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

Highway 124 Rehabilitation
Culvert Replacement
Station 25+160 - Twp. of Croft
GWP 5467-09-00

Highway 124
From 1.0 km West of West Junction Hwy 520, Easterly 20.7 km to 2.4 km East of Hwy 510

FINAL FOUNDATION INVESTIGATION REPORT

Date: May 30, 2013
Ref. Nº: 12/08/12141-F2

Geocres No. 31E-322B

LVM | MERLEX

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Station 25+160 - Twp. of Croft
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Final Foundation Investigation Report

Prepared by:

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Property and Confidentiality

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North Bay, Ontario
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Attention: **Mr. Al Rose**

REVISION AND PUBLICATION REGISTER		
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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 for the proposed replacement of an existing culvert and a possible detour or protection system to be used during the culvert replacement. This culvert replacement is located on Highway 124, some 350 m West of the East Junction with Hwy 520, in the Township of Croft.

The foundation investigation location was specified by the MTO in the RFP/TPM documentation Agreement No. 5011-E-0021. The terms of reference for the scope of work are outlined in LVM | MERLEX's Proposal P-11-151, dated March, 2012. The purpose of this investigation was to determine the subsurface conditions in the area of the culvert, proposed detour and possible protection system in order to provide geotechnical design recommendations. 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 existing 800 mm diameter Corrugated Steel Pipe (CSP) culvert, to be replaced, is located at Station 25+160, Township of Croft. The topography at the site is low, and the culvert allows flow from a ditch, on the south side of the embankment, to Whalley Lake to the north. The existing highway embankment currently supports two undivided lanes of highway, running in an east-west direction. The existing highway, at the culvert location, is constructed on a rock fill embankment some 4.3 m in height, with centerline elevation of 294.0 m at the culvert location. The culvert at this location is an 800 mm diameter CSP culvert, some 28.67 m in length. Flow was not observed in the culvert at the time of this investigation (see Photo Essay, Appendix 4). In general, the flow at this culvert location is from south to north based on culvert inverts and topography.

Infrastructure at the culvert location consists of overhead wires on the south (right) side of the highway.

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 124 is generally slightly rolling. There are exposed bedrock ridges. At many locations, significant layers of earth overlay the bedrock. Organic terrain was also observed. Within the specific culvert area overburden consists primarily of silts and sands.

3 INVESTIGATION PROCEDURES

The field work for this investigation was carried out during the period of August 29th to September 20th, 2012 during which time ten (10) sampled boreholes and DCPTs, were

advanced. For the purposes of foundation design for the culvert replacement and for the detour or possible protection system, two boreholes were advanced at the culvert outlet, three boreholes were advanced through the embankment and five boreholes were advanced along the south toe of the embankment, two of which were advanced at the culvert inlet.

The field investigation was carried out using a Bombardier and a truck 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. At the boreholes, a Dynamic Cone Penetration Test (DCPT) was carried out to give a continuous plot of the soil resistance with depth. When cohesive deposits were encountered, the in-situ strength was measured using an "N" size field vane, vane collar, and calibrated torque meter. All samples taken during this investigation were stored in labeled airtight containers for transport to our North Bay laboratory for visual examination and select laboratory testing.

Groundwater conditions in the open boreholes were observed during the advancement of, and immediately following, completion of the individual boreholes. All open boreholes were backfilled upon completion with compacted auger cuttings, in the general order they were removed and, where necessary, bentonite pellet backfill was added to the boreholes to bring them up to grade. 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 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, Atterberg Limits testing, as well as specific gravity testing. 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 C (Figures Nos. L-1 to L-7).

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

4 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 Figure 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 and Dynamic Cone Penetration Tests (DCPT), plus field observations. Typically such boundaries represent transitions from one zone to another and are not an exact demarcation of a 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 25+160, TWP OF CROFT

A plan and profile illustrating the borehole locations and stratigraphic sequences is shown on Figure No. 2, Appendix 3. During the course of the exploration program, ten (10) sampled boreholes were put down at this site, with Borehole Nos. 3, 9, and 10 advanced through the embankment, and Borehole Nos. 1 and 4, and 2 and 8, advanced at the culvert inlet and outlet, respectively. Boreholes No. 5 to 7 inclusive were advanced at the toe of the embankment to the south (right) of the existing embankment. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 10 were recorded at 290.6, 290.2, 294.0, 290.7, 293.1, 291.9, 292.6, 290.5, 294.0, and 294.0 m, respectively.

4.1.1 Pavement Structure

At surface at Borehole Nos. 3, 9, and 10, a pavement structure consisting of 65 to 75 mm of asphalt and 425 to 550 mm crushed gravel was penetrated.

4.1.2 Fill

Underlying the crushed gravel at Borehole Nos. 3, 9, and 10, a deposit of fill consisting of brown sand trace to with silt trace to some gravel was penetrated. A distinction between the subbase and embankment fill was not observed. The natural moisture content measured on samples of this deposit was in the order of 2 to 22%. Gradation analyses were carried out on five (5) samples of this deposit, the results of which indicated 1 to 20% gravel size particles, 63 to 81% sand size particles, and 6 to 23% silt and clay size particles (Figure No. L-1, Appendix 3). Based on SPT ‘N’ values of 15 to 76 blows per 300 mm penetration, the compactness of this deposit was described as compact to very dense, generally compact. This deposit was encountered to a depth of 4.3 m below grade at Borehole Nos. 3 and 9 (elevation 289.7 m). Auger refusal, probably on a boulder/rock fill, was encountered in this deposit at a depth of 2.3 m at Borehole No. 10 (elevation 291.7 m).

4.1.3 Surficial Organics

At surface at BH Nos. 2, 6, 7, and 8, a layer of surficial organics, some 50 to 100 mm thick, was penetrated.

4.1.4 Peat

Underlying the surficial organics at Borehole No. 8, a deposit of black fibrous peat was encountered. The natural moisture content measured on samples of this deposit was in the order of 56%. This deposit was encountered to a depth of 0.8 m below grade (elevation 289.7 m).

4.1.5 Silty Sand

At surface at Borehole Nos. 1, 4, and 5, underlying the surficial organics at Borehole Nos. 2, 6, and 7, underlying the peat at Borehole No. 8, and underlying the fill at Borehole Nos. 3 and 9, a deposit of grey silty sand described as a sand with silt to a silt and sand, trace to with gravel was penetrated. Trace organics were encountered in this deposit. The natural moisture content measured on samples of this deposit was in the order of 15 to 39%. Gradation analyses were carried out on five (5) samples of this deposit, the results of which indicated 0 to 25% gravel size particles, 35 to 78% sand size particles, and 22 to 65% silt and clay size particles (Figure No. L-2, Appendix 3). Based on SPT 'N' values of 0 (static weight of hammer) to 4 blows per 300 mm penetration, the compactness of this deposit was described as very loose. This deposit was encountered to depths of 1.5, 1.5, 5.7, 0.9, 0.7, 0.8, 1.4, and 5.2 m below grade at Borehole Nos. 1, 2, 3, 4, 5, 7, 8, and 9, respectively (elevations 289.1, 288.7, 288.3, 289.8, 292.4, 291.8, 289.1, and 288.8 m, respectively).

4.1.6 Silty Clay

Underlying the silty sand at Boreholes Nos. 2, 3, 7, and 8, and at surface at Borehole No. 6, a deposit of grey silty clay was penetrated. The natural moisture content measured on samples of this deposit was in the order of 25 to 54%. Hydrometer analyses were carried out on six (6) samples of this deposit, the results of which indicated 0% gravel size particles, 1 to 14% sand size particles, 56 to 83% silt size particles, and 16 to 40% clay size particles (Figure No. L-3, Appendix 3). Atterberg Limits testing was carried out on six (6) samples of this deposit, the results of which indicated a Plastic Limit in the order of 19 to 23% and a Liquid Limit in the order of 32 to 46% (Figure No. L-6, Appendix 4). Based on results of Atterberg Limits testing, this deposit was described as a silty clay of low to medium plasticity (CL to CI). Based on in-situ shear strengths of 16 to 94 kPa, this deposit was described as soft to stiff. This deposit was encountered to depths of 3.8, 6.7, 0.8, 3.8, and 3.7 m below grade at Borehole Nos. 2, 3, 6, 7, and 8, respectively (elevations 286.4, 287.3, 291.1, 288.8, and 286.8 m, respectively).

4.1.7 Silt

Underlying the silty clay at Borehole Nos. 2, 3, 6, 7, and 8 and underlying the silty sand at Borehole No. 9, a deposit of grey silt, trace to with sand, trace clay gravel was penetrated. The natural moisture content measured on samples of this deposit was in the order of 18 to 26%. Hydrometer analyses were carried out on three (3) samples of this deposit, the results of which indicated 0% gravel size particles, 7 to 31% sand size particles, 69 to 88% silt size particles, and 2 to 5% clay size particles (Figure No. L-4, Appendix 3). This deposit was encountered to

depths of 5.8 and 1.5 m below grade at Borehole Nos. 2 and 6, respectively (elevations 284.4 and 290.4 m, respectively). Auger refusal was encountered in the deposit at depths of 8.7, 6.2, 6.1, and 9.0 m, at Borehole Nos. 3, 7, 8 and 9, respectively (elevations 285.3, 286.4, 284.4, and 285.0 m, respectively).

4.1.8 Sand

Underlying the silty sand deposit at Borehole Nos. 1, 4, and 5, and underlying the silt deposit at Borehole Nos. 2 and 6, a deposit of grey sand trace to with silt, some to with gravel was penetrated. Occasional cobbles and boulders were encountered in this deposit. The natural moisture content measured on samples of this deposit was in the order of 10 to 23%. Gradation analyses were carried out on two (2) samples of this deposit, the results of which indicated 18 to 27% gravel size particles, 49 to 77% sand size particles, and 5 to 24% silt and clay size particles (Figure No. L-5, Appendix 3). Auger refusal was encountered in this deposit at depths of 2.9, 6.9, 1.9, 1.5, and 3.8 m at Borehole Nos. 1, 2, 4, 5, and 6, respectively (elevations 287.7, 283.3, 288.8, 291.6, and 288.1 m, respectively).

4.1.9 DCPT

Dynamic Cone Penetration Tests (DCPT) were advanced from grade at BH Nos. 1 to 10. DCPT refusal was encountered at depths of 3.1, 6.2, 8.1, 2.2, 1.5, 3.9, 6.2, 6.5, 8.8, and 4.8 m below grade at Borehole Nos. 1 to 10, respectively (elevations 287.5, 284.0, 285.9, 288.5, 291.6, 288.0, 286.4, 284.0, 285.2, and 289.2 m, respectively).

4.2 GROUNDWATER DATA

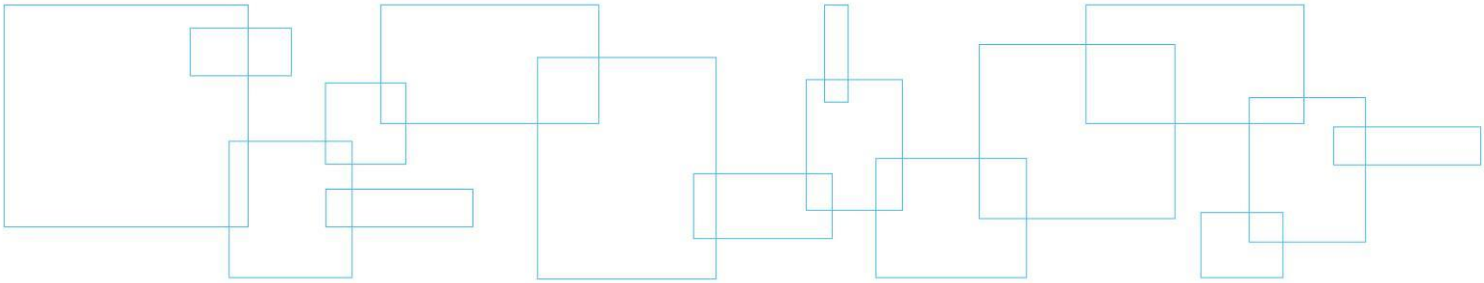
The water level in Whalley Lake was measured at elevation 290.0 m at the time of this investigation.

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. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix B). The water levels were measured between elevations 289.0 and 291.3 m upon completion at Borehole Nos. 1 to 4, and 6 to 8. Borehole Nos. 5, 9, and 10 were dry upon completion.

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

Appendix 1 Key Plan

Drawing No. 1 Key Plan



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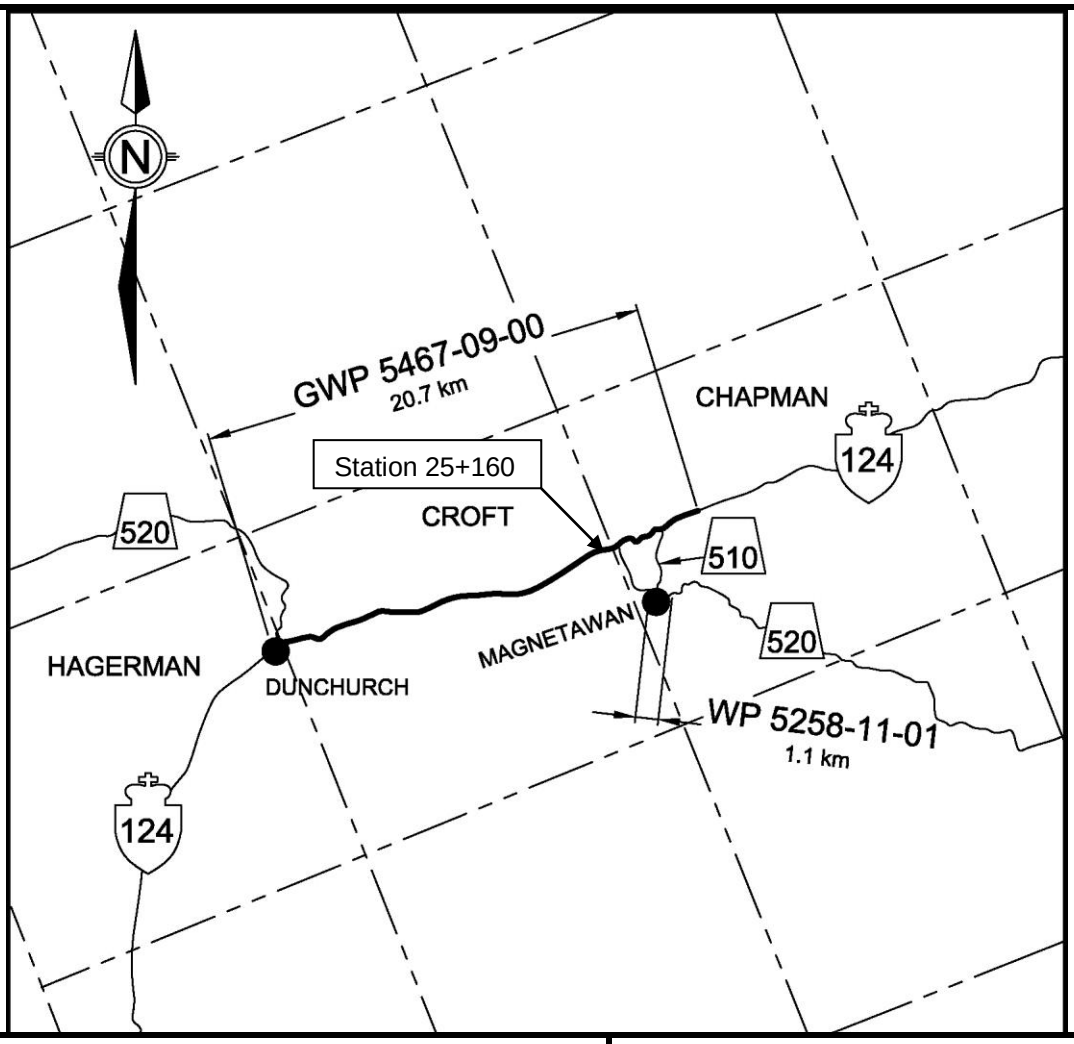
KEY PLAN

Drawing No. 1

NOT TO SCALE



FINAL
FOUNDATION INVESTIGATION REPORT
GWP 5467-09-00
Highway 124

From 1.0 km West of West Junction Hwy 520,
Easterly 20.7 km to 2.4 km East of Hwy 510

Reference No: 12/08/12141-F2 May 2013

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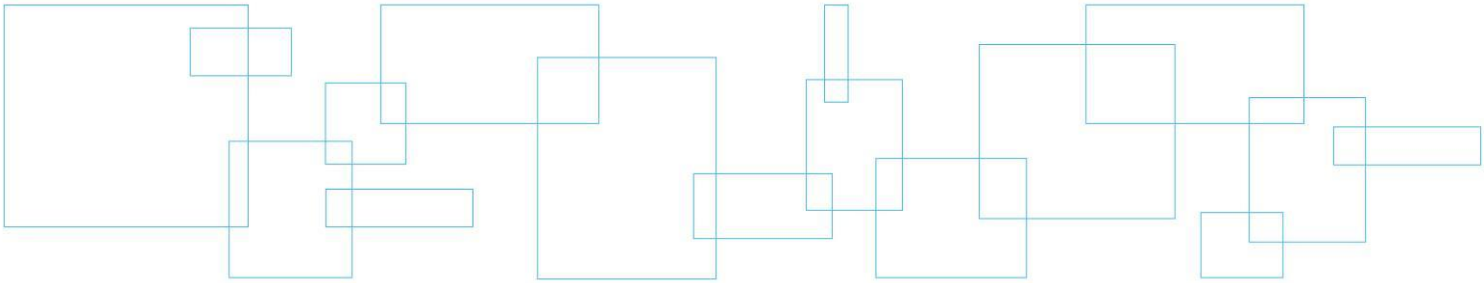
Appendix 2 Subsurface Data

Enclosure No. 1	List of Abbreviations and Symbols
Enclosure Nos. 2 to 11	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. 01

LVM

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 625.3 E 291 724.5 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 30 August 2012 TIME (Completed) 11:10:00 AM CHECKED BY MAM

DATE (Completed) 30 August 2012

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)
290.6	Ground Surface										
0.0	SAND - grey sand with silt trace orgranics (very loose)		1	AS		▽	290				
			2	SS	3	▽					0 78 (22)
289.1											
1.5	SAND - brown sand trace silt some gravel occasional cobbles and boulders (dense/very dense)		3	SS	56	▨	289				
			4	SS	41		288				18 77 (5)
287.7											
2.9	Auger Refusal										
287.5											
3.1	DCPT Refusal End of Borehole										

COMMENTS

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

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

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 30/8/12 11:00:00 AM	0.8 ▽	1.8 ▨
2) 31/8/12 10:00:00 AM	0.4 ▽	-
3)	- ▼	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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

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

METRIC

RECORD OF BOREHOLE NO. 02

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 658.2 E 291 725.3 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 31 August 2012 TIME (Completed) 10:10:00 AM CHECKED BY MAM

DATE (Completed) 31 August 2012

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
290.2	Ground Surface					
0.0	100 mm organics					
	SILT AND SAND - grey sand and silt trace gravel		1	AS		
	(very loose)		2	SS	WH	▽
288.7						
1.5	SILTY CLAY - grey silty clay		3	SS	PM	
	(soft/stiff)		4	SS	PM	
			5	SS	PM	
286.4						
3.8	SILT - grey silt with sand trace clay		6	SS	2	▨
	(very loose)		7	SS	WH	
284.4						
5.8	SAND - grey sand some silt some gravel					
284.0	(dense)		8	SS	57	
6.2	DCPT Refusal					
283.3						
6.9	Auger Refusal End of Borehole					

ELEVATION SCALE: 290, 289, 288, 287, 286, 285, 284

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)
1	46		(53)	
0	0	60	40	
0	1	74	25	
0	26	72	2	

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) 31/8/12 10:00:00 AM	1.2 ▽	4 ▨
2)	- ▽	-
3)	- ▼	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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

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

METRIC

RECORD OF BOREHOLE NO. 03

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 642.2 E 291 722.0 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers and NQ casing COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 13 September 2012 TIME (Completed) 12:00:00 PM CHECKED BY MAM

DATE (Completed) 13 September 2012

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)
294.0	Ground Surface										
0.0	65 mm Asphalt 425 mm Crushed Gravel FILL - brown sand some to with silt trace to some gravel (compact/dense)		1	AS							
	trace asphalt		2	SS	15		293				1 76 (23)
			3	SS	48		292				
			4	SS	26		291				
			5	SS	16						19 63 (18)
289.7			6	SS	25		290				
4.3	SANDY SILT - brown sandy silt trace clay trace organics (loose)		7	SS	4	▽	289				1 35 54 10
288.3											
5.7	SILTY CLAY - grey silty clay (stiff)		8	SS	3		288				0 1 83 16
287.3											
6.7	SILT - grey silt some sand trace clay (very loose)		9	SS	2	▨	287				
285.9							286				
8.1	DCPT Refusal										
285.3											
8.7	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) 13/9/12 12:00:00 PM	4.7 ▽	7.1 ▨
2)	- ▽	-
3)	- ▼	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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

METRIC

RECORD OF BOREHOLE NO. 04

LVM

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 626.9 E 291 728.8 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 30 August 2012 TIME (Completed) 9:10:00 AM CHECKED BY MAM

DATE (Completed) 30 August 2012

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)
290.7	Ground Surface										
0.0	SILTY SAND - brown silty sand with gravel occasional cobbles/boulders (loose)		1	AS		▽			○		25 43 (32)
289.8							290				
0.9	SAND - grey sand trace silt with gravel occasional cobbles/boulders (compact/dense)		2	SS	10	▩			○		
288.8			3	SS	36		289		○		
1.9	Auger Refusal										
288.5											
2.2	DCPT Refusal End of Borehole										

COMMENTS

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

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

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 30/8/12 9:05:00 AM	0.5 ▽	1.2 ▩
2)	- ▽	-
3)	- ▼	-

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

METRIC

RECORD OF BOREHOLE NO. 05

LVM

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 625.5 E 291 694.6 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 30 August 2012 TIME (Completed) 12:05:00 PM CHECKED BY MAM

DATE (Completed) 30 August 2012

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
293.1	Ground Surface					
0.0	SILTY SAND - brown silty sand trace gravel		1	AS		
292.4						
0.7	SAND - brown sand with silt with gravel occasional cobbles/boulders (dense)		2	SS	35/200 mm	
291.6						
1.5	Auger Refusal DCPT Refusal End of Borehole					

ELEVATION SCALE: 293, 292

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)

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) 30/8/12 12:00:00 PM	DRY	1.4
2)	-	-
3)	-	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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

METRIC

RECORD OF BOREHOLE NO. 06

LVM

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 631.6 E 291 757.3 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 29 August 2012 TIME (Completed) 5:22:00 PM CHECKED BY MAM

DATE (Completed) 29 August 2012

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
291.9	Ground Surface					
0.0	50 mm organics					
	SILTY CLAY - brown to grey silty clay some sand		1	AS		
291.1						
0.8	SILT - brown sandy silt		2	SS	22	
	(compact)					
290.4						
1.5	SAND - grey sand with silt with gravel		3	SS	17	▽
	occasional cobbles/boulders					
	(loose/compact)		4	SS	7	
			5	SS	7	
288.1						
288.0	Auger Refusal					
3.9	DCPT Refusal End of Borehole					

ELEVATION SCALE: 291, 290, 289, 288

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)
	0	14	70	16
	0	31	(69)	
	27	49	(24)	

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) 29/8/12 5:15:00 PM	1.7 ▽	1.8 ▨
2)	- ▽	-
3)	- ▼	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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

METRIC

RECORD OF BOREHOLE NO. 07

LVM

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 638.5 E 291 797.7 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 29 August 2012 TIME (Completed) 2:30:00 PM CHECKED BY MAM

DATE (Completed) 29 August 2012

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)
292.6	Ground Surface										
0.0	50 mm organics										
	SILTY SAND - brown silty sand trace organics		1	AS							
291.8	(loose)										
0.8	SILTY CLAY - brown to grey silty clay trace sand		2	SS	13						0 5 56 39
	(stiff)		3	SS	5						
			4	SS	2						
			5	SS	WH						0 0 77 23
288.8											
3.8	SILT - grey silt sand trace clay		6	SS	10						0 7 88 5
	(loose)										
			7	SS	4						
286.4			8	SS	25/50 mm						
6.2	Auger Refusal DCPT Refusal End of Borehole										

COMMENTS

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

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

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 29/8/12 2:25:00 PM	2.3	4.2
2) 29/8/12 5:10:00 PM	1.8	-
3) 31/8/12 10:10:00 AM	1.3	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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

METRIC

RECORD OF BOREHOLE NO. 08

LVM

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 655.8 E 291 718.5 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 30 August 2012 TIME (Completed) 4:40:00 PM CHECKED BY MAM

DATE (Completed) 30 August 2012

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
290.5	Ground Surface					
0.0	100 mm organics					
	PEAT - black fibrous peat with sand		1	AS		
289.7						
0.8	SILTY SAND - grey silty sand trace gravel		2	SS	WH	
289.1	(very loose)					
1.4	SILTY CLAY - grey silty clay		3	SS	WH	
	(soft)					
			4	SS	PM	
			5	SS	PM	
286.8						
3.7	SILT - grey silt with sand		6	SS	6	
	(very loose/loose)					
			7	SS	WH	
284.4						
6.1	Auger Refusal					
284.0						
6.5	DCPT Refusal End of Borehole					

ELEVATION SCALE: 290, 289, 288, 287, 286, 285, 284

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

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

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L
WATER CONTENT (%)
20 40 60

UNIT WEIGHT γ kN/m^3

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

COMMENTS

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

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

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 30/8/12 4:35:00 PM	1.1	4.8
2) 31/8/12 8:00:00 AM	0.1	-
3)	-	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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

METRIC

RECORD OF BOREHOLE NO. 09

LVM

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 643.5 E 291 732.4 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 17 September 2012 TIME (Completed) 2:00:00 PM CHECKED BY MAM

DATE (Completed) 17 September 2012

ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
294.0	Ground Surface					
0.0	75 mm Asphalt 550 mm Crushed Gravel		1	AS		
293.4						
0.6	FILL - brown sand trace to some silt trace to some gravel		2	SS	29	
	(compact/very dense)					
	layer of asphalt		3	SS	70	
			4	SS	18	
	layer of rock fill		5	SS	46	
	layer of asphalt		6	SS	48	
289.7						
4.3	SANDY SILT - grey sandy silt trace some clay trace organics		7	SS	4	
	(loose)					
288.8						
5.2	SILT - grey silt with sand trace gravel		8	SS	24	
	(compact)					
			9	SS	18	
285.2						
8.8	DCPT Refusal					
285.0						
9.0	Auger Refusal End of Borehole					

ELEVATION SCALE: 293, 292, 291, 290, 289, 288, 287, 286, 285

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

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

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
2	4	81		(15)
3	20	74		(6)
7	0	35	54	11

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) 17/9/12 6:08:00 AM	-	-
2)	-	-
3)	-	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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

METRIC

RECORD OF BOREHOLE NO. 10

REFERENCE 12/08/12141-F2 DATUM Geodetic LOCATION N 5060 635.4 E 291 709.4 - Township of Croft ORIGINATED BY JL

PROJECT GWP 5467-09-00, Highway 124 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Inc. DATE (Started) 20 September 2012 TIME (Completed) 10:30:00 AM CHECKED BY MAM

DATE (Completed) 20 September 2012

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)
294.0	Ground Surface							20 40 60 80 100	20 40 60		
0.0	65 mm Asphalt 450 mm Crushed Gravel FILL - brown sand some silt with gravel (dense/very dense)		1	AS							
			2	SS	24		293				
	asphalt layer		3	SS	76		292				20 66 (14)
291.7											
2.3	Auger Refusal on Rock Fill						291				
289.2							290				
4.8	DCPT Refusal End of Borehole										

COMMENTS

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

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

○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS

Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 20/9/12 10:25:00 AM	DRY	2.1
2)	-	-
3)	-	-

MEL-GEO 12141 - AREA 2 - BOREHOL LOGS.GPJ MEL-GEO.GDT 5/6/13

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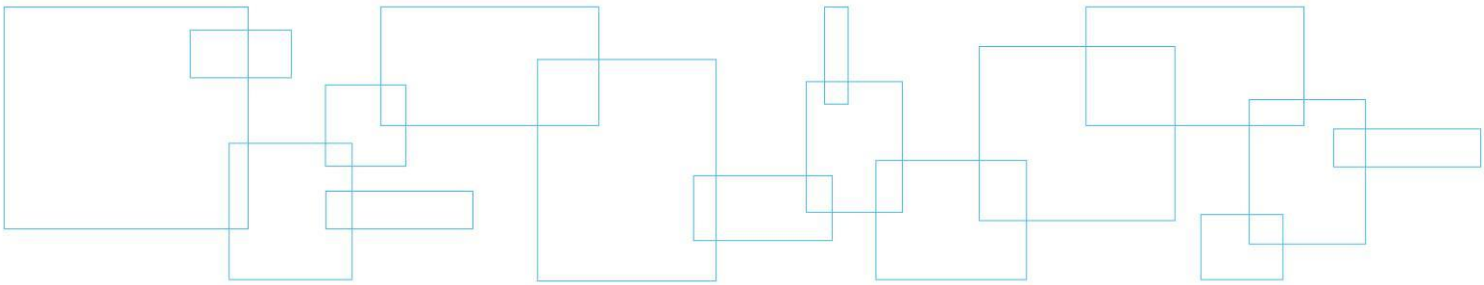
Appendix 3 Borehole Plan and Lab Data

Drawing No. 2:	Borehole Location and Soil Strata
Figure Nos. L-1 to L-5:	Grain Size Distribution Curves
Figure No. L-6:	Atterberg Limits Sheet
Figure No. L-7:	Shear Strength Chart
Figure No. L-8:	Lab Test Summary Sheet



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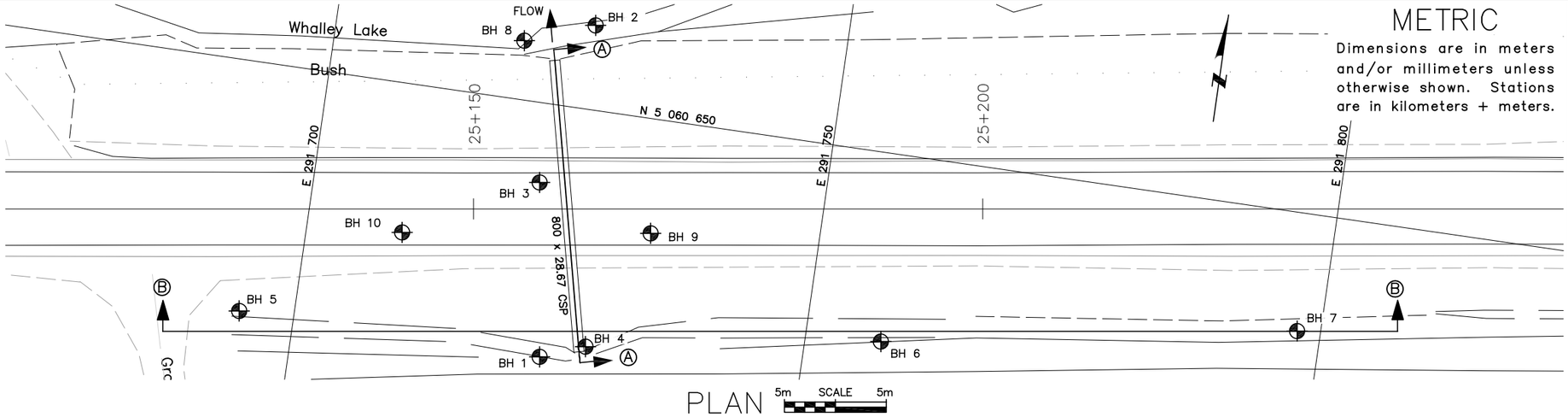
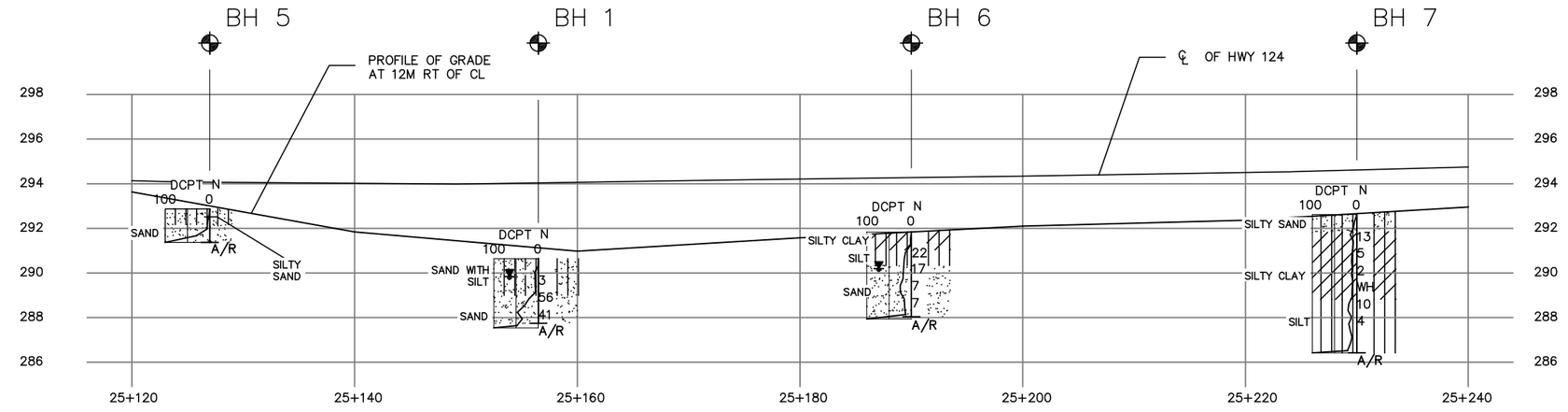
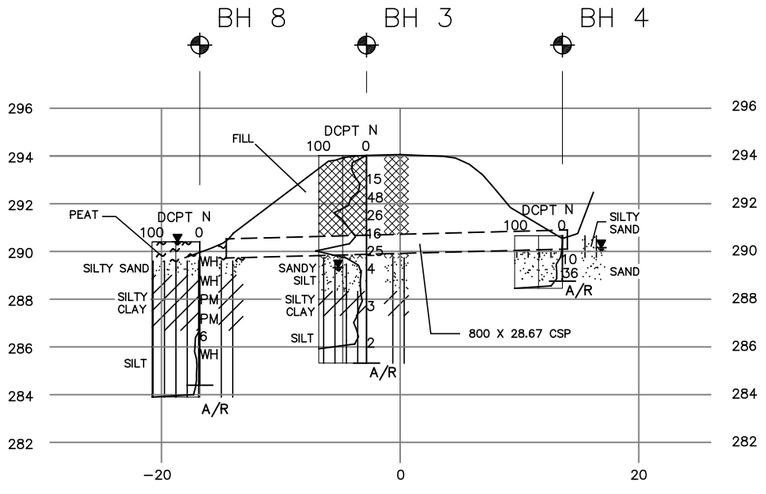


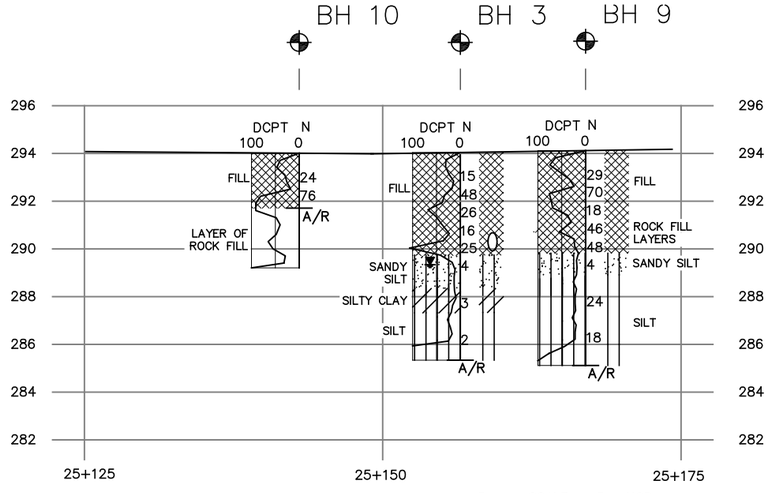
PLAN 5m SCALE 5m



DETOUR PROFILE AT Ⓑ – Ⓑ 5m SCALE 5m HOR 2.5m 2.5m VER



SECTION AT CULVERT Ⓐ – Ⓐ 5m SCALE 5m HOR 2.5m 2.5m VER



℄ PROFILE 5m SCALE 5m HOR 2.5m 2.5m VER

Cont No

GWP No 5467–09–00

N

HWY NO. 124
Township of Croft
Culvert at Station 25+160
BOREHOLE LOCATIONS & SOIL STRATA

Drawing 2

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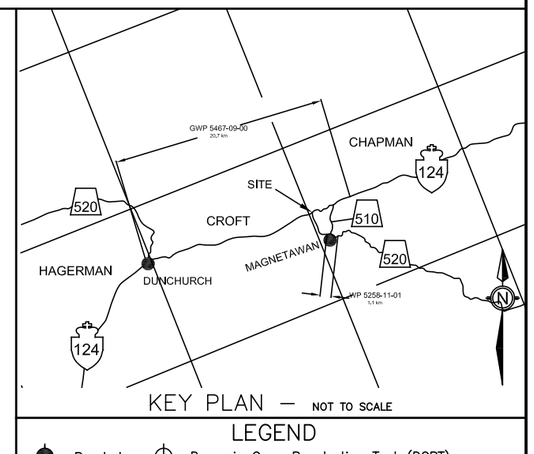
METRIC

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



KEY PLAN – NOT TO SCALE

LEGEND

- Borehole
- Dynamic Cone Penetration Test (DCPT)
- Borehole and DCPT
- 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.	Elev.	O/S	Co–ordinates Northerly	Co–ordinates Easterly
Borehole No. 1	290.6	14.5m Rt	5060625.3	291724.5
Borehole No. 2	290.2	18.0m Lt	5060658.2	291725.3
Borehole No. 3	294.0	2.6m Lt	5060642.2	291722.0
Borehole No. 4	290.7	13.5m Rt	5060626.9	291728.8
Borehole No. 5	293.1	10.0m Rt	5060625.5	291694.6
Borehole No. 6	291.9	13.0m Rt	5060631.6	291757.3
Borehole No. 7	292.6	12.0m Rt	5060638.5	291797.7
Borehole No. 8	290.5	16.5m Lt	5060655.8	291718.5
Borehole No. 9	294.0	2.4m Rt	5060638.8	291733.5
Borehole No. 10	294.0	2.3m Rt	5060635.4	291709.4

NOTE 1: 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.

NOTE 2: The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

REVISIONS	DATE	BY	DESCRIPTION
	Jan 2013	IK	DRAFT
	May 2013	MCM	FINAL

HWY No. 124 – Croft Twp – Culvert at Station 25+159.20			REF 12141–F2
SUBM'D		GEOCRES 31E–322B	SITE
DRAWN IK	CHK MAM	DATE January 2013	FIG 2

Reference No.: 12/08/12141-F2
Date: May 2013

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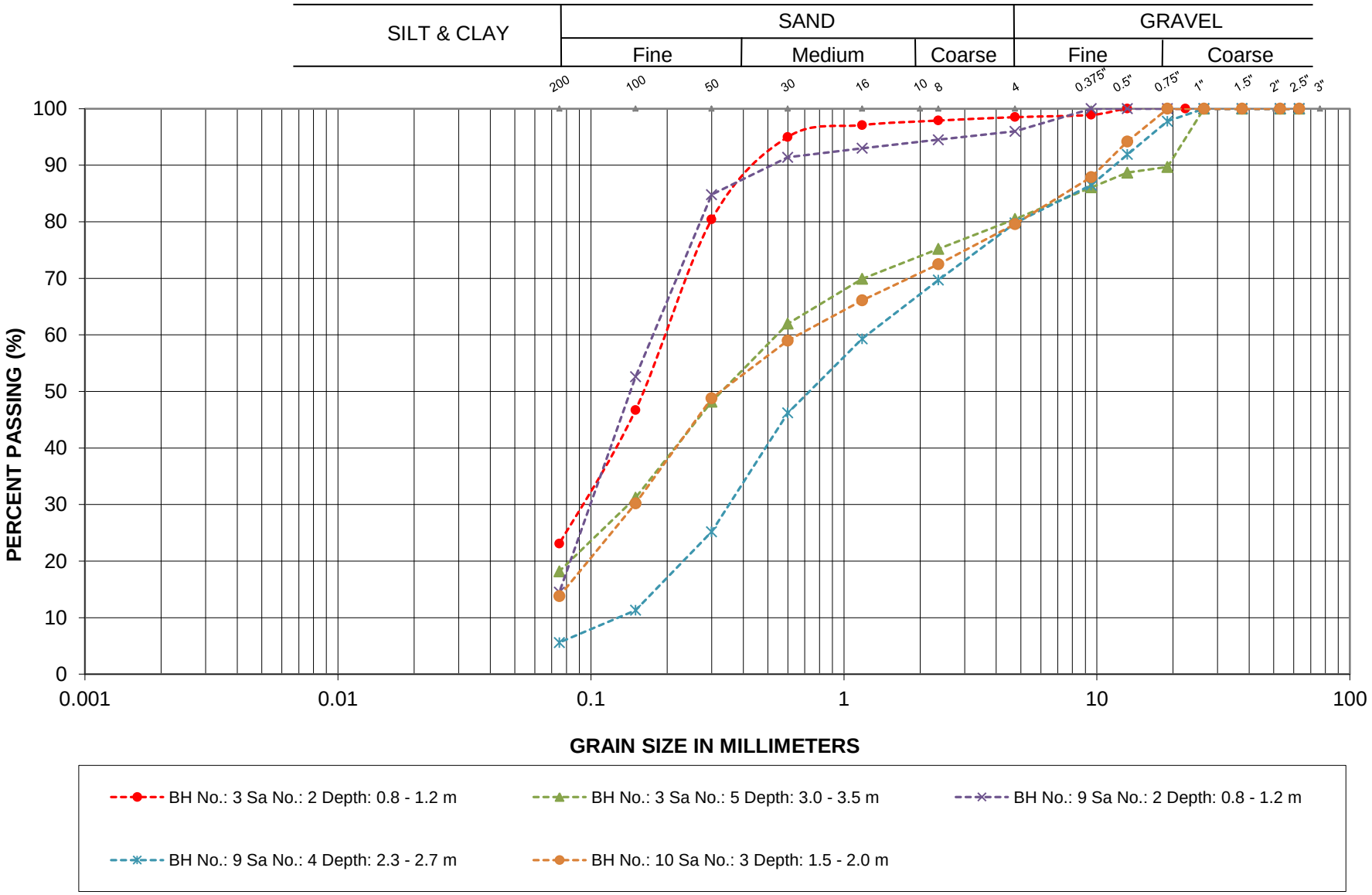
GRAIN SIZE ANALYSIS



G.W.P.: 5467-09-00
LOCATION: Hwy 124

EMBANKMENT FILL

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FIGURE L-1

Reference No.: 12/08/12141-F2
Date: May 2013

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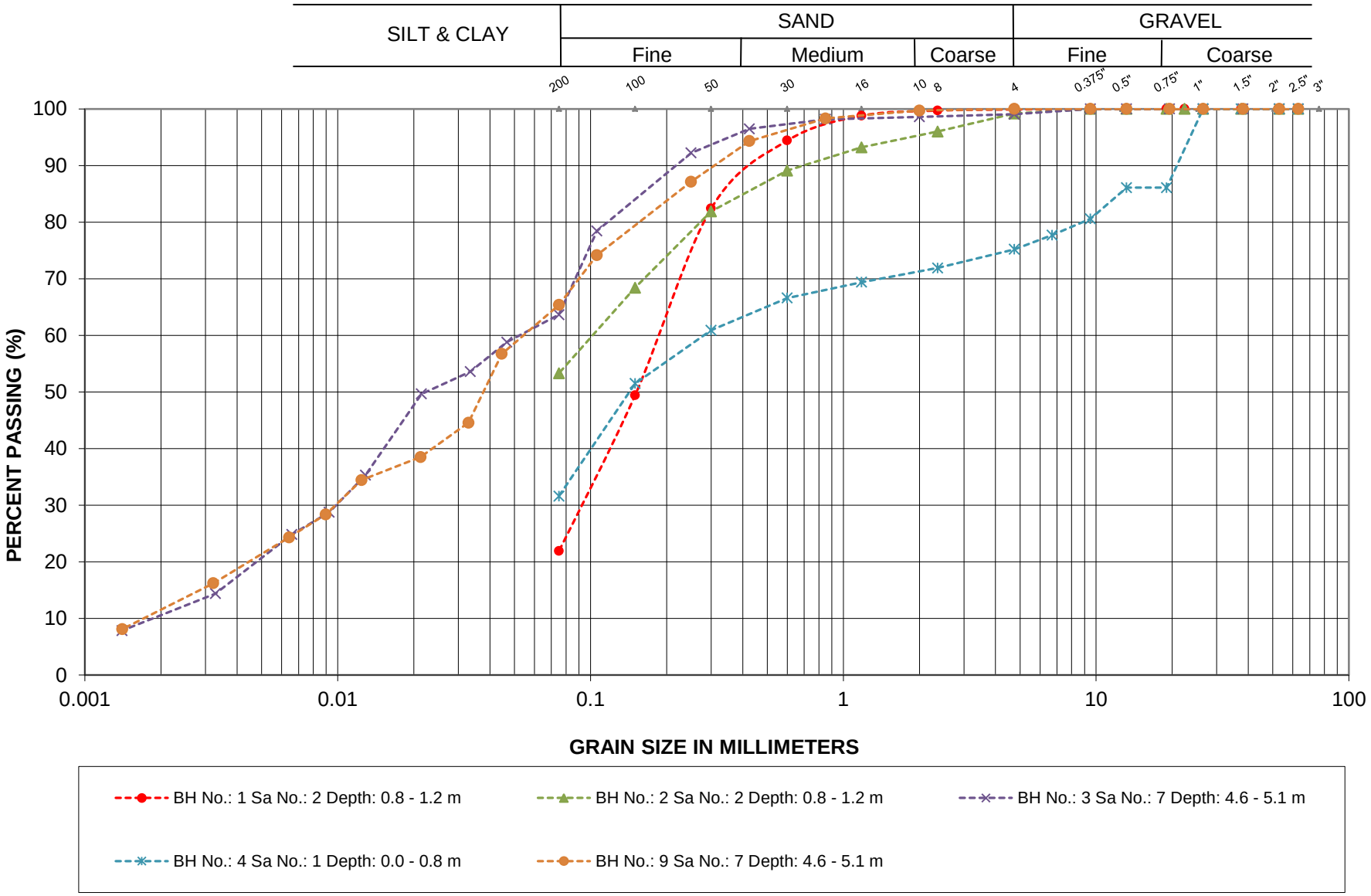
GRAIN SIZE ANALYSIS



G.W.P.: 5467-09-00
LOCATION: Hwy 124

SILTY SAND/SANDY SILT

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FIGURE L-2

Reference No.: 12/08/12141-F2
Date: May 2013

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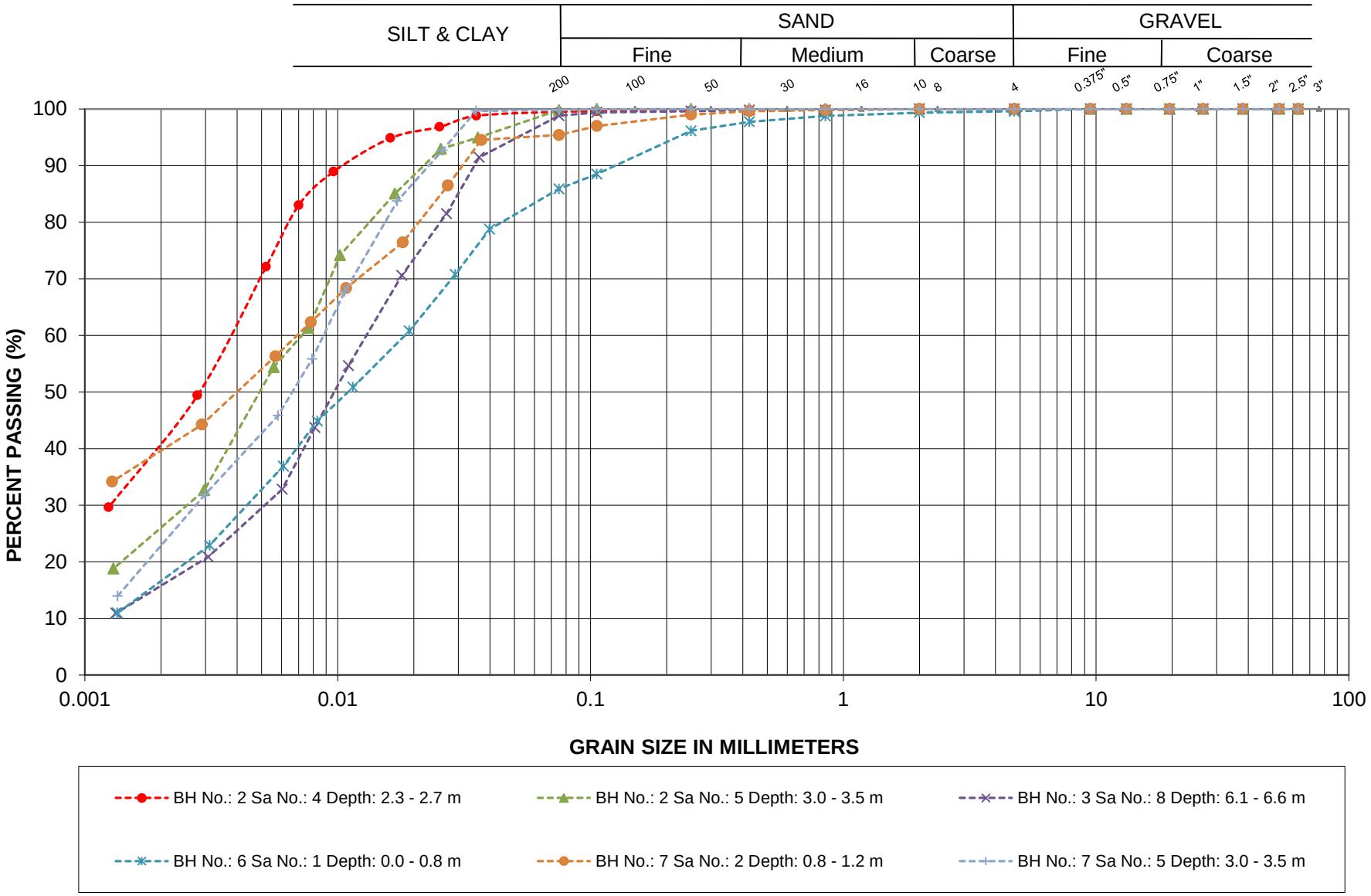
GRAIN SIZE ANALYSIS



G.W.P.: 5467-09-00
LOCATION: Hwy 124

SILTY CLAY

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FIGURE L-3

Reference No.: 12/08/12141-F2
Date: May 2013

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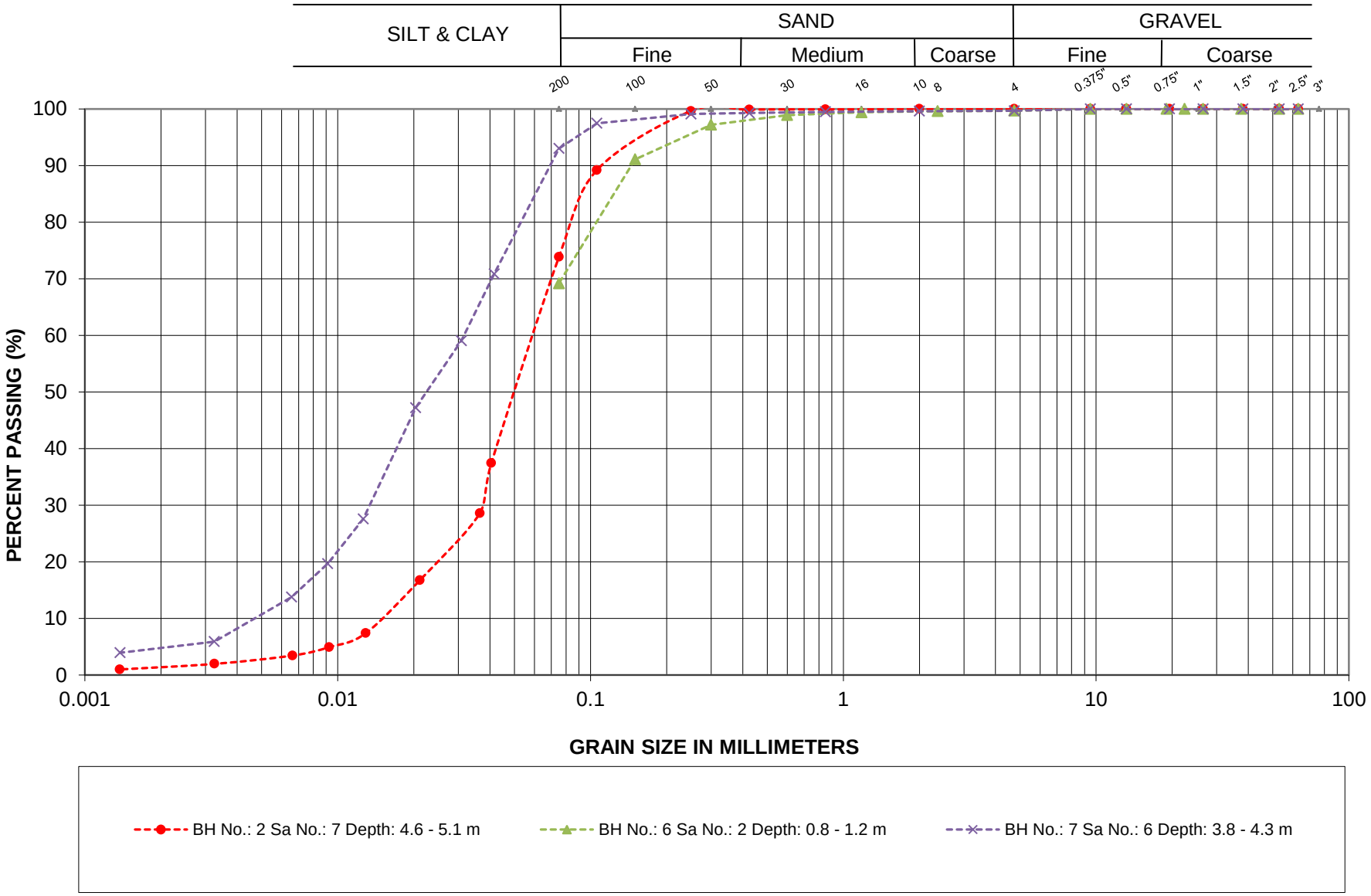
GRAIN SIZE ANALYSIS



G.W.P.: 5467-09-00
LOCATION: Hwy 124

SILT

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FIGURE L-4

Reference No.: 12/08/12141-F2
Date: May 2013

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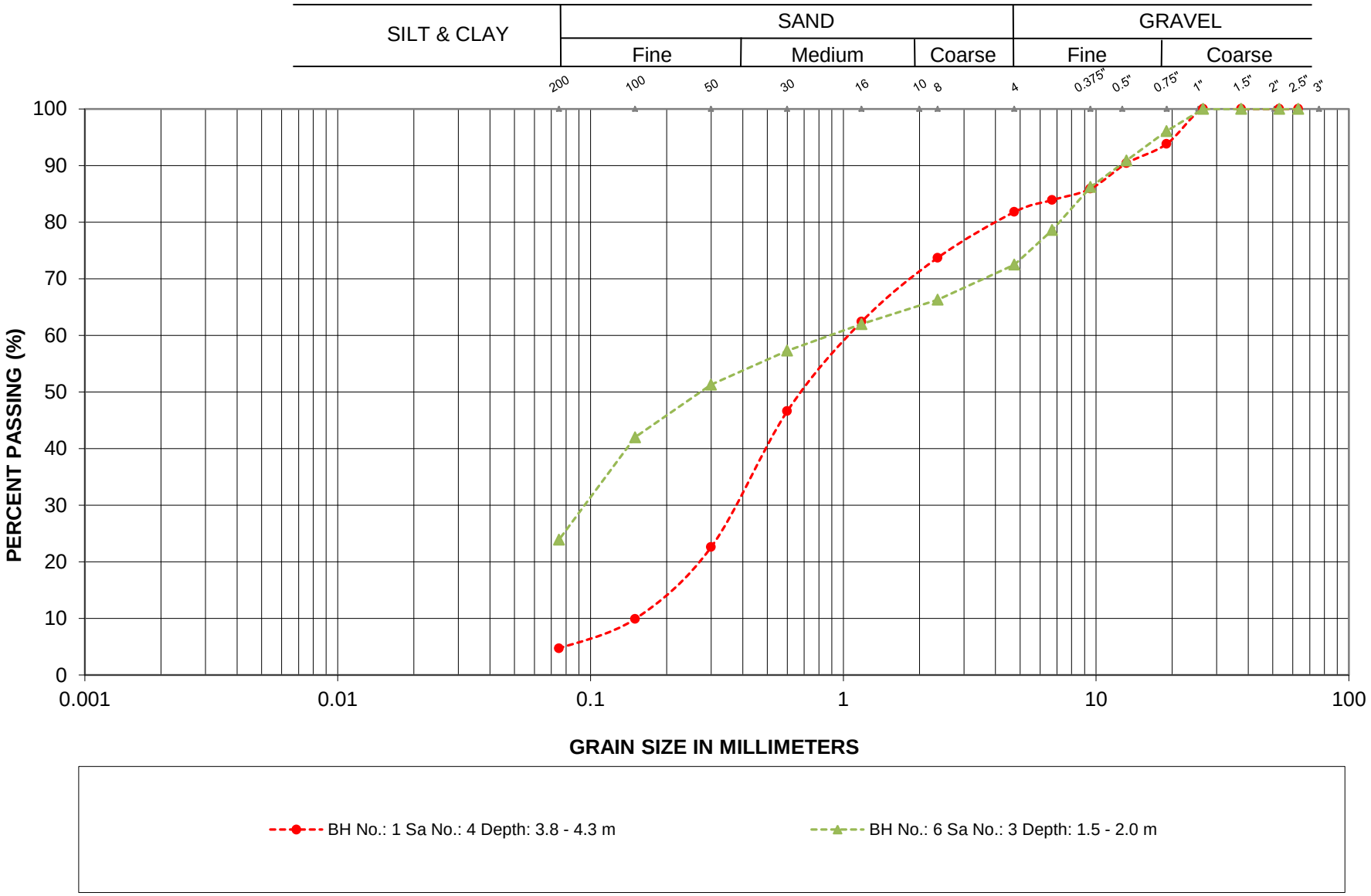
GRAIN SIZE ANALYSIS



G.W.P.: 5467-09-00
LOCATION: Hwy 124

SAND

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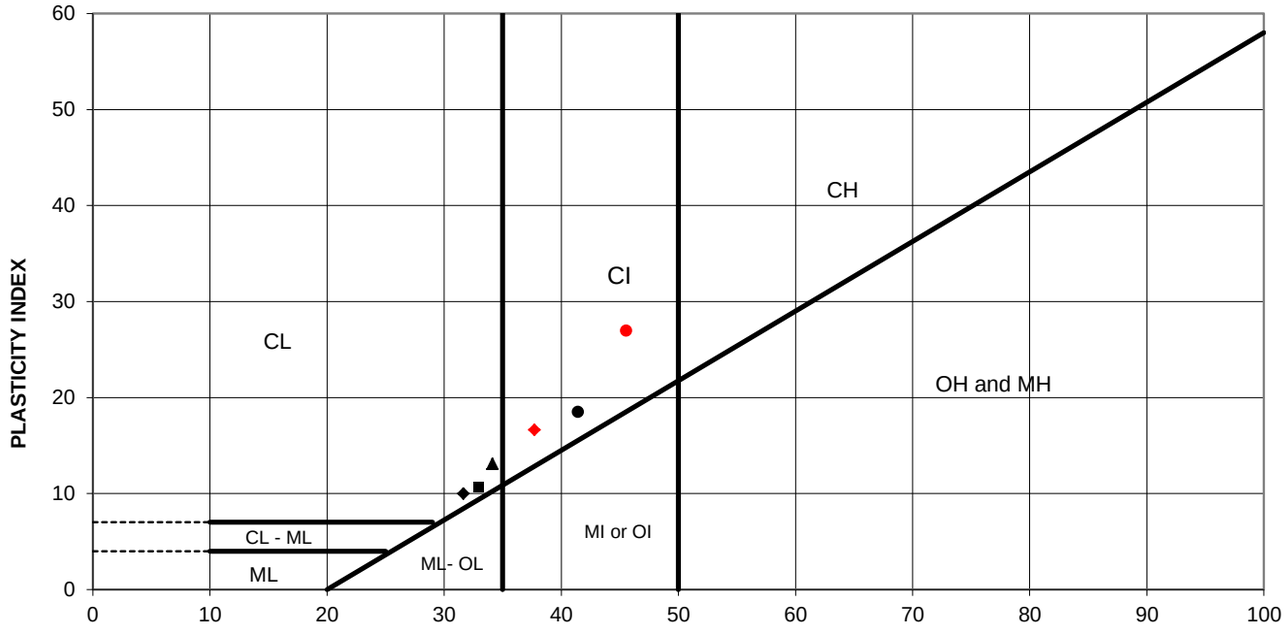
FIGURE L-5

ATTERBERG LIMITS TEST RESULTS

FIGURE L-6

ATTERBERG INDICES



SYMBOL	BH	Sa. No.	Depth(m)	Elev.(m)	Liquid Limit	Plastic Limit	Plasticity Index	NMC %
●	2	4	2.3	287.9	41.4	23.0	18.5	53.6
◆	2	5	3.0	287.2	31.7	21.7	10.0	46.0
■	3	8	6.1	287.9	32.9	22.3	10.6	30.1
▲	6	1	0.0	291.9	34.1	21.1	13.1	33.5
●	7	2	0.8	291.8	45.6	18.6	27.0	24.8
◆	7	5	3.0	289.6	37.7	21.1	16.6	34.5

Date: May-13
Project: Hwy 124
G.W.P: 5467-09-00

Prep'd: AT
Chkd: MAM
Ref. No.: 12/08/12141-F2

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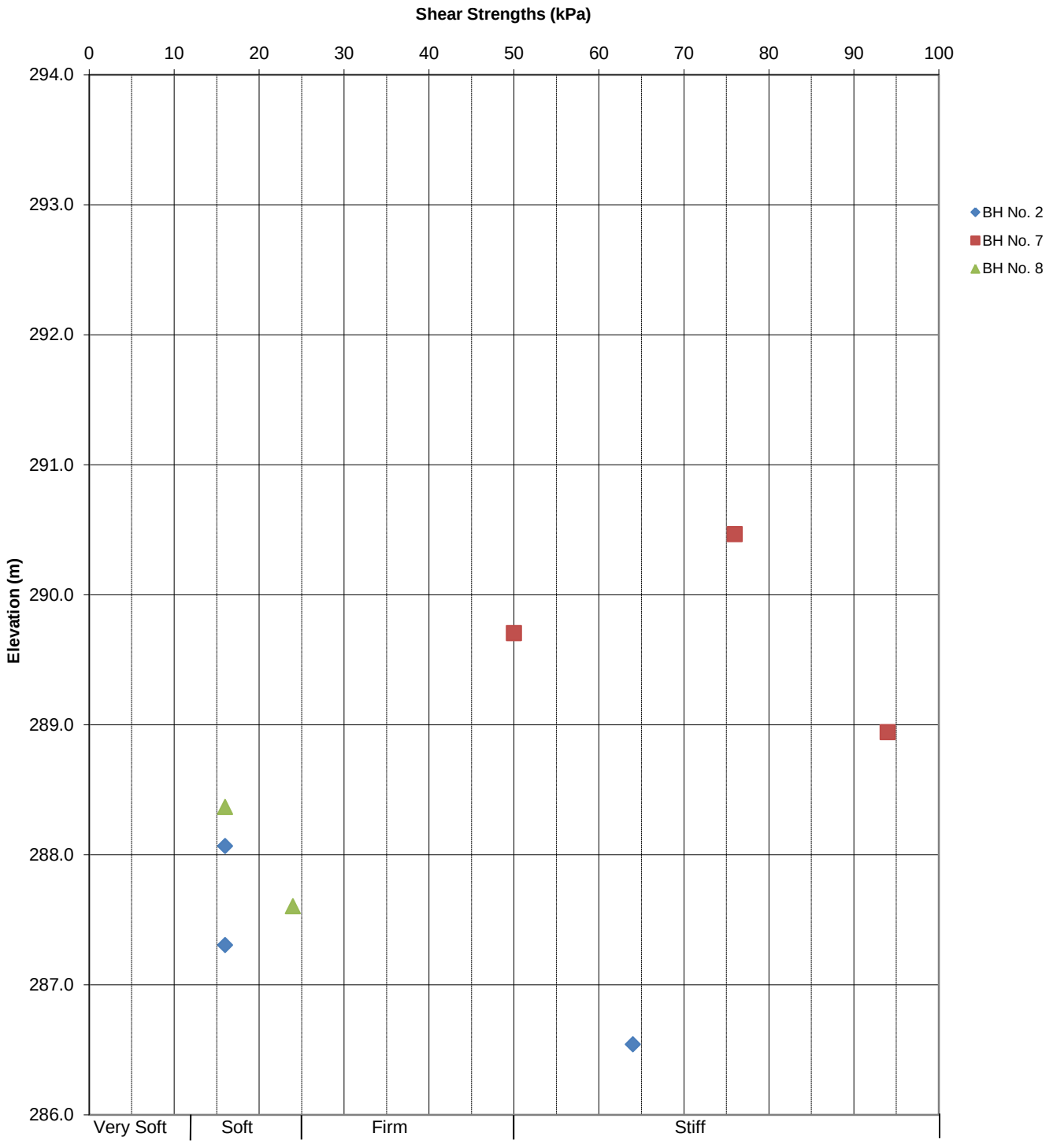
IN-SITU SHEAR STRENGTHS	Figure No. L-7

In-Situ Shear Strengths vs. Depth



Project: 12/08/12141-F2
G**WP:** 5467-00-00

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Date: May 2013
Checked:MAM

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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					37.5				N/A			
	2	0.8	0	78	22		23.3				3			
	3	1.5					17.5				56			
	4	2.3	18	77	5		13.0				41			
2	1	0.0					23.5				N/A			
	2	0.8	1	46	53		31.9				WH			
	3	1.5					45.2				PM			
	4	2.3	0	0	60	40	53.6	41.4	23.0		PM			
	5	3.1	0	1	74	25	46.0	31.7	21.7		PM			
	6	3.8					26.1				2			
	7	4.6	0	26	72	2	17.6				WH			
	8	6.1					10.1				57			
3	1	0.0					5.3				N/A			
	2	0.8	1	76	23		10.1				15			
	3	1.5					9.2				48			
	4	2.3					6.7				26			
	5	3.1	19	63	18		14.0				16			
	6	3.8					15.4				25			
	7	4.6	1	35	54	10	31.0				4			
	8	6.1	0	1	83	16	30.1	32.9	22.3		3			
	9	7.6					25.5				2			
4	1	0.0	25	43	32		18.5				N/A			
	2	0.76					14.0				10			
	3	1.52					21.0				36			
5	1	0.0					14.6				N/A			
	2	0.8					12.9				35/200 mm			
6	1	0.0	0	14	70	16	33.5	34.1	21.1		N/A			

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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 (%)				
6	2	0.8	0	31	69		18.9				22			
	3	1.5	27	49	24		15.4				17			
	4	2.3					21.4				7			
	5	3.1					22.7				7			
7	1	0.0					18.1				N/A			
	2	0.8	0	5	56	39	24.8	45.6	18.6		13			
	3	1.5					38.8				5			
	4	2.3					45.3				2			
	5	3.1	0	0	77	23	34.5	37.7	21.1		WH			
	6	3.8	0	7	88	5	24.2				10			
	7	4.6					23.7				4			
	8	6.1					18.8				25/50 mm			
8	1	0.0					55.7				N/A			
	2	0.8					39.1				WH			
	3	1.52					46.7				WH			
	4	2.29					53.01				PM			
	5	3.05					34.3				PM			
	6	3.81					22.57				6			
	7	4.57					18.49				WH			
9	1	0					2.95				N/A			
	2	0.76	4	8	15		6.31				29			
	3	1.52					6.22				70			
	4	2.29	20	74	6		3.32				18			
	5	3.05					13.14				46			
	6	3.81					21.5				48			
	7	4.57	0	35	54	11	31.37				4			
	8	6.1					23.19				24			

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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 (%)				
9	9	7.6					21.7				18			
10	1	0.0					2.3				N/A			
	2	0.8					8.8				24			
	3	1.5					7.4				76			

Appendix 4 Photo Essay

Enclosure No. 12: Photo Essay

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Existing Embankment – Looking East	Photo: 1

South Embankment Slope – Looking West	Photo: 2

Project: Hwy 124 – Station 25+160, Twp of Croft	Photos Provided By: LVM Date: September 2012

South Embankment Slope – Looking East	Photo: 3

Culvert Invert – Looking South	Photo: 4

Project: Hwy 124 – Station 25+160, Twp of Croft	Photos Provided By: LVM Date: September 2012

Location of Culvert Outlet – Looking North	Photo: 5

Culvert Outlet	Photo: 6

Project: Hwy 124 – Station 25+160, Twp of Croft	Photos Provided By: LVM Date: September 2012