

<b>SITE NUMBER AND NAME:</b> GP045 Smoky River East Valley Slope Slide and Sinkhole		<b>HIGHWAY &amp; KM:</b> 43:04, 35.005	<b>PREVIOUS INSPECTION DATE:</b> May 30, 2020	<b>INSPECTION DATE:</b> July 19, 2021
<b>LEGAL DESCRIPTION:</b> SW 16-72-02 W6M	<b>NAD 83 COORDINATES:</b> UTM Northing Easting 11 6121684 420116		<b>RISK ASSESSMENT:</b> Slide: PF: 10 CF: 3 TOTAL: 30 Sinkhole: PF: 11 CF: 6 TOTAL: 66	
<b>AVERAGE ANNUAL DAILY TRAFFIC (AADT):</b> 5930 (west) & 6470 (east) (Reference No. 30720 & 70000114)			<b>CONTRACT MAINTENANCE AREA (CMA):</b> 504	

<b>SUMMARY OF SITE INSTRUMENTATION:</b>  There is no instrumentation at the GP045 site. Two reference stakes were placed 2 m upslope of the erosion scarp so that erosion progress could be checked in 2022.  LAST READING DATE: N/A	<b>INSPECTED BY:</b> Chris Gräpel James Lyons Roger Skirrow (AT) Rocky Wang (AT) Ed Szmata (AT) Max Shannon (AT) Dwayne Lowen (AT MCI)
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**PRIMARY SITE ISSUE:** Hwy 43 was twinned through the site by AT in 1999/2000 under Contract No. 6335/01 with the construction of a new SBL/EBL, while the original highway became the new NBL/WBL.

A landslide and a sinkhole have developed in the median backslope above the SBL/EBL of Hwy 43:04 at km 35. The site is situated along the east valley slope of the Smoky River valley and is about 1.3 km southeast of the Smoky River bridge. The landslide and sinkhole were first noticed by the local MCI and the highway maintenance contractor in 2015 and activated in the fall of 2016. An erosion channel extends from sinkhole into the SBL median ditch.

The sinkhole appears to be related to the decommissioned CSP culvert which has been replaced with a steel pipe culvert. AT reports that the connection between the steel pipe culvert and the original CSP pipe is not properly connected which could be allowing material above the connection to fall into the culvert and block it. Water appears to flow up through the sinkhole and into the SBL median ditch. The alignment of the culvert may have bends in it which could also promote partial blockage with woody debris.

**APPROXIMATE DIMENSIONS:** The landslide is about 150 m wide and extends up the median backslope to a height of about 15 m above the SBL east side ditch. The height of the drop along the backscarp varies from 1 m to 2.3 m and open with apertures measuring up to 0.5m with several small grabens developing near the crest of the backscarp.

The sinkhole is between 10 to 15 m in diameter and is about 3 to 4 m deep. Erosion extending from the sinkhole and into the median ditch on the north side of the SBL is approximately 260 m in length with several scour holes.

The erosion in the west side slope of the SBL above the 900 mm diameter SWSP extends 40 m across the toe of the slope above the outlet. The culvert outlet is elevated approximately 2 to 3 m above the base of the erosion.

**DATE OF ANY REMEDIAL ACTION:** Downstream segment of CSP culvert decommissioned, grouted, and replaced with a steel pipe culvert. The sinkhole appears to be at the connection between the CSP culvert and the steel pipe culvert. The method of steel pipe construction is unknown, but appears to have been done with trenchless methods.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress		X			
Slope Movement	X		Installed two wooden stakes (1 and 2) 2 m upslope of the erosion/slope movement occurring at the culvert outlets		

			(900 and 1200 mm diameter) to monitor future movement/erosion.		
Erosion	X				
Seepage	X		Sinkhole above culvert. 900 mm diameter culvert. Height of backscarp is approx 1.2 m. Very small flow through 900 mm diameter (smooth walled). 1200 mm CSP culvert (grouted) is just east of 900 mm diameter.	X	
Culvert Distress	X				

**COMMENTS**

Sinkhole

- WP077 and 078 mark the east and west limits of the sinkhole on north side of EBLs
- AT says the sinkhole is bigger now, about twice the size it was a year or two ago
- 0.9-m-diameter steel pipe culvert and, decommissioned/grouted 1.2-m-diameter CSP are present at the downstream toe of the embankment. The history of the construction and repair of the CSP culvert (i.e., decommissioning of the downstream segment and installation of the steel pipe culvert) is not clear. Outlet of culverts at WPs 081 and WP084.
- Water trickling out of 900-mm-diameter culvert in a surging manner. AT says “surging” trickle flow has been observed before.
- Camera survey of culvert, estimated to have been taken 2 years ago. Sinkhole formed between 2016 and 2018 when downstream segment of CSP culvert was grouted and decommissioned. The camera survey indicates that there is a “lip” where the pipe pieces don’t meet. AT has a camera survey video.
- Erosion at outlet sloped at 80%, pipe is up in the air by about 2 to 3 m, plunge pool erosion at outlet has exposed, natural soil that includes gravel, cobbles, and boulders (there is a gravel pit nearby)
- Location where sinkhole appears to be where the two pipes (original 1.2-m-diameter CSP and 0.9-m-diameter steel pipe culvert) joined, could have been a push pit for the drilled-in-place 900 mm culvert
- Went to inlet of 1200 mm CSP culvert (WP080). Inlet has no trash rack and woody debris was found on top of the crown of the culvert. Water flow is rising above the inlet to the culvert and could indicate that the culvert is blocked with woody debris (this could explain the “surging” behaviour observed at the outlet of the 0.9-m-diameter steel pipe culvert)
- Erosion from sinkhole to ditch indicates that water flow during large runoff events rising to surface and flowing into ditch.
- NBL lanes have reverse superelevation due to settlement of embankment near inlet of culvert. Embankment was built quickly and compaction may not have been to contract requirements. Highest part of embankment for NBL has settled.
- KCB requested to prepare a proposal for camera survey of the inlet and outlet of the culvert to assess for damage or a bad joint and also to assess for blockage of the culvert. Proposal should include design of culvert repairs at the sinkhole.

Landslide about 200 m west of sinkhole, WP079

- The slide is in a natural slope between the SBL and the NBL that is approximately 20 m high and slopes at about 5H:1V
- Well-developed toe roll in SBL median ditch.
- AT says that slide has not changed much since last inspection
- Review of drone video and based on the shape of the headscarp indicates that slide appears to have been initiated and then expanded with additional sliding on the flank (the direction of expansion is unknown).

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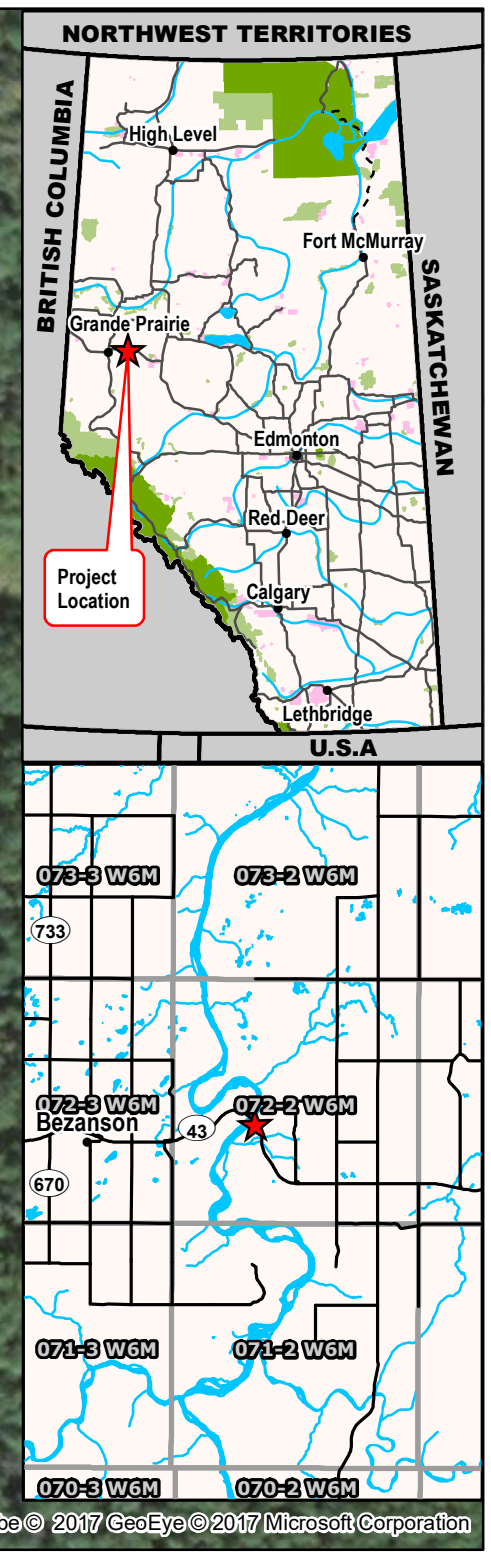
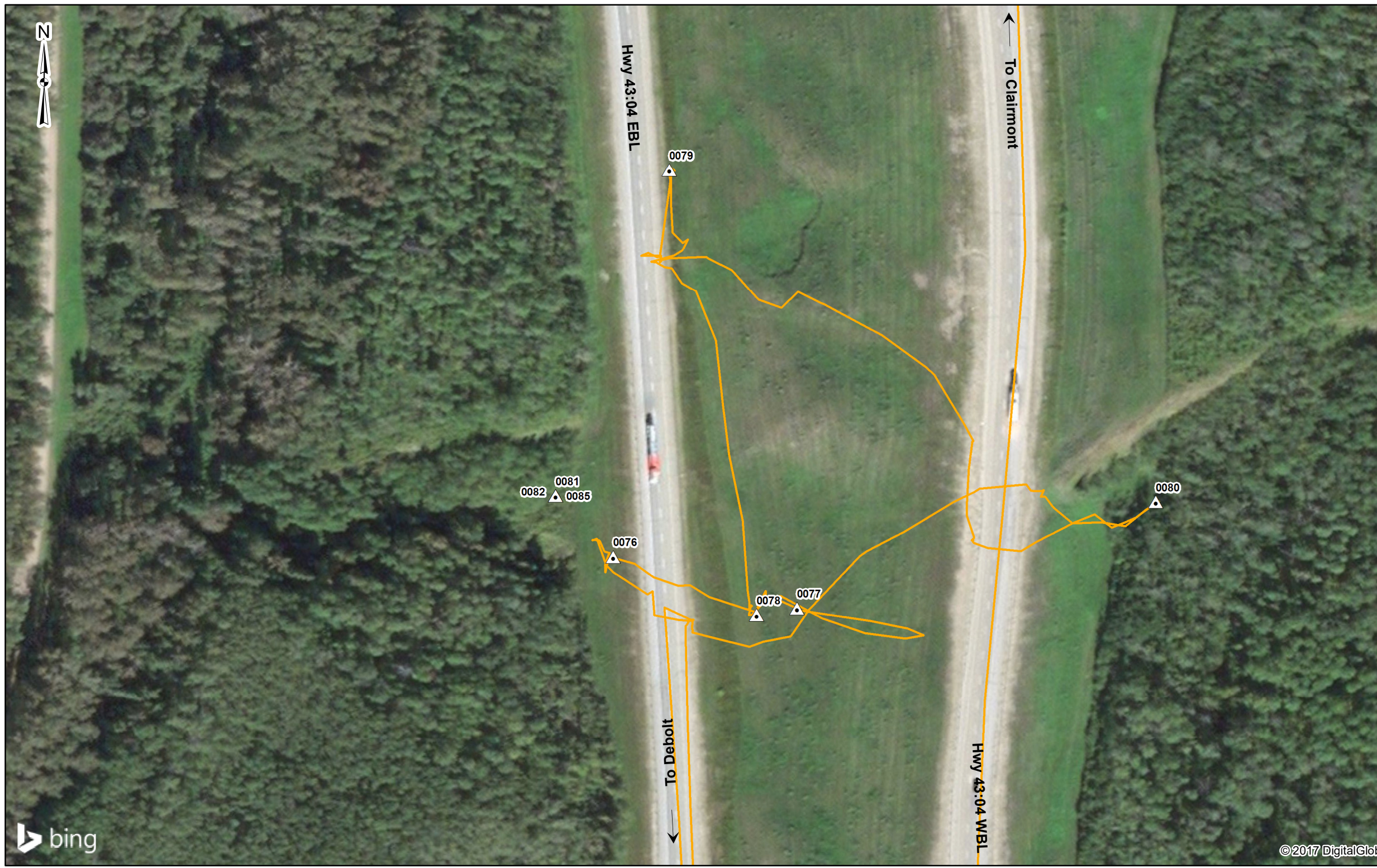
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Chris Gräpel, M.Eng., P.Eng.  
Senior Civil Engineer, Associate



Time: 16:28:52 PM  
 Date: October 05, 2021  
 File: Z:\AEDM\A05116A01\ABT Grande Prairie South GRM\PI400 Drawings\GIS\MXD\2021\Section B\GP045\_210929.mxd



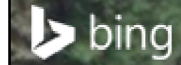
- Legend**
- GPS Waypoints (July 19, 2021)
  - GPS Track (July 19, 2021)



**NOTES:**  
 1. HORIZONTAL DATUM: NAD83  
 2. GRID ZONE: UTM Zone 11N  
 3. IMAGE SOURCE: Microsoft BING Maps

CLIENT

PROJECT	GRANDE PRAIRIE SOUTH REGION GEOHAZARD RISK MANAGEMENT PROGRAM	
TITLE	Site Plan GP045 Smoky River East Valley Hwy 43:04, km 35.005	
SCALE	PROJECT No.	FIG No.
1:1,500	A05116A01	1



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**Photo 1** Overview of the GP045 site, highlighting the slide, sinkhole, culvert outlet location, and recent asphalt patching. Photo taken July 19, 2021 facing east.





**Photo 2 Sinkhole located on the north side of the EBL lanes of Hwy 43. Photo taken July 19, 2021 facing south.**





**Photo 4** Toe bulge in the north (eastbound) ditch of Hwy 43. Photo taken July 19, 2021 facing east.





**Photo 6** Inlet of 1200 mm diameter CSP culvert. Photo taken July 19, 2021 facing southeast.

