August 28, 2009

CG25309.B

Alberta Transportation
2nd Floor, 803 Manning Road NE
Calgary, AB T2E 7M8

Attn: Mr. Ross Dickson

Re: Southern Region Geohazard Assessment Program
Highway 742:02 – Goat Pond, South Fan
2009 Annual Inspection Report

This letter documents the June 11, 2009 inspection of the "Goat Pond, South Fan" site located approximately 14 km southbound from the Highway 742/Three Sisters Parkway junction in Canmore, AB. This segment of Highway 742:02 is a two lane, gravel surfaced road and this site is located at the highway crossing of the lowermost portion of a fluvial fan around an unnamed creek from a drainage basin below Three Sisters Pass.

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 11, 2009 by Mr. Andrew Bidwell, P.Eng., and Mr. Bryan Bale, EIT of AMEC in the company of Mr. Neil Kjelland, P.Eng. and Mr. Ross Dickson of AT along with Mr. George Field, Public Safety Specialist for Kananaskis Country with the Parks Division of Alberta Tourism, Parks and Recreation.

BACKGROUND

This site was previously assessed as part of the 2007/2008 geohazards review of the Highway 742 corridor[1]. Please refer to the April 2009 report on this review for a general description of the physical setting and site layout.

A roughly 100 m long segment of the highway is judged to be at risk from debris being deposited onto the road during peak flows along the creek, either at the existing creek crossing or in response to natural shifting and realignment of the creek channel across the fan.

[1] See Appendix A section re. "~Km 5.4 (?) Debris Flow" in AMEC report "Geohazards Review, Highway 742 and Highway 940 Corridors, Southwestern Alberta", submitted to AT on April 8, 2009, AT Consulting Services Agreement CE044/04, AMEC project number CG25262.

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The previous assessment recommended that this site be inspected during the 2009 spring runoff in order to:

- See how the site looks during peak or near-peak flow conditions (the single previous inspection was during October 2008 at which time there was no surface flow along the channel).

- Check if the amount and distribution of debris upstream of the highway changes during the spring 2009 runoff and re-assess the Risk Level for the site on that basis.

SITE OBSERVATIONS

- There was no surface flow along the creek channel for at least 200 to 300 m upstream of the highway crossing nor was there any flow visible for the short distance that the defined channel extends downstream of the highway crossing. Photos 1 and 2, attached, show views of the creek channel from the June 11, 2009 site inspection.

- There were little to no apparent changes to the site appearance since the October 2008 site inspection. It remains unclear as to whether or not there is a culvert below the highway at the crossing.

- The Parks Division personnel remarked that they are not aware of any issues with debris being deposited onto the highway at this site in recent years, but that there is typically "water running across the road each spring".

ASSESSMENT

The hazard of debris being deposited onto the highway at the existing crossing during peak flows and/or the creek channel shifting upstream of the highway crossing and leading to debris being deposited on the highway nearby has not changed. However, given the lack of surface flow in mid-June 2009 likely indicates that the channel carries significant flows less often than first estimated based on the October 2008 site inspection.

There does not appear to be a culvert installed at this site, or if there is then both the inlet and outlet are completely buried by channel deposits.

It may be that surface flow along the channel is able to cross the highway by percolating through the coarse fluvial deposits below the road fill at the crossing along with some water flowing across the road surface without significant erosive force (the creek channel gradient is 5° or less in this area). However, this has not been confirmed to date by a visual inspection while the creek is flowing at surface.

RISK LEVEL

The recommended Risk Level for this site, based on AT's debris flow risk matrix, is as follows:

- Probability Factor of 6 because the site conditions are judged to be between

  Probability Factor of 5 – remote probability of a debris flow based on channel morphology and presence of debris in the potential source zone.

  And

  Probability Factor of 7 – Inactive, occasional debris flow; a debris flow has occurred in the historic past and/or debris buildup in the channel/source area is considered to be ongoing.

  This is a reduction from the Probability Factor of 7 recommended after the October 2008 site inspection.

- Consequence Factor of 5 to reflect debris deposited onto the highway requiring at least partial closure of the highway while maintenance crews use an excavator or loader to clear the debris.

Therefore, the recommended Risk Level for this site is 30. This is a reduction from the Risk Level of 35 recommended after the October 2008 site inspection.

RECOMMENDATIONS

No repair measures are recommended at this time. Instead, any debris flows onto the highway should treated as an immediate priority maintenance task during which time the southern end of Highway 742 will remain accessible via a lengthy detour on Highway 40.

The April 2009 report provided the following comments on possible mitigative measures for the risk to the highway at this site:

It is not practical to attempt to reduce the Probability Factor of debris flows along the creek channel because the source area for the debris comprises the entire creek watershed above the highway. Therefore, the most effective approach to reduce the Risk Level at this site would be to reduce the possibility of debris being deposited onto the road surface in the event of future debris flows or creek channel shifts. This could be done by:

- *Raising the grade of the road surface along an approximately 50 to 100 m segment of the highway centered around the creek channel crossing and, when necessary, cleaning*

of accumulated debris along the main creek channel for a short distance upslope of the road into the ongoing highway maintenance program.

- *Alternatively, constructing a diversion berm a short distance upstream from the road crossing in order to attempt to divert debris flows from reaching the road. The diversion berm could be constructed by an excavator using the existing channel deposits. However, such in-channel work with a permanent change to the drainage course would likely not be approved by the environmental regulatory authorities given that there is the alternative option of raising the road grade as described above.*

These comments remain valid.

It was also noted that a study of historic aerial photographs of this site should allow the frequency of debris flows along this channel to be more precisely estimated and identify any changes in the watershed upstream of the highway that may make this site more prone to significant debris flows in the future. A more extensive ground traverse of the channel upstream of the highway would also be worthwhile to further assess and characterize the debris flow conditions and risk to the highway. The installation of a rainfall gauge with a datalogger to record hourly precipitation amounts would be of interest in a longer-term research effort into debris flow activity along this creek channel.

CLOSURE

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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

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

APEGGA Permit to Practice No. P-04546

Reviewed by:

Pete Barlow, M.Sc., P.Eng.
Principal Geotechnical Engineer

Attachments: Photos 1 and 2
AT Debris Flow Risk Matrix