

Highway 940 – Km 20.8 Ditch Erosion

This site is located approximately 21 km northbound along Highway 940 from the intersection between Highway 940 and Highway 3, in Coleman, AB. The site location is shown on Figures B1 and B3 in Appendix B. The site coordinates are listed in Table B1 in Appendix B.

The site inspection was performed on September 27, 2008 by Mr. Andrew Bidwell, P.Eng. of AMEC.

Background

AMEC is not aware of any previously reported problems or repair work at this site. The September 2008 site inspection was performed as part of the Highway 940 geohazard corridor review.

A general description of the geological and climatic conditions in this area is presented in Section 5.2 of this report.

Site Observations

- The site is located at the south side of a large fill embankment across a northeastwards flowing, unnamed tributary of Vicary Creek. The embankment is greater than 10 m high with benched sideslopes and slope angles of 26° between benches. Photo 940-19 shows a general view of the embankment.
- The concrete culvert at the base of the embankment is approximately 1.3 m in diameter. The culvert inlet was clear of debris at the time of the inspection. It was not possible to see through the culvert to the outlet, but flow was passing through the culvert and there did not appear to be any blockage.
- There was significant erosion visible along both ditches at the south end of the embankment. As shown on Photos 940-19 and 940-22, these segments of the ditches are between the upland area south of the creek valley and the unnamed creek channel. The eroded segments along the ditches are incised up to 2 to 3 m and appear to have bottomed-out on relatively erosion resistant bedrock. The width between the crests of the ditch sideslopes along the eroded segments is up to 3 to 4 m.
 - Photos 940-20 and 940-21 shows views of the erosion along the east ditch.
 - Photo 940-23 shows the erosion along the west ditch.

- Some very minor erosion gullies were noted in the rocky embankment fill slope near the west shoulder of the road in the central portion of the embankment.

Assessment

The erosion in the ditches at the south end of the embankment is occurring where the ditch gradient increases and the ditch flow increases in velocity. The erosion to date poses little risk to the highway. The potential for further downcutting and ditch sidewall destabilization resulting in ditch widening appears to be limited by the bedrock exposed along the ditch bases. This reduces the likelihood of the road embankment sideslope becoming destabilized and possibly eventually undermining the highway itself, however this 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 6 based on the apparently active ditch erosion but with further downcutting possibly limited by the exposed bedrock along the ditch bases.
- Consequence Factor of 1 based on the current lack of immediate impact on the road surface.

Therefore, the current recommended Risk Level for this site is 6. The Consequence Factor may increase over time if the ditch erosion worsens or expands laterally and begins to destabilize the embankment slope.

Recommendations

Repair work is not recommended for the ditch erosion at this time.

It is recommended that this site be inspected annually for the next couple of years in order to check if the ditch erosion is expanding or worsening and to further assess if it could eventually destabilize the embankment slope. This will help in determining whether or not repair work to mitigate the ditch erosion would be worthwhile as a proactive measure.

If it becomes necessary to repair the ditch erosion in the future, this could be accomplished by using a small excavator to shape the ditch to a "U" shaped cross-section and lining the ditch base and sidewalls with erosion protection products (e.g. Armorflex articulating concrete block revetment system underlain by a geosynthetic liner) to minimize further erosion and downcutting along the ditch. Bioengineering measures

to provide erosion protection for the ditch sidewalls could also be considered. However, their applicability for the rocky soils and exposed bedrock at this relatively high elevation site (approximately 1700 m elevation) as well as their capacity to handle peak seasonal flows in the ditches would need to be verified and overall it may be more effective to use a synthetic erosion protection product.

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Photo 940-19 (top) – Facing southbound across the downstream embankment slope. Note the benched embankment slope. Also note the erosion visible along the segment of the east road ditch between the upland area south of the creek valley and the creek channel.



Photo 940-20 (middle) – Facing upstream along the eroded segment of the east road ditch. Further downcutting along this segment of the ditch appears to be limited by the bedrock exposed along the base of the ditch.



Photo 940-21 (bottom) – Facing downstream along the eroded segment of the east road ditch (same area as shown in Photo 940-20).

Hwy 940 – Km 20.8 Ditch Erosion



Photo 940-22 (top) – Facing southbound across the upstream embankment slope, with erosion visible along the segment of the west road ditch between the upland area to the south of the creek valley and the creek channel.



Photo 940-23 (bottom) – Facing upstream along the eroded segment of the west road ditch. Bedrock was discontinuously exposed along this segment of the ditch (covered in places with gravelly deposits from ditch flow).