



**PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN REPORT
FOR
NEW AMABLE-DU-FOND RIVER BRIDGE – HIGHWAY 630
CALVIN TOWNSHIP, NORTH BAY AREA – SITE NO. 43-086
AGREEMENT NUMBER 5005-E-0001
GWP NO. 177-98-00**

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PART A
PRELIMINARY FOUNDATION INVESTIGATION REPORT
for
New Amable-du-Fond River Bridge – Highway 630
Calvin Township, North Bay Area – Site No. 43-086
Agreement Number 5005-E-0001
GWP No. 177-98-00

1. INTRODUCTION

This report presents the results of the preliminary foundation investigation carried out at the site of the preferred alignment of a new bridge carrying Highway 630 over the Amable-du-Fond River in the Township of Calvin, North Bay Area and including the approach embankments for the realigned Highway 630. The preliminary foundation study was carried out for Stantec Consulting Limited (Stantec) on behalf of the Ministry of Transportation of Ontario (MTO).

MTO plans to replace the two existing single-lane bridges located at the Highway 630 crossing of the Amable-du-Fond River about 1.4 km south of Highway 17. A new structure will replace the southern bridge, Site No. 43-086. The preliminary investigation for the northern structure was reported separately.

Stantec and MTO considered four alternative alignments of the Highway 630 across the Amable-du-Fond River. A description of the alignments is provided below:

- Alternative 1: Existing Highway 630 alignment.
- Alternative 2: New alignment to the west side.
- Alternative 3: New alignment to the east side.
- Alternative 4: New alignment to the east side with a 250 m radius.

It is understood that Stantec and MTO presently identified Alternative 3 as the preferred alignment for the River crossing and Highway 630 realignment. However, the selected alternative could be different from the currently preferred alignment.



Part A of this report summarizes the results of the preliminary foundation investigation carried out at the site of the (Preferred) Alternative No. 3 new Amable-du-Fond River south bridge foundations and associated approach embankments.

2. SITE DESCRIPTION

Site photographs are included in Appendix A for illustration. The existing Highway 630 through the investigated section is presently a two-lane rural highway leading from Highway 17 to the Town of Kiosk. A bedrock outcrop island separates the Amable-du-Fond River into a north branch and a south branch over which the two bridges were constructed. The Key Map provided on Drawing ADF - B1 shows approximately the four alternative alignments and the preferred bridge sites.

Photographs 1 to 4 show the approximate alternative alignments. The preferred new bridge will span the south branch of the Amable-du-Fond River about 7 m east of the existing structure. The ground surface along the preferred alignment is undulating and partly covered with cobbles and boulders and exposed rock outcrops (Photographs 2 and 3). The Highway 630 grades typically rise up from the bridge locations towards the north and south.

Forested areas cover the land along the investigated section of the Highway 630. A few residences and community facilities use the land presently. Ottawa Valley Raillink railway tracks exists about 200 m north of the bridge site (Eau Claire Station).

The investigated bridge and embankment sites are located in a geological area comprising bedrock outcrops and shallow soil cover. Undulating bedrock outcrops along the river bed have produced shallow rapids and relatively fast water flow (Photographs 2 and 3). The bedrock underlying the bridge site comprises plutonic rocks (gneissic monzonitic rock with minor gneissic granitic rocks) of the Canadian Shield.

The depth of foundation frost penetration depth for the area of the Amable-du-Fond River Bridge is 2.0 m according to the OPSD 3090.100.



3. INVESTIGATION PROCEDURES

The subsurface investigation was carried out during the period from October 31 to December 14, 2006. Peto MacCallum Ltd. (PML) surveyed the exposed bedrock and investigated the soil cover over the bedrock by means of test pits. The survey and test pits comprised a total of 14 survey points and test pits numbered from B1 to B14 and reported in Record of Borehole logs, in accordance with MTO format.

The test pits were advanced through the soil cover with a track-mounted excavator, supplied and operated by a local contractor, working under the full-time supervision of a member of our engineering staff. The test pits were extended to depths ranging from the 1.2 to 2.1 m. One of the three test pits terminated by refusal on possible bedrock at 1.2 m depth.

The survey points and test pits were laid out in general accordance with the requirements noted in the Request for Proposal and as modified for the actual site conditions (bedrock outcrops) after discussions with MTO. The locations of the survey points and test pits (boreholes) are approximate and are shown on the Foundation Drawing ADF-B2. PML determined the ground surface elevations at the outcrop and test pit locations in relation to a benchmark provided by DelBosco Surveying Limited. All elevations in this report are expressed in meters.

Soils were identified in accordance with the MTO Soil Classification Manual procedures. The groundwater conditions in the test pits were assessed during the digging of the test pits by visual examination of the soil and, where encountered, by measuring the groundwater level in the open holes. PML backfilled all of the test pits in accordance with the MTO and MOE (Reg. 903) guidelines for test pit abandonment.

The recovered soil samples were returned to our laboratory for detailed visual examination and classification. The laboratory testing program consisted of two natural moisture content determinations and two grain size distribution analyses of selected soil samples. One moisture-density test was performed on a sample of the native soil. The grain size determinations are reported on Figures B-1. All of the test results are summarized on the Record of Borehole sheets.



4. SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Record of Borehole sheets for details of the subsurface conditions including soil classifications, inferred soil stratigraphy, natural moisture content determinations, grain size analyses, moisture-density relationship test and groundwater observations.

The general stratigraphy revealed in the test pits comprised discontinuous topsoil overlying native cohesionless gravelly sand, sand and gravel and boulders overlying bedrock or extensive bedrock outcrops. All test pits terminated in the gravel and sand deposits or bedrock which were considered competent soil to support the proposed embankment and bridge foundations for preliminary discussion purposes. The boundaries between soil strata were established at the test pit location only. Between and beyond the test pits and survey points, the boundaries are assumed and may vary.

4.1.1 Fill

Fill was not encountered in the test pits however fill soils should be expected at the site as part of the approach embankments to the existing bridge.

4.1.2 Topsoil

Boreholes B-12, B-13 and B-14 encountered discontinuous layers of topsoil 200 mm thick.

4.1.3 Sand/Gravel/Boulders

Cohesionless compact to loose and dense mixtures of sand, gravel and cobbles/boulders in varying proportions were encountered below the topsoil. These soils extended to the 1.2 to 2.1 m termination depths of the three boreholes B-12 to B-14, elevations 175.4 to 177.2.

The grain size distribution charts of two samples of the soil cover are included as Figure B-1. The moisture content determinations on the soil samples were about 3 and 4%.



4.1.4 Bedrock

Bedrock was encountered at the surface of eleven survey locations designated B-1 to B-11 approximately surveyed on the “rock island” between the bridge locations and at the north end of the south margin of the river at levels ranging from elevations 173.3 to 175.7. Inferred bedrock was also found in test pit B-12 dug on the south bank of the river to 1.2 m depth, elevation 175.4.

4.1.5 Groundwater

Groundwater was not encountered during the excavation of the test pits. The groundwater at the site is expected to be governed by the level of water in the Amable–du-Fond River that was at about elevation 172.5 at the time of the investigation (December 14, 2006) near the proposed new bridge crossing.

Seasonal fluctuations and variations due to rainfall patterns affect the groundwater levels at this site.

5. MISCELLANEOUS

Mr. R. Mount, P. Eng and Mr. M. Rapsey supervised the subsurface investigation under the direction of Mr. C.M.P. Nascimento, P. Eng., Senior Project Engineer. T.B. Concrete and Aggregates Ltd. supplied the backhoe used for the test pits. This report was prepared by Mr. C.M.P. Nascimento, P. Eng. and reviewed by Mr. Brian R. Gray, MEng, P. Eng, MTO Designated Contact.

PART B
PRELIMINARY FOUNDATION DESIGN REPORT

for
New Amable-du-Fond River Bridge – Highway 630
Calvin Township, North Bay Area – Site No. 43-086
Agreement Number 5005-E-0001
GWP No. 177-98-00

6. GENERAL

6.1 General

There are currently two existing single-lane bridges at the Highway 630 crossing of the Amable-du-Fond River about 1.4 km south of Highway 17. A new structure will replace the southernmost structure, Site No. 43-086 on a new alignment to the east of the existing bridge. This is the preferred alternative alignment (Alternative 3) as indicated by Stantec.

This Part B of the report provides preliminary foundation engineering recommendations regarding design and comments for construction of the southernmost new Amable-du-Fond River Bridge on Highway 630, as part of the bridge Preliminary Design. The recommendations are preliminary and based on the results of the current limited subsurface investigation, as outlined in Part A of this report. The recommendations are for planning purposes and for providing information necessary for the feasibility study. The comments on the construction aspects are to highlight those aspects that could affect the planning of the project.

The following sections of this report discuss the key issues (foundation alternatives, embankment settlement, stability and geometry, construction concerns such as groundwater control) for the proposed bridge and propose the scope of work for Detail Design.

Table 1 contains a list of the standard specifications referenced in this report. All elevations in this report are in metres.



6.2 Bridge Foundation Alternatives

We understand that the preferred alignment alternative No. 3 will cross the south branch of Amable-du-Fond River about 7 m to the east of the existing bridge and anticipate that the new bridge will be a single-span structure.

For the purpose of the discussions in this report, we assumed that the top of the new bridge deck would be maintained at about the existing elevation 177.0.

The soil stratigraphy revealed in the boreholes generally indicated that the new north and south abutments will be located over bedrock outcrops. The water level in the Amable-du-Fond River, which was at about elevation 172.5 (December 14, 2006) likely fluctuates seasonally and determines the groundwater table at the bridge foundation site.

Founding the new north and south bridge abutments on spread footings placed on the bedrock encountered at the site is feasible. The founding level for the south abutment is near the level of the water in the Amable-du-Fond River, therefore construction of the spread footing at this location may require the local installation of temporary cofferdams schemes to keep the founding subgrade in the dry. Alternatively, a pad of tremie concrete may be cast over the prepared rock surface to facilitate footing construction in the dry.

During detail design, the rock should be inspected by a rock specialist (geologist or rock mechanics engineer) to evaluate the depth of removal of weathered zones and the potential for damage due to freezing.

A scheme with pile foundations at the north and south abutments for an integral abutment design alternative is also possible. However, this alternative is not recommended given the proximity of the river with potential scour concerns of the approach fill at the abutment and the required extent of rock excavation to provide the required free pile length.

We consider that drilled caissons to support the foundations are not practical for this site due to the presence of shallow bedrock.



The seismic site coefficient for the stratigraphy conditions at this site is 1.0 [soil profile Type I, Canadian Highway Bridge Design Code (CHBDC) 2006 Edition, clause 4.4.6].

6.3 Spread Footings

For the preliminary design of the structure abutment footings, we assumed the following preliminary reference elevations:

Foundation Element	Subgrade Reference Elevation
North Abutment	173.6
South Abutment	172.8

Notes: Allowance for a foundation frost depth is not required for footing on the bedrock.
Elevations allowed for removal of about 0.5 m of the weathered rock below the encountered rock surface.

The recommended preliminary bearing resistances for minimum 1.0 m wide footings for the abutments constructed on unweathered bedrock are as follows:

Factored Geotechnical Resistance at ULS	10,000 kPa
Geotechnical Resistance at SLS	N/A

The groundwater level will not influence the computation of the ULS resistance. The geotechnical resistance at SLS normally allows for 25 mm of total compression of the founding medium. Considering the bedrock to be unyielding, settlement criteria will not govern the design.

The rock quality should be evaluated for Detail Design and, if of poor quality should be evaluated by a rock mechanic specialist to determine the requirements for rock bolting and/or protection against scour by river action.

The footings founded directly on the unweathered bedrock will not require frost protection.



The friction developed between the underside of the concrete footing and the bedrock will partly resist the lateral loads imposed on the foundations by the approach embankment fills. Rock dowels may be used for providing the additional required resistance. Calculation of these forces should be in accordance with the CHBDC. A coefficient of friction equal to 0.7 may be assumed between concrete footings and the bedrock.

7. NEW APPROACH EMBANKMENTS

The alignment of the north approach embankment is located on a bedrock outcrop with exposed bedrock and bedrock covered with shallow topsoil, and the south approach embankment is over loose to compact/dense sand and gravel deposits containing cobbles and boulders overlying bedrock at 1.2 m depths near the bridge site.

We anticipate that construction of earth or rock fill embankment for the bridge approaches and the new Highway 630 platform will be straightforward in view of the encountered subgrade conditions.

Earth or rock fill approach embankments and new embankments should be designed and constructed in accordance with OPSD 200.010, 201.010, 202.010, 202.020, 3101.150, 3101.200 and SP 206S03, as applicable. The side slopes of the approach embankments will be stable where they are inclined no steeper than 2H:1V for earth fill and 1.25H:1V for rock fill.

Since the subgrade for the new embankments comprise of unyielding bedrock or very dense sand and gravel containing boulders, settlements of the foundation subgrade will be negligible. Completion of the settlements of the cohesionless native soils will occur during construction.

Most of the settlements of the embankments constructed with granular materials will occur during construction with some 10 mm estimated adjacent to the new bridge abutments.

The earth fill slopes, if employed, should be protected against surface erosion by sodding (OPSS 571) and suitable vegetation. The new approach embankments should be protected against scour caused by the river waters (OPSS 511).



8. EARTH PRESSURES

The abutment walls should resist the unbalanced lateral earth pressure imposed by the backfill adjacent to the wall. The lateral earth pressure, p (kPa) may be computed using the equivalent fluid pressure diagrams presented in Section 6.9 of the CHBDC or employing the following equation.

$$p = K(\gamma h + q) + C_p + C_s$$

where K = coefficient of lateral earth pressure (dimensionless)
 γ = unit weight of free-draining granular material, kN/m^3
 h = depth below final grade, m
 q = surcharge load, kPa, if present.
 C_p = compaction pressure, kPa (refer to clause 6.9.3 of CHBDC)
 C_s = earth pressure induced by seismic events, kPa (refer to clause 4.6.4 of CHBDC)
 where ϕ = angle of internal friction of retained soil (35° for Granular A or Granular B Type II)
 δ = angle of friction between the soil and wall (23.5° for Granular A or Granular B Type II)

The seismic site coefficient for the conditions at this site was provided previously (Section 6.2).

Free-draining granular material should be used as backfill behind the wall. The following parameters are recommended for design:

PARAMETERS	GRANULAR A OR GRANULAR B TYPE II
Internal Friction Angle, ϕ (degrees)	35
Unit weight, γ (kN/m^3)	22.8
Coefficient of Active Earth Pressure, K_a	0.27
Coefficient of Earth Pressure At Rest, K_o	0.43
Coefficient of Passive Earth Pressure, K_p	3.69

The assigned geotechnical parameter values are the same for both granular materials in view of their similar physical characteristics.



The coefficient of earth pressure at-rest should be used for design of rigid and unyielding walls, the active earth pressure coefficient for unrestrained structures. The earth pressure coefficients should be reviewed if the slope of the backfill exceeds 10° to the horizontal. Alternatively, the material above the top of the wall could be treated as a surcharge load (q in the preceding equation).

The magnitude of the passive resistance is dependent on the actual lateral movement of the structure toward the retained soil. We refer to Figure C6.16 of the CHBDC for this computation. The subsoil/backfill should be considered as medium dense sand for the project.

A subdrain system (SP 405F03) and/or weep holes (OPSD 3190.100) should be installed to minimize the build-up of hydrostatic pressure behind the wall. The subdrains pipes should be surrounded by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be installed on a positive grade and lead to a frost-free outlet.

Backfilling adjacent to retaining structures should be carried out in conformance with Ontario Provincial Standard specifications for granular backfill at abutments (OPSD 3101.150).

Operation of compaction equipment adjacent to retaining structures should be restricted to limit the compaction pressure noted in clause 6.9.3 of the CHBDC. Refer to SP 105S10 for additional information in this regard.



9. CONSTRUCTION CONSIDERATIONS

9.1 Excavation

Excavation for construction of the abutment foundations on spread footings will extend through the shallow cohesionless native soils containing boulders. The contract should allow for the removal/excavation of boulders.

The bedrock is classified as Type 1 soil according to Occupational Health and Safety Act (Ontario Regulation 213/91) criteria. The dense/loose to compact sand and gravel soil is classed Type 3 soil. The existing embankment fills should also be classified as Type 3 soil. The excavations should be carried out in accordance with the soils in the slopes having the highest number. The need to excavate flatter side slopes if excessively soft/wet materials or concentrated seepage zones are encountered locally should be considered.

The cohesionless soils below the groundwater are considered as Type 4 soil if groundwater is not adequately controlled. For this condition, side slopes should be cut at 3H:1V slopes.

9.2 Road Protection Considerations

Should construction and traffic staging require traffic adjacent to the future excavations it is anticipated that a suitable roadway protection scheme following SP 105S19 will be required to support the walls of the excavation and adjacent traffic lanes during construction.

Several protection scheme alternatives such as sheet piling, sheeting supported by rakers or bracing, cantilever or anchored soldier piles and lagging may be considered. It is noted however that soldier pile and lagging schemes are not considered adequate where the excavation will be carried out through embankment sand and gravel fills or cohesionless native materials in particular under the groundwater table. For preliminary design purposes, the road protection schemes should be designed for performance level 1b to prevent movement of the existing embankment. The contractor is responsible for the selection, detailed design and performance of a road protection scheme.



9.3 Groundwater Control Considerations

The water levels observed are close to those of the proposed founding subgrade for the south bridge abutments and may fluctuate seasonally and with precipitation patterns. In view of the proximity of the river, the use of conventional sump pumping will not be adequate to control the groundwater in the excavations for the south abutment and temporary cofferdams may be required. Alternatively, the founding subgrade may be covered with a layer of concrete placed following tremie methods to allow construction of the footing in the dry.

The contract documents should clearly state that groundwater control in the excavations is the contractor's responsibility.

10. SCOPE OF ADDITIONAL FOUNDATION INVESTIGATION

Based on the results of the site review and assuming that the new bridge will be located at the alignment investigated, the recommended additional scope of the foundation investigation is as follows:

- Boreholes should be carried out for the north and south abutment foundations for the new alignment, in accordance with the MTO standard borehole configuration for shallow foundations on bedrock.
- Boreholes should be carried out 20 m from the abutment sites for approach embankment design.
- Additional approach embankments boreholes should be provided along the preferred alignment to investigate the extent and condition of the native cohesionless soils encountered in the current investigation.



11. DISCUSSION OF FOUNDATION ALTERNATIVES

11.1 Advantages and Disadvantages of Foundation Alternatives

The following table summarizes the advantages and disadvantages and inferred risks/consequences of each of the foundation alternatives for the new southern bridge at the Amable-du-Fond River on Highway 630. The pile foundation option is not a recommended alternative foundation, as outlined previously in the report.

ADVANTAGES AND DISADVANTAGES

SPREAD FOOTINGS ON BEDROCK		DRIVEN PILES	
ADVANTAGES	DISADVANTAGES	ADVANTAGES	DISADVANTAGES
Less costly than deep foundation alternative Conventional design and construction of foundations Allows semi-integral abutment design	Requires ground water control to establish founding subgrade in the dry at the south abutment or a tremie concrete pad	Allows integral abutment design and construction	More costly than shallow foundation alternative Requires pre-drilling to allow pile installation through rock Potential scour problems from river flow

- Notes: 1. Spread footings on engineered fill is not applicable at this site.
 2. Driven piles include integral abutment designs. Caisson foundations were not considered practical at this site.

11.2 Preferred Foundation Option Considerations

From the foundation perspective the spread footings are considered feasible. The driven pile foundations are possible but impractical because of potential scour from the river flow and due to extensive rock excavation to install the piles. Spread footing foundations are considered the least costly alternative and therefore the preferred option.

The selected foundation alternative also depends on other considerations, such as structural design and road grades, which are being evaluated separately by Stantec.



12. CLOSURE

This preliminary design report was prepared by Mr. C. M. P. Nascimento, P.Eng., Senior Project Engineer and reviewed by Mr. B. R. Gray, MEng, P.Eng., MTO Designated Principal Contact.

Yours very truly,

Peto MacCallum Ltd.

A handwritten signature in cursive script, appearing to read "C. M. P. Nascimento", is positioned to the left of the first professional seal.

C. M. P. Nascimento, P.Eng.,
Senior Project Engineer



A handwritten signature in cursive script, appearing to read "Brian R. Gray", is positioned to the left of the second professional seal.

Brian R. Gray, MEng, P.Eng.
MTO Designated Principal Contact

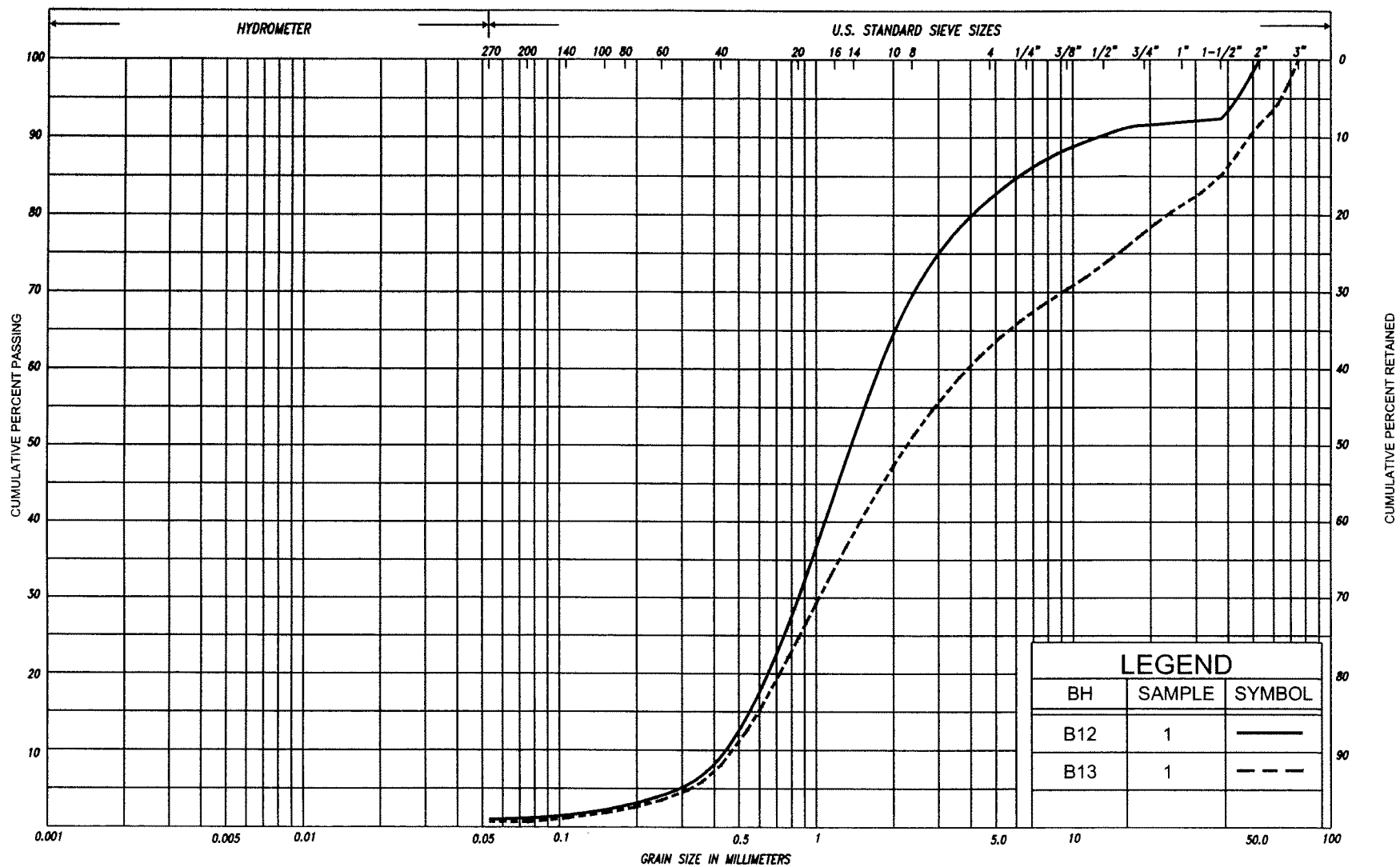


CN/BRG:cn-mi



TABLE 1
LIST OF STANDARD SPECIFICATIONS REFERENCED IN REPORT

DOCUMENT	TITLE	DATE
OPSS 511	Construction Specification for Rip-Rap, Rock Protection and Granular Sheeting	November 2004
OPSS 571	Construction Specification for Sodding	November 2001
SP 105S10	Construction Specification for Compaction	November 2004
SP 105S19	Construction Specification for Protection Systems	November 2006
SP 206S03	Construction Specification for Grading	November 2006
SP 405F03	Construction Specification for Pipe Subdrains	November 2006
OPSD 200.010	Earth/Shale Grading – Undivided Rural	November 2005
OPSD 201.010	Rock Grading-Undivided Rural	November 2005
OPSD 202.010	Slope Flattening Using Excess Material on Earth or Rock Embankment	November 2005
OPSD 202.020	Drainage Gap for Slope Flattening on Rock or Granular Embankment	November 2005
OPSD 3090.100	Foundation Frost Depth for Northern Ontario	November 2005
OPSD 3101.150	Minimum Granular Backfill Requirements - Abutments	November 2005
OPSD 3101.200	Rock Backfill Requirements - Abutments	November 2005
OPSD 3190.100	Retaining Wall and Abutment Wall Drain Detail	November 2005



LEGEND		
BH	SAMPLE	SYMBOL
B12	1	—
B13	1	- - -

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

GRAIN SIZE DISTRIBUTION
GRAVELLY SAND to SAND some gravel
trace silt

FIG No. B-1
HWY 630
G.W.P. No. 177-98-00

EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
C_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	n	1, %	POROSITY	e_{max}	1, %	VOID RATIO IN LOOSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	w	1, %	WATER CONTENT	e_{min}	1, %	VOID RATIO IN DENSEST STATE
ρ_w	kg/m ³	DENSITY OF WATER	S_r	%	DEGREE OF SATURATION	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
γ_w	kN/m ³	UNIT WEIGHT OF WATER	w_L	%	LIQUID LIMIT	D	mm	GRAIN DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_p	%	PLASTIC LIMIT	D_n	mm	n PERCENT - DIAMETER
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_s	%	SHRINKAGE LIMIT	C_u	1	UNIFORMITY COEFFICIENT
ρ_d	kg/m ³	DENSITY OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	h	m	HYDRAULIC HEAD OR POTENTIAL
γ_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
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	v	m/s	DISCHARGE VELOCITY
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	DTPL		DRIER THAN PLASTIC LIMIT	i	1	HYDRAULIC GRADIENT
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	APL		ABOUT PLASTIC LIMIT	k	m/s	HYDRAULIC CONDUCTIVITY
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL	WTP		WETTER THAN PLASTIC LIMIT	j	kN/m ²	SEEPAGE FORCE
e	1, %	VOID RATIO						

RECORD OF BOREHOLE No B-1

1 of 1

METRIC

G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+995 CL ORIGINATED BY R.M.
 DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.
 DATUM Geodetic DATE October 31, 2006 CHECKED BY C.N.

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)							GR	SA	SI	CL
175.7	Ground surface																				
0.0	Bedrock at surface																				
	* Borehole dry																				

RECORD OF BOREHOLE No B-2

1 of 1

METRIC

G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+989 CL ORIGINATED BY R.M.
 DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.
 DATUM Geodetic DATE October 31, 2006 CHECKED BY C.N.

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)							GR	SA	SI	CL
175.1	Ground surface																				
0.0	Bedrock at surface																				
	* Borehole dry																				

RECORD OF BOREHOLE No B-3

1 of 1

METRIC

G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+985, o/s 5.0m Rt. ORIGINATED BY R.M.
DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.
DATUM Geodetic DATE October 31, 2006 CHECKED BY C.N.

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
174.3	Ground surface																
0.0	Bedrock at surface																
	* Borehole dry																

RECORD OF BOREHOLE No B-4

1 of 1

METRIC

G.W.P. 177-98-00	LOCATION	Highway 630 (New) Sta. 9+985 CL	ORIGINATED BY	R.M.
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DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.

DATUM Geodetic DATE October 31, 2006 CHECKED BY C.N

SOIL PROFILE					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
174.7	Ground surface				
0.0	Bedrock at surface				
* Borehole dry					

RECORD OF BOREHOLE No B-5

1 of 1

METRIC

G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+981.5 CL ORIGINATED BY R.M.
 DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.
 DATUM Geodetic DATE October 31, 2006 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 kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					w _p	w	w _L	WATER CONTENT (%)					GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
174.1	Ground surface																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								

1 of 1

METRIC

Foundation Design

ON MOT VER3 06TF056-2.GPJ ON MOT.GDT 7/27/2007 3:46:46 PM

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

20
15 — 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No B-7

1 of 1

METRIC

G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+970, o/s 5.0m Rt. ORIGINATED BY R.M.
 DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.
 DATUM Geodetic DATE October 31, 2006 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 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		
173.9	Ground surface																
0.0	Boulder at surface																
	* Borehole dry																

RECORD OF BOREHOLE No B-8

1 of 1

METRIC

G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+970, o/s 3.0m Lt. ORIGINATED BY R.M.
 DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.
 DATUM Geodetic DATE October 31, 2006 CHECKED BY C.N.

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
174.3	Ground surface																
0.0	Boulder at surface																
	* Borehole dry																

RECORD OF BOREHOLE No B-9

1 of 1

METRIC

G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+968, o/s 9.0m Rt. ORIGINATED BY R.M.
 DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.
 DATUM Geodetic DATE October 31, 2006 CHECKED BY C.N.

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)							GR	SA	SI	CL
173.6	Ground surface																				
0.0	Bedrock at surface																				
	* Borehole dry																				

RECORD OF BOREHOLE No B-10

1 of 1

METRIC

G.W.P.	177-98-00	LOCATION	Highway 630 (New) Sta. 9+968, o/s 5.0m Rt.	ORIGINATED BY	R.M.
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DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.

DATUM Geodetic DATE October 31, 2006 CHECKED BY C.N

[illegible]

RECORD OF BOREHOLE No B-11

1 of 1

METRIC

G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+968, o/s 3.0m Lt. ORIGINATED BY R.M.
 DIST 54 HWY 630 BOREHOLE TYPE Manual COMPILED BY N.S.B.
 DATUM Geodetic DATE October 31, 2006 CHECKED BY C.N.

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
173.6	Ground surface																
0.0	Bedrock at surface																
	* Borehole dry																

RECORD OF BOREHOLE No B-12										1 of 1		METRIC					
G.W.P. 177-98-00			LOCATION Highway 630 (New) Sta. 9+935 CL					ORIGINATED BY M.R									
DIST 54 HWY 630			BOREHOLE TYPE Excavator					COMPILED BY M.R									
DATUM Geodetic			DATE December 14, 2006					CHECKED BY C.N									
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									
176.6	Ground surface																
0.0	Topsoil																
0.2	Sand some gravel, trace silt																
	Dense Brown Moist		1	CS	-		176										18 81 (1)
175.4																	
1.2	End of borehole Refusal on possible bedrock																
	NOTE: The Relative density of the deposit was assessed by probing the test pit walls to 1.2m depth and by observation of the test pit walls and ease of excavation. * Borehole dry Upon completion of excavating moderate caving at 1.2m Sample 1: Moisture-density relationship test (ASTM D698) : Max. Dry Den. = 1955 Kg/m ³ Opt. water content = 8.6 %																

RECORD OF BOREHOLE No B-13										1 of 1		METRIC					
G.W.P. 177-98-00			LOCATION Highway 630 (New) Sta. 9+898, o/s 8.0m Lt.					ORIGINATED BY M.R									
DIST 54 HWY 630			BOREHOLE TYPE Excavator					COMPILED BY M.R									
DATUM Geodetic			DATE December 14, 2006					CHECKED BY C.N									
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									
179.1	Ground surface																
0.0	Topsoil						179										
0.2	Gravelly sand trace silt																
	Compact Brown Moist to loose		1	CS	-		178										37 62 (1)
177.0																	
2.1	End of borehole						177										
NOTE: The relative density of the deposit was assessed by probing the test pit walls to 1.2m depth and by observation of the test pit walls and ease of excavation. Borehole terminated due to excessive caving of side walls * Borehole dry																	

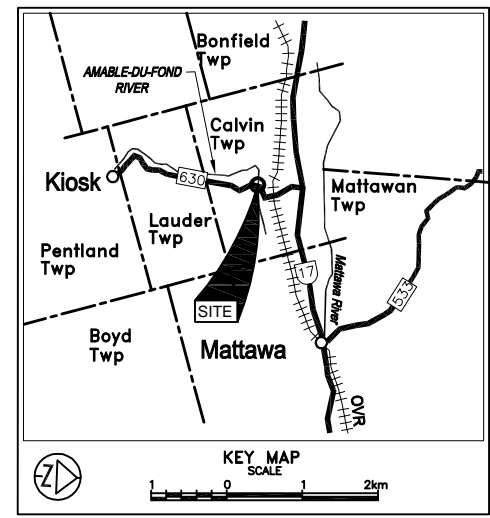
RECORD OF BOREHOLE No B-14

1 of 1


METRIC

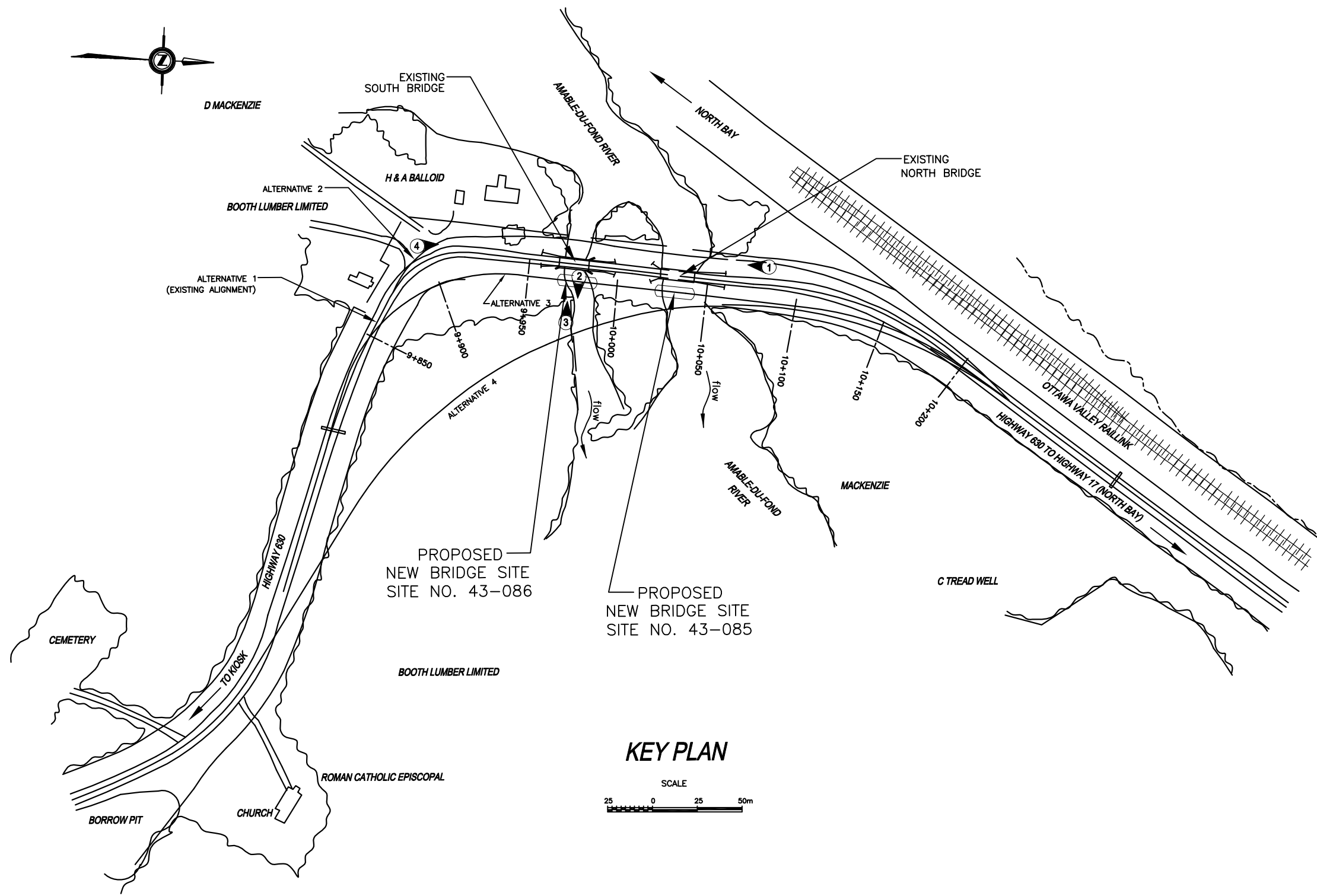
G.W.P. 177-98-00 LOCATION Highway 630 (New) Sta. 9+886, o/s 2.0m Rt. ORIGINATED BY M.R
 DIST 54 HWY 630 BOREHOLE TYPE Excavator COMPILED BY M.R
 DATUM Geodetic DATE December 14, 2006 CHECKED BY C.N

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
179.3	Ground surface							20	40	60	80	100					
0.0	Topsoil																
0.2	Gravelly sand, trace silt cobbles and boulders						179										
	Compact Brown Moist to loose						178										
177.2																	
2.1	End of borehole																
	NOTE: The relative density of the deposit was assessed by probing the test pit walls to 1.2m depth and by observation of the test pit walls and ease of excavation. Borehole terminated due to excessive caving of side walls * Borehole dry																



LEGEND

 Photograph location and view direction

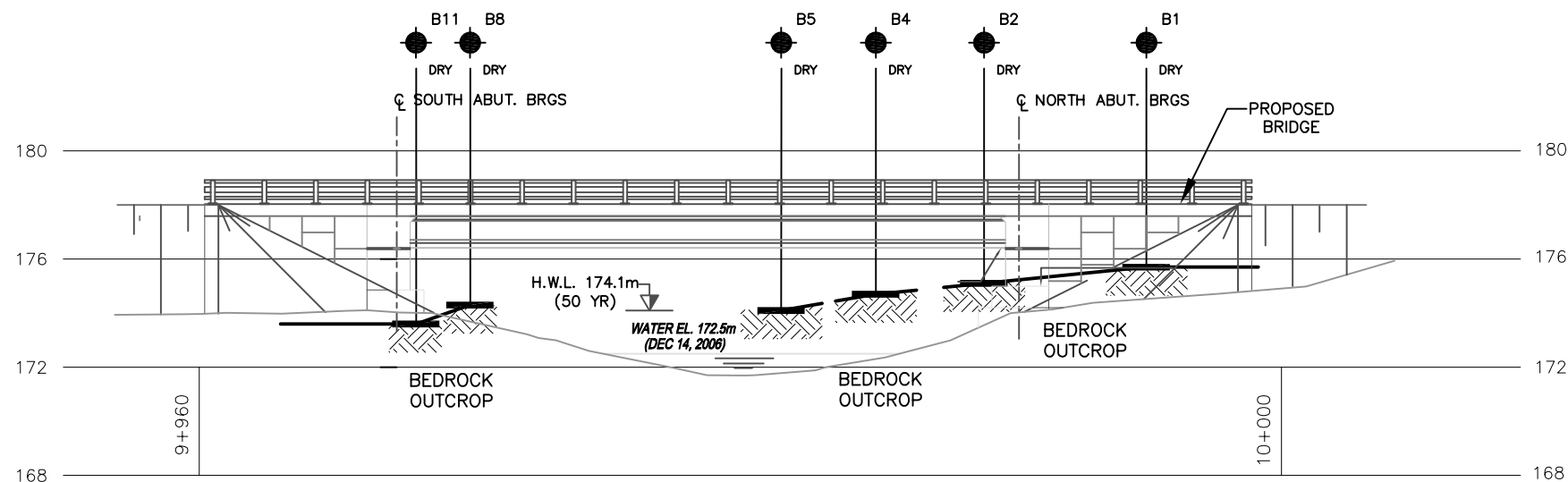
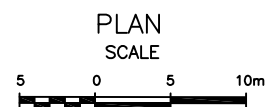
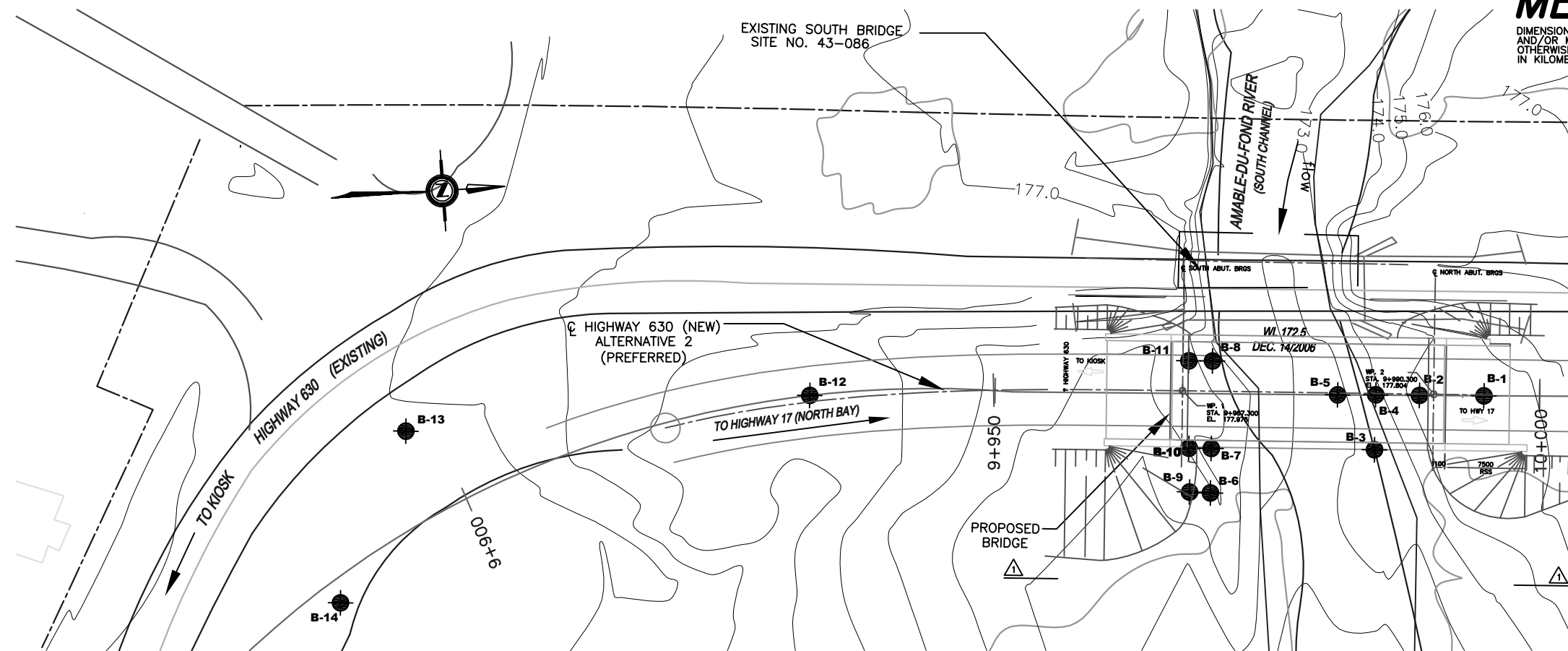


NOTES:

- REFER TO DRAWING ADF-B-2 FOR BOREHOLE LOCATIONS PLAN.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.

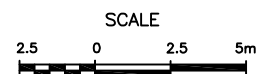
REF. No.: 612_base_137_88_00-Amable Plan
received in pdf format from Stantec Consulting Ltd.
dated October 27, 2006

REVISIONS							
	DATE	BY	DESCRIPTION				
Geocres No. 31L-108							
HWY No	630					DIST	SUDBURY
SUBM'D	GD	CHECKED	CN	DATE	JULY 16, 2007	SITE	43-086
DRAWN	NA	CHECKED	CN	APPROVED	BRG	DWG	ADF-B-1



(EAST SIDE VIEW 1-1 SHOWN)

PROFILE HWY 630 (NEW)



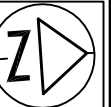
NOTES:

1. REFER TO DRAWING ADF-B-1 FOR KEY PLAN.
2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.

METRIC

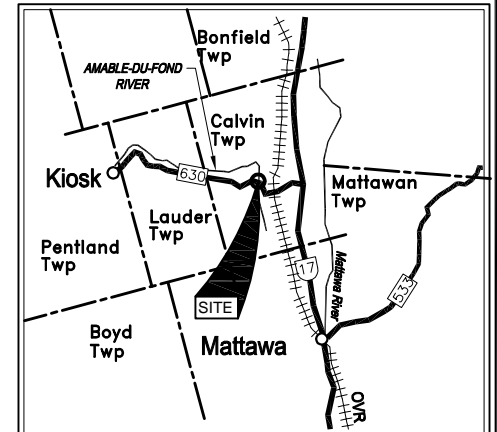
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES

CONT No
GWP No 177-98-00
AMABLE-DU-FOND RIVER BRIDGE
HIGHWAY 630
BOREHOLE LOCATIONS



SHEET

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS



KEY MAP
SCALE
0 1 2 km

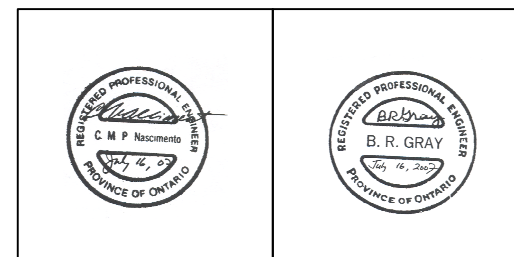
LEGEND

- Borehole
- Dynamic Cone Penetration Test (Cone)
- Borehole & Cone
- N Blows/0.3m (Std. Pen Test, 475 J / blow)
- CONE Blows/0.3m (60° Cone, 475 J / blow)
- W L at time of investigation DEC 2006

BH No	ELEVATION	STA.	o/s CL
B-1	175.7	9+995	CL
B-2	175.1	9+989	CL
B-3	174.3	9+985	5.0m Rt.
B-4	174.7	9+985	CL
B-5	174.1	9+981.5	CL
B-6	174.6	9+970	9.0m Rt.
B-7	173.9	9+970	5.0m Rt.
B-8	174.3	9+970	3.0m Lt.
B-9	173.6	9+968	9.0m Rt.
B-10	173.3	9+968	5.0m Rt.
B-11	173.6	9+968	3.0m Lt.
B-12	176.6	9+935	CL
B-13	179.1	9+898	8.0m Lt.
B-14	179.3	9+886	2.0m Rt.

NOTE

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



REF. No.: 612_base_137_88_00-Amable Plan
received in pdf format from Stantec Consulting Ltd.
dated October 27, 2006

REVISIONS	DATE	BY	DESCRIPTION
AUG.13/07	CN		PROFILE ADDED

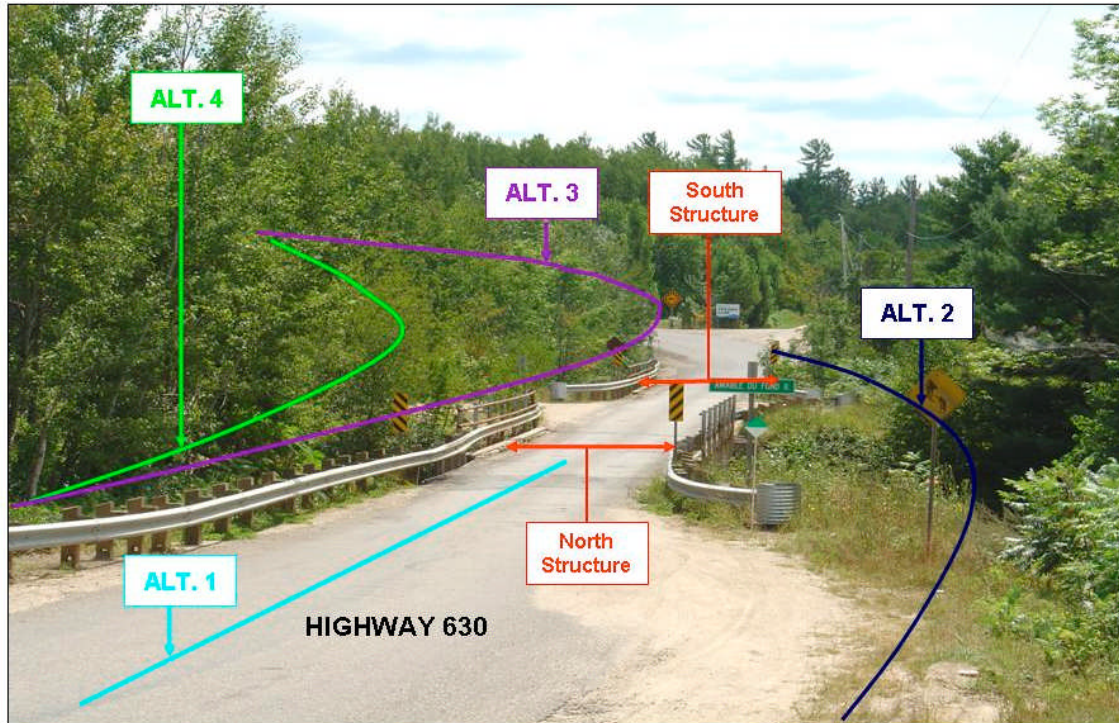
Geocres No. 31L-108	HWY No 630	DIST SUDBURY
SUBM'D GD	CHECKED CN	DATE JULY 16, 2007
DRAWN NA	CHECKED CN	APPROVED BRG
		DWG ADF-B-2



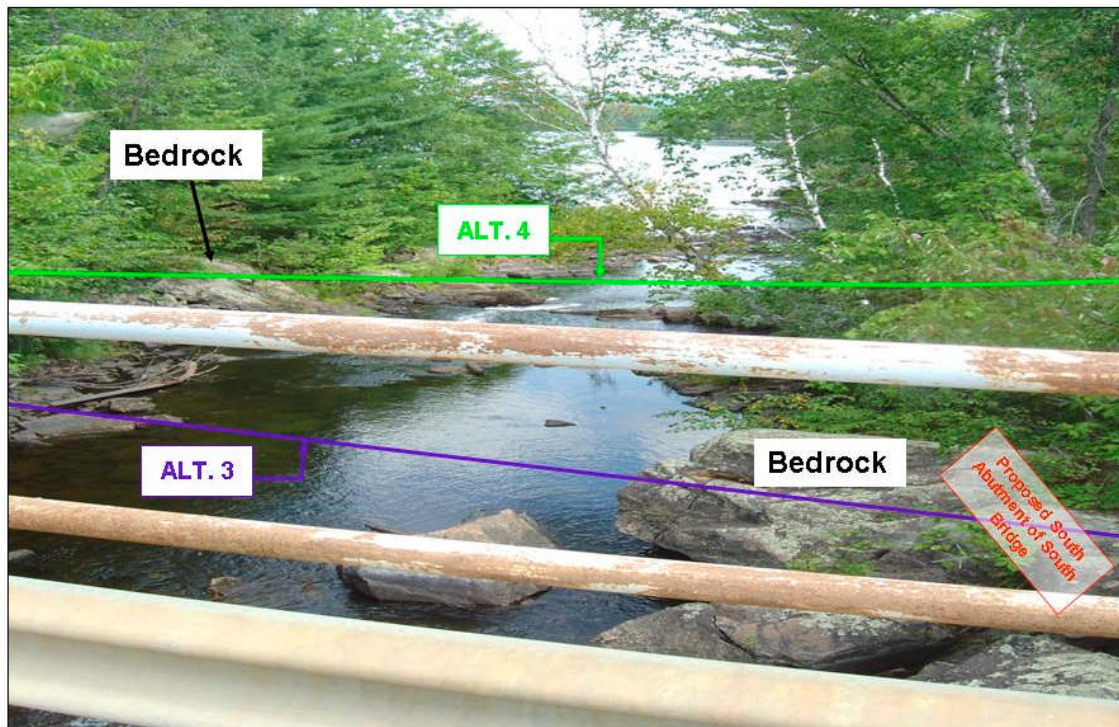
APPENDIX A

Site Photographs

AMABLE-DU-FOND RIVER BRIDGE (SOUTH)



Photograph 1 VIEW: Looking south from west shoulder of Highway 630 about 30 m north of northern single lane Amable-du-Fond River Bridges. Alignment alternatives 1 (existing alignment), 2 (west side) and 3 and 4 (both east side) are shown. Alternative 3 is the preferred alignment. (August 17, 2006)

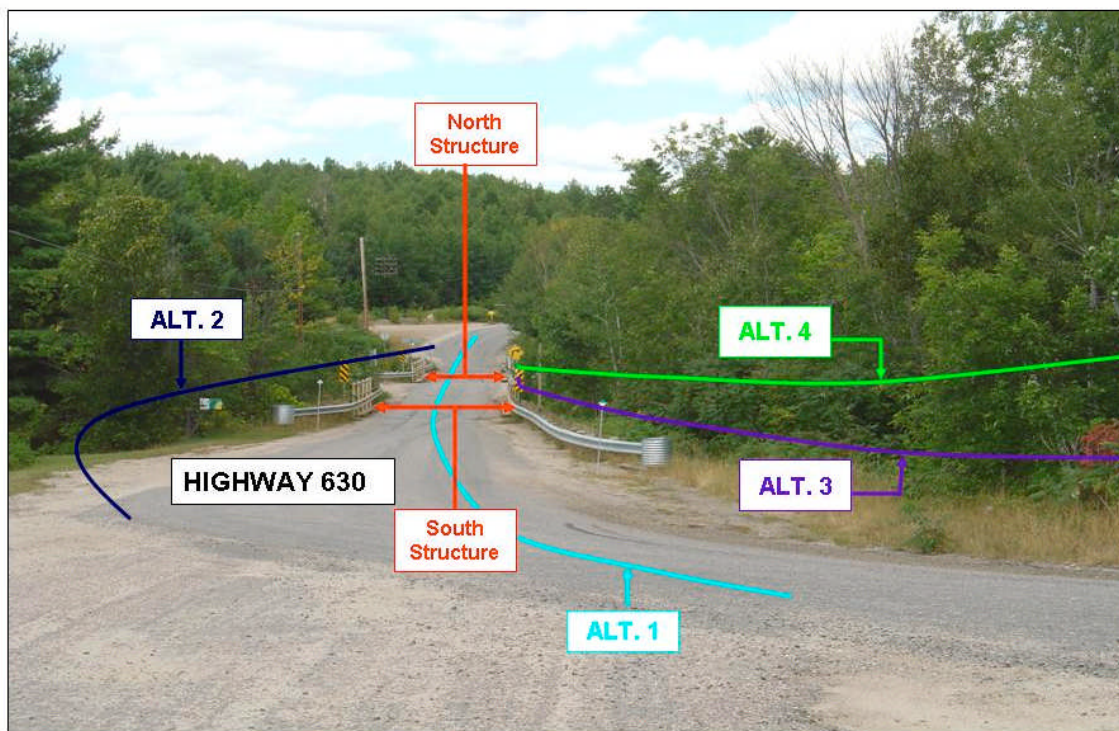


Photograph 2 VIEW: Looking east (downstream) from east side of middle of south Amable-du-Fond River bridge. Note exposed bedrock and alternative alignments. Alternative 2 is the preferred alignment. (August 17, 2006)

AMABLE-DU-FOND RIVER BRIDGE (SOUTH)



Photograph 3 VIEW: Looking west from south bank of Amable-du-Fond River about 10 m downstream from south bridge structure. (August 17, 2006)



Photograph 4 VIEW: Looking north from west shoulder of Highway 630 about 50 m south of southern Amable-du-Fond River Bridge. (August 17, 2006)