



October 31, 2013

FOUNDATION INVESTIGATION REPORT

**REPLACEMENT OF PRUNE CREEK BRIDGE
HIGHWAY 583, SITE NO. 39W-046
TOWNSHIP OF WAY, ONTARIO
MINISTRY OF TRANSPORTATION, ONTARIO
GWP 5149-06-00 WP 5484-09-01**

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REPORT





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PART A

FOUNDATION INVESTIGATION REPORT
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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by LEA Consulting Ltd. (LEA) on behalf of the Ministry of Transportation, Ontario (MTO) to provide detail foundation engineering services for the replacement of the Prune Creek Bridge (Site No. 39W-046), located on Highway 583 (south of Hearst, Ontario) in the Township of Way.

The purpose of this investigation is to establish the subsurface conditions at the location of the proposed replacement bridge structure, including the associated approach embankments, by borehole drilling, rock coring, in situ testing and laboratory testing on selected soil and rock core samples. The location of the investigation area is shown in plan on Drawings 1 and 4.

2.0 SITE DESCRIPTION

The Prune Creek Bridge site is situated in the Township of Way, on Highway 583 approximately 16.2 km south of the west junction of Highway 11 and Highway 583, in Hearst, Ontario. The surrounding land is generally flat, but slopes down towards the creek banks along the north and south sides of the creek, with nearby residential development and sparse tree covered terrain beyond the highway right-of-way limits. Immediately east and west of the existing bridge, the creek bends northerly. The creek banks in the area adjacent to the existing bridge are vegetated with landscaped grass and small shrubs. The creek flows in a westerly direction and is about 10 m wide at the existing bridge location. The creek meanders to the north immediately west of the existing bridge and runs essentially parallel to the highway at the west toe of slope.

The existing structure consists of an approximately 10 m wide by 33 m long, three-span bridge, constructed in 1962. The structure is founded on timber piles driven to unknown depths. The existing ground surface along the structure ranges from about Elevation 249.1 m to 248.9 m sloping downwards from south to north. The existing embankment front slopes are formed at approximately 2 horizontal to 1 vertical (2H:1V) on both the north and south sides of the creek. The existing embankment side slopes are generally about 2H:1V. There are no visible signs of approach embankment instability or settlement.

The water level shown on the GA drawing for November 2011 is at Elevation 244.8 m. The creek level measured by Golder during the field investigations, which took place in March to April and in December 2012, varied between Elevation 245.5 m and 247.6 m. The high water level is reported to be Elevation 247.3 m; however, a creek water level at Elevation 247.6 m was recorded on March 22, 2012 during the spring freshet. The existing highway embankment grade is about 4 m above the surrounding ground surface adjacent to the creek.

3.0 INVESTIGATION PROCEDURES

The fieldwork for this subsurface investigation was carried out on March 22, April 19 to 21 and December 6 to 12, 2012, at which time eight boreholes (Boreholes P1 to P8) were advanced. On June 4 2013, a supplementary borehole was advanced immediately adjacent to Borehole P8 to confirm the refusal condition encountered originally at a shallower depth. Boreholes P1 and P6 to P8/8A were advanced using a truck-mounted drill rig supplied and operated by Landcore Drilling Inc. of Sudbury, Ontario; whereas, Boreholes P2 to P5 were advanced using a D-25 semi-portable drill rig supplied and operated by Walker Drilling Ltd. of Barrie, Ontario. Boreholes P1, P2, P7 and P8/P8A were advanced approximately at the corners of the proposed north and south abutments of the bridge, which partially overlap the existing Highway 583 embankment.



Boreholes P3 and P6 were advanced along the proposed approach embankments. Boreholes P4 and P5 were advanced along the west toe of slope at the north approach on the alignment of an originally proposed retaining wall, where the existing creek meanders towards the existing roadway. The approximate locations of the Boreholes advanced as part of the field investigations are shown on Drawings 1 and 4.

Borehole P1 and P6 to P8/P8A were advanced using 108 mm ID continuous flight hollow stem augers and NW casing, while Boreholes P2 to P5 were advanced using NW casing and wash boring techniques. Where coring was required, a NQ size core barrel was used. Soil samples were obtained at intervals of depth of about 0.75 m to 1.5 m, using a 50 mm outer diameter (O.D.) split-spoon sampler (operated by an automatic hammer on the drill rig), in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586). Boreholes advanced by semi-portable equipment employed full weight hammers lifted manual and dropped from the SPT height. Selected samples of the cohesive soils were obtained using 76 mm O.D. thin-walled 'Shelby' tubes (ASTM D1587, Thin-Walled Tube Sampling) for relatively undisturbed samples. Field vane shear tests were carried out in cohesive soils for determination of undrained shear strengths (ASTM D2573, Field Vane Strength Shear Test) using MTO Standard "N" size vanes. All open boreholes were backfilled upon completion in accordance with Ontario Regulation 903 Wells (as amended).

A supplemental investigation consisting of two test pits (TP1 and TP2) was carried out on September 25, 2013 to obtain soil samples in chemical characterization for soil disposal purposes. The test pits were advanced using a Komatsu 228 excavator operated by Villeneuve Construction Co. Ltd. of Hearst, Ontario. Test pits TP1 and TP2 were located on the west bank of the existing creek alignment where the creek meanders towards the north parallel to the existing highway embankment, as shown on Drawing 4.

The groundwater conditions were observed in the open boreholes and test pits during and immediately following the drilling/excavation operations and a standpipe piezometer was installed in each of Boreholes P1 and P2 to permit monitoring of the groundwater level. The piezometers consist of a 50 mm diameter PVC pipe, with a 3 m long slotted screen sealed within a sand filter pack at a selected depth interval within the boreholes. Above the sand filter pack and piezometer screen, the annulus surrounding the piezometer pipe was partially backfilled with bentonite pellets to create a seal, then backfilled to near surface with a mixture of cuttings from the boreholes and bentonite. A seal of bentonite was placed to ground surface. The piezometer installation details and water level readings are indicated on the borehole records contained in Appendix A. The piezometers were decommissioned on June 4 and June 5, 2013.

The fieldwork was supervised on a full-time basis by a member of Golder's technical staff who located the boreholes/test pits in the field, arranged for the clearance of underground service locations, directed the drilling/excavation, sampling and in situ testing operations and logged the boreholes/test pits. The soil samples were identified in the field, placed in labelled containers and transported to Golder's laboratory in Sudbury for further examination and laboratory testing. Index and classification tests consisting of water content, organic content, Atterberg limits and grain size distribution were carried out on selected soil samples. In addition, a one-dimensional consolidation (oedometer) test was carried out on one sample of the silty clay to clay deposit. Uniaxial compressive strength (UCS) testing was carried out on specimens of the recovered bedrock core. The geotechnical laboratory testing was completed according to applicable MTO LS standards. The results of the laboratory testing are shown on the Record of Borehole and Drillhole sheets in Appendix A and on the figures contained in Appendix B.

A sample of the creek water was obtained during the borehole investigation using appropriate sampling protocols and submitted to a specialist analytical laboratory under chain of custody procedures for testing for a



suite of inorganic parameters including: resistivity/conductivity; pH; sulphate; and chloride. The results of the analytical testing are summarized in Table C1 in Appendix C.

During the supplemental test pit investigation, soil samples were obtained from each soil horizon, field screened for evidence of potential petroleum impacts (head space readings) and immediately placed into laboratory-supplied jars and vials. One soil sample from each test pit, which indicated the highest head space readings for hydrocarbons, was submitted to a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory under change of custody procedures for analysis of a suite of parameters for soil disposal purposes, namely: benzene, toluene, ethylbenzene and xylenes (BTEX); petroleum hydrocarbon fractions F₁ to F₄ (PHC F₁-F₄); metals, chloride and sodium and toxicity leachate characterization procedure (TCLP). The results of the analytical testing are included in Appendix C.

The borehole and test pit locations and elevations were measured in the field by Golder personnel relative to existing site features and surveyed to an existing temporary benchmark. The borehole and test pit locations (referenced to the MTM NAD83 co-ordinate system), ground surface elevations (referenced to Geodetic datum) and depths are shown on Drawings 1 and 4 and presented on the Record of Borehole and Test Pit sheets in Appendix A and are summarized below.

Borehole Number	MTM NAD83 Northing (m)	MTM NAD83 Easting (m)	Ground Surface Elevation (m)	Borehole/Test Pit Depth (m)
P1	5495077.0	323212.5	249.1	17.4
P2	5495106.2	323199.2	245.7	18.3
P3	5495124.1	323197.4	246.7	9.8
P4	5495150.0	323194.7	245.6	8.2
P5	5495168.9	323192.7	246.4	8.1
P6	5495061.1	323209.9	249.1	11.3
P7	5495080.2	323201.7	248.0	15.4
P8/8A	5495112.1	323211.7	248.8	19.8
TP1	5495134.0	323187.0	245.8	3.7
TP2	5495143.9	323185.4	245.6	3.7

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

Based on NOEGTS¹ Mapping, the subsoils in the vicinity of the Prune Creek Bridge site generally consist of clayey till deposited as a ground moraine. A bedrock plain is located about 40 m south of the bridge site and an area of peat/organics is located about 100 m north of the bridge site.

Published literature indicates that the site is located in the Quetico Subprovince of the Superior Province (OGS, 1991)². The bedrock of this domain consists of muscovite-bearing granitic rocks (peraluminous), and

¹ Northern Ontario Engineering Geology Terrain Study, Ontario Geological Society Map Reference Number 42GNW.

² Ontario Geological Survey, Geology of Ontario, 1991. , Special Volume 4, Part 1. Eds P.C. Thurston, H.R. Williams, R.H. Sutcliffe and G.M. Stott, Ministry of Northern Development and Mines, Ontario.



may include biotite granite. Beyond the muscovite-bearing granitic boundary, bedrock consists of meta-sedimentary rocks.

4.2 Subsurface Conditions

The borehole/test pit locations, ground surface elevations and interpreted stratigraphic conditions at the site are shown on Drawings 1 to 4. The detailed subsurface soil and groundwater conditions encountered in the boreholes/test pits and the results of in situ and laboratory testing are given on the Record of Borehole, Drillhole and Test Pit sheets contained in Appendix A. The results of geotechnical laboratory testing are also presented on Figures B1 to B10 and photographs of the bedrock core are shown on Figure B11, contained in Appendix B. The stratigraphic boundaries shown on the borehole/test pit records and on the interpreted stratigraphic profiles on Drawings 1 to 4 are inferred from non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. The subsoil conditions will vary between and beyond the borehole locations.

In summary, the subsoil conditions encountered at the site generally consist of embankment fill and/or peat, overlying a soft to stiff deposit of silty clay to clay. The upper cohesive deposit is underlain by a very loose to compact deposit of sandy silt to sand and silt till and a hard deposit of sandy clayey silt to clayey silt till. A more detailed description of the soil deposits encountered in these boreholes is provided in Sections 4.2.1 to 4.2.8.

4.2.1 Asphalt Surface Treatment

A 150 mm to 200 mm thick layer of asphalt surface treatment material was encountered from ground surface (Elevation 249.1 m to 248.8 m) in Boreholes P1, P6 and P8, which were advanced through the existing Highway 583.

4.2.2 Fill

Embankment fill consisting of granular material and/or cohesive soil fill was encountered underlying the asphalt surface treatment layer in Boreholes P1, P6 and P8/8A and at ground surface in Borehole P4. The total thickness of fill below the existing roadway surface layer is between 2.1 m and 2.8 m and the top of the fill is between about Elevation 248.9 m and 248.6 m. Borehole P4, which was advanced at the northwest toe of slope where the creek meanders towards the roadway, encountered fibrous peat fill and granular fill from ground surface, at Elevation 245.6 m. The total thickness of the fill at the northwest toe of slope in Borehole P4 is 1.5 m, comprised of a 0.6 m thick layer of peat and a 0.9 m thick layer of silty sand.

The granular fill under the roadway surface layer consists of moist to wet, brown silty sand, sand or sand and gravel to sand, trace to some silt. The Standard Penetration Test (SPT) "N"-values measured within the granular fill range from 5 blows to 23 blows per 0.3 m of penetration indicating a loose to compact relative density.

The natural moisture content measured on two samples of the granular fill is 3 per cent and 4 per cent.

The cohesive fill is comprised of moist, brown clayey silt, trace to some gravel, trace organics. The SPT "N"-values measured within the clayey silt fill are 13 blows and 21 blows per 0.3 m suggesting a stiff to very stiff consistency



A grain size distribution test completed on one selected sample of the cohesive fill is shown on Figure B1 in Appendix B. The results of an Atterberg limits test completed on the same sample of the cohesive fill yielded a liquid limit of about 24 per cent, a plastic limit of about 16 per cent and a corresponding plastic index of 8 per cent, as shown on Figure B2 in Appendix B, and indicates that the material is a clayey silt of low plasticity.

The natural moisture content measured on one sample of the cohesive fill is 11 per cent.

4.2.3 Silty Peat to Peat

A 0.6 m to 2.3 m thick deposit of moist to wet, brown to black, amorphous or fibrous silty peat to peat some silt was encountered from ground surface, between Elevations 248.0 m and 245.6 m in Boreholes P2, P3, P5 and P7 and Test Pits TP1 and TP2.

The SPT “N”-values measured within the peat to silty peat deposit range from 3 blows to 6 blows per 0.3 m of penetration, suggesting a soft to firm consistency.

The natural moisture content measured on one sample of the silty peat is 47 per cent.

4.2.4 Silty Clay to Clay

A 1.8 m to 5.0 m thick deposit of wet brown to grey silty clay to clay, trace to some sand, trace to some gravel, trace to some organics was encountered below the fill in Borehole P1, P4, P6 and P8/8A and below the peat deposit in Boreholes P2, P3, P5 and P7 where the deposit was fully penetrated. In Test Pits TP1 and TP2, where the silty clay to clay deposit was not fully penetrated, the deposit is up to 3.7 m thick. The surface of the deposit was encountered at depths between 0.6 m and 3.0 m below ground surface, between Elevations 247.2 m and 244.1 m.

The SPT “N”-values measured within the silty clay to clay deposit range from 0 blows (i.e. weight of hammer) to 12 blows per 0.3 m of penetration and indicate a very soft to stiff consistency. The higher “N”-values were encountered near the surface of the deposit (i.e. directly beneath the fill) or at the bottom of the deposit (directly over the sandy silt to sand and silt till deposit). In situ field vane tests within the silty clay to clay deposit measured undrained shear strengths ranging from 19 kPa to 30 kPa, indicating a soft to firm consistency. The in situ vane test results, together with the SPT “N”-values excluding those within the upper or lower portions of the deposit, suggest that the silty clay to clay deposit generally has a soft to firm consistency.

The natural moisture content measured on twenty-three samples of the silty clay to clay deposit ranges from 22 per cent to 79 per cent. The natural moisture content measured on one sample of the clayey silt portion of the deposit is 19 per cent.

The results of grain size distribution tests completed on nine selected samples of the silty clay to clay deposit are shown on Figure B3 in Appendix B. It should be noted that Sample 6 from Borehole P2, taken across the silty clay to clay deposit and the underlying sandy silt to sand and silt till deposit, returned a grain size distribution similar to that of the underlying sandy silt to sand and silt till deposit and it is considered that this test result was influenced by the composition of the underlying deposit.

Atterberg limits tests were carried out on nineteen selected samples of the cohesive deposit, eighteen of which returned liquid limits ranging from about 38 per cent to 82 per cent, plastic limits ranging from about 18 per cent to 36 per cent and plasticity indices ranging from about 20 per cent to 46 per cent, indicating a silty clay to clay



of intermediate to high plasticity as shown on Figure B4 in Appendix B. The Atterberg limits test on Sample 6 from Borehole P2, near the transition zone with the underlying till deposit, returned a liquid limit of about 22 per cent, a plastic limit of about 13 per cent and a plasticity index of about 9 per cent, indicating a clayey silt of low plasticity.

A laboratory consolidation test was carried out on one sample of the silty clay to clay deposit obtained from a Shelby tube sample in Borehole P7. A preconsolidation stress of about 80 kPa was estimated from the void ratio versus logarithmic pressure plot and from the total work versus pressure plot. A bulk unit weight of about 15.9 kN/m^3 and a specific gravity of about 2.74 were measured on the consolidation test sample. Details of the test results are shown on Figure B5 in Appendix B, and the test results are summarized below.

Borehole/ Sample No.	Sample Depth/ Elevation	σ_{vo}' (kPa)	σ_p' (kPa)	$\sigma_p' - \sigma_{vo}'$ (kPa)	OCR	C_c	C_r	e_o	c_v^* (cm^2/s)
Borehole P7/ Sample 4	3.4 m/ 244.7 m	32	80	48	2.5	0.78	0.069	1.88	1.5×10^{-3}

Note: For the overly consolidated stress range, $13 \text{ kPa} \leq \sigma_v' \leq 31 \text{ kPa}$
 where: σ_{vo}' is the in situ vertical effective overburden stress in kPa
 σ_p' is the preconsolidation stress in kPa
 OCR is over consolidation ratio
 e_o is initial void ratio
 C_c is the compression index
 C_r is the recompression index
 c_v is the coefficient of consolidation in cm^2/s

4.2.5 Sand and Gravel and Sand

A 1.0 m thick deposit of wet, brown sand and gravel and a 1.3 m thick deposit of wet, brown/grey sand some gravel trace to some silt was encountered below the cohesive deposit in Boreholes P3 and P7, respectively. The surface of these deposits was encountered at depths of 4.1 m and 5.8 m below ground surface, corresponding to Elevation 242.6 m and Elevation 242.2 m in the respective boreholes.

The SPT "N"-values measured within the sand to sand and gravel deposit are 10 blows and 16 blows per 0.3 m of penetration, indicating a compact relative density.

The natural moisture content measured on one sample of the sand deposit is 17 per cent.

The result of a grain size distribution test completed on one selected sample of the sand deposit is shown on Figure B6 in Appendix B.

4.2.6 Sandy Silt to Sand and Silt (Till)

A till deposit comprised of moist to wet, brown to grey sandy silt to sand and silt, trace to some gravel, trace to some clay was encountered below the silty clay to clay deposit in Boreholes P1, P2, P4 to P6 and P8 and below the sand and gravel and the sand deposits in Boreholes P3 and P7. The surface of this deposit was encountered at depths between 4.4 m and 7.6 m below ground surface, between Elevations 243.0 and 240.9 m. The deposit is between 1.6 and 3.9 m thick where it was fully penetrated in Boreholes P1 to P3, P7 and P8. In boreholes P4 to P6, where the boreholes were terminated within this deposit, the deposit is up to 5.2 m thick.



The SPT “N”-values measured within the sandy silt to sand and silt till deposit range from 0 blows (i.e. weight of hammer) to 237 blows per 0.3 m of penetration and indicate that the deposit is generally very loose to loose in the upper 2 m to 3 m becoming compact to very dense with depth.

The natural moisture content measured on eleven samples of the sandy silt to sand and silt till deposit range from 9 per cent to 18 per cent. In general, the upper very loose to loose portion of the deposit was wet, while the lower compact to dense portion of the deposit was moist.

The results of grain size distribution tests completed on eight selected samples of the sandy silt to sand and silt till deposit are shown on Figure B7 in Appendix B.

Atterberg limits tests were carried out on seven selected samples of the deposit, three of which classify the material as non-plastic. The results of the remaining four Atterberg limits tests yielded liquid limits ranging from about 15 per cent to 17 per cent, plastic limits ranging from about 12 per cent to 13 per cent and plasticity indices ranging from 2 per cent to 4 per cent, as shown on Figure B8 in Appendix B, and indicate that the material is classified as silt of slight plasticity.

4.2.7 Sandy Clayey Silt to Clayey Silt (Till)

A till deposit comprised of moist to dry, grey sandy clayey silt to clayey silt, trace to some gravel was encountered below the sandy silt to sand and silt till deposit in Boreholes P1 to P3, P7 and P8/8A. The surface of the deposit was encountered at depths between 7.6 m and 10.2 m below ground surface, between Elevations 239.3 m and 237.0 m. The deposit is 6.6 m thick where it was fully penetrated in Boreholes P2 and up to 7.2 m thick in Boreholes P1 to P3 and P8/8A, which were terminated within this deposit.

SPT “N”-values measured within this deposit range from 43 blows to 155 blows per 0.3 m of penetration suggesting a hard consistency. In seven instances, the split-spoon sampler did not penetrate the full sample depth due to the presence of inferred gravel/cobbles. In eight instances, NQ coring was required to advance the boreholes through the deposit. Grinding of the augers and/or casing was noted throughout this deposit in Boreholes P1 and P2.

At the north abutment in Borehole P2, cobbles were encountered at a depth of 11.6 m below ground surface corresponding to Elevation 234.1 m. At the south abutment in Boreholes P7 and P1, a 2.7 m thick zone of coarse gravel and cobbles was encountered between 9.8 m and 12.5 m depth (Elevation 238.2 m to 235.5 m) and a 1.4 m thick zone was encountered between 15.4 m and 16.0 m depth (Elevation 233.7 m and 233.1 m), in the respective boreholes.

The natural moisture content measured on nine samples of the sandy clayey silt to clayey silt till deposit range from 8 per cent to 11 per cent.

The results of grain size distribution tests completed on six selected samples of the sandy clayey silt to clayey silt till are show on Figure B9 in Appendix B.

Atterberg limits tests, carried out on six selected samples, yielded liquid limits ranging from about 18 per cent to 21 per cent, plastic limits ranging from about 11 per cent to 12 per cent and plasticity indices ranging from about 6 per cent to 10 per cent, as shown in Figure B10 in Appendix B. These test results indicate that the material is classified as clayey silt of low plasticity.



4.2.8 Refusal/Bedrock

Refusal to further split spoon advancement was recorded in Borehole P7 at a depth of about 15.4 m below ground surface, Elevation 232.6 m. The bedrock surface was encountered in Borehole P2 and P8/8A at depths of 15.3 m and 16.6 m below ground surface, respectively, corresponding to Elevations 230.4 m and 232.2 m. The bedrock was cored for lengths of 3.0 m and 3.2 m in the respective boreholes. The retrieved bedrock core is described as fine grained, slightly to moderately weathered, grey, gneiss. In Borehole P2, a 100 mm thick vein of white quartz was noted within the core at a depth of 16.1 m below ground surface (Elevation 229.6 m) and a 200 mm thick mica schistose zone was noted at a depth of 16.3 m below ground surface (Elevation 229.3 m). In Borehole P8/8A, a 400 mm thick quartz vein was encountered at a depth of 19.4 m below ground surface (Elevation 229.4 m). Photographs of the retrieved bedrock core are shown on Figure B11 in Appendix B.

The Total Core Recovery (TCR) from Boreholes P2 and P8/8A is 100 per cent. The Rock Quality Designation (RQD) measured on the core runs is 79 per cent to 31 per cent, indicating a rock mass of poor to good quality as per Table 3.10 of the Canadian Foundation Engineering Manual (CFEM, 2006)³.

Laboratory Uniaxial Compression Strength (UCS) testing was carried out on two core samples of the bedrock from Borehole P2. The UCS values are presented on the Record of Drillhole sheet in Appendix A and summarized below. The bedrock is considered to be strong as per Table 3.5 of CFEM (2006)³.

Borehole	Elevation (m)	UCS (MPa)
P2	230.2	60
P2	229.1	77

4.3 Groundwater Conditions

Groundwater levels were measured in the open boreholes and test pits during and upon completion of drilling/excavation and a piezometer was installed in each of Boreholes P1 and P2 to monitor the groundwater levels. The piezometers are sealed within the sandy silty clay to clay and silty peat deposits in the respective boreholes. Details of the piezometer installations and water level readings are presented on the Record of Borehole sheets in Appendix A. The piezometers were decommissioned on June 4 and June 5, 2013.

The measured groundwater levels in the open boreholes, test pits and piezometers are presented below.

Borehole	Installation	Time and/or Date	Groundwater Depth (m)	Groundwater Elevation (m)
P1	Open Borehole	March 22, 2012	2.3	246.8
	Piezometer	April 20, 2012	1.8	247.3
		December 6, 2012	2.4	246.7
		June 5, 2013	1.8	247.3

³ Canadian Geotechnical Society 2006. Canadian Foundation Engineering Manual, 4th Edition, BiTech Publications.



Borehole	Installation	Time and/or Date	Groundwater Depth (m)	Groundwater Elevation (m)
P2	Open Borehole	April 20, 2012	0.4	245.3
	Piezometer	December 6, 2012	0.2	245.5
		June 4, 2013	0.0	245.7
P3	Open Borehole	April 20, 2012	0.7	246.0
P4	Open Borehole	April 21, 2012	0.8	244.8
P5	Open Borehole	April 21, 2012	1.2	245.2
P6	Open Borehole	December 6, 2012	2.4	246.7
P7	Open Borehole	December 9, 2012	1.5	246.5
P8/8A	Open Borehole	December 12, 2012	6.2	242.6
TP1	Open Test Pit	September 25, 2013	Dry	-
TP2	Open Test Pit	September 25, 2013	3.7	241.9

Groundwater levels encountered in the boreholes/test pits during and shortly after drilling/excavating may not be representative of static groundwater levels since the groundwater levels in the boreholes may not have stabilized. Groundwater and creek water levels in the area are subject to seasonal fluctuations and to fluctuations after precipitation events and snowmelt.

The water level shown on the GA drawing for November 2011 is at Elevation 244.8 m. The high water level is reported to be at Elevation 247.3 m. During the preliminary field investigation, the water level in Prune Creek was measured at Elevation 247.3 m on March 20, 2012, and due to the spring freshet, the creek level rose to Elevation 247.6 m as measured on March 22, 2012. The creek level was measured at Elevation 245.1 m between April 17 and 21, 2012, and on December 9, 2012. The creek level was measured at Elevation 245.7 m on June 4, 2013 when the piezometers were decommissioned.

4.4 Analytical Testing

The analytical test results on a sample of creek water are presented in Table C1 in Appendix C. The creek water was tested for suite of parameters including: resistivity/conductivity; pH; sulphate; and chloride.

The analytical test results on two soil samples, which indicated the highest head space readings for hydrocarbons from the test pit investigation, are also presented in Appendix C. The results of the analytical laboratory testing of the soil samples indicate the following:

- BTEX and F₁-F₄ fractions are below the method detection limits;
- The concentration of the metals are lower than the MOE Generic Site Conditions Standards Table 1 (Full Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use) as outlined in the Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act (April 15, 2011); and



- TCLP sample concentrations are lower than O. Reg 558 – Schedule 4 (Leachate Quality Criteria) levels.

5.0 CLOSURE

The field drilling program was supervised by Mr. Indulis Dumpis, Mr. Ed Savard and Mr. Shane Albert. This Foundation Investigation Report was prepared by Mr. David Muldowney, P.Eng. and reviewed by Ms. Sarah Coyne, P.Eng., a geotechnical engineer and Associate. Mr. Jorge Costa, P.Eng., a Designated MTO Foundations Contact and Principal with Golder, conducted an independent quality control review of this report.



Report Signature Page

GOLDER ASSOCIATES LTD.

David Muldowney, P.Eng.
Geotechnical Engineer



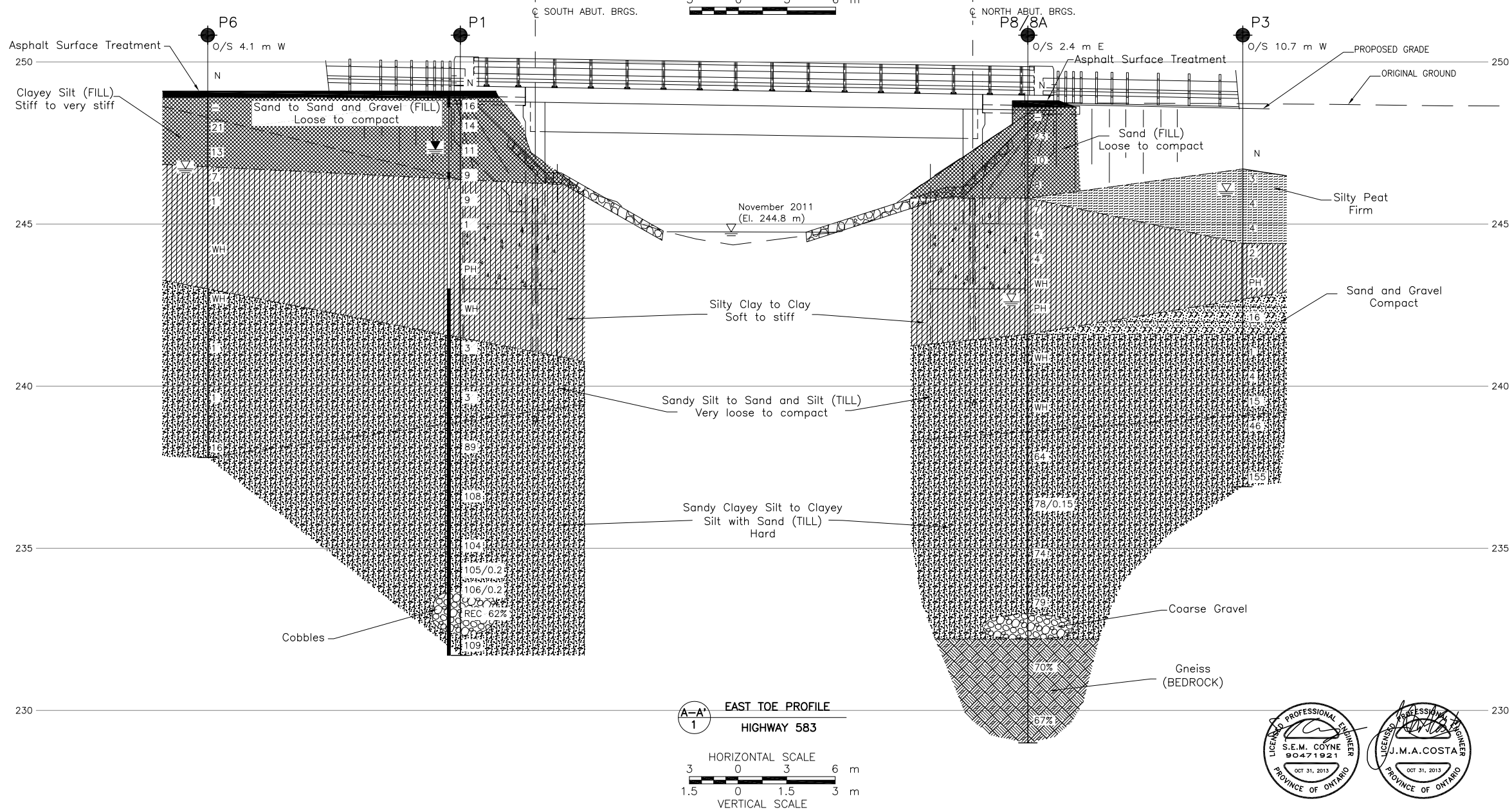
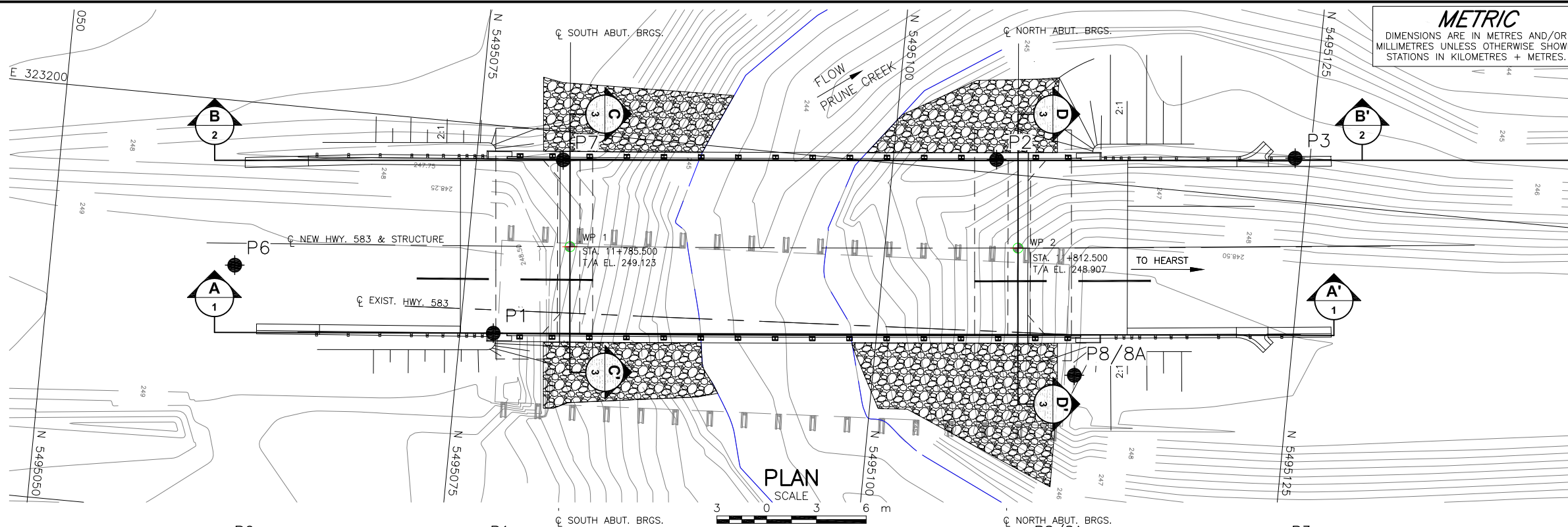
Sarah E. M. Coyne, P.Eng.
Senior Geotechnical Engineer, Associate



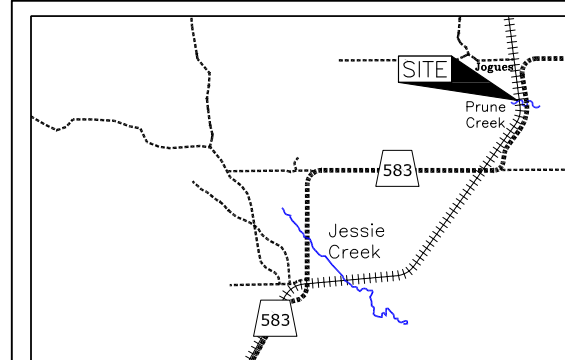
Jorge M. A. Costa, P.Eng.
Designated MTO Contact, Principal

MT/DAM/SEMC/JMAC/kp

[http://capws.golder.com/sites/capws2/p111910008mtosixbridgesnearhearst/reports/reports/2prune creek/2c final detail report/11-1191-0008-2 rpt 13oct31 final prune creek fidr.docx](http://capws.golder.com/sites/capws2/p111910008mtosixbridgesnearhearst/reports/reports/2prune%20creek/2c%20final%20detail%20report/11-1191-0008-2%20rpt%2013oct31%20final%20prune%20creek%20fidr.docx)

CONT No.
WP No. 5484-09-01HIGHWAY 583
PRUNE CREEK BRIDGE
BOREHOLE LOCATIONS AND
SOIL STRATA

SHEET

Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

KEY PLAN

SCALE
1.6 0 1.6 km

LEGEND

- Borehole
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- R Refusal
- 100% Rock Quality Designation (RQD)
- WL in piezometer, measured on June 5, 2013
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
P1	249.1	5495077.0	323212.5
P2	245.7	5495106.2	323199.2
P3	246.7	5495124.1	323197.4
P6	249.1	5495061.1	323209.9
P7	248.0	5495080.2	323201.7
P8/8A	248.8	5495112.1	323211.7

NOTES

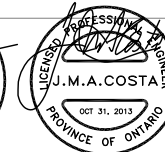
This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

Base plans provided in digital format by LEA, drawing file nos. 8960-Prune-S01.dwg, received October 22, 2013.



NO.	DATE	BY	REVISION
Geocres No. 42G-46			
HWY. 583		PROJECT NO. 11-1191-0008	
SUBM'D. DAM		CHKD. SEMC	DATE: OCT 2013
DRAWN: JJJ		CHKD.	APPD. JMAC
		DIST. SITE: 39W-046	
		DWG. 1	

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

CONT No.
WP No. 5484-09-01



HIGHWAY 583
PRUNE CREEK BRIDGE
SOIL STRATA

SHEET



Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

LEGEND

- Borehole
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- R Refusal
- 100% Rock Quality Designation (RQD)
- WL in piezometer, measured on June 4, 2013
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
P2	245.7	5495106.2	323199.2
P3	246.7	5495124.1	323197.4
P6	249.1	5495061.1	323209.9
P7	248.0	5495080.2	323201.7

NOTES

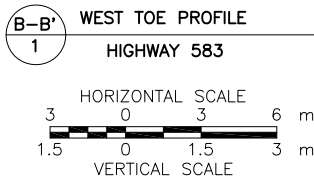
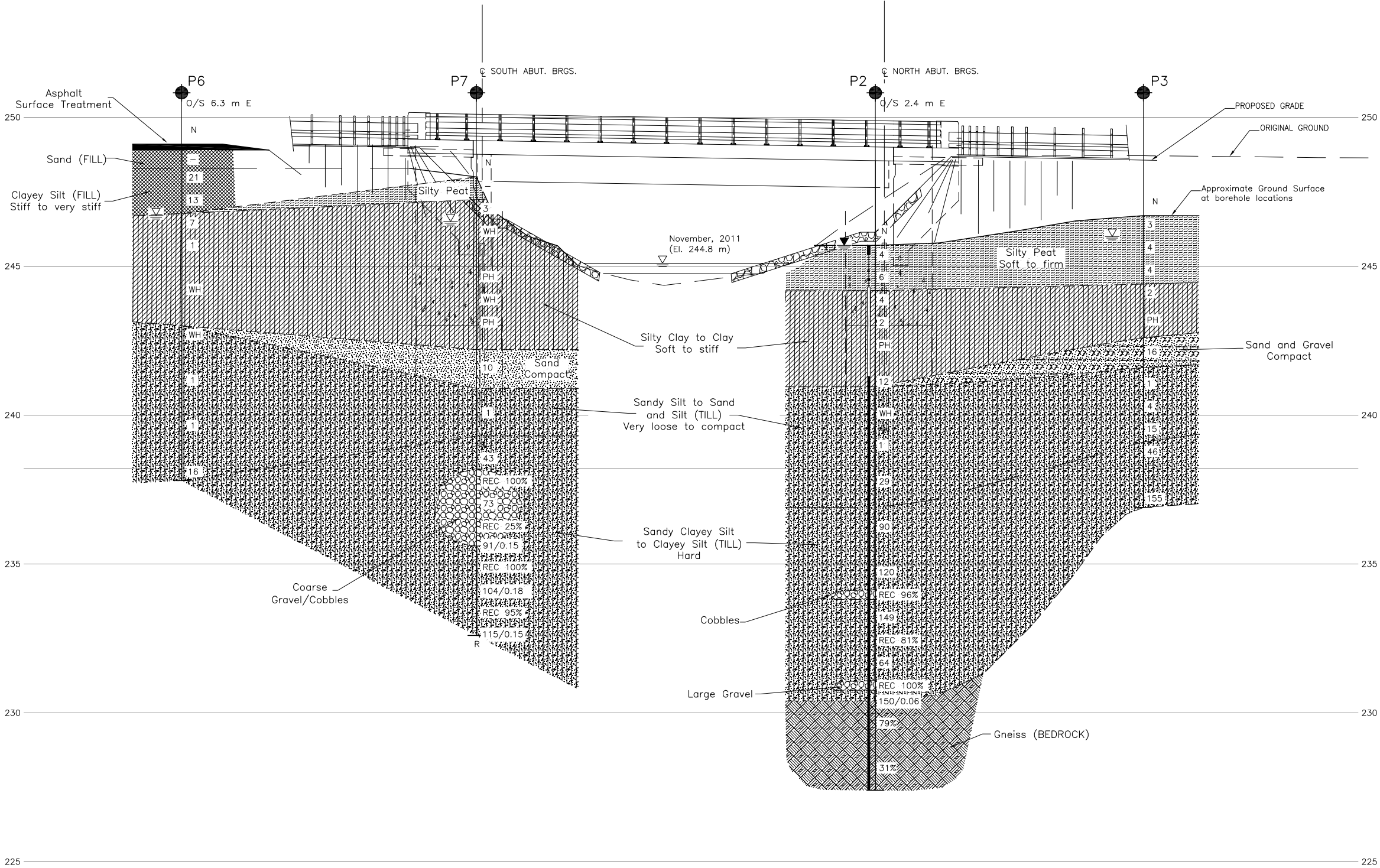
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NO.	DATE	BY	REVISION
Geocres No. 42G-46			
HWY. 583		PROJECT NO. 11-1191-0008	DIST.
SUBM'D. DAM	CHKD. SEMC	DATE: OCT 2013	SITE: 39W-046
DRAWN: JJL	CHKD.	APPD. JMAC	DWG. 2

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

CONT No.
WP No. 5484-09-01



HIGHWAY 583
PRUNE CREEK BRIDGE
SOIL STRATA

SHEET



Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

LEGEND

- Borehole
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- R Refusal
- 100% Rock Quality Designation (RQD)
- WL in piezometer, measured on June 4, 2013
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
P1	249.1	5495077.0	323212.5
P2	245.7	5495106.2	323199.2
P7	248.0	5495080.2	323201.7
P8/8A	248.8	5495112.1	323211.7

NOTES

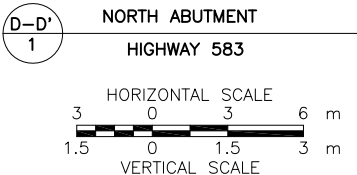
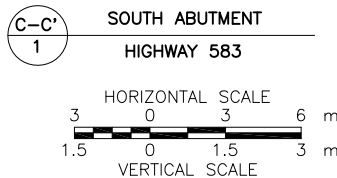
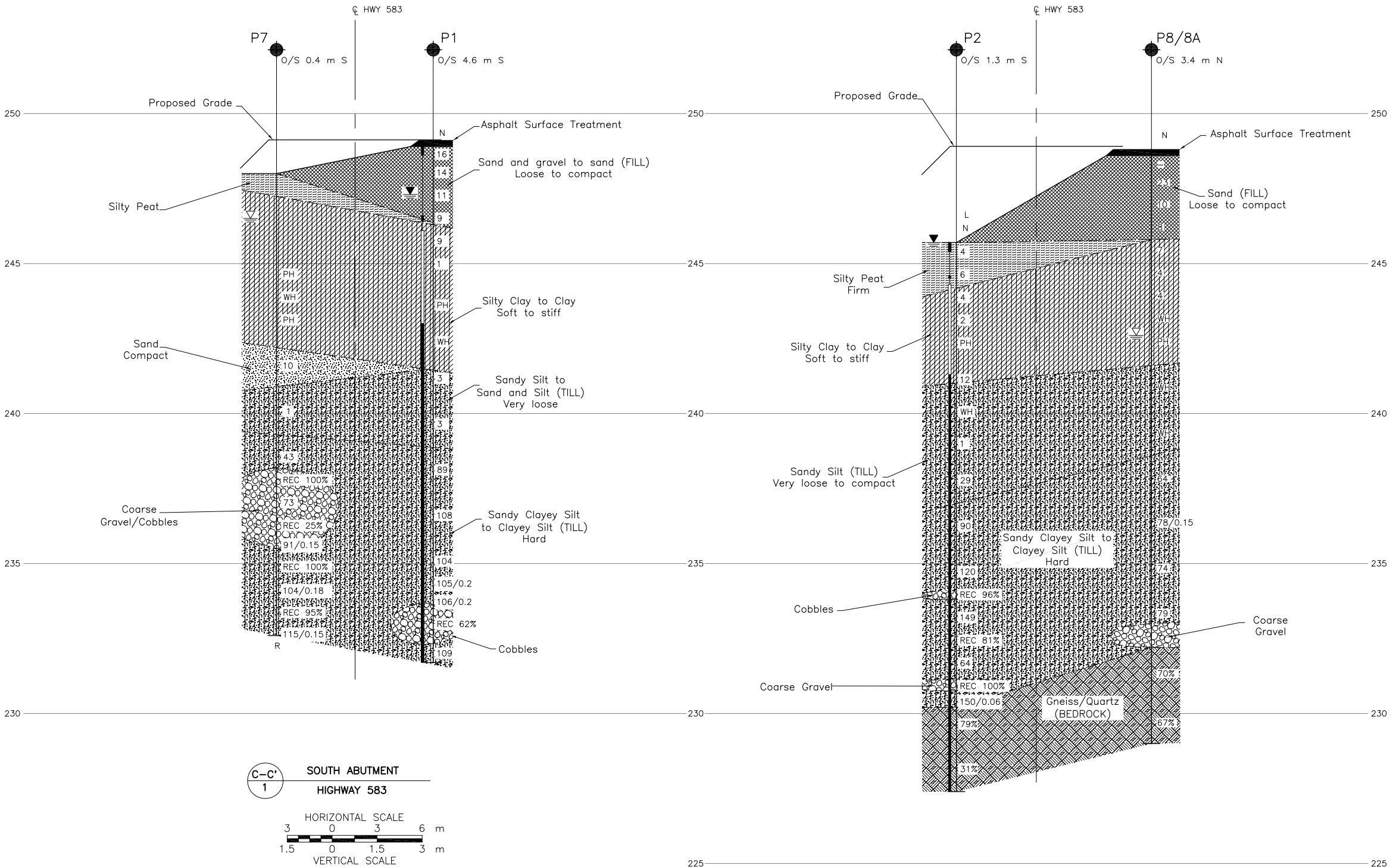
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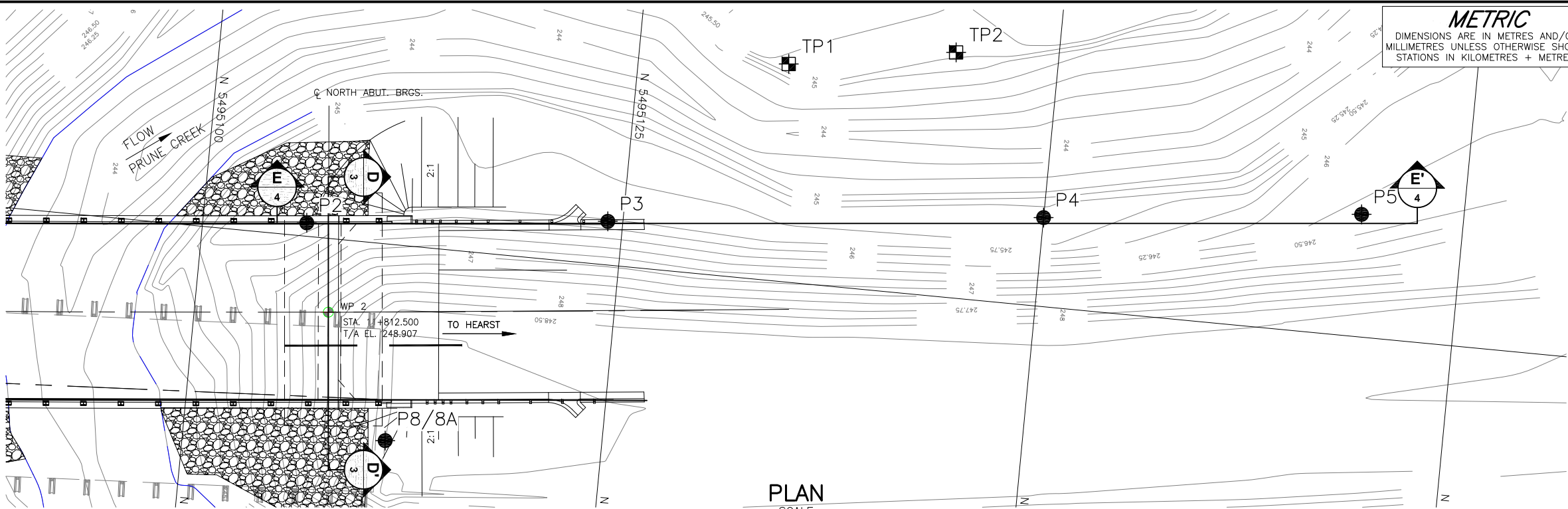
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REFERENCE

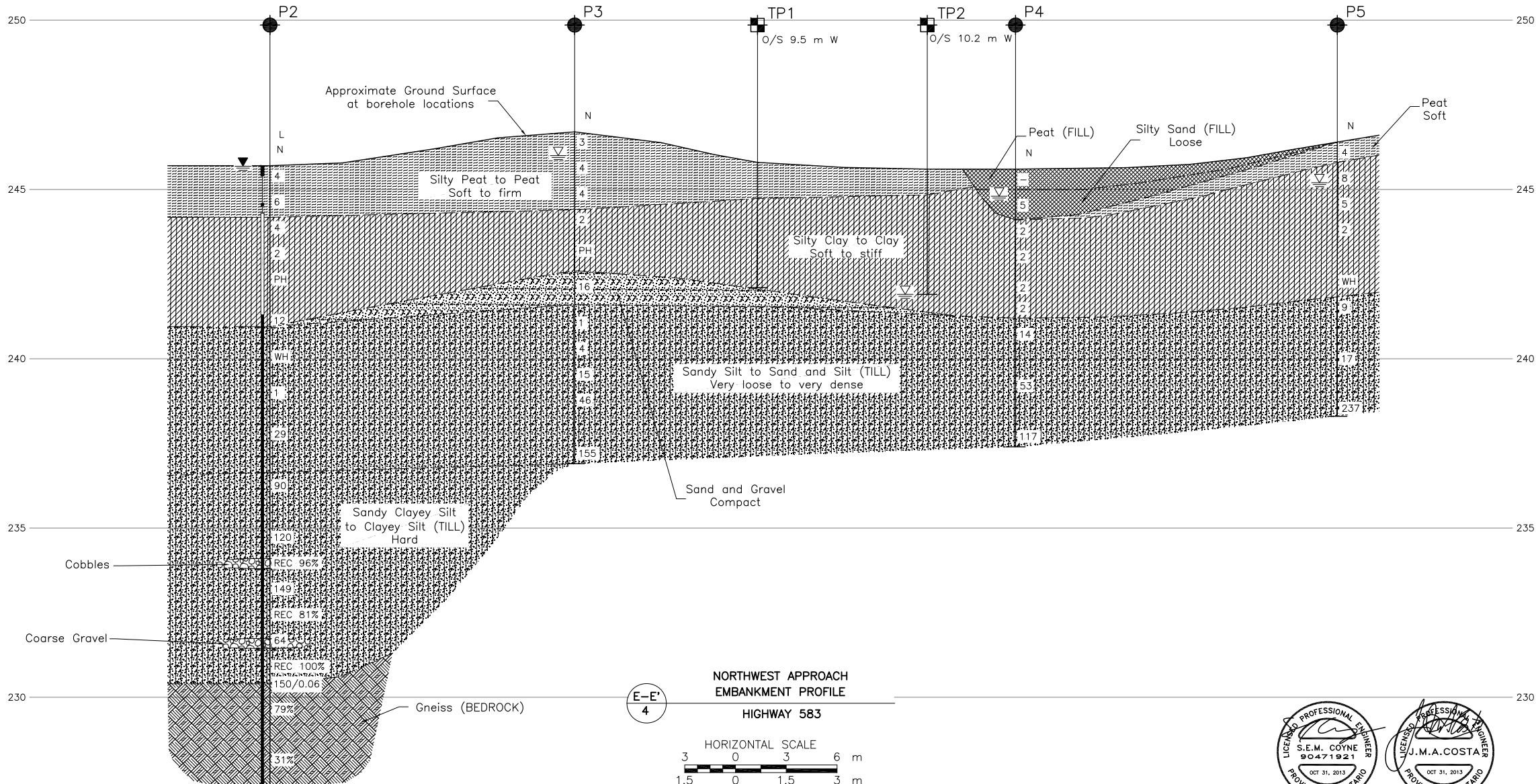
Base plans provided in digital format by LEA, drawing file nos. 8960-Prune-S01.dwg, received October 22, 2013.



NO.	DATE	BY	REVISION
Geocres No. 42G-46			
HWY. 583		PROJECT NO. 11-1191-0008	
SUBM'D. DAM		CHKD. SEMC	SITE: 39W-046
DRAWN: JJL		APPD. JMAC	DWG. 3



PLAN
SCALE
3 0 3 6 m



NORTHWEST APPROACH
EMBANKMENT PROFILE
HIGHWAY 583
E-E'
4

HORIZONTAL SCALE
3 0 3 6 m
VERTICAL SCALE
1.5 0 1.5 3 m

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

CONT No.
WP No. 5484-09-01

SHEET

HIGHWAY 583
PRUNE CREEK BRIDGE RETAINING WALL
BOREHOLE/TEST PIT LOCATIONS
AND SOIL STRATA

Golder Associates Ltd.
SUDBURY, ONTARIO, CANADA

LEGEND

Borehole

Test Pit

Seal

Piezometer

Standard Penetration Test Value

Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow)

Refusal

100% Rock Quality Designation (RQD)

WL in piezometer, measured on December 6, 2012

WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
P2	245.7	5495106.2	323199.2
P3	246.7	5495124.1	323197.4
P4	245.6	5495150.0	323194.7
P5	246.4	5495168.9	323192.7
P8/8A	248.8	5495112.1	323211.7
TP1	245.8	5495134.0	323187.0
TP2	245.6	5495143.9	323185.4

NOTES

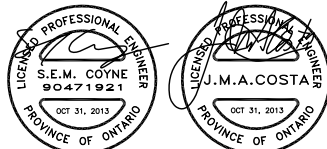
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The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

Base plans provided in digital format by LEA, drawing file nos. 8960-Prune-S01.dwg, received October 22, 2013.



NO.	DATE	BY	REVISION
Geocres No. 42G-46			
HWY. 583		PROJECT NO. 11-1191-0008	DIST.
SUBM'D. DAM	CHKD. SEMC	DATE: OCT 2013	SITE: 39W-046
DRAWN: JJJ	CHKD.	APPD. JMAC	DWG. 4



APPENDIX A

Record of Boreholes and Drillholes



LIST OF SYMBOLS

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

I. GENERAL

π	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
FoS	factor of safety

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	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
γ'	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 or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	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_α	secondary compression index
m_v	coefficient of volume change
C_v	coefficient of consolidation (vertical direction)
C_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	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

* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

Notes: 1
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$



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

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.) drive open sampler for a distance of 300 mm (12 in.)

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 cm² 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.

III. SOIL DESCRIPTION

(a) Non-Cohesive (Cohesionless) Soils

Density Index	N
Relative Density	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

(b) Cohesive Soils Consistency

	c_u, s_u	
	kPa	psf
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

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 ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
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)
γ	unit weight

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

V. MINOR SOIL CONSTITUENTS

Per cent by Weight	Modifier	Example
0 to 5	Trace	Trace sand
5 to 12	Trace to Some (or Little)	Trace to some sand
12 to 20	Some	Some sand
20 to 30	(ey) or (y)	Sandy
over 30	And (non-cohesive (cohesionless)) or With (cohesive)	Sand and Gravel Silty Clay with sand / Clayey Silt with sand



LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS 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 and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 m to 2 m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	Less than 6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: * Grains greater than 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 diameter, 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 varied 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 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 abbreviation 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 and infillings are also noted.

Abbreviations

JN Joint	PL Planar
FLT Fault	CU Curved
SH Shear	UN Undulating
VN Vein	IR Irregular
FR Fracture	K Slickensided
SY Stylolite	PO Polished
BD Bedding	SM Smooth
FO Foliation	SR Slightly Rough
CO Contact	RO Rough
AXJ Axial Joint	VR Very Rough
KV Karstic Void	
MB Mechanical Break	

PROJECT 11-1191-0008				RECORD OF BOREHOLE No P1				1 OF 2 METRIC					
W.P. 5149-06-00				LOCATION N 5495077.0; E 323212.5				ORIGINATED BY ID					
DIST HWY 583				BOREHOLE TYPE 108mm ID Continuous Flight Hollow Stem Augers, NW Casing, NQ Coring				COMPILED BY DM					
DATUM Geodetic				DATE March 22, 2012				CHECKED BY SEMC					
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p W W _L			
249.1	GROUND SURFACE												
0.0	Asphalt Surface Treatment (150 mm)												
0.2	Sand to sand and gravel, trace to some silt (FILL) Loose to compact Brown Moist to wet		1	SS	16								
			2	SS	14								
			3	SS	11								
246.4			4	SS	9								
2.7	SILTY CLAY, trace sand, layered above 3.7 m depth Soft to stiff Brown to grey below 4.3 m depth Wet		5	SS	9								
			6	SS	1								
			7	TO	PH								
			8	SS	WH								
241.5													
7.6	SAND and SILT, trace to some gravel, trace to some clay (TILL) Very loose Grey Wet		9	SS	3								
			10	SS	3								
238.9													
10.2	CLAYEY SILT, with sand, trace to some gravel (TILL) Hard Grey Moist		11	SS	89								
	Switched to NW casing at 10.7 m depth. Intermittent grinding of casing below 10.7 m depth.												
			12	SS	108								
			13	SS	104								
			14	SS	105/0.2								

Continued Next Page

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

SUD_MTO_003 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:


PROJECT 11-1191-0008		RECORD OF BOREHOLE No P1				2 OF 2 METRIC																			
W.P. 5149-06-00		LOCATION N 5495077.0; E 323212.5				ORIGINATED BY ID																			
DIST _____ HWY 583		BOREHOLE TYPE 108mm ID Continuous Flight Hollow Stem Augers, NW Casing, NQ Coring				COMPILED BY DM																			
DATUM Geodetic		DATE March 22, 2012				CHECKED BY SEMC																			
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL									
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					W _p W W _L												
--- CONTINUED FROM PREVIOUS PAGE ---																									
231.7 17.4	CLAYEY SILT, with sand, trace to some gravel (TILL) Hard Grey Moist Spoon bouncing at 15.0 m depth. Casing refusal at 15.2 m depth. Casing advance noted harder and softer layers below 15.2 m depth. Cobbles encountered between 15.4 m and 16.8 m depth as follows: <table border="1" style="margin-top: 5px; width: 100%;"> <thead> <tr> <th>Depth (m)</th> <th>Thickness (mm)</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td>15.4</td> <td>210</td> <td>Granite</td> </tr> <tr> <td>16.0</td> <td>275</td> <td>Granite/gneiss</td> </tr> </tbody> </table> END OF BOREHOLE Note: 1. Water level at a depth of 2.3 m below ground surface (Elev. 246.8 m) upon completion of drilling. 2. Water level in piezometer at a depth of 1.8 m below ground surface (Elev. 247.3 m) on April 20, 2012. 3. Water level in piezometer at a depth of 2.4 m below ground surface (Elev. 246.7 m) on December 6, 2012. 4. Water level in piezometer at a depth of 1.8 m below ground surface (Elev. 247.3 m) on June 5, 2013.	Depth (m)	Thickness (mm)	Type	15.4	210	Granite	16.0	275	Granite/gneiss	15	SS	106/0.2		234										
		Depth (m)	Thickness (mm)	Type																					
		15.4	210	Granite																					
16.0	275	Granite/gneiss																							
1	RC	REC 62%		233																					
16	SS	109		232																					

PROJECT 11-1191-0008				RECORD OF BOREHOLE No P2				1 OF 2 METRIC					
W.P. 5149-06-00				LOCATION N 5495106.2; E 323199.2				ORIGINATED BY ID					
DIST HWY 583				BOREHOLE TYPE NW Casing, Wash Boring, NQ Coring				COMPILED BY DM					
DATUM Geodetic				DATE April 19 and 20, 2012				CHECKED BY SEMC					
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)			
245.7	GROUND SURFACE												
0.0	Silty PEAT (AMORPHOUS), some sand, containing wood fibres Firm Brown Wet		1	SS	4								
			2	SS	6								
244.2													
1.5	Sandy SILTY CLAY to CLAY, trace sand, trace to some gravel, trace organics Soft to stiff Brown to dark grey Wet		3	SS	4								
			4	SS	2								
			5	TO	PH								
240.9			6	SS	12								
4.8	Sandy SILT, trace to some gravel, trace to some clay (TILL) Very loose to compact Brown to grey Wet												
	Sand and gravel layer 350 mm thick at 4.8 m depth.		7	SS	WH								
	Clayey silt seam at 6.4 m depth.		8	SS	1								
	Becoming moist to dry below 7.2 m depth.												
			9	SS	29								
237.0													
8.7	Sandy CLAYEY SILT, trace gravel (TILL) Hard Grey Moist		10	SS	90								
	Casing grinding between 9.1 m and 11.6 m depth.												
			11	SS	120								
	Casing refusal at 11.6 m depth.		1	RC	REC 96%								
	Cobbles 125 mm and 175 mm thick encountered at 11.6 m depth (granite).		12	SS	149								
			2	RC	REC 81%								
			13	SS	64								
	Three coarse gravel pieces 50 mm to 75 mm thick encountered at 14.3 m depth (granite/meta sediment).		3	RC	REC 100%								

Continued Next Page

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

SUD_MTO 003 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:

PROJECT 11-1191-0008				RECORD OF BOREHOLE No P2				2 OF 2 METRIC										
W.P. 5149-06-00		LOCATION N 5495106.2; E 323199.2		ORIGINATED BY ID														
DIST _____ HWY 583		BOREHOLE TYPE NW Casing, Wash Boring, NQ Coring		COMPILED BY DM														
DATUM Geodetic		DATE April 19 and 20, 2012		CHECKED BY SEMC														
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)					
	--- CONTINUED FROM PREVIOUS PAGE ---							20	40	60	80	100	W _p	W	W _L			
230.4 15.3	GNEISS (BEDROCK) Bedrock cored from 15.3 m depth to 18.3 m depth. For coring details see Record of Drillhole P2.		4	RC	REC 100%												RQD = 79%	
			5	RC	REC 100%													RQD = 31%
227.4 18.3	END OF BOREHOLE Note: 1. Water level at a depth of 0.4 m below ground surface (Elev. 245.3 m) upon completion of drilling. 2. Water level in piezometer at a depth of 0.2 m below ground surface (Elev. 245.5 m) on December 6, 2012. 3. Water level in piezometer at ground surface (Elev. 245.7 m) on June 4, 2013.																	

PROJECT: 11-1191-0008

RECORD OF DRILLHOLE: P2

SHEET 1 OF 1

LOCATION: N 5495106.2 ; E 323199.2

DRILLING DATE: April 19 and 20, 2012

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-25

DRILLING CONTRACTOR: Walker Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.		RUN No.	COLOUR % RETURN	FLUSH	RECOVERY				R.Q.D. %	FRACT. INDEX METRES	DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY				Diametral Point Load Index (MPa)	RMC -Q' AVG.	NOTES WATER LEVELS INSTRUMENTATION	
				DEPTH (m)	FLUSH				TOTAL CORE %	SOLID CORE %	TYPE AND SURFACE DESCRIPTION	Jr			Ja	Jn	k, cm/s	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³					
REFER TO PREVIOUS PAGE		230.4																								
	NW	GNEISS Fine grained Grey Slightly to moderately weathered		15.3																						
16		Quartz vein between 16.1 m and 16.2 m depth. Mica-schistose zone between 16.4 and 16.6 m depth.		4	GREY 100																					
17	April 20, 2012 NG Coring																									
18																										
		END OF DRILLHOLE		227.4	18.3																					
19																										
20																										
21																										
22																										
23																										
24																										
25																										

DEPTH SCALE

1 : 50





LOGGED: ID

CHECKED: SEMC



SUD-RCK 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:

PROJECT		11-1191-0008				RECORD OF BOREHOLE No P3				1 OF 1 METRIC							
W.P.		5149-06-00		LOCATION		N 5495124.1; E 323197.4		ORIGINATED BY		ID							
DIST		HWY 583		BOREHOLE TYPE		NW Casing, Wash Boring		COMPILED BY		DM							
DATUM		Geodetic		DATE		April 20, 2012		CHECKED BY		SEMC							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
246.7	GROUND SURFACE							20	40	60	80	100					
0.0	Silty PEAT (Fibrous) containing wood Soft to firm Brown to black Wet		1	SS	3	▽	246										
			2	SS	4		245										
			3	SS	4												
244.4																	
2.3	SILTY CLAY, trace sand, trace gravel, trace organics Firm Dark grey Wet		4	SS	2		244									OC=1.7%	1 1 24 74
			5	TO	PH		243										
242.6																	
4.1	SAND and GRAVEL Compact Brown Wet		6	SS	16		242										
241.6																	
5.1	Sandy SILT to SAND and SILT, trace to some clay, trace gravel (TILL) Very loose to compact Brown Wet		7	SS	1		241										
			8	SS	4		240									NP	2 32 58 8
	Moist and grey below 6.9 m depth		9	SS	15												
239.1							239										
7.6	Sandy CLAYEY SILT, trace gravel (TILL) Hard Grey Moist		10	SS	46		238										4 23 48 25
236.9			11	SS	155		237										
9.8	END OF BOREHOLE																
	Note: 1. Water level at a depth of 0.7 m below ground surface (Elev. 246.0 m) upon completion of drilling.																

SUD_MTO 003 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:

PROJECT		11-1191-0008				RECORD OF BOREHOLE No P4				1 OF 1 METRIC							
W.P.		5149-06-00		LOCATION		N 5495150.0; E 323194.7		ORIGINATED BY		ID							
DIST		HWY 583		BOREHOLE TYPE		NW Casing, Wash Boring		COMPILED BY		DM							
DATUM		Geodetic		DATE		April 21, 2012		CHECKED BY		SEMC							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
245.6	GROUND SURFACE																
0.0	Peat (Fibrous), some sand, some silt (FILL) Black / brown Moist		1	AS	-		245										
245.0	Silty sand, some gravel (FILL) Loose Brown		2	SS	5		244										
244.1	CLAY, trace to some sand, trace gravel, trace to some organics Soft to firm Brown to dark grey Wet	3	SS	2	243												
1.5		4	SS	2	242												
241.2		5	SS	2	241												
4.4		6	SS	2	240												
241.2	SAND and SILT, trace to some gravel, trace clay (TILL) Compact to very dense Brown to grey Wet to moist	7	SS	14	239												
4.4		8	SS	53	238												
237.4		9	SS	117													
8.2	END OF BOREHOLE																
Note: 1. Water level at a depth of 0.8 m below ground surface (Elev. 244.8 m) upon completion of drilling.																	

SUD_MTO 003 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:


PROJECT		11-1191-0008		RECORD OF BOREHOLE No P5				1 OF 1 METRIC						
W.P.		5149-06-00		LOCATION		N 5495168.9; E 323192.7		ORIGINATED BY ID						
DIST		HWY 583		BOREHOLE TYPE		NW Casing, Wash Boring		COMPILED BY DM						
DATUM		Geodetic		DATE		April 21, 2012		CHECKED BY SEMC						
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
246.4	GROUND SURFACE													
0.0	PEAT (Fibrous), some silt Soft Brown Moist		1	SS	4		246							0 4 47 49
245.8			2	SS	8		245							
0.6	CLAY, trace sand, trace gravel Soft to firm Brown to grey Wet		3	SS	5		244							
			4	SS	2		243							
			5	SS	WH		242							
241.8	SAND and SILT trace to some gravel, trace clay (TILL) Loose to very dense Brown to grey Wet to moist		6	SS	9		241							
4.6	Casing grinding below 6.1 m depth.		7	SS	17		240							32 34 31 3
			8	SS	237		239							
238.3	END OF BOREHOLE													
8.1	Note: 1. Water level at a depth of 1.2 m below ground surface (Elev. 245.2 m) upon completion of drilling.													

SUD_MTO 003 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:

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

PROJECT 11-1191-0008		RECORD OF BOREHOLE No P6				1 OF 1 METRIC										
W.P. 5149-06-00		LOCATION N 5495061.1; E 323209.9				ORIGINATED BY ID										
DIST HWY 583		BOREHOLE TYPE 108mm ID Continuous Flight Hollow Stem Augers				COMPILED BY DM										
DATUM Geodetic		DATE December 6, 2012				CHECKED BY SEMC										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
249.1	GROUND SURFACE															
0.0	Asphalt Surface Treatment (200 mm)															
0.2	Sand, trace silt (FILL)		1	AS	-											
248.3	Brown Frozen															
0.8	Clayey silt, with sand, trace to some gravel, trace organics (FILL)		2	SS	21											
	Stiff to very stiff															
	Brown Moist		3	SS	13											
246.8	SILTY CLAY															
2.3	Soft to firm		4	SS	7											
	Grey Wet															
			5	SS	1											
			6	SS	WH											
243.0	Sandy SILT, trace to some clay, trace to some gravel (TILL)		7	SS	WH											
6.1	Very loose to compact															
	Grey Wet															
			8	SS	1											
			9	SS	1											
			10	SS	16											
237.8	END OF BOREHOLE															
11.3	Note: 1. Water level at a depth of 2.4 m below ground surface (Elev. 246.7 m) upon completion of drilling.															

MSUD MTO 003 1111910008.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:

PROJECT <u>11-1191-0008</u>		RECORD OF BOREHOLE No P7				2 OF 2 METRIC										
W.P. <u>5149-06-00</u>		LOCATION <u>N 5495080.2; E 323201.7</u>				ORIGINATED BY <u>ID</u>										
DIST <u> </u> HWY <u>583</u>		BOREHOLE TYPE <u>108mm ID Continuous Flight Hollow Stem Augers, NW Casing, NQ Coring</u>				COMPILED BY <u>DM</u>										
DATUM <u>Geodetic</u>		DATE <u>December 8 and 9, 2012</u>				CHECKED BY <u>SEMC</u>										
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
	--- CONTINUED FROM PREVIOUS PAGE ---															
232.6 15.4	END OF BOREHOLE SPOON REFUSAL (HAMMER BOUNCING) Note: 1. Water level at a depth of 1.5 m below ground surface (Elev. 246.5 m) upon completion of drilling.		13	SS	115/0.15											

SUD_MTO_003 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:

[illegible]

PROJECT 11-1191-0008		RECORD OF BOREHOLE No P8/P8A				2 OF 2 METRIC																										
W.P. 5149-06-00		LOCATION N 5495112.1; E 323211.7				ORIGINATED BY ID/EHS																										
DIST _____ HWY 583		BOREHOLE TYPE 108mm ID Continuous Flight Hollow Stem Augers				COMPILED BY DM																										
DATUM Geodetic		DATE December 12, 2012 and June 4, 2013				CHECKED BY SEMC																										
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)																			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						WATER CONTENT (%)																		
	--- CONTINUED FROM PREVIOUS PAGE ---						20 40 60 80 100																									
232.2	Sandy CLAYEY SILT, trace gravel (TILL) Hard Grey Moist		15	SS	79																											
16.6	Coarse gravel encountered between 15.8 and 16.6 m depth as follows: <table border="1" style="font-size: small;"> <thead> <tr> <th>Depth (m)</th> <th>Thickness (mm)</th> <th>Type</th> </tr> </thead> <tbody> <tr><td>15.8</td><td>50</td><td>Gneiss</td></tr> <tr><td>16.0</td><td>75</td><td>Gneiss</td></tr> <tr><td>16.2</td><td>50</td><td>Gneiss</td></tr> <tr><td>16.4</td><td>63</td><td>Gneiss</td></tr> <tr><td>16.5</td><td>75</td><td>Gneiss</td></tr> <tr><td>16.6</td><td>25</td><td>Gneiss</td></tr> </tbody> </table>	Depth (m)	Thickness (mm)	Type	15.8	50	Gneiss	16.0	75	Gneiss	16.2	50	Gneiss	16.4	63	Gneiss	16.5	75	Gneiss	16.6	25	Gneiss										
Depth (m)	Thickness (mm)	Type																														
15.8	50	Gneiss																														
16.0	75	Gneiss																														
16.2	50	Gneiss																														
16.4	63	Gneiss																														
16.5	75	Gneiss																														
16.6	25	Gneiss																														
	GNEISS (BEDROCK)																															
	Bedrock cored from 16.6 m depth to 19.8 m depth.																															
	For coring details see Record of Drillhole P2.																															
229.0			1	RC	REC 100%								RQD = 70%																			
			2	RC	REC 100%								RQD = 67%																			
19.8	END OF BOREHOLE																															
	Note: 1. Water level at a depth of 6.2 m below ground surface (Elev. 242.6 m) upon completion of drilling. 2. Borehole moved 1.2 m north to obtain field vane at 5.8 m depth. 3. Borehole moved to 1.5 m north on June 4, 2013 to obtain Sample 14 and 15 and bedrock core (as Borehole P8A).																															

SUD_MTO_003 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:

PROJECT: 11-1191-0008

RECORD OF DRILLHOLE: P8/P8A

SHEET 1 OF 1

LOCATION: N 5495112.1 ; E 323211.7

DRILLING DATE: December 12, 2012 and June 4, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 850

DRILLING CONTRACTOR: Landcore Drilling Ontario Inc.

DEPTH SCALE METRES	DRILLING RECORD		DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	COLOUR % RETURN	FLUSH	RECOVERY		R.Q.D. %	FRACT. INDEX METRES	DISCONTINUITY DATA						HYDRAULIC CONDUCTIVITY				Diameter Point Load Index (MPa)	RMC -Q AVG.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
									TOTAL CORE %	SOLID CORE %			B Angle	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	10 ⁻³																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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DEPTH SCALE

1 : 50




LOGGED: ID/EHS


CHECKED: SEMC

SUD-RCK 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:

PROJECT <u>11-1191-0008</u>		RECORD OF TEST PIT No TP1		1 OF 1 METRIC	
W.P. <u>5149-06-00</u>		LOCATION <u>N 5495134.0 ;E 323187.0</u>		ORIGINATED BY <u>SA</u>	
DIST <u> </u> HWY <u>583</u>		BOREHOLE TYPE <u>Komatsu 228 Excavator</u>		COMPILED BY <u>DM</u>	
DATUM <u>Geodetic</u>		DATE <u>September 25, 2013</u>		CHECKED BY <u>SEMC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								20 40 60 80 100					W _p W W _L				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED									
245.8 0.0	GROUND SURFACE Silty PEAT Brown Moist to wet		1				245										
244.7			2					244									
1.1	SILTY CLAY to CLAY, trace to some sand Dark grey to grey Wet	3			243												
		4															
242.1	END OF TEST PIT																
3.7	Note: 1. Test pit dry upon completion.																

PROJECT <u>11-1191-0008</u>		RECORD OF TEST PIT No TP2		1 OF 1 METRIC	
W.P. <u>5149-06-00</u>		LOCATION <u>N 5495143.9 ;E 323185.4</u>		ORIGINATED BY <u>SA</u>	
DIST <u> </u> HWY <u>583</u>		BOREHOLE TYPE <u>Komatsu 228 Excavator</u>		COMPILED BY <u>DM</u>	
DATUM <u>Geodetic</u>		DATE <u>September 25, 2013</u>		CHECKED BY <u>SEMC</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE												
								● QUICK TRIAXIAL × REMOULDED												
							20	40	60	80	100									
							20	40	60	80	100									
245.6	GROUND SURFACE																			
0.0	Silty PEAT Brown Moist		1				245													
244.8																				
0.8	SILTY CLAY to CLAY, trace sand Brown to grey Wet		2				244													
			3				243													
241.9							242													
3.7	END OF TEST PIT Note: 1. Water seepage noted at base of test pit upon completion.																			

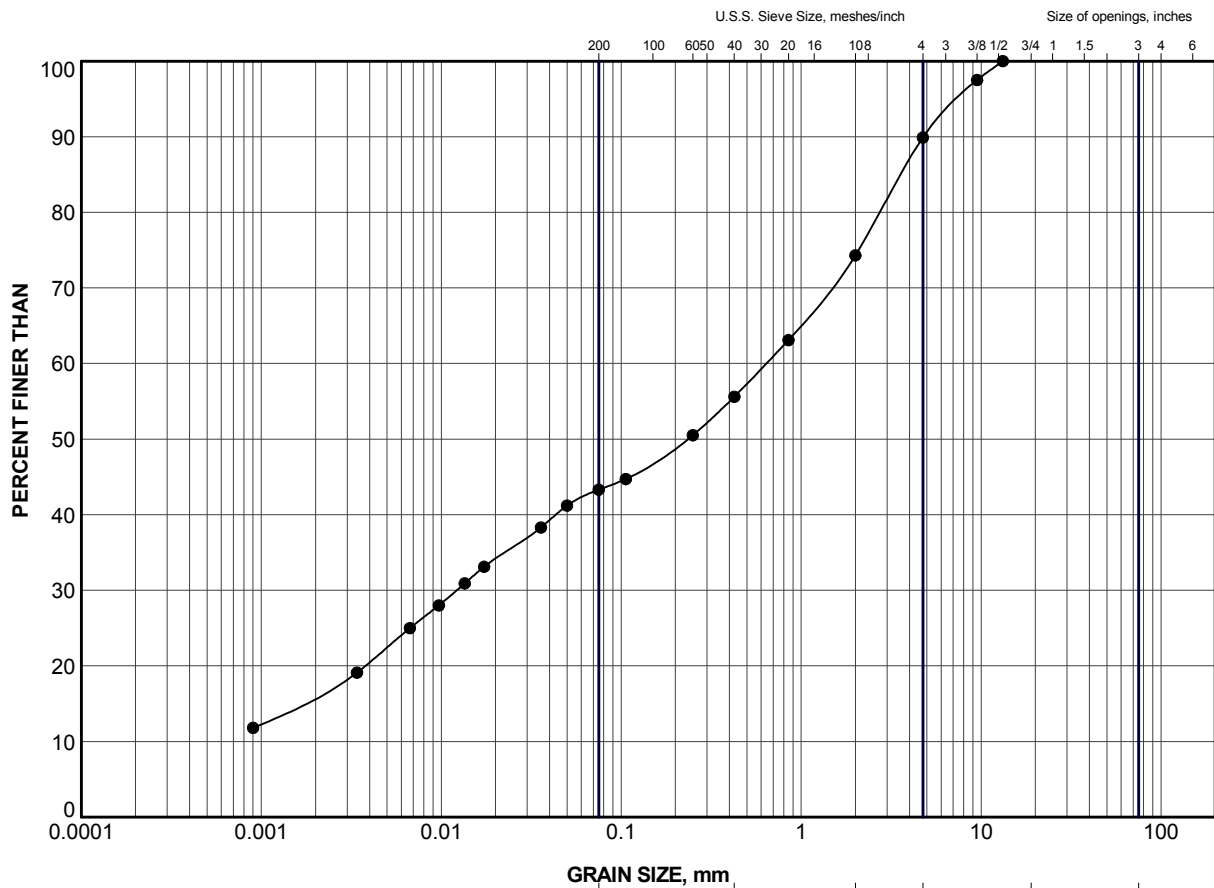
+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SUD-MTO 002 1111910008D.GPJ GAL-MISS.GDT 22/10/13 DATA INPUT:




APPENDIX B

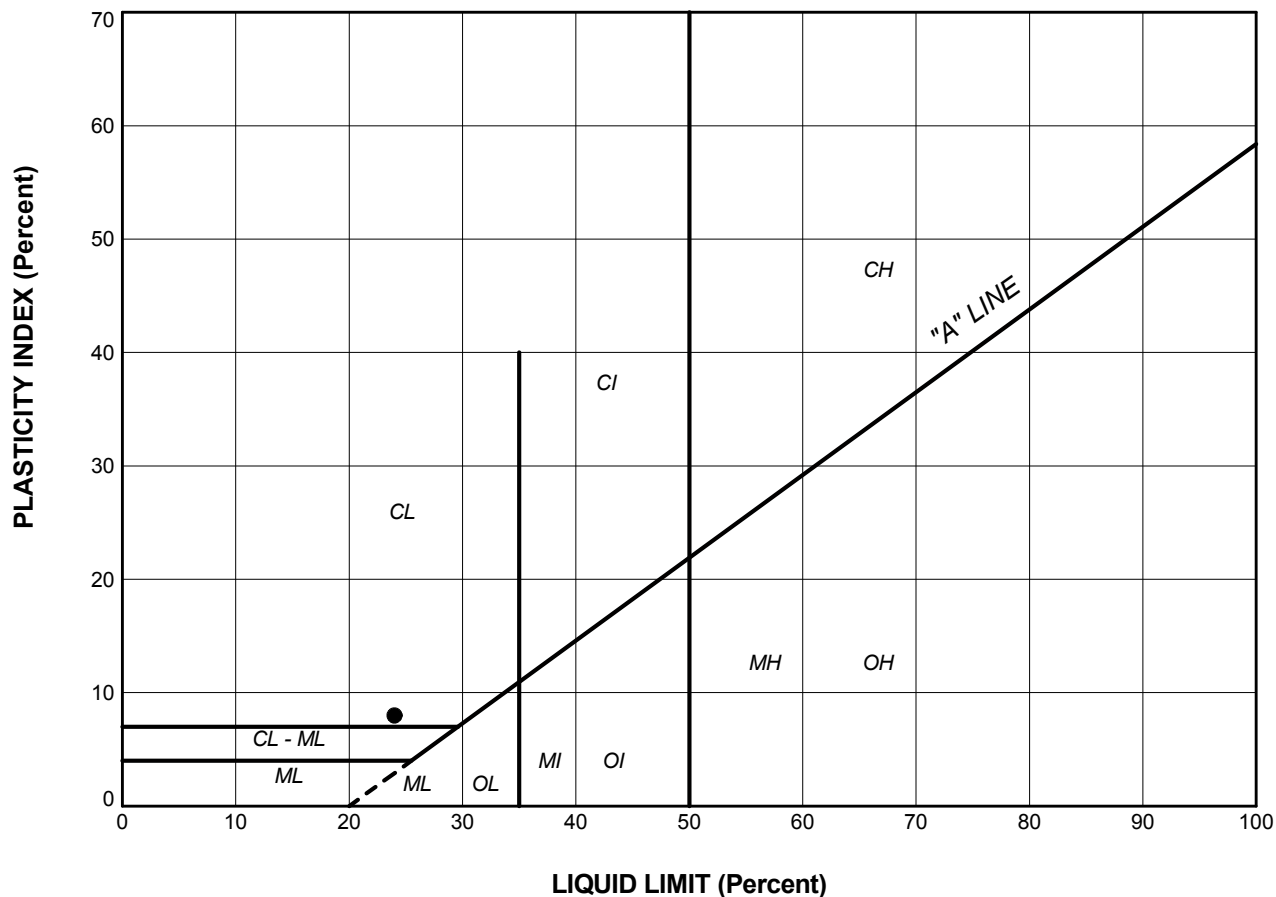
Laboratory Test Results



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	P6	2	248.0

PROJECT					
HIGHWAY 583 PRUNE CREEK BRIDGE					
TITLE					
GRAIN SIZE DISTRIBUTION CLAYEY SILT (FILL)					
PROJECT No.		11-1191-0008		FILE No. 1111910008D.GPJ	
DRAWN	JJL	Oct 2013	SCALE	N/A	REV.
CHECK	DAM	Oct 2013			
APPR	SEMC	Oct 2013			
 Golder Associates SUDBURY, ONTARIO			FIGURE B1		



SOIL TYPE
 C = Clay
 M = Silt
 O = Organic

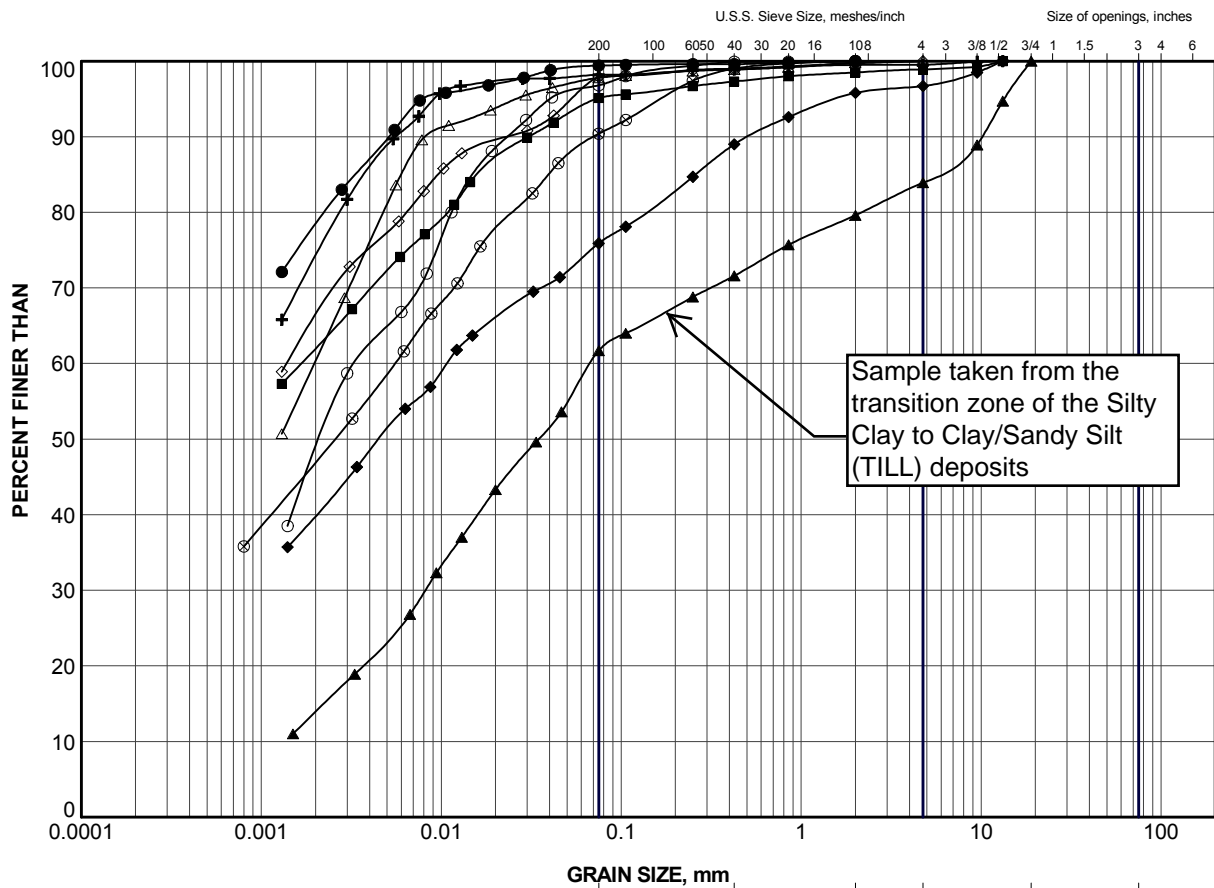
PLASTICITY
 L = Low
 I = Intermediate
 H = High

LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	P6	2	24.0	16.0	8.0

PROJECT					
HIGHWAY 583 PRUNE CREEK BRIDGE					
TITLE					
PLASTICITY CHART CLAYEY SILT (FILL)					
PROJECT No. 11-1191-0008			FILE No. 1111910008D.GPJ		
DRAWN	JJL	Oct 2013	SCALE	N/A	REV.
CHECK	DAM	Oct 2013	FIGURE B2		
APPR	SEMC	Oct 2013			




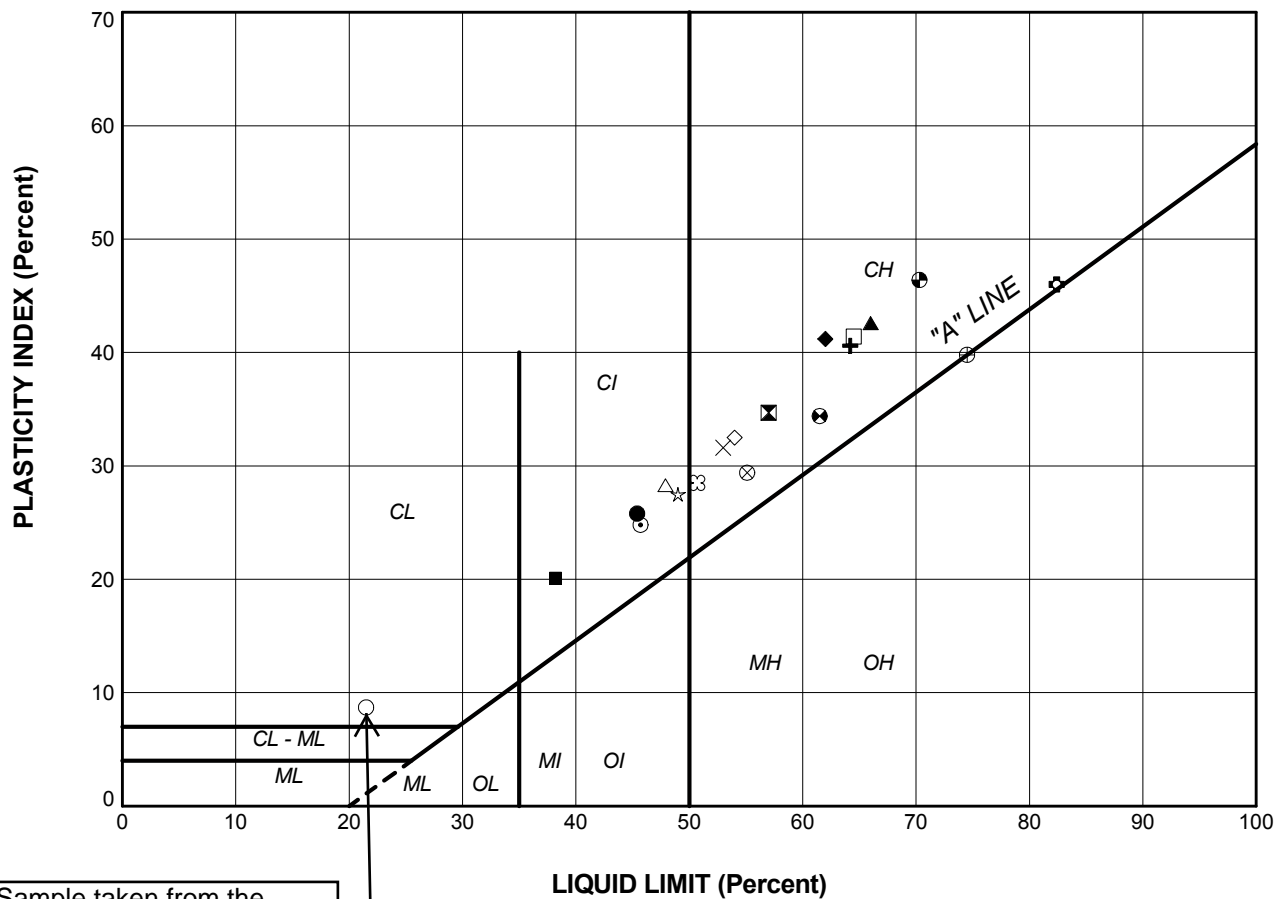


CLAY AND SILT	GRAVEL SIZE, mm					Cobble Size
	fine	medium	coarse	fine	coarse	
	SAND SIZE			GRAVEL SIZE		

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	P1	8	242.4
■	P2	3	243.9
▲	P2	6	241.1
+	P3	4	244.1
◆	P4	3	243.8
◇	P4	5	242.1
○	P5	2	245.3
△	P7	5	243.9
⊗	P8/P8A	6	244.7

PROJECT					
HIGHWAY 583 PRUNE CREEK BRIDGE					
TITLE					
GRAIN SIZE DISTRIBUTION SILTY CLAY to CLAY					
PROJECT No.		11-1191-0008		FILE No. 1111910008D.GPJ	
DRAWN	JJL	Oct 2013	SCALE	N/A	REV.
CHECK	DAM	Oct 2013			
APPR	SEMC	Oct 2013			
 Golder Associates SUDBURY, ONTARIO			FIGURE B3		



Sample taken from the transition zone of the Silty Clay to Clay/Sandy Silt (TILL) deposits

LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	P1	5	45.4	19.6	25.8
■	P1	6	38.2	18.1	20.1
▲	P1	8	66.0	23.4	42.6
+	P2	3	64.2	23.6	40.6
◆	P2	4	62.0	20.8	41.2
◇	P2	5	54.0	21.5	32.5
○	P2	6	21.5	12.8	8.7
△	P3	4	47.9	19.6	28.3
⊗	P3	5	55.1	25.7	29.4
⊕	P4	3	74.5	34.7	39.8
□	P4	5	64.5	23.1	41.4
⊗	P5	2	61.5	27.1	34.4
⊕	P5	5	70.3	23.9	46.4
☆	P6	4	49.0	21.5	27.5
⊗	P7	2	50.7	22.2	28.5
⊕	P7	4	57.0	22.3	34.7
⊗	P7	5	45.7	20.9	24.8
⊕	P8/P8A	6	82.4	36.4	46.0
×	P8/P8A	8	53.0	21.4	31.6

PROJECT					
HIGHWAY 583 PRUNE CREEK BRIDGE					
TITLE					
PLASTICITY CHART SILTY CLAY to CLAY					
PROJECT No.		11-1191-0008		FILE No.	
				1111910008D.GPJ	
DRAWN	JJL	Oct 2013	SCALE	N/A	REV.
CHECK	DAM	Oct 2013			
APPR	SEMC	Oct 2013			
			FIGURE B4		



CONSOLIDATION TEST SUMMARY**FIGURE B5**

Pg. 1 of 4

SAMPLE IDENTIFICATION

Project Number:	11-1191-0008	Sample Number:	4
Borehole Number:	7	Sample Depth, m:	3.51

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	2		
Date Started	June 13, 2013		
Date Completed	June 20, 2013		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.517	Unit Weight, kN/m ³	15.88
Sample Diameter, cm	6.347	Dry Unit Weight, kN/m ³	9.33
Area, cm ²	31.64	Specific Gravity, Measured	2.743
Volume, cm ³	79.64	Solids Height, cm	0.873
Water Content, %	70.20	Volume of Solids, cm ³	27.62
Wet Mass, g	128.92	Volume of Voids, cm ³	52.02
Dry Mass, g	75.75		

TEST COMPUTATIONS

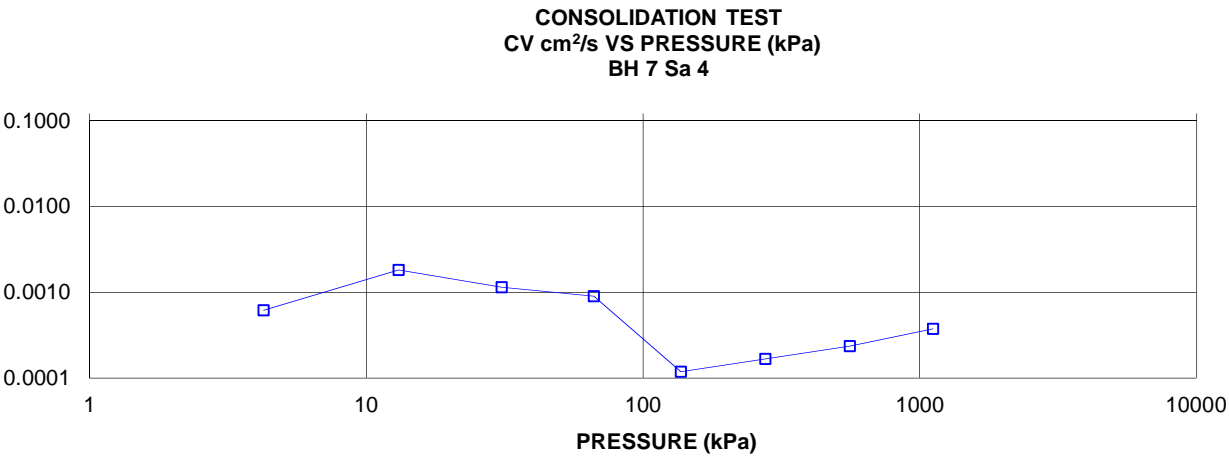
Pressure kPa	Primary Consolidation	Corr. Height cm	Void Ratio	Average Height cm	t ₉₀ sec	cv. cm ² /s	mv m ² /kN	k cm/s	Total Work kJ/m ³
0	0	2.517	1.884	2.517					
4	0.03	2.514	1.880	2.516	2160	0.0006	3.09E-04	1.88E-08	0.003
13	0.05	2.509	1.874	2.511	735	0.0018	2.28E-04	4.06E-08	0.020
31	0.12	2.497	1.860	2.503	1162	0.0011	2.70E-04	3.02E-08	0.126
66	0.28	2.469	1.828	2.483	1441	0.0009	3.16E-04	2.81E-08	0.674
137	1.76	2.293	1.626	2.381	10140	0.0001	9.94E-04	1.15E-08	7.906
277	2.10	2.083	1.386	2.188	6000	0.0002	5.92E-04	9.82E-09	26.815
558	1.33	1.950	1.234	2.017	3650	0.0002	1.88E-04	4.36E-09	53.493
1117	1.00	1.850	1.119	1.900	2018	0.0004	7.11E-05	2.64E-09	96.492
558	-0.14	1.864	1.135	1.857					
137	-0.55	1.919	1.198	1.891					
31	-0.61	1.979	1.267	1.949					
4	-0.52	2.031	1.327	2.005					

Note:

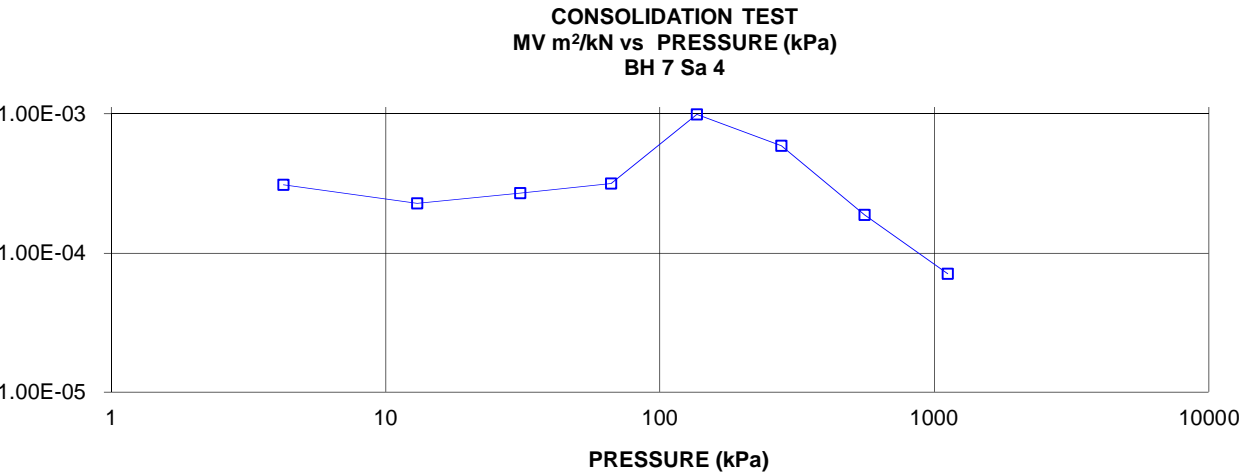
k calculated using α based on t₉₀ values.**SAMPLE DIMENSIONS AND PROPERTIES - FINAL**

Sample Height, cm	2.031	Unit Weight, kN/m ³	16.68
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m ³	11.56
Area, cm ²	31.64	Specific Gravity, Measured	2.743
Volume, cm ³	64.26	Solids Height, cm	0.873
Water Content, %	44.27	Volume of Solids, cm ³	27.62
Wet Mass, g	109.28	Volume of Voids, cm ³	36.64
Dry Mass, g	75.75		

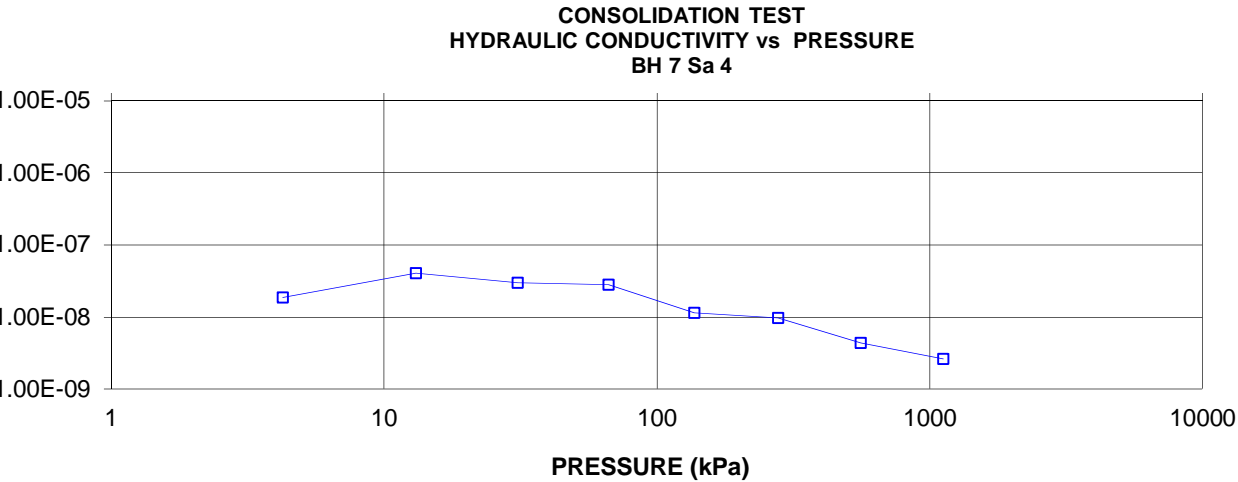
COEFFICIENT OF CONSOLIDATION,
cm²/s

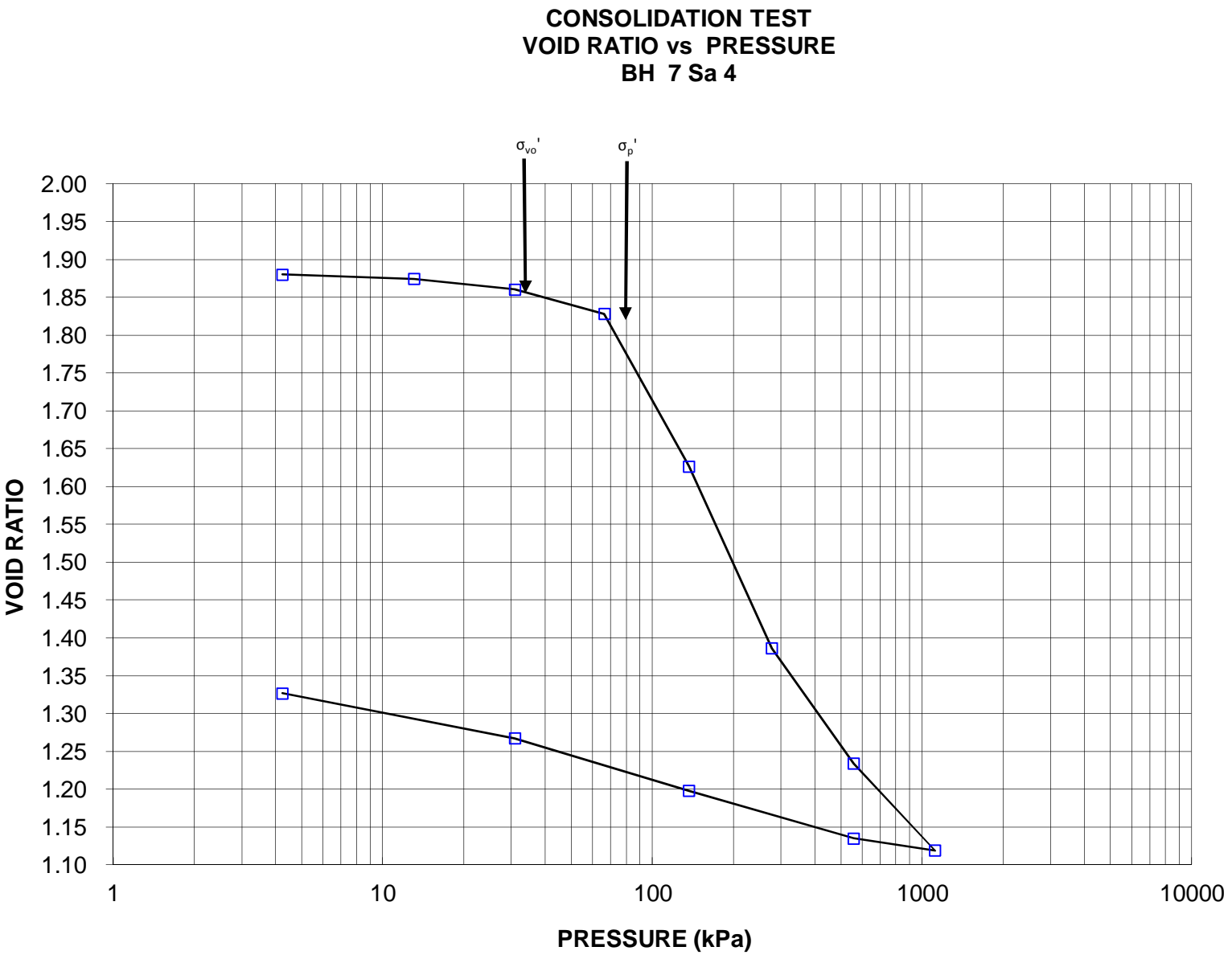


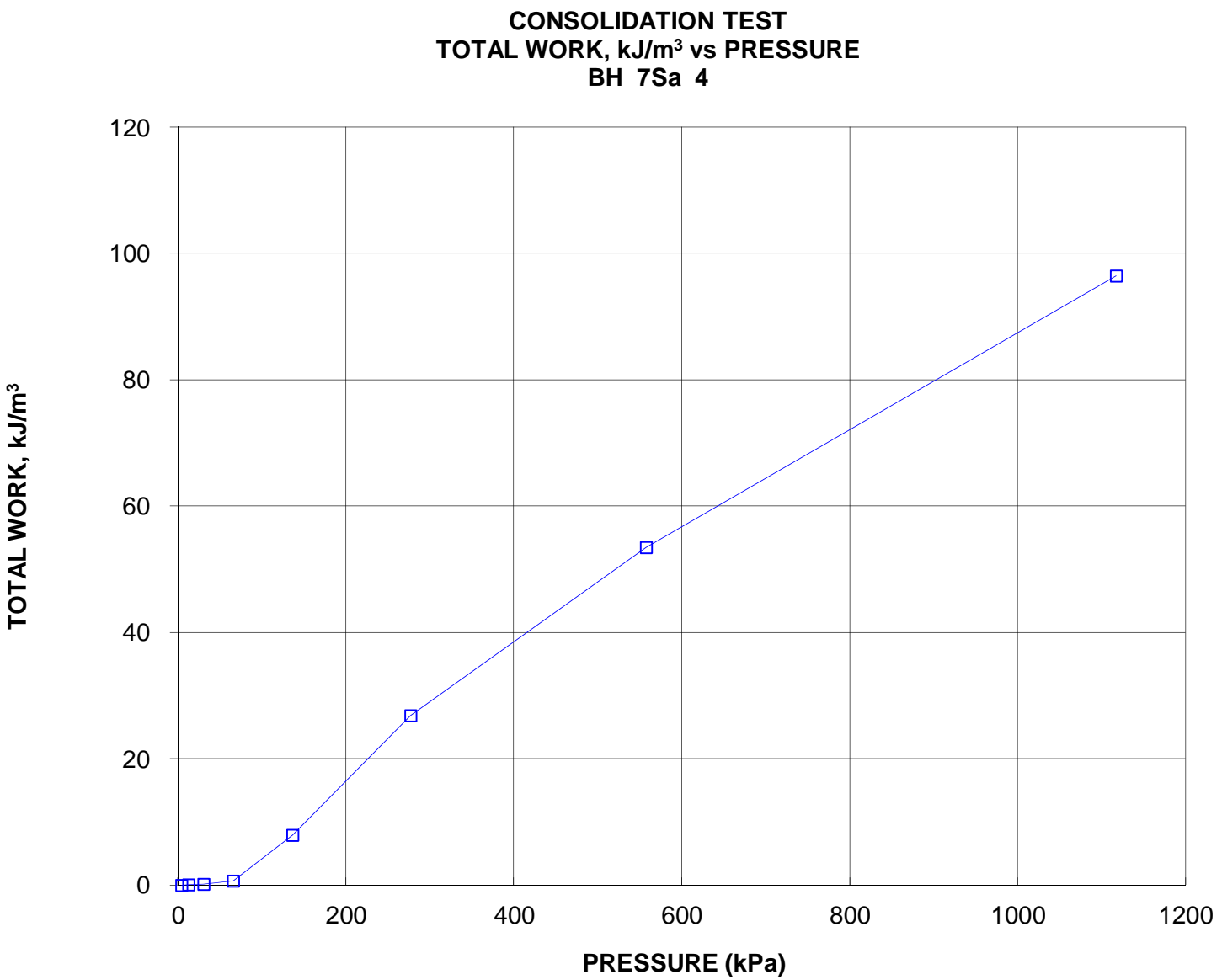
VOLUME COMPRESSIBILITY, m²/kN

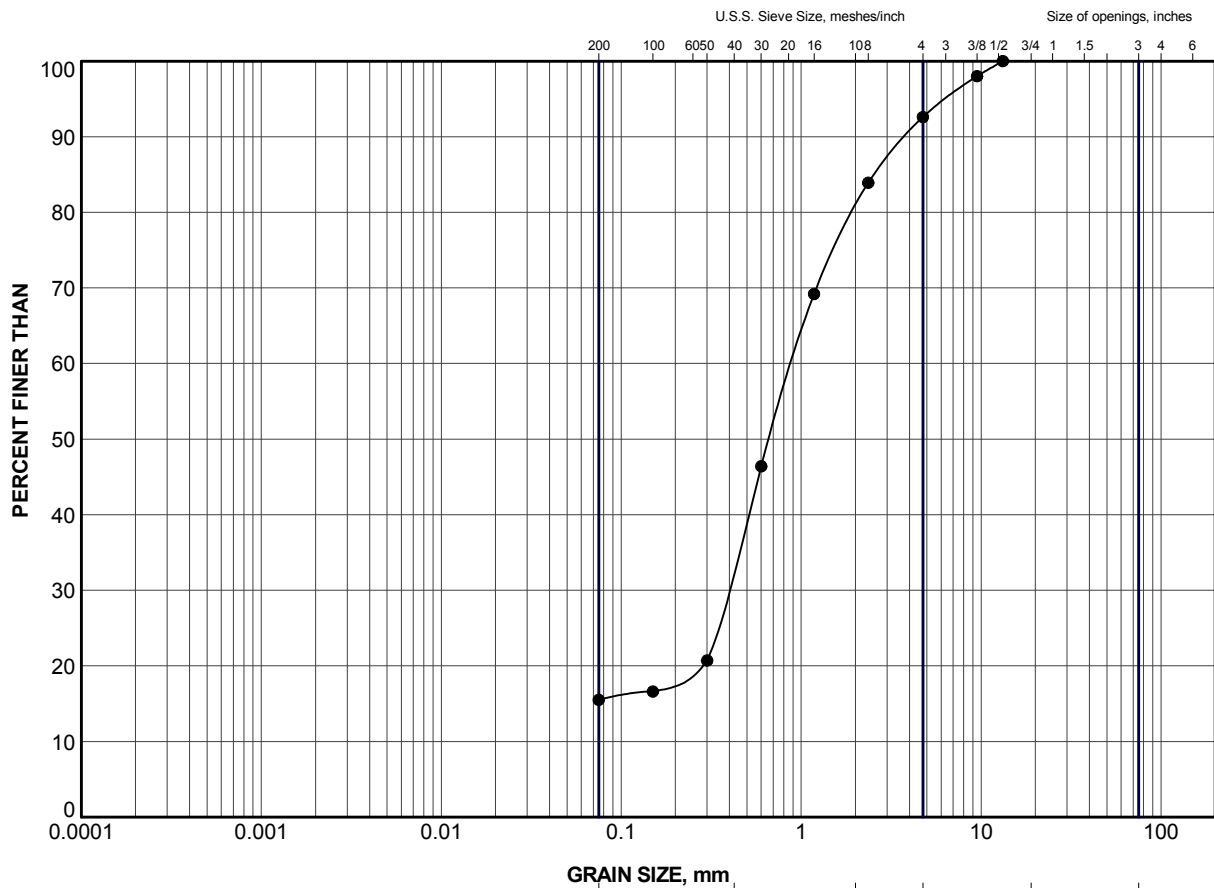


HYDRAULIC CONDUCTIVITY,
cm/s








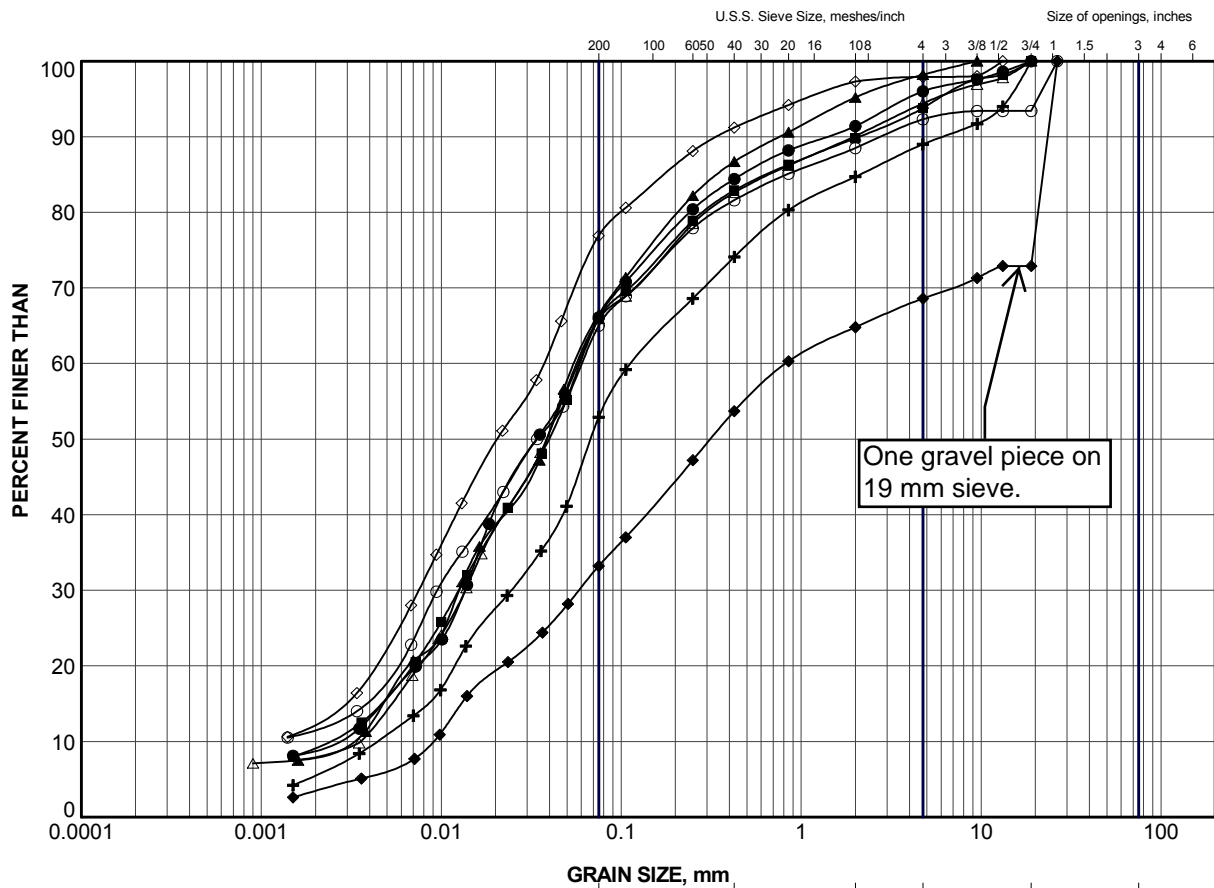


CLAY AND SILT	fine	medium	coarse	fine	coarse	Cobble Size
	SAND SIZE			GRAVEL SIZE		

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	P7	7	241.6

PROJECT					
HIGHWAY 583 PRUNE CREEK BRIDGE					
TITLE					
GRAIN SIZE DISTRIBUTION SAND					
PROJECT No.		11-1191-0008		FILE No. 1111910008D.GPJ	
DRAWN	JJL	Oct 2013	SCALE	N/A	REV.
CHECK	DAM	Oct 2013			
APPR	SEMC	Oct 2013			
 Golder Associates SUDBURY, ONTARIO			FIGURE B6		



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	P1	9	241.2
■	P2	7	240.1
▲	P3	8	240.3
+	P4	8	239.2
◆	P5	7	240.0
◇	P6	7	242.7
○	P6	10	238.1
△	P8/P8A	10	240.9

PROJECT

HIGHWAY 583
PRUNE CREEK BRIDGE

TITLE

GRAIN SIZE DISTRIBUTION

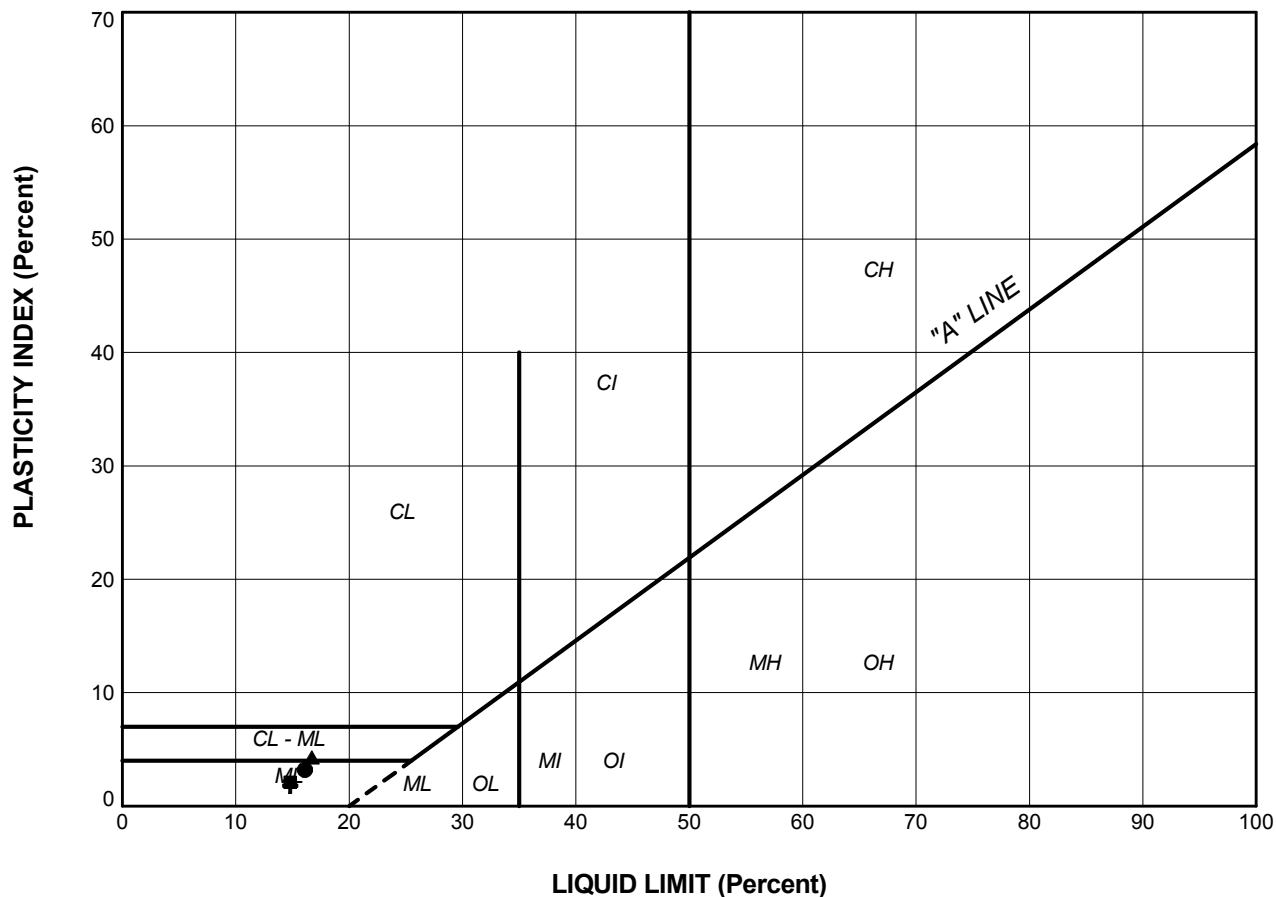
SANDY SILT to SAND AND SILT (TILL)



Golder Associates
SUDBURY, ONTARIO


PROJECT No.	11-1191-0008	FILE No.	1111910008D.GPJ
DRAWN	JJL	Oct 2013	SCALE N/A
CHECK	DAM	Oct 2013	REV.
APPR	SEMC	Oct 2013	

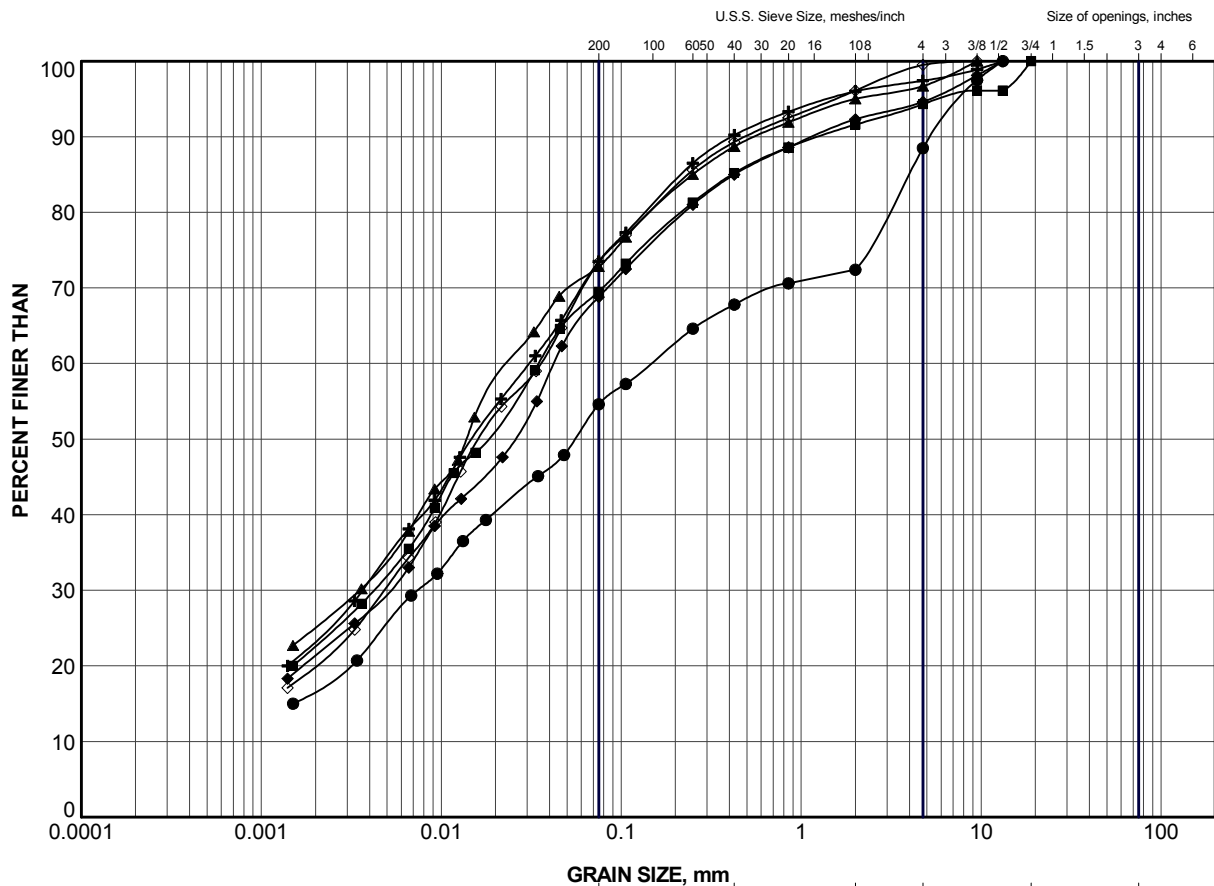
FIGURE B7



LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	P6	7	16.1	12.9	3.2
■	P6	8	14.8	12.7	2.1
▲	P6	10	16.7	12.4	4.3
+	P8/P8A	10	14.8	13.0	1.8

PROJECT					
HIGHWAY 583 PRUNE CREEK BRIDGE					
TITLE					
PLASTICITY CHART SANDY SILT to SAND AND SILT (TILL)					
PROJECT No.		11-1191-0008		FILE No.	
DRAWN		J.J.L.		Oct 2013	
CHECK		DAM		Oct 2013	
APPR		SEMC		Oct 2013	
 Golder Associates SUDBURY, ONTARIO				SCALE N/A REV.	
FIGURE B8					



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	P1	12	236.7
■	P2	10	236.3
▲	P3	10	238.8
+	P7	10	237.0
◆	P7	12	234.1
◇	P8/P8A	12	237.8

PROJECT

HIGHWAY 583
PRUNE CREEK BRIDGE

TITLE

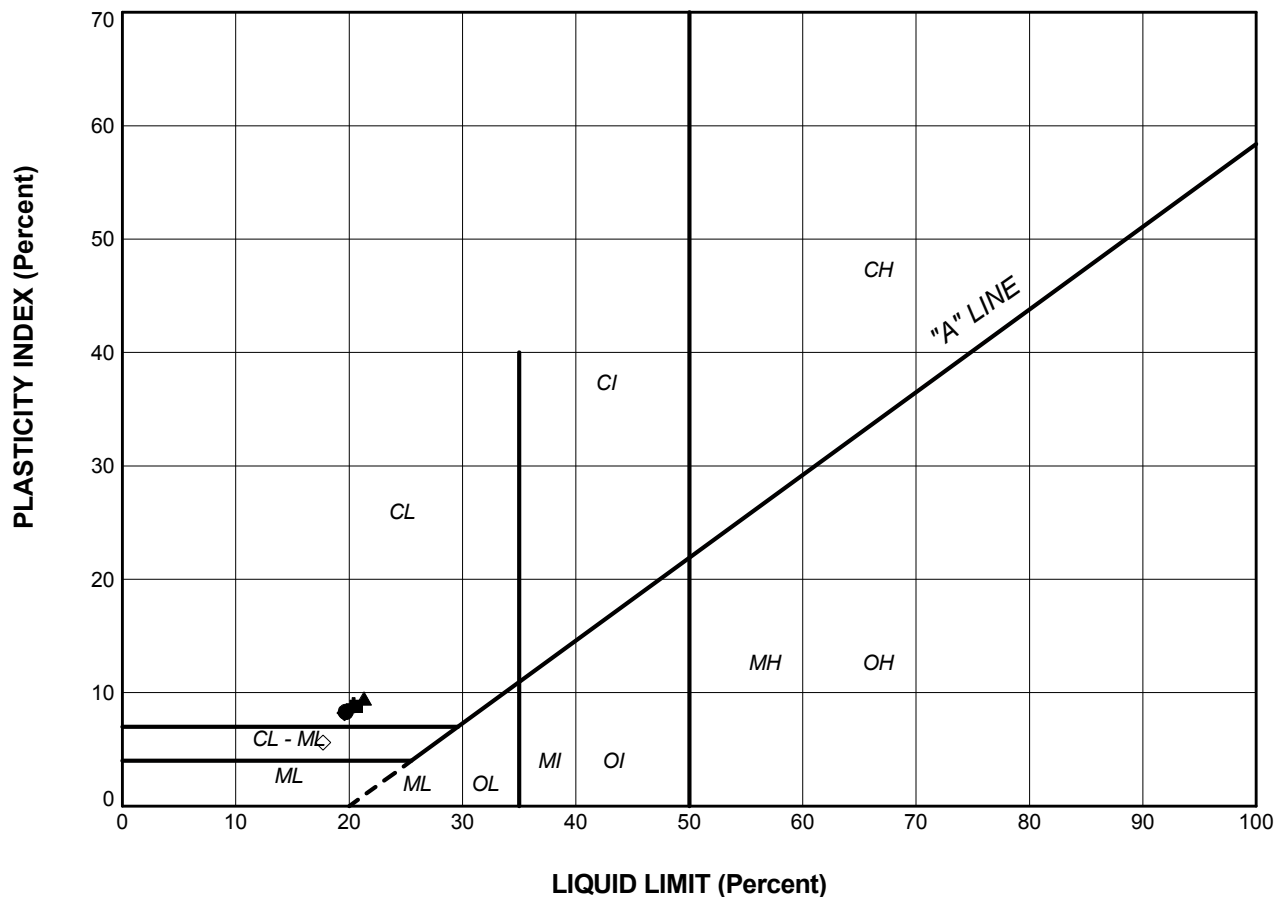
GRAIN SIZE DISTRIBUTION
SANDY CLAYEY SILT to CLAYEY SILT (TILL)



**Golder
Associates**
SUDBURY, ONTARIO


PROJECT No.	11-1191-0008	FILE No.	1111910008D.GPJ
DRAWN	JJL	Oct 2013	SCALE N/A
CHECK	DAM	Oct 2013	REV.
APPR	SEMC	Oct 2013	

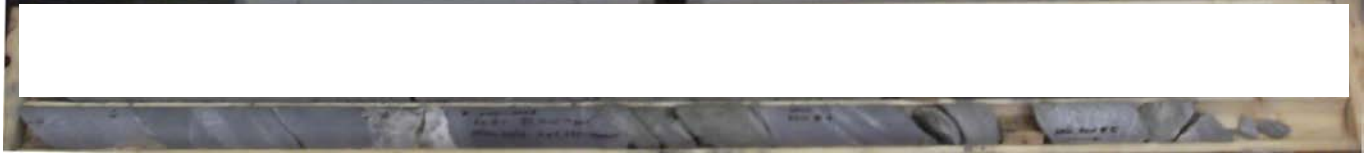
FIGURE B9



LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	P1	12	19.7	11.4	8.3
■	P2	10	20.6	11.8	8.8
▲	P3	10	21.3	11.8	9.5
+	P7	10	20.4	11.5	8.9
◆	P7	12	19.6	11.4	8.2
◇	P8/P8A	12	17.7	12.1	5.6

PROJECT					
HIGHWAY 583 PRUNE CREEK BRIDGE					
TITLE					
PLASTICITY CHART SANDY CLAYEY SILT to CLAYEY SILT (TILL)					
PROJECT No.		11-1191-0008		FILE No.	
DRAWN		JLL		Oct 2013	
CHECK		DAM		Oct 2013	
APPR		SEMC		Oct 2013	
 Golder Associates SUDBURY, ONTARIO				SCALE N/A REV.	
FIGURE B10					

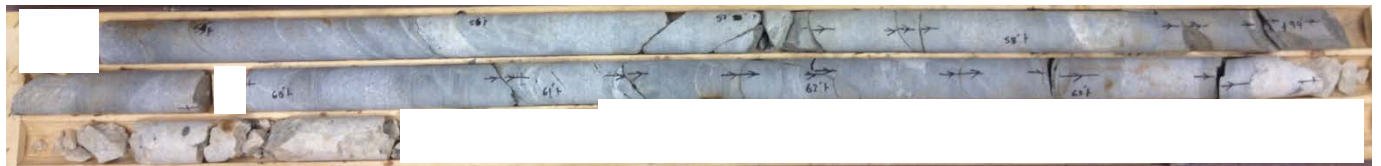


Borehole P2 (Box 1 of 2)
Elevation 230.4 m to 228.8 m



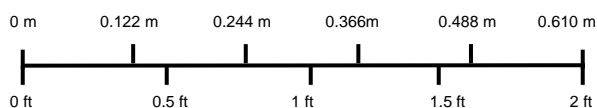
Borehole P2 (Box 2 of 2)
Elevation 228.8 m to 227.4 m


(Note: tape used to prevent loss of core during transport)



Borehole P8/8A (Box 1 of 1)
Elevation 232.2 m to 229.0 m

(Note: tape used to prevent loss of core during transport)



PROJECT		HIGHWAY 583 PRUNE CREEK BRIDGE	
TITLE		BEDROCK CORE PHOTOGRAPHS	
		PROJECT No. 11-1191-0008	FILE No. ----
		DESIGN MT Oct 2013	SCALE AS SHOWN REV.
		CADD --	
		CHECK SEMC Oct 2013	
		REVIEW JMCA Oct 2013	FIGURE B11



APPENDIX C

Analytical Laboratory Test Results



Table C1 - Summary of Analytical Testing of Creek Water

Parameter	Units	Result
Resistivity	ohm-cm	14,000
Conductivity	µmho/cm	73
pH	pH	7.20
Sulphate	mg/L	80
Chloride	mg/L	41

Notes:

1. Sample obtained March 23, 2012
2. Analytical testing carried out by Maxxam Analytics Inc.

Prepared by: DAM
Reviewed by: SEMC

Your Project #: 11-1191-0008
Site#: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Your C.O.C. #: EO863712

Attention: David Muldowney

Golder Associates Ltd
1010 Lorne St
Sudbury, ON
P3C 4R9

Report Date: 2013/10/04

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B3G4937
Received: 2013/09/28, 09:40

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Chloride (20:1 extract)	2	N/A	2013/10/04	CAM SOP-00463	EPA 325.2
Cyanide (WAD) in Leachates	2	N/A	2013/10/03	CAM SOP-00457	Ontario MOE CN-3015
Petroleum Hydro. CCME F1 & BTEX in Soil	2	2013/10/01	2013/10/03	CAM SOP-00315	CCME CWS
Petroleum Hydrocarbons F2-F4 in Soil	2	2013/10/03	2013/10/03	CAM SOP-00316	CCME CWS
Fluoride by ISE in Leachates	2	2013/10/03	2013/10/03	CAM SOP-00449	SM 4500FC
Mercury (TCLP Leachable) (mg/L)	2	N/A	2013/10/03	CAM SOP-00453	EPA 7470
Total Metals Analysis by ICP	2	2013/10/03	2013/10/03	CAM SOP-00408	SW-846 6010C
Total Metals in TCLP Leachate by ICPMS	2	2013/10/03	2013/10/03	CAM SOP-00447	EPA 6020
Moisture	2	N/A	2013/10/02	CAM SOP-00445	R.Carter,1993
Nitrate(NO3) + Nitrite(NO2) in Leachate	2	N/A	2013/10/03	CAM SOP-00440	SM 4500 NO3/NO2B
PAH Compounds in Leachate by GC/MS (SIM)	2	2013/10/02	2013/10/03	CAM SOP-00318	EPA 8270
TCLP - % Solids	2	2013/10/01	2013/10/02	CAM SOP-00401	EPA 1311 modified
TCLP - Extraction Fluid	2	N/A	2013/10/02	CAM SOP-00401	EPA 1311 modified
TCLP - Initial and final pH	2	N/A	2013/10/02	CAM SOP-00401	EPA 1311 modified

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

* Results relate only to the items tested.

Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

-2-

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Antonella Brasil, Project Manager
Email: ABrasil@maxxam.ca
Phone# (905) 817-5817

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

RESULTS OF ANALYSES OF SOIL

Maxxam ID		TG5607		TG5608		
Sampling Date		2013/09/25 16:00		2013/09/25 16:30		
	Units	TP1	RDL	TP2	RDL	QC Batch
Inorganics						
Soluble (20:1) Chloride (Cl)	ug/g	ND	20	ND	20	3374274
Final pH	pH	6.17		6.16		3368820
Leachable Fluoride (F-)	mg/L	0.7	0.1	0.3	0.1	3372492
Leachable Free Cyanide	mg/L	ND	0.002	ND	0.002	3372489
Initial pH	pH	9.01		8.74		3368820
Moisture	%	40	1.0	28	1.0	3370850
TCLP - % Solids	%	100	0.2	100	0.2	3368817
TCLP Extraction Fluid	N/A	FLUID 1		FLUID 1		3368819
Leachable Nitrite (N)	mg/L	ND	0.1	ND	0.1	3372490
Leachable Nitrate (N)	mg/L	260	5	ND	1	3372490
Leachable Nitrate + Nitrite	mg/L	260	5	ND	1	3372490
Metals						
Leachable Mercury (Hg)	mg/L	ND	0.001	ND	0.001	3371492

N/A = Not Applicable

ND = Not detected

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		TG5607	TG5608		
Sampling Date		2013/09/25 16:00	2013/09/25 16:30		
	Units	TP1	TP2	RDL	QC Batch
Metals					
Leachable Arsenic (As)	mg/L	ND	ND	0.2	3372683
Leachable Barium (Ba)	mg/L	1.1	0.7	0.2	3372683
Leachable Boron (B)	mg/L	0.5	0.2	0.1	3372683
Leachable Cadmium (Cd)	mg/L	ND	ND	0.05	3372683
Leachable Chromium (Cr)	mg/L	ND	ND	0.1	3372683
Leachable Lead (Pb)	mg/L	ND	ND	0.1	3372683
Leachable Selenium (Se)	mg/L	ND	ND	0.1	3372683
Leachable Silver (Ag)	mg/L	ND	ND	0.01	3372683
Acid Extractable Sodium (Na)	ug/g	420	270	100	3372939
Leachable Uranium (U)	mg/L	ND	ND	0.01	3372683

SEMI-VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		TG5607	TG5608		
Sampling Date		2013/09/25 16:00	2013/09/25 16:30		
	Units	TP1	TP2	RDL	QC Batch
Polyaromatic Hydrocarbons					
Leachable Benzo(a)pyrene	ug/L	ND	ND	0.04	3371892
Surrogate Recovery (%)					
Leachable D10-Anthracene	%	106	103		3371892
Leachable D14-Terphenyl (FS)	%	94	92		3371892
Leachable D8-Acenaphthylene	%	94	91		3371892

ND = Not detected

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		TG5607		TG5608		
Sampling Date		2013/09/25 16:00		2013/09/25 16:30		
	Units	TP1	RDL	TP2	RDL	QC Batch
BTEX & F1 Hydrocarbons						
Benzene	ug/g	ND	0.020	ND	0.020	3373478
Toluene	ug/g	ND	0.020	ND	0.020	3373478
Ethylbenzene	ug/g	ND	0.020	ND	0.020	3373478
o-Xylene	ug/g	ND	0.020	ND	0.020	3373478
p+m-Xylene	ug/g	ND	0.040	ND	0.040	3373478
Total Xylenes	ug/g	ND	0.040	ND	0.040	3373478
F1 (C6-C10)	ug/g	ND	10	ND	10	3373478
F1 (C6-C10) - BTEX	ug/g	ND	10	ND	10	3373478
F2-F4 Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	ug/g	ND	20	ND	10	3372378
F3 (C16-C34 Hydrocarbons)	ug/g	ND	100	ND	50	3372378
F4 (C34-C50 Hydrocarbons)	ug/g	ND	100	ND	50	3372378
Reached Baseline at C50	ug/g	YES		YES		3372378
Surrogate Recovery (%)						
1,4-Difluorobenzene	%	103		103		3373478
4-Bromofluorobenzene	%	87		95		3373478
D10-Ethylbenzene	%	96		94		3373478
D4-1,2-Dichloroethane	%	123		125		3373478
o-Terphenyl	%	88		101		3372378

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

Test Summary

Maxxam ID TG5607
Sample ID TP1
Matrix Soil

Collected 2013/09/25
Shipped
Received 2013/09/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride (20:1 extract)	AC/EC	3374274	N/A	2013/10/04	Alina Dobreanu
Cyanide (WAD) in Leachates	TECH/CN	3372489	N/A	2013/10/03	Louise Harding
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	3373478	2013/10/01	2013/10/03	Domnica Andronescu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	3372378	2013/10/03	2013/10/03	Jeevaraj Jeevaratnam
Fluoride by ISE in Leachates	ISE	3372492	2013/10/03	2013/10/03	Surinder Rai
Mercury (TCLP Leachable) (mg/L)	CVAA	3371492	N/A	2013/10/03	Magdalena Carlos
Total Metals Analysis by ICP	ICP	3372939	2013/10/03	2013/10/03	Suban Kanapathipillai
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	3372683	2013/10/03	2013/10/03	Hua Ren
Moisture	BAL	3370850	N/A	2013/10/02	Valentina Kaftani
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	3372490	N/A	2013/10/03	Sandeep Singh
PAH Compounds in Leachate by GC/MS (SI	GC/MS	3371892	2013/10/02	2013/10/03	Darryl Tiller
TCLP - % Solids	BAL	3368817	2013/10/01	2013/10/02	Jian (Ken) Wang
TCLP - Extraction Fluid		3368819	N/A	2013/10/02	Jian (Ken) Wang
TCLP - Initial and final pH	PH	3368820	N/A	2013/10/02	Jian (Ken) Wang

Maxxam ID TG5608
Sample ID TP2
Matrix Soil

Collected 2013/09/25
Shipped
Received 2013/09/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Chloride (20:1 extract)	AC/EC	3374274	N/A	2013/10/04	Alina Dobreanu
Cyanide (WAD) in Leachates	TECH/CN	3372489	N/A	2013/10/03	Louise Harding
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	3373478	2013/10/01	2013/10/03	Domnica Andronescu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	3372378	2013/10/03	2013/10/03	Jeevaraj Jeevaratnam
Fluoride by ISE in Leachates	ISE	3372492	2013/10/03	2013/10/03	Surinder Rai
Mercury (TCLP Leachable) (mg/L)	CVAA	3371492	N/A	2013/10/03	Magdalena Carlos
Total Metals Analysis by ICP	ICP	3372939	2013/10/03	2013/10/03	Suban Kanapathipillai
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	3372683	2013/10/03	2013/10/03	Hua Ren
Moisture	BAL	3370850	N/A	2013/10/02	Valentina Kaftani
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	3372490	N/A	2013/10/03	Sandeep Singh
PAH Compounds in Leachate by GC/MS (SI	GC/MS	3371892	2013/10/02	2013/10/03	Darryl Tiller
TCLP - % Solids	BAL	3368817	2013/10/01	2013/10/02	Jian (Ken) Wang
TCLP - Extraction Fluid		3368819	N/A	2013/10/02	Jian (Ken) Wang

Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

Test Summary

TCLP - Initial and final pH	PH	3368820	N/A	2013/10/02	Jian (Ken) Wang
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Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

Package 1	6.3°C
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Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Sample TG5607-01: F2-F4 Analysis.
Detection limits were adjusted for high moisture content.

Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	Value	Units
3370850	Moisture	2013/10/02							0	20		
3371492	Leachable Mercury (Hg)	2013/10/03	98	80 - 120	99	80 - 120	ND, RDL=0.001	mg/L	NC	25	ND	mg/L
3371892	Leachable D10-Anthracene	2013/10/03	103	50 - 130	103	50 - 130	103	%				
3371892	Leachable D14-Terphenyl (FS)	2013/10/03	89	50 - 130	90	50 - 130	89	%				
3371892	Leachable D8-Acenaphthylene	2013/10/03	96	50 - 130	98	50 - 130	95	%				
3371892	Leachable Benzo(a)pyrene	2013/10/03	102	50 - 130	101	50 - 130	0.06, RDL=0.04	ug/L				
3372378	o-Terphenyl	2013/10/03	100	50 - 130	98	50 - 130	100	%				
3372378	F2 (C10-C16 Hydrocarbons)	2013/10/03	101	50 - 130	100	80 - 120	ND, RDL=10	ug/g	NC	30		
3372378	F3 (C16-C34 Hydrocarbons)	2013/10/03	104	50 - 130	101	80 - 120	ND, RDL=50	ug/g	NC	30		
3372378	F4 (C34-C50 Hydrocarbons)	2013/10/03	102	50 - 130	100	80 - 120	ND, RDL=50	ug/g	NC	30		
3372489	Leachable Free Cyanide	2013/10/03	88	80 - 120	101	80 - 120	ND, RDL=0.002	mg/L	NC	20	ND	mg/L
3372490	Leachable Nitrite (N)	2013/10/03	100	80 - 120	100	85 - 115	ND, RDL=0.1	mg/L	NC	25	ND	mg/L
3372490	Leachable Nitrate (N)	2013/10/03	100	80 - 120	97	85 - 115	ND, RDL=1	mg/L	NC	25	ND	mg/L
3372490	Leachable Nitrate + Nitrite	2013/10/03	100	80 - 120	98	85 - 115	ND, RDL=1	mg/L	NC	25	ND	mg/L
3372492	Leachable Fluoride (F-)	2013/10/03	113	80 - 120	100	80 - 120	ND, RDL=0.1	mg/L	NC	25	ND	mg/L
3372683	Leachable Arsenic (As)	2013/10/03	105	75 - 125	105	75 - 125			NC	35	ND	mg/L
3372683	Leachable Barium (Ba)	2013/10/03	108	75 - 125	108	75 - 125			NC	35	ND	mg/L
3372683	Leachable Boron (B)	2013/10/03	105	75 - 125	120	75 - 125			NC	35	ND	mg/L
3372683	Leachable Cadmium (Cd)	2013/10/03	105	75 - 125	105	75 - 125			NC	35	ND	mg/L
3372683	Leachable Chromium (Cr)	2013/10/03	105	75 - 125	105	75 - 125			NC	35	ND	mg/L
3372683	Leachable Lead (Pb)	2013/10/03	105	75 - 125	108	75 - 125			NC	35	ND	mg/L
3372683	Leachable Selenium (Se)	2013/10/03	107	75 - 125	108	75 - 125			NC	35	ND	mg/L
3372683	Leachable Silver (Ag)	2013/10/03	102	75 - 125	103	75 - 125			NC	35	ND	mg/L
3372683	Leachable Uranium (U)	2013/10/03	107	75 - 125	107	75 - 125			NC	35	ND	mg/L
3372939	Acid Extractable Sodium (Na)	2013/10/03	103	75 - 125	100	80 - 120	ND, RDL=100	ug/g				
3373478	1,4-Difluorobenzene	2013/10/03	106	60 - 140	106	60 - 140	106	%				
3373478	4-Bromofluorobenzene	2013/10/03	110	60 - 140	109	60 - 140	102	%				
3373478	D10-Ethylbenzene	2013/10/03	97	60 - 140	90	60 - 140	89	%				
3373478	D4-1,2-Dichloroethane	2013/10/03	125	60 - 140	122	60 - 140	124	%				
3373478	Benzene	2013/10/03	99	60 - 140	100	60 - 130	ND, RDL=0.020	ug/g	NC	50		
3373478	Toluene	2013/10/03	97	60 - 140	99	60 - 130	ND, RDL=0.020	ug/g	NC	50		
3373478	Ethylbenzene	2013/10/03	115	60 - 140	121	60 - 130	ND, RDL=0.020	ug/g	NC	50		
3373478	o-Xylene	2013/10/03	119	60 - 140	124	60 - 130	ND, RDL=0.020	ug/g	NC	50		
3373478	p+m-Xylene	2013/10/03	107	60 - 140	112	60 - 130	ND, RDL=0.040	ug/g	NC	50		
3373478	F1 (C6-C10)	2013/10/03	90	60 - 140	91	80 - 120	ND, RDL=10	ug/g	NC	50		
3373478	Total Xylenes	2013/10/03					ND, RDL=0.040	ug/g	NC	50		

Maxxam Job #: B3G4937
Report Date: 2013/10/04

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: SA

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		Leachate Blank	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	Value	Units
3373478	F1 (C6-C10) - BTEX	2013/10/03					ND, RDL=10	ug/g	NC	50		
3374274	Soluble (20:1) Chloride (Cl)	2013/10/04	107	75 - 125	100	75 - 125	ND, RDL=20	ug/g	NC	35		

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

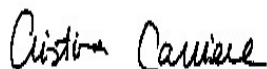
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

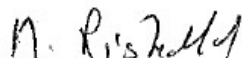
Validation Signature Page

Maxxam Job #: B3G4937

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

A handwritten signature in black ink, appearing to read "Cristina Carriere".

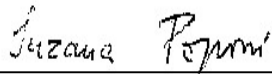
Cristina Carriere, Scientific Services

A handwritten signature in black ink, appearing to read "M. Riskallah".

Medhat Riskallah, Manager, Hydrocarbon Department

A handwritten signature in black ink, appearing to read "Michael Wang".

Michael Wang, Senior Analyst

A handwritten signature in black ink, appearing to read "Suzana Popovic".

Suzana Popovic, Supervisor, Hydrocarbons

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Your Project #: 11-1191-0008
 Site#: 11-1191-0008
 Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
 Your C.O.C. #: na

Attention: David Muldowney

Golder Associates Ltd
 1010 Lorne St
 Sudbury, ON
 P3C 4R9

Report Date: 2013/10/17

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B3H2928

Received: 2013/10/10, 13:11

Sample Matrix: Soil
 # Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Acid Extr. Metals (aqua regia) by ICPMS	2	2013/10/17	2013/10/17	CAM SOP-00447	EPA 6020
Polychlorinated Biphenyl in Leachate	2	2013/10/16	2013/10/16	CAM SOP-00309	SW846 8082
TCLP - % Solids	2	2013/10/15	2013/10/16	CAM SOP-00401	EPA 1311 modified
TCLP - Extraction Fluid	2	N/A	2013/10/16	CAM SOP-00401	EPA 1311 modified
TCLP - Initial and final pH	2	N/A	2013/10/16	CAM SOP-00401	EPA 1311 modified
TCLP Zero Headspace Extraction	2	2013/10/11	2013/10/11	CAM SOP-00430	EPA 1311 modified
VOCs in ZHE Leachates	2	2013/10/15	2013/10/15	CAM SOP 00226	EPA 8260 modified

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

* Results relate only to the items tested.

Maxxam Job #: B3H2928
Report Date: 2013/10/17

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: DM

-2-

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Antonella Brasil, Project Manager
Email: ABrasil@maxxam.ca
Phone# (905) 817-5817

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B3H2928
Report Date: 2013/10/17

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: DM

RESULTS OF ANALYSES OF SOIL

Maxxam ID		TK7235	TK7236		
Sampling Date		2013/09/25 16:00	2013/09/25 16:30		
	Units	TP 1	TP 2	RDL	QC Batch
Charge/Prep Analysis					
Amount Extracted (Wet Weight) (g)	N/A	25	25	N/A	3382849
Inorganics					
Final pH	pH	6.18	7.36		3387186
Initial pH	pH	9.07	9.13		3387186
TCLP - % Solids	%	100	100	0.2	3387180
TCLP Extraction Fluid	N/A	FLUID 1	FLUID 1		3387185

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B3H2928
Report Date: 2013/10/17

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: DM

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

Maxxam ID		TK7235	TK7236		
Sampling Date		2013/09/25 16:00	2013/09/25 16:30		
	Units	TP 1	TP 2	RDL	QC Batch
Metals					
Acid Extractable Aluminum (Al)	ug/g	18000	9900	50	3388232
Acid Extractable Antimony (Sb)	ug/g	0.24	ND	0.20	3388232
Acid Extractable Arsenic (As)	ug/g	4.0	2.1	1.0	3388232
Acid Extractable Barium (Ba)	ug/g	120	57	0.50	3388232
Acid Extractable Beryllium (Be)	ug/g	0.85	0.49	0.20	3388232
Acid Extractable Bismuth (Bi)	ug/g	ND	ND	1.0	3388232
Acid Extractable Boron (B)	ug/g	12	9.4	5.0	3388232
Acid Extractable Cadmium (Cd)	ug/g	0.13	0.10	0.10	3388232
Acid Extractable Calcium (Ca)	ug/g	94000	130000	50	3388232
Acid Extractable Chromium (Cr)	ug/g	52	32	1.0	3388232
Acid Extractable Cobalt (Co)	ug/g	14	8.1	0.10	3388232
Acid Extractable Copper (Cu)	ug/g	30	17	0.50	3388232
Acid Extractable Iron (Fe)	ug/g	31000	18000	50	3388232
Acid Extractable Lead (Pb)	ug/g	12	6.6	1.0	3388232
Acid Extractable Magnesium (Mg)	ug/g	23000	29000	50	3388232
Acid Extractable Manganese (Mn)	ug/g	520	470	1.0	3388232
Acid Extractable Molybdenum (Mo)	ug/g	0.60	ND	0.50	3388232
Acid Extractable Nickel (Ni)	ug/g	36	21	0.50	3388232
Acid Extractable Phosphorus (P)	ug/g	540	490	50	3388232
Acid Extractable Potassium (K)	ug/g	4000	2100	200	3388232
Acid Extractable Selenium (Se)	ug/g	ND	ND	0.50	3388232
Acid Extractable Silver (Ag)	ug/g	ND	ND	0.20	3388232
Acid Extractable Sodium (Na)	ug/g	320	210	100	3388232
Acid Extractable Strontium (Sr)	ug/g	100	98	1.0	3388232
Acid Extractable Thallium (Tl)	ug/g	0.21	0.12	0.050	3388232
Acid Extractable Tin (Sn)	ug/g	ND	ND	5.0	3388232
Acid Extractable Uranium (U)	ug/g	1.4	1.0	0.050	3388232
Acid Extractable Vanadium (V)	ug/g	48	30	5.0	3388232
Acid Extractable Zinc (Zn)	ug/g	74	42	5.0	3388232
Acid Extractable Mercury (Hg)	ug/g	ND	ND	0.050	3388232

ND = Not detected

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Maxxam Job #: B3H2928
Report Date: 2013/10/17

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: DM

VOLATILE ORGANICS BY GC/MS (SOIL)

Maxxam ID		TK7235	TK7236		
Sampling Date		2013/09/25 16:00	2013/09/25 16:30		
	Units	TP 1	TP 2	RDL	QC Batch
Volatile Organics					
Leachable Benzene	mg/L	ND	ND	0.020	3385488
Leachable Carbon Tetrachloride	mg/L	ND	ND	0.020	3385488
Leachable Chlorobenzene	mg/L	ND	ND	0.020	3385488
Leachable Chloroform	mg/L	ND	ND	0.020	3385488
Leachable 1,2-Dichlorobenzene	mg/L	ND	ND	0.050	3385488
Leachable 1,4-Dichlorobenzene	mg/L	ND	ND	0.050	3385488
Leachable 1,2-Dichloroethane	mg/L	ND	ND	0.050	3385488
Leachable 1,1-Dichloroethylene	mg/L	ND	ND	0.020	3385488
Leachable Methylene Chloride(Dichloromethane)	mg/L	ND	ND	0.20	3385488
Leachable Methyl Ethyl Ketone (2-Butanone)	mg/L	ND	ND	1.0	3385488
Leachable Tetrachloroethylene	mg/L	ND	ND	0.020	3385488
Leachable Trichloroethylene	mg/L	ND	ND	0.020	3385488
Leachable Vinyl Chloride	mg/L	ND	ND	0.020	3385488
Surrogate Recovery (%)					
Leachable 4-Bromofluorobenzene	%	96	95		3385488
Leachable D4-1,2-Dichloroethane	%	79	77		3385488
Leachable D8-Toluene	%	104	104		3385488

POLYCHLORINATED BIPHENYLS BY GC-ECD (SOIL)

Maxxam ID		TK7235	TK7236		
Sampling Date		2013/09/25 16:00	2013/09/25 16:30		
	Units	TP 1	TP 2	RDL	QC Batch
PCBs					
Leachable Total PCB	ug/L	ND	ND	3	3387210
Surrogate Recovery (%)					
Leachable Decachlorobiphenyl	%	126	120		3387210

ND = Not detected

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Maxxam Job #: B3H2928
Report Date: 2013/10/17

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: DM

Test Summary

Maxxam ID TK7235
Sample ID TP 1
Matrix Soil

Collected 2013/09/25
Shipped
Received 2013/10/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	3388232	2013/10/17	2013/10/17	John Bowman
Polychlorinated Biphenyl in Leachate	GC/ECD	3387210	2013/10/16	2013/10/16	Sarah Huang
TCLP - % Solids	BAL	3387180	2013/10/15	2013/10/16	Jian (Ken) Wang
TCLP - Extraction Fluid		3387185	N/A	2013/10/16	Jian (Ken) Wang
TCLP - Initial and final pH	PH	3387186	N/A	2013/10/16	Jian (Ken) Wang
TCLP Zero Headspace Extraction		3382849	2013/10/11	2013/10/11	Walt Wang
VOCs in ZHE Leachates	GC/MS	3385488	2013/10/15	2013/10/15	Edwin Ayala

Maxxam ID TK7236
Sample ID TP 2
Matrix Soil

Collected 2013/09/25
Shipped
Received 2013/10/10

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Acid Extr. Metals (aqua regia) by ICPMS	ICP/MS	3388232	2013/10/17	2013/10/17	John Bowman
Polychlorinated Biphenyl in Leachate	GC/ECD	3387210	2013/10/16	2013/10/16	Sarah Huang
TCLP - % Solids	BAL	3387180	2013/10/15	2013/10/16	Jian (Ken) Wang
TCLP - Extraction Fluid		3387185	N/A	2013/10/16	Jian (Ken) Wang
TCLP - Initial and final pH	PH	3387186	N/A	2013/10/16	Jian (Ken) Wang
TCLP Zero Headspace Extraction		3382849	2013/10/11	2013/10/11	Walt Wang
VOCs in ZHE Leachates	GC/MS	3385488	2013/10/15	2013/10/15	Edwin Ayala

Maxxam Job #: B3H2928
Report Date: 2013/10/17

Golder Associates Ltd
Client Project #: 11-1191-0008
Site Location: PRUNE CREEK BRIDGE, HEARST, ONTARIO
Sampler Initials: DM

GENERAL COMMENTS

Sample TK7235-01: TCLP VOCs Extraction: Sample(s) analyzed past hold time. Analysis performed with client's consent.

Sample TK7236-01: TCLP VOCs Extraction: Sample(s) analyzed past hold time. Analysis performed with client's consent.

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QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
3385488	Leachable 4-Bromofluorobenzene	2013/10/15	100	70 - 130	104	70 - 130	96	%		
3385488	Leachable D4-1,2-Dichloroethane	2013/10/15	72	70 - 130	81	70 - 130	79	%		
3385488	Leachable D8-Toluene	2013/10/15	110	70 - 130	107	70 - 130	106	%		
3385488	Leachable Benzene	2013/10/15	87	70 - 130	96	70 - 130	ND, RDL=0.020	mg/L	NC	30
3385488	Leachable Carbon Tetrachloride	2013/10/15	97	70 - 130	105	70 - 130	ND, RDL=0.020	mg/L	NC	30
3385488	Leachable Chlorobenzene	2013/10/15	101	70 - 130	105	70 - 130	ND, RDL=0.020	mg/L	NC	30
3385488	Leachable Chloroform	2013/10/15	82	70 - 130	91	70 - 130	ND, RDL=0.020	mg/L	NC	30
3385488	Leachable 1,2-Dichlorobenzene	2013/10/15	97	70 - 130	99	70 - 130	ND, RDL=0.050	mg/L	NC	30
3385488	Leachable 1,4-Dichlorobenzene	2013/10/15	98	70 - 130	101	70 - 130	ND, RDL=0.050	mg/L	NC	30
3385488	Leachable 1,2-Dichloroethane	2013/10/15	81	70 - 130	93	70 - 130	ND, RDL=0.050	mg/L	NC	30
3385488	Leachable 1,1-Dichloroethylene	2013/10/15	99	70 - 130	107	70 - 130	ND, RDL=0.020	mg/L	NC	30
3385488	Leachable Methylene Chloride (Dichloromethane)	2013/10/15	84	70 - 130	92	70 - 130	ND, RDL=0.20	mg/L	NC	30
3385488	Leachable Methyl Ethyl Ketone (2-Butanone)	2013/10/15	68	60 - 140	80	60 - 140	ND, RDL=1.0	mg/L	NC	30
3385488	Leachable Tetrachloroethylene	2013/10/15	112	70 - 130	113	70 - 130	ND, RDL=0.020	mg/L	NC	30
3385488	Leachable Trichloroethylene	2013/10/15	91	70 - 130	99	70 - 130	ND, RDL=0.020	mg/L	NC	30
3385488	Leachable Vinyl Chloride	2013/10/15	90	70 - 130	95	70 - 130	ND, RDL=0.020	mg/L	NC	30
3387210	Leachable Decachlorobiphenyl	2013/10/16	126	60 - 130	121	60 - 130	124	%		
3387210	Leachable Total PCB	2013/10/16	106	60 - 130	101	60 - 130	ND, RDL=3	ug/L	NC	40
3388232	Acid Extractable Aluminum (Al)	2013/10/17	NC	75 - 125	101	80 - 120	ND, RDL=50	ug/g		
3388232	Acid Extractable Antimony (Sb)	2013/10/17	102	75 - 125	99	80 - 120	ND, RDL=0.20	ug/g	NC	30
3388232	Acid Extractable Arsenic (As)	2013/10/17	103	75 - 125	98	80 - 120	ND, RDL=1.0	ug/g	5.0	30
3388232	Acid Extractable Barium (Ba)	2013/10/17	97	75 - 125	96	80 - 120	ND, RDL=0.50	ug/g	2.7	30
3388232	Acid Extractable Beryllium (Be)	2013/10/17	105	75 - 125	95	80 - 120	ND, RDL=0.20	ug/g	NC	30
3388232	Acid Extractable Bismuth (Bi)	2013/10/17	102	75 - 125	102	80 - 120	ND, RDL=1.0	ug/g		
3388232	Acid Extractable Boron (B)	2013/10/17	101	75 - 125	93	80 - 120	ND, RDL=5.0	ug/g	NC	30
3388232	Acid Extractable Cadmium (Cd)	2013/10/17	102	75 - 125	101	80 - 120	ND, RDL=0.10	ug/g	NC	30
3388232	Acid Extractable Calcium (Ca)	2013/10/17	NC	75 - 125	102	80 - 120	ND, RDL=50	ug/g		
3388232	Acid Extractable Chromium (Cr)	2013/10/17	105	75 - 125	100	80 - 120	ND, RDL=1.0	ug/g	0.06	30
3388232	Acid Extractable Cobalt (Co)	2013/10/17	104	75 - 125	101	80 - 120	ND, RDL=0.10	ug/g	8.7	30
3388232	Acid Extractable Copper (Cu)	2013/10/17	103	75 - 125	99	80 - 120	ND, RDL=0.50	ug/g	4.9	30
3388232	Acid Extractable Iron (Fe)	2013/10/17	NC	75 - 125	105	80 - 120	ND, RDL=50	ug/g		
3388232	Acid Extractable Lead (Pb)	2013/10/17	NC ⁽¹⁾	75 - 125	102	80 - 120	ND, RDL=1.0	ug/g	5.6	30
3388232	Acid Extractable Magnesium (Mg)	2013/10/17	NC	75 - 125	95	80 - 120	ND, RDL=50	ug/g		
3388232	Acid Extractable Manganese (Mn)	2013/10/17	NC	75 - 125	99	80 - 120	ND, RDL=1.0	ug/g		
3388232	Acid Extractable Molybdenum (Mo)	2013/10/17	109	75 - 125	104	80 - 120	ND, RDL=0.50	ug/g	NC	30
3388232	Acid Extractable Nickel (Ni)	2013/10/17	103	75 - 125	102	80 - 120	ND, RDL=0.50	ug/g	6.4	30
3388232	Acid Extractable Phosphorus (P)	2013/10/17	NC	75 - 125	89	80 - 120	ND, RDL=50	ug/g		
3388232	Acid Extractable Potassium (K)	2013/10/17	104	75 - 125	96	80 - 120	ND, RDL=200	ug/g		
3388232	Acid Extractable Selenium (Se)	2013/10/17	105	75 - 125	100	80 - 120	ND, RDL=0.50	ug/g	NC	30
3388232	Acid Extractable Silver (Ag)	2013/10/17	103	75 - 125	102	80 - 120	ND, RDL=0.20	ug/g	NC	30

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QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
3388232	Acid Extractable Sodium (Na)	2013/10/17	104	75 - 125	94	80 - 120	ND, RDL=100	ug/g		
3388232	Acid Extractable Strontium (Sr)	2013/10/17	NC	75 - 125	100	80 - 120	ND, RDL=1.0	ug/g		
3388232	Acid Extractable Thallium (Tl)	2013/10/17	88	75 - 125	93	80 - 120	ND, RDL=0.050	ug/g	NC	30
3388232	Acid Extractable Tin (Sn)	2013/10/17	105	75 - 125	100	80 - 120	ND, RDL=5.0	ug/g		
3388232	Acid Extractable Uranium (U)	2013/10/17	107	75 - 125	104	80 - 120	ND, RDL=0.050	ug/g	2.6	30
3388232	Acid Extractable Vanadium (V)	2013/10/17	105	75 - 125	98	80 - 120	ND, RDL=5.0	ug/g	NC	30
3388232	Acid Extractable Zinc (Zn)	2013/10/17	NC ⁽¹⁾	75 - 125	101	80 - 120	ND, RDL=5.0	ug/g	1.2	30
3388232	Acid Extractable Mercury (Hg)	2013/10/17	99	75 - 125	111	80 - 120	ND, RDL=0.050	ug/g	NC	30

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.


NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

(1) - The recovery in the matrix spike was not calculated (NC). Spiked concentration was less than 2x that native to the sample.

Validation Signature Page

Maxxam Job #: B3H2928

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).


 Charles Ancker, B.Sc., M.Sc., C.Chem, Senior Analyst

 
 Eva Pranjic, M.Sc., C.Chem, Scientific Specialist

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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