

**Submitted To AECOM Canada Ltd.
189 Wyld Street Suite 103, North Bay, Ontario P1B 1Z2
On Behalf of the Ontario Ministry of Transportation**

**Culvert Replacement – Boyne Creek Culvert
Highway 60
Station 15+935 – Township of Franklin
Site No. 42-043/C
GWP 5333-11-00**

FINAL PRELIMINARY FOUNDATION INVESTIGATION REPORT

Date: April 24, 2015
Ref. Nº: 14/07/14083-F6

Geocres No. 31E-348

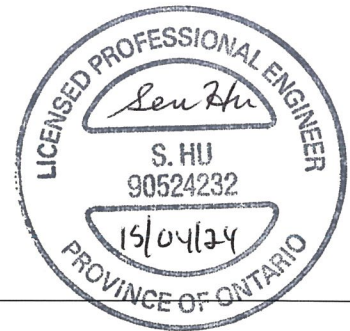


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Final Preliminary Foundation Investigation Report

Prepared by:

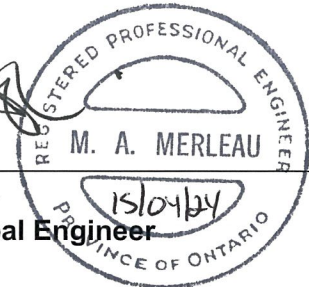


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Test results mentioned herein are only valid for the sample(s) stated in this report.

LVM-Merlex's subcontractors who may have accomplished work either on site or in laboratory are duly qualified as stated in our Quality Manual's procurement procedure. Should you require any further information, please contact your Project Manager."

Client:

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Attention: **Mr. Al Rose**

REVISION AND PUBLICATION REGISTER		
Revision N°	Date	Modification And/Or Publication Details
00	2015-02-20	DRAFT FIDR Issued
01	2015-04-24	FINAL Issued

REPORT DISTRIBUTION	
5 hard copies and 1 electronic copy	MTO Project Manager
1 hard copy and 1 electronic copy	MTO Pavements and Foundations Section, Foundations Group
1 hard copy	File

1 INTRODUCTION

LVM-Merlex, a Division of EnGlobe Corp., has been retained by AECOM Canada Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to carry out a preliminary foundation investigation at an existing centerline culvert site (Site No. 42-043/C) located at Station 15+935 in the Township of Franklin on Highway 60, some 2.3 km west of the intersection between Highway 60 and Highway 35 (see Drawing No. 1 in Appendix 1).

The foundation investigation location was specified by the MTO in the Terms of Reference for work under Agreement No. 5013-E-0032: GWP 5333-11-00 for Design-Build. The terms of reference for the scope of work are outlined in LVM-Merlex's Proposal P-14-051 dated May, 2014. The purpose of this investigation was to determine the subsurface conditions in the area of the existing culvert. LVM-Merlex investigated the foundation area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

2 SITE DESCRIPTION

The single span cast-in-place concrete Rigid Frame Box (RFB) culvert is located on Highway 60 at Station 15+935 in the Township of Franklin. At the culvert location, the highway runs locally in a north-south direction. The flow through the culvert is from the west to the east (right to left). A north-south orientation is used in this report for description purposes.

The culvert was constructed in 1963. The structure was rehabilitated in 1964 with the addition of a thickened deck slab at the east end, as well as increased wall thickness on the south side. The concrete RFB culvert at this location has an inside span of 9.14 m in width, a height of 4.57 m, and is some 19 m in length. The culvert has concrete wing walls on all four quadrants approximately 5.8 metres in length at a 30° skew from the culvert barrel.

The topography at this site is located in a valley area. The existing highway, at the culvert location, is constructed through a granular fill embankment some 7.6 m in height, with centerline elevation of 326.8 m at the culvert location. The existing embankment extending out from the existing concrete wing walls, in the area of the culvert, have been built on slope angles of approximately 2H:1V to 2.3H:1V.

2.1 SITE PHYSIOGRAPHY AND SURFICIAL GEOLOGY

This project is located in the Geomorphic Sub-province known as the Muskoka Ridges and Pockets. The topography on this section of Highway 60 is generally rolling. Significant layers of earth overlay the bedrock. Organic materials were also observed. Within the project area native overburden primarily consists of sand and silt overlying the silts overlying the bedrock.

Bedrock in the area consists of the migmatitic rocks and gneisses of undetermined protolith.

3 INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out during the period between August 26th and September 3rd, 2014 during which time three (3) sampled boreholes were advanced. One (1) borehole was advanced through the embankment at the location of the culvert, and a single borehole was advanced at each of the inlet (west) and the outlet (east) ends of the culverts.

The field investigation was carried out using a truck and bombardier mounted CME drilling rig equipped with hollow stem augers, standard augers, casing equipment and routine geotechnical sampling equipment. Soil samples were obtained at the borehole locations 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). 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. The number of blows per 300 mm penetration was recorded as the “N” value. 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. A single 19 mm diameter standpipe was installed in one (1) open borehole prior to backfilling to allow for further monitoring of the shallow groundwater levels. 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 in accordance with requirements of Ontario Regulation 903. At the borehole through the embankment, the upper portion of the hole, where necessary, was backfilled with an asphalt cold patch to seal the existing asphalt surface.

The fieldwork for this investigation was under the full time direction of a senior member of the LVM-Merlex 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 2), with a summary of results presented on the laboratory sheets in Appendix 3 (Figures Nos. L-1 to L-3 and Table No. L4).

The location of the individual boreholes was 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. The borehole elevations are based on a survey carried out by others.

4 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Records of Borehole Logs (Appendix 2) and on Drawing No. 2 (Appendix 3). Please note that stratigraphic delineations presented on the borehole logs and soil strata plot are the results of non-continuous sampling, response to drilling progress, the results of SPT, 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 CULVERT STATION 15+935, TOWNSHIP OF FRANKLIN

A plan and profile illustrating the borehole locations and stratigraphic sequences is shown on Drawing No. 2, Appendix 3. During the course of the preliminary exploration program, three (3) sampled boreholes were put down at this site, with Borehole No. 1 advanced at the culvert inlet (right side), Borehole No. 2 advanced through the embankment, and Borehole No. 3 advanced at the culvert outlet (left side). At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 3 were recorded at elevations 322.1 m, 326.5 m, and 323.4 m, respectively.

4.1.1 Pavement Structure

Borehole No. 2 was advanced through the embankment where a pavement structure consisting of 102 mm asphalt and 203 mm crushed gravel was penetrated.

4.1.2 Granular Fill

Underlying the pavement structure at Borehole No. 2 and below ground surface at Borehole No. 1, a layer of granular fill consisting of brown sand with to trace gravel, silty to trace silt, trace clay was penetrated. The natural moisture content measured on samples of this deposit recovered in Borehole No. 2 was in the order of 4% to 18%. On the one sample recovered from Borehole No. 1 the natural moisture content was measured at 58%. Gradation analysis was carried out on one (1) sample of this deposit, the results of which indicated 24% gravel size particles, 69% sand size particles, and 7% silt and clay size particles (Figure No. L-1, Appendix 3). Based on SPT 'N' values of 9 to 21 blows per 300 mm penetration, the compactness of this deposit was described as loose to compact. This deposit was encountered to depths of 0.6 m and 4.4 m below grade at Borehole Nos. 1 and 2 respectively (elevation 321.5 m and 322.1 m, respectively).

4.1.3 Sand and Silt

Underlying the silty sand fill and the sand fill at Borehole Nos. 1 and 2, and below ground surface at Borehole No.3, a layer of brown to grey sand and silt trace gravel trace clay was penetrated. The natural moisture content measured on samples of this deposit was in the order of 17% to 33% except two samples of 52% and 47% encountered at shallow depths of the deposit in Borehole Nos. 1 and 2. Gradation analyses were carried out on five (5) samples of this deposit, the results of which indicated 0% to 9% gravel size particles, 42% to 54% sand size particles, 45% to 57% silt size particles, and 1% to 2% clay size particles (Figure Nos. L-2 in Appendix 3). Based on SPT 'N' values of 1 to 14 blows per 300 mm penetration, this deposit was described as very loose to compact, generally very loose. This deposit was encountered to depths of 2.9 m, 10.1 m, and 10.1 m below grade at Borehole Nos. 1 to 3, respectively (elevations 319.2 m, 316.4 m and 313.3 m, respectively).

4.1.4 Silt

Underlying the sand and silt deposit at Borehole Nos. 1 to 3 inclusive, a layer of grey silt, sandy to trace sand, trace gravel, trace clay was penetrated. The natural moisture content measured on samples of this deposit was in the order of 21% to 29%. Gradation analyses were carried out on three (3) samples of this deposit, the results of which indicated 0% to 6% gravel size particles, 7% to 34% sand size particles, 45% to 82% silt size particles, and 2% to 7% clay size particles (Figure Nos. L-3 in Appendix 3). Based on SPT 'N' values of 4 to 59 blows per 300 mm penetration and 75 blows per 50 mm penetration, this deposit was described as loose to very dense, generally compact. This deposit was encountered to depths of 5.5 m, 14.9 m, and 11.0 m below grade at Borehole Nos. 1 to 3, respectively (elevations 316.6 m, 311.6 m and 312.4 m, respectively), where bedrock was encountered.

4.1.5 Bedrock

Underlying the above described silts at Borehole Nos. 1 to 3 inclusive, the bedrock was proven by diamond core drilling. The bedrock was described as grey to pink gneiss bedrock. Based on Rock Quality Designation (RQD) values ranging from 74% to 91%, the bedrock was described as good to excellent quality. Sampling in the bedrock was terminated at depths of 8.6 m, 18.0 m, and 14.0 m below grade at Borehole Nos. 1 to 3, respectively (elevations 313.5 m, 308.5 m, and 309.4 m, respectively). It should be noted that, when encountered, the underlying bedrock surfaces in this area can be very erratic in nature, varying substantially in elevation over short horizontal distances.

4.2 GROUNDWATER DATA

The survey information indicates that the water level in the creek was measured at some 321.6 m on August 14, 2014 by others. At the time of this investigation, the creek water levels were measured at elevation 321.7 m at the inlet area on August 26th, 2014 and 321.9 m at the outlet area on August 27th, 2014, respectively.

Measurements of the groundwater table and cave-in levels were undertaken, where possible, in the open boreholes during the advance of the individual borings and upon completion. A standpipe was installed in Borehole Nos. 1 and 2 to obtain post borehole completion water levels. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix 2) and shown on the Borehole Locations and Soil Strata Drawing No. 2 in Appendix 3.

The water levels were measured at elevations 321.7 m (2014-08-26), 321.8 m (2014-09-04), and 321.8 m (2014-08-27) at Borehole Nos. 1 to 3, respectively.

The groundwater and creek water levels will fluctuate seasonally/yearly.

Appendix 1 Key Plan

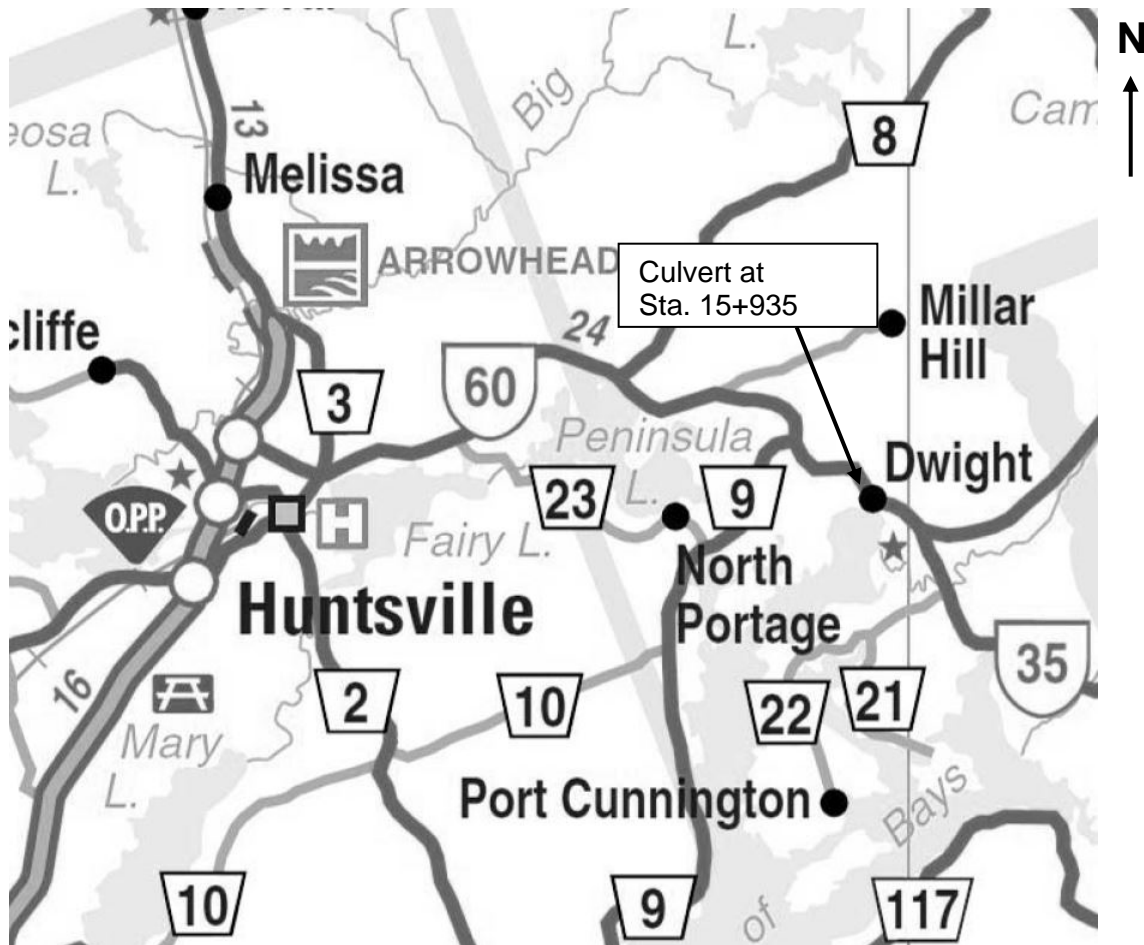
Drawing No. 1

Key Plan

MACRO KEY PLAN

Drawing No.1

NOT TO SCALE



FINAL PRELIMINARY FOUNDATION INVESTIGATION REPORT

GWP 5333-11-00

Highway 60

Culvert at Station 15+935

Site No. 42-043/C

Township of Franklin



Reference No: 14/07/14083-F6

April 2015

Appendix 2 Subsurface Data

Enclosure No. 1	List of Abbreviations and Symbols
Enclosure Nos. 2 to 4	Record of Borehole Sheet

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
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
WS	Wash Sample
WH	Sampler advanced by static weight of hammer and/or rods
Rec	% recovery from individual run of rock core
RQD	Rock quality designation (%)

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 60° cone attached to AW rod 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

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

3. SOIL DESCRIPTION (Cont'd)

c) Cohesive Soils:

RQD (%)	Classification
Less than 25	Very poor quality
25 to 50	Poor quality
50 to 75	Fair quality
75 to 90	Good quality
90 to 100	Excellent quality

d) 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.

e) Soil Moisture:

Moisture	Described as
Dry	Below optimum moisture content
Moist	Near optimum moisture content
Wet	Above optimum moisture content

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%

Terminology for cobbles and boulders is based on auger response and field observations:

Occasional	Obstructions encountered in borehole, however advance is not impeded
Numerous	Obstructions are essentially continuous over drilled length

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.

METRIC

RECORD OF BOREHOLE NO. 1



REFERENCE 14/07/14083 DATUM Geodetic LOCATION N 5021920.7 E 342654.6 - Franklin Twp., Station 15+941 ORIGINATED BY JL
 PROJECT GWP 5333-11-00, Highway 60 - F6 BOREHOLE TYPE Truck Mounted CME 45 - Hollow Stem Augers COMPILED BY SH
 CLIENT AECOM DATE (Started) 26 August 2014 TIME
 DATE (Completed) 26 August 2014 (Completed) 5:30:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 WATER CONTENT (%) 20 40 60 PLASTIC LIMIT (w _p) NATURAL MOISTURE CONTENT (w) LIQUID LIMIT (w _L)	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)	
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES						
322.1	Ground Surface										
0.0	FILL - silty sand, trace gravel Occasional rootlets brown		1	SS	WH						
321.5											
0.6	SAND and SILT, trace clay grey (very loose)		2	SS	WH					0 42 57 1	
			3	SS	WH						
			4	SS	2						
319.2											
2.9	SILT, sandy, trace gravel, trace clay grey (loose/very dense)		5	SS	5					6 33 59 2	
			6	SS	11						
			7	SS	59						
316.6											
5.5	Auger Refusal Start rock coring BEDROCK - grey gneiss good to excellent quality		8	RC	Rec=100% ROD=91%						
			9	RC	Rec=100% ROD=74%						
313.5											
8.6	End of Sampling End of Borehole										
COMMENTS								+ 3, × 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) 26/8/14 5:30:00 PM		0.36	▽ - 1.5
								2) -		-	▽ -
3) -		-	▽ -								

MEL-GEO 14083 - BOREHOLE LOGS - F6.GPJ MEL-GEO.GDT 22/4/15

METRIC

RECORD OF BOREHOLE NO. 2



REFERENCE	14/07/14083	DATUM	Geodetic	LOCATION	N 5021941.6 E 342661.9 - Franklin Twp., Station 15+925	ORIGINATED BY	JL
PROJECT	GWP 5333-11-00, Highway 60 - F6			BOREHOLE TYPE	Track Mounted CME 45 - Hollow Stem Augers	COMPILED BY	SH
CLIENT	AECOM	DATE (Started)	3 September 2014	TIME (Completed)	2:30:00 PM	CHECKED BY	MAM
		DATE (Completed)	3 September 2014				

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)					
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				
								○ UNCONFINED		+ FIELD VANE						● QUICK TRIAXIAL		× LAB VANE		
326.5	Ground Surface						20	40	60	80	100	20	40	60						
0.0	102 mm Asphalt 203 mm Crush Gravel FILL - sand, with to trace gravel, trace silt and clay brown compact		1	SS	21							○								
			2	SS	15							○				24 69 (7)				
			3	SS	16							○								
			4	SS	9							○								
			5	SS	11							○								
			6	SS	14							○								
322.1																				
4.4	SAND and SILT, trace gravel, trace clay trace rootlets and wood pieces grey (compact/very loose)		7	SS	14							○				9 45 (46)				
			8	SS	4								○			0 53 45 2				
			9	SS	3								○							
			10	SS	4								○							
			11	SS	4								○							
316.4																				
10.1	SILT, sandy to trace sand, trace gravel, trace clay grey (loose/compact)		12	SS	4								○							
			13	SS	WH								○							
Continued Next Page																				
COMMENTS							+ 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) 3/9/14 2:30:00 PM		4.9		▽ - 1						
										2) 4/9/14 1:30:00 PM		4.67		▽ -						
										3)		-		▽ -						
The stratification lines represent approximate boundaries. The transition may be gradual																				

MEL-GEO 14083 - BOREHOL LOGS - F6.GPJ MEL-GEO.GDT 22/4/15

METRIC**RECORD OF BOREHOLE NO. 2**

REFERENCE 14/07/14083 DATUM Geodetic LOCATION N 5021941.6 E 342661.9 - Franklin Twp., Station 15+925 ORIGINATED BY JL
 PROJECT GWP 5333-11-00, Highway 60 - F6 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY SH
 CLIENT AECOM DATE (Started) 3 September 2014 TIME
 DATE (Completed) 3 September 2014 (Completed) 2:30:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
	Continued from Previous Page													
311.6			14	SS	14									4 7 82 7
14.9	Auger Refusal Start rock coring BEDROCK - grey to pink gneiss good quality		15	RC	Rec= 100% ROD= 79%									
			16	RC	Rec= 100% ROD= 89%									
308.5														
18.0	End of Sampling End of Borehole													

MEL-GEO 14083 - BOREHOLE LOGS - F6.GPJ MEL-GEO.GDT 22/4/15

METRIC**RECORD OF BOREHOLE NO. 3**

REFERENCE 14/07/14083 DATUM Geodetic LOCATION N 5021952.3 E 342685.8 - Franklin Twp., Station 15+925 ORIGINATED BY JL
 PROJECT GWP 5333-11-00, Highway 60 - F6 BOREHOLE TYPE Truck Mounted CME 45 - Hollow Stem Augers COMPILED BY SH
 CLIENT AECOM DATE (Started) 27 August 2014 TIME
 DATE (Completed) 27 August 2014 (Completed) 5:00:00 PM CHECKED BY MAM

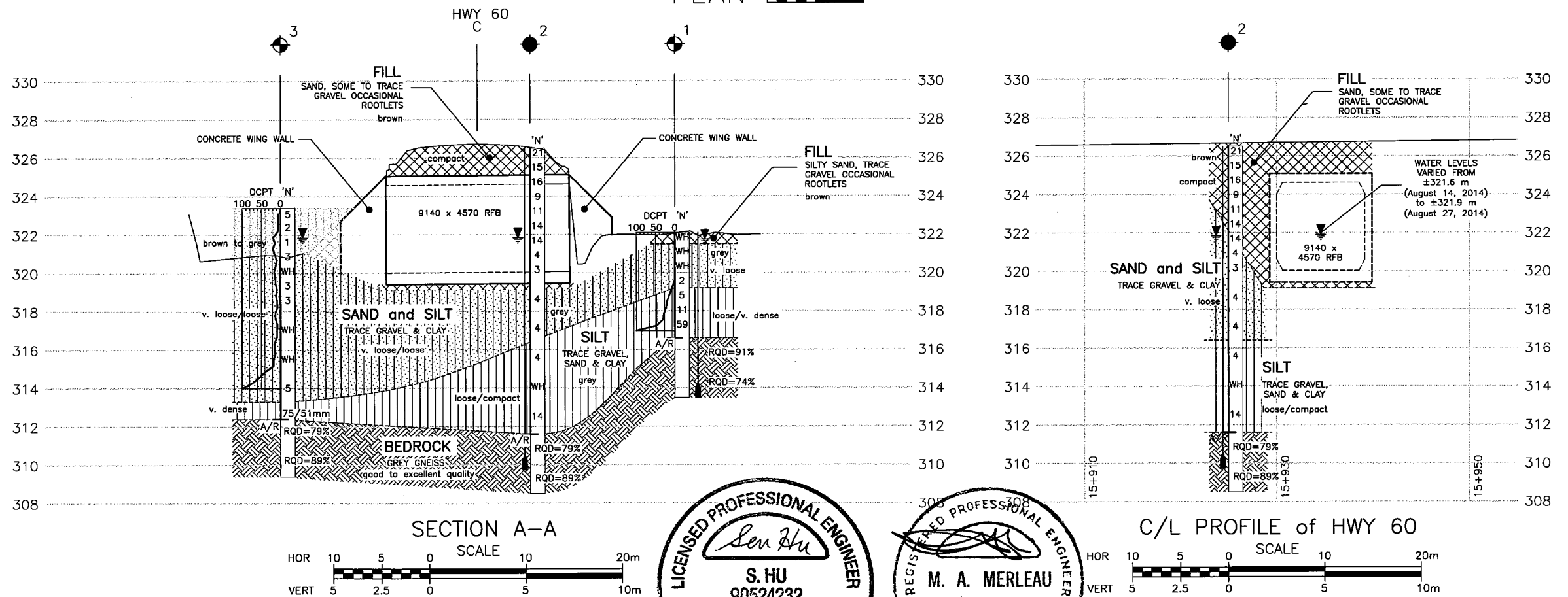
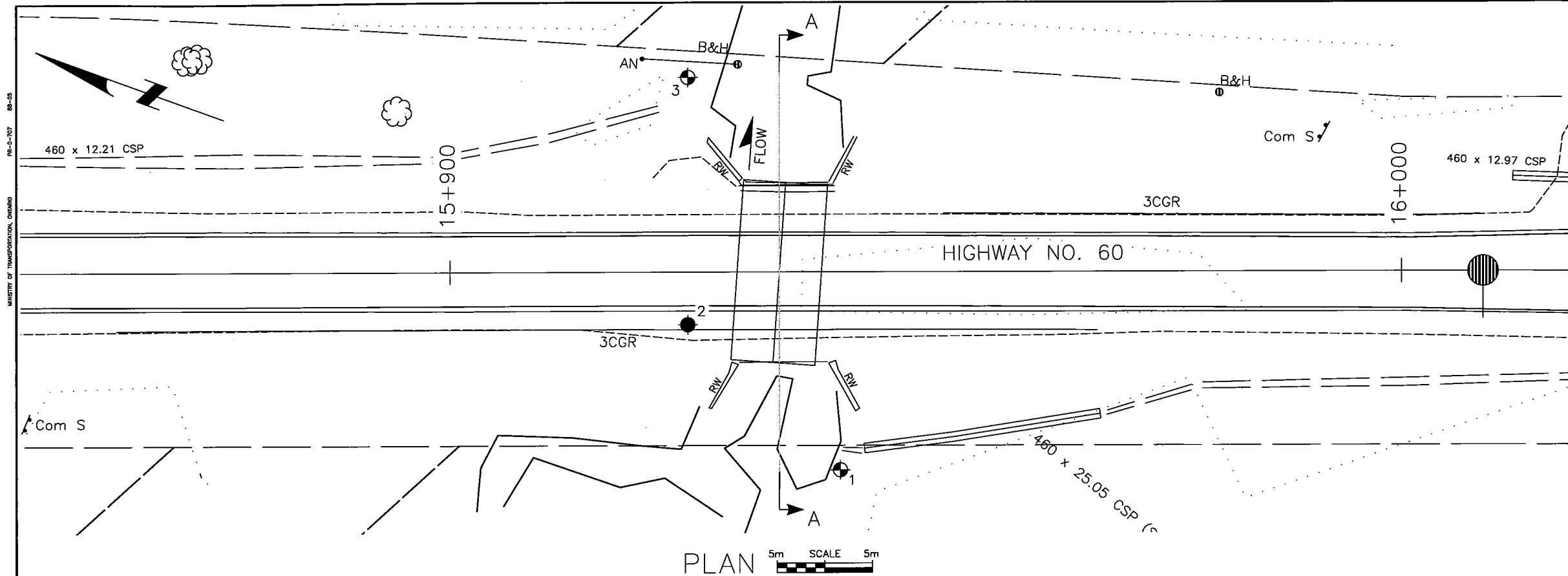
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Continued from Previous Page		13	RC	Rec=100% RQD=84%		310										
309.4 14.0	End of Sampling End of Borehole																

MEL-GEO 14083 - BOREHOLE LOGS - F6.GPJ MEL-GEO.GDT 22/4/15

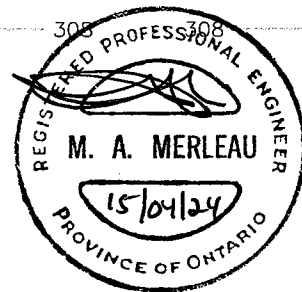
Appendix 3 Borehole Plan and Lab Data

Drawing No. 2: Borehole Location and Soil Strata
Figure Nos. L-1 to L-3: Grain Size Distribution Curves
Table No. L-4: Laboratory Test Summary Sheet

CAD FILE LOCATION AND NAME: 2014\14083 - F&V & F&M, Hwy 60, Huntsville & Hwy 113, Cobalt (GECOM)\FOUNDATIONS\Drawings\F&V\Working - Do Not Move or Delete Files\14083-F&V - Drawing Package, Culvert at 15+930.dwg
MODIFIED: 3/26/2015 8:50:25 AM BY: GRASSER
DATE PLOTTED: 3/26/2015 8:50:36 AM BY: RYAN GRASSER



This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The proposed structure location is shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.



DRAWING NOT TO BE SCALED
50mm ON ORIGINAL DRAWING

DISTRICT
CONT. No.
GWP No. 5333-11-00

HWY 60
CULVERT AT STATION 15+935
FRANKLIN TOWNSHIP

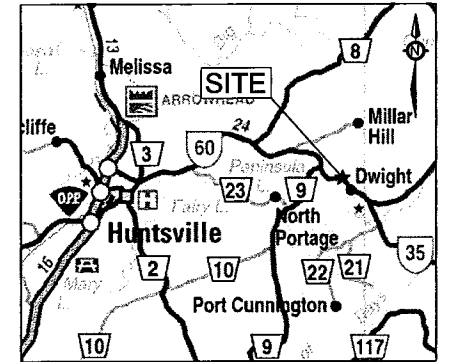
BOREHOLE LOCATIONS
AND SOIL STRATA

LVM Merlex

DRAWING

2

METRIC



KEY PLAN
N.T.S.

LEGEND

- Borehole
- ⊙ Borehole w/ Dynamic Cone Penetration Test
- 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
- ↑ Piezometer

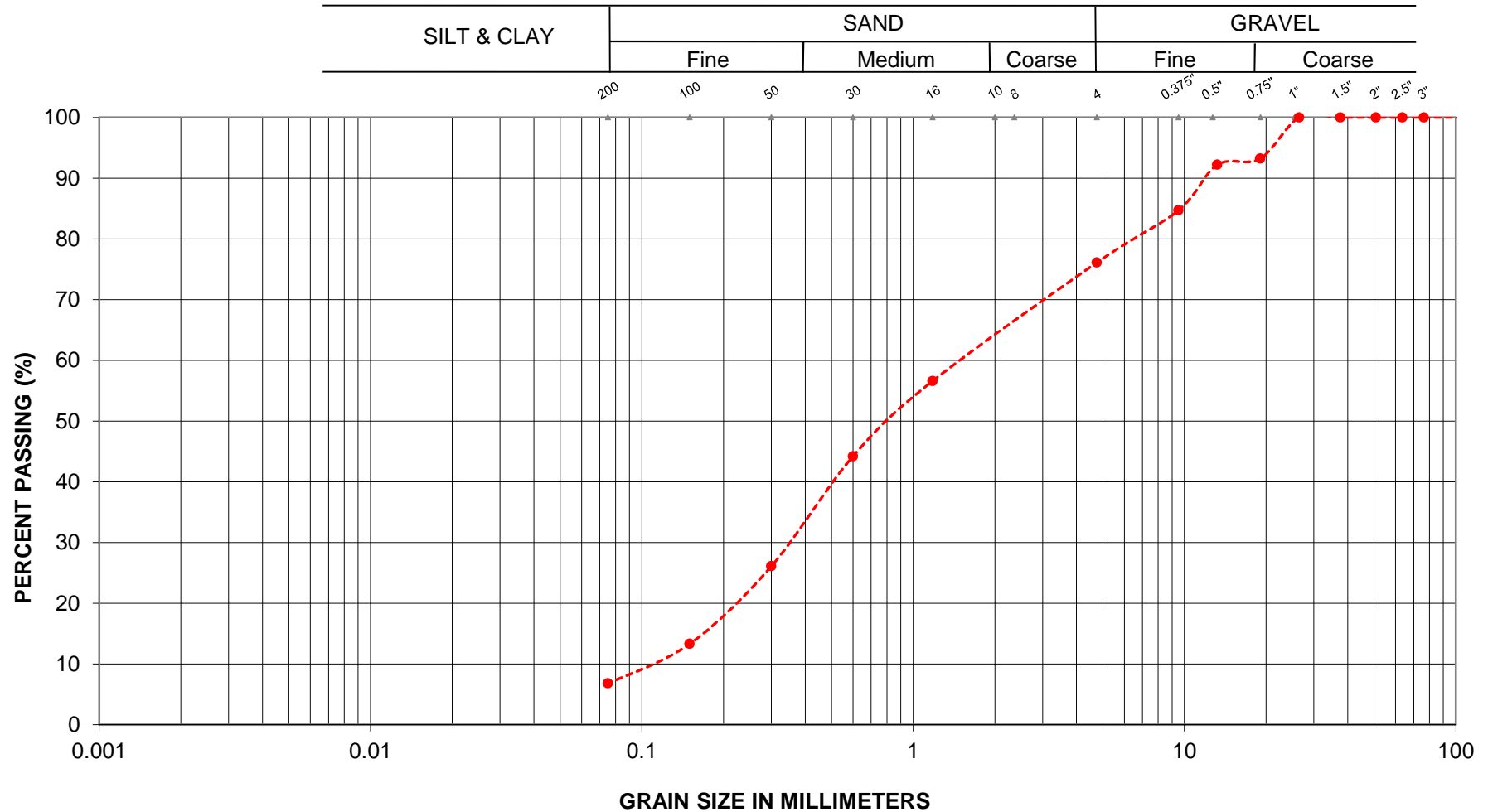
BOREHOLE No.	ELEVATION	O/S	NORTHING	EASTING
1	322.1	20.5m Rt	5021920.7	342854.6
2	326.5	5.5m Lt	5021941.6	342861.9
3	323.4	20.5m Lt	5021952.3	342885.8

- NOTES:**
- 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.
 - Base plan and alignment provided in digital format by exp. on November 24, 2014.
 - The size of opening of the culvert was established from Contract Drawing titled "General Plan" (No. D-4910-1) dated October, 1961 (W.P. 208-60).

GEOCREs No. 31E-348

REVISIONS	FEB/15	RG	DRAFT				
	MAR/15	RG	FINAL				
DESCRIPTION							
DESIGN	CHK		CODE		LOAD		DATE MAR/15
DRAWN	RG	CHK	SH	SITE	STRUCT	SCHEME	DWG 2

GRAIN SIZE ANALYSIS



---●--- BH No.: 2 Sa No.: 2 Depth: 0.76 - 1.22 m

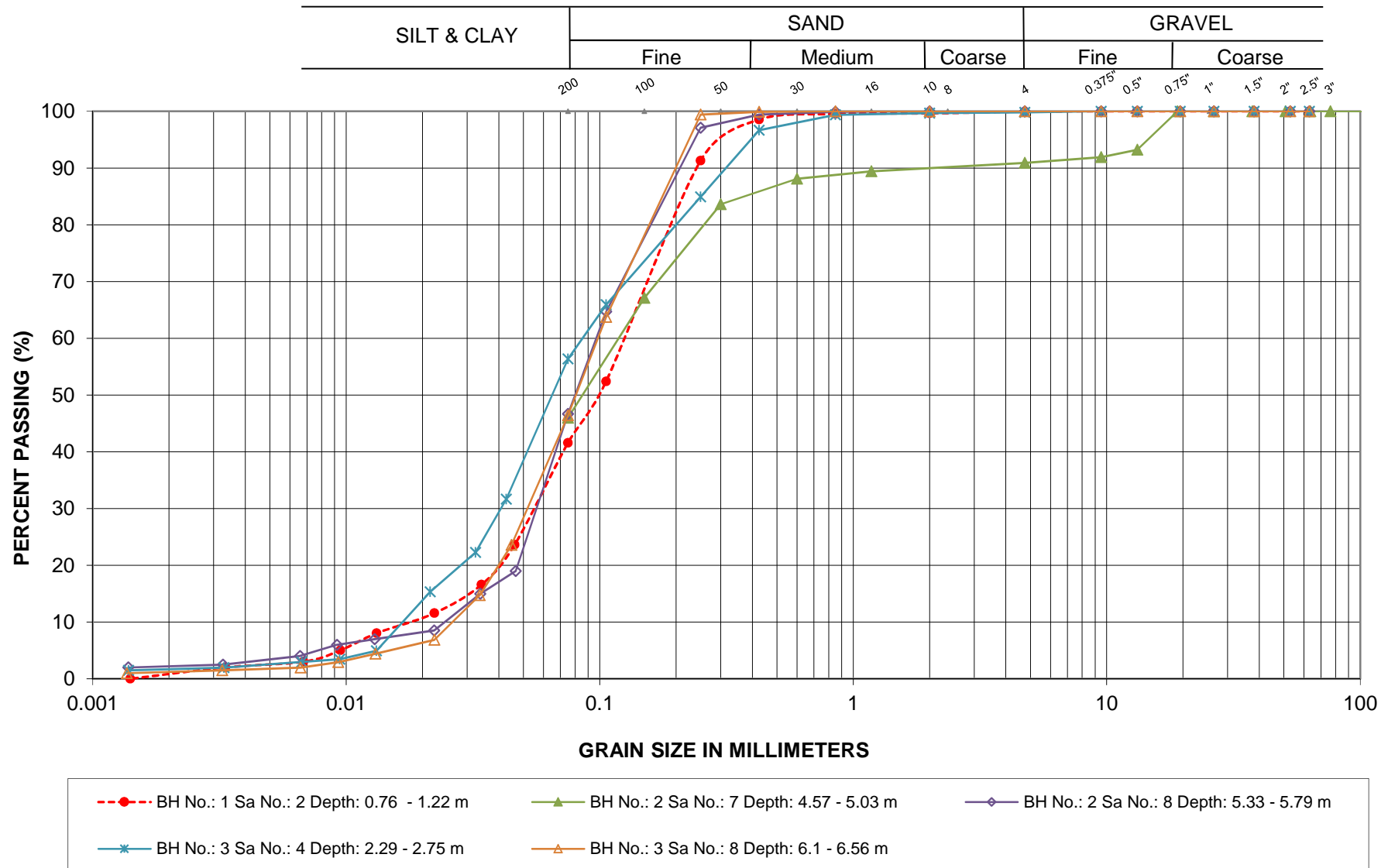
SAND FILL

LOCATION: Hwy 60 Sta. 15+935 Culvert
TWP. Franklin, Ontario

LVM-Merlex, a Division EnGlobe Corp.

FIGURE L-1

GRAIN SIZE ANALYSIS



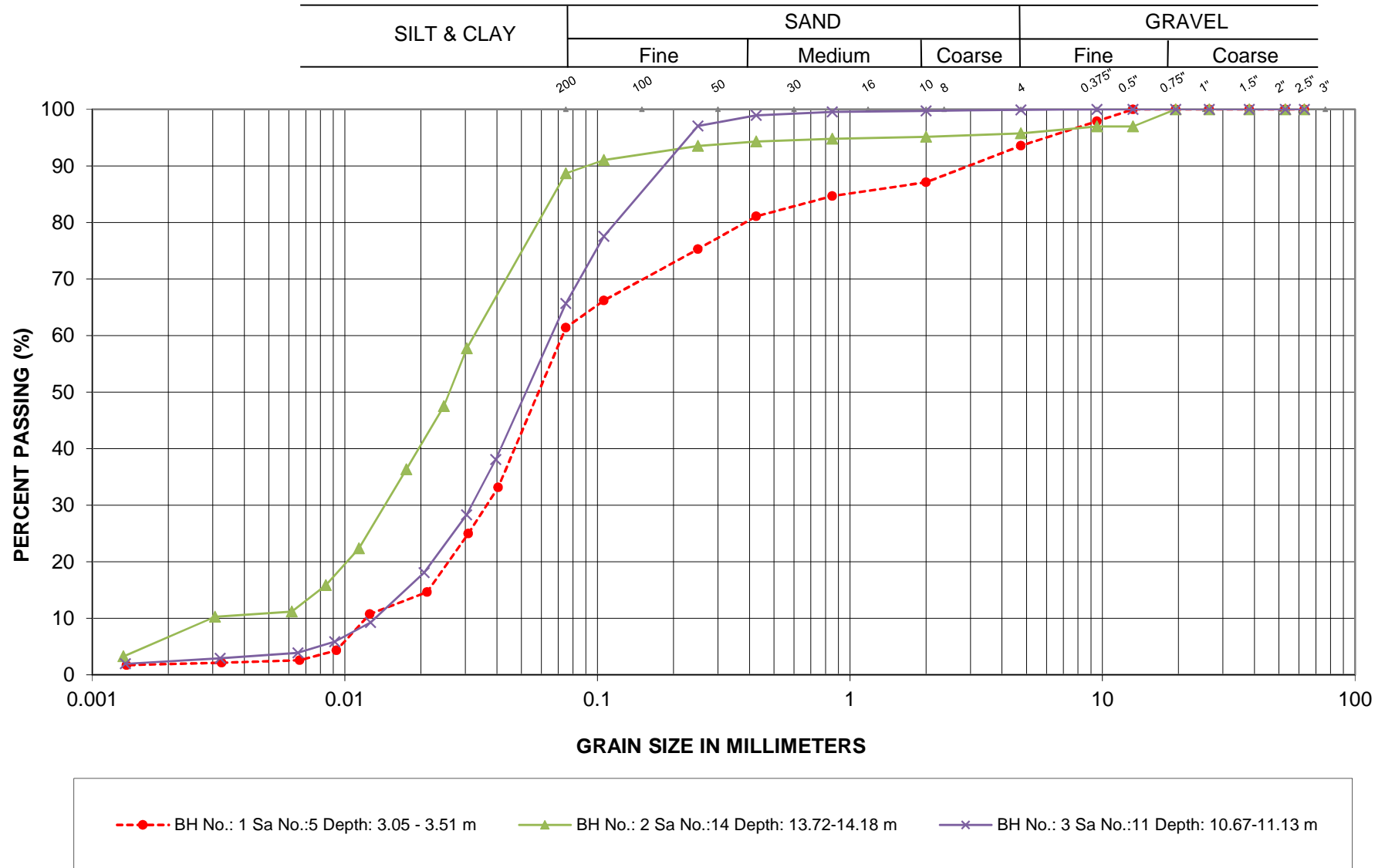
SAND AND SILT

LOCATION: Hwy 60 Sta. 15+935 Culvert
TWP. Franklin, Ontario

LVM-Merlex, a Division EnGlobe Corp.

FIGURE L-2

GRAIN SIZE ANALYSIS



Sandy SILT to SILT

LOCATION: Hwy 60 Sta. 15+935 Culvert
TWP. Franklin, Ontario

LVM-Merlex, a Division EnGlobe Corp.

FIGURE L-3

Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m ³)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
1	1	0.3					58.0				WH			
	2	1.0	0	42	57	1	52.1				WH			
	3	1.8					33.2				WH			
	4	2.5					48.5				2			
	5	3.3	6	33	59	2	26.6				5			
	6	4.0					28.1				11			
	7	4.8					25.2				59			
2	1	0.2					4.2				21			
	2	1.0	24	69	7		3.5				15			
	3	1.8					4.8				16			
	4	2.5					6.0				9			
	5	3.3					6.9				11			
	6	4.0					17.7				14			
	7	4.8	9	45	46		16.5				14			
	8	5.6	0	53	45	2	46.6				4			
	9	6.3					29.3				3			
	10	7.9					26.4				4			
	11	9.4					25.0				4			
	12	10.9					26.9				4			
	13	12.4					27.3				WH			
	14	14.0	4	7	82	7	28.5				14			
3	1	0.3					13.8				5			
	2	1.0					17.8				2			
	3	1.8					32.5				1			
	4	2.5	0	44	54	2	28.2				3			

Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m ³)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
3	5	3.3					23.1				WH			
	6	4.0					29.7				3			
	7	4.8					26.6				3			
	8	6.3	0	54	45	1	26.3				WH			
	9	7.9					25.9				WH			
	10	9.4					18.8				5			
	11	10.9	0	34	64	2	21.1				75/51mm			

Appendix 4 Photo Essay

Enclosure No. 5:

Photo Essay

Embankment at Culvert Location – Looking North

Photo: 1



Culvert Inlet – Looking North

Photo: 2



Project: Hwy 60 – Culvert 15+935

Photos Provided By: LVM

Date: August 2014

Creek Downstream at Culvert Inlet– Looking West (Right Side)

Photo: 3



Creek Upstream at Culvert Outlet – Looking East (Left Side)

Photo: 4



Project: Hwy 60 – Culvert 15+935

Photos Provided By: LVM

Date: August 2014

