Foundation Investigation Report

Retaining Walls, Highway 48 – Little Rouge River Culvert (Site No. 37-1195/C), Town of Markham, Regional Municipality of York, Ontario, Ministry of Transportation, Ontario, Agreement No. 2016-E-0029

Submitted to:

AECOM Canada Ltd.
300 Water Street
Whitby, Ontario
L1N 9J2

Submitted by:

Golder Associates Ltd.
6925 Century Avenue, Suite #100 Mississauga, Ontario, L5N 7K2 Canada

+1 905 567 4444

1671430 (WO6)

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by AECOM Canada Ltd. (AECOM) on behalf of the Ministry of Transportation, Ontario (MTO) to provide detail foundation investigation and engineering services for the proposed retaining walls at the inlet and outlet of Little Rouge River Culvert (Site No. 37-1195/C) to accommodate widening of Highway 48 in the Town of Markham, Regional Municipality of York, Ontario, at the general location shown on the Key Plan on Drawing 1.

The Terms of Reference and scope of work are outlined in MTO's Work Item Order No. 2016-E-0029-006, dated October 24, 2017, which forms part of the Consultant's Assignment for the Central Region Large Value Retainer under Agreement No. 2016-E-0029-006.

2.0 SITE DESCRIPTION

The existing Little Rouge River Culvert is located across Highway 48, approximately 90 m north of the Highway 48 – 19th Avenue intersection in the Town of Markham, Regional Municipality of York, Ontario. The site is surrounded by residential properties, with the topography generally flat-lying to gently rolling. The existing Highway 48 grades down from approximately Elevation 239 m at the 19th Avenue interchange to about Elevation 236 m at the Little Rouge River Culvert crossing, and then rises to the north of the culvert. The storm sewer ditches extend along both sides of Highway 48 with the bottom / invert levels ranging from about Elevation 229.5 m to Elevation 236.5 m near 19th Avenue and at about 50 m north of the culvert. The water level in the culvert, as shown on the 60% drawings provided by AECOM, was at Elevation 229.4 m on July 10, 2018.

The existing Little Rouge River Culvert consists of a concrete box that is approximately 2.8 m high, 6.3 m wide and 40 m long.

Surface erosion was noted along the embankment slopes on both sides of Highway 48, with the most predominant erosion noted in the northeast quadrant of the culvert, as shown on Photograph 1 below. At the time of the site reconnaissance, it appeared that the erosion gullies had been filled in and the embankment slope facing was restored. Minor erosion was noted along the east side of Highway 48 as noted on Photograph 2.

Photograph 1: Surface erosion on east side of Highway 48

Photograph 2: Surface erosion on west side of Highway 48

3.0 INVESTIGATION PROCEDURES

Field work at the Little Rouge River Culvert site was carried out from May 16 to 28, 2018, during which time four boreholes (designated as Boreholes 17-1 to 17-4) were advanced at approximately the borehole locations shown on Drawing 1 and as follows: Boreholes 17-1 and 17-3 were advanced from the roadway platform in the southbound and northbound shoulder of Highway 48 south and north of the culvert, respectively; and Boreholes 17-2 and 17-4 were advanced at the west and east toe of the embankment of Highway 48, to the north and south of the culvert, respectively, near the culvert ends.

Borehole 17-1 was drilled using 210 mm outer diameter hollow-stem augers and Borehole 17-3 was drilled using 102 mm outer diameter solid stem augers both advanced by a D90 truck-mounted drill rig. Boreholes 17-2 and 17-4 were advanced using 89 mm inner diameter casing with a portable tripod drill rig. All drill rigs were supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. Soil samples were obtained at 0.75 m and 1.5 m intervals of depth using a 50 mm outer diameter split-spoon sampler driven by an automatic hammer in Boreholes 17-1 and 17-3 and driven by a full-weight manual hammer in Boreholes 17-2 and 17-4, in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586)[1].

Boreholes 17-1 and 17-3 were advanced through the road embankment to depths of about 12.3 m below existing ground surface. Boreholes 17-2 and 17-4 were advanced at the west and east toe of the embankment of Highway 48, respectively, and terminated upon casing refusal at a depth of about 5.0 m and 3.2 m below existing ground surface.

The groundwater conditions in the open boreholes were observed during and immediately following the drilling operations. A standpipe piezometer was installed in each of Boreholes 17-2 and 17-4 to permit monitoring of the water level. The installed piezometer in Boreholes 17-2 and 17-4 consists of a 50 mm diameter PVC pipe, with a 1.5 m slotted screen sealed within a filter sand pack with the bottom of the piezometer set at the bottom of the borehole. The borehole and annulus surrounding the piezometer pipe above the filter sand pack were backfilled to the ground surface with bentonite pellets. Piezometer installation details and water level readings are described on

[1] ASTM D1586 – Standard Test Method for Standard Penetration Tests and Split Barrel Sampling of Soils.

the respective borehole record in Appendix A. Boreholes 17-1 and 17-3 were backfilled to ground surface with bentonite, in accordance with Ontario Regulation 903, Wells (as amended).

The field work was monitored on a full-time basis by a member of Golder's technical staff who located the boreholes in the field, directed the sampling and in situ testing operations, logged the boreholes and examined the soil samples. The soil samples were identified in the field, placed in labelled containers and transported to Golder's laboratory in Mississauga for further visual review and geotechnical laboratory testing on selected samples, consisting of natural moisture content, Atterberg limits and grain size distribution analyses conducted in accordance with MTO and / or ASTM Standards as applicable.

The borehole locations were marked in the field by Golder personnel relative to the existing culvert and other site features. The locations given in the Record of Borehole sheets and shown on Drawing 1 are positioned relative to MTM NAD 83 (Zone 10) northing and easting coordinates and the ground surface elevations are referenced to Geodetic datum. The borehole locations, including in geographic coordinates of Latitude and Longitude, ground surface elevations and drilled depths are summarized below.

Borehole No.	MTM NAD83		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing (m) (Latitude)	Easting (m) (Longitude)		
17-1	4867396.4 (43.946341)	322615.0 (-79.278066)	236.0	12.3
17-2	4867430.5 (43.946648)	322605.9 (-79.278178)	233.4	5.0
17-3	4867413.0 (43.946490)	322622.2 (-79.277976)	236.1	12.3
17-4	4867387.2 (43.946257)	322637.2 (-79.277790)	231.8	3.2

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

This section of Highway 48 is located within the South Slope physiographic region, as delineated in *The Physiography of Southern Ontario* (Chapman and Putnam, 1984)[2].

The South Slope physiographic region is comprised of calcareous clay till with lacustrine clay and silt reworked by glaciers, with numerous scattered drumlins and deep valley cuts caused by streams flowing towards Lake Ontario.

4.2 General Overview of Subsurface Conditions

The detailed subsurface soil and groundwater conditions encountered in the boreholes and the results of the in situ and laboratory tests are provided on the borehole records in Appendix A. The results of the in situ field tests (i.e.,

[2] Chapman, L.J. and Putnam, D,F. 1984. *The Physiography of Southern Ontario*, Ontario Geological Survey, Special Volume 2, Third Edition. Accompanied by Map P. 2715, Scale 1:600,000.

SPT “N”-values) as presented on the borehole records, on the stratigraphic profiles and in Section 4 are uncorrected. The results of the laboratory test are presented on the borehole records in Appendix A and in the laboratory test plots in Appendix B. The results of the analytical testing of a soil sample are presented in Maxxam’s report included in Appendix C, and summarized in Section 4.4.

The stratigraphic boundaries shown on the borehole records and on the interpreted stratigraphic profile on Drawing 1 are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. Variation in the stratigraphic boundaries between and beyond boreholes will exist and is to be expected; however, the factual data presented on the borehole records governs any interpretation of the site conditions.

In general, the native subsurface soils encountered near the proposed retaining walls adjacent to the Little Rouge River Culvert consist of fill underlain by a native soil deposit comprised of clayey silt with sand, underlain in places by a gravelly sand or silt and sand deposit, further underlain by a till deposit comprised of clayey silt with sand to silt and sand. A detailed description of the subsurface conditions encountered in the boreholes is presented in the following sections of this report.

4.2.1 Topsoil

An approximately 1.2 m and 0.1 m thick layer of topsoil (fill) was encountered immediately below ground surface in Boreholes 17-2 and 17-4, respectively.

The Standard Penetration Tests (SPT) “N”-values measured within the thicker topsoil fill layer are 18 blows and 22 blows per 0.3 m of penetration indicating a compact level of compactness.

4.2.2 Fill

Boreholes 17-1 and 17-3 were advanced from the Highway 48 platform and penetrated an approximately 3.0 m and 3.8 m thick layer of fill. At the toe of the roadway embankment an approximately 1.2 m and 1.5 m thick layer of fill was encountered underlying the topsoil in Boreholes 17-2 and 17-4, respectively. The base of the fill layer extends to between Elevations 233.0 m and 230.2 m.

The fill material is generally non-cohesive and the layer is interlayered, with the layer consisting of gravelly sand, sand, silty sand, silt and sand, or silt. A layer of cohesive fill material consisting of clayey silt to sandy clayey silt was encountered interlayered with or underlying the non-cohesive fill material in Boreholes 17-1 and 17-3.

SPT “N”-values measured within the non-cohesive portion of the fill layer range from 6 blows to 78 blows per 0.3 m of penetration, with two discrete values of 114 blows per 0.3 m of penetration and 50 blows for 0.14 m of penetration, indicating that the non-cohesive fill has a loose to very dense level of compactness. SPT “N”-values measured within the cohesive portion of the fill are 33 blows and 36 blows per 0.3 m of penetration, and one value of 100 blows per 0.13 m of penetration, suggesting that the cohesive fill has a hard consistency.

Atterberg limits testing was carried out on one sample of the cohesive fill layer and measured a liquid limit of about 16 per cent, a plastic limit of about 11 per cent, and corresponding plasticity index of about 5 per cent. The result, which is plotted on a plasticity chart on Figure B-1 in Appendix B, indicates that the cohesive fill layer is clayey silt-silt of low plasticity. Atterberg limits testing was also carried out on two samples of the silt portion of the non-cohesive fill and indicate that the material is non-plastic. Natural water contents ranging between about 6 per cent

and 25 per cent were measured on selected samples of the non-cohesive fill material, while natural water contents of about 8 per cent and 13 per cent were measured on samples of the cohesive fill.

4.2.3 Clayey Silt with Sand

A 2.6 m and 1.7 m thick deposit of clayey silt with sand was encountered underlying the fill layer in Boreholes 17-1 and 17-3 at Elevations 233.0 m and 232.3 m, respectively.

SPT “N”-values ranging from 16 blows to 28 blows per 0.3 m of penetration and “N”-values of 71 blows per 0.3 m of penetration and 50 blows per 0.13 m of penetration were measured within the clayey silt with sand deposit, suggesting a very stiff to hard consistency.

Grain size distribution tests were carried out on two samples of the clayey silt with sand deposit and the results are shown on Figure B-2 of Appendix B. The deposit consists of clayey silt with sand containing trace to some gravel. Atterberg limits testing was carried out on two samples of the cohesive deposit and measured liquid limits of about 22 per cent and 25 per cent, plastic limits of about 14 per cent and plasticity indices of about 8 per cent and 11 per cent. These results, which are plotted on a plasticity chart on Figure B-3 in Appendix B, indicate that the cohesive deposit is a clayey silt of low plasticity. The natural water content measured on two samples of this deposit are about 15 per cent and 17 per cent.

4.2.4 Gravelly Sand

A 1.6 m thick deposit of gravelly sand was encountered underlying the clayey silt with sand deposit in Borehole 17-1 at Elevation 230.4 m.

An SPT “N”-value of 40 blows per 0.3 m of penetration was measured within the gravelly sand deposit, indicating a dense level of compactness. A grain size distribution test was carried out on one sample of the gravelly sad deposit and the result is shown on Figure B-4, in Appendix B. The natural water content measured on one sample of the gravelly sand deposit is 14 per cent.

4.2.5 Silt and Sand

A 1.6 m thick deposit of silt and sand was encountered underlying the clayey silt with sand deposit in Borehole 17-3 at Elevation 230.6 m.

An SPT “N”-value of 38 blows per 0.3 m of penetration was measured within the silt and sand deposit, indicating a dense level of compactness. A grain size distribution test was carried out on one sample of the silt and sand deposit and the result is shown on Figure B-5, in Appendix B. The natural water content measured on one sample of the gravelly sand deposit is 19 per cent.

4.2.6 Clayey Silt with Sand to Silt and Sand Till

A till deposit comprised of clayey silt with sand grading to a silt and sand was encountered underlying the fill layer in Boreholes 17-2 and 17-4, underlying the gravelly sand deposit in Borehole 17-1 and underlying the silt and sand deposit in Borehole 17-3. The surface of the till deposit was encountered between Elevations 231.0 m and 228.8 m. All borehole terminated within this deposit, penetrating it for a thickness of 1.6 m to 5.2 m.

The SPT “N”-values measures within the till deposit range between 76 blows per 0.3 m of penetration and 300 blows per 0.13 m of penetration, suggesting a hard consistency / very dense level of compactness.

Grain size distribution tests were carried out on four samples of the till deposit and the results are shown on Figure B-6 of Appendix B. Atterberg limits testing was carried out on five samples of the till deposit and one Atterberg

limits test indicated non-plastic material, while four tests measured liquid limits between about 12 per cent and 18 per cent, plastic limits between about 9 per cent and 12 per cent and plasticity indices between about 1 per cent and 6 per cent. These results, which are plotted on a plasticity chart on Figure B-7 in Appendix B, indicate that the cohesive portion of the till deposit is a clayey silt-silt of low plasticity and the non-cohesive portion of the till deposit contains a silt of slight plasticity. The natural water content measured on selected samples of the till deposit ranged between about 7 per cent and 12 per cent.

4.3 Groundwater Conditions

The groundwater levels in the open boreholes were measured upon completion of drilling operations. A standpipe piezometer was installed in each of Boreholes 17-2 and 17-4 to permit monitoring of the groundwater level at this site. Details of the piezometer installation and the measured groundwater levels are shown on the borehole records in Appendix A. The groundwater level recorded in the open boreholes and standpipe piezometers are summarized below.

Borehole No.	Ground Surface Elevation (m)	Depth to Water Level (m)	Groundwater Elevation (m)	Date	Comments
17-1	236.0	5.2	230.8	May 16, 2018	Open borehole (borehole caved to 6.6 m depth)
17-2	233.4	0.9 m	232.5	May 28, 2018	Piezometer
		1.0	232.4	June 22, 2018	
17-3	236.1	4.1	232.0	May 23, 2018	Open borehole
17-4	231.8	0.2	231.6	May 24, 2018	Open borehole at completion of drilling
		0.1	231.7	June 22, 2018	Piezometer

The groundwater level observations at this site will be subject to seasonal fluctuations and precipitation events, and the water levels should be expected to be higher during the spring season or during and following periods of heavy precipitation.

4.4 Analytical Testing Results

A soil samples was submitted to MAXXAM Analytical Laboratory for analysis of parameters used to assess the potential corrosivity of the site soil to steel and concrete. Detailed analytical test results are included in Appendix C and the test results are summarized below.

Borehole No. / Sample No.	pH	Resistivity (ohm-cm)	Electrical Conductivity (umho/cm)	Soluble Chloride (ug/g)	Soluble Sulphates (ug/g)
17-4 / 4	8.00	2,900	349	110	78

5.0 CLOSURE

This Foundation Investigation Report was prepared by Ms. Nikol Kochmanová, P.Eng., a geotechnical engineer with Golder. Jorge Costa, P.Eng., a MTO Foundations Designated Contact and Senior Consultant for Golder, conducted a quality control review of the report.

Golder Associates Ltd.

Nikol Kochmanová, Ph.D., P.Eng., PMP
Geotechnical Engineer

Jorge M.A. Costa, P.Eng.
MTO Foundation Designated Contact, Senior Consultant

NK/JMAC/rb

REFERENCES

Chapman, L.J. and Putnam, D.F. 1984. The Physiography of Southern Ontario, Ontario Geological Survey, Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

Ontario Water Resources Act

Ontario Regulation 903Wells (as amended)

MINISTRY OF TRANSPORTATION, ONTARIO

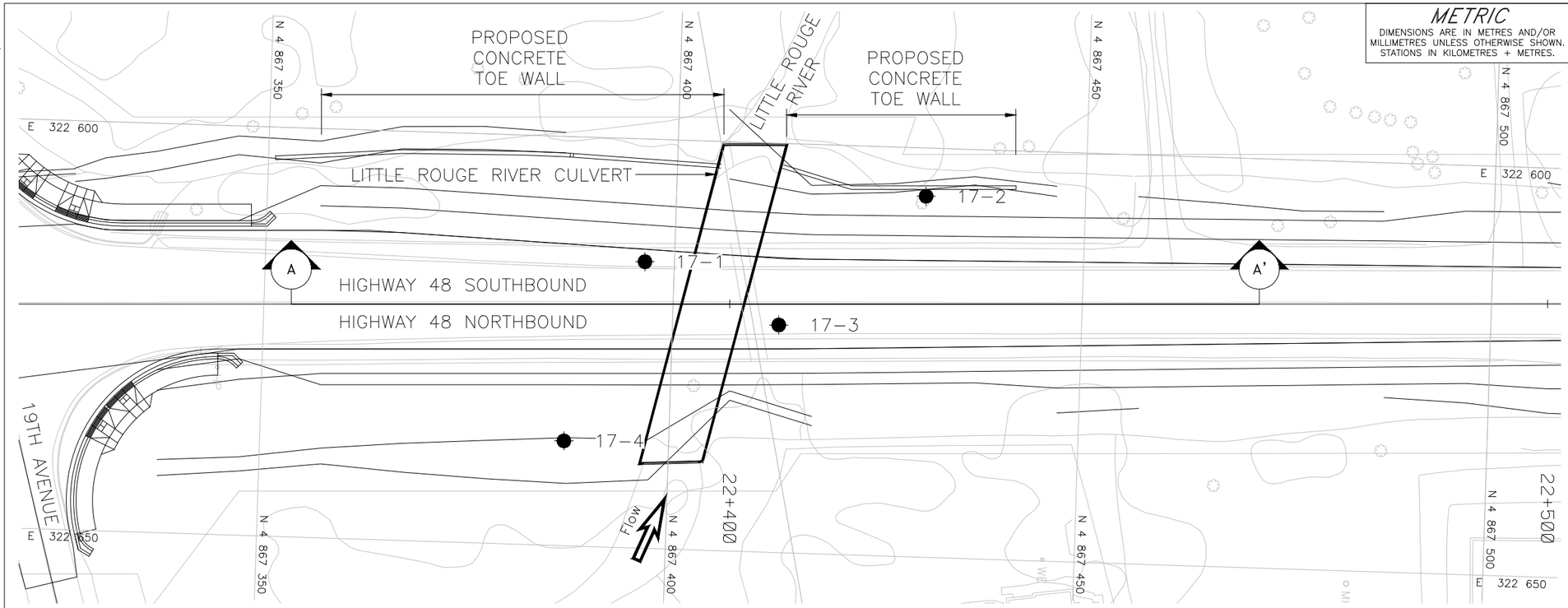
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. 2019-2005
WP No. 2087-17-00

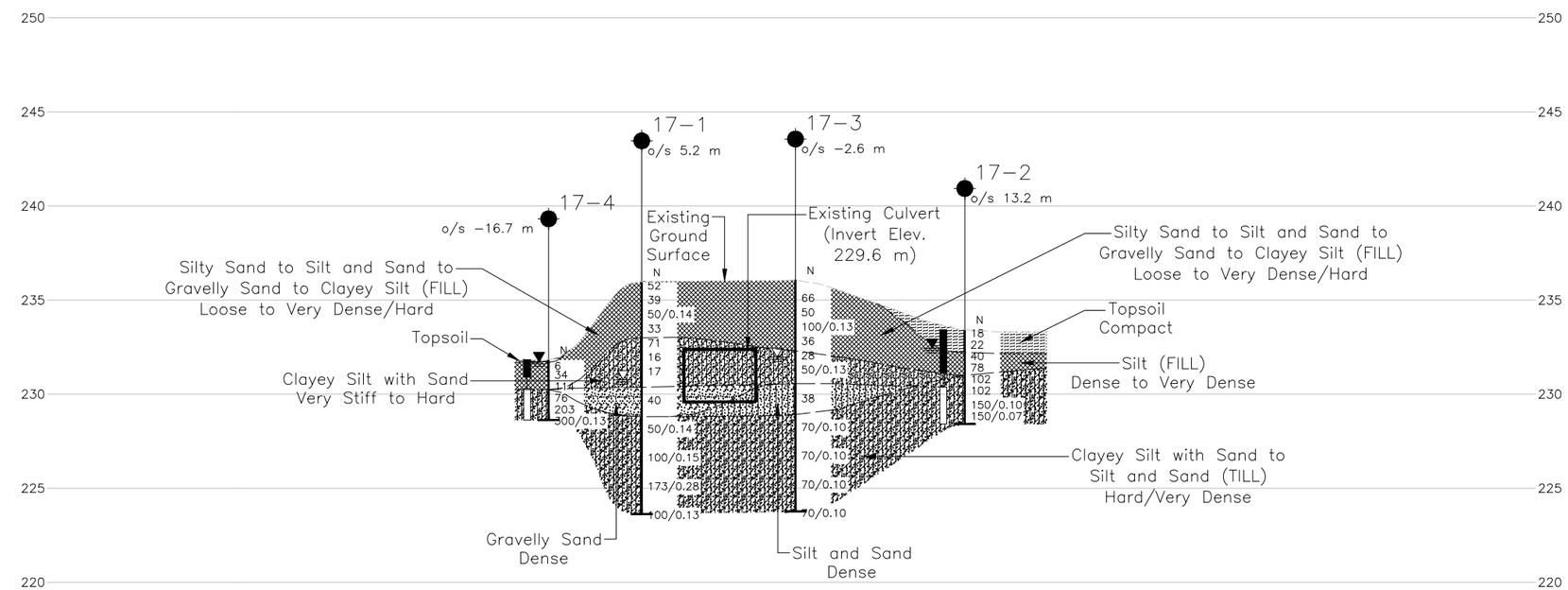
SHEET

RETAINING WALLS – LITTLE ROUGE RIVER CULVERT
HIGHWAY 48
BOREHOLE LOCATIONS AND SOIL STRATA

GOLDER

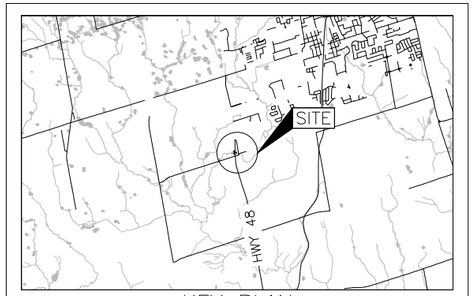


PLAN
SCALE
6 0 6 12 m



PROFILE A – A'

SCALE HORIZONTAL 6 0 6 12 m
SCALE VERTICAL 3 0 3 6 m



KEY PLAN
SCALE
1.5 0 1.5 3 km

LEGEND

- Borehole
- Seal
- Piezometer
- N — Standard Penetration Test Value
- 16 — Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL upon completion of drilling
- WL in piezometer, measured on Jun. 22, 2018

BOREHOLE CO-ORDINATES (MTM NAD 83 ZONE 10)

No.	ELEVATION	NORTHING	EASTING
17-1	236.0	4867396.4	322615.0
17-2	233.4	4867430.5	322605.9
17-3	236.1	4867413.0	322622.2
17-4	231.8	4867387.2	322637.2

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

Base plans provided in digital format by Aecom, drawing file nos. Hwy48 19th_bgd_ph.dwg, xs_Hwy48 at 19th.dwg, Hwy48 19th_plan.dwg, Hwy48 and 19th_alignment.dwg, received June 25, 2018, 60572848 R1-3 South Toe Wall.dwg and 60572848 R1-4 North Toe Wall.dwg, received October 12, 2018. Retaining Walls plan provided in digital format by Aecom, drawing file no. X-60572848 Structural Retaining Walls.dwg, received January 11, 2019.

LICENSED PROFESSIONAL ENGINEER N. KOCHMAN 100117863 Jan. 23, 2019 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.M.A.COSTA Jan. 23, 2019 PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
.	.	.	.

Geocres No. 30M14-481

HWY. 48	PROJECT NO. 1671430		DIST. .
SUBM'D. NK	CHKD. NK	DATE: 01/23/2019	SITE: 37-1195/C
DRAWN: DD	CHKD. NK	APPD. JMAC	DWG. 1

PLOT DATE: January 23, 2019
FILENAME: S:\Clients\MTO\Hwy_48\99_PROJ\1671430_Aecom\40_PROD\0004_Little_Rouge_River_Retaining_Walls\1671430-0004-BG-0001.dwg

APPENDIX A

Borehole Records

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x,	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
FoS	factor of safety

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
σ_1, σ_2, σ_3	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split-spoon
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.)

Dynamic Cone Penetration Resistance; N_d:

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60º cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH:	Sampler advanced by hydraulic pressure
PM:	Sampler advanced by manual pressure
WH:	Sampler advanced by static weight of hammer
WR:	Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Non-Cohesive (Cohesionless) Soils

Compactness Condition	N Blows/300 mm or Blows/ft
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency

	c_u, s_u kPa	c_u, s_u psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limit
w_l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane (LV-laboratory vane test)
γ	unit weight

Note: 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

V. MINOR SOIL CONSTITUENTS

Per cent by Weight	Modifier	Example
0 to 5	Trace	Trace sand
5 to 12	Trace to Some (or Little)	Trace to some sand
12 to 20	Some	Some sand
20 to 30	(ey) or (y)	Sandy
over 30	And (non-cohesive (cohesionless)) or With (cohesive)	Sand and Gravel Silty Clay with sand / Clayey Silt with sand

GOLDER

RECORD OF BOREHOLE No 17-1

SHEET 1 OF 1

METRIC

PROJECT 1671430 W06

G.W.P. 2087-17-00

LOCATION N 4867396.4; E 322615.0 MTM NAD 83 ZONE 10 (LAT. 43.946341; LONG. -79.278066)

ORIGINATED BY CC

DIST Central HWY 48

BOREHOLE TYPE 210 mm O.D., Hollow Stem Augers, Truck-mounted Drill Rig

COMPILED BY AM

DATUM Geodetic

DATE May 16, 2018

CHECKED BY NK

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	GR	SA	SI	CL
236.0	GROUND SURFACE							
0.0 / 235.3	Gravelly sand, trace organics (FILL) Very dense Brown Moist	1	SS	52				
0.7 / 234.5	Silty sand. some gravel (FILL) Dense Brown Moist	2	SS	39				
1.5 / 234.0	Gravelly sand, some silt (FILL) Very dense Brown Moist	3	SS	50 / 0.14				
2.0 / 233.3	Clayey silt, some sand, trace gravel (FILL) Hard Brown Moist	4A, 4B	SS	33				
3.0 / 230.4	Silt and sand, some gravel (FILL) Dense Brown Moist	5	SS	71				
	CLAYEY SILT with SAND, trace gravel Very stiff to hard Grey Moist	6	SS	16	4	39	45	12
		7	SS	17				
5.6 / 228.8	Gravelly SAND, trace to some silt, trace clay Dense Grey Moist	8	SS	40	24	61	12	3
7.2 / 223.7	CLAYEY SILT with SAND to SILT and SAND, trace to some clay, trace to some gravel (TILL) Hard/Very dense Grey Moist	9	SS	50/0.14				
		10	SS	100 / 0.15	6	51	36	7
		11	SS	173 / 0.28				
		12	SS	100/0.13	7	51	33	9
12.3	END OF BOREHOLE							

NOTES:

1. Borehole caved to 6.6 m below ground surface upon completion of drilling.

2. Water level measured in open borehole at a depth of 5.2 m below ground surface (Elev. 230.8 m) upon completion of drilling.

GROUND WATER CONDITIONS: ▽

ELEVATION SCALE: 235, 234, 233, 232, 231, 230, 229, 228, 227, 226, 225, 224

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

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

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

WATER CONTENT (%): 10 20 30

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTO\HWY_48\02_DATA\GINT\HWY_48.GPJ GAL-GTA.GDT 18-8-21

GOLDER

RECORD OF BOREHOLE No 17-2

SHEET 1 OF 1 **METRIC**

PROJECT 1671430 W06
G.W.P. 2087-17-00
DIST Central HWY 48
DATUM Geodetic

LOCATION N 4867430.5; E 322605.9 MTM NAD 83 ZONE 10 (LAT. 43.946648; LONG. -79.278178)
BOREHOLE TYPE 89 mm I.D., Casing, Portable Drill Rig
DATE May 28, 2018

ORIGINATED BY AM
COMPILED BY AM
CHECKED BY NK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
233.4	GROUND SURFACE										
0.0	TOPSOIL - ORGANIC SILT, some gravel, trace to some sand Compact Dark brown Moist to wet		1	SS	18		233				
232.2			2	SS	22						
1.2	Silt, some sand, some gravel (FILL) Dense to very dense Brown Moist		3	SS	40		232		○		
231.0			4A 4B	SS	78		231		○	NP	
2.4	CLAYEY SILT with SAND to SILT and SAND, trace to some clay, some gravel (TILL) Hard/Very dense Brown to grey Moist to wet		5	SS	102				⊢●		
			6	SS	102		230				
			7	SS	150 / 0.10				○⊣		18 37 33 12
	- Casing refusal on inferred cobbles at 4.5 m depth		8A 8B	SS	150 / 0.07		229				
228.4											
5.0	CASING REFUSAL END OF BOREHOLE										

NOTES:

1. Water level measured at a depth of 0.9 m below ground surface (Elev. 232.5 m) during piezometer installation.

2. Water level measured in standpipe piezometer at a depth of 1.0 m bellow ground surface (Elev. 232.4 m) on June 22, 2018.

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GOLDER

PROJECT 1671430 W06

RECORD OF BOREHOLE No 17-3

SHEET 1 OF 1

METRIC

G.W.P. 2087-17-00 LOCATION N 4867413.0; E 322622.2 MTM NAD 83 ZONE 10 (LAT. 43.946490; LONG. -79.277976) ORIGINATED BY AM

DIST Central HWY 48 BOREHOLE TYPE 102 mm O.D., Solid Stem Auger, Truck-mounted Drill Rig COMPILED BY AM

DATUM Geodetic DATE May 23, 2018 CHECKED BY NK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
236.1	GROUND SURFACE										
0.0	Sand, trace gravel to gravelly, trace to some silt (FILL) Very dense Brown Moist		1	SS	66		235				
	- 152 mm layer of gravelly clayey silt encountered at 1.6 m		2A 2B 2C	SS	50		234		○		
233.9											
2.2	Sandy clayey silt to silt, some gravel (FILL) Hard Brown Moist		3	SS	100 / 0.13		233				
			4	SS	36				○		
232.3											
3.8	CLAYEY SILT with SAND, trace to some gravel Very stiff to hard Grey-brown Moist		5	SS	28	▽	232				
			6	SS	50/0.13				○		9 34 38 19
230.6							231				
5.5	SILT and SAND, trace clay Dense Brown Wet		7	SS	38		230		○		0 46 53 1
229.0											
7.1	CLAYEY SILT with SAND to SILT and SAND, trace to some clay, trace to some gravel (TILL) Hard/Very dense Brown to grey below 11.5 m Moist - 0.1 m sand layer encountered at 7.8 m depth		8	SS	70/0.10		229				
			9	SS	70/0.10		228				
							227		○		
			10	SS	70/0.10		226				
	- Augers grinding on inferred cobble/ boulder at 11.0 m depth						225				
223.8			11	SS	70/0.10		224		○		
12.3	END OF BOREHOLE										
	NOTE: 1. Water level in open borehole measured at a depth of 4.1 m below ground surface (Elev. 232.0 m) upon completion of drilling.										

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTO\HWY_48\02_DATA\GINT\HWY_48.GPJ GAL-GTA.GDT 18-8-21

GOLDER

PROJECT 1671430 W06

RECORD OF BOREHOLE No 17-4

SHEET 1 OF 1

METRIC

G.W.P. 2087-17-00 LOCATION N 4867387.2; E 322637.2 MTM NAD 83 ZONE 10 (LAT. 43.946257; LONG. -79.277790) ORIGINATED BY AM

DIST Central HWY 48 BOREHOLE TYPE 89 mm I.D., Casing, Portable Drill Rig COMPILED BY AM

DATUM Geodetic DATE May 24, 2018 CHECKED BY NK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
231.8	GROUND SURFACE										
0.0	Topsoil (FILL)										
0.1	Silt and sand, trace to some gravel, trace clay, trace organics (FILL) Loose to dense Grey Moist		1	SS	6						
			2	SS	34		231		○	NP	
230.2	- Split spoon bouncing at 1.4 m		3A	SS	114						
1.6	- 50 mm gravel layer encountered at 1.5 m		3B				230		○		
	SILT and SAND, trace to some clay, trace gravel (TILL) Very dense Grey Wet		4	SS	76						
			5	SS	203		229		○	NP	5 52 36 7
228.6			6	SS	300/0.13						
3.2	CASING REFUSAL END OF BOREHOLE										

NOTES:

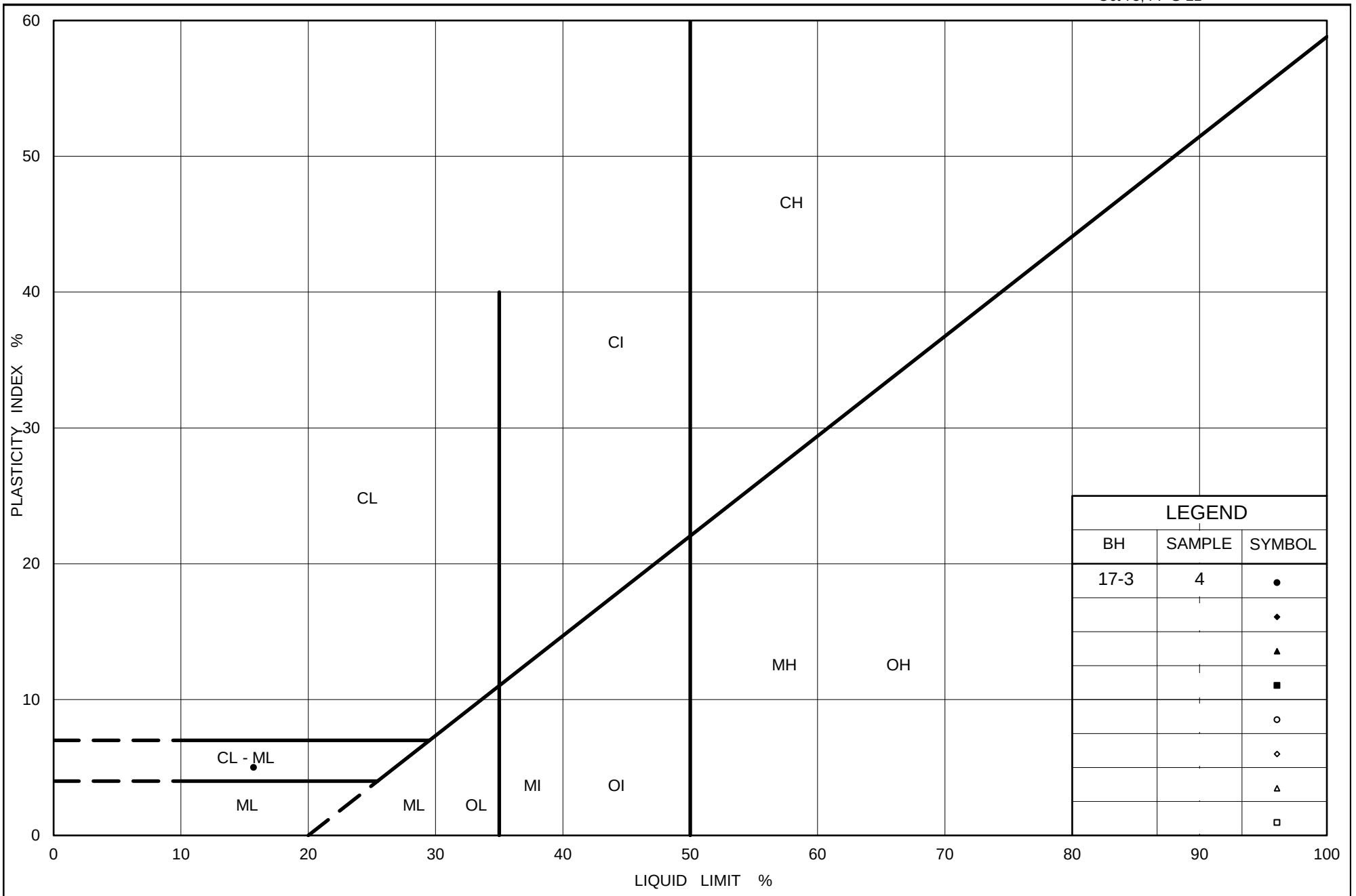
1. Water level in open borehole measured at a depth of 0.2 m below ground surface (Elev. 231.6 m) upon drilling completion.

2. Water level measured in standpipe piezometer at a depth of 0.1 m bellow ground surface (Elev. 231.7 m) on June 22, 2018.

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

APPENDIX B

Geotechnical Laboratory Test Results



Ministry of Transportation

Ontario

PLASTICITY CHART
Sandy Clayey Silt - Silt (Fill)

Figure No. B1

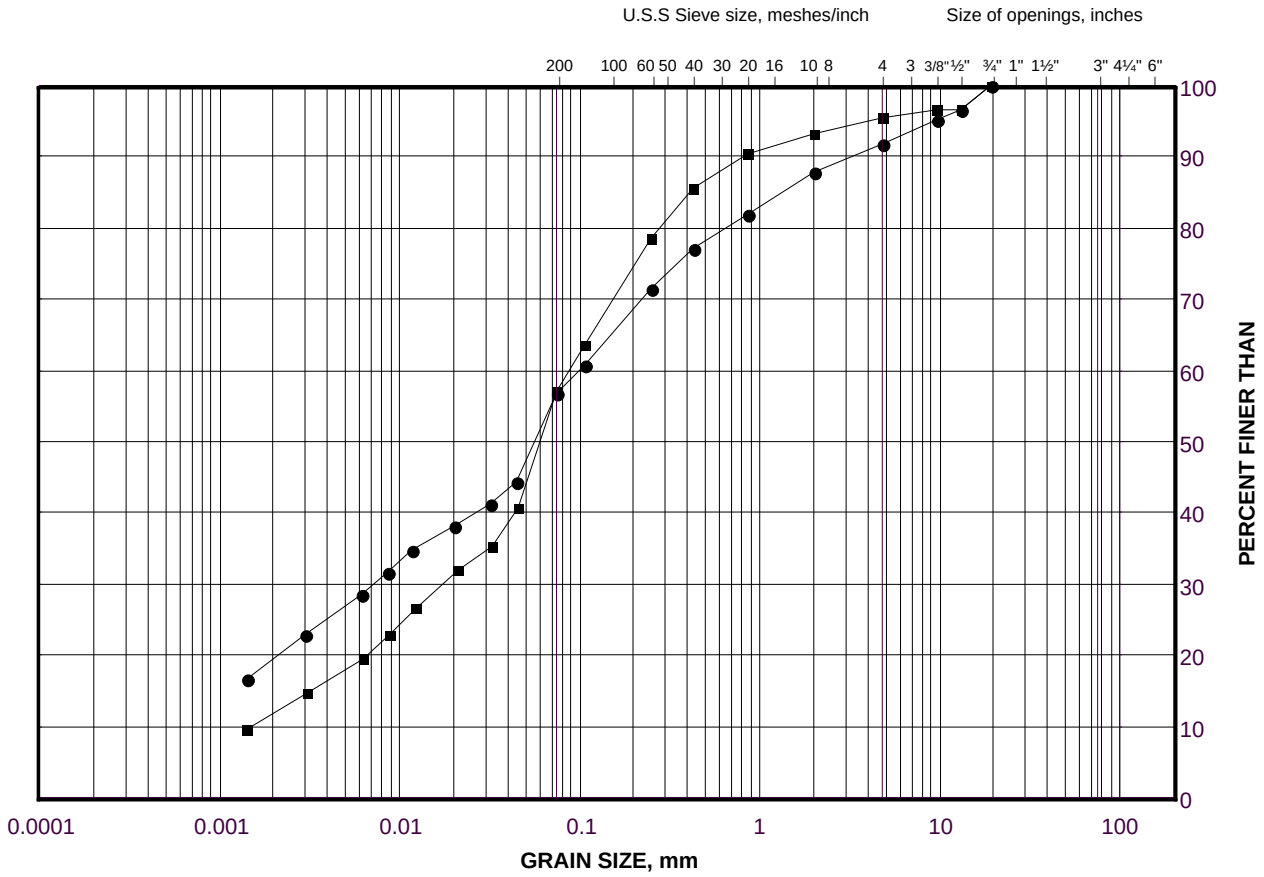
Project No. 1671430

Checked By: NK

GRAIN SIZE DISTRIBUTION

Clayey Silt with Sand

FIGURE B2



LEGEND

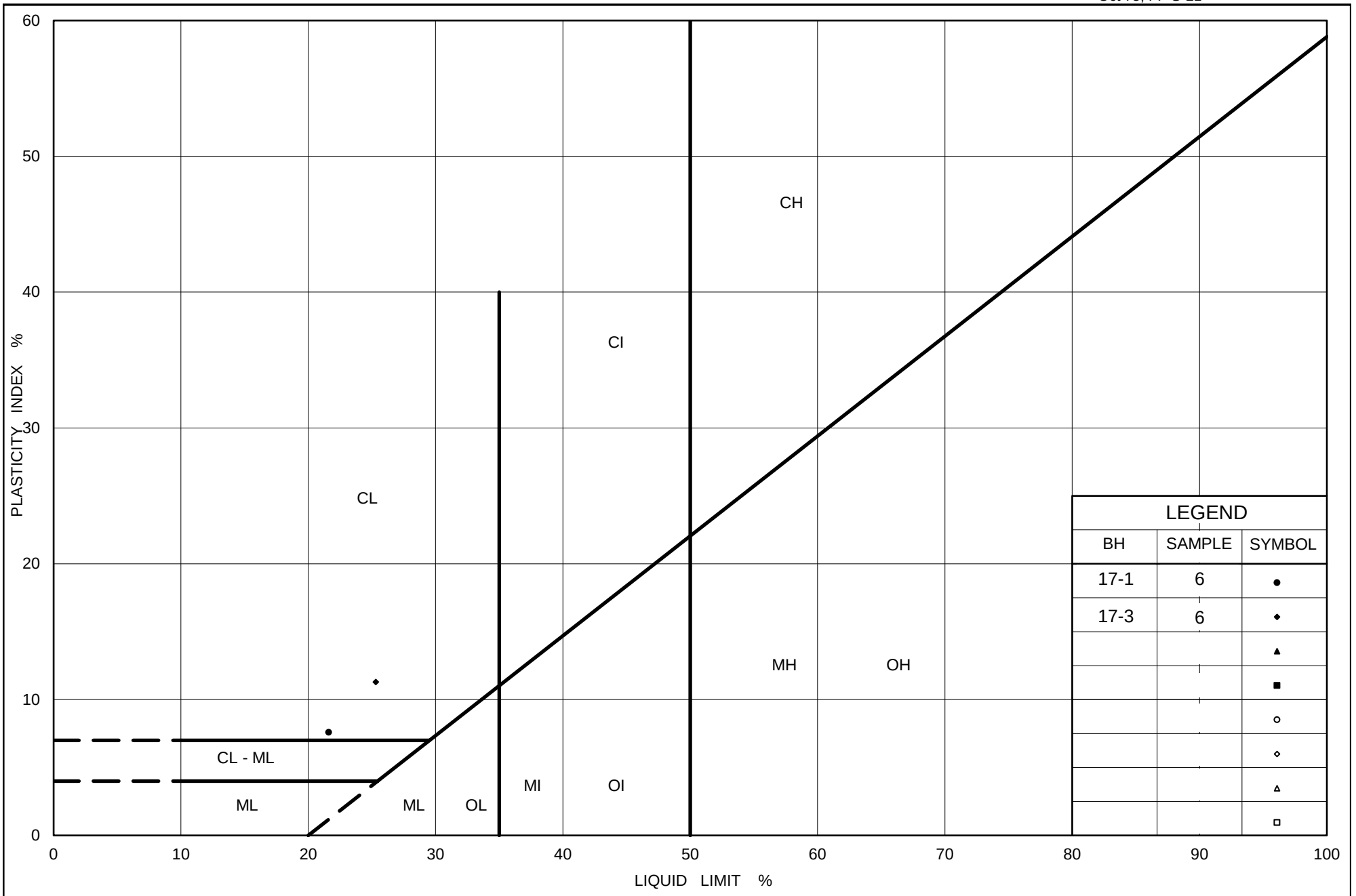
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	17-3	6	231.3
■	17-1	6	231.8

Project Number: 1671430

Checked By: NK

Golder Associates

Date: 07-Aug-18



Ministry of Transportation

Ontario

PLASTICITY CHART
Clayey Silt with Sand

Figure No. B3

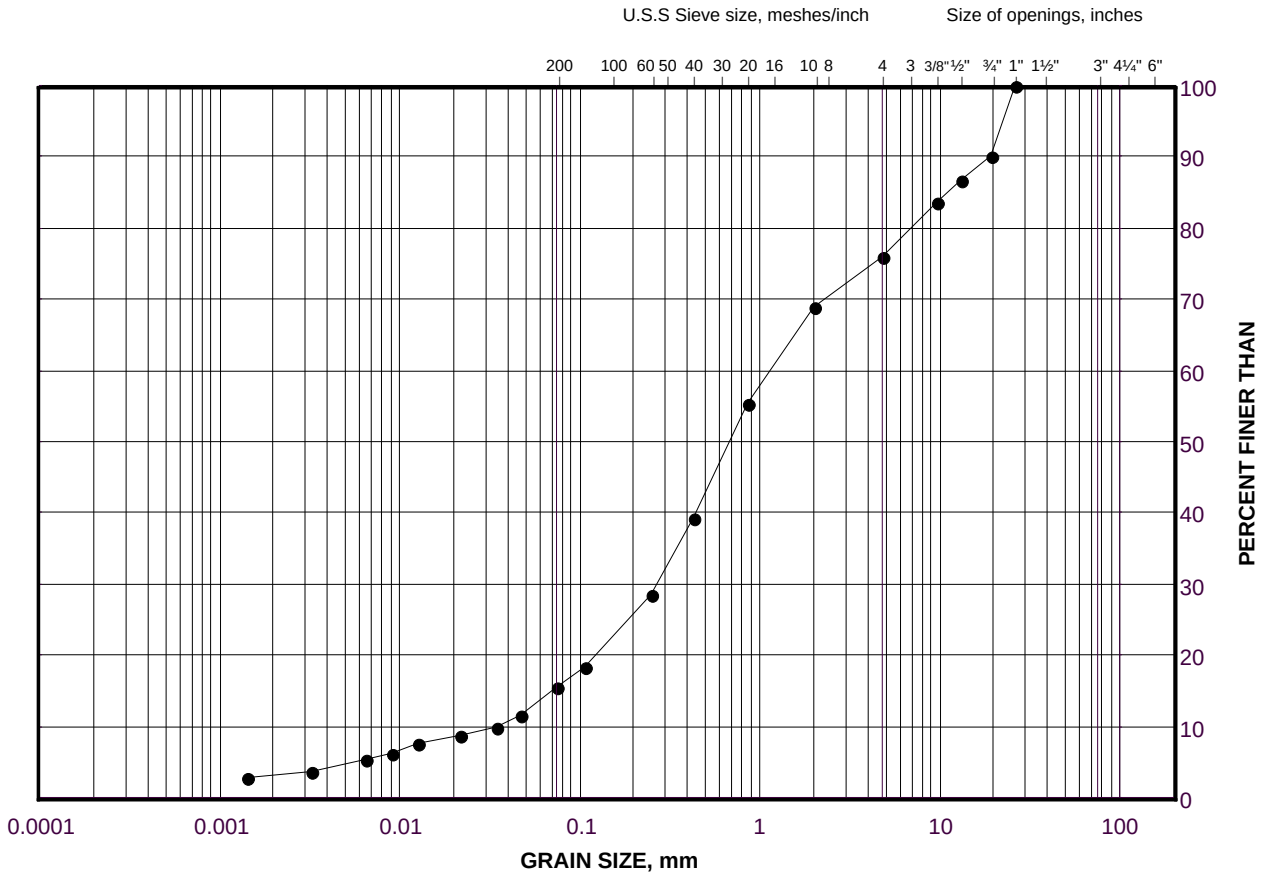
Project No. 1671430

Checked By: NK

GRAIN SIZE DISTRIBUTION

Gravelly Sand

FIGURE B4



LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	17-1	8	229.6

Project Number: 1671430

Checked By: NK

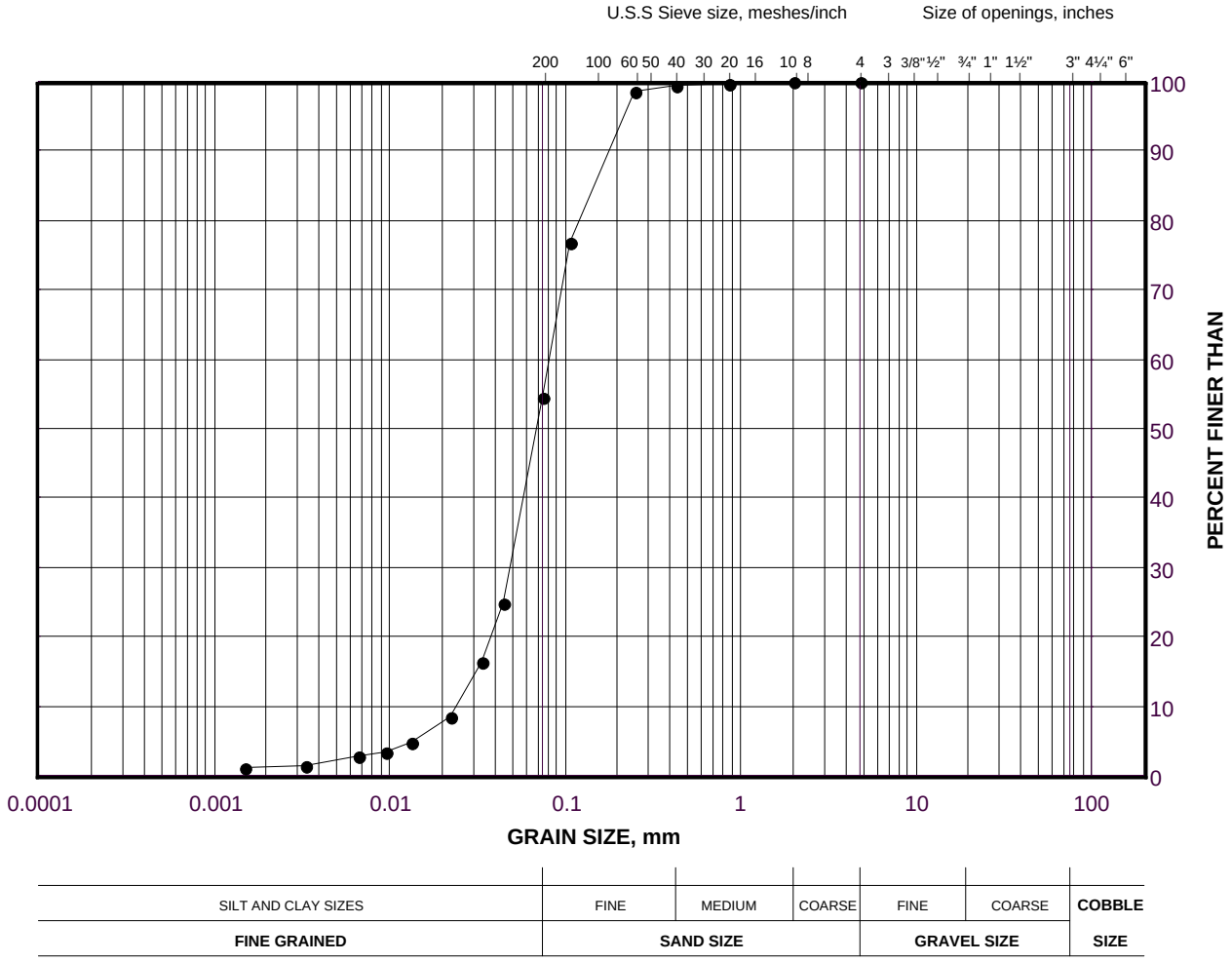
Golder Associates

Date: 07-Aug-18

GRAIN SIZE DISTRIBUTION

Silt and Sand

FIGURE B5



LEGEND

SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	17-3	7	229.7

Project Number: 1671430

Checked By: NK

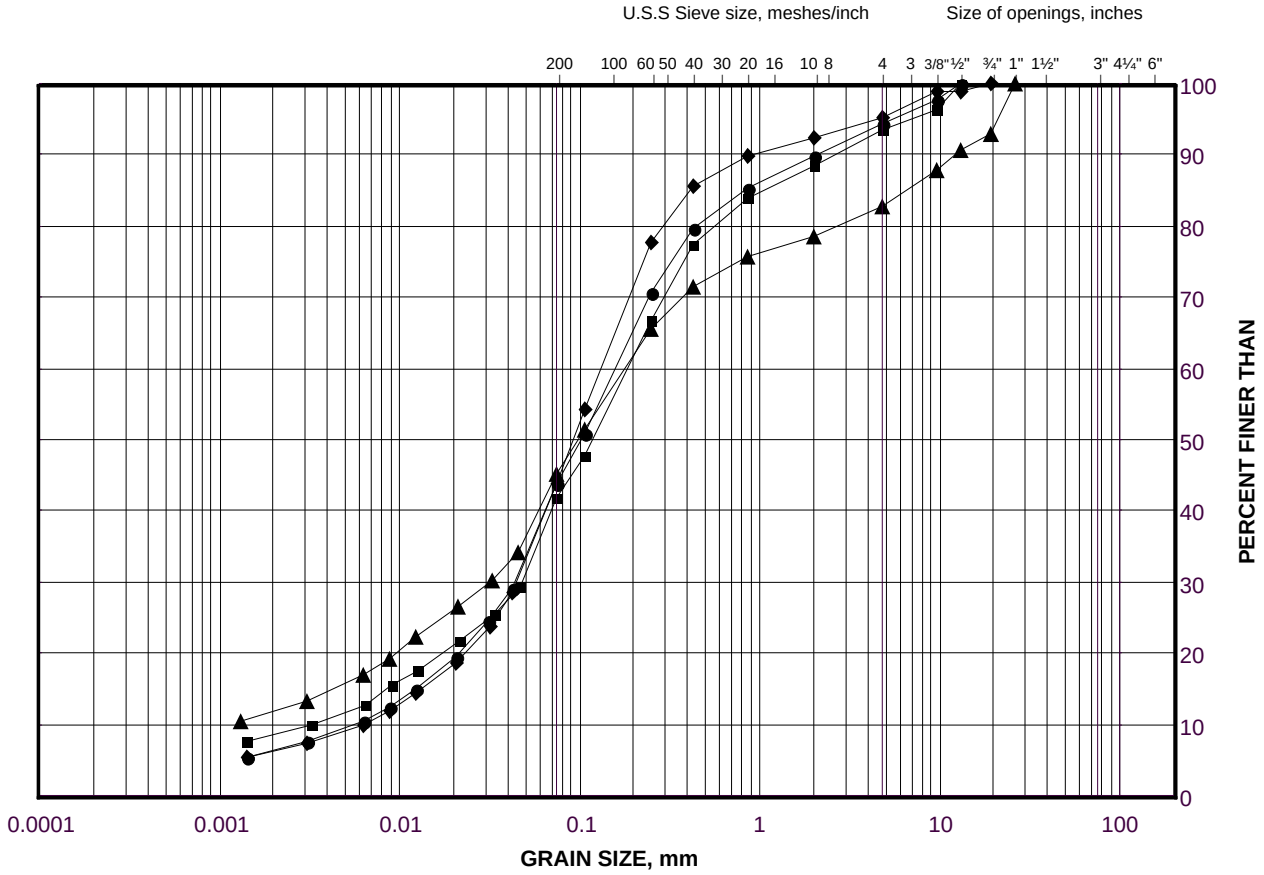
Golder Associates

Date: 07-Aug-18

GRAIN SIZE DISTRIBUTION

Clayey Silt with Sand to Silt and Sand (Till)

FIGURE B6



LEGEND

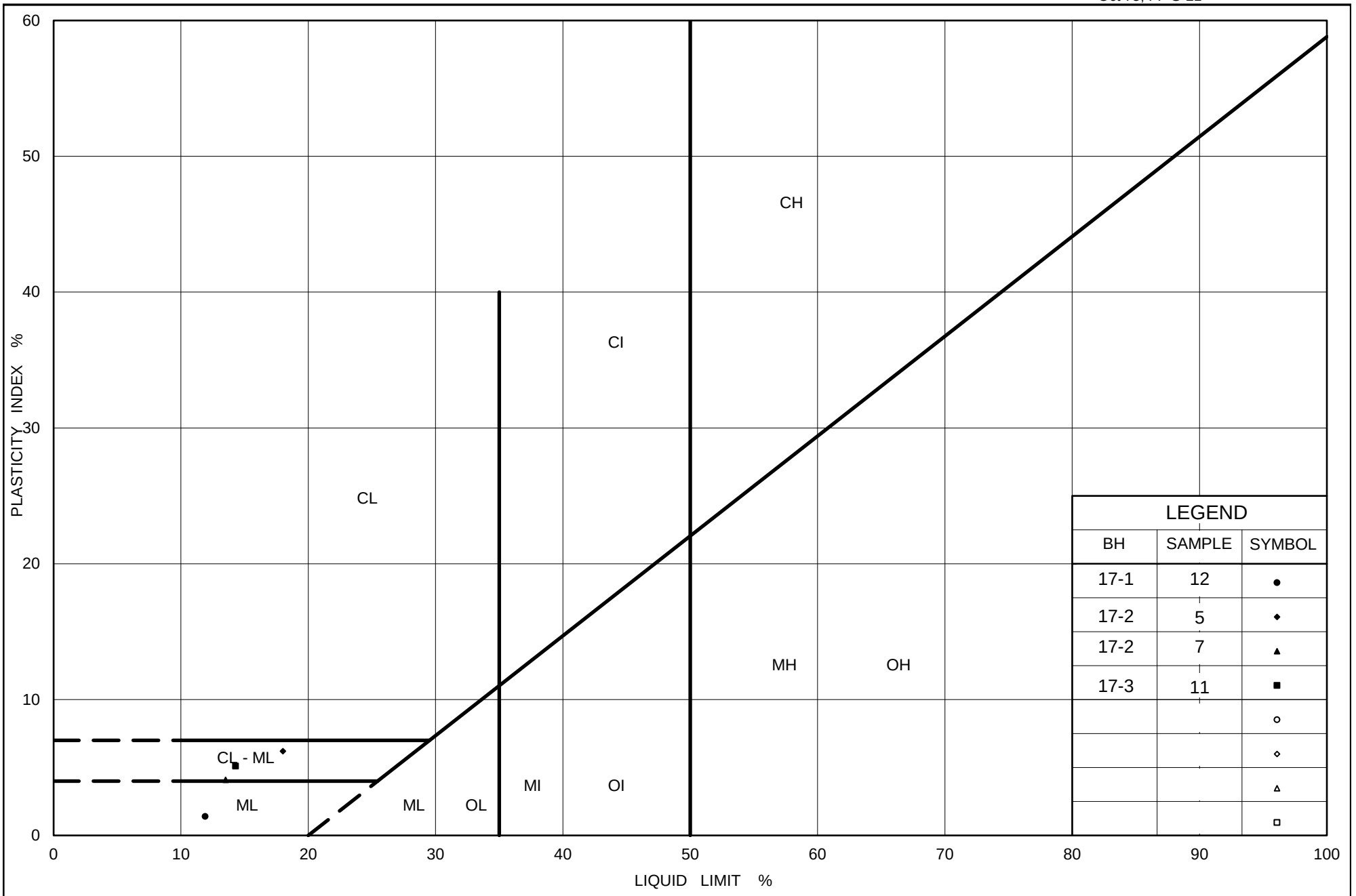
SYMBOL	Borehole	SAMPLE	ELEVATION(m)
●	17-1	10	226.6
■	17-1	12	223.7
◆	17-4	5	229.1
▲	17-2	7	229.3

Project Number: 1671430

Checked By: NK

Golder Associates

Date: 07-Aug-18



Ministry of Transportation

Ontario

PLASTICITY CHART
Clayey Silt with Sand to Silt and Sand (Till)

Figure No. B7

Project No. 1671430

Checked By: NK

APPENDIX C

Analytical Chemical Test Results

Maxxam
A Bureau Veritas Group Company

Your Project #: 1671430 W0006
Site Location: HWY 48 AND 19TH AVE
Your C.O.C. #: n/a

Attention: Nikol Kochmanova

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2018/06/15
Report #: R5242750
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8E2845
Received: 2018/06/12, 15:59

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride (20:1 extract)	1	N/A	2018/06/15	CAM SOP-00463	EPA 325.2 m
Conductivity	1	N/A	2018/06/15	CAM SOP-00414	OMOE E3530 v1 m
pH CaCl2 EXTRACT	1	2018/06/14	2018/06/14	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	1	2018/06/13	2018/06/15	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	1	N/A	2018/06/15	CAM SOP-00464	EPA 375.4 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your Project #: 1671430 W0006
Site Location: HWY 48 AND 19TH AVE
Your C.O.C. #: n/a

Attention: Nikol Kochmanova

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2018/06/15
Report #: R5242750
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8E2845
Received: 2018/06/12, 15:59

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ema Gitej, Senior Project Manager
Email: EGitej@maxxam.ca
Phone# (905)817-5829

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B8E2845
Report Date: 2018/06/15

Golder Associates Ltd
Client Project #: 1671430 W0006
Site Location: HWY 48 AND 19TH AVE
Sampler Initials: AM

SOIL CORROSIVITY PACKAGE (SOIL)

Maxxam ID		GYB555			GYB555		
Sampling Date		2018/05/24			2018/05/24		
COC Number		n/a			n/a		
	UNITS	**17-4 SA#4**	**RDL**	**QC Batch**	**17-4 SA#4 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Resistivity	ohm-cm	2900		5578503			
Inorganics							
Soluble (20:1) Chloride (Cl)	ug/g	110	20	5582214	120	20	5582214
Conductivity	umho/cm	349	2	5582341			
Available (CaCl2) pH	pH	8.00		5580453			
Soluble (20:1) Sulphate (SO4)	ug/g	78	20	5582215	72	20	5582215

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Maxxam Job #: B8E2845
Report Date: 2018/06/15

Golder Associates Ltd
Client Project #: 1671430 W0006
Site Location: HWY 48 AND 19TH AVE
Sampler Initials: AM

TEST SUMMARY

Maxxam ID: GYB555
Sample ID: 17-4 SA#4
Matrix: Soil

Collected: 2018/05/24
Shipped:
Received: 2018/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5582214	N/A	2018/06/15	Deonarine Ramnarine
Conductivity	AT	5582341	N/A	2018/06/15	Tahir Anwar
pH CaCl2 EXTRACT	AT	5580453	2018/06/14	2018/06/14	Tahir Anwar
Resistivity of Soil		5578503	2018/06/15	2018/06/15	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	5582215	N/A	2018/06/15	Deonarine Ramnarine

Maxxam ID: GYB555 Dup
Sample ID: 17-4 SA#4
Matrix: Soil

Collected: 2018/05/24
Shipped:
Received: 2018/06/12

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5582214	N/A	2018/06/15	Deonarine Ramnarine
Sulphate (20:1 Extract)	KONE/EC	5582215	N/A	2018/06/15	Deonarine Ramnarine

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Maxxam Job #: B8E2845
Report Date: 2018/06/15

Golder Associates Ltd
Client Project #: 1671430 W0006
Site Location: HWY 48 AND 19TH AVE
Sampler Initials: AM

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	22.3°C

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8E2845
Report Date: 2018/06/15

QUALITY ASSURANCE REPORT

Golder Associates Ltd
Client Project #: 1671430 W0006
Site Location: HWY 48 AND 19TH AVE
Sampler Initials: AM

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5580453	Available (CaCl2) pH	2018/06/14			101	97 - 103			0.21	N/A
5582214	Soluble (20:1) Chloride (Cl)	2018/06/15	NC	70 - 130	102	70 - 130	<20	ug/g	2.3	35
5582215	Soluble (20:1) Sulphate (SO4)	2018/06/15	NC	70 - 130	109	70 - 130	<20	ug/g	8.1	35
5582341	Conductivity	2018/06/15			100	90 - 110	<2	umho/cm	0.50	10

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

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Maxxam Job #: B8E2845
Report Date: 2018/06/15

Golder Associates Ltd
Client Project #: 1671430 W0006
Site Location: HWY 48 AND 19TH AVE
Sampler Initials: AM

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

Page ____ of ____

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required
Company Name:	Golder Associates Ltd	Company Name:		Quotation #:		[X] Regular TAT (5-7 days) Most analyses
Contact Name:	Nikol Kochmanová	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	6925 Century Ave Suite 100 Mississauga ON L5N 7K2	Address:		Project #:	1671430-W0006	Rush TAT (Surcharges will be applied)
				Site Location:	Hwy 48 and 19th Ave	[ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Phone:	905-567-4444 Fax: 905-567-6561	Phone:	Fax:	Site #:		Date Required:
Email:	Nikol_Kochmanova@golder.com	Email:		Sampled By:	AM	Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153			Other Regulations	
[ ] Table 1	[ ] Res/Park	[ ] Med/ Fine	[ ] CCME	[ ] Sanitary Sewer Bylaw
[ ] Table 2	[ ] Ind/Comm	[ ] Coarse	[ ] MISA	[ ] Storm Sewer Bylaw
[ ] Table 3	[ ] Agri/ Other		[ ] PWQO	Region
[ ] Table ____			[ ] Other (Specify)	
FOR RSC (PLEASE CIRCLE) Y / N			[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)	

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	Corrosivity Package (Cl, SO4, pH, resistivity) no sulphide and redox potential								HOLD- DO NOT ANALYZE
1	17-4 SA#4	2018/05/24	AM	Soil									X								
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

LABORATORY USE ONLY

CUSTODY SEAL Y / (N)		COOLER TEMPERATURES
Present	Intact	
		22 / 22 / 23

COOLING MEDIA PRESENT: Y / (N)

COMMENTS

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Alex MacMillan	2018/06/12	16:00	Junaid Ulmer	18/06/12	15:59

12-Jun-18 15:59
Ema Gitej
B8E2845
VMK ENV-1084

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