

Slide Name: (GP 32) SH 736 Little Puskwaskau River (BF 76515)
Inspection Date: May 3, 2005
Inspection by: Alberta Infrastructure & Transportation and EBA staff listed on Page 1

1.0 BACKGROUND

The recurrence of a slide at the downstream fill slope (10 m fill) at the Little Puskwaskau River culvert, was noticed by AIT maintenance staff in 2004. EBA provided an inspection of the site (November 2004) and a report (EBA File 710011.029, November 2005) after investigating the complex history of previous distress at this site. The current slide occurred at an identical location as the 1996 failure.

The existing bridge culvert was constructed in 1966-67 and included various deficiencies:

- i) soft subgrade foundation soils
- ii) inadequate backfill placement with steep slopes (2H:1V or steeper)
- iii) inadequate structural assembly of culvert
- iv) insufficient hydraulic capacity of culvert

Over the years, the culvert was inspected to reveal structural cracking and leaking. A liner for the entire length and extension at the upstream end was constructed between June and October 1996. During the extension and lining construction, a flood occurred causing failure of the fill slopes (both upstream and downstream) in June 1996. Apparently, the slide failures were repaired by regrading the slopes. With the upstream extension of the culvert, the upstream slope was reconstructed at 3H:1V; the downstream slope was reconstructed at a steeper 2H:1V. At the time of construction, it was recorded by AIT that defects were identified on the liner and fill placement.

After completion of the lining and extension of the culvert, leakage and structural distress as well as corrosion of culvert were persistently reported. Squeezing of culvert outlet bevel at toe of downstream slope was observed. As the culvert is on a slight skew, the culvert outflow eroded the toe rip-rap around the outlet apron toe area aggravating a loss of toe support. Seepage into the fill, piping erosion along the base of the culvert and erosion at the toe of the downstream slope are contributing causes of the slope failure. Additional details are contained in the EBA Call-Out Inspection (November 8, 2005).

Due to past history of failure and inadequate construction, it may be preferable to consider reconstruction of this culvert crossing instead of repairing the existing distressed culvert and downstream slide.

2.0 OBSERVATIONS

The slide is in the same condition as inspected in November 2004. The slide has not deteriorated and roadway width has not yet been affected.

3.0 RISK ASSESSMENT

PF (11) * CF (3) = 33

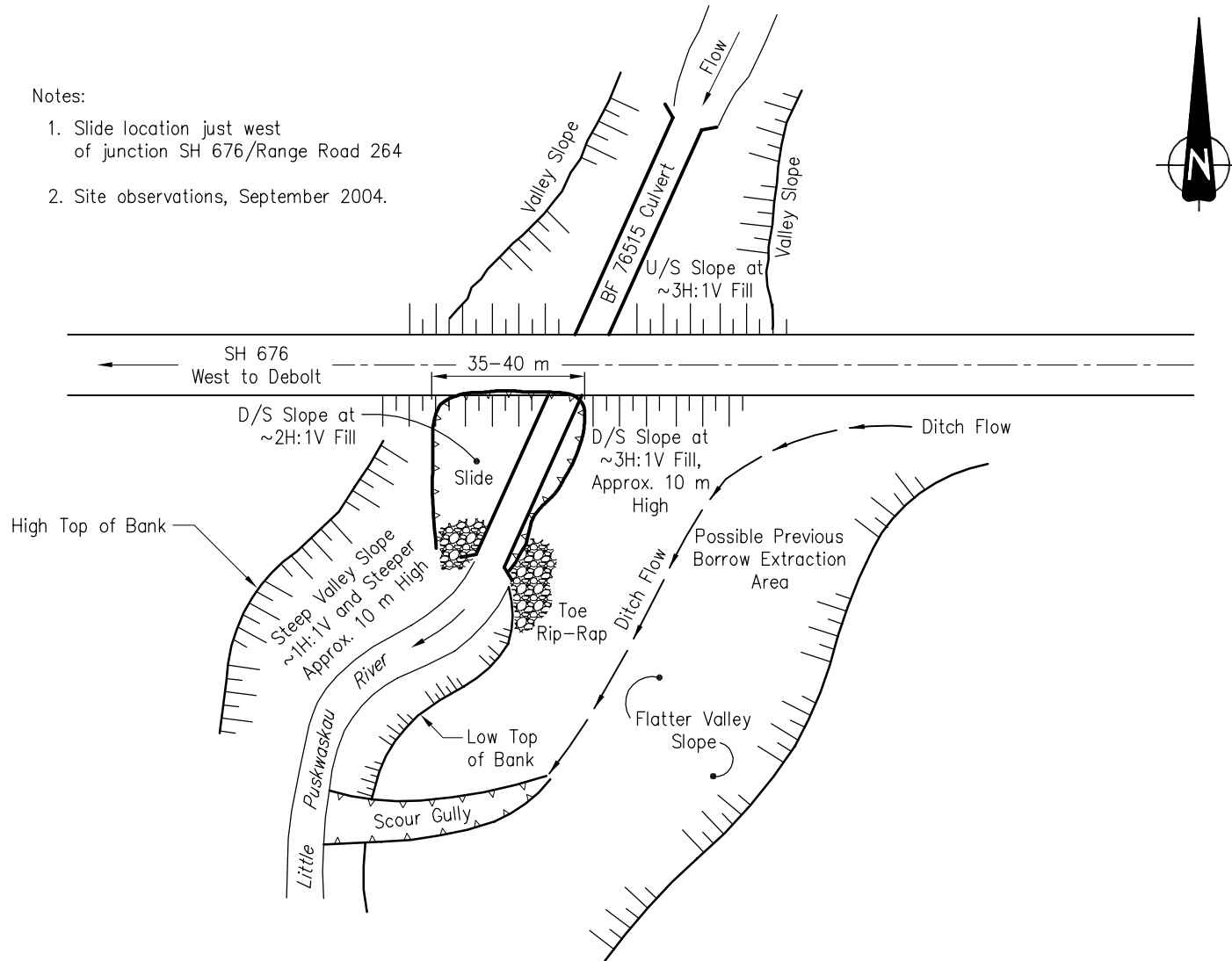
CF is rated 3 because the closure of one lane of the roadway may be required in the event of slide deterioration. PF is rated 11 as the slide failure has already occurred and deterioration of headscarp is considered active with an increasing rate of movement.

4.0 ACTION

- Barricade off the shoulder area to provide a minimum setback space of 3 m (or one lane) from edge of headscarp.
- Repair the slide as well as the structural distressed culvert, or reconstruct the culvert and overlying fill completely.
- AIT maintenance staff should inspect the site regularly to ensure safety to the driving public. Any deterioration of the slide should be reported. Signage of "slide" should be posted as a safety warning to the driving public.

Notes:

1. Slide location just west of junction SH 676/Range Road 264
2. Site observations, September 2004.



Not To Scale

Figure 1
Plan of Slide at
Downstream Fill Slope

7100131029R01B.dwg



Note:

- i) Slide occurrence noted by AT in Sept 2004
- ii) Photos Taken in March 2005

**Photo 1**

Looking west and downstream

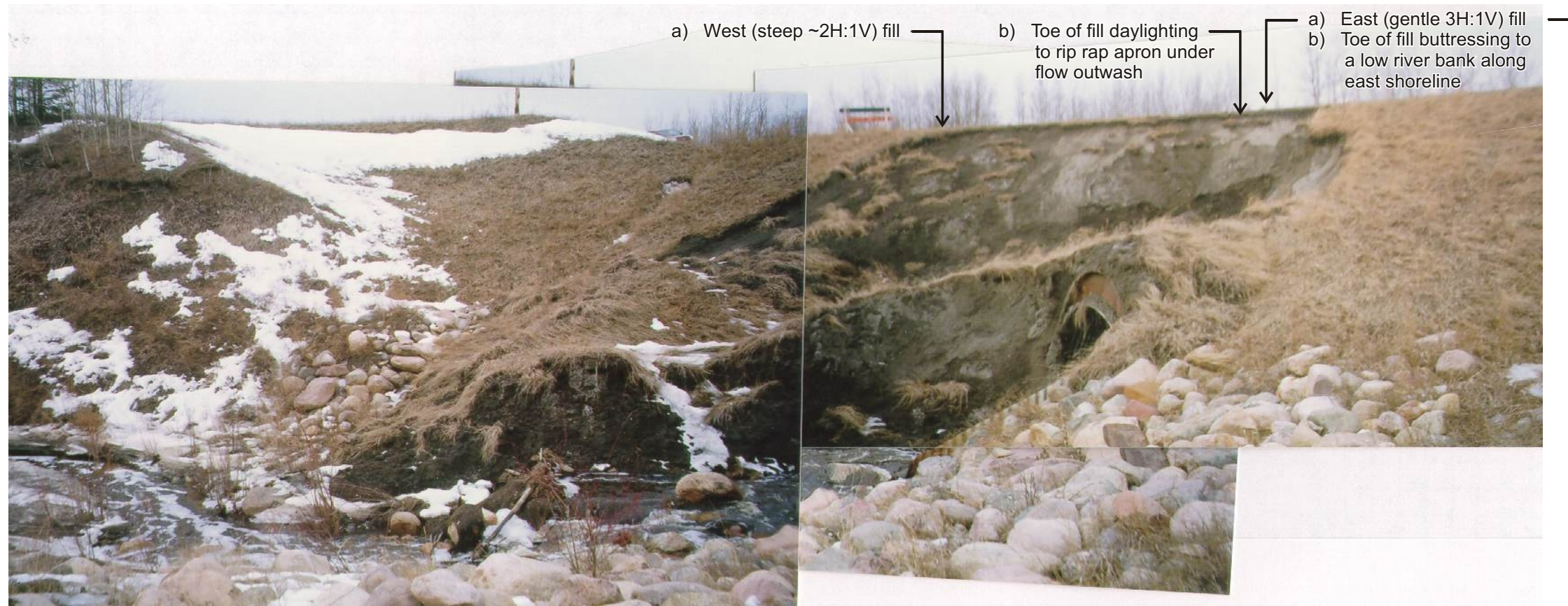
- 1) Sideslope slide at west downstream face of 8 to 10 m high fill embankment
- 2) 4.3 m diameter SPCSP culvert (with 3.6 m inner lining) on a skew to roadway
- 3) West side of downstream slope (failed) slightly steeper (~2H:1V); east side of downstream slope at gentler (~3H:1V) slope (not failed)
- 4) Culvert was apparently not extended on downstream side; culvert was extended longer at upstream side (fill at 3H:1V to 4H:1V)
- 5a) Culvert outlet seemed to flow and scour onto west rip rap apron (prior to failure)
- 5b) Internal erosion of fill (from seepage and leakage from culvert joints) may have weakened toe area of this steep downstream fill slope
- 5c) Both upstream and downstream fill slopes failed (1996) due to flood event. Fill slopes were reconstructed with (3H:1V to 4H:1V) upstream fill (culvert extension at upstream end) and with a steep (2H:1V at west corner) downstream fill slope unchanged (no extension at downstream end)

General Photographs of Site

(Page 1 of 4)

7100131029R01B.cdr



**Photo 2**

Looking west

- 1) Culvert outflowed and scoured on west downstream rip rap apron
- 2) Culvert aligned on a skew to outflow over toe of steep fill corner of west half fill
- 3) Steepness of fill is apparent at the west corner
- 4a) Culvert apparently too short and was cosmetically extended at outlet with bevel triangular plates to allow rip rap placement
- 4b) Inward deflections (1200 mm on east-failure side; 300 mm on west side) of outlet bevel observed by AT in 2003 - 2004
- 5) Toe scour fill can be partial cause of slope failure; other causes include steep slope design, fill construction and internal erosion of fill

**Photo 3**

Looking north

- 1) Another view of outlet and toe scour
- 2) Slide debris covered over rip rap apron (east and downstream portion)

Note:

- i) Slide occurrence noted by AT in Sept 2004
- ii) Photos Taken in March 2005

General Photographs of Site

Note:

- i) Slide occurrence noted by AT in Sept 2004
- ii) Photos Taken in March 2005



Photo 4

Looking east

- 1) Another view of slide movement and headscarp of fill

Photo 5

Looking east

- 1) Nominal bevel (1/2) extension of culvert installed for fitting in rip rap apron
- 2) Near side of culvert bevel (slide side) failed under slide movement

General Photographs of Site

Note:

- i) Slide occurrence noted by AT in Sept 2004
- ii) Photos Taken in March 2005

**Photo 6**

Looking at slide from east bank gentle bench

- 1) An erosion gully formed from ditch (south side of highway) outfall

**Photo 7**

Looking downstream along eroded gully

- 1) Steep gully (2 m deep and 3 m wide) along east side of river bank (gentle bench) and was caused by erosion from ditch outfall towards river
- 2) The highway south ditch flows down the shoulder of fill and valley slope