

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – GRANDE PRAIRIE DISTRICT
2020 INSPECTION**



Site Number	Location	Name	Hwy	km
GP38	NW of Grande Cache	2.0 km N of Kakwa River Bridge	40:38	25.9
Legal Description		UTM Co-ordinates (NAD 83)		
SE8-63-4-W6		11U N 6,033,120	E 398,445	

	Date	PF	CF	Total
Previous Inspection:	May 28, 2019	5	2	10
Current Inspection:	May 26, 2020	5	2	10
Road AADT:	1,370	Year:		2019
Inspected By:	Don Proudfoot, Nicole Wilder (Thurber) Ed Szmata, Rishi Adhikari (AT)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	The original issue was a landslide in a 12 m high sidehill highway embankment fill caused by creek erosion. Site construction has been completed; however, some minor reflective hairline diagonal cracking was observed in pavement and there was some erosion and seepage noted parallel to swale	
Dimensions:	Original slide was about 60 m wide along highway, by ~60 m long from highway down to creek.	
Date of any remediation:	Construction was completed in summer 2018.	
Maintenance:	Full depth pavement reclamation was placed in June 2016. An ACP patch was placed in 2018 during construction of the toe berm.	
Observations:	Description	Worse?
<input checked="" type="checkbox"/> Pavement Distress	Hairline cracks are projecting through the ACP patch which coincide with the locations of the previous scarp crack. Cracks were in similar condition in 2020.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement		<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Some minor erosion was observed beside and below the coconut mat just south of the culvert outlet which appeared similar to what was observed in 2019 and along the west edge of the swale.	<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	There was some ice within the outlet of the new 2.43 m diameter SPCSP extension.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	There was a power pole installed through the toe berm fairly close to the culvert alignment.	<input checked="" type="checkbox"/>
Instrumentation October 8, 2020: Inclinometers SI17-1 = Previously there was a rate of 5.2 mm/yr @ 10.0 to 12.4 m depth; however, now there has been no discernible movement observed; SI17-2 = Sheared off at 12.2 m depth; SI17-3 = Sheared off at 11.0 m depth. Piezometers PN17-1A = 0.7 m BGS; PN17-1B = not functioning; PN17-2A = 0.05 m AGS; PN17-2B = 0.57 m BGS; PN17-3A = not functioning; PN17-3B = 1.72 m BGS		
Assessment:		
A scarp crack was noted on the highway affecting approximately 60 m length of highway surface. At the north end, the scarp crack entered the southbound shoulder at roughly a 45-degree angle, angled off into the northbound driving lane, ran along the northbound lane for about 50 m except for a short distance where it extended into the northbound shoulder, then at the south end cut across the highway. There is an overall vertical drop of about 14 m from the highway to the creek. Based on these observations, it		

appeared that the highway surface and west embankment fill was moving westwards as a result of the previous creek erosion.

In February 2017, a geotechnical investigation was performed at this site, consisting of three test holes completed with inclinometer and dual piezometers in each test hole. The soil conditions consisted of 2 to 4 m of clay highway embankment fill, over clay till extending to 10 to 15 m BGS and underlain by clay. Very rapid movements in excess of 100 mm/yr were recorded in two of the 3 inclinometers shortly after installation, while SI17-1 was moving at a rate of ~20 mm/yr since installation. The depth of movement is coincident with the elevation of the creek, about 12 m BGS of the highway.

It was inferred that the landslide was a result of the creek eroding out/undermining the toe of the slope combined with highway embankment loading over the clay layer. The overall embankment fill and native slope before the repair was in the range of 3H:1V to 5H:1V, which was too steep for the underlying clay materials.

Remedial measures for GP38, which consisted of extending the culvert to allow a toe berm to be constructed, were carried out in 2017/2018. A drainage swale was also constructed, and rip rap placed at the end of the culvert extension.

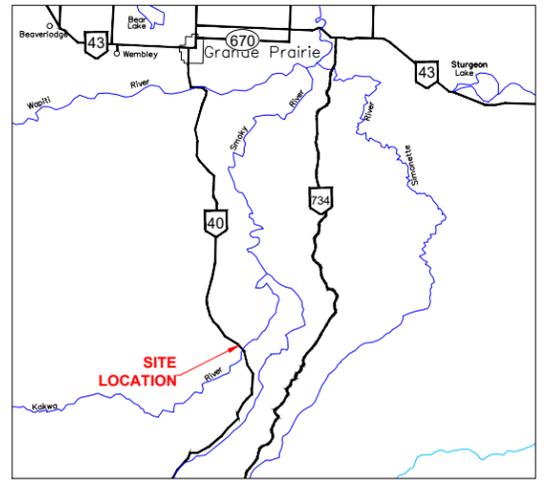
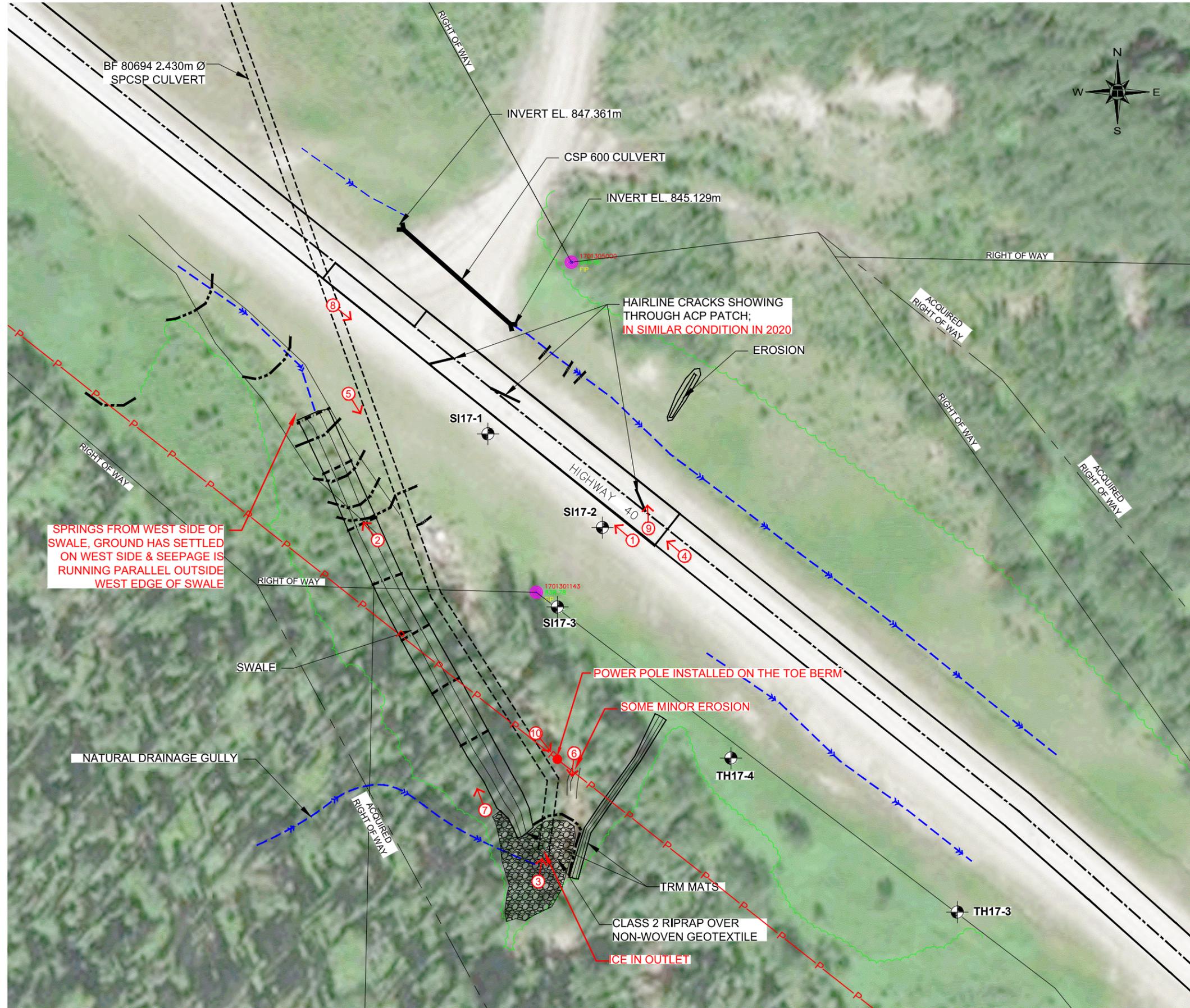
The previous 2.5 m diameter CSP culvert was replaced with a 2.43 m diameter SPCSP culvert on the north side of this slide area, crossing beneath the highway in a northeast to southwest direction. The previous culvert did not have any identifiable distress during past inspections; however, the outfall from this culvert had a 1.5 m drop over 7 m distance which contributed to erosion of the creek banks. There was work performed at the culvert outlet and further upslope along the west highway ditch in the winter/spring of 2016. This work reportedly consisted of grading, erosion control soil covering, riprap placement around/above the outlet, and installation of a subdrain.

After the repair construction was completed in 2018, minor erosion was noted along the west edge of the swale and beside and below coconut mat just south of the culvert outlet. The erosion is likely from the excessive rain and surface runoff flow that occurred in 2019 as this erosion was in fairly similar condition in 2020. Ground seepage was observed from springs along the west side of the swale making the ground very soft. The areas that have been broadcast seeded now show grass growth.

There are hairline cracks projecting through the ACP patch since the repair of the landslide in similar locations to previously observed which were in similar condition in 2020. This is evidence that the landslide may have been adjusting to the new fill placement from the toe berm construction; however, it appears that the movement has been slowing down.

Recommendations:

In the short term, the site should be monitored every one to two years to ensure the toe berm functions properly and that large increases landslide movement do not occur. The minor erosion observed should be monitored and if these areas worsen then they should be removed and replaced with compacted clay fill and erosion control matting. The area near where the springs are located may need further drainage measures to drain to the creek.



KEY PLAN
SCALE: 1:2 000 000

LEGEND

- APPROXIMATE TEST HOLE LOCATION
- TREE LINE
- HIGHWAY
- DRAINAGE DITCH
- SILT FENCE
- BARRIER

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE
2. MAY 26, 2020 FEATURES SHOWN IN RED



SATELLITE IMAGERY FROM ESRI WORLD IMAGERY (DOWNLOADED 2019-11-19)



PEACE REGION (GRANDE PRAIRIE)
GP38-1: HWY 40:38, 2.0km NORTH OF
KAKWA RIVER BRIDGE

2020 INSPECTION PLAN

DWG No. 13353-GP38-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:1000
DATE	DECEMBER 2020
FILE No.	13353





Photo 1.
Looking north
towards the
highway and SIs.



Photo 2.
Looking north
along the west ditch
at erosion control soil
covering and silt
fencing.



Photo 3.
Looking north at
the 2.43 m
diameter SPCSP
outlet and riprap.



Photo 4.
Looking north along
the highway at
where patch had
been placed.



Photo 5.
Looking southeast
at swale and toe
berm.



Photo 6.
Looking southwest
at where minor
erosion has
occurred beneath
coconut matting.



Photo 7.
Looking northwest towards swale where there are several springs and ground seepage runs parallel to outside west edge of swale.



Photo 8.
Looking southeast along the highway SBL towards the buried 2.43 m diameter SPCSP culvert.



Photo 9.
Looking north at diagonal crack that has reflected through the new asphalt patch.



Photo 10.
Looking southeast at new power pole that was installed on toe berm near culvert alignment.