

G.I.-30 SEPT. 1976

GEOCRES No. 30M13-123

DIST. 6 REGION

W.P. No. 88-78-28/29

CONT. No.

W. O. No.

STR. SITE No.

HWY. No. 407

LOCATION KIPLING AVE /  
WOODBIDGE TILL RETAINING  
STRUCTURES

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ministry  
of  
Transportation

FILE No. \_\_\_\_\_ DATE \_\_\_\_\_

REMARKS \_\_\_\_\_

Lloyd Grouther 5433

ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION

WP 88-78-28/29 DIST 6  
HWY 407 STR SITE

Kipling Avenue/Woodbridge Till  
Retaining Structures

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## FOUNDATION INVESTIGATION REPORT

For  
Kipling Avenue/Woodbridge Till  
Retaining Structures  
W.P. 88-78-28/29  
Hwy 407, District 6, Toronto

### INTRODUCTION

This report summarizes the foundation recommendations for the above-noted structures which are proposed to minimize the impact of the Kipling Avenue extension work on the 'Woodbridge Till'.

The Woodbridge Till has been designated an Area of Natural and Scientific Interest by Ministry of Natural Resources. It comprises a sequence of soil strata from different geological periods.

In the vicinity of the Woodbridge Till, the proposed Kipling Avenue goes from fill in the south to cut in the north. Accordingly, the south structure ( Kipling Avenue Retaining Wall ) will retain Kipling Avenue from encroaching onto the Woodbridge Till and the north structure ( Woodbridge Cut Retaining Wall ) will retain the Woodbridge Till in cut from encroaching on Kipling Avenue.

### SITE DESCRIPTION

The site is located along the west side of the proposed Kipling Avenue extending  $53.5 \pm$  m north of the 147.2 m contour of the north slope of the existing C.N.R. embankment, in the Town of Vaughan, District of Toronto. Reference is made to the plan in Figure 1.

The proposed retaining structures extend from the bottom part of the C.N.R. embankment, across the Rainbow Creek Tributary valley, to a natural slope. The valley of Rainbow Creek Tributary extends for 33.5 m immediately north of the reference on the C.N.R. embankment. The ground surface slopes from the 147.2 m contour of the C.N.R. embankment, at 1.7H:1V to the floor of the valley, then is relatively flat at 140.9 m for 15.0 m before sloping up at 0.9H:1V to intersect the Woodbridge Cut retaining wall at elevation 147.6 m. Reference is made to the plan in Figure 1 and section in Figure 2. Apart from the 'Woodbridge Till', which is exposed on the south side of the natural slope and the C.N.R. embankment, the site is generally densely vegetated with shrubs and trees.

The site lies within the physiographic region known as South Slope ( Chapman and Putnam, 1984 ) and it consists largely of glacial till deposits.

## SUBSURFACE CONDITIONS

No subsurface investigation was carried out specifically for this project. Instead, reference is made to a number of boreholes drilled previously in this area for various projects, and the observations obtained during a site visit on 91 07 16. A copy of each of the relevant Record of Borehole sheets is appended for reference. Figures 1 and 2 illustrate the borehole locations and topographic details.

### Kipling Avenue Retaining Wall -

Reference is made to BH 7, 8 and 10 from the Foundation Report W.P. 33-89-01 (Rainbow Creek Tributary Culvert) and BH 101 from the Foundation Report for W.P. 88-78-26 (C.N.R. Subway), which indicate a groundwater elevation near the ground surface ( $140.0 \pm$  m) and an extensive deposit of generally compact to very dense gravelly sand to silty sand extending from the surface (below elevation  $140.0$  m). The C.N.R. embankment is expected to be moderately compacted cohesive fill, while the north bank of the valley is expected to be hard cohesive glacial till. Cobbles and boulders are present on the surface and may be present in the C.N.R. embankment fill, the Rainbow Creek valley deposit and the glacial till embankment to the north. The non-cohesive gravelly sand to silty sand deposit is susceptible to disturbance under conditions of unbalanced hydrostatic head.

### Woodbridge Cut Retaining Wall -

Reference is made to BH P7 from the Foundation Investigation Report for W.P. 88-78-02(C) (High Mast Light Foundations), which indicates an extensive deposit of cohesive glacial till extending from the surface. Site observations revealed that the glacial till extends from the creek up to the top of the Woodbridge Till (elevation  $156 \pm$  m). Hand probing of the material within 2 m above the creek level indicated that it is generally hard. Based on this and BH P7, it is anticipated that the glacial till is essentially hard clayey silt and that the groundwater elevation is around the creek level ( $140.0 \pm$  m) although it may be slightly higher outside the creek valley. Cobbles and boulders are present in the glacial till deposit.

## DISCUSSION AND RECOMMENDATIONS

### Foundation

#### Kipling Avenue Retaining Structure -

The proposed Kipling Avenue Retaining Structure will retain the Kipling Avenue fill over the valley of Rainbow Creek Tributary. The wall will extend the 147.2 m contour on the north slope of the C.N.R. embankment, 33.5 m north to the intersection of the 152.4 m contour of the glacial till embankment. The wall will be in the order of 7 m high and will extend below the invert of the proposed Rainbow Creek Tributary Culvert (140.9 m). Specifics of the wall geometry are illustrated in Figure 2.

It is recommended that this wall be a Reinforced Earth Company wall or equivalent.

The following bearing capacities may be assumed below elevation 138.0 m :

Factored Bearing Capacity at U.L.S. = 500 kPa  
Bearing Capacity at S.L.S. Type II = 200 kPa

The wall should be designed to accommodate possible scour at both the base and edge intersections. Consideration should be given to both adequate embedment and armouring with rock protection to accommodate scour.

#### Woodbridge Till Retaining Structure -

The proposed Woodbridge Till Retaining Wall will retain the required cut to construct Kipling Avenue to a grade of approximately 147.6 m. The wall will extend for 4 m, raising from elevation 148.2 m to elevation 151.8 m (0.6 m to 4.2 m high), then 6 m at elevation 151.8 m (4.2 m high), then for 10 m grading from elevation 151.8 m to elevation 148.2 m (4.2 m to 0.6 m high). Reference is made to Figure 2 for an illustration of the wall geometry.

For portions of the wall higher than 1 to 2 m, it is recommended that the wall should be permanent soldier pile/lagging wall, supplemented, if necessary, by permanent soil anchors. This type of wall would require provisions to change a typical shoring wall into a permanent structure such as :

- double corrosion protected soil anchors

- concrete facing for lagging or concrete lagging instead of timber lagging
- concrete facing for soldier piles or concrete soldier piles
- insulation for wall facing
- permanent wall drainage behind wall facing

Alternatively, a conventional retaining wall would be considered but would involve additional encroachment into the Woodbridge Till to accommodate backfill.

Reference is made to contracts for GO ALRT GGE-313 (Harwood Avenue) and MTO 90-18 (400/407) for examples of specifications for permanent soldier pile/lagging retaining walls. It is suggested that a conceptual design could be prepared by your designers using the following design parameters, following which a meeting with, or a review by the Foundation Design Section could be used to refine the design.

- assume 150 mm diameter post grouted anchors with an allowable bond stress of 100 kPa
- assume that the bond zone will extend from a plane defined by  $45^\circ - \phi/2$  from the point of contraflexure of the soldier pile
- assume that soil anchors will be perpendicular to the plane defining the bond zone
- assume the following soil parameters
  - . groundwater at elevation 142.0 m
  - . effective angle of internal friction =  $32^\circ$
  - . unit weight of soil = 21 kN/cu.m

For those portions of the wall less than 1 to 2 m high, consideration could be given to a gravity type structure such as gabions.

Dewatering recommendations will be provided by the Foundation Design Section when wall geometry is finalized.

MISCELLANEOUS

The site visit was carried out by D. Kwok, Project Foundation Engineer. The report was prepared by D. Dundas, Senior Foundation Engineer and reviewed by M. Devata, Chief Foundation Engineer.



A handwritten signature in cursive script, reading "D. Dundas".

D. Dundas, P. Eng.  
Senior Foundation Engineer

A handwritten signature in cursive script, reading "M. Devata".

M. Devata, P. Eng.  
Chief Foundation Engineer

## APPENDIX

## 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/0.3 m)	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

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	FOIL SAMPLE

### STRESS AND STRAIN

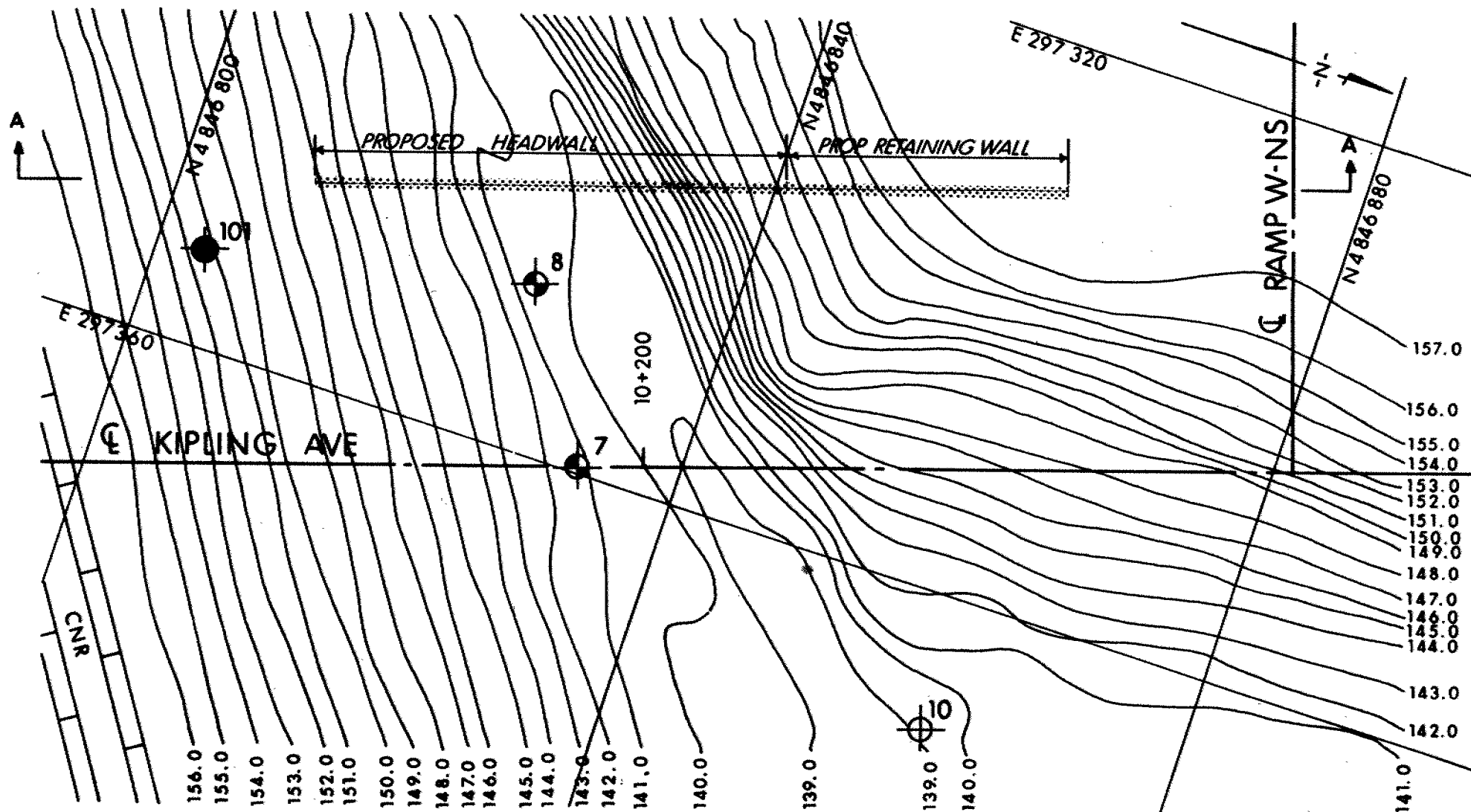
$u_w$	kPa	PORE WATER PRESSURE
$r_u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS 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
$S_f$	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>3</sup>	SEEPAGE FORCE
$\gamma'$	kN/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

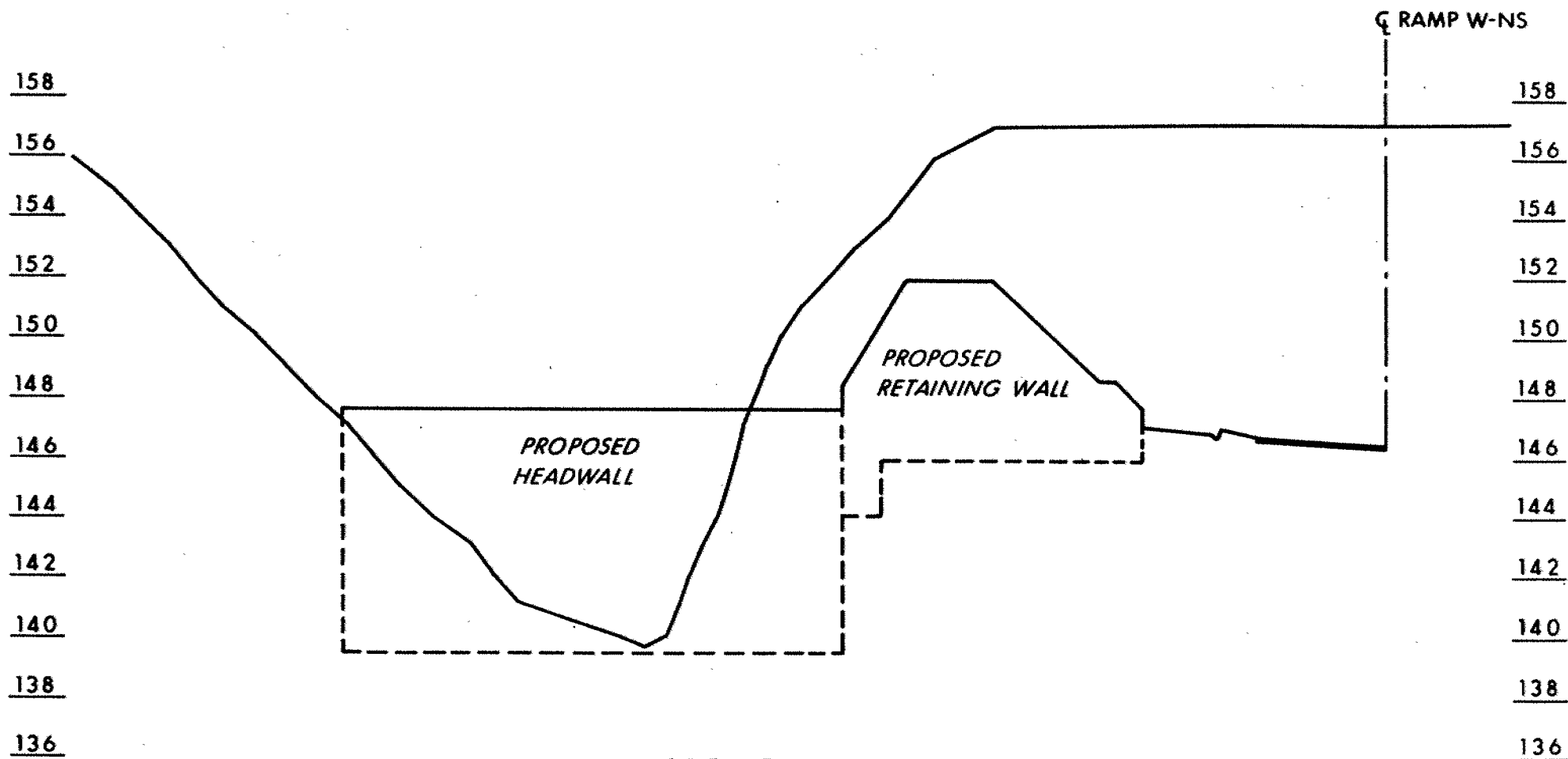


# PLAN

SCALE 1:400

APPROX

FIG 1



SECTION A-A

SCALE 1:400 Hor 1:200 Vert APPROX

FIG 2



+3, x5: Numbers refer to Sensitivity

W.P. 88-78-28/29  
formerly

RECORD OF BOREHOLE No 7

1 OF 2

METRIC

W.P. 33-89-01 LOCATION Co-ords. N 4 846 833.0 , E 297 359.4 ORIGINATED BY B.P.W.  
DIST 6 HWY Kipling Ave. BOREHOLE TYPE Cone Test, HS Auger COMPILED BY CC  
DATUM Geodetic DATE 90 01 09/10 CHECKED BY DD

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 7 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100					
140.7	Ground Surface												
0.0	Silty Clay with Sand Stiff occasional Boulders	1	SS	8			AUGER						
139.2		2	SS	7									
1.5		3	SS	35									
		4	SS	120	/28cm								
	Gravelly Sand to Silty Sand Trace Clay Loose to Very Dense	5	SS	96									10 76 5 9
		6	SS	92									22 54 21 3
		7	SS	53									
		8	SS	79									
130.6		9	SS	87	/15cm								
10.1	Het. Mix. of Sand and Silt Trace Gravel occ. Clayey Zones Hard	10	SS	91									1 27 69 3
127.6		11	SS	83	/15cm								
13.1	Gravelly Sand to Silty Sand Trace Clay Very Dense												
125.5													

15.2

Continued

3, 5: Numbers refer to  
Sensitivity

20  
15 5 (2) STRAIN AT FAILURE  
10

Continued

W.P. 88-78-28/29 formerly		RECORD OF BOREHOLE No 7		2 OF 2		METRIC																	
W.P. 33-89-01		LOCATION Co-ords. N 4 846 833.0 , E 297 359.4		ORIGINATED BY B.P.W.																			
DIST 6 HWY Kipling Ave.		BOREHOLE TYPE Cone Test, HS Auger		COMPILED BY CC																			
DATUM Geodetic		DATE 90 01 09/10		CHECKED BY DD																			
SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT		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	20 40 60 80 100			w <sub>p</sub> w w <sub>L</sub>	WATER CONTENT (%) 10 20 30										
125.5	<div style="font-size: 2em; font-weight: bold; margin-bottom: 10px;">Continued</div> Grovelly Sand to Silty Sand Trace Clay Very Dense		12	SS	89	/15cm																	
15.2			125																				
123.8			124																				
16.9	End of Borehole		13	SS	100	/15cm																	
<p><b>** Note</b> This Borehole information originally contained in report for W.P. 88-78-28 by B.P. Walker Associates</p> <p><b>* GROUND WATER CONDITIONS</b></p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="text-align: center;">PIEZO. NO.</th> <th style="text-align: center;">GROUND WATER ELEVATION (Metres)</th> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">141.0</td> </tr> </table>		PIEZO. NO.	GROUND WATER ELEVATION (Metres)	1	141.0																		
		PIEZO. NO.	GROUND WATER ELEVATION (Metres)																				
		1	141.0																				

<div style="display: flex; justify-content: space-between;"> <span>W.P. 88-78-28/29 formerly</span> <span>RECORD OF BOREHOLE No 8</span> <span>1 OF 2</span> <span>METRIC</span> </div>													
W.P. 33-89-01		LOCATION Co-ords. N 4 846 826.2, E 297 348.2		ORIGINATED BY B.P.W.									
DIST 6 HWY Kipling Ave.		BOREHOLE TYPE Cone Test, HS Auger, BX Casing		COMPILED BY CC									
DATUM Geodetic		DATE 90 01 02/09		CHECKED BY DD									
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	20 40 60 80 100					
140.2	Ground Surface												
0.0	occasional Boulders												
		1	SS	10									
		2	SS	87									7 61 24 8
		3	SS	53									
		4	SS	98									
	Gravelly Sand to Silty Sand	5	SS	77									
	Trace Clay	6	SS	105									
	Loose to Very Dense	7	SS	80	/13cm								
		8	SS	120									40 50 7 3
		9	SS	103	/26cm								0 51 46 3
		10	SS	91									
125.0													

Continued

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

Continued

W.P. 88-78-28/29		RECORD OF BOREHOLE No 8				2 OF 2		METRIC	
W.P. 33-89-01		LOCATION Co-ords. N 4 846 826.2, E 297 348.2				ORIGINATED BY B.P.W.			
DIST 6 HWY Kipling Ave.		BOREHOLE TYPE Cone Test, HS Auger, BX Casing				COMPILED BY CC			
DATUM Geodetic		DATE 90 01 02/09				CHECKED BY DD			

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT 7 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	W <sub>P</sub>	W			W <sub>L</sub>				
125.0 15.2	Continued           Gravelly Sand to Silty Sand Trace Clay Loose to Very Dense		11	SS	89																
					12	SS	74	/15cm													
					13	SS	148	/26cm													
					14	SS	86	/15cm													
			15	SS	166	/15cm															
			16	SS	110	/15cm															
			17	SS	80	/5cm															
			18	SS	114	/15cm															
			19	SS	100N	/3cm															
112.7																					
27.5	End of Borehole  ** Note This Borehole information originally contained in report for W.P. 88-78-26 by B.P. Walker Associates  * GROUND WATER CONDITIONS <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">PIEZO. NO.</td> <td style="width: 50%;">GROUND WATER ELEVATION (Metres)</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">140.2</td> </tr> </table>		PIEZO. NO.	GROUND WATER ELEVATION (Metres)	1	140.2															
PIEZO. NO.	GROUND WATER ELEVATION (Metres)																				
1	140.2																				

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

W.P. 88-78-28/29 formerly RECORD OF BOREHOLE No 101										METRIC						
W P 88-78-26		LOCATION CO-ORDS N 4 846 803.4; E 297 353.6						ORIGINATED BY T.O.								
DIST 6 HWY KIPLING AVE.		BOREHOLE TYPE TRIPOD CONTINUOUS SAMPLES						COMPILED BY U.S.S.								
DATUM GEODETTIC		DATE MAY 14, 1990						CHECKED BY								
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT Y 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	W <sub>p</sub>	W	W <sub>L</sub>	WATER CONTENT (%)	10 20 30			
151.6	GROUND SURFACE															
0.0	FILL-CLAYEY SILT/SILTY CLAY with sand, trace of gravel, trace organic stained soil, soft to very stiff		1	SS	4											
			2	SS	6											
			3	SS	10											
			4	SS	7											
			5	SS	17											
			6	SS	15											
148.4			7	SS	27											
0.2	SILTY CLAY-trace sand, sandy silt layers, brown/grey, hard,		8	SS	42											
			9	SS	36											
			10	SS	60/25											
146.7			11	SS	128											
14.9	END OF BOREHOLE															

OFFICE REPORT ON SOIL EXPLORATION

# memorandum



Tel. 235-3731  
Fax. 235-5240


To: Mr. V. Boehnke  
Head, Structural Section  
Central Region

Date: 1991 04 04

Attn: S. Markovic

From: Foundation Design Section  
Room 315, Central Building

Subject: Kipling Avenue/Woodbridge Till Retaining Structure  
W.P. 88-78-28/29, Site N/A  
Hwy. 407, District 6, Toronto

Further to your memo of November 16, 1990, we have reviewed the foundation aspects of the proposal to construct retaining structures along the west side of Kipling Avenue. This memo provides foundation recommendations for the retaining structure proposals and is formatted to facilitate inclusion into a contract package if necessary. No foundation investigation was carried out for this project. However, the Woodbridge Till site may be investigated to confirm recommendations provided in this memo and to provide subsurface details for contract purposes. 

D. Dundas, P.Eng.  
Foundation Engineer

DD/ms

WP 88-78-28/29

# Woodbridge Till Retaining Structures.

Site Visit — date: 91 07 16 weather: sunny.

- the existing Woodbridge Till face is exposed and standing at about  $50-70^\circ$ . No apparent seepage was noted. The surface is generally covered with some weathered material. (Photo 1)
- (about 600 mm deep)  
An inspection strip was made at location 1 (Photo 2). It was about 2 m above the creek level. It comprised about 150 mm of weathered material ~~the~~ overlying grey clayey silt (glacial till), some sand, trace gravel and occasional cobbles. The material is very stiff to hard. There were occasional sand seams in it.
- At inspection location 2, the Till material was exposed at the creek level. It was a grey clayey silt (glacial till), trace gravel. The material was hard. On top of the till was about 300 mm light brown weathered till material (Photos 3, 4 and 5)
- At inspection location 3, a test pit was dug to about 750 mm. It was located at about 3 m above creek level (Photo 6). The material was a sandy silt, trace organics, numerous root hairs. It was brown and generally in a compact state.

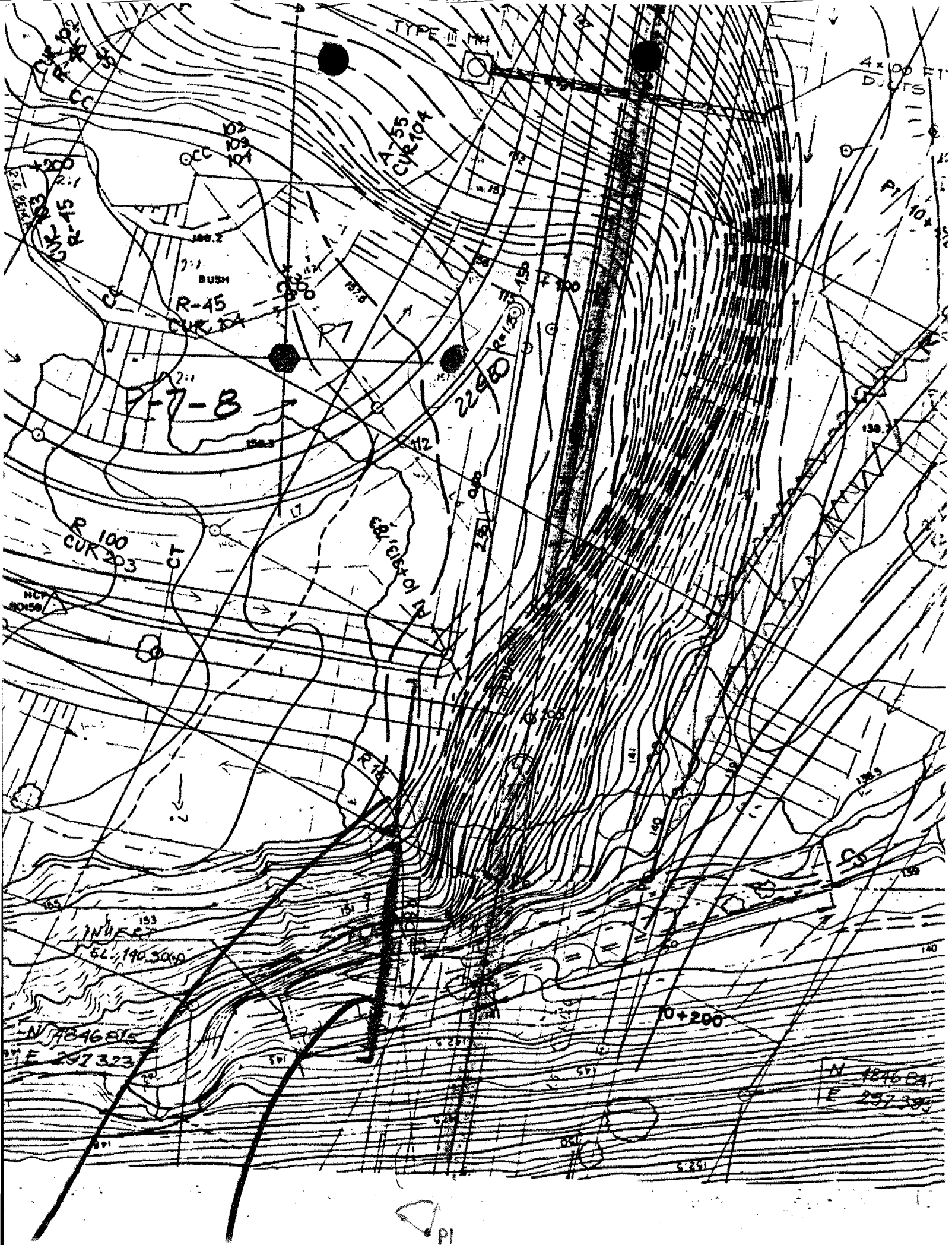




Photo 1 Woodbridge Till



photo 2

inspection location 1



Photo 3

Inspection location 2



Photo 4

Inspection location 2



Photo 5

Inspection location 2

- Till extends down into the stream



Photo 6

Inspection location 3

SEND  
TO

MR. M. DEVATA

CHIEF FOUNDATIONS ENGINEER  
FOUNDATION DESIGN SECTION

RECEIVED

ATTN: J. DONAAS

SENIOR FOUNDATION ENGINEER

FROM

S. MARKOVIC STRUCTURAL SECTION

DATE 2/04/26 @ 10:45

SUBJECT

WP 88-78-28/29 HWY 407/KIPLING AVE I/C RETAINING WALLS

WITH REFERENCE TO OUR LETTER OF 9/04/25 AND OUR DISCUSSION OF 9/04/24, ENCLOSED PLEASE FIND THE FOLLOWING INFORMATION, FORWARDED BY THE GRADING CONSULTANT, MARSHALL, MACKLIN, MONAGHAN:

- PLAN VIEW OF KIPLING AVE RETAINING WALLS (SCALE 1:500) DENOTING OFFSETS FROM  $\phi$  KIPLING AVE;
- DRAWING 16-88061 "PROPOSED RETAINING WALL @ WOODBRIDGE CUT" SHOWING PLAN VIEW AND SECTIONS AT THE WALL;

REPLY

- CROSS SECTIONS AT THE WOODBRIDGE CUT PLOTTED FROM LATEST SURVEY DATA @ STA 10+560 AND STA 10+565.

FOR ANY QUESTIONS OR CONCERNS, OR SHOULD YOU REQUIRE FURTHER INFORMATION, PLEASE CONTACT THE UNDERSIGNED AT TEL 5506.

S. MARKOVIC

REPLY FROM

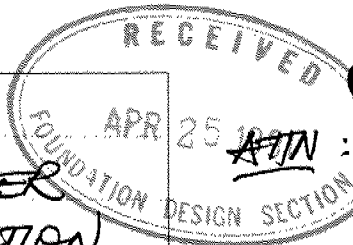
REPLY DATE

SEND  
TO

MR. M. DEVATA

CHIEF FOUNDATION ENGINEER

FOUNDATION DESIGN SECTION



ATTN:

D. DUNDAS

SENIOR FDN. ENG.

FROM

S. MARKOVIC

DEPT.

STRUCTURAL SECTION

DATE

9/04/25

SUBJECT

WP 88-78-28/29 HWY 401/KIPLING AVE I/C RETAINING WALLS

IN RESPONSE TO YOUR QUESTION OF 9/04/24 REGARDING YOUR ESTIMATED WALL LENGTHS NOT MATCHING THOSE ON MARSHALL MACKLIN MONAGHAN DRAWINGS:

- 1) I SPOKE TO THE CONSULTANT THIS A.M. AND THEY ARE FORWARDING (BY FAX) THE LATEST SURVEY DATA IN THE VICINITY OF THE WOODBRIDGE CUT (TODAY). AS PER THEIR ADVICE, PLEASE DO NOT RELY ON THE CONTOUR LINES SHOWN ON THE GRADING DRAWINGS (INCLUDING THE LATEST ISSUE OF CONTRACT DRAWINGS), AS THEY ARE BASED ON INFORMATION APPROX 20 YEARS OLD.
- 2) THEY WILL ALSO SKETCH AND MARK ON A PLAN VIEW, THE OFFSET BETWEEN THE RETAINING WALLS AND THE  $\Phi$  KIPLING AVE FOR YOUR

REPLY REFERENCE.

- 3) THIS INFORMATION WILL BE FORWARDED TO YOU AS SOON AS IT IS RECEIVED (NOT YET RECEIVED @ 9/04/25 @ 16:30).

S. Markovic

REPLY FROM

REPLY DATE

Structural Section  
Central Region  
1201 Wilson Avenue  
Atrium Tower, 4th Floor  
Downsview, Ontario, M3M 1J8  
Telephone: 235-5506

**MINISTRY OF TRANSPORTATION**

**m e m o r a n d u m**

TO: Mr. Dave Dundas  
Senior Foundation Engineer

DATE: April 12, 1991

RE: W.P. 88-78-02 Highway 407/Kipling Avenue Interchange  
W.P. 88-78-28 Kipling Avenue Retaining Structure  
W.P. 88-78-29 Woodbridge cut North Retaining Structure

With reference to our letter of 90/11/16, we requested your opinion regarding the most suitable retaining structure type(s) at the proposed locations, and the foundation information required to design them.

As discussed, this information was to be provided by 90/12/14, to be followed by a Foundation Report, if required.

Could you please advise us on the status of the above investigations.

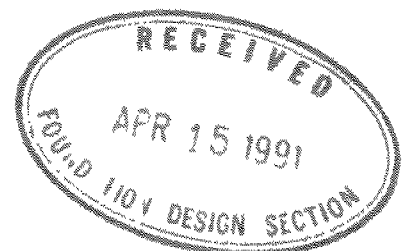
*S. Markovic*

S. M. Markovic  
Sr. Structural Engineer  
for  
V. F. Boehnke  
Head, Structural Section

SMM:dd

*status was discussed with S. Markovic on April 24/91*

*D.D.*



REPLY  
COPYL. Markovic  
Structural SectionSEND  
TO

DEPT

DATE

SUBJECT

Foundation Design Section

Feb 21/91

WP 88-78-28/29 Kipling Ave / Woodhouse Inc. Rebuilding  
Kipling Ave. Summers

Further to our telephone conversations of Feb. 21/91,  
this memo will confirm that we recommend  
a Reinforced Earth Co. Retaining Wall for  
the full portion of this project.

D. Dunder, P.Eng.  
Sr. Foundation Engineer

REPLY

REPLY FROM

REPLY DATE

Structural Section  
Central Region  
1201 Wilson Avenue  
Atrium Tower, 4th Floor  
Downsview, Ontario, M3M 1J8  
Telephone: 235-5506

## MINISTRY OF TRANSPORTATION

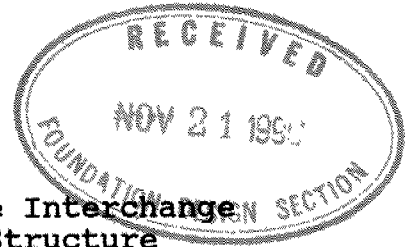
### m e m o r a n d u m

TO: Mr. M. Devata  
Chief Foundation Engineer  
Foundation Design Section  
3rd Floor, Central Building

DATE: November 16, 1990

Attn: Mr. D. Dundas  
Senior Foundation Engineer

RE: W.P. 88-78-02 Highway 407/Kipling Avenue Interchange  
W.P. 88-78-28 Kipling Avenue Retaining Structure  
W.P. 88-78-29 Woodbridge Cut North Retaining Structure



As discussed in our meeting of 90/11/08, we require foundation recommendations for the above retaining structures, proposed to minimize impact of the Interchange on the "Woodbridge Cut".

Woodbridge Cut is a geological formation consisting of a sequence of clay strata from different geological periods. It is located within the limits of the interchange, and has been designated an Area of Natural and Scientific Interest (ANSI) by MNR. AS a result of this new information (1989), and in keeping with our objective that the ANSI be affected as little as possible by the interchange, we are working within the following constraints:

- a) Minimum encroachment on the Woodbridge Cut;
- b) The face of the cut is to be left exposed to continue eroding; (the south structure must be sufficiently embedded beyond the existing face to allow for this).
- c) Minimal removal/excavation of the ANSI material.

The ANSI, a steep face with a creek flowing at its bottom (Rainbow Creek Tributary), is located on the west side of Kipling Avenue, north of the CNR and south of the S-E ramp. IN the vicinity of the ANSI, Kipling Avenue goes from fill in the south into cut in the north. Therefore, the south structure will retain Kipling Avenue from encroaching onto the ANSI and the north structure will retain the ANSI away from Kipling Avenue.

We expect that the following attached drawings, prepared by Marshall Macklin Monaghan Ltd. (90/11/09), together with the plans forwarded on 90/11/08, sufficiently describe the location and configuration of the proposed structures.

- i) Plan view of the retaining structures;
- ii) Plan view of the ANSI strata, based on a recent detailed survey.

We would like to have your opinion regarding the most suitable retaining structure type(s) at the proposed locations, and the foundation information required to design them.

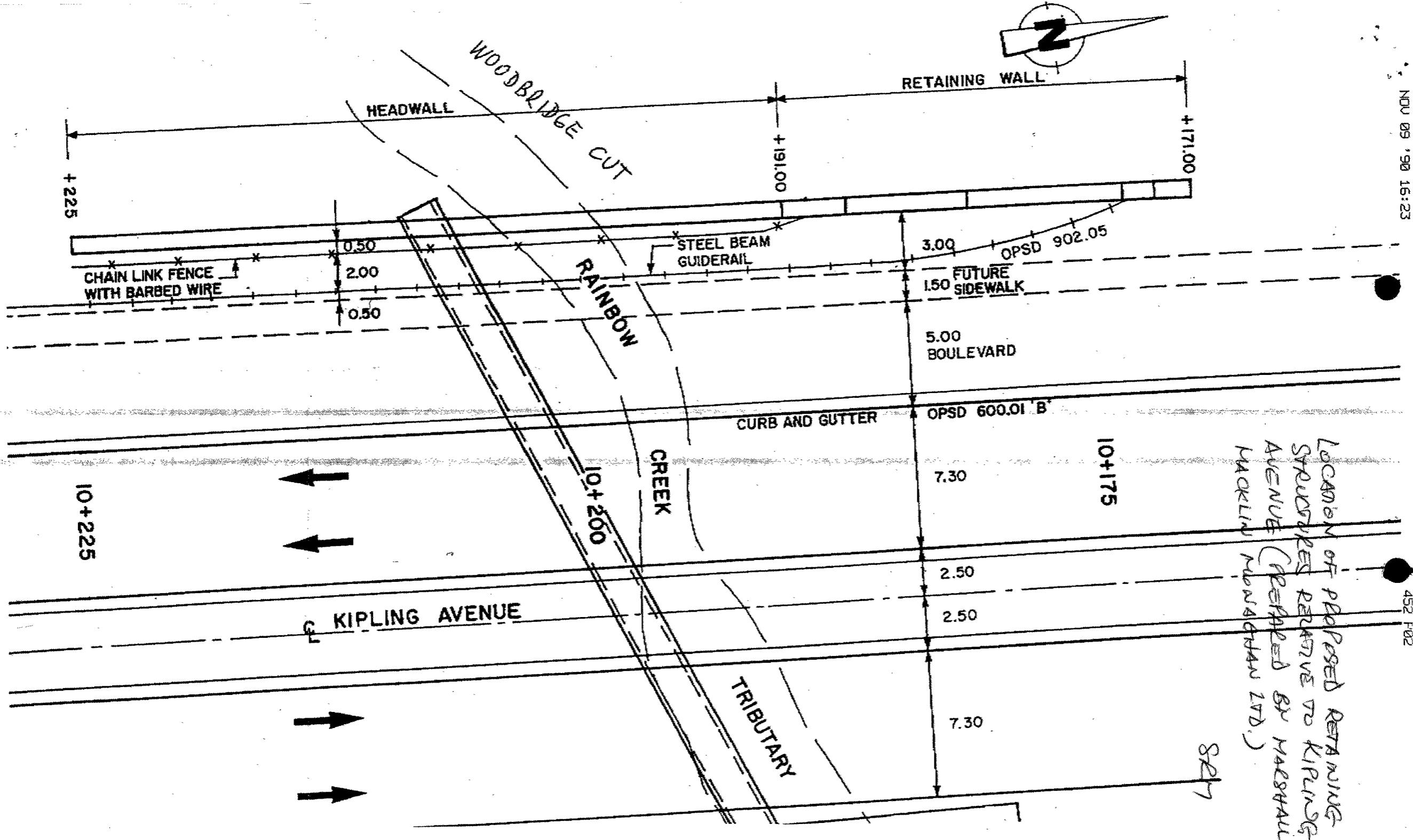
Please provide the above recommendations, based on existing information, by December 14, 1990, to be followed by a Foundation Investigation Report at a later date, if required.

Should you have any questions or concerns, please contact the undersigned.



S. Markovic  
Sr. Structural Engineer  
for  
V. F. Boehnke  
Head, Structural Section

SM:dd

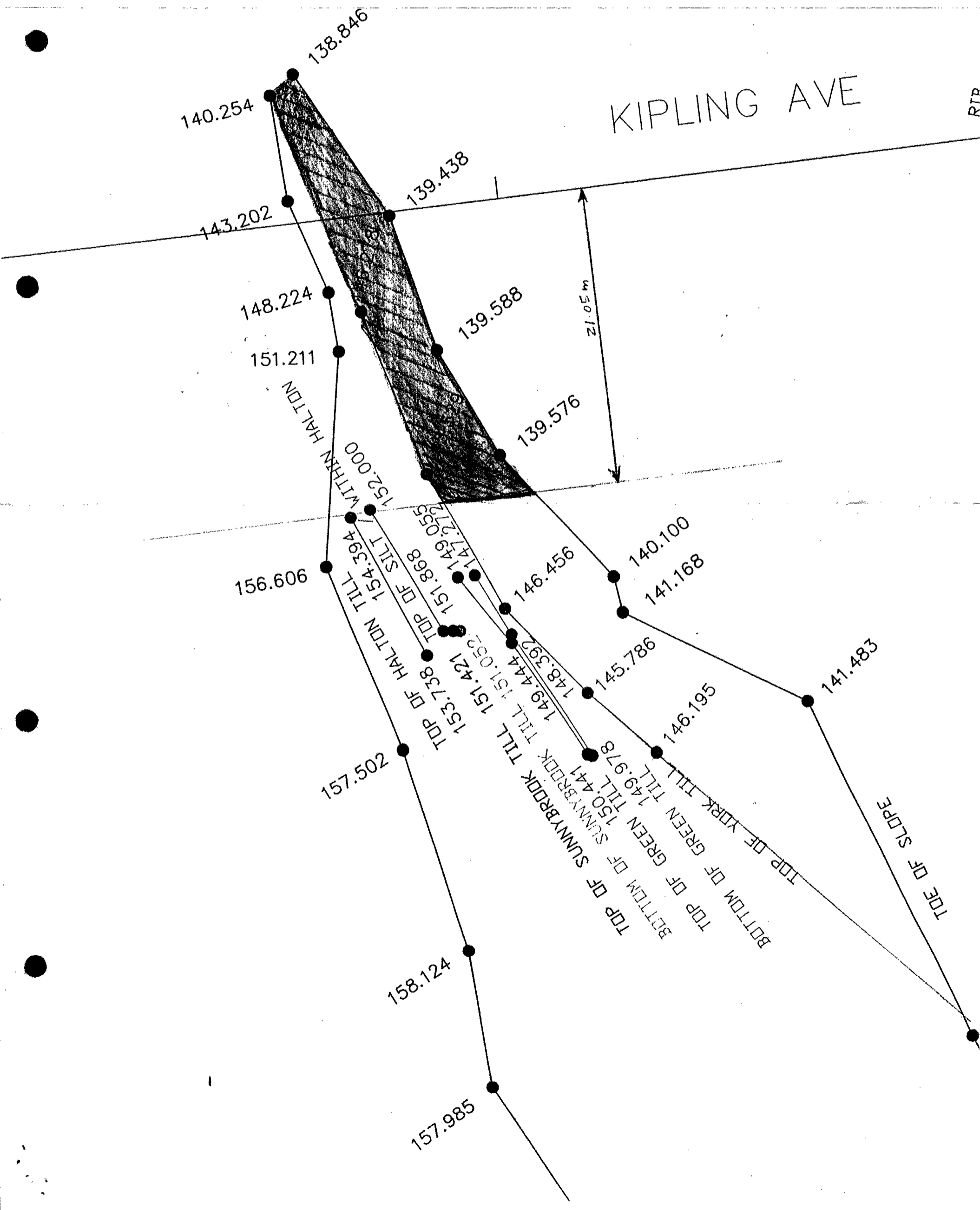


827

Scale 1:250 8RM

ELEVATIONS OF SOIL STRATA  
OF THE WOODBRIDGE CUT  
(BASED ON DETAILED SURVEY  
INFORMATION - SURVEY 1960).  
S-41

(PREPARED BY MARSHALL MACKLIN  
MONAGHAN LTD.)



M E M O R A N D U M

Geotechnical Section, Central Region

Telephone: 235-5434

To: Mr. M. Devata  
Chief Foundation Engineer  
Foundation Design Section  
3rd Floor, Central Bldg.

Date: 90-06-05

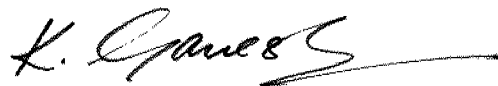
Attention: D. Dundas  
Senior Foundation Eng.

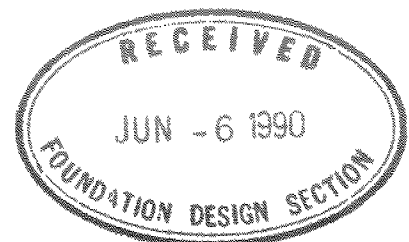
Re: W.P. 88-78-02, Hwy. 407 and  
Kipling Ave. Interchange  
Woodbridge Cut

Attached, please find a copy of the report by Ross Kelly, Staff Geologist with Mines and Mineral Division of M.N.D.M.

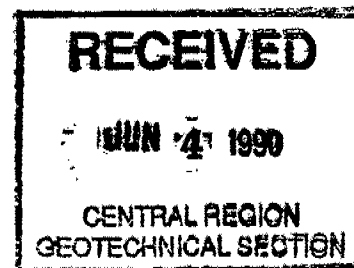
We thank you and your staff for the assistance given in helping to expedite the geological investigation necessary to resolve the Woodbridge Cut issue.

KG/GC/rb  
Attach.

  
K. Ganesh  
P.D.E.O.  
for:  
G. Cautillo  
Head, Geotechnical Section



Disk File: c:\wp-docs\workprj\1978\88-78-02



RESULTS OF A QUATERNARY GEOLOGY  
HOLLOW STEM AUGERING PROGRAM - WOODBRIDGE, ONTARIO\*  
MAY 1990

By: ROSS KELLY  
STAFF GEOLOGIST  
MINES & MINERALS DIVISION  
MNDM  
SOUTHERN ONTARIO  
LONDON

500-90-01

\*Draft Copy

A handwritten signature in dark ink, appearing to be "R. Kelly".

#### EXECUTIVE SUMMARY

The most complete sequence of stratigraphic units, as found in the existing Woodbridge Cut, occurs at BH WB-90-02 and 03, and most likely southwest of boreholes along the south side of the proposed Hwy 407 - Kipling Avenue ramp.

## HISTORICAL BACKGROUND

The Woodbridge Cut was exposed in the early 1960's during construction of the Canadian National Railways Toronto bypass line. Rail construction through an area between two small tributaries of the Humber River gave rise to a cut measuring some 150m in length and 17m in height.

Investigation of the site by a geological field party first occurred in 1962. The importance of the site to the geological community was soon recognized. Subsequently, detailed description and sampling of the cut was undertaken during the years of 1963, 1964 and 1965. Additional studies followed thereafter. Results of these geological investigations are detailed in a number of scientific publications (Dreimanis and Karrow 1965; White 1967; Churcher 1968; Karrow 1969; White 1975; Churcher and Morgan 1976; Williams et al. 1981).

Geological studies indicate deposits at the site range in age from Illinoian (>125,000 years B.P.) to Late Wisconsinan (13,000 years B.P.). The Woodbridge section exposes a number of units which are unique or rarely seen elsewhere in the Great Lakes region. Most important of these are Illinoian aged till, known as the York Till, and organic rich sediments of the Early Wisconsinan, Scarborough Formation. These units provide an important glimpse into the early glacial history of central North America. For this reason the Woodbridge Cut has been a required stop for a multitude of geological field excursions.

## PRESENT STUDY

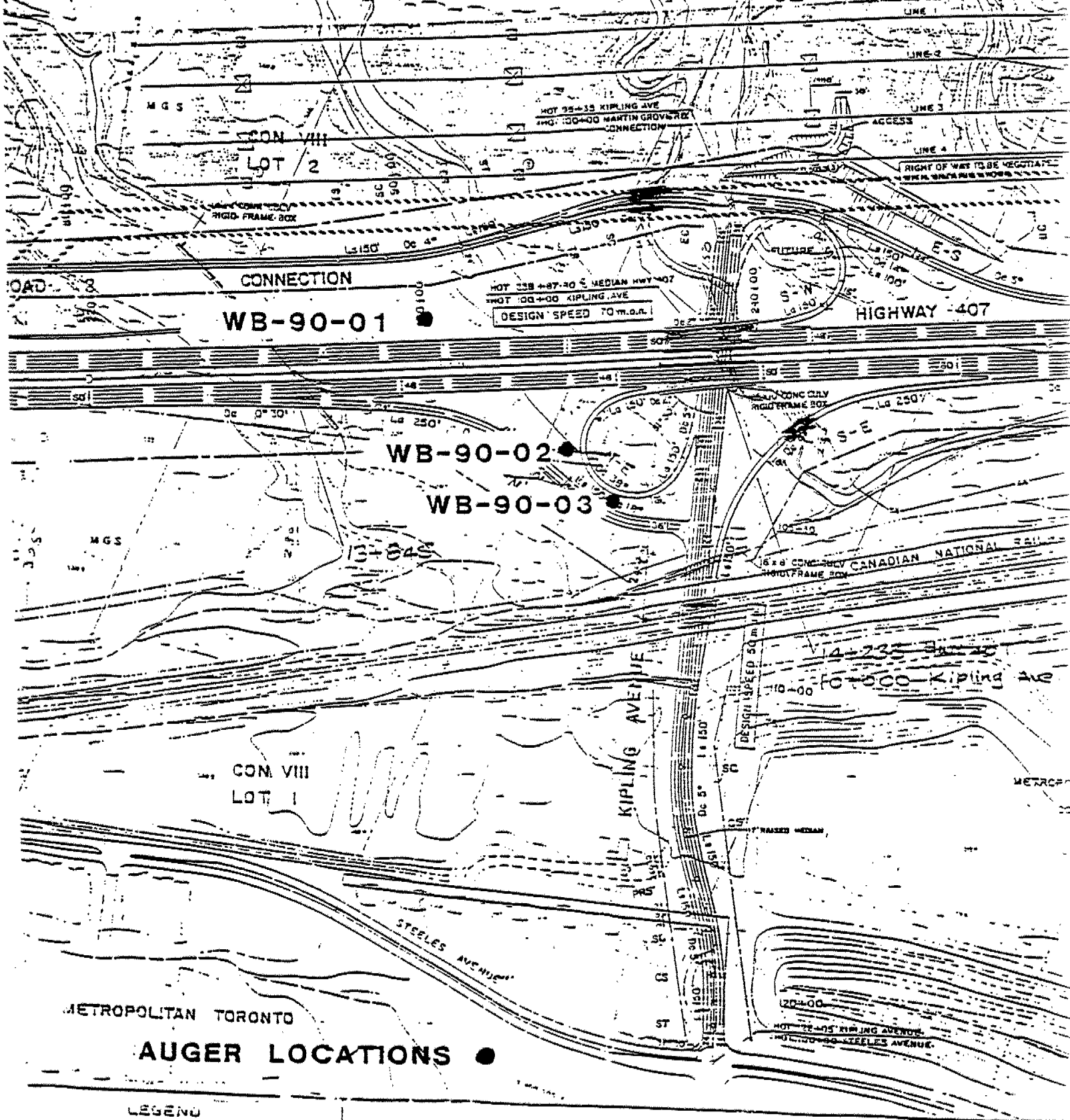
Construction of Highway 407 and associated access roads through the Woodbridge area are slated for the immediate future. The impending extension of Kipling Avenue northward from Steeles Avenue to Highway 407 will directly impact upon the Woodbridge Cut. Proposed construction will significantly alter the quality of the exposure. Future scientific investigations and field excursions are likely to be severely restricted.

The Ontario Ministry of Transportation requested the assistance of the Mines and Minerals Division of the Ministry of Northern Development and Mines in conducting an investigation of the subsurface Quaternary geology in the vicinity of the Woodbridge Cut. The objectives of this study were to identify and establish the lateral continuity of the various Quaternary units. A limited program of hollow stem augering with continuous coring was employed to meet the stated aims. Augering was carried out at three selected locations, which are identified on Figure 1. Additional samples from the MOT geotechnical drilling program were examined to provide further information. The results of the augering program are presented herein.

REGIONAL MUNICIPALITY OF YORK  
TOWN OF VAUGHAN

A 3 - PICHECA

POSSIBLE EXTENSION OF KIPLING  
AVENUE TO HIGHWAY 7 BY OTHERS



AUGER LOCATIONS ●

LEGEND

HIGHWAY 407

Figure 1

## QUATERNARY STRATIGRAPHY OF THE TORONTO REGION

The Quaternary deposits of the Toronto Region are unique in Ontario in that they provide the oldest Quaternary record, including Illinoian till and Sangamonian Interglacial deposits.

Additionally, deposits of the Toronto region have played an important role in the development of the pre-Late Wisconsinan stratigraphic framework for the Great Lakes Region (Dreimanis and Karrow 1972). A diagram illustrating the stratigraphic framework for southern Ontario, including the Toronto area, is presented in Figure 2.

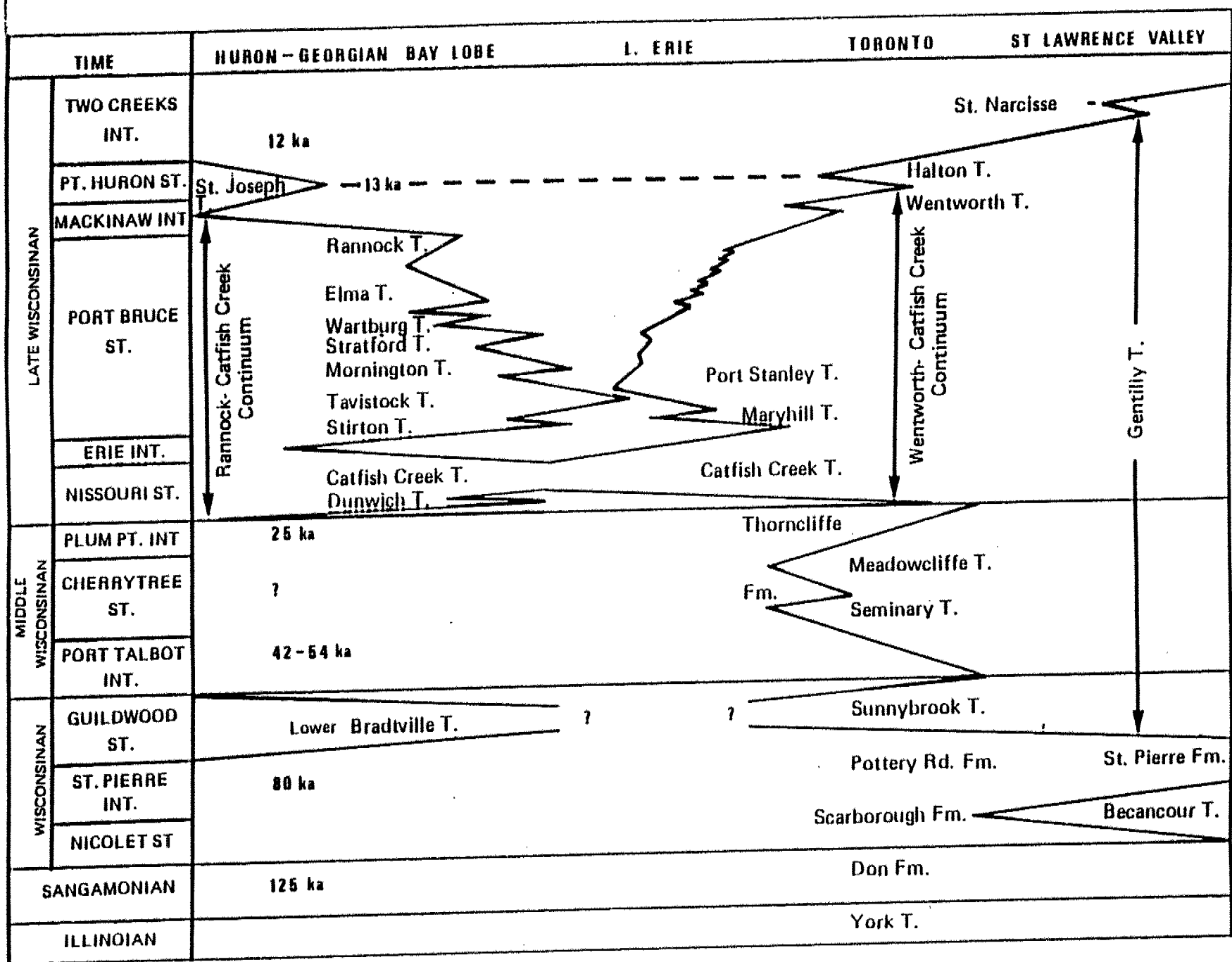


Figure 2: Tills and ice fluctuations, Lake Huron to St. Lawrence valley.  
 Note variable time scale in radiocarbon years (modified from Karrow, 1984 )

## STRATIGRAPHY OF THE WOODBRIDGE CUT

The Woodbridge Cut exposes deposits ranging in age from Illinoian to Late Wisconsinan. The stratigraphy and lithology of the section as determined by previous geological investigations is illustrated in Figure 3. A brief description of each of the units follows.

ILLINOIAN The oldest deposit at the cut is exposed at the eastern end of the section. This unit consists of approximately 5m of oxidized and unoxidized yellowish brown to greyish sandy silt - silty sand till. This till is believed to be of Illinoian age and has been named the York Till (Karrow 1967).

Overlying the York Till is a unit of interbedded till, sands and gravels. Peculiar "V" shaped gravel-rich bodies originate at the top of this unit and extend downward into the York Till. These features have been interpreted as ice-wedge casts (Williams et al. 1981). The age of this unit is speculative, but is most likely associated with retreat of the Illinoian age glacier which deposited the York Till.

EARLY WISCONSINAN Overlying the York Till and its associated till-sand-gravel complex at their western end is a variably coloured, non-calcareous, fine textured diamicton. The colour of this sediment unit varies from greenish grey to bluish to rusty brown. The origin of this unit is unclear; however, suggestions of till, colluvium and accretion glei have been proposed (White 1975).

Overlying the noncalcareous diamicton unit and the interbedded till-sand-gravel complex is a thick sequence of bedded, organic rich silts with sand and clay. This unit is thickest in the centre of the cut, reaching some 5m, thinning to less than 2m at either end. At the western end of the section this unit continues into sands, gravels and organic rich silts. Studies of fossil insects and plant remains obtained from this unit indicate that the sediments were deposited under cold climate conditions. A relationship with the Early Wisconsinan Scarborough Formation is likely (Karrow 1969).

Overlying the organic-rich sediments at the west and possibly at the east end is a dark grey, nearly clast free, clayey silt to silty clay till. This till is believed to be the Early Wisconsinan Sunnybrook Till.

LATE WISCONSINAN A thin lens of gravelly sandy diamicton overlies in part either the Sunnybrook Till or older deposits. This material is thought to be the equivalent of the Late Wisconsinan Wentworth Till (White 1975).

A 3-4m thick layer of greyish brown clayey silt till overlies all of these older units. This till is referred to as the Halton Till. The Halton Till is overlain by a thin layer of stratified silts which in turn is overlain by a 4m thick deposit of silty clay diamicton known as the Wildfield Till (White 1975). A thin layer of possible lacustrine sediment overlies the Wildfield Till. Soil forming processes have obliterated much of the evidence for the origin of this upper unit.

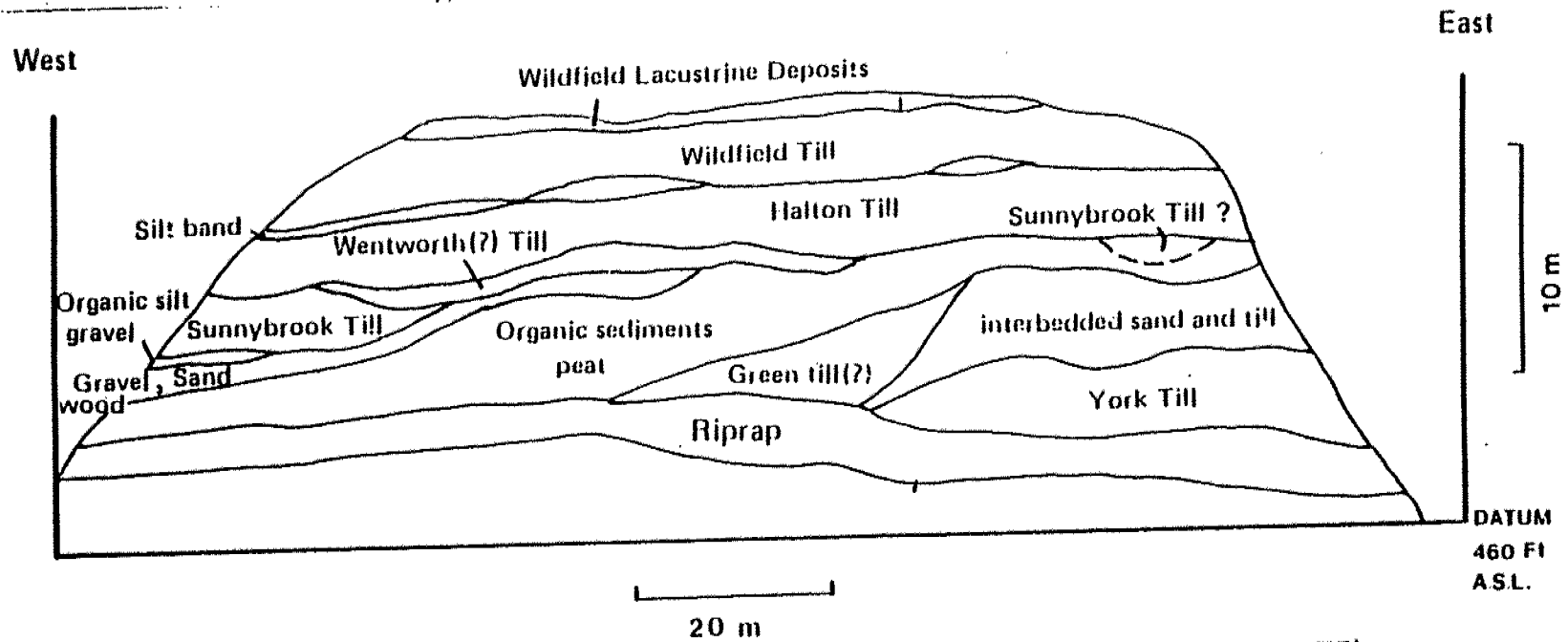


Figure 3 : Stratigraphy and lithology of the Woodbridge cut (after White, 1975)

LATE WISCONSIAN cont'd.

The uppermost units at the Woodbridge Cut, Wentworth Till to topmost lacustrine beds, were identified as distinctive glacial events related to glacial advance and retreat. Recent ideas suggest that this sequence of units represent deposition under more or less continuous ice cover during the Late Wisconsinan (Sharpe 1980). The units would then represent a Halton Till complex.

## AUGERING RESULTS

The results of the drilling program point out the variability and rapid lateral change of the Quaternary units within the area investigated. A detailed description of sediments encountered in each of the augered holes is provided in the attached text and graphic logs. Stratigraphic correlatives of the various sediment units are also provided. A brief summary of each detailed log is provided below.

### SITE WB-90-01

The upper 10 feet of sediment in this borehole consists of light brown, massive to faintly stratified clayey silt till. This till is correlated with the Late Wisconsinan Halton Till.

Underlying the Halton Till is a fining up succession of gravelly sands to sandy and clayey silts. This unit extends to a depth of some 32'. The nature of the sediment sequence suggests fluvial and lacustrine depositional environments are represented. This unit is not present at the Woodbridge Cut, but has been noted elsewhere in the Humber River Valley (White 1975). Stratigraphically, the unit is thought to be younger than the Late Wisconsinan Wentworth Till; but older than the Halton Till (White 1975).

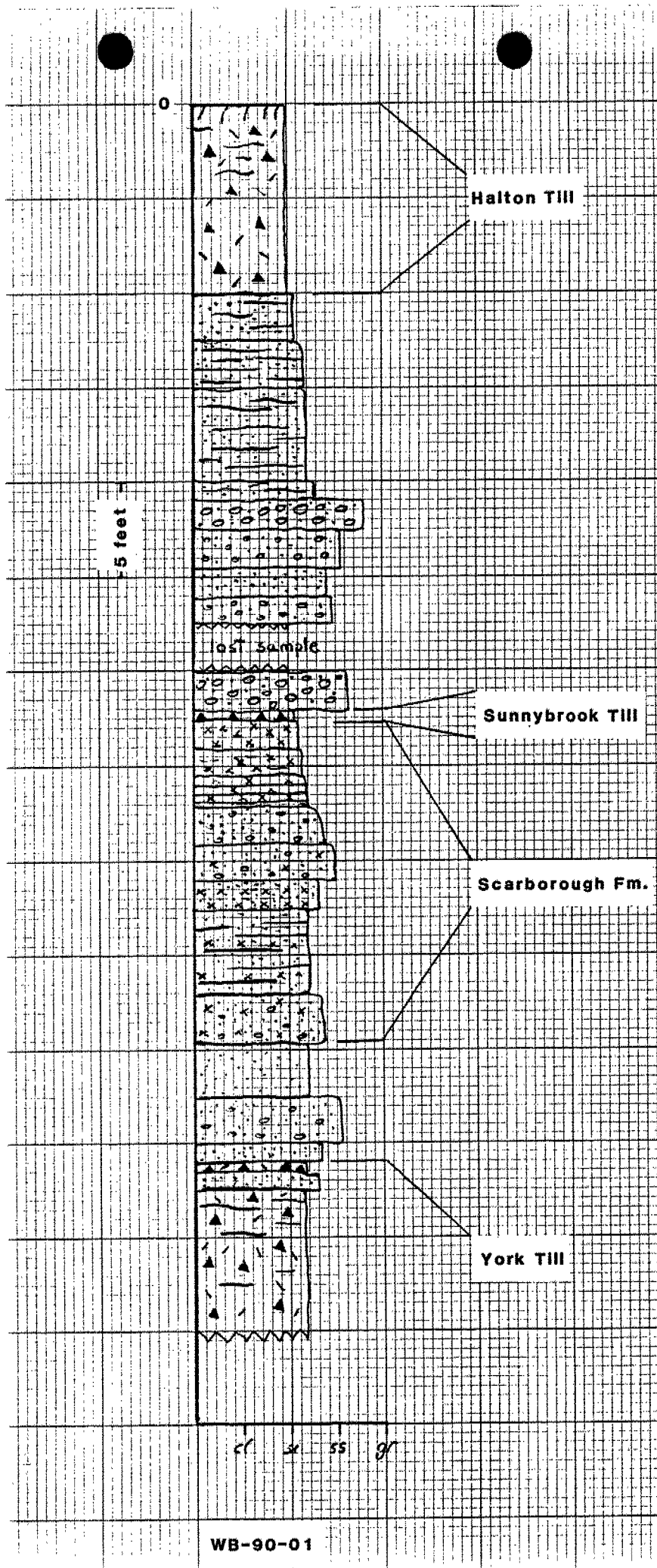
Underlying the gravelly sand-silt sequence is a thin layer of grey, massive, clayey silt till. This unit extends from only 32' - 32' 6" depth. On the basis of its stratigraphic position this till is correlated with the Early Wisconsinan Sunnybrook Till.

Underlying the Sunnybrook Till is a thick succession of organic rich, silty sands and silts with cleaner gravelly sands and sands. Thin layers of organic matter as well as shell fragments are found throughout. Total thickness of the sediment package totals 17 feet, extending from 32' 6" to 49' 6" depth. This unit is correlated with the Early Wisconsinan Scarborough Formation.

Extending from 49' 6" to 57' 6" depth is a complex of sand-gravel and till. Near the base of the sequence, till layers are more numerous and are interbedded with thin sand layers. Underlying the sand-gravel-till complex is a grey, massive, silty sand to sandy silt till. This till represents the Illinoian age York Till. The overlying sand-gravel-till complex may represent fluvial sediments associated with retreating Illinoian age glacial ice.

# KEY

GRAVEL		STRATIFICATION		CLAY	cl
SAND		FAINT STRATIFICATION		SILT	si
DIAMICTON		CONTORTED STRATIFICATION		SAND	ss
RIPPLE CROSS-LAMINATION		SHEARS		GRAVEL	gr
CLIMBING RIPPLES		FLOWS		AZIMUTH	
TROUGH CROSS-BEDDING		MUD PELLETS		till fabric	
LOW ANGLE CROSS-BEDDING		DISH STRUCTURES		paleocurrent	
FLAT BEDDED		PSEUDONODULES			
		DIAMICTON BALL			



odbridge WB-90-01 Surface Elevation 530'

Depth below surface

- 0-1' dark grey-black, massive, silt - clayey silt, organic matter, Ap soil horizon.
- 1-5' light yellowish brown - light brown, mottled, massive - faintly stratified, clayey silt till, oxidized along vertical and horizontal cracks and around clasts, clasts common, subangular - subrounded, size 2 mm - 10 cm, black shale, granite, whitish calcite precipitate along horizontal fractures.
- 5-10' light yellowish brown - light brown, mottled, stratified, clayey silt - sandy silt till, small clasts <2 cm, subangular - subrounded, black shale, rare granite, whitish calcite precipitate along horizontal fractures, interbedded lower contact. Halton Till.
- 10-12'6" light yellowish brown, stratified, friable, poorly sorted, silty fine sand with rare, small (<1 cm), limestone clasts.
- 12'6"-15' light yellowish brown - orangish brown, oxidized, interbedded clayey silt and silty fine sand, finer textured layers 3-5 mm thick, coarser layers 1-2 cm thick. glaciolacustrine.
- 20' light yellowish brown - light brown, oxidized, interbedded clayey silt and fine - medium sand, finer layers 3-5 mm thick, coarser layers 1-3 mm.
- 20-21' light yellowish brown - light brown, stratified, poorly sorted, sandy silt - silty clay, rare, small clast (<1 cm), subrounded, limestone; rare, thin (<2 mm), oxidized, sand layer, sharp lower contact.
- 21-22'6" light yellowish brown, massive - stratified, poorly sorted, sandy gravel; matrix, fine - very coarse sand, clasts small (<2 cm), subrounded - rounded, limestone, rare mafic igneous and granite.
- 22'6"-25' light brown (orangish tinge), massive - stratified, poorly sorted, gravelly sand; matrix medium - very coarse sand, clasts small (1-3 cm), subrounded - rounded, limestone common, rare granite.
- 25-25'6" light brown, massive, well sorted, medium sand, oxidized at bottom, sharp lower contact.
- 25'6"-26' light yellowish brown, massive, well sorted coarse sand, sharp lower contact.
- 26-27'6" light yellowish brown - light brown, oxidized, massive, poorly sorted, gravelly sand; sand, fine - very coarse, clasts 1-4 cm, subrounded - rounded, limestone common.
- 27'6"-30' sample lost.

- 30-32' light brown, massive, very poorly sorted, friable, sandy gravel; matrix, silt - very coarse sand, clasts, 1-5 cm, subrounded - rounded, limestone common, sharp lower contact.
- 32-32'6" dark grey, oxidized at top, massive, clayey silt - silty clay till; clasts common, small (<.5 cm), subangular - subrounded, limestone common, indistinct lower contact. Sunnybrook Till.
- 32'6"-34' dark grey, massive, silt - silty very fine sand, rare, small, disseminated organic matter fragments, whitish burrow traces. Scarborough Formation.
- 34-35'6" dark grey - black, massive, silt - silty very fine sand, rare, disseminated organic matter fragment. Scarborough Formation.
- 35'6"-35'9" dark grey - black, massive, very poorly sorted, pebbly silty very fine sand diamicton, rare organic matter fragment, clasts small (<1 cm), subrounded - rounded, greenish limestone common.
- 35'9"-37' dark grey - black with thin whitish layers, thin bedded, silty fine sand - fine sand rhythmites; couplets 1-1.5 cm thick, coarser unit of couplet 1-2 mm thick, rare organic matter fragment, sharp lower contact.
- '-37'6" dark grey, massive, very poorly sorted, pebbly sand diamicton; matrix silt - coarse sand, clasts common, small (<1.5 cm), rounded, limestone common, sharp lower contact.
- 37'6"-39' orangish brown, oxidized, massive, friable, very poorly sorted, fining up sequence of sandy gravel to gravelly sand; matrix, fine sand - very coarse sand, clasts 1-3 cm at bottom to <2 cm at top, rounded, limestone common, rare granite, sharp lower contact.
- 39-41' dark grey - black, massive - faintly stratified, very poorly sorted, gravelly sand; sand, very fine - very coarse, clasts small (1-2 cm), subrounded - rounded, limestone common, rare organic matter fragment, sharp lower contact.
- 41-41'6" dark grey - greenish grey - rusty brown, cross-laminated, coarsening up sequence, silty fine sand - medium sand; organic matter rich layers at base of sequence, 1-2 mm thick.
- 41'6"-42'6" dark grey - greenish grey, stratified, coarsening up sequence, silty very fine sand - fine sand; thin (1-5 mm) organic matter rich layers at base, interbedded with thin (1-2 mm) sand rich layers, changing to cross laminated fine sand at top, sharp lower contact.
- 42'6"-47' greenish grey - medium grey, thin bedded, cross-laminated silty fine sand with thin (1-4 mm) organic matter rich lenses and layers; cross-lamination very low angle to flat, slightly undulating, sharp lower contact.

- 47'2" dark grey - black, whitish mottles, massive, sandy silt - silty sand; organic matter rich, small, disseminated fragments, at very top of unit is thin 1-2 mm whitish, calcite rich layer, gradational lower contact.
- 47'2"-47'5" dark grey - black, whitish mottles, massive, very poorly sorted, pebbly silty sand, organic matter fragments common, shell fragments, pebbles small (<1 cm), rounded, limestone.
- 47'5"-48' dark grey - black, massive, sandy silt, organic matter and shell fragments common.
- 48-49'6" dark greenish grey - black, massive, gritty silty fine sand; rare small (<1 cm) clast, limestone, organic matter and shell fragments rare - common, sharp lower contact. Scarborough Formation.
- 49'6"-52'6" dark grey - orangish staining, faintly laminated, poorly sorted, silty sand; slightly cemented, oxidized along horizontal bedding planes, sharp lower contact.
- 52'6"-55' light yellowish brown - light brown, oxidized, massive, poorly sorted, sandy gravel; matrix, silt - very coarse sand, clasts 1-6 cm, subangular - rounded, limestone common, rare granite, sharp lower contact.
- 57'6" variably coloured, medium grey - yellowish brown - brownish grey, interbedded, fine - coarse sand, silty sand and silty sand diamicton; sand layers 1 mm - 1.5 cm thick, diamicton layers .5 - 7 cm thick, clasts common, size 1-3 cm, subangular - subrounded, limestone, black shale common, rare felsic and mafic igneous. York Drift.
- 57'6"-60' medium grey, massive - weakly stratified, hard, silty sand - sandy silt till; thin (<3 mm), medium - coarse sand interbeds, clasts common, small (<1 cm), subangular - subrounded, black shale, limestone common, rare felsic and mafic igneous. York Till.
- 60-65' medium grey, massive - weakly stratified, silty sand - sandy silt till; clasts common, size .5 - 3 cm, subangular - subrounded, grey limestone, black shale common, rare granite. York Till.

end of hole

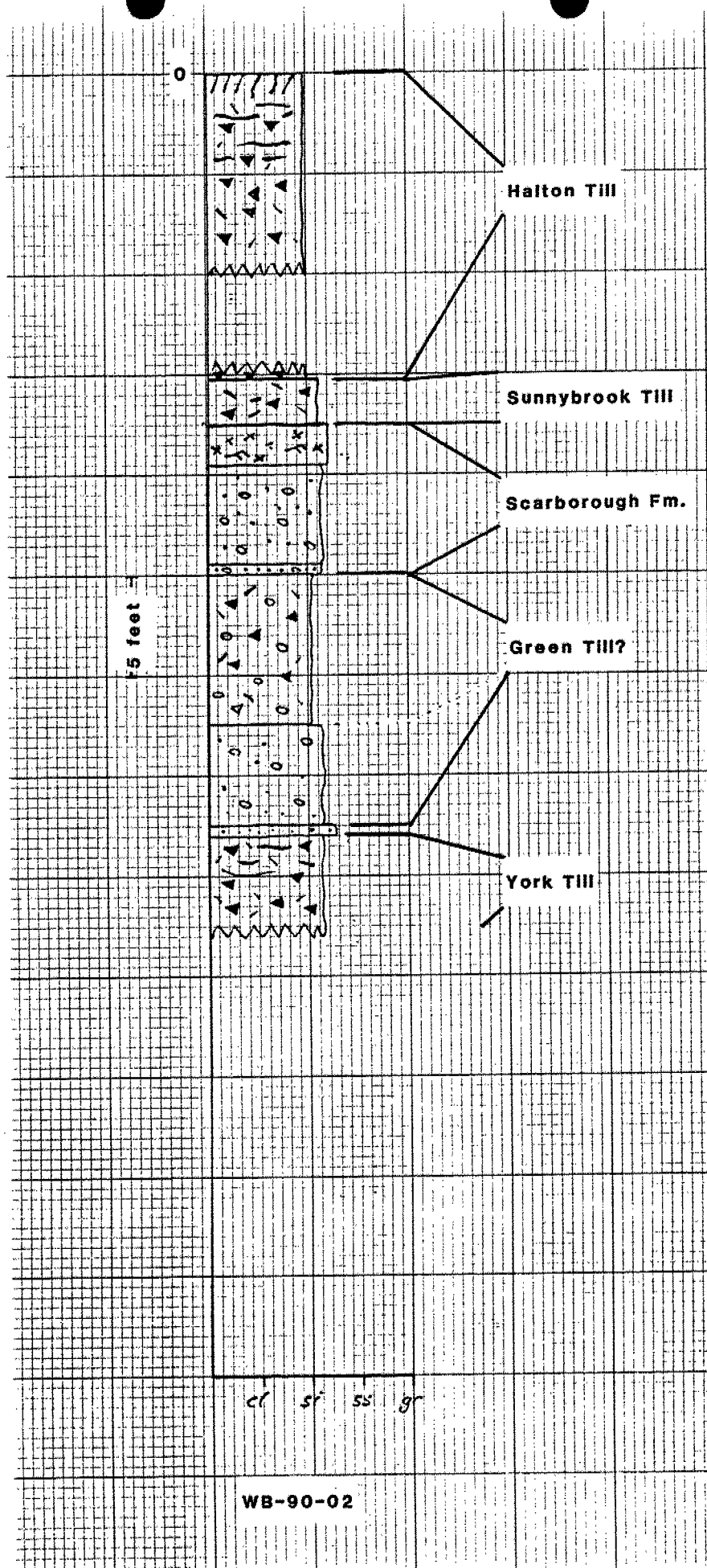
SITE WB-90-02

At this location a light-medium brown, clayey silt till extends from the surface to a depth of some 15'. This till correlates with the Late Wisconsinan Halton Till.

Underlying the Halton Till is a thin layer of grey, massive, sandy silt till. Unfortunately the contact between the Halton Till and this till was unclear as sample recovery was poor at that point. The lower till does however, overly organic rich sediments, therefore, it can be correlated with the Early Wisconsinan Sunnybrook Till. The Sunnybrook Till extends from 15' to 17' 6" depth.

Underlying the Sunnybrook Till, extending to a depth of 24' 6", is a complex of organic matter rich sandy silts, sands and gravelly sands. Shell fragments were also noted. These sediments are correlated with the Early Wisconsinan Scarborough Formation.

A peculiar greenish grey to greyish brown, massive to stratified silty sand diamicton underlies the Scarborough Formation. This unit extends from 24' 6" to 37' 6" depth. From depth 32' 6" to 37' 6" the unit is friable and is better sorted. The origin of this sediment package is unclear as is its place in the regional stratigraphic framework. This unit is equivalent to the Green Till? identified in the Woodbridge Cut (Figure 3). Underlying the Green Till? is a thin layer of well sorted sand which in turn overlies grey, sandy silt York Till. The York Till was encountered at a depth of 38 feet, a depth much shallower than in either of boreholes 1 or 3.



Woodbridge      WB-90-02      Surface Elevation    525'

Depth Below Surface

- 0-1'      dark grey brown, massive, clayey silt, organic matter rich, Ah soil horizon.
- 1-4'6"      light - medium brown, yellowish mottles, massive - faintly stratified, clayey silt - silty clay till; clasts common, small (<1 cm), black shale common, rare granite, amphibolite, whitish calcite precipitate and oxidation along horizontal and vertical fractures. Halton Till.
- 4'6"-10'      light - medium brown, rare yellowish mottle, massive, clayey silt - silty clay till; clasts common, small (<2 cm), black shale, limestone, rare granite, mafic igneous, calcite precipitate and oxidation along fractures. Halton Till.
- 10-15'      sample lost.
- 15-17'6"      medium grey, massive - weakly stratified, will break into thin layers, silty very fine sand - sandy silt till; clasts common, small (<2 cm), subangular - subrounded, black shale, limestone common, sharp lower contact. Sunnybrook Till.
- 17'6"-19'6"      medium - dark grey, faintly laminated, very fine - fine sand; laminations, low angle - cross-laminated, organic matter and shell fragments common, sharp lower contact. Scarborough Formation.
- 19'6"-24'6"      light yellowish brown, massive, gravelly sand; matrix, silt - very coarse sand, clasts subrounded - rounded, up to 5 cm, most 1-2 cm, limestone common.
- 24'6"-25'      medium - dark grey, massive, silty sand - sandy silt diamicton; clasts rare, small (<1 cm), limestone, sharp lower contact.
- 25-25'6"      greenish brown, massive - weakly stratified, gritty silty sand diamicton; no obvious organic matter or shell fragments, possibly till flow, below Scarborough ?
- 25'6"-28'      greyish green - olive green, whitish mottles, massive, pebbly silty sand diamicton; clasts common, small (<.5 cm), black shale, limestone common, rare felsic and mafic igneous.
- 28-32'6"      greyish green - olive green, whitish mottles, massive weakly stratified, pebbly silty sand - sandy silt diamicton; clasts common, small (<1 cm), subangular - subrounded, black shale, limestone common, rare felsic and mafic igneous, gradational lower contact.

32'6"-37'6" light grey - greenish grey, massive - weakly stratified, friable, very poorly sorted, pebbly sand with thin (1-2 cm), well sorted, medium - coarse sand interbeds; clasts rare, small (<1 cm), rounded, sharp lower contact.

37'6"-38' light grey - whitish grey, massive, loose, well sorted fine sand; sharp lower contact.

38-40' light - medium grey, massive - weakly stratified, sandy silt - silty sand till; rare, well sorted fine sand layer, 2-5 mm thick, clasts common, small (<2 cm), subangular - subrounded, limestone, black shale common, rare granite. York Drift.

40-42'6" medium grey, massive - weakly stratified, sandy silt - silty sand till, clasts common, small (<2 cm), subangular - subrounded, limestone, black shale common, rare red shale. York Till.

end of hole

#### SITE WB-90-03

Light brown, massive, clayey silt Halton Till extends from the ground surface to a depth of 15' at this site. The till is underlain by a thin, 6", layer of silty sand. This unit probably is the equivalent of the gravelly sand-silt succession underlying the Halton Till in hole WB-90-01.

The sand unit overlies 3 feet of silty sand which contains infrequent organic matter fragments. This unit extends from 15' 6" to 18' 6" depth and is correlated with the Early Wisconsinan Scarborough Formation.

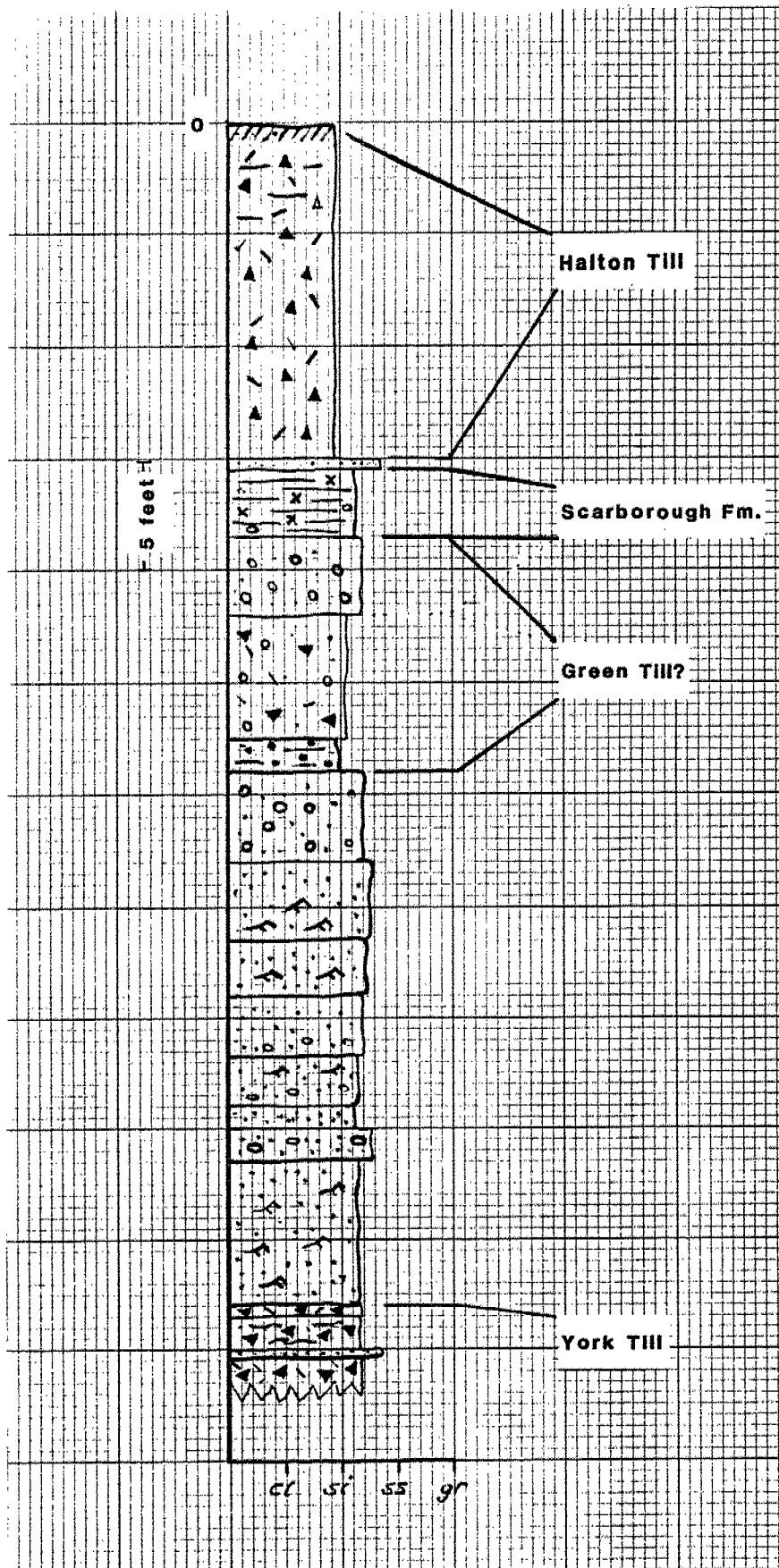
Underlying the Scarborough Formation is a greenish, massive, clayey silt diamicton extending to a depth of 27' 6". This unit correlates with the Green Till? noted at site WB-90-02 and at the Woodbridge Cut. Associated with this diamicton and immediately underlying it is a 1' 6" thick layer of clayey silt glaciolacustrine sediment which contains numerous mud pellets and diamicton clots. These features and the stratigraphic position of the glaciolacustrine unit would seem to suggest that the overlying greenish diamicton is actually a glacial till of probable Early Wisconsinan age.

Underlying the diamicton/glaciolacustrine complex is a thick succession of fluvial, silty and gravelly sands. This sequence extends from 29' to 53' depth. Stratigraphically this unit correlates with the sediments encountered in the other boreholes immediately above the York Till.

The York Till was first encountered at site WB-90-03 at a depth of 53'. From 53' to 56' the till was found to contain numerous sandy interbeds. The drill was unable to penetrate through the till past a depth of 56'.

#### ADDITIONAL OBSERVATIONS

Samples from two boreholes drilled by MOT along the SE off-ramp of Kipling Avenue were examined to provide additional information. These boreholes encountered Halton Till, underlying sandy sediments and York Till. No other Quaternary units were noted.



Woodbridge

WB-90-03

Surface Elevation 520'

Depth Below Surface

- 0-1' dark grey - black, massive, clayey silt, organic matter rich, Ah soil horizon.
- 1-5' light medium brown, yellowish mottles, massive - weakly stratified, clayey silt - silty clay till; clasts common, small (<1 cm), black shale, limestone common, rare felsic and mafic igneous, whitish calcite precipitate and oxidation along fractures. Halton Till.
- 5-15' light - medium brown, rare yellowish mottle, massive, clayey silt till; clasts common, small (<2 cm), subangular - subrounded, faintly striated, black shale, limestone common, rare felsic igneous, sharp lower contact. Halton Till.
- 15-15'6" light - medium grey, massive, silty very fine sand; rare small (<.5 cm) clast, limestone, black shale, gradational lower contact.
- 15'6"-18'6" light - medium grey, weakly stratified, silty very fine sand; breaks into thin (.5 cm) layers, rare, small clast (<1 cm), subrounded, limestone, rare organic matter fragment, oxidized along horizontal fractures, gradational lower contact. glaciolacustrine. Scarborough Formation.
- 18'6"-22' light - medium grey, massive, sandy silt diamicton; clasts common, small (<.5 cm), subangular - subrounded, limestone, black shale, sharp lower contact.
- 22-27'6" greyish green - olive green, greyish mottles, massive, silty clay - clayey silt diamicton (till?); clasts common, small (<1.5 cm), black shale, limestone common, rare felsic and mafic igneous, sandstone, sharp lower contact.
- 27'6"-27'9" light - medium brown, stratified, interbedded clayey silt - silty clay diamicton and silty clay with mud pellets, diamicton clots. ice marginal glaciolacustrine.
- 27'9"-29' light greyish brown, massive weakly stratified, clayey silt - silty clay diamicton/glaciolacustrine; numerous small clasts, black shale, limestone and whitish mud pellets, sharp lower contact.
- 29'-33' light yellowish brown, massive, very poorly sorted, friable, pebbly sand; clasts common, small (<1 cm), subangular - subrounded, sharp lower contact. possible sediment gravity flow.
- 33-33'3" light whitish brown, massive, well sorted, loose, fine sand, sharp lower contact.
- 3'3"-33'4" light yellowish brown, massive, pebbly silty fine sand; clasts rare, small (<.5 cm), sharp lower contact.

- 33'4"-35' light whitish brown, cross-laminated, well sorted, fine sand, gradational lower contact.
- 35-35'6" light yellowish brown, flat - cross-laminated, moderately well sorted, silty fine sand; slightly oxidized, partially cemented, sharp lower contact.
- 35'6"-36' light whitish grey, cross-laminated, well sorted, fine sand; grades into finer sand below.
- 36-36'6" light yellowish brown, flat - low angle cross-lamination, moderately well sorted, silty fine sand; slightly cemented, sharp lower contact.
- 36'6"-38' light whitish brown, cross-laminated, moderately well sorted, fine - medium sand; rare small (3-4 mm), rounded clast.
- 38-38'4" light greyish brown, faintly laminated, well sorted very fine sand; breaks into thin (.5 cm) layers, sharp lower contact.
- 38'4"-38'6" light yellowish brown, massive, poorly sorted, pebbly silty fine sand; clasts rare, small (<1 cm), subrounded - rounded, limestone, black shale, sharp lower contact.
- 38'6"-39' light yellowish brown, cross-laminated, silty very fine sand; slightly cemented, oxidized along bedding planes, sharp lower contact.
- 39-41'9" light brown, cross-laminated, loose, moderately well sorted, pebbly sand - medium/coarse sand; two fining up cycles, small clasts (<1 cm), rounded, at base of each cycle, sharp lower contacts.
- 41'9"-42'3" light yellowish brown, cross-laminated, well sorted, very fine sand; oxidized along bedding planes, sharp lower contact.
- 42'3"-42'5" light yellowish brown, massive - weakly stratified, poorly sorted, pebbly silty very fine sand; clasts rare, small, subrounded, limestone, slightly cemented, sharp lower contact.
- 42'5"-44' light yellowish brown - light brown, cross-laminated, moderately well sorted, fine - coarse sand; rare small clast (<.5 cm), sharp lower contact.
- 44-45' light yellowish brown - light greyish brown, cross-laminated, moderately well sorted, silty very fine sand; oxidized along bedding planes, sharp lower contact.
- 45-46'6" light whitish brown, cross-laminated, moderately well sorted, pebbly fine - coarse sand; rare pebble lense, clasts rounded, 2-5 mm, slightly cemented layers, sharp lower contact.
- 46'6"-47' light yellowish brown, cross-laminated - flat laminated, moderately well sorted, silty very fine sand; oxidized along bedding planes, sharp lower contact.

- 47-47'6" light yellowish brown - light whitish brown, flat - cross-laminated, coarsening up sequence, silty very fine sand to fine sand, rare small pebble at top, sharp lower contact.
- 47'6"-47'8" light whitish brown, cross-laminated, well sorted, fine sand; slightly cemented layer at bottom, sharp lower contact.
- 47'8"-48'3" light yellowish brown, cross-laminated, well sorted, fine sand; sharp lower contact.
- 48'3"-49' light greyish brown - light yellowish brown, interbedded, moderately well sorted, silty very fine sand and well sorted, fine sand; finer beds 1-2 cm thick, coarser beds .5 cm thick, sharp lower contact.
- 49-49'6" light yellowish - whitish brown, cross-laminated, well sorted, fine sand; texture fines slightly at bottom, sharp lower contact.
- 49'6"-50' light greyish brown, cross-laminated, silty very fine sand with thin (1-3 mm), fine sand interbeds, sharp lower contact.
- 50-51' light yellowish brown, cross-laminated, moderately well sorted, silty fine sand; slightly oxidized along bedding planes, sharp lower contact.
- 51-51'4" light brown, faintly laminated, moderately well sorted, silty very fine sand; sharp lower contact.
- 51'4"-52' light brown, massive - faintly cross-laminated, well sorted, fine sand; sharp lower contact.
- 52-52'2" light whitish brown, cross-laminated, well sorted, fine sand; sharp lower contact.
- 52'2"-52'5" light brown, cross-laminated, moderately well sorted, silty very fine sand; sharp lower contact.
- 52'5"-53' light whitish brown, cross-laminated, well sorted, medium sand; sharp lower contact.
- 53-53'3" light yellowish brown, oxidized, massive, sandy silt till; clasts common, small (<1 cm), black shale, limestone common, subangular. York Till.
- 53'3"-55' medium grey, massive - weakly stratified, sandy silt - silty sand till; clasts common, small (<2 cm), subangular - subrounded, limestone, black shale common, rare thin (1-2 mm) well sorted fine sand layer near bottom of unit. York Till.
- 55-55'3" light grey, massive, loose, well sorted, fine sand; sand layer within till.

5'3"-55'8" light - medium grey, flat laminated - slightly undulating, moderately well sorted, silty fine sand with thin (<1 mm) clayey silt lenses, sharp lower contact.

55'8"-56' light - medium grey, stratified - massive, silty sand till with thin well sorted fine sand layers/lenses; clasts common within till, small (<2 cm), subangular - subrounded, black shale, limestone, rare granite. York Till (drift).

end of hole - till material very hard.

## SUMMARY

1. The most complete sequence of stratigraphic units occurs in the immediate vicinity of the existing Woodbridge Cut.
2. The Illinoian age York Till was observed in all boreholes at depths ranging from 38' - 57' 6" below the ground surface. A complex of sand-gravel-till overlying the York Till was encountered in all holes.
3. The Early Wisconsinan Scarborough Formation appears to be restricted to the immediate vicinity of the Woodbridge Cut. The thickness and lithology of this unit varies greatly.
4. A peculiar greenish diamicton underlying the Scarborough Formation may in fact be a glacial till. This hypothesis needs further clarification.
5. The Early Wisconsinan Sunnybrook Till is thin and not laterally extensive.
6. A pre-Halton Till, Late Wisconsinan Till, unit was not positively identified.
7. A complex of gravelly sands, sands and silts underlying the Halton Till was identified in only borehole WB-90-01. This unit is not laterally extensive.
8. The Late Wisconsinan Halton Till caps the stratigraphic sequence in all boreholes.

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Ministry of Transportation  
Ministère des Transports

Regional Geotechnical Section  
Central Region  
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Telephone: (416) 235-5438

April 19, 1990

Mr. John L. Riley  
Regional Ecologist  
Central Region  
Ministry of Natural Resources  
820 Yonge Street South  
R.R. #2  
Aurora, Ontario  
L4G 3G8

Dear Sir:

Re: W.P. 88-78-02, Hwy. 407/Kipling Ave. Int.  
Woodbridge Cut, ANSI

This is in reference to your memo dated April 17, 1990 to Carolyn M. Southey of our Environmental Unit.

The Ministry would like to proceed immediately with trying to find a comparable deposit of York Till in the general area of the Kipling/407 Interchange.

At a meeting held on April 18, 1990 between Geotechnical Section and Foundation Section, it was decided that we would prefer to work with the Ontario Geological Survey.

Foundation Section is currently on site investigating the foundations for high mast lighting and is prepared to provide the appropriate drilling rig, equipment etcetera, to carry out the investigation.

We would expect the representative of the Ontario Geological Survey to play a supervisory/interpretative role in the investigation. Geotechnical Section can assist as required.



- 2 -

Please contact Mr. Dave Dundas, Senior Foundation Engineer, Foundation Section, M.T.O. at 235-3731 to set up the investigation.

If you require any additional information, please contact Mr. Karan Ganesh at 235-5434.

Yours truly,



G. Cautillo, P. Eng.  
Head, Geotechnical Section

GC/rb

c.c. C. Southey  
D. Dundas  
D. Soloman

# memorandum



To: Distribution Date: 1990 04 20

From: Foundation Design Section  
Room 315, Central Building

RE: Minutes of Meeting  
Highway 407/Kipling Avenue Interchange  
W.P. 88-78-02, District 6

Held: April 18, 1990, 3:00 p.m.  
Foundation Design Section

Purpose: To clarify the concerns of MNR with respect to the exposed face of the York Till and to identify the course of action in determining the possibility of exposing an alternate face.

Attendance: G. Cautillo - Central Region, Geotechnical Section  
K. Ganesh - " " " "  
M. Devata - Foundation Design Section  
D. Dundas - " " "  
B. Bennett - " " "

- G. Cautillo explained briefly the situation involving MNR
- the CN Railway, when constructing their line just north of Steeles, exposed a rare face of the York Till stratigraphy in a cut section they created
- since that time, it has been declared nationally as a landform to be preserved for the study of Canadian geology
- the proposed configuration of the Highway 407/Kipling Interchange would result in the obliteration of this feature
- J. Reilly, of the MNR, proposed three options to the MTO that would satisfactorily preserve the exposed York Till
- in brief this would involve either,
  1. redesigning the Hwy. 407/Kipling Ave. I.C.
  2. shifting the proposed Kipling Avenue alignment eastward or,
  3. exposing the York Till at an alternate location
- of the three options provided, the third was considered to be most feasible and practical by the MTO
- the Geotechnical Section, with the help of the Foundation Design Section, was assigned the task of co-ordinating with the MNR to locate this alternate face of York Till

- since the Foundation Design Section is presently conducting a field investigation at the proposed high mast lighting pole locations, it was suggested by the Planning and Design Section to have an MNR representative on site while a borehole was being advanced at the P-9 pole location situated in the N-E Ramp loop, to identify the possible presence of the York Till
- in response, the MNR stipulated that the boring would require continuous sampling and that a qualified geologist be on hand to retrieve and identify the samples.
- D. Dundas asked if either the MTO or MNR had looked into using aerial photography to distinguish similar topographic features at possible alternate locations
- as well, it was suggested that perhaps the borehole advanced at HML pole P-9 was not ideally situated as a possible alternate location for an exposed cut face
- G. Cautillo remarked that it would be more practical to advance a series of boreholes along the proposed Martingrove Road Extension to the east and west of the Rainbow Creek Valley where a deep cut is proposed

M. Devata suggested that since the type of investigation that MNR wishes to conduct is beyond the scope of the routine investigations carried out by the Foundation Design Section, the MNR could have access to the hired drill rig for their investigation following completion of the HML project

- M. Devata offered to have the drilling services provided to the MNR charged to the F.D.S. cost centre
- the one stipulation attached to this proposal was the assurance that the MNR provide the personnel qualified to supervise the fieldwork, interpret the results and draw their conclusions
- the Geotechnical Section agreed to forward a memo to MNR with the joint proposal
- the Geotechnical Section was advised that the drilling rig would be on site until April 30, 1990.

BB/jb  
cc: Attendees

*B. Bennett*  
B. Bennett, P. Eng.  
Foundation Engineer

memo

To: File

Date: 90 04 18

Re: WP 88-78-02(c)

Kipling /407

York Till preservation

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On 90 04 18 we had a meeting with Guy Canillo, Karen Connel, Betty Bennett Murty Denton and D. Dundas attending.

It was agreed that the Foundation Design Section would make a drill available on or after April 30 for the purpose of exploring for another York Till deposit. The existing exposed York Till here will be excavated during the proposed construction unless it is protected by retaining structures.

Karen will write MNR and MNR will instruct D. Dundas to coordinate drill. MNR will supply manpower to search for York Till.

Subsequently Don Solomon of P&Y became involved. At meeting on 90 04 16 with M. Denton, D. Dundas, K. Connel and D. Solomon it was agreed that FDS would report to General on this assignment and we would proceed as previously agreed.

D. Dundas  
Sr. Foundation Eng.