

SITE NUMBER AND NAME: NC052 – Pembina River Bridge	HIGHWAY AND KM: 621:02, km 16.420	PREVIOUS INSPECTION: June 2, 2023	CURRENT INSPECTION: June 14, 2024
LEGAL DESCRIPTION: SE 01-50-09-W5	NAD83 COORDINATES: UTM11U 5905008N, 621749E		RISK ASSESSMENT: PF: 10 CF: 10 Total: 100
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 1,030 (2023)		CONTRACTOR MAINTENANCE AREA (CMA): 509	

SUMMARY OF INSTRUMENTATION: Three slope inclinometers (SI), one pneumatic piezometers, one vibrating wire piezometer and one standpipe piezometer functioning.	INSPECTED BY: Stantec: Leslie Cho, Sonja Pharand TEC: Kristen Tappenden, Wilf Cousineau
LAST READING DATE: May 16, 2024	
PRIMARY SITE ISSUE: Slope instability at east abutment. Artesian pressures at west abutments. Shallow groundwater table at east abutment. Bridge (BF74969) rotating with crushed bearing plates.	
APPROXIMATE DIMENSIONS: 40 m wide by 60 m long.	
DATE OF ANY REMEDIAL ACTION: Winter 2014/2015 – Dewatering of east abutment using sub-horizontal drains. Fall 2020 – Riprap placed on slope south of east abutment to about halfway down slope. Summer/Fall 2022 – Pavement patches at the location of the potholes near the east and west abutments.	

ITEM	CONDITIONS EXIST		DESCRIPTION AND LOCATION	NOTICEABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Transverse crack near SI13-01.		X
Slope Movement	X		Ground crack at toe of east abutment south of riprap channel.		X
Erosion	X		Downslope of riprap south of east abutment.		X
Seepage	X		Artesian flow from SI-1 on west abutment and SI14-01 in the river near the east bank.		X
Bridge/Culvert Distress	X		Top of east pier rotating to the east. East abutment pushing into bridge deck. Through cracks in both abutment seats. Separation of guardrails at all four corners of bridge deck.		X

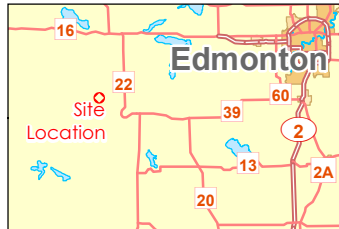
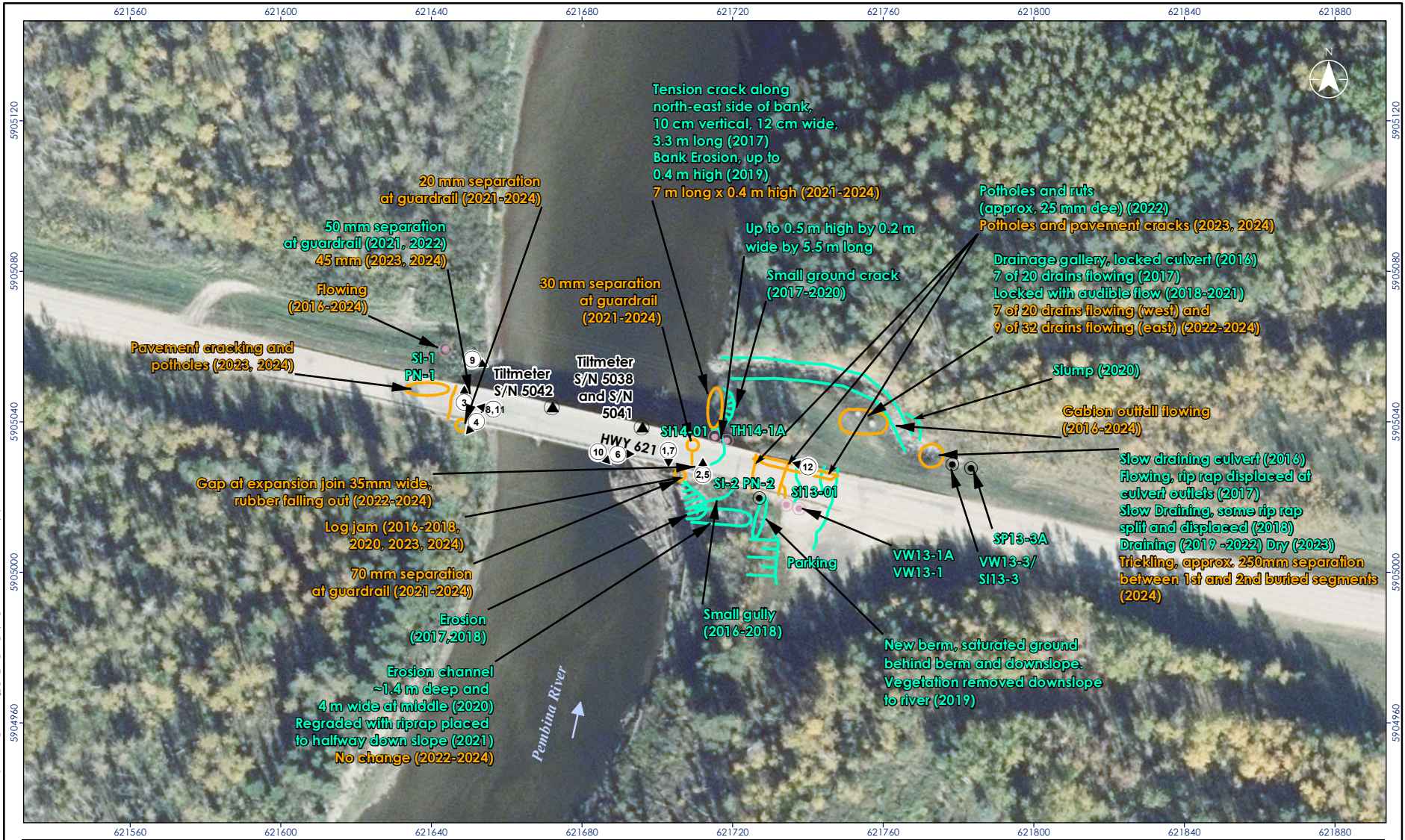
COMMENTS
<ul style="list-style-type: none"> • Bridge rotation appears unchanged since 2021. The separation of the guardrails along the bridge deck have remained relatively unchanged with 30 mm, 70 mm, 45 mm, and 20 mm of separation at the NE, SE, NW, and SW corners, respectively (Photos 1 to 4). • The expansion joint at the east abutment has a gap 35 mm wide in the westbound lane where the rubber has fallen below the bridge deck, similar to the previous inspection in 2023 (Photo 5). • The three tiltmeters installed at the bridge are all non-operational. • Spring 2023 SI readings show signs of creeping a rate of less than 1 mm/year in SI-1. SI-2 previously showed signs of creeping from Spring 2014 to Spring 2022 whereafter cumulative displacements returned to 2014 levels. • Piezometric levels at the site have been relatively stable since installing the horizontal drains.

- Concrete cracks at both east and west abutment seats appear unchanged. A 20 mm gap was written onto the crack at the west abutment at an unknown date. This same gap was measured to be 20 mm by Stantec since 2016 (Photos 6 and 8). The overhanging outlet for the drain pipe near the centre of the east abutment has been broken / removed.
- Erosion gullies remain present on the headslope below the east abutment (Photo 6).
- The girders were in contact with the abutment backwall at the east abutment. The bearing plates appear to be crushed at both abutments (Photo 7).
- In the westernmost drainage gallery, 7 of the 20 drains were flowing and in the easternmost gallery, 9 of the 32 drains were flowing. Significant build-up of minerals was observed in the subdrains.
- Water was trickling out of the culvert east of the gabion outfall. The last section of beveled culvert at the outlet is separating, and there is about 0.2 to 0.3 m of separation between the first and second buried culvert segments.
- Slow flow was observed at the gabion outfall. The water around the gabion was murky, and algae-covered.
- The ground crack south of the riprap channel near SI14-01 appeared unchanged at about 7 m long with vertical difference up to about 0.4 m high (Photo 9).
- No apparent change was observed in the riprap channel and erosion south of the bridge at the east abutment slope (Photo 10).
- Driftwood was observed (Photo 10) against the south and east sides of the east pier. Two pieces of driftwood are stuck behind the underslung diaphragms against the east side of the bridge, above the east pier.
- Potholes are present adjacent to the west abutment patch and east of the east patch (Photos 11 and 12).
- The nearest detour route to cross the Pembina River appears to be at Range Road 91 and Township Road 491A, approximately a 12-minute drive south of the site. This detour would require the use of gravel roads and would not be suitable for all types of traffic.

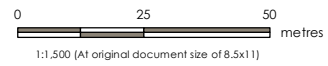
RECOMMENDATIONS

- The bridge should be inspected by a bridge engineer.
- Batteries should be replaced for the remaining tiltmeter to collect regular readings. Otherwise, regular survey of the bridge should be conducted to monitor its rate of rotation/movement. The cable for two of the tiltmeters has been torn apart, possibly due to driftwood, and is likely no longer repairable.
- The riprap channel south of the bridge should be extended downslope to the river or revegetated for increased erosion protection.
- Driftwood piles against the bridge piers should be removed.
- Pavement cracks should be sealed and potholes should be filled to reduce surface water infiltration into the slope.
- The subdrains should be cleaned/ flushed out to reduce mineral build-up and improve performance.
- Site inspections should continue annually.
- Instrumentation readings should continue semi-annually.

PREPARED BY: Sonja Pharand, P.Eng.	PREPARED BY: Xiteng Liu, M.Sc., P.Eng., PMP	PERMIT TO PRACTICE:



- Photo Number and Direction
- Non-Operational Instrument
- Operational Instrument
- Tiltmeter Data Logger
- Previous Observation
- 2024 Observation



Notes
 1. Coordinate System: NAD 1983 UTM Zone 11N
 2. Base features: Geographics, ©Department of Natural Resources Canada. All rights reserved.
 3. Imagery: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Project Location: Hwy 621:02 Alberta
 Prepared by SP on 2024-10-06
 GR by LC on 2024-10-06
 IR by XL on 2024-10-06

Client/Project: Transportation and Economic Corridors
 Geohazard Monitoring Program
 NC52 HWY 621:02 Pembina River Bridge

Figure No.: 1
 Title: **Site Plan**

2024 Site Inspection Photos at NC052



Photo 1: Guardrail separation at southeast corner of bridge. Looking south.



Photo 2: Guardrail separation at northeast corner of bridge. Looking north.

2024 Site Inspection Photos at NC052



Photo 3: Guardrail separation at northwest corner of bridge. Looking north.



Photo 4: Guardrail separation at southwest corner of bridge. Looking southwest.

2024 Site Inspection Photos at NC052



Photo 5: Gap at expansion joint with rubber falling out. Looking north.



Photo 6: Cracking of east abutment and gullies on headslope. Looking east.

2024 Site Inspection Photos at NC052



Photo 7: Girders in contact with east abutment. Movement of bearing plate. Looking south.



Photo 8: 20 mm crack at west abutment. Looking west.

2024 Site Inspection Photos at NC052



Photo 9: Riprap lined channel and ground crack north of east abutment. Looking east.



Photo 10: Riprap placed south of bridge along previous erosion channel. Driftwood collected near the east pier. Looking southeast.

2024 Site Inspection Photos at NC052



Photo 11: Pavement surface at west abutment. Looking northwest.



Photo 12: Pavement surface at east abutment. Looking west.