



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 S23 – Slide East Of Mill Creek, Highway 507:02
2008 Annual Inspection Report**

This letter documents the 2008 annual site inspection of Site S23 – Slide East Of Mill Creek, along Highway 507:02, immediately east of the bridge over Mill Creek and approximately 5 km eastbound from the junction between Highway 507 and Highway 774 near 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 26, 2008 by Mr. Andrew Bidwell, P.Eng. and Mr. Bryan Bale of AMEC in the company of Mr. Ross Dickson and 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 report¹ and are summarized as follows:

- This site is on the east approach slope to the bridge over Mill Creek. The highway is oriented east/west on a cross-slope down towards the north. The highway appears to have been constructed in a slight cut, possibly with a small fill embankment along the north side of the right-of-way.
- The highway was damaged by landslide movement at this site during the mid-1980's and early 1990's.

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

- A repair was made in late 1993 consisting of excavating an approximately 120 m segment of the highway through the landslide damaged area to approximately 6 m depth and reconstructing with higher quality backfill along with the installation of a trench drain along the south ditch and a series of finger drains trenched into the landsliding slope above the highway. There were no records of post-repair monitoring of the site, however the lack of records or further information in the file implies that the repair was successful.
- This site came to attention in 2004 when AT personnel noted an apparent reactivation of the landslide movement above (south of) the highway with the toe of the landsliding encroaching into the south ditch. No damage to the road surface was noted.
- AMEC performed a call-out site inspection of this site in September 2006. It appeared that the east end of the landsliding in the slope above the highway was relatively active with numerous rotational landslide blocks visible in the slope profile and delineated by numerous open tension cracks and areas of uniformly back-tilted trees. The west end of the landslide above the highway appeared to be relatively inactive. There was no damage to the highway surface at the time of the 2006 inspection, nor during the 2007 site inspection. A schematic site plan and cross-section of the landslide area are attached as Figures S23-1 and S23-2.

SITE OBSERVATIONS

- There were some minor changes in the visual appearance of the site since the June 2007 inspection, however the overall landslide conditions and associated risk to the highway had not changed significantly.
- The toe lobe from the landslide above the highway appeared to have encroached very slightly more into the south ditch since the 2006 and 2007 inspections, however the fenceline crossing the toe area of the landslide was straight and did not appear to have been deformed by significant landslide movement in recent years. The ditch was still able to convey surface flow despite the encroachment. There were no signs of significant erosion in the ditch to constriction of its width by the landslide toe lobe. Photos S23-1 and S23-2 show views of the toe lobe in the south ditch.
- The eastern flank of the landsliding above the highway was traversed and it appeared that there had been some additional dropdown and lateral movement of the landslide body relative to the headscarp since the 2006 inspection, however the headscarp did not appear to have retrogressed any further upslope. Photo S23-3 shows the headscarp area as it appeared during the June 2008 inspection.

ASSESSMENT

It appears that the active landslide movement in the east end of the landslide area upslope of the highway is ongoing. However, the rate of movement is uncertain and to date there has been negligible consequence to the south ditch capacity and no visible damage to the highway surface.

It is possible that continued landslide movement will eventually block the south ditch, and/or further reactivation of the landsliding may affect a larger area and damage the highway itself (as was reported prior to the 1993 repair). This does not appear likely based on the visual inspection of the landslide area and adjacent slopes, however it cannot be entirely ruled out.

RISK LEVEL

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

- Probability Factor of 10 to reflect the apparent active landslide movement in the slope above the highway with uncertainty as to whether or not the movement rate is increasing, decreasing or holding steady.
- Consequence Factor of 2 to reflect the potential for future landslide movement to eventually block the south ditch and encroach onto the south shoulder of the highway. This is a reduction from the value of 3 recommended after the 2007 inspection.

Therefore, the recommended Risk Level for this site is 20, which is a reduction from the value of 30 recommended after the 2007 inspection.

RECOMMENDATIONS

Maintenance and Short Term Measures

No specific measures are recommended for this site at this time.

Long Term Measures

If the landslide movement worsens and begins to block the south ditch, then one of the following options could be used to restore and maintain the ditch capacity:

- Excavate the landslide debris as necessary to clear the ditch. This will only work for the short term as it will promote additional landslide movement that will "re-fill" the ditch.

- Install a one of two layer gabion wall or another type of reinforced block wall system keyed into the ditch base in order to attempt to hold the landslide toe lobe above the ditch base. This may work for a reasonable period of time if the gabion wall is sufficient to support the localized portion of the landslide mass. However, the gabion wall may get pushed over or even flowed over by continued landslide movement.
- Installation of additional trench drains extending up into the landslide area to try to lower the groundwater levels in the landslide area and increase the resisting force against landslide movement.
- Trim the slope in the landslide area back to a lower angle, in conjunction with additional trench drains in order to try to stabilize the landsliding. This option would be extremely costly and disruptive without a very high assurance of success, and is not recommended.

The annual site inspections by AT and AMEC personnel should be discontinued. Additional inspections should be performed if the landslide movement accelerates and the south ditch becomes blocked and/or visible cracking and settlement of the road surface is noted by AT or maintenance contractor personnel.

Investigation

No 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**

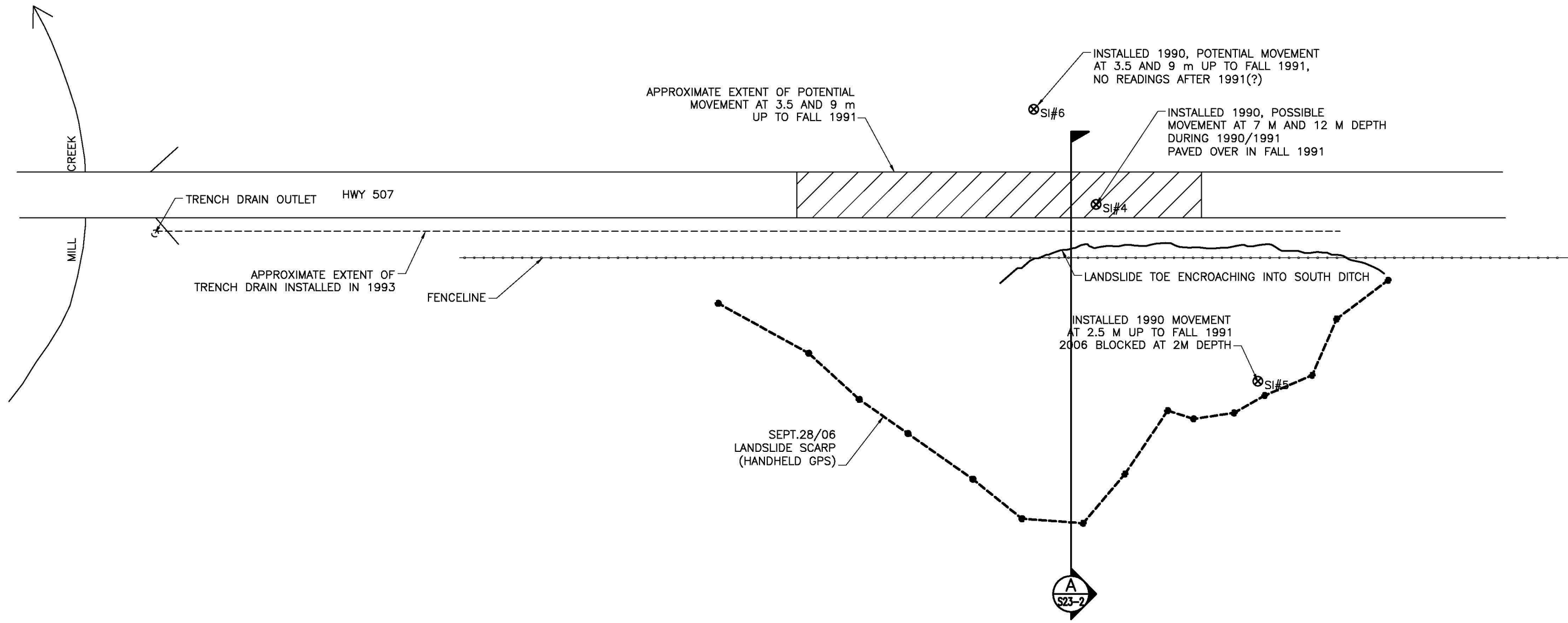
Andrew Bidwell, M.Eng., P.Eng.
Associate Geological Engineer

APEGGA Permit to Practice No. P-04546

Reviewed by:

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

Attachments: Site Plan
Cross-Section
Photos



APPROXIMATE EXTENT OF POTENTIAL MOVEMENT AT 3.5 AND 9 m UP TO FALL 1991

INSTALLED 1990, POTENTIAL MOVEMENT AT 3.5 AND 9 m UP TO FALL 1991, NO READINGS AFTER 1991(?)

INSTALLED 1990, POSSIBLE MOVEMENT AT 7 M AND 12 M DEPTH DURING 1990/1991 PAVED OVER IN FALL 1991

APPROXIMATE EXTENT OF TRENCH DRAIN INSTALLED IN 1993

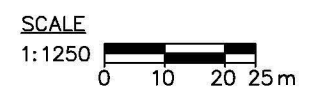
LANDSLIDE TOE ENCRANCHING INTO SOUTH DITCH

INSTALLED 1990 MOVEMENT AT 2.5 M UP TO FALL 1991 2006 BLOCKED AT 2M DEPTH

SEPT. 28/06 LANDSLIDE SCARP (HANDHELD GPS)

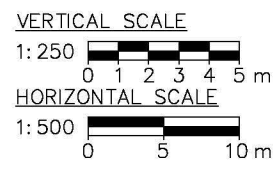
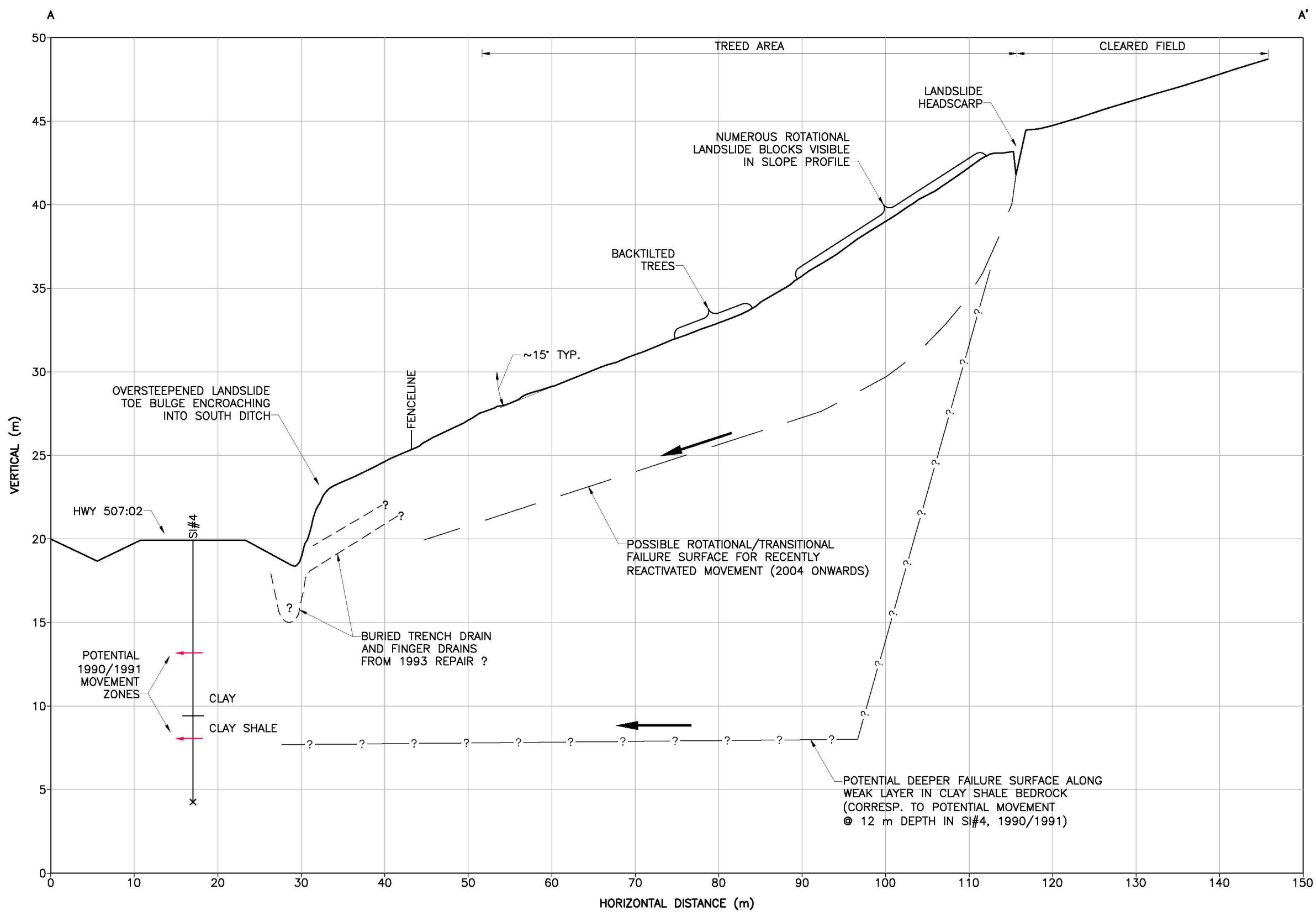
NOTES:

1. SCHEMATIC SITE PLAN BASED ON SITE RECON ON SEPTEMBER 28, 2006. ALL SITE FEATURE LOCATIONS AND DIMENSIONS ARE APPROXIMATE.



		PROJECT: SOUTHERN REGION GEOHAZARD ASSESSMENT			
		TITLE: SITE S23 - SLIDE EAST OF MILL CREEK SITE PLAN			
CLIENT:		DATE: AUGUST 2008	JOB No.: CG25277.B	CAD FILE: 25277N01.dwg	FIGURE No.: S23-1
				REV. A	

I:\02\25277\25277N02.dwg - FIGURE S23-2 - Aug. 06, 2008 12:09pm - michelle.newbigging



		PROJECT: SOUTHERN REGION GEOHAZARD ASSESSMENT					
		TITLE: SITE S23 - SLIDE EAST OF MILL CREEK					
CLIENT:			DATE: AUGUST 2008	JOB No.: CG25277.B	CAD FILE: 25277N02.dwg	FIGURE No.: FIGURE S23-2	REV. A



Photo S23-1 (top) – June 2008

Facing west along the south highway ditch. The toe lobe from the landslide upslope of the highway is visible encroaching into the ditch, however at the time of the inspection the ditch was still able to pass surface flow and there were no signs of significant erosion due to constriction of the ditch width.



Photo S23-2 (bottom) – June 2008

Another view of the toe lobe encroaching into the south highway ditch, facing east. The toe lobe appeared to have possibly encroached further into the ditch since the 2007 inspection, however the fenceline across the toe lobe was straight and did not appear to have been disturbed or recently repaired after being deformed by ground movement.



Photo S23-3 (top) – June 2008

Typical view of the landslide headscarp above the highway and in the east end of the landslide area, as it appeared in June 2008. It appeared that there had been additional downdrop of the landslide mass since this area was last viewed in the fall of 2006, however without significant upslope retrogression of the headscarp.