

66K-63

Mr. S. McCombie,
Bridge Planning Engineer,
Bridge Division, Admin. Bldg.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

Attn: Mr. A. S. Melnyshyn

October 20, 1966

Recommended Stage Construction - Q.E.W.

66-68 11-F 63

Our investigation of the three sites on the Q.E.W. (Fifteen Mile Creek, W.P. 213-63; Sixteen Mile Creek, W.P. 214-63, and Eighteen Mile Creek, W.P. 211-63), has disclosed the presence of a very soft, highly compressible, organic layer of silt and clay overlying bedrock or till. The thickness of this layer is in the order of 30 to 40 ft. There is also ample evidence of settlements and slope instability at the above mentioned three creek crossings. 66-67

Based on our findings, relatively large settlements of the embankments to be built on the soft and compressible layer, can be expected.

The proximity of the present Q.E.W. and the thickness of the compressible layer, rules out subexcavation and removal of this material. Depending on the final choice of the structures for the crossing of the creeks, partial subexcavation may be given consideration. However, this may be more for embankment stability reasons than settlement reduction. In order to reduce settlements that will have to be contended with after the road has been opened to traffic, we would strongly recommend that the embankments (grading contract) be built as far ahead as possible.

Should you wish to discuss any aspects of this problem, or would require additional information, please feel free to call on this Office.

AGS/ndef

cc: Foundations Office

Gen. Files

A. G. Sternac
A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER

MEMORANDUM

W.P. 211-63

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division.

FROM: Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

DATE: December 5, 1966

Our File Ref.

IN REPLY TO: DEC 13 1966

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Q.E.W. Crossing of 18 Mile Creek
District #4 (Hamilton)

W.J. 66-P-63 -- W.P. 211-63

W.P. 286-66-01

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure site.

We believe that you will find the factual data and recommendations contained therein, adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

AGS/MdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
G. K. Hunter (2)
H. Greenland
T. J. Kovich
W. S. Melinyshyn
A. Watt

Foundations Office
Gen. Files

A. G. Stermac
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

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FOUNDATION INVESTIGATION REPORT
For
Q.E.W. Crossing of 18 Mile Creek
District #4 (Hamilton)
W.J. 66-F-63 -- W.P. 211-63

1. INTRODUCTION:

A request, dated June 17, 1965, to conduct a foundation investigation at the proposed crossing of 18 Mile Creek by the north and south service roads of the Q.E.W., was received from the Bridge Planning Section (Mr. W. S. Melinyshyn).

It is proposed to reconstruct the existing Q.E.W. as a controlled access highway from the Stoney Creek traffic circle to St. Catharines, and to construct service roads north and south of the main road. This program will necessitate the construction of two structures to carry the service roads over 18 Mile Creek.

Subsequently, a foundation investigation was conducted at the proposed site to determine the subsoil conditions. Field and laboratory test results, together with discussion and recommendations for the structure foundations and embankment designs, are reported herein.

2. TOPOGRAPHY AND GEOLOGY:

The site is located within the Niagara Fruit Belt lying between the Niagara Escarpment and Lake Ontario, and is approximately 1.5 miles east of Jordan Harbour, in the township of Louth, County of Lincoln.

The general area was inundated by the Pleistocene Lake Iroquois. As the lake level receded much below the present level of Lake Ontario, 18 Mile Creek cut a valley through the till. Later, the rise in Lake Ontario water level to approximately its present level, drowned the outlet of the creek and created a lagoon

2. TOPOGRAPHY AND GEOLOGY: (cont'd.) ...

and marsh cut off from the lake by a barrier beach. Water flow is to the north into Lake Ontario.

The surrounding area is generally being used for orchard cultivation.

3. FIELD AND LABORATORY WORK:

Using conventional diamond drilling equipment adapted for soil sampling purposes, together with a raft where necessary, 37 sampled boreholes and 21 dynamic cone penetration tests were carried out at the site. A driving energy of 350 ft.-lbs. per blow was used for the dynamic cone penetration tests.

In cohesive materials, 2-inch I.D. Shelby tube samples were obtained by manually pushing the tubes into the soil if possible. Otherwise, samples of cohesive and non-cohesive materials were obtained using a 2-inch O.D. split-spoon sampler driven according to the specifications of the Standard Penetration Test. In-situ shear strength was established, where possible, with a field vane test.

BXL-size rock core samples were obtained from some of the boreholes to prove the bedrock.

Samples were visually examined and identified in the field and subsequently in the laboratory. Laboratory tests were conducted on selected representative samples to determine, where applicable, Atterberg limits, bulk density, grain-size distribution, natural moisture content, organic content, and shear strength. The shear strength was determined by means of quick triaxial and unconfined compression tests.

Results of the laboratory and field tests, together with the location and elevations of the boreholes, are presented in the Appendix of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

The subsoil at the site consists generally of a deposit of organic silt underlain by a variable deposit of silty sand and then a deep deposit of clayey silt with sand. On the north side of the existing Q.E.W., this deposit is directly underlain by shale bedrock; whereas, on the south side there is a relatively thin layer of silty sand with gravel and some clay between the deposit and the shale bedrock. A portion of the site is covered by a shallow fill which is generally silty sand.

The stratigraphical profiles shown on Drawings 66-F-63A and 66-F-63B are estimated from the field data as shown in detail on the borehole log sheets in the appendix of this report. The different soil deposits are described below.

4.2) Silty Sand (Fill):

This material is found as a shallow deposit approximately parallel to the existing highway embankment and, presumably, was placed prior to or during the embankment construction. The deposit is silty sand with a relative density varying from very loose to compact, as estimated from 'N' values between 2 and 16 blows per foot.

4.3) Organic Silt:

This deposit was encountered either beneath the silty sand or at the ground surface in all boreholes except No's 3, 13, 15, and 19, which were on or near the edge of the valley. The deposit is about 15 to 20 feet thick over most of the site and tapers out near the valley's edge.

The material, as sampled, varied from grey-brown to grey, and was highly organic with organic pieces generally visible, and well-decayed pieces of roots and wood were not uncommon. Occasional samples were fibrous. Some sand and occasional gravel were noted as well as occasional sand seams.

cont'd. /4 ...

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.3) Organic Silt: (cont'd.) ...

The shear strength of the deposit was quite variable but generally decreased with depth. The shear strength appeared to be greatly influenced by the old fill, and generally was up to 100% higher beneath fill areas than otherwise. Reference should be made to Drawings 66-F-63A and 66-F-63B as well as to the attached borehole log sheets for specific shear strength values.

In general, the bulk density increased with depth from about 96 p.c.f. to about 120 p.c.f. The water content tended to decrease with depth from about 80% to about 25%, corresponding with a decrease in organic content from as much as 10% to about 0.5% by weight. The Atterberg limits also were quite variable and can best be evaluated by reference to the borehole log sheets included in the appendix to this report.

4.4) Silty Sand to Sandy Silt:

This deposit occurred over most of the central portion of the site as a single layer about 7 to 21 feet thick, underlying the organic silt stratum. The layer petered out toward the east and west valley walls and to the south, but tended to increase in depth toward the north (i.e., the lake).

Farther to the south and west of the present structure, similar material occurred within the clayey silt with sand stratum as two or more irregular layers.

The deposit varied from very loose to very dense with 'N' values between 2 and 127 blows per foot. In general, the deposit was compact to dense.

cont'd. /5 ...

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.5) Clayey Silt with Sand:

This deposit was encountered in all boreholes, either beneath the organic silt or the silty sand to sandy silt deposit, and appeared to represent the original material into which the creek valley had been carved. Hence, the deposit varied in thickness from 67 feet near the edge of the valley to a minimum of 11.5 feet near the centre of the valley.

The deposit was generally very stiff to hard in consistency with occasional stiff pockets. 'N' values varied from about 10 to 120 blows per foot. Four Shelby tube samples were obtained which yielded shear strengths between 1000 p.s.f. and 2400 p.s.f. Liquid limits varied from 15% to 35%, plastic limits from 11% to 20%, and water contents from 12% to 23%.

4.6) Sandy Silt with Gravel:

This deposit was encountered in the area south of the Q.E.W. only, beneath the clayey silt with sand stratum, and overlaid the shale bedrock. It was 2 to 10 feet in thickness. The material was predominantly silty sand with gravel and some clay, and was very dense with 'N' values between 76 and much in excess of 100 blows per foot.

4.7) Bedrock:

Bedrock consisted of red Queenston Shale and was encountered between elevations 191.3 and 198.3 feet. It was proven in nineteen boreholes by diamond drilling to obtain BXL-size core. Recovery was generally good; however, some sections of core tended to grind up, giving poor recovery. This is a characteristic of shale bedrock.

cont'd. /6 ...

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.8) Water Table:

The water table was observed in the boreholes during the drilling program and varied from about elev. 251.0 to the creek level of 245.4. In general, the water table was the same as the creek level.

5. EXISTING STRUCTURE:

The existing structure is a double rigid frame box culvert which was constructed about 1938. Specific foundation details are not available; however, the structure would appear to be founded on spread footings.

There are numerous vertical cracks on the north and south walls of the culvert. The west wingwall has broken off the culvert on both the north and south ends. The top of the west wingwall on the north side is about 1" below the top of the adjacent culvert, and the culvert and east wingwall tilt down to the east with the east end of the east wingwall 4-1/2 inches below the point at which the west wingwall has broken off. The south end of the structure also tilts down to the east with a difference of 12-1/2 inches between the outside top of the west and the east wingwalls. Longitudinally, there is a difference in elevation of 12-1/2 inches and 3-1/2 inches on the west and east sides, respectively.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

Two alternatives were proposed to carry the north and south service roads of the Q.E.W. over 18 Mile Creek. One proposal was to extend the existing box culverts to accommodate the required additional highway width. The alternative proposal was to construct two 3-span (45'-45'-45') structures 34 feet wide to accommodate the service roads.

cont'd. /7 ...

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.1) General: (cont'd.) ...

Subsoil at the site consists generally of a deposit of organic silt of variable thickness, underlain by deposits of silty sand, clayey silt with sand, and silty sand with gravel, and then shale bedrock.

6.2) Embankments:

The proposed grade of the service roads is such that the top of embankment on the north service road would vary from about elev. 279.0 on the west to elev. 281.0 on the east extreme of the investigation and, on the south service road the grade would similarly vary from elev. 279.0 to elev. 285.0. The elevation of the existing ground surface varies from elev. 245.0 to about elev. 255.0 over most of the embankment area; hence, the anticipated fills will be in the order of 30 to 35 feet in height with side slopes of 2 to 1.

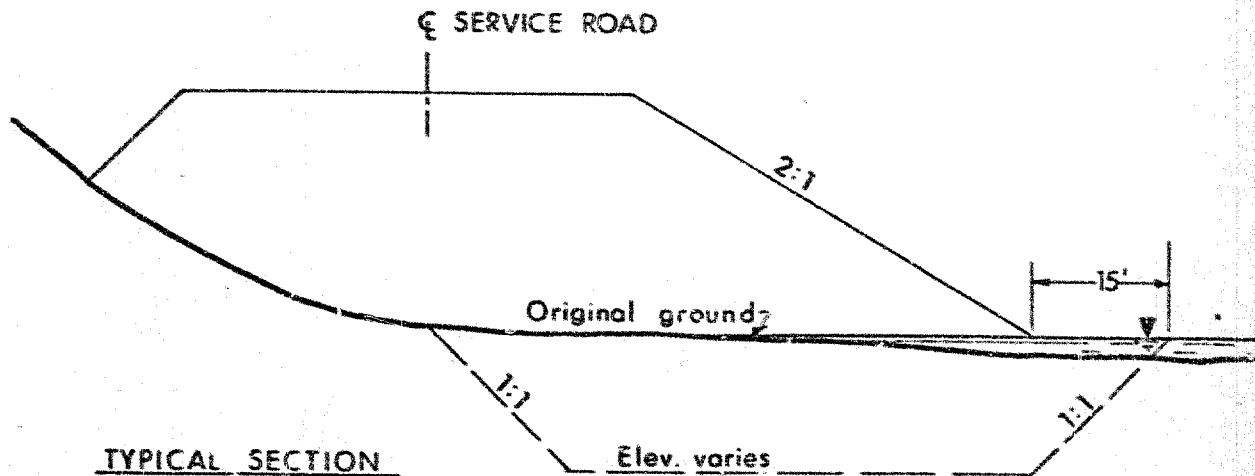
Subsoil to about elev. 225.0 on the north service road and elev. 230.0 on the south service road is inadequate to support the proposed embankments without extensive berms. Since adequate berms on the south embankment would restrict or entirely block the creek channel, it is therefore proposed that the unsuitable foundation material (organic silt) be subexcavated and replaced with a suitable granular material, as specified by the Regional Materials Section.

The subexcavation should extend from the centre-line of the proposed service roads outwards from the existing Q.E.W. to the toe of the proposed embankments. (See sketch on following page.) Side slopes of 1 to 1 may be used for the subexcavation. The bottom of the subexcavation will be about elev. 225.0 for the north service road, and about elev. 230.0 for the south service road. Any pockets of organic material indicated on Drawings 66-F-63A and 66-F-63B, lower than the suggested depth, should also be subexcavated as well as any pockets encountered during construction.

cont'd. /8 ...

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.2) Embankments: (cont'd.) ...



In plan, the subexcavation should extend from Sta. 150+90 to Sta. 153+65 on the north service road, and from Sta. 152+80 to about Sta. 158+00 on the south service road.

For construction purposes, the subexcavation should be carried out transversely in 12-to 15-foot widths and immediately replaced by suitable granular material. Specific recommendations pertaining to subexcavation and backfilling will be discussed in the soils report of the Regional Materials Section.

6.3) Structures:

The existing structure is a reinforced concrete twin box culvert. Although bridge structures could be constructed (piled foundations would be necessary), it is considered preferable and desirable to extend the existing structure.

For estimating purposes, if a trestle-type of structure is to be considered, it should be about 700 feet long for the

cont'd. /9 ...

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.3) Structures: (cont'd.) ...

south service road and about 300 feet long for the north service road, and should be founded on either steel H-piles or lined concrete caissons driven to bedrock at about elev. 190.0 to 195.0. If this type of structure is to be adopted, more detailed foundation recommendations will be provided by this Section.

The natural subsoil at the site is inadequate for the use of spread footing type foundations. However, the recommended subexcavation procedure for the embankments will replace the unsuitable organic silt with granular fill which would be adequate for the footings, from the centre-line of the service roads to the outer limits of the embankment. The area between the centre-line of the service roads and the existing structure on which the new structure will be constructed, also should be subexcavated to remove all organic material, and to replace that material with granular fill. The limits of this subexcavation should be 15 feet outside the outside extremes of the footings of the culvert. 1 to 1 side slopes may be used. In order to ensure the stability of the existing structure during construction, temporary sheeting may be required.

The foundation for the culvert may be designed for a safe bearing load of 1 t.s.f. A dewatering scheme will be required for the construction of the foundation.

6.4) Settlement:

Organic soils such as the organic silt at this site are known to consolidate considerably under load. The subexcavation procedures outlined above, will reduce the settlement problems considerably; however, it is not practical to remove

cont'd. /10 ...

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.4) Settlement:

all the organic material beneath the entire embankment. Therefore, some settlement is inevitable.

Settlements could be further reduced by constructing the embankments as much prior to the construction of the structure, as possible. Nevertheless, provision should be made between the old and the new culvert to accommodate some differential settlement.

6.5) Future Q.E.W. Development:

At a future date, the existing Q.E.W. is to be re-constructed. Any increase in the grade above the existing grade will cause additional settlement of the embankments. More detailed foundation investigation and recommendations will be required prior to the core-lane reconstruction.

7. SUMMARY:

The results of a foundation investigation for the proposed north and south service road crossings of 18 Mile Creek by the Q.E.W., are presented.

The subsoil at the site consists, in general, of a deposit of organic silt underlain by silty sand to sandy silt, all of which lies in a valley cut into a deposit of clayey silt with sand. This deposit is underlain by a variable deposit of silty sand with gravel and then shale bedrock.

Proposals for a short-span structure or a multi-span trestle-type structure are briefly discussed and could be constructed on a pile-type foundation using either steel H-piles or lined concrete caissons bearing on bedrock.

The proposal of a reinforced concrete box culvert is discussed in detail, together with recommendations for sub-excavation of the organic silt and the replacement of this material

cont'd. /11 ...

7. SUMMARY: (cont'd.) ...

with suitable granular fill. Temporary sheeting may be required to ensure the stability of the existing structure during the subexcavation program. The structure could then be founded on the granular fill with an allowable design load of 1 t.s.f.

Some dewatering scheme will be required for the construction of the foundations of the culvert.

The construction of the approach fills has been discussed with details of subexcavation as required for slope stability. The subexcavation is to proceed in 12-to 15-foot wide strips with each strip backfilled with suitable granular material before proceeding with the next strip.

Settlement problems will be reduced by the subexcavation scheme, but could be further reduced by constructing the embankments as much prior to the construction of the structure and final grade, as possible.

Provision should be made for differential settlement between the old and the new culverts.

Future development of the core-lanes of the Q.E.W. may require additional foundation investigation.

8. MISCELLANEOUS:

The field investigation was carried out during the period July 18 to September 12, 1966. The equipment was owned and operated by Canadian Longyear Ltd. under the supervision of Mr. R. Magi, Project Foundation Engineer. This report was prepared by Mr. L. Palmer, Project Foundation Engineer.

The entire project was under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

December 1966

APPENDIX I

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 300	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_P	PLASTIC LIMIT
I_P	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_P}{I_P}$
I_C	CONSISTENCY INDEX = $\frac{w_L - w}{I_P}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

MEMORANDUM

66-F-63

Mr. A.G. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Building.

FROM: Bridge Division,
Downsview, Ontario.

DATE: June 7th, 1966.

FILE REF.

IN REPLY TO:

SUBJECT:

✓ W.P. #211-63, Site #18-20,
Eighteen Mile Creek,
W.P. #214-63, Site #18-22,
Sixteen Mile Creek,
W.P. #209-63-2, Site #36-21b,
C.N.R. Overhead at Fruitland Road,
Q.E.W., District #4.

Further to my memo of May 26th I am enclosing herewith one print each of the bridge site plans E-4737-1 and E-4736-1 for Eighteen and Sixteen mile creeks. The probable location of footings have been marked in red. At Sixteen Mile Creek extra boreholes have been shown in green for the future widening of the existing structures. At Eighteen Mile Creek footings have also been shown in blue for the extension of the existing culvert. It has not yet been decided which type of structure will be built at this location.

Also enclosed is a print of E-4738-1 for the C.N.R. structure on Fruitland Road to the south of the Fruitland Interchange. No preliminary structure site report is available for this project since it has just recently been added to the program.

Attached are the site reports for Sixteen and Eighteen Mile Creeks. Eighteen Mile Creek is particularly inaccessible for your machinery and also will require floating of the drill rig in the marshy area.

Would it be possible to have some sort of hole put down in the centreline of the creeks to aid in the calculations of scour? This would also apply to Fifteen Mile Creek previously sent to you.

JFW/cw

Encl.

cc. R. Forrest
A. Crowley

W.S. Selinsky
W.S. Selinsky,

Regional Bridge Location Engineer.

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

S. McCombie, Bridge Planning Engineer, Admin. Building.

66-F-63

Bridge Division,
Downsview, Ontario,
October 5th, 1966.

Mr. A. Barnes,
Director,
Department of Energy and
Resources Management,
Conservation Authorities Branch,
Box 358,
DOWNSVIEW, Ontario.

RE: The Fifteen Mile Creek Bridge,
W.P. 213-03,
Sixteen Mile Creek Bridge,
W.P. 214-03, Highway Q.E.W., 15-165
District #4.

Dear Sir:

Our Department is presently engaged in the design of Service Roads and associated structures and interchanges along the Q.E.W. to achieve a complete control of access.

Service road bridges are to be built on Fifteen Mile Creek and Sixteen Mile Creek offset approximately 135' from the Q.E.W. center-line (see attached plans).

Enclosed please find relevant correspondence from the Hon. R. Welch, M.P.P. for Lincoln. He writes on behalf of farmers and residents who are pressing for some type of permanent structures which will effectively raise and maintain water levels in these drainage basins. Irrigation systems are dependent on this water and it seems reasonable that in conjunction with the construction of the service road structure, weirs could be built to conserve the water.

The effects of raising water levels to higher elevations and the results of backwater, however, can best be determined by your Branch. It is conceivable that for as many people as would support such a project there may be some who will object due to inundation of their property.

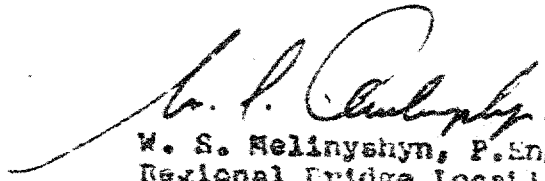
-- 2 --
RE: The Fifteen Mile Creek Bridge,
W.P. 213-63,
The Sixteen Mile Creek Bridge,
W.P. 214-63.

Our feeling is that a scheme using weirs, spillways and check dams is feasible. Special design features and certain modifications to our structures will be required if the above are constructed (such as adjustments to size of openings, footing locations, scour protection etc.) Our present schedule calls for design of the bridges immediately to meet the 1968 construction program.

We would appreciate your Office reviewing the proposals as requested by the Hon. R. Welton, M.P.P. and informing our Department of your comments. If feasible, and in order to design our bridges, we would require details as to the desirable water levels which would have to be maintained; your opinion as to who would be responsible for the design, construction and maintenance of the weirs, etc., and your comments regarding contribution towards the cost. No doubt your Branch makes contribution towards projects of this type.

Though not specifically mentioned the same treatment may be required at Eighteen Mile Creek where tentative extensions to the existing twin concrete culverts are contemplated.

Yours very truly,



W. S. Melinysbyn, P.Eng.,
Regional Bridge Location Engineer.

WSM/cas
Encl.

cc H. Greenland
C. Hunter
S. McCombie
W. Wigle
J. Harris

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac, Principal Foundation Eng., Room 107, Lab. Bldg.

Mr. W.C. Wigle,
Program Engineer,
Program Section,
Admin. Bldg.

Bridge Division,
Downsview, Ontario.

December 18th, 1966.

Fifteen Mile Creek, W.P. 213-63,
Sixteen Mile Creek, W.P. 214-63,
Eighteen Mile Creek, W.P. 286-66,
S.H.M. Service Roads, District #1.

286-66

not W.P. Card

Reference is made to previous correspondence concerning the above structures and the problems associated with the inclusion of same as requested by the Hon. R. Welch, M.P.P. for Lincoln.

Having discussed this with the Niagara Peninsula Conservation Authority a solution has been reached which will allow us to shortly undertake the design the structures independent of the Authority's work. (See attached letter)

Investigation of the sites by the Foundation Branch has revealed that embankment stability and settlements of the approaches require special consideration. Their recommendation is to construct the embankments wall in advance of the opening of the service roads. (See letter)

We request that this be reviewed with the possibility of calling the grading contract, at least for the approaches, first, followed later by the structures and paving.

WBM/aw

W.C. Melnyshyn
W.C. Melnyshyn,
Regional Bridge Location Engineer.

c.c. G.K. Hunter
A. Stermac
R. Forrest

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

*all
Eighteen mile creek
W.P. 211-63
66-F-63*

alp

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

September 5, 1967

-- EIGHTEEN-MILE CREEK CULVERT --
North & South Service Roads (Q.E.W.)
W.P. 286-66, Site No. 18-60, W.J. 66-7-63
District #4 (Hamilton)

We have reviewed the Preliminary Bridge Plan Drawing D-6134-P for the above mentioned structure, and submit the following comments:

i) The subexcavation of organic silt should extend for the full length of the proposed multi-plate pipe arch culvert extensions. In order to ensure stability of the existing structure during subexcavation and backfilling operations, temporary sheeting may be required.

ii) The subexcavation should be extended at least 5 ft. on either side of the outside extremes of the proposed width of the culvert and backfilled to the required grade with suitable granular material. Side slopes of 1:1 may be used for the subexcavation.

iii) Some differential settlements between the existing structure and the new extensions can be anticipated. For this reason, care should be exercised in the design to ensure that the structure is so articulated that the differential settlements can take place without impairing the performance of the overall structure.

iv) Tip elevation for piles 3 - 14 & 30 to support future stop logs is not indicated on the drawings.

MB/ndef

cc: Messrs. S. McCombie
W. S. Melnyshyn
T. J. Kovish
C. K. Hunter (2)

M. Devata

M. Devata,
SUPERVISING FOUNDATION ENGR.

For:

A. G. Sternac,
PRINCIPAL FOUNDATION ENGR.

Foundations Files
Gen. Files

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac,
Principal Foundation Engineer

Mr. W. Melinshyn,
Regional Bridge Location Engineer,
Central Region,
Administration Building

66-F-62

Bridge Division,
Downsview, Ontario

August 22, 1967

Eighteen Mile Creek Culvert
North & South Service Roads (Q.E.W.)
W.P. 286-66, Site No. 18-20
District No. 4 - Hamilton

Attached herewith are prints of the revised Preliminary
Bridge Plan Drawing D-6134-P for the above-mentioned structure.

The estimated cost of the proposed structure is \$65,000.
This cost includes tender, materials, engineering and sundry
construction.

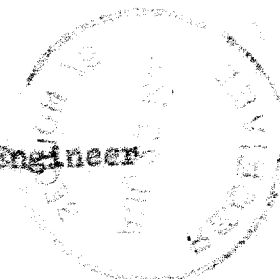
Any comments or revisions you may have should be submitted
within three weeks.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. S. McCombie
A. Stermac
R. Forrest
E. Cross



Department of Highways Ontario

Copy for the information of

Mr. A. Stermac, Principal Foundation Engineer,
Room 107, Lab. Building

Mr. W. Melinyshyn,
Reg. Bridge Location Engineer,
Central Region,
Administration Building

Bridge Division,
Downsview, Ontario

June 28, 1967

Eighteen Mile Creek
Twin 15' x 17' Rigid Frame Culvert
W.P. 286-66, Site No. 18-20
N.&S. Service Roads, Q.E.W.
District No. 4

WP 21-63
65 F-163

Attached herewith are prints of the Preliminary Bridge
Plan Drawing D-6134-P for the above-mentioned structure.

The estimated cost of the proposed structure is \$250,000.
This cost includes tender, materials, engineering and sundry
construction.

Any comments or revisions you may have should be submitted
within three weeks.

CSG:rd

C.S. Grebaki,
Bridge Design Engineer

Attach.

c.c. S. McCombie
A. Stermac
R. Forrest
E. Cross

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

July 6, 1967


Eighteen Mile Creek
Twin 15' x 17' Rigid Frame Culvert
W.P. 286-66 -- Site No. 18-20,
N. & S. Service Roads, Q.E.W.
-- District No. 4 (Hamilton) --

WP-211-63
66-F-63

We understand that the above-named structure has
been revised to a pipe arch culvert scheme.

When the new preliminary plan is available, we
will be pleased to review it.

ACC/kdeF


A. C. Calder,
SENIOR FOUNDATION ENGR.
For:
K. Devata,
SUPERVISING FOUNDATION ENGR.

cc: Messrs. S. McCombie
W. S. Melinyshyn
Foundations Files ✓
Gen. Files

Copy for the information of
Mr. A. Stermac,
Principal Foundation Engineer

Mr. W. Melinyshyn,
Regional Bridge Location Engineer,
Central Region,
Administration Building

Bridge Division,
Downsview, Ontario

October 17, 1967

Eighteen Mile Creek Culvert
W.P. 286-66, Site No. 18-20
N.&S. Service Roads (Q.E.W.
District No. 4

W.P. 211-67
66-F 63

Attached herewith are prints of the revised Preliminary
Bridge Plan Drawing D-6134-P2 for the above-mentioned structure.

The estimated cost will remain the same as previously
submitted.

Any comments or revisions you may have should be submitted
within three weeks.

CSG:rd

C.S. Grebski,
Bridge Design Engineer

Attach.

c.c. S. McCombie
A. Stermac (2)
R. Forrest
E. Cross

Meeting held to resolve remaining matters.

Re: Q.E.W. Service Roads at the Crossing of 18 Mile Creek
District No. 4 (Hamilton)

W.J. 66-F-63

--

W.P. 211-63

A meeting was held in the Foundation Section on March 29, 1968, to discuss the grouting techniques for the granular material below and around the structural plate pipe arch culvert and, also, the dewatering scheme requirements. The members present are as follows:

Mr. A. G. Stermac	Foundation Section
Mr. M. Devata	Foundation Section
Mr. C. S. Grebski	Bridge Office
Mr. M. Gvildys	Bridge Office
Mr. T. J. Kovich	Regional Materials & Testing

After discussing various items, it was agreed that:

i) Crusher-run rock will be used instead of Granular Base Course - Class 'A' material around the pipe. Mr. Kovich will supply the necessary specials for this item.

ii) No dewatering scheme will be required. The temporary sheeting for grouting purposes will not be shown on the design drawings. If the contractor wishes to adopt the sheeting, he may incorporate this in the scheme for grouting.

iii) Mr. Gvildys will discuss with the structural plate pipe arch suppliers and prepare the necessary specifications for the installation of pipe arch culvert and grouting requirements under water around the pipe.



DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-63

LOCATION QEW & 18 Mile Creek, N. Service Rd., Stn. 153+35.9.5' Rt.

ORIGINATED BY R.M.

W.P. 211-63

BORING DATE July 18 & 19, 1966

COMPILED BY J.M. LP

DATUM Geodetic

BOREHOLE TYPE Washboring, NX-BX, Cone

CHECKED BY AK

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	SIRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		WP	WL	P.C.F.	
250.9	GROUND LEVEL	.								
0.0	Silty Sand - Loose								ELEV. 245.9
243.9		.								
7.0	Organic Silt - Firm to Stiff, Brown to Grey					+3				106
240						+4				
230						+2.5				120
224.9		.				+5				
26.0	Silty Sand to Sandy Silt								
224.9	Sense	.								
217.9										
33.0	Clayey Silt with Hard	/ / / / /								
193.4										
57.5	Shale Bedrock									
184.1		.								
66.6	End of Borehole	.								
						15-0 5 % Strain 10				

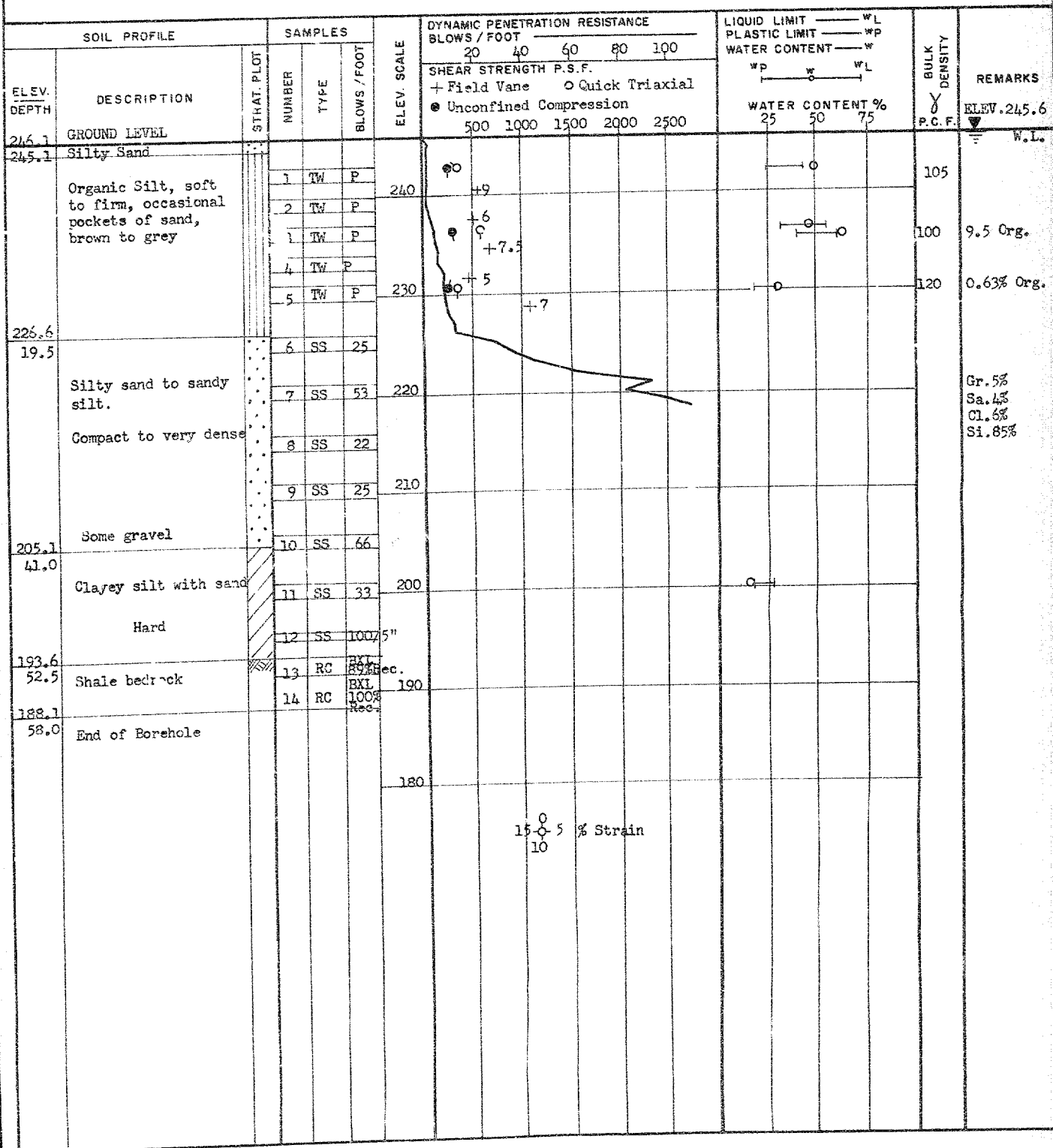
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION
JOB 66-F-63
W.P. 211-63
DATUM Geodetic

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

LOCATION QJW & 18 Mile Ck., N. Service Rd., Stn. 153+20, 60' Lt.
BORING DATE July 20 & 21, 1966
BOREHOLE TYPE Washboring, NX-BK; Cone

ORIGINATED BY R.M.
COMPILED BY _____
CHECKED BY DL



FOUNDATION SECTION

ORIGINATED BY R.M.

COMPILED BY J.M., LP

CHECKED BY

[illegible]

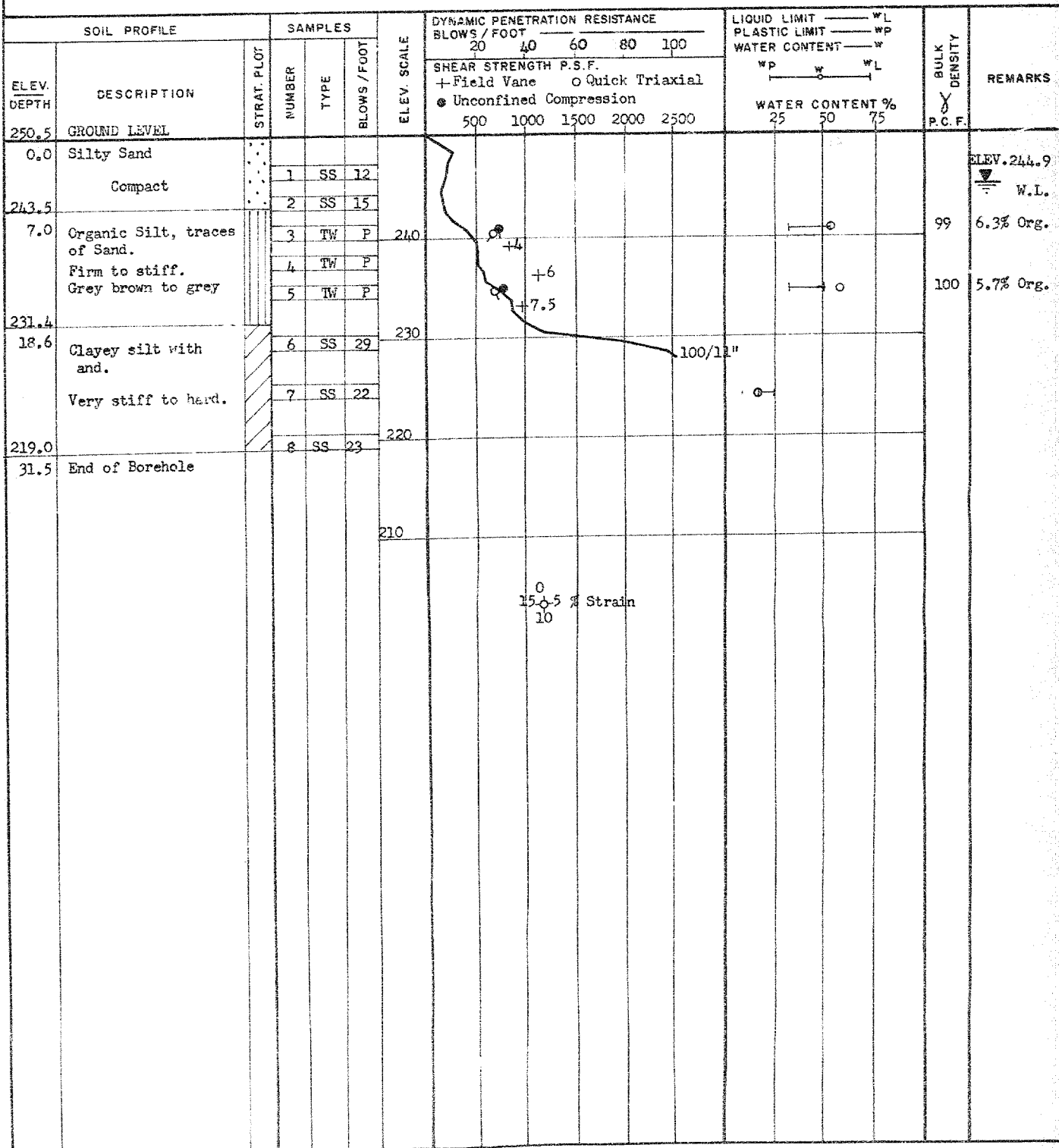
DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-63 LOCATION CEW & 18 Mile Ck. N. Service Rd., Stn. 153/54, 6.0' Rt. ORIGINATED BY R.M.
W.P. 211-63 BORING DATE July 22 & 25, 1966 COMPILED BY J.M. LP
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing, Cone CHECKED BY LL



0
15-5 % Strain
10

FOUNDATION SECTION

CHECKED BY

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DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-63

LOCATION QEW & 18 Mile Ck., N. Service Rd., Stn. 152/51, 40' Lt.

ORIGINATED BY R.M.

W. P. 211-63

BORING DATE July 27, 28 & 29, 1966

COMPILED BY J.M. LP

DATUM Water

SOREHOLE TYPE Washboring, NX-BX; Cone

CHECKED BY AK

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. + Field Vane O Quick Triaxial ● Unconfined Comp.	WATER CONTENT %		
245.4	WATER LEVEL									
243.4	Water									
2.0	Organic silt, grey brown to grey. Soft to stiff		1	TW	P	240	0	10	95	4.9% Org.
			2	TW	P		+6	10	115	2.6% Org.
			3	TW	P		+6	10	120	0.3% Org.
			4	TW	P		+6	10		
			5	SS	2	230	+9	10		
224.6			6	TW	P			10		0.7% Org.
20.8	Silty sand-compact		7	SS	17			10		Sa70%, Si24%, Cl. 6%
222.4			8	SS	20	220		10		
23.0	Clayey silt with sand. Stiff to Hard		9	SS	10		+15	10		
			10	SS	32	210		10		
			11	SS	33			10		
			12	SS	29	200		10		
196.3			13	SS	100/6"			10		Gr. 3%, Sa46%, Si43%, Cl. 8%
49.1	Shale Bedrock		14	RC	BXL 81% Rec.					
			15	RC	BXL 85% Rec.	190				
187.4			16	RC	BXL 88% Rec.					
58.0	End of Borehole					180				
							15 0 5 10			

FOUNDATION SECTION

ORIGINATED BY R.M.

COMPILED BY J.M. LP

CHECKED BY HK

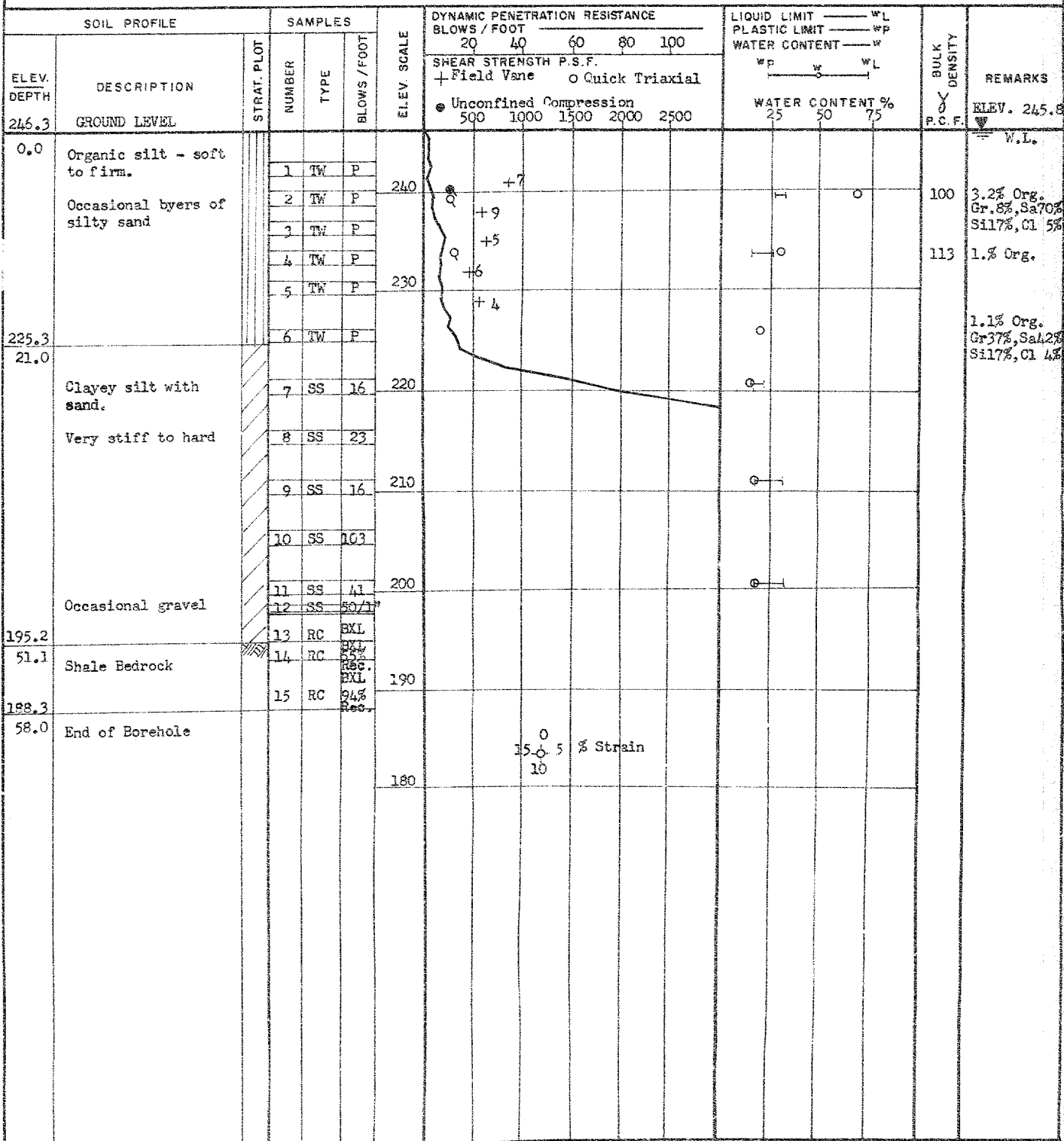
SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. + Field Vane ○ Quick Triaxial ● Unconfined Compression			WATER CONTENT % 25 50 75					
245.4	WATER LEVEL						20 40 60 80 100								
243.6	Water														
1.8	Organic Silt		1	SS	1 1/2"	240		+4						120	1.1% Org.
	Soft to stiff		2	TW	P			+5							
			3	TW	P			+5.5							
231.9			4	TW	P										6.3% Org.
13.5	Silty sand-loose		5	SS	2	230									Gr1%, Sa65%
228.9															Si25%, Cl.9%
226.4	Org. silt		6	SS	16										
19.0	Silty Sand-compact														
223.4			7	SS	24	220									
22.0	Clayey silt with sand		8	SS	22										
	Very stiff to hard		9	SS	21	210									
			10	SS	22										
			11	SS	23	200									
196.2															
49.2	Shale Bedrock		12	RC	EXL 21% Rec.	190									
			13	RC	EXL 50% Rec.										
			14	SS	50% Rec.										
185.4			15	RC	EXL 50% Rec.										
60.0	End of Borehole		16	SS	120/1 1/2"	180									

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 9

FOUNDATION SECTION

JOB 66-F-63 LOCATION QEW & 18 Mile Ck., N. Service Rd., Stn. 152+20, 60.0' Ltd. ORIGINATED BY P.M.
W.P. 211-63 BORING DATE August 5, 8 & 9, 1966 COMPILED BY _____
DATUM Geodetic BOREHOLE TYPE Washboring, NX-BX; Cone CHECKED BY ll



DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-P-63

LOCATION 25W & 18 Mile Cr., N. Service Rd., Stn. 152+60, 16' Lt.

ORIGINATED BY R.M.

W.P. 211-63

BORING DATE August 4, 1966

COMPILED BY J.M. LP

DATUM Watter

BOREHOLE TYPE Washboring, BX-Casing

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — WL			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	ELEV. SCALE	PLASTIC LIMIT — WP	WATER CONTENT — W	WATER CONTENT %		
245.4	Water Level												
243.5	Water												
1.9	Probable Organic Silt					240							
229.9						230							
13.5	Probable Sandy silt to silty sand												
224.4													
21.0	Probable clayey silt with sand					220							
						210							
						200							
194.2			1	SS	95/6"								
51.2	Shale Bedrock		2	SS	165/2"								
189.3			3	RC	81/2" Rec								
56.1	End of Borehole		4	RC	93/2" Rec								
						130							

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-63

LOCATION QEW & 18 Mile Ck. N. Service Rd., Stn. 151/98, 14.0' Ltd. ORIGINATED BY R.M.

W. P. 211-63

BORING DATE August 4 & 5, 1966

COMPILED BY J.M., LP

DATUM Geodetic

BOREHOLE TYPE Washboring, NX-BX: Cone

CHECKED BY

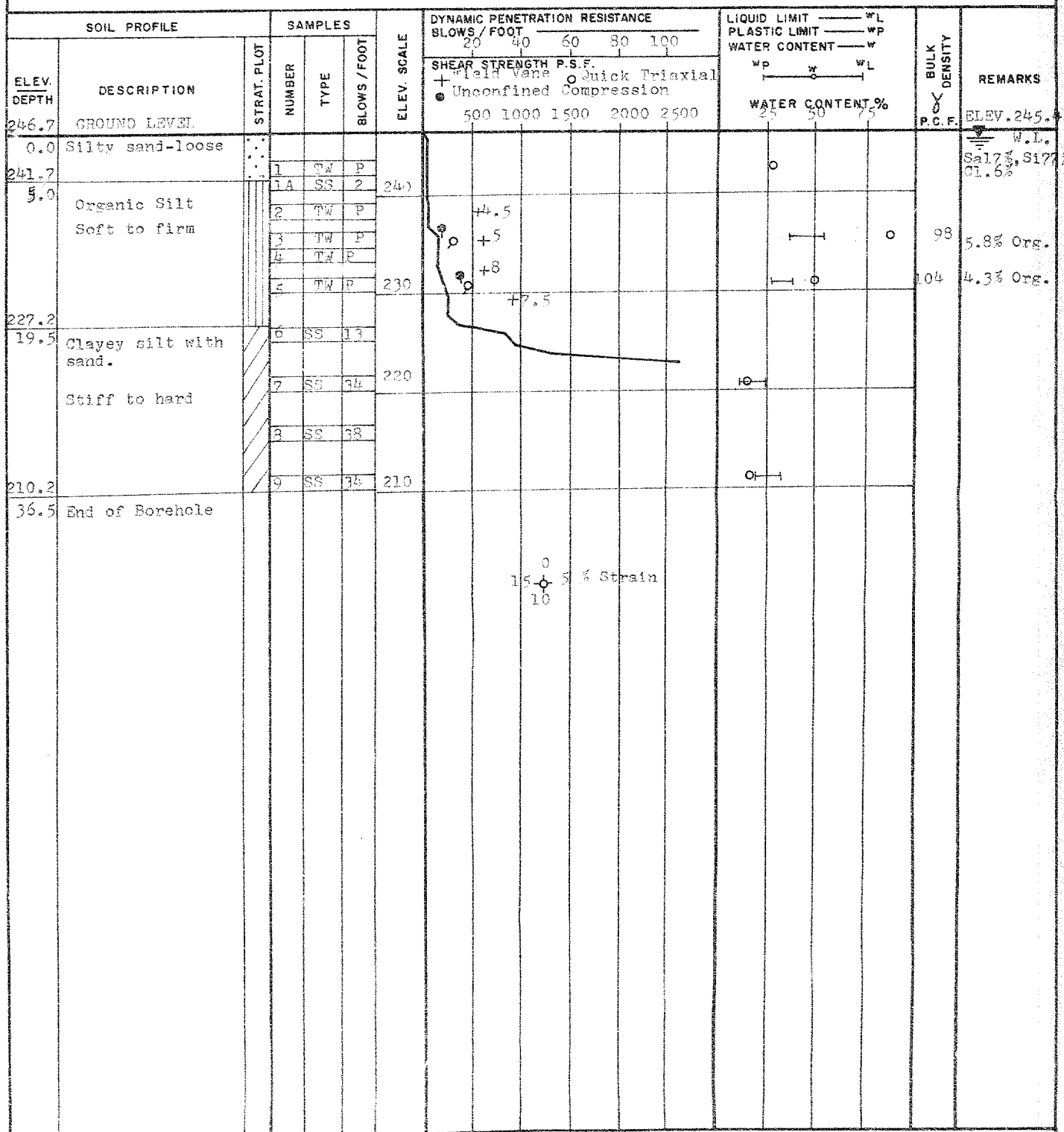
SOIL PROFILE						SAMPLES	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	Liquid Limit — WL Plastic Limit — WP Water Content — W	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			
							+ Field Vane Quick Triaxial			
							Unconfined Compression			
							500 1000 1500 2000 2500			
								WATER CONTENT % 25 50 75		
249.0	GROUND LEVEL									
0.0	Silty Sand, Loose		1	SS	5					
242.5			2	SS	5					
6.5	Organic silt, soft to firm, grey brown to grey. Occasional small pockets of sand		3	TW	P	240	+4			92
			4	TW	P		+3.5			
			5	TW	P		+3.5			
230.0						230	+3			121
19.0	Clayey Silt with sand.		6	SS	-					
			7	SS	23					
	Soft to Hard		8	SS	23	220				
			9	SS	13					
			10	SS	31	210				
			11	SS	32					
			12	SS	150	200				
193.9										
55.1	Shale Bedrock		13	RC	BXL 79% Rec	190				
189.0										
60.0	End of Borehole									
						180				

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION
JOB 66-7-63
W.P. 211-63
DATUM Geodetic

RECORD OF BOREHOLE NO. 12

FOUNDATION SECTION

LOCATION QEW & 18 Mile Cr., N. Service Rd., Stn. 151+48.58' Lt ORIGINATED BY R.M.
BORING DATE August 9, 1966 COMPILED BY J.M. LP
BOREHOLE TYPE Washboring, NY Casing: Cone CHECKED BY ML



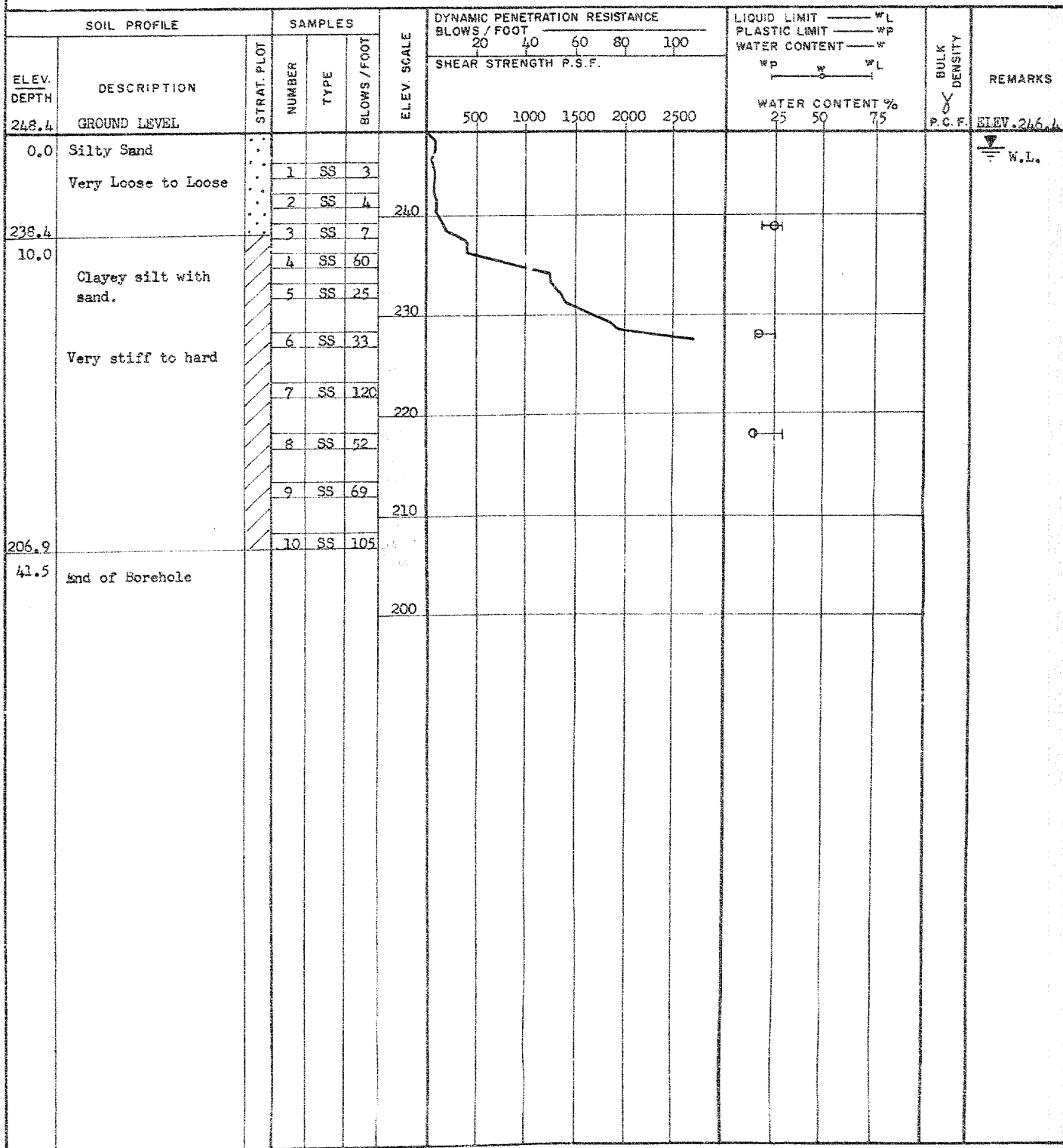
DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 13

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-63 LOCATION QEW & 18 Mile Ck., N. Service Rd., Stn. 151+27, 16' Ltd. ORIGINATED BY R.M.
W.P. 211-63 BORING DATE August 9, & 10, 1966 COMPILED BY _____
DATUM Geodetic BOREHOLE TYPE Washboring, NX-Casing; Cone CHECKED BY JK



FOUNDATION SECTION

CHECKED BY

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. + Field Vane O Quick Triaxial ● Unconfined Compression	WATER CONTENT % 25 50 75		
251.0	GROUND LEVEL									
0.0	Silty Sand									
246.5	Loose		1	SS	4		+4			
4.5	Organic Silt		2	SS	-		+10			
	Soft to stiff		3	TW	P	240	0			98 6% Org.
239.0			4	SS	9		+10			
12.0	Clayey silt with sand.		5	SS	24					
	Stiff to hard.		6	SS	16	230	+2			
			7	TW	P		0			138 Gr2%, Sa 9% Si71%, Cl18%
			8	SS	31	220				
			9	SS	42					
209.5			10	SS	44	210				
41.5	End of Borehole					200				
							15 0 5 % Strain 10			

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— W _L PLASTIC LIMIT ——— W _P WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	20 40 60 80 100	W _P ——— W _L	WATER CONTENT %			
262.7	GROUND LEVEL												
0.0	Silty Sand-Loose		1	SS	15	260							ELEV. 258.4
258.7			2	SS	43								W.L.
4.0	Clayey silt with sand.		3	SS	40								
			4	SS	40	250							
			5	SS	37								
	Very stiff to hard.		6	SS	21								
			7	SS	24	240							
			8	SS	24								
			9	SS	44	230							
			10	SS	45								
			11	SS	42	220							
214.7													
48.0	Silty sand, some gravel, some clay. compact.		12	SS	30	210							
205.7			13	SS	27								
57.0			14	SS	56	200							
			15	RC									
194.3			16	RC		190							
68.4	Shale Bedrock		17	RC	BXL 96% Rec.								
187.8													
74.9	End of Borehole					180							

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 16

FOUNDATION SECTION

JOE 66-F-63

LOCATION QEW & 18 Mile Ck., S. Service Rd., Stn. 152/90, 20' Lt.

ORIGINATED BY R.M.

W. P. 211-63

BORING DATE August 10, 11, 12 & 15, 1966

COMPILED BY J.M., LP

DATUM Geodetic

BOREHOLE TYPE Washboring, NX-BX; Cone

CHECKED BY AK

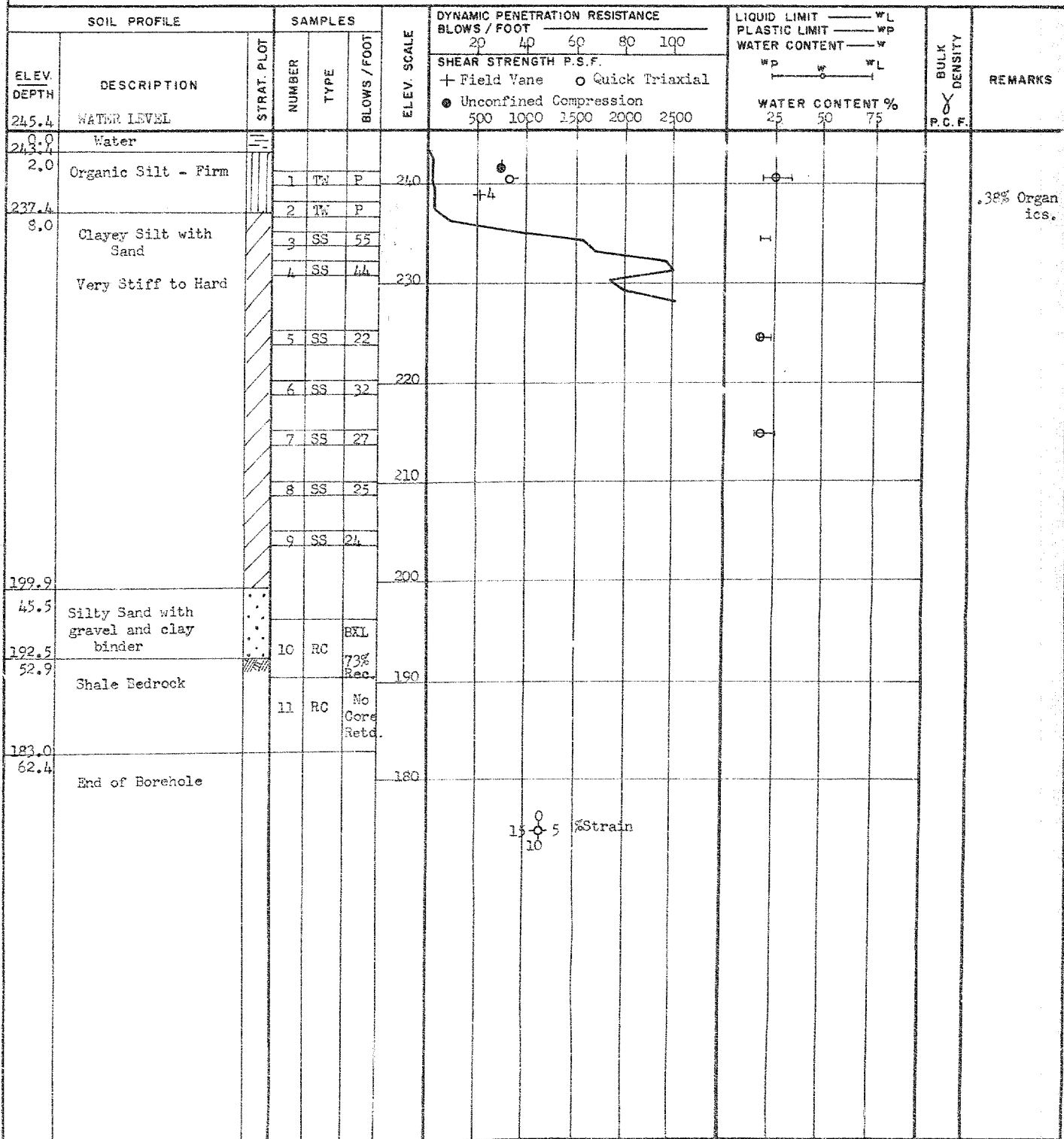
SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	BLOWS / FOOT	W _L	W _P		
245.4	Water Level										
0	Water										
241.9	Organic Silt - Firm		1	SS	2/18"	240					
3.5			2	TW	P						
237.4			3	TW	P						
8.0			4	SS	26						
	Clayey Silt with Sand		5	SS	21	230					
			6	SS	27						
	Stiff to Hard		7	SS	30	220					
			8	SS	23						
			9	SS	14	210					
			10	SS	22						
199.9			11	SS	153	200					
198.3	Silty sand with gravel		12	RC	EXL 64% Rec.						
47.1	Shale Bedrock		13	RC	EXL 80% Rec.	190					
189.4											
56.0	End of Borehole					180					

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

JOB 66-F-63 LOCATION CEW & 18 Mile Ck. S. Service Rd., Stn. 152+90, 16.0' Rt. ORIGINATED BY R.M.
W.P. 211-63 BORING DATE August 15, 16 & 17, 1966 COMPILED BY J.M., LP
DATUM Water BOREHOLE TYPE Washboring, NX-BX; Cone CHECKED BY JK



DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 18

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-P-63

LOCATION QEW & 18 Mile Cr., S. Service Rd., Stn. 153+25, 3.0' Rt.

ORIGINATED BY R.M.

W.P. 211-63

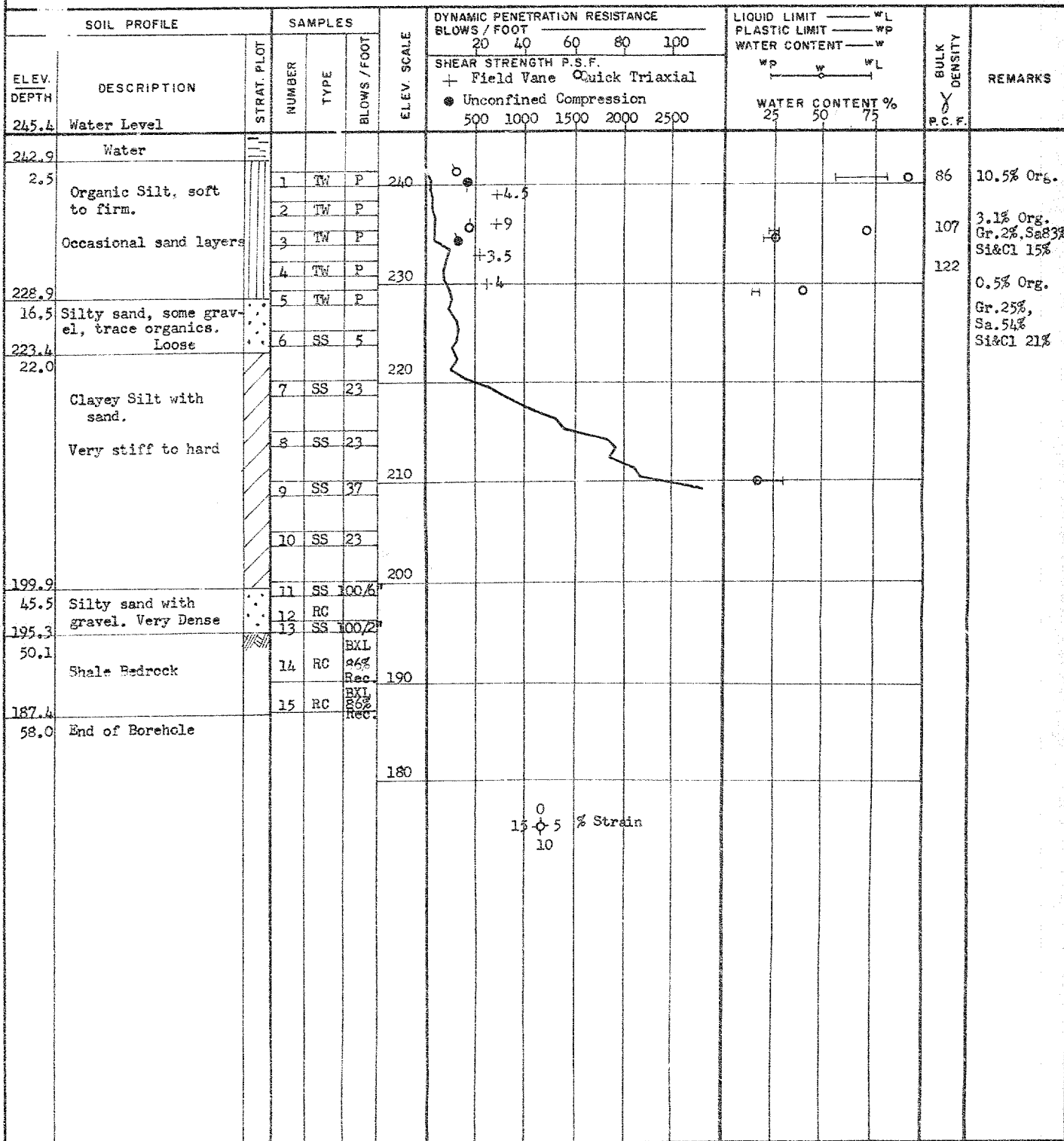
BORING DATE August 17, 18 & 19, 1966

COMPILED BY J.M., LP

DATUM Water

BOREHOLE TYPE Washboring, NX-BX, Cone

CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 19

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-63 LOCATION QEW & 18 Mile Ck., S. Service Rd., Stn. 152+32 121.0 Rt. ORIGINATED BY R.M.
W.P. 211-63 BORING DATE August 18, 19, & 23, 1966 COMPILED BY J.M. LP
DATUM Geodetic BOREHOLE TYPE Washboring, NX-BX; Cone CHECKED BY LL

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	25	50	75		
269.9	GROUND LEVEL															
268.4	Silty Sand															
1.5			1	SS	46											
			2	SS	21											
	Clayey silt with sand.		3	SS	40	260										
			4	SS	47											
	Very stiff to hard		5	SS	28											
			6	SS	31	250										
			7	SS	35											
			8	SS	25	240										
			9	SS	26											
			10	SS	25	230										
			11	SS	49											
			12	SS	36	220										
			13	SS	29											
			14	SS	27	210										
			15	SS	47											
200.9			16	SS	95/6	200										
69.0	Silty sand with gravel, some clay		17	RC	81% Rec.											
195.6			18	RC	93% Rec.	190										
74.5	Shale Bedrock															
189.6																
80.1	End of Borehole					180										

ELEV. 255.0
W.L.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 20

FOUNDATION SECTION

JOB 66-F-63

LOCATION GEW & 18 Mile Ck., S. Service Rd., Stn. 153+47, 40' Rt.

ORIGINATED BY R.M.

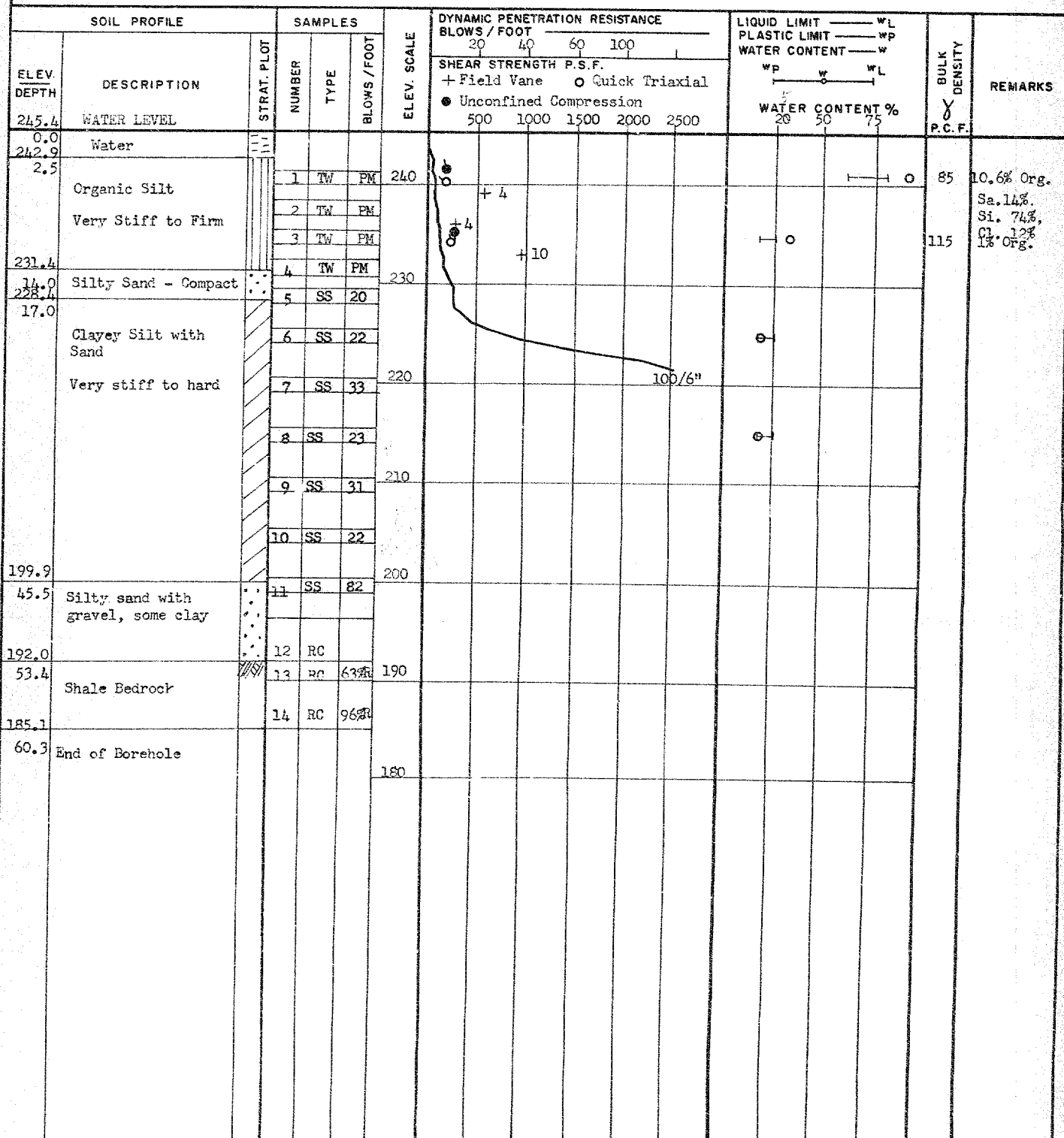
W.P. 211-63

BORING DATE August 19, 1966

COMPILED BY J.M., LP

DATUM Geodetic

BOREHOLE TYPE Washboring and Cone Penetration

CHECKED BY *JK*

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-63 LOCATION CEW & 18 Mile Creek, S. Service Rd., Stn. 153465 19.0' Lt. ORIGINATED BY R.M.

W.P. 211-63 BORING DATE August 23, 24, 25 & 26, 1966 COMPILED BY J.M., L.P.

DATUM Geodetic BOREHOLE TYPE Washboring, NX-BX; Cone CHECKED BY JK

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. + Field Vane o Quick Triaxial			WATER CONTENT % 25 50 75				
258.7	GROUND LEVEL													
0	Silty sand and Clayey silt with Sand		1	SS	9									
			2	SS	16									
250.2			3	SS	10	250								
8.5	Organic silt Firm to stiff		4	TW	P									
			5	TW	P									
			6	TW	P	240								
			7	SS	10									
			8	TW	P	230								
227.7			8A	SS	23									
31.	Silty Sand, Compact		9	SS	59	220								
224.7														
34.	Clayey Silt with Sand Hard		10	SS	52									
220.7														
38.	Silt to Sandy Silt Very Dense		11	SS	51	210								
216.7			12	SS	85									
42.			13	SS	24	200								
202.7			14	SS	94 1/2"									
56.	Silty sand with gravel some clay Very dense		15	RC										
193.7			16	RC	BXL 76% Rec	190								
65.0	Shale Bedrock		17	RC	BXL 93% Rec									
184.4														
74.3	End of Borehole					180								

FOUNDATION SECTION

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT					WATER CONTENT				
						20	40	60	80	100	WP	WL	PLASTIC LIMIT		
SHEAR STRENGTH P.S.F.						WATER CONTENT %					P.C.F.				
+ Field Vane o Quick Triaxial						25 50 75									
● Unconfined Compression						500 1000 1500 2000 2500									
245.4	WATER LEVEL														
243.9	Water														
1.5	Organic Silt		1	TW	P	240	o	+6						98	4.4% Org.
	Very soft to soft		2	TW	P			+7							
			3	TW	P			+3							
			4	TW	P	230	o	+6						119	0.8% Org.
227.9			5	TW	P										
17.5	Clayey Silt with Sand		6	TW	P			+2						132	Gr.2%, Sa.3%, Si.74%, Cl.21%
	Stiff to very stiff		7	SS	24	220									
			8	SS	24										
			9	SS	26	210									
			10	SS	24										
201.4			11	SS	97/6	200									
44.0	Silty sand with gravel, some clay		12	SS	100/6										
191.9	Very dense		13	RC											
53.5	Shale Bedrock		14	RC		190									
180.4						180									
65.0	End of Borehole														

FOUNDATION SECTION

ORIGINATED BY R.M.

COMPILED BY J.M. LP

CHECKED BY

SOIL PROFILE		SAMPLES	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE BLOWS / FOOT	SHEAR STRENGTH P.S.F.			P.C.F.	
				+ Field Vane ○ Quick Triaxial				
				● Unconfined Compression				
				500 1000 1500 2000 2500				
						WATER CONTENT % 25 50 75		
245.9	GROUND LEVEL							ELEV. 245.4
0.0	Organic Silt Soft		1 TW P					W.L.
236.9			2 TW P					20% Org.
9.0	Clayey Silt with Sand		3 SS 23					
			4 SS 20					
	Stiff to Hard		5 TW F-H					136
			6 SS 25					
			7 SS 32					
			8 SS 24					
			9 SS 31					
			10 SS 24					
201.4			11 SS 50/1"					
44.5	Silty sand with gravel, some clay		12 RC					
194.6			13 RC					
51.3	Shale Bedrock							
187.3								
58.6	End of Borehole							

FOUNDATION SECTION

ORIGINATED BY R.M.

COMPILED BY J. M. L. P.

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F. + Field Vane O Quick Triaxial ● Unconfined Compression 500 1000 1500 2000 2500					WATER CONTENT % 25 50 75				
248.4	GROUND LEVEL														
0	Organic Silt Firm to stiff		1	SS	5				+10						▼ 245.8 WL.
			2	TW	P	240			+3					112	3.5% Org.
			3	TW	P				+5					121	
			4	TW	P				+4					119	1.3% Org.
			5	TW	P	230			+2						
229.4	Silty Sand, Some Clay-Compact		6	SS	13										
223.9			7	SS	66	220									
24.5	Clayey Silt with Sand Hard		8	SS	48										Sa. 9%, Si. 80%, Cl. 11%.
			9	SS	42	210									
			10	SS	39										
202.4			11	SS	112/5"										
46.0	End of Borehole					200									
									15 O 10	5 % Strain					

FOUNDATION SECTION

ORIGINATED BY R.M.

COMPILED BY J.M., LP

CHECKED BY

[illegible]

FOUNDATION SECTION

JOB 66-F-63 LOCATION QEW & 18 Mile Ck., S. Service Rd., Stn. 155+91, 40' Rt. ORIGINATED BY R.M.
W.P. 211-63 BORING DATE August 31 & September 1, 1966 COMPILED BY J.M., LP
DATUM Geodetic BOREHOLE TYPE Washboring, NX-Cased CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F. + Field Vane O Quick Triaxial		WATER CONTENT %			
246.2	GROUND LEVEL					● Unconfined Compression 500 1000 1500 2000 2500		25 50 75			ELEV. 245.6
0.0	Organic Silt Very stiff to stiff		1	TW	P	240	5			96	5% Org.
			2	TW	P		8				
			3	TW	P		3			118	0.9% Org. Sa. 20% Si. 67% Cl. 13%
			4	TW	P						
230.2			5	TW	P	230	5			127	
16.0	Clayey Silt with Sand Very stiff		6	SS	25						
			7	SS	27						
221.3			8	SS	37	220					
25.0	Sandy Silt		9	SS	87						
213.2											
33.0	Clayey Silt with sand Hard		10	SS	84	210					
			11	SS	83						
199.7			12	SS	84						
46.5	End of Borehole					190					
							0 150.5 10	% Strain			

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB <u>66-F-63</u>	LOCATION <u>QEW & 18 Mile Ck., S. Service Rd., Stn. 155+53, 2.0' Rt.</u>	ORIGINATED BY <u>R.M.</u>
W.P. <u>211-63</u>	BORING DATE <u>September 1 & 2, 1966</u>	COMPILED BY <u>J.M., LP</u>
DATUM <u>Geodetic</u>	BOREHOLE TYPE <u>Washboring NX-Cased</u>	CHECKED BY <u>AK</u>

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 30

FOUNDATION SECTION

JOB 66-F-63 LOCATION QEW & 18 Mile Ck., S. Service Rd., Stn. 156/47, 18¹ Rt. ORIGINATED BY R.M.
W.P. 211-63 BORING DATE September 6, 1966 COMPILED BY J.M., LP
DATUM Geodetic BOREHOLE TYPE Washboring, NX-Cased CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. + Field Vane O					WATER CONTENT %				
	GROUND LEVEL						● Unconfined Compression 500 1000 1500 2000 2500					25 50 75				ELEV. 245.7
246.3	Organic Silt															W.L.
0.0																
242.8			1	TW	P-H										135	
3.5	Clayey Silt with Sand		2	SS	39	240										
	Very Stiff to Hard		3	SS	36											
			4	SS	28											
			5	SS	26	230										
			6	SS	26											
			7	SS	18	220										
216.8																
29.5	Sandy Silt		8	SS	50											
	Dense															
209.8			9	SS	27	210										
36.5	End of Borehole															
						200										

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 31

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-63

LOCATION QEW & 18 Mile Cr., S. Service Rd., Stn. 157+00, 45' Rt.

ORIGINATED BY R.M.

W. P. 211-63

BORING DATE September 6 & 7, 1966

COMPILED BY J.M.

DATUM Geodetic

BOREHOLE TYPE Washboring, NK-Cased

CHECKED BY JK

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. + Field Vane o Quick Triaxial ● Unconfined Compression 500 1000 1500 2000 2500	WATER CONTENT % 25 50 75				
246.0	GROUND LEVEL										ELEV. 245.4	
0.0	Organic Silt		1	TW	P	240	●	+8			90	9.2% Org.
	Very soft to firm		2	TW	P		●	+4				
			3	TW	P			+8				
233.0			4	TW	P		●				129	0.5% Org.
13.0	Clayey Silt with Sand		5	SS	35	230						
	Very Stiff to Hard		6	SS	27							
223.0			7	SS	25	220						
23.0	Sandy Silt		8	SS	26							
216.0	Compact		9	SS	34	210						
28.0			10	SS	86							
213.0	Sandy Silt											
33.0	Dense											
207.0												
204.5												
41.5	End of Borehole					200						

FOUNDATION SECTION

ORIGINATED BY R.M.

COMPILED BY J.M. LP

CHECKED BY

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		PLASTIC LIMIT		WATER CONTENT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.		W.P.		W.L.			
							+ Field Vane o Quick Triaxial							
							● Unconfined Compression				WATER CONTENT %			
							500 1000 1500 2000 2500				25 50 75			
246.5	GROUND LEVEL													ELEV. 245.9
0.0	Organic Silt		1	TW	P		●	+4					100	4.9% Org.
	Soft to Firm		2	TW	P	240	o	+5					119	2.7% Org.
			3	TW	P			+4						
			4	TW	P			+6					120	1.5% Org.
			5	TW	P	230	o							
228.5														
18.0	Clayey Silt with sand.		6	SS	18									
	Very stiff to hard		7	SS	22	220								
			8	SS	40									
			9	SS	51	210								
205.0			10	SS	81									
41.5	End of Borehole					200								
								0 150-5 10	% Strain					

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 33

FOUNDATION SECTION

JOB 66-F-63 LOCATION QEW & 18 Mile Ck., S. Service Rd., Stn. 158+80, 57' Rt. ORIGINATED BY R.M.
W.P. 211-63 BORING DATE September 8, 1966 COMPILED BY _____
DATUM Geodetic BOREHOLE TYPE Washboring, NX-Cased CHECKED BY MR

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT						LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. + Field Vane O Quick Triaxial ● Unconfined Compression 500 1000 1500 2000 2500						wp	w		
217.3	GROUND LEVEL															
0.0	Organic Silt Soft to stiff		1	TW	P			+6								
			2	TW	P	240		+6							96	5.2% Org.
			3	TW	P											
235.3			4	TW	P			+4	0						128	
12.0	Clayey Silt with sand. Very stiff to hard		5	SS	25	230										
			6	SS	26											
223.3			7	SS	51	220										
24.0	Sandy Silt Very dense															
219.3			8	SS	88											
28.0			9	SS	72	210										
205.5			10	SS	113											
41.5	End of Borehole					200										
								0 15 0 5 10	% Strain							

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO.34

FOUNDATION SECTION

JOB 66-F-63 LOCATION QEW & LR Mile Ck. S. Service Rd., Stn. 154+55, 55' Rt. ORIGINATED BY R.M.
W.P. 211-63 BORING DATE September 7, 1966 COMPILED BY J.M., LP
DATUM Water BOREHOLE TYPE Washboring, NX-Cased CHECKED BY SR

SOIL PROFILE			STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER		TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F. + Field Vane O Quick Triaxial ● Unconfined Compression 500 1000 1500 2000 2500					WATER CONTENT % 25 50 75						
245.4	WATER LEVEL																
243.3	Water																
2.1	Organic Silt Very soft to stiff		1	TW	P	240	●							○	116	1.5% Org.	
			2	TW	P					+4							
			3	TW	P		87						○	120	1.4% Org.		
			4	TW	P				+8								
228.4			5	TW	P	230	●							○	112	0.7% Org.	
17.0	Clayey silt with sand. Very stiff to hard		6	SS	22										124	Sa. 40%	
			7	SS	49	220										Si 50%	
			8	SS	24								○			Cl. 10%	
			9	SS	28	210											
			10	SS	35								○				
			11	SS	100 1/4"	200											
200.1																	
45.3	End of Borehole																

FOUNDATION SECTION

ORIGINATED BY R.M.

COMPILED BY J.M. JP

CHECKED BY

CHECKED BY

[illegible]

FOUNDATION SECTION

DATUM Geodetic BOREHOLE TYPE Washboring, NX-Cased CHECKED BY AK

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F. + Field Vane ○ Quick Triaxial ● Unconfined Compression 500 1000 1500 2000 2500					WATER CONTENT % 25 50 75				
247.0	GROUND LEVEL														ELEV. 245.5
245.0	Silty sand														W.L.
2.0	Organic Silt		1	TW	P		●								104 7.2% Org.
	Soft to firm		2	TW	P	240	●								107 5.6% Org.
			3	TW	P		●								113 1.5% Org.
			4	TW	F										
			5	TW	P	230									2.1% Org.
	Layers of silty sand		6	TW	P										Gr 2%, Sa 56%
226.0	Clayey silt with sand.		7	SS	50	220									Sl 27%, Cl 5%
21.0	Hard		8	SS	74										
			9	SS	29	210									
			10	SS	69										
204.0	Silty sand with gravel some clay very dense.		11	SS	100	200									
46.0	End of Borehole														

FOUNDATION SECTION

CHECKED BY AK

[illegible]

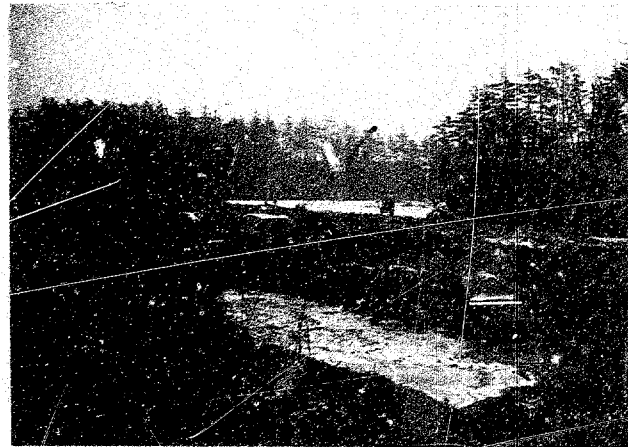
18 MILE CREEK & Q. E. W. NORTH & SOUTH SERVICE ROAD

W.P. 211-63 JOB. 66-F-63

Date of Photo's 26 Feb. 1969



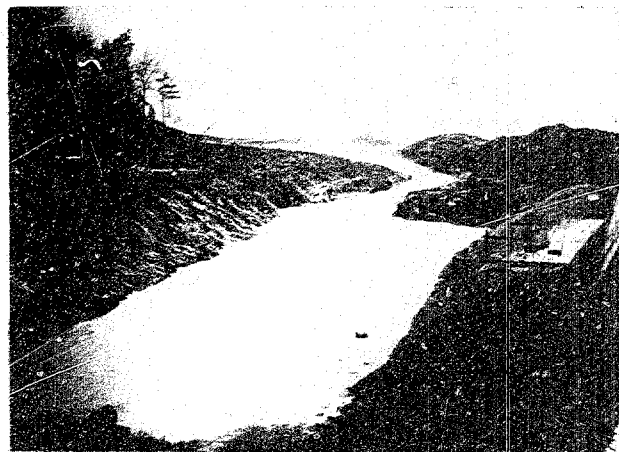
Excavation of organic material for
South Service Road.



General view of South Service Road
excavation.



Excavation of organic material for
South Service Road. S.-W. view.

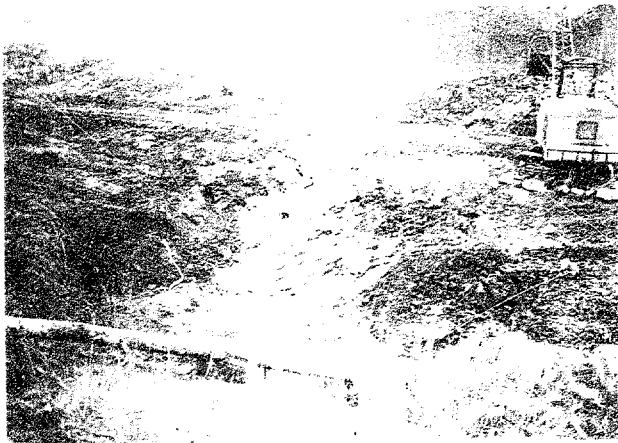


18 Mile Creek Channel. North view.

18 MILE CREEK & Q.E.W. NORTH & SOUTH SERVICE ROAD

WP 211-63 JOB 66-F-63

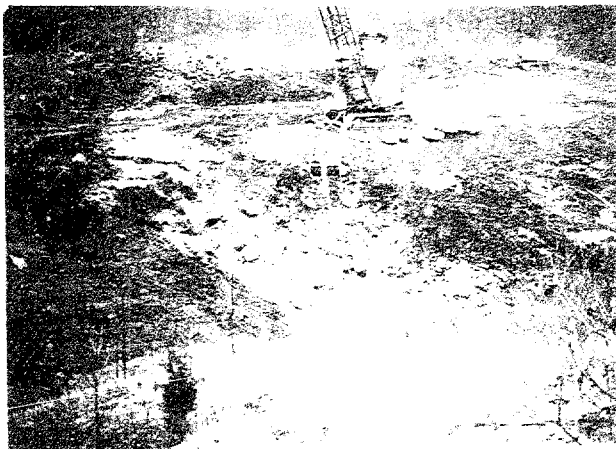
Date of Photo's 26 Feb 1969



Excavation of organic material for
South Service Road.



General view of South Service Road
excavation.

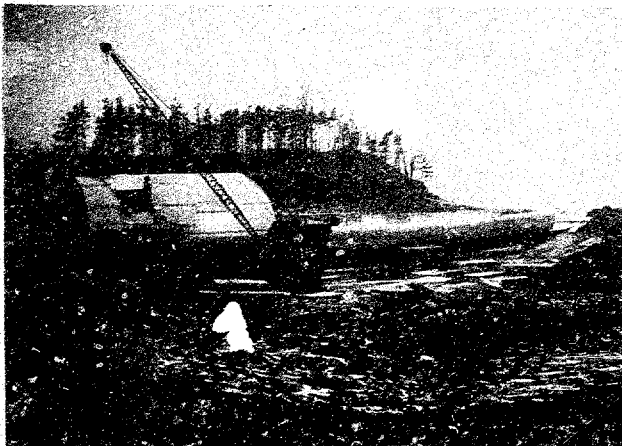


Excavation of organic material for
South Service Road S-W view



18 Mile Creek Channel, North view.

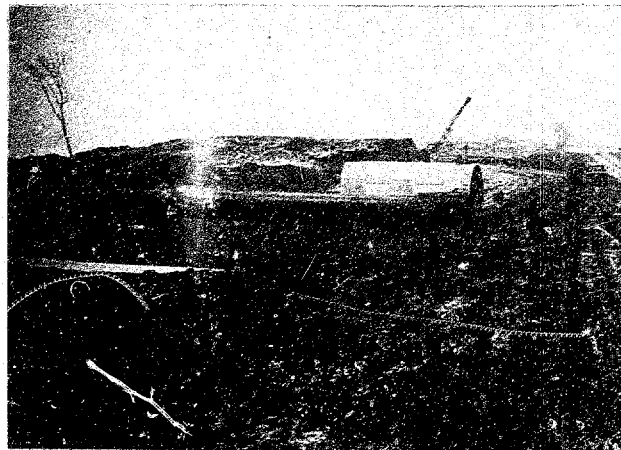
18 MILE CREEK & Q.E.W. NORTH & SOUTH SERVICE ROAD



Culvert installation for North Service Road. North - West view.

W.P. 211-63 JOB 66-F-63

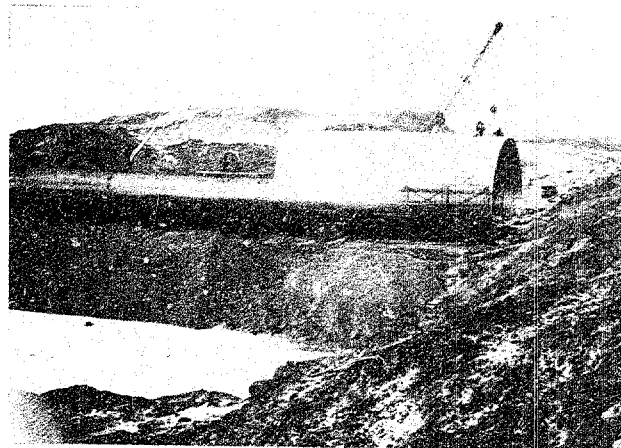
Date of Photo's 26 Feb. 1969



Channel & Culvert, East view.



Culvert installation, North-West view.

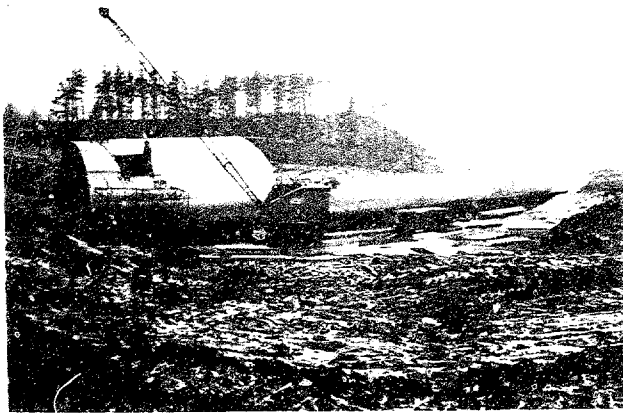


Channel & Culvert, East view.

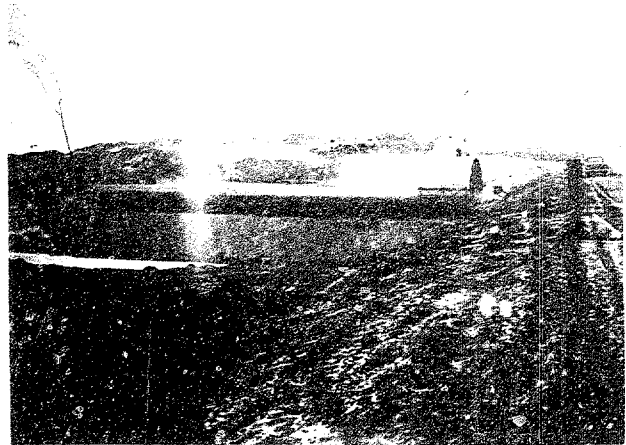
18 MILE CREEK & Q.E.W. NORTH & SOUTH SERVICE ROAD

W.P. 211-63 JOB 66-F-63

Date of Photo's 26 Feb. 1969



Culvert installation for North Service Road. North - West view



Channel & Culvert, East view



Culvert installation, North-West view.



Channel & Culvert, East view

DEPARTMENT OF HIGHWAYS BRIDGE INSPECTION REPORT

Sufficiency Rating..... Index No....Lincoln QEW-52.20
 Highway No Q.E.W. District No. 4 County Lincoln
 Number & Name of Structure 18 mile Creek Bridge
 Type of Structure Double Rigid frame box culvert
 Inspected By E. Van Pellen Date of Inspection Apr. 10, 1956
 Mileage From Jct. Hwy. #20 and Q.E.W. 22.7 mi

Bridge Dimensions

Span 2 @ 15' Bridge Plan No. D-111
 Length of Bridge floor 36'
 Width of Bridge Roadway 10'4" - 9" Width of Bridge.....
 Clearance..... Date of Construction 1938

Approach Geometrics

Good

1

Waterway Adequacy

Satisfactory

Condition of Bridge

Abutments

Ballast Walls

Piers

RETURN TO D.H.O.

BRIDGE MAINTENANCE

SECTION

Bearings

Main Girders, Trusses or Ribs

Floor Beams

Stringers

Deck

Wearing Surface

Expansion Joints

Handrail Posts

Handrails

Wingwalls

Cracked, broken off culvert

Curbs

Sidewalks

Drainage

Scour occurred at North side due to unsufficient drainage of road.

Retaining Walls

Embankment Slopes

Additional Observations

Skew 9° - 56 (not enough)

General Condition of Structure

Fair

Structural Strength

H-20Y

Recommendations

Structure needs some repairs

Date. Apr. 18 195 6

Sig.

Action

Date 195

Sig.

Remedial Measures

Plan No. D -

Date Commenced.

File No.

Date Completed.

Date 195

Sig.

Page 4.

Rough Sketch of Structure or of Part of Structure

DEPARTMENT OF HIGHWAYS
BRIDGE INSPECTION REPORT

Sufficiency Rating _____ Index No LINCOLN C.E.W. - 5220

Highway No Q.E.W. District No 4 County)
District) LINCOLN

Number & Name of Structure 18 MILE CREEK

Type of Structure DOUBLE RIGID FRAME BOX CULVERT

Inspected by A. J. PERCY Date of Inspection April 11 1961

Mileage From JCT. HWY. #20 & Q.E.W. - 22.7 MILES EAST

ADDENDUM

There are several vertical cracks in the walls of this culvert and the wingwall at the north side were both broken off of the culvert. It appears as if the foundations on the north side have settled considerably. The concrete appears to be in good condition.

Possibly the cracks could be cleaned out and refilled with an epoxy resin mortar as settlement may have stopped. If it cracks again it is not likely that anything else could be done to it.

The structure is in fair condition.

RETURN TO D.H.O.
BRIDGE MAINTENANCE
SECTION

DEPARTMENT OF HIGHWAYS
BRIDGE INSPECTION REPORT

Sufficiency Rating..... Index No. Lincoln Co. E.W. 52 20
Highway No. Q.E.W. District No. 4 County)
District).....
Number & Name of Structure... 18 Mile Creek Bridge
Type of Structure... Double R. H-frame box culvert
Inspected by... F.D.V. Date of Inspection Feb. 195 8
Mileage From.....

ADDENDUM

Same conditions.

RETURN TO D.H.O.
BRIDGE MAINTENANCE
SECTION

23-68-107

*18. Eighteen-Mile
Creek Culvert.*

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

September 5, 1967

-- EIGHTEEN-MILE CREEK CULVERT --

North & South Service Roads (I.E.W.)
N.P. 286-56, Site No. 18-60, W.J. 56-F-63
District #4 (Hawilton)

We have reviewed the Preliminary Bridge Plan Drawing D-6134-F for the above mentioned structure, and submit the following comments:

i) The subexcavation of organic silt should extend for the full length of the proposed multi-plate pipe arch culvert extensions. In order to ensure stability of the existing structure during subexcavation and backfilling operations, temporary sheeting may be required.

ii) The subexcavation should be extended at least 5 ft. on either side of the outside extremes of the proposed width of the culvert and backfilled to the required grade with suitable granular material. Side slopes of 1:1 may be used for the subexcavation.

iii) Some differential settlements between the existing structure and the new extensions can be anticipated. For this reason, care should be exercised in the design to ensure that the structure is so articulated that the differential settlements can take place without impairing the performance of the overall structure.

iv) Tip elevation for piles 3 - 14 & 30 to support future stop logs is not indicated on the drawings.

RD/ndef

cc: Messrs. S. McCombie
W. S. Melnyshyn
T. J. Kovich
G. K. Hunter (2)

M. Levata
M. Levata,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Sternac,
PRINCIPAL FOUNDATION ENGR.

Foundations Files
Gen. Files

Mr. C. S. Grebski,
Structural Design Engineer,
Structural Office,
Design Services Branch,
West Building.

Foundations Office,
Design Services Branch,
West Bldg., Downsview.

August 16, 1973.

18 Mile Creek Pipe Arch Culvert
Q.E.W., Site No. 18-20
District #4 (Hamilton)
W.O. 66-P-063 --- W.P. 280-66

It is understood that stop logs will be installed at the entrance of the above-mentioned pipe arch culvert to raise the upstream water level to an elevation of 249 for irrigation purposes (the minimum water level at Lake Ontario being at elevation 242). This Office was requested to investigate the possibility of a culvert failure caused by piping resulting from the installation of the stop logs. We have reviewed the available information and submit our comments as follows:

The bedding and backfill (below elevation 246) to the pipe arch culvert consists of 2" clear stone, which was to be pressure grouted. According to information obtained from Hamilton District Personnel, the pressure grouting was not carried out successfully. The backfill to the concrete twin box culvert under Q.E.W. is believed to be locally available silty sand. With a 7-foot head difference between the upstream and downstream side of the culvert, it is believed that some fines will enter into and hence plug the voids of the clear stone bedding and backfill of the pipe arch culvert under the North Service Road (Q.E.W.). However, it is our opinion that piping condition and consequent failure of the culvert are not likely to take place.

Tremendous uplift pressure, resulting from the head difference between the outside and inside the pipe arch culvert, will be acting on the bottom of the culvert. This may create a problem at the entrance of the culvert, where the fill material is not sufficient to counteract the uplift force. This would possibly lead to a complete failure of the culvert. In view of this, it would be advantageous to construct an earth dyke incorporating a new stop log structure some 50 feet upstream of the culvert entrance and an impervious blanket between the downstream toe of

the earth dyke to the culvert entrance. It should be noted that the subsoil consists of up to 14 feet of soft to firm organic silt. Earth dyke of up to 7 feet high, constructed with 2:1 side slopes will be stable. However, large settlement can be anticipated due to the compressible nature of the organic silt.

CSP/ao

c.c. W. Lin
J. Carter
G.C.E. Burkhardt
C. R. Robertson

Foundations Files
Documents

C. S. Poon,
Project Foundations Engineer,
For: M. Devata,
Principal Foundations Engineer.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
Room 107, West Bldg.

FROM: Structural Office,
West Bldg., DOWNSVIEW.

ATTENTION:

DATE: July 18th, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: Repairs to 18 Mile Creek Pipe Arch,
W.P.286-66, Site 18-20,
Q.E.W, District 4, Hamilton.

We are in the process of designing repair measures for the upstream end of this pipe arch.

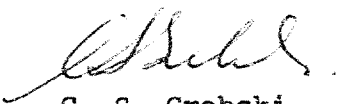
The repair work involves concrete buttresses attached to the upstream end of the pipe. These buttresses are part of a small dam. Eight by eight timbers are fitted into vertical H-piles. The buttresses connect the h-piles to the pipe.

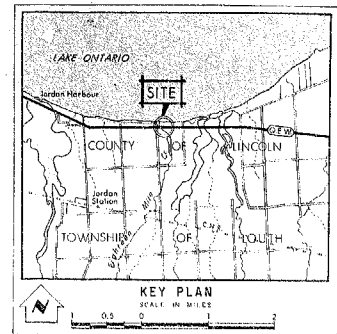
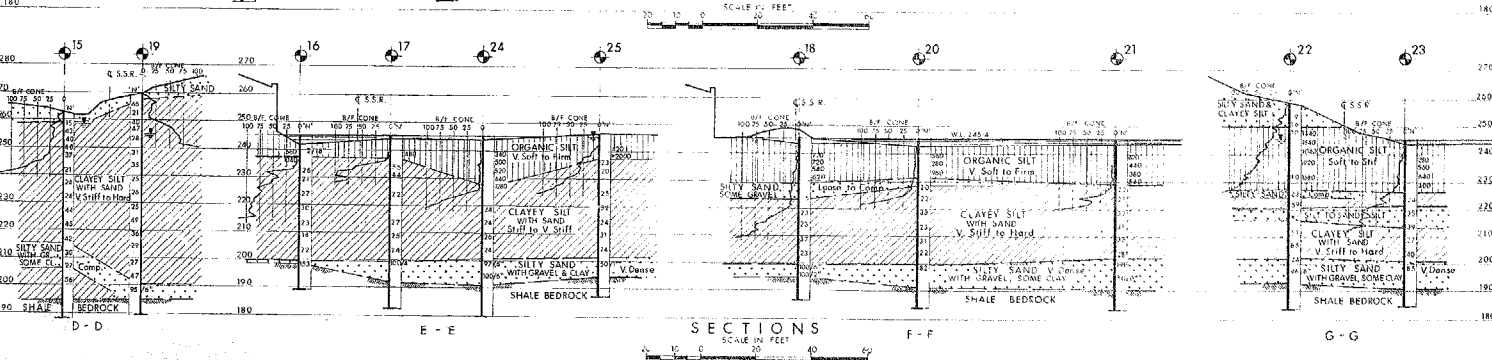
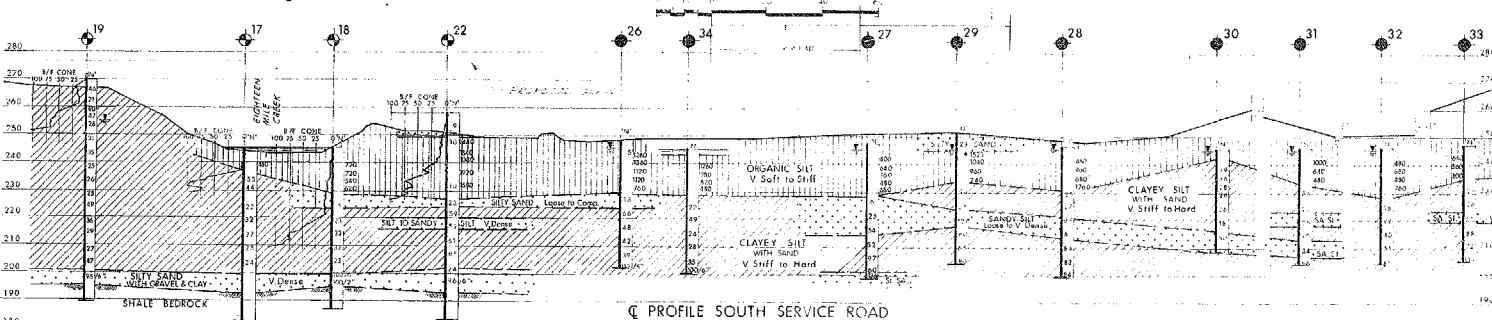
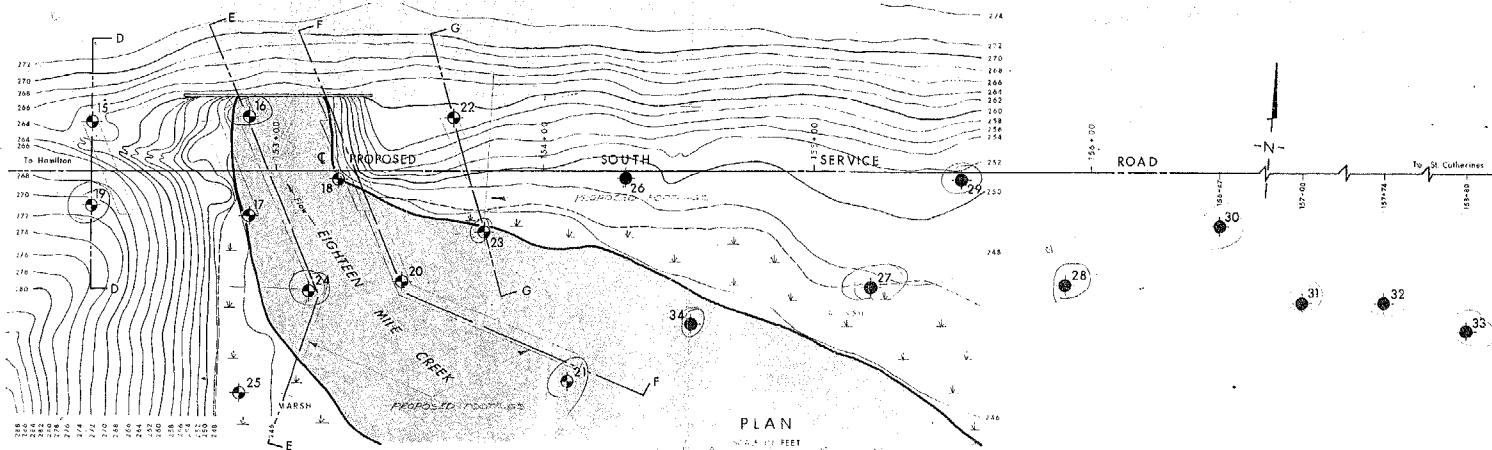
Before doing the repair work, we request that your office investigate this combination pipe and dam for the purpose of avoiding a culvert failure caused by piping of the water along the pipe. In some ways, this culvert is similar to the Markham Culvert which failed recently.

We are enclosing plans of this structure and we appreciate your recommendations at your earliest convenience.

CSG:dp
Encls.

cc. W. Lin,
D. Waller, District 4.


C. S. Grebski,
Structural Design Engineer.



LEGEND

- Bore Hole
- ⊕ Cone Penetration Hole
- ⊕ Bore & Cone Penetration Hole
- Water Levels established at time of field investigation, AUG 8, 1966

NOTE Field Vane Shear Strength ($\frac{1}{2}$ to $\frac{1}{3}$) Values are shown here in the 'V' values column in the organic silt layer

NO.	ELEVATION	STATION	OFFSET
15	262.7	102+33	16' 11"
16	215.4	102+40	29' 11"
17	235.3	102+60	10' 41"
18	235.4	102+27	9' 45"
19	260.9	102+32	12' 50"
20	245.4	102+37	30' 15"
21	245.3	102+17	18' 45"
22	278	102+02	19' 11"
23	247.4	102+12	22' 47"
24	250.4	102+19	33' 18"
25	252.4	102+07	80' 18"
26	248.4	102+31	3' 47"
27	257.1	102+29	42' 18"
28	256.2	102+47	40' 18"
29	257.2	102+58	2' 40"
30	256.3	102+27	18' 13"
31	256.7	102+14	45' 14"
32	249.0	102+14	31' 41"
33	227.3	102+40	57' 13"
34	245.4	102+55	55' 47"

NOTE
The boundaries between soil strata have been established only of 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 & TESTING DIVISION - FOUNDATION SECTION

EIGHTEEN MILE CREEK

KING'S HIGHWAY NO. 6, E.W. SOUTH SERVICE RD. DIST. NO. 4
CO. LINCOLN
TWP. SOUTH LOT 12 CON. 2

BORE HOLE LOCATIONS & SOIL STRATA

DESIGNED BY E.M.	CHECKED BY G.T.	DATE DEC. 1966	APP. NO. R-4734-1
PROJECT NO. 211-63	CHECKED BY G.T.	DATE DEC. 1966	APP. NO. R-4734-1
PROJECT NO. 211-63		PROJECT NO. 211-63	
PROJECT NO. 211-63		PROJECT NO. 211-63	