THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

December 9, 2005 File: 15-85-11

Alberta Infrastructure and Transportation
Room 223, Provincial Building
4709–44 Avenue
Stony Plain, Alberta
T7Z 1N4

Attention: Mr. Michael Baik

NORTH CENTRAL REGION GEOHAZARD ASSESSMENT
HWY 32:10 km 32.2 STOCKWELL EROSION (NC46)
CALL OUT INSPECTION REPORT

Dear Sir;

This letter documents a call out undertaken by Thurber Engineering Ltd. (Thurber) for the above noted site located southwest of Whitecourt, Alberta. The legal land description is 32-59-12-W5M. The work was undertaken under the terms of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE046/2004, Part D) with Alberta Infrastructure and Transportation (AIT).

The inspection was undertaken on May 31, 2005 by Mr. Don Law, P.Eng. of Thurber. The reconnaissance was carried out in the presence of Mr. Roger Skirrow, P.Eng., Mr. Mike Baik and Mr. Daryl Yagos (MCI) of AIT.

1. BACKGROUND

It is understood that erosion has been occurring in the ditch between Hwy 32:10 and the service road running parallel to the highway (see Figure NC46-1 for locations) since the construction of the service road in 2003. During construction, fill was placed to raise the ground level in the area where the erosion has occurred.

2. SITE OBSERVATIONS

The ditch area between the highway and the service road was inspected. In addition, the area upstream and downstream of the erosion was viewed to assess the topography for possible realignment. The following points summarize the observations made during the reconnaissance. Site features are shown on the site plan (Figure NC46-1) attached for inclusion in Section F. A cross-section through the erosion feature is provided in Figure NC46-2. Selected photographs taken during the site reconnaissance are attached.

- Water draining from a wet muskeg deposit runs south through an 800 mm diameter CSP culvert under the service road, and then to the east between the highway and the service road over a distance of about 210 m. The ditch water then discharges to the north through two 600 mm diameter CSP culverts (twin culverts).

- An erosion gully was observed over a length of about 170 m, located approximately as shown on the site plan. The gully was typically 0.8 m to 1.0 m deep and 4 m to 6 m wide, but was up to 1.5 m deep in some places. The erosion gully was formed in very silty sand and sandy silt soil. The gully was flat lying across its base, was observed to have a relatively uniform gradient along its length, and consisted of a very stiff to hard clay soil in the four locations observed in detail along its length. The ditch water appeared to be meandering across the bottom of the gully, and the meandering action had widened the gully locally in some places along its length.

- A silt and sand bar was observed at the downstream end of the gully, located approximately as shown on the site plan. The inlet ends of the culvert were completely buried with sand/silt material at the time of the site visit, with the ditch water seeping through the silt/sand bar before entering the culvert. Water was observed ponded behind the silt/sand bar, which provides a barrier to flow from a highway centerline culvert that discharges to a location southeast of the twin culverts, as shown on the site plan. The outlet (north) end of the centerline culvert was approximately one-third submerged, whereas the inlet end was dry at the time of the site reconnaissance.

- Silt and sand deposits were observed downstream of the twin culvert outlets extending a distance of approximately 100 m into the bush. The ditch water eventually dissipates in this area. The twin culvert outlets are approximately 80% to 90% full of silt and sand deposits.

3. EVALUATION

The twin culverts were not functioning well at the time of the site visit due to the accumulation of silt and sand at the downstream end of the erosion gully. The source of the deposits is expected to be material removed from the sides and base of the gully during erosion, and re-deposited at the twin culvert inlet location. A significant amount of the eroded material has been transmitted through the twin culverts and has been deposited downstream in the bush area. There is no potential for further migration of the sediment into a body of water (river or lake).

Based on the relatively wide base and flat bottom observed in the erosion gully and the meandering nature of the streambed, it is anticipated that the erosion has occurred quickly through surficial silts and sand fill material, and further downcutting has been slowed significantly by the hard clay base (likely native soil).

The erosion gully is not impacting the highway or service road at the present time. However, if left untreated, the erosion gully may migrate laterally a sufficient distance to impact the service road in the future. As a result, additional sediment transport may be experienced which would deposit in the vicinity of the twin culvert inlets and potentially completely block flow through the culverts in the future. Further, the ponded water may build up higher in the outlet area of the highway centerline culvert, which may soften the side slope and potentially trigger slope instability.

4. RISK LEVEL

A risk level of 9 is considered applicable to the highway at this site, based on a Probability Factor of 9 (active with moderate steady or decreasing rate of erosion) and a Consequence Factor of 1 (minor consequence of continued erosion, no immediate impact to driver safety).

5. RECOMMENDATIONS

5.1 Potential Remedial Measures

It is recommended to undertake remedial measures at the site to control the erosion and resulting sediment deposit, and to rehabilitate existing areas that have been impacted by the sediment. Consideration was given to building the ditch area back up to its original grade at the time of construction completion in 2003, however, due to the relatively hard bottom of the gully that is currently reducing further downcutting and the uniform gradient that exists at present for this portion of the ditch, it is recommended to keep the elevation of the ditch invert close to its existing elevation. Redirection of the water away from the area between the

highway and service road was also considered, however this was determined to be impractical.

The erosion gully side slopes should be flattened to a typical slope angle of 2H:1V or flatter by excavation and removal of the silt and sand material. A suitable offsite waste disposal location site should be determined for the excavated material. The slope material should not be pushed into the ditch bottom. The estimated excavation quantity required for the erosion gully is about 200 to 300 m^3.

The sediment collected in the silt/sand bar area in the vicinity of the twin culvert inlets and the sediment deposits observed in the area downstream of the twin culvert outlets should be removed and disposed of in a suitable manner. The culverts should be flushed to remove all remaining sediment and to reestablish effective flow through the twin culverts. The estimated quantity of sediment material in these two areas is in the order of 1500 m^3 and 2500 m^3, and will depend somewhat on the extent of sediment removal determined to be necessary within the bush area downstream of the twin culverts. Disturbed areas should be topsoiled and revegetated soon after removal of the sediment to reduce the likelihood of further erosion in these areas.

The base and sides of the erosion gully after trimming and removal of loose sediment should be lined with large (up to about 200 mm diameter) well graded pit run gravel. The pit run gravel treatment should extend over the full length of the ditch; approximately 220 m. The gravel should be placed on a non-woven geotextile for separation from the underlying silt, sand and clay soils, and should be compacted in one lift at a thickness of about 200 mm (compacted thickness). The estimated quantity of pit run gravel is 250 m^3 to 300 m^3. Grading of the pit run surface may be designed to include small ditch check structures at selected intervals to impede the flow and reduce the erosive force in the ditch. This design should be finalized once the survey information is available.

A topographic survey is recommended to obtain accurate quantities and to provide a basis for design and tender of the remedial works.

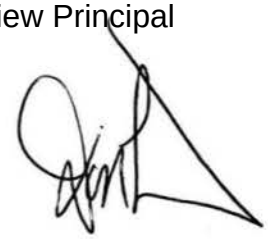
5.2 Estimated Construction Costs

The cost of this work is expected to be in the order of $40,000 to $70,000. The actual costs will be dependent on contractor availability and market costs at the time of tender. A more detailed cost estimate could be prepared once the design has been completed and quantities are known with a higher degree of accuracy.

6. CLOSURE

We trust this assessment meets your needs at this time. Please contact the undersigned should questions or concerns arise.

Yours very truly,
Thurber Engineering Ltd.
Dimitri Papanicolas, P.Eng.
Review Principal



Don Law, P.Eng.
Principal, Project Engineer
/slp

Attachments

cc: Mr. Roger Skirrow, P.Eng., Director of Geotechnical Services, AIT

Z:\15\15-85-11-NC\NC46\FIGURE NC46-1.dwg

N

HIGHWAY CENTRELINE CULVERT

A'

STOCKWELL'S FARM

WHITECOURT

HIGHWAY 32:10

PONDED WATER

SILT/SAND BAR

EROSION GULLY

170m

SERVICE ROAD (GRAVEL SURFACE)

2x 600mmØ CSP

A

800mmØ CSP

BUSH

SILT DEPOSITS

MUSKEG

LEGEND

FLOW DIRECTION

NOTE: SITE FEATURE LOCATIONS ARE APPROXIMATE

ALBERTA INFRASTRUCTURE AND TRANSPORTATION

SITE PLAN

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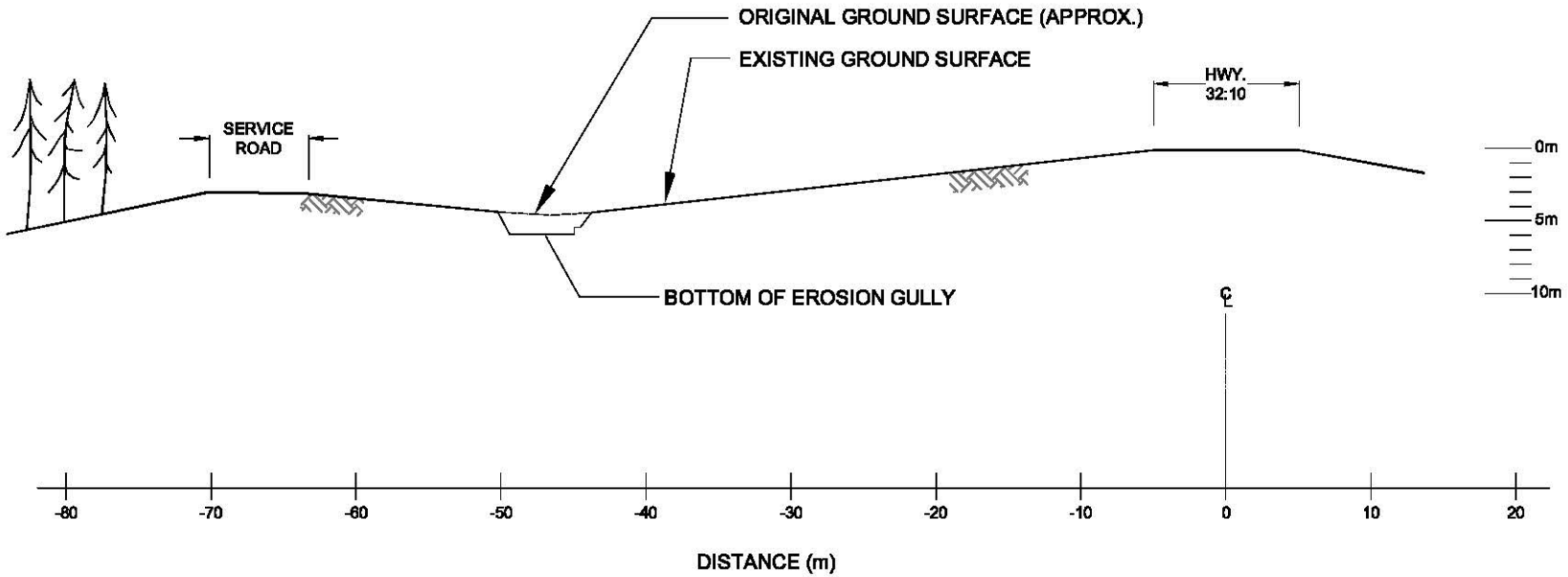
DJL	CMH	
DATE:	SCALE:	DRAWING No.
DECEMBER, 2005	N.T.S.	FIGURE NC46-1

Z:\15\15-85-11-NC\NC46\FIGURE NC46-2.dwg



NOTE: SEE SITE PLAN FOR SECTION LOCATION

ALBERTA INFRASTRUCTURE AND TRANSPORTATION

CROSS-SECTION A-A'

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ENGINEER:	DRAWN:	APPROVED:	
DJL	CMH		
DATE:	SCALE:	DRAWING No.	REV.:
DECEMBER, 2005	APPROX. 1:500	FIGURE NC46-2	

Photo 1 – Looking east from 800 mm dia CSP outlet. May 31, 2005

Photo 2 – Looking east from approx. Section A-A'. May 31, 2005

Photo 3 – Inlet of twin culverts (water seeping in through overlying silt and sand).

Photo 4 – Twin culvert outlet area (looking west). May 31, 2005

Photo 5 – Sand/Silt bar and ponded water in twin culvert inlet area. May 31, 2005

Photo 6 – Ponded water in centreline culvert outlet area. May 31, 2005