ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – GRANDE PRAIRIE DISTRICT
2019 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
GP42 Call Out	North of Grande Cache	9 km N of Wanyandie Rd	40:36	37.5
Legal Description		**UTM Co-ordinates (NAD 83)**		
NE16-59-6-W6		11U N 5,996,900	E 379,900	

	Date	PF	CF	Total
Previous Inspection:	May 23, 2018	12	3	36
Current Inspection:	May 28, 2019	12	3	36
Road AADT:	980		**Year:**	2017
Inspected By:	Don Proudfoot, Nicole Wilder (Thurber) Ed Szmata, Rocky Wang, Austin Dillman (AT)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	Landslide with 5.1 m high backscarp in embankment fill on east side of highway (5.5 m from guardrail).	
Dimensions:	About ~100 m long by 50 m wide. The main scarp is approximately 20 m wide.	
Date of any remediation:		
Maintenance:		
Observations:	**Description**	**Worse?**
☐ Pavement Distress		☐
☑ Slope Movement	The landslide occurred within the east embankment fill. The slump appears to be a shallow retrogressive slide. Fresh retrogressive movement was noted towards the northeast as the slide is closer to the guardrail. There were also minor scarps near the main body of the landslide and more signs of movement further south.	☑
☑ Erosion	Active erosion taking place by surface water and seepage flowing down slope.	☑
☑ Seepage	Seepage was observed from the base of the main scarp, and within intermediate tension cracks throughout the slide mass. There are preferential water runoff channels on either side of the higher lobe near center of slide mass. Water is ponding at the bottom of the main scarp (Photo 3).	☑
☐ Bridge/Culvert Distress		☐
☑ Other	Some backslope slumping was observed on the west (upslope) side of the highway and was in similar condition in 2019.	☐

Instrumentation: None

Assessment:

The slide is approximately 100 m long by 50 m wide with the main scarp approximately 20 m wide. The soils exposed in the slide scarp appeared to consist of 1.8 m of fill over clay till, with a layer of trees/stumps at the base of the fill (AT indicated there may also be a hardpan layer at ~8 m – info from the Bin Wall site). The toe bulge of the slide was approximately 2.5 m high, with many tilted/bent trees in the lower half of the slide, which suggests prior, continuous movements.

There was no pavement distress observed during the inspection, but there was relatively fresh sloughing, slide retrogression towards the highway and seepage within the slide mass, which was marked with many small secondary scarps and tears further downslope. Seepage was observed from the base of the main scarp, and intermittently further downslope, and was ponding in some lower lying areas.

It is anticipated that the slide is a retrogressive slide that was triggered by water seepage. Poor embankment materials and a relatively steep embankment slope may also have contributed to causing the slide. The northern flank of the upper slide portion appears to be an older slide that has re-activated. The main scarp appears to be retrogressing further back towards the highway (measured at 5.5 m from the guardrail) and at the current rate of retrogression could soon begin to affect the highway.

The backslope slumping appears to be shallow based and is not anticipated to be connected to the slide below the highway.

Recommendations:

Investigation:
Drill 1 or 2 test holes above the main scarp on the edge or downslope of the highway to a depth of about 20 m (this would verify the depth of the hardpan layer). The test holes should be completed with piezometers (and one if possible downslope with an inclinometer). This would provide information on the soil and groundwater conditions and potential depth of slide movement at this location and confirm slope stabilization design measures.

Short Term:
In the short term, the slide should be regularly monitored for regression of the slide scarp, which could necessitate adequate signage and traffic control marking one lane driving lane closure.

Medium to Long Term:
Option 1) – Repair similar to the Bin Wall further north, depends on hardpan depth:
A gabion wall (or bin wall) is recommended to be built below the highway and backfilled with granular fill. Sub-excavate the failed slide mass down to intact foundation soil above the wall location and rebuild the slope with imported 6-80 gravel to a slightly flatter 3H:1V inclination. The new fill material should be placed and compacted in thin horizontal lifts, benched into the intact slope surface to stabilize the slide area. Some of the more suitable excavated material could be used to provide a covering layer overtop the gravel and below the wall as the finished slope surface to shed runoff, with any excess removed from the site. The slide mass downslope of the wall could be completed with an armoured ditch to provide better drainage.

Ballpark Cost ~$1 to 1.5 Million

Option 2) – Construct a pile wall between the slide and the highway, consisting of steel H piles, or possibly concrete piles.

Ballpark Cost ~$1.5 Million

For either option: subdrain(s) should be installed along the base of the slide excavation (and perhaps below the upslope ditch) to drain any subsurface water that may enter the new fill zone. Also, a portion of the guardrail will have to be removed during construction and a temporary detour will likely have to be constructed on the west side of existing highway to allow two-way traffic.

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SAME

SOIL PROFILE IN SCARP:
0-1.8m FILL
1.8m TREES / STUMPS
1.8-3.2m CH TILL WITH SHALE CHUNKS

FRESH MOVEMENT

FRESH SLUMPING & SEEPAGE

PREVIOUS SLIDE, ALSO MOVING

5.5m FROM GUARDRAIL

~20m

3.2m HIGH SCARP (2017)
4m HIGH SCARP (2018)
5.1m HIGH SCARP (2019)

SEEPAGE

PONDED WATER

WP745

HWY 40:36

MORE SIGNS OF MOVEMENT

RUNOFF CHANNELS

SEEPAGE

HIGHER AREA (INTERMEDIATE TOE)

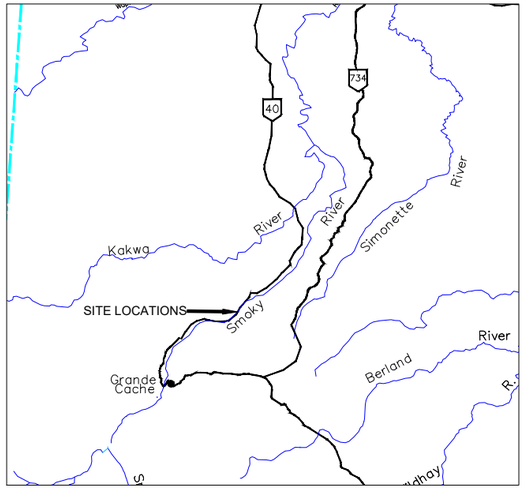
INTERMEDIATE TENSION CRACKS WITH WATER

TILTED, BENT, BROKEN, FALLEN TREES

2.5m HIGH TOE BULGE

1150 1140 1130 1120 1110 1100 1090 1080

N W E S



KEY PLAN
SCALE: 1:2 000 000

LEGEND

- CONTOUR LINE (CONTOUR INTERVAL =2.5m)
- DIRECTION AND NUMBER OF PHOTO
- SCARP CRACK
- SEEPAGE
- PROPOSED TEST HOLE WITH PIEZOMETER

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. MAY 28, 2019 FEATURES SHOWN IN RED.

0 10 20 30 40 50m
SCALE 1:750

BASE PLAN FROM 2005 LIDAR

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE)
(GP42) HWY 40:36, km 37.5 SLIDE

2019 INSPECTION PLAN

DWG No. 13353-GP42-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:750
DATE	NOVEMBER 2019
FILE No.	13353

THURBER ENGINEERING LTD.

THURBER

	**Photo 1.** Looking northeast at the main scarp.
	**Photo 2.** Looking east at the east flank of the main scarp.

	**Photo 3.** Looking east at the slide from above the main scarp. approached
	**Photo 4.** Looking east at recent tears and sloughed material.

	**Photo 5.** Looking southeast at area observed with fresh sloughing and tears.
	**Photo 6.** Looking northwest at the main scarp.

	**Photo 7.** Looking southwest at the intermediate toe area.
	**Photo 8.** Looking west at the west flank of the slide mass.