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

Little Mollie Creek Culvert
Twp. of Vrooman
Site No. 47-401/C

Highway 560, 6.5 km East of Junction with Highway 144
GWP 5263-10-00

FINAL FOUNDATION INVESTIGATION REPORT

Date: December 06, 2013
Ref. Nº: 13/05/13073-F8

Geocres No. 41P-53

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Final Foundation Investigation Report

Prepared by:

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TABLE OF CONTENTS

Appendices

Property and Confidentiality

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189 Wyld Street, Suite 103
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Attention: **Mr. Al Rose**

REVISION AND PUBLICATION REGISTER		
Revision N°	**Date**	**Modification And/Or Publication Details**
00	2013-10-01	DRAFT FIDR Issued
01	2013-12-06	Final FIDR 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 has been retained by AECOM Canada Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to carry out a foundation investigation at the site of an existing centerline culvert. The site is located on Highway 560, some 6.5 km East of Highway 144 junction, in the Township of Vrooman.

The foundation investigation location was specified by the MTO in the Terms of Reference for work under Agreement No. 5012-E-0025. The terms of reference for the scope of work are outlined in LVM | MERLEX's Proposal P-13-022, dated February, 2013. The purpose of this investigation was to determine the subsurface conditions in the area of the 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 site of this foundation investigation is located on Highway 560 some 6.5 km East of the Junction With Highway 144 in the Township of Vrooman. The local topography at the site is a low wetland to the left and right of the embankment. The existing highway embankment currently supports two undivided lanes of highway, running in a west to east direction. The existing highway, at the culvert location, is constructed on a granular fill embankment some 3.6 m in height, with centerline elevation of 386.1 m at the culvert location. The culvert at this location has been described, in the RFP, as a 3.6 m diameter CSP culvert, some 21.0 m in length, measured along the invert. However, field measurements indicate that the culvert is a SPCSPA of nominal dimension 3600x2800 mm. Flow through the culvert is from south to north (right to left) (see Photo Essay, Appendix 4).

Infrastructure at the culvert location consists of overhead wires on the left (north) side of the highway.

2.1 SITE PHYSIOGRAPHY AND SURFICIAL GEOLOGY

This project is located in the Geomorphic Sub-province known as the Eastern Sandy Uplands. The topography on this section of Highway 560 is generally flat. Significant layers of earth overlay the bedrock. Organic terrain was also observed. Within the project area native overburden consists primarily of shallow sand deposits.

Bedrock in the area, as indicated on OGS Map 2506, is of the Early Precambrian period consisting of Felsic Igneous and Metamorphic rocks. At the location of this culvert foundation investigation, the bedrock generally comprises of granitic rocks, syenite, pegmatite, unsubdivided migmatite.

3 INVESTIGATION PROCEDURES

The field work for this investigation was carried out on July 3rd, 2013 during which time four (4) sampled boreholes were advanced. Bedrock coring was undertaken at two borehole locations on August 15th and 16th, 2013. Two (2) boreholes were advanced through the embankment at the location of the culvert, and one borehole was advanced at each the inlet and outlet ends of the culvert.

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 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 mounted in a trip (automatic) hammer. The number of blows per 300 mm penetration was recorded as the "N" value. When shallow auger refusal was encountered at the boreholes located at the culvert ends, NQ size diamond coring equipment was used to determine the nature of shallow refusal. 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. Standpipes were installed in select open boreholes prior to backfilling. 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. At the borehole(s) through the embankment, the upper portion of the hole, where necessary, was backfilled with an asphalt cold patch to seal the existing surface treatment.

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 2), with a summary of results presented on the laboratory sheets in Appendix 3 (Figures Nos. L-1 to L-3).

The location of the individual boreholes were determined in the field using highway chainage (established by others) and offset relative to highway centerline. The MTO co-ordinates, northing and easting, were then established for the boring locations. Elevations contained in this report are referenced to a geodetic datum. The borehole elevations are based on a survey carried out by exp. Services. The benchmark used at the culvert at Station 10+000 was

described as a nail and washer in the south face of Hydro Pole at Station 10+016.5, 15.5 m left of centerline (see Drawing No. 2, Appendix 3).

4 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Record of Borehole Logs (Appendix 2) and on Drawing No. 2 (Appendix 3). 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, 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 10+000, TWP OF VROOMAN

A plan and profile illustrating the borehole locations and stratigraphic sequences is shown on Drawing No. 2, Appendix 3. During the course of the exploration program, four (4) sampled boreholes were put down at this site, with Borehole Nos. 1 and 4 advanced at the culvert ends (inlet (right/south) and outlet (left/north), respectively), and Borehole Nos. 2 and 3 advanced through the embankment. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 4 were recorded at 384.3, 386.0, 385.8, and 384.3 m, respectively.

4.1.1 Pavement Structure

Borehole Nos. 2 and 3 were advanced on the shoulder where a pavement structure consisting of surface treatment underlain by some 125 to 150 mm of crushed gravel was penetrated.

4.1.2 Surficial Organics/Peat

At ground surface, at Borehole No. 1, a layer of surficial organics some 100 mm thick was penetrated. At ground surface, at Borehole No. 4, a 1.2 m thick layer of black fine fibrous peat was penetrated. The natural moisture content measured on samples of this peat deposit was in the order of 167 to 272%. The peat deposit was encountered to a depth of 1.2 m below grade at Borehole No. 4 (elevation 383.1 m).

4.1.3 Embankment Fill

Underlying the pavement structure, at Borehole Nos. 2 and 3, a layer of granular fill consisting of brown sand trace to some silt trace to some gravel was penetrated. The natural moisture content measured on samples of this deposit was in the order of 3 to 17%. Gradation analyses were carried out on four (4) samples of this deposit, the results of which indicated 4 to 13% gravel size particles, 76 to 88% sand size particles, and 7 to 11% silt and clay size particles (Figure No. L-1, Appendix 3). Based on SPT ‘N’ values of 3 to 30 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 3.6 m at Borehole Nos. 2 and 3 (elevations 382.4 and 382.2 m, respectively).

4.1.4 Sand

Underlying the thin layer of surficial organics at Borehole No. 1, underlying the peat at Borehole No. 4, and underlying the embankment fill at Borehole Nos. 2 and 3, a deposit of grey sand some to with silt trace to some gravel was penetrated. Occasional cobbles/boulders were encountered in the lower reaches of this deposit at Borehole No. 4. The natural moisture content measured on samples of this deposit was in the order of 8 to 23%. Gradation analyses were carried out on two (2) samples of this deposit, the results of which indicated 0 to 14% gravel size particles, 65 to 86% sand size particles, and 14 to 21% silt and clay size particles (Figure No. L-2, Appendix 3). Based on SPT 'N' values of 0 (static weight of hammer) to greater than 100 blows per 300 mm penetration, this deposit was described as very loose to very dense, generally very dense. Auger refusal was encountered in this deposit at depths of 1.7, 5.5, 4.0, and 2.5 m below grade at Borehole Nos. 1 to 4, respectively (elevations 382.6, 380.5, 381.8, and 381.8 m, respectively). Diamond core drilling was undertaken past auger refusal at Borehole Nos. 1 and 4, to confirm the nature of the refusal material. Sands with cobbles and boulders were encountered between depths of 1.7 to 2.3 m below grade (elevation 382.6 to 382.0 m) at Borehole No. 1, before encountering the bedrock surface.

4.1.5 Bedrock

Underlying the above described sands at Borehole Nos. 1 and 4, bedrock was proven by diamond core drilling. The bedrock was described as grey granitic bedrock. Based on RQD values of 76 to 100% the bedrock was described as good to excellent quality. Sampling in the bedrock was terminated at depths of 5.3 and 5.5 m below grade at Borehole Nos. 1 and 4, respectively (elevations 379.1 and 378.8 m, respectively). It should be noted that, when encountered, the underlying bedrock surfaces in this area are very erratic in nature, varying substantially in elevation over short horizontal distances.

4.2 GROUNDWATER DATA

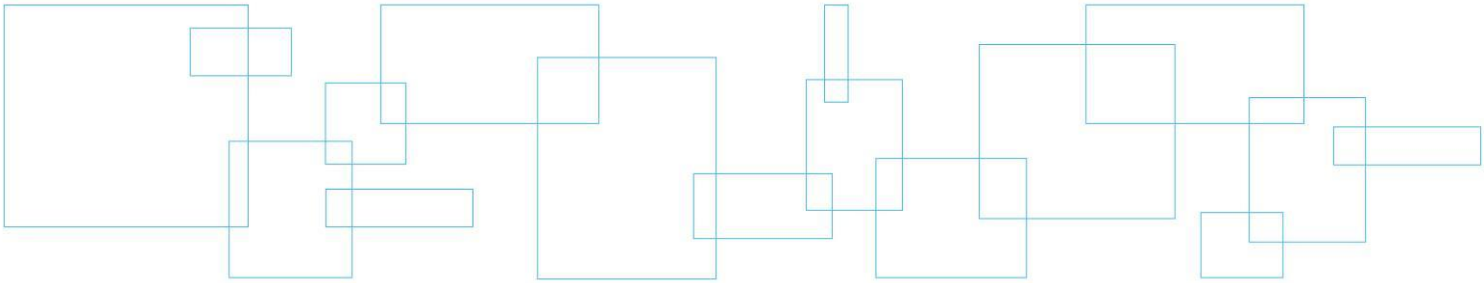
At the time of this investigation, the water level at the culvert outlet was measured at elevation 383.8 m.

Measurements of the groundwater and cave-in levels were undertaken, where possible, in the open boreholes during the advance of the individual borings and upon completion. Standpipes were installed in Borehole Nos. 1, 2 and 4, to obtain post completion water levels. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix 2). The water levels in Borehole Nos. 1, 2, and 4, were measured at elevation 383.9 m. These water levels appeared stable at the time of drilling.

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

Appendix 1 Key Plan

Drawing No. 1 Key Plan



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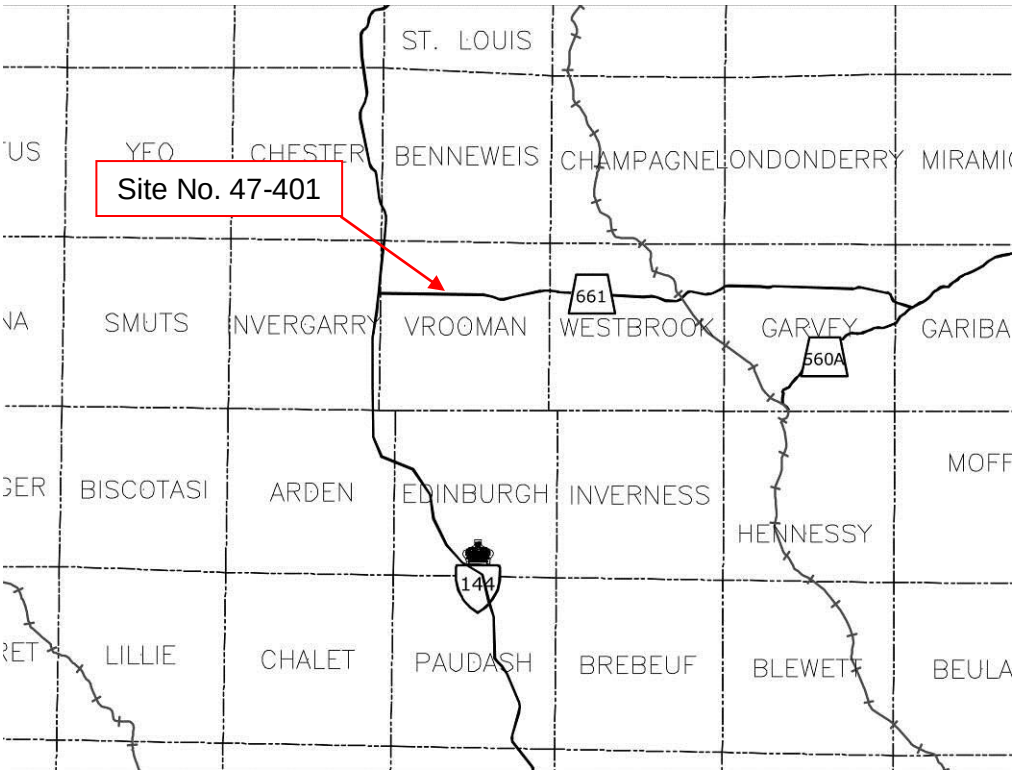
KEY PLAN

Drawing No. 1

NOT TO SCALE



FINAL
FOUNDATION INVESTIGATION REPORT
GWP 5263-10-00
Highway 560

Reference No: 13/05/13073-F8 December 2013

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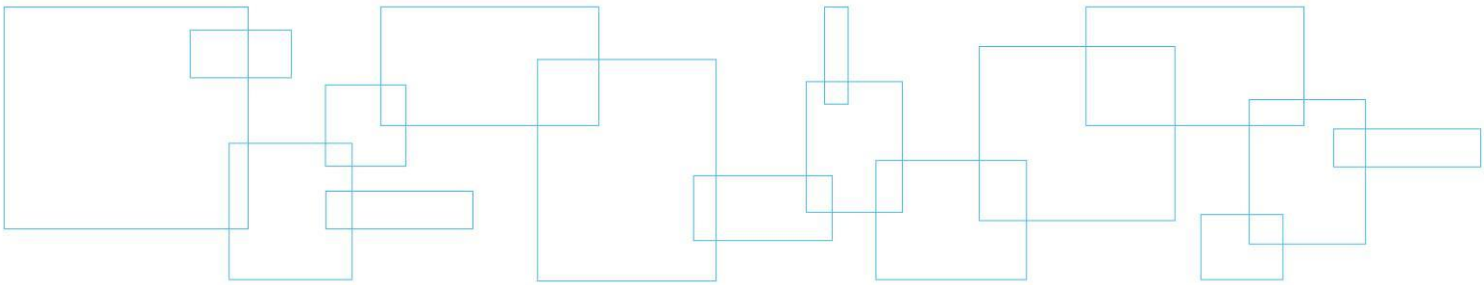
Appendix 2 Subsurface Data

Enclosure No. 1	List of Abbreviations and Symbols
Enclosure Nos. 2 to 5	Record of Borehole Sheet



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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

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) *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%

Terminology for cobbles and/or boulders frequency is an estimate based on drill response and field observations:

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

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. 1

REFERENCE 13/05/13073-F8 DATUM Geodetic LOCATION N 5259319.7 E 247453.0 - Township of Vrooman ORIGINATED BY JL

PROJECT GWP 5263-10-00, Hwy 560 - Sta 10+000 Twp of Vrooman BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 2013 July 3 TIME (Completed) CHECKED BY MAM

DATE (Completed) 2013 July 3

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
384.3	Ground Surface										
0.0	100 mm surficial organics SAND - grey sand trace to some silt trace gravel (very loose/loose)		1	SS	WH	▽	384				
			2	SS	8	▽					0 86 (14)
382.6			3	SS	25/50 mm	▽	383				
1.7	Auger Refusal Advanced NW Casing to 1.7 m depth, start coring		4	RC							
382.0	Cobbles/boulders						382				
2.3	BEDROCK - grey granitic bedrock excellent quality		5	RC	Rec= 100% RQD= 100%						
			6	RC	Rec= 100% RQD= 90%		381				
379.1							380				
5.2	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) 13/7/3 12:00:00 PM	0.9 ▽	1.7 ▨
2) 13/7/3 12:20:00 PM	0.4 ▽	1.5
3)	- ▼	-

MEL-GEO 13073-F8 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/1

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

METRIC

RECORD OF BOREHOLE NO. 2

L|V|M

REFERENCE 13/05/13073-F8 DATUM Geodetic LOCATION N 5259323.5 E 247463.9 - Township of Vrooman ORIGINATED BY JL

PROJECT GWP 5263-10-00, Hwy 560 - Sta 10+000 Twp of Vrooman BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 2013 July 3 TIME (Completed) CHECKED BY MAM

DATE (Completed) 2013 July 3

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
386.0	Ground Surface										
0.0	25 mm Asphalt 150 mm Crushed Gravel FILL - brown sand trace to some silt trace to some gravel (compact)		1	SS	23						
			2	SS	17		385				13 76 (11)
			3	SS	7	▽					
						▽▼	384				
			4	SS	8	🖼					
							383				
382.4			5	SS	3						6 87 (7)
3.6	SAND - grey sand with silt some gravel (very dense)		6	SS	58		382				14 65 (21)
			7	SS	50/125 mm		381				
380.5											
5.5	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) 13/7/3 10:30:00 AM	1.8 ▽	2.6 🖼
2) 13/7/3 4:30:00 PM	2.1 ▽	-
3) 13/7/4 9:00:00 AM	2.1 ▼	-

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

METRIC

RECORD OF BOREHOLE NO. 3

REFERENCE 13/05/13073-F8 DATUM Geodetic LOCATION N 5259332.9 E 247460.8 - Township of Vrooman ORIGINATED BY JL

PROJECT GWP 5263-10-00, Hwy 560 - Sta 10+000 Twp of Vrooman BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 2013 July 3 TIME (Completed) CHECKED BY MAM

DATE (Completed) 2013 July 3

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
385.8	Ground Surface										
0.0	25 mm Asphalt 125 mm Crushed Gravel FILL - brown sand trace to some silt trace gravel (loose/compact)		1	SS	30						
			2	SS	8		385				
			3	SS	6		384				5 84 (11)
			4	SS	4		383				
382.2			5	SS	5						4 88 (8)
3.6	SAND - grey sand trace to some silt trace gravel										
381.8			6	SS	50/75 mm		382				
4.0	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

$\circ$ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 13/7/3 2:50:00 PM	DRY	1.5
2)	-	-
3)	-	-

MEL-GEO 13073-F8 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/1

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

METRIC

RECORD OF BOREHOLE NO. 4

L|V|M

REFERENCE 13/05/13073-F8 DATUM Geodetic LOCATION N 5259336.8 E 247470.6 - Township of Vrooman ORIGINATED BY JL

PROJECT GWP 5263-10-00, Hwy 560 - Sta 10+000 Twp of Vrooman BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 2013 July 3 TIME (Completed) CHECKED BY MAM

DATE (Completed) 2013 July 3

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL)
384.3	Ground Surface										
0.0	PEAT - black fine fibrous peat		1	SS	WH	▽	384		272		
			2	SS	WH	▽			167		
383.1											
1.2	SAND - grey sand some silt trace gravel occasional cobbles/boulders		3	SS	25/50 mm	▨	383		○		
381.8						▨	382				
2.5	Auger Refusal Advanced NW casing to 2.5 m, start coring Bedrock - grey granitic bedrock good quality		4	RC	Rec= 100% RQD= 76%		381				
			5	RC	Rec= 100% RQD= 82%		380				
378.8							379				
5.5	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

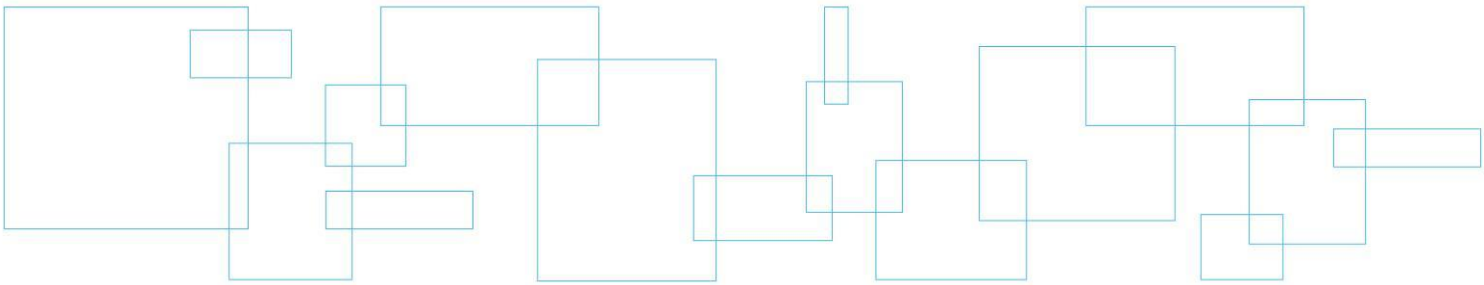
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 13/7/3 4:35:00 PM	0.9 ▽	2 ▨
2) 13/7/3 5:05:00 PM	0.4 ▽	1.4
3)	- ▼	-

MEL-GEO 13073-F8 - BOREHOL LOGS.GPJ MEL-GEO.GDT 13/10/1

L|V|M
120 Progress Court, North Bay, On P1A 0C2 Phone: (705)476-2550 Fax: (705)476-8882 Email: northbay@lvm.ca

Appendix 3 Borehole Plan and Lab Data

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



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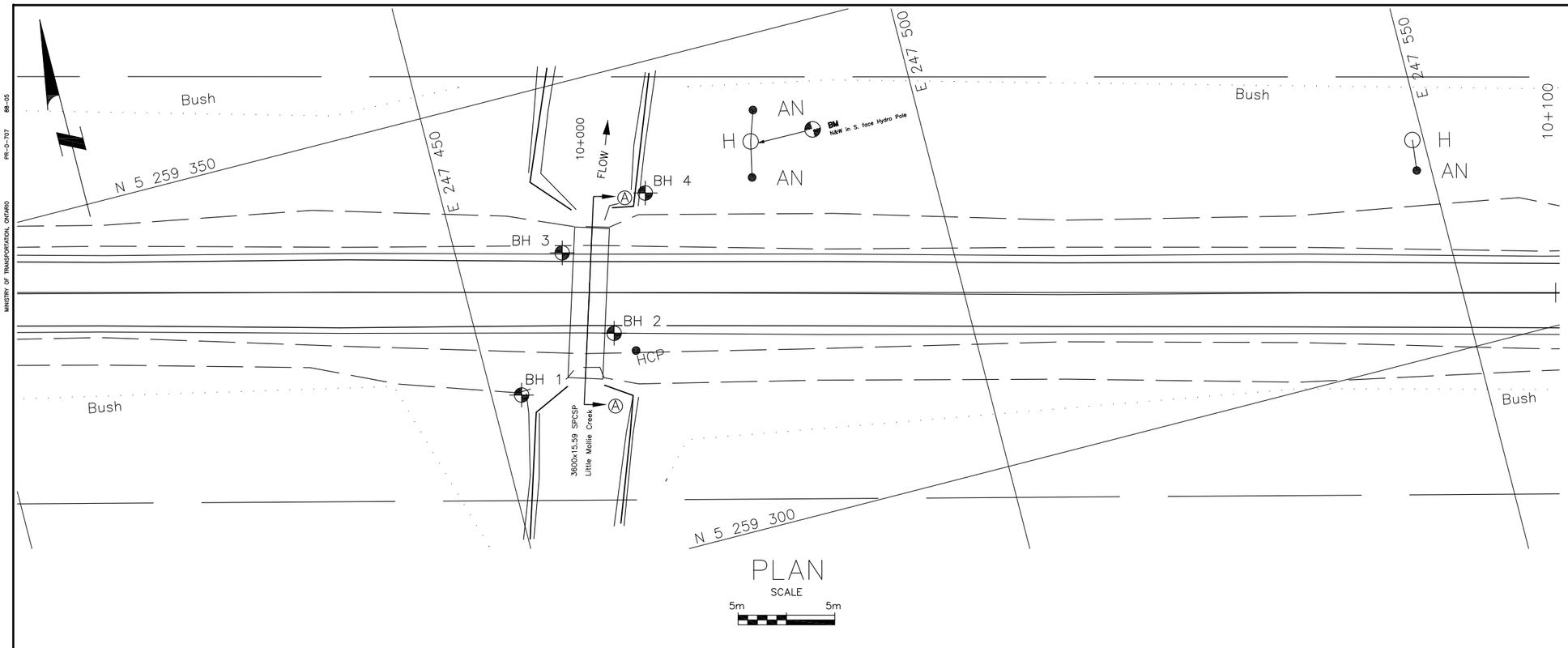
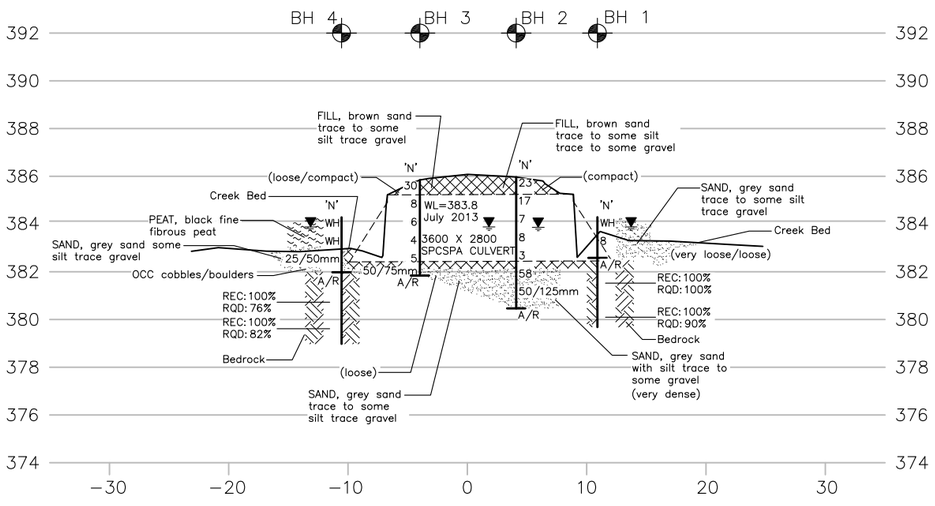


PLAN

SCALE

5m 5m

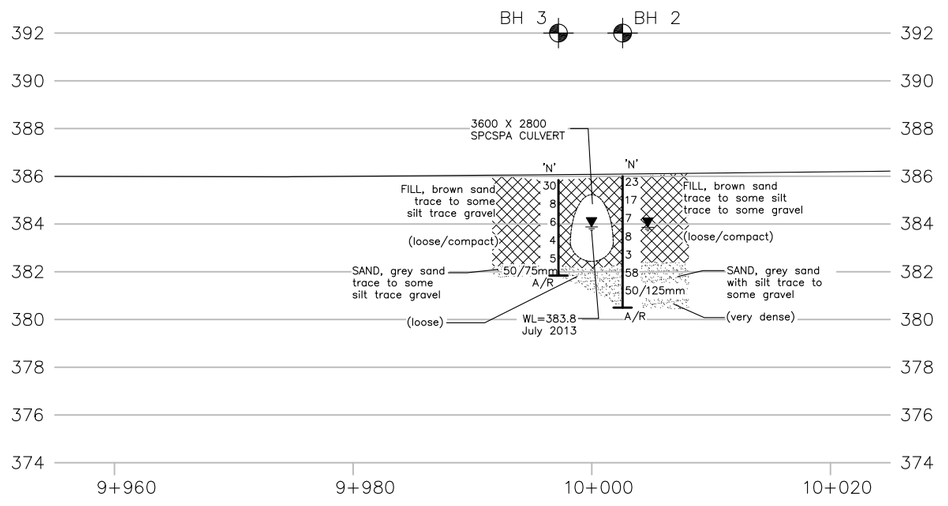


SECTION AT CULVERT Ⓐ − Ⓐ

SCALE

5m 5m HOR

2.5m 2.5m VER



℄ PROFILE

SCALE

5m 5m HOR

2.5m 2.5m VER

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. 5263-10-00

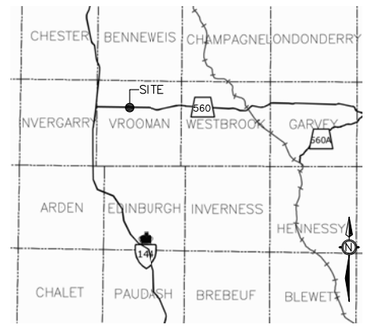
HWY 560
LITTLE MOLLIE CREEK CULVERT
SITE NO. 47-401/C

BOREHOLE LOCATIONS AND SOIL STRATA

LVM

SHEET

METRIC



KEY PLAN

N.T.S.

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.	ELEVATION	O/S	NORTHING	EASTING
1	384.3	10.6m Rt	5259319.7	247453.0
2	386.0	4.2m Rt	5259323.5	247463.9
3	385.8	4.1m Lt	5259332.9	247460.8
4	384.3	10.3m Lt	5259336.8	247470.6

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.

GEOCRES No. 41P-53

REVISIONS

DESCRIPTION				
DESIGN	CHK	CODE	LOAD	DATE DEC/13
DRAWN MCM	CHK AT	SITE 47-401/C	STRUCT	SCHEME DWG 2

Reference No.: 13/05/13073-F8
Date: December 2013

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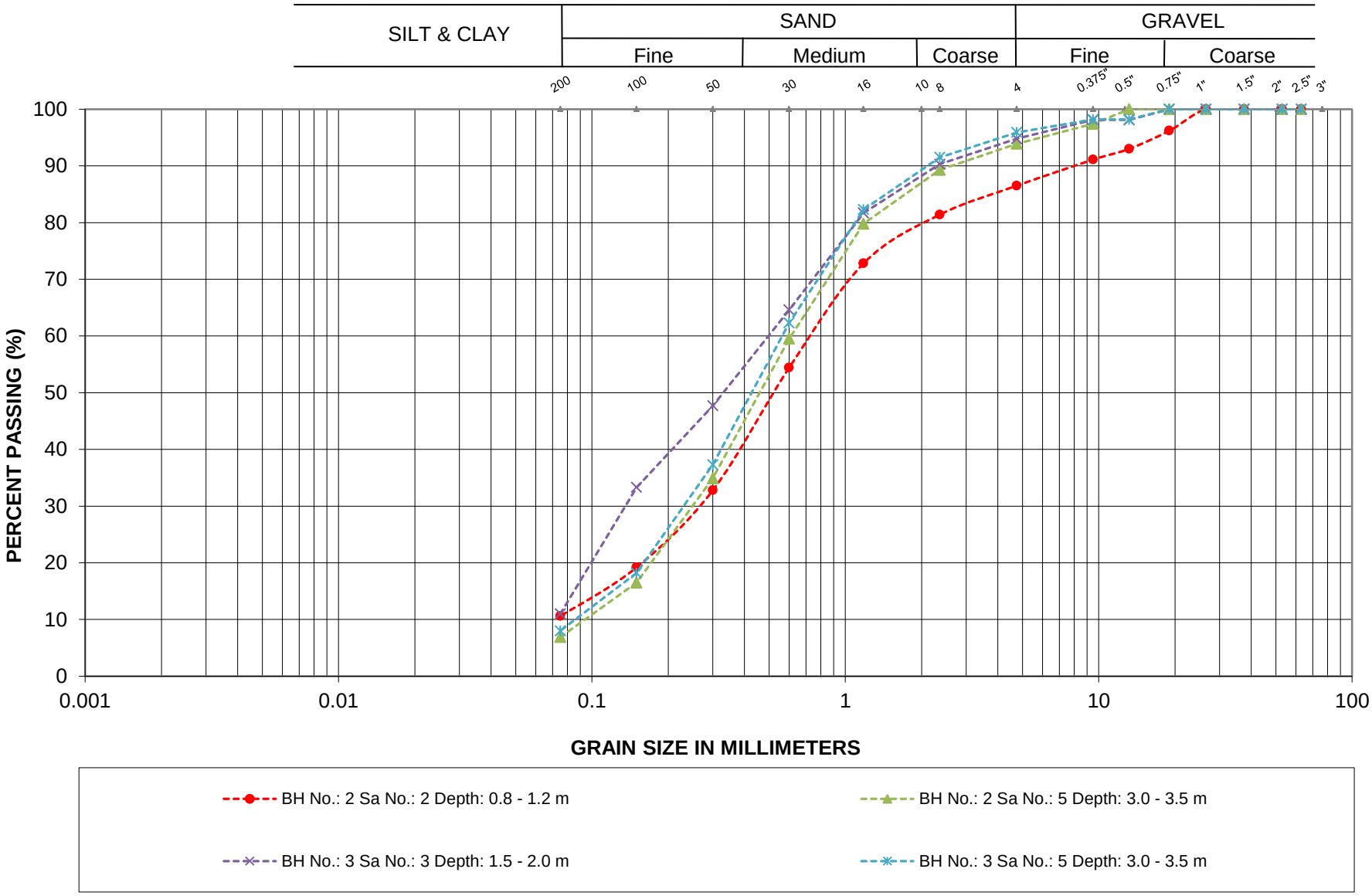
GRAIN SIZE ANALYSIS



G.W.P.: 5263-10-00
LOCATION: Hwy 560

EMBANKMENT FILL

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FIGURE L-1

Reference No.: 13/05/13073-F8
Date: December 2013

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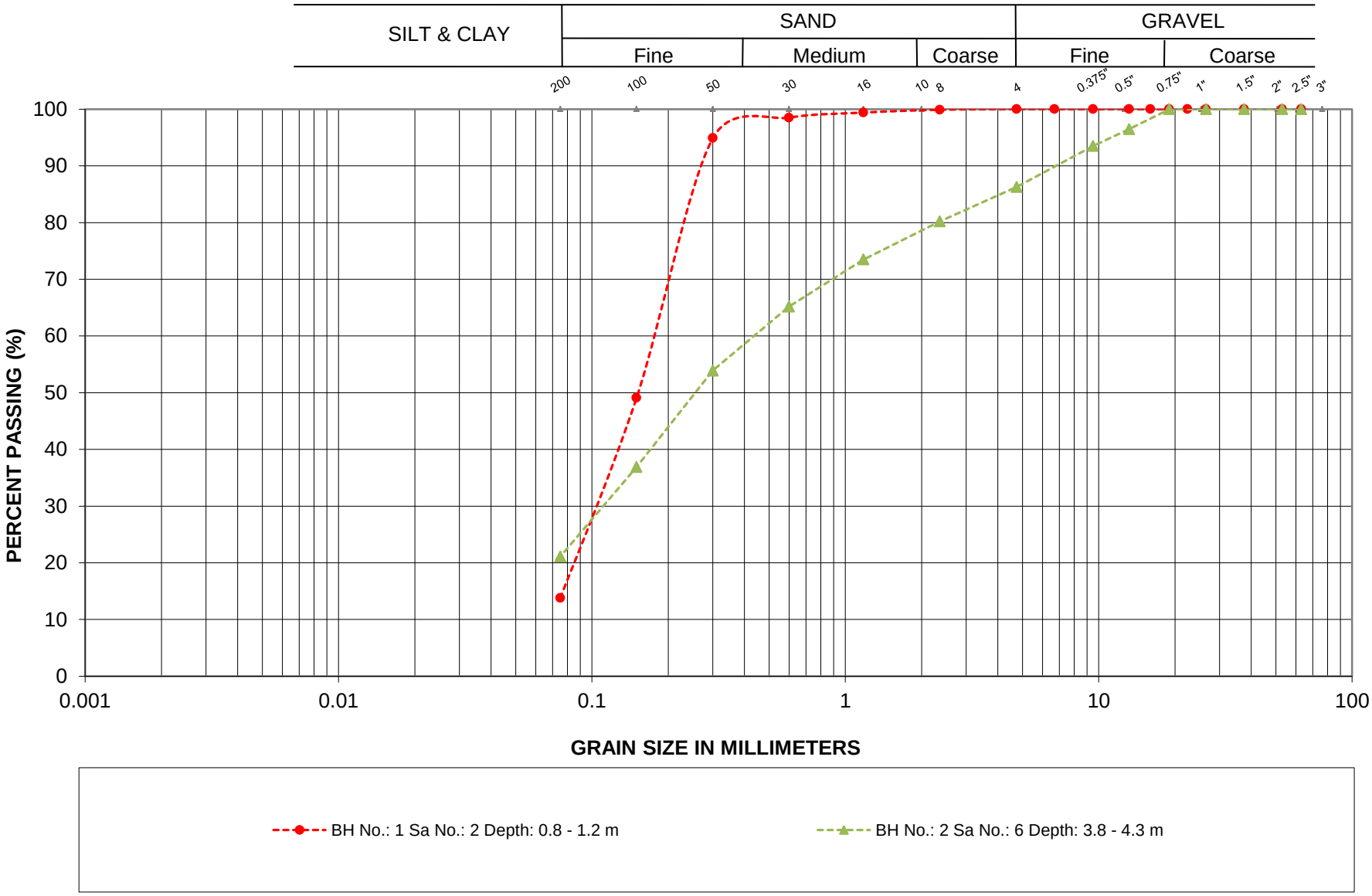
GRAIN SIZE ANALYSIS



G.W.P.: 5263-10-00
LOCATION: Hwy 560

SAND

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FIGURE L-2

LVM | MERLEX

Laboratory Tests - Summary Sheet

Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
1	1	0.0					20.8				WH			
	2	0.8	0	86	14		23.5				8			
	3	1.5					18.9				25/50 mm			
2	1	0.0					3.5				23			
	2	0.8	13	76	11		7.8				17			
	3	1.5					11.1				7			
	4	2.3					17.1				8			
	5	3.1	6	87	7		16.0				3			
	6	3.8	14	65	21		8.4				58			
	7	4.6					9.0				50/125 mm			
3	1	0.0					7.7				30			
	2	0.8					5.2				8			
	3	1.5	5	84	11		12.3				6			
	4	2.3					15.7				4			
	5	3.1	4	88	8		14.3				5			
	6	3.8					10.8				50/75 mm			
4	1	0.0					272.0				WH			
	2	0.8					167.0				WH			
	3	1.5					13.3				25/50 mm			

Appendix 4 Photo Essay

Enclosure No. 6: Photo Essay

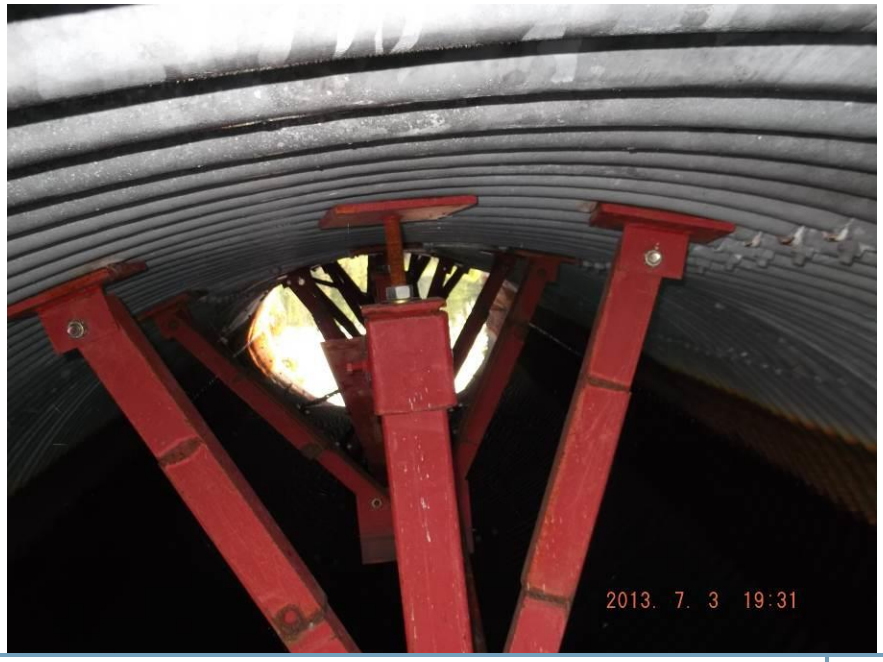
Existing Embankment at Culvert Location – Looking East	Photo: 1

Culvert Inlet – Looking South	Photo: 2

Project: Hwy 560 – Station 10+000, Twp of Vrooman	Photos Provided By: LVM Date: July 2013

Culvert Outlet – Looking North	Photo: 3

View through culvert – Looking South	Photo: 4



Project: Hwy 560 – Station 10+000, Twp of Vrooman	Photos Provided By: LVM Date: July 2013