

SUPPLEMENTARY FOUNDATION INVESTIGATION REPORT

HIGHWAY 69 FOUR LANING FROM 4km SOUTH
OF ESTAIRE TO 1km NORTH OF HIGHWAY 537
(12km), CN RAIL OVERHEAD STRUCTURES
AND APPROACH EMBANKMENTS

OCT. 24, 2006
G.W.P. 312-99-00
WP 5047-00-01, SITE 46-494N
WP 5048-00-01, SITE 46-494S
Geocres Number: 41I-203

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Ministry Of Transportation



SUPPLEMENTARY FOUNDATION INVESTIGATION REPORT
HIGHWAY 69, FOUR-LANING
FROM 4KM SOUTH OF ESTAIRE TO 1KM NORTH OF HIGHWAY 537, 12KM
CN RAIL OVERHEAD STRUCTURES AND APPROACH EMBANKMENTS
ONTARIO
G.W.P. 312-99-00,
WP 5047-00-01, SITE 46-494N
WP 5048-00-01, SITE 46-494S
Geocres Number: 41I-203

Report to

Ministry of Transportation Ontario
Planning and Design Section, North Bay

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October 24, 2006

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SUPPLEMENTARY FOUNDATION INVESTIGATION REPORT
HIGHWAY 69, FOUR-LANING
FROM 4KM SOUTH OF ESTAIRE TO 1KM NORTH OF HIGHWAY 537, 12KM
CN RAIL OVERHEAD STRUCTURE AND APPROACH EMBANKMENT
ONTARIO
G.W.P. 742-93-00,
W.P. 5047-00-01, SITE 46-494N
W.P. 5048-00-01, SITE 46-494S

Geocres Number: 41I-203

PART 1: FACTUAL INFORMATION

1 INTRODUCTION

The proposed widening and realignment of Highway 69 over a 12km length, from 4km south of Estaire to 1km north of Highway 537 will include the crossing of a swamp in a low-lying area that is traversed by a rail track owned and operated by CN Rail. The site is located approximately 10km south of Sudbury, just south of the intersection of the existing Highway 69 and Highway 537, at the boundary between the Townships of Secord and Dill.

The area where the proposed Hwy69 crosses the CNR track is characterized by a swamp underlain by peat, outwash loose soils and deep compressible deposits. The design will include the construction of two parallel overhead structures carrying Highway 69 NBL and SBL over the swamp and rail tracks and associated approach embankments.

Previous investigation programs carried out at this site are summarized in a report by Thurber Engineering Ltd. (Thurber) dated September 2004¹. This report indicated that, depending on the subsurface conditions beneath the CNR track, there was potential for settlement of the track resulting from the installation of piles and protection works for Piers 2N, 2S, 3N and 3S. The purpose of the supplementary drilling program presented herein was to investigate the embankment foundation soils immediately beneath the CNR track and to assess the potential for settlement of the track during installation of driven piles for the piers close to the track.

1 Foundation Investigation Report, Highway 69, Four Laning from 4km South of Estaire to 1km North of Highway 537, 12km - CNR Overhead Structures and Approach Embankments. Ontario. September 7, 2004. GWP 312-99-00 WP 5047-00-01, Site 46-494N, WP 5048-00-01, Site 46-494S, Geocres Number: 41I-184

The work was carried out in general accordance with our proposal letter to MTO dated June 14, 2006. Authorization to proceed with the work was provided in an electronic message by MTO dated June 15, 2006.

This report should be read in conjunction with Thurber's report dated September 7, 2004¹.

2 SITE DESCRIPTION

The realigned Highway 69 at the proposed bridge sites runs in an approximate south-north direction, parallel to and 300m east of the existing Highway 69.

The general site area is located within the physiographic region known as the Canadian Shield, locally characterized by Pre-Cambrian bedrock of the Central Gneiss Belt. The bedrock elevation varies significantly in the area. Bedrock outcrops are present in some areas of the site but in other areas the bedrock is mostly overlain by glacial deposits (till) with particle sizes ranging from silt to boulder size, deep post-glacial lake sediments (glaciolacustrine origin) and by organic deposits in the low lying areas.

The proposed highway alignment will traverse a 450m wide depression/channel with bedrock outcrops to the north and south. CN Rail track of the Bala Subdivision crosses the channel in an approximate east-west orientation. Drainage in the general area is to the southwest and is controlled by the Wanapitei River, north of the site.

The southern portion of the channel is occupied by a low-lying, flat, wet and poorly drained swamp. Standing water was noted in the swamp at several locations. CN Rail track crosses this swamp. The area to the south of the swamp consists of a thin veneer of organic soil over bedrock or bedrock outcrops. The terrain is rugged and sparsely covered with mature vegetation and trees.

The ground rises to the north with a vertical relief of up to 5m above the swamp elevation. An area extending about 100m north of the swamp is wooded, consisting mostly of mature spruce and cedar, beyond which there is farmland.

3 SITE INVESTIGATION AND FIELD TESTING

The supplementary site investigation and field testing described herein was carried out on July 19 and July 20, 2006. The site investigation consisted of drilling two boreholes, INC and ISC, to 12.8m and 9.8m depth, respectively, one at each of the locations where the centreline of the proposed Hwy 69 NBL and SBL alignments cross CNR track.

The locations of the boreholes are shown on the attached Drawings 1 and 2 – Borehole Locations and Soil Strata.

The borehole locations were marked at the CNR track and utility clearances were obtained by Thurber prior to any drilling being carried out. Authorization to carry out the investigation program was obtained by Thurber from CNR with the support of MTO. CNR also provided track block and flagging.

Landcore Drilling of Sudbury, ON, supplied and operated a truck mounted drill rig and sampling equipment.

Hollow stem auger drilling technique was used to advance the boreholes and disturbed samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT).

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The drilling supervisor logged the boreholes and the recovered samples and processed them for transport to Thurber's Oakville office. All boreholes were grouted on completion of the drilling program in accordance to O'Reg 128/03.

4 LABORATORY TESTING

All recovered soil samples were subjected to visual identification and natural moisture content determination. The results of this testing are shown on the Record of Borehole sheets in Appendix A.

Selected samples were subjected to gradation analysis (sieve and hydrometer) and Atterberg Limit testing. The test results are shown on the Record of Borehole sheets in Appendix A and on the charts in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

5.1 General

A description of the subsurface conditions in the general project area was presented in Thurber's report of September 7, 2004 and it will not be repeated herein. Of interest to the potential of settlement of CNR track due to nearby construction activities is the subsurface conditions immediately beneath the track and at the proposed piers close to the track.

Reference is made to the Record of Borehole sheets prepared by Peto MacCallum Ltd. in their report dated May 23, 2003², to the Record of Borehole sheets for boreholes drilled by Thurber presented in the September 2004^(opt. cit.) report and the Record of Borehole sheets included in Appendix A of this report. Details of the encountered soil stratigraphy in the area of interest are presented in the borehole logs and on the attached Drawings 1 and 2. The factual information at the borehole locations governs any interpretation of site conditions.

The area was found to be underlain by granitic bedrock of the Canadian Shield. The bedrock is overlain by broadly graded generally compact to dense granular soils including silt, sand, cobbles and boulders, which are overlain by compressible glaciolacustrine and glaciofluvial soils and organic soils. The glaciolacustrine deposits consist of plastic silt and clay. The silt and clay deposit is fairly thick under the north portion of the swamp,

with thickness up to 35m. The glaciolacustrine deposits are overlain by outwash glaciofluvial loose to compact sand and silt with interbeds of clayey material. The southern portion of the sand and silt deposit appears to have been eroded in the recent geological past by surface water draining towards the Wanapitei River to the west and replaced by peat. CNR track embankment runs in a northeast-southwest direction apparently sub parallel to the southern edge of the interface of the peat and the sand and silt deposit.

The following sections present the subsurface conditions immediately beneath the CNR track at the SBL and NBL bridge alignments.

5.2 CNR Track and Hwy69 NBL

Borehole INC indicates that at the Hwy69 NBL centreline, the CNR track fill consists of ballast, sand and wood corduroy to 2.4m depth. The corduroy overlies 1.3m of loose silty sand, with one SPT blow count of 4 and gradation of 65% sand, 28% silt and 7% clay. Sandy peat was encountered underlying the silty sand to 4.6m depth, which in turn overlies 3m of loose silt to silty sand to 7.6m depth. The SPT blow counts in this deposit were 2 and 4, the water content in the order of 25% and gradation from two hydrometer tests of 32% and 64% sand, 54% and 20% silt and 15% and 17% clay. Soft silty clay was encountered underlying the silt and silty sand deposit from 7.6m to 9.1m depth and below 9.8m depth to the end of the borehole at 12.8m depth. The clay deposit was soft to firm, with SPT blow counts of 2 to 6 and water content of 28% to 33%. One hydrometer test indicated gradation consisting of 4% sand, 63% silt and 33% clay. One Atterberg limits test indicated that the clay was low plastic (CL). A lens of loose sand embedded in the clay deposit was encountered between 9.1m and 9.8m depth. The sand deposit consists of 89% sand and 11% fines (silt and clay).

The groundwater in the borehole at the end of drilling was at 4.9m depth. This is a very short term observation and is expected to rise to the swamp surface water elevation with time.

5.3 CNR Track and Hwy69 SBL

Borehole ISC indicates that at the Hwy69 SBL centreline, the CNR track fill consists of 1.1m of ballast and 1m of dense sand fill. The fill overlies 2.8m of loose fibrous peat, to 4.9m depth. Two SPT blow counts in the peat were 3 and 2 and the water content was 351%. The peat is underlain by soft silty clay to the bottom of the borehole. The top 1.2m of this clay deposit had inclusions of peat. The SPT blow count in the clay deposit was 2 at three different depths. The water content ranged from 30% to 39%. Two hydrometer tests indicated 0% and 1% of sand, 67% and 73% silt and 32% and 26% clay. One set of Atterberg limit tests confirmed that the clay is low plastic (CL).

The groundwater level inside the borehole at the end of drilling was also 4.9m. This is a very short term observation and is expected to rise to the swamp surface water elevation with time.

Engineering analysis and report prepared by:



Paulo Branco, Ph.D., P.Eng
Project Engineer, Principal



Report Reviewed by:
P. K. Chatterji, Ph.D., P.Eng.
Review Principal

Appendix A

Record of Borehole Sheets

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT 'N' VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

Sensitivity = $\frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$



Water Level



Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
	HIGHLY ORGANIC SOILS		Pt
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

RECORD OF BOREHOLE No INC

1 OF 2

METRIC

W.P. 5249-05-00 LOCATION HWY 69 Four Lining - CNR Crossing, Estaire, Ontario ORIGINATED BY GA
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 19.07.06 - 19.07.06 CHECKED BY PJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
							WATER CONTENT (%)										
							20 40 60										
0.0	BALLAST																
0.9	SAND, trace to some gravel, trace silt Brown Moist (FILL)																
1.8	WOOD (Corduroy)		1	SS	32												
2.4	Silty SAND, trace rootlets, trace clay Loose Dark Grey Moist		2	SS	4												
3.7	Sandy PEAT, trace rootlets and organics Dark Brown																
4.6	Sandy SILT to Silty SAND, some clay Loose Grey Wet		3	SS	2												
			4	SS	4												
7.6	Silty CLAY, trace sand Soft Grey		5	SS	2												
9.1	SAND, some silt Loose Grey Wet		6	SS	4												
9.8	Silty CLAY																

Continued Next Page

+ 3 . × 3 : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No INC

2 OF 2

METRIC

W.P. 5249-05-00 LOCATION HWY 69 Four Laning - CNR Crossing, Estaire, Ontario ORIGINATED BY GA
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 19.07.06 - 19.07.06 CHECKED BY PJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	20					
	Firm to Soft Grey		7	SS	6									
			8	SS	2									
12.8	END OF BOREHOLE AT 12.80 m. BOREHOLE OPEN TO 12.80 m AND WATER LEVEL AT 4.88 m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG.													

RECORD OF BOREHOLE No ISC

1 OF 2

METRIC

W.P. 5249-05-00 LOCATION HWY 69 Four Lining - CNR Crossing, Estaire, Ontario ORIGINATED BY GA
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.06 - 20.07.06 CHECKED BY PJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
								20 40 60 80 100						
					20 40 60 80 100					20 40 60				

Continued Next Page

+³ x³: Numbers refer to
Sensitivity

20
15 10 5
10 (%) STRAIN AT FAILURE

ONTMT4S 6415.GPJ 24/07/06

RECORD OF BOREHOLE No ISC

2 OF 2

METRIC

W.P. 5249-05-00 LOCATION HWY 69 Four Laning - CNR Crossing, Estaire, Ontario ORIGINATED BY GA
 HWY 69 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.06 - 20.07.06 CHECKED BY PJB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	W _p W W _L	20 40 60				
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 4.88 m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG.													

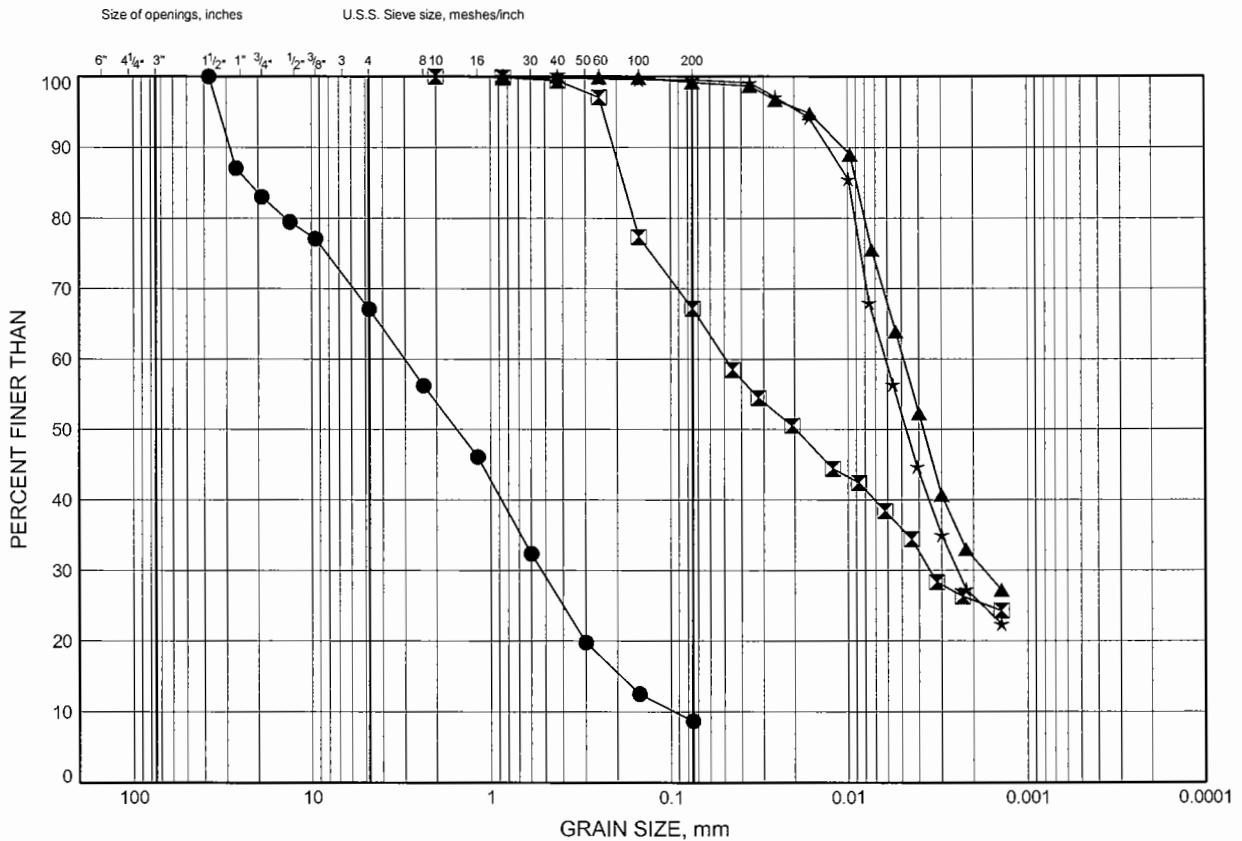
Appendix B

Laboratory Test Results

GRAIN SIZE DISTRIBUTION

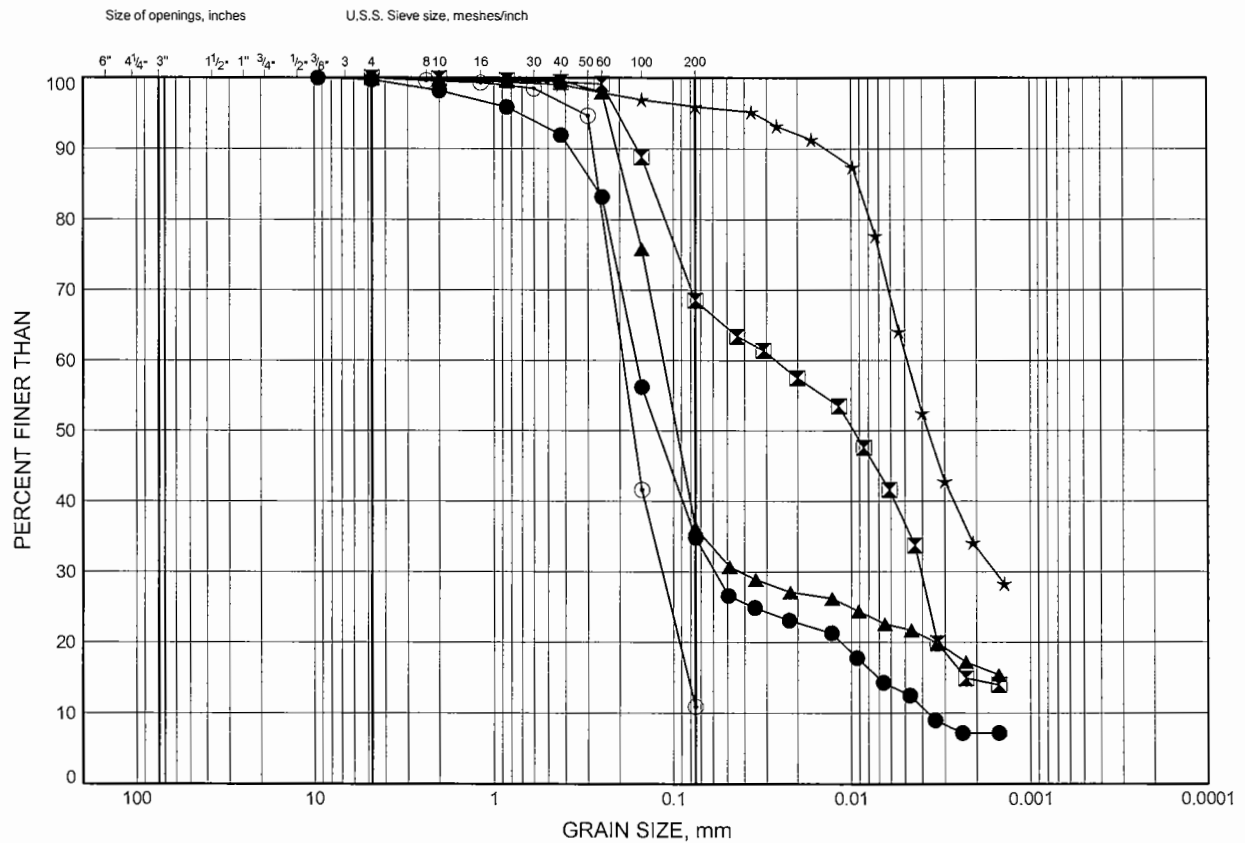
FIGURE B1

BH - ISC



GRAIN SIZE DISTRIBUTION

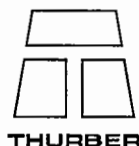
BH - INC



SYMBOL	BH	DEPTH (m)	
●	INC	3.35	SILTY SAND
⊠	INC	4.88	SANDY SILT TO SILTY SAND
▲	INC	6.40	SANDY SILT TO SILTY SAND
★	INC	7.92	SILTY CLAY
⊙	INC	9.45	SAND

Date ..October 2006.....

Project ..5249-05-00..

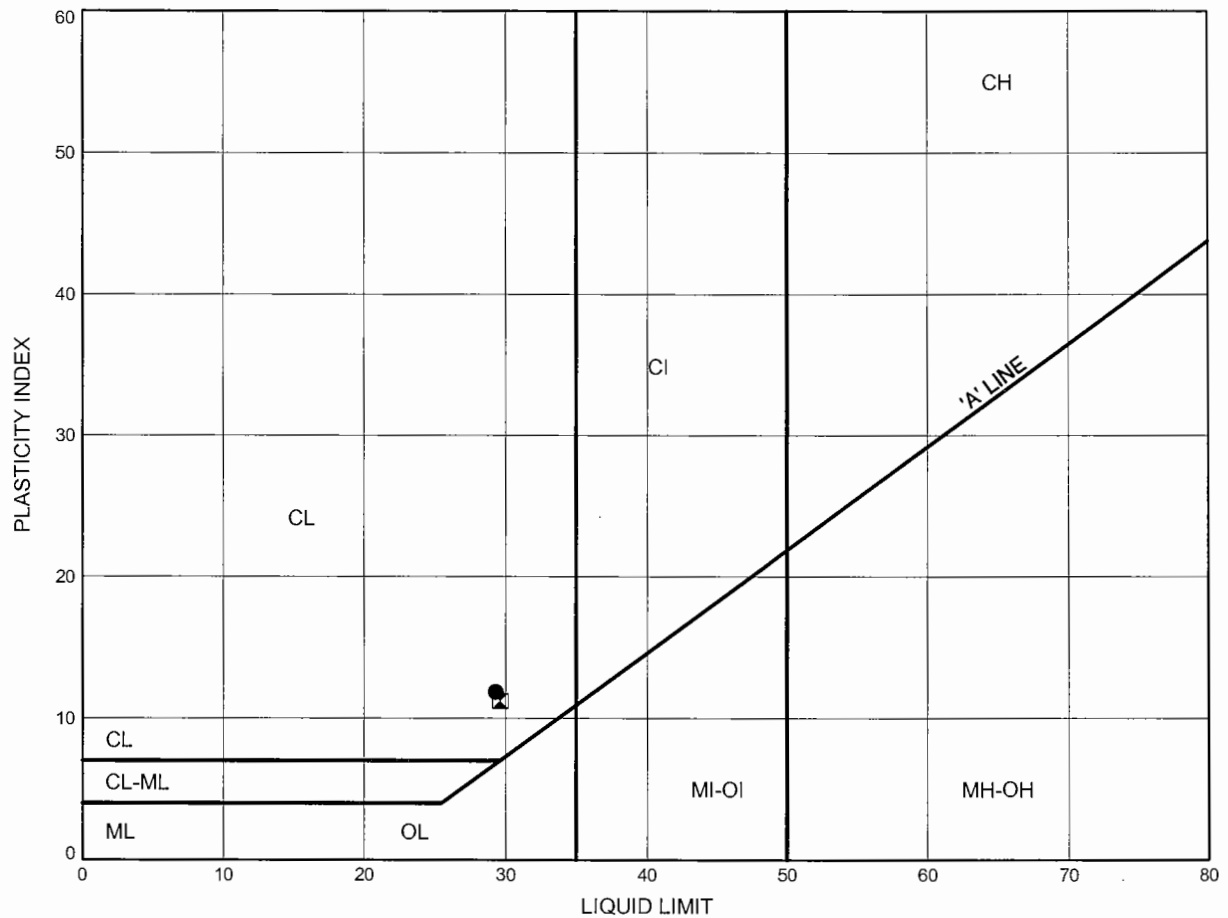


Prep'dJHL.....

Chkd.PJB.....

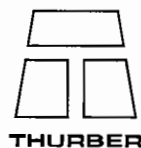
HWY 69 Four Laning - CNR Crossing, Estaire, Ontario
ATTERBERG LIMITS TEST RESULTS

FIGURE B3

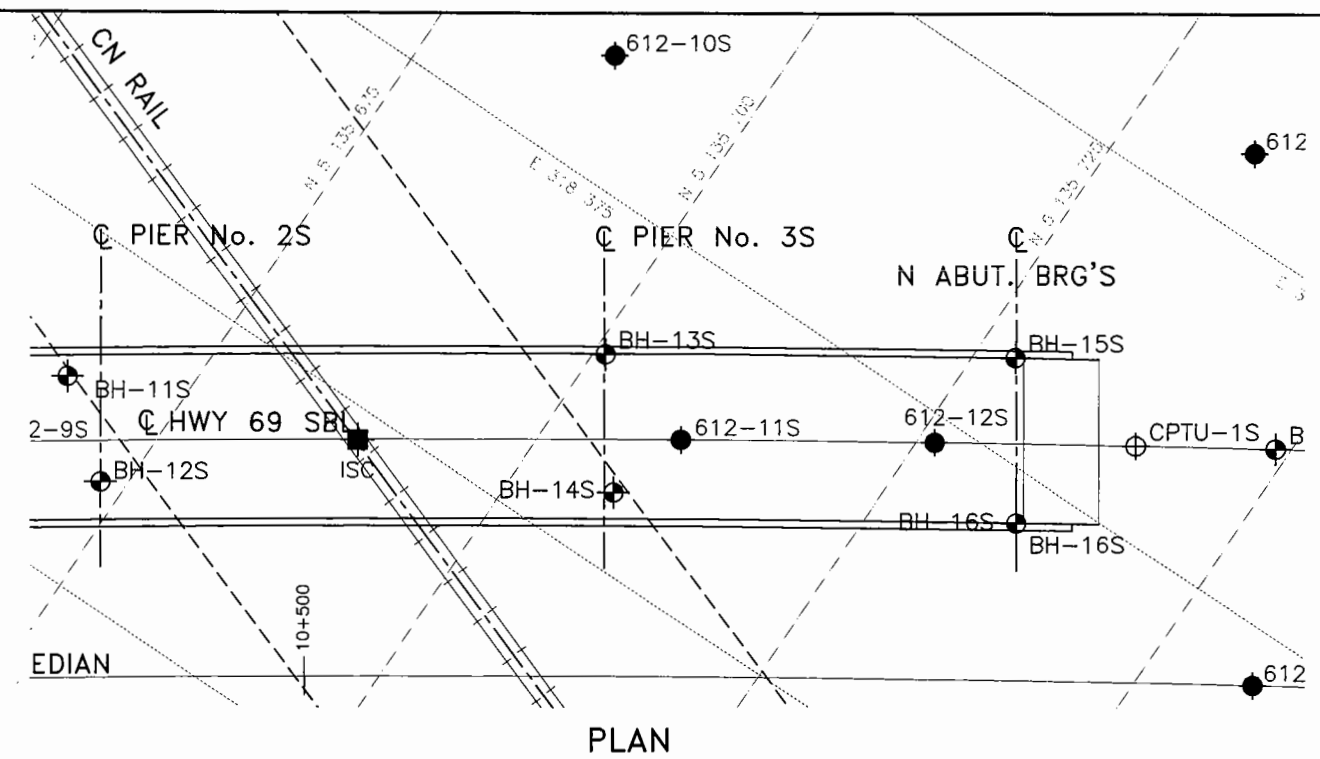


SYMBOL	BH	DEPTH (m)	
●	INC	10.97	SILTY CLAY
⊠	ISC	7.92	SILTY CLAY

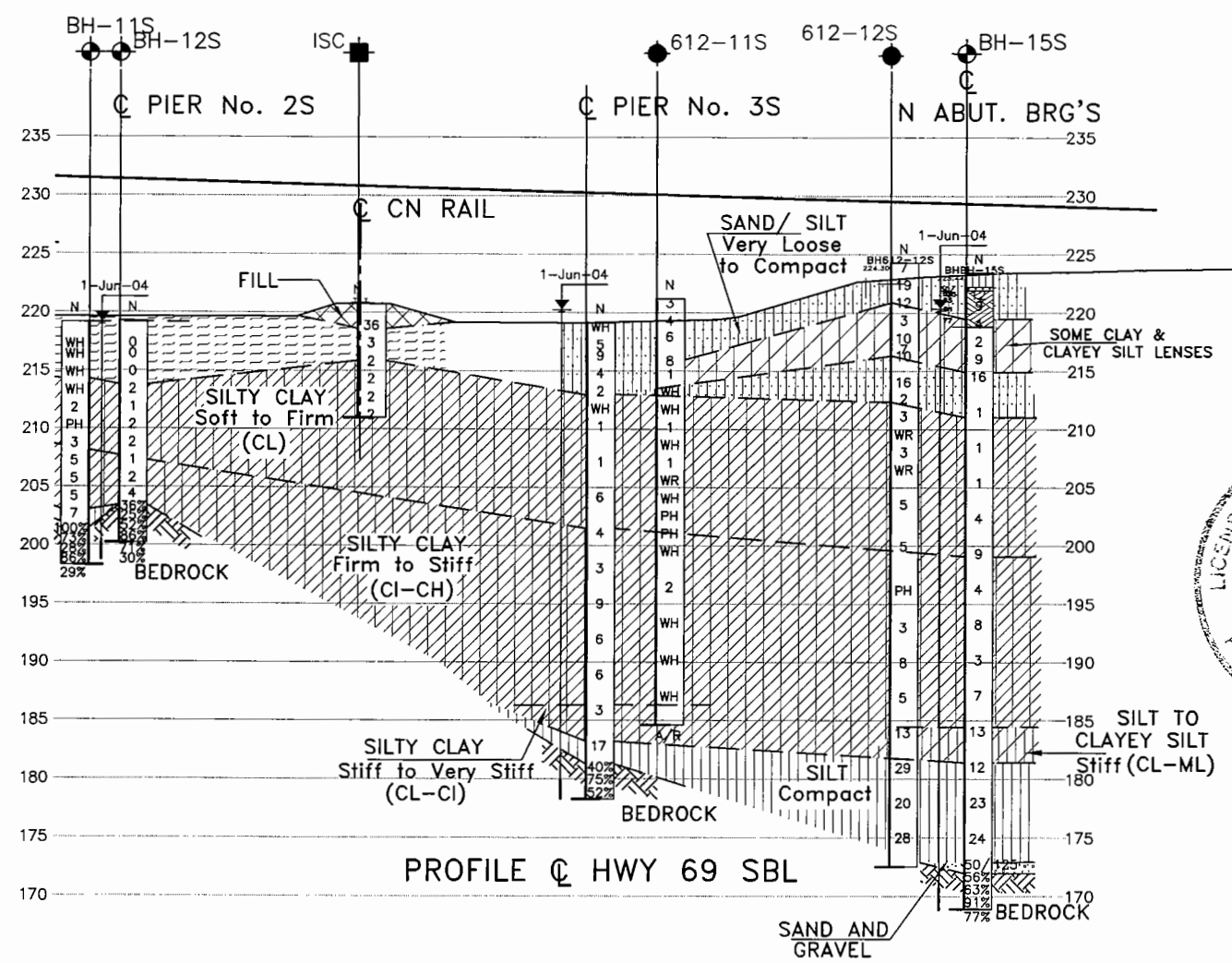
Date October 2006
 Project 5249-05-00



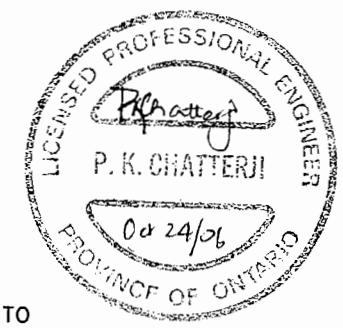
Prep'd JHL
 Chkd. PJB



PLAN

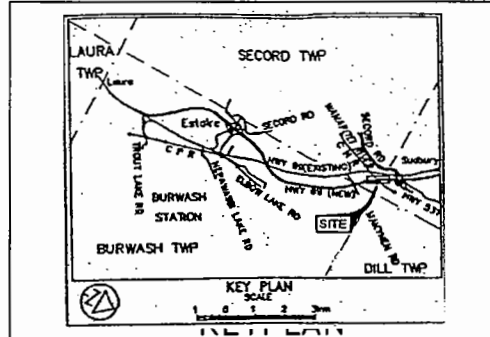


PROFILE \oslash HWY 69 SBL



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

PLATE No	CONT 2006-5158	SHEET 137
WP	5249-05-00	
HWY 69 FOUR-LANING-CNR OVERHEAD SBL STRUCTURE BOREHOLE LOCATIONS AND SOIL STRATA		



LEGEND			
	Bore Hole by Peto MacCallum Ltd.		
	Piezocone by Conetec		
	Bore Hole by Thurber		
	Bore Hole by Thurber (CNR Embankment)		
	Blows/ 0.3m (Std Pen Test, 475 J/blow)		
	Blows/ 0.3m (60° Cone, 475 J/blow)		
	Pressure, Hydraulic		
	WL at Time of Investigation		
	Head Artesian Water		
	Piezometer		
	90% Rack Quality Designation (RQD)		
	Auger Refusal		

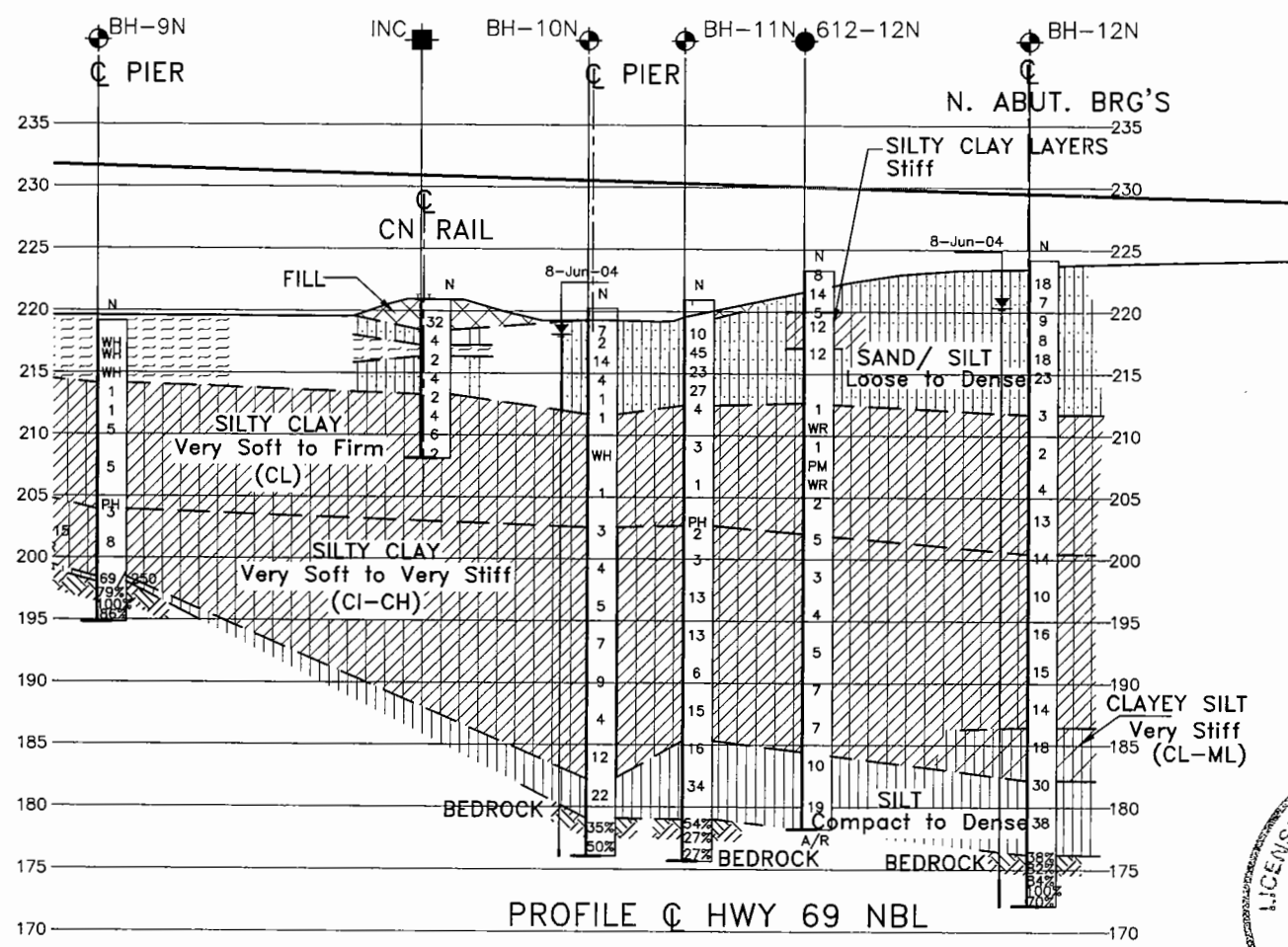
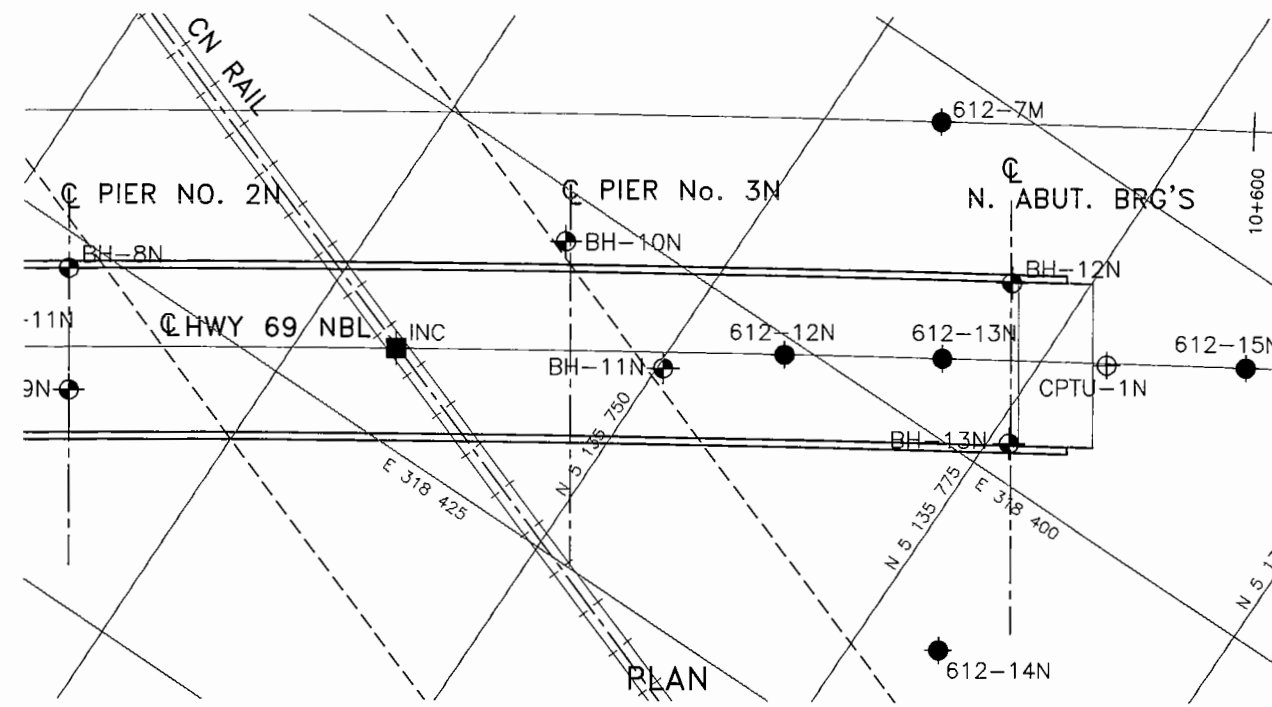
NO	ELEVATION	NORTHING	EASTING
BH-1S	223.00	5135606.32	318451.37
BH-2S	221.69	5135610.49	318448.47
BH-3S	224.28	5135612.10	318455.54
BH-4S	225.48	5135613.57	318462.23
BH-5S	225.19	5135617.67	318459.32
BH-6S	218.99	5135632.76	318432.38
BH-7S	219.05	5135636.85	318429.49
BH-8S	219.09	5135638.49	318436.57
BH-9S	219.24	5135640.08	318443.14
BH-10S	219.20	5135644.11	318440.28
BH-11S	219.17	5135666.34	318410.91
BH-12S	219.27	5135673.16	318416.36
BH-13S	219.14	5135700.88	318385.65
BH-14S	219.03	5135707.44	318394.36
BH-15S	223.44	5135727.91	318367.90
BH-16S	223.43	5135735.20	318378.72
ISC	CN Track Level	5135688	318402

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

DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

MILEAGE 245.67 BALA SUBDIVISION

REVISIONS	DESCRIPTION
DESIGN PJB	CHK CODE CHBDC-00/LOAD CL625-ONT
DRAWN SS	CHK PJB SITE 46-494S
	DATE JULY, 04
	DWG 1



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

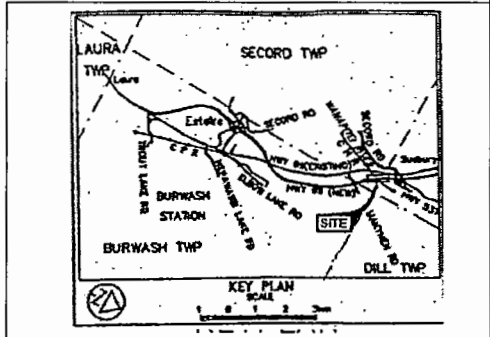
PLATE No
CONT 2006-5158
WP 5249-05-00

HWY 69 FOUR-LANING-CNR
OVERHEAD NBL STRUCTURE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET
118

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LEGEND

- Bore Hole by Peto MacCallum Ltd.
- ⊕ Piezocone by Conetec
- ⊙ Bore Hole by Thurber
- Bore Hole by Thurber (CNR Embankment)
- N Blows/ 0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/ 0.3m (60° Cone, 475 J/blow)
- PH Pressure, Hydraulic
- WL at Time of Investigation
- ⊕ Head Artesian Water
- ⊕ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
BH-1N	224.12	5135641.05	318473.15
BH-2N	223.36	5135645.04	318470.24
BH-3N	223.62	5135646.67	318477.06
BH-4N	223.58	5135648.26	318484.12
BH-5N	223.32	5135652.40	318481.14
BH-6N	219.00	5135673.63	318450.12
BH-7N	219.24	5135680.77	318461.00
BH-8N	219.23	5135706.69	318427.42
BH-9N	219.16	5135712.04	318435.44
BH-10N	220.25	5135738.40	318403.54
BH-11N	220.96	5135750.44	318407.54
BH-12N	224.20	5135769.65	318386.48
BH-13N	224.00	5135776.52	318397.21
INC	CN Track Level	5135732	318417

NOTE

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

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DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING