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**FACTUAL REPORT ON**

**PRELIMINARY GEOTECHNICAL INVESTIGATION  
FOR STRUCTURE FOUNDATIONS  
FEASIBILITY STUDY  
HIGHWAY 407 BETWEEN HIGHWAY 10  
AND TORBRAM ROAD  
BRAMPTON, ONTARIO**

**Submitted to:**

**Ministry of Transportation Ontario  
1201 Wilson Avenue  
Downsview, Ontario  
M3M 1J8**

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**August 1993**

**931-1348**

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August 4, 1993

931-1348

Mr. M. S. Devata, P. Eng.  
Ministry of Transportation Ontario  
1201 Wilson Avenue,  
Central Building, Room 315  
Foundation Design Section  
Downsview, Ontario  
M3M 1J8

Attention: Mr. D. Dundas, P. Eng.

**RE: PRELIMINARY GEOTECHNICAL INVESTIGATION  
FOR STRUCTURE FOUNDATIONS FEASIBILITY STUDY  
HIGHWAY 407 BETWEEN HIGHWAY 10 AND TORBRAM ROAD  
BRAMPTON/MISSISSAUGA, ONTARIO**

Dear Sirs:

We are pleased to submit herewith our report for the preliminary Geotechnical Investigation for the Structure Foundations Feasibility Study, along the proposed Highway 407 between Highway 10 and Torbram Road, in the Cities of Brampton and Mississauga, Ontario.

Authorization for this project was given in the Ministry of Transportation Ontario (MTO) Agreement No. 4620-9193-1002, issued on July 14, 1993. The detailed Terms of Reference for this investigation are outlined in Golder Associates' proposal No. P31-1188, dated May 31, 1993.

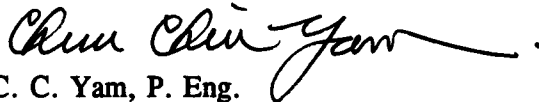
This report was prepared in accordance with the following basic instructions given to us by your Mr. D. Dundas on July 15, 1993.

- The report should be simple and a detailed description or interpretation of the subsurface conditions is not required.
- The report should include borehole location plans and a complete set of Record of Borehole sheets.

We trust that the information contained in this report meets with your present requirements. If there are any queries regarding the contents of this report, or if we can be of further assistance on this project, please do not hesitate to call us.

Yours truly,

**GOLDER ASSOCIATES LTD.**



C. C. Yam, P. Eng.  
Senior Geotechnical Engineer



J. L. Seychuk, P. Eng.  
Senior Principal

CCY/JLS/jm/pds

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## 1.0 INTRODUCTION

Golder Associates Ltd. has been retained by the Ministry of Transportation Ontario (MTO) to carry out a preliminary geotechnical investigation along the proposed route of Highway 407 between Highway 10 and Torbram Road in the Cities of Brampton and Mississauga, Ontario (Figure 1).

The length of the above section of Highway 407 is about 8.4 km in the east-west direction with a total of 34 bridge structures located on related exit ramps, loop ramps, flyovers, basket weave ramps and major road or railway intersections. The purpose of this investigation is to determine the physical subsurface conditions at a number of pre-determined (by MTO) locations along the route for feasibility study purposes.

For this investigation, a program of 37 boreholes was planned by MTO at pre-determined locations between Highway 10 (Station 365+00) and Torbram Road (Station 630+00) as shown on Figure 2 to Figure 10. These boreholes are located in the following groupings.

GROUPINGS	BOREHOLE	PLAN LOCATION
1. Highway 10	F701, F702 F703, F704	Figure 3
2. Kennedy Road	F705, F706	Figure 4
3. Hwy. 407 and Hwy. 410 interchange	F707, F708 F709, F710 F711, F712 F713 F714, F715 F735, F736, F737	Figure 4  Figure 9
4. Tomken Road	F716, F717, F718 F719, F720	Figure 5
5. Dixie Road	F721, F722	Figure 5
6. Bramalea Road	F723, F724, F725, F726 F727, F728, F729, F730	Figure 6
7. Torbram Road	F731, F732 F733, F734	Figure 7

Authorization for this project is given in MTO Agreement No. 4620-9193-1002, issued on July 14, 1993. The detailed Terms of Reference for this investigation are outlined on Golder Associates' proposal No. P31-1188, dated May 31, 1993. The provision of geotechnical engineering recommendations and the determination of any environmental/chemical aspects relating to the foundation subsoil are not part of the Terms of Reference of this project.

## **2.0 GENERAL SITE DESCRIPTION AND REGIONAL GEOLOGY**

### **2.1 Site Description**

The section of the proposed route of Highway 407 investigated in this study extends from Highway 10 to Torbram Road, and is located north of Derry Road and south of Steeles Avenue in the Cities of Brampton and Mississauga, Ontario. This area is predominantly comprised of relatively flat to slightly undulating farm land and grassy fields divided by high volume streets and highways, with deep river valleys and their associated flood plains in the central portion of the site (Figure 1).

### **2.2 Regional Geology**

The site of the proposed Highway 407 is located in a physiographic region known as the Peel Plain (Chapman, L.J., and Putnam, D.F., "The Physiography of Southern Ontario, 2nd Edition", 1973). This area is between about Elevation 150 m to 200 m above sea level with a gradual slope toward Lake Ontario. Across the plain, rivers and streams have cut deep valleys and there are, therefore, no large undrained depressions, swamp or bogs in the whole area. The region is generally characterized by level to undulating tracts of bevelled till and clay deposits. The general stratigraphy of the area is clay soils underlain by a till or boulder clay containing fragments of palaeozoic shale and limestone. Localized deposits of varved clays may be encountered in some low lying areas, in till or bedrock depressions. The Peel Plain extends across the contact of the grey (Dundas formation) and red (Queenston formation) shales.

### 3.0 FIELD WORK PROCEDURES

The field work for this investigation was carried out between June 16 and July 1, 1993, during which time a total of 38 boreholes (BH F701 to BH F737 inclusive, and F732A) were put down at the locations outlined on Table 1 and shown in Figures 2 to 10. It should be noted that the borehole numbers, as shown on the Record of Borehole sheets and drawings of this report, have F prefixes designating foundation boreholes for this investigation. The field work program was carried out in accordance with the Terms of Reference specified by MTO.

The boreholes were advanced to depths of between 4 m and 27 m below ground surface using two track mounted CME 75 power auger drill rigs supplied and operated by a local specialist drilling contractor.

The borings were advanced through the overburden using either solid stem or hollow stem augers, depending on soil conditions encountered. In each borehole, samples were obtained from the overburden soil or weathered bedrock at 0.75 m intervals to a depth of 6.0 m, and then at 1.5 m intervals to the end of the borehole using standard 50 mm O.D. split spoon sampling equipment. In situ vane tests were carried out to determine the undrained shear strength of the surficial clay stratum in Borehole F732A adjacent to the original Borehole F732.

Bedrock was cored in twelve boreholes (F705, F707, F710, F712, F713, F714, F716, F722, F723, F728, F732A, F737), as detailed on the Record of Borehole sheets, using NQ or BQ diamond coring bits. The Terms of Reference by MTO specified that the rock coring should be B-size. Due to the very poor recovery of B-size rock cores from Borehole F712, and as per discussion with your Mr. Dundas on June 21, 1993, rock cores from other boreholes were taken using NQ size coring bit.

Following completion of sampling and rock coring, piezometers were installed at selected boreholes (total 23) to permit monitoring of the groundwater levels at the borehole locations. Boreholes without piezometer installations were backfilled with pea gravel and/or native soil/auger cuttings after drilling and sampling (Table 3).



Following completion of each boring, a dynamic penetration cone was driven, within one metre of the borehole, until greater than 100 blow counts were recorded for two consecutive feet of penetration.

The completed investigation program includes a total of 283 m of auger drilling/sampling and about 100 m of dynamic cone footage in overburden and weathered shale bedrock. The rock coring footage in the shale bedrock is about 43 m. The detailed drilling and dynamic cone test footage/rock coring in each borehole is summarized on the attached Table 2.

The field work was supervised throughout by a team of our geotechnical engineering and technical staff who cleared the borehole locations of buried services, directed the drilling and sampling operations, logged the boreholes and cared for the samples obtained. All of the overburden soil samples were visually identified in the field, placed in labelled air-tight containers and returned to our geotechnical laboratory in Mississauga for detailed examination and selective testing. Representative soil samples were tested for index properties such as water content, grain size distribution, plasticity and the like. The "B" size and "N" size rock core was placed into either special cardboard or wooden core boxes. Measurements of Rock Quality Designation (RQD), Solid Core Recovery (SCR) and major joints/fractures were logged in the field immediately upon core retrieval from the core barrel. All of the rock cores obtained were wrapped in the field, to provide protection from drying, and stored in a humidity room in our laboratory before further examination and testing. Point Load tests were carried out on selected sections of rock core to determine inferred compressive strength of intact rock (Table 4).

The stations and offsets, coordinates and ground surface elevations for the boreholes were originally established on site by MTO prior to the commencement of the field work. However, due to the presence of aboveground or underground utility services, surface topography or other on site conditions, some of the boreholes were relocated for field drilling purposes. Where the locations and/or ground surface elevations for the completed boreholes differed from those of the originally staked locations, new locations and elevations were surveyed by our staff. The location coordinates and the ground surface elevation of the boreholes are summarized on Table 1. All of the borehole stations and offsets, coordinates and the ground surface elevations are in metric scale and the ground surface elevations are referred to Geodetic datum.

It should be noted that Figures 1 to 10 are in imperial scale as provided to us by MTO. However, the summary of borehole elevations and coordinates presented on these figures is in metric units.

#### **4.0 GENERALIZED SUBSURFACE CONDITIONS**

The detailed stratigraphy encountered in each borehole and the results of the laboratory tests carried out on representative samples are given on the attached Record of Borehole sheets. The results of dynamic cone tests are also included in the respective Record of Borehole sheets. Ground surface and available bedrock elevations at borehole locations and water levels recorded in piezometers or open holes are summarized on Tables 2 and 3, respectively. Results of point load tests carried on selected rock core samples are given on Table 4 following the text of this report.

The gradation (grain size distribution) test results summarized on the Record of Borehole sheets are based on the Unified Soil Classification System with the following grain size demarkation values:-

- between clay and silt sizes                    -        0.002 mm diameter
- between silt and sand sizes                   -        0.075 mm diameter
- between sand and gravel sizes               -        4.75 mm diameter
- between gravel and cobble sizes            -        75 mm diameter

Because it is not included in the Unified Soil Classification system, the above demarkation value between clay and silt sizes (0.002 mm diameter) is defined according to the M.I.T. Soil Classification system.

It should be noted that the soil strata boundaries indicated on the Record of Borehole sheets are inferred from non-continuous sampling and from observations of drilling conditions (i.e. hydraulic pressures, casing advance, water return, etc.). These boundaries typically represent transitions from one soil type to another and are not intended to indicate an exact plane of geological change. Conditions will also vary between boreholes.

The section of the proposed route of Highway 407 included in this investigation program is about 8.4 km long between Highway 10 and Torbram Road. At Highway 410, the proposed major interchange is bounded by Steeles Avenue on the north side and Derry Road on the south side. The site area is generally flat to slightly undulating with ground surface at about elevation 206 m at the west end (Boreholes F701, F702 at Hwy. 10), reducing gradually eastward to about elevation 181 m at Torbram Road (Boreholes F733, F734). In the north-south direction, along Highway 410, the ground surface at the north end of the interchange is at about elevation 194 m (Boreholes F735, F736) reducing gradually southward to about elevation 189 m (Boreholes F714, F715) south of the Highway 407 centre line. The middle portion of the site area (between Hwy. 410 and Tomken Road) is criss-crossed with deep river valleys and their associated flood plains formed by the Etobicoke creek system. The ground surface in the flood plains was found to be at about Elevation 181 m (i.e Borehole 716).

In general, the site area is covered by a deposit of glacial till overlying shale bedrock. Surficial fill of granular or clay materials is encountered in boreholes located on road shoulders. Surficial sediments of clay or granular strata are found in low lying areas or river valleys. The surficial fills or sediments are underlain by glacial tills. For detailed subsurface information at a specific site, reference should be made to the respective Record of Borehole sheets.

The groundwater levels, as measured on July 20, 1993 in piezometers installed in boreholes, are given on the respective Record of Borehole sheets and also on Table 3. For boreholes without a piezometer installation, groundwater levels measured within open holes at the end of the drilling are also included. It should be noted that the water levels measured in the boreholes or piezometers do not necessarily represent the long term groundwater level(s) that may exist in the strata. Furthermore, the groundwater level(s) may be subject to fluctuation due to seasonal and precipitation conditions.

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TABLE 1

SURVEY RESULTS FOR BOREHOLES  
HIGHWAY 407, BRAMPTON, ONTARIO

Borehole No.	Station (m)	Off-Set (m)	Co-Ordinates		Ground Surface Elevation (m)	Remarks
			Northing (m)	Easting (m)		
F701	18 + 374.556	44.196	4834630.803	287359.142	206.45	Relocated
F702	18 + 357.616	-36.576	4834673.726	287287.342	206.71	As Staked
F703	19 + 419.968	63.108	4835419.433	288052.993	197.55	Relocated
F704	19 + 351.264	-76.200	4835451.818	287901.221	199.49	As Staked
F705	19 + 751.450	82.296	4835669.565	288272.739	196.01	Relocated
F706	19 + 774.934	-68.354	4835780.076	288165.922	195.99	Relocated
F706	20 + 445.496	39.624	4836263.522	288642.088	192.05	As Staked
F708	20 + 463.784	-45.722	4836324.631	288579.768	193.09	As Staked
F709	20 + 567.416	54.864	4836359.641	288719.928	192.20	As Staked
F710	20 + 607.000	-54.864	4836450.421	288646.675	193.96	As Staked
F711	21 + 210.544	69.194	4836929.819	289037.822	182.73	Relocated
F712	21 + 173.968	-70.104	4836950.801	288894.587	183.13	As Staked
F713	20 + 946.871	-493.693	4836946.070	288425.270	192.03	Relocated
F714	20 + 436.352	586.740	4835961.804	289098.589	188.76	As Staked
F715	20 + 320.528	505.968	4835900.998	288962.862	189.72	As Staked
F716	21 + 456.522	88.940	4737158.210	289147.210	181.28	Relocated
F717	21 + 381.232	6.096	4837112.881	289041.874	182.19	As Staked
F718	21 + 378.184	-112.18	4837154.570	288935.020	188.13	Relocated
F719	21 + 919.08	49.042	4837620.733	289233.406	185.15	Relocated
F720	21 + 954.256	-45.720	4837676.148	289146.301	186.03	As Staked
F721	22 + 727.096	39.624	4838408.210	289409.781	184.48	Relocated
F722	22 + 745.236	-33.528	4838445.603	289347.991	185.04	Relocated
F723	23 + 761.720	30.480	4839349.485	289819.355	180.20	As Staked
F724	23 + 682.472	-24.384	4839301.312	289735.871	180.98	As Staked
F725	24 + 215.948	36.576	4839756.029	290020.310	184.17	Relocated
F726	24 + 223.668	-30.480	4839791.594	289962.775	184.66	Relocated
F727	24 + 366.624	-353.568	4840059.257	289731.685	187.10	Relocated
F728	24 + 357.604	-417.576	4840079.742	289669.166	187.68	As Staked

SURVEY RESULTS FOR BOREHOLES  
HIGHWAY 407, BRAMPTON, ONTARIO

Borehole No.	Station (m)	Off-Set (m)	Co-Ordinates		Ground Surface Elevation (m)	Remarks
			Northing (m)	Easting (m)		
F729	24 + 398.676	-524.256	4840613.937	289589.382	188.27	Relocated
F730	24 + 429.232	-612.648	4840227.912	289523.463	186.23	As Staked
F731	24 + 749.232	1.60	4840259.705	290234.408	182.35	Relocated
F732	24 + 634.048	-32.328	4840163.653	290134.889	182.14	Relocated
F732A	24 + 635.248	-31.978	4840163.303	290136.089	182.14	Relocated
F733	25 + 644.78	33.528	4841069.422	290605.797	181.60	Relocated
F734	25 + 709.99	-28.956	4841144.751	290565.841	181.50	Relocated
F735	10 + 061.433	73.152	4837344.231	288261.094	193.92	As Staked
F736	10 + 053.337	-82.296	4837288.352	288115.811	194.48	As Staked
F737	9 + 573.753	-143.256	4836812.892	288202.717	197.09	Relocated

TABLE 2

SUMMARY OF BOREHOLE STRATIGRAPHY RESULTS  
HIGHWAY 407, BRAMPTON, ONTARIO

BOREHOLE NO.	DATE COMPLETED (m/d/y)	OVERBURDEN, WEATHERED ROCK AND ROCK CORES ( m )					ELEVATIONS (m)			DYNAMIC CONE TEST (m)
		OVERBURDEN (A)	WEATHERED ROCK (B)**	TOTAL (A + B)	ROCK CORE (C)*	TOTAL (A + B + C)	GROUND SURFACE (m)	TOP OF BEDROCK (m)	BOTTOM OF BOREHOLE (m)	
F701	6/17/93	18.44	-	18.44	-	18.44	206.45	-	188.01	3.66
F702	6/18/93	27.53	-	27.53	-	27.53	206.71	-	179.18	2.74
F703	6/21/93	9.42	-	9.42	-	9.42	197.55	-	188.13	1.98
F704	6/17/93	9.25	-	9.25	-	9.25	199.49	-	190.24	2.74
F705	6/18/93	6.25	0.15	6.40	4.62	11.02	196.01	189.76	184.99	3.20
F706	6/17/93	5.20	3.20	8.40	-	8.40	195.99	190.79	187.59	2.95
F707	6/29/93	2.10	1.30	3.40	3.30	6.70	192.05	189.95	185.35	1.57
F708	6/29/93	2.10	3.10	5.20	-	5.20	193.09	190.99	187.89	2.36
F709	6/30/93	2.30	1.60	3.90	-	3.90	192.20	189.90	188.30	1.98
F710	7/1/93	2.40	0.30	2.70	4.30	7.00	193.96	191.56	186.96	1.35
F711	6/21/93	2.30	0.80	3.10	-	3.10	182.73	180.43	179.63	2.13
F712	6/21/93	2.30	0.40	2.70	4.30	7.00	183.13	180.83	176.13	2.70
F713	6/23/93	8.80	0.40	9.20	2.70	11.90	192.03	183.23	180.13	3.96
F714	6/30/93	6.80	0.30	7.10	2.80	9.90	188.76	181.96	178.86	2.74
F715	6/30/93	6.10	0.80	6.90	-	6.90	189.72	183.62	182.82	2.97
F716	6/22/93	2.40	-	2.40	3.00	5.40	181.28	178.88	175.88	2.13
F717	6/22/93	3.80	0.82	4.62	-	4.62	182.19	178.39	177.57	2.44
F718	6/22/93	4.90	1.40	6.30	-	6.30	188.13	182.93	181.83	3.05
F719	6/22/93	5.90	0.40	6.30	-	6.30	185.15	179.25	178.85	1.68
F720	6/21/93	6.30	-	6.30	-	6.30	186.03	-	179.73	2.36
F721	6/28/93	7.80	-	7.80	-	7.80	184.48	-	176.68	3.55
F722	7/1/93	10.70	0.10	10.80	3.10	13.90	185.04	174.34	171.14	3.58

TABLE 2 (CONT'D)

SUMMARY OF BOREHOLE STRATIGRAPHY RESULTS  
HIGHWAY 407, BRAMPTON, ONTARIO

BOREHOLE NO.	DATE COMPLETED (m/d/y)	OVERBURDEN, WEATHERED ROCK AND ROCK CORES (m)					ELEVATIONS (m)			DYNAMIC CONE TEST (m)
		OVERBURDEN (A)	WEATHERED ROCK (B)**	TOTAL (A + B)	ROCK CORE (C)*	TOTAL (A + B + C)	GROUND SURFACE (m)	TOP OF BEDROCK (m)	BOTTOM OF BOREHOLE (m)	
F723	6/23/93	4.60	0.30	4.90	3.0	7.90	180.20	175.60	172.30	2.95
F724	6/22/93	3.90	1.60	5.50	-	5.50	180.98	177.08	175.48	2.82
F725	6/28/93	7.70	0.40	8.10	-	8.10	184.17	176.47	176.07	2.31
F726	6/25/93	7.20	0.70	7.90	-	7.90	184.66	177.46	176.76	3.23
F727	6/28/93	5.90	0.40	6.30	-	6.30	187.10	181.20	180.80	2.08
F728	6/25/93	5.60	0.10	5.70	3.10	8.80	187.68	182.08	178.88	2.74
F729	6/24/93	5.20	0.10	5.30	-	5.30	188.27	183.07	182.97	3.05
F730	6/24/93	4.40	0.60	5.00	-	5.00	186.23	181.83	181.23	2.13
F731	6/25/93	4.60	1.60	6.20	-	6.20	182.35	177.75	176.15	2.59
F732	6/23/93	6.20	0.20	6.40	-	6.40	182.14	175.94	175.74	3.00
F732A	6/24/93	6.10	-	6.10	2.90	9.00	182.14	176.04	173.14	-
F733	6/28/93	8.50	0.80	9.30	-	9.30	181.60	173.10	172.30	2.92
F734	6/25/93	7.70	-	7.70	-	7.70	181.50	-	173.80	2.34
F735	6/30/93	10.70	-	10.70	-	10.70	193.92	-	183.22	3.84
F736	7/1/93	13.70	1.60	15.30	-	15.30	194.48	180.78	178.18	2.74
F737	6/29/93	4.30	0.30	4.60	5.80	10.40	197.09	192.79	186.69	3.05

Notes:

- (1) \* - NQ rock coring was used for all the boreholes except for BH F712 where BQ rock coring was used.  
 (2) \*\* - Sampling in weathered rock by auger drilling and split spoon sampling equipment.

**SUMMARY OF WATER LEVELS IN BOREHOLES AND PIEZOMETERS  
HIGHWAY 407, BRAMPTON, ONTARIO**

Borehole No.	Ground Surface Elevation (m)	Piezometer Installation	Water Level In Piezometer			Remarks
			Date	Depth (m)	Elevation (m)	
F701	206.45	None	6/17/93	-	-	W.L. at elev. 195.17 m during drilling
F702	206.71	1	7/20/93	7.04	199.67	
F703	197.55	1	7/20/93	0.46	197.09	
F704	199.49	None	6/07/93	-	-	Dry on completion of drilling
F705	196.01	1	7/20/93	1.47	194.54	
F706	195.99	1	7/20/93	0.91	195.08	
F707	192.05	1	7/20/93	0.51	191.54	
F708	193.09	None	6/29/93	-	-	Dry on completion of drilling
F709	192.20	None	6/30/93	-	-	Dry on completion of drilling
F710	193.96	1	7/20/93	1.32	192.64	
F711	182.73	1	7/20/93	1.27	181.46	
F712	183.13	1	7/20/93	1.09	182.04	
F713	192.03	1	7/20/93	6.78	185.25	
F714	188.76	1	7/20/93	0.13	188.63	
F715	189.72	1	7/20/93	0.15	189.57	
F716	181.28	1	7/20/93	1.04	180.24	
F717	182.19	None	6/22/93	-	-	W.L. at elev. 181.30 during drilling
F718	188.13	1	7/20/93	4.90	183.23	
F719	185.15	1	7/20/93	0.61	184.54	
F720	186.03	None	6/21/93	-	-	W.L. at elev. 182.34 during drilling



**SUMMARY OF WATER LEVELS IN BOREHOLES AND PIEZOMETERS  
HIGHWAY 407, BRAMPTON, ONTARIO**

Borehole No.	Ground Surface Elevation (m)	Piezometer Installation	Water Level In Piezometer			Remarks
			Date	Depth (m)	Elevation (m)	
F721	184.48	None	6/28/93	-	-	W.L. at elev. 181.43 during drilling
F722	185.04	1	7/20/93	1.75	183.29	
F723	180.20	1	7/20/93	0.97	179.23	
F724	180.98	None	6/22/93	-	-	W.L. at elev. 179.30 during drilling
F725	184.17	1	7/20/93	1.70	182.47	
F726	184.66	None	6/25/93	-	-	W.L. at elev. 182.83 during drilling
F727	187.10	None	6/28/93	-	-	Dry on completion of drilling
F728	187.68	1	7/20/93	1.52	186.16	
F729	188.27	None	6/24/93	-	-	W.L. at elev. 185.22 during drilling
F730	186.23	1	7/20/93	1.47	184.76	
F731	182.35	None	6/25/93	-	-	Dry on completion of drilling
F732	182.14	None	6/23/93	-	-	W.L. at elev. 181.53 during drilling
F732A	182.14	1	7/20/93	0.61	181.53	
F733	181.60	1	7/20/93	1.55	180.05	
F734	181.50	None	6/25/93	-	-	W.L. at elev. 178.15 during drilling
F735	193.92	1	7/20/93	2.92	191.00	
F736	194.48	None	7/01/93	-	-	W.L. at elev. 186.58 during drilling
F737	197.09	1	7/20/93	8.53	188.56	

August, 1993

TABLE 4

931-1348  
Page 1 of 2

RESULT OF POINT LOAD TESTS ON DUNDAS/QUEENSTON SHALE SAMPLES  
HIGHWAY 407, BRAMPTON, ONTARIO

BORE HOLE	DEPTH (m)	ROCK DESCRIPTION	DATE OF ROCK CORE*		**LOAD DIRECTION (D/A)	TEST SAMPLE	STANDARD POINT LOAD INDEX, I <sub>s</sub> (50)		INFERRED UNIAXIAL COMPRESSIVE STRENGTH		REMARKS
			SAMPLING	TESTING			(psi)	(MPa)	(psi)	(MPa)	
F705	7.01	Shale	June 18/93	July 13/93	A	Moist	190.3	1.3	4568.0	31.5	Queenston Formation
	7.62	Shale, tr. Limestone			D	Moist	197.9	1.4	4750.3	32.8	
	8.51	Limestone/Siltstone			A	Moist	878.2	6.1	21077.6	145.4	
	8.80	Limestone			A	Moist	600.7	4.1	14417.8	99.4	
	9.76	Shale			A	Moist	142.6	1.0	3423.3	23.6	
	10.37	Shale			D	Moist	173.2	1.2	4156.5	28.7	
F707	3.73	Limestone	June 29/93	July 13/93	A	Moist	739.5	5.1	17747.3	122.4	Dundas Formation
	6.17	Shale, tr. Limestone			D	Moist	246.6	1.7	5918.5	40.8	
F710	5.79	Limestone/Siltstone	July 1/93	July 13/93	A	Moist	738.8	5.1	17731.2	122.3	Dundas Formation
	5.18	Shale			A	Moist	86.9	0.6	2084.6	14.4	
	6.27	Shale			D	Moist	74.7	0.5	1793.1	12.4	
	4.80	Limestone/Siltstone			D	Moist	747.1	5.2	17930.5	123.7	
F713	10.49	Limestone	June 23/93	July 13/93	A	Moist	759.3	5.2	18223.9	125.7	Dundas Formation
	11.07	Limestone/Siltstone			D	Moist	177.8	1.2	4267.5	29.4	
F714	7.24	Shale	June 30/93	July 13/93	D	Moist	100.3	0.7	2406.5	16.6	Dundas Formation
	7.96	Shale			A	Moist	84.4	0.6	2025.4	14.0	
	9.09	Limestone			D	Moist	747.1	5.2	17930.5	123.7	

Notes: \* Rock Cores kept in moisture room during the period  
 \*\* D - Test in diametral direction  
 A - Test along axis of Rock core

August, 1993

TABLE 4

931-1348  
Page 2 of 2

RESULT OF POINT LOAD TESTS ON DUNDAS/QUEENSTON SHALE SAMPLES  
HIGHWAY 407, BRAMPTON, ONTARIO

BORE HOLE	DEPTH (m)	ROCK DESCRIPTION	DATE OF ROCK CORE*		**LOAD DIRECTION (D/A)	TEST SAMPLE	STANDARD POINT LOAD INDEX, $I_p(50)$		INFERRED UNIAXIAL COMPRESSIVE STRENGTH		REMARKS
			SAMPLING	TESTING			(psi)	(MPa)	(psi)	(MPa)	
F716	3.33	Limestone	June 22/93	July 13/93	D	Moist	299.8	2.1	7195.8	49.6	Dundas Formation
	3.74	Limestone			A	Moist	940.3	6.5	22568.3	155.6	
	4.97	Shale			D	Moist	50.0	0.3	1199.3	8.3	
F722	13.72	Limestone	July 1/93	July 13/93	D	Moist	570.9	3.9	13701.8	94.5	Dundas Formation
F723	5.02	Shale	June 23/93	July 13/93	D	Moist	49.9	0.3	1197.3	8.3	Dundas Formation
	6.25	Shale			D	Moist	99.9	0.7	2398.6	16.5	
	7.80	Limestone			A	Moist	655.7	4.5	15736.5	108.5	
F728	6.33	Shale	June 25/93	July 13/93	A	Moist	32.7	0.2	785.6	5.4	Dundas Formation
	6.74	Shale			A	Moist	40.3	0.3	967.0	6.7	
	8.51	Shale			D	Moist	120.1	0.8	2883.1	19.9	
F732A	7.24	Shale	June 24/93	July 13/93	D	Moist	74.5	0.5	1787.2	12.3	Dundas Formation
	7.96	Limestone			D	Moist	744.2	5.1	17861.4	123.2	
F737	5.34	Shale	June 29/93	July 13/93	D	Moist	26.3	0.2	630.5	4.3	Dundas Formation
	8.00	Shale			D	Moist	99.6	0.7	2390.7	16.5	
	5.49	Limestone			D	Moist	569.0	3.9	13657.0	94.2	
	9.66	Limestone/Siltstone			D	Moist	596.7	4.1	14320.9	98.8	
	10.34	Shale			D	Moist	249.0	1.7	5967.8	41.2	

Notes: \* Rock Cores kept in moisture room during the period  
\*\* D - Test in diametral direction  
A - Test along axis of Rock core

## EXPLANATION OF TERMS USED IN REPORT

**N VALUE:** THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m, N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS  $\bar{N}$ .

**DYNAMIC CONE PENETRATION TEST:** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

**CONSISTENCY:** COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ( $c_u$ ) AS FOLLOWS:

$c_u$ (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

**DENSENESS:** COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

**RECOVERY:** SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING AND BEDDING:**

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$r_u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_t$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	kN/m <sup>3</sup>	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\gamma_d$	kN/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	kN/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m <sup>2</sup>	SEEPAGE FORCE
$\gamma'$	kN/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						



# RECORD OF BOREHOLE No F701

METRIC

W P 87-78-00 LOCATION Co-ord. N4834630.8;E287359.1 ORIGINATED BY SC  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 16, 17, 1993 CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
206.5	Ground Surface										
0.0	Sand, trace silt and gravel, occasional clay inclusions, brown (FILL)		1	SS	43						
			2	SS	13						
204.3	Compact to dense										
2.2	Clayey silt to silty clay, trace sand and gravel Hard to very stiff  (Glacial Till)		3	SS	42						
			4	SS	41						
			5	SS	45						
			6	SS	62						
201.3	Hard	Brown									
5.2	Very stiff	Grey	7	SS	26						
			8	SS	26						
			9	SS	18						
			10	SS	19						
196.3											
10.2	Sandy silt, trace clay, gravel, cobbles Grey Compact to very dense		11	SS	28						
			12	SS	135/30cm						
	(Glacial Till)										
			13	SS	55						

# RECORD OF BOREHOLE No F701

METRIC

W P 87-78-00 LOCATION Co-ord. N4834630.8;E287359.1 ORIGINATED BY SC  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE July 16, 17, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100						SHEAR STRENGTH kPo		

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No F702

METRIC

W P 87-78-00 LOCATION Co-ord:N4834673.7;E287287.3  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test  
DATUM Geodetic DATE June 17 & 18, 1993  
ORIGINATED BY SC  
COMPILED BY PD  
CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
206.7	Groundsurface													
0.0	Clayey silt, trace sand and gravel, organics (FILL)		1	SS	20									
205.2														
1.5			2	SS	17									
	Clayey silt to silty clay, trace sand and gravel Stiff to hard		3	SS	33									
	(Glacial Till)		4	SS	42									
			5	SS	34									
			6	SS	56									
201.5		Brown	7	SS	24									
5.2		Grey	8	SS	26									
			9	SS	23									
			10	SS	22									
			11	SS	28									
195.1														
11.6	Sandy silt, trace clay, gravel, cobbles		12	SS	107/28cm									
	Grey													
	Dense to very dense													
	(Glacial Till)		13	SS	70									

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No F702

METRIC

W P 87-78-00 LOCATION Co-ord: N4834673.7 ; E287287.3 ORIGINATED BY SC  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 17 & 18, 1993 CHECKED BY CY

SOIL PROFILE		SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT $\gamma$ (KN/m <sup>3</sup> )	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
191.6																
15.1	Sandy silt, trace clay, gravel, cobbles	14	SS	43											23.4	4 34 49 13
	Grey															
	Dense to very dense (Glacial Till)	15	SS	120/13cm												
		16	SS	128/15cm												4 44 47 5
		17	SS	82												
		18	SS	68												
		19	SS	46												
		20	SS	115/18cm												
		21	SS	155/18cm												
179.2		22	SS	160/10cm												
27.5	End of Borehole															
	* Water level at Elev. 199.67 m on July 20, 1993															

OFFICE REPORT ON SOIL EXPLORATION





# RECORD OF BOREHOLE No F703

METRIC

W P 87-78-00 LOCATION Co-ord:N4835419.4;E288053.0 ORIGINATED BY PD  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 21, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
197.6	Ground Surface																
0.0	Topsoil		1	SS	10												
			2	SS	17												
	Clayey silt, some sand, trace gravel, Stiff to hard (Glacial Till)		3	SS	79												
			4	SS	76												
			5	SS	101												
193.9 3.7	Brown Grey		6	SS	85												
			7	SS	87												
			8	SS	75												
			9	SS	100/15cm												
190.6																	
7.0	Sandy silt, trace clay, trace to some gravel, cobbles		10	SS	100/15cm												
	Very dense (Glacial Till)																
188.2			11	SS	155/28cm												
9.4	End of Borehole																
	* Water level at Elev. 197.09 m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No F704

METRIC

W P 87-78-00

LOCATION Co-ord:N4835451 .8:E287901.2

ORIGINATED BY PD

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem Auger & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 17, 1993

CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
199.5	Ground Surface										
0.0	Top Soil		1	SS	9						
198.9			2	SS	34						
0.6			3	SS	46						
	Clayey silt, some sand and trace of gravel Firm to hard (Glacial Till)		4	SS	55						
			5	SS	73						
195.8			6	SS	38						
3.7			7	SS	45						
			8	SS	54						
			9	SS	132/25cm						
193.2			10	SS	130/23cm						
6.3											
	Sandy silt, trace to some clay, gravel Grey										
	Very dense (Glacial Till)										
190.3											
9.2											
	End of Borehole										
	* Borehole dry at end of drilling on June 17, 1993. Borehole back filled with native material										

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No F705

METRIC

W P 87-78-00 LOCATION Co-ord.:N4835669.6;E288272.7 ORIGINATED BY PD  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger, NQ Rock Coring & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 18, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
196.0	Ground Surface																GR SA SI CL
0.0	Sand or sand and gravel with clay inclusions compact, brown		1	SS	17												
194.8	(FILL)		2	SS	10												
1.2	Silty clay, some sand, trace gravel. Very stiff to hard		3	SS	26												
	(Glacial Till)		4	SS	34												
			5	SS	67												
			6	SS	170/25cm												
191.1	Brown																
4.9	Grey		7	SS	100/15cm												
189.8			8	SS	100/15cm												
6.2	Bedrock - Reddish brown shale, with numerous grey limestone layers		9	NQ RC	REC 100% RQD 48%												
	(Queenston Formation)		10	NQ RC	REC 93% RQD 50%												
185.5			11	NQ RC	REC 100% RQD 69%												
10.5	Grey shale with lime stone/siltstone layers																
185.0	(Dundas Formation)																
11.0	End of Borehole																
	* Water level at Elev. 194.54m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No F706

METRIC

W P 87-78-00 LOCATION Co-ord.: N4835780.1; E288165.9 ORIGINATED BY PD  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 17, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
196.0	Ground Surface																GR SA SI CL
0.0	Clayey silt, trace to some sand and gravel. Brown Firm to hard (Glacial Till)		1	SS	9												
			2	SS	27												
			3	SS	45												
			4	SS	39												
192.3	Clayey silt, some sand trace gravel and shale fragments. Reddish brown, hard (Glacial Till)		5	SS	89												23 28 33 16
3.7			6	SS	87												
190.8	Bedrock - reddish brown shale, completely to highly weathered (Queenston Formation)		7	SS	100/75cm												
5.2			8	SS	100/13cm												
			9	SS	100/8cm												
187.6	End of Borehole																
8.4	* Water level at Elev. 195.08 m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No F707

METRIC

W P 87-78-00 LOCATION Co-ord.:N4836263.5;E288642.1 ORIGINATED BY PD  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger, NQ Rock Coring & Cone Test COMPILED BY PD  
DATUM Gonderic DATE June 29, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ (KN/m <sup>3</sup> )	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH kPo					
192.1	Ground Surface							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
0.0	Topsoil		1	SS	6									
	Clayey silt to silty clay, trace sand and gravel. Very stiff to hard (Glacial Till)		2	SS	27									
			3	SS	47									
190.0			4	SS	143/25 cm								21.3	
2.1	completely weathered		5	SS	120/13 cm									
188.7			6	NQ RC	REC 93% RQD 50%									
3.4	moderately to slightly weathered		7	NQ RC	REC 97% RQD 0%									
	Bedrock-grey shale with limestone layers  (Dundas Formation)		8	NQ RC	REC 97% RQD 83%									
	Limestone Layers													
185.4	End of Borehole													
6.7	* Water level at Elev. 191.54 cm on July 20, 1993													

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No F708

METRIC

W P 87-78-00 LOCATION Co-ord.: N4836324.6; E288579.8 ORIGINATED BY PD  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 29, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ (KN/m <sup>3</sup> )	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH kPa					
193.1	Ground Surface							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
0.0	Top soil		1	SS	11									
	Clayey silt to silty clay, trace sand and gravel. Stiff to hard (Glacial till)		2	SS	23								20.8	2 12 54 32
			3	SS	132/23cm									
191.0	Bedrock-grey shale completely weathered to highly weathered (Dundas Formation)		4	SS	186/20cm									
2.1			5	SS	130/15cm									
			6	SS	120/10cm									
			7	SS	120/8cm									
187.9														
5.2	End of Borehole													
	* Borehole dry at end of drilling on June 29, 1993 Borehole backfilled with native material													

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No F709

METRIC

W P 87-78-00 LOCATION Co-ord.:N4836359.6;E288719.9 ORIGINATED BY SC  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 30, 1993 CHECKED BY CY

SOIL PROFILE		SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)
							20 40 60 80 100										
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE										
192.2	Ground Surface																
0.0	Clayey silt to silty clay, trace to some sand and gravel  Brown Very stiff to hard  (Glacial Till)		1	SS	28											5 13 54 28	
			2	SS	64												
189.9																	
2.3	Bedrock -grey shale, completely to highly weathered  (Dundas Formation)		3	SS	140/20cm												
			4	SS	127/28cm												
188.3																	
			5	SS	130/5cm												
3.9	End of Borehole.  * Hole dry at end of drilling on June 30, 1993  Borehole backfilled with native material																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No F710

METRIC

W P 87-78-00 LOCATION Co-ord.:N4836450.4:E288646.7 ORIGINATED BY SC  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger, NQ Rock Coring & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 30, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
194.0	Ground Surface																
192.6	Clayey silt, some sand, trace gravel																
1.4	Hard (Glacial Till)		1	SS	46												
	Brown Grey		2	SS	130/23cm												
191.6			3	SS	135/20cm												
2.4	Weathered																
	Bedrock - Grey shale with Limestone layers		4	NQ RC	REC 98% RQD 55%												
	(Dundas Formation)		5	NQ RC	REC 100% RQD 95%												
	Thick limestone Layer		6	NQ RC	REC 100% RQD 93%												
187.0																	
7.0	End of Borehole																
	* Water level at Elev. 192.64 m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE





# RECORD OF BOREHOLE No F711

METRIC

W P 87-78-00 LOCATION Co-ord:N4836929.8;E289037.8 ORIGINATED BY SC  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 21, 1993 CHECKED BY CY

SOIL PROFILE		STRAT PLOT	SAMPLES		GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE						
182.7	Ground Surface									
0.0	Sandy silt, trace clay and gravel. Brown, stratified. Loose		1	SS	5					
181.2										
1.5	Silty clay. Trace sand and gravel. Brown, hard (Till)		2	SS	41					9 13 52 26
180.4										
2.3	Bedrock-grey shale Highly weathered									
179.6	(Dundas Formation)									
3.1	End of Borehole									
	* Water level at Elev. 181.46 m on July 20, 1993									

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No F712

METRIC

W P 87-78-00

LOCATION Co-ord.: N4836950.8; E288894.6

ORIGINATED BY SC

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Auger, BQ Rock Coring & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 21, 1993

CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa						
183.1	Ground Surface							20 40 60 80 100	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	10	20	30		
0.0	Silty sand, trace to some gravel Brown, stratified Compact		1	SS	16									
181.7	Sandy silt, some clay, gravel, compact		2	SS	19'									14 37 34 15
180.8	(Glacial Till)													
2.3	Bedrock - grey shale with occasional thin layers of limestone/ siltstone  Highly weathered  (Dundas Formation)		3	SS	127									
			4	BQ RC	REC 44% RQD 0%									
			5	BQ RC	REC 37% RQD 6%									
			6	BQ RC	REC 37% RQD 0%									
176.1	End of Borehole													
7.0	* Water level at Elev. 182.04 m on July 20, 1993													

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No F713

METRIC

W P 87-78-00 LOCATION Co-ord. N4836946.1; E288425.3 ORIGINATED BY SC  
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger, NQ Rock Coring & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 23, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80	100
192.0	Ground Surface																
0.0	Clayey silt to silty clay, trace sand and gravel with roots and organics (Fill)  Brown to dark brown  Firm to stiff		1	SS	9												
189.9			2	SS	17												
2.1	Clayey silt, some sand gravel  (Glacial Till)  Brown  Stiff to hard		3	SS	13												
			4	SS	14												
187.5			5	SS	92												
4.5	Sandy silt, trace clay and gravel, boulders Grey   Boulders  (Glacial Till)  Very dense		6	SS	125/25cm												
			7	SS	110/15cm												
			8	SS	60/5cm												
185.0																	
7.0	Clayey silt to silty clay, trace sand and gravel, shale fragments  (Glacial Till)		9	Ss	120/15cm												
183.2																	
8.8	Bedrock-grey shale with thick limestone/siltstone layers  Weathered  Limestone and Siltstone		10	SS	58/10cm												
			11	NQ RC	REC 63% RQD 23%												
			12	NQ RC	REC 96% RQD 40%												
180.1	(Dundas Formation)																
11.9	End of Borehole  * Water level at Elev. 185.25 m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No F714

METRIC

W P 87-78-00 LOCATION Co-ord.N4835961.8;E289098.6 ORIGINATED BY SC  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger, NO Rock Coring & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 30, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
188.8	Ground Surface																GR SA SI CL
0.0	Clayey silt to silty clay, some sand and gravel Stiff to hard  (Glacial Till)		1	SS	24												
			2	SS	45												
			3	SS	64												
			4	SS	83												4 26 46 24
185.1		Brown															
3.7		Grey	5	SS	130/18cm												
184.4																	
4.4	Sandy silt, trace to some clay, gravel  Very dense  (Glacial Till)		6	SS	110/18cm												
			7	SS	105												10 24 51 15
			8	SS	110/10cm												
182.0																	
6.8	Bedrock-grey shale with occasional thin limestone layers  (Dundas Formation)		9	SS	110/18cm												
			10	NQ RC	REC 100% RQD 67%												
			11	NQ RC	REC 97% RQD 70%												
178.9																	
9.9	End of Borehole  * Water level at Elev. 188.63 m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No F715

METRIC

W P 87-78-00

LOCATION Co-ord.:N4835901.0;E288962.9

ORIGINATED BY AO

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem Auger & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 30, 1993

CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100					
189.7 0.0	Ground Surface												
	Organic Top soil		1	SS	6								
	Clayey silt to silty clay, some sand and gravel		2	SS	25								
	(Glacial Till)		3	SS	64								
	Very stiff to hard		4	SS	77								
186.7 3.0	Brown Grey		5	SS	79								
			6	SS	165/23cm								
			7	SS	175/23cm								
			8	SS	130/15cm								
183.6													
6.1	Bedrock - grey shale Highly weathered		9	SS	106/15cm								
182.8 (Dundas Formation)			10	SS	130/8cm								
6.9	End of Borehole												
	* Water level at Elev. 189.57m on July 20, 1993												

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No F716

METRIC

W p 87-78-00

LOCATION Co-ord.:N4837158.2;E289147.2

ORIGINATED BY SC

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Auger, NQ Rock Coring & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 22, 1993

CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
181.3	Ground Surface																
0.0	Coarse sand with some gravel and cobbles Brown		1	SS	8												
179.9	Loose																
1.4	Silty clay with sand and gravel, shale fragments. Hard (Till)		2	SS	110/20												
178.9																	
2.4	Bedrock-grey shale with occasional thin limestone/siltstone layers. Moderately to slightly weathered (Dundas Formation)		3	NQ RC	REC 91% RQD 79%												
			4	NQ RC	REC 100% RQD 79%												
175.9																	
5.4	End of Borehole																
	* Water level at Elev. 180.24m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No F717

METRIC

W P 87-78-00 LOCATION Co-ord.:N4837112.9;E289041.9 ORIGINATED BY SC  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 22, 1993 CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100		
182.2	Ground Surface												
0.0	Clayey silt, trace sand gravel, cobbles Very stiff												
	Brown		1	SS	22								
180.8													
1.4	Coarse to fine sand with gravel and cobbles Dense, Brown		2	SS	34								
179.4			3	SS	43								
2.8	Sandy silt, some clay gravel and rock fragments Dense		4	SS	42								
178.4	(Glacial Till)												
3.8	Bedrock-grey shale Highly weathered		5	SS	120/6 cm								15 33 36 16
177.6	(Dundas Formation)		6	SS	105/6 cm								
4.6	End of Borehole												
	* Water level at Elev. 181.30m at end of drilling on June 22, 1993												
	Borehole backfilled with native materials												

+3, x5 : Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No F718

METRIC

W P 87-78-00 LOCATION Co-ord.N4837154.6;E288935.0 ORIGINATED BY SC  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 22, 1993 CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
188.1	Ground Surface																
0.0	Clayey silt, trace sand and gravel Very stiff to hard  (Glacial Till)		1	SS	21												
			2	SS	32												
			3	SS	45												
			4	SS	53												
184.5	Brown Grey		5	SS	59												
3.6			6	SS	105/5cm												
183.2	Bedrock - grey shale Highly weathered		7	SS	135/18cm												
4.9			8	SS	105/13cm												
181.8	(Dundas Formation)																
6.3	End of Borehole  * Water level at Elev. 183.23m on July 20, 1993																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No F719

METRIC

W P 87-78-00 LOCATION Co-ord.:N4837620.7;E289233.4 ORIGINATED BY PD  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Core Test COMPILED BY PD  
DATUM Geodetic DATE June 22, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
185.1	Ground Surface																
0.0	Top soil		1	SS	9												
	Clayey silt, trace sand and gravel (Till)																
184.0	Brown		2	SS	35												
1.1	Sandy silt to silty sand, trace clay and gravel		3	SS	102												
	Very Dense (Glacial Till)		4	SS	178/25cm												8 47 42 3
			5	SS	150/15cm												
181.1	Brown		6	SS	172/25cm												
4.0	Grey		7	SS	136/23cm												
179.9			8	SS	110/15cm												
5.2	Grey sandy silt, trace clay, shale fragments (Till)																
179.2																	
5.9	Bedrock - grey shale		9	SS	115/15cm												
178.8																	
6.3	(Dundas Formation) End of Borehole																
	* Water level at Elev. 184.54m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No F720

METRIC

W P 87-78-00

LOCATION Co-ord. N4837676.1; E289146.3

ORIGINATED BY PD

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem Auger & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 21, 1993

CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				NATURAL MOISTURE CONTENT			UNIT WEIGHT Y	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 <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	WATER CONTENT (%)				
186.0	Ground Surface															
0.0	Top soil		1	SS	9											
184.8	Sand and gravel. Brown Compact (Fill)		2	SS	23											
1.2	Clayey silt, trace sand, gravel. Brown, very stiff to hard		3	SS	26											
183.4	(Glacial Till)		4	SS	160/23m											
2.6	Sandy silt to silty sand, trace clay and gravel		5	SS	100/8cm											
	Very dense		6	SS	100/15cm											
181.7	Brown		7	SS	100/15cm											
4.3	Grey		8	SS	185/23cm											
	(Glacial Till)		9	SS	110/15cm											
179.7	End of Borehole															
6.3	* Water level at Elev. 182.34m at end of drilling on June 21, 1993  Backhole backfilled with native materials															

+3, x5 : Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No F721

METRIC

W P 87-78-00 LOCATION Co-ord.:N4838408.2;E289409.8 ORIGINATED BY PD  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 28, 1993 CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
184.5	Ground Surface															
0.0	Silty clay, trace sand gravel with roots and organic pockets		1	SS	27											
	Grey Brown		2	SS	17											
	(Fill)		3	SS	11											
182.4																
2.1	Clayey silt to silty clay, some sand, trace to some gravel		4	SS	30											
	Hard Brown		5	SS	39											
	(Glacial Till)		6	SS	56											
179.6			7	SS	112											2 28 49 21
4.9	Sandy silt, trace to some clay, trace gravel		8	SS	106	15cm										
	Very dense															
	(Glacial Till)		9	SS	152	25cm										13 29 41 17
177.5																
7.0	Brown Grey															
176.7			10	SS	200	8cm										
7.8	End of Borehole															
	* Water level at Elev. 181.43m at end of drilling on June 28, 1993															
	Borehole backfilled with native material															

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No F722

METRIC

W P 87-78-00

LOCATION Co-ord.: N4838445.6; E289348.0

ORIGINATED BY AO

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem Auger, NQ Rock Coring & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE July 1, 1993

CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
185.0	Ground Surface													GR SA SI CL
0.0	Sand and gravel. Brown compact (Fill)		1	SS	14									
184.4														
0.6	Clayey silt, trace sand and gravel with organic pockets. Dark brown. Firm to stiff		2	SS	17									
			3	SS	10									
182.9	(Fill)													
2.1	Clayey silt to silty clay, trace to some sand, trace gravel Very stiff to hard		4	SS	28									1 12 49 38
	Brown (Glacial Till)		5	SS	41									
			6	SS	60									
180.4														
4.6			7	SS	133									
179.8		Brown												
5.2		Grey	8	SS	135									
	Sandy silt, trace to some clay, trace gravel, rock fragments at depth		9	SS	154/15cm									
	Very dense													
	(Glacial Till)		10	SS	120/17cm									
			11	SS	120/11cm									
174.3														
10.7	Bedrock-grey shale with occasional thin layers of limestones/siltstones moderately weathered		12	SS	125/10cm									
			13	NQ RC	REC 82% RQD 28%									
	(Dundas Formation)		14	NQ RC	REC 78% RQD 53%									
171.1														
13.9	End of Borehole													
	* Water level at Elev. 183.29 m on July 20, 1993													

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No F723

METRIC

W P 87-78-00 LOCATION Co-ord.:N4839349.5;E289819.4 ORIGINATED BY PD  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger, NQ Rock Coring & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 23, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH kPo					
180.2	Ground Surface							○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE						GR SA SI CL
0.0	Top Soil		1	SS	13							46	19 39 33 9	
	Sandy silt to silty sand, trace clay and gravel, becoming coarser at depth		2	SS	15									
			3	SS	41									
178.1	Brown													
2.1	Grey													
	Compact to very dense (Glacial Till)		4	SS	53									
		5	SS	55								8 50 37 5		
		6	SS	165/28cm										
175.6		7	SS	120/5cm										
4.6	Bedrock - grey shale with occasional layers of limestone/siltstone		8	NQ RC	REC 97% RQD 83%									
	Limestone Siltstone													
	Slightly weathered to fresh		9	NQ RC	REC 98% RQD 63%									
	(Dundas Formation)													
172.3														
7.9	End of Borehole													
	*Water level at Elev. 179.23m on July 20, 1993													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No F724

METRIC

W P 87-78-00 LOCATION Co-ord.: N4839301.3; E289735.9 ORIGINATED BY PD  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 22, 1993 CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
181.0	Ground Surface																GR SA SI CL
0.0	Top Soil		1	SS	6												
	Clayey silt, trace sand gravel. Very stiff. Brown																
179.6	(Glacial Till)		2	SS	20												
1.4	Sandy silt to silty sand, trace clay, trace to some gravel		3	SS	32												
178.3	Brown		4	SS	121/28cm												
2.7	Grey																
	Dense to very dense		5	SS	127/25cm												13 61 23 3
	(Glacial Till)																
177.1			6	SS	146/20cm												
3.9	Bedrock - grey shale, highly weathered		7	SS	150/13cm												
	(Dundas Formation)																
175.5			8	SS	150/10cm												
5.5	End of Borehole																
	* Water level at Elev. 179.30m at end of drilling on June 22, 1993																
	Borehole backfilled with native material																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No F725

METRIC

W P 87-78-00 LOCATION Co-ord.: N4839756.0; E290020.0 ORIGINATED BY SC  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 28, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
184.2	Ground Surface																GR SA SI CL
0.0	Clayey silt to silty clay, trace sand and gravel																
	Very stiff to hard		1	SS	26												
	(Glacial Till)		2	SS	33												
182.1																	
2.1	Sandy silt, trace clay trace to some gravel		3	SS	58												
			4	SS	115/23cm												8 42 38 12
180.5		Brown															
3.7		Grey	5	SS	102/15cm												
	Very dense		6	SS	120/23cm												
	(Glacial Till)		7	SS	125/23cm												27 35 32 6
			8	SS	129/30cm												
176.5			9	SS	125/25cm												
7.7	Bedrock - grey shale		10	SS	130/5cm												
176.1	Highly weathered																
8.1	(Dundas Formation)																
	End of Borehole																
	* Water level at Elev. 182.47m on July 20, 1993																

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No F726

METRIC

W P 78-87-00

LOCATION Co-ord.: N4839791.6; E289962.8

ORIGINATED BY SC

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem Auger & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 25, 1993

CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH kPa					
184.7	Ground Surface													GR SA SI CL
0.0	Asphalt Concrete													
0.2	Sand and gravel													
	Compact. Brown		1	SS	15									
	(Fill)		2	SS	11									
182.6														
2.1	Sandy silt, trace clay some gravel		3	SS	7									16 41 36 7
			4	SS	85/30cm									
	Loose to very dense		5	SS	120/20cm									
183.3	Brown		6	SS	123/28cm									18 34 38 10
4.4	Grey		7	SS	118/30cm									
	(Glacial Till)		8	SS	120/25cm									
177.5														
7.2	Bedrock - grey shale, completely weathered		9	SS	115/30cm									
176.8														
7.9	(Dundas Formation)													
	End of Borehole													
	* Water level at Elev. 182.83m at end of drilling on June 25, 1993													
	Borehole backfilled with native material													

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10





# RECORD OF BOREHOLE No F727

METRIC

W P 87-78-00 LOCATION Co-ord.: N4840059.3; E289731.7 ORIGINATED BY SC  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test. COMPILED BY PD  
DATUM Geodetic DATE June 28, 1993 CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
187.1	Ground Surface																
0.0	Clayey silt, trace sand, Gravel																
	Brown		1	SS	25												
	Very stiff to hard		2	SS	38												
	(Glacial Till)		3	SS	120	20cm											
184.3																	
2.8	Sandy silt, trace clay Gravel. Brown		4	SS	110	23cm											
183.4	(Glacial Till)																
3.7	Clayey silt to silty clay, trace sand with shale fragments		5	SS	74												
	Dark grey. Hard		6	SS	105												
	(Glacial Till)		7	SS	115	25cm											
181.2																	
5.9																	
180.8	Weathered grey shale		8	SS	135	18cm											
6.3	End of Borehole																
	* Hole dry at end of drilling on June 28, 1993																
	Borehole backfilled with native material																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No F728

METRIC

W P 87-78-00

LOCATION Co-ord.:N4840079.7:E289669.2

ORIGINATED BY SC

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem Auger, NQ Rock Coring & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 24, 25, 1993

CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
187.7	Ground Surface															GR SA SI CL
0.0	Clayey silt, trace sand, gravel, roots and organic pockets (Fill)		1	SS	11											
186.3	1.4 Sandy silt, trace clay and gravel. Brown Compact to very dense (Glacial Till)		2	SS	25											8 37 44 11
			3	SS	102											
			4	SS	110/28cm											
184.0	3.7 Clayey silt, trace sand and shale fragments Brown Grey Hard (Glacial Till)		5	SS	112/25cm											13 29 44 14
			6	SS	46											
182.1	7 SS 110/20cm		7	SS	110/20cm											
5.6	Bedrock - grey shale with occasional thin layers of limestone and siltstone (Dundas Formation)		8	NQ RC	REC 97% RQD 32%											
			9	NQ RC	REC 100% RQD 72%											
178.9	8.8 End of Borehole															
	* Water level at Elev. 186.16m on July 20, 1993															

+3, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No F729

METRIC

W P 87-78-00 LOCATION Co-ord.: N4840163.9; E289589.4 ORIGINATED BY SC  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 24, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
188.3	Ground Surface																GR SA SI CL
0.0	Clayey silt, trace sand, gravel and organic pockets																
186.9	Dark brown. Firm (Fill)		1	SS	10												
1.4	Clayey silt, trace sand, gravel		2	SS	22												
	Brown Very stiff to hard		3	SS	38												
185.4	(Glacial Till)																
2.9	Sandy silt, trace clay gravel		4	SS	62												
184.6	(Glacial Till)																
3.7	Clayey silt, trace sand and shale fragments.		5	SS	161/30cm												
	(Glacial Till)		6	SS	120/5cm												
183.1			7	SS	116/8cm												
183.0/5.3	Bedrock-grey shale Highly weathered																
	End of borehole																
	* Water level at Elev. 185.22m at end of drilling on June 24, 1993																
	Borehole backfilled with native material																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

20  
15  $\pm$  5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No F730

METRIC

W P 87-78-00

LOCATION Co-ord.: N4840227.9; E289523.5

ORIGINATED BY SC

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem Auger & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 24, 1993

CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ (KN/m <sup>3</sup> )	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
186.2	Ground Surface												
0.0	Asphalt												
0.1	Clayey silt, trace sand, gravel, boulders and organic pockets		1	SS	19								
184.8	(Fill)												
1.4	Clayey silt to silty clay, some sand, trace gravel. Brown. Hard		2	SS	36							22.1	10 18 47 25
	(Glacial Till)		3	SS	88								
183.3													
2.9	Clayey silt, some sand and shale fragments		4	SS	86								38 15 34 13
	(Glacial Till)		5	SS	105/110 cm								
181.8													
4.4	Bedrock-grey shale, completely weathered		6	SS	105/110 cm								
181.2			7	SS	130/135 cm								
5.0	End of Borehole												
	* Water level at Elev. 184.76m on July 20, 1993												

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15  
10  
5 (% ) STRAIN AT FAILURE

# RECORD OF BOREHOLE No F731

METRIC

W P 87-78-00 LOCATION Co-ord.:N4840259.7:E290234.4 ORIGINATED BY PD  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 25, 1993 CHECKED BY CY

SOIL PROFILE		STRAT PLOT	SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
182.4	Ground Surface																
0.0	Top soil		1	SS	8												
0.4	Clayey silt to silty clay, some sand, trace gravel		2	SS	37												1 18 48 33
	Brown		3	SS	28												
	Very stiff to hard		4	SS	51												2 24 50 24
	(Glacial Till)		5	SS	61												
	Some shale fragments		6	SS	178/28cm												
177.8	Bedrock - grey shale		7	SS	120/15cm												
4.6	Completely to highly weathered		8	SS	175/25cm												
	(Dundas Formation)		9	SS	120/13cm												
176.2	End of Borehole																
6.2	*Hole dry at end of drilling on June 25, 1993  Borehole backfilled with native material																

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No F732

METRIC

W P 87-78-00 LOCATION Co-ord.: N4840163.7; E290134.9 ORIGINATED BY PD  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 23, 1993 CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
182.1	Ground Surface												
0.0	Clayey silt to silty clay, some sand, trace gravel, roots and organic pockets		1	SS	4								3 25 49 23
			2	SS	6								
	Soft to Stiff		3	SS	7								
	Dark Brown		4	SS	14								
179.2													
2.9	Sandy silt to silty sand, trace clay, gravel		5	SS	149								7 56 34 3
	Very dense		6	SS	135/20cm								
			7	SS	100/15cm								
177.0													
5.1	Brown Grey (Glacial Till)		8	SS	120/15cm								
175.9													
6.2	Bedrock - grey shale		9	SS	150/15cm								
175.7/6.4	End of Borehole												
	*Water level at Elev. 181.53m at end of drilling on June 23, 1993												
	Borehole backfilled with native material												

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No F732A

METRIC

W P 78-87-00 LOCATION Co-ord.:N4840163.3;E290136.1 ORIGINATED BY PD  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & NQ Rock Coring COMPILED BY PD  
 DATUM Geodetic DATE June 24, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa						
182.1	Ground Surface							20 40 60 80 100						
0.0	Clayey silt to silty clay, some sand, trace gravel, roots and organic pockets													
	Soft to Stiff													
	Dark Brown													
179.2														
2.9	Sandy silt to silty sand, trace clay, gravel													
	Very dense													
177.0		Brown												
5.1		Grey												
	(Glacial Till)													
176.0														
6.1	Bedrock-grey shale with occasional thin layers of limestone or siltstone		1	NQ RC	REC 91% RQD 35%									
	Moderately to slightly weathered (Dundas Formation)		2	NQ RC	REC 98% RQD 43%									
173.1														
9.0	End of Borehole													
	* Water level at Elev. 181.53m on July 20, 1993													
	Note : Overburden stratigraphy based on that of borehole F732													

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No F733

METRIC

W P 87-78-00

LOCATION Co-ord.:N4871069.4;E290605.8

ORIGINATED BY PD

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem Auger & Cone Test

COMPILED BY PD

DATUM Geodetic

DATE June 28, 1993

CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
181.6	Ground Surface															
0.0	Topsoil		1	SS	5											
	Clayey silt to silty clay, some sand and gravel. Firm to hard (Glacial Till)		2	SS	22											
			3	SS	38											
			4	SS	52											
			5	SS	63											
177.3	Brown		6	SS	90											
4.3	Grey		7	SS	55											
176.4			8	SS	89											
5.2	Sandy silt, trace clay and gravel Very dense (Glacial Till)		9	SS	155	15cm										
			10	SS	170	15cm										
173.1			11	SS	200	15cm										
8.5	Bedrock-grey shale Completely weathered															
172.3																
3.3	End of Borehole															
	* Water level at Elev. 180.05m on July 20, 1993															

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10





# RECORD OF BOREHOLE No F734

METRIC

W P 87-78-00 LOCATION Co-ord.:N48 1144.8;E290565.8 ORIGINATED BY PD  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 25, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
181.5	Ground Surface										
0.0	Top Soil		1	SS	6						
0.3	Clayey silt to silty clay, some sand trace gravel		2	SS	32						
	Firm to hard		3	SS	45						
	Brown		4	SS	98						
	(Glacial Till)		5	SS	110						
177.8			6	SS	140	23cm					
3.7			7	SS	100	15cm					
177.1	Brown		8	SS	160						
4.4	Grey		9	SS	155	15cm					
	Sandy silt, trace to some clay, gravel										
	Very dense										
	(Glacial Till)										
173.8			10	SS	150	13cm					
7.7	End of Borehole										
	*Water level at Elev. 178.15m at end of drilling on June 25, 1993										
	Borehole backfilled with native material										

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No F735

METRIC

W P 78-87-00 LOCATION Co-ord.:N4837344.2;E288261.1 ORIGINATED BY AO  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE June 30, 1993 CHECKED BY CY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
193.9	Ground Surface																GR SA SI CL
0.0	Top soil		1	SS	12												
193.4																	
0.5	Clayey silt to silty clay, some sand and gravel		2	SS	12												
	Stiff to hard.		3	SS	14												
	(Glacial Till)		4	SS	33												
			5	SS	47												12 17 47 24
			6	SS	83												
189.5	Brown Grey																
4.4			7	SS	133/23	m											
188.7																	
5.2	Sandy silt, trace clay and gravel		8	SS	110												
	Very dense (Glacial till)		9	SS	56												8 38 43 11
			10	SS	129												
			11	SS	127												
183.2			12	SS	130/8	cm											
10.7	End of Borehole																
	*Water level at Elev. 191.0m in piezometer on July 20, 1993																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No F736

METRIC

W P 78-87-00 LOCATION Co-ord.: N4837288.4; E288115.8 ORIGINATED BY SC  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
DATUM Geodetic DATE July 1, 1993 CHECKED BY CY


SOIL PROFILE		SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ (KN/m <sup>3</sup> )	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES						20 40 60 80 100
194.5	Ground Surface												
0.0	Clayey silt, sand and gravel												
	Very stiff to hard		1	SS	24								
	(Glacial Till)		2	SS	36								
			3	SS	37								
			4	SS	53								
190.9			5	SS	39								
3.6	Brown Grey		6	SS	62							23.2	5 34 45 16
			7	SS	58								
188.1		8	SS	72									
6.5	Sandy silt, trace clay some gravel												
	Very dense												
	(Glacial Till)		9	SS	66								
			10	SS	52								17 43 34 6
			11	SS	55								
		12	SS	132/20cm									
180.8													
13.7	Bedrock-grey shale completely weathered		13	SS	125/20cm								
	(Dundas Formation)												

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No F736

METRIC

W P 87-78-00 LOCATION Co-ord.: N4837288.4; E288115.8 ORIGINATED BY SC  
 DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger & Cone Test COMPILED BY PD  
 DATUM Geodetic DATE July 1, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100							
								SHEAR STRENGTH kPa					WATER CONTENT (%)						
								○ UNCONFINED + FIELD VANE											
								● QUICK TRIAXIAL x LAB VANE											
179.2	Bedrock-grey shale		14	SS	150/8 cm														
15.3	End of Borehole																		
	* Water level in open hole at Elev. 186.58m during drilling on July 1, 1993																		
	Borehole backfilled with native material																		

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No F737

METRIC

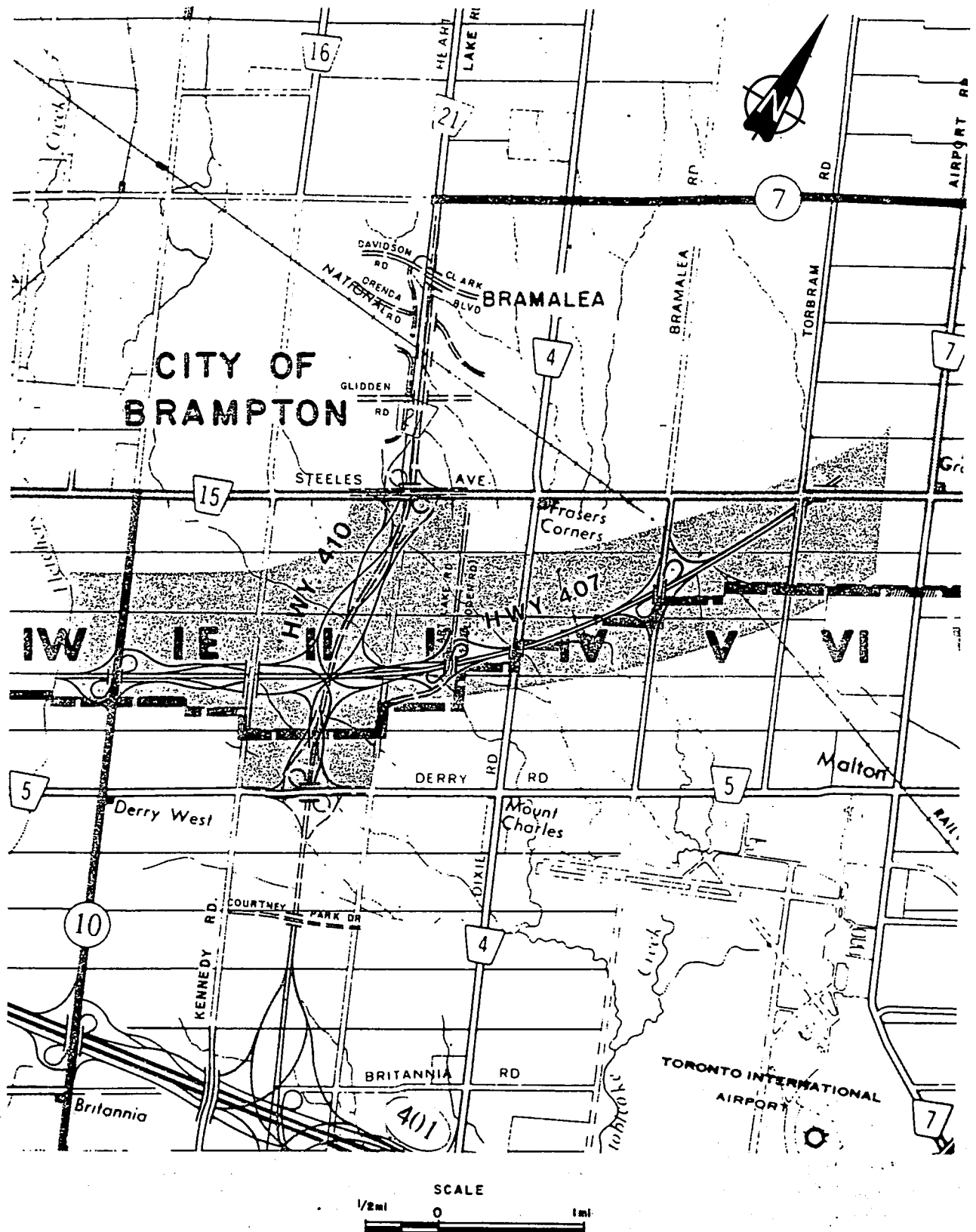
W P 87-78-00 LOCATION Co-ord.:N4836812.9;E288202.7 ORIGINATED BY SC  
DIST 6 HWY 407 BOREHOLE TYPE Solid Stem Auger, NO Rock Coring & Cone Test COMPILED BY PD  
DATUM Geodetic DATE June 29, 1993 CHECKED BY CY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH kPo					
197.1	Ground Surface							○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE	10 20 30				GR SA SI CL	
0.0	Clayey silt, trace to some sand and gravel													
	Very stiff to hard (Glacial Till)		1	SS	27									
			2	SS	25									
			3	SS	32									
			4	SS	36									
153.6		Brown Grey	5	SS	116/23cm									24 13 44 19
3.5			6	SS	155/25cm									
192.8														
4.3	Lightly weathered to fresh at depth		7	NQ RC	REC 73% RQD 29%									
	Bedrock - grey shale with some limestone layers (Dundas Formation)		8	NQ RC	REC 98% RQD 57%									
			9	NQ RC	REC 100% RQD 73%									
	0.5 m thick Limestone Layer		10	NQ RC	REC 98% RQD 82%									
186.7														
10.4	End of Borehole													
	* Water level at Elev. 188.56m on July 20, 1993													

OFFICE REPORT ON SOIL EXPLORATION

# SITE LOCATION PLAN

FIGURE 1



Date JULY / 1993  
Project 931-1348

**Golder Associates**

Drawn JCM  
Chkd: CY

FORM PRODUCED JUNE 1986

FORM G.A.-U-4 (Imperial)

HIGHWAY 407  
(W.P. 87-78-00)  
STATION 355+00 TO 365+00

FIGURE 2

CON. 2 W.H.S.  
LOT 13

CON. 1 W.H.S.  
LOT 13



LEGEND	
PROPOSED PAVEMENT	=====
PROPOSED R.O.W.	-----
PARKWAY BELT WEST	-----
H.E.P.C. CORRIDOR	
FUTURE UTILITY CORRIDOR	

**HIGHWAY 407**  
**W.P. 87-78-00**

CON. 2 W.H.S.  
LOT 12

CON. 1 W.H.S.  
LOT 12

TO MISSISSAUGA  
McLAUGHLIN RD.

FLETCHER'S CREEK SUBDIVISION

CITY OF BRAMPTON

CITY OF MISSISSAUGA

S. SAINANEY  
H. KALSI  
N. SALIM

STEPHEN MINTER

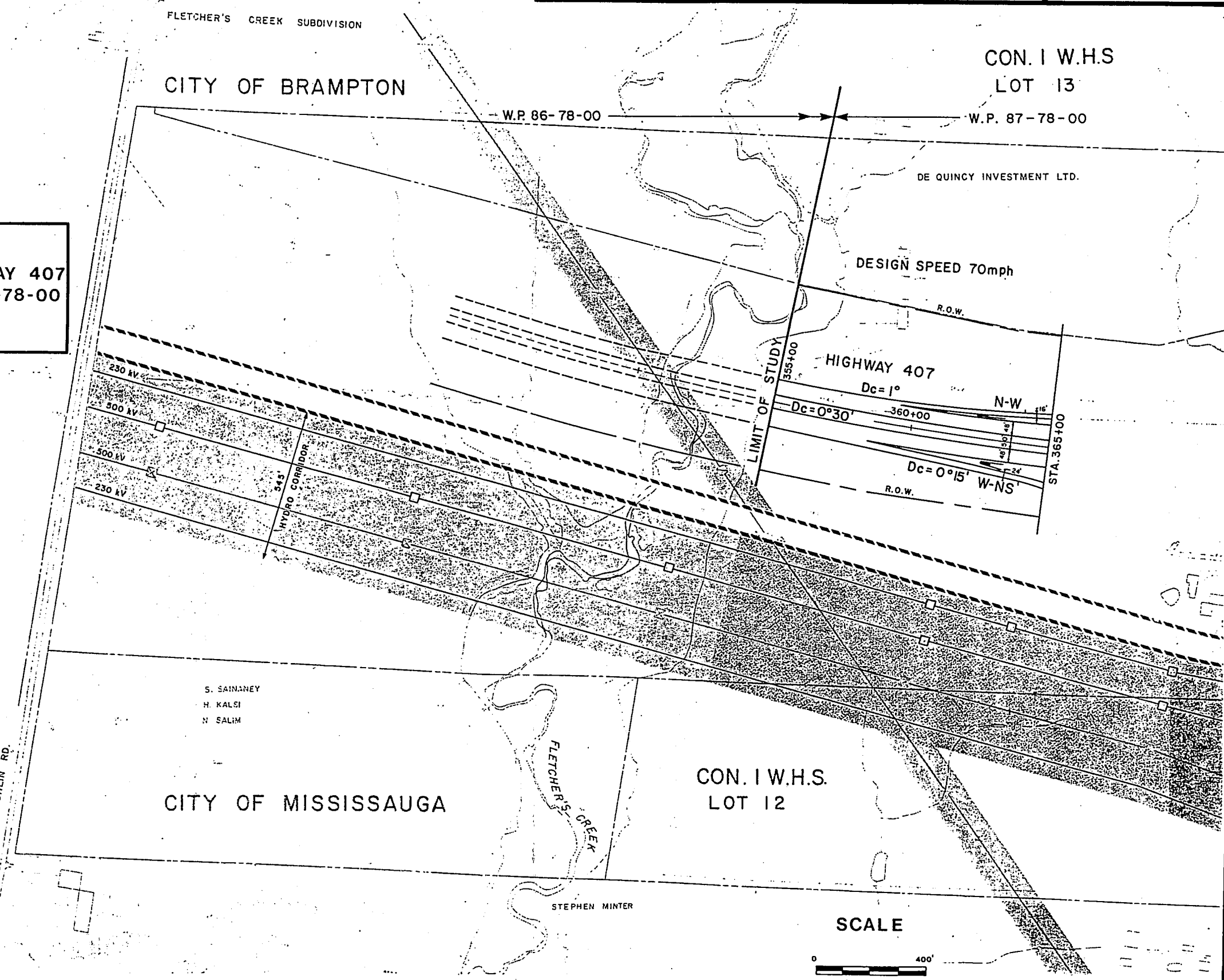
Date.....JULY / 1993.....  
Project.....931-1348.....

SCALE



**Golder Associates**

Drawn.....DY.....  
Chkd.....CY.....



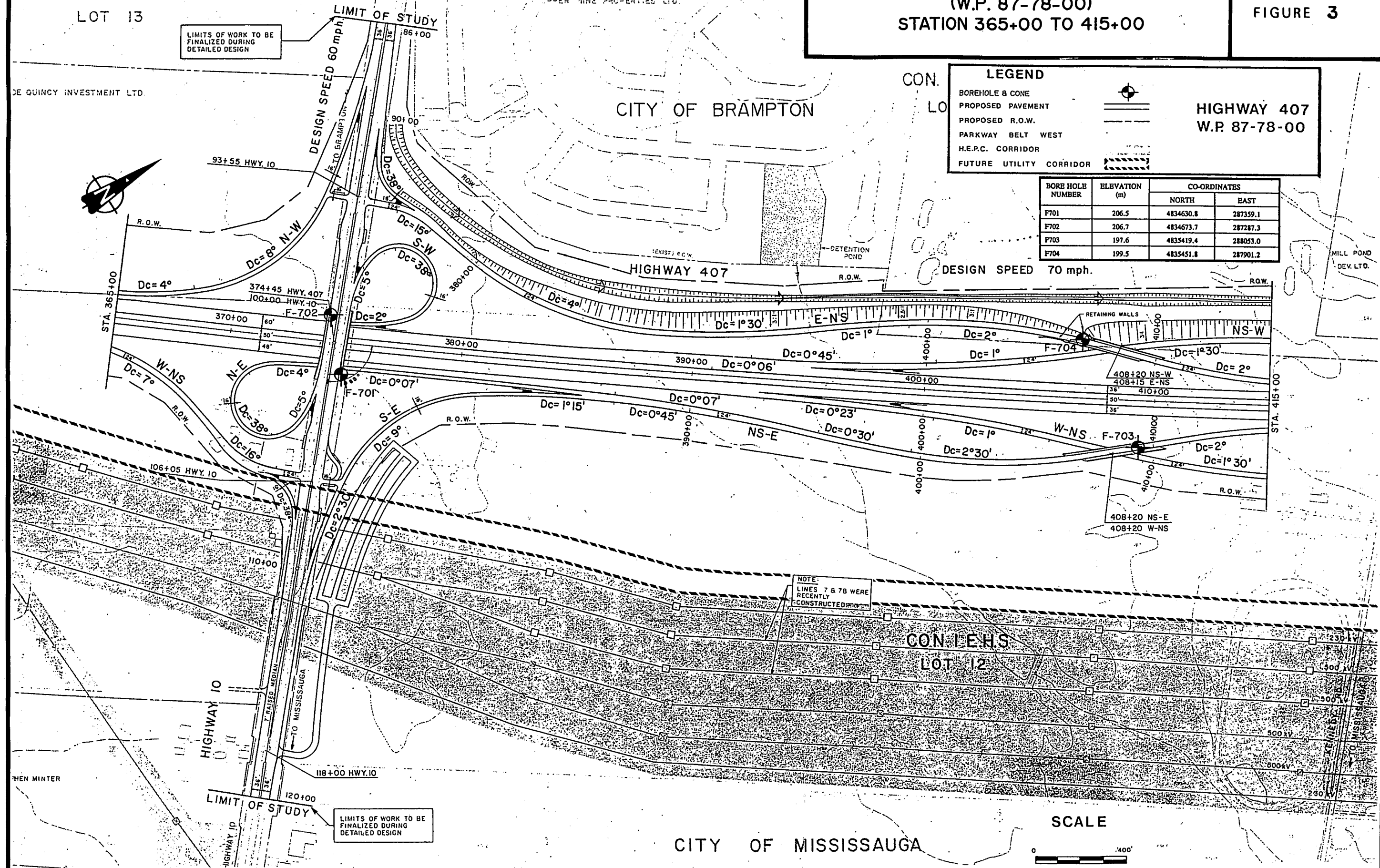
CON. I W.H.S  
LOT 13

DE QUINCY INVESTMENT LTD.

UPPER NINE PROPERTIES LTD.

HIGHWAY 407  
(W.P. 87-78-00)  
STATION 365+00 TO 415+00

FIGURE 3



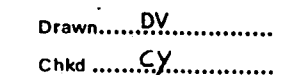
Date..... JULY / 1993  
Project..... 931-1348

**Golder Associates**

Drawn..... JCM  
Chkd..... CY

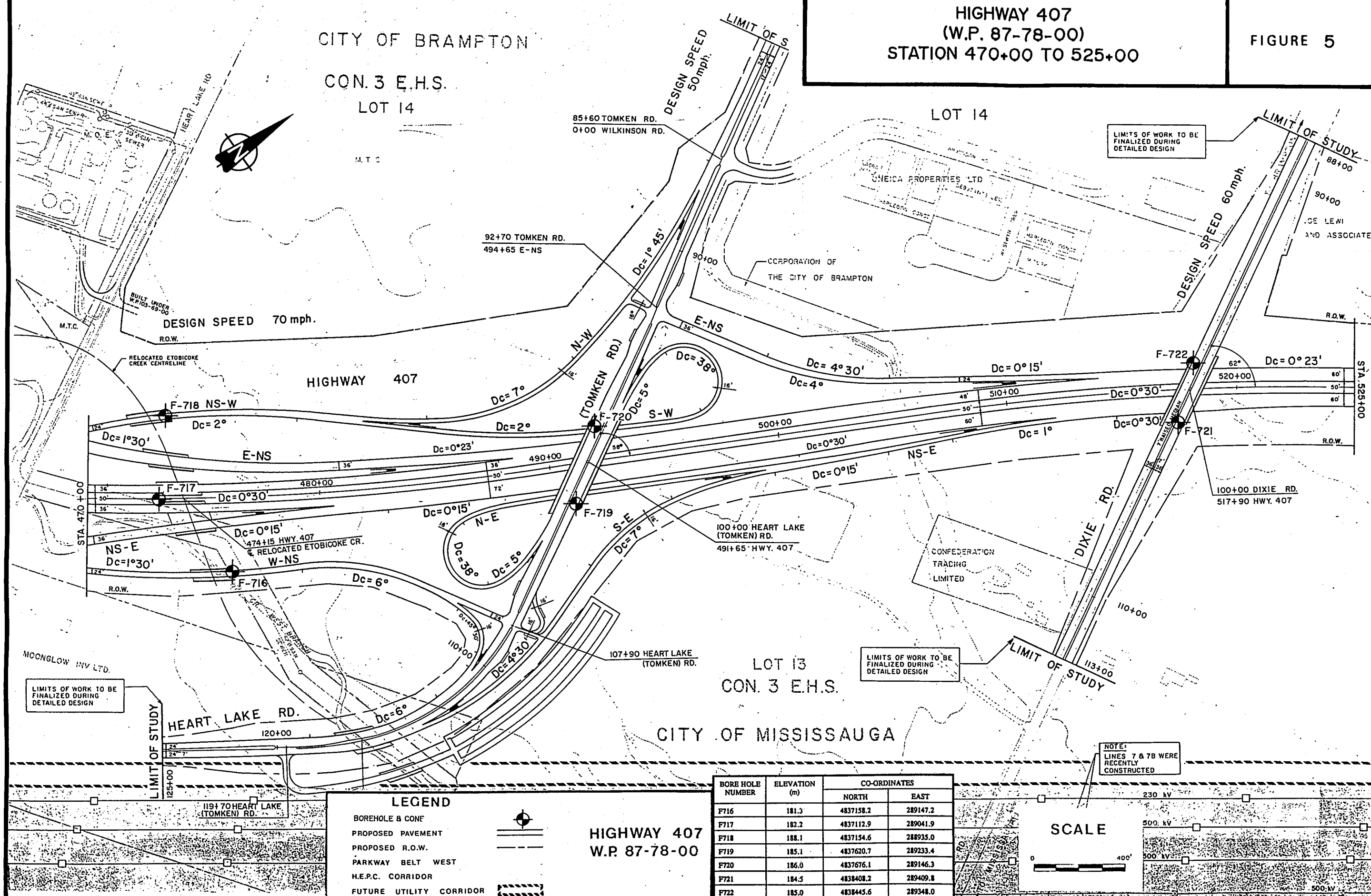


## FIGURE 4



# HIGHWAY 407 (W.P. 87-78-00) STATION 470+00 TO 525+00

FIGURE 5



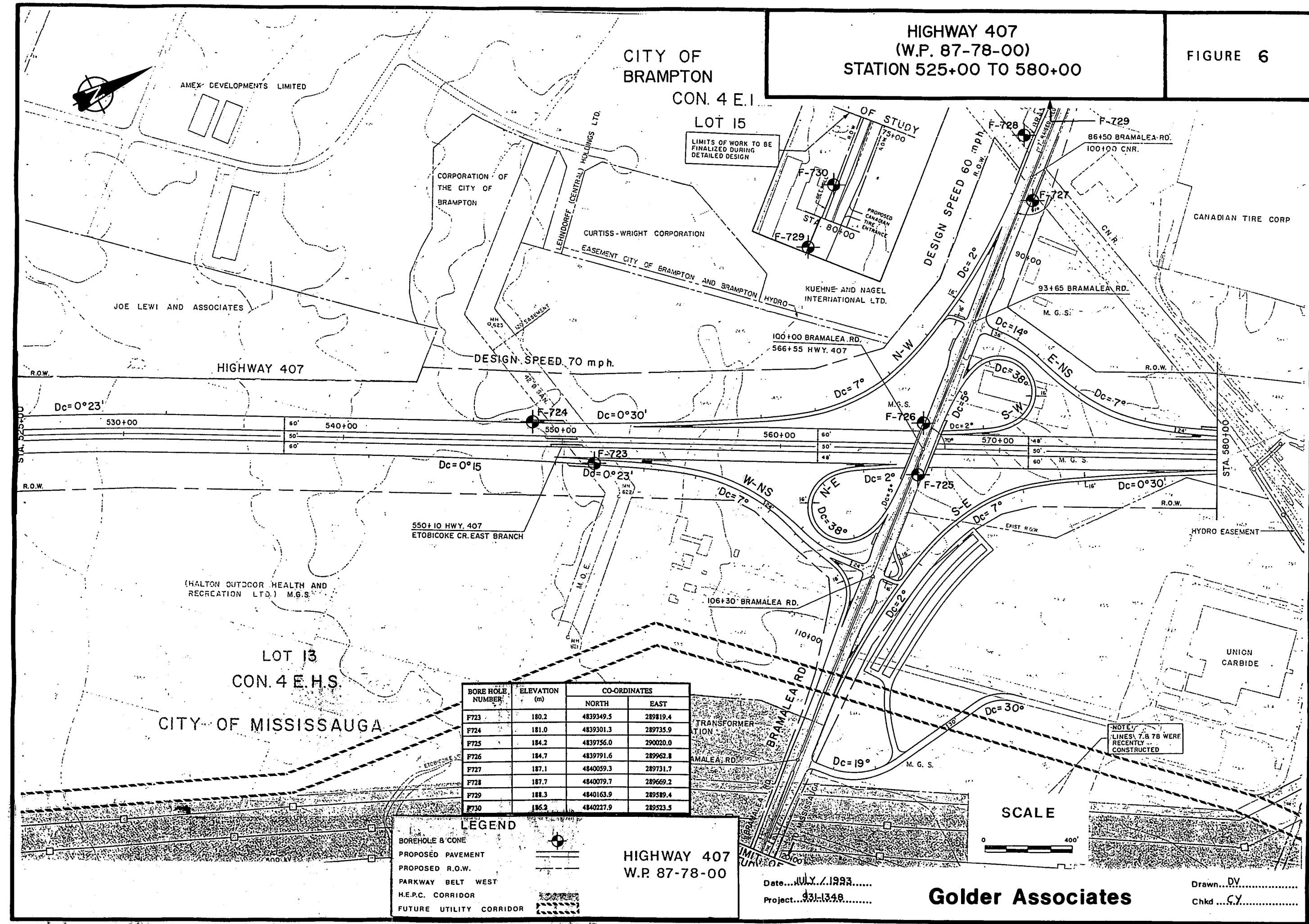
Date...JULY 7, 1993  
Project...931-1348

**Golder Associates**

Drawn...DV  
Chkd...CY

# HIGHWAY 407 (W.P. 87-78-00) STATION 525+00 TO 580+00

FIGURE 6



BORE HOLE NUMBER	ELEVATION (m)	CO-ORDINATES	
		NORTH	EAST
F723	180.2	4839349.5	289819.4
F724	181.0	4839301.3	289735.9
F725	184.2	4839756.0	290020.0
F726	184.7	4839791.6	289962.8
F727	187.1	4840059.3	289731.7
F728	187.7	4840079.7	289669.2
F729	188.3	4840163.9	289589.4
F730	186.2	4840227.9	289523.5

**LEGEND**

- BOREHOLE & CONE
- PROPOSED PAVEMENT
- PROPOSED R.O.W.
- PARKWAY BELT WEST
- H.E.P.C. CORRIDOR
- FUTURE UTILITY CORRIDOR

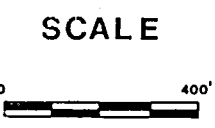
HIGHWAY 407  
W.P. 87-78-00

Date... JULY 1, 1993  
Project... 93-1348

**Golder Associates**

Drawn... DV  
Chkd... CY

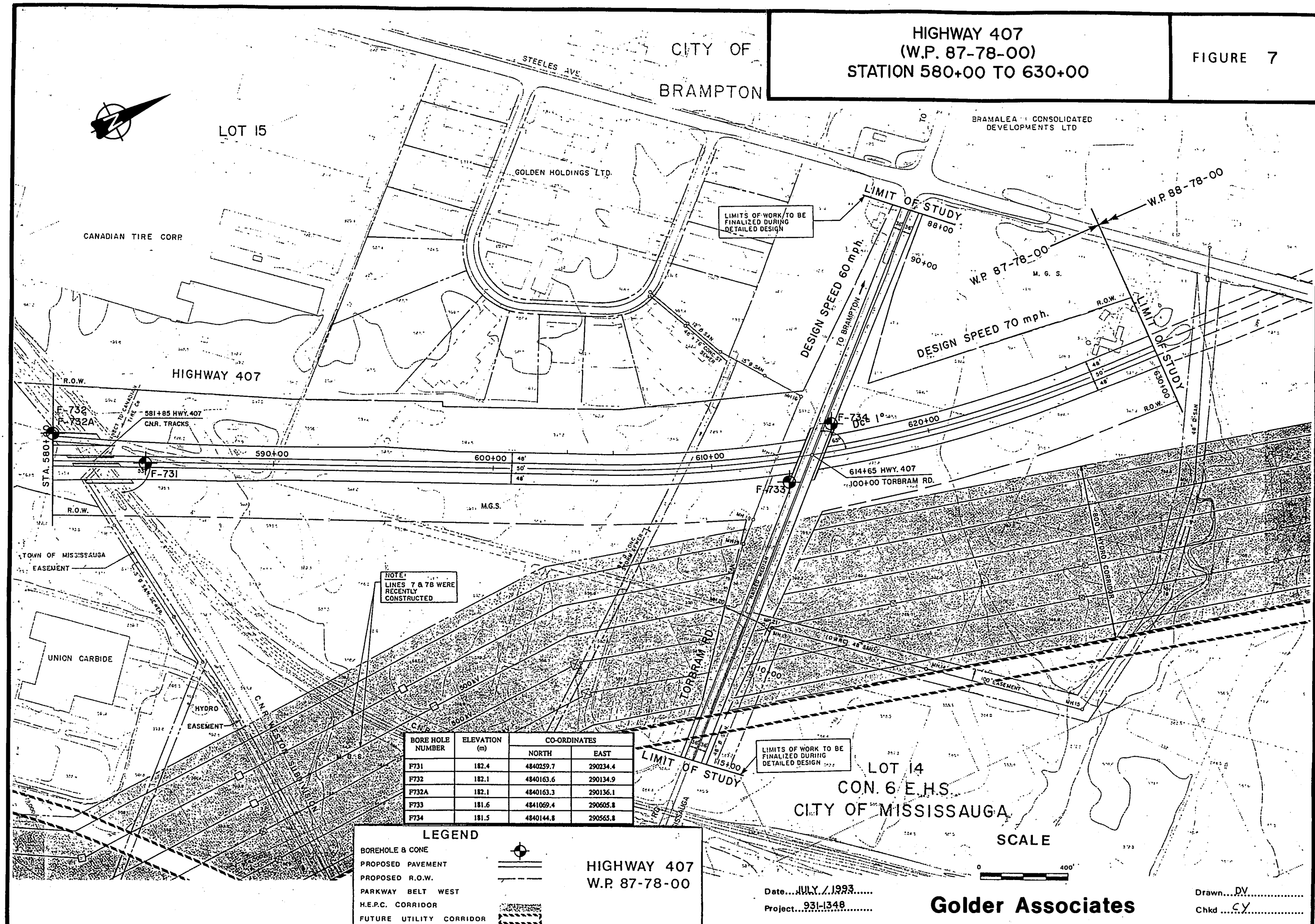
NOTE:  
LINES 7 & 8 WERE  
RECENTLY  
CONSTRUCTED





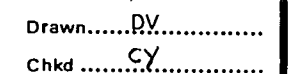
# HIGHWAY 407 (W.P. 87-78-00) STATION 580+00 TO 630+00

FIGURE 7





## FIGURE 9



## FIGURE 10

