

G.I.-30 SEPT. 1976

GEOCRES No. 31E-104DIST. 52 REGION W.P. No. CONT. No. 70-229W. O. No. STR. SITE No. HWY. No. 35LOCATION Boshung LakeNo. of PAGES -=====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

~~Ram~~ Pamela

Jim McDougall called from North Bay
He left the following message:

Site: Boskung Lake
Huntsville

Borehole #1
Sta. 201 + 49
Offset 23.55 m left
Elev. 310.026 m

Borehole #2
Sta. 202 + 12
22.95 m left
Elev. 309.310 m
Glen Hill can be reached
at 489-3795

Monika

BM. 768096
CAP ON ROCK
25.85 m left
200+31 metres left
Elev. 314.509 m



Ministry of
Transportation and
Communications

FILE No. _____ DATE _____

REMARKS _____

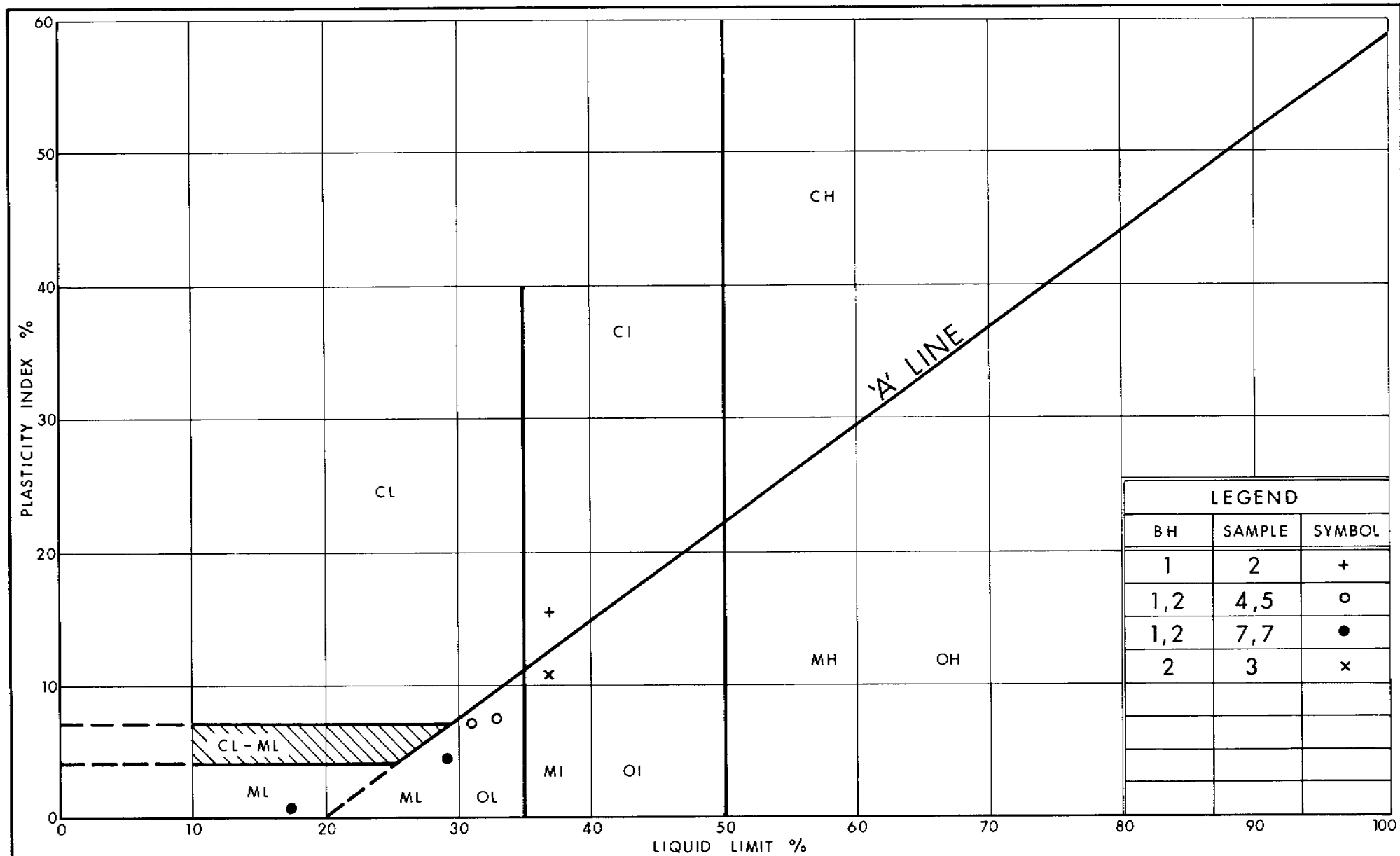
Merlex Engineering - Mike Merleau - 705-476-2550

MINDEN PATROL PATROL SUPER WAYNE TOY 286-1631

PATROMAN - MERU MINTÉ

HAIBURTON PY Hwy 12 2 km east Haliburton Rd 1 - 457-1940

Mobilization 195 km to Hwy 1284 Hwy 35

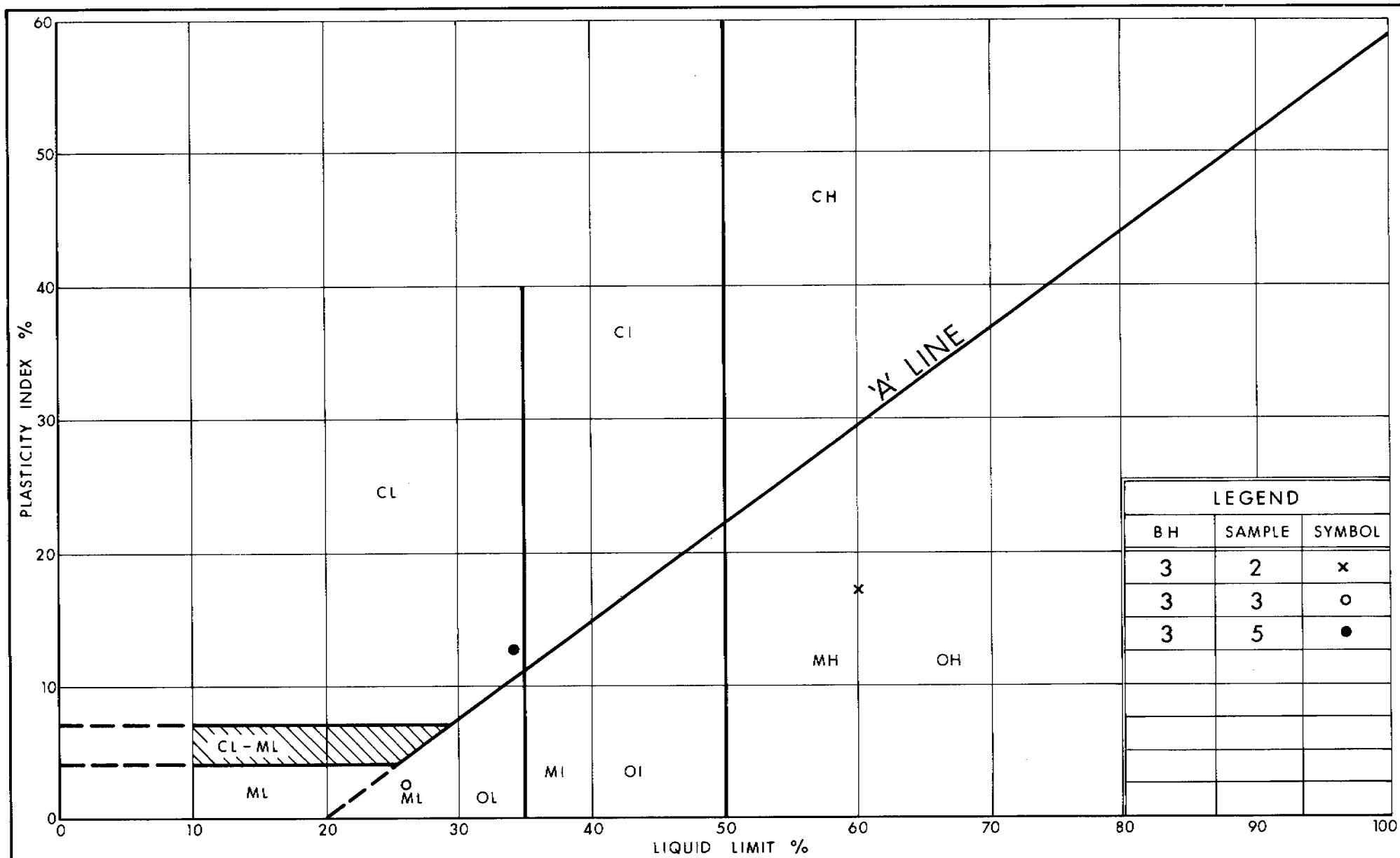


Ministry of
Transportation
Ontario

PLASTICITY CHART

FIG No

CONT 70-229



Ontario

Ministry of
Transportation

PLASTICITY CHART

FIG No

CONT 70-229



memorandum

To: J. McDougall, P. Eng
Head, Geotechnical Section
Northern Region

From: Pavements and Foundation Section
Room 315, Central Building
Downsview, Ontario

Re: Hwy 35, vicinity of Boshkung Lake
Cont. 70-229
District 52, Huntsville

1995 12 12

This memo provides recommendations to correct the on going settlement problem at the above mentioned site. The site is located approximately 2 km north of Carnarvon, beside Boshkung Lake, in the County of Haliburton, Township of Stanhope. The physiographic region has been described by Chapman and Putnam (1984) as the Algonquin highlands. The relief is rough, with rounded knobs ridges and outcrops of bedrock.

The existing pavement at the site has experienced settlement for some times. The segment of the highway has been repaired several times. The maintenance mainly consisted of adding more material to maintain the grade. As part of the pavement distress, a portion of the guardrail has also tilted towards the slope. The embankment is about 10m high with rockfill visible at the bottom half of the slope. The top portion of the slope is composed of granular material.

We wrote a memo on August 10, 1995 that contained our preliminary assessment of the problem. We suggested that information on the thickness and composition of the granular layer above the rockfill was required in order to assess the problem more thoroughly. Your office provided us this information along with cross sections of the embankment.

The Northern Region geotechnical section carried out an investigation at the site to find out the thickness of the granular layer over the rockfill. A total of twelve test holes was advanced. Six test holes (TH 1 through TH 6) were advanced on the east side and six (TH 7 through TH 12) were put down on the west side of the highway in the area which had experienced settlement. The test holes were advanced to depths ranging from 0.8m to 1.0m on the east side and 1.2m to 4.8m on the west side before meeting refusal to further penetration. The depths of penetration suggested the thickness of the granular fill above the rockfill.

The asphalt thickness on the east side ranged from 80mm to 160mm. On the west side at few locations there were two layers of asphalt. The thickness of the upper layer ranged from 70mm to 550mm. The thickness of the second lower layer that separated from the upper asphalt layer by granular material ranged from 260mm to 830mm. Generally the granular material contained coarse gravel underlain by fine to medium sand with gravel and occasional rock mix.

DISCUSSION

In addition to the above mentioned information our conclusion is based on a site visit to study the nature of the distress, the pattern of the failure and its possible cause. In our opinion the settlement is due to the movement of the fill within the embankment itself rather than a deep seated failure. No sign of distress was noted at the toe of the slope. In our opinion the settlement is caused due to the following reasons:

Improper Side Slopes of the Embankment

From the result of the test holes, it is obvious that in due course of time more settlement took place on the west side of the embankment (near the slope face) than on the east side (near the exposed rock). The thickness of the fill up to 4.8m is reported on the west side, which mainly resulted from on going maintenance of the highway, i.e. adding more material to maintain the grade..

We reviewed a critical cross sections at station 16+205 provided to us by the Geotechnical Section, Northern Region (Re: 164-90-01, dated August 15, 1995, Scale 1:100). The cross section was drawn on a true scale. From the cross section it is evident that the side slope of the rockfill is at 1H:1V, and the side slope of the granular fill is 1.5H:1V. Normally the permanent rockfills are constructed at 1.25H:1V side slopes and the granular fill at 2H:1V. The side slopes of the embankment is therefore, unstable and causing lateral movement of the soil resulting from slippage and loss of ground.

Loss of Granular Fill in the underlying Rockfill

The result of the test holes also indicated that immediately above the rockfill the granular material consist of fine to medium sand with gravel. There is no separating layer between the rockfill and granular material. This situation may have caused loss of fines into the underlying rockfill and added up to the settlement of the highway.

Improper Drainage

On the east side of the highway, directly across from the area of the settlement, there are massive rock outcrops. Between the rock outcrops and the highway, there is a ditch which has no apparent drainage system to allow the water to flow out of the ditch. Since the ditch beside the site is in a low area, all the runoff from the area collects in this ditch and flows through the embankment out at the bottom of the slope on the west side of Hwy 35. It is possible that the water is washing out the fines of the embankment which is also causing the settlement.

RECOMMENDATIONS:

For a long term solution to the on going settlement problem our recommendations are as follow:

Construct the rockfill portion of the embankment at 1.25H:1V or flatter. For the granular fill portion, maintain a side slope of 2H:1V or flatter. In areas where the granular fill is very thick, some of the granular fill may be replaced with rockfill.

Provide a layer of coarse material such as 50mm crushed stone overlain by geotextile as a separator between the granular material and the rockfill.

Provide a proper drainage system for the ditch to allow water to flow from the ditch through a channel, rather than through the embankment fill. A CSP type conduit may be used for this purpose. As an alternative, the ditch may be sealed and false graded to carry water to the south or somewhere else.



K.S.Q. Ahmad, P. Eng.
Foundation Engineer

For

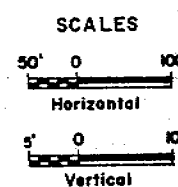
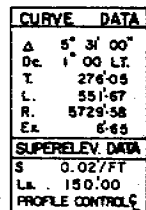
T.C. Kim, P. Eng.
Senior Foundation Engineer

MCCORMICK, RANKIN & ASSOCIATES
LIMITED

PORT CREDIT CONSULTING ENGINEERS

PORT CREDIT

OTTAWA

[illegible]

memorandum

Ontario

To: A.Devolin
Senior Project Manager
Northern Region

Date: 10 August 1995

From: J.I. McDougall, P. Eng.
Head Geotechnical Section

Subject: Wp 164-90-01 Hwy 35 Settlement Area
Vicinity Boshkung Lake, Township of Stanhope,
District 52, Huntsville
=====

In response to your memo of July 20, 1995 and further to a field review of the site in the presence of the District and the Foundation Section, we wonder if the situation is a deep seated movement or a surficial movement in the upper fill exasperated by the steep slope and the migration of water from the east ditch through the fill.

We hope to drill the southbound lane and shoulder to determine if an alternate recommendation would address the problem. The alternate treatment would be similar to what we did on Hwy 17 just past the Kukagaki Rd. on Contract 91-234, where we used tensar reinforced fill to solve a compareable problem.

Geotechnical

cc: Tai Kim



J.I. McDougall
Head

Al Devolin
Senior Project Manager
Planning & Design
Northern Region
NORTH BAY

From: G.W. Hines
District Engineering Supvr.

RE: W.P. 164-90-01 - HWY. #35, SETTLEMENT AT BUSKONG LAKE

BOSNIEN

[illegible]

Huntsville District is in agreement with your recommendations of July 20, 1995.

I inspected the site on July 28, 1995 and I note that runoff from the East side of the highway is not contained by a ditch (drawing attached). All the runoff from the area must traverse through the rockfill and out at the bottom of the slope on the West side of Hwy. #35. I wonder if excessive infiltration of water could be creating the slippage that we see happening at this location?

Perhaps the ditch should be sealed and false graded to carry water to the South. Other possibilities are to shift the alignment and/or lower the grade.

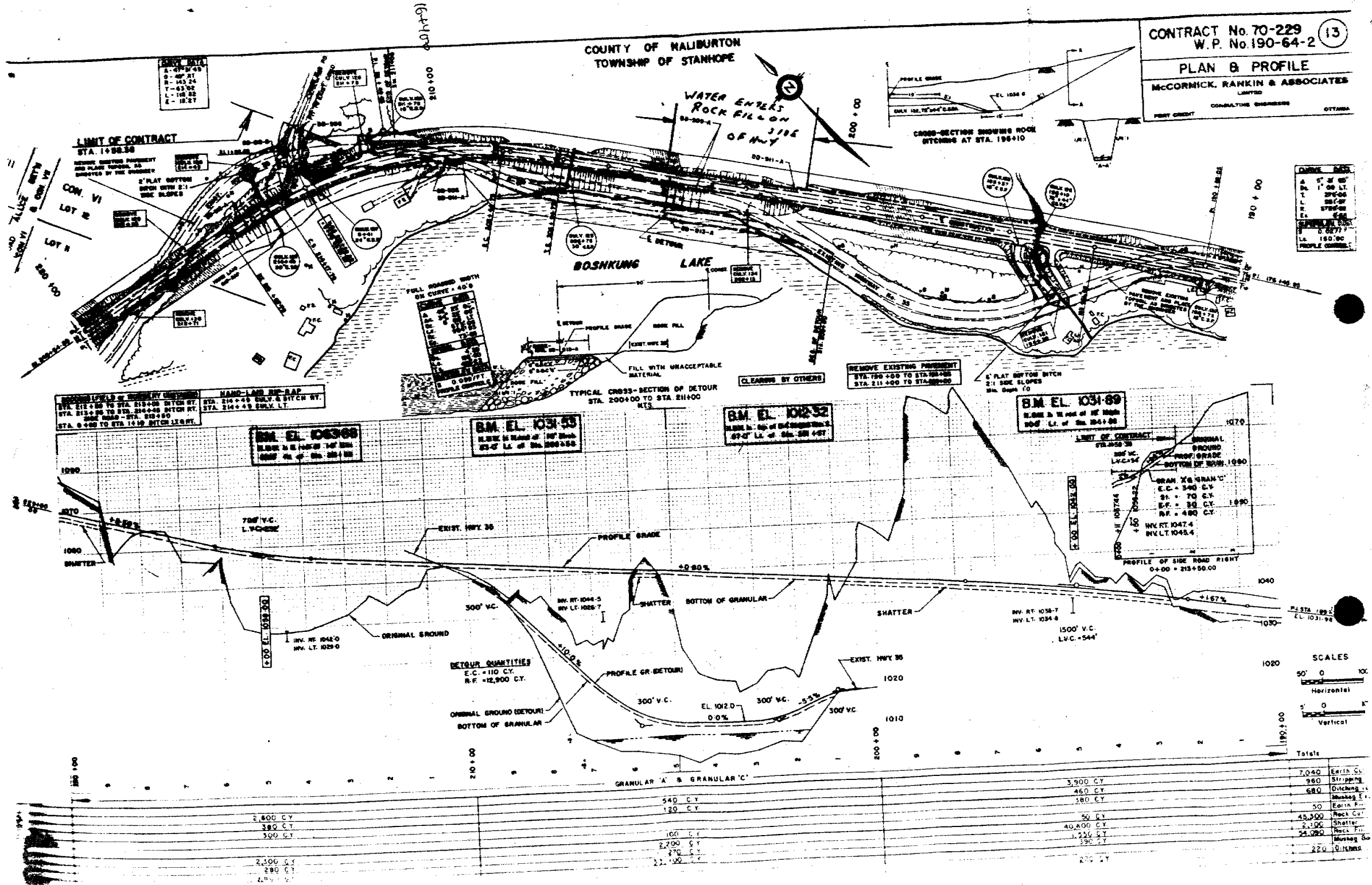
G.W. Hines
Dist. Engineering Supvr.

GWH:sl

c.c. - J. McDougall

COUNTY OF HALIBURTON
TOWNSHIP OF STANHOPE

CONTRACT No. 70-229
W.P. No. 190-64-2 (13)
PLAN & PROFILE
McCORMICK, RANKIN & ASSOCIATES
LIMITED
CONSULTING ENGINEERS
OTTAWA



memorandum



To: J. McDougall, P. Eng.
Head, Geotechnical Section
Northern Region

From: Pavements and Foundations Section
Room 315, Central Building

Subject: Hwy 35, vicinity of Boshkung Lake
Cont. 70-229
District 52, Huntsville

Date: 95 08 10

A joint site visit was made on 95 07 12, attended by yourself, Paul DeVilliers (Special Projects Supervisor, District 52), Tae Kim and the undersigned. As observed, the existing pavement at the site has shown signs of settlement. A portion of the guardrail has also tilted towards the slope. The embankment is 10 \pm m high with rock fill visible at the bottom half of the slope. The top portion of the slope appears to be granular in nature. The area at the slope toe was also inspected and no obvious sign of distress was noted.

The previous investigation carried out by this office in 1989 has included three boreholes at the toe of the embankment. The analysis was done assuming a deep-seated slope failure mechanism and consequently a stabilizing berm was recommended at the toe of the slope.

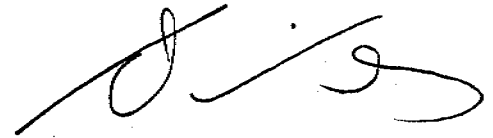
As discussed in the field, more investigation work is warranted before the construction of the stabilizing berm. The following possible causes of failure should also be carefully examined:

- Creep in the granular fill due to oversteepened side slopes.
- Loss of fines from the granular fill to the underlying rock fill due to the lack of a separation layer.
- Massive rock outcrops can be found on the north side of the highway directly across from the failed zone. No proper surface drainage system is available in the ditch area at the slope toe. It is envisaged that water may have found its way through the embankment and washed fines out of it. This may have induced settlements in the highway.

As agreed, you will look into possibilities of initializing the investigation by your office with a view to reveal the thickness and composition of the granular layer above the rock fill. In addition, you will arrange with Surveys and Plans Section for at least three cross-sectional profiles of the existing slope covering the concerned area. These cross-sections should extend from the north side of the highway all the way down to

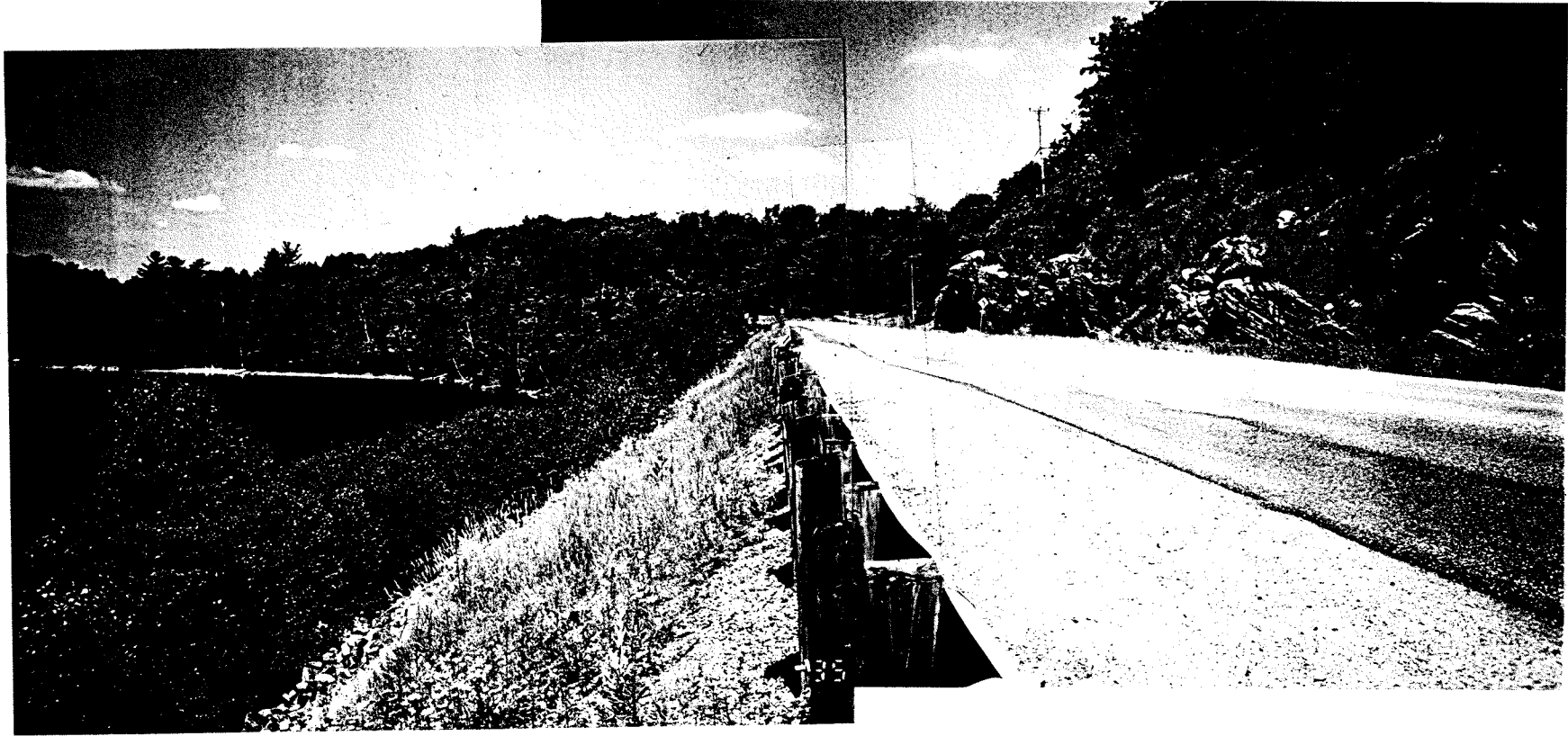
the lake bottom.

Once the above information is available, we will carry out the analyses and provide you with the recommendations. We are pleased to discuss with you further on the details of the supplementary investigation.

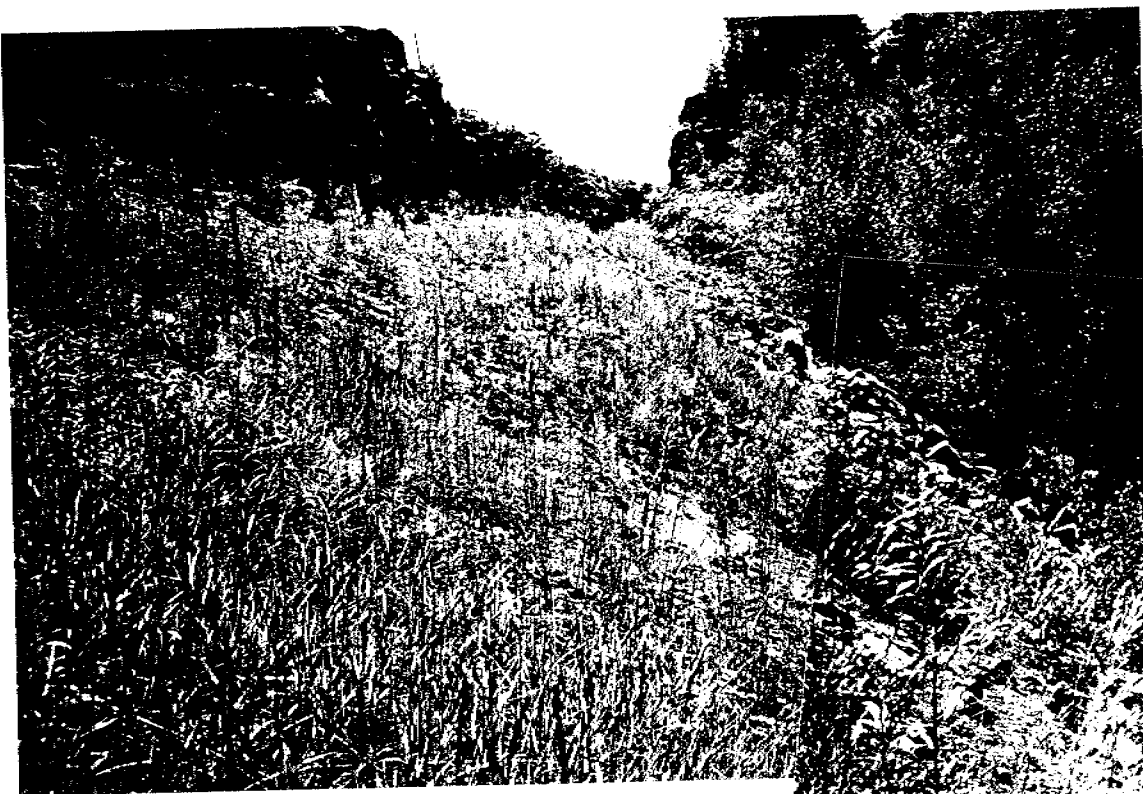
A handwritten signature in black ink, appearing to be 'David Kwok', written in a cursive style.

David Kwok, P. Eng.
Project Foundation Engineer
for
Tae Kim, P. Eng.
Senior Foundation Engineer

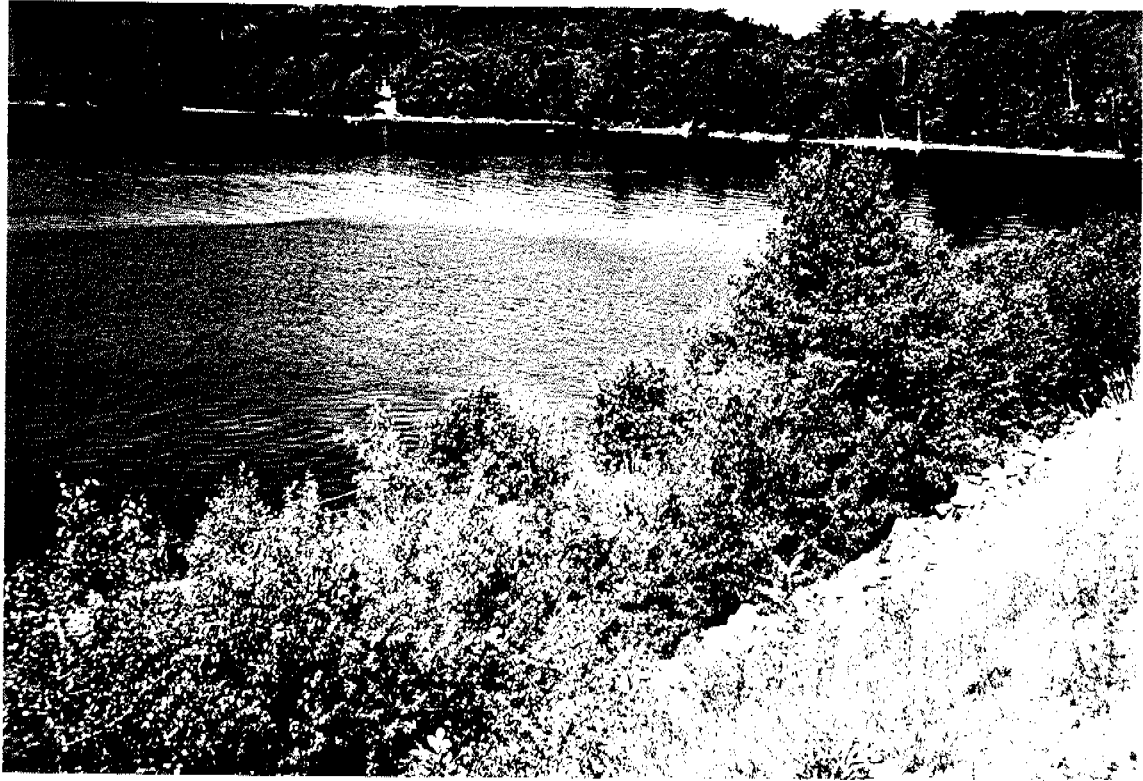
c.c. Paul DeVilliers











memorandum



To: J. McDougall, P. Eng.
Head, Geotechnical Section
Northern Region

Attention: H. Pattenden

From: Pavements and Foundations Section
Room 315, Central Building

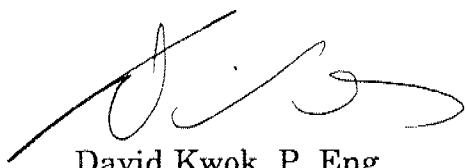
Subject: Hwy 35, vicinity of Boshkung Lake
Cont. 70-229
District 52, Huntsville

Date: 95 06 26

We refer to the telephone conversation (Pattenden/Kwok) on 95 06 23 regarding the recommendations given in our memorandum dated 89 12 01 for the slope improvement works at the above-noted location.

The engineers involved in this project before are no longer with this office. We have reviewed the memorandum report and based on our interpretation, the proposed stabilizing berm should be constructed to El. 311 m. This would probably result in a fill cover of 1 \pm m to the existing berm at that location but the exact magnitude of this fill cover is not a controlling factor in the construction configurations.

We believe that the above has clarified the previous recommendations.



David Kwok, P. Eng.
Project Foundation Engineer
for
Tae Kim, P. Eng.
Senior Foundation Engineer

memorandum



To: J. McDougall
Head, Geotechnical Section
North Bay

Date: 1989 12 01

From: Foundation Design Section
Room 315, Central Building

RE: Settlement, Highway 35, Vicinity of Boshkung Lake
Stations 200+00 to 211+00, Contract 70-229
District #11, Huntsville

The following is a summary of the results of our foundation investigation and analysis of the above mentioned site.

Site Description

The site is located approximately 2+km north of Carnarvon, beside Boshkung Lake. The physiographic region has been described by Chapman and Putnam (1984) as the Algonquin highlands. The relief is rough, with rounded knobs ridges and outcrops of bedrock at the site.

Subsurface Conditions

At the edge of the former detour and the toe of the embankment, the subsoil was found to consist of 11 to 2m of rock or gravelly sand fill (to elevation 309.6/305.5m). This was underlain by up to 2.5m of clayey silt beneath which at elevation 307.2m lies a silt of low plasticity to the end of the boreholes (elevation 302.7m) where a 0.6±m layer of sand was encountered.

Under Boshkung Lake, the subsoil consisted of 1.4m of silty sand encountered at elevation 304.9m. The material was underlain by 1.5m of organic silty sand which in turn was underlain at elevation 302m± by 3.6± clayey silt which overlies a deposit of sandy silt to silty sand found at elevation 298.4 to the end of the borehole (3.1m+).

For a more detailed description of the subsurface and groundwater conditions encountered, reference should be made to the Record of Borehole Log Sheets contained in the Appendix of this report (Boreholes 1, 2 and 3). The plan locations of the borings are shown on Figure 1.

Discussion

A request was made for our comments and recommendations regarding a settlement problem along this section of Highway 35 which has been patched from time to time. Our observations at the site, included cracks in the pavement, a shifting guiderail, trees with curved trunks etc. and analysis based on the fieldwork indicate that a slope stability problem exists.

Recommendations

Stability analyses in terms of total stresses have been carried out for the existing cross section with and without various berm designs. Details of the assumptions and results of the stability analyses are provided in Figure 2. Based on these, it is recommended that the following berm (refer to figure 3) be constructed as indicated below.

1. Rockfill (or other acceptance granular material) should be used to construct the berm in two phases.
2. First a 7m minimum wide berm should be constructed from the lake bottom to elevation 311m.
3. The second phase is to be constructed from the first half of the berm (phase 1) over the detour to the ditch line at the toe of the embankment to elevation 311m. Refer to Figure 3, Proposed Berm.
4. The berms are to be constructed with 2 horizontal to 1 vertical side and forward slopes.

Miscellaneous

The fieldwork for this investigation was carried out in two parts.

The First half was carried out from 87-08-19 to 87-08-20 under the supervision of J. Matthews, Co-op Student, and P. Marks, Foundation Engineer. The equipment was owned and operated by Johnston Drilling under the general supervision of K. Selby, Chief, Foundation Engineer (West).

The second half was carried out from 88-12-13 to 88-12-16 under the supervision of G. Beauchesne, Co-op Student and S. Holmes, Foundation Engineer. The equipment was owned and operated by Merlex Engineering Ltd. under the general supervision of P. Payer, Senior Foundation Engineer.

This report was prepared by P. Marks, reviewed by P. Payer and approved by M. Devata, Chief Foundation Engineer.



P. Marks, P. Eng.
Foundation Engineer

for

M. Devata, P. Eng.
Chief Foundation Engineer

MD/PM/jb

APPENDIX

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 1" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	FOIL SAMPLE

STRESS AND STRAIN

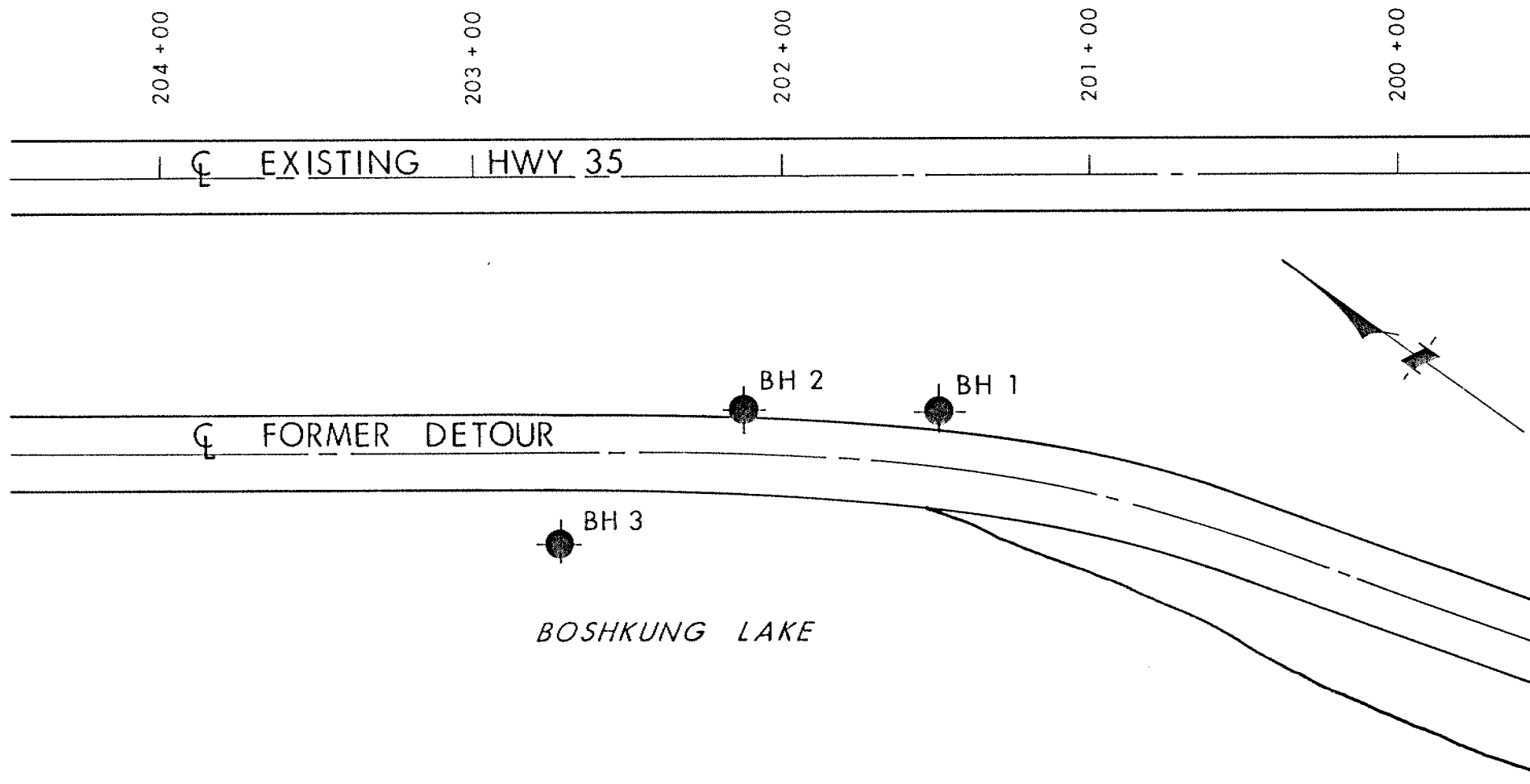
u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_a	1	RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
t_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{v0}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

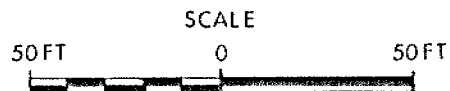
PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ³ /s	RATE OF DISCHARGE
γ_d	kN/m ³	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						



SETTLEMENT HWY 35 - VICINITY OF BOSHKUNG LAKE

PLAN



NOTES:

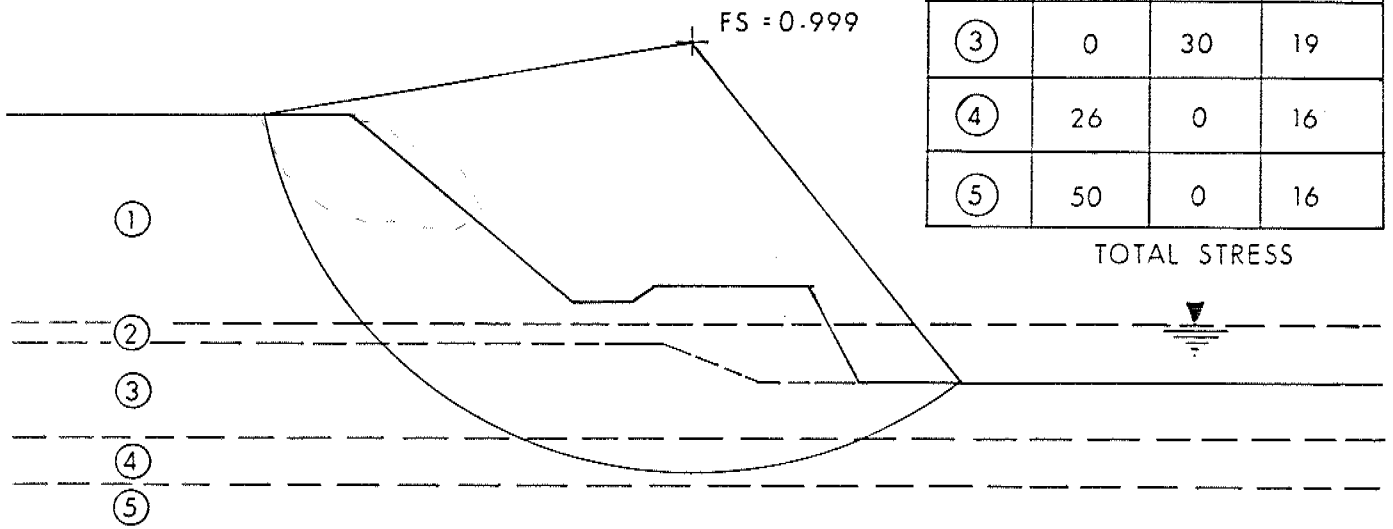
- ① This Fig is in Imperial Units.
- ② For Subsoil information refer to Record of Borehole Sheets.

Geocres No 31E - 104
 Cont 70 - 229
 Dist 11
 Figure No 1

SOIL PARAMETERS

SOIL	C (kPa)	ϕ (°)	γ (kN/m ³)
①	0	30	18.1
②	0	30	18.1
③	0	30	19
④	26	0	16
⑤	50	0	16

TOTAL STRESS

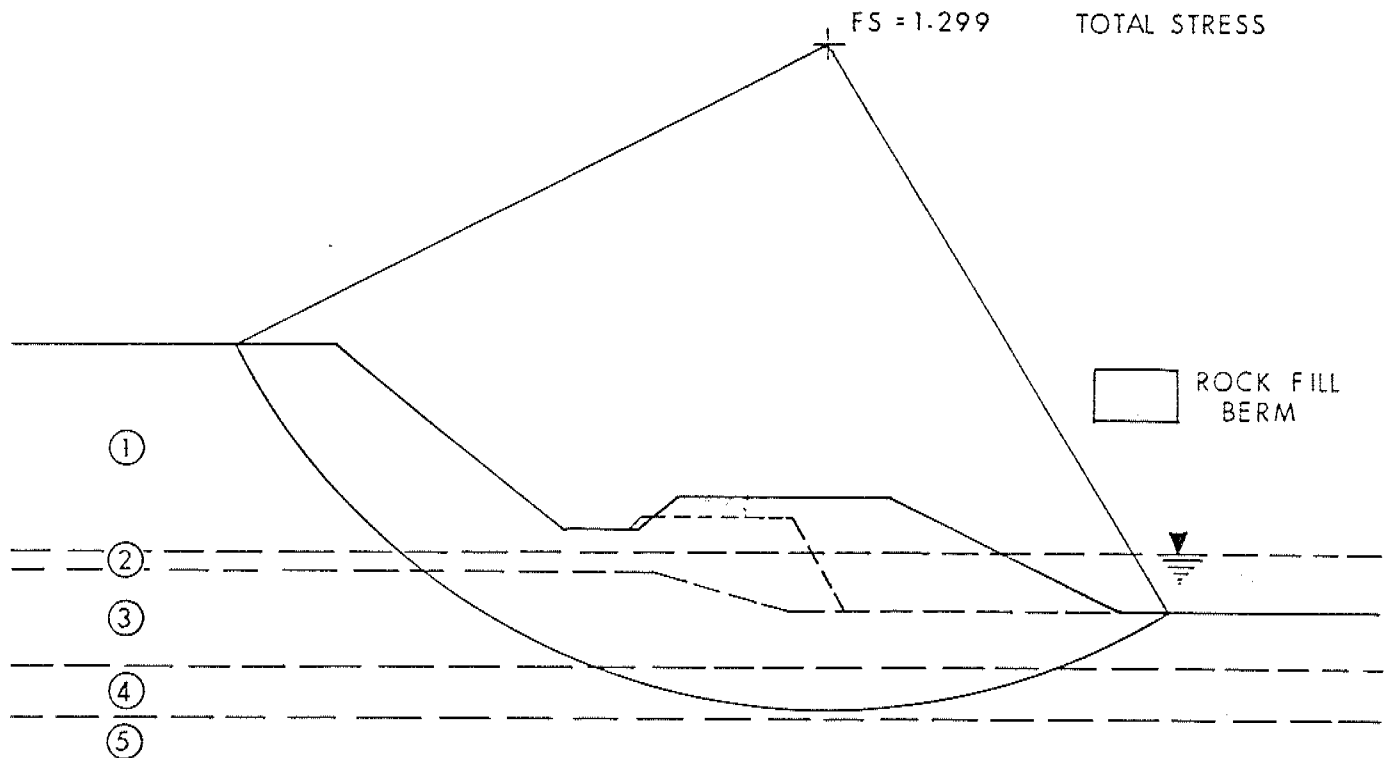


EXISTING EMBANKMENT

SOIL PARAMETERS

AS ABOVE

TOTAL STRESS



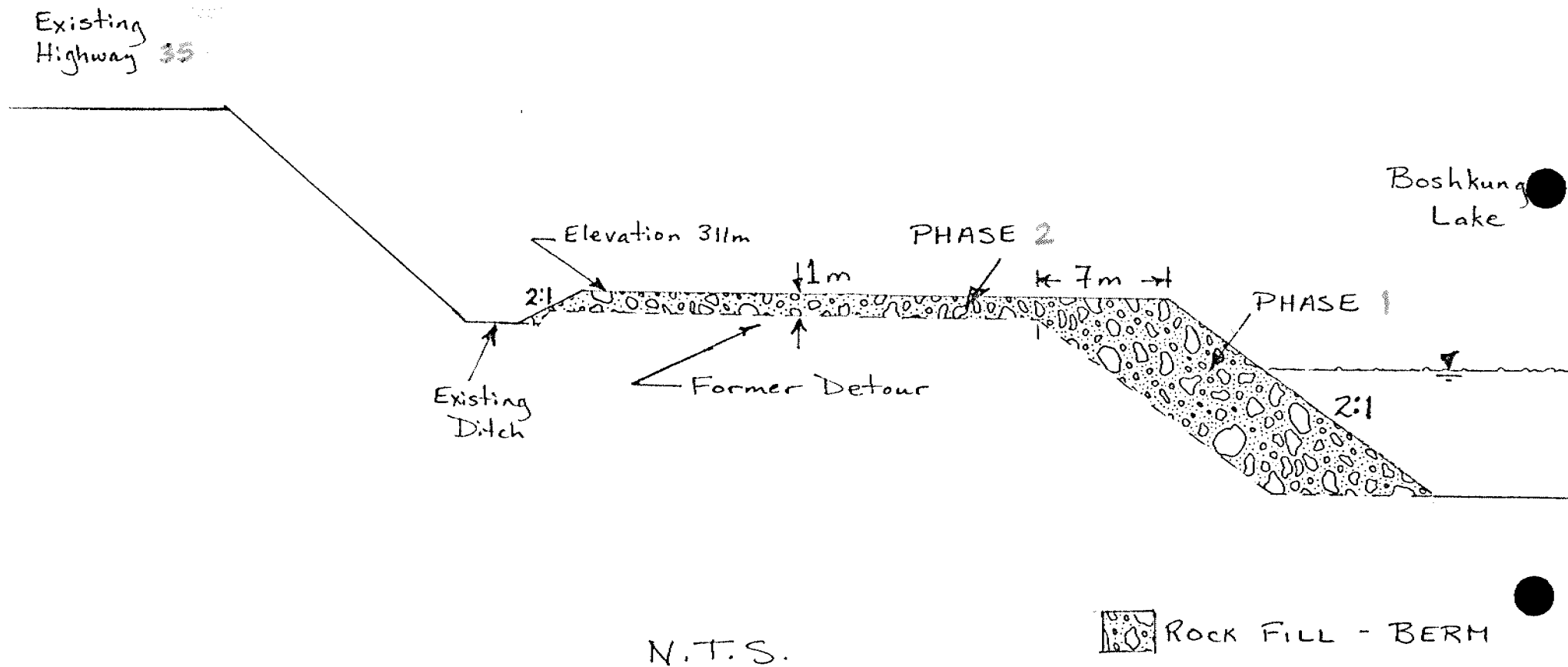


FIGURE 3: PROPOSED BERM

RECORD OF BOREHOLE No 1

METRIC

Cont. 70-229 LOCATION #Sta: 201+49, 0/S 77.4' Lt & Hwy. 35 ORIGINATED BY JM
DIST 11 HWY 35 BOREHOLE TYPE Continuous Flight Auger (H.S.) COMPILED BY PM
DATUM Geodetic DATE 87 08 19 - 87 08 20 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
310.0	Ground Level						20	40	60	80	100	20	40	60			
0.4	Gravelly Sand Fill		1	SS	20												
	Clayey Silt With Thin Sand Layers Occ. Trace of Organics Very Stiff		2	SS	23											0 5 (95)	
307.1			3	SS	18											0 3 (97)	
2.9	Silt of Low Plasticity Trace of Sand Stiff		4	SS	11												
			5	SS	9												
			6	SS	10												
			7	TW	PH											19.2 0 5 (95)	
303.4	Gravelly Sand		8	SS	59											35 54 (11)	
0.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

Note:

Stations & Offsets in Imperial Units

RECORD OF BOREHOLE No 2

METRIC

Cont. 70-229 LOCATION #Sta: 202+12, O/S 75.4' Lt. Q Hwy. 35 ORIGINATED BY JM
DIST 11 HWY 35 BOREHOLE TYPE Continuous Flight Auger (H.S.) COMPILED BY PM
DATUM Geodetic DATE 87 08 20 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100	W _p	W	W _L		
309.3	Ground Level															
0.0	Gravelly Sand Trace of Organics (Fill) Compact		2	SS	14										36 56 (16)	
307.2			3	SS	17										0 3 (97)	
2.1	Silt of Low Plasticity With Thin Layers of V. Fine Sand Stiff		4	ss	8											
			5	TW	PH										18.2 0 2 (98)	
			6	SS	10											
			7	TW	PH											
302.7	Sand		8	SS	33											
6.6	End of Borehole															
<p>Note: Stations & Offsets in Imperial Units</p>																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

METRIC

Cont. 70-229 LOCATION *Sta: 202+73 , O/S 120.9' Lt G Hwy. 35 ORIGINATED BY GB
 DIST 11 HWY 35 BOREHOLE TYPE BX Casing COMPILED BY PM
 DATUM Geodetic DATE 88 12 14 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
307.6	Lake Water Level																GR SA SI CL
0.0																	
304.9	Bottom of Lake						306										
2.7	Silty Sand, Trace of Organics						304										0 94 (6)
303.5	Very Loose		1	SS	0												
4.1	Highly Organic Soil to Organic Silty Sand		2	SS	0												
302.0	Very Soft/Loose		3	SS	0		302										0 68 (32)
5.6	Clayey Silt		4	SS	0												
	Very Soft						300										0 2 (96)
	to		5	SS	3												
	Stiff		6	SS	14		298										
298.4																	
9.2	Sandy Silt		7	SS	3		296										0 21 (79)
	to																
295.3	Silty Sand																
	Very Loose		8	SS													0 94 (6)
12.3	End of Borehole																

Note:
Stations & Offsets in Imperial Units

memorandum



Tel: 3731

To: J. McDougall
Head, Geotechnical Section
North Bay

Date: 1987 10 08

Atten: E.W. Veritsky
Pavement Design and
Evaluation Officer

From: Foundation Design Section
Room 315, Central Building

RE: Settlement Highway 35
Vicinity of Boshkung Lake
Stations 200 + 00 to 211 + 00
District #11, Huntsville

As per your request, two boreholes were completed at the toe of the slope in August, 1987. They indicated a cohesive deposit which could be responsible for the movement and cracking observed on Highway 35 at the above site. However, this cracking may also be due to settlement or a small stability problem. Since the highway has just been repaired we are recommending that the site be observed until next spring. If any further movements occur, we will carry out a complete investigation at that time. If you are in agreement with the above, please indicate as such.

A handwritten signature in dark ink, appearing to read "P. Marks".

P. Marks, P. Eng.
Project Foundations Engineer

PM/mnj