

DATE July 28, 2016**PROJECT No.** 1649982-1000-2000-M01**TO** Mr. John Gawley, P.Eng.
Dillon Consulting Limited**CC** Mr. George McCluskey, P. Eng.
Dillon Consulting Limited**FROM** Mr. Michael E. Beadle, P. Eng.**EMAIL** mbeadle@golder.com

**FOUNDATION AND PAVEMENT ENGINEERING COMMENTS
DETAIL DESIGN OF LOW BAY INSPECTION BAYS
SARNIA COMMERCIAL VEHICLE INSPECTION FACILITIES
GWP 3032-13-00**

This technical memorandum provides our pavement and foundation engineering comments for the design of the new low bay inspection bays to be constructed as part of GWP 3032-13-00.

Background

Golder Associates Ltd. (Golder) previously carried out geotechnical investigations for the design of Sarnia commercial vehicle inspection facility (CVIF), the results of which were provided in the following reports:

- Golder Report No. 021-3131 entitled "Pavement Design Report, Truck Inspection Stations, Highway 402 – Sarnia, Highway 401 – Windsor, GWP 5-96-00, Contract 2000-0073, Ministry of Transportation, Southwestern Region" dated October 28, 2002;
- Golder Report No. 05-1130-120 entitled "Foundation Investigation and Design Report, Sarnia South Commercial Vehicle Inspection Facility, Highway 402, from 4.5 km to 5.1 km East of Lambton Road 26 (Mandaumin Road), GWP 1000-00-00, Agreement No. 3004-E-0030, Ministry of Transportation – Southwestern Region" dated December 7, 2005; and
- Golder Report No. 05-1130-120-1 entitled "Geotechnical Investigation, Sarnia South Commercial Vehicle Inspection Facility, Highway 402, from 4.5 km to 5.1 km East of Lambton Road 26 (Mandaumin Road), GWP 1000-00-00, Agreement No. 3004-E-0030, Ministry of Transportation – Southwestern Region" dated October 21, 2005.

The subsurface conditions encountered in the boreholes drilled at the site generally consisted of surficial topsoil and fill materials overlying discontinuous layers of clayey silt which are underlain by an extensive deposit of silty clay till. The clayey silt layers were about 0.8 to 1.2 metres thick and had N values, as determined by standard penetration testing (ASTM D1588), of 5 to 27 blows per 0.3 metres with water contents of about 13 per cent. The silty clay till had N values of 7 to 41 blows per 0.3 metres with water contents of about 12 to 20 per cent. Location plans and records of boreholes from the previous investigations are provided in Appendix A.

All of the boreholes were free of observable water during drilling between September 13 and 19, 2005.



The pavements within the existing inspection area were constructed under Contract 2006-3029 and consist of 250 millimetres of reinforced concrete founded on a minimum of 300 millimetres Ontario Provincial Standard Specifications (OPSS) Granular A. Grade beams on spread footings are present in the inspection area. The areas adjacent to the footings and grade beams were backfilled with Granular A. The remainder of the concrete pavements at the site consist of 225 millimetres of plain jointed concrete pavement and 300 millimetres of Granular A.

Based on the information provided to Golder, two new low bay inspection bays will be constructed at the site by converting two of the existing at grade inspection lanes (corresponding to Bays 2 and 3). The existing concrete pavement will be removed from the new low bay locations and the existing granular materials excavated to accommodate the low bay, which will be founded typically about 0.5 metres below the existing pavement surface. At each end of the bays, a pre-formed drain will be installed in slightly lower areas. Depending on the extent of the excavations for the existing grade beams and associated foundations, clayey silt and silty clay till may also be encountered. The new low bay slab will be reinforced and bear on 300 millimetres of Granular A and 100 millimetres of rigid insulation. The insulation thickness is considered appropriate based on local estimates of freezing degree days.

Discussion

Based on the results of the boreholes previously completed at the site, the new low bays will be founded in the existing granular fill supporting the concrete pavement, and/or native clayey silt and silty clay till (based on boreholes 2 and 13). It is expected that, in the short term, cuts to depths of about 0.5 metres will remain vertical. Following excavation to subgrade level, the subgrade should be proofrolled under the direction of the QVE. Any poorly performing areas should be subexcavated a maximum of 300 millimetres and restored using compacted Granular A. The Granular A base beneath the insulation and slab should be placed in maximum 200 millimetre thick lifts and compacted. A geotextile between the subgrade and Granular A is not considered to be warranted at this site.

For loading on the low bay base slabs, a composite modulus of subgrade reaction (inclusive of the subgrade and 300 millimetres of compacted Granular A) of 65 kilopascals per millimetre (kPa/mm) may be used. The modulus of subgrade reaction is not an intrinsic property of the soil and is dependent on loading geometry and the like. Further, the quoted value should be considered reasonable within an order of magnitude. Thus, we suggest varying the subgrade modulus in the structural calculations by half and twice the value provided above to assess the sensitivity of the structural design to the subgrade modulus. If the design is sensitive to the modulus, we will review the design in additional detail in consultation with Dillon.

For any elements that may be required to resist lateral loadings, lateral pressures may be assessed using the following:

- Select, free-draining granular fill meeting the specifications of OPSS Granular A or Granular B Type III should be used as backfill. Longitudinal drains and weep holes should be installed to provide positive drainage of the granular backfill, where feasible. Other aspects of granular backfill requirements with respect to subdrains should be in accordance with OPSD 3501.00.
- A compaction surcharge equal to 12 kPa should be included in the lateral earth pressures for the structural design of the wall, in accordance with CHBDC Figure 6.9.3. Compaction equipment should be used in accordance with OPSS 501.06.

- The granular fill may be placed either in a zone with a width equal to at least 1.2 metres behind the back of the stem (Case i from Commentary on CHBDC Figure C6.9.1(I) or within the wedge-shaped zone defined by a line drawn at 1.5 horizontal to 1 vertical extending up and back from the rear face of the footing (Case ii from Commentary on CHBDC Figure C6.9.1(I)).
- For Case i, the pressures are based on the existing materials and the following parameters (unfactored) may be assumed for the existing granular fill:

Soil unit weight: 21 kN/m³

Coefficients of lateral earth pressure:

Active, K_a 0.33

At rest, K_o 0.50

For Case ii, the pressures are based on the granular fill as placed and the following parameters (unfactored) may be assumed for Granular A:

Soil unit weight: 22 kN/m³

Coefficients of lateral earth pressure:

Active, K_a 0.27

"At rest", K_o 0.43

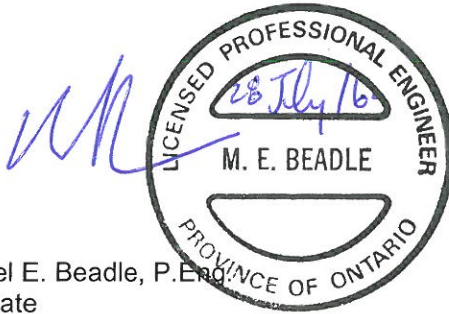
If the wall support allows lateral yielding, active earth pressures may be used in the geotechnical design of the structure. If the wall support does not allow lateral yielding, "at rest" earth pressures should be assumed for geotechnical design.

It is understood that the existing concrete pavements will be restored to match the existing conditions. This is considered appropriate and prudent. The existing concrete pavements consist of 225 millimetres of plain jointed concrete (with dowelled joints) over 300 millimetres of Granular A. All disturbed areas should be reinstated to the underside of new slab elevation using compacted Granular A placed in maximum 200 millimetre thick lifts. Similar to the above, a composite modulus of subgrade reaction of 65 kPa/mm can be used based on the existing subgrade soils and 300 millimetres of compacted Granular A. Care will be required to ensure that the new slabs are appropriately dowelled into the existing adjacent slabs. The concrete should have a minimum compressive strength at 28 days of 30 megapascals (MPa) and a minimum flexural strength of 4.5 MPa. The concrete should be designed to accommodate exposure class C-2. Saw cut control joints should be provided to tie into the existing joints.

We also understand that some trenching will be required outside of the inspection area and pavement restoration will be required. The trenches should be backfilled using compacted Granular A placed in maximum 200 millimetre thick lifts. Temporary pavement restoration can be completed using 100 millimetres (2@50) SuperPave 12.5. Final restoration should consist of 225 millimetres of concrete with the properties noted above. Care will be required to dowel the new concrete into the existing concrete. If required, fast-track concrete can be used for the permanent trench restoration. Fast-track concrete should be provided in accordance with SSP399S43.

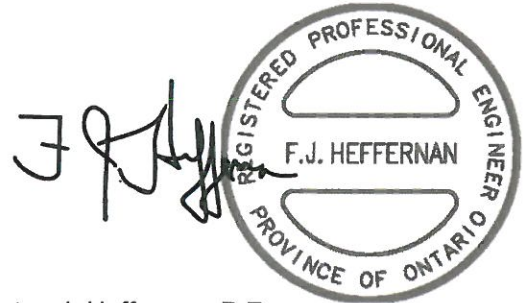
We trust that this technical memorandum provides sufficient information for your immediate requirements. If any point requires further clarification, or if we can be of additional assistance, please contact this office.

GOLDER ASSOCIATES LTD.



Michael E. Beadle, P.Eng.
Associate

MEB/SJB/FJH/cr



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

Attachments: Appendix A - Location Plans and Records of Boreholes, Golder Report Nos. 021-3131, 05-1130-120 and 05-1130-120-1

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APPENDIX A

LOCATION PLANS AND RECORDS OF BOREHOLES
GOLDER REPORT NOS. 021-3131, 05-1130-120
AND 05-1130-120-1

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

PROJECT 021-3131

G.W.P. 5-96-00

LOCATION SARNIA STATION - WEST BOUND LANES

ORIGINATED BY MA

DIST HWY

BOREHOLE TYPE POWER AUGER (UNCASED)

COMPILED BY WDR

DATUM

DATE August 22, 2002

CHECKED BY

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	GROUND SURFACE							20 40 60 80 100						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								20 40 60 80 100						

(Golder Report No. 021-3131)

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

PROJECT 021-3131

G.W.P. 5-96-00

LOCATION SARNIA STATION - EAST BOUND LANES

ORIGINATED BY MA

DIST HWY

BOREHOLE TYPE POWER AUGER (UNCASED)

COMPILED BY WDF

DATUM

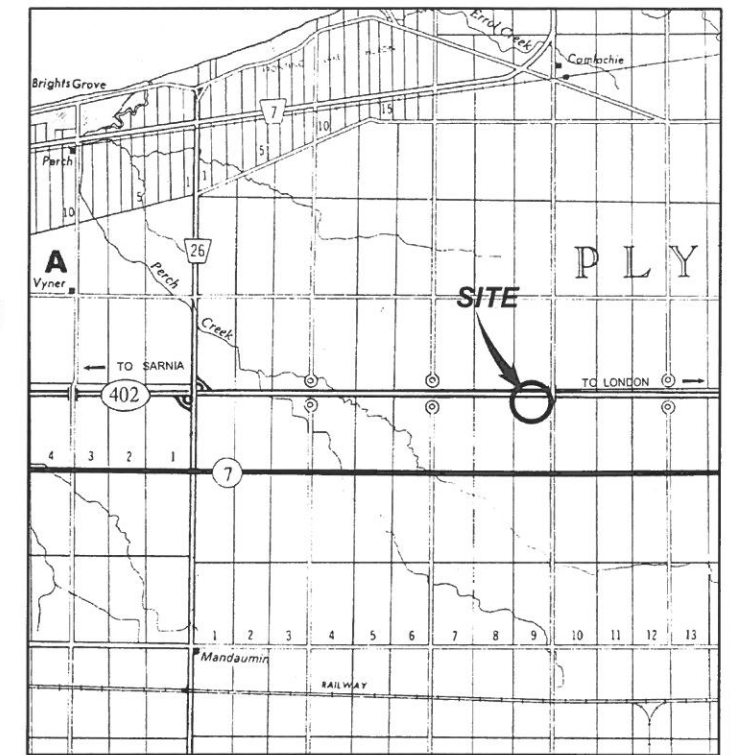
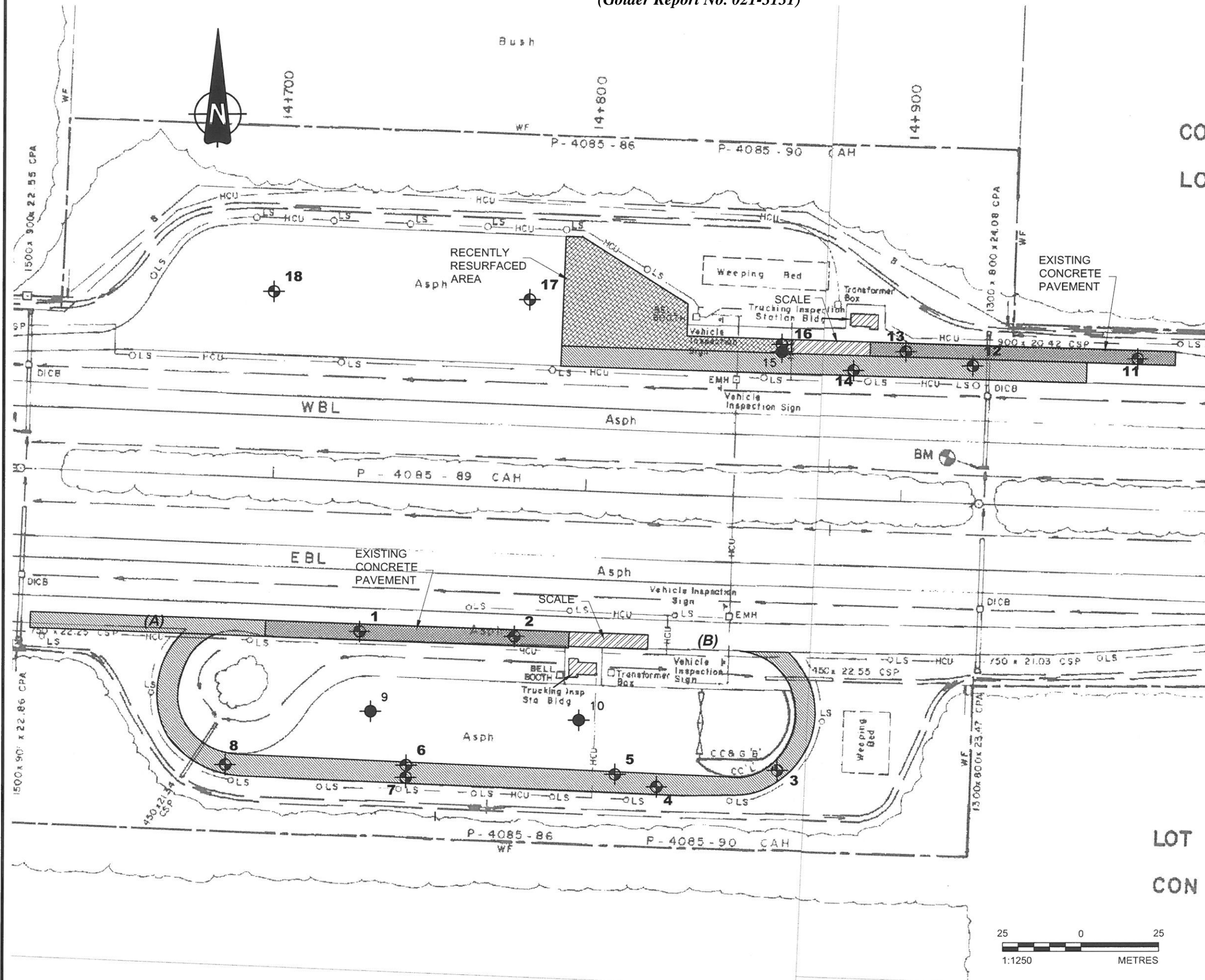
DATE August 23, 2002

CHECKED BY 

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
								20 40 60 80 100		10 20 30				
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								20 40 60 80 100						



(Golder Report No. 021-3131)

(Golder Report No. 021-3131)



KEY PLAN

LEGEND

-  BOREHOLE LOCATIONS
-  CORE LOCATIONS
- (A)** SCALE APPROACH
(OUTSIDE WHEEL PATH: 19mm
INSIDE WHEEL PATH: 21mm)
- (B)** SCALE EXIT
(OUTSIDE WHEEL PATH: 13mm
INSIDE WHEEL PATH: 8mm)

 MILL 90mm / PAVE 90mm

REFERENCE

PLAN PROVIDED BY: THE MINISTRY OF
TRANSPORTATION AND COMMUNICATIONS
TITLE: BELL UPDATE DATED: 94-04
SCALE: 1:20 PLATE No. 178-402/21-0


**NOTE: THIS DRAWING IS TO BE READ IN
CONJUNCTION WITH ACCOMPANYING REPORT**

PROJECT

SOUTHWESTERN REGION TRUCK INSPECTION STATIONS

TITLE

**LOCATION PLAN
SARNIA NORTH & SOUTH**

 Golder Associates LONDON, ONTARIO	PROJECT No. 021-3131		FILE No. 0213131D001	
	CADD	MSW	10/28/02	SCALE AS SHOWN REV. 0
	CHECK		10/28/02	<div style="font-size: 2em; font-weight: bold; text-align: center;">FIGURE 1</div>

BOREHOLE LOG DATA**SARNIA SOUTH****BH 1**

0	-	210	Conc
210	-	460	Cr Gran
460	-	480	Styrofoam
480	-	1.98	Br & Gry Cl Si W Sa Tr Gr, N = 20, 11, <u>SA 1, SA 2</u>

BH 2

0	-	230	Conc
230	-	610	Cr Gran
610	-	635	Styrofoam
635	-	1.98	Gry Cl Si W Sa Tr Gr Tr Tps; N = 17, 12, <u>SA 1, SA 2</u>

BH 3

0	-	195	Asph
195	-	460	Cr Gran
460	-	1.98	Br & Gry Cl Si W Sa Tr Gr, N = 17, 15, <u>SA 1, SA 2</u>

BH 4

0	-	170	Asph
170	-	405	Cr Gran
405	-	1.98	Gry Cl Si W Sa Tr Gr, N = 12, 8, <u>SA 1, SA 2</u>

BH 5

0	-	155	Asph
155	-	510	Cr Gran, <u>SA 1</u>
510	-	1.98	Gry & Br Cl Si W Sa Tr Gr, N = 17, 16, <u>SA 2, SA 3</u>

BH 6

0	-	155	Asph
155	-	460	Cr Gran
460	-	1.98	Gry & Br Cl Si W Sa Tr Gr, N = 13, 15, <u>SA 1, SA 2</u>

BH 7

0	-	130	Asph
130	-	380	Cr Gran
380	-	1.98	Gry & Br Cl Si W Sa Tr Gr, N = 14, 14, <u>SA 1, SA 2</u>

BH 8

0	-	140	Asph
140	-	510	Cr Gran, <u>SA 1</u>
510	-	1.98	Gry & Br Cl Si W Sa Tr Gr, N = 13, 17, <u>SA 2, SA 3</u>

SARNIA NORTHBH 11

0	-	215	Conc
215	-	610	Cr Gran
610	-	635	Styrofoam
635	-	1.68	Gry & Br Cl Si W Sa Tr Gr, N = 13, 22, <u>SA 1, SA 2</u>

BH 12

0	-	215	Asph
215	-	510	Cr Gran, <u>SA 1</u>
510	-	1.68	Br Cl Si W Sa Tr Gr, N = 16, 27, <u>SA 2, SA 3</u>

BH 13

0	-	220	Conc
220	-	610	Cr Gran, <u>SA 1</u>
610	-	635	Styrofoam
635	-	1.52	Br Si Sa & Gr, N = 21, 10, <u>SA 2, SA 3A</u>
1.52	-	1.68	Gry Cl Si W Sa Tr Gr, N = 10, <u>SA 3B</u>

BH 14

0	-	230	Asph
230	-	530	Cr Gran
530	-	565	Styrofoam
565	-	1.37	Br Cl Si W Sa Tr Gr, N = 17, 13, <u>SA 1, SA 2</u>
1.37	-	1.68	Gry Sa & Gr, N = 13

BH 16

0	-	250	Asph
250	-	635	Cr Gran
635	-	910	Br Si Sa & Gr, N = 2, <u>SA 1A</u>
910	-	1.37	Gry Cl Si W Sa Tr Gr, Tps, Wood, N = 2, 25 blows/0.15 m, <u>SA 1B, SA 2</u>
	-	NFP	Practical Refusal

BH 17

0	-	160	Asph
160	-	480	Cr Gran, <u>SA 1</u>
480	-	1.68	Br & Gry Cl Si W Sa Tr Gr Tr Tps, N = 12, 15, <u>SA 2, SA 3</u>

BH 18

0	-	160	Asph
160	-	460	Cr Gran
460	-	1.68	Br & Gry Cl Si W Sa Tr Gr Tr Tps, N = 10, 15, <u>SA 1, SA 2</u>

LABORATORY TEST RESULTS**SARNIA SOUTH****BH 1 SA 1**

w _L	=	27.2 %
I _p	=	10.3 %
w	=	11.9 %

BH 1 SA 2

w	=	23.8 %
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BH 2 SA 1

% Passing		
9.5 mm	=	100.0
4.75 mm	=	99.5
2.00 mm	=	98.1
425 µm	=	94.5
75 µm	=	85.8
5 µm	=	52.7
2 µm	=	35.9
w	=	12.8 %

BH 2 SA 2

w	=	25.7 %
---	---	--------

BH 3 SA 1

w	=	13.5 %
---	---	--------

BH 3 SA 2

w	=	16.4 %
---	---	--------

BH 4 SA 1

w	=	14.2 %
---	---	--------

BH 4 SA 2

w	=	21.2 %
---	---	--------

BH 5 SA 1

% Passing		
19.0 mm	=	100.0
9.5 mm	=	68.1
4.75 µm	=	53.6
2.00 µm	=	43.9
425 µm	=	27.9
75 µm	=	14.5
w	=	5.9 %

BH 5 SA 2

w	=	12.4 %
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BH 5 SA 3

w _L	=	33.8 %
I _p	=	17.1 %
w	=	16.0 %

BH 6 SA 1

w	=	15.3 %
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BH 6 SA 2

% Passing		
9.5 mm	=	100.0
4.75 mm	=	99.0
2.00 mm	=	96.4
425 µm	=	91.5
75 µm	=	81.2
5 µm	=	48.6
2 µm	=	33.0
w	=	14.6 %

BH 7 SA 1

w	=	14.4 %
---	---	--------

BH 7 SA 2

w	=	16.4 %
---	---	--------

BH 8 SA 1

% Passing		
19.0 mm	=	100.0
9.5 mm	=	77.1
4.75 mm	=	59.9
2.00 mm	=	45.5
425 µm	=	26.2
75 µm	=	13.9
w	=	5.4 %

BH 8 SA 2

w	=	14.7 %
---	---	--------

BH 8 SA 3

w	=	15.6 %
---	---	--------

SARNIA NORTH**BH 11 SA 1**

w	=	10.4 %
---	---	--------

BH 11 SA 2

w _L	=	30.0 %
I _P	=	16.0 %
w	=	14.6 %

BH 12 SA 1

% Passing		
26.5 mm	=	100.0
19.0 mm	=	94.4
9.5 mm	=	64.1
4.75 mm	=	45.6
2.00 mm	=	32.9
425 µm	=	17.3
75 µm	=	8.5
w	=	5.2 %

BH 12 SA 2

w	=	12.7 %
---	---	--------

BH 12 SA 3

w	=	14.3 %
---	---	--------

BH 13 SA 1

% Passing		
19.0 mm	=	100.0
9.5 mm	=	73.1
4.75 mm	=	57.5
2.00 mm	=	32.9
425 µm	=	24.9
75 µm	=	10.2
w	=	7.2 %

BH 13 SA 2

% Passing		
19.0 mm	=	100.0
9.5 mm	=	84.7
4.75 mm	=	74.1
2.00 mm	=	63.9
425 µm	=	41.9
75 µm	=	17.8
5 µm	=	5.0
2 µm	=	3.5
w	=	7.3 %

BH 13 SA 3A

w	=	7.3 %
---	---	-------

BH 13 SA 3B

w	=	18.3 %
---	---	--------

BH 14 SA 1

w	=	12.7 %
---	---	--------

BH 14 SA 2

w	=	14.0 %
---	---	--------

BH 16 SA 1A

w	=	10.7 %
---	---	--------

BH 16 SA 1B

w = 16.7 %

BH 16 SA 2

w = 20.1 %

BH 17 SA 1

w = 4.2 %

BH 17 SA 2

w = 13.5 %

BH 17 SA 3

w = 18.7 %

BH 18 SA 1

w_L = 29.6 %

I_p = 12.3 %

w = 13.9 %

BH 18 SA 2

w = 25.2 %

PAVEMENT CORES
Selected Locations

<u>LOCATION</u>	<u>ASPHALT/CONCRETE</u>	<u>THICKNESS</u> (mm)	<u>REMARKS</u>
<u>SARNIA SOUTH</u>			
1	C	210	Wire mesh @ 180 millimetres.
2	C	230	
3	A	195	
4	A	170	
5	A	155	
6	A	155	
7	A	130	
8	A	140	
9	A	155	
10	A	155	
<u>SARNIA NORTH</u>			
11	C	215	Wire mesh @ 100 millimetres.
12	A	215	Wire mesh @ 140 millimetres.
13	C	220	
14	A	230	In rut.
15	A	210	
16	A	250	
17	A	160	
18	A	160	

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761347.1 :E 331394.3

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 13, 2005

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p W W _L				WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE					
203.52							20 40 60 80 100							
0.00	ASPHALT						(Golder Report No. 05-1130-120)							
0.15	FILL, Granular Base													
203.06														
0.46	FILL, sand, some gravel													
0.58	FILL, silty clay, trace sand, gravel Firm Brown		1	SS	7						○	18 45	34	
202.15														
1.37	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at elev. 199.5m		2	SS	17						○			
			3	SS	23						○			
			4	SS	20									
			5	SS	19									
			6	SS	13									
198.49														
5.03	END OF BOREHOLE													
	Borehole dry during drilling September 13, 2005													

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

PROJECT 05-1130-120 LOCATION N 4761347.8 ; E 331387.6 ORIGINATED BY M.A.
G.W.P. 1000-00-00 DIST 1 HWY 402 BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS COMPILED BY DCH
DATUM GEODETIC DATE September 13, 2005 CHECKED BY WJ

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	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
203.50	ASPHALT													
0.00	FILL, Granular Base													
0.18														
203.04														
0.46	FILL, silty clay, trace sand, gravel Stiff Grey and brown		1	SS	11		203							
202.13							202							
1.37	CLAYEY SILT some sand, trace gravel, silt seams Very Stiff Brown		2	SS	16									
201.37							201							
2.13	SILTY CLAY, trace sand, trace gravel (TILL) Very Stiff Brown becoming grey at elev. 199.9m		3	SS	25									
			4	SS	22		200							
			5	SS	21									
			6	SS	16		199							
198.47	END OF BOREHOLE													
5.03	Borehole dry during drilling September 13, 2005													

(Golder Report No. 05-1130-120)

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761377.3 :E 331355.5

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 13, 2005

CHECKED BY *[Signature]*

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	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
202.18												
0.06	TOPSOIL, clayey Brown						202					
0.30	FILL, silty clay, trace sand, trace gravel Brown											
	CLAYEY SILT trace sand, trace gravel Very stiff Brown		1	SS	23		201					
200.81												
1.37	SILTY CLAY, trace sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at elev. 199.3m		2	SS	25		200					
			3	SS	25							
			4	SS	16		199					
			5	SS	16							
			6	SS	13		198					
197.15												
5.03	END OF BOREHOLE Borehole dry during drilling September 13, 2005											

(Golder Report No. 05-1130-120)

0 20 49 31

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761350.3 :E 331335.9

ORIGINATED BY D.B.

DIST 1 HWY 402


BOREHOLE TYPE MANUAL AUGER/SOLID STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 13, 2005

CHECKED BY *WJ*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)				
202.84	TOPSOIL, clayey Black SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown becoming grey at elev. 199.9m													
0.00														
0.18														
			1	SS	13		202							
			2	SS	30		201							
			3	SS	32		200							
			4	SS	11		199							
			5	SS	10		198							
			6	SS	7		197							
			7	SS	9		196							
196.90	END OF BOREHOLE													
5.94	Borehole dry during drilling September 13, 2005													

RECORD OF BOREHOLE No 5

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761363.3 :E 331336.7

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE MANUAL AUGER/SOLID STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 19, 2005

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L		
202.84 0.00	TOPSOIL, clayey												
0.18	Dark brown CLAYEY SILT trace sand, trace gravel Very Stiff Brown		1	SS	27		202						
201.47 1.37	SILTY CLAY, trace sand, trace gravel (TILL) Very Stiff Brown becoming grey at elev. 200.4m		2	SS	25		201						
			3	SS	28		200						
			4	SS	17		199						
			5	SS	16		198						
			6	SS	17		197						
196.74 6.10	END OF BOREHOLE Borehole dry during drilling September 19, 2005												

(Golder Report No. 05-1130-120)

RECORD OF BOREHOLE No 6

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761380.3 :E 331337.9

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 19, 2005

CHECKED BY *WY*

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								\circ UNCONFINED \bullet QUICK TRIAXIAL	$+$ FIELD VANE \times LAB VANE						
202.84 0.00 0.12	TOPSOIL, clayey Brown SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at 199.2m														
			1	SS	12		202								
			2	SS	19		201								
			3	SS	18		200						1 16 48 35		
			4	SS	12										
			5	SS	10		199								
			6	SS	10		198								
197.81 5.03	END OF BOREHOLE Borehole dry during drilling September 19, 2005														

RECORD OF BOREHOLE No 7

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761389.6 :E 331352.0

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 14, 2005

CHECKED BY *[Signature]*

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
203.42								20 40 60 80 100						
0.00	TOPSOIL, silty Brown													
0.12	FILL, clayey silt, trace sand, gravel													
202.96	CLAYEY SILT, trace sand, trace gravel Very Stiff Brown		1	SS	26									
0.46														
202.05	SILTY CLAY, trace sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at elev. 199.8m		2	SS	20									
1.37														
			3	SS	27									
			4	SS	22									
			5	SS	16									
			6	SS	10									
198.39														
5.03	END OF BOREHOLE Borehole dry during drilling September 14, 2005													

(Golder Report No. 05-1130-120)

RECORD OF BOREHOLE No 8

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761383.1 :E 331361.0

ORIGINATED BY M.A.

DIST 1 HWY 402





BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 14, 2005

CHECKED BY *[Signature]*

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
								20 40 60 80 100								10 20 30		
203.42																		
0.00	TOPSOIL, sandy Brown						203											
0.24	FILL, clayey silt, trace sand, gravel Firm Brown																	
202.29			1	SS	6													
1.13	CLAYEY SILT, some sand, trace gravel Stiff Brown						202											
			2	SS	14													
201.29																		
2.13	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at elev. 199.8m						201											
			3	SS	21													
			4	SS	24		200											
			5	SS	21													
							199											
			6	SS	11													
198.39																		
5.03	END OF BOREHOLE Borehole dry during drilling September 14, 2005																	

RECORD OF BOREHOLE No 9

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761352.1 ; E 331308.0

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 19, 2005

CHECKED BY *WY*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
202.43 0.00 0.15	TOPSOIL, clayey Brown FILL, silt, some sand and clayey silt Compact / Very Stiff Brown and grey		1	SS	22		202							
201.06 1.37	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at elev. 200.3m		2	SS	26		201							
			3	SS	16		200							0 16 48 36
			4	SS	12		199							
			5	SS	9		198							
			6	SS	12		197							
196.33 6.10	END OF BOREHOLE Borehole dry during drilling September 19, 2005		7	SS	12									

(Golder Report No. 05-1130-120)

PROJECT 05-1130-120 **RECORD OF BOREHOLE No 10** 1 OF 1 **METRIC**
 G.W.P. 1000-00-00 LOCATION N 4761364.9 :E 331311.2 ORIGINATED BY M.A.
 DIST 1 HWY 402 BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS COMPILED BY DCH
 DATUM GEODETIC DATE September 19, 2005 CHECKED BY [Signature]

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 kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
202.63 0.00 0.12	TOPSOIL, clayey Brown FILL, silty clay, trace sand, gravel Stiff Brown and grey													
201.42 1.21	SILTY CLAY, trace sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at elev. 199.5m		1	SS	11									
			2	SS	23									
			3	SS	20									
			4	SS	11									
			5	SS	8									
			6	SS	13									
			7	SS	9									
196.53 6.10	END OF BOREHOLE Borehole dry during drilling September 19, 2005													

PROJECT 05-1130-120 **RECORD OF BOREHOLE No 11** 1 OF 1 **METRIC**
 G.W.P. 1000-00-00 LOCATION N 4761411.4 :E 330946.3 ORIGINATED BY M.A.
 DIST 1 HWY 402 BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS COMPILED BY DCH
 DATUM GEODETIC DATE September 16, 2005 CHECKED BY [Signature]

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	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
201.65 0.00 0.12	TOPSOIL, clayey Brown SILTY CLAY trace sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at elev. 198.8m							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				
			1	SS	15		201					
			2	SS	23		200					
			3	SS	17		199					
			4	SS	16		198					
			5	SS	13		197					
196.62 5.03	END OF BOREHOLE Borehole dry during drilling September 16, 2005		6	SS	11							

(Golder Report No. 05-1130-120)

RECORD OF BOREHOLE No 12

1 OF 1

METRIC

PROJECT 05-1130-120

G.W.P. 1000-00-00

LOCATION N 4761411.2 : E 330953.3

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 16, 2005

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT (%)						
201.62								20 40 60 80 100		10 20 30					
0.09	TOPSOIL, clayey Brown CLAYEY SILT trace sand, trace gravel Firm to Very Stiff Brown						201								
200.25			1	SS	5										
1.37	SILTY CLAY, trace sand, trace gravel (TILL) Stiff to Very Stiff Brown becoming grey at elev. 198.7m						200								
			2	SS	21										
			3	SS	22		199								
			4	SS	13		198								
			5	SS	8		197								
			6	SS	8										
196.59															
5.03	END OF BOREHOLE Borehole dry during drilling September 16, 2005														

(Golder Report No. 05-1130-120)

2 15 45 33

PROJECT 05-1130-120

RECORD OF BOREHOLE No 13

1 OF 1

METRIC

G.W.P. 1000-00-00

LOCATION N 4761392.4 :E 331392.2

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/SOLID STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE November 28, 2005

CHECKED BY *[Signature]*

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								○ UNCONFINED	+ FIELD VANE	×					
								● QUICK TRIAXIAL	×	LAB VANE					
204.06	GROUND SURFACE						20	40	60	80	100				
0.00	FILL, Granular Base														
0.12	FILL, Sand and gravel, trace silt														
203.51	Brown														
0.55	FILL, silty clay, trace sand, trace gravel														
	Very stiff		1	SS	22										
	Grey														
202.54	SILTY CLAY, trace sand, trace gravel (TILL)		2	SS	13										
1.52	Stiff to hard														
	Brown becoming grey at elev. 199.7m		3	SS	27										
			4	SS	36										
			5	SS	41										
			6	SS	24										
			7	SS	24										
197.96	END OF BOREHOLE														
6.10	Borehole dry during drilling November 28, 2005														

(Golder Report No. 05-1130-120)

PROJECT 05-1130-120

RECORD OF BOREHOLE No 14

1 OF 1

METRIC

G.W.P. 1000-00-00

LOCATION N 4761381.7 ; E 331459.6

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/SOLID STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE November 28, 2005

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	
203.80	GROUND SURFACE												
0.00	FILL, sand and gravel, trace silt Brown												
203.46													
0.34	FILL, silty clay, trace sand, trace gravel Very stiff Grey		1	SS	18		203						
202.43													
1.37	SILTY CLAY, trace sand, topsoil, rootlets Firm Grey		2	SS	8		202						
201.67													
2.13	SILTY CLAY, trace sand, trace gravel (TILL) Very stiff to hard Brown becoming grey at elev. 200.1m		3	SS	27		201						
			4	SS	35		200						
			5	SS	39		199						
			6	SS	22								
			7	SS	19		198						
197.70	END OF BOREHOLE												
6.10	Borehole dry during drilling November 28, 2005												

(Golder Report No. 05-1130-120)

PROJECT 05-1130-120

RECORD OF BOREHOLE No 15

1 OF 1

METRIC

G.W.P. 1000-00-00

LOCATION N 4761367.7 :E 331436.8

ORIGINATED BY M.A.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/SOLID STEM AUGERS

COMPILED BY DCH

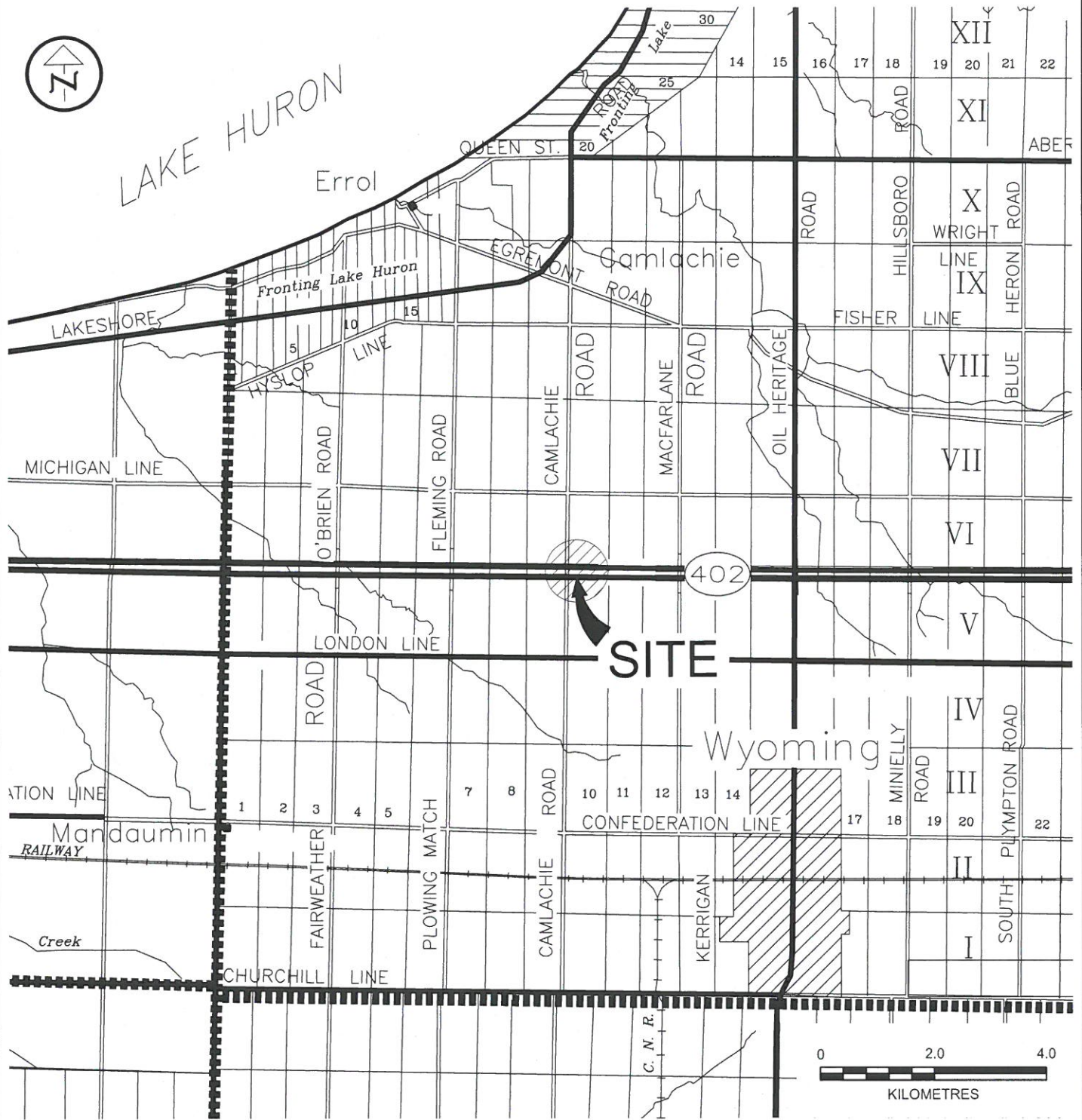
DATUM GEODETIC

DATE November 28, 2005

CHECKED BY *WY*

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
204.07	GROUND SURFACE															
0.00	ASPHALT															
0.15	FILL, Granular Base															
203.61																
0.46	FILL, silty clay, trace sand, trace gravel Very stiff Grey		1	SS	25											
202.85																
1.22	SILTY CLAY, trace sand, trace gravel (TILL) Very stiff to hard Brown becoming grey at elev. 199.8m		2	SS	25											
			3	SS	26											
			4	SS	39											
			5	SS	26											
			6	SS	21											
			7	SS	19											
197.97																
6.10	END OF BOREHOLE															
	Borehole dry during drilling November 28, 2005															

ON MTO 05-1130-120.GPJ ON MOT GDT 12/7/05



PROJECT		SARNIA SOUTH CVIF	
		GWP 1000-00-00, HIGHWAY 402 RECONSTRUCTION	
TITLE			
KEY PLAN			
PROJECT No. 05-1130-120		FILE No. 051130120-F001	
CADD DCH/		SCALE AS SHOWN REV. 0	
CHECK M		Sept. 23/05	
Golder Associates LONDON, ONTARIO		FIGURE 1	

PLOT DATE: December 08, 2005
Geotechnical\1130-100\05-1130-120
FILENAME: N:\active\2005\1130 - - HWY 407 Drafting\051130120-0002.dwg

$1 = 1 \text{ metric}$

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

PROJECT 05-1130-120-1

G.W.P. 63-00-00

LOCATION SEE DRAWING 1

ORIGINATED BY D.M.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 14, 2005

CHECKED BY

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	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
0.00	GROUND SURFACE FILL, Granular road Base												
0.43	FILL, silty clay, trace sand, trace gravel Stiff Grey and brown		1	SS	13								
1.56	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to very stiff Brown becoming grey at elev. (3.6m depth)		2	SS	12								
			3	SS	16								
			4	SS	24								
			5	SS	17								
			6	SS	16								
			7	SS	16								
			8	SS	14								
			9	SS	14								
			10	SS	15								
			11	SS	20								
			12	SS	17								
			13	SS	19								
10.36	END OF BOREHOLE Borehole dry during drilling September 4, 2005												

(Golder Report No. 05-1130-120-1)

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

PROJECT 05-1130-120-1

G.W.P. 63-00-00

LOCATION SEE DRAWING 1

ORIGINATED BY D.M.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 15, 2005

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT		UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)		
0.00	GROUND SURFACE												
0.15	TOPSOIL, clayey brown												
	FILL, clayey silt, some sand, trace gravel, topsoil												
	Stiff												
	Brown and grey		1	SS	15								
1.37	SILTY CLAY, some sand, trace gravel (TILL)		2	SS	14								
	Stiff to very stiff		3	SS	22								
	Brown becoming grey at elev. (3.6m depth)		4	SS	23								
			5	SS	16								
			6	SS	14								
			7	SS	14								
			8	SS	14								
			9	SS	16								
			10	SS	12								
			11	SS	16								
			12	SS	15								
			13	SS	15								
10.36	END OF BOREHOLE												
	Borehole dry during drilling												
	September 15, 2005												

(Golder Report No. 05-1130-120-1)

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

PROJECT 05-1130-120-1

G.W.P. 63-00-00

LOCATION SEE DRAWING 1

ORIGINATED BY D.M.

DIST 1 HWY 402

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY DCH

DATUM GEODETIC

DATE September 16, 2005

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT		UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)		
0.00	GROUND SURFACE FILL, Granular road Base												
0.48	FILL, silty clay, trace sand, trace gravel, some topsoil Stiff Brown and grey		1	SS	12								
			2	SS	10								
1.90	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to very stiff Brown becoming grey at elev. (5.2m depth)		3	SS	11								
			4	SS	20								
			5	SS	21								
			6	SS	14								
			7	SS	15								
			8	SS	10								
			9	SS	13								
			10	SS	15								
			11	SS	17								
			12	SS	12								
			13	SS	12								
11.28	END OF BOREHOLE Borehole dry during drilling September 16, 2005												

(Golder Report No. 05-1130-120-1)

>144-

ON MTO 05-1130-120-1.GPJ ON MOT.GDT 9/23/05

+ 3 . X 3

Numbers refer to Sensitivity

○ 3%

STRAIN AT FAILURE

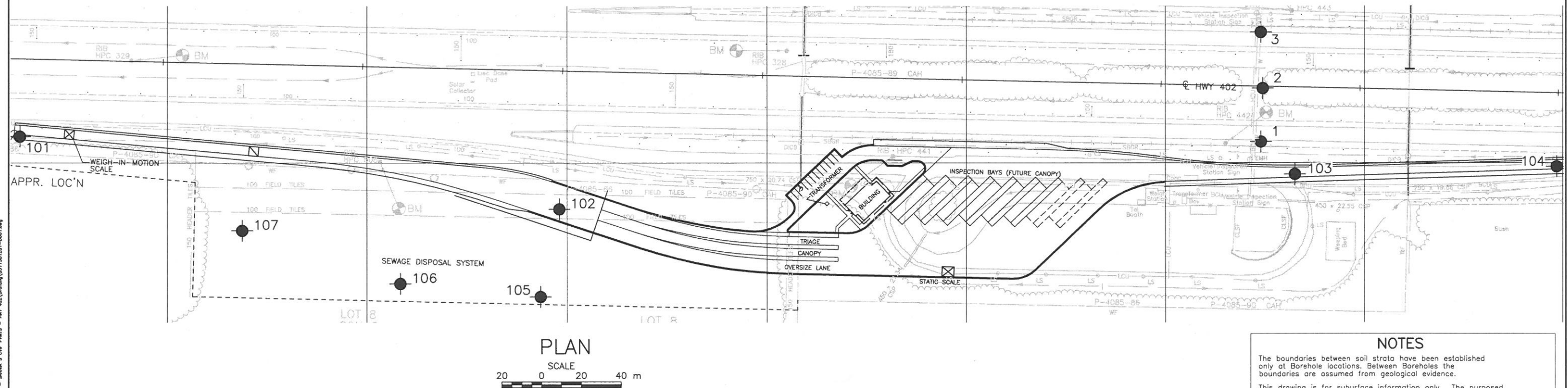
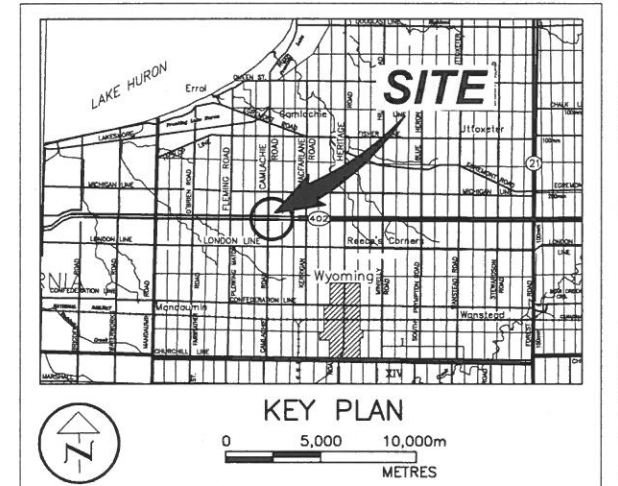


SARNIA SOUTH CVIF
BOREHOLE LOCATIONS

SHEET



Golder Associates Ltd.
LONDON, ONTARIO, CANADA



NOTES

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

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

REFERENCE

REFERENCE :
BASE DRAWING SUPPLIED BY
DILLON CONSULTING

NO.	DATE	BY	REVISION
Geocres No.			
HWY. No.	402	PROJECT NO.:	051130120-1
SUBM'D.	—	CHKD:	DATE: Sept 29/05
DRAWN:	DCH	CHKD:	APPD.
			DWG. 1

BOREHOLE LOG DATA

CVIF ROADWAY

BH 101

0	-	100	Br Cl Tps	
100	-	1.72	Br Si Cl Tr Sa Tr Gr, <u>SA 3</u>	600 - 750
			<u>SA 4</u>	1.30 - 1.52

BH 102

0	-	100	Br Si Tps	
100	-	1.52	Br Cl Si Tr Sa Tr Gr	

BH 103

0	-	300	Asph	
300	-	550	Cr Gran, <u>SA 1</u>	
550	-	1.68	Br Si Cl Tr Sa Tr Gr	

SA 1

w = 3.8%

BH 104

0	-	290	Asph	
290	-	500	Cr Gran	
500	-	1.68	Br Cl Si Tr Sa Tr Gr, <u>SA 2</u>	

SA 2

w = 13.5%

CVIF SEWAGE DISPOSAL AREA

BH 105

0	-	100	Br Cl Tps	
100	-	1.52	Br Cl Si W Sa Tr Gr, <u>SD-1</u>	300 - 600
			<u>SD-2</u>	900 - 1.05
			<u>SD-3</u>	1.30 - 1.52

SD-1

w = 16.5%

SD-3

% Passing	
4.75 mm =	100%
2.00mm =	99%
425 µm =	95%
75 µm =	79%
5 µm =	22%
2 µm =	16%
MWD =	1.95 Mg/m ³
MDD =	1.63 Mg/m ³
W _{opt} =	19.4%
W _L =	37.7%
W _P =	20.9%
I _P =	16.8%

BH 106

0	-	270	Br Cl Tps	
270	-	1.52	Br Cl Si W Sa Tr Gr, <u>SD-4</u>	300 - 600
			<u>SD-5</u>	750 - 900
			<u>SD-6</u>	1.30 - 1.52

SD-6

% Passing	
9.5 mm =	100%
4.75 mm =	99%
2.00mm =	96%
425 µm =	88%
75 µm =	64%
5 µm =	32%
2 µm =	24%
MWD =	2.00 Mg/m ³
MDD =	1.77 Mg/m ³
W _{opt} =	13.3%
W _L =	28.5%
W _P =	17.1%
I _P =	11.4%
w =	10.0%

BH 107

0	-	250	Br Cl Tps	
250	-	1.52	Br & Gry Si Cl W Sa Tr Gr, <u>SD-7</u>	300 - 600
			<u>SD-8</u>	750 - 900
			<u>SD-9</u>	1.30 - 1.52

SD-7

w	=	17.6%
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SD-9

% Passing

2.00mm	=	100%
425 µm	=	94%
75 µm	=	81%
5 µm	=	40%
2 µm	=	29%
MWD	=	1.85 Mg/m ³
MDD	=	1.51 Mg/m ³
W _{opt}	=	22.7%
W _L	=	44.4%
W _P	=	24.9%
I _p	=	19.5%
w	=	21.6%