

**ALBERTA TRANSPORTATION  
GEOHAZARD ASSESSMENT PROGRAM  
PEACE REGION – HIGH LEVEL  
2019 CALLOUT**



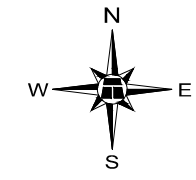
<b>Site Number</b>	<b>Location</b>	<b>Name</b>	<b>Hwy</b>	<b>km</b>
691-2-1	Manning, Alberta		691:02	0.06
<b>Legal Description</b>		<b>UTM Co-ordinates</b>		
South Abutment: NE21-091-23-W5M		11U E 461,782	N	6,308,097

	<b>Date</b>	<b>PF</b>	<b>CF</b>	<b>Total</b>
<b>Previous Inspection:</b>				
<b>Current Inspection:</b>	06-August-2019	10	4	40
<b>Road AADT:</b>	400		<b>Year:</b>	2018
<b>Inspected By:</b>	Ed Szmata, TRANS		Don Proudfoot, Thurber	
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs	<input checked="" type="checkbox"/> Plans	<input type="checkbox"/> Maintenance Items	






<b>Primary Site Issue:</b>	Landslide affecting the side slope of Hwy 691	
<b>Dimensions:</b>	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.	
<b>Date of Remediation:</b>	None to date	
<b>Maintenance:</b>	Warning signs and barricades have been placed at the site	
<b>Observations:</b>	<b>Description</b>	<b>Worsened?</b>
<input checked="" type="checkbox"/> Pavement Distress	Tension cracks located 0.5 to 0.8 m into the pavement from the guardrail	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	There was a massive 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	<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	There are signs of erosion rills in the bare backslope of the landslide	<input type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	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 till	<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	The outlet of a 600 mm dia. C.S.P. centreline 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	<input type="checkbox"/>

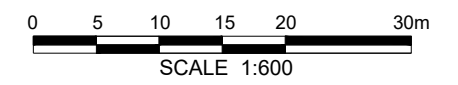
<input checked="" type="checkbox"/> Other	The toe of the landslide is about 12 m from an alley that services some mobile homes located at the base of the slope in a residential subdivision.	<input type="checkbox"/>
<b>Instrumentation:</b>		
There is no instrumentation at this site		
<b>Assessment:</b>		
<p>The site is located along the north side of Hwy. 691 near its intersection with Hwy. 35, at Manning, Alberta. At this location, Hwy. 35 descends a hill on an embankment fill into the Notikewin River valley to the north of the site, while Hwy 691 is located along the top edge of the valley. Based on available published surficial geology maps (attached) and satellite images, the Notikewin River created many meander bends as it cut its way down to form the present valley and the site is located along the outside edge/valley slope of one of these bends.</p> <p>Clay till was exposed in the bare backscarp of the landslide and seepage was noted coming from the slope. It is possible that the till has lost its cohesion over time and that the wet weather that has occurred this year has resulted in a higher than usual water table that has triggered the slope movement. The landslide has left the slope in an over steep unvegetated condition and it is likely that the backscarp of the slide, which is currently right at the guardrail, will retrogress into the pavement over time if left un-remediated.</p> <p>The risk level for this site has been assessed a Probability factor of 10 (active with moderate movement) and Consequence Factor of 4 (high fill slope where a partial closure of the road would result from a further slide movement and residential subdivision is close by) for a total Risk Level of 40.</p>		
<b>Recommendations:</b>		
<p>Short-Term:</p> <ul style="list-style-type: none"> <li>▪ In the short-term AT should visually monitor the site and be prepared to adjust the locations of the barricades and add additional warning signs if the landslide backscarp retrogresses further into the paved road surface</li> </ul> <p>Medium-Term:</p> <ul style="list-style-type: none"> <li>▪ 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.</li> </ul> <p>Long-Term:</p> <ul style="list-style-type: none"> <li>▪ If some land can be purchased from the resident located immediately south of the slide area, Hwy 691 could be re-aligned to the south away from the slide, the failed slope could be flattened and the graded material could be used to build a toe berm at the base of slope. The ballpark cost for this option could range from \$500,000 to \$1,000,000 depending on whether a partial purchase of land vs. a total buyout of the private property is completed.</li> <li>▪ Alternatively, a pile wall or bin wall could be built along the edge of the highway, and a slope flattening, and toe berm could be constructed with imported fill to stabilize the site for a ballpark cost of \$1,000,000.</li> <li>▪ The soil nail option could potentially be modified to a longer-term option if soil nails and mesh are applied to the whole slope, using nails that also provide drainage, and a toe berm is built at the toe of slope after removing all the slide debris. The longer-term version would likely be similar in cost to the pile wall option.</li> </ul>		

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**LEGEND**

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



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



**PEACE REGION (PEACE RIVER / HIGH LEVEL) 2019  
AUGUST 6, 2019 CALLOUT - HWY 691, MANNING, AB**

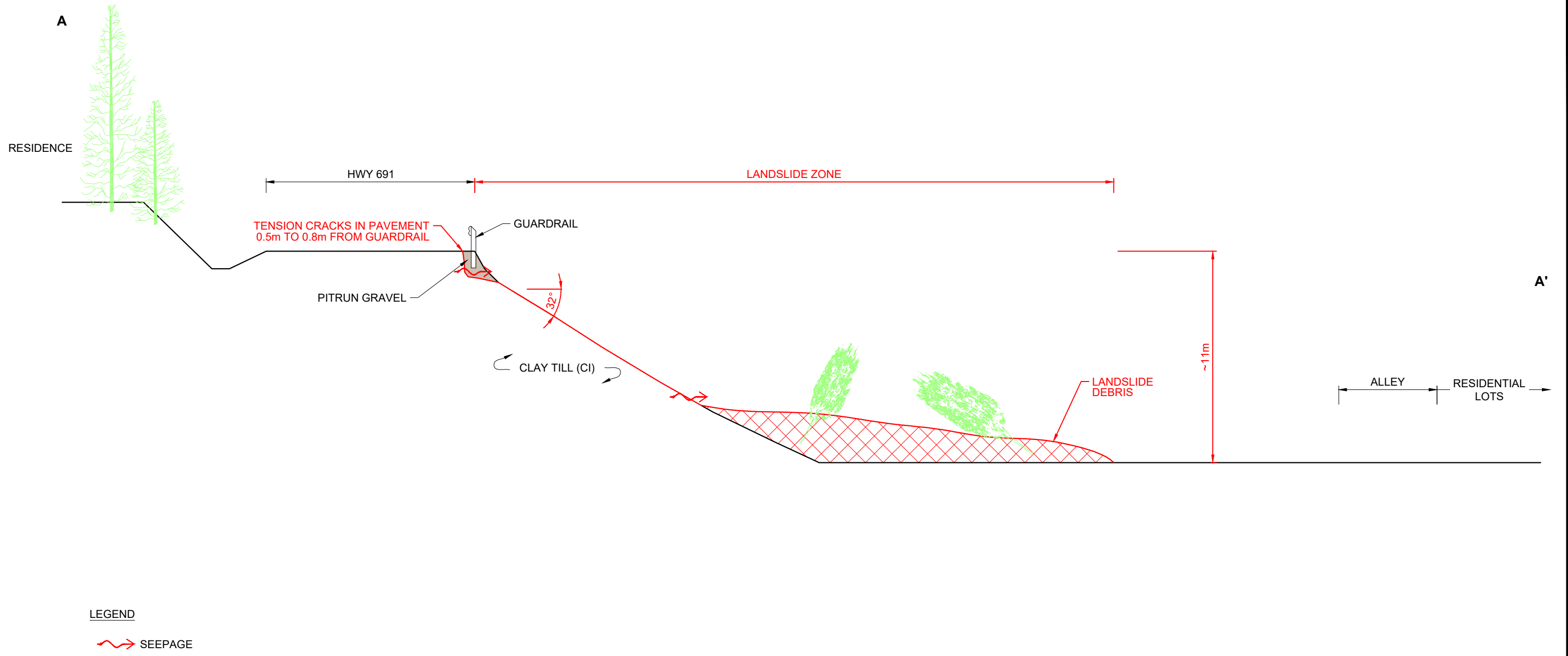
**SITE PLAN**

**FIGURE 1**

DRAWN BY	KLW
DESIGNED BY	DWP
APPROVED BY	DWP
SCALE	1:600
DATE	SEPTEMBER 2019
FILE No.	13351



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PEACE REGION (PEACE RIVER / HIGH LEVEL) 2019  
AUGUST 6, 2019 CALLOUT - HWY 691, MANNING, AB

SECTION A-A'

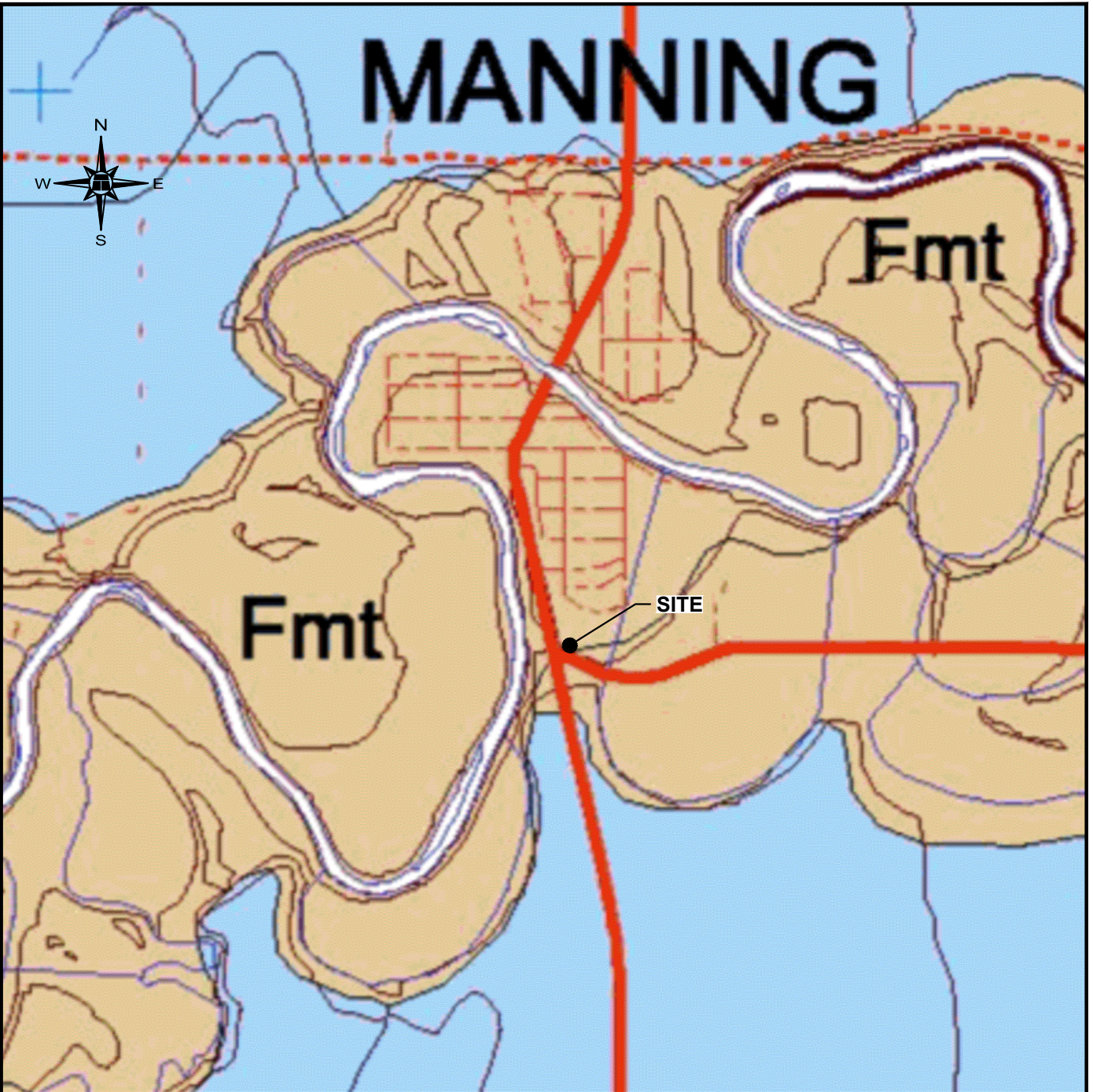
FIGURE 2

DRAWN BY	KLW
DESIGNED BY	DWP
APPROVED BY	DWP
SCALE	1:200
DATE	SEPTEMBER 2019
FILE No.	13351



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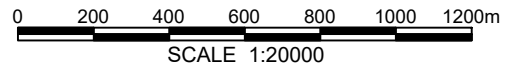


**LEGEND**

- FLUVIAL DEPOSITS
- GLACIOLACUSTRINE DEPOSITS

**REFERENCE:**

PAULSEN, R.C. SURFICIAL GEOLOGY OF THE MANNING AREA (NTS 84C/NW), 2004, ALBERTA GEOLOGICAL SURVEY MAP 292 SCALE: 1:100,000.



**PEACE REGION (PEACE RIVER / HIGH LEVEL) 2019  
AUGUST 6, 2019 CALLOUT - HWY 691, MANNING, AB**

**SURFICIAL GEOLOGY MAP**

**FIGURE 3**



DRAWN BY	KLW
DESIGNED BY	DWP
APPROVED BY	DWP
SCALE	1:20000
DATE	OCTOBER 2019
FILE No.	13351



**THURBER ENGINEERING LTD.**



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 at the west flank of the slide. A 600 mm dia. Concrete pipe is located at the flank further down the slope.



Photo 4, Seepage coming from the till in the backscarp at the slide mass.



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.





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 south at the failed slope from the north end of the alley.