MERLEX ENGINEERING LTD.

CONSULTING GEOTECHNICAL ENGINEERS

FINAL
FOUNDATION INVESTIGATION REPORT

CULVERT STATION 13+454 – TWP. OF PERRY
GWP 324-00-00
MEL SITE A

Highway 518, From Highway 11,
Westerly 13.0 km, and
From Star Lake Road, Northerly 1.2 km
MTO Huntsville Area

MEL Ref. No.: 10/03/10034A January 20, 2011

Submitted to:

AECOM Canada Ltd.
189 Wyld Street
North Bay, Ontario
P1B 1Z2

Geocres No. 31E-307

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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 a culvert located at Station 13+454, Township of Perry. GWP 324-00-00 on Highway 518 passes through parts of the Townships of Perry and McMurrich and is located from the junction of Highways 11 and 518 westerly for 13.0 km and from Star Lake Road at Emsdale, northerly 1.2 km. This foundation investigation project involves the replacement of one 760 mm diameter CSP culvert in an embankment that is 5.7 m high, above the culvert invert at centerline.

The foundation investigation location was specified by the MTO in the RFP/TPM documentation Agreement No. 5007-E-0030. The terms of reference for the scope of work are outlined in MEL's proposal P-09-077, dated June 2009. The purpose of the investigation was to determine the subsurface conditions in the area of the culvert and along a possible detour route. MEL investigated the foundation area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

2.0 SITE DESCRIPTION

The CSP culvert is located on Highway 518 at Station 13+454, Township of Perry. The topography at the site is generally of moderate relief and the flow through the culvert is from the south to north side of the embankment. The vegetation to the north of the embankment at this culvert location consists of scrub and grasses with occasional coniferous and deciduous trees, with a generally low lying and flat land. To the south of the embankment the vegetation consists of scrub and mature coniferous and deciduous trees, in generally low lying land. Gravel entrances are present, to the north and south of the embankment, (both up and down chainage

from the culvert) which are constructed with fill to meet the grade of the existing highway embankment.

The existing highway embankment supports two undivided lanes of highway, running in an east-west direction. The existing road embankment is 5.7 m higher than the culvert invert at centerline, with the paved surface at elevation 316.3 m and the culvert invert at elevation 310.6 m. The embankment slopes are approximately 2.5H:1V and 2.2H:1V at the right and left slopes, respectively. At the culvert location, a visual review indicated no signs of embankment instability, and there were no obvious signs of settlement of the pavement structure at the culvert location. The culvert report states that the bottom of the right end of the culvert is rusted out with the left end submerged and approximately 75% of the culvert rusted out. A further review of this culvert, once it has been dewatered, is scheduled. A pole line and high pressure gas main parallel the highway alignment to the south (right).

2.1 Site Physiography and Surficial Geology

This Highway 518 project is located in the Geomorphic Sub-province known as the Muskoka Ridges and Pockets at the west boundary of the Algonquin Uplands. The topography on this section of Highway 518 is rolling. There are exposed bedrock ridges. At many locations, significant layers of earth overlay the bedrock and organic terrain was also observed. At this specific culvert site, native overburden consists generally of a thin veneer of silty clay overlying loose to compact silts with auger refusal (presumably bedrock) around elevation 302 m (9 m depth) at the culvert location.

Bedrock in the area, as indicated on OGS Map 2441, is of the Late to Middle Precambrian Era. The project area comprises of Metasediments (conglomerates, greywacke, arkose, calcareous sandstones and siltstones, shale and derived metamorphic rocks).

3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out during the period of June 26 to July 1 and July 12, 2010, when eight (8) sampled boreholes were advanced. Three boreholes were undertaken at the culvert location at Station 13+454, Perry Township, with two at the ends of the existing culverts and one through the embankment. Five additional borings were advanced along the proposed detour alignment to the left (north) of the existing embankment.

The field investigation was carried out using a Bombardier mounted CME 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 diameter 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 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 and recorded during 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 (Figure Nos. L-1 to L-7).

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. A-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 design purposes only. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. A-1 to A-8 were recorded at 311.0, 316.2, 312.0, 314.8, 315.2, 313.6, 315.3, and 314.2 m, respectively.

4.1 Culvert, Station 13+454, Township of Perry – MEL SITE A

A plan, profile and cross section showing the borehole locations and stratigraphic sequences is shown on Figure No. A-1, Appendix C. During the course of the exploration program, three (3) sampled boreholes were put down at the culvert station, with Borehole Nos. A-1 and A-3 advanced at the culvert ends, and Borehole No. A-2, advanced through the embankment.

4.1.1 Organics

At Borehole No. A-1, some 150 mm of free water was encountered at surface, underlain by a surficial layer, some 450 mm thick of black fine fibrous rooty organics. At Borehole No. A-3 some 150 mm of grass and surficial organics was encountered.

4.1.2 Silty Clay

Underlying the surficial organics at Borehole Nos. A-1 and A-3, a deposit of brown silty clay containing trace to some sand was penetrated. The natural moisture content from samples of this deposit was in the order of 28 to 36%. Hydrometer analysis was carried out on three (3) samples of this deposit, the results of which indicated 0% gravel size particles, 2 to 18% sand size particles, 59 to 71% silt size particles, and 23 to 32% clay size particles (Figure No L-1,

Appendix C). Atterberg Limit testing was completed on three (3) samples of this deposit. The results indicated a plastic limit of 18 to 25% and a liquid limit of 31 to 37%, resulting in a USCS classification of CL to CI (Figure No. L-7, Appendix C). Based on field vane tests, which all indicated a shear strength of greater than 100 kPa, the consistency of this deposit was described as very stiff. This deposit was encountered to depths of 1.5 and 2.3 m below ground surface at Borehole Nos. A-1 and A-3, respectively (elevation 309.5 and 309.7 m, respectively).

4.1.3 Silt

Underlying the silty clay, at Borehole Nos. A-1 and A-3, a deposit of grey silt containing trace to some clay trace fine sand was penetrated. Natural moisture contents from samples of this deposit are in the order of 26 to 37%. Hydrometer analysis was carried out for six (6) samples of this deposit, the results of which indicated 0% gravel size particles, 1 to 7% sand size particles, 79 to 96% silt size particles, and 3 to 14% clay size particles (Figure No. L-2, Appendix C). Atterberg limit testing was carried out on the six samples and all samples were classified as non plastic. Based on the SPT values of 2 to 27 blows for 300 mm penetration, the compactness of this deposit was described as very loose to compact, generally compact. Auger refusal was encountered in this deposit at depth of 10.5 m below ground surface at Borehole No. A-3 (elevation 301.5 m).

4.1.4 Sand

Underlying the silt, at Borehole No. A-1, a deposit of silty fine sand containing trace gravel trace clay was penetrated at a depth of 7.3 m below grade (elevation 303.2 m). The natural moisture content from a sample of this deposit was in the order of 21%. Hydrometer analysis was carried out on one sample of this deposit, the results of which indicated 7% gravel size particles, 59% sand size particles, 32% silt size particles, and 2% clay size particles (Figure No. L-3, Appendix

C). Based on the SPT value of 48 blows per 300 mm penetration, the compactness of this deposit was described as dense. Auger refusal was encountered in this deposit at a depth of 8.7 m below ground surface (elevation 302.3 m).

4.1.5 Embankment Fill

At Borehole No. A-2, undertaken from the top of the embankment, a deposit of brown fine to medium sand containing trace silt trace gravel (fill) some 1.0 m in thickness was penetrated along the right shoulder. Natural moisture content from this sample was in the order of 5%. Auger refusal was encountered at a depth of 1.0 m. Two additional (unsampled) auger probes were advanced within 2 m of Borehole No. A-2 in an attempt to advance deeper into the embankment. Refusal was encountered at these auger probe locations at a depth of 1.0 and 1.1 m below ground surface. Based on drill response and previous a geotechnical investigation carried in this area, refusal was due to cobble/boulder sizes/rock fill. In addition, both embankment foreslopes had exposed blasted rock fill for the full face height. Refusal at Borehole No. A-2 was encountered at elevation 315.2 m. A series of geotechnical boreholes were advanced by MEL, from the top of the embankment between Stations 13+400 to 13+600. These boreholes refused on rock fill at depths of 0.7 to 1.2 m (see Geotechnical Borehole Logs, Appendix D).

4.2 Detour, Township of Perry – MEL SITE A

During the course of the exploration program, five (5) sampled boreholes were put down along the proposed detour alignment, with Boreholes Nos. A-4 to A-8 advanced to the left (north) of the existing embankment.

4.2.1 Organics

At Borehole Nos. A-5 and A-6, a surficial layer some 100 to 150 mm thick of grass (root mass) mixed with sand and gravel was encountered at surface.

4.2.2 Embankment Fill (Gravel Entrance)

At the surface at Borehole No. A-4, and underlying the grass and sand at Borehole No. A-5, a deposit of embankment fill, for a gravel entrance, was encountered. The fill varied in composition and was a heterogeneous mix of fine to medium sand trace to some silt trace clay to gravelly sand, to silt, trace to with clay trace fine sand. Trace asphalt was encountered in this deposit at a depth of 2.5 m below ground surface at Borehole No. A-4 and at a depth of 3.0 m in Borehole No. A-5. Wood pieces were also encountered at this depth at Borehole No. A-5. The natural moisture content from samples of this fill deposit was in the order of 8 to 33%. Gradation analysis was carried out on four (4) samples of this deposit, the results of which indicated 5 to 38% gravel size particles, 20 to 62% sand size particles, 11 to 51% silt size particles, and 1 to 24% clay size particles (Figure No. L-4, Appendix C). Atterberg Limit testing was carried out on two (2) samples of this deposit which exhibited plastic characteristics, the results of which indicated a liquid limit of 25 to 30% and a plastic limit of 16 to 20%, resulting in a USCS classification of CL (Figure No. L-7, Appendix C). Based on the SPT values of 0 (static weight of the hammer) to 95 blows per 300 mm penetration, the compactness of this deposit was highly variable and described as very loose to very dense, generally loose. This deposit extended to 3.8 and 5.5 m below ground surface at Borehole Nos. A-4 and A-5, respectively (elevations 311.0 and 309.7 m, respectively).

4.2.3 Rip Rap

At Borehole No. A-7, a deposit of rip rap/cobble and boulder sizes was encountered at surface. This deposit was encountered to depth of 1.0 m (elevation 314.3 m).

4.2.4 Sand

At Borehole No. A-8, a deposit of brown fine sand trace to some gravel trace silt containing occasional cobbles was encountered. The natural moisture content of samples of this deposit was in the order of 13 to 14%. Auger refusal was encountered at depth of 0.7 m below ground surface (elevation 313.5 m).

4.2.5 Silty Clay

Underlying the fill at Borehole No. A-4, and at surface at Borehole No. A-6, a deposit of grey silty clay was encountered. The natural moisture content from samples of this deposit was in the order of 41 to 43%. Based on field vane tests, which indicated a shear strength of greater than 100 kPa, the consistency of this deposit was described as very stiff. This deposit was encountered to depths of 5.6 and 1.2 m at Boreholes Nos. A-4 and A-6, respectively (elevations 309.2 and 312.4 m, respectively).

4.2.6 Silt

Underlying the fill at Borehole No. A-5, and underlying the silty clay at Borehole Nos. A-4 and A-6, and underlying the rip rap at Borehole No. A-7, a deposit of grey silt trace fine sand trace clay was encountered. The natural moisture content from samples of this deposit was in the order of 24 to 36%. Hydrometer analysis was carried out on four (4) samples of this deposit, the results of which indicated 0% gravel size particles, 0 to 2% sand size particles, 89 to 95% silt size particles, and 4 to 9% clay size particles (Figure No. L-5, Appendix C). Atterberg limit testing

was carried out on the six samples and all samples were classified as non plastic. Based on the SPT values of 1 to 18 blows per 300 mm penetration, the compactness of this deposit was described as very loose to compact, generally loose. This deposit was encountered to a depth of 11.6 m below ground surface at Borehole No. A-5 (elevation 303.7 m). Whereas auger refusal was encountered in this deposit at depths of 12.0, 7.4, and 7.5 m below ground surface at Boreholes Nos. A-4, A-6, and A-7, respectively (elevations 302.8, 306.2, and 307.8 m, respectively).

4.2.7 Sand

Underlying the silt at Borehole No. A-5, a deposit of grey fine to medium sand with silt trace gravel trace clay was encountered. The natural moisture content from samples of this deposit was in the order of 14%. Hydrometer analysis was carried out on one sample of this deposit, the results of which indicated 8% gravel size particles, 66% sand size particles, 24% silt size particles, and 2% clay size particles (Figure No. L-6, Appendix C). A SPT value of 77 blows per 175 mm penetration was recorded, however this elevated STP result was due to the resistance of the underlying refusal material and not representative of the compactness of the thin sand layer. Auger refusal was encountered at depth of 12.5 m (elevation 302.5 m) in this deposit.

4.3 Groundwater Conditions

Groundwater and cave-in levels in the open boreholes were measured during the advance of the individual boreholes and upon completion. These levels were recorded on the individual Record of Borehole Log Sheets (Appendix B). The groundwater level was recorded at 0 (at surface) to 4.7 m depth in the boreholes at the toe of the embankment, with Borehole No. A-5 being dry following completion. At the culvert inlet (Borehole No. A-3) and outlet (Borehole No. A-1) the groundwater level in the open boreholes was recorded at elevation 311.4 and 311.0 m,

respectively, at the time of this field investigation. These groundwater levels will fluctuate seasonally.

MERLEX ENGINEERING LTD.

M. A. Merleau, P. Eng.
Principal

J. R. Berghamer, P. Eng.
Project Engineer

Z:\PROJECT FILES\2010\10034 - PAVE & FDN, Hwy 518 Sprucedale (AECOM)\`FOUNDATION\Reports\FINAL\Final - Site A - Station 13+454 - Twp of Perry\10034A- FINAL FIR, Hwy 518 GWP 324-00-00 - SITE A, Culvert 13+454.doc

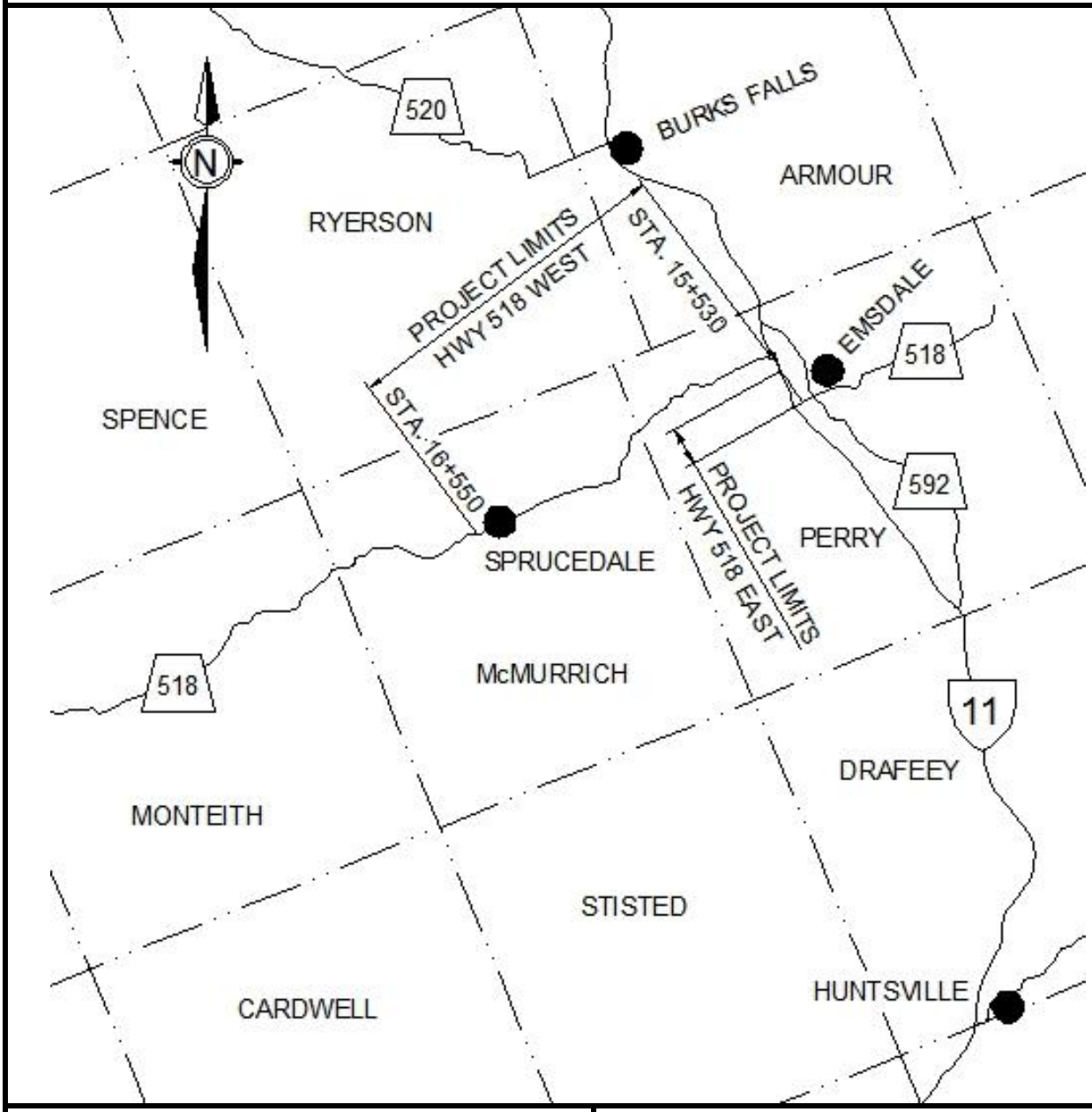
APPENDIX A

Figure No. 1: Key Plan

KEY PLAN

Figure No. 1

NOT TO SCALE



FINAL
FOUNDATION INVESTIGATION REPORT
GWP 324-00-00

Highway 518, From Highway 11, Easterly
Easterly 13.0 km and From
Star Lake Road Northerly 1.2 km

MEL Ref. No.: 10/03/10034A January 2011

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APPENDIX B

Enclosure No. 1: List of Abbreviations and Symbols

Enclosure Nos. 2 to 9: 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. A-1

REFERENCE 10/03/10034 DATUM Geodetic LOCATION N 5044051.8 E 315552.0 - Perry Township ORIGINATED BY JL

PROJECT GWP 324-00-00 - Highway No. 518 - MEL Site A BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/6/28 - 10/6/28 TIME 2:30:00 PM CHECKED BY MAM

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
311.0	Ground Surface							
0.0	±150 mm surface water							
310.5	PEAT - black fine fibrous peat and organics	1	AS	N/A				
0.5	SILTY CLAY - brown silty clay some sand	2	SS	5	0	18	59	23
309.5	(very stiff)							
1.5	SILT - grey silt trace to some clay trace fine sand	3	SS	7	0	7	79	14
		4	SS	11				
	(very loose/compact)	5	SS	2	0	1	96	3
		6	SS	5				
		7	SS	11	0	1	94	5
		8	SS	10				
303.7								
7.3	SAND - silty fine to medium sand trace gravel trace clay	9	SS	43	7	59	32	2
	(dense)							
302.3								
302.2	Auger Refusal							
8.8	DCPT Refusal End of Borehole							

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

ELEVATION SCALE: 310 309 308 307 306 305 304 303

>100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L

WATER CONTENT (%): 20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)

COMMENTS

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

$+^3$, $\times^3$: Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

$\circ^{3\%}$ STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/6/28 2:30:00 PM	0	1.6
2)	-	-
3)	-	-

MEL-GEO 10034 - SITE A - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/20

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.:3 (Pg. 1 of 1)

METRIC

RECORD OF BOREHOLE NO. A-2

REFERENCE 10/03/10034 DATUM Geodetic LOCATION N 5044029.2 E 315560.0 - Perry Township ORIGINATED BY JL

PROJECT GWP 324-00-00 - Highway No. 518 - MEL Site A BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/7/12 - 10/7/12 TIME CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	w_P w w_L	γ	
316.2	Ground Surface							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%) 20 40 60	kN/m³	GR SA SI CL
0.0	FILL - fine to medium sand trace gravel trace silt		1	AS	N/A		316		○		
315.2			2	SS	18				○		
1.0	Auger Refusal						315				
314.7											
1.5	DCPT Refusal End of Borehole										

COMMENTS

Undertook two additional borings within 2 m of Borehole No A-2 with auger refusal at 1.0 and 1.1 m depth.

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) 10/7/12	DRY	-
2)	-	-
3)	-	-

MEL-GEO 10034 - SITE A - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/20

MERLEX ENGINEERING LTD.
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ENCLOSURE NO.:4 (Pg. 1 of 1)

METRIC

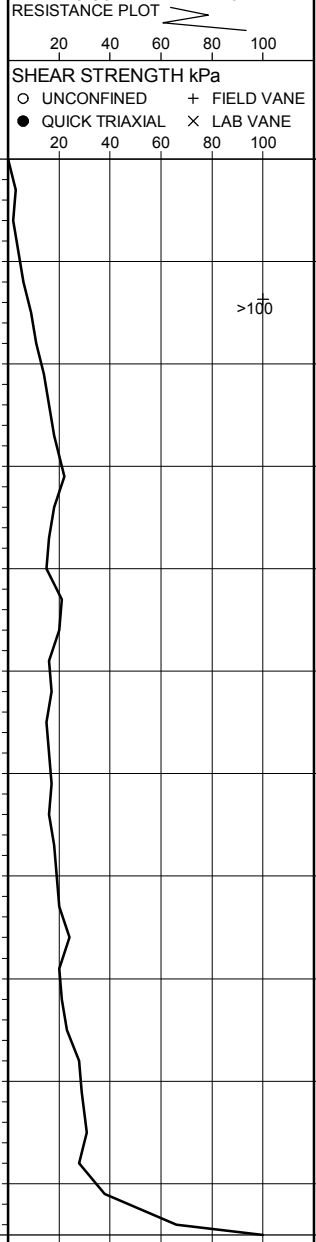
RECORD OF BOREHOLE NO. A-3

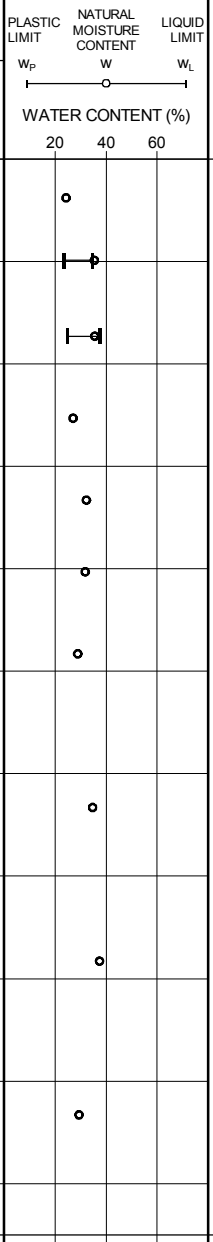
REFERENCE 10/03/10034 DATUM Geodetic LOCATION N 5044013.6 E 315569.5 - Perry Township ORIGINATED BY JL

PROJECT GWP 324-00-00 - Highway No. 518 - MEL Site A BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/7/12 - 10/7/12 TIME CHECKED BY MAM

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
312.0	Ground Surface					
0.0	±150 mm grass and organics					
	SILTY CLAY - brown to grey silty clay trace sand		1	AS	N/A	▽
	(very stiff)		2	SS	8	
			3	SS	9	
309.7						
2.3	SILT - grey silt trace clay trace sand		4	SS	27	
			5	SS	9	▽
	(loose/compact)					
			6	SS	24	
			7	SS	4	
			8	SS	12	
			9	SS	6	
			10	SS	22	
301.5						
10.5	Auger Refusal DCPT Refusal End of Borehole					





UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	0	2	66	32
	0	2	71	27
	0	2	93	5
	0	2	95	3
	0	2	91	7

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) 10/7/12 1:00:00 PM	0.6 ▽	3.5 ▽
2)	- ▽	-
3)	- ▽	-

MEL-GEO 10034 - SITE A - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/20

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

METRIC

RECORD OF BOREHOLE NO. A-4

REFERENCE 10/03/10034 DATUM Geodetic LOCATION N 5044048.5 E 315570.6 - Perry Township ORIGINATED BY JL

PROJECT GWP 324-00-00 - Highway No. 518 - MEL Site A BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/6/25 - 10/6/25 TIME 9:20:00 AM CHECKED BY MAM

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS
314.8	Ground Surface					
0.0	FILL - brown fine sand some silt trace gravel trace organics		1	AS	N/A	
			2	SS	48	
313.6						
1.2	FILL - brown silt trace clay trace sand					
			3	SS	10	
	(compact)					
312.4						
2.4	FILL - fine to medium sand trace silt trace gravel trace asphalt		4	SS	64	
	(compact/very dense)		5	SS	10	
311.0						
3.8	SILTY CLAY - grey silty clay		6	SS	6	
	(very stiff)		7	SS	7	▽
309.2						
5.6	SILT - grey silt trace clay trace fine sand					▽
			8	SS	2	
	(very loose/loose)					
			9	SS	1	
			10	SS	8	
			11	SS	4	
302.8						
12.0	Auger Refusal DCPT Refusal End if Borehole					

ELEVATION SCALE: 314, 313, 312, 311, 310, 309, 308, 307, 306, 305, 304, 303

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/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

COMMENTS

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

$+^3$, $\times^3$: 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) 10/6/29 9:25:00 AM	4.7 ▽	5.8 ▣
2)	- ▽	-
3)	- ▼	-

MEL-GEO 10034 - SITE A - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/20

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

METRIC

RECORD OF BOREHOLE NO. A-5

REFERENCE 10/03/10034 DATUM Geodetic LOCATION N 5044059.1 E 315594.3 - Perry Township ORIGINATED BY JL

PROJECT GWP 324-00-00 - Highway No. 518 - MEL Site A BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/6/29 - 10/6/29 TIME 12:30:00 PM CHECKED BY MAM

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 + 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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
315.2	Ground Surface										
0.0	±150mm grass and mixed sand and gravel		1	AS	N/A		315				
	FILL - grey silt with clay and sand trace gravel		2	SS	WH						5 20 51 24
313.8							314				
1.4	FILL - brown fine to medium sand some silt so silty trace clay some gravel to gravelly		3	SS	5						12 62 20 6
			4	SS	16		313				
	(compact/very dense)										
	trace asphalt		5	SS	95		312				38 50 11 1
	trace wood pieces										
			6	SS	13		311				
			7	SS	10						14 47 31 8
309.7							310				
5.5	SILT - grey silt trace to some sand trace clay		8	SS	18		309				
	(loose/compact)										
			9	SS	4		308				0 1 94 5
							307				
			10	SS	6		306				
							305				
			11	SS	6						
303.6							304				
11.6	SAND - fine to medium sand with silt trace gravel trace silt										
	(very dense)		12	SS	777 / 175 mm		303				8 66 24 2
302.7											
~~302.6~~	DCPT Refusal										
12.6	Auger Refusal End of Borehole										

COMMENTS

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

$+^3$, $\times^3$: 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) 10/6/29 12:30:00 PM	DRY	3.8
2)	-	-
3)	-	-

MEL-GEO 10034 - SITE A - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/20

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

METRIC

RECORD OF BOREHOLE NO. A-6

REFERENCE 10/03/10034 DATUM Geodetic LOCATION N 5044032.7 E 315528.4 - Perry Township ORIGINATED BY JL

PROJECT GWP 324-00-00 - Highway No. 518 - MEL Site A BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/7/1 - 10/7/1 TIME 11:30:00 AM CHECKED BY MAM

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
313.6	Ground Surface			
0.0	±100 mm grass and mixed sand and gravel	1	AS	N/A
	SILTY CLAY - brown to grey silty clay	2	SS	9
312.4				
1.2	(very stiff) SILT - grey silt trace clay trace to some sand	3	SS	13
		4	SS	9
	(loose/compact)	5	SS	7
		6	SS	9
		7	SS	8
		8	SS	10
306.2				
306.4	Auger Refusal			
7.5	DCPT Refusal End of Borehole			

GROUND WATER CONDITIONS

ELEVATION SCALE: 313, 312, 311, 310, 309, 308, 307

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/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

COMMENTS

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

$+^3, \times^3$: Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

$\circ$ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 10/7/1 11:30:00 AM	3.1	4.7
2) 10/7/1 12:00:00 PM	0.9	2.2
3)	-	-

MEL-GEO 10034 - SITE A - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/20

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

METRIC

RECORD OF BOREHOLE NO. A-7

REFERENCE 10/03/10034 DATUM Geodetic LOCATION N 5044013.7 E 315486.5 - Perry Township ORIGINATED BY JL

PROJECT GWP 324-00-00 - Highway No. 518 - MEL Site A BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/7/1 - 10/7/1 TIME 2:00:00 PM CHECKED BY MAM

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
315.3	Ground Surface									
0.0	RIP RAP - rock shatter, cobbles/boulders									
314.3										
1.0	SILT - grey silt trace silt trace sand									
			1	SS	10					
	(loose/compact)		2	SS	15		0	2	89	9
			3	SS	4		0	2	94	4
			4	SS	6					
			5	SS	8					
			6	SS	18		0	0	95	5
307.8										
7.5	Auger Refusal DCPT Refusal End of Borehole									

ELEVATION SCALE: 315, 314, 313, 312, 311, 310, 309, 308

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/m^3

COMMENTS

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

$+^3$, $\times^3$: Numbers on right refer to Sensitivity
Numbers on left refer to values greater than 120 kPa

$\circ$ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

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

MEL-GEO 10034 - SITE A - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/20

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

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

METRIC

RECORD OF BOREHOLE NO. A-8

REFERENCE 10/03/10034 DATUM Geodetic LOCATION N 5044023.4 E 315510.6 - Perry Township ORIGINATED BY JL

PROJECT GWP 324-00-00 - Highway No. 518 - MEL Site A BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started/Completed) 10/7/12 - 10/7/12 TIME 9:50:00 AM 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
314.2	Ground Surface										
0.0	SAND - fine sand trace to some gravel trace silt occasional cobbles		1	AS	N/A		314		○		
313.5						▽					
313.3	DCPT Refusal		2	SS	50 / 125 mm				○		
0.9	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) 10/7/12 9:50:00 AM	0.6 ▽	0.06 ▣
2)	- ▽	-
3)	- ▽	-

MEL-GEO 10034 - SITE A - BOREHOLE LOGS.GPJ MEL-GEO.GDT 11/1/20

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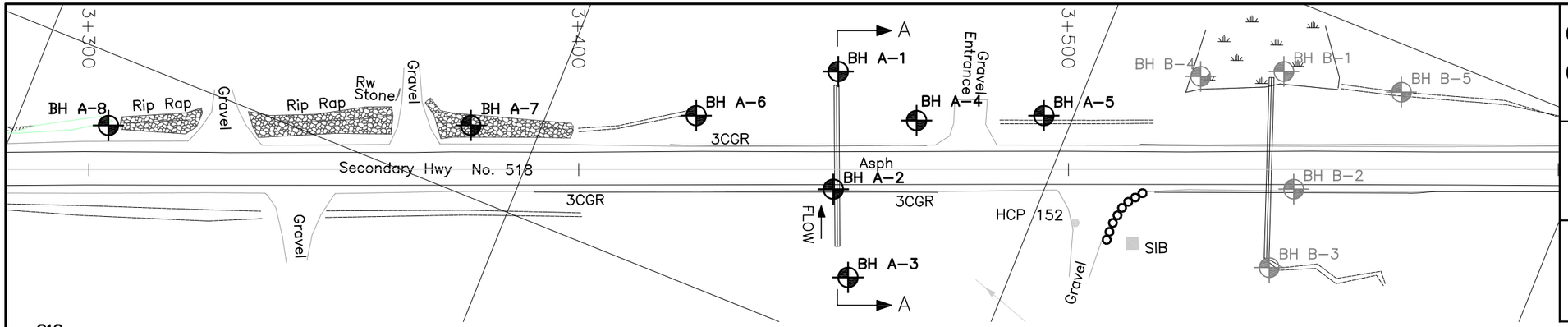
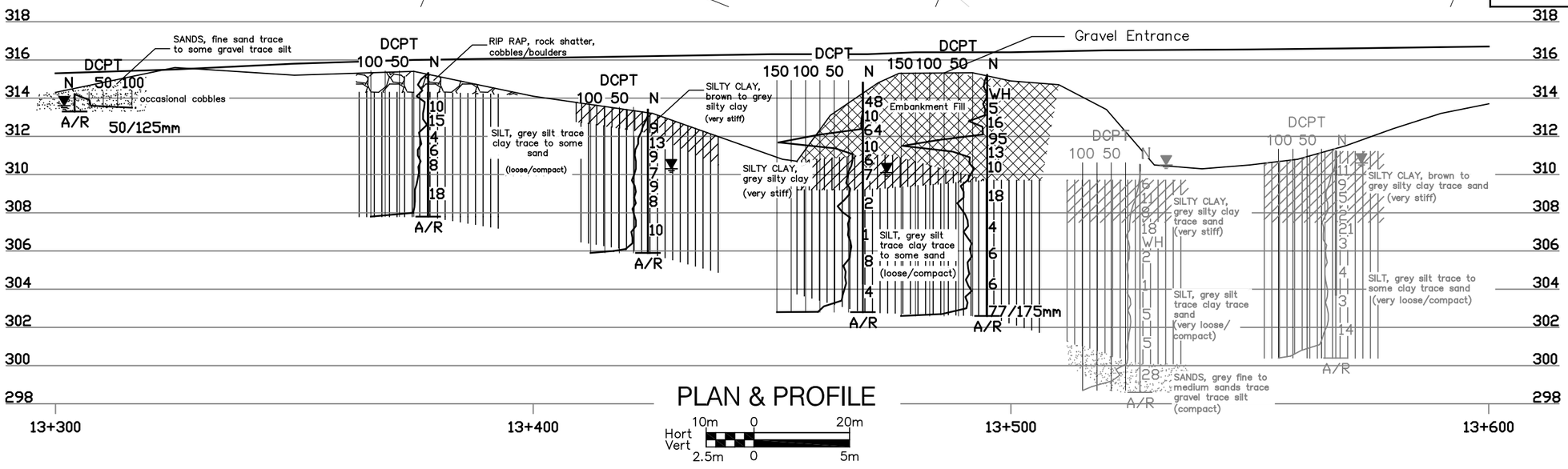
APPENDIX C

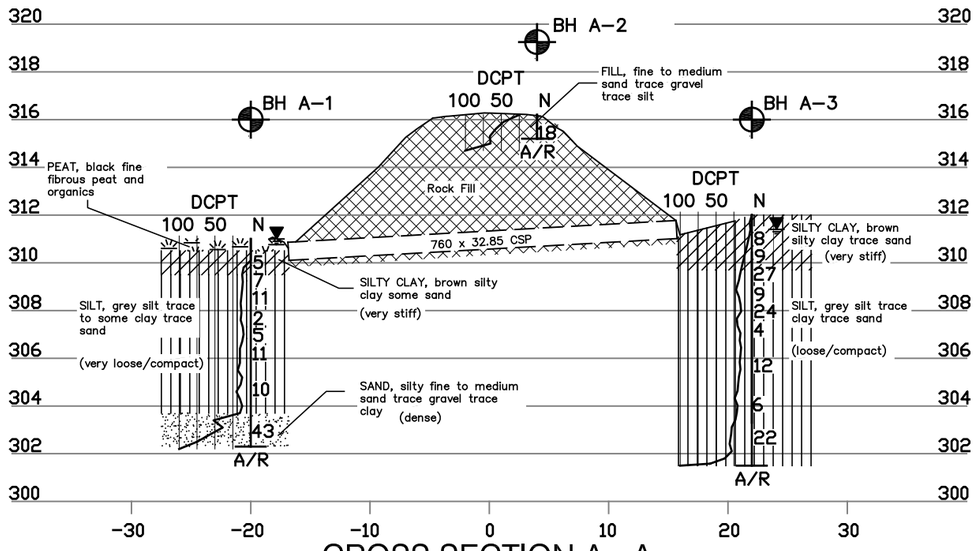
Figure No. A-1:	Borehole Locations & Soil Strata
Figure Nos. L-1 to L-6:	Summary Grain Size Analysis Graph
Figure No. L-7:	Atterberg Limits





PLAN & PROFILE

Hort 10m 0 20m
Vert 2.5m 0 5m



CROSS SECTION A - A

Hort 5m 0 10m
Vert 2.5m 0 5m

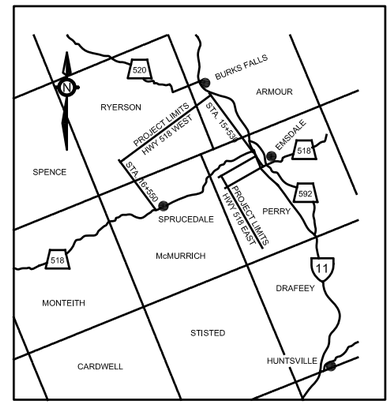
GEOCRES No 31E-307
GWP No 324-00-00

N

HWY NO. 518 - Township of Perry
Sta. 13+454 - MEL Site A
Culvert Replacement and Detour
BOREHOLE LOCATIONS & SOIL STRATA

Figure A-1

MERLEX ENGINEERING LTD.
Consulting Geotechnical Engineers



KEY PLAN - NOT TO SCALE

LEGEND

- Borehole
- "N" Blows/0.3 m (Std Pen Test, 475 J/blow)
- DCPT 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

Borehole No.	Co-ordinates Northerly	Co-ordinates Easterly	Elev.
Borehole No. A-1	5044051.8	315552.0	311.0
Borehole No. A-2	5044029.2	315560.0	316.2
Borehole No. A-3	5044013.6	315569.5	312.0
Borehole No. A-4	5044048.5	315570.6	314.8
Borehole No. A-5	5044059.1	315594.3	315.2
Borehole No. A-6	5044032.7	315528.4	313.6
Borehole No. A-7	5044013.7	315486.5	315.3
Borehole No. A-8	5044023.4	315510.6	314.2

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.

METRIC

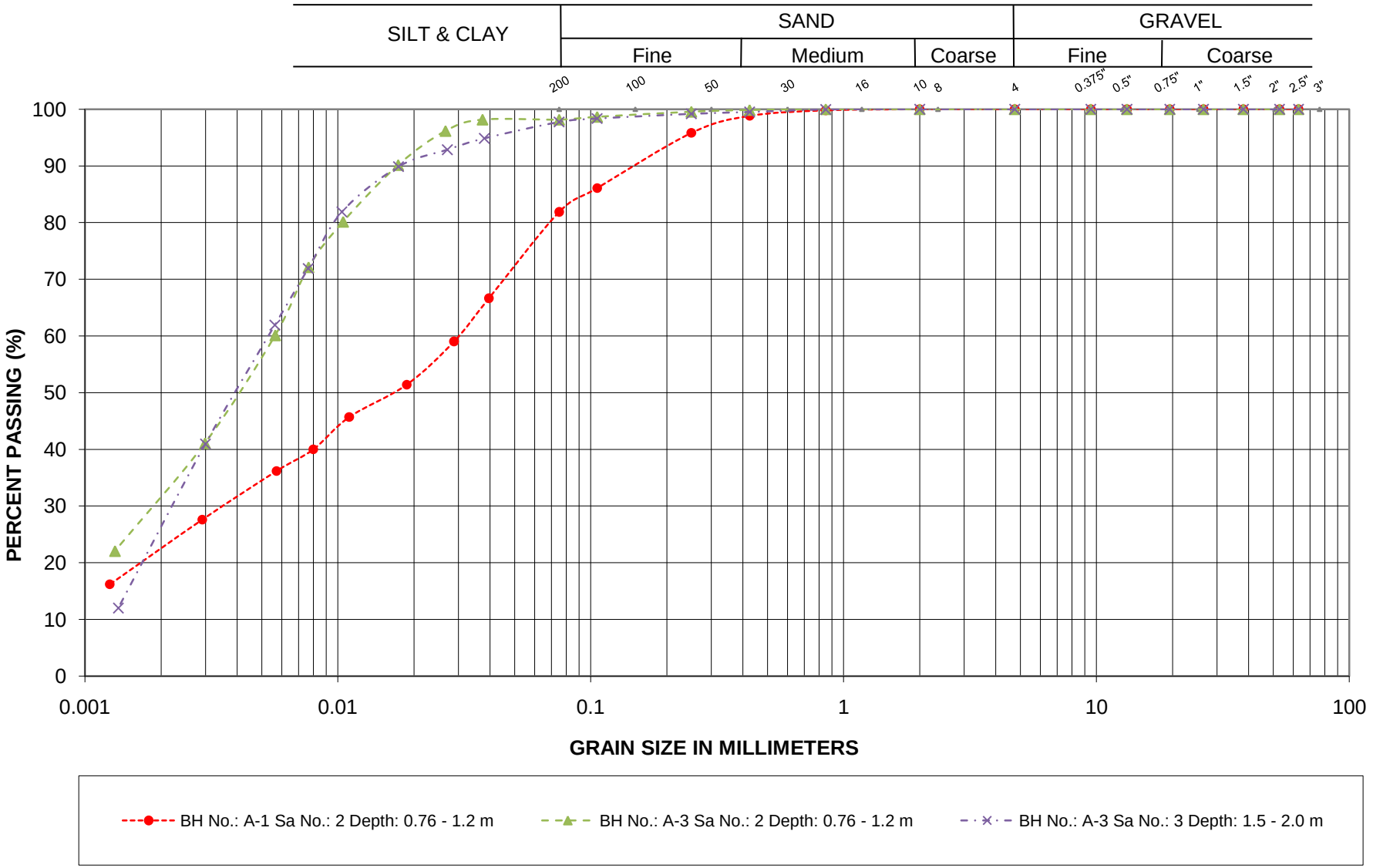
Dimensions are in meters and/or millimeters unless otherwise shown. Stations are in kilometers + meters.

REVISIONS	DATE	BY	DESCRIPTION
	Nov. 19/10	RG	DRAFT

HWY No. 518 – Sta. 13+454 – Perry Township			DIST
SUBM'D			SITE A
DRAWN RG	CHK MAM	DATE October 2010	FIG A-1

Reference No.: 10/03/10034A
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 324-00-00
LOCATION: Hwy 518 MEL Site A

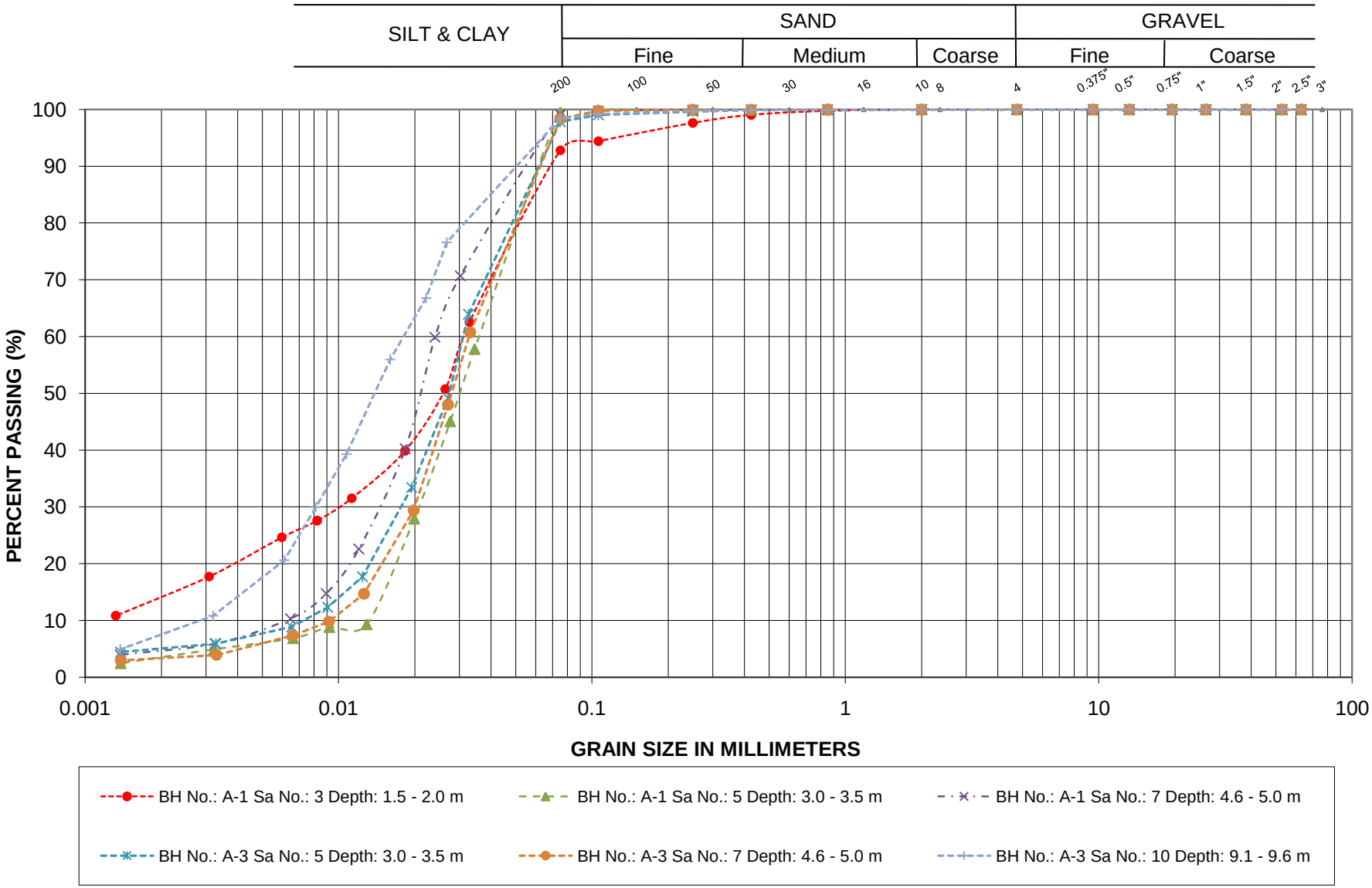
SILTY CLAY - Silty Clay

MERLEX ENGINEERING LTD.

FIGURE L-1

Reference No.: 10/03/10034A
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 324-00-00
LOCATION: Hwy 518 MEL Site A

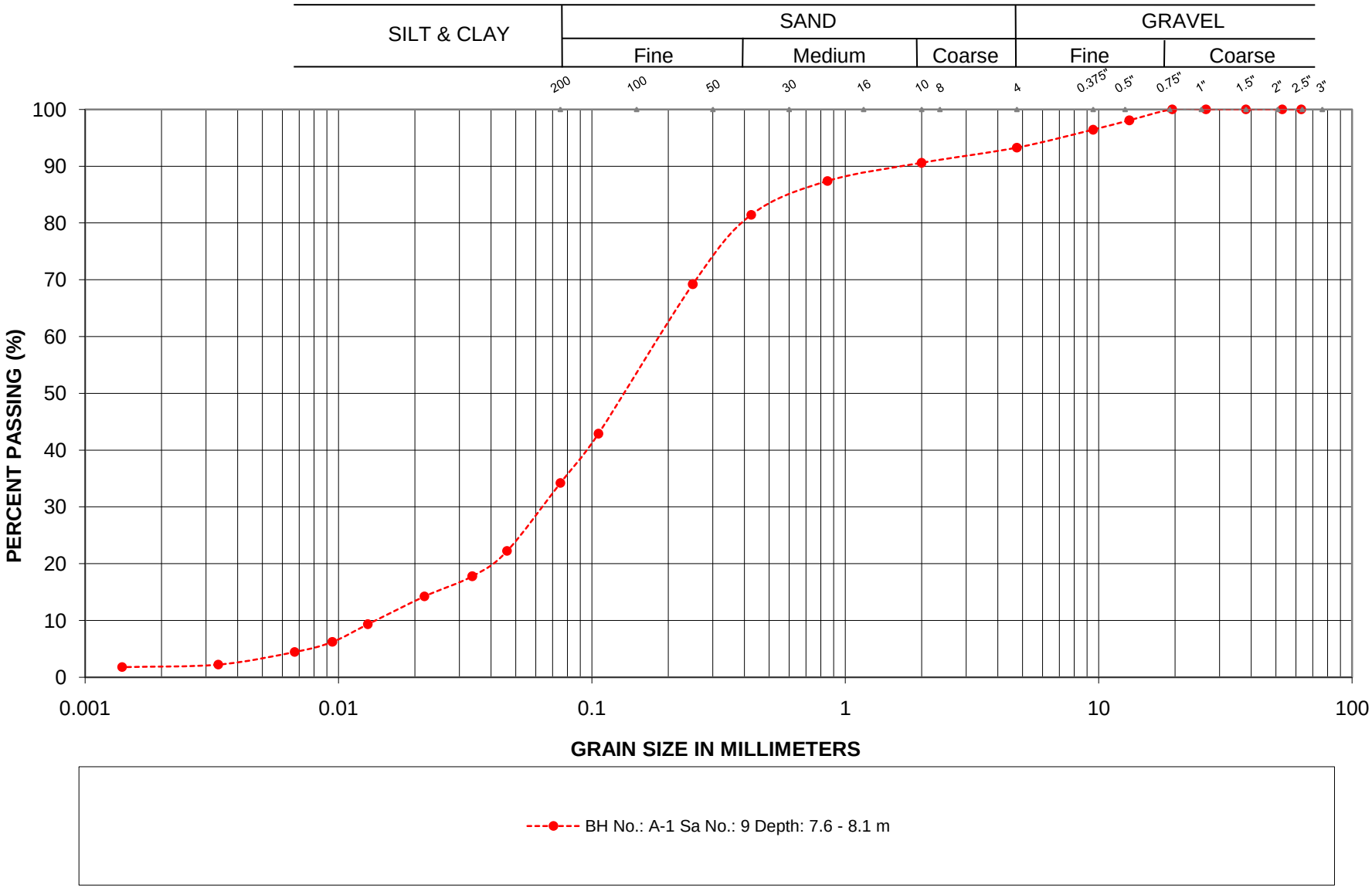
SILTS - Silt, Trace to Some Clay, Trace Sand

MERLEX ENGINEERING LTD.

FIGURE L-2

Reference No.: 10/03/10034A
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 324-00-00
LOCATION: Hwy 518 MEL Site A

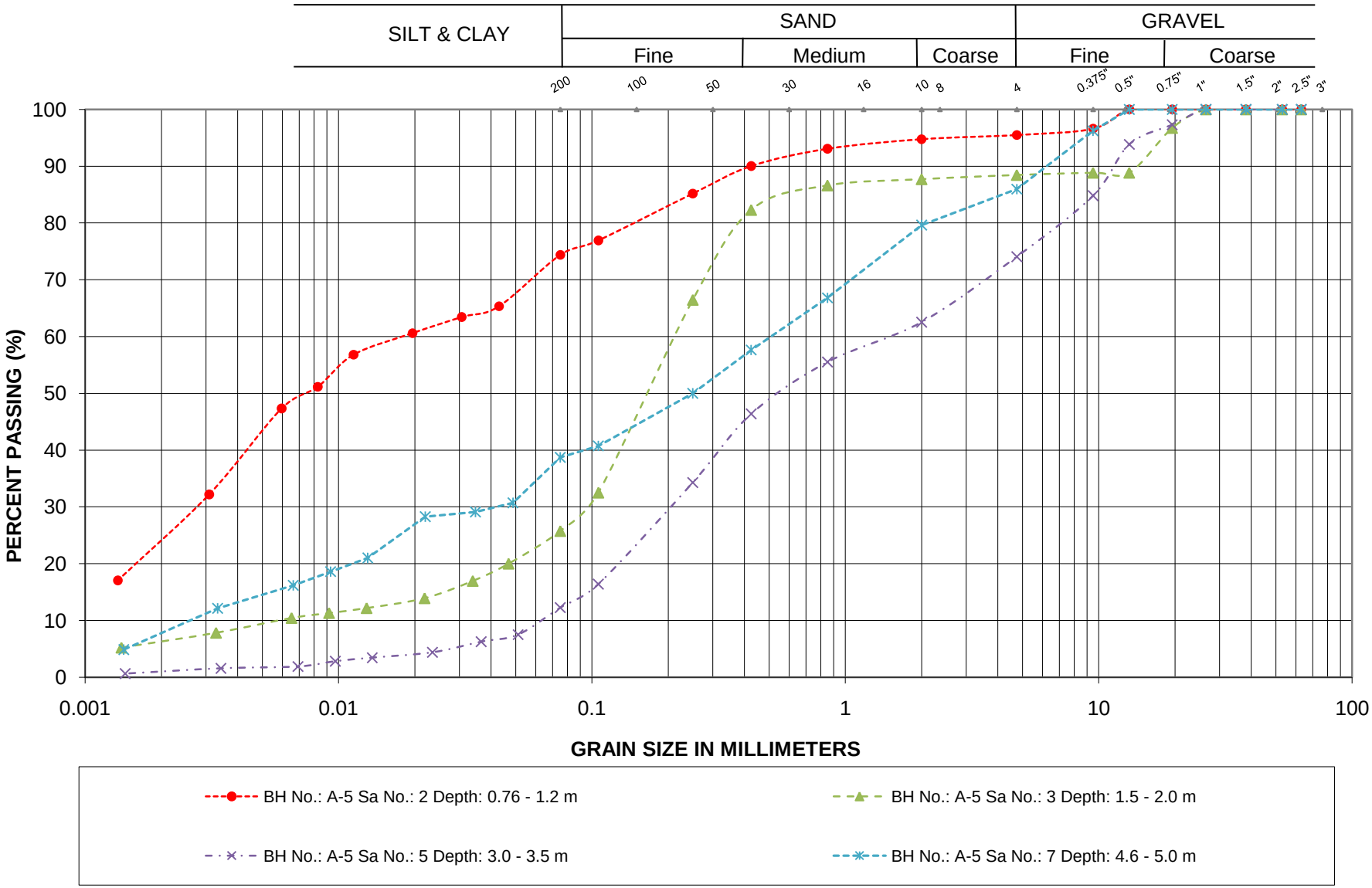
SANDS - Sand, With Silt, Trace Gravel, Trace Clay

MERLEX ENGINEERING LTD.

FIGURE L-3

Reference No.: 10/03/10034A
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 324-00-00
LOCATION: Hwy 518 MEL Site A

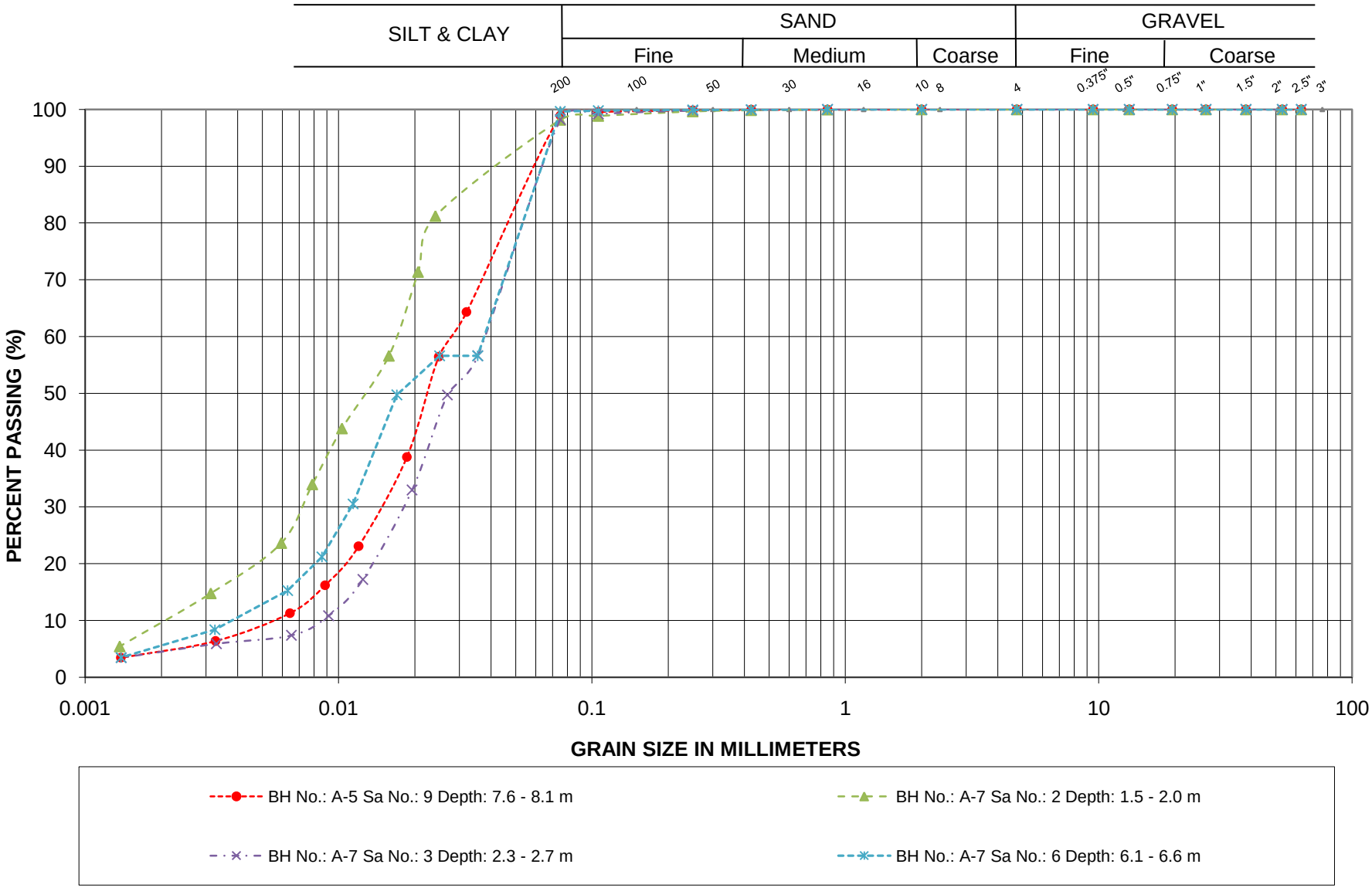
FILL - Embankment Fill, Varying Composition

MERLEX ENGINEERING LTD.

FIGURE L-4

Reference No.: 10/03/10034A
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 324-00-00
LOCATION: Hwy 518 MEL Site A

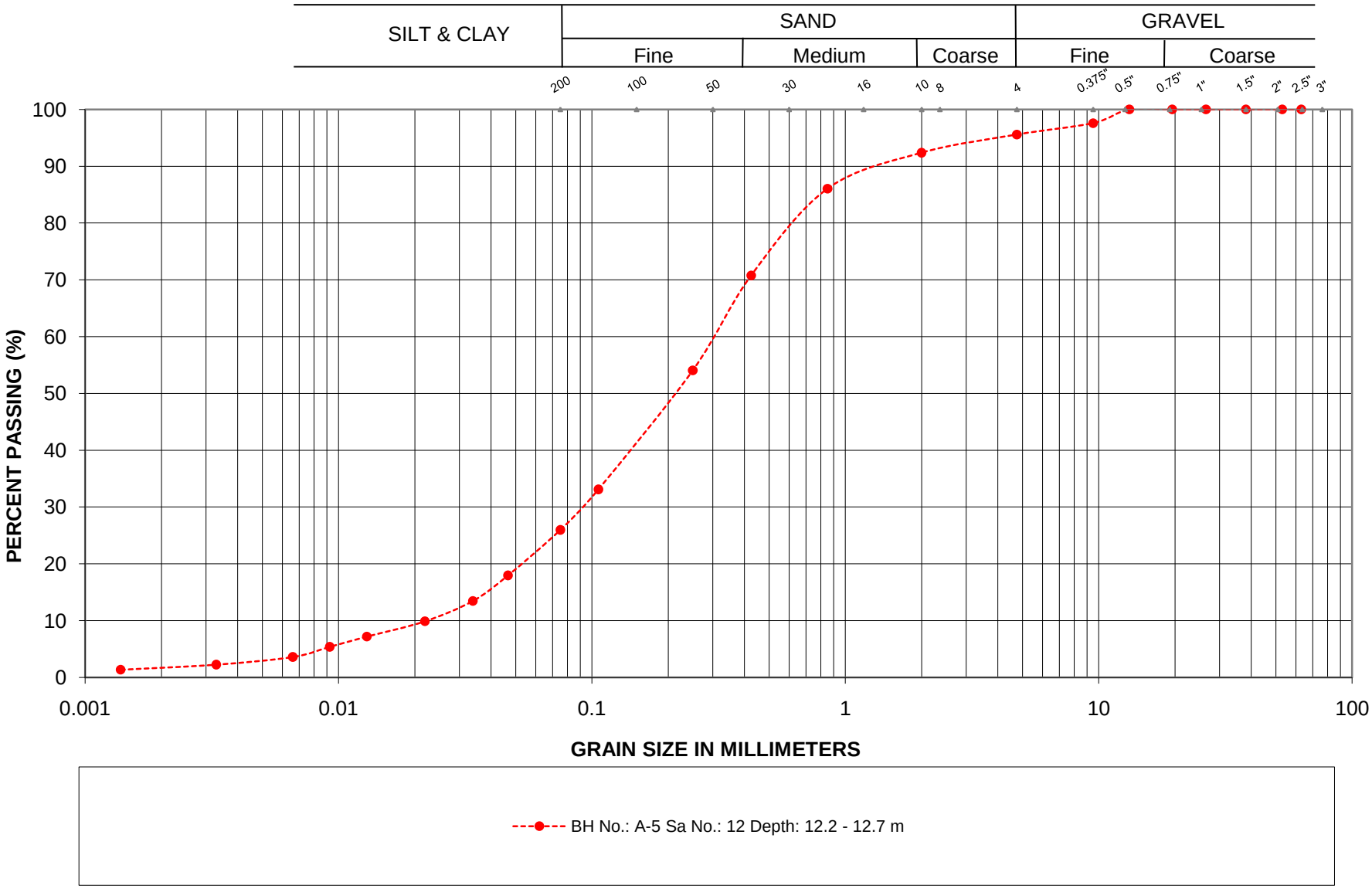
SILTS - Silt, Trace Sand, Trace Clay

MERLEX ENGINEERING LTD.

FIGURE L-5

Reference No.: 10/03/10034A
Date: January 2011

GRAIN SIZE ANALYSIS



PROJECT: G.W.P. 324-00-00
LOCATION: Hwy 518 MEL Site A

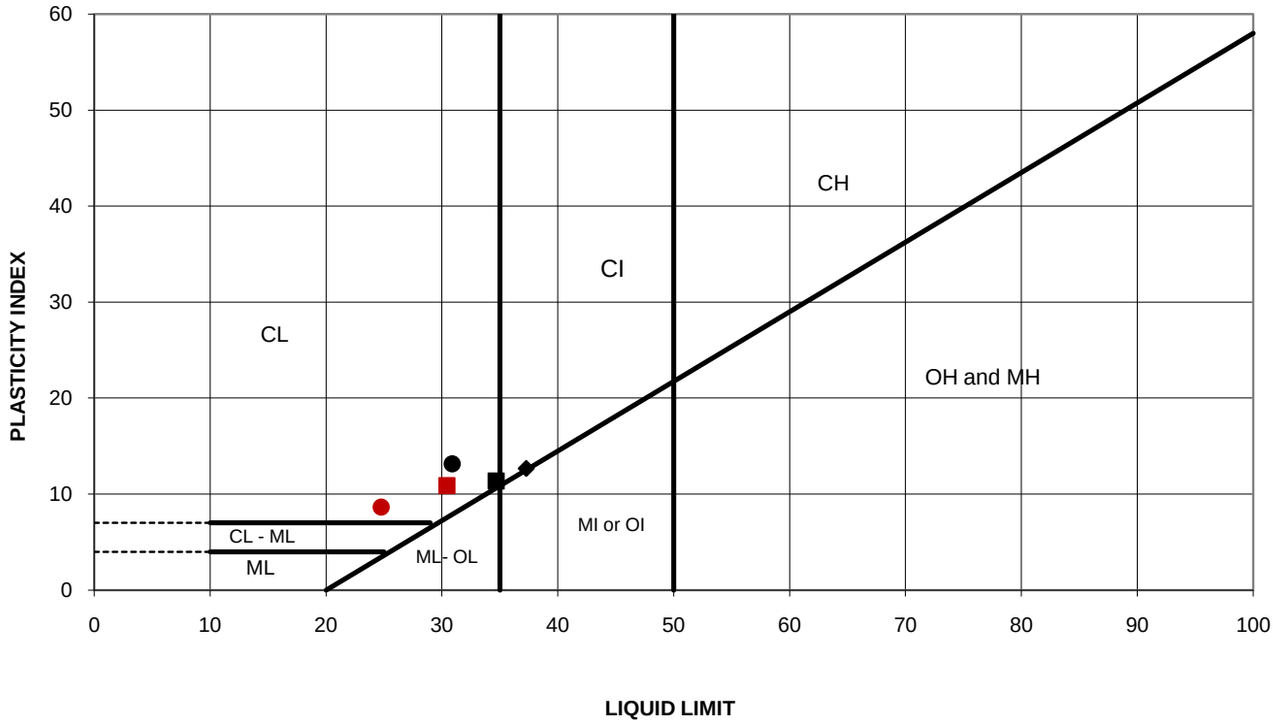
SANDS - Sand, With Silt, Trace Gravel, Trace Clay

MERLEX ENGINEERING LTD.

FIGURE L-6

ATTERBERG LIMITS TEST RESULTS	FIGURE L- 7

ATTERBERG INDICES



SYMBOL	BH	Sa. No.	Depth(m)	Elev.(m)	Plasticity Index	Plastic Limit	Liquid Limit	NMC %
●	A-1	2	0.8	310.2	13.2	17.7	30.9	28.2
■	A-3	2	0.8	311.2	11.4	23.3	34.7	35.4
◆	A-3	3	1.5	310.5	12.7	24.6	37.3	35.5
●	A-5	2	0.8	314.4	8.7	16.1	24.8	24.6
■	A-5	7	4.6	310.2	10.9	19.5	30.4	32.6

Date: Jan-11
Project: Hwy 518, MEL Site A

Prep'd: AT
Chkd: MAM
Ref. No.: 10/03/10034A

MERLEX ENGINEERING LTD.

APPENDIX D

Photos Nos. 1 and 2:	Culvert Photos
Enclosure No. 10:	Geotechnical Borehole Logs with Abbreviations

Culvert Inlet - Site A	Photo: 1

Culvert Outlet – Site A	Photo: 2

Reference No.: 10/03/10034A Project: Hwy 518 – Township of Perry, Culvert Replacement Station 13+454, MEL Site A	Originated By: JL Date: July, 2010

ABBREVIATIONS FOR BOREHOLE SURVEY DATA SHEETS

Accep	Acceptable
Agg	Aggregate
Amor	Amorphous
Asph	Asphalt
AP	Auger Probe
BR	Bedrock
Blk	Black
Bl	Blue
BH	Borehole
Bld (y)	Boulder (y)
Blds	Boulders
BU	Break Up
Br	Brown
CF	Channel Face
Cl	Clay
Co	Coarse
Cob	Cobbles
Comp	Compact
Conc	Concrete
Contam	Contaminated
Cord	Corduroy
Cr	Crushed
Dk	Dark
Decomp	Decomposed
D	Datum
E	Earth
Fib	Fibrous
w	Field Moisture Content
F	Fine
Fr Wat	Free Water
FB	Frost Boil
FH	Frost Heave
Gran	Granular
Gr	Gravel (ly)
Grn	Green
Gry	Grey
H	Heavy
Hi	Highly
HP	High Plasticity
HM	Hot Mix
Lt	Light
Liq	Liquid
W_L	Liquid Limit
Lo	Loam
L	Loose
Mrl	Marl
Matl	Material
Max	Maximum
MDD	Maximum Dry Density
MWD	Maximum Wet Density
Med	Medium
MP	Medium Plasticity
Mod	Moderate
Mott	Mottled
Mul	Mulch
NFP	No Further Progress
NFP (Blds)	No Further Progress (Boulders)
Num	Numerous
Occ	Occasional
Wopt	Optimum Moisture Content
Ora	Orange
Org	Organic
Org M	Organic Matter
Ob	Overburden
Pavt	Pavement
Pedo	Pedological
Pen Mac	Penetration Macadam
Wp	Plastic Limit
Ip	Plasticity Index
Psty	Polystyrene
Poss	Possible
PST	Prime & Surface Treated
Quant	Quantity
Reinf	Reinforced
RSS	Remoulded Shear Strength
RF	Rock Fill
Sa	Sand
Sat	Saturated
SH	Shale
St	Sensitivity
SSM	Select Subgrade Material
Sh Rk	Shot Rock
Si (y)	Silt (y)
Sl (y)	Slight (ly)
SP	Slight Plasticity
Stn (y)	Stoney
D_R	Relative Density
Stks	Streaks
Surf	Surface
Temp	Temperature
TH	Test Hole
TP	Test Pit
Tps	Topsoil
Tr	Trace
USS	Undisturbed Shear Strength
Unreinf	Unreinforced
Varv	Varved
VF	Very Fine
WT	Water Table
Weath	Weathered
W	With
Wd (y)	Wood (y)
Yel	Yellow

13+400 3.6 Lt C/L

0	- 50	Asph
50	- 250	Cr Gr
250	- 700	F-Med Sa Tr Gr
700		NFP RF

13+449 3.6 Rt C/L

0	- 50	Asph
50	- 200	Cr Gr
200	- 900	Med Sa W Gr
900		NFP RF

13+450 3.6 Lt C/L

0	- 60	Asph
60	- 280	Cr Gr
280	- 900	F-Med Sa Tr Gr
900		NFP RF

13+459 3.6 Rt C/L

0	- 50	asph
50	- 200	Cr Gr
200	- 900	Med Sa W Gr
900		NFP RF

13+490 3.6 Lt C/L

0	- 50	Asph
50	- 260	Cr Gr
260	- 800	F-Med Sa Tr Gr
800		NFP RF

13+490 3.6 Rt C/L

0	- 50	Asph
50	- 230	Cr Gr
230	- 900	F-Med Sa Tr Gr
900		NFP RF

13+500 4.4 Lt C/L

0	- 150	Cr Gr
150	- 370	F Sa W Si
370	- 700	F-Med Sa Tr Gr
700		NFP RF

13+500 3.6 Lt C/L

0	- 40	Asph
40	- 200	Cr Gr
200	- 1.0	F-Med Sa Tr Gr
1.0		NFP RF

13+500 3.6 Rt C/L

0	- 40	Asph
40	- 200	Cr Gr
200	- 800	F-Med Sa Tr Gr
800		NFP RF

13+500 4.8 Rt C/L

0	- 240	Cr Gr
240	- 900	F-Med Sa W Gr
900		NFP RF

13+500 5.0 Rt C/L

0	- 200	Cr Gr
200	- 750	F-Med Sa Tr Gr
750		NFP RF

13+507 3.6 Lt C/L

0	- 50	Asph
50	- 220	Cr Gr
220	- 400	F Sa W Si
400	- 750	F-Med Sa Tr Gr
750		NFP RF

13+507 3.6 Rt C/L

0	- 40	Asph
40	- 300	Cr Gr
300	- 800	F-Med Sa Tr Gr
800		NFP RF

13+517 3.6 Lt C/L

0	- 50	Asph
50	- 300	Cr Gr
300	- 900	F-Med Sa Tr Gr
900		NFP RF

13+517 3.6 Rt C/L

0	- 50	Asph
50	- 260	Cr Gr
260	- 800	F-Med Sa Tr Gr
800		NFP RF

13+525 3.6 Lt C/L05/03

0	- 40	Asph
40	- 220	Cr Gr
220	- 1.0	F-Med Sa Tr Gr
1.0		NFP RF

13+525 3.6 Rt C/L

0	-	40	Asph
40	-	280	Cr Gr
280	-	800	F-Med Sa Tr Gr
800			NFP RF

13+526 1.4 Lt C/L

0	-	45	Asph
45	-	230	Cr Gr
230	-	1.1	F-Med Sa W Gr
1.1			NFP RF

13+550 3.6 Lt C/L

0	-	50	Asph
50	-	240	Cr Gr
240	-	1.0	F-Med Sa Tr Gr
1.0			NFP RF

13+550 3.6 Rt C/L

0	-	40	Asph
40	-	230	Cr Gr
230	-	1.0	F-Med Sa W Gr
1.0			NFP RF

13+560 3.6 Rt C/L

0	-	50	Asph
50	-	260	Cr Gr
260	-	1.0	F-Med Sa W Gr
1.0			NFP RF

13+575 4.4 Lt C/L

0	-	240	Cr Gr
240	-	1.2	F-Med Sa Tr Gr
1.2			NFP RF

13+575 3.6 Lt C/L

0	-	40	Asph
40	-	260	Cr Gr
260	-	1.1	F-Med Sa Tr Gr
1.1			NFP RF

13+575 3.6 Rt C/L

0	-	50	Asph
50	-	200	Cr Gr
200	-	700	F-Med Sa Tr Gr
700	-	1.1	F-Med Sa Tr Gr & RF Mixed
1.1			NFP RF

13+600 3.6 Lt C/L

0	-	50	Asph
50	-	250	Cr Gr
250	-	1.0	F-Med Sa Tr Gr
1.0			NFP RF

13+600 1.6 Rt C/L

0	-	40	Asph
40	-	260	Cr Gr
260	-	800	F-Med Sa Tr Gr
800			NFP RF

13+600 3.6 Rt C/L

0	-	40	Asph
40	-	200	Cr Gr
200	-	800	F-Med Sa Tr Gr
800			NFP RF

13+600 4.6 Rt C/L

0	-	250	Cr Gr
250	-	900	F-Med Sa Tr Gr
900			NFP RF