



THURBER ENGINEERING LTD.

MEMORANDUM

To: Christine Shillinglaw, P.Eng.
McIntosh Perry Consulting Engineers

October 28, 2020

From: Stephen Peters, P.Eng.
Reviewed by PK Chatterji, P.Eng.

Thurber File No.: 20244

**FOUNDATION ENGINEERING CHANGE ORDER 5
HIGHWAY 11 CULVERT REHABILITATION (SITE NO. 42X- 194/C0)
NORTHEASTERN REGION**

AGREEMENT NO. 5017-E-0003

Dear Ms. Shillinglaw:

Thurber Engineering Ltd. (Thurber) has prepared this memorandum to provide foundation engineering support to McIntosh Perry Consulting Engineers (MP) for the rehabilitation of the Highway 11 culvert (site no. 42X-194/C0 located approximately 200 m south of the Highway 117 overpass.

Exp Services (exp) has provided foundation design recommendations within Geocres Report 31E-383 for the trenchless overflow culvert, to be located south of the existing culvert alignment, and for lining/grouting of the existing culvert. The authors of the Geocres Report are solely responsible for the accuracy and quality of the subsurface information in their report and the design recommendations they have provided. It is understood that a survey discrepancy was incorporated in exp's original borehole survey and the updated Borehole Location and Stratigraphy drawing provided on Oct. 26th, 2020 is attached.

Thurber's scope of work is outlined in the memorandum dated March 23, 2020.

Culvert Settlements

The General Arrangement (GA) drawing provided by MP indicates that the existing culvert is a closed box concrete culvert with an opening of 3.05 m wide by 1.52 m height and an overall length of 76.3 m. The proposed GRP Structural Liner from Channeline International is indicated to be 2.748 m wide (outside) by 1.224 m height (outside) with a wall thickness of 0.104 m. The weight of the liner is approximately 1,100 kg/linear meter. Based on the increase in loading from the new liner and grouting of the annulus, the settlement of the foundation soils is estimated to be in the order of 15 to 20 mm. Lesser settlement would be expected at the toes of the embankment. Additional settlement is expected if substrate is added inside the culvert.

It is anticipated that some groundwater drawdown will occur as part of the liner installation and installation of the new overflow culvert to the south. It is estimated that settlement, in the order of 5 to 10 mm, could occur for each 1 meter of temporary drawdown.



It should be noted that the anticipated settlement is elastic and will occur relatively quickly. The structural capacity of the existing concrete culvert should be reviewed.

Cross Vane

The General Arrangement (GA) drawing provided by MP indicates a cross vane is to be installed at the outlet (west) end of the culvert. It is understood that this cross vane takes the place of the rock fill ramp/weir that was requested as part of the scope of work and therefore, foundation recommendation for a rock fill ramp/weir are no longer required.

The low flow channel is shown to be filled with 500 to 700 mm diameter boulders placed to a base elevation near the culvert invert elevation/existing ground level of the existing culvert. Some removal of the existing ground would be required along the alignment of the new overflow culvert to maintain a consistent base elevation. Special foundation preparations are not required, provided the native soils are protected from erosion.

Trenchless Settlement Monitoring

The new overflow culvert is proposed to be installed 5.5 m (center to center) south of the existing culvert alignment. The new overflow culvert is proposed to have a 2.4 m diameter. The trenchless installation should be completed in accordance with the requirements of Special Provision "Pipe Installation by Trenchless Methods" (July 2020). Monitoring of the roadway surface will be required during trenchless installation. Thus, designer fill-ins are as follows:

**** The Contractor shall furnish, install and monitor Surface Settlement Monitoring Points (SMP) and In Ground Settlement Monitoring Points (IMP) at the locations shown in the Contract Package and in accordance with Section 7.07 of Pipe Installation by Trenchless Methods.

***** Project specific review and alert levels are not required. The review and alert levels within Section 7.08 of Pipe Installation by Trenchless Methods are applicable.

It is understood that MTO is also proposing an instrumentation monitoring plan for the culvert liner to be installed within the existing culvert and the Ministry is working directly with LEA/MP for the design of that monitoring program.

Additional Trenchless Recommendations

As indicated above, the design recommendation for the trenchless installation have been provided by exp. However, additional designer fill-ins are required.

* Auger Jack and Bore, Pipe Ramming and Horizontal Directional Drilling

** N/A

*** Rockfill, wood logs and organics have been encountered within the boreholes (Geocres 31E-383) and could be encountered during trenchless



installation. The Contractor's equipment should be capable of handling such obstructions and the Contractor shall provide their methodology of how they will remove the obstructions.

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

Yours truly,
Thurber Engineering Ltd.

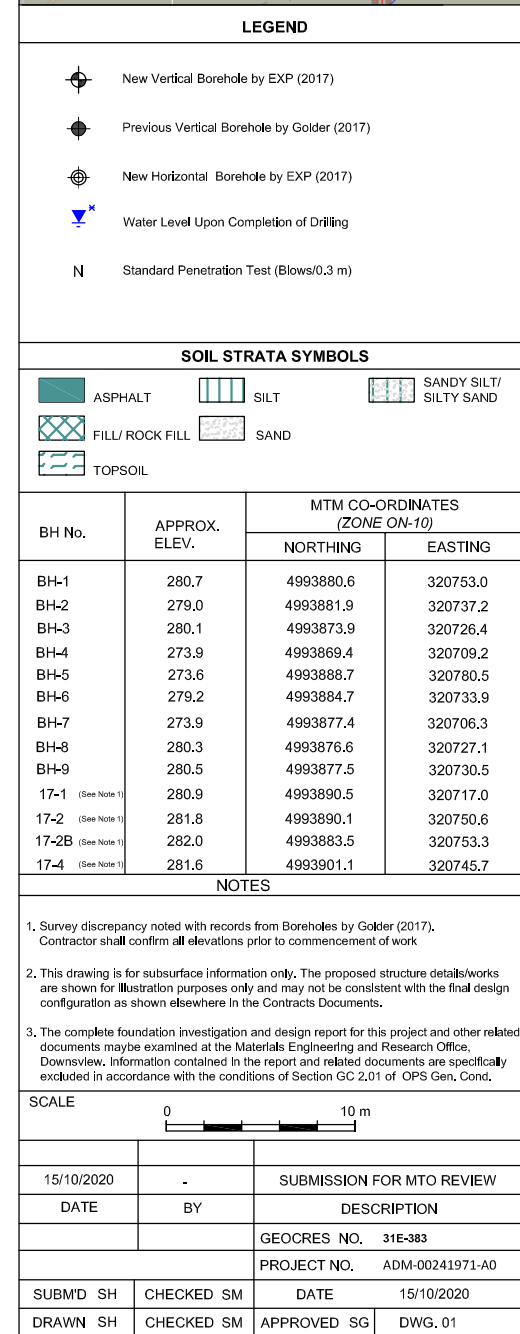
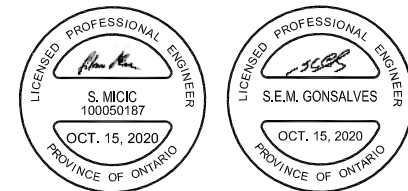
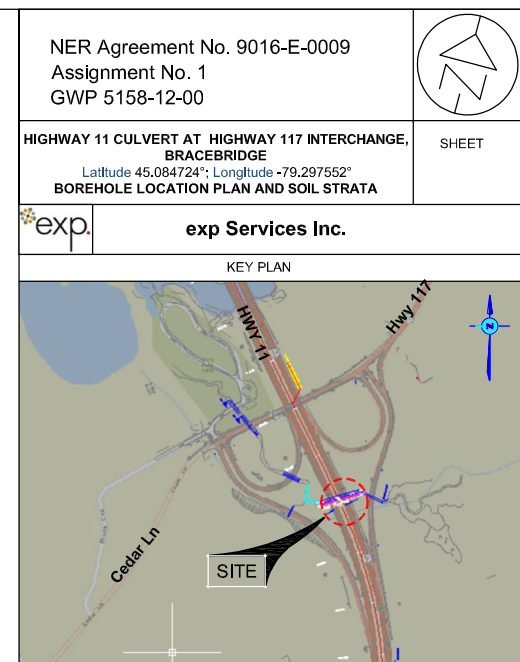
Stephen Peters, P.Eng.
Geotechnical Engineer

Dr. Fred Griffiths, P.Eng.
Senior Associate
Senior Geotechnical Engineer

Dr. PK Chatterji
Designated MTO Contact
Senior Geotechnical Engineer

Attachments

- Borehole Location and Soil Strata Drawing, Geocres 31E-383 (updated October 2020)
- Monitoring Location Plan



NOTES:

1. SURFACE MONITORING POINTS SHALL CONSIST OF HARDENED STEEL MARKERS TREATED OR COATED TO RESIST CORROSION, WITH AN EXPOSED CONVEX HEAD HAVING A MINIMUM 12 MM DIAMETER, SIMILAR TO SURVEYOR'S PK NAILS. EACH POINT SHALL BE RIGIDLY AFFIXED SO AS NOT TO MOVE RELATIVE TO THE SURFACE TO WHICH IT IS ATTACHED.
2. IN GROUND MONITORING POINTS SHALL CONSIST OF 12-18MM REBAR ENCASED IN 50-70 MM, SCH40 PVC, SET TO A DEPTH OF 1.7M BELOW THE GROUND SURFACE. THE ASSEMBLY SHALL BE PLACED IN A DRILL HOLE, BACKFILLED WITH UNIFORM SAND AND PROVIDED WITH SUITABLE PROTECTIVE COVERS AS PER TYPICAL DETAIL.
3. MONITORING FREQUENCY SHALL BE AS PER THE CONTRACT DOCUMENTS.

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

CONT No
GWP No 5158-12-01
HIGHWAY 11 TRENCHLESS
CULVERT REPLACEMENTS
CULVERT 42-194/00
MONITORING LOCATION PLAN

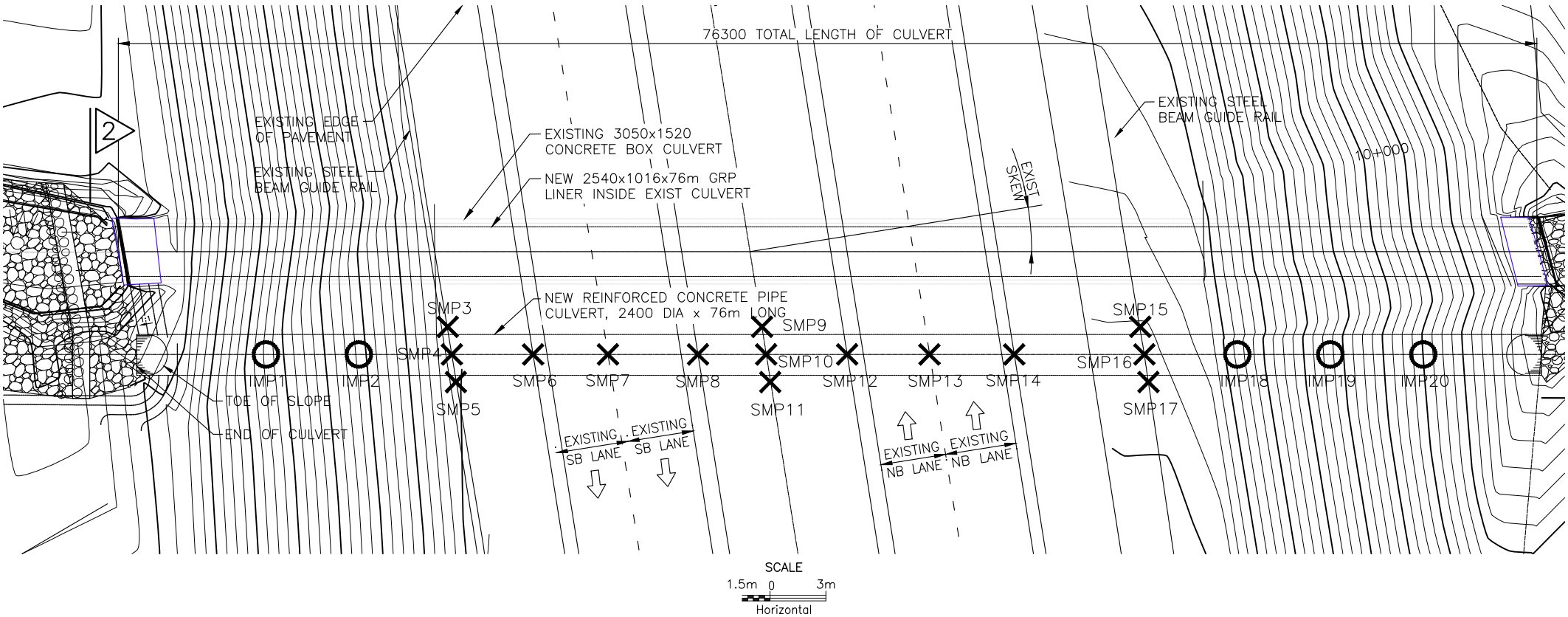


SHEET

McINTOSH PERRY



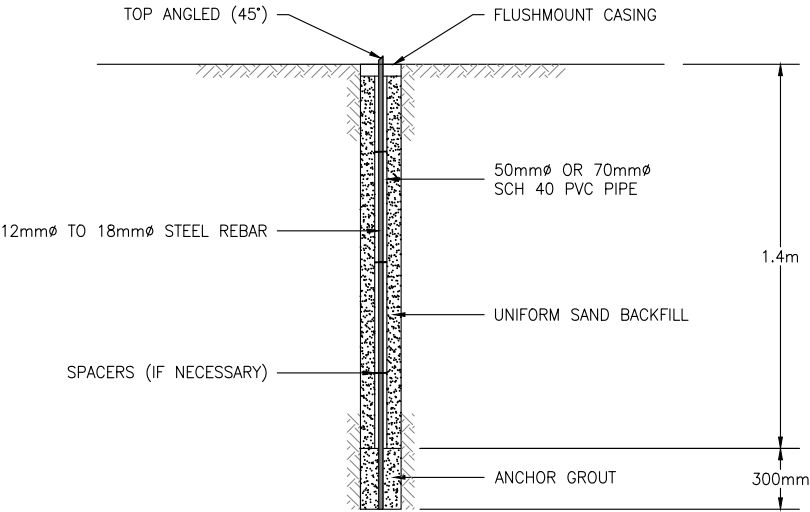
TRENCHLESS CULVERT REINSTATEMENT
CULVERT 42-194/00



X SURFACE SETTLEMENT MONITORING POINT (SMP)
O IN GROUND SETTLEMENT MONITORING POINT (IMP)

NO.	NORTHING	EASTING
IMP1	4 993 872.6	320 710.3
IMP2	4 993 873.9	320 715.1
SMP3	4 993 876.5	320 719.4
SMP4	4 993 875.1	320 720.0
SMP5	4 993 875.1	320 720.0
SMP6	4 993 876.2	320 724.2
SMP7	4 993 877.2	320 728.1
SMP8	4 993 878.4	320 732.8
SMP9	4 993 880.7	320 735.8
SMP10	4 993 879.3	320 736.3
SMP11	4 993 877.9	320 736.9
SMP12	4 993 880.4	320 740.6
SMP13	4 993 881.5	320 744.9
SMP14	4 993 882.6	320 749.3
SMP15	4 993 885.8	320 755.5
SMP16	4 993 884.4	320 756.0
SMP17	4 993 883.0	320 756.6
IMP18	4 993 885.6	320 760.9
IMP19	4 993 886.9	320 765.7
IMP20	4 993 888.1	320 770.6

SETTLEMENT MONITORING POINT (SP) DETAIL



REVISIONS		DATE	BY	DESCRIPTION
DESIGN	SP	CHK	FG	CODE
DRAWN	BH	CHK	SP	SITE 42-194/C2
		LOAD	STRUCT	DATE OCT 2020
		DWG	1	