ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – GRANDE PRAIRIE DISTRICT
2020 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
GP41	Grande Cache	East Hwy Ditch Erosion	40:34	32.4
Legal Description		**UTM Co-ordinates (NAD 83)**		
SE4-57-8-W6		11U N 5,973,920 E 360,760		

	Date	PF	CF	Total
Previous Inspection:	May 22, 2019	10	3	30 (Erosion Risk Scale)
Current Inspection:	May 25, 2020	11	4	44 (Erosion Risk Scale)
Road AADT:	1,540		**Year:**	2019
Inspected By:	Don Proudfoot, Nicole Wilder (Thurber) Ed Szmata, Rishi Adhikari (AT)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	Erosion gully has formed in the east highway ditch, alongside Class 1 riprap ditch protection placed in 2014.	
Dimensions:	Erosion ~400 m long x <3.8 m wide x <1.2 m deep (Lower or northernmost ~250 m straddles along the highway side of riprap protection, while the southernmost ~150 m is still grassed). A second erosion channel is present running along the edge of the highway pavement parallel to the existing erosion channel and is <1.2 m wide and <0.6 m deep.	
Date of any remediation:		
Maintenance:		
Observations:	**Description**	**Worse?**
☐ Pavement Distress	There are two locations where the erosion has cut into the pavement 0.4 m and several areas along the new erosion channel that are starting to cut into it.	☑
☐ Slope Movement		☐
☑ Erosion	Active erosion activity along the east highway ditch over ~400 m length, has intermittent locations that are more severe. The worst area near the middle of the eroded length, is up to 3.8 m wide and 1.2 m deep (compared to about 3.7 m wide and 1.2 m deep last year). A new erosion channel has formed running parallel to the existing one and along the east edge of the highway.	☑
☐ Seepage		☐
☐ Bridge/Culvert Distress		☐
☐ Other		☐

Instrumentation: None

Assessment:
The riprap in the east ditch was placed by the maintenance contractor in 2014 to curtail erosion that had formed up to 1.2 m deep. The erosion gullies were reportedly filled with 6-80 gravel, then covered with woven geotextile, which in turn was covered with Class 1 riprap (predominantly conglomerate). It is not known if the 6-80 gravel was compacted or placed loose. However, it appears that the finished riprap surface was not placed deeper than the edges (i.e. not in a well-defined ditch channel), and the runoff is not being confined to the riprap.

In the erosion gully at a location near the north end, woven geotextile was exposed beneath the edge of the riprap, and the erosion gully has extended just outside and below the edge of this geotextile. The extent of geotextile placement is not known, but non-woven geotextile should have been used beneath the entire area of riprap placement. Runoff that enters the ditch has found a path of lesser resistance alongside the west edge of the riprap, incising into the placed 6-80 gravel and/or the natural bed material below.

Runoff entering into the east highway ditch may have also increased in recent years due to extensive bush clearing upslope (to the east) of the highway for a subdivision. This runoff is finding its way into the east highway ditch via channelized gullies. A new erosion channel has formed and has started eating into the highway pavement edge.

The gradient is too steep for the volume of runoff on the unprotected (grassed) ditch portion at the south end above the riprap (measured at ~5 percent). Further downslope in the riprap lined ditch, the runoff volume likely becomes greater, and the existing ditch gradient is steeper (measured at between 7 to 9 percent), and this combination is also too great for the existing ditch bed material and/or 6-80 gravel, where the runoff is not confined to a depressed riprap channel.

The highway has now been affected by the erosion in several locations, (Photo 5 & 6). The erosion has encroached into the edge of the pavement and will continue eroding it away and may lead to partial lane closure if it isn't dealt with soon. There is a new erosion gully that has formed near the south end of the site which begins adjacent to the highway pavement as shown on Photo 11 and extends north as shown on Photo 5 and 6.

The conglomerate riprap consists of gravel held together by a sandstone matrix. It has weathered over time and in several places is gradually breaking down into smaller pieces.

Recommendations:

Investigation:
A hydrology study is recommended, to assess flows, and to determine the size of erosion resistant surfacing that is required for the east highway ditch at this site.

Short Term:
In lieu of an investigation, repair the erosion along the east ditch (over the northern 250 m length where riprap was placed) as follows:

1) Remove the existing predominantly conglomerate, Class 1 sized riprap. It could be salvaged for re-use if desired or replaced with more durable riprap meeting AT specifications that will last longer.
2) Remove all loose fill by excavation down to the base of the erosion gullies (min. 1 m deep), separating any gravel/clay while rolling the clay back along the side slopes (cutting into the backslope should be discouraged).
3) Re-build the bottom of the ditch by compacting the excavated clay back into the erosion channel in thin lifts using a Sheepsfoot compactor, supplementing with imported clay from a borrow source where required.
4) Grade the surface, forming a neatly contoured, flat-bottomed (min. 2 m wide) channel having a minimum vertical height of 0.5 m from the bottom to both edges, before covering the surface with "Type B" non-woven geotextile.
5) Line the bottom and sides of the ditch overtop of the geotextile with either
   a. Class 2 riprap, or
   b. 0.3 m thick gabion mattress. Gabion basket ditch check weirs should also be incorporated into the liner stepped at maximum 10 m intervals along the channel.

Ballpark Cost ~$1.0 Million

For the southern 150 m length of erosion, the erosion could be repaired by:

1) Remove all loose and wet material from the erosion gully, over-excavating where necessary.
2) Compact the bottom of the ditch in thin lifts using a Sheepsfoot compactor, supplementing with imported clay from a borrow source where required.

3) Grade the surface, forming a neatly contoured, flat-bottomed (min. 2 m wide) channel having a minimum vertical height of 0.5 m from the bottom to both edges, before covering the surface with “Type B” non-woven geotextile.
4) Line the bottom and sides of the ditch overtop of the geotextile with either
   c. The salvaged Class 1 riprap from the north end, or
   d. 0.23 m thick gabion mattress. Gabion basket ditch check weirs should also be incorporated into the liner stepped at maximum 10 m intervals along the channel.

Ballpark Cost ~$0.3 Million

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NORTH END EROSION
(RUNOFF LEAVES HIGHWAY DITCH)

EROSION GULLY AVERAGES 3.0m WIDE x 0.9m DEEP;
ADJACENT TO 4.5m WIDE RIPRAP CHANNEL

EROSION GULLY AVERAGES 3.3m WIDE x 1.1m DEEP;
ADJACENT TO 3m WIDE RIPRAP CHANNEL

NORTH END EDGE OF GULLY IS 3.5m
FROM WHITE PAVEMENT LINE OF NBL

EROSION GULLY VARIES FROM 2.4m WIDE x 0.7m DEEP TO
3.8m WIDE x 1.2m DEEP; RUNS ALONGSIDE 2.8m WIDE RIPRAP
CHANNEL AND NOW ENCROACHES 0.4m INTO HWY PAVEMENT

EROSION CUTTING 0.4m INTO HWY ASPHALT

THIS AREA WAS CLEARED OF TREES PRIOR
TO 2016 AND WATER RUNOFF FROM
SUBDIVISION IS CREATING SOME EROSION
ALONG DITCH BACKSLOPE

NEW EROSION RUNNING ALONG HWY

START OF RIPRAP CHANNEL

EROSION GULLY

EROSION GULLY VARIES
FROM 1.1m WIDE x 0.4m DEEP
TO 2.3m WIDE x 0.7m DEEP
IN GRASS DITCH

SECOND EROSION CHANNEL HAS WORSENED
AND NOW UP TO 1.2m WIDE, 0.6m DEEP

WELCOME TO GRANDE CACHE SIGN

SECOND EROSION COMING FROM END
OF GUTTER 0.5m, WIDE 0.2m DEEP

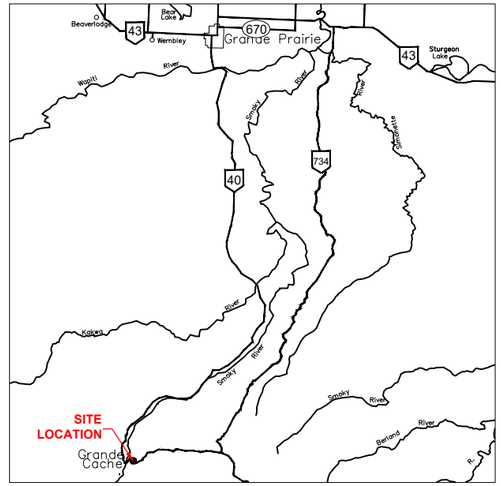
START OF EROSED GULLY

SOME EROSION; GRASS
COVERED DITCH, BUT NO
DISTINCT GULLY

HWY 40:36 – 1 NBL, 2 SBL

0, 100, 200, 300, 400, 500

N W E S



KEY PLAN
SCALE: 1:200 000

LEGEND

① DIRECTION AND NUMBER OF PHOTO

NOTES :

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. STATIONING ALONG HWY SHOWN EVERY 100m. (NORTH END = 0)
3. MAY 25, 2020 FEATURES SHOWN IN RED.

0 25 50 75 100 150 200 m
SCALE 1:3000

SATELLITE IMAGERY FROM ESRI WORLD IMAGERY (DOWNLOADED 2016-12-20)

Alberta

PEACE REGION (GRANDE PRAIRIE)
HWY 40:36 WEST EDGE GRANDE CACHE

MAY 25, 2020 INSPECTION PLAN

DWG No. 13353-GP41-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:3000
DATE	DECEMBER 2020
FILE No.	13353

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	**Photo 1.** Looking south from the north end of the erosion gully.
	**Photo 2.** Looking south at further eroded gully in ditch.

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	**Photo 3.** Looking south at a runoff erosion gully that enters the east highway ditch near the north end which has eroded the ditch
	**Photo 4.** Looking south where deepest portion of the erosion gully in the east ditch is and is now encroaching into the roadway.

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	**Photo 5.** Looking north along the erosion gully further south where the erosion is up to 1.2 m deep and cutting into the highway now.
	**Photo 6.** Looking north along the erosion gully where the erosion has gotten closer to the roadway.

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	**Photo 7.** Looking north along the erosion gully from the start of the riprap in the east ditch.
	**Photo 8.** Looking south along the erosion gully just south of where the rip rap lined channel starts.

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	**Photo 9.** Looking north along the erosion gully formed in a grassed ditch, south of where the riprap starts.
	**Photo 10.** Looking north from the beginning of the erosion gully in the grassed ditch (near the south end).

	**Photo 11.** Looking south at new erosion that runs near highway pavement.
	**Photo 12.** Looking south where a second channel of erosion exists and has cut into the roadway.