ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA & FORT MCMURRAY DISTRICTS
2023 SITE INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
NC90-1	17 Km NW of Athabasca	**Baptiste Creek Bridge NW Approach Fill Landslide**	02:42	17.94

Legal Description	UTM Co-ordinates (NAD 83)		
SW-6-67-23-W4M	12	6071799	E 338303

	Date	PF	CF	Total
Previous Inspection:	June 5, 2020	6	3	18
Current Inspection	May 16, 2023	4	3	12
Road WAADT:	1,460		**Year:**	2022
Inspected By:	Arthur Kavulok, Amy Driessen and Kristen Tappenden (TEC) Tarek Abdelaziz and José Pineda (TEL)			
Report Attachments:	☑ Photographs	☑ Plans	☑ Maintenance Items	

Primary Site Issue	Landslide within the NW approach fill of Bridge File (BF) 7055, impacting highway, NW wing wall, abutment supports, and the capacity of the creek channel
Dimensions:	The slide is approximately 30 m long and 40 m wide
Site History / Available Information:	The existing bridge structure was constructed in 2008 under TEC Contract No. 7681/08 to replace a six-span bridge structure that was constructed in the 1970s. The new structure consists of a 47 m single span steel girder bridge with integral abutments. The construction of the new bridge required the construction of a temporary detour on the west side of the old bridge as well as a temporary bridge structure. The old bridge was supported on seven rows of piles. The tips of the old bridge piles were founded at an approximate elevation of 577 m. The piles of the old bridge were cut off and left in place as per the as-built drawings. In addition, the creek was realigned/shaped as part of the 2008 contract. The approach fill head slope is inclined at 2H:1V and 3H:1V on the north and south side of the Baptiste Creek, respectively. The side slopes of the approach fill are approximately 3H:1V on both sides of the creek. Approximately 6 m of fill was placed on the west side of the bridge to the north of the creek alignment to accommodate the construction of the new bridge. Records indicate that instability occurred within the south head slope during the construction of the old bridge in the 70s. The repair at that time, consisted of flattening the head slope from 2H:1V to 3H:1V, resulting in an increase of the bridge span by about 10 m. In 1979, an instability occurred to the east of the north abutment outside the bridge location. The repair of the north abutment consisted of slope flattening along with the construction of a toe buttress and finger drains. In September 2017, TEC noticed a lateral movement of the NW side slopes. A void formed adjacent to the taper of the existing trough drain and below the NW corner of the abutment seat. Between October 16 and 20, 2017, eleven cubic meters of Class C concrete was used to fill voids formed behind the trough drain taper and

	below abutment seat. A concrete block was also constructed by the face of the abutment seat to fill the gap formed below the abutment seat. However, major slope movement occurred abruptly on October 23, 2017. The sudden movement resulted in the formation of a gap below the wing wall and the abutment seat, and the failure of the trough drain. Repairs at the NW side slopes were completed from March 3, 2019 to October 15, 2019. The repairs consisted of: (a) installation of cantilever and tied-back sheet pile walls, (b) slope flattening of the northwest slope, (c) instream work to restore the creek channel, and (d) structural work to repair the landslide-induced damages to the north bridge abutment. Geotechnical instrumentation including load cells, strain gauges, vibrating wire piezometers, and a slope inclinometer were also installed to monitor wall deflections, anchor loads, and slope movements to monitor the effectiveness of the recent repair measures. The vibrating wire piezometers, load cells, and strain gauges were all wired to a Campbell Scientific CR6 datalogger which was programed to take daily readings.	
Observations:	**Description**	**Worse?**
☐ Pavement Distress		☐
☐ Slope Movement		☐
☑ Erosion	A void (100 mm wide x 200 mm deep) developed along the edge of the wingwall at the top of the NW approach fill slope	☐
☐ Seepage		☐
☐ Bridge/Culvert Distress		☐
☑ Other	Debris (likely from highway) accumulating on the flatter sections of the drain trough behind Pile Wall B; a bit of settlement within the highway side slope above the drain tough; shrinkage cracks (200 mm wide x 450 mm deep x 2 m long) along the face of the abutment seat below the bridge structure; well vegetated slopes	☐

Active Instrumentation (1SI, 2VWs, 7 VCs, 3SG):

Slope inclinometer SI19-1, located at the toe of the slope above Pile Wall A location, showed a rate of movement of 1.3 mm/yr over 0.4 m to 1.7 m depth since the fall of 2022 readings. The movement noted in the upper 1.7 m is likely of the backfill material around the SI casing.

Since 2019 vibrating wire piezometer VW19-1A (tip depth at 5 m) showed a decrease in ground water level by up to 0.3 m whereas VW19-1B (tip depth at 10 m) showed an increase in water level of 0.1 m. Groundwater levels were measured at 3.9 m and 2.2 m below ground surface at VW19-1A and VW19-1B, respectively.

Load cells were installed in seven selected anchors along the tied-back sheet pile wall. The design load/lock-off load for VC2135, VC2131, VC2136, and VC2133 is 140 kN and 210 kN for Cells VC2132, VC2134, and VC2130. All load cell readings recorded in the spring of 2023 were at or slightly below their design load/lock-off load but did not show significant changes in readings since they were last read in September 2022. Load Cells VC2135, VC2134, and VC2130 showed increases in load of 2.12 kN, 0.3 kN, and 0.78 kN, respectively. VC2132, VC2131, VC2136 and VC2133 showed decreases in load of 1.3 kN, 2.02 kN, 0.56 kN, and 0.75 kN, respectively.

The upper, middle and lower strain gauges showed decreases in total micro-strain of 28.5, 7.4 and 6.41, respectively, since the previous readings in September 2022.

Assessment (Refer to attached Figures and Photos)**:**

The 2019 repairs have been effective in stabilizing the landslide movement.

The shrinkage cracks and voids noted during the site visit may reflect minor grading issues during construction.

The highway side slope fill above the drain trough settled a bit, resulting in a slight exposure of the top edge of the drain trough. Hence, the surface water from the highway may run along the edge of the drain trough rather than being discharged into the trough. This may result in the development of an erosion feature along the edge of the drain trough, parallel to the highway, in the long-term. If severe erosion occurs, the integrity of the drain can be undermined.

Recommendations:

As the 2019 repairs have been noted to be successful in stabilizing the landslide movement, this site can be taken out of the GRMP site inspections program.

Continued monitoring of the geotechnical instrumentation is recommended.

The local MCI should get the drain trough cleared of debris on a regular basis (at least once a year), and undertake the following maintenance items in the short-term:

(a) fill the cracks developed along the face of abutment seat below the bridge with low strength fillcrete,

(b) fill the void developed at the top of the slope by the edge of the wing wall with ACP or fillcrete, and

(c) retouch the highway side slope to make the final grade flush with or a bit higher than the edge of the concrete drain trough.

Closure:

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

Yours very truly,
Thurber Engineering Ltd.
Tarek Abdelaziz, Ph. D, P.Eng.
Principal | Geotechnical Review Engineer

PROFESSIONAL ENGINEER ALBERTA
JOSÉ G. PINEDA CARDENAS
July 10, 2023
ID 93452

PROFESSIONAL ENGINEER ALBERTA
TAREK ABDELAZIZ
ID 91085
July 10, 2023

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: _____
RM APEGA ID #: 91085
DATE: July 10, 2023
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

José Pineda, M.Eng., P.Eng.
Associate | Senior Geotechnical Engineer

H:\32000\32122 AT GRMP Athabasca and Fort McMurray Districts 2021-2025\CAD\2023 GEO HAZARD\JGP\32122-NC90 FIGURE 1.dwg - F1 - Jun. 15, 2023

PONDING WATER IN DITCH
DRY (2023)
RUTTING
EROSION RILLS
NOT VISIBLE (2023)
I. PIN
ROAD ALLOWANCE
ROAD ALLOWANCE
TO SLAVE LAKE
NEW GUARDRAIL
10H:1V
18+025
HWY 2:42
REMOVE AND DISPOSE EXISTING GUARDRAIL AND INSTALL NEW GUARDRAIL SECTIONS FROM STA. 17+987.4 TO STA. 18+042
BLEND IN FILL TO COVER BACKSIDE OF DRAIN TROUGH AND SHEET PILE
1.0m WIDE x 0.3m DEEP FILTER GRAVEL (DES 8, CL 25)
INSTALL TIED BACK SHEET PILE WALL B
BURRITO FILTER FRAVEL WRAPPED IN NON-WOVEN GEOTEXTILE TYPE B INSTALLED AT THE BASE OF THE WALL TO DRAIN SEEPAGE FROM ANCHOR HOLES INTO THE ARMORED CREEK BANK
18+000
HIGHWAY SIDE SLOPE FILL SETTLED A BIT
ACP PATCH 19m LONG
VOID (100mm WIDE, 200mm DEEP)
DRAIN TROUGH BEHIND PILE WALL B.
SOME DEBRIS ACCUMULATION ALONG THE FLATTER PORTIONS OF DRAIN TROUGH (2023)
FLATTEN SLOPE TO 6H:1V AND BLEND EDGES OF REGRADED ARE. WELL VEGETATED (2023)
CONSTRUCT SWALE LINED WITH TRM TYPE C (CURLEX ENFORCER) AS PER ALBERTA TRANSPORTATION'S BMP #13
VARIES
5.9H:1V
5.1H:1V
CONCRETE DRAIN TROUGH
SHRINKAGE CRACKS (200mm WIDE x 450mm DEEP x 2m LONG)
NOT ENCOUNTERED
0.610 m Ø STEEL CASING AND HP 310x132 PILE (TYP)
WING WALL
17+975
UPPER 6m REMOVED
324 mm STEEL PIPE PILES FILLED WITH CONCRETE
HV1
HV2
HV3
HV4
3H:1V
19.5m
INSTALL BARBED WIRE FENCE (TYPE B)
TH19-1
REMOVE LOOSE MATERIAL, BACKFILL WITH GRANULAR FILL (DES 2, CL 25) OVERLAIN BY 300 mm OF COMPACTED CLAY CAP
SALVAGE AND REPLACE CLASS 1M RIPRAP UNDER BRIDGE DRAIN
508 mm STEEL PIPE PILES FILLED WITH CONCRETE
CREEK BED
VERTICAL DRAIN(TYP)
RESTORE CHANNEL ALIGNMENT
INSTALL CANTILEVER SHEET PILE WALL A
17+950
FILLED IN VOID OF EXISTING RIPRAP WITH CLASS I RIPRAP
HWY RIGHT-OF-WAY
FILL VOIDS WITH FILTER GRAVEL (DES 8, CL 25) TO ELEV 577.65 m
REGRADE CREEK BED, RECONSTRUCT NORTH BANK, AND ARMOUR NORTH AND SOUTH BANKS WITH CLASS 1 RIPRAP (REFER TO SHEETS 6, 8, 10, 11 FOR DETAILS)
LIMIT OF WSP 2018-07-18 SURVEY
SW06-067-23 W4M
LIMIT OF WSP 2018-07-18 SURVEY
SW06-067-23 W4M
588
585.0
582.5
580.0
577.5

N
W
E
S

LEGEND

- NEW INSTRUMENT LOCATION
- CP — CONTROL POINT
- VERTICAL DRAIN
- HV — FORMER PILES TO BE EXPOSED (HYDROVAC)
- STABILIZED LANDSLIDE AREA
- EXISTING CLASS 1M RIPRAP
- DESIGN GRADING LIMITS
- CLASS 1 RIPRAP
- TRM TYPE C
- T — TELUS LINE (APPROXIMATE)
- TA — ABANDONED TELUS LINE
- X — BARBED WIRE FENCE
- NEW TYPE B FENCE
- P — OVERHEAD POWER LINE (APPROXIMATE)
- TREELINE
- GUARD RAIL
- 582 — GROUND SURFACE CONTOUR
- Fd. I. PIN — FOUND IRON PIN
- PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION

NOTE:
JUNE 16, 2023 SITE INSPECTION OBSERVATIONS SHOWN IN RED.

0 4 8 12 16 20 24m
SCALE 1:400

Alberta

NORTH CENTRAL
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2023 GEOHAZARD ASSESSMENT
NC90 - BAPTISTE CREEK BRIDGE
NW APPROACH FILL LANDSLIDE (BF7055)
HWY 2:42, 17km NW OF ATHABASCA

FIGURE 1

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:400
DATE	MAY 2023
FILE No.	32122

THURBER ENGINEERING LTD.

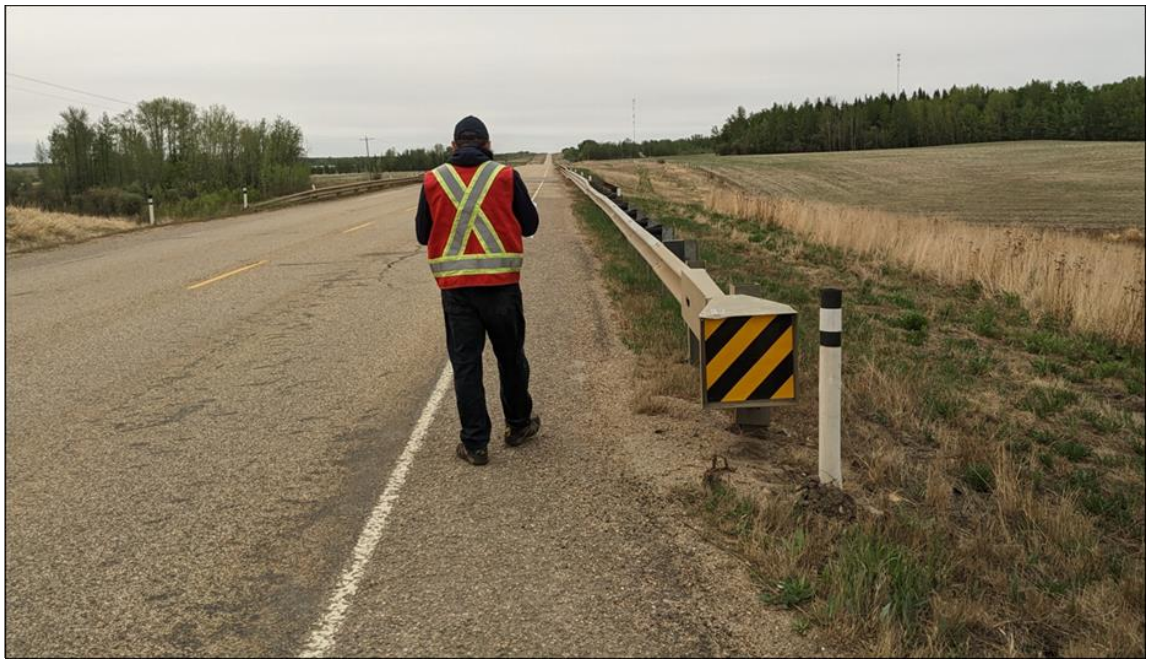

Photo 1. Looking south at guardrail and embankment west side slope; note growth of grass vegetation within the slope surface

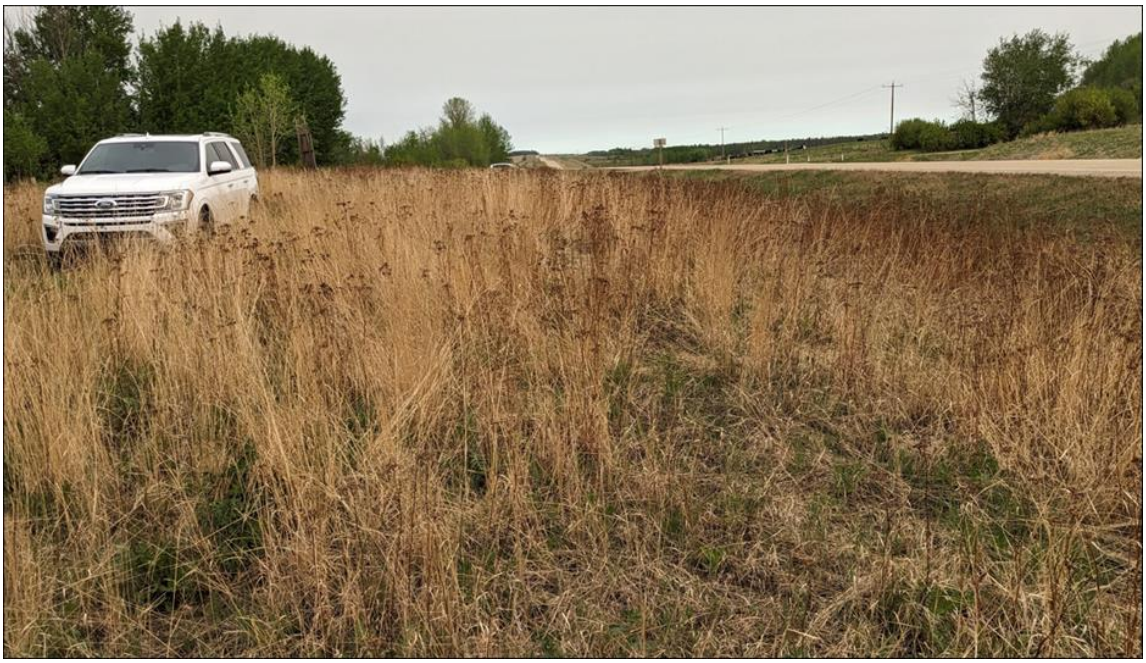

Photo 2. Looking north at the highway west ditch to the north of the repaired area; note growth of grass vegetation.

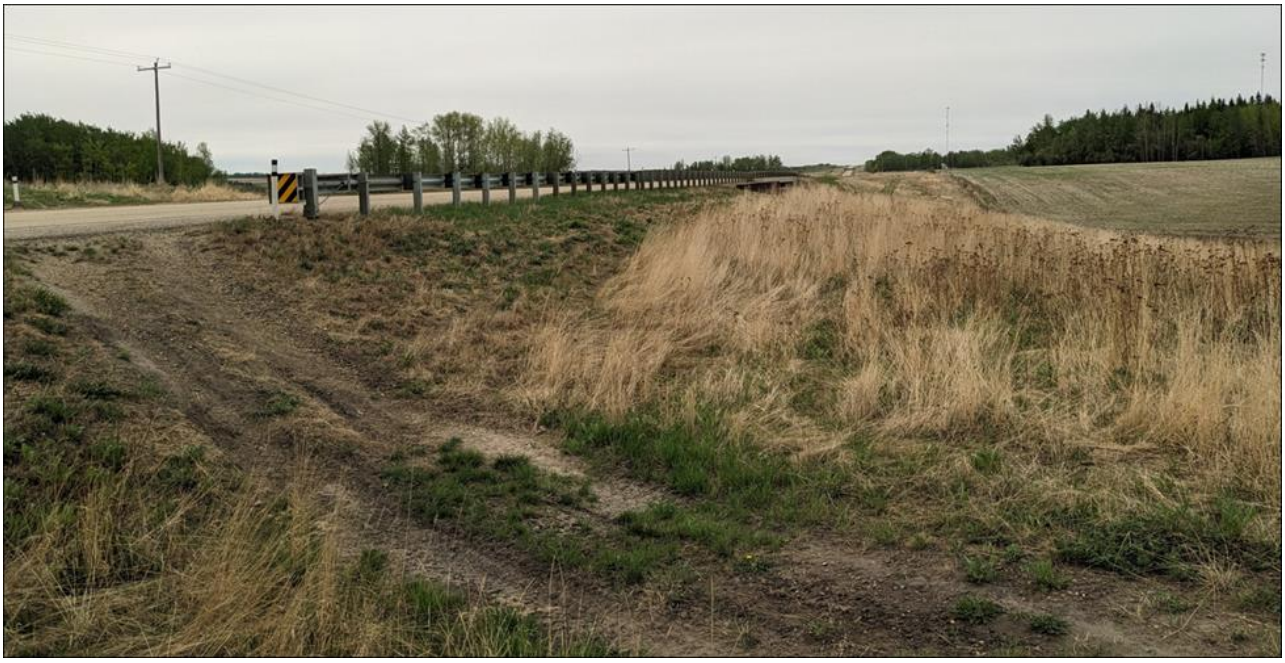

Photo 3. Looking south at the highway west ditch to the north of the repaired area.

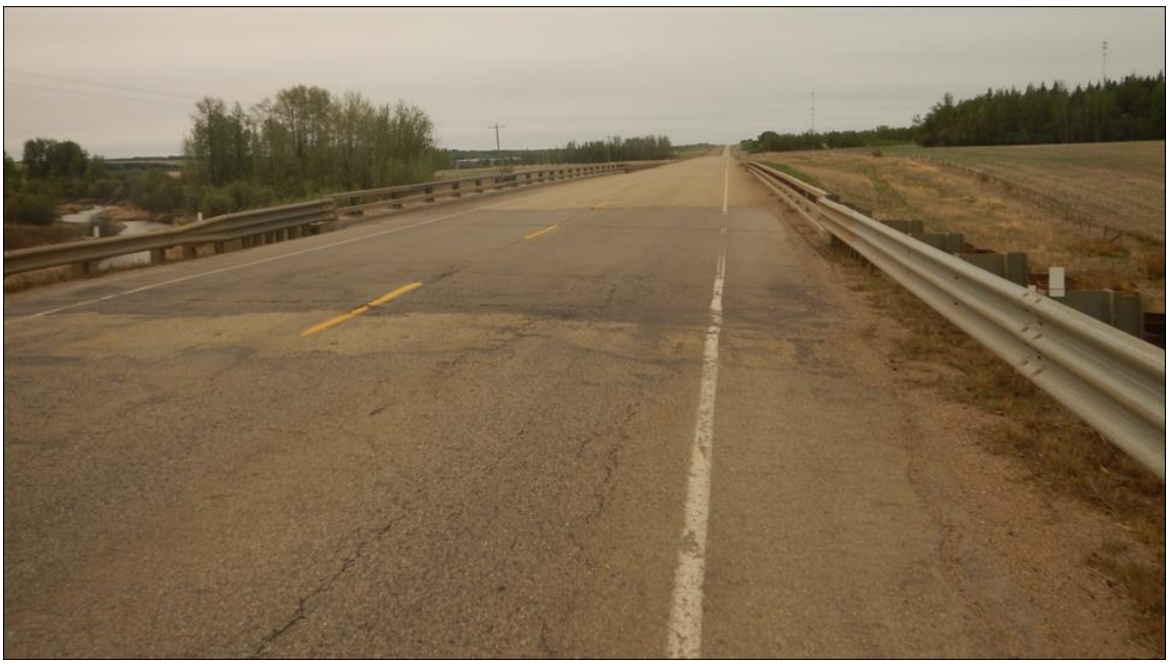

Photo 4. Looking south at the 2019 ACP Patch.

Photo 5. Looking south at guardrail and concrete drain trough behind Sheet Pile Wall B; accumulated debris from the road in the drain trough.

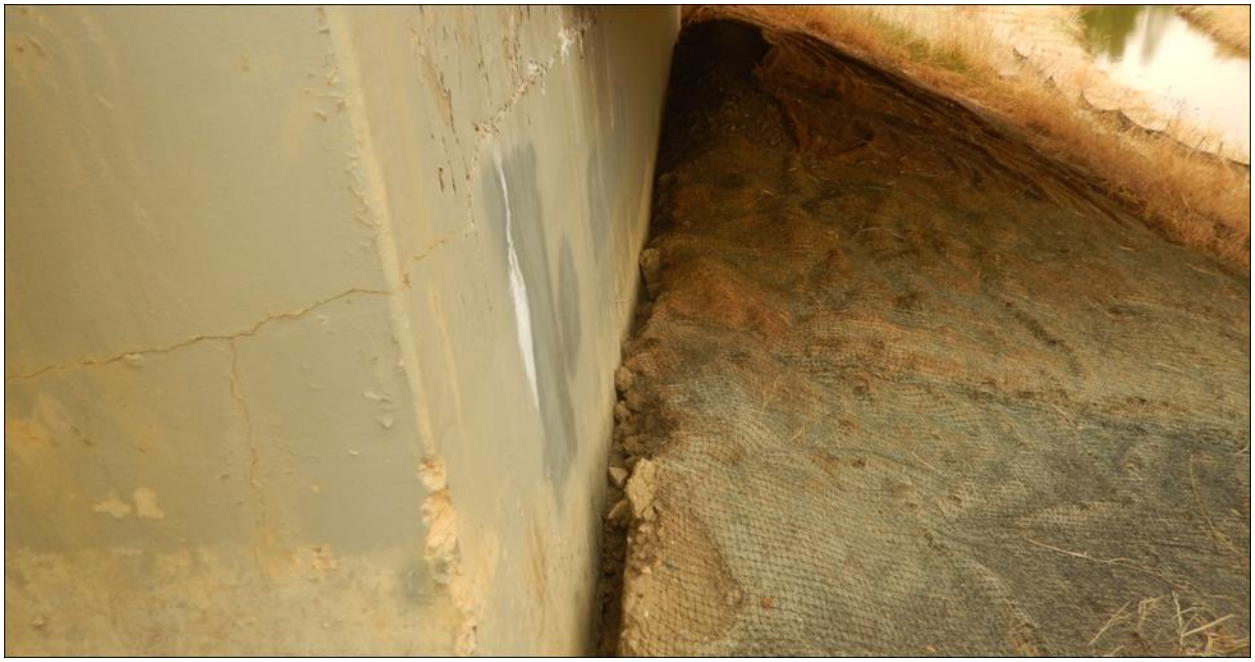

Photo 6. Shrinkage crack along the face of the abutment seat (200 mm wide, 450 mm deep, 2 m long)

Photo 7. Looking at 100 mm wide x 200 mm deep void at the end of the wing wall

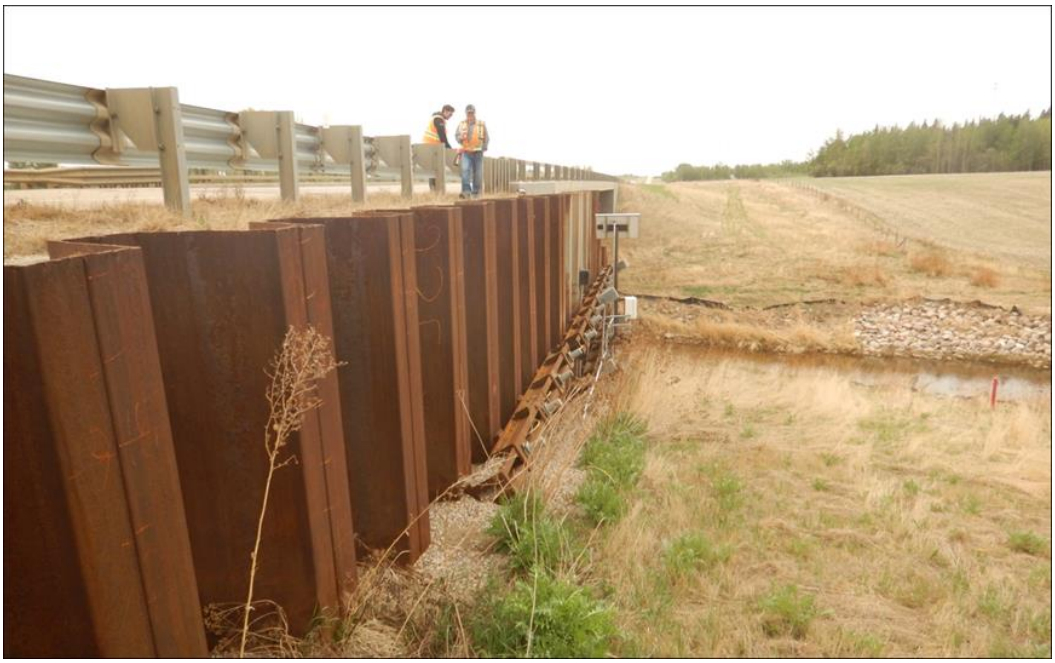

Photo 8. Sheet Pile Wall B with three rows of anchors supporting the highway embankment.

Photo 9. Well grown vegetation along the 6H:1V north facing slope

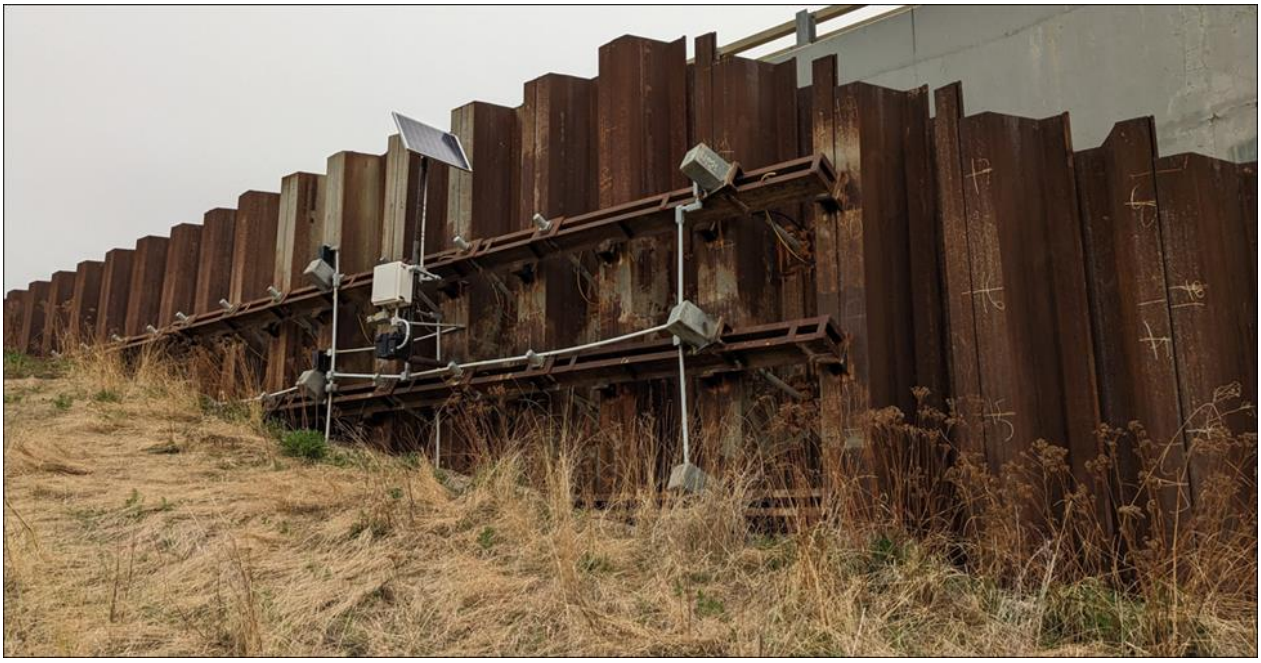

Photo 10. Datalogger enclosure and solar panel installed on Sheet Pile Wall B

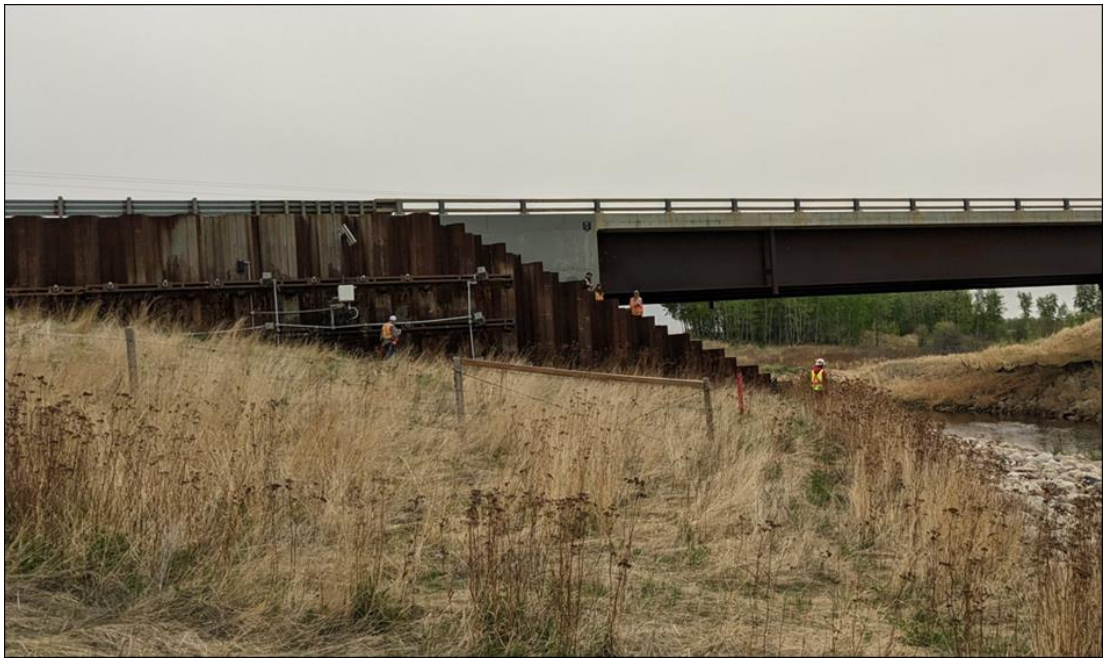

Photo 11. Well grown vegetation on both sides of the barbed Wire Fencing Installed on 6H:1V north facing slope

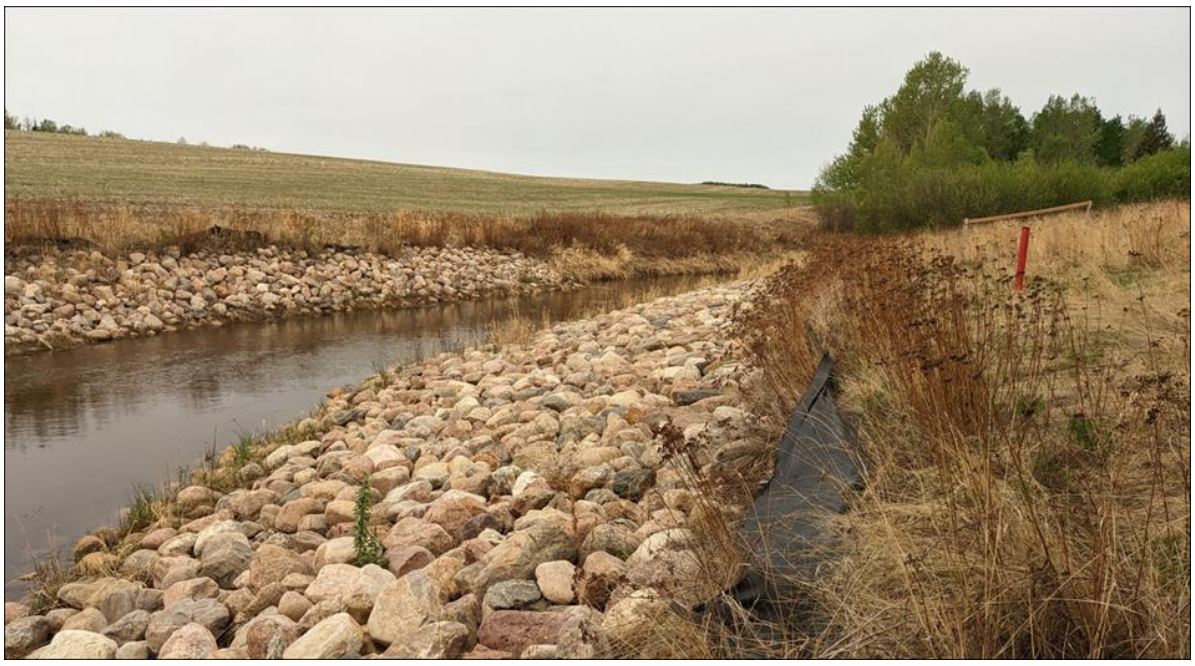

Photo 12. Looking west at the armored creek bank from the bottom of the slope (i.e.at Sheet Pile Wall A location); banks were armored using Class 1 Riprap

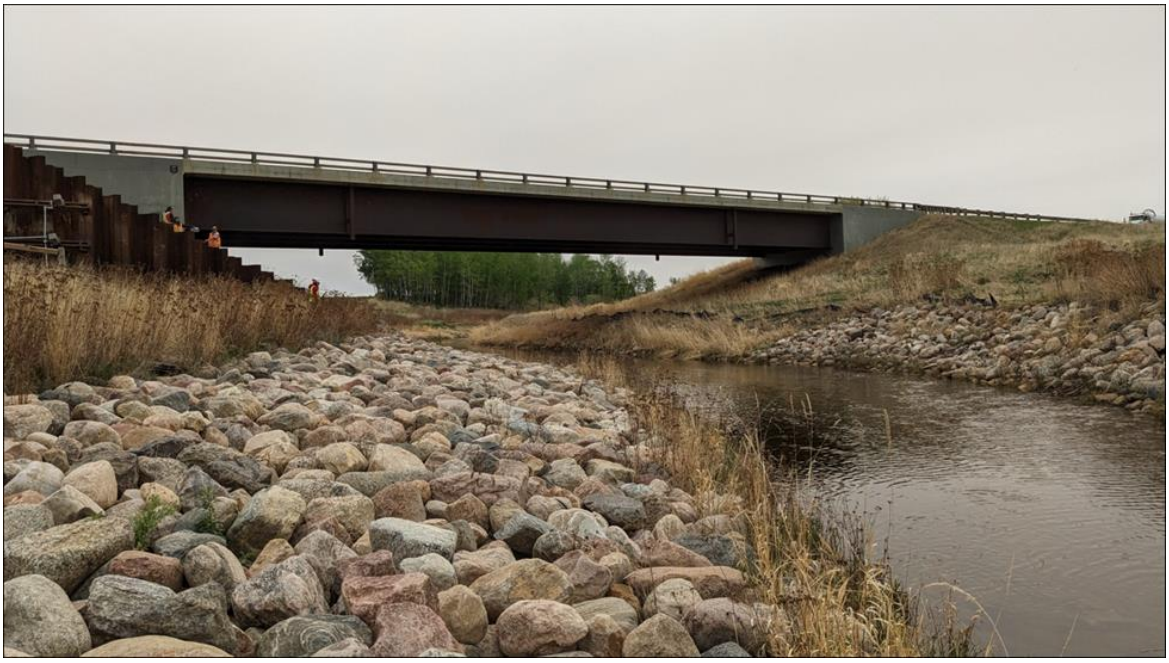

Photo 13. Looking east at the armored creek banks from the bottom of the slope