

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



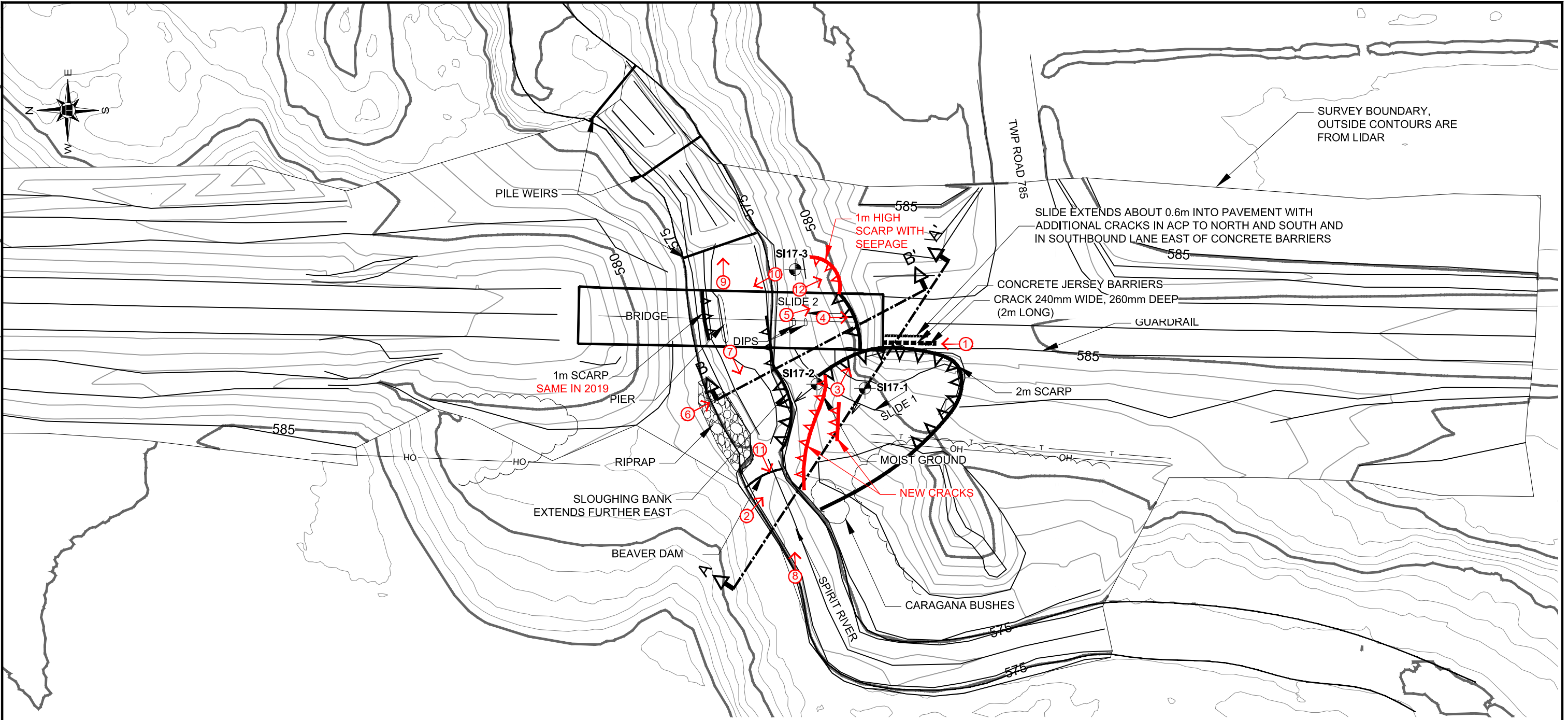
Site Number	Location	Name	Hwy	km
GP040	4.7 km's N. of Rycroft	Spirit River Bridge (BF75106)	2:68	4.7
Legal Description		UTM Co-ordinates		
SE¼ 34-078-5 W6M		11U E 394291	N 6184727	

	Date	PF	CF	Total
Previous Inspection:	24-May-2018	11	4	44
Current Inspection:	30-May-2019	12	6	72
Road AADT:	3,360		Year:	2018
Inspected By:	Ed Szmata, AT Rocky Wang, AT Dwayne Lowen, AT		Nicole Wilder, Thurber Renato Clementino, Thurber	
Report Prepared By:	Nicole Wilder, Renato Clementino (Review)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			







Primary Site Issue:	<p>In 2013, a landslide began to develop in the west side of the south abutment headslope and sideslope of the Spirit River Bridge (BF75106). It appears there is also a second localized slide below the bridge south abutment which extends towards the east where a previous tension crack existed and has now developed into a 1 m high scarp.</p> <p>Erosion was also observed at the toe of the south abutment headslope beneath the bridge.</p>	
Dimensions:	<p>The upper portion of the landslide located close to the south abutment was about 20 m in width across the backscarp and extended down to the river bank. The lower portion of the landslide located on the river terrace was about 35 m in width across the backscarp. The second slide to the east was approximately 30 m in width.</p>	
Maintenance:	<p>Jersey Barriers were placed around the scarp on the edge of the highway in spring 2017.</p>	
Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Cracks were present along the backscarp of the landslide in the shoulder of the SBL of Hwy 2:68 at the south abutment (Photo 1) and on the east side of jersey barriers, these appeared to be in similar condition in 2019.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	A landslide occurred on the west side of the south abutment headslope (Photos 2 and 3). A 35 m long tension crack has formed on the terrace below the main backscarp and another localized slide failure is present below the south abutment which extends northeast which has worsened since the last inspection. Two dips were present in the south headslope. Soil loss/settlement were evident at the crest of the south abutment headslope. There was a 1 m high scarp observed on the north abutment which may be exacerbated during highwater.	<input checked="" type="checkbox"/>

<input checked="" type="checkbox"/> Erosion	Erosion was observed at the toe of the south abutment headslope beneath the bridge and has extended further east.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	The ground was moist near SI17-2 and water was also observed on the south abutment headslope (Photo 5). Seepage was also noted within the scarp that has formed on the east side of the south abutment.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	The top of the southeast abutment of the bridge appeared to be pushing against and spalling the girders. The south abutment is being undermined and it looks like 3 concrete counterforts were constructed under the centre with 2 H piles at each edge with cables under the bridge widening section.	<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation October 8, 2019: Inclinometers SI17-1 = Sheared off at 4.6 m depth; SI17-2 = Sheared off at 4.3 m depth; SI17-3 = movement between 0.2 m to 3.9 m at a rate of 13.5 mm/yr in spring 2019 which has slowed to 1.3 mm/yr in fall 2019. Piezometers PN17-1A = not functioning; PN17-1B = 3.3 m BGS; PN17-2 = 0.98 m BGS; PN17-3 = not functioning.		
Assessment: <p>In 2013, as a result of heavy rains, the water level in the Spirit River rose and shifted toward the south. The raised river level which caused erosion at the toe of the south bridge abutment headslope and sideslope, resulting in the occurrence of the landslide in the south abutment fill.</p> <p>It is important that the abutment headslope and sideslope be stabilized in order to avoid causing further distress to the bridge structure.</p> <p>A geotechnical investigation consisting of three test holes with slope inclinometers and pneumatic piezometers was performed in summer of 2017. Simplified stratigraphic cross sections are attached on Drawing No. 13353-GP40-1-2 and 3, which show the soil conditions encountered in the boreholes, piezometric conditions and inferred slip surface of the landslides. The slip surface appears to be based in high plastic clay and clay till, toeing out at the river.</p>		
Recommendations:		Cost
Regularly monitor the landslide for activity		Maintenance
<p>A preliminary remediation report was prepared by Thurber for stabilization options along the south bank of the river and repair the abutment headslope dated January 7, 2019</p> <p>Three options were considered to stabilize the landslide which were:</p> <ul style="list-style-type: none"> ▪ Cast-in place concrete pile wall ▪ Driven Steel H-pile wall ▪ Hardy Ribs <p>The preferred option was using a cast-in place concrete pile wall with soils nails for which a tender package was prepared (TND0021103). It is our understanding that this remediation work will be carried out in 2020 under the overlay assignment that will be performed by CAP Engineering.</p>		

H:\1300013353 Geohazard Assessment - Grand Prairie (CON0017603)\Drafting\2019\NPW\13353-GP40-1-1-3.dwg - 1 - Dec. 05, 2019

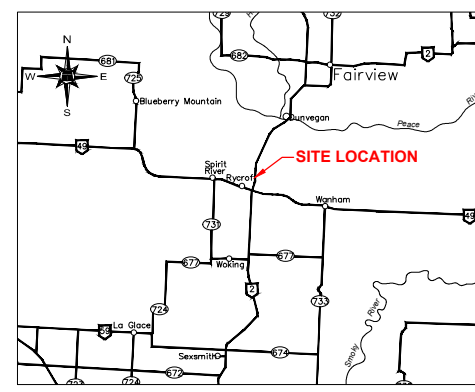
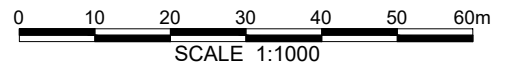



LEGEND

-  APPROXIMATE INSTRUMENT / TEST HOLE LOCATION
-  SCARP CRACK
-  APPROXIMATE OVERHEAD POWER LINE LOCATION
-  APPROXIMATE TELUS BURIED CABLE LOCATION
-  APPROXIMATE BUSH LINE LOCATION
-  PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE
2. MAY 30, 2019 FEATURES SHOWN IN RED






PEACE REGION (GRANDE PRAIRIE)

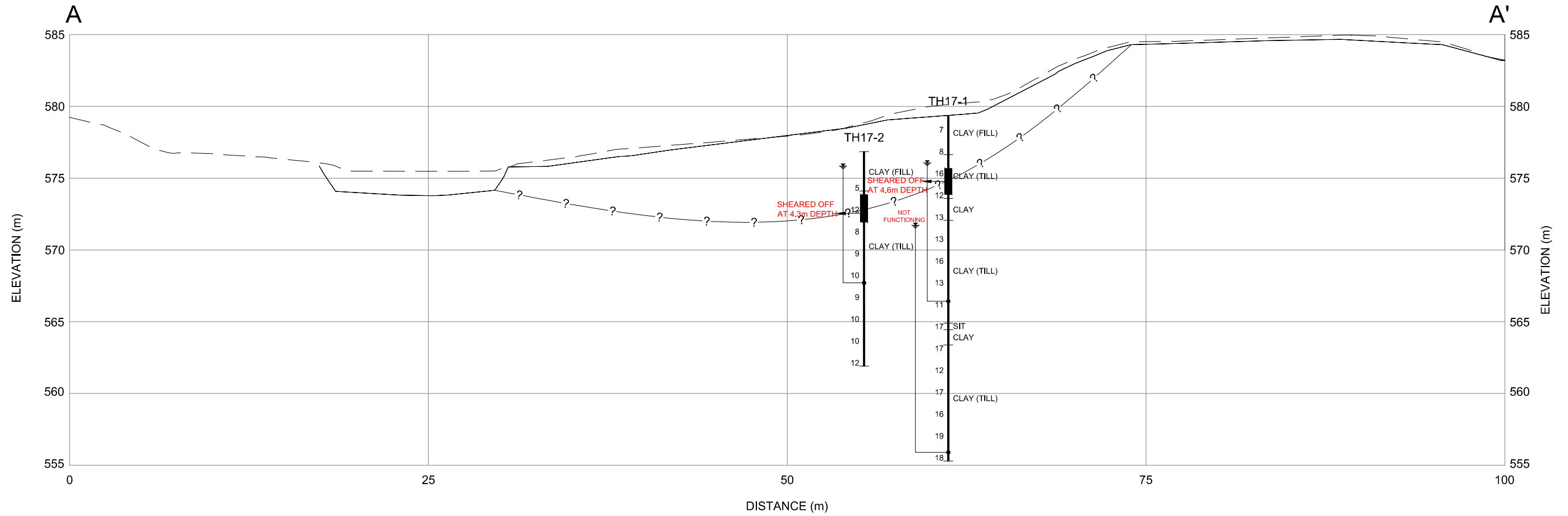
**GP40-1: HWY 2-68 KM 4.7 SPIRIT RIVER BRIDGE
2019 INSPECTION PLAN**

DWG No. 13353-GP40-1-1








DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	RVC
SCALE	1:1000
DATE	DECEMBER 2019
FILE No.	13353



THURBER ENGINEERING LTD.



LEGEND

-  SPT N VALUE
-  WATER LEVEL IN PIEZOMETER (OCTOBER 8, 2019)
-  PNEUMATIC PIEZOMETER TIP
-  PROFILE FROM SURVEY
-  PROFILE FROM LIDAR
-  ZONE OF MOVEMENT NOTED IN SLOPE INCLINOMETER
-  INFERRED SLIP SURFACE OF LANDSLIDE

NOTE

DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.



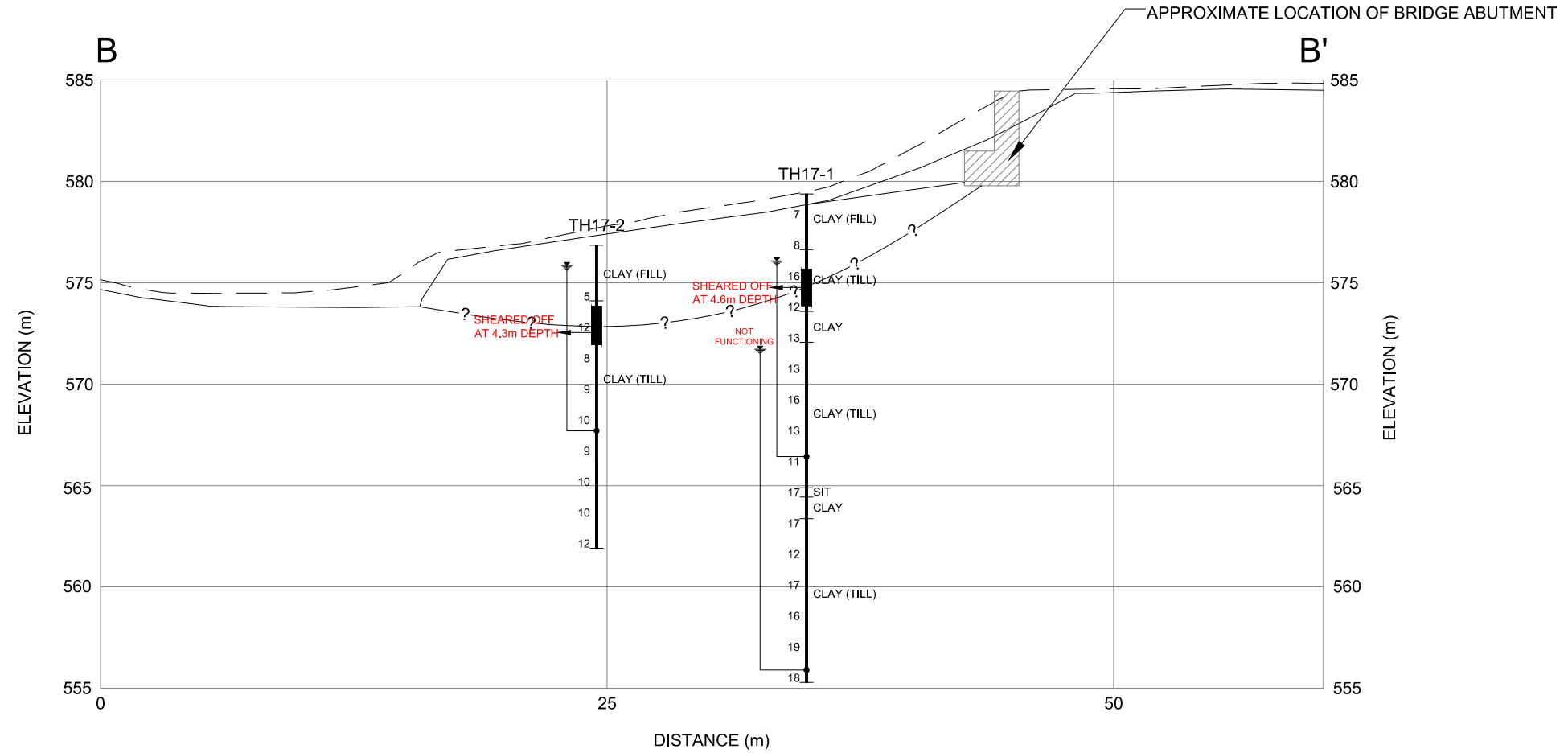
PEACE REGION (GRANDE PRAIRIE)

GP40-1: HWY 2-68 KM 4.7 SPIRIT RIVER BRIDGE
CROSS - SECTION A - A'








DWG No. 13353-GP40-1-2

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	RVC
SCALE	1:300
DATE	DECEMBER 2019
FILE No.	13353







LEGEND

-  SPT N VALUE
-  WATER LEVEL IN PIEZOMETER (OCTOBER 8, 2019)
-  PNEUMATIC PIEZOMETER TIP
-  PROFILE FROM SURVEY
-  PROFILE FROM LIDAR
-  ZONE OF MOVEMENT NOTED IN SLOPE INCLINOMETER
-  -?- INFERRED SLIP SURFACE OF LANDSLIDE

NOTE

DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.

	
PEACE REGION (GRANDE PRAIRIE)	
GP40-1: HWY 2-68 KM 4.7 SPIRIT RIVER BRIDGE CROSS - SECTION B - B'	
DWG No. 13353-GP40-1-3	
DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	RVC
SCALE	1:300
DATE	DECEMBER 2019
FILE No.	13353



THURBER ENGINEERING LTD.



Photo 1.
Looking north at
the Slide 1 scarp
cracks along the
edge of the SBL.



Photo 2.
Looking east at the
Slide 1 scarp along
the edge of the
road.



Photo 3.
Looking east at the flank of Slide 1.



Photo 4.
Looking south at the west side of the south abutment. Note the settlement of the soil. It appears that the bridge was widened after the original construction. Concrete counterforts are under the original bridge and steel H piles with cables are under the widened part.



Photo 5.
Looking southeast
at the scarp and
flank of Slide 2.



Photo 6.
Looking at the
south abutment.
Note the river bank
slumping.



Photo 7.
Looking upstream of the bridge at the river bank erosion/slumping. The toe of Slide 1 is located at the caragana bushes.



Photo 8.
Looking downstream towards the bridge pier and bank erosion below the south abutment.



Photo 9.
Pile weirs located
in the streambed
downstream of the
bridge.



Photo 10.
Looking north at
1m high scarp on
north abutment.



Photo 11.
Looking west
towards beaver
dam.



Photo 12.
Looking southeast
at the scarp and
flank of Slide 2.