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

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH044-1 (A) PH044-2 (B)	North of Manning, AB	Meikle River Slides A and B	35:08	26.14 25.82
Legal Description		**UTM Co-ordinates**		
Slide A: SW7-94-22-W5M Slide B: SW7-94-22-W5M		11U E 467,665 11U E 467,800	N 6,333,024 N 6,332,742	

	Date	PF	CF	Total
Previous Inspection:	16-May-2019	Slide A: 11 Slide B: 11	3 2	33 22
Current Inspection:	4-June-2020	Slide A: 11 Slide B: 11	3 2	33 22
Road AADT:	1530		**Year:**	2020
Inspected By:	Rocky Wang, TRANS Ed Szmata, TRANS		Ken Froese, Thurber	
Report Attachments:	☑ Photographs	☑ Plans	☐ Maintenance Items	

Primary Site Issue:	Sideslope slumping of high embankment into oxbow of the Meikle River.	
Dimensions:	Slide A: 34 m length of highway, 18 m high embankment Slide B: 65 m length of highway, 24 m high embankment	
Date of Remediation:	1993, Slide B: Pile wall installed	
Maintenance:	2008: spray-patch of cracks. 2016: Overlay and chip seal of Highway 35 including these sites. High tension steel cable barrier (HTSC) installed. 2019: HTSC replaced with W-Beam guardrail	
Observations (Slide A):	**Description**	**Worsened?**
☑ Pavement Distress	Cracks on pavement are not related to slide. Dip same as 2016.	☐
☑ Slope Movement	Continued retrogressive movement. The backscarp is 5.8 m from the highway; the slide mass continues to expand, move, and break up.	☑
☑ Erosion	Increased erosion around the culvert outlet. A gully is forming north of the outlet.	☑
☑ Seepage	Salt-staining observed in face of highest scarp in 2015 not visible.	☐
☑ Bridge/Culvert Distress	Culvert outlet became obstructed by toe roll in 2017 but exposed again in 2019. Concrete lining downslope entirely destroyed.	☑
☐ Other		☐

Observations (Slide B):	Description	Worsened?
☐ Pavement Distress		☐
☑ Slope Movement	The backscarp is about 1.8 m from the back of the post of the new W beam guardrail. Slide expanded, particularly to the north, in 2020.	☑
☑ Erosion	Erosion rills between the highway shoulder and the backscarp; newer erosion rill south of the pile wall was not present in 2018. Gully has formed on north side of slide bowl.	☑
☐ Seepage		☐
☐ Bridge/Culvert Distress	Gully forming below abandoned culvert south of slide resulting in one segment detaching.	☐
☐ Other		☐

Instrumentation (as of Fall 2020):

Slide A	Two slope inclinometers (SI-27 and -45) remain operational and SI-23 sheared off since June 2, 2014 at 27.4 m depth. Continued slow deep-seated creep movement (annual movement rates of less than 1.0 mm) has been detected in the inclinometers between 31.5 m and 37.8 m depth.
Slide B	One slope inclinometer (SI-42 installed to a depth of 44 m) remains operational and has registered no discernible movement since installation in 1996.

Note: The instruments at these two sites are located outside the limits of the active landslide zones.

Assessment:

SLIDE A (km 26.14, was STATION 0+650) – See Drawing 13351-PH044-1-1:
The slide movement consists of a rotational slide with two slide blocks occurring on an 18 m high embankment inclined at an overall angle of 18°. More ravelling was noticed at the upper slide block again in 2019. The lower slope appeared the more active in 2020 with new tension cracks observed on the east side, active movement on the west half, development of a erosion gully, and further movement over and below the hanging culvert outlet (which was uncovered by slide movement in 2019). The dip in the pavement surface, which was first observed in 2015 directly above the slide, was overlaid in 2016 and has not yet reappeared. It is believed that the slide has occurred due to a gradual loss of cohesion of the clay embankment fill due to surface weathering (similar at Slide B). The crest of the slide has retrogressed about 0.5 m from 2015 to 2016 (a total regression of 1.7 m since 2009) and evidence of seepage (salt staining) was noted in the backscarp about 1 m below the crest in 2015 (covered with colluvium in 2016). A high-tension steel cable guardrail was installed in 2016 and measurement of the crest were reset to this new reference (consult 2016 drawings for list of previous measurements). The measurements were reset again in 2019 as the HTSC was replaced with w-beam guardrail. There was some further movement toward the highway between 2017 and 2018 including a tension crack that opened up about 5.3 m from the HTSC barrier. The tension crack was covered over with debris in 2019 and 2020; however, the main scarp appeared to have regressed slightly to 5.8 m from the guardrail. The toe of the slide has affected the culvert outlet resulting in cracking and heaving of the concrete apron. The loss of the apron has resulted in the formation of an erosion channel from the culvert flow leading to additional slumping at, and further downslope, of the outlet.

As part of the overlay contract, a culvert located at the south end of the Slide A embankment fill (about 160 m from the area of distress) was sealed with grout and the ditch check in the upslope (east) ditch was removed in 2016.

SLIDE B (km 25.82 was STATION 0+500): - See Drawing 13351-PH044-2-1
The slide movement consists of a rotational slide that appears to be located downslope of the pile wall. Although the wall appears to be protecting the highway, there is increasing raveling and eroding of the slope adjacent to the highway. An erosion gully to the south of the pile wall increased in size between 2015 and 2016 but appeared stable in 2017 and was not visible in 2018 (may be covered in gravel or graded). A Telus cable was relocated further downslope after construction was completed in 2016. After being relatively stable for the past few years, there was new movement observed in 2020: tension cracks have formed closer to the roadway along the main scarp, an intermediate scarp formed in the main scarp, and a skin slide extension has developed to the north.

The gully below the abandoned culvert south of the slide continued to downcut and a segment of the culvert has become detached. This feature could eventually retrogress to the highway.

It is believed that the slide has occurred due to a gradual loss of cohesion of the clay embankment fill due to surface weathering. Ongoing slope movement could eventually reduce the support to the back of the pile wall and result in distress to the wall and highway.

Recommendations:

Medium-Term:

- Slide A: Consideration should be given to lining the culvert and welding a downpipe to the outlet to direct culvert flow to the bottom of the slope into a dissipation bowl. This could reduce some of the driving force on the slide and minimize issues that may arise from the reduced culvert flow due to the covered outlet.
- Slide B: Drainage water should be prevented from running on to the slide area. An asphalt curb could be used to direct surface runoff away from the slide which will also reduce the ravelling of the embankment between the highway and pile wall.

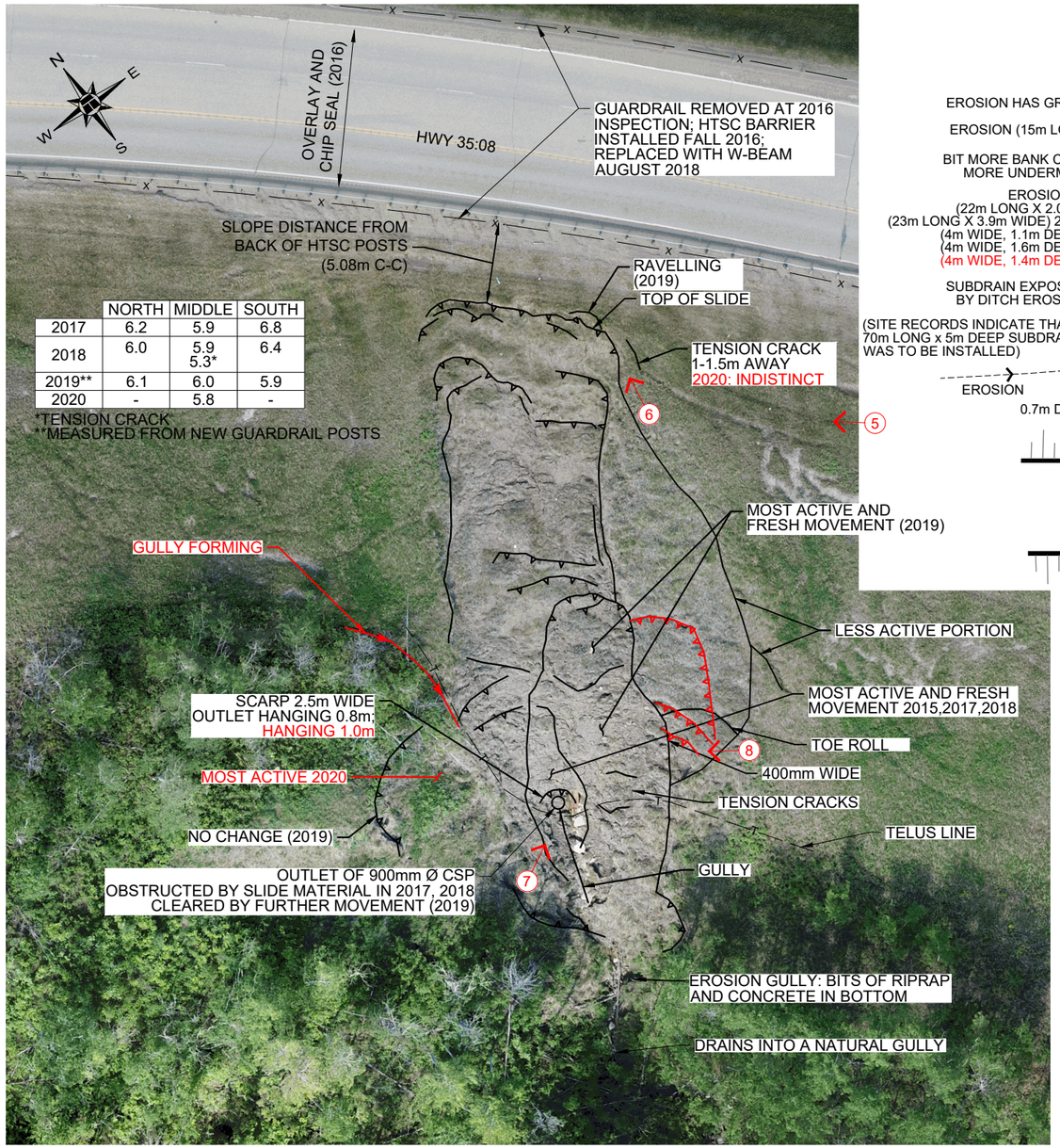
Long-Term:

- Slide A: the slide material (predominantly clay till) could be removed, and the slope reconstructed at a flatter angle with well-compacted, moisture-conditioned clay benched into the intact fill slope. The culvert should be replaced or repaired following excavation of the slumped material and extended to a flatter area downslope where a dissipation bowl should be constructed. Extending the outlet may allow sufficient room for a small toe berm so the slope could be flattened somewhat. In addition, the area surrounding the culvert inlet should be regraded and protected with a high-flow soil covering.
- Slide A: alternatively, a pile wall could be constructed at the shoulder to protect the highway similar to the approach taken at Slide B.
- Slide B: Consideration could be given to excavating and replacing the slide material below the wall and reconstructing the slope at a flatter angle with well-compacted, moisture-conditioned clay benched into the intact fill. Soil nailing could be considered as an alternative to stabilize the upper portion of the slide.
- Slide B: The concrete ditch liner at the north end of the slide is cracked and could be repaired with fillcrete which would prolong the useful life.

Ongoing Investigation:

- It is recommended that the annual GeoHazard inspection should continue as scheduled.
- If a drill rig is in the area on other work, it is suggested that one or two additional inclinometers be installed at each of these sites as the existing instrumentation is outside active movement areas.

H:\13000\13351 Geohazard Assessment - Peace RiverHigh Level (CON0017602)\Drafting\2020\KEF\13351 PH044-1-1.dwg - PH44-2 - September 11, 2012



	NORTH	MIDDLE	SOUTH
2017	6.2	5.9	6.8
2018	6.0	5.9 5.3*	6.4
2019**	6.1	6.0	5.9
2020	-	5.8	-

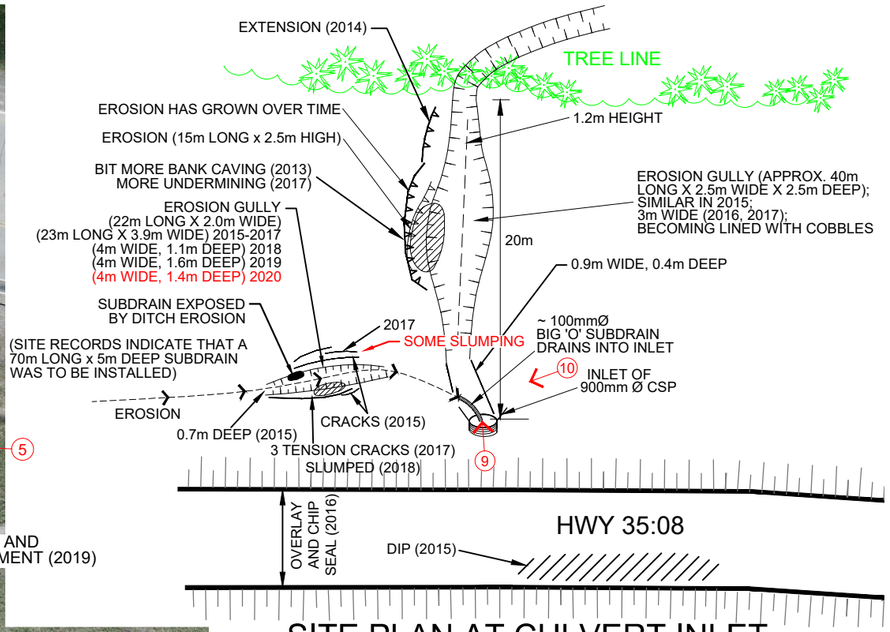
*TENSION CRACK
**MEASURED FROM NEW GUARDRAIL POSTS

SITE PLAN AT CULVERT OUTLET

1:400

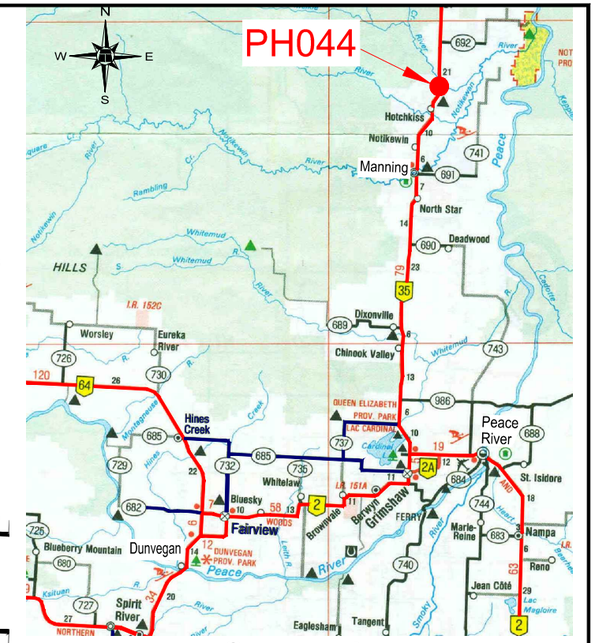
0 5 10 15 20 25m

SCALE 1:400



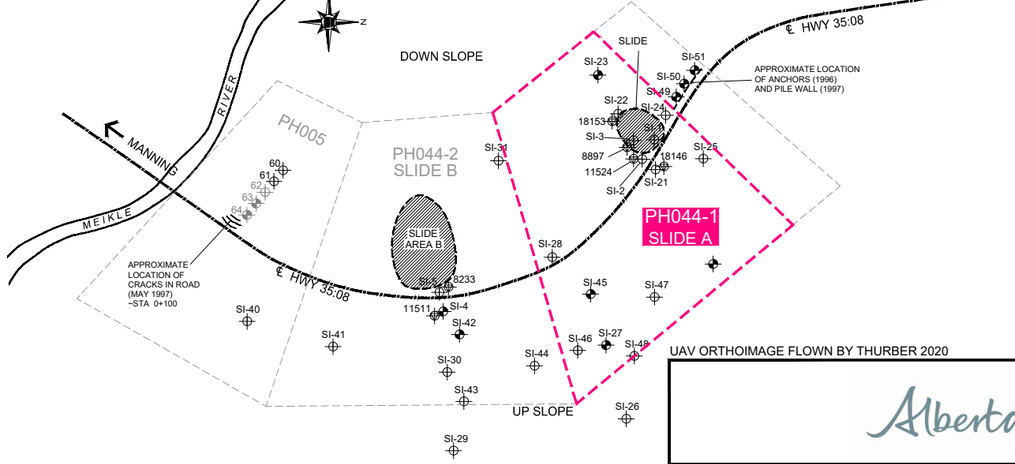
SITE PLAN AT CULVERT INLET

N.T.S.



SITE MAP

NOT TO SCALE



SITE PLAN

N.T.S.

UAV ORTHOIMAGE FLOWN BY THURBER 2020

LEGEND

- SLOPE INCLINOMETER *(currently using)*
- SLOPE INCLINOMETER *(not in use)*
- PIEZOMETER *(not in use)*
- SLIDE BACKSCARP
- PHOTO AND DIRECTION

NOTES

1. BASE PLAN COPIED FROM GAEA ENGINEERING DRAWING DATED MAY 1997
2. SI's 40-48 INSTALLED JULY 1996
3. SI's 49-51 INSTALLED DEC. 1997
4. FEATURE LOCATIONS ARE APPROXIMATE.
5. PREVIOUS OBSERVATIONS SHOWN IN BLACK AND RESET IN 2018
6. JUNE 2020 OBSERVATIONS SHOWN IN RED

Alberta

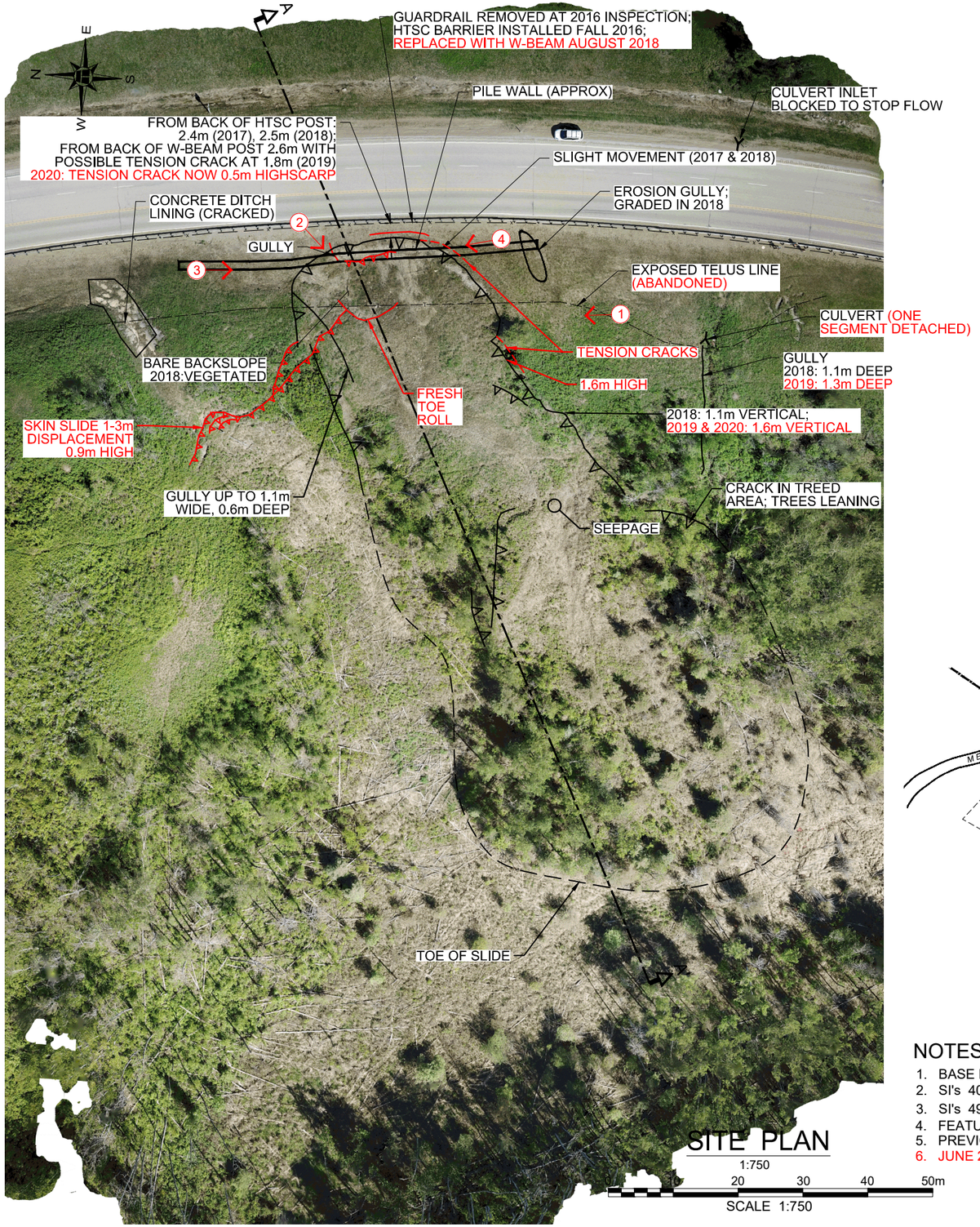
PEACE REGION (PEACE RIVER / HIGH LEVEL)

PH044-1: HWY 35:08 - MEIKLE RIVER km 26.14, SLIDE AREA A
2020 GEOHAZARD ASSESSMENT

DWG No. 13351-PH044-1-1

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	DECEMBER 2020
FILE No.	13351

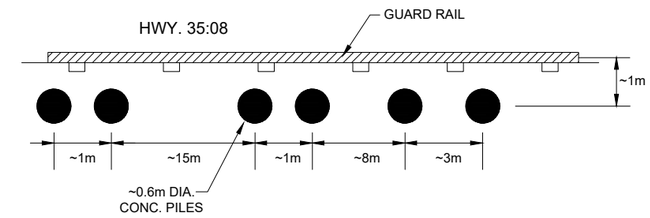
THURBER ENGINEERING LTD.



SITE PLAN
1:750

20 30 40 50m

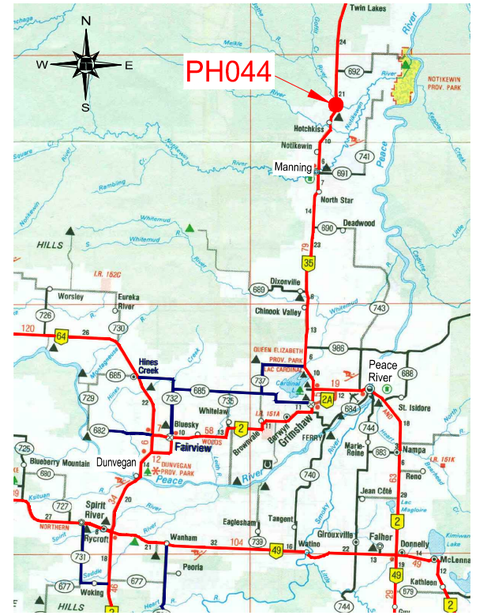
SCALE 1:750



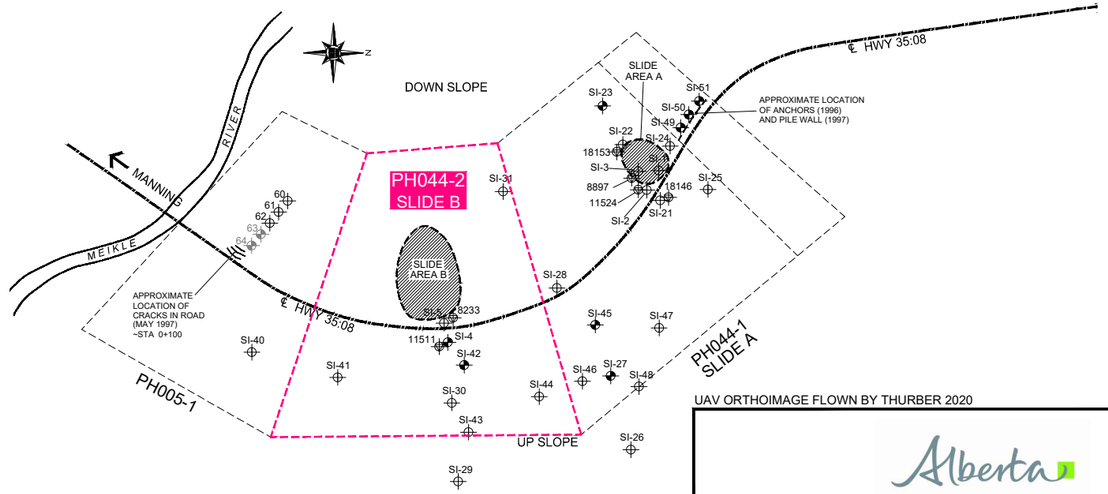
PILE WALL
N.T.S.

LEGEND :

- SLOPE INCLINOMETER *(currently using)*
- SLOPE INCLINOMETER *(not in use)*
- PIEZOMETER *(not in use)*
- SLIDE BACKSCARP
- 1 PHOTO AND DIRECTION



SITE MAP
NOT TO SCALE



SITE PLAN
N.T.S.

UAV ORTHOIMAGE FLOWN BY THURBER 2020

NOTES :

1. BASE PLAN COPIED FROM GAEA ENGINEERING DRAWING DATED MAY' 97
2. SI's 40-48 INSTALLED JULY 1996
3. SI's 49-51 INSTALLED DEC. 1997
4. FEATURE LOCATIONS ARE APPROXIMATE.
5. PREVIOUS OBSERVATIONS SHOWN IN BLACK
6. JUNE 2020 OBSERVATIONS SHOWN IN RED

Alberta

PEACE REGION (PEACE RIVER / HIGH LEVEL)

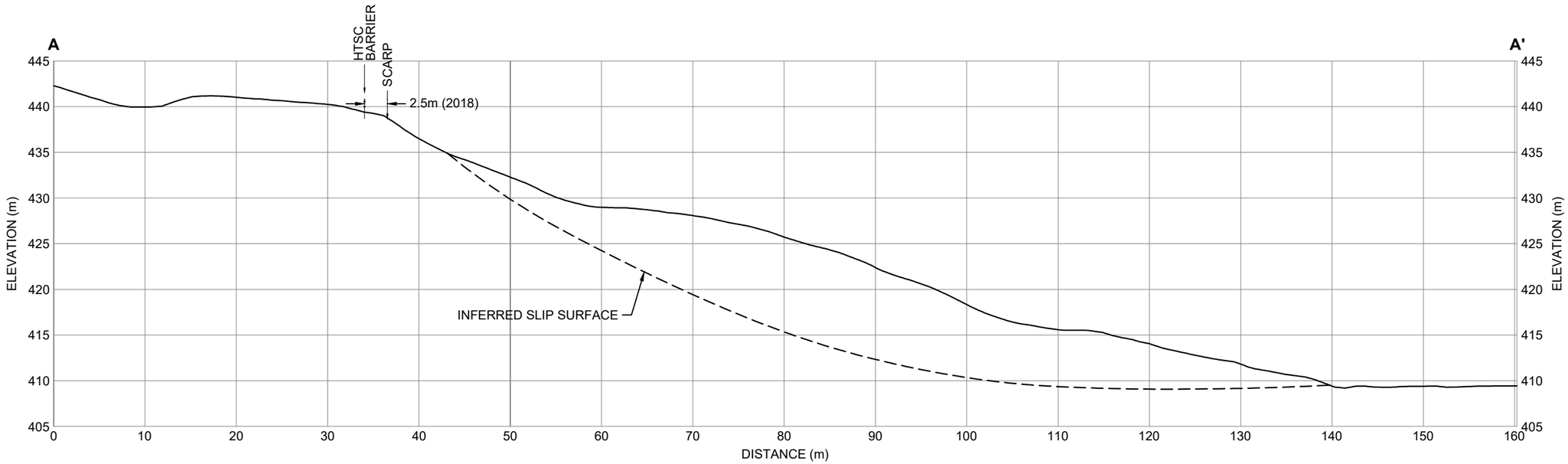
**PH044-2: HWY 35:08 - MEIKLE RIVER km 25.82,
SLIDE AREA B
2020 GEOHAZARD ASSESSMENT**

DWG No. 13351-PH044-2-1

DRAWN BY	KLW
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	DECEMBER 2020
FILE No.	13351

THURBER ENGINEERING LTD.

H:\13000\13351 Geohazard Assessment - Peace RiverHigh Level (CON0017602)\Drafting\2020\KEF\13351 PH044-2-1.dwg - PH44-1 - Jun. 15, 2010



NOTE:
1. GROUND PROFILE FROM LIDAR DATA (DATE UNKNOWN) PROVIDED BY ALBERTA TRANSPORTATION

PEACE REGION (PEACE RIVER / HIGH LEVEL)

PH044-2: HWY 35:08 - MEIKLE RIVER km 25.82, SLIDE AREA B
2018 GEOHAZARD ASSESSMENT

DWG No. 13351-PH044-2-2

DRAWN BY	ML
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	1:500
DATE	DECEMBER 2018
FILE No.	13351

THURBER ENGINEERING LTD.

H:\13000\13351 Geohazard Assessment - Peace River\High Level (CON0017602)\Drafting\2020\KEF\13351 PH044-2-1.dwg - PH44-1 (2) - Jun. 15, 2010

Photo 1 – Slide B: Backscarp and highway, looking north.

Photo 2 – Slide B: View of slope failure and slide block, looking southwest.

Photo 3 – Slide B: Backscarp and highway, looking south.

Photo 4 – Slide B: View of backscarp looking north.

Photo 5 – Slide A: Increased retrogression movement, looking north.

Photo 6 – Slide A: Embankment sideslope, looking northeast.

Photo 7 – Slide A: Slope movement near the toe of the slope, looking east. Culvert outlet became buried in 2017 and exposed again in 2019 (deteriorated significantly since 2015).

Photo 8 – Slide A: Downslope view, looking west. Over-steepened exposed slope face is more vegetated than in 2015. A former grass-covered access route is located on the left side of the small hill in the center of the photo.

Photo 9 – Slide A: Erosion gully outside culvert inlet, looking northeast.

Photo 10 – Slide A: Erosion gully in sideslope draining towards culvert inlet, looking north.

Slide A: 2020 UAV photo of slide.

Slide A: 2020 UAV oblique photo of slide.

Slide B: 2020 UAV photo of slide and concrete apron.