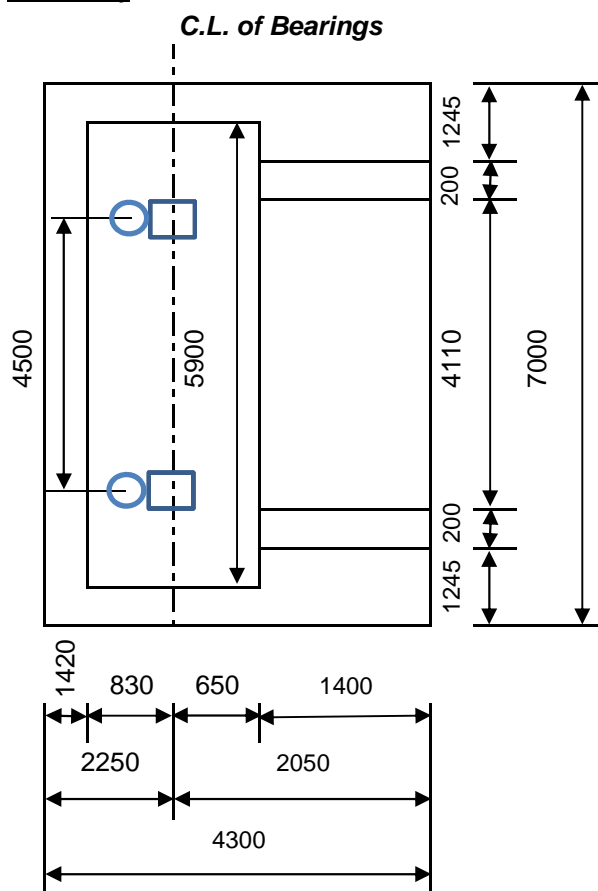
Forces Diagram:



Forces

	ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces	226	298	289	305	229	231
Vertical Forces	4777	4743	4734	4394	4627	3769
Longitudinal Bending Moments	max	551	1105	1033	1154	961
	min	282	-272	-199	-320	749
Lateral Forces	0	0	50	165	0	0
Lateral Bending Moments	0	0	385	1271	0	0

Geometry



Notes

Foundation Type: Spread footing

Backfill: CC

Hydrostatic pressure of fluid CC added, assuming 1.5m pours.

Footing bottom elevation: 181.0 m

Thickness of footing 1000 mm

Units: forces in [kN]
bending moments in [kNm]

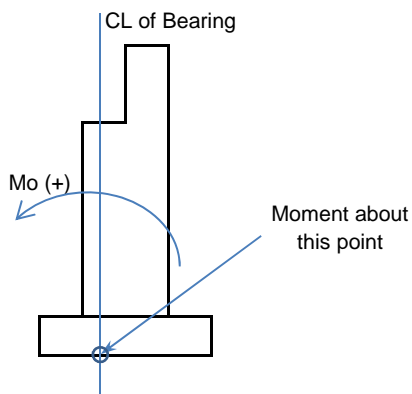
Trail Bridge 4 - West Abutment

Status: In progress

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.

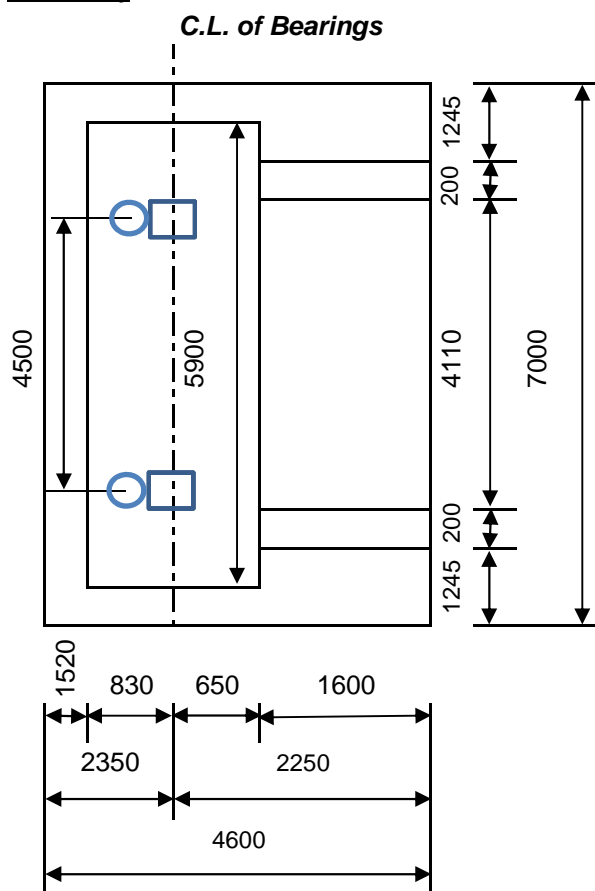
Forces Diagram:



Forces

		ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces		708	780	771	786	712	616
Vertical Forces		5504	5470	5461	5121	5313	4340
Longitudinal Bending Moments	max	670	1120	1061	1159	1080	782
	min	304	-146	-87	-185	801	156
Lateral Forces		0	0	50	165	0	0
Lateral Bending Moments		0	0	313	1032	0	0

Geometry



Notes

Foundation Type: Spread footing
Backfill: Regular Backfill

Footing bottom elevation: 180.0 m
 Thickness of footing 1000 mm

Units: forces in [kN]
 bending moments in [kNm]

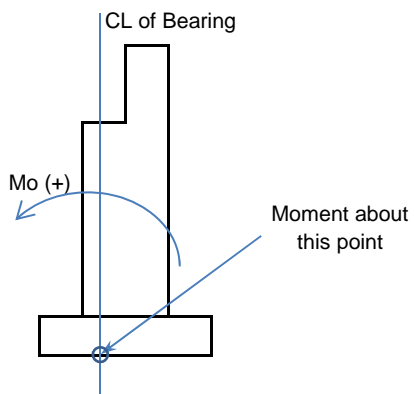
Trail Bridge 4 - East Abutment

Status: In progress

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.

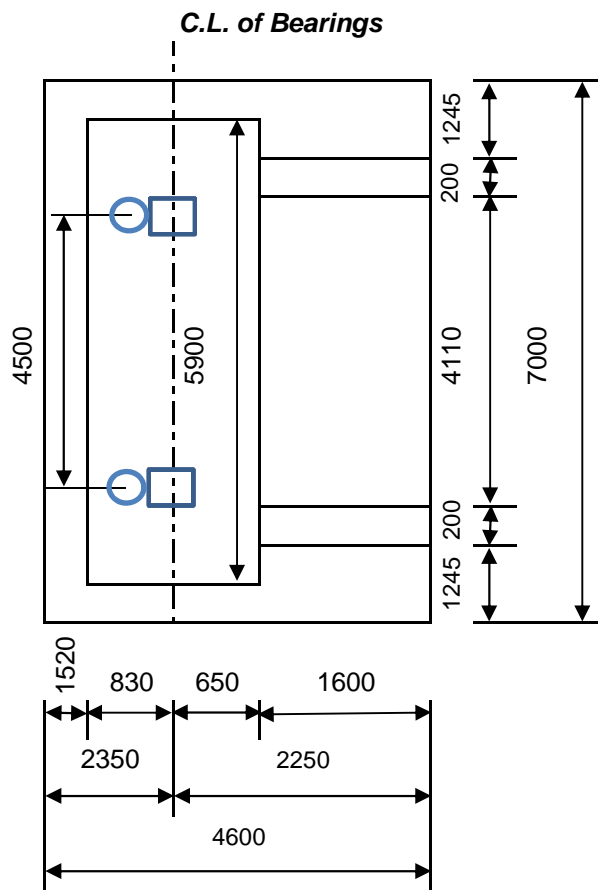
Forces Diagram:



Forces

	ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces	694	766	757	772	698	604
Vertical Forces	5504	5470	5461	5121	5313	4340
Longitudinal Bending Moments	max	647	1097	1038	1136	1056
	min	272	-178	-119	-217	767
Lateral Forces	0	0	50	165	0	0
Lateral Bending Moments	0	0	313	1032	0	0

Geometry



Notes

Foundation Type: Spread footing
Backfill: Regular Backfill

Footing bottom elevation: 179.2 m
Thickness of footing: 1000 mm

Units: forces in [kN]
bending moments in [kNm]

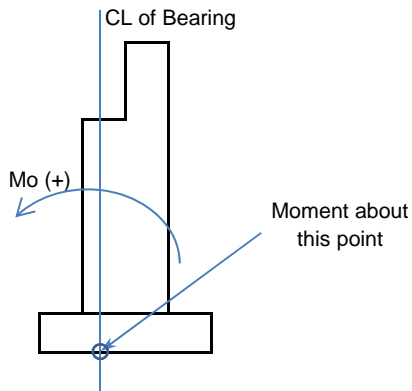
Trail Bridge 5 - West Abutment

Status: In progress

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.

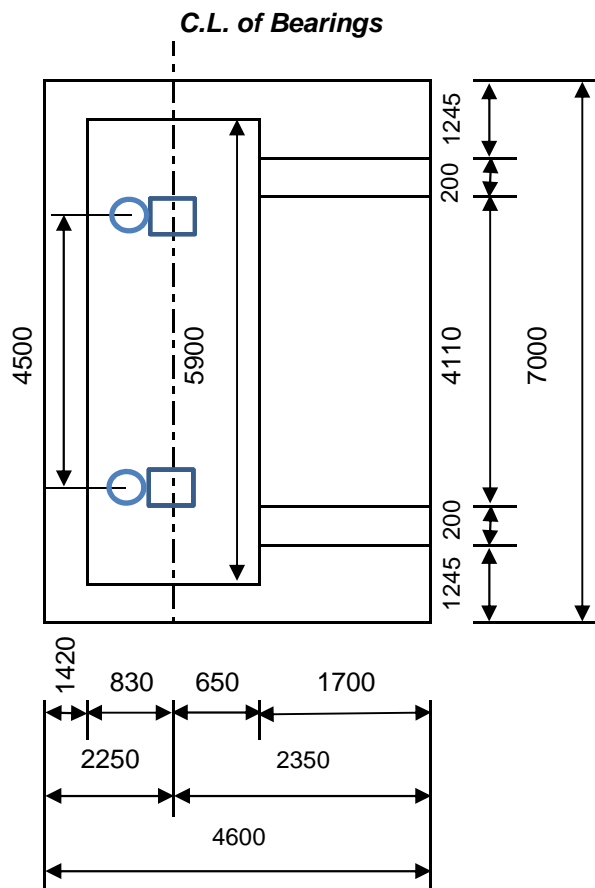
Forces Diagram:



Forces

	ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces	517	589	580	596	519	464
Vertical Forces	5090	5056	5048	4708	4925	4016
Longitudinal Bending Moments	max 81	577	512	620	458	300
	min -173	-669	-604	-712	236	-391
Lateral Forces	0	0	50	165	0	0
Lateral Bending Moments	0	0	345	1139	0	0

Geometry



Notes

Foundation Type: Spread footing
Backfill: LWF

Footing bottom elevation: 180.9 m
Thickness of footing: 1000 mm

Units: forces in [kN]
bending moments in [kNm]

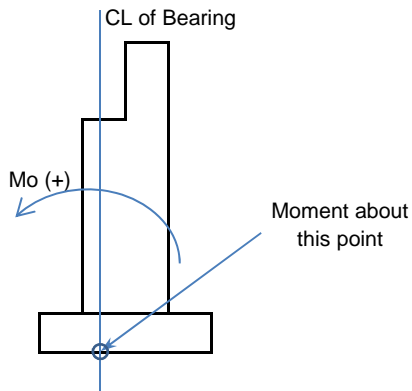
Trail Bridge 5 - East Abutment

Status: In progress

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.

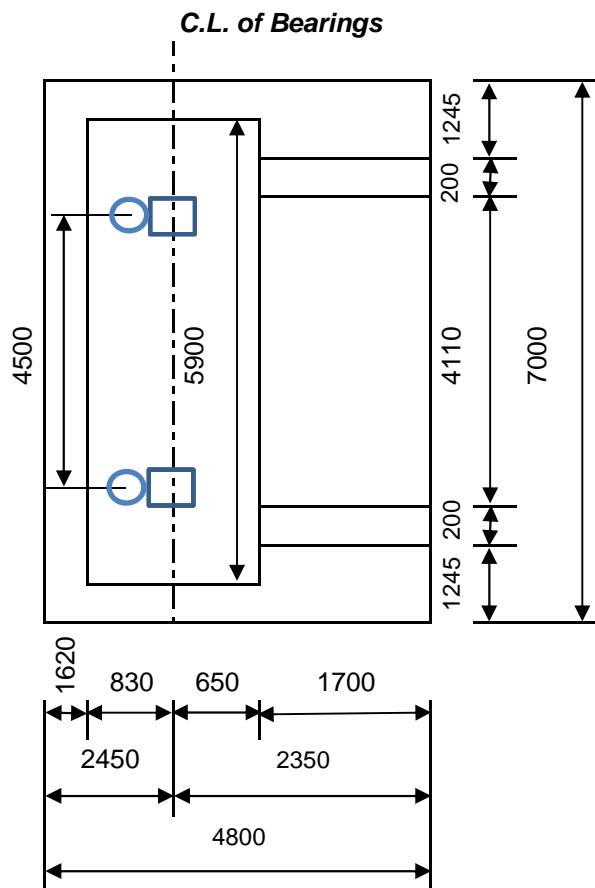
Forces Diagram:



Forces

	ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces	448	520	510	526	449	408
Vertical Forces	5679	5645	5637	5297	5498	4483
Longitudinal Bending Moments	max	700	1153	1094	1193	1085
	min	23	-430	-371	-469	459
Lateral Forces	0	0	50	165	0	0
Lateral Bending Moments	0	0	315	1040	0	0

Geometry



Notes

Foundation Type: Spread footing
Backfill: LWF

Footing bottom elevation: 180.9 m
Thickness of footing: 1000 mm

Units: forces in [kN]
bending moments in [kNm]

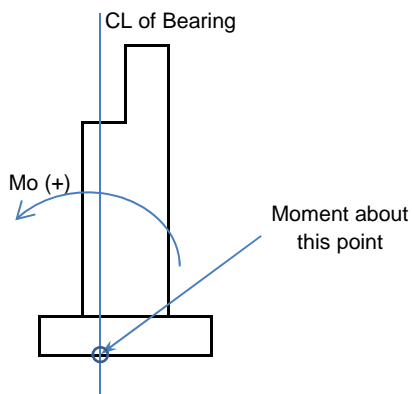
Trail Bridge 7 - West Abutment

Status: In progress

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:



Forces

Units: forces in [kN]

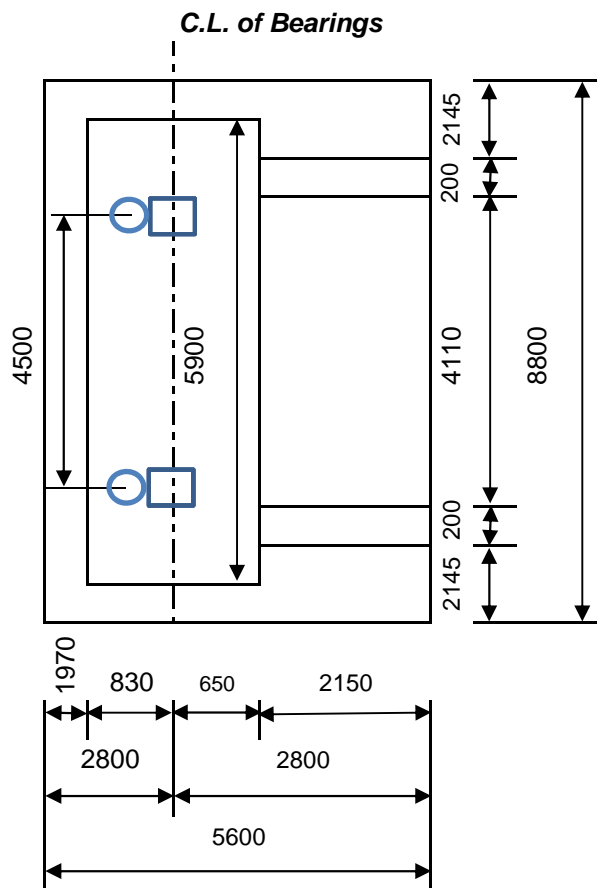
bending moments in [kNm]

		ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces		111	223	209	233	113	167
Vertical Forces		6855	6815	6823	6458	6728	5436
Longitudinal Bending Moments	max	147	1015	901	1090	743	339
	min	-687	-1554	-1441	-1629	-30	-868
Lateral Forces		0	0	87	287	0	0
Lateral Bending Moments		0	0	670	2213	0	0

Notes

Foundation Type: Spread footing
Backfill: Cellular Concrete

Geometry



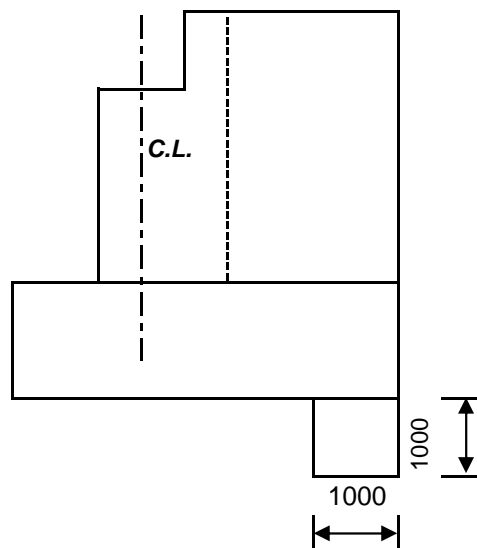
Hydrostatic pressure of fluid CC added, assuming 1.5m pours.

Ditch in front of the abutment.

Footing bottom elevation: 182.0 m

Thickness of footing 1000 mm

Shear key 1 x 1m under footing.



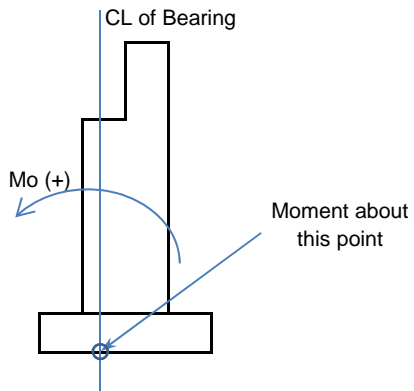
Trail Bridge 7 - East Abutment

Status: In progress

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.

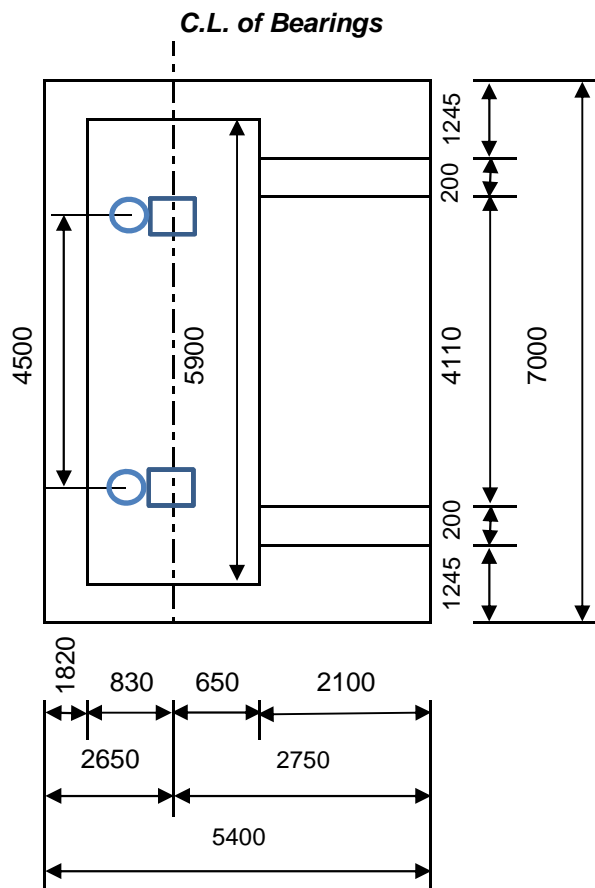
Forces Diagram:



Forces

	ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces	797	910	895	920	802	715
Vertical Forces	7083	7042	7050	6686	6876	5597
Longitudinal Bending Moments	max	-110	642	544	707	509
	min	-765	-1517	-1419	-1582	-87
Lateral Forces	0	0	87	287	0	0
Lateral Bending Moments	979	979	1559	2895	979	783

Geometry



Notes

Foundation Type: Spread footing
Backfill: Regular Backfill

There is asymmetrical backfill around, causing lateral 979kNm ULS.

Footing bottom elevation: 183.4 m
Thickness of footing: 1000 mm

Units: forces in [kN]
bending moments in [kNm]

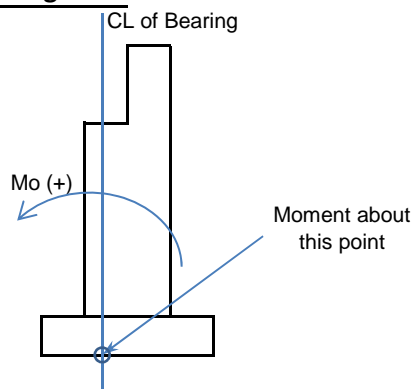
Trail Bridge 7A - North and South Abutment

Status: In progress

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.

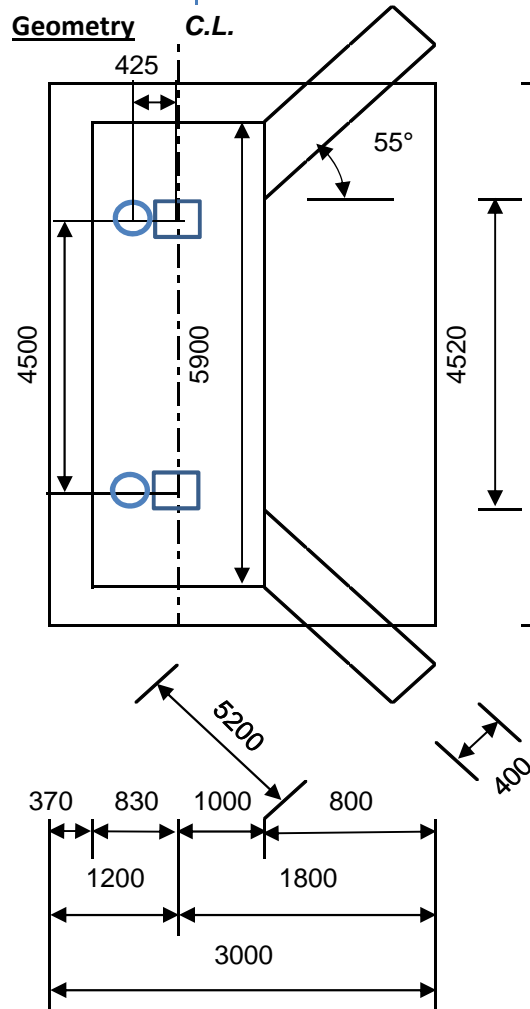
Forces Diagram:



Forces

		ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces		456	493	488	496	458	485
Vertical Forces		2500	2478	2464	2223	2352	1963
Longitudinal Bending Moments	max	-838	-753	-764	-746	-1135	-692
	min	-1355	-1440	-1429	-1447	-1324	-1102
Lateral Forces		0	0	23	75	0	0
Lateral Bending Moments		0	0	53	173	0	0

Geometry



Notes

Foundation Type: Spread footing
Backfill: Regular Backfill

Footing bottom elevation: North 182.7 m South 182.6 m

Thickness of footing 800 mm

Units: forces in [kN]
bending moments in [kNm]

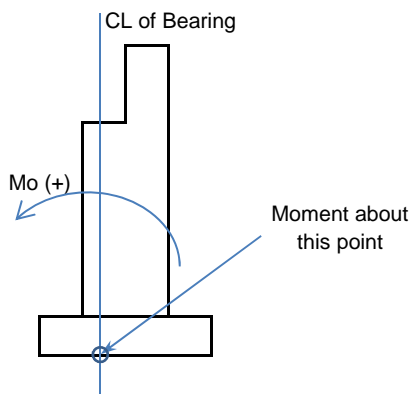
Trail Bridge 8 - East Abutment

Status: In progress

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.

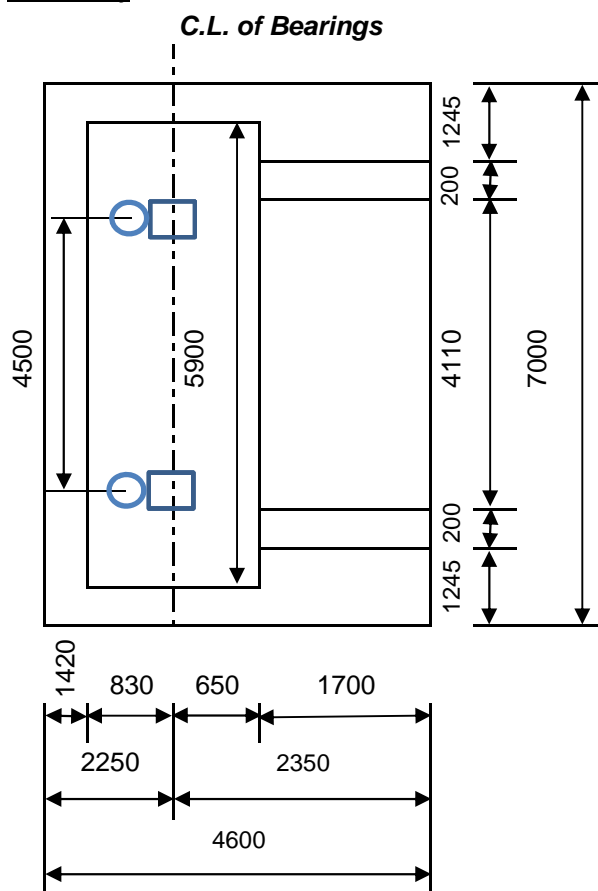
Forces Diagram:



Forces

	ULS 1	ULS 2	ULS 3	ULS 4	ULS 9	SLS 1
Longitudinal Forces	704	816	802	826	708	640
Vertical Forces	6544	6503	6511	6147	6299	5156
Longitudinal Bending Moments	max	647	1357	1264	1419	1267
	min	98	-612	-519	-674	780
Lateral Forces	0	0	87	287	0	0
Lateral Bending Moments	0	0	549	1810	0	0

Geometry



Notes

Foundation Type: Spread footing
Backfill: Regular Backfill

Footing bottom elevation: 185.8 m
Thickness of footing: 1000 mm

Units: forces in [kN]
bending moments in [kNm]

Loads

CHBDC S6-06

Wind

Cl. 3.10

return period for determining of wind pressure is considered as 50 years
as the maximum span length is less than 125 m

Cl. 3.10.1.2(b)

hourly mean reference wind pressure: $q = 470 \text{ Pa}$
location: Windsor

Table A3.1.1

gust effect coefficient: $C_g = 2.5$

Cl. 3.10.1.3

height above ground: $H = 10.0 \text{ m}$

Cl. 3.10.1.4

wind exposure coefficient: $C_e = (0.1H)^{0.2} \leq 1.0 \Rightarrow C_e = 1.0$

Cl. 3.10.1.4

substructure:

Cl. 3.10.3.3

horizontal wind drag coefficient: $C_h = 2.0$

Cl. 3.10.3.3

horizontal drag load: $F_h = q C_e C_g C_h = 2350 \text{ Pa} = 2.35 \text{ kN/m}^2$

Cl. 3.10.2.2