



March 2010

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## WINDSOR-ESSEX PARKWAY

# Geotechnical Data Report Addendum No. 4 Supplementary Geotechnical Investigation

**Submitted to:**

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REPORT



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## **1.0 INTRODUCTION**

This addendum presents the results of a supplementary geotechnical drilling and testing program related to the Windsor-Essex Parkway from the Highway 3 and Highway 401 interchange to the Ojibway Parkway area. The work was undertaken by Golder Associates Ltd. (Golder) working under a subcontract to URS Canada Inc. (URS) on behalf of the Ministry of Transportation Ontario (MTO). This report is Addendum No. 4 to the original Report No. 07-1130-207-0-R01 entitled, "Windsor-Essex Parkway, Geotechnical Data Report", dated June 2009.

While this report provides data related to the borehole drilling and sampling, no interpretations are provided with respect to conditions between samples, tests or borehole locations. The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests. These boundaries, therefore, may represent transitions between soil types rather than exact planes of geological change. Furthermore, subsurface conditions will vary between and beyond the samples and borehole locations. Use of this report is subject to important limitations summarized following the text of this report.





## **2.0 SITE DESCRIPTION**

The proposed Windsor-Essex Parkway (WEP) begins near the existing western terminus of Highway 401 and generally follows the alignments of Highway 3, Huron Church Road and the E.C. Row Expressway to the border crossing plaza site near the Detroit River as illustrated by the Key Plan shown on Figure 1 and Drawings 1 through 6. The alignment of the WEP follows the horizontal alignment of these roadways with some areas within the existing rights-of-way and some parallel to and west/south of the existing roadways.

The site character near the existing terminus of Highway 401 to near the E.C. Row Expressway is generally residential or commercial with low-rise buildings and urban street rights-of-way. The topography in the area is relatively flat with the ground surface elevation gently undulating between about 187 m and 179 m with a general decline from southeast to northwest (toward the river). Within the Highway 3 and Huron Church Road portion of the WEP, the alignment crosses several municipal drains including the Cahill Drain, Lennon Drain and Grand Marais Drain.

Between Huron Church Road and Ojibway Parkway, along the south side of E.C. Row Expressway, the site is characterised by relatively low-lying and flat areas. The topography gently undulates with a topographic relief generally less than 5 m between approximately elevations 179 m and 184 m with a general decline from east to west toward the Detroit River. The ground surface is covered with a mixture of low vegetation and trees.



## **3.0 INVESTIGATION PROCEDURES**

### **3.1 Drilling and Sampling**

The latest phase of the subsurface explorations for the Windsor-Essex Parkway was carried out between November 16, 2009 and January 26, 2010. During this time, a total of 14 sampled deep boreholes (from 27.3 to 39.4 m deep, including rock coring) and 3 sampled shallow boreholes (8.1 to 12.7 m deep) were advanced within the proposed alignment (i.e. from the existing terminus of Highway 401 along Highway 3, Huron Church Road and E.C. Row Expressway to Ojibway Parkway). Cone penetration tests were also completed as part of the supplementary field testing and the results of these tests have been reported in Addendum No. 3. At the cone penetration test (CPT) locations, sampled boreholes (a total of 27, approximately 3 to 5 m deep) were drilled either to facilitate the start of the CPTs or to characterize the shallow subsurface conditions adjacent to the CPT locations. These shallow boreholes are reported in this addendum. In addition, one borehole, 343A, was advanced to recover additional thin-walled tube samples adjacent to borehole 343. In general, the testing locations are designated with increasing numbers from east to west. Locations of all boreholes and cone penetration tests are shown on Drawings 1 through 6.

Field work was supervised on a full-time basis by members of Golder's staff who located the boreholes, directed the drilling, sampling and in situ testing operations and logged the boreholes. All borehole field locations were determined by Golder relative to points staked in the field by Golder using GPS systems and measured references to local landmarks or features. The final borehole locations were surveyed by Callon-Dietz Surveyors under subcontract to Golder. The borehole locations from the current investigation, including MTM NAD83 northing and easting coordinates and ground surface elevations, referenced to geodetic datum, are summarized in Table 1 and shown on Drawings 1 through 6. Boreholes had not been abandoned at the time of this report completion but must be abandoned in accordance with O. Reg. 372/07 (amendment to O. Reg. 903) or current applicable regulations.

The boreholes were advanced using hollow stem augers and mud-rotary drilling using all-terrain vehicle and track-mounted drill rigs supplied and operated by specialist drilling contractors. Samples of the overburden were generally obtained at 0.75 to 1.5 m intervals of depth using either 50 mm outside diameter split-spoon samplers in accordance with the Standard Penetration Test (SPT) procedures (ASTM D1586) or thin-walled tube samplers (ASTM D1587). The Standard Penetration Test was conducted using an automatic hammer for some boreholes while others were completed using a conventional rope and cat-head hammer. Table 2 summarizes the hammer systems used for each of the boreholes in which Standard Penetration Tests were conducted. In general, the sampling routine in the deep boreholes consisted of a repeating sequence of a split-spoon sample, a field vane shear test and a thin-wall tube sample. In some areas, deviations from this sampling routine were necessary to assure recovery of sufficient thin-wall tube samples from critical depths. In the event that the soil strength was sufficient to prohibit completion of field vane shear tests, split-spoon samples were obtained instead. Bulk samples of the near-surface brown or mottled brown and grey native soils were collected from the auger cuttings at thirteen borehole locations. Samples of bedrock were obtained using 'NQ'-sized rock core barrels. The Record of Borehole sheets are provided in Appendix A for all boreholes along with the Record of Drillhole sheets for rock coring information. Photographs of the rock core are included in Appendix B. The soil samples and rock



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cores were identified in the field, placed in labelled containers and transported to Golder's laboratories in London and Mississauga for further examination and testing.

Water levels in the open boreholes were observed throughout the drilling operations. For a total of 11 deep boreholes, piezometers were installed at the bottom of the holes following rock coring to measure groundwater pressures within the bedrock. These piezometers consisted of 13 mm diameter rigid CPVC pipe with a 300 mm long porous tip section installed within a silica sand filter pack. Each piezometer was sealed within the bedrock using bentonite pellet backfill. The remainder of the annular space within the boreholes was filled with cement-bentonite grout. During drilling near the soil-bedrock interface in boreholes BH-341, BH-343 and BH-345, flowing artesian groundwater conditions were encountered. Vibrating wire piezometers (VWPs) were installed at the overburden-bedrock interface in these three boreholes to measure groundwater pressures at the soil/bedrock interface. An additional VWP was installed in BH-345 at a depth of about 15.0 m to measure the groundwater pressure within the soil profile at that depth. Following the installation of the VWPs, these boreholes were sealed by filling them with cement-bentonite grout.

**Table 1: Coordinates and Elevations of Borehole Locations**

<b>Borehole Location Number</b>	<b>MTM NAD83 Northing (m)</b>	<b>MTM NAD83 Easting (m)</b>	<b>Ground Surface Elevation (m)</b>
BH-301	4677712	335231	186.25
BH-304	4677998	335083	188.00
BH-305	4677924	335038	185.86
BH-308	4678306	334724	185.41
BH-310	4678399	334483	185.05
BH-311	4678262	334394	184.85
BH-314	4678751	333462	183.07
BH-318	4679049	332858	182.29
BH-321	4679180	332649	183.14
BH-323	4679521	332168	181.30
BH-325	4679788	331973	180.80
BH-326	4679918	331984	181.78
BH-334	4681380	331322	181.81
BH-336	4681503	331179	182.40
BH-341	4682256	329379	178.80
BH-343	4682232	329086	179.14
BH-343A	4682231	329086	179.14
BH-345	4682149	328863	179.48
CPT-302	4677757	335155	186.26
CPT-303	4677840	335113	186.02
CPT-306	4677912	334965	186.02
CPT-307	4678157	334805	186.43
CPT-309	4678205	334657	185.31
CPT-312	4678320	334283	185.22
CPT-313	4678688	333600	184.04
CPT-315	4678801	333406	184.31



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Borehole Location Number	MTM NAD83 Northing (m)	MTM NAD83 Easting (m)	Ground Surface Elevation (m)
CPT-316	4678831	333265	182.99
CPT-317	4679042	332972	182.64
CPT-319	4679084	332701	183.71
CPT-320	4679156	332737	183.50
CPT-322	4679294	332478	181.50
CPT-324	4679665	332003	180.85
CPT-328	4680024	331863	181.64
CPT-329	4680101	331832	181.98
CPT-330	4680268	331830	182.05
CPT-331	4680439	331811	182.49
CPT-332	4680430	331722	181.88
CPT-333	4680844	331554	182.33
CPT-335	4681416	331211	182.27
CPT-337	4681554	331053	181.49
CPT-338	4681980	330142	181.22
CPT-339	4682147	329636	179.53
CPT-340	4682203	329539	179.58
CPT-342	4682247	329169	178.75
CPT-344	4682206	328975	179.56

**Table 2: Hammer System Used for Standard Penetration Testing**

Automatic Trip Hammer System			
BH-304	BH-311	BH-318	BH-336
BH-305	BH-314	BH-325	
Rope and Cathead System			
BH-301	CPT-302	CPT-319	CPT-335
BH-308	CPT-303	CPT-320	CPT-337
BH-310	CPT-306	CPT-322	CPT-338
BH-321	CPT-307	CPT-324	CPT-339
BH-323	CPT-309	CPT-328	CPT-340
BH-326	CPT-312	CPT-329	CPT-342
BH-334	CPT-313	CPT-330	CPT-344
BH-341	CPT-315	CPT-331	
BH-343	CPT-316	CPT-332	
BH-345	CPT-317	CPT-333	



## **3.2 Laboratory Testing**

Upon return of the samples to the Golder laboratories, the following suite of tests was carried out:

- Natural water content of soils determinations were completed on 320 samples in accordance with ASTM D2216.
- Atterberg limits determinations were completed on 82 samples in accordance with ASTM D4318.
- Mechanical sieve analyses, with or without hydrometer tests, were carried out on 67 samples in accordance with ASTM D422.
- Oedometer tests with unload-reload cycles were completed on a total of 15 specimens in accordance with ASTM D2435.

The laboratory test results are presented in Appendix C.



## **4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS**

### **4.1 Site Geology**

The study area is located in the physiographic region of Southwestern Ontario known as the St. Clair Clay Plains. Within this region, Essex County and the southwestern part of Kent County are normally discussed as a subregion known as the Essex Clay Plain. The clay plain was deposited during the retreat of ice sheets (late Pleistocene Era) when a series of glacial lakes inundated the area. In general, the ice sheets deposited till in the area of Windsor and Detroit. Depending on the locations of the glacial ice sheets and depths of water in the ice-contact glacial lakes, the till may have been directly deposited at the contact between the ice sheet and the 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 the ice were deposited through the lake water (lacustrine depositional environment). Glacial till, in its common usage, often indicates a very dense or hard composition resulting from consolidation and densification under the weight of the ice sheet. The mineral soil particles typically have a distribution of grain sizes ranging from cobbles to clay. In many areas of Windsor and Detroit, the soils described as “glacial till” were deposited through water and have a soft to firm consistency as a result.

The major soil stratum in the study area, consisting primarily of silty clay and clayey silt, typically ranging in thickness from about 20 to 35 m, exhibits a till-like structure exemplified by a random distribution of coarser particles within the primarily fine-grained silt and clay deposit (also called “diamict”). In most of the eastern and northern parts of the Windsor metropolitan area below frost depth, the near-surface clay is generally stiff to hard and brown. Underlying this stiff to hard “crust”, the silty clay becomes grey-brown and firm to stiff in consistency. Below the groundwater level, the silty clay becomes soft to firm, particularly in the western and southern areas of metropolitan Windsor.

Surficial layers or pockets of more typical layered lacustrine (lake-deposited) silty clay, silt or sand may be encountered overlying the extensive stratum of “till-like” silty clay. Silt and sand deposits, on the order of 2 m in thickness, can often be found near the ground surface in areas near the western side of Windsor and the southwestern limits of the study area. A relatively thin stratum, on the order of 1 to 6 m in thickness, of very dense or hard basal glacial till or dense silty sand may be found directly overlying the bedrock surface.

### **4.2 Site Stratigraphy**

The detailed subsurface soil, bedrock and groundwater conditions encountered in the boreholes, together with the results of the field and laboratory testing, are shown on the Record of Borehole sheets following the text of this report and in Appendix C.

In summary, the soils generally consist of surficial topsoil or fill materials overlying Upper Granular Deposits underlain by extensive clayey silt to silty clay deposits interbedded with silty sand and sandy silt deposits, underlain by the Lower Granular Deposits which overlies limestone bedrock encountered at depths ranging from 22 to 35 m.



#### **4.2.1 Topsoil and Fill**

Topsoil was encountered at the ground surface in the majority of the boreholes along the proposed alignment. Buried topsoil layers overlain by surficial fill were found at five borehole locations. The topsoil layers were dark brown to black and about 0.1 to 1.4 m thick. Classification of materials identified in this report as topsoil was based solely on visual and textural evidence. Testing of organic content or other constituents or nutrients, or the topsoil's general suitability as a vegetal growth supporting medium, was not carried out. Therefore, the use of materials classified as topsoil in this report cannot be relied upon for supporting growth of landscaped vegetation (e.g. select grasses).

Fill materials consisting mostly of clayey silt or sand and gravel with traces of organics or bricks were identified in the boreholes generally to the east of Malden Road. These fill layers were found either at the ground surface or overlain by surficial topsoil and were 0.2 to 2.9 m thick. The fill exhibited Standard Penetration Test "N" values of 5 to 14 blows per 0.3 metres for the cohesive materials (firm to stiff consistency) and 7 to 20 blows per 0.3 metres for the cohesionless materials (loose to compact relative density). Natural water content of the fills ranged from about 7 to 21 per cent.

Asphalt concrete pavement layers, from 0.02 to 0.1 m thick, were encountered at the ground surface in five borehole locations.

#### **4.2.2 Upper Granular Deposits**

Native granular soils consisting of sand, silty sand or sandy silt were encountered at most of the borehole locations west of CPT-319. These soils were overlain by the surficial topsoil or fill materials and underlain by the extensive clayey silt to silty clay deposit. The thickness of the Upper Granular Deposits ranged from 0.3 to 2.8 m, generally increasing westward. In some instances, classification of this material was based only on auger cuttings and visual and textural evidence. The results of grain size distributions determined for two samples of this material are provided on Figure C-2; however, it is noted that gravel sizes larger than about 40 mm maximum dimension were not recovered by the sampling methods used. Therefore, Figure C-2 is considered representative of the fraction of the deposit smaller than about 25 mm in maximum dimension. The Upper Granular Deposits exhibited N values between 4 and 31 blows per 0.3 m penetration, generally indicating a loose to compact relative density. Natural water content of the Upper Granular Deposits ranged from about 3 to 28 per cent.

#### **4.2.3 Clayey Silt to Silty Clay Deposit**

A thick deposit of clayey silt to silty clay was encountered in all boreholes completed for this project that penetrated deeper than about 3 m. These deposits were found to extend down to the bedrock or the Lower Granular deposits (where present) in the deep boreholes. Seams or interbeds of sand or sandy silt were found



embedded within the Clayey Silt to Silty Clay Deposit. These seams or interbeds typically range between 0.3 and 1.8 m thick. These interbeds are not described in further detail and the classification characteristics of the interbeds are considered similar to those described in Section 4.2.2, above. The Clayey Silt to Silty Clay Deposit was generally brown or mottled brown and grey within a depth of 2 to 5 m below the ground surface and grey below these depths.

The Clayey Silt to Silty Clay Deposit exhibited N values ranging from 2 blows per 0.3 metres to 66 blows per 0.2 metre penetration. Undrained shear strength measured by field vane shear tests in these deposits ranged from about 20 kilopascals (kPa) to over 144 kPa. Generally, the field vane shear strengths indicated a firm to stiff consistency of these deposits. A soft to firm consistency was identified by the vane results in boreholes 341, 343 and 345 between about elevations 173 m and 163 m. The sensitivity (ratio of undisturbed to remoulded vane shear strength) of the deposits ranged from 1.1 to 5.8, but was typically less than 2.0.

The natural water content measured on select samples from these deposits ranged between about 5 and 50 per cent but was typically between 13 and 27 per cent. Grain size distribution curves for samples of the clayey silt to silty clay deposit are shown on Figures C-3A to C-3D (inclusive). Atterberg limits testing indicated plastic limits ranging from 4 to 22 per cent, liquid limits ranging from 22 to 56 per cent and plasticity indices from 7 to 34 per cent. Of the 82 samples subjected to Atterberg limits testing, 13 exhibited liquid limits greater than 35 per cent. The results of the Atterberg limits testing are presented on Figures C-1A to C-1D (inclusive). The results of the oedometer tests are also presented in Appendix C following the grain size distribution data.

#### **4.2.4 Lower Granular Deposits**

Deposits of compact to very dense sand, silty sand, sandy silt and sand and gravel were encountered beneath the Clayey Silt to Silty Clay Deposit in multiple boreholes along the alignment. This deposit typically exhibited N values of between 17 blows per 0.3 m penetration and more than 100 blows per 0.1 m penetration. Grain size distribution data is presented in Figure C-4, although it is noted that gravel larger than about 40 mm maximum dimension was not recovered by the sampling methods used. Therefore, Figure C-4 is considered representative of the fraction of the deposit smaller than about 25 mm in maximum dimension. This deposit also includes zones or interbeds of clayey silt and silty clay, similar in composition to those described in Section 4.2.3, above. These materials are considered representative of the complex depositional environment near the contact between glacial ice and the bedrock. The consistency of these interbeds typically varies from firm to hard. The thickness of the Lower Granular Deposit, where present, varied up to about 8 m.

#### **4.2.5 Bedrock**

Limestone bedrock of the Hamilton Group (Dundee Formation) or Detroit River Group (Lucas Formation) were encountered in the boreholes at depths ranging from about 22 to 34 m below the ground surface as shown in Table 3 below. The rock encountered in the boreholes was mostly light brown to grey and was described as fresh and medium strong. Hydrocarbon staining on the rock was observed in boreholes west of BH-334,





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inclusive. It is unknown whether the hydrocarbon odour is from natural sources, though some of the rock formations along the proposed highway are known to contain natural bitumen. Rock quality designation (RQD) values ranged between 0 and 100 per cent and were typically above 80 per cent below the upper 2 m of rock. A description of some of the terms used in the description of the bedrock samples from this site is provided on the Lithological and Geotechnical Rock Description Terminology sheet that precedes the Record of Borehole sheets included with this report.

**Table 3: Depth to Bedrock**

Borehole Number	Ground Surface Elevation (m)	Depth To Bedrock (m)	Bedrock Surface Elevation (m)
BH-301	186.25	30.42	155.83
BH-305	185.86	30.76	155.10
BH-311	184.85	34.29	150.56
BH-314	183.07	33.05	150.02
BH-318	182.29	32.56	149.73
BH-321	183.14	34.02	149.12
BH-323	181.30	33.10	148.20
BH-325	180.80	32.31	148.49
BH-326	181.78	32.61	149.17
BH-334	181.81	33.22	148.58
BH-336	182.40	32.33	150.07
BH-341	178.80	21.73	157.06
BH-343	179.14	23.44	155.70
BH-345	179.48	21.79	157.68

### 4.3 Groundwater Conditions

Groundwater level measurements were obtained during the field work and these are summarized in Tables I and II. A description of the piezometer installations was provided in Section 3.1 above and details are illustrated on the Record of Borehole sheets.

For those boreholes in which groundwater was encountered below the ground surface during drilling, the measured groundwater level during drilling will not necessarily be representative of actual groundwater conditions due to the low permeability of the soils and the action of cutting and removal of soils. The latest readings for each piezometer may be most reflective of static groundwater levels. The groundwater pressure elevations may be different within the overburden soil and bedrock. Groundwater levels are expected to fluctuate seasonally and are expected to rise during wet periods of the year.

The groundwater in the project area contains dissolved hydrogen sulphide that is liberated from the water on exposure to atmospheric pressure. Hydrogen sulphide gas was noted by its characteristic odour during drilling of Boreholes BH-341, BH-343 and BH-345 when the bedrock and artesian water pressures were encountered. Concentrations did not exceed health and safety trigger levels of on-site monitoring equipment for the drilling



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conducted for this report; however, it is known that personnel protective equipment alarms have been triggered during drilling completed for other projects when flowing artesian water has been encountered.



## **5.0 MISCELLANEOUS**

The investigation was carried out using equipment supplied and operated by Lantech Drilling Services Inc. and Aardvark Drilling Inc., which are Ontario Ministry of Environment licensed well contractors. The field operations were supervised by Mr. David J. Mitchell, Mr. Chris Collins, Mr. Matt Rhody, Mr. Steve Mayer, Mr. Taner Aktas, Mr. Dan Babcock, Mr. Lubo Kosciuszko and Mr. Mrinmoy Kanungo under the direction of Dr. Storer J. Boone, P.Eng.

The routine laboratory testing was carried out at Golder's London laboratory under the direction of Mr. Chris M. Sewell. The laboratory is an accredited participant in the MTO Soil and Aggregate Proficiency Program and is certified by the Canadian Council of Independent Laboratories for testing Types C and D aggregates.

The oedometer tests were carried out at Golder's Mississauga laboratory by Ms. Marijana Manojlovic. In addition to also being a participant in the MTO Soils and Aggregate Proficiency Program, the Mississauga laboratory is an MTO registered laboratory in the Specialty of Soil and Rock Including Testing for Foundation Engineering – Low and High Complexity.

This report was prepared by Mr. Mrinmoy Kanungo, EIT and Mr. Scott Gryba, P.Eng. under the direction of the Project Manager, Dr. Storer J. Boone, P.Eng. This report was reviewed by Mr. Fintan J. Heffernan, P.Eng., the Designated MTO Contact and Quality Control Auditor for this assignment.

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MK/SJB/FJH/cr

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TABLE I

**SUMMARY OF GROUNDWATER LEVELS IN DEEP PIEZOMETERS**

Geotechnical Data Report Addendum No. 4  
Windsor-Essex Parkway  
Windsor, Ontario

BOREHOLE (#)	GROUND SURFACE ELEVATION (m)	ENCOUNTERED GROUNDWATER ELEVATION (m)	MEASURED GROUNDWATER ELEVATION (m)										Jan.6/10	Feb.24/10
			Nov. 30/09	Dec.1/09	Dec.2/09	Dec.4/09	Dec.7/09	Dec.9/09	Dec.16/09	Dec.18/09	Dec.22/09			
BH-301	186.25	159.7	-	-	-	-	-	-	180.74	180.61	180.53	177.92	178.15	
BH-305	185.86	dry	-	-	-	-	-	-	-	-	-	178.14	178.39	
BH-311	184.85	dry	-	-	-	-	-	-	-	-	-	178.12	178.32	
BH-314	183.07	dry	-	-	-	-	-	-	-	-	-	178.16	178.34	
BH-318	182.29	dry	-	-	-	-	-	-	-	-	-	178.15	178.36	
BH-321	183.14	181.7 & 151.7	-	-	-	-	-	-	178.31	178.28	178.36	178.26	178.52	
BH-323	181.30	150.1	-	-	-	-	-	-	-	178.81	178.84	178.94	179.12	
BH-325	180.80	dry	-	-	-	-	-	-	-	-	-	179.27	179.35	
BH-326	181.78	dry	dry	179.29	179.34	179.39	179.39	179.44	-	-	-	179.52	179.55	
BH-334	181.81	154.1	-	-	-	-	-	-	-	-	180.76	180.89	180.89	
BH-336	182.40	dry	-	-	-	-	-	-	-	-	-	180.93	180.96	

- NOTES:
1. Table to be read in conjunction with accompanying report.
  2. Deep piezometers installed below the soil-bedrock interface in the boreholes.

Prepared By: MK  
Checked By: SJB

TABLE II

**SUMMARY OF GROUNDWATER LEVELS FROM VIBRATING WIRE PIEZOMETERS**

Geotechnical Data Report Addendum No. 4  
Windsor-Essex Parkway  
Windsor, Ontario

<u>BOREHOLE</u> (#)	<u>GROUND</u> <u>SURFACE</u>	<u>ENCOUNTERED</u>	<u>MEASURED GROUNDWATER</u>											
	<u>ELEVATION</u> (m)	<u>ELEVATION</u> (m)	<u>Nov. 19/09</u>	<u>Nov. 20/09</u>	<u>Nov. 21/09</u>	<u>Nov. 22/09</u>	<u>Dec.1/09</u>	<u>Dec.2/09</u>	<u>Dec.3/09</u>	<u>Dec.4/09</u>	<u>Dec.8/09</u>	<u>Dec.15/09</u>	<u>Jan.6/10</u>	<u>Feb.24/10</u>
BH-341	178.80	dry	-	-	-	-	182.25	180.49	180.48	180.56	180.59	180.54	180.51	180.42
BH-343	179.14	177.3	-	180.92	180.78	180.80	-	180.62	-	180.71	180.74	180.69	180.65	180.58
BH-345 shallow	179.48	177.5	180.09	180.13	180.16	180.20	-	179.95	-	180.06	180.07	179.98	179.90	179.82
BH-345 deep			180.85	180.86	180.88	180.91	-	180.72	-	180.82	180.85	180.80	180.78	180.68

## NOTES:

1. Table to be read in conjunction with accompanying report.
2. Vibrating wire piezometers (VWPs) installed at the soil-bedrock interface in the boreholes.  
An additional VWP was installed at elev. 164.48 m in BH-345.
3. Artesian water flow encountered at soil-bedrock interface in BH-341, BH-343 and BH-345.

Prepared By: MK  
Checked By: SJB

## IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

**Standard of Care:** Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

**Basis and Use of the Report:** This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

**Soil, Rock and Groundwater Conditions:** Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

## **IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)**

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

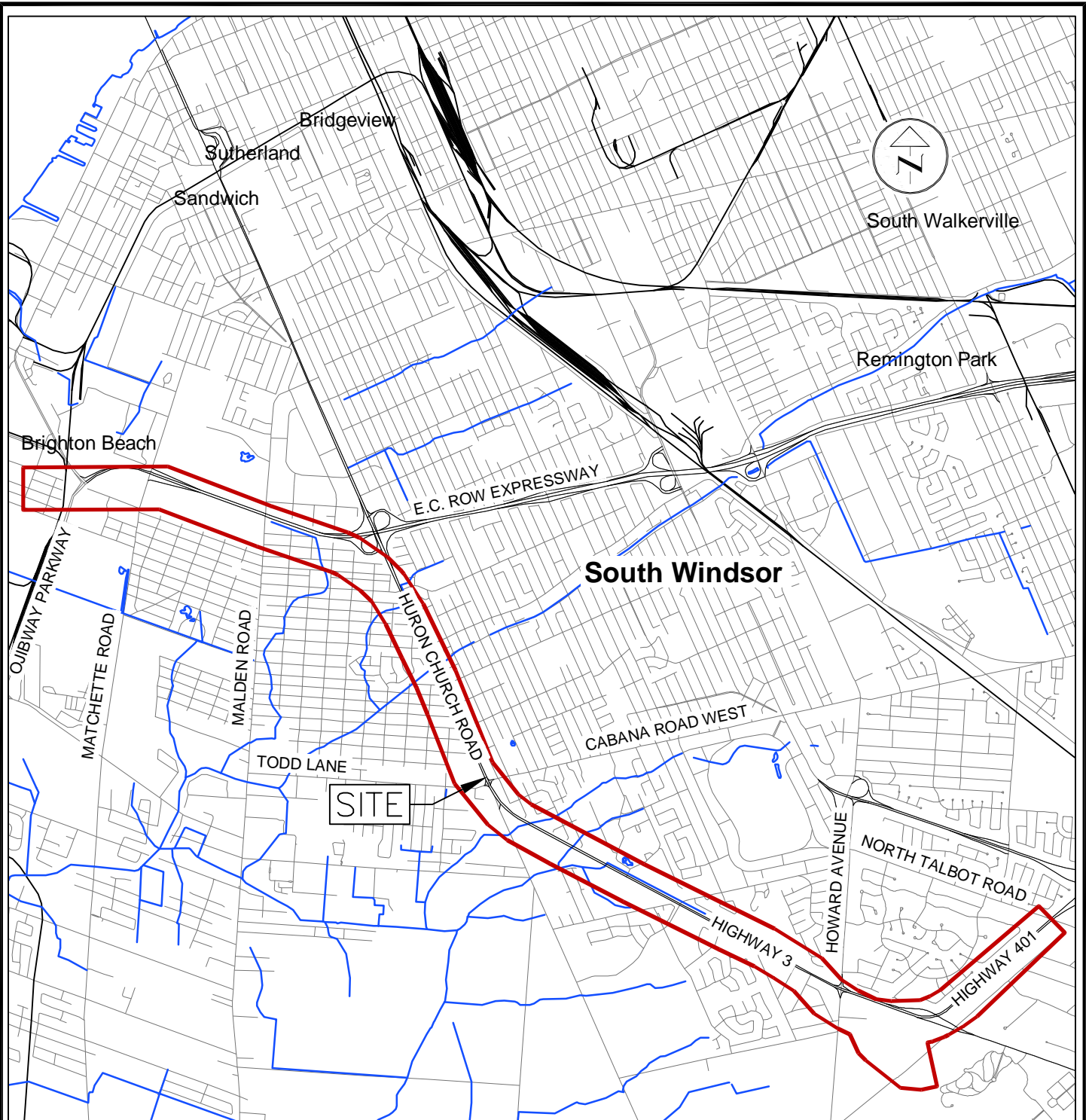
**Sample Disposal:** Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

**Follow-Up and Construction Services:** All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

**Changed Conditions and Drainage:** Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



## REFERENCES

- 1) DRAWING BASED ON CANMAP STREETFILES V2005.4.

## NOTES

- 1) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

PROJECT

WINDSOR-ESSEX PARKWAY  
SUPPLEMENTARY INVESTIGATION  
WINDSOR, ONTARIO

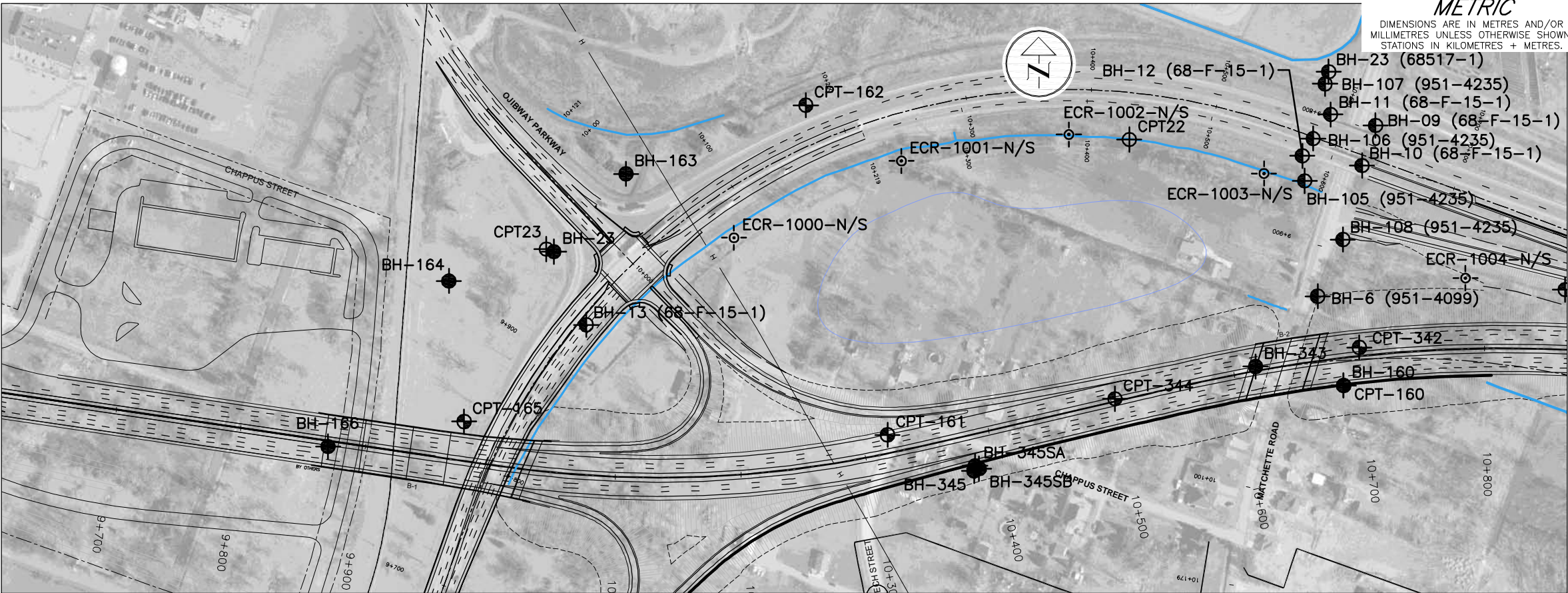
TITLE

## KEY PLAN



PROJECT No.			09-1132-0080			FILE No.			0911320080-5000-R03001								
						SCALE			AS SHOWN			REV.			0		
CADD			WDF			Mar. 10/10			FIGURE 1								
CHECK																	





**NOTE**  
Horizontal and vertical alignment of road ways and general structure alignments shown are based on drawings provided by URS during conceptual design. Final alignments and structure arrangements may differ.



STN 9+800 TO STN 10+800



**REFERENCE**  
Base plans provided in digital format by URS.



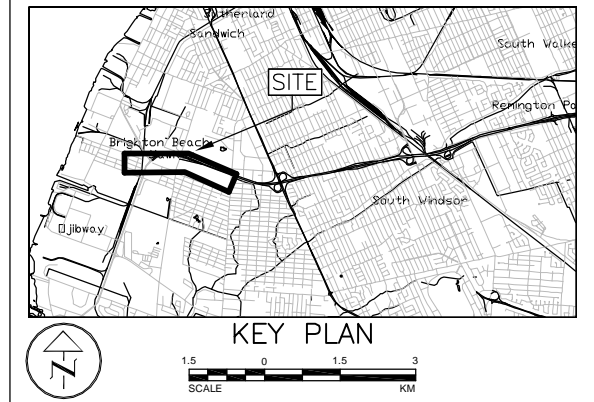
STN 10+800 TO STN 11+800

No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
MAL-4	Grnd	4681952.0	330160.0
CPT-338	181.22	4681980.3	330141.7
CPT-339	179.53	4682147.4	329635.6
CPT-340	179.58	4682203.2	329538.7
BH-341	178.80	4682255.6	329378.7
CPT-342	178.75	4682246.9	329168.7
BH-343	179.14	4682231.8	329086.3
CPT-344	179.56	4682206.2	328974.6
BH-345	179.48	4682149.0	328862.7

**METRIC**  
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No. -  
WP No. -

WINDSOR - ESSEX PARKWAY  
Windsor, Ontario  
BOREHOLE LOCATION MAP  
SHEET  
1

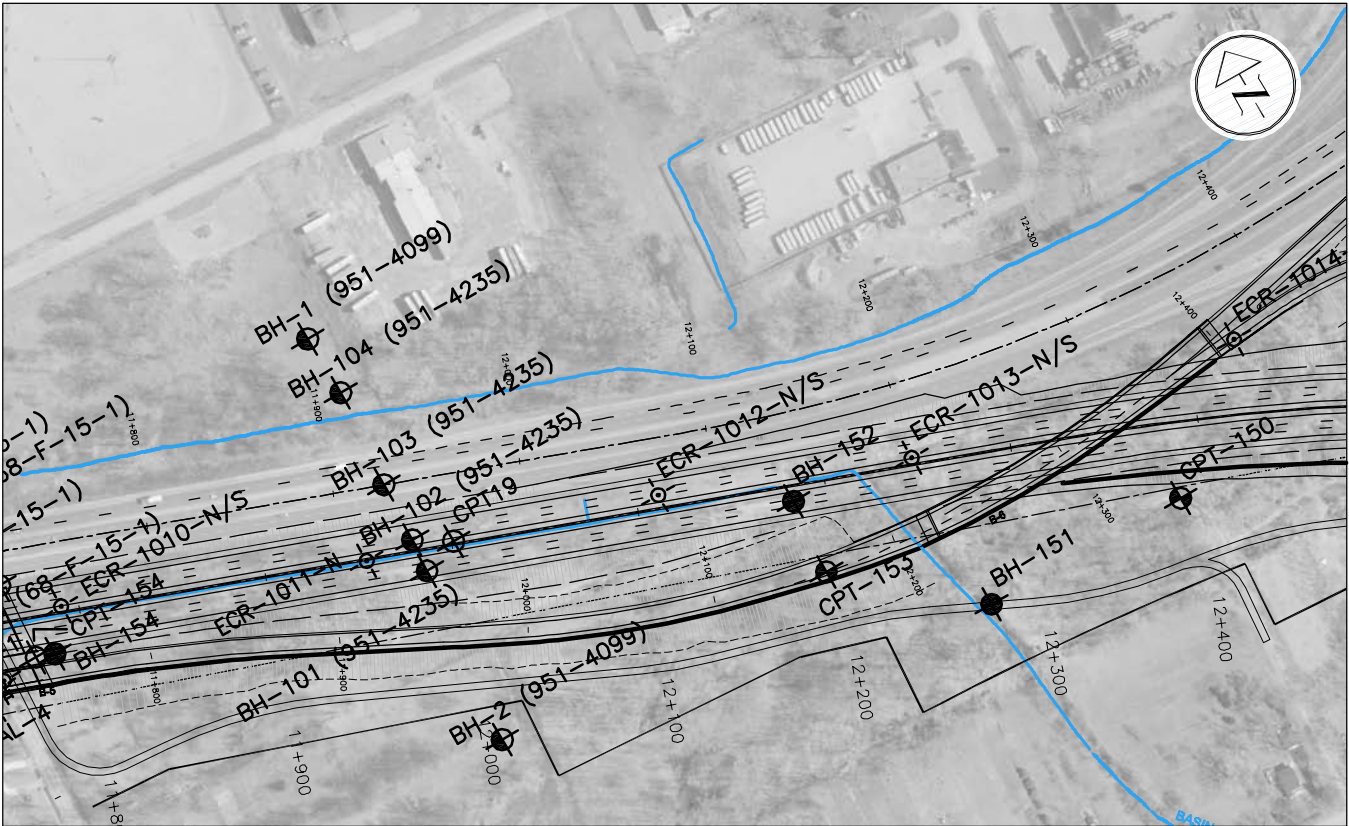


- LEGEND**
- Borehole - Current Investigation
  - Borehole - Previous Investigations
  - Borehole - Pavement Holes
  - Borehole and Cone Penetration Test
  - Cone Penetration Test

No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
BH-23	178.92	4682323.0	328529.0
BH-154	180.87	4681959.9	330200.6
BH-156	179.52	4682106.6	329876.3
BH-158	179.30	4682144.3	329769.9
BH-160	178.51	4682216.8	329156.2
BH-163	178.77	4682384.7	328586.3
BH-164	179.06	4682299.7	328445.6
BH-166	179.00	4682168.3	328349.6
BH-23 (68517-1)	178.92	4682465.8	329144.3
BH-6 (951-4099)	178.79	4682287.6	329135.6
BH-105 (951-4235)	179.05	4682379.2	329125.0
BH-106 (951-4235)	184.35	4682412.8	329132.0
BH-107 (951-4235)	178.97	4682456.2	329141.5
BH-108 (951-4235)	178.50	4682332.6	329155.7
BH-05 (68-F-15-1)	180.69	4682005.8	330193.3
BH-06 (68-F-15-1)	180.75	4682042.1	330185.3
BH-07 (68-F-15-1)	180.53	4682056.5	330145.1
BH-08 (68-F-15-1)	180.93	4682020.2	330165.6
BH-09 (68-F-15-1)	178.46	4682423.2	329181.5
BH-10 (68-F-15-1)	178.55	4682391.3	329170.8
BH-11 (68-F-15-1)	178.46	4682431.9	329145.8
BH-12 (68-F-15-1)	178.37	4682399.1	329123.4
BH-13 (68-F-15-1)	178.43	4682264.9	328554.7
CPT-20	179.76	4681775.0	329868.0
CPT-21	179.89	4682147.0	329759.0
CPT-22	178.89	4682412.0	328986.0
CPT-23	178.93	4682325.0	328523.0
CPT-154	180.75	4681963.3	330191.0
CPT-155	179.69	4682065.8	329981.7
CPT-159	178.77	4682292.8	329332.1
CPT-160	178.51	4682216.8	329156.2
CPT-161	179.06	4682177.6	328793.9
CPT-162	178.99	4682439.2	328729.1
CPT-165	178.98	4682188.2	328457.7
ECR-1000-N/S	Grnd	4682334.0	328672.0
ECR-1001-N/S	Grnd	4682395.0	328805.0
ECR-1002-N/S	Grnd	4682416.0	328938.0
ECR-1003-N/S	Grnd	4682385.0	329093.0
ECR-1004-N/S	Grnd	4682302.0	329253.0
ECR-1005-N/S	Grnd	4682259.0	329419.0
ECR-1006-N/S	Grnd	4682210.0	329560.0
ECR-1007-N/S	Grnd	4682167.0	329706.0
ECR-1008-N/S	Grnd	4682114.0	329864.0
ECR-1009-N/S	Grnd	4682055.0	330004.0
ECR-1010-N/S	Grnd	4681980.0	330216.0
MAL-1	Grnd	4681961.0	330170.0
MAL-2	Grnd	4681959.0	330166.0
MAL-3	Grnd	4681954.0	330160.0

Geocres No. 40J6-27			
HWY. 401	PROJECT NO. 09-1132-0080	DIST. WEST	
SUBM'D. SJB	CHKD.	DATE: Mar. 10/10	SITE:
DRAWN: WDF	CHKD.	APPD.	DWG. 1





**METRIC**  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN.  
STATIONS IN KILOMETRES + METRES.

CONT No. —  
WP No. —

WINDSOR — ESSEX PARKWAY

Windsor, Ontario

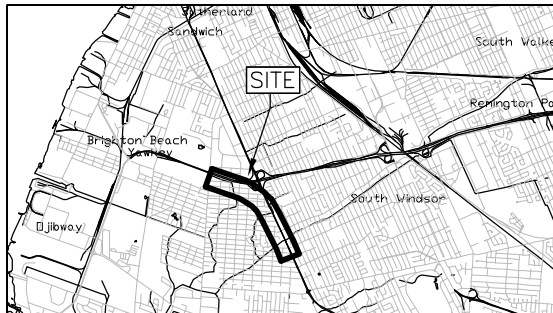
SHEET

2

BOREHOLE LOCATION MAP



**Golder Associates Ltd.**  
LONDON, ONTARIO, CANADA



KEY PLAN

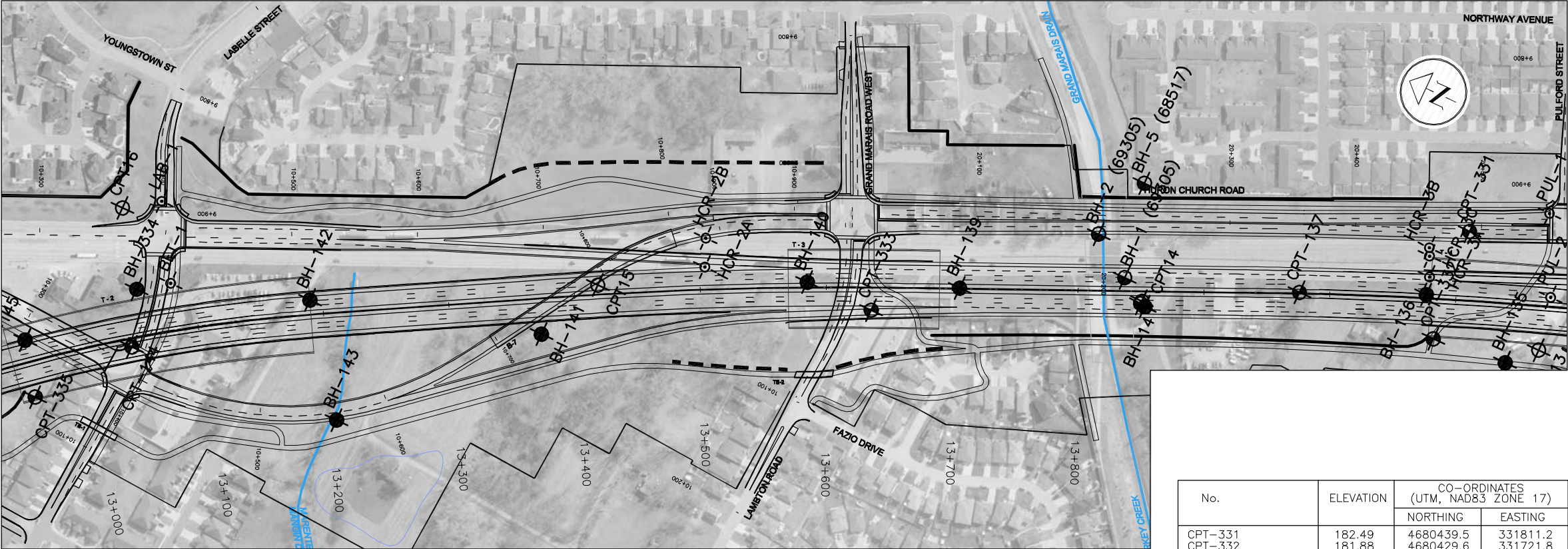


LEGEND

- Borehole — Current Investigation
- Borehole — Previous Investigations
- Borehole — Pavement Holes
- Borehole and Cone Penetration Test
- ⊕ Cone Penetration Test

STN 11+800 TO STN 12+450

STN 12+450 TO STN 13+000



REFERENCE

Base plans provided in digital format by URS.

STN 13+000 TO STN 14+200

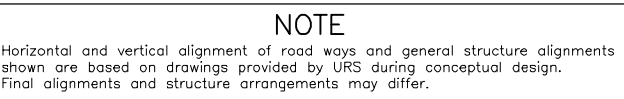
No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
CPT-331	182.49	4680439.5	331811.2
CPT-332	181.88	4680429.6	331721.8
CPT-333	182.33	4680843.8	331553.7
BH-334	181.81	4681379.6	331322.2
CPT-335	182.27	4681416.4	331210.7
BH-336	182.40	4681502.9	331179.1
CPT-337	181.49	4681554.3	331053.5

No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
BH-14	182.06	4680648.0	331648.0
BH-139	182.30	4680787.5	331599.3
BH-140	182.00	4680899.3	331552.4
BH-141	181.72	4681073.1	331425.8
BH-142	181.11	4681251.2	331372.6
BH-143	181.26	4681191.8	331295.2
BH-145	182.21	4681442.8	331248.2
BH-147	180.83	4681670.0	331004.6
BH-149	180.98	4681628.0	330949.6
BH-151	180.35	4681734.8	330842.9
BH-152	180.16	4681834.5	330579.3
BH-154	182.45	4681903.1	331085.9
BH-155	182.68	4681905.5	331136.8
BH-156	183.18	4681888.6	331168.9
BH-157	181.51	4680689.7	331736.7
BH-158	181.87	4680672.3	331662.2
BH-159	181.87	4680705.6	331684.8
BH-160	182.61	4682037.3	330399.7
BH-161	181.20	4681802.3	330382.8
BH-162	178.48	4681899.5	330393.0
BH-163	181.46	4681917.5	330394.5
BH-164	183.10	4681950.5	330396.0
BH-165	182.45	4682003.9	330400.6
BH-166	182.06	4681049.0	331661.1
BH-167	181.93	4681417.0	331376.0
BH-168	182.05	4681625.0	331208.0
BH-169	180.65	4681547.0	330938.0
BH-170	181.23	4681906.0	330413.0
BH-171	181.38	4680541.5	331710.2
BH-172	181.34	4681363.6	331279.2
BH-173	182.21	4681442.8	331248.2
BH-174	181.85	4681540.8	331126.5
BH-175	180.72	4681651.5	330951.4
BH-176	180.85	4681733.4	330757.6
BH-177	180.95	4681793.3	330575.6
BH-178	Grnd	4681920.0	330368.0
BH-179	Grnd	4681873.0	330519.0
BH-180	Grnd	4681823.0	330645.0
BH-181	Grnd	4681792.0	330824.0
BH-182	Grnd	4681752.0	330942.0
BH-183	Grnd	4681679.0	331063.0
BH-184	Grnd	4681678.0	331233.0
BH-185	Grnd	4681674.0	331226.0
BH-186	Grnd	4681669.0	331219.0
BH-187	Grnd	4680978.0	331529.0
BH-188	Grnd	4680987.0	331550.0
BH-189	Grnd	4681139.0	331494.0
BH-190	Grnd	4681357.0	331338.0

Geocres No. 40J6-27

HWY. 401	PROJECT NO.09-1132-0080	DIST. WEST
SUBM'D. SJB	CHKD.	DATE: Mar. 10/10
DRAWN: WDF	CHKD.	APPD.
		DWG. 2





STN 14+200 TO STN 14+800 and STN 10+000 TO STN 10+500



No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
CPT-324	180.85	4679664.9	332002.7
BH-325	180.80	4679787.7	331972.9
BH-326	181.78	4679917.6	331984.5
BH-326SA	181.58	4679915.6	331987.4
BH-326SB	181.70	4679914.3	331984.0
CPT-328	181.64	4680024.3	331862.9
CPT-329	181.98	4680100.8	331832.3
CPT-330	182.05	4680268.1	331829.9

**METRIC**  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN.  
STATIONS IN KILOMETRES + METRES.

CONT No. -  
WP No. -

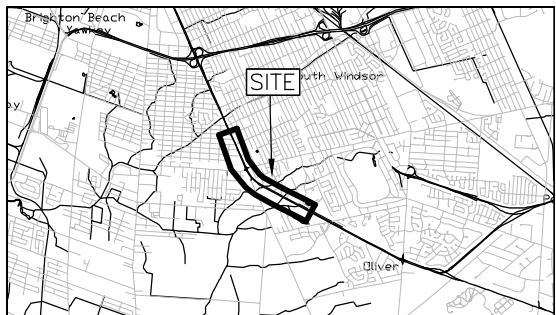
**WINDSOR – ESSSEX PARKWAY**  
Windsor, Ontario

**BOREHOLE LOCATION MAP**

SHEET  
3








**Golder Associates Ltd.**  
LONDON, ONTARIO, CANADA



## KEY PLAN



### LEGEND

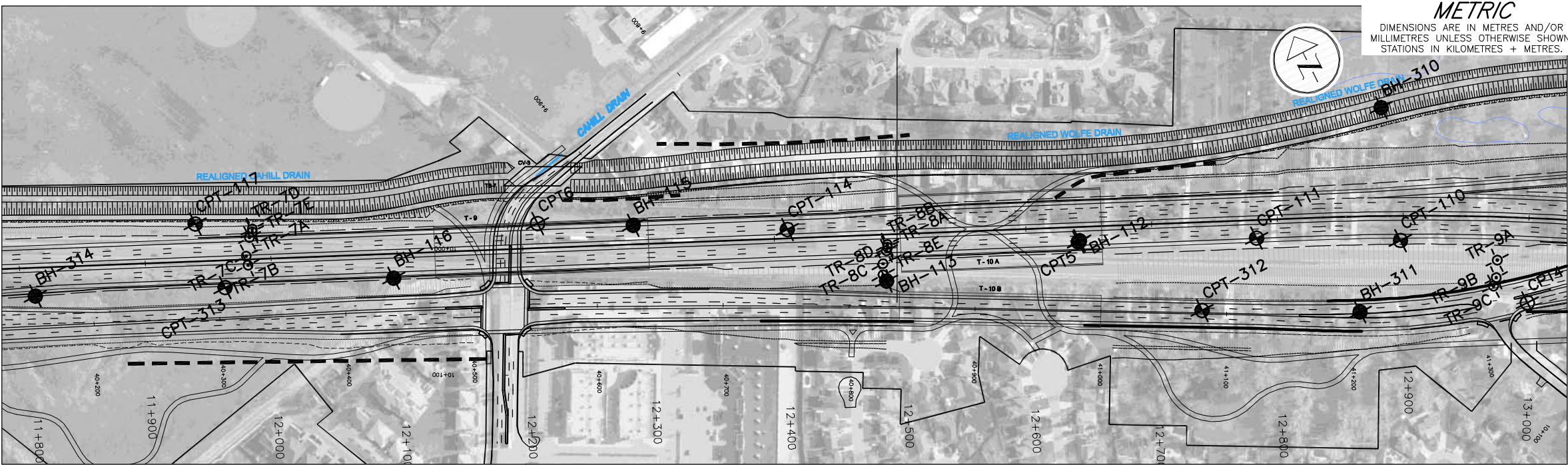
- |   |                                    |
|---|------------------------------------|
|  | Borehole — Current Investigation   |
|  | Borehole — Previous Investigations |
|  | Borehole — Pavement Holes          |
|  | Borehole and Cone Penetration Test |
|  | Cone Penetration Test              |

No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
BH7	183.17	4678848.0	333325.0
BH-118	182.66	4678903.5	333302.9
BH-119	182.50	4678961.6	333120.6
BH-122	181.66	4679265.4	332537.9
BH-126	180.61	4679237.2	332335.5
BH-127	181.27	4679370.9	332251.6
BH-129	180.78	4679625.1	332109.7
BH-131	180.80	4679944.8	331856.4
BH-132	181.47	4680070.8	331910.3
BH-135	182.02	4680369.9	331728.7
BH-136	181.75	4680449.5	331751.3
CPT-7	183.18	4678844.0	333327.0
CPT-8	182.48	4678967.0	333109.0
CPT-9	182.32	4679205.0	332828.0
CPT-10	181.81	4679264.0	332533.0
CPT-11	180.91	4679634.0	332110.0
CPT-12	181.61	4680072.0	331924.0
CPT-120	184.49	4678947.2	333029.8
CPT-121	181.97	4679024.8	333077.4
CPT-123	181.60	4679309.7	332536.3
CPT-124	181.51	4679354.6	332455.0
CPT-128	180.87	4679490.6	332200.8
CPT-13	182.08	4680350.0	331749.0
CPT-130	180.82	4679821.8	332036.1
CPT-133	181.64	4680184.7	331953.4
CPT-134	181.36	4680151.4	331888.7
CAB-1	Grnd	4679699.0	332153.0
HCL-1A	Grnd	4679462.0	332232.0
HCL-1B	Grnd	4679499.0	332210.0
HCR-3A	Grnd	4680453.0	331765.0
HCR-3B	Grnd	4680463.0	331786.0
HCR-3C	Grnd	4680460.0	331780.0
HCR-4A	Grnd	4679987.0	332000.0
HCR-4B	Grnd	4679976.0	331981.0
HCR-4C	Grnd	4679977.0	331985.0
HCR-4D	Grnd	4679980.0	331988.0
PUL-1	Grnd	4680388.0	331851.0
PUL-2	Grnd	4680359.0	331791.0
TOD-1	Grnd	4679648.0	332099.0
TR-5A	Grnd	4679352.0	332451.0
TR-5B	Grnd	4679356.0	332453.0
TR-5C	Grnd	4679342.0	332431.0
TR-5D	Grnd	4679346.0	332454.0
TR-5E	Grnd	4679354.0	332451.0
TR-6A	Grnd	4679092.0	332913.0
TR-6B	Grnd	4679088.0	332911.0
TR-6C	Grnd	4679077.0	332912.0
TR-6D	Grnd	4679100.0	332921.0
TR-6E	Grnd	4679103.0	332922.0
TR-6F	Grnd	4679104.0	332922.0

Geocres No. 40J6-27

HWY. 401		PROJECT NO.09-1132-0080		DIST. WEST	
SUBM'D. SJB		CHKD.		DATE: Mar. 10/10	
DRAWN: WDF		CHKD.		APPD. DWG. 3	

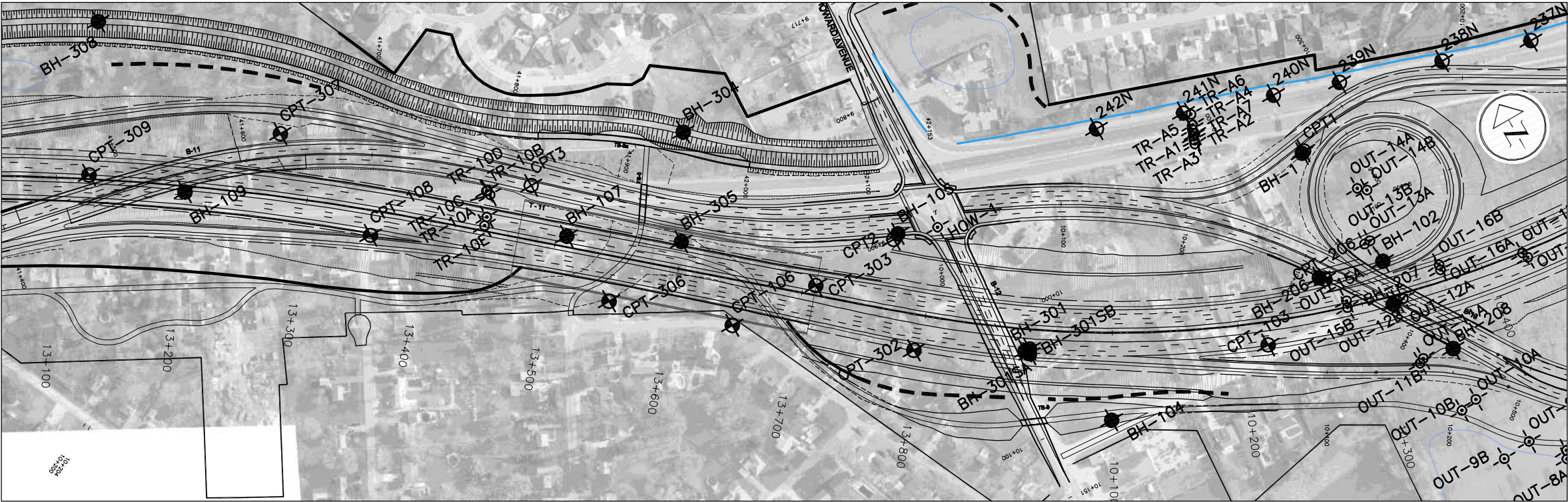




**METRIC**  
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

STN 11+750 TO STN 13+050

**NOTE**  
Horizontal and vertical alignment of road ways and general structure alignments shown are based on drawings provided by URS during conceptual design. Final alignments and structure arrangements may differ.



STN 13+050 TO STN 13+848 and STN 10+000 TO STN 10+450

LEGEND	
	Borehole - Current Investigation
	Borehole - Previous Investigations
	Borehole - Pavement Holes
	Borehole and Cone Penetration Test
	Cone Penetration Test

REFERENCE	
Base plans provided in digital format by URS.	

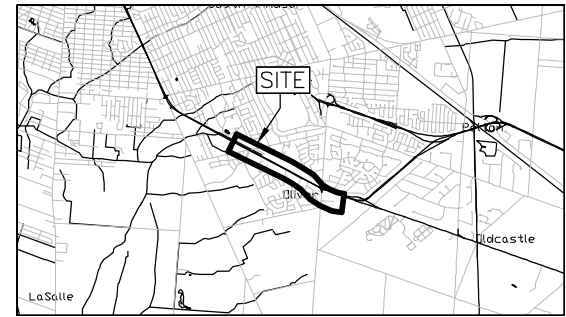
No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
BH-301	186.25	4677712.2	335231.1
BH-301SA	186.30	4677708.5	335233.0
BH-301SB	186.45	4677711.9	335235.1
CPT-302	186.26	4677756.9	335154.9
CPT-303	186.02	4677840.3	335113.1
BH-304	188.00	4677998.2	335082.8
BH-305	185.86	4677923.8	335038.1
CPT-306	186.02	4677911.6	334964.7
CPT-307	186.43	4678157.2	334805.1
BH-308	185.41	4678306.4	334724.2
CPT-309	185.31	4678204.8	334657.1
BH-310	185.05	4678398.7	334482.8
BH-311	184.85	4678261.8	334394.2
CPT-312	185.22	4678319.9	334283.0
CPT-313	184.04	4678688.4	333599.7
BH-314	183.07	4678750.8	333462.3

No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
TR-7A	Grnd	4678715.0	333635.0
TR-7B	Grnd	4678696.0	333624.0
TR-7C	Grnd	4678703.0	333628.0
TR-7D	Grnd	4678720.0	333640.0
TR-7E	Grnd	4678718.0	333639.0
TR-8A	Grnd	4678478.0	334083.0
TR-8B	Grnd	4678480.0	334084.0
TR-8C	Grnd	4678468.0	334074.0
TR-8D	Grnd	4678476.0	334081.0
TR-8E	Grnd	4678460.0	334070.0
TR-9A	Grnd	4678249.0	334510.0
TR-9B	Grnd	4678237.0	334503.0
TR-9C	Grnd	4678232.0	334498.0
TR-A1	Grnd	4677790.0	335431.0
TR-A2	Grnd	4677793.0	335432.0
TR-A3	Grnd	4677787.0	335430.0
TR-A4	Grnd	4677801.0	335436.0
TR-A5	Grnd	4677798.0	335434.0
TR-A6	Grnd	4677809.0	335439.0
TR-A7	Grnd	4677794.0	335434.0

CONT No. -	
WP No. -	
WINDSOR - ESSEX PARKWAY Windsor, Ontario	SHEET 4
BOREHOLE LOCATION MAP	



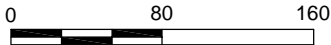
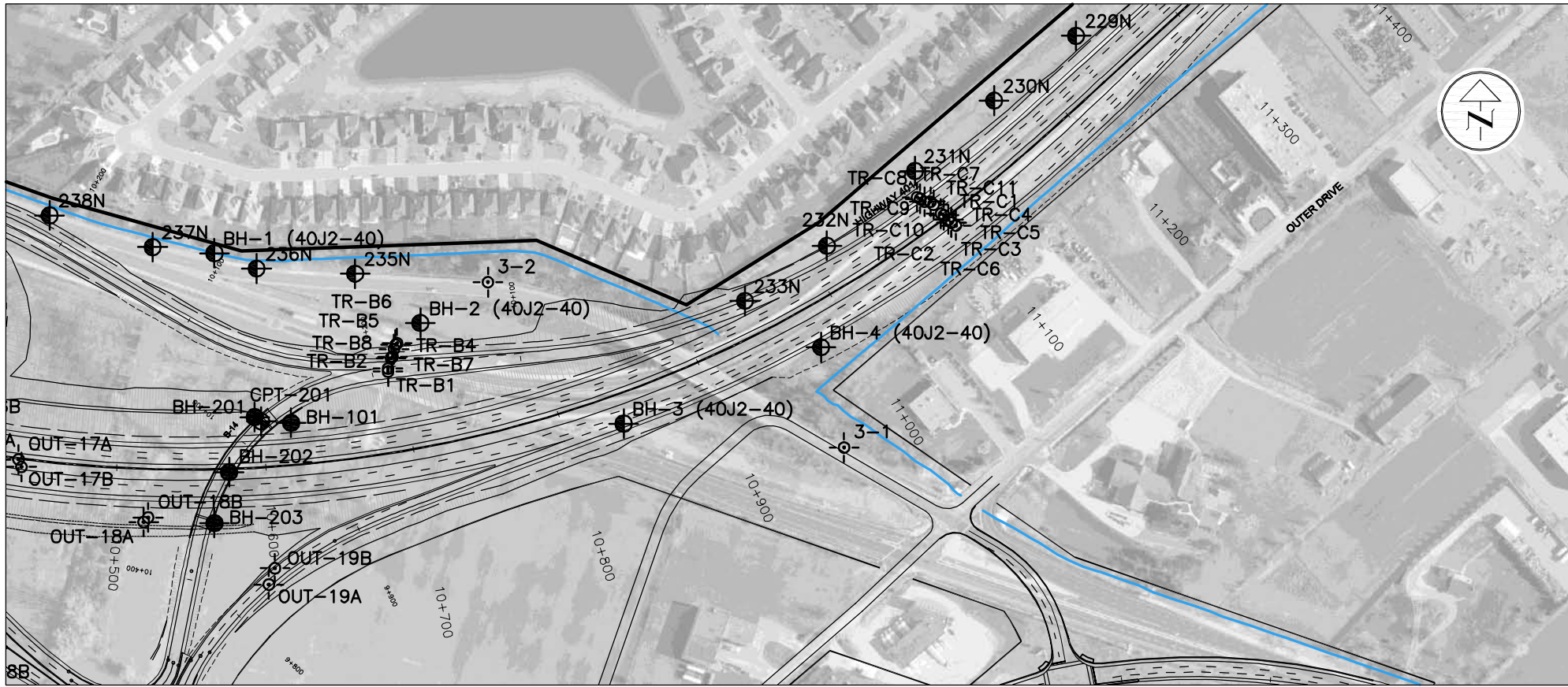
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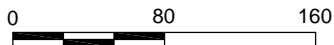
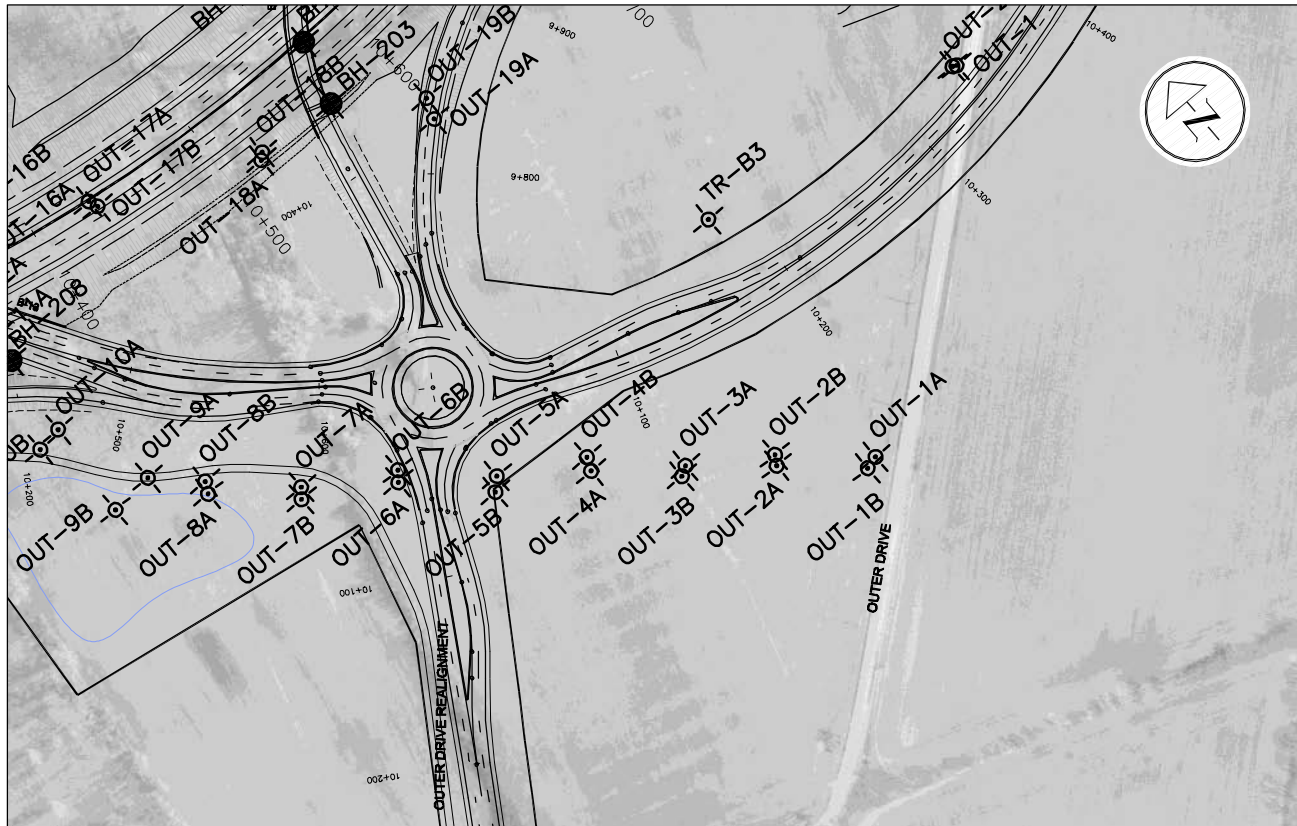
No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
237N	187.77	4677724.5	335702.0
238N	187.82	4677745.8	335632.9
239N	187.56	4677771.9	335553.8
240N	187.42	4677789.2	335503.3
241N	187.24	4677812.8	335434.4
242N	187.05	4677836.5	335368.3
BH-1	186.70	4677738.0	335500.0
BH-102	186.60	4677631.8	335512.7
BH-104	186.15	4677630.3	335263.1
BH-105	186.16	4677843.2	335190.1
BH-107	185.85	4677973.1	334961.3
BH-109	185.30	4678155.0	334716.3
BH-112	184.58	4678413.3	334221.3
BH-113	184.41	4678454.5	334070.3
BH-115	183.79	4678585.3	333911.1
BH-116	183.64	4678634.3	333722.5
BH-206	186.48	4677645.8	335462.4
BH-207	186.89	4677598.1	335502.7
BH-208	186.88	4677543.9	335526.5
CPT1	186.69	4677739.0	335502.0
CPT2	186.35	4677841.0	335185.0
CPT3	185.91	4678022.0	334957.0
CPT4	185.09	4678208.0	334516.0
CPT5	184.69	4678413.0	334220.0
CPT6	184.08	4678621.0	333844.0
CPT-103	186.30	4677620.0	335400.7
CPT-106	185.72	4677846.1	335039.9
CPT-108	185.60	4678051.6	334826.8
CPT-110	184.82	4678297.8	334448.6
CPT-111	184.92	4678351.4	334347.6
CPT-114	184.21	4678526.7	334018.6
CPT-117	183.29	4678744.1	333601.5
CPT-206	186.48	4677642.5	335465.8
HOW-1	Grnd	4677832.0	335220.0
OUT-10A	Grnd	4677500.0	335522.0
OUT-10B	Grnd	4677498.0	335508.0
OUT-11A	Grnd	4677549.0	335502.0
OUT-11B	Grnd	4677547.0	335498.0
OUT-12A	Grnd	4677598.0	335512.0
OUT-12B	Grnd	4677599.0	335507.0
OUT-13A	Grnd	4677651.0	335512.0
OUT-13B	Grnd	4677651.0	335507.0
OUT-14A	Grnd	4677692.0	335524.0
OUT-14B	Grnd	4677687.0	335530.0
OUT-15A	Grnd	4677619.0	335472.0
OUT-15B	Grnd	4677614.0	335470.0
OUT-16A	Grnd	4677603.0	335459.0
OUT-16B	Grnd	4677607.0	335550.0
TR-10A	Grnd	4678018.0	334914.0
TR-10B	Grnd	4678036.0	334925.0
TR-10C	Grnd	4678032.0	334925.0
TR-10D	Grnd	4678036.0	334924.0
TR-10E	Grnd	4678013.0	334909.0

Geocres No. 40J6-24			
HWY. 401	PROJECT NO.09-1132-0080	DIST. WEST	
SUBM'D. SJB	CHKD.	DATE: Mar. 10/10	SITE:
DRAWN: WDF	CHKD.	APPD.	DWG. 4





STN 10+450 TO 11+300



STN 10+350 TO STN 10+650

**METRIC**  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN.  
STATIONS IN KILOMETRES + METRES.

CONT No. —  
WP No. —

WINDSOR — ESSEX PARKWAY  
Windsor, Ontario

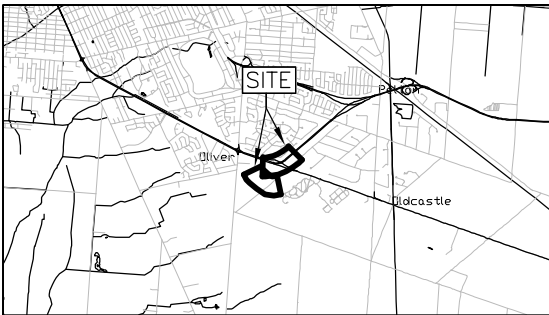
SHEET

5

BOREHOLE LOCATION MAP



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KEY PLAN



LEGEND

- Borehole — Current Investigation
- Borehole — Previous Investigations
- Borehole — Pavement Holes
- Borehole and Cone
- Cone Penetration Test

No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
229N	187.34	4677866.4	336321.6
230N	187.37	4677822.9	336266.7
231N	187.06	4677775.6	336213.6
232N	186.75	4677725.4	336154.5
233N	186.39	4677688.5	336099.5
235N	188.50	4677706.7	335837.9
236N	187.56	4677710.1	335771.8
237N	187.77	4677724.5	335702.0
238N	187.82	4677745.8	335632.9
BH-1 (40J2-40)	187.20	4677720.4	335743.5
BH-2 (40J2-40)	186.60	4677673.6	335881.7
BH-3 (40J2-40)	187.80	4677606.0	336018.1
BH-4 (40J2-40)	187.20	4677657.3	336150.5
BH-201	187.67	4677610.4	335770.5
BH-202	187.31	4677573.5	335753.3
BH-203	187.23	4677539.3	335743.5
BH-101	187.37	4677606.6	335794.9
CPT-201	187.67	4677607.5	335774.9
3-1	Grnd	4677590.0	336166.0
3-2	Grnd	4677701.0	335927.0

NOTE

Horizontal and vertical alignment of road ways and general structure alignments shown are based on drawings provided by URS during conceptual design.  
Final alignments and structure arrangements may differ.

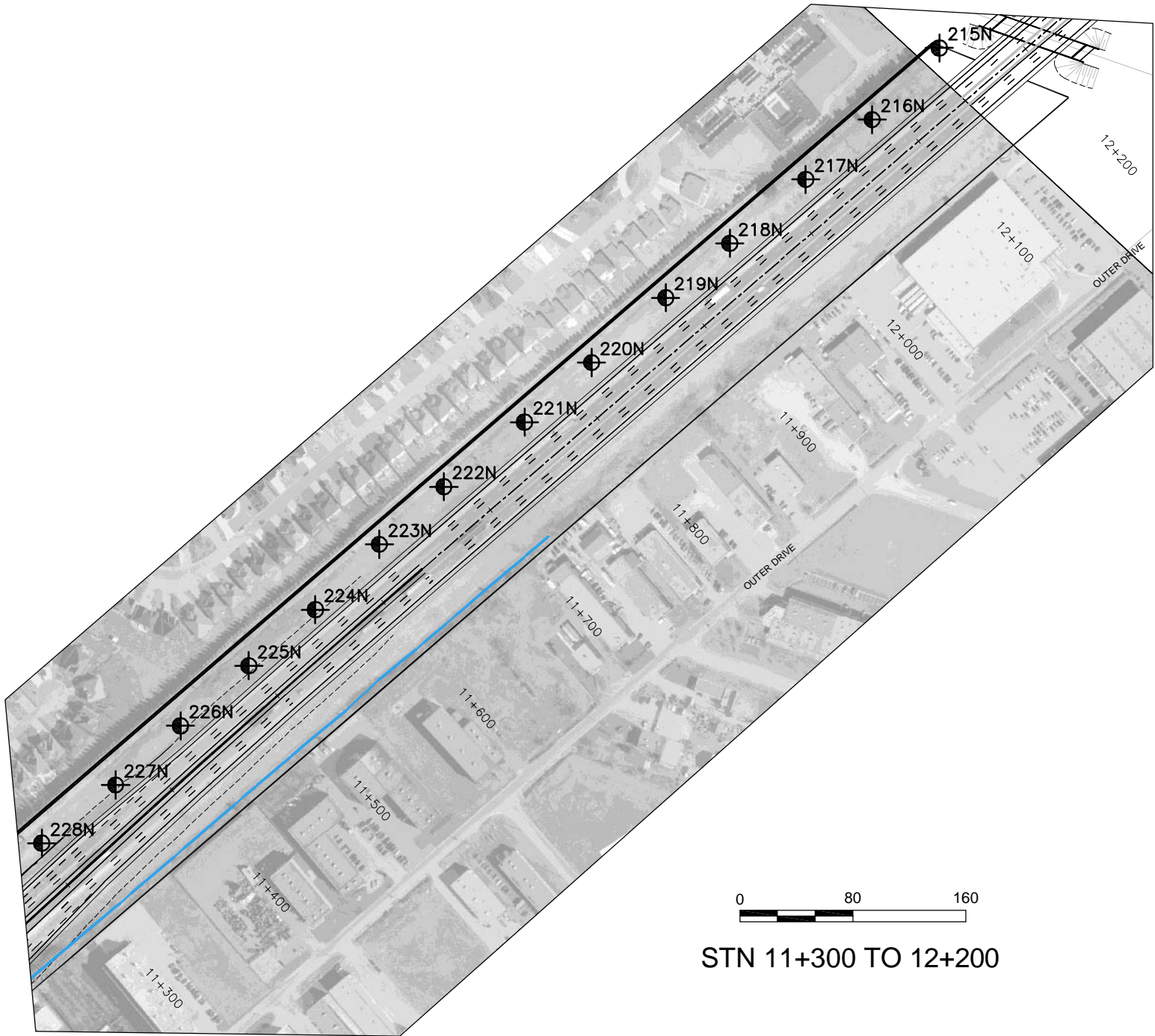
REFERENCE

Base plans provided in digital format by URS.

No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
OUT-1	Grnd	4677342.0	336010.0
OUT-2	Grnd	4677343.0	336008.0
OUT-1A	Grnd	4677211.0	335844.0
OUT-1B	Grnd	4677209.0	335837.0
OUT-2A	Grnd	4677241.0	335801.0
OUT-2B	Grnd	4677246.0	335804.0
OUT-3A	Grnd	4677272.0	335764.0
OUT-3B	Grnd	4677269.0	335759.0
OUT-4A	Grnd	4677302.0	335724.0
OUT-4B	Grnd	4677309.0	335727.0
OUT-5A	Grnd	4677332.0	335684.0
OUT-5B	Grnd	4677326.0	335678.0
OUT-6A	Grnd	4677363.0	335642.0
OUT-6B	Grnd	4677368.0	335646.0
OUT-7A	Grnd	4677394.0	335601.0
OUT-7B	Grnd	4677389.0	335597.0
OUT-8A	Grnd	4677423.0	335561.0
OUT-8B	Grnd	4677429.0	335564.0
OUT-9A	Grnd	4677450.0	335542.0
OUT-9B	Grnd	4677448.0	335518.0
OUT-17A	Grnd	4677582.0	335612.0
OUT-17B	Grnd	4677577.0	335614.0
OUT-18A	Grnd	4677540.0	335696.0
OUT-18B	Grnd	4677543.0	335699.0
OUT-19A	Grnd	4677498.0	335780.0
OUT-19B	Grnd	4677509.0	335784.0
TR-B1	Grnd	4677641.0	335860.0
TR-B2	Grnd	4677643.0	335860.0
TR-B3	Grnd	4677364.0	335857.0
TR-B4	Grnd	4677656.0	335864.0
TR-B5	Grnd	4677659.0	335865.0
TR-B6	Grnd	4677660.0	335866.0
TR-B7	Grnd	4677650.0	335862.0
TR-B8	Grnd	4677651.0	335863.0
TR-C1	Grnd	4677746.0	336233.0
TR-C2	Grnd	4677747.0	336231.0
TR-C3	Grnd	4677741.0	336238.0
TR-C4	Grnd	4677743.0	336236.0
TR-C5	Grnd	4677741.0	336238.0
TR-C6	Grnd	4677739.0	336241.0
TR-C7	Grnd	4677755.0	336220.0
TR-C8	Grnd	4677758.0	336215.0
TR-C9	Grnd	4677757.0	336217.0
TR-C10	Grnd	4677755.0	336224.0
TR-C11	Grnd	4677753.0	336226.0

NO.	DATE	BY	REVISION
Geocres No. 40J6-27			
HWY.	401	PROJECT NO.09-1132-0080	DIST. WEST
SUBM'D.	SJB	CHKD.	DATE: Mar. 10/10
DRAWN:	WDF	CHKD.	APPD.
		DWG.	5





STN 11+300 TO 12+200

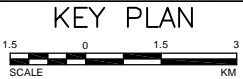
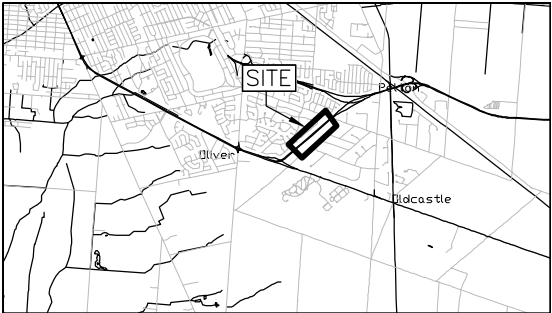


**METRIC**  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN.  
STATIONS IN KILOMETRES + METRES.

CONT No. —	
WP No. —	
WINDSOR — ESSSEX PARKWAY Windsor, Ontario	
BOREHOLE LOCATION MAP	
SHEET 6	



**Golder Associates Ltd.**  
LONDON, ONTARIO, CANADA



LEGEND

- Borehole — Current Investigation
- Borehole — Previous Investigations
- Borehole — Pavement Holes
- Borehole and Cone
- Cone Penetration Test

No.	ELEVATION	CO-ORDINATES (UTM, NAD83 ZONE 17)	
		NORTHING	EASTING
215N	189.69	4678473.3	337006.7
216N	189.29	4678422.6	336959.2
217N	189.25	4678380.3	336912.2
218N	189.13	4678335.0	336858.4
219N	189.03	4678296.5	336813.1
220N	188.85	4678250.7	336760.7
221N	188.81	4678208.5	336713.2
222N	188.49	4678162.8	336656.1
223N	188.24	4678122.1	336610.5
224N	188.32	4678075.8	336565.2
225N	188.09	4678036.1	336518.1
226N	187.72	4677993.6	336469.8
227N	187.61	4677951.7	336423.8
228N	187.41	4677910.5	336371.5

NOTE

Horizontal and vertical alignment of road ways and general structure alignments shown are based on drawings provided by URS during conceptual design.  
Final alignments and structure arrangements may differ.

REFERENCE

Base plans provided in digital format by URS.

NO.	DATE	BY	REVISION
Geocres No. 40J6-27			
HWY.	401	PROJECT NO.09-1132-0080	DIST. WEST
SUBM'D.	SJB	CHKD.	DATE: Mar 10/10
DRAWN:	WDF	CHKD.	APPD.
		DWG.	6

## LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

### I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
SS	Split-spoon
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

### III. SOIL DESCRIPTION

#### (a) Cohesionless Soils

Density Index (Relative Density)	N Blows/300 mm or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

### II. PENETRATION RESISTANCE

#### Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split spoon sampler for a distance of 300 mm (12 in.)

#### Consistency

	<u>kPa</u>	<u>psf</u>
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

#### (b) Cohesive Soils

#### Dynamic Cone Penetration Resistance; $N_d$ :

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

**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 and rod

#### Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm<sup>2</sup> pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance ( $Q_t$ ), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

### IV. SOIL TESTS

w	water content
$w_p$	plastic limit
$w_l$	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test <sup>1</sup>
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement <sup>1</sup>
$D_R$	relative density (specific gravity, $G_s$ )
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
$SO_4$	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane (LV-laboratory vane test)
$\gamma$	unit weight

**Note: 1** Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

## LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

### **I. General**

$\pi$	3.1416
$\ln x$ ,	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

### **II. STRESS AND STRAIN**

$\gamma$	shear strain
$\Delta$	change in, e.g. in stress: $\Delta \sigma$
$\epsilon$	linear strain
$\epsilon_v$	volumetric strain
$\eta$	coefficient of viscosity
$\nu$	poisson's ratio
$\sigma$	total stress
$\sigma'$	effective stress ( $\sigma' = \sigma - u$ )
$\sigma'_{vo}$	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
$\sigma_{oct}$	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
$\tau$	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

### **III. SOIL PROPERTIES**

#### **(a) Index Properties**

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
$\gamma'$	unit weight of submerged soil ( $\gamma' = \gamma - \gamma_w$ )
$D_R$	relative density (specific gravity) of solid particles ( $D_R = \rho_s / \rho_w$ ) (formerly $G_s$ )
e	void ratio
n	porosity
S	degree of saturation

#### **(a) Index Properties (continued)**

w	water content
$w_L$	liquid limit
$w_p$	plastic limit
$I_p$	plasticity index $= (w_L - w_p)$
$w_s$	shrinkage limit
$I_L$	liquidity index $= (w - w_p) / I_p$
$I_C$	consistency index $= (w_L - w) / I_p$
$e_{max}$	void ratio in loosest state
$e_{min}$	void ratio in densest state
$I_D$	density index $= (e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

#### **(b) Hydraulic Properties**

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

#### **(c) Consolidation (one-dimensional)**

$C_c$	compression index (normally consolidated range)
$C_r$	recompression index (over-consolidated range)
$C_s$	swelling index
$C_a$	coefficient of secondary consolidation
$m_v$	coefficient of volume change
$c_v$	coefficient of consolidation
$T_v$	time factor (vertical direction)
U	degree of consolidation
$\sigma'_p$	pre-consolidation pressure
OCR	over-consolidation ratio $= \sigma'_p / \sigma'_{vo}$

#### **(d) Shear Strength**

$\tau_p, \tau_r$	peak and residual shear strength
$\phi'$	effective angle of internal friction
$\delta$	angle of interface friction
$\mu$	coefficient of friction $= \tan \delta$
$c'$	effective cohesion
$c_u, s_u$	undrained shear strength ( $\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
$p'$	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 + \sigma_3)/2$ or $(\sigma'_1 + \sigma'_3)/2$
$q_u$	compressive strength $(\sigma_1 + \sigma_3)$
$S_t$	sensitivity

- Notes:**
- 1  $\tau = c' + \sigma' \tan \phi'$
  - 2 shear strength  $= (\text{compressive strength})/2$
  - \* density symbol is  $\rho$ . Unit weight symbol is  $\gamma$  where  $\gamma = \rho g$  (i.e. mass density x acceleration due to gravity)



# LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

## WEATHERING STATE

Fresh: no visible sign of weathering.

**Faintly weathered:** weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable.

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.  
Completely weathered: rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

## BEDDING THICKNESS

<u>Description</u>	<u>Bedding Plane Spacing-</u>
Very thickly bedded	>2 m
Thickly bedded	0.6 m to 2m
Medium bedded	0.2 m to 0.6m
Thinly bedded	60 m to 0.2 m
Very thinly- bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	< 6 mm

## JOINT OR FOLIATION SPACING

<u>Description</u>	<u>Spacing</u>
Very wide	> 3 m
Wide	1 – 3 m
Moderately close	0.3 – 1 m
Close	50 – 300 mm
Very close	< 50 mm

## GRAIN SIZE

Term	Size*
Very Coarse Grained	> 60 mm
Coarse Grained	2 – 60 mm
Medium Grained	60 microns – 2 mm
Fine Grained	2 – 60 microns
Very Fine Grained	< 2 microns

Note: \*Grains >60 microns diameter are visible to the naked eye.

## CORE CONDITION

### Total Core Recovery (TCR)

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

### Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full circumference, measured relative to the length of the total core run.

### Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid sticks.

## DISCONTINUITY DATA

### Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

### Dip with Respect to (W.R.T.) Core Axis

The angle of the discontinuity relative to the axis (length) of the core, In a vertical borehole a discontinuity with a 90° angle is horizontal.

### Description and Notes

An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces

### Abbreviations

B – Bedding	P - Polished
FO - Foliation Schistosity	S - Slickensided
CL - Cleavage	SM - Smooth
SH - Shear Plane Zone	R - Ridged / Rough
VN - Vein	ST - Stepped
F - Fault	PL - Planar
CO - Contact	FL - Flexured
J - Joint	UE - Uneven
FR - Fracture	W - Wavy
M F - Mechanical Fracture	C - Curved
- Parallel To	
⊥ - Perpendicular To	



# **APPENDIX A**

## **Record of Borehole Sheets**

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 301</b>		1 OF 4	<b>METRIC</b>
W.P. _____	LOCATION <u>N 4677712.2 ;E 335231.1</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 2, 2009 - December 3, 2009</u>	CHECKED BY _____			


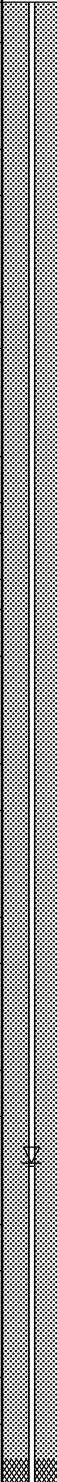




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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 15/03/10

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 301</b>		2 OF 4		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4677712.2; E 335231.1</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 2, 2009 - December 3, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE									
	CLAYEY SILT, some sand, trace gravel Stiff Grey		15	TO	PH		171							1 15 53 31				
				16	SS		7	170										
								169										
								168										
					167													
167.04	SILTY CLAY, trace sand Firm Grey		18	TO	PH											1 24 44 31		
19.21																		
				19	TO		PH	166										
					165													
165.37	CLAYEY SILT, some sand, trace gravel Stiff Grey		20	SS	8													
20.88																		
								164										
								163										
								162										
			21	TO	PH													
			22	SS	28													
			23	SS	18													
159.73	SAND, fine, trace silt Very dense Grey		24	SS	72													
26.52																		
157.29	CLAYEY SILT, some sand, trace gravel Hard Grey		25	SS	66													
28.96																		

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 301</b>		3 OF 4		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4677712.2; E 335231.1</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 2, 2009 - December 3, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT  W <sub>P</sub>	NATURAL MOISTURE CONTENT  W	LIQUID LIMIT  W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE										
							20	40	60	80	100							
155.83	LIMESTONE, fresh, medium strong, laminated, very fine to fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		26	SS	100/25mm													
30.42			27	NQ RC	-		71	0	0									
			28	NQ RC	-		98	48	45									
			29	NQ RC	-		77	60	50									
			30	NQ RC	-		100	82	65									
			31	NQ RC	-		100	73	67									
150.28	END OF BOREHOLE																	
35.97																		
	Groundwater encountered at about elev. 159.7m during drilling on December 2 and 3, 2009.  Water level measured at elev. 178.15m on February 24, 2010.  Water level measured at elev. 177.92m on January 6, 2010.  Borehole sealed with cement-bentonite grout.																	

PROJECT: 09-1132-0080

# RECORD OF DRILLHOLE: 301

SHEET 4 OF 4

LOCATION: N 4677712.2 ;E 335231.1

DRILLING DATE: December 2, 2009 - December 3, 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 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 &amp; symbols.</small>										DISCONTINUITY DATA			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	DIP w.r.t. CORE AXIS		TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
										TOTAL CORE %	SOLID CORE %			10°	10°																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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		ROCK SURFACE		155.83																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

DEPTH SCALE



1 : 75



LOGGED: SG

CHECKED:

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 304</b>		1 OF 1		<b>METRIC</b>	
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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N VALUES			SHEAR STRENGTH kPa					w <sub>p</sub>	w	w <sub>L</sub>		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	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Very stiff Brown becoming grey below about elev. 182.8m																				
2.90			4	SS	3																
			5	SS	25																
			6	SS	34																
			7	SS	18																
			8	SS	12																
			9	SS	6																
179.92	END OF BOREHOLE																				
8.08	Borehole dry during drilling on November 27, 2009.																				

PROJECT 09-1132-0080 **RECORD OF BOREHOLE NO 305** 1 OF 4 **METRIC**

W.P. \_\_\_\_\_ LOCATION N 4677923.8 ;E 335038.1 ORIGINATED BY SM

DIST WEST HWY 401 / 3 BOREHOLE TYPE POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC COMPILED BY LMK/DMB

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

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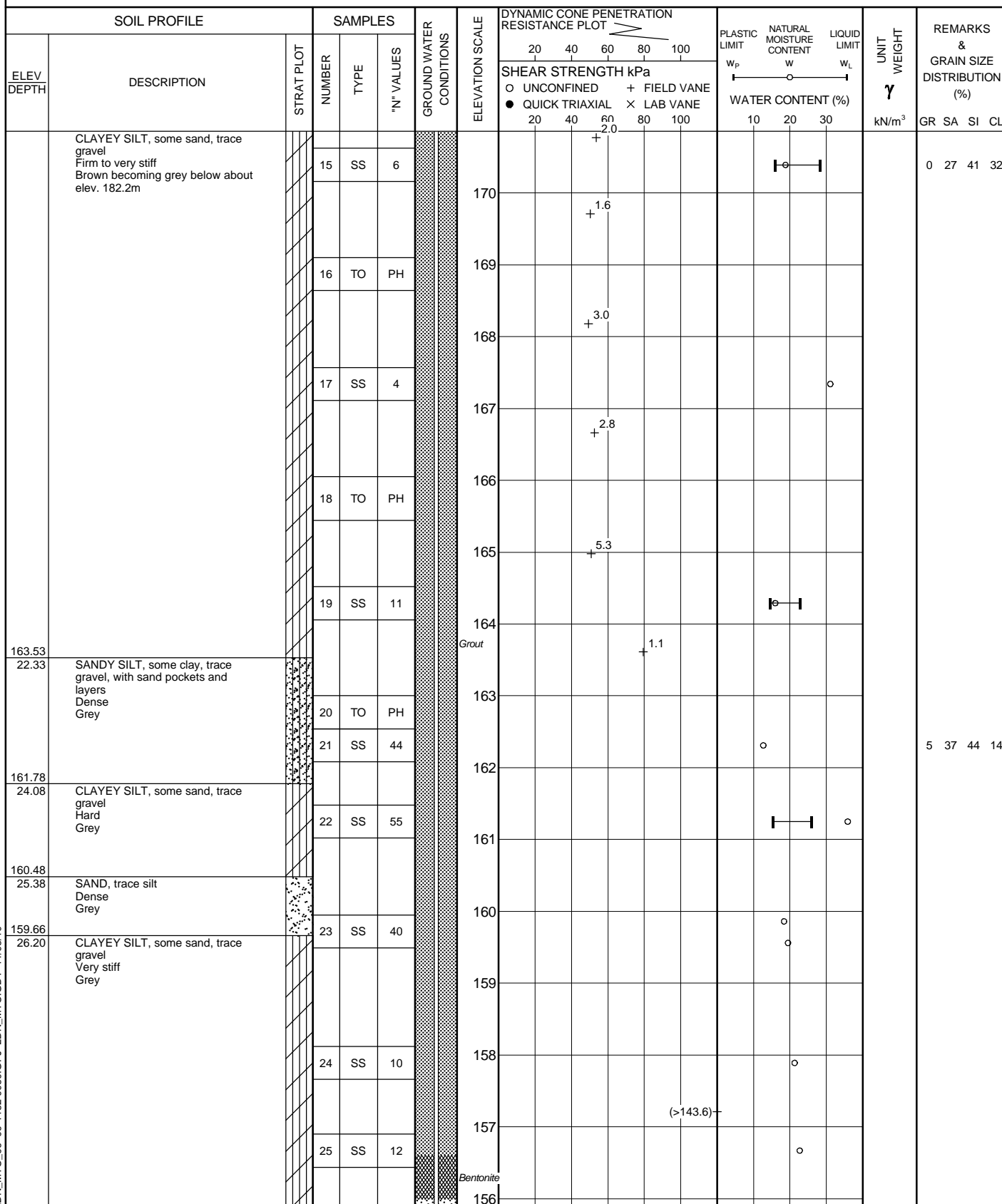
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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10



PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 305</b>		2 OF 4	<b>METRIC</b>
W.P. _____	LOCATION <u>N 4677923.8 ;E 335038.1</u>	ORIGINATED BY <u>SM</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>	BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>	COMPILED BY <u>LMK/DMB</u>			
DATUM <u>GEODETIC</u>	DATE <u>November 30, 2009 - December 1, 2009</u>	CHECKED BY _____			



Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

DN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 305</b>		3 OF 4		<b>METRIC</b>	
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 <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		
155.09	CLAYEY SILT, some sand, trace gravel Very stiff Grey		26	SS	100/ 0mm															
30.77	LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous Light brown to grey  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		27	NQ RC	-		100	38	17											
			28	NQ RC	-		98	74	64											
			29	NQ RC	-		T.C.R. (%) 98	S.C.R. (%) 79	R.Q.D. (%) 75											
			30	NQ RC	-		100	71	83											
149.99																				
35.87	END OF BOREHOLE  Borehole dry during drilling on November 30, 2009 to December 1, 2009.  Water level measured at elev. 178.39 on February 24, 2010.  Water level measured at elev. 178.14 on January 6, 2010.																			

INCLINATION: -90°      AZIMUTH: ---

SHEET 4 OF 4

DATUM: GEODETIC

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 308</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4678306.4 ; E 334724.2</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, HOLLOW STEM</u>		COMPILED BY <u>WDF/DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>January 14, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE						● QUICK TRIAXIAL	× LAB VANE
185.41	GROUND SURFACE					▽										
0.00	TOPSOIL, clayey Firm Black						185									
184.55	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Firm to stiff Brown becoming grey below about elev. 181.8m						184									
0.86		1	SS	7			183									
							182									
		2	SS	26			181									
							180									
		3	SS	34			179									
							178									
		4	SS	58			177									
							176									
		5	SS	15			175									
					174											
	6	SS	16		173											

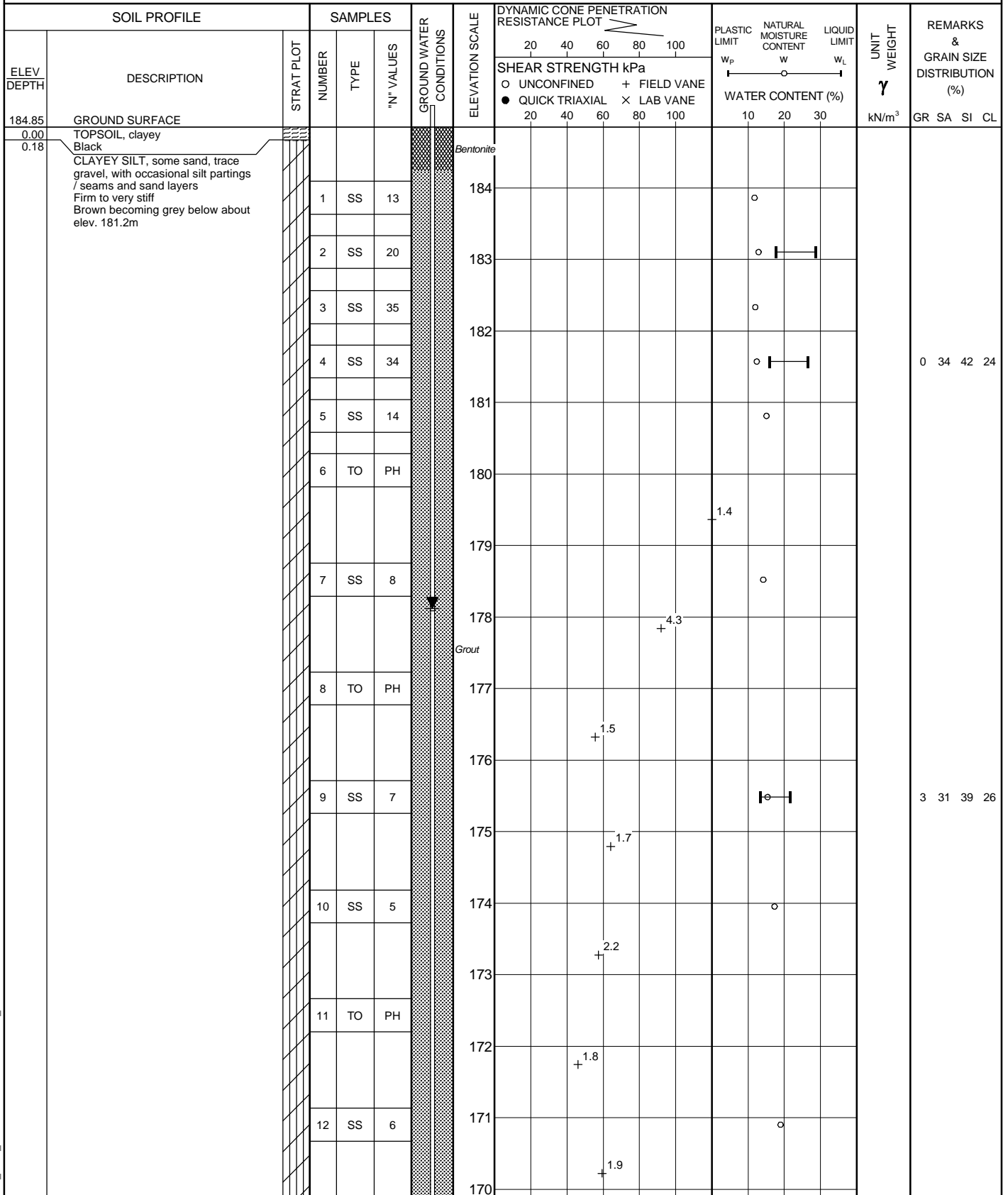
LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 310</b>		1 OF 1	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4678398.7 ; E 334482.8</u>		ORIGINATED BY <u>TA</u>	
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, HOLLOW STEM</u>		COMPILED BY <u>WDF/DMB</u>	
DATUM <u>GEODETIC</u>		DATE <u>January 14, 2010</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W <sub>p</sub>	W	W <sub>L</sub>		GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
185.05	GROUND SURFACE									20	40	60	80	100	10	20	30																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 311</b>		1 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4678261.8 ; E 334394.2</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 3, 2009 - December 4, 2009</u>		CHECKED BY _____	



LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

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

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 311</b>		2 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4678261.8 ; E 334394.2</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 3, 2009 - December 4, 2009</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE					
	CLAYEY SILT, some sand, trace gravel, with occasional silt partings / seams and sand layers Firm to very stiff Brown becoming grey below about elev. 181.2m		13	TO	PH									
			14	SS	5									0 28 40 32
			15	SS	4									
			16	TO	PH									
			17	SS	10									
			18	TO	PH									
			19	SS	14									
			20	SS	30									
158.63	SANDY SILT, trace clay Dense Grey		21	SS	5									
157.95	CLAYEY SILT, some sand, trace gravel Stiff Grey		22	SS	24									3 47 35 15
156.42	SANDY SILT, some clay, trace gravel Compact Grey													
154.90														

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 311</b>		3 OF 4		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4678261.8 ; E 334394.2</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 3, 2009 - December 4, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										WATER CONTENT (%)		
					20			40	60	80	100	10						20	30	
29.95	SAND, fine to coarse, some silt, trace gravel Dense to very dense Grey						Bentonite										7 80 7 6			
			23	SS	30		154													
							153													
			24	SS	58															
151.85							152													
33.00	SAND AND GRAVEL, trace silt Very dense Grey						Sand													
			25	SS	55		151													
150.56																				
34.29	LIMESTONE, fresh, medium strong, weakly laminated to laminated, very fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		26	NQ RC	-			90	80	85										
			27	NQ RC	-		150		97	61	43									
			28	NQ RC	-		149		100	78	46									
			29	NQ RC	-		148		97	93	87									
			30	NQ RC	-		147		96	94	94									
								146												
145.86							Piezometer													
38.99	END OF BOREHOLE																			
	Borehole dry during drilling on December 3 and 4, 2009.																			
	Water level measured at elev. 178.32 on February 24, 2010.																			
	Water level measured at elev. 178.12 on January 6, 2010.																			



PROJECT: 09-1132-0080

**RECORD OF DRILLHOLE: 311**

SHEET 4 OF 4

LOCATION: N 4678261.8 ;E 334394.2

DRILLING DATE: December 1, 2009 - December 4, 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 (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	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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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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>		<b>RECORD OF BOREHOLE No 314</b>		1 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4678750.8 ; E 333462.3</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>LMK/DMB</u>	
DATUM <u>GEODETIC</u>		DATE <u>December 7, 2009 - December 9, 2009</u>		CHECKED BY _____	

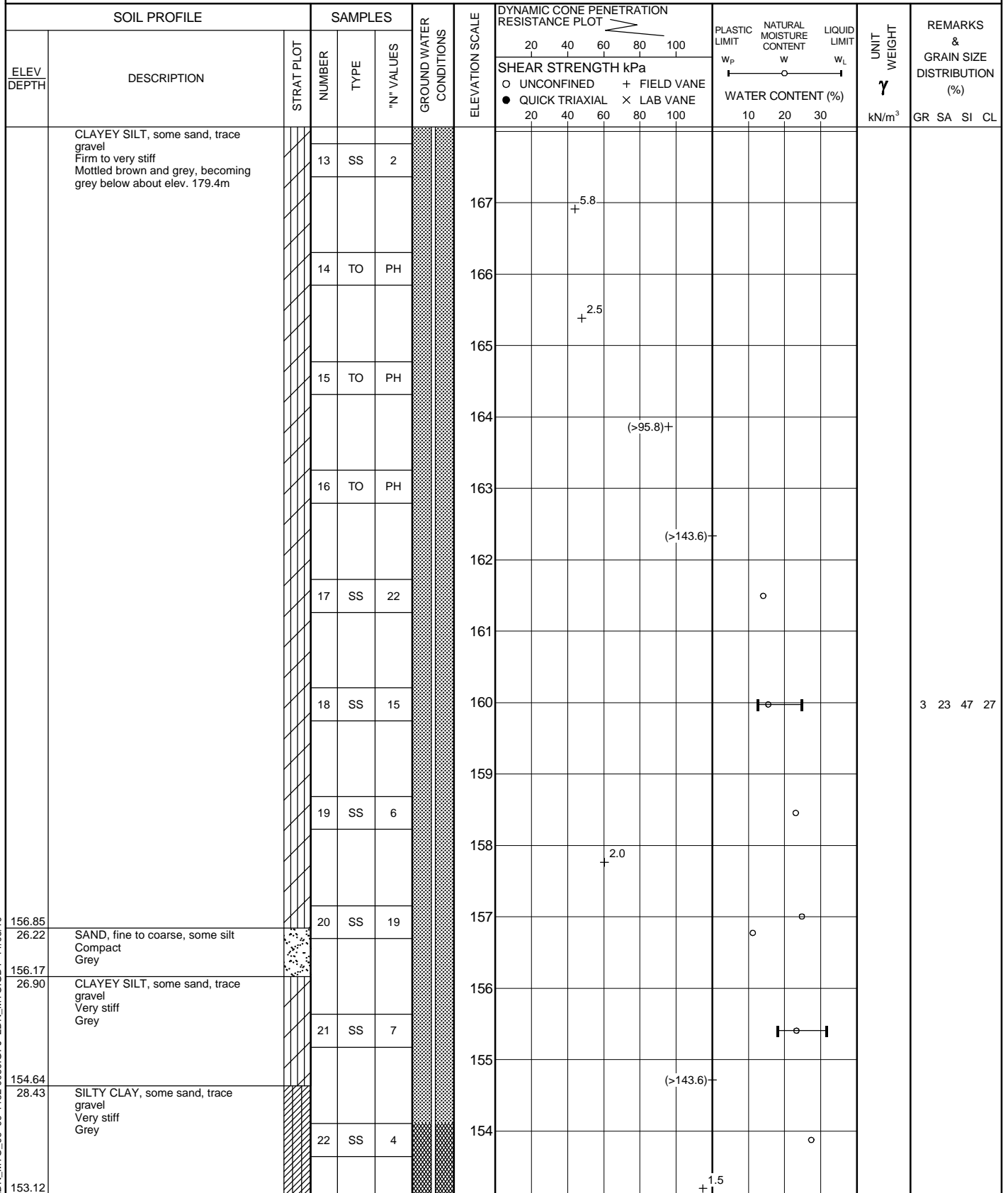
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W <sub>p</sub>	W	W <sub>L</sub>		
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE					
183.07	GROUND SURFACE													
0.00	TOPSOIL, clayey Black													
0.23	CLAYEY SILT, some sand, trace gravel Firm to very stiff Mottled brown and grey, becoming grey below about elev. 179.4m													
			1	SS	6									
			2	SS	27									
			3	SS	31									
			4	SS	26									
			5	SS	18									
			6	SS	11									
			7	TO	PH									
			8	SS	6									
			9	TO	PH									
			10	TO	PH									
			11	SS	6									
			12	TO	PH									

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 314</b>		2 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4678750.8 ; E 333462.3</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>LMK/DMB</u>	
DATUM <u>GEODETIC</u>		DATE <u>December 7, 2009 - December 9, 2009</u>		CHECKED BY _____	



LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 314</b>		3 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4678750.8 ; E 333462.3</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>LMK/DMB</u>	
DATUM <u>GEODETIC</u>		DATE <u>December 7, 2009 - December 9, 2009</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE										WATER CONTENT (%)		
								20	40	60	80	100						10	20	30
29.95	SILTY SAND, some gravel, trace clay Compact Grey						152										11 44 35 10			
			23	SS	21															
			24	SS	23															
150.02	LIMESTONE, fresh, medium strong, weakly laminated, fine grained, faintly porous Light brown to grey  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)						150													
33.05			25	NQ RC	-															
			26	NQ RC	-															
			27	NQ RC	-															
			28	NQ RC	-															
144.82	END OF BOREHOLE  Borehole dry during drilling between December 7 and 9, 2009.  Water level measured at elev. 178.35 on February 24, 2010.  Water level measured at elev. 178.17 on January 6, 2010.						145													
38.25																				

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

PROJECT: 09-1132-0080

# RECORD OF DRILLHOLE: 314

SHEET 4 OF 4

LOCATION: N 4678750.8 ;E 333462.3

DRILLING DATE: December 7, 2009 - December 9, 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)	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 <small>NOTE: For additional abbreviations refer to list of abbreviations &amp; symbols.</small>										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 <sup>-8</sup>	10 <sup>-6</sup>	10 <sup>-4</sup>	10 <sup>-2</sup>	2	4	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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DEPTH SCALE

1 : 75

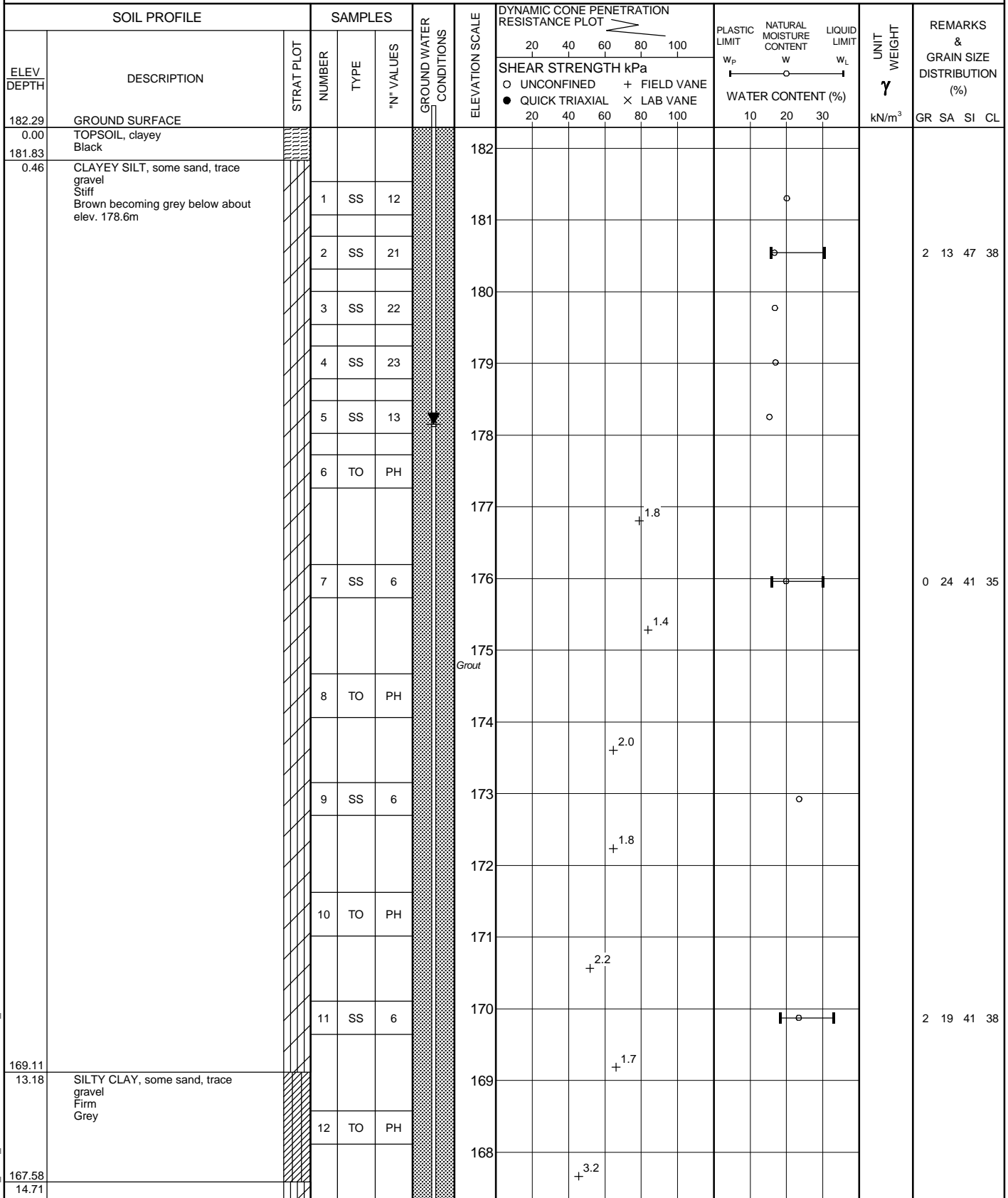


LOGGED: SG

CHECKED:

LDN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 318</b>		1 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4679049.3 ; E 332857.8</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 10, 2009 - December 14, 2009</u>		CHECKED BY _____	

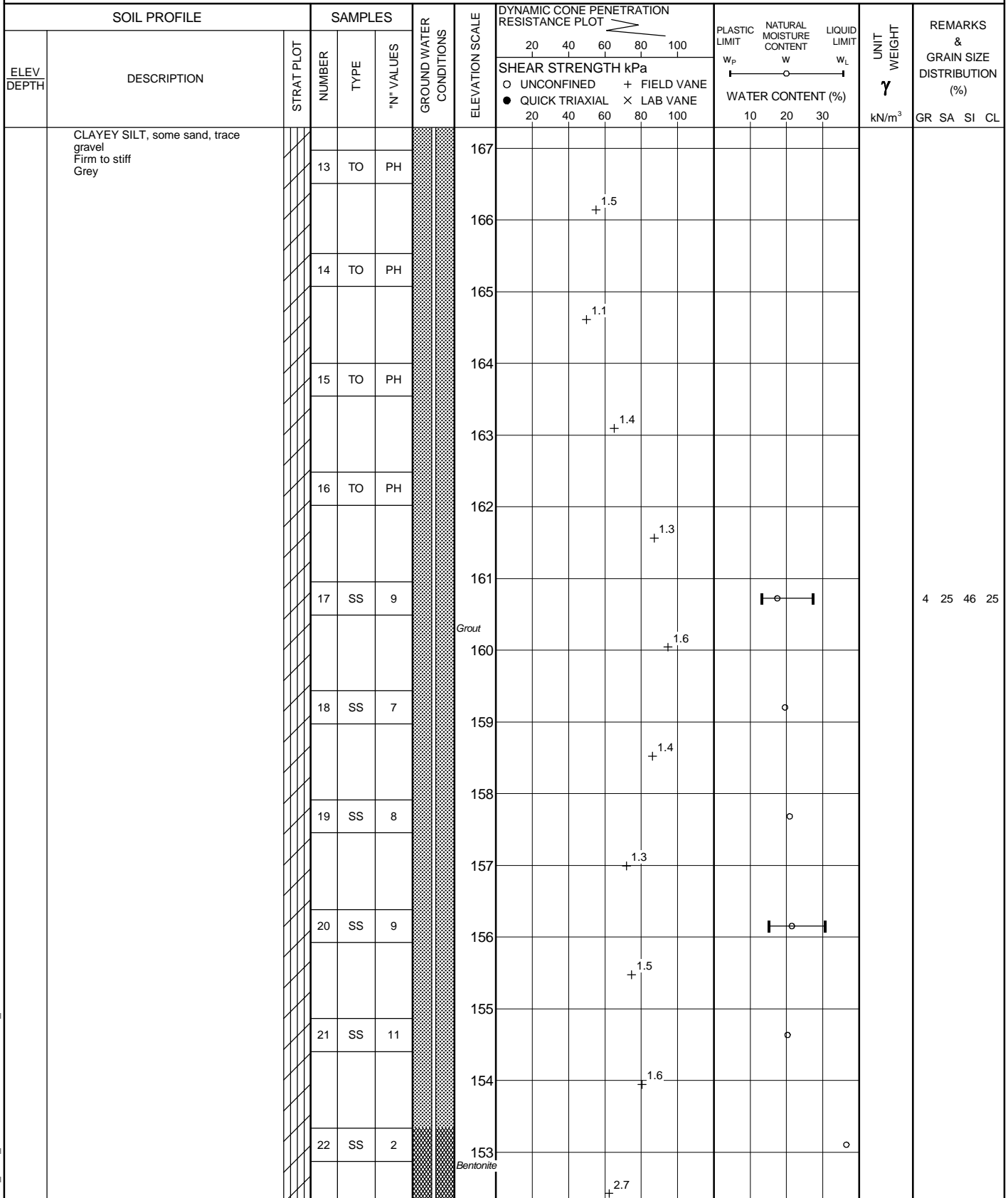


LDN\_MTO\_06 09-1132-0080 GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 318</b>		2 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4679049.3 ; E 332857.8</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 10, 2009 - December 14, 2009</u>		CHECKED BY _____	



LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 318</b>		3 OF 4		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4679049.3 ; E 332857.8</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 10, 2009 - December 14, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
150.81	CLAYEY SILT, some sand, trace gravel Firm to stiff Grey		23	SS	4												
31.48	SAND AND GRAVEL, some silt, trace clay Compact Grey		24	SS	25												
149.72	LIMESTONE, fresh, medium strong, weakly laminated, fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		25	NQ RC	-												
32.57			26	NQ RC	-												
			27	NQ RC	-												
			28	NQ RC	-												
144.93	END OF BOREHOLE																
37.36	Borehole dry during drilling between December 10 and 14, 2009.  Water level measured at elev. 178.35 on February 24, 2010.  Water level measured at elev. 178.15 on January 6, 2010.																



PROJECT: 09-1132-0080

# RECORD OF DRILLHOLE: 318

SHEET 4 OF 4

LOCATION: N 4679049.3 ;E 332857.8

DRILLING DATE: December 10, 2009 - December 15, 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 (mm)	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						RECOVERY		R.Q.D.	FRACT.	DISCONTINUITY DATA					TYPE AND SURFACE DESCRIPTION
				(m)						TOTAL CORE %	SOLID CORE %	%	INDEX PER 0.3	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 AT ELEV. 149.72m		149.83															
				32.46															
				32.57	1														
33		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, light grey to brown		149.10					149										
				33.19															
34		LIMESTONE, fresh, medium strong, laminated to bedded, fine grained, faintly porous, light grey to brown			2				148										
35		LIMESTONE, fresh, medium strong, weakly laminated, fine to coarse grained, faintly porous, light grey to brown, fossiliferous		147.66					147										
				34.63	3														
36									146										
37		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, light grey		145.47					145										
				36.82															
				145.13															
				37.16															
38		LIMESTONE, fresh, medium strong, weakly laminated, fine grained, faintly porous, light grey to brown END OF DRILLHOLE		37.36															
39																			
40																			
41																			
42																			
43																			
44																			
45																			
46																			
47																			

DEPTH SCALE

1 : 75

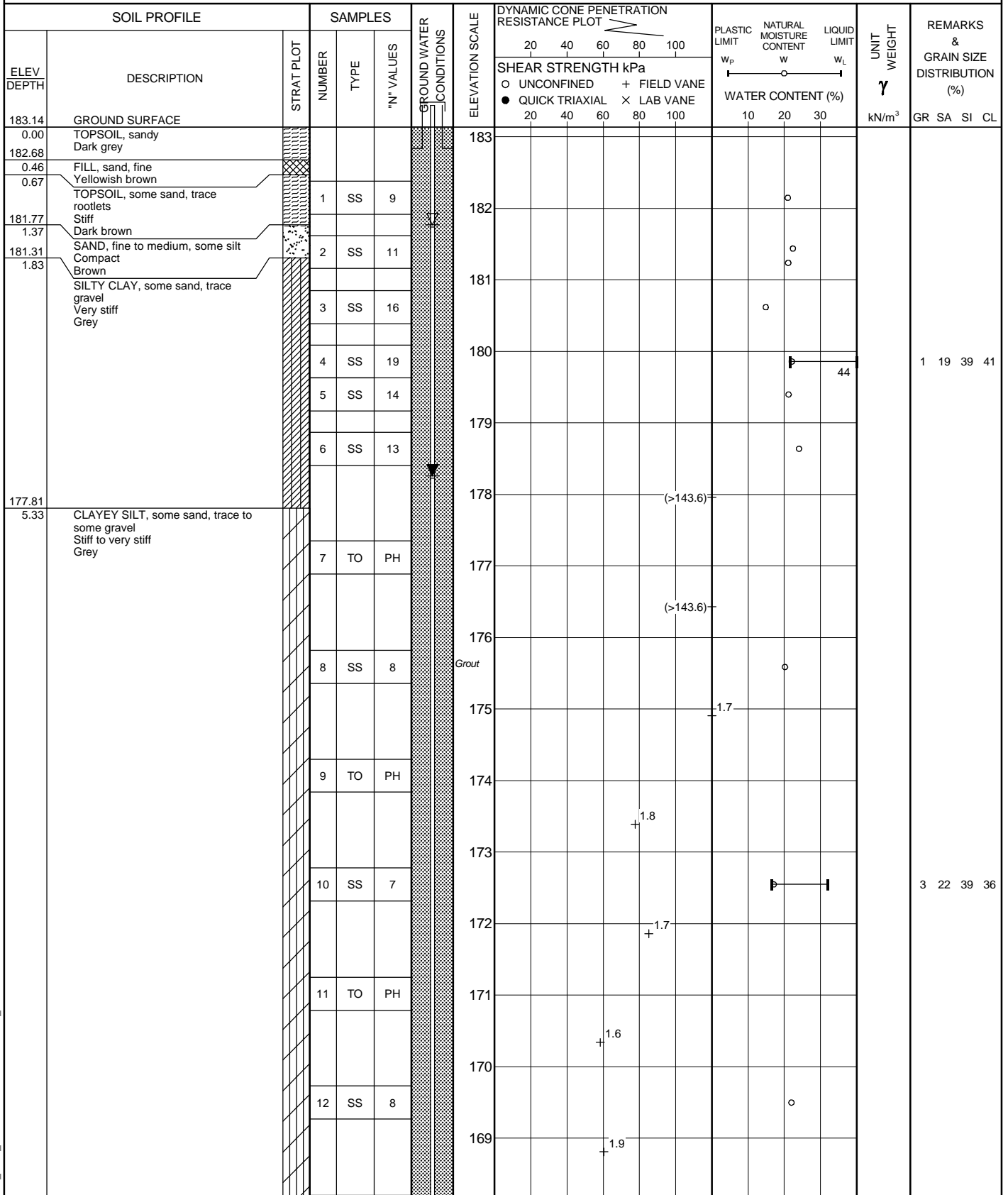


LOGGED: SG

CHECKED:

LDN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR LDN.GDT 12/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 321</b>		1 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4679179.9; E 332649.0</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 9, 2010 - December 14, 2010</u>		CHECKED BY _____	

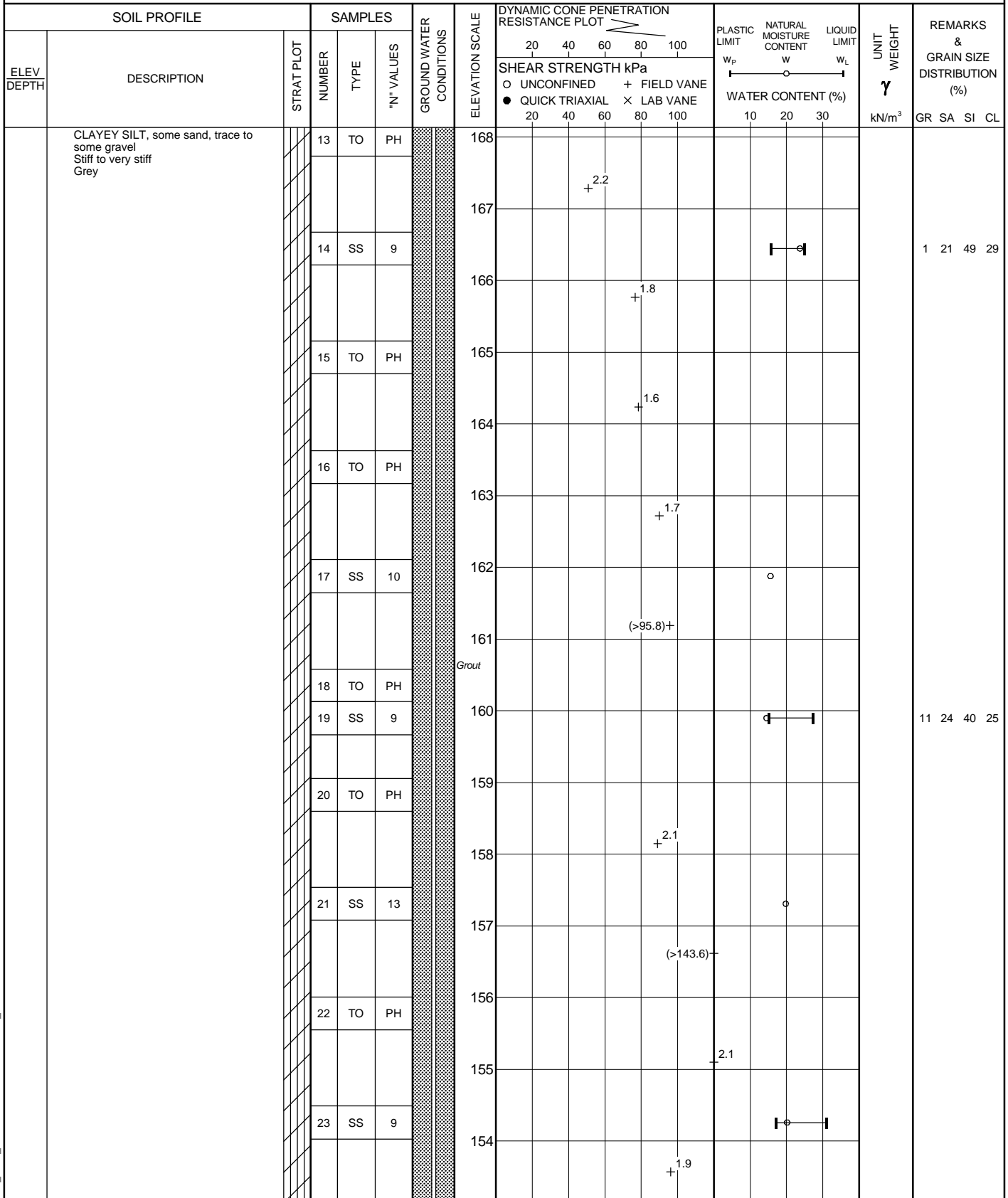


LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 321</b>		2 OF 4		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4679179.9 ; E 332649.0</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 9, 2010 - December 14, 2010</u>		CHECKED BY _____			



LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 321</b>		3 OF 4		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4679179.9 ; E 332649.0</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 9, 2010 - December 14, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE							
							20	40	60	80	100				
	CLAYEY SILT, some sand, trace to some gravel Stiff to very stiff Grey		24	TO	PH										
151.24															
31.90	SAND AND GRAVEL, trace silt Very dense Grey		25	SS	51										21 69 7 3
			26	SS	100/ 130mm										
149.12															
34.02	LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		27	NQ RC	-										
			28	NQ RC	-										
			29	NQ RC	-										
			30	NQ RC	-										
143.73															
39.41	END OF BOREHOLE														
	Groundwater encountered at about elev. 181.7m and at about elev. 151.7m during drilling between December 9 and 14, 2009.  Water level measured at elev. 178.52 on February 24, 2010.  Water level measured at elev. 178.26 on January 6, 2010.														

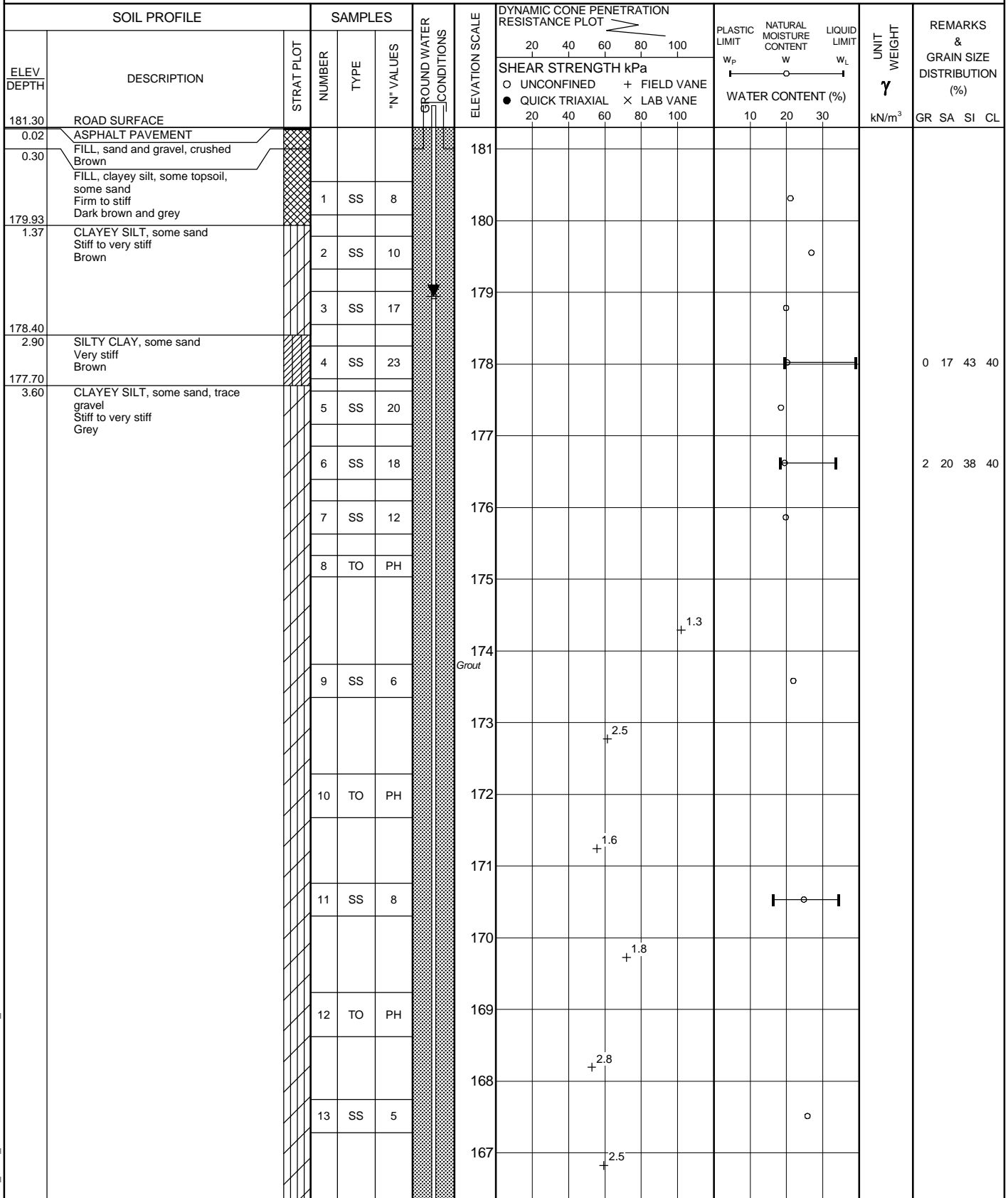
INCLINATION: -90°      AZIMUTH: ---

SHEET 4 OF 4

DATUM: GEODETIC

\_LDN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR\_LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 323</b>		1 OF 4 <b>METRIC</b>	
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 _____	

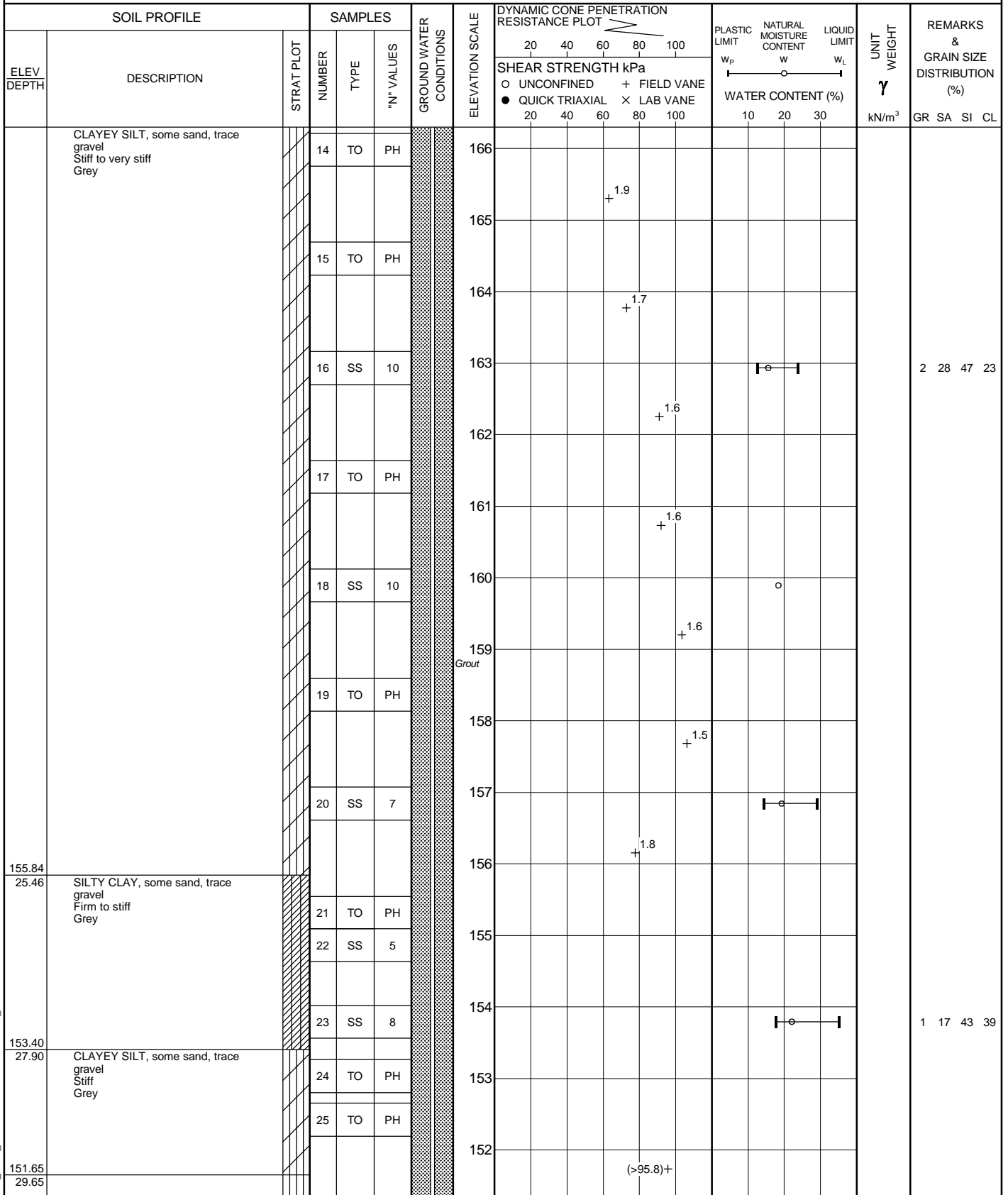


LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity    ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 323</b>		2 OF 4		<b>METRIC</b>	
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

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 323</b>		3 OF 4	<b>METRIC</b>
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 <sub>P</sub>	NATURAL MOISTURE CONTENT  W	LIQUID LIMIT  W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	SILT, some clay, some sand, trace gravel Compact Grey		26	SS	29												
150.05																	
31.25	SAND AND GRAVEL, trace silt Very dense Brown		27	SS	100/ 100mm												
148.19																	
33.11	LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous Light brown to grey  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		28	NQ RC	-		73		30		33						
			29	NQ RC	-		100		92		92						
			30	NQ RC	-		T.C.R. (%) 95		S.C.R. (%) 95		R.Q.D. (%) 95						
			31	NQ RC	-		100		100		100						
142.96																	
38.34	END OF BOREHOLE																
	Groundwater encountered at about elev. 150.1m during drilling between December 15 and 17, 2009.  Water level measured at elev. 179.12 on February 24, 2010.  Water level measured at elev. 178.94 on January 6, 2010.																



PROJECT: 09-1132-0080

**RECORD OF DRILLHOLE: 323**

SHEET 4 OF 4

LOCATION: N 4679521.4 ;E 332167.6

DRILLING DATE: December 15, 2009 - December 17, 2009

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: LANTECH

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.												HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)		NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION				2	4	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
										TOTAL CORE %	SOLID CORE %				DIP W.R.T. CORE AXIS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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		ROCK SURFACE		148.20																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

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 325	1 OF 4	METRIC	
W.P.		LOCATION	N 4679787.7 ;E 331972.9		ORIGINATED BY	SM	
DIST	WEST	HWY	401 / 3		BOREHOLE TYPE	POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC	
DATUM	GEODETC		DATE	December 16, 2009 - December 17, 2009		COMPILED BY	LMK/DMB
						CHECKED BY	

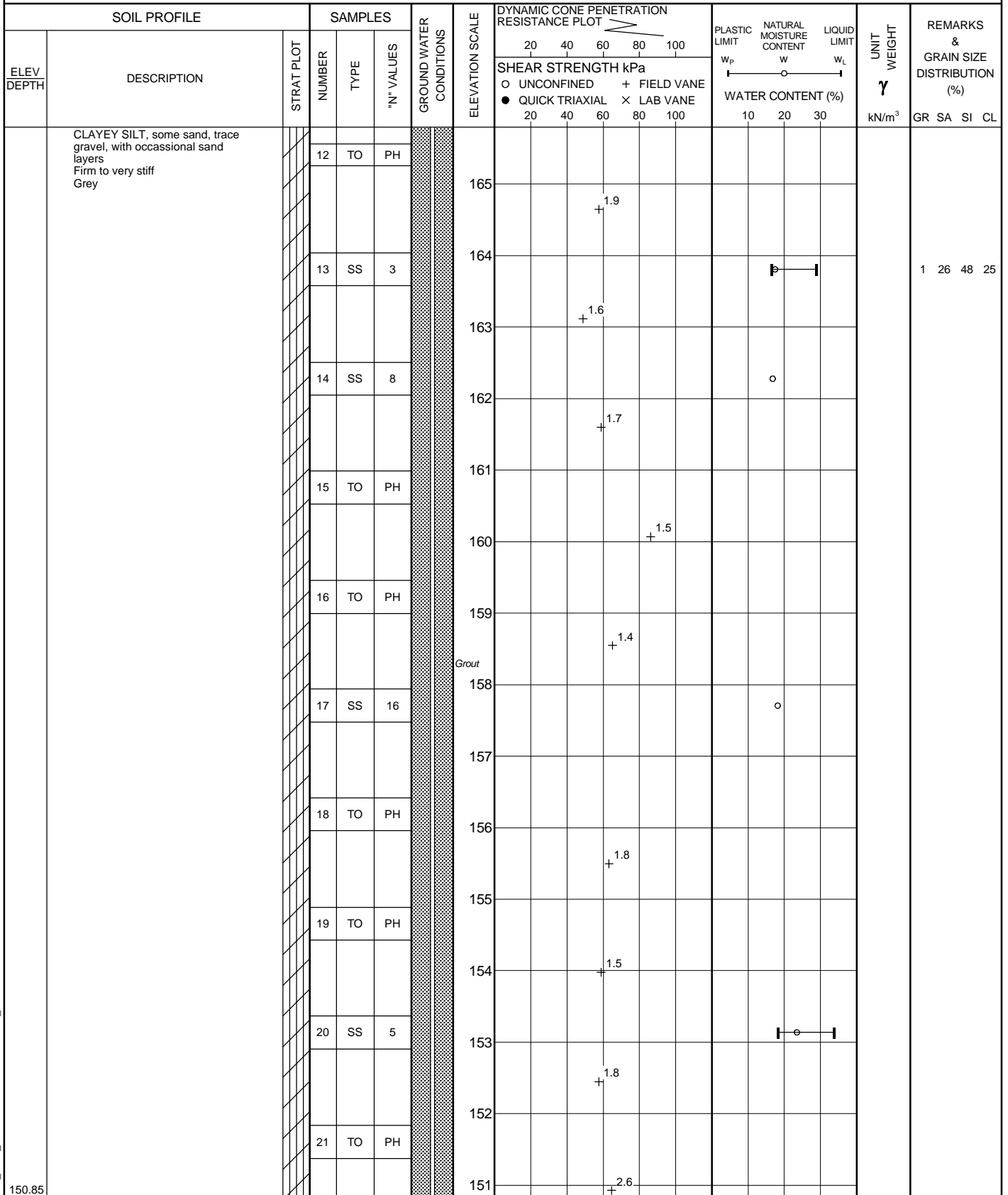
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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 325</b>		2 OF 4	<b>METRIC</b>
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

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 325</b>		3 OF 4		<b>METRIC</b>	
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 <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										

29.95	SANDY SILT, some clay, trace to some gravel Compact to very dense Grey		22	SS	17		150										10 40 38 12
148.48	LIMESTONE, fresh, medium strong, weakly laminated to laminated, very fine to fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		23	SS	82/ 175mm		149										
32.32			24	NQ RC	-		148	88	78	78							
			25	NQ RC	-		147	97	95	94							
			26	NQ RC	-		146	T.C.R. (%) 100	S.C.R. (%) 98	R.Q.D. (%) 86							
			27	NQ RC	-		145										
							144	100	95	88							
143.31	END OF BOREHOLE  Borehole dry during drilling between December 14 and 17, 2009.  Water level measured at elev. 179.35 on February 24, 2010.  Water level measured at elev. 179.28 on January 6, 2010.																
37.49																	

INCLINATION: -90°      AZIMUTH: ---

## DRILLING CONTRACTOR: AARDVARK

DATUM: GEODETIC



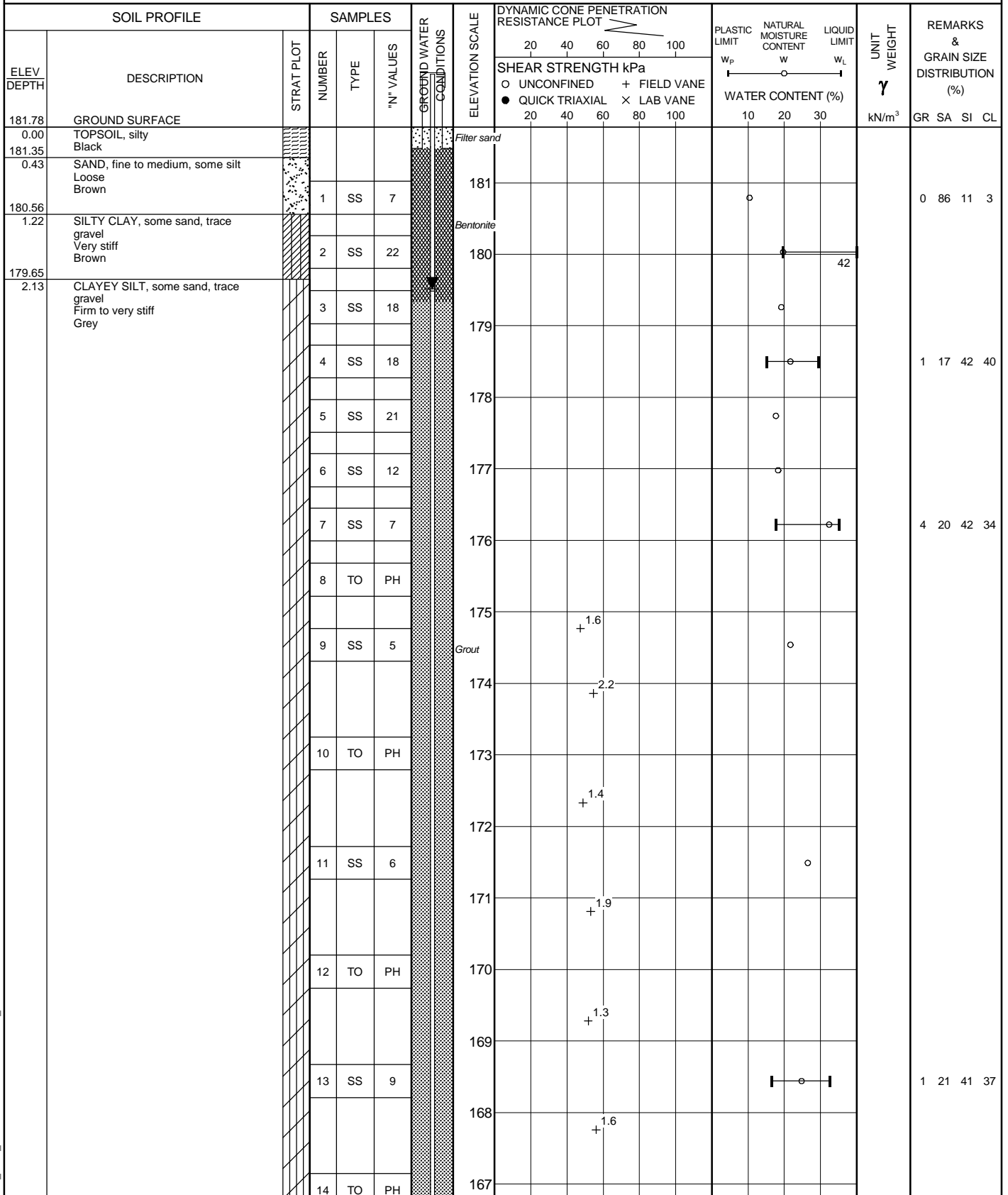
**Golder  
Associates**

1 : 75

CHECKED:

DN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR\_LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 326</b>		1 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4679917.6 ; E 331984.5</u>		ORIGINATED BY <u>DB</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 25, 2009 - November 30, 2009</u>		CHECKED BY _____	



LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

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



PROJECT <u>09-1132-0080</u>		RECORD OF BOREHOLE No 326		2 OF 4	METRIC
W.P. _____		LOCATION <u>N 4679917.6 ;E 331984.5</u>		ORIGINATED BY <u>DB</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 25, 2009 - November 30, 2009</u>		CHECKED BY _____	

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

<b>PROJECT</b> 09-1132-0080		<b>RECORD OF BOREHOLE No 326</b>		3 OF 4	<b>METRIC</b>
<b>W.P.</b> _____		<b>LOCATION</b> N 4679917.6 ; E 331984.5		<b>ORIGINATED BY</b> DB	
<b>DIST</b> WEST <b>HWY</b> 401 / 3		<b>BOREHOLE TYPE</b> POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC		<b>COMPILED BY</b> LMK/DMB	
<b>DATUM</b> GEODETIC		<b>DATE</b> November 25, 2009 - November 30, 2009		<b>CHECKED BY</b> _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	CLAYEY SILT, some sand, trace clay Very stiff Grey		21	SS	7												
150.16																	
31.62	SANDY SILT, some clay, trace gravel Very dense Grey		22	SS	55												
149.16																	
32.62	LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		23	SS	100												
			24	NQ RC	-		61	0	0								
			25	NQ RC	-		94	62	75								
			26	NQ RC	-		95	67	57								
			27	NQ RC	-		T.C.R. (%) 100	S.C.R. (%) 94	R.Q.D. (%) 86								
			28	NQ RC	-		100	100	97								
144.10																	
37.68	END OF BOREHOLE  Borehole dry during drilling between November 25 and 30, 2009.  Water level measured at elev. 179.55 on February 24, 2010.  Water level measured at elev. 179.52 on January 6, 2010.																

INCLINATION: -90°      AZIMUTH: ---

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DATUM: GEODETIC

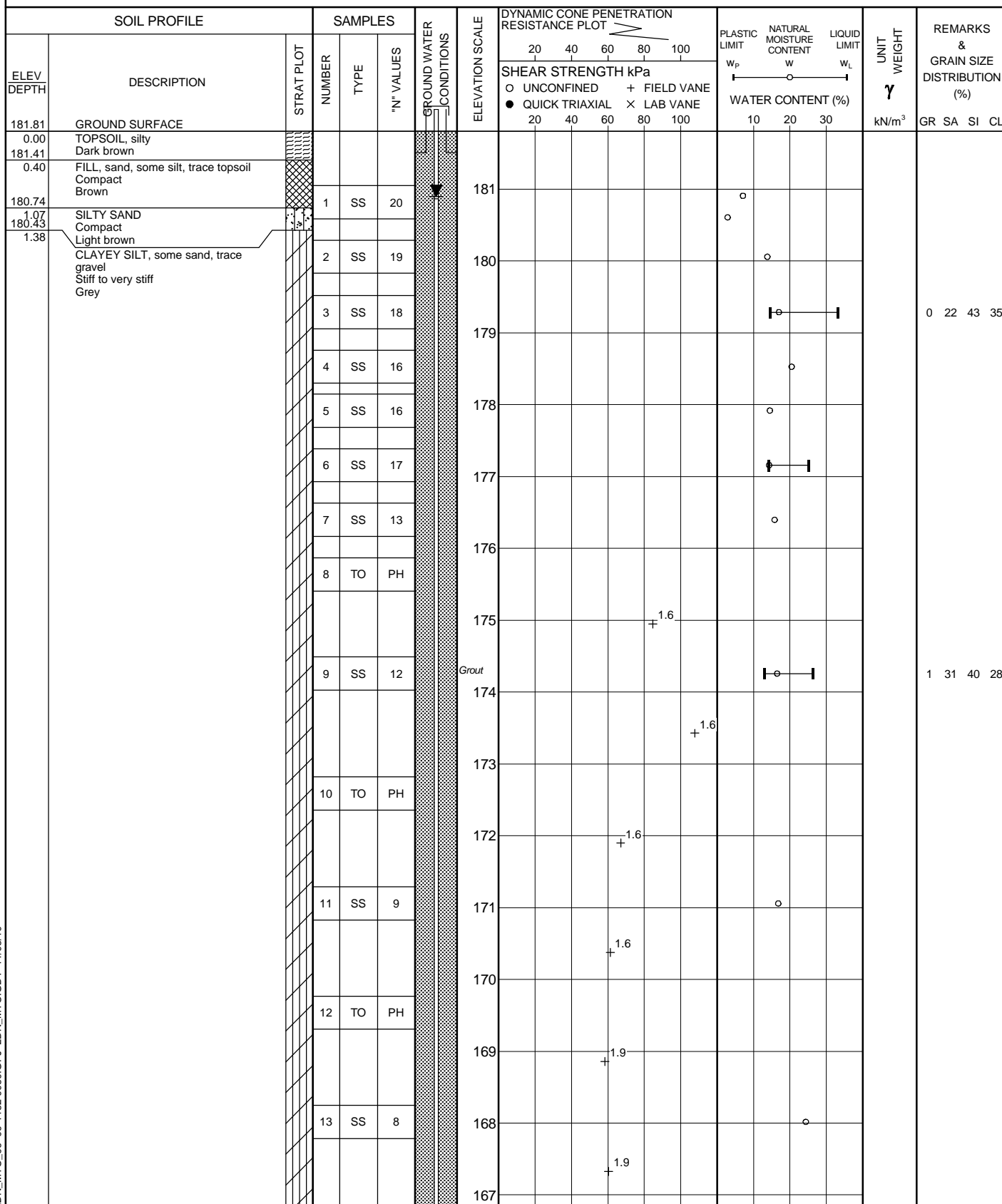


**Golder  
Associates**

CHECKED:

DN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR\_LDN.GDT 12/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 334</b>		1 OF 4	<b>METRIC</b>
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 _____			

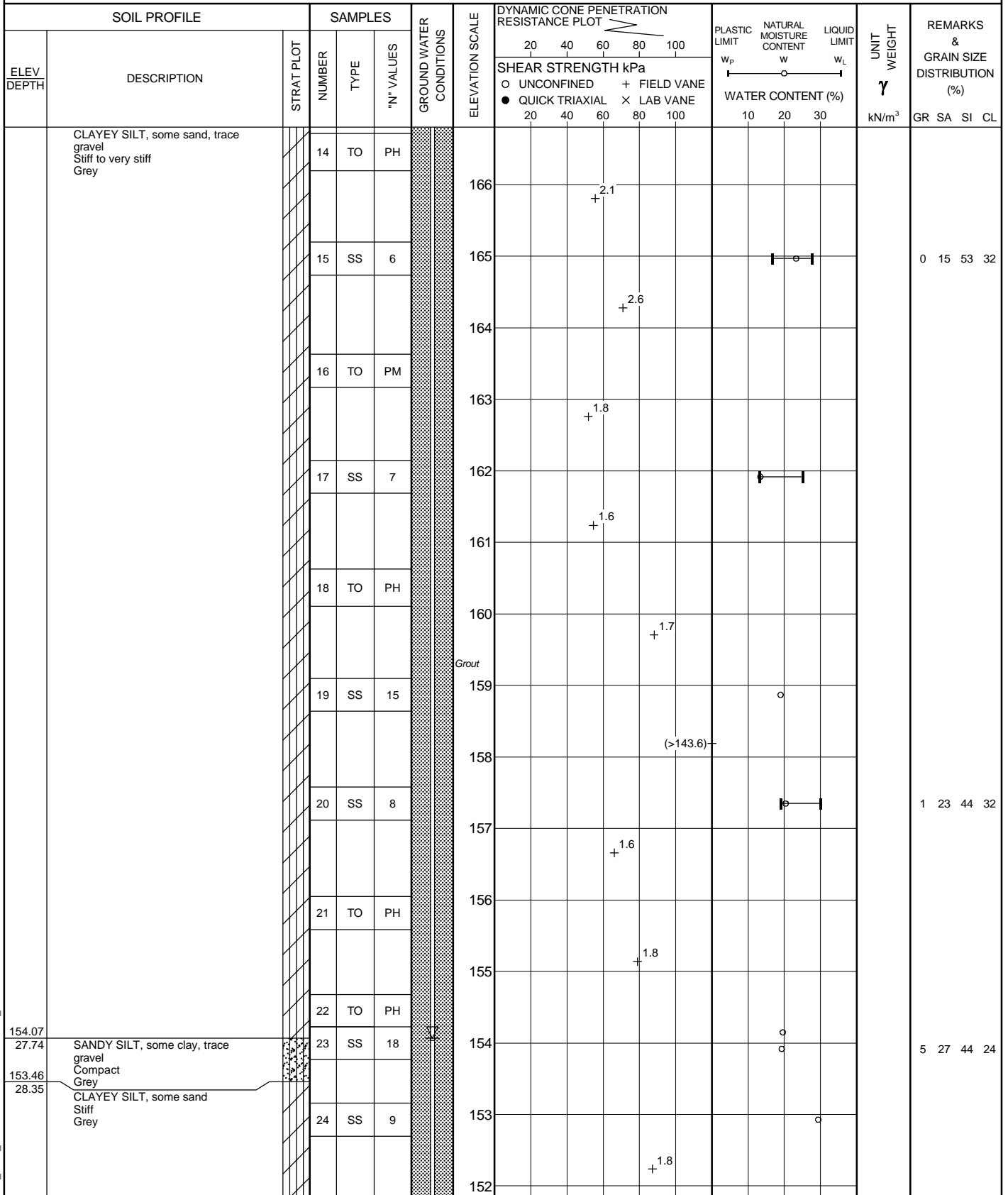


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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 334</b>		2 OF 4	<b>METRIC</b>
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

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 334</b>		3 OF 4	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4681379.6 ; E 331322.2</u>		ORIGINATED BY <u>MR</u>	
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, MUD ROTARY WITH HQ TRICONE, NQRC</u>		COMPILED BY <u>LMK/DMB</u>	
DATUM <u>GEODETIC</u>		DATE <u>December 18, 2009 - December 21, 2009</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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 ● QUICK TRIAXIAL × LAB VANE										
							20	40	60	80	100							
151.02	CLAYEY SILT, some sand Stiff Grey		25	TO	PH													
30.79	SANDY SILT, some gravel, trace clay Very dense Grey		26	TO	PH													
			27	SS	35/ 75mm													
148.58	LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		28	SS	50/ 25mm													
33.23			29	NQ RC	-		89	58	26									
			30	NQ RC	-		98	96	94									
			31	NQ RC	-		100	92	92									
			32	NQ RC	-		100	97	97									
143.56	END OF BOREHOLE																	
38.25	Groundwater encountered at about elev. 154.1m during drilling between December 18 and 21, 2009.  Water level measured at elev. 180.90 on February 24, 2010.  Water level measured at elev. 180.90 on January 6, 2010.																	



PROJECT: 09-1132-0080

# RECORD OF DRILLHOLE: 334

SHEET 4 OF 4

LOCATION: N 4681379.6 ;E 331322.2

DRILLING DATE: December 18, 2009 - December 21, 2009

DATUM: GEODETIC

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DRILLING CONTRACTOR: LANTECH

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	PENETRATION RATE (m/min)	COLOUR % RETURN	FLUSH	ELEVATION	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough Br - Broken Rock  NOTE: For additional abbreviations refer to list of abbreviations & symbols.										HYDRAULIC CONDUCTIVITY k, cm/sec			DIAMETRAL POINT LOAD INDEX (MPa)		NOTES WATER LEVELS INSTRUMENTATION			
				DEPTH (m)						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION				2	4	6						
										TOTAL CORE %	SOLID CORE %				DIP W.R.T. CORE AXIS			10 <sup>-8</sup>	10 <sup>-6</sup>				10 <sup>-4</sup>	10 <sup>-2</sup>				
												80 60 40 20	80 60 40 20	80 60 40 20	5 10 15 20	0 30 60 90												
		ROCK SURFACE		148.59																								
		LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous, grey		33.22																								
34	MUD ROTARY NO ROCK CORE	LIMESTONE, fresh, medium strong, laminated, very fine grained, faintly porous, grey to brown		33.44	1				148																			
		LIMESTONE, fresh, medium strong, massive to weakly laminated, very fine grained, faintly porous, grey to brown, zone of hydrocarbon staining from 34.47m to 34.53m depth		147.67																								
35				34.14	2				147																			
				147.28																								
36				34.53																								
			LIMESTONE, fresh, medium strong, weakly laminated, fine grained, faintly porous, brown		146.00					146																		
			LIMESTONE, fresh, medium strong, laminated, fine grained, faintly porous, brown, lower 0.46m vuggy		35.81	3																						
37										145																		
38						4				144																		
			END OF DRILLHOLE		143.56																							
				38.25																								
39																												
40																												
41																												
42																												
43																												
44																												
45																												
46																												
47																												
48																												

DEPTH SCALE

1 : 75

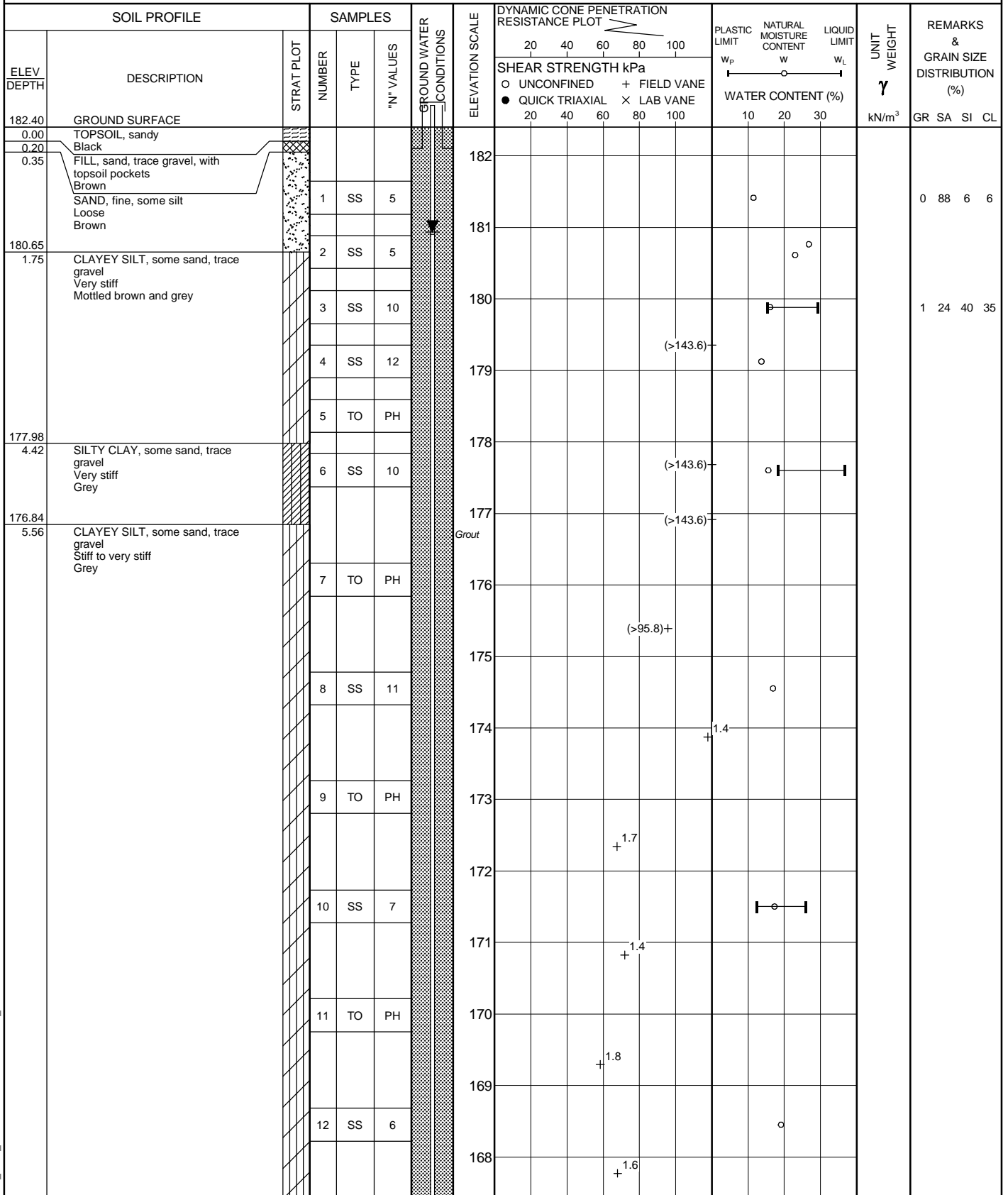


LOGGED: SG

CHECKED:

LDN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR LDN.GDT 11/03/10 DATA INPUT: LMK

<b>PROJECT</b> 09-1132-0080		<b>RECORD OF BOREHOLE No 336</b>		1 OF 4	<b>METRIC</b>
W.P. _____		LOCATION N 4681502.9; E 331179.1		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 December 18, 2009 - December 22, 2009		CHECKED BY _____	

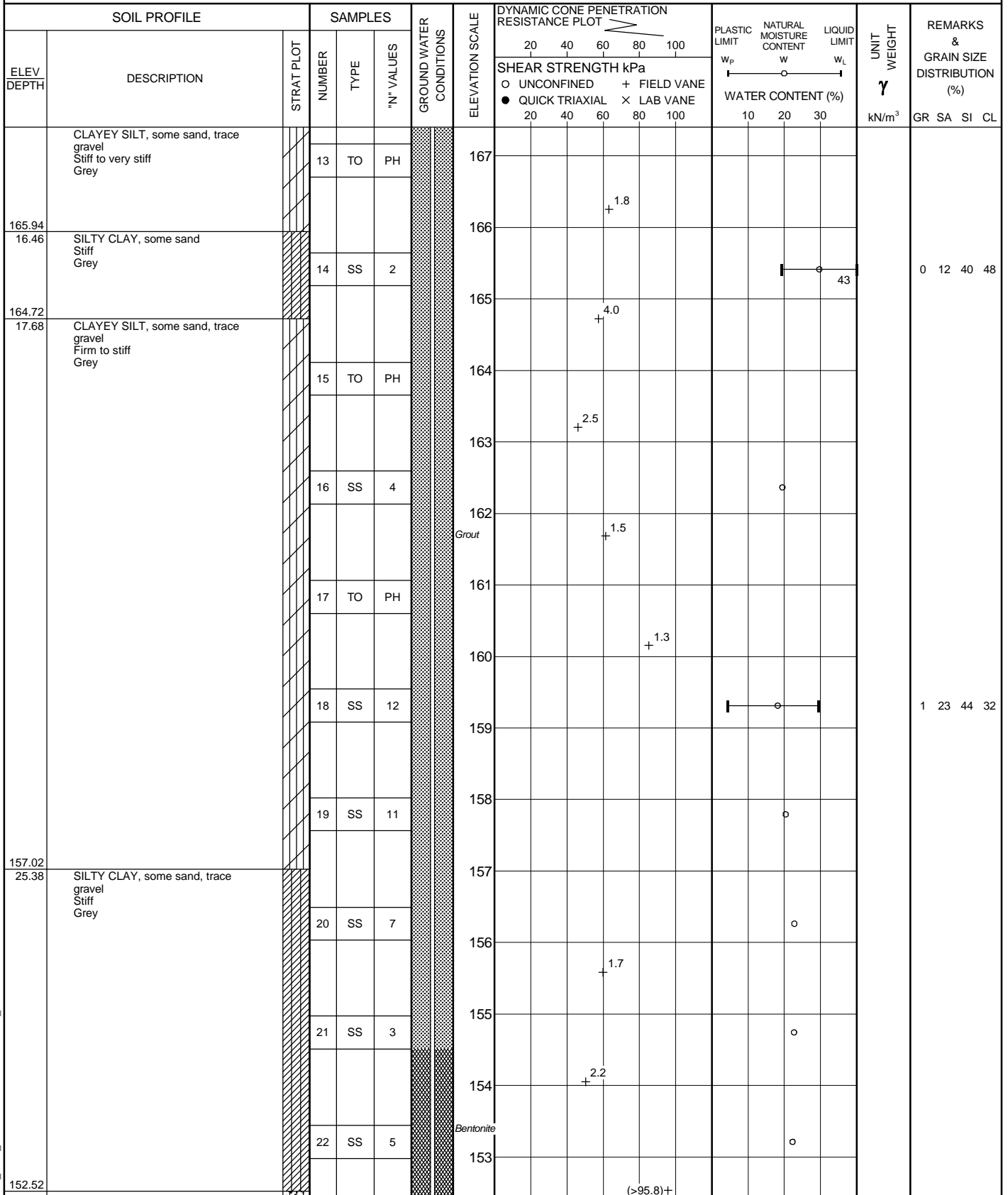


LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 336</b>		2 OF 4		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4681502.9; E 331179.1</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>December 18, 2009 - December 22, 2009</u>		CHECKED BY _____			



LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 336</b>		3 OF 4		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4681502.9; E 331179.1</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>December 18, 2009 - December 22, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								20 40 60 80 100										
								○ UNCONFINED + FIELD VANE										
								● QUICK TRIAXIAL × LAB VANE										
								20 40 60 80 100										
29.88	SANDY SILT, some clay, trace gravel Dense to very dense Grey																	
			23	SS	35													
150.06			24	SS	158/ 175mm													
32.34	LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		25	NQ RC	-			74	49	25								
			26	NQ RC	-			96	90	87								
			27	NQ RC	-			T.C.R. (%) 100	S.C.R. (%) 91	R.Q.D. (%) 83								
			28	NQ RC	-			92	90	90								
144.96							Piezometer											
37.44	END OF BOREHOLE						145											
	Borehole dry during drilling between December 18 and 22, 2009.  Water level measured at elev. 180.95 on February 24, 2010.  Water level measured at elev. 180.93 on January 6, 2010.																	

INCLINATION: -90°      AZIMUTH: ---

## DRILL RIG: MUD ROTARY WITH HQ TRICONE, NQRC

DATUM: GEODETIC



**Golder  
Associates**

CHECKED:

DN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR\_LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 341</b>		1 OF 3 <b>METRIC</b>	
W.P. _____		LOCATION <u>N 4682255.5 ; E 329378.7</u>		ORIGINATED BY <u>DB/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>November 24, 2009 - December 1, 2009</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT <div style="text-align: center;"> </div>	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
178.80	GROUND SURFACE						179						
0.00	TOPSOIL, sandy Black												
177.95	SANDY SILT, some clay Loose to compact Brown		1	SS	10		178						
177.43	CLAYEY SILT, some sand Firm to stiff Brown becoming grey below about elev. 175.9m		2	SS	9		177						
1.37			3	SS	13		176						
			4	SS	8		175						
174.99	SILTY CLAY, some sand, trace gravel Firm to stiff Grey		5	TO	PH		174						
3.81			6	SS	5		173						
			7	TO	PH		172						
			8	SS	4		171						
			9	TO	PH		170						
			10	TO	PH		169						
			11	TO	PH		168						
			12	SS	3		167						
169.27	CLAYEY SILT, some sand, trace gravel Soft to very stiff Grey						166						
9.53							165						

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>		<b>RECORD OF BOREHOLE No 341</b>		2 OF 3	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4682255.5 ; E 329378.7</u>		ORIGINATED BY <u>DB/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>November 24, 2009 - December 1, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
								○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × LAB VANE						
	CLAYEY SILT, some sand, trace gravel Soft to very stiff Grey						20   40   60   80   100	20   40   60   80   100	10   20   30					
			13	TO	PH		164	1.4						8   22   42   28 Oedometer
							163	1.8						
			14	SS	5		162							
							161	1.8						
			15	TO	PH		160	(>95.8)±						
			16	TO	PH		159							
							158	(>143.6)±					5   24   39   32 Oedometer	
			17	SS	7		157							
157.06							156	91   74   73						
21.74	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)		18	NQ RC	-		155							
			19	NQ RC	-		154	89   74   83						
			20	NQ RC	-		153	98   92   92						
			21	NQ RC	-		152	96   94   84						
151.55							151							
27.25	END OF BOREHOLE													
	Borehole dry during drilling between Nov. 24 and Dec. 1, 2009. Borehole sealed with cement-bentonite grout.													

PROJECT: 09-1132-0080

## RECORD OF DRILLHOLE: 341

SHEET 3 OF 3

LOCATION: N 4682255.5 ;E 329378.7


DRILLING DATE: November 24, 2009 - December 1, 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 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)	ELEVATION						RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		DIP W.R.T. CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 <sup>-8</sup>	10 <sup>-6</sup>	10 <sup>-4</sup>	10 <sup>-2</sup>	2	4	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
											TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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22	MUD ROTARY NO. ROCK CORE	ROCK SURFACE		157.06						157																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

DEPTH SCALE

1 : 75



LOGGED: SG

CHECKED:

LDN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR\_LDN.GDT 12/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 343</b>		1 OF 3	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4682231.8 ;E 329086.3</u>		ORIGINATED BY <u>MR/LK</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 18, 2009 - November 19, 2009</u>		CHECKED BY _____	

[illegible]

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 343</b>		2 OF 3	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4682231.8 ; E 329086.3</u>		ORIGINATED BY <u>MR/LK</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 18, 2009 - November 19, 2009</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT   NATURAL MOISTURE   LIQUID LIMIT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		w <sub>p</sub>	w	w <sub>L</sub>		
								○ UNCONFINED      + FIELD VANE	WATER CONTENT (%)					
						● QUICK TRIAXIAL      × LAB VANE	20   40   60   80   100	10   20   30						
	CLAYEY SILT, some sand, trace gravel Firm to very stiff Grey		12	TO	PH		164		1.3					
			13	SS	PH		163							
			14	TO	PH		162							
			15	TO	PH		161		1.2					
			16	TO	PH		160		1.7					
156.43							Grout 159							
22.71	SAND AND GRAVEL, trace silt Very dense Grey		17	SS	13		158							
155.70			18	SS	58		157							
23.44	LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, with hydrocarbon staining Grey to dark brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		19	SS	50/ 100mm		156							
			20	NQ RC	-		155	100	71	60				
			21	NQ RC	-		154	63	61	61				
			22	NQ RC	-		153							
			23	NQ RC	-		152	100	99	99				
150.74							151	98	72	77				
28.40	END OF BOREHOLE Groundwater encountered at about elev. 177.3m during drilling between Nov. 18 and 19, 2009. Borehole sealed with cement-bentonite grout.													

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 12/03/10

PROJECT: 09-1132-0080

**RECORD OF DRILLHOLE: 343**

SHEET 3 OF 3

LOCATION: N 4682231.8 ;E 329086.3

DRILLING DATE: November 18, 2009 - November 19, 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 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)					RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA					
				TOTAL CORE %					SOLID CORE %	DIP W.R.T. CORE AXIS			HYDRAULIC CONDUCTIVITY k, cm/sec								
				80 60 40 20					80 60 40 20	80 60 40 20	5 10 15 20	0 30 60 90	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup>								
		ROCK SURFACE		155.70																	
24	MUD ROTARY NQ ROCK CORE	LIMESTONE, fresh, medium strong, laminated, very fine to fine grained, faintly porous with occasional pits, brown to dark brown, heavy hydrocarbon staining		23.44	1			155								Broken core from 23.44m to 23.84m					
		LIMESTONE, fresh, medium strong, weakly laminated to laminated, fine grained, faintly porous with occasional pits, grey, zones of hydrocarbon staining, occasional fossils		154.73																	
25		LIMESTONE, fresh, medium strong, weakly laminated to laminated, fine grained, faintly porous with occasional pits, grey, zones of hydrocarbon staining, occasional fossils		24.41				154													
		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, grey, zones of hydrocarbon staining		153.90	2																
26		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, grey, zones of hydrocarbon staining		25.24																	
		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, grey, zones of hydrocarbon staining		153.63				153													
27		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous to pitted, dark brown, heavy hydrocarbon staining		25.60																	
		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous to pitted, dark brown, heavy hydrocarbon staining		152.62	3			152													
28		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, grey, zones of hydrocarbon staining		26.52																	
		LIMESTONE, fresh, medium strong, weakly laminated, very fine to fine grained, faintly porous, grey, zones of hydrocarbon staining		151.65				151													
29		LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous to pitted, dark brown, heavy hydrocarbon staining, fossiliferous		27.49	4																
		LIMESTONE, fresh, medium strong, weakly laminated, very fine grained, faintly porous to pitted, dark brown, heavy hydrocarbon staining, fossiliferous		28.13																	
		END OF DRILLHOLE		150.74																	
				28.40																	
30																					
31																					
32																					
33																					
34																					
35																					
36																					
37																					
38																					

DEPTH SCALE

1 : 75

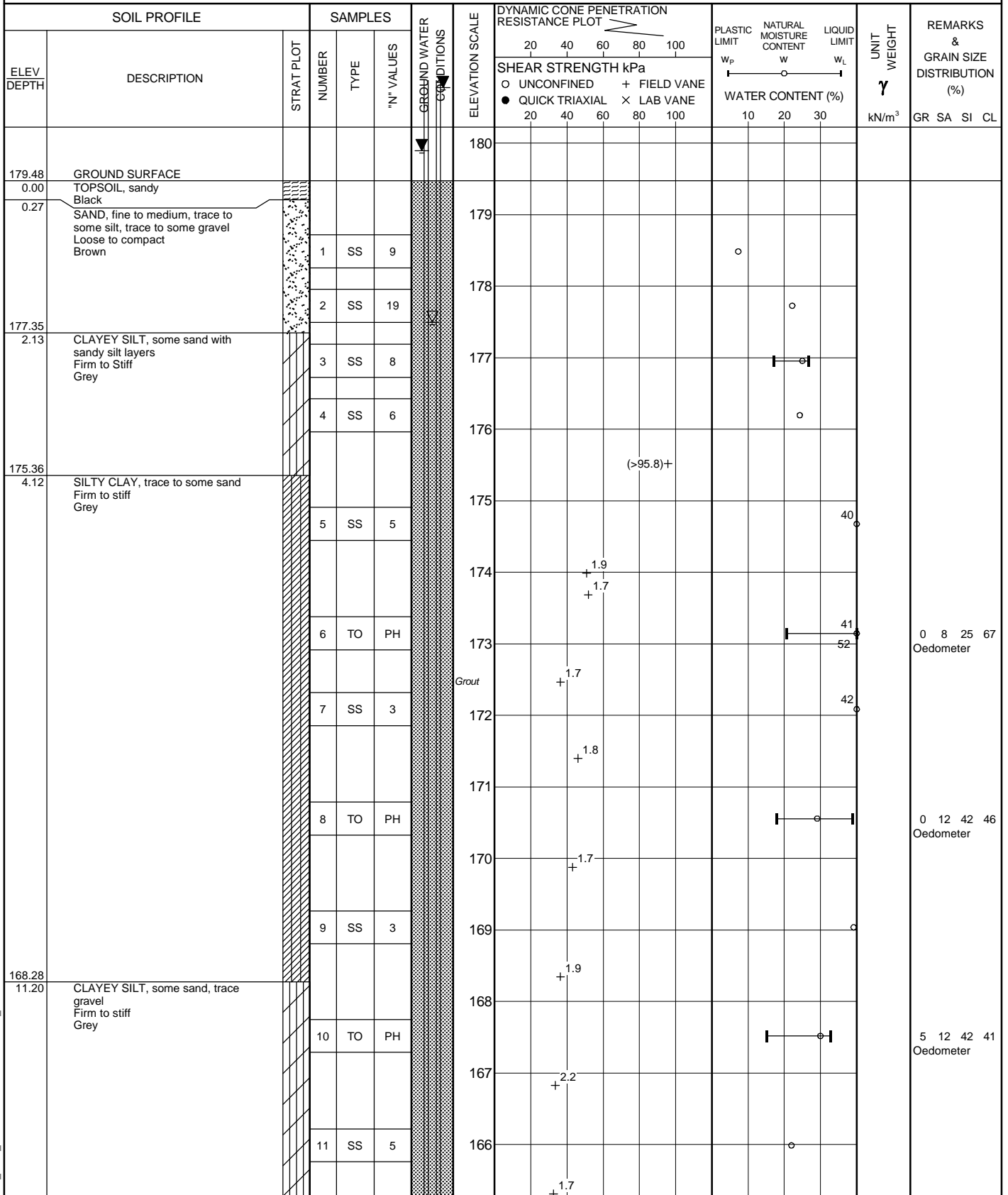


LOGGED: SG

CHECKED:

LDN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR LDN.GDT 11/03/10 DATA INPUT: LMK

<b>PROJECT</b> 09-1132-0080		<b>RECORD OF BOREHOLE No 345</b>		1 OF 3	<b>METRIC</b>
W.P. _____		LOCATION N 4682149.0; E 328862.7		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 November 16, 2009 - November 17, 2009		CHECKED BY _____	



LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO\_GDT 11/03/10

Continued Next Page

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



PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 345</b>		2 OF 3		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4682149.0 ; E 328862.7</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>November 16, 2009 - November 17, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
	CLAYEY SILT, some sand, trace gravel Firm to stiff Grey							20 40 60 80 100							
			12	TO	PH		VWP #2								
								1.7							
			13	TO	PH										
							Grout								
								(>95.8)+							
			14	SS	10										
			15	SS	22										
157.68			16	SS	50/ 75mm		VWP #1								
21.80	LIMESTONE, fresh, medium strong, weakly laminated to laminated, fine grained, faintly porous Light grey to brown  (FOR DETAILED DESCRIPTIONS REFER TO RECORD OF DRILLHOLE)		17	NQ RC	-			83 64 69							
			18	NQ RC	-			68 44 44							
			19	NQ RC	-			T.C.R. (%) 98 S.C.R. (%) 56 R.Q.D. (%) 9							
			20	NQ RC	-			100 72 42							
			21	NQ RC	-			99 99 99							
151.23	END OF BORHEOLE														
28.25	Groundwater encountered at about elev. 177.5m during drilling between November 16 and 17, 2009.	Upper Piezometer	Water level measured at elev. 179.82 on February 24, 2010.				Lower Piezometer	Water level measured at elev. 180.68 on February 24, 2010.							
			Water level measured at elev. 179.90 on January 6, 2010.					Water level measured at elev. 180.78 on January 6, 2010.							

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

INCLINATION: -90°      AZIMUTH: ---

DATUM: GEODETIC

[illegible]

CHECKED:

DN\_ROCK\_03 09-1132-0080-ROCK.GPJ GLDR\_LDN.GDT 11/03/10 DATA INPUT: LMK

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No 343A</b>		1 OF 2	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4682230.6 ; E 329086.3</u>		ORIGINATED BY <u>MR</u>	
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, HOLLOW STEM</u>		COMPILED BY <u>LMK</u>	
DATUM <u>GEODETIC</u>		DATE <u>November 23, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20    40    60    80    100	W <sub>P</sub> W                      W <sub>L</sub>	WATER CONTENT (%)				
								SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE						
179.14	GROUND SURFACE						179							
0.00	TOPSOIL, silty Firm Black						178							
178.07														
1.07	SAND, fine, some silt Loose Brown													
1.37	SANDY SILT Very loose to loose Brown and grey													
177.01							177							
2.13	CLAYEY SILT, some sand, trace gravel Stiff Brown becoming grey below about elev. 176.2m						176							
							175							
175.18							174							
3.96	SILTY CLAY, trace to some sand, trace gravel Firm to stiff Grey						173							
							172							
							171							
							170							
							169							
							168							
							167							
166.94							166							
12.20	CLAYEY SILT, some sand, trace gravel Firm to very stiff Grey						165							
			1	SS	PH									
			2	SS	PH									

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>	<b>RECORD OF BOREHOLE No 343A</b>	2 OF 2	<b>METRIC</b>
W.P. _____	LOCATION <u>N 4682230.6 ; E 329086.3</u>	ORIGINATED BY <u>MR</u>	
DIST <u>WEST</u> HWY <u>401 / 3</u>	BOREHOLE TYPE <u>POWER AUGER, HOLLOW STEM</u>	COMPILED BY <u>LMK</u>	
DATUM <u>GEODETIC</u>	DATE <u>November 23, 2009</u>	CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE					W <sub>p</sub>	W	W <sub>L</sub>		GR SA SI CL				
					20    40    60    80    100					10    20    30											
	CLAYEY SILT, some sand, trace gravel Firm to very stiff Grey	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></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PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-302</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4677756.9; E 335154.9</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 12, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×						LAB VANE		
186.26	GROUND SURFACE																			
0.00	TOPSOIL, clayey																			
0.15	Black																			
	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Very stiff to hard Brown		1	SS	23								○							
			2	SS	36															
			3	SS	32								○							
			4	SS	39															
182.60	END OF BOREHOLE																			
3.66	Borehole dry during drilling on January 12, 2010.																			

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-303</b>		1 OF 1		<b>METRIC</b>	
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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)							
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE					w <sub>p</sub> w      w <sub>L</sub>							
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															
			2	SS	28								○							
			3	SS	55															
			4	SS	51								○							
182.36 3.66	END OF BOREHOLE  Groundwater encountered at about elev. 185.7m during drilling on January 11, 2010.																			

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-306</b>		1 OF 1		<b>METRIC</b>	
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 ○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × LAB VANE					w <sub>p</sub>	w	w <sub>L</sub>					
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 <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-307</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4678157.2; E 334805.1</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 13, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL MOISTURE   LIQUID CONTENT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × LAB VANE					w <sub>p</sub> w   w <sub>L</sub>				
186.43	GROUND SURFACE							20	40	60	80	100					
0.00	TOPSOIL, clayey Black						186										
0.30	FILL, clayey silt, some sand, trace gravel, trace topsoil																
185.67	Brown																
0.76	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Stiff to hard Brown		1	SS	13		185										
			2	SS	15												
			3	SS	36		184										
			4	SS	69		183										
181.86	END OF BOREHOLE						182										
4.57	Borehole dry during drilling on January 13, 2010.																

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-309</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4678204.8 ; E 334657.1</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>December 22, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE				W <sub>p</sub>	W	W <sub>L</sub>		GR	SA	SI	CL
185.31	GROUND SURFACE																		
0.00	FILL, limestone gravel, crushed																		
0.13	Grey																		
0.30	FILL, sand and gravel																		
	Brown																		
	CLAYEY SILT, some sand, trace gravel, with occasional fissures, silt partings and seams		1	SS	14														
	Stiff to hard																		
	Brown		2	SS	20														
			3	SS	55														
			4	SS	70														
181.65	END OF BOREHOLE																		
3.66	Borehole dry during drilling on December 22, 2009.																		



PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-312</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4678319.9 ; E 334283.0</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 15, 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					w <sub>p</sub>	w	w <sub>L</sub>					
								○ UNCONFINED                      + FIELD VANE ● QUICK TRIAXIAL                  × LAB VANE												
185.22	GROUND SURFACE						20	40	60	80	100									
0.00	TOPSOIL, clayey Black																			
0.23	FILL, clayey silt, some sand, trace gravel, trace organics																			
184.46	Brown and grey																			
0.76	CLAYEY SILT, some sand, trace gravel, with cobbles and occasional silt partings Stiff to hard Brown		1	SS	14										○					
			2	SS	17															
			3	SS	38										○					
			4	SS	66/ 200mm															
180.65	END OF BOREHOLE																			
4.57	Borehole dry during drilling on January 15, 2010.																			





PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-313</b>		1 OF 1		<b>METRIC</b>	
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  $\gamma$  kN/m <sup>3</sup>	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 <sub>p</sub>	W	W <sub>L</sub>					
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															
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.																			



PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-315</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4678800.6 ; E 333406.3</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					w <sub>p</sub> w                      w <sub>L</sub>							
								○ UNCONFINED                      + FIELD VANE ● QUICK TRIAXIAL                      × LAB VANE					WATER CONTENT (%)							
184.31	GROUND SURFACE							20	40	60	80	100		10	20	30				
0.00	TOPSOIL, clayey Very stiff Black					▽	184													
			1	SS	16															
182.94	CLAYEY SILT, some sand, trace gravel, with occasional fissures and silt partings Stiff to hard Brown						183									○				
1.37			2	SS	12															
			3	SS	11															
			4	SS	48															
			5	SS	50										○					
179.89	END OF BOREHOLE						180													
4.42	Groundwater encountered at about elev. 180.5m during drilling on January 21, 2010.																			

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-316</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4678831.3 ; E 333265.0</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 <sub>p</sub>	w	w <sub>L</sub>						
182.99	GROUND SURFACE					▽	182														
0.00	TOPSOIL, clayey Black																				
182.63	CLAYEY SILT, some sand, trace gravel, with occasional fissures, silt partings and seams Very stiff to hard Brown		1	SS	25			181													
0.36																					
			2	SS	45																
			3	SS	56	180															
179.33	END OF BOREHOLE		4	SS	45																
3.66	Groundwater encountered at about elev. 181.5m during drilling on January 21, 2010.																				

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-317</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4679041.7 ; E 332972.4</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 26, 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		w <sub>p</sub>	w	w <sub>L</sub>		
								○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × LAB VANE	WATER CONTENT (%)					
182.64	GROUND SURFACE							20   40   60   80   100						
0.00	TOPSOIL, clayey Black													
182.21	CLAYEY SILT, some sand, trace gravel, with occasional fissures, silt partings and seams Very stiff to hard Brown													
0.43			1	SS	21									
			2	SS	36									
			3	SS	33									
			4	SS	33									
178.98	END OF BOREHOLE													
3.66	Borehole dry during drilling on January 26, 2010.													

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-319</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4679084.5 ; E 332701.0</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 21, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w <sub>p</sub>	w	w <sub>L</sub>		GR	SA	SI	CL
								20	40	60	80	100	WATER CONTENT (%)							
183.71	ROAD SURFACE																			
0.05	ASPHALT PAVEMENT																			
0.20	FILL, limestone gravel, crushed Grey SAND, fine, some silt Compact Brown		1	SS	22															
			2	SS	21															
181.58																				
2.13	CLAYEY SILT, some sand, trace gravel Hard Grey		3	SS	31															
180.81																				
2.90	END OF BOREHOLE																			
	Groundwater encountered at about elev. 182.2m during drilling on December 21, 2009.																			



PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-320</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4679155.5 ; E 332737.0</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 21, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL MOISTURE   LIQUID CONTENT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	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 <sub>p</sub>	w	w <sub>L</sub>					
183.50	GROUND SURFACE																			
0.00	TOPSOIL, sandy, some rootlets Black																			
182.89																				
0.61	SAND, fine, some silt Compact to dense Brown		1	SS	18								o							
181.62			2	SS	31															
1.88	CLAYEY SILT, some sand, trace gravel Very stiff to hard Grey																			
180.60			3	SS	18								o							
2.90	END OF BOREHOLE																			
	Groundwater encountered at about elev. 182.0m during drilling on December 21, 2009.																			

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-322</b>		1 OF 1		<b>METRIC</b>	
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 <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED      + FIELD VANE								
						● QUICK TRIAXIAL      × LAB VANE										
181.50	ROAD SURFACE							20	40	60	80	100				
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 <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-324</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4679664.9 ; E 332002.7</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>January 25, 2010</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT   NATURAL LIMIT   MOISTURE   LIQUID CONTENT   LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								○ UNCONFINED   + FIELD VANE	● QUICK TRIAXIAL   × LAB VANE											
180.85	GROUND SURFACE																			
0.00	TOPSOIL, clayey Very stiff Black		1	SS	18															
179.48																				
1.37	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Very stiff Brown		2	SS	18															
177.95			3	SS	27															
2.90	END OF BOREHOLE																			
	Borehole dry during drilling on January 25, 2010.																			

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-329</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4680100.8 ; E 331832.3</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 18, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w <sub>p</sub>	w	w <sub>L</sub>					
								○ UNCONFINED                      + FIELD VANE ● QUICK TRIAXIAL                  x LAB VANE												
181.98	GROUND SURFACE							20	40	60	80	100								
0.00	FILL, clayey silt, some sand, trace gravel, trace topsoil, trace rootlets Stiff Brown						181													
181.07																				
0.99	FILL, silty sand, some topsoil Compact Dark brown		1	SS	14															
180.61							180													
1.37	TOPSOIL, sandy Stiff Black		2	SS	6															
179.85	SILTY FINE SAND Loose Brown																			
2.13																				
179.08	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Stiff to very stiff Grey		3	SS	15															
2.90	END OF BOREHOLE																			
	Borehole dry during drilling on December 18, 2009.																			

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-330</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4680268.1 ; E 331829.9</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 17, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)							
								○ UNCONFINED                      + FIELD VANE ● QUICK TRIAXIAL                  x LAB VANE					w <sub>p</sub> w                      w <sub>L</sub>							
182.05	ROAD SURFACE																			
0.00	ASPHALT PAVEMENT																			
0.13	FILL, limestone gravel, crushed																			
181.59	Grey																			
0.46	SILTY FINE SAND Loose Brown		1	SS	6															
180.68																				
1.37	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Firm to very stiff Grey		2	SS	8															
			3	SS	29															
179.15																				
2.90	END OF BOREHOLE																			
	Groundwater encountered at about elev. 180.5m during drilling on December 17, 2009.																			

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-331</b>		1 OF 1	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4680439.5 ; E 331811.2</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>December 17, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE					WATER CONTENT (%) w <sub>p</sub> w      w <sub>L</sub>					GR	SA	SI	CL
182.49	GROUND SURFACE																				
0.00	TOPSOIL, sandy																				
182.16	Black																				
0.33	SAND, fine, some silt																				
	Compact		1	SS	19									○							
	Brown																				
180.66			2	SS	23																
1.83	CLAYEY SILT, some sand, trace																				
	gravel																				
2.13	Very stiff																				
	Grey																				
2.41	SANDY SILT, some clay, trace		3	SS	20																
	gravel																				
179.59	Compact													○							
	Grey																				
2.90	CLAYEY SILT, some silt, trace																				
	gravel, with occasional silt partings																				
	Very stiff																				
	Grey																				
	END OF BOREHOLE																				
	Borehole dry during drilling on December 17, 2009.																				

LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-332</b>		1 OF 1	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4680429.6 ; E 331721.8</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 17, 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 $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR   SA   SI   CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W <sub>p</sub>	W	W <sub>L</sub>		
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE					WATER CONTENT (%)				
181.88	GROUND SURFACE						20	40	60	80	100	10	20	30			
0.08	FILL, limestone gravel, crushed Grey																
0.38	FILL, clayey silt, some sand, trace gravel																
0.63	Brown TOPSOIL, sandy Black		1	SS	19								○				
180.20	SILTY FINE SAND Loose to compact		2	SS	9												
1.68	Brown SANDY SILT, some clay																
179.75	Loose Grey																
2.13	CLAYEY SILT, some sand, trace gravel, with occasional silt partings		3	SS	17								○				
178.98	Very stiff Grey																
2.90	END OF BOREHOLE																
	Groundwater encountered at about elev. 180.4m during drilling on December 17, 2009.																



PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-333</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4680843.8 ; E 331553.7</u>		ORIGINATED BY <u>TA</u>			
DIST <u>WEST</u> HWY <u>401 / 3</u>		BOREHOLE TYPE <u>POWER AUGER, SOLID STEM</u>		COMPILED BY <u>DMB</u>			
DATUM <u>GEODETIC</u>		DATE <u>December 16, 2019</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × LAB VANE		W <sub>p</sub>	W	W <sub>L</sub>		
182.33	ROAD SURFACE													
0.05	ASPHALT PAVEMENT													
181.95	FILL, limestone gravel, crushed													
0.38	Grey													
	SAND, fine, some silt		1	SS	23									
	Compact													
	Brown													
180.50			2	SS	17									
1.83	SANDY SILT, some clay, trace													
180.19	gravel													
2.14	Compact													
	Grey													
	CLAYEY SILT, some sand, trace		3	SS	19									
	gravel, with occasional silt partings													
179.43	Very stiff													
2.90	Grey													
	END OF BOREHOLE													
	Borehole dry during drilling on December 16, 2009.													




LDN\_MTO\_06 09-1132-0080.GPJ LDN\_MTO.GDT 11/03/10

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-335</b>		1 OF 1		<b>METRIC</b>	
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  $\gamma$  kN/m <sup>3</sup>	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 <sub>p</sub>	W	W <sub>L</sub>					
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 <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-337</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4681554.3 ; E 331053.5</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 15, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w <sub>p</sub>	w	w <sub>L</sub>					
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE												
181.49	GROUND SURFACE							20	40	60	80	100								
0.00	TOPSOIL, clayey Black						181													
180.88																				
0.61	FILL, clayey silt, some sand, trace gravel, trace rootlets, trace brick Stiff Brown		1	SS	11															
180.12							180													
1.37	CLAYEY SILT, some sand, trace gravel, with occasioanl fissures, sand seams and silt partings Stiff to very stiff Brown		2	SS	13															
			3	SS	27		179													
178.59																				
2.90	END OF BOREHOLE																			
	Borehole dry during drilling on December 15, 2009.																			

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-338</b>		1 OF 1	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4681980.3 ; E 330141.6</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 15, 2009</u>		CHECKED BY _____	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIQUID LIMIT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W <sub>p</sub>	W	W <sub>L</sub>		GR	SA	SI	CL	
								20	40	60	80	100									
181.22	GROUND SURFACE																				
0.00	TOPSOIL, sandy, trace clay Black																				
0.23	FILL, clayey silt, some sand, trace gravel																				
180.61	Brown																				
0.61	SILTY FINE SAND, trace organics Loose to compact Dark brown		1	SS	8									o							
179.39			2	SS	10																
1.83	SANDY SILT, some clay Compact Grey																				
2.13	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Stiff Grey		3	SS	10									o							
178.32																					
2.90	END OF BOREHOLE																				
	Groundwater encountered at about elev. 179.6m during drilling on December 15, 2009.																				

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-339</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4682147.4 ; E 329635.6</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 8, 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  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
179.53	GROUND SURFACE																				
0.00	TOPSOIL, sandy																				
0.15	Black																				
	SANDY SILT, some clay, trace gravel, with sand pockets, silt partings and seams Compact Brown		1	SS	16																
			2	SS	21																
177.40																					
2.13	CLAYEY SILT, some sand, trace gravel Very stiff Grey		3	SS	18																
176.56																					
2.97	SILTY CLAY, some sand, trace gravel Very stiff Grey		4	SS	18																
175.87																					
3.66	END OF BOREHOLE																				
	Borehole dry during drilling on December 8, 2009.																				

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-340</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4682203.2 ; E 329538.7</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 10, 2009</u>		CHECKED BY _____			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIQUID LIMIT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		GR	SA	SI	CL	
179.58	GROUND SURFACE																				
0.00	TOPSOIL, sandy Black																				
179.25	SANDY SILT, some clay, trace gravel, with silt partings Loose to compact Brown																				
0.33			1	SS	9																
			2	SS	10																
177.19	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Very stiff Grey																				
2.39			3	SS	16																
176.68																					
2.90	END OF BOREHOLE																				
	Borehole dry during drilling on December 10, 2009.																				

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-342</b>		1 OF 1	<b>METRIC</b>
W.P. _____		LOCATION <u>N 4682246.9 ; E 329168.7</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 4, 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  $\gamma$  kN/m <sup>3</sup>	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 <sub>p</sub>	w	w <sub>L</sub>					
178.75	GROUND SURFACE																			
0.00	TOPSOIL, sandy, trace to some clay Black																			
178.10																				
0.65	SILTY FINE SAND Compact Brown		1	SS	17															
177.38																				
1.37	SANDY SILT, some clay, trace gravel, with silt partings Loose Grey		2	SS	7															
176.62																				
2.13	CLAYEY SILT, some sand, trace gravel, with occasional silt partings Stiff Grey		3	SS	10															
175.85																				
2.90	END OF BOREHOLE																			
	Borehole dry during drilling on December 4, 2009.																			

PROJECT <u>09-1132-0080</u>		<b>RECORD OF BOREHOLE No CPT-344</b>		1 OF 1		<b>METRIC</b>	
W.P. _____		LOCATION <u>N 4682206.2 ; E 328974.6</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 2, 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					w <sub>p</sub>	w	w <sub>L</sub>						
								○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   × LAB VANE					WATER CONTENT (%)								
179.56	GROUND SURFACE							20	40	60	80	100									
0.00	TOPSOIL, sandy, trace to some rootlets						▽														
0.15	Black																				
	SAND, fine some silt		1	SS	10										○						
	Compact																				
	Brown																				
177.86	SAND AND GRAVEL, some silt		2	SS	10																
1.80	Compact																				
	Brown																				
	SILT, some clay, trace to some sand, trace gravel																				
	Compact		3	SS	16										○						
176.66	Brown becoming grey below about elev. 177.4m																				
2.90	END OF BOREHOLE																				
	Groundwater encountered at about elev. 177.9m during drilling on December 2, 2009.																				





# **APPENDIX B**

## **Rock Core Photographs**



## APPENDIX B ROCK CORE PHOTOGRAPHS



Photo 1: BH-301 – Rock Core Boxes 1 and 2. Elevation 155.83 metres to 150.28 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS

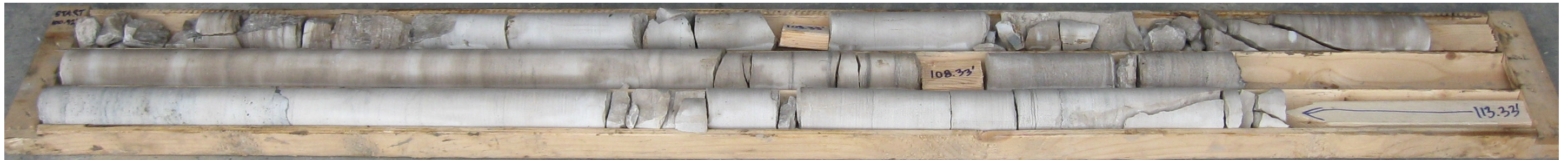


Photo 2: BH-305 – Rock Core Boxes 1 and 2. Elevation 155.10 metres to 149.99 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS

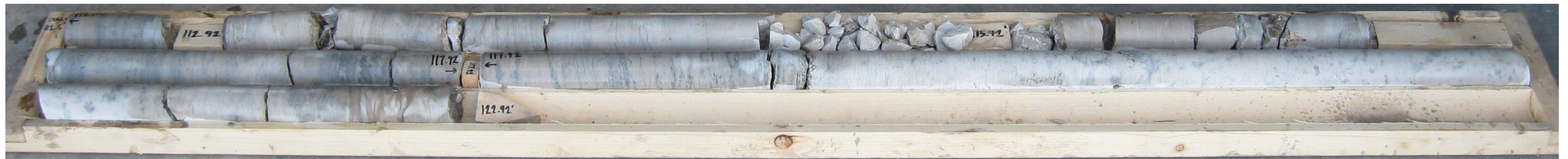


Photo 3: BH-311 – Rock Core Boxes 1 and 2. Elevation 150.56 metres to 145.86 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS

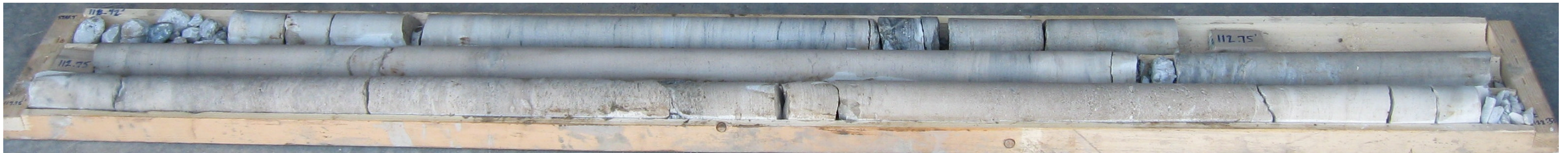


Photo 4: BH-314 – Rock Core Boxes 1 and 2. Elevation 150.02 metres to 144.81 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS

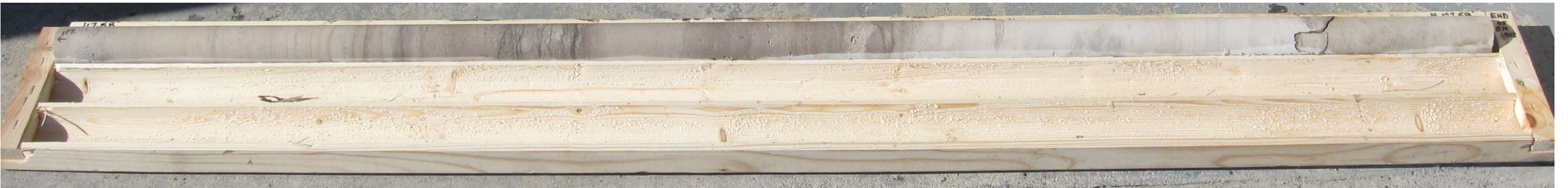
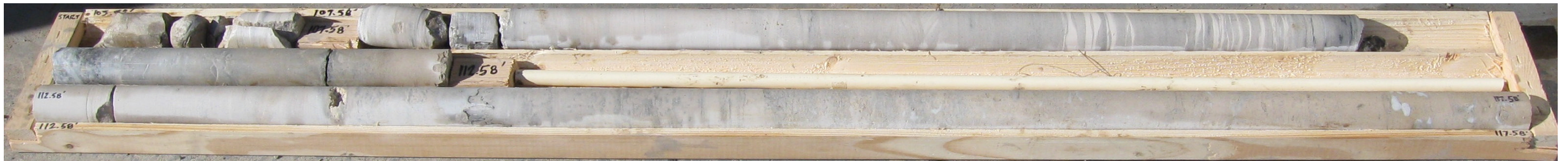


Photo 5: BH-318 – Rock Core Boxes 1 and 2. Elevation 149.73 metres to 144.93 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS

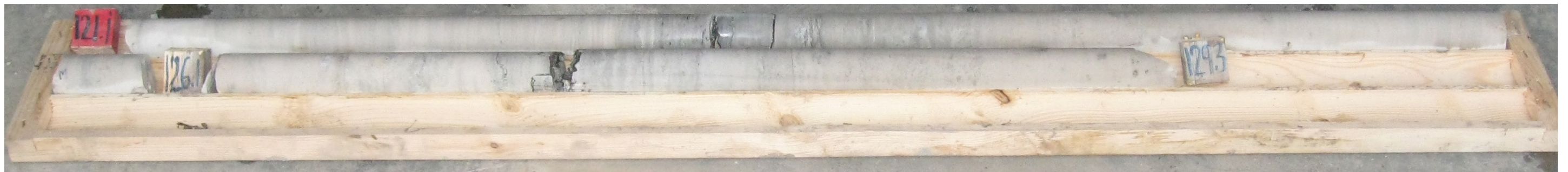


Photo 6: BH-321 – Rock Core Boxes 1 and 2. Elevation 149.12 metres to 143.73 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS



Photo 7: BH-323 – Rock Core Boxes 1 and 2. Elevation 148.20 metres to 142.96 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS



Photo 8: BH-325 – Rock Core Boxes 1 and 2. Elevation 148.49 metres to 143.31 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS



Photo 9: BH-326 – Rock Core Boxes 1 and 2. Elevation 149.17 metres to 144.10 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS



Photo 10: BH-334 – Rock Core Boxes 1 and 2. Elevation 148.58 metres to 143.55 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS

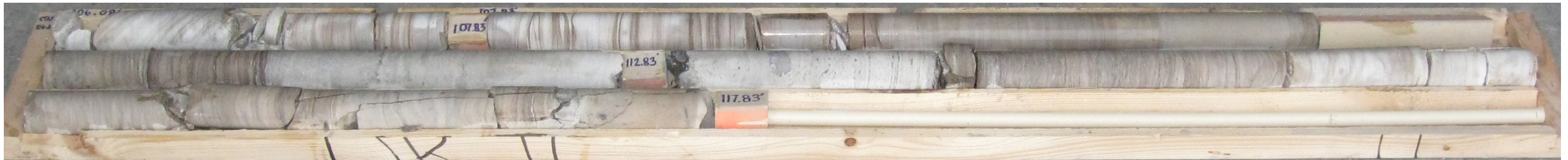


Photo 11: BH-336 – Rock Core Boxes 1 and 2. Elevation 150.07 metres to 144.96 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS



Photo 12: BH-341 – Rock Core Boxes 1 and 2. Elevation 157.06 metres to 151.55 metres





## APPENDIX B ROCK CORE PHOTOGRAPHS

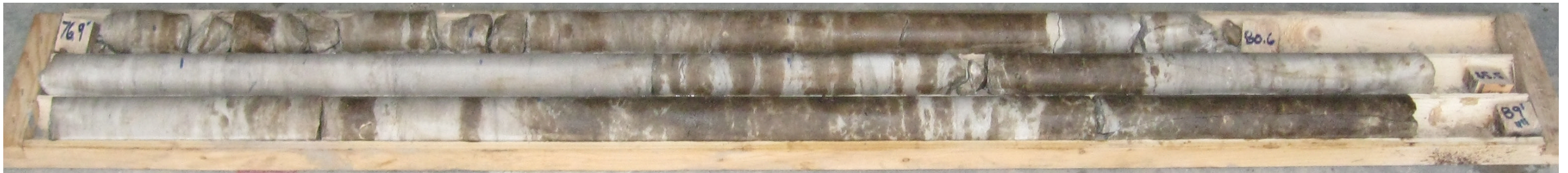


Photo 13: BH-343 – Rock Core Boxes 1 and 2. Elevation 155.70 metres to 150.75 metres





**APPENDIX B**  
**ROCK CORE PHOTOGRAPHS**



Photo 14: BH-345 – Rock Core Boxes 1 and 2. Elevation 157.68 metres to 151.22 metres



# **APPENDIX C**

## **Laboratory Tests**



LABORATORY TEST DATA SUMMARY													
BOREHOLE	SAMPLE No.	Depth (m)	Natural Water Content (%)	Windsor-Essex Parkway					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Wet Unit Weight (kN/m³)	Specific Gravity
				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	<75µm (%)					
301	1	0.76	18.5										
301	2	1.52	16						30.2	14.6	15.6		
301	3	2.29	13.6										
301	4	3.05	18.7										
301	5	3.51	14	0	27	46	27		22.9	12.3	10.6		
301	6	4.27	12.3										
301	7	5.03	17.5										
301	9	7.32	14.7	6	33	40	21						
301	11	10.36	17.4										
301	13	12.65	18.1	2	31	43	24		22.9	13.6	9.3		
301	14	13.41	17.6										
301	20	21.03	19.7	1	15	53	31		23.7	14.8	8.9		
301	22	24.08	17.3	1	24	44	31		29	16.4	12.6		
301	23	25.60	18.4										
301	24	27.13	18.2										
301	25a	28.80	22.1										
301	25b	29.03	18.4										
301	26	30.18	31.8										
304	1	0.76	16.4										
304	2	1.52	16.8										
304	3	2.29	18.7										
304	4	3.05	24										
304	5	3.81	11.8						28	14.5	13.5		
304	6	4.57	12.6										
304	7	5.33	12.1										
304	8	6.10	12.3										
304	9	7.62	13.3						22.7	13.8	8.9		
305	1	0.76	12.4										
305	2	1.52	16.3	3	28	37	32		36.9	16.8	20.1		
305	3	2.29	13.5										
305	4	3.05	13.1										
305	5	3.81	12.8	1	34	41	24		23.6	13.6	10		
305	6	4.57	14.8										
305	7	6.10	16										
305	8	7.62	16.4										
305	12	12.19	16.6										
305	15	15.24	18.8	0	27	41	32		28.1	15.8	12.3		
305	17	18.29	31.1										
305	19	21.34	16						22.8	14.4	8.4		
305	21	23.32	12.7	5	37	44	14						
305	22	24.38	35.9						25.8	15.2	10.6		
305	23a	26.00	18.4										

LABORATORY TEST DATA SUMMARY													
Windsor-Essex Parkway													
BOREHOLE	SAMPLE	Depth	Natural Water Content	Gravel	Sand	Silt	Clay	<75µm	Liquid Limit	Plastic Limit	Plasticity Index	Wet Unit Weight	Specific Gravity
No.	No.	(m)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(kN/m³)	
305	23b	26.30	19.5										
305	24	27.74	21.3										
305	25	28.96	22.7										
308	1	0.76	21.8										
308	2	1.52	13.4										
308	3	2.29	12.3						25.1	16.8	8.3		
308	4	3.05	14.1										
308	5	3.81	13.9										
308	6	4.57	12.9										
308	7	6.10	15.5										
308	8	7.62	16.2										
308	9	9.14	16.5										
308	10	10.67	17.3						22.7	14.7	8		
308	12	12.19	16.6										
310	1	0.76	20.1										
310	2	1.52	13.4										
310	3	2.29	13.5						26.6	14.8	11.8		
310	4	3.05	11.8										
310	5	3.81	12.9										
310	6	4.57	13.1										
310	7	6.10	14.8										
310	8	7.62	15.9						22.4	13.6	8.8		
310	9	9.14	16.4										
310	10	10.67	16.5										
310	12	12.19	17.4										
311	1	0.76	11.8										
311	2	1.52	12.9						28.5	17.6	10.9		
311	3	2.29	12										
311	4	3.05	12.4	0	34	42	24		26.4	15.9	10.5		
311	5	3.81	15.1										
311	7	6.10	14.2										
311	9	9.14	15.4	3	31	39	26		21.5	13.4	8.1		
311	10	10.67	17.3										
311	12	13.72	19										
311	14	16.76	16.8	0	28	40	32		27.2	15.4	11.8		
311	15	18.29	31.8										
311	17	21.34	13.5						21.6	15.1	6.5		
311	19	24.38	20.8										
311	20a	26.06	20.3										
311	20b	26.29	18.3										
311	21	27.43	28.7						30.9	17.1	13.8		
311	22	28.96	9.8	3	47	35	15						

LABORATORY TEST DATA SUMMARY													
BOREHOLE	SAMPLE No.	Depth (m)	Natural Water Content (%)	Windsor-Essex Parkway					Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Wet Unit Weight (kN/m³)	Specific Gravity
				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	<75µm (%)					
311	23	30.48	19.2										
311	24	32.00	13.7	7	80	7	6						
311	25	33.53	14.2										
314	1	0.76	22.1										
314	2	1.52	11.9										
314	3	2.29	12.5	0	32	42	26		26.4	12.9	13.5		
314	4	3.05	13										
314	5	3.81	13.7										
314	6	4.57	13.7	1	33	41	25		23.5	14	9.5		
314	8	7.62	15.9										
314	11	12.19	22.6										
314	17	21.34	14.1										
314	18	22.86	15.5	3	23	47	27		24.6	12.6	12		
314	19	24.38	23.1										
314	20a	26.06	24.8										
314	20b	26.29	11.2										
314	21	27.43	23.3						31.5	18	13.5		
314	22	28.96	27.4										
314	23	30.48	9.9	11	44	35	10						
314	24	32.00	9.7										
318	1	0.76	20.1										
318	2	1.52	16.7	2	13	47	38		30.3	15.6	14.7		
318	3	2.29	16.8										
318	4	3.05	17										
318	5	3.81	15.3										
318	7	6.10	19.9	0	24	41	35		29.9	15.9	14		
318	9	9.14	23.5										
318	11	12.19	23.4	2	19	41	38		32.8	18.2	14.6		
318	17	21.34	17.5	4	25	46	25		27.2	13.1	14.1		
318	18	22.86	19.6										
318	19	24.38	20.9										
318	20	25.91	21.5						30.6	15	15.6		
318	21	27.43	20.3										
318	22	28.96	36.5										
318	23	30.48	25.8										
318	24	32.00	14.8	34	29	33	4						
321	1	0.76	21										
321	2a	1.70	22.4										
321	2b	1.90	21.1										
321	3	2.29	14.9										
321	4	3.05	22.1	1	19	39	41		43.6	21.6	22		
321	5	3.51	21.2										

LABORATORY TEST DATA SUMMARY														
BOREHOLE	SAMPLE No.	Depth (m)	Windsor-Essex Parkway							Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Wet Unit Weight (kN/m³)	Specific Gravity
			Natural Water Content (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	<75µm (%)						
321	6	4.27	24.1											
321	8	7.32	20.2											
321	10	10.36	17.1	3	22	39	36		32	16.5	15.5			
321	12	13.41	22											
321	14	16.46	23.7	1	21	49	29		24.8	15.6	9.2			
321	17	21.03	15.6											
321	19	23.01	14.5	11	24	40	25		27.1	15.1	12			
321	21	25.60	19.8											
321	23	28.65	20.2						31	17	14			
321	25	31.70	9	21	69	7	3							
321	26	33.22	11.3											
323	1	0.76	21.1											
323	2	1.52	26.9											
323	3	2.29	19.9											
323	4	3.05	20.2	0	17	43	40		38.9	19.4	19.5			
323	5	3.68	18.5											
323	6	4.45	19.5	2	20	38	40		33.4	18.2	15.2			
323	7	5.21	19.8											
323	9	7.49	21.9											
323	11	10.54	24.8						34.2	16.2	18			
323	13	13.56	25.8											
323	16	18.14	15.6	2	28	47	23		23.6	12.6	11			
323	18	21.18	18.4											
323	20	24.23	19.3						29	14.2	14.8			
323	23	27.28	22.1	1	17	43	39		35	17.6	17.4			
323	26	30.18	11.4											
325	1	0.76	21.3											
325	2	1.52	21.3	1	19	48	32		31.9	20.2	11.7			
325	3	2.29	18											
325	4	3.05	23.4											
325	6	6.10	24.1											
325	8	9.14	19.6	1	21	44	34		32.5	16.8	15.7			
325	10	12.19	25.6											
325	13	16.76	17.5	1	26	48	25		28.9	16.4	12.5			
325	14	18.29	16.8											
325	17	22.86	18.2											
325	20	27.43	23.5						33.7	18.3	15.4			
325	22	30.48	9.4	10	40	38	12							
325	23	32.00	9											
326	1	0.76	10.4	0	86	11	3							
326	2	1.52	19.7						42	19.6	22.4			
326	3	2.29	19.2											

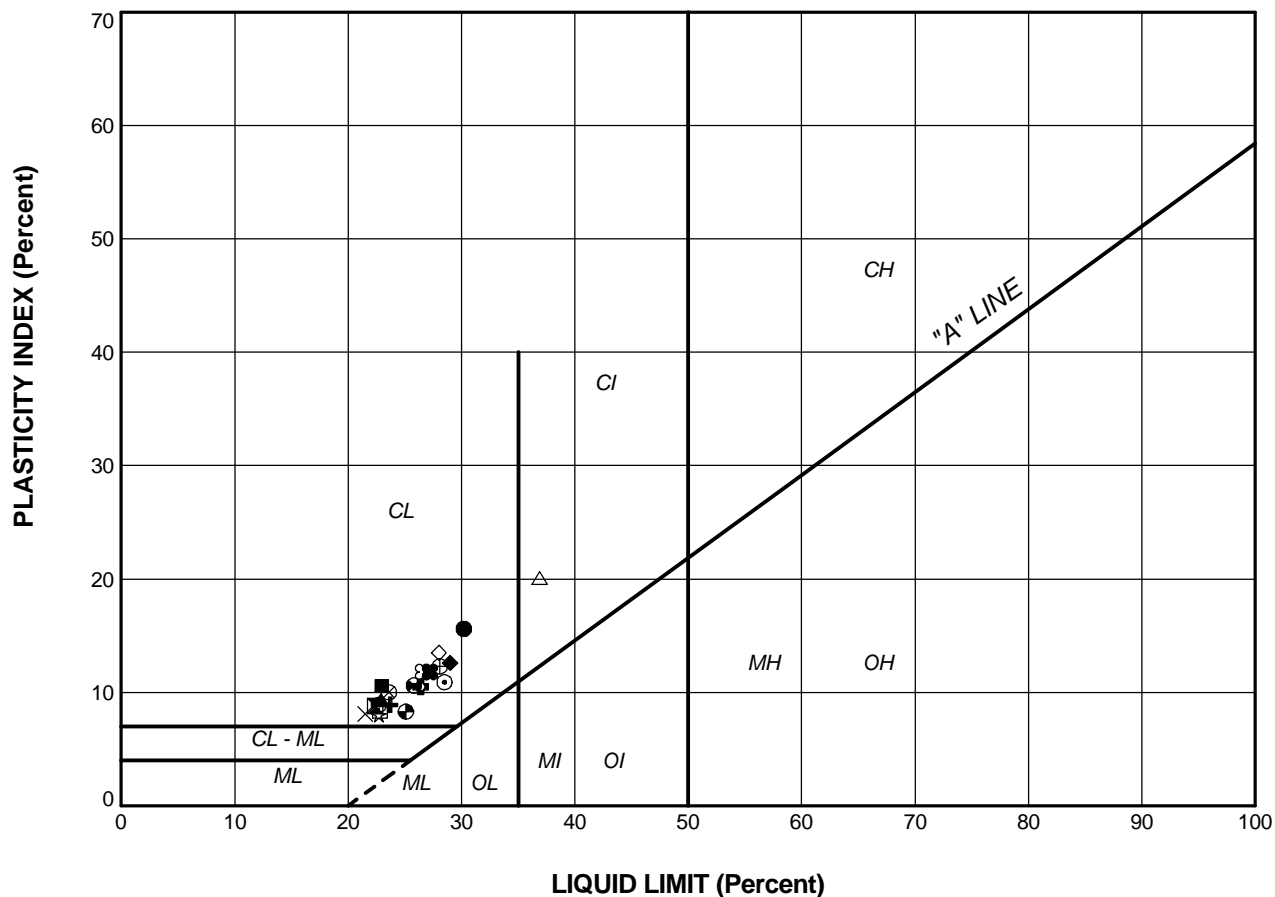
LABORATORY TEST DATA SUMMARY												
Windsor-Essex Parkway												
BOREHOLE	SAMPLE	Depth	Natural Water Content	Gravel	Sand	Silt	Clay <75µm	Liquid Limit	Plastic Limit	Plasticity Index	Wet Unit Weight	Specific Gravity
No.	No.	(m)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(kN/m³)	
326	4	3.05	21.7	1	17	42	40	29.3	15	14.3		
326	5	3.81	17.7									
326	6	4.57	18.3									
326	7	5.33	32.4	4	20	42	34	35	17.5	17.5		
326	9	7.01	21.7									
326	11	10.06	26.5									
326	13	13.11	24.8	1	21	41	37	32.6	16.5	16.1		
326	15	16.15	22.5									
326	17	22.25	20.8									
326	19	26.82	20.1	2	25	44	29	26.6	15.4	11.2		
326	20	28.35	25.1									
326	21	29.87	35.2					30	16.7	13.3		
326	22a	31.50	33.6									
326	22b	31.73	14.9	5	43	40	12					
334	1a	0.90	7.1									
334	1b	1.20	2.9									
334	2	1.52	13.8									
334	3	2.29	17	0	22	43	35	33	14.5	18.5		
334	4	3.05	20.5									
334	5	3.66	14.5									
334	6	4.42	14.3					25	14.1	10.9		
334	7	5.18	15.8									
334	9	7.32	16.5	1	31	40	28	26.2	12.9	13.3		
334	11	10.52	16.8									
334	13	13.56	24.4									
334	15	16.61	23.3	0	15	53	32	27.7	16.7	11		
334	17	19.66	13.4					25	13.2	11.8		
334	19	22.71	19									
334	20	24.23	20.4	1	23	44	32	30	18.9	11.1		
334	23a	27.66	19.6									
334	23b	27.89	19.3	5	27	44	24					
334	24	28.65	29.4									
334	27	31.70	6.5									
336	1	0.76	11.5	0	88	6	6					
336	2a	1.64	26.8									
336	2b	1.79	23									
336	3	2.29	16.1	1	24	40	35	29.2	15.2	14		
336	4	3.05	13.7									
336	6	4.57	15.6					36.6	18.2	18.4		
336	8	7.62	16.9									
336	10	10.67	17.3					25.8	12.4	13.4		
336	12	13.72	19.1									

LABORATORY TEST DATA SUMMARY												
Windsor-Essex Parkway												
BOREHOLE	SAMPLE	Depth	Natural Water Content	Gravel	Sand	Silt	Clay <75µm	Liquid Limit	Plastic Limit	Plasticity Index	Wet Unit Weight	Specific Gravity
No.	No.	(m)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(kN/m³)	
336	14	16.76	29.7	0	12	40	48	42.7	19.2	23.5		
336	16	19.81	19.5									
336	18	22.86	18.2	1	23	44	32	29.3	4.2	25.1		
336	19	24.38	20.4									
336	20	25.91	22.8									
336	21	27.43	22.7									
336	22	28.96	22.3									
336	23	30.48	10	2	45	42	11					
336	24	32.00	7.1									
341	1	1.04	20									
341	2	1.52	5.2					33.5	19.9	13.6		
341	3	2.29	25									
341	4	3.05	24									
341	5	4.11	32.2	0	14	27	59	49.1	19.7	29.4	18.63	2.73
341	6	5.64	27.7									
341	7	7.16	25.4	3	17	40	40	35.5	16.6	18.9	19.89	2.74
341	8	8.69	26.1									
341	11	12.50	43.3	0	15	53	32	29.5	16	13.5	17.80	2.71
341	12	13.26	34.2									
341	13	14.78	10	8	22	42	28	26.5	14.5	12	20.52	2.70
341	14	16.31	18.9									
341	16	19.36	19	5	24	39	32	32.4	15	17.4	20.81	2.72
341	17	20.88	18.3									
343	1a	0.91	18.1									
343	1b	1.14	15.8									
343	2	1.52	25.2									
343	3	2.29	23.2					25.7	16.9	8.8		
343	4	3.05	29.2									
343	5	4.57	35.4	0	10	30	60	45.1	18.4	26.7	18.50	2.73
343	6	6.10	27.2									
343	7	7.16	27.5	1	12	42	45	35.8	15.4	20.4	19.56	2.72
343	8	8.69	22.1									
343	9	9.91	50.2	0	5	27	68	56.4	22	34.4	17.03	2.72
343	10	11.43	37.9									
343	13	15.85	18.8									
343	16	19.05	22.7	4	14	44	38	33.9	14.8	19.1	20.50	2.71
343	17	20.88	25.3									
343	18a	22.50	16.2									
343	18b	22.80	8.7									
343A	2	14.00	27.4	2	18	39	42	29.7	15.1	14.6	19.49	2.74
343A	4	17.00	21.6	2	19	45	34	32.5	15.4	17.1	20.49	2.70
345	1	0.76	7.3									



LABORATORY TEST DATA SUMMARY													
Windsor-Essex Parkway													
BOREHOLE	SAMPLE	Depth	Natural Water Content	Gravel	Sand	Silt	Clay	<75µm	Liquid Limit	Plastic Limit	Plasticity Index	Wet Unit Weight	Specific Gravity
No.	No.	(m)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(kN/m³)	
345	2	1.52	22.2										
345	3	2.29	25						26.7	17.1	9.6		
345	4	3.05	24.3										
345	5	4.57	40.3										
345	6	6.10	41.3	0	8	25	67		52.4	20.6	31.8	17.84	2.72
345	7	7.16	41.5										
345	8	8.69	29.1	0	12	42	46		38.8	17.9	20.9	19.42	2.72
345	9	10.21	39.2										
345	10	11.73	30	5	12	49	41		32.7	15	17.7	19.21	2.69
345	11	13.26	22										
345	12	14.78	14.8										
345	13	16.31	21.5	10	24	40	26		28.1	14.6	13.5	20.51	2.71
345	14	19.36	15.7						28.9	16.4	12.5		
345	15	20.88	19.1										
CPT-302	1	0.76	12.8										
CPT-302	3	2.29	12.4										
CPT-303	2	1.52	13.7										
CPT-303	4	3.05	11.9										
CPT-306	1	0.76	18.6										
CPT-306	3	2.29	12.4										
CPT-307	1	0.76	20.3										
CPT-307	4	3.05	12										
CPT-309	2	1.52	11.7										
CPT-309	3	2.29	11.9										
CPT-312	1	0.76	17										
CPT-312	3	2.29	12.7										
CPT-313	2	1.52	14.2										
CPT-313	4	3.05	11.6										
CPT-315	2	1.52	17.8										
CPT-315	5	3.81	13.1										
CPT-316	2	1.52	12.3										
CPT-316	3	2.29	11.8										
CPT-317	1	0.76	19.6										
CPT-317	4	3.05	14.1										
CPT-319	1	0.76	6.9										
CPT-319	3	2.29	18.6										
CPT-320	1	0.76	17.8										
CPT-320	3	2.29	14.2										
CPT-322	2	1.52	21.2										
CPT-322	3	2.29	19.7										
CPT-324	2	1.52	16.3										
CPT-324	3	2.29	19.2										

LABORATORY TEST DATA SUMMARY														
BOREHOLE	SAMPLE	Depth	Windsor-Essex Parkway							Liquid Limit	Plastic Limit	Plasticity Index	Wet Unit Weight	Specific Gravity
			Natural Water Content	Gravel	Sand	Silt	Clay	<75µm						
			(%)	(%)	(%)	(%)	(%)	(%)						
No.	No.	(m)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(kN/m³)		
CPT-328	1	0.76	20.3											
CPT-328	3	2.29	21.9											
CPT-329	2	1.52	21.6											
CPT-329	3	2.69	20.9											
CPT-330	1	0.76	18.1											
CPT-330	3	2.29	19.4											
CPT-331	1	0.76	5.4											
CPT-331	3	2.65	23.3											
CPT-332	1	0.76	11											
CPT-332	3	2.29	18.6											
CPT-333	1	0.76	9.8											
CPT-333	3	2.29	24.3											
CPT-335	1	0.76	27.6											
CPT-335	3	2.29	15											
CPT-337	2	1.52	22.9											
CPT-337	3	2.29	18.7											
CPT-338	1	0.76	14											
CPT-338	3	2.29	24.2											
CPT-339	2	1.52	23.3											
CPT-339	4	3.05	26.5											
CPT-340	1	0.76	21.9											
CPT-340	3	2.64	24.6											
CPT-342	2	1.52	23.5											
CPT-342	3	2.29	25											
CPT-344	1	0.76	7.8											
CPT-344	3	2.29	22.9											

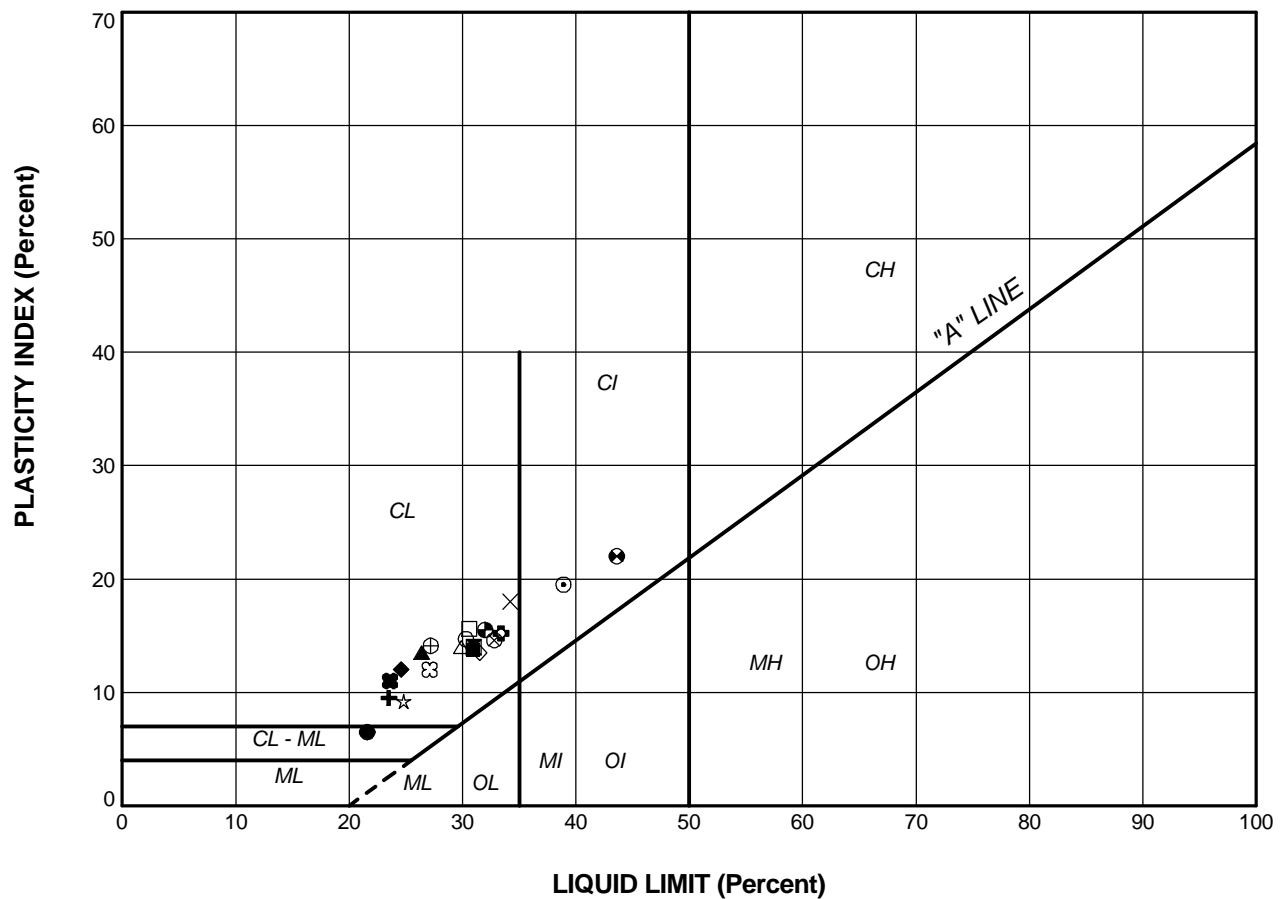


### LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	301	2	30.2	14.6	15.6
■	301	5	22.9	12.3	10.6
▲	301	13	22.9	13.6	9.3
+	301	20	23.7	14.8	8.9
◆	301	22	29.0	16.4	12.6
◇	304	5	28.0	14.5	13.5
○	304	9	22.7	13.8	8.9
△	305	2	36.9	16.8	20.1
⊗	305	5	23.6	13.6	10.0
⊕	305	15	28.1	15.8	12.3
□	305	19	22.8	14.4	8.4
⊙	305	22	25.8	15.2	10.6
⊛	308	3	25.1	16.8	8.3
☆	308	10	22.7	14.7	8.0
⊗	310	3	26.6	14.8	11.8
⊕	310	8	22.4	13.6	8.8
⊙	311	2	28.5	17.6	10.9
⊛	311	4	26.4	15.9	10.5
×	311	9	21.5	13.4	8.1
■	311	14	27.2	15.4	11.8

PROJECT				WINDSOR-ESSEX PARKWAY SUPPLEMENTARY INVESTIGATION WINDSOR, ONTARIO			
TITLE				PLASTICITY CHART			
PROJECT No.		09-1132-0080		FILE No.		0911320080-5000-R030C1	
DRAWN	WDF	Mar 02/10	SCALE		N/A		REV.
CHECK							FIGURE C-1A



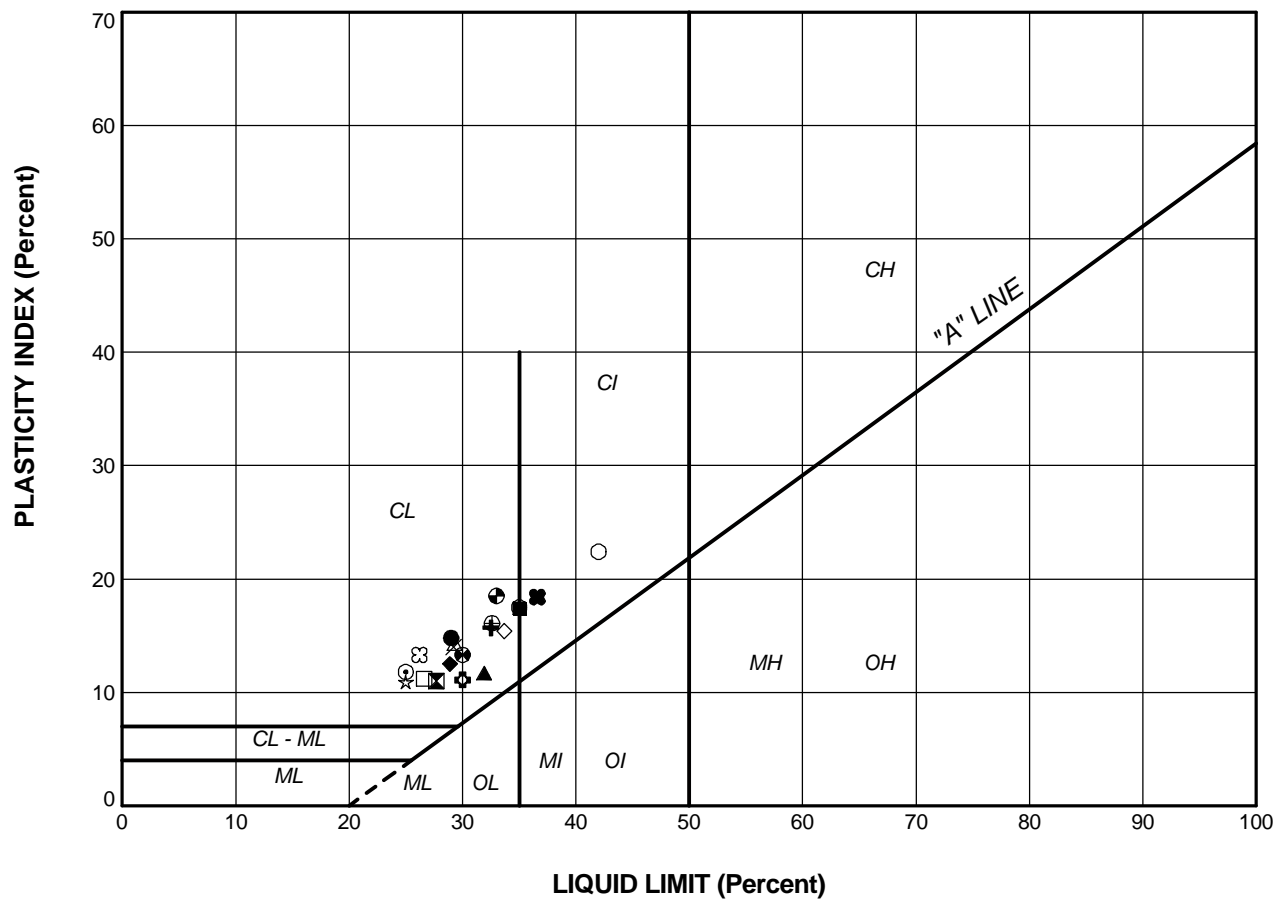


### LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	311	17	21.6	15.1	6.5
■	311	21	30.9	17.1	13.8
▲	314	3	26.4	12.9	13.5
+	314	6	23.5	14.0	9.5
◆	314	18	24.6	12.6	12.0
◇	314	21	31.5	18.0	13.5
○	318	2	30.3	15.6	14.7
△	318	7	29.9	15.9	14.0
⊗	318	11	32.8	18.2	14.6
⊕	318	17	27.2	13.1	14.1
□	318	20	30.6	15.0	15.6
⊙	321	4	43.6	21.6	22.0
⊛	321	10	32.0	16.5	15.5
☆	321	14	24.8	15.6	9.2
⊗	321	19	27.1	15.1	12.0
⊕	321	23	31.0	17.0	14.0
⊙	323	4	38.9	19.4	19.5
⊛	323	6	33.4	18.2	15.2
×	323	11	34.2	16.2	18.0
■	323	16	23.6	12.6	11.0

PROJECT				WINDSOR-ESSEX PARKWAY SUPPLEMENTARY INVESTIGATION WINDSOR, ONTARIO			
TITLE				PLASTICITY CHART			
PROJECT No.		09-1132-0080		FILE No.		0911320080-5000-R030C1	
DRAWN	WDF	Mar 02/10	SCALE		N/A		REV.
CHECK							FIGURE C-1B



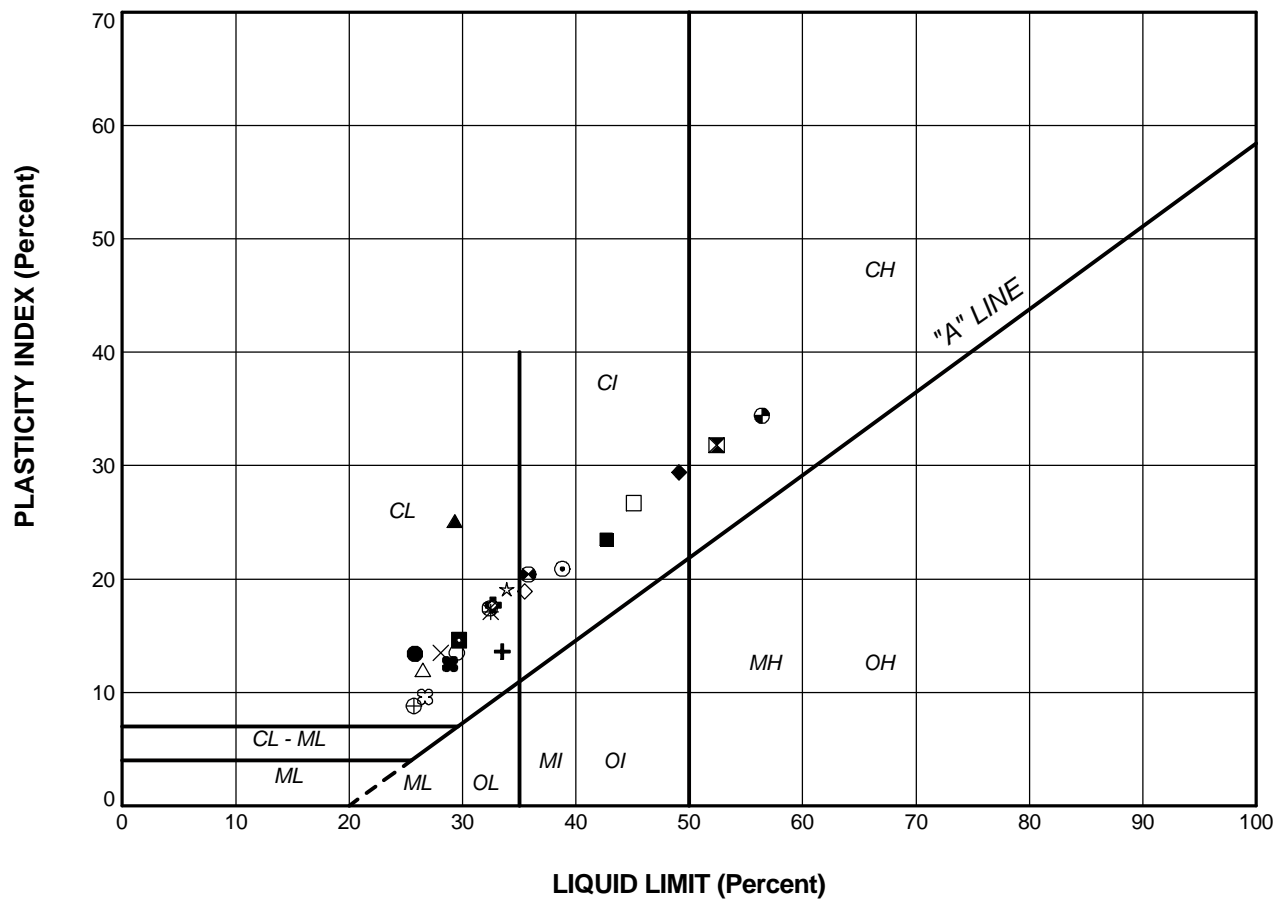


### LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	323	20	29.0	14.2	14.8
■	323	23	35.0	17.6	17.4
▲	325	2	31.9	20.2	11.7
+	325	8	32.5	16.8	15.7
◆	325	13	28.9	16.4	12.5
◇	325	20	33.7	18.3	15.4
○	326	2	42.0	19.6	22.4
△	326	4	29.3	15.0	14.3
⊗	326	7	35.0	17.5	17.5
⊕	326	13	32.6	16.5	16.1
□	326	19	26.6	15.4	11.2
⊙	326	21	30.0	16.7	13.3
⊛	334	3	33.0	14.5	18.5
☆	334	6	25.0	14.1	10.9
⊗	334	9	26.2	12.9	13.3
⊕	334	15	27.7	16.7	11.0
⊙	334	17	25.0	13.2	11.8
⊛	334	20	30.0	18.9	11.1
×	336	3	29.2	15.2	14.0
⊛	336	6	36.6	18.2	18.4


PROJECT				WINDSOR-ESSEX PARKWAY SUPPLEMENTARY INVESTIGATION WINDSOR, ONTARIO			
TITLE				PLASTICITY CHART			
PROJECT No.		09-1132-0080		FILE No.		0911320080-5000-R030C1	
DRAWN	WDF	Mar 02/10	SCALE		N/A		REV.
CHECK							FIGURE C-1C

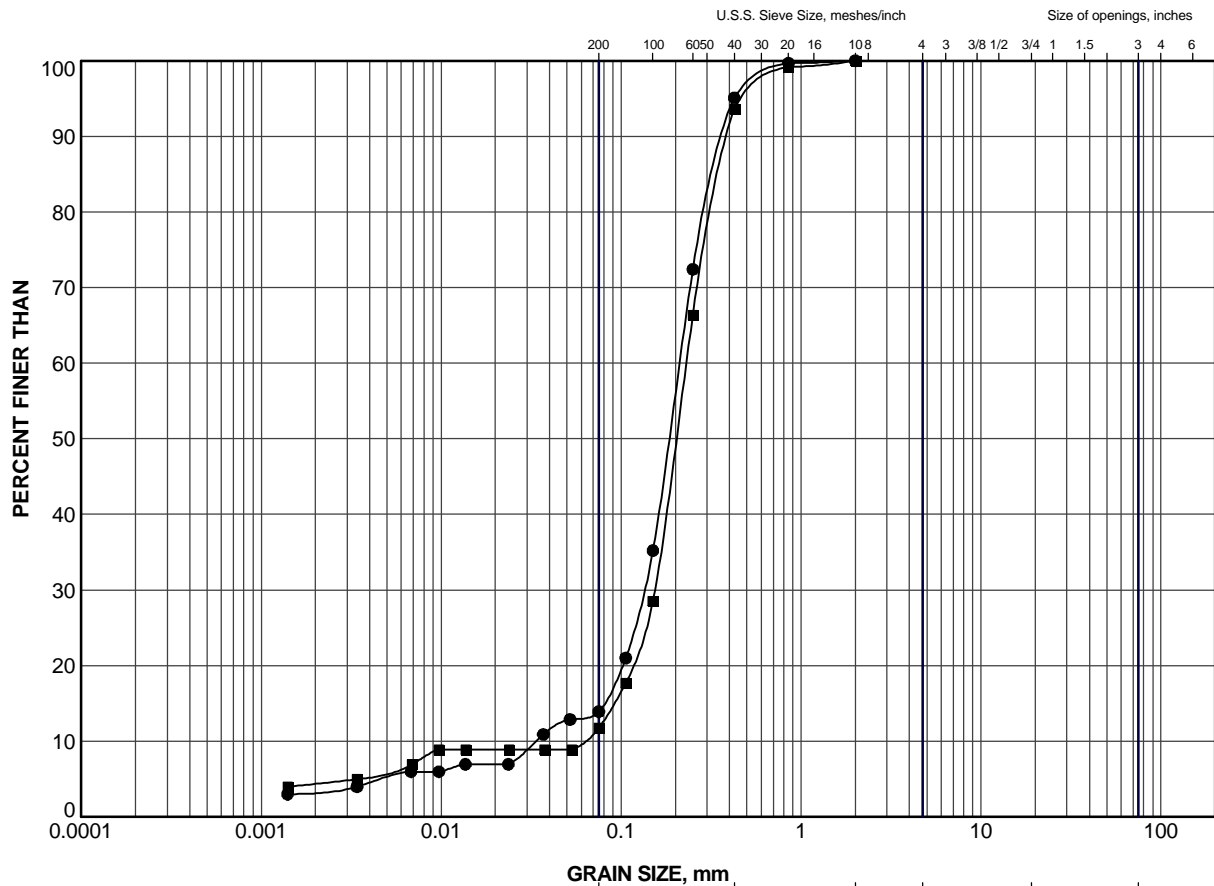




### LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	336	10	25.8	12.4	13.4
■	336	14	42.7	19.2	23.5
▲	336	18	29.3	4.2	25.1
+	341	2	33.5	19.9	13.6
◆	341	5	49.1	19.7	29.4
◇	341	7	35.5	16.6	18.9
○	341	11	29.5	16.0	13.5
△	341	13	26.5	14.5	12.0
⊗	341	16	32.4	15.0	17.4
⊕	343	3	25.7	16.9	8.8
□	343	5	45.1	18.4	26.7
⊗	343	7	35.8	15.4	20.4
⊕	343	9	56.4	22.0	34.4
☆	343	16	33.9	14.8	19.1
⊗	345	3	26.7	17.1	9.6
⊕	345	6	52.4	20.6	31.8
⊗	345	8	38.8	17.9	20.9
⊕	345	10	32.7	15.0	17.7
×	345	13	28.1	14.6	13.5
■	345	14	28.9	16.4	12.5
■	343A	2	29.7	15.1	14.6
*	343A	4	32.5	15.4	17.1

PROJECT		WINDSOR-ESSEX PARKWAY SUPPLEMENTARY INVESTIGATION WINDSOR, ONTARIO	
TITLE		PLASTICITY CHART	
PROJECT No.	09-1132-0080	FILE No.	0911320080-5000-R030C1
DRAWN	WDF	SCALE	N/A
CHECK		REV.	
 <b>Golder Associates</b> LONDON, ONTARIO		<b>FIGURE C-1D</b>	



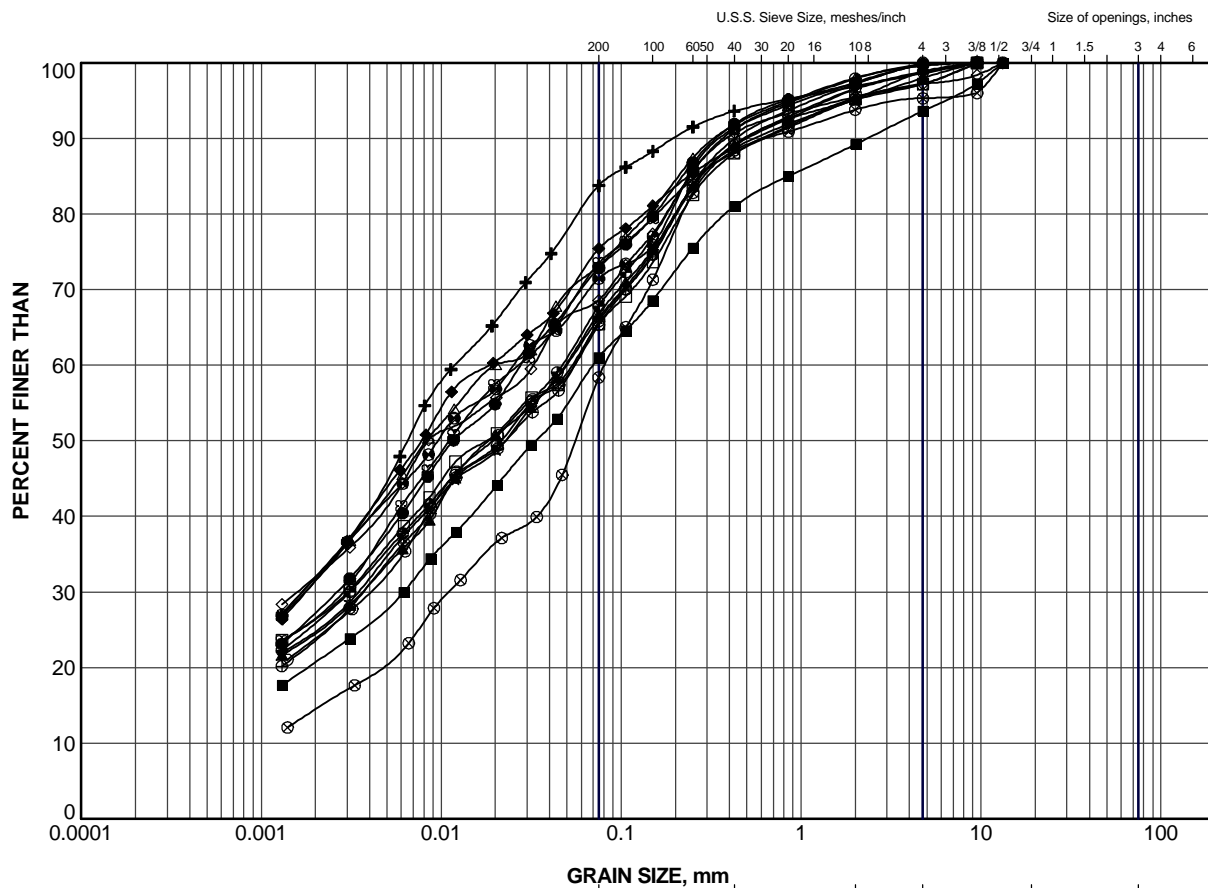
GRAVEL SIZE, mm						
CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

#### LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	326	1	180.8
■	336	1	181.4

PROJECT		WINDSOR-ESSEX PARKWAY SUPPLEMENTARY INVESTIGATION WINDSOR, ONTARIO			
TITLE		GRAIN SIZE DISTRIBUTION UPPER GRANULAR DEPOSIT			
PROJECT No.		09-1132-0080		FILE No. 0911320080-5000-R030C2	
DRAWN		WDF		Mar 10/10	
CHECK					
Golder Associates LONDON, ONTARIO		<div>SCALE</div> <div>N/A</div> <div>REV.</div>			
		FIGURE C-2			





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

### LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	301	5	182.5
■	301	9	178.7
▲	301	13	173.4
+	301	20	165.0
◆	301	22	161.9
◇	305	2	184.1
○	305	5	181.8
△	305	15	170.4
⊗	305	21	162.3
⊕	311	4	181.6
□	311	9	175.5
⊙	311	14	167.9
⊗	314	3	180.5
☆	314	6	178.3
⊗	314	18	160.0

PROJECT

WINDSOR-ESSEX PARKWAY  
SUPPLEMENTARY INVESTIGATION  
WINDSOR, ONTARIO

TITLE

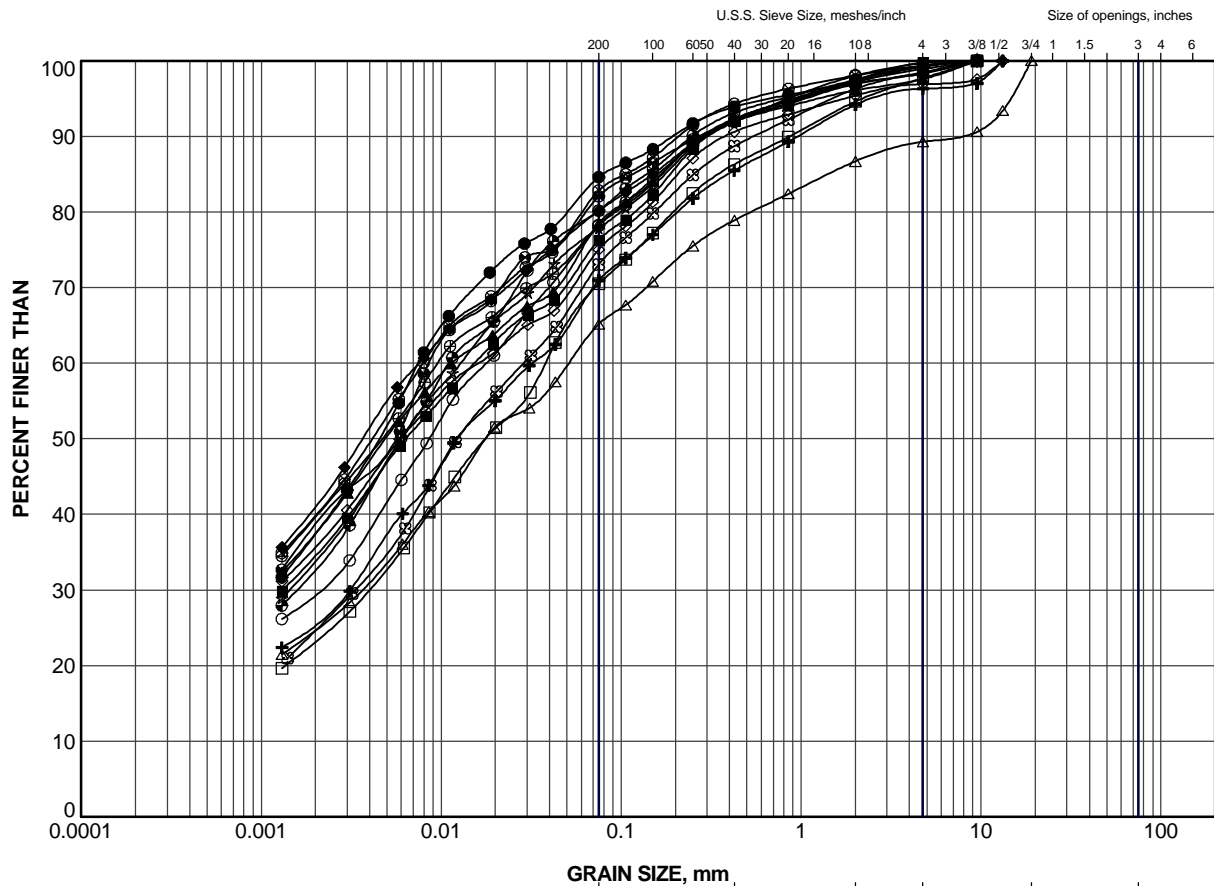
**GRAIN SIZE DISTRIBUTION**  
**CLAYEY SILT TO SILTY CLAY DEPOSIT**



**Golder  
Associates**  
LONDON, ONTARIO

PROJECT No.	09-1132-0080	FILE No.	0911320080-5000-R030C3
DRAWN	WDF	Mar 10/10	SCALE N/A REV.
CHECK			

**FIGURE C-3A**



### LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	318	2	180.5
■	318	7	176.0
▲	318	11	169.9
+	318	17	160.7
◆	321	4	179.9
◇	321	10	172.5
○	321	14	166.4
△	321	19	159.9
⊗	323	4	178.0
⊕	323	6	176.6
□	323	16	162.9
⊙	323	23	153.8
⊗	325	2	179.0
☆	325	8	171.4
⊗	325	13	163.8

PROJECT

WINDSOR-ESSEX PARKWAY  
SUPPLEMENTARY INVESTIGATION  
WINDSOR, ONTARIO

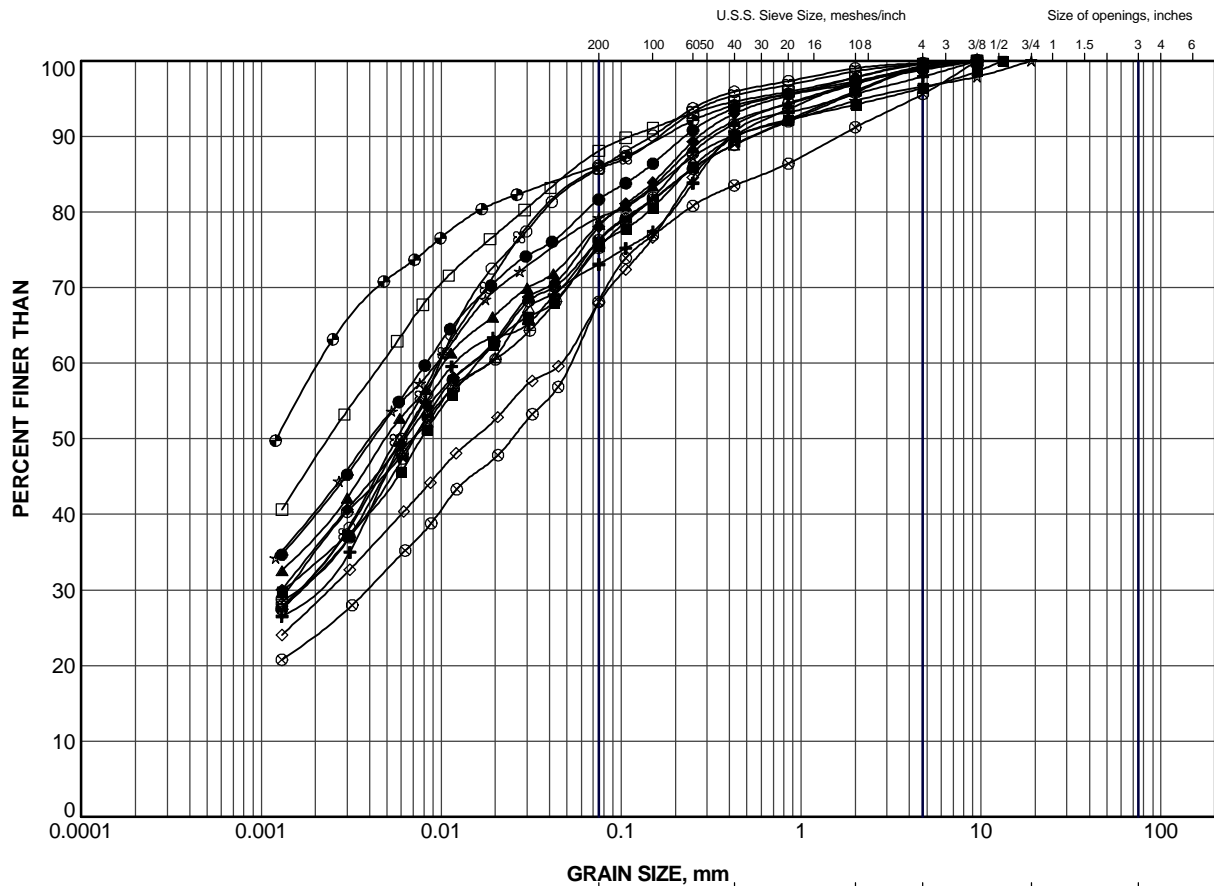
TITLE

**GRAIN SIZE DISTRIBUTION**  
**CLAYEY SILT TO SILTY CLAY DEPOSIT**



PROJECT No.	09-1132-0080	FILE No.	0911320080-5000-R030C3
DRAWN	WDF	Mar 10/10	SCALE N/A
CHECK			REV.

**FIGURE C-3B**



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

### LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	326	4	178.5
■	326	7	176.2
▲	326	13	168.4
+	326	19	154.7
◆	334	3	179.3
◇	334	9	174.3
○	334	15	165.0
△	334	20	157.3
⊗	334	23	153.9
⊕	336	3	179.9
□	336	14	165.4
⊙	336	18	159.3
⊗	341	5	174.5
☆	341	7	171.4
⊗	341	11	166.1

PROJECT

WINDSOR-ESSEX PARKWAY  
SUPPLEMENTARY INVESTIGATION  
WINDSOR, ONTARIO

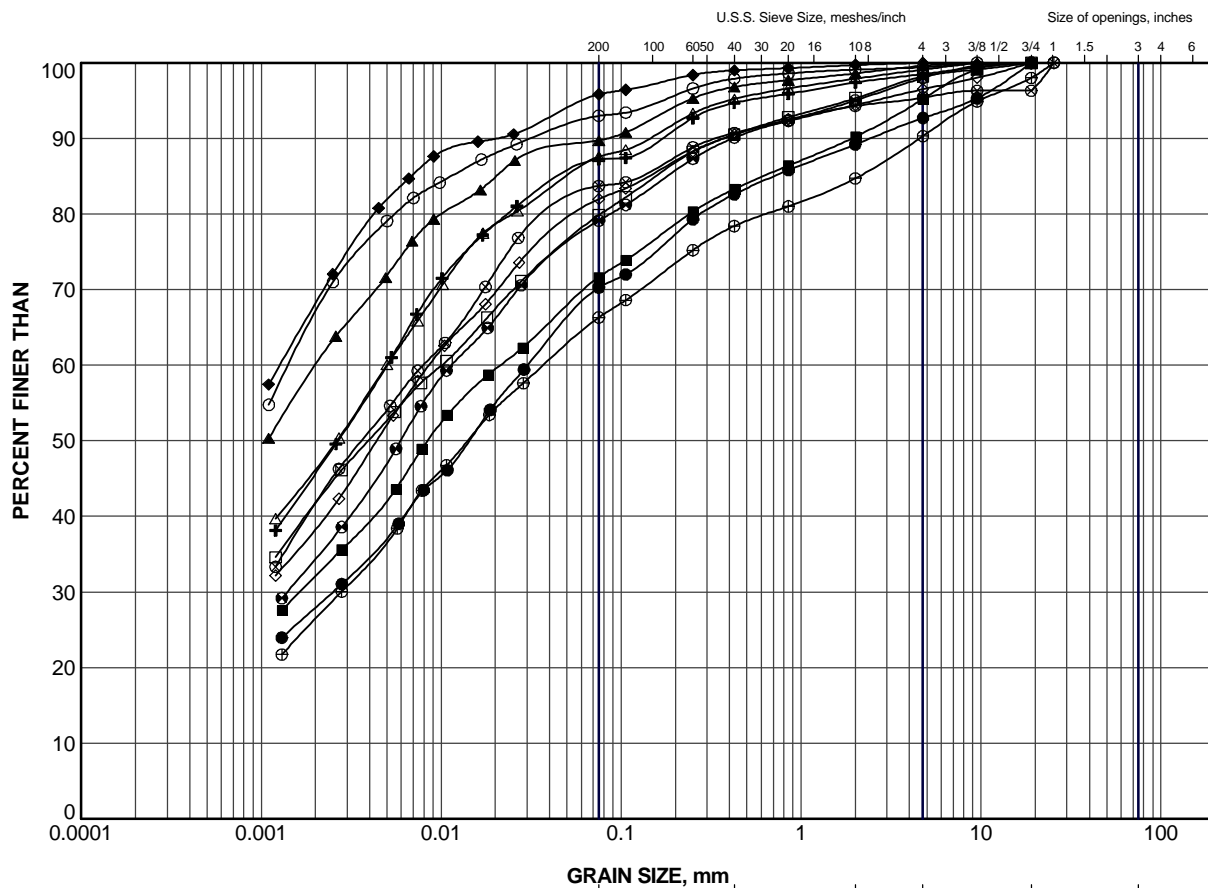
TITLE

**GRAIN SIZE DISTRIBUTION**  
**CLAYEY SILT TO SILTY CLAY DEPOSIT**



PROJECT No.	09-1132-0080	FILE No.	0911320080-5000-R030C3
DRAWN	WDF	Mar 10/10	SCALE N/A REV.
CHECK			

**FIGURE C-3C**



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

### LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	341	13	163.8
■	341	16	159.2
▲	343	5	174.3
+	343	7	171.8
◆	343	9	169.0
◇	343	16	159.9
○	345	6	173.1
△	345	8	170.6
⊗	345	10	167.5
⊕	345	13	162.9
□	343A	2	165.2
⊙	343A	4	162.2

PROJECT

WINDSOR-ESSEX PARKWAY  
SUPPLEMENTARY INVESTIGATION  
WINDSOR, ONTARIO

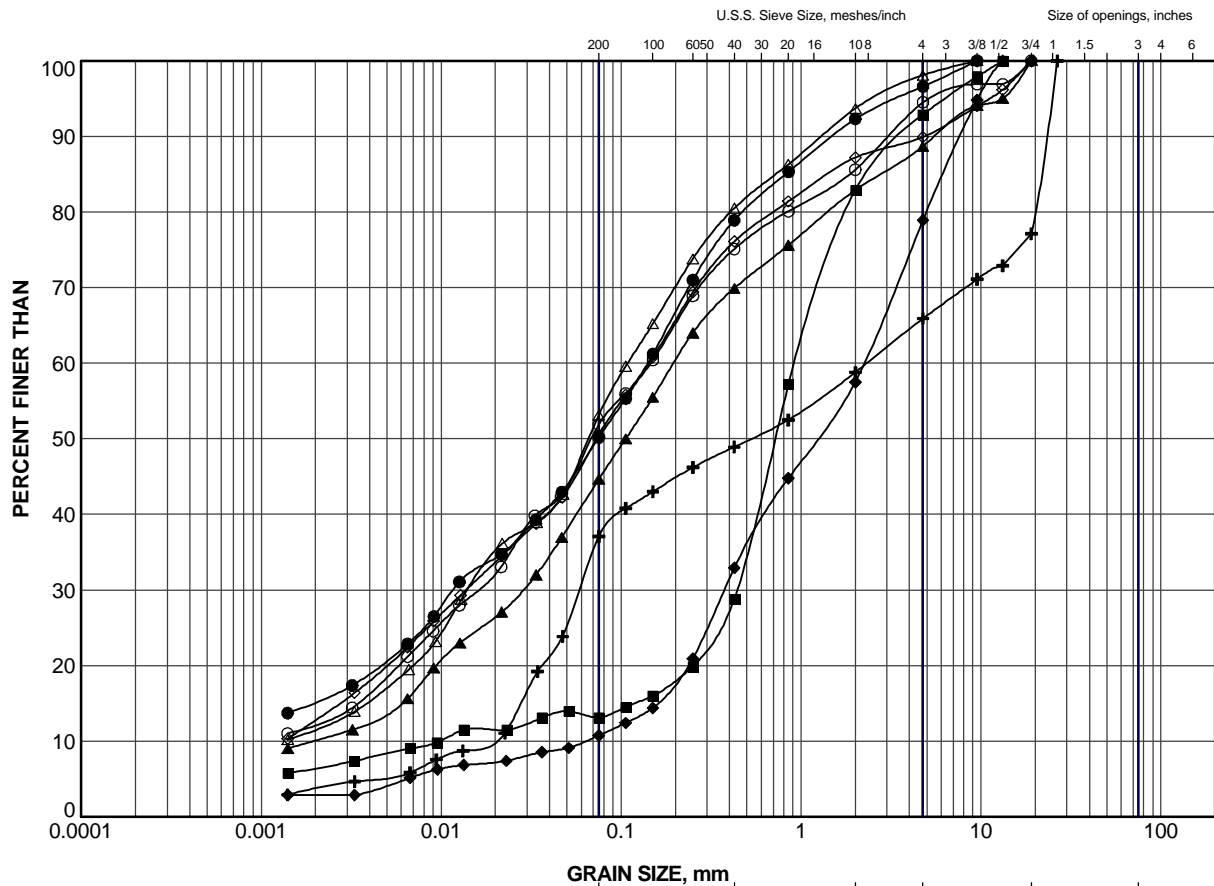
TITLE

**GRAIN SIZE DISTRIBUTION**  
**CLAYEY SILT TO SILTY CLAY DEPOSIT**



**Golder Associates**  
LONDON, ONTARIO

PROJECT No.	09-1132-0080	FILE No.	0911320080-5000-R030C3
DRAWN	WDF	Mar 10/10	SCALE N/A REV.
CHECK			<b>FIGURE C-3D</b>



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

### LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	311	22	155.7
■	311	24	152.6
▲	314	23	152.4
+	318	24	150.1
◆	321	25	151.1
◇	325	22	150.1
○	326	22	150.1
△	336	23	151.7

PROJECT

WINDSOR-ESSEX PARKWAY  
SUPPLEMENTARY INVESTIGATION  
WINDSOR, ONTARIO

TITLE

GRAIN SIZE DISTRIBUTION  
LOWER GRANULAR DEPOSIT



**Golder Associates**  
LONDON, ONTARIO

PROJECT No.	09-1132-0080	FILE No.	0911320080-5000-R030C4
DRAWN	WDF	Mar 10/10	SCALE N/A
CHECK			REV.

**FIGURE C-4**

# CONSOLIDATION TEST SUMMARY

FIGURE BH 341 SA 5 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	5
Borehole Number	341	Sample Depth, m	4.1-4.6

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	5		
Date Started	12/9/2009		
Date Completed	01/01/2010		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m <sup>3</sup>	18.63
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m <sup>3</sup>	14.09
Area, cm <sup>2</sup>	31.52	Specific Gravity, measured	2.73
Volume, cm <sup>3</sup>	59.89	Solids Height, cm	1.000
Water Content, %	32.23	Volume of Solids, cm <sup>3</sup>	31.51
Wet Mass, g	113.76	Volume of Voids, cm <sup>3</sup>	28.37
Dry Mass, g	86.03	Degree of Saturation, %	97.7

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv. cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	1.900	0.900	1.900				
4.85	1.885	0.885	1.892				
9.55	1.868	0.868	1.876				
19.34	1.838	0.838	1.853				
38.86	1.792	0.792	1.815				
68.27	1.749	0.749	1.770	780	1.97E-04	7.75E-04	1.49E-08
19.34	1.766	0.766	1.757				
4.87	1.784	0.784	1.775				
9.55	1.781	0.781	1.782				
19.37	1.774	0.774	1.777				
38.84	1.760	0.760	1.767				
67.92	1.743	0.743	1.751	300	5.01E-04	3.13E-04	1.54E-08
155.39	1.675	0.675	1.709	378	3.78E-04	4.07E-04	1.51E-08
310.78	1.610	0.610	1.642	360	3.67E-04	2.20E-04	7.93E-09
621.22	1.541	0.541	1.575	260	4.68E-04	1.17E-04	5.35E-09
1243.40	1.475	0.475	1.508	180	6.19E-04	5.59E-05	3.39E-09
2487.15	1.404	0.404	1.439	130	7.81E-04	3.00E-05	2.30E-09
1243.40	1.419	0.419	1.411				
310.78	1.460	0.460	1.439				
67.92	1.521	0.521	1.490				
19.37	1.573	0.573	1.547				
4.87	1.612	0.612	1.592				

Note:

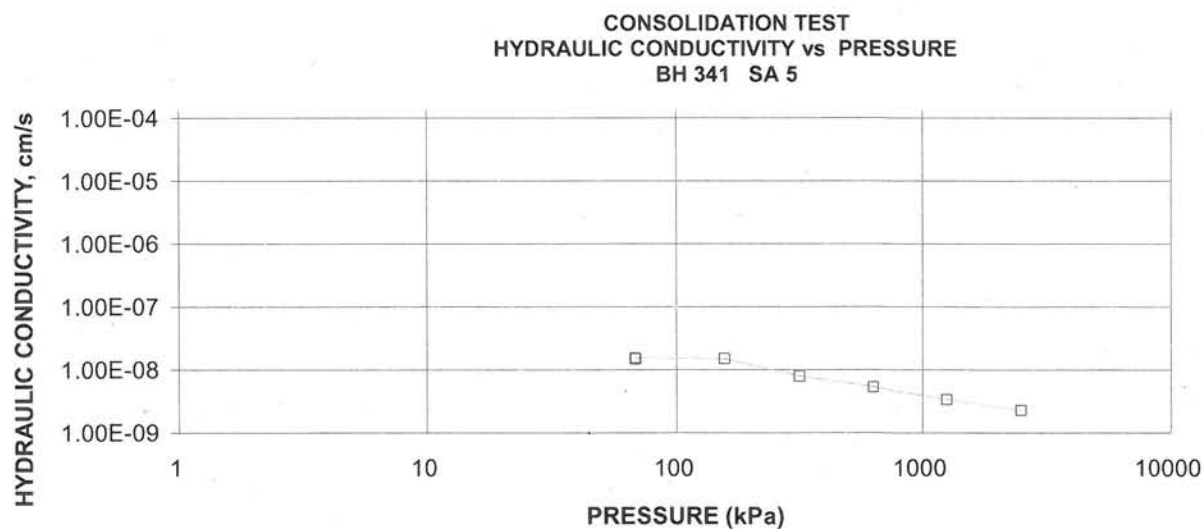
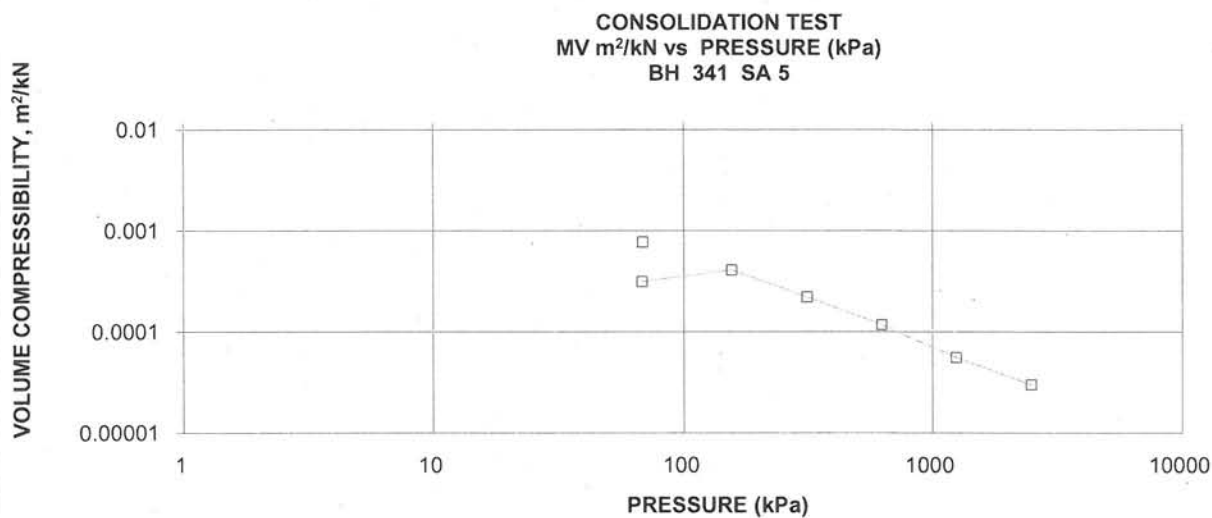
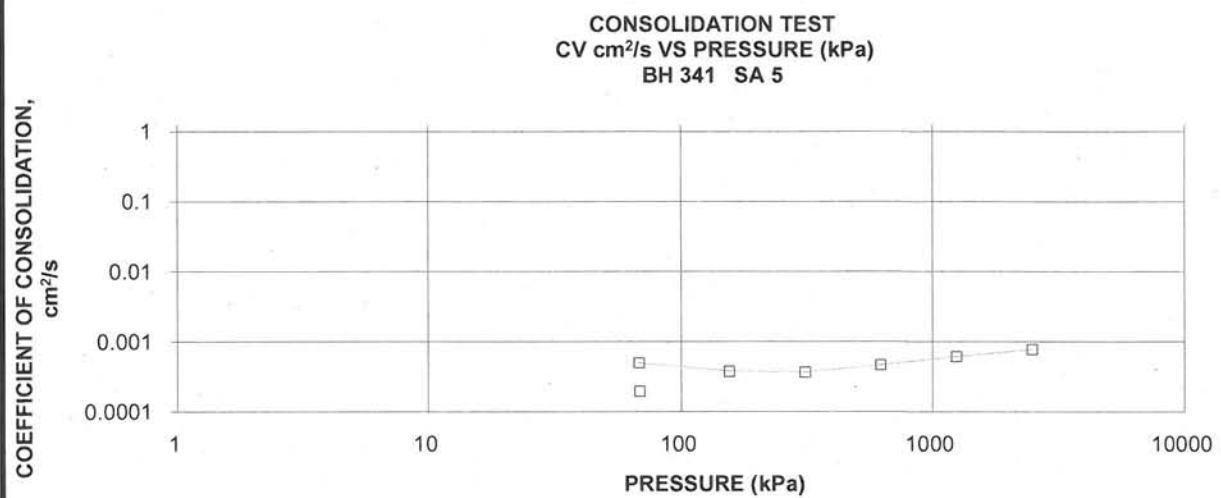
k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.61	Unit Weight, kN/m <sup>3</sup>	20.76
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m <sup>3</sup>	16.61
Area, cm <sup>2</sup>	31.52	Specific Gravity, measured	2.73
Volume, cm <sup>3</sup>	50.81	Solids Height, cm	1.000
Water Content, %	25.01	Volume of Solids, cm <sup>3</sup>	31.51
Wet Mass, g	107.55	Volume of Voids, cm <sup>3</sup>	19.29
Dry Mass, g	86.03		

# CONSOLIDATION TEST SUMMARY

FIGURE BH 341 SA 5 OED B

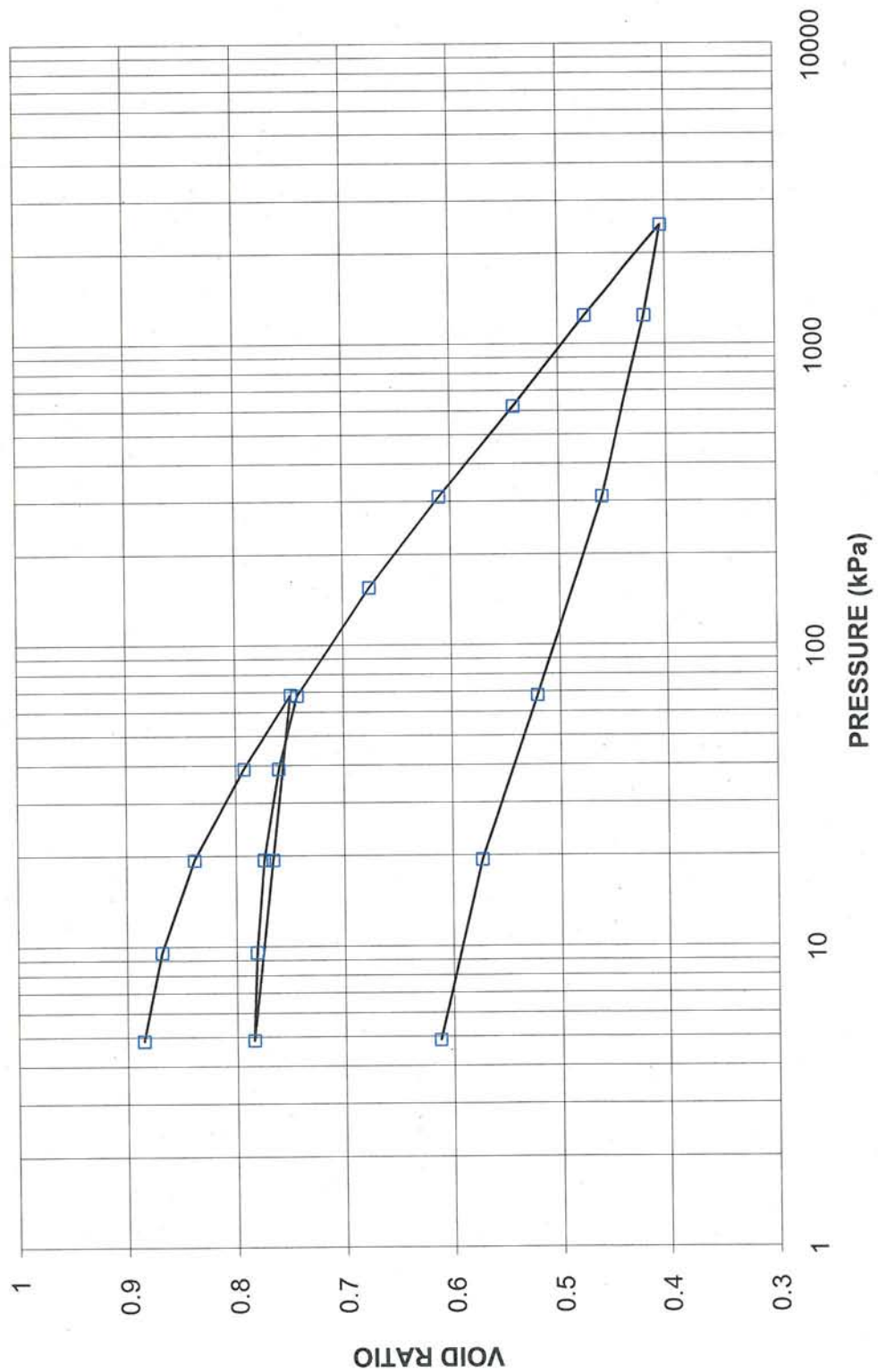




# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 341 SA 5 OED C

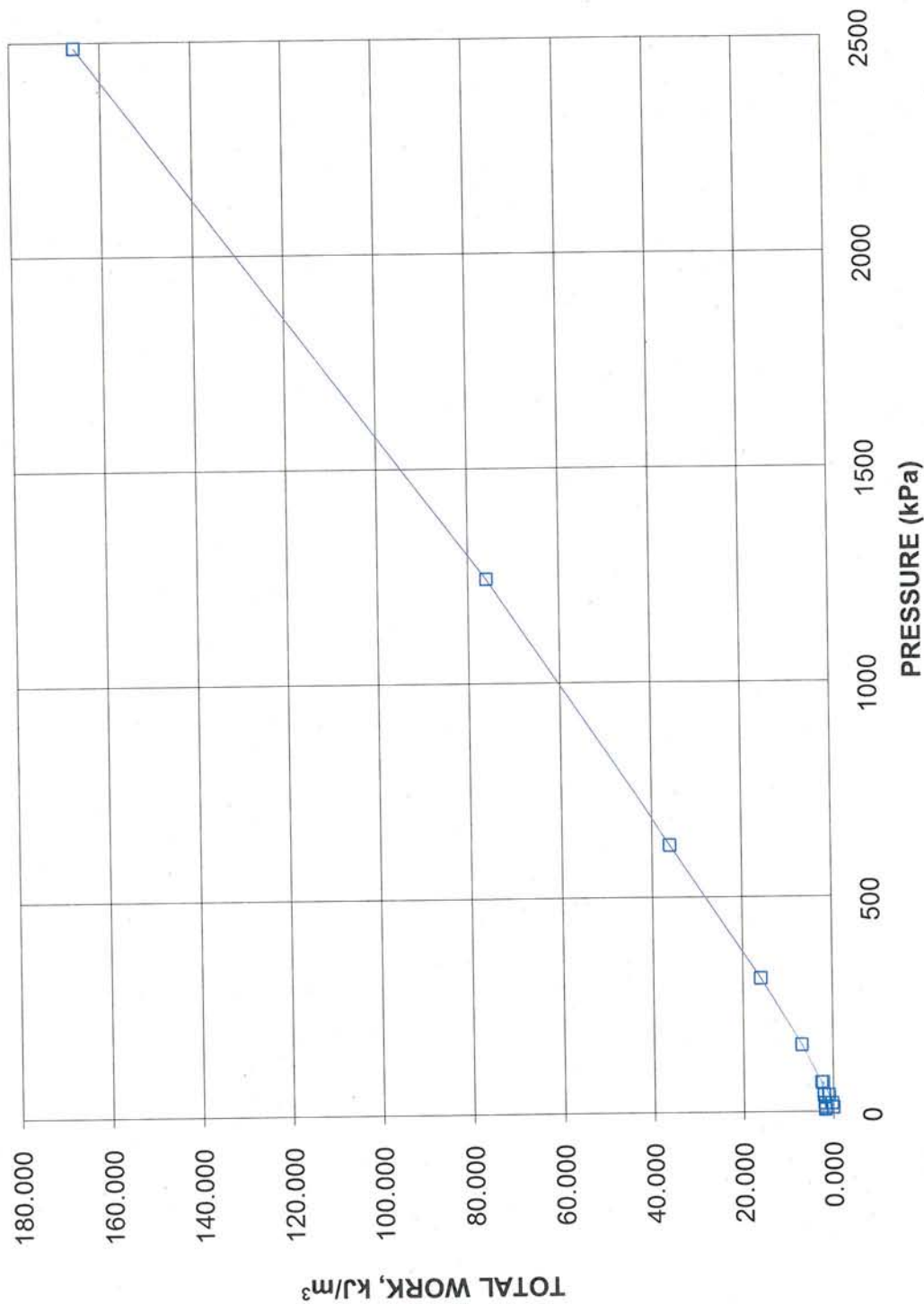
CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 341 SA 5



CONSOLIDATION TEST  
TOTAL WORK VS PRESSURE

FIGURE BH 341 SA 5 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 341 SA 5



# CONSOLIDATION TEST SUMMARY

FIGURE BH 341 SA 7 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	7
Borehole Number	341	Sample Depth, m	7.2-7.6

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	3		
Date Started	12/9/2009		
Date Completed	01/01/2010		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m <sup>3</sup>	19.89
Sample Diameter, cm	6.32	Dry Unit Weight, kN/m <sup>3</sup>	15.87
Area, cm <sup>2</sup>	31.32	Specific Gravity, measured	2.74
Volume, cm <sup>3</sup>	79.56	Solids Height, cm	1.500
Water Content, %	25.37	Volume of Solids, cm <sup>3</sup>	46.97
Wet Mass, g	161.37	Volume of Voids, cm <sup>3</sup>	32.58
Dry Mass, g	128.71	Degree of Saturation, %	100.2

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	2.540	0.694	2.540				
4.75	2.526	0.684	2.533				
9.56	2.514	0.676	2.520				
19.49	2.495	0.663	2.504				
39.32	2.450	0.634	2.472				
78.29	2.390	0.594	2.420	900	3.19E-04	6.05E-04	1.89E-08
100.00	2.372	0.582	2.381	1440	1.93E-04	3.19E-04	6.03E-09
78.29	2.375	0.583	2.374				
19.49	2.387	0.592	2.381				
4.75	2.395	0.597	2.391				
9.56	2.395	0.597	2.395				
19.49	2.393	0.595	2.394				
39.11	2.386	0.591	2.389				
78.29	2.375	0.584	2.380	108	2.57E-03	1.10E-04	2.76E-08
100.00	2.367	0.579	2.371	4200	6.56E-05	1.38E-04	8.86E-10
156.50	2.328	0.552	2.348	1020	2.65E-04	2.75E-04	7.14E-09
312.87	2.249	0.499	2.288	450	5.70E-04	2.00E-04	1.12E-08
625.47	2.178	0.452	2.213	252	9.52E-04	8.92E-05	8.32E-09
1250.61	2.098	0.399	2.138	1680	1.33E-04	5.05E-05	6.60E-10
2501.71	2.015	0.344	2.056	1140	1.82E-04	2.60E-05	4.63E-10
1250.61	2.028	0.352	2.021				
312.87	2.066	0.378	2.047				
100.00	2.102	0.401	2.084				
39.11	2.131	0.421	2.116				
4.75	2.180	0.454	2.155				

Note:

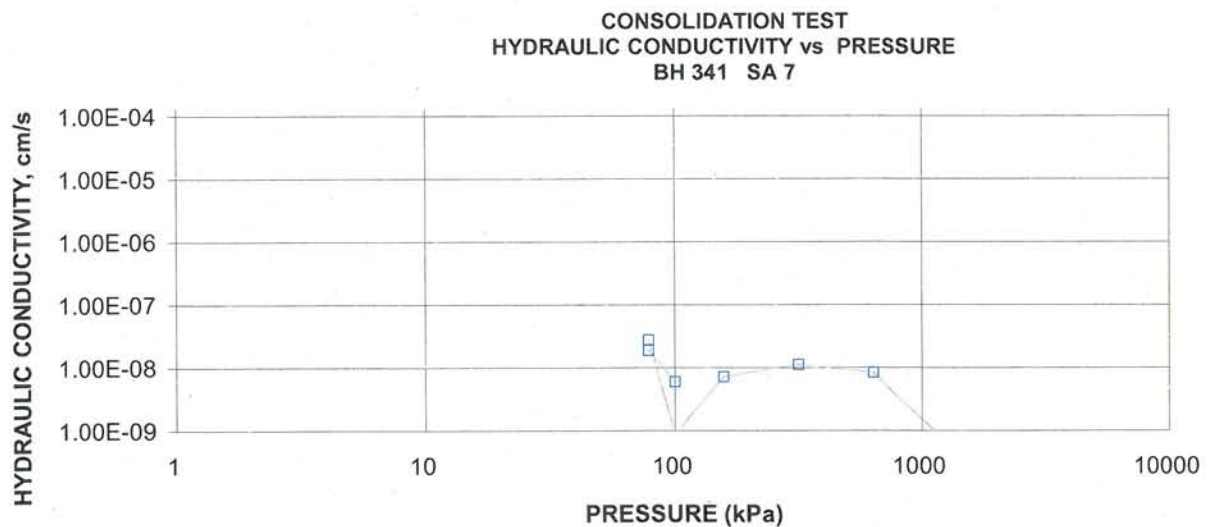
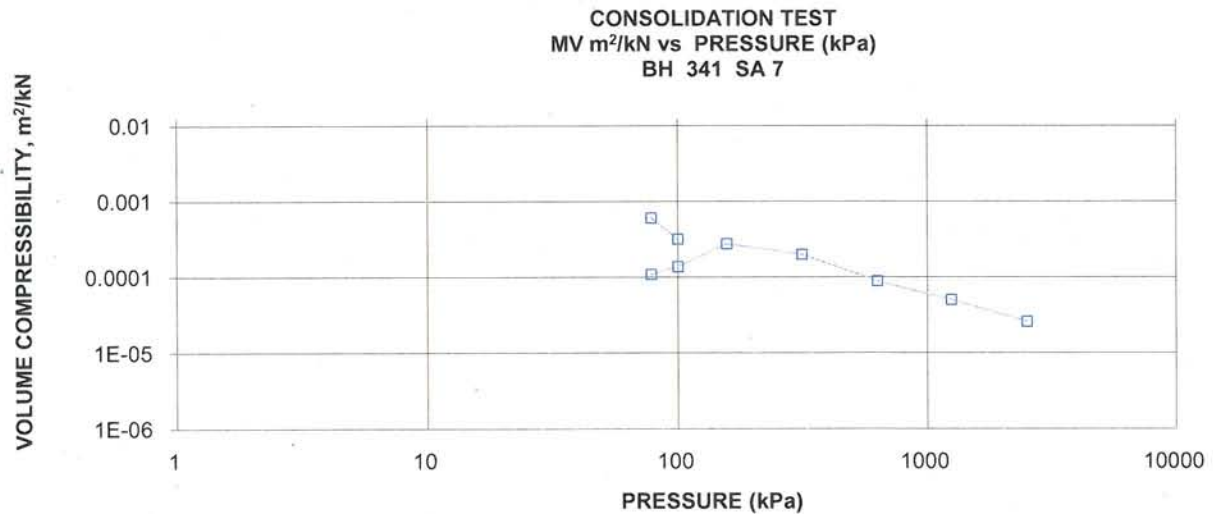
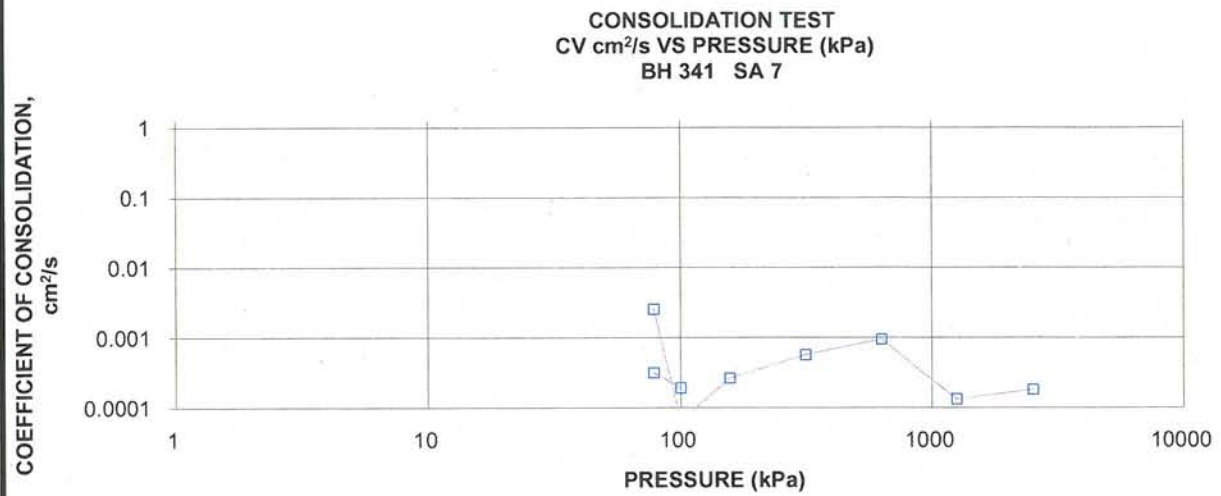
k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.18	Unit Weight, kN/m <sup>3</sup>	21.74
Sample Diameter, cm	6.32	Dry Unit Weight, kN/m <sup>3</sup>	18.48
Area, cm <sup>2</sup>	31.32	Specific Gravity, measured	2.74
Volume, cm <sup>3</sup>	68.29	Solids Height, cm	1.500
Water Content, %	17.63	Volume of Solids, cm <sup>3</sup>	46.97
Wet Mass, g	151.40	Volume of Voids, cm <sup>3</sup>	21.32
Dry Mass, g	128.71		

# CONSOLIDATION TEST SUMMARY

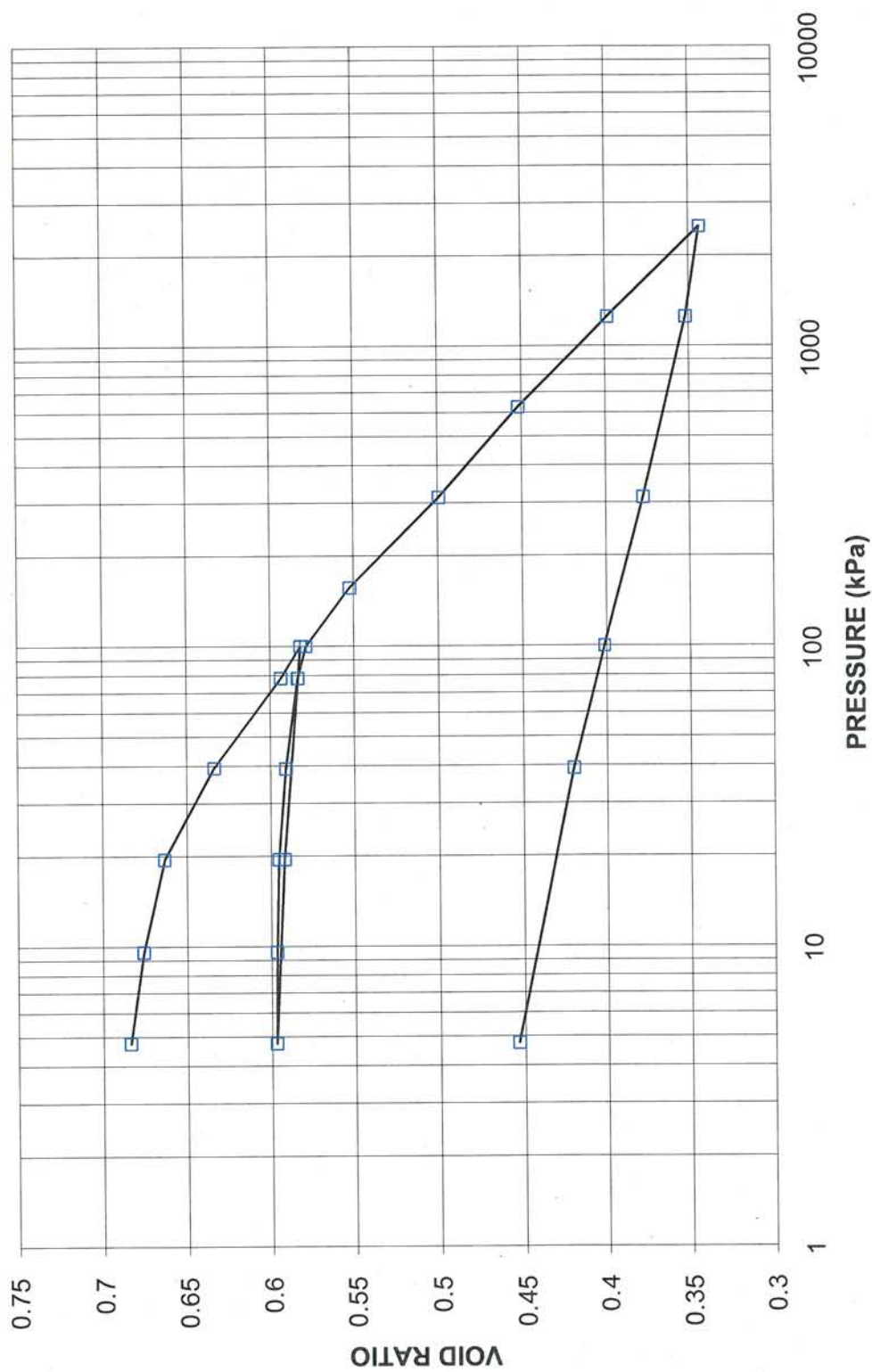
FIGURE BH 341 SA 7 OED B



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 341 SA 7 OED C

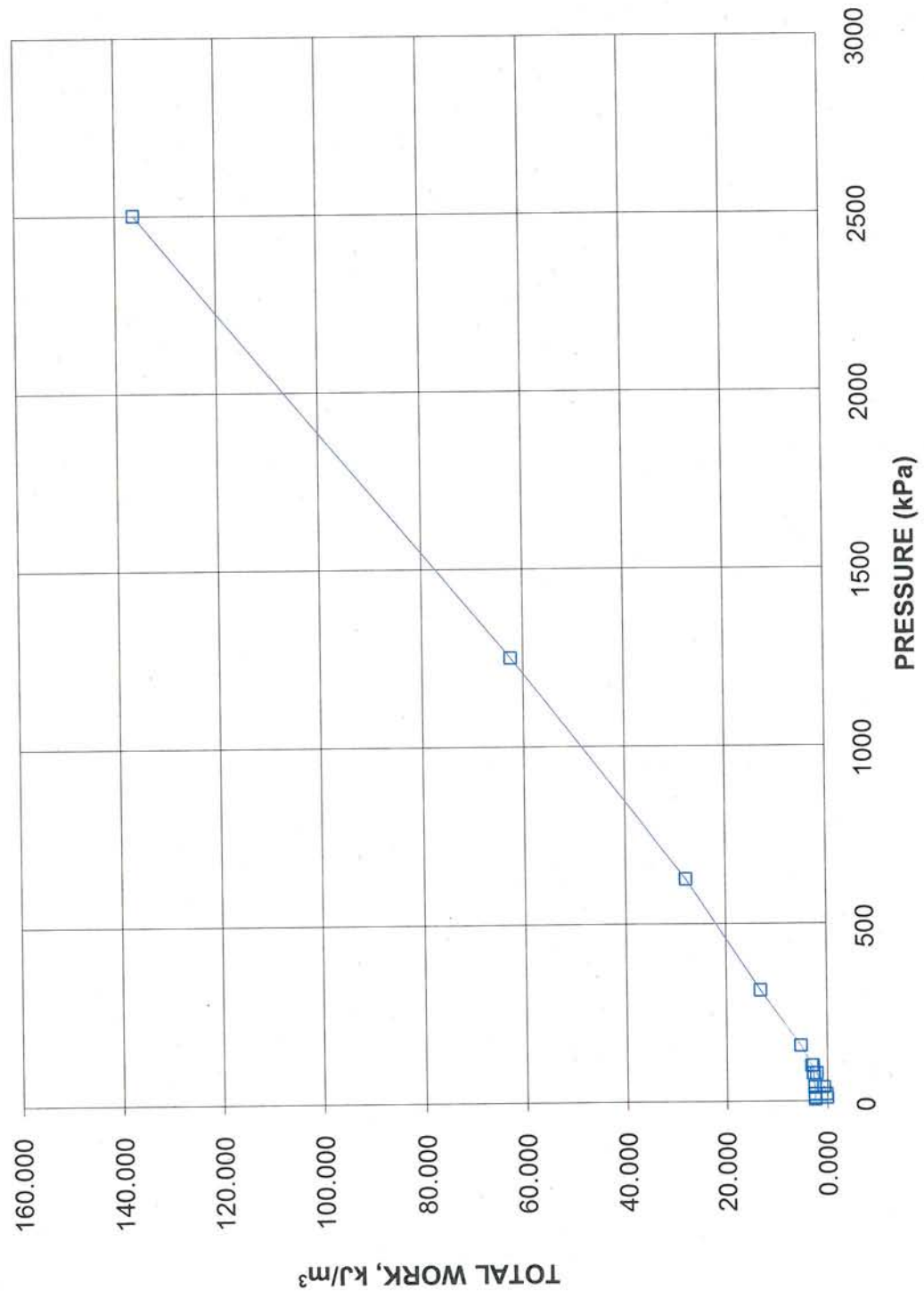
CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 341 SA 7



CONSOLIDATION TEST  
TOTAL WORK VS PRESSURE

FIGURE BH 341 SA 7 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 341 SA 7





**CONSOLIDATION TEST SUMMARY**

FIGURE BH 341 SA 11 OED A

**SAMPLE IDENTIFICATION**

Project Number	09-1132-0080	Sample Number	11
Borehole Number	341	Sample Depth, m	12.5-13.0

**TEST CONDITIONS**

Test Type	Standard	Load Duration, hr	24
Oedometer Number	7		
Date Started	12/11/2009		
Date Completed	01/05/2010		

**SAMPLE DIMENSIONS AND PROPERTIES - INITIAL**

Sample Height, cm	1.90	Unit Weight, kN/m <sup>3</sup>	17.80
Sample Diameter, cm	6.32	Dry Unit Weight, kN/m <sup>3</sup>	12.43
Area, cm <sup>2</sup>	31.37	Specific Gravity, measured	2.71
Volume, cm <sup>3</sup>	59.60	Solids Height, cm	0.888
Water Content, %	43.27	Volume of Solids, cm <sup>3</sup>	27.87
Wet Mass, g	108.20	Volume of Voids, cm <sup>3</sup>	31.74
Dry Mass, g	75.52	Degree of Saturation, %	103.0

**TEST COMPUTATIONS**

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	1.900	1.139	1.900				
4.80	1.899	1.138	1.900				
9.64	1.897	1.136	1.898				
19.59	1.885	1.122	1.891				
39.00	1.867	1.102	1.876				
78.25	1.845	1.076	1.856	96	1.76E-03	3.06E-04	5.27E-08
150.68	1.799	1.025	1.822	252	6.45E-04	3.33E-04	2.10E-08
78.25	1.805	1.032	1.802				
19.59	1.830	1.060	1.818				
4.80	1.846	1.078	1.838				
9.59	1.843	1.074	1.845				
19.68	1.840	1.071	1.841				
39.25	1.828	1.058	1.834				
78.25	1.815	1.043	1.821	84	1.94E-03	1.86E-04	3.53E-08
150.68	1.788	1.012	1.801	66	2.41E-03	1.95E-04	4.60E-08
313.90	1.670	0.880	1.729	300	4.88E-04	3.81E-04	1.82E-08
626.40	1.548	0.742	1.609	270	4.70E-04	2.06E-04	9.46E-09
1250.61	1.446	0.628	1.497	360	3.05E-04	8.58E-05	2.56E-09
2501.21	1.342	0.511	1.394	26	3.66E-03	4.37E-05	1.57E-08
1250.61	1.358	0.529	1.350				
313.90	1.406	0.583	1.382				
78.25	1.475	0.661	1.441				
19.68	1.541	0.735	1.508				
4.80	1.591	0.791	1.566				

Note:

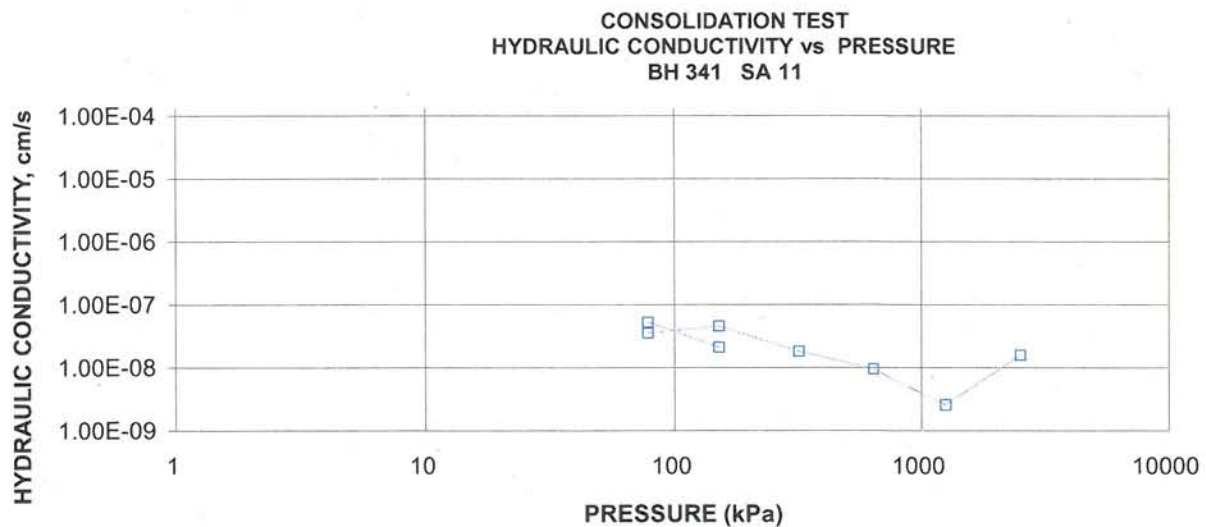
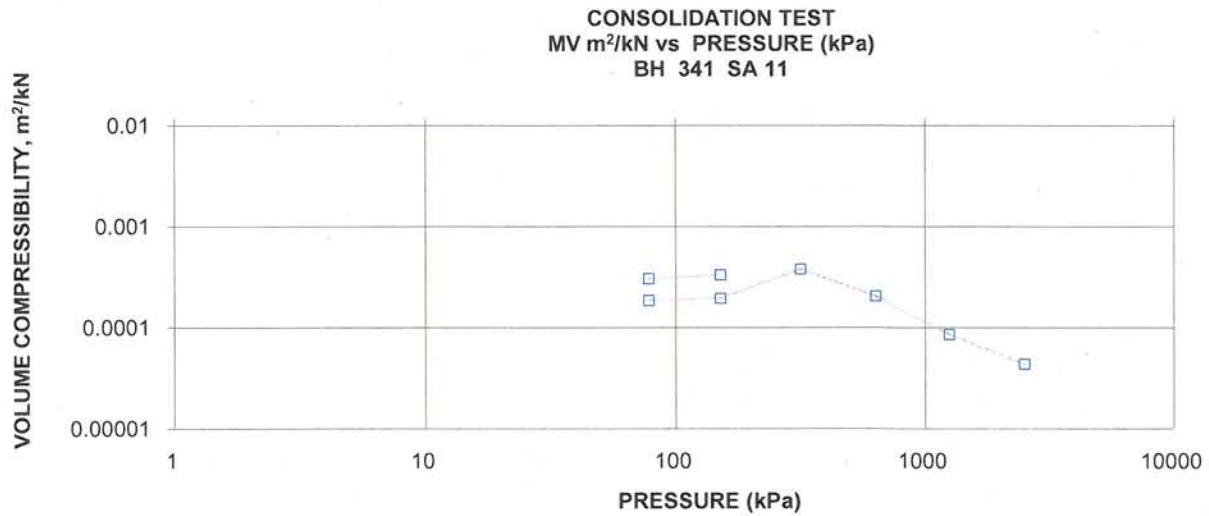
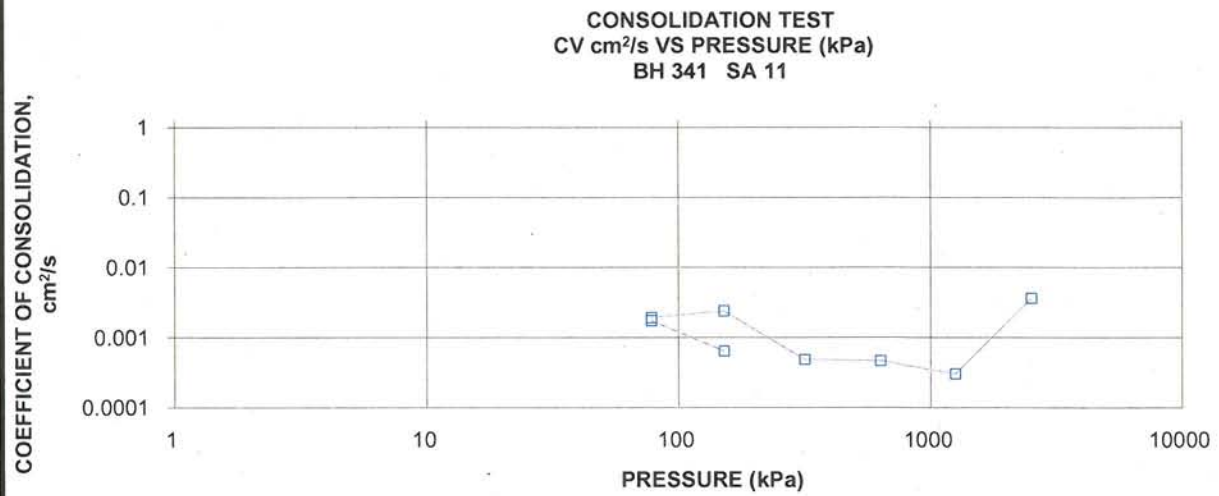
k calculated using cv based on t<sub>50</sub> values.**SAMPLE DIMENSIONS AND PROPERTIES - FINAL**

Sample Height, cm	1.59	Unit Weight, kN/m <sup>3</sup>	19.69
Sample Diameter, cm	6.32	Dry Unit Weight, kN/m <sup>3</sup>	14.83
Area, cm <sup>2</sup>	31.37	Specific Gravity, measured	2.71
Volume, cm <sup>3</sup>	49.92	Solids Height, cm	0.888
Water Content, %	32.76	Volume of Solids, cm <sup>3</sup>	27.87
Wet Mass, g	100.26	Volume of Voids, cm <sup>3</sup>	22.06
Dry Mass, g	75.52		



# CONSOLIDATION TEST SUMMARY

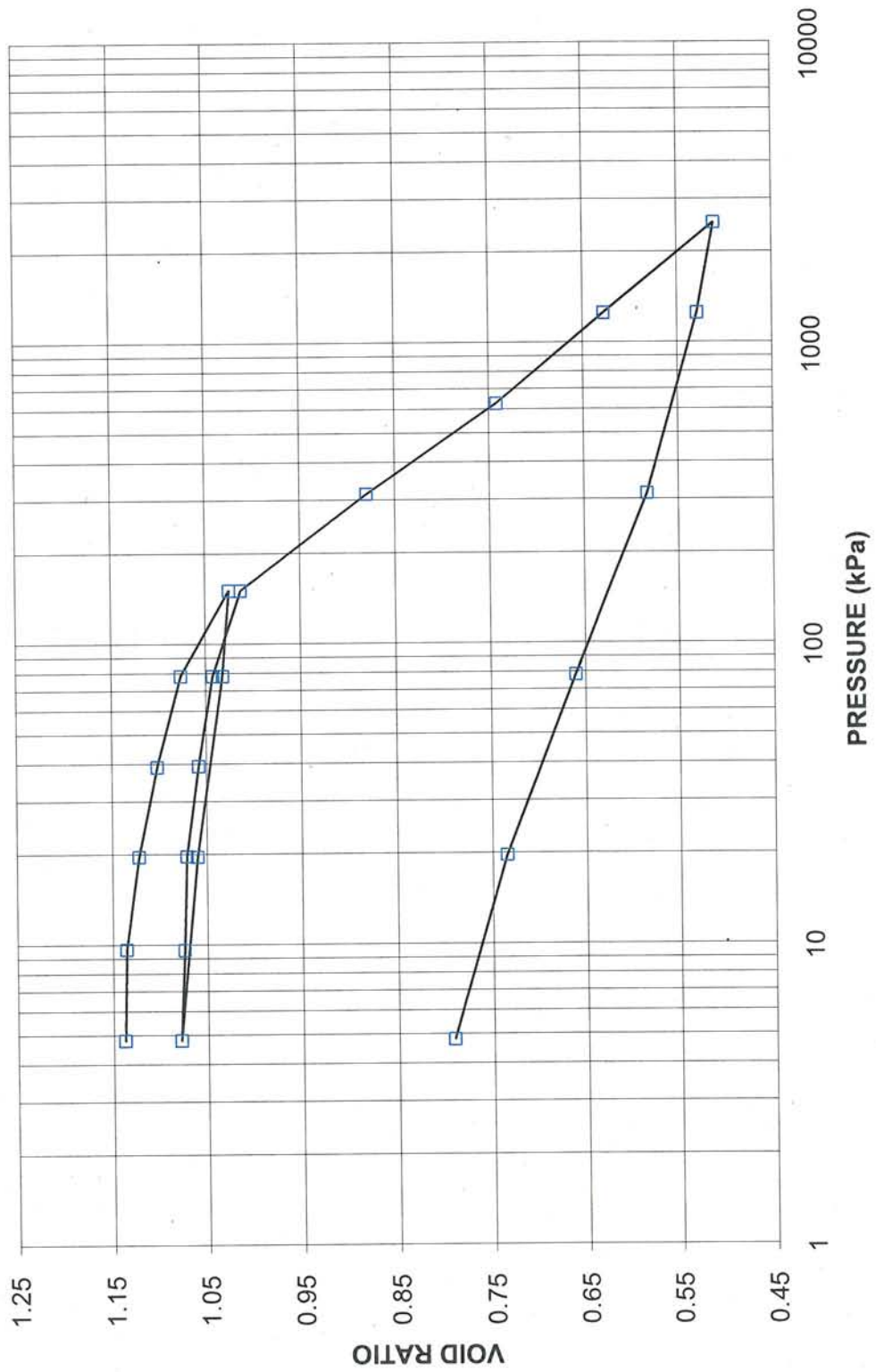
FIGURE BH 341 SA 11 OED E



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 341 SA 11 OED C

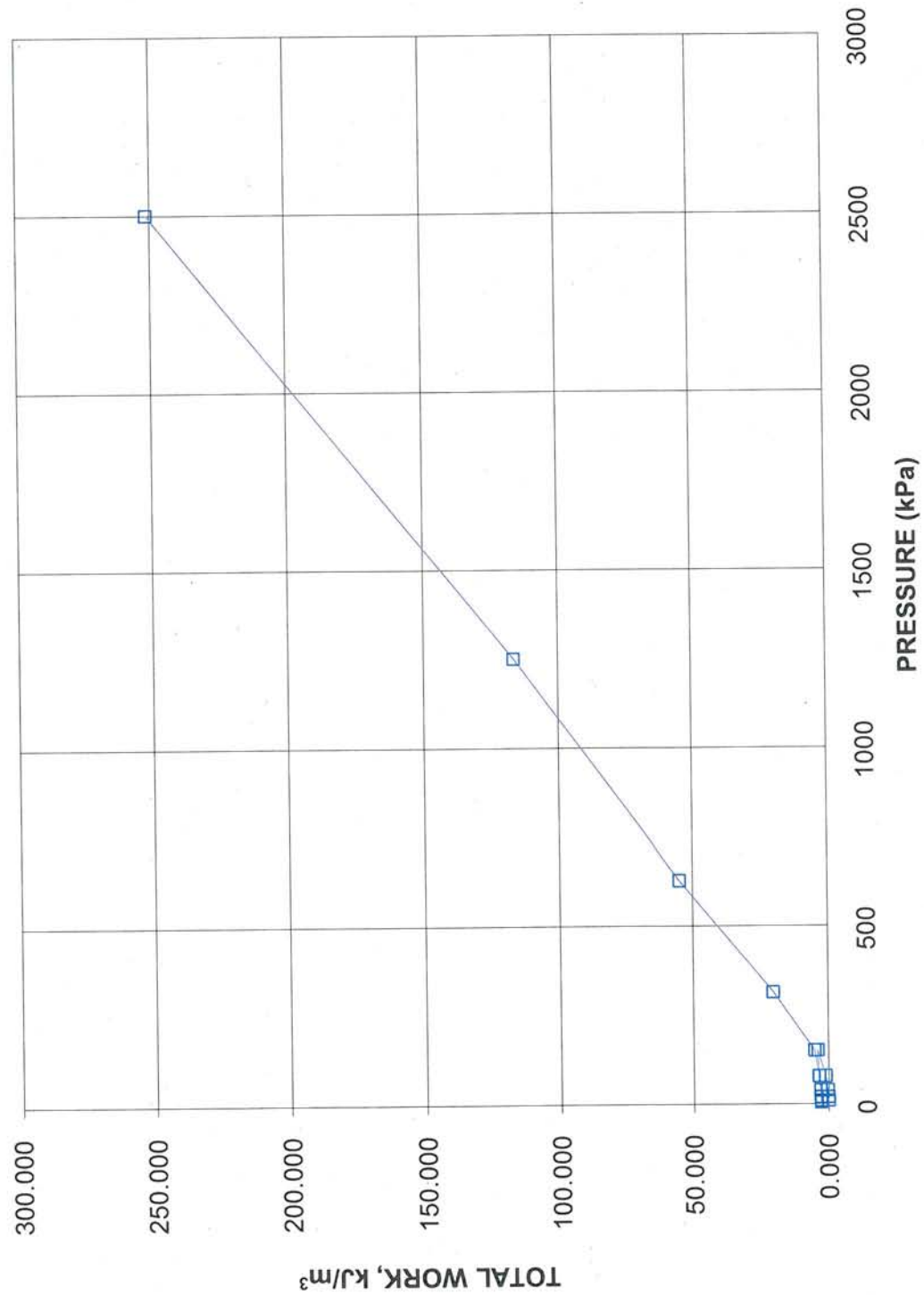
CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 341 SA 11



CONSOLIDATION TEST  
TOTAL WORK VS PRESSURE

FIGURE BH 341 SA 11 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 341 SA 11



# CONSOLIDATION TEST SUMMARY

FIGURE BH 341 SA 13 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	13
Borehole Number	341	Sample Depth, m	14.8-15.2

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	8		
Date Started	12/14/2009		
Date Completed	01/08/2010		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m <sup>3</sup>	20.52
Sample Diameter, cm	6.35	Drv Unit Weight, kN/m <sup>3</sup>	18.66
Area, cm <sup>2</sup>	31.62	Specific Gravity, measured	2.70
Volume, cm <sup>3</sup>	60.08	Solids Height, cm	1.339
Water Content, %	9.97	Volume of Solids, cm <sup>3</sup>	42.33
Wet Mass, g	125.69	Volume of Voids, cm <sup>3</sup>	17.75
Dry Mass, g	114.29	Degree of Saturation, %	64.2

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	1.900	0.419	1.900				
4.70	1.888	0.410	1.894				
9.55	1.878	0.402	1.883				
19.52	1.863	0.392	1.870				
38.70	1.842	0.376	1.852				
77.52	1.809	0.352	1.826	300	5.44E-04	4.38E-04	2.34E-08
160.83	1.767	0.320	1.788	168	9.33E-04	2.67E-04	2.44E-08
77.64	1.769	0.322	1.768				
19.52	1.781	0.331	1.775				
4.70	1.787	0.334	1.784				
9.55	1.786	0.334	1.786				
19.31	1.785	0.333	1.785				
38.70	1.780	0.329	1.782				
78.16	1.773	0.325	1.777	96	1.61E-03	8.40E-05	1.33E-08
164.24	1.761	0.316	1.767	51	3.00E-03	7.52E-05	2.21E-08
313.19	1.725	0.288	1.743	102	1.46E-03	1.29E-04	1.85E-08
623.24	1.680	0.255	1.702	84	1.69E-03	7.59E-05	1.26E-08
1242.75	1.630	0.217	1.655	51	2.63E-03	4.25E-05	1.10E-08
2480.92	1.579	0.179	1.604	42	3.00E-03	2.17E-05	6.38E-09
1242.75	1.586	0.185	1.582				
623.24	1.595	0.192	1.591				
164.24	1.618	0.208	1.607				
38.70	1.643	0.227	1.630				
4.70	1.679	0.254	1.661				

Note:

k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.68	Unit Weight, kN/m <sup>3</sup>	24.33
Sample Diameter, cm	6.35	Drv Unit Weight, kN/m <sup>3</sup>	21.12
Area, cm <sup>2</sup>	31.62	Specific Gravity, measured	2.70
Volume, cm <sup>3</sup>	53.07	Solids Height, cm	1.339
Water Content, %	15.19	Volume of Solids, cm <sup>3</sup>	42.33
Wet Mass, g	131.65	Volume of Voids, cm <sup>3</sup>	10.74
Dry Mass, g	114.29		

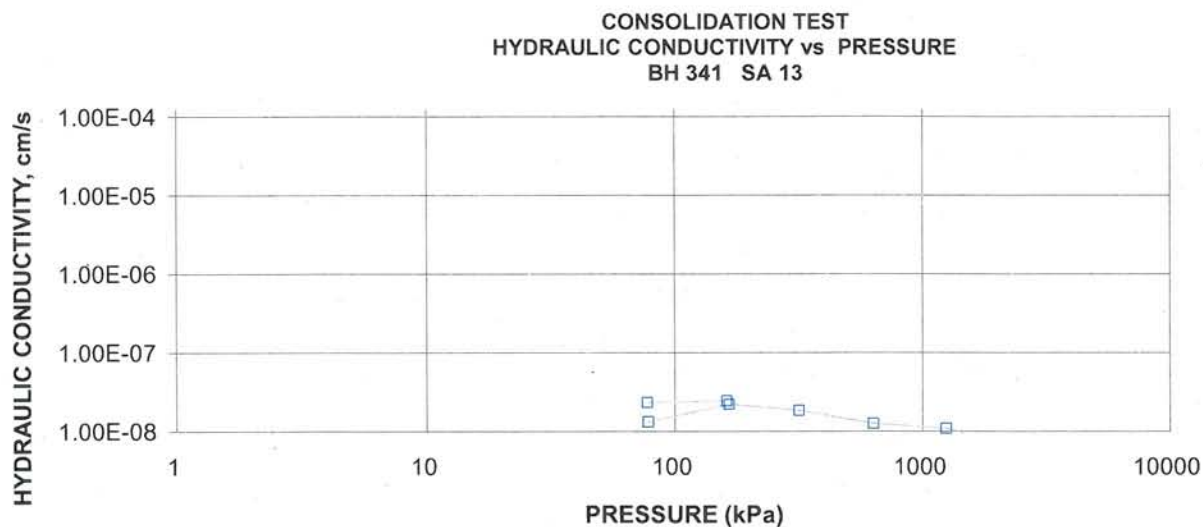
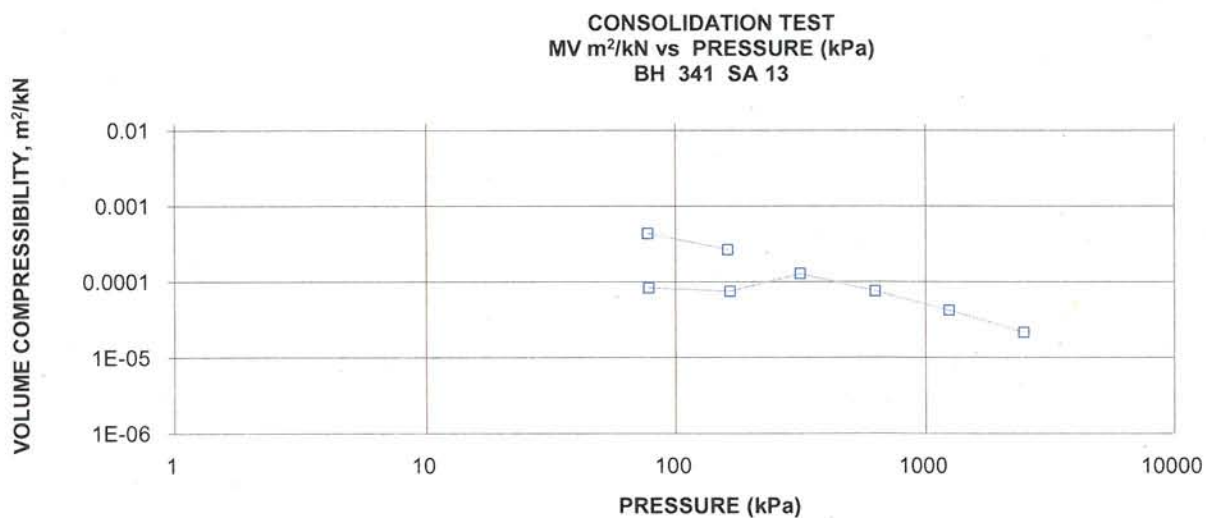
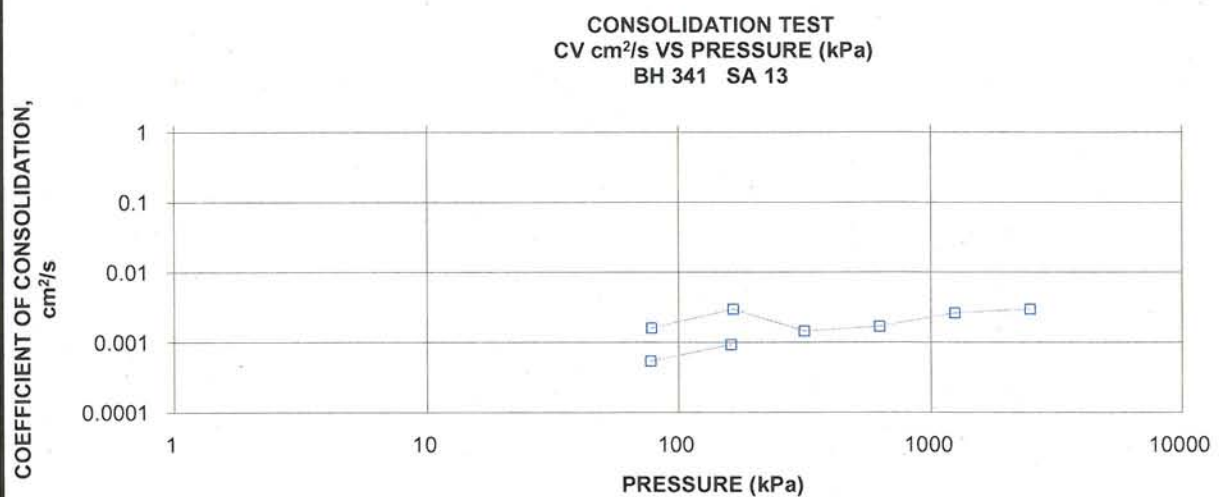
Prepared By: LFG

Golder Associates

Checked By:

# CONSOLIDATION TEST SUMMARY

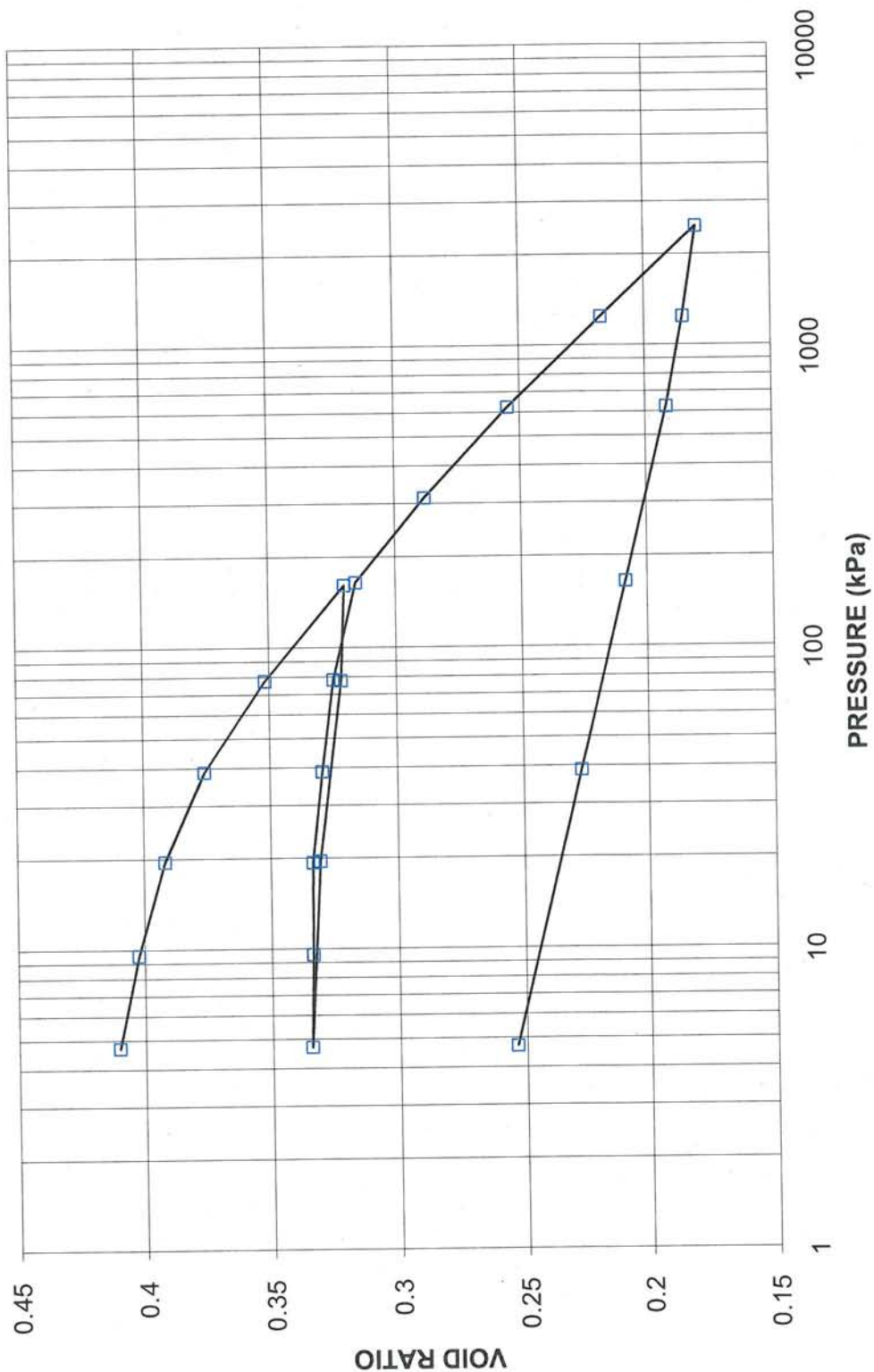
FIGURE BH 341 SA 13 OED B



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 341 SA 13 OED C

CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 341 SA 13



Project No. 09-1132-0080

Prepared By: LFG

Golder Associates

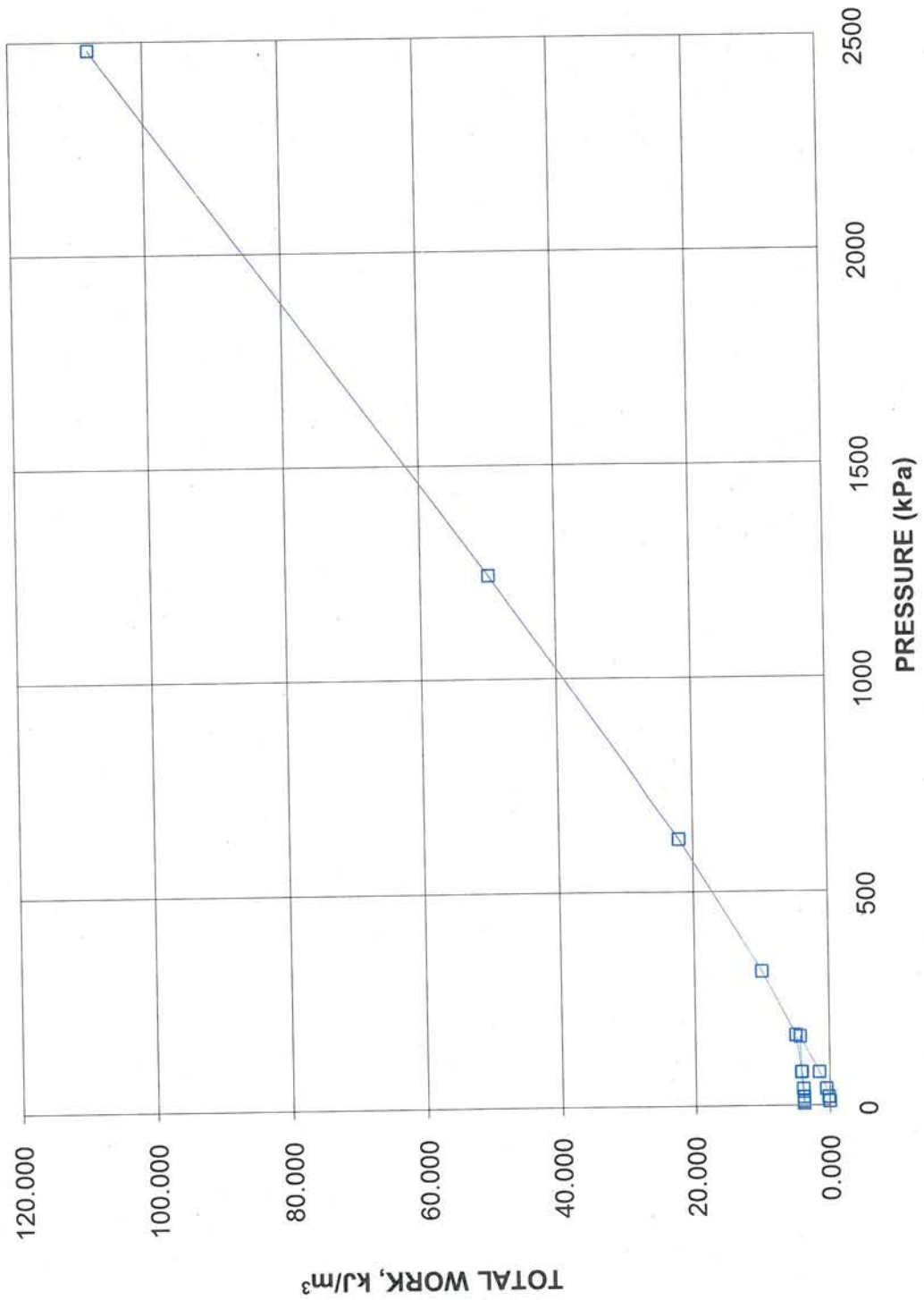
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# CONSOLIDATION TEST TOTAL WORK VS PRESSURE

FIGURE BH 341 SA 13 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 341 SA 13



Project No. 09-1132-0080

Prepared By: LFG

Golder Associates

Checked By:



# CONSOLIDATION TEST SUMMARY

FIGURE BH 341 SA 16 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	16
Borehole Number	341	Sample Depth, m	19.4-19.8

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	6		
Date Started	12/14/2009		
Date Completed	01/09/2010		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m <sup>3</sup>	20.81
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m <sup>3</sup>	17.49
Area, cm <sup>2</sup>	31.57	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	59.98	Solids Height, cm	1.246
Water Content, %	18.97	Volume of Solids, cm <sup>3</sup>	39.34
Wet Mass, g	127.30	Volume of Voids, cm <sup>3</sup>	20.64
Dry Mass, g	107	Degree of Saturation, %	98.3

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	1.900	0.525	1.900				
4.84	1.893	0.519	1.897				
9.53	1.889	0.516	1.891				
19.31	1.880	0.509	1.885				
38.81	1.861	0.494	1.871				
77.62	1.835	0.472	1.848				
155.06	1.796	0.442	1.816	300	5.38E-04	2.60E-04	1.37E-08
210.00	1.783	0.430	1.789	618	2.54E-04	1.33E-04	3.31E-09
77.64	1.792	0.438	1.787				
19.34	1.811	0.453	1.802				
4.84	1.823	0.463	1.817				
9.53	1.821	0.462	1.822				
19.55	1.817	0.458	1.819				
38.81	1.810	0.453	1.814				
77.76	1.800	0.444	1.805				
155.13	1.785	0.433	1.793	120	1.31E-03	9.66E-05	1.24E-08
210.00	1.777	0.426	1.781	1440	1.08E-04	8.54E-05	9.03E-10
310.30	1.754	0.407	1.765	378	4.04E-04	1.20E-04	4.74E-09
620.46	1.701	0.365	1.727	195	7.50E-04	9.03E-05	6.63E-09
1242.53	1.649	0.323	1.675	195	7.05E-04	4.37E-05	3.02E-09
2483.26	1.596	0.281	1.622	84	1.54E-03	2.25E-05	3.38E-09
620.46	1.622	0.302	1.609				
210.00	1.638	0.315	1.630				
77.76	1.665	0.337	1.652				
19.55	1.703	0.367	1.684				
4.84	1.730	0.388	1.716				

Note:

k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.73	Unit Weight, kN/m <sup>3</sup>	22.26
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m <sup>3</sup>	19.22
Area, cm <sup>2</sup>	31.57	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	54.60	Solids Height, cm	1.246
Water Content, %	15.81	Volume of Solids, cm <sup>3</sup>	39.34
Wet Mass, g	123.92	Volume of Voids, cm <sup>3</sup>	15.26
Dry Mass, g	107		

Prepared By: LFG

Golder Associates

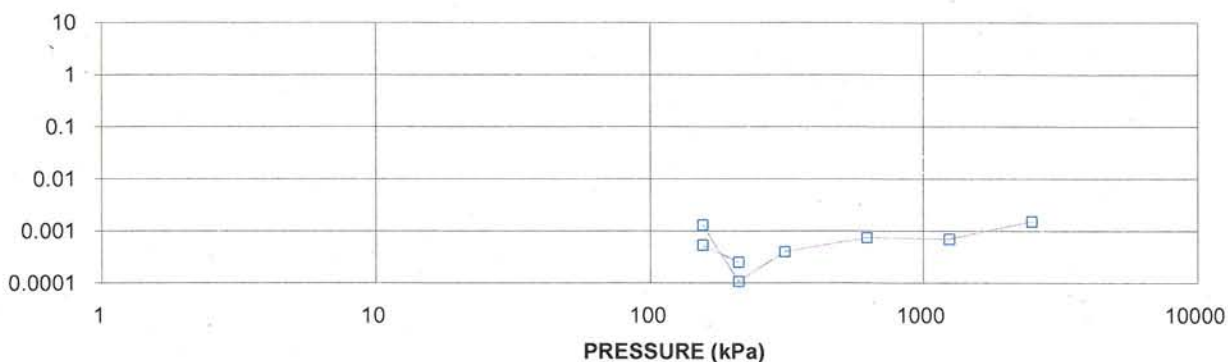
Checked By:

# CONSOLIDATION TEST SUMMARY

FIGURE BH 341 SA 16 OED B

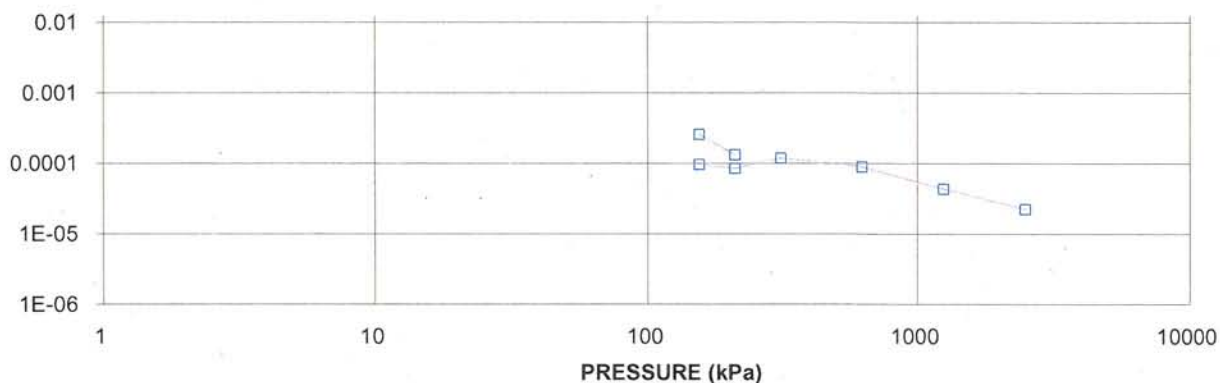
COEFFICIENT OF CONSOLIDATION,  
cm<sup>2</sup>/s

CONSOLIDATION TEST  
CV cm<sup>2</sup>/s VS PRESSURE (kPa)  
BH 341 SA 16



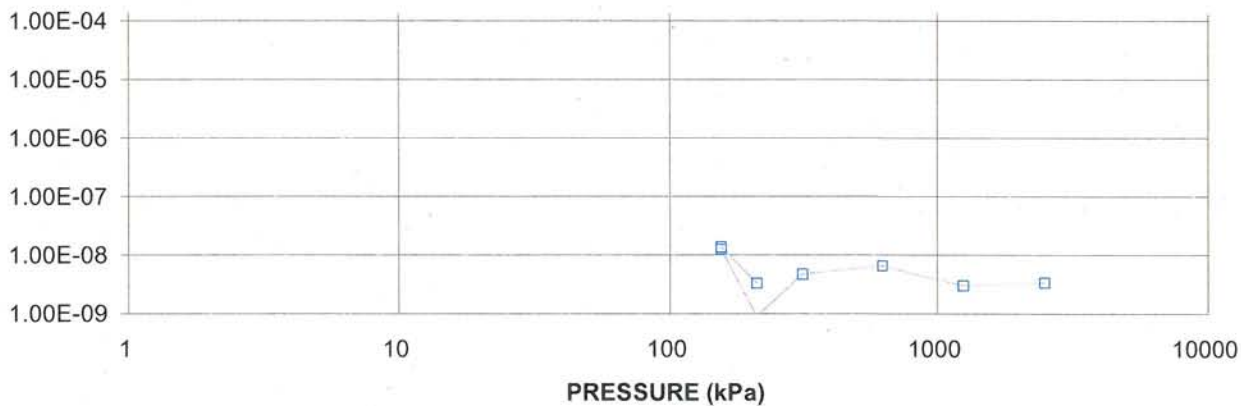
VOLUME COMPRESSIBILITY, m<sup>2</sup>/kN

CONSOLIDATION TEST  
MV m<sup>2</sup>/kN vs PRESSURE (kPa)  
BH 341 SA 16



HYDRAULIC CONDUCTIVITY, cm/s

CONSOLIDATION TEST  
HYDRAULIC CONDUCTIVITY vs PRESSURE  
BH 341 SA 16



Project No. 09-1132-0080

Prepared By: LFG

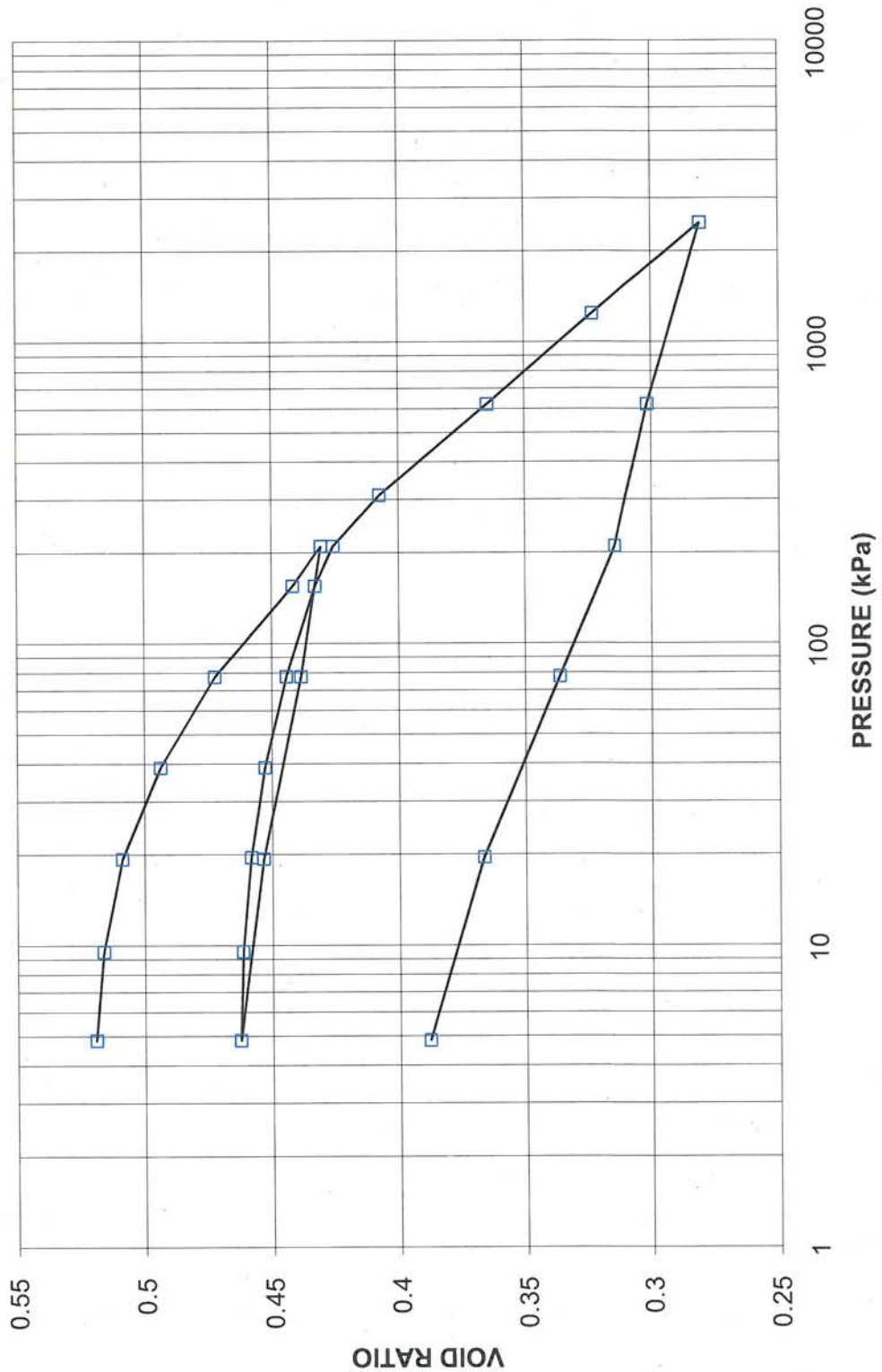
**Golder Associates**

Checked By:

**CONSOLIDATION TEST  
VOID RATIO VS LOG PRESSURE**

**FIGURE BH 341 SA 16 OED C**

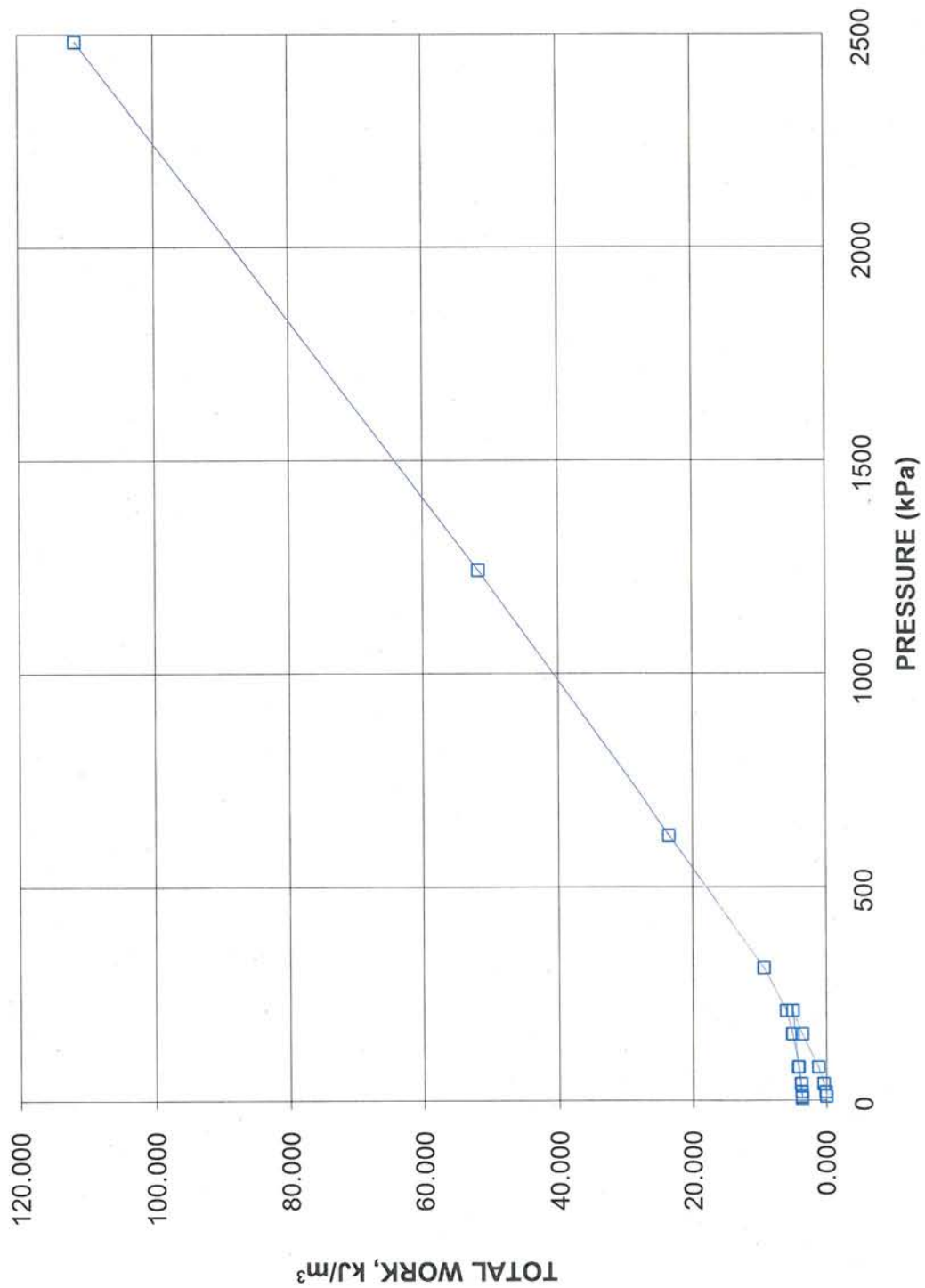
**CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 341 SA 16**



# CONSOLIDATION TEST TOTAL WORK VS PRESSURE

FIGURE BH 341 SA 16 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 341 SA 16



Project No. 09-1132-0080

Prepared By: LFG

Golder Associates

Checked By:

# CONSOLIDATION TEST SUMMARY

FIGURE BH 343 SA 5 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	5
Borehole Number	343	Sample Depth, m	4.6-5.0

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	12		
Date Started	11/30/2009		
Date Completed	12/19/2009		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.55	Unit Weight, kN/m <sup>3</sup>	18.50
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m <sup>3</sup>	13.66
Area, cm <sup>2</sup>	31.57	Specific Gravity, measured	2.73
Volume, cm <sup>3</sup>	80.50	Solids Height, cm	1.301
Water Content, %	35.38	Volume of Solids, cm <sup>3</sup>	41.08
Wet Mass, g	151.84	Volume of Voids, cm <sup>3</sup>	39.42
Dry Mass, g	112.16	Degree of Saturation, %	100.7

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	2.550	0.959	2.550				
4.71	2.550	0.959	2.550				
9.48	2.549	0.959	2.550				
19.34	2.545	0.955	2.547				
38.80	2.532	0.945	2.538				
77.14	2.511	0.930	2.522	360	8.65E-04	2.10E-04	1.78E-08
19.34	2.528	0.943	2.520				
4.71	2.554	0.962	2.541				
9.56	2.550	0.959	2.552				
19.34	2.543	0.954	2.546				
38.80	2.527	0.942	2.535				
77.14	2.508	0.927	2.518	375	8.28E-04	1.89E-04	1.54E-08
154.78	2.469	0.897	2.488	360	8.43E-04	2.01E-04	1.66E-08
313.31	2.387	0.834	2.428	336	8.59E-04	2.02E-04	1.70E-08
623.42	2.282	0.754	2.335	366	7.30E-04	1.32E-04	9.45E-09
1244.98	2.152	0.653	2.217	360	6.69E-04	8.25E-05	5.41E-09
2486.19	2.010	0.545	2.081	270	7.86E-04	4.47E-05	3.45E-09
1244.98	2.036	0.564	2.023				
313.31	2.118	0.627	2.077				
77.14	2.212	0.699	2.165				
19.47	2.299	0.767	2.255				
4.95	2.364	0.816	2.331				

Note:

k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.36	Unit Weight, kN/m <sup>3</sup>	19.40
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m <sup>3</sup>	14.74
Area, cm <sup>2</sup>	31.57	Specific Gravity, measured	2.73
Volume, cm <sup>3</sup>	74.62	Solids Height, cm	1.301
Water Content, %	31.62	Volume of Solids, cm <sup>3</sup>	41.08
Wet Mass, g	147.62	Volume of Voids, cm <sup>3</sup>	33.54
Dry Mass, g	112.16		

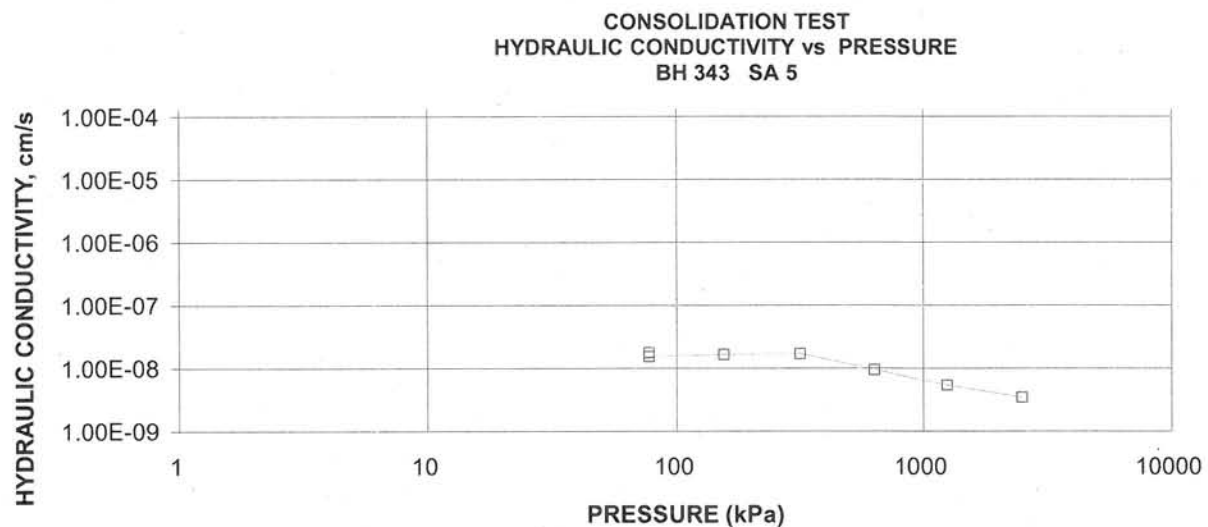
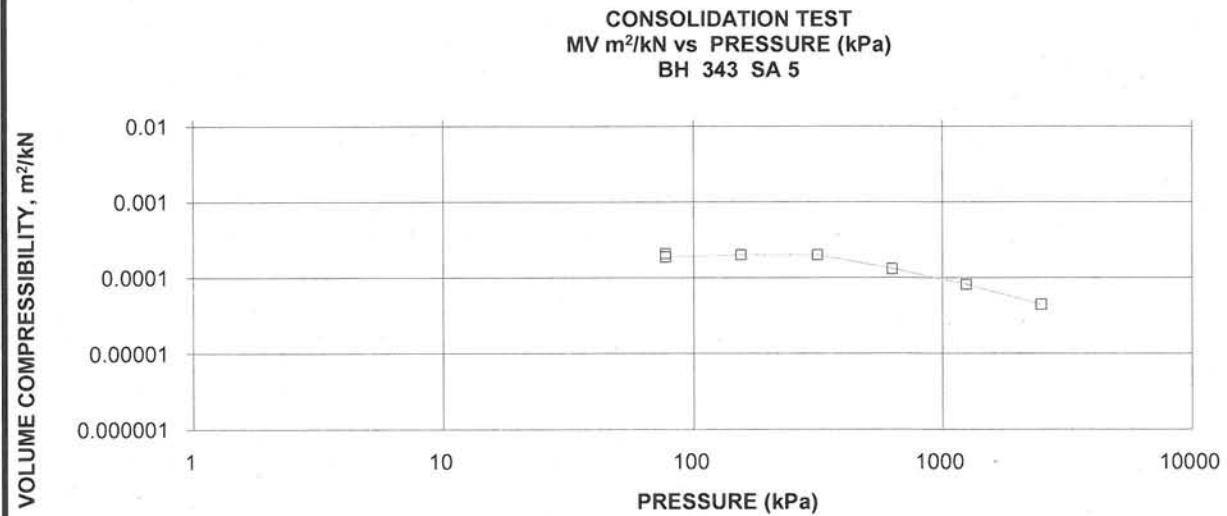
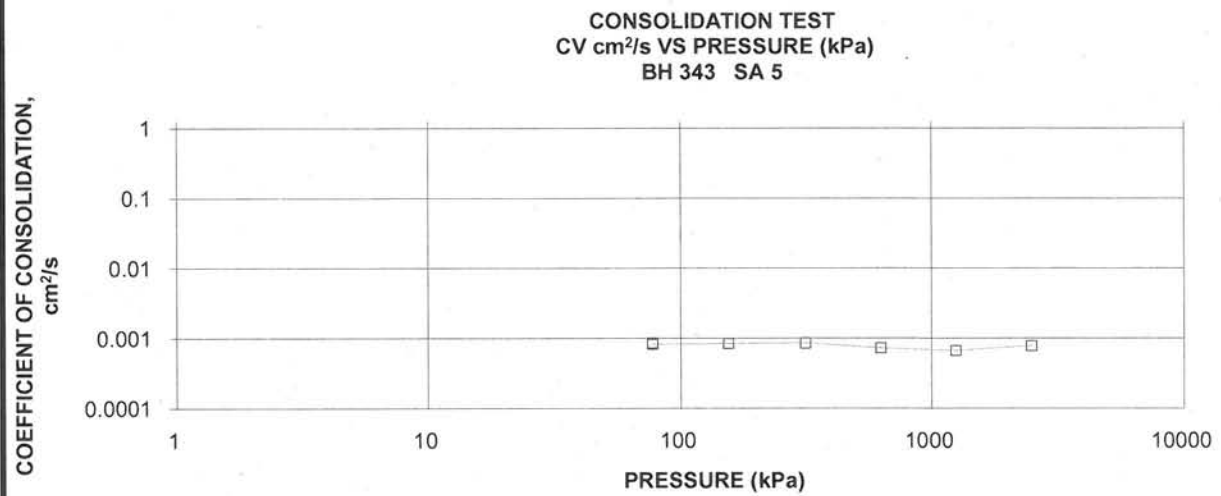
Prepared By: LFG

Golder Associates

Checked By:

# CONSOLIDATION TEST SUMMARY

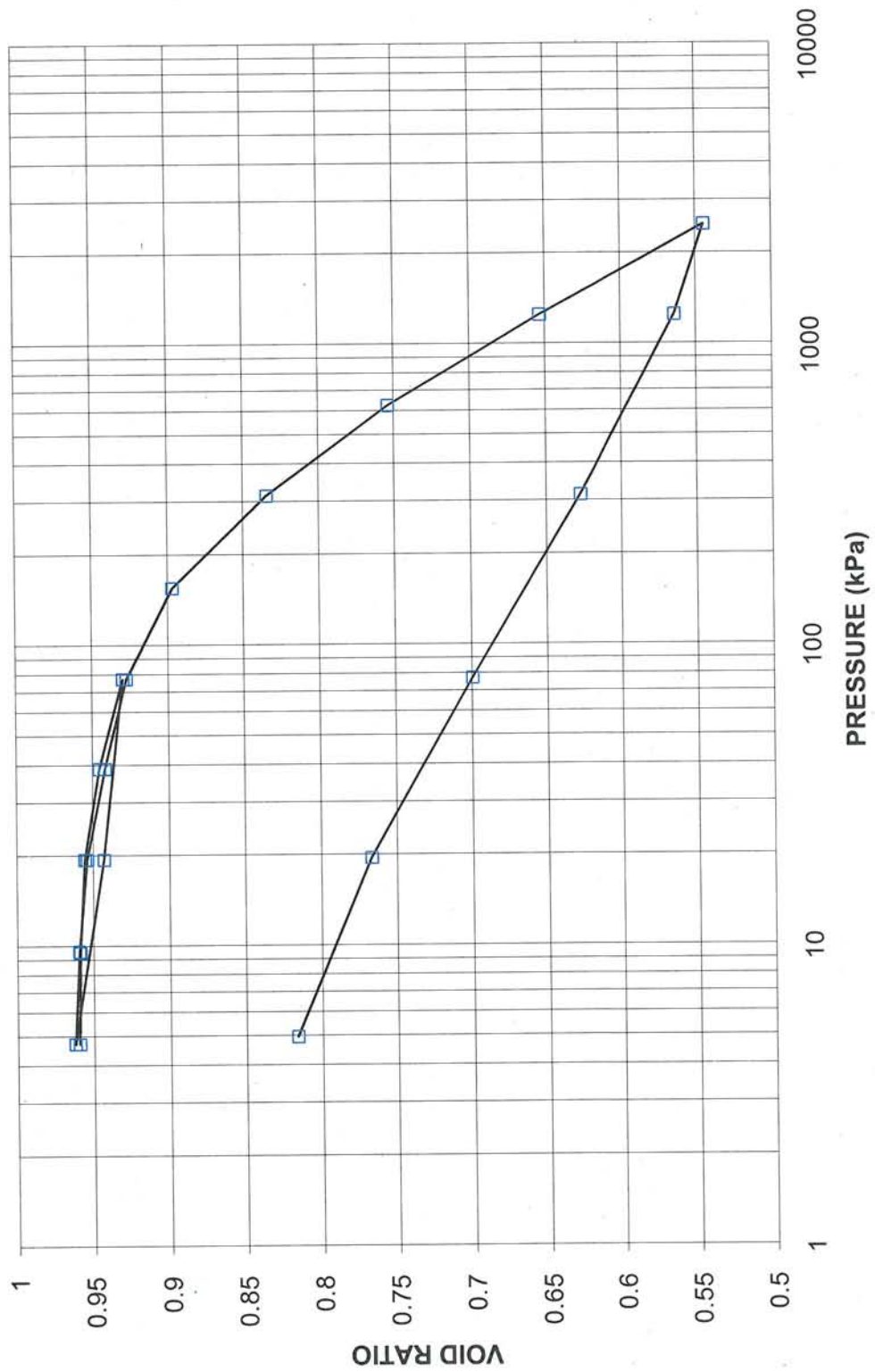
FIGURE BH 343 SA 5 OED B



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 343 SA 5 OED C

CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 343 SA 5

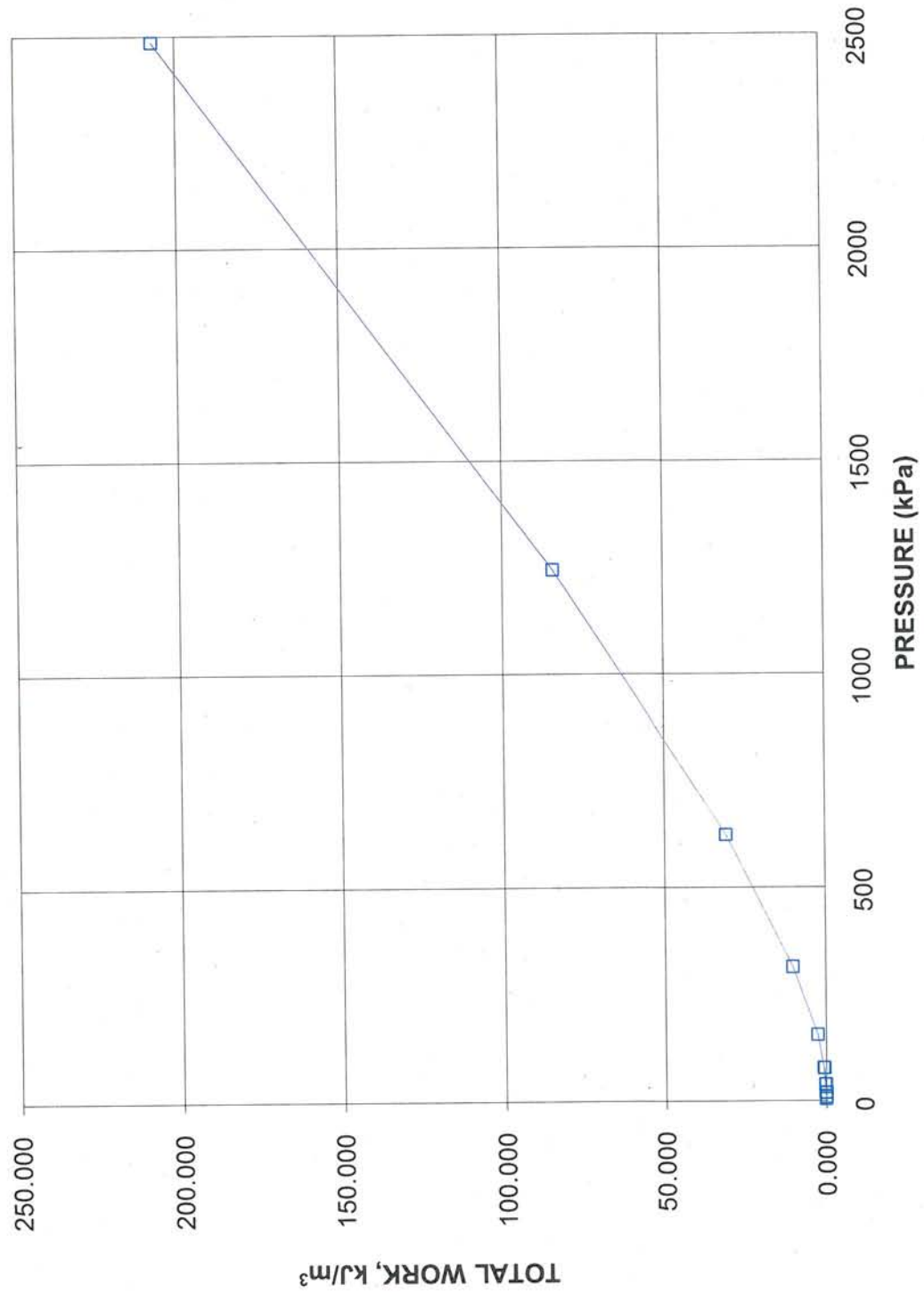




CONSOLIDATION TEST  
TOTAL WORK VS PRESSURE

FIGURE BH 343 SA 5 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 343 SA 5



**CONSOLIDATION TEST SUMMARY**

FIGURE BH 343 SA 7 OED A

**SAMPLE IDENTIFICATION**

Project Number	09-1132-0080	Sample Number	7
Borehole Number	343	Sample Depth, m	7.2-7.6

**TEST CONDITIONS**

Test Type	Standard	Load Duration, hr	24
Oedometer Number	7		
Date Started	11/26/2009		
Date Completed	12/12/2009		

**SAMPLE DIMENSIONS AND PROPERTIES - INITIAL**

Sample Height, cm	1.90	Unit Weight, kN/m <sup>3</sup>	19.56
Sample Diameter, cm	6.32	Dry Unit Weight, kN/m <sup>3</sup>	15.34
Area, cm <sup>2</sup>	31.37	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	59.60	Solids Height, cm	1.093
Water Content, %	27.48	Volume of Solids, cm <sup>3</sup>	34.28
Wet Mass, g	118.86	Volume of Voids, cm <sup>3</sup>	25.32
Dry Mass, g	93.24	Degree of Saturation, %	101.2

**TEST COMPUTATIONS**

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv. cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	1.900	0.739	1.900				
4.90	1.897	0.736	1.899				
9.59	1.895	0.734	1.896				
19.43	1.883	0.723	1.889				
39.05	1.865	0.707	1.874				
78.25	1.844	0.687	1.854	120	1.40E-03	2.93E-04	4.03E-08
156.13	1.801	0.648	1.822	114	1.43E-03	2.89E-04	4.05E-08
78.13	1.804	0.651	1.802				
19.43	1.827	0.672	1.816				
4.74	1.844	0.688	1.836				
9.62	1.841	0.685	1.843				
19.43	1.837	0.681	1.839				
39.05	1.825	0.670	1.831				
78.12	1.815	0.661	1.820	84	1.93E-03	1.45E-04	2.75E-08
156.13	1.793	0.641	1.804	72	2.21E-03	1.47E-04	3.19E-08
312.24	1.744	0.596	1.768	135	1.13E-03	1.65E-04	1.84E-08
625.06	1.648	0.508	1.696	102	1.38E-03	1.62E-04	2.19E-08
1249.84	1.574	0.440	1.611	93	1.37E-03	6.22E-05	8.33E-09
2499.02	1.495	0.368	1.534	72	1.60E-03	3.32E-05	5.21E-09
1249.84	1.514	0.386	1.505				
312.24	1.542	0.411	1.528				
78.12	1.586	0.452	1.564				
19.43	1.636	0.497	1.611				
4.90	1.674	0.532	1.655				

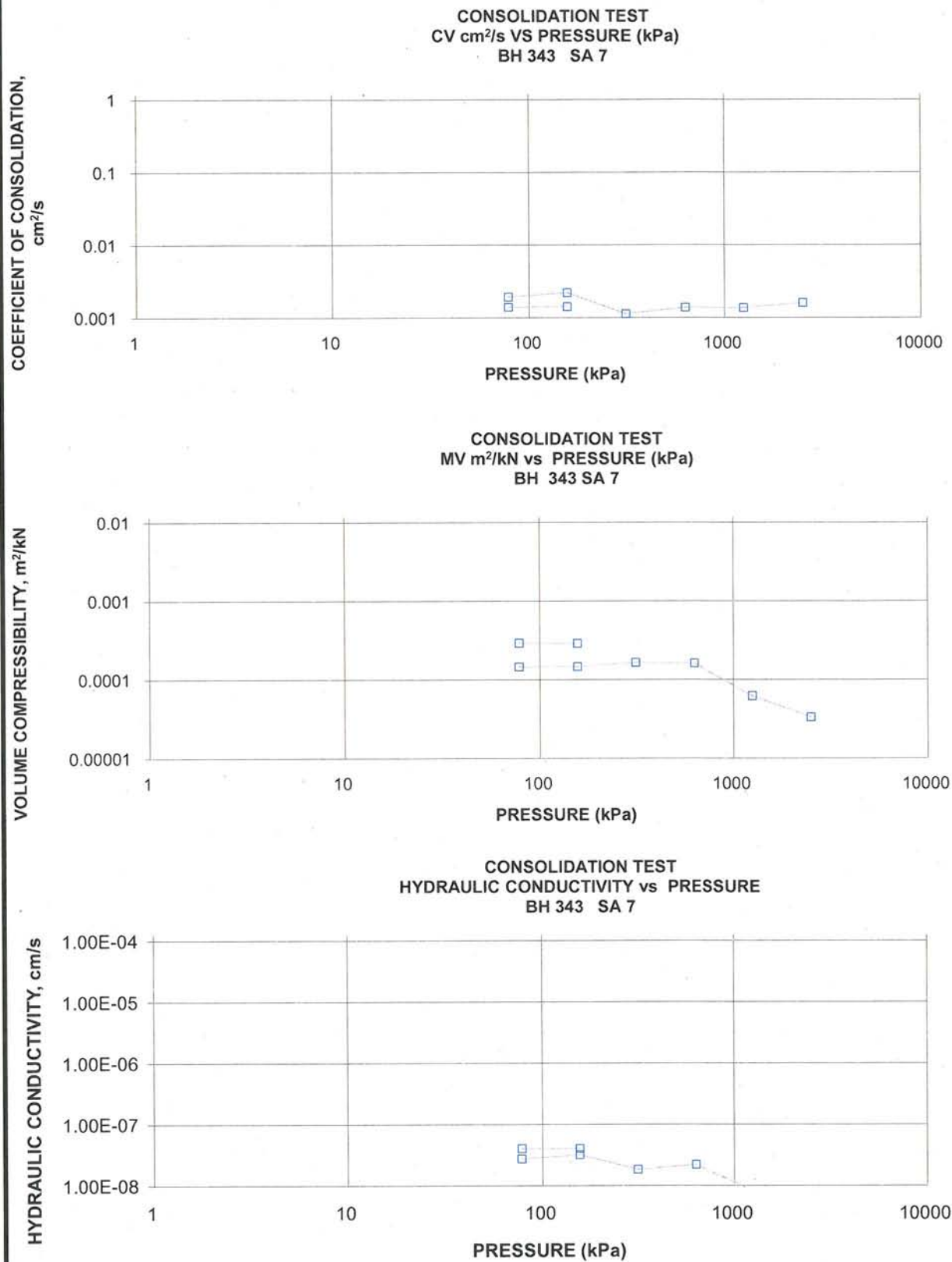
Note:

k calculated using cv based on t<sub>50</sub> values.**SAMPLE DIMENSIONS AND PROPERTIES - FINAL**

Sample Height, cm	1.67	Unit Weight, kN/m <sup>3</sup>	21.23
Sample Diameter, cm	6.32	Dry Unit Weight, kN/m <sup>3</sup>	17.41
Area, cm <sup>2</sup>	31.37	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	52.53	Solids Height, cm	1.093
Water Content, %	21.94	Volume of Solids, cm <sup>3</sup>	34.28
Wet Mass, g	113.70	Volume of Voids, cm <sup>3</sup>	18.25
Dry Mass, g	93.24		

# CONSOLIDATION TEST SUMMARY

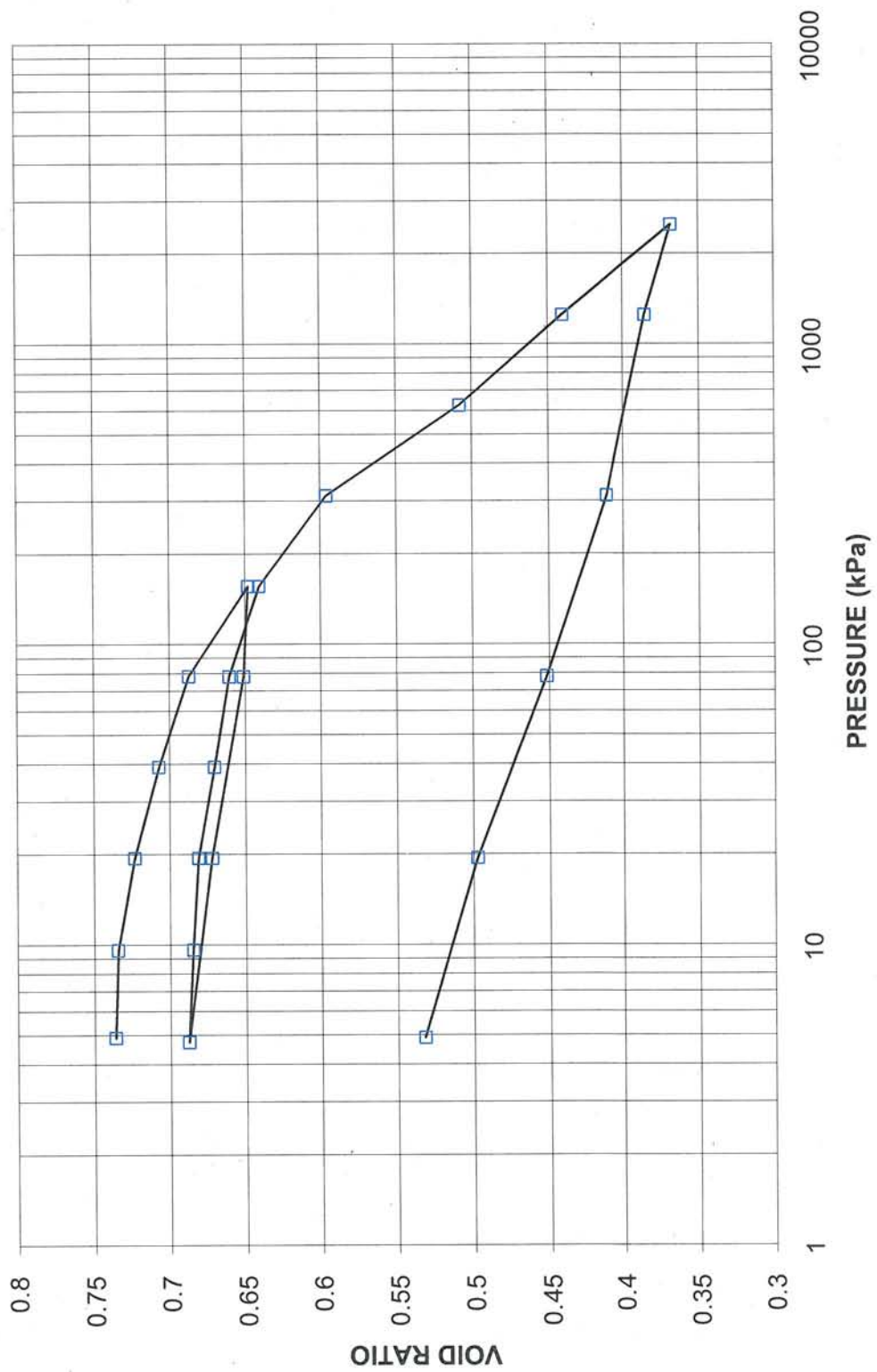
FIGURE BH 343 SA 7 OED B



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 343 SA 7 OED C

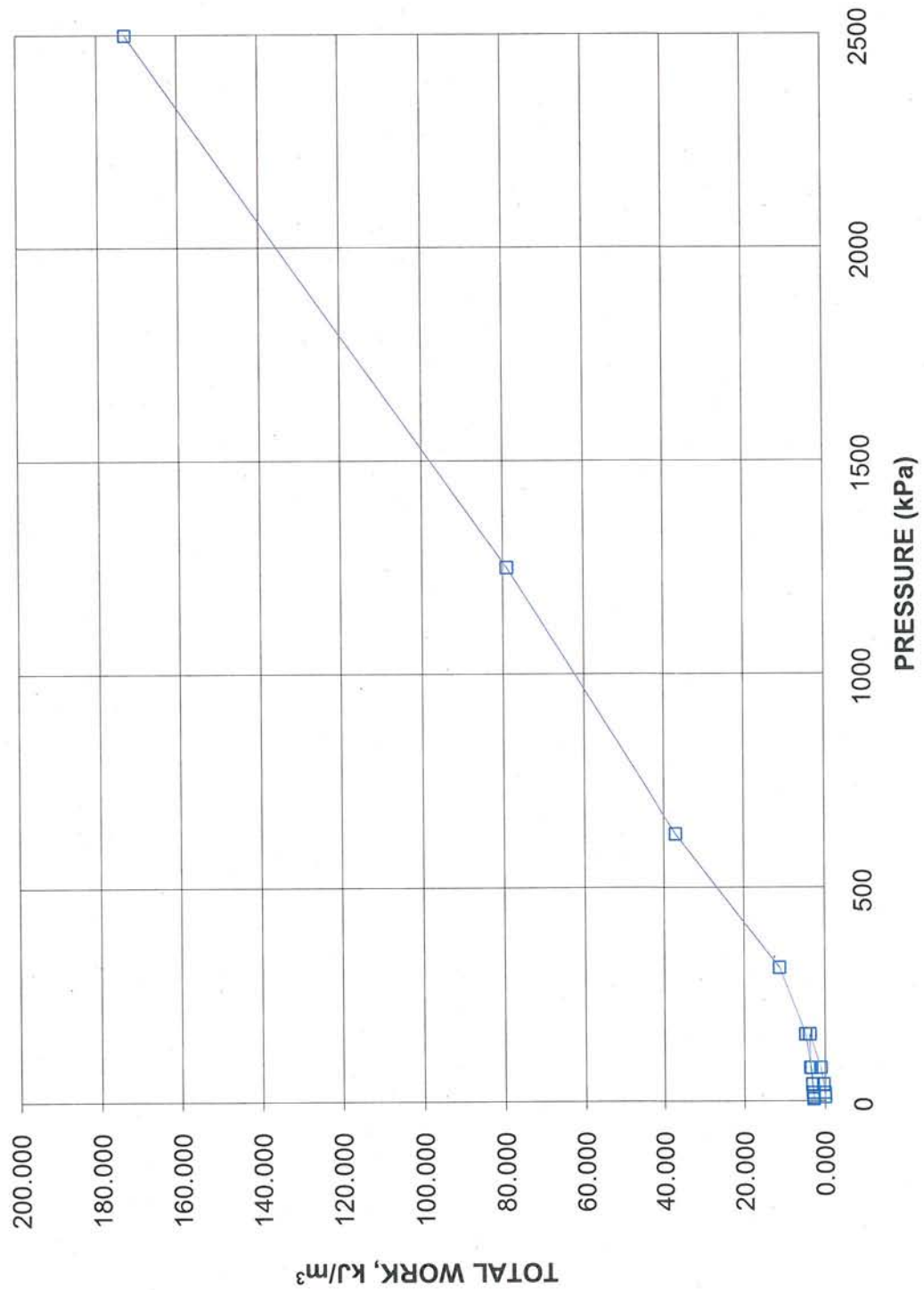
CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 343 SA 7



**CONSOLIDATION TEST  
TOTAL WORK VS PRESSURE**

FIGURE BH 343 SA 7 OED D

**CONSOLIDATION TEST  
TOTAL WORK, kJ/m<sup>3</sup> vs PRESSURE  
BH 343 SA 7**



# CONSOLIDATION TEST SUMMARY

FIGURE BH 343 SA 9 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	9
Borehole Number	343	Sample Depth, m	9.9-10.4

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	10		
Date Started	11/27/2009		
Date Completed	12/19/2009		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m <sup>3</sup>	17.03
Sample Diameter, cm	6.36	Dry Unit Weight, kN/m <sup>3</sup>	11.34
Area, cm <sup>2</sup>	31.72	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	80.57	Solids Height, cm	1.080
Water Content, %	50.24	Volume of Solids, cm <sup>3</sup>	34.24
Wet Mass, g	139.93	Volume of Voids, cm <sup>3</sup>	46.32
Dry Mass, g	93.14	Degree of Saturation, %	101.0

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv. cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	2.540	1.353	2.540				
4.69	2.539	1.352	2.540				
9.65	2.532	1.346	2.536				
17.70	2.518	1.333	2.525				
38.81	2.468	1.286	2.493				
75.65	2.392	1.215	2.430	960	3.01E-04	8.11E-04	2.39E-08
154.33	2.284	1.116	2.338	618	4.33E-04	5.37E-04	2.28E-08
77.39	2.297	1.128	2.291				
17.70	2.353	1.180	2.325				
4.69	2.400	1.223	2.377				
9.65	2.395	1.219	2.398				
19.22	2.379	1.204	2.387				
38.57	2.354	1.180	2.366				
77.26	2.317	1.146	2.335	480	5.57E-04	3.75E-04	2.05E-08
154.57	2.261	1.095	2.289	510	5.03E-04	2.82E-04	1.39E-08
309.24	2.150	0.991	2.205	660	3.61E-04	2.84E-04	1.01E-08
617.44	2.015	0.867	2.082	480	4.43E-04	1.71E-04	7.43E-09
1235.22	1.880	0.742	1.948	330	5.63E-04	8.62E-05	4.76E-09
2471.49	1.745	0.616	1.813	240	6.71E-04	4.31E-05	2.83E-09
1235.22	1.764	0.634	1.754				
309.24	1.849	0.713	1.806				
75.65	1.945	0.801	1.897				
19.25	2.043	0.893	1.994				
4.69	2.117	0.961	2.080				

Note:

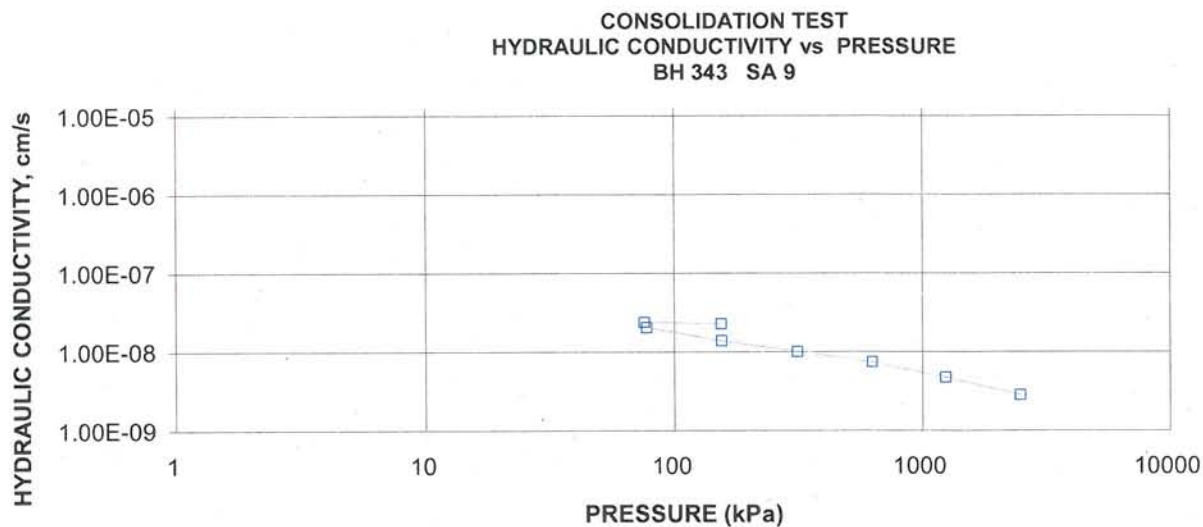
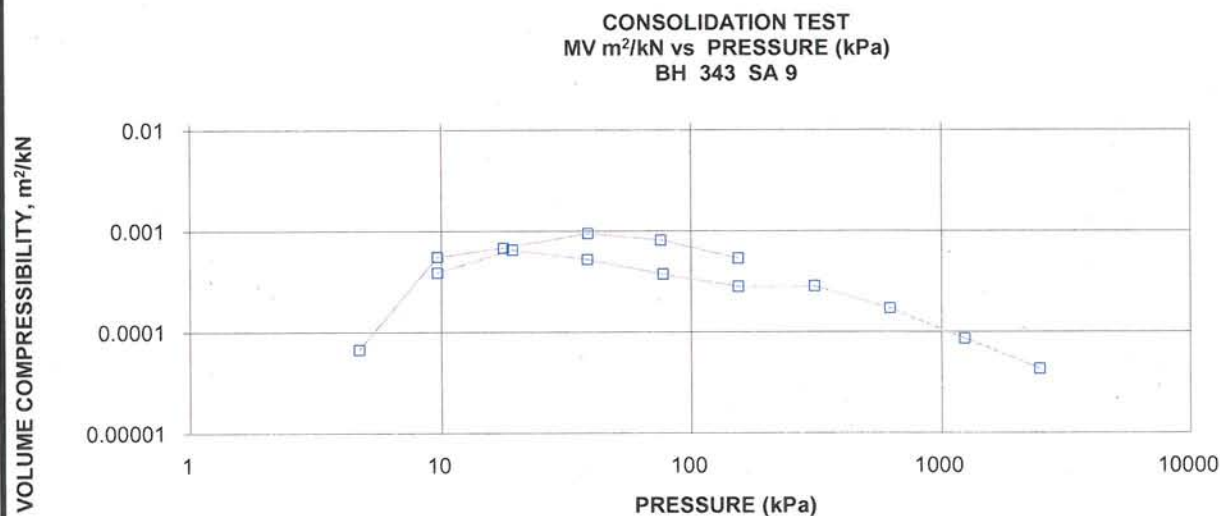
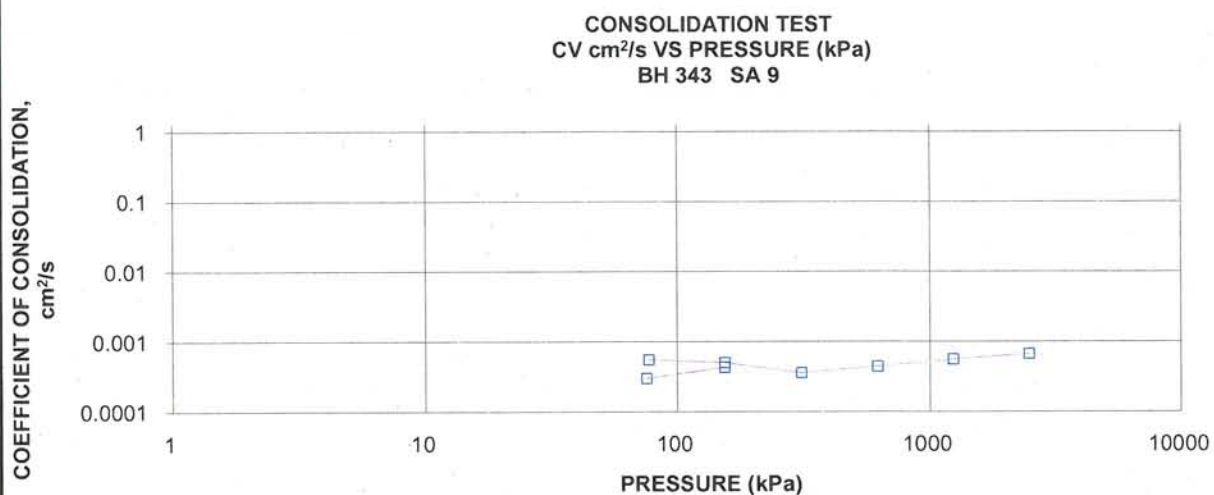
k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.12	Unit Weight, kN/m <sup>3</sup>	18.70
Sample Diameter, cm	6.36	Dry Unit Weight, kN/m <sup>3</sup>	13.60
Area, cm <sup>2</sup>	31.72	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	67.15	Solids Height, cm	1.080
Water Content, %	37.46	Volume of Solids, cm <sup>3</sup>	34.24
Wet Mass, g	128.03	Volume of Voids, cm <sup>3</sup>	32.91
Dry Mass, g	93.14		

# CONSOLIDATION TEST SUMMARY

FIGURE BH 343 SA 9 OED B

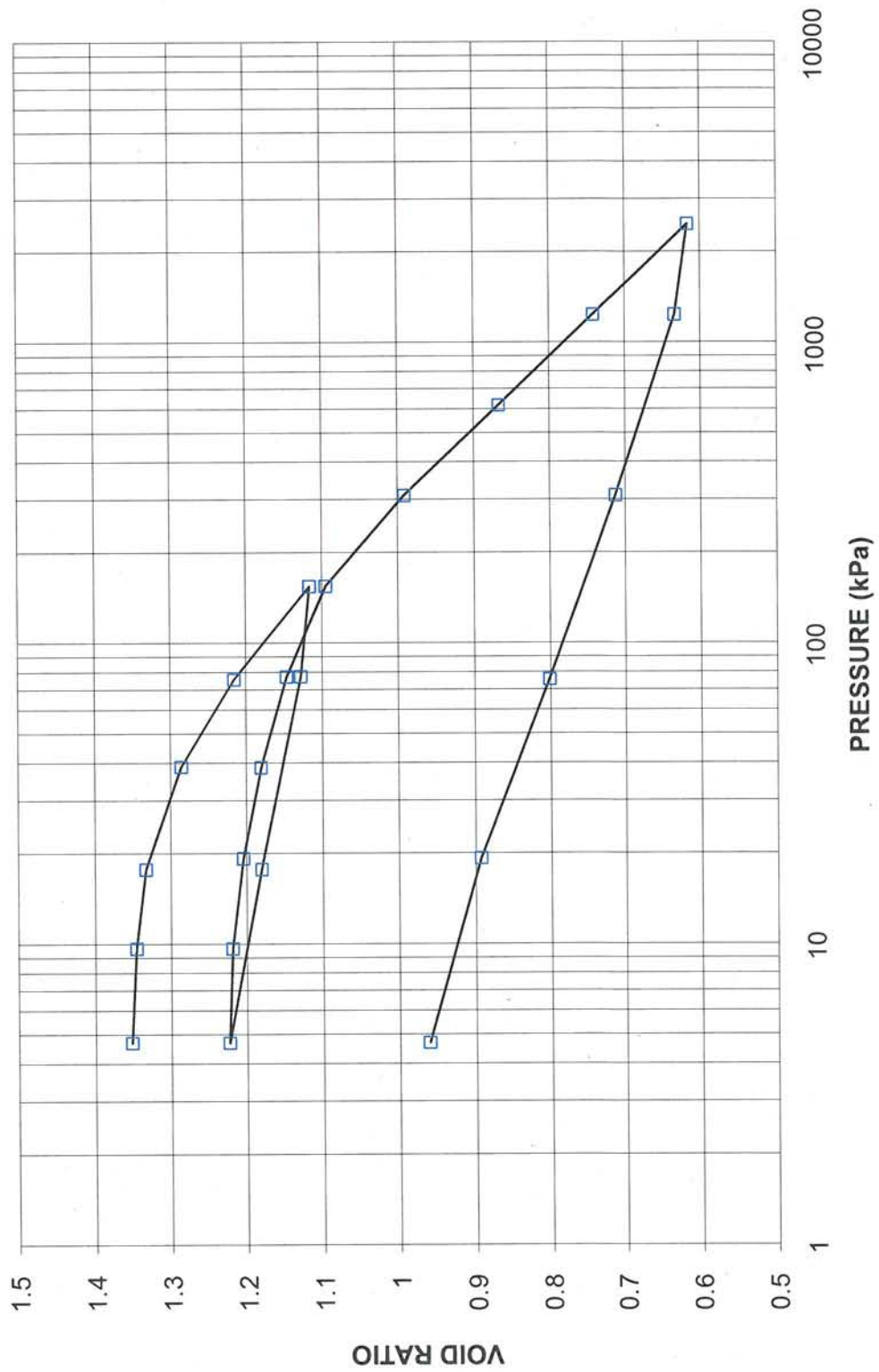




# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 343 SA 9 OED C

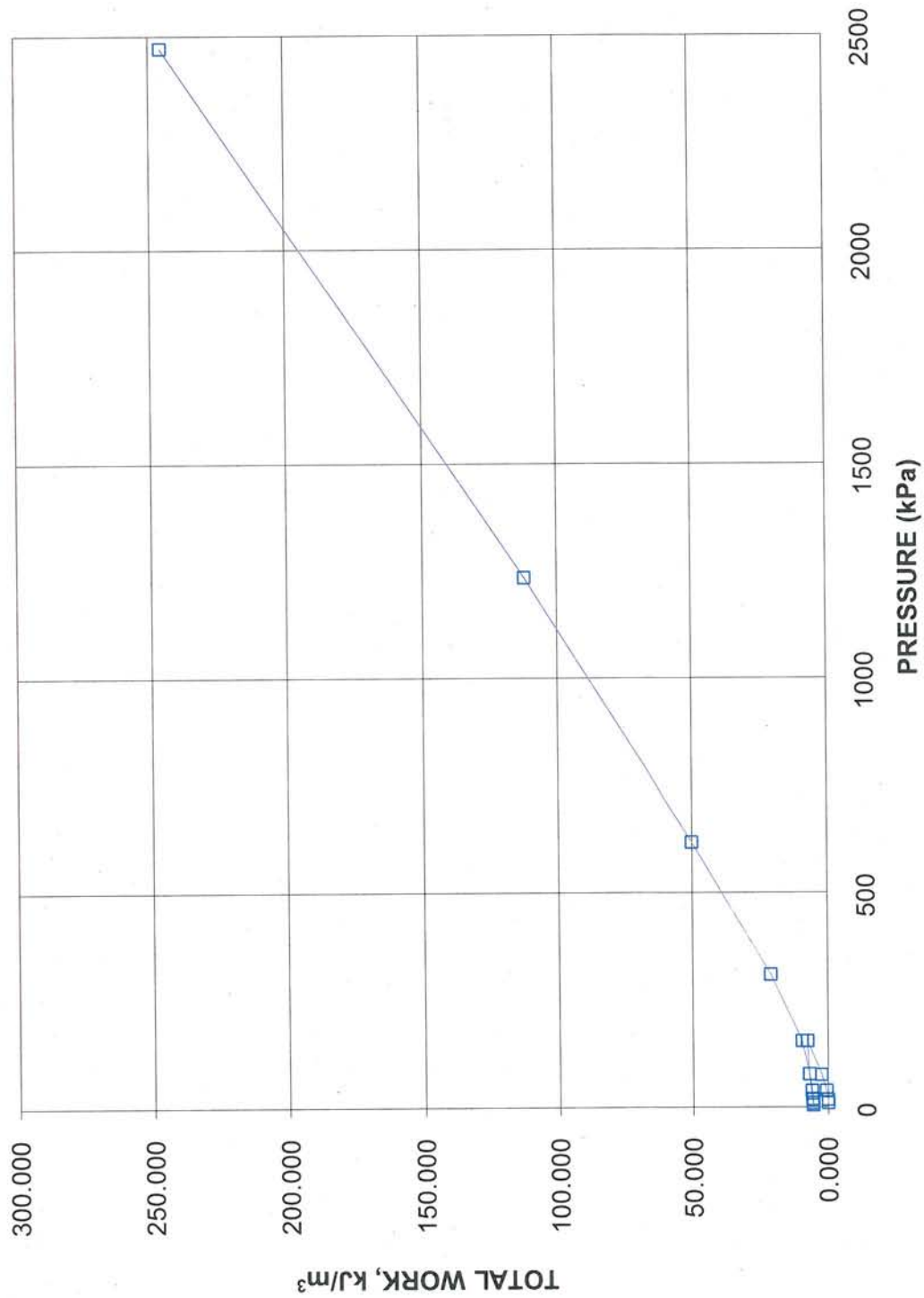
CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 343 SA 9



CONSOLIDATION TEST  
TOTAL WORK VS PRESSURE

FIGURE BH 343 SA 9 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 343 SA 9



# CONSOLIDATION TEST SUMMARY

FIGURE BH 343 SA 16 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	16
Borehole Number	343	Sample Depth, m	19.1-19.5

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	11		
Date Started	11/27/2009		
Date Completed	12/17/2009		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m <sup>3</sup>	20.50
Sample Diameter, cm	6.31	Drv Unit Weight, kN/m <sup>3</sup>	16.70
Area, cm <sup>2</sup>	31.27	Specific Gravity, measured	2.71
Volume, cm <sup>3</sup>	79.43	Solids Height, cm	1.596
Water Content, %	22.73	Volume of Solids, cm <sup>3</sup>	49.91
Wet Mass, g	166.01	Volume of Voids, cm <sup>3</sup>	29.52
Dry Mass, g	135.26	Degree of Saturation, %	104.2

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	2.540	0.591	2.540				
4.81	2.537	0.589	2.538				
9.57	2.532	0.586	2.534				
19.14	2.523	0.581	2.527				
39.31	2.501	0.567	2.512				
77.85	2.482	0.555	2.491				
156.61	2.426	0.520	2.454	330	8.94E-04	2.80E-04	2.46E-08
313.11	2.369	0.484	2.397	252	1.12E-03	1.43E-04	1.57E-08
78.38	2.385	0.494	2.377				
19.11	2.415	0.513	2.400				
4.81	2.434	0.525	2.425				
9.65	2.433	0.524	2.433				
17.95	2.429	0.522	2.431				
39.17	2.417	0.514	2.423				
78.50	2.404	0.506	2.410				
156.87	2.385	0.494	2.394	210	1.34E-03	9.60E-05	1.26E-08
312.93	2.357	0.477	2.371	177	1.56E-03	7.04E-05	1.07E-08
625.88	2.300	0.441	2.328	174	1.53E-03	7.18E-05	1.07E-08
1251.88	2.229	0.396	2.264	150	1.67E-03	4.46E-05	7.32E-09
2503.76	2.152	0.348	2.190	114	2.06E-03	2.42E-05	4.89E-09
1251.88	2.159	0.353	2.155				
312.93	2.194	0.374	2.176				
78.50	2.243	0.405	2.218				
19.14	2.290	0.435	2.266				
4.81	2.322	0.455	2.306				

Note:

k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.32	Unit Weight, kN/m <sup>3</sup>	21.67
Sample Diameter, cm	6.31	Drv Unit Weight, kN/m <sup>3</sup>	18.27
Area, cm <sup>2</sup>	31.27	Specific Gravity, measured	2.71
Volume, cm <sup>3</sup>	72.61	Solids Height, cm	1.596
Water Content, %	18.60	Volume of Solids, cm <sup>3</sup>	49.91
Wet Mass, g	160.42	Volume of Voids, cm <sup>3</sup>	22.70
Dry Mass, g	135.26		

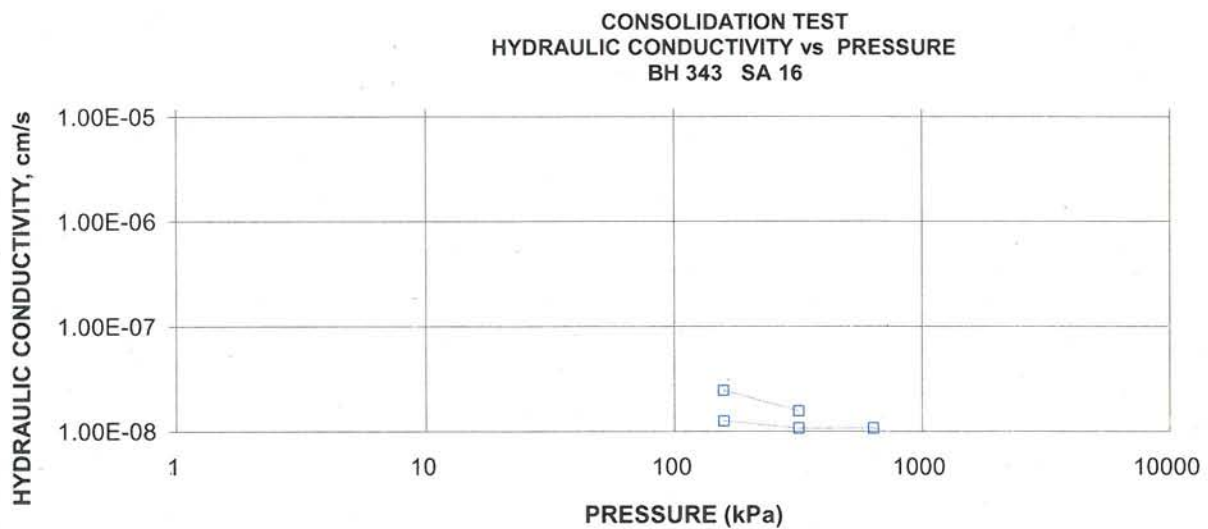
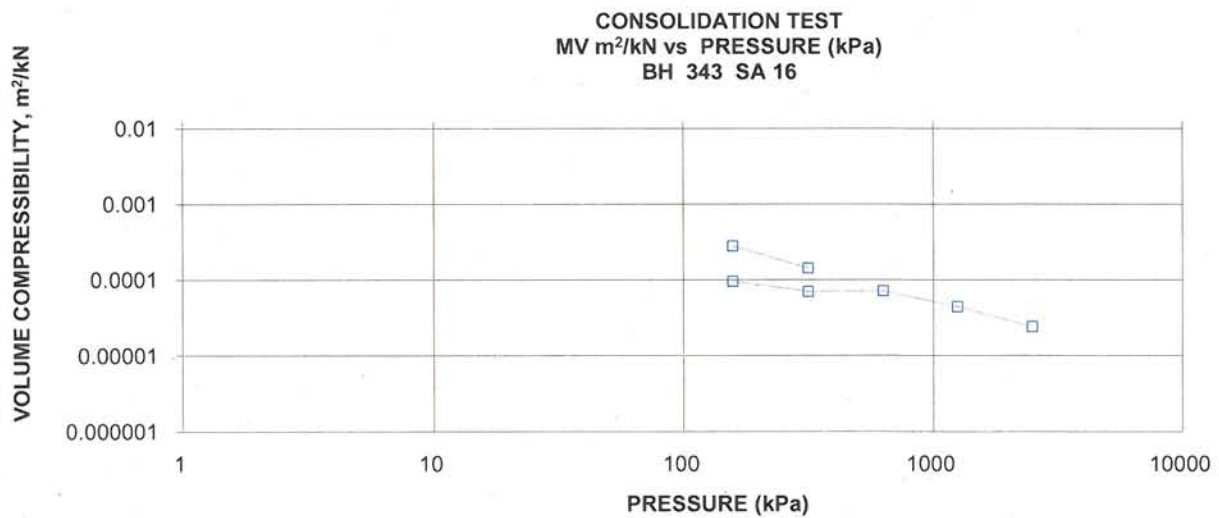
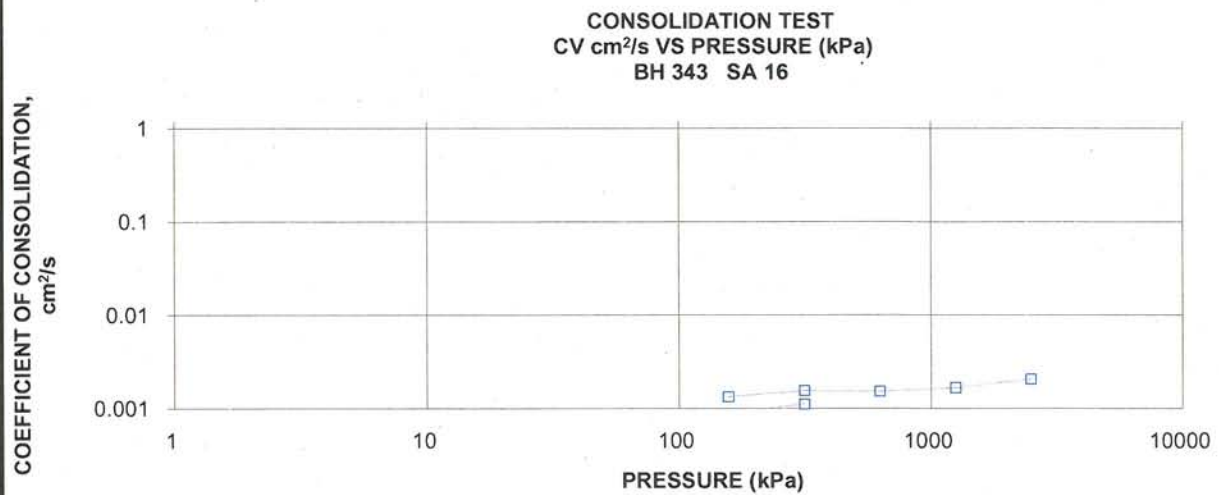
Prepared By: LFG

Golder Associates

Checked By:

# CONSOLIDATION TEST SUMMARY

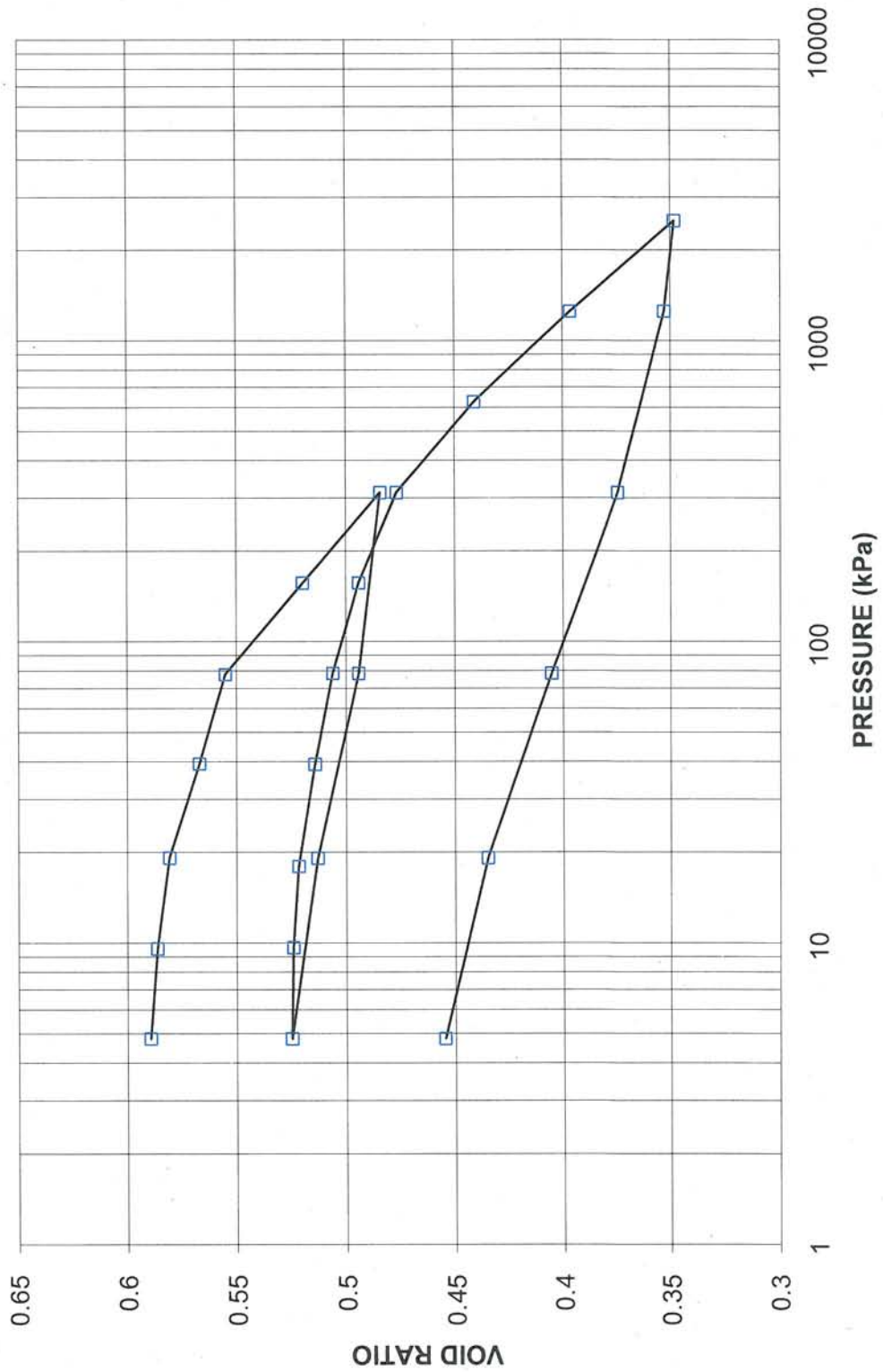
FIGURE BH 343 SA 16 OED B



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 343 SA 16 OED C

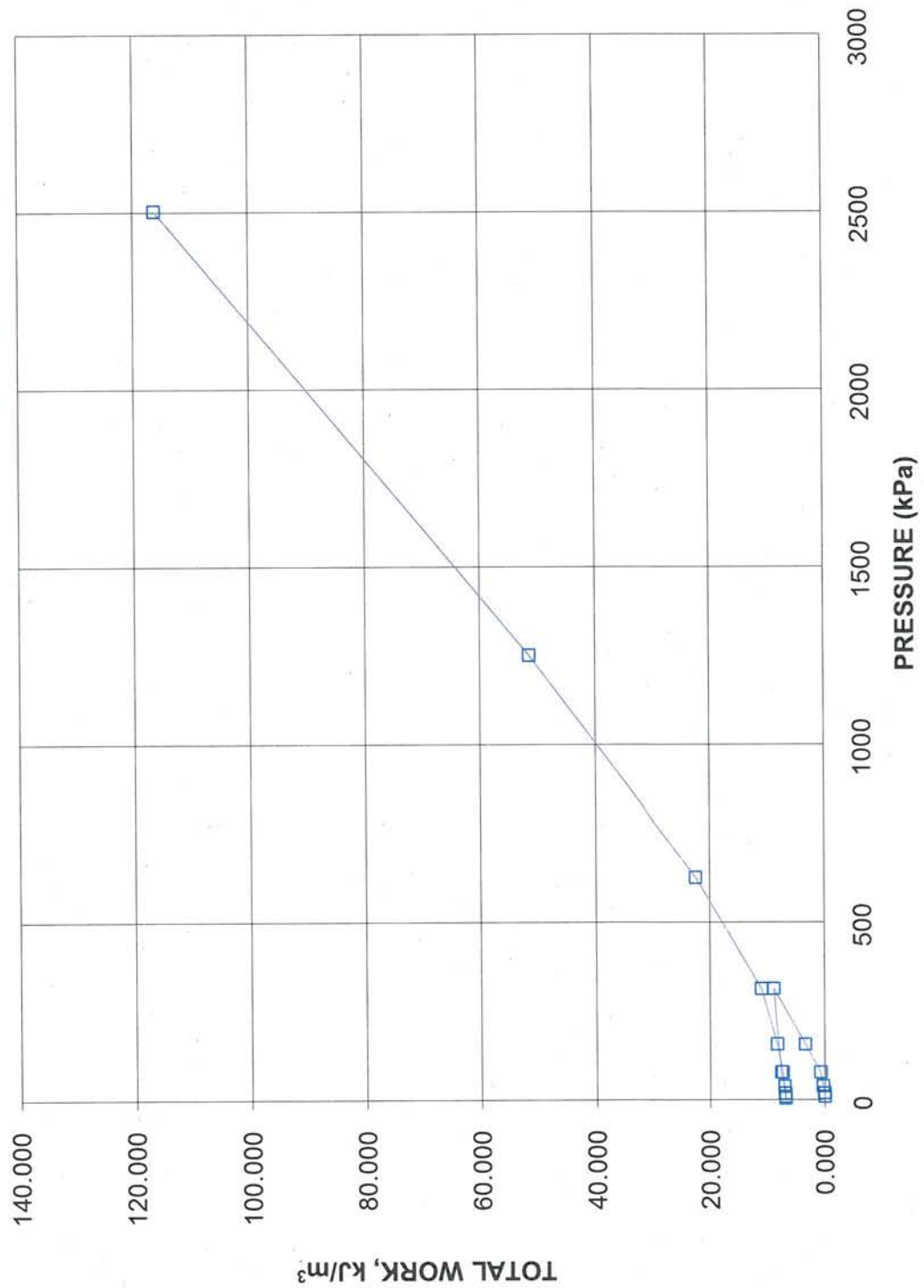
CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 343 SA 16



# CONSOLIDATION TEST TOTAL WORK VS PRESSURE

FIGURE BH 343 SA 16 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 343 SA 16



# CONSOLIDATION TEST SUMMARY

FIGURE BH 343A SA 2 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	2
Borehole Number	343A	Sample Depth, m	13.7-14.2

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	1		
Date Started	12/8/2009		
Date Completed	12/26/2009		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m <sup>3</sup>	19.49
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m <sup>3</sup>	15.29
Area, cm <sup>2</sup>	31.47	Specific Gravity, measured	2.74
Volume, cm <sup>3</sup>	79.78	Solids Height, cm	1.443
Water Content, %	27.44	Volume of Solids, cm <sup>3</sup>	45.40
Wet Mass, g	158.53	Volume of Voids, cm <sup>3</sup>	34.38
Dry Mass, g	124.4	Degree of Saturation, %	99.3

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	2.535	0.757	2.535				
4.85	2.522	0.748	2.528				
9.51	2.517	0.744	2.519				
19.40	2.507	0.738	2.512				
39.13	2.494	0.728	2.500				
77.87	2.460	0.705	2.477				
150.24	2.401	0.664	2.430	420	6.89E-04	3.21E-04	2.16E-08
77.87	2.404	0.666	2.403				
19.12	2.408	0.669	2.406				
4.85	2.412	0.672	2.410				
9.51	2.408	0.669	2.410				
19.40	2.407	0.668	2.407				
39.13	2.405	0.667	2.406				
77.92	2.403	0.666	2.404				
150.24	2.387	0.655	2.395	660	4.26E-04	8.62E-05	3.60E-09
311.07	2.279	0.580	2.333	405	6.58E-04	2.65E-04	1.71E-08
622.18	2.185	0.514	2.232	255	9.57E-04	1.20E-04	1.12E-08
1244.54	2.093	0.451	2.139	153	1.46E-03	5.80E-05	8.33E-09
2488.73	2.008	0.391	2.050	240	8.58E-04	2.71E-05	2.28E-09
1244.54	2.013	0.396	2.010				
622.18	2.034	0.410	2.024				
150.24	2.077	0.440	2.055				
39.13	2.113	0.464	2.095				
4.85	2.145	0.487	2.129				

Note:

k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.15	Unit Weight, kN/m <sup>3</sup>	21.45
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m <sup>3</sup>	18.07
Area, cm <sup>2</sup>	31.47	Specific Gravity, measured	2.74
Volume, cm <sup>3</sup>	67.51	Solids Height, cm	1.443
Water Content, %	18.70	Volume of Solids, cm <sup>3</sup>	45.40
Wet Mass, g	147.66	Volume of Voids, cm <sup>3</sup>	22.11
Dry Mass, g	124.4		

Prepared By: LFG

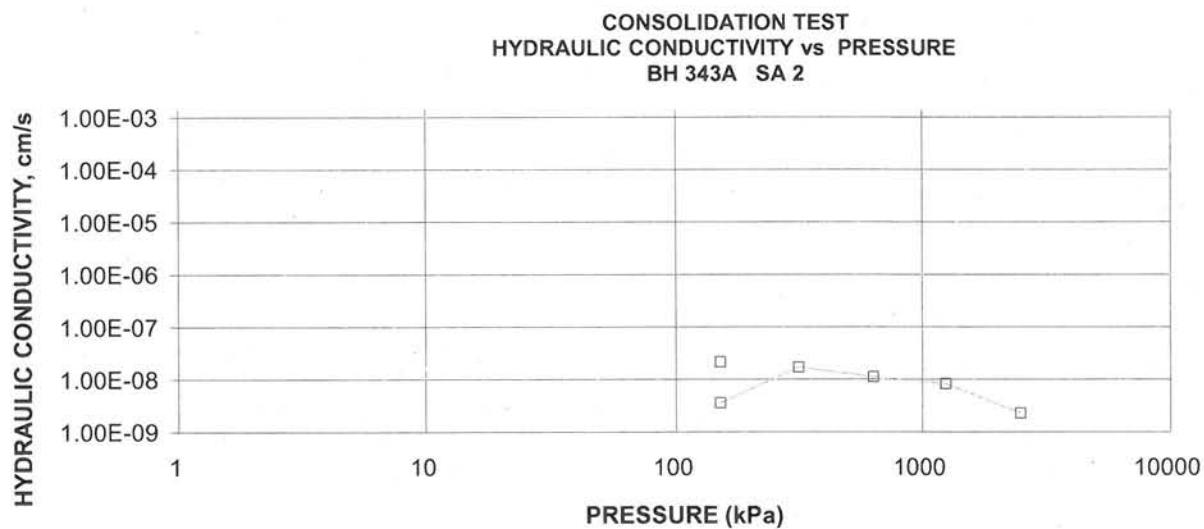
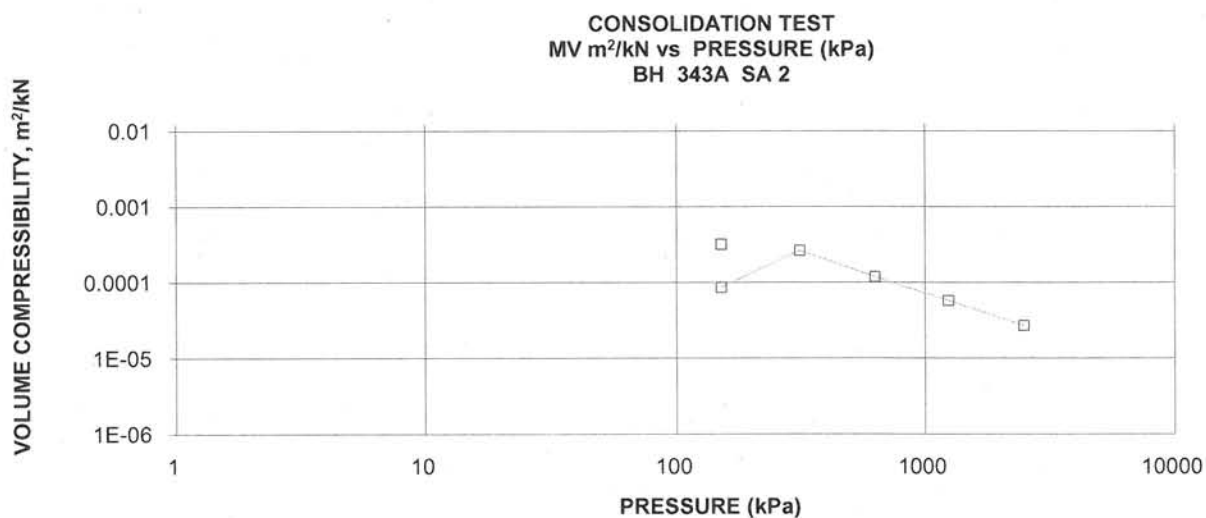
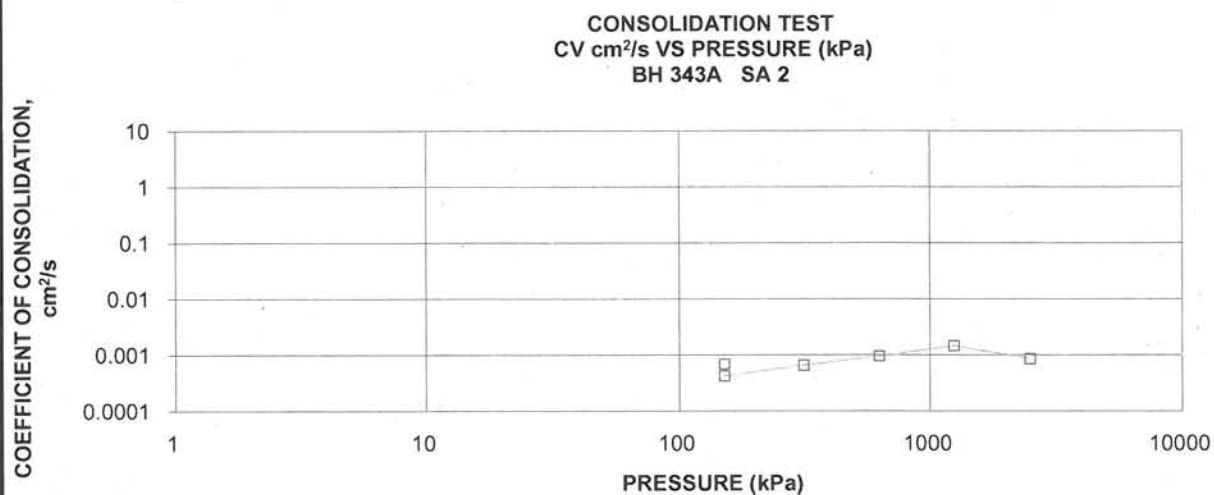
Golder Associates

Checked By:



# CONSOLIDATION TEST SUMMARY

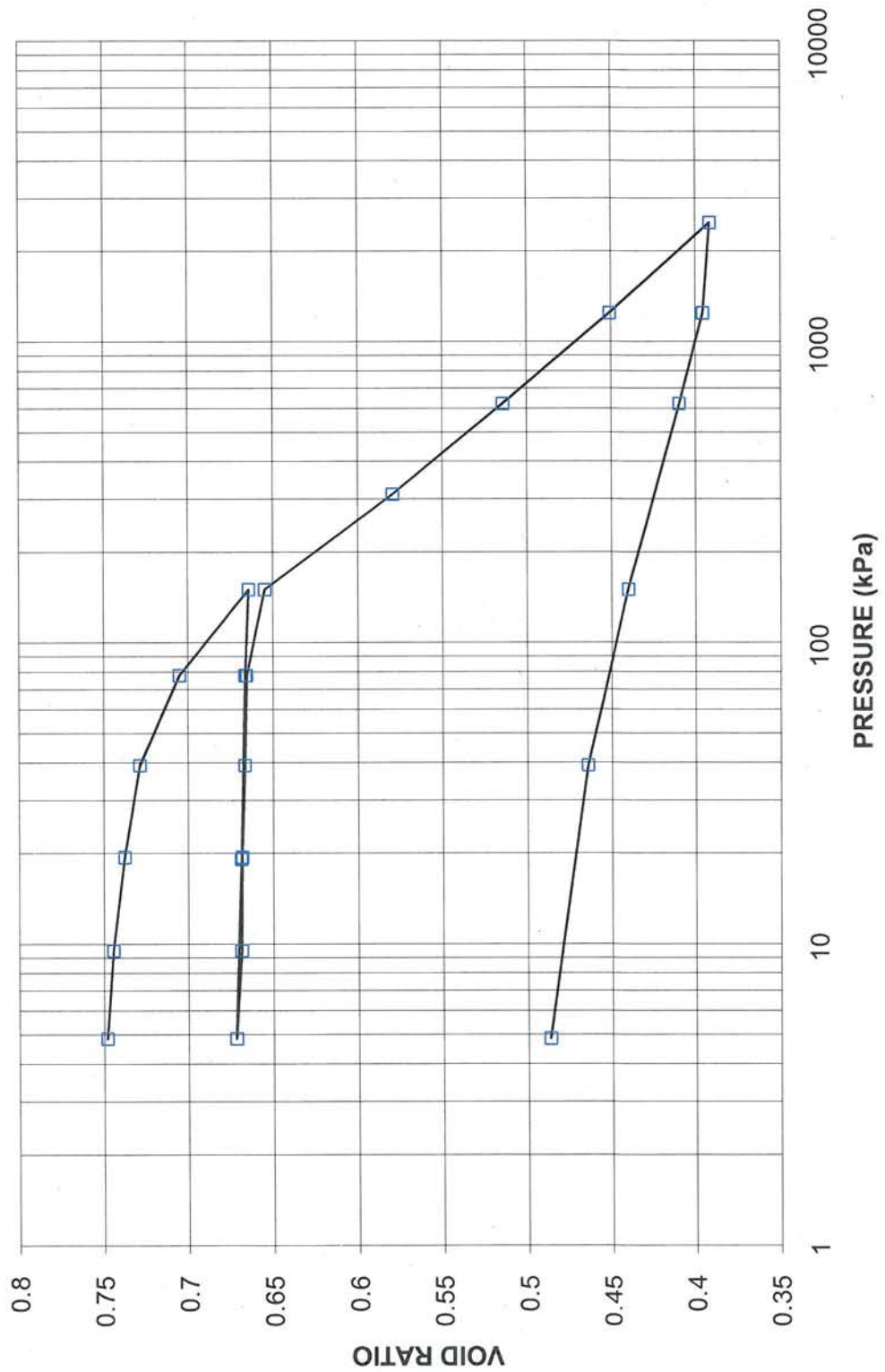
FIGURE BH 343A SA 2 OED B



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 343A SA 2 OED C

CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 343A SA 2



Project No. 09-1132-0080

Prepared By: LFG

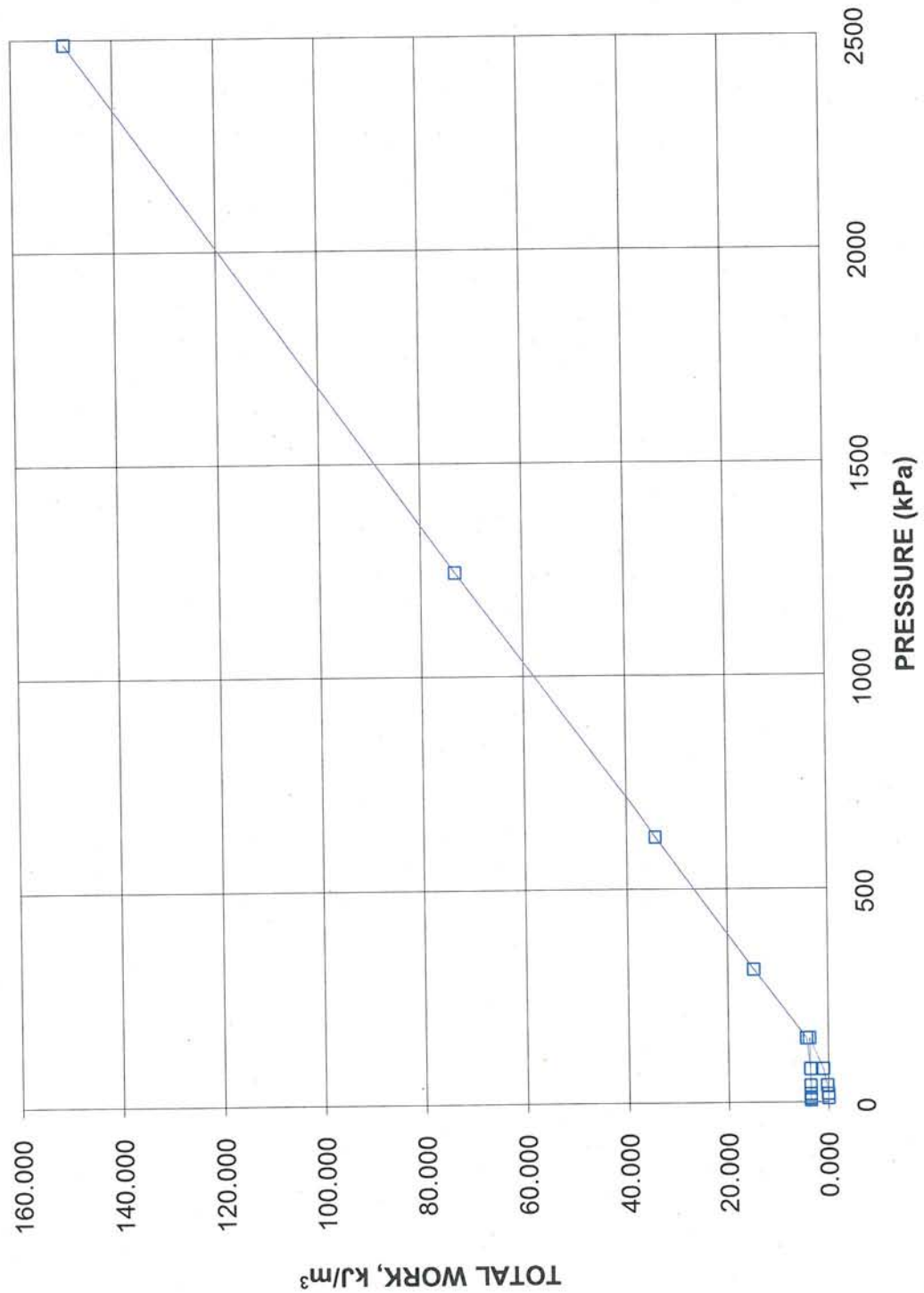
Golder Associates

Checked By:

CONSOLIDATION TEST  
TOTAL WORK VS PRESSURE

FIGURE BH 343A SA 2 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 343A SA 2



# CONSOLIDATION TEST SUMMARY

FIGURE BH 343A SA 4 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	4
Borehole Number	343A	Sample Depth, m	16.8-17.2

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	9		
Date Started	12/14/2009		
Date Completed	01/07/2010		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m <sup>3</sup>	20.49
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m <sup>3</sup>	16.86
Area, cm <sup>2</sup>	31.47	Specific Gravity, measured	2.70
Volume, cm <sup>3</sup>	59.79	Solids Height, cm	1.210
Water Content, %	21.55	Volume of Solids, cm <sup>3</sup>	38.07
Wet Mass, g	124.94	Volume of Voids, cm <sup>3</sup>	21.72
Dry Mass, g	102.79	Degree of Saturation, %	102.0

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	1.900	0.571	1.900				
4.88	1.888	0.561	1.894				
9.60	1.886	0.559	1.887				
19.53	1.878	0.552	1.882				
38.92	1.867	0.543	1.873				
90.00	1.842	0.523	1.855				
175.02	1.811	0.497	1.827	150	1.09E-03	1.91E-04	2.04E-08
90.00	1.814	0.500	1.813				
19.53	1.829	0.512	1.822				
4.88	1.842	0.523	1.835				
9.51	1.841	0.522	1.842				
19.62	1.836	0.518	1.839				
38.92	1.830	0.513	1.833				
90.00	1.818	0.503	1.824				
174.95	1.804	0.491	1.811	84	1.91E-03	8.61E-05	1.61E-08
311.24	1.775	0.467	1.790	150	1.05E-03	1.13E-04	1.16E-08
622.13	1.720	0.422	1.747	120	1.25E-03	9.29E-05	1.14E-08
1244.48	1.662	0.374	1.691	84	1.67E-03	4.91E-05	8.02E-09
2489.66	1.601	0.323	1.631	48	2.72E-03	2.58E-05	6.88E-09
1244.48	1.611	0.331	1.606				
311.24	1.636	0.353	1.623				
90.00	1.667	0.378	1.652				
19.53	1.703	0.407	1.685				
4.88	1.731	0.431	1.717				

Note:

k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.73	Unit Weight, kN/m <sup>3</sup>	21.80
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m <sup>3</sup>	18.50
Area, cm <sup>2</sup>	31.47	Specific Gravity, measured	2.70
Volume, cm <sup>3</sup>	54.47	Solids Height, cm	1.210
Water Content, %	17.80	Volume of Solids, cm <sup>3</sup>	38.07
Wet Mass, g	121.09	Volume of Voids, cm <sup>3</sup>	16.40
Dry Mass, g	102.79		

Prepared By: LFG

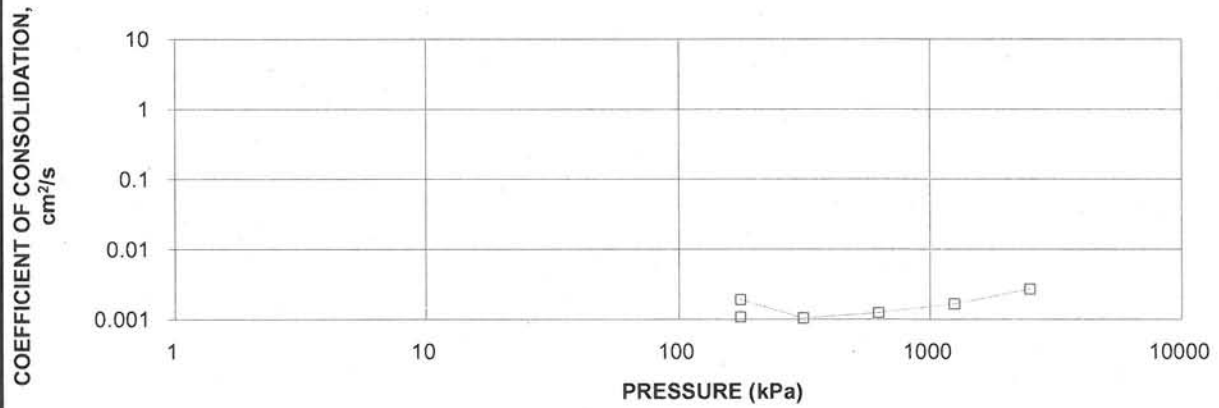
Golder Associates

Checked By:

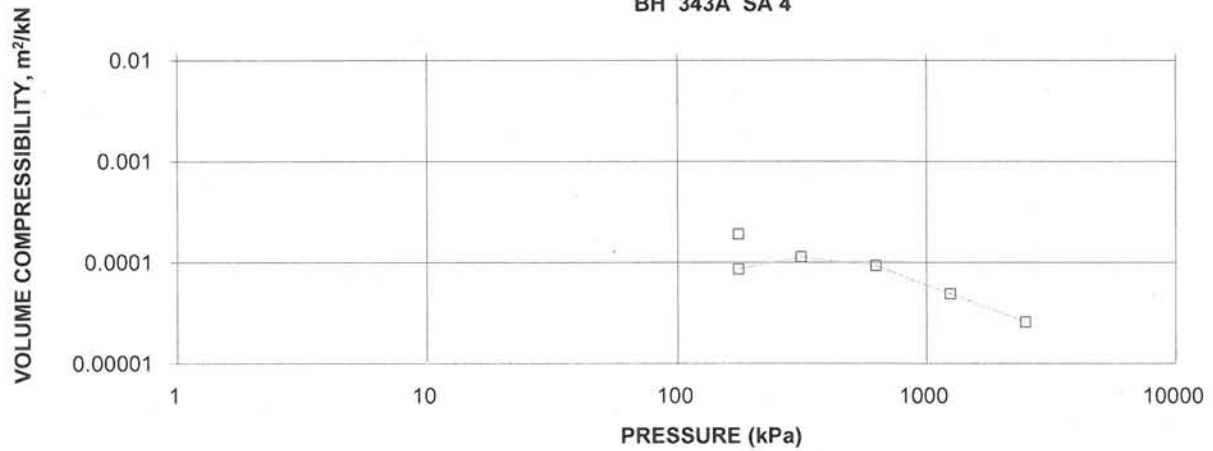
# CONSOLIDATION TEST SUMMARY

FIGURE BH 343A SA 4 OED B

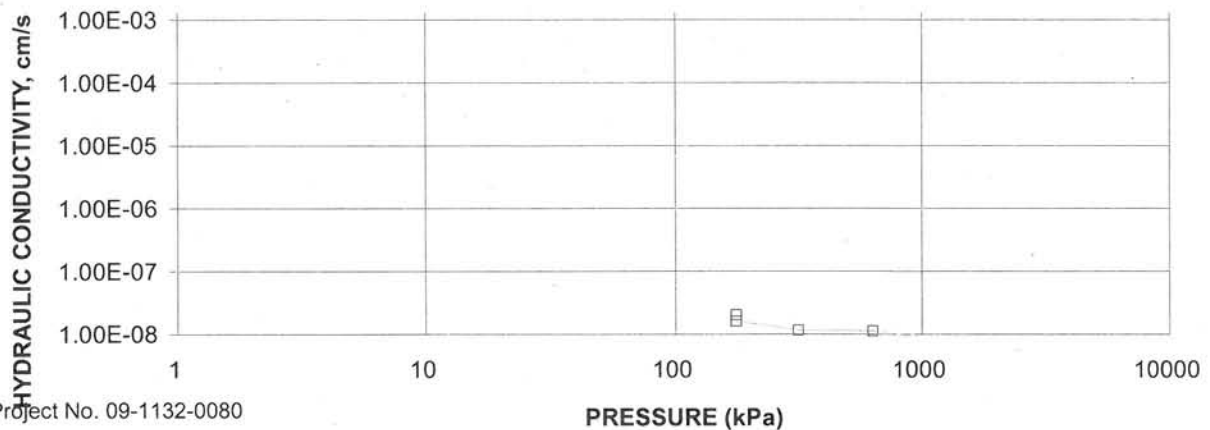
CONSOLIDATION TEST  
CV cm<sup>2</sup>/s VS PRESSURE (kPa)  
BH 343A SA 4



CONSOLIDATION TEST  
MV m<sup>2</sup>/kN vs PRESSURE (kPa)  
BH 343A SA 4



CONSOLIDATION TEST  
HYDRAULIC CONDUCTIVITY vs PRESSURE  
BH 343A SA 4



Project No. 09-1132-0080

Prepared By: LFG

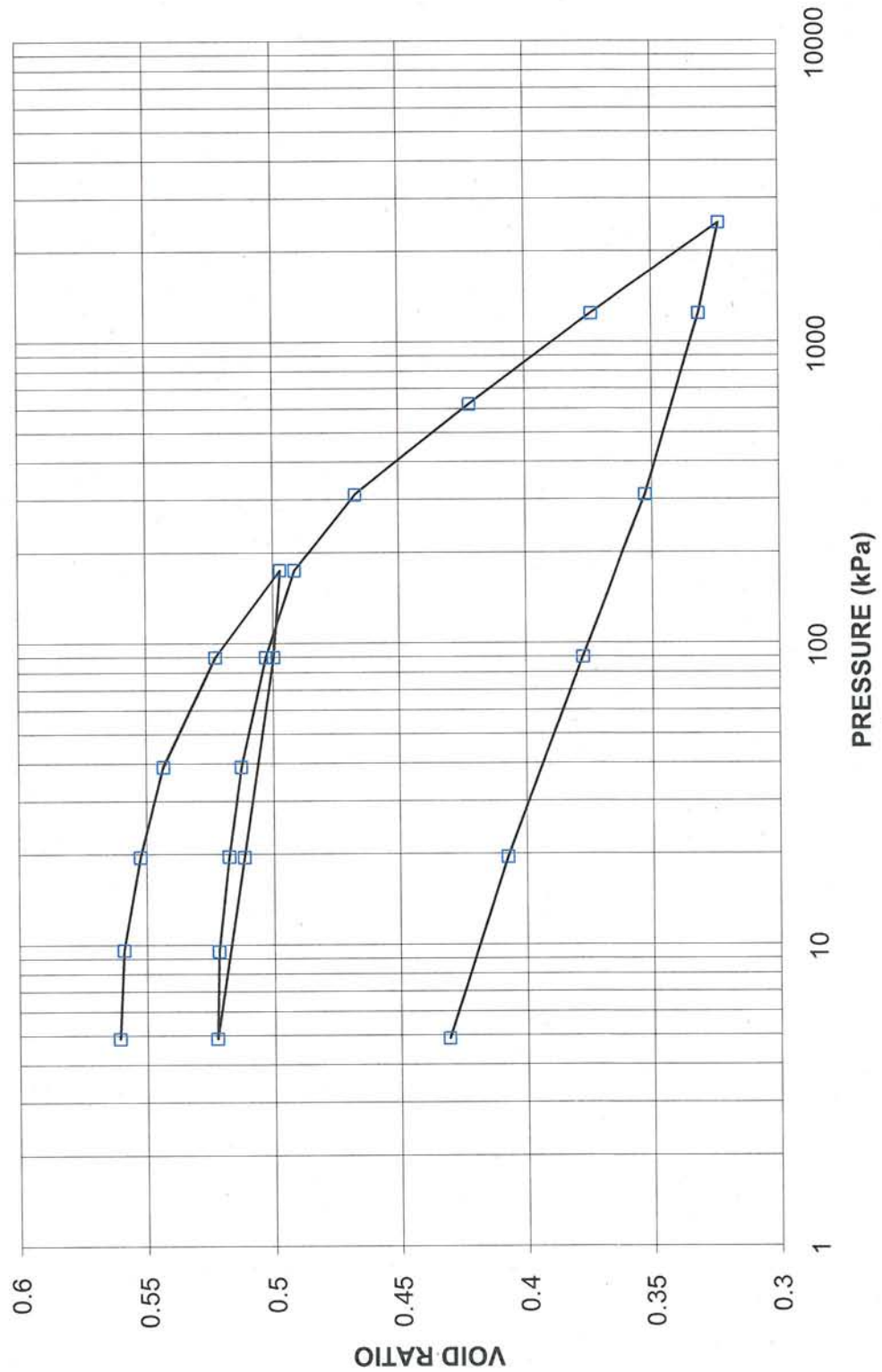
**Golder Associates**

Checked By:

# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 343A SA 4 OED C

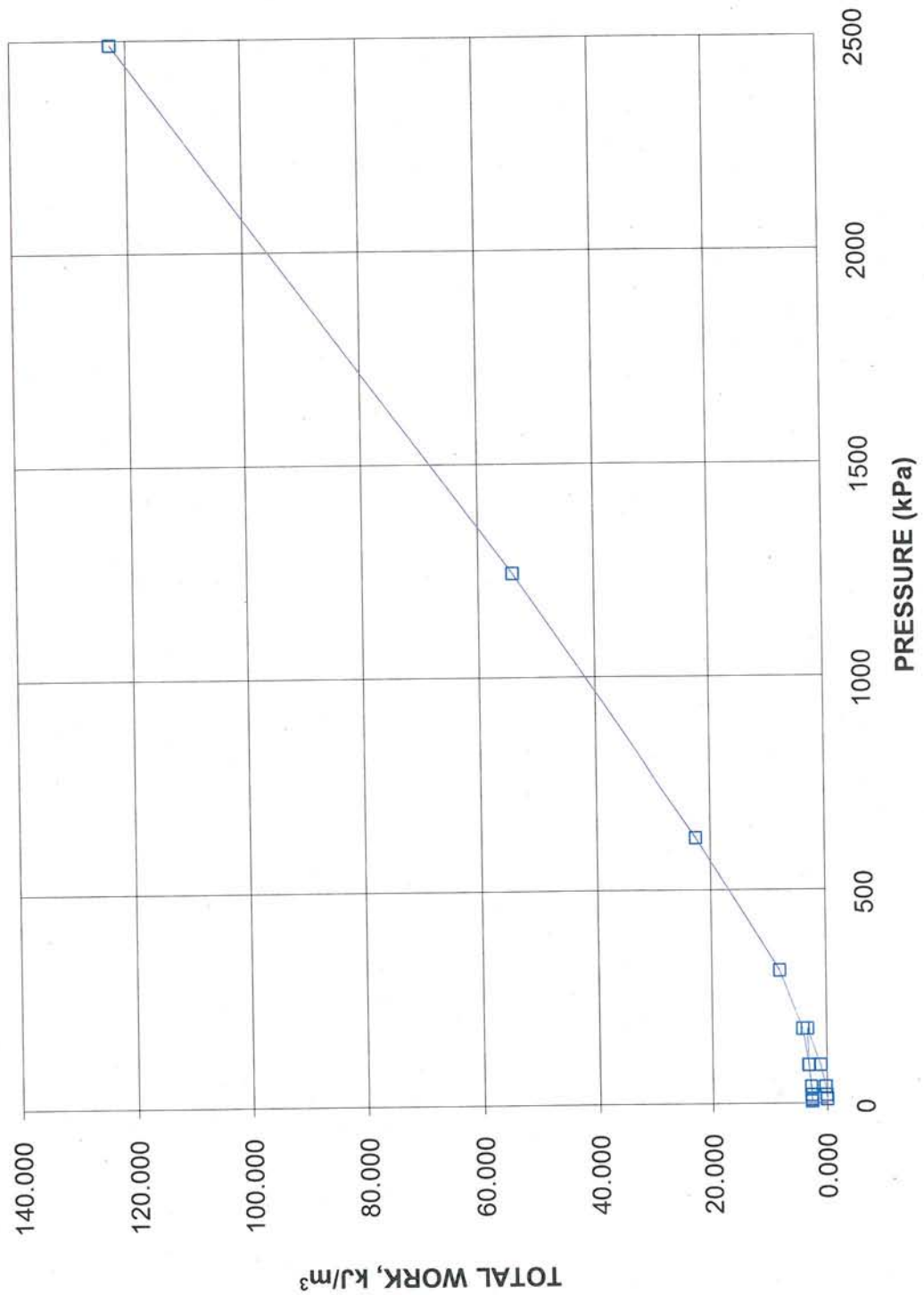
CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 343A SA 4



# CONSOLIDATION TEST TOTAL WORK VS PRESSURE

FIGURE BH 343A SA 4 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 343A SA 4





# CONSOLIDATION TEST SUMMARY

FIGURE BH 345 SA 6 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	6
Borehole Number	345	Sample Depth, m	6.1-6.6

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	4		
Date Started	12/8/2009		
Date Completed	12/27/2009		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m <sup>3</sup>	17.84
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m <sup>3</sup>	12.62
Area, cm <sup>2</sup>	31.57	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	80.19	Solids Height, cm	1.202
Water Content, %	41.33	Volume of Solids, cm <sup>3</sup>	37.94
Wet Mass, g	145.84	Volume of Voids, cm <sup>3</sup>	42.25
Dry Mass, g	103.19	Degree of Saturation, %	100.9

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv. cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	2.540	1.114	2.540				
4.77	2.499	1.080	2.520				
9.56	2.498	1.079	2.499				
19.34	2.495	1.076	2.497				
38.76	2.487	1.070	2.491				
77.68	2.469	1.054	2.478	150	2.01E-03	1.87E-04	3.68E-08
19.55	2.485	1.068	2.477				
4.87	2.500	1.080	2.492				
9.53	2.494	1.075	2.497				
19.55	2.490	1.072	2.492				
38.76	2.482	1.066	2.486				
77.76	2.468	1.054	2.475	156	1.92E-03	1.46E-04	2.76E-08
155.15	2.431	1.023	2.449	203	1.45E-03	1.88E-04	2.66E-08
313.69	2.349	0.955	2.390	330	8.48E-04	2.03E-04	1.69E-08
623.83	2.186	0.819	2.268	540	4.67E-04	2.07E-04	9.47E-09
1244.36	2.032	0.691	2.109	360	6.05E-04	9.75E-05	5.79E-09
2484.58	1.880	0.564	1.956	270	6.94E-04	4.83E-05	3.29E-09
1244.36	1.903	0.583	1.891				
313.69	1.982	0.650	1.943				
77.76	2.081	0.732	2.032				
19.55	2.179	0.814	2.130				
4.87	2.257	0.878	2.218				

Note:

k calculated using cv based on t<sub>50</sub> values.

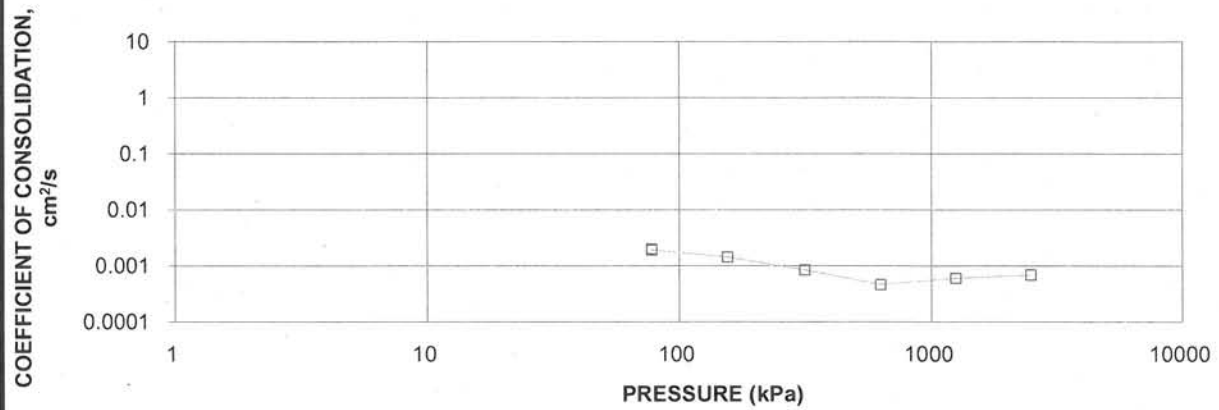
## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.26	Unit Weight, kN/m <sup>3</sup>	19.14
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m <sup>3</sup>	14.21
Area, cm <sup>2</sup>	31.57	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	71.24	Solids Height, cm	1.202
Water Content, %	34.74	Volume of Solids, cm <sup>3</sup>	37.94
Wet Mass, g	139.04	Volume of Voids, cm <sup>3</sup>	33.30
Dry Mass, g	103.19		

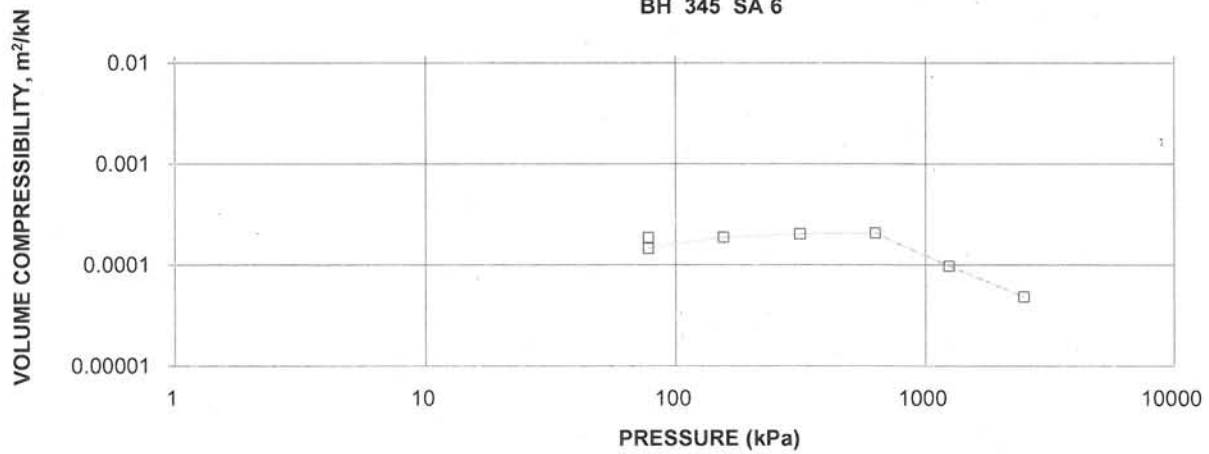
# CONSOLIDATION TEST SUMMARY

FIGURE BH 345 SA 6 OED B

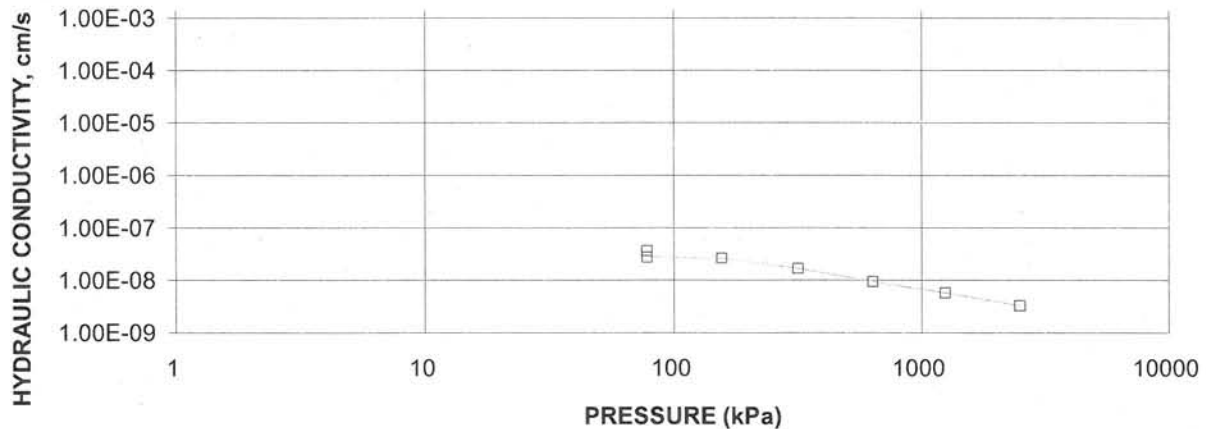
CONSOLIDATION TEST  
CV cm<sup>2</sup>/s VS PRESSURE (kPa)  
BH 345 SA 6



CONSOLIDATION TEST  
MV m<sup>2</sup>/kN vs PRESSURE (kPa)  
BH 345 SA 6



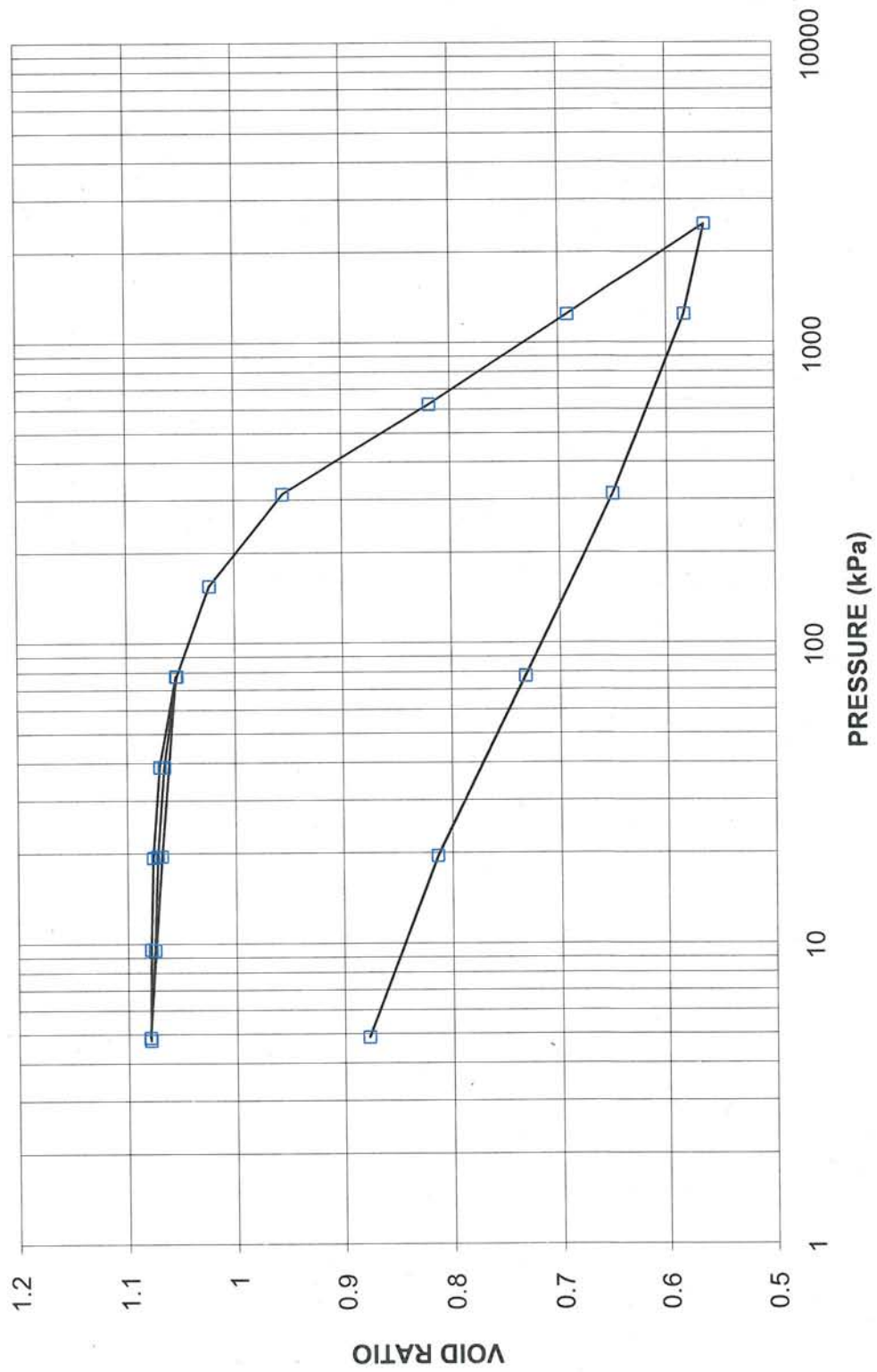
CONSOLIDATION TEST  
HYDRAULIC CONDUCTIVITY vs PRESSURE  
BH 345 SA 6



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 345 SA 6 OED C

CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 345 SA 6



Project No. 09-1132-0080

Prepared By: LFG

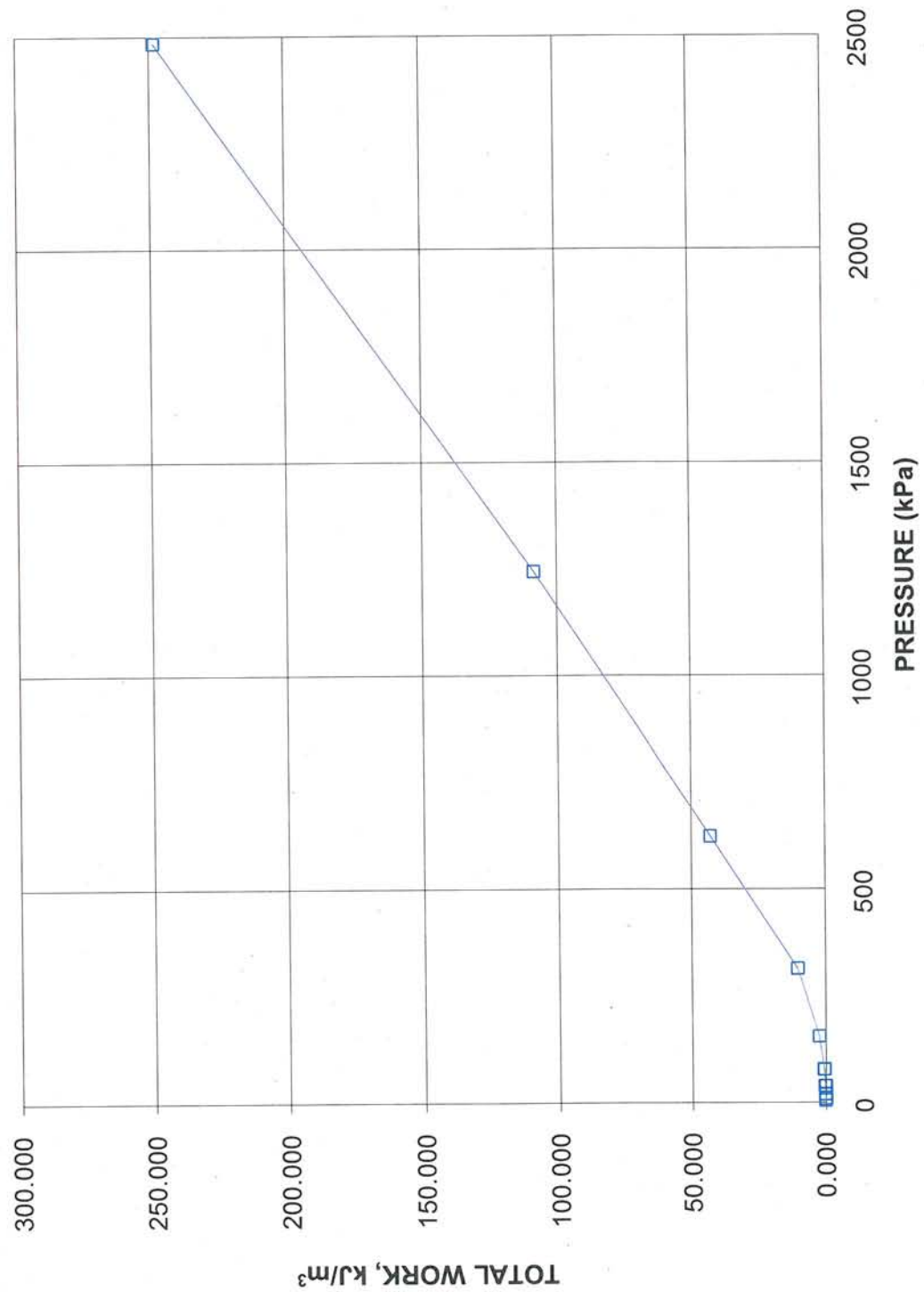
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# CONSOLIDATION TEST TOTAL WORK VS PRESSURE

FIGURE BH 345 SA 6 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 345 SA 6



# CONSOLIDATION TEST SUMMARY

FIGURE BH 345 SA 8 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	8
Borehole Number	345	Sample Depth, m	8.7-9.2

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	8		
Date Started	11/26/2009		
Date Completed	12/14/2009		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m <sup>3</sup>	19.42
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m <sup>3</sup>	15.04
Area, cm <sup>2</sup>	31.62	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	60.08	Solids Height, cm	1.071
Water Content, %	29.09	Volume of Solids, cm <sup>3</sup>	33.88
Wet Mass, g	118.94	Volume of Voids, cm <sup>3</sup>	26.20
Dry Mass, g	92.14	Degree of Saturation, %	102.3

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	1.900	0.773	1.900				
4.83	1.896	0.770	1.898				
9.56	1.888	0.762	1.892				
19.31	1.873	0.748	1.880				
38.68	1.858	0.734	1.865				
77.64	1.825	0.704	1.842	312	5.33E-04	4.36E-04	2.28E-08
154.90	1.774	0.656	1.800	30	5.29E-03	3.49E-04	1.81E-07
77.52	1.778	0.660	1.776				
19.31	1.800	0.680	1.789				
4.76	1.812	0.691	1.806				
9.47	1.810	0.689	1.811				
19.52	1.808	0.688	1.809				
38.74	1.801	0.681	1.804				
77.52	1.785	0.667	1.793	211	7.47E-04	2.08E-04	1.52E-08
155.03	1.765	0.648	1.775	117	1.32E-03	1.38E-04	1.78E-08
309.64	1.716	0.601	1.740	210	7.07E-04	1.69E-04	1.17E-08
618.32	1.654	0.544	1.685	150	9.27E-04	1.05E-04	9.56E-09
1237.69	1.586	0.480	1.620	120	1.07E-03	5.78E-05	6.07E-09
2476.60	1.519	0.418	1.552	81	1.46E-03	2.85E-05	4.07E-09
1237.69	1.530	0.428	1.524				
309.64	1.563	0.459	1.547				
77.52	1.609	0.502	1.586				
19.31	1.653	0.543	1.631				
4.83	1.679	0.567	1.666				

Note:

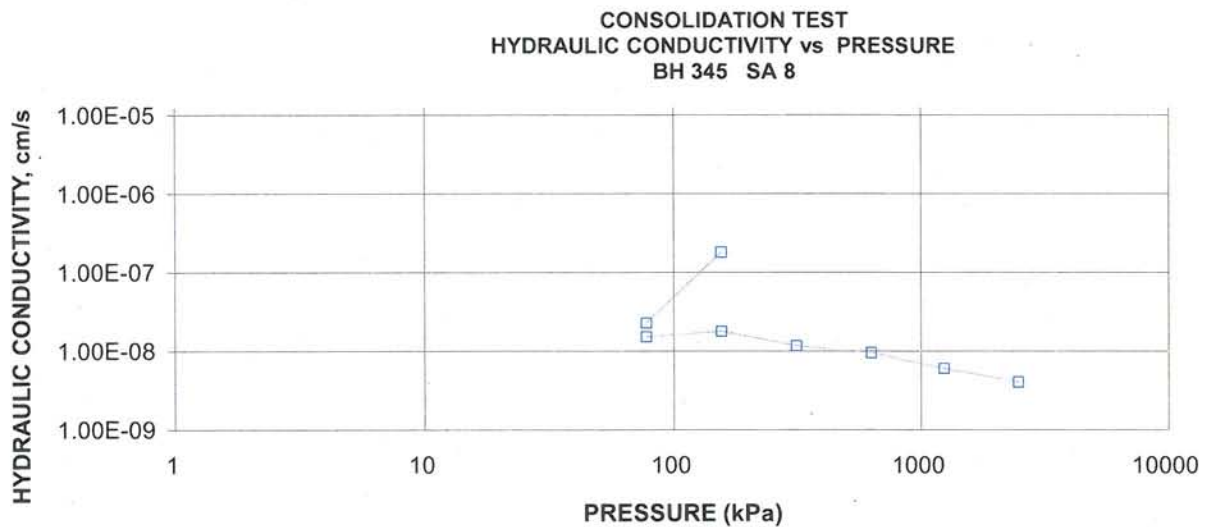
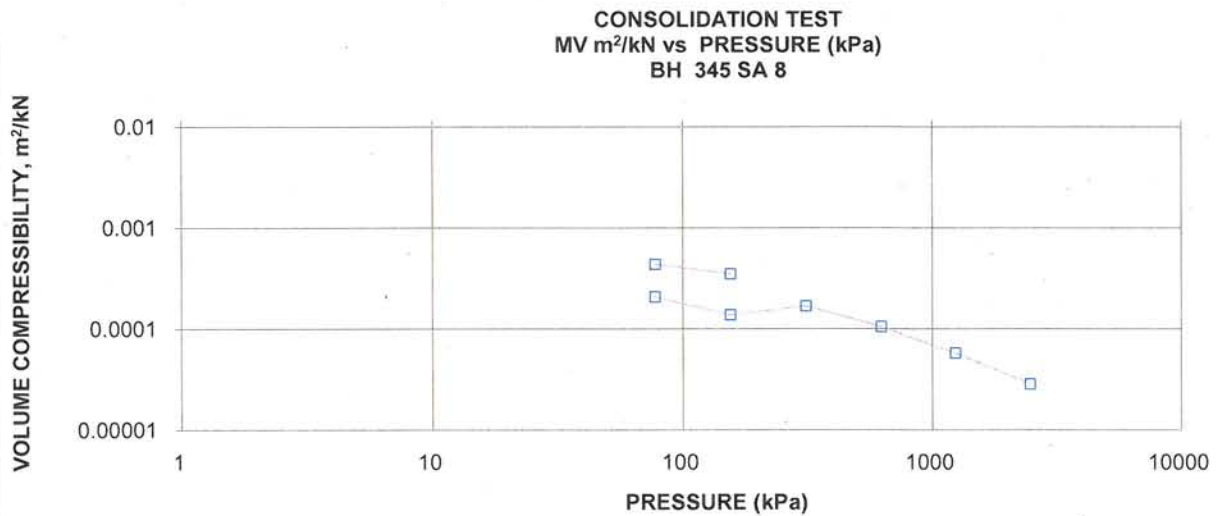
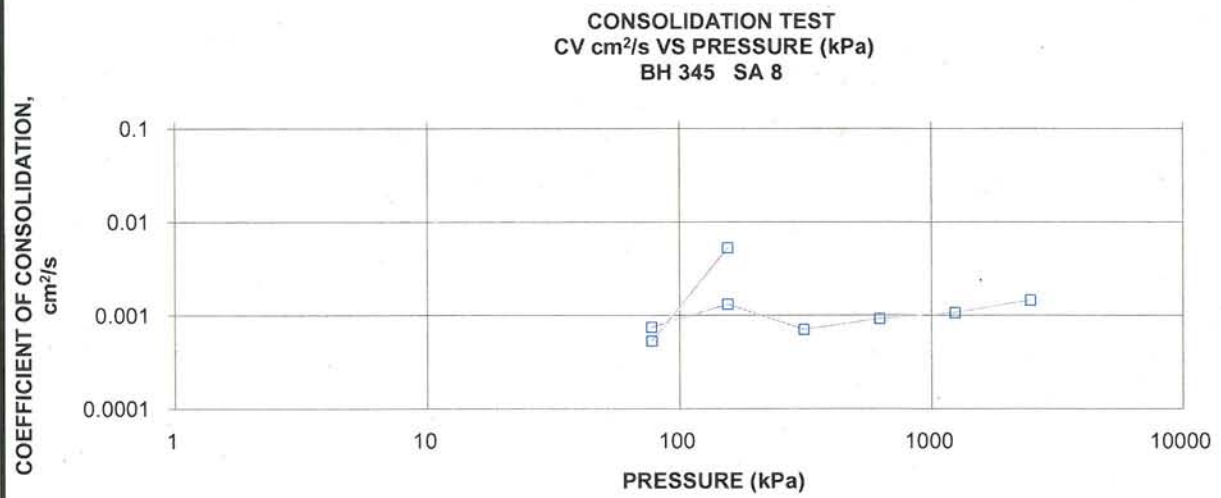
k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.68	Unit Weight, kN/m <sup>3</sup>	20.84
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m <sup>3</sup>	17.03
Area, cm <sup>2</sup>	31.62	Specific Gravity, measured	2.72
Volume, cm <sup>3</sup>	53.07	Solids Height, cm	1.071
Water Content, %	22.40	Volume of Solids, cm <sup>3</sup>	33.88
Wet Mass, g	112.78	Volume of Voids, cm <sup>3</sup>	19.20
Dry Mass, g	92.14		

# CONSOLIDATION TEST SUMMARY

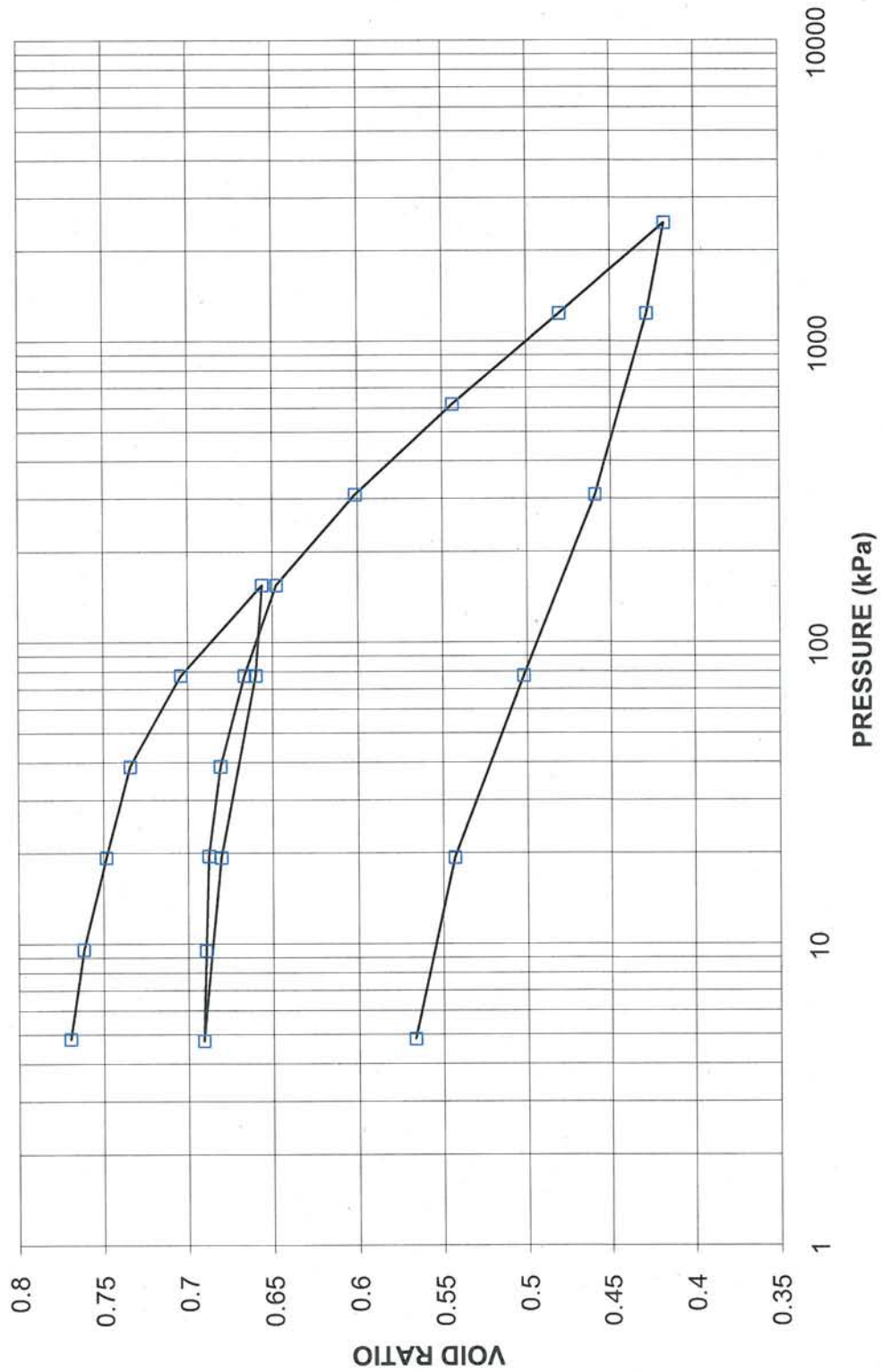
FIGURE BH 345 SA 8 OED B



**CONSOLIDATION TEST  
VOID RATIO VS LOG PRESSURE**

FIGURE BH 345 SA 8 OED C

CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 345 SA 8

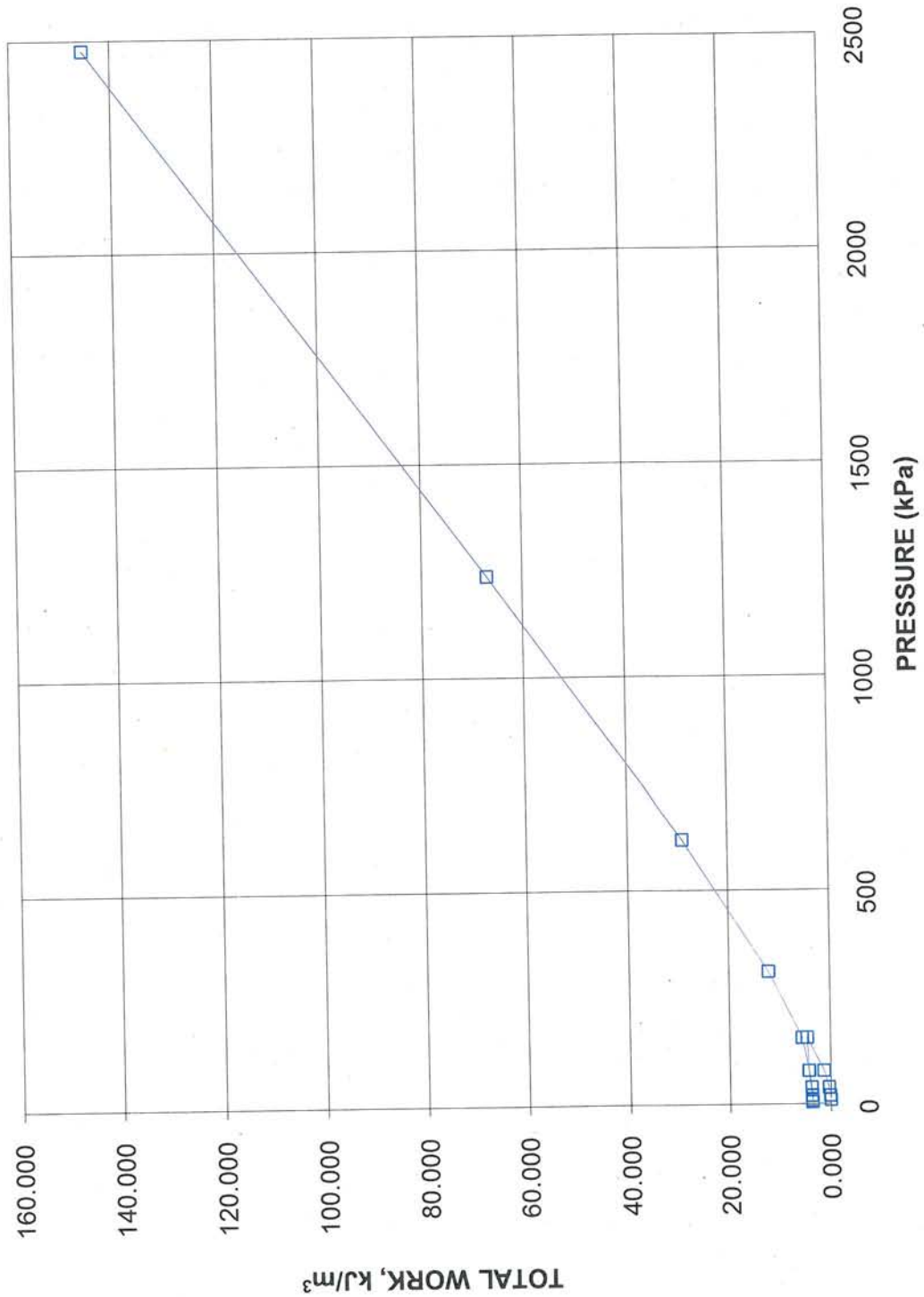




# CONSOLIDATION TEST TOTAL WORK VS PRESSURE

FIGURE BH 345 SA 8 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 345 SA 8



Project No. 09-1132-0080

Prepared By: LFG

Golder Associates

Checked By:

# CONSOLIDATION TEST SUMMARY

FIGURE BH 345 SA 10 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	10
Borehole Number	345	Sample Depth, m	11.7-12.2

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	2		
Date Started	11/27/2009		
Date Completed	12/15/2009		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.55	Unit Weight, kN/m <sup>3</sup>	19.21
Sample Diameter, cm	6.32	Drv Unit Weight, kN/m <sup>3</sup>	14.78
Area, cm <sup>2</sup>	31.37	Specific Gravity, measured	2.69
Volume, cm <sup>3</sup>	79.84	Solids Height, cm	1.426
Water Content, %	29.98	Volume of Solids, cm <sup>3</sup>	44.72
Wet Mass, g	156.37	Volume of Voids, cm <sup>3</sup>	35.12
Dry Mass, g	120.3	Degree of Saturation, %	102.7

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	2.545	0.785	2.545				
4.87	2.518	0.766	2.532				
9.77	2.509	0.760	2.513				
19.76	2.492	0.748	2.500				
39.25	2.444	0.714	2.468				
78.17	2.390	0.676	2.417	378	7.57E-04	5.47E-04	4.06E-08
159.54	2.323	0.630	2.356	240	1.13E-03	3.21E-04	3.57E-08
78.13	2.329	0.634	2.326				
19.68	2.349	0.648	2.339				
4.87	2.369	0.662	2.359				
9.59	2.365	0.659	2.367				
19.68	2.355	0.652	2.360				
39.25	2.351	0.649	2.353				
78.17	2.339	0.640	2.345	90	2.99E-03	1.23E-04	3.61E-08
156.25	2.312	0.622	2.325	84	3.15E-03	1.33E-04	4.12E-08
312.12	2.255	0.581	2.283	108	2.37E-03	1.45E-04	3.36E-08
624.17	2.178	0.528	2.216	96	2.51E-03	9.58E-05	2.35E-08
1246.60	2.096	0.470	2.137	54	4.14E-03	5.23E-05	2.13E-08
2495.09	2.006	0.407	2.051	42	4.91E-03	2.82E-05	1.35E-08
1246.60	2.016	0.414	2.011				
312.12	2.051	0.438	2.033				
78.13	2.100	0.473	2.075				
19.76	2.153	0.510	2.127				
4.87	2.190	0.536	2.172				

Note:

k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.19	Unit Weight, kN/m <sup>3</sup>	20.90
Sample Diameter, cm	6.32	Drv Unit Weight, kN/m <sup>3</sup>	17.17
Area, cm <sup>2</sup>	31.37	Specific Gravity, measured	2.69
Volume, cm <sup>3</sup>	68.70	Solids Height, cm	1.426
Water Content, %	21.70	Volume of Solids, cm <sup>3</sup>	44.72
Wet Mass, g	146.41	Volume of Voids, cm <sup>3</sup>	23.98
Dry Mass, g	120.3		

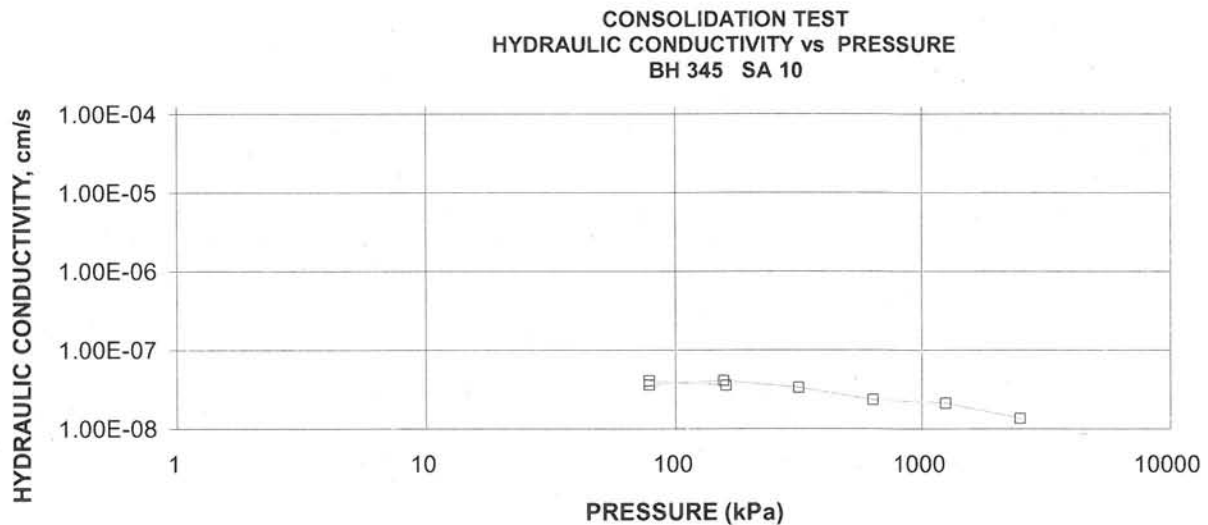
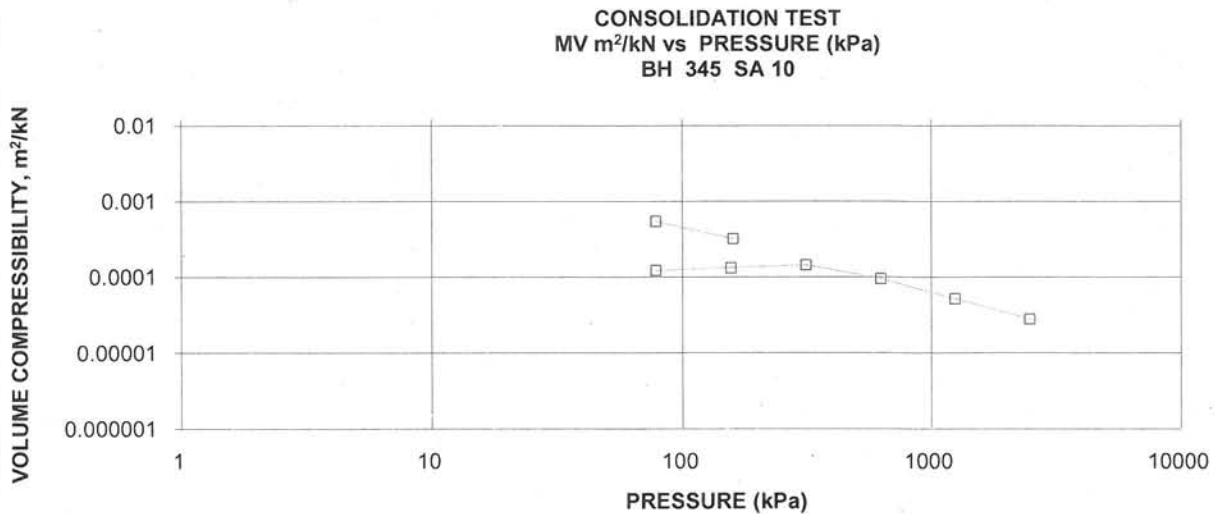
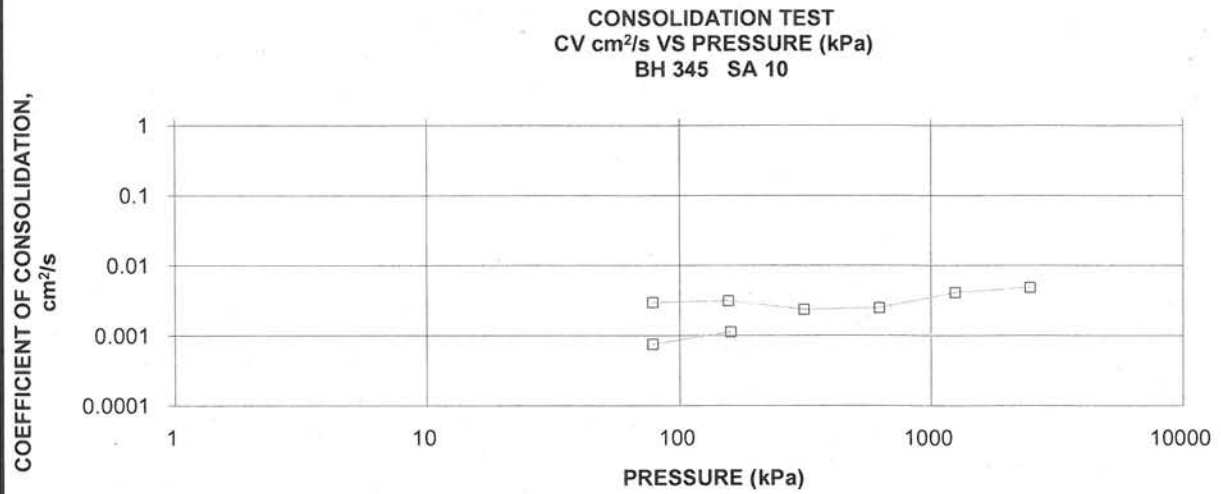
Prepared By: LFG

Golder Associates

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# CONSOLIDATION TEST SUMMARY

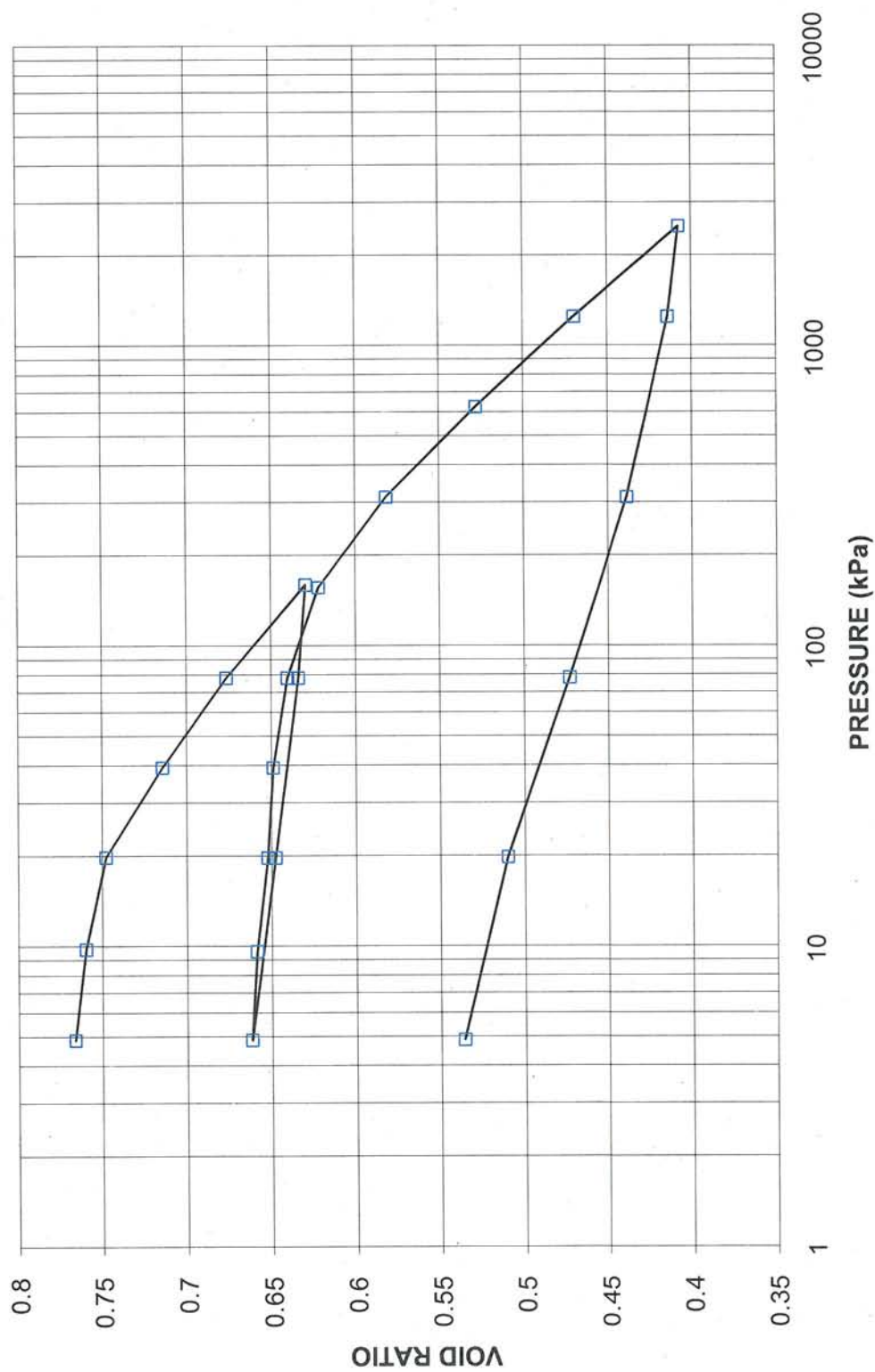
FIGURE BH 345 SA 10 OED B



# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 345 SA 10 OED C

CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 345 SA 10



Project No. 09-1132-0080

Prepared By: LFG

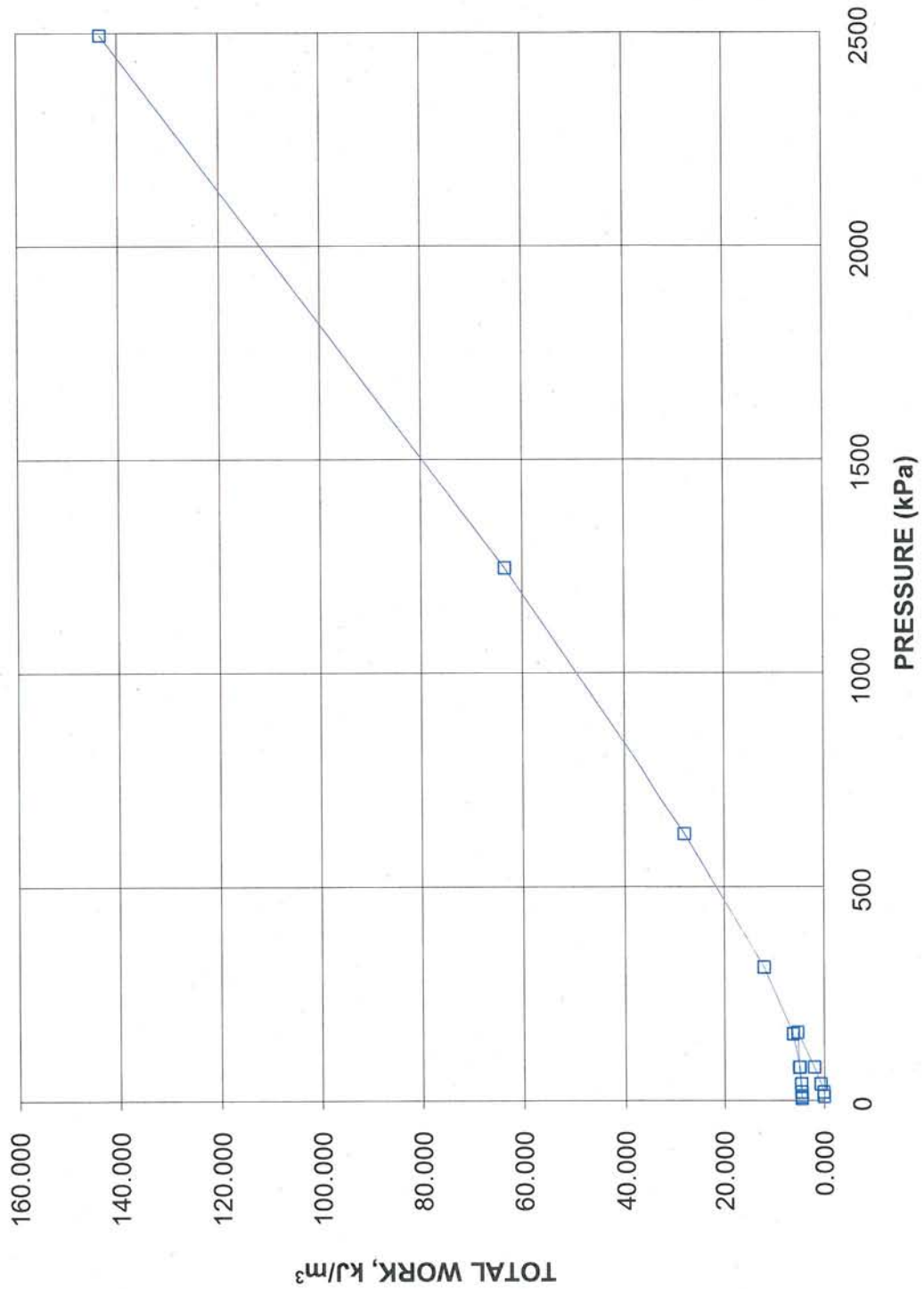
Golder Associates

Checked By:

# CONSOLIDATION TEST TOTAL WORK VS PRESSURE

FIGURE BH 345 SA 10 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 345 SA 10



Project No. 09-1132-0080

Prepared By: LFG

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# CONSOLIDATION TEST SUMMARY

FIGURE BH 345 SA 13 OED A

## SAMPLE IDENTIFICATION

Project Number	09-1132-0080	Sample Number	13
Borehole Number	345	Sample Depth, m	16.3-16.8

## TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	9		
Date Started	11/26/2009		
Date Completed	12/15/2009		

## SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m <sup>3</sup>	20.51
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m <sup>3</sup>	16.88
Area, cm <sup>2</sup>	31.47	Specific Gravity, measured	2.71
Volume, cm <sup>3</sup>	59.79	Solids Height, cm	1.207
Water Content, %	21.51	Volume of Solids, cm <sup>3</sup>	37.98
Wet Mass, g	125.06	Volume of Voids, cm <sup>3</sup>	21.82
Dry Mass, g	102.92	Degree of Saturation, %	101.5

## TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t <sub>50</sub> sec	cv, cm <sup>2</sup> /s	mv m <sup>2</sup> /kN	k cm/s
0.00	1.900	0.574	1.900				
4.72	1.867	0.547	1.884				
9.51	1.857	0.539	1.862				
19.37	1.837	0.522	1.847				
38.90	1.805	0.496	1.821				
77.84	1.769	0.466	1.787				
155.76	1.728	0.432	1.749	300	4.99E-04	2.77E-04	1.36E-08
311.35	1.687	0.398	1.707	168	8.50E-04	1.39E-04	1.16E-08
78.01	1.695	0.405	1.691				
19.37	1.710	0.417	1.703				
4.88	1.722	0.427	1.716				
9.51	1.721	0.426	1.722				
19.53	1.717	0.423	1.719				
38.93	1.712	0.419	1.715				
77.88	1.703	0.411	1.708				
155.64	1.694	0.404	1.699	48	2.95E-03	6.09E-05	1.76E-08
311.40	1.679	0.391	1.686	54	2.58E-03	5.10E-05	1.29E-08
622.63	1.639	0.358	1.659	111	1.21E-03	6.75E-05	8.03E-09
1244.76	1.592	0.319	1.616	66	1.94E-03	3.98E-05	7.55E-09
2488.08	1.542	0.278	1.567	42	2.86E-03	2.12E-05	5.95E-09
1244.76	1.550	0.284	1.546				
311.40	1.570	0.301	1.560				
77.88	1.596	0.323	1.583				
19.53	1.623	0.345	1.610				
4.72	1.641	0.360	1.632				

Note:

k calculated using cv based on t<sub>50</sub> values.

## SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.64	Unit Weight, kN/m <sup>3</sup>	22.46
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m <sup>3</sup>	19.54
Area, cm <sup>2</sup>	31.47	Specific Gravity, measured	2.71
Volume, cm <sup>3</sup>	51.64	Solids Height, cm	1.207
Water Content, %	14.94	Volume of Solids, cm <sup>3</sup>	37.98
Wet Mass, g	118.30	Volume of Voids, cm <sup>3</sup>	13.66
Dry Mass, g	102.92		

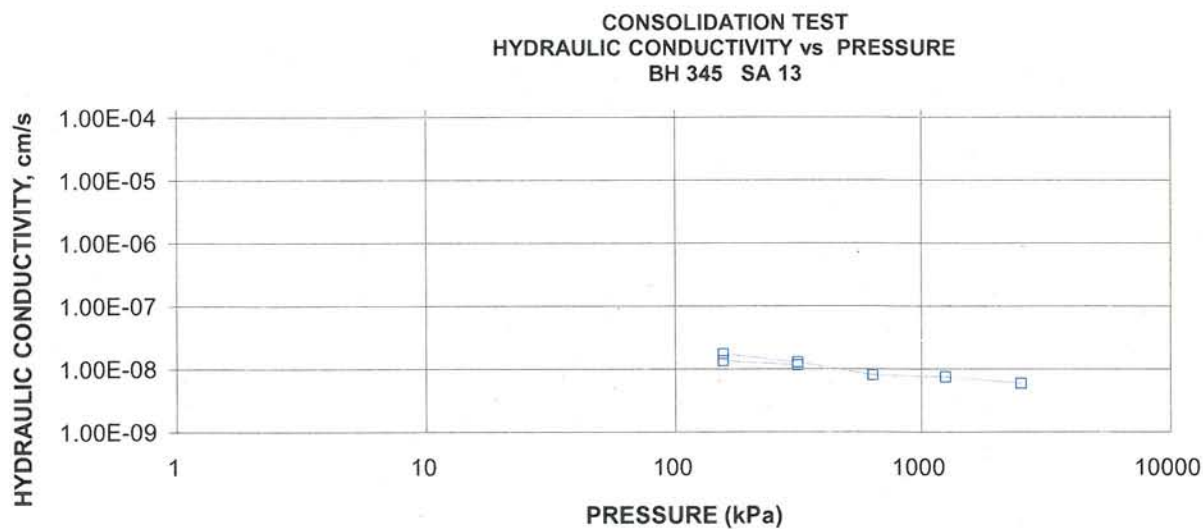
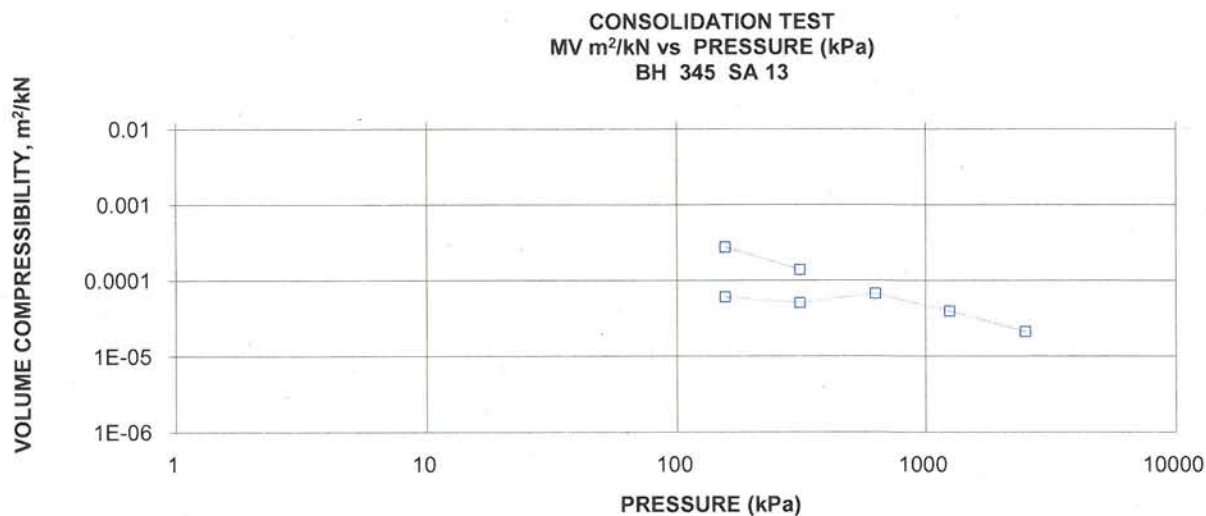
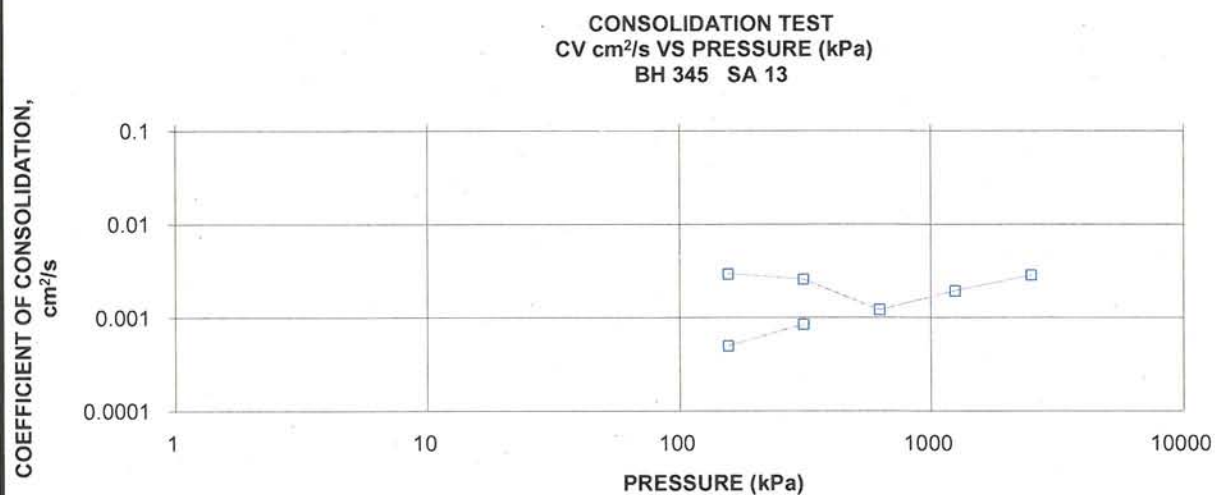
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# CONSOLIDATION TEST SUMMARY

FIGURE BH 345 SA 13 OED B

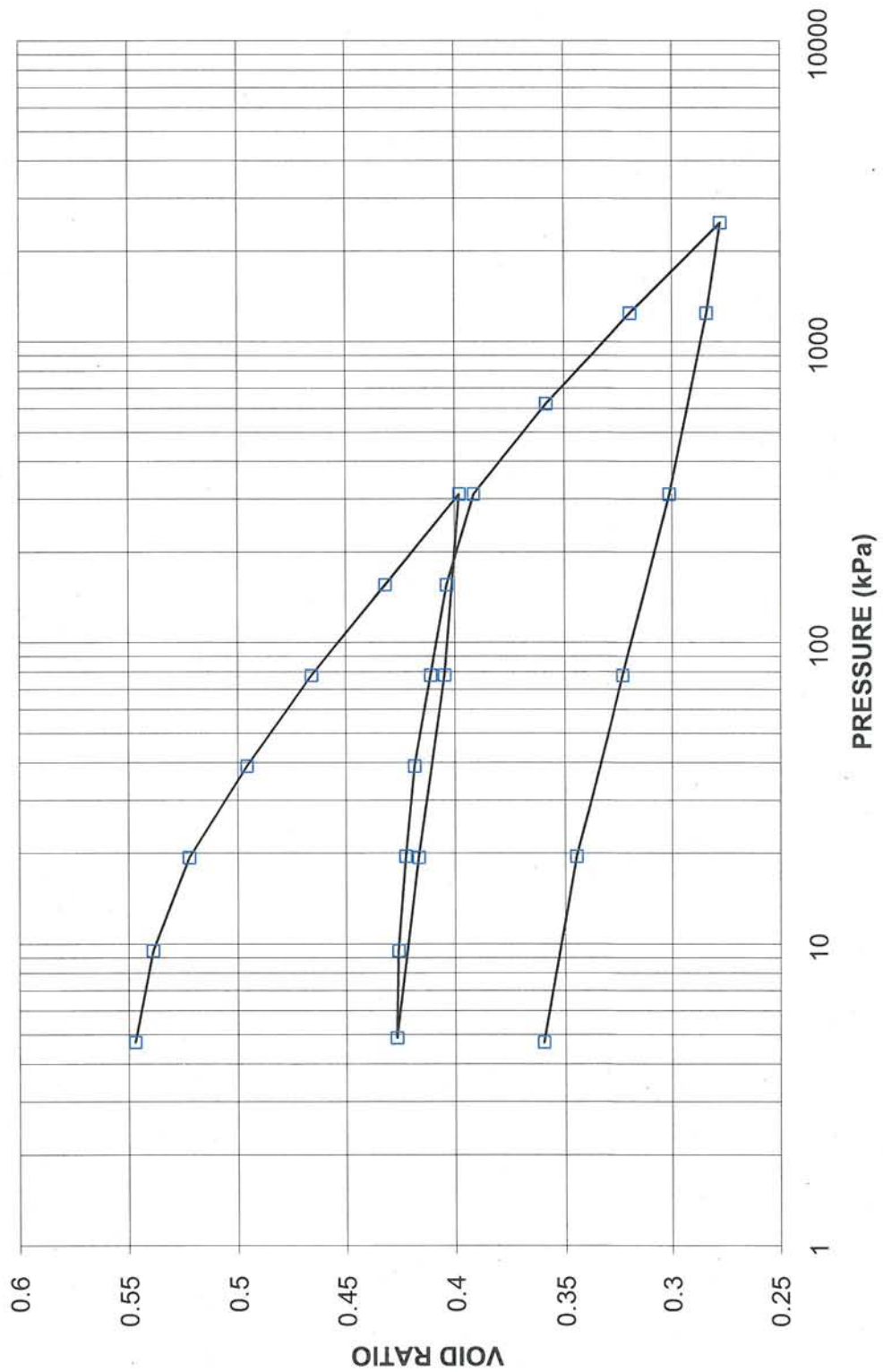




# CONSOLIDATION TEST VOID RATIO VS LOG PRESSURE

FIGURE BH 345 SA 13 OED C

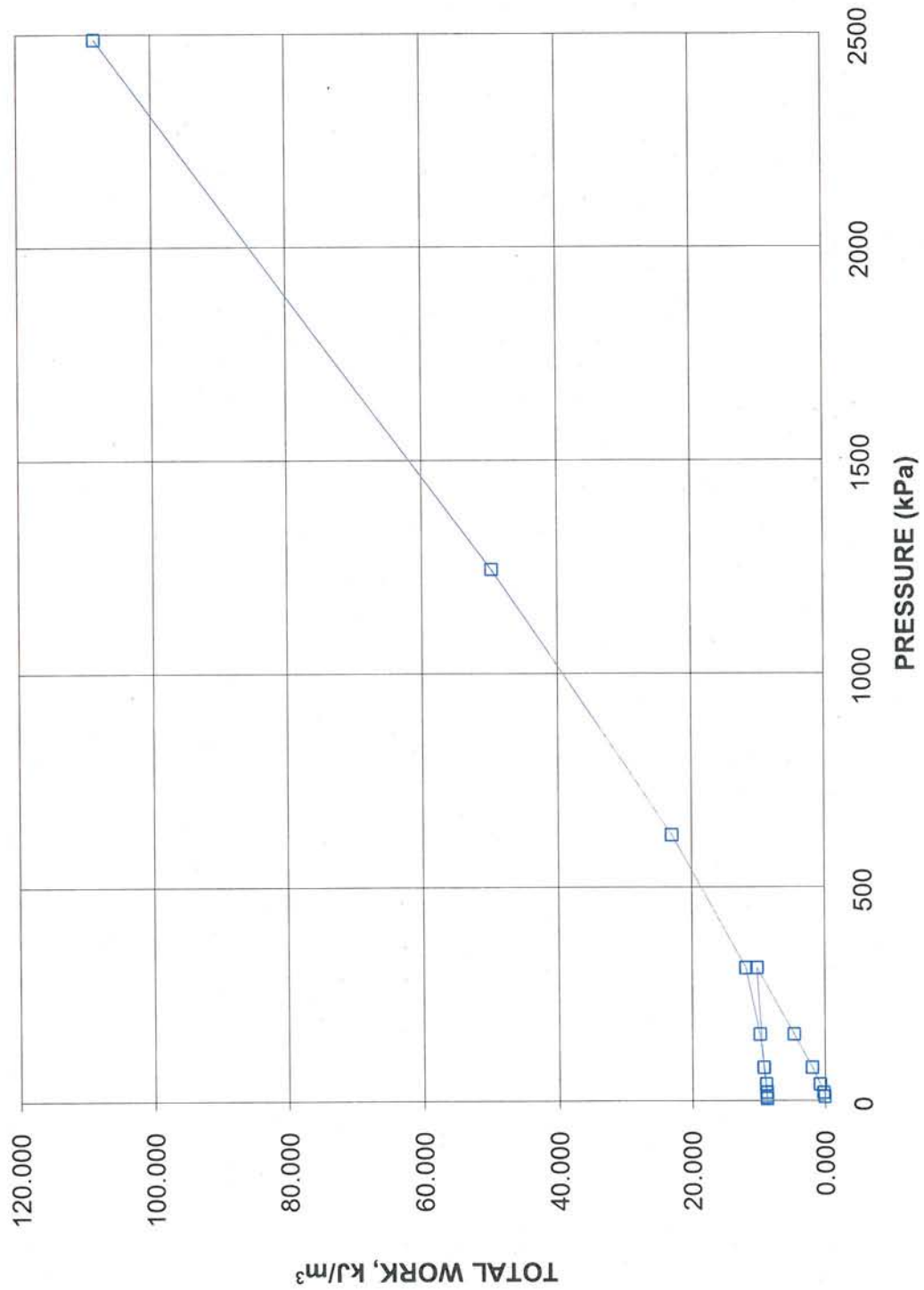
CONSOLIDATION TEST  
VOID RATIO vs PRESSURE  
BH 345 SA 13



# CONSOLIDATION TEST TOTAL WORK VS PRESSURE

FIGURE BH 345 SA 13 OED D

CONSOLIDATION TEST  
TOTAL WORK,  $\text{kJ/m}^3$  vs PRESSURE  
BH 345 SA 13



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