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GEOCRES No. 42E-6

DIST. 19 REGION

W.P. No. 381-87-01

CONT. No.

W. O. No.

STR. SITE No. 48E-10

HWY. No. 11

LOCATION Hwy 11 at West Narrows
Kenogamisis Lake

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ministry of
Transportation and
Communications

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FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 381-87-01 DIST 19
HWY 11 STR SITE 48E-10

Kenogamisis Lake
West Narrows Bridge

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GEOCRES 42E-6

DATE

MAY 05 1995

FOUNDATION INVESTIGATION REPORT

For

Kenogamisis Lake

West Narrows Bridge

W.P. 381-87-01, Site 48E-10

Highway 11, District 19, Thunder Bay

INTRODUCTION

This report contains the results of a foundation investigation carried out at the above mentioned site. In order to provide information for the rehabilitation work on the existing structure, two sampled boreholes were drilled through the bridge deck in February, 1988. Subsequent to the recent request by letter dated February 2, 1994, for the foundation investigation, two additional boreholes were advanced through the approach fill on April 18, 1994.

Boreholes were advanced to a maximum depth of 18.7 m (El. 314.4) below the existing ground level using 82 mm I.D. continuous flight hollow stem auger.

SITE DESCRIPTION

The site under investigation is located about 2.5 km east of Highway 584 at the crossing of Highway 11 and Kenogamisis Lake in the Township of Ashmore.

The topography of the area is generally undulating to rolling with isolated rock outcrops and localized organic deposits in poorly drained areas. The site is located in a glaciofluvial landforms and outwash is widespread through out the area. The outwash sand or lake plains silt and clay in this area is often underlain by ground moraine till or bedrock.

SUBSURFACE CONDITIONS

The underlying subsoil at this site consists of 1.3 m to a maximum of about 6.8 m very loose to compact granular fill with occasional cobbles and boulders. This is underlain by 3.6 m to 7.9 m compact to very dense sand with varying proportions of silt and gravel which overlies very dense heterogeneous mixture of silt, sand and gravel (glacial till). For classification purposes, the soils encountered at this site can be divided into three different zones.

- a) Sand, Some Silt, Some Gravel (Granular Fill)
- b) Sand, Trace of Silt, Trace of Gravel
- c) Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)

The subsurface conditions encountered during the course of the investigation, together with the field and laboratory test results are shown on the Record of Borehole Sheets contained in the Appendix of this report. A Stratigraphical Section is shown on Drawing No. 3818701-A. This drawing also shows the location and elevation of the borings. Description of the strata encountered are given below.

Sand, Some Silt, Some Gravel (Granular Fill)

This fill which was placed to raise the finished grade of Highway 11, consists of sand with varying proportions of silt and gravel. Occasional cobbles and boulders were encountered at various depths and BH 101 could not be advanced more than 6.8 m deep due to the presence of boulders. The thickness of the fill was observed to vary from a minimum of 1.3 m to a maximum of 6.8 m and extends to elevation 328.6 to 324.1. The Standard Penetration Test values vary over a wide range (2 blows/0.3 m to over 100 blows/0.3 m) and this may be due to the presence of boulders.

Sand, Trace of Silt, Trace of Gravel

This sand deposit was encountered immediately below the fill. The upper 0.7 m to 2.1 m of this deposit was observed to contain varying proportions of organics. The thickness of this deposit varies from a minimum of 3.6 m to a maximum of 7.9 m and extends to elevation 320.7 to 320.1. The results of the Gradation Test carried out on representative soil samples indicate that this deposit is predominantly composed of sand (69% to 99%). The Standard Penetration Test values vary from a minimum of 21 blows/0.3 m to a maximum of 66 blows/0.3 m, indicating compact to very dense state of denseness.

Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)

This glacial deposit was encountered between elevation 320.5 and 320.1. The Gradation Test results indicate 3% to 55% gravel, 23% to 53% sand and 18% to 59% silt. The Standard Penetration Test results were observed to vary from 93 blows/0.3 m to over 100 blows/0.3 m, indicating very dense state of denseness. The full extent of this deposit was not proven below elevation 314.4.

Groundwater Conditions

The groundwater level measurements were taken in open boreholes and was observed at or near lake level, ie elevation 329.7. Seasonal fluctuation of the groundwater level may be expected due to the influence of the lake. The water level in each borehole is as follows:

<u>Borehole No.</u>	<u>Elevation</u>	<u>Remarks</u>
1	329.7	Lake water level
2	329.7	Lake water level
101	329.0	
102	329.3	

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to replace the existing timber bridge at the crossing of Highway 11 and Kenogamisis Lake (West Narrows). Two alternatives are under consideration for the replacement structure and the alternatives are as follows:

- 1) Single span 38.6 m long with minimum profile grade elevation 335.0 which is about 1.9 m higher than the existing grade (Option #1))
- 2) Three spans (approximately 11.6 m end spans and 15.4 m centre span) with minimum profile grade elevation 334.4 which is about 1.3 m higher than the existing grade (Option #2). This option was not included in the request for foundation investigation.

The new structure will be constructed along the same alignment as the existing bridge. Two construction alternatives are under consideration for the replacement structure and the alternatives are as follows:

- 1) Replace the structure on existing alignment with single lane detour located 15 m south of the existing bridge.
- 2) Staged construction utilizing half of existing bridge for traffic.

The existing timber bridge consists of seven spans with a length of 4.6 m and total length of approximately 32.3 m. The structure is supported by timber piles which are extended to the bridge deck. The founding level or embedded length of the piles is not available. Number of piles as well as the deck have deteriorated at several locations.

The approach embankment in the proximity of the abutments is protected by rock lining.

However, surface erosion as well as undermining has been noticed near both abutments.

Structure Foundations

Option #1

Considering the subsoil conditions at this site, it is recommended that the abutments be supported on steel H-piles driven to about elevation 318.5. The following axial capacity values are recommended for the design of the pile.

	<u>HP 310x110</u>	<u>HP 310x79</u>
Factored Axial Capacity at U.L.S.	1600 kN	1150 kN
Axial Capacity at S.L.S.	1150 kN	900 kN

Option #2

The recommendation given under option #1 should be used for the abutment and centre pier foundations as well as for the design of piles. Considering the lake water level and construction difficulties, it is suggested that pile bents be used to support the bridge deck.

Driving of piles shall be carefully monitored and controlled employing the Hiley Dynamic Pile Driving formula driven in accordance with MTO Standards SS103-10 or SS103-11 assuming an ultimate capacity as follows:

<u>Pile Type</u>	<u>Ultimate Capacity (kN)</u>
HP 310x110	3450
HP 310x79	2700

The pile tips should be reinforced with pile driving shoes as per MTO Standard (DD-3301 latest revision). Presence of boulders within the fill may impose difficulty for driving of piles. In the area where piles are to be driven, the existing fill will have to be pre-augered down to the lake bottom or removed and replaced with granular fill containing particle size less than 75 mm to facilitate driving of piles.

Pile cap at the abutments should have a minimum of 2.6 m earth cover to protect against the frost penetration.

Lateral Earth Pressure

Earth pressure should be computed as per Section 6.7.4.5 of the O.H.B.D.C., and the coefficient of earth pressure at rest shall be used for rigid and unyielding walls. The granular "A" or "B" backfill should be in accordance with the Special Provision No. 109F03. The following parameters are recommended for the granular backfill.

	<u>Granular "A"</u>	<u>Granular "B"</u>
Angle of Internal Friction	$\phi = 35^\circ$	$\phi = 30^\circ$
Unit Weight (kN/m^3)	$\gamma = 22.8$	$\gamma = 21.2$

Approach Embankment

The proposed finished grade of Highway 11, depending on the option, is expected to be 1.3 m to 1.9 m higher than the existing grade. If the finished grade is set at or below 335.0, no major instability problems are anticipated for the approach embankment constructed with 2 horizontal to 1 vertical side slopes. The fill should consist of granular material up to a height of at least 1.0 m above the high water level and the remaining portion may consist of well compacted acceptable material. Any spongy or soft area observed within the base width of the embankment should be removed before placing the fill. The benching for the approach fill should be carried out in accordance with OPSD 208.01. The approach fill should be protected by about 0.6 m

thick rock lining consisting of 200 mm to 300 mm boulders to a height of at least 1.0 m above the high water level.

Other Considerations

If the traffic is diverted through a single lane detour during construction, steel H-piles may be used to support the temporary structure, and the piles may be designed assuming the axial capacities recommended above.

If stage construction is utilized for traffic, the excavation may be supported by soldier piles and timber lagging. Presence of cobbles and boulders within the fill may impose difficulty for driving of soldier piles. Considering this, the soldier piles may have to be lowered in large diameter pre-augered holes extending down to the bottom of the lake and driven to the required depth. These holes should be backfilled with non-shrinkable grout after driving the piles. The supporting system may be designed assuming the following parameters.

Angle of Internal Friction $\phi = 30^\circ$

Unit Weight (kN/m³) $\gamma = 20$

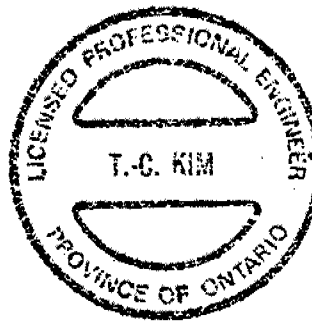
MISCELLANEOUS

The field work for this investigation was carried out under the supervision of M. Vasavithasan, Foundation Engineer. The equipment used was owned and operated by Dominion Soil Thunder Bay Ltd. This report was prepared by M. Vasavithasan, Foundation Engineer and reviewed by Tae C. Kim, Senior Foundation Engineer.



M. Vasavithasan

M. Vasavithasan, P. Eng.
Foundation Engineer



Tae C. Kim

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

APPENDIX

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. 381 - 87 - 01 LOCATION STA 12 + 748.3: O/S 3.0m RT. G HWY. 11 ORIGINATED BY R O
DIST 19 HWY 11 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M V
DATUM GEODETIC DATE 88 02 15 CHECKED BY T C K

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					
333.1	Top of Bridge Deck																
0.0																	
329.7	Ice Level																
3.4																	
328.1	Lake Bottom																
5.0																	
	SAND, Some Silt, Some Gravel, Occasional Cobbles, Very Loose to Loose, (Fill)		1	SS	2												
			2	SS	4												
			3	SS	7												
			4	SS	34												
			5	SS	9												
324.1			6	SS	24												
9.0	Organics		7	SS	27												
	SAND, Trace of Silt, Trace of Gravel, Compact to Dense		8	SS	38												
			9	SS	21												
320.5			10	SS	31												
12.6			11	SS	108	/6cm											
	Heterogeneous Mixture of SILT, SAND and GRAVEL, Very Dense (Glacial Till)		12	SS	112												
			13	SS	50	/10cm											
315.9																	
17.2	End of Borehole																
	Note: Formerly BH #1 of W. P. 359 - 87 - 01																

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. 381 - 87 - 01 LOCATION STA. 12 + 769.4; O/S 2.5m LT. & HWY. 11 ORIGINATED BY R.O.
 DIST 19 HWY 11 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M.V.
 DATUM GEODETIC DATE 88 02 16 CHECKED BY T.C.K.

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					
333.1	Top of Bridge Deck																
0.0							332										
329.7	Ice Level						330										
329.1	Lake Bottom																
4.0	SAND, Some Silt, Some Gravel, Occasional Cobbles, Compact (FII)		1	SS	17		328										
327.8			2	SS	13												
5.3	SILTY SAND to SANDY SILT, Very Loose to Compact		3	SS	2												
	Organics		4	SS	1		326										
325.6	Organic Silt With Sand		5	SS	66												
7.5			6	SS	30												
			7	SS	63		324										
	SAND, Some Silt, Trace of Gravel, Compact to Dense		8	SS	28												11 68 (20)
			9	SS	48		322										
320.1			10	SS	38												
13.0			11	SS	93		320										
	Heterogeneous Mixture of SILT, SAND and GRAVEL, Very Dense		12	SS	150	/28cm	318										55 23 (22)
	(Glacial Till)		13	SS	100	/18cm											
			14	SS	100	/28cm	316										29 53 (18)
314.4																	
18.7	End of Borehole																
	* Note: Formerly BH #2 of W. P. 359 - 87 - 01																

RECORD OF BOREHOLE No 101

1 OF 1

METRIC

W.P. 381 - 87 - 01 LOCATION STA. 12 + 722.3; O/S 3.9m RT. @ HWY. 11 ORIGINATED BY M.V.
 DIST 19 HWY 11 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M.V.
 DATUM GEODETIC DATE 94 04 18 CHECKED BY T.C.K.

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			'N' VALUES	20	40	60	80	100	W _p	W		
332.8	Hwy. 11 Shoulder															
0.0																
	SAND, Some Silt, Some Gravel, Occasional Cobbles and Boulders, Compact (Fill)		1	SS	23											
			2	SS	107											
			3	SS	22											
328.0																
6.8	End of Borehole															

RECORD OF BOREHOLE No 102

1 OF 1

METRIC

W.P. 381 - 87 - 01 LOCATION STA. 12 + 793.9: O/S 3.8m LT. @ HWY. 11 ORIGINATED BY M.V.
DIST. 19 HWY. 11 BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGER COMPILED BY M.V.
DATUM GEODETIC DATE 94 04 18 CHECKED BY T.C.K.

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
333.1	Hwy. 11 Shoulder																
0.0	Asphalt																
	SAND, Some Silt, Some Gravel, Occasional Cobbles, Compact (Fill)		1	SS	62		332										
			2	SS	12		330										
328.6			3	SS	11												
4.5			4	SS	55		328										
	SAND, Trace of Silt, Compact to Dense		5	SS	30												
			6	SS	31		326										
			7	SS	29												
			8	SS	31		324										
	Silt		9	SS	25												
			10	SS	48		322										
320.7			11	SS	105	18cm											
12.4	End of Borehole Probable Bedrock																

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 '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

MECHANICAL PROPERTIES OF SOIL

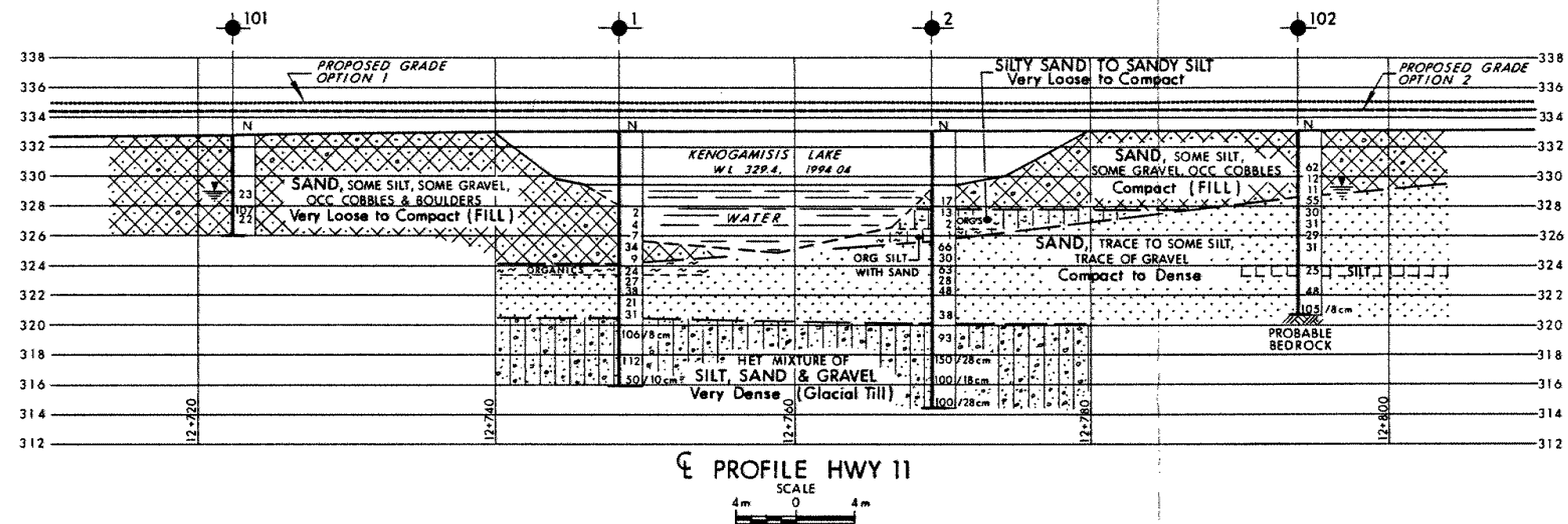
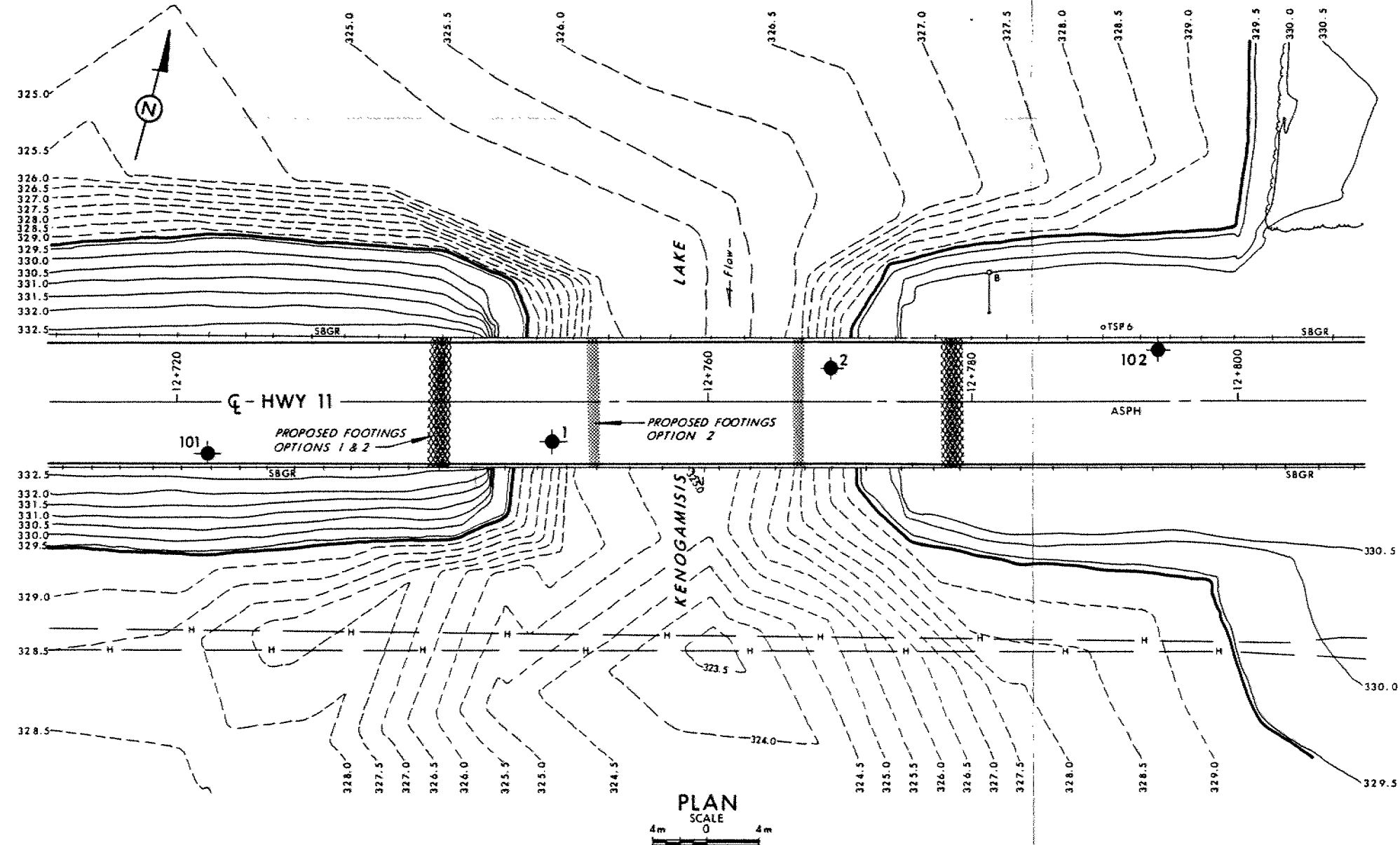
m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
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 = $\frac{c_u}{\tau_r}$

STRESS AND STRAIN

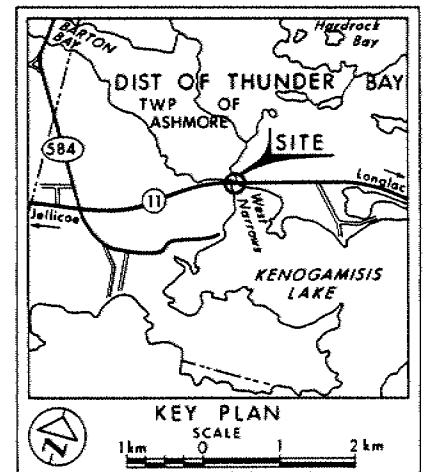
u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa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

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^2	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

**METRIC**DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES.CONT No
WP No 381-87-01KENOGAMIS LAKE
(WEST NARROWS)
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 1988 02 and 1994 04

No	ELEVATION	STATION	OFFSET (to Hwy 11)
1	333.1	12+748.3	3.0m RT
2	333.1	12+769.4	2.5m LT
101	332.8	12+722.3	3.9m RT
102	333.1	12+793.9	3.8m LT

Formerly
WP 359-87-01
1988 02**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 GC 2.01 of OPS Gen. Cond.

REV	DATE	BY	DESCRIPTION

Geocres No 42E-6

HWY No 11	DIST 19
SUBWD MV [CHECKED] DATE 1995 03 10	SITE 48E-10
DRAWN RS [CHECKED] APPROVED	DWG 3818701-A

