

SITE NUMBER AND NAME: NC018 – Pembina River Bridge (North of Cherhill)	HIGHWAY AND KM: 764:02, km 12.052	PREVIOUS INSPECTION: July 31, 2023	CURRENT INSPECTION: June 13, 2024
LEGAL DESCRIPTION: NW-15-57-5-W5	NAD83 COORDINATES: UTM11U 5978069 N, 652940 E		RISK ASSESSMENT: PF: 9 CF: 10 Total: 90
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 450 (2023)		CONTRACTOR MAINTENANCE AREA (CMA): 509	

SUMMARY OF INSTRUMENTATION: Six slope inclinometers and two standpipe piezometers functional.	INSPECTED BY: Stantec: Leslie Cho and Sonja Pharand TEC: Kristen Tappenden
LAST READING DATE: May 15, 2024	
PRIMARY SITE ISSUE: Washed out head slope at north abutment of BF9333.	
APPROXIMATE DIMENSIONS: 35 m wide by 13 m long	
DATE OF ANY REMEDIAL ACTION: Major bridge and slope repairs undertaken in 1997 including constructing a buttress fill along the east side of the north approach fill, placing free-draining coarse granular material on the north abutment head slope, unloading the south abutment which required installation of another bridge pier and extending the bridge deck south, and installing a horizontal and vertical subdrain system to relieve artesian pressures.	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICEABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress		X			X
Slope Movement		X			X
Erosion	X		North abutment head slope washed out. Riprap channel collapsed east of north abutment.	X	
Seepage		X			X
Bridge/Culvert Distress	X		North abutment head slope washed out.	X	
Other		X			X

COMMENTS
<ul style="list-style-type: none"> The highway surface currently does not appear to be affected by the loss of the north embankment head slope (Photos 1 to 4). The significant drift accumulation observed on the upstream side of the bridge during the 2023 call-out inspection was largely removed (Photo 5). The current crest of the head slope was measured to be about 2.3 m away from the concrete north abutment wall. Additional tension cracks are present, suggesting that additional material loss is likely to occur (Photo 6). Erosion channels were observed on the riverbank below the north abutment. Minor surficial erosion was observed at the end of the concrete drain trough on the east side of the north abutment. A larger erosion channel or dried stream exists within the northeast ditch, above (north of) the riprap channel. The collapsed riprap channel wrapped in geotextile was observed at the east extent of the washed out head slope (Photo 7). It appeared relatively unchanged from the 2023 call-out inspection. Erosion and slumping were observed along the riverbank west of the north bridge abutment (Photo 8).

- Riprap armouring was observed along the water line on the south riverbank (Photos 9 & 10). A small slump along the riverbank was observed about 15 m to 20 m west of the south abutment and appeared to be in a similar state as observed during the 2023 call-out inspection. It is unlikely this slump is affecting the bridge.
- A small erosion channel has continued to develop along the south head slope (Photo 11).
- The area between the south head slope and drainage galleries was observed to be wet (Photo 12). Water was pooling in this area during the 2023 call-out inspection.
- The west drainage gallery could not be opened, but trickling water could be heard coming from it. All three drains in the eastern drainage gallery were flowing. Siltation within both drainage galleries was apparent.
- The slope inclinometers show no appreciable change in movement rates other than seasonal variations since about 2005. Movement rates vary between 2 mm/year and less than 1 mm/year.
- Water levels at the site have generally been increasing since 2001. The water levels in SP2 and SP96-1 are 7.8 m and 4.5 m below ground surface, respectively.
- A Probability Factor of 9 was assessed since the bridge embankment slopes contain erodible soils with little vegetation cover. In addition, it is anticipated that loss of riverbank and bridge embankment slopes will continue with each high precipitation event or freshet from rapid snowmelt. Given that significant loss of infrastructure has already occurred, and the eroded material is directly flowing into a fish bearing river, a Consequence Factor of 10 was assessed.

RECOMMENDATIONS

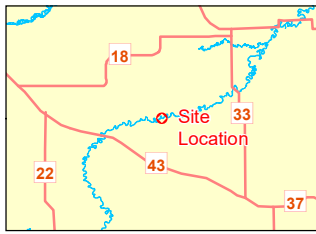
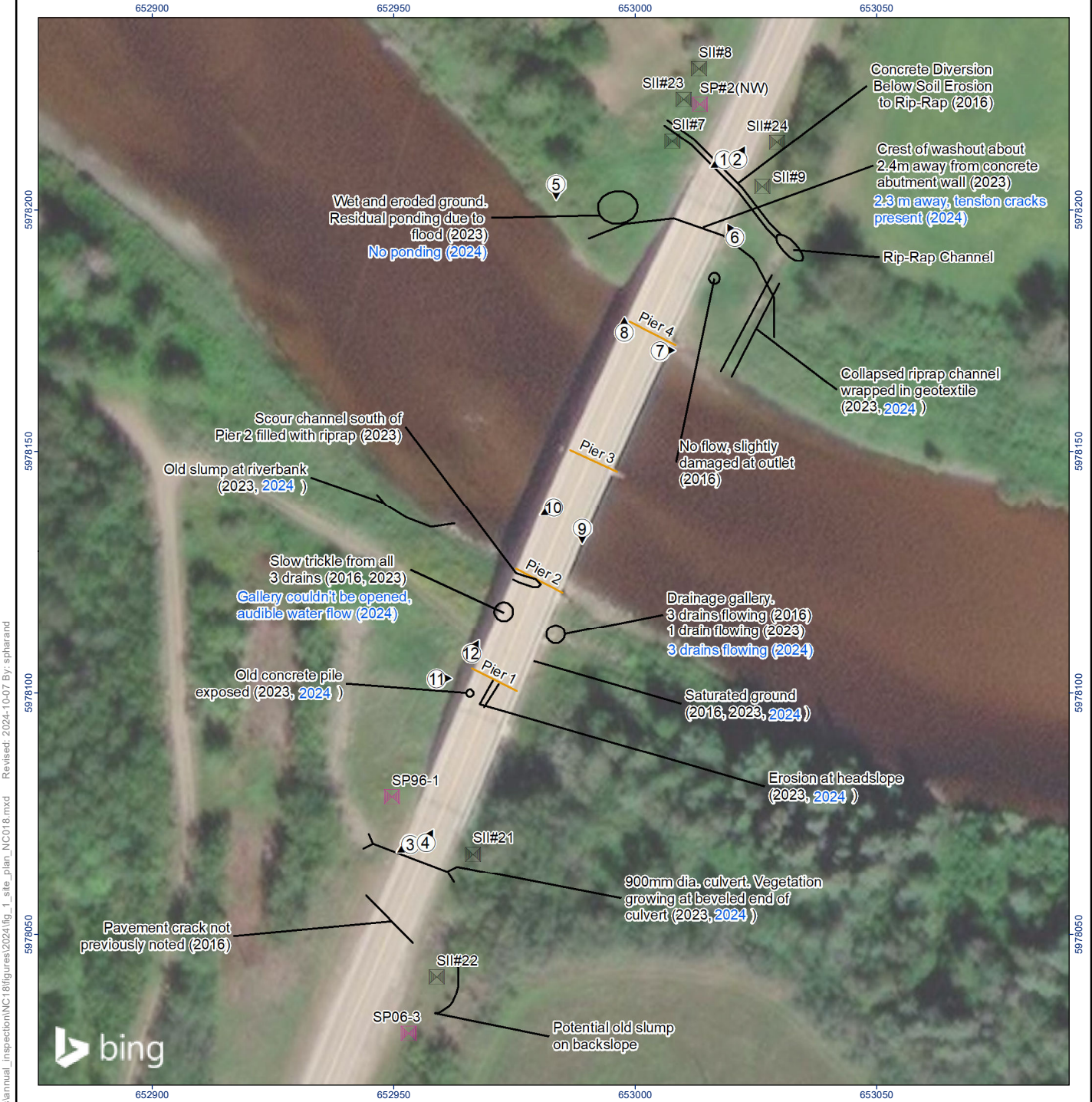
- The bridge should be monitored regularly (in the spring following freshet, fall and following high precipitation events) for adverse impacts due to significant loss of the north head slope.
- A periodic subdrain cleaning program should be implemented to reduce risk of potential siltation and clogging of subdrains. The cleaning method may consist of pressure washing the insides of the subdrains and removing the dirty water and sediment from the collection points with a hydrovac. The outlet pipes to the river should be temporarily plugged until the collection points have been cleaned out to reduce migration of dirty water into the river. The outlet should also be flushed by forcing water out from the drainage galleries. The anticipated cost for subdrain cleaning is \$6,000 excluding any consulting effort.
- For long-term remediation, Stantec recommends the following for high-level consideration:
 - Rebuilding the bridge head slope to its original configuration with concrete slope protection.
 - The north riverbank should be regraded to remove existing erosion and slumping areas.
 - Riprap should be placed for erosion protection 20 m upstream and downstream of the north abutment up to the 1:100 year water level.
 - The high-level cost for the above remediation is \$800,000 to \$1.1M excluding engineering and environmental permitting and/or assessment. The estimated high-level cost assumes stream isolation cost of \$300,000.
 - Final design details should be confirmed by a hydrotechnical and/or bridge engineer.
- The site did not return any records of historic resources based on a search of the Listing of Historic Resources. However, Historical Resources Act approval will be required since the remediation options are not included under its Land Use Bulletin.
- The washed-out head slope may be a reportable incident to the Alberta Environment hotline due to release of a deleterious substance that may have caused, is causing, or may continue to cause an adverse effect.
- *Public Lands Act* approvals may also be required, however, given this is TEC property, requirements may vary depending on how the land is titled and if there is a disposition for the bridge.
- Work below the ordinary high-water mark (i.e., 1:2-year flood elevation) will require notification/approvals under the *Water Act*, *Fisheries Act*, and *Canadian Navigable Waters Act*.
- The site inspection frequency should continue annually with the next site visit in 2025.



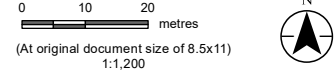
NORTH CENTRAL REGION GRMP
EDSON / STONY PLAIN
SITE INSPECTION FORM



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



- Approximate Location of Slope Inclinerometer (SI)
- Approximate Location of Stand Piezometer (SP)
- Piers
- Previous Observation
- 2024 Observation
- Photos and Direction



Stantec

Project Location: Hwy 764.02, km 12.052
 Prepared by SP on 2024-09-17
 TR by LC on 2024-09-17
 IR by XL on 2024-09-17

Client/Project: Transportation and Economic Corridors
 Geohazard Monitoring Program,
 NC18 Hwy 764.02, km 12.052

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

Notes

- Coordinate System: NAD 1983 UTM Zone 11N
- Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
- Background: © 2024 Microsoft Corporation © 2024 Maxar ©CNES (2024) Distribution Airbus DS

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2024 Inspection Photos at NC018



Photo 1: Highway surface at north abutment. Looking southwest.



Photo 2: Highway surface at north abutment. Looking northeast.

2024 Inspection Photos at NC018



Photo 3: Highway surface at south abutment. Looking northeast.



Photo 4: Highway surface at south abutment. Looking southwest.

2024 Inspection Photos at NC018



Photo 5: Majority of drift accumulation upstream under bridge removed. Looking southeast.



Photo 6: North abutment head slope washed away with further tension cracks. Looking northwest.

2024 Inspection Photos at NC018



Photo 7: East extent of washout at north abutment. Note collapsed riprap channel wrapped in geotextile. Looking east.



Photo 8: West extent of washout at north abutment. Looking north.

2024 Inspection Photos at NC018



Photo 9: Downstream side of south abutment. Looking south.



Photo 10: Upstream side of south abutment. Looking southwest.

2024 Inspection Photos at NC018



Photo 11: South abutment head slope. Looking east.



Photo 12: Saturated ground between drainage galleries and Pier 1. Looking northeast.