



**TABLE A**  
**ROCK CORE DESCRIPTIONS**

LOCATION (BH)	CORE RECOVERY				CORE DESCRIPTION	
	RC	DEPTH (m)	REC (%)	RQD (%)	DEPTH (m)	DESCRIPTION
C8-1	5	2.8 – 3.1	100	73	2.8 – 5.9	GABBRO: Dark green to black and grey, fine to medium crystalline, high strength, slightly weathered to unweathered, close to moderate spaced flat to dipping cross joints, rough planar with occasional horizontal slickensides, with some vertical fissures, tight to open to 1 mm, generally slightly altered with black silty infilling, occasional white scale, fair to excellent quality.
	6	3.1 – 4.3	100	70		
	7	4.3 – 5.9	100	99		
C8-3	7	4.9 – 6.0	98	15	4.9 – 8.1	GABBRO: Dark green to black and grey, fine to medium crystalline, high strength, slightly weathered to unweathered, very close to close spaced (moderate below 7.2 m) flat to dipping cross joints, rough planar with occasional horizontal slickensides, with numerous vertical fissures (some compound), tight to open (5 mm), generally slightly altered with black silty infilling, very poor to poor becoming excellent quality.
	8	6.0 – 7.6	100	29		
	9	7.6 – 8.1	100	100		
C8-5	7	5.2 – 6.3	100	100	5.2 - 8.3	GABBRO: Dark green to black and grey, fine to medium crystalline, high strength, slightly weathered to unweathered, close to moderate spaced flat to dipping (locally vertical) cross joints, rough planar, locally open (to 1 mm), tight to slightly altered with black silt infilling, occasional green scale on parting surface, good to excellent quality.
	8	6.3 – 7.2	100	85		
	9	7.2 – 8.3	100	95		

RQD = Rock Quality Designation

Originated: JFW  
 Compiled: FP  
 Checked: AS / CN



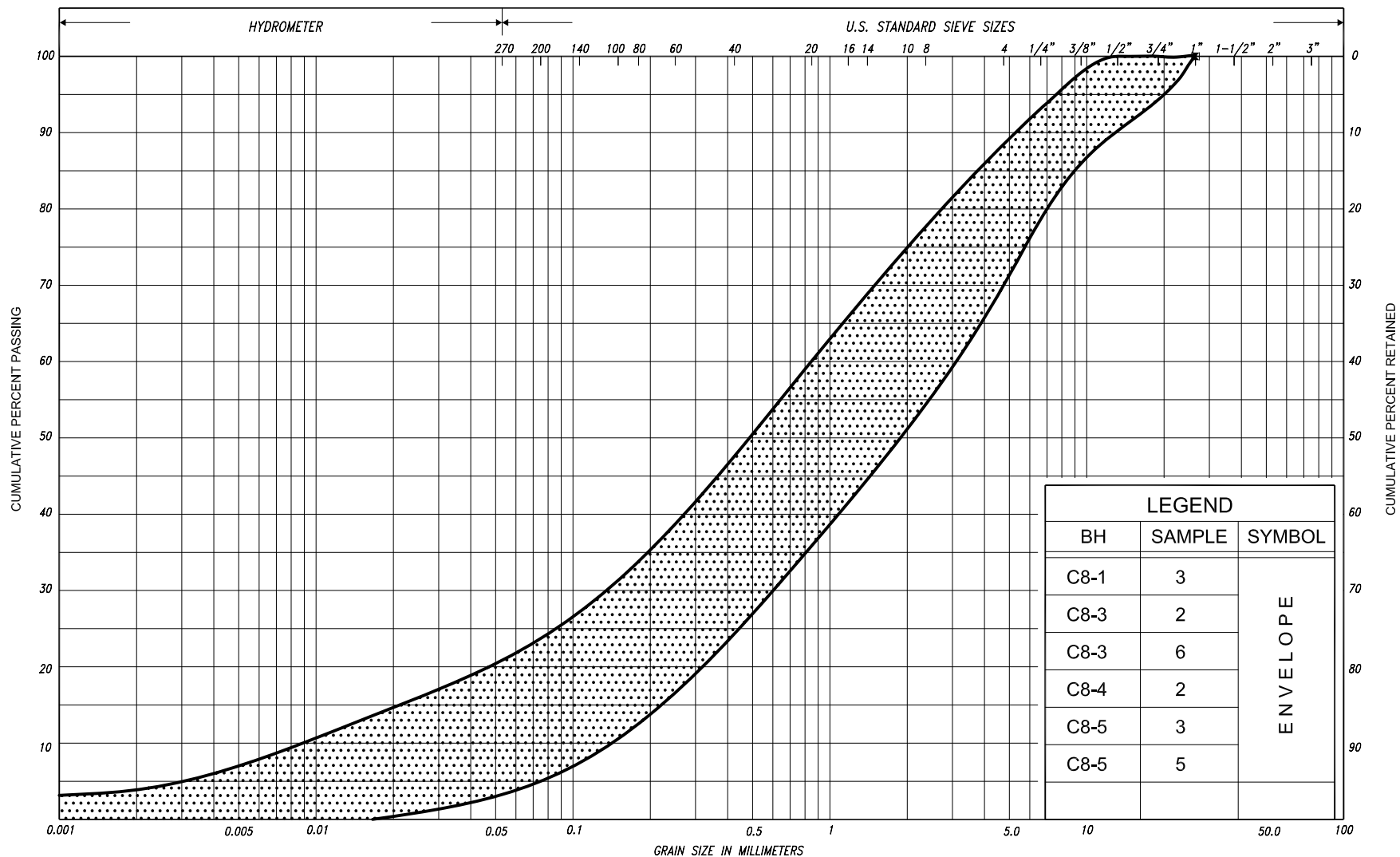
**TABLE A**  
**ROCK CORE DESCRIPTIONS**

LOCATION (BH)	CORE RECOVERY				CORE DESCRIPTION	
	RC	DEPTH (m)	REC (%)	RQD (%)	DEPTH (m)	DESCRIPTION
Bridge Pier - SBL Sta. 20+803, o/s 18.8 LT CL (P1-SBL)	5	5.0 – 6.1	100	86	5.0 – 9.7	GABBRO: Dark green to black and grey, fine to medium crystalline, high strength, slightly weathered to unweathered, close to moderate spaced flat to dipping cross joints, rough planar with occasional horizontal slickensides, with some vertical fissures, tight to open to 1 mm, generally slightly altered with black silty infilling, occasional white scale, good to excellent quality.
	6	6.1 – 7.6	95	91		
	7	7.6 – 9.1	100	88		
	8	9.1 – 9.7	96	85		
Bridge Pier - NBL Sta. 20+809, o/s 18.8 RT CL (P2-NBL)	5	4.9 – 6.2	96	87	4.9 – 8.9	GABBRO: Dark green to black and grey, fine to medium crystalline, high strength, slightly weathered to unweathered, close to moderate (locally wide) spaced flat to dipping (locally vertical) cross joints, rough planar (locally with horizontal slickensides, tight to slightly altered with black silty infilling, occasional white scale, fair to excellent quality.
	6	6.2 – 6.9	100	96		
	7	6.9 – 7.6	100	100		
	8	7.6 – 8.9	100	63		

RQD = Rock Quality Designation

Originated: JFW  
 Compiled: FP  
 Checked: AS / CN





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

## GRAIN SIZE DISTRIBUTION

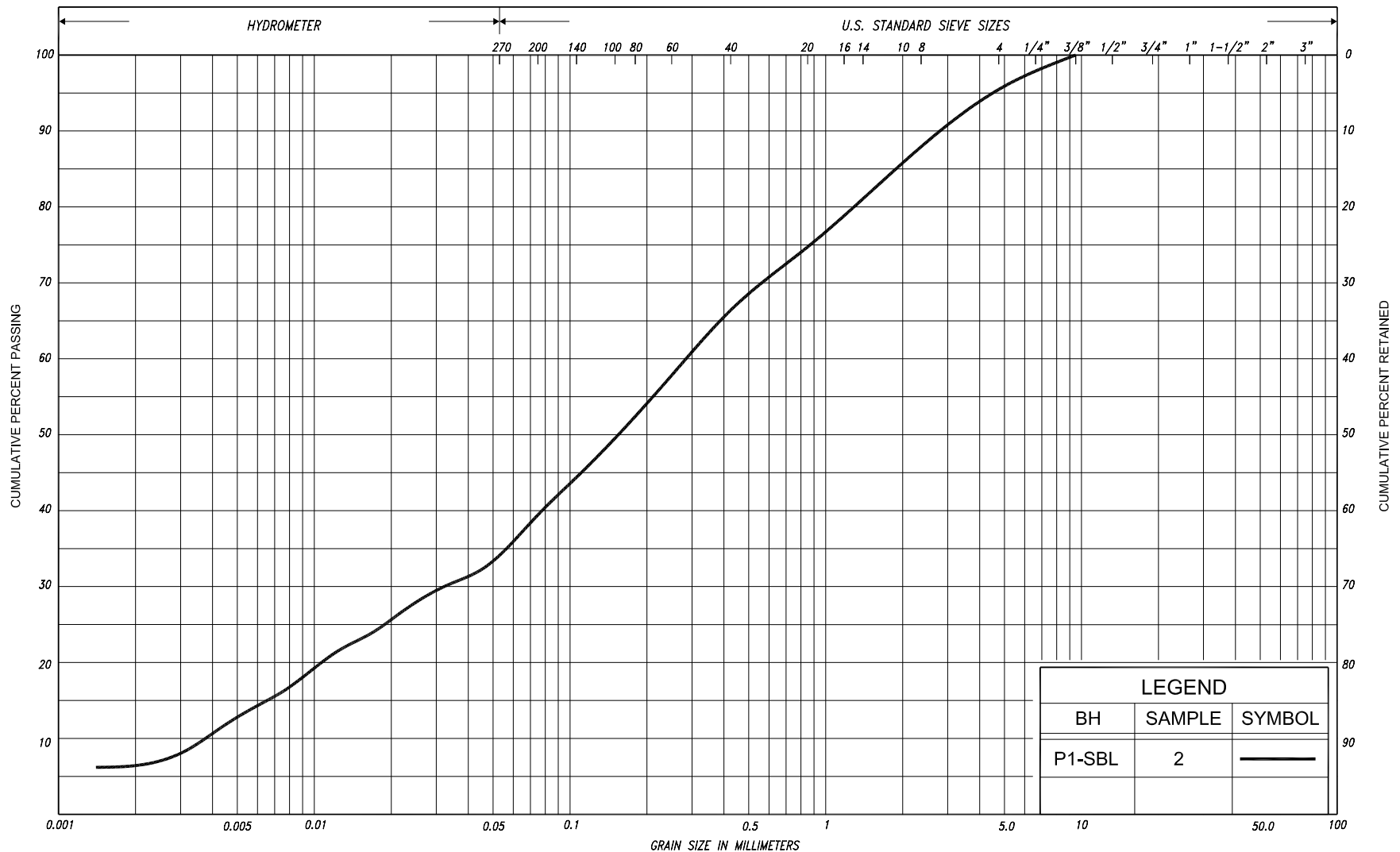
SAND, some to with gravel  
trace to some silt, trace clay

FIG No. C8-GS-1

HWY: 69

G.W.P. No. 5203-06-00





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

## EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

**JOINTING AND BEDDING:**

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

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE
F V	FIELD VANE		

### STRESS AND STRAIN

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

### MECHANICAL PROPERTIES OF SOIL

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

### PHYSICAL PROPERTIES OF SOIL

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

## METRIC

$+^7, \times^5$ : Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 315-2

1 of 1

METRIC

G.W.P. 5203-06-00	LOCATION	Hwy 69 (New), Sta. 20+787, o/s 19.0m Lt. CL Med.	ORIGINATED BY	F.P.
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DIST	54	HWY	69	BOREHOLE TYPE	Manual Probe	COMPILED BY	A.S.
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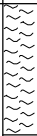

DATUM Geodetic DATE May 11, 2009 CHECKED BY C.N.

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RECORD OF PENETRATION TEST No 315-3

1 of 1 METRIC

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+787.5 CL ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY A.S.  
 DATUM Geodetic DATE March 02, 2009 CHECKED BY C.N.

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa			WATER CONTENT (%)						
187.9 0.0	Ground Surface Probable peat														GR SA SI CL
	Probable sand Compact														
185.4 2.5	End of dynamic cone penetration test Refusal on probable bedrock														

**RECORD OF BOREHOLE No 315-4**

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+787.5, o/s 58.0m Rt. CL Med. ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY A.S.  
 DATUM Geodetic DATE March 01, 2009 CHECKED BY C.N.

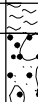
SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa												
187.6	Top of Ice					187														
0.0	Snow and ice						20	40	60	80	100									
187.2																				
0.4	Peat, coarse fibrous																			
186.8	Dark brown																			
0.8	Sand, with gravel cobbles and boulders																			
186.1	Brown Moist																			
1.5	End of borehole																			
	Refusal on probable boulders																			
	* Borehole dry																			

# RECORD OF BOREHOLE No 315-5

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+795, o/s 55.0m Lt. CL Med. ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY A.S.  
 DATUM Geodetic DATE March 02, 2009 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE									
189.1	Top of Ice						20	40	60	80	100						
0.0	Snow and ice																
188.6																	
0.5 188.3	Topsoil		1	SS	30/5cm												
0.8	Sand, some gravel cobbles and boulders																
187.6	Compact    Brown    Moist																
1.5	End of borehole																
	Refusal on probable boulders																
	Sample 1: Sampler bouncing																
	*    Borehole dry																

## 1 of 1

METRIC

## Foundation Design


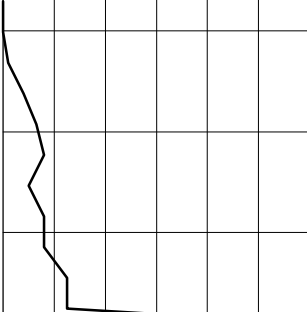
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RECORD OF PENETRATION TEST No 315-7

1 of 1 METRIC

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+812.5, o/s 58.0m Lt. CL Med. ORIGINATED BY F.P.  
DIST 54 HWY 69 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY A.S.  
DATUM Geodetic DATE February 17, 2009 CHECKED BY C.N.

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa											
									○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE					
188.6 0.0	Top of Snow Probable snow and ice  Probable peat  Probable sand Compact																
185.1 3.5	End of dynamic cone penetration test Refusal on probable bedrock																

RECORD OF PENETRATION TEST No 315-8

1 of 1 METRIC

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+812.5, o/s 58.0m Rt. CL Med. ORIGINATED BY F.P.  
DIST 54 HWY 69 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY A.S.  
DATUM Geodetic DATE March 01, 2009 CHECKED BY C.N.

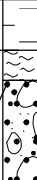

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa			WATER CONTENT (%)						
187.9	Top of Ice														
0.0	Snow and ice														
	Probable peat														
186.7	Probable sand														
1.2	Compact End of dynamic cone penetration test  Refusal on probable boulders														

# RECORD OF BOREHOLE No 315-9

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+814 CL ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY A.S.  
 DATUM Geodetic DATE March 01, 2009 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT							PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE											
187.6 0.0	Top of Snow Snow and ice						20	40	60	80	100								
187.1 0.5 186.8 0.8	Peat, coarse fibrous Dark brown Sand, some gravel cobbles and boulders					 *	187												
185.8 1.8	Compact    Grey    Wet End of borehole Refusal on probable boulders  Sample 1: Sampler bouncing   <																		

**RECORD OF PENETRATION TEST No 315-10**

1 of 1 **METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+820 CL ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY A.S.  
 DATUM Geodetic DATE March 02, 2009 CHECKED BY C.N.



SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE								
187.6 0.0	Ground Surface  Probable peat  Probable sand with gravel  Compact															
184.9 2.7	End of dynamic cone penetration test  Refusal on probable bedrock															

# RECORD OF BOREHOLE No 315-11

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+820, o/s 12.8m Rt. CL Med. ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY A.S.  
 DATUM Geodetic DATE March 01, 2009 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa												
189.3	Top of Ice					*	189													
0.0 189.0	Snow and ice							20	40	60	80	100								
0.3 188.7	Topsoil							○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×						LAB VANE	WATER CONTENT (%)	
0.6 188.1	Sand, some gravel cobbles and boulders							20	40	60	80	100						20	40	60
1.2 187.1	Brown Moist																			
	End of borehole																			
	Refusal on probable boulders																			
	* Borehole dry																			

# RECORD OF BOREHOLE No 315-12

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+821, o/s 18.8m Lt. CL Med. ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY A.S.  
 DATUM Geodetic DATE March 02, 2009 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
188.3 0.0	Ground Surface							20	40	60	80	100					
188.1 0.2	Topsoil																
187.7 0.6	Sand, with gravel cobbles and boulders						188										
	End of borehole																
	Refusal on probable boulders																
	* Borehole dry																

**RECORD OF BOREHOLE No 315-13**

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+830, o/s 51.0m Rt. CL Med. ORIGINATED BY F.P.  
DIST 54 HWY 69 BOREHOLE TYPE Manual Probe COMPILED BY A.S.  
DATUM Geodetic DATE March 27, 2009 CHECKED BY C.N.

SOIL PROFILE				SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)							GR	SA	SI	CL		
						○ UNCONFINED			● QUICK TRIAXIAL	+	×	FIELD VANE	LAB VANE										
191.2	Ground Surface																						
0.0	Bedrock at surface																						
	* Borehole dry																						

# RECORD OF BOREHOLE No 315-14

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+833, o/s 60.0m Lt. CL Med. ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY A.S.  
 DATUM Geodetic DATE March 02, 2009 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
190.3 0.0	Top of Ice Snow and ice					*	190	20	40	60	80	100					
189.7 0.6	Topsoil																
189.5 0.8	Sand, some gravel cobbles and boulders																
189.1 1.2	Brown Moist End of borehole Refusal on probable boulders  <																



**RECORD OF BOREHOLE No 315-15**

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Hwy 69 (New), Sta. 20+837.5 CL ORIGINATED BY F.P.  
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probe COMPILED BY A.S.  
 DATUM Geodetic DATE March 30, 2009 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)			
191.6	Ground Surface					*														
0.0	Boulders at surface																			

**METRIC**

Hwy 69 (New), Sta. 20+807.3, o/s 58m Lt CL Med.

ORIGINATED BY F.P.

COMPILED BY A.S.

\_\_\_\_ CHECKED BY B.R.G.

20  
15 — 5 (%) STRAIN AT FAILURE  
10

## METRIC

DATUM Geodetic DATE March 02, 2009 CHECKED BY B.R.G.

**+<sup>7</sup>, ×<sup>5</sup>:** Numbers refer to Sensitivity

RECORD OF BOREHOLE No C8-3										1 of 1		METRIC				
G.W.P. 5203-06-00			LOCATION			Coords: 5 096 739.8 N; 221 577.1 E Hwy 69 (New), Sta. 20+803 CL Med.			ORIGINATED BY F.P.							
DIST 54 HWY 69			BOREHOLE TYPE C.F.H.S.A. and NQ Diamond Coring						COMPILED BY A.S.							
DATUM Geodetic			DATE February 26 and 28, 2009						CHECKED BY B.R.G.							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa									
187.7	Top of Snow						20	40	60	80	100					
0.0	Snow and ice															
187.3																
0.4	Peat, coarse fibrous															
186.9																
0.8	Dark brown Wet		1	SS	20/5cm											
	Sand, with gravel some silt, trace clay cobbles and boulders															
	Loose to Grey Wet compact		2	SS	15											30 52 15 3
			3	SS	4											
			4	SS	16											
			5	SS	24											
182.8	with silt, some gravel		6	SS	12/17cm											15 61 20 4
4.9	Gabbro bedrock		7	RC NQ	REC 98%											RQD 15%
	Slightly weathered to unweathered		8	RC NQ	REC 100%											RQD 29%
	Hight strength		9	RC NQ	REC 100%											RQD 100%
	Very poor to poor becoming excellent quality															
179.6	End of borehole															
8.1																
	Samples 1 & 6: Sampler bouncing															
	* 2009 02 28															
	▽ Water level observed during drilling															
	▼ Water level measured after drilling															
	C.F.H.S.A. denotes Continuous Flight Hollow Stem Augers															

## METRIC

DATUM Geodetic DATE March 01, 2009 CHECKED BY B.R.G.

ON MOT VER3 06TF035C.GPJ ON MOT.GDT 7/7/2009 9:00:26 AM

(%) STRAIN AT FAILURE

## 1 of 1

METRIC

## Foundation Design

LOCATION

Hwy 69 (New), Sta. 20+798, o/s 58m Rt CL Med.

ORIGINATED BY F.P.

BOREHOLE TYPE C.F.H.S.A. and NQ Diamond Coring

COMPILED BY A.S.

DATE February 26, 2009

CHECKED BY B.R.G.

ON MOT VER3 06TF035C.GPJ ON MOT.GDT 7/7/2009 9:00:28 AM

$+$ <sup>7</sup>,  $\times$ <sup>5</sup>: Numbers refer to Sensitivity




(%) STRAIN AT FAILURE

**RECORD OF BOREHOLE No P1-SBL**

1 of 1

**METRIC**

G.W.P. 5203-06-00 LOCATION Coords: 5 096 737.8 N; 221 558.4 E  
Hwy 69 (New), Sta. 20+803, o/s 18.8m Lt CL Med. ORIGINATED BY F.P.  
DIST 54 HWY 69 BOREHOLE TYPE C.F.H.S.A. and NQ Diamond Coring COMPILED BY A.S.  
DATUM Geodetic DATE February 18 and 24, 2009 CHECKED BY B.R.G.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						PLASTIC LIMIT  w <sub>p</sub>	NATURAL MOISTURE CONTENT  w	LIQUID LIMIT  w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											WATER CONTENT (%)		
								○ UNCONFINED			+ FIELD VANE										
187.7	Ground Surface							20	40	60	80	100									
0.0 187.4	Peat, coarse fibrous		1	CS	-		187										5 55 34 6				
0.3	Dark brown		2	SS	10/8cm																
	Sand, with silt trace clay, trace gravel cobbles and boulders																				
	Compact Brown Moist		3	CS	-																
			4	CS	-		184														
							183														
182.7	Gabbro bedrock						182										RQD 86%				
5.0	Slightly weathered to unweathered  High strength  Good to excellent quality		5	RC NQ	REC 100%												RQD 91%				
			6	RC NQ	REC 95%		181										RQD 88%				
			7	RC NQ	REC 100%		180										RQD 85%				
			8	RC NQ	REC 96%		179														
178.0	End of borehole						178														
9.7																					
	<div>* 2009 02 24</div> <div> Water level observed during drilling</div> <div> Water level measured after drilling</div> <div>C.F.H.S.A. denotes Continuous Flight Hollow Stem Augers</div>																				

<b>RECORD OF BOREHOLE No P2-NBL</b> 1 of 1 <b>METRIC</b>																
G.W.P. 5203-06-00		LOCATION		Coords: 5 096 748.1 N; 221 594.9 E Hwy 69 (New), Sta. 20+809, o/s 18.8m Rt CL Med.				ORIGINATED BY F.P.								
DIST 54 HWY 69		BOREHOLE TYPE		C.F.H.S.A. and NQ Diamond Coring				COMPILED BY A.S.								
DATUM Geodetic		DATE		February 24 and 25, 2009				CHECKED BY B.R.G.								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa									
187.4 0.0	Top of Snow						<div style="display: flex; justify-content: space-between;"> <span>20 40 60 80 100</span> <span>20 40 60 80 100</span> </div>									
187.1 0.3	Snow/ice															
186.6 0.8	Peat, coarse fibrous Dark brown		1	CS	-	▽*	187									
	Sand with gravel, trace silt cobbles and boulders Compact Brown Wet		2	SS	26		186									
							185									
			3	SS	20/8cm		184									
							183									
182.5 4.9	Gabbro bedrock		4	SS	15/15cm		182									
	Slightly weathered to unweathered High strength Fair to excellent quality		5	RC NQ	REC 96%		181									RQD 87%
			6	RC NQ	REC 100%		180									RQD 96%
			7	RC NQ	REC 100%		179									RQD 100%
			8	RC NQ	REC 100%											RQD 63%
178.5 8.9	End of borehole															
<div style="display: flex; justify-content: space-between;"> <div> <p>* 2009 02 25</p> <p>▽ Water level observed during drilling</p> <p>▽ Water level measured after drilling</p> <p>C.F.H.S.A. denotes Continuous Flight Hollow Stem Augers</p> </div> <div> <p>20</p> <p>15 — 5</p> <p>10</p> </div> </div>																




<b>RECORD OF BOREHOLE No D7-2</b>										1 of 1		<b>METRIC</b>				
G.W.P. 5378-02-00		LOCATION		Hwy. 69 Sta. 20+800, o/s 0.4m Lt. Co-ords. 5 096 737 N; 221 577 E						ORIGINATED BY R.E.						
DIST 54 HWY 69		BOREHOLE TYPE		Casing + Washboring						COMPILED BY R.E.						
DATUM Geodetic		DATE		March 09, 2004						CHECKED BY C.N.						
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
187.6 0.0	Top of Ice Snow/Ice															
187.0 0.6	End of borehole Refusal on probable bedrock or boulder					187										
	Boulders observed near borehole location															

RECORD OF PENETRATION TEST No D7-3

1 of 1 METRIC

G.W.P. 5378-02-00 LOCATION Hwy. 69 Sta. 20+808, o/s 50.8m Lt.  
Co-ords. 5 096 739 N; 221 526 E ORIGINATED BY R.E.  
DIST 54 HWY 69 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY R.E.  
DATUM Geodetic DATE March 09, 2004 CHECKED BY C.N.

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)							GR	SA	SI	CL		
						20			40	60	80	100	○ UNCONFINED									● QUICK TRIAXIAL	+ FIELD VANE
188.4 0.0	Top of Ice Snow/Ice																						
187.8 0.6	End of dynamic cone penetration test Refusal on probable bedrock or boulder   <																						

## RECORD OF PENETRATION TEST No D7-3A

1 of 1 METRIC

G.W.P. <u>5378-02-00</u>	LOCATION <u>Hwy. 69 Sta. 20+809, o/s 49.7m Lt. Co-ords. 5 096 740 N; 221 527 E</u>	ORIGINATED BY <u>R.E.</u>
DIST <u>54</u> HWY <u>69</u>	BOREHOLE TYPE <u>Dynamic Cone Penetration Test</u>	COMPILED BY <u>R.E.</u>
DATUM <u>Geodetic</u>	DATE <u>March 09, 2004</u>	CHECKED BY <u>C.N.</u>

[illegible]

BH No	ELEVATION	STA MOWAT TWP	o/s CL ME
315-1	188.1	20+780	18.8m Rt.
315-2	189.3	20+787	19.0m Lt.
315-3	187.9	20+787.5	CL
315-4	187.6	20+787.5	58.0m Rt.
315-5	189.1	20+795	55.0m Lt.
315-6	187.7	20+800	18.8m Rt.
315-7	188.6	20+812.5	58.0m Lt.
315-8	187.9	20+812.5	58.0m Rt.
315-9	187.6	20+814	CL
315-10	187.6	20+820	CL
315-11	189.3	20+820	12.8m Rt.
315-12	188.3	20+821	18.8m Lt.
315-13	191.2	20+830	51.0m Rt.
315-14	190.3	20+833	60.0m Lt.
315-15	191.6	20+837.5	CL

- NOTE -

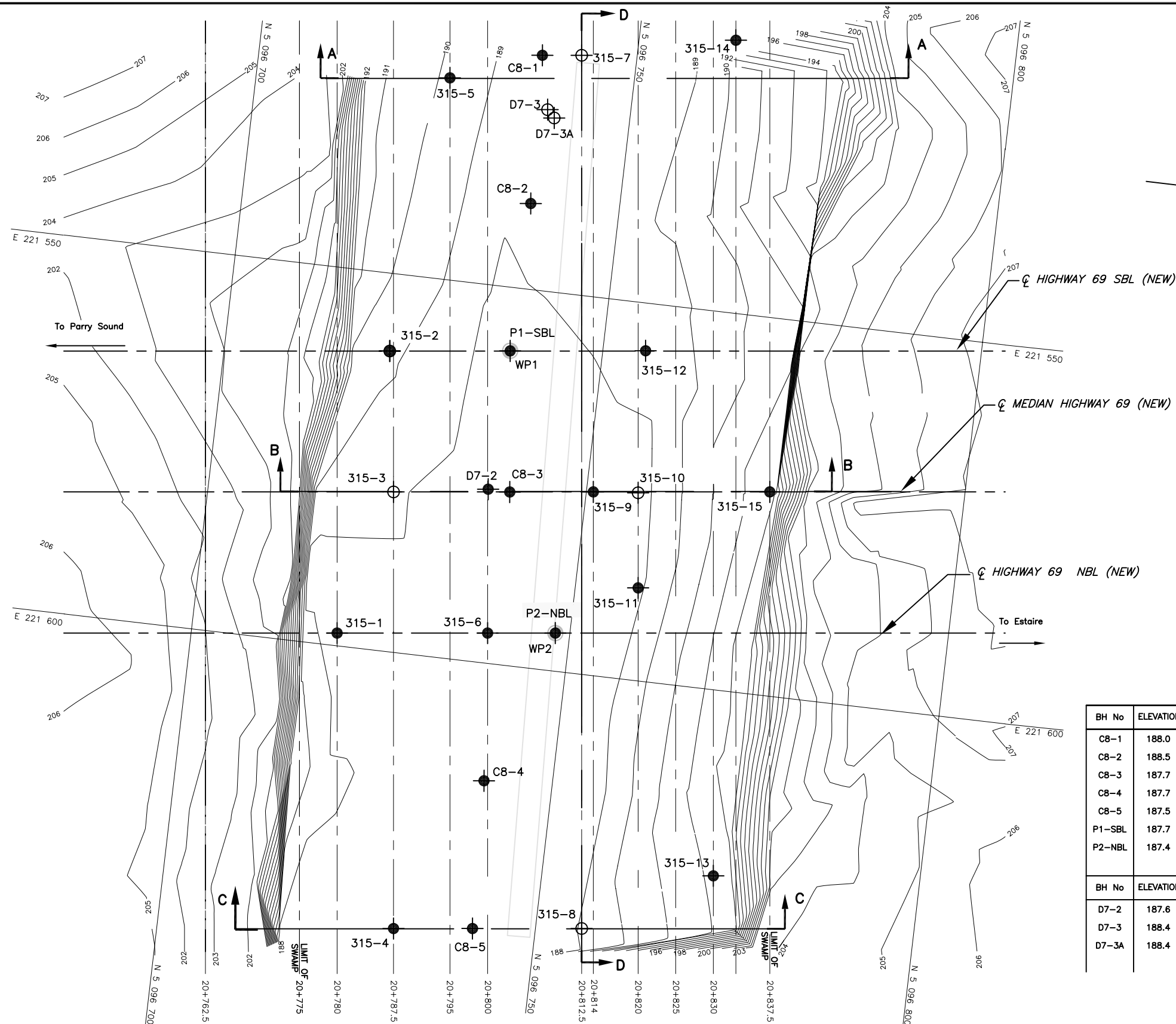
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS			
	DATE	BY	DESCRIPTION

Geocres No. 41H-243

HWY No 69				DIST 54	
SUBM'D	MN	CHECKED AS	DATE NOV. 18, 2009		SITE --
DRAWN	NA	CHECKED CN	APPROVED BRG		DWG 315-1

REF.: MRC DRAWINGS: S6454-329-PRCRDS.DWG.dwg;  
H6454xb2 contours zone 10.dwg;



NOTES:

1. DRAWING 315-1 SHOULD BE READ IN CONJUNCTION WITH THE TEXT AND THE RECORD OF BOREHOLE LOGS.
2. REFER TO DRAWING 315-2 FOR PROFILES A-A, B-B, C-C AND SECTION D-D.

THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.

4. D7 SERIES BOREHOLE/CONE STATIONS AND OFFSETS ARE ADJUSTED TO NEW ALIGNMENT OF HWY 69 (NEW).
5. D7 SERIES BOREHOLES DATA WERE TAKEN FROM PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN REPORT PREPARED BY PML (PML REFERENCE: 04TF008 – MID) GEOCRE NO. 411-171, DATED MAY 31, 2004.
6. DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.

PLAN  
SCALE



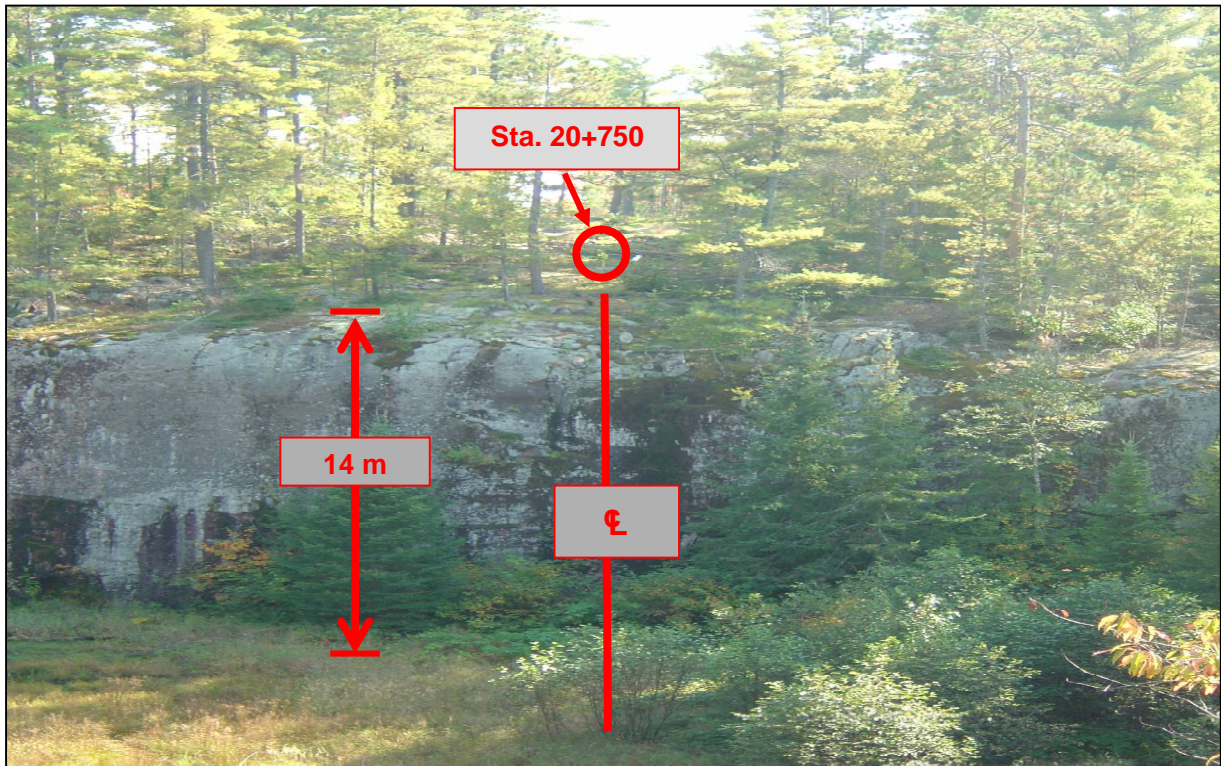




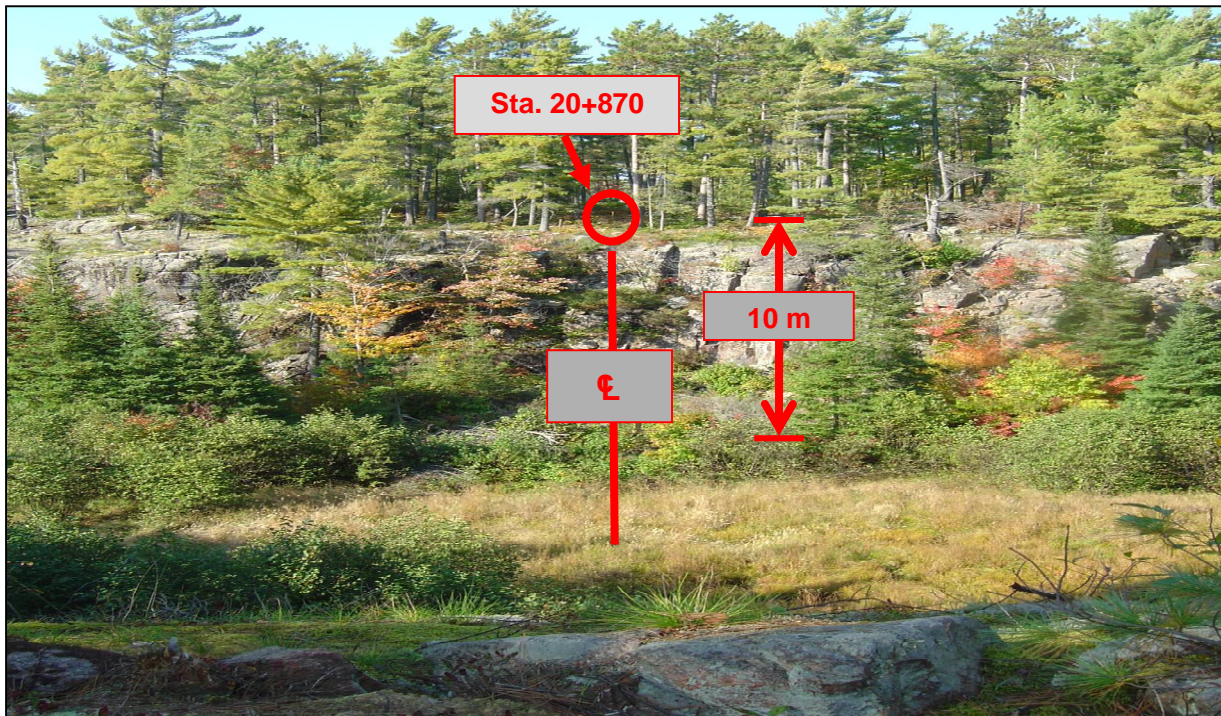
## **APPENDIX A**

### **SITE PHOTOGRAPHS**





**Photograph 1** VIEW: Looking south along median from about Sta. 20+845 across the Ojibway Canyon. Stake at Sta. 20+750 visible on 14 m high bedrock exposure. (September 26, 2008)



**Photograph 2** VIEW: Looking north along median from about Sta. 20+770 across Ojibway Canyon. Stake at Sta. 20+870 visible on 10 m high vertical bedrock exposure. Talus bedrock boulders visible at toe of slope. (September 26, 2008)





**Photograph 3** VIEW: Looking east (toward existing Highway 69) from south side of Ojibway Canyon at about SBL Sta. 20+765. Swamp with open water visible across floor of canyon. (September 26, 2008)



**Photograph 4** VIEW: Facing north at rock face north edge of the Canyon boulders strewn throughout. (March 27, 2009)





**Photograph 5** VIEW: Facing north to rock face at the south edge of the canyon. (March 27, 2009)



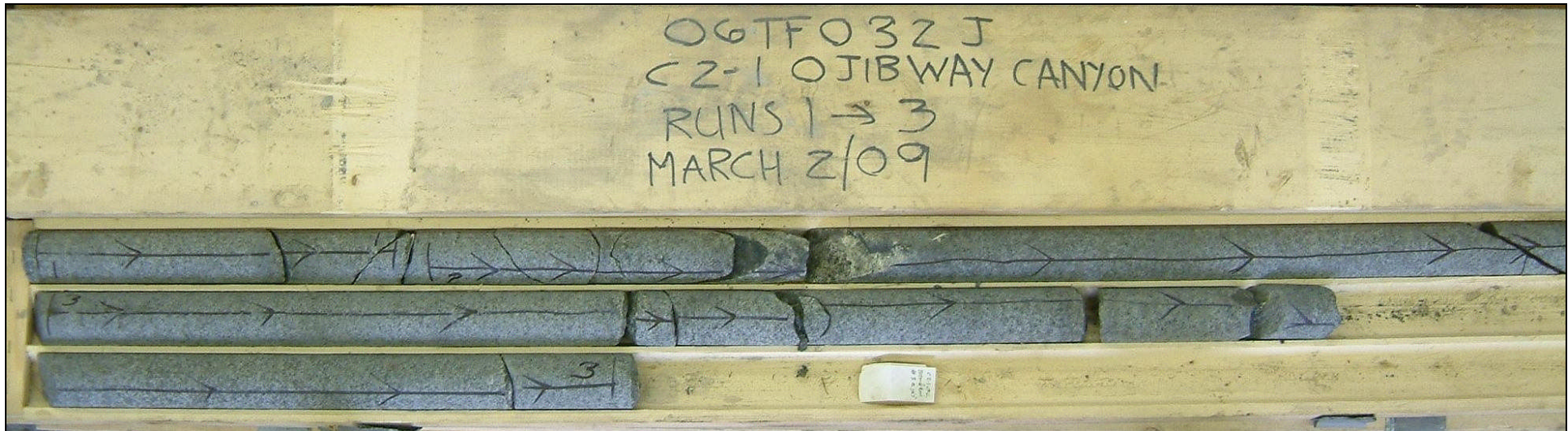
**Photograph 6** VIEW: Shovel prove location at Sta. 20+787, 19LT, surface boulders throughout area. (March 27, 2009)



## **APPENDIX B**

### ROCK CORE PHOTOGRAPHS



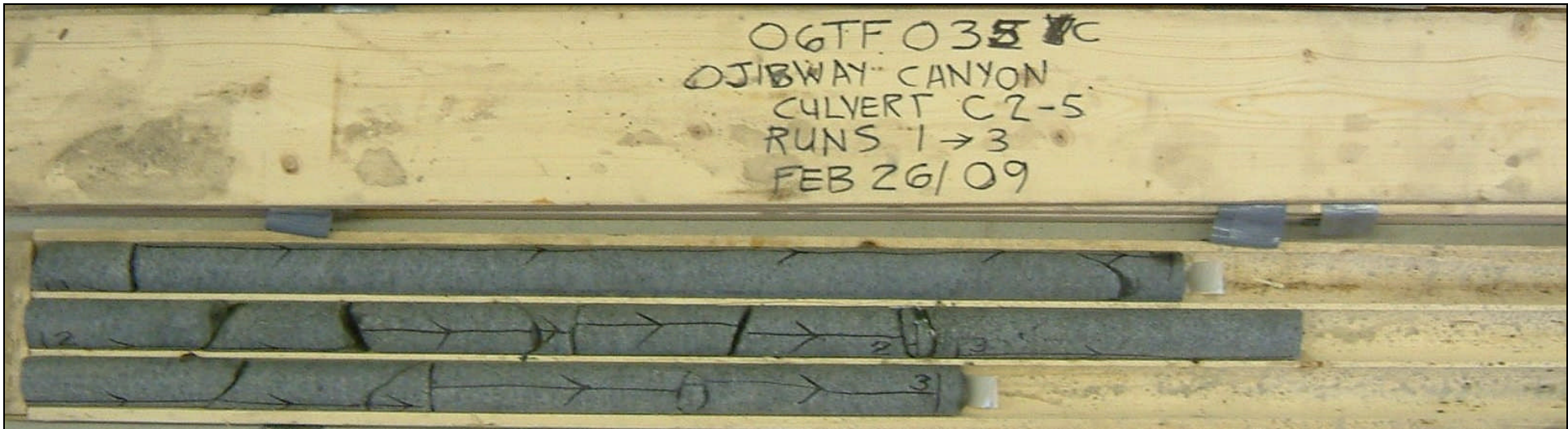


**Photograph 1:** Culvert C8, borehole C8-1, RC-5 to RC-7. RQD ranged from 70 to 99%. Rock quality ranged from fair to excellent.

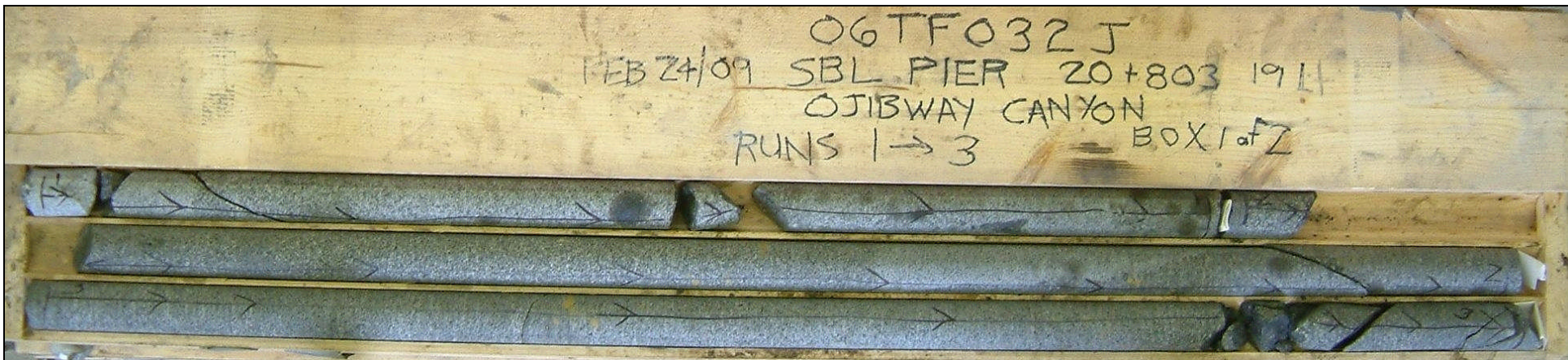


**Photograph 2:** Culvert C8, borehole C8-3, RC-7 to RC-9. RQD ranged from 15 to 100%. Rock quality ranged from very poor to excellent.



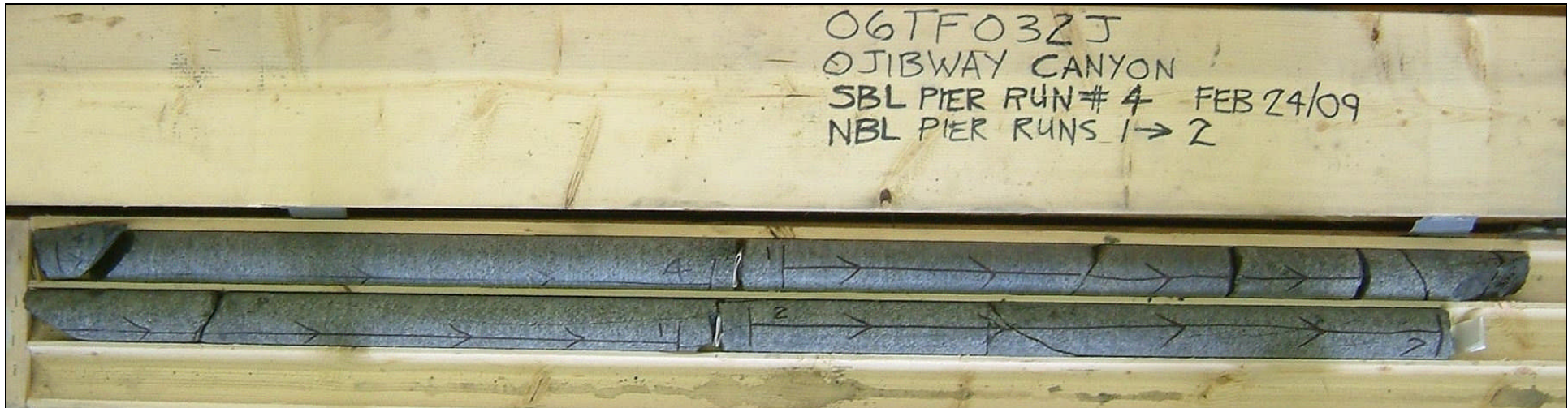


**Photograph 3:** Culvert C8, borehole C8-5, RC-7 to RC-9. RQD ranged from 85 to 100%. Rock quality ranged from good to excellent.



**Photograph 4:** Bridge Pier 1 at Sta. 20+803 (SBL), borehole P1-SBL, samples RC-5 to RC-8. RQD ranged from 85 to 91%. Rock quality ranged from good to excellent.





**Photograph 5:** Bridge Pier 2 at Sta. 20+809 (NBL), borehole P2-NBL, samples RC-5 to RC-8. RQD ranged from 63 to 100%. Rock quality ranged from fair to excellent.