



**ALTERNATE INTERCHANGE LOCATION FOUNDATION
ASSESSMENT REPORT
HIGHWAY 11 ACCESS REVIEW FROM 1.0 KM NORTH OF
HIGHWAY 141 NORTHERLY FOR 5.5 KM
TOWN OF HUNTSVILLE
G.W.P. NO. 320-00-00**

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TABLE OF CONTENTS

1. INTRODUCTION	1
2. SITE DESCRIPTION	2
3. SITE ASSESSMENT PROCEDURES	4
3.1 General	4
3.2 Reference Documents and Literature Review	4
3.3 Site Reconnaissance.....	5
3.3.1 Site Reconnaissance Notes.....	5
4. INFERRED SUBSURFACE CONDITIONS.....	8
4.1 General	8
4.2 Drainage.....	10
5. FOUNDATION ASSESSMENT AND RANKING	10
5.1 Criteria Used In Assessing Alternatives	10
5.1.1 Extent of Soft Ground/Swamps (Table S -1).....	11
5.1.2 Groundwater Conditions (Table S -2)	11
5.1.3 Structure Foundations (Table S-3).....	12
5.1.4 Embankment Settlement (Table S-4).....	12
5.1.5 Embankment Stability (Table S-5)	12
5.1.6 Construction Feasibility (Table S-6).....	13
5.2 Weighting of Evaluation Criteria for Interchange Alternatives (Tables S-1 to S-6)	13
5.3 Scoring of Foundation Criteria for Interchange Alternatives (Table S-7)	15
6. ALTERNATIVE INTERCHANGE LOCATIONS REVIEW AND RECOMMENDATIONS	17
6.1 General	17
6.2 Embankment Design	17
6.3 Embankment Stability.....	18
6.4 Embankment Settlements	18
6.5 Structure Foundations	19
6.6 Construction Considerations	20
6.7 Assessment of Advantages and Disadvantages	20



7. PREFERRED INTERCHANGE ALTERNATIVE	23
7.1 Recommended Interchange Location.....	23
7.2 Additional Studies.....	24
8. CLOSURE.....	25

Table 1 – Recommended Locations for Foundation Investigations
Structures and Culverts

Table S-1 – Soft Ground/Swamps

Table S-2 – Groundwater Conditions

Table S-3 – Structure Foundations

Table S-4 – Embankment Settlement

Table S-5 – Embankment Stability

Table S-6 – Construction Feasibility

Table S-7 – Scoring of Foundation Criteria (Interchanges)

Figure 1 – Project Location Map

Figure 2 – Legend

Drawings 1 to 3 – Plans – Alternatives 1A to 1C and 2A to 2C

Drawings 4 and 5 – Plans - 1992 Recommended Plan

Drawings 6 to 8 – Current Recommended Plan

Appendix A – List of Reference Documents

Appendix B – MOE Well Records

Appendix C – Site Photographs 1 to 60

**ALTERNATE INTERCHANGE LOCATION
FOUNDATION ASSESSMENT REPORT**

for
Highway 11 from 1.0 km North of Highway 141
Northerly for 5.5 Km
Town of Huntsville
G.W.P. No. 320-00-00

1. INTRODUCTION

This report provides the alternate interchange location foundation assessment for a section of Highway 11 that extends from 1.0 km north of Highway 141 northerly for 5.5 km in the Town of Huntsville. The study was carried out for the Ministry of Transportation of Ontario (MTO) on behalf of Stantec Consulting Ltd. (Stantec).

The study corridor covers the section from Sta. 17+400, about 1.7 km south of the at-grade intersection at Stephenson Road 8/Greer Road to Sta. 22+900 in the Township of Stephenson. This section of Highway 11 was four-laned by twinning to the west for the southbound lanes and using the previous two-lane highway for the northbound lanes. The median is presently about 30 m wide. Traffic access to the highway occurs at two at-grade intersections located at Stephenson Road 8/Greer Road and Allensville Road/Rowanwood Road.

This study involves the review of the alternatives for fully controlled access to the subject section of Highway 11 including interchange options that is intended to remove all existing at-grade accesses. Consequently, the project will entail the future construction of a new interchange with a grade separation structure. Upon completion of the preliminary reviews, MTO and Stantec selected six interchange alternatives in addition to the proposed 1992 design. These alternatives are described as follows:

- Alternative 1A – Interchange at Sta. 20+200 (Parclo A)
- Alternative 1B – Interchange at Sta. 20+300 (Includes underpass at Sta. 21+420)
- Alternative 1C – Interchange at Sta. 20+200 (Diamond)
- Alternative 2A – Interchange at Sta. 21+780 (Parclo A)
- Alternative 2B – Interchange at Sta. 21+780 (Parclo B)
- Alternative 2C – Interchange at Sta. 21+780 (Diamond)
- Alternative 3A – 1992 Recommended Plan



Stantec provided site plans of the Study corridor illustrating the seven interchange alternatives. The purpose of this assessment was to identify the geologic features and hydrogeology along the highway corridor and to assess the potential impact of these features on the design and construction of the possible interchanges listed above. All elevations in this report are expressed in metres.

2. SITE DESCRIPTION

The study area is located about 141 km south of North Bay in the Geographic Township of Stephenson. The 5.5 km section of Highway 11 being reviewed extends from about 1.0 km north of Highway 141 to about 1.6 km north of existing Allensville Road/Rowanwood Road at-grade intersection. A Project Location Map (Figure 1) is enclosed for reference.

Land uses in the vicinity of the highway corridor within the study limits include industrial/commercial activity from the Muskoka Concrete and Natural Stone facilities and a number of residences and farmhouses along the Highway 11 sideroads. A TransCanada Pipe Lines Ltd. (TCPL) facility crosses the Highway 11 corridor north of Allensville Road/Rowanwood Road and Highway 11 intersection, at about Sta. 21+600. A transportation corridor for the CNR tracks is located about 100 m west of the Highway 11 southbound lanes (SBL) between Sta. 17+100 to 17+600.

The Lancelot (Bullen) Creek crosses the highway alignment about 520 m south of Allensville Road, at approximate Sta. 20+760. In addition, about 920 m north of Allensville Road, an unnamed creek culvert crosses Highway 11 at approximate Sta. 22+200.

Currently, the Highway 11 at-grade intersections and structures along the study corridor include the following:

ROAD	STATION	STRUCTURE	STATION
Stephenson Road 8 / Greer Road	19+120	Lancelot (Bullen) Creek Culvert	20+760
Allensville Road / Rowanwood Road	21+280	Unnamed Creek Culvert	22+200



From about 700 m south of the southern project limit, the topographic levels within the Highway 11 corridor rises about 31 m northerly from about elevation 290 to elevation 321 at about Sta. 20+200. The topographic levels north of this section drop about 39 m along the highway corridor from about elevation 321 to elevation 282. The lowest grade levels are found near elevation 282 in the 400 m long swamp areas which start about 150 m north of the Allensville Road/Rowanwood Road at-grade intersection.

The highway corridor extends along undulating terrain in rock outcrop and glaciolacustrine delta areas containing sands and gravels, and over knobby and rolling topography in areas of bedrock ridges and knobs with glaciolacustrine plains. Wet swampy areas associated with water courses are also found. Exposed rock outcrops, ridges and up to 3 m high rock cuts were noted. A description of the landforms and physiography along the study corridor is provided in Section 4.1 of this report.

From the well records obtained from the Ministry of the Environment (MOE), it was found that sandy unit extended about 0.6 to 54.0 m depth with local 5.0 to 15.0 m thick clayey units overlying the sandy units. The granite bedrock was encountered at 0.6 to 24.0 m depth and extended to 14.3 to 84.4 m.

The study area is located within the Central Gneiss Belt. The bedrock in this area consists of Precambrian rock of Mesoproterozoic age. The predominant bedrock types in the area are migmatites, gneisses (biotite and quartzofeldspathic gneisses) and felsic igneous rocks (granodiorites and granites). The local bedrock topography along this section of highway is undulated and the rock is found at widely varying depths ranging from near or at ground surface to over 30 m below the ground surface; scattered bedrock outcroppings are present along the route.

The groundwater is at relatively high levels in the lower elevations including the flood plains of the Lancelot (Bullen) Creek and its tributary.



3. SITE ASSESSMENT PROCEDURES

3.1 General

The foundation evaluation involved a review of the available geological, topographical and hydrogeological mapping, existing geotechnical reports, studies, aerial photographs and construction drawings for the existing highway. A field visual reconnaissance was carried out to verify the inferred data. Subsurface explorations, in-situ testing and sampling were not carried out in accordance with the terms of reference for the study.

3.2 Reference Documents and Literature Review

The general physiographic conditions along the corridor and the seven alternate interchange locations were obtained primarily from existing geological maps and reports from the MTO GEOCREs library. Four boreholes were previously drilled north of the intersection of Allensville Road/Rowanwood Road (Geocres No.: 31E-107). Thirty-two well records which were obtained from the MOE supplemented the data.

The documents and literature reviewed in whole or in part for this study are listed in Appendix A. The list reflects the selected data that contains geotechnical content relevant to the assessment. The list of the wells considered for the project is included in Appendix B.

The delineation of swamps and water courses/bodies as well as the location of significant earth deposits (silt/sand) and rock outcrops along the study corridor were interpreted from maps including Ontario Base Maps and aerial photographs provided by Stantec and the Ministry of Natural Resources (MNR).



3.3 Site Reconnaissance

Reconnaissance visits of the existing alignment and the adjacent lands within the study corridor were carried out on November, 2007 and September, 2008. The site reconnaissance visits consisted of a drive-by and walk-through of selected sections of Highway 11 and adjacent lands.

The alternative interchange locations were identified by unique colours as shown in Figure 2 (Legend) and reproduced on the following drawings attached to this report:

- Drawings 1 to 3 – Alternatives 1A to 1C and 2A to 2C
- Drawings 4 and 5 – 1992 Recommended Alternative (PDR Plates 7 and 37)

The ground truth checks verified the surficial geology and drainage conditions inferred from the literature and map reviews. Relevant natural features in selected areas of the corridor were photographed. The locations of 60 representative site photographs are indicated on Drawings 1 to 3 and 6 to 8. The photographs are included in Appendix C.

3.3.1 Site Reconnaissance Notes

Travelling north on Highway 11 from the Highway 141 interchange, the terrain conditions are typical of the Northern Ontario landscape - extensive swamp areas between bedrock outcrops kilometre after kilometre characteristic from Gravenhurst northerly to North Bay.

It is inferred from the local geology that the principal overburden deposits are glaciolacustrine in origin and comprise silts and sands with variable content of gravel and coarser particles along the highway corridor.

Moving north along Highway 11 from about 700 m south of the south project limit, a number of rock outcrops and rock cuts are visible east of the NBL, within the median, and west of the Highway 11 SBL. Photograph 1 shows bedrock outcrops in the median area from Sta. 16+700 to 16+730. The Highway 11 NBL and SBL are flanked by swamp areas between about Sta. 17+100 to 17+300. In Photograph 2 rock outcrops in the median and east of NBL from Sta. 17+300 to 17+400 are visible. Bedrock outcrops in the ditch areas for the SBL at Sta. 17+800 are shown in



Photograph 3 and in the NBL right slopes at Sta. 18+160 are shown in Photographs 4 and 5. Bedrock outcrops are present in the NBL right-of-way between about Sta. 19+960 and 20+088 (Photograph 10).

South of Stephenson Road 8 West/ Greer Road at-grade intersection, the highway profile slopes downward at about 1.5% grade from north to south from about elevation 329.5 to elevation 293 traversing through hilly areas and swamp areas. The Muskoka Ready Mix Concrete Plant built on 2 m high fill pad in swamp area is to the east of Stephenson Road 8 East (Photograph 8). Extensive aggregate extraction operations exist along Stephenson Road 8 at the Port Sydney - Utterson Sand and Gravel Pit.

Wet swampy areas are interspersed between the bedrock ridges and outcrops. An extensive bush area abutting Greer Road and Stephenson Road 8 for about 1 km south of the existing at-grade intersection is shown in Photograph 6. Photograph 7 shows the extensive swampy area in vicinity of Stephenson Road 8 and Highway 11 at-grade intersection and along Stephenson Road 8 East.

North of Stephenson Road 8 West/Greer Road to the Allensville Road/Rowanwood Road at-grade intersection, the terrain surrounding the highway is hilly with low lying swamp areas containing bedrock outcrops.

The highway profile gently slopes downward at an approximately 0.4 % grade between the at-grade intersections from about elevation 293.0 to elevation 284.5. Prominent bedrock outcrops are visible within 50 m east of the crossing of Stephenson Road 8 East and the TransCanada Pipeline (TCPL) Easement. The Lancelot (Bullen) Creek culvert runs west to east crossing the Highway 11 at approximate Sta. 20 +760. On Rowanwood Road, a single lane bridge crosses the Lancelot (Bullen) Creek about 350 m south of the existing Rowanwood Road/ Highway 11 intersection (Photograph 55).

The alignments of the crossroads and ramps of a possible future interchange at about Sta. 20+200 are shown on Photographs 11 to 14 and 16 to 20. The alignments of the proposed new ramps of the interchange alternatives 1A, 1B and 1C will require the extension of the existing



Lancelot (Bullen) Creek culvert to facilitate the construction of the merging lane width of the alternative new ramps (i.e. parallel to Highway 11) as depicted in Photographs 21 to 24.

Bedrock and swamp areas are evident at the Allensville Road/ Rowanwood Road/Highway 11 intersection in Photographs 26 to 28 and 38 to 41. Extensive swamps and ponded water areas are readily evident from 150 m south to the Rowanwood Road/Highway 11 at-grade crossing as illustrated in Photographs 52, 53 and 54. Further, a significant wet and swampy area exists to the north of the TCPL easement where an alternative location for an interchange for Allensville Road/Rowanwood Road has been contemplated (Photographs 30 and 31).

Highway 11 cuts into a bedrock ridge with 2 m rock cuts in the NBL and SBL from about Sta. 22+620 to 22+680 as shown in Photographs 48 to 50.

The alignments of the cross roads and ramps of a possible future interchange at Allensville Road/ Rowanwood Road are shown on Photographs 29 to 36 and 42 to 45.

The TCPL gas meter station is located north of Allensville Road and west of Highway 11 and the pipeline crosses the highway at about Sta. 21+600 (Photographs 34 to 36). Allensville Road from Old Muskoka Road easterly to Highway 11 winds at the foot of a major bedrock outcrop (Photograph 37). Bedrock outcrops also exist at the intersection of Old Muskoka Road and Stephenson Road 12 West. The bedrock cuts are up to 3.0 m in height.

An unnamed creek tributary culvert crosses the highway at about Sta. 22+200 (Photograph 46). Open farmland on the east side of Rowanwood Road about 500 m south of Highway 11 crossing with TransCanada Pipeline Easement is visible in Photographs 57 and 58. Swamp conditions exist at the existing culverts crossing the unnamed creek to Spider Lake at about Sta. 22+200. Here, the alignment of the E/W-N and N-E/W ramps are restricted because the ramps must merge with Highway 11 before the water course and utilize the existing concrete culvert to minimize the impacts to the stream (Photographs 44, 45 and 46) and to avoid extending the culvert.



Extensive bush and swamp areas associated with Spider Lake and Penfold Lake exist to the east of Highway 11 up to the north section of the project. Between the swamps areas there are gently undulating to rolling glacial lacustrine plains characterized by extensive silt deposits overlying sand and gravel mantling bedrock or ground moraine comprising shallow sand till deposits mantling the granitic bedrock. Heavy bush and swamp areas exist south of the MTO picnic area and to the west extending to about Sta. 22+700 (Photograph 47).

4. INFERRED SUBSURFACE CONDITIONS

4.1 General

The site is located in the area of the Canadian Shield where extensive glaciation has occurred. This project is located within the physiographic region known as the Number 11 Strip. This area is comprised of a narrow strip of land that follows Highway 11 from Gravenhurst to North Bay. The local topography is undulating as the highway traverses areas which alternate between steep rock ridges and low lying, swampy areas. The native overburden soils consist mainly of fine sands and silts, generally classified as Berriedale fine sand and Magnetawan silt.

The alignment traverses several different geological units:

- Wetland areas containing peat, silt, sand and clay deposits, typical of the Northern Ontario Region
- Glaciolacustrine plains comprising sands and silts
- Bedrock knobs, where the granite bedrock is overlain by a relatively shallow overburden
- Bedrock outcrops, where the bedrock is exposed or under a relatively thin overburden veneer

The study area of the Highway 11 is located within the Central Gneiss Belt. The bedrock in this area consists of Precambrian rock of Mesoproterozoic age. The predominant bedrock types in the area are migmatites, gneisses (biotite and quartzofeldspathic gneisses) and felsic igneous rocks (granodiorites and granites). The local bedrock along this section of highway undulated from near or at ground surface and locally dipped to more than 35 m below the ground surface; a few bedrock outcroppings are present along the route.



North of Allensville Road/Rowanwood Road intersection at Highway 11, limited subsurface investigation data (Geocres No.: 31E-107) indicates that loose to very loose silt to low plastic silt to sandy silt layers extend to 11.1 to 29.0 m below ground surface. Local 2.4 to 9.2 m thick very soft to soft clayey silt to silty clay unit is underlying the cohesionless silty/sandy layers and extends up to 16.0 to 20.3 m depth. The clayey silt to silty clay is underlain by compact to very dense silt to sandy silt which extends to 28.7 to 37.2 m depth. The levels of bedrock or competent soil for pile foundations were found at depths of 25.6 to 37.2 m below ground surface in the previous boreholes. These depths are shown on the attached drawings 1 to 3 and 6 to 8.

Artesian condition was encountered locally at 21.3 m depth with a hydrostatic head of about 23.5 m, 2.2 m above grade surface. Groundwater was encountered at 0.2 to 1.0 m depth below ground surface.

The anticipated extent of the major physiographic units and geology along the study corridor is shown on the enclosed Drawings 1 to 3 and 6 to 8. The legends and symbols used are provided on the Legend, Figure 2.

The approximate average extent of these physiographic/geologic formations along Highway 11 is generally summarized below with reference to the existing alignment chainage.

APPROXIMATE CHAINAGE	PREDOMINANT GEOLOGIC UNIT	LENGTH (m)	PERCENT OF TOTAL (%)
17+400 to 19+300	Glaciolacustrine Delta [GL (D)]	1,900	34.6
19+300 to 21+650	Bedrock ridges locally covered by shallow glaciolacustrine deposits [BR (R)]	2,350	42.7
21+650 to 22+900	Wetland/swamps within glaciolacustrine deposits and bedrock knobs [GL (P) + BR (N)]	1,250	22.7
TOTAL LENGTH		5,500	100.0



The average extent of the geologic units is approximate and will vary for the NBL and SBL of the highway.

4.2 Drainage

Generally, surface water runoff along the study corridor drains into streams, such as the Lancelot (Bullen) Creek and other unnamed creeks, swamps and scattered ponds. These flow generally to the east where Spider Lake and Penfold Lake are encountered 300 and 200 m east of the highway respectively, and ultimately to Mary Lake located further east.

Groundwater is inferred typically near ground surface (less than 1 m deep) in the low-lying areas. Artesian condition with a head of about 2 m above ground surface was reported in one of the boreholes drilled previously north of the Allensville Road/Rowanwood Road intersection.

5. FOUNDATION ASSESSMENT AND RANKING

5.1 Criteria Used In Assessing Alternatives

The terms of reference for this project identified six criteria to be considered from a foundation perspective, as follows:

- Extent of Soft Ground
- Groundwater Conditions
- Structure Foundations
- Embankment Settlement
- Embankment Stability
- Construction Considerations

A rationale for what each criterion represents and a method for measuring and evaluating each criterion was developed. The results of the evaluation are provided in Tables S-1 to S-6 for the structure alternatives. A discussion of the assessment criteria follows.



5.1.1 Extent of Soft Ground/Swamps (Table S -1)

The potential impact of soft ground and/or swamps for each alternative interchange location was evaluated on the basis of the total length of the alternative with inferred soft ground/swamps between 0 and 3 m deep; 3 and 10 m deep; and over 10 m deep.

For the purpose of this discussion, soft ground/swamps less than 3 m deep that may be excavated with conventional backhoe equipment were considered the most favourable. Soft and/or swamp grounds that are between 3 and 10 m deep typically requires a long-stick excavator and are of intermediate favourability. The treatment of areas with soft ground/swamps over 10 m deep need special equipment such as drag lines or require non-conventional treatment (wick drains, preloading) and are the least favourable.

5.1.2 Groundwater Conditions (Table S -2)

The extent of each interchange alternative with inferred groundwater at depths greater than 5 m (most favourable condition); between 1 and 5 m deep; and between 0 and 1 m deep (least favourable condition) were employed to assess the potential impact of this criterion.

The greater the groundwater depth the easier structures and embankments are to construct and the better the performance of embankments.



5.1.3 Structure Foundations (Table S-3)

The type of foundation required to support bridges, interchange structures and major culverts was employed to assess the potential impact of this criterion. Shallow foundations were considered to be the most favourable and deep foundations the least favourable. The favourability of integral abutment foundations was considered to fall between the shallow and deep type of foundations. The potential foundation type was estimated based on the inferred type and quality of founding subgrade materials along each route alternative.

5.1.4 Embankment Settlement (Table S-4)

Evaluation of embankment settlement was based on the total length of interchange alternatives over compressible materials. For evaluation purposes, the compressible soils were grouped into less than 3 m deep; 3 to 10 m deep; and more than 10 m deep zones. Each of these groups was further divided into potentially sandy or clayey deposits.

The most favourable condition was defined as the swamp areas containing less than 3 m of compressible deposits of a sandy nature (for example, loose sand), and the least favourable conditions are in areas with compressible deposits of soft clayey soils deeper than 10 m.

5.1.5 Embankment Stability (Table S-5)

The potential impact of embankment stability was evaluated on the basis of the total length of embankment and composition of the founding material. Conventional embankments that require little or no excavation and use conventional slope configurations were considered the most favourable, followed in decreasing favourability by embankments that require significant subexcavation, embankments that may require toe-stabilizing berms and (the least favourable) sections that may contain deeper than 10 m soft clays or sections with twinning of high embankments requiring pre-loading and wick drains.



5.1.6 Construction Feasibility (Table S-6)

The impact of construction feasibility was considered on the basis of the number of structures (bridge and major culvert) required on each alternative for Table S-6 and the number and type of structures and the length of swamp sections, in conjunction with the inferred founding conditions for Table F-6. In addition, embankments in swamps requiring conventional construction were considered most favourable and those requiring special construction were considered least favourable.

5.2 Weighting of Evaluation Criteria for Interchange Alternatives (Tables S-1 to S-6)

A weighting system was developed to enable selection of the preferred interchange location. The weighting system involved two factors:

- A favourability factor F to score the assessment for each of the evaluation criteria based on the foregoing discussion. The F values ranged from 5 for the most favourable to 1 for the least favourable.
- An impact weight B_i to reflect the significance of each of the six criteria on the design and construction of the highway. The impact weight for all criteria totals 1.00. The six evaluation criteria were compared in terms of relative importance and impact and assigned an individual impact weight as presented below:

EVALUATION CRITERION	IMPACT WEIGHT, B_i
Soft Ground/Swamp	0.10
Groundwater Conditions	0.15
Structure Foundations	0.25
Embankment Settlement	0.20
Embankment Stability	0.20
Construction Feasibility	0.10
TOTAL	1.00



The more important the individual evaluation criterion was considered for the design and/or construction of the highway, the higher the impact weight assigned. A value of 0 would be assigned if the criterion was deemed to have no impact on alternative route selection for the specific project.

The favourability factors, F , used in Tables S-1 to S-6, and the impact weights, B_i , used in the scoring Table S-7 are summarized in the following table.

EVALUATION CRITERION	IMPACT WEIGHT, B_i	FAVOURABILITY FACTOR, F						TABLE	
		MOST		AVERAGE		LEAST			
Soft Ground/ Swamps	0.10	Based on relative length and depth of soft ground (SG) and/or swamps (SWP):						S-1	
		SG or SWP 0 to 3 m Deep		SG or SWP 3 to 10 m Deep		SG or SWP Over 10 m Deep			
		F=5		F=3		F=1			
Groundwater Conditions	0.15	Based on inferred groundwater (G/W) depth:						S-2	
		G/W Deeper than 5 m		G/W 1 to 5 m		G/W 0 to 1 m			
		F=5		F=3		F=1			
Structure Foundations	0.25	Based on estimated type of foundation requirements:						S-3	
		Shallow Found.		Integral abutment		Deep Found.			
		F=5		F=4		F=3			
Embankment Settlement	0.20	Based on length of sections with compressible soil within three depth ranges:						S-4	
		Less than 3 m deep		3 to 10 m deep		Deeper than 10 m			
		Silty/ Sandy	Clayey	Silty / Sandy	Clayey	Silty / Sandy	Clayey		
		F=5	F=4	F=4	F=3	F=2	F=1		
Embankment Stability	0.20	Based on estimated type of construction required to establish embankment on competent ground:						S-5	
		Conventional Embankment		Significant Subexcavation		Toe-Stabilizing Berms Required			Potential Pre-Loading/ Wick Drains
		F=5		F=3		F=2			F=1
Construction Feasibility	0.10	Based on the required number of structures						S-6	
		Bridge Foundation			Culverts				
		Shallow		Deep		New			Extension
		F=5		F=4		F=4			F=5



The computations provide Weighted Favourability Values A_i for each subsection. For example, with reference to Table S-1, Soft Ground/Swamps Evaluation Criterion, the weighted favourability value A_1 for the embankment alternative was obtained by multiplying the Favourability factor F by the length of alignment for which the condition is applicable and dividing by the total length of the soft ground or swamp in the subsection, as presented below:

DEPTH RANGE (m)	LENGTH (m)	FAVOURABILITY FACTOR, F
0 - 3	50	5
3 - 10	790	3
>10	80	1

$$A_1 = \text{Weighted Favourability Value} = \frac{(50 \times 5) + (790 \times 3) + (80 \times 1)}{50 + 790 + 80} = 2.93$$

The weighted favourability value, A_i , computed for each subsection is provided on Tables S-1 to S-6.

5.3 Scoring of Foundation Criteria for Interchange Alternatives (Table S-7)

For the scoring of the foundation criteria, each of the Favourability Values A_i was normalized to ratios of 1.0. The Normalized Favourability Values, N_i , shown next to each A_i on the table eliminate the effect of unrelated A_i numbers on the Scores and provide a meaningful input of the Impact Weights on the final rankings. This is achieved by dividing each Weighted Favourability Value A_i by the highest A_i amongst all Alternatives for the criterion, and thus making all Normalized Favourability Values less than 1.00.

The interchange alternatives were scored by adding the N_i for each of the evaluation criteria multiplied by the Impact Weight, B_i for the criterion. The Scores based on the N_i values (multiplied by 5 to produce values higher than 1.00 for ease of comparison) are shown on Table S-7.



An example of the computation of the Scores is provided below, for reference. The example is the calculation of the Score of **4.56** for the Interchange Alternative 1B which was obtained as follows:

EVALUATION CRITERIA		SOFT GROUND/ SWAMPS	GROUNDWATER CONDITIONS	STRUCTURE FOUNDATIONS	EMBANKMENT SETTLEMENT	EMBANKMENT STABILITY	CONSTRUCTION FEASIBILITY
TABLE NO.		S-1	S-2	S-3	S-4	S-5	S-6
IMPACT WEIGHT, B _i		0.10	0.15	0.25	0.20	0.20	0.10
1B	A1	2.16	3.51	4.50	4.11	4.58	4.67
	N1	0.74	0.92	0.90	0.94	0.96	0.93
Notes:							
Highest A _i		2.93	3.81	5.00	4.36	4.75	5.00

$$\text{Score 1B} = 5[(2.16/2.93) \times 0.10 + (3.51/3.81) \times 0.15 + (4.50/5.00) \times 0.25 + (4.11/4.36) \times 0.20 + (4.58/4.75) \times 0.20 + (4.67/5.00) \times 0.10]$$

Score 1B = 4.56

[The ratios in brackets represent each of the N_i values, such as (2.16/2.93) = 0.74]

These Scores and Rankings of the foundation evaluation are provided in Table S-7 and the results are summarized below:

INTERCHANGE ALTERNATIVES		SCORE	RANKING
1A	Interchange at Sta. 20+200 (Parclo A) (Blue)	5.00	1
1B	Interchange at Sta. 20+300 (Note 1) (Dark Green)	4.56	3
1C	Interchange at Sta. 20+200 (Diamond) (Purple)	4.86	2
2A	Interchange at Sta. 21+780 (Parclo A) (Brown)	3.08	5
2B	Interchange at Sta. 21+780 (Parclo B) (Red)	3.01	6
2C	Interchange at Sta. 21+780 (Diamond) (Green)	3.37	4
3A	1992 Recommended Plan	2.90	7

Note 1 – Includes Underpass at Allensville Road and Rowanwood Road at about Sta. 21+420



The results indicated that Interchange Alternative 1A has the highest Score 5.00. The Score of 4.86 for Interchange Alternative 1C is close to the score of Interchange Alternative 1A and is practically equivalent in terms of foundation favourability. The 1992 Recommended Interchange has a score of 2.90, which ranks at 7. The selection of the Preferred Route also depends on other parameters or facets that are being analysed by Stantec.

6. ALTERNATIVE INTERCHANGE LOCATIONS REVIEW AND RECOMMENDATIONS

6.1 General

From the structure foundation design and construction perspective, the interchange alternative that incorporates the highest scoring is preferred. It is considered that the three interchange alternatives 1A, 1B and 1C have close Scores of 5.00, 4.56 and 4.86, respectively, as shown on Table S-7. Therefore, either of those three interchange alternatives is preferable over the remaining Interchange Alternatives.

6.2 Embankment Design

The embankments in Alternatives 1A, 1B and 1C in this study traverse comparatively shorter section of wet and swampy soils than those in Alternatives 2A, 2B, 2C and 3A.

The embankments should comprise of rockfill in sections requiring construction below the water table or in swampy terrain. Elsewhere embankments could be constructed of earth fill, including the zones above the rockfill. Embankment design and construction procedures for rockfill and earth fill embankments shaped at 1.25H:1V and 2H:1V respectively above original grades should be suitable for this project. Embankment geometry through swamps should include a minimum 2 m wide bench on both sides according to Northern Region Directive 98-200.



For preliminary evaluation purposes the design of embankments through swamps should allow for subexcavation of soft compressible soils to depths typically less than 3 m. Locally, deeper areas may occur up to about 10 m deep. At these locations the slope of the rockfill below existing grade should be taken as 1.25H:1V. Also as a guideline for preliminary design, the rockfill line should be carried at least 2.0 m above the water level in the swamps where earth fill is used in combination with rockfill to construct the embankments. Above grade, the embankments constructed with earth fill will be stable at 2H: 1V slopes or flatter above the water table. Rockfill embankments should also be stable at 1.25H: 1V slopes or flatter.

6.3 Embankment Stability

It is anticipated that limited subexcavation of soft soils and organics (less than 3 m) will be typically required for construction of the roadway embankments. Most of the alignment alternatives traverse similar geologic formations comprising glaciolacustrine deposits containing sands and silts. However, construction of embankments up to 12 m high for crossing roads and ramps are also expected in view of the undulation topography along the corridor.

The requirement to use non-standard slope configurations for the new embankments, such as toe-stabilizing berms or preloading with wick drains and/or a wider median width to preserve the stability of the existing embankments depends on the design embankment height and local depth of soft ground. On this project, these requirements are considered to be unlikely.

6.4 Embankment Settlements

It is anticipated that the post-construction settlement of embankments founded on bedrock or competent glaciolacustrine soil deposits will be minimal. Significant settlements may occur in the wet and swampy areas located at the alternative interchange locations north of Allensville Road/ Rowanwood Road intersection and west of the Highway 11 for the Alternatives located to the north of the Stephenson Road 8 intersection.



The swamp soils including those within the Lancelot (Bullen) Creek floodplain and those in the swamps located to the north of the Allensville Road/Rowanwood Road intersection, are typically not considered suitable for supporting the highway embankments due to their high compressibility and low strength. The magnitude and rate of the settlements will depend on the thickness and nature of the soils in each of the swamps and may exceed MTO criteria if placed on very soft to firm clayey soils and/or may affect existing embankments/structures which are in close proximity. These settlements should be evaluated during future preliminary or detail design studies.

6.5 Structure Foundations

The type of foundations of the structures is likely to comprise shallow and deep foundations for the east and west abutments, respectively of the interchange underpass at about Sta. 20+200 (Alternatives 1A, 1B and 1C) and deep foundations for both abutments for the interchange underpass at about Sta. 21+780 (Alternatives 2A, 2B, 2C and 3A) and underpass at Sta. 21+400 for Alternative 1B.

The type of foundation (shallow or deep) will depend ultimately on the road grades at the structures and structural design concepts. Foundation material for deep pile foundations is expected to consist of competent glaciolacustrine soils or bedrock. At the east abutment location of the proposed Highway 11 interchange underpass at approximate Sta. 20+200, shallow native sandy/silty soils mantling bedrock is capable of supporting the anticipated underpass on spread footings. However, at the west abutment location, more than 30 m deep pile foundation is expected to native competent silty/sandy deposit or to bedrock.

Further, at the alternative structure locations near Sta. 21+780, more than 30 m deep pile foundations are expected for both east and west abutment locations to competent glaciolacustrine sandy/silty deposits or bedrock.

Integral abutments on piles are also feasible at both underpass locations.

Foundations for culverts are expected to comprise competent native soils or rockfill.



Special foundation design considerations involving deep foundations may be required where the embankments crossing swamps are placed directly on the compressible materials and preloaded to reduce post-construction settlements. In particular at the structures near Sta. 21+780, artesian groundwater conditions should be considered during preliminary and detail design.

6.6 Construction Considerations

It is anticipated that the typical embankment construction will be accomplished with conventional methods since the alignment traverses competent glaciolacustrine deposits for the most part with areas covered by shallow deposits mantling bedrock and bedrock outcrops.

Non-conventional construction procedures for swamp excavation or embankment widening would only be required to reduce postconstruction settlements to tolerable levels or to twin embankments through soft deposits without negative effects on the stability of the existing embankments. Special construction methods may include the use of lightweight fill, wick drains and/or staged construction.

6.7 Assessment of Advantages and Disadvantages

The following tables were presented to overview assessments of advantages and disadvantages, costs and risk/consequences for embankment alternatives and interchange alternatives from the foundation perspective.

INTERCHANGE ALTERNATIVE DESCRIPTION	ADVANTAGES	DISADVANTAGES
Alternative 1A Interchange at Sta. 20+200 (Parclo A) (Blue)	<ul style="list-style-type: none">• Structure foundations for I/C location at about Sta. 20+200 may be founded on spread footing on competent native soils or bedrock at the east abutment location and integral abutments on piles at the west abutment location• Lower to moderate cost for structure foundation	<ul style="list-style-type: none">• Requires extension of culvert at Lancelot (Bullen) Creek• Erosion protection will be required for approach embankments• One crossing of TCPL



INTERCHANGE ALTERNATIVE DESCRIPTION	ADVANTAGES	DISADVANTAGES
<p>Alternative 1B Interchange at Sta. 20+300 Includes underpass at Sta. 21+420 (Dark Green)</p>	<ul style="list-style-type: none"> • Structure foundations for I/C location at about Sta. 20+200 may be founded on spread footing on competent native soils or bedrock at the east abutment location and integral abutments on piles at the west abutment location • Structure foundation for Allensville/Rowanwood Road location may be founded on pile foundation or integral abutments. • Moderate cost for structure foundation 	<ul style="list-style-type: none"> • Requires extension of culvert at Lancelot (Bullen) Creek • The approach embankments at Allensville/Rowanwood Road structure location will be over possible wet and swampy terrain with possible artesian conditions • Erosion protection will be required for approach embankments • Requires special groundwater control method during construction due to artesian conditions • One crossing of TCPL
<p>Alternative 1C Interchange at Sta. 20+200 (Diamond) (Purple)</p>	<ul style="list-style-type: none"> • Structure foundations for I/C location at about Sta. 20+200 may be founded on spread footing on competent native soils or bedrock at the east abutment location and integral abutments on piles at the west abutment location • Lower to moderate cost for structure foundation 	<ul style="list-style-type: none"> • Requires extension of culvert at Lancelot (Bullen) Creek • Erosion protection will be required for approach embankments • One crossing of TCPL
<p>Alternative 2A Interchange at Sta. 21+780 (Parclo A) (Brown)</p>	<ul style="list-style-type: none"> • Structure foundations for I/C location may be founded on integral abutments on pile foundation • High cost for structure foundation 	<ul style="list-style-type: none"> • Requires extension of unnamed creek at Sta. 22+200 • The approach embankments at Allensville/Rowanwood Road structure location will be over possible wet and swampy terrain with possible artesian conditions • Requires special groundwater control method during construction due to artesian conditions • Erosion protection will be required for approach embankments • Two crossings of TCPL



INTERCHANGE ALTERNATIVE DESCRIPTION	ADVANTAGES	DISADVANTAGES
Alternative 2B Interchange at Sta. 21+780 (Parclo B) (Red)	<ul style="list-style-type: none"> • Structure foundations for I/C location may be founded on integral abutments on pile foundation • High cost for structure foundation 	<ul style="list-style-type: none"> • Requires extension of unnamed creek at Sta. 22+200 • The approach embankments at Allensville/Rowanwood Road structure location will be over possible wet and swampy terrain with possible artesian conditions • Requires special groundwater control method during construction due to artesian conditions • Erosion protection will be required for approach embankments • Four crossings of TCPL
Alternative 2C Interchange at Sta. 21+780 (Diamond)) (Green)	<ul style="list-style-type: none"> • Structure foundations for I/C location may be founded on integral abutments on pile foundation • High cost for structure foundation 	<ul style="list-style-type: none"> • Requires extension of unnamed creek at Sta. 22+200 • The approach embankments at Allensville/Rowanwood Road structure location will be over possible wet and swampy terrain with possible artesian conditions • Requires special groundwater control method during construction due to artesian conditions • Erosion protection will be required for approach embankments • Two crossings of TCPL
Alternative 3A 1992 Recommended Plan	<ul style="list-style-type: none"> • Structure foundations for I/C location may be founded on integral abutments on pile foundation • High cost for structure foundation 	<ul style="list-style-type: none"> • The approach embankments at Allensville/Rowanwood Road structure location will be over possible wet and swampy terrain with possible artesian conditions • Requires special groundwater control method during construction due to artesian conditions • Erosion protection will be required for approach embankments • Four crossings of TCPL

Note: Ramps are not considered



7. PREFERRED INTERCHANGE ALTERNATIVE

7.1 Recommended Interchange Location

Stantec indicated that the Recommended Alternative location for the interchange is Alternative 1C located at approximate Sta. 20+200 (about 1.1 km north of the intersection of Stephenson Road 8). This Alternative is shown on the enclosed Drawings 6 to 8.

This interchange alternative includes an underpass over the existing Highway 11 northbound and southbound lanes, associated ramps and new service roads, West Service Road and East Service Road (between Stephenson Road 8/Greer Road and Allensville Road/Rowanwood Road) west and east of the existing Highway 11, respectively.

The recommended interchange location will also require the construction of embankments up to 12 m high for the crossing road and west ramps. The subsurface conditions for these high fills should be investigated as part of the interchange in particular within the valley occupied by a tributary of the Lancelot (Bullen) Creek.

The Score for the recommended interchange location from a Foundations perspective (Interchange Alternative 1C) was 4.86, being the second highest of the interchange alternatives, however practically equivalent to the highest score of 5.00.

At the east abutment location of the preferred interchange alternative, an 8 to 9 m high bedrock outcrop is visible and dipping down at an angle about 60 to 80°, whereas, a wet and swampy area covers the west abutment location with no visible sign of bedrock outcrop. The bedrock will likely be found at depths in excess of 30 to 40 m at the west abutment and pier based on conditions previously encountered in the area.

The foundation type at the east abutment will likely be on spread footings placed on shallow competent sandy/silty soil or bedrock.



For the likely over 30 m deep pile foundation at the pier and west abutment, piles will be set on or into sloping bedrock and should be equipped with "Rock Points", Oslo Point or Titus H Bearing Pile Points Rock Injector Model (Titus Point).

The groundwater is expected to be at 1 to 5 m below the ground surface. The groundwater is subject to fluctuations at the site due to seasonal conditions and rainfall patterns.

7.2 Additional Studies

The preliminary assessments in this report are based on literature reviews and site reconnaissance only. The recommendations are intended for planning purposes only. Additional data should be obtained by conducting subsurface investigation(s) to confirm the data inferred during these studies. In particular, the depth and extent of organic/soft/wet soils in swamps and low-lying areas should be investigated.

The potential bridge and interchange structure locations, overpass/underpass structures and major culvert locations should also be investigated. The bedrock at each location should be carefully delineated both longitudinally and transversely and proven with cores to confirm that the preferred sites are adequate for the construction of the structures.

The recommended locations for foundations investigations for bridges and culverts are listed in the enclosed Table 1.



8. CLOSURE

This report was prepared by Mr. C.M.P. Nascimento, P. Eng., Senior Project Engineer with the assistance of Mr. N. Rahman, BASc and reviewed by Mr. B.R. Gray, MEng, P.Eng., MTO Designated Principal Contact.

Yours very truly,

Peto MacCallum Ltd.



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



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

CN/BRG:nr-lnr



TABLE 1
RECOMMENDED LOCATIONS FOR FOUNDATION INVESTIGATIONS
STRUCTURES AND CULVERTS
PREFERRED INTERCHANGE LOCATION

PROPOSED WORKS	STATIONS
Highway 11 (Mainline)	
Interchange Underpass at Highway 11 NBL and SBL	Sta. 20+200
Lancelot (Bullen) Creek Culvert (Extensions)	Sta. 20+760
Crossing Road	
Culvert for Tributary of Lancelot (Bullen) Creek	Sta. 9+900
East Service Road	
Culvert for Tributary of Lancelot (Bullen) Creek	Sta. 9+600
West Service Road / Highway 11 Ramp E/W-S	
Culverts at Swamp Crossing (50 m long)	Sta. 9+650
Highway 11 Ramp N-E/W	
Culvert at swamp crossing	Sta. 20+320

NOTE: 1. Chainages may vary for northbound and southbound mainlines to be confirmed / refined during detailed design.



TABLE S-1– SOFT GROUND/SWAMPS

INTERCHANGE ALTERNATIVES		SOFT GROUND/SWAMPS DEPTHS AND FAVOURABILITY						WEIGHTED FAVOURABILITY VALUE(Ai)	
		L1	F1	L2	F2	L3	F3		
		Depth Range (0 - 3 m)		Depth Range (3 - 10 m)		Depth Range (>10 m)			
1A	Interchange at Sta. 20+200 (Paclo A) (Blue)	50	5	790	3	80	1	2.93	A ₁
1B	Interchange at Sta. 20+300 (Note 1) (Dark Green)	40	5	310	3	320	1	2.16	A ₂
1C	Interchange at Sta. 20+200 (Diamond) (Purple)	–	5	630	3	140	1	2.64	A ₃
2A	Interchange at Sta. 21+780 (Paclo A) (Brown)	–	5	1840	3	3255	1	1.72	A ₄
2B	Interchange at Sta. 21+780 (Paclo B) (Red)	–	5	90	3	3425	1	1.05	A ₅
2C	Interchange at Sta. 21+780 (Diamond) (Green)	–	5	120	3	1600	1	1.14	A ₆
3A	1992 Recommended Plan	–	5	220	3	4020	1	1.10	A ₇

NOTES: Embankment lengths (L1, L2, L3) measured at ramps and approach fills

Enter weighted favourability value A_i in Table S-7.

Note 1: Includes underpass at Sta. 21+420 (Allensville Road and Rowanwood Road Interchange).



TABLE S-2– GROUNDWATER CONDITIONS

INTERCHANGE ALTERNATIVES		GROUNDWATER DEPTHS AND FAVOURABILITY						WEIGHTED FAVOURABILITY VALUE(Ai)	
		L1	F1	L2	F2	L3	F3		
		Depth Range (>5m)		Depth Range (1 - 5m)		Depth Range (0 -1 m)			
1A	Interchange at Sta. 20+200 (Paclo A) (Blue)	3915	5	2600	3	920	1	3.81	A ₁
1B	Interchange at Sta. 20+300 (Note 1) (Dark Green)	1740	5	1765	3	670	1	3.51	A ₂
1C	Interchange at Sta. 20+200 (Diamond) (Purple)	2435	5	2625	3	770	1	3.57	A ₃
2A	Interchange at Sta. 21+780 (Paclo A) (Brown)	530	5	630	3	5095	1	1.54	A ₄
2B	Interchange at Sta. 21+780 (Paclo B) (Red)	480	5	1500	3	3515	1	1.90	A ₅
2C	Interchange at Sta. 21+780 (Diamond) (Green)	530	5	2495	3	1720	1	2.50	A ₆
3A	1992 Recommended Plan	1080	5	—	3	4240	1	1.81	A ₇

NOTES: Enter weighted favourability value A_i in Table S-7.

Note 1: Includes underpass at Sta. 21+420 (Allensville Road and Rowanwood Road Interchange).



TABLE S-3– STRUCTURE FOUNDATIONS

INTERCHANGE ALTERNATIVES		CONTEMPLATED STRUCTURE/INTERCHANGE SITE												WEIGHTED FAVOURABILITY VALUE(Ai)	
		Highway 11 Underpass At Sta. 20+200		Highway 11 Underpass At Sta. 20+300		Highway 11 Underpass At Sta. 21+420		Highway 11 Structure At Sta. 20+780		Lancelot (Bullen) Creek Bridge At Sta. 10+400 (*) Sta.10+550 (**)		Lancelot (Bullen) Creek Bridge At Sta. 9+400 ⁽¹⁾ Sta.10+550 ⁽¹¹⁾			
		Type	F1	Type	F2	Type	F3	Type	F4	Type	F5	Type	F6		
1A	Interchange at Sta. 20+200 (Paclo A) (Blue)	A	5	–	–	–	–	–	–	A	5	–	–	5.00	A ₁
1B	Interchange at Sta. 20+300 (Note 1) (Dark Green)	–	–	A	5	B	4	–	–	–	–	–	–	4.50	A ₂
1C	Interchange at Sta. 20+200 (Diamond) (Purple)	A	5	–	–	–	–	–	–	A	5	–	–	5.00	A ₃
2A	Interchange at Sta. 21+780 (Paclo A) (Brown)	–	–	–	–	–	–	B	4	–	–	B	4	4.00	A ₄
2B	Interchange at Sta. 21+780 (Paclo B) (Red)	–	–	–	–	–	–	B	4	–	–	–	–	4.00	A ₅
2C	Interchange at Sta. 21+780 (Diamond) (Green)	–	–	–	–	–	–	B	4	–	–	B	4	4.00	A ₆
3A	1992 Recommended Plan	–	–	–	–	–	–	–	–	–	–	B	4	4.00	A ₇

NOTES: Enter weighted favourability value A_i in Table S-7.

A: Shallow Foundation, F = 5

B: Deep Foundation: Integral Abutments, F = 4; Others, F=3

Note 1: Includes underpass at Sta. 21+420 (Allensville Road and Rowanwood Road Interchange).

(*) New Alternate 1A West Service Road Chainage (**) New Alternate 1C West Service Road Chainage

⁽¹⁾ New Alternate 2C East Side Road Chainage ⁽¹¹⁾ New Alternate 2A East Side Road Chainage



TABLE S-4– EMBANKMENT SETTLEMENT

INTERCHANGE ALTERNATIVES		SUBSOIL TYPE AND FAVOURABILITY FACTOR						WEIGHTED FAVOURABILITY VALUE(Ai)	
		Less than 3 m Deep		3-10 m Deep		Deeper than 10 m			
		L1	L2	L3	L4	L5	L6		
		Silty/Sandy (F1=5)	Clayey (F2 =4)	Silty/Sandy (F3=4)	Clayey (F4 =3)	Silty/Sandy (F5=2)	Clayey (F6 =1)		
1A	Interchange at Sta. 20+200 (Paclo A) (Blue)	3735	–	2780	840	–	80	4.36	A ₁
1B	Interchange at Sta. 20+300 (Note 1) (Dark Green)	1740	40	1765	310	–	320	4.11	A ₂
1C	Interchange at Sta. 20+200 (Diamond) (Purple)	2435	–	2625	630	–	140	4.24	A ₃
2A	Interchange at Sta. 21+780 (Paclo A) (Brown)	530	–	430	1840	200	3255	2.17	A ₄
2B	Interchange at Sta. 21+780 (Paclo B) (Red)	480	–	600	90	900	3425	1.87	A ₅
2C	Interchange at Sta. 21+780 (Diamond) (Green)	530	–	95	120	2350	1650	2.05	A ₆
3A	1992 Recommended Plan	1080	–	–	220	–	4020	1.89	A ₇

NOTE: Enter weighted favourability value A_i in Table S-7.

Note 1: Includes underpass at Sta. 21+420 (Allensville Road and Rowanwood Road Interchange).



TABLE S-5– EMBANKMENT STABILITY

INTERCHANGE ALTERNATIVES		EMBANKMENT REQUIRING SPECIAL OR CONVENTIONAL DESIGN				WEIGHTED FAVOURABILITY VALUE(A _i)	
		L1	L2	L3	L4		
		Conventional Embankment (F1 = 5)	Embankment Requiring Subexcavation (F2 = 3)	Embankment Requiring Toe-Stabilizing Berms (F3 = 2)	Embankment Requiring pre-loading/ Wick Drains (F4 = 1)		
1A	Interchange at Sta. 20+200 (Paclo A) (Blue)	6515	920	–	–	4.75	A ₁
1B	Interchange at Sta. 20+300 (Note 1) (Dark Green)	3505	470	–	200	4.58	A ₂
1C	Interchange at Sta. 20+200 (Diamond) (Purple)	5060	630	–	140	4.69	A ₃
2A	Interchange at Sta. 21+780 (Paclo A) (Brown)	1160	1840	1715	1540	2.60	A ₄
2B	Interchange at Sta. 21+780 (Paclo B) (Red)	1980	90	1395	2030	2.73	A ₅
2C	Interchange at Sta. 21+780 (Diamond) (Green)	3025	120	500	1100	3.71	A ₆
3A	1992 Recommended Plan	1080	220	1900	2120	2.25	A ₇

NOTE: Enter weighted favourability value A_i in Table S-7.

Note 1: Includes underpass at Sta. 21+420 (Allensville Road and Rowanwood Road Interchange).

TABLE S-6– CONSTRUCTION FEASIBILITY

INTERCHANGE ALTERNATIVES		REQUIRED NUMBER OF STRUCTURES								WEIGHTED FAVOURABILITY VALUE(Ai)	
		Bridges						Major Culverts			
		Highway 11 Underpass At Sta. 20+200 (F=5)	Highway 11 Underpass At Sta. 20+300 (F=5)	Highway 11 Underpass At Sta. 21+420 (F=4)	Highway 11 Underpass At Sta. 21+780 (F=4)	Lancelot (Bullen) Creek Bridge At West Service Road (F=5)	Lancelot (Bullen) Creek Bridge At East Side Road (F=4)	To be Constructed (F=4)	To be Extended (F=5)		
1A	Interchange at Sta. 20+200 (Paclo A) (Blue)	1	–	–	–	1	–	–	1	5.00	A ₁
1B	Interchange at Sta. 20+300 (Note 1) (Dark Green)	–	1	1	–	–	–	–	1	4.67	A ₂
1C	Interchange at Sta. 20+200 (Diamond) (Purple)	1	–	–	–	1	–	–	1	5.00	A ₃
2A	Interchange at Sta. 21+780 (Paclo A) (Brown)	–	–	–	1	–	1	–	1	4.33	A ₄
2B	Interchange at Sta. 21+780 (Paclo B) (Red)	–	–	–	1	–	–	–	1	4.50	A ₅
2C	Interchange at Sta. 21+780 (Diamond) (Green)	–	–	–	1	–	1	–	1	4.33	A ₆
3A	1992 Recommended Plan	–	–	–	–	–	1	–	1	4.50	A ₇

NOTES: Enter weighted favourability value A_i in Table S-7.

Embankment construction considered not applicable for this Table on this project.

Bridge Foundations Favourability: Shallow F=5 and Deep F=4; Culvert Favourability: New F=4; Extension F=5

Note 1: Includes underpass at Sta. 21+420 (Allensville Road and Rowanwood Road Interchange).



TABLE S-7 – SCORING OF FOUNDATION CRITERIA (INTERCHANGES)

EVALUATION CRITERIA		SOFT GROUND/ SWAMPS		GROUNDWATER CONDITIONS		STRUCTURE FOUNDATIONS		EMBANKMENT SETTLEMENT		EMBANKMENT STABILITY		CONSTRUCTION FEASIBILITY		SCORE	RANKING
TABLE No.		S1		S2		S3		S4		S5		S6			
IMPACT WEIGHT, Bi		0.10		0.15		0.25		0.20		0.20		0.10			
INTERCHANGE ALTERNATIVES		Ai	Ni	Ai	Ni	Ai	Ni	Ai	Ni	Ai	Ni	Ai	Ni		
1A	Interchange at Sta. 20+200 (Paclo A) (Blue)	2.93	1.00	3.81	1.00	5.00	1.00	4.36	1.00	4.75	1.00	5.00	1.00	5.00	1
1B	Interchange at Sta. 20+300 (Note 1) (Dark Green)	2.16	0.74	3.51	0.92	4.50	0.90	4.11	0.94	4.58	0.96	4.67	0.93	4.56	3
1C	Interchange at Sta. 20+200 (Diamond) (Purple)	2.64	0.90	3.57	0.94	5.00	1.00	4.24	0.97	4.69	0.99	5.00	1.00	4.86	2
2A	Interchange at Sta. 21+780 (Paclo A) (Brown)	1.72	0.59	1.54	0.40	4.00	0.80	2.17	0.50	2.60	0.55	4.33	0.87	3.08	5
2B	Interchange at Sta. 21+780 (Paclo B) (Red)	1.05	0.36	1.90	0.50	4.00	0.80	1.87	0.43	2.73	0.57	4.50	0.90	3.01	6
2C	Interchange at Sta. 21+780 (Diamond) (Green)	1.14	0.39	2.50	0.66	4.00	0.80	2.05	0.47	3.71	0.78	4.33	0.87	3.37	4
3A	1992 Recommended Plan	1.10	0.38	1.81	0.48	4.00	0.80	1.89	0.43	2.25	0.47	4.50	0.90	2.90	7

NOTES: Enter weighted favourability value Ai in Table S-7.

Ai - Weighted Favourability Value

Ni - Normalized Favourability Value

Note 1: Includes underpass at Sta. 21+420 (Allensville Road and Rowanwood Road Interchange).



REFERENCE: THIS FIGURE WAS REPRODUCED FROM ONTARIO ROAD ATLAS – 2006 BY MAPART PUBLISHING CORP.

GEOCREs No.: 31E-296

PROJECT LOCATION MAP

METRIC

PLAN

SCALE



Ontario



Peto MacCallum Ltd.
CONSULTING ENGINEERS



Stantec Consulting Ltd.

HIGHWAY 11
Highway 11 Between Highway 141
and Allensville Road
G.W.P. 320 - 00 - 00



FIGURE













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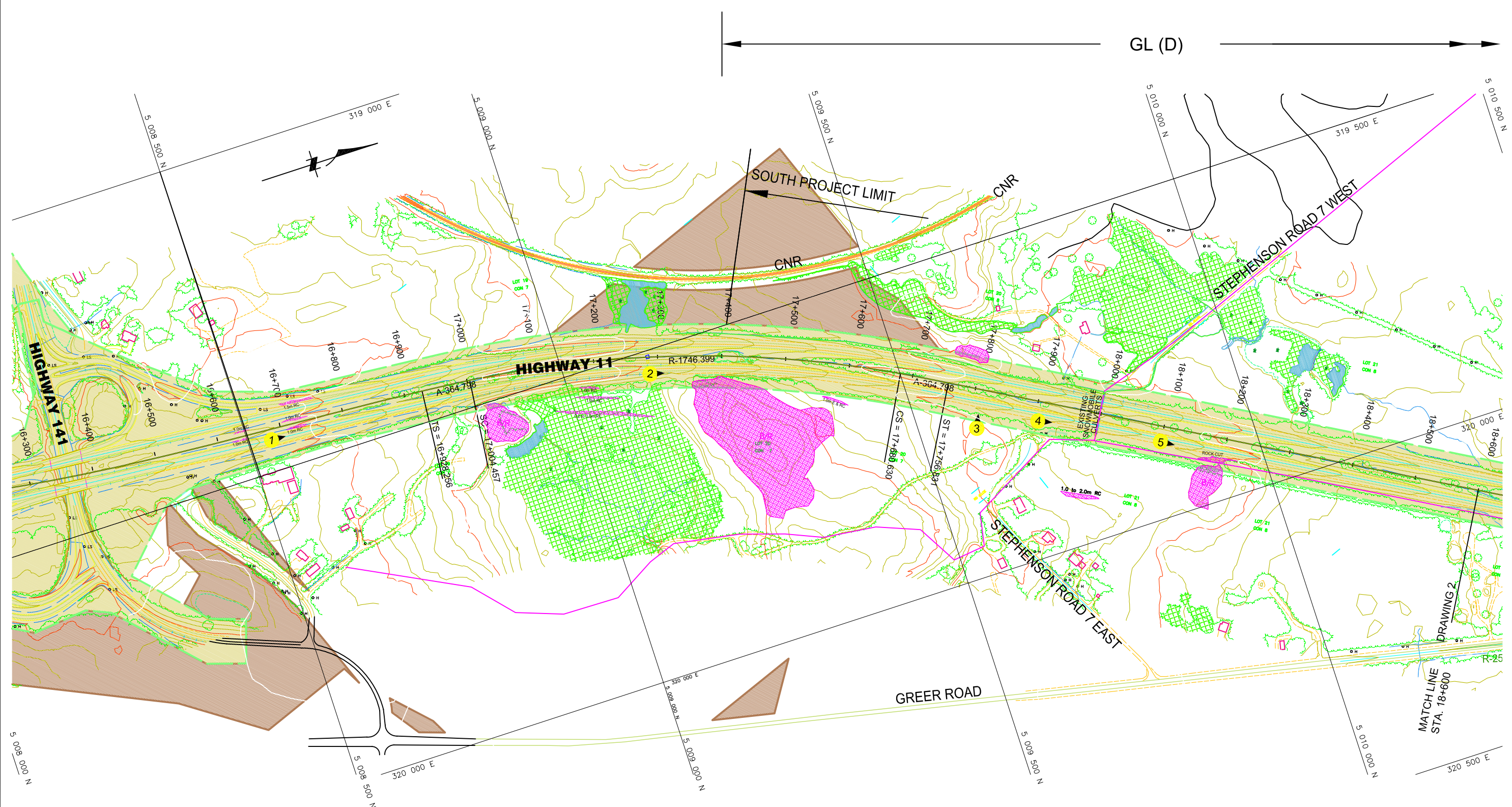
NOTES:

1. BEDROCK OUTCROPS SHOWN ON PLAN ARE BASED ON EXISTING CONSTRUCTION DATA, SITE RECONNAISSANCE AND AERIAL PHOTOGRAPHS. THE SYMBOLS ON THE PLANS INDICATE THE LOCAL PRESENCE OF THE BEDROCK UNIT AND DO NOT REPRESENT THE FULL EXTENT OF EACH ROCK OUTCROP.
2. THE EXTENT OF SWAMPS, WATER BODIES AND FILL AREAS IS AS INTERPRETED FROM SITE RECONNAISSANCE AND AERIAL PHOTOGRAPHS. THE AREAS EXTENT SHOWN ON THE PLANS REPRESENT ESTIMATES ONLY AND ACTUAL AREAS MAY VARY FROM THOSE SHOWN.
3. ESTIMATED DEPTH TO COMPETENT GROUND AND OR BEDROCK IN SWAMPS IS BASED ON GEOLOGICAL EVIDENCE, DESKTOP LITERATURE SEARCH DATA AND LIMITED SITE RECONNAISSANCE INFORMATION AND MAY VARY SUBSTANTIALLY WITHIN THE LIMITS OF THE SWAMP.
4. THE GEOLOGIC UNIT SYMBOLS SHOWN ON THE PLANS REPRODUCE THOSE SHOWN ON GEOLOGIC MAPPING OF THE AREA AND ARE ONLY A GENERAL REPRESENTATION OF BEDROCK AND SOIL UNITS.
5. THE PLANS ARE AN ENCLOSURE TO THE ALTERNATE INTERCHANGE LOCATION SELECTION STUDY PREPARED BY PETO MACCALLUM LTD. THE DATA ON THESE PLANS MUST BE READ IN CONJUNCTION WITH THE REPORT.
6. THE DETAIL SHOWN ON THE PLAN IS CONSIDERED APPROPRIATE FOR ALTERNATE INTERCHANGE LOCATION SELECTION PURPOSES. WHEN THE PREFERRED INTERCHANGE LOCATION HAS BEEN SELECTED, A SUBSURFACE INVESTIGATION SHOULD BE UNDERTAKEN TO DELINEATE THE STRATIGRAPHIC CONDITIONS ON A SITE SPECIFIC BASIS FOR PRELIMINARY AND DETAILED DESIGN PURPOSES.

LEGEND:

	HIGHWAY 11 (EXISTING)		BEDROCK OUTCROP (R O/C)
	ALTERNATE 1A		SOFT GROUND / SWAMP
	ALTERNATE 1B		ANTICIPATED DEPTH (metres) TO COMPETENT MATERIAL/BEDROCK
	ALTERNATE 1C		WATER BODY
	ALTERNATE 2A	GL (D)	GLACIOLACUSTRINE (DELTA)
	ALTERNATE 2B	GL (P)	GLACIOLACUSTRINE (PLAIN)
	ALTERNATE 2C	BR (R)	BEDROCK (RIDGES)
		BR (N)	BEDROCK (KNOBS)
			PHOTOGRAPH NUMBER (ARROW SHOWS DIRECTION OF VIEW)

GEOCRES No.: 31E-296



GL (D)

LEGEND:

- | | | | |
|--|-------------------|--|--------------|
| | HWY 11 (EXISTING) | | ALTERNATE 2A |
| | ALTERNATE 1A | | ALTERNATE 2B |
| | ALTERNATE 1B | | ALTERNATE 2C |
| | ALTERNATE 1C | | |

GEOCRES No.: 31E-296

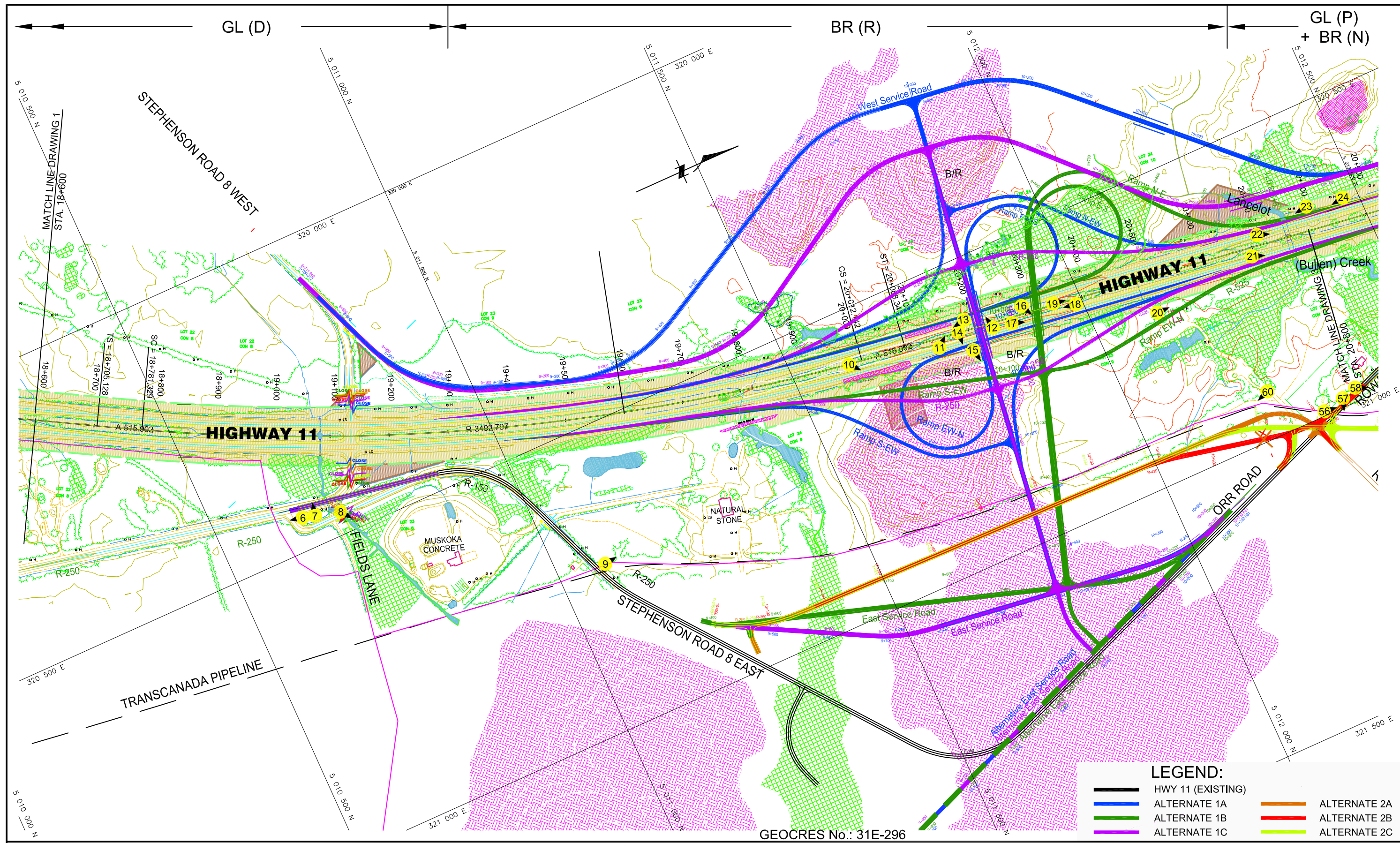
HIGHWAY 11 - STA. 16+200 TO 18+600

PLAN
SCALE



METRIC

 Peto MacCallum Ltd. CONSULTING ENGINEERS	Stantec Consulting Ltd.	 DRAWING 1
	HIGHWAY 11 HIGHWAY 11 BETWEEN HIGHWAY 141 AND ALLENSVILLE ROAD GWP No. 320-00-00	



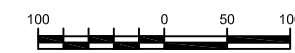
LEGEND:

	HWY 11 (EXISTING)		ALTERNATE 2A
	ALTERNATE 1A		ALTERNATE 2B
	ALTERNATE 1B		ALTERNATE 2C
	ALTERNATE 1C		

GEOCRES No.: 31E-296

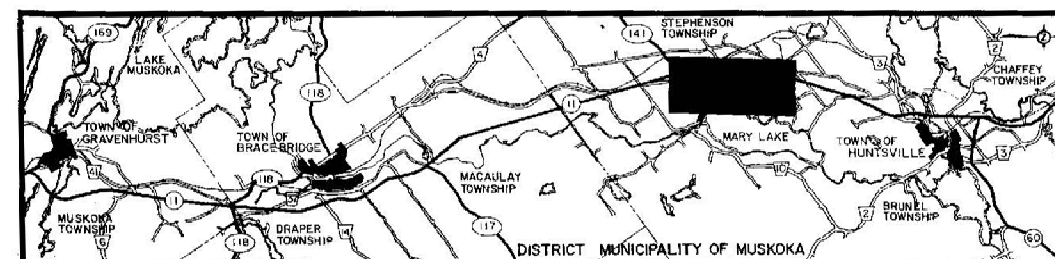
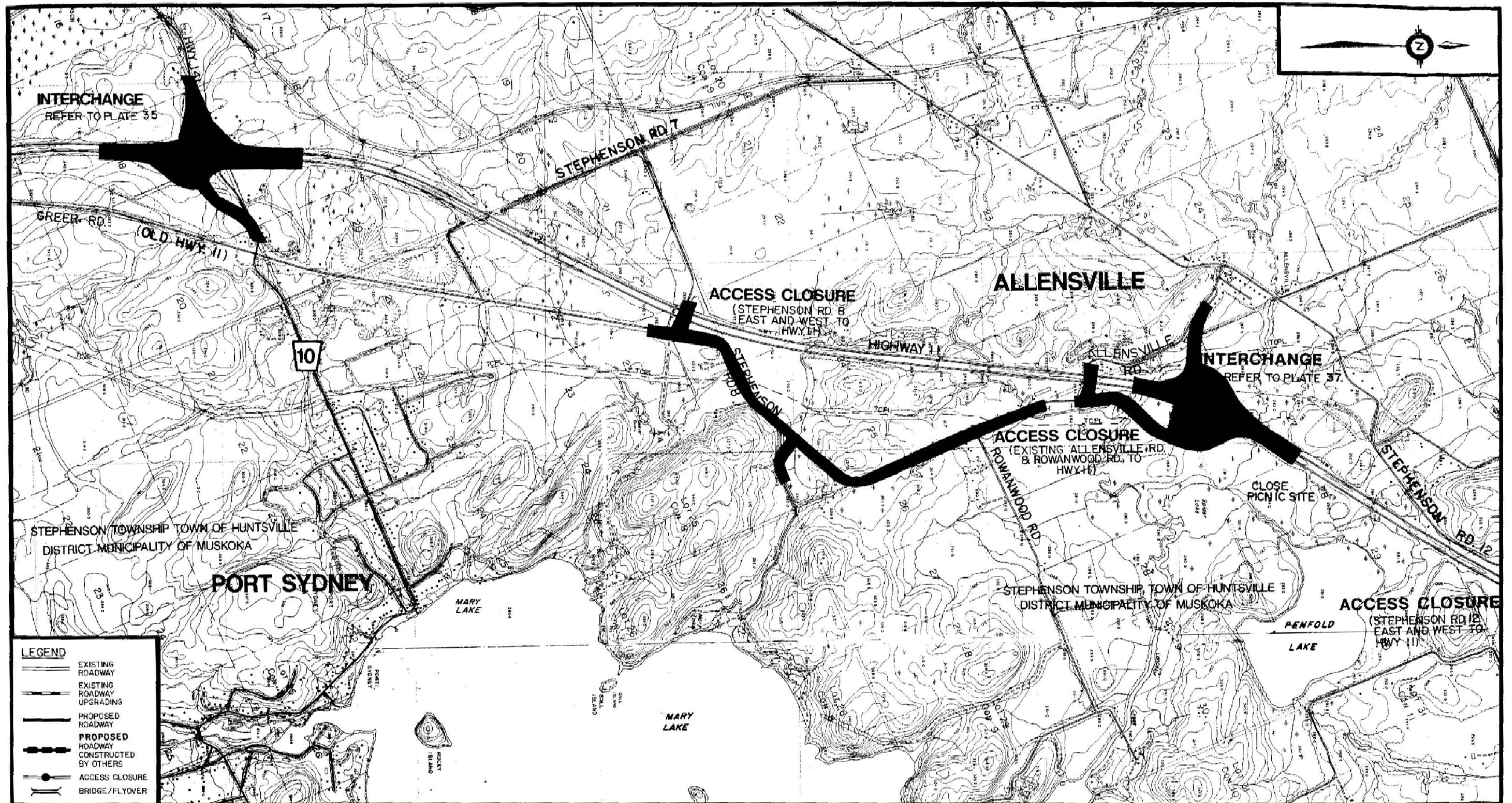
HIGHWAY 11 - STA. 18+600 TO 20+800

PLAN
SCALE



METRIC

 Peto MacCallum Ltd. CONSULTING ENGINEERS	Stantec Consulting Ltd.	 DRAWING 2
	HIGHWAY 11 HIGHWAY 11 BETWEEN HIGHWAY 141 AND ALLENSVILLE ROAD GWP No. 320-00-00	



RECOMMENDED NETWORK

FROM HIGHWAY 141 TO ALLENSTOWN RD.

PLATE
7

SCALE
300 200 100 0 100 200 300

NOTE:

THIS DRAWING WAS REPRODUCED FROM THE "Highway 11: Preliminary Design Study for the Ultimate Freeway Design" REPORT W.P. 347-87-00

GEOCRES No.: 31E-296

1992 - RECOMMENDED PLAN

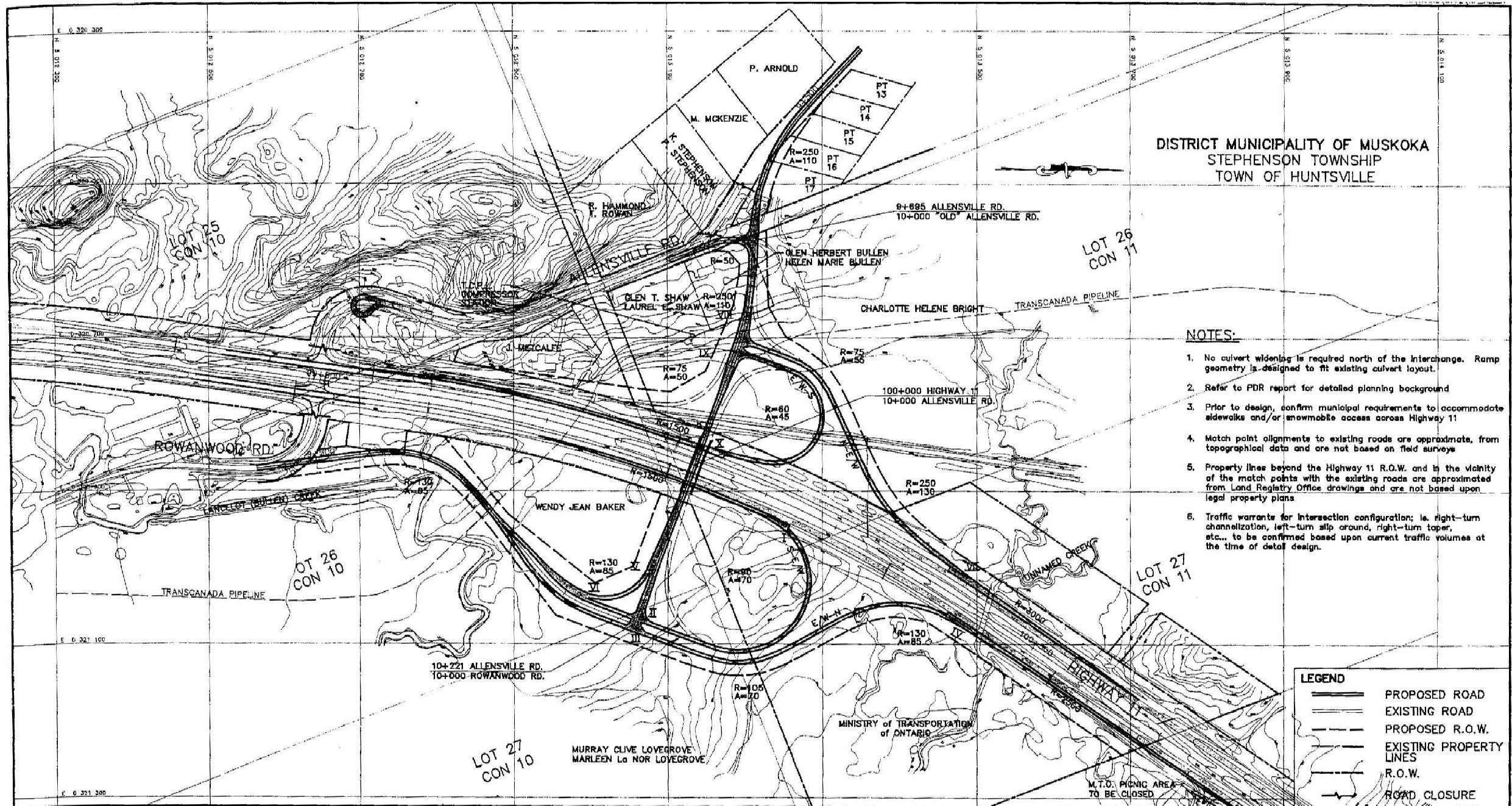


HIGHWAY 11
HIGHWAY 11 BETWEEN HIGHWAY 141
AND ALLENSTOWN ROAD
GWP No. 320-00-00

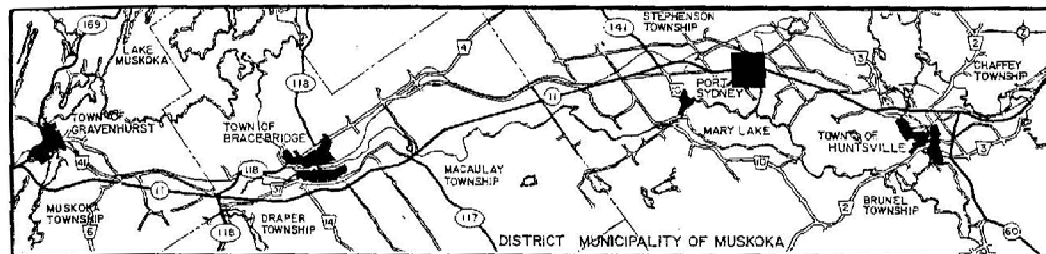


DRAWING
4

METRIC



- NOTES:**
1. No culvert widening is required north of the interchange. Ramp geometry is designed to fit existing culvert layout.
 2. Refer to PDR report for detailed planning background.
 3. Prior to design, confirm municipal requirements to accommodate sidewalks and/or snowmobile access across Highway 11.
 4. Match point alignments to existing roads are approximate, from topographical data and are not based on field surveys.
 5. Property lines beyond the Highway 11 R.O.W. and in the vicinity of the match points with the existing roads are approximated from Land Registry Office drawings and are not based upon legal property plans.
 6. Traffic warrants for intersection configuration; i.e. right-turn channelization, left-turn slip around, right-turn taper, etc., to be confirmed based upon current traffic volumes at the time of detail design.



RECOMMENDED CONFIGURATION

ALLENSVILLE RD./ROWANWOOD RD. INTERCHANGE

PLATE

37

SCALE



NOTE:

THIS DRAWING WAS REPRODUCED FROM THE "Highway 11: Preliminary Design Study for the Ultimate Freeway Design" REPORT W.P. 347-87-00

GEOCRES No.: 31E-296

1992 - RECOMMENDED PLAN

METRIC



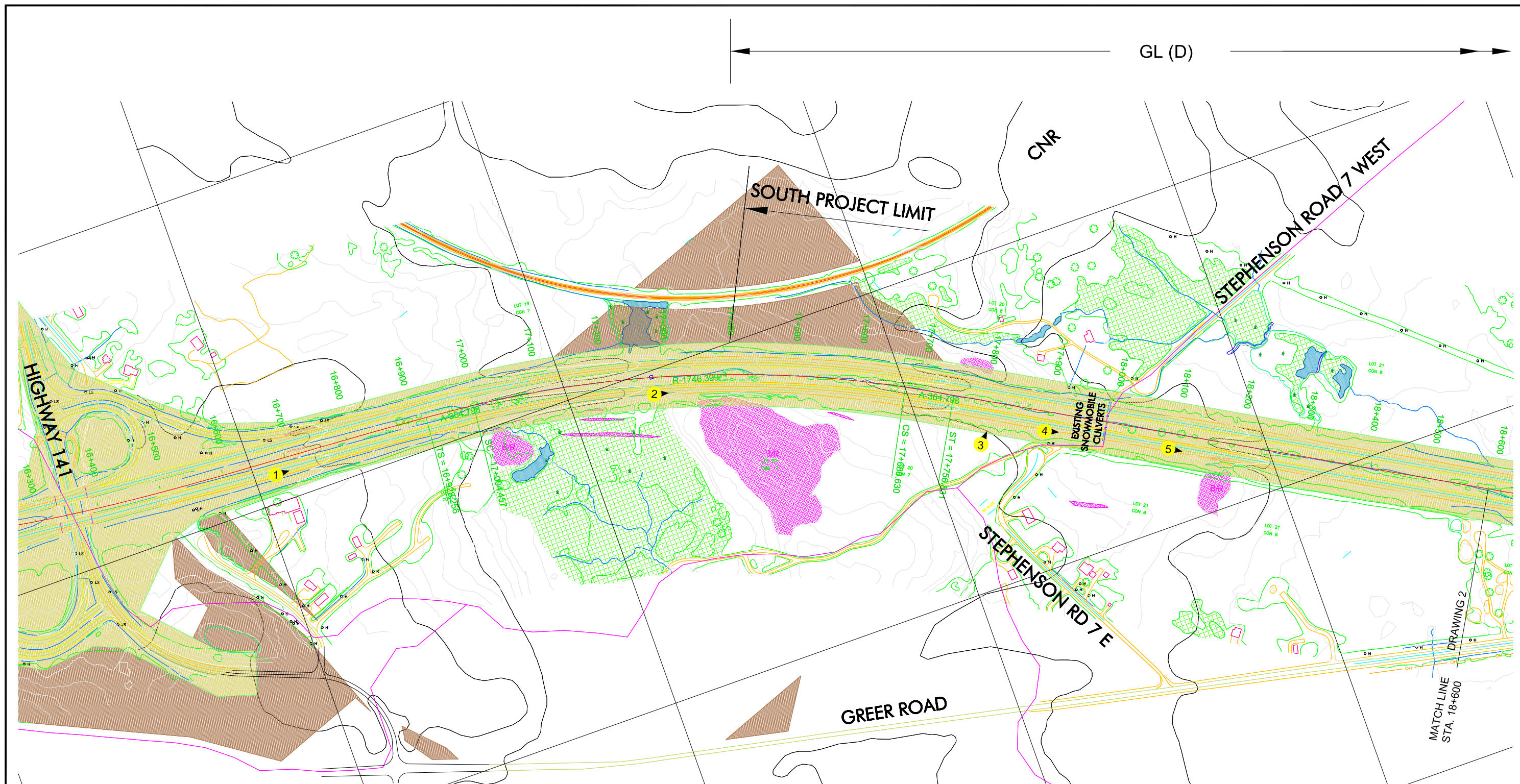
PML Peto MacCallum Ltd.
CONSULTING ENGINEERS



HIGHWAY 11
HIGHWAY 11 BETWEEN HIGHWAY 141
AND ALLENSVILLE ROAD
GWP No. 320-00-00



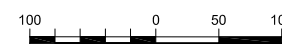
DRAWING
5



GEOCRES No.: 31E-296

HIGHWAY 11 - STA. 16+200 TO 18+600

RECOMMENDED PLAN
SCALE



METRIC



PML **Peto MacCallum Ltd.**
CONSULTING ENGINEERS

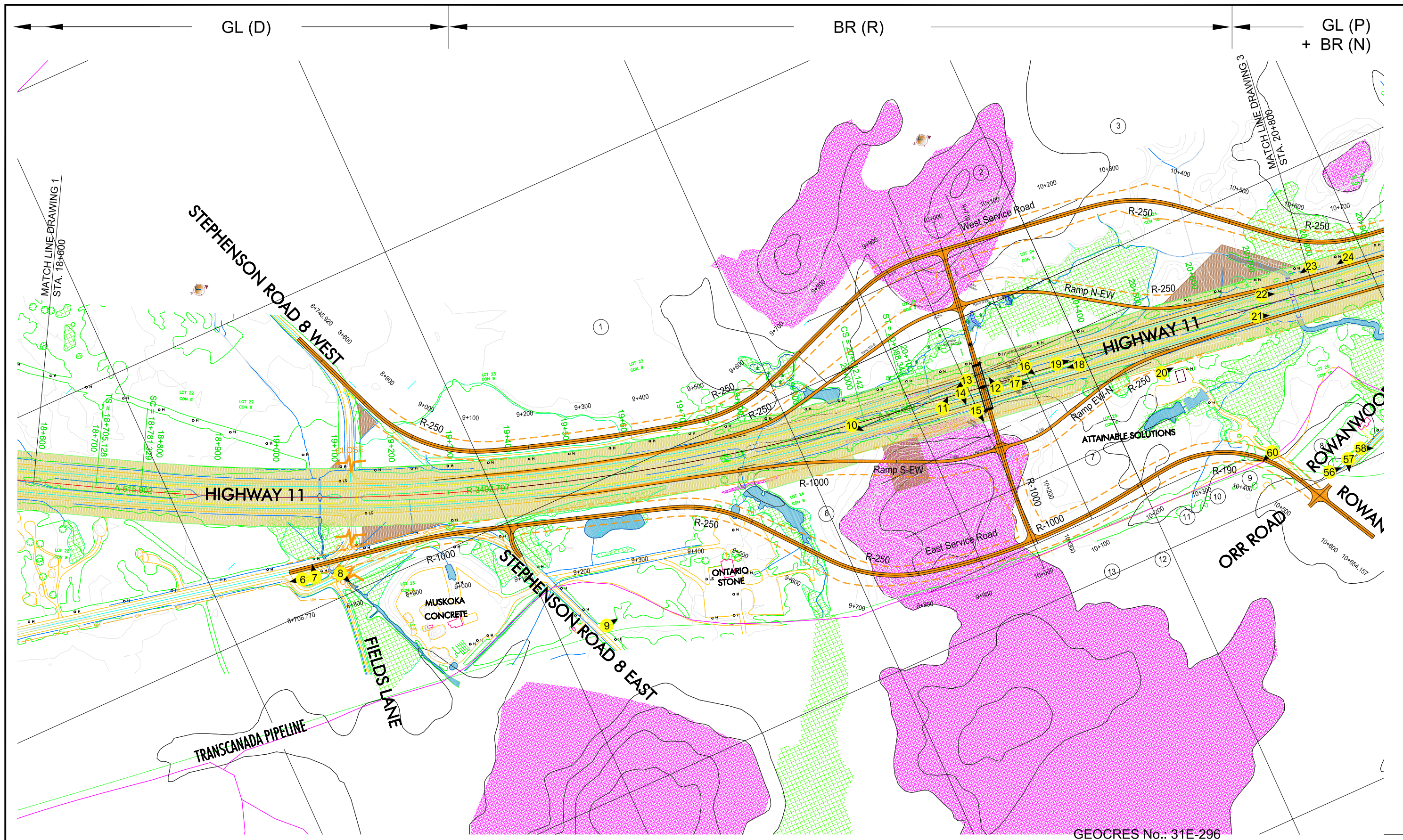


Stantec Consulting Ltd.

HIGHWAY 11
HIGHWAY 11 BETWEEN HIGHWAY 141
AND ALLENSVILLE ROAD
GWP No. 320-00-00



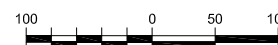
DRAWING
6



METRIC


HIGHWAY 11 - STA. 18+600 TO 20+800

RECOMMENDED PLAN
SCALE



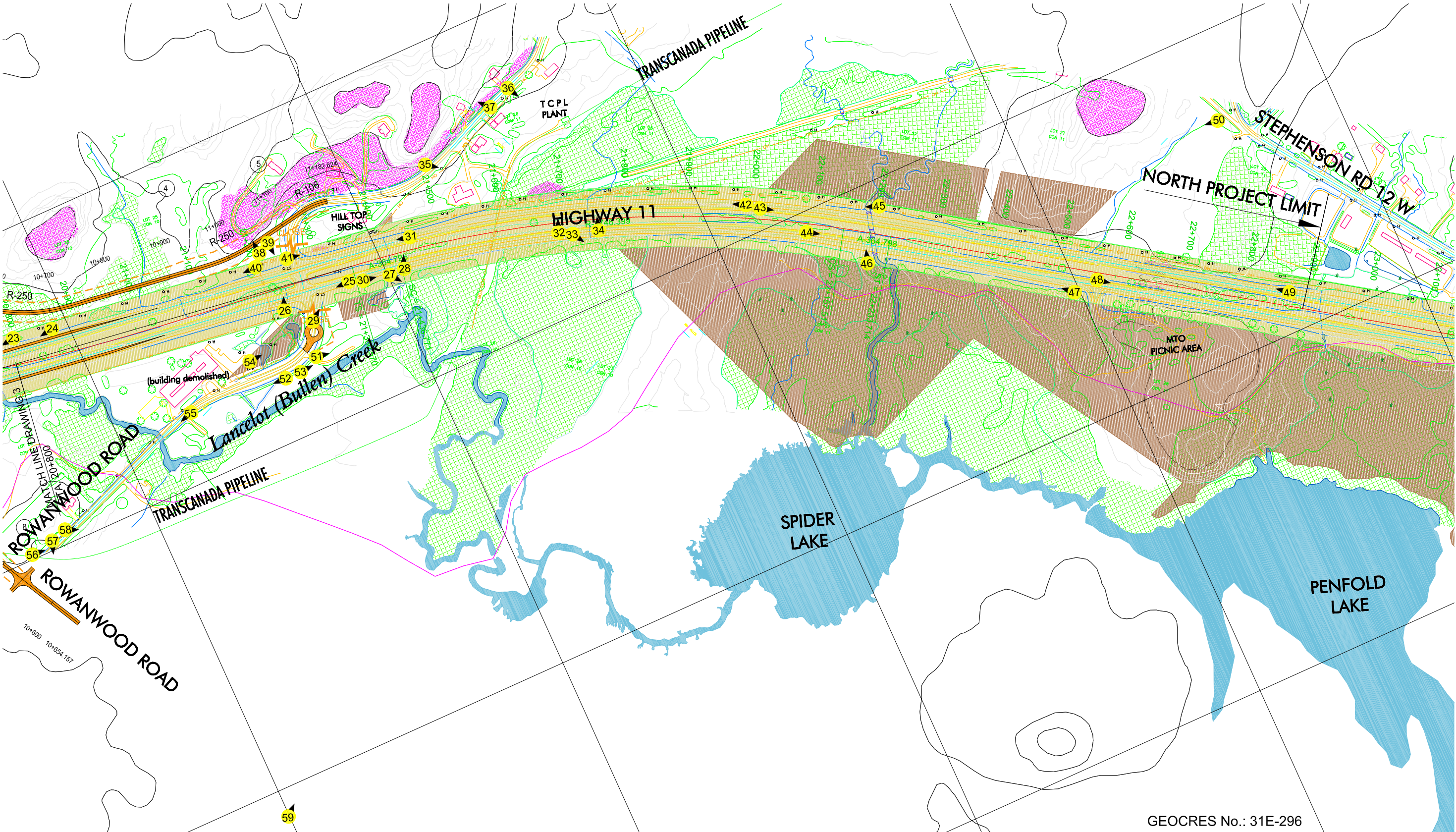

Ontario

Peto MacCallum Ltd.
CONSULTING ENGINEERS


Stantec Consulting Ltd.
HIGHWAY 11
 HIGHWAY 11 BETWEEN HIGHWAY 141
 AND ALLENSVILLE ROAD
GWP No. 320-00-00


DRAWING
7

GL (P) + BR (N)



GEOCRES No.: 31E-296

HIGHWAY 11 - STA. 20+800 TO 22+900

RECOMMENDED PLAN
SCALE



METRIC



Ontario



Peto MacCallum Ltd.
CONSULTING ENGINEERS



Stantec Consulting Ltd.

HIGHWAY 11
HIGHWAY 11 BETWEEN HIGHWAY 141
AND ALLENSVILLE ROAD
GWP No. 320-00-00



DRAWING
8



APPENDIX A

List of Reference Documents



LIST OF REFERENCE DOCUMENTS

HIGHWAY 11 FROM 1.0 KM NORTH OF HIGHWAY 141
NORTHERLY FOR 5.5 KM
TOWN OF HUNTSVILLE
TOWNSHIP OF STEPHENSON, ONTARIO
GWP NO. 320-00-00

A. Geological Maps

- Ontario Geological Survey 1991. Bedrock geology of Ontario, Southern sheet; Ontario Geological Survey, Map 2544 Scale 1:1 000 000.
- Ministry of Natural Resources, Sheet 1017630050100, dated 2003. Map base by Natural Resources Information Branch Air Photography 1986. Scale 1: 10 000.
- Ontario Geological Survey 1981. Southern Ontario Engineering Geology Terrain Study, Data Base Map, Muskoka, Map 5504, Scale 1:100 000.

B. Physiography

- Ontario Geological Survey Map P. 2715, Physiography of Southern Ontario, Ontario Ministry of Natural Resources.

C. MTO Documents

- Foundation Investigation Report for Interchange at Highway 11 near Allensville Road and Rowanwood Road, District 11, Huntsville, WP No. 341-87-00, GEOCREs No. 31E-107 dated October 1991.
- Foundation Investigation and Stability Analysis for the Embankment Approaches, Sta. 23+000 to 31+000, Huntsville By-Pass, Highway 11, District 11, W.J. 61-F-100, GEOCREs No. 31E-25.
- Piezometer Installation and Stability Analysis, C.N.R. Overpass - Sta. 29+00, Huntsville By-Pass, W.P. 617-56, GEOCREs No. 31E-26, dated January 1958.
- Plates No. 557-1/25-0 to 42-0 for W.P. No. 62-86-00 and W.P. No. 346-91-00.

D. Well Records (See Appendix B)

- Water Well Records from Ontario Northern Area provided by the Ministry of the Environment from 1946 - 1969 (32 wells).

E. Air Photo

- Photo mosaic of oblique colored aerial photographs taken along the study corridor provided by Stantec Consulting Ltd.
- Aerial photographs 87-4509, 21-083 and 21-084.
- Aerial photographs 87-4510, 21-066 and 21-067.
- Aerial photographs 87-4511, 21-040 and 21-041.



APPENDIX B

MOE Well Records



MUSKOGA DISTRICT 42

MUNICIPALITY CONCESSION ETC	LGT	WELL NO	LTH EASTING NORTHING	ELEV FEET	DATE	GRILLER	CSG INS	KIND OF WATER	STAT FEET	PUMP LVL	TEST RATE GPM	TEST TIME HR/MN	WATER USE	CHNER/LOG DEPTHS IN FEET TO WHICH FORMATIONS EXTEND	
MUNTSVILLE TOWN (STEPHENSON)															
CCN	1	25	417	437126 5003570	1000	04/67	1102	2	FR	102	6	16	6	2/00 DO	HOGG C BLDR GRVL 0012 GRNT 0104
CCN	1	26	717	437400 5003450	1000	04/68	1102	2	FR	152	FLW	30		DO	MITIC B MSND 0012 GRNT 0153
CCN	2	22	418	439400 5006125	1050	10/64	2512	3	FR	157	10	158	2	1/00 PS	CAMP PIONEER MSND 0002 GRNT 0162
CCN	5	14	419	431180 5006210	1100	07/66	2512	3	FR	180		256		1/00 DO	JOINER G PRDG 0004 GRNT 0256
CCN	5	17	743	432550 5005900	1040	02/69	1102	2	FR	180	5	20	10	2/00 CO	SMITH B MSND 0028 GRNT 0190
CCN	6	11	644	425710 5006460	995	10/68	2512	3	FR	87	11	35	10	1/00 DO	WHITE LGANE RED TPCL BLDR 0007 GREY GRNT 0157
CCN	6	13	724	430320 5006930	995	02/68	1413	3	FR	39	8	18	14	3/00 IN	ONTARIO HYDRC MSND 0008 RED MSND 0039
CCN	6	15	420	431150 5007400	1000	06/63	1102	2	FR	42	5	5	4	2/00 CO	HLNT M MSND 0022 GRNT 0045
CCN	6	15	726	431360 5007470	1000	06/68	1102	2	FR	141	22	22	6	2/00 CO	HAIGHT G MSND BLDR 0015 GRNT 0142
CCN	6	24	421	434720 5006700	1000	11/65	1102	2	FR	370	57	65	8	CC	MCKENKIE G N GRNT 0371
CCN	6	25	424	434880 5008675	1000	08/59	2512	3		CRV					BROWN C GRVL MSND 0022 GRVL 0047
CCN	6	25	423	435150 5008525	1000	08/59	2802	2		14					KIPP K J RED GRNT 0005 GREY GRNT 0062
CCN	6	25	423	435170 5008450	1000	08/59	2802	2		CRV					KIPP K J RED GRNT 0005 GREY GRNT 0019
CCN	6	25	422	435170 5008400	1000	08/59	2802	2		9					KIPP K J RED GRNT 0005 GREY GRNT 0018
CCN	6	30	427	436450 5009350	950	07/56	2512	3	FR	95	68	98		1/30 DO	NEHILL J TPSL 0024 GREY GRNT 0098
CCN	6	22	428	437675 5009550	1000	05/49	1640	3		CRV					GENSBURG S HPAN BLDR 0033 GRNT 0073
CCN	7	15	456	431250 5007600	995	07/68	2512	3	FR	99	8	90	9	1/30 DO	CAN NAT RAILWAYS MSND 0002 RED GRNT 0102
CCN	7	16	723	431300 5007650	955	08/68	1102	2	FR	221			12	2/00	PATTERSON M TPSL 0002 GRNT 0222
CCN	7	17	739	421770 5007850	1100	05/68	2512	3	FR	65	14	120	4	1/00 DO	DNG CLAY BLDR 0005 GRNT 0120
CCN	7	20	425	432975 5008480	1025	06/59	2512	3	FR	50	45	47	3	5/00 CO	GRIMES S PRDG 0015 GRVL 0065
CCN	7	20	430	432975 5008525	1025	05/66	2512	3	FR	91	60	65	6	14/00 CO	GCCLEY J MSND 0091
CCN	7	24	431	424275 5009520	975	07/57	2512	3		CRV					WCCDCROFT J MSND 0018 GREY GRNT 0277
CCN	7	25	758	434550 5009600	990	10/68	2512	3		CRV					DENRICK PRDG 0005 GRNT 0048
CCN	9	24	433	433550 5011310	950	06/64	2512	3	FR	190	12	201		1/00 DO	HOWSE L CLAY 0050 Q5ND 0078 GRNT 0201
CCN	9	26	434	434200 5011550	1050	08/60	3118	6	FR	119	17	20	2	1/00 DO	BULLEN U BLUE CLAY 0010 GRNT 0120
CCN	12	27	435	433760 5014200	950	05/58	2512	3	FR	200	30	104		2/00 ST	HARES G BLUE CLAY 0010 GRNT 0104
CCN	12	25	436	434510 5014475	1000	09/58	3118	3	FR	47	18	47	3	1/00 CO	ROCK HOTEL CLAY 0008 GRNT 0047
CCN	13	23	437	435210 5016630	1050	05/53	2512	3	FR	180	75	150	4	1/00 PS	HAWN C CSND 0042 MSND 0075 Q5ND 0180 FSND 0
CCN	14	6	756	424550 5013480	955	10/68	2512	3	FR	171	16	100	3	1/00 DO	HILLWARD B MSND HPAN 0033 GREY GRNT 0173
CCN	14	27	440	432760 5016060	1000	09/61	1636	3	FR	70	55	55	10	2/00 CC	BOLES B FSND 0070 GRVL 0084
CCN	14	27	435	432515 5016040	1000	07/61	1636	3	FR	80	61	61	10	3/00 TR DO	CANADA PINE PLANTATI HP. 0015 Q5ND 0070 GRVL 0085
CCN	6	8	415	426600 5002600	1025	04/59	2512	3		CRV					NAT. WENS A B MSND 0004 RED GRNT 0050



APPENDIX C

Site Photographs 1 to 60



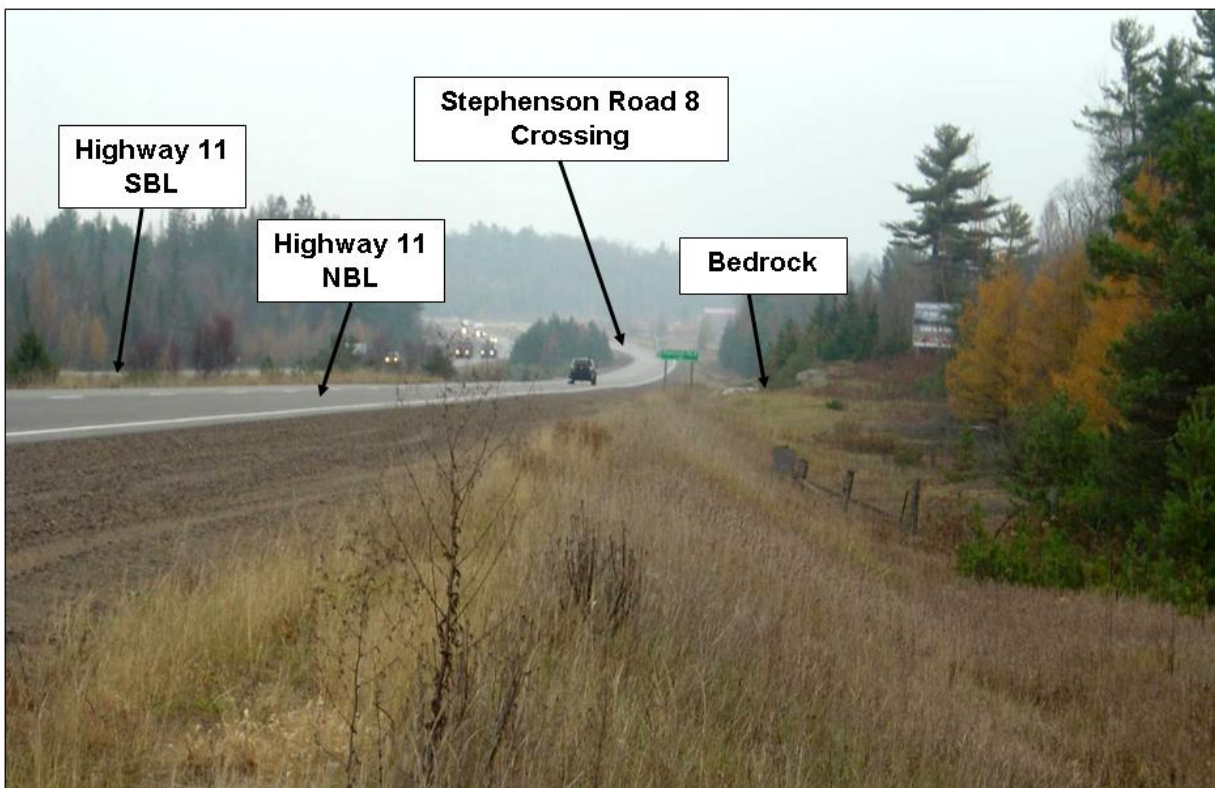
Photograph 1 VIEW: Looking north from east shoulder Highway 11 NBL at about Sta. 16+700. Bedrock outcrops typically up to 1.0 m visible in median. (Nov. 2007)



Photograph 2 VIEW: Looking north from east shoulder of Highway 11 NBL at about Sta. 17+300, with bedrock slope visible to Sta. 17+400. (Nov. 2007)



Photograph 3 VIEW: Looking west across Highway 11 from Stephenson Road 7 East cul-de-sac at about Sta. 17+800 at 1.5 m rock cut in Highway 11 SBL ditch. (Nov. 2007)



Photograph 4 VIEW: Looking north from Highway 11 NBL ditch at about Sta. 17+900 with bedrock cut (1.0 to 2.0 m) in distance (Sta. 18+160). (Nov. 2007)



Photograph 5 VIEW: Looking north from east shoulder of Highway 11 NBL at about Sta. 18+100 at 1.5 to 2.0 m bedrock cut (Sta. 18+160). Stephenson Road 8 is 1.0 km in distance. (Nov. 2007)



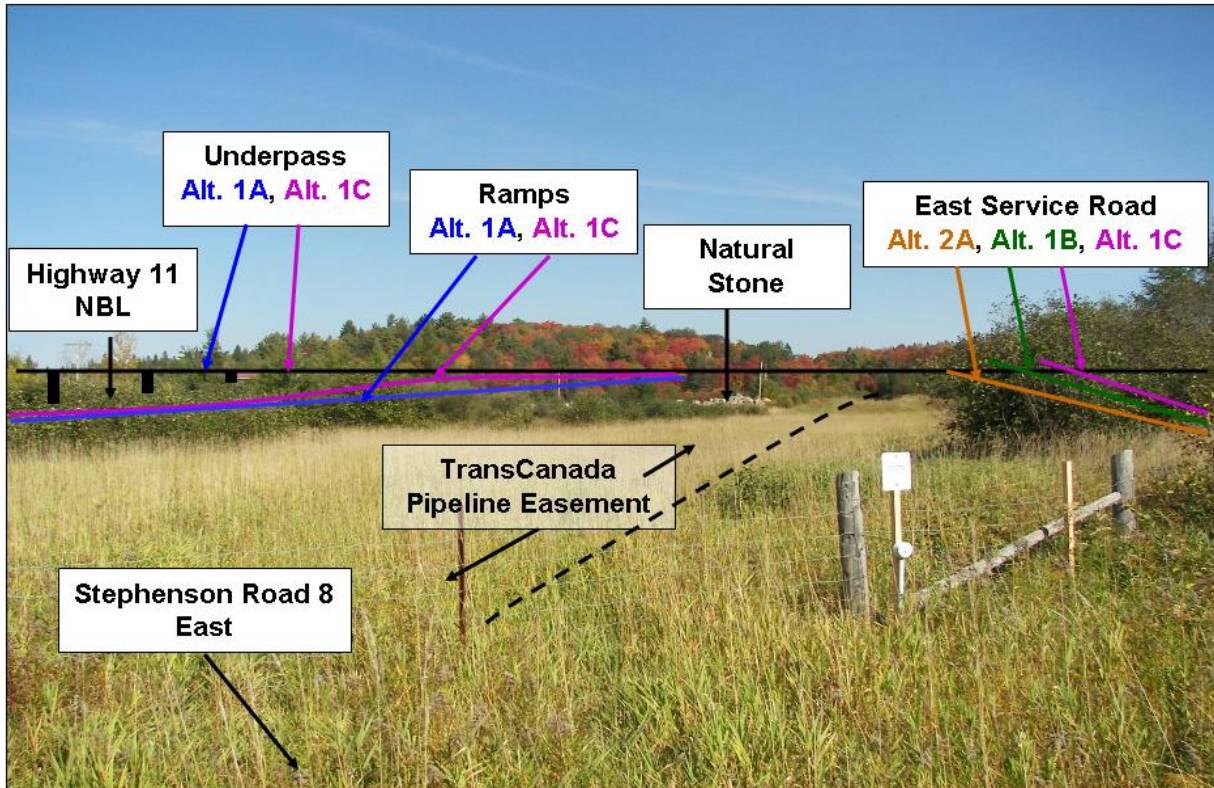
Photograph 6 VIEW: Looking south from east shoulder of Stephenson Road 8 along Greer Road. Bush area both sides of road. (Nov. 2007)



Photograph 7 VIEW: Looking west from east shoulder of Stephenson Road 8 at about Sta. 19+080 at the at grade crossing with Highway 11. Swamp area in foreground. (Nov. 2007)



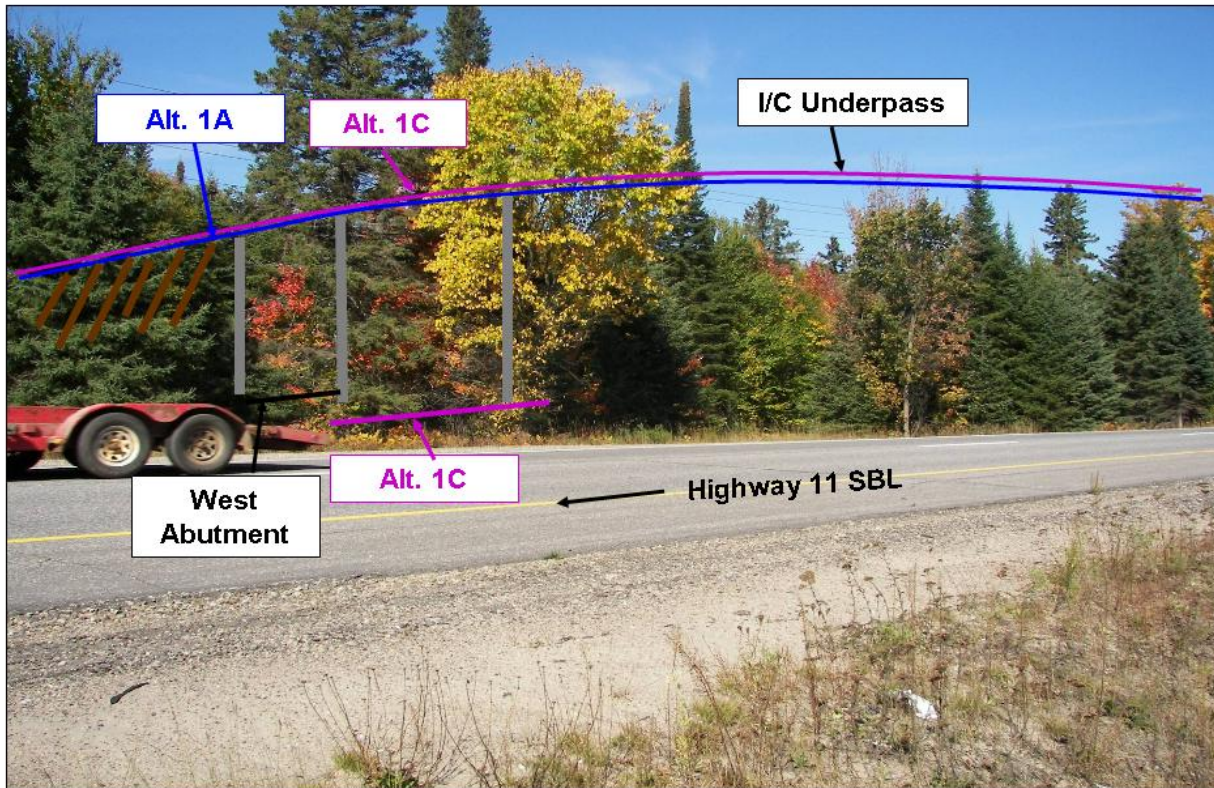
Photograph 8 VIEW: Looking east from east shoulder of Stephenson Road 8, at about Sta. 19+080. Culvert (2200 SPCSP) ON Stephenson Road 7 East in foreground with Muskoka Ready Mix Concrete plant on fill pad in background. (Nov. 2007)



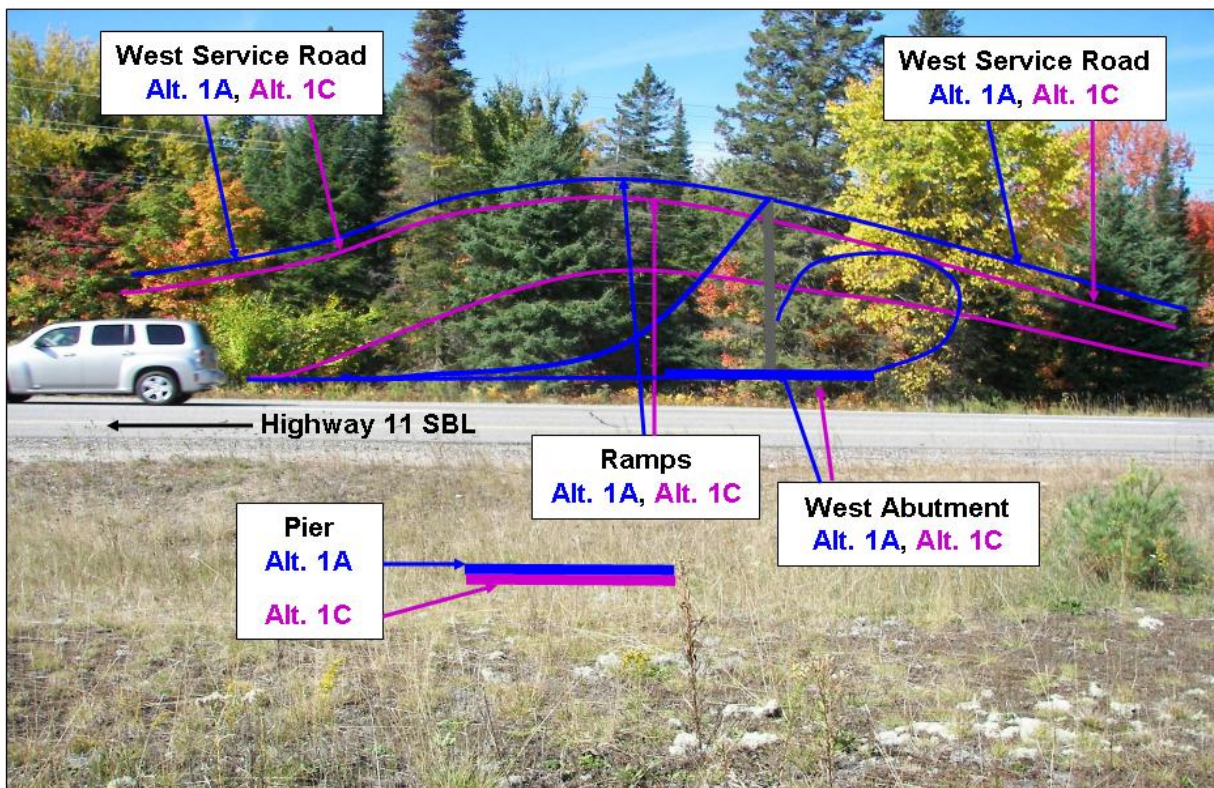
Photograph 9 VIEW: Looking northerly from north shoulder of Stephenson Road 8 East along TransCanada Pipeline alignment. Natural Stone in middle of view. Alignment for ramps of Alt. 1A and 1C cross over forested rock outcrop. (Sept. 26, 2008)



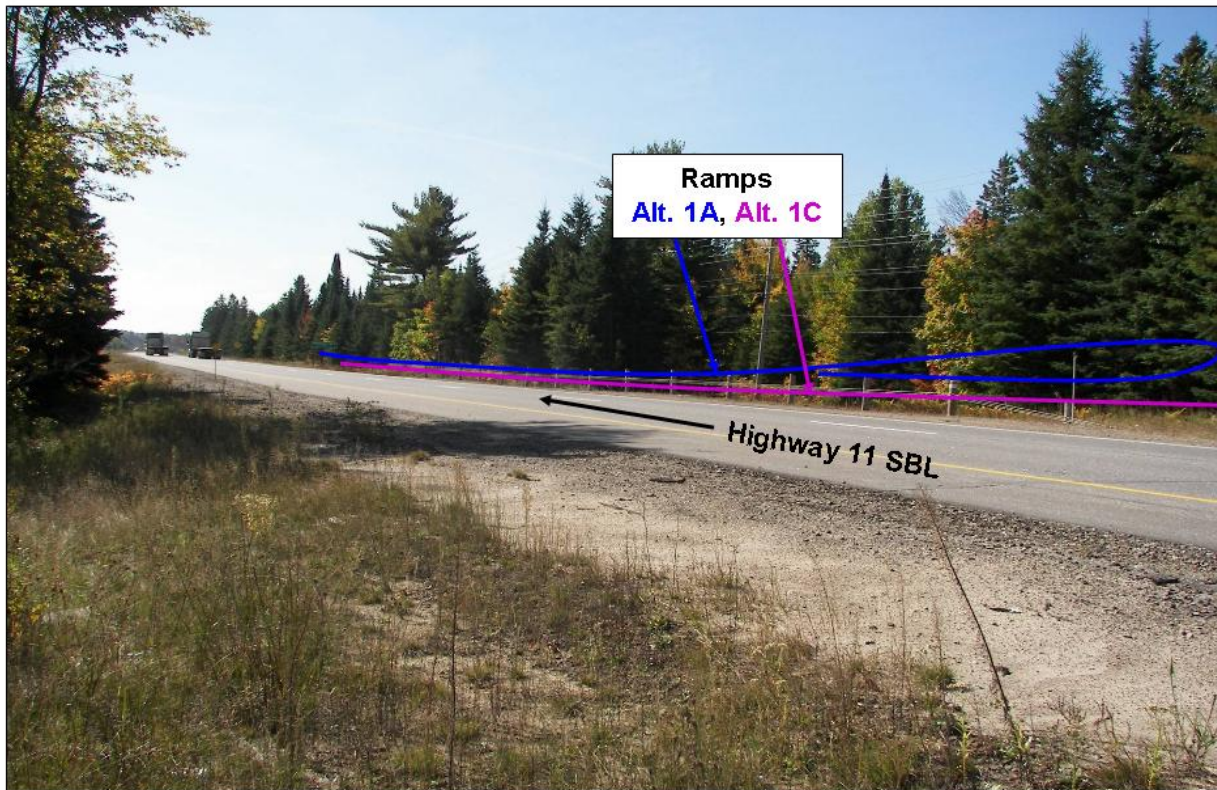
Photograph 10 VIEW: Looking northeasterly from median of Highway 11 at about Sta.19+960. Rock cut in photograph is 1.0 to 3.0 m high and located about 240 m south of I/C Alt. 1A and 1C. (Sept. 26, 2008)



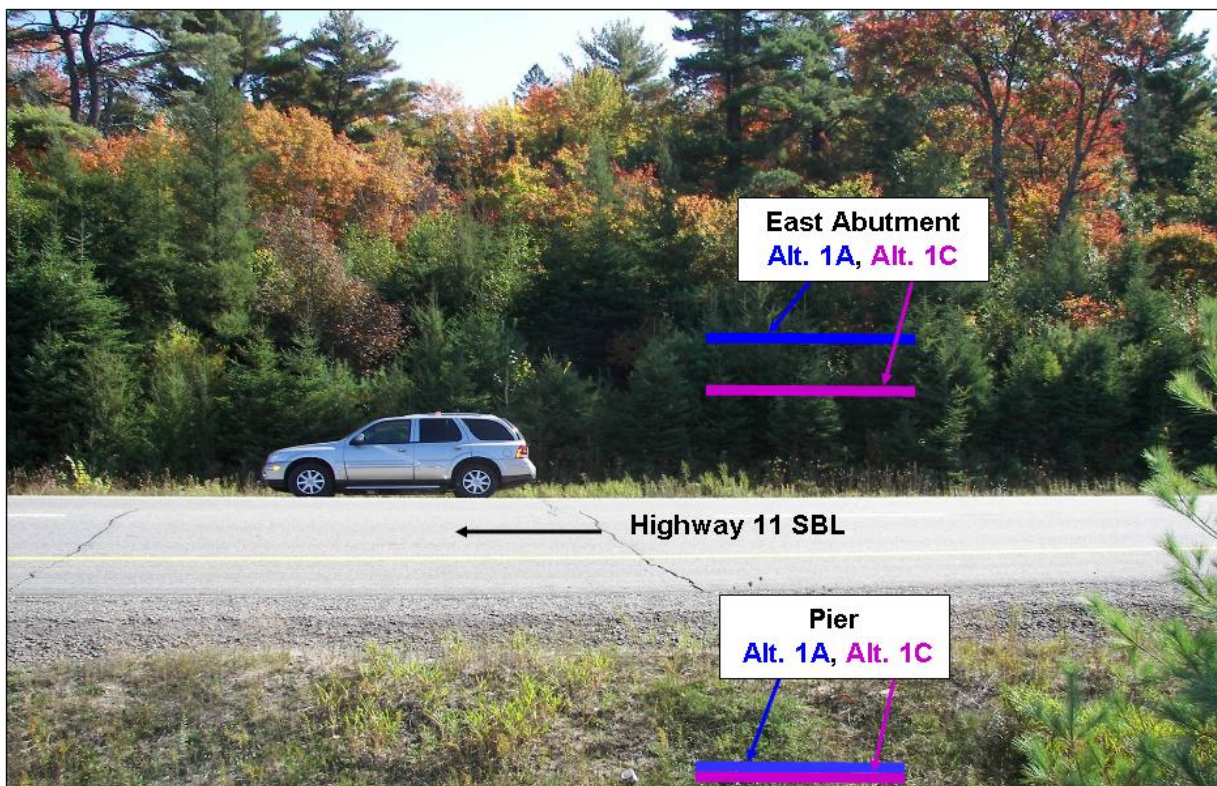
Photograph 11 VIEW: Looking northwesterly from east shoulder of Highway 11 SBL at west abutment option of I/C underpass (Sta. 20+200). (Sept. 26, 2008)



Photograph 12 VIEW: Looking west from median of Highway 11 across SBL at approximate locations of pier (foreground) and west abutment of I/C underpass (Sta. 20+200). Ground surface slopes down from west shoulder towards Bullen Creek floodplain. (Sept. 26, 2008)



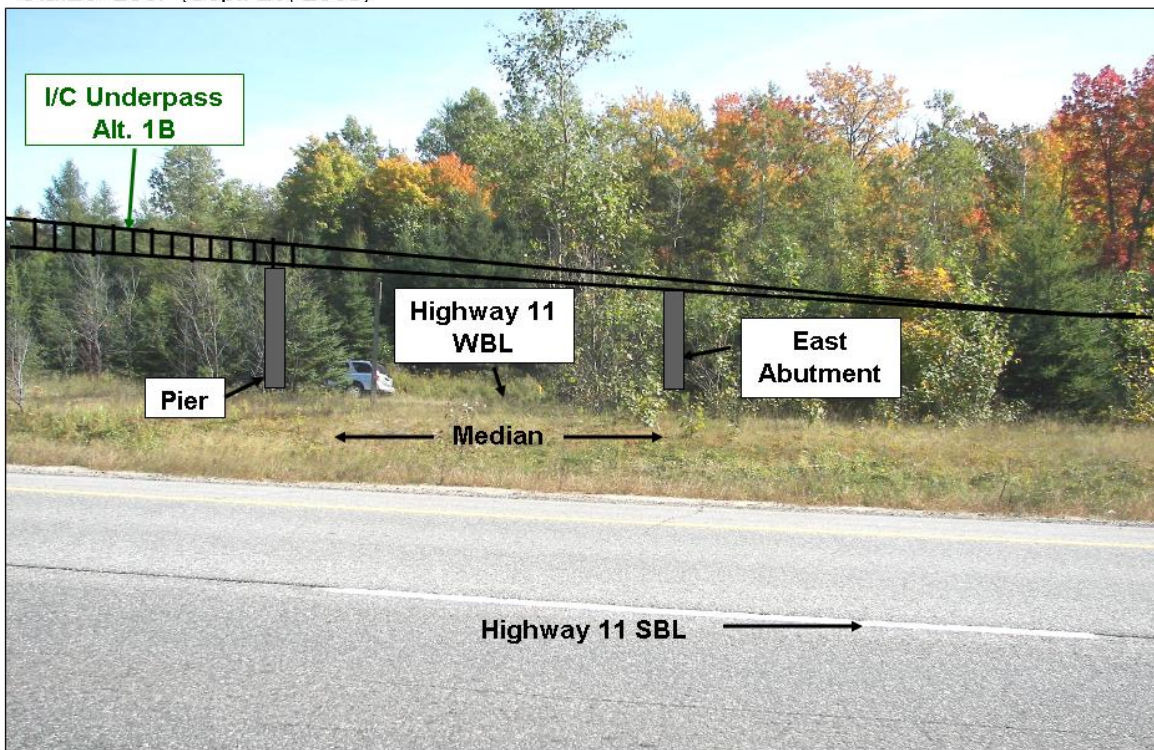
Photograph 13 VIEW: Looking southwesterly from east shoulder of Highway 11 SBL at alignment of on-ramps from I/C at Sta. 20+200. Highway embankment is about 6 m high at guardrail. (Sept. 26, 2008)



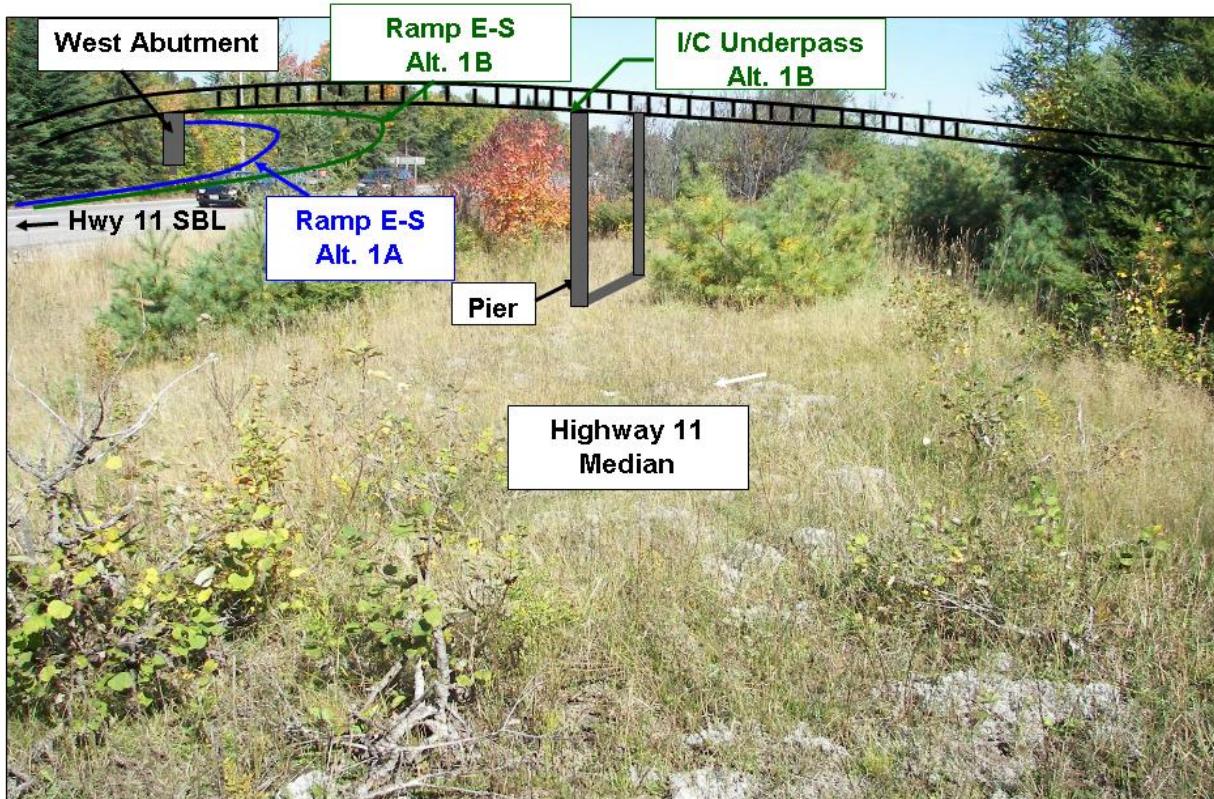
Photograph 14 VIEW: Looking east from median of Highway 11 across NBL at approximate location of east abutment of I/C underpass (Sta. 20+200). Bedrock outcrops about 10 m beyond east shoulder. (Sept. 26, 2008)



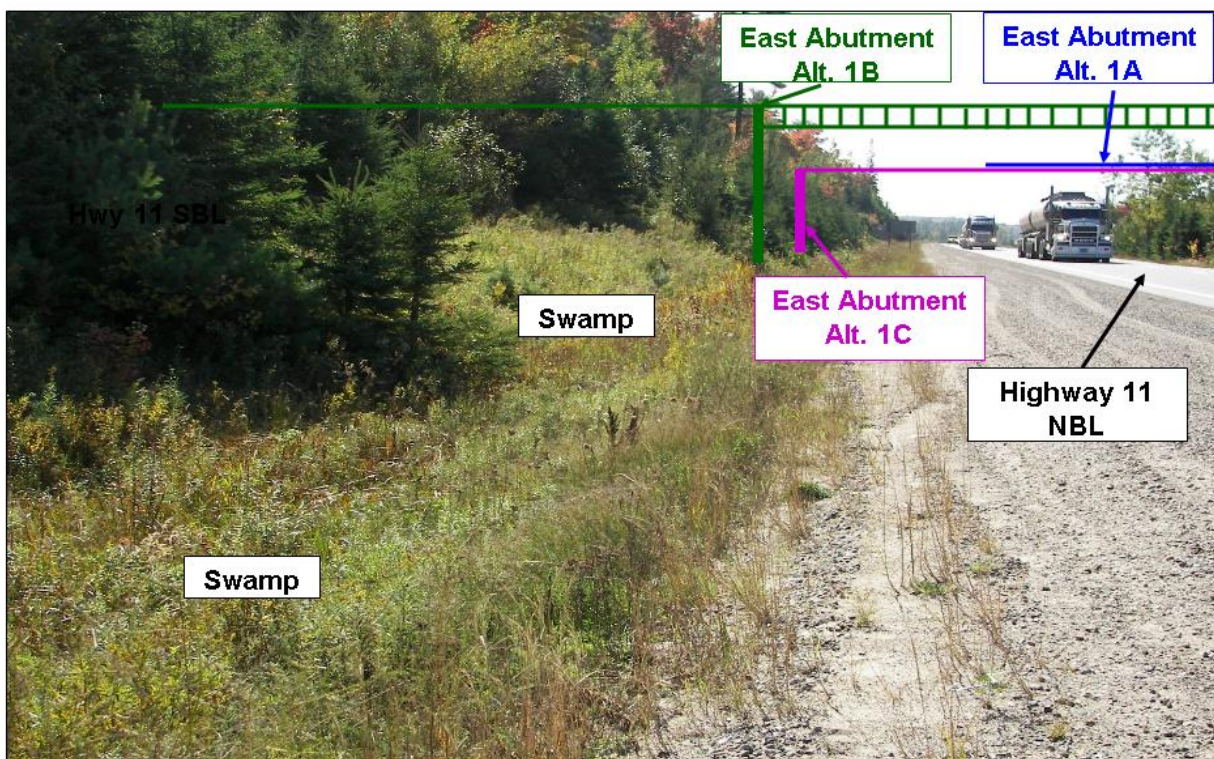
Photograph 15 VIEW: Looking east at rock outcrops about 15 m east of Highway 11 NBL at Sta. 20+200. (Sept. 26, 2008)



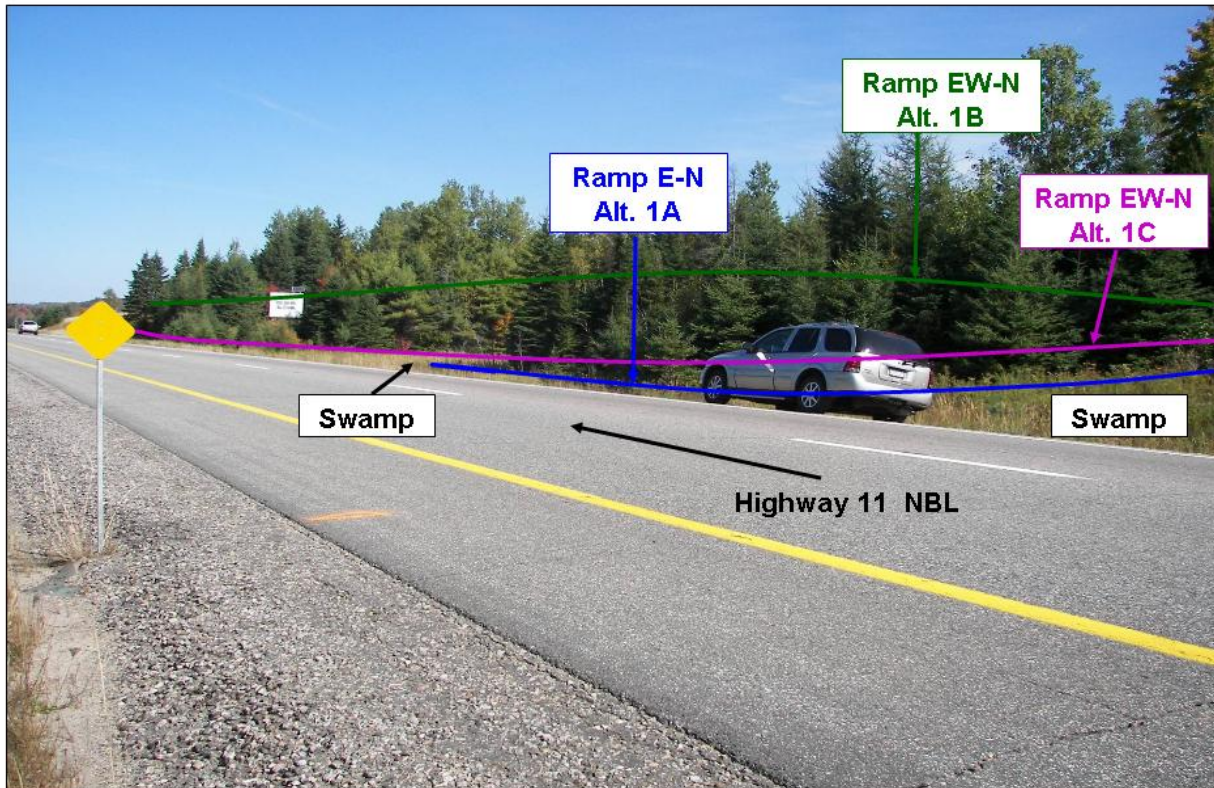
Photograph 16 VIEW: Looking northeasterly from west shoulder of Highway 11 SBL at pier and east abutment locations of I/C underpass at Sta. 20+300. (Sept. 26, 2008)



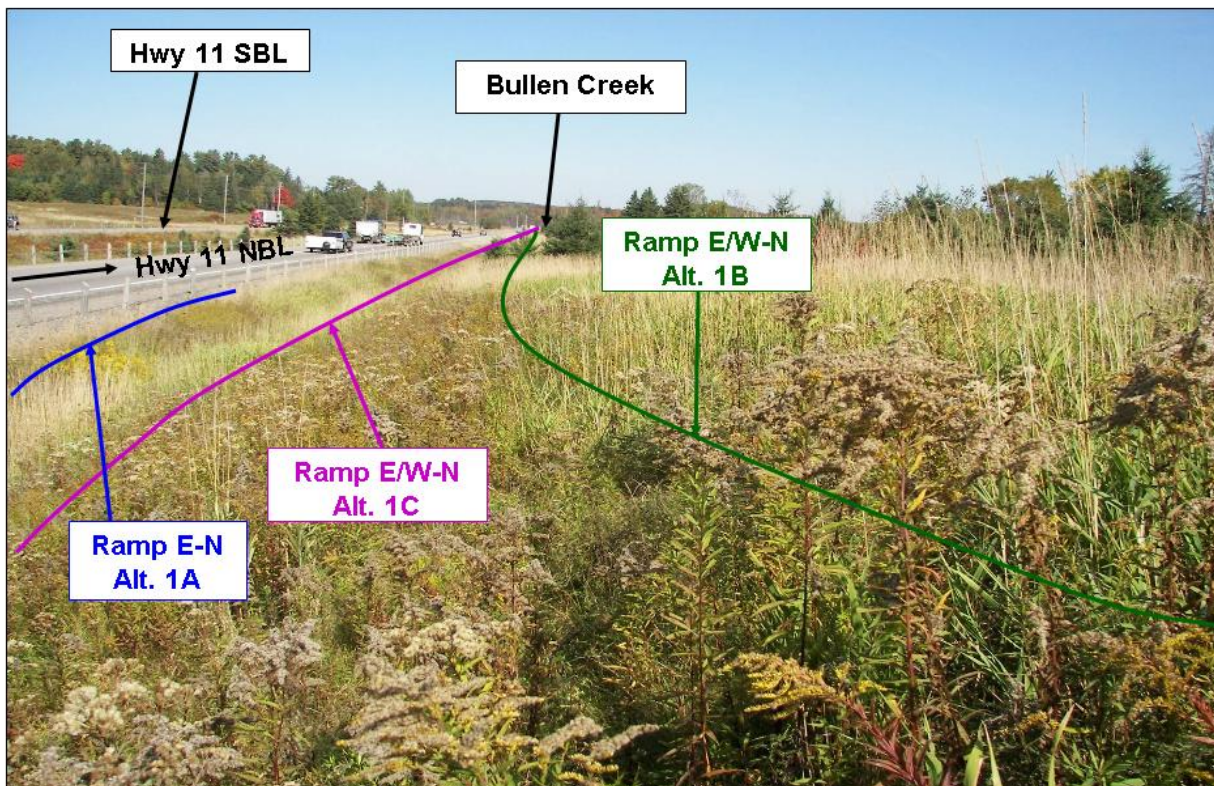
Photograph 17 VIEW: Looking northwesterly from median of Highway 11 at Sta. 20+250 at west abutment and pier locations of I/C underpass. (Sept. 26, 2008)



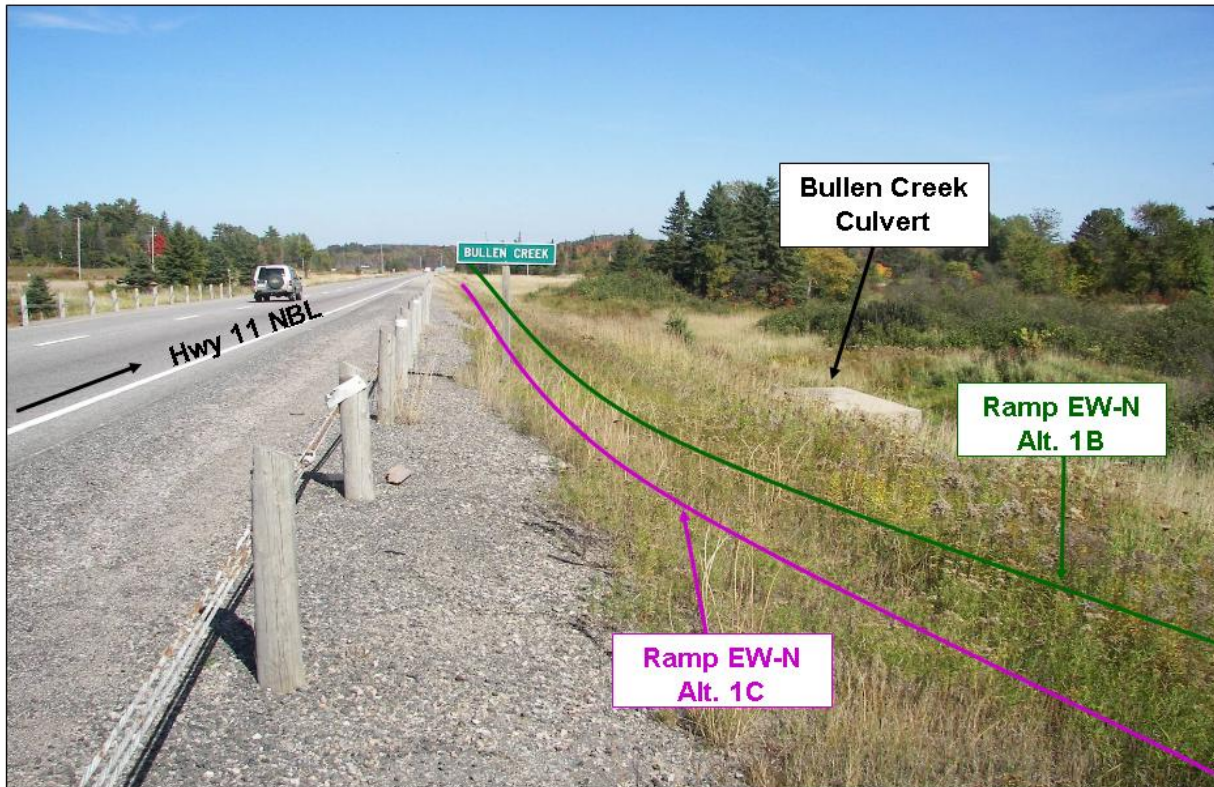
Photograph 18 VIEW: Looking south from east shoulder of Highway 11 NBL at about Sta. 20+400. East abutments for underpasses for I/C at Sta. 20+200 (Alt. 1A and 1C) and at Sta. 20+300 are illustrated. Note swamps in foreground. High ground behind east abutments of Alt. 1A and 1C is a rock outcrop. (Sept. 26, 2008)



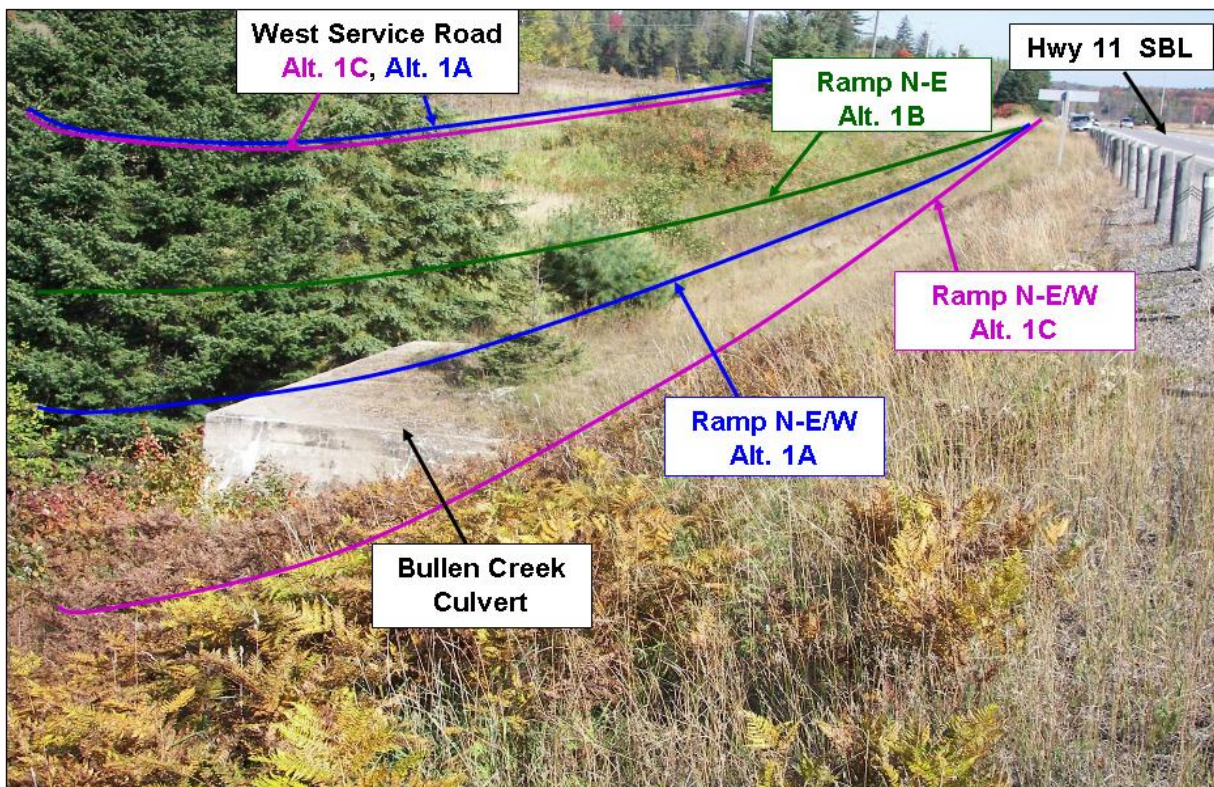
Photograph 19 VIEW: Looking northeasterly from west shoulder of Highway 11 NBL at alignment of EW-N ramps of I/C at Sta. 20+200 and 20+300. Note swamps along alignments of EW-N ramp of Alt. 1C and E-N ramp of Alt. 1A. (Sept. 26, 2008)



Photograph 20 VIEW: Looking northerly from 30 m east of east shoulder of Highway 11 NBL at Sta. 20+500. Alignment of ramps, E-N for Alt. 1A, E/W-N for Alt. 1B and 1C extend over east end of Bullen Creek culvert. (Sept. 26, 2008)



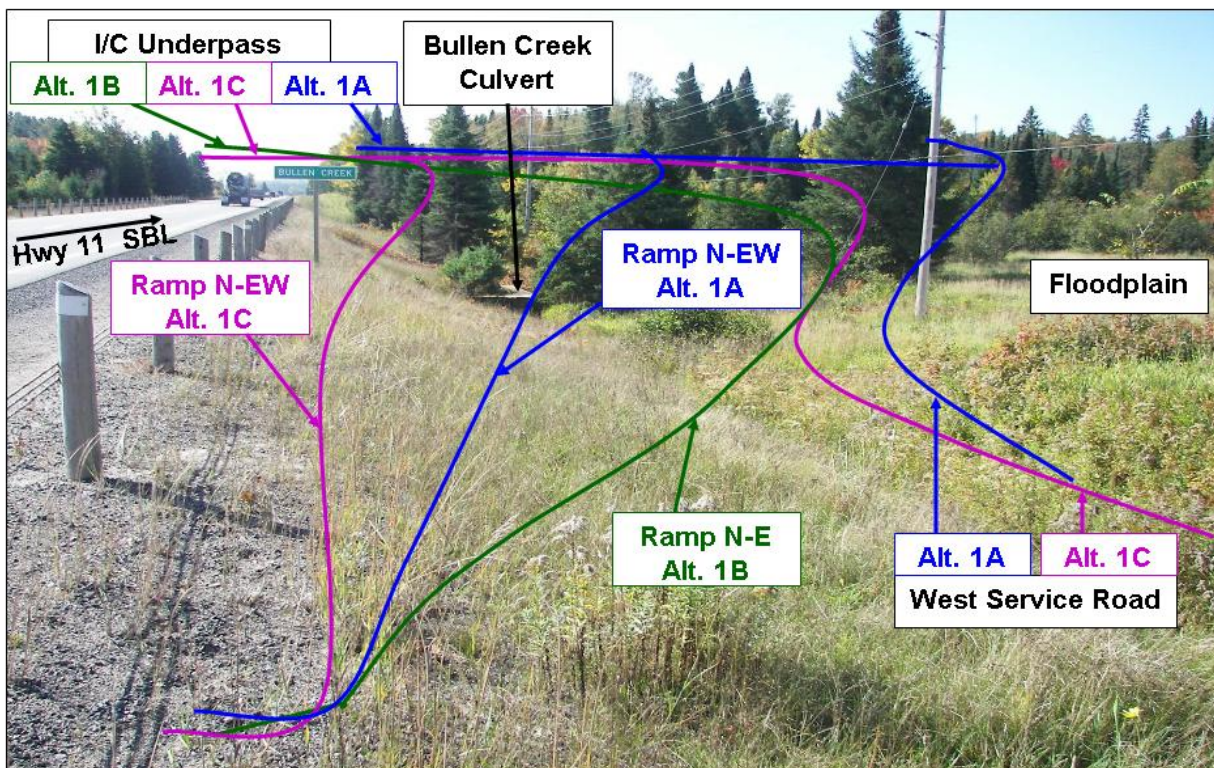
Photograph 21 VIEW: Looking north from east shoulder of Highway 11 NBL at Sta. 20+700. EW-N ramps for Alt. 1B and 1C extend over east end of Bullen Creek culvert floodplain. (Sept. 26, 2008)



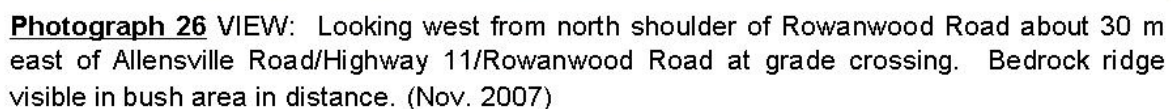
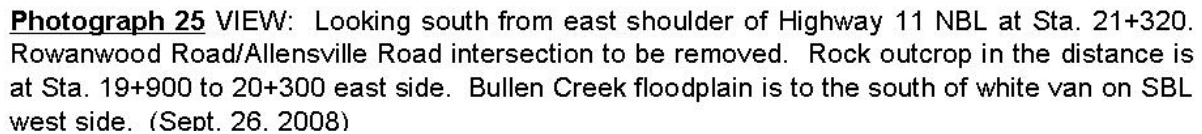
Photograph 22 VIEW: Looking north from west shoulder rounding of Highway 11 SBL at Sta. 20+700 across the west end of Bullen Creek culvert. Note that current ramp alternatives require the extension of the culvert westerly. (Sept. 26, 2008)



Photograph 23 VIEW: Looking southwesterly at west end of Bullen Creek culvert at about Sta. 20+780. Floodplain is visible beyond and west of trees in foreground. Estimated embankment height over the Bullen Creek floodplain is 6 m. (Sept. 26, 2008)



Photograph 24 VIEW: Looking south from west shoulder rounding of Highway 11 SBL at about Sta. 20+820. Alternative west ramps and service roads are illustrated for I/C alternatives at Sta. 20+200 (Alt. 1A and 1C) and Sta. 20+300 (Alt. 1B). West end of Bullen Creek culvert and floodplain in photograph will affect the preferred alignment. (Sept. 26, 2008)

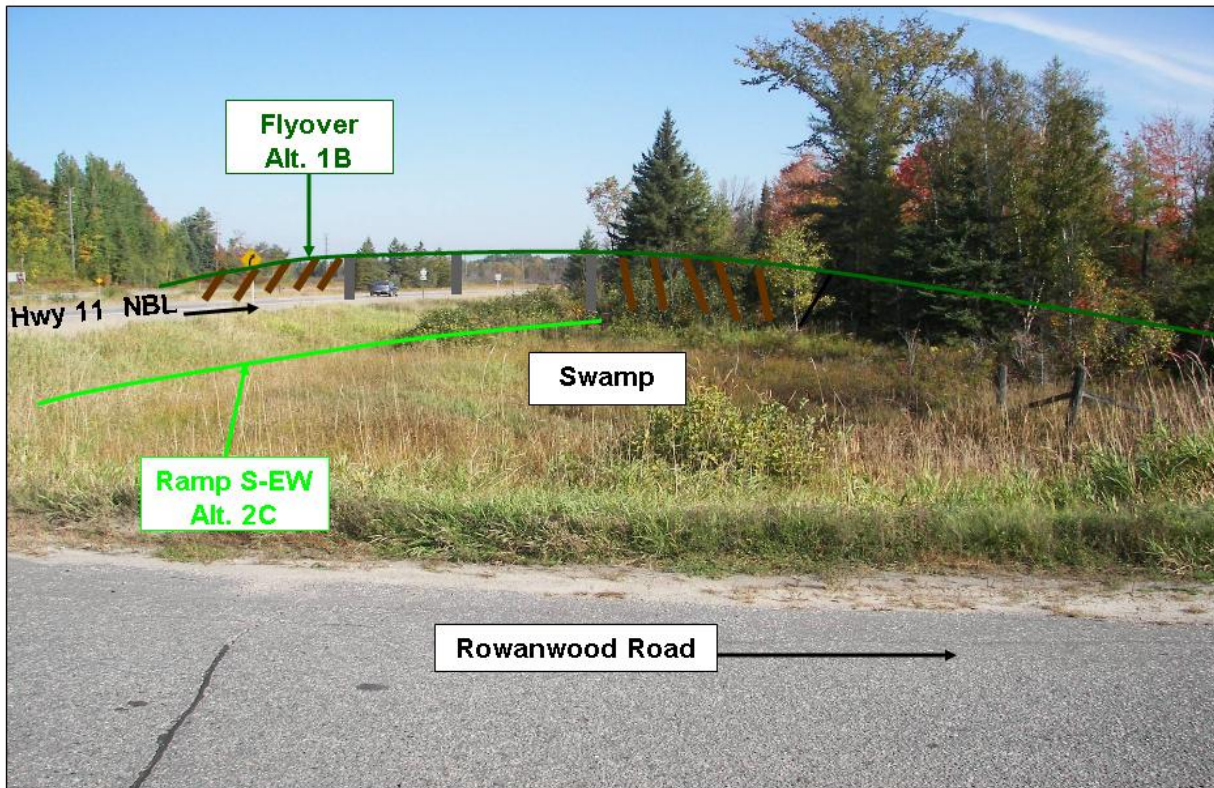




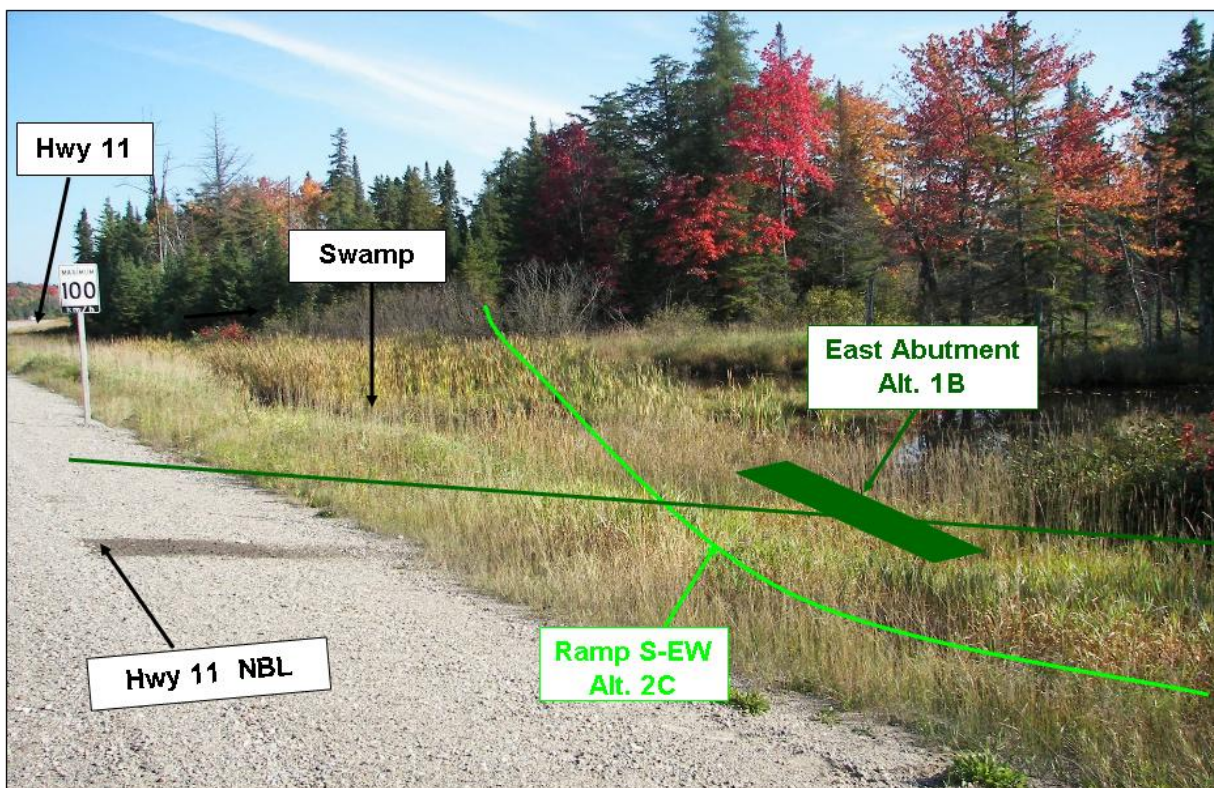
Photograph 27 VIEW: Looking northeast from east shoulder of Highway 11 NBL at about Sta. 21+400, about 100 m north of the Allensville/Rowanwood Roads/Highway 11 at grade crossing. Extensive ponded water in major swamp area east of Highway NBL. (Nov. 2007)



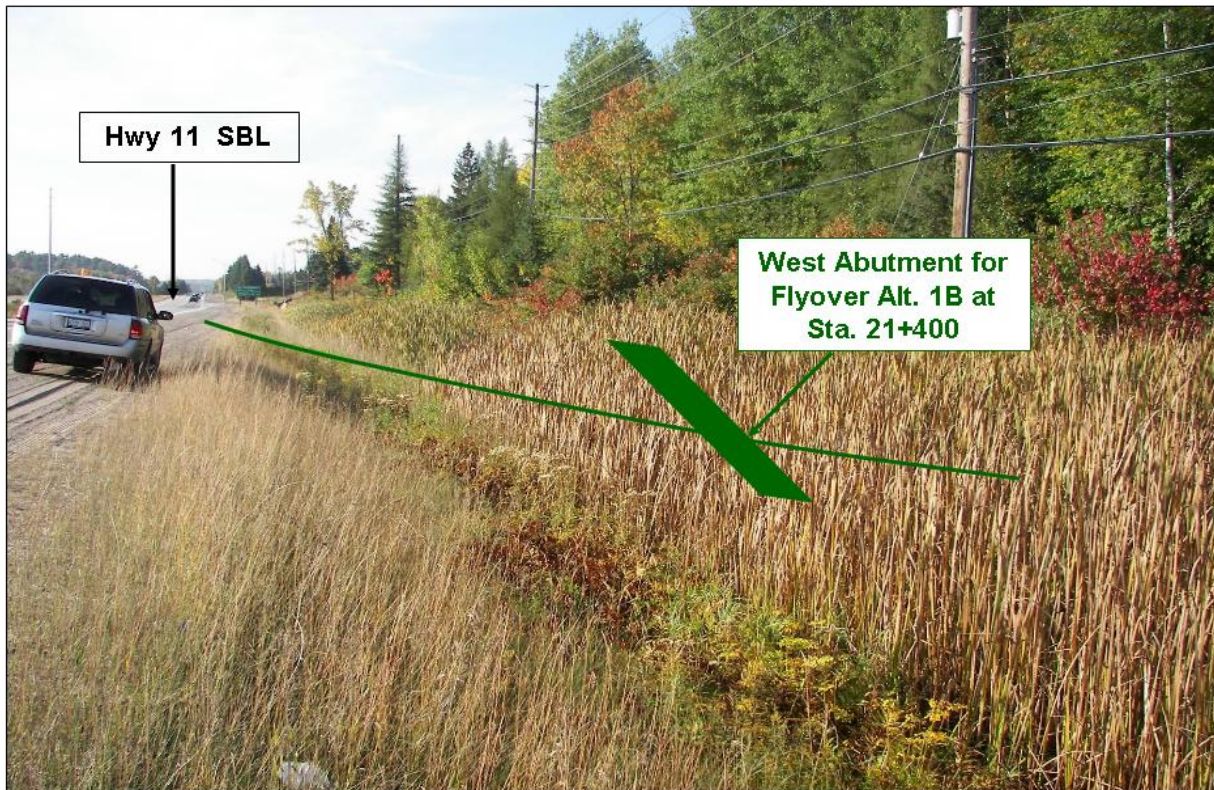
Photograph 28 VIEW: Looking west from east shoulder of Highway 11 NBL at about Sta. 21+400 about 100 m north of the Allensville/Rowanwood Roads/Highway 11 at grade crossing. Bedrock exposure in Highway 11 SBL ditch area. (Nov. 2007)



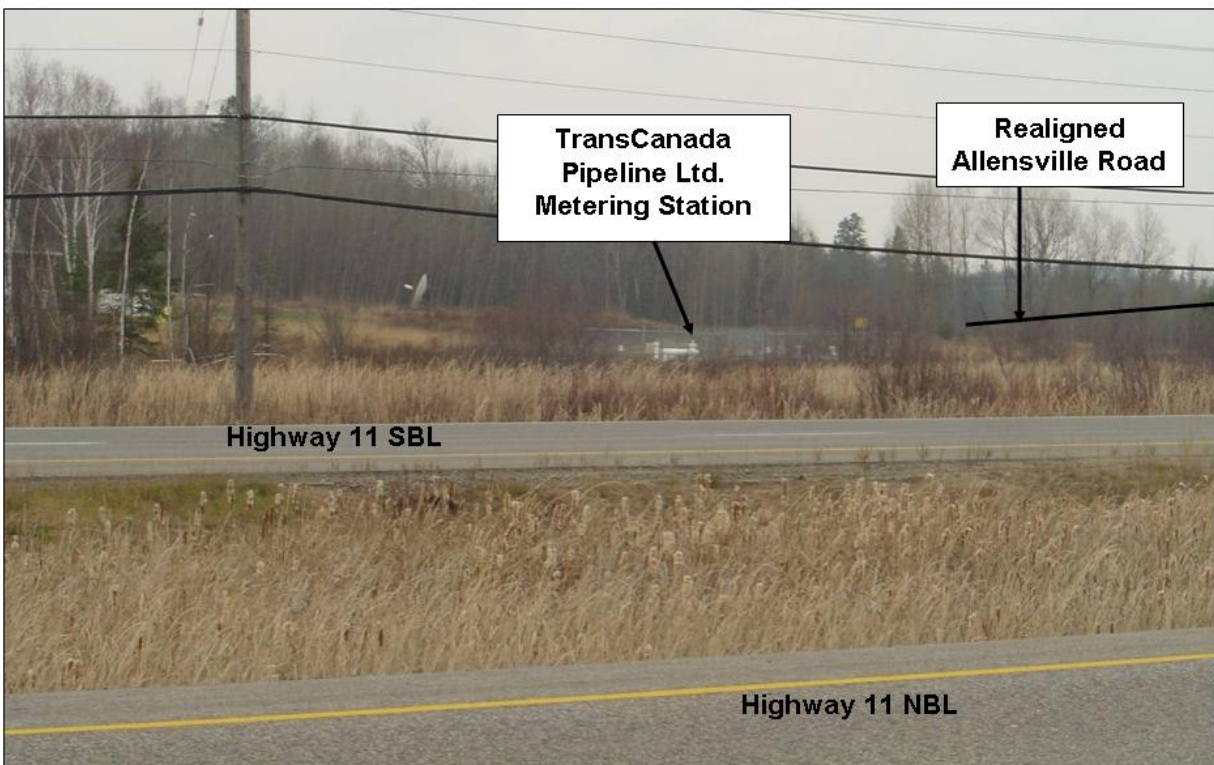
Photograph 29 VIEW: Looking northwesterly from south shoulder of Rowanwood Road about 30m east of Highway 11 NBL. (Sept. 26, 2008)



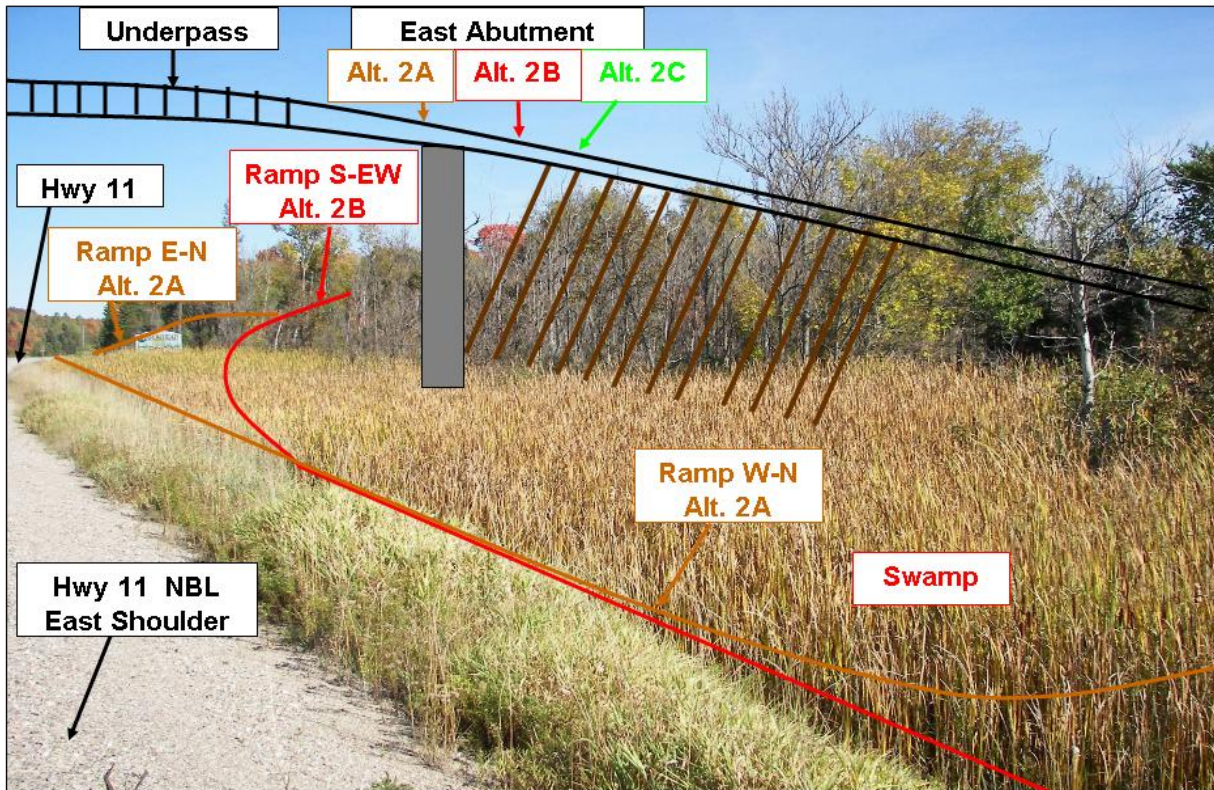
Photograph 30 VIEW: Looking northeasterly from east shoulder of Highway 11 NBL at Sta. 21+350. East abutment foundations is located in swamp area with open water. (Sept. 26, 2008)



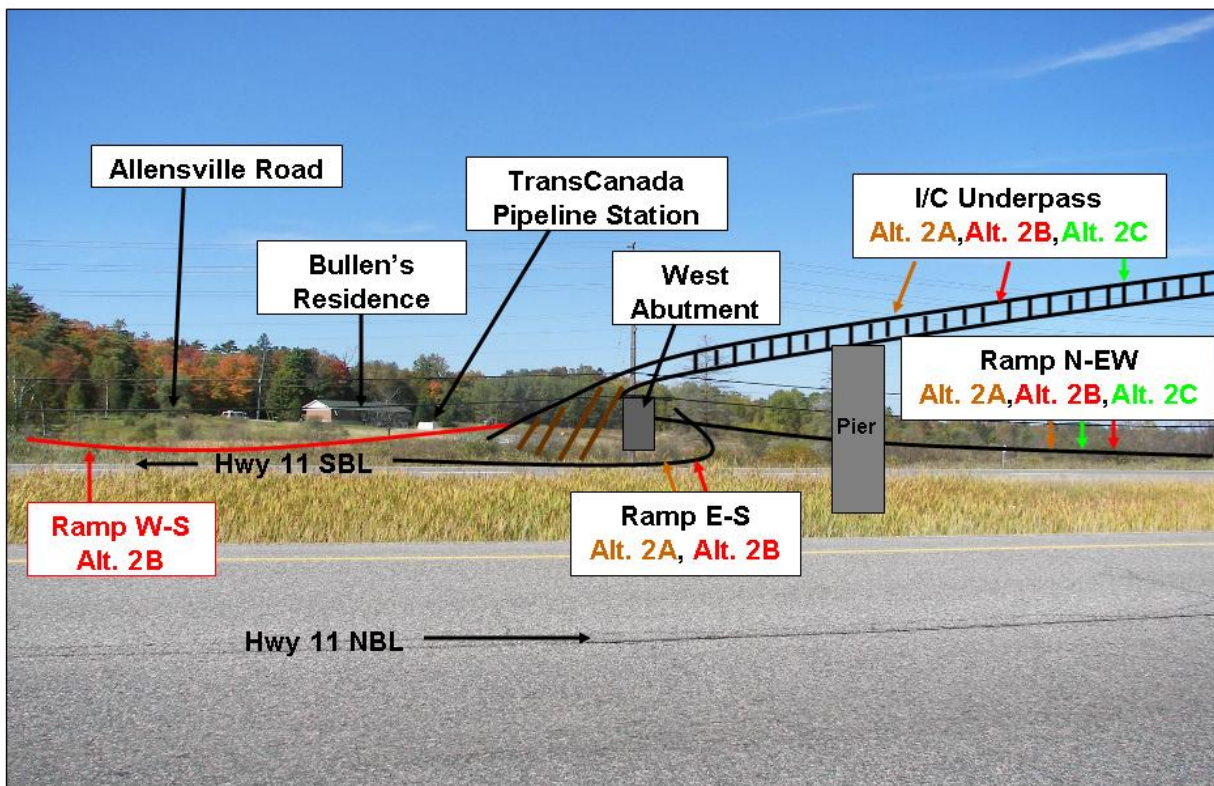
Photograph 31 VIEW: Looking south along west shoulder of Highway 11 SBL at Sta. 21+450. Foundation for west abutment of flyover is located in swampy area in the west ditch of the highway. (Sept. 26, 2008)



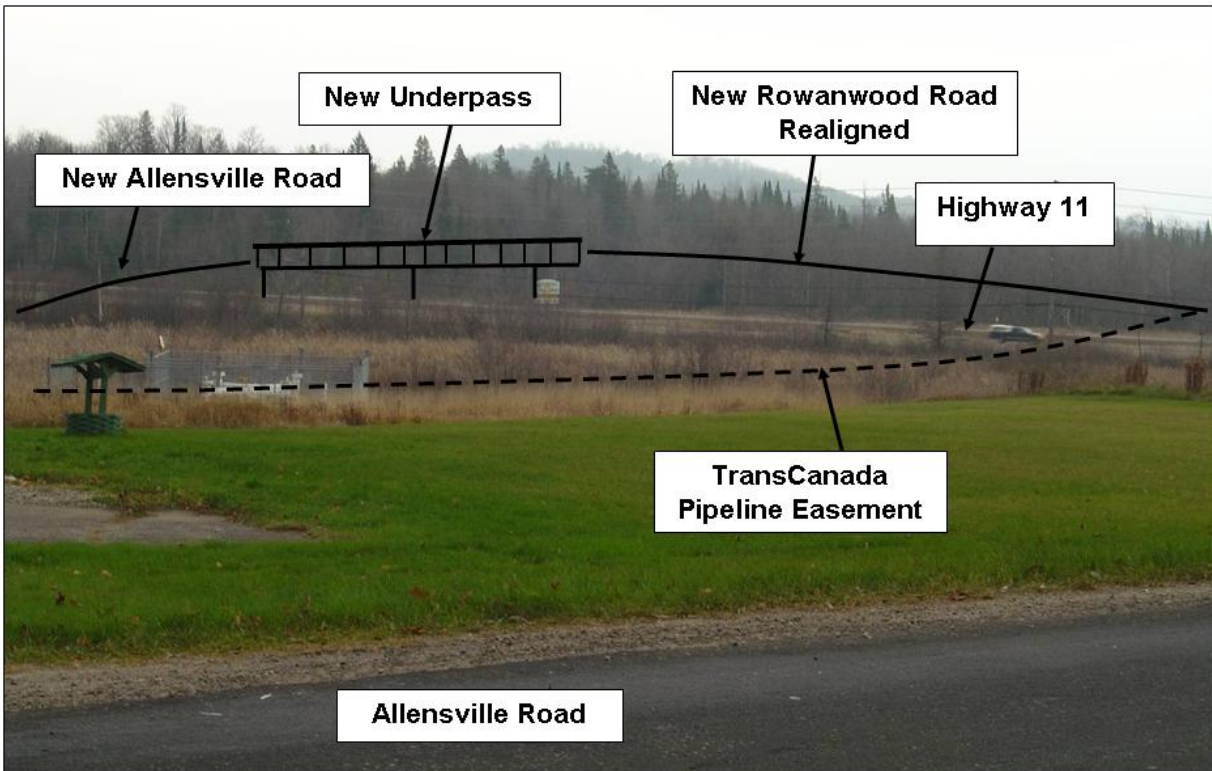
Photograph 32 VIEW: Looking west from east shoulder of Highway 11 NBL at about Sta. 21+650 across swamp area. Realigned Allensville Road extends across major swamp. TransCanada Pipeline Metering Station on west side of Highway 11 SBL. Bedrock at bushline at Allensville Road. (Nov. 2007)



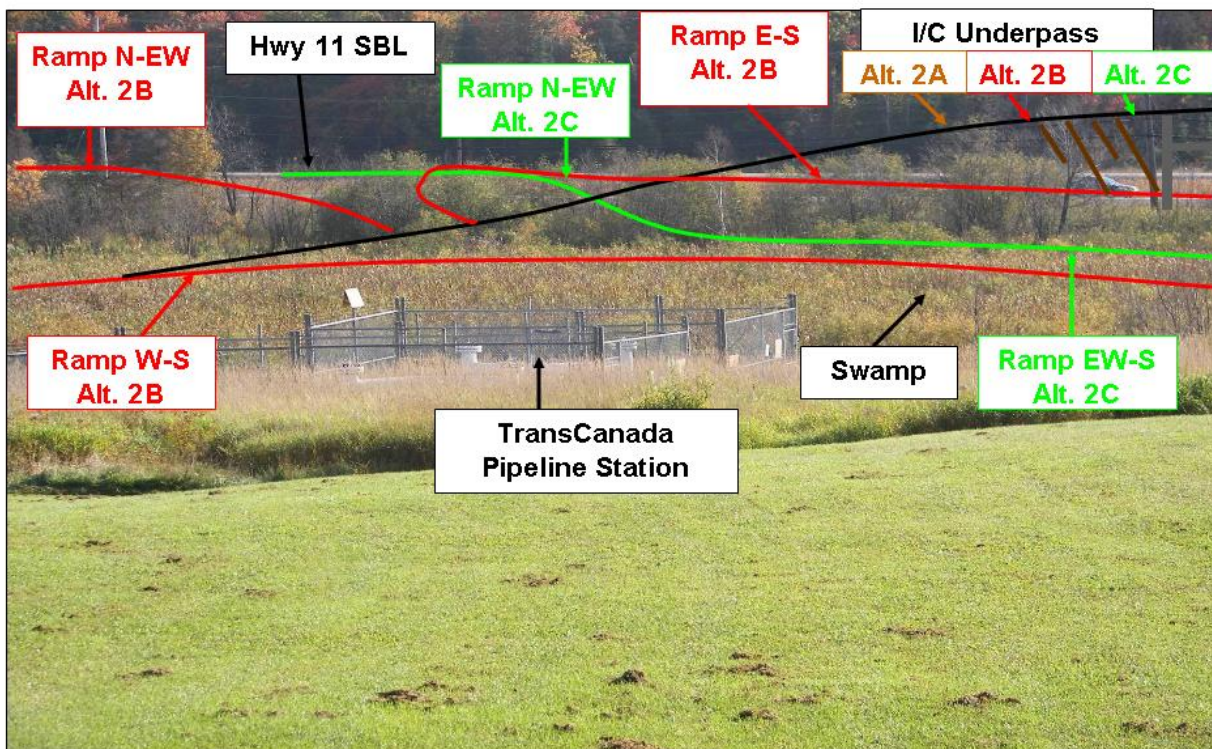
Photograph 33 VIEW: Looking north from east shoulder of Highway 11 NBL at about Sta. 21+700. An extensive swamp is located to the east. East abutment and ramps of Alt. 2A, 2B and 2C are located in the swamp area. (Sept. 26, 2008)



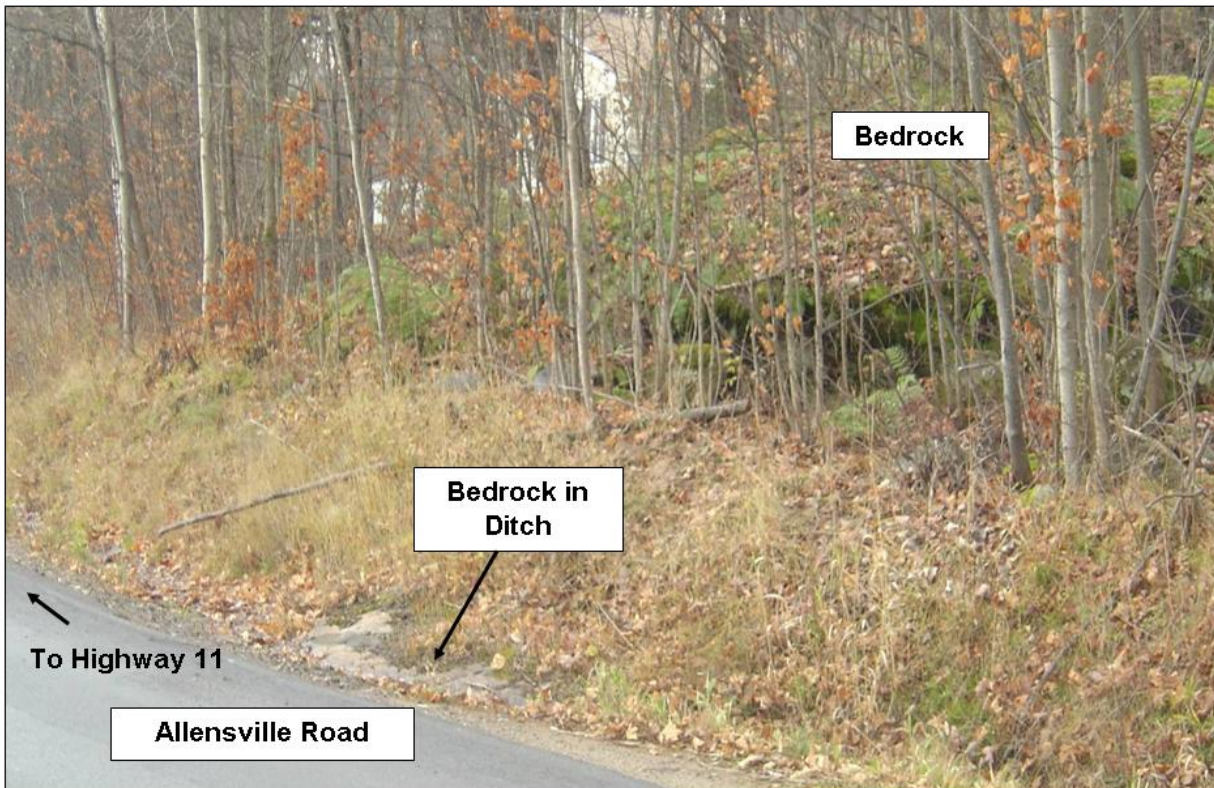
Photograph 34 VIEW: Looking northwesterly from east shoulder of Highway 11 NBL at Sta. 21+700. I/C underpass is common to Alt. 2A, 2B and 2C. Swamps noted at proposed pier and west abutment which are drawn on the photograph. (Sept. 26, 2008)



Photograph 35 VIEW: Looking east from west shoulder of Allensville Road along Highway 11 between about Sta. 21+600 to 21+900. New Allensville Road from west (left) crosses Highway 11 with underpass structure. Rowanwood Road realigned 100 to 200 m east of Highway 11 NBL in heavily bush and swamp areas. (Nov. 2007)



Photograph 36 VIEW: Looking northeasterly to Highway 11 (Sta. 21+780) from road outcrop on Allensville Road (Bullen's Residence). View shows TransCanada Pipeline Plant ramps W-S (Alt. 2B) and EW-S (Alt. 2C) cross pipeline at a location to the right of the photograph field of view. (Sept. 26, 2008)



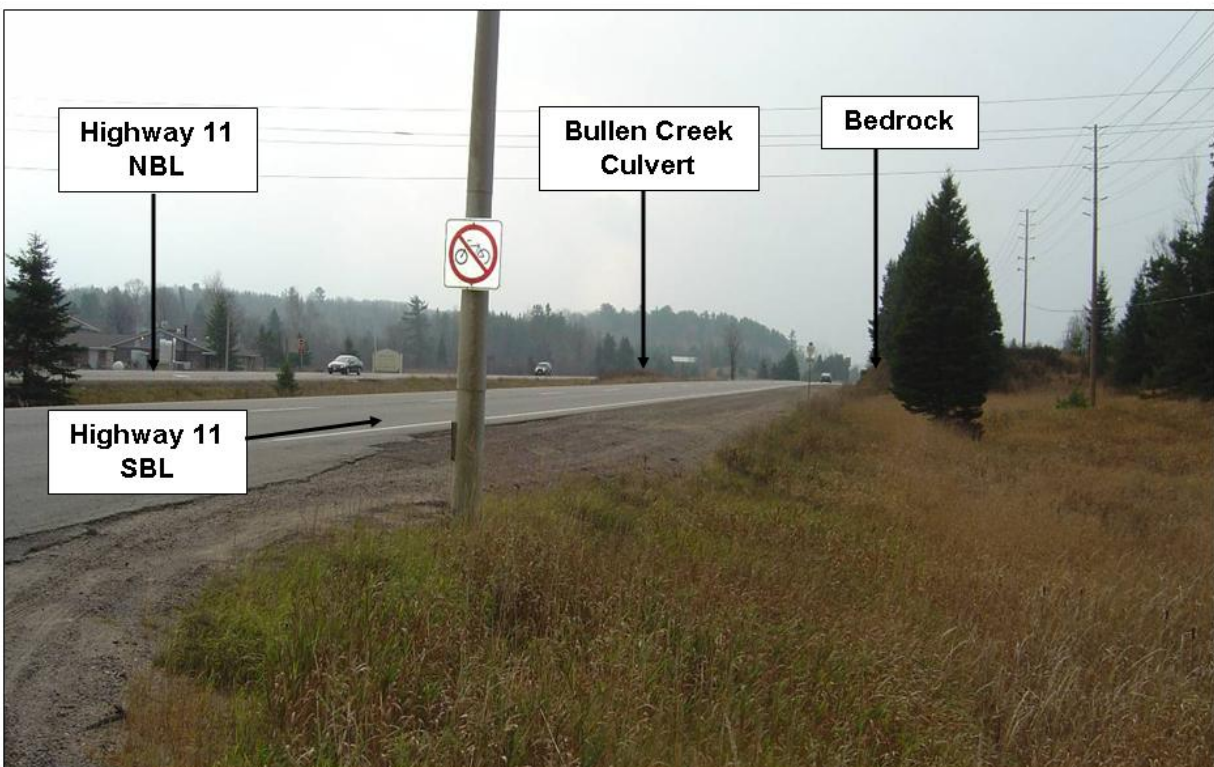
Photograph 37 VIEW: Looking west from Allensville Road just south of Bullen's Residence. Extensive bedrock outcrops visible to the west and in the west road ditch. (Nov. 2007)



Photograph 38 VIEW: Looking west from south shoulder of Allensville Road, about 20 m west of the at grade crossing with Highway 11 SBL. Extensive bedrock outcrops in ridge beyond Allensville Road. (Nov. 2007)



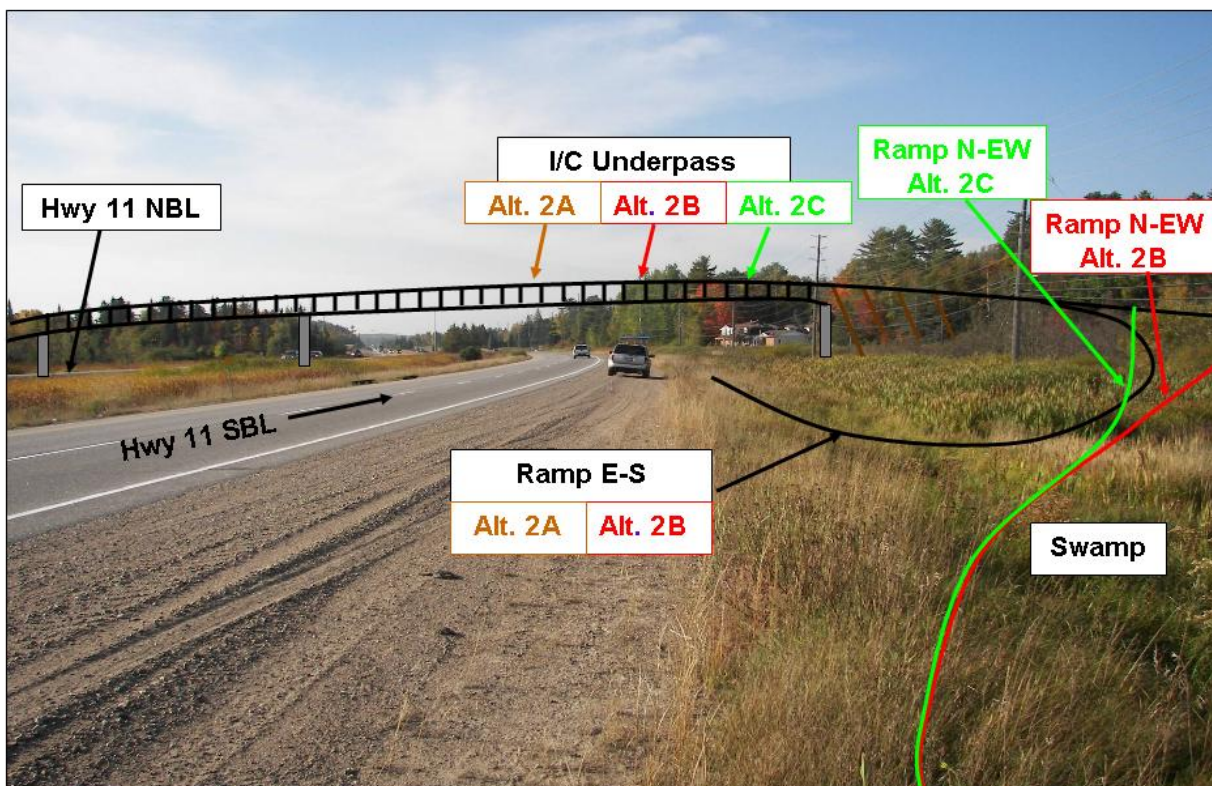
Photograph 39 VIEW: Looking east from south shoulder of Allensville Road about 50 m west of Highway 11 at grade crossing at about Sta. 21+280. Extensive swamp area extends entire width of photo along Rowanwood Road parallel to Highway 11 NBL. (Nov. 2007)



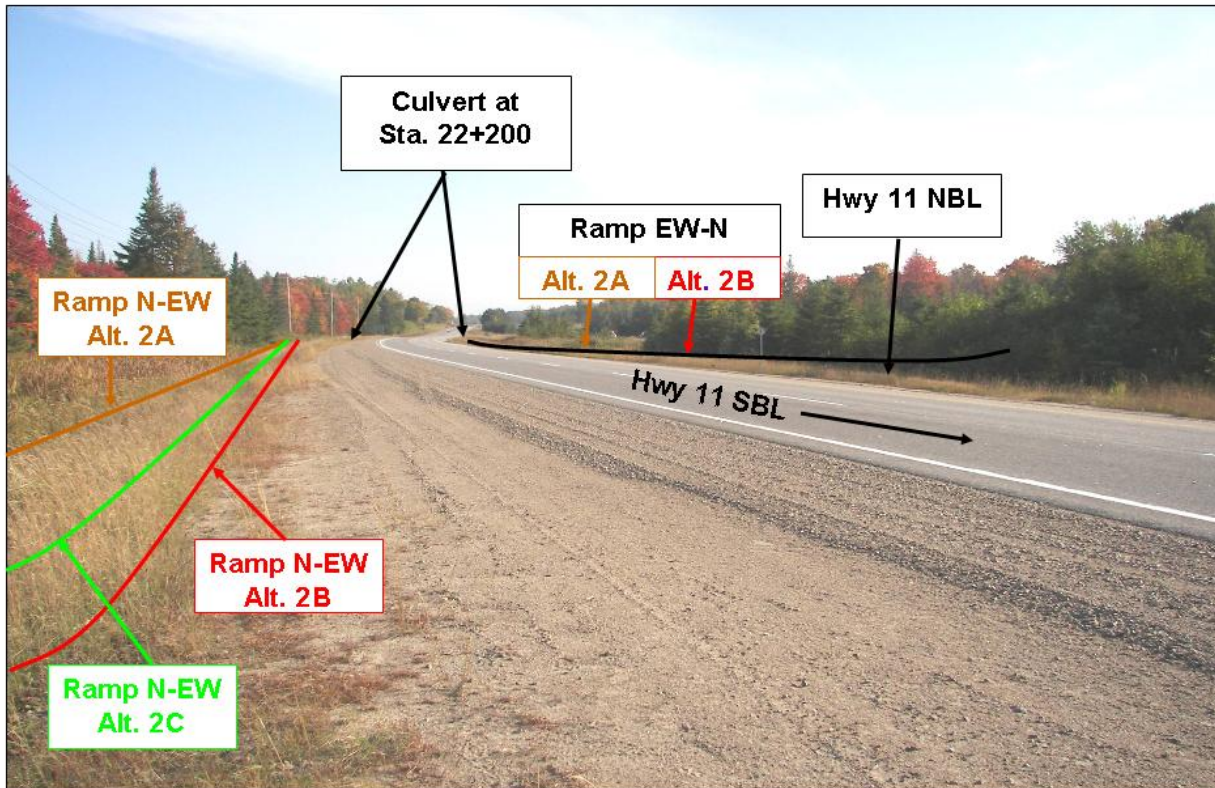
Photograph 40 VIEW: Looking south from south shoulder of Allensville Road, 10 m west of Highway 11 SBL along west ditch of Highway 11 SBL. Bedrock outcrop on west side (right side photo). Bullen Creek culvert crossing Highway 11, some 500 m south of intersection. (Nov. 2007)



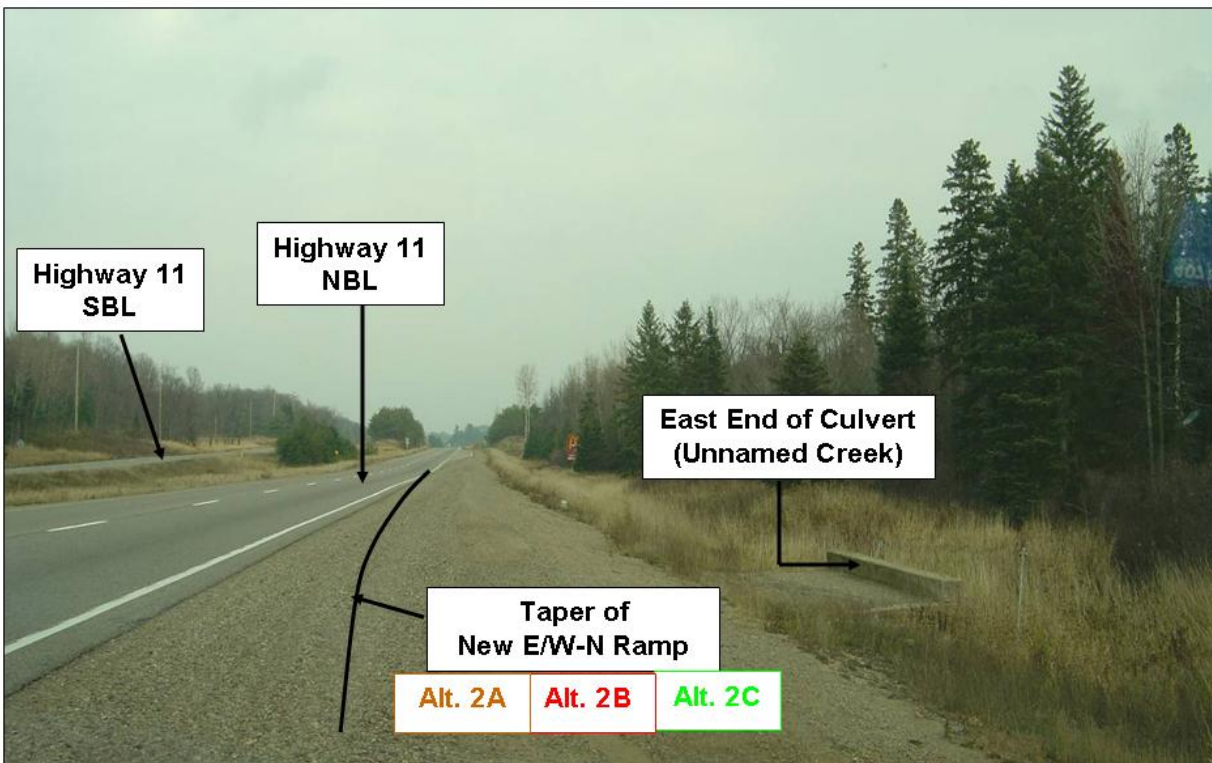
Photograph 41 VIEW: Looking north from south shoulder of Allensville Road, 10 m west of Highway 11 SBL along west ditch line of Highway 11 SBL. Bedrock outcrop on west side of Highway 11 SBL and extensive swamp on east side of Highway 11 NBL in treed area. (Nov. 2007)



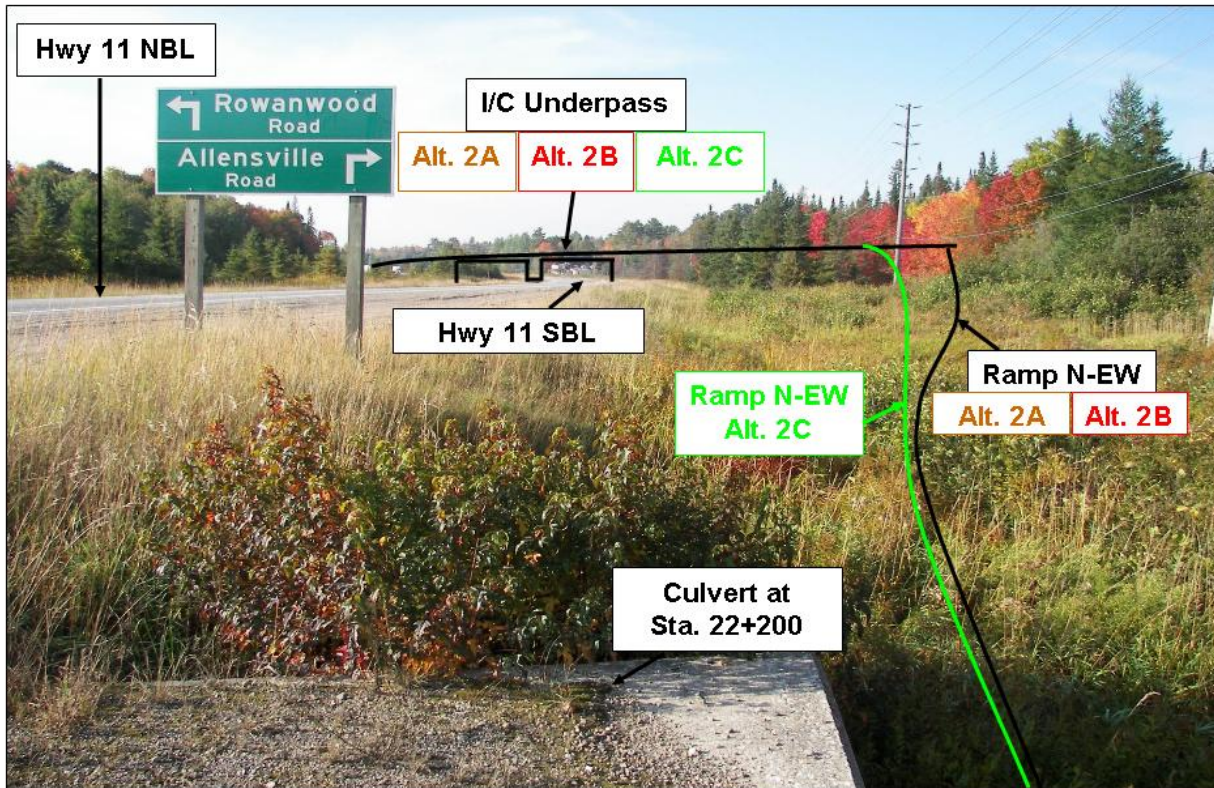
Photograph 42 VIEW: Looking south from west shoulder of Highway 11 SBL at Sta. 21+900. Extensive swamp in median and west of Highway 11. (Sept. 26, 2008)



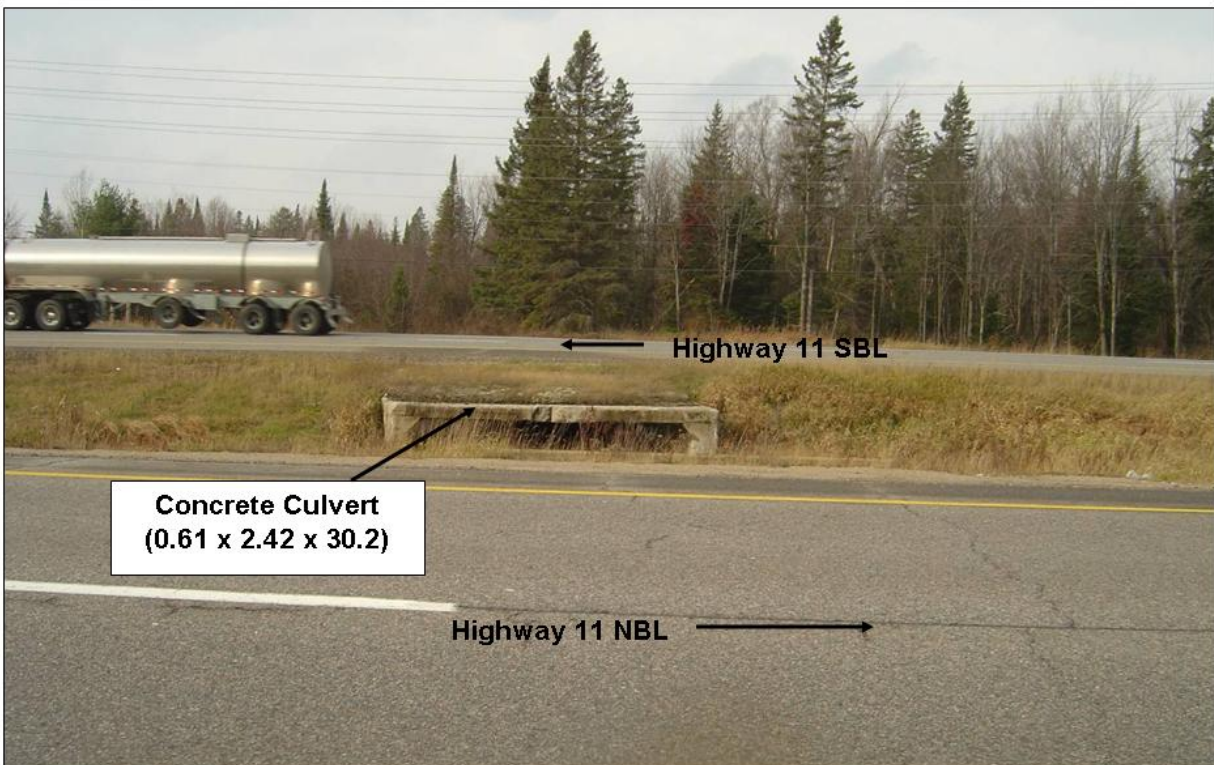
Photograph 43 VIEW: Looking north from west shoulder of Highway 11 SBL from Sta. 21+970. Proposed ramps will require the extension of the existing culvert at Sta. 22+200. (Sept. 26, 2008)



Photograph 44 VIEW: Looking north from east shoulder of Highway 11 NBL at about Sta. 22+100. Unnamed tributary to Spider Lake restricts alignment of the E/W-N Ramp. The proposed ramp must be parallel to Highway 11 before this water course and utilize the existing concrete culvert to minimize impacts to the stream. (Nov. 2007)



Photograph 45 VIEW: Looking south across west end of culvert of stream feeding Spider Lake at Sta. 22+200. Note proposed ramps will require the extension of the culvert. (Sept. 26, 2008)



Photograph 46 VIEW: Looking west from east shoulder of Highway 11 NBL at about Sta. 22+200. Unnamed tributary to Spider Lake restricts alignment of the N-E/W Ramp. The proposed ramp must be parallel to Highway 11 before this water course and utilize the existing concrete culvert to minimize impacts to the stream. (Nov. 2007)



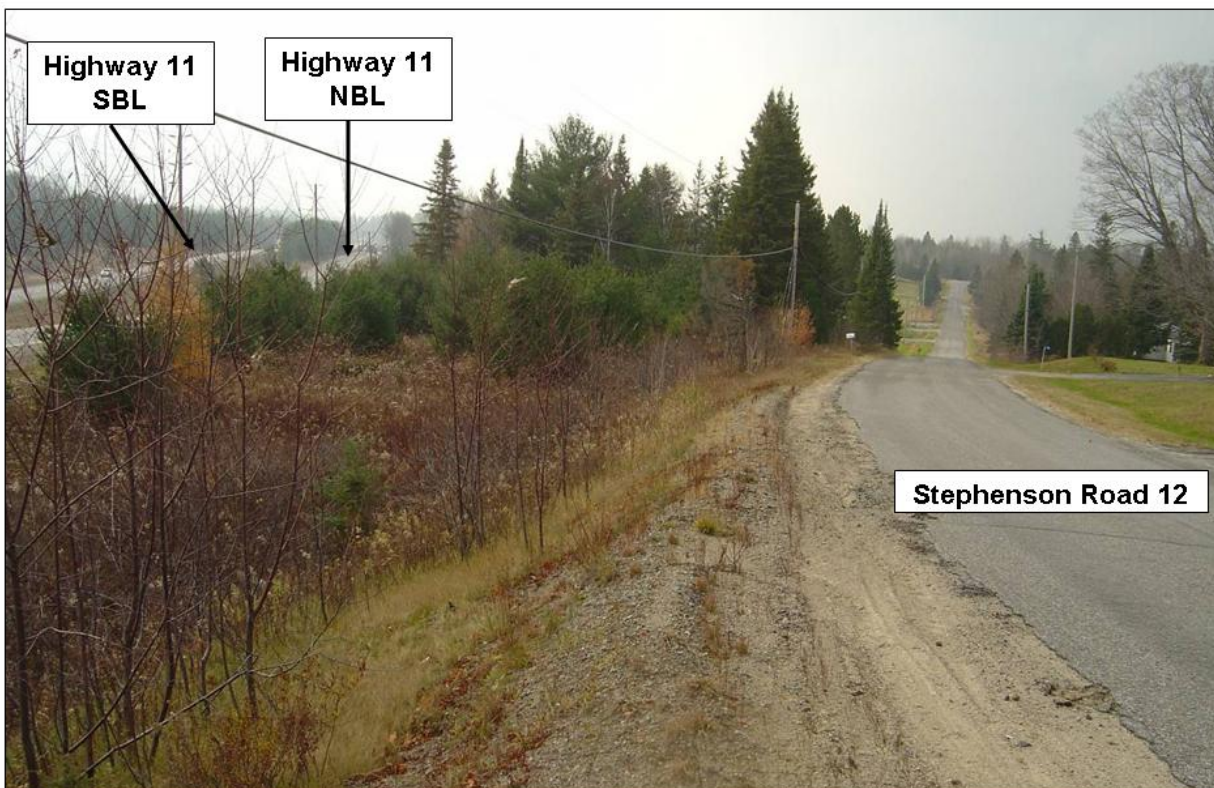
Photograph 47 VIEW: Looking south from south shoulder of Right-in-Lane to Picnic Area at about Sta. 22+525. (Nov. 2007)



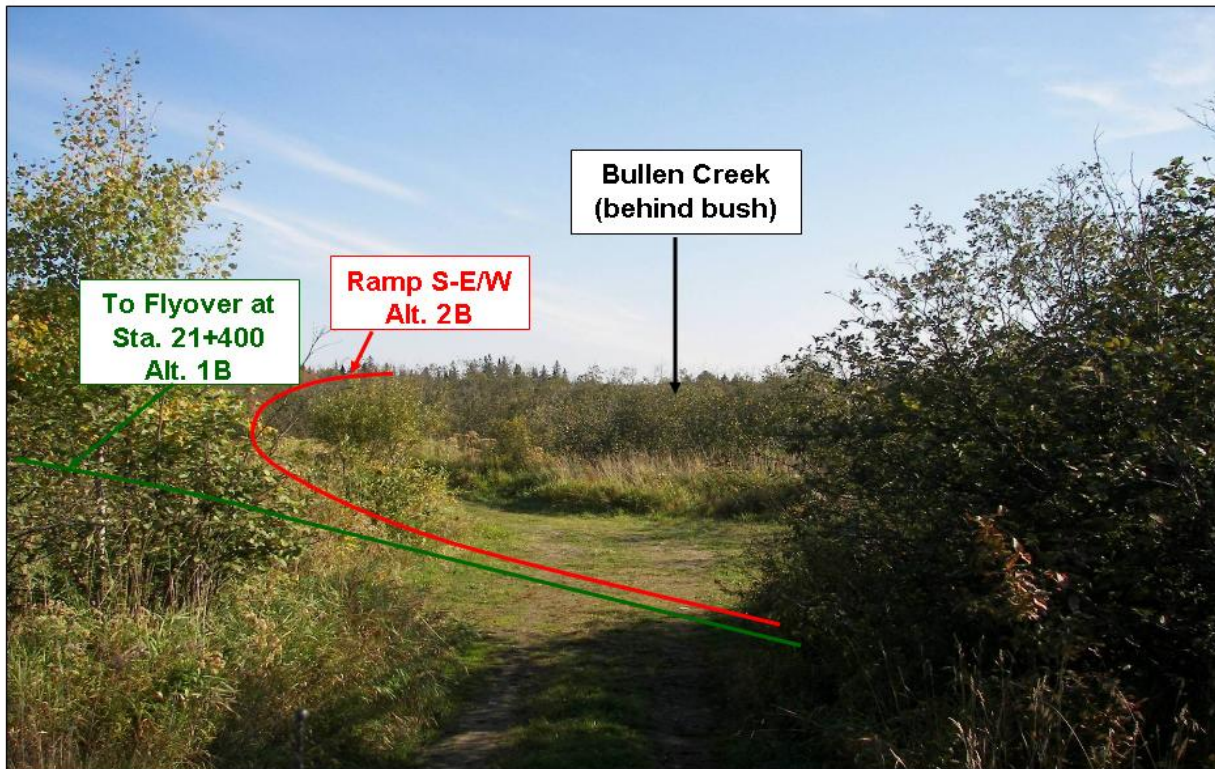
Photograph 48 VIEW: Looking north from traffic island at right turn into MTO Picnic Area at about Sta. 22+580 along Highway 11 NBL east ditch. Bedrock visible in median at Sta. 22+650. (Nov. 2007)



Photograph 49 VIEW: Looking south from west shoulder of Highway 11 SBL at about Sta. 22+680. Bedrock exposures (1.0 to 2.0 m) on both sides of Highway SBL at Sta. 22+620 to 22+680. (Nov. 2007)



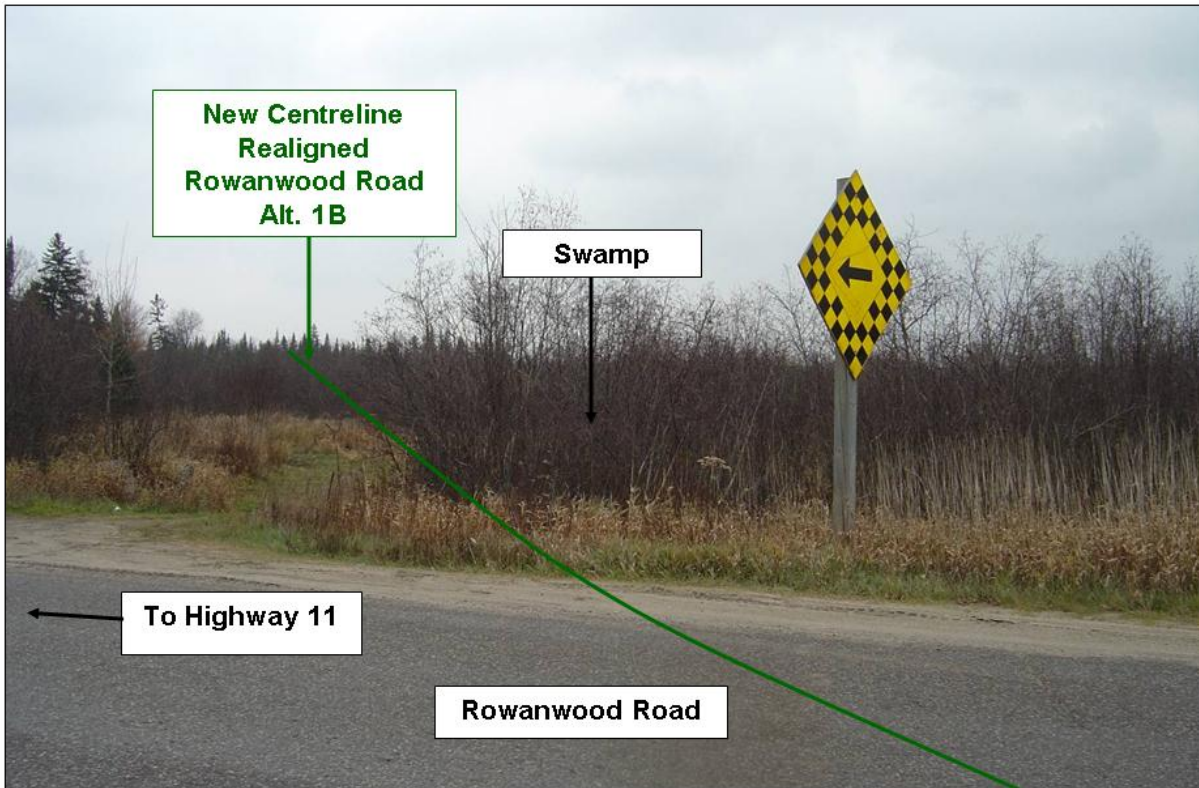
Photograph 50 VIEW: Looking south from east shoulder of Stephenson Road 12 across bush area and Highway 11 bedrock cut in distance. Bedrock cut at Sta. 22+750. (Nov. 2007)



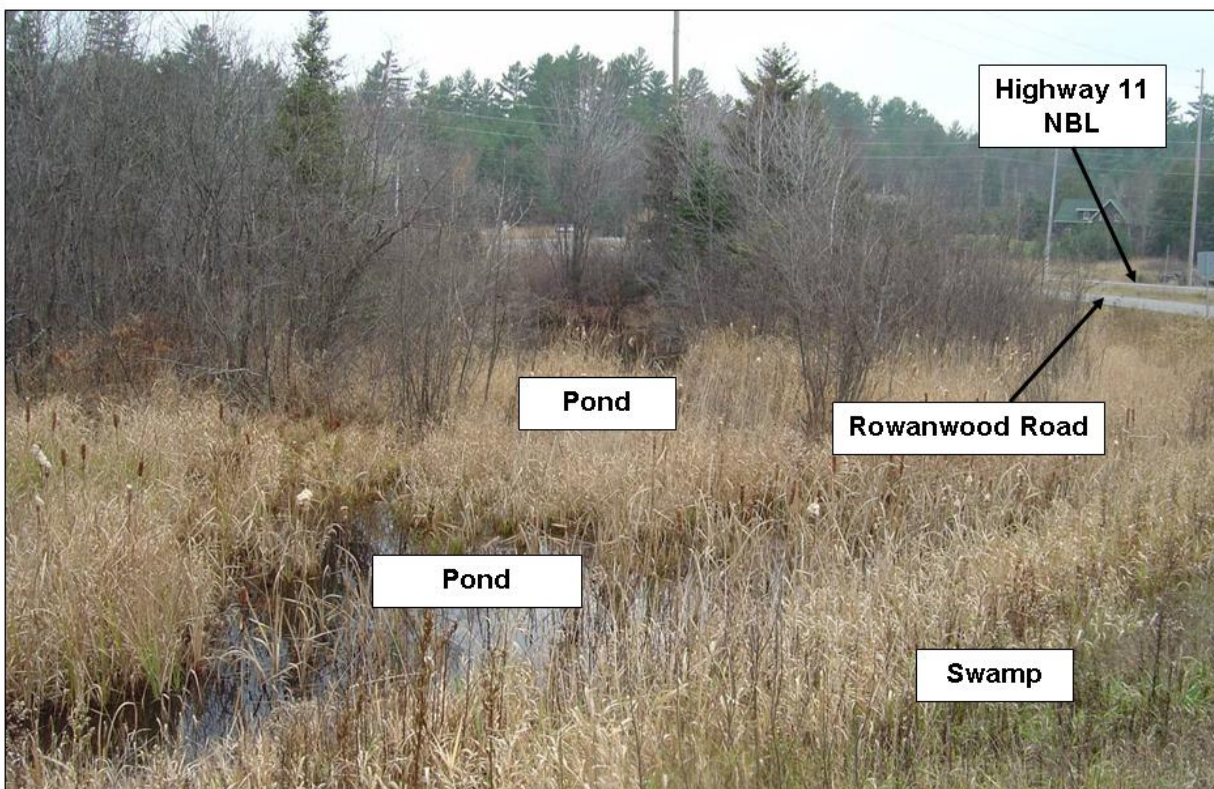
Photograph 51 VIEW: Looking northerly from north shoulder of Rowanwood Road about 120m east of east shoulder of Highway 11 NBL. Connection of Rowanwood Road to alternative flyover at Sta. 21+400 or interchange at Sta. 21+780 are illustrated. Roads are in the Bullen Creek floodplain. (Sept. 26, 2008)



Photograph 52 VIEW: Looking south from east shoulder of Rowanwood Road at about 100 m north of Rowanwood Retirement Home. Swamp area in foreground. (Nov. 2007)



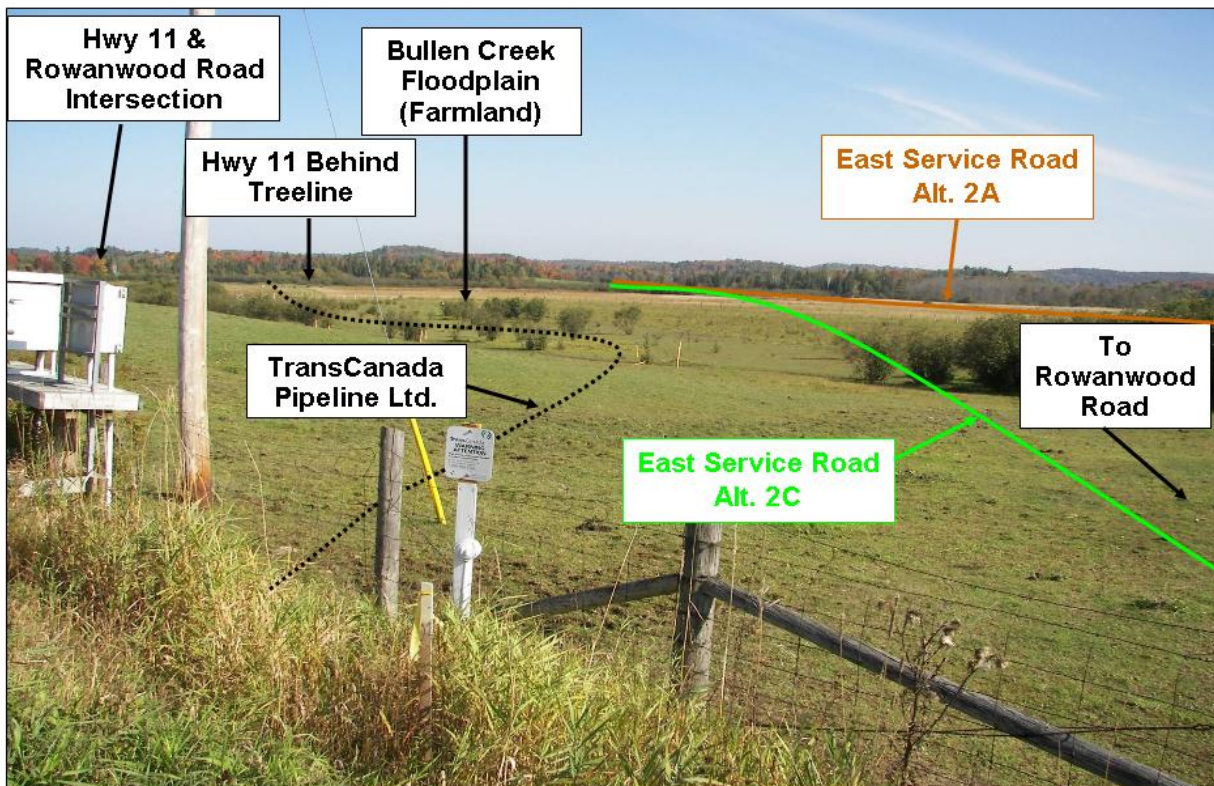
Photograph 53 VIEW: Looking north from west shoulder of Rowanwood Road about 50 m south of Highway 11 at grade crossing along the new centreline of the realigned Rowanwood Road across major swamp area. (Nov. 2007)



Photograph 54 VIEW: Looking west from west shoulder of Rowanwood Road at about Sta. 21+200, some 100 m south of the Highway 11 at grade crossing. Two major ponds readily evident in swamp area at SE quadrant of Rowanwood Road and Highway 11 at grade intersection. (Nov. 2007)



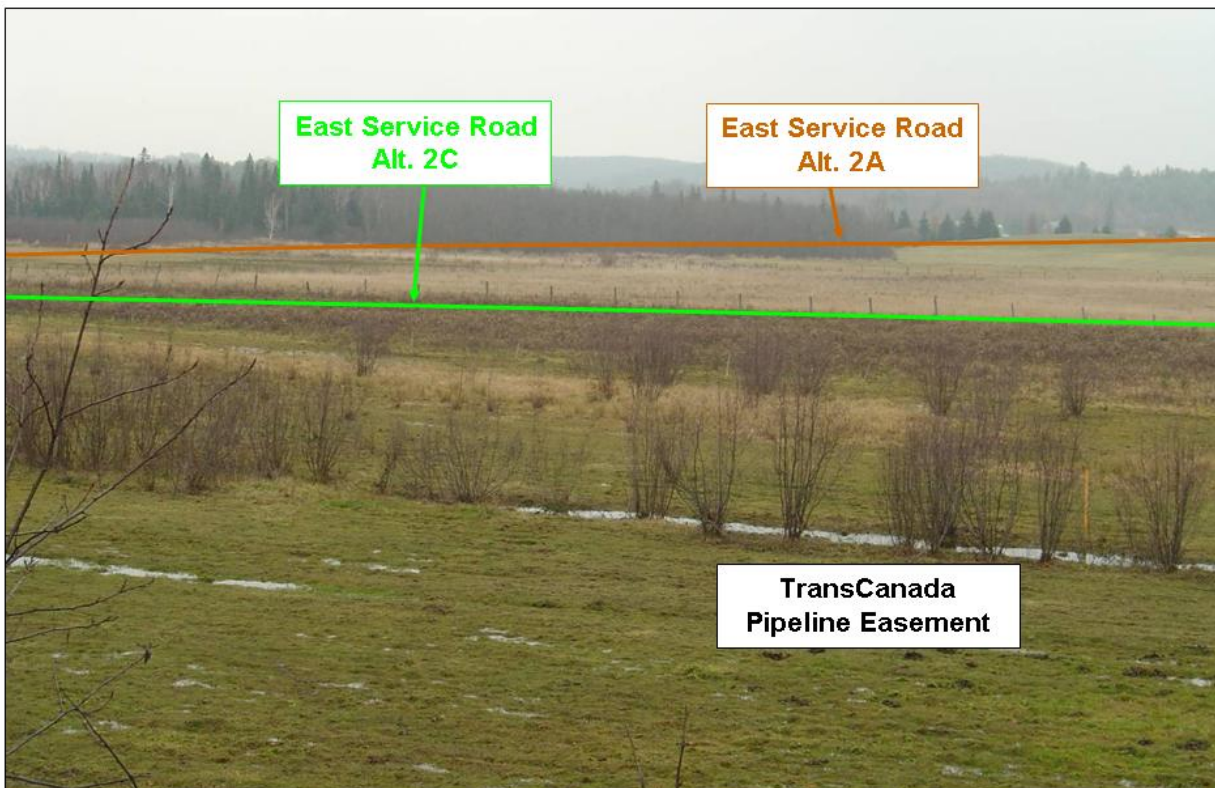
Photograph 55 VIEW: Looking south from east shoulder of Rowanwood Road at single lane bridge structure crossing Bullen Creek at 50 m south of Rowanwood Retirement Home. (Nov. 2007)



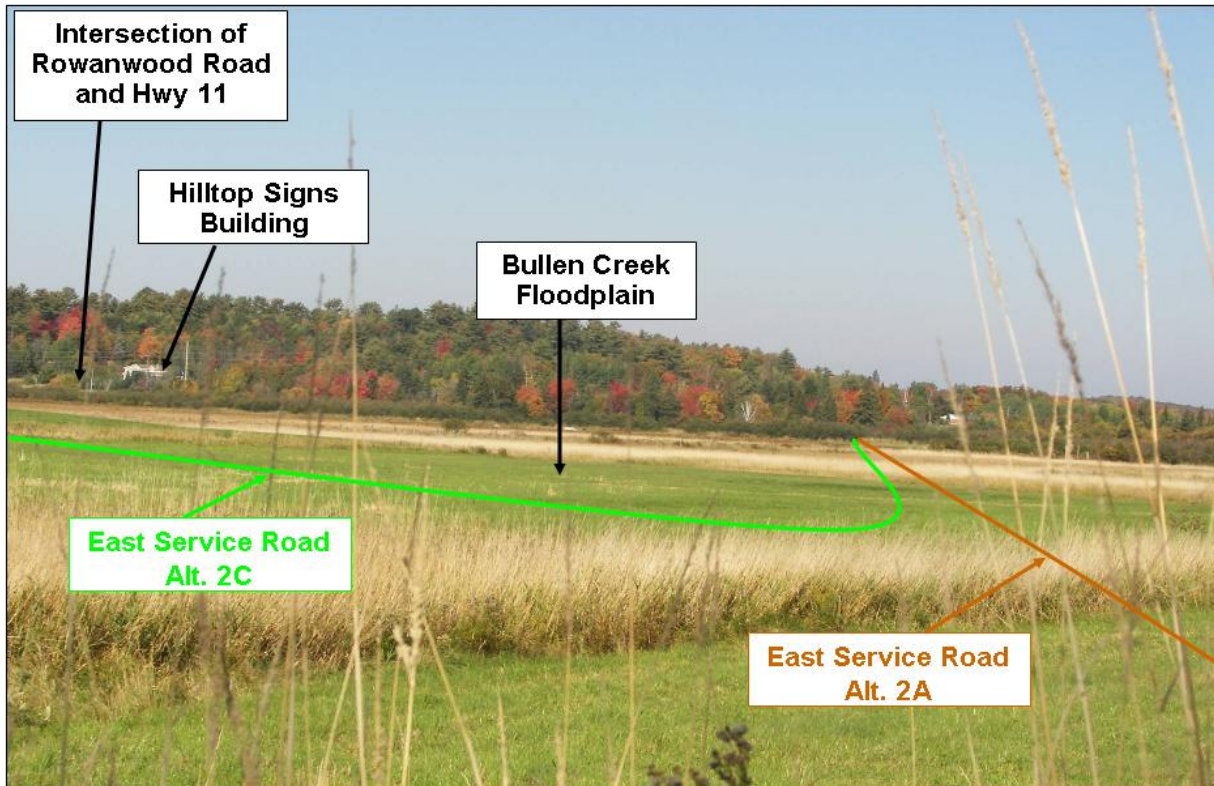
Photograph 56 VIEW: Looking northerly from TransCanada Pipeline Ltd. crossing of Rowanwood Road across Bullen Creek floodplain. Both east Service Road alternatives traverse the Bullen Creek floodplain. (Sept. 26, 2008)



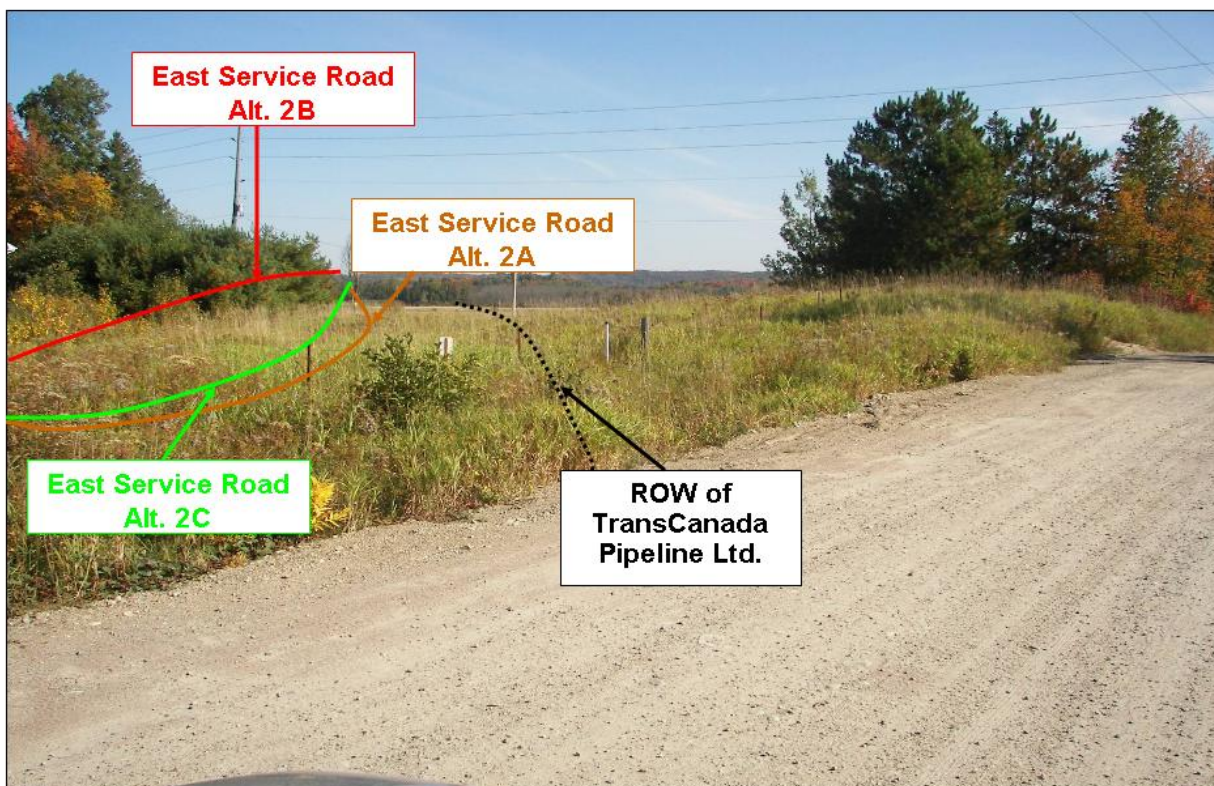
Photograph 57 VIEW: Looking east from east shoulder of Rowanwood Road opposite No.119 (Hoover/Robertson) across open field. TransCanada Pipeline Easement in foreground at creek. (Nov. 2007)



Photograph 58 VIEW: Looking northeast from east shoulder of Rowanwood Road opposite No. 119 (Hoover/Robertson) across open field with bush and swamp area in distance. TransCanada Pipeline Easement in foreground at creek. (Nov. 2007)



Photograph 59 VIEW: Looking westerly from Rowanwood Road to Highway 11 across Bullen Creek floodplain. (Sept. 26, 2008)



Photograph 60 VIEW: Looking southerly along right-of-way of TransCanada Pipeline Ltd. East Service Road alternatives 2A, 2B and 2C traverse typically silty/sandy deposits in this section. (Sept. 26, 2008)