



October 14, 2010

CG25332.200

Alberta Transportation  
2<sup>nd</sup> Floor, 803 Manning Road NE  
Calgary, AB T2E 7M8

Attn: Mr. Ross Dickson

**Re: Southern Region Geohazard Assessment Program  
Site S33 – Highway 774, Beaver Mines/“Limber Pine Creek” Site  
2010 Annual Inspection Report**

This letter documents the 2010 annual inspection of the Beaver Mines/“Limber Pine Creek” site located approximately 4.2 km southbound along Highway 774 from Beaver Mines, AB.

AMEC Earth & Environmental (AMEC), a division of AMEC Americas Limited, performed this inspection in partial fulfillment of the scope of work for the supply of geotechnical services for Alberta Transportation’s (AT’s) Southern Region (AT contract CE061/08).

The site inspection was performed on June 22, 2010 by Mr. Bryan Bale, P.Eng., and Mr. Andrew Bidwell, P.Eng., of AMEC in the company of Mr. Neil Kjelland, P.Eng., Mr. Roger Skirrow, P.Eng., and Mr. Ross Dickson of AT.

## **BACKGROUND**

The first work related to this site under AT’s Southern Region Geohazard Management Program was a call-out site inspection by AMEC in June 2008. AT’s request for the call-out inspection followed reports by AT operations and/or maintenance contractor personnel of significant erosion of the downstream face of the large road fill embankment earlier in 2008. Please refer to the report on June 2008 call-out site inspection<sup>1</sup> for a site description along with the initial assessment and recommendations at that time.

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<sup>1</sup> “Report On June 26, 2008 Site Inspection, Site S33 – Highway 774 “Limber Pine Creek”, South Of Beaver Mines, Alberta”, AMEC report submitted to AT, September 8, 2008, AT Consulting Services Agreement CE061/08, AMEC project no. CG25277.D.

## **SITE OBSERVATIONS**

The June 22, 2010 site inspection was the second inspection by AMEC since the initial inspection in June 2008.

Please refer to Figures 1 and 2, attached, for a site plan and cross-section of the highway embankment.

The key observations from the June 2010 inspection are summarized as follows:

- The site has been repaired since the June 2009 inspection. A new segment of culvert outlet has been attached and the slope has been rebuilt. Rip-rap has been placed at the culvert outlet, and in one of the erosion gullies. The repair appears effective, and the slope was in good condition. Photos S33-1 and S33-2 show comparative pictures of the site before and after repair.
- The slope was poorly vegetated at the time of the inspection, and it does not appear that the slope was reseeded after the repair. Refer to Photo S33-3.
- The volume of water flowing through the culvert was likely larger than typical, as evidenced by the flow in the ditch to the north of the highway where the water was flowing overtop the regular ditch channel and overland towards the culvert. The water was being directed through the culvert and into the creek to the south of the site area without causing erosion damage. The repaired culvert and armouring appears sufficient to handle the flow at the site (Photo S33-4).
- Some seepage was observed discharging from the slope approximately midway down the embankment. This likely indicates groundwater flow through the embankment, and may be the cause of the erosion gullies that form near this elevation across the site area. These gullies appear to be in the same condition as has been observed since 2008.
- The inlet and length of the culvert pipe were clear of sediment at the time of the inspection. It was possible to see through the entire length of the culvert (same condition as in past inspections. The dent that has been visible in the crown of the culvert during past inspections appears unchanged. As before, the dent appeared to be within roughly the middle portion of the culvert length.

## **ASSESSMENT**

The repair work appears to have effectively repaired the erosion damage around the culvert outlet. The other erosion gullies upslope and northeast of the culvert outlet remains in the same condition as in past inspections, and currently poses little risk to the road.

The failure of the culvert outlet and erosion of the embankment slope from around the culvert outlet was likely due to:

- Erosion by groundwater seepage through the base of the embankment along with high exit gradients for the seepage around the culvert outlet, or,
- Erosion by creek flow that bypasses the culvert due to the inlet being too high along with the broad, distributed nature of the creek flow in the area upstream of the highway (i.e. not a single, defined channel flowing directly into the culvert), or,
- Erosion due to leakage from the culvert into the base of the embankment.

The mechanism that caused the erosion around the culvert outlet is still not fully understood and it is possible that the erosion may form again despite the recent repairs. The repairs have restored the embankment slopes and culvert outlet to the pre-failure condition, and have eliminated most of the risk to the road surface. However, it would be prudent to continue to visually monitor the site conditions to verify that the repairs continue to be effective.

## **RISK LEVEL**

Based on AT's Risk Level Criteria, the recommended Risk Level for this site is as follows:

- Probability Factor of 3 to reflect the likelihood that ongoing seepage through the embankment will continue, but it is improbable that it will cause extensive damage following the repair work that has been completed.
- Consequence Factor of 1 to reflect that any damage will be minor, and will not affect the road surface immediately. It is assumed that if erosion occurs again, it will occur at a similar rate as observed in 2008 and 2009, and will not immediately damage the road.

Therefore, the recommended Risk Level is 3, which is a reduction from the value of 44 recommended in 2009.

## **RECOMMENDATIONS**

The site should be monitored by the maintenance contractor to identify problems that may arise following the repair. No further inspections are recommended as part of the Geohazard Assessment program.



The regraded embankment slope areas should be hydroseeded as soon as possible to minimize future erosion of the exposed soils.

## **CLOSURE**

This report has been prepared for the exclusive use of Alberta Transportation for the specific project described herein. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it are the responsibility of such third parties. AMEC Earth & Environmental, a division of AMEC Americas Limited, cannot accept responsibility for such damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report has been prepared in accordance with accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

We trust that this meets your needs at this time. Please contact the undersigned if you have any questions or require any further information.

Respectfully Submitted,

**AMEC Earth & Environmental,  
a division of AMEC Americas Limited**

ORIGINAL SIGNED  
OCTOBER 14, 2010

Bryan Bale, M.Sc., P.Eng.  
Geotechnical Engineer

APEGGA Permit to Practice No. P-04546

Reviewed by:

Andrew Bidwell, M.Eng, P.Eng.  
Associate Geological Engineer

Attachments: Figures 1 and 2  
Photos



**Photo S33-1 – June 2009 (top)**  
Facing upstream towards the southeast embankment slope prior to the repair work. Note the failure of the culvert outlet and the erosion around the outlet that has retrogressed up the embankment slope towards the highway. Compare with Photo S33-2.



**Photo S33-2 – June 2010 (bottom)**  
Taken from the same angle as Photo S33-1, showing the repaired culvert outlet and regraded slope. The erosion gullies to the northeast were either lined with rip-rap or left unrepaired.

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**Photo S33-3 – June 2010**

Looking northeast along the embankment crest. The repaired slope appears stable, but has very little vegetation cover.



**Photo S33-4 – June 2010**

Looking down the embankment fill towards the repaired culvert outlet. The culvert was flowing at several hundred litres/minute at the time of the inspection, and the flow was leaving the site area as intended without causing erosion damage.