ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – GRANDE PRAIRIE DISTRICT
2018 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
GP09	East of Grande Cache	Muskeg River Bank Protection	40:32	47.5
Legal Description		**UTM Co-ordinates (NAD 83)**		
S1/2-15—57-5-W6		11U N 5,976,192	E 391,234	

	Date	PF	CF	Total
Previous Inspection:	May 29, 2017	9	2	18
Current Inspection:	May 22, 2018	9	2	18
Road AADT:	1020		**Year:**	2017
Inspected By:	Don Proudfoot, Nicole Wilder (Thurber) Ed Szmata, Rocky Wang (AT)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	Highway Embankment/Riverbank Erosion and Toe Scour	
Dimensions:	About 300 m long by <10m wide	
Date of any remediation:	Winter, 2003 – Embankment widening was performed to increase the embankment width from 9 to 20 m from the road shoulder at the highway embankment toe erosion/scour. River channel diversion/deepening, and a modified Class 3 rock riprap spur/apron, were also constructed, to divert channel flow away from this area of highway embankment. Some riverbank trimming, riprap clusters, and root wad placement were also performed as part of environmental compensation.	
Maintenance:		
Observations:	**Description**	**Worse?**
☐ Pavement Distress		☐
☐ Slope Movement		☐
☑ Erosion	There is active erosion and toe scour along the south highway embankment over ~130 m length containing up to a 1.2 m high bank, located >50 m downstream of the previously eroded embankment toe. The erosion is approximately 21.4 m from the highway shoulder.	☐
☐ Seepage		☐
☐ Bridge/Culvert Distress		☐
☑ Other	The water level was slightly lower than the previous year. A large log has been swept up against the north river bank. Root wads located east of the rock spur are helping divert water away from the NE river bank.	☐

Instrumentation: None

Assessment:

The highway was constructed around 1970, which included about a 100 m length of Class 2 and 3 rock ripraps for bank protection. Subsequent to highway construction, river channel flow began to slowly erode the toe of the riverbank and the south highway embankment. A 2000 landslide risk assessment documented the lateral erosion over a 40 m length of highway embankment at ~2m/year between 1999 to 2000.

In 2003, the implemented remediation methods described above (and detailed on the attached drawing 21211-P) appear to have controlled the erosion to date for the most part at this location. There is still some surface erosion due to highway runoff that is affecting the embankment consisting of crushed gravel over woven geotextile. There is about a 10.7 m distance from the guardrail to the waters edge at the narrowest point. The channel diversion techniques have transferred the riverbank toe erosion further downstream. There is an approximate 130 m length of active toe erosion beginning about 50 m downstream of the previously affected toe erosion area. The highway is further from the edge of the river at this location (measured at about 21.4 m from the shoulder to the top of the 1.2 m high eroded bank), therefore a buffer exists before it intrudes into the highway clear zone.

A preliminary engineering study with conceptual design alternatives was performed by Thurber and Terrace Engineering (report dated April 29, 2014), as part of flood mitigation contract 15746. A drawing showing the interpreted extent of lateral erosion based on aerial photographs dating back to 1951 is attached for reference.

Recommendations:

Short Term:
Continue monitoring the effects of the previously mitigated area for performance information, as well as the new active erosion developing further downstream. Monitoring points (consisting of semi permanent hubs/lathe or steel pins) should be installed so that lateral erosion in proximity to the highway shoulder can be tracked. Due to the favorable performance, and since the active erosion is still quite far from the highway, it is suggested that inspection for this site be relaxed to once every 2 years unless a flow event occurs.

Additional gravel replenishment may be required on the crushed gravel surface overlying woven geotextile that is being affected by surface erosion.

Medium to Long Term

Alternative conceptual design recommendations were provided in the aforementioned 2014 report to deal with the highway embankment erosion (see attached conceptual design drawings).

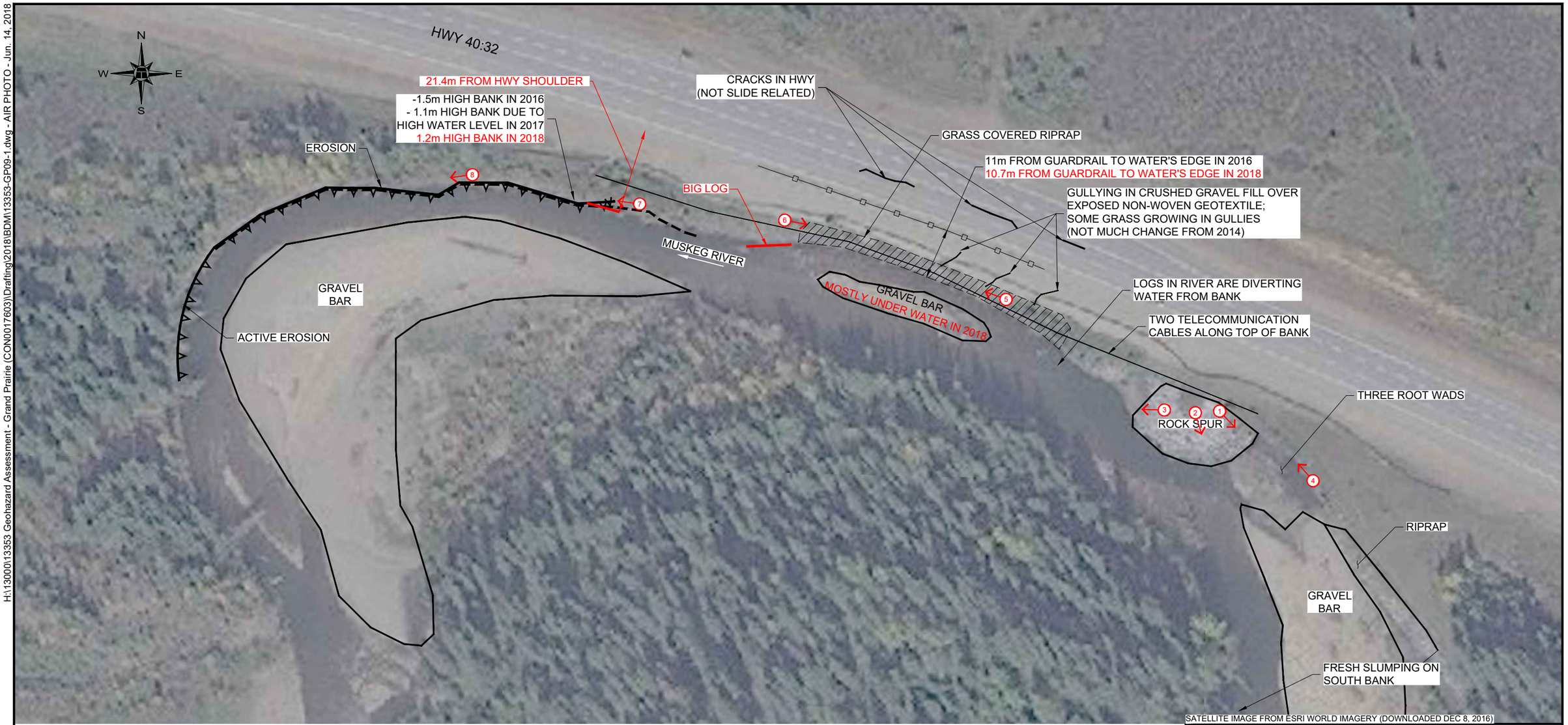
1. SPURS: The recommended remedial option to mitigate continued bank erosion was adding two more riprap spurs (consisting of Modified Class 3 rock) further downstream of the existing spur. The spurs would consist of a 1.1 m thick layer of riprap on the slope, with a 4.0 m long x 2.2 m thick riprap apron located 4.2 m below design highwater, along with some channel enlargement. The ballpark cost for this work is in the order of **$700,000**.

2. GUIDEBANK: An alternative of constructing a linear guide bank was also assessed, which involves placing Modified Class 3 riprap over a 100 m length of riverbank (at similar dimensions described above for the spur apron). The ballpark cost of this alternative is **$800,000**.

3. Bank Protection Reinforcement: This alternative involves reinforcing the existing riprap where it is undersized and sparse. This is a cheaper, but higher risk alternative, as the riprap would not meet current design standards. The ballpark cost of this alternative is **$300,000**.

A cost estimate to perform the detailed design and tender preparation (#17234) for either options 1 or 2 above was submitted to AT in March 2017, but has not yet been approved.

H:\13000\13353 Geohazard Assessment - Grand Prairie (CON0017603)\Drafting\2018\BDM\13353-GP09-1.dwg - AIR PHOTO - Jun. 14, 2018



LEGEND

- CRACK
- BANK TOE AT RIVER'S EDGE
- GUARD RAIL
- DIRECTION AND NUMBER OF PHOTO

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE
2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
3. MAY 22, 2018 FEATURES SHOWN IN RED

0 10 20 30 40 50 60m

SCALE 1:1000

Alberta Transportation

PEACE REGION (GRANDE PRAIRIE) 2018
GP09-1

2018 INSPECTION PLAN

DWG No. 13353-GP09-1

DRAWN BY	ML
DESIGNED BY	BDM
APPROVED BY	DWP
SCALE	1:5000
DATE	MAY 22, 2018
FILE No.	13353

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	**Photo 1.** Looking east from the Class 3+ rock riprap spur at the root wads protruding from the embankment.
	**Photo 2.** Looking southeast (upstream) along the river from the rock spur.

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	**Photo 3.** Looking northwest (downstream) along the river from the rock spur.
	**Photo 4.** Looking west at the rock spur. A root wad is in the picture foreground.

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	**Photo 5.** Looking west along the toe of the embankment. Note the grass covered riprap and the gullying in the crushed gravel embankment that is overtop woven geotextile.
	**Photo 6.** Looking east along the toe of the south highway. No significant toe erosion here.

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	**Photo 7.** Looking west along the river bank at active toe erosion.
	**Photo 8.** Looking west along the edge of the river. Note the continued erosion of the outside bank.