



MERLEX ENGINEERING LTD.

CONSULTING GEOTECHNICAL ENGINEERS

FINAL FOUNDATION INVESTIGATION REPORT

SITE C

**CULVERT STATION 11+490 – TWP. OF McCLINTOCK
GWP 5553-04-00**

**Highway 60, From 0.3 km West of Highway 35
Easterly 9.4 km To 0.6 km West of
the Oxtongue Lake Narrows Bridge**

MEL Ref. No.: 08/07/08085C

July 20, 2009

Submitted to:

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

Geocres No.: 31E-290



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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 at a culvert located at Station 11+490, Township of McClintock. The GWP 5553-04-00 on Highway 60 runs from 0.3 km west of Highway 35 easterly 9.4 km to 0.6 km west of the Oxtongue Lake Narrows Bridge (see Figure No. 1, Key Plan, in Appendix A). This project involves the replacement of a single 1.2 m diameter CSP culvert in a 6.5 m high embankment.

The foundation investigation location was specified by the MTO in the RFP/TPM documentation Agreement No. 5006-E-0037. The terms of reference for the scope of work are outlined in MEL's proposal P-05-029, dated April 2, 2008. The purpose of the investigation was to determine the subsurface conditions in the area of the culvert. 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 60, approximately 6.5km east of Highway 35. The topography at the site is generally of moderate relief and the direction of flow in the culvert is from north to south. The existing highway embankment supports two undivided lanes of highway, running in an east west direction. The existing road embankment, at the culvert location, is some 6.5m higher than the grade level to the north and south sides of the road. Photo No. 1, Appendix C) shows the area north of the embankment at the inlet to the existing culvert.



2.1 Site Physiography and Surficial Geology

This Highway 60 project falls within the limits of the geomorphic sub-province known as the Algonquin Uplands. The topography at the site is generally rolling. There is exposed bedrock ridges present at many locations throughout the project with several within the area of the culvert under investigation. At other locations, significant layers of earth overlay the bedrock. Within the project area overburden conditions consist primarily of earth containing varying amounts of silt and sand. Organic terrain is also present.

Bedrock in the area is highly metamorphosed rocks of the Grenville Province of the Precambrian Shield. The high degree of metamorphism has changed the initial rock (siltstone, greywacke, arkoses, calcareous sandstone) mass fabric and structure resulting in a blocky, medium grained and very strong rock mass (OGS Map 2441).

3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out during the period of October 29 and 30, 2008 and consisted of a total of eight (8) sampled boreholes.

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. The boreholes were advanced using 165 mm O.D. continuous flight hollow stem augers and/or 110 mm O.D. continuous flight standard augers. Soil samples were obtained at regular intervals of depth using the standard 50 mm O.D. split spoon sampler advanced, using an automatic hammer, in accordance with the Standard Penetration Test (SPT) procedures at all borehole locations. A Dynamic Cone Penetration Test (DCPT) was advanced from grade to establish a general indication of resistance characteristics of the overburden at the boring locations.



Groundwater conditions in the open boreholes were observed 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, additional granular backfill was added to the boreholes to bring them up to grade. At the borehole through the embankment, the upper portion of the hole was backfilled with a cold patch to seal the existing asphalt surface.

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 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. 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. C-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 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.

4.1 Culvert, Station 11+490, Township of McClintock - SITE C

A plan and profile showing the borehole locations and stratigraphic sequences is shown on Figure No. C-1, Appendix C. During the course of the exploration program, eight (8) sampled boreholes were put down at this site, with Borehole No. C1 advanced from the surface of the existing highway embankment. Borehole Nos. C2 and C3 were advanced at the south and north ends of the existing culvert respectively. Borehole Nos. C3, C4, C5, C6, C7, and C8 were advanced to the north of the existing embankment for a possible detour.

At the location of Borehole No. C1 embankment fill, consisting of sands with some gravel and some fines, with cobble and boulder sizes (boulders/rock fill) present below a ± 1 m depth, was encountered to a depth of 2.7 m, at which depth auger refusal, on boulders/rockfill, was encountered. At this location the DCPT penetrated to a depth of 8.8 m before encountering refusal. Four additional attempts to advance the borehole, in close proximity of the original borehole location, were undertaken with auger refusal encountered at depth varying between depths of 1.1 to 2.4 m below grade. Based on drill response and site topography and geology it is considered that this refusal is due to the presence of rock fill/boulders in the embankment fill. Typical gradation curves of the portion of embankment fill which was retained in the 37 mm inside diameter of the split spoon sampler are found on Figure L-1 and indicate 26 to 34% gravel size particles, 59 to 63% sand size particles, and 7 to 11% silt and clay size particles. Based on the SPT values, which ranged from 62 to greater than 100 blows per 300 mm



penetration, the compactness of the embankment fill was described as very dense. The SPT values are probably on the high side due to the influence of cobbles and boulder sizes in the embankment fill, below a 1 m depth.

Borehole No. C2 was advanced from the south toe of embankment at the outlet to the existing 1.2 m CSP culvert. At this location a relatively thin deposit of dark brown fine fibrous peat/organics was penetrated to a depth of 0.5m below grade. This was underlain by a stratum fine sands trace to some silt. Typical gradation curves are shown on Figure L-2 and indicate 5 to 6% gravel size particles, 65 to 75% sand size particles, 20 to 29 % silt and clay size particles. Based on the SPT values, which was 50 to 75 blows per 300 mm penetration, the compactness of the deposit was described as very dense. Auger refusal, at the borehole, was encountered at a depth of 2.8 m. An auger probe was advanced at a location 3 m east of the original borehole and refusal was met at a depth of 2.5 m. Based on the response during drilling and geology of the area it is interpreted that refusal was due to the presence of bedrock.

Borehole No. C3 was advanced at the inlet to the culvert, along with Borehole Nos. C4, C5, C6, C7, and C8 which were advanced parallel to the north toe of the embankment, for a possible detour, at generally an offset of 14 m from centerline. These boreholes indicated a relatively thin layer of overburden, consisting of an upper layer of dark brown peat/organics and fine sand with a trace of gravel and silt. This organic layer was absent at Borehole No. C7 and varied from 100 to 800 mm in thickness at the remaining borehole advanced along the north side of the embankment. The thickness of the organics was greatest, 800 mm thick, at the inlet location at Borehole C3. This deposit, at the boreholes parallel to the north toe of slope, was underlain by a sand, trace to with gravel and trace to some silts. Typical gradation curves are shown on Figure L-3 and indicate 1 to 23% gravel size particles, 55 to 91% sand size particles, 6 to 26% silt size particles and 2 to 4% clay size particles. Based on the SPT values, which



was 35 to greater than 100 blows per 300 mm penetration, the compactness of the deposit was described as dense to very dense. Auger refusal, at these borehole locations, was encountered at a depths varying between 0.7 and 2.7 m below existing grade. At each of the borehole locations additional auger probes were advanced, within a short distance up and/or down chainage, and auger refusal depths similar to the borehole were encountered. Based on topography and geology of the area this refusal was interpreted as probably due to the presence of bedrock.

4.2 Groundwater Conditions

Groundwater and cave-in levels in the open boreholes were taken during the advance of the individual borings and upon completion. These levels were recorded on the individual Record of Borehole Log Sheets (Appendix B). Borehole C1, which was advanced from the top of the embankment and met refusal at a relatively shallow depth of 2.7 m, was dry upon completion. The water level in the boreholes at the inlet and outlet were measured, upon completion, at a depth of 0.3 m below grade. At the remaining boreholes, paralleling the north toe of the embankment, water levels upon completion were measured at depths varying between 0 (at ground surface) to 0.2 m, except at Borehole C6 and C7 which were dry upon completion. These groundwater levels will fluctuate seasonally.

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M. A. Merleau, P. Eng.
Principal

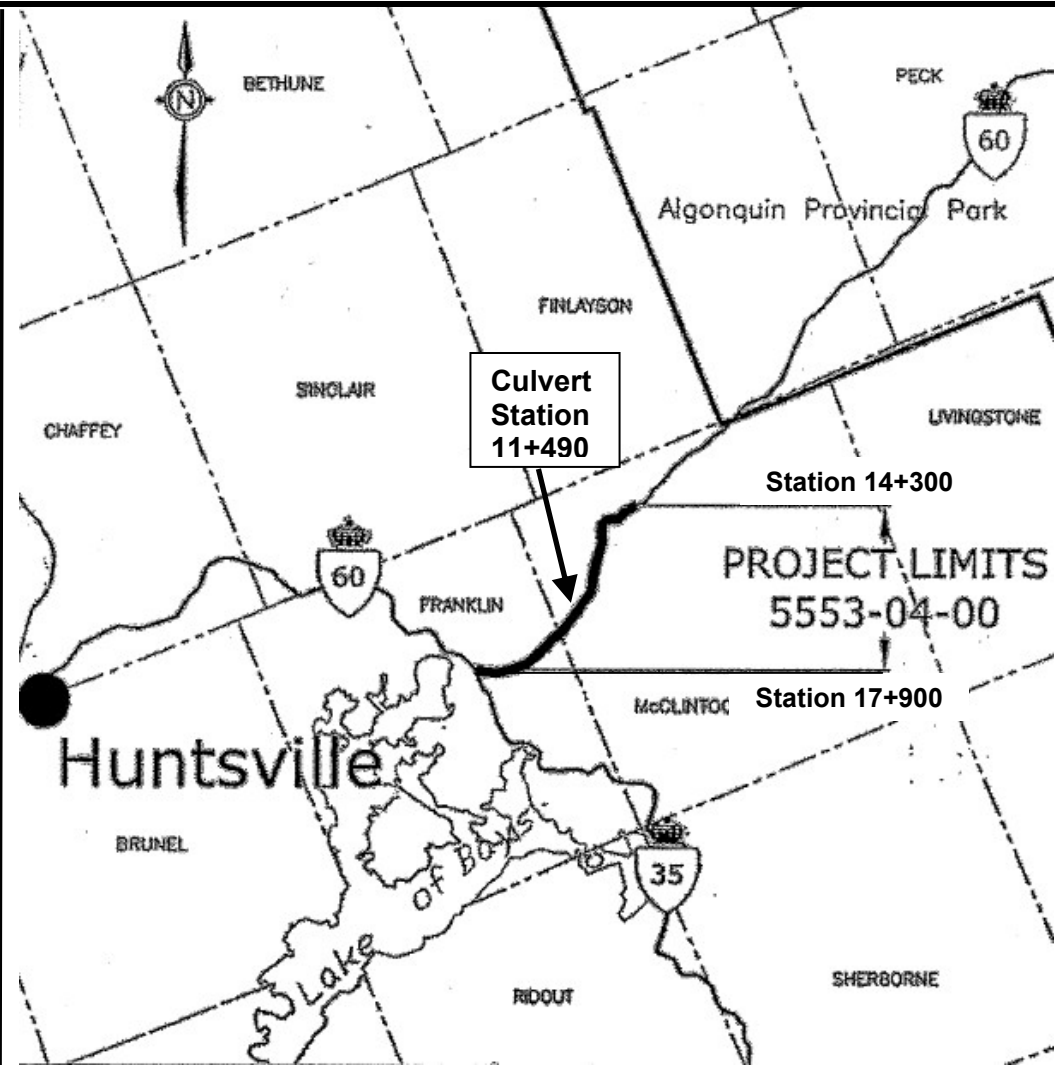
J. R. Berghamer, P. Eng.
Project Engineer

APPENDIX A

Figure No. 1 Key Plan

KEY PLAN

NOT TO SCALE



**FINAL
FOUNDATION INVESTIGATION REPORT
SITE C – CULVERT STATION 11+490
GWP 5553-04-00**

Highway 60, From Highway 35
Easterly 9.1 km To 0.6 km West Of
The Oxtongue Lake Narrows Bridge

MEL Ref. No.: 08/07/08085C

July 2009



MERLEX ENGINEERING LTD.

CONSULTING GEOTECHNICAL ENGINEERS

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.

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METRIC**RECORD OF BOREHOLE NO. C1**

REFERENCE 08/07/08085 DATUM Geodetic LOCATION Site C - Culvert Station 11+490, McClintock Twp ORIGINATED BY JL
 PROJECT GI & FDN - Highway 60, GWP 5553-04-00 BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY MCM/RG
 CLIENT AECOM Canada Ltd. DATE (Started) October 30, 2008 TIME CHECKED BY MAM
 DATE (Completed) October 30, 2008

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES								
	Continued from Previous Page												
372.7							373						
8.8	Refusal of DCPT End of Borehole <u>Attempts to Further Advance Borehole C1</u> Auger Probe @ 1.5 m West Auger Refusal @ 1.4 m Auger Probe @ 2.0 m East Auger Refusal @ 1.1 m Auger Probe @ 1.5 m East Auger Refusal @ 2.4 m Auger Probe @ 3.0 m East Auger Refusal @ 1.9 m												

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METRIC

RECORD OF BOREHOLE NO. C2



REFERENCE 08/07/08085 DATUM Geodetic LOCATION Site C - Culvert Station 11+490, McClintock Twp ORIGINATED BY JL
 PROJECT GI & FDN - Highway 60, GWP 5553-04-00 BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY MCM/RG
 CLIENT AECOM Canada Ltd. DATE (Started) October 30, 2008 DATE (Completed) October 30, 2008 TIME _____ CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES								
374.4	Ground Surface												
0.0	PEAT												
374.0	Black Fine Fibrous Peat with Sands, Cobbles and Boulders		1	AS									
0.5	SAND												
	Brown Fine Sand trace Silt trace Gravel		2	SS	75								
	(dense)												
	occasional cobble sizes		3	SS	50								
			4	SS	56								
371.6	Refusal on Augers End of Borehole												
2.8	Auger Probe @ 3.0 m East Auger Refusal @ 2.5 m												
COMMENTS								+ 3, X 3: Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE					
The stratification lines represent approximate boundaries. The transition may be gradual.								WATER LEVEL RECORDS					
								Date (dd/mm/yy)/Time		Water Depth (m)		Cave In (m)	
								1) 12/4/08 11:00:00 AM		0.33		1.3	
								2)		-		-	
3)		-		-									

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METRIC**RECORD OF BOREHOLE NO. C3**

REFERENCE 08/07/08085 DATUM Geodetic LOCATION Site C - Culvert Station 11+490, McClintock Twp ORIGINATED BY JL
 PROJECT GI & FDN - Highway 60, GWP 5553-04-00 BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY MCM/RG
 CLIENT AECOM Canada Ltd. DATE (Started) October 30, 2008 TIME _____ CHECKED BY MAM
 DATE (Completed) October 30, 2008

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES								
375.0	Ground Surface												
0.0	PEAT Black Fine Fibrous Peat trace sand, gravel and Boulders		1	AS									
374.2	SAND Brown Fine Sand some Silt trace Gravel (Dense)		2	SS	40								
373.5	Refusal on DCPT End of Borehole Auger Probe @ 2.0 m West Auger Refusal @ 1.5 m												
1.6													

WATER LEVEL RECORDS	
Date (dd/mm/yy)/Time	Water Depth (m)
1) 12/3/08 12:00:00 PM	0.9
2) 12/3/08 3:00:00 PM	0.3
3)	-

COMMENTS

+ 3, X³ : Numbers on right refer to Sensitivity
 Numbers on left refer to values greater than 120 kPa
 O 3% STRAIN AT FAILURE

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

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METRIC**RECORD OF BOREHOLE NO. C4**

REFERENCE 08/07/08085 DATUM Geodetic LOCATION Site C - Culvert Station 11+490, McClintock Twp ORIGINATED BY JL
 PROJECT GI & FDN - Highway 60, GWP 5553-04-00 BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY MCM/RG
 CLIENT AECOM Canada Ltd. DATE (Started) October 30, 2008 TIME CHECKED BY MAM
 DATE (Completed) October 30, 2008

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE								
375.9	Ground Surface											
0.0	100 mm Free Water and Snow											
	PEAT		1	AS								
375.3	Fine Fibrous Peat trace Gravel and Sands											
0.6	SAND											
	Brown Fine Sand trace Silt trace Gravel		2	SS	42							1 81 16 2
	Cobbles and Boulders		3	SS	40							
			4	SS 25/50mm								14 66 20 2
373.2	Auger Refusal End of Borehole											
2.7	Auger Probe @ 3.0 m West Auger Refusal @ 2.5m											

COMMENTS		WATER LEVEL RECORDS	
+ ³ , X ³ : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE		Date (yy/mm/dd) Time	Water Depth (m)
		1) 12/3/08 12:00:00 PM	0
		2)	-
		3)	-

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

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METRIC

RECORD OF BOREHOLE NO. C5



REFERENCE 08/07/08085 DATUM Geodetic LOCATION Site C - Culvert Station 11+490, McClintock Twp ORIGINATED BY JL
 PROJECT GI & FDN - Highway 60, GWP 5553-04-00 BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY MCM/RG
 CLIENT AECOM Canada Ltd. DATE (Started) October 30, 2008 TIME _____ CHECKED BY MAM
 DATE (Completed) October 30, 2008

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES								
378.4 0.0	Ground Surface PEAT												
	Black Fine Fibrous Peat, some Sand												
378.0 0.5	SAND		1	AS									
	Brown Fine Sand some Silt trace Gravel Occasional Cobbles		2	SS	36								9 61 26 4
			3	SS	58								23 55 (22)
376.2 2.2	Auger Refusal End of Borehole												
	Auger Probe @ 3.0 m West Auger Refusal @ 1.9 m												

COMMENTS		WATER LEVEL RECORDS		
+ 3, X 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE		Date (yy/mm/dd)Time	Water Depth (m)	Cave In (m)
		1) 12/4/08 1:40:00 PM	0.4	0.9
		2) 12/4/08 3:00:00 PM	0.2	0.76
		3)	-	-

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

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METRIC**RECORD OF BOREHOLE NO. C6**

REFERENCE 08/07/08085 DATUM Geodetic LOCATION Site C - Culvert Station 11+490, McClintock Twp ORIGINATED BY JL
 PROJECT GI & FDN - Highway 60, GWP 5553-04-00 BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY MCM/RG
 CLIENT AECOM Canada Ltd. DATE (Started) October 30, 2008 TIME _____ CHECKED BY MAM
 DATE (Completed) October 30, 2008

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE								
376.1 0.0	Ground Surface PEAT											
375.8 0.3	Black Silty Fine Sand trace Organics Occasional Cobbles SAND		1	AS								
	Brown Fine Sand some Silt Trace Gravel		2	SS	35							
374.9 1.2	Auger Refusal End of Borehole Auger Probe @ 2.0 m East Auger Refusal @ 0.7 m Auger Probe @ 2.0 m West Auger Refusal @ 1.5 m											

COMMENTS

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

+ 3, X 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 (yy/mm/dd)/Time	Water Depth (m)	Cave In (m)
1) 10/30/08	DRY	-
2)	-	-
3)	-	-

MEL-GEO 08085 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 7/7/09

MERLEX ENGINEERING LTD.

2-120 Progress Court, North Bay, Ontario, P1B-8G4 Phone: (705) 476-2550 Fax: (705) 476-8882 Email: merlex@merlex.ca

METRIC

RECORD OF BOREHOLE NO. C7



REFERENCE 08/07/08085 DATUM Geodetic LOCATION Site C - Culvert Station 11+490, McClintock Twp ORIGINATED BY JL
 PROJECT GI & FDN - Highway 60, GWP 5553-04-00 BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY MCM/RG
 CLIENT AECOM Canada Ltd. DATE (Started) October 30, 2008 TIME _____ CHECKED BY MAM
 DATE (Completed) October 30, 2008

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			"N" VALUES	20					
378.0 0.0	Ground Surface SAND Brown Fine to Medium Sand trace Silt trace Gravel Occasional Cobbles												
377.3 0.7	Auger Refusal End of Borehole Auger Probe @ 1.0 m East Auger Refusal @ 0.6 m Auger Probe @ 5.0 m West Auger Refusal @ 0.7 m												

COMMENTS		WATER LEVEL RECORDS	
		Date (yy/mm/dd) Time	Water Depth (m) Cave In (m)
+ 3, X ³ : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa O 3% STRAIN AT FAILURE		1) 10/30/08	DRY ▽ -
		2)	- ▽ -
		3)	- ▽ -

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

MEL-GEO 08085 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 7/7/09

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METRIC

RECORD OF BOREHOLE NO. C8



REFERENCE 08/07/08085 DATUM Geodetic LOCATION Site C - Culvert Station 11+490, McClintock Twp ORIGINATED BY JL
 PROJECT GI & FDN - Highway 60, GWP 5553-04-00 BOREHOLE TYPE CME 45B - Hollow Stem Augers COMPILED BY MCM/RG
 CLIENT AECOM Canada Ltd. DATE (Started) October 30, 2008 TIME CHECKED BY MAM
 DATE (Completed) October 30, 2008

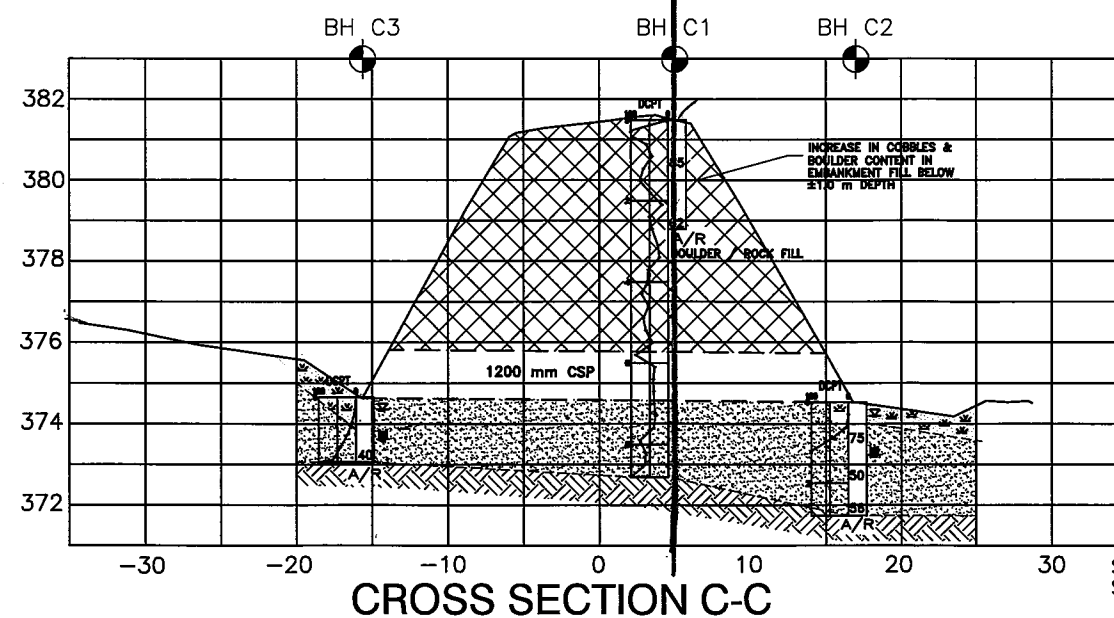
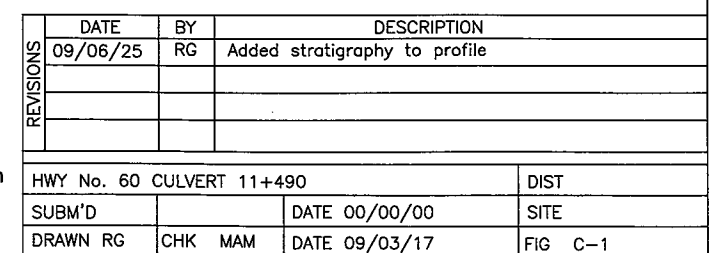
SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE								
379.3	Ground Surface											
379.0	100 mm Black Fine Fibrous Peat											
0.1	SAND											
	Brown Fine Sand trace Silt trace Gravel		1	AS								
			2	SS	54/150 mm							15 64 (21)
378.0	Auger Refusal End of Borehole											
1.3	Auger Probe @ 2.0 m West Auger Refusal @ 1.1 m											

COMMENTS		WATER LEVEL RECORDS	
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	
		Date (yy/mm/dd) Time	Water Depth (m)
		1) 12/4/08 2:25:00 PM	DRY
		2) -	-
		3) -	-

MEL-GEO 08085 - BOREHOLE LOGS.GPJ MEL-GEO.GDT 7/7/09

APPENDIX C

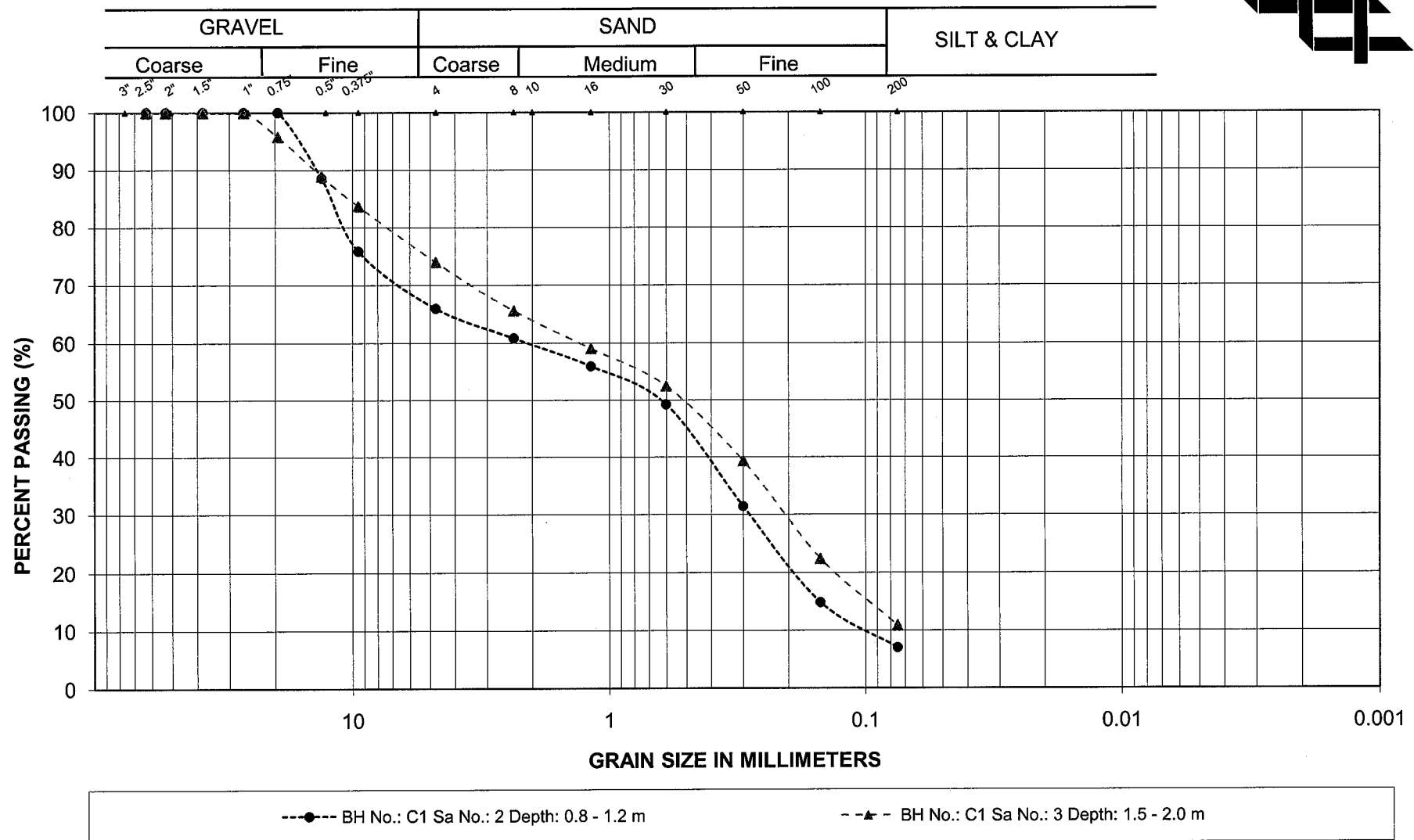
Figure C-1	Borehole Locations & Soil Strata
Figures L-1 to L-3	Summary Grain Size Analysis Graph
Enclosure No. 10	Photo Essay



Reference No.: 08085-C

Date: March 19, 2009

GRAIN SIZE ANALYSIS



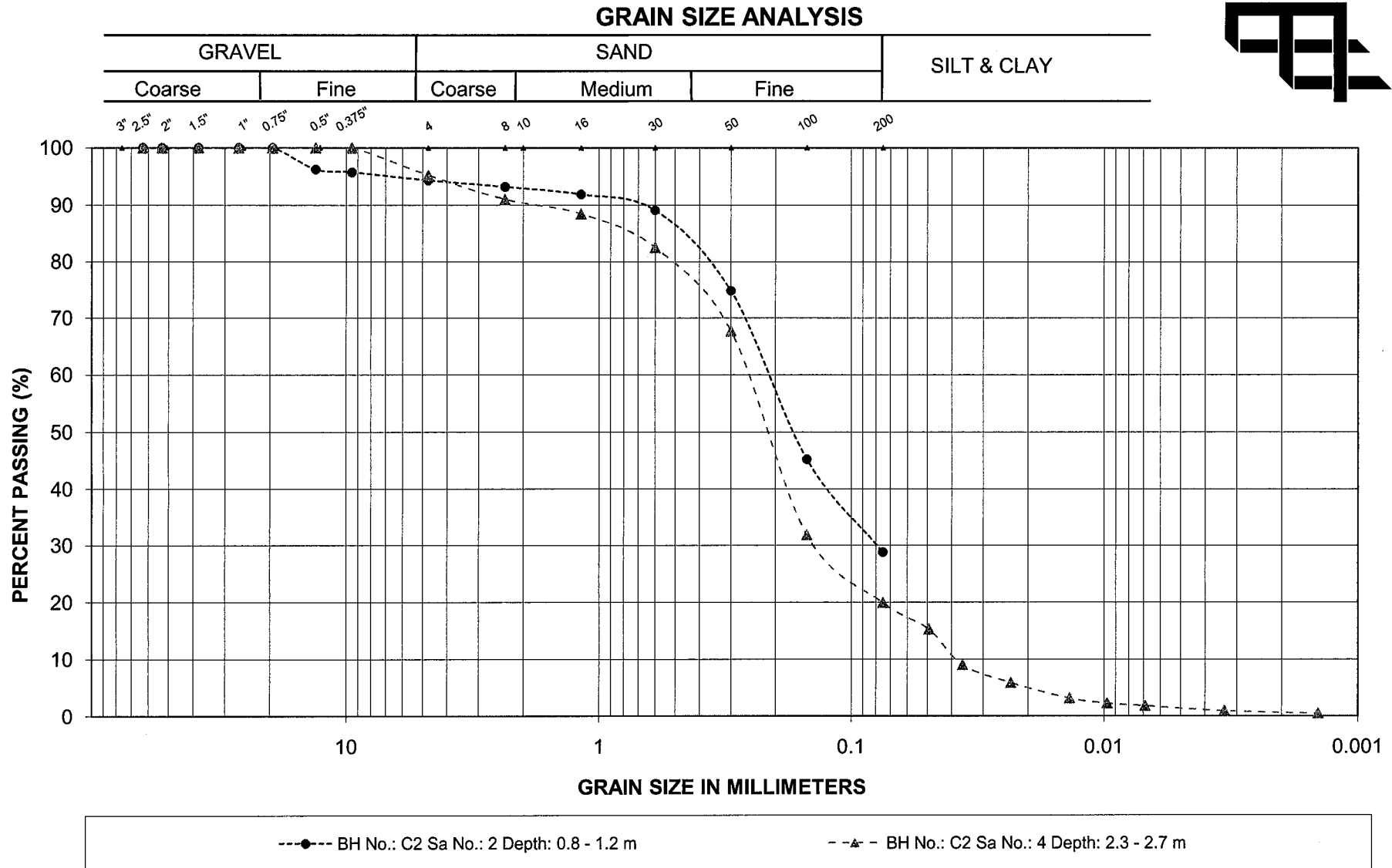
PROJECT: Hwy 60 - Culvert Station 22+490
LOCATION: McClintock Twp

EMBANKMENT FILL
SAND, with gravel, trace of silt.

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FIG L-1

Reference No.: 08085-C
Date: March 19, 2009

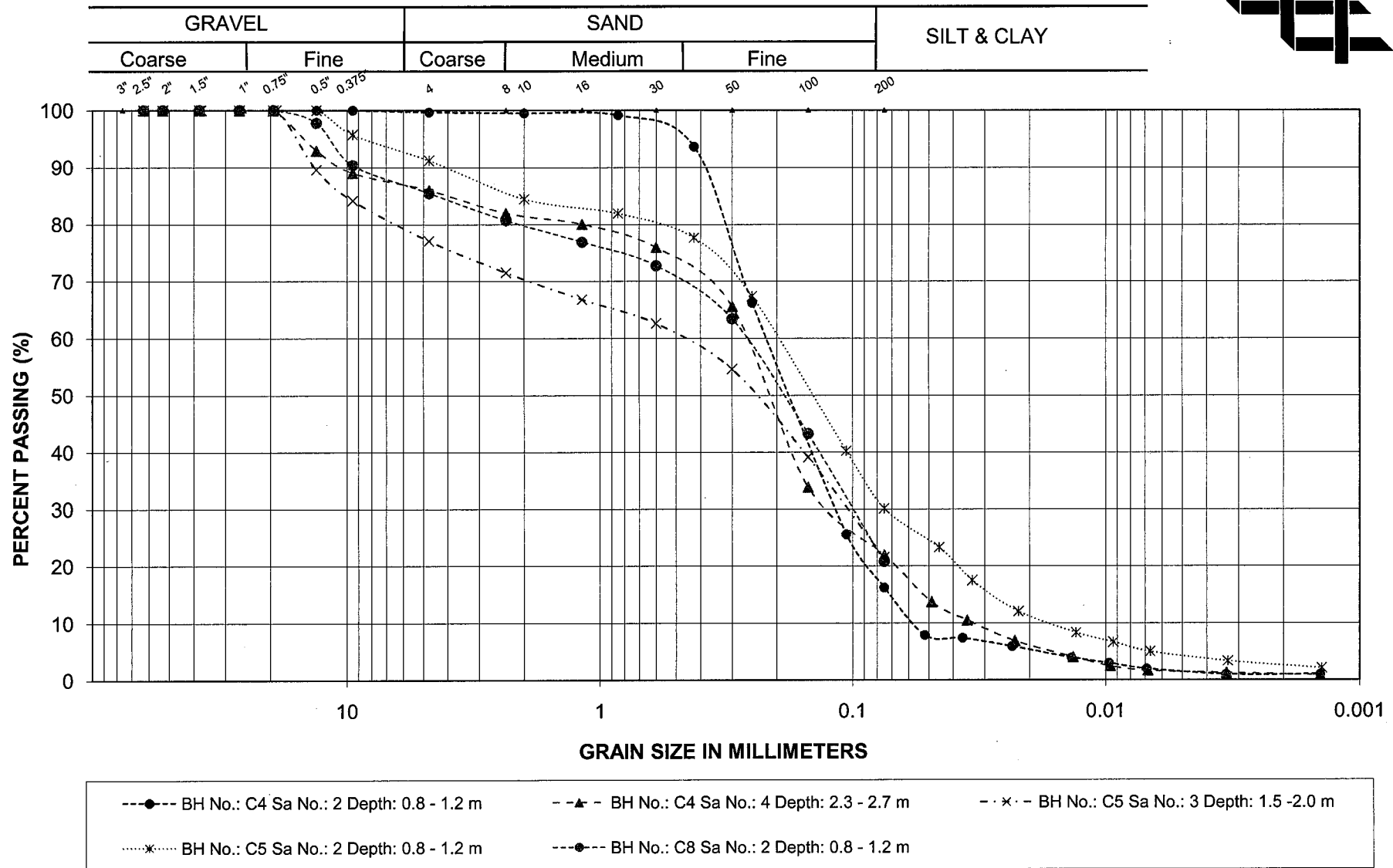


PROJECT: Hwy 60 - Culvert Station 22+490
LOCATION: McClintock Twp.

SAND, trace of gravel, some to with silt.

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FIG L-2

GRAIN SIZE ANALYSIS

NATIVE OVERBURDEN

PROJECT: Hwy 60 - Culvert Station 22+490

SANDS - trace to with gravel and trace to some silt

LOCATION: McClintock Twp.

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FIG L-3



Left: Looking east from Station 11+450 at culvert inlet.
Right: Station 11+489 looking east along possible detour alignment.

Photos: 1 - 2



Station 11+489 looking west along possible detour alignment.

Photo: 3



Reference No.: 08/07/08085C

Project: Foundation Investigation and Design Report, Highway 60, From Highway 35
Easterly 9.1 km To 0.6 km West Of The Oxtongue Lake Narrows Bridge,
GWP 5553-04-00

Provided By: MEL

Date: November 2008