

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – SWAN HILLS
2019 INSPECTION**

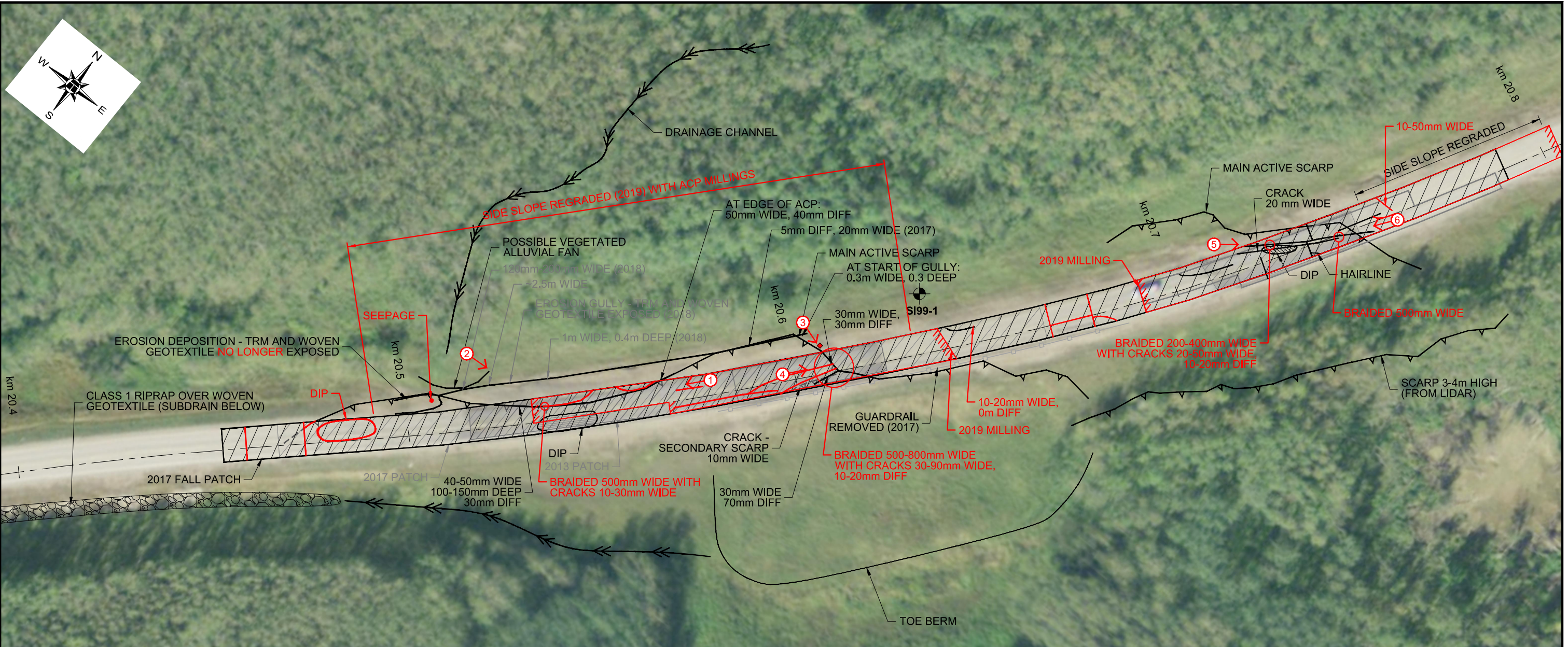


| Site Number | Location | Name | Hwy | km |
|--------------------------|--------------------|---|--------|-------------|
| SH023-11 | Little Smoky River | Little Smoky River Valley, North Hill – Site #11 | 744:02 | 20.46-20.79 |
| Legal Description | | UTM Co-ordinates | | |
| NE21-76-22-W5M | | 11U E 478,317 | N | 6,162,188 |

| | Date | PF | CF | Total |
|-----------------------------|--|----|---|-------|
| Previous Inspection: | 20-Jun-2018 | 10 | 4 | 40 |
| Current Inspection: | 12-Jun-2019 | 10 | 4 | 40 |
| Road AADT: | 240 | | Year: | 2019 |
| Inspected By: | Roger Skirrow, TRANS Ed Szmata, TRANS | | Ken Froese, Thurber Niels Rasmussen, Thurber | |
| Report Attachments: | <input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items | | | |

| | | | |
|---|---|-------------------------------------|--|
| Primary Site Issue: | Highway traverses deep-seated (likely 35 m to 45 m deep at this Site), retrogressive landslides with ongoing creep movements due partly to erosion at toe by the Little Smoky River and Peavine Creek resulting in cracking and sagging of the pavement surface at numerous locations. Approx. 4 km of the highway crosses this unstable north valley slope. Site #11 is 60 m above and 260 m away from the Peavine Creek. | | |
| Dimensions: | 330 m length of highway affected by cracking and distortion | | |
| Date of Remediation: | 1988: 6 m deep subdrain installed in upslope ditch from Sta. 20+600 to 20+860. 2000: Toe berm, gravel drainage blanket, and subdrain pipe (drains to Site #10) installed (by AGRA/AMEC). Patching of the highway and ditch cleaning done at the same time. 2005: West ditch lined with ECP and GeoRidge (20 m spacing). 2017: ACP patch placed over south portion of Site #11. Guardrail removed and sideslopes regraded (1,200 m ³ of pitrun). Fall 2017: Milled and patched. 2019: Milling over most of the Site. | | |
| Maintenance: | Routine ACP crack sealing, milling, and patching, when required. | | |
| Observations: | Description | Worsened? | |
| <input checked="" type="checkbox"/> Pavement Distress | Major scarp crack parallels and crosses the highway at two locations with numerous associated cracks. | <input checked="" type="checkbox"/> | |
| <input checked="" type="checkbox"/> Slope Movement | Site is located on an active deep-seated landslide moving toward the Peavine Creek. There is significant vertical deformation of the pavement. | <input checked="" type="checkbox"/> | |
| <input checked="" type="checkbox"/> Erosion | 95 m-long gully formed in upslope ditch exposing erosion control fabrics near the west end was regraded in 2019 using milled material. | <input type="checkbox"/> | |
| <input type="checkbox"/> Seepage | | <input type="checkbox"/> | |
| <input type="checkbox"/> Bridge/Culvert Distress | | <input type="checkbox"/> | |

| | | |
|--|--|--------------------------|
| <input type="checkbox"/> Other | | <input type="checkbox"/> |
| Instrumentation: | | |
| Destroyed: (year lost) | <i>Installed in 1999 by AGRA: SI99-1 (2000, sheared about 24m), PN99-1 (2008), SP99-3 (2006), SP99-4 (2006), SP99-5 (unknown), SP99-6 (2005), Installed in 2000 by AGRA: SI00-1 (2002), SP00-1 Installed in 2001 by Thurber: S01-1 (2002, sheared at 5.5m), SP-TH01-1A (2006), SP-TH01-1B (2006)</i> | |
| Assessment: | | |
| <p>The overall valley slope is moving as several separate slide blocks in response to the toe erosion and downcutting of two different rivers resulting in numerous scarps, sag ponds, and differential movement zones going in slightly different directions. The highway intersects the scarps of these blocks at several locations resulting in an uneven highway surface and cracking. There is approximately 55 m to 60 m elevation difference between the highway and the Peavine Creek located about 250 m to the southeast with two significant scarps identified from LiDAR at 110 m and 205 m from the highway.</p> <p>Site #11 is located on an active scarp with significant vertical deformation observed to be affecting the highway and guardrail. Two significant scarp cracks were identified crossing the highway surface and could also be traced in the adjacent ditches (although obscured by regrading done in 2019). The Site was recently milled to reduce highway surface undulations which has exposed more of the cracking previously covered by patching. The south of the two scarp cracks, at the previous guardrail location (removed since the 2016 inspection), has the greater deformation. There was less vertical deformation at the north scarp crack; however, there is a significant 4 m high scarp located downslope in the trees (identified from LiDAR topography). At both locations, the crack pattern is becoming braided with settlement occurring in the central portion.</p> <p>Historically, there has also been shallow movement of the embankment which was remediated in 2000 with the construction of a toe berm and blanket drain. Without instrumentation, it is difficult to determine the present effectiveness of the toe berm; however, there did not appear to be signs of toe berm instability (such as cracking or bulging); however, the crack pattern in the highway above the berm continues to expand.</p> | | |
| Recommendations: | | |
| <p>Short-Term:</p> <ul style="list-style-type: none"> ▪ Road maintenance should continue as necessary to maintain as safe roadway surface and may consist of milling, patching, and crack sealing of the ACP. <p>Long-Term:</p> <ul style="list-style-type: none"> ▪ It is understood that, at this time, the only long-term remediation option under consideration is realignment of the entire north hill section of Highway 744. However, given the high cost of this option and as it is a low volume highway, it is unlikely that a full realignment will be undertaken in the near-future. Consideration is also being given to a shorter realignment which would include both of the SH023 sites as they currently require frequent maintenance. ▪ However, given the significant vertical distortion, vertical realignment of the highway at this Site #11 should be considered. Lowering of the highway grade, or subcut and replacement with light-weight fill, would reduce the driving weight at the top of this slide block and might decrease the rate of maintenance. Alternatively, a horizontal shift of at least 20 m into the slope could be considered to move the highway off this active slide block. The Maintenance Contractor Inspector estimates a \$2M cost to realign the highway around the current Sites #10 and #11. <p>Ongoing Investigation:</p> <ul style="list-style-type: none"> ▪ It is recommended that the annual GeoHazard inspection should continue as scheduled. ▪ As this is one of the more-active Sites along this north valley slope, consideration should be given to installing two or three slope inclinometers to evaluate the ongoing performance of the toe berm and assessing current slope movement rates particularly if vertical or horizontal realignment is being considered. | | |

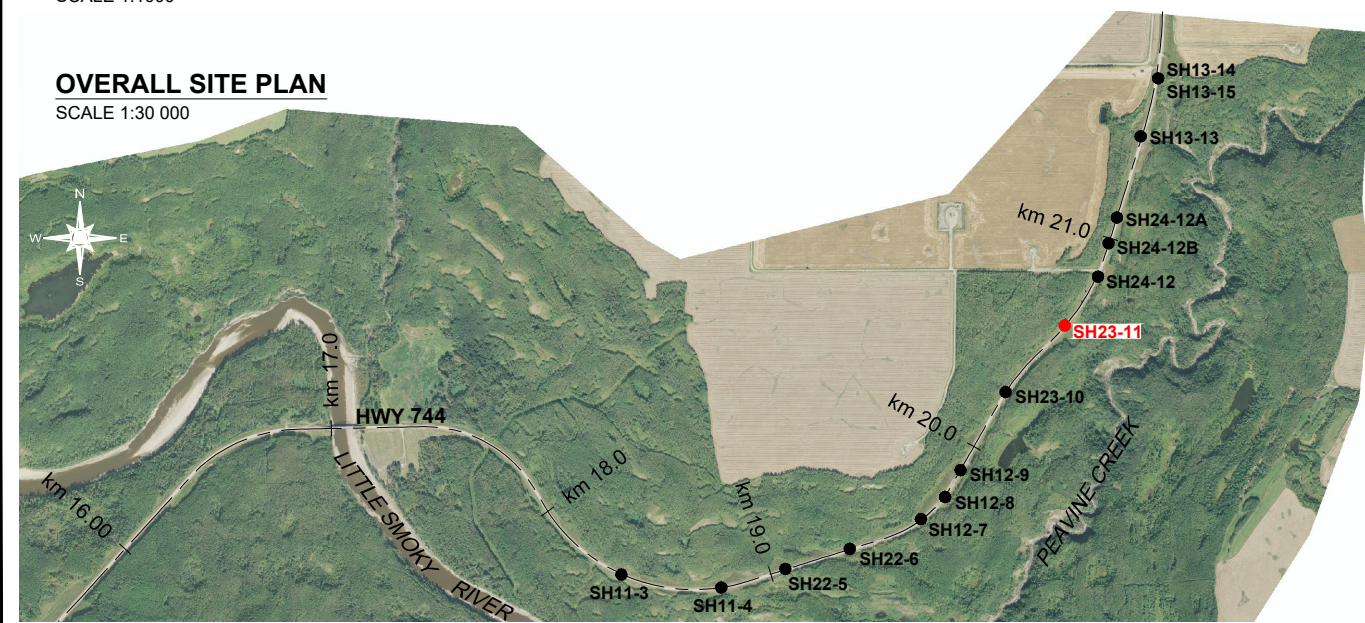


DETAILED SITE PLAN

SCALE 1:1000

OVERALL SITE PLAN

SCALE 1:30 000

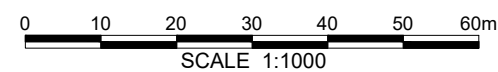


LEGEND

- LANDSLIDE SCARP (GREY FOR PORTIONS OBSCURED BY PATCHING OR GRADING)
- SLOPE INCLINOMETER (APPROXIMATE)
- GUARDRAIL
- RED TEMPORARY HAZARD SIGN
- ASPHALT PATCH
- DIRECTION AND NUMBER OF PHOTO

NOTES

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK (2013-2015 FROM AMEC FIGURE 1, PROJECT EG10030, PROVIDED BY ALBERTA TRANSPORTATION).
3. JUNE 2019 OBSERVATIONS SHOWN IN RED.



SATELLITE IMAGE FROM VALTUS IMAGERY (DATED 2014)



PEACE REGION (SWAN HILLS)

**SH023-11: HWY 744:02 LITTLE SMOKY RIVER VALLEY
2019 SITE INSPECTION PLAN**

DWG No. 13355-SH023-11

| | |
|-------------|---------------|
| DRAWN BY | KLW |
| DESIGNED BY | KEF |
| APPROVED BY | DWP |
| SCALE | AS SHOWN |
| DATE | DECEMBER 2019 |
| FILE No. | 13355 |





Photo 1 – Looking southwest at the southwest end of the main scarp crack through Site 11.



Photo 2 – Looking east at vertical distortion of highway at south end of site and regraded sideslope where there had been a significant gully.



Photo 3 – Looking east at main scarp crack crossing highway (see Photo #4).



Photo 4: Looking northeast where main scarp crack crosses the highway at the central portion of Site 11.



Photo 5 – Looking northeast at north scarp crack.



Photo 6 – Looking southwest at north scarp crack.