

DATE July 28, 2016**PROJECT No.** 1649982-1000-2000-M02**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

**PAVEMENT AND FOUNDATION ENGINEERING COMMENTS
DETAIL DESIGN OF LOW BAY INSPECTION BAYS
WINDSOR COMMERCIAL VEHICLE INSPECTION FACILITIES
GWP 3033-13-00**

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 3033-13-00.

Background

Golder Associates Ltd. (Golder) previously carried out geotechnical investigations for the design of Windsor 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; and
- Golder Report No. 05-1130-031-1-8 entitled "Foundation Investigation and Design Report, Windsor South Commercial Vehicle Inspection Station, Highway 401 Reconstruction, GWP 63-00-00, Agreement No. 3004-E-0006, Ministry of Transportation – Southwestern Region" dated February 7, 2006.

The subsurface conditions encountered in the boreholes drilled at the site generally consisted of surficial topsoil and fill materials overlying layers of silty clay, clayey silt till and silty clay till. The silty clay layers were about 0.6 to 0.8 metres thick and had N values, as determined by standard penetration testing (ASTM D1588), of 8 to 9 blows per 0.3 metres with water contents of about 20 per cent. The clayey silt till and silty clay till had N values of 8 to 47 blows per 0.3 metres with water contents of about 10 to 22 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 on August 11 and 12, 2005.

The pavements within the existing inspection area were constructed under Contract 2005-3046 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 low bay, a pre-formed drain will be installed in slightly lower areas. Depending on the extent of the excavations for the 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, compacted and tested clayey earth fill placed during original pavement construction, silty clay and silty clay till. 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 Quality Value Engineer (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 55 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 Canadian Highway Bridge Design Code (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/m ³
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/m ³
Coefficients of lateral earth pressure:	
Active, K_a	0.27
"At rest", K_o	0.43

If the wall support and superstructure allow 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 250 millimetres of plain jointed concrete (with dowelled joints) over 300 millimetres of Granular A in the inspection areas and 225 millimetres of concrete over 300 millimetres of Granular A in the other areas. 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 55 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.

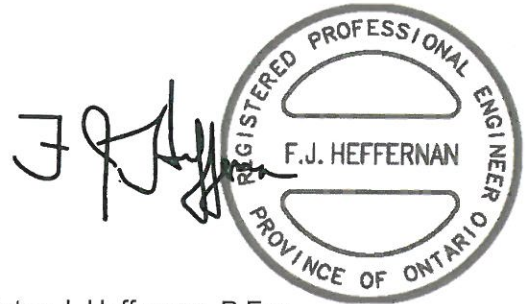
We trust that this technical memorandum provides sufficient information for your immediate requirements. If any point requires further clarification, or if we can be of additional assistance, please contact this office.

GOLDER ASSOCIATES LTD.



Michael E. Beadle, P. Eng.
Associate

MEB/SJB/FJH/cr



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

Attachment: Appendix A - Location Plans and Records of Boreholes, Golder Report Nos. 021-3131 and 05-1130-031-1-8

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APPENDIX A

LOCATION PLANS AND RECORDS OF BOREHOLES GOLDER REPORT NOS. 021-3131 AND 05-1130-031-1-8

BOREHOLE LOG DATA**WINDSOR SOUTH****BH 1**

0	-	145	Asph
145	-	265	Cr Gran, <u>SA 2</u>
265	-	910	Br Si Sa Tr Gr Tr Cl, N = 32, <u>SA 3</u>
910	-	1.68	Br & Gry Si Cl W Sa Tr GR Tr Tps, N = 6, <u>SA 4, SA 5</u>

BH 2

0	-	105	Asph
105	-	305	Cr Gran, <u>SA 2</u>
305	-	710	Br Sa Tr Gr Tr Tps, N = 16, <u>SA 3A</u>
710	-	1.68	Br & Gry Si Cl W Sa Tr Gr Tr Tps, Wet, N = 16, 6, <u>SA 3B, SA 4</u>

BH 3

0	-	130	Asph
130	-	405	Cr Gran, <u>SA 2</u>
405	-	910	Br Sa Tr Gr Tr Cl, N = 15, SA 3A
910	-	1.68	Br & Gry Si Cl W Sa Tr Gr Tr Rootlets, Tr Wood, N = 8, SA 3B, SA 4

BH 4

0	-	135	Asph
135	-	460	Cr Gran, SA 2
460	-	1.07	Br Si Sa Tr Gr (Styrofoam), N = 15, SA 3
1.07	-	1.68	Br & Gry Si Cl W Sa Tr Gr, Tr Tps, Tr Rootlets, N = 7, SA 4

BH 5

0	-	115	Asph
115	-	330	Cr Gran, SA 2
330	-	935	Br Si Sa Tr Gr Tr Cl, N = 28, SA 3
935	-	1.68	Br & Gr Si Cl W Sa W Tps W Org W Roots Tr Gr, N = 5, SA 4

BH 6

0	-	135	Asph
135	-	585	Br Sa Tr Gr Tr Cl, SA 2, SA 3
585	-	1.68	Br & Gry Si Cl W Sa W Tps, Rootlets, Org, Tr Gr, N = 6, 7, SA 4, SA 5

BH 7

0	-	95	Asph
95	-	460	Cr Gran, SA 1
460	-	1.14	Br Sa Tr Gr Tr Cl, N = 11, SA 2, SA 3A
1.14	-	1.68	Br & Gry Si Cl W Sa Tr Gr Tr Rootlets, Tr Org, N = 9, Wet @ 1.22, SA 3B, SA 4

BH 8

0	-	100	Asph
100	-	280	Cr Gran, SA 1
280	-	1.04	Br Sa Tr Gr Tr Cl, N = 10, SA 2, SA 3A
1.04	-	1.68	Br & Gry Si Cl W Sa Tr Gr, N = 10, SA 3B, SA 4

BH 9

0	-	120	Asph
120	-	380	Cr Gran
380	-	840	Br Sa & Si Sa Tr Gr, SA 1A
840	-	1.68	Br Si Cl Tr Sa Tr Gr, N = 7, 8, SA 1B, SA 2

BH 10

0	-	95	Asph
95	-	305	Cr Gran
305	-	710	Br Sa W Gr
710	-	1.68	Gry Si Cl Tr Sa Tr Gr Tr Tps, N = 7, 8, SA 1, SA 2

WINDSOR NORTHBH 1

0	-	160	Asph
160	-	610	Br Cr Gran
610	-	1.68	Gry Si Cl W Sa Tr Gr Tr Tps, N = 12, 16, SA 1, SA 2

BH 2

0	-	225	Conc
225	-	760	Br Sa Tr Si, SA 1
760	-	1.68	Br Si Cl W Sa Tr Gr Tr Tps, N = 12, 12, SA 2, SA 3

BH 3

0	-	145	Asph
145	-	250	Cr Gran
250	-	760	Br Sa, SA 1
760	-	1.68	Br Si Cl W Sa Tr Gr Tr Tps, N = 20, 15, SA 2, SA 3

BH 4

0	-	130	Asph
130	-	305	Cr Gran
305	-	610	Br Sa Tr Gr
610	-	635	Styrofoam
635	-	760	Br Sa Tr Gr, SA 1A
760	-	1.68	Gry Si Cl W Sa Tr Gr Tr Tps, N = 16, 12, SA 1B, SA 2

BH 5

0	-	235	Conc
235	-	585	Br Sa
585	-	610	Styrofoam
610	-	760	Br Sa
760	-	1.68	Br Si Cl Tr Sa Tr Gr, N = 8, 16, SA 1, SA 2

BH 6

0	-	115	Asph
115	-	305	Cr Gran
305	-	860	Br Sa, SA 1A
860	-	1.68	Br Si Cl W Sa Tr Gr Tr Tps, N = 7, 11, SA 1B, SA 2

BH 7

0	-	160	Asph
160	-	330	Cr Gran
330	-	865	Br Sa W Gr, SA 1A
865	-	1.68	Br Si Cl Tr Sa Tr Gr Tr Tps, N = 7, 12, SA 1B, SA 2

BH 8

0	-	145	Asph
145	-	305	Cr Gran
305	-	760	Br Sa W Gr
760	-	1.22	Br Si Cl Tr Sa Tr Gr Tr Tps, N = 10, SA 1
1.22	-	1.68	Br Si Sa Tr Gr, N = 18, SA 2

BH 9

0	-	150	Asph
150	-	740	Cr Gran
740	-	840	Br Sa Tr Gr, N = 6
840	-	1.68	Gr Si Cl Tr Sa Tr Gr Tr Tps, N = 6, 10 SA 1, SA 2

LABORATORY TEST RESULTS**WINDSOR SOUTH****BH 1 SA 2**

w = 4.7 %

BH 1 SA 3

w = 8.2 %

BH 1 SA 4

w = 16.5 %

BH 1 SA 5

w = 28.0 %

BH 2 SA 2

w = 6.4 %

BH 2 SA 3A

w = 8.1 %

BH 2 SA 3B

w = 14.3 %

BH 2 SA 4

w = 20.8 %

BH 3 SA 2

% Passing	=	
19.0 mm	=	100.0
9.5 mm	=	83.7
4.75 µm	=	61.1
2.00 µm	=	42.3
425 µm	=	25.0
75 µm	=	15.3
w	=	6.5 %

BH 3 SA 3A

w = 7.5 %

BH 3 SA 3B

w = 21.2 %

BH 3 SA 4

% Passing	=	
19.0 mm	=	100.0
9.5 mm	=	98.2
4.75 µm	=	97.6
2.00 µm	=	96.4
425 µm	=	92.8
75 µm	=	71.4
5 µm	=	40.8
2 µm	=	31.8
w	=	20.0 %

BH 4 SA 2

w = 16.3 %

BH 4 SA 3

w = 8.9 %

BH 4 SA 4

w _L	=	33.8 %
I _p	=	16.5 %
w	=	21.7 %

BH 5 SA 2

w = 9.4 %

BH 5 SA 3

w = 8.0 %

BH 5 SA 4

w = 15.4 %

BH 6 SA 2

w = 6.1 %

BH 6 SA 3

% Passing
 19.0 mm = 100.0
 9.5 mm = 97.6
 4.75 µm = 95.9
 2.00 µm = 89.1
 425 µm = 50.5
 75 µm = 12.0
 w = 8.0 %

BH 6 SA 4

w_L = 45.4 %
 I_P = 24.1 %
 w = 21.9 %

BH 6 SA 5

w = 50.2 %

BH 7 SA 1

w = 4.7 %

BH 7 SA 2

w = 9.4 %

BH 7 SA 3A

w = 7.7 %

BH 7 SA 3B

w = 19.1 %

BH 7 SA 4

w = 17.2 %

BH 8 SA 1

w = 5.4 %

BH 8 SA 2

w = 9.0 %

BH 8 SA 3A

w = 8.5 %

BH 8 SA 3B

w = 14.8 %

BH 8 SA 4

w = 16.6 %

BH 9 SA 1A

w = 7.6 %

BH 9 SA 1B

w = 17.5 %

BH 9 SA 2

% Passing
 9.5 mm = 100.0
 4.75 µm = 99.3
 2.00 µm = 97.5
 425 µm = 93.7
 75 µm = 78.5
 5 µm = 47.3
 2 µm = 29.4
 w = 20.3 %

BH 10 SA 1

w = 20.9 %

BH 10 SA 2

w = 21.1 %

WINDSOR NORTH**BH 1 SA 1**

w = 14.1 %

BH 1 SA 2

w = 21.3 %

BH 2 SA 1

% Passing

19.0 mm = 100.0

9.5 mm = 99.4

4.75 µm = 97.1

2.00 µm = 93.4

425 µm = 67.0

75 µm = 11.5

w = 13.4 %

BH 2 SA 2

w = 13.3 %

BH 2 SA 3

w = 15.3 %

BH 3 SA 1

% Passing

19.0 mm = 100.0

9.5 mm = 93.6

4.75 µm = 88.4

2.00 µm = 82.6

425 µm = 58.2

75 µm = 10.9

w = 10.8 %

BH 3 SA 2

w = 12.1 %

BH 3 SA 3

w = 16.1 %

BH 4 SA 1A

w = 12.3 %

BH 4 SA 1B

w = 13.7 %

BH 4 SA 2

w = 16.2 %

BH 5 SA 1

w = 11.4 %

BH 5 SA 2w_L = 27.5 %I_p = 11.9 %

w = 13.7 %

BH 6 SA 1A

w = 9.5 %

BH 6 SA 1B

w = 15.9 %

BH 6 SA 2

% Passing

9.5 mm = 100.0

4.75 µm = 98.5

2.00 µm = 97.0

425 µm = 91.7

75 µm = 74.5

5 µm = 40.5

2 µm = 29.5

w = 12.8 %

BH 7 SA 1A

w = 7.4 %

BH 7 SA 1B

w = 13.8 %

BH 7 SA 2

w _L	=	34.9 %
I _p	=	17.1 %
w	=	14.1 %

BH 8 SA 1

w	=	14.5 %
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BH 8 SA 2

w	=	12.5 %
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BH 9 SA 1

w	=	18.0 %
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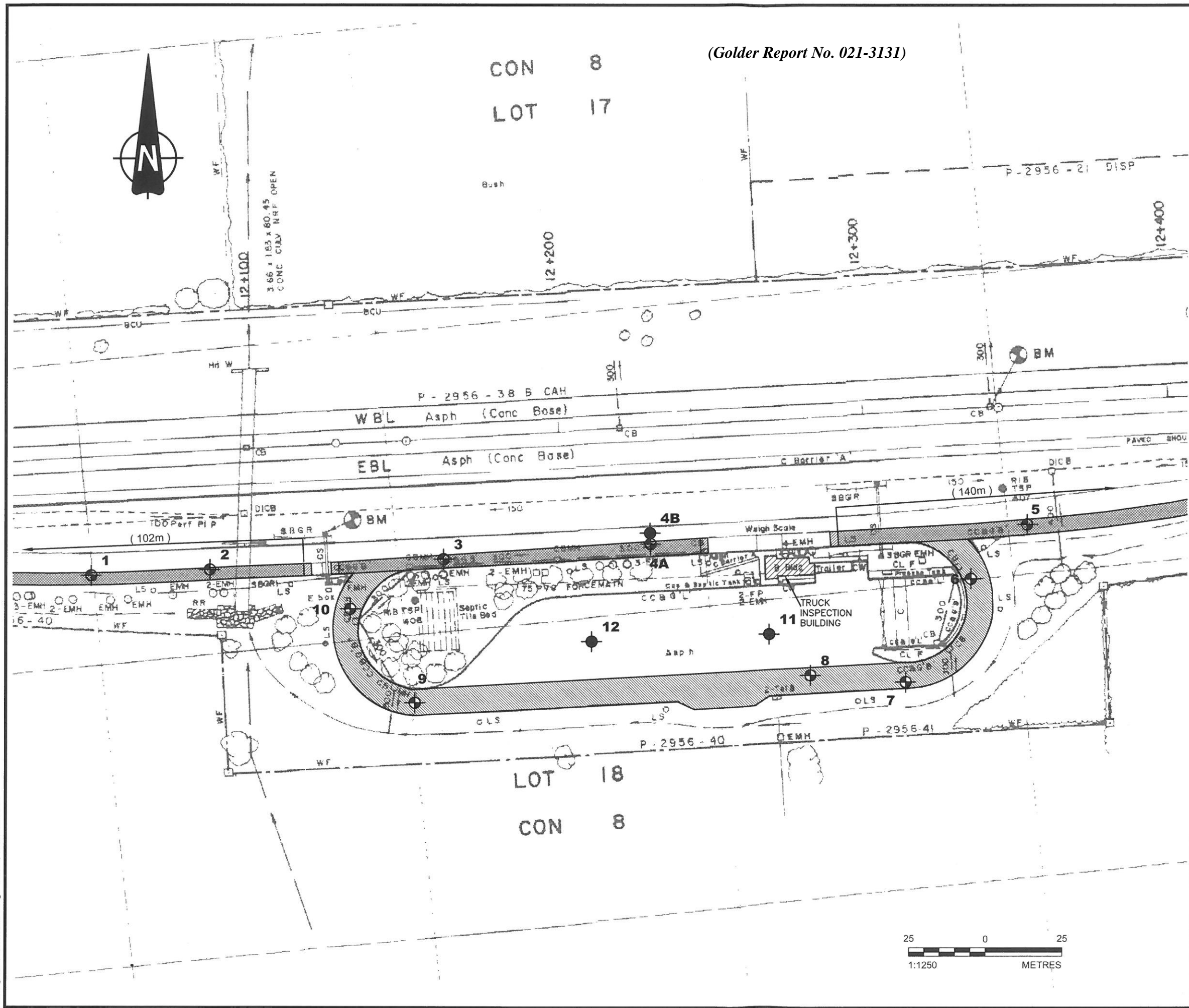
BH 9 SA 2

w	=	11.2 %
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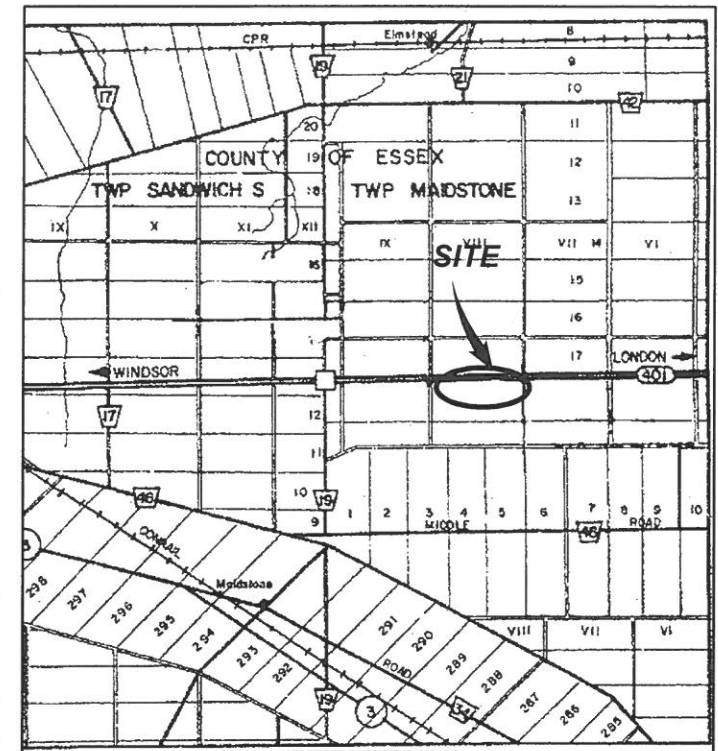
PAVEMENT CORES
Selected Locations

<u>LOCATION</u>	<u>ASPHALT/CONCRETE</u>	<u>THICKNESS</u> (mm)	<u>REMARKS</u>
<u>WINDSOR SOUTH</u>			
1	A	145	
2	A	105	
3	A	130	
4A	A	150	
4B	A	135	
5	A	115	
6	A	135	
7	A	95	
8	A	100	
9	A	120	Appears porous, cracked.
10	A	95	
11	A	100	
12	A	95	
<u>WINDSOR NORTH</u>			
1	A	160	
2	C	225	Wire mesh at 65 millimetres.
3	A	145	
4	A	130	
5	C	235	Wire mesh at 120 millimetres.
6	A	115	
7	A	160	
8	A	145	
9	A	150	
10	A	170	

Drawing file: 0213131D003.dwg Oct 28, 2002 - 11:51am



(Golder Report No. 021-3131)



KEY PLAN

LEGEND

- BOREHOLE LOCATIONS
- CORE LOCATIONS
- MILL 90mm / PAVE 90mm
- MILL 50mm / PAVE 50mm
- MILL 100mm / PAVE 100mm

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

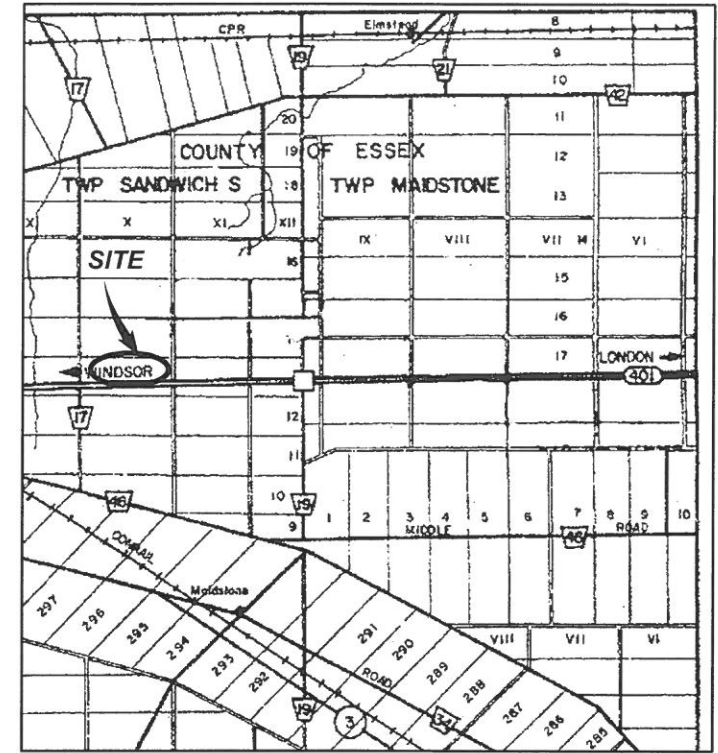
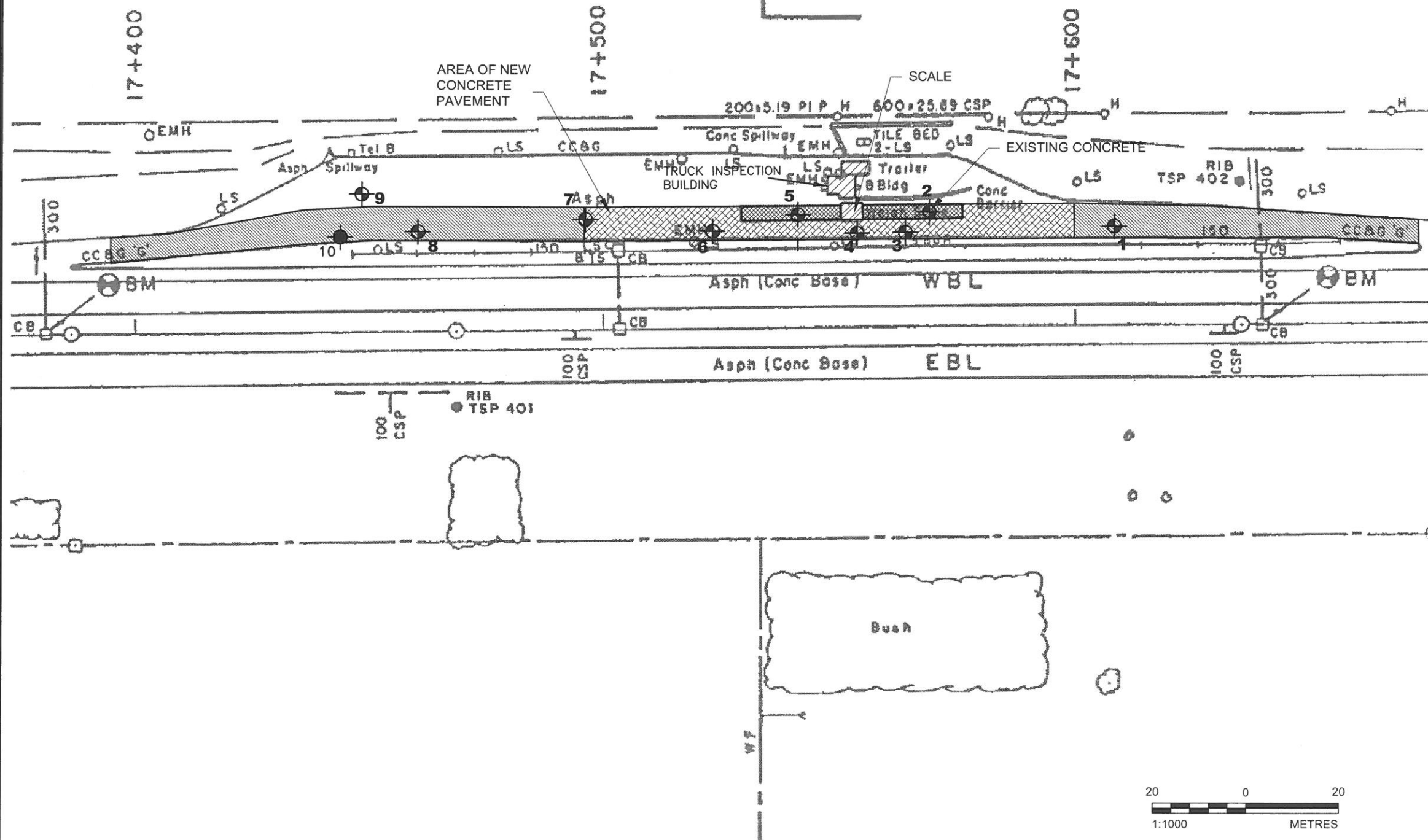
NOTE: THIS DRAWING IS TO BE READ IN CONJUNCTION
WITH ACCOMPANYING REPORT

PROJECT	SOUTHWESTERN REGION TRUCK INSPECTION STATIONS			
TITLE	LOCATION PLAN - WINDSOR SOUTH			
 Golder Associates LONDON, ONTARIO	PROJECT No.	021-3131	FILE No.	0213131D003
	CADD	10/28/02	SCALE	AS SHOWN
	CHECK	10/28/02	REV.	0
			FIGURE 2	

DT 13

DT 12

(Golder Report No. 021-3131)



KEY PLAN


LEGEND

- BOREHOLE LOCATIONS
- CORE LOCATIONS
- 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 - WINDSOR NORTH			
	PROJECT No.	021-3131	FILE No. 0213131D002
	CADD	MS/	10/28/02
	CHECK	10/28/02	SCALE AS SHOWN REV. 0
			FIGURE 3

PROJECT 05-1130-031-1-TIS

RECORD OF BOREHOLE No 301

1 OF 1

METRIC

G.W.P. 63-00-00

LOCATION N 4677869.2 ; E 275811.7

ORIGINATED BY M.A.

DIST 1 HWY 401

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY WDF

DATUM GEODETIC

DATE August 11, 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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
187.87	PAVEMENT SURFACE													
0.00	ASPHALT													
0.23	FILL, Granular Base													
0.40	FILL, sand, fine to medium, trace silt, trace gravel Compact Brown		1	SS	20		187							
186.50														
1.37	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey at elev. 183.5m		2	SS	11		186							
			3	SS	13		185							0 19 45 36
			4	SS	27		184							
			5	SS	37									
			6	SS	18		183							
182.84	END OF BOREHOLE													
5.03	Borehole dry during drilling August 11, 2005													

(Golder Report No. 05-1130-031-1-8)

PROJECT 05-1130-031-1-TIS

RECORD OF BOREHOLE No 302

1 OF 1

METRIC

G.W.P. 63-00-00

LOCATION N 4677873.3 :E 275817.0

ORIGINATED BY M.A.

DIST 1 HWY 401

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY WDF

DATUM GEODETIC

DATE August 11, 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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
187.90	PAVEMENT SURFACE													
0.00	ASPHALT													
0.15	FILL, Granular Base													
0.30	FILL, sand, fine to medium, trace silt, trace gravel													
186.92	Loose Brown													
0.98	FILL, silty clay, trace to some sand, some topsoil, trace gravel		1	SS	7		187							
186.07	Stiff Brown and black		2	SS	11		186							
1.83	SILTY CLAY, trace to some sand, trace gravel (TILL)		3	SS	12		185							
	Stiff to Hard Brown		4	SS	32		184							
			5	SS	37		183							
182.87			6	SS	20									
5.03	END OF BOREHOLE													
	Borehole dry during drilling August 11, 2005													

(Golder Report No. 05-1130-031-1-8)

1 20 42 37

PROJECT 05-1130-031-1-TIS RECORD OF BOREHOLE No **303** 1 OF 1 **METRIC**
 G.W.P. 63-00-00 LOCATION N 4677830.9 ; E 276272.5 ORIGINATED BY M.A.
 DIST 1 HWY 401 BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS COMPILED BY WDF
 DATUM GEODETIC DATE August 11, 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						
187.91	GROUND SURFACE							20 40 60 80 100						
0.09	TOPSOIL, clayey Black FILL, silty clay, trace to some sand, trace gravel Stiff Brown and grey		1	SS	9									
			2	SS	8									
			3	SS	10									
184.62			4	SS	16									
3.29	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey at elev. 184.3m		5	SS	31									
			6	SS	20									
			7	SS	15									
			8	SS	17									
181.36	END OF BOREHOLE													
6.55	Borehole dry during drilling August 11, 2005													

(Golder Report No. 05-1130-031-1-8)

PROJECT 05-1130-031-1-TIS RECORD OF BOREHOLE No 304 1 OF 1 METRIC
 G.W.P. 63-00-00 LOCATION N 4677830.1 E 276344.5 ORIGINATED BY M.A.
 DIST 1 HWY 401 BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS COMPILED BY WDF
 DATUM GEODETIC DATE August 11, 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		
187.72	0.00 FILL, Granular Base													
0.23	FILL, sand, fine to medium, trace silt													
186.81	Loose Brown													
0.91	FILL, silty clay, trace sand, trace gravel, trace topsoil		1	SS	6		187							
	Firm Grey		2	SS	6		186							
185.59														
2.13	SILTY CLAY, trace to some sand, trace gravel (TILL)		3	SS	9		185							0 17 44 39
	Stiff to Hard		4	SS	32									
	Brown to grey at elev. 184.1m		5	SS	25		184							
			6	SS	15		183							0 18 45 37
			7	SS	9									
			8	SS	8		182							
181.17														
6.55	END OF BOREHOLE													
	Borehole dry during drilling													
	August 11, 2005													

(Golder Report No. 05-1130-031-1-8)

ON MTO 05-1130-031-1-T.GPJ ON MOT.GDT 9/15/05

PROJECT 05-1130-031-1-TIS

RECORD OF BOREHOLE No 305

1 OF 1

METRIC

G.W.P. 63-00-00

LOCATION N 4677804.3 ; E 276299.0

ORIGINATED BY M.A.

DIST 1 HWY 401

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY WDF

DATUM GEODETIC

DATE August 11, 2005

CHECKED BY *WDF*

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			20 40 60 80 100	20 40 60 80 100					
187.76	PAVEMENT SURFACE													
0.00	ASPHALT													
0.12	FILL, Granular Base													
0.30	FILL, sand, fine to medium, trace silt, trace gravel													
187.06	Brown													
0.70	FILL, silty clay, trace sand, trace topsoil		1	SS	8		187							
186.39	Firm													
1.37	Brown													
	SILTY CLAY, some sand		2	SS	8		186							0 44 23 33
185.63	Stiff													
	Brown													
2.13	SILTY CLAY, trace to some sand, trace gravel (TILL)		3	SS	16		185							
	Stiff to Hard													
	Brown to grey at elev. 183.4m													
			4	SS	27		184							
			5	SS	31		183							
			6	SS	14		182							
			7	SS	11									
			8	SS	9									
181.21														
6.55	END OF BOREHOLE													
	Borehole dry during drilling August 11, 2005													

(Golder Report No. 05-1130-031-1-8)

ON_MTO_05-1130-031-1-T.GPJ ON_MOT.GDT 9/15/05

PROJECT 05-1130-031-1-TIS		RECORD OF BOREHOLE No 306		1 OF 1	METRIC
G.W.P. 63-00-00	LOCATION N 4677786.8 ; E 276275.1	ORIGINATED BY M.A.			
DIST 1 HWY 401	BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS	COMPILED BY WDF			
DATUM GEODETIC	DATE August 11, 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 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						
187.42	PAVEMENT SURFACE													
0.09	ASPHALT CONCRETE													
0.30	FILL, sand, fine to medium, trace silt, trace gravel Dense Brown		1	SS	34									
186.05														
1.37	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey at elev. 183.8m		2	SS	8									
			3	SS	20									
			4	SS	34									
			5	SS	20									
			6	SS	10									
182.39	END OF BOREHOLE													
5.03	Borehole dry during drilling August 11, 2005													

(Golder Report No. 05-1130-031-1-8)

0 19 43 38

PROJECT 05-1130-031-1-TIS

RECORD OF BOREHOLE No 307

1 OF 1

METRIC

G.W.P. 63-00-00

LOCATION N 4677787.3 ; E 276264.1

ORIGINATED BY M.A.

DIST 1 HWY 401

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY WDF

DATUM GEODETIC

DATE August 12, 2005

CHECKED BY *WDF*

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			20 40 60 80 100	20 40 60 80 100					
187.28	PAVEMENT SURFACE													
0.00	ASPHALT													
0.12	FILL, Granular Base													
186.83														
0.45	FILL, sand, fine to medium, trace silt, trace gravel Dense Brown		1	SS	35		187							
185.91							186							
1.37	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey		2	SS	15		185							
			3	SS	25		184							
			4	SS	35		183							
			5	SS	25									
			6	SS	20									
182.25	END OF BOREHOLE													
5.03	Borehole dry during drilling August 12, 2005													

(Golder Report No. 05-1130-031-1-8)

0 18 43 39

PROJECT 05-1130-031-1-TIS

RECORD OF BOREHOLE No 308

1 OF 1

METRIC

G.W.P. 63-00-00

LOCATION N 4677807.4 ; E 276246.4

ORIGINATED BY M.A.

DIST 1 HWY 401

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY WDF

DATUM GEODETIC

DATE August 12, 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			20 40 60 80 100	20 40 60 80 100					
187.52	PAVEMENT SURFACE													
0.00	ASPHALT													
187.12	FILL, Granular Base													
0.40	FILL, sand, fine, trace silt, trace gravel Compact Brown		1	SS	18		187							
186.39														
1.13	FILL, silty clay, some sand, trace gravel Stiff Grey		2	SS	9		186							
186.00														
1.52	SILTY CLAY, trace sand Stiff Brown													
185.39														
2.13	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey at elev. 183.9m		3	SS	25		185							1 20 43 36
			4	SS	30		184							
			5	SS	28		183							
			6	SS	16		182							
			7	SS	13		181							
			8	SS	9									
180.97	END OF BOREHOLE													
6.55	Borehole dry during drilling August 12, 2005													

(Golder Report No. 05-1130-031-1-8)

PROJECT 05-1130-031-1-TIS

RECORD OF BOREHOLE No 309

1 OF 1

METRIC

G.W.P. 63-00-00

LOCATION N 4677803.6 E 276202.5

ORIGINATED BY M.A.

DIST 1 HWY 401

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY WDF

DATUM GEODETIC

DATE August 12, 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							
187.28	PAVEMENT SURFACE														
0.09	ASPHALT														
0.30	CONCRETE														
186.30	FILL, sand, trace silt, trace gravel Compact Brown														
0.98	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey at elev. 183.7m		1	SS	15										
			2	SS	24										
			3	SS	35										
			4	SS	23										
			5	SS	18										
			6	SS	14										
			7	SS	13										
			8	SS	11										
180.73	END OF BOREHOLE														
6.55	Borehole dry during drilling August 12, 2005														

PROJECT 05-1130-031-1-TIS

RECORD OF BOREHOLE No 310

1 OF 1

METRIC

G.W.P. 63-00-00

LOCATION N 4677802.5 ; E 276227.5

ORIGINATED BY M.A.

DIST 1 HWY 401

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY WDF

DATUM GEODETIC

DATE August 12, 2005

CHECKED BY *WDF*

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			20 40 60 80 100	20 40 60 80 100					
187.31	PAVEMENT SURFACE													
0.09	ASPHALT													
0.30	CONCRETE													
186.25	FILL, sand, fine to medium, trace silt, trace gravel Compact Brown		1	SS	13		187							(Golder Report No. 05-1130-031-1-8)
1.06	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey at elev. 184.4m		2	SS	11		186							1 21 40 38
			3	SS	35		185							
			4	SS	34		184							
			5	SS	24		183							4 19 43 34
			6	SS	16		182							
			7	SS	13		181							
180.76	END OF BOREHOLE		8	SS	12									
6.55	Borehole dry during drilling August 12, 2005													

PROJECT 05-1130-031-1-TIS RECORD OF BOREHOLE No **311** 1 OF 1 **METRIC**
 G.W.P. 63-00-00 LOCATION N 467788.5 :E 276226.7 ORIGINATED BY M.A.
 DIST 1 HWY 401 BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS COMPILED BY WDF
 DATUM GEODETIC DATE August 12, 2005 CHECKED BY WDF

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									
186.99	PAVEMENT SURFACE														
0.00	ASPHALT														
0.12	FILL, Granular Base														
0.24	FILL, sand, fine to medium, trace silt, trace gravel Compact Brown		1	SS	15										
185.62															
1.37	CLAYEY SILT, trace to some sand, trace gravel (TILL) Stiff to Hard Brown		2	SS	8										
			3	SS	45										
184.09															
2.90	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey at elev. 183.4m		4	SS	33										
			5	SS	21										
			6	SS	14										
			7	SS	14										
			8	SS	9										
180.44															
6.55	END OF BOREHOLE														
	Borehole dry during drilling August 12, 2005														

(Golder Report No. 05-1130-031-1-8)

6 35 42 17

(Golder Report No. 05-1130-031-1-8)

6 35 42 17

PROJECT 05-1130-031-1-TIS

RECORD OF BOREHOLE No 312

1 OF 1

METRIC

G.W.P. 63-00-00

LOCATION N 4677789.6 E 276201.9

ORIGINATED BY M.A.

DIST 1 HWY 401

BOREHOLE TYPE POWER AUGER/HOLLOW STEM AUGERS

COMPILED BY WDF

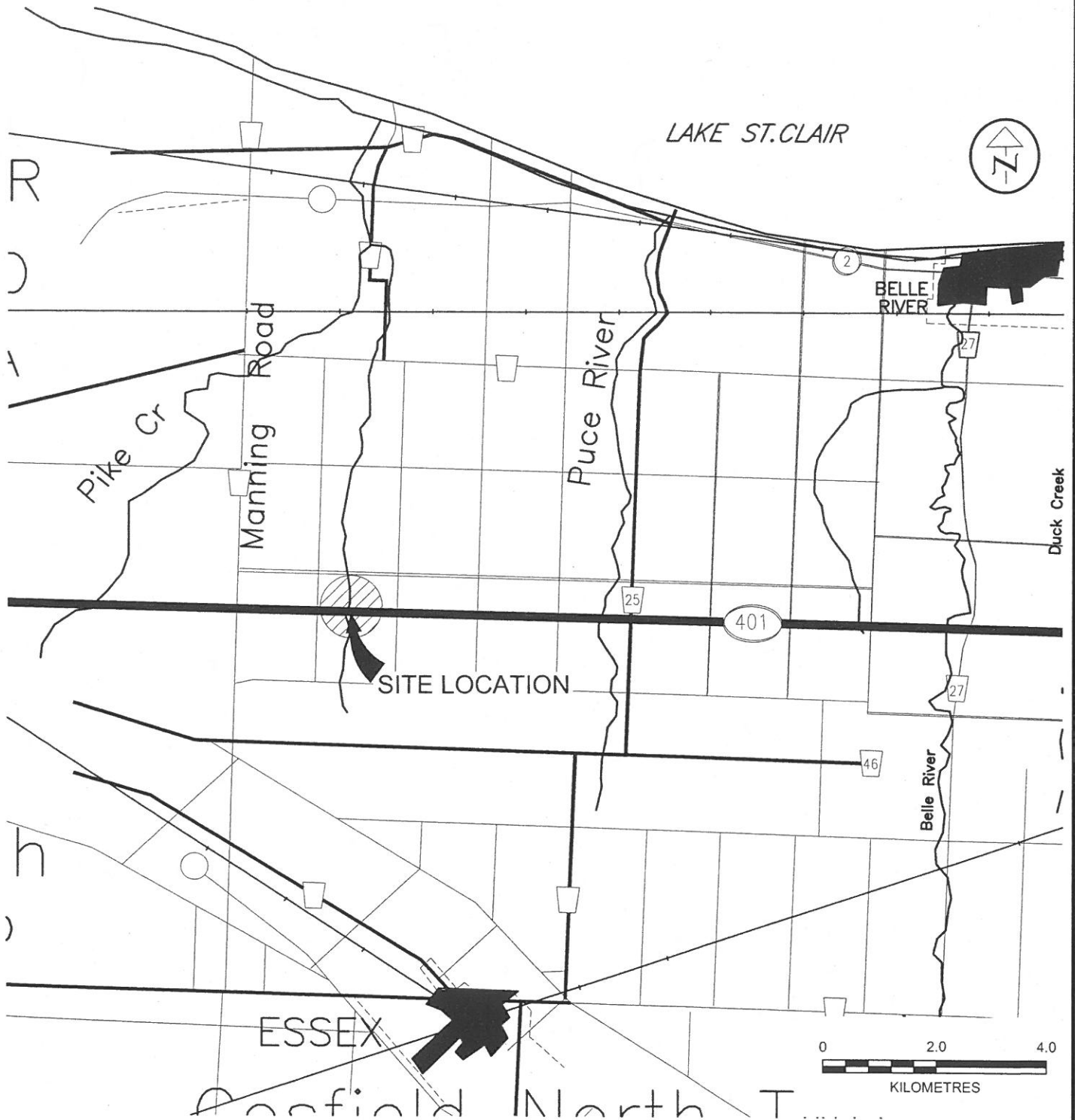
DATUM GEODETIC

DATE August 12, 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			20	40						60	80	100	20	40
187.02	PAVEMENT SURFACE																		
0.09	ASPHALT CONCRETE																		
0.30	FILL, sand, fine to medium, trace silt, trace gravel Compact Brown		1	SS	25														
185.50																			
1.52	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to Hard Brown to grey at elev. 184.1m		2	SS	18														
			3	SS	47														
			4	SS	24														
			5	SS	17														
			6	SS	15														
			7	SS	15														
			8	SS	14														
180.47	END OF BOREHOLE																		
6.55	Borehole dry during drilling August 12, 2005																		

(Golder Report No. 05-1130-031-1-8)



PROJECT
WINDSOR SOUTH COMMER. VEHICLE INSP. STATION
WP 63-00-00
HIGHWAY 401 RECONSTRUCTION

TITLE

KEY PLAN



PROJECT No. 05-1130-031-1-8		FILE No. 051130031-1-8F001	
CADD	DCH	SCALE	AS SHOWN
CHECK	Sept. 15/05	REV.	0

FIGURE 1



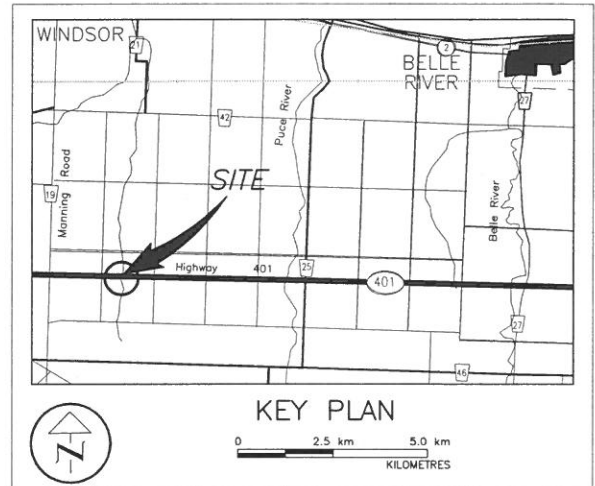
**WINDSOR SOUTH COMMERCIAL
VEHICLE INSPECTION STATION**
BOREHOLE LOCATIONS

SHEET



Golder Associates Ltd.
LONDON, ONTARIO, CANADA

(Golder Report No. 05-1130-031-1-8)



KEY PLAN

LEGEND

● Borehole
(Current Investigation - Golder Associates)

No.	ELEVATION (metres)	CO-ORDINATES	
		NORTH	EAST
301	187.87	4 677 869.2	275 811.7
302	187.90	4 677 873.3	275 817.0
303	187.91	4 677 830.9	276 272.5
304	187.72	4 677 830.1	276 344.5
305	187.76	4 677 804.3	276 299.0
306	187.42	4 677 786.8	276 275.1
307	187.28	4 677 787.3	276 264.1
308	187.52	4 677 807.4	276 246.4
309	187.28	4 677 803.6	276 202.5
310	187.31	4 677 802.5	276 227.5
311	186.99	4 677 788.5	276 226.7
312	187.02	4 677 789.6	276 201.9

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 : DRAWING BY DILLON CONSULTING
ENTITLED: Windsor South CVIF
SITE No. :
DATED: SEPT 2005

NO.	DATE	BY	REVISION
40J2-75			
HWY. No.	401	PROJECT NO.:	05-1130-031-1-8
SUBM'D.	-	CHKD.	DATE: SEPT 16/05
DRAWN:	WDF	CHKD.	MEB APPD.
			DWG. 1

