ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – HIGH LEVEL
2020 CALLOUT

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH087	North of Town of Peace River	Whitemud River (km 46.2)	743:02	43.4
Legal Description		**UTM Co-ordinates**		
NW1-88-21-W5		11V N 6,273,215	E 487,109	

	Date	PF	CF	Total RISK LEVEL
Previous Inspection:	None	-	-	-
Current Inspection:	24-June-2020	13	4	52
Photos by Kurz	13-July-2020	13	7	91
Road AADT:	110		**Year:**	2019
Inspected By:	Ed Szmata, TRANS		Ken Froese, Thurber	
Report Attachments:	☑ Photographs	☑ Plans	☐ Maintenance Items	

Primary Site Issue:	Landslide cracking across the gravelled road.		
Dimensions:	75 m length of highway affected.		
Date of any remediation:	None		
Maintenance:	None	**Worsened?**	
Observations:	**Description**	**Yes**	**No**
☑ Pavement Distress	Cracks in gravel road with significant differential at north side through and adjacent to east shoulder. Less differential at south side.	☑	☐
☑ Slope Movement	Dip across roadway surface. Numerous historical and active scarps on slope above and below roadway.	☑	☐
☐ Erosion		☐	☐
☑ Seepage	Seepage in the east ditch on the south side of the site.	☑	☐
☐ Culvert Distress		☐	☐
☐ Other		☐	☐
Instrumentation:			
None.			

Assessment:

(It should be noted that the conditions documented herein are at the time of the initial callout inspection. The further deterioration of the site in the weeks following is documented below.)

The site was discovered on June 24, 2020, while driving from the PH039B callout inspection on the north valley slope. It is not known when the cracking first started or if there was been historical issues at this location.

The site is located on Highway 743:02 near the middle of the south slope of the Whitemud Creek valley about 630 m south of the bridge and 220 m north of the existing PH011 GeoHazard site (not currently on the annual inspection program). The valley slopes down to the west at this site. At the time of the callout inspection, there was an arc-shaped pattern of cracks extending across the highway with the apex on the east edge of the gravelled surface. The extent of the cracks was about 73 m wide measured along the west shoulder. The cracks did not appear to extend into the sideslope, and fresh movement was not observed in the uneven terrain below the highway. However, many of the birch trees on the slope below appeared to be dead potentially due to slide movements cutting the root system or ponding water drowning them. The difference in understorey vegetation was readily apparent on the unmanned aerial vehicle (UAV) imagery.

On the west side of the roadway surface, the cracks were typically less than 20 mm in width with no vertical differential and did not typically extend across the roadway. Some of the pattern was likely obscured by routine grading. On the east side of the highway, the cracks were typically 20 mm to 30 mm in width and up to 70 mm of vertical differential was observed in the ditch where they had not been graded. Some of the cracks were open enough to measure depths up to 100 mm. There was an overall depression of the roadway surface in the vicinity of the east cracks. There was water flowing down the ditch from the south and accumulating in the ditch near the slide. The grader operator related that he creates a low berm of gravel along the shoulder to try to keep the water off of the roadway. There was recent seepage on the roadway surface and ditch and deposition in the ditch from previous run-off and/or seepage. The east ditch was wet and soft.

LiDAR provided by Alberta Transportation shows an unstable valley slope leading down to a tributary stream of the Whitemud Creek. Drawing 13351-PH087-1 shows the LiDAR image (grey-shaded by slope angle from white at 0° to black at 35°) with the major scarps identified along with the one arcing through the highway (and associated cracks). The terrain shows indications of a developing retrogression pattern bounded to the northeast by a significant scarp face whose south face is 35 m high and standing at 34°. There is also instability moving in a perpendicular direction on the north side of this feature. This drawing also shows the scarps and cracks identified from field observations and confirmed from UAV imagery. The digital elevation model (DEM) from the UAV imagery was created using structure-from-motion (SfM) techniques as is shown in Detail A. Detail B shows the orthoimage assembled as part of the SfM process.

The conclusion is that this movement at the highway is part of an ongoing larger, retrogressive slide complex likely driven by the downcutting of the tributary channel which is about 135 m horizontal away and 20 m lower in elevation. The heavier-than-normal rainfall this year has likely also contributed both through raising of the groundwater table and increased river flows. The LiDAR also shows that the slope above the highway has also been subject to historical movement. It is probable that the movement seen at the highway is part of a re-activation of the retrogressive movement which will presumably continue up the slope if not otherwise remediated.

Post-Inspection Update:

Additional photographs from Erwin Kurz, AT MCI, were provided to Thurber on July 13, 2020 (select ones attached below). These photos show that the slide at PH087 has continued to move requiring ongoing grading to maintain the highway surface. Combined with increased movement at a second set of sites on the north side of the valley (PH039A and B), the highway has been temporarily closed. A higher Risk Level of 91 has been assigned to this site based on the July 13, 2020 conditions.

Recommendations:

Short-Term (<3 months):

- The highway should be kept closed until the movement rates have subsided which will likely require a significant reduction in rainfall amount. The roadway should be inspected routinely to assess the relative rates of movement.
- Once movement has subsided, the roadway should be regraded minimizing the amount of material placed and lowering the grade were feasible. The resulting undulations where the roadway crosses scarps may necessitate warning signs and a reduced speed limit.
- Once opened, frequent visits by the AT Maintenance Contractor are recommended to ensure that the roadway remains safe for the travelling public as this slide will deteriorate.

Medium-Term:

- Construction of a short realignment (as shown approximately on Figure 1 below) could be undertaken if movements do not subside. The terrain is relatively flat along this path and hence the re-alignment should only involve minor cuts and fills (+/-2 m). There is some risk though that this re-alignment could also be affected by movements in the future as it would also be cross through ancient landslide terrain.
- Reconnaissance of the slope at the toe of the tributary stream could be undertaken to assess the potential for armouring of the tributary creek to control toe erosion.

Long-Term:

- The highway could be realigned south of the Whitemud Creek bridge to rise out of the valley perpendicular to the valley slope and then curve back to cross the tributary creek east of PH011-1, as shown approximately on Figure 2 below. The curved alignment is required due to the proximity of the Peace River valley to the east of the Whitemud Creek valley. This re-alignment would be expensive and involve a very large cut and require that all excavated material be hauled out of the valley and stockpiles at least 300 m away from the valley crest. This would also require a significant new overland road segment to bring the new alignment back to the existing in the plateau area, as well as a new bridge file culvert and embankment fill at the tributary crossing.

Design:

It is recommended that a preliminary engineering assessment be completed to further develop the medium- and long-term re-alignments. Due to the relatively low AADT for this road it is presumed that only the medium term short re-alignment would be economically feasible at this time but it might be useful to have a relative cost for the longer term bigger re-alignment for comparison and future planning.

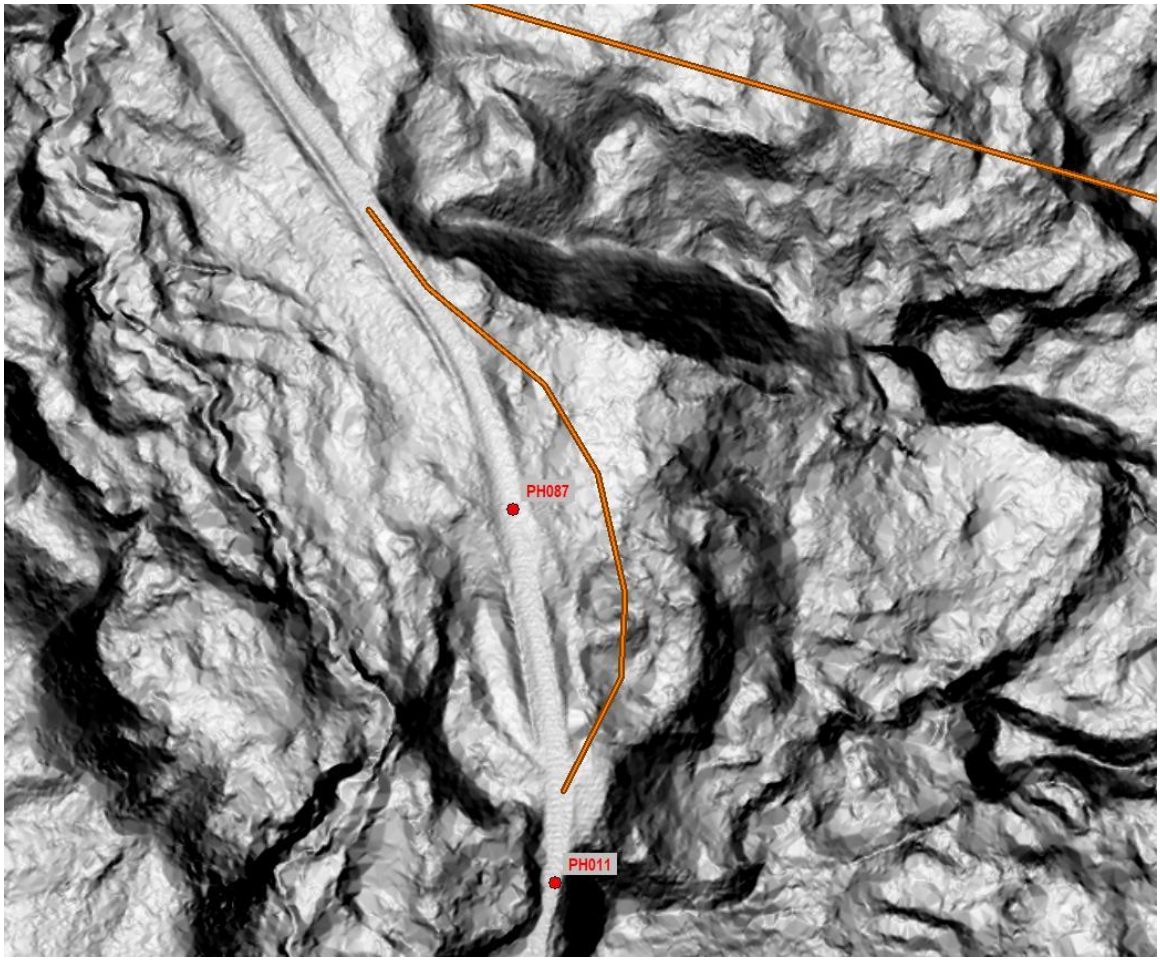


Figure 1: Medium term short realignment around PH087 slide

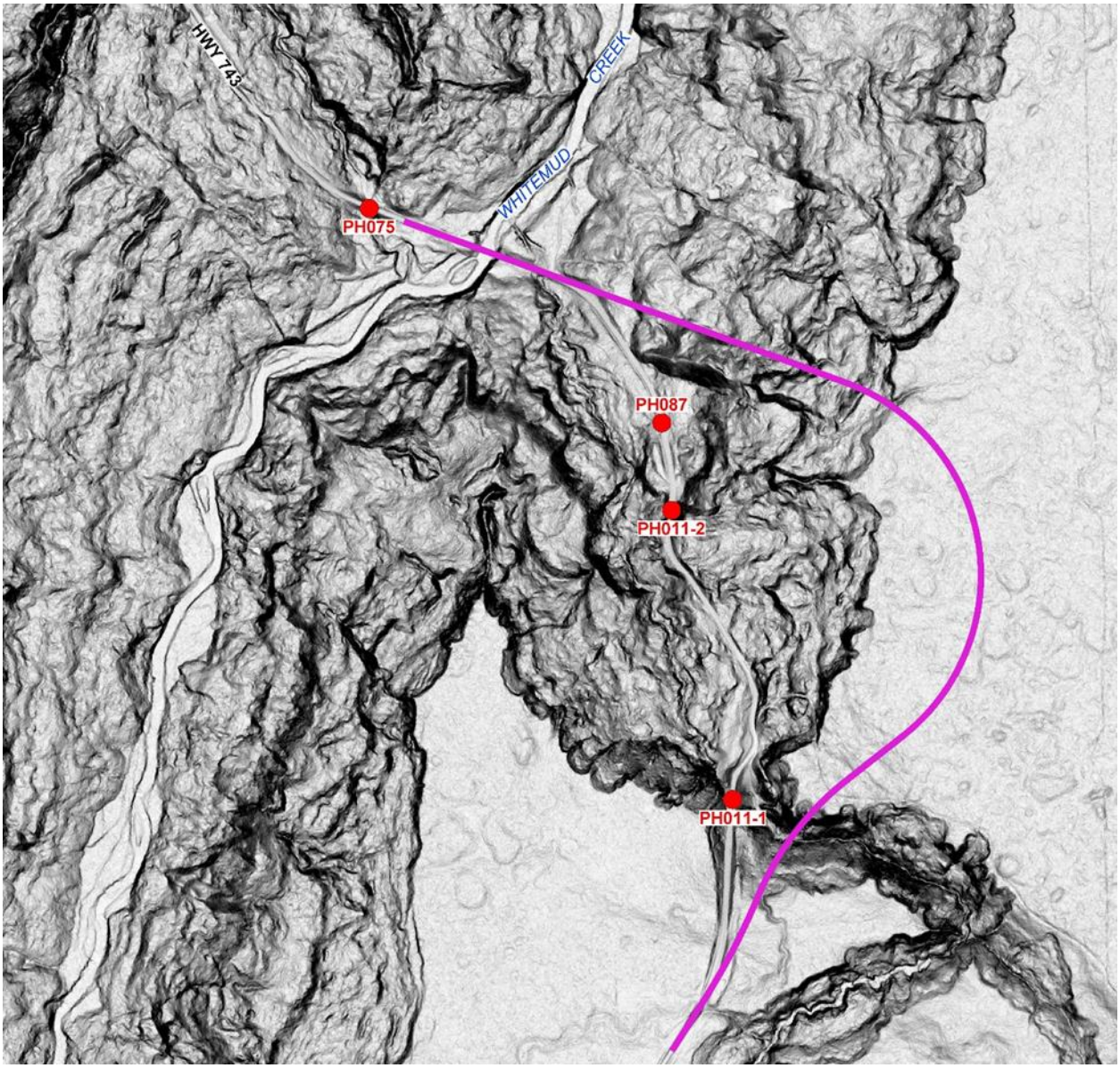
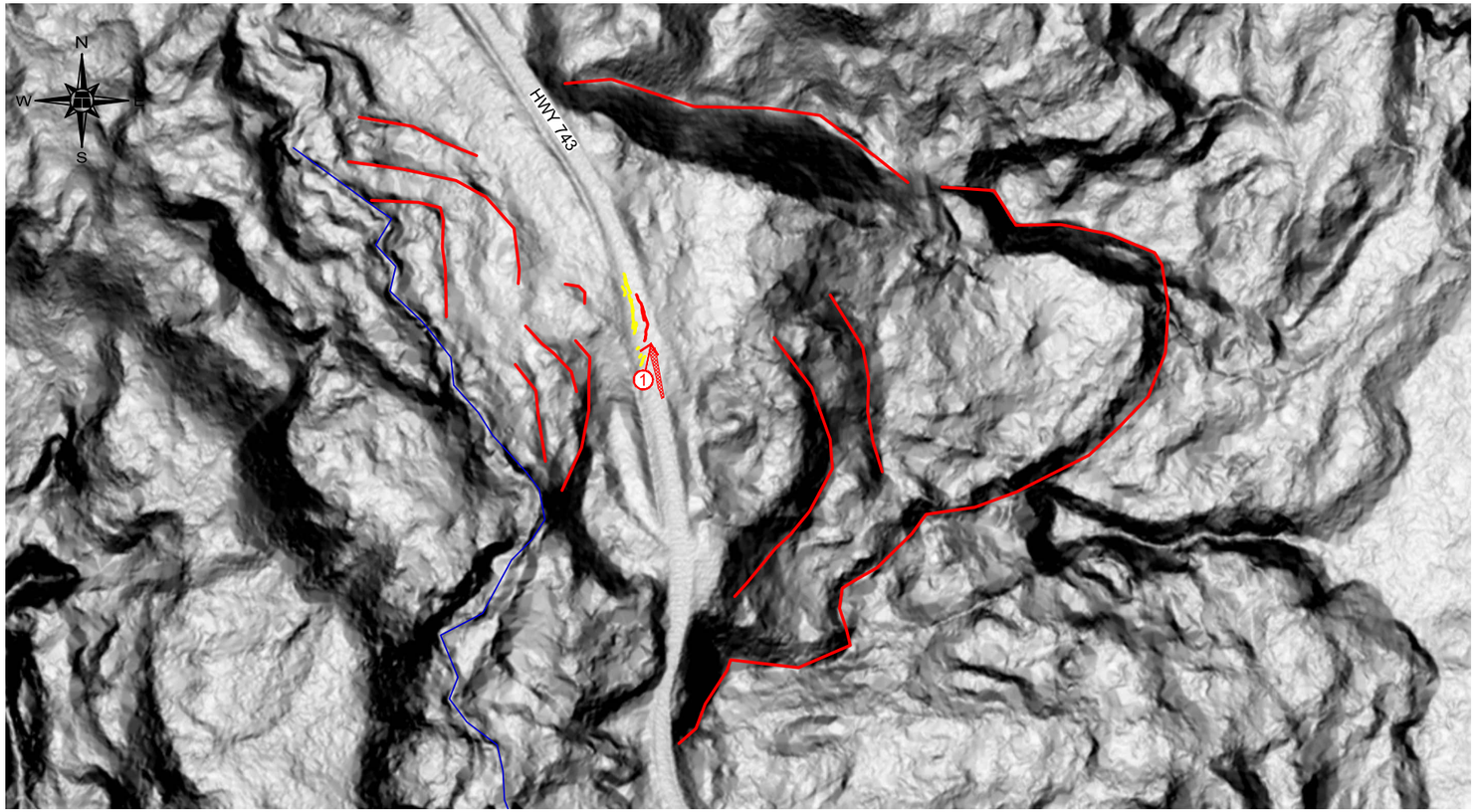


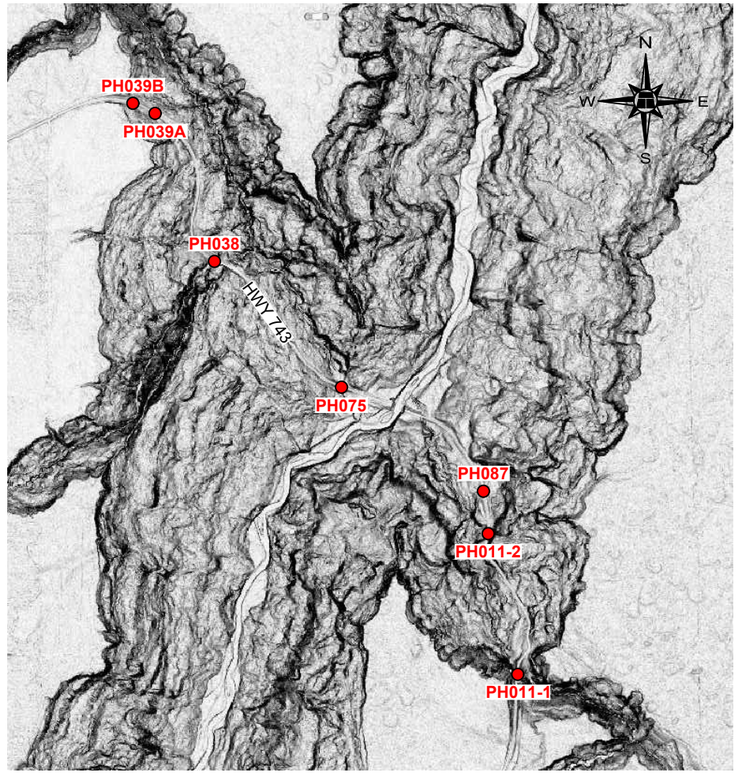
Figure 2: Long term realignment for Hwy 743:02 south of the Whitemud Creek

H:\13000\13351 Geohazard Assessment - Peace River\High Level (CON0017602)\Drafting\2020\KEF\13351-PH087 Callout.dwg - Layout1 - Jul. 20, 2020



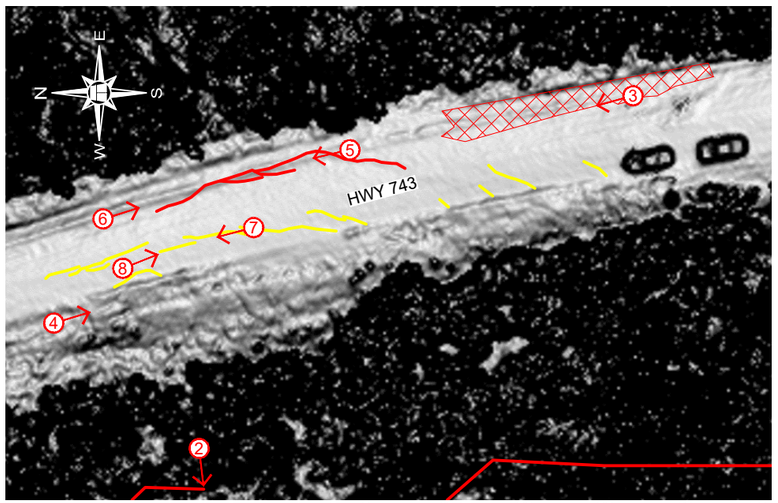
SITE PLAN - 2008 LIDAR
SCALE 1:4000

0 10 20 30 40 50 60 70 m
SCALE 1:1250



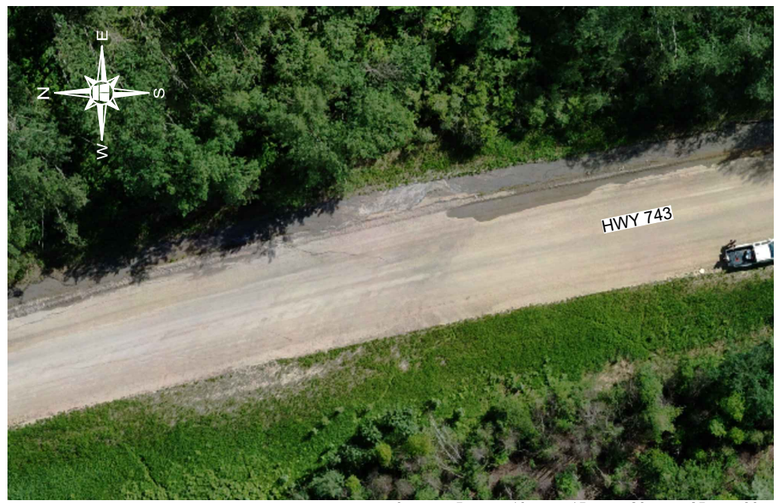
KEY PLAN - 2008 LIDAR
SCALE 1:30000

0 250 500 750 1000 1500 2000 m
SCALE 1:30,000



DETAIL A - 2020 DEM
SCALE 1:750

0 10 20 30 40 50m
SCALE 1:750



DETAIL B - 2020 ORTHOIMAGE
SCALE 1:500

0 5 10 15 20 25 30m
SCALE 1:500

LEGEND
- SCARP
- CRACK
- FRESH SEEPAGE
- PHOTOGRAPH NUMBER AND DIRECTION

UAV IMAGERY TAKEN BY THURBER ON JUNE 24, 2020
LIDAR PROVIDED BY ALBERTA TRANSPORTATION; (SLOPE-SHADED TO BLACK AT 35°)

Alberta

PEACE REGION (PEACE RIVER/HIGH LEVEL AREA)
PH087

2020 CALL OUT PLAN

DWG No. 13351-PH087-1

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	JULY 2020
FILE No.	13351

THURBER ENGINEERING LTD.

Photo 1 – Looking north at natural ridge northeast of the site (UAV photo).

Photo 2 – Looking at dead birch trees downslope of the slide.

Photo 3 – Looking north at the slide located just beyond (north) of the seepage in the east ditch. There was no obvious vertical distortion of the roadway surface at the time of the callout inspection.

Photo 4 – Looking south at the sideslope of the highway below the slide.

Photo 5 – Looking north at the main scarp crack cutting through the low graded berm. Note the wet material accumulated behind the berm from seepage further south.

Photo 6 – Looking south at the main scarp crack in the east ditch. The “shale slope” sub-site of PH011 is visible in the background at the curve in the road.

Photo 7 – Looking north at tension cracks on the west side of the roadway.

Photo 8 – Looking south at tension cracks on the west side of the roadway.

Kurz, July 13, 2020 – Looking south at PH087 site.

Kurz, July 13, 2020 – Looking north at PH087 site.