

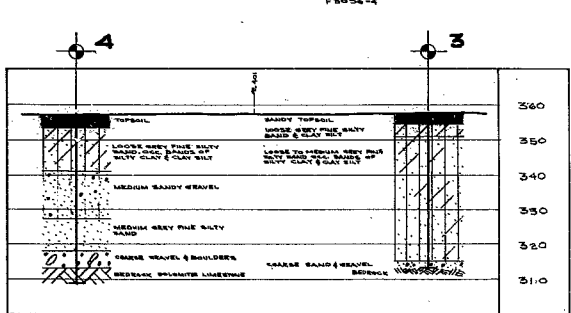
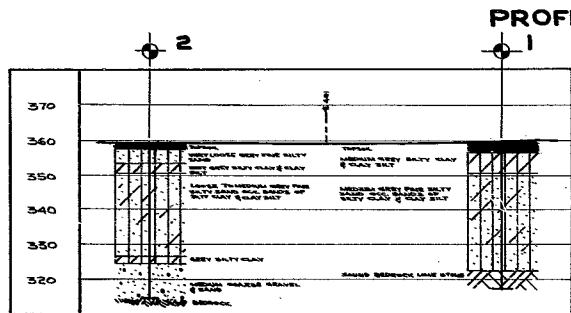
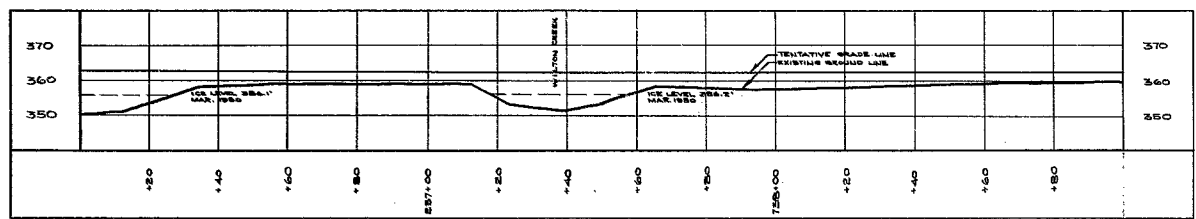
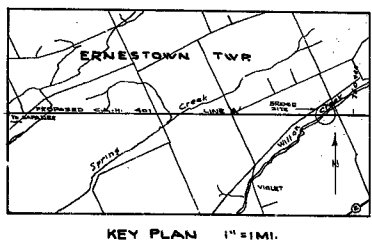
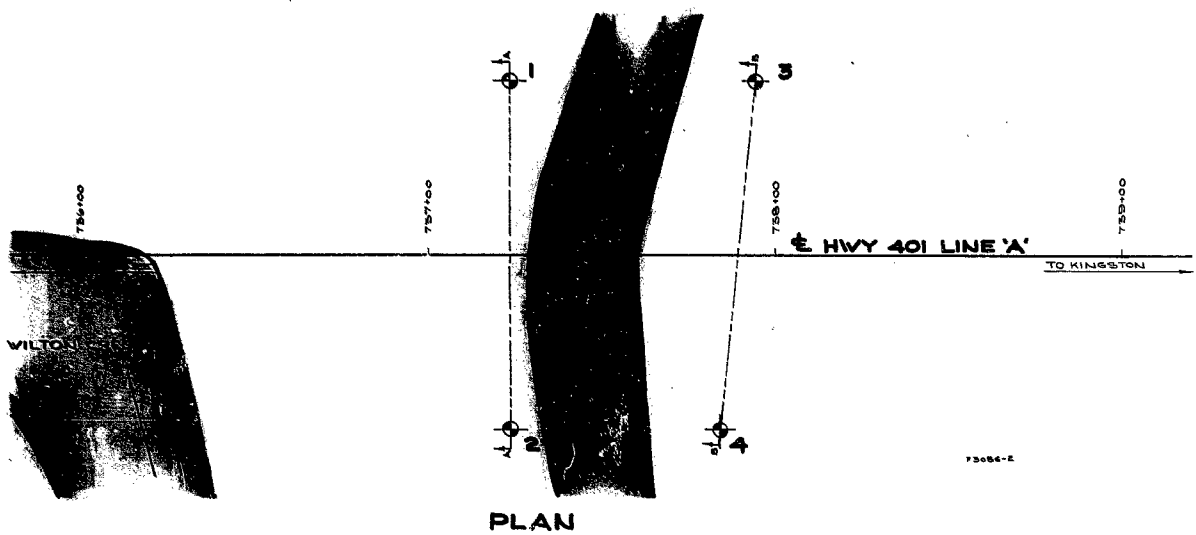
W.P. 35-59

HWY. 401

& WILTON

CREEK

31C-59



LEGEND			
BORE HOLE			
PENETRATION HOLE			
BORE & PENETRATION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM E.
1	359.4'	757+25	50' LT.
2	359.5'	757+25	50' RT.
3	358.5'	757+94	50' LT.
4	357.4'	757+94	50' RT.

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

**WILTON CREEK DIVERSION
PROPOSED CROSSING**

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY. 401 DISTRICT 10 COUNTY LAMBTON & ADAMSTOWN
TOWNSHIP ERNESTOWN LOT 20 CON. 1

LOCATION ASSEMBLY OF MAPS

DRAWN BY: T. MELLORGE CHECKED BY: W.P. 35-59
DATE: 26 MAY 1959 APPROVED BY: F59-23A
SCALE: 1" = 20' DRAWING NO. 310-59
GEOGRAPHIC No.

25-60-219

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Section.
Attention: Mr. S. McCombie.

June 22, 1959.

Re: FOUNDATION REPORT -

Hwy. 401 Line 'A' & Wilton Creek Diversion
Crossing,
Approximately 6 Miles N.E. of Napanee,
Lot 20, Con. V, Twp. of Ernestown.

Submitted herewith is our report on the foundation investigation recently completed at the above noted structure location. The field work consisted of four sampled borings, supplemented by dynamic cone penetration tests. Limestone bedrock was cored at each borehole location.

For your convenience, the principal comments arising out of our study of the subsoil conditions at this site, are as follows:-

- (1) The stratigraphy consists of a shallow alluvial deposit of silt and sandy clay, underlain by a water-bearing stratum of fine silty sand. Limestone bedrock was encountered at elevations varying from 322' to 313', which correspond to depths below existing ground surface, of 18' and 45', respectively.
- (2) The strength and compressibility characteristics of the upper layers of alluvial material are such that spread footing support is not recommended. End-bearing "H" piles founded directly upon the limestone bedrock, are recommended. Typical pile length will be of the order of 40 ft.

cc'd. /c ...

Recommendations: (cont'd.) ...

- (3) Pile cut-off elevation should not be lower than elevation 364' - this limitation is set to guard against the possibility of piping of the silty sand material found to be under artesian conditions. If this placement depth is not considered adequate to provide against stream erosion and scour, sheet pile protection should be used.
- (4) Observations on the high water level of the creek during the time of investigation, indicated a flood elevation of 361'. The tentative grade line shown on the available profiles, is at approximately elevation 362'. In view of the high water level noted, it appears necessary that a grade raise of the order of four feet is required at this structure location.
- (5) No problems, with respect to approach fill instability, appear evident. The topsoil layer should be stripped prior to placing fill material, and back slopes on the upstream face should be protected by rip-rap.

Should there be any queries in connection with the contents of this report, do not hesitate to call our office.

LGS/MdeF
Encl.

L. G. Soderman,
PRINCIPAL FOUNDATION AND SOILS ENGINEER.

cc: Messrs. A. M. Toye
H. A. Tregaskes
D. G. Ramsay
S. Markiewicz
L. E. Walker
J. E. Graspier
Dr. F. Karrow
Foundation Section.
Gen. Files.

FOUNDATION REPORT

on

Hwy. 401 Line 'A' & Wilton Creek Diversion
Crossing,

Approximately 6 Miles N.E. of Wapaneé,
Lot 20, Con. V, Twp. of Ernestown.

Plan No: F-3056-2

Profile No: F-3056-4

Chainage: Sta. 738+55.

Distribution:

Mr. A. M. Tove, Bridge Engineer.	(2)
Mr. H. A. Tregaskes, Construction Engineer.	(1)
Mr. D. G. Ramsay, Design Engineer.	(1)
Mr. S. Markiewicz, Project Design Engineer.	(1)
Mr. L. E. Walker, District Engineer, Kingston.	(1)
Mr. J. E. Gruspier, Regional Soils Engineer, Kingston Regional Office.	(1)
Mr. C. Karrow, Department of Mines.	(1)
Foundation Section.	(1)
Gen. Files.	(1)

S.D. 1-57-23

M.F. 35-59

INTRODUCTION:

Presented in this report are the results of a subsoil investigation carried out at a structure location approximately 6 miles N. E. of Napanee where proposed highway 401 line A crosses the Wilton Creek diversion in Lot 20, Con. 5, township of Ernestown (Sta. 738 + 55, Profile No. F-3050-4). This report contains the field and laboratory findings and recommendations for the foundation of the structure.

The field work commenced on April 10, 1959 and was completed on April 15, 1959.

DESCRIPTION OF THE SITE & GEOLOGY:

The site is located on a moderately steep-sided but broad flat-floored valley. Wilton Creek meanders at the site, flowing at a velocity of approximately 1 ft./sec. Some evidence of minor erosion was exhibited on the banks of the creek some distance upstream between the existing bridge at the gravel road and the site. Two water springs were observed on the north side of the creek up on the slope of the valley. The area on both sides of the creek is presently in swamp or marsh. The Topography is further complicated by the presence of a few drumlins. Immediately before the investigation the entire valley was flooded due to spring thaw and rain. Judging from hydrologic studies and field observations it appears that a creek diversion or channel improvement is necessary at the site.

Physiographically, the site under consideration is located on the Napanee Limestone Plain, a level to undulating plain of limestone from which the glaciers stripped most of the overburden. With the plain follows glacial drainage channels marked by deposition rather than erosion.

cont'd, 2...

DESCRIPTION OF THE SITE & GEOMORPHOLOGY: (cont'd)

residing in its valley being lined with outwash deposits of sand as well as silts and clays. At this site a surface veneer of alluvial deposits was found to overlie the sand deposits, which are underlain by limestone bedrock of the Black River formation.

DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of 4 sampled boreholes carried out by a standard Standard drill adapted for soil sampling. Conventional wash boring procedures were followed and samples were recovered at depths required. Samples were obtained by means of 2" I. D. thin-walled Shelby tube samplers or a 2" O. D. split barrel spoon sampler. The dimensions of this spoon sampler and the energy used in driving it conform to requirements of the Standard Penetration Test. Sampling in the fine sand where artesian water conditions were encountered, was attempted but without success. A wash sample was kept where sampling was not possible. Bedrock was proven by drilling 5 ft. into it by means of an AIT corer and the core retained in a 5 ft. double tube core barrel. In addition to the sampled boreholes, a dynamic cone penetration profile was obtained adjacent to each hole. Upon receipt in the laboratory, samples were visually examined and identified. Routine index tests were carried out on selected representative samples. Rock core samples were carefully examined to determine the quality and soundness of the rock. Laboratory test results have been presented in the borehole logs and detailed in tabular form.

The location plan and subsail profile are presented in Drawing No. F-59-23A.

GENERAL CONDITIONS:

The site is covered by a shallow alluvial deposit of silts, clays and sands, followed by an outwash deposit of sand overlying limestone bedrock.

In each of the sampled boreholes the topsoil was found to be underlain by a layer of silty clay, clay silt and silty sand of alluvial origin, extending from Elevations 357' to 350'. Below the alluvial deposits the stratum of fine silty sand was encountered between Elevations 350' and 326' to 318'. Underneath the stratum of fine silty sand a layer of coarse sand & gravel varying from 2' to 10' in thickness was intersected. This gravel and sand layer was found immediately above the bedrock.

Bedrock surface was encountered at Elev. 322' in Boring 1, Elev. 314.5' in Borings 2 and 3, and Elev. 313' in Boring 4. In general, the soil types encountered are as follows:

1. Alluvial Deposits:

This layer of silty clay, clay silt and silty sand, believed to be the result of river deposition in recent geologic times, was found to be continuous all over the site. It contains a considerable amount of organic matter and cannot be relied upon to provide any bearing strength. The colour is predominately grey and the average moisture content was found to be 35%.

2. Grey Fine Silty Sand:

This stratum of fine silty sand, believed to be of outwash origin, was encountered below the layer of alluvial deposits. Occasional bands of silty clay and clay silt were encountered throughout. It contains approximately 40% silt and exists in a loose to medium state of packing. The colour is predominately grey. The average moisture content was found to be 21%. Its thickness ranges from 24' in Boring 2, to 35' in Boring 4. The stratum is water-bearing below Elev. 341' in Boring 4 and Elev. 325'

DEFECTS IN NEGATIVE DUE TO

SUBSOIL CONDITIONS: (cont'd)

2. Gray Fine Silty Sands: (cont'd)

in Boring 2. In view of the low "N" values (standard penetration resistance expressed in number of blows per foot) recorded in the field and the artesian water conditions encountered during the boring programme, this stratum of loose to medium fine silty sand is not suitable as a bearing layer for the foundation of the structure.

3. Bedrock:

Underneath the fine silty sand stratum a layer of medium to dense coarse sand and gravel with boulders was intersected immediately above the bedrock. The thickness of this layer of coarse sand and gravel with boulders ranges from 2' in Boring 3, to 10' in Boring 2. Bedrock is composed of fine-grained limestone with pods of coarse crystalline calcite of the Black River series. The limestone is in a sound condition with no sign of weathering or fracture. Bedrock is at Elev. 322' in Boring 1, Elev. 314.5' in Borings 2 and 3, and Elev. 313' in Boring 4. Judging from the elevations of bedrock surface encountered in the 4 borings, it appears that the formation is dipping in a south-easterly direction.

WATER CONDITIONS:

Observations and measurements carried out during the exploration programme indicate that the ground water table at the site is at or slightly below the ground surface at approximately Elev. 358'. Immediately before the leveeigation, due to spring thaw and rain, a flood condition was observed at the site. The flood elevation at that time was at approximately Elev. 360'. During spring-run-off, the highest flood elevation at the site has been reported to be at approximately Elev. 361'.

WATER CONDITIONS: (cont'd)

During boring and sampling operations artesian water conditions were noted at Elevations 325' and 324.5' in Boring 2, and at Elev. 341' and 313' in Boring 4. The excess hydrostatic head reached Elev. 361' (2 ft. & 4 ft. above ground surface in Borings 2 and 4 respectively) in both borings. The critical elevation below which piping occurs during dewatered or footing excavations, has been estimated to be at 340' in Boring 2 and 346' in Boring 4. No artesian water conditions were noted in Borings 1 and 3.

FOUNDATION CONSIDERATIONS:

Subsoil and water conditions at the site are such that no satisfactory foundation support can be obtained in the overburden layers above bedrock. End-bearing piles driven to refusal into the limestone bedrock appear to be the only means of obtaining satisfactory footing support. In view of the rather loose state of the sand stratum yielding little lateral support to the 45 ft. long (approximately) piles required to reach bedrock, timber piles are not recommended. Steel H-piles, driven to refusal into sound bedrock will provide adequate footing support for the structure. Sound bedrock is at Elev. 322' to 313'.

In view of the artesian water conditions encountered at the site, to guard against "piping" during operations of dewatering or the placing of footings, excavations should not be carried below Elev. 340'. If footings placed at or slightly above 340' (approximately 2 ft. below ground-surface assuming stream-bed elevation at approx. elev. 340'), are considered as providing inadequate protection against stream erosion and scour, remedial measures such as sheet piling should be used.

CONCLUSIONS & RECOMMENDATIONS: (cont'd)

The tentative grade line as shown on Drawing No. F-59-23A apparently has not allowed for high water conditions at the site. A grade raise appears to be necessary and should be based on the highest flood elevation of 361'. No approach fill stability problems are anticipated. Prior to the placing of embankment fill, all topsoil should be removed. Bank slopes on the upstream face of the fill should be protected by rip-rap.

CONCLUSIONS & RECOMMENDATIONS:

- (1) The site is covered by a shallow alluvial deposit of silts, clays and sands, followed by an outwash deposit of fine silty sand overlying limestone bedrock.
- (2) Subsoil conditions are such that no satisfactory foundation support can be obtained in the overburden above bedrock.
- (3) As such end-bearing piles driven to refusal into the limestone bedrock appear to be the obvious means of obtaining satisfactory footing support. Steel H-piles are recommended. Bedrock is at approximately Elev. 322' to 313'. No total or differential settlements of any consequence need be anticipated.
- (4) To guard against piping, excavations should not be carried below Elev. 346'. If footings placed at this elevation are considered as providing inadequate protection against stream erosion and scour, sheet piling should be used.
- (5) A grade raise at the site is necessary and should be based on the highest flood elevation of 361'.

CONCLUSIONS & RECOMMENDATIONS: (cont'd)

- (6) No approach fill stability problems are anticipated. Prior to the placing of embankment fill, all topsoil should be removed. Bank slopes or the upstream face of fill should be protected by rip-rap.

ALC

A. Loh,
Foundations Engineer.

APPENDIX I.

Table No. 1.

SUMMARY OF FIELD & LABORATORY TESTS

 JOB P-59-23

 W P 35-59

MOLE NO	SAMP NO	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET N RESIST. BLOWS FT	MOIST CONT %	PLASTIC LIMIT %	LIQUID LIMIT %	SHRINK STRENGTH %	UNIT WEIGHT pcf	REMARKS
1	T1 S2 T3 T4 T5 T6 S7 R8	3'-5' 6'-7'6" 9'-11' 15'9"-17'9" 20'-22' 25'-27' 30'-31'6" 37'4"-42'4"	Med. grey silty clay & clay silt " " " " " " Medium grey fine silty sand with occasional bands of silty clay and clay silt " " " " " " " " " " " " Fine-grained limestone	12 12 11 Pushed " 2 11 -	28.0 23.5 22.0 18.4 23.3 - 19.7 -	16.8 - - - - - - -	44.0 - - - - - - -	- - - - - - - -	112.0 - - 128.0 - - - -	
2	S1 S2 S3 S4 S5 S6	3'-5' 6'-8' 9'-11' 15'-17' 17'-25' 25'-35'	Very loose to very fine silty sand Soft grey silty clay & clay silt Loose to medium grey fine silty sand with occasional bands of silty clay & clay silt " " " " " " " "	2 9 13 Pushed - -	40.7 - 19.8 22.1 - -	- - - - - -	- - - - - -	- - - - - -	- - - - - -	
3	T1 S2 T3 S4 S5 S6 S7	3'-4'6" 6'-7'6" 9'-10'6" 13'-14'6" 15'-16'6" 20'-21'6" 25'-26'6"	Loose grey silty sa. & clay silt Loose to medium grey fine silty sand with occasional bands of silty clay & clay silt " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " "	5 6 13 Pushed " " " "	34.6 21.6 19.2 24.6 21.5 27.0 21.5	- - - - - - -	- - - - - - -	- - - - - - -	- - - - - - -	

Table No. 1 (cont'1)

SUMMARY OF FIELD & LABORATORY TESTS

JOB P-59-23

WP 35-59

HOLE NO	SAMP NO	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETN REACT BLOW/FT	MOIST CONT	PLASTIC LIMIT	LIQUID LIMIT %	SHEAR STRENGTH LB/FT ²	DENS WEIGHT PCF	REMARKS
4	S1	3'-4'6"	Topsoil 3' to 4'. Silty Sand:							
			4' to 4'6"	Pushed	127.0	-	-	-	-	
	S2	6'-7'6"	Loose grey silty sand with	10	20.8	-	-	-	-	
	S3	10'-11'6"	occasional bands of silty clay and clay silt	2	-	-	-	-	-	
	A4	16'6"-19'6"	Medium sandy gravel	-	-	-	-	-	-	
	S5	20'-25'	" "	-	-	-	-	-	-	
	S6	30'-31'6"	Medium grey fine silty sand	14	-	-	-	-	-	
	R7	44'5"-48'9"	Dolomitic limestone	-	-	-	-	-	-	
			Tl denotes thin walled shelly samples.							
			S1 denotes split spoon samples.							
			W1 denotes wash samples.							
			R1 denotes rock core samples.							

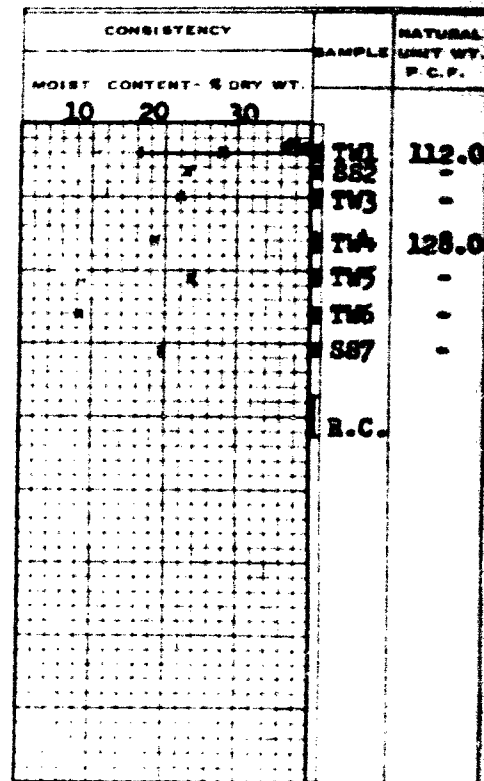
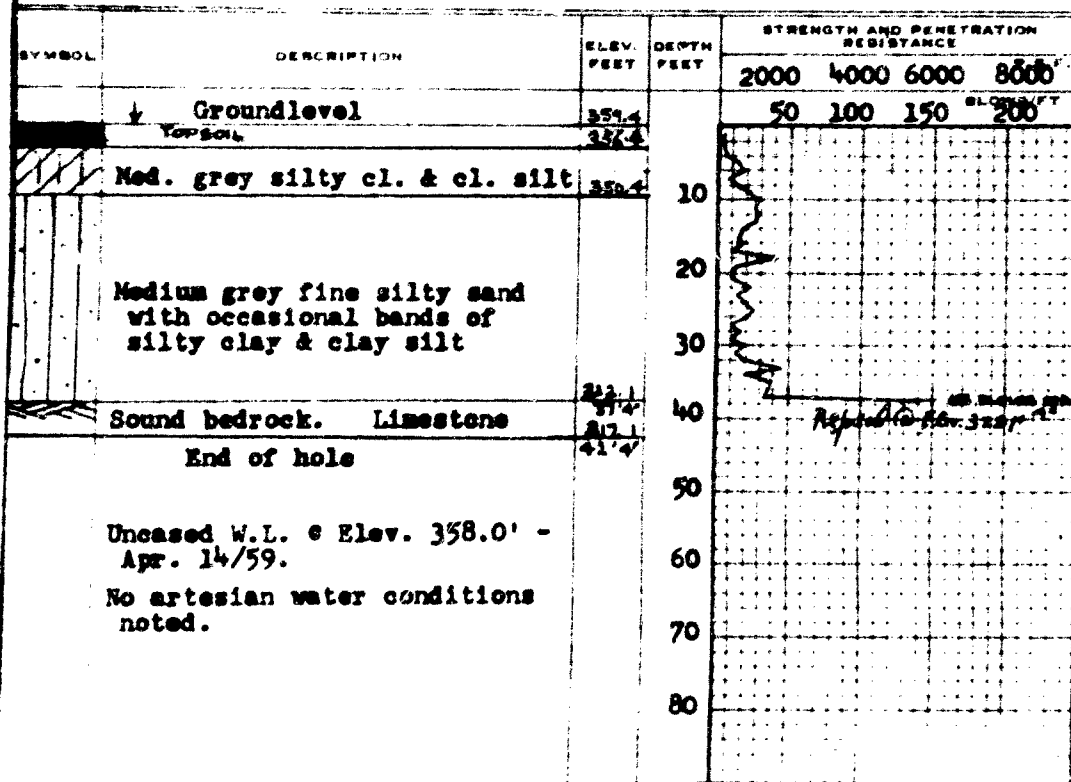
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 35-59 BORE HOLE NO. 1
 JOB F-59-23 STATION 737+23 (59' Lt.)
 DATUM Geodetic COMPILED BY B.K.
 BORING DATE Apr. 10/59 CHECKED BY A.L.

2" DIA SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA CONE
 2" SHELBY CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) --- O
 VANE TEST (C) AND SENSITIVITY (S) --- +
 NATURAL MOISTURE AND LIQUIDITY INDEX --- LI
 LIQUID LIMIT --- L
 PLASTIC LIMIT --- P



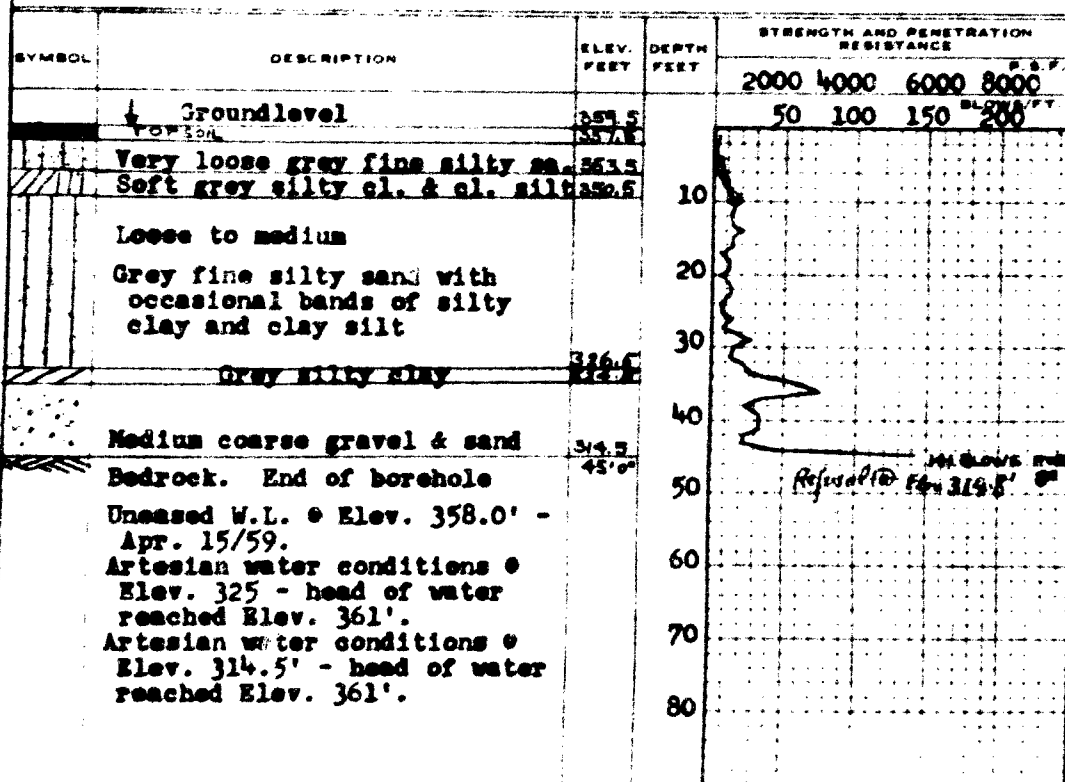
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 35-59 BORE HOLE NO. 2
JOB F-59-23 STATION 737+23 (50' Rt.)
DATUM Geodetic COMPILED BY B.K.
BORING DATE Apr. 14/59 CHECKED BY A.L.

2" DIA SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) — \bigcirc
VANE TEST (C) AND SENSITIVITY (S) — \oplus
NATURAL MOISTURE AND LIQUIDITY INDEX — \times
LIQUID LIMIT — \times
PLASTIC LIMIT — \times



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			881	
			882	
			883	
			884	

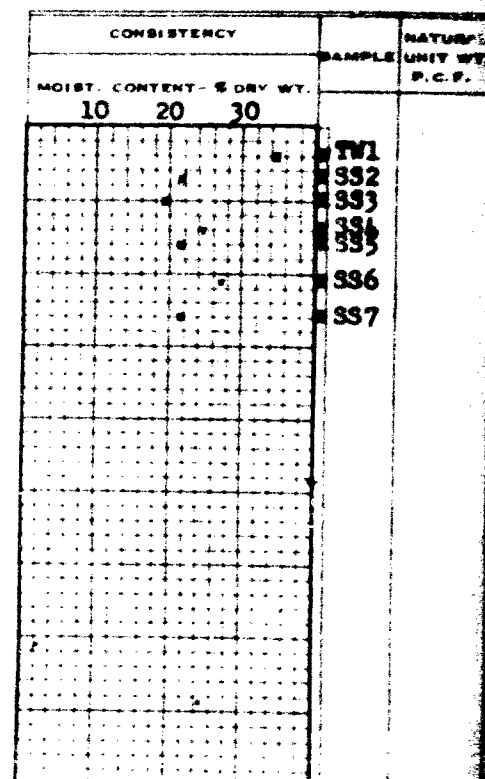
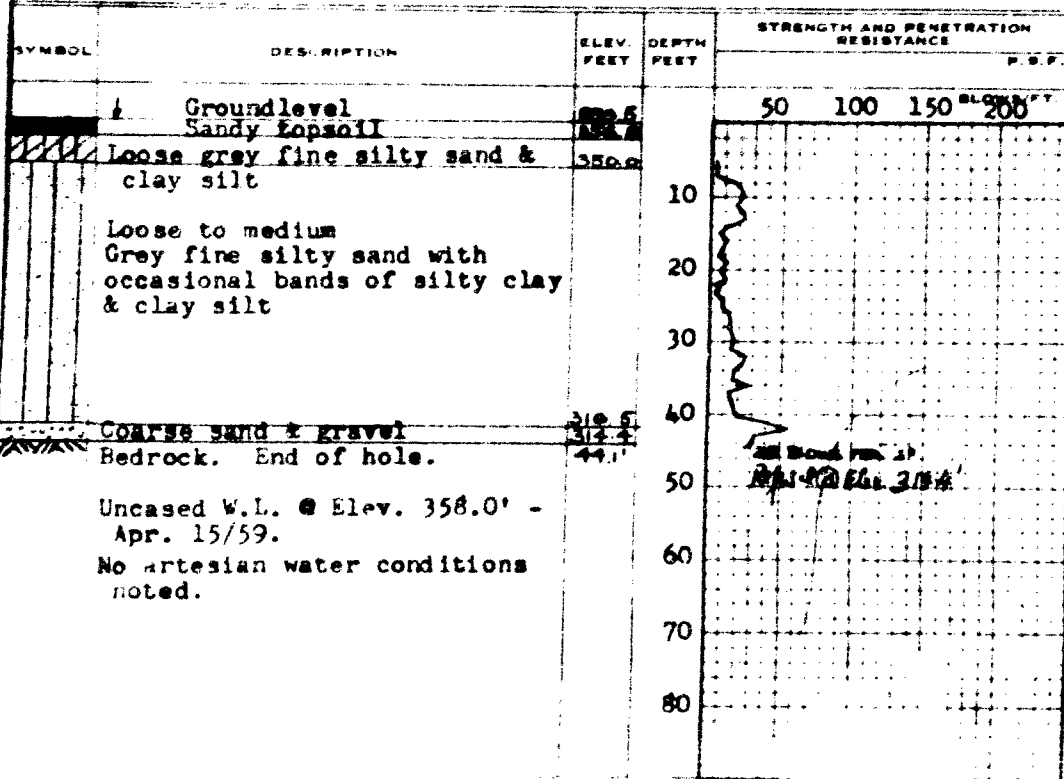
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 35-59 BORE HOLE NO. 3
 JOB F-59-23 STATION 737294 (50' Lt.)
 DATUM Geodetic COMPILED BY B.K.
 BORING DATE Apr. 14/59 CHECKED BY A.L.

1" DIA SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) --- O
 VANE TEST (C) AND SENSITIVITY (S) --- +
 NATURAL MOISTURE AND LIQUIDITY INDEX --- LI
 LIQUID LIMIT --- L
 PLASTIC LIMIT --- P



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 35-59 BORE HOLE NO. 4
JOB P-59-23 STATION 732+84 (50' Rt.)
DATUM Geodetic COMPILED BY B.E.
BORING DATE Apr. 15/59 CHECKED BY A.L.

2" DIA SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) ○
VANE TEST (C) AND SENSITIVITY (S) +^h
NATURAL MOISTURE AND
LIQUIDITY INDEX X
LIQUID LIMIT —
PLASTIC LIMIT —

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE P.S.F.
	Groundlevel	357.4		
	Topsoil	353.4		
	Loose grey fine silty sand with occasional bands of silty clay and clay silt	341.0	10	
	Medium sandy gravel	327.4	20	
	Medium grey fine silty sand	318.4	30	
	Coarse gravel & boulders	313.0	40	
	Bedrock. Dolomitic limestone	301.6	50	
	End of hole		60	
	Artesian water conditions @ Elev. 341' to Elev. 328.		70	
	- head of water reached Elev. 361.0'.		80	
	Artesian water conditions @ Elev. 313.0'			
	- head of water reached Elev. 360.5'.			

CONSISTENCY	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.	
10 20 30	
	SS1
	SS2
	SS3
	WS4
	WS5
	WS6
	R.C.



ONTARIO

DEPARTMENT OF HIGHWAYS

23-60-219

*check of creek has been
changed some report submitted
- if enough info without field
work for Service Road.*

Location Section,
Planning & Design Branch,
359 Jarvis Street.

October 29, 1959.

MEMORANDUM FOR:

Mr. A. Rutka,
Material & Research Engineer,
Downsview.

ATTENTION: Mr. D. Smith

RE: Proposed Crossing of Wilton Creek
on Service Road, Twp. Ernestown.
W.P. 227-60

We have forwarded under separate cover, print of Plans
F 3056-2 and DM 4382-3, and Profile F 3056-4, showing proposed
crossing as described above.

This project is on Work Schedule No. 13 of the 1960-61
list.

Would you please let us have your recommendation on this
crossing.

PH/ww
c.c. a. Strain
File

P. Harvey
P. Harvey,
Location Plans Engineer.