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Alberta Infrastructure & Transportation
3rd Floor, Provincial Building
Bag 900-29 9621 - 96 Avenue
PEACE RIVER, AB T8S 1T4

Via Courier
No. of Pages: 11

Attention: Ed Szmata

Subject **Hwy 43:06/08 Junction SH 736 at Debolt
Erosion Distress along Headslope Ditches
At Bridge Culvert (BF 74554) Inlet - Call-out Inspection**

1.0 INTRODUCTION

As requested by Alberta Infrastructure and Transportation (AIT) for a callout inspection, Karl Li, P.Eng. of EBA visited the site on November 22, 2005 with Mr. Ed Szmata of AIT. The following is a report of the callout inspection.

2.0 SITE

The subject site is located near the junction of SH 736 with Hwy 43:04. Bridge Culvert (74554) is a 200 m long 4.6 m diameter SPCSP which was constructed in 2001 for a highway twinning over Debolt Creek. The creek flows from north to south at this location. A 13 m high headslope fill with 3H:1V sideslopes was constructed above the culvert invert elevation. A sketch of the site is presented on Figure 1. Photos of the ditch and sideslope erosion distress area are attached.

It was reported in late 2005 by AIT maintenance forces that erosion distress of the ditch has occurred along the toe of the north sideslope, upstream of the culvert on both sides.

2.1 SITE OBSERVATIONS

As shown in Figure 1 and the attached photos, the ditch erosion occurred along the highway ditches flowing down the upstream sideslope (north side) at the bridge culvert inlet. The ditch flows are from both the east and west directions along the north ditch of the westbound lanes of this twinned highway.

2.1.1 East Ditch

Observations of the east ditch and its outfall to the Debolt Creek are as follows:

- The erosion originated from a steep ditch section (about 40 to 50 m length) where the ditch discharges into the creek. The erosion scour has retrogressed upslope resulting in erosion along a ditch section (about 50 m length) along the flat grade portion of the highway.
- A steep erosion scarp of about 0.5 to 1 m high is evident along the affected area.
- Previous ditch protection included random riprap lining along the steep section and permeable weave ditch barriers along flat portion of the ditch. The previous erosion protection measures have failed.
- The ditch erosion along the steep section has caused some shallow sloughing of the embankment sideslope east of the culvert.
- Erosion along this east ditch is more severe than the west ditch as noted in Section 2.1.2 below.

A review of AT records indicates that prior to the 2001 twinning construction, previous erosion scour was noted along the former east ditch on bridge culvert construction. Drawing 18910-C, dated 2001). A review of the highway mosaic indicates that a substantial catchment area to the east can generate substantial flow in this east ditch outfall area at Debolt Creek.

- This distressed portion of highway ditch along the westbound lanes (WBL) of this twinned highway is the former ditch for the previous 2 lane highway embankment prior to the twinning construction in 2001. The new twinning construction forms the present eastbound lanes (EBL). It is possible that during 2001 twinning construction, only minor regrading of this ditch was carried out to repair any previous erosion. Thus, the present ditch erosion failure may be a historic failure that was “touched up” during the 2001 twinning construction.
- Substantial ditch flow is collected from a large catchment area along a 5.8 km stretch of farmland area (north of highway) east of this Debolt Creek outfall location. This catchment farm land area is located between Debolt Creek and Harper Creek to the east. Based on the highway mosaics, the ditch extends from Debolt Creek (Station 51+200 @ highway ditch Elevation 637 m) to 1 km west of Harper Creek (Station 56+000 @ Elevation 669 m).

Along this stretch, the grade drops about 32 m over 5.8 km. With this large catchment area it is probable that runoff at the times of snowmelt and high precipitation events generates substantial ditch flows, initiating the erosion at the ditch outfall at Debolt Creek.

2.1.2 West Ditch

Observations of the west ditch and its outfall to Debolt Creek are as follows:

- the erosion is located along a steep ditch section (about 40 to 50 m length) at the discharge to the creek.
- the ditch flow is mainly contributed from outflow from the surface runoff drainage collected from a 0.5 km section of ditch to the west.
- a steep erosion scarp about 0.5 to 1 m high is visible along the affected ditch area.
- previous ditch protection included a combination of random riprap lining and permeable weave ditch barrier. The previous protection installations failed.
- the erosion noted on the west ditch is less than the erosion observed in the east ditch discussed above.

A review of the highway mosaics indicate that the ditch flow from the west is primarily generated from a 0.5 km stretch of catchment area north of the highway. The flow should not be substantial.

3.0 ASSESSMENT

On the basis of the information provided in Section 2, the following comments are provided.

3.1 EAST DITCH

Substantial ditch flow is likely generated from a large catchment area causing the current erosion distress of the east ditch at the outflow zone towards the creek. In addition, the records indicate that previous erosion distress prior to the 2001 twinning was noted in the bridge construction records.

From site observation, the undermining of previous riprap ditch lining indicates substantial flow down this ditch.

Possible options for remediation design include:

- Downdrain culvert to pipe the ditch flow into Debolt Creek. The size of the culvert should be compatible to ditch flow based on a hydrotechnical assessment.
- Drop structures and hard armour lining to channel the surface flow down the coulee and headslope. This option will require “quality” regrading and reconstruction of the eroded channel to provide a trapezoidal or box channel section. Gabion lining and drop structure may be preferable construction.

- The shallow sloughing of the embankment sideslope can be repaired with regrading, topsoiling, reseeding and installation of erosion protection matting after implementation of either of above options.
- The portion of ditch on the flatter grade should be regraded, topsoiled, seeded, covered with erosion blankets and the permeable ditch barriers reinstalled.

3.2 WEST DITCH

Less substantial flow is assessed for this west ditch, which channels the outflow from a 800 m diameter centerline culvert across SH 736.

Possible remediation design options are the same as discussed for the east ditch. The drop structure and hard armour lining option will require “quality” regrading construction of the eroded channel subgrade to a trapezoidal or box channel section. Gabion lining, combined with a drop structure are the preferred design.

4.0 CLOSURE

EBA appreciates the opportunity to provide the above comments and assessment. Should you require further information, please contact the undersigned.

EBA Engineering Consultants Ltd.

Reviewed by



Karl Li, P.Eng.
Project Engineer
Direct Line: 780.451.2130 x266
kli@eba.ca

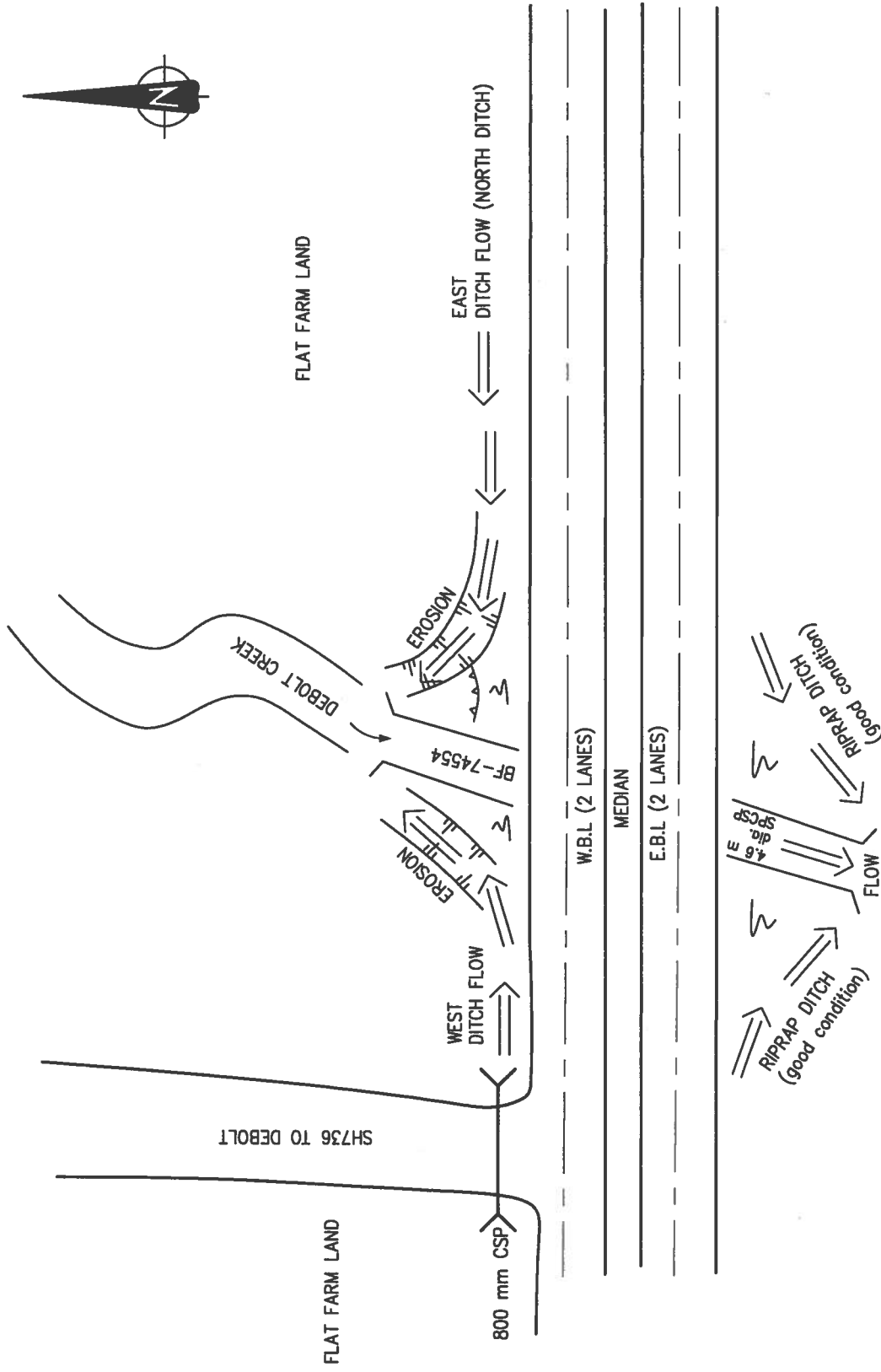


A.F. (Tony) Ruban, P.Eng.
Senior Geotechnical Engineer
Direct Line: 780.451.2130 x236
truban@eba.ca



FIGURES





NOT TO SCALE

Figure 1
Site Plan

Debolt Creek Culvert (BF74554)



PHOTOGRAPHS





Photo 1

- Looking west at junction SH 736
- Bridge culvert (BF 74554) inlet and Debolt Creek coulee (top right of photo).
- Erosion of highway ditch retrogressed from culvert headslope (u/s) ditch outfall to flat highway ditch at top and east of bridge culvert (centre bottom of photo).
- West side of bridge culvert, west ditch collects from centreline culvert below SH 736 (top centre of photo).



Photo 2

- Looking west at u/s inlet of bridge culvert and Debolt Creek coulee.
- Erosion of headslope ditch (close up).



Photo 3

- Looking west at culvert inlet and headslope.
- Close up of erosion and shallow sloughing of headslope.
- East ditch down headslope (bottom of photo).
- West ditch down headslope (top of photo along siltation fences).



Photo 4
Looking east at east ditch down u/s headslope.
-Erosion of outfall ditch.

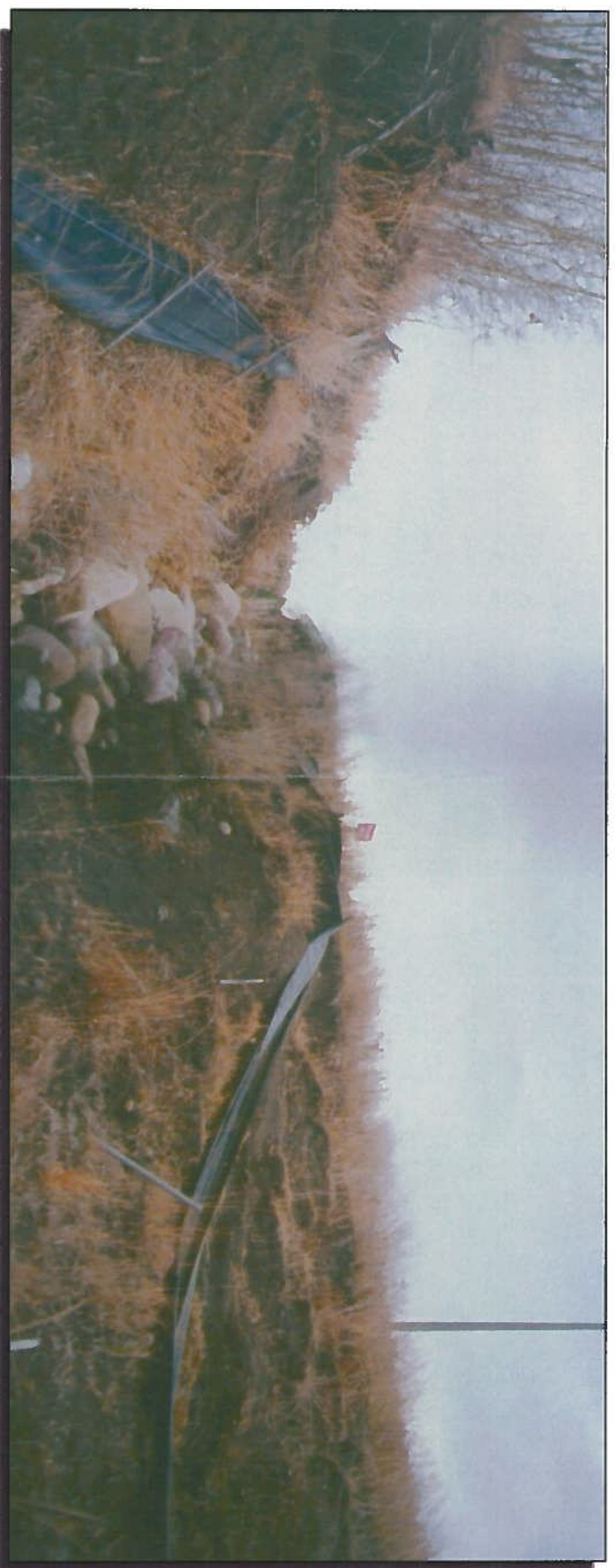


Photo 5
Looking east at east ditch outfall.
-Top portion of outfall ditch (closeup).



Photo 6
Looking south at inlet and headslope.
-East ditch outfall (on left) with headslope sloughing.
-West ditch outfall (on right).



Photo 7
Looking south up headslope at west ditch.
-Outfall and erosion of ditch down headslope.



Photo 8
Looking north at Debolt Creek coulee.
-Close up of erosion of west ditch down headslope.
-Creek flow from north to south (towards photo).



Photo 9
Another looking at east ditch down headslope.



Photo 10
Another look at centreline culvert at SH 736 just west of bridge culvert headslope.