September 8, 2008

CG25277.B

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

Attn: Mr. Ross Dickson

Re: Southern Region Geohazard Assessment Program
Site S16 – Chain Lakes, Highway 22:08
2008 Annual Inspection Report

This letter documents the 2008 annual site inspection of Site S16 – Chain Lakes, along Highway 22:08, approximately 45 km south of Longview, AB and approximately 3.6 km south of the junction between Highway 22 and Highway 533. The highway crosses an unnamed creek via a fill embankment at this site.

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 25, 2008 by Mr. Andrew Bidwell, P.Eng. and Mr. Bryan Bale of AMEC in the company of Mr. Roger Skirrow of AT.

BACKGROUND

A general description of the geohazard conditions at this site along with the site geological setting and chronology of previous events, investigations, monitoring and repair work were provided in the previous annual inspection report[1] and are summarized as follows:

- A landslide occurred at this site in July 2005 and resulted in the closure of the southbound lane of the highway. A subsequent geotechnical site investigation determined that the landslide was seated in the glaciolacustrine silt and clay soils underlying the road embankment, with the failure surface possibly extending along the weathered surface of the underlying clay shale bedrock.

[1] AMEC report "Southern Region Geohazard Assessment, Annual Assessment Report, 2007", project number CG25263, submitted to AT on November 6, 2007.

AMEC Earth & Environmental
A division of AMEC Americas Limited
221 – 18th Street SE
Calgary, AB, CANADA T2E 6J5
Tel +1 (403) 248-4331
Fax +1 (403) 248-2188 www.amec.com

- Repair work consisting of a tied-back pile wall and the trenchless installation of a replacement culvert was completed during the summer of 2006.

- Two slope inclinometers (SI's) were installed in March 2007 to enable follow-up monitoring for landslide movement at this site. SI 2007-1 was installed immediately upslope of the central portion of the pile wall, and SI 2007-2 was installed a short distance downslope of the pile wall.

SITE OBSERVATIONS

Key observations regarding changes in the site conditions since the 2007 inspection are summarized as follows:

- The segment of the road surface through the repair area that was repaved in early 2007 showed a diagonal crack across the southbound lane at the south end of the repaved area. Photo S16-1 shows the crack, which had an aperture of 5 to 10 mm at the time of the inspection. The portion of the southbound lane bounded by the crack had downdropped between roughly 0 and 5 mm relative to the northbound lane. The approximate location of the crack is shown on the attached site plan.

- The north end of the repaved area did not show any signs of damage, as shown on Photo S16-2.

- The revegetation on the regraded embankment slopes was well-established, as shown on Photo S16-3.

- Settlement of the backfill used to bury the pile wall and reconstruct the west embankment slope had exposed the tops of most of the piles with an open tension crack having formed between the downslope side of the piles. Photos S16-3 and S16-4 show typical views of the exposed piles. The downdrop of the backfill on the downslope side of the pile wall was up to approximately 50 mm and the open tension crack along the downslope side of the pile wall varied in aperture up to approximately 30 mm.

- A groundwater discharge area was noted on the lower portion of the southwest embankment slope, approximately 3 to 5 m downslope and southwest of SI 2007-2 (see site plan). The discharge area was delineated by a clover patch underlain by moss cover on the slope. No distinct surface flow channel could be found through the thick vegetation, but the ground was soft and there was audible water flow.

- The groundwater discharge area further to the south that was noted in June 2007 was not present during the June 2008 inspection.

- Some surface water flow was visible in the upslope (east) highway ditch on the north side of the driveway extending east from the highway alignment, however it infiltrated into the ground a short distance to the north.

The May 2008 instrument readings at this site showed that SI 2007-2 (downslope of the pile wall) is tracking active landslide movement around the same elevation as the 2005 landslide movement. SI 2007-1 (upslope of the pile wall) is showing much smaller amounts of landslide movement at a similar elevation and above the base of the pile wall. Please refer to the Spring 2008 monitoring report for further details and discussion.

ASSESSMENT

Overall, the site appears to be in good condition after the 2006 repair and to date the SI's installed in the west embankment slope have shown that the pile wall appears to be preventing significant, ongoing landslide movement below the road surface. However, the cracking in the southbound lane may represent the southern flank of ongoing landslide movement that is damaging the road surface despite the pile wall installation. The cracking may also simply be the result of normal post-construction settlement of the backfill used to reconstruct the upper portion of the road embankment. Future inspections of the site will help to determine if the damage to the road surface is continuing or worsening.

The groundwater discharge areas noted at different locations on the lower portion of the west embankment slope during the 2007 and 2008 inspections are certainly not favourable from a stability perspective for the road embankment. However, to date they do not appear to have triggered any localized slope instability.

RISK LEVEL

The current recommended Risk Level for this site, based on AT's general geohazard risk matrix, is as follows:

- The Probability Factor for this site should be set at 6 to reflect the active landslide movement that has been confirmed in SI 2007-2 downslope of the pile wall and the lesser, but confirmed, landslide movement measured to date in SI 2007-1 upslope of the pile wall. This is an increase from the value of 5 recommended after the 2007 site inspection, based on the Spring 2008 SI data.

- The Consequence Factor for this site should be set at 1 to reflect the design of the pile wall that does not rely on the support of the upper portion of the embankment slope downslope of the pile wall to maintain support to the road surface. This also reflects the

fact that the road surface cracking to date in the south end of the repair area is very minor and easily manageable as a maintenance issue.

Therefore, the current recommended Risk Level for this site is 6, which is a slight increase from the value of 5 that was recommended after the 2007 inspection.

RECOMMENDATIONS

Maintenance and Short Term Measures

- AT's maintenance contractor should seal the crack across the southbound lane at the south end of the repaved area.

Long Term Measures

- The semi-annual instrument readings should be continued until at least the spring of 2009 in order to confirm that the pile wall is being effective in minimizing any landslide movement upslope of the pile wall.

- Another annual site inspection should be performed in 2009. A decision on whether or not to continue the annual site inspections can be based on the findings from the 2009 inspection.

Investigation

No further investigation work for this site is recommended at this time.

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

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

APEGGA Permit to Practice No. P-04546

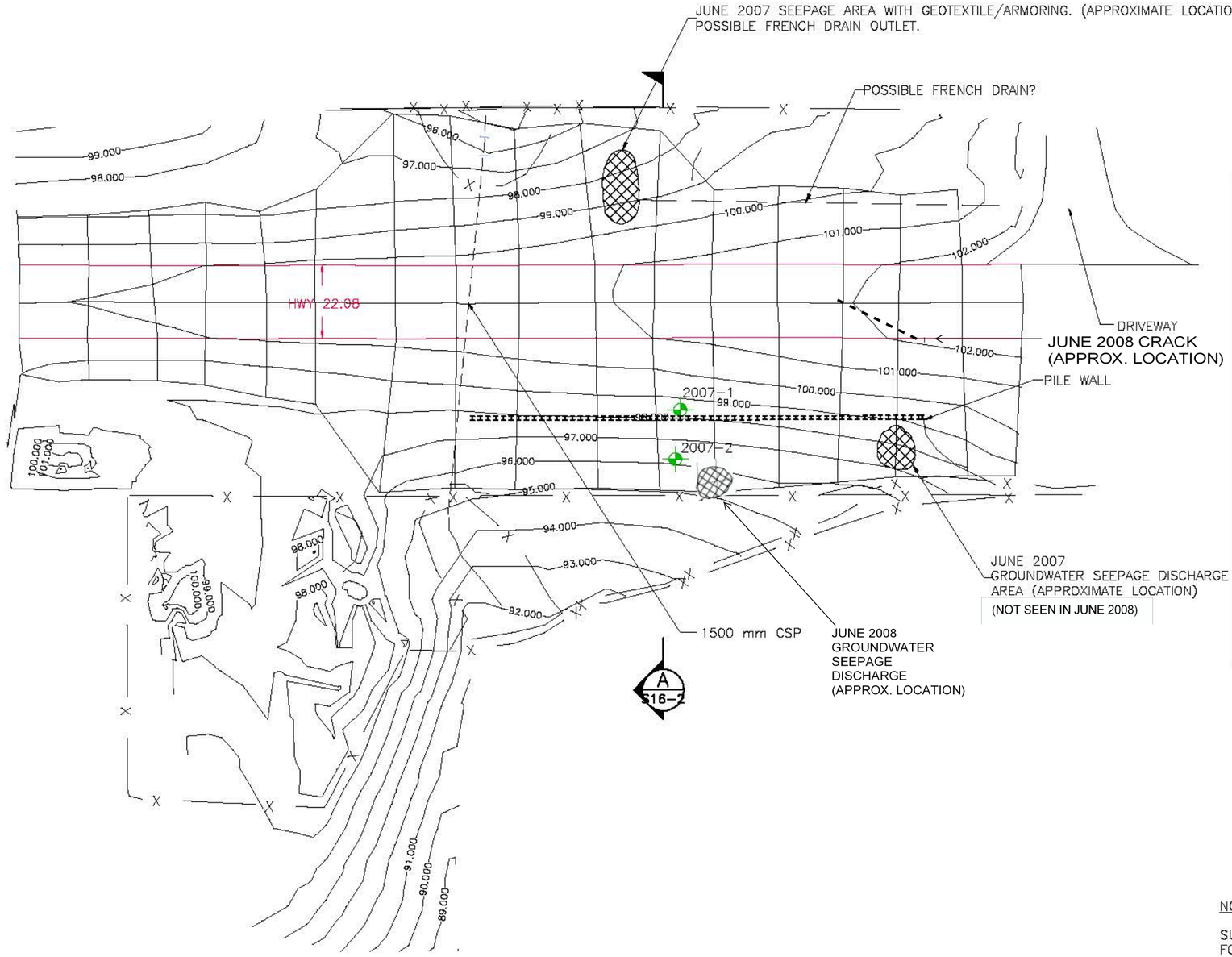
Reviewed by:

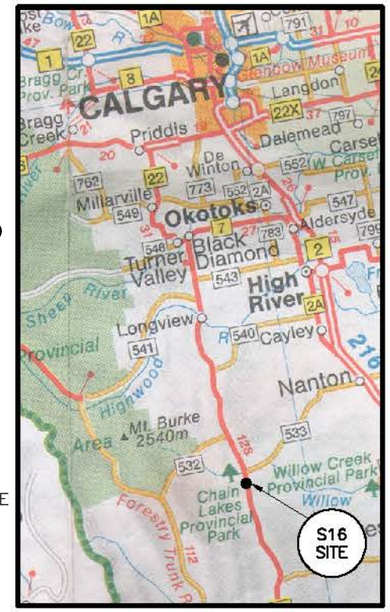
Paul Cavanagh, M.Eng., P.Eng.
Associate Geotechnical Engineer

Attachments: Site Plan
Photos

JUNE 2007 SEEPAGE AREA WITH GEOTEXTILE/ARMORING. (APPROXIMATE LOCATION)
POSSIBLE FRENCH DRAIN OUTLET.

POSSIBLE FRENCH DRAIN?





LEGEND:

SLOPE INCLINOMETER

NOTES:

SURVEY PROVIDED BY AMEC INFRASTRUCTURE FOR LANDSLIDE REMEDIATION CONTRACT NO. 7231/06

SCALE
1: 750
0 5 10 15 m

amec Earth & Environmental

CLIENT: Alberta Transportation

PROJECT:	SOUTHERN REGION GEOHAZARD ASSESSMENT
TITLE:	S16 – CHAIN LAKES, HWY 22:08 SITE PLAN
DATE:	AUGUST 2008
JOB No.:	CG25277.B
CAD FILE:	
FIGURE No.:	FIG. S16–1
REV.	A

Photo S16-1 (top) – June 2008

Facing south across the segment of the southbound lane that was taken out of the service by the 2005 landslide and repaved following the 2006 repair.

Photo S16-2 (bottom) – June 2008

Facing north across the segment of the southbound lane that was taken out of the service by the 2005 landslide and repaved following the 2006 repair.

The visible crack in the foreground and extending across the southbound lane at the south end of the repair area has formed since the spring of 2007. It may represent the south flank of continued landsliding affecting the highway (despite the installation of the pile wall), or simply post-construction settlement of the upper portion of the road embankment fill that was reconstructed in 2006.

Photo S16-3 (top) – June 2008

Typical view facing south along the pile wall alignment on the west embankment slope. Settlement of the backfill used to bury the top of the pile wall and reconstruct the embankment slope has exposed the tops of most of the piles and opened a tension crack along the pile wall alignment.

Photo S16-4 (bottom) – June 2008

Closer view of the exposed top of one of the piles.