FOUNDATION REPORT

on

Hwy.401 and Creek Crossing 4 miles west of Rodney

Con.VI, Twp. of Aldborough

Pl.No. - F-3531-6
Pr.No. - F-3531-2

Distribution

Mr. A. Toye
Bridge Engineer (2)

Mr. H. Tregaskes
Construction Engineer (1)

Mr. D.G. Ramsey
Design Engineer (1)

Mr. W.L. Fraser
District Engineer, London (1)

Mr. [illegible] Watt
Water Resources Commission (1)

Dr. P. Karrow
Department of Mines (1)

Foundation Section (1)

File (1)

W.P.
W.J. F-58-44

INTRODUCTION

An investigation has been carried out to determine the competence of the subsoil layers for supporting the foundations of the proposed structure located some 4 miles west of Rodney where Hwy.No.401 Line 'A' crosses a creek in Con.VI, township of Aldborough.

A study of the plan (No.P-3531-6) and profile (No.P-3531-2) indicates that a diversion or channelisation of the creek at the site appears to be necessary. At the time of the investigation information regarding corrective measures of the creek was not available. The following report, therefore deals with subsoil conditions for a structure contemplated at approximately station 536+50 only.

The field work commenced on November 27, 1958 and was completed on December 5, 1958.

DESCRIPTION OF THE SITE AND GEOLOGY

Physiographically the site under consideration is located on the Bothwell Sand Plain, which is the delta of the Thames River in glacial Lake Warren. A shallow surface layer of sand overlies the lacustrine clay in this area. The topography is generally level with occasional knolls and ridges of sand and gravel. Most of the land at and near the site is in pasture or woods indicating a region of low-grade soil. Poor drainage is expected due to the slow percolation through the clay below the sandy surface. At this site the subsoil profile consists of a veneer of sand and reworked glacial deposits of silts and clays overlying the stiff clay stratum which according to available geological information extends to a considerable depth over bedrock.

DESCRIPTION OF FIELD & LABORATORY WORK

Field work consisted of three sampled boreholes, carried out by a skid-mounted coredrill machine adapted for soil sampling. Boreholes were advanced by the conventional wash boring procedure and samples were recovered at depth intervals of five feet. In the cohesive material encountered relatively undisturbed 2 inch I.D. thin walled shelby tube samplers were used. In the granular material, samples were recovered by means of a 2 inch O.D. split barrelled sampling spoon. The driving energy used and dimensions of this split spoon sampler conforms to the requirements of the Standard Penetration Tests. In addition, a dynamic cone penetration profile was obtained adjacent to each sampled borehole.

Upon receipt in the laboratory, samples were visually examined and classified. Routine index tests were performed on selected representative samples. The results of laboratory tests are shown in the borehole logs and in details in tabular form.

The location plan and subsoil profiles are presented in Drawing No. F-58-44-A.

SUBSOIL CONDITIONS

Reference to the borehole profiles show that uniform subsoil conditions exist at the site. The stratigraphy is composed of a stratum of homogeneous stiff silty clay overlain by a thin layer of sand or clay silt of glacial origin.

On the east side of the contemplated crossing (approximately Sta. 536+50) in boring One, the topsoil is underlain by a layer of stiff brown sandy clay silt, which extends from elevations 683.2 to 678.7. Underlying this layer of sandy clay silt is the stiff silty clay stratum, which commences at elevation 678.7 and

extends to elevation 648.7 where the borehole terminated. It is known from available geological information, that this clay stratum continues below elevation 678.7 to a considerable depth over bedrock. The upper sone of the stiff clay stratum from elevation 678.7 to 675.2 has been subjected to oxidation, resulting in its present brownish color. Below the oxidized zone the color is predominatly grey. Some 10% of fine to medium gravel in the stiff silty clay throughout the depth of boring appeared ev ent. Similar stratifications were encountered in borings two and three except that the stiff grey silty clay stratum commenced at elevations 680 and 679.2 in borings two and three respectively. In boring two a layer of sand with coarse gravel was encountered between elevations 683 and 680 underlying the topsoil and overlying the stiff grey silty clay, and in boring three the oxidized clay layer was between elevations 682.2 and 679.2 and no layer of sand or clay silt was encountered.

In general the stiff clay contains about 25% silt and 10% fine to medium gravel in it. It has an averaged unit weight of 133.5 p.c.f averaged moisture content of 17% and atterberg limits of 30% for liquid limit and 15.6% for plastic limit. The results of laboratory strength tests show an average value of 2800 p.c.f. to be representative for the upper 20 feet of the stratum. The results of laboratory and field tests have been summarized and included on table No.1 in this report. Judging from its moisture contents and atterberg limits the stiff clay appears to be fully saturated and heavily consolidated.

WATER CONDITIONS

From visual observation it was seen that the water level at the site was at or close to the normal creek elevation. Water levels in the boreholes were recorded during the time of boring

and they confirmed that the water level was at approximately elevation 678, which corresponds to the normal water level of the creek.

FOUNDATION SUPPORT

Spread footing support for a bridge or culvert structure can be obtained at elevation 677 or below. At this elevation or below laboratory shear strength measurements and field penetration resistance are such that an allowable bearing capacity of at least 3 t.s.f. can be provided by the stiff clay. This safe allowable bearing pressure incorporates a safety factor of three. Settlements consequent upon application of this bearing pressure will be within tolerable limits. The final depth at which footings should be founded will be controlled by the depth of the creek diversion channel. Consideration must be given to founding footings at a below stream bed elevation.

No excessive seepage problems with respect to shallow footing excavations are anticipated since the water table is at or close to the top of the stiff clay stratum which is of very low permeability.

The subsoil is competent to support the proposed embankment loadings.

CONCLUSIONS AND RECOMMENDATIONS

From the foregoing discussion it follows that:

1. The stratigraphy of the site is composed of a stratum of homogeneous stiff silty clay, the upper three or four feet of which was oxidized, overlain by a layer of sand or sandy clay silt of glacial origin.

2. Subsoil conditions are such that an allowable bearing capacity of at least 3 t.s.f. can be provided by the stiff clay for spread footing support at elevation 677 or below. Settlements consequent upon application of this load will be within tolerable limits. Footings should be placed below the proposed creek realignment channel bottom.

3. No excessive seepage problems with respect to shallow footing excavations are anticipated.

4. The subsoil is competent to support the proposed embankment loadings.

A. Loh
Foundation Engineer

AL/JM

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB F58-44

W.P.

HOLE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S1	5-7	Stiff brown sandy clay silt	18						
1	T2	10-12	Stiff grey silty clay	29	17.3	14.2	28.5	2600	133.2	approximately 10%
1	T3	15-17	Stiff grey silty clay	36	15.1	14.6	29.2	4320	134.0	fine to medium
1	T4	20-22	Stiff grey silty clay	34	18.4	14.0	29.1	1585	134.0	gravel throughout
1	S5	25-26½	Stiff grey silty clay	32						
1	S6	30-31½	Stiff grey silty clay	34						
1	S7	34-35½	Stiff grey silty clay	27						
2	T1	5-7	Stiff grey silty clay	25	17.5	16.4	31.0	2660	133.0	approximately 10%
2	T2	10-12	Stiff grey silty clay	36	17.4			3310	132.0	fine to medium
2	T3	15-17	Stiff grey silty clay	39	17.9			2660	131.5	gravel throughout
2	T4	20-22	Stiff grey silty clay	37						
2	S5	25-26½	Stiff grey silty clay	25						
2	S6	30-31½	Stiff grey silty clay	32						
2	S7	34-35½	Stiff grey silty clay	34						
3	T1	5-7	Stiff grey silty clay	27	16.8	16.9	30.6	3030	135.5	approximately 10%
3	T2	10-12	Stiff grey silty clay	40	17.1			3840	133.5	fine to medium
3	T3	15-17	Stiff grey silty clay	44	16.9	17.5	31.0	2910	135.0	gravel throughout
3	S4	19-20½	Stiff grey silty clay	34						
3	S5	25-26½	Stiff grey silty clay	38						
3	S6	30-31½	Stiff grey silty clay	36						
3	S7	34-35½	Stiff grey silty clay	34						

S1 denotes split spoon sample
T1 denotes thin walled shelby sample

DEPARTMENT OF HIGHWAYS – ONTARIO

MATERIALS & RESEARCH BRANCH – FOUNDATIONS SECTION – DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENETN JOB F-58-44 W.P. BORING 1 STA. 535+75 (41' RT

CASING Bx & Ax (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 27 NOV. 1958

ABBREVIATIONS

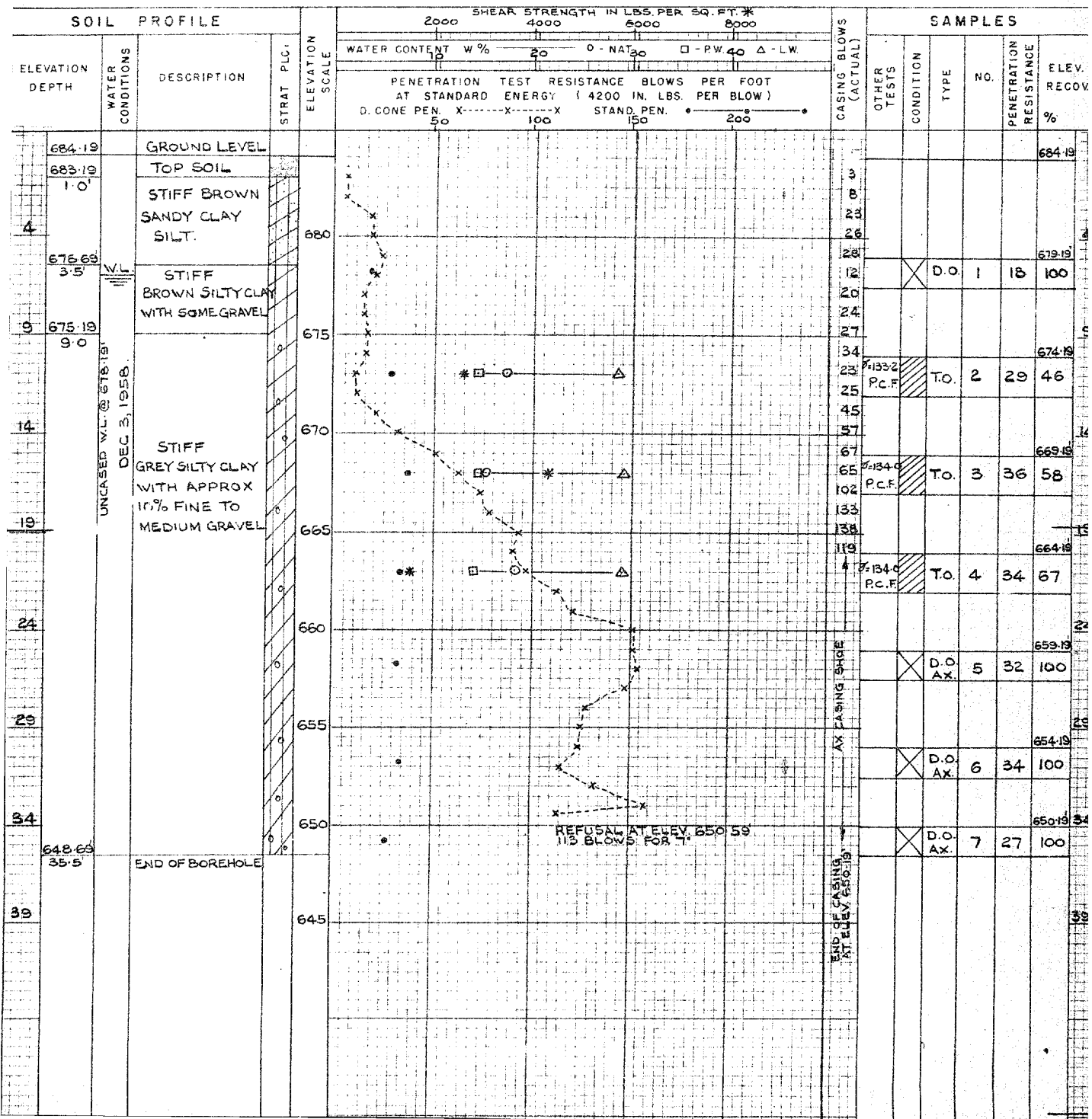
V - INSITU VANE SHEAR TEST; Q - TRIAXIAL QUICK; K - PERMIABILITY
M - MECHANICAL ANALYSIS; S - TRIAXIAL SLOW; C - CONSOLIDATION
U - UNCONFINED COMPRESSION; WL - WATER LEVEL IN CASING; CA. - CASING
Q_C TRIAXIAL CONSOLIDATED QUICK; WT. - WATER TABLE IN SOIL; γ - UNIT WEIGHT

SAMPLE TYPES

C.S. - CHUNK; S.S. - SLEEVE SAMPLE
D.O. - DRIVE OPEN; P.S. - PISTON SAMPLE
D.F. - DRIVE FOOT VALVE; W.S. - WASHED SAMPLE
T.O. - THIN WALLED OPEN; R.C. - ROCK CORE

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F.58-44 W.P. BORING 2 STA. 536+69 ℄

CASING Bx & Ax (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 1 DEC. 1958

ABBREVIATIONS

V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Q_c - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
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SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SHEAR STRENGTH IN LBS. PER SQ FT. * (2000, 4000, 6000, 8000)

WATER CONTENT W % (10, 20, 30, 40) O - NAT. □ - P.W. Δ - L.W.

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)

D. CONE PEN. X------X------X (50, 100, 150) STAND. PEN. •——•——• (200)

ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	CASING BLOWS (ACTUAL)	OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV. %
683.97'		GROUND LEVEL									683.97'
682.97' 1.0'		TOP SOIL									
4 679.97' 4.0'		SAND WITH COARSE GRAVEL		680	2 4 2 3						678.97'
	W.L. CASED WL @ 676.97' ON DEC. 3/58				5 7 10 12 20	Ø=133.0 P.C.F.		T.O.	1	25	71
9				675	34 41 68	Ø=132.2 P.C.F.		T.O.	2	36	673.97' 58
14		STIFF GREY SILTY CLAY WITH APPROX 10% FINE TO MEDIUM GRAVEL		670	86 86 94						668.97' 14
					56 106 147	Ø=131.5 P.C.F.		T.O.	3	39	75
19				665	181 162						663.97' 19
								T.O.	4	37	56
24				660							658.97' 24
								D.O. Ax	5	25	100
29				655							653.97' 29
								D.O Ax	6	32	100
34				650							648.97' 34
								D.O. Ax	7	34	100
648.47' 35.5'		END OF BOREHOLE									
39				645							39

REFUSAL AT ELEV. 665.37' 113 BLOWS FOR .7'

Ax CASING SHOE

END OF CASING AT ELEV. 648.97'

FORM OB-ML-126

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-58-44 W.P. BORING 3 STA. 536+87 (63' LT.)

CASING BX & AX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 3 DEC. 1958

ABBREVIATIONS

V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
D_C - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
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WL - WATER LEVEL IN CASING
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W.S. - WASHED SAMPLE
R.C. - ROCK CORE

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

ELEVATION / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT
683.15'		GROUND LEVEL	
682.15' / 1.0'		TOP SOIL	
		STIFF BROWN SILTY CLAY SOME GRAVEL	
679.15' / 4.0'	W.L.		
	CASED W.L. @ 678.15' DEC. 3, 1958		
		STIFF GREY SILTY CLAY APPROX 10% FINE TO MED. GRAVEL THROUGHOUT.	
647.65' / 35.5'		END OF BOREHOLE	

SHEAR STRENGTH IN LBS. PER SQ. FT. * 2000 4000 6000 8000

WATER CONTENT W % 10 20 30 40 ○ - NAT. □ - P.W. △ - L.W.

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS PER BLOW)

D. CONE PEN. X------X------X STAND. PEN. • 50 100 150 200

ELEVATION SCALE: 680, 675, 670, 665, 660, 655, 650, 645

REFUSAL AT ELEV 667.55' 113 BLOWS

AX CASING SHOE

END OF CASING AT ELEV 649.15

CASING BLOWS (ACTUAL): 2 4 7 16 11 16 24 31 45 56 83 123 135 145

SAMPLES

OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV. %
					683.15'
γ=135.5 P.C.F.		T.O.	1	27	46
					678.15'
γ=133.5 P.C.F.		T.O.	2	40	56
					673.15'
γ=135.0 P.C.F.		T.O.	3	44	67
					668.15'
		D.O. AX	4	34	100
					663.15'
		D.O. AX	5	38	100
					658.15'
		D.O. AX	6	36	100
					653.15'
		D.O. AX	7	34	100
					649.15'

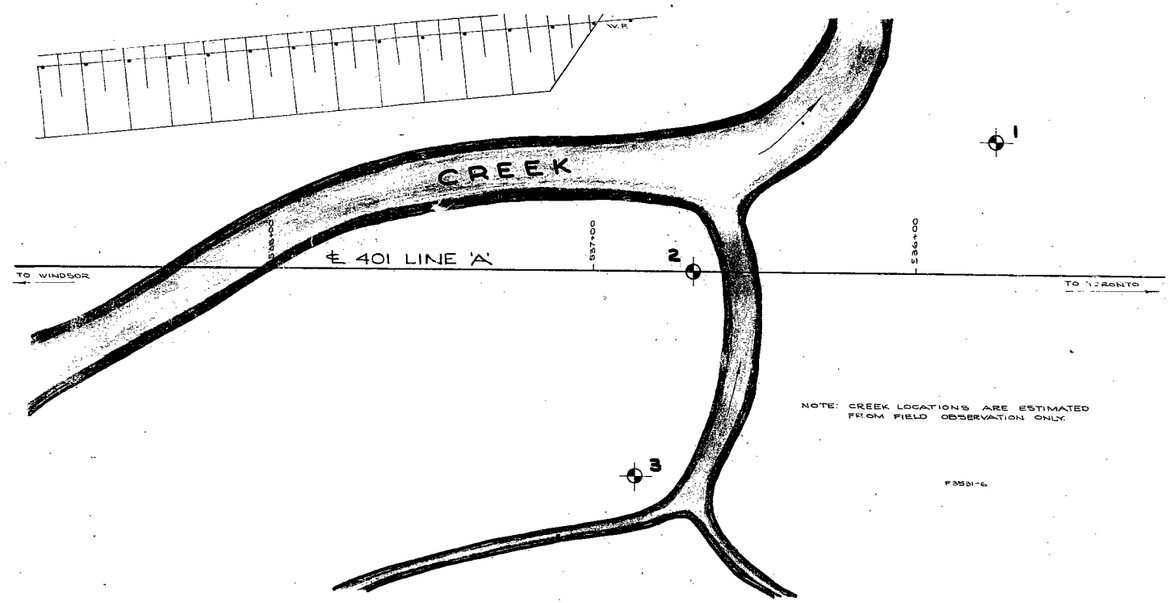
#58-F-44

HWY #401 & CREEK

CROSSING 4 MI.

W. OF RODNEY

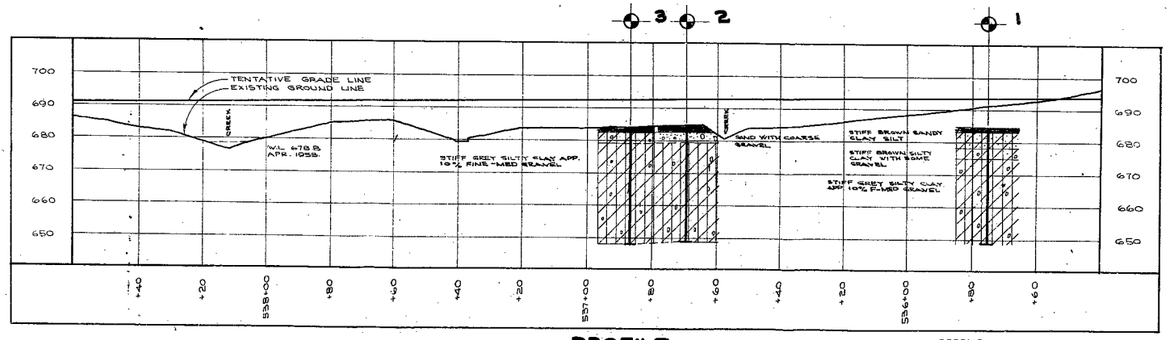
CON VI.



PLAN

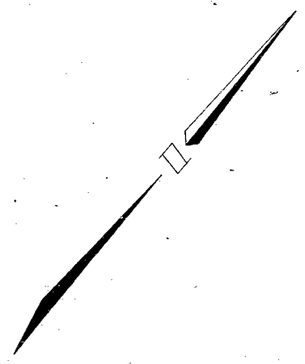
NOTE: CREEK LOCATIONS ARE ESTIMATED FROM FIELD OBSERVATION ONLY.

F3531-6



PROFILE

F 3531-2
401-6-14



LEGEND

BORE HOLE

PENETRATION HOLE

BORE & PENETRATION HOLE

HOLE NO.	ELEVATION	STATION	DISTANCE FROM ℄
1	684.19'	555+75	41' RT.
2	683.97'	536+69	℄
3	683.15'	534+87	63' LT.

— NOTE —

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

PROPOSED CROSSING OF CREEK

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY. 401 DISTRICT 2 COUNTY ELGIN
TOWNSHIP SOUTH DORCHESTER LOT C CON. VI
LOCATION 3½ MI. W. OF RODNEY

DRAWN BY T.MELLORS	CHECKED BY:	W.P.
DATE FEB 27/59	APPROVED BY:	DRAWING NO. F58-44A
SCALE 1" = 20'		