MERLEX ENGINEERING LTD.

CONSULTING GEOTECHNICAL ENGINEERS

FINAL
FOUNDATION INVESTIGATION AND DESIGN REPORT

NORTHBOUND PASSING LANE – TWP. of Grenfell
GWP 162-98-00
MEL SITE D

Highway 11, From 0.3 km South of the Highway 11/66 Intersection
Northerly 11.7 km to 3.5 km South of Highway 570

MEL Ref. No.: 09/10/09181D January 14, 2011

Submitted to:

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1.0 INTRODUCTION

Merlex Engineering Ltd. (MEL) has been retained by AECOM Canada Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to carry out a foundation investigation for three areas within the proposed northbound passing lane. The general work project (GWP 162-98-00) is located on Highway 11 and passes through parts of the Townships of Eby and Grenfell, and the location is described as: from 0.3 km South of the Highway 11/66 intersection Northerly 11.7 km to 3.5 km South of Highway 570. The three areas are located at: Stations 13+450 to 13+775 (MEL Site D-1), Stations 14+000 to 14+025 (MEL Site D-2), and Stations 14+125 to 14+250 (MEL Site D-3), Township of Grenfell. The project involves the widening of the current highway embankment, which will include earth cut widening between Stations 13+450 and 13+775, rock cut widening between Stations 14+000 and 14+025, and fill widening between Stations 14+125 and 14+250.

The foundation investigation location was specified by the MTO in the RFP/TPM documentation Agreement No. 5008-E-0067. The terms of reference for the scope of work are outlined in MEL's proposal P-09-037, dated May 2009. The purpose of the investigation was to determine the subsurface conditions along select areas of the proposed passing lane. MEL investigated the foundation areas by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

2.0 SITE DESCRIPTION

The proposed northbound passing lane foundation investigation sites are located between Stations 13+450 and 13+775 (MEL Site D-1), Stations 14+000 and 14+025 (MEL Site D-2), and Stations 14+125 and 14+250 (MEL Site D-3), all in the Township of Grenfell. The topography at

the site is generally of moderate relief. The existing highway embankment at the three sites currently supports two undivided lanes of highway, running in a north south direction.

The existing highway, between Stations 13+450 to 13+725 is constructed in an earth cut, with a centerline elevation between 332.6 and 338.1 m, and the north bound passing lane will require cutting into the existing backslope. The existing highway between Stations 14+000 to 14+025 is in a rock cut, with a centerline elevation between 323.4 and 325.0 m, and the north bound passing lane will require cutting into the existing bedrock backslope. Between Stations 14+125 to 14+250, the existing highway is constructed on a fill embankment, with a centerline elevation between 318.2 and 320.6 m, and a fill will be required to construct the north bound passing lane within the above noted limits.

Within the area of investigation there are no entrances (side road, commercial, field, etc) and infrastructure is limited to overhead power and communication wires which are on the opposite side of the highway.

2.1 Site Physiography and Surficial Geology

This project is located in the Geomorphic Sub-province known as the Eastern Sandy Uplands. The topography on this section of Highway 11 is generally rolling. There are exposed bedrock ridges. At many locations, layers of earth overlay the bedrock. Organic terrain was also observed however no organic terrain was observed in the areas of this specific investigation. Within the project area overburden consists primarily of sand and gravel containing varying amounts of silt and occasional stratum of silt.

Bedrock in the area, as indicated on OGS Map 2440, is of the Early Precambrian Era. At the location of the three passing lane foundation sections, the bedrock comprises of Metavolcanics including basaltic and andesitic flows, tuffs and breccias.

3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out between February 27 and March 1, 2010, during which eight (8) sampled boreholes were advanced at Site D-1, three (3) sampled boreholes at Site D-2, and five (5) sampled boreholes advanced at Site D-3. Each borehole was advanced to the east of the existing embankment along the alignment of the proposed passing lane.

The field investigation was carried out using a Bombardier mounted CME 45B drilling rig equipped with hollow stem augers, standard augers, and routine geotechnical sampling equipment. Soil samples were obtained at regular intervals of depth using the standard 50 mm O.D. split spoon sampler advanced in accordance with the Standard Penetration Test (SPT) procedures (ASTM D-1586) at the borehole locations. The SPT method involves advancing a 50 mm O.D. split spoon sampler with the force of a 63.5 kg hammer freely dropping 760 mm mounted in a trip (automatic) hammer. The number of blows per 300 mm penetration was recorded as the “N” value. At the boreholes, a Dynamic Cone Penetration Test (DCPT) was carried out to give a continuous plot of the soil resistance with depth. When cohesive deposits were encountered, the in-situ strength was measured using an “N” size field vane, vane collar, and calibrated torque meter. All samples taken during this investigation were stored in labeled airtight containers for transport to our North Bay laboratory for visual examination and select laboratory testing.

Groundwater conditions in the open boreholes were observed during the advancement of and immediately following completion of the individual boreholes. All open boreholes were backfilled upon completion with compacted auger cuttings in the general order they were removed and, where necessary, bentonite pellet backfill was added to the boreholes to bring them up to grade. The field work for this investigation was under the full time direction of a senior member of our engineering staff, who was responsible for locating the boreholes, clearing the borehole locations of underground services, in-situ sampling and testing operations, logging of the boreholes, labeling and preparation of samples for transport to our North Bay laboratory, plus overall drill supervision. All samples received a visual confirmatory inspection in our laboratory. Laboratory testing of select samples included routine testing for natural moisture content determination and particle size analysis. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix B), with a summary of results presented on the laboratory sheets in Appendix C (Figures Nos. L-1 to L-3).

The location of the individual boreholes were determined in the field using highway chainage (established by others) and offset relative to highway centerline. The MTO co-ordinates, northing and easting, were then established for the boring locations. Elevations contained in this report are referenced to a geodetic datum.

4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Record of Borehole Logs (Appendix B) and on Figure No. D-1 (Appendix C). Please note that stratigraphic delineation presented on the borehole logs and soil strata plot are the results of non-continuous sampling, response to drilling progress, the results of SPT and Dynamic Cone Penetration Test (DCPT) plus field observations. Typically such boundaries

represent transitions from one zone to another and are not an exact demarcation of specific geological unit. Additional consideration should be given to the fact that subsurface conditions may vary markedly between adjacent boreholes and beyond any specific boring location, and are shown on the drawings for illustration purposes only.

4.1 Passing Lane, Station 13+450 to 13+775, TWP of Grenfell – MEL SITE D-1

A plan and profile showing the borehole locations and stratigraphic sequences is shown on Figure No. D-1, Appendix C. During the course of the exploration program, eight (8) sampled boreholes were put down at this site, with Borehole Nos. D-1-01 to D-1-08, advanced to the east of the existing embankment. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. D-1-01 to D-1-08 were recorded at 337.6, 338.2, 338.2, 337.2, 337.2, 336.4, 335.2, and 334.2 m, respectively.

4.1.1 Sand and Gravel

At surface at Borehole Nos. D-1-01 and D-1-02 a deposit of brown sand and gravel to gravelly sand, trace silt containing occasional cobbles and boulders was penetrated. The natural moisture content obtained from samples of this deposit was in the order of 2 to 5%. Gradation analyses were carried out on two (2) samples of this deposit, the results of which indicated 39 to 46% gravel size particles, 52 to 59% sand size particles, and 2% silt and clay size particles (Figure No. L-1, Appendix C). Based on SPT values of 18 to 27, the compactness of this deposit was described as compact. This deposit was encountered to depth of some 1.4 m below ground surface (elevations 336.2 and 336.8 m, at Borehole Nos. D-1-01 and D-1-02, respectively).

4.1.2 Sand

At the surface of Borehole Nos. D-1-03 to D-1-08 inclusive, and underlying the sand and gravel at Borehole Nos. D-1-01 and D-1-02, a deposit of brown sand containing varying amounts of gravel (generally trace to with gravel), trace silt containing occasional cobbles and boulders was penetrated. Gravel content generally decreases with depth in this deposit, except at Borehole No. D-1-06, where a gravel and sand seam was encountered at elevation 334.1 m. Natural moisture contents from samples of this deposit were in the order of 2 to 9%. Gradation analyses were carried out on 13 samples of this deposit which were retained in the spilt spoon sampler (37 mm inside diameter), the results of which indicated 1 to 27% gravel size particles, 80 to 98% sand size particles, and 1 to 4% silt and clay size particles (Figure Nos. L-2 and L-3, Appendix C). A gradation analysis was carried out on one (1) sample of the gravel and sand seam encountered in this deposit, the results of which indicated 55% gravel size particles, 43% sand size particles, and 2% silt and clay size particles. Based on SPT values of 6 to 40 blows per 300 mm penetration, the compactness of this deposit was described as loose to dense, generally compact. Sampling was terminated at a depth of 5 m below ground surface at Borehole Nos. D-1-01 to D-1-03 (elevations 332.6, 333.2, and 333.2 m, respectively). Auger refusal was encountered in this deposit at Borehole Nos. D-1-04 to D-1-08 inclusive at depths of 4.5, 3.8, 3.7, 2.4, and 3.1 m below ground surface, respectively (elevations 337.2, 333.4, 332.7, 332.8, and 331.1 m respectively).

4.2 Passing Lane, Station 14+000 to 14+025, TWP of Grenfell – MEL SITE D-2

A plan and profile showing the borehole locations and stratigraphic sequences is shown on Figure No. D-1, Appendix C. During the course of the exploration program, three (3) sampled boreholes were put down at this site, with Borehole Nos. D-2-01 to D-2-03 advanced to the east of the existing embankment. At the time of the subsurface investigation, the ground surface

elevations at Boreholes Nos. D-2-01 to D-2-03 were recorded at 330.0, 329.2, and 325.7 m, respectively.

4.2.1 Bedrock

At the three borehole locations at this site, bedrock was exposed at the existing ground surface at an offset of 16 m right of centerline. At this site the bedrock is sound with vertical and sub horizontal jointing with a generally wide spacing.

4.3 Passing Lane, Station 14+125 to 14+250, TWP of Grenfell – MEL SITE D-3

A plan and profile showing the borehole locations and stratigraphic sequences is shown on Figure No. D-1, Appendix C. During the course of the exploration program, five (5) sampled boreholes were put down at this site, with Borehole Nos. D-3-01 to D-3-05 inclusive advanced to the east of the existing embankment. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. D-3-01 to D-3-05 were recorded at 317.6, 316.3, 316.5, 316.5 and 317.2 m, respectively.

4.3.1 Silt

At the surface of Borehole No. D-3-01, a deposit of brown silt containing trace sand to silt and sand, trace clay was penetrated. The sand content generally increases with depth in this deposit. Natural moisture contents from samples of this deposit were in the order of 23 to 29%. Gradation and hydrometer analyses were carried out on three (3) samples of this deposit which were retained in the spilt spoon sampler (37 mm inside diameter), the results of which indicated 0% gravel size particles, 4 to 44 sand size particles, 56 to 90% silt size particles, and 4 to 6% clay size particles (Figure No. L-4, Appendix C). Based on SPT values of 0 (static weight of

hammer) to 11, the compactness of this deposit is described as very loose to compact. This deposit was encountered to depth of 4.3 m below ground surface (elevation 313.3 m).

4.3.2 Sand

Underlying the silt at Borehole No. D-3-01, a deposit of grey sand containing trace to with silt was penetrated. Natural moisture contents from samples of this deposit were in the order of 14 to 23%. Based on SPT values of 2 to 12 blows per 300 mm penetration the compactness of this deposit is described as very loose to compact. Auger and DCPT refusal was encountered in this deposit at depth of 9.7 m below ground surface (elevation 307.9 m).

4.3.3 Silt and Organics

At the surface of Borehole No. D-3-02, a thin deposit of silt with organics and rootlets was penetrated. The natural moisture content from a sample of this deposit was in the order of 42%. Auger refusal was encountered at a depth of 0.3 m below ground surface (elevation 316.0 m).

4.3.4 Surficial Organics

At the surface of Borehole Nos. D-3-04 and D-3-05, a thin layer of surface grass and organics some 50 mm thick was penetrated.

4.3.5 Sand

Underlying the surficial organics at Borehole Nos. D-3-04 and D-3-05, and at the surface of Borehole No. D-3-03 a deposit of brown fine sand containing some silt was penetrated. Natural moisture contents from samples of this deposit were in the order of 15 to 28%. Based on SPT values of 22 to 24, the compactness of this deposit is described as compact. Auger refusal was encountered in this deposit at a depth of 0.7, 0.8, and 2.2 m below ground surface at Borehole

Nos. D-3-03 to D-3-05, respectively (elevations 315.8, 315.7, and 315.0 m, respectively). DCPT refusal was generally encountered at a similar elevation to auger refusal, except at Borehole No. D-3-05 where DCPT refusal was encountered at a depth of 3.2 m (elevation 314.0 m).

4.4 Groundwater Conditions

Groundwater and cave-in levels in the open boreholes were measured, where possible, during the advance of the individual borings and upon completion. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix B). Borehole Nos. D-1-01 to D-1-08 were recorded as dry at the time of sampling. The water level was measured at a depth of 1.6 m at Boreholes No. D-3-01 (elevation 316.0 m). These groundwater levels will fluctuate seasonally.

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5.0 DESIGN COMMENTS AND RECOMMENDATIONS

5.1 General

Three sites along the proposed northbound passing lane were identified as requiring a foundation investigation in the RFP. These three site are located between Stations 13+450 and 13+775 (MEL Site D-1), between Stations 14+000 and 14+025 (MEL Site D-2), and between Stations 14+125 and 14+250 (MEL Site D-3), in the Township of Grenfell. Based on data from this foundation investigation and the geotechnical investigation, which was also carried out by MEL, the embankment supporting the existing pavement structure at these sites has been constructed using granular materials (pavement structure) over granular fills consisting of sands and gravels.

As detailed in the geotechnical report prepared by MEL, at Site D-1 the earth cut will be widened by excavating the native material to provide for 450 mm of granular material for a pavement structure. At Site D-2, it is anticipated that the rock cut will be widened by rock excavation/controlled blasting operations to provide for 900 mm of granular material for a pavement structure. At Site D-3, the embankment fill will be widened to match the existing embankment fill height allowing for 900 mm of granular material for a pavement structure. Granular fill or rock fill will be used dependent upon availability of materials at the time of construction. Details on the pavement design are contained in the Pavement Design Report as prepared by MEL – Reference No. 09/10/09181, dated October 21, 2010.

5.2 Foundation Consideration

5.2.1 Station 13+450 to 13+775, TWP of Grenfell – MEL SITE D-1

Along the proposed passing lane at this site, the existing embankment is constructed of granular materials. The new passing lane will cut into the existing backslope which consists of sands and

gravels to sand trace gravel in a generally compact state of compactness. This granular material was dry at the time of this investigation and underlain by bedrock at depths varying between elevations 333.4 to 331.0 m, based on drill response. These are very competent founding conditions for a highway platform. Since this section of the passing lane will be constructed in a cut, settlement of the new platform will not develop since the area has been preloaded (provided proper compaction of the pavement structure granulars is carried out). The existing backslope is gentle, less than 4H:1V earth highway backslope, and can be constructed on a 2H:1V slope throughout this area following construction operations. To prevent erosion, topsoil and seed should be applied as soon as practical after slope construction. The backslopes can also be cut back to an angle of 3H:1V, provided a sufficient distance from the property line is available, to generate more fill for this project.

5.2.2 Station 14+000 to 14+025, TWP of Grenfell – MEL SITE D-2

The section of existing highway in this area is constructed on granular material, some 1 m thick, underlain by bedrock. In order to insure drainage of the granular materials the Pavement Design Report, prepared by MEL, specifies 900 mm of granular over the rock cut subgrade, constructed as per OPSS 206. Since the rock cut will be less than 10 m in height the rock face can be cut back to a vertical face as per NRE Directive 2000-204. No issues from a foundation perspective will develop in this area.

As bedrock was encountered at surface, bedrock excavation and/or blasting operations will be required at this site. Even though the area is rural and isolated, a blast design, as per OPSS 120, is required to be provided by the basting contractor before blasting operations are carried out. Based on a plan review, infrastructure is limited to a pole line on the opposite side of the highway. If any other structures (utilities, water wells, etc.) are located within 150 m of the blast

area, a pre-blast survey will be required, as per OPSS 120.07.03. Blast monitoring would have to be carried out, during blasting operations, by a blast monitoring consultant provided by the contractor, if there are sensitive structures within the above noted distance.

5.2.3 Station 14+125 to 14+250, TWP of Grenfell – MEL SITE D-3

Throughout this area the existing highway is constructed using granular fill and the new passing lane will be constructed in a similar manner. The relationship between the existing highway centerline profile relative to the existing grade at the boreholes is shown on Figure No. D-1, Appendix C. The depth of granular fill required to construct the embankment along the passing lane varies from some 3 m in the south to approximately 1 m to the north of this area. The 3 m of embankment fill will result in a pressure exerted on the generally compact silts in the order of 90 kPa, which is less than the estimated factored bearing resistance at ULS of 450 kPa. This new load will not overstress the founding soils and settlement that develops from this load will be negligible, estimated at 5 mm, will occur essentially immediately as the load is placed due to the essentially cohesionless nature of the underlying soils. Distortion due to frost penetrating the moderately to highly susceptible subgrade soils (silts) will not occur since the fill depth over the silt is greater than the frost penetration depth of 2.3 m as provided in the RFP (Section 6.10.2.3).

5.2.4 Embankment Stability

The maximum new embankment fill depth, over the silt deposit at MEL Site D-3, is up to 3 m. A stability analysis using the program Slope/W was carried out with a standard embankment slope established at 2H:1V which returned a factor of safety in the order of 1.4 for failure through the native silt subgrade with the water table at elevation 316.0 m, 1.5 m below ground surface (see

Figure No. S-1, Appendix D). As, such the stability of the new embankment slope will not be an issue.

6.0 CLOSURE

Information provided in this report is valid only at the locations described above. Any assumptions of continuity of soil stratigraphy between boreholes, as shown on the enclosed cross-sections, is intended as an aid for design purposes only and does not constitute a statement of existing conditions for contractual or construction purposes. Field investigation was carried out using a CME drill rig mounted on a Bombardier carrier owned by Chrisdamat Management Ltd. The report was prepared by Mr. J. R. Berghamer, P. Eng and reviewed by the firm's principal and MTO designate Mr. M. A. Merleau, P. Eng.

Details of the investigation, the material analysis and recommendation in this report are considered to be complete. However, should any questions arise, please do not hesitate to contact the undersigned.

MERLEX ENGINEERING LTD.

M. A. Merleau, P. Eng.
Principal

J. R. Berghamer, P. Eng.

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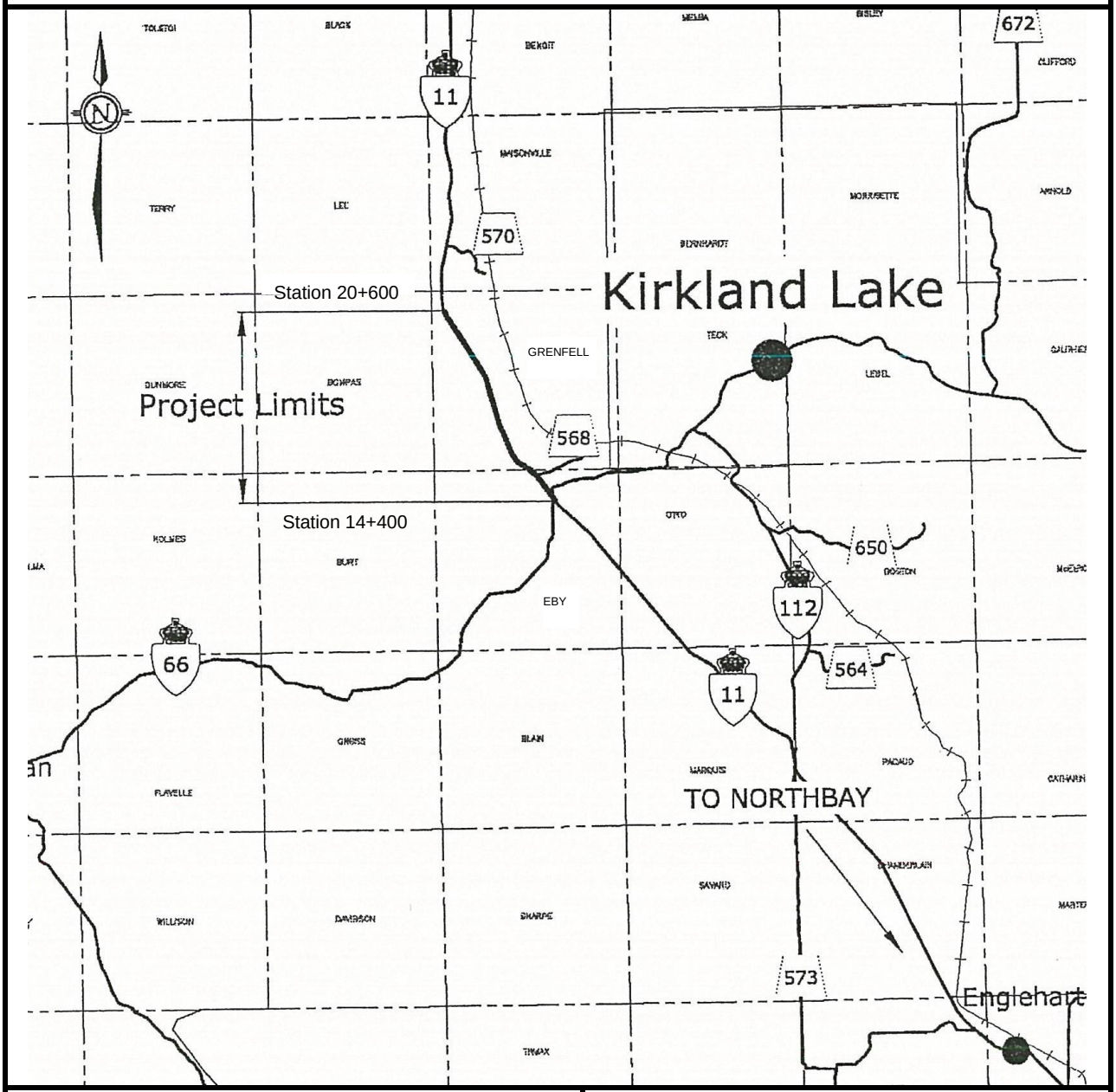
APPENDIX A

Figure No. 1: Key Plan

KEY PLAN

Figure No. 1

NOT TO SCALE



FINAL
FOUNDATION INVESTIGATION AND DESIGN REPORT
GWP 162-98-00

Highway 11, From 0.3 km South of Highway 66, Northerly 11.7 km to 3.5 km South of Highway 570

MEL Ref. No.: 09/10/09181D January 2011

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APPENDIX B

Enclosure No. 1: List of Abbreviations and Symbols

Enclosure Nos. 2 to 17: Record of Borehole Sheets

LIST OF ABBREVIATIONS & DESCRIPTION OF TERMS

The abbreviations and terms, used to describe retrieved samples and commonly employed on the borehole logs, on the figures and in the report are as follows:

1. ABBREVIATIONS

AS Auger Sample
CS Chunk Sample
DS Denison type sample
FS Foil Sample
HB Hammer Bouncing
NFP No Further Progress
PH Sampler advanced by hydraulic pressure
PM Sampler advanced by manual pressure
RC Rock core with size & percentage of recovery
SS Split Spoon
ST Slotted Tube
TO Thin-walled, open
TP Thin-walled, piston
WH Sampler Advanced by static weight (weight of hammer and/or rods)
WS Wash Sample

2. PENETRATION RESISTANCE/"N"

Dynamic Cone Penetration Test (DCPT):

A continuous profile showing the number of blows for each 300 mm of penetration of a 50 mm diameter 90° point cone driven by a 63 kg hammer falling 760 mm.

Plotted as —•—•—•—•

Standard Penetration Test (SPT) or "N" Values

The number of blows of a 63 kg hammer falling 760 mm required to advance a 50 mm O.D. drive open sampler 300 mm.

3. SOIL DESCRIPTION

a) *Cohesionless Soils:*

"N" (blows/0.3 m)	*Relative Density*
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

3. SOIL DESCRIPTION (Cont'd)

b) *Cohesive Soils:*

Undrained Shear Strength (kPa)	*Consistency*
Less than 12	very soft
12 to 25	soft
25 to 50	firm
50 to 100	stiff
100 to 200	very stiff
over 200	hard

c) *Method of Determination of Undrained Shear Strength of Cohesive Soils:*

+ 3.2 - Field Vane test in borehole. The number denotes the sensitivity to remoulding.

D - Laboratory Vane Test

¨ - Compression test in laboratory

For a saturated cohesive soil the undrained shear strength is taken as one-half of the undrained compressive strength.

4. TERMINOLOGY

Terminology used for describing soil strata is based on the proportion of individual particle sizes present in the samples (please note that, with the exception of those samples subject to a grain-size analysis, all samples were classified visually and the accuracy of visual examination is not sufficient to determine exact grain sizing):

Trace, or occasional	Less than 10%
Some	10 to 20%
With	20 to 30%
Adjective (i.e. silty or sandy)	30 to 40%
And (i.e. sand and gravel)	40 to 60%

5. LABORATORY TESTS

P Standard Proctor Test
A Atterberg Limit Test
GS Grain Size Analysis
H Hydrometer Analysis
C Consolidation

SAMPLE DESCRIPTION NOTES:

1. **FILL:** The term fill is used to designate all man-made deposits of natural soil and/or waste materials. The reader is cautioned that fill materials can be very heterogeneous in nature and variable in depth, density and degree of compaction. Fill materials can be expected to contain organics, waste materials, construction materials, shot rock, rip-rap, and/or larger obstructions such as boulders, concrete foundations, slabs, abandoned tanks, etc.; none of which may have been encountered in the borehole. The description of the material penetrated in the borehole therefore may not be applicable as a general description of the fill material on the site as boreholes cannot accurately define the nature of fill material. During the boring and sampling process, retrieved samples may have certain characteristics that identify them as 'fill'. Fill materials (or possible fill materials) will be designated on the Borehole Logs. If fill material is identified on the site, it is highly recommended that testpits be put down to delineate the nature of the fill material. However, even through the use of testpits defining the true nature and composition of the fill material cannot be guaranteed. Fill deposits often contain pockets or seams of organics, organically contaminated soils or other deleterious material that can cause settlement or result in the production of methane gas. It should be noted that the origins and history of fill material is frequently very vague or non-existent. Often fill material may be contaminated beyond environmental guidelines and the material will have to be disposed of at a designated site (i.e. registered landfill). Unless requested or stated otherwise in this report, fill material on this site has not been tested for contaminants however, environmental testing of the fill material can be carried out at your request. Detection of underground storage tanks cannot be determined with conventional geotechnical procedures.

2. **TILL:** The term till indicates a material that is an unstratified, glacial deposit, heterogeneous in nature and, as such, may consist of mixtures and pockets of clay, silt, sand, gravel, cobbles and/or boulders. These heterogeneous deposits originate from a geological process associated with glaciation. It must be noted that due to the highly heterogeneous nature of till deposits, the description of the deposit on the borehole log may only be applicable to a very limited area and therefore, caution must be exercised when dealing with a till deposit. When excavating in till, contractors may encounter cobbles/boulders or possibly bedrock even if they are not indicated on the borehole logs. It must be appreciated that conventional geotechnical sampling equipment does not identify the nature or size of any obstruction.

3. **BEDROCK:** Auger refusal may be due to the presence of bedrock, but possibly could also be due to the presence of very dense underlying deposits, boulders or other large obstructions. Auger refusal is defined as the point at which an auger can no longer be practically advanced. It must be appreciated that conventional geotechnical sampling equipment does not differentiate between nature and size of obstructions that prevent further penetration of the boring below grade. Bedrock indicated on the borehole logs will be labeled 'possibly' or 'probable' etc. based on the response of the boring and sampling equipment, surrounding topography, etc. Bedrock can be proven at individual borehole locations, at your request, by diamond core drilling operations or, possibly, by testpits. It must also be appreciated that bedrock surfaces can be, and most times are, very erratic in nature (i.e. sheer drops, isolated rock knobs, etc.) and caution must be used when interpreting subsurface conditions between boreholes. A bedrock profile can be more accurately estimated, at the clients' request, through a series of closely positioned unsampled auger probes combined with core drilling.

4. **GROUNDWATER:** Although the groundwater table may have been encountered during this investigation and the elevation noted in the report and/or on the record of boreholes, it must be appreciated that the elevation of the groundwater table will fluctuate based upon seasonal conditions, localized changes, erratic changes in the underlying soil profile between boreholes, underlying soil layers with highly variable permeabilities, etc. These conditions may affect the design and type and nature of dewatering procedures. Cave-in levels recorded in borings give a general indication of the groundwater level in cohesionless soils however, it must be noted that cave-in levels may also be due to the relative density of the deposit, drilling operations etc.

ENCLOSURE NO.:2 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-1-01

REFERENCE 09181 DATUM Geodetic LOCATION N 5332309.65 E 362544.36 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/27 - 10/2/27 TIME 9:30:00 AM CHECKED BY MAM

SOIL PROFILE			SAMPLES									
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
337.6	Ground Surface										
0.0	SAND and GRAVEL - brown sand and gravel trace silt (compact)		1	AS	N/A		337	Soil Frozen			
			2	SS	18						46 52 (2)
336.2											
1.4	SAND - brown sand trace to with gravel trace silt		3	SS	22		336				25 74 (1)
	Gravel content decreasing with depth (compact)		4	SS	19		335				
	brown ---- grey		5	SS	24		334				
			6	SS	21						3 96 (1)
332.6			7	SS	20		333				
5.0	End of Sampling										
331.9							332				
5.7	DCPT Refusal End of Borehole										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+³, ×³ : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/2/27 9:30:00 AM	DRY	3.5
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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ENCLOSURE NO.:3 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-1-02

REFERENCE 09181 DATUM Geodetic LOCATION N 5332357.55 E 362530.68 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/28 - 10/2/28 TIME 12:20:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
338.2	Ground Surface										
0.0	SAND and GRAVEL - brown gravelly fine sand trace silt Occasional cobble and boulders		1	AS	N/A		338	DCPT Refusal - Boulders			
			2	SS	27						39 59 (2)
336.8							337				
1.4	SAND - brown fine to medium sand trace to with gravel trace silt Occasional cobbles Gravel content decreasing with depth		3	SS	12						27 72 (1)
			4	SS	9		336				
	(compact)		5	SS	11		335				
			6	SS	18		334				0 97 (3)
333.2			7	SS	24						
5.0	End of Sampling End of Borehole										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+³, ×³ : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/2/28 12:20:00 PM	DRY	4
2)	-	-
3)	-	-

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ENCLOSURE NO.:4 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-1-03

REFERENCE 09181 DATUM Geodetic LOCATION N 5332405.93 E 362518.02 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/28 - 10/2/28 TIME 1:40:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						GR	SA	SI	CL
338.2	Ground Surface													
0.0	SAND - brown fine to medium sand some gravel trace silt		1	AS	N/A		338	Soil Frozen						
	Occasional cobbles													
	Gravel content decreasing with depth		2	SS	17		337				17	82	(1)	
	(compact)		3	SS	16									
			4	SS	8		336				0	98	(2)	
			5	SS	10		335							
			6	SS	10		334				2	97	(1)	
333.2			7	SS	23									
5.0	End of Sampling						333							
							332							
331.2														
7.0	DCPT Refusal End of Borehole													

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+³, ×³ : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/2/28 1:40:00 PM	DRY	3.5
2)	-	-
3)	-	-

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ENCLOSURE NO.:5 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-1-04

REFERENCE 09181 DATUM Geodetic LOCATION N 5332453.77 E 362503.43 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/28 - 10/2/28 TIME 2:50:00 PM CHECKED BY MAM

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
337.2	Ground Surface										
0.0	SAND - brown fine to medium sand trace gravel trace silt		1	AS	N/A		337				
			2	SS	8						2 97 (1)
	(loose/compact)						336				
			3	SS	8						
							335				
			4	SS	10						
			5	SS	29		334				
			6	SS	29		333				7 89 (4)
332.7											
332.6	Auger Refusal										
4.6	DCPT Refusal End of Borehole										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/2/28 2:50:00 PM	DRY	4
2)	-	-
3)	-	-

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ENCLOSURE NO.:6 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-1-05

REFERENCE 09181 DATUM Geodetic LOCATION N 5332502.15 E 362490.77 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/28 - 10/2/28 TIME 3:55:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
337.2	Ground Surface										
0.0	SAND - brown fine to medium sand some gravel trace silt		1	AS	N/A		337				
			2	SS	10						19 80 (1)
	(compact/dense)						336				
			3	SS	11						
							335				
			4	SS	11						17 82 (1)
333.9			5	SS	36		334				
3.3	DCPT Refusal										
333.4											
3.8	Auger Refusal End of Borehole										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/2/28 3:55:00 PM	DRY	3.3
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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ENCLOSURE NO.:7 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-1-06

REFERENCE 09181 DATUM Geodetic LOCATION N 5332549.98 E 362476.18 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/3/1 - 10/3/1 TIME 9:45:00 AM CHECKED BY MAM

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
336.4	Ground Surface							
0.0	SAND - brown fine to medium sand trace gravel trace silt	1	AS	N/A				
		2	SS	17				
	(loose/dense)	3	SS	6	2	97		(1)
	gravel and sand seam	4	SS	40	55	43		(2)
		5	SS	19				
332.7								
3.7	DCPT Refusal Auger Refusal End of Borehole							

STRATA PLOT

GROUND WATER CONDITIONS

ELEVATION SCALE: 336, 335, 334, 333

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L

WATER CONTENT (%) 20 40 60

UNIT WEIGHT γ kN/m³

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+³, ×³ : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/3/1 9:45:00 AM	DRY	3.3
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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ENCLOSURE NO.:8 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-1-07

REFERENCE 09181 DATUM Geodetic LOCATION N 5332598.09 E 362462.56 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/3/1 - 10/3/1 TIME 11:00:00 AM CHECKED BY MAM

SOIL PROFILE			SAMPLES														
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
335.2	Ground Surface													
0.0	SAND - brown fine to medium sand trace gravel trace silt		1	AS	N/A		335							
	(compact)		2	SS	18		334				6	92		(2)
			3	SS	25		333							
332.8														
2.4	DCPT Refusal Auger Refusal End of Borehole													

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/3/1 11:00:00 AM	DRY	1.9
2)	-	-
3)	-	-

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ENCLOSURE NO.:9 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-1-08

REFERENCE 09181 DATUM Geodetic LOCATION N 5332622.42 E 362456.70 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/3/1 - 10/3/1 TIME 12:25:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
334.2	Ground Surface										
0.0	SAND - brown fine to medium sand trace gravel trace silt		1	AS	N/A		334				
	(compact)		2	SS	12						1 95 (4)
							333				
			3	SS	17						
							332				
331.5			4	SS	26						
2.7	DCPT Refusal										
331.1											
3.1	Auger Refusal End of Borehole										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/3/1 12:25:00 PM	DRY	2.8
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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ENCLOSURE NO.:10 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-2-01

REFERENCE 09181 DATUM Geodetic LOCATION N 5332838.63 E 362394.43 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/3/1 - 10/3/1 TIME CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
330.0	Exposed Bedrock Surface										
0.0											

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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ENCLOSURE NO.:11 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-2-02

REFERENCE 09181 DATUM Geodetic LOCATION N 5332857.87 E 362388.98 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/3/1 - 10/3/1 TIME CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
329.2	Exposed Bedrock Surface										
0.0											

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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ENCLOSURE NO.:12 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-2-03

REFERENCE 09181 DATUM Geodetic LOCATION N 5332877.11 E 362383.53 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/3/1 - 10/3/1 TIME CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
325.7	Exposed Bedrock Surface										
0.0											

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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ENCLOSURE NO.:13 (Pg. 1 of 1)

METRIC

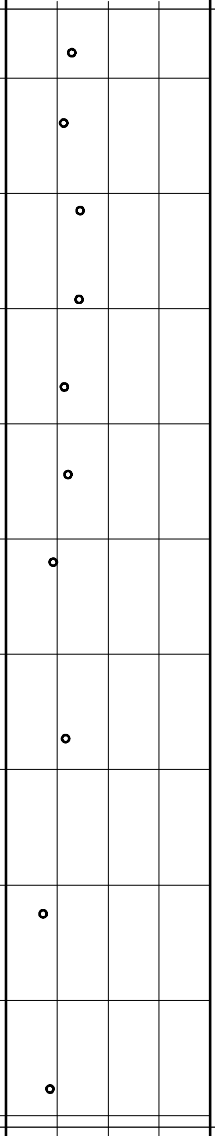
RECORD OF BOREHOLE NO. D-3-01

REFERENCE 09181 DATUM Geodetic LOCATION N 5332959.17 E 362361.33 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/27 - 10/2/27 TIME 1:50:00 PM CHECKED BY MAM

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
317.6	Ground Surface								
0.0	±50 mm organics SILT - brown silt trace to with sand to silt and sand trace clay	1	AS	N/A					
	(very loose/compact)	2	SS	11		0	4	90	6
	brown -------- grey	3	SS	10		0	22	74	4
	Sand content increases with depth	4	SS	WH					
		5	SS	7		0	44		(56)
313.3		6	SS	WH					
4.3	SAND - grey fine to medium sand trace to with silt	7	SS	2					
	(loose/compact)	8	SS	4					
		9	SS	3					
307.9		10	SS	12					
9.7	DCPT Refusal Auger Refusal End of Borehole								



COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+³, ×³ : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/2/27 1:50:00 PM	1.6	2.6
2)	-	-
3)	-	-

MERLEX ENGINEERING LTD.
2-120 Progress Court, P1B-8G4 Phone: 1-705-476-2550 Fax: 1-705-476-8882 Email: merlex@merlex.ca

ENCLOSURE NO.:14 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-3-02

REFERENCE 09181 DATUM Geodetic LOCATION N 5333007.28 E 362347.71 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/27 - 10/2/27 TIME 2:30:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
316.3	Ground Surface										
0.0	SILT - grey silt with organics with rootlets		1	AS	N/A		316		○		
316.0											
0.3	Auger Refusal										
315.8											
0.5	DCPT Refusal End of Borehole										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

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ENCLOSURE NO.:15 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-3-03

REFERENCE 09181 DATUM Geodetic LOCATION N 5333031.06 E 362339.93 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/27 - 10/2/27 TIME CHECKED BY MAM

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
316.5	Ground Surface										
0.0	±50 mm organics SAND - brown fine sand some silt		1	AS	N/A		316				
315.8											
0.7	DCPT Refusal Auger Refusal End of Borehole										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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ENCLOSURE NO.:16 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-3-04

REFERENCE 09181 DATUM Geodetic LOCATION N 5332055.11 E 362333.12 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/27 - 10/2/27 TIME 3:10:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
316.5	Ground Surface										
0.0	±50 mm grass and organics										
	SAND - brown fine sand some silt		1	AS	N/A		316		○		
315.7											
0.8	DCPT Refusal Auger Refusal End of Borehole										

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

MERLEX ENGINEERING LTD.
2-120 Progress Court, P1B-8G4 Phone: 1-705-476-2550 Fax: 1-705-476-8882 Email: merlex@merlex.ca

ENCLOSURE NO.:17 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. D-3-05

REFERENCE 09181 DATUM Geodetic LOCATION N 5333079.17 E 362326.31 - Grenfell Township ORIGINATED BY JL

PROJECT GWP 162-98-00, Highway 11 North - Site D BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY RG

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/2/27 - 10/2/27 TIME 4:20:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
317.2	Ground Surface										
0.0	±50 mm grass and organics										
	SAND - brown fine sand some silt (compact)		1	AS	N/A		317		○		
			2	SS	24				○		
							316				
			3	SS	22				○		
315.0											
2.2	Auger Refusal						315				
314.0											
3.2	DCPT Refusal End of Borehole						314				

COMMENTS

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, × 3 : Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

MEL-GEO 09181 - SITE D - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/14

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APPENDIX C

Figure No. D-1:	Borehole Locations & Soil Strata
Figure Nos. L-1 to L-3:	Summary Grain Size Analysis Graph

METRIC

Dimensions are in meters and/or millimeters unless otherwise shown. Stations are in kilometers + meters.

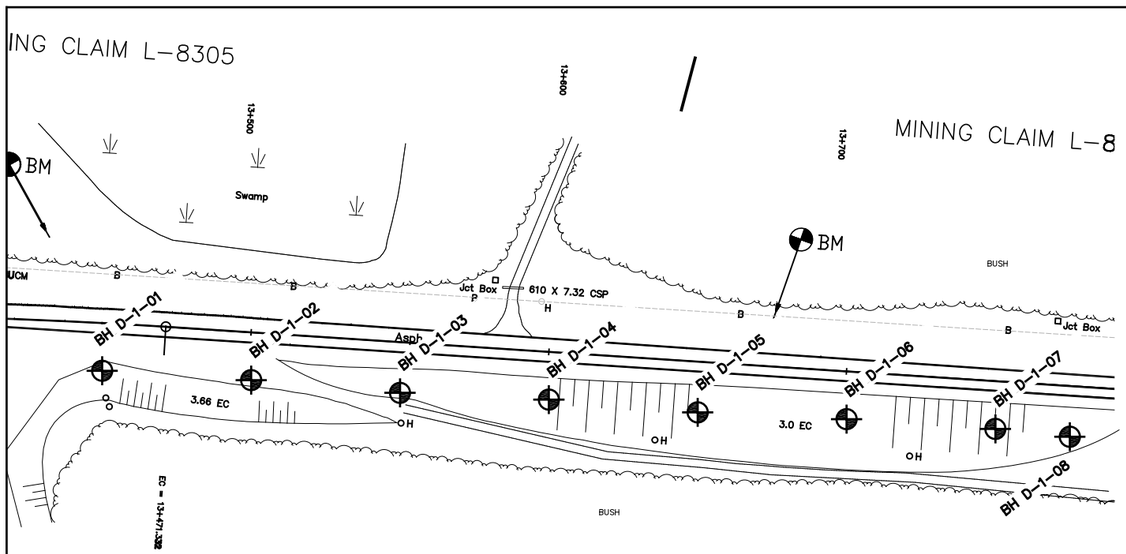
GEOCRES No 42A-82
WP No 162-98-00

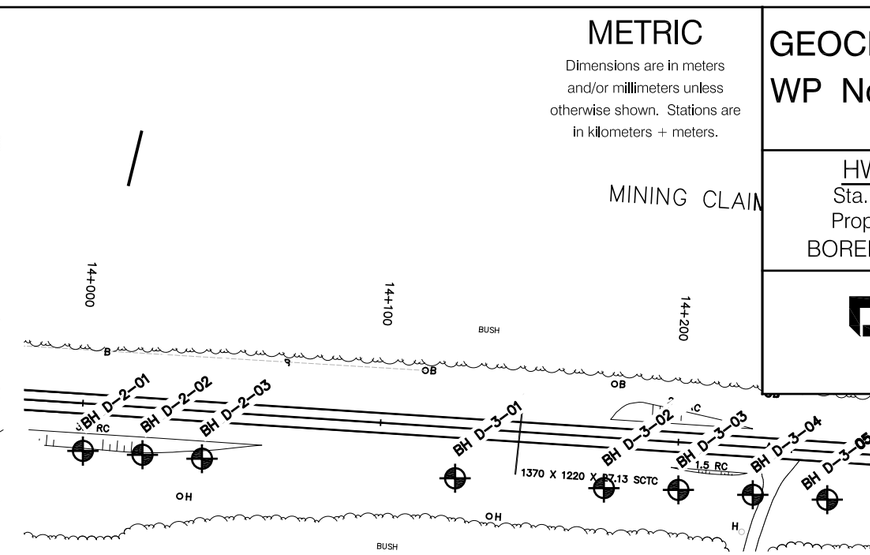
N

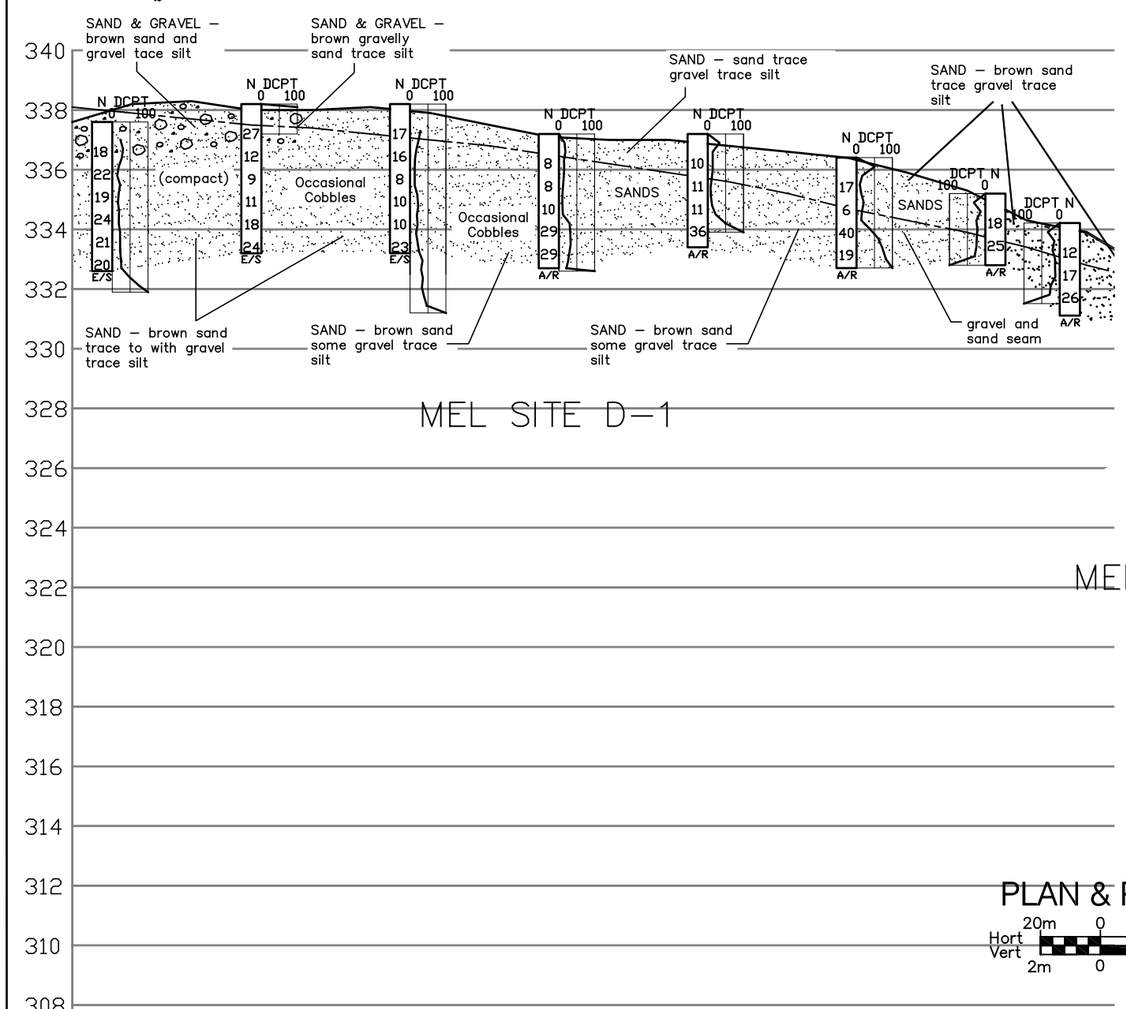
HWY 11 - Township of Grenfell
Sta. 13+450 to 14+250 - MEL Site D
Proposed Northbound Passing Lane
BOREHOLE LOCATIONS & SOIL STRATA

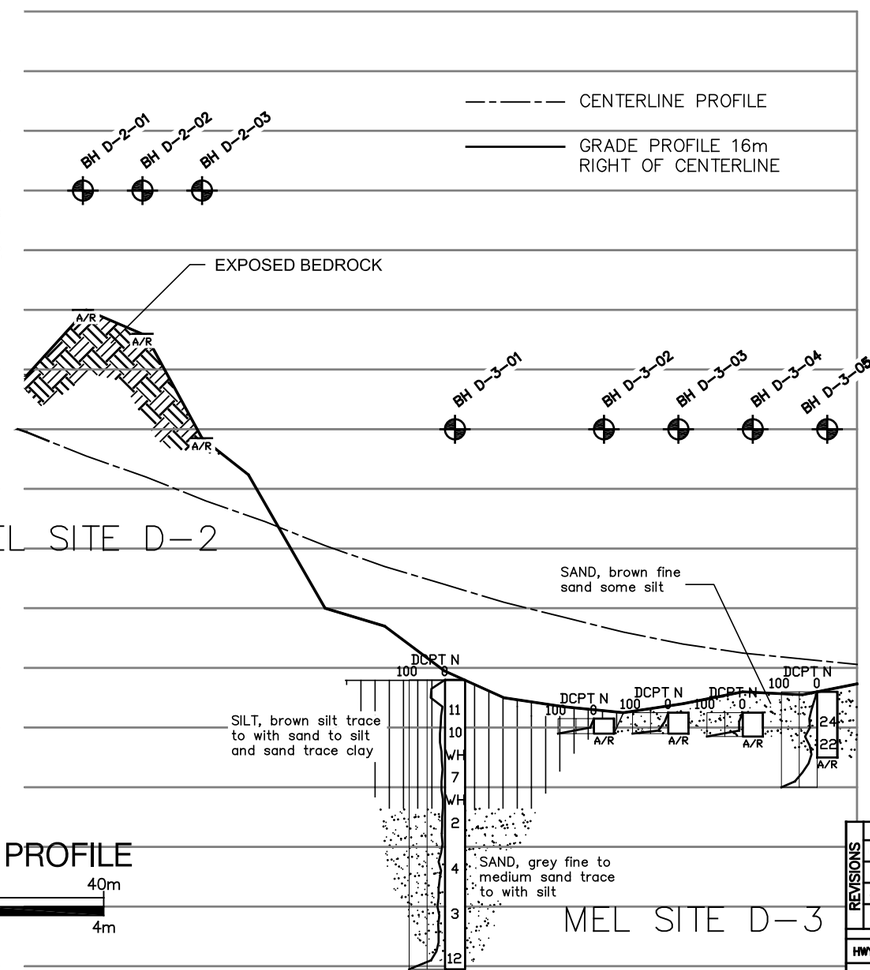
Figure D-1

MERLEX ENGINEERING LTD.
Consulting Geotechnical Engineers



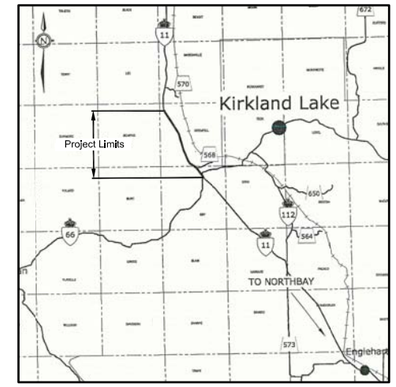






PLAN & PROFILE

Hort 20m 0 40m
Vert 2m 0 4m



KEY PLAN - NOT TO SCALE

LEGEND

- Borehole
- N Blows/0.3 m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3 m (60° Cone, 475 J/blow)
- Water Level at Time of Investigation
- A/R Auger Refusal at Elevation
- E/S End of Sampling
- O/S Offset from ℄

Borehole No.	O/S	Co-ordinates Northerly	Co-ordinates Easterly	Elev.
D-1-01	16m Rt	5332309.7	362544.4	337.6
D-1-02	16m Rt	5332357.6	362530.7	338.2
D-1-03	17m Rt	5332405.9	362518.0	338.2
D-1-04	16m Rt	5332453.8	362503.4	337.2
D-1-05	17m Rt	5332502.2	362490.8	337.2
D-1-06	16m Rt	5332550.0	362476.2	336.4
D-1-07	16m Rt	5332598.1	362432.6	335.2
D-1-08	17m Rt	5332622.4	362456.7	334.2
D-2-01	16m Rt	5332838.6	362394.4	330.0
D-2-02	16m Rt	5332857.9	362389.0	329.2
D-2-03	16m Rt	5332877.1	362877.1	325.7
D-3-01	17m Rt	5332959.2	362361.3	317.6
D-3-02	17m Rt	5333007.3	362347.7	316.3
D-3-03	16m Rt	5333031.1	362339.9	316.5
D-3-04	16m Rt	5332055.1	362333.1	316.5
D-3-05	16m Rt	5333079.2	362326.3	317.2

NOTE 1:
The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

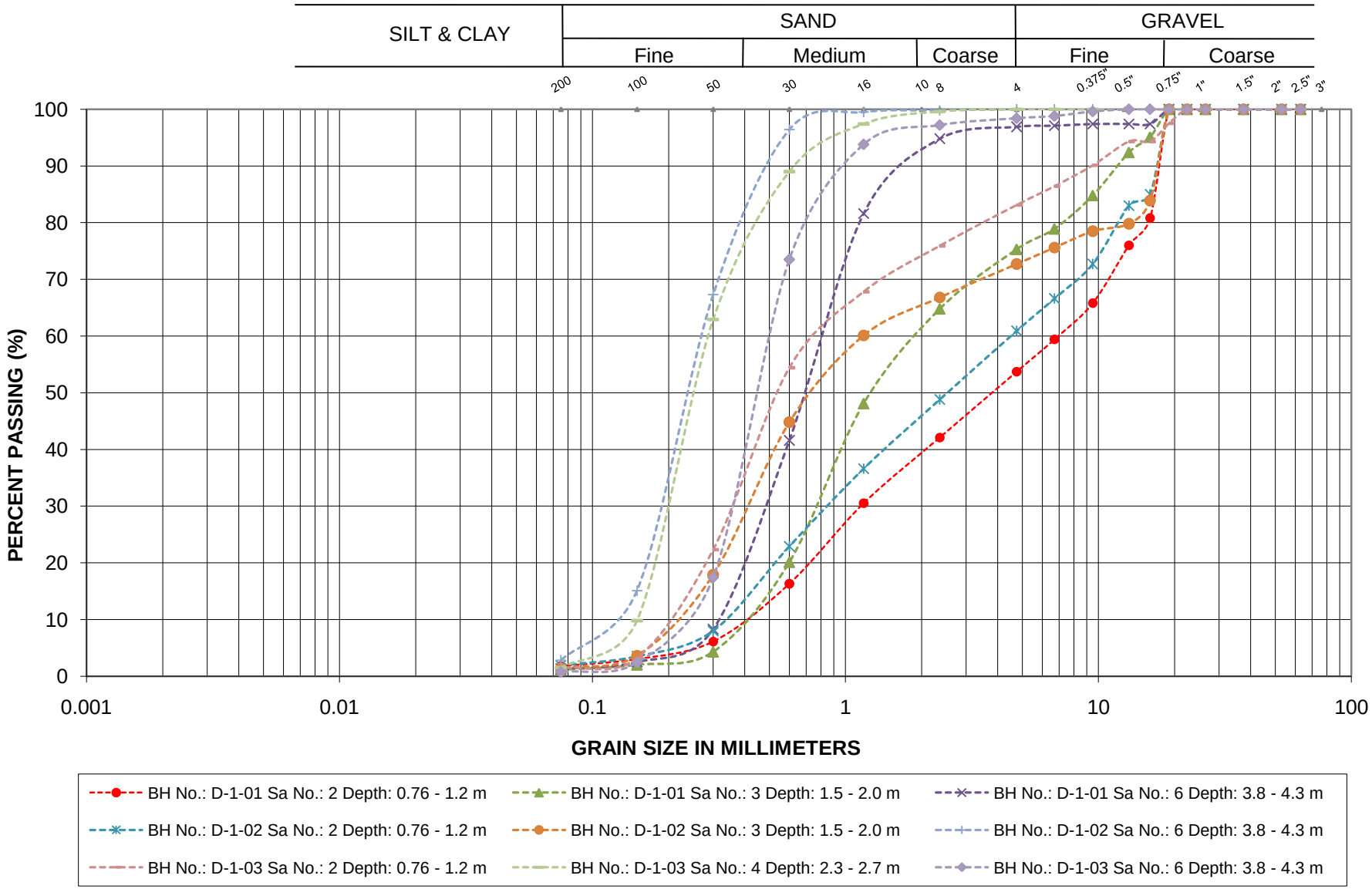
REVISIONS

DATE	BY	DESCRIPTION
Oct 10/10	RG	Draft
Nov 10/10	RG	Revisions
Jan 10/11	RG	Final Revisions

HWY No. 11 – Northbound Passing Lane – 13+450 to 14+250			REF NO. 09181
SUBM'D			SITE D
DRAWN RG	CHK MAM	DATE SEPTEMBER 2010	FIG D-2

Reference No.: 09/10/09181D
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 162-98-00
LOCATION: Hwy 11 MEL Site D

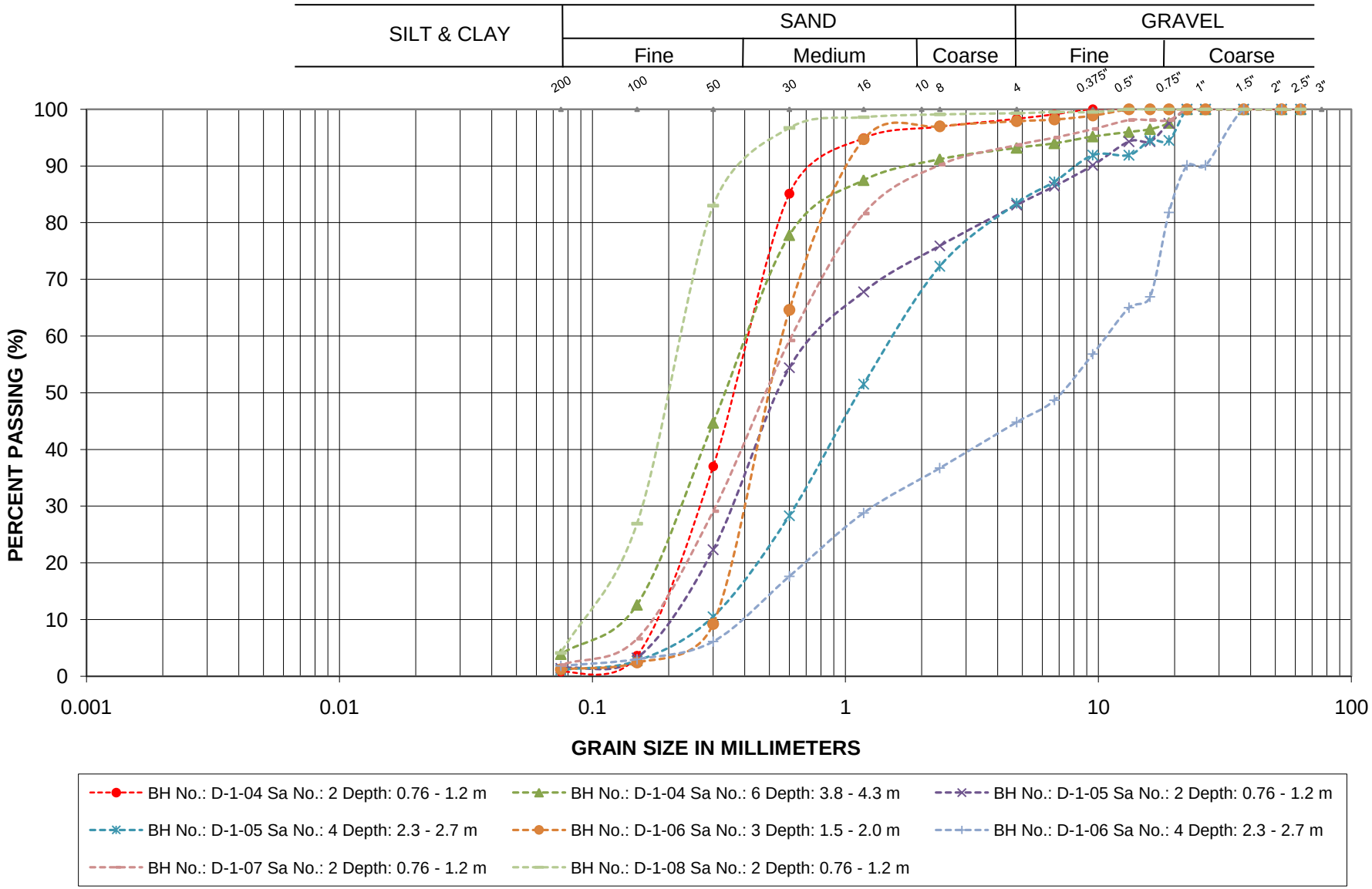
SANDS - Sand, Trace to Some Gravel, Trace Silt

MERLEX ENGINEERING LTD.

FIGURE L-1

Reference No.: 09/10/09181D
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 162-98-00
LOCATION: Hwy 11 MEL Site D

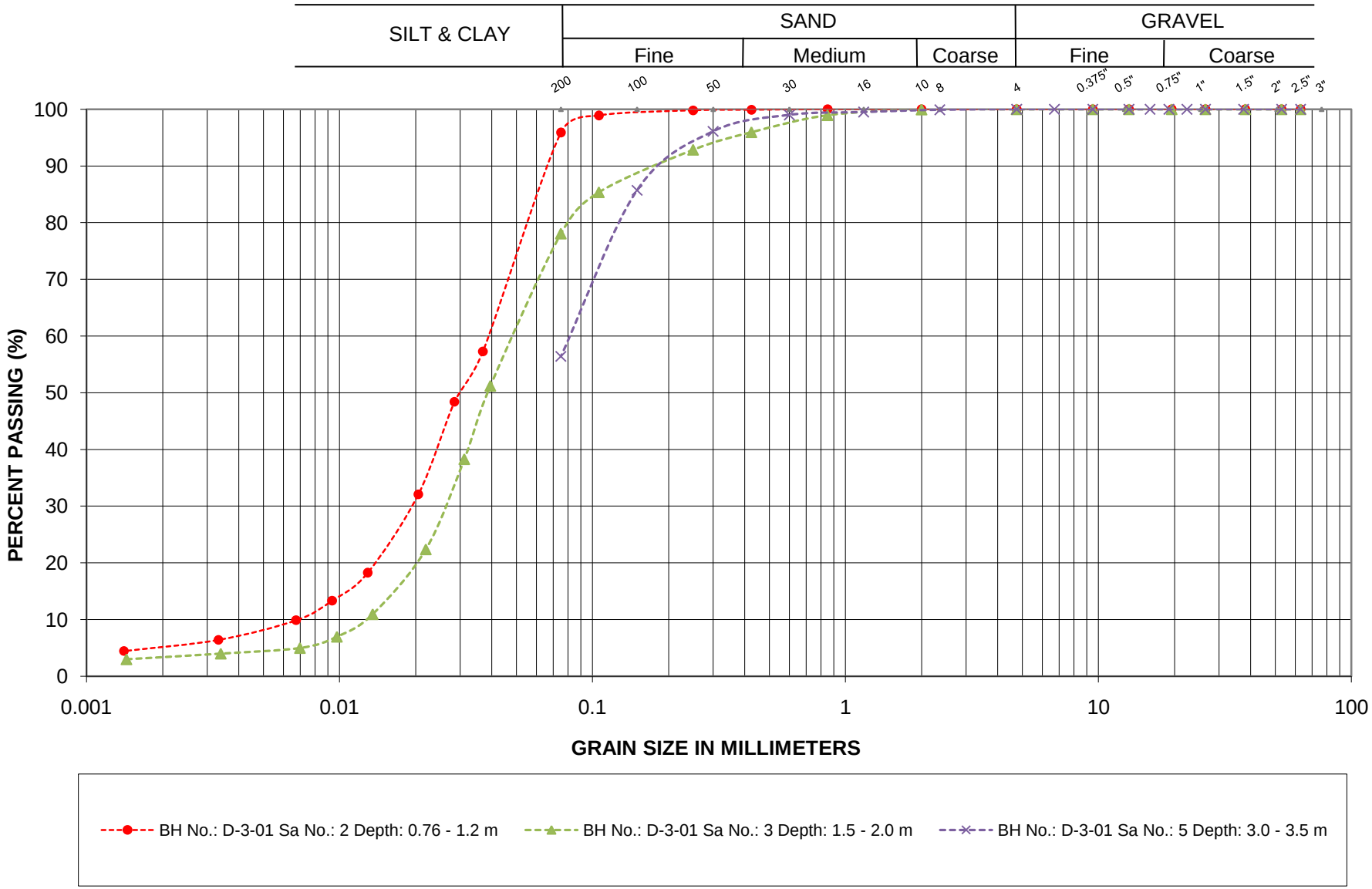
SANDS - Sand, Trace to Some Gravel, Trace Silt

MERLEX ENGINEERING LTD.

FIGURE L-2

Reference No.: 09/10/09181D
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 162-98-00
LOCATION: Hwy 11 MEL Site D

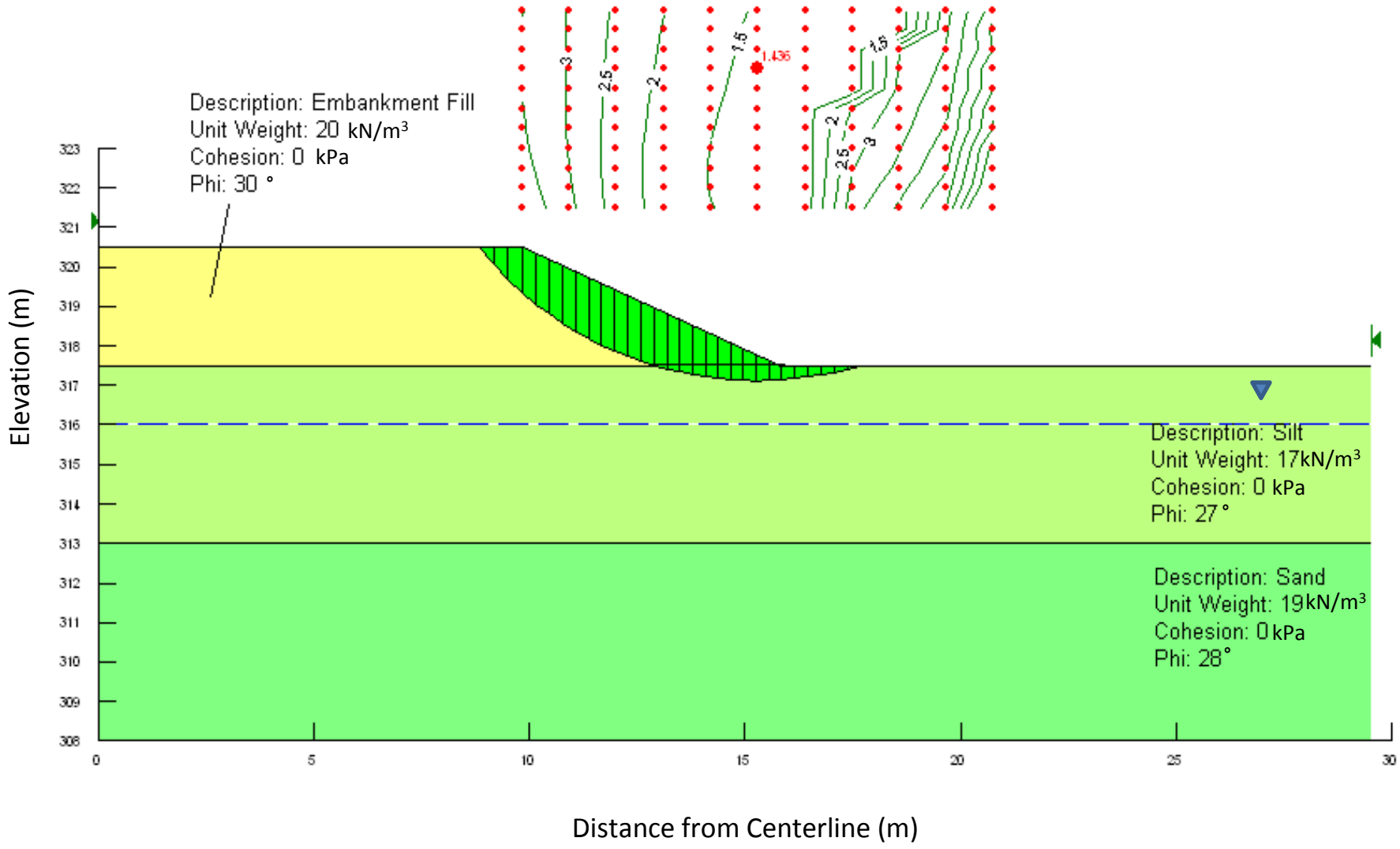
SILT - Silt, Trace to With Sand, Trace Clay to Silt and Sand

MERLEX ENGINEERING LTD.

FIGURE L-3

APPENDIX D

Figure No. S-1: Stability Analysis


Description: Embankment Fill
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Phi: 30 °
Description: Silt
Unit Weight: 17kN/m³
Cohesion: 0 kPa
Phi: 27 °
Description: Sand
Unit Weight: 19kN/m³
Cohesion: 0 kPa
Phi: 28°
1.436
Elevation (m)
Distance from Centerline (m)