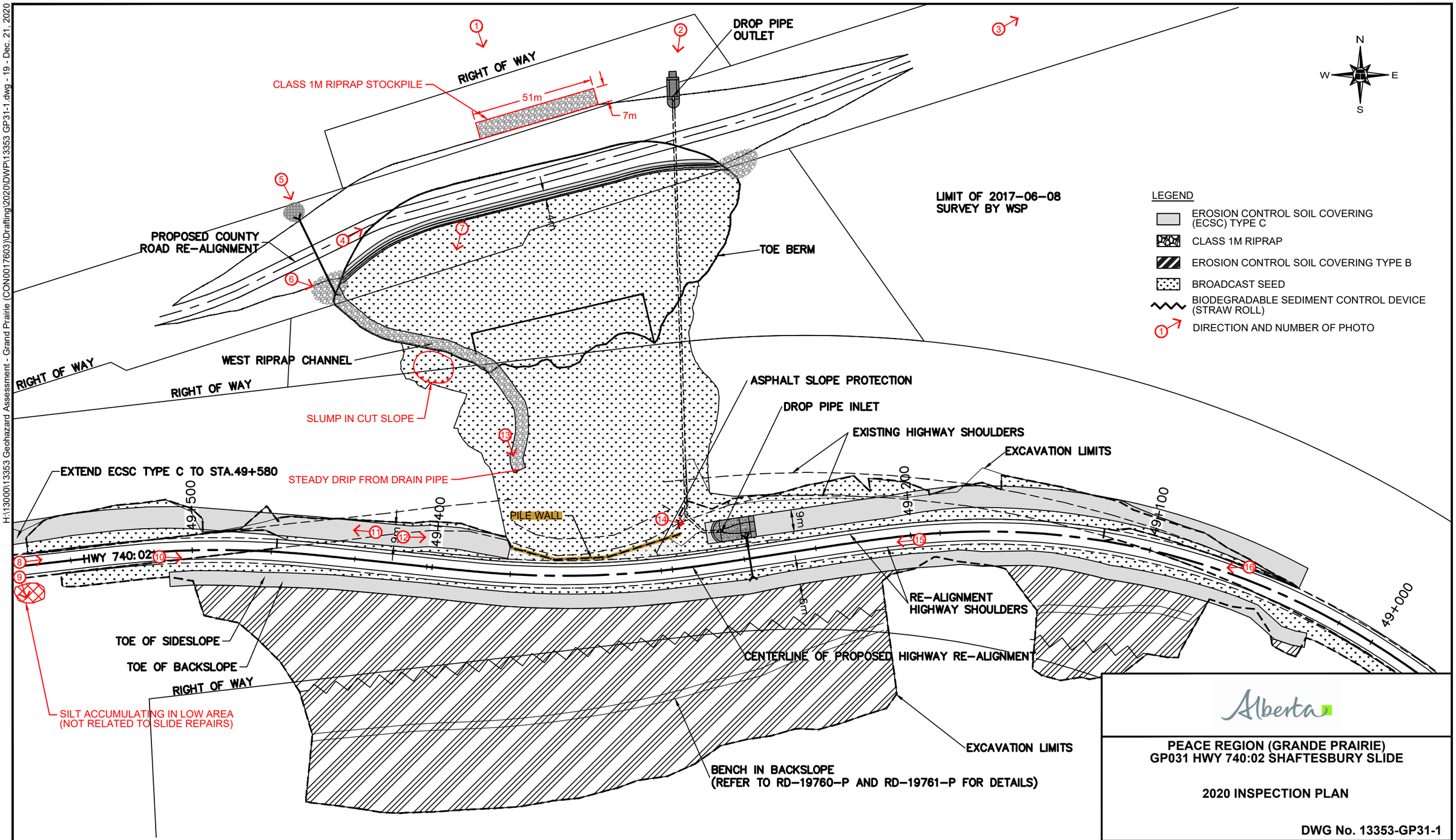
H:\13000\13353 Geohazard Assessment - Grand Prairie (CON0017603)\Drafting\2020\DWP\13353 GP31-1.dwg - 19 - Dec. 21, 2020



NOTES :

1. JUNE 11, 2020 FEATURES SHOWN IN RED

0 20 40 60 80 m

SCALE 1:1500

Alberta

PEACE REGION (GRANDE PRAIRIE)
GP031 HWY 740:02 SHAFTESBURY SLIDE

2020 INSPECTION PLAN

DWG No. 13353-GP31-1

DRAWN BY	KLW
DESIGNED BY	DWP
APPROVED BY	DWP
SCALE	1:1500
DATE	DECEMBER 2020
FILE No.	13353

THURBER ENGINEERING LTD.

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

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
GP031	South slope of the Peace River Valley near the Shaftesbury ferry crossing	Shaftesbury Slide, South Site	740:02	49.3
Legal Description		**UTM Co-ordinates (NAD 83)**		
LSD 4-9-82-23-W5M		11U N 6 216 300 E 466 120		

	Date	PF	CF	Total
Previous Inspection:	June 5, 2017	15	8	120
Current Inspection:	June 11, 2020	10	1	10
Road AADT:	160		**Year:**	2019
Inspected By:	Don Proudfoot (Thurber) Ed Szmata, Rocky Wang (AT)			
Report Attachments:	☑ Photographs ☑ Plans ☑ Maintenance Items			

Primary Site Issue:	A landslide was affecting the original alignment of the highway over a 70 m width. A pile wall which had been constructed along the shoulder of the road failed and the highway was shifted onto a detour around the backscarp of the slide. The slide extended down the slope to the terrace where Range Road No.234 is located 35 m below the highway. The backslope, which was about 7 m high, had also been subject to slumping.
Dimensions:	The main slide was 70 m wide along the highway. Three slumps were affecting the backslope over a combined width of about 80m, west of the main slide.
History and Date of any Remediation:	The original slide occurred in 2007. A pile wall was completed in 2009. It consisted of 114 driven steel HP310x79 piles and 45 screw anchors (Chance anchors). The piles along the main section of the wall were 22 m long while the "wing wall" piles at each end were 15 m long. The tie-back anchors were 25 m long. Prior to the slide the highway had dropped and was built back up behind the wall with a MSE zone against the wall and granular subbase further away from the wall. The wall failed in July 2014 due to loss of soil support on the downslope side and the highway was shifted onto a gravel detour behind the backscarp of the slide. In the summer of 2017, Thurber conducted a geotechnical investigation and prepared a preliminary engineering assessment with design options for the repair of the landslide. The selected design, which was constructed in 2018 and 2019, consisted of a realignment of the highway into the hillside, cutting back the backslope to a flatter inclination, constructing a toe berm to buttress the highway slope and constructing a concrete pile wall along the downslope shoulder of the highway.
Maintenance:	Maintenance has not been required since the construction of the latest stabilization measures

Observations:	**Description**	**Worse?**
☐ Pavement Distress		☐

☑ Slope Movement	A small slump has formed in the cut slope above the west riprap channel	☑
☑ Erosion	There is evidence of erosion outside the project limits resulting in silt accumulating in a low spot in the southwest highway ditch	☐
☑ Seepage	There was a steady drip coming from the drainpipe indicating the presence of groundwater	☐
☐ Bridge/Culvert Distress		☐
☑ Other	Some excess Class 1M riprap was stockpiled along the toe of the toe berm and is available for future repairs when needed	☐

Instrumentation:

4 slope inclinometers were installed in the pile wall and have measured deflections as follows:

- SI18-P10 = 0.9 mm of pile head deflection
- SI18-P30 = 1.8 mm of pile head deflection
- SI18-P50 = 2.2 mm of pile head deflection
- SI18-P70 = 1.8 mm of pile head deflection

Assessment:

The previous failure occurred because the slope below the original pile wall slid away leaving the wall unsupported. This resulted in a catastrophic failure of the steel piles, which were severely bent over. High groundwater levels were also a factor. In addition, the backslope inclination was too steep for the clayey soils that were present in it.

The new design added a large toe berm and cut back the backslope to reduce the overall inclination of the combined fill and backslope. A drainage blanket was constructed under the berm to prevent a buildup of groundwater behind the new berm fill. The pile wall was added to protect the new road surface from the existing landslide scarp that was located at the edge of the temporary detour fill. Surface drainage was also controlled by draining the upslope ditch water into a welded SWSP drop pipe, and precipitation and groundwater seepage from the slide mass into a riprap lined swale, both of which were extended down to the terrace at the toe of the valley slope.

The remedial measures appear to be performing well to date. Pile deflections are all within expected ranges and the global stability of the toe berm and backslope slopes look good. Grass is starting to catch on the site and the erosion prevention measures appear to be working.

The slump located above the west riprap channel is likely located in weak native material that had been pre-sheared during landslide events prior to construction. This should be repaired soon before it grows in size.

Recommendations:

<u>Maintenance</u>

The local slump above the west riprap channel should be excavated and replaced with free draining gravel.

It is recommended to inspect this site again next year to better gauge well the site is performing since the remedial measures.

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	**Photo 1.** Looking south at the repaired landslide area form the terrace level.
	**Photo 2.** Outfall for SWSP drop pipe performing well to date.

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	**Photo 3.** Grass starting to catch on excess soil stockpile area.
	**Photo 4.** County road aligned over top of berm ad finished with gravel surfacing.

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	**Photo 5.** Outlet of culvert draining end of West Riprap Channel.
	**Photo 6.** West Riprap Channel. A small slump has formed in the cut slope above the curve of the channel

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	**Photo 7.** View of slump above channel.
	**Photo 8.** Looking east along Hwy 740 at repaired slide site.

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	**Photo 9.** Silty runoff accumulating in low area south of highway. Not related to the landslide repairs.
	**Photo 10.** Looking east at new highway realignment.

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	**Photo 11.** Southwest ditch, looking west.
	**Photo 12.** Looking east at pile wall.

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	**Photo 13.** Drain outlet dripping water.
	**Photo 14.** Looking east toward inlet of drop pipe and outlet of centreline pipe.

	**Photo 15.** Looking west at realigned highway and backslope.
	**Photo 16.** Looking southwest at realigned backslope.