

SITE NUMBER AND NAME: C011-I & -II Erosion and Sinkholes		HIGHWAY & KM: 837:02, 5.637	PREVIOUS INSPECTION DATE: June 10, 2020	INSPECTION DATE: June 24, 2021
LEGAL DESCRIPTION: C017-I: 10-04-30-21-W4M C017-II: 10-04-30-21-W4M	NAD 83 COORDINATES: UTM Northing Easting 12 5711672 368445 12 5711584 368473		RISK ASSESSMENT: PF: 1 CF: 2 TOTAL: 2 PF: 2 CF: 5 TOTAL: 10	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 260 (north) & 270 (south) (Ref No. 106230 & 107250)			CONTRACT MAINTENANCE AREA (CMA): 517	

SUMMARY OF SITE INSTRUMENTATION: There is no instrumentation at the C011 site. LAST READING DATE: N/A	INSPECTED BY: Chris Gräpel (KCB) James Lyons (KCB) Roger Skirrow (AT) Tony Penney (AT)
PRIMARY SITE ISSUE: Erosion in the ditch on the east side (northbound lane) of Hwy 837 near the geocell armoring; and of the unarmored fill that was placed in either 2015 or the spring of 2016.	
APPROXIMATE DIMENSIONS: The site is approximately 200 m long, and the highway embankment above the ditch is approximately 1.2 m high sloped at approximately 4H:1V.	
DATE OF ANY REMEDIAL ACTION: October 2002 – geocell and gabion basket drop structures installed; Spring 2016 – unarmored fill placed downstream of the gabion basket drop structures to divert water away from the edge of the highway. Summer 2019 – Since 2018, the HMC has regraded the unarmored fill from the C018 site downslope of geocell on the backslope above the existing erosion gully. 2020 – The HMC replaced approx. 60 m of the geocell armoring (upstream of the gabion basket drop structure).	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Pavement cracked on westbound shoulder		X
Slope Movement	X		Steep gully slopes in unarmoured fill are failing		X
Erosion	X		Erosion of ditch and unarmored fill stockpile. Continued erosion of gully.	X	
Seepage		X	None observed		X
Culvert Distress		X	Culvert inlet open		X

COMMENTS
KCB and AT discussed potentially separating the C011 site into two subsites (i.e., C011-I and -II). C011-I would be the north portion of the site (ditch erosion that was partially repaired in 2020) and C011-II, which would capture the gully erosion downslope of the geocell armoring/gabion drop structures and the sinkholes on the east and west side of Hwy 837.
The geocell armoring upstream of the gabion drop structure was repaired in fall 2020 (Photos 1 and 3). The repaired geocell armoring appears to be in good conditions and vegetation has started growing on the ditch side slopes.
The unarmoured fill stockpile continues to be affected by gully erosion (Photo 2).
The erosion gully downslope of the unarmoured fill stockpile continues to expand off highway right-of-way.
The CSP culvert upslope of the geocell armoring is corroding and appears to be in similar condition as during the 2020 inspection (Photo 4).

Three sinkholes were identified on the east slope of the highway embankment downstream of the geocell and gabion basket drop structures during the 2017 inspection (Waypoints 507, 508, and 509). An additional sinkhole was identified on the west side of the highway (west of Waypoint 507) during the 2019 inspection along with a zone of settlement at the edge of the pavement. A new sinkhole was observed during the 2020 inspection at the east limit of the area shown in Figure 1. An additional sinkhole was observed during the 2021 inspection (Photo 8) that measured approximately 3 m wide by 3.5 m long. The surface of the embankment slope has several sinkholes as shown in Figure 1, including a line of sinkholes extending southeast from Waypoints 507, 508, and 509. The line between sinkholes on the east and west side of the highway indicates a preferential flow path along the sinkholes on both sides of the embankment at a shallow depth below the highway. The presence of the sinkholes indicates that dispersive soil fill is present in the embankment and foundation. AT operations crews should monitor this site for possible settlement or collapse of the pavement like they do at the C058 site on Hwy 570:02. A sinkhole was noticed further to the east on the north side of the highway and the rate of water discharge from the sinkhole is enough to have created a small gully.

Discussed remedial actions and additional investigation:

- A sediment pond could be constructed on private land downslope of the erosion gully to trap sediments, but would require regular maintenance and sediment removal.
- A seamless HDPE slope drain could be used to convey flows over the eroded areas and into the sediment pond, or to a natural creek channel for discharge into the Red Deer River.
- The unarmoured fill stockpile should also be protected with granular fill and riprap to protect against ditch erosion.
- A tracer dye test could be completed to assess the connectivity of the sinkholes observed on the north and south sides of the highway.

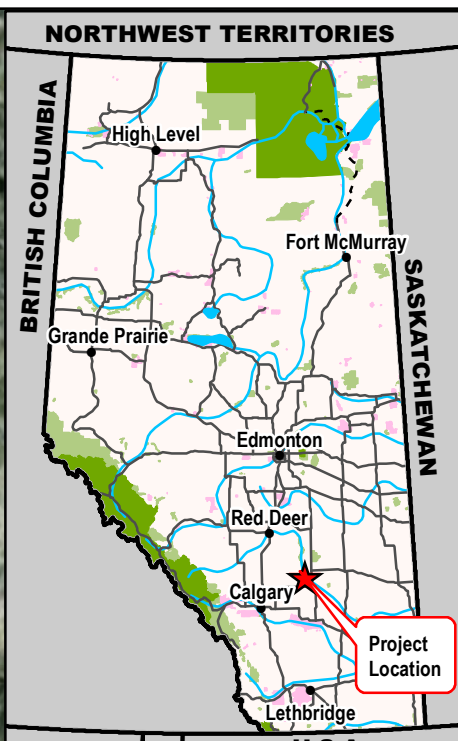
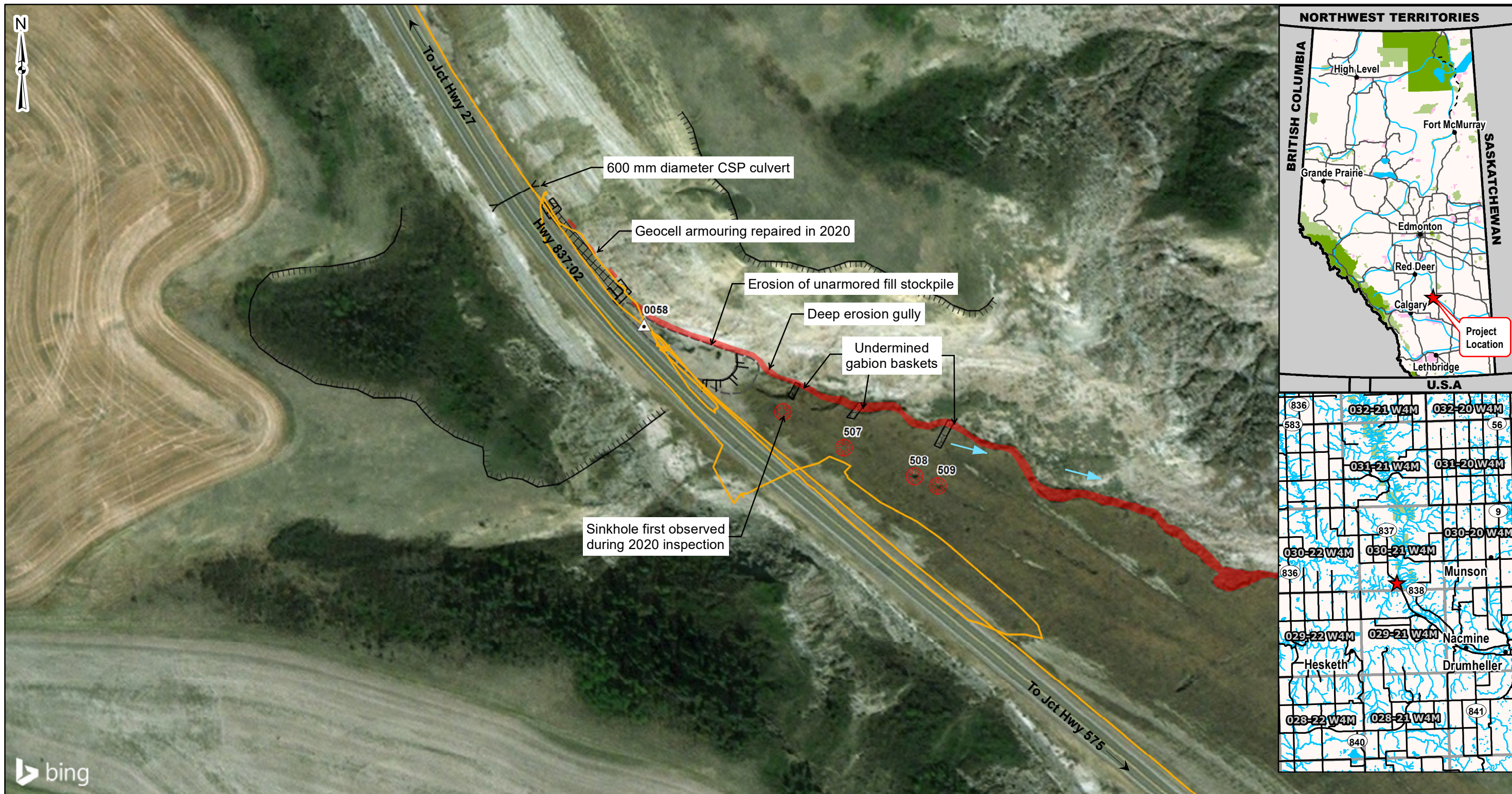
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Chris Gräpel, M.Eng., P.Eng.
Civil Engineer, Associate



Legend

	GPS Waypoint (June 24, 2021)		Flow Direction
	GPS Track (June 24, 2021)		Sinkhole
	Culvert		Erosion
	Top of Slope		Fill
	Scarp		Gabion Baskets
			Geo Cell



NOTES: 1. HORIZONTAL DATUM: NAD83 2. GRID ZONE: UTM Zone 12N 3. IMAGE SOURCE: Bing Maps, Microsoft Corporation 2020 4. Location of new sinkhole observed in 2020 is approximate and was determined based on photos.	CLIENT 	PROJECT CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM
		TITLE Site Plan C011 - Ditch Erosion Hwy 837:02, km 5.637
SCALE 1:1,500	PROJECT No. A05116A02	FIG No. 1

Time: 10:58:50 AM
 Date: November 09, 2021
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Inspection Photographs

- Photo 1** The gabion basket drop structure that was previous being undermined (near the unarmoured fill stockpile) was repaired in fall 2020. Photo taken June 24, 2021 facing northwest.



- Photo 2** Gully erosion downstream of the gabion baskets is in similar condition since the 2019 inspection. Photo taken June 24, 2021 facing southeast.



Photo 3 Geocell armouring in the westbound ditch was replaced in fall 2020 and vegetation has begun to grow on the ditch side slopes. Photo taken June 24, 2021 facing northwest.



Photo 4 The CSP culvert underlying Hwy 837 (oriented east to west) is corroding, and appears to be in worse condition since the 2020 inspection. Photo taken June 24, 2021 facing northwest.



Photo 5 Asphalt cracking and rill erosion in the northbound shoulder and embankment slope, respectively. Photo June 13, 2021 looking southeast.



Photo 6 Slope failure triggered by gully erosion at the toe of the slope north of Hwy 837 doesn't appear to have changed since the 2020 inspection. Photo taken June 24, 2021 facing southeast.



Photo 7 A previously observed sinkhole on the west side of Hwy 837 appears to have increased in size since the 2020 inspection. Photo taken June 24, 2021 facing north.



Photo 8 Sinkhole observed approximately mid-slope on the east highway embankment slope. The sinkhole was approximately 3 m wide and 3.5 m long (depth not measured). Photo taken June 24, 2021 facing north.

