Golder Associates Ltd.

309 Exeter Road, Unit #1
London, Ontario, Canada N6L 1C1
Telephone: (519) 652-0099
Fax: (519) 652-6299

FOUNDATION INVESTIGATION REPORT
STRUCTURAL CULVERT
STATION 21+151
TOWNSHIP OF MAIDSTONE
HIGHWAY 401 RECONSTRUCTION
GWP 65-00-00, AGREEMENT NO. 3006-E-0037
MINISTRY OF TRANSPORTATION - SOUTHWESTERN REGION

Submitted to:

Dillon Consulting Limited
130 Dufferin Avenue, Suite 1400
London, Ontario
N6A 5R2

DISTRIBUTION:

9 Copies - Dillon Consulting Limited
2 Copies - Golder Associates Ltd.

December 20, 2007

07-1130-035-1 (-6)
Geocres No. 40J2-101

TABLE OF CONTENTS

SECTION PAGE

1.0 INTRODUCTION

Golder Associates Ltd. (Golder Associates) has been retained by Dillon Consulting Limited (Dillon) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out foundation investigations as part of the detail design work for GWP 65-00-00. The project involves the detail design for widening and improvements of a section of Highway 401 between Windsor and Tilbury and includes:

- Removal of the existing pavement structure full depth and rebuild with a new concrete pavement structure;
- The existing roadway will be widened to a 6-lane cross section including 3.0 metre fully paved outside shoulders with rumble strips and 3.0 metre paved median shoulders with rumble strips;
- Construction of a concrete tall wall median barrier and a closed drainage system;
- Installation of partial illumination at the Belle River Road interchange;
- Interchange improvements at Belle River Road;
- Rehabilitation of Maidstone Township Road 3 Underpass Structure (Site No. 6-236);
- Rehabilitation and widening of the Belle River Structure (Site No. 6-84);
- Reconstruction of the Belle River Road Overpass Structure (Site No. 6-85);
- Rehabilitation and widening of the Duck Creek Structure, EBL and WBL (Site No. 6-86);
- Rehabilitation of four concrete culverts and replacement of one culvert; and
- Upgrading of permanent highway signing.

This report addresses the rehabilitation and internal footing replacement works for the structural culvert at Station 21+151 Township of Maidstone.

The purpose of the foundation investigation is to determine the subsurface conditions at the locations of the proposed works by drilling boreholes and carrying out in situ testing and laboratory testing on selected samples. The terms of reference for the scope of work are outlined in the MTO's Request for Proposal and in Golder Associates' proposal P61-3151 dated January 4, 2007. The work was carried out in accordance with our Quality Control Plan for Foundation Engineering dated March 14, 2007 and our letter regarding foundation engineering services dated April 20, 2007.

Dillon provided Golder with preliminary drawings for this project in digital format.

2.0 SITE DESCRIPTION

GWP 65-00-00 extends along Highway 401 from 1.3 kilometres east of Puce Road easterly to 2.5 kilometres east of Belle River Road. GWP 65-00-00 includes the rehabilitation of one structure, the rehabilitation and widening of two structures, reconstruction of one structure, rehabilitation or replacement of five culverts, interchange improvements at Belle River Road and reconstruction of the pavement to a six lane cross-section with a tall wall median barrier and closed drainage system. The structural culvert at Station 21+151 Township of Maidstone is located approximately 70 metres west of Concession Road 2 West. The location of the project site is shown on the Key Plan, Figure 1.

Highway 401 is one of the most important transportation facilities in Ontario and connects major urban centres in southern Ontario with Quebec and the United States of America. The subject section of Highway 401 is a Class I, controlled access, divided rural freeway. Along most of this section of highway, the existing cross-section consists of a 6.80 metre wide median with both the westbound and eastbound lanes consisting of 3.50 metre wide inner shoulders, two 3.75 metre wide lanes and 3.00 metre wide outer paved shoulders. In the vicinity of the Belle River Road (Essex County Road 27) Interchange, the outer shoulders are 2.50 metres with variable width speed change lanes.

The culvert at Station 21+151 Township of Maidstone carries flow from Municipal Drain DMA21150 (Rolstein's Drain) under Highway 401. Flow in the culvert is from south to north.

The adjacent topography is generally flat to slightly rolling with a ground surface elevation ranging from 183 metres to 184 metres.

2.1 Site Geology

The project is located in the Essex Clay Plain, a subregion of the physiographic region of southern Ontario known as the St. Clair Clay Plain, as identified in "The Physiography of Southern Ontario", by Chapman and Putnam (1984). The clay plain is described as a till plain that has been locally smoothed by shallow deposits which settled in depressions in the till. The prevailing soil type is reported to be the Brookston clay.

Based on the Ontario Department of Mines and Northern Affairs Preliminary Maps P.749 and P.750 entitled "Quaternary Geology of the Windsor-Essex Area" Western and Eastern Parts, respectively, the project area is reportedly located in predominantly clayey silt till.

The subcropping bedrock is reported to be limestone of the Dundee formation of Middle Devonian Age (Geological Survey of Canada, Map 1263A entitled "Geology, Toronto-Windsor Area", dated 1969).

3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out on May 9 and July 5, 2007 at which time three boreholes were drilled at the locations indicated on Drawing 1.

The as-drilled borehole locations, ground surface elevations and depths of boreholes drilled by Golder are as follows:

BOREHOLE	LOCATION (m)		GROUND SURFACE ELEVATION (m)	BOREHOLE DEPTH (m)
	Northing	Easting		
601	4,677,538	285,117	184.57	10.36
602	4,677,527	285,100	183.09	7.32
603	4,677,588	285,100	183.06	7.32

The existing culvert has the following characteristics:

DIMENSIONS (m)	OBVERT ELEVATION (m)		CONSTRUCTION	MUNICIPAL DRAIN ID
	(Lt)	(Rt)		
5.55 x 1.55 x 50.73	184.02	183.97	Concrete, non rigid frame open footing	DMA21150

The soil stratigraphy encountered in the boreholes is shown on the attached Record of Borehole sheets. The investigation was carried out using a truck-mounted CME 45 power auger and an all-terrain vehicle mounted CME 850 power auger supplied and operated by a specialist drilling contractor. Samples of the overburden were obtained at 0.75 and 1.5 metre intervals of depth using 50 millimetre outside diameter split spoon sampling equipment in accordance with the standard penetration test (SPT) procedures. Groundwater conditions in the boreholes were observed throughout the drilling operations and the boreholes were backfilled in accordance with current MTO procedures and Ontario Regulation 128/03.

The field work was supervised on a full-time basis by experienced members of our engineering staff who directed the drilling, sampling and in situ testing operations and logged the boreholes. The ground surface elevations and borehole locations were also determined by members of our staff.

The samples were identified in the field, placed in labelled containers and transported to our London laboratory for further examination and routine classification testing. Index and classification tests consisting of water content determinations, grain size distribution analyses and Atterberg limits determinations were carried out on selected samples. The results of the testing are shown on the Record of Borehole sheets and in Appendix A.

4.0 SUBSURFACE CONDITIONS

4.1 Site Stratigraphy

The detailed subsurface soil and groundwater conditions encountered in the boreholes, together with the results of the in situ testing and the laboratory testing carried out on selected samples, are given on the attached Record of Borehole sheets following the text of this report and in Appendix A. The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous samples and observations of drilling resistance and, therefore, may represent transitions between soil types rather than exact planes of geological change. Further, the subsurface conditions will vary between and beyond the borehole locations.

The boreholes drilled at the site encountered a surficial topsoil layer and/or clayey silt fill overlying a deposit of clayey silt till.

The locations and elevations of the boreholes, together with the interpreted stratigraphic profiles, are shown on the attached Drawing 1. A detailed description of the subsurface conditions encountered in the boreholes is provided on the Record of Borehole sheets and is summarized in the following sections.

4.1.1 Topsoil and Fill

A topsoil layer between 150 and 210 millimetres thick was found at the ground surface in all of the boreholes drilled at this site.

A 1.9 metre thick layer of clayey silt fill was encountered beneath the topsoil in borehole 601 at elevation 184.4 metres. The clayey silt fill was stiff with N values of 10 to 14 blows per 0.3 metres and a water content of 20 per cent.

4.1.2 Clayey Silt Till

Clayey silt till was encountered in all boreholes drilled at the site. The clayey silt till was found beneath the clayey silt fill at about elevation 182.4 metres in borehole 601 and beneath the topsoil from about elevation 182.9 metres in boreholes 602 and 603. All of the boreholes drilled at the site were terminated in a layer of clayey silt till after exploring it for some 7.2 to 8.2 metres. The results of grain size testing on six samples of clayey silt till recovered from the standard penetration testing are presented on Figure A-1.

The clayey silt till was stiff to hard with N values of 8 to 38 blows per 0.3 metres and had water contents of 16 to 21 per cent with an average water content of 18 per cent. The average plastic and liquid limits based on the results of six Atterberg limits determinations were 17 per cent and

34 per cent, respectively, with an average plasticity index of 17 per cent. The results of the plasticity testing indicate an inorganic clayey soil of low to intermediate, but typically low, plasticity. The results of the Atterberg limits testing are presented on the Plasticity Chart, Figure A-2.

Although cobbles and boulders were not specifically encountered in the boreholes, the presence of these materials should be expected due to the depositional history of the glacial tills.

4.2 Groundwater Conditions

All of the boreholes drilled at this site were observed to be dry both during and at the completion of drilling.

The water level at the outlet of Municipal Drain 21150 was measured at elevation 182.55 and 182.39 metres on May 9 and July 5, 2007, respectively. On July 5, 2007, the water level at the culvert inlet was 182.43 metres.

Based on the location of the interface of the brown and grey clayey silt till at elevations 180.2 to 180.6 metres and the drain water levels at elevation 182.5 metres, the long-term groundwater level elevation is inferred to be approximately 182.5 metres.

Groundwater levels at the piezometer installed in borehole 5 for Geocres No. 40J2-99 was at 183.1 metres. Encountered water levels ranging from 182.7 to 183.2 metres were observed for the investigation at Concession Road 3, Geocres No. 40J2-103.

The groundwater levels are expected to fluctuate seasonally and are expected to be higher during periods of sustained precipitation or during spring melt conditions.

5.0 MISCELLANEOUS

The investigation was carried out using equipment supplied and operated by Aardvark Drilling Inc., which are Ontario Ministry of Environment licensed well contractors. The field operations were supervised by Mr. Daniel R. P. Babcock, E.I.T. and Mr. Michael Arthur under the direction of Mr. David J. Mitchell. The routine laboratory testing was carried out at Golder Associates' London laboratory under the direction of Mr. Chris M. Sewell. The laboratory is an accredited participant in the MTO Soil and Aggregate Proficiency Program and is certified by the Canadian Council of Independent Laboratories for testing Types C and D aggregates.

This report was prepared by Ms. Dirka U. Prout, P. Eng. under the direction of the Project Manager, Mr. Philip R. Bedell, P. Eng. This report was reviewed by Mr. Fintan J. Heffernan, P. Eng., the Designated MTO Contact and Quality Control Auditor for this assignment.

GOLDER ASSOCIATES LTD.

Dirka U. Prout, P. Eng.
Geotechnical Engineer

Philip R. Bedell, P. Eng.
Principal

Fintan J. Heffernan, P. Eng.
Designated MTO Contact

DB/DUP/PRB/FJH/cr
n:\active\2007\1130 - geotechnical\1130-0000\07-1130-035-1 dillon - gwp 65-00-00 fdn - hwy 401\reports\6- structural culvert 21+151\dec 20 07 - (final) part a - structural culvert sta 21+151.doc

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
SS	Split-spoon
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
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.) split spoon 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) Cohesionless Soils

Density Index (Relative Density)	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.

LIST OF SYMBOLS

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

I. General

π	3.1416
in x,	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

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
v	poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	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

(a) Index Properties (continued)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	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_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
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

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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 601

1 OF 1

METRIC

PROJECT 07-1130-035-1
G.W.P. 65-00-00
LOCATION N 4677538.2 ;E 285117.4
ORIGINATED BY MA
DIST 1 HWY 401
BOREHOLE TYPE HOLLOW STEM AUGER
COMPILED BY DCH
DATUM GEODETIC
DATE May 9, 2007
CHECKED BY

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 × LAB VANE) (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
184.57	GROUND SURFACE										
0.00	TOPSOIL, clayey										
0.21	Brown FILL, clayey silt, trace sand, trace gravel, trace topsoil Stiff Brown & grey		1	SS	10		184				
			2	SS	14		183				
182.44											
2.13	CLAYEY SILT (TILL), some sand, trace gravel Stiff to Hard Brown becoming Grey below about elev. 180.2m		3	SS	23		182				
			4	SS	38						1 15 47 37
			5	SS	32		181				
			6	SS	18		180				
			7	SS	13		179				
							178				
			8	SS	17		177				1 16 48 35
							176				
			9	SS	14		175				
174.21			10	SS	13						
10.36	END OF BOREHOLE Borehole dry during drilling on May 9, 2007.										

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

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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 602

1 OF 1

METRIC

PROJECT 07-1130-035-1
G.W.P. 65-00-00
LOCATION N 4677527.4 ;E 285099.6
ORIGINATED BY DB
DIST 1 HWY 401
BOREHOLE TYPE HOLLOW STEM AUGER
COMPILED BY DCH
DATUM GEODETIC
DATE July 5, 2007
CHECKED BY

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 × LAB VANE) (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
183.09	GROUND SURFACE						183				
0.00	TOPSOIL, silty										
0.15	Brown CLAYEY SILT (TILL), some sand, trace gravel Very Stiff to Stiff Brown becoming Grey below about elev. 180.5m		1	SS	10		182				1 15 44 40
			2	SS	16						
			3	SS	23		181				
			4	SS	10		180				
			5	SS	9		179				2 13 48 37
			6	SS	9		178				
			7	SS	8						
			8	SS	9		177				
175.77			9	SS	10		176				
7.32	END OF BOREHOLE Borehole dry during drilling on July 5, 2007.										

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

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

Golder Associates
London, Ontario

RECORD OF BOREHOLE No 603

1 OF 1 **METRIC**

PROJECT 07-1130-035-1 | G.W.P. 65-00-00 | LOCATION N 4677588.1 ;E 285100.1 | ORIGINATED BY DB

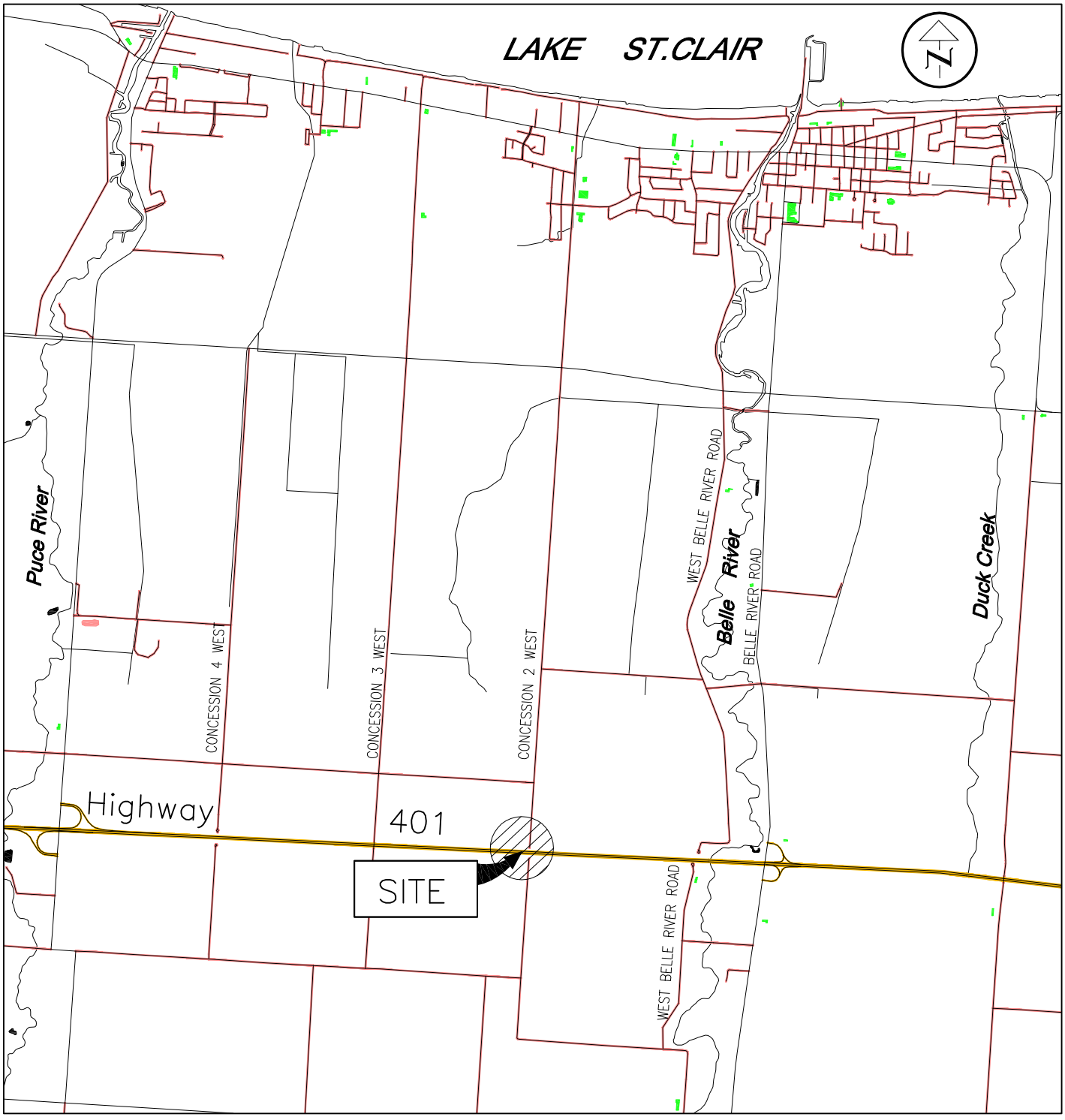
DIST 1 | HWY 401 | BOREHOLE TYPE HOLLOW STEM AUGER | COMPILED BY DCH

DATUM GEODETIC | DATE July 5, 2007 | CHECKED BY

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 × LAB VANE (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
183.06	GROUND SURFACE										
0.00	TOPSOIL, silty										
0.15	Brown CLAYEY SILT (TILL), some sand, trace gravel Stiff to Very Stiff Brown becoming Grey below about elev. 180.6m		1	SS	12		182				
			2	SS	19		181				0 15 42 43
			3	SS	18						
			4	SS	9		180				1 15 48 36
			5	SS	9		179				
			6	SS	9		178				
			7	SS	9						
			8	SS	9		177				
175.74			9	SS	9		176				
7.32	END OF BOREHOLE Borehole dry during drilling on July 5, 2007.										

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

ON_MTO 071130035-1-6.GPJ LDN_MTO.GDT 12/20/07



PROJECT

STRUCTURAL CULVERT - STATION 21+151
HIGHWAY 401 RECONSTRUCTION
GWP 65-00-00

TITLE

KEY PLAN

NOTE

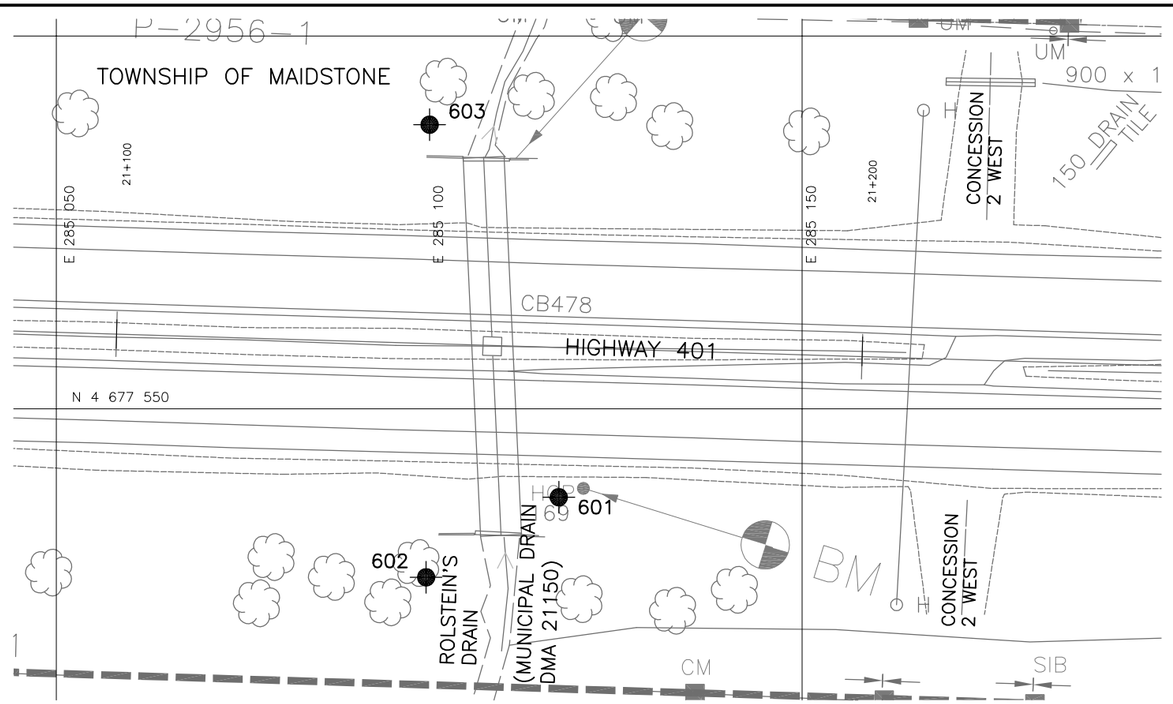
THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

Golder Associates
LONDON, ONTARIO

PROJECT No. 07-1130-035-1-6			FILE No. 0711300351-6-F01001	
			SCALE AS SHOWN	REV. 0
CADD	WDF	Sept. 25/07	FIGURE 1	
CHECK				

DRAWING FILE: 0711300351-6-F01001.DWG Plot Date: Dec 20, 2007 - 4:00pm

MINISTRY OF TRANSPORTATION, ONTARIO



PLAN
SCALE
10 0 10m

METRIC

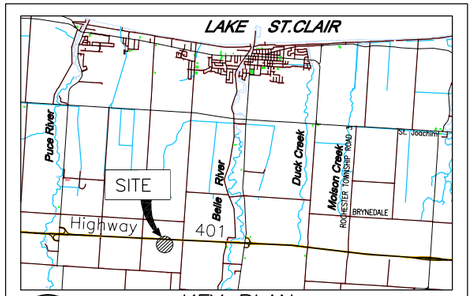
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 65-00-00

SHEET

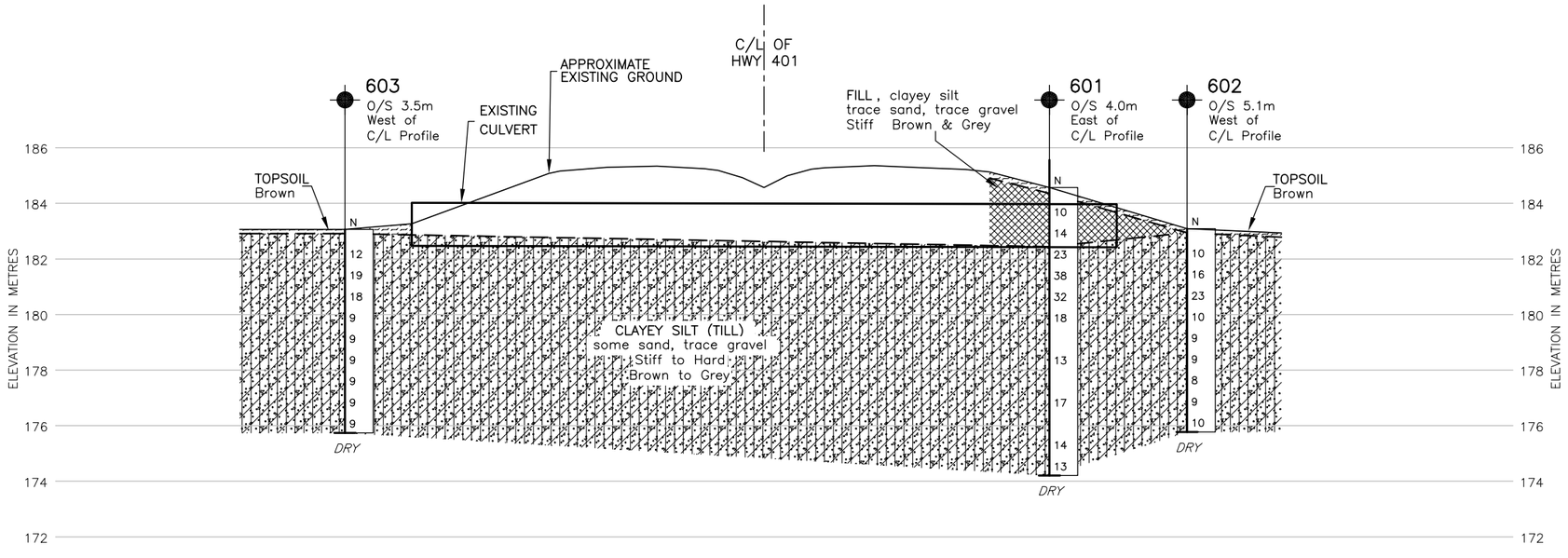
HIGHWAY 401 RECONSTRUCTION
STUCTURAL CULVERT – STATION 21+151
TOWNSHIP OF MAIDSTONE
BOREHOLE LOCATION AND SOIL STRATA

Golder Associates Ltd.
LONDON, ONTARIO, CANADA



LEGEND

- Borehole – Current Investigation
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- *DRY* Borehole dry during drilling



PROFILE ALONG C/L OF CULVERT

VERTICLE SCALE
2 0 2 m

HORIZONTAL SCALE
4 0 4 m

No.	ELEVATION	CO-ORDINATES (MTM Zone 11)	
		NORTHING	EASTING
601	184.57	4 677 538.2	285 117.4
602	183.09	4 677 527.4	285 099.6
603	183.06	4 677 588.1	285 100.1

NOTES

This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

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 Dillon.

NO.	DATE	BY	REVISION

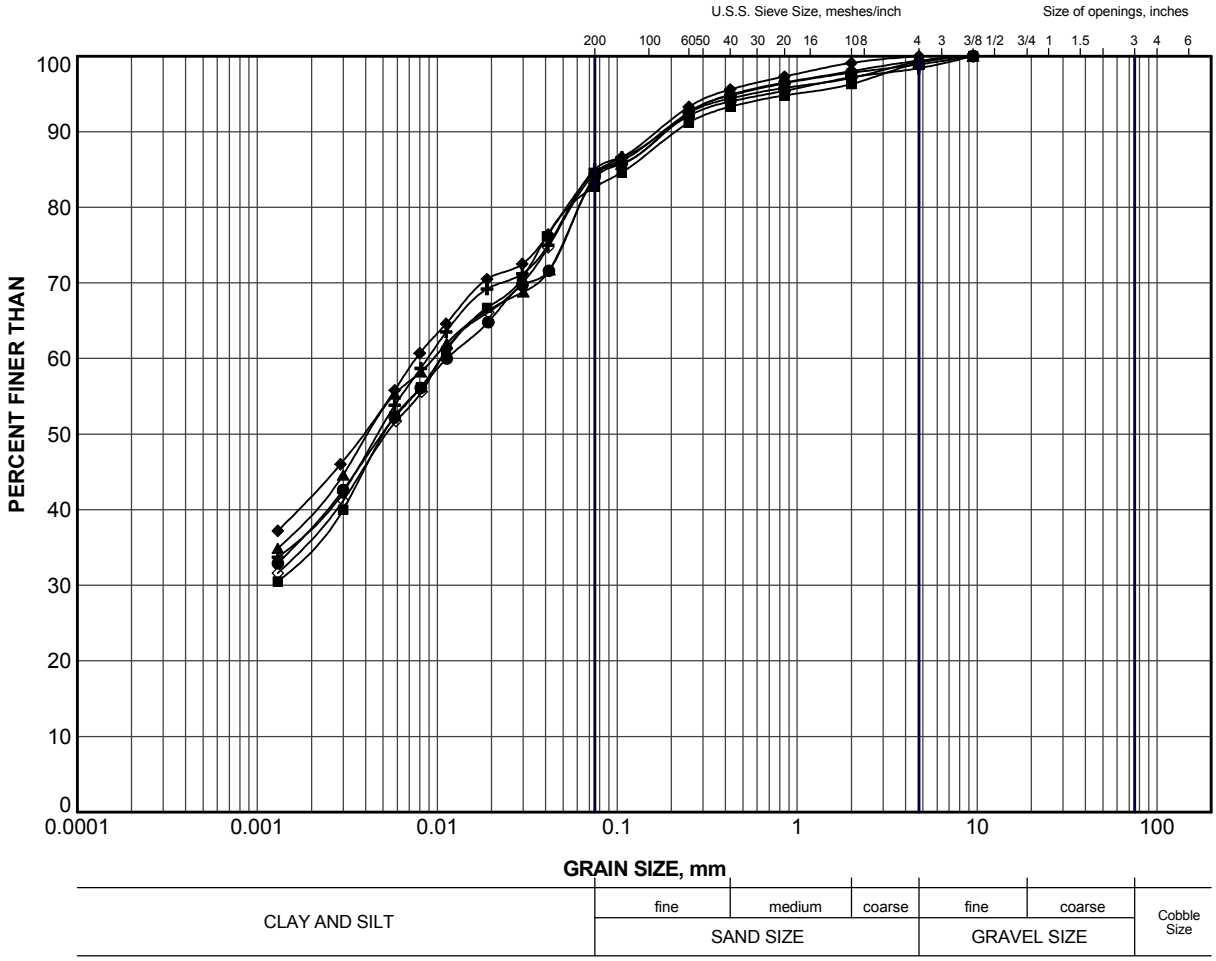
Geocres No. 40J2-101

HWY.	401		PROJECT NO. 07-1130-035-1-6		DIST.
SUBM'D.	DUP	CHKD.	PRB	DATE: Sept. 25/07	SITE: 6-475-C
DRAWN:	WDF	CHKD.		APPD.	DWG. 1

PLOT DATE: December 20, 2007
FILENAME: N:\active\2007\1130 - Geotechnical\1130-0000\07-1130-035-1 DILLON - QWP 65-00-00 FDN - HWY 401\Drafting\AutoCAD files\06 - Structural\1130351-6-00100I-REMOVE STAMPS.dwg

APPENDIX A

LABORATORY TEST DATA



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	601	4	181.3
■	601	8	176.7
▲	602	1	182.1
✚	602	5	179.1
◆	603	2	181.3
◇	603	4	179.8

PROJECT

STRUCTURAL CULVERT - STATION 21+151
HIGHWAY 401 RECONSTRUCTION
GWP 65-00-00

TITLE

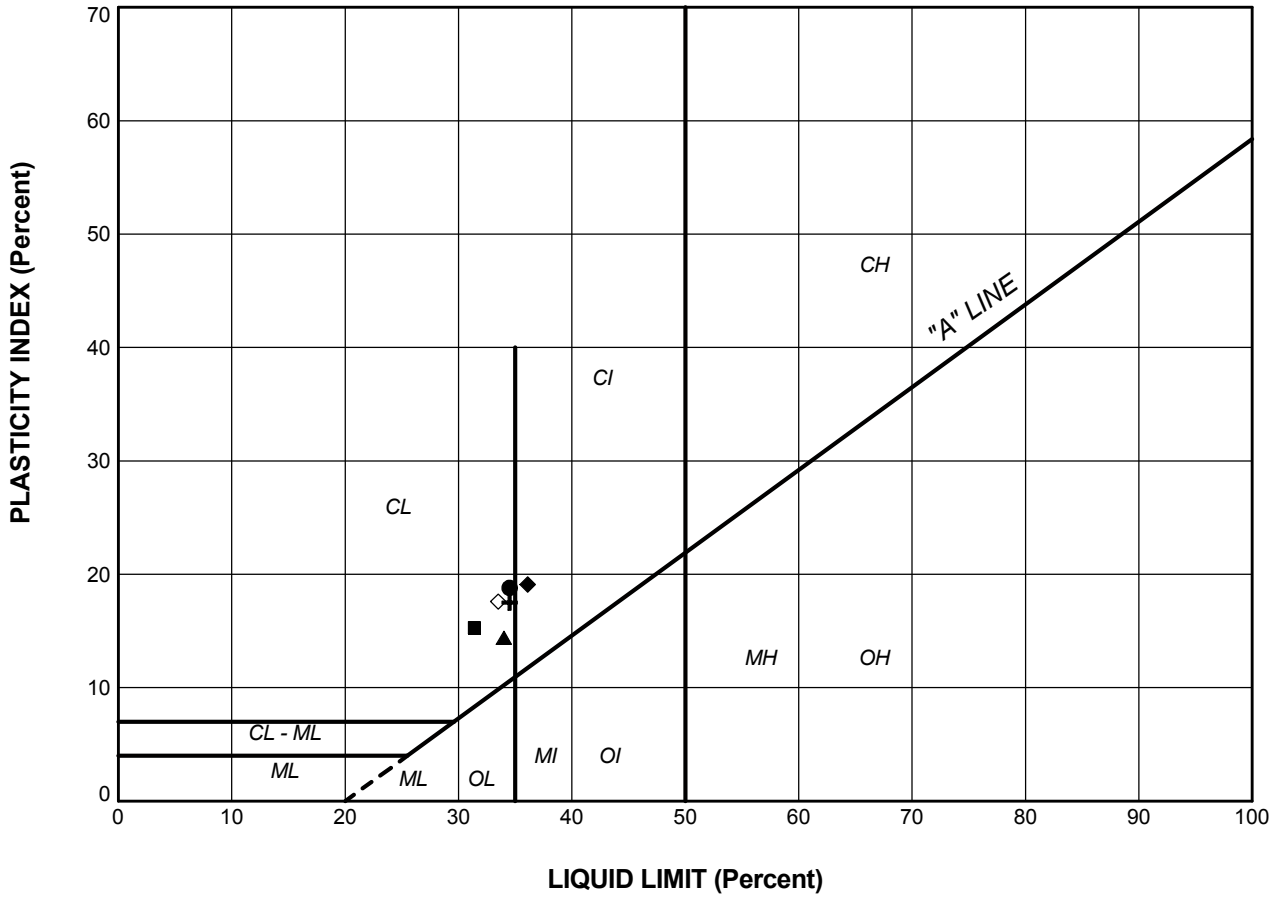
GRAIN SIZE DISTRIBUTION

CLAYEY SILT (TILL)

Golder Associates
LONDON, ONTARIO

PROJECT No.	07-1130-035-1			FILE No.	071130035-1-6-F010a1
				SCALE	N/A
DRAWN	WDF	Sep 25/07			
CHECK				**FIGURE**	**A-1**

LDN_MTO_NEW GLDR_LDN.GDT



SOIL TYPE
C = Clay
M = Silt
O = Organic

PLASTICITY
L = Low
I = Intermediate
H = High

LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	601	4	34.5	15.7	18.8
■	601	8	31.4	16.1	15.3
▲	602	1	34.0	19.6	14.4
✚	602	5	34.5	17.0	17.5
◆	603	2	36.1	17.0	19.1
◇	603	4	33.5	15.9	17.6

PROJECT
STRUCTURAL CULVERT - STATION 21+151
HIGHWAY 401 RECONSTRUCTION
GWP 65-00-00

TITLE
PLASTICITY CHART

Golder Associates
LONDON, ONTARIO

PROJECT No.			07-1130-035-1	FILE No.	071130035-1-6-F010a2
				SCALE N/A	REV.
DRAWN	WDF	Sep 25/07			
CHECK				**FIGURE A-2**	

MTO_PI GLDR_LDN.GDT

APPENDIX B

SITE PHOTOGRAPH

SITE PHOTOGRAPH

Photograph 1: Inlet of culvert at Site 6-475-C.