SOUTHERN REGION GRMP
SITE INSPECTION FORM

SITE NUMBER AND NAME: **S040 Dorothy Sinkholes**	HIGHWAY & KM: 848:02, 11.507	PREVIOUS INSPECTION DATE: May 31, 2022	INSPECTION DATE: **June 18, 2024**
LEGAL DESCRIPTION: 06-04-27-17 W4M	NAD 83 COORDINATES: UTM 12 Northing 5681315 Easting 406434	RISK ASSESSMENT: PF: 8 CF: 4 TOTAL: 32	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 200 (east) & 160 (south) (Reference No. 114210 & 116220)		CONTRACT MAINTENANCE AREA (CMA): 521	

SUMMARY OF SITE INSTRUMENTATION:	INSPECTED BY:
There is no instrumentation at the S040 site. LAST READING DATE: N/A	Chris Gräpel (KCB) James Lyons (KCB) Tony Penney (TEC) Rocky Wang (TEC)

PRIMARY SITE ISSUE: Voids/sinkholes forming in dispersive soils and/or bedrock beneath and near the highway surface.

APPROXIMATE DIMENSIONS: An approximate 500 m long section of the highway is being impacted at a hairpin curve along the highway alignment.

DATE OF ANY REMEDIAL ACTION: Ongoing – sinkholes close to the highway are backfilled with gravel containing fines. No recent repairs have been completed at the site.

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Road Surface Distress		X	No sinkholes observed on highway surface during 2024 inspection.		X
Slope Movement		X	N/A – none observed during 2024 inspection.		X
Erosion	X		Ongoing erosion of dispersive soils creating voids, sinkholes, and gullies	X	
Seepage	X		Groundwater seepage		X
Culvert Distress	X		A joint at the culvert outlet is separated	X	

COMMENTS

Previous assessments have identified natural groundwater seepage and surface water flow as triggers for void/sinkhole formation. Voids previously observed near the highway are in areas of concentrated drainage (e.g., ditches, and rills and gullies on natural slopes). It is suspected that the ditch does not have the capacity for regularly rainfall events and there have been flows across the highway surface during rainfall events (heavy or prolonged rainfall).

During the 2017 inspection, a sinkhole approximately 1 m in diameter and 0.5 m to 1.5 deep opened near the middle of the highway after KCB and Alberta Transportation and Economic Corridors (TEC) drove over the site (north of Waypoint 512). The area has been repaired by TEC but there may be other soil voids forming beneath the highway surface at the site. A second sinkhole was observed 2 m away from the culvert inlet that is partially undermining the south shoulder of the highway (Waypoint 512).

During the 2018 inspection, a 0.15 m diameter sinkhole approximately 0.10 m deep was observed near the north shoulder of the highway (Waypoint 693). TEC marked the location with a survey stake and flagging to warn motorists. A long, shallow sinkhole was discovered along the south shoulder approximately 100 m east of Waypoint 693.

During the 2024 inspection, an Unmanned Aerial Vehicle (UAV) flight of the site was completed to take aerial imagery to support the inspection (Photo 1 and 2).

The large sinkhole approximately 30 m from the north edge of the highway on the inside of the hairpin curve (Waypoint 164) appears to be increasing in size between the 2022 and 2024 inspection (Photo 1 and 2). A second sinkhole located further downslope appears larger than during the 2022 inspection.

During the 2024 inspection the back slope was inspected but no sinkholes were observed. No sinkholes were observed along or near the highway surface.

A sinkhole was observed at a suspected buried/collapsed CSP culvert inlet, downhill (east) of the hairpin turn (Photo 3 and 4). The sinkhole appears deep and is obscured by vegetation. The sinkhole is located downstream of a draw north of the highway (i.e., where surface water runoff is concentrated). The CSP culvert outlet (on the north side of the highway) has a separated joint (Photo 5).

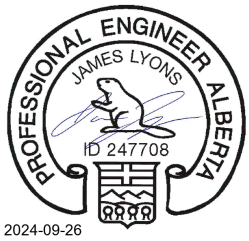
During the 2024 inspection, the highway surface appears to have been recently graded and it is in good condition (Photo 6).

Maintenance/Repair/Monitoring Recommendations:

- Install signage (e.g., speed reduction and hazard markers) to warn motorists of hazards at the site (e.g., potential washouts and collapse features); improve drainage (e.g., increase ditch drainage capacity) to reduce infiltration into underlying dispersive soils and erosion of steep natural slopes; backfill sinkholes and voids as needed; conduct a geotechnical site investigation that includes:
  - a detailed topographic survey of the area (e.g., a LiDAR survey or an unmanned aerial vehicle [UAV] photogrammetry survey), so previous, current and future locations of sinkholes and voids can be plotted relative to the survey data to assess if they correspond to areas with concentrated drainage.
- A risk assessment guideline for dispersive soil sites should be developed.
- The site should be regularly inspected by TEC's MCI, particularly after precipitation events (heavy or prolonged rainfall).
- The site should be inspection every two years as part of the Southern Region GRMP Section B Inspections.

(iv) KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.

(v) This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.



James Lyons, P.Eng.
Civil Engineer

PERMIT TO PRACTICE
KLOHN CRIPPEN BERGER LTD.

RM SIGNATURE: _____

RM APEGA ID #: 187607

DATE: 26 Sep. 2024

PERMIT NUMBER: P009196
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Legend

- GPS Waypoint (May 31, 2022)
- Sinkholes (AMEC 2016)
- Sinkholes (KCB, 2016, 2017, 2018)
- Flow Direction
- Guardrail
- Fence
- Culvert
- Flow Direction
- Fence

0 100 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: MICROSOFT CORPORATION 2022 MAXAR CNES, DISTRIBUTION AIRBUS DS
4. APPOXIMATE LOCATIONS OF PREVIOUSLY IDENTIFIED SINKHOLES DERIVED FROM AMEC 2016, FIGURE 1

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: SOUTHERN REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
S040 - Dorothy Sinkholes
Hwy 848:02, km 11.507

SCALE	PROJECT No.	FIG No.
1:1,250	A05116A03	1

File: \\int.klohn.com\Proj\Data\AIEDM\A05116A02 ABT Central Region GRMP\400 Drawings\GIS\02_ProFiles\2024\Section B\AT_CentralRegion_SectionB_240627\AT_CentralRegion_SectionB_240627.aprx Date: Time: Creator: : EQuine

Inspection Photographs

Photo 1 **An aerial photo of the S040 Dorothy Sinkholes site. The erosion on the ditch slope, approximate location of the culvert inlet, and two sinkholes are indicated by a red arrow, square, and circles, respectively. Photo taken June 28, 2024, facing southeast.**

Photo 2 **Aerial photo of the highway at the S040 Dorothy Sinkholes site. The erosion on the ditch slope and two sinkholes are indicated by a red arrow and circles, respectively. Photo taken June 18, 2024, facing southwest.**

Photo 3 **Sinkhole observed on the north side of the highway near the corrugated-steel-pipe (CSP) culvert (outlet shown in Photo 5). Photo taken June 18, 2024.**

Photo 4 **Location of sinkhole (shown in Photo 3) obscured by vegetation. The sinkhole could be above the inlet of an old collapse CSP culvert. Photo taken June 18, 2024, facing south.**

Photo 5 **The CSP culvert has a separated joint (indicated by red arrow) near the culvert outlet on the north side of the highway. Photo taken June 18, 2024, facing north.**

Photo 6 **The highway surface was in good condition during the inspection. Photo taken June 18, 2024, facing east.**