



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

**Highway 535 Rehabilitation
Culvert Replacement – Site No. 46-380/C
Maskinonge Creek Culvert
Station 12+957 - TWP of Jennings
GWP 5563-04-00
WP 5536-05-01**

**Highway 535
From 8.1 km North of Highway 64 (Noelville) Northerly 12.1 km;
And, 0.6 km North of Highway 64 Northerly 1.4 km
District of Sudbury**

FINAL FOUNDATION INVESTIGATION REPORT

Date: April 9, 2012
Ref. N^o: 11/04/11046-F6

Geocres No. 41I-283

LVM | MERLEX

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1.0 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 design of a protection system. This culvert replacement (GWP 5563-04-00, WP 5536-05-01) is located on Highway 535, some 18.5 km south of Hwy 17, in the Township of Jennings.

The foundation investigation location was specified by the MTO in the RFP/TPM documentation Agreement No. 5010-E-0015. The terms of reference for the scope of work are outlined in MEL's proposal P-10-169, dated December, 2010. The purpose of this investigation was to determine the subsurface conditions in the areas of the culvert in order to provide design recommendations. LVM | MERLEX investigated the foundation areas by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

2.0 SITE DESCRIPTION

The foundation investigation for this culvert is located at Station 12+957, Township of Jennings (Site No. 46-380/C). The topography at the site is generally of low relief. The existing highway embankment currently supports two undivided lanes of highway, running in a north south direction. The existing highway, at the culvert location, is constructed on a fill embankment some 5.0 m in height, with centerline elevation at 201.2 m at the culvert location. The culvert at this location is a 5.5 x 3.6 m SPCSPA culvert, some 18.4 m in length at the top of the pipe with the culvert invert at elevation 196.7 m (see Photo Essay, Appendix D). Flow through the culvert is from west to east.

The Maskinonge Creek drains a relatively large low lying swamp (wetland area) located directly to the west (left) of the highway embankment. The creek flows east where the channel width is constricted by bedrock ridges to the north and south of the culvert location.

Infrastructure at the culvert location consists of overhead power and communication wires on the west (left) side of the highway.

2.1 Site Physiography and Surficial Geology

This project is located in the Geomorphic Sub-province known as the North Shore - Sudbury Ridges and Pockets. The topography on this section of Highway 535 is generally rolling. There are a few exposed bedrock ridges. At many locations, significant layers of earth overlay the bedrock. Organic terrain was also observed. Within the project area, overburden consists primarily of sands. The Maskinonge Creek at the culvert location is a wetland area.

Bedrock in the area, as indicated on OGS Map 2506, is of the Late to Middle Precambrian Era. At the location of this culvert foundation investigation, the bedrock comprises of Felsic Igneous Rocks including; granitic rocks, syenite, pegmatite, derived gneisses, and migmatites.

3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out between May 25th and September 12th, 2011, during which five (5) sampled boreholes were advanced. For the purposes of foundation design for the culvert replacement, one borehole was advanced through the embankment slightly down chainage from the culvert, and one borehole was advanced at each the inlet and outlet end of the culvert. Two boreholes were advanced through the embankment, one up and one down chainage from the culvert, for the purposes of design of a protection system. Shallow refusal was encountered at one borehole (Borehole No. 2), as such, one unsampled probe was

advanced beyond the obstruction with a Gardner Denver 300 hydraulic rock drill in order to determine the nature of shallow refusal.

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. The unsampled probes were advanced with a Gardner Denver hydraulic rock drill rig. Access to the east end of the culvert was flooded and, as such, a light weight barrel raft and Mobile B-24 drill rig were used to advance the borehole using wash boring techniques. Soil samples were taken using the SPT method.

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, as well as specific gravity. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix B), with a summary of results presented on the laboratory summary sheet and in Appendix C (Figures Nos. L-1 and L-2).

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

4.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Record of Borehole Logs (Appendix B) and on Figure No. 2 (Appendix C). Please note that stratigraphic delineation presented on the borehole logs and soil strata plot are the results of non-continuous sampling, response to drilling progress, the results of SPT and Dynamic Cone Penetration Test (DCPT) plus field observations. Typically such boundaries represent transitions from one zone to another and are not an exact demarcation of 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 Maskinonge Creek Culvert, Station 12+957, TWP of Jennings – Site No. 46-380/C

A plan and profile illustrating the borehole locations and stratigraphic sequences is shown on Figure No. 2, Appendix C. During the course of the exploration program, five (5) sampled boreholes were put down at this site, with Borehole Nos. 1 to 3 advanced through the existing embankment, and Borehole Nos. 4 and 5 advanced at either end of the culvert. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1, 2, 3, and 5 were recorded at 201.1, 201.4, 201.1, and 199.0 m, respectively. Borehole No. 4 was advanced at the culvert end, with a raft mounted drill, located in the creek. The surface water level at Borehole No. 4 was recorded at elevation 198.6 m.

4.1.1 Surficial Layers

At surface at Borehole Nos. 1 to 3, a surficial pavement structure consisting of 150 to 175 mm of asphalt and 175 to 200 mm of crushed gravel was encountered. An additional 50 mm of asphalt was encountered underlying the crushed gravel at Borehole No. 3. At surface at Borehole No. 4, free water was encountered to elevation 197.1 m. A 200 mm thick layer of silty organics was encountered at the surface at BH No. 5.

4.1.2 Fill

Underlying the layer of surficial silty organics at Borehole No. 5, a deposit of fill consisting of brown silt trace sand trace clay was penetrated. The natural moisture content measured on samples of this deposit was in the order of 21%. This deposit was encountered to a depth of 0.8 m below grade (elevation 198.2 m).

4.1.3 Embankment Fill

Underlying the surficial pavement structure at Borehole Nos. 1, 2, and 3, and underlying the silt fill at Borehole No. 5, a deposit of embankment fill consisting of brown sand trace to some

gravel trace to with silt, occasional cobbles was penetrated. The natural moisture content measured on samples of this deposit was in the order of 5 to 21%. Gradation analyses were carried out on six (6) samples of this deposit, the results of which indicated 6 to 14% gravel size particles, 60 to 83% sand size particles, and 9 to 33% silt and clay size particles (see Figure No. L-1, Appendix C). Based on SPT 'N' values of 3 to 29 blows per 300 mm penetration, the compactness of this deposit was described as very loose to compact, generally compact.

DCPT refusal was encountered at a depth of 1.3 m below grade at Borehole No. 2 (elevation 200.1 m). Auger refusal was encountered on a boulder size rock at depth of 3.4 m below ground surface at Borehole No. 2 (elevations 198.0 m). This obstruction was bypassed using the hydraulic rock drill. This fill deposit was encountered to depths of 5.0, 5.0, and 2.3 m below grade at Borehole Nos. 1, 3, and 5 (elevations 196.1, 196.1, and 196.7 m, respectively).

4.1.4 Peat

Underlying the embankment fill at Borehole No. 5, a deposit of black fine fibrous peat with wood inclusions was encountered. The natural moisture content measured on samples of this deposit was in the order of 309 to 323%. This deposit was encountered to a depth of 3.5 m below grade (elevation 195.5 m).

4.1.5 Organic Silt

Underlying the free water at Borehole No. 4, and underlying the peat at Borehole No. 5, a deposit of black organic silt was penetrated. The natural moisture content measured on samples of this deposit was in the order of 83 to 141%. This deposit was encountered to depths of 2.2 and 4.0 m below grade at Borehole Nos. 4 and 5, respectively (elevations 196.4 and 195.0 m, respectively).

4.1.6 Sand

Underlying the embankment fill at Borehole Nos. 1, 2 and 3, and underlying the organic silt at Borehole Nos. 4 and 5, a deposit of grey sand trace to with gravel trace to some silt trace gravel was penetrated. The natural moisture content measured on samples of this deposit was in the order of 9 to 24%. Gradation analyses were carried out on five (5) samples of this deposit the results of which indicated 0 to 30% gravel size particles, 55 to 99% sand size particles, 2 to 25% silt and clay size particles (see Figure No. L-2, Appendix C). Based on SPT 'N' values of 4 to 29 blows per 300 mm penetration, the compactness of this deposit was described as loose to compact, generally compact. Auger refusal was encountered in this deposit at depths of 10.4, 10.3, 6.0, and 8.8 m below grade at Borehole Nos. 1, 3, 4, and 5, respectively (elevations 190.7, 190.8, 192.6, and 190.2 m, respectively). DCPT refusal was encountered at depths of 9.9, 10.7, 6.2, and 8.4 m below grade at Borehole Nos. 1, 3, 4, and 5, respectively (elevations 191.2, 190.4, 192.4, and 190.6 m, respectively). Bedrock (based on drill response) was encountered at a depth of 9.4 m (elevation 192.0 m) in the hydraulic rock drill probe hole advanced at Borehole No. 2.

4.2 Groundwater Conditions

Surface water was encountered in the culvert at an elevation of 198.6 m, at the time of this investigation. 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. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix B). The water level was recorded at elevations 198.8, 198.9, 199.2, and 198.6 m at Borehole Nos. 1, 2, 3, and 5, respectively. Borehole No. 4 was advanced at the culvert end, in the creek, and as such the water level was that of the creek at the time of this investigation (elevation 198.6 m). The groundwater levels will fluctuate seasonally. The creek water level in June 1966 was recorded at elevation 197.75 m.

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M. A. Merleau, P. Eng.
Principal Engineer
MTO Designate

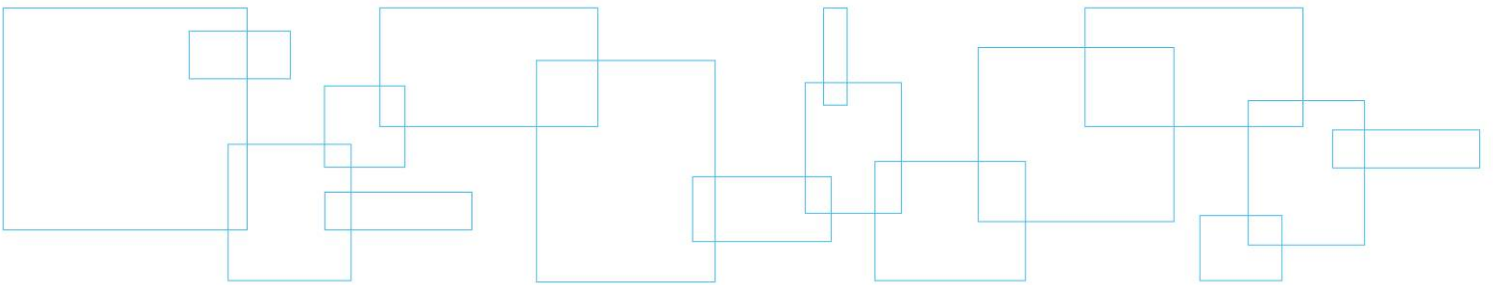
J. R. Berghamer, P. Eng.
Regional Manager

Z:\PROJECT FILES\2011\11046 - PAVE & FDN, Hwy 535 Noelville to Hagar (AECOM)\FOUNDATION\Reports\FINAL\Area 6 - GWP 5563-04-00 - Site 46-380C - Maskinonge Creek Culvert\11046-F6 - FINAL FIDR, Hwy 535 GWP 5563-04-00 - Maskinonge Creek.doc

Appendix A

Key Plan

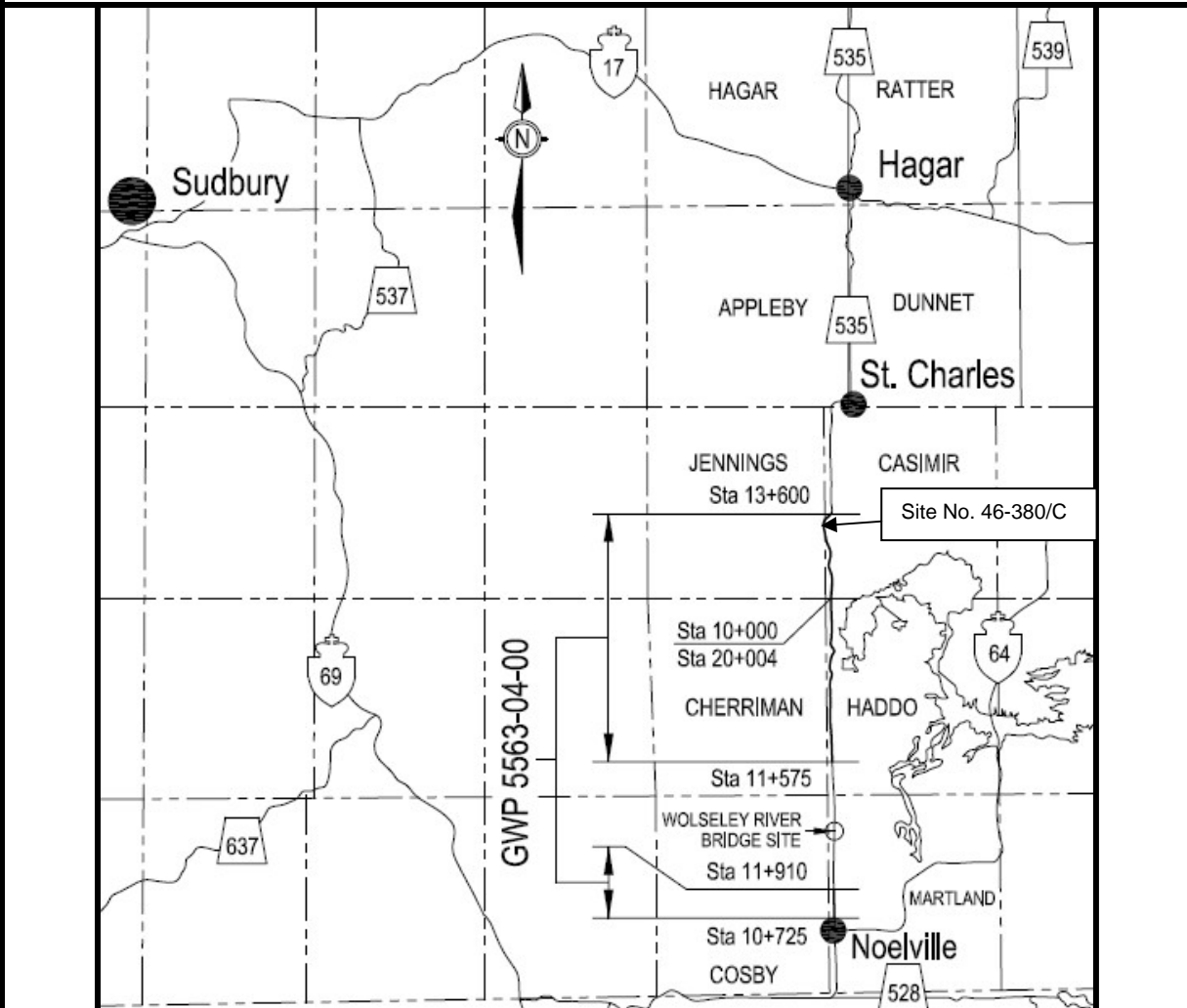
Figure No. 1: Key Plan



KEY PLAN

Figure No. 1

NOT TO SCALE



FINAL FOUNDATON INVESTIGATION REPORT GWP 5563-04-00

Highway 535
From 8.1 km North of Highway 64
(Noelville) Northerly 12.1 km;
And, 0.6 km North of Highway 64
Northerly 1.4 km
District of Sudbury

Ref. No.: 11/04/11046-F6

April, 2012

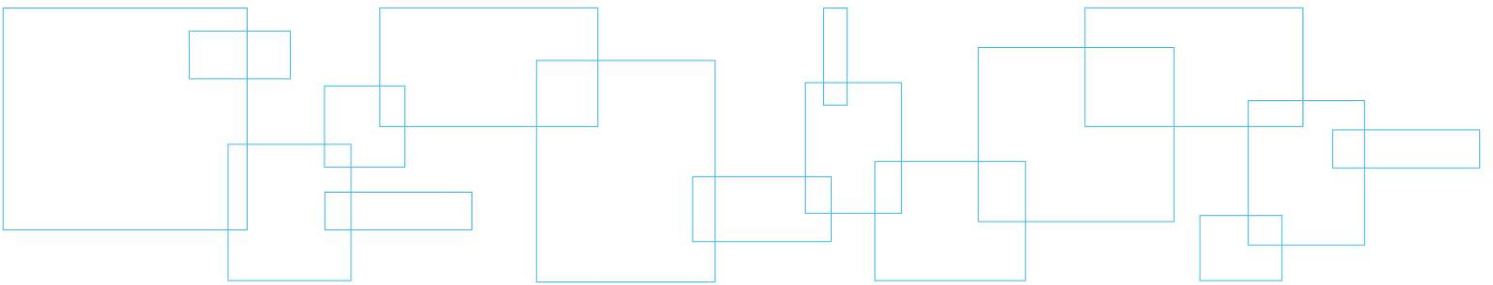
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Appendix B

Abbreviations Record of Borehole Sheets

Enclosure No. 1: List of Abbreviations and Symbols

Enclosure Nos. 2 to 6: Record of Borehole Sheets



LIST OF ABBREVIATIONS AND 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 |
| NP | Non Plastic |
| 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 |

3. SOIL DESCRIPTION (Cont'd)

b) *Cohesive Soils:*

| Undrained Shear Strength (kPa) | Consistency |
|--------------------------------|-------------|
| Less than 12 | very soft |
| 12 to 25 | soft |
| 25 to 50 | firm |
| 50 to 100 | stiff |
| 100 to 200 | very stiff |
| over 200 | hard |

c) *Method of Determination of Undrained Shear Strength of Cohesive Soils:*

- + 3.2 - Field Vane test in borehole.
The number denotes the sensitivity to remoulding.
- D - Laboratory Vane Test
- .. - Compression test in laboratory

For a saturated cohesive soil the undrained shear strength is taken as one-half of the undrained compressive strength.

4. TERMINOLOGY

Terminology used for describing soil strata is based on the proportion of individual particle sizes present in the samples (please note that, with the exception of those samples subject to a grain-size analysis, all samples were classified visually and the accuracy of visual examination is not sufficient to determine exact grain sizing):

| | |
|---------------------------------|---------------|
| Trace, or occasional | Less than 10% |
| Some | 10 to 20% |
| With | 20 to 30% |
| Adjective (i.e. silty or sandy) | 30 to 40% |
| And (i.e. sand and gravel) | 40 to 60% |

5. LABORATORY TESTS

- P Standard Proctor Test
- A Atterberg Limit Test
- GS Grain Size Analysis
- H Hydrometer Analysis
- C Consolidation

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

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

LVM | MERLEX

REFERENCE 11/04/11046-F6 DATUM Geodetic LOCATION N5129807.6 E348166.0 - Township of Jennings - Maskinonge Cree ORIGINATED BY JL
 PROJECT WP 5536-05-01, Highway 535 - Site No. 46-380/C BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT
 CLIENT AECOM Inc. DATE (Started) May 25, 2011 TIME
 DATE (Completed) May 25, 2011 (Completed) 2:20:00 PM CHECKED BY JRB

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|---|-------------|---------|------|------------|-------------------------|-----------------|--|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV. DEPTH | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" VALUES | | | | | | | | |
| 201.1 | Ground Surface | | | | | | | | | | | | |
| 0.0 | 175 mm asphalt 200 mm crushed gravel | | 1 | AS | N/A | | | | | | | | |
| | FILL - brown sand trace to some gravel trace to with silt | | 2 | SS | 17 | | | | | | | | 13 60 (27) |
| | (compact/very loose) | | 3 | SS | 13 | | | | | | | | |
| | | | 4 | SS | 3 | | | | | | | | 14 66 (20) |
| | | | 5 | SS | 5 | | | | | | | | |
| | brown | | 6 | SS | 6 | | | | | | | | |
| | grey | | 7 | SS | 9 | | | | | | | | 8 83 (9) |
| 196.1 | 50 mm asphalt pieces | | | | | | | | | | | | |
| 5.0 | SAND - grey sand some to with gravel some silt trace clay | | 8 | SS | 6 | | | | | | | | |
| | (loose/compact) | | 9 | SS | 9 | | | | | | | | 16 59 20 5 |
| | | | 10 | SS | 5 | | | | | | | | |
| | | | 11 | SS | 29 | | | | | | | | 30 55 13 2 |
| 191.2 | Continued Next Page | | | | | | | | | | | | |

| COMMENTS | | WATER LEVEL RECORDS | |
|--|--|-----------------------|-----------------|
| + 3, × 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE | | Date (dd/mm/yy)/Time | Water Depth (m) |
| | | 1) 5/25/11 2:20:00 PM | 2.3 |
| | | 2) | - |
| | | 3) | - |

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

MEL-GEO 11046 - BH LOGS MASKINONGE.GPJ MEL-GEO.GDT 4/12/12

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METRIC**RECORD OF BOREHOLE NO. 1****LVM | MERLEX**

REFERENCE 11/04/11046-F6 DATUM Geodetic LOCATION N5129807.6 E348166.0 - Township of Jennings - Maskinonge Cree ORIGINATED BY JL
 PROJECT WP 5536-05-01, Highway 535 - Site No. 46-380/C BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT
 CLIENT AECOM Inc. DATE (Started) May 25, 2011 TIME
 DATE (Completed) May 25, 2011 (Completed) 2:20:00 PM CHECKED BY JRB

| SOIL PROFILE | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|----------------------------------|-------------|--------|------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" VALUES | | 20 | 40 | 60 | 80 | 100 | | | | | |
| | Continued from Previous Page | | | | | | | | | | | | | | | |
| 9.9 | DCPT Refusal | | | | | 191 | | | | | | | | | | |
| 190.7 | | | | | | | | | | | | | | | | |
| 10.4 | Auger Refusal End of Borehole | | | | | | | | | | | | | | | |

MEL-GEO 11046 - BH LOGS MASKINONGE.GPJ MEL-GEO.GDT 4/12/12

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

METRIC

RECORD OF BOREHOLE NO. 2

LVM | MERLEX

REFERENCE 11/04/11046-F6 DATUM Geodetic LOCATION N5129819.1 E348162.6 - Township of Jennings - Maskinonge Cree ORIGINATED BY JL
 PROJECT WP 5536-05-01, Highway 535 - Site No. 46-380/C BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT
 CLIENT AECOM Inc. DATE (Started) May 25, 2011 TIME
 DATE (Completed) May 25, 2011 (Completed) 5:30:00 PM CHECKED BY JRB

| 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 WATER CONTENT (%) | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | | | | | | | | | | | |
|--|--|-------------|---------|------|------------|-------------------------|-----------------|---|--|----------------------|---------------------------------------|----------------------|-----------------|-------------|-----------------------|-----|-----|----|---|---|----|---|---|
| ELEV DEPTH | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" VALUES | | | | | | | | | | | | | | | | | | |
| 201.4 | Ground Surface | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 150 mm asphalt 200 mm crushed gravel FILL - silty sand trace gravel occasional cobbles | | 1 | AS | N/A | | | | | | | | | | | | | | | | | | |
| 200.1 | | | 2 | SS | 10 | | | | | | | | | | | | | | | | | | |
| 1.3 | DCPT Refusal | | 3 | SS | 12 | | | | | | | | | | | | | | | | | | |
| | | | 4 | SS | 29 | | | | | | | | | | | | | | | | | | |
| | | | 5 | SS | 36/200 mm | | | | | | | | | | | | | | | | | | |
| 198.0 | Auger Refusal on boulders | | | | | | | | | | | | | | | | | | | | | | |
| 3.4 | Hydraulic rock drill probe advanced from surface - unsampled Occasional cobbles/boulders in sands from 3 m to 9.4 m depth | | | | | | | | | | | | | | | | | | | | | | |
| 192.0 | BEDROCK | | | | | | | | | | | | | | | | | | | | | | |
| 9.4 | (based on drill response) Continued Next Page | | | | | | | | | | | | | | | | | | | | | | |
| COMMENTS Borehole advanced beyond auger refusal with Gardner Denver 300 hydraulic rock drill 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 <table border="1"> <thead> <tr> <th>Date (dd/mm/yy)/Time</th> <th>Water Depth (m)</th> <th>Cave In (m)</th> </tr> </thead> <tbody> <tr> <td>1) 5/25/11 5:30:00 PM</td> <td>2.5</td> <td>3.2</td> </tr> <tr> <td>2)</td> <td>-</td> <td>-</td> </tr> <tr> <td>3)</td> <td>-</td> <td>-</td> </tr> </tbody> </table> | | | | Date (dd/mm/yy)/Time | Water Depth (m) | Cave In (m) | 1) 5/25/11 5:30:00 PM | 2.5 | 3.2 | 2) | - | - | 3) | - | - |
| Date (dd/mm/yy)/Time | Water Depth (m) | Cave In (m) | | | | | | | | | | | | | | | | | | | | | |
| 1) 5/25/11 5:30:00 PM | 2.5 | 3.2 | | | | | | | | | | | | | | | | | | | | | |
| 2) | - | - | | | | | | | | | | | | | | | | | | | | | |
| 3) | - | - | | | | | | | | | | | | | | | | | | | | | |


MEL-GEO 11046 - BH LOGS MASKINONGE.GPJ MEL-GEO.GDT 4/12/12

LVM | MERLEX

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

METRIC**RECORD OF BOREHOLE NO. 2****LVM | MERLEX**

REFERENCE 11/04/11046-F6 DATUM Geodetic LOCATION N5129819.1 E348162.6 - Township of Jennings - Maskinonge Cree ORIGINATED BY JL
 PROJECT WP 5536-05-01, Highway 535 - Site No. 46-380/C BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT
 CLIENT AECOM Inc. DATE (Started) May 25, 2011 TIME
 DATE (Completed) May 25, 2011 (Completed) 5:30:00 PM CHECKED BY JRB

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|--|---|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | | |
| | Continued from Previous Page | | | | | | | | | | | | | | | | |
| | BEDROCK |  | | | | | | | | | | | | | | | |
| 188.9 | | | | | | | | | | | | | | | | | |
| 12.5 | End of Hydraulic Rock Drill Probe End of Borehole | | | | | | | | | | | | | | | | |

MEL-GEO 11046 - BH LOGS MASKINONGE.GPJ MEL-GEO.GDT 4/12/12

LVM | MERLEX

METRIC

RECORD OF BOREHOLE NO. 3

LVM | MERLEX

REFERENCE 11/04/11046-F6 DATUM Geodetic LOCATION N5129796.0 E348179.2 - Township of Jennings - Maskinonge Cree ORIGINATED BY JL
 PROJECT WP 5536-05-01, Highway 535 - Site No. 46-380/C BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT
 CLIENT AECOM Inc. DATE (Started) May 26, 2011 TIME May 26, 2011 (Completed) 5:20:00 PM CHECKED BY JRB

| 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 | | | | | | | | |
| 201.1 | Ground Surface | | | | | | | | | | | | |
| 0.0 | 150 mm asphalt 175 mm crushed gravel 50 mm asphalt FILL - brown sand some to with silt trace to some gravel (loose/compact) | | 1 | AS | N/A | | 201 | | | | | | |
| | | | 2 | SS | 21 | | 200 | | | | | | 8 73 (19) |
| | | | 3 | SS | 15 | | 199 | | | | | | |
| | | | 4 | SS | 4 | | 198 | | | | | | |
| | brown grey | | 5 | SS | 15 | | 197 | | | | | | 14 62 (24) |
| | asphalt and gravel mix | | 6 | SS | 20 | | 196 | | | | | | |
| 196.1 | | | 7 | SS | 12 | | 195 | | | | | | |
| 5.0 | SAND - grey sand trace to some silt trace gravel (loose/compact) | | 8 | SS | 6 | | 194 | | | | | | 1 99 (0) |
| | | | 9 | SS | 24 | | 193 | | | | | | |
| | | | 10 | SS | 29 | | 192 | | | | | | |
| 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) 5/26/11 5:20:00 PM 1.9 3.8 2) - - 3) - - | | | | | | |
| The stratification lines represent approximate boundaries. The transition may be gradual. | | | | | | | | | | | | | |

MEL-GEO 11046 - BH LOGS MASKINONGE.GPJ MEL-GEO.GDT 4/12/12

LVM | MERLEX

METRIC**RECORD OF BOREHOLE NO. 3****LVM | MERLEX**

REFERENCE 11/04/11046-F6 DATUM Geodetic LOCATION N5129796.0 E348179.2 - Township of Jennings - Maskinonge Cree ORIGINATED BY JL
 PROJECT WP 5536-05-01, Highway 535 - Site No. 46-380/C BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT
 CLIENT AECOM Inc. DATE (Started) May 26, 2011 TIME
 DATE (Completed) May 26, 2011 (Completed) 5:20:00 PM CHECKED BY JRB




| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | | | | | |
|---------------|---------------------------------|-------------|---------|------|------------|----------------------------|-----------------|---|----|------------|------------------------------------|-------------------------------------|-----------------------------------|-------------------------|---|-------------------|---|----------|---------|----|---------|
| ELEV DEPTH | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | WATER CONTENT (%) | | | GR | SA | (SI CL) |
| | | | | | | | | ○ UNCONFINED | + | FIELD VANE | | | | | | ● QUICK TRIAXIAL | × | LAB VANE | | | |
| | Continued from Previous Page | | | | | | | 20 | 40 | 60 | 80 | 100 | 20 | 40 | 60 | kN/m ³ | | | | | |
| 190.8 | | | 11 | AS | N/A | | 191 | | | | | | | | | | | | | | |
| 10.3 | Auger Refusal | | | | | | | | | | | | | | | | | 4 | 79 (17) | | |
| 190.4 | | | | | | | | | | | | | | | | | | | | | |
| 10.7 | DCPT Refusal End of Borehole | | | | | | | | | | | | | | | | | | | | |

MEL-GEO 11046 - BH LOGS MASKINONGE.GPJ MEL-GEO.GDT 4/12/12

LVM | MERLEX

METRIC**RECORD OF BOREHOLE NO. 4****LVM | MERLEX**

REFERENCE 11/04/11046-F6 DATUM Geodetic LOCATION N5129804.1 E348179.2 - Township of Jennings - Maskinonge Cree ORIGINATED BY JL
 PROJECT WP 5536-05-01, Highway 535 - Site No. 46-380/C BOREHOLE TYPE Raft and Mobile B24 COMPILED BY AT
 CLIENT AECOM Inc. DATE (Started) August 23, 2011 TIME (Completed) CHECKED BY JRB
 DATE (Completed) August 23, 2011

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT  20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L WATER CONTENT (%) 20 40 60 | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA (SI CL) | | | | | | | | | | | | |
|----------------------|--|---|---------|------|------------|-------------------------|--|---|---|--|----------------------|-----------------|-------------|----|---|---|----|---|---|----|---|---|
| ELEV. DEPTH | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" VALUES | | | | | | | | | | | | | | | | | |
| 198.6 0.0 | Water Level Water | | | | | | | | | | | | | | | | | | | | | |
| 197.1 1.5 | ORGANIC SILT - black organic silt trace sand |  | | | | | | | | | | | | | | | | | | | | |
| 196.4 2.2 | SAND - grey sand trace silt trace gravel (compact) |  | 1 | SS | 4 | | | | | | | | | | | | | | | | | |
| | | | 2 | SS | 18 | | | | | | | | | | | | | | | | | |
| | | | 3 | SS | 21 | | | | | | | | | | | | | | | | | |
| | | | 4 | SS | 11 | | | | | | | | | | | | | | | | | |
| 192.6 6.0 | Auger Refusal | | 5 | SS | 70/100 mm | | | | | | | | | | | | | | | | | |
| 192.0 6.2 | DCPT Refusal 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 | | WATER LEVEL RECORDS <table border="1"> <thead> <tr> <th>Date (dd/mm/yy)/Time</th> <th>Water Depth (m)</th> <th>Cave In (m)</th> </tr> </thead> <tbody> <tr> <td>1)</td> <td>-</td> <td>-</td> </tr> <tr> <td>2)</td> <td>-</td> <td>-</td> </tr> <tr> <td>3)</td> <td>-</td> <td>-</td> </tr> </tbody> </table> | | Date (dd/mm/yy)/Time | Water Depth (m) | Cave In (m) | 1) | - | - | 2) | - | - | 3) | - | - |
| Date (dd/mm/yy)/Time | Water Depth (m) | Cave In (m) | | | | | | | | | | | | | | | | | | | | |
| 1) | - | - | | | | | | | | | | | | | | | | | | | | |
| 2) | - | - | | | | | | | | | | | | | | | | | | | | |
| 3) | - | - | | | | | | | | | | | | | | | | | | | | |

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

MEL-GEO 11046 - BH LOGS MASKINONGE.GPJ MEL-GEO.GDT 4/12/12

LVM | MERLEX

METRIC

RECORD OF BOREHOLE NO. 5

LVM | MERLEX

REFERENCE 11/04/11046-F6 DATUM Geodetic LOCATION N5129793.1 E348155.3 - Township of Jennings - Maskinonge Cree ORIGINATED BY JL
 PROJECT WP 5536-05-01, Highway 535 - Site No. 46-380/C BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT
 CLIENT AECOM Inc. DATE (Started) June 29, 2011 TIME (Completed) 6:30:00 PM CHECKED BY JRB

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|-------------|---------|------|------------|-------------------------|-----------------|--|-----------------|-----------------|--|---------------------------------------|
| ELEV DEPTH | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" VALUES | | | 20 40 60 80 100 | 20 40 60 80 100 | 20 40 60 80 100 | | |
| 199.0 | Ground Surface | | | | | | | | | | | |
| 0.0 | 200 mm Silty Organics | | 1 | AS | N/A | | | | | | | |
| 198.2 | FILL - brown silt trace sand trace clay | | | | | | | | | | | |
| 0.8 | FILL - grey sand some gravel trace silt | | 2 | SS | 14 | | | | | | | |
| | occasional cobbles and boulders | | | | | | | | | | | |
| | | | 3 | SS | 45/150mm | | | | | | | |
| 196.7 | PEAT - black fine fibrous peat with wood inclusions | | 4 | SS | 4 | | | | | | 323 | |
| 2.3 | | | | | | | | | | | | |
| | | | 5 | SS | 2 | | | | | | 309 | |
| 195.5 | ORGANIC SILT - black organic silt | | | | | | | | | | | |
| 3.5 | | | | | | | | | | | | |
| 195.0 | | | 6 | SS | 5 | | | | | | 141 | |
| 4.0 | SAND - grey sand trace silt (loose/compact) | | | | | | | | | | | |
| | | | 7 | SS | 4 | | | | | | | |
| | | | | | | | | | | | | |
| | | | 8 | SS | 12 | | | | | | | |
| | | | | | | | | | | | | |
| | | | 9 | SS | 18 | | | | | | | |
| | | | | | | | | | | | | |
| 190.6 | DCPT Refusal | | | | | | | | | | | |
| 8.4 | | | | | | | | | | | | |
| 190.2 | Auger Refusal | | | | | | | | | | | |
| 8.8 | End of Borehole | | | | | | | | | | | |
| COMMENTS | | | | | | | | WATER LEVEL RECORDS | | | | |
| | | | | | | | | Date (dd/mm/yy)/Time | Water Depth (m) | Cave In (m) | | |
| | | | | | | | | 1) 6/29/11 2:30:00 PM | 0.4 | 3.3 | | |
| | | | | | | | | 2) | - | - | | |
| | | | | | | | | 3) | - | - | | |
| The stratification lines represent approximate boundaries. The transition may be gradual. | | | | | | | | + 3, x 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa O 3% STRAIN AT FAILURE | | | | |

LVM | MERLEX

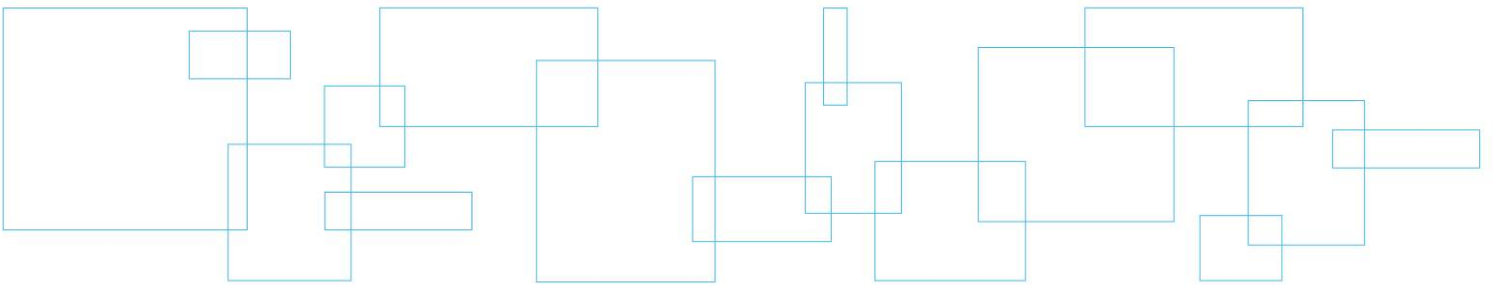
120 Progress Court, North Bay, On P1A 0C2 Phone: (705)476-2550 Fax: (705)476-8882 Email: northbay@lvm.ca

MEL-GEO 11046 - BH LOGS MASKINONGE.GPJ MEL-GEO.GDT 4/12/12

Appendix C

Borehole Location Plan Labwork

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



SITE No 46-380/C

GWP No 5563-04-00

GEOCRES No 411-283

N

HWY NO. 535 – Township of Jennings

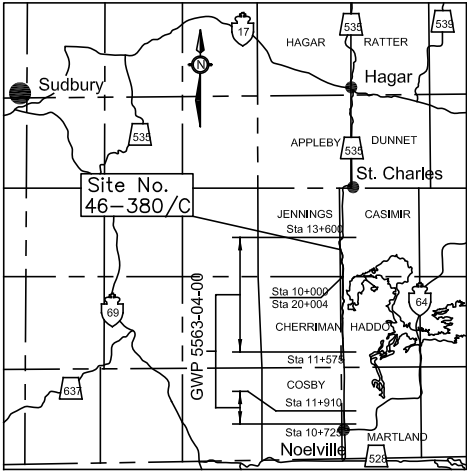
Maskinonge Creek

Culvert Replacements– Station 12+957

BOREHOLE LOCATIONS & SOIL STRATA

Figure 2

LVM | MERLEX



KEY PLAN – NOT TO SCALE

LEGEND

- Borehole
- Dynamic Cone Penetration Test (DCPT)
- Borehole & 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

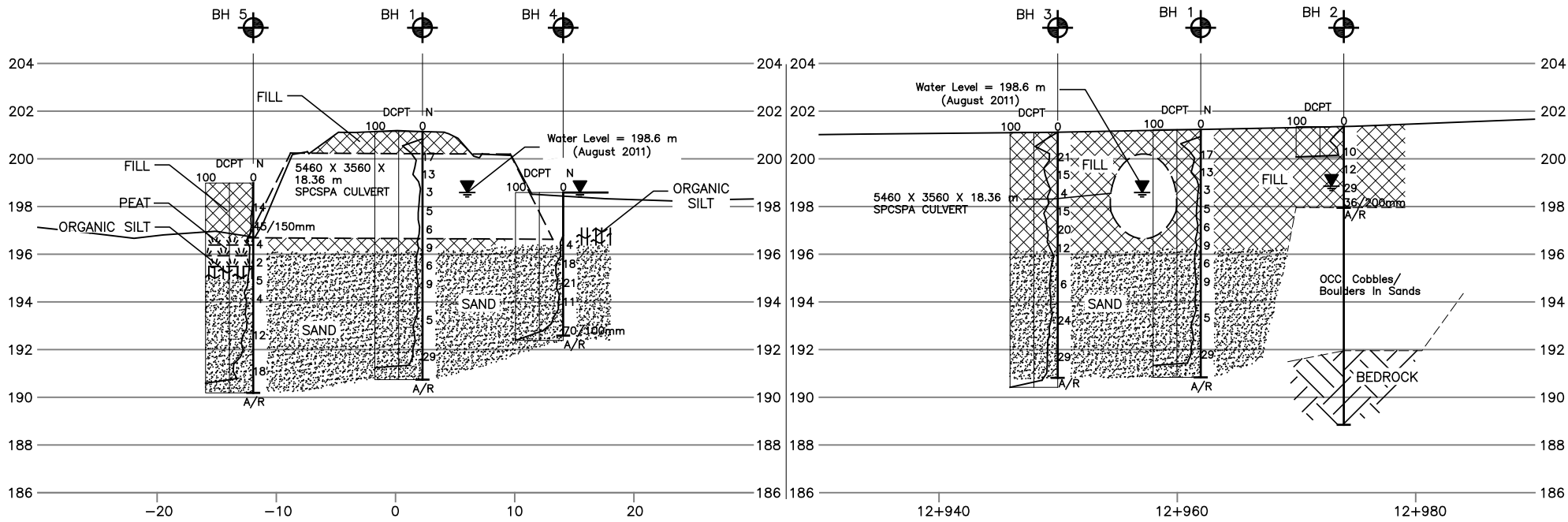
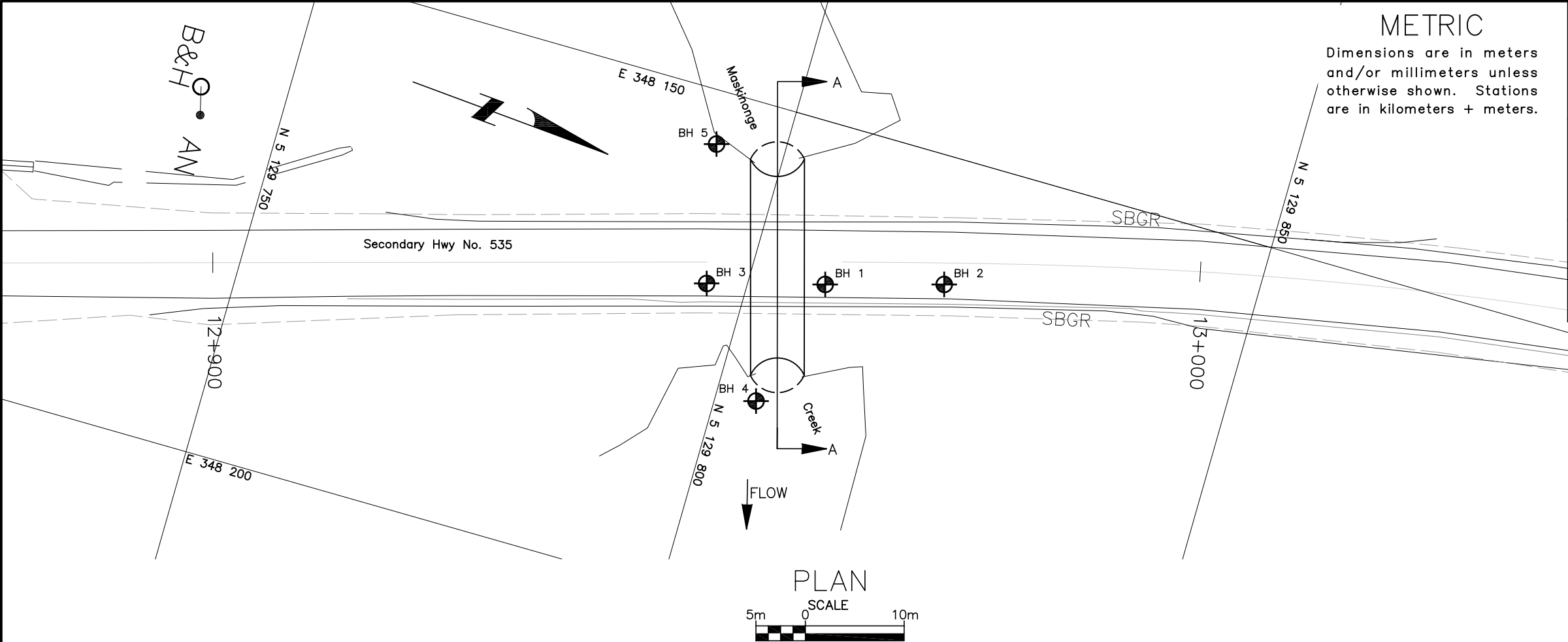
| Borehole No. | Elev. | O/S | Co-ordinates | |
|----------------|-------|----------|--------------|----------|
| | | | Northerly | Easterly |
| Borehole No. 1 | 201.1 | 2.2m Rt | 5129807.6 | 348166.0 |
| Borehole No. 2 | 201.4 | 2.1m Rt | 5129819.1 | 348162.6 |
| Borehole No. 3 | 201.1 | 2.1m Rt | 5129796.0 | 348169.2 |
| Borehole No. 4 | 198.6 | 14.0m Rt | 5129804.1 | 348179.2 |
| Borehole No. 5 | 199.0 | 12.0m Lt | 5129793.1 | 348155.3 |

NOTE:
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 |
|---|------|----|---------------|
| | | | |
| | | | |
| | | | |
| | | | |
| HWY No. 535 – Jennings Twp – Maskinonge Creek | | | REF: 11046 |
| SUBM'D | | | SITE 46-380/C |
| DRAWN MCM | | | CHK MAM |
| DATE September 2011 | | | FIG 2 |

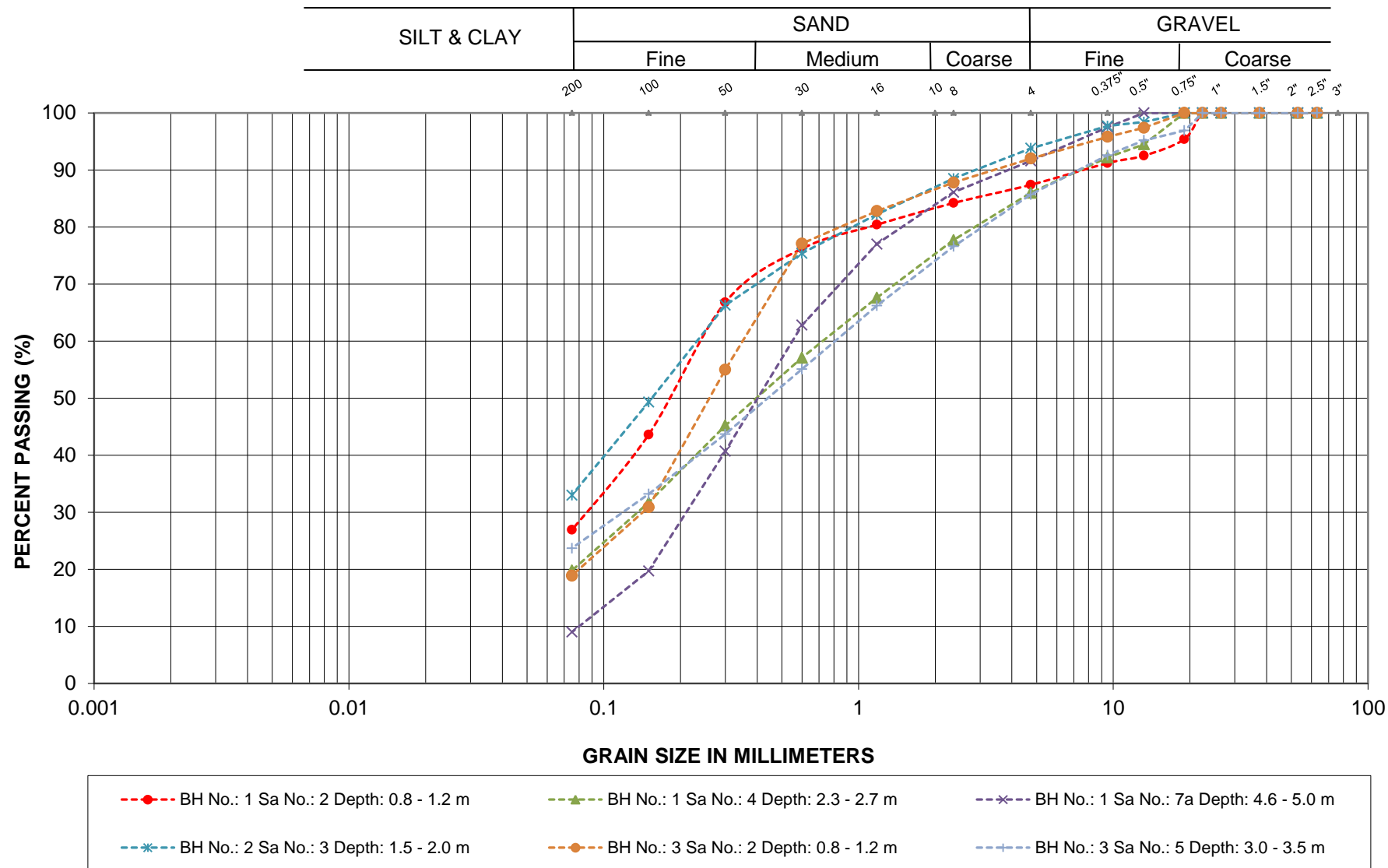
METRIC

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



CROSS SECTION A – A

PROFILE

GRAIN SIZE ANALYSIS

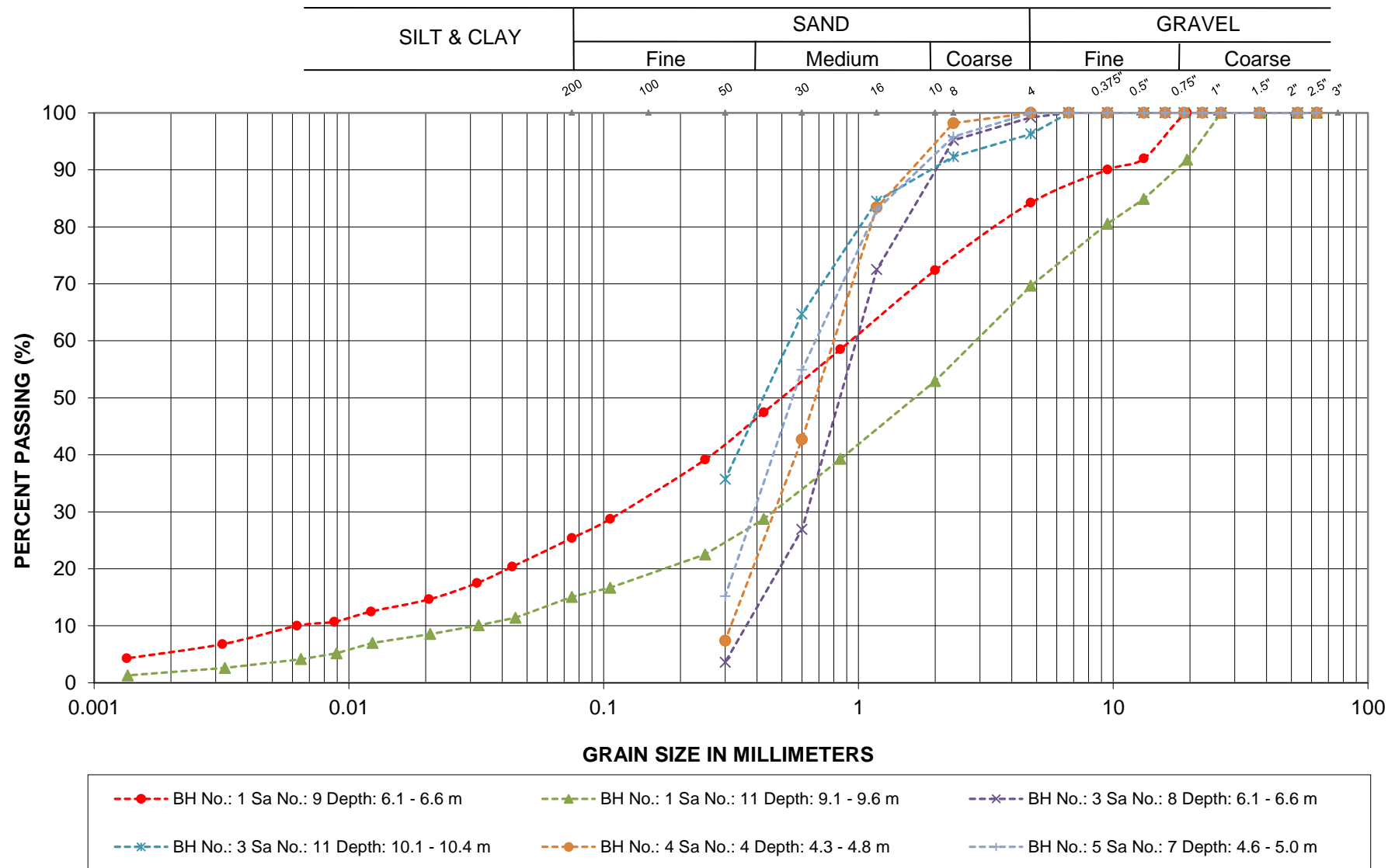
G.W.P.: 5563-04-00
 LOCATION: Hwy 535
 SITE: 46-380/C

EMBANKMENT FILL

LVM | MERLEX

FIGURE L-1

GRAIN SIZE ANALYSIS



G.W.P.: 5563-04-00
 LOCATION: Hwy 535
 SITE: 46-380/C

SAND

LVM | MERLEX

FIGURE L-2

Laboratory Tests - Summary Sheet

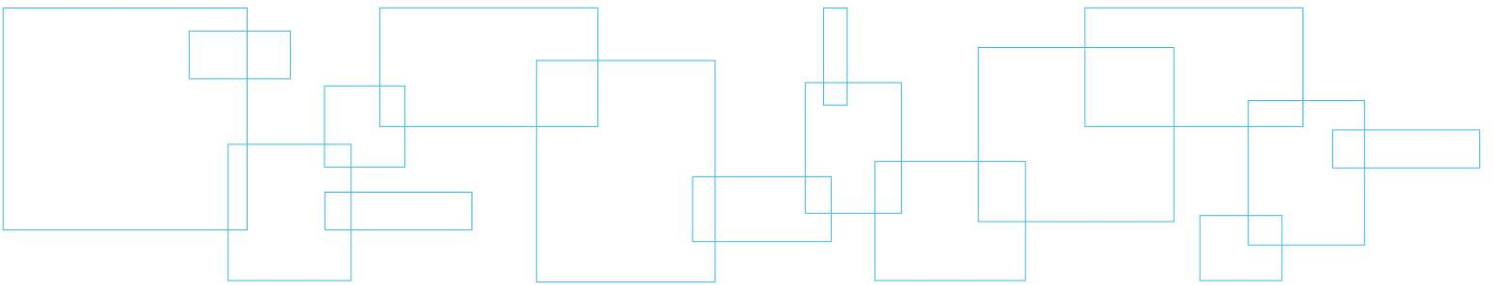
| Borehole No. | Sample No. | Depth | Grain Size Analysis | | | | NMC | Atterberg Limits | | | SPT 'N' | USCS | Unit Weight (kN/m3) | Remarks |
|--------------|------------|-------|---------------------|---------------|---------------|---------------|------|------------------|--------|--------|----------|------|---------------------|---------|
| | | | Gravel Size (%) | Sand Size (%) | Silt Size (%) | Clay Size (%) | | LL (%) | PL (%) | IP (%) | | | | |
| 1 | 1 | 0.0 | | | | | 5.4 | | | | N/A | | | |
| | 2 | 0.8 | 13 | 60 | 27 | | 7.2 | | | | 17 | | | |
| | 3 | 1.5 | | | | | 8.2 | | | | 13 | | | |
| | 4 | 2.3 | 14 | 66 | 20 | | 9.9 | | | | 3 | | | |
| | 5 | 3.0 | | | | | 13.8 | | | | 5 | | | |
| | 6 | 3.8 | | | | | 13.1 | | | | 6 | | | |
| | 7a | 4.6 | 8 | 83 | 9 | | 14.1 | | | | 9 | | | |
| | 7b | 4.6 | | | | | 9.5 | | | | 9 | | | |
| | 7c | 4.6 | | | | | 13.5 | | | | 9 | | | |
| | 8 | 5.3 | | | | | 11.6 | | | | 6 | | | |
| | 9 | 6.1 | 16 | 59 | 20 | 5 | 14.5 | | | | 9 | | | |
| | 10 | 7.6 | | | | | 11.2 | | | | 5 | | | |
| | 11 | 9.1 | 30 | 55 | 13 | 2 | 8.5 | | | | 29 | | | |
| 2 | 1 | 0.0 | | | | | 9.4 | | | | N/A | | | |
| | 2 | 0.8 | | | | | 10.7 | | | | 10 | | | |
| | 3 | 1.5 | 6 | 61 | 33 | | 13.6 | | | | 12 | | | |
| | 4 | 2.3 | | | | | 15.0 | | | | 29 | | | |
| | 5 | 3.0 | | | | | 14.8 | | | | 36/200mm | | | |
| 3 | 1 | 0.0 | | | | | 5.9 | | | | N/A | | | |
| | 2 | 0.8 | 8 | 73 | 19 | | 6.5 | | | | 21 | | | |
| | 3 | 1.5 | | | | | 7.6 | | | | 15 | | | |
| | 4 | 2.3 | | | | | 12.9 | | | | 4 | | | |
| | 5 | 3 | 14 | 62 | 24 | | 10.4 | | | | 15 | | | |
| | 6a | 3.8 | | | | | 10.9 | | | | 20 | | | |
| | 6b | 3.8 | | | | | 6.5 | | | | 20 | | | |
| | 7 | 4.6 | | | | | 8.0 | | | | 12 | | | |
| | 8 | 6.1 | 1 | 99 | 0 | | 18.9 | | | | 6 | | | |

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 (%) | | | | |
| 3 | 9 | 7.6 | | | | | 18.1 | | | | 24 | | | |
| | 10 | 9.1 | | | | | 19.0 | | | | 29 | | | |
| | 11 | 10.1 | 4 | 79 | 17 | | 11.0 | | | | N/A | | | |
| 4 | 1a | 1.9 | | | | | 83.2 | | | | 4 | | | |
| | 1b | 1.9 | | | | | 16.8 | | | | 4 | | | |
| | 2 | 2.7 | | | | | 12.2 | | | | 18 | | | |
| | 3 | 3.5 | | | | | | | | | 21 | | | |
| | 4 | 4.3 | 0 | 98 | 2 | | 21.5 | | | | 11 | | | |
| | 5 | 5.8 | | | | | | | | | 70/100mm | | | |
| 5 | 1 | 0 | | | | | | | | | N/A | | | |
| | 2 | 0.8 | | | | | | | | | 14 | | | |
| | 3 | 1.5 | | | | | | | | | 45/150mm | | | |
| | 4 | 2.3 | | | | | | | | | 4 | | | |
| | 5 | 3 | | | | | | | | | 2 | | | |
| | 6 | 3.8 | | | | | | | | | 5 | | | |
| | 7 | 4.6 | 0 | 96 | 4 | | | | | | 4 | | | |
| | 8 | 6.1 | | | | | | | | | 12 | | | |
| | 9 | 7.6 | | | | | | | | | 18 | | | |

Appendix D Photo Essay

Enclosure No. 7: Photo Essay



Top: Embankment at culvert outlet, looking north
Bottom: Embankment at culvert inlet, looking north

Photo: 1 - 2



Reference Number: 11/04/11046-F6

Project: Hwy 535 – Maskinonge Creek Culvert – Site No. 46-380/C

Provided By: LVM | MERLEX

Date: May 2011

Top: Stream at culvert outlet, looking east
Bottom: Stream at culvert inlet, looking west

Photo: 3 - 4



Reference Number: 11/04/11046-F6

Project: Hwy 535 – Maskinonge Creek Culvert – Site No. 46-380/C

Provided By: LVM | MERLEX

Date: May 2011

Top: Culvert site, looking north
Bottom: Culvert barrel, looking west

Photo: 5 - 6



Reference Number: 11/04/11046-F6

Project: Hwy 535 – Maskinonge Creek Culvert – Site No. 46-380/C

Provided By: LVM | MERLEX

Date: May/August 2011

Top: Drilling Borehole No. 4, looking east

Photo: 7



Reference Number: 11/04/11046-F6

Project: Hwy 535 – Maskinonge Creek Culvert – Site No. 46-380/C

Provided By: LVM | MERLEX

Date: August 2011