August 23, 2011

Alberta Transportation
Room 301, Provincial Building
9621 - 96 Avenue
Peace River, Alberta T8S 1T4

Attention: Mr. Ed Szmata

PEACE REGION (PEACE RIVER/HIGH LEVEL) GEOHAZARD ASSESSMENT
HWY 986:01 (PH 7), DAISHOWA SITE 7 AND 8 – STATION 12+100 TO 13+000
2011 ANNUAL INSPECTION REPORT

Dear Sir:

This letter documents the 2011 annual site inspection of an area of previous erosion located along Hwy 986:01, on the east side of the Peace River, north of the Town of Peace River, Alberta (Figure PH7-1). Thurber Engineering Ltd. (Thurber) undertook this inspection in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE105/2008) with Alberta Transportation (TRANS).

Mr. R. Saunders, P.Eng. of Thurber undertook the inspection on May 25, 2011 in the company of Mr. Neil Kjelland, P.Eng. and Mr. Ed Szmata of TRANS and Mr. Don Proudfoot, P.Eng. of Thurber.

1. BACKGROUND

Thurber’s last annual site inspection was in May 2010. The site conditions at that time are described in our Part B assessment letter in the PH7 site binder. Additional information of the site is provided in the Geotechnical File Review in Section A of the binder.

Previously, the PH 7 site encompassed a 2 km length of this highway extending from the Peace River Bridge to the top of the east valley slope. However, the area has now been subdivided into four separate areas. This area is located at a historic landslide site where erosion on both sides of the roadway had been of ongoing concern.
Historically, the main concern in this reach was with respect to erosion along the creek on the north below the roadway which was mitigated several years ago with an armoured channel and drop structures. More recently, erosion in the south ditch and at the culvert outlet located at Sta. 12+100 (Figure PH7-1) was mitigated in late 2007.

2. SITE OBSERVATIONS

Observations made during the 2010 inspection are noted on the site plan presented as Figure PH7-1 and described in the following sections.

2.1 South Ditch

The erosion and gullying that had occurred along the south side of the highway was mitigated in late 2007 with a series of different commercial products. These materials were installed as a test section for comparative purposes and have been inspected annually.

Observations after the 2011 spring break-up are summarized below.

<table>
<thead>
<tr>
<th>Erosion Control Measure</th>
<th>Station (approx.)</th>
<th>Photo</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culvert intake and riprap</td>
<td>12+115</td>
<td>7-01</td>
<td>Settlement of riprap and/or erosion under culvert intake. No change since installation.</td>
</tr>
<tr>
<td>Rolled Erosion Control Product (Coconut Mat)</td>
<td>12+125 to 12+221</td>
<td>7-02</td>
<td>Good condition; well established vegetation</td>
</tr>
<tr>
<td>Channel Soxx</td>
<td>12+221 to 12+319</td>
<td>7-03</td>
<td>Good condition; well established vegetation</td>
</tr>
<tr>
<td>Coletanche</td>
<td>12+319 to 12+414</td>
<td>7-04</td>
<td>Generally good condition; local water filled bubbles observed under the liner.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7-05</td>
<td></td>
</tr>
<tr>
<td>Geoweb (Geocell)</td>
<td>12+414 to 12+525</td>
<td>7-06</td>
<td>Fair to good condition; cells typically infilled to within 25 mm of grade; numerous cells torn near surface.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7-07</td>
<td></td>
</tr>
<tr>
<td>Gabion Mattress</td>
<td>12+525 to 12+636</td>
<td>7-08</td>
<td>Good condition</td>
</tr>
<tr>
<td>Interlocking Blocks</td>
<td>12+636 to 12+745</td>
<td>7-09</td>
<td>Good condition; minor local settlement; a few broken blocks. Local settlement observed, but interlock intact.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7-10</td>
<td></td>
</tr>
<tr>
<td>Cabled Concrete</td>
<td>12+745 to 12+853</td>
<td>7-11</td>
<td>Fair condition; channelization along block gaps; exposed geotextile; lifting-wires exposed and pose tripping hazard.</td>
</tr>
<tr>
<td>Pillow Concrete</td>
<td>12+853 to 12+965</td>
<td>7-12</td>
<td>Good condition; protruding rebar poses tripping hazard</td>
</tr>
</tbody>
</table>
The mitigated channel sections described above are all functional at this time. However, erosion and gully ing on the south side of the channel has been occurring since 2008 in several areas between Stations 12+450 and 12+750. If left unchecked, this erosion could deepen, resulting in a breach of the channel.

2.2 North Channel and Highway Fill Slopes

The overall condition of the riprap lined North Channel appeared to be good except for at a couple of locations where erosion and slumping of the riprap had occurred, likely due to spring flooding/ice jams (Photos 7-15 to 7-18). The largest of these sections was approximately 35 m long as shown in Figure 7-1.

The inlet to the channel was partially blocked by debris and a low, recently constructed beaver dam (Photo 7-13). Also, willow growth within the channel itself is becoming quite thick (Photo 7-14).

The overall condition of the two gabion drop structures (Sta. 12+550 and 12+600) was also noted to be good (Photos 7-19 and 7-21). Some torn gabion baskets were observed within the drop structures, particularly the upper one. Some of this damage may be within previously repaired areas.

No changes were observed at the location of a small shallow slide noted in the highway fill slope at about Station 12+595.

The erosion runnels noted in previous inspections between Sta. 12+300 and 12+460 were noted to be in similar condition as last year.

2.3 Culvert Discharge

Prior to 2007, the runoff from the south ditch was collected in a culvert near Sta. 12+115 and discharged on the downslope side of the roadway. As part of the south ditch erosion control measures, this culvert now connects to a buried drain pipe which discharges into a gabion energy dissipation structure at the toe of the embankment (Photo 7-23) No significant changes were observed to this structure since 2009. However, beaver activity in this area has created a lake which the outlet now discharges into (Photo 7-24).

3. ASSESSMENT

The major erosion and gully ing which has been problematic within this segment of the Daishowa east access roadway appears to have been mitigated along both the north and south sides of the highway.

The only major change to conditions at this site are along the north channel where local bank slumping and breach of the rip rap was noted.
The erosion runnels noted on the north highway fill slope area should be mitigated. In this area, winter road gravel has not been cleaned from below the guard rail, and water runs along the edge of the road. However, at some locations the water has broken through the gravel, which results in concentrated flow down the slope.

The shallow slide or settlement noted at Sta. 12+595 is not considered a threat to the highway at this time, but should continue to be monitored.

The willows noted within the upper portion of the North Channel could potentially reduce the hydraulic capacity of the channel and this issue should be assessed by a hydraulic engineer.

4. RISK LEVEL

The Risk Level for this site has been assessed as follows:

\[ \text{PF (3) \times CF (2)} = 6 \]

This is based on a Probability Factor of 3 reflecting inactive with low probability of reactivation (providing erosion control measures are maintained) and a Consequence Factor of 2 reflecting the proximity of previous erosion to the roadway. This rating reflects the extensive mitigation this area has seen over the past few years.

5. RECOMMENDATIONS

5.1 Short Term

The local bank erosion and breach of the rip rap armour in the north channel should be repaired prior to spring flooding in 2012.

The erosion which is occurring along the south upslope side of the ditch near Sta. 12+500 is also of concern if left unmitigated. It is recommended that several low diversion berms be constructed on the south side of the channel, angled slightly upslope and discharging just above the gabion basket structures installed at the beginning of every channel test section.

Tripping hazards were identified in the south channel associated with the Cabled Concrete and the Pillow Concrete test sections. The lifting wires used to position the Cabled Concrete panels pose threats to wildlife and people walking as well as skis on snowmobiles. In the Pillow Concrete test section, the rebar stakes used to hold the pillows during filling protrude some 100 mm to 150 mm vertically and could cut wildlife or damage ATVs. It is recommended both the wires and rebar be cut flush to the ground to reduce the risk of injury/damage.
The effect of the willows growing in the upper portion of the North Channel should be assessed by a hydraulic engineer. If it is determined that the hydraulic capacity of the channel is being adversely affected by their presence, they should be cut flush to the channel bottom with the roots left in place.

5.2 Long Term

The erosion runnels between Sta. 12+300 and Sta. 12+460 should be repaired. Initially this could be done by regrading the slope to reduce concentration of water flow in the runnels. However, the ultimate cause of this erosion is the winter road gravel being left in place below the guard rail. If the gravel were completely removed, water flow would be much less concentrated, and erosion less severe.

Alternatively, a permanent curb could be constructed along the guard rail with all flow directed to controlled discharge points, such as a split culvert, that carries the flow to the lined channel at the toe of the slope. “Geocell” would be one possible option to construct the curb. The curb would likely have to be on the north side of the guard rail to avoid conflict with snow clearing equipment. If such an option were to be implemented, about 150 m of curb would be required. Two controlled discharges, likely totalling 300 m length would also be required.

5.3 Investigation

Further geotechnical investigation at this site is not required at this time.

5.4 Maintenance

Repairs should be made on an ongoing basis to the damaged gabion baskets at the two drop structures on the North Channel. Repairs are relatively easy to undertake while the baskets are still intact. However, if unmitigated, the damaged baskets could lose their structural integrity which would compromise the entire drop structure(s).
6. CLOSURE

We trust this assessment and recommendations meet with your needs at this time. Please contact the undersigned should questions arise or if conditions at this site worsen.

Yours truly,
Thurber Engineering Ltd.
Chris Workman, M.Eng., P.Eng.
Review Principal

Robert Saunders, M.Eng., P.Eng
Senior Geotechnical Engineer

Attachments