

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – SWAN HILLS
2020 INSPECTION**



Site Number	Location	Name	Hwy	km
SH022-5 SH022-6	Little Smoky River	Little Smoky River Valley, North Hill – Sites #5 and #6	744:02	19.00-19.14 19.20-19.53
Legal Description		UTM Co-ordinates		
Site 5: SW21-76-22-W5M		11U E 477,204	N	6,161,204
Site 6: SW21-76-22-W5M		11U E 477,479	N	6,161,291

	Date	PF	CF	Total
Previous Inspection:	11-Jun-2019	9	3	Site 5: 27
		9	3	Site 6: 27
Current Inspection:	2-June-2020	11	3	Site 5: 33
		9	3	Site 6: 27
Road AADT:	240	Year:		2020
Inspected By:	Rocky Wang, TRANS		Ken Froese, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs			
	<input checked="" type="checkbox"/> Plans		<input checked="" type="checkbox"/> Maintenance Items	

Primary Site Issue:	Highway traverses deep-seated, 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 #5 is 60 m above and 505 m away from the Little Smoky River and Site #6 is 65 m above and 460 m away.		
Dimensions:	Site 5: 145 m length of highway affected by cracking and distortion Site 6: 330 m length of highway affected by cracking and distortion		
Date of Remediation:	May have been significant overlay at both Sites #5 and #6 incorporating GBC "sandwich."		
Maintenance:	Routine ACP crack sealing, milling, and patching (2014 and 2015), when required. 2017: Patched (portion of Site #6) 2019: Patched EBL over most of Site #5 and both lanes over most of Site #6; spot-patching of larger cracks at both sites; milling at both sites 2020: Line painting		
Observations (Site 5):	Description	Worsened?	
<input checked="" type="checkbox"/> Pavement Distress	Numerous longitudinal and traverse cracks are present which have continued to increase slightly each year. Some were patched after recent milling.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Slope Movement	Site is located on an active deep-seated landslide moving toward the Little Smoky River. There is a significant scarp located about 20 m downslope from the pavement edge at km 19.06. A new slide formed at the edge of pavement in 2020 at km 19.07.	<input checked="" type="checkbox"/>	
<input type="checkbox"/> Erosion		<input type="checkbox"/>	

<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	Culvert at km 19.07: inlet is partially blocked and too high and outlet was obstructed in by new slide in 2020.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Observations (Site 6):	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Numerous longitudinal and traverse cracks are present which have continued to increase each year. Cracks have reflected through 2019 patching.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Site is located on an active deep-seated landslide moving toward the Little Smoky River. This site crosses over a sag pond/graben.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	An erosion gully is present at km 19.40. There is a small scarp on the north side at the west end of the gully.	<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	Culvert at km 19.23: inlet fully obstructed by small slump and outlet also somewhat obstructed.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation:		
None.		
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.</p> <p>Site 5: The crack widths and lengths appear to have continued to increase somewhat in length and width every year. Given the overall valley condition, continued creep movement is expected which may manifest as increased crack lengths, widths, and height differential as well as vertical pavement distortion although the incremental change between 2019 and 2020 was minimal. The retrogressive scarp about 5 m in width located at km 19.06, just west of the culvert outlet at km 19.07, was likely triggered by erosion, had widened somewhat in 2020 but did not appear to have advanced closer to the highway. However, there was a new slide in the highway embankment which has completed obstructed the culvert outlet at km 19.07. The scarp was at the edge of pavement; the Maintenance Contractor was notified and arranged for signage and fill placement shortly after the site visit. A second brief visit was undertaken by Thurber on June 24, 2020 to confirm that efforts were underway to maintain highway safety. At that time, the emergency fill had also slumped downward.</p> <p>Site 6: The crack widths and lengths appear to have continued to increase somewhat in length and width every year and had reflected through the Fall 2017 patch that was applied on the eastern portion of the site. A new patch was placed over the central part of the site in Spring 2019 and the cracks have started to reflect through it by the 2020 inspection. There were two noticeable sags in the vertical alignment within the patch that are likely too deep to be filled with an overlay – the one at about km 19.4 has grown in length since 2019. Given the overall valley condition, continued creep movement is expected which may manifest as increased crack lengths, widths, and height differential as well as vertical pavement distortion. The erosion feature at km 19.40 deteriorated between 2015 and 2016 but seems relatively stable since 2017. The gully is full of cattails indicating poor drainage over a portion of the ditch.</p>		

Recommendations:**Short-Term:**

- Road maintenance should continue as necessary to maintain a safe roadway surface and may consist of milling, patching, and crack sealing of the ACP.

Medium-Term:

- Preliminary engineering should be undertaken for short-term repair of the new slide at km 19.07. Consideration should be given to replacing the culvert at this location at the same time to ensure that the discharge is controlled (elephant trunk down to sag pond). It is anticipated that a local excavation and replacement with geo-grid reinforced gravel will be the simplest solution; the potential for the lower slide at km 19.06 to retrogress into the highway at this location should also be considered in the design.
- Culvert inlet and outlet at km 19.07 (Site 5) should be cleaned out and consideration given to replacing the culvert at a lower elevation to better drain the upslope sag pond and limit infiltration.
- Culvert inlet and outlet at km 19.23 (Site 6) should be cleaned out.
- Erosion gully at km 19.4 (Site 6) could be regraded and lined with erosion-resistant material(s).

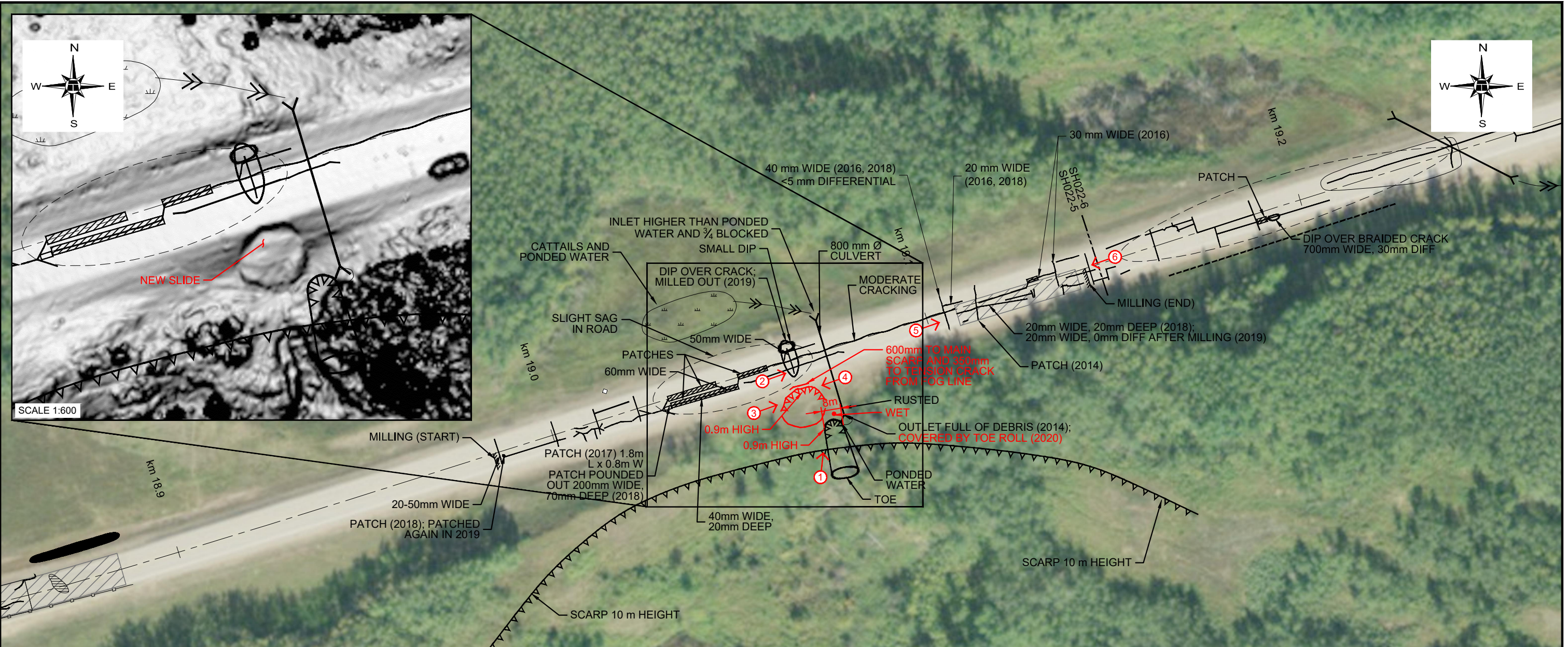
Long-Term:

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 realignment will be undertaken in the near future. Consideration is also being given to a shorter realignment which will occur farther up the slope and will likely not include Site #5 but will likely connect with the existing alignment at Site #6.

Ongoing Investigation:

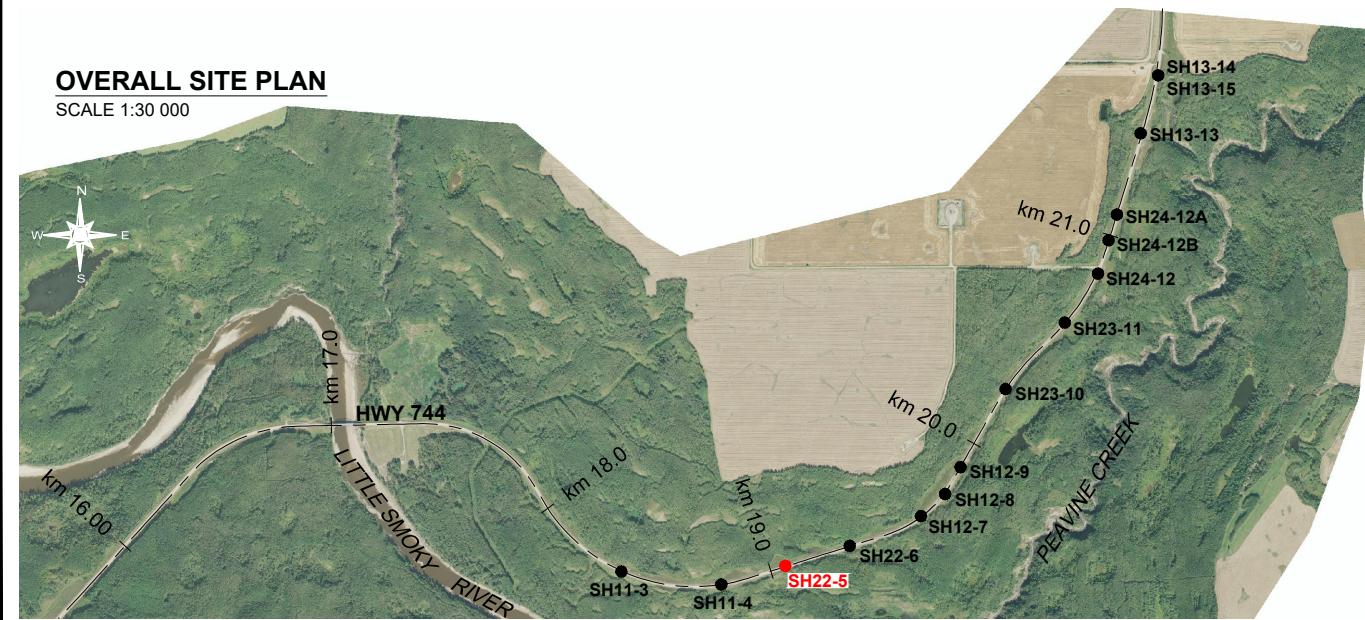
- It is recommended that the annual GeoHazard inspection should continue as scheduled.

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DETAILED SITE PLAN
SCALE 1:1000

OVERALL SITE PLAN
SCALE 1:30 000

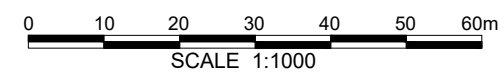


LEGEND

- CULVERT
- GUARDRAIL
- RED TEMPORARY HAZARD SIGN
- CURVE SIGN
- 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 2020 OBSERVATIONS SHOWN IN RED.



SATELLITE IMAGE FROM VALTUS IMAGERY (DATED 2014)
DIGITAL ELEVATION SURFACE GENERATED FROM UAV IMAGERY (THURBER 2020)



PEACE REGION (SWAN HILLS)

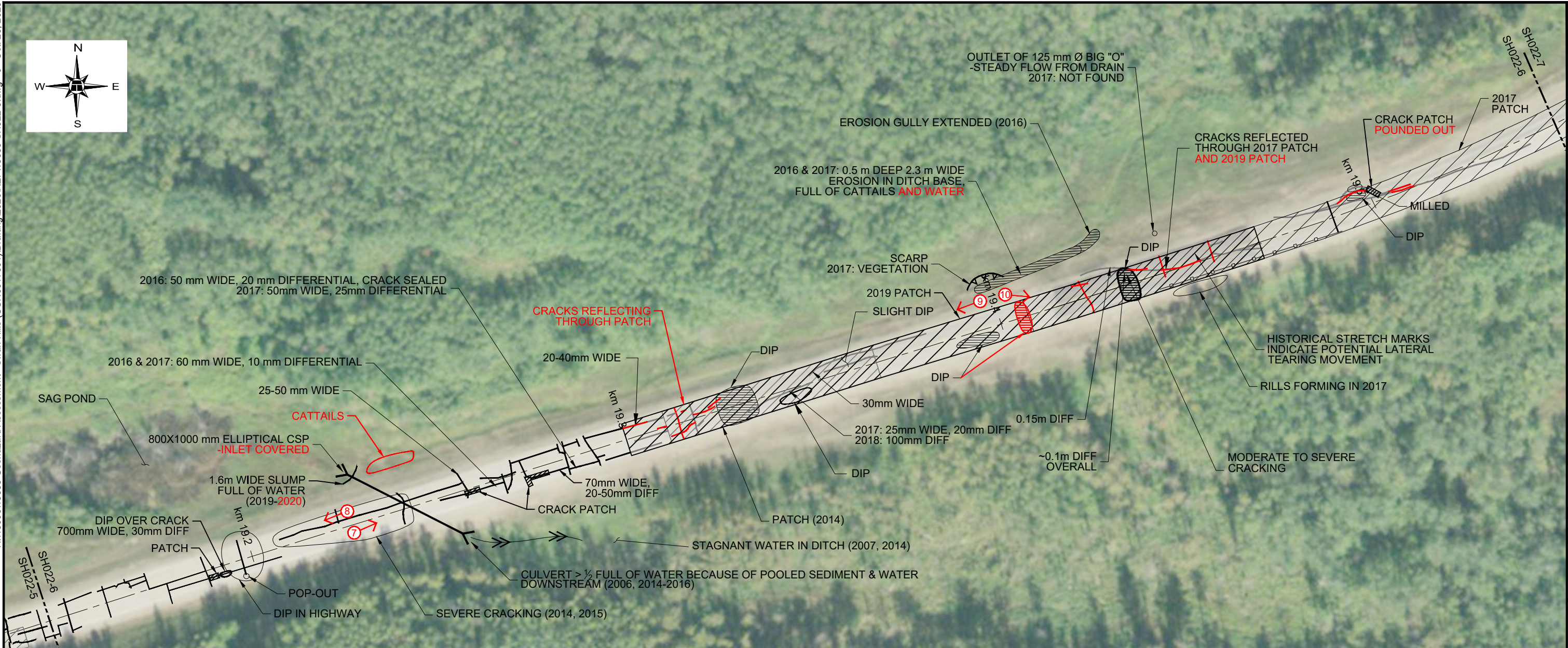
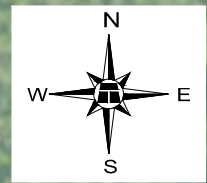
**SH022-5: HWY 744:02 LITTLE SMOKY RIVER VALLEY
2019 SITE INSPECTION PLAN**

DWG No. 13355-SH022-5

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	OCTOBER 2020
FILE No.	13355

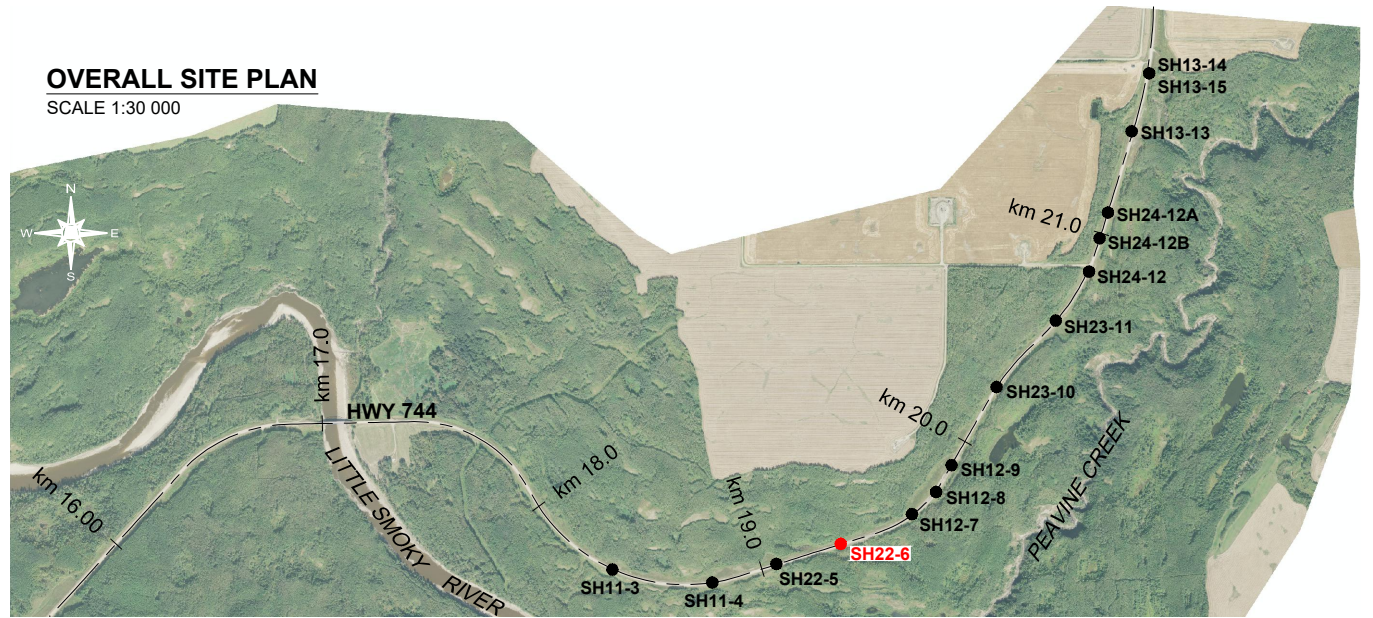


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DETAILED SITE PLAN
SCALE 1:1000

OVERALL SITE PLAN
SCALE 1:30 000

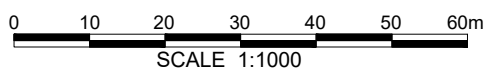


LEGEND

- CULVERT
- GUARDRAIL
- RED TEMPORARY HAZARD SIGN
- ASPHALT PATCH
- DIRECTION AND NUMBER OF PHOTO

NOTES

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3. JUNE 2020 OBSERVATIONS SHOWN IN RED.



SATELLITE IMAGE FROM VALTUS IMAGERY (DATED 2014)



PEACE REGION (SWAN HILLS)

**SH022-6: HWY 744:02 LITTLE SMOKY RIVER VALLEY
2020 SITE INSPECTION PLAN**

DWG No. 13355-SH022-6

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	OCTOBER 2020
FILE No.	13355





Photo 1, Site 5 (June 24, 2020) – Looking north at slump that has formed at the north edge of the deep landslide depression adjacent to the highway at about km 19.06.



Photo 2, Site 5 – Looking east at crack pattern over culvert outlet at km 19.07 and new slide at edge of right shoulder.



Photo 2, Site 5 (June 24, 2020): Looking east at partially-repaired slide on right shoulder.



Photo 3: Looking east at new slump on shoulder that has blocked the culvert outlet (km 19.07).



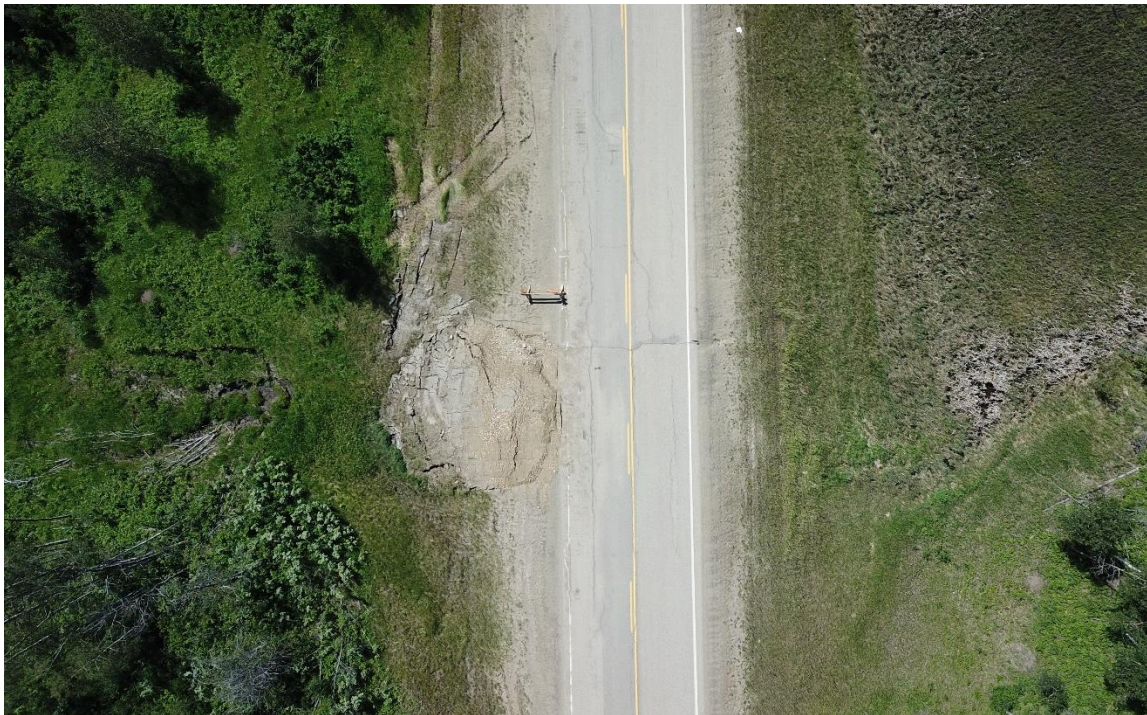
Photo 3, Site 5 (June 24, 2020): Emergency fill placed on the shoulder has also slumped.



Photo 4, Site 5: Looking west at new slide over the culvert outlet at km 19.07.



Photo 4, Site 5 (June 24, 2020): Looking west after emergency fill placement.



UAV, Site #5 (June 24, 2020): Showing attempted repair and continued retrogression



Photo 5, Site 5 – Looking northeast at partially-milled patch between km 19.10 to km 19.13.



Photo 6, Site 5 – Looking southwest at milled patch between km 19.10 to km 19.13.



Photo 7, Site 6 – Looking northeast at 2019 patch at km 19.3. There is a noticeable dip about 20 m to 30 m east of the start of the patch.



Photo 8, Site 6 – Looking west at west end of Site #6 toward Site #5.



Photo 9, Site 6 – Looking west at cattails in gully at km 19.40 and recent patch.



Photo 10, Site 6 – Looking east at 2019 patch near east end of site.