

G.I.-30 SEPT. 1976

GEOCRES No. 31E-141DIST. 52 REGION G.W.P. No. 291-97-00(C)CONT. No. W. O. No. STR. SITE No. HWY. No. 69LOCATION Embankments over swampsNo of PAGES -=====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

FOUNDATION INVESTIGATION REPORT
EMBANKMENTS OVER SWAMPS
G.W.P. 291-97-00, HIGHWAY 69
FOUR LANING 2.7 km NORTH OF HIGHWAY 141
NORTHERLY 4 km TO 5.5 km SOUTH OF HIGHWAY 518
(BADGER ROAD)
DISTRICT 52, HUNTSVILLE

Final

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Job No. 98TF010

March, 1999

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FOUNDATION INVESTIGATION REPORT
EMBANKMENTS OVER SWAMPS
G.W.P. 291-97-00, HIGHWAY 69
FOUR LANING 2.7 km NORTH OF HIGHWAY 141
NORTHERLY 4 km TO 5.5 km SOUTH OF HIGHWAY 518
(BADGER ROAD)
DISTRICT 52, HUNTSVILLE

INTRODUCTION

Construction of the realigned Highway 69, associated ramps and cross roads in the study corridor will involve 47 swamp crossings.

This report summarizes the results of the foundation investigation carried out for construction of embankments in the 5 swamps in which special procedures are required to deal with stability concerns and/or construction methods. The swamps have been identified by number sequentially with the numbering system employed for the 26.5 km section to the south (GWP 290-97-00), the number and location of each swamp is provided on Table I, Appendix A. The approximate locations of the swamps are indicated on Drawing No. 1, Appendix A.

It should be noted that most of the swamps are located adjacent to an existing or abandoned highway embankment. Approximately 400 m of the proposed roadway at the south end of this project overlaps the north end of the adjoining project (G.W.P. 290-97-00, Highway 69 Four Laning, From Tower Road (MacTier), northerly 26.5 km to 2.7 km north of Highway 141) carried out by Peto MacCallum Ltd. in 1997 – 1998 (project No. 97TF088B). Two “special” swamps (Swamps 10 and 11) were identified in this section of the roadway.

Swamps in which the thickness of peat and/or soft clay is typically less than 6 m and/or the height of embankment fill is less than 3 m are dealt with in the Pavement Design Report which is provided under separate cover (project number 98TF010).

PHYSIOGRAPHY AND GEOLOGY

The study area is part of the Precambrian Laurentian peneplane. The topography is quite irregular in detail and the area is dotted with many small lakes separated by rocky ridges. Soil cover is generally sparse. The region is wooded. Swamp environments have developed in low lying poorly drained areas.

The overburden is underlain by metamorphic gneisses and migmatites; in many places the structural alignment influences the topography.

The bedrock formations are of Precambrian age and are largely composed of veined, banded, and homogeneous pink and grey migmatitic gneisses produced by injection and granitization of the original rock types.

INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out during the period from March to September 1998.

The investigation comprised 91 testholes (boreholes, probeholes and test pits) advanced to depths of 0.1 to 14.4 m below existing grade. The approximate locations of the testholes advanced in each swamp are shown on the appended Testhole Location Plans, Drawing Nos. 2 to 6, Appendix B.

The testhole schedule was established in accordance with the requirements of MTO Northern Region Pavement Design Practices and Guidelines (May 20, 1997). The control lines as staked out in the field by Stantec Consulting Ltd. were used to reference the testholes (centreline northbound and southbound lanes for Highway 69 north of Station 14+900, centreline median south of Station 14+900, centreline pavement for side roads, and edge of pavement for ramps). Geodetic elevations were provided. Where geodetic elevations along the control lines are not available, ground surface elevations at the testholes were recorded as $D \pm$ relative to the ground surface at the control lines and subsequently interpolated from profile drawings (dated November 10, 1998) provided by Stantec Consulting Ltd.

The testholes were advanced using track-mounted power auger, track-mounted excavator or hand augers.

Deep boreholes were advanced using a track-mounted CME-55 drillrig equipped with continuous flight solid and hollow stem augers supplied by a specialist drilling contractor. Representative samples of the overburden were recovered in each swamp at frequent depth intervals using a conventional split spoon sampler in conjunction with Standard Penetration Tests. In addition, field vane tests, dynamic cone tests and shelby tube sampling were carried out at selected locations.

Shallow probeholes were advanced by members of our engineering staff using hand augers.

Test pits were excavated into the toe of the existing highway embankments within swamp areas. The test pits were advanced using a track-mounted excavator supplied and operated by a local contractor.

The drilling and test pitting were carried out under the full-time supervision of members of our engineering team.

Soils were identified visually in the field in accordance with the MTO Soil Classification procedures. Representative soil samples were returned to our laboratory for detailed visual examination, classification and laboratory testing.

Water level observations were made in the open testholes during and upon completion of augering.

The laboratory testing program consisted of:

- Moisture content determinations
- Grain size analyses
- Atterberg Limits tests
- Consolidation tests
- Consolidated undrained triaxial compression tests

The results of laboratory moisture content determinations and Atterberg Limits tests are shown on the attached Log of Borehole/ Probehole sheets. The results of the remaining tests are presented in Appendix C.

SUBSURFACE CONDITIONS

Reference is made to the appended Log of Borehole/Probehole Sheets for details of the fieldwork including soil classifications, inferred stratigraphy, standard penetration test 'N' values, dynamic cone penetration test resistance, field vane test undrained shear strength values, groundwater observations, results of laboratory moisture content determinations and Atterberg Limits tests.

Soil profiles at selected locations in each swamp are shown on Drawings 2A and 2B to 6A, 6B, 6C and 6D, Appendix B. The boundaries between strata have been established at the testhole locations only. Between testholes, the boundaries are assumed and may be subject to error.

The subsurface stratigraphy in the swamps typically comprised peat, clay, silt and/or sand with discontinuous soft clay layers mantling bedrock.

A highway embankment currently exists within Swamps 11, 12 and 14; the soil profile typically comprised a pavement structure and sand fill over rockfill. Peaty fill and rockfill were identified in testholes excavated along the toe of the embankments. The testholes were terminated when refusal was met on probable rockfill; test pits were terminated when the rockfill was penetrated.

The subsurface stratigraphy of the abandoned embankment within Swamp 13 comprised sand fill overlying discontinuous silt fill or topsoil layer, peat, clay, silt with local soft clay layer, and/or sand mantling probable bedrock.

A summary of the subsoil conditions is presented in Table III, Appendix D.

A brief summary of the geotechnical characteristics of the major soil types is presented below:

Peat

Surficial peat was typically encountered in all the swamps. The peat was dark brown to black and typically amorphous to fibrous in texture. The thickness of the peat ranged from 0.1 to 5.9 m with the greatest thickness of peat encountered in Swamp 10. Standard penetration test "N" values ranged from 0 to 4. In Swamp 14, dynamic penetration resistance values of the peat layer ranged from 2 to 6. Field vane tests measured undrained shear strength values ranging from 8 to 36 kPa, with an average value of 18 kPa. The moisture contents of the peat ranged from 86 to 967%.

Peat was generally encountered below the rockfill and peaty fill in the testholes excavated along the toe of the existing highway embankments.

A 0.3 to 3.6 m thick peat layer was contacted below the abandoned Highway 69 embankment within Swamp 13 at depths of 0.6 to 4.2 m and extended to depths of 2.5 to 7.8 m. This peat exhibits undrained shear strengths in the range of 31 to greater than 100 kPa. Standard penetration test "N" values ranged from 1 to 4. The moisture contents of the peat ranged from 60 to 451%.

Topsoil

A 100 to 400 mm thick surficial topsoil layer was encountered locally in Swamps 10 and 12. In Swamp 13, a 450 mm thick topsoil layer was penetrated locally below the sand fill at a depth of 1.8 m. The topsoil comprised dark brown to black silty sand or silt.

Pavement Structure

In Swamps 12 and 14, a pavement structure was encountered in the testholes drilled on the existing pavements. The pavement structure comprised 130 to 330 mm of asphaltic concrete underlain by 220 to 600 mm of crushed stone followed by 270 to 670 mm of sand. The moisture content of one crushed stone sample was measured to be 3%.

Fill

Sand fill was encountered surficially in some testholes drilled on the existing Highway 69 embankments and the abandoned embankment within Swamps 12 and 13. Standard penetration test "N" values ranged from 4 to 11. The moisture contents of the sand fill ranged from 14 to 21%.

In Swamp 13, an 80 mm thick asphalt concrete layer was noted within the sand fill. A 1.6 m thick gravel and cobble layer was contacted locally within the sand fill. A 1.5 m thick silt fill with organic was encountered locally below the sand fill at a depth of 0.6 m. Standard penetration test "N" value recorded was 3. The silt fill was saturated.

Rockfill and peat fill were generally encountered in testholes excavated along the toe of the existing highway embankments within Swamps 11, 12 and 14.

Clay

The peat is typically underlain by soft clay, although soft to firm clay was encountered in Swamp 11. The thickness of the clay layer varied from 0.3 to 7.3 m with the maximum thickness encountered in Swamp 13 southbound lane.

Soft clay was often encountered within the silt and/or sand deposits at greater depths. The thickness of the clay layers within the sandy soils ranged from 0.2 to 4.0 m with the maximum thickness encountered in Swamp 13 southbound lane.

Standard penetration test "N" values ranged from 0 to 3. Field vane tests carried out in the clay layer measured undrained shear strength values of 8 to 40 kPa, with an average value of 17 kPa. Sensitivity numbers ranged between 1 and 10. The moisture contents of the clay varied between 28 and 93%.

Clay, about 1.1 to 4.0 m thick, was encountered below the abandoned embankment within Swamp 13 at depths of 2.5 to 7.8 m and extended to depths of 3.6 to 12.4 m. The clay exhibits

undrained shear strengths in the range of 18 to 64 kPa, with an average value of 32 kPa. Sensitivity numbers ranged from 3 to 10. The moisture contents ranged from 30 to 55%.

The results of grain size analyses, Atterberg limits tests, consolidation tests and consolidated undrained triaxial compression tests are presented in Appendix C.

Consolidation tests measured initial void ratios ranging from 1.35 to 2.0 recompression indexes ranging from 0.05 to 0.10, and compression indexes ranging from 0.50 to 1.0. Consolidated undrained triaxial compression tests measured friction angles ranging from 20° to 24°, respectively.

The liquid limits ranged from 44 to 52, plastic limit from 21 to 23, with corresponding plastic indices of 21 to 29, indicating the clay material is medium to high plastic. The moisture contents ranged between 46 and 65% indicating the clay material is wetter than liquid limit. Based on the results of the laboratory tests, the clay samples from Swamps 12, 13 and 14 are considered as CI in accordance with the MTC Soil Classification Manual. The clay sample from Swamp 11 is considered as CH.

An Atterberg Limits test carried out on a silt and clay sample retrieved from Station 16+321, 2.0 m Lt C/L southbound lane at 3.95 to 4.25 m depth (see Peto MacCallum Ltd. Pavement Design Report, WP 291-97-00, dated October 16, 1998) measured a liquid limit of 44 and a plasticity index of 18. The moisture content was 58%, indicating the silt and clay sample is wetter than liquid limit. Based on the results of the laboratory tests, the silt and clay sample is considered as CI in accordance with the MTC Soil Classification Manual.

Consolidation test carried out on the silt and clay sample measured an initial void ratio of 1.65, a recompression index of 0.05 and a compression index of 0.64.

Sand

Sand was encountered below the peat and clay in all swamps. The sand unit ranged in thickness from less than 1 to 4 m; it contains varying amount of silt and gravel. Clay layers are often noted within the sand deposits. Standard penetration test "N" values ranged from 0 per 300 mm

penetration to 50 blows per 100 mm penetration. Dynamic cone resistance values varied from 2 per 300 mm penetration to 50 per 75 mm penetration. The sand was generally very loose to loose but becoming very dense near the bedrock. Moisture contents ranged from 6 to 18%.

Silt

Silt was encountered locally in Swamps 11, 12 and 13. The silt unit ranged in thickness from less than 1 to 1.5 m. The silt contains varying amount of sand and clay. The moisture contents ranged from 24 to 51%.

Bedrock

Bedrock was inferred by auger refusal in all the testholes at depths of 0.1 to 14.4 m, with the following exceptions:

Bedrock was exposed at ground surface in 2 of the testholes drilled in Swamp 13.

Bedrock was not encountered in the testholes drilled/excavated along the toe of the existing embankments within Swamps 11, 12 and 14. These testholes were terminated in rockfill, peat, clay or sand at depths of 0.5 to 4.2 m.

The bedrock comprises granitic gneisses and migmatites.

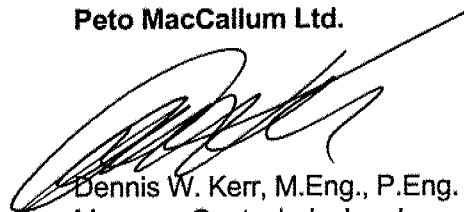
CLOSURE

The field investigation was carried out under the direction and supervision of Mr. D. MacRae, P.Eng. This report was prepared by Mr. E. Wong, P.Eng. and reviewed by Mr. D.W. Kerr, P.Eng., Manager Geotechnical and Geo-Environmental Services, Hamilton office.

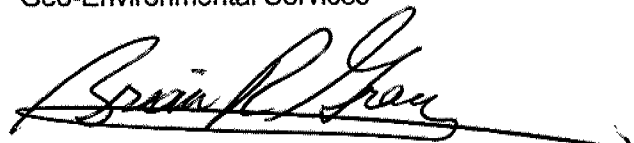
Yours very truly

Peto MacCallum Ltd.




Dennis W. Kerr, M.Eng., P.Eng.
Manager Geotechnical and
Geo-Environmental Services




Brian R. Gray, M.Eng., P.Eng.
Vice-President
Geotechnical and
Geo-Environmental Services

EW:mmm

APPENDIX A

Table I – Swamp Number and Location
Drawing No. 1 – Swamp Location Plan

TABLE I

SWAMP NUMBER AND LOCATION
Embankment Over Swamps
Highway 69 – Highway 141 to Badger Road
G.W.P. 291-97-00

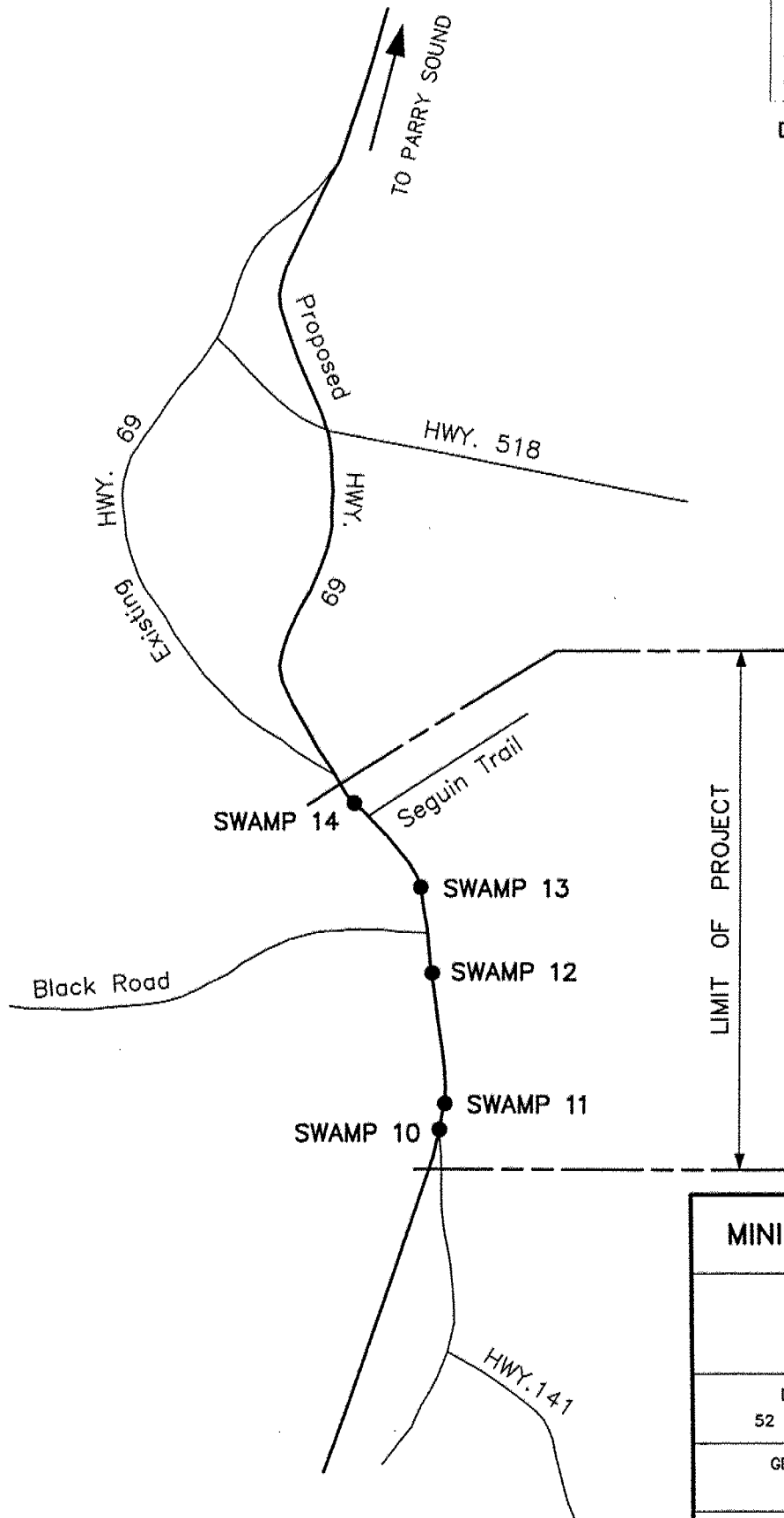
SWAMP NO. ⁽¹⁾	DISTRICT MUNICIPALITY	TOWNSHIP	ROAD COMPONENT	STATION
10 ⁽²⁾	Parry Sound	Seguin	Hwy 69, NBL	14+440 – 14+500
11 ⁽²⁾	Parry Sound	Seguin	Hwy 69, NBL	14+620 – 14+700
12	Parry Sound	Seguin	Hwy 69, SBL	15+260 – 15+495
13	Parry Sound	Seguin	Hwy 69, NBL	16+230 – 16+300
			Hwy 69, SBL	16+230 – 16+300
14	Parry Sound	Seguin	Hwy 69, NBL	16+755 – 16+830
			Hwy 69, SBL	16+755 – 16+830

- (1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)
- (2) Same swamp crossing in GWP 290-97-00

PLATE No
DRAWING No
CONT No
GWP No 291-97-00



DISTRICT MUNICIPALITY OF PARRY SOUND
GEOG TWP SEGUIN



MINISTRY OF TRANSPORTATION

KING'S HIGHWAY 69

DISTRICT
52 HUNTSVILLE

REGION
NORTHERN

GEOG. TWP.
SEGUIN

DISTRICT MUNICIPALITY
PARRY SOUND

SWAMP LOCATION PLAN

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BAYFORD ROAD, HAMILTON, ONTARIO L8E 3C8
TEL: (905) 581-2231 FAX: (905) 581-8363

DATE	SCALE	JOB NO.	DRAWING NO.
FEB. 1999	N.T.S.	98TF010	1

NOTE: SWAMPS NUMBERED SEQUENTIALLY WITH THE NUMBERING SYSTEM EMPLOYED FOR THE STUDY CONDUCTED FOR THE 26.5 Km. LONG SECTION TO THE SOUTH OF THIS PROJECT G.W.P. 290-97-00.

APPENDIX B

List of Abbreviations

OPSD – 100.06

Testhole Logs

Drawing Nos. 2 to 6 – Testhole Location Plans

Drawing Nos. 2A and 2B to 6A to 6D – Soil Profiles

ABBREVIATIONS FOR BORING AND TEST DATA

Accep	Acceptable	Gry	Grey	Psty	Polystyrene
Agg	Aggregate	H	Heavy	Poss	Possible
Amor	Amorphous	Hi	Highly	PST	Prime & Surface Treated
Asph	Asphalt	HP	High Plasticity	Quant	Quantity
BR	Bedrock	HM	Hot Mix	Reinf	Reinforced
Blk	Black	Lt	Light	RSS	Remoulded Shear Strength
Bl	Blue	Liq	Liquid	RF	Rock Fill
BH	Borehole	W _L	Liquid Limit	Sa	Sand
Bld (y)	Boulder (y)	Lo	Loam	Sat	Saturated
Blds	Boulders	L	Loose	SH	Shale
BU	Break Up	Mrl	Marl	St	Sensitivity
Br	Brown	Matl	Material	SSM	Select Subgrade Material
CF	Channel Face	Max	Maximum	Sh Rk	Shot Rock
Cl	Clay	MDD	Maximum Dry Density	Sl (y)	Silt (y)
Co	Coarse	MWD	Maximum Wet Density	Sl (y)	Slight (ly)
Cob	Cobbles	Med	Medium	SP	Slight Plasticity
Comp	Compact	MP	Medium Plasticity	Stn (y)	Stoney
Conc	Concrete	Mod	Moderate	D _R	Relative Density
Contam	Contaminated	Mott	Mottled	Stks	Streaks
Cord	Corduroy	Mul	Mulch	Surf	Surface
Cr	Crushed	NFP	No Further Progress	Temp	Temperature
Dk	Dark	NFP (Blds)	No Further Progress (Boulders)	TH	Test Hole
Decomp	Decomposed	Num	Numerous	TP	Test Pit
D	Dense	OCC	Occasional	Tps	Topsoli
E	Earth	Wopt	Optimum Moisture Content	Tr	Trace
Fib	Fibrous	Ora	Orange	USS	Undisturbed Shear Strength
w	Field Moisture Content	Org	Organic	Unreinf	Unreinforced
F	Fine	Org M	Organic Matter	Varv	Varved
Fr Wat	Free Water	Ob	Overburden	VF	Very Fine
FB	Frost Boil	Pavt	Pavement	WT	Water Table
FH	Frost Heave	Pedo	Pedological	Weath	Weathered
Gran	Granular	Pen Mac	Penetration Macadam	W	With
Gr	Gravel (ly)	Wp	Plastic Limit	Wd (y)	Wood (y)
Grn	Green	Ip	Plasticity Index	Yel	Yellow

ONTARIO PROVINCIAL STANDARD DRAWING

Date 1986 07 18 Rev

ABBREVIATIONS GEOTECHNICAL

Date

OPSD - 100.06

SUSCEPTIBILITY TO FROST HEAVING

HSFH - High
MSFH - Medium
LSFH - Low

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N', - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 0.3 m INTO THE SUBSOIL. DRIVEN BY MEANS OF A 63.5 kg HAMMER FALLING FREELY A DISTANCE OF 0.76 m.

DYNAMIC PENETRATION RESISTANCE: - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 51 mm, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS. 0.3 m INTO THE SUBSOIL. THE DRIVING ENERGY BEING 475 J PER BLOW.

DESCRIPTION OF SOIL

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

<u>CONSISTENCY</u>	<u>'N' BLOWS/0.3 m</u>	<u>c kPa</u>	<u>DENSENESS</u>	<u>'N' BLOWS/0.3 m</u>
VERY SOFT	0 – 2	0 – 12	VERY LOOSE	0 – 4
SOFT	2 – 4	12 – 25	LOOSE	4 – 10
FIRM	4 – 8	25 – 50	COMPACT	10 – 30
STIFF	8 – 15	50 – 100	DENSE	30 – 50
VERY STIFF	15 – 30	100 – 200	VERY DENSE	> 50
HARD	> 30	> 200		
W.T.P.L. WETTER THAN PLASTIC LIMIT			D.T.P.L. DRIER THAN PLASTIC LIMIT	
A.P.L. ABOUT PLASTIC LIMIT				

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		
SS-0	SPLIT SPOON SUNK UNDER HAMMER WEIGHT		

SOIL TESTS

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

+ - UNDISTURBED SHEAR STRENGTH DETERMINED FROM IN SITU VANE TEST.

GWP 291-97-00 Highway 69

District 52, Huntsville

Swamp 10

Station 14+440 - 14+500

Northbound Lane/Twp. of Seguin

Datum Centre Line Median

S10-1	14+450	C/L	El. 238.54	S10-7	14+500	C/L	El. 238.41
	0-200	Blk Sa Tps			0-100	Blk Si(y) Sa Tps	
	200-750	Br F-Med Sa W Si			100	NFP BR	
	750	NFP BR					
S10-2	14+450	18.80 RT C/L	El. 235.02	S10-8	14+500	18.80 RT C/L	El. 235.38
	0-350	Blk Si(y) Sa Tps			0-300	Blk Si(y) Sa Tps	
	350	NFP BR			300	NFP BR	
S10-3	14+450	40.50 RT C/L	El. 234.30	S10-9	14+500	40.50 RT C/L	El. 234.34
	0-1.00	Blk Fib Peat			0-500	Blk F Fib Peat	
	1.00-5.80	Blk Amor Peat			500	NFP BR	
	5.80	NFP BR					
S10-4	14+475	7.30 RT C/L	El. 234.89				
	0-250	Blk Si(y) Sa Tps					
	250-2.00	L Br Sa Wet					
	2.00	NFP BR					
S10-5	14+475	18.80 RT C/L	El. 234.18				
	0-300	Fr Wat					
	300-2.60	Blk Fib Peat					
	2.60-3.00	L Gry Sa W Gr Wet					
	3.00	NFP BR					
S10-6	14+475	30.30 RT C/L	El. 234.29				
	0-5.90	Blk Fib Peat					
	5.90-7.50	L To Comp Gry Sa W Si Wet					
	7.50	NFP BR					

METRIC

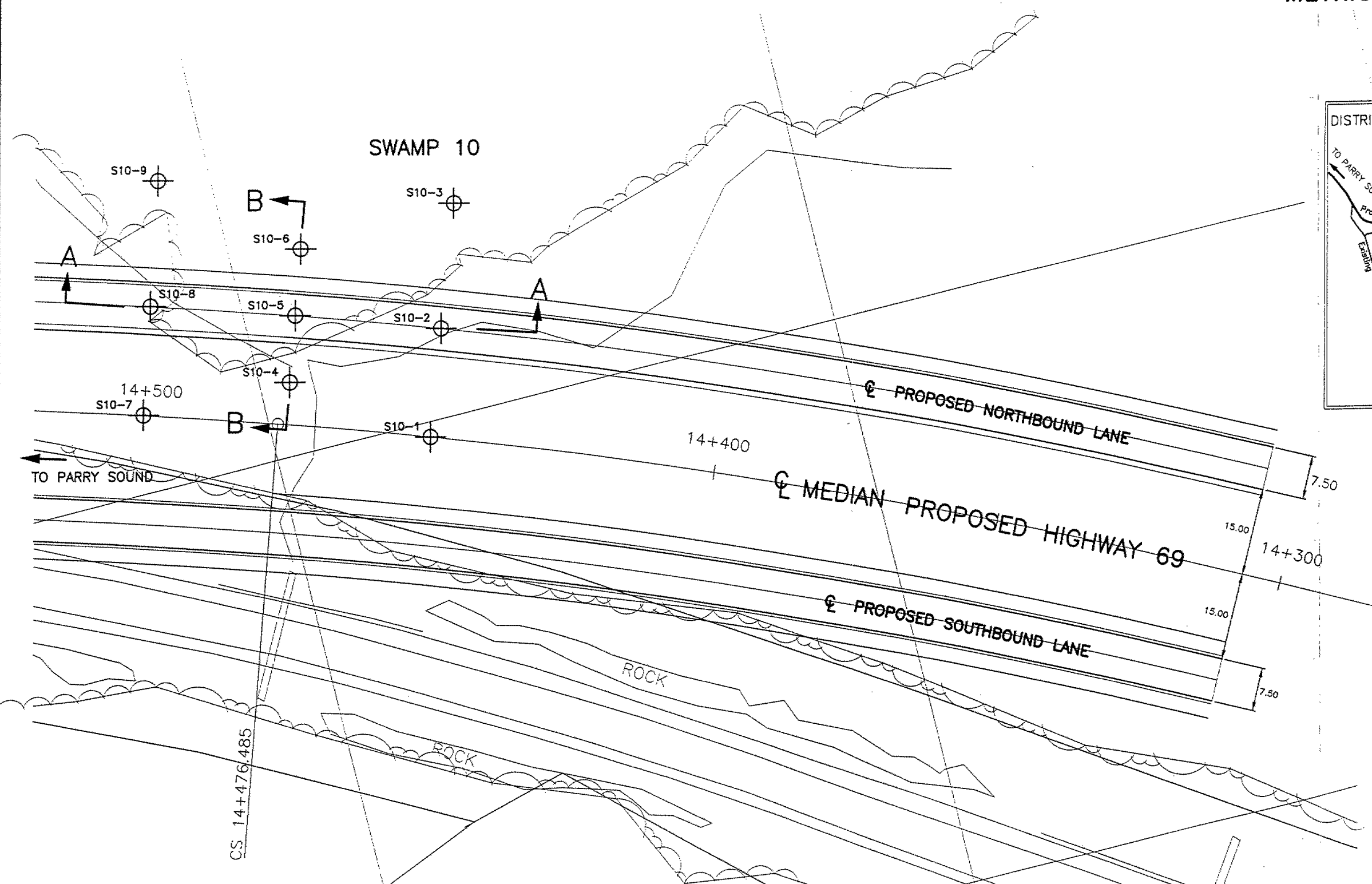
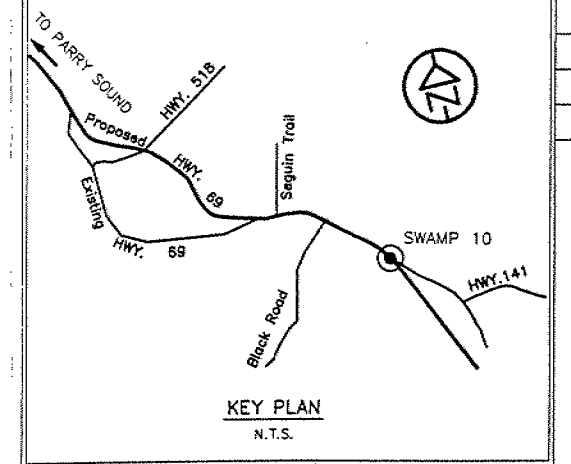
PLATE No
 PLATE No
 CONT No
 GWP No 291-97-00



SHEET

STA TO STA
 Survey SURVEYED Revised REVISED

DISTRICT MUNICIPALITY OF PARRY SOUND
 GEOG TWP SEGUIN



LEGEND

- PROBEHOLE
- BOREHOLE
- TEST PIT

NOTE REFER TO DRAWINGS 2A AND 2B
 FOR SOIL PROFILES.

MINISTRY OF TRANSPORTATION

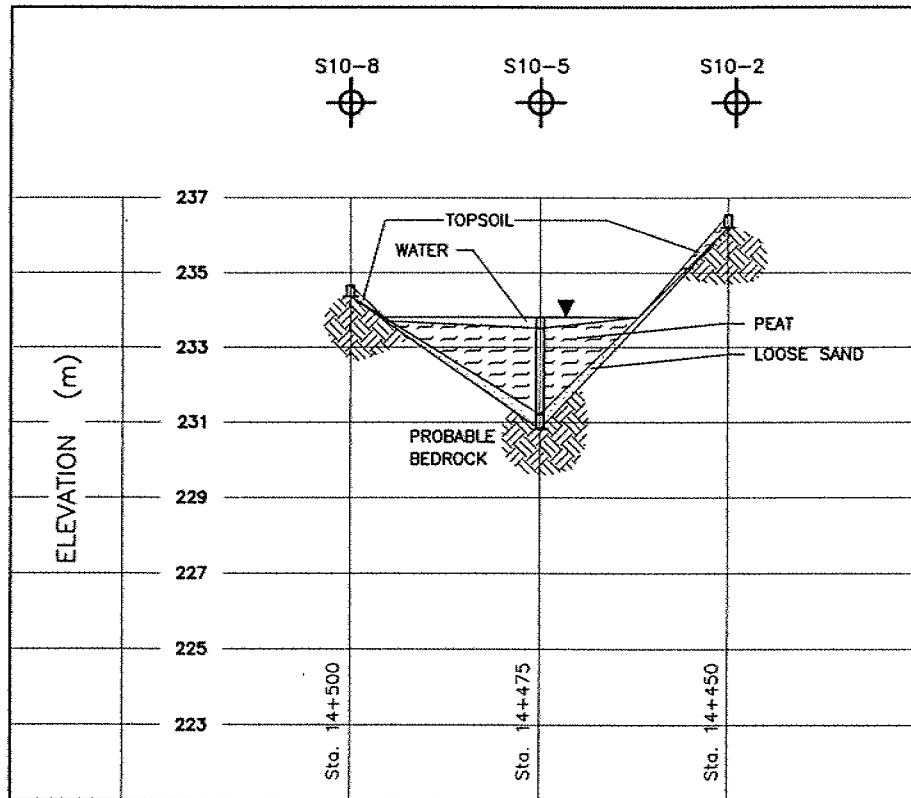
KING'S HIGHWAY 69

DISTRICT 52 HUNTSVILLE	REGION NORTHERN
GEOG. TWP. SEGUIN	DISTRICT MUNICIPALITY PARRY SOUND

SWAMP 10
 TESTHOLE LOCATION PLAN

Peto MacCallum Ltd.
 CONSULTING ENGINEERS
 45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C8

DRAWN CB	DATE NOV. 1998	SCALE 1:750	JOB NO. 98TF010	DRAWING NO. 2
CHECKED EW				
APPROVED DWK				



LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 2 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

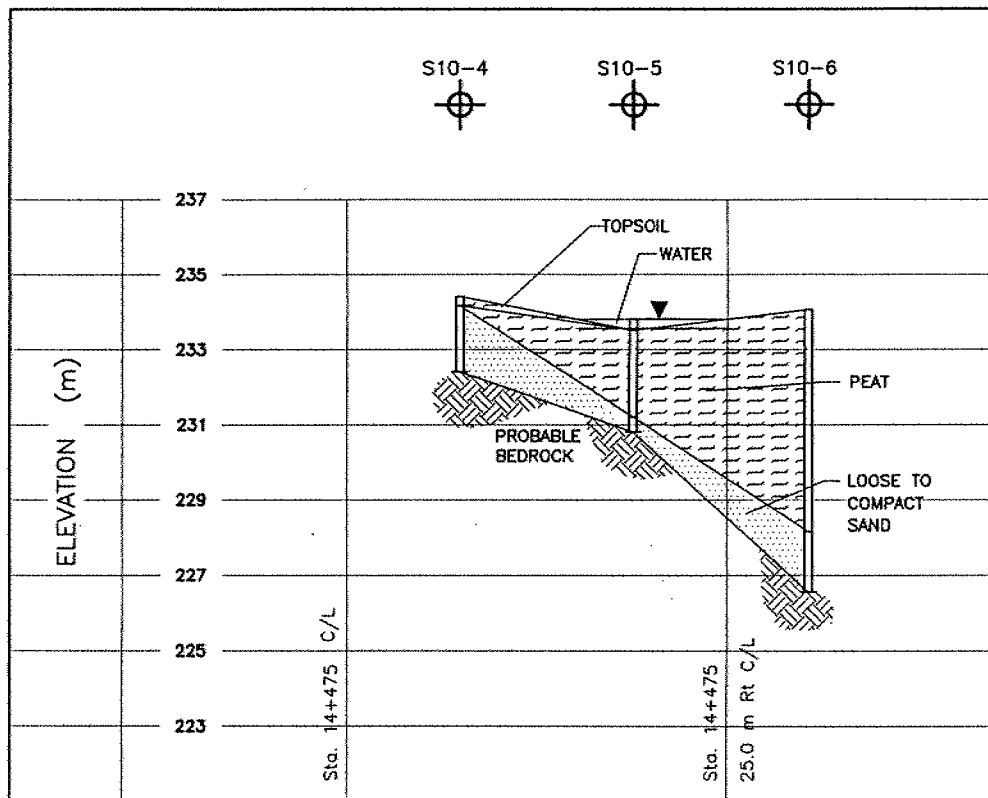
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TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C6
Tel: (905) 561-2231 Fax: (905) 561-6363

SWAMP 10 - SOIL PROFILES

DATE	SCALE	JOB NO.	DRAWING NO.
FEB. 1999	AS SHOWN	98TF010	2A



SECTION B-B (NORTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:500

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

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G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C6
Tel: (905) 561-2231 Fax: (905) 561-6363

SWAMP 10 - SOIL PROFILES

DATE	SCALE	JOB NO.	DRAWING NO.
FEB. 1999	AS SHOWN	98TF010	2B

GWP 291-97-00 Highway 69
District 52, Huntsville
Swamp 11
Station 14+620 - 14+700
Northbound Lane/Twp. of Seguin
Datum Centre Line Median

S11-1 14+631 3.00 LT C/L El. 234.39
0-800 Peat And Sa Fill
800-1.40 R F
1.40-2.00 Gry Sa W Si Wet

Note: Testhole terminated above program depth to
avoid potential embankment movement.

S11-6 14+631 26.50 RT C/L El. 233.76
0-1.80 Blk Amor Peat
1.80-4.50 V L Gry Si(y) F Sa Tr Cl Tr Gr
OCC Cob Wet
4.50 NFP BR
Fr Wat @ 0

S11-2 14+654 2.80 LT C/L El. 234.41
0-1.20 Peat Fill
1.20-3.70 R F And Peat
3.70-4.20 Gry Si(y) Cl
Fr Wat @ 1.00

Note: Testhole terminated above program depth to
avoid potential embankment movement.

S11-7 14+654 1.50 RT C/L El. 233.86
0-2.55 Blk Amor Peat Wet
2.55-7.05 Soft Gry Si(y) Cl Tr F Sa
7.05-9.00 L To Comp Gry Si Tr Cl Tr F Sa
OCC Cob Wet
9.00 NFP BR
Fr Wat @ 0

S11-3 14+677 2.80 LT C/L El. 234.91
0-1.30 Peat And Sa Fill
1.30-2.20 R F And Peat
2.20-2.50 Br Amor Peat Wet
2.50-2.80 Gry Si(y) Sa Wet

Note: Testhole terminated above program depth to
avoid potential embankment movement.

S11-9 14+654 26.30 RT C/L El. 233.86
0-1.20 Blk Amor Peat
1.20-6.00 Soft Gry Si(y) Cl W F Sa
Tr Gr
6.00-8.25 L To Comp Gry Med-Co Sa Tr
Gr Tr Si OCC Cob Wet
8.25 NFP BR

S11-4 14+631 1.50 RT C/L El. 233.76
0-1.50 Blk Amor Peat Wet
1.50-4.50 V L Gry Si(y) F Sa W Cl Tr Gr
OCC Cobs Wet
4.50 NFP BR
Fr Wat @ 0

Note: Edge of Water Course

S11-10 14+677 2.00 RT C/L El. 233.51
0-2.40 Blk Amor Peat
2.40-8.55 Soft Gry Si(y) Cl W Si And F Sa
Seams
8.55-11.10 L To Comp Gry Si(y) F Sa
OCC Cob @ 10.20
11.10 NFP BR

GWP 291-97-00 Highway 69

District 52, Huntsville

Swamp 11

Station 14+620 - 14+700

Northbound Lane/Twp. of Seguin

Datum Centre Line Median

S11-12 14+677	27.0 RT C/L	El. 233.28
0-900	Blk Amor Peat Wet	
900-2.70	L Gry F to Med Sa Tr Si Tr Gr	
	Wet	
2.70-3.90	L Lt Br Si W F Sa Tr Cl Wet	
3.90	NFP BR	
	Fr Wat @ 1.30	

LOG OF BOREHOLE NO. S11-5

PROJECT G.P.W. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 14+631, 13.5 m Rt., Hwy 69, NBL, Twp. of Seguin

BORING DATE 98.03.17

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers / Cone Test

TECHNICIAN D. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				PLASTIC LIMIT W_P				
							BLOWS/0.3M				WATER CONTENT %				
							20	40	60	80	10	20	30		
							20	40	60	80	10	20	30		
0	GROUND ELEVATION 233.27													Upon completion of augering, free water at ground surface, cave at 1.30 m.	
	Peat Fibrous, Black		235												
			234												
1.5				1	SS	1							W=192		
2.40			233												
	Silty Sand With Clay Trace Gravel Occasional Cobbles At 6.0 m, Grey, Wet Very Loose To Very Dense		232	2	SS	2							W=42		
3.0															
			231	3	SS	2									
4.5			230												
6.0			229	4	SS	14									
6.60															
	End Of Borehole Auger Refusal Probable Bedrock		228												
7.5															
9.0															
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

1. Cone test was carried out at a distance of 1.5 m from the borehole.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S11-8

PROJECT GWP 291-97-00

OUR PROJECT 97TF010

LOCATION Station 14+654, 14.2 m Rt., Highway 69, NBL, Twp. of Seguin

BORING DATE 98.05.17

ENGINEER

E. W.

BORING METHOD Continuous Flight Hollow Stem Augers / Vane Test

TECHNICIAN

D. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N-1 VALUES	20 40 60 80				PLASTIC LIMIT W_p				
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				WATER CONTENT %				
							BLOWS/0.3m				W_p W W_L				
							20 40 60 80				10 20 30				
0	GROUND ELEVATION 233.30													Upon completion of augering, borehole caved at 0.90 m with water level at ground surface.	
	Peat		233												
	Amorphous		232												
	Black, Wet		231												
1.5															
2.55															
3.0	Silty Clay		230											Sample 1, CH $W_L = 52$ $W_p = 23$ $I_p = 29$	
	Trace Sand														
	Grey														
	Soft														
4.5															
6.0															
7.5															
9.0															
9.45															
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- 1.4 Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S11-11

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 14+677, 15.0 m Rt., Hwy 69, NBL, Twp. of Seguin

BORING DATE 98.03.17 ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers / Vane Test

TECHNICIAN D. R.

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u (kPa) +		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS			
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST		PLASTIC LIMIT W_p					
							BLOWS/0.3m		WATER CONTENT %					
							20	40	60	80		10	20	30
	GROUND ELEVATION 233.0													
0	Peat Amorphous, Black		232								Upon completion of augering, free water at ground surface, cave at 1.50 m.			
1.5			231	1	SS	2				W=410				
1.95														
	Silty Sand With Clay Grey, Wet Very Loose		230	2	SS	3								
3.0			229											
4.5			228	3	SS	2								
4.95														
	Silty Clay With Silt Seams Trace Sand Grey Soft To Firm		227	4	SS	3								
6.0			226	5	TW	P.H.				W=58				
6.45														
	Sand And Gravel Trace Silt Grey, Wet Dense		225	6	SS	80								
7.5														
8.10														
	End Of Borehole Auger Refusal Probable Bedrock		224											
9.0														
10.5														
12.0														
13.5														
15.0														
16.5														

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- ⁴ Number refers to sensitivity.

CHECKED BY: E.W.

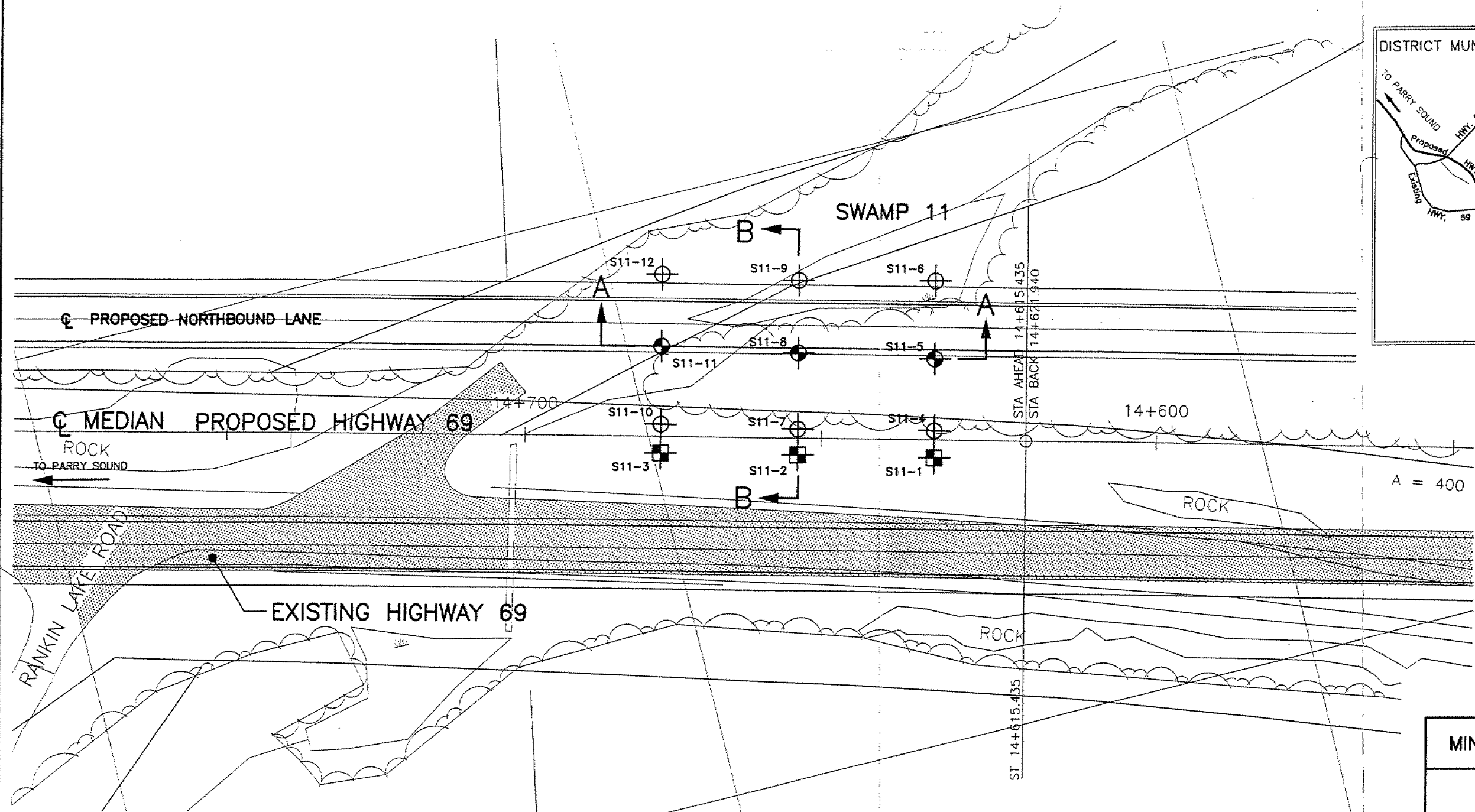
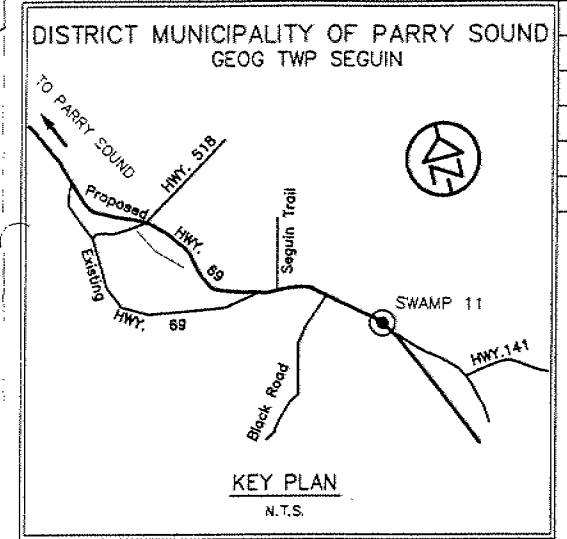
METRIC

PLATE No
PLATE No
CONT No
GWP No 291-97-00



SHEET

STA TO STA
Survey SURVEYED Revised REVISED



LEGEND

- PROBEHOLE
- BOREHOLE
- TEST PIT
- EXISTING HIGHWAY 69

NOTE REFER TO DRAWINGS 3A AND 3B FOR SOIL PROFILES.

MINISTRY OF TRANSPORTATION

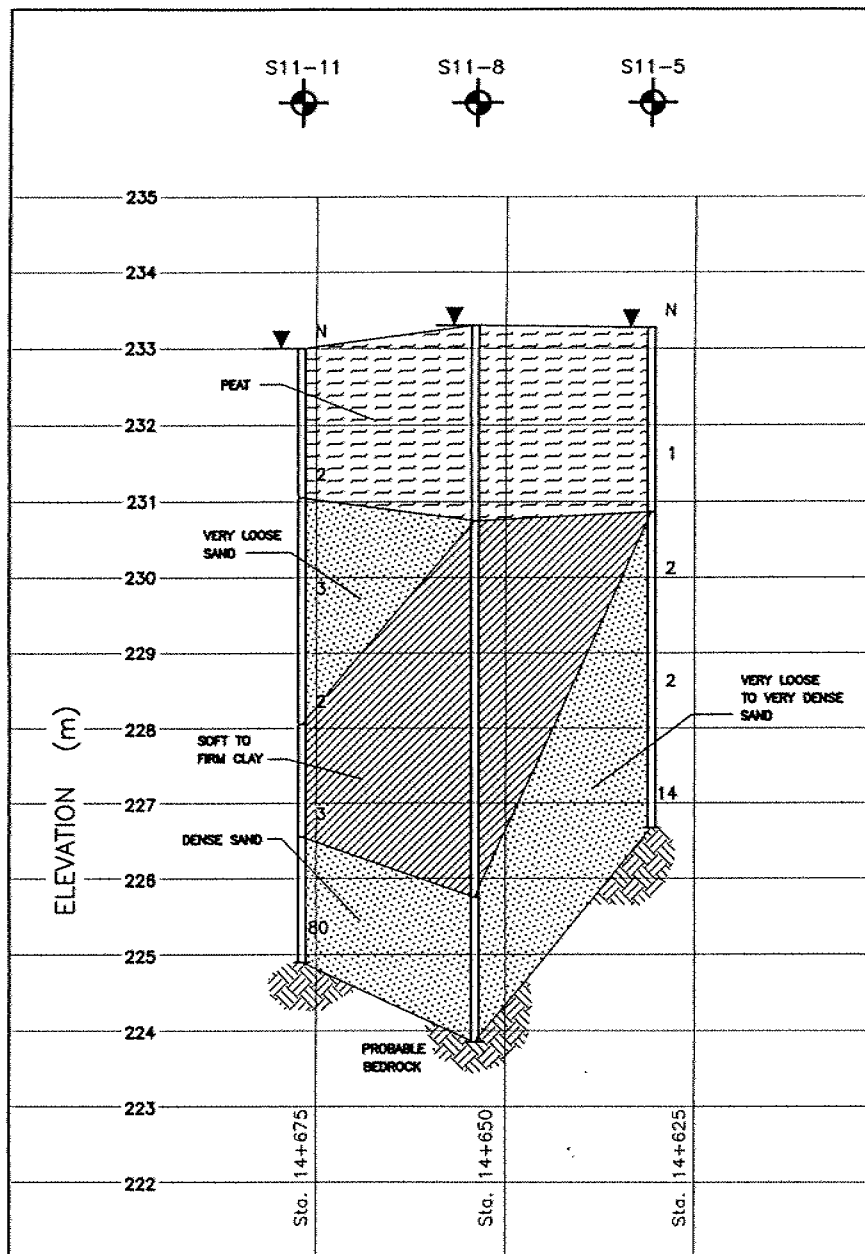
KING'S HIGHWAY 69

DISTRICT 52 HUNTSVILLE	REGION NORTHERN
GEOG. TWP. SEGUIN	DISTRICT MUNICIPALITY PARRY SOUND

**SWAMP 11
TESTHOLE LOCATION PLAN**

Peto MacCallum Ltd.
CONSULTING ENGINEERS
42 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C8

DRAWN CB	DATE NOV. 1998	SCALE 1:750	JOB NO. 98TF010	DRAWING NO. 3
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SECTION A-A (NORTHBOUND LANE)

SCALE VERTICAL 1:100
HORIZONTAL 1:1000

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 3 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

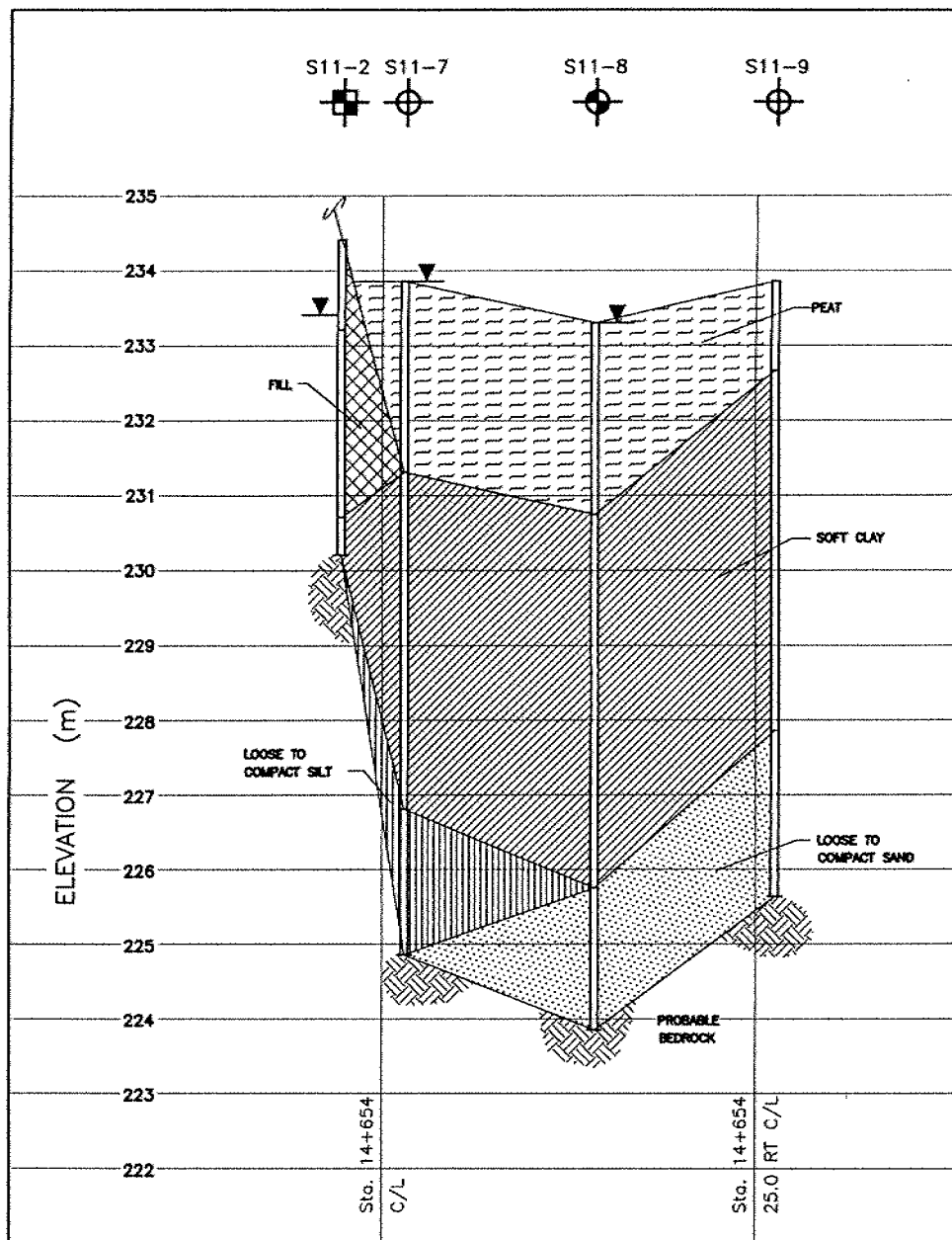
G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 11 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C8
Tel: (905) 561-2231 Fax: (905) 561-6363

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	3A



SECTION B-B (NORTHBOUND LANE)

SCALE VERTICAL 1:100
HORIZONTAL 1:500

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 3 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 11 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C8
Tel: (905) 561-2231 Fax: (905) 561-8383

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	3B

GWP 291-97-00 Highway 69

District 52, Huntsville

Swamp 12

Station 15+260 - 15+495

Southbound Lane/Twp. of Seguin

Datum Centre Line Southbound Lane

S12-1 15+260 11.50 RT C/L El. 247.35
 0-130 Asph
 130-450 Cr Gr Moist
 w @ 290 = 3%
 450-900 Br F-Med Sa W Si Tr Gr Moist
 900 NFP RF/BR

S12-2 15+260 C/L El. 244.80
 0-400 Blk Si Tps Moist
 400-900 Br F-Med Si(y) Sa Moist
 900 NFP RF/BR

S12-3 15+275 C/L El. 244.60
 0-3.50 Dk Br Amor Peat Sat
 3.50 NFP BR

S12-4 15+280 2.50 RT C/L El. 244.59
 (Toe of Existing Embankment)
 0-200 Dk Br Peat Wet
 200-3.70 RF Sat
 3.70-3.90 Gry Cl W Si Sat
 Fr Wat @ 0

S12-5 15+293 3.00 RT C/L El. 245.38
 0-3.35 Dk Br Amor Peat Sat
 3.35-5.20 Gry Cl(y) Si Sat
 5.20-5.50 Gry F Sa Tr Si Sat
 5.50 NFP BR
 TH Caved @ 1.35
 Fr Wat @ 0

S12-6 15+293 5.00 LT C/L El. 244.72
 0-4.25 Dk Br Amor Peat Sat
 4.25-5.50 Gry Med-Co Sa Tr Si Sat
 5.50-5.75 Gry Cl(y) Si Tr F Sa
 5.75-6.40 Gry Med-Co Sa Tr Si Sat
 6.40 NFP BR
 TH Caved @ 900
 Fr Wat @ 0

S12-7 15+293 16.00 LT C/L El. 244.72
 0-500 Fr Wat
 500-4.40 Blk F Fib Peat Sat
 4.40-5.30 Gry Si(y) Cl
 5.30-5.60 Gry F-Med Sa Tr Si Sat
 5.60 NFP BR

S12-8 15+299 5.00 RT C/L El. 245.21
 (Toe of Existing Embankment)
 0-100 Br Peat Moist
 100-3.20 RF Moist
 Sat @ 900
 3.20-3.50 Br Co Fib Peat
 w @ 3.30 = 818%
 Cu @ 3.20 = 25 kPa
 (Pocket Penetrometer)
 Fr Wat @ 900

S12-9 15+317 3.50 RT C/L El. 245.52
 0-3.65 Dk Br Amor Peat Moist
 3.65-6.40 Gry F Sa W Si W Cl Tr Gr Sat
 6.40 NFP BR
 TH Caved @ 900
 Fr Wat @ 900

GWP 291-97-00 Highway 69
District 52, Huntsville
Swamp 12
Station 15+260 - 15+495
Southbound Lane/Twp. of Seguin
Datum Centre Line Southbound Lane

S12-11 15+317	15.00 LT C/L	El. 244.70
0-400	Fr Wat	
400-5.10	Blk F Fib Peat Sat	
5.10-6.80	Gry Si(y) Cl Sat	
6.80-7.80	Gry F-Med Sa Tr Si Sat	
7.80	NFP BR	

S12-12 15+322	5.00 RT C/L	El. 245.35
(Toe of Existing Embankment)		
0-400	Blk Sa And Peat Moist	
400-3.20	RF Moist	
	Sat @ 800	
3.20-3.50	Br F-Co Fib Peat Sat	
	Fr Wat @ 800	

S12-13 15+344	4.50 RT C/L	El. 244.69
0-350	Fr Wat	
350-3.80	Blk F Fib Peat Sat	
3.80-4.30	Gry Sa Sat	
4.30-5.20	Gry Si(y) Cl Tr Sa	
5.20-5.40	Gry Si W F Sa Sat	
5.40-5.70	Gry Si(y) Cl Tr Sa	
5.70	NFP BR	

S12-14 15+344	5.0 LT C/L	El. 244.69
0-300	Fr Wat	
300-4.50	Blk F Fib Peat Sat	
4.50-6.30	Gry F-Med Sa Tr Si Sat	
6.30	NFP BR	

S12-15 15+344	15.50 LT C/L	El. 244.69
0-400	Fr Wat	
400-4.50	Blk F Fib Peat Sat	
4.50-7.80	Gry F-Med Sa Tr Si Sat	
7.80	NFP BR	

S12-16 15+354	5.00 RT C/L	El. 244.50
(Toe of Existing Embankment)		
0-200	Br Peat And Tps Wet	
200-2.50	RF Sat	
2.50-2.70	Br Co Fib Peat Sat	
	Fr Wat @ 0	

S12-17 15+369	9.00 RT C/L	El. 245.70
0-500	Br Sa And Gr Tr Si (Fill)	
500	NFP RF/BR	

S12-18 15+369	5.50 RT C/L	El. 244.70
0-100	Blk Si Tps Moist	
100-1.00	Gry F-Med Sa W Si (Fill) Wet	
1.00-2.40	Blk F Fib Peat Wet	
2.40	NFP BR	

S12-19 15+369	3.50 RT C/L	El. 244.50
0-200	Ice/Fr Wat	
200-2.30	Br F Fib Peat Sat	
2.30	NFP BR	
	Fr Wat @ 0	

GWP 291-97-00 Highway 69

District 52, Huntsville

Swamp 12

Station 15+260 - 15+495

Southbound Lane/Twp. of Seguin

Datum Centre Line Southbound Lane

S12-20 15+369 4.50 LT C/L El. 244.70
0-400 Fr Wat
400-3.70 Blk F Fib Peat Sat
3.70 NFP BR

S12-21 15+369 14.50 LT C/L El. 244.70
0-400 Fr Wat
400-2.50 Blk F Fib Peat Sat
2.50-7.20 Gry Si(y) Cl
7.20-7.40 Gry F-Med Sa Tr Si Sat
7.40 NFP BR

S12-22 15+392 7.50 RT C/L El. 245.36
(Existing Hwy. 69 Embankment)
0-1.50 Dk Br F-Med Sa Tr Si Num
Cob And Blds Moist (Fill)
1.50 NFP Poss RF/BR

S12-23 15+392 3.50 RT C/L El. 245.37
0-100 Dk Br Fib Peat Moist
100-900 Br Sa Tr Si Num Cob And Blds
Moist
900 NFP BR

S12-24 15+392 4.50 LT C/L El. 244.97
(Toe of Existing Embankment)
0-200 Dk Br Si Tps Moist
200 NFP BR

S12-25 15+392 14.50 LT C/L El. 244.69
0-300 Fr Wat
300-1.90 Blk F Fib Peat Sat
1.90-2.30 Gry F-Med Sa Tr Si Sat
2.30 NFP BR

S12-26 15+417 8.50 RT C/L El. 244.99
0-1.85 Blk Amor Peat Moist (Poss Fill)
1.85 NFP BR
TH Caved @ 900
Fr Wat @ 600

S12-27 15+417 4.50 RT C/L El. 244.84
0-1.90 Blk Amor Peat Tr Gry Sa Wet
(Poss Fill)
1.90 NFP BR
Fr Wat @ 1.85

S12-29 15+417 13.00 LT C/L El. 244.70
0-200 Fr Wat
200-3.20 Blk F Fib Peat Sat
3.20-3.40 Gry F-Med Sa Tr Si Sat
3.40 NFP BR

S12-30 15+442 12.00 RT C/L El. 245.62
(Toe of Existing Embankment)
0-250 Blk Peat And Sa Moist
250-3.00 RF Moist
Sat @ 500
3.00-3.50 Br Amor Peat Sat
3.50-3.70 Gry F-Med Sa Sat
Fr Wat @ 500

GWP 291-97-00 Highway 69

District 52, Huntsville

Swamp 12

Station 15+260 - 15+495

Southbound Lane/Twp. of Seguin

Datum Centre Line Southbound Lane

S12-31 15+442 7.50 RT C/L El. 244.77
 0-2.60 Dk Br Amor Peat Sat
 2.60-4.10 Gry F Sa Tr Si Sat
 4.10-4.60 Gry Cl(y) Si W F Sa
 4.60 NFP BR
 TH Caved @ 900
 Fr Wat @ 600

S12-33 15+442 14.00 LT C/L El. 244.77
 0-200 Fr Wat
 200-3.20 Blk F Fib Peat Sat
 3.20-5.00 Gry Si(y) Cl
 5.00 NFP BR

S12-34 15+467 12.00 RT C/L El. 245.58
 (Toe of Existing Embankment)
 0-200 Blk Peat And Sa Moist
 200-2.00 RF Moist
 Sat @ 400
 2.00-2.20 Br Co Fib Peat Sat
 Fr Wat @ 400

S12-37 15+467 13.50 LT C/L El. 244.73
 0-200 Fr Wat
 200-3.70 Blk F Fib Peat Sat
 3.70-5.00 Gry Si(y) Cl
 5.00 NFP BR

S12-38 15+492 6.00 RT C/L El. 245.46
 0-1.20 Br Med-Co Sa W Gr Tr Si Moist
 (Poss Fill)
 Cob @ 300
 1.20 NFP Poss RF/BR

S12-40 15+492 15.00 LT C/L El. 244.74
 0-200 Fr Wat
 200-4.00 Blk F Fib Peat Sat
 4.00-7.20 Gry Si(y) Cl
 7.20-9.20 Gry Med Sa Tr Si Tr Gr Sat
 9.20 NFP BR

LOG OF BOREHOLE NO. S12-10

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 15+317, 4.50 m Lt C/L, Hwy 69, SBL, Twp of Seguin BORING DATE 98.03.16

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Cone Test/ Vane Test

TECHNICIAN D. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_P				
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				WATER CONTENT %				
							BLOWS/0.3M				W_P W W_L				
	GROUND ELEVATION 244.70						20 40 60 80				10 20 30				
0	Peat Fibrous, Dark Brown, Moist		244										Upon completion of augering, free water at 0.90 m, caved at 0.90 m.		
1.50			243	1	SS	4						W=489			
	Becoming Amorphous Peat, Saturated		242	2	AS							W=659			
3.0			241	3	SS	2						W=570			
3.65			240	4	SS	2									
4.5	Sand With Silt And Clay Trace Gravel, Grey, Saturated, Very Loose		239	5	SS	2									
5.80			238												
6.00	Clayey Silt Trace Sand, Grey Soft			6	SS	50/100 mm									
6.35						x 50/125 mm									
7.5	Sand With Gravel Trace Silt, Grey, Saturated, Very Dense														
9.0	End Of Borehole Auger Refusal Probable Bedrock														
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

- Vane and cone tests were carried out at a distance of 1.5 m from the borehole.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S12-28

PROJECT G.W.P. 291-97-00




OUR PROJECT 98TF010

LOCATION Station 15+417, 3.50 m Lt C/L, Hwy 69, SBL, Twp. of Seguin BORING DATE 98.03.16

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers

TECHNICIAN D. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L			GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_P			
							DYNAMIC CONE PENETRATION x				WATER CONTENT W			
							STANDARD PENETRATION TEST •				W_P W W_L			
							BLOWS/0.3M				WATER CONTENT %			
0	GROUND ELEVATION 244.72						20	40	60	80	10	20	30	Upon completion of augering, free water and caved at ground surface.
	Peat		244											
	Amorphous, Dark Brown, Saturated													
-1.35														
	Sand With Gravel		243	1	SS	2								
2.15	Trace Silt													
	Gery, Saturated													
	Very Loose		242											
3.0	End Of Borehole													
	Auger Refusal													
	Probable Bedrock													
4.5														
6.0														
7.5														
9.0														
10.5														
12.0														
13.5														
15.0														
16.5														

NOTES:

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S12-32

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 15+442, 4.50 m Lt C/L, Hwy 69, SBL, Twp. of Seguin BORING DATE 98.03.16

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers

TECHNICIAN D. R.

SOIL PROFILE				SAMPLES				SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_P					
							DYNAMIC CONE PENETRATION x				WATER CONTENT W					
							STANDARD PENETRATION TEST •				W_P W W_L					
							BLOWS/0.3M				WATER CONTENT %					
GROUND ELEVATION 244.77				20 40 60 80				10 20 30								
0														Upon completion of augering, free water at ground surface, caved at 0.60 m.		
	Peat Amorphous, Black, Saturated		244													
1.5			243	1	SS	2										
2.30																
	Sand Trace Silt, Grey, Saturated, Very Loose		242													
3.0				2	SS	1										
3.05			241										W=67			
	Clayey Silt With Sand Silty Clay Seams, Grey, Very Soft		240	3	SS	50										
4.5																
4.70																
4.90			239													
	Sand With Gravel Grey, Saturated, Very Dense															
6.0																
	End Of Borehole Auger Refusal Probable Bedrock															
7.5																
9.0																
10.5																
12.0																
13.5																
15.0																
16.5																

NOTES:

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S12-35

PROJECT G.W.P. 291-97-00







OUR PROJECT 98TF010

LOCATION Station 15+467, 10.00 m Rt. C/L, Hwy 69, SBL, Twp. of Seguin BORING DATE 98.03.16

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN D. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_p				
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST *				WATER CONTENT W				
							BLOWS/0.3M				W_p W W_L				
							20	40	60	80	10	20	30		
0	GROUND ELEVATION 244.97														
-0.40	Fill Amorphous Peat With Sand Dark Brown, Moist		244					+						Upon completion of augering, free water at ground surface, caved at 0.60 m.	
1.5	Peat Amorphous, Brown, Saturated		243					+							
			242						+						
3.0			241					+							
-4.00			240					+							
4.5	Sand Grey, Saturated Compact		239												
5.00	End Of Borehole Auger Refusal Probable Bedrock														
6.0															
7.5															
9.0															
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S12-36

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 15+467, 4.00 m Lt. C/L, Hwy 69, SBL, Twp. of Seguin BORING DATE 98.03.16

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN D. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_P				
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST				WATER CONTENT %				
							BLOWS/0.3M				W_P W W_L				
							20 40 60 80				10 20 30				
0	GROUND ELEVATION 244.73														
	Peat Amorphous, Black, Saturated		244											Upon completion of augering, free water at ground surface.	
1.5			243	1	SS	1									
			242												
3.0			241	2	SS	2							W=326		
3.50			240												
4.5	Clay And Silt Grey, Very Soft		239	3	SS	0							W=65 W _L =44	Sample 3, CI W _L =44 W _P =23 I _p =21	
5.50			238												
6.0	Silt With Clay Grey, Very Soft		237	4	SS	16									
6.40															
7.5	Sand Trace Gravel, Grey, Saturated, Compact														
7.45															
	End Of Borehole Auger Refusal Probable Bedrock														
9.0															
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- +⁴ Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S12-39

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 15+492, 6.00 m Lt. C/L, Hwy 69, SBL, Twp. of Seguin BORING DATE 98.03.16

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers / Vane Test / Cone Test

TECHNICIAN D. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_P				
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				WATER CONTENT %				
							BLOWS/0.3M				W_P — W — W_L				
							20 40 60 80				10 20 30				
0	GROUND ELEVATION 244.74														
	Peat Fibrous, Dark Brown, Saturated		244											Upon completion of augering, free water at 0.30 m, cave at 1.20 m.	
1.5			243	1	SS	3									
2.15															
	Becoming Amorphous		242												
3.0															
3.65			241	2	SS	1									
	Clay And Silt Grey Soft		240												
4.5															
4.90															
	Sand Trace Silt, Trace Gravel Grey, Saturated Very Loose To Compact		239	3	SS	0									
6.0															
6.40															
6.70															
	Becoming Very Dense		238	4	SS	50/150mm									
7.5															
	End of Borehole Auger Refusal Probable Bedrock														
9.0															
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

- Vane and cone tests were carried out at a distance of 1.5 m and 2.5 m from the borehole, respectively.

CHECKED BY: E.W.

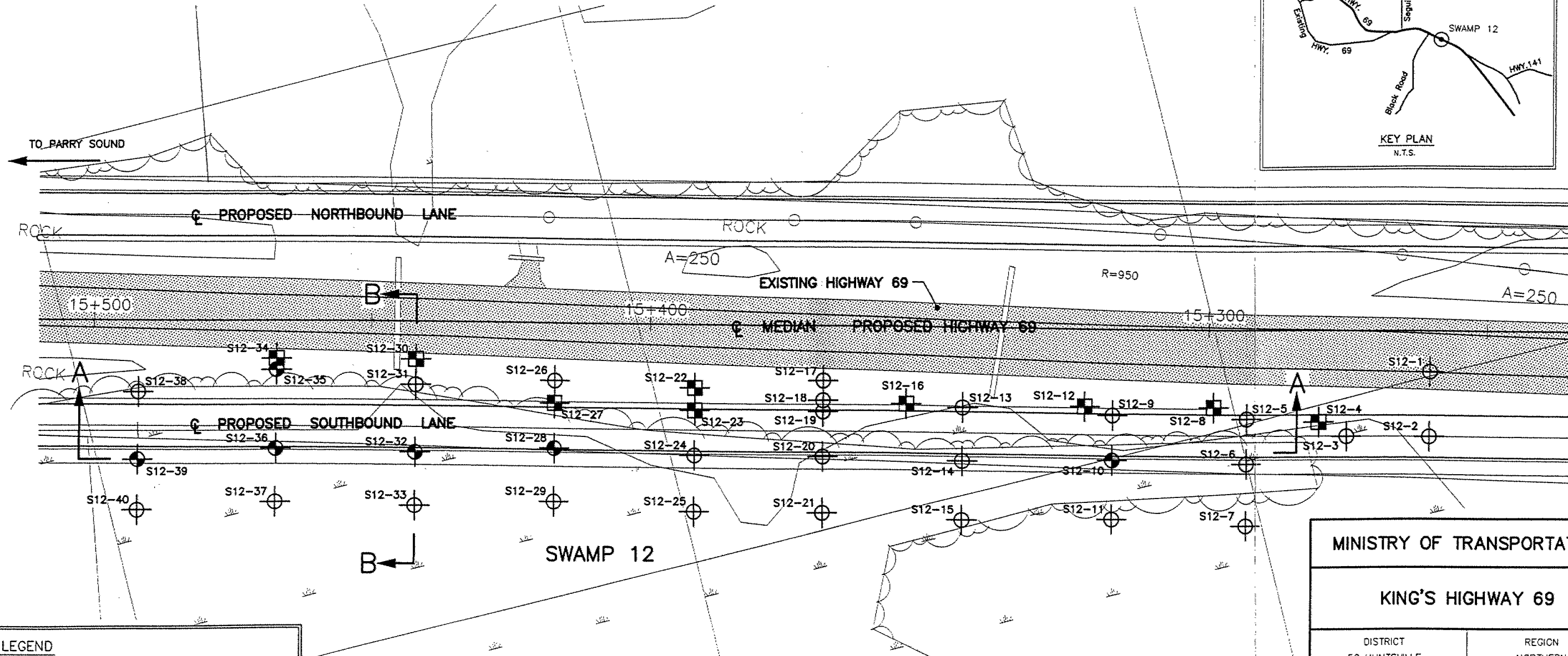
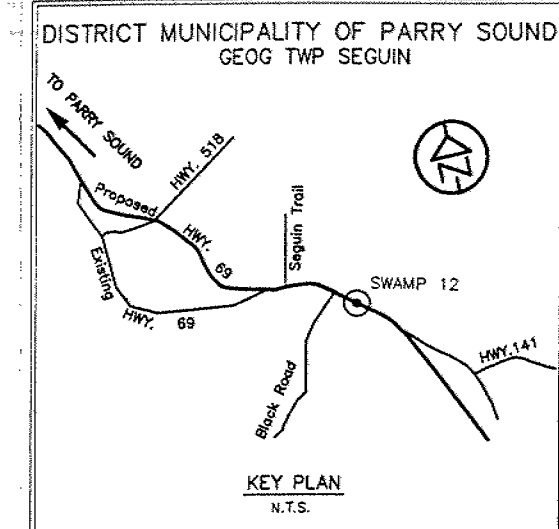
METRIC

PLATE No
PLATE No
CONT No
GWP No 291-97-00



STA TO STA
Survey SURVEYED Revised REVISED

SHEET



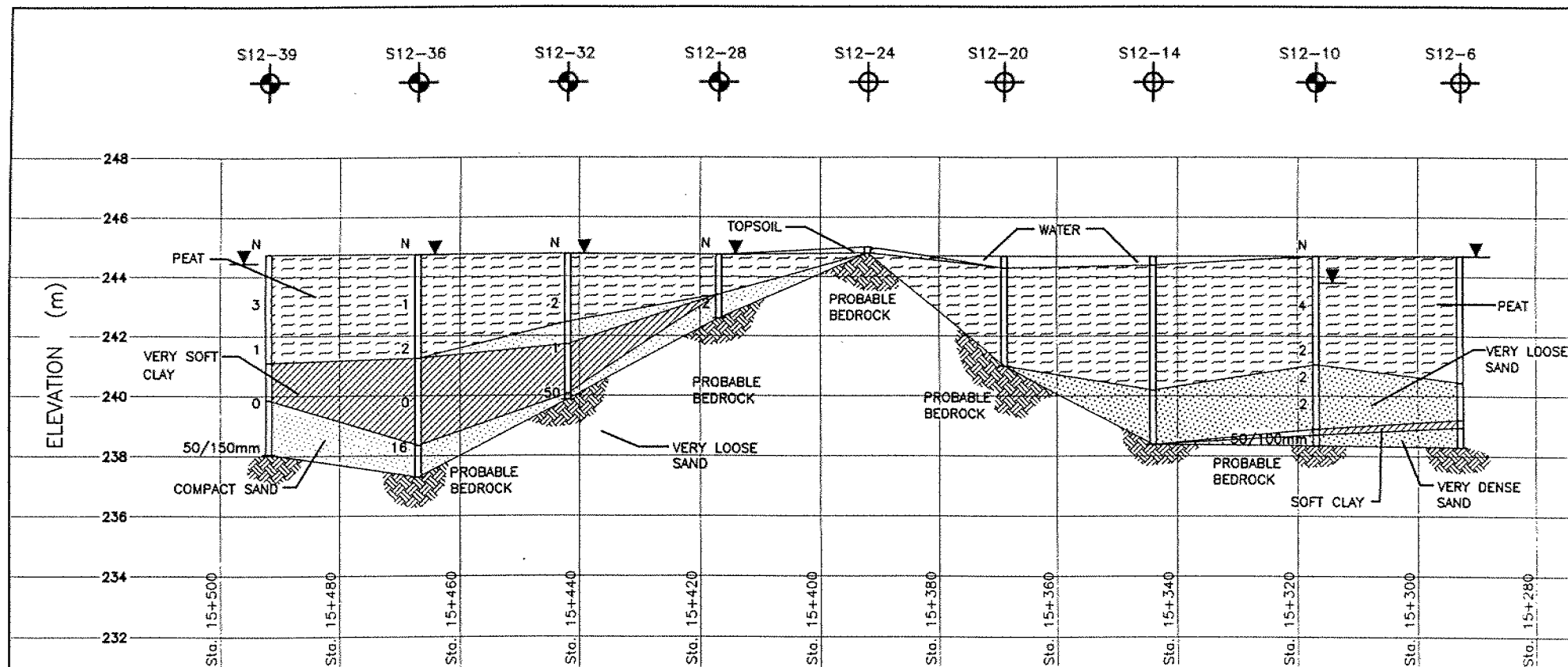
LEGEND

- BOREHOLE
- PROBEHOLE
- TEST PIT
- EXISTING HIGHWAY 69

NOTE REFER TO DRAWINGS 4A AND 4B FOR SOIL PROFILES.

MINISTRY OF TRANSPORTATION					
KING'S HIGHWAY 69					
DISTRICT 52 HUNTSVILLE			REGION NORTHERN		
GEOG. TWP. SEGUIN			DISTRICT MUNICIPALITY PARRY SOUND		
SWAMP 12 TESTHOLE LOCATION PLAN					
<i>Peto MacCallum Ltd.</i> <u>CONSULTING ENGINEERS</u> 45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C8					
DRAWN	CB	DATE	SCALE	JOB NO.	DRAWING NO.
CHECKED	EW	NOV. 1998	1:750	98TF010	4
APPROVED	DWK				





SECTION A-A (SOUTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:1000

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		ASPHALT
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 4 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

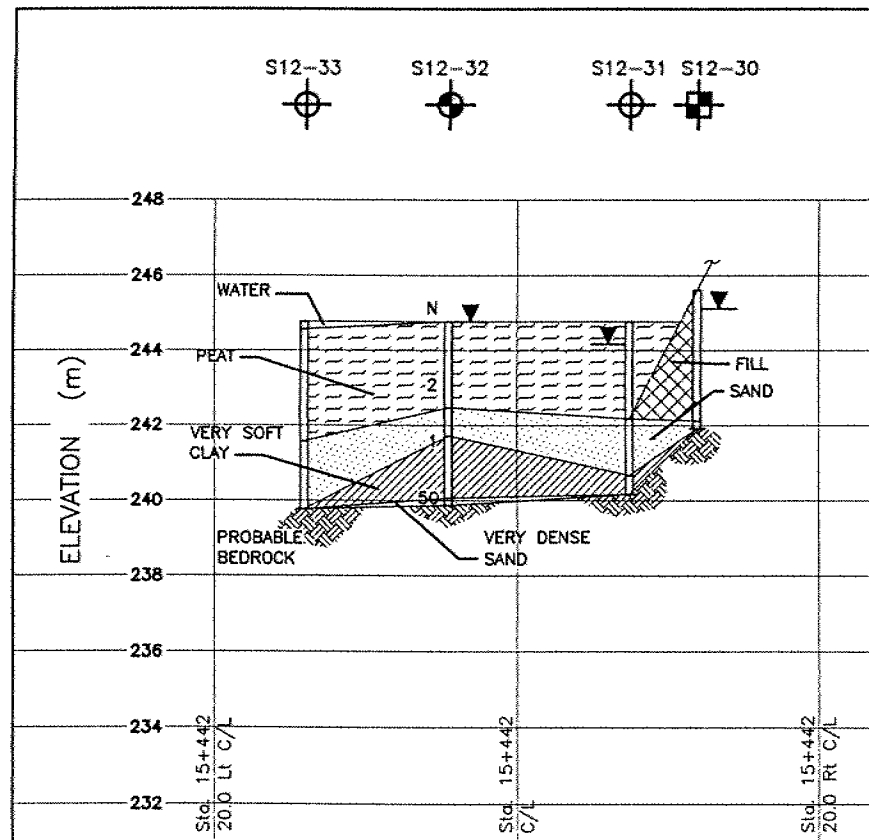
G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 12 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BLAIRFORD ROAD, HAMILTON, ONTARIO L8E 3G6
Tel (905) 591-2231 Fax (905) 591-5783

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	4A



SECTION B-B (SOUTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:500

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		ASPHALT
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 4 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 12 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BLAIRFORD ROAD, HAMILTON, ONTARIO, L8E 3G8
Tel: (905) 551-2231 Fax: (905) 501-5153

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	4B

GWP 291-97-00 Highway 69

District 52, Huntsville

Swamp 13

Station 16+230 - 16+300

Southbound Lane/Twp. of Seguin

Datum Centre Line Southbound Lane

S13-1	16+220	C/L	El. 233.42
	0-000	NFP BR	

S13-2	16+220	14.00 LT C/L	El. 233.67
	0-000	NFP BR	

S13-10	16+296	3.00 LT C/L	El. 233.43
	0-700	Fr Wat	
	700-3.10	Gry Si(y) Cl Tr Sa Tr Org	
	3.10-3.20	Gry Sa Sat	
	3.20	NFP BR	

S13-12	16+296	11.00 LT C/L	El. 232.74
	0-500	Fr Wat	
	500-3.20	Gry Si(y) Cl Tr Sa Tr Org	
	3.20-3.70	Gry Sa Sat	
	3.70	NFP BR	

LOG OF BOREHOLE NO. S13-3

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+250 13.00 m Rt C/L, Hwy 69, SBL Twp. of Seguin BORING DATE 98.09.01

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN M. R.

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u (kPa) +		LIQUID LIMIT W_L		GROUNDWATER OBSERVATIONS AND REMARKS			
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST		WATER CONTENT %					
							BLOWS/0.3M		WATER CONTENT %					
							20	40	60	80		10	20	30
0	GROUND ELEVATION 234.36						20	40	60	80	10	20	30	Upon completion of augering, free water at 2.20 m.
	Sand Fill Trace Silt, Brown, Dry, Loose		234											
-1.40			233	1	SS	8								
1.5	Becoming Dark Brown			2	SS	7								
-2.20			232											
	Becoming Saturated			3	SS	6								
-2.90														
3.0	Gravel And Cobble Fill Grey, Saturated		231	4	SS	8/50mm								
			230											
4.5	Sand Fill Brown Saturated			5	SS	4*								
5.40			229											
6.0	Peat Amorphous, Wet Sand Seams, Dark Brown, Wet													
			228	6	SS	4							W=113	
			227											
7.5				7	SS	2							W=44	
7.75														
	Clay With Silt And Sand Seams Grey, High Plastic, Stiff													
			226											
9.0			225	8	SS	1								
			224											
10.5	Sand Trace Silt, Grey, Saturated, Very Loose			9	SS	0								
			223											
11.60														
12.0	With Gravel													
12.30			222											
	End Of Borehole Auger Refusal Probable Bedrock													
13.5														
15.0														
16.5														

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- +³ Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S13-4

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+250, C/L, Hwy 69, SBL, Twp of Seguin

BORING DATE 98.09.02

ENGINEER

E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN

M. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L			GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - 1 VALUES	20 40 60 80				PLASTIC LIMIT W_P			
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				WATER CONTENT W			
							BLOWS/0.3M				W_P W W_L			
							20 40 60 80				10 20 30			
0	GROUND ELEVATION 232.98													
0.60	Sand Fill Numerous Rock Fragments													
1.5	Silt Fill Organic, Dark Brown, Saturated, Very Loose		232											
2.10			231	1	SS	3								
3.0	Peat Amorphous, Occasional Decayed Wood Pieces, Dark brown, Saturated		230											
3.30			229	2	SS	4						W=194		
4.5	With Sand Layers, Grey, Saturated		228	3	SS	1						W=451		
5.70			227											
6.0	Clay Grey, Soft		226	4	SS	0								
7.20			226	5	AS									
7.5	Silt Trace Sand, Grey, Saturated, Very Loose		225	6	SS	4								
8.40			224	7	AS									
9.0	Clay Mottled Brown And Grey, Soft		223	8	SS	0*						W=55		
10.5			222	9	AS									
12.0			221	10	SS	0								
12.35			220	11	SS	15								
13.20	Silt And Sand Grey, Saturated, Compact		219	12	SS	86/230mm								
13.5	Sand With Silt, Grey, Saturated, Very Dense		218											
14.35														
15.0	End Of Borehole Auger Refusal Probable Bedrock													
16.5														

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- * No Recovery.
- +7 Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S13-5

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+250, 13.00 m Lt. C/L, Hwy 69, SBL, Twp. of Seguin BORING DATE 98.09.02

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stern Augers / Vane Test

TECHNICIAN M. R.

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_P				
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				WATER CONTENT W				
							BLOWS/0.3M				W_P W W_L				
							20 40 60 80				WATER CONTENT %				
											10 20 30				
0	GROUND ELEVATION 232.46													Upon completion of augering, free water at 0.30 m.	
	Peat Amorphous, Dark Brown, Saturated		232												
			231	1	SS	1							W=86		
1.5			230												
			229	2	SS	1							W=410		
3.0			228												
			227	3	SS	1							W=184		
4.5	4.75	Clayey Silt Organic, Brown, Very Soft	226	4	TW	P.H.							W=92		
	5.70		225												
6.0		Clay Grey, High Plastic, Soft	224	5	TW	P.H.									
	7.20		223	6	SS	0							W=93		
7.5	With Silt Seams		222												
9.0			221	7	SS	0							W=47		
10.5			220												
	11.50														
12.0	12.00	With Sand And Gravel													
		End Of Borehole Auger Refusal Probable Bedrock													
13.5															
15.0															
16.5															

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- +³ Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S13-6

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+269, 9.00 m Lt. C/L, Hwy 69, NBL, Twp. of Seguin BORING DATE 98.09.02

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN M. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				PLASTIC LIMIT W_P				
							BLOWS/0.3M				WATER CONTENT %				
							20	40	60	80	10	20	30		
0	GROUND ELEVATION 234.10													Upon completion of augering, free water at 2.40 m.	
0.18	Sand Fill, Brown Loose														
	Ashphaltic Concrete (80mm)		233												
	Sand Fill Trace Silt, Trace Gravel, Brown, Moist, Loose		232	1	SS	8									
1.5			231												
3.0			230	2	SS	4									
4.20															
4.5	Peat Amorphous, Dark Brown, Damp		229	3	SS	4							W=523		
	Becoming Fibrous Peat Occasional Decomposed Wood Pieces		228												
6.0	Clay Grey, High Plastic, Very Soft		227	4	TW	P.H.							W=44		
7.20															
	Sand With Silt Brown, Saturated, Loose		226	5	SS	6									
8.60															
9.0	End Of Borehole Auger Refusal Probable Bedrock		225												
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S13-7

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+269, C/L, Hwy 69, SBL, Twp. of Seguin

BORING DATE 90.09.03

ENGINEER

E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN

M. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				PLASTIC LIMIT W_P				
							BLOWS/0.3M				WATER CONTENT %				
							20	40	60	80	10	20	30		
0	GROUND ELEVATION 232.49													Upon completion of augering, free water at 0.30 m.	
0.60	Sand Fill With Rock Fragments		232												
1.5	Peat Amorphous. Dark Brown, Saturated		231												
				1	SS	1						W=209			
				230											
3.0			229												
			2	SS	1							W=398			
4.20															
4.5	Clay Grey, High Plastic, Firm		228												
				3	SS	0									
5.70			227												
6.0	Silt With Sand Grey, Saturated, Very Loose		226												
			4	TW	P.H.							W=51			
7.00															
7.5	Clay Grey, Soft		225												
				5	SS	0									
9.0			224												
8.85															
	Sand And Silt With Gravel Grey, Saturated, Loose		223												
			5	SS	9										
10.5			222												
10.55															
12.0	End Of Borehole Auger Refusal Probable Bedrock		221												

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- + Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S13-8

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+269, 13.00 m Lt. C/L, Hwy 69, SBL, Twp. of Seguin




















BORING DATE 98.09.02

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN

M. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_p				
							DYNAMIC CONE PENETRATION x				WATER CONTENT W				
							STANDARD PENETRATION TEST •				W_p W W_L				
							BLOWS/0.3M				WATER CONTENT %				
	GROUND ELEVATION 232.36						20	40	60	80	10	20	30		
0	Peat Amorphous Dark Brown		232											Upon completion of augering, free water at 0.30 m.	
			231												
1.5	1.70			1	SS	0									
	Becoming Fibrous		230												
															
3.0			229	2	SS	0									
															
4.20			228												
4.5	Clay Brown, High Plastic Very Soft			3	SS	0									
			227												
5.70															
6.0	Becoming Mottled Brown And Grey		226	4	SS	0									
				5	TW	P.H.									
			225												
7.5															
			224	6	SS	0									
8.25															
	Sand Grey, Saturated Loose		223												
9.0															
9.45															
	End Of Borehole Auger Refusal Probable Bedrock		222												
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

1. +³ Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S13-9

PROJECT G.W.P. 291-97-00




OUR PROJECT 98TF010

LOCATION Station 16+296, 5.00 m Rt C/L, Hwy 69, SBL, Twp. of Seguin BORING DATE 98.09.01

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN M. R.

SOIL PROFILE				SAMPLES				SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_P					
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				WATER CONTENT W					
							BLOWS/0.3M				W_P W W_L					
							20 40 60 80				10 20 30					
0	GROUND ELEVATION 232.74															
	Sand Fill Trace Silt, Brown, Wet		232											(Old Hwy 69 Embankment Fill)		
1.50																
	Peat Amorphous, Dark Brown, Moist		231													
2.45				1	SS	2							W=60			
	Silty Clay Trace Sand, Grey, Very Soft		230													
3.0				2	SS	0							W=46 W _L =48	Sample 2, CI W _L = 48 W _p = 21 I _p = 27		
3.55			229													
	End Of Borehole Auger Refusal Probable Bedrock															
4.5																
6.0																
7.5																
9.0																
10.5																
12.0																
13.5																
15.0																
16.5																

NOTES:

1. +4 Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S13-11

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+296, 9.00 m Lt. C/L, Hwy 69, NBL, Twp of Seguin BORING DATE 98.03.08

ENGINEER E. W.

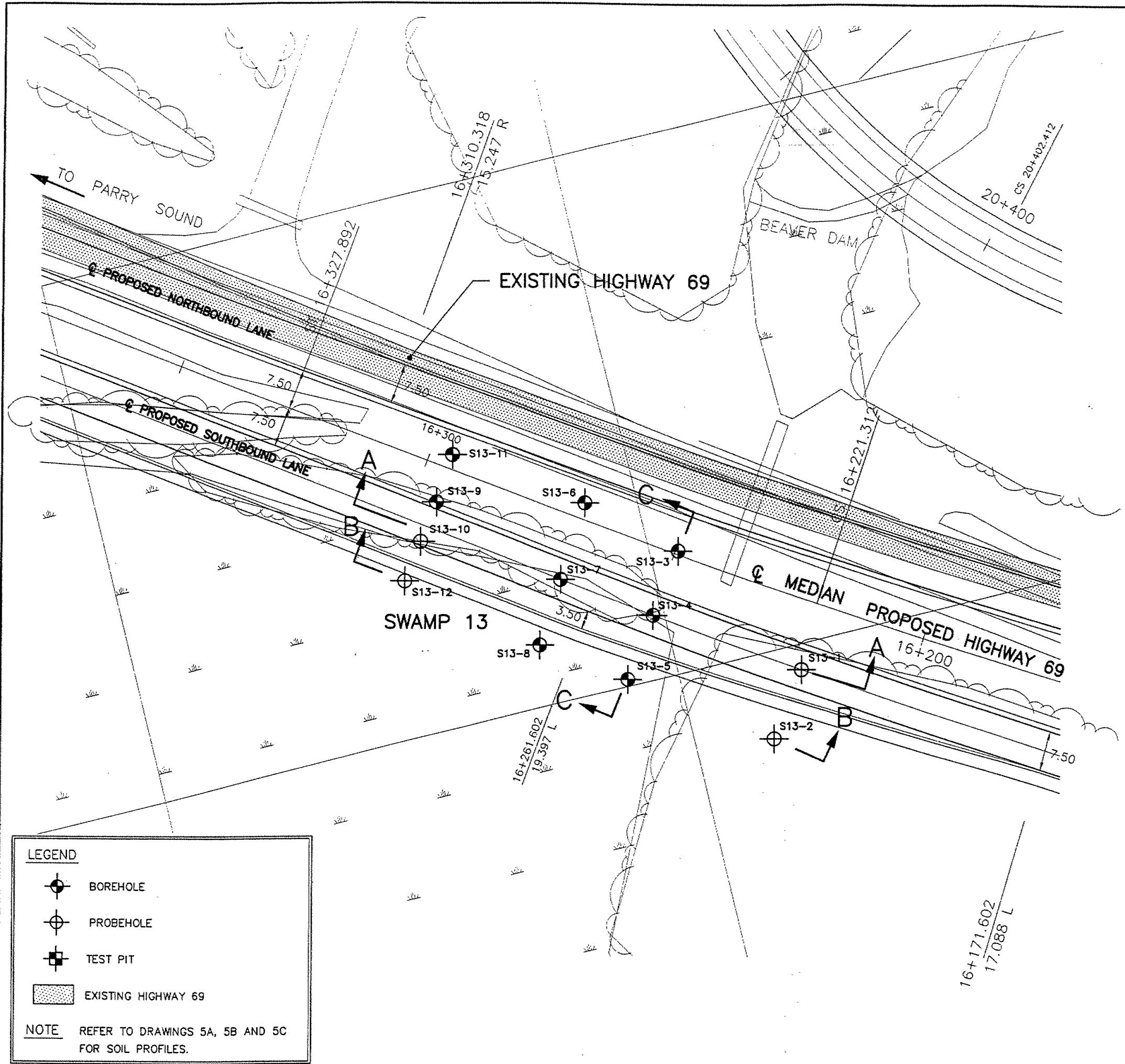
BORING METHOD Continuous Flight Hollow Stem Augers

TECHNICIAN M. R.

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L			GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_p			
							DYNAMIC CONE PENETRATION x				WATER CONTENT W			
							STANDARD PENETRATION TEST •				W_p W W_L			
							BLOWS/0.3M				WATER CONTENT %			
							20	40	60	80	10	20	30	
0	GROUND ELEVATION 233.75													Upon completion of augering, free water at 2.70 m.
	Sand Fill With Silt Brown, Moist, Loose		233											
1.5			232	1	SS	11								
1.85														
2.30	Topsoil Clayey Silt, Dark Brown, High Organic		231											
2.60														
3.0	Peat Amorphous, Dark Brown		230	2	SS	3								
3.95														
4.5	Clay Grey, High Plastic, Very Soft		229											
4.75														
5.10	With Silt Layers													
6.0	With Gravel		228											
	End Of Borehole Auger Refusal Probable Bedrock													
7.5														
9.0														
10.5														
12.0														
13.5														
15.0														
16.5														

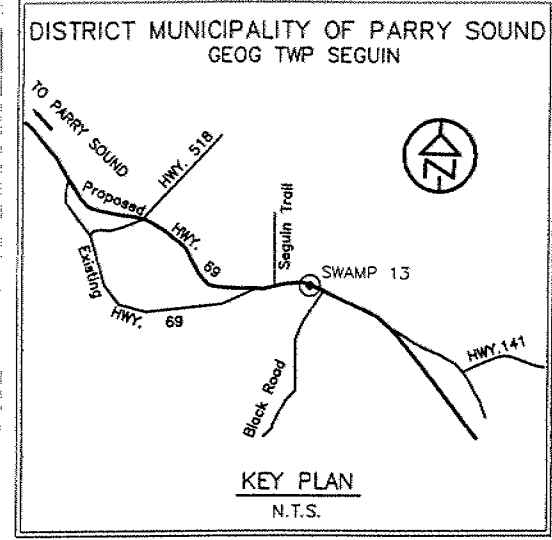
NOTES:

CHECKED BY: E.W.



METRIC

PLATE No		SHEET
PLATE No		
CONT No		
GWP No	291-97-00	
STA	TO STA	
Survey	SURVEYED	Revised
	REVISED	



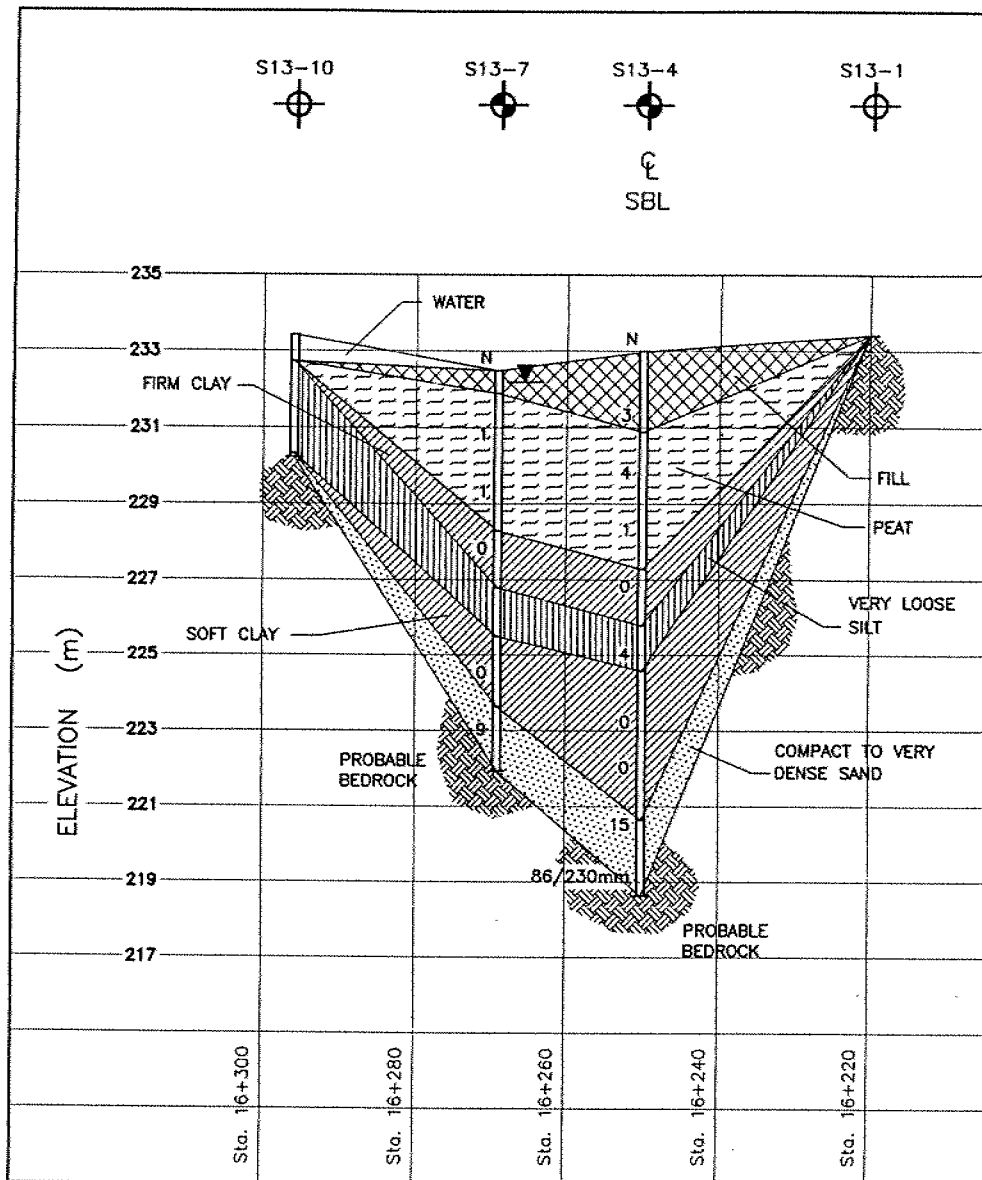
LEGEND

- BOREHOLE
- PROBEHOLE
- TEST PIT
- EXISTING HIGHWAY 69

NOTE REFER TO DRAWINGS 5A, 5B AND 5C FOR SOIL PROFILES.



MINISTRY OF TRANSPORTATION				
KING'S HIGHWAY 69				
DISTRICT 52 HUNTSVILLE		REGION NORTHERN		
GEOG. TWP. SEGUIN		DISTRICT MUNICIPALITY PARRY SOUND		
SWAMP 13 TESTHOLE LOCATION PLAN				
<i>Peto MacCallum Ltd.</i> <u>CONSULTING ENGINEERS</u> 45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C8				
DRAWN CB	DATE NOV. 1998	SCALE 1:750	JOB NO. 98TF010	DRAWING NO. 5
CHECKED EW				
APPROVED DWK				



SECTION A-A (SOUTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:1000

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 5 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOF OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

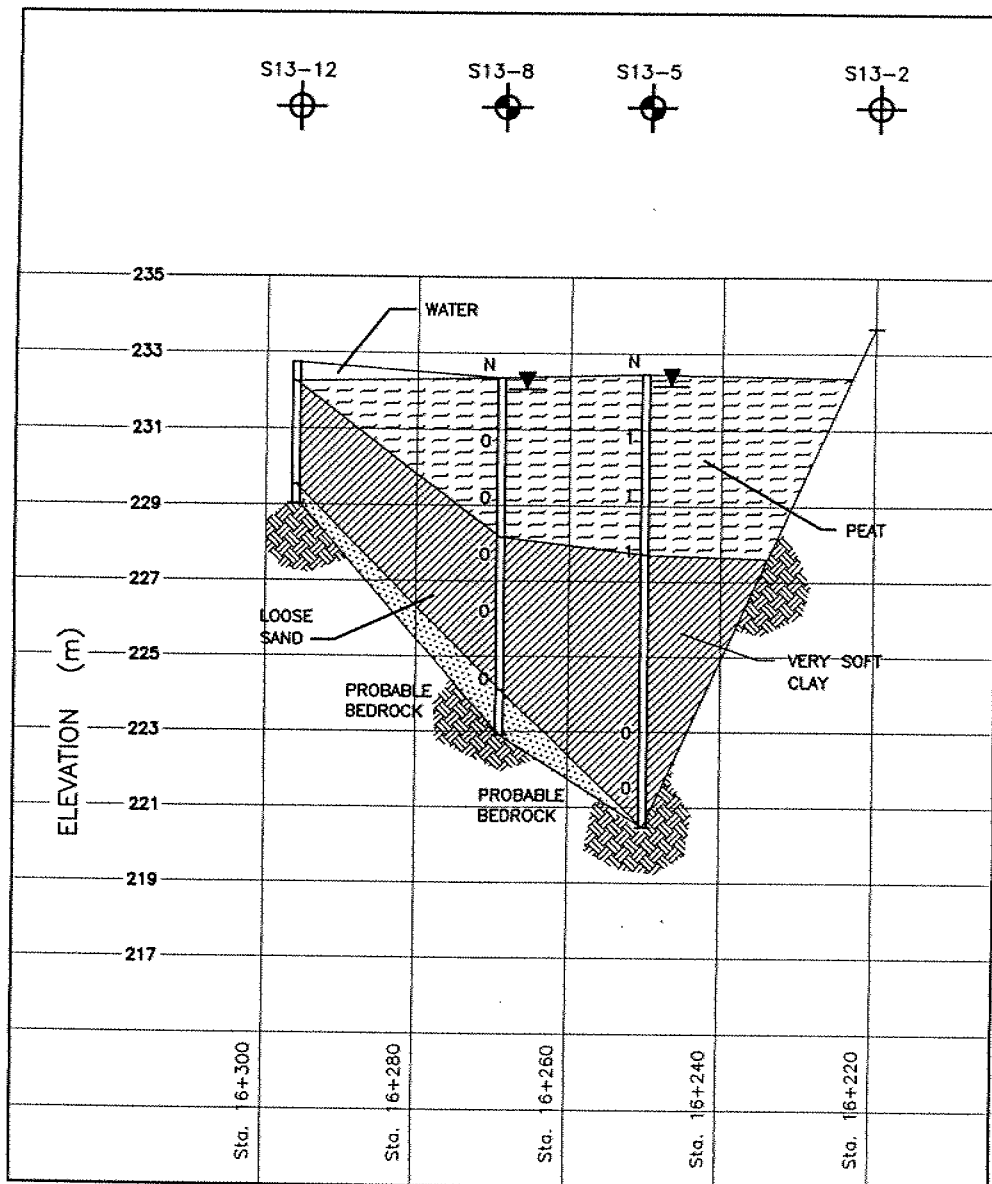
G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 13 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

43 BURFORD ROAD, HAMILTON, ONTARIO L8E 3G6
Tel: (905) 561-2231 Fax: (905) 561-5363

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	5A



SECTION B-B (SOUTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:1000

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 5 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOF OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

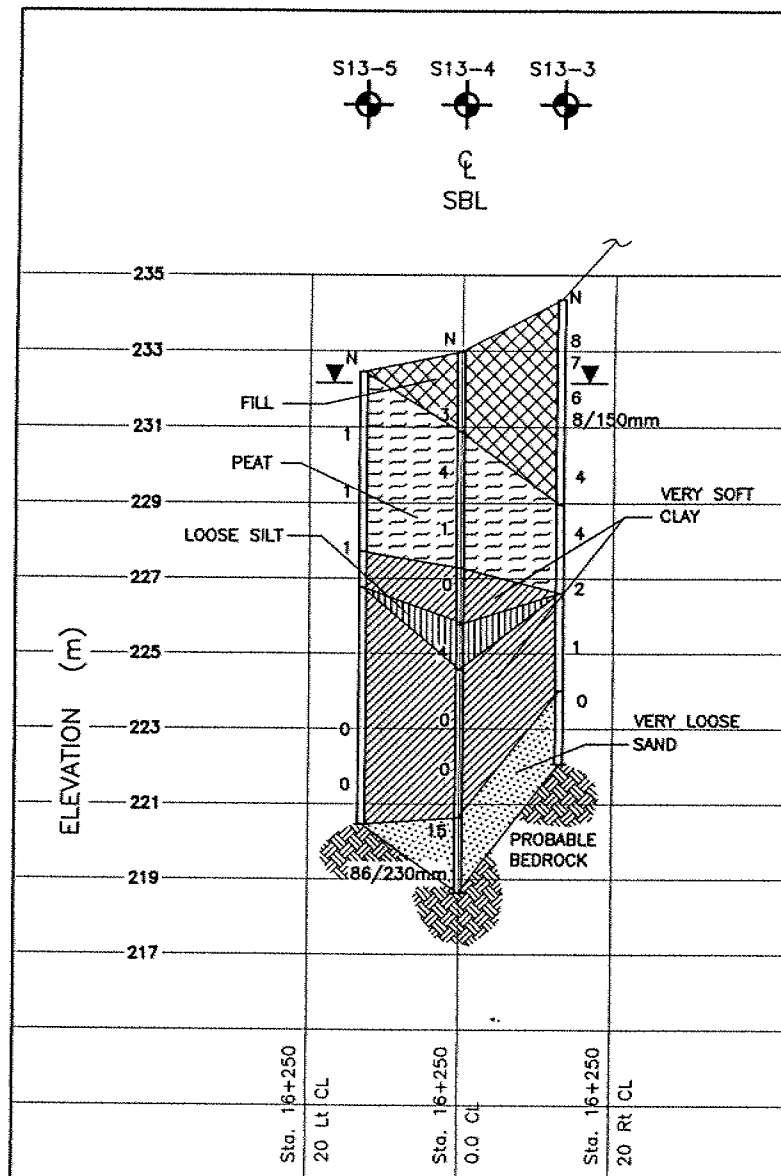
G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 13 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C6
Tel: (905) 581-2231 Fax: (905) 581-6363

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	5B



SECTION C-C (NORTHBOUND/SOUTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:1000

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 5 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOF OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 13 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C8
Tel: (905) 561-2231 Fax: (905) 561-6363

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	5C

S14-4	16+790	9.60 RT C/L	El. 234.65
	(Edge of Existing Pavement)		
	0-220	Asph	
	220-480	Cr Gr Moist	
	480-1.15	Br F-Med Sa Tr Si Tr Gr (Fill) Moist	
	1.15	NFP Poss RF/BR	
S14-5	16+790	6.10 RT C/L	El. 234.45
	(Edge of Existing Paved Shoulder)		
	0-330	Asph	
	330-930	Cr Gr Moist	
	930-1.20	Br F-Med Sa Tr Si Tr Gr (Fill) Moist	
	1.20-1.70	RF	
	1.70	NFP RF	
S14-7	16+796	11.00 LT C/L	233.40
	0-3.35	Dk Br F Fib Peat OCC Decomp Wd Pieces	
	3.35-3.95	V Soft Br Org Si(y) Cl	
	3.95-9.15	V Soft Gry To Br Cl W Si And Sa Seams	
	9.15-11.45	Br Si(y) F Sa Sat	
	11.45	NFP BR	

GWP 291-97-00 Highway 69

District 52, Huntsville

Swamp 14

Station 16+755 - 16+830

Northbound Lane/Twp. of Seguin

Datum Centre Line Northbound Lane

S14-8	16+815	C/L	El. 233.40
	0-2.90	Dk Br Amor Peat OCC Decomp	
		Wd Pieces	
	2.90-3.35	Br Org Si(y) Cl	
	3.35-6.45	V Soft Br And Gry Cl W Si	
		Seams	
	6.45-7.30	Gry F Sa And Si Sat	
	7.30-9.30	Gry Cl	
	9.30-10.80	Gry F Sa And Si Sat	
	10.80	NFP BR	
		Fr Wat @ 600	

S14-9	16+815	11.00 LT C/L	El. 233.40
	0-4.25	Dk Br Amor Peat	
	4.25-4.90	Br Org Si(y) Cl	
	4.90-7.00	V Soft Gry Cl	
	7.00-10.80	Br And Gry Cl W Si Seams	
	10.80-11.35	Gry Si(y) F Sa Tr Gr Sat	
	11.35	NFP BR	
		Fr Wat @ 600	

S14-10	16+830	C/L	El. 233.40
	0-1.50	Dk Br F Fib Peat	
	1.50-3.00	Dk Br Amor Peat OCC Decomp	
		Wd Pieces	
	3.00-3.65	Br Org Si(y) Cl	
	3.65-3.95	Gry Cl	
	3.95	NFP BR	

GWP 291-97-00 Highway 69
District 52, Huntsville
Swamp 14
Station 16+755 - 16+830
Southbound Lane/Twp. of Seguin
Datum Centre Line Southbound Lane

S14-12 16+757 6.50 LT C/L El. 233.80
0-900 Dk Br F Fib Peat Sat
900-5.05 Dk Br Amor Peat Sat
5.05-7.00 Gry F-Med Sa Tr Si Sat
7.00 NFP BR
Fr Wat @ 0

S14-13 16+782 8.00 RT C/L El. 233.80
0-900 Dk Br F Fib Peat
900-3.95 Dk Br Amor Peat
3.95-9.75 Gry Si(y) Cl Tr Sa Sat
9.75-10.05 Gry Sa Sat
10.05 NFP BR
Fr Wat @ 0

S14-14 16+782 C/L El. 233.80
0-900 Dk Br F Fib Peat Moist
900-3.65 Dk Br Amor Peat Sat
3.65-10.05 Gry Si(y) Cl Tr Sa
10.05-10.50 Gry F-Med Sa Tr Gr Tr Si Sat
OCC Cob
10.50 NFP BR
TH Caved @ 1.85
Fr Wat @ 900

S14-15 16+782 8.00 LT C/L El. 233.80
0-1.85 Dk Br F Fib Peat Sat
1.85-3.80 Dk Br Amor Peat Sat
3.80-8.20 Gry Si(y) Cl Tr Sa Sat
8.20-9.45 Gry F-Med Sa Tr Gr Tr Si Sat
9.45 NFP BR
BH Caved @ 900
Fr Wat @ 0

S14-16 16+807 10.50 RT C/L El. 233.80
0-3.80 Dk Br Amor Peat Sat
3.80-11.15 Gry Si(y) Cl Tr Sa Sat
Cob @ 11.00
11.15-12.05 Gry F-Med Sa Tr Gr Si Sat
12.05 NFP BR
TH Caved @ 1.85
Fr Wat @ 900

S14-18 16+807 11.50 LT C/L El. 234.0
0-3.05 Dk Br Amor Peat Sat
3.05-5.35 Gry Si (y) Cl Tr F Sa
5.35 NFP BR
TH Caved @ 1.20
Fr Wat @ 900

LOG OF BOREHOLE NO. S14-6

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+796, C/L, Hwy 69, NBL, Twp. of Sequin

BORING DATE 98.03.12

ENGINEER

E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN

M. R.

SOIL PROFILE				SAMPLES		SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L			GROUNDWATER OBSERVATIONS AND REMARKS	
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	20 40 60 80				PLASTIC LIMIT W_P			
							DYNAMIC CONE PENETRATION x				WATER CONTENT %			
							STANDARD PENETRATION TEST				W_P W W_L			
							BLOWS/0.3M				10 20 30			
0	GROUND ELEVATION 233.40													
	Peat		233											
	Fine Fibrous To Amorphous, Dark Brown		232	1	SS	0								
1.5			231											
			230	2	SS	0								
3.0	Clay		229											
	Grey		228											
	Very Soft		227	3	SS	8								
4.40	With Silt Seams		226	4	SS	45								
			225											
6.00	Sand		224											
	Trace Silt, Grey, Saturated, Loose To Dense													
7.5														
8.85	End Of Borehole Auger Refusal Probable Bedrock													
9.0														
10.5														
12.0														
13.5														
15.0														
16.5														

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- +⁹ Number refers to sensitivity.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S14-11

PROJECT G.W. P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+757, 1.50 m Rt. C/L, Hwy 69, SBL, Twp. of Seguin BORING DATE 98.03.24 ENGINEER

E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Cone Test

TECHNICIAN D. R.

[illegible]

NOTES:-

1. Cone test was carried out at a distance of 1.5 m from the borehole.

CHECKED BY: E.W.

LOG OF BOREHOLE NO. S14-17

PROJECT G.W.P. 291-97-00

OUR PROJECT 98TF010

LOCATION Station 16+807, 0.50 m Lt. C/L, Hwy 69, SBL, Twp of Seguin BORING DATE 98.02.12

ENGINEER E. W.

BORING METHOD Continuous Flight Hollow Stem Augers/ Vane Test

TECHNICIAN M. R.

SOIL PROFILE				SAMPLES			SHEAR STRENGTH C_u (kPa) +				LIQUID LIMIT W_L				GROUNDWATER OBSERVATIONS AND REMARKS
DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N = VALUES	20 40 60 80				PLASTIC LIMIT W_P				
							DYNAMIC CONE PENETRATION x STANDARD PENETRATION TEST •				WATER CONTENT %				
							BLOWS/0.3M				WATER CONTENT %				
							BLOWS/0.3M				WATER CONTENT %				
0	GROUND ELEVATION 233.80						20 40 60 80				10 20 30				
	Peat		233											Upon completion of augering, free water at ground surface, caved at 1.20 m.	
	Amorphous,														
	Dark brown, Saturated														
1.5			232	1	SS	1							W=967		
			231												
3.0				2	SS	1								W=538	
			230												
4.30															
4.5	Silty Clay		229	3	SS	0								W=64	
	Trace Sand,														
	Grey,														
	Soft														
5.95			228	4	TW	P.H.								W _L =45	
														W=54	
6.0				5	SS	2									
6.40	Sand With Silt		227												
	Trace Gravel,														
	Grey, Saturated,														
	Very Loose														
7.00															
7.5	Clayey Silt		226												
	Grey,														
	Firm														
9.0	End Of Borehole														
	Auger Refusal														
	Probable Bedrock														
10.5															
12.0															
13.5															
15.0															
16.5															

NOTES:

- Vane test was carried out at a distance of 1.5 m from the borehole.
- +³ Number refers to sensitivity.

CHECKED BY: E.W.

METRIC

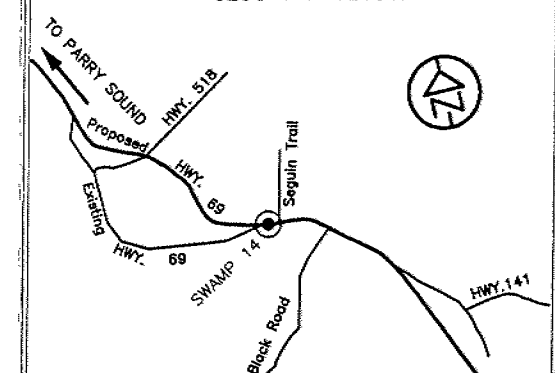
PLATE No
PLATE No
CONT No
GWP No 291-97-00



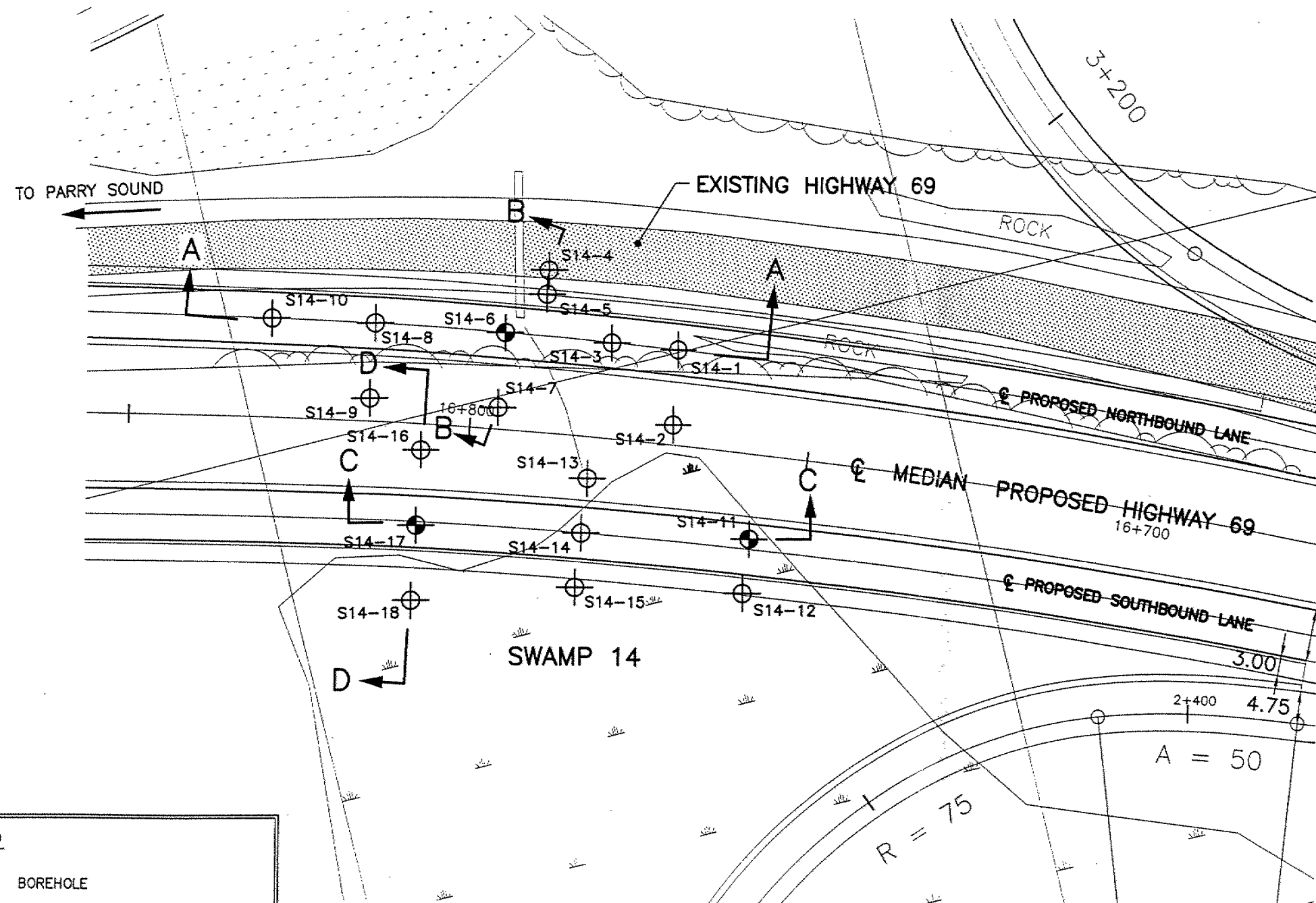
SHEET

STA TO STA
Survey SURVEYED Revised REVISED

DISTRICT MUNICIPALITY OF PARRY SOUND
GEOG TWP SEGUIN



KEY PLAN
N.T.S.



LEGEND

- BOREHOLE
- PROBEHOLE
- TEST PIT
- EXISTING HIGHWAY 69

NOTE REFER TO DRAWINGS 6A TO 6D
FOR SOIL PROFILES.

10m 5m 0 5m 10m

MINISTRY OF TRANSPORTATION

KING'S HIGHWAY 69

DISTRICT
52 HUNTSVILLE

REGION
NORTHERN

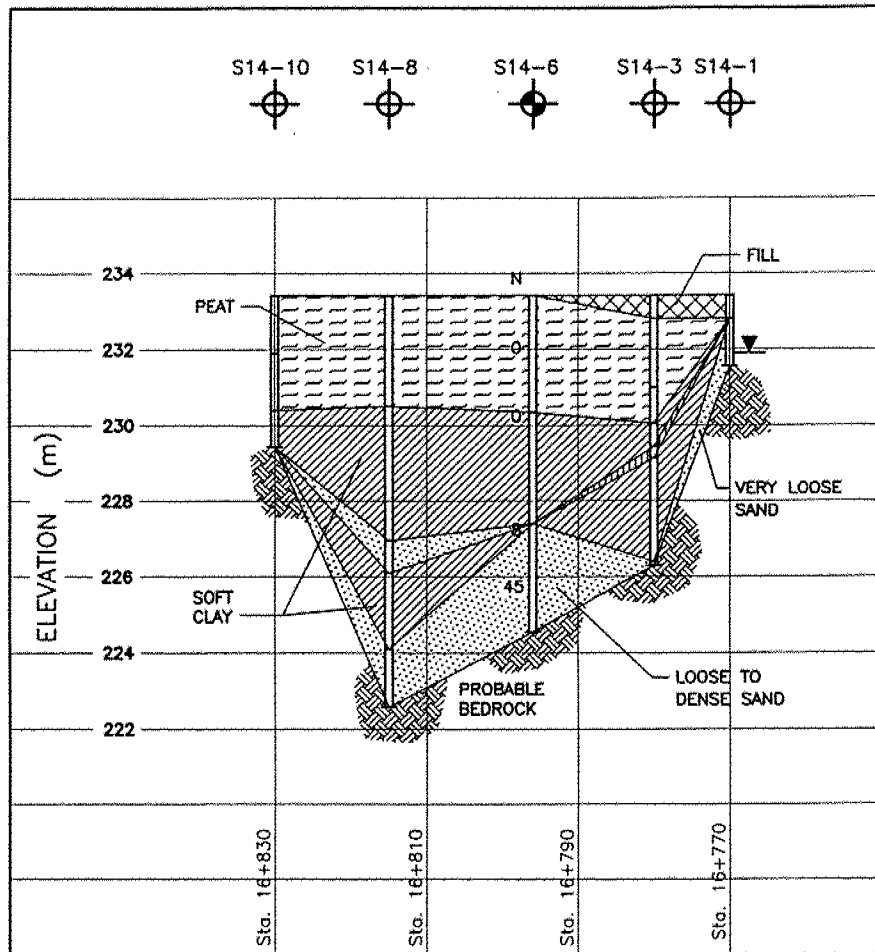
GEOG. TWP.
SEGUIN

DISTRICT MUNICIPALITY
PARRY SOUND

SWAMP 14
TESTHOLE LOCATION PLAN

Peto MacCallum Ltd.
CONSULTING ENGINEERS
45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C6

DRAWN	CB	DATE	SCALE	JOB NO.	DRAWING NO.
CHECKED	EW	NOV. 1998	1:750	98TF010	6
APPROVED	DWK				



SECTION A-A (NORTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:1000

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTE

1. REFER TO DRAWING NO. 6 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

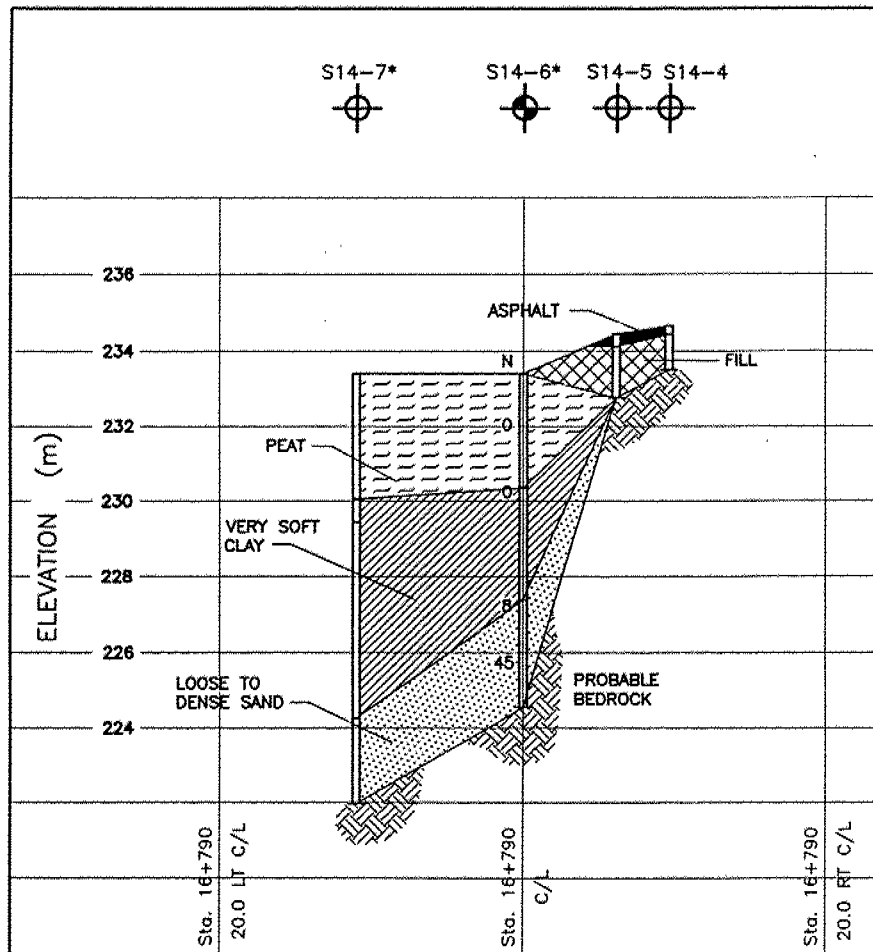
Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C8
Tel: (905) 561-2231 Fax: (905) 561-8383

DATE	SCALE	JOB NO.	DRAWING NO.
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SWAMP 14 - SOIL PROFILES

JAN. 1999	AS SHOWN	98TF010	6A
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SECTION B-B (NORTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:500

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 6 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.
4. * TESTHOLE DRILLED AT STA. 14+796.

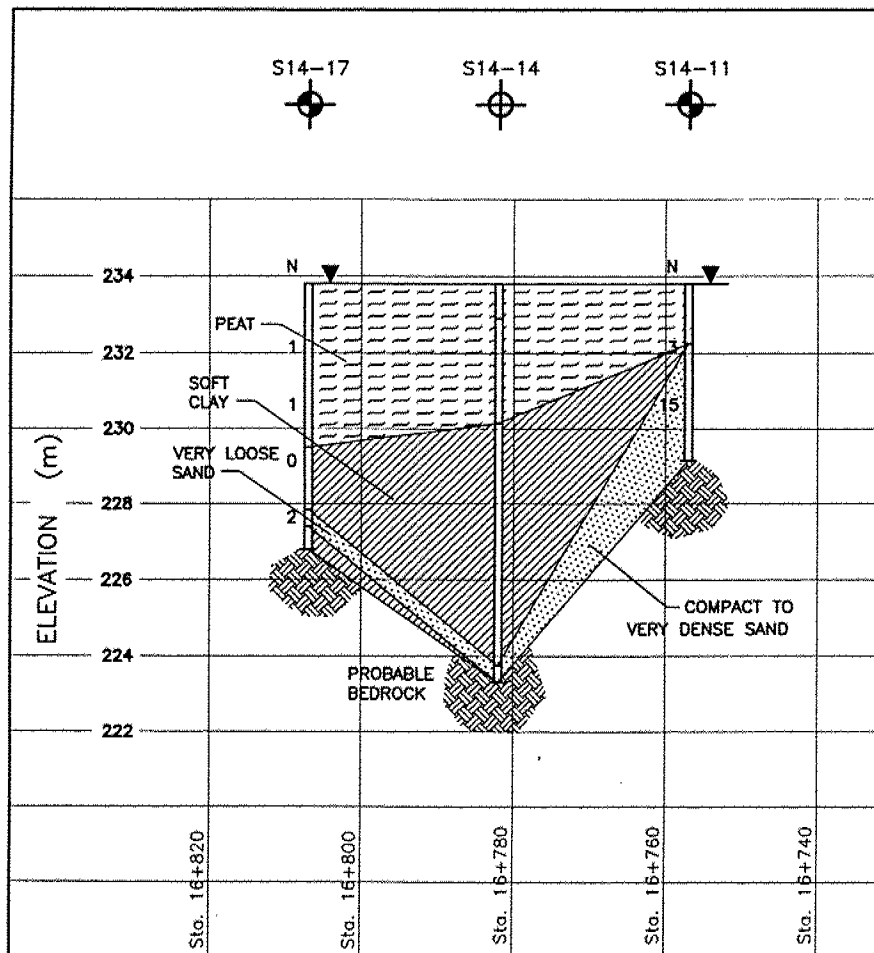
G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 14 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C6
Tel: (905) 561-2231 Fax: (905) 561-6363

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	6B



SECTION C-C (SOUTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:1000

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 6 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

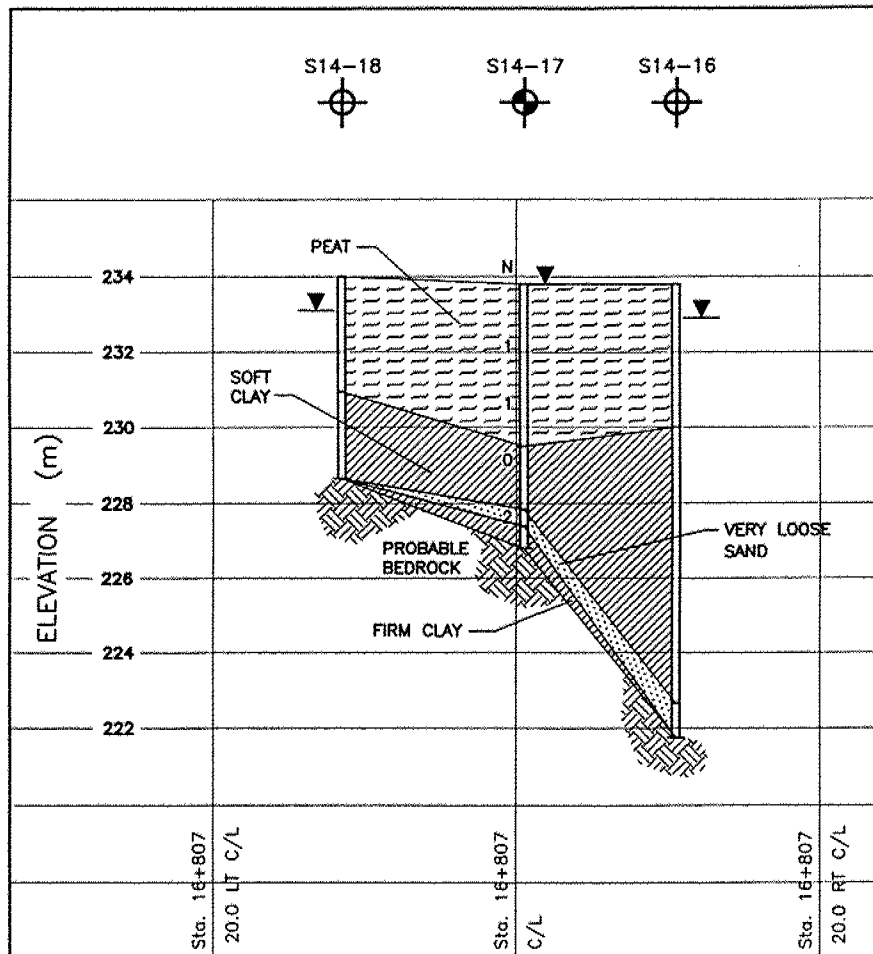
G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURNFORD ROAD, HAMILTON, ONTARIO L8E 3C8
Tel. (905) 561-2231 Fax (905) 561-6363

SWAMP 14 - SOIL PROFILES

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	6C



SECTION D-D (SOUTHBOUND LANE)

SCALE VERTICAL 1:200
HORIZONTAL 1:500

LEGEND

	PROBEHOLE		BOREHOLE		TEST PIT
	FILL		SAND		SILT
	PEAT/TOPSOIL		BEDROCK (INFERRED)		WATER
	CLAY		OBSERVED WATER LEVEL (DURING OR UPON COMPLETION OF DRILLING)		

NOTES

1. REFER TO DRAWING NO. 6 FOR TESTHOLE AND SECTION LOCATIONS
2. REFER TO LOG OF TESTHOLE SHEETS FOR DETAILED SUBSURFACE CONDITIONS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT TESTHOLE LOCATION. BETWEEN TESTHOLES, BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.

G.W.P. 291-97-00, HIGHWAY 69
TWP. OF SEGUIN
DISTRICT 52, HUNTSVILLE, ONTARIO

SWAMP 14 - SOIL PROFILES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

45 BURFORD ROAD, HAMILTON, ONTARIO L8E 3C6
Tel: (905) 561-2231 Fax: (905) 561-6363

DATE	SCALE	JOB NO.	DRAWING NO.
JAN. 1999	AS SHOWN	98TF010	6D

APPENDIX C

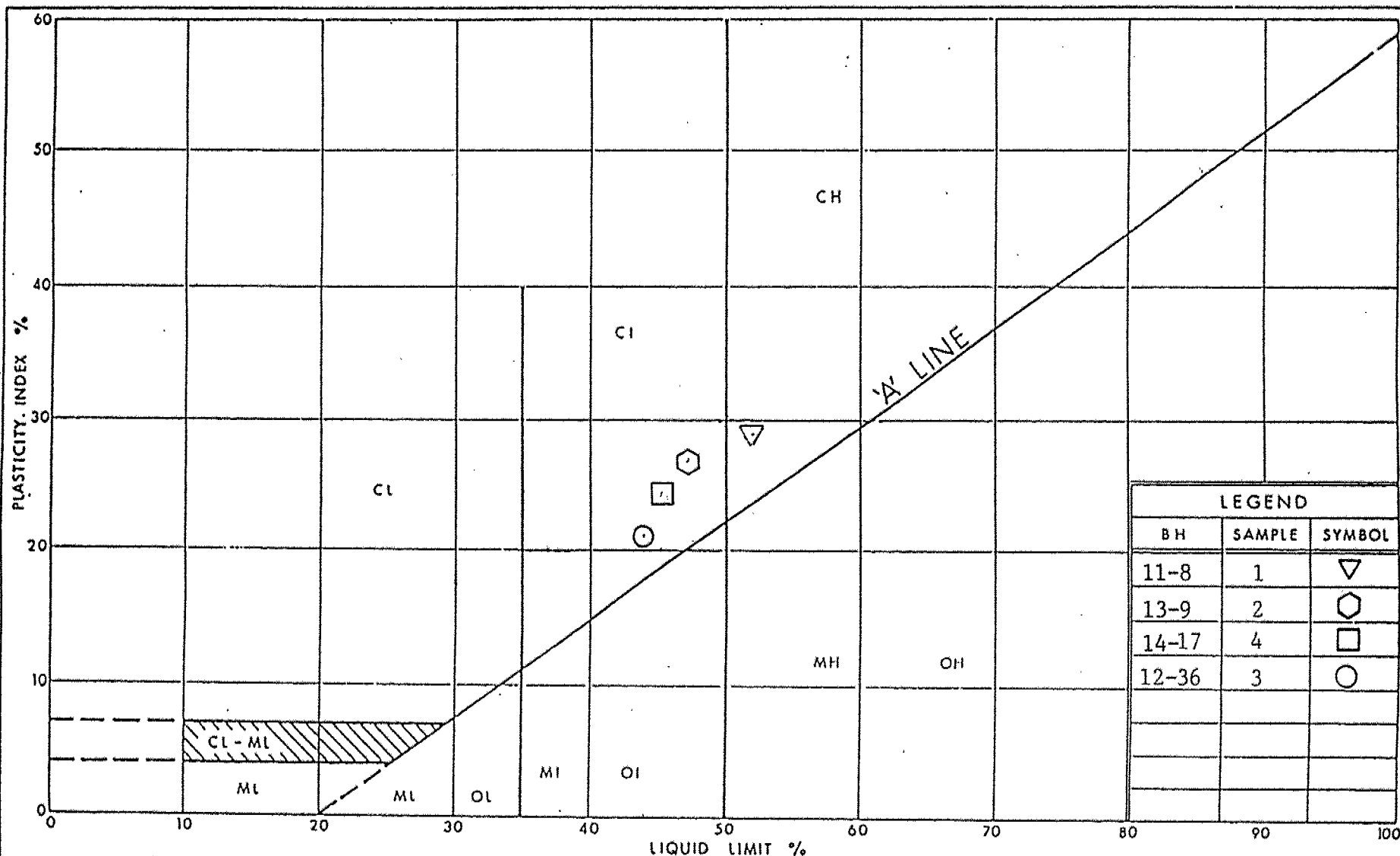
Laboratory Test Results

Table II -	Laboratory Triaxial Compression Test Results
Figure 1 -	Plasticity Chart, Silty Clay
Figure 2 -	Plasticity Chart, Silt and Clay
Figures 3 to 6 -	Consolidation Test Results
Figures 7 to 10 -	Particle Size Distribution Charts

TABLE II
TRIAXIAL COMPRESSION TEST RESULTS
G.W.P. 291-97-00

SWAMP NO.	TESTHOLE NO.	STATION	SAMPLE DEPTH (m)	CONSOLIDATED UNDRAINED TEST				
				SOIL TYPE	CELL PRESSURE (kPa)	DEVIATOR STRESS (kPa)	SHEAR* STRENGTH (kPa)	FRICTION ANGLE (Degree)
11	8	14+654 14.2 m RT C/L, NBL	5.5 – 6.1	Silty Clay	105	69.0	63.4	23.3
13	9	16+296 5.0 m RT C/L, SBL	2.8 – 3.4	Silty Clay	60	35.2	32.7	21.7
14	17	16+807 0.5 m LT C/L, SBL	5.2 – 5.8	Silty Clay	90	62.1	56.8	24.1
**	**	16+321 2.0 m LT C/L, SBL	4.0 – 4.3	Silt and Clay	125	254.8	60.0	19.7

* Shear strength defined by a line drawn through the origin tangent to the failure circle.



Ontario

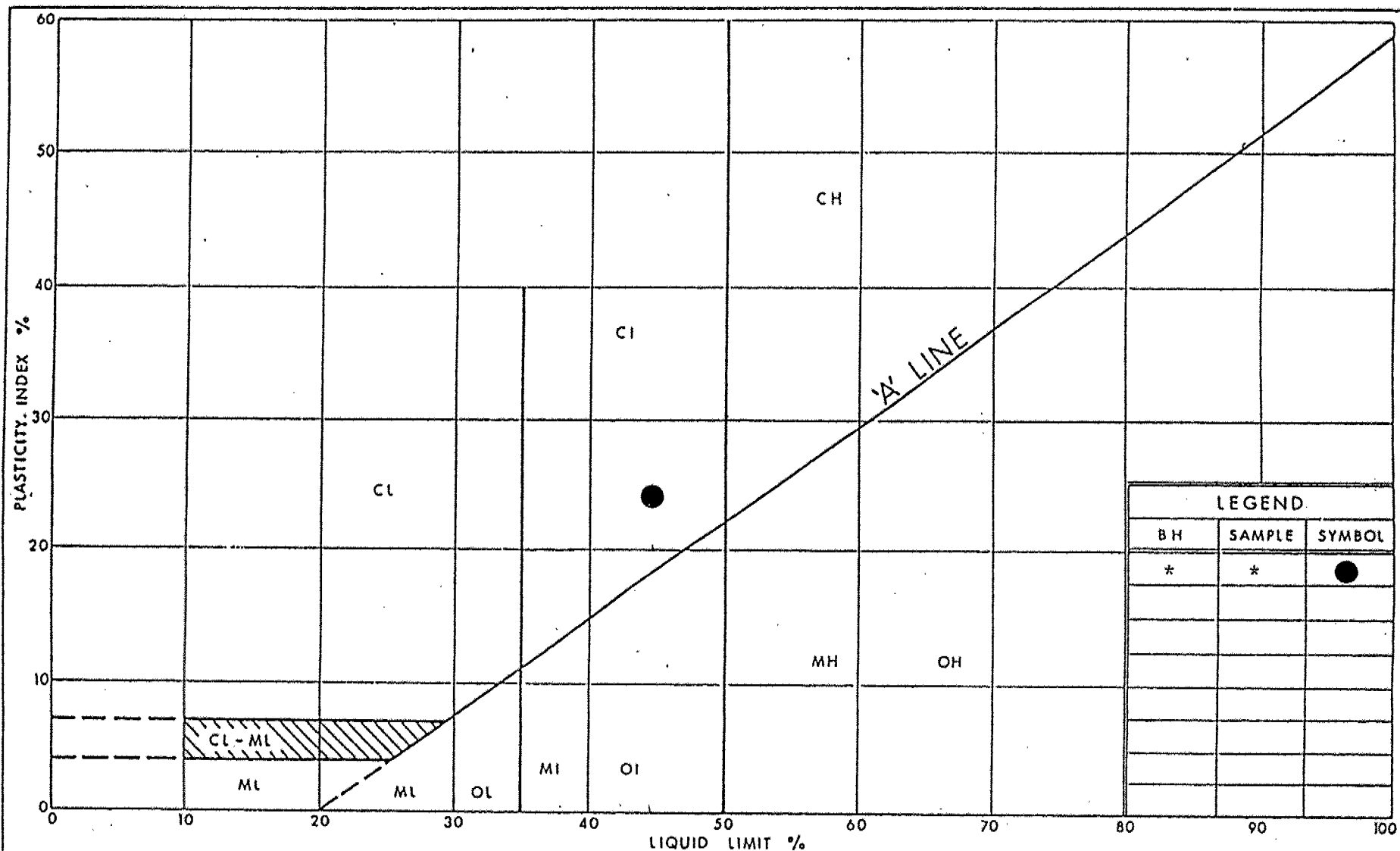
Ministry of
Transportation

PLASTICITY CHART SILTY CLAY

FIG No 1

G.W.P. 291-97-00

District 52, Huntsville



LEGEND		
BH	SAMPLE	SYMBOL
*	*	●



Ministry of
Transportation
Ontario

PLASTICITY CHART

SILT AND CLAY

FIG No 2

G.W.P. 291-97-00

District 52, Huntsville

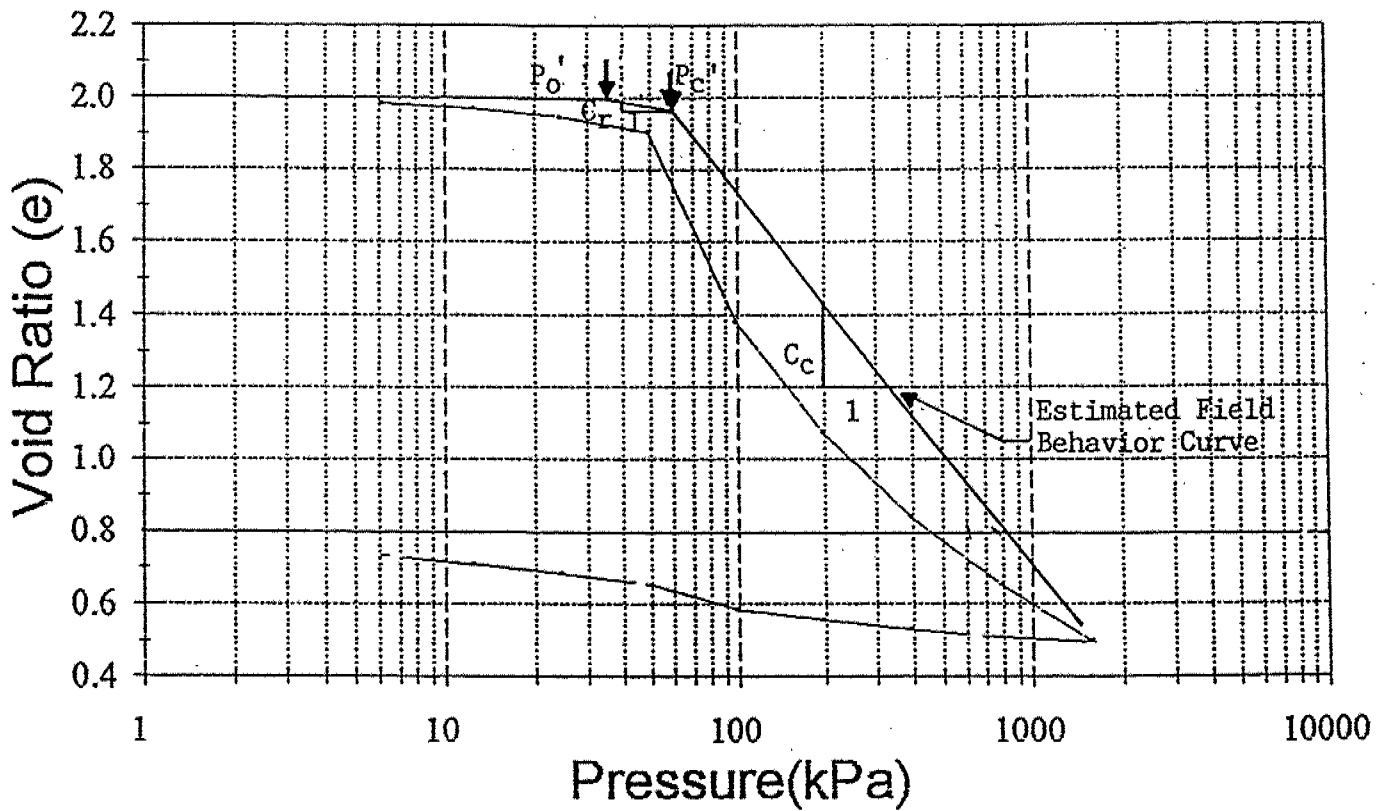
* Sample retrieved from Station 16+321, 2.00 m Lt C/L Southbound Lane, Twp of Seguin, Depth = 3.95 - 4.25 m
(see Peto MacCallum Ltd., Pavement Design Report, W.P. 291-97-00, dated October 16, 1998)

FIGURE 3

Laboratory Consolidation Test Results

Borehole S11-8, Sample 1
Depth: 5.5 – 6.1 m
Description: Silty Clay

Void Ratio versus Log of Pressure



G.W.P. 291-97-00

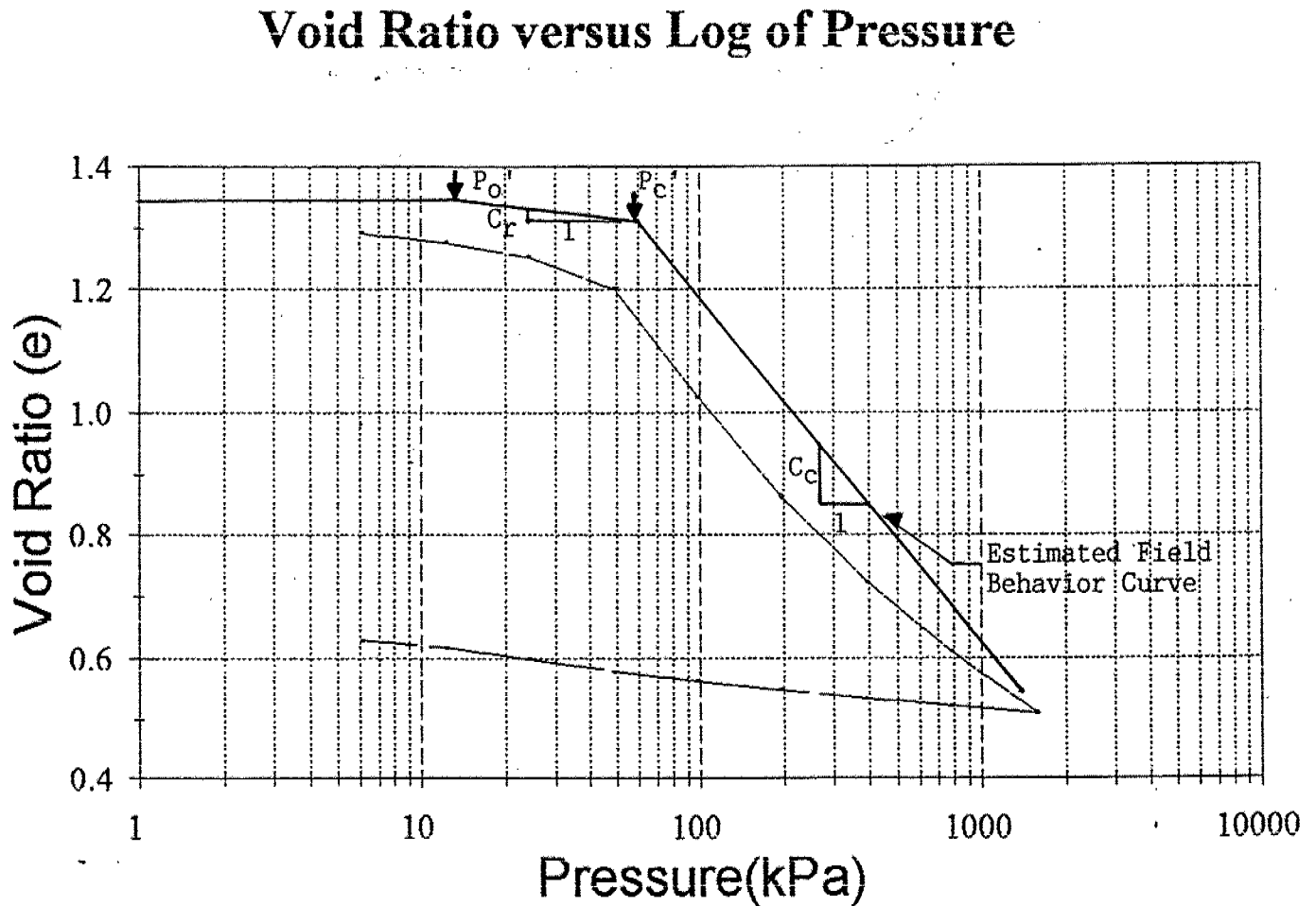
98TF010

$P_o' = 38$ kPa
 $P_c' = 60$ kPa
 $C_c = 1.0$
 $C_r = 0.10$
 $e_o = 1.99$
 $w_o = 62\%$
 $\gamma = 14.3$ kN/m³

FIGURE 4

Laboratory Consolidation Test Results

Borehole S13-9, Sample 2
Depth: 2.8 – 3.4 m
Description: Silty Clay



G.W.P. 291-97-00

98TF010

$P'_{o'} = 15.7 \text{ kPa}$
 $P'_c = 60 \text{ kPa}$
 $C_c = 0.55$
 $C_r = 0.06$
 $e_o = 1.35$
 $w_o = 46\%$
 $\gamma = 16.9 \text{ kN/m}^3$

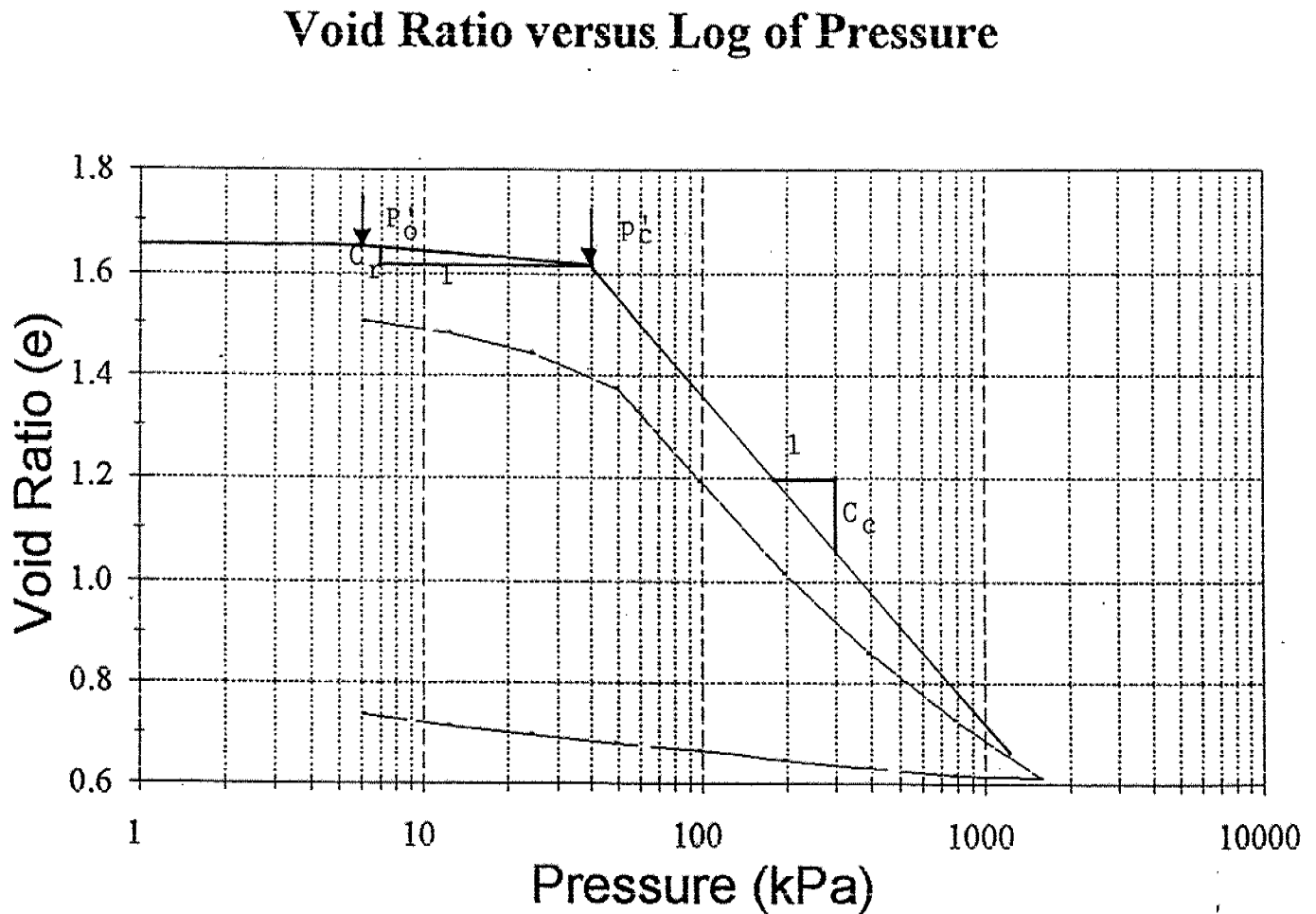
FIGURE 5

Laboratory Consolidation Test Results

*Station 16+321, 2.00 m Lt C/L, SBL

Depth: 3.95 – 4.25 m

Description: Silt and Clay



G.W.P. 291-97-00

98TF010

* see Peto MacCallum Ltd., Pavement Design
Report, W.P. 291-97-00, dated October 16, 1998

$P'_o = 6 \text{ kPa}$
 $P'_c = 40 \text{ kPa}$
 $C_c = 0.64$
 $C_r = 0.05$
 $e_o = 1.65$
 $w_o = 58\%$
 $\gamma = 16.2 \text{ kN/m}^3$

FIGURE 6

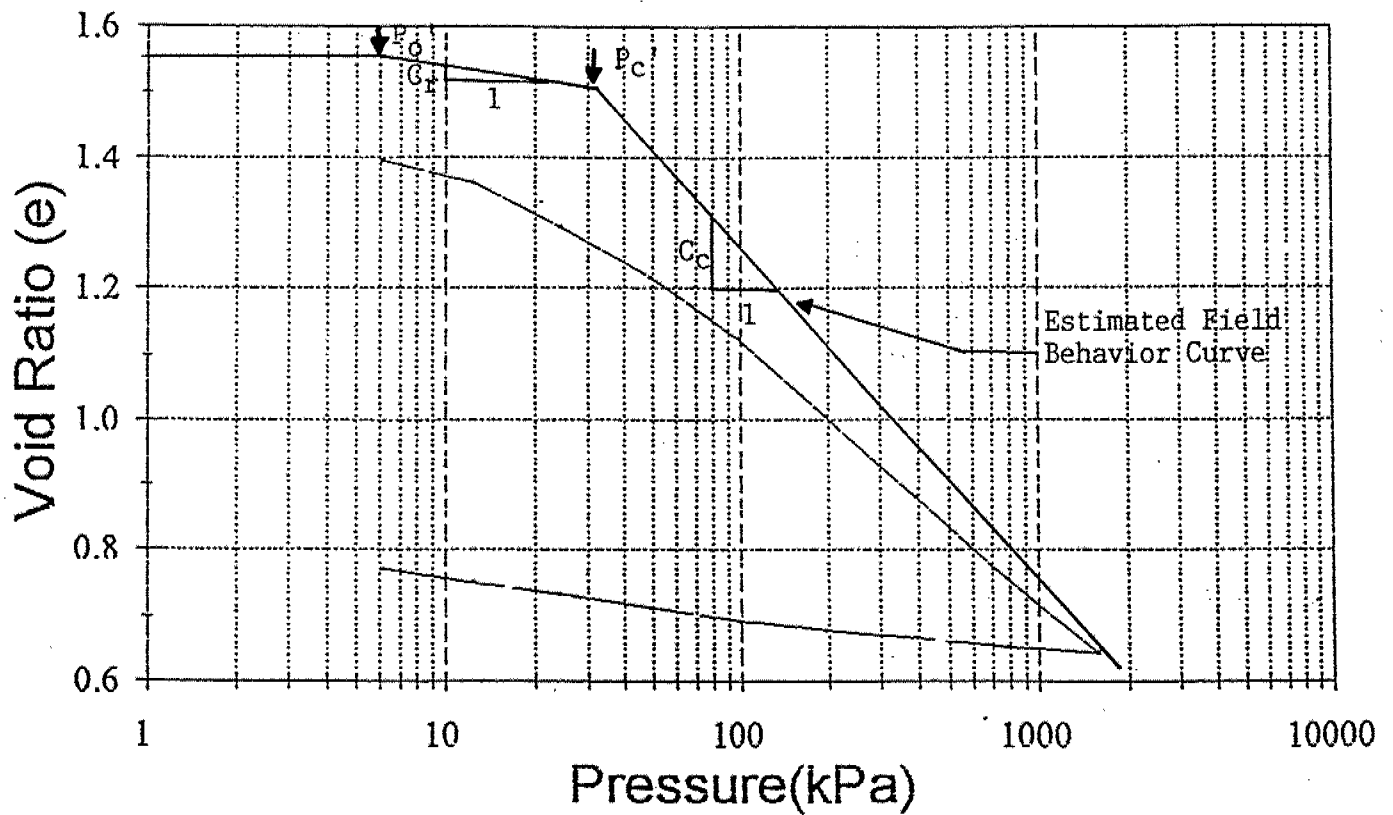
Laboratory Consolidation Test Results

Borehole S14-17, Sample 4

Depth: 5.5 – 6.7 m

Description: Silty Clay

Void Ratio versus Log of Pressure



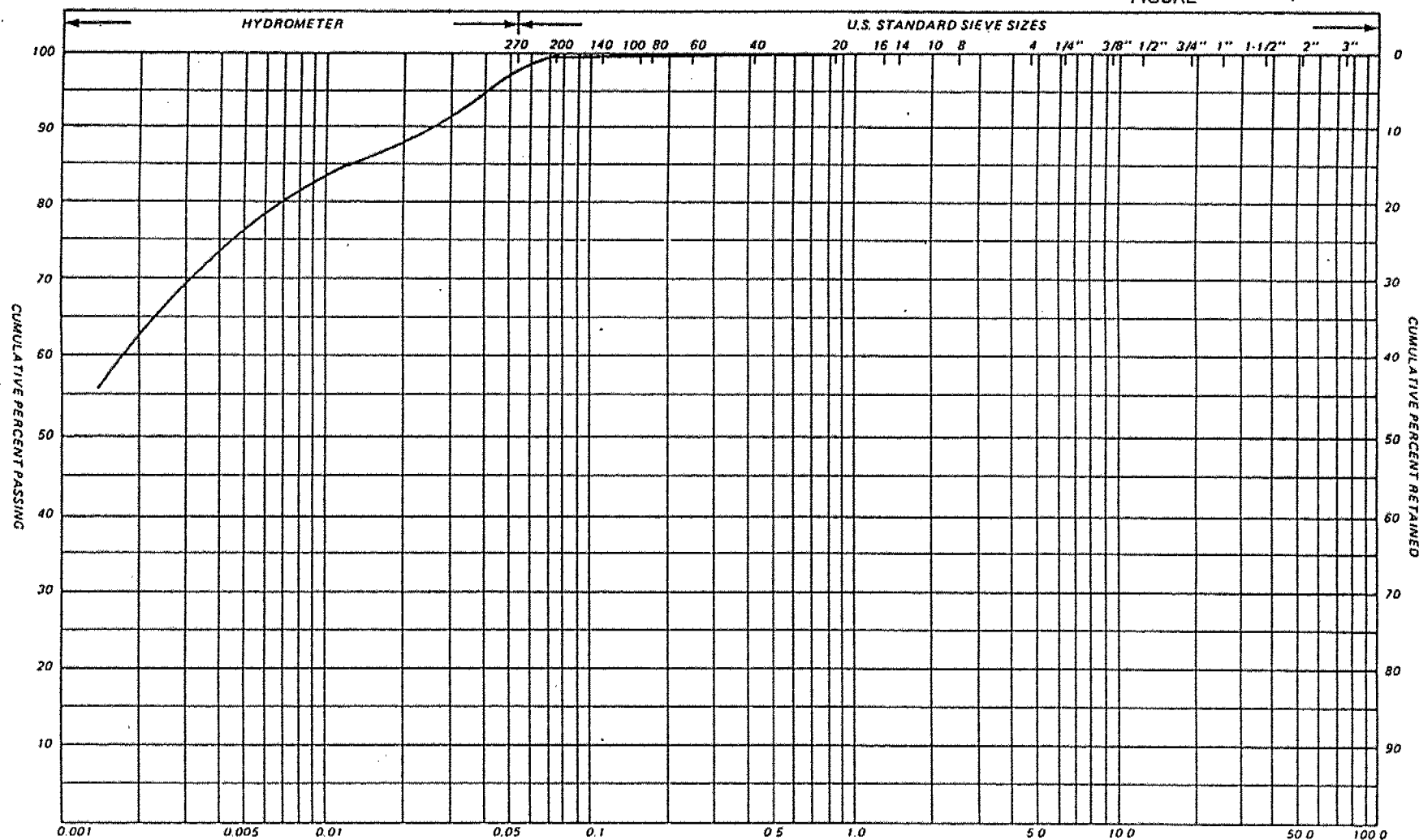
G.W.P. 291-97-00

98TF010

$P'_o = 6 \text{ kPa}$
 $P'_c = 31 \text{ kPa}$
 $C_c = 0.50$
 $C_r = 0.07$
 $e_o = 1.56$
 $w_o = 57\%$
 $\gamma = 17.1 \text{ kN/m}^3$

PARTICLE SIZE DISTRIBUTION CHART

PML REF. 98TF010
REPORT NO. -
FIGURE 7

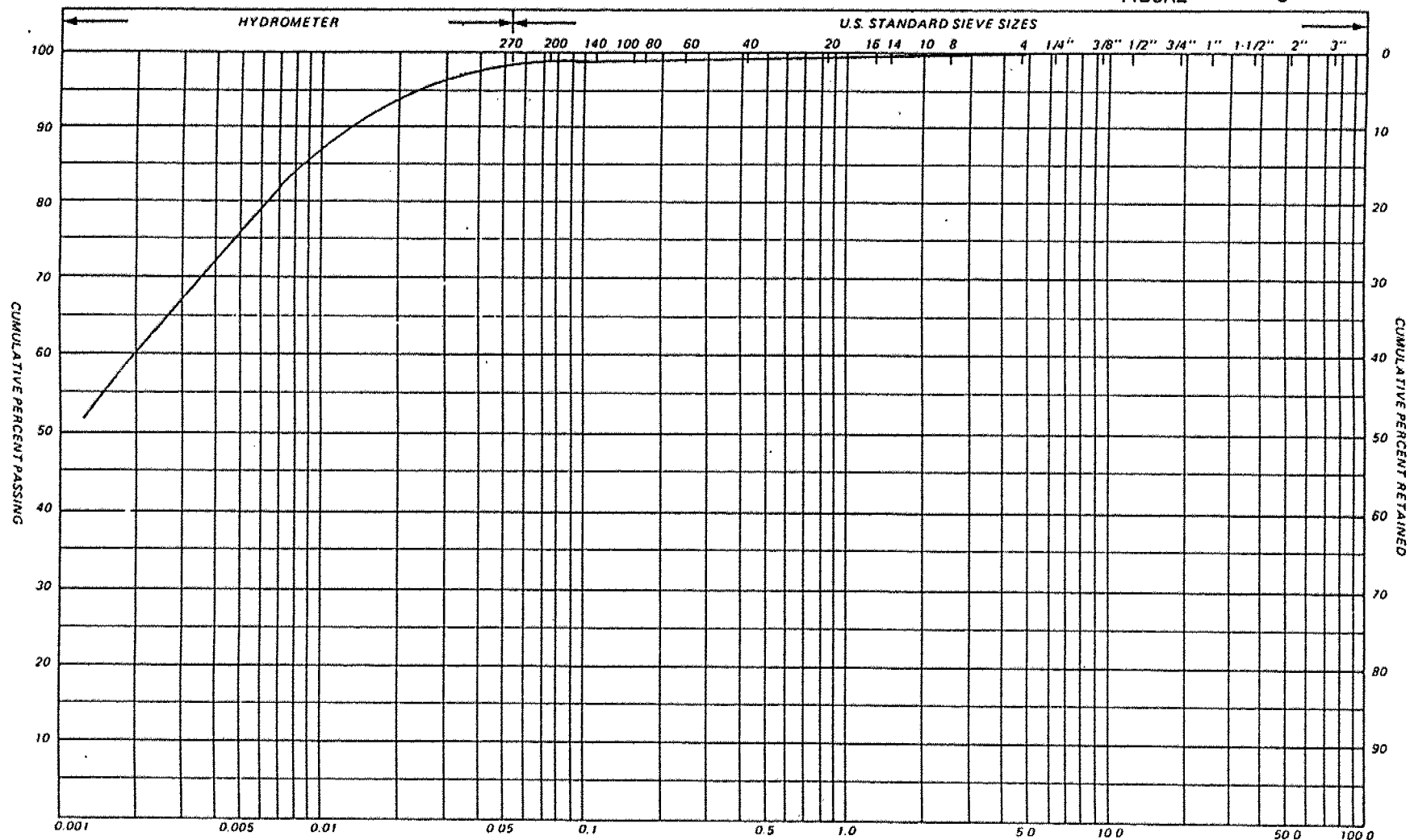


SILT & CLAY				FINE SAND			MEDIUM SAND		COARSE SAND		GRAVEL		COB.	UNIFIED
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	COB.	M.I.T.
CLAY	SILT			V. FINE	FINE	MED.	COARSE	GRAVEL						U.S. BUREAU

REMARKS Silty clay trace of sand
Borehole S11-8, Sample 1, Depth 5.50 - 6.10 m

PARTICLE SIZE DISTRIBUTION CHART

PML REF. 98TF010
REPORT NO. -
FIGURE 8

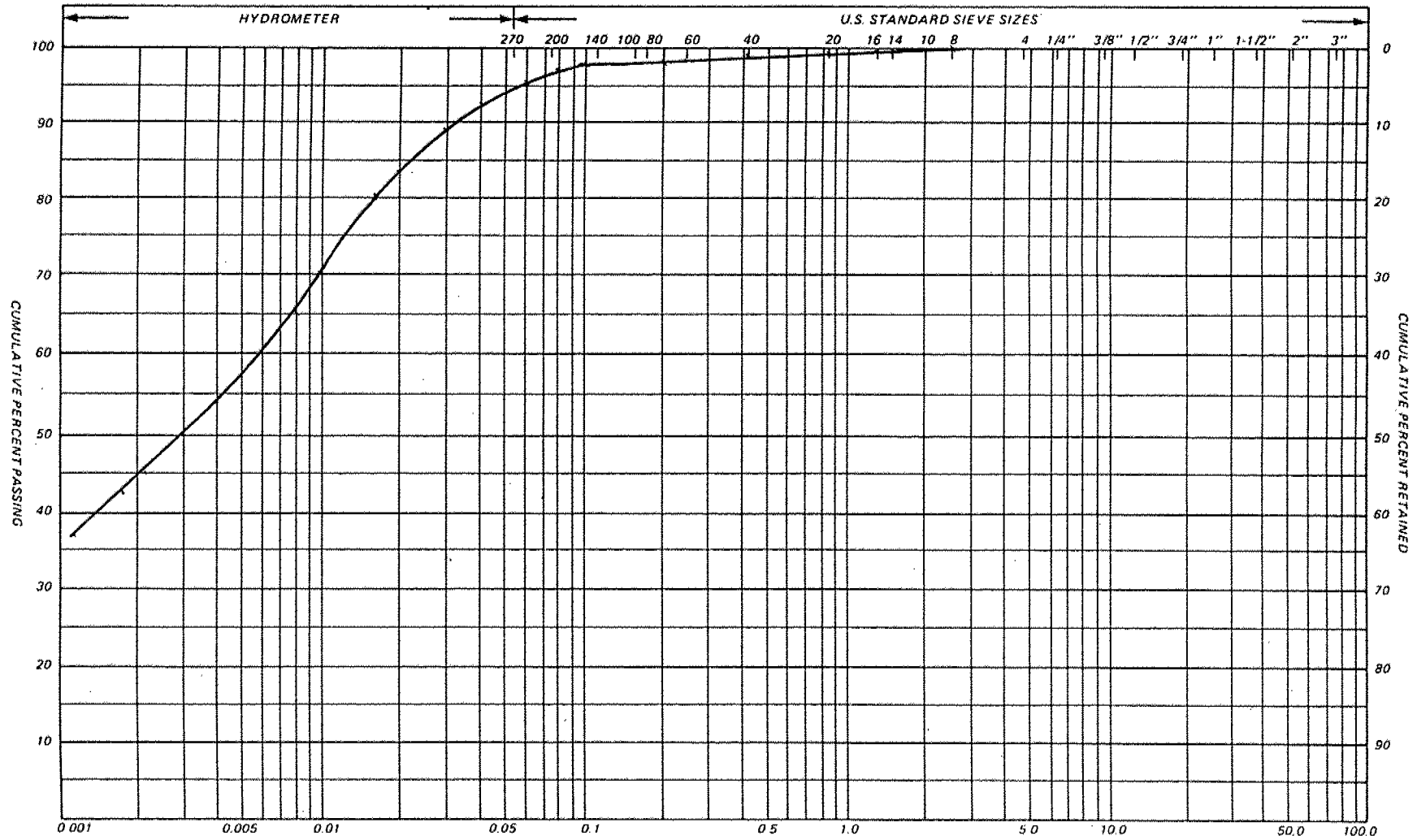


GRAIN SIZE IN MILLIMETERS																
SILT & CLAY				FINE		MEDIUM		COARSE		GRAVEL						
												LOW S.F.T.	UNIFIED			
CLAY	FINE		MEDIUM		COARSE		SAND				GRAVEL		COBBLES	MIT		
CLAY		SILT				V. FINE		FINE		MED.		COARSE		GRAVEL		U.S. BUREAU
						SAND										

REMARKS Silty clay trace of sand
Borehole S13-10, Sample 2, Depth 2.75 - 3.55 m

PARTICLE SIZE DISTRIBUTION CHART

PML REF. 98TF010
REPORT NO. -
FIGURE 9

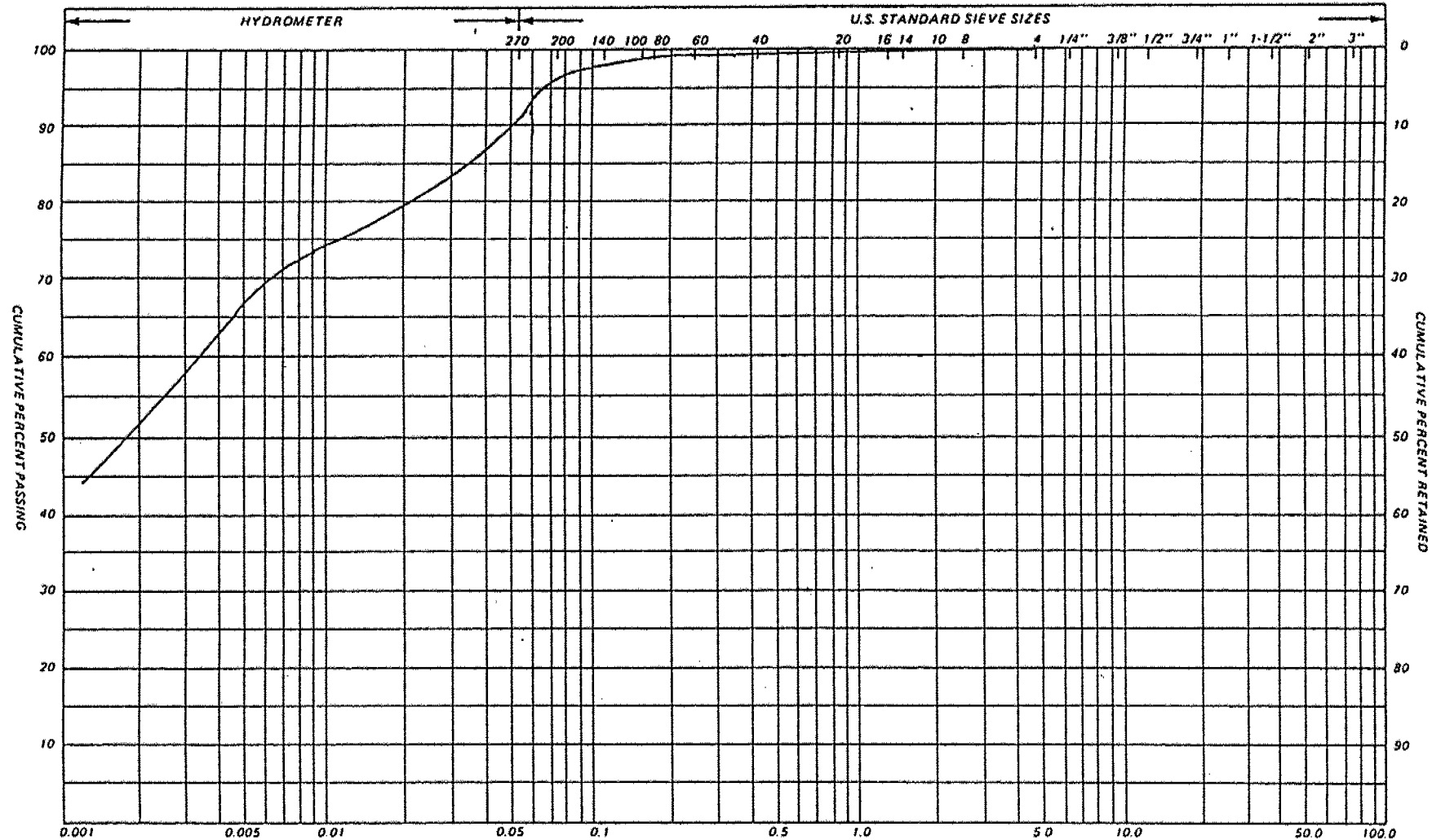


SILT & CLAY				FINE SAND			COARSE SAND	GRAVEL		COBBLES	UNIFIED
CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND		GRAVEL		COBBLES	M.I.T.
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL			U.S. BUREAU

REMARKS: Silt and Clay
Station 16+321, 2.00 m Lt C/L, SBL, Depth = 3.95 – 4.25 m
(see Peto MacCallum Ltd., Pavement Design Report, W.P. 291-97-00, Dated October 16, 1998)

PARTICLE SIZE DISTRIBUTION CHART

PML REF. 98TF010
REPORT NO. -
FIGURE 10



SILT & CLAY				GRAIN SIZE IN MILLIMETERS			GRAVEL		COB	UNIFIED
				FINE	MEDIUM	COARSE				
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL		COBBLES	M.I.T.
		SILT			SAND					U.S. BUREAU
CLAY		SILT		V. FINE	FINE	MED. COARSE	GRAVEL			
				SAND						

REMARKS Silty clay trace of sand
Borehole S14-17, Sample 4, Depth 5.20 – 5.80 m

APPENDIX D

Table III – Summary of Subsoil Conditions

TABLE III
SUMMARY OF SUBSOIL CONDITIONS
SWAMP CROSSINGS
G.W.P. 291-97-00

SWAMP ⁽¹⁾ NO.	ROAD COMPONENT	NO. OF TESTHOLES	PEAT THICKNESS (m)	CLAY THICKNESS (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)
10 ⁽²⁾	Hwy 69, NBL, Twp of Seguin Station 14+440 – 14+500	9	0.5 – 5.9	0	Peat/clay identified in 4 of the 9 testholes; underlying materials consisted of probable bedrock or sand over probable bedrock. Topsoil over sand and/or probable bedrock identified in the remaining testholes.	0.1 – 7.5
11 ⁽²⁾	Hwy 69, NBL, Twp of Seguin Station 14+620 – 14+700	12	0.8 – 2.6	4.5 – 6.2	<u>General Area</u> Peat/clayey silt revealed in 9 testholes outside the limits of the existing fill; underlying materials consisted of sand with local 1.5 m thick silty clay layer (to 6.5 m depth) over probable bedrock <u>Toe of Existing Embankment</u> 3 testholes excavated adjacent to fill encountered peat/sand fill over peat/rockfill or rockfill over sand or clay. Testholes terminated in sand/clay at depths of 2.0 to 4.2 m.	3.9 – 11.0

(1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)

(2) Same swamp crossing in GWP 290-97-00

TABLE III Cont'd

**SUMMARY OF SUBSOIL CONDITIONS
SWAMP CROSSINGS
G.W.P. 291-97-00**

SWAMP ⁽¹⁾ NO.	ROAD COMPONENT	NO. OF TESTHOLES	PEAT THICKNESS (m)	CLAY THICKNESS (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)
12	Hwy 69, SBL, Twp of Seguin Station 15+260 – 15+495	40	0.1 – 4.7	0.2 – 4.7	<p><u>General Area</u> Peat/clay identified in 28 testholes drilled outside the limits of the existing fill; underlying materials consisted of probable bedrock or sand and/or silt with local 0.2 to 1.65 m thick silty clay/ clay and silt/clayey silt layers (to 4.9 to 6.0 m depth) over probable bedrock.</p> <p>Topsoil over sand and/or probable bedrock or sand fill over 1.4 m thick of peat layer (to 2.4 m depth) over probable bedrock identified in 3 testholes</p> <p><u>Existing Hwy 69 Embankment</u> Pavement structure or sand fill or peaty fill over rockfill over clay or sand and/or peat identified in 9 testholes. Testholes terminated at depths of 0.5 to 3.9 m in inferred rockfill or underlying sand, clay or peat.</p>	0.2 – 9.2

(1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)

(2) Same swamp crossing in GWP 290-97-00

TABLE III Cont'd

**SUMMARY OF SUBSOIL CONDITIONS
SWAMP CROSSINGS
G.W.P. 291-97-00**

SWAMP ⁽¹⁾ NO.	ROAD COMPONENT	NO. OF TESTHOLES	PEAT THICKNESS (m)	CLAY THICKNESS (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)
13	<u>Hwy 69, NBL,</u> <u>Twp of Sequin</u> Station 16+230 – 16+300	3	0.3 – 2.4 (at depth)	1.2 – 2.7 (at depth)	<u>Abandoned Embankment</u> 1.9 to 5.4 m of sand fill with local (80 mm thick) asphalt or 0.6 m thick gravel and cobble layer over local (0.6 m thick) topsoil layer over peat, clay and/or sand over probable bedrock.	5.1 – 12.3
13	<u>Hwy 69, SBL,</u> <u>Twp of Sequin</u> Station 16+230 – 16+300	9	4.2 – 4.8	4.1 – 7.3	<u>General Area</u> Exposed bedrock identified in 2 testholes. Peat/clay identified surficially in 2 of the 6 testholes drilled outside the limits of the fill; underlying materials consisted of probable bedrock or sand over probable bedrock. Silt and clay identified surficially in 2 of the 6 testholes; underlying materials consisted of sand over probable bedrock.	0 – 12.0

⁽¹⁾ Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)

⁽²⁾ Same swamp crossing in GWP 290-97-00

TABLE III Cont'd

**SUMMARY OF SUBSOIL CONDITIONS
SWAMP CROSSINGS
G.W.P. 291-97-00**

SWAMP ⁽¹⁾ NO.	ROAD COMPONENT	NO. OF TESTHOLES	PEAT THICKNESS (m)	CLAY THICKNESS (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)
13	Hwy 69, SBL, Twp of Seguin Station 16+230 – 16+300	3	1.0 – 3.6 (at depth)	1.1 – 4.0 (at depth)	<u>Abandoned Embankment</u> 3 testholes drilled through existing fill encountered 0.6 to 1.5 m of sand and/or silt fill over peat (to 2.5 to 5.7 m depth) over clay (to 3.6 to 5.7 m depth) over probable bedrock or silt over clay (to 8.9 to 12.4 m depth) over sand over probable bedrock.	3.6 – 14.4
14	Hwy 69, NBL, Twp of Seguin Station 16+755 – 16+830	10	0.6 – 4.3	0.6 – 6.6	<u>General Area</u> Peat/clay identified in 8 testholes drilled outside the limits of the fill; underlying materials consisted of probable bedrock or sand and/or silt with local 2.0 to 2.7 m thick soft clay layer (to 7.0 to 9.3 m depth) over probable bedrock. <u>Existing Pavement</u> Pavement structure over sand and/or probable rockfill identified in the remaining 2 testholes	1.2 – 11.4

(1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)

(2) Same swamp crossing in GWP 290-97-00

TABLE III Cont'd

**SUMMARY OF SUBSOIL CONDITIONS
SWAMP CROSSINGS
G.W.P. 291-97-00**

SWAMP ⁽¹⁾ NO.	ROAD COMPONENT	NO. OF TESTHOLES	PEAT THICKNESS (m)	CLAY THICKNESS (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)
14	Hwy 69, SBL, Twp of Seguin Station 16+755 – 16+830	8	1.6 – 5.1	1.7 – 7.4	Peat/clay identified in all testholes; underlying materials consisted of probable bedrock or sand over probable bedrock.	4.6 – 12.1

⁽¹⁾ Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)

⁽²⁾ Same swamp crossing in GWP 290-97-00

**FOUNDATION DESIGN REPORT
EMBANKMENTS OVER SWAMPS
G.W.P. 291-97-00, HIGHWAY 69
FOUR LANING 2.7 km NORTH OF HIGHWAY 141
NORTHERLY 4 km TO 5.5 km SOUTH OF HIGHWAY 518
(BADGER ROAD)
DISTRICT 52, HUNTSVILLE**

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Job No. 98TF010

March, 1999

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OPSD 203.030	
OPSD 203.030 (Mod)	

FOUNDATION DESIGN REPORT
EMBANKMENTS OVER SWAMPS
G.W.P. 291-97-00, HIGHWAY 69
FOUR LANING 2.7 km NORTH OF HIGHWAY 141
NORTHERLY 4 km TO 5.5 km SOUTH OF HIGHWAY 518
(BADGER ROAD)
DISTRICT 52, HUNTSVILLE

INTRODUCTION

Construction of the realigned Highway 69, associated ramps and cross roads in the study corridor will involve 47 swamp crossings.

This report provides recommendations for construction of embankments in the 5 swamps in which special procedures are required to deal with stability concerns and/or construction methods. These comments are based on the plan and profile drawings (Profiles NB/SB Lanes, Highway 69, G.W.P. 291-97-00) provided by Stantec Consulting Ltd. in November, 1998.

Construction recommendations for the remaining swamps are dealt with in the Pavement Design Report which is provided under separate cover (project No. 98TF010 dated February, 1999).

Most of the swamps are located adjacent to an existing or abandoned highway embankment. Approximately 400 m of the proposed roadway at the south end of this project overlaps the north end of the adjoining project (G.W.P. 290-97-00, Highway 69 Four Laning, From Tower Road (MacTier), northerly 26.5 km to 2.7 km north of Highway 141) carried out by Peto MacCallum Ltd. in 1997- 1998. The swamps have been identified by number sequentially with the numbering system employed for the project to the south. The number and location of each swamp is provided on Table I, Appendix A. Two swamps (Swamps 10 and 11) are located within the limits of both projects.

The profile drawings indicate that the finished road grade through the subject swamps will be 2.5 to 9.0 m above the existing grade. Embankments will be constructed using rock fill.

Construction of the realigned Highway 69 will be carried out in two stages. The majority of the new alignment will be constructed during Stage 1. The southbound lane in the northerly portion of the

project, the northbound lane through the mid section, the south crossover, part of Seguin Trail East and the bridge structure will be constructed during the second stage.

The subsurface stratigraphy in the subject swamps typically comprised a relatively thick peat deposit overlying clay, silt and/or sand with discontinuous clay layers which mantles bedrock.

The thicknesses of the peat and clay deposits ranged from 0.1 to 5.9 m and 0.2 to 7.4 m, respectively.

The undrained shear strength of the peat generally ranged from 8 to 36 kPa, with an average value of 18 kPa. It is considered to be capable of supporting a fill height of 1.0 to 3.5 m.

The undrained shear strength of the clay deposit ranged from 8 to 40 kPa, with an average value of 17 kPa.

Peat, clay, sand with discontinuous soft clay layers and bedrock were identified in testholes drilled on the abandoned highway embankment within Swamp 13.

The peat below the abandoned highway embankment within Swamp 13 exhibits shear strengths in the range of 31 to greater than 100 kPa. The clay underlying the peat also exhibits shear strength values in the range of 18 to 64 kPa, with an average value of 32 kPa.

SWAMP TREATMENT

The embankments will be constructed using rockfill. The southbound lanes will primarily be constructed along new alignment; construction of the northbound lanes will involve widening and upgrading of the existing roadway. The construction schedule calls for the work to be done in two years. The southbound lanes and widened portion of the northbound lanes will be constructed during the first year and the project completed the following year.

The maximum depth to the base of the peat and soft clay deposit at the test locations ranged from 5.9 to 12.4 m. Bedrock was inferred at depths of 7.5 to 14.4 m.

The rockfill embankments in swamps along the alignment are to be constructed in accordance with one of the following methods:

- 1) OPSD 203.010 (Mod) to a depth of 8 m or shallower if a firm bottom is encountered ("firm bottom" is considered to be loose to compact sand/silt or bedrock).
- 2) Install 600 mm diameter sand drains to bedrock spaced at 3 m intervals along toe of existing embankment fill.

Install a second row of 600 mm diameter sand drains to bedrock spaced at 3 m intervals (staggered from first row) 3 m from toe of existing embankment fill.

OPSD 203.030 (excavate to depth of 6 m) in the zone within 6 m of the toe of the existing embankment fill, subject to the following conditions:

- i) face of excavation from toe of existing slope to a depth of 6 m to be cut at an inclination of 1:1.
- ii) Length of excavation parallel to embankment slope NOT to exceed 5 m before placement of rockfill to at least 1 m above swamp level in excavated area.
- ii) Total excavation to be backfilled to at least 1 m above swamp level at the end of each day.

OPSD 203.010 (Mod) to a depth of 8 m or bedrock if shallower in the zone beyond 6 m of the toe of the existing embankment fill.

Place 4 m high surcharge above the design finished grade on the portion of the NBL to be widened.

Surcharge to be maintained for at least 6 months.

- 3) OPSD 203.030 (excavate to a depth of 6 m) in the zone within 6 m of the toe of the existing embankment fill, subject to the following conditions:
 - i) Length of excavation parallel to embankment slope NOT to exceed 5 m before placement of rockfill to at least 1 m above swamp level in excavated area.

- ii) total excavation to be backfilled to at least 1 m above swamp level at the end of each day.

OPSD 203.010 (Mod) to a depth of 8 m or bedrock if shallower beyond 6 m of the toe of the existing embankment fill.

Place 1.5 m high surcharge above the design finished grade on the portion of NBL to be widened.

Surcharge to be maintained for at least 6 months.

The recommended measures for construction of the embankment fills for each swamp are provided on Table IV-Swamp Crossings and Treatment. The recommended construction procedures are based on the following criteria:

- | | | |
|-----|--|---|
| i) | Base of compressible soils is greater than 8 m below grade | limiting <u>post construction</u> settlement of the embankment fill surface due to consolidation of the compressible foundation soils to 70 mm. |
| ii) | Base of compressible soils is less than 8 m below grade | negligible <u>post construction</u> settlement of the embankment fill surface due to consolidation of the foundation soils. |

Post construction settlement is considered to be the settlement that occurs during the 10 year period following completion of construction of the embankment fill and is computed on the basis of a 6 month construction period for swamps 11 to 14, 12 months for Swamp 10.

The "8 m" criteria was selected following review of the soil profile revealed in the boreholes, our experience on the project to the south, consultation with Stantec Consulting Ltd. consideration of a reasonable magnitude of post construction settlement that could be tolerated in conjunction with the potential impact of a deep excavation that could initiate instability/movement of the existing roadway embankment, the cost to extend the depth of excavation to limit consolidation of the foundation soil and the magnitude of post construction settlement that would occur in any event due to the increased thickness of rockfill.

The stability of the recommended treatment for construction of the rockfill embankments across the swamps noted on Table IV was analyzed using the Bishop Simplified Method of Analysis. The computed factor of safety against a general failure is considered to be at least 1.3 for short term construction conditions and about 1.5 for long term.

With the exception of Swamps 11 and 13, it is anticipated that all peat and soft clay above the underlying sand/silt identified in the swamps will be excavated or displaced during the placement of the embankment fill.

The height of embankment fill in the future northbound lanes through Swamp 13 is only 2.5 m. The peat/clay underlying this portion of the roadway alignment has experienced significant consolidation from the fill placed previously to construct both the former and current highway alignments. Excavation to depths of 10 to 12 m to remove the compressible soils is likely to cause instability in the existing roadway embankment. Therefore, the recommended treatment for the northbound lanes of Swamp 13 involves partial excavation of the compressible soils and placement of a 1.5 m high surcharge fill for a period of at least 6 months to limit post construction settlements.

Similar treatment (4 m surcharge) is recommended for construction of the northbound lanes in Swamp 11. Installation of sand drains is also recommended for this swamp to expedite consolidation of the compressible soils and limit post construction settlement due to the greater embankment fill height.

Some settlement of the embankment fill surface in all swamps both during and following completion of construction due to consolidation of the clayey soils that exist within the sandy soils at depth as well as consolidation of the rock fill and compression of the sand/silt deposits is to be expected.

The computed settlement of the surface of the rockfill due to "consolidation" of the rockfill embankment and consolidation of the clay deposits that exist at the depth within native sand deposit below the embankments during construction (based on a 6 month construction period for

Swamps 11 to 14, 12 months for Swamp 10) and the 10 year period following completion of the embankment fill are provided on Table V – Computed Rockfill and Embankment Settlement. At least 80% of the post construction settlement will occur during the first two years after completion of construction of the embankments.

The shoulder width should be widened by 1 m in rockfill embankments constructed through swamps founded on bedrock, 2 m if founded on a firm base per MTO practice.

The rockfill should be placed in accordance with OPSD 202.010. A 2 m wide midheight berm should be constructed if the height of the embankment fill exceeds 6 m in accordance with the Northern Region Pavement Design Practices and Guidelines (May 20, 1997).

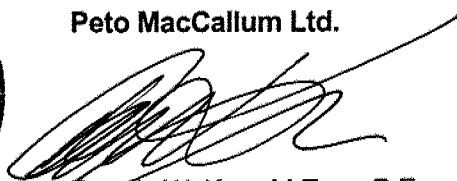
CLOSURE

This report was prepared by Mr. E. Wong, P.Eng. and reviewed by Mr. D.W. Kerr, P.Eng., Manager Geotechnical and Geo-Environmental Services, Hamilton office.



Yours very truly

Peto MacCallum Ltd.


Dennis W. Kerr, M.Eng., P.Eng.
Manager Geotechnical and
Geo-Environmental Services



EW:mmma



Brian R. Gray, M.Eng., P.Eng.
Vice-President
Geotechnical and
Geo-Environmental Services

TABLE IV
SWAMP CROSSINGS
SUMMARY OF SUBSOIL CONDITIONS AND TREATMENT
G.W.P. 291-97-00

SWAMP NO. ⁽¹⁾	ROAD COMPONENT	MAX. FILL ⁽³⁾ HEIGHT (m)	DEPTH TO BASE OF PEAT/CLAY (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)	TREATMENT ⁽⁴⁾
10 ⁽²⁾	Hwy 69, NBL, Twp of Seguin Station 14+440 – 14+500	9.0	0.5 – 5.9	Peat/clay identified in 4 of the 9 testholes; underlying materials consisted of probable bedrock or sand over probable bedrock. Topsoil over sand and/or probable bedrock identified in the remaining testholes.	0.1 – 7.5	1 ✓ <u>Excavate</u>
11 ⁽²⁾	Hwy 69, NBL, Twp of Seguin Station 14+620 – 14+700	8.0	4.2 – 8.6	<u>General Area</u> Peat/clayey silt revealed in 9 testholes outside the limits of the existing fill; underlying materials consisted of sand and/or silt with local 1.5 m thick silty clay layer (to 6.5 m depth) over probable bedrock <u>Toe of Existing Embankment</u> 3 testholes excavated adjacent to fill encountered peat/sand fill over peat/rockfill or rockfill over sand or clay. Testholes terminated in sand/clay at depths of 2.0 to 4.2 m. Sand, bedrock interpreted to be at 4.5 to 11.9 m depth.	3.9 – 11.9	2 ✗ <u>Do not appear with sand draw treatment.</u>

- (1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)
(2) Same swamp crossing in G.W.P. 290-97-00
(3) From November 10, 1998 Stanley Consulting Ltd. profile drawings
(4) Swamp Treatment – refer to final page of this table

TABLE IV Cont'd

**SWAMP CROSSINGS
SUMMARY OF SUBSOIL CONDITIONS AND TREATMENT
G.W.P. 291-97-00**

SWAMP NO. ⁽¹⁾	ROAD COMPONENT	MAX. FILL ⁽³⁾ HEIGHT (m)	DEPTH TO BASE OF PEAT/CLAY (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)	TREATMENT ⁽⁴⁾
12	Hwy 69, SBL, Twp of Seguin Station 15+260 – 15+495	3.0	4.6 – 7.2	<p>General Area Peat/clay identified in 28 testholes drilled outside the limits of the existing fill; underlying materials consisted of probable bedrock or sand and/or silt with local 0.2 to 1.65 m thick silty clay/ clay and silt/clayey silt layers (to 4.9 to 6.0 m depth) over probable bedrock.</p> <p>Topsoil over sand and/or probable bedrock or sand fill over 1.4 m thick of peat (to 2.4 m depth) over probable bedrock identified in 3 testholes</p> <p>Existing Hwy 69 Embankment Pavement structure or sand fill or peaty fill over rockfill over clay or sand and/or peat identified in 9 testholes. Testholes terminated at depths of 0.5 to 3.9 m in inferred rockfill or underlying sand, clay or peat.</p>	0.2 – 9.2	1

(1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)

(2) Same swamp crossing in G.W.P. 290-97-00

(3) From November 10, 1998 Stanley Consulting Ltd. profile drawings

(4) Swamp Treatment – refer to final page of this table

TABLE IV Cont'd

**SWAMP CROSSINGS
SUMMARY OF SUBSOIL CONDITIONS AND TREATMENT
G.W.P. 291-97-00**

SWAMP NO. ⁽¹⁾	ROAD COMPONENT	MAX. FILL HEIGHT ⁽³⁾ (m)	DEPTH TO BASE OF PEAT/CLAY (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)	TREATMENT ⁽⁴⁾
13	Hwy 69, NBL Twp. of Sequin Station 16+230 – 16+300	2.5	5.1 – 10.4 (at depth)	<u>Abandoned Embankment</u> 1.9 to 5.4 m of sand fill with local (80 mm thick) asphalt or (0.6 m thick) gravel and cobble layer over local (0.5 m thick) topsoil layer over peat, clay and/or sand over probable bedrock.	5.1 – 12.3	3 see dirt buffer area

- (1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)
 (2) Same swamp crossing in G.W.P. 290-97-00
 (3) From November 10, 1998 Stanley Consulting Ltd. profile drawings
 (4) Swamp Treatment – refer to final page of this table

TABLE IV Cont'd

**SWAMP CROSSINGS
SUMMARY OF SUBSOIL CONDITIONS AND TREATMENT
G.W.P. 291-97-00**

SWAMP NO. ⁽¹⁾	ROAD COMPONENT	MAX. FILL ⁽³⁾ HEIGHT (m)	DEPTH TO BASE OF PEAT/CLAY (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)	TREATMENT ⁽⁴⁾
13	Hwy 69, SBL, Twp of Seguin Station 16+230 – 16+300	2.5	3.2 – 12.0 (at depth)	<p><u>General Area</u></p> <p>Exposed bedrock identified in 2 testholes.</p> <p>Peat/clay identified surficially in 2 of the 6 testholes drilled outside the limits of the fill; underlying materials consisted of probable bedrock or sand over probable bedrock.</p> <p>Silt and clay identified surficially in 2 of the 6 testholes; underlying materials consisted of sand over probable bedrock.</p>	0 – 12.0	3* <i>top of peat exc</i>
		2.5	3.6 – 12.4 (at depth)	<p><u>Abandoned Embankment</u></p> <p>3 testholes drilled through existing fill encountered 0.6 to 1.5 m of sand and/or silt fill over peat (to 2.5 to 5.7 m depth) over clay (to 3.6 to 5.7 m depth) over probable bedrock or silt over clay (to 8.9 to 12.4 m depth) over sand over probable bedrock.</p>	3.6 – 14.4	3* <i>top of peat exc</i>

* Placement of 1.5 m thick surcharge on SBL embankment fill will reduce post construction settlements noted on Table IV by 50%

- (1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)
(2) Same swamp crossing in G.W.P. 290-97-00
(3) From November 10, 1998 Stanley Consulting Ltd. profile drawings
(4) Swamp Treatment – refer to final page of this table

TABLE IV Cont'd

**SWAMP CROSSINGS
SUMMARY OF SUBSOIL CONDITIONS AND TREATMENT
G.W.P. 291-97-00**

SWAMP NO. ⁽¹⁾	ROAD COMPONENT	MAX. FILL ⁽³⁾ HEIGHT (m)	DEPTH TO BASE OF PEAT/CLAY (m)	NOTES AND/OR UNDERLYING MATERIALS	DEPTH TO PROBABLE BEDROCK (m)	TREATMENT ⁽⁴⁾
14	Hwy 69, NBL, Twp of Seguin Station 16+755 – 16+830	3.0	4.0 – 10.8	<p><u>General Area</u></p> <p>Peat/clay identified in 8 testholes drilled; underlying materials consisted of probable bedrock or sand and/or silt with local 2.0 to 2.7 m thick soft clay layer (to 7.0 to 9.3 m depth) over probable bedrock.</p> <p><u>Existing Pavement</u></p> <p>Pavement structure over sand and/or probable bedrock identified in the remaining 2 testholes</p>	1.8 – 11.4	<p>3*</p> <p>OG cut to TA, etc.</p>
14	Hwy 69, SBL Twp of Seguin Station 16+755 – 16+830	4.0	1.6 – 11.2	<p>Peat/clay identified in all testholes; underlying materials consisted of probable bedrock or sand over probable bedrock.</p>	4.6 – 12.1	<p>OG - 3*</p> <p>OG cut to TA, etc.</p>

* Placement of 1.5 m thick surcharge on SBL embankment fill will reduce post construction settlements noted on Table IV by 50%

(1) Swamp designation numbered sequentially from swamp crossings in project to the south (GWP 290-97-00)

(2) Same swamp crossing in G.W.P. 290-97-00

(3) From November 10, 1998 Stanley Consulting Ltd. profile drawings

(4) Swamp Treatment – refer to final page of this table

TABLE IV Cont'd

SWAMP CROSSINGS
SUMMARY OF SUBSOIL CONDITIONS AND TREATMENT
G.W.P. 291-97-00

- 1) OPSD 203.010 (Mod) to a depth of 8 m or shallower if a firm bottom is encountered ("firm bottom" is considered to be loose to compact sand/silt or bedrock).
- 2) Install 600 mm diameter sand drains to bedrock spaced at 3 m intervals along toe of existing embankment fill.

Install a second row of 600 mm diameter sand drains to bedrock spaced at 3 m intervals (staggered from first row) 3 m from toe of existing embankment fill.

Do we need this?

OPSD 203.030 (excavate to depth of 6 m) in the zone within 6 m of the toe of the existing embankment fill, subject to the following conditions:

- i) face of excavation from toe of existing slope to a depth of 6 m to be cut at an inclination of 1:1.
- ii) Length of excavation parallel to embankment slope NOT to exceed 5 m before placement of rockfill to at least 1 m above swamp level in excavated area.
- ii) Total excavation to be backfilled to at least 1 m above swamp level at the end of each day.

OPSD 203.010 (Mod) to a depth of 8 m or bedrock if shallower in the zone beyond 6 m of the toe of the existing embankment fill.

Place 4 m high surcharge above the design finished grade on the portion of the NBL to be widened.

Surcharge to be maintained for at least 6 months.

- 3) OPSD 203.030 (excavate to a depth of 6 m) in the zone within 6 m of the toe of the existing embankment fill, subject to the following conditions:

- i) Length of excavation parallel to embankment slope NOT to exceed 5 m before placement of rockfill to at least 1 m above swamp level in excavated area.
- ii) total excavation to be backfilled to at least 1 m above swamp level at the end of each day.

OPSD 203.010 (Mod) to a depth of 8 m or bedrock if shallower beyond 6 m of the toe of the existing embankment fill.

Place 1.5 m high surcharge above the design finished grade on the portion of NBL to be widened.

Surcharge to be maintained for at least 6 months.

TABLE V
COMPUTED ROCKFILL AND FOUNDATION SETTLEMENTS⁽¹⁾

Embankments Over Swamps
Highway 69 – Highway 141 to Badger Road
G.W.P. 291-97-00

Swamp No.	Road Component	Max. ⁽²⁾ Rockfill Thickness (m)	Construction Period ⁽⁵⁾			Post Construction Period ⁽⁷⁾		
			Rockfill (mm)	Foundation ⁽⁶⁾ (mm)	Total (mm)	Rockfill (mm)	Foundation ⁽⁶⁾ (mm)	Total (mm)
10	<u>Hwy 69, NBL,</u> <u>Twp of Seguin</u> Station 14+440 – 14+500	14.9	75	55	130	40	0	40
11	<u>Hwy 69, NBL,</u> <u>Twp of Seguin</u> <u>Toe of Existing Embankment</u> Station 14+620 – 14+700	14.0 ⁽³⁾	55	400 ⁽⁴⁾	455	55	70	125
	<u>General Area</u> Station 14+620 – 14+700	16.6 ⁽³⁾	70	210	280	75	0	75
12	<u>Hwy 69, SBL,</u> <u>Twp of Seguin</u> Station 15+260 – 15+495	10.2	30	80 – 95	110 – 125	45	10 – 20	55 – 65

- (1) Refer to Table IV for Swamp Treatment
 (2) Height of rockfill embankment plus thickness of rockfill below grade
 (3) Does not include height of surcharge
 (4) Includes consolidation settlement induced by rockfill surcharge
 (5) Based on a 6 month construction period for Swamps 11 to 14, 12 months for Swamp 10
 (6) Settlement due to compression of sand/silt granular soils and consolidation of compressible clayey soils within sand/silt deposits
 (7) Settlement during 10 year period, 10 years following completion of embankment

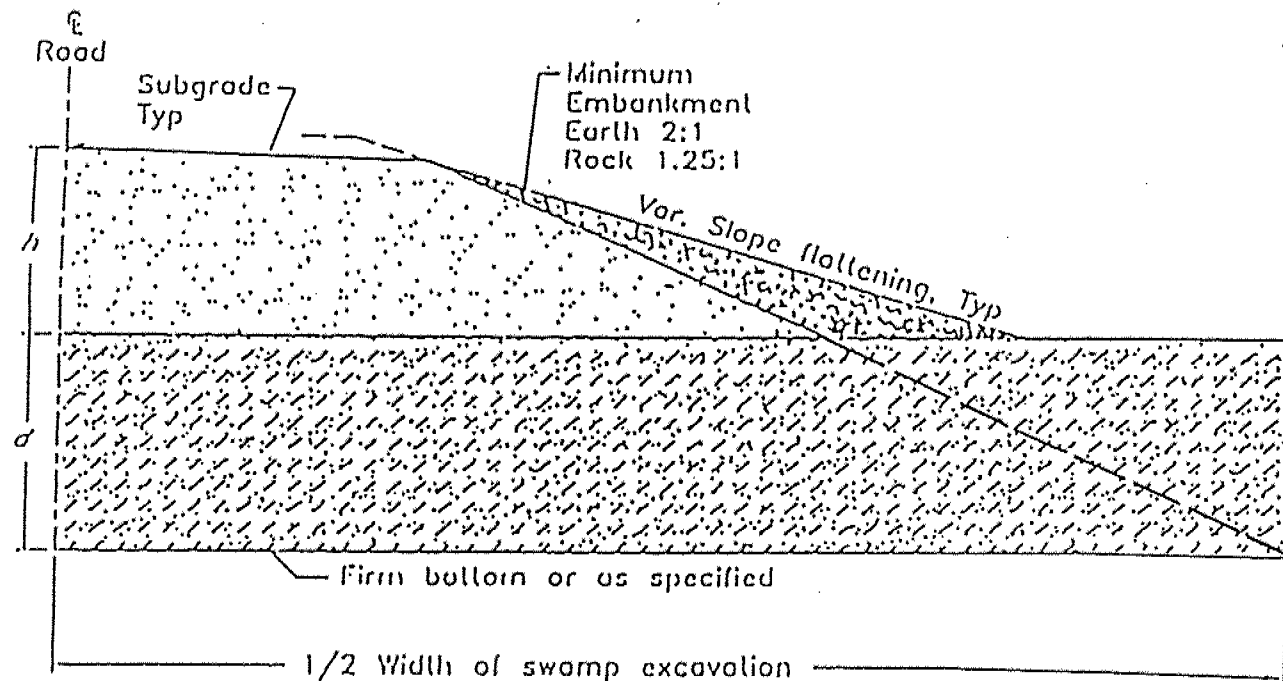
TABLE V Cont'd

COMPUTED ROCKFILL AND FOUNDATION SETTLEMENTS

**Embankments Over Swamps
Highway 69 – Highway 141 to Badger Road
G.W.P. 291-97-00**

Swamp No.	Road Component	Max. ⁽²⁾ Rockfill Thickness (m)	Construction Period ⁽⁵⁾			Post Construction Period ⁽⁷⁾		
			Rockfill (mm)	Foundation ⁽⁶⁾ (mm)	Total (mm)	Rockfill (mm)	Foundation ⁽⁶⁾ (mm)	Total (mm)
13	<u>Hwy 69, NBL, Twp of Seguin</u> Station 16+230 – 16+300	8.5 ⁽³⁾	25	165*	190	35	20 – 30	55 – 65
13	<u>Hwy 69, SBL, Twp of Seguin</u> Station 16+230 – 16+300	10.5*	30	75 – 175	105 – 205	50	15 – 25	65 – 75
14	<u>Hwy 69, NBL, Twp of Seguin</u> Station 16+755 – 16+830	11.0*	45	130 – 155	175 – 200	50	15 – 25	65 – 75
14	<u>Hwy 69, SBL, Twp of Seguin</u> Station 16+755 – 16+830	12.0*	45	70	115	55	15 – 25	65 – 80

- * Computed settlements are based on theoretical height of rockfill. Actual rockfill thickness may be 1 to 2 m greater due to "punching" of rockfill into underlying clay
- (1) Refer to Table IV for Swamp Treatment
- (2) Height of rockfill embankment plus thickness of rockfill below grade
- (3) Does not include height of surcharge
- (4) Includes consolidation settlement induced by rockfill surcharge
- (5) Based on a 6 month construction period for Swamps 11 to 14, 12 months for Swamp 10
- (6) Settlement due to compression of sand/silt granular soils and consolidation of compressible clayey soils within sand/silt deposits
- (7) Settlement during 10 year period, 10 years following completion of embankment



NOTES:

- Height of fill is the vertical difference between top of subgrade and top of swamp elevation measured at new road centreline.
- For divided roads with median < 10 metres, excavate swamp material full width.
- For divided roads with median \geq 10 metres, excavate swamp material to limits shown.
- All dimensions are in millimetres or metres unless otherwise shown.

LEGEND:

- | | |
|--|-----------------------------------|
| | Embankment materials as specified |
| | Excavated swamp material |
| | Excavate and backfill |

h - Height of fill
d - Depth of swamp

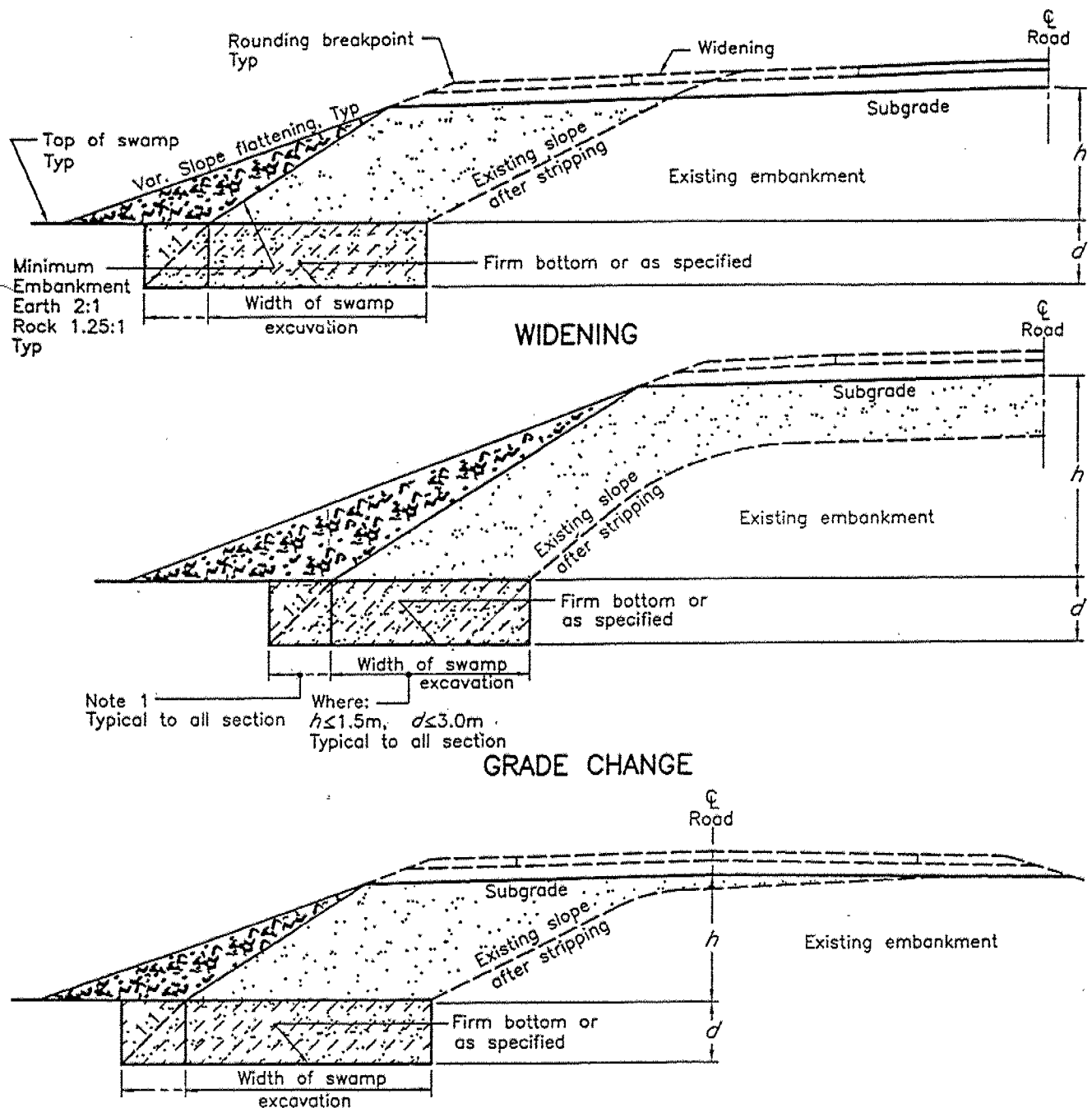
ONTARIO PROVINCIAL STANDARD DRAWING

EMBANKMENTS OVER SWAMP NEW CONSTRUCTION

1998 03 01 Rev

OPSD - 203.010 (MOD)





NOTES:

RE-ALIGNMENT AND GRADE CHANGE

- 1 Additional excavation required where:
 $h \leq 3.0\text{m}$ and $d \leq 6.0\text{m}$.
- A For given limits of height h and depth d , both requirements must be met in order to apply.
- B Topsoil shall be stripped from existing slopes.
- C Height of fill is the vertical difference between top of subgrade and top of swamp elevation measured at new road centreline.
- D All dimensions are in millimetres or metres unless otherwise shown.

LEGEND:

- h - Height of fill
 d - Depth of swamp
- Embankment materials as specified
 Excavated swamp material
 Excavate and backfill

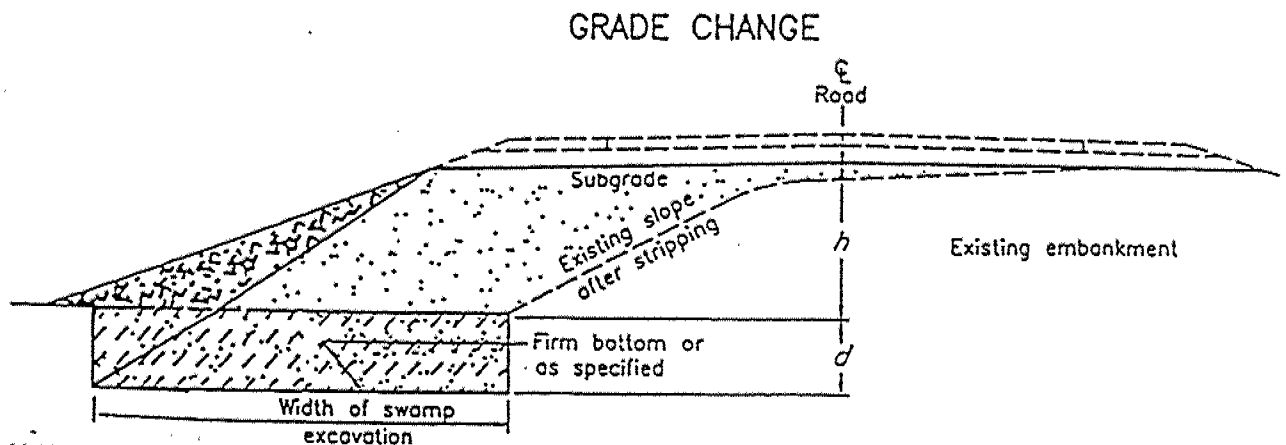
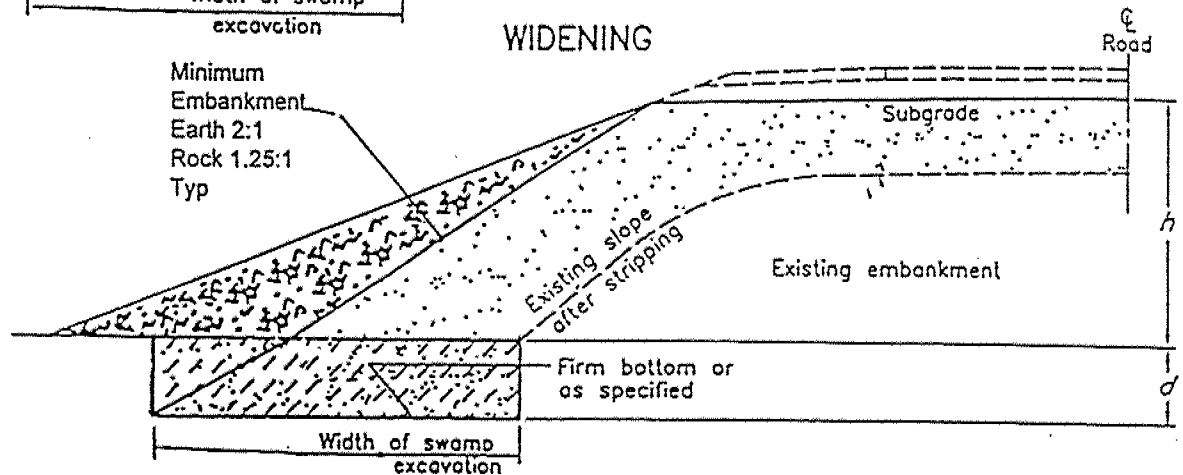
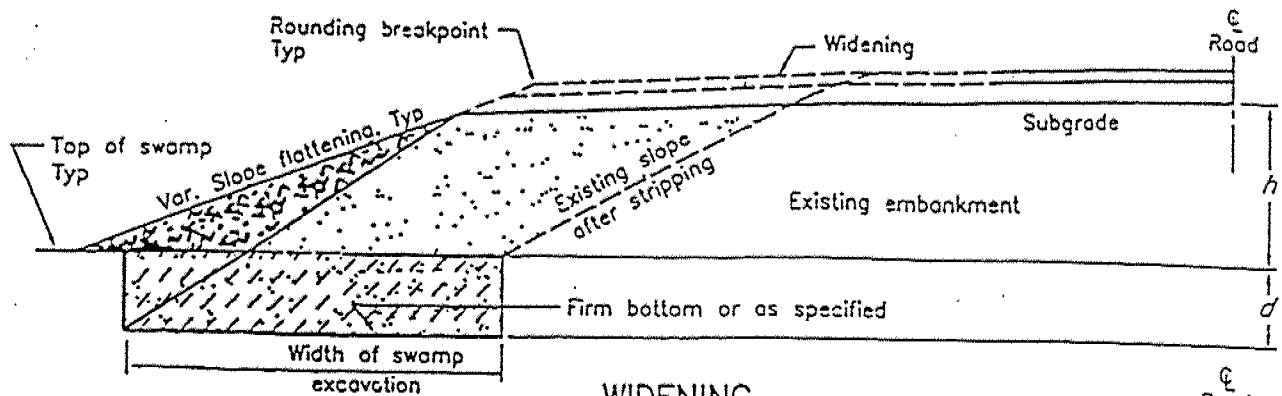
ONTARIO PROVINCIAL STANDARD DRAWING

1998 03 01 Rev

EMBANKMENTS OVER SWAMP
EXISTING SLOPES MAINTAINED

OPSD - 203.030





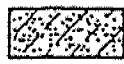


NOTES:

RE-ALIGNMENT AND GRADE CHANGE

- A Topsoil shall be stripped from existing slopes.
- B Height of fill is the vertical difference between top of subgrade and top of swamp elevation measured at new road centreline.
- C All dimensions are in millimetres or metres unless otherwise shown.

LEGEND:

- h - Height of fill
- d - Depth of swamp
-  Embankment materials as specified
-  Excavated swamp material
-  Excavate and backfill

ONTARIO PROVINCIAL STANDARD DRAWING

1998 03 01 | Rev

EMBANKMENTS OVER SWAMP
EXISTING SLOPES MAINTAINED



OPSD - 203.030 (MOD)



memorandum

To: Mike Pearsall, P. Eng. 1999 03 31
Senior Project Engineer
Northern Region

From: Pavements and Foundations Section
Room 232, Central Building
Downsview, Ontario

Re: Final Foundation Investigation Report
Embankment Over Swamps
Highway 69, Four Laning 2.7 km North of Hwy 141 N'ly 4 km to 5.5 km South
of Hwy 518 (Badger Road)
GWP 291-97-00, District 52, Huntsville

We have conceptually reviewed the Final Foundation Investigation Report for the above project produced by Peto MacCallum Ltd for Stantec Consulting Ltd dated March 1999, to determine the Consultant's performance in providing the deliverables as would be required by MTO for similar consultant assignments. The accuracy of the subsurface information and the adequacy and the technical aspects of the recommendations remain the responsibility and liability of the consultant. The Ministry assumes no responsibility or liability for these aspects of the reports. These aspects will be reviewed in order to assess the consultant's performance in this assignment upon implementation of the recommendations in the design and upon review of the performance of the foundations for the completed project. Following are our comments:

Swamp Treatment

For Swamp 11, after the recommended 6m of soft material excavation, it is expected that most of the remaining soft material will be displaced with the rock fill. We do not think that the sand drain treatment is required for the embankment at Swamp 11. We will be glad to discuss with the Consultant different options of embankment construction over swamp.

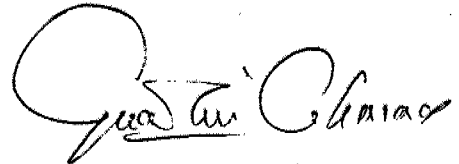
MTO prefers total excavation of soft material where possible. A full excavation is considered to be economical in the long term. Excavation of soft material in excess of 10m has been successfully carried out on MTO projects. Alternatively, partial excavation and then displacement of soft material with rock fill has been carried out in several projects. The Consultant should comment on MTO's preference for this project.

Cross sections at each swamp locations showing the proposed excavations in relation to the existing embankment shall be provided for analyzing the feasibility of full or partial excavation.

Drawings

Cross sections are very small and not to true-scale. Also, N-values or shear strength etc. are not plotted on most of the cross sections.

If you have any questions, please advise.



K. Ahmad, P. Eng
Foundation Engineer

For

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

cc: D. Yeo
T. Kazmierowski

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memorandum

To: Mike Pearsall, P. Eng. 1999 01 11
Senior Project Engineer
Northern Region

From: Pavements and Foundations Section
Room 232, Central Building
Downsview, Ontario

Re: Draft Foundation Investigation Report
Embankment Over Swamps
Highway 69, Four Laning 2.7 km North of Hwy 141 N'ly 4 km to 5.5 km South
of Hwy 518 (Badger Road)
GWP 291-97-00, District 52, Huntsville

We have conceptually reviewed the Draft Foundation Investigation Report for the above project produced by Peto MacCallum Ltd for Stantec Consulting Ltd dated December 1998, to determine the consultant's performance in providing the deliverables as would be required by MTO for similar consultant assignments. The accuracy of the subsurface information and the adequacy and the technical aspects of the recommendations remain the responsibility and liability of the consultant. The Ministry assumes no responsibility or liability for these aspects of the reports. These aspects will be reviewed in order to assess the consultant's performance in this assignment upon implementation of the recommendations in the design and upon review of the performance of the foundations for the completed project. Following are our comments:

Swamp Treatment

- For Option 1, the depth or elevation of the firm bottom should be specified. Also, it is not clear if this option is proposed for areas that are away from the existing embankments. If the excavation is carried out adjacent to the existing embankment then the integrity of the embankment may be effected.
- For Option 2, do we need the 2m wide berm for stability purposes? Please specify.
- The figure for OPSD 203.030 is not provided in the report. Also, the depth of the proposed excavation should be specified.

- For Option 4, we feel that there will be significant long term settlement if the peat or soft material is not excavated.
- In our opinion, to minimize the long term settlement and maintenance, if possible, all peat and soft material should be excavated. In areas where the swamp is adjacent to the existing embankment, consideration should be given to partially excavating the peat and soft material without disturbing the existing embankment. The excavation and backfilling should be carried out in small sections.

Logs

- Location of the boreholes should be shown by Northing and Eastings instead of Stations and offset.

Drawings

- Cross sections are very small and not in true-scale. Also, N-values or shear strength etc. are not plotted.
- Horizontal scales shown on Drawings 2A, 3A, and 4A of Section B-B are wrong.
- On the borehole location plans the existing and proposed Highway 69 are not marked.
- On Section A-A for swamp 12 (Drawing 4A), all stations are incorrect.

If you have any questions, please advise.



K. Ahmad, P. Eng
Foundation Engineer

For

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

cc: D. Smith
T. Kazmierowski



memorandum

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

1998 12 03

Attn.: Dale Smith, P. Eng.

From: Pavements and Foundations Section
Room 232, Central Building
Downsview, Ontario

Re: Consultant Proposal for the Grade Raise
Near Tourist Information Centre at Seguin Trail
Highway 69, Four Laning from 2.7 km North of Hwy 141 Northerly 4km to 5.5
km south of Hwy 518
GWP 291-97-00 (C), District 52, Huntsville

This is in response to your fax dated December 2, 1998. With your memo, we also received excerpts from the draft Pavement and Design Report, Pages 13,22,23 and Logs Pages 17 to 21 produced by Peto MacCallum Ltd. dated October 1998.

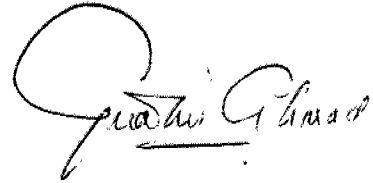
We understand from your memo and the Consultant's report (Page 13) that at Highway 69 near Station 16+420, the grade of the existing embankment will be raised by 750mm.

Two boreholes, that the Consultant put down beside the existing embankment (Station 16+420) at an offset of 6.5m and 8.7m left from the centerline, encountered 1.6m and 3.6m thick peat respectively. The Consultant could not drill through the existing rock fill embankment to investigate the underlying material. The Consultant concluded that the portion of the embankment (near Station 16+420) appears to be underlain by swamp materials and if the grade is raised, it would cause a settlement problem. Therefore, the Consultant proposed to use lightweight fill material to raise the grade.

We understand that the existing embankment was constructed in the early 1960 and there has been no stability or settlement problem with the embankment. We feel that if peat was encountered adjacent to the embankment does not necessary mean that the peat lies under the embankment. Since the embankment is performing well (no settlement, no crack or stability problem) it is possible that either the peat was excavated from the embankment area or maybe it was displaced by the rock fill

during the embankment construction. However, to confirm that there is no peat or compressible material under the existing embankment the Consultant should carry out further investigation.

If you have any questions, please advise.

A handwritten signature in black ink, appearing to read 'K. Ahmad', with a large, stylized initial 'K'.

K. Ahmad, P. Eng
Foundation Engineer

For

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

cc: T. Kazmierowski

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