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DIST. 4 REGION

W.P. No. 2509-75-02

CONT. No. 83-404

W. O. No.

STR. SITE No.

HWY. No. Q.E.W.

LOCATION Oakville South Truck
Inspection Station

No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 2509-75-02

DIST 4

HWY Q.E.W.

STR SITE

Oakville South Truck
Inspection Station

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FOUNDATION INVESTIGATION REPORT
For
Oakville South Truck
Inspection Station
W.P. 2509-75-02
Q.E.W.-Eastbound Between 3rd & 4th Line
District 4, Hamilton

INTRODUCTION

This report contains the results of a foundation investigation program carried out at the above mentioned location. The fieldwork was performed on 80-05-01, utilizing an auger machine equipped with solid stem continuous flight augers. The fieldwork consisted of three sample boreholes, with boring depth ranging to 19.7 feet. Bedrock was penetrated in all borings for a maximum thickness of 17.7 feet.

DESCRIPTION OF SITE AND GEOLOGY

The site is located along the Q.E.W. south service road approximately 300 feet east of the existing north truck inspection station, within the Town of Oakville, Regional Municipality of Halton.

The topography of the area is generally flat, with a shallow gradient to the lake. Rivers in the area have cut deeply into the underlying shale resulting in steep valley-walls.

Physiographically, the site is located within the South Slope Region which is characterized in this area by a thin veneer of red shale-derived till overlying the reddish Queenston shale.

SUBSURFACE CONDITIONS

Underlying approximately 2 feet of granular roadway fill and overlying bedrock is a thin veneer of red silty clay with a trace of sand and gravel. This glacial till deposit was encountered

for depths of 2.0 to 4.5 feet and contained occasional weathered shale partings. Standard Penetration Test 'N' values ranging from 4 to 14 blows per foot indicating a consistency for this deposit ranging from firm to stiff.

Bedrock was encountered in all borings at depths ranging from 2.0 to 6.5 feet corresponding to elevations of 354.0 to 353.5 respectively. Bedrock is described as a highly weathered, red, soft shale with occasional greenish grey shale layers. The boundaries between the various soil types are shown on the attached Record of Borehole Sheets. The locations and elevations of the borings, along with an estimated stratigraphical profile based on borehole data, are shown on Drawing No. 25097502-A.

GROUNDWATER

Subartesian groundwater conditions were encountered across the site with groundwater being encountered with the shale at depths of 10.5 and 12.5 feet corresponding to elevations of 349.5 and 347.5. Water levels then rose within the boreholes and stabilized after 4 hours at a depth of 4 feet corresponding to elevation 356, indicating a maximum subartesian head of 8.5 feet.

DISCUSSION AND RECOMMENDATIONS

Present planning calls for the construction of a second truck inspection station in Oakville for eastbound traffic along the Q.E.W. The proposed weigh scale arrangement consists of an approximate 20x30 foot masonry building with basement and a 100x12 foot scale pit. No significant grade changes above the existing south service road profile are anticipated. According to design requirements for acceptable operation of the weighing mechanism, the scale pit and approach slabs must remain flush after construction.

In view of the uniform conditions underlying the site and the shallow depth to bedrock, our recommendations regarding the foundation for the truck inspection building and scale pit are as follows:

Structure Foundations

Based on design considerations the base of the weigh scale and inspection building basement will be located about 10 feet below the proposed profile grade. It is recommended that for the spread footings of the building and the raft footing for the base of the scale pit located at or below elevation 352, a bearing capacity of 5 t.s.f. may be used for design purposes.

Settlement in the scale pit area will be negligible since the foundation will be located well within the shale bedrock, and the net loading on the shale will be low since the weight of the scale structure will be compensated by the weight of the excavated soil and shale displaced by the structure.

To ensure uniform performance of the weigh scale and approach slab areas, it is recommended that the granular base for the approach slabs extend down to shale bedrock at elevation 353. Well-compacted Granular 'C' material will be suitable for the granular base material under the approach slabs and behind the scale pit walls.

Construction Considerations

In consideration of the rapid weathering characteristics of the shale upon exposure to air and water, it is recommended that the shale at the base of the foundation excavation be protected with a thin coat of low strength concrete upon exposure to the elements.

For excavations carried out below elevation 350, subartesian conditions will require the installation of a positive dewatering scheme to prevent water flow into the excavation.

MISCELLANEOUS

The fieldwork for this foundation investigation report was carried out under the supervision of Mr. T.J. Kazmierowski, Project Foundations Engineer, using equipment rented from Master Soil Investigation Ltd., Toronto.

This report was prepared by Mr. T.J. Kazmierowski and reviewed by Mr. K. Selby, Supervising Engineer.



A handwritten signature in black ink, appearing to read 'T.J. Kazmierowski', written in a cursive style.

T.J. Kazmierowski, P. Eng.
Project Foundations Engineer

A handwritten signature in black ink, appearing to read 'K. Selby', written in a cursive style.

K. Selby, P. Eng.
Senior Foundations Engineer

May 16, 1980

RECORD OF BOREHOLE No 1

W P 2509-75-02 LOCATION Co-ords. N 15 782 530; E 943 405 ORIGINATED BY TJK
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Solid Continuous Flight Augers COMPILED BY TJK
 DATUM Geodetic DATE May 1, 1980 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES			20	40	60	80	100					
360.0	Pavement Shoulder																GR SA SI CL
0.0	Granular Fill																
2.0	Red Silty Clay trace Sand and Gravel, Occ. Weathered Shale		1	SS	4												
355.0	Partings Firm																
5.0	Red		2	SS	34												
	Highly Weathered		3	SS	105/	9"											
	Soft		4	SS	50/	1"											
	Shale With Occ.		5	SS	100/	4"											
	Greenish Grey Shale Layers		6	SS	100/	5"											
			7	SS	100/	1"											
340.4			8	SS	100/	1"											
19.6	End of Borehole																
	Note: Stabilized water levels after 4 hours.																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 2

W P 2509-75-02 LOCATION Co-ords. N 15 782 464; E 943 352 ORIGINATED BY TJK
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Solid Continuous Flight Augers COMPILED BY TJK
 DATUM Geodetic DATE May 1, 1980 CHECKED BY _____

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
360.0	Pavement Shoulder															
0.0	Granular Fill															
358.0																
2.0	Red Silty Clay		1	SS	8											
	Trace Sand and Gravel															
	Occ. Weathered Shale		2	SS	14											
353.5	Partings Stiff															
6.5	Red		3	SS	1127	6"										
	Highly Weathered															
	Soft		4	SS	1007	4"										
	Shale with Occ.		5	SS	857	6"										
	Greenish Grey Shale		6	SS	1007	5"										
	Layers		7	SS	1007	1"										
340.4			8	SS	1007	2"										
19.6	End of Borehole															
	Note: Stabilized water levels after 4 hours.															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to
Sensitivity

20
15 \div 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 3

W P 2509-75-02 LOCATION Co-ords. N 15 782 470; E 943 410 ORIGINATED BY TJK
 DIST 4 HWY Q.E.W. BOREHOLE TYPE Solid Continuous Flight Augers COMPILED BY TJK
 DATUM Geodetic DATE May 1, 1980 CHECKED BY _____

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION {%}
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20					
356.0	Ground Surface												GR SA SI CL
0.0	Ditch Line Red Silty Clay Trace Sand & Gravel												
354.0													
2.0	Red		1	SS	28								
	Highly Weathered		2	SS	100/	4"							
	Soft												
	Shale with occasional		3	SS	100/	3"	350						
	Greenish Grey Shale		4	SS	100/	2"							
	Layers		5	SS	100/	3"							
			6	SS	100/	2"							
			7	SS	100/	2"	340						
336.3			8	SS	100/	3"							
19.7	End of Borehole												
	Note: Stabilized Water Levels Not Obtained.												

OFFICE REPORT ON SOIL EXPLORATION

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS N_c .

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON "A" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH AS FOLLOWS:

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF SPT 'N' VALUES AS FOLLOWS:

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS & SYMBOLS




LABORATORY TESTING

TRIAxIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG. $\bar{C}IU$ = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

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

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_o COEFFICIENT OF EARTH PRESSURE AT REST
 k_A COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_P COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE 
 w SLOPE ANGLE-BACKFACE OF WALL 
 β ANGLE OF SLOPE 
 N_q, N_c, N_{γ} BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_o INITIAL VOIDS RATIO
 e_{max} e IN LOOSEST STATE
 e_{min} e IN DENSEST STATE
 D_r RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
 n POROSITY
 w WATER CONTENT
 w_L LIQUID LIMIT
 w_p PLASTIC LIMIT
 w_s SHRINKAGE LIMIT
 I_p PLASTICITY INDEX = $w_L - w_p$
 I_L LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
 A_c ACTIVITY = $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu\text{m Soil Fraction}}$
 Om ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_R RESIDUAL SHEAR STRENGTH
 c COHESION INTERCEPT
 $\sigma_1, \sigma_2, \sigma_3$ NORMAL PRINCIPAL STRESSES
 u PORE WATER PRESSURE
 u_e EXCESS u
 r_u PORE PRESSURE RATIO
 q_u UNCONFINED COMPRESSIVE STRENGTH
 s_u UNDRAINED SHEAR STRENGTH
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR DEFORMATION
 k_s MODULUS OF SUBGRADE REACTION
 m, n STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS

HYDRAULIC TERMS

h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 m_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT OF CONSOLIDATION
 C_c COMPRESSION INDEX
 C_r RECOMPRESSION INDEX
 d DRAINAGE PATH DISTANCE
 T_v TIME FACTOR
 U DEGREE OF CONSOLIDATION
 O_r OVERCONSOLIDATION RATIO (OCR)

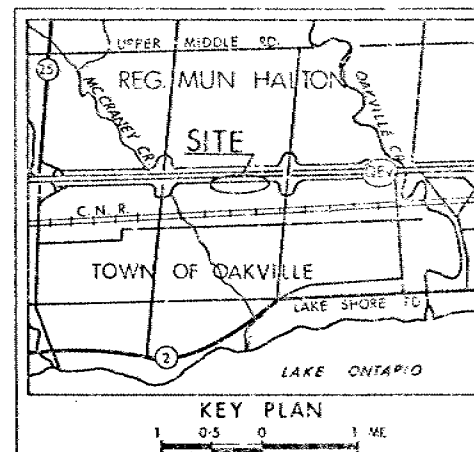
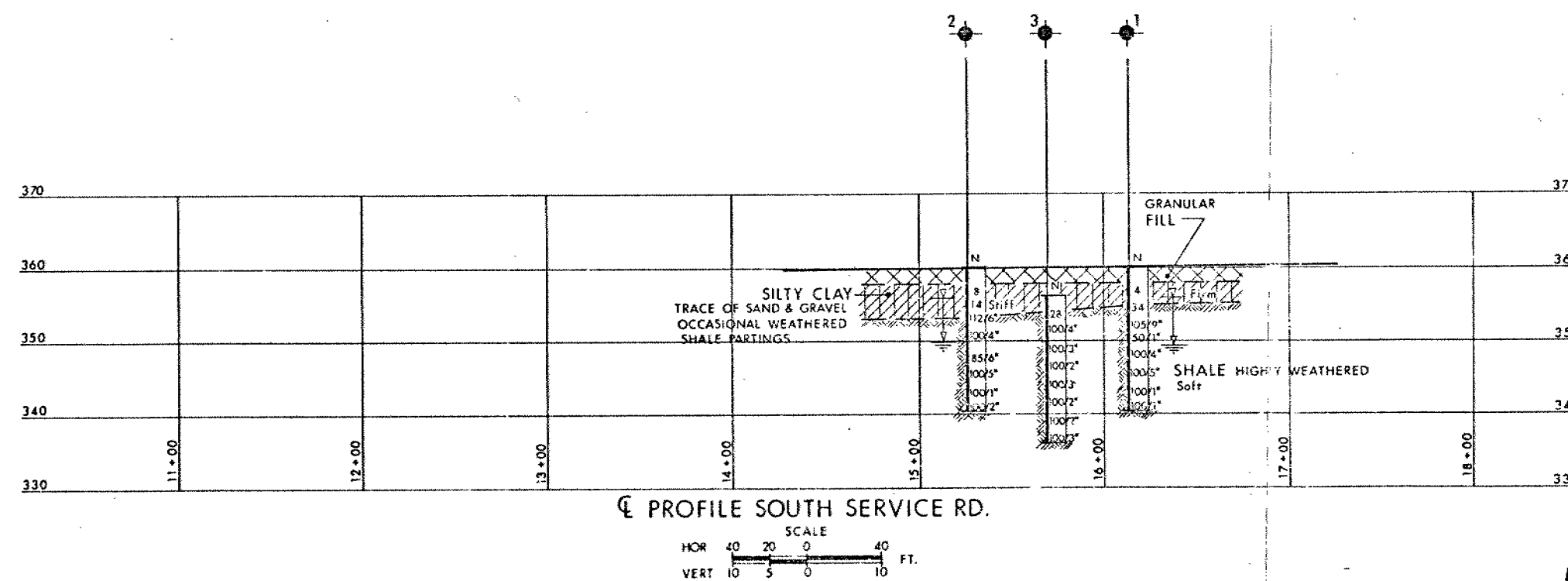
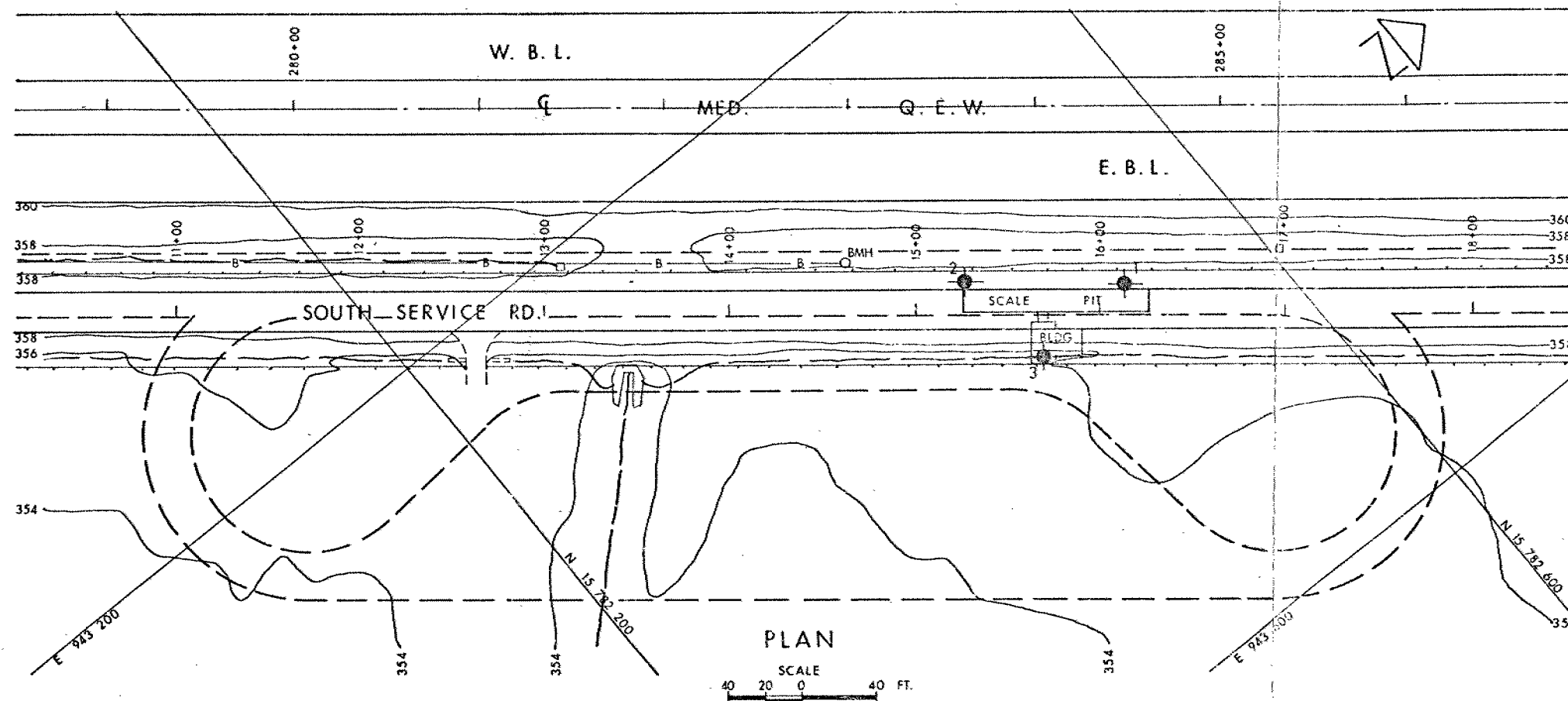
NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS

CONT No
WP No 2509-75-02

Q.E.W. OAKVILLE SOUTH
TRUCK INSPECTION STATION
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350ft lbs energy)
- CONE Blows/ft (60° Cone, 350ft lbs energy)
- W.L. at time of investigation 80 05 01
- Head
- Subsidence Condition Encountered

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	360.0	15 782 530	943 405
2	360.0	15 782 464	943 352
3	356.0	15 782 470	943 410

-NOTE-

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore holes the boundaries are assumed from geological evidence.

GEOCRE No 30MS-121

REVISIONS	DATE	BY	DESCRIPTION

HWY No QEW
SUBMITTAL CHECKED DATE 80 05 15
DRAWING CHECKED

