

Golder Associates Ltd.

32 Steacie Drive
Kanata, Ontario, Canada K2K 2A9
Telephone 613-592-9600
Fax 613-592-9601



Geo Cres # 31G-220-1

REPORT ON

**ADDITIONAL FOUNDATION INVESTIGATION
HAZELDEAN ROAD UNDERPASS
STRUCTURE SITE 3-721
HIGHWAY 7 TWINNING FROM HIGHWAY 417
TO 3 KM WEST OF JINKINSON ROAD
G.W.P. 256-99-00**

Submitted to:

McIntosh Perry Consulting Engineers Ltd.
115 Walgreen Road, R.R. No. 3
Carp, Ontario
K0A 1L0

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PART A

**ADDITIONAL FOUNDATION INVESTIGATION REPORT
HAZELDEAN ROAD UNDERPASS
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G.W.P. 256-99-00**

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by McIntosh Perry Consulting Engineers Ltd. on behalf of the Ministry of Transportation, Ontario (MTO) to carry out an additional foundation investigation associated with the twinning of Highway 7 from two to four lanes in former West Carleton and Goulbourn Townships which are now part of the City of Ottawa, and in Beckwith Township in Lanark County. The additional foundation investigation services were required for the west abutment of the Hazeldean Road underpass structure as part of W.P. 256-99-00.

2.0 SITE DESCRIPTION

The proposed Hazeldean Road (Regional Road 36) underpass structure is located approximately 2.5 km southwest of Highway 417, in West Carleton Township in the Regional Municipality of Ottawa-Carleton. The underpass structure consists of two 45 metre long spans with perched, pile-supported abutments with foreslopes oriented at 2 horizontal to 1 vertical. The underpass structure is designated as MTO's Structure Site 3-721.

The initial geotechnical foundation investigation for the structure included four boreholes (boreholes 02-501, 02-502, 02-506 and 02-507) which were advanced at two alternative locations for the west abutment of the underpass structure in December 2002 (see Drawing 1 for locations). The boreholes were advanced to depths between 3.2 and 6.5 metres below the existing ground surface.

The overburden materials encountered at these boreholes generally consisted of peat underlain by sand and glacial till. Overburden depths ranged between about 3.2 and 3.4 metres below the existing ground surface, at elevations between 130.4 and 130.0 metres, respectively.

Practical refusal to augering was encountered on the bedrock surface at all of the boreholes at depths of about 3.4, 3.3 and 3.2 metres below the existing ground surface for boreholes 02-501, 02-502 and 02-506 and 02-507, respectively, (i.e. elevations 130.0, 130.3 and 130.4 metres). Limestone bedrock was confirmed at boreholes 02-501 and 02-507 and cored to depths of 6.5 and 6.2 metres, respectively, below the existing ground surface (i.e. elevations 126.95 and 127.30 metres). The detailed soil and bedrock conditions encountered in these boreholes are given on the Record of Borehole sheets and in the initial foundation report, Golder report 021-1155-2, entitled "Foundation Investigation and Design Report Hazeldean Road Underpass Structure Site 3-721 Highway 7 Twinning from Highway 417 to 3 km west of Jinkinson Road G.W.P. 256-99-00", dated September 2003.

Construction of the west abutment of the Hazeldean Road underpass was currently underway. The installation of drill casing began in early November 2006 starting at the location of pile W-1 and progressing to pile W-5 (see Drawing 1 for pile locations). To satisfy seismic requirements the H-piles were to be socketted a minimum of 1.5 metres into competent bedrock. In drilling, it was found that some of the socket locations were hydrostatically connected. Socketting was successfully achieved at piles W-1, W-2, W-4 and W-5 (a boulder was encountered at pile W-3 and installation was postponed). However, in drilling for pile W-6, the bedrock surface was encountered slightly lower than expected (elevation 129.97 metres). Competent bedrock was encountered for the first 0.6 metres below the bedrock surface at which point it was reported that soft resistance and/or soil was encountered during drilling. The drilling was continued to elevation 127.10 metres without encountering significant resistance at which time the drilling was suspended and direction was requested from MTO Foundations and Golder Associates.

It was agreed between MTO Foundations and Golder Associates that a supplementary foundation investigation would be undertaken to verify the bedrock conditions at pile W-6. It was also agreed that initial drilling would take place at pile W-6 and subsequently at adjacent piles W-5 and W-7. Depending on the results of the field investigation at the first three locations additional investigation at the remaining pile location would be considered.

3.0 INVESTIGATION PROCEDURES

The field work for this subsurface investigation was carried out on November 15, 16, 17 and 20, 2006. On those days, three boreholes (boreholes 06-1 to 06-3, inclusive) were put down at the locations shown on Drawing 1. A ramp was constructed on the west side of the foundation trench adjacent to the pile locations to allow access for the drill rig. The height of the drill casings was such that it was not practical to drill the boreholes within the installed casings; therefore the boreholes were drilled adjacent to drill casings W-5, W-6 and W-7 at the west abutment. The boreholes were advanced using a track mounted drill rig supplied and operated by Marathon Drilling Company Ltd. of Ottawa, Ontario. The boreholes were advanced to depths which vary from 10.2 m to 14.4 m below the present ground surface.

The bedrock was cored for depths ranging from 5.8 to 9.7 metres, after practical refusal to augering had been reached. The boreholes were backfilled with bentonite and/or cement grout upon completion.

The field work was supervised by an experience technician from our staff who located the boreholes in the field, directed the drilling and sampling, and logged the boreholes. The bedrock samples were identified in the field, placed in labelled containers and transported to our laboratory for further examination.

The borehole locations were determined by Golder relative to existing site features. The borehole elevations were determined by McIntosh Perry Consulting Engineers Ltd. The borehole locations, including MTM NAD83 northing and easting coordinates and ground surface elevations referenced to geodetic datum, are summarized in the following table and are shown on Drawing 1.

Borehole Number	Borehole Location	MTM NAD83 Northing (m)	MTM NAD83 Easting (m)	Ground Surface Elevation (m)
06-1	West of W-6	5012313.4	346335.9	134.8
06-2	West of W-7	5012311.5	346336.1	134.7
06-3	West of W-5	5012315.4	346336.6	134.7

4.0 SITE GEOLOGY AND STRATIGRAPHY

4.1 Regional Geological Conditions

The study area for this investigation lies within the minor physiographic region known as the Smith Falls Limestone Plain, as delineated in *The Physiography of Southern Ontario*¹ that lies within the major physiographic region of the Ottawa-St. Lawrence Lowland.

The Smith Falls Limestone Plain is characterized by shallow overburden deposits overlying limestone bedrock of the Ottawa Formation; this formation consists of grey limestone with some shaly partings and seams.² The shallow overburden soils are typically between 1 metre and 3 metres in thickness and are commonly comprised of sandy and gravelly till derived from the Precambrian Shield to the north, overlain by glaciofluvial sediments that consist of layered sands and gravels. Large areas of the plain are covered with peat and muck, due to poor drainage as a consequence of the relatively flat topography and shallow depth to bedrock.¹

4.2 Site Stratigraphy

As an additional foundation investigation to facilitate the pile installation of the west abutment of the underpass structure, three boreholes were advanced adjacent to drill casings W-5, W-6 and W-7. The borehole locations and ground surface elevations are shown on Drawing 1. The detailed bedrock conditions encountered in the boreholes are given on the Record of Borehole sheets.

Four boreholes had been previously advanced at the west abutment location as part of the initial foundation investigation for the underpass structure, as previously noted, (Golder Report 021-1155-2). The Record of Borehole sheets from that investigation are also attached.

In summary, the subsurface conditions encountered during the current investigation consist of about 4.4 to 4.6 metres of overburden, overlying limestone. These overburden materials are underlain by limestone bedrock.

A more detailed description of the subsurface conditions encountered in the boreholes is provided in the following sections. In the following discussion, emphasis is placed on the subsurface conditions indicated in the boreholes from the present investigation. The previous borehole information is referenced in regard to the overburden material and bedrock elevations.

¹ Chapman, L.J. and D.F. Putnam. *The Physiography of Southern Ontario*, Ontario Geological Survey Special Volume 2, Third Edition, 1984. Accompanied by Map P.2715, Scale 1:600,000.

² Belanger, J.R. "Urban Geology of Canada's National Capital Area", in *Urban Geology of Canadian Cities*, Geological Association of Canada Special Paper 42, Ed. P.F. Karrow and O.L. White, 1998.

4.2.1 Overburden

The overburden materials encountered prior to construction consisted of peat underlain by sand and glacial till. Overburden depths prior to construction ranged between about 3.2 and 3.4 metres below the existing ground surface, at elevations between 130.4 and 130.0 metres, respectively. At the time of the current investigation about 1.2 metres of granular fill material had been placed above the existing ground surface.

4.2.2 Limestone Bedrock

Limestone bedrock underlies the overburden material at this site. In the boreholes put down adjacent to the pile casings, the surface of the bedrock was encountered between elevations 130.2 and 130.3 metres. In the previous investigation the bedrock surface was encountered between elevations 130.0 and 130.4 metres.

The following table summarizes the bedrock surface depths and elevations as encountered at the locations of boreholes 06-1 to 06-3, and as encountered at the previous boreholes 02-501, 02-502, 02-506 and 02-507; the bedrock was cored in all of the boreholes with the exception of borehole 02-502 and 02-506.

Borehole Number	Ground Surface Elevation (m)	Depth to Bedrock (m)	Bedrock Surface Elevation (m)
02-501	133.4	3.4	130.0
02-502	133.6	3.3	130.3
06-3	134.7	4.6	130.3
06-1	134.8	4.6	130.2
06-2	134.7	4.4	130.3
02-506	133.6	3.2	130.4
02-507	133.5	3.2	130.4

The borehole at pile W-6 (see the borehole and drillhole log for 06-1) encountered the bedrock surface at elevation 130.2 metres and solid rock core was retrieved to elevation 127.8 metres. Fractured rock core was obtained from elevations 127.8 to 126.3 metres. Solid rock core was then retrieved to the depth of the borehole at elevation 120.4 metres. Rock Quality Designation (RQD) values measured on recovered bedrock core samples at borehole 06-1 typically ranged from about 32 to 98 percent, the former of which relates to the fractured zone of the bedrock, while the latter relates to the bedrock below the fractured zone. The subsequent boreholes put down at pile W-7 (see the borehole and drillhole log for 06-2) and pile W-5 (see the borehole and drillhole log for 06-3) were drilled to determine the lateral extent of the fractured zone. Solid rock core was retrieved from the borehole at pile W-7 (borehole 06-2) from the bedrock surface at elevation 130.3 metres to the depth investigated at elevation 123.3 metres. Rock Quality

Designation (RQD) values measured on recovered bedrock core samples at borehole 06-2 typically ranged from about 52 to 70 percent. Some fractured bedrock was encountered at the bedrock surface at pile W-5 (borehole 06-3) between elevations 128.9 and 130.3 metres above the base of the existing socket depth. The borehole was drilled to elevation 124.5 metres. Rock Quality Designation (RQD) values below the surface fractured zone typically ranged from 64 to 89 percent.

A description of some of the terms used in the description of the bedrock samples from this site is provided on the *Lithological and Geotechnical Rock Description Terminology* sheet which precedes the Record of Borehole sheets included with this report.

Given the subsurface conditions encountered at boreholes 06-1 to 06-3 it was agreed with MTO Foundations that no further investigation at the west abutment was required.

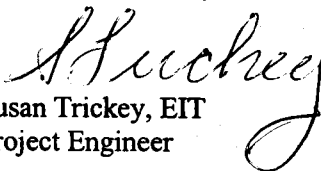
4.2.3 Groundwater Conditions

The groundwater conditions were not noted at the time of this investigation. However, the water level measured in the piezometer installed in borehole 02-501 at the time of the initial investigation on January 8, 2003 was at elevation 133.1 metres. It should be noted that groundwater levels are expected to fluctuate seasonally and are expected to rise during wet periods of the year.

5.0 MISCELLANEOUS

The investigation was carried out using equipment supplied and operated by Marathon Drilling. The field portions were supervised by Mr. Jim Samotowka under the direction of Ms. Susan Trickey, EIT. The report was prepared by Ms. Susan Trickey, EIT, under the direction of the Project Manager, Mr. Michael Cunningham, P.Eng. This report was reviewed by Mr. Fintan J. Heffernan P.Eng, the designated MTO contact for this project.

GOLDER ASSOCIATES LTD.


Susan Trickey, EIT
Project Engineer





F.J. Heffernan, P. Eng.
MTO Designated Foundations Contact

SAT/FJH/tb/kdc

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PART B

**ADDITIONAL FOUNDATION DESIGN REPORT
HAZELDEAN ROAD UNDERPASS
STRUCTURE SITE 3-721
HIGHWAY 7 TWINNING FROM HIGHWAY 417
TO 3 KM WEST OF JINKINSON ROAD
G.W.P. 256-99-0**

6.0 ENGINEERING RECOMMENDATIONS

6.1 General

This section of the report provides additional foundation design recommendations for the construction of the west abutment of the Hazeldean Road underpass structure. The recommendations are based on interpretation of the factual data obtained from the boreholes advanced during the subsurface investigations at this site. The interpretation and recommendations provided are intended only to provide the designers with sufficient information to assess the feasible foundation construction for the pile installation at the west abutment of the underpass structure.

The underpass structure consists of two 45 metre long spans with perched, pile-supported integral abutments with foreslopes oriented at 2 horizontal to 1 vertical. The west abutment design called for the installation of HP 310 x 110 steel H-piles socketted 1.5 metres into competent bedrock and concreted into place for the socket depth. Socketting was required to satisfy the seismic requirements of the abutment design. An ultimate and serviceability limit states bearing value of 2000 kN was used for design. The upper 3 metres of the H-piles were to be surrounded by 600 millimetre corrugated steel pipes, filled with loose, dry, fine sand.

6.2 Pile Installation

Following the completion of the additional foundation investigation it was recommended that foundation construction at the west abutment proceed given the following recommendations:

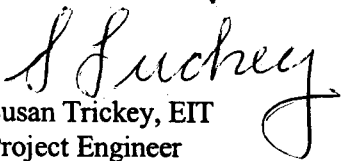
- The socket elevation for pile W-6 should be founded below elevation 126.2 metres within competent bedrock.
- The sockets at piles W-5 and W-7 as previously installed as per the original design are acceptable from a foundation point of view.
- All the previously socketted piles which are founded within competent bedrock are acceptable from a foundation point of view.
- All newly socketted piles at the west abutment should be monitored to determine that competent bedrock is encountered.
- If "soft" rock or fractured rock is encountered Golder Associates should be called to the site to observe the drilling and to determine whether alternative foundation recommendations are required.

We have subsequently spoken to the McIntosh Perry Contract Administrator, who informed us that solid rock was found at the remaining west abutment locations and the design 1.5 metre socket was formed. We also understand that the piling at the east abutment was installed and solid rock was encountered at the pile locations and the 1.5 metre socket was formed.

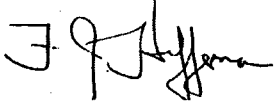
7.0 MISCELLANEOUS

This report was prepared by Ms. Susan Trickey, EIT under the direction of the Project Manager, Mr. Michael Cunningham P.Eng. This report was reviewed by Mr. Fintan J. Heffernan P.Eng, the designated MTO contact for this project.

GOLDER ASSOCIATES LTD.


Susan Trickey, EIT
Project Engineer




Fintan J. Heffernan, P.Eng.
Designated MTO Foundations Contact

SAT/FJH/tb

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LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE		III. SOIL DESCRIPTION	
AS	Auger sample	(a)	Cohesionless Soils
BS	Block sample	Density Index	N
CS	Chunk sample	(Relative Density)	<u>Blows/300 mm</u>
DO	Drive open		<u>Or Blows/ft.</u>
DS	Denison type sample	Very loose	0 to 4
FS	Foil sample	Loose	4 to 10
RC	Rock core	Compact	10 to 30
SC	Soil core	Dense	30 to 50
ST	Slotted tube	Very dense	over 50
TO	Thin-walled, open		
TP	Thin-walled, piston		
WS	Wash sample		
II. PENETRATION RESISTANCE		(b)	Cohesive Soils
Standard Penetration Resistance (SPT), N:		Consistency	C _u S _n
The number of blows by a 63.5 kg. (140 lb.)			Kpa
hammer dropped 760 mm (30 in.) required		Very soft	0 to 12
to drive a 50 mm (2 in.) drive open		Soft	12 to 25
Sampler for a distance of 300 mm (12 in.)		Firm	25 to 50
		Stiff	50 to 100
		Very stiff	100 to 200
		Hard	Over 200
			Psf
			0 to 250
			250 to 500
			500 to 1,000
			1,000 to 2,000
			2,000 to 4,000
			Over 4,000
Dynamic Penetration Resistance; N _d :		IV. SOIL TESTS	
The number of blows by a 63.5 kg (140 lb.)		w	water content
hammer dropped 760 mm (30 in.) to drive		w _p	plastic limited
Uncased a 50 mm (2 in.) diameter, 60° cone		w _l	liquid limit
attached to "A" size drill rods for a distance		C	consolidation (oedometer) test
of 300 mm (12 in.).		CHEM	chemical analysis (refer to text)
PH:	Sampler advanced by hydraulic pressure	CID	consolidated isotropically drained triaxial test ¹
PM:	Sampler advanced by manual pressure	CIU	consolidated isotropically undrained triaxial test
WH:	Sampler advanced by static weight of hammer		with porewater pressure measurement ¹
WR:	Sampler advanced by weight of sampler and rod	D _r	relative density (specific gravity, G _s)
		DS	direct shear test
		M	sieve analysis for particle size
		MH	combined sieve and hydrometer (H) analysis
		MPC	modified Proctor compaction test
		SPC	standard Proctor compaction test
		OC	organic content test
		SO ₄	concentration of water-soluble sulphates
		UC	unconfined compression test
		UU	unconsolidated undrained triaxial test
		V	field vane test (LV-laboratory vane test)
		γ	unit weight

Note:

1. Tests which are anisotropically consolidated prior shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	= 3.1416
$\ln x$	natural logarithm of x
$\log_{10} x$ or $\log x$	logarithm of x to base 10
g	Acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma'$
ϵ	linear strain
ϵ_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stresses (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s/\rho_w$) formerly (G_s)
e	void ratio
n	porosity
S	degree of saturation
*	Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)

(a) Index Properties (cont'd.)

w	water content
w_L	liquid limit
w_p	plastic limit
I_p	plasticity Index $= (w_L - w_p)$
w_s	shrinkage limit
I_L	liquidity index $= (w - w_p)/I_p$
I_c	consistency index $= (w_L - w)/I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index $= (e_{max} - e)/(e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
C_s	swelling index
C_{α}	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	Overconsolidation ratio $= \sigma'_p/\sigma'_{vo}$

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction $= \tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi=0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1. $\tau = c' + \sigma' \tan \phi'$

2. Shear strength $= (\text{Compressive strength})/2$

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE

Fresh: no visible sign of weathering

Faintly Weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

BEDDING THICKNESS

<u>Description</u>	<u>Bedding Plane Spacing</u>
Very thickly bedded	>2 m
Thickly bedded	0.6 m to 2m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	<6 mm

JOINT OR FOLIATION SPACING

<u>Description</u>	<u>Spacing</u>
Very wide	>3 m
Wide	1 - 3 m
Moderately close	0.3 - 1 m
Close	50 - 300 mm
Very close	<50 mm

GRAIN SIZE

<u>Term</u>	<u>Size*</u>
Very Coarse Grained	>60 mm
Coarse Grained	2 - 60 mm
Medium Grained	60 microns - 2mm
Fine Grained	2 - 60 microns
Very Fine Grained	<2 microns

Note: *Grains >60 microns diameter are visible to the naked eye.

O:\Templates\Rock Description Terminology

CORE CONDITION

Total Core Recovery

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core 100% for core in solid sticks.

DISCONTINUITY DATA

Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to (W.R.T.) Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

Description and Notes

An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

B -	Bedding	Ca-	Calcite
FO-	Foliation/Schistosity.	P-	Polished
CL -	Cleavage	S-	Slickensided
SH -	Shear Plane/Zone	SM-	Smooth
VN-	Vein	R-	Ridged/Rough
F -	Fault	ST-	Stepped
CO-	Contact	PL-	Planar
J -	Joint	FL-	Flexured
FR-	Fracture	UE-	Uneven
MF -	Mechanical	W-	Wavy
A-	Angular	C-	Curved
BP-	Bedding Plane	H-	Hackly
BL-	Blast Induced	SL-	Sludge Coated
	Parallel To	TCA-	To Core Axis
	Perpendicular To	STR-	Stress Induced

PROJECT 06-1120-371-1000		RECORD OF BOREHOLE No 06-1		1 OF 1	METRIC
W.P. 256-99-03		LOCATION N 5012313.4; E 346335.9		ORIGINATED BY D.J.S.	
DIST _____ HWY 7		BOREHOLE TYPE CME 55, 108mm I.D. Hollow Stem Auger		COMPILED BY N.B.H.S.	
DATUM Geodetic		DATE Nov. 15, 2006		CHECKED BY S.A.T.	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
							20 40 60 80 100	20 40 60 80 100	25 50 75					
134.8 0.0	GROUND SURFACE OVERBURDEN													
130.2 4.6	LIMESTONE with shale interbeds (BEDROCK) Fresh Thinly to medium bedded Grey		1	NQ	RC	DD								
127.8 7.0	LIMESTONE with shale interbeds (BEDROCK) Fractured Grey		2	NQ	RC	DD								
126.3 8.5	LIMESTONE (BEDROCK) Thinly to medium bedded Grey Bedrock cored between 4.6m and 14.4m depth. For bedrock coring details refer to Record of Drillhole 06-1.		3	NQ	RC	DD								
			4	NQ	RC	DD								
			5	NQ	RC	DD								
			6	NQ	RC	DD								
			7	NQ	RC	DD								
120.4 14.4	End of Borehole													

MISS MTO 061120371-1000.GPJ ON MOT.GDT 9/12/06

PROJECT: 06-1120-371-1000

RECORD OF DRILLHOLE: 06-1

SHEET 1 OF 1

LOCATION: N 5012313.4; E 346335.9

DRILLING DATE: 15/11/2006

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55, 108mm I.D. Hollow Stem Auger

DRILLING CONTRACTOR: Marathon Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	CORRECTION																	NOTES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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(m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH 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(m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)	DEPTH (m)</

DEPTH SCALE

1:75



LOGGED: D.J.S.

CHECKED: S.A.T.

MIS-RCK-001 061120371-1000-CORE GPJ GLDR CAN GDT 9/12/08

PROJECT 06-1120-371-1000				RECORD OF BOREHOLE No 06-2				1 OF 1		METRIC					
W.P. 256-99-03				LOCATION N 5012311.5; E 346336.1				ORIGINATED BY D.J.S.							
DIST HWY 7				BOREHOLE TYPE CME 55, 108mm I.D. Hollow Stem Auger				COMPILED BY N.B.H.S.							
DATUM Geodetic				DATE Nov. 17, 2006				CHECKED BY S.A.T.							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
134.7 0.0	GROUND SURFACE OVERBURDEN							20 40 60 80 100				25 50 75			GR SA SI CL
130.3 4.4	LIMESTONE with shale interbeds (BEDROCK) Fresh Very thinly to medium bedded Grey		1	NQ	RC	DD									
			2	NQ	RC	DD									
			3	NQ	RC	DD									
126.0 8.8	LIMESTONE with a near vertical fracture and very thin calcite seams (BEDROCK) Fresh Very thinly to medium bedded Grey Bedrock cored between 4.4m and 11.4m depth. For bedrock coring details refer to Record of Drillhole 06-2.		4	NQ	RC	DD									
			5	NQ	RC	DD									
123.3 11.4	End of Borehole														

MISS MTO 061120371-1000.GPJ ON MOT.GDT 9/12/06

PROJECT: 06-1120-371-1000

RECORD OF DRILLHOLE: 06-2

SHEET 1 OF 1

LOCATION: N 5012311.5; E 346336.1

DRILLING DATE: 17/11/2006

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55, 108mm I.D. Hollow Stem Auger

DRILLING CONTRACTOR: Marathon Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH	FR/FX-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN	F-FAULT J-JOINT P-POLISHED S-SUCKENSIDED	R-ROUGH ST-STEPPED PL-PLANAR	SM-SMOOTH UE-UNEVEN W-WAVY C-CURVED	FL-FLEXURED BC-BROKEN CORE MB-MECH. BREAK B-BEDDING	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
													RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY		DIP W.R.T. CORE AXIS	TYPE AND SURFACE DESCRIPTION	10 ⁻⁸	10 ⁻⁶	10 ⁻⁴	10 ⁻²	DIAMETRAL POINT LOAD INDEX (MPa)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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DEPTH SCALE

1 : 75



LOGGED: D.J.S.

CHECKED: S.A.T.

MIS-ROCK 001 061120371-1000-CORE.GPJ GLDR CAN.GDT 9/11/2006

PROJECT <u>06-1120-371-1000</u>		RECORD OF BOREHOLE No 06-3		1 OF 1	METRIC
W.P. <u>256-98-03</u>		LOCATION <u>N 5012315.4; E 346336.6</u>		ORIGINATED BY <u>D.J.S.</u>	
DIST <u>HWY 7</u>		BOREHOLE TYPE <u>CME 55, 108mm I.D. Hollow Stem Auger</u>		COMPILED BY <u>N.B.H.S.</u>	
DATUM <u>Geodetic</u>		DATE <u>Nov. 20, 2008</u>		CHECKED BY <u>S.A.T.</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m³	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 ● QUICK TRIAXIAL x REMOULDED					w _p w w _L				
							20	40	60	80	100	25	50	75			
134.7 0.0	GROUND SURFACE OVERBURDEN																
130.3 4.5	LIMESTONE with near vertical calcite seams (BEDROCK) Fractured Grey		1	NQ RC	DD												
128.9 5.8	LIMESTONE with shale interbeds (BEDROCK) Fresh Thinly to medium bedded Grey		2	NQ RC	DD												
			3	NQ RC	DD												
126.1 8.6	LIMESTONE (BEDROCK) Fresh Thinly to medium bedded Grey Bedrock cored between 4.5m and 10.2m depth. For bedrock coring details refer to Record of Drillhole 06-3.		4	NQ RC	DD												
124.5 10.2	End of Borehole																

MISS MTO 061120371-1000.GPJ ON MOT.GDT 21/12/08

PROJECT: 06-1120-371-1000

RECORD OF DRILLHOLE: 06-3

SHEET 1 OF 1

LOCATION: N 5012315.4; E 346336.8

DRILLING DATE: 20/11/2006

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55, 108mm I.D. Hollow Stem Auger

DRILLING CONTRACTOR: Marathon Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	FLUSH	RECOVERY	R.Q.D. %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	DIAMETRAL INDEX (mm)	NOTES WATER LEVELS INSTRUMENTATION
		ROCK SURFACE		130.20 4.50										
5		LIMESTONE with near vertical calcite seams (BEDROCK) Fractured Grey		128.90 5.80	1		0							
6		LIMESTONE with shale interbeds (BEDROCK) Fresh Thinly to medium bedded Grey			2		0							
7														
8					3		0							
9		LIMESTONE (BEDROCK) Fresh Thinly to medium bedded Grey		126.10 8.80										
10					4		0							
11		End of Drillhole		124.50 10.20										
12														
13														
14														
15														
16														
17														
18														
19														

DEPTH SCALE

1 : 75



LOGGED: D.J.S.

CHECKED: S.A.T.

MIS-RCK 001 061120371-1000-CORE.GPJ GLDR CAN GDT 21/12/06

MISS MTO 021-1155-2.GPJ ON MOT.GDT 27/10/03

+3, X3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT: 021-1155-2

RECORD OF DRILLHOLE: 02-501

SHEET 2 OF 2

LOCATION: N 5012322.3 ; E 346338.2

DRILLING DATE: Dec. 16, 2002

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55 Bombardier, 200mm I.D. Hollow Stem Auger

DRILLING CONTRACTOR: Marathon Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm)	COLOUR % RETURN	FR/FX-FRACTURE F-FAULT			SM-SMOOTH			FL-FLEXURED			BC-BROKEN CORE			NOTES WATER LEVELS INSTRUMENTATION			
								CL-CLEAVAGE			J-JOINT			R-ROUGH			UE-UNEVEN				MB-MECH. BREAK		
								SH-SHEAR			P-POLISHED			ST-STEPPED			W-WAVY				B-BEDDING		
		Refer to previous page		130.00																			
4		LIMESTONE (BEDROCK) with shale seams		3.43																			
5		Fresh																					
6		Weak to medium strong																					
		Thinly to medium - bedded																					
		Grey																					
7		End of Borehole		126.95																			
8				8.48																			
9																							
10																							
11																							
12																							
13																							

DEPTH SCALE

1:50






LOGGED: D.B.

CHECKED: M.I.C.




MISS ROCK 021-1155-2 ROCK GPJ GLDR CAN GDT 27/10/03 JFC

PROJECT 021-1155-2		RECORD OF BOREHOLE No 02-502		1 OF 1	METRIC
W.P. 256-09-00		LOCATION N 5012321.3 : E 346343.0		ORIGINATED BY D.B.	
DIST HWY 7		BOREHOLE TYPE CME 55 Bombardier, 108mm I.D. Hollow Stem Auger		COMPILED BY M.I.C.	
DATUM Geodetic		DATE Dec. 17, 2002		CHECKED BY L.C.C.	

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			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								20 40 60 80 100					W _p W W _L				
133.6	Ground Surface																
0.0	Peat Wet																
133.2																	
0.4	Sand, trace gravel Loose Grey Wet		1	SS	6										1 97 (2)		
131.8			2	SS	17												
1.8	Sand and Silt, some gravel, trace clay, with cobbles and boulders (Till) Dense to very dense Grey Wet																
			3	SS	53												
130.3			4	SS	20/0.2												
3.3	End of Borehole Refusal to sampler and auger penetration Note: Water level in open borehole at 0.1 m depth (Elev. 133.5m) on completion of drilling.																

ISS_MTO 021-1155-2.GPJ ON MOT.GDT 27/10/03

PROJECT <u>021-1155-2</u>		RECORD OF BOREHOLE No 02-506		1 OF 1	METRIC
W.P. <u>256-99-00</u>		LOCATION <u>N 5012308.6; E 348336.0</u>		ORIGINATED BY <u>D.B.</u>	
DIST <u> </u> HWY <u>7</u>		BOREHOLE TYPE <u>CME 55 Bombardier, 108mm I.D. Hollow Stem Auger</u>		COMPILED BY <u>M.I.C.</u>	
DATUM <u>Geodetic</u>		DATE <u>Dec. 17, 2002</u>		CHECKED BY <u>L.C.C.</u>	

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			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								<div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL x REMOULDED</div></div>					<div><div>102030</div><div>W_p W W_L</div></div>				
133.6	Ground Surface																
0.0	Peat Wet																
133.0							133										
0.6	Sand, trace silt Compact Wet																
132.5			1	SS	17												
1.1	Silty Sand, some gravel, trace clay with cobbles and boulders, some sand seams (Till) Compact to very dense Grey Wet						132										
			2	SS	28												
			3	SS	90/0.20		131										
130.4																	
3.2	End of Borehole Auger Refusal																
	Notes: 1. Water noted during drilling at approximately ground surface. 2. Refusal to split-spoon sampling and augering occurred at 2.6m depth; presence of boulder inferred. 3. Borehole moved 1.0m and augered to refusal at 3.2m depth (Elev. 130.4m).																

PROJECT 021-1155-2		RECORD OF BOREHOLE No 02-507		1 OF 1	METRIC
W.P. 256-99-00		LOCATION N 5012302.0 E 346340.4		ORIGINATED BY D.B.	
DIST _____ HWY 7		BOREHOLE TYPE CME 55 Bombardier, 108mm I.D. Hollow Stem Auger		COMPILED BY M.I.C.	
DATUM Geodetic		DATE Dec. 17, 2002		CHECKED BY L.C.C.	

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 (%)				
							20 40 60 80 100	20 40 60 80 100	10 20 30					
133.5	Ground Surface													
0.0	Peat Wet													
132.9							133							
0.6	Sand, trace silt Loose Wet													
132.5														
1.0	Sand and Silt, some gravel, trace clay, with cobbles and boulders, some sand seams (Till) Compact to very dense Grey Wet		1	SS	17									1 94 (5)
			2	SS	13									
			3	SS	89									
			4	SS	89/0 10									
130.4														
3.2	LIMESTONE (BEDROCK) with shale seams Fresh Weak to medium strong Thinly- bedded Grey Bedrock cored between 3.2 m and 6.2 m depth For bedrock coring details refer to Record of Drillhole 02-507						130							
							129							
							128							
127.3														
6.2	End of Borehole													
	Notes: 1. Water level in open borehole at 0.1 m depth (Elev. 133.4m) on completion of drilling. * Sampler bouncing after 39 blows.													

MISS_MTO 021-1155-2.GPJ ON MOT.GDT 27/10/03

PROJECT: 021-1155-2

RECORD OF DRILLHOLE: 02-507

SHEET 2 OF 2

LOCATION: N 5012302.0 ; E 346340.4

DRILLING DATE: Dec. 17, 2002

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55 Bombardier, 200mm I.D. Hollow Stem Auger

DRILLING CONTRACTOR: Marathon Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	COLOR % RETURN	FRFX-FRACTURE F-FAULT				SM-SMOOTH		FL-FLEXURED		BC-BROKEN CORE		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN		MB-MECH BREAK			
								SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY		B-BEDDING			
		Refer to previous page		130.40															
4	Relay Drill NQ Core	LIMESTONE (BEDROCK) with shale seams Fresh Weak to medium strong Thinly-bedded Grey		3.15	1														
5																			
6					2														
6		End of Borehole		127.32 8.23															
7																			
8																			
9																			
10																			
11																			
12																			
13																			

MISS ROCK 021-1155-2 ROCK.GPJ GLDR.CAN.GDT 27/10/03 JFC

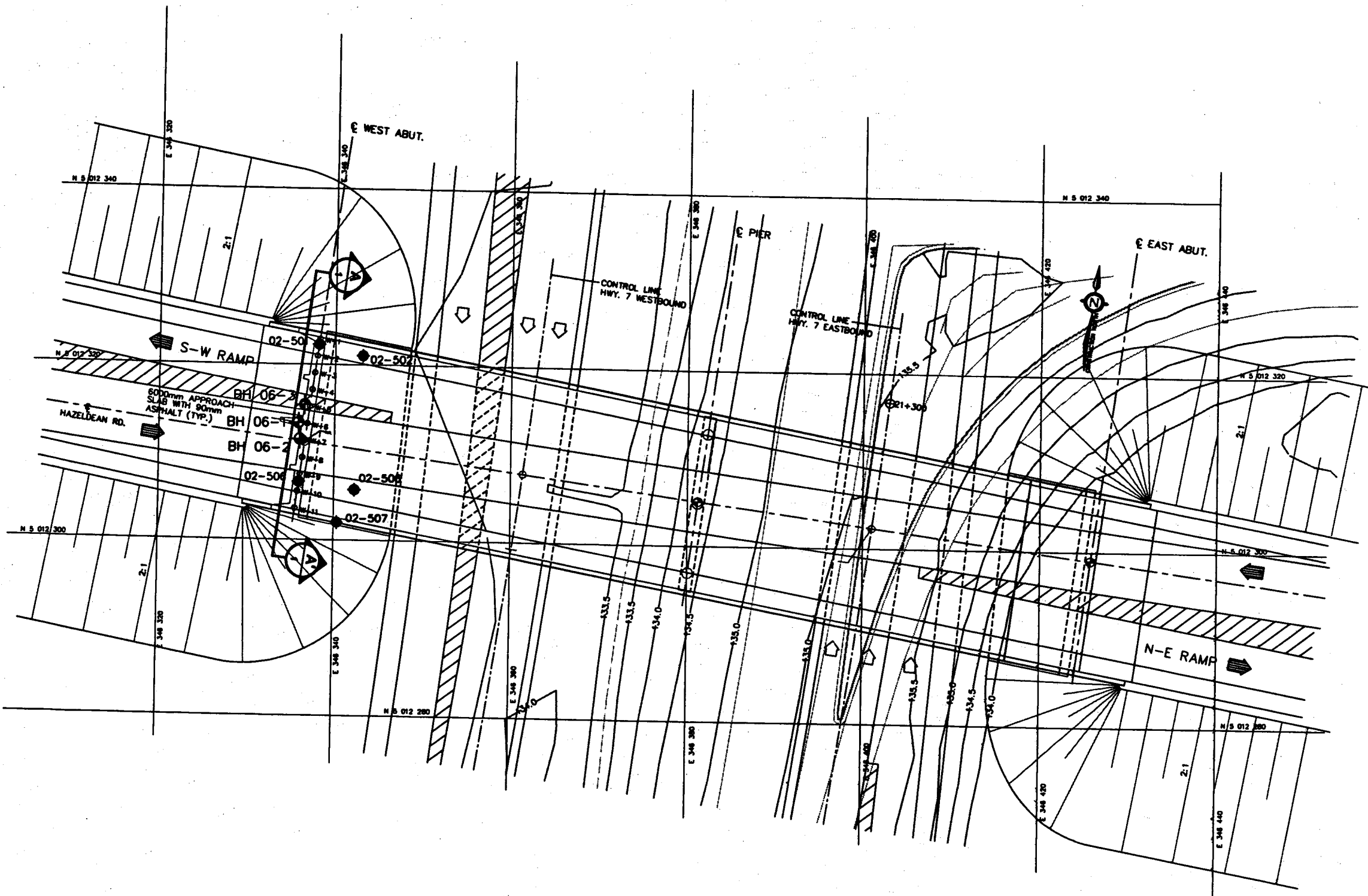
DEPTH SCALE

1: 50

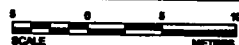


LOGGED: D.B.

CHECKED: M.I.C.



WEST ABUTMENT PLAN



CONT No.
WP No. 256-99-00

HAZELDEAN ROAD UNDERPASS

BOREHOLE LOCATIONS
AT WEST ABUTMENT

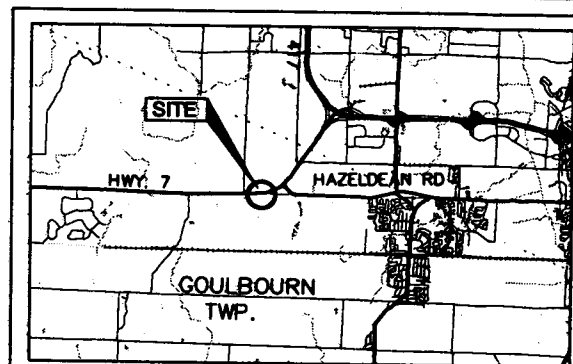


SHEET

360



Golder Associates Ltd.
OTTAWA, ONTARIO, CANADA



KEY PLAN

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

LEGEND

- Borehole - Present Investigation
- Borehole - Previous Investigation
- W-11 West Abutment Pile

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
06-1	134.8	5 012 313.4	346 335.9
06-2	134.7	5 012 311.5	346 336.1
06-3	134.7	5 012 315.4	346 336.6
02-501	133.4	5 012 322.3	346 338.2
02-502	133.6	5 012 321.3	346 343.0
02-506	133.6	5 012 306.6	346 336.0
02-507	133.5	5 012 302.0	346 340.4

NOTES

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

REFERENCE

General arrangement drawing provided in digital format (file: GA.DWG) by Marshall Macklin Monaghan, on April 24, 2003

NO.	DATE	BY	REVISION

Geocres No. PROJECT NO. 06-1120-371 DIST. 42

HWY. SUBM'D. SAT CHKD. SAT DATE: DEC. 2006 SITE: 3-721

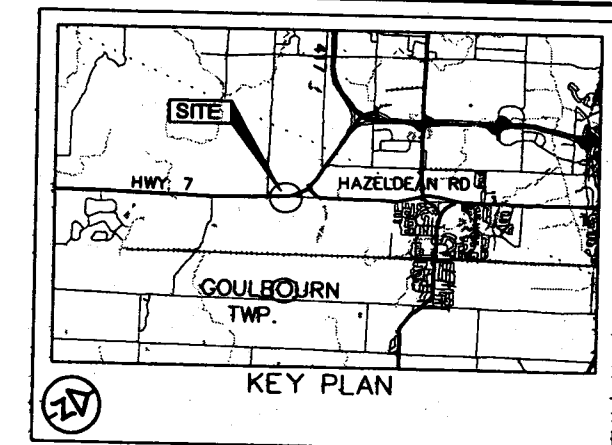
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CONT No.
WP No. 256-99-00
HAZELDEAN ROAD UNDERPASS
SOIL STRATA AT WEST ABUTMENT

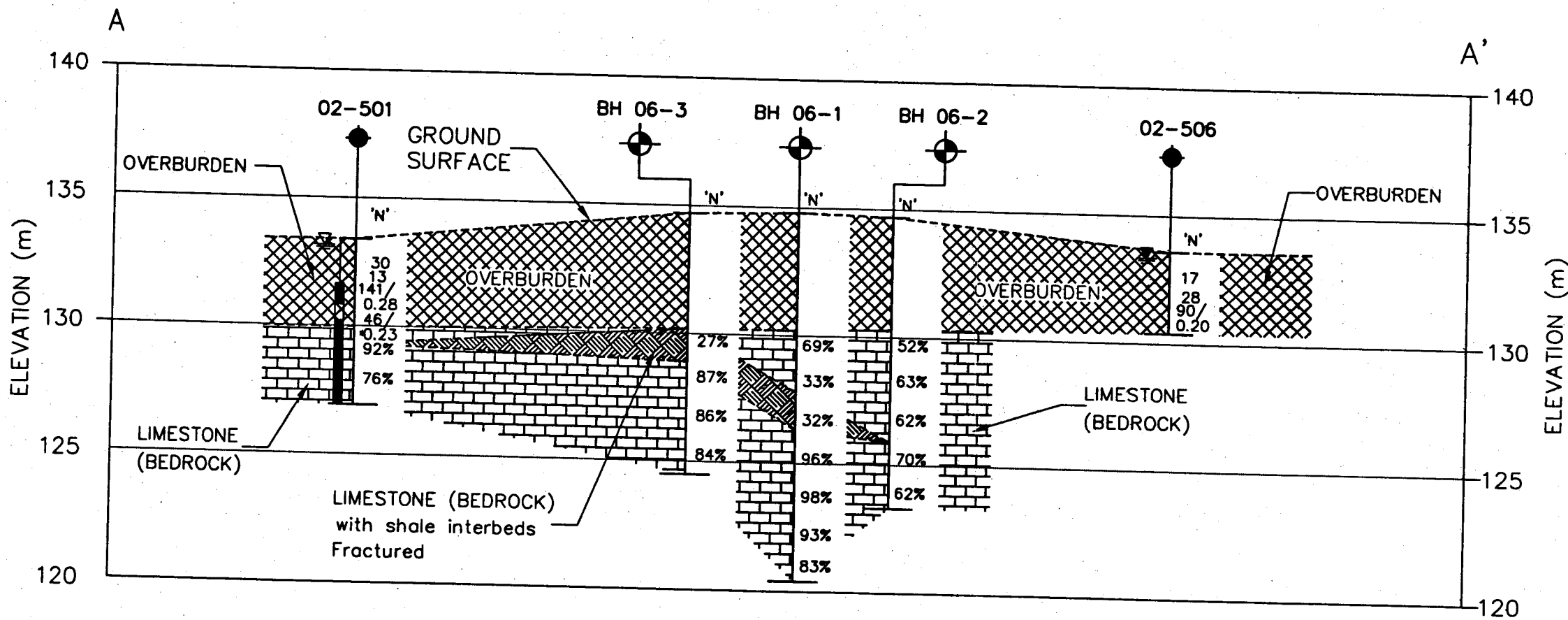
SHEET
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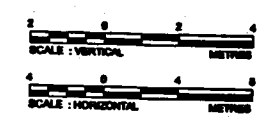
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METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN



WEST ABUTMENT PROFILE



LEGEND			
	Borehole - Present Investigation		
	Borehole - Previous Investigation		
	Seal		
	Piezometer		
	Standard Penetration Test Value		
	Rock Quality Designation (RQD)		
	WL in piezometer, measured on Jan. 08, 2003		
	WL upon completion of drilling		

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
06-1	134.8	5 012 313.4	346 335.9
06-2	134.7	5 012 311.5	346 336.1
06-3	134.7	5 012 315.4	346 336.6
02-501	133.4	5 012 322.3	346 338.2
02-502	133.6	5 012 321.3	346 343.0
02-506	133.6	5 012 306.6	346 336.0
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NO.	DATE	BY	REVISION

Geocres No.	PROJECT NO. 06-1120-371	DIST. 42
HWY.	DATE: DEC. 2006	SITE: 3-721
SUBM'D. SAT	CHKD. SAT	APPD. F.H
DRAWN: NBHS	CHKD. SAT	DWG. 2