

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 41P-12

DIST. 14 REGION

W.P. No. 161-74-02

CONT. No. 86-220

W. O. No.

STR. SITE No. 47-22

HWY. No. 65

LOCATION Montreal River Bridge

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

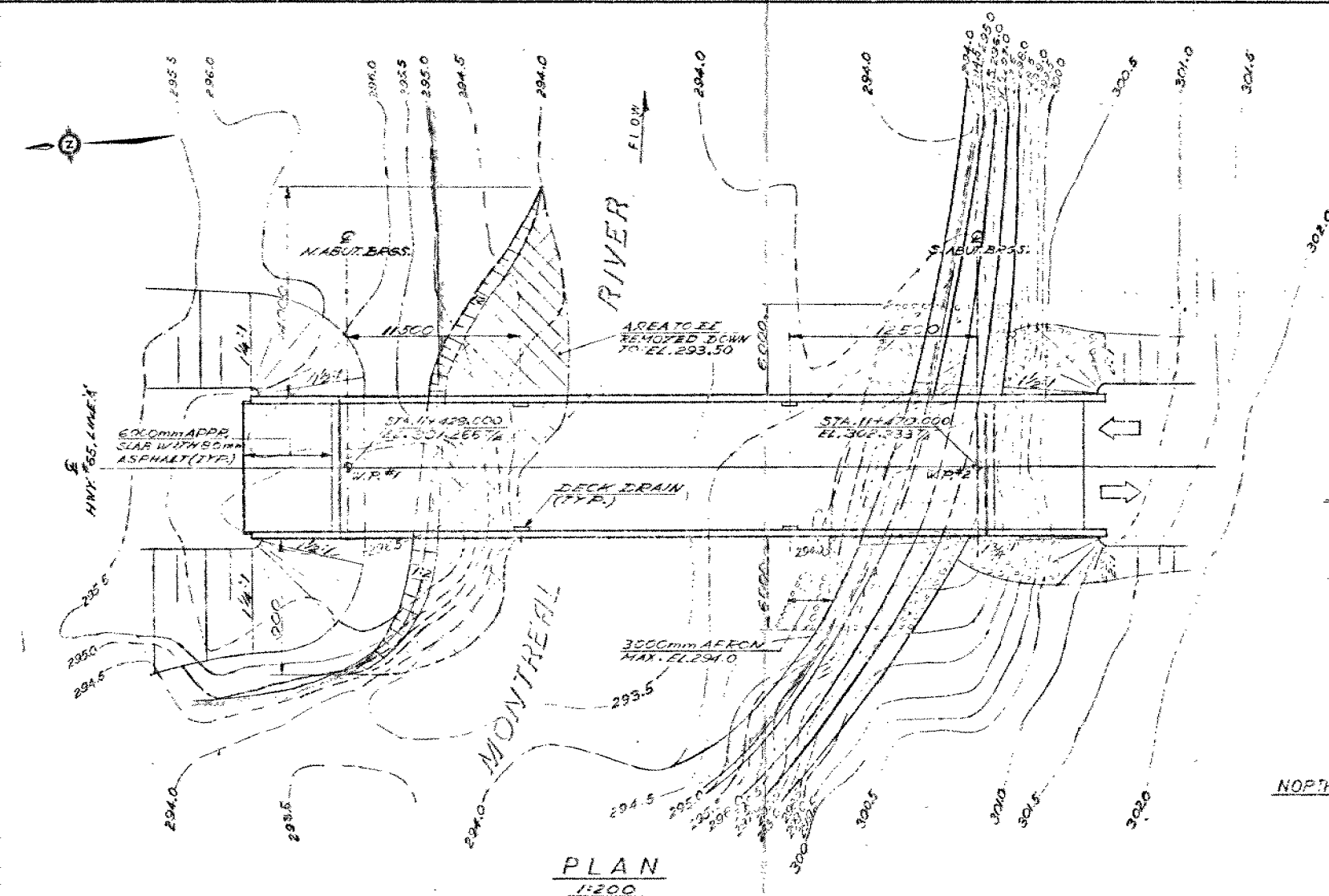
REMARKS:

G.I.-30 SEPT. 1976

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DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

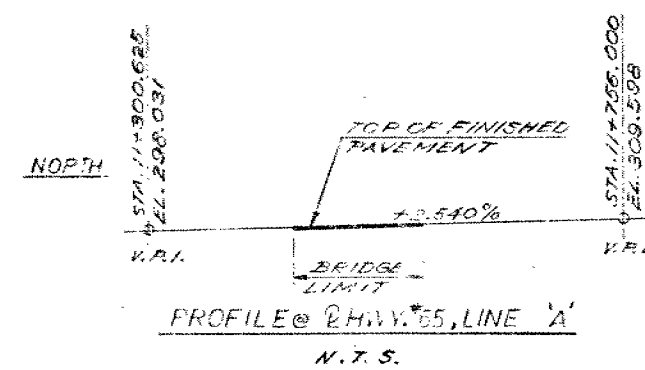
DIST. No. 14  
CONT No  
WP No 161-74-02  
MONTREAL RIVER BRIDGE  
AT LONG RAPIDS  
GENERAL ARRANGEMENT

SHEET

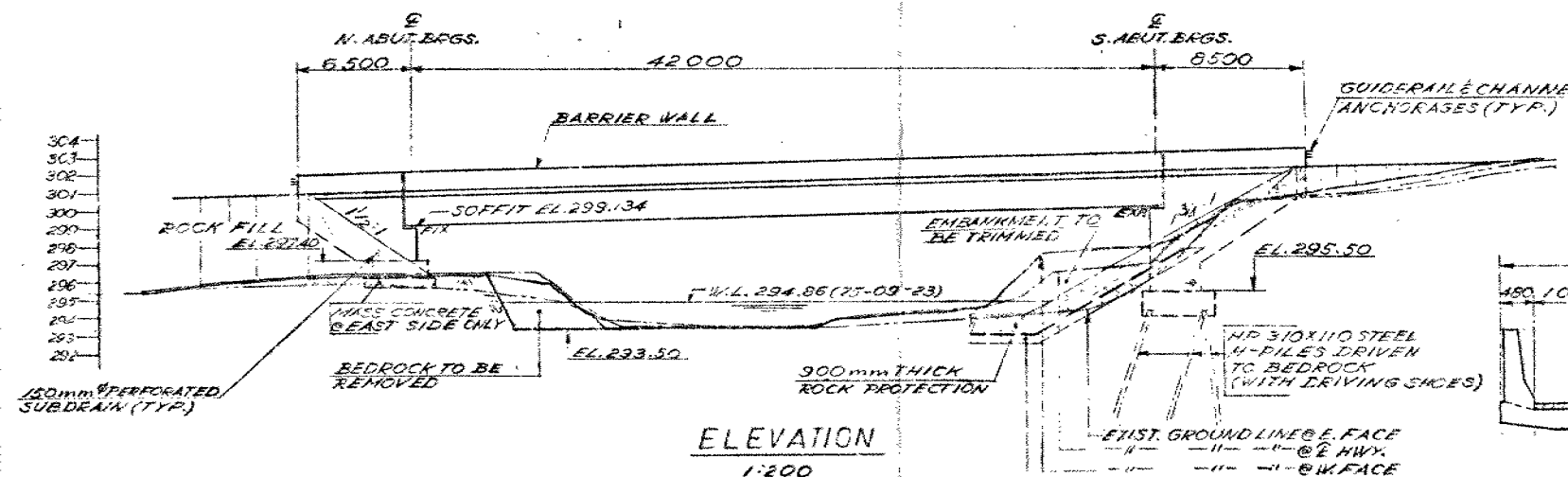


PLAN  
1:200

NOTE:  
W.P. DENOTES WORKING POINT  
T/A DENOTES TOP OF ASPHALT

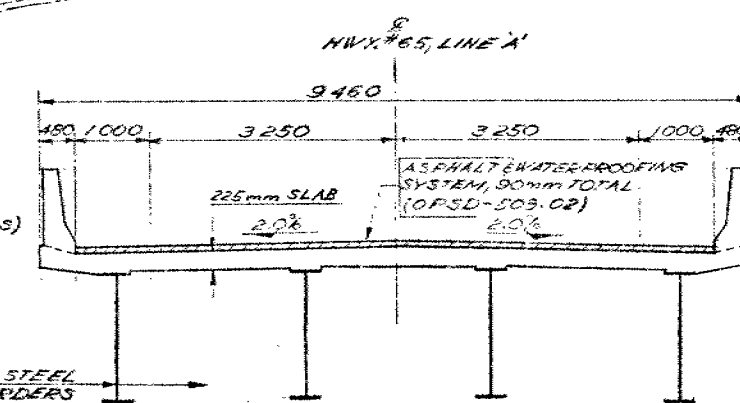


PROFILE @ HWY. 55, LINE 'A'  
N.T.S.



ELEVATION  
1:200

PLACE 500mm GRANULAR 'A' BLANKET UNDER ROCK PROTECTION TO EL. 297.63



TYP. DECK SECTION  
1:50

NOTES:  
**REINFORCING STEEL**  
REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED.  
BARS MARKED WITH SUFFIX 'C' SHALL BE COATED BARS.  
**CLASS OF CONCRETE**  
NORTH ABUTMENT FOOTING & MASS CONCRETE - 20 MPa  
REMAINDER - 30 MPa  
**CLEAR COVER TO REINFORCING STEEL**  
FOOTINGS - 100 ± 25 mm  
ABUTMENT & WINGWALLS:  
FRONT FACE - 50 ± 20 mm  
BACK FACE - 70 ± 20 mm  
DECK: TOP - 70 ± 20 mm  
BOTTOM - 40 ± 10 mm  
BARRIER WALLS - 70 ± 20 mm  
APPROACH SLABS - 75 ± 25 mm  
UNLESS OTHERWISE NOTED ON DRAWINGS.  
**CONSTRUCTION NOTES:**  
THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ± 3 mm.

- LIST OF DRAWINGS
- 47-22-1 GENERAL ARRANGEMENT
  - 2 BORE HOLE LOCATIONS & SOIL STRATA
  - 3 FOOTING LAYOUT
  - 4 NORTH ABUTMENT
  - 5 SOUTH ABUTMENT
  - 6 STRUCTURAL STEEL
  - 7 SPLICE DETAILS & BEARINGS
  - 8 DECK
  - 9 BARRIER WALL
  - 10 6000mm APPROACH SLAB
  - 11 JOINT ANCHORAGE & ARMOURING
  - 12 BRIDGE DATE & SITE NUMBER DATA
  - 13 AS CONSTRUCTED ELEV. & DIM.
  - 14 STANDARD DETAILS
  - 15 QUANTITIES - STRUCTURE I
  - 16 QUANTITIES - STRUCTURE II



B.M. 299.746  
N.E.W. IN S. ROOT 20 POPLAR  
73.1 RT. 11+438.351

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	CHECK	LOADING	DESCRIPTION	DATE	BY

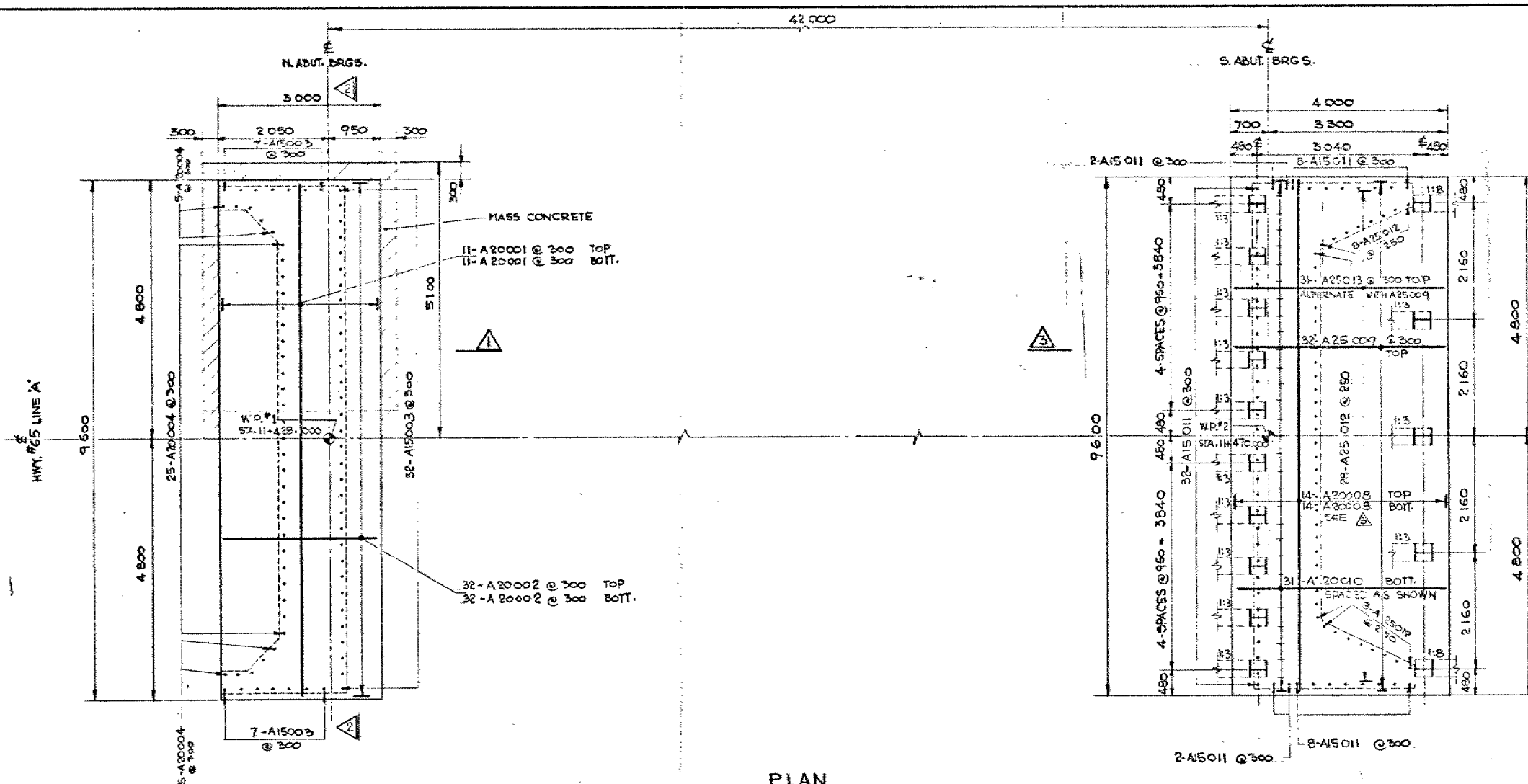
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DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

DIST. 14  
CONT No  
WP No 161-74-02

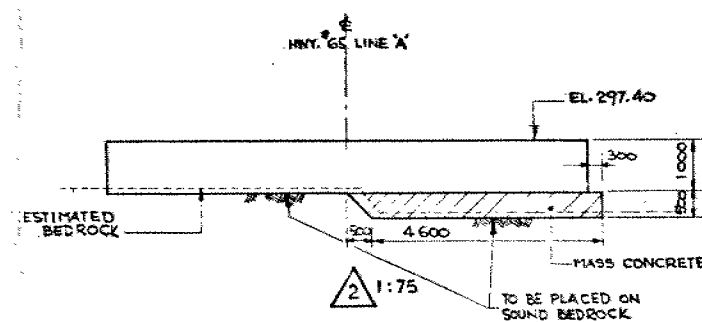
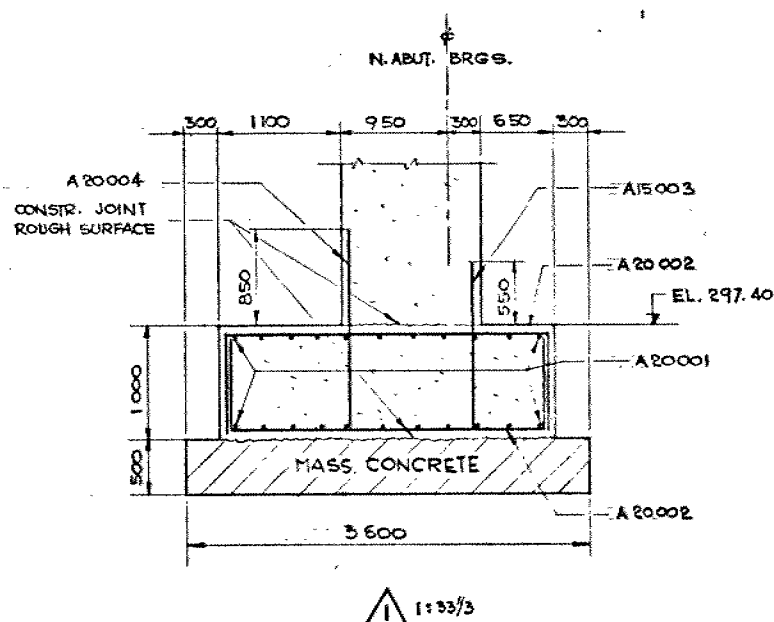
MONTREAL RIVER BRIDGE  
AT LONG RAPIDS  
FOOTING LAYOUT



SHEET



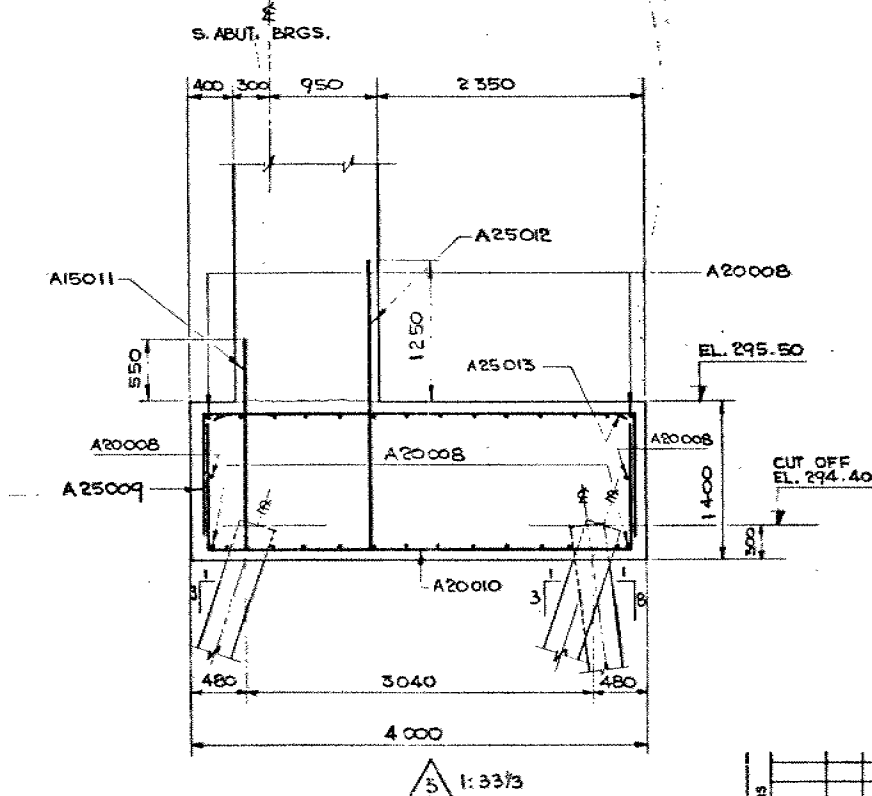
PLAN  
1:50



LIST OF STEEL H PILES

LOCATION	TYPE	N° REQ'D	LENGTH	PILE DESIGN DATA		REMARKS
				LOAD @ S.L.S.	FACTORED TYPE II CAPACITY @ S.L.S.	
SOUTH ABUTMENT	HP 300x110	15	9,500	1150 KN/PILE	1600 KN/PILE	WITH DRIVING SHOES

NOTES:  
• PILE LENGTH SHOWN IS THE THEORETICAL LENGTH BELOW CUT OFF ELEVATION.  
• PILES TO BE DRIVEN TO BEDROCK.  
• PILE SPACING MEASURED AT UNDERSIDE OF FOOTING.

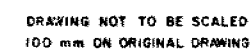


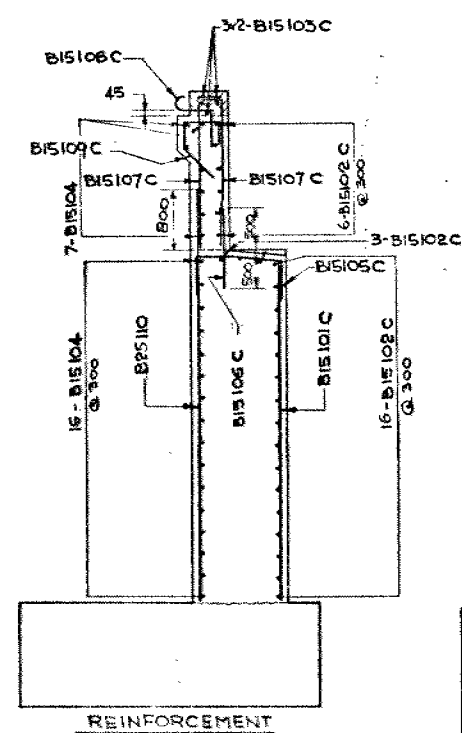
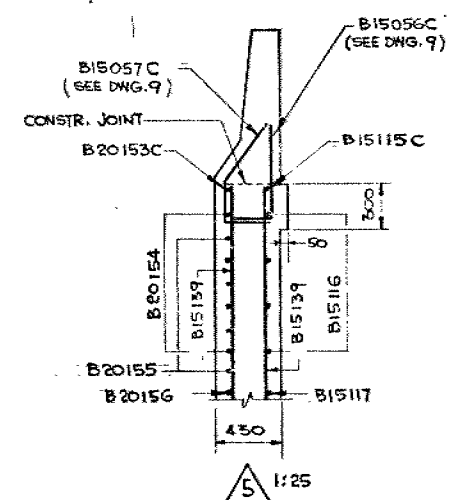
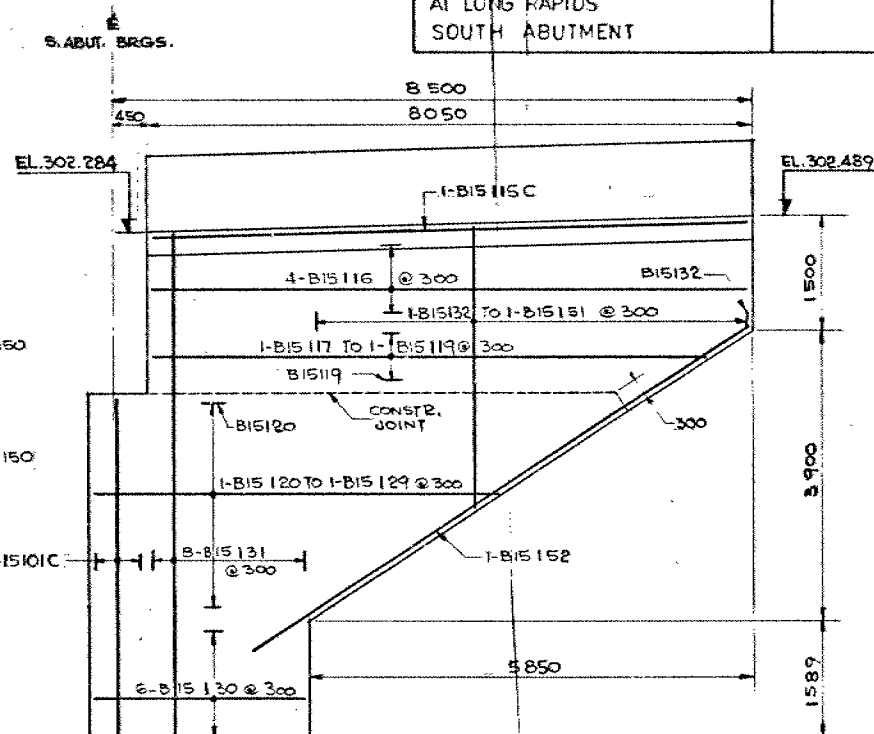
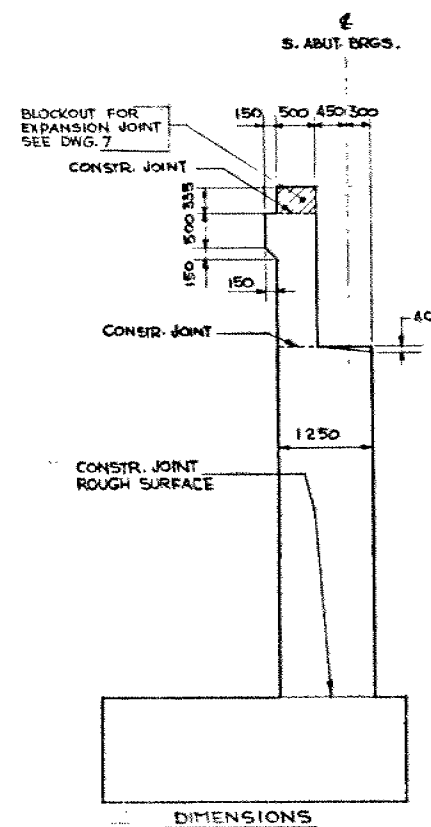
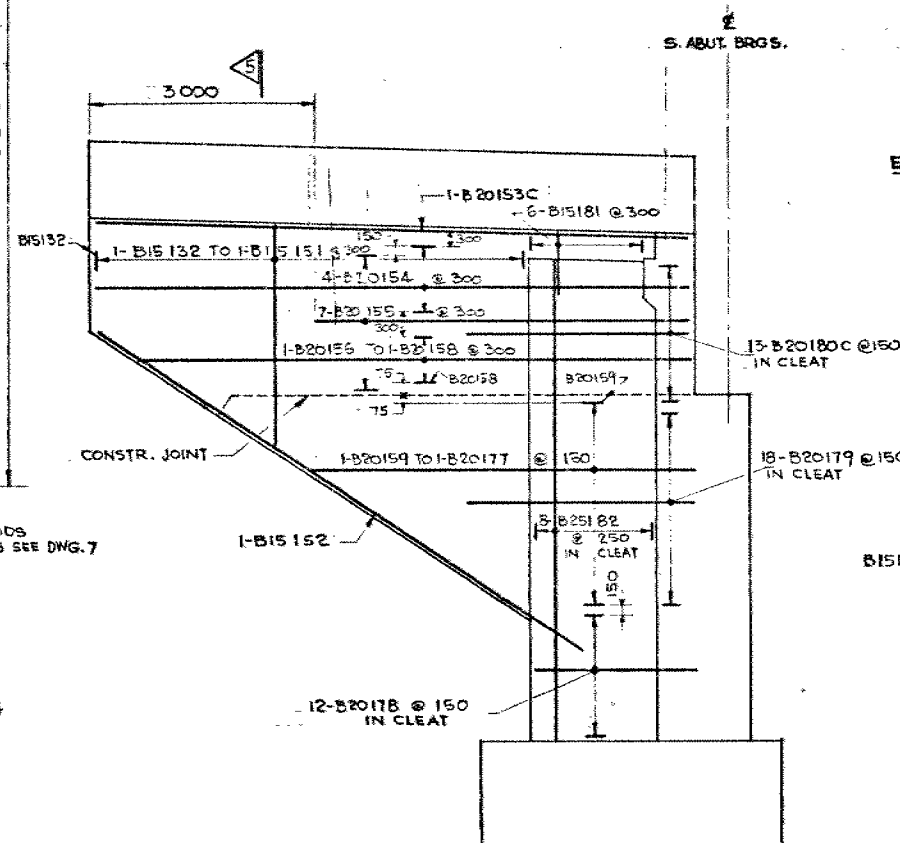
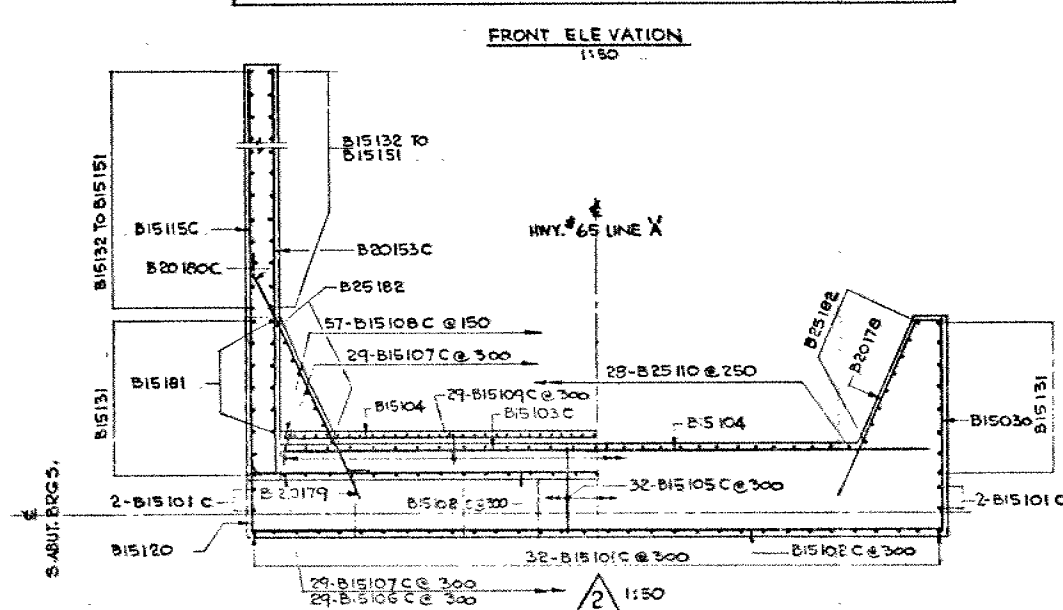
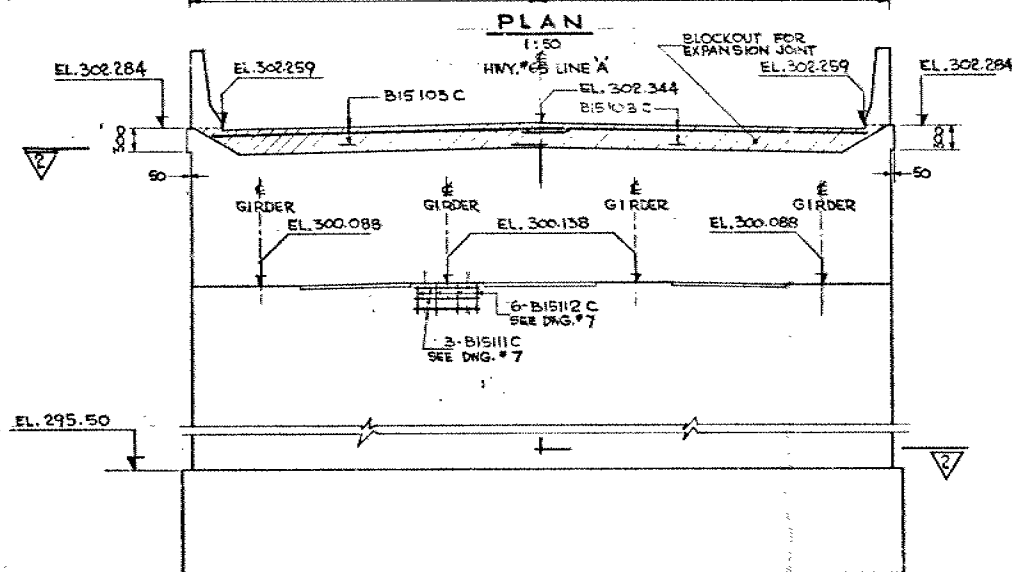
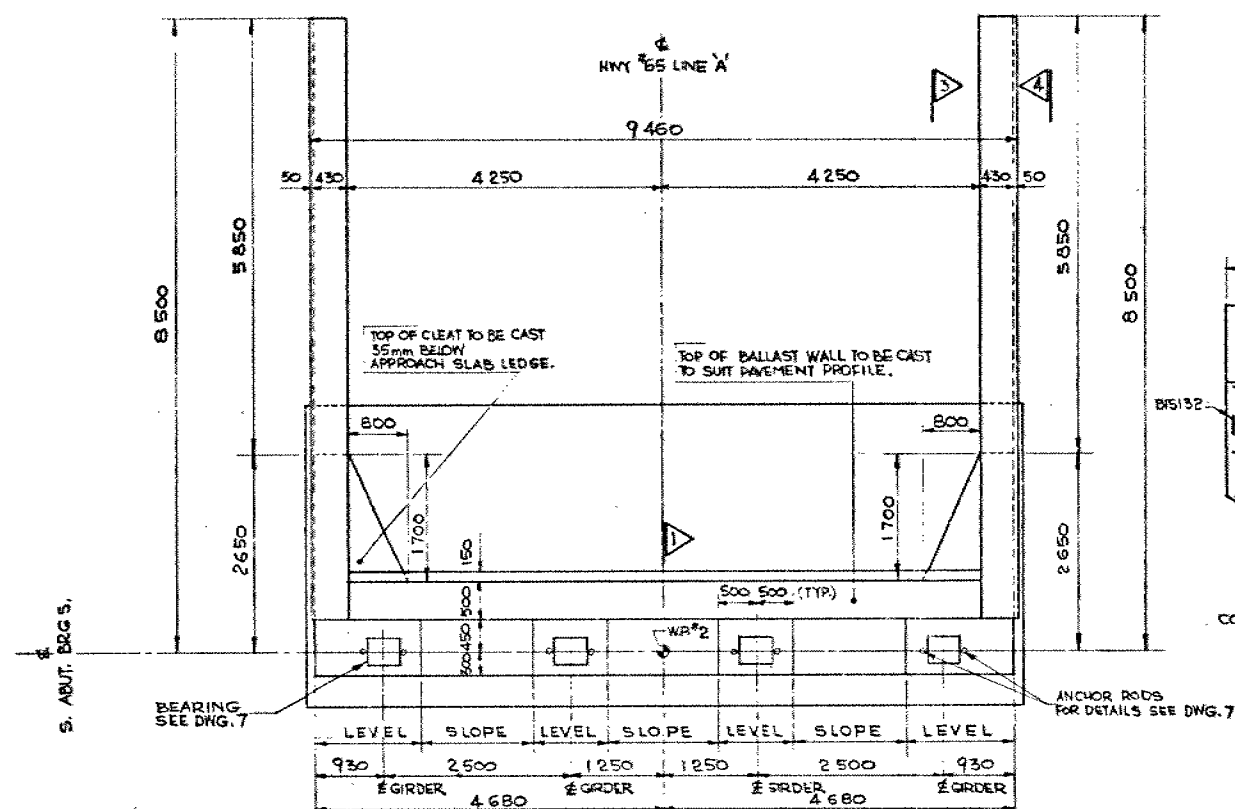
DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN		CHECK	LOADING HRC-01-83 DATE SEPT. / 83
DRAWING		CHECK	SITE No 17-22 DWG 3



SHEET

[illegible]



METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

DIST. 14

CONT No

WP No 161-74-02

MONTREAL RIVER BRIDGE  
AT LONG RAPIDS  
SOUTH ABUTMENT

**SHEET**

## DIMENSIONS

## REINFORCEMENT

DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS							
DATE	BY	DESCRIPTION				DATE	
DESIGN	CHECK	LOADING				DATE	
DRAWING	CHECK	SITE No.				DWG	



# FOUNDATION INVESTIGATION REPORT

CONTRACT NO 86-220



Ministry of  
Transportation and  
Communications

INDEX

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1	Index
2	Abbreviations & Symbols
3 - 10	Foundation Investigation Report For Montreal River Bridge W.P. 161-74-01 Site: 47-022

NOTE: For purposes of the contract this report supercedes all other foundation reports prepared by or for the Ministry in connection with the above-mentioned project.

# EXPLANATION OF TERMS USED IN REPORT

2

**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 'A' 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
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

### MECHANICAL PROPERTIES OF SOIL

$m_v$	$\text{kPa}^{-1}$	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	$\text{m}^2/\text{s}$	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_t$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	$\text{kg}/\text{m}^3$	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	$\text{KN}/\text{m}^3$	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	$\text{kg}/\text{m}^3$	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	$\text{KN}/\text{m}^3$	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	$\text{kg}/\text{m}^3$	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	$\text{KN}/\text{m}^3$	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	$\text{kg}/\text{m}^3$	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	$\text{m}^3/\text{s}$	RATE OF DISCHARGE
$\gamma_d$	$\text{KN}/\text{m}^3$	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	$\text{m}/\text{s}$	DISCHARGE VELOCITY
$\rho_{sat}$	$\text{kg}/\text{m}^3$	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	$\text{KN}/\text{m}^3$	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	$\text{m}/\text{s}$	HYDRAULIC CONDUCTIVITY
$\rho'$	$\text{kg}/\text{m}^3$	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	$\text{KN}/\text{m}^2$	SEEPAGE FORCE
$\gamma'$	$\text{KN}/\text{m}^3$	UNIT WEIGHT OF SUBMERGED SOIL						



Foundation Investigation Report  
For  
Montreal River Bridge at Long Rapids  
5.2 km South of Jct. Hwy. #65 and Hwy. #66  
Hwy. #65, District #14 (New Liskeard)  
W.P. 161-74-01 Site 47-022

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### INTRODUCTION

Presented in this Report are the results of a Foundation Investigation carried out at the above site, during the period of 76 10 05-08. The fieldwork consisted of two sampled boreholes. The borings were advanced by a skid-mounted diamond drill adapted for sampling using nw casing.

### SITE DESCRIPTION

The site of the proposed river crossing is located approximately 152 m downstream of the existing single lane Bailey bridge carrying Hwy. 65 across the Montreal River. This is approximately 5.3 km south of the junction of Highway 65 and 66.

The south shore along the centreline of the proposed alignment consists of an approximately 4.8 m high embankment with numerous protruding boulders varying in size from 0.3 to 0.6 m in diameter. This slope is inclined at an approximate gradient of 1.7 horizontal to 1 vertical.

The north shore, however, consists primarily of a massive granite outcrop measuring approximately 29 m along centreline from station 11 + 410 to 11 + 439 and approximately 7.6 m to the east and 10.6 m to the west from centreline.

Geologically, the bedrock within the immediate area dates back to the Early Precambrian era. These rocks originate from a felsic intrusive origin characterized by the existence of trondhjemite, granodiorite, quartz monzonite, along with simple batholiths and stocks. In addition, geophysical interpretations indicate the existence of diabase dykes.

### SUBSURFACE CONDITIONS

Subsoil in the site area consists mainly of alluvial deposits essentially granular in nature overlying granite bedrock. On the north bank of the river the bedrock outcrops over an area some 29 m x 18 m in plan. On the south bank it is overlain by about 13.7 m to 14.3 m of granular type subsoil.

The boundaries between the different soil types are shown on the Record of Borehole Sheets contained within the Appendix. The estimated stratigraphical profile is shown on Drawing No. 2 of the contract documents. The various soil types encountered are described in some detail as follows.

#### Medium to Coarse Sand With Fine Gravel

This material occurs on the south bank of the river from below the topsoil to depths of 3 to 3.6 m. Standard penetration test 'N' values range from 6 to 18 blow/0.3 m, indicating a loose to compact state. The average natural moisture content is about 14.8%. Grain size distribution curves are shown on Figure 1. The upper 1.5 m contains frequent boulders of estimated size 0.3 to 0.6 m in diameter.

#### Fine to Medium Sand, Trace of Silt

This deposit is about 9.5 m in thickness and immediately follows the medium to coarse sand with fine gravel. Standard penetration test 'N' values range randomly from 2 to 25 blows/0.3 m which is indicative of a very loose to compact denseness. The natural moisture content ranges from 21.0% to 26%. Grain size distribution curves are shown on Figure 2.

#### Sand and Gravel, Traces of Silt

This deposit is believed to be of glacial origin and immediately overlies the bedrock. The thickness is about 1.2 to 1.5 m. The relatively density is assessed to be very dense based upon Standard Penetration Test 'N' values ranging from 60 to 150 blows/0.3 m.

Bedrock

Bedrock outcrops on the north side of the river and consists of moderately fractured yet fairly sound, hard granite. Bedrock elevations across the area of the proposed abutment location varies from 295.7 at an offset of 6.1 m east to 296.8 at an offset of 4.5m west. On the south side of the river, the bedrock was proven by the recovery of BX size core samples. The surface of the bedrock varies between El. 285.6 and El. 286.3. The bedrock is described as moderately fractured, hard, medium to coarse textured granite. The rock cores indicated vertical fractures ranging in length from 0.18 m to 0.7 m.

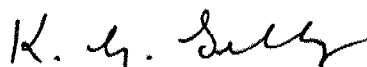
Groundwater

Groundwater level observations in the two boreholes at the proposed location of the south abutment during the period of the subsurface investigation indicates a groundwater level of about 295.

River level readings taken during the same period show the river level to be at about 294.8.



P. Payer, P. Eng.  
Senior Foundations Engineer



K.G. Selby, P. Eng.  
Chief Foundations Engineer  
(West)

APPENDIX

# RECORD OF BOREHOLE No 1

METRIC

W P 161-74-01 LOCATION Sta. 11 + 473.9 4.6 m RT  $\angle$  Line 'A'  
 DIST 14 HWY 65 BOREHOLE TYPE NW Casing & BXT Core ORIGINATED BY RVV  
 DATUM Geodetic DATE 1976 10 6 & 7 COMPILED BY SO  
 CHECKED BY *SO*

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
300.0	Ground Level															
0.0	Topsoil															
0.3	Sand, Med to Coarse with Fine Gravel (Boulders in Upper 1.5 m)  Loose to Compact		1	SS	7											
			2	SS	6											
296.3			3	SS	18											
3.7	Sand Fine to Medium trace of silt  Very Loose to Compact		4	SS	14											35 63 (2)
			5	SS	12											0 98 (2)
			6	SS	4											
			7	SS	3											0 90 (10)
			8	SS	2											
			9	SS	8											
			10	SS	23											
			11	SS	25											0 97 (3)
			12	SS	14											
286.9			13	WS	-											
13.1	Sand and Gravel		14	SS	150											
285.6	Trace of Silt (Glacial Till) Very Dense															
14.4	Bedrock		15	BXT	REC											
284.1	Granite Hard			RC	96%											
15.9	Moderately Fractured															
	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 2

METRIC

W P 161-74-01 LOCATION Sta. 11 + 477.4 4.6 m LT & Line 'A'  
DIST 14 HWY 65 BOREHOLE TYPE BW Casing & BXT Core  
DATUM Geodetic DATE 1976 10 7 & 8  
ORIGINATED BY RVV  
COMPILED BY SO  
CHECKED BY

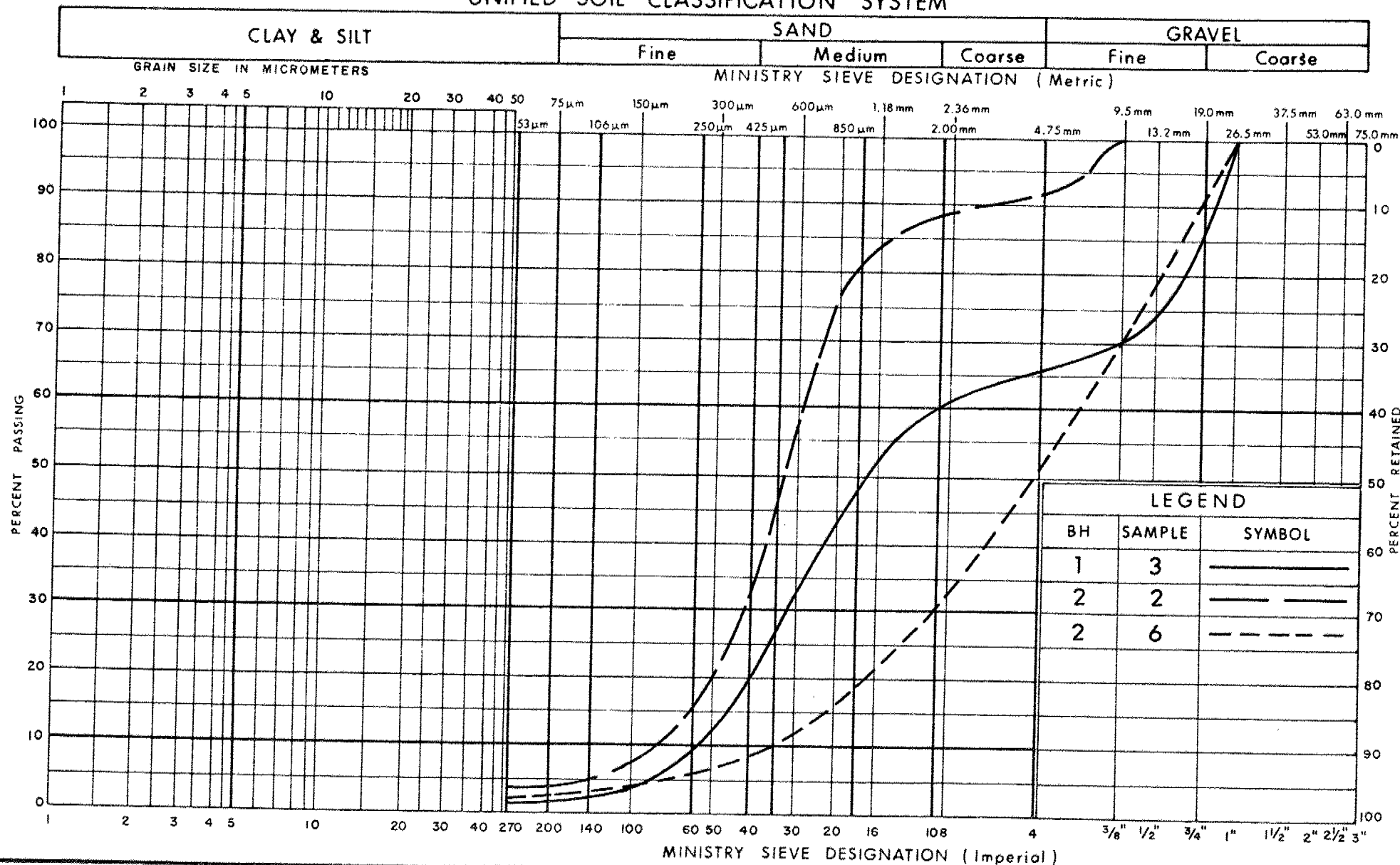
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
300.2	Ground Level																
0.0	Topsoil																
0.3	Sand Medium to Coarse with Fine Gravel (Boulders in Upper 1.5 m) Loose to Compact		1	SS	8		300										
297.1			2	SS	13		298										
3.1	Sand Fine to Medium  trace of silt  Very Loose to Compact		3	SS	8		296										9 87 (4)
			4	SS	3		294										
			5	SS	14		292										
							290										0 94 (6)
287.8			6	SS	60		288										
12.4	Sand and Gravel Trace of Silt (Glacial Till) Very Dense																51 47 (2)
286.3	Bedrock Granite Hard		7	RC	100%												
13.9	End of Borehole																
14.3																	

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

## UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

Ministry of  
Transportation and  
Communications

GRAIN SIZE DISTRIBUTION  
SAND, MEDIUM TO COARSE  
WITH GRAVEL

FIG No 1

W P 161-74-01



GRAIN SIZE DISTRIBUTION  
SAND, FINE TO MEDIUM  
TRACE OF SILT

W P 161-74-01



# FOUNDATION INVESTIGATION & DESIGN REPORT

W.P. 161-74-~~01~~  
02

DIST. 14

HWY. 65

STR. SITE 47-022

Montreal River Bridge at Long Rapids  
3.3 Miles South of the  
Junction of Hwys. 65 and 66

## DISTRIBUTION

J. McAllister (2)  
R.S. Pillar  
C.S. Grebski  
B.J. Giroux  
G.A. Wrong  
S. McCombie  
C.G. Campbell  
M.J. Bernhardt  
J.J. McNamee (2)

R. Hore

J. Anderson)  
R. Murphy ) cover only  
G. Sloan )

Files ✓

SAMPLE DISPOSITION NOTICE		
TYPE	DISCARD AFTER	RECOMM. BY
JARS	Dec 6/76	KAS
TUBES		
ROCK CORES	Contracked	KAS.

41P - 12  
GEOCRES No.

GEOCRES

DATE DEC 02 1976

## INTRODUCTION

The Soil Mechanics Section was requested to carry out a foundation investigation for a new proposed Hwy. 65 alignment crossing the Montreal River.

Following this request a field investigation was carried out by this Office to determine the subsoil conditions which are of significance to the planning and design of the proposed alignment.

This report contains the results obtained from our investigation, along with our recommendations pertaining to the approaches and abutments.

## SITE DESCRIPTION

Geologically, the bedrock within the immediate area dates back to the Early Precambrian era. These rocks originate from a felsic intrusive origin characterized by the existence of trondhjemite, granodiorite, quartz monzonite, along with simple batholiths and stocks. In addition, geophysical interpretations indicate the existence of diabase dykes.

The site of the proposed river crossing is located approximately 500 feet downstream of the existing single lane Bailey bridge carrying Hwy. 65 across the Montreal River. This is approximately 3.3 miles south of the junction of Highways 65 and 66.

The south shore along the centreline of the proposed alignment consists of an approximately 16 foot high embankment with numerous protruding boulders varying in size from 1 to 2 feet in diameter. This slope is inclined at an approximate gradient of 1.7 horizontal to 1 vertical.

The north shore, however, consists primarily of a massive granite outcrop measuring approximately 95 feet along centreline from station 146+30 to 147+25 and approximately 25 feet to the east and 35 feet to the west from centreline.

## SUBSURFACE CONDITIONS

### General

Subsoil in the site area consists mainly of alluvial deposits essentially granular in nature overlying granite bedrock. On the north bank of the river the bedrock outcrops over an area some 95 feet x 60 feet in plan. On the south bank it is overlain by about 45 to 47 feet of granular type subsoil.

The boundaries between the different soil types are shown on the Record of Borehole Sheets contained within the Appendix. The estimated stratigraphical profile on Drawing #1617401-A is based on this information. The various soil types encountered are described in some detail as follows.

### Medium to Coarse Sand With Fine Gravel

This material occurs on the south bank of the river from below the topsoil to depths of 10 to 12 feet. Standard penetration test 'N' values range from 6 to 18 blows/ft., indicating a loose to compact state. The average moisture content is about 14.8%. Grain size distribution curves are shown on Figure 1. The upper 5 feet contains frequent boulders of estimated size 12 to 24 inches in diameter.

### Fine to Medium Sand, Trace of Silt

This deposit is about 31 feet in thickness and immediately follows the medium to coarse sand with fine gravel. Standard penetration test 'N' values range randomly from 2 to 25 blows/ft. which is indicative of a very loose to compact denseness. The average moisture content was determined to be 23% ranging from 21.0% to 25.5%. Grain size distribution curves are shown on Figure 2.

### Sand and Gravel, Traces of Silt

This deposit is believed to be of glacial origin and immediately overlies the bedrock. The thickness is believed to be of glacial origin and immediately overlies the bedrock. The thickness is about 4 to 5 feet. The relative density is assessed to be very dense based upon Standard Penetration Test 'N' values ranging from 60 to 150 blows/ft.

### Bedrock

Bedrock outcrops on the north side of the river and consists of moderately fractured yet fairly sound, hard granite. Bedrock elevations across the area of the proposed abutment location varies from 970.0

at an offset of 20 feet east to 973.7 at an offset of 15 feet west.

On the south side of the river, the bedrock was proved by the recovery of 5 foot core samples of BX size and is described as moderately fractured, hard, medium to coarse textured granite. The rock cores obtained indicated vertical fractures ranging in length from 0.6 to 2.4 feet. These rock cores are described in more detail on the Diamond Drill Record Sheet contained within the Appendix.

#### Groundwater

Groundwater level observations in the two boreholes at the proposed location of the south abutment during the period of the subsurface investigation indicates a groundwater level of about 970'.

River level readings taken during the same period show the river level to be at about 967.8'.

### DISCUSSION AND RECOMMENDATIONS

#### General

It is proposed to construct a simply supported structure having a single span of between 120 and 130 feet. The proposed grade elevations are approximately 992 feet at the south abutment and 989 feet at the north abutment. This will require fills of approximately 15 to 20 feet at the north abutment and about 7 feet at the south abutment. The maximum height of fill will therefore be about 32 feet above the level of the river bed.

#### Recommendations

North abutment: It is recommended to found the north abutment footing directly upon the exposed bedrock surface. For design purposes a safe bearing capacity of up to 50 T.S.F. may be assumed.

To provide sufficient lateral resistance against sliding, it is recommended to anchor the footing into the bedrock with steel dowels securely grouted in predrilled holes at least 3 feet in depth.

South abutment: It is recommended to found the south abutment footing on steel H piles driven to the sound bedrock at approximate elevation 938'.

Because of the presence of boulders in the upper 5 feet of the overburden, difficulties could be experienced in driving piles. To preclude this it is recommended that the area through which piles have to be driven be excavated down to elevation 979+ and refilled with suitable boulder free fill.

298.5 m

It is also recommended to utilize reinforced pile tips to prevent damage to the piles while being driven through the overlying glacial till.

Recommended safe pile loads may be determined from the maximum structural capacity of the pile section selected.

#### Approaches

Approaches will consist of a 7 foot earth fill at the south abutment and a 15 to 20 foot rock fill on bedrock at the north abutment. No slope stability problems are anticipated.

The forward and side slopes of the south approach may be constructed with slopes of  $1\frac{1}{2}:1$ . However, some protection against surface erosion will be required since sod cannot normally be established on slopes steeper than 2:1.

The side slopes of the north approach, which will be composed of a rock fill, may be constructed with slopes of not steeper than  $1\frac{1}{2}:1$ .

#### GENERAL

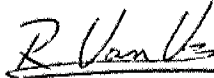
No dewatering problems are anticipated at either one of the two proposed abutment locations.

A minimum cover of 7 feet will be required to protect the pile caps against the effects of frost heave.

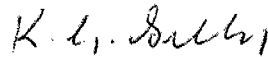
Due to the relatively fast currents, the south approach and adjacent river bed should be protected against erosion as per requirements of the Hydrology Section.

MISCELLANEOUS

All field work was performed under the direct supervision of Mr. R. Van Veen during the period of October 5 to October 8, 1976 using a skid mounted BBS-1 type diamond drill.



R. Van Veen  
Project Engineer



K.G. Selby, P. Eng.  
Supervising Engineer

KGS/RVV/gs  
November, 1976

## APPENDIX

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO  
ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 161-74-01 LOCATION Sta. 148+20 o/s 15' Rt. of Hwy. 65 Line 'A' ORIGINATED BY RVV  
DIST 14 HWY 65 BORING DATE Oct. 6 & 7, 1976 COMPILED BY RVV  
DATUM Geodetic BOREHOLE TYPE NW Casing & EXT Core CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS  % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	$W_P$	$W$	$W_L$	
984.3	Ground Level														
0.0	Topsoil														
1.0	Sand, medium to coarse with fine gravel (boulders in upper 5')		1	SS	7	980									
			2	SS	6										
972.3	Loose to Compact		3	SS	18										35 63 ( 2 )
12.0			4	SS	14	970									0 98 ( 2 )
			5	SS	12										
	Sand		6	SS	4										
	Fine to Medium trace of silt		7	SS	3	960									0 90 (10)
			8	SS	2										
			9	SS	8										
			10	SS	23										
	Very Loose to Compact		11	SS	25	950									0 97 ( 3 )
			12	SS	14										
941.3			13	WS	-	940									
43.0	Sand & gravel, trace of silt. (Glac. Till)		14	SS	150										
937.3	Very Dense														
47.0	Bedrock Granite Hard		15	BXT RC	Rec. 96%										
932.1	Moderately fractured														
52.2	End of Borehole														

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 2

WP 161-74-01

LOCATION Sta. 148+32 o/s 15' Lt. of Hwy. 65 Line 'A'

ORIGINATED BY RVV

DIST 14 HWY 65

BORING DATE October 7 &amp; 8, 1976

COMPILED BY RVV

DATUM Geodetic

BOREHOLE TYPE BW Casing &amp; BXT Core

CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	$W_P$	$W$	$W_L$		
985.0	Ground Level															
0.0	Topsoil															
1.0	Sand, medium to coarse with fine gravel (boulders in upper 5')		1	SS	8	980							o			
974.8	Loose to Compact		2	SS	13											
10.2	Sand		3	SS	8	970							o			
	fine to medium		4	SS	3								o			
	trace of silt		5	SS	14	960										
	Very Loose to Compact					950										
944.5			6	SS	60											
40.5	Sand & gravel, trace of silt (Glac. Till)					940										
939.6	Very Dense															
938.2	Bedrock Granite. Hard		7	RC	100%											
46.8	End of Borehole															

20  
15  $\diamond$  5 % STRAIN AT FAILURE  
10



Ministry of  
Transportation and  
Communications

# DIAMOND DRILL RECORD

HOLE NO. \_\_\_\_\_ SHEET NO. \_\_\_\_\_

DIP

90°

PROPERTY W.P. 161-74-01  
LOCATION \_\_\_\_\_  
LATITUDE \_\_\_\_\_  
DEPARTURE \_\_\_\_\_  
BEARING \_\_\_\_\_

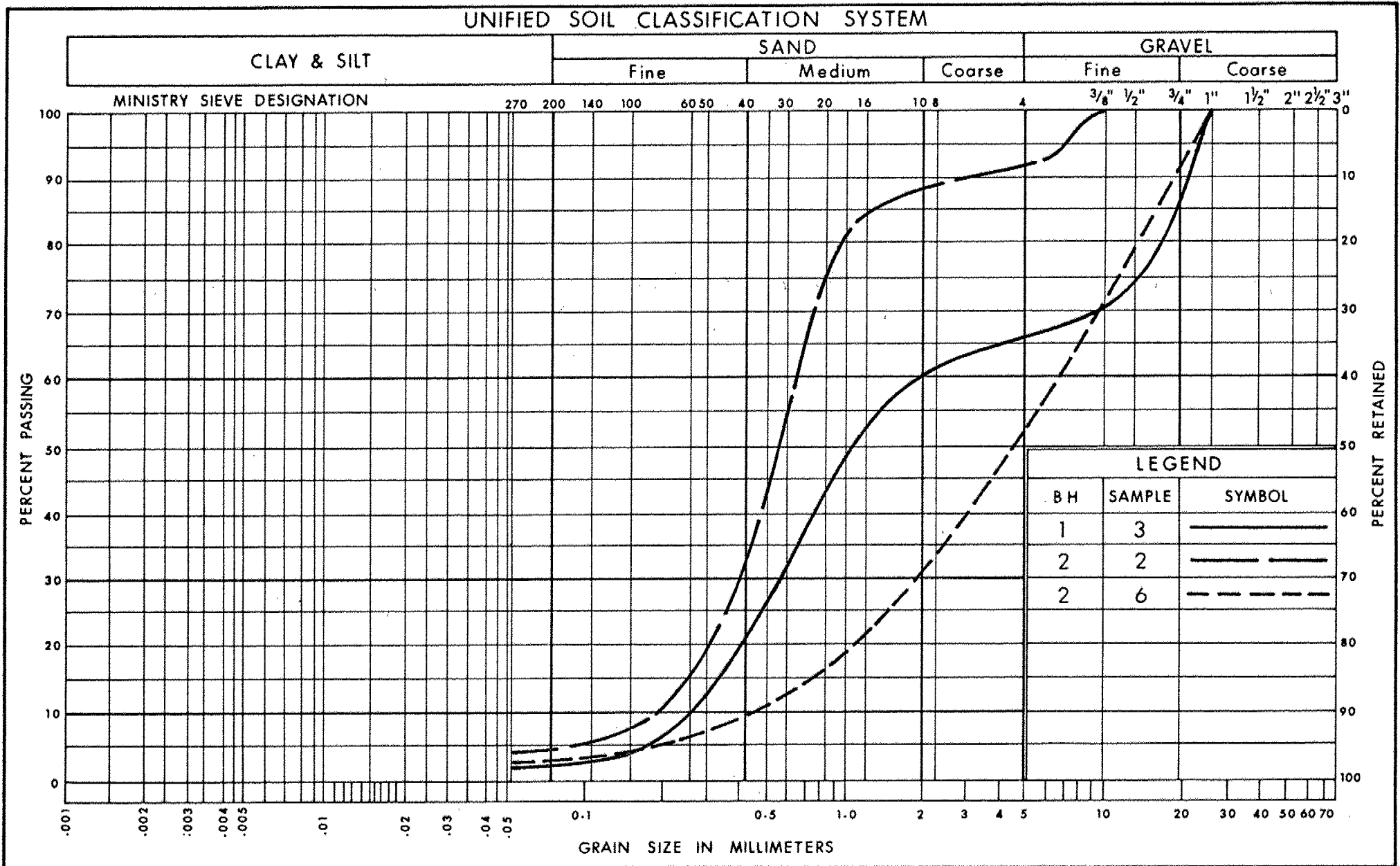
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
TOTAL FOOTAGE \_\_\_\_\_

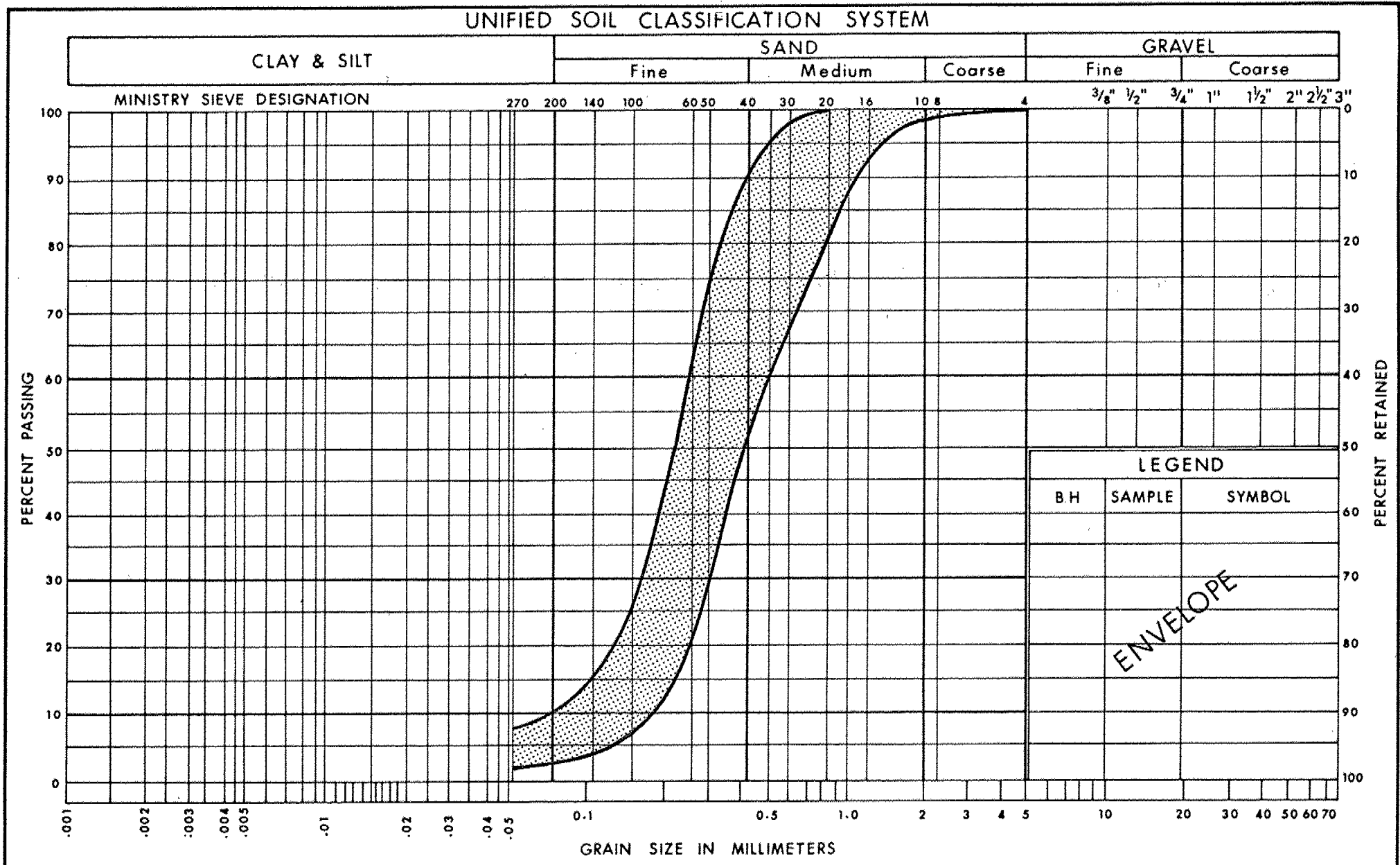
ELEV. COLLAR \_\_\_\_\_  
DATUM \_\_\_\_\_  
DATE STARTED \_\_\_\_\_  
DATE COMPLETED \_\_\_\_\_  
DRILLED BY \_\_\_\_\_  
LOGGED BY \_\_\_\_\_

FOOTAGE		FORMATION	SAMPLE NUMBER			REMARKS
FROM	TO					
		Hole #1				
47.0'	52.2'	Granite, light grey to pink, med. to coarse textured, hard				Horizontally fractured throughout Fracture every 3"
						Vertical fracture 47.0' - 49.4'
		Hole #2				
45.4'	46.8'	Granite, pink, med. to coarse textured, hard				Horizontally fractured every 3 - 4"
						Vertical fracture 45.4' - 46.0'

DATE OF EXAMINATION November 10/76

Z. Koniuszy





Ministry of  
Transportation and  
Communications  
Ontario  
**ENGINEERING SERVICES BRANCH**

GRAIN SIZE DISTRIBUTION  
SAND, FINE TO MEDIUM  
TRACE OF SILT

FIG No 2

W P 161-74-01

## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### PENETRATION RESISTANCE

'N' = STANDARD PENETRATION RESISTANCE - 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>c LB/SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC

### TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W	THINWALL OPEN
W.S	WASHED SAMPLE	T.P	THINWALL PISTON
S.T	SLOTTED TUBE SAMPLE	O.S	OESTERBERG SAMPLE
A.S	AUGER SAMPLE	F.S	FOIL SAMPLE
C.S	CHUNK SAMPLE	R.C	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

### SOIL TESTS

U	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

## ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

### SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	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
$w_s$	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
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

IN TERMS OF  
EFFECTIVE STRESS  
 $\tau_f = c' + \sigma' \tan \phi'$

IN TERMS OF  
TOTAL STRESS  
 $\tau_f = c_u + \sigma \tan \phi$

### GENERAL

$\pi$	= 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
$\sigma$	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	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
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

# RECORD OF BOREHOLE No 1

METRIC

W P 161-74-01 LOCATION Sta. 11 + 473.9 4.6 m RT  $\angle$  Line 'A' ORIGINATED BY RVV  
DIST 14 HWY 65 BOREHOLE TYPE NW Casing & BXT Core COMPILED BY SO  
DATUM Geodetic DATE 1976 10 6 & 7 CHECKED BY *SO*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH										WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE									
300.0	Ground Level																			
0.0	Topsoil																			
0.3	Sand, Med to Coarse with Fine Gravel (Boulders in Upper 1.5 m)  Loose to Compact		1	SS	7															
			2	SS	6															
296.3			3	SS	18												35 63 (2)			
3.7	Sand Fine to Medium trace of silt  Very Loose to Compact		4	SS	14															
			5	SS	12												0 98 (2)			
			6	SS	4															
			7	SS	3												0 90 (10)			
			8	SS	2															
			9	SS	8															
			10	SS	23															
			11	SS	25												0 97 (3)			
			12	SS	14															
286.9			13	WS	-															
13.1	Sand and Gravel Trace of Silt (Glacial Till) Very Dense		14	SS	150															
285.6																				
14.4	Bedrock Granite Hard Moderately Fractured		15	BXT RC	REC 96%															
284.1																				
15.9	End of Borehole																			

+3, x5: Numbers refer to  
Sensitivity

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



# RECORD OF BOREHOLE No 2

METRIC

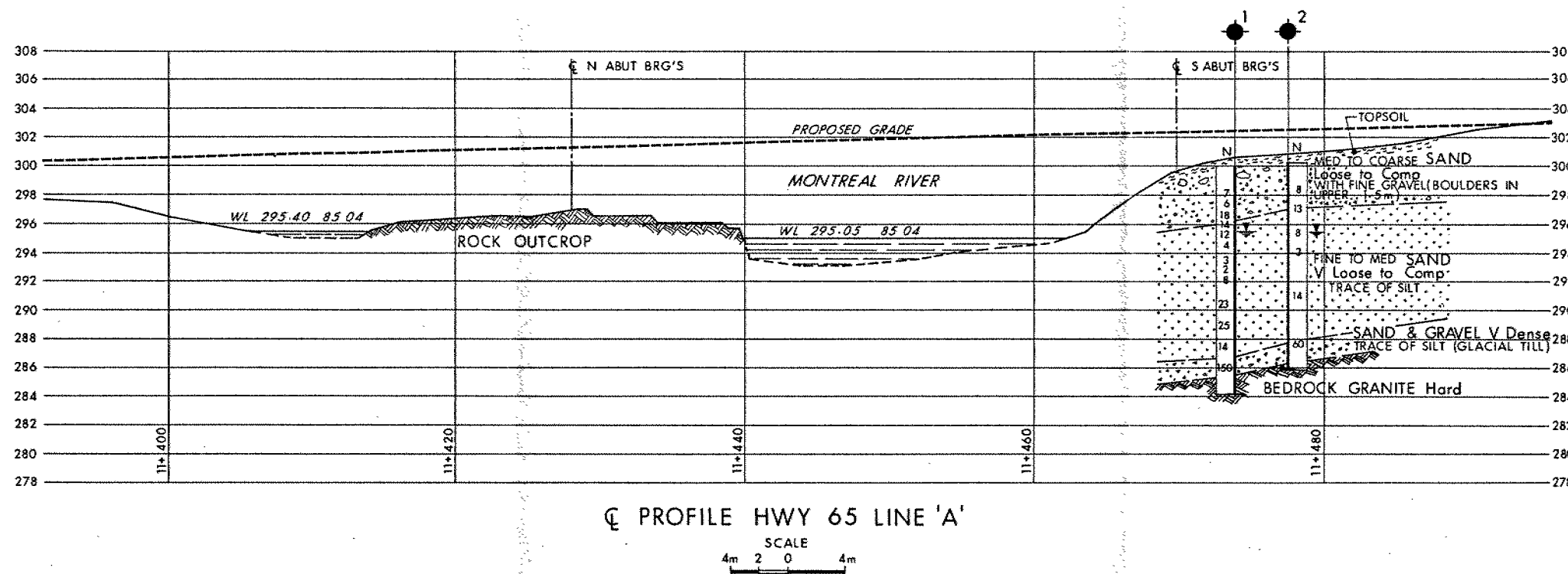
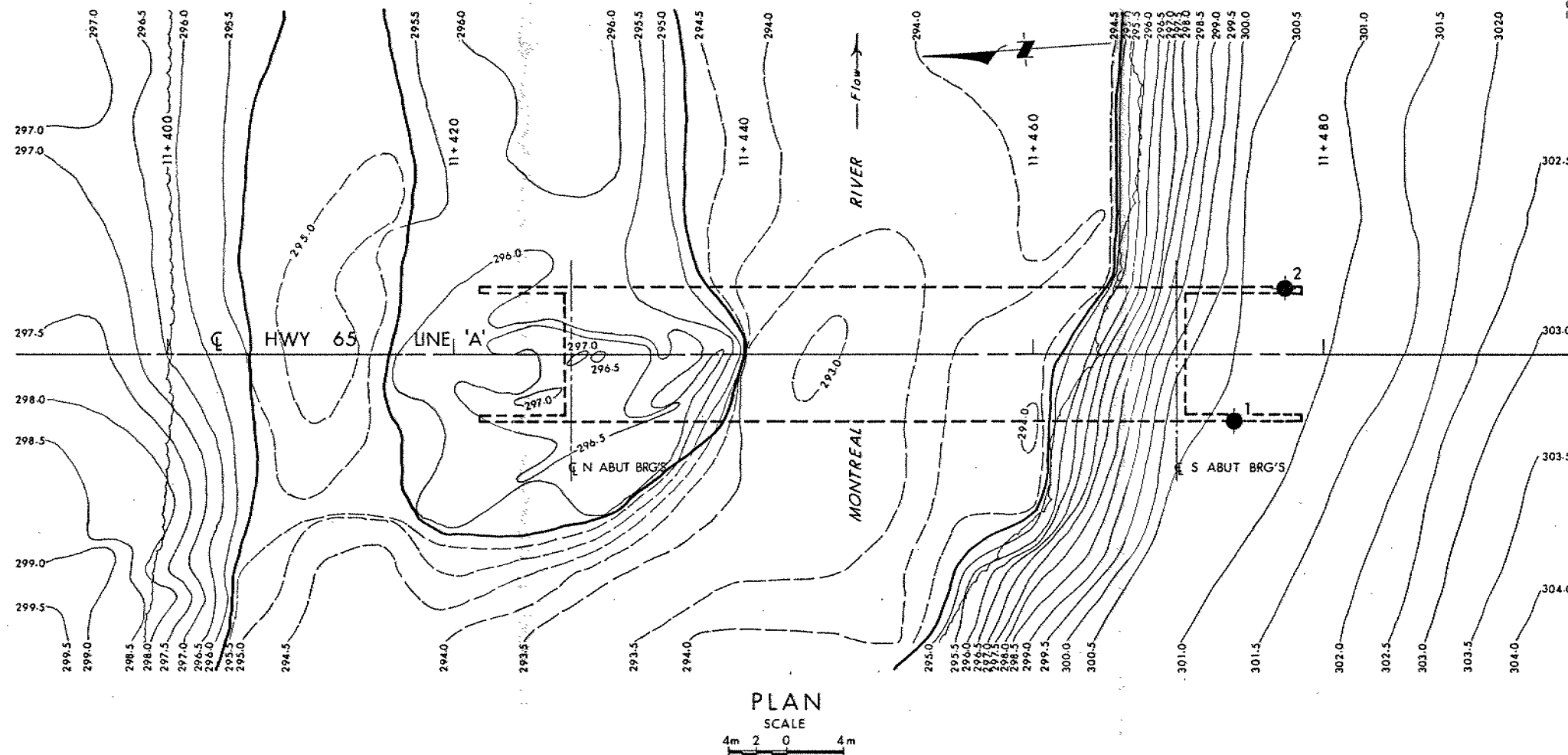
W P 161-74-01 LOCATION Sta. 11 + 477.4 4.6 m LT & Line 'A' ORIGINATED BY RVV  
DIST 14 HWY 65 BOREHOLE TYPE BW Casing & BXT Core COMPILED BY SO  
DATUM Geodetic DATE 1976 10 7 & 8 CHECKED BY *SO*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
300.2	Ground Level													
0.0	Topsoil						300							
0.3	Sand Medium to Coarse with Fine Gravel (Boulders in Upper 1.5 m)		1	SS	8		298							
297.1	Loose to Compact		2	SS	13		296							9 87 (4)
3.1	Sand Fine to Medium trace of silt  Very Loose to Compact		3	SS	8		294							
			4	SS	3		292							
			5	SS	14		290							0 94 (6)
			6	SS	60		288							51 47 (2)
12.4	Sand and Gravel Trace of Silt (Glacial Till) Very Dense													
286.3	Bedrock Granite Hard		7	RC	100%									
13.9	End of Borehole													
14.3														

+3, x5: Numbers refer to  
Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10





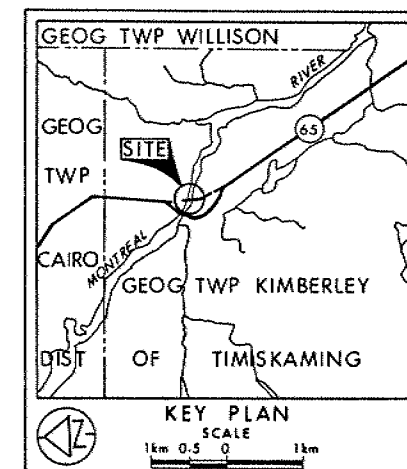
**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES.

CONT No  
WP No 161-74-02

MONTREAL RIVER  
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



- LEGEND**
- Bore Hole
  - ⊕ Dynamic Cone Penetration Test (Cone)
  - ⊕ Bore Hole & Cone
  - N Blows/0.3m (Std Pen Test, 475 J/blow)
  - CONE Blows/0.3m (60° Cone, 475 J/blow)
  - WL at time of investigation 76 10

No	ELEVATION	STATION	OFFSET
1	300.0	11+473.9	4.6m RT
2	300.2	11+477.4	4.6m LT

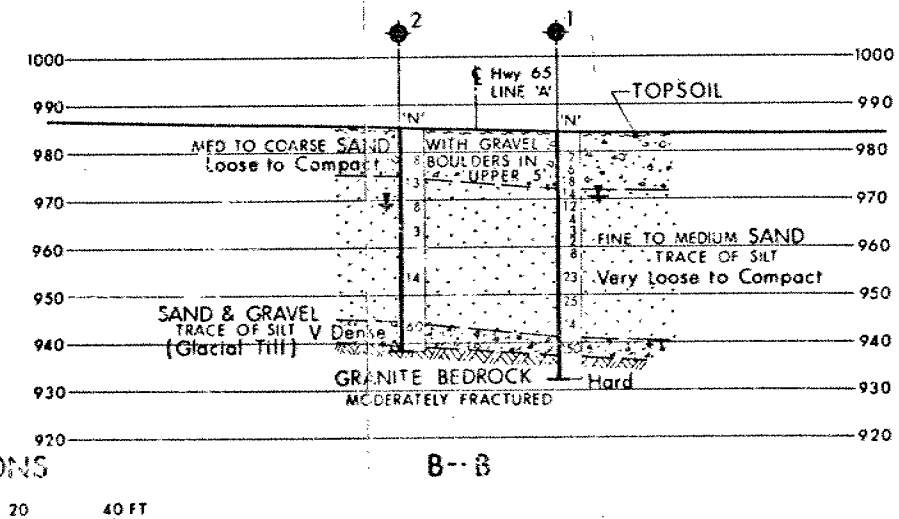
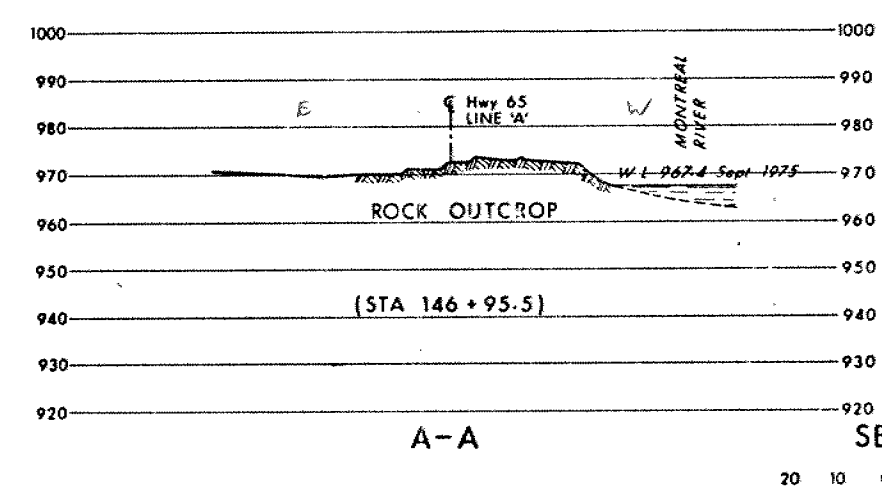
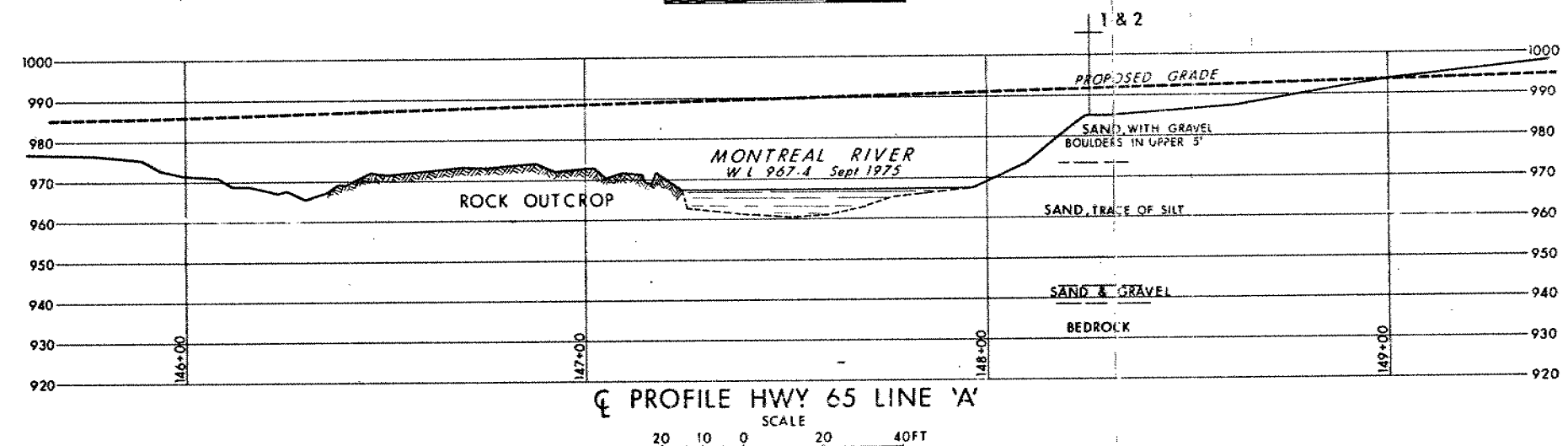
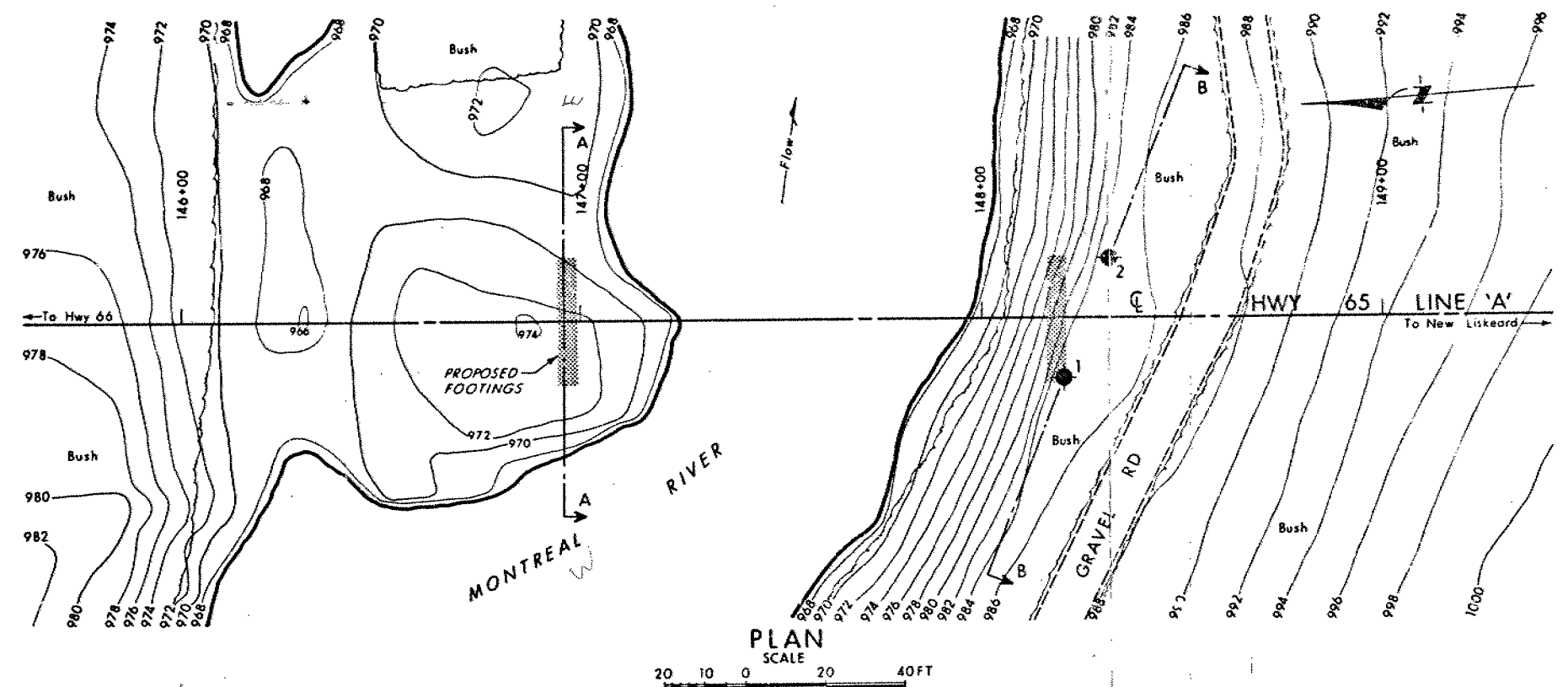
**NOTE**  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION

Geocres No 41P-12

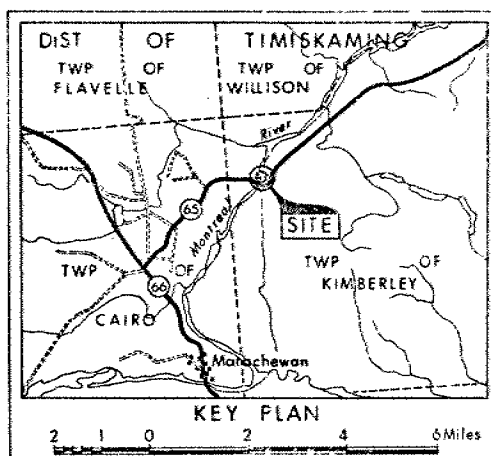
HWY No 65 LINE 'A'	DIST 14
SUBMD KS CHECKED DATE 86 10 07 SITE 47-22	
DRAWN DT CHECKED APPROVED DWG 2	



CONT No  
WP No 161-74-01

**MONTREAL RIVER**  
(3.3 Mi South of Jct of Hwys 65 & 66)  
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



**LEGEND**

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std. Pen. Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- W.L. at time of investigation Oct 1976  
RIVER W.L. 967.8 Oct 5, 1976

No	ELEVATION	STATION	OFFSET
1	984.3	148+20	15' RT
2	985.0	148+32	15' LT

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

REVISIONS	DATE	BY	DESCRIPTION

HWY No 65 LINE 'A' SITE 14  
SUBMITTED BY: CHECKED: DATE Nov 24, 1976 SITE 47-22  
DRAWN BY: CHECKED: DATE Nov 24, 1976 SITE 47-22  
SWG 1617401-A