

December 2013

CG25399

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

**Attention: Mr. Ross Dickson**

Dear Ross:

**Re: Southern Region Geohazard Assessment  
2013 Annual Inspection Report  
Site S36: Highway 800:02, Belly River Erosion Site**

This report documents the 2013 annual site inspection of the Site S36 – Belly River site located in 18-3-27 W4M, approximately 9 km northbound along Highway 800 from the junction of Highway 5 and Highway 800 and approximately 17 km westbound along Highway 5 from Cardston, AB. The site is located within the boundaries of the Blood Indian Reserve 148.

AMEC Environment & Infrastructure (AMEC), a division of AMEC Americas Limited, performed this inspection in partial fulfilment of the scope of work for the supply of geotechnical services for Alberta Transportation's (AT's) Southern Region (AT contract CON0013506).

The site inspection was performed by Bryan Bale, P.Eng., Hui Wang, P.Eng, and Tyler Clay, E.I.T., of AMEC; and Roger Skirrow, P.Eng., and Ross Dickson, of AT during the 2013 Annual Tour.

## **1.0 SUMMARY**

The site was repaired in 2012. The repaired area appeared stable and overall the site was in good condition apart from minor erosion and settlement issues. The risk level has decreased significantly due to the repair work. Ongoing instrument monitoring and inspections are recommended to assess the performance of the repair. The site should be inspected and instruments read next in 2014.

## **2.0 BACKGROUND**

A call-out inspection<sup>1</sup> was performed at this site in June 2009 by AMEC after AT reported that the riverbank and valley slope above the Belly River had retrogressed rapidly towards Hwy 800 and that the road surface was at risk of becoming undermined. The inspection noted that landsliding was occurring on the outside bank of a meander of the Belly River, and that the nearly vertical upper scarp would likely continue to retrogress into the highway ditch and road shoulder. At the time of the inspection, the headscarp was offset 3 to 4 m from the fenceline and approximately 12 m from the paved road surface. Short-term repair work was recommended to

<sup>1</sup> AMEC Earth & Environmental, 2009. *Report on June 26, 2009 Site Inspection, Highway 800:02 – Belly River Erosion Site*, Project Number CG25309.D submitted to AT, July 2, 2009.

stabilize the upper scarps. The selection and design of an overall and more permanent repair for the site was also recommended.

AMEC inspected the site again on May 12, 2010 after AT reported that the headscarp of the landslide had retrogressed further towards the highway. At the time of the May 2010 inspection it was noted that the headscarp had retrogressed to approximately 2 to 3 m upslope of the fenceline and had reached the ditch invert, and was approximately 5 to 6 m from the downslope edge of the road surface. An approximately 15 m long segment of the fence had been undermined since the June 2009 inspection.

AT proceeded with a temporary repair at the site in late May and early June 2010, with geotechnical input provided by AMEC. An approximately 40 to 50 m wide segment of the landslide headscarp centered around the point of maximum retrogression towards the road was excavated back to a 1H:1V slope and 6 m long launched soil nails were installed in the excavated slope face. The approximate area of the repair work is shown on Figure 1. Nails were installed on a 1 m grid, with 2 to 3 rows of nails installed. AT's maintenance contractor also installed a buried drainage pipe along the west ditch across the landslide encroachment area in order to intercept ditch flow and divert it around the slide area to prevent the water from discharging directly into the landslide headscarp area.

AMEC performed a geotechnical investigation and instrument installation in March 2011, and prepared a repair design. Construction of the repair was performed in 2012. The repair included bank armouring, flow control structures, buttress fill, sub-drainage and bioengineering erosion control. Piezometers were installed in the sub-drain to monitor drain performance and some of the monitoring instruments from the 2012 geotechnical investigation remain operational. The instrumentation and ongoing visual observation of the site condition will provide long-term monitoring of the future repair performance. Please refer to AMEC's design report for details<sup>2</sup>.

### 3.0 SITE OBSERVATIONS

Please refer to Figure S36-1, attached, for a site plan of the new repair, and also to AMEC's design report (AMEC, 2012) for more information on the general site layout and conditions.

Key observations from the May 2013 inspection are summarized as follows:

- The site repair work was complete and the site was re-vegetated in Spring 2012 Refer to Photos S36-1 and S36-2 for a comparison of the site before and after the repair as viewed from the river towards the north end of the site. No evidence of continued slide activity was identified.

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<sup>2</sup> AMEC Environment & Infrastructure, 2012, *Hwy 800:02 – Belly River Site, Design of Streambank Protection and Slope Stabilization*, AMEC Report, File No. LT106510, February 2012.

### Borrow Area

- The borrow area at the south end of the site was in fair condition, with minor rilling of the benches. There was approximately 10% vegetation coverage with young grass sprouting. Refer to Photo S36-3.
- The southwest ridge at the borrow area was in good condition and had compost berms, hydroseed and broadcast mulch products installed. There was approximately 10% of vegetation growth coverage. The only visible area of erosion contained in the main bench below the borrow area and in the woven mat covered collection ditch. Refer to Photo S36-4.

### Buttress Fill Area

- The buttress fill area was in good condition. The upper bench faces of the buttress fill appeared stable; however, there was practically no vegetation growth. The mulch area on the bench platforms had approximately 5% vegetation growth coverage. Approximately 80% of the tree or shrub plantings appeared to have survived. The erosion protection mat areas had 30 to 40% vegetation coverage.
- The lower-most bench face within the main slide area appeared stable, was covered with broadcast mulch and had 30 to 40% vegetation coverage. Refer to Photo S36-5. The bench platform had poplar plantings, mulch and was 50% vegetated. Most of the tree plantings appeared to be alive. The designed back-tilt of the bench was wet during the inspection. The sub-drains discharged in this area and appeared to be wet at the outlets. There were two piezometer installations on the bench. Refer to Photo S36-6 for an overall view of the bench area.
- The second bench face was in similar condition as the lower-most bench. The bench itself had approximately 70% of the poplar plantings alive.
- The third bench face had 30% vegetation cover with no visible erosion. There was one piezometer installation on the face.
- The south collection ditch was intact with minor sediment deposits. It was wet at the time of the inspection and had approximately 30 to 40% vegetation coverage. Refer to Photo S36-7.
- The access road at approximately mid-slope was covered in mulch and seed, with 10 to 30% vegetation coverage and no visible erosion. The upslope cobble lined ditch of the access road appeared to be in good condition. Refer to Photo S36-8.
- The bench faces upslope from the access road had no visible erosion and 10 to 30% vegetation coverage. The benches themselves had no visible erosion, were 10 to 30% vegetated and most of the rose plantings were alive. There was a settlement area near

an old instrument installation that was reportedly a warranty defect that will be fixed in the future. Refer to Photo S36-9.

#### Riverbank Area

- The flat area near river level at the south end of the site was in good condition. All the willow plantings were alive, including those along the Longitudinal Peak Stone Toe Protection (LPSTP). There was good vegetation growth along the LPSTP. Refer to Photo S36-10 for a general view of the area.
- The river flow was relatively high during the inspection. The LPSTP appeared to be effectively aligned and the vanes were intact. The vanes had trapped a large amount of wood debris and were becoming infilled with sediment as planned. Refer to Photo S36-11.
- A 1.0 m wide and 0.35 m deep settlement area or erosion hole was observed along the top of the rip rap and edge of the willow cuttings at the north end of the site. Refer to Photo S36-12.

#### Highway Area

- The west highway ditch was re-graded and had coconut matting and straw berms installed. The erosion control measures were in good condition, vegetative growth was starting and there was no visible erosion. The ditch was wet. Rip-rap was in place at the ditch outlet, there were no signs of current or past flow. Refer to Photo S36-13.
- The instruments on the road shoulder at the north end of the site appeared intact.
- The road above the previous slide area had no visible damage.

## **4.0 ASSESSMENT**

In general, the repaired area appeared to be in good condition aside from minor erosion issues in areas with exposed soil. It is expected that the erosion rates will reduce as vegetation develops. Vegetation had established well in the first few weeks of the growing season.

The observed settlement erosion areas will be checked during follow up inspections but are not considered to affect the repair performance or represent significant issues.

The performance of the repair will be assessed from ongoing monitoring instrument readings and visual inspections to check for stability of the benches, drainage conditions, vegetation growth and performance of the LPSTP and vanes. During the inspection all repair components appeared to be functioning as intended.

## **5.0 RISK LEVEL**

AMEC recommends the following Risk Level for this site, based on AT's general geohazard risk matrix:

- Probability Factor of 2, based on the repair work substantially changing site conditions and essentially removing the previous slide hazard and conditions driving slide movement. Remobilization of previous slide movement along the same extents is considered improbable. This is a significant reduction from the previous probability factor of 13 assigned in 2011 prior to the repair work. This factor can be reduced further following observation of stable conditions for several years.
- Consequence Factor of 2, reflecting the removal of the geohazard as a result of the repair work. In its observed state, there was no longer an observable hazard that would impact the pavement. If the slide were to continue there is no longer a risk of scarp collapse affecting the road. This is a reduction from the previous factor of 3 assigned in 2011 prior to repair work, when active sliding was still present adjacent to the highway.

Therefore, the recommended Risk Level is 4 (i.e. 2 x 2), which is reduced significantly from the 2011 assessment of 39 and reflects the completion of the 2012 repair work.

## **6.0 RECOMMENDATIONS**

The instruments at the site should continue to be monitored semi-annually as part of the Southern Region Geohazard Program and the site should be inspected during the 2014 Annual Tour to check the repair performance and for changing conditions.

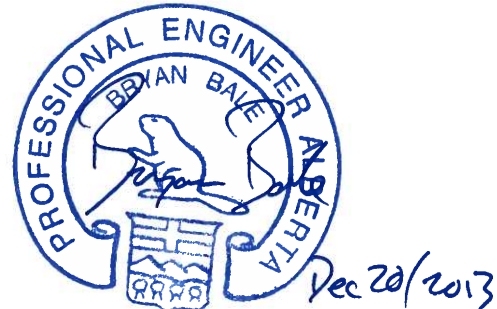
## 7.0 CLOSURE

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 Environment & Infrastructure, 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 Environment & Infrastructure,  
a division of AMEC Americas Limited**



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APEGA Permit to Practice No. P-04546

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