

MEMORANDUM

To: Christopher Schueler, P.Eng.
AECOM

Date: January 11, 2016

From: Sydney Pang, P.Eng.
Alastair Gorman, P.Eng.
(Reviewed by P.K. Chatterji, P.Eng.)

File: 19-4406-20

PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN SILVER CREEK CULVERT (SITE 15-165/BC)

1. INTRODUCTION

This memorandum presents a brief summary of the factual findings from a geotechnical assessment carried out for the existing Highway 7 crossing at Silver Creek in the Municipality of Lanark. It also presents preliminary geotechnical recommendations for use in assessment of the existing foundations and for preliminary design at the site. It is understood that the required minimum rehabilitation work is proposed to include concrete repairs on the barrel, inlet and outlet.

The recommendations provided in this memorandum are for planning, structure evaluation and preliminary design purposes only. Additional investigation and analysis may be required in any subsequent detail design phase of the project.

The following reference numbers apply to this site:

- Current W.P. 4014-13-01
- Site No. 15-165/BC
- GEOCRES No. Not Applicable
- Historic W.P. Not Applicable

2. SITE DESCRIPTION

The site is located on Highway 7 near the Silver Lake Provincial Park, approximately 27 km west of Perth in the Geographic Township of Sherbrooke, Municipality of Lanark. Based on the description in Section 6.3.3 of the RFP, the existing culvert is a cast-in-place concrete rigid frame open footing culvert with a span of 6.1 m, an overall length of 21 m and an approximate fill cover of 0.6 m above the culvert. A historic geomatics drawing dated June 2006 confirms the dimensions above and indicates a culvert height of 1.4 m. The highway embankment in the vicinity of the culvert is approximately 1.5 m high. The year of construction is unknown and the culvert has never been rehabilitated.

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The mapping in the Physiography of Southern Ontario by Chapman and Putnam shows that the site lies within the physiographical region known as Algonguin Highlands. The subsurface in this area is characterized by glacial tills and outwash sand and gravel of varying thicknesses overlying Precambrian granitic bedrock.

Locally, this site lies within swampy terrain where Silver Creek flows under the highway.

3. SUBSURFACE CONDITIONS

No foundation information was found in the Geocres library for this culvert site.

4. SITE OBSERVATIONS

Foundations engineering staff from Thurber visited the site in 2014 to observe conditions related to the general geotechnical performance.

There were no obvious signs of settlement or distress in the foundations. It appears that the pavement in the vicinity of the culvert has recently been resurfaced.

The highway embankment slopes appeared to be stable, with no obvious signs of instability or bulging. There were some minor toe erosion at the creek water level near the outlet area. Visible concrete deterioration was noted on the outlet face of the culvert.

Photographs of the structure and the overlying embankment are attached in Appendix B.

Results of structural inspections carried out in 2010 and 2011 indicated concrete deterioration in the form of spalling, cracking and honeycombing at random locations on the interior and exterior faces of the culvert.

5. EXISTING FOUNDATIONS

Based on a historic geomatics drawing dated June 2006, the culvert is of the concrete, rigid frame, open footing type. This information generally confirms the dimensions discussed in section 2 above.

There is no historic drawing nor other information available for the footing dimensions and founding stratum. According to the geomatics drawing, it may be assumed that the culvert is founded at approximately 2.8 m depth below the highway grade. Using a highway grade at Elevation 178.4 m, it is estimated that the founding level of the culvert is at approximate Elevation 175.6 m. Confirmation of these levels may be required for the rehabilitation works.

6. ASSESSMENT OF EXISTING FOUNDATIONS

There is no site-specific foundation information on which to base an assessment of the structure foundations.

Structural inspection was carried out by others in 2011 as part of the Ontario Bridge Management System (OBMS). Results documented on inspection forms indicate concrete spalling at some



locations and scaling along the culvert length, and presence of a wide soffit crack that extended to the wall with exposed reinforcing steel at the south end.

The RFP document suggested that the required minimum rehabilitation work is expected to consist of concrete repair on the barrel, inlet and outlet. Accordingly, there should not be appreciable increase in the loading on the foundations.

As per an MTO internal memorandum titled "Bridge Office Bulletin: Design and Evaluation of Foundations" dated August 20, 2013, MTO guidelines for bridge rehabilitation do not require foundation elements to be evaluated, provided that the rehabilitation treatment does not increase loading by more than 10% from the original design. Assuming these guidelines are applicable to this site, it is anticipated that additional site investigation and field testing would not be required to support the preparation of foundation design recommendations, unless replacement/extension of the structure is anticipated or there would be an increase in loading in excess of 10% of the original foundation design loadings.

In addition, an underwater inspection carried out in 2009 indicated that the culvert footings were partially exposed from the stream bed at both walls. This wording and the sketches in the report indicate that the tops of the footings were exposed above the stream bed. It is not known if the culvert was constructed like this or if the exposure is the result of scour. The fact that the tops of the footings are partially exposed does not necessarily indicate a problem. However, without any information on the depth of the footings or the founding stratum, it is not possible to carry out any analysis. In practical terms, the culvert appears to be performing satisfactorily to date, suggesting that the foundations have not been compromised.

If the performance of the footings is considered to be a concern, we recommend that a further search be made for design drawings and that a site investigation and testing program be carried out to explore the ground conditions below the culvert.

7. EXCAVATION AND ROADWAY PROTECTION

If the selected rehabilitation strategy requires excavation above or beside the culvert, it is recommended that site investigation and field testing be carried out in order to characterize the fill and to select parameters for the design of the rehabilitation, roadway protection, shoring and dewatering. The number and depth of boreholes can be determined after the rehabilitation strategy has been selected.

8. CLOSURE

Factual subsurface information for foundation purposes is not available for this site. Visual observations during our site visit in 2014, structural inspection records from 2010 and 2011 have been used in preparation of this memorandum.

This memorandum was prepared by Dr. Sydney Pang, P.Eng., and reviewed by Mr. Alastair Gorman, P.Eng., and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.



THURBER ENGINEERING LTD.

Sydney Pang
Jan. 11, 2016

Sydney Pang, P.Eng.
Senior Foundation Engineer

[Signature]
DPX 11/16

Alastair Gorman, P.Eng.
Project Manager, Senior Foundation Engineer

P.K. Chatterji
Jan 11/16

P.K. Chatterji, P.Eng.
Review Principal, Designated MTO Contact
Attachments

Appendix A
Historic Drawings

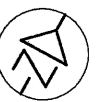
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METRIC

PLATE No 255-7/9-0

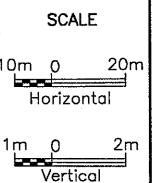
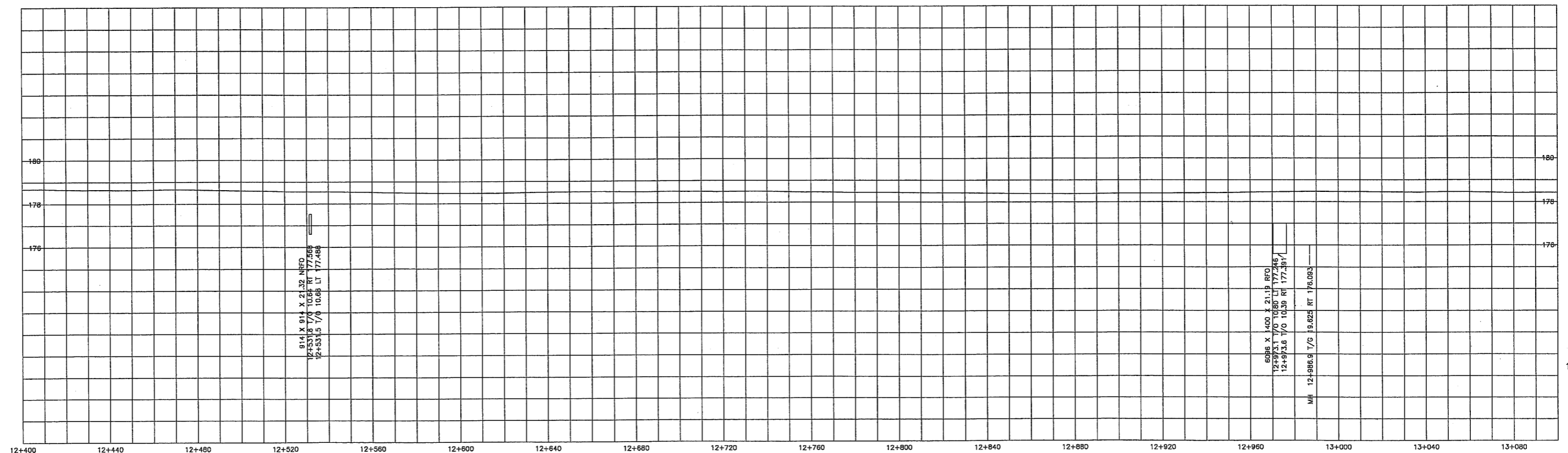
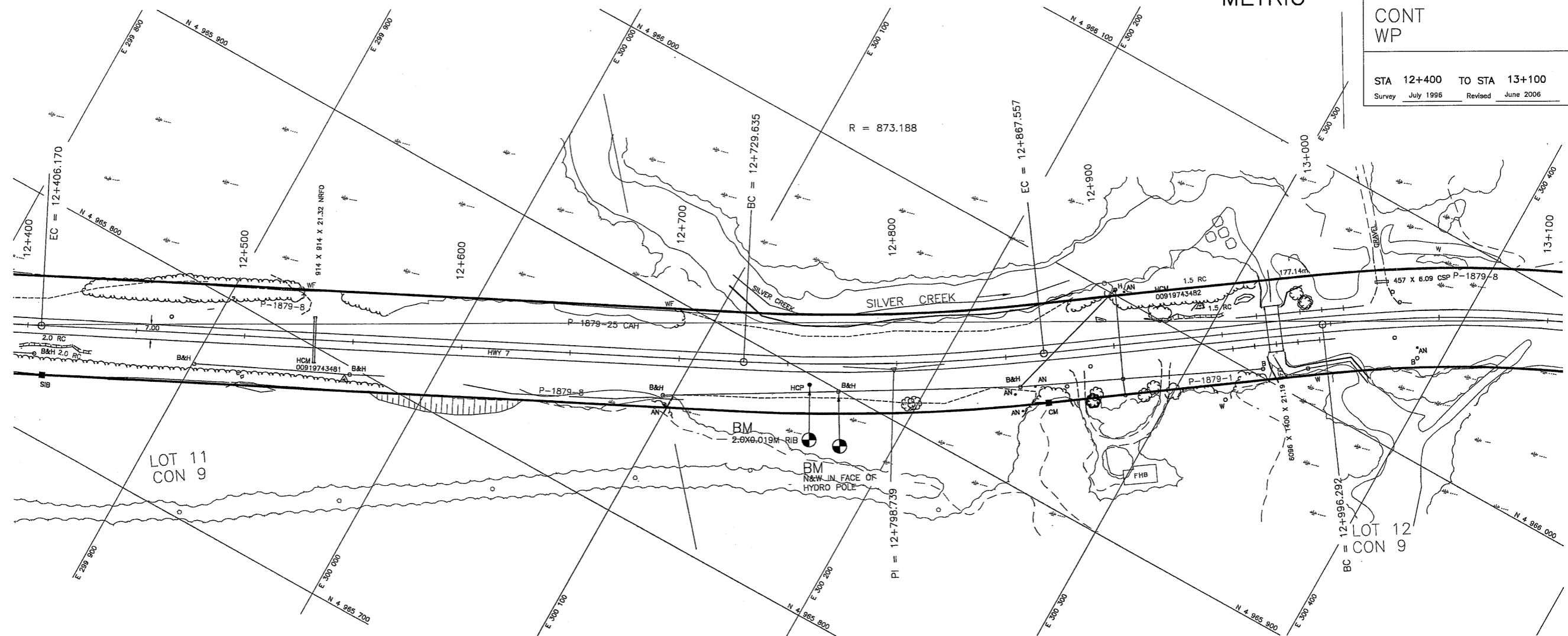
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STA 12+400 TO STA 13+100
Survey July 1996 Revised June 2006



SHEET

Drawing Prepared by J. D. Barnes Limited July 2005





Appendix B

Site Photographs



Photo 1 North End of Culvert Looking South



Photo 2 Top of Highway Embankment Looking East (repaved surface)



Photo 3 South End of Culvert Looking North