ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – HIGH LEVEL
2020 INSPECTION REPORT

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH086	Manning, Alberta	Pinewood Estates	691:02	0.06
Legal Description		**UTM Co-ordinates**		
South Abutment: NE21-091-23-W5M		11U E 461,782	N 6,308,097	

	Date	PF	CF	Total
Previous Inspection:	6-Aug-2019	10	4	40
Current Inspection:	4-Jun-2020	11	4	44
Road AADT:	680		**Year:**	2020
Inspected By:	Rocky Wang, TRANS Ed Szmata, TRANS		Ken Froese, Thurber	
Report Attachments:	☑ Photographs	☑ Plans	☐ Maintenance Items	

Primary Site Issue:	Landslide affecting the side slope of Hwy 691	
Dimensions:	50 m length of highway, 30 m wide, ~11 m high slope Tension cracks extend about 4 m further west The active slide is about 36 m wide parallel to the highway and 20 long in the downslope direction. Tension cracks extend an additional 15 m to the east. The slope is about 11 m high at the slide location. The bare backslope of the slide is inclined at 32 degrees and the side slopes outside the slide are inclined at 28 degrees to the horizontal.	
Date of Remediation:	None to date	
Maintenance:	Warning signs and jersey barriers have been placed at the site	
Observations:	**Description**	**Worsened?**
☑ Pavement Distress	2019 tension cracks became scarp in 2020; New tension crack formed at west end.	☑
☑ Slope Movement	2019 slide mass continues to move and break up. It extended both east and west in 2020.	☑
☑ Erosion	Exposed soil of slide mass eroding.	☐
☑ Seepage	Previous seepage from gravel layer not observed in 2020; lower quarter of slope appears to have seepage.	☑
☑ Bridge/Culvert Distress	600 mm CSP culvert outlet hanging 1.3m in 2020 and riprap apron destroyed by slide movement. Piece of 600 mm concrete culvert on west flank of slope but origin and inlet unknown.	☑
☑ Other	Area at toe of slide and beyond is soft and wet.	☐

Instrumentation:

There is no instrumentation at this site

Assessment:

There was a sudden movement/failure in the slope on July 26, 2019. Tension cracks were also noted near the top of the slope in the bush to the east of the main slide area
Seepage was noted coming out of the top of the bare backslope from a pit run gravel layer under the pavement as well as lower in the slope from the

The outlet of a 600 mm dia. C.S.P. centerline culvert drains onto the west flank of the slide from the intersecting ditches of Hwy. 691 and Hwy.35. The downstream riprap apron of the culvert has been disturbed by the slide movement. The outlet of a 600 mm dia. concrete pipe is also present lower on the west flank of the slide but the inlet of this pipe and where it drains from are unknown. The toe of the landslide is about 12 m from an alley that services some mobile homes located at the base of the slope in a residential subdivision.

The site is located along the north side of Hwy 691 on the east side of the intersection with Hwy 35 and is located within the town of Manning, Alberta. At this location, Hwy 35 descends northward down a hill on an embankment fill into the Notikewin River valley north of the site. Hwy 691 runs roughly parallel to the top edge of the valley. Based on available published surficial geology maps and satellite images, the Notikewin River created many meander bends as it cut its way down to form the present valley. The site is located along the crest of one of these abandoned bends.

The initial movement at the site occurred relatively quickly on July 26, 2019, and was about 36 m in length (measured perpendicular to the Hwy 691). Additional tension cracks were noted in the bush east of the main slide area. Clay till was exposed in the bare backscarp of the landslide. Seepage was observed from a pit-run gravel layer below the pavement and lower in the slope from within the clay till. It is possible that the clay till has lost its cohesion over time and that the wetter-than-average weather in 2019 resulted in an elevated water table which triggered the movement. The landslide has left the slope in an over-steep, unvegetated condition which will likely retrogress into the pavement over time. As observed in 2020, the slide has regressed further into the highway up to 1.2 m. Many of the tension cracks observed in 2019 became part of the scarp in 2020 for a total slide length of 50 m. The culvert outlet rirprap apron was displaced by movement and there is a tension crack in the highway extending further west beyond the culvert. At least two guardrail posts were mostly exposed in the central portion of the slide.

Recommendations:

Short-Term:

- Routine visual monitoring of the site and adjustment of the locations of the barricades and warning signs if/as the landslide backscarp retrogresses further into the paved road surface.

Medium-Term:

- Consideration could be given to installing 3 rows of soil nails and a reinforced soil covering mesh to reinforce the soil in the upper part of the slope to try to slow future retrogression of the slide until more permanent measures can be put in place. A continuous pipe could also be attached to the end of the culvert to carry water all the way down to the bottom of the slope to reduce the amount of water that is spilt into the slide area. A ballpark cost for these measures is about $300,000 if a soil nailing rig is currently available in Alberta. The cost could be higher if a rig is mobilized from out of province. This would be a temporary fix that might delay more permanent measures by a few years.
- Alternatively, the culvert could be abandoned and replaced with a new culvert under Hwy 35. The flow would then be discharged on the vegetated slope of the river.

Long-Term:

- A possible remedial measure is to realign the highway to a new intersection between about 150 m to 400 m further south depending on the land acquisition on the south side of the residences located in the southeast corner of the intersection. The exact alignment will depend on which properties can be acquired. It is recommended that the abandoned portion of Hwy 691 be removed the slope flattened. This is likely the most expensive option but also the most robust.
- Alternatively, the slope could be buttressed by a toe berm and granular fill. Water from the culvert would need to be controlled via an armoured swale extending down the toe berm or by re-aligning the culvert by boring a new SWSP under Hwy 35 to outlet to the west..

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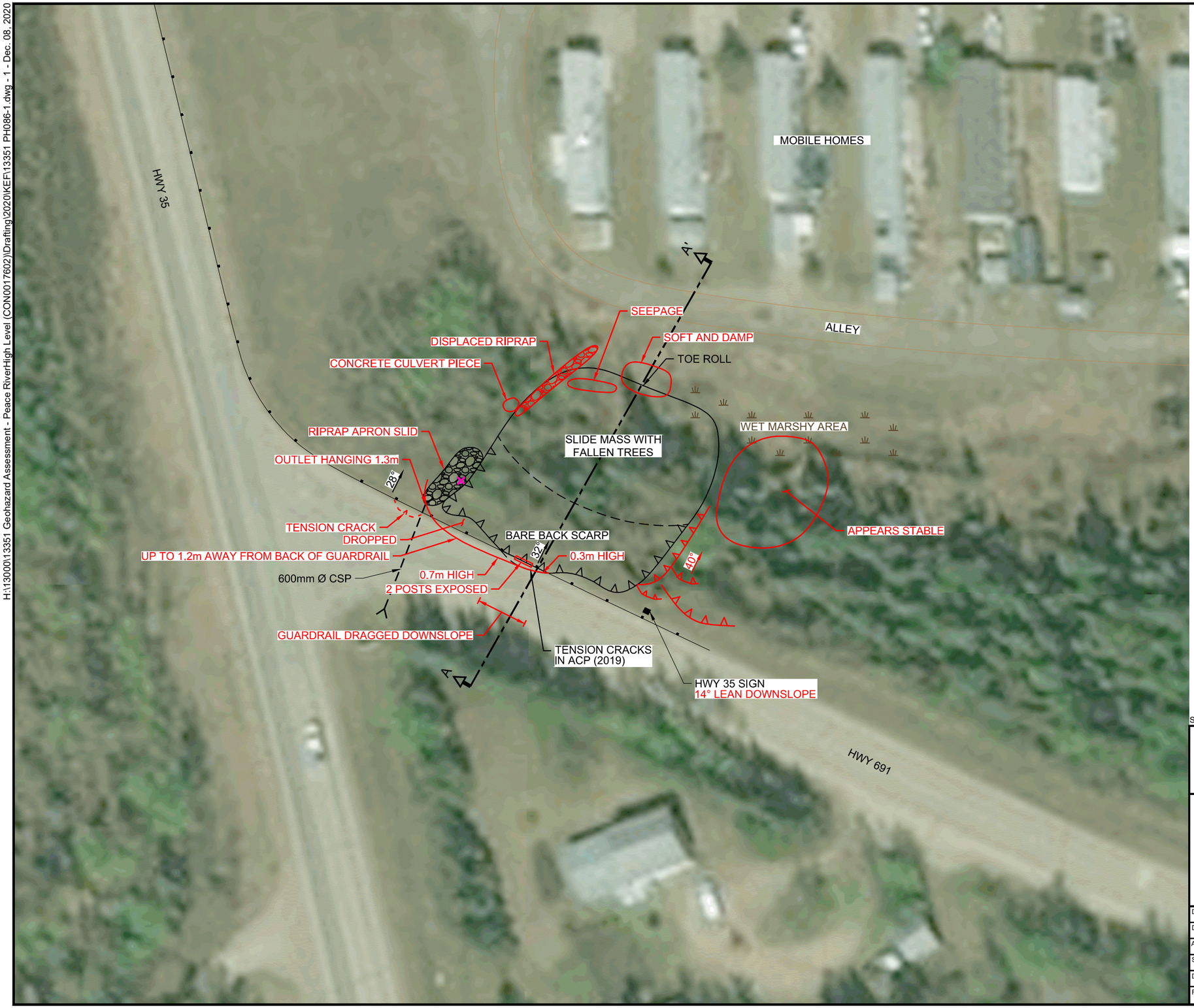

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LEGEND

- BACKSCARP OF LANDSLIDE
- TENSION CRACKS
- GUARD RAIL
- OUTLET OF 600mm Ø CSP CONCRETE PIPE
- RIPRAP

NOTES:

1. PREVIOUS OBSERVATIONS SHOWN IN BLACK
2. JUNE 2020 OBSERVATIONS SHOWN IN RED

0 5 10 15 20 30m
SCALE 1:600

SATELLITE IMAGE FROM ESRI WORLD IMAGERY (DOWNLOADED 2019-08-28)

Alberta

PEACE REGION (PEACE RIVER / HIGH LEVEL)

PH086-1: HWY 691:02 PINEWOOD ESTATES
2020 GEOHAZARD ASSESSMENT

DWG No. 13351-PH086-1-1

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	1:600
DATE	DECEMBER 2020
FILE No.	13351

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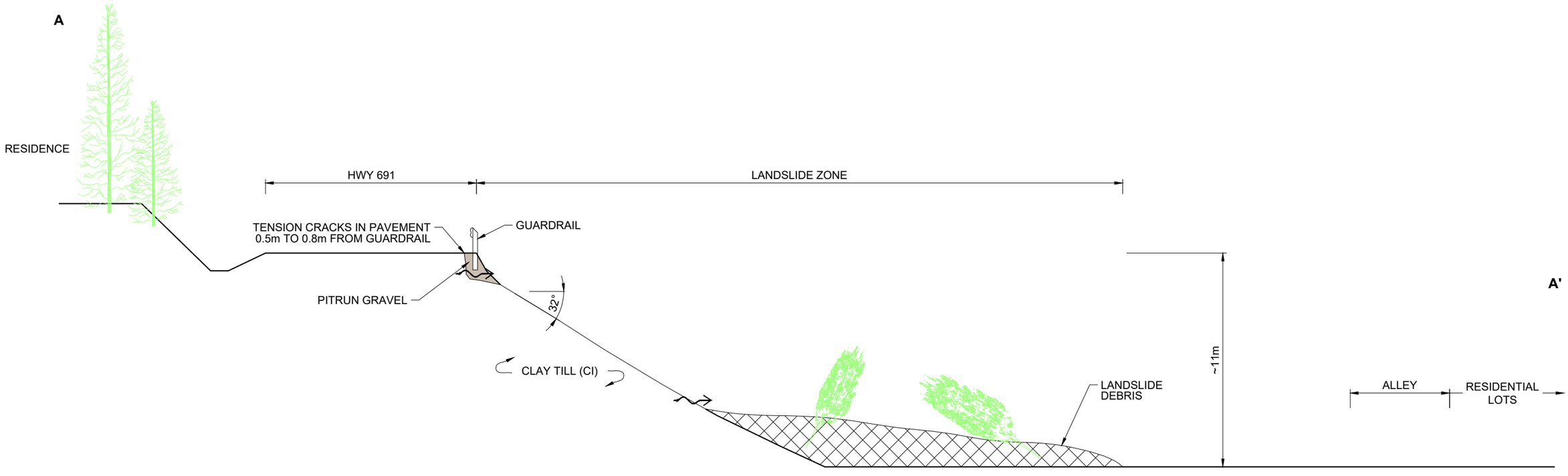

LEGEND

SEEPAGE

Alberta

PEACE REGION (PEACE RIVER / HIGH LEVEL)

PH086-1: HWY 691:02 PINEWOOD ESTATES
2020 GEOHAZARD ASSESSMENT

DWG No. 13351-PH086-1-2

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	1:200
DATE	DECEMBER 2020
FILE No.	13351

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Photo 1 – Looking East along Hwy. 691 toward the landslide.

Photo 2, Backscarp of landslide is at the guardrail along Hwy. 691.

Photo 3, A 600 mm dia. C.S.P. outlets in the west flank of the slide. A 600 mm dia. concrete pipe piece is located at the flank further down the slope.

Photo 4, Exposed till in the backscarp at the slide mass. Seepage was observed in this face at the time of the callout but appeared dry in June 2020.

Photo 5, Looking east at the failed slope. The culvert outlet is in the forefront.

Photo 6, Looking west along Hwy. 691 at the landslide cracks in the highway surface.

Photo 7, Looking west at the failed slope with slide mass and fallen/tilted trees at toe.

Photo 8, Looking south at the failed slope from the alley behind the mobile homes

Photo 9, Looking east at wet and soft ground of alley at toe of slide.