

#62-F-124

W.P. #27-61-1

Hwy. #101

WAWA EASTERLY

EMBANKMENT

FAILURE

## MEMORANDUM

23-62-178.

To: Mr. J. W. MacDougall,  
District Engineer,  
Sault Ste. Marie.  
Attention: Mr. D. S. Cornell,  
Construction Engr.

FROM: Mr. A. G. Stermac,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.  
DATE: December 28, 1962.

OUR FILE REF.

IN REPLY TO

SUBJECT: Re: Stability of Rock Fill Embankments,  
Highway #101 Wawa Easterly,  
Contract #62-178.

5

42-C-2

1. INTRODUCTION:

During our recent investigation of the embankment failure at Sta. 256+20 on the above-mentioned contract a request was received by this office from Mr. E. R. Saint, Regional Soils Engineer to carry out borings at certain other locations in order to establish whether or not stability problems might occur under the proposed rock embankments. Borings were subsequently carried out at various locations which were decided upon as a result of a discussion between Mr. Lloyd Burley, Project Supervisor on the contract and Mr. K. Selby of this office. This report contains the results of our field and subsequent laboratory investigations, together with our recommendations pertaining to the construction of the proposed embankments.

2. FIELD WORK:

A total of eleven boreholes and sixteen dynamic cone

cont'd. /2 ...

2. FIELD WORK: (cont'd.) ...

penetration tests was carried out at various locations between Sta. 0+00 and Sta. 300+00. Borings were carried out by means of a conventional diamond drill adapted for the purpose and mounted on a raft. The locations and elevations of all borings are shown on the accompanying drawings #62-F-124 B-J. All survey work was carried out by D.H.O. personnel under the supervision of Mr. Burley.

3. SUBSOIL CONDITIONS:

Subsoil at the various sites consists of deposits of muck, silty clay, clayey silt, silt, sand and gravel. Depths of the deposits vary greatly. The estimated stratigraphical profiles and the borehole layouts at each of the locations investigated are shown on drawings #62-F-124 B-J which are included in the appendix of this report. For convenience the subsoil conditions occurring at, or close to, the proposed embankment toes are described separately below:-

Sta. 16+00 - 17+00 Approx. (Culvert Site)

Subsoil consists of at least 16.0' of compact sandy silt with occasional gravels. The upper 6.0' contains traces of organics.

Sta. 31+00 - 33+50 Approx. (22' Rock Fill)

Lake depth here is about 3'. Subsoil consists of about 1'

cont'd. /3 ...

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

of muck overlying about 2' of loose clayey silt with sand which is underlain by granite bedrock.

Sta. 43+00 - 45+00 Approx. (20' Rock Fill)

Lake depth here is 2' to 3'. Subsoil consists of about 4' of very loose clayey silt sand and gravel containing organics followed by bedrock.

Sta. 132+00 - 133+00 Approx. (50' Rock Fill)

Lake depth here is about 30'. Subsoil consists of about 20' of loose clayey silt with sand followed by bedrock.

Sta. 133+50 - 135+00 Approx. (20' Rock Fill)

Lake depth here is about 3' - 6'. Subsoil consists of about 30' of loose to compact sandy silt to silty sand with the upper 3.0' containing traces of soft clay and organics. This deposit is underlain by granite bedrock.

Sta. 190+50 - 192+50 Approx. (15' Rock Fill)

Lake depth here is about 2'. Subsoil consists of about 10' of loose to compact sandy silt followed by bedrock.

Sta. 196+50 - 197+00 Approx. (18' Rock Fill)

Lake depth here is 2' to 3'. Subsoil consists of at least 24' of soft to firm clayey silt to silty clay containing stratified layers of fine sandy silt.

cont'd. /4 ...

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

Sta. 201+00 - 204+00 Approx. (15' Rock Fill)

Lake depth here is 2' to 3'. Subsoil consists of about 10' of very loose sandy silt with organics followed by about 30' of very soft to soft clayey silt to silty clay.

Sta. 270+00 - 290+00 Approx. (15' Rock Fill)

Lake depth here is about 4'. Subsoil consists of about 10' of loose sandy silt with organics, followed by a very dense deposit of sand gravel and boulders.

4. RECOMMENDATIONS:

As a result of our investigations it is apparent that some failures of the proposed embankments might occur during construction. The most critical locations appear to be between Stations 132+00 and 135+00, 196+50 and 197+00, 201+00 and 204+00, and 270+00 and 290+00. However, it is felt that it would be unwise at this stage to propose expensive remedial measures based on the very limited number of borings carried out. We therefore recommend that construction be carried out according to the original design proposals. If failures occur at specific sections this office should be informed as soon as possible and we will advise the district of the remedial measures to be taken.

cont'd. /5 ...

5. MISCELLANEOUS:

The field work was carried out during the period Nov. 9th - 16th, 1962. Equipment used was owned and operated by Canadian Longyear Ltd. Drilling was supervised by Mr. B. Ghadiali of the Foundation Section. This report was written by Mr. K. G. Selby.

KGS/tt  
Attach.

cc: Messrs. H. A. Tregaskes  
H. D. McMillan  
H. McArthur  
J. W. MacDougall  
E. R. Saint  
G. A. Wrong  
L. R. Eadie  
Foundations Office ✓  
Gen. Files

APPENDIX 1.

JOB 62-F-124 LOCATION Sta. 202+00 66' left of C (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 9, 1962. COMPILED BY H.S.  
DATUM 940' BOREHOLE TYPE Washboring using HX Casing. CHECKED BY K.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT _____	Liquid Limit _____ WL	BULK DENSITY  P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. x Field Vane Test Results Unconfined Shear Strength 500    1000    1500    2000    2500	PLASTIC LIMIT _____ WP WATER CONTENT _____ W WP ———— W ———— WL WATER CONTENT % 20      40      60		
940	Lake Level									
937.8	Water									
2.2	Fine sandy silt with trace of organics.		1	SS	4					
			2	SS	2					
	Very loose.		3	SS	2	930				
927.5			4	SS	1		x			
12.6			5	TW	P		x			
	Clayey silt to silty clay - very soft to soft - grey.		6	TW	P	920				
			7	TW	P					
			8	SS	5	910				
			9	SS	2		x			
899.0			10	TW	4	900				
41.0	Fine sandy silt very loose - grey.									
894.0										
46.0	End of borehole Presumed Bedrock					890				





DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

# RECORD OF BOREHOLE NO. 12

FOUNDATION SECTION

JOB 62-F-124 LOCATION Sta. 270+00 38' left of E. (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 8, 1962. COMPILED BY H.S.  
DATUM 940' BOREHOLE TYPE Washboring using HX Casing. CHECKED BY K.S.

SOIL PROFILE			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	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		10	20	30	40	50	WP	W	WL		
940	Lake Level						100	200	300	400	500	WATER CONTENT % 20 40 60				
937.5	Water															
2.5			1	SS	P	935										Sa. 30%
	Fine sandy silt with trace of organic.															Si. 68%
	Grey.					930										Cl. 2%
																Sens = 1.3
																Sens = 5.7
																Sens = 4.0
																Sens = 6.0
926.5																
13.6	End of borehole.					925										Sens = 6.5
																100 blows for 6" End of cone test.



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 14

FOUNDATION SECTION

JOB 62-F-124 LOCATION Sta. 197+00 60' left of E (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 10, 1962. COMPILED BY H.S.  
DATUM 940' BOREHOLE TYPE Washboring using HX Casing. CHECKED BY K.S.

SOIL PROFILE			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	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. *Field Vane Test Results			wp	w	wL		
940	Lake Level						100	200	300					
937.7	Water													
2.4	Clayey silt to silty clay with stratified layers of fine sandy silt.		1	SS	1									
			2	TW	P									
			3	TW	P	930								
			4	TW	P									
	Soft to firm grey.		5	TW	P									
			6	TW	5	920								
913.5			7	TW	8									
26.6	End of borehole.					910								

Sens = 3.0  
Sa. 6%  
Sl. 69%  
Cl. 25%  
Sens = 4.0  
Sens = 3.5  
Sa. 40%  
Sl. 59%  
Cl. 1%

CHECKED BY \_\_\_\_\_ K.S.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 15

FOUNDATION SECTION

JOB 62-F-124

LOCATION Sta. 193/50 43' left of E (Hwy. 101)

ORIGINATED BY \_\_\_\_\_ B.M.G.

W. P. 27-61-1

BORING DATE Nov. 11, 1962.

COMPILED BY \_\_\_\_\_ H.S.

DATUM 940

BOREHOLE TYPE Dynamic Cone Penetration Test.

CHECKED BY \_\_\_\_\_ K.S.

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	LIQUID LIMIT ——— WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	BLOWS / FOOT	PLASTIC LIMIT ——— WP		
940.0	Lake Level									
937.2	Water									
2.8	Probably silt, sand and gravel.									
924.4	Probable Bedrock. End of cone test.									
15.6										

Depth of water 2.9

FOUNDATION SECTION

ORIGINATED BY B.M.G.

COMPILED BY H.S.

CHECKED BY            K.S.

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— wp WATER CONTENT ——— w wp ——— w ——— WL WATER CONTENT % 20 40 60	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				
940'	Lake Level										
	Water										
937											
3.0	Silty sand and sandy silt.		1	SS	6	935					Sa. 83% Si. 15% Cl. 2%
	Trace of organics to elev. 935'		2	SS	8						
	Loose to compact.		3	SS	11	930					Gr. 7% Sa. 1% Si. 74% Cl. 18%
	Grey.		4	SS	18						
926.8			5	SS	13						Gr. 14% Sa. 56% Si. 26% Cl. 4%
13.3	End of borehole.					925					
	Presumed Bedrock.					920					

FOUNDATION SECTION

JOB 62-F-124 LOCATION Sta. 191+20 50' left of E (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 11, 1962. COMPILED BY H.S.  
DATUM 940' BOREHOLE TYPE Dynamic Cone Penetration Test. CHECKED BY K.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— $w_L$			BULK DENSITY P. C. F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT				PLASTIC LIMIT ——— $w_P$				
							10	20	30	40	50	WATER CONTENT ——— $w$			
							SHEAR STRENGTH P.S.F.				$w_P$ ——— $w$ ——— $w_L$			WATER CONTENT %	
940.0	Lake Level					940									
936.9	Water														
3.1	Probably silt, sand, gravel and boulders.					935								Depth of water 3.1	
						930									
	Probably bedrock. End of cone test.					925									

Refusal



FOUNDATION SECTION

[illegible]

FOUNDATION SECTION

JOB 62-F-124 LOCATION Sta. 134+00 73' left of C (Hwy.101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 12, 1962. COMPILED BY H.S.  
DATUM 940' BOREHOLE TYPE Washboring using HX Casing. CHECKED BY K.S.

[illegible]

JOB 62-F-124 LOCATION Sta. 132+25 93' left of E (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 13, 1962. COMPILED BY H.S.  
DATUM 940' BOREHOLE TYPE Washboring using HX Casing. CHECKED BY K.S.

[illegible]

JOB 62-F-124 LOCATION Sta. 132+30 90' left of E. (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 13, 1962. COMPILED BY H.S.  
DATUM 940' BOREHOLE TYPE Dynamic Cone Penetration Test. CHECKED BY K.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		10	20	30	40	50	$w_p$ ——— $w$ ——— $w_L$ WATER CONTENT %				
940.0	Lake Level					940										
	Water					930										
						920										
						910										
907.8 32.2	Probably clayey silt with sand and gravel.					900										
889.8 50.2	Probably Bedrock. End of cone test.					890										
						880										

Depth of  
water 32.2

Refusal

# RECORD OF BOREHOLE NO. 20

FOUNDATION SECTION

JOB 62-F-124 LOCATION Sta. 132/40 100' Left of E (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 14, 1962 COMPILED BY H.S.  
DATUM 940.0' BOREHOLE TYPE Dynamic Cone Penetration Test. CHECKED BY K.S.

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	10	20	30	40	50	SHEAR STRENGTH P.S.F.		
940.0'	Lake Level				940									
0.0	Water													Depth of Water 31'-10"
908.2 31.8	Probably clayey silt with sand and gravel.													
892.2 47.8	Probably Bedrock End of cone test.													

Refusal

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 21

FOUNDATION SECTION

JOB 62-F-124

LOCATION Sta. 44/90 180' left of E (Hwy. 101)

ORIGINATED BY B.M.G.

w. p. 27-61-1

BORING DATE Nov. 14, 1962.

COMPILED BY H.S.

DATUM 940'

BOREHOLE TYPE Washboring using HK Casing.

CHECKED BY K.S.

[illegible]

FOUNDATION SECTION

CHECKED BY            K.S.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 23

FOUNDATION SECTION

JOB 62-F-124LOCATION Sta. 44+90 46' left off (Hwy. 101).ORIGINATED BY B.M.G.W.P. 27-61-1BORING DATE Nov. 14, 1962.COMPILED BY H.S.DATUM 940'BOREHOLE TYPE A shallow hole dug with a shovel.CHECKED BY K.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	PLASTIC LIMIT — WP	WATER CONTENT — W		
940	Lake Level					940					
0.6	Water										
1.0	Muskeg										
1.10	Clayey silt. Gray		1	hand							0.3% organic content.
						935					



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION

## RECORD OF BOREHOLE NO. 24

FOUNDATION SECTION

JOB 62-F-124 LOCATION Sta. 32+00 50' left of C (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 15, 1962. COMPILED BY H.S.  
DATUM 940' BOREHOLE TYPE Dynamic and Standard Penetration Test CHECKED BY K.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 20 40 60	BULK DENSITY $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.			
940	Lake Level										
937'	Water										
3.0	Muskeg										
3.9	Clayey silt and sand.		1	S	5	935					Gr. 3% Sa. 10% Si. 75% Cl. 12% 0.3% organic content.
934.2	Loose. Grey.										
5.9	Probably Bedrock. End of borehole.							Refusal			

FOUNDATION SECTION

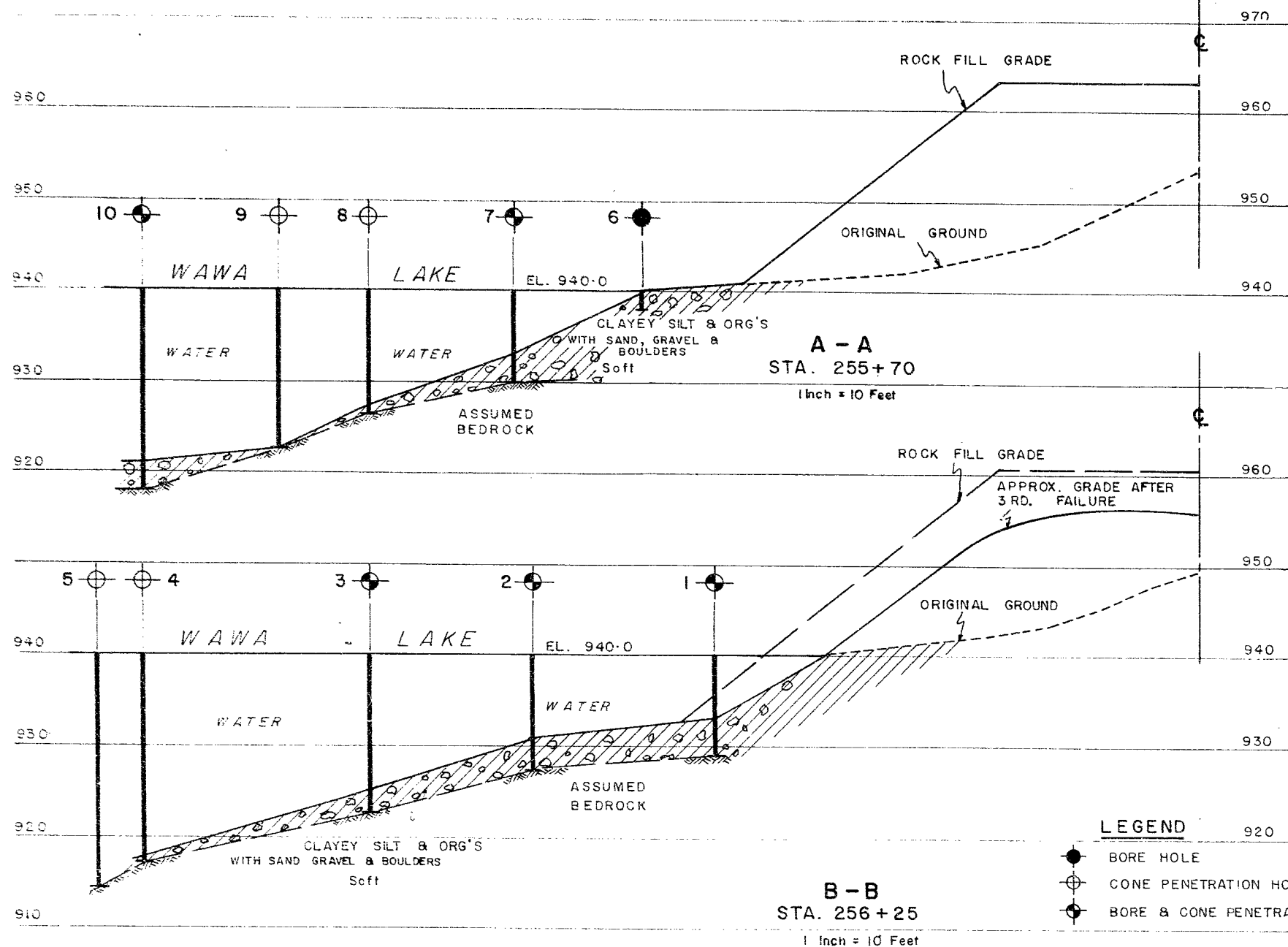
JOB 62-F-124 LOCATION Sta. 31+50 51' left of C (Hwy. 101). ORIGINATED BY B.M.G.  
W. P. 27-61-1 BORING DATE Nov. 15, 1962. COMPILED BY H.S.  
DATUM 940 BOREHOLE TYPE Dynamic and Standard Penetration Test. CHECKED BY K.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W	WATER CONTENT %		
94.0'	Lake Level										
	Water										
3.1	Silty clay and sand	▨	1	SS	5	935	→ Refusal				Sa. 13% Sl. 68% Cl. 19%
4.0	End of borehole. Presumed Bedrock.										

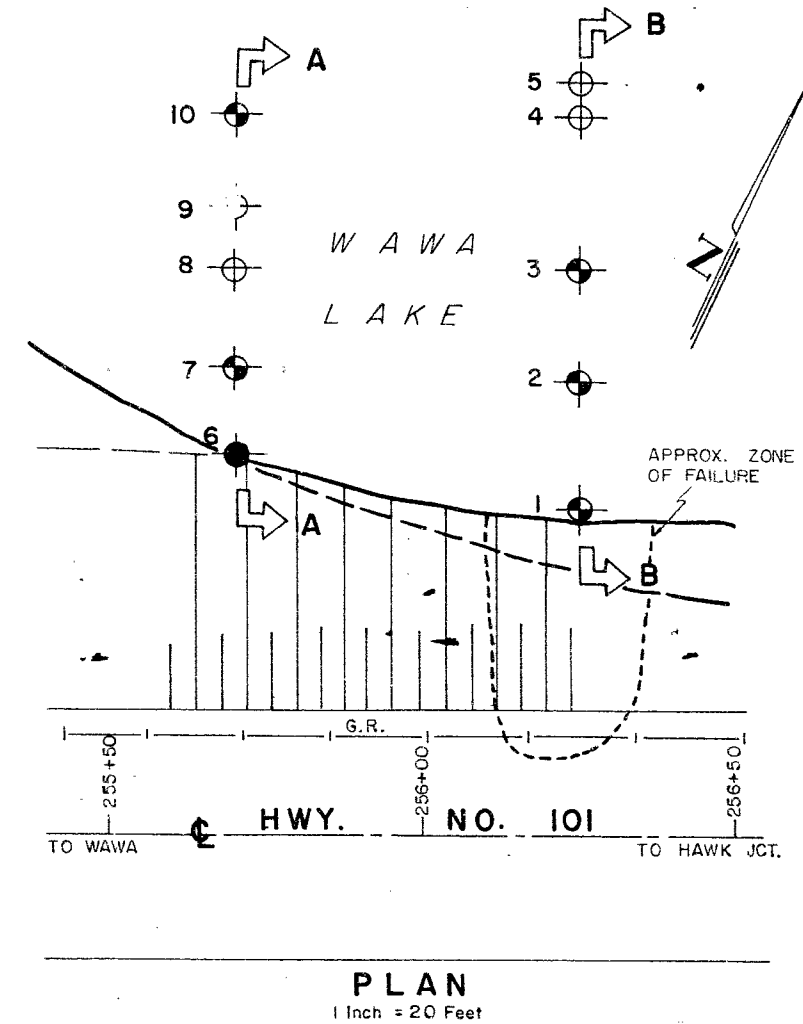
JOB 62-F-124 LOCATION Sta. 16+00 2' right of E (Hwy. 101) ORIGINATED BY B.M.G.  
W.P. 27-61-1 BORING DATE Nov. 15, 1962. COMPILED BY H.S.  
DATUM Geodetic BOREHOLE TYPE Washboring using HX Casing. CHECKED BY K.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— W <sub>L</sub> PLASTIC LIMIT ——— W <sub>P</sub> WATER CONTENT ——— W W <sub>P</sub> ——— W <sub>L</sub> WATER CONTENT % 20 40 60	BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		10	20	30	40	50			
940.5 940.0 0.5	Water													Lake W.L. = 940'
933.7 6.3	Compact - Grey		1	SS	14	935								Gr. 25% Sa. 14% Si. 59% Cl. 2% 0.3% Organic content.
	Sandy silt with trace of gravel.		2	SS	18	930								Gr. 8% Sa. 24% Si. 66% Cl. 2%
924.0	Compact - Grey.		3	SS	17	925								
16.6	End of borehole.													
						920								
						915								
						910								

End of cone test.

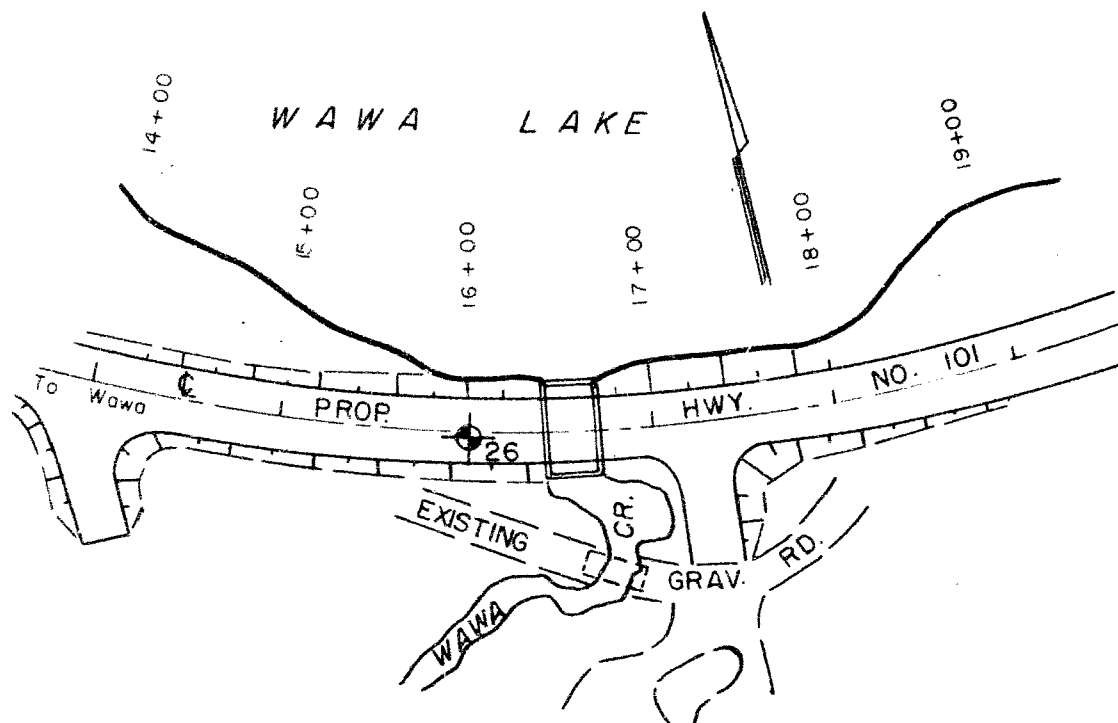


- LEGEND**
- BORE HOLE
  - ⊕ CONE PENETRATION HOLE
  - ⊙ BORE & CONE PENETRATION HOLE



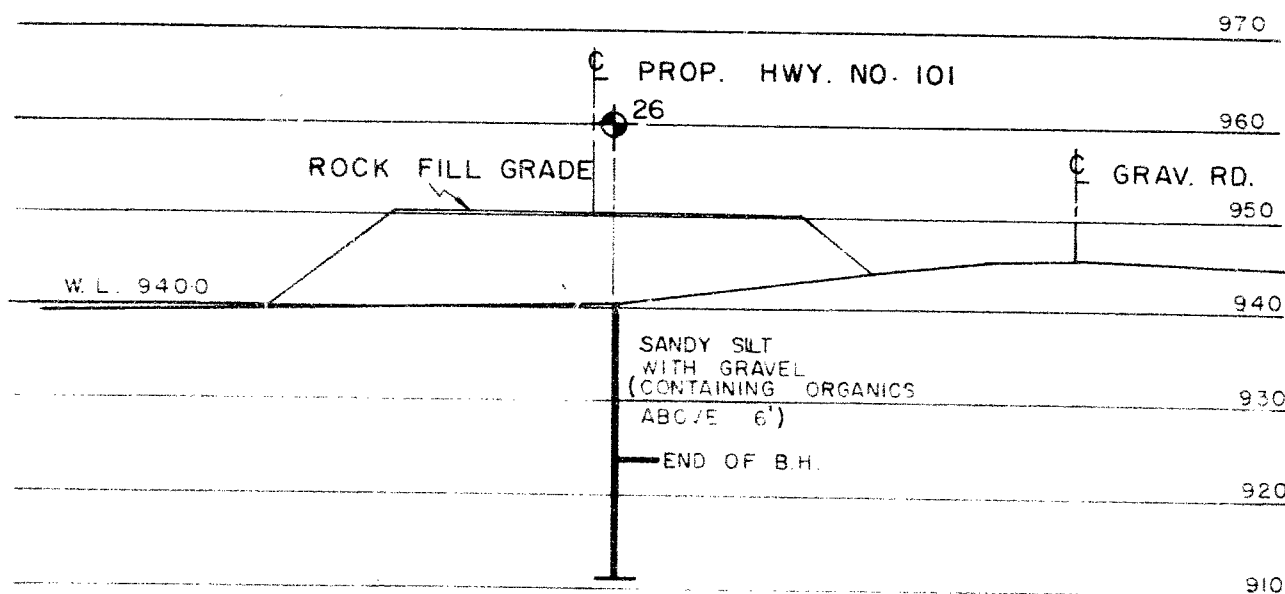
DATE OF INVESTIGATION NOV. 3 & 4, 1962

ORIGINATED B. GHADIALI	DEPARTMENT OF HIGHWAYS - ONTARIO	CONT. 62-178
DRAWN JC	MATERIALS & RESEARCH SECTION	W.P. NO. 27-61-1
CHECKED <i>RC</i>	EMBANKMENT FAILURE	JOB NO. 62-F-124
APPROVED <i>R. L. S. L.</i>	HIGHWAY NO. 101 - WAWA EAST	DWG. NO. 62-F-124A
DATE NOV. 30, 1962		



# PLAN

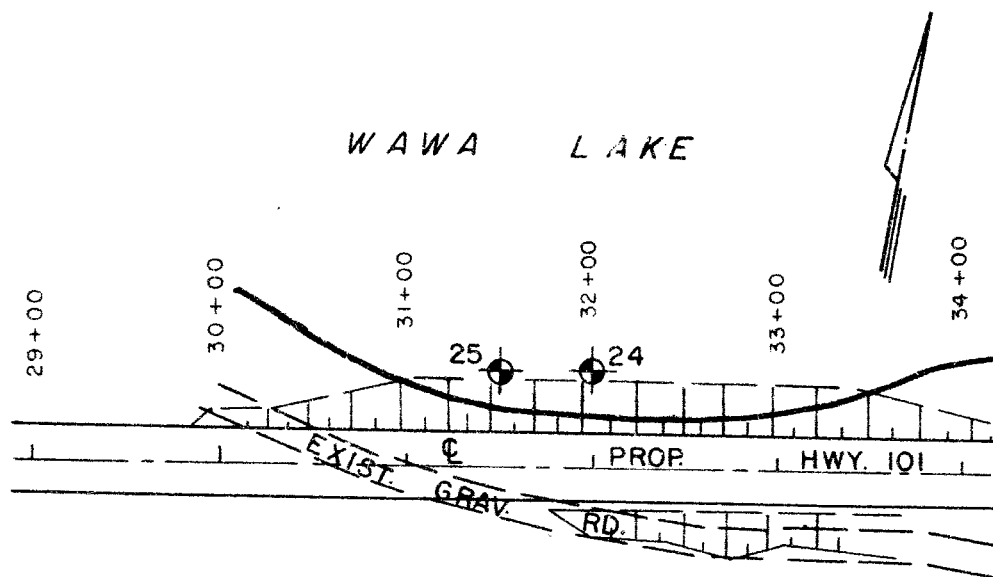
1 inch = 100 feet



# STA. 16+00

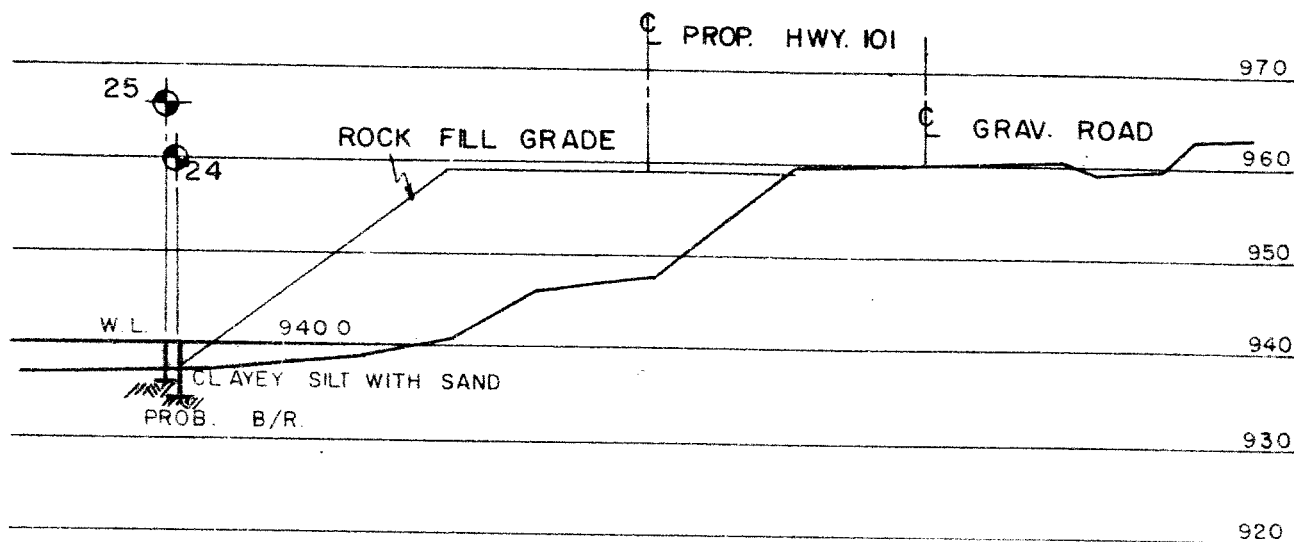
1 inch = 20 feet

ORIGINATED K. SELBY	DEPARTMENT OF HIGHWAYS - ONTARIO	CONT. 62-178
DRAWN JC	MATERIALS & RESEARCH SECTION	W. P. NO. 27-61-1
CHECKED J.R.	HWY. NO. 101 - WAWA EAST	JOB NO. 62-F-124
APPROVED K. Selby	PROPOSED EMBANKMENT	DWG. NO. 62-F-124B
DATE DEC. 6, 1962	AT STA. 16+00	



# PLAN

1 inch = 100 feet



# STA. 32+00

1 inch = 20 feet

ORIGINATED K. SELBY

DRAWN *KS*

CHECKED *KS*

APPROVED *K. Selby*

DATE DEC. 6, 1962

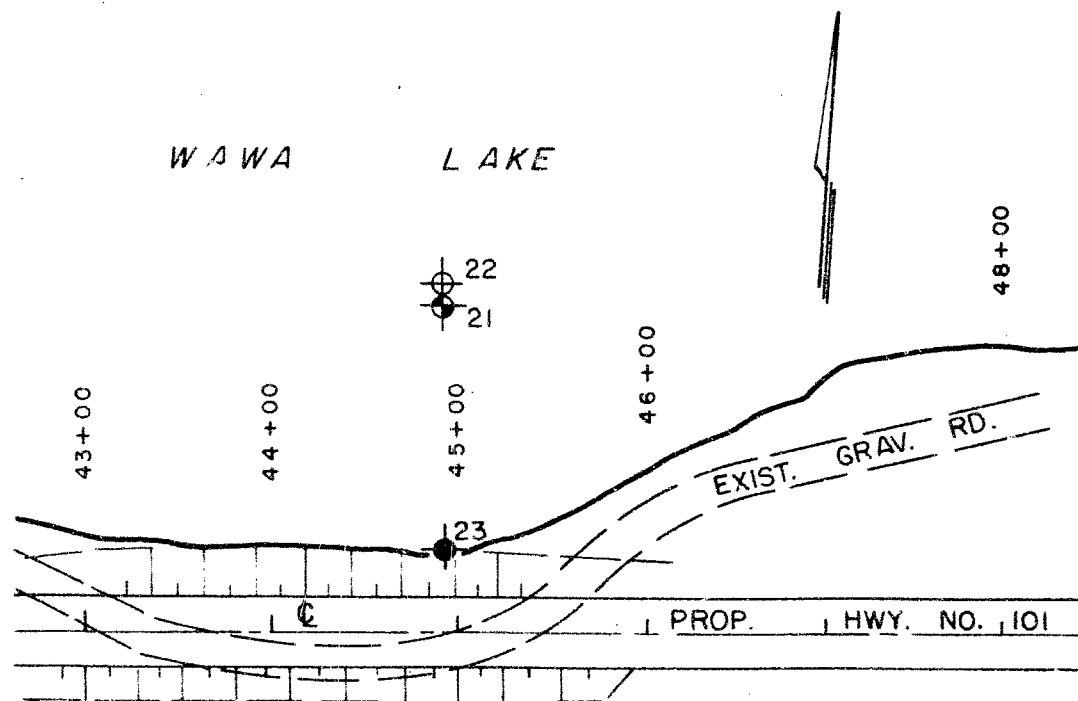
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH SECTION  
HWY. NO. 101 - WAWA EAST  
PROPOSED EMBANKMENT  
AT STA. 32+00

CONT. 62-178

W. P. NO. 27-61-1

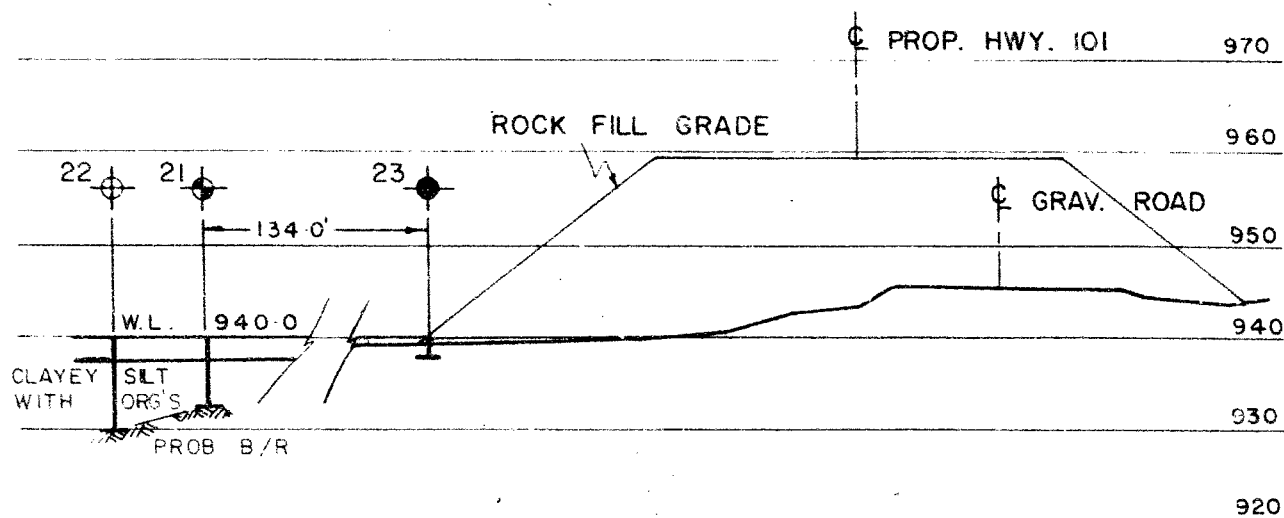
JOB NO. 62-F-124

DWG. NO. 62-F-124C



# PLAN

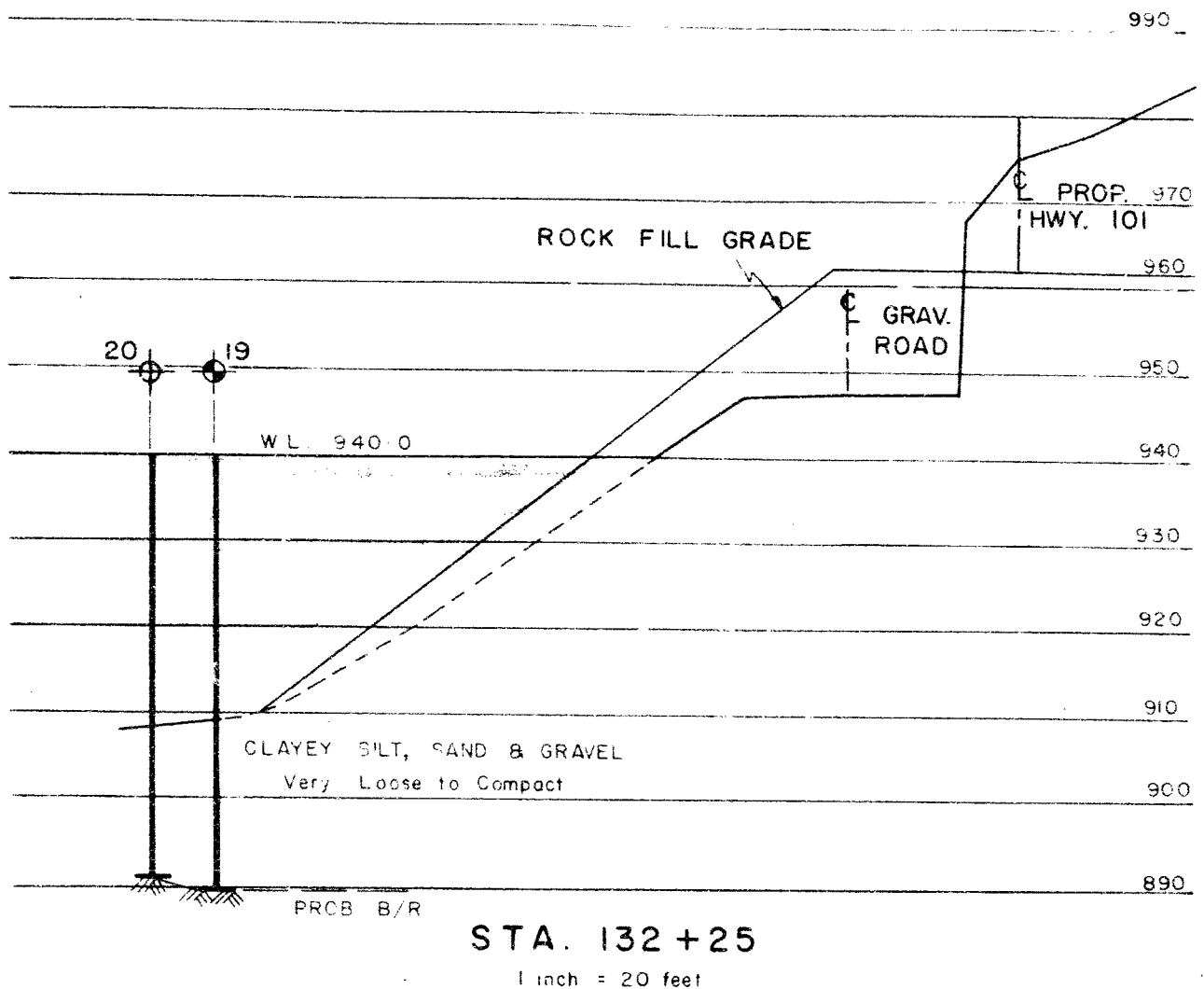
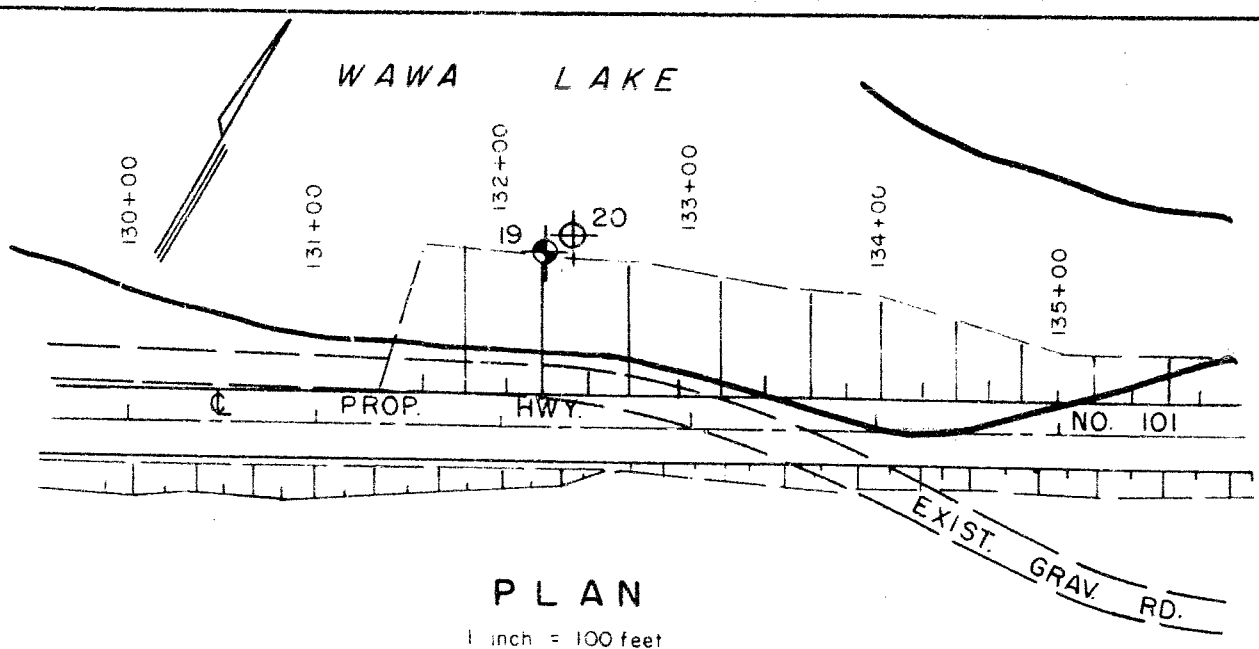
1 inch = 100 feet



# STA. 44+90

1 inch = 20 feet

ORIGINATED K. SELBY	DEPARTMENT OF HIGHWAYS - ONTARIO	CONT. 62-178
DRAWN JC	MATERIALS & RESEARCH SECTION	W. P. NO. 27-61-1
CHECKED JLR	HWY. NO. 101 - WAWA EAST	JOB NO. 62-F-124
APPROVED K. L. Selby	PROPOSED EMBANKMENT	DWG. NO. 62-F-124D
DATE DEC. 6, 1962	AT STA. 44+90	



ORIGINATED K. SELBY

DRAWN *JS*

CHECKED *JS*

APPROVED *K. Selby*

DATE DEC. 6, 1962

DEPARTMENT OF HIGHWAYS - ONTARIO  
**MATERIALS & RESEARCH SECTION**  
 HWY. NO. 101 - WAWA EAST  
 PROPOSED EMBANKMENT  
 AT STA. 132+25

CONT. **62-178**

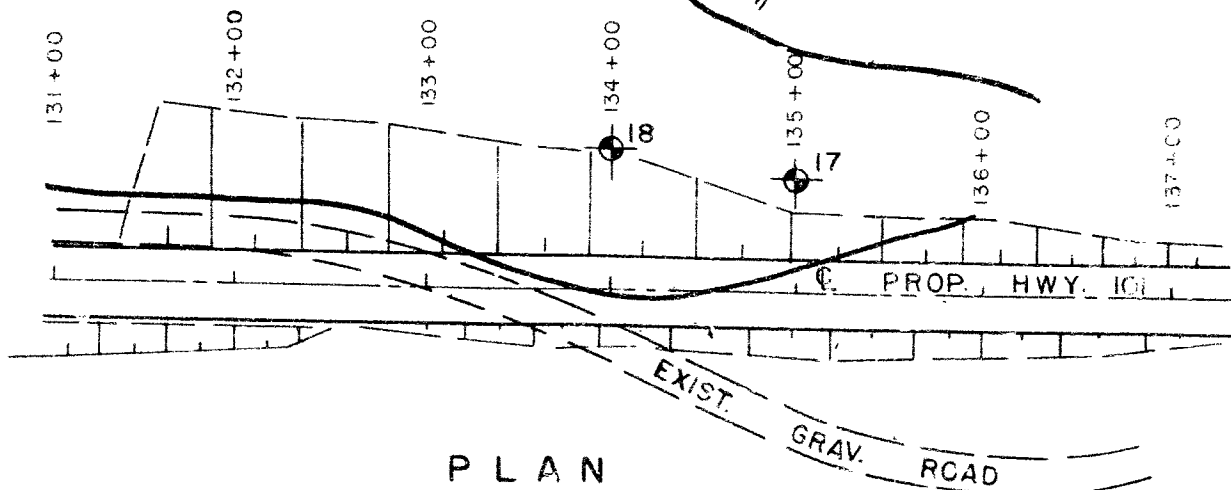
W. P. NO. 27-61-1

JOB NO. 62-F-124

DWG. NO. **62-F-124E**

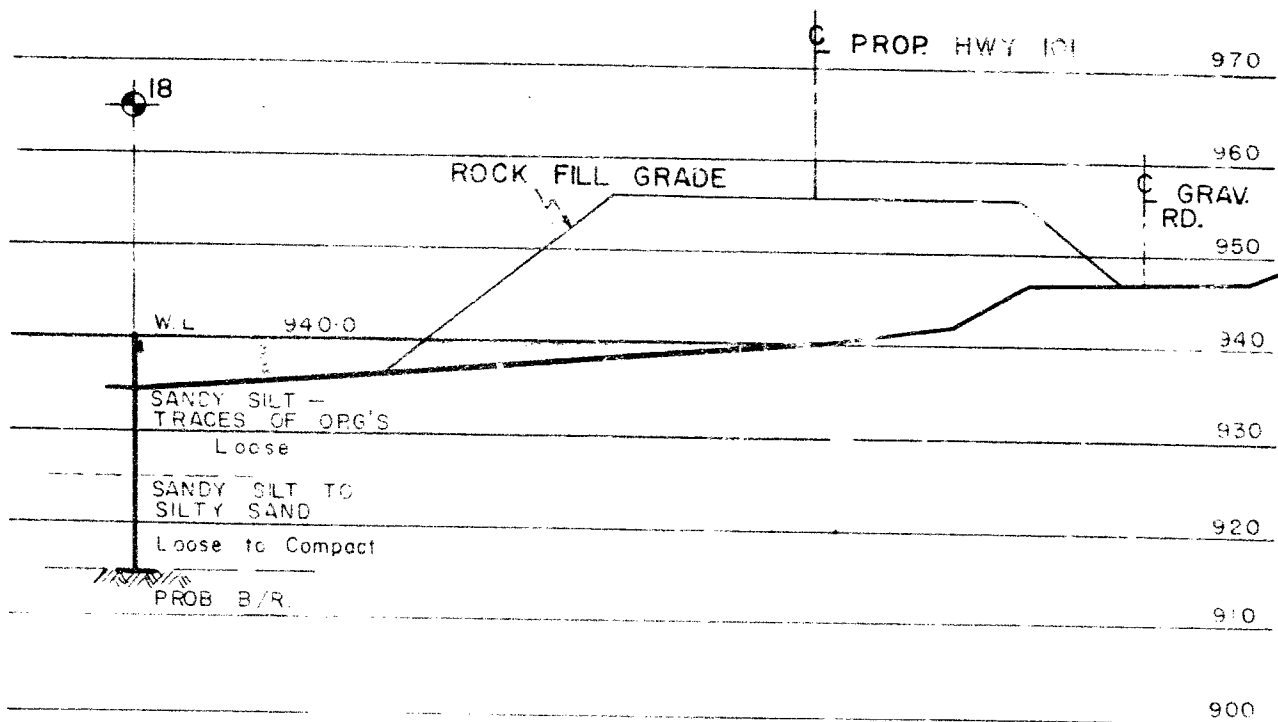


WAWA LAKE



PLAN

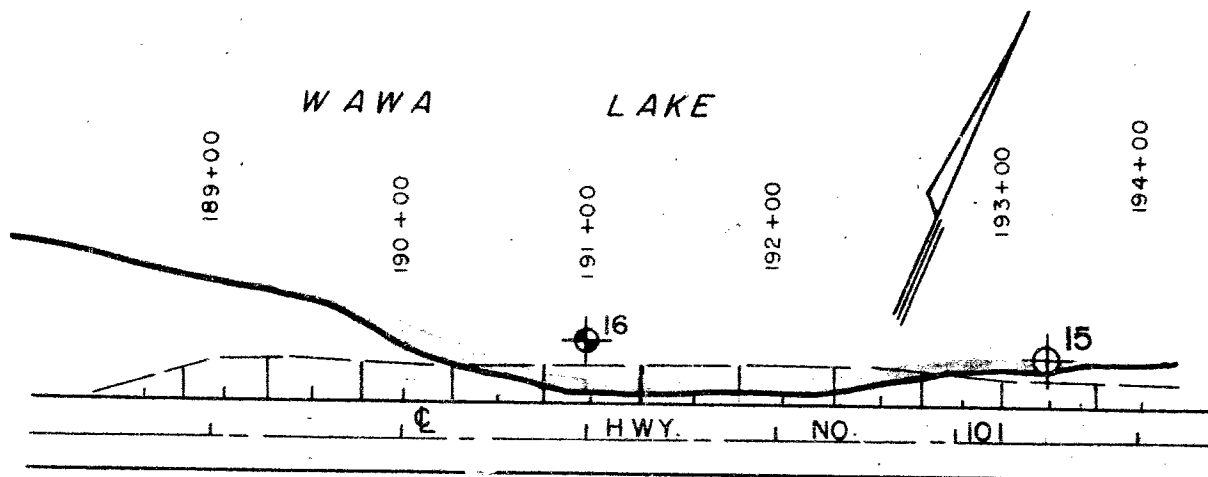
1 inch = 100 feet



STA. 134 + 00

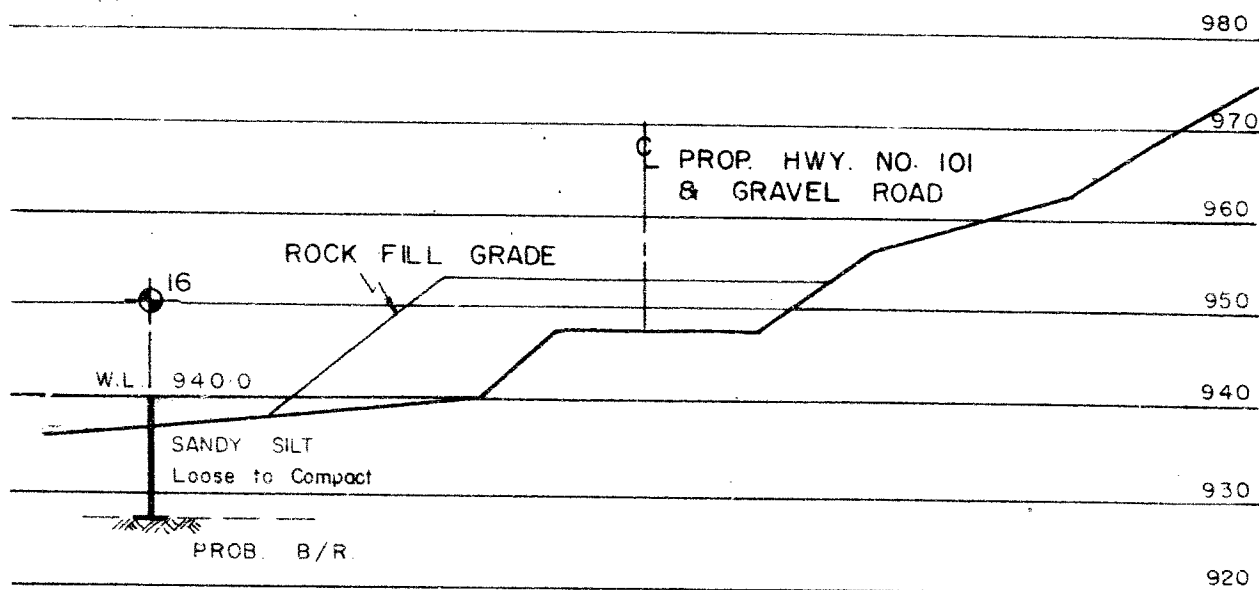
1 inch = 20 feet

ORIGINATED	K. SELBY	DEPARTMENT OF HIGHWAYS - ONTARIO	CONT.	62-178
DRAWN	JK	MATERIALS & RESEARCH SECTION	W. P. NO.	27-61-1
CHECKED	JK	HWY. NO. 101 - WAWA EAST	JOB NO.	62-F-124
APPROVED	12.1.5.66	PROPOSED EMBANKMENT	DWG. NO.	62-F-124F
DATE	DEC. 6, 1962	AT STA. 134 + 00		



# PLAN

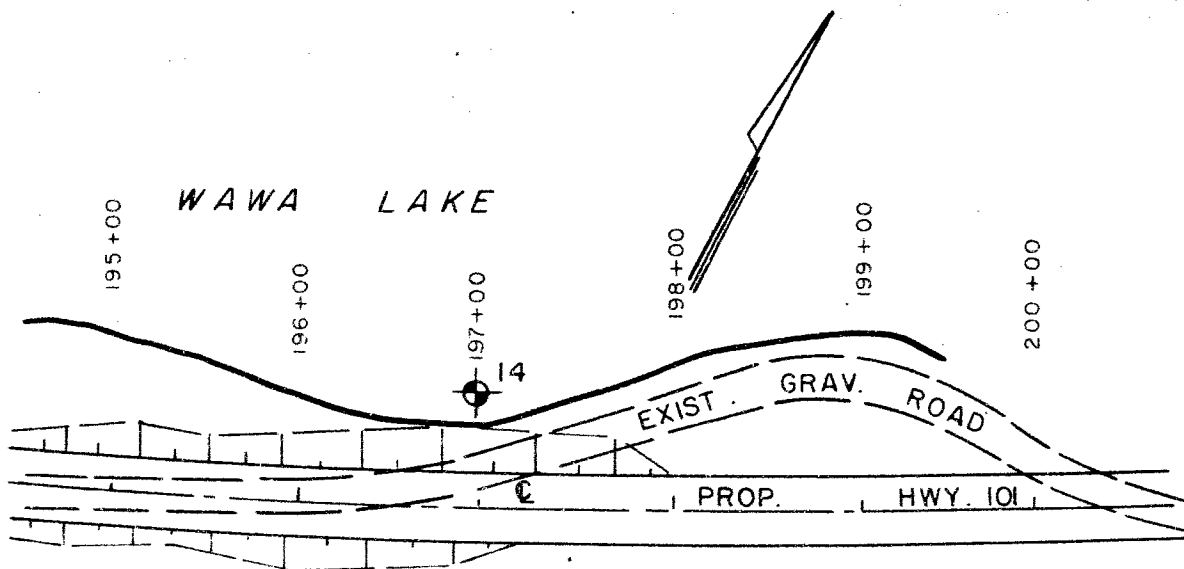
1 inch = 100 feet



# STA. 191+00

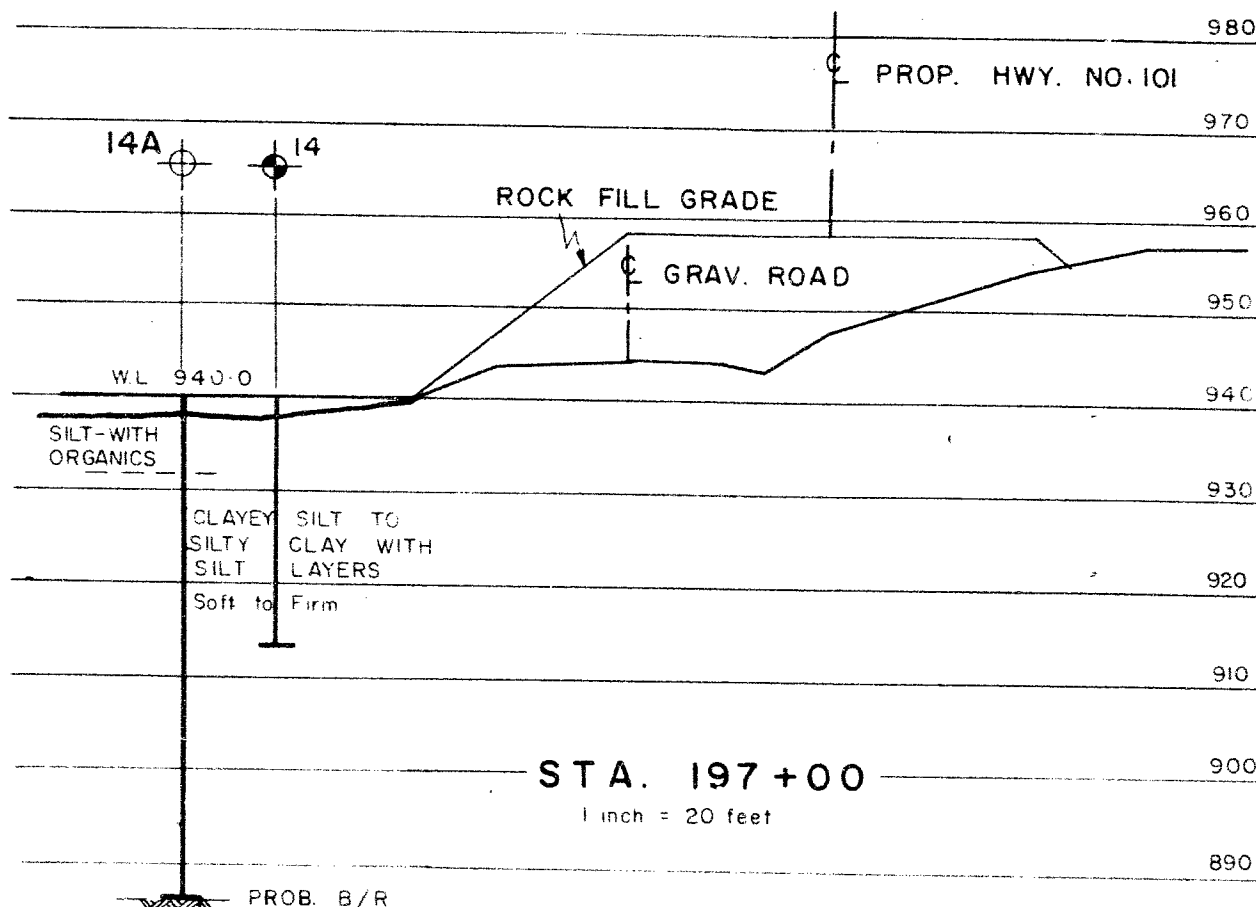
1 inch = 20 feet

ORIGINATED K. SELBY	DEPARTMENT OF HIGHWAYS - ONTARIO	CONT. 62-178
DRAWN JC	MATERIALS & RESEARCH SECTION	W. P. NO. 27-61-1
CHECKED JR	HWY. NO. 101 - WAWA EAST	JOB NO. 62-F-124
APPROVED K. L. Selby	PROPOSED EMBANKMENT	DWG. NO. 62-F-124G
DATE DEC. 6, 1962	AT STA. 191+00	



# PLAN

1 inch = 100 feet



STA. 197+00

1 inch = 20 feet

ORIGINATED K. SELBY

DRAWN *SC*

CHECKED *AK*

APPROVED *12 Dec 6, 1962*

DATE DEC. 6, 1962

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH SECTION

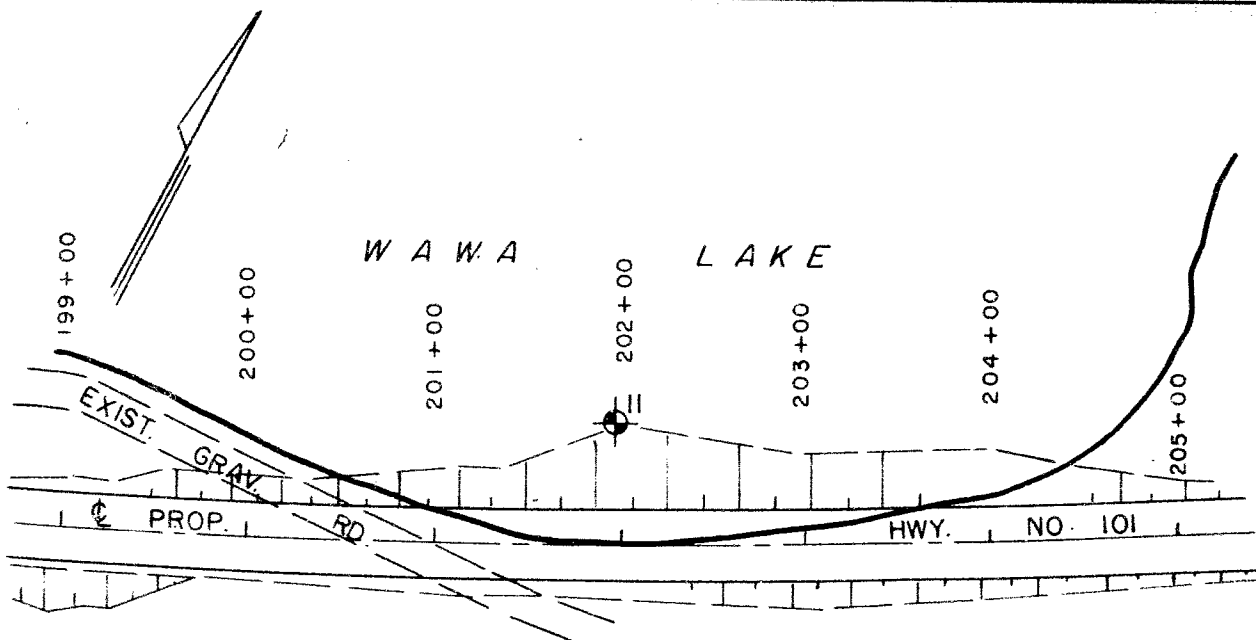
HWY. NO. 101 - WAWA EAST  
PROPOSED EMBANKMENT  
AT STA. 197+00

CONT. 62-178

W. P. NO. 27-61-1

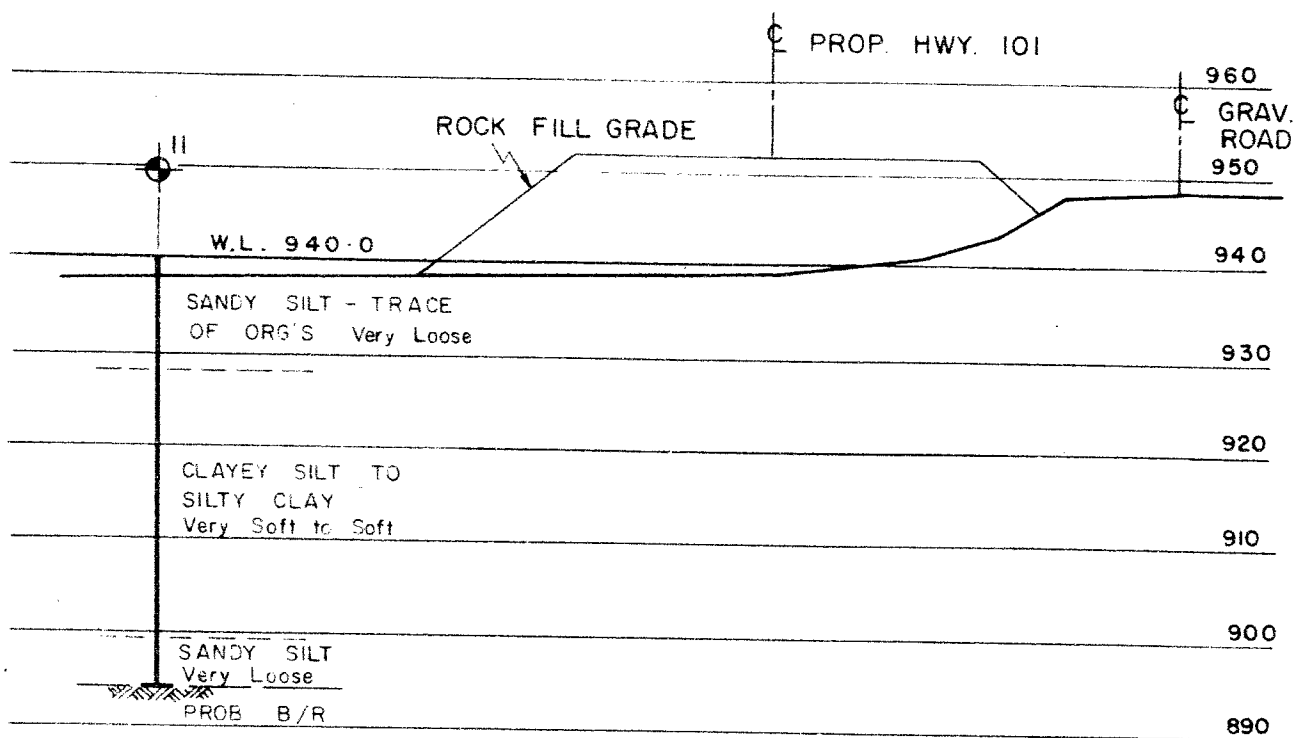
JOB NO. 62-F-124

DWG. NO. 62-F-124H



# PLAN

1 inch = 100 feet



# STA. 202+00

1 inch = 20 feet

ORIGINATED K. SELBY

DRAWN *JS*

CHECKED *AR*

APPROVED *R. L. Smith*

DATE DEC. 6, 1962

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH SECTION

HWY. NO. 101 - WAWA EAST  
PROPOSED EMBANKMENT  
AT STA. 202+00

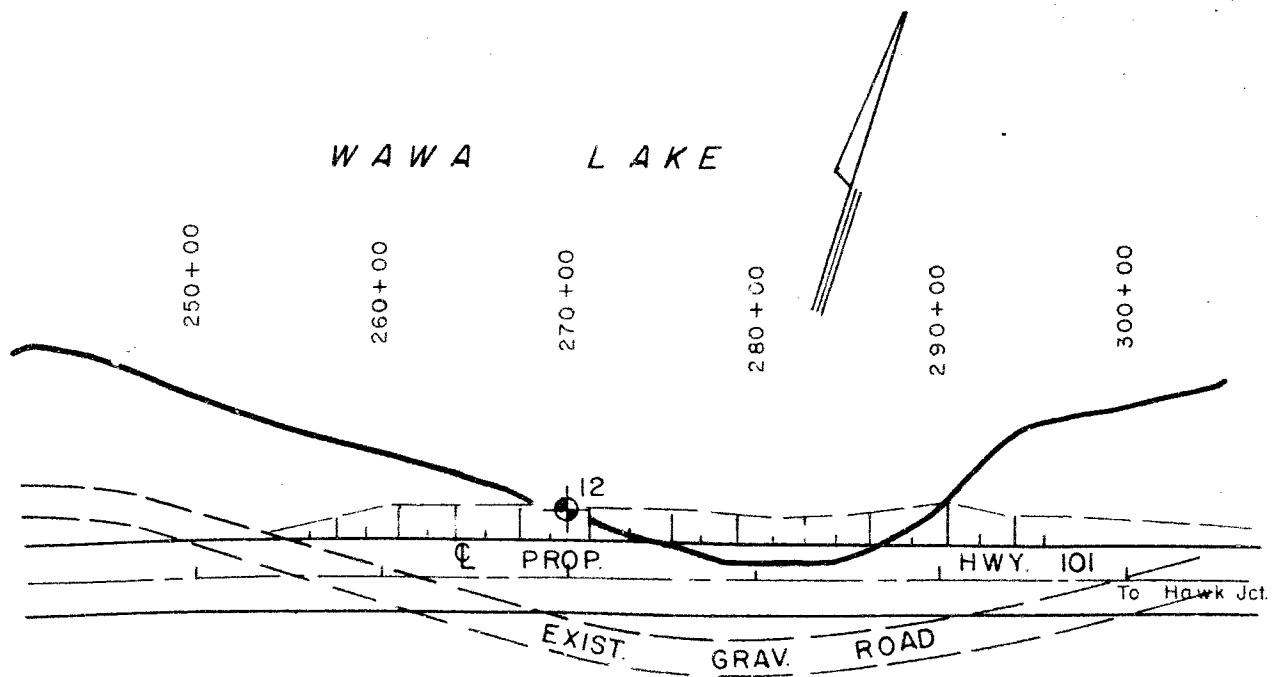
CONT.

62-178

W. P. NO. 27-61-1

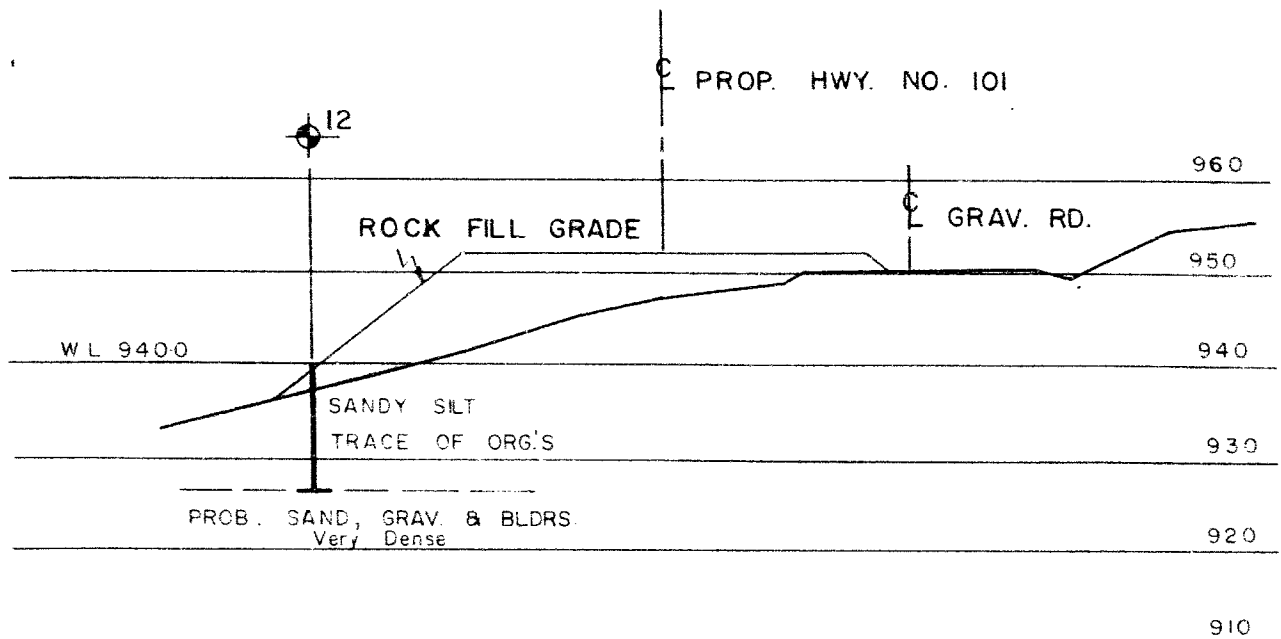
JOB NO. 62-F-124

DWG. NO. 62-F-124J



# PLAN

1 inch = 100 feet



STA. 270+00

1 inch = 20 feet

ORIGINATED K. SELBY

DRAWN *KS*

CHECKED *WR*

APPROVED *R. L. Selby*

DATE DEC. 6, 1962

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH SECTION

HWY. NO. 101 - WAWA EAST  
PROPOSED EMBANKMENT  
AT STA. 270+00

CONT. 62-178

W. P. NO. 27-61-1

JOB NO. 62-F-124

DWG. NO. 62-F-124K

ORIGINATED	K.S.	DEPARTMENT OF HIGHWAYS - ONTARIO	CONT.	62-178
DRAWN	D.M.	MATERIALS & RESEARCH SECTION	W. P. NO.	27-61-1
CHECKED	<i>[Signature]</i>	HWY. NO. 101 - WAWA EAST	JOB NO.	62-F-124
APPROVED	<i>[Signature]</i>	PROPOSED BERMS	DWG. NO.	62-F-124L
DATE	DEC. 11, 1962	STA. 196+50 - 205+00		

## Materials and Research Section

8234

Mr. D. S. CORNELL

Date: Nov 6<sup>th</sup> 62

CONSTR. ENG. DISTRICT

\* 18 SAULT ST. MARIE

Attention

Re: EMBANKMENT FAILURE HWY #101  
6 MILES EAST OF WAWA CONT. # (2-178)

Dear Sir,

FOUNDATION INVESTIGATION W.S. 62-F-124

HISTORY During construction of the rock fill embankment

between stations 255+00 and 262+00 a failure took place at Sta. 256+25. The fill was just up to grade at that point - it about 22' high. The center 7 feet (measured back from the toe) slid down into the lake. The length of the failed area was about 30'. The fill was then rebuilt to grade and failed again in the same manner. It was again rebuilt to a height two or three feet below grade and it failed once more. These events took place during October 1962. The Foundation Section was requested to investigate the situation by E. Smith on 29<sup>th</sup> Oct '62.

FIELDWORK Two borings and soundings were conducted under the supervision of the writer. These were located on two lines at right angles to the fill into the lake. One line was at Sta. 256+25 the other was at Sta. 255+70. The borings revealed that a layer of soft silty clay to clayey silt of shallow depth (4'-6') had existed under the toe of the embankment and had been partially displaced during the fill operations. The rest of the remaining soft material cannot now be observed because of the pressure of the fill. It is difficult to note that the original soft borings carried out revealed the presence of a base or soft deposit between the approximate elevations 126.0 and 132.0 at Sta. 255+00 35' left. It is probable that soft material still exists along the toe of the fill between stations 255+00 and 260+00 as the present borings continued

## ONTARIO DEPT. OF HIGHWAYS

8235

DEFECTS IN NEGATIVE DOCUMENT  
CONDITION OF ORIGINAL DOCUMENT

Materials and Research Section

Mr. D. S. CORNELL

Date: Nov 6<sup>th</sup> 1962

CONSTR. ENGR. DIST.

118 SAULT ST. MARIE

Attention

Re: EMBANKMENT FAILURE, HWY #101  
6 MILES EAST OF WAWA CONT. 62-178

Dear Sir,

Continued

indicates that complete displacement has not occurred

RECOMMENDATIONS

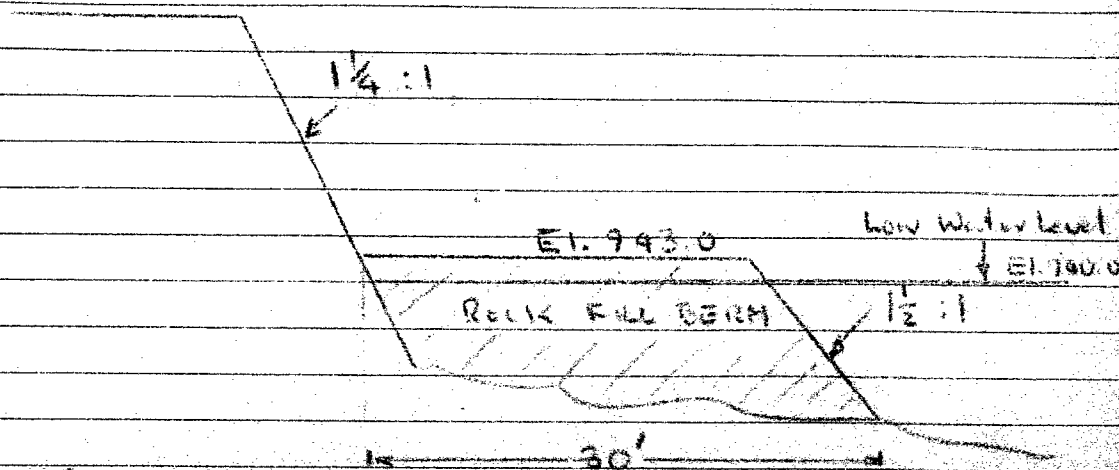
It is our opinion that remedial measures should be taken not only at the failure zone but also along the toe of the existing fill between stations 255+00 and 260+00. These recommendations are as follows:-

(1) Sta. 255+70 to Sta. 256+75.

A berm should be constructed with the dimensions shown on the accompanying sketch. This berm should be built from the lake edge outwards in order to displace soft material on the bottom.

(2) Sta. 257+00 to Sta. 259+50

Additional rock fill should be dumped within these limits to provide a 2:1 slope from the water's edge to the lake bottom. The 2:1 slopes should be carried down a point 3' above low water level.



RECOMMENDED BERMS STA 255+70 to STA 256+75

Continued



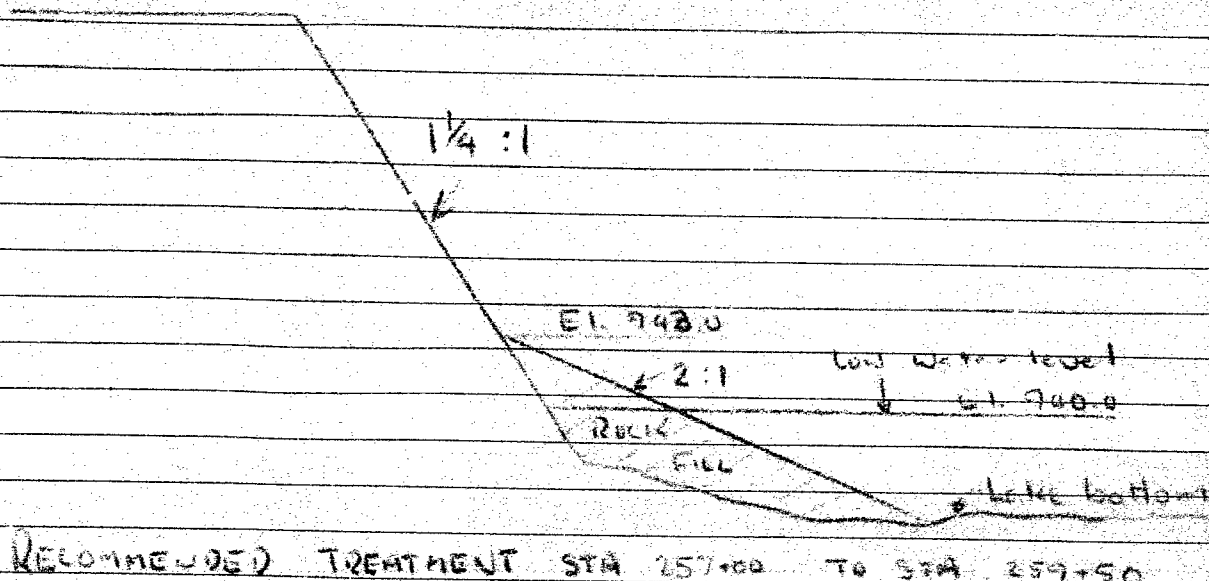
Mr. D. S. CORNELL  
CONSTR. ENG. DIV. # 10  
SUOLT. ST. MARI

Date: Nov. 6<sup>th</sup> 1962

Attention \_\_\_\_\_

Re: EMBANKMENT FAILURE HWY. # 101  
6 MILES EAST OF WAWA (ONT. 61-178)

Dear Sir,

Continued

Note :- No more fill should be placed on the embankments until the above recommendations have been carried out.

The sections recommended may be modified slightly to facilitate construction.

R. J. Selby  
Senior Foundation Engineer  
Foundation Section  
Materials & Research Division  
D. H. O.

Mr. J. W. MacDougall,  
District Engineer,  
Sault Ste. Marie.

Mr. A. G. Stermac,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.

Attention: Mr. D. E. Cornell,  
Construction Engr.

December 10, 1962.

Failure of the Rock Fill Embankment  
During Construction at Approximate  
Sta. 200+00, Hwy. #101, Near Easterly,  
Contract No. 62-F-178 -- W.J. 62-F-124.

Regarding our telephone conversation of today in connection with the above-mentioned embankment failure, we are submitting for your attention, our recommendations for the remedial measures to be taken, together with a summary of the subsoil conditions.

Between Stations 196+50 and 205+00, our borings indicate the subsoil at the left toe of slope to consist of up to 10' of loose silt with organics, followed by up to 50' of soft to stiff clayey silt to silty clay. It is probable that construction difficulties due to failures will occur across this entire section and, therefore, it is our recommendation that stabilizing berms be constructed on the lake side of the fill sections. The dimensions of these proposed berms are shown on the accompanying sketch. Notes regarding construction procedures to be followed are also given on the sketch. If subsoil conditions at some locations appear to be more favourable than the borings indicate, the berms at these locations may be dispensed with and a transition as shown on the sketch, may be employed.

We would appreciate it if you would keep us informed during the progress of this work.

If you have any further queries in connection with this matter, please do not hesitate to contact us.

EGC/WMAF  
Encl.

cc: Messrs. H. A. Tregaskes  
H. D. McMillan  
E. McArthur  
J. W. MacDougall  
E. H. Saint  
G. A. Wrong  
L. B. Sadie  
Foundations Office  
Gen. Files

*K. L. Selby*  
K. L. Selby,  
A. G. STERMAC ENGR.

For:

A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

Mr. J. W. MacDougall,  
District Engineer,  
Sault Ste. Marie,  
District #18.

Attention: Mr. D. S. Cornell,  
Construction Engr.

Mr. A. G. Stermac,  
Principal Foundation Engr.,  
Foundation Section,  
Materials & Research Division.

December 5, 1962.

D.H.C. FOUNDATION INVESTIGATION - W.J. 62-F-124,  
Embankment Failure, Hwy. #101, 6 Miles East of Wawa,  
Contract #62-178 -- District #18, Sault Ste. Marie.

Enclosed, we are forwarding to you, a copy of our  
Foundation Report in connection with the recent embankment  
failure at Station 256+20 at the above-noted location.

The report is identical to the one given to Mr.  
Lloyd Burley, Project Supervisor on the contract. In addition,  
we have included Drawing No. 62-F-124A, showing the stratigraphical  
profiles and borehole layout.

A number of borings were carried out on this contract  
at various other locations. The results of these, and our  
comments, will be forwarded to you in the near future.

KGS/MdeF  
Attach.

cc: Messrs. E. B. Saint  
L. Badie  
G. A. Wrong

Foundations Office ✓  
Gen. Files.

*K. G. Selby*  
K. G. Selby,  
SENIOR FOUNDATION ENGR.  
For:

A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

## MEMORANDUM

To: Mr. D. S. Cornell,  
Construction Engr.,  
District #18,  
Sault Ste. Marie.

FROM: Mr. K. G. Selby,  
Sr. Foundation Engr.,  
Foundation Section,  
Materials and Research Division.

DATE: November 6, 1962.

OUR FILE REF.

IN REPLY TO

SUBJECT: FOUNDATION INVESTIGATION - W.J. 62-F-124,  
Embankment Failure, Hwy. #101, 6 Miles  
East of Wawa, Contract #62-178.

History:

During construction of the rock fill embankment between Stations 255+00 and 262+00, a failure took place at Sta. 256+25. The fill was just up to grade at that point - i.e., about 22' high. The outer 7' (measured back from the toe), slid down into the lake. The length of the failed area was about 30'. The fill was then rebuilt to grade and failed again in the same manner. It was again rebuilt to a height two or three feet below grade and it failed once more. These events took place during October, 1962. The Foundation Section were requested to investigate the situation by Mr. E. R. Saint on 25th October, 1962.

Field Work:

Ten borings and soundings were carried out under the supervision of the writer. These were located on two lines at rightangles to the Centre Line into the lake. One line was at Sta. 256+25; the other was at Sta. 255+70. The borings revealed that a layer of soft silty clay to clayey silt of shallow depth (4' - 6'), had existed under the toe of the embankment and had been partly displaced during the fill operations. The extent of remaining soft material cannot now be discovered because of the presence of the fill. It is of interest to note that the original soils borings carried out, revealed the presence of a loose or soft deposit between the approximate elevations 936.0 and 932.0 at Sta. 258+00, 35' left. It is probable that soft material still exists along the toe of the fill between Stations 255+00 and 260+00, as the present borings indicate that complete displacement has not occurred.

cont'd. /2 ...

Mr. D. S. Cornell, Const. Engr.,  
Dist. #18, Sault Ste. Marie.

Nov. 6/62

Recommendations:

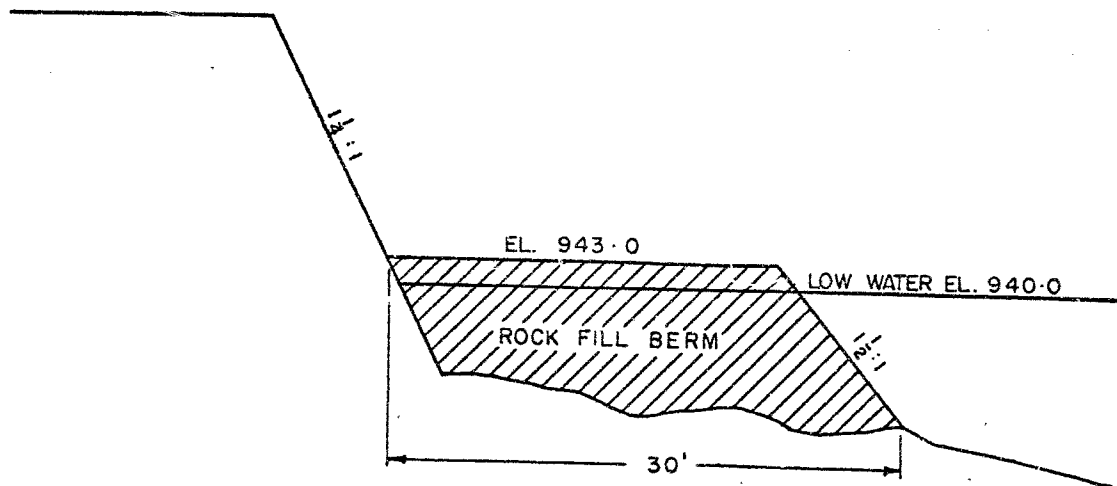
It is our opinion that remedial measures should be taken, not only at the failure zone, but also along the toe of the existing fill between Stations 255+00 and 260+00. These recommendations are as follows:-

(1) Sta. 255+70 to Sta. 256+75:

A berm should be constructed with the dimensions shown on the accompanying sketch. This berm should be built from the lake edge outwards in order to displace soft material on the bottom.

(2) Sta. 257+00 to Sta. 259+50:

Additional rock fill should be dumped within these limits to provide a 2:1 slope from the water's edge to the lake bottom. The 2:1 slopes should be carried from a point 3' above low water level.

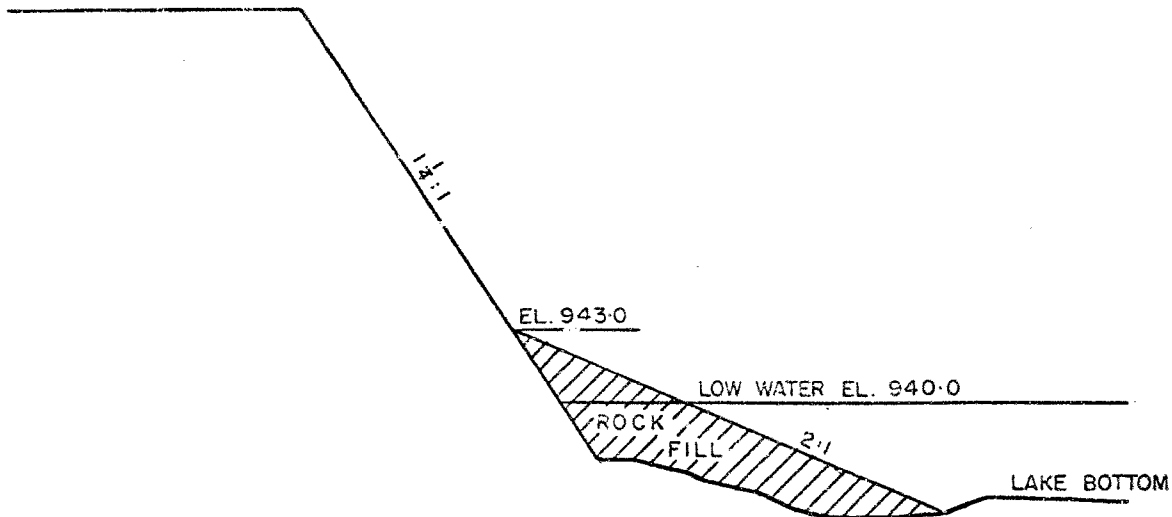


Recommended Berms - Sta. 255+70 to Sta. 256+75

cont'd. /3 ...

Mr. D. S. Cornell, Const. Engr.,  
Dist. #18, Sault Ste. Marie.

Nov. 6/62



Recommended Treatment - Sta. 257+00 to Sta. 259+50

Note:-

No more fill should be placed on the embankments until the above recommendations have been carried out.

The sections recommended may be modified slightly, to facilitate construction.

*K. G. Selby*  
K. G. Selby,  
Senior Foundation Engineer,  
Foundation Section,  
Materials & Research Division,  
D.H.O.

## ONTARIO DEPT. OF HIGHWAYS

Materials and Research Section

8232

Mr.

A. STERMACDate: NOV. 1<sup>st</sup> 1962FOUNDATION SECT.D.H.O. DOWNSVIEW

Attention

R Y Lo

Re:

CONTRACT 62-178EMBANKMENT FAILURE

Dear Sir,

ENCLOSED ARE THREE PHOTOS.

\* 1 (NUMBER IN BOTTOM RIGHT CORNER  
ON THE BACK OF THE PHOTO)

SHORE LINE IS EAST - WEST  
VIEW IS FROM EAST ABOUT  
400' FROM THE FAILURE.

\* 2 VIEW ABOUT 40' FROM THE  
FAILURE FROM THE WEST.  
DRILL ROD IS AT TOP CENTRE

\* 3 VIEW FROM WEST ABOUT 200'  
FROM THE FAILURE - THE  
DRILL ROD IS VISIBLE ON THIS  
PHOTO TOO.

EXTENT OF FAILURE :-

WIDTH ABOUT 30'

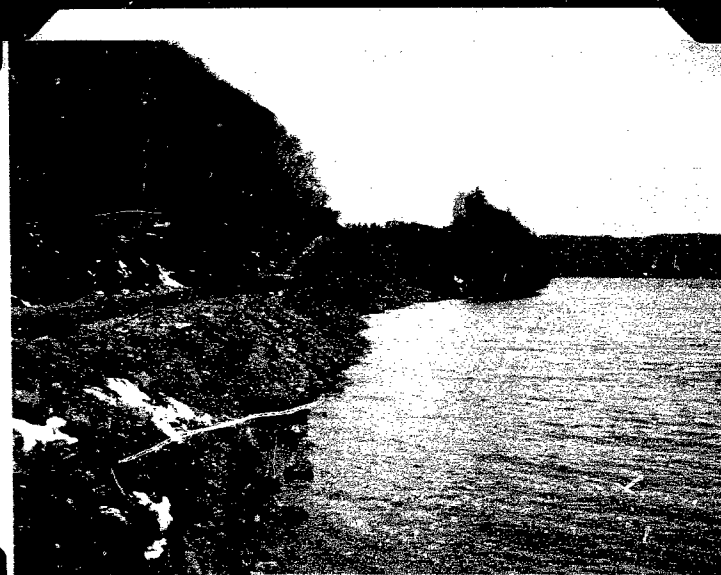
DEPTH UNKNOWN

LENGTH POSSIBLY 50'-70'

A. L. B. H.



CONT. 62-178  
HWY. \*101 WAWA  
PHOTOS TAKEN  
ON NOV. 13<sup>th</sup>  
1962



CONT. 62-178  
HWY. \*101  
WAWA  
STA. 255-262  
(LOOKING EAST)



CONT. 62-178  
HWY. \*101  
WAWA.  
STA. 262-255  
(LOOKING WEST)

CONT. 62-178  
HWY. \*101  
WAWA  
FAILURE AT  
STA. 256+25  
LEFT OF C





CONT. 62-178  
HWY #101 WAA  
PHOTOS TAKEN  
ON NOV. 13<sup>th</sup>  
1962



CONT. 62-178  
HWY #101  
WAA  
STA 255-262  
(LOOKING EAST)



CONT. 62-178  
HWY #101  
WAA  
STA 262-255  
(LOOKING WEST)

CONT. 62-178  
HWY #101  
WAA  
FAILURE AT  
STA 256+25  
LEFT OF C