

SITE INSPECTION FORM

SITE NUMBER AND NAME: GP053 Rock Slope North of McIntyre Mine		HIGHWAY & KM: 40:36, 16.295 to 17.161	PREVIOUS INSPECTION DATE: June 12, 2023	INSPECTION DATE: June 10, 2024
LEGAL DESCRIPTION: West SE 15-58-08-W6M East NW-14-58-08-W6M	NAD 83 COORDINATES: UTM Northing Easting 11 5986971 362772 11 5987248 363835		RISK ASSESSMENT: PF: 12 CF: 5 TOTAL: 60	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 820 (east) & 820 (west) (Reference No. 70000788, 2023)			CONTRACT MAINTENANCE AREA (CMA): 504	

SUMMARY OF SITE INSTRUMENTATION: There is no instrumentation at the GP053 site, but instruments are installed at the GP008 slide site within the limits of the rockfall corridor. LAST READING DATE: N/A	INSPECTED BY: Chris Gräpel (KCB) Courtney Mulhall (KCB) Robert Senior (TEC) Rishi Adhikari (TEC) Babatunde Awokunle (TEC)
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PRIMARY SITE ISSUE: Series of rockfall hazards from rock slope along/above west side of Hwy 40:36. Talus deposits and rockfall particles from rock slope constrict north highway ditch and falling rocks are a traffic hazard. This site is located along the west valley slope of the Smoky River and is the rockfall component of the former GP008A site that has been made into a separate site with three subsites in 2022 for rockfalls only. GP008 site is now for road surface slumping and slides only.

APPROXIMATE DIMENSIONS: Corridor is approximately 1.0 km long.

GP053-I: Rock slope is approximately 200 m long and 39 m high above pavement surface with an approximate cut angle of 50° from horizontal with a mid-slope ledge/bench.

GP053-II: Rock slope is approximately 500 m long and 5 m to 20 m high above pavement surface with an approximate cut angle of 35° to 50° from horizontal.

GP053-III: Rock slope is approximately 100 m long and 4 m to 10 m high above pavement surfaces with an approximate cut angle of 22° from horizontal.

Ditch geometry varies from v-notched up to 4 m wide, up to 1.5 m deep with 2H:1V to 3H:1V side slopes.

DATE OF ANY REMEDIAL ACTION: Ongoing ditch cleaning and removal of rockfall particles from pavement surface. As well as patching and paving (more so due to GP008 slides along same section of highway).

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Majority of pavement distress along corridor due to GP008 slide movements. No change in pavement distress from rockfall hazards observed.		X
Slope Movement	X		Previously fallen rockfall particles (up to 1.0 m x 1.0 m x 1.0 m) and talus materials between toe of slope and pavement edge on west side of highway, including a few larger particles (approximately 0.3 m x 0.3 m x 0.3 m) near or within 1 m of pavement edge.		X
Erosion	X		Differential weathering, freeze thaw, ice jacking, and seepage eroding rock mass. Some erosion along crest of slope.		X

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Seepage		X	None observed at time of 2024 inspection.		X
Culvert Distress	X		Culvert inlets crushed and/or partially blocked by rockfall particles in north highway ditch (Photo 9 and 10).		X

COMMENTS

Review of air photos from the early 1980s indicates the GP053 rock slope and highway were constructed downslope/south of a pre-existing mine access road for the former McIntyre Mine (now CST Canada Coal Ltd.) which is still present. Mine development upslope/north of the rock slope could be influencing the performance of the slope.

In 1998, gradeline improvements were made along this section of highway which resulted in some of the original rock slopes being excavated further with drill-and-blast methods while other sections were not.

Brow of rock slope has minimal to no soil and some trees.

Rock mass consists of bedded and sheared sedimentary rocks, with coal seams which are weathering faster. Faster weathering of the coal results in the undermining of more competent rocks, which results in overhanging blocks and particles with little support that eventually fall, and the deposition of talus cones/slopes at the toe of the coal seams with occasional adjacent lateral rock block piles/cones (Photos 1 to 3, and 5 to 8). Cubical shaped rockfall particles appear to be rolling and bouncing down the talus cones bringing them closer to the highway (i.e., the talus cones act like chutes for rockfall particles) (Photo 6). Whereas flat platy shaped rockfall particles appear to get hung up in the talus.

GP053-I (Photos 1 to 4):

- Bedrock structure consists of bedding planes dipping from the south to southwest (dip estimated between 59° to 86°). The rock mass appears to have relatively tight bedding planes, but the rock mass is fractured perpendicular to the bedding planes which generates rockfall events. The bedrock structure changes in the east part of the slope to a gentle fold with dip of approximately 20° (Photos 3 and 4), dipping to the southeast towards the highway.
- Mid-slope bench that has talus cones/slopes, which could potentially bounce/launch/roll rockfall particles out onto the highway (Photo 1). A pile of rock blocks was also observed along this bench.

GP053-II (Photos 5 to 8):

- Bedrock structure consists of bedding planes dipping into the slope towards the north (dip estimated between 39° to 80°). The rock mass appears to be of similar quality to the GP053-I site, with one location showing more intact and massive bedrock that still shows drill-and-blast-hole “barrels”.

GP053-III:

- Bedrock structure is different at this site from the previous sites with bedding planes dipping from the east to southwest (dip estimated between 55° to 60°). The bedding planes vary from a few centimeters thick to over 1 m thick. More fractured or possibly blast damaged zones appear to have been removed, likely during construction, leaving an uneven slope surface.

Several hanging rock blocks observed at the subsites with some close to falling.

TEC says that some rock particles make it to the highway, and some are large enough to require a front-end loader to remove.

Maintenance/Repair/Monitoring Recommendations:

- Short-term:
 - “Watch for fallen rock” signs already installed on either side of the site, on the east shoulder before the site for northbound traffic and on the west shoulder before the site for southbound traffic. Additional signage (e.g., “watch for fallen rock, no parking) should be installed along the site to further warn motorists of rockfall hazards.
 - Clean highway ditch regularly to maintain rockfall storage volume (i.e., keep the ditch as wide and deep as possible to retain material within the ditch) and reduce the potential for material reaching

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the highway. TEC reported that there are no utilities below the ditch at this site, but AbaData indicates there may be a pipeline (depth unknown) that crosses the highway from south to north near the GP053-I site. Estimated cost: approximately \$20,000 to \$70,000.

- Repair and/or clean-out culvert inlets which are damaged and partially covered by rockfall particles to maintain ditch flow.
- Long-term:
 - KCB submitted a final preliminary engineering report (PER) in August 2024, which included design of rockfall hazard mitigation actions, for four sites along Hwy 40:36 between km 8.395 to km 17.161, including this site. In the PER the following options were presented:
 - A maintenance program that includes rock scaling of loose blocks and cleaning highway ditch of accumulated debris every two years. Estimated cost: approximately \$257,000.
 - To provide a 95% rockfall catchment for GP053-01, installing drapery mesh along 140 m of highway and shotcrete protection over fractured coal seams. Estimated cost: approximately \$3.1 Million.
 - To provide a 95% rockfall catchment for GP053-02: installing drapery mesh along 140 m of highway and shotcrete protection over fractured coal seams. Estimated cost: approximately \$3.6 Million.
 - To provide a 90% rockfall catchment for GP053-01 and GP053-02: there are no requirements for structural mitigation actions. However, KCB recommended installing shotcrete protection over fractured coal seams. Estimated cost: approximately \$3.6 Million.

The environmental considerations for the proposed mitigation work were also included in the PER.

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Alberta Transportation and Economic Corridors (Client) for the specific application to the Peace Region (Grande Prairie District – South) Geohazard Risk Management Program (Contract No. CON0022166), and it may not be relied upon by any other party without KCB's written consent.

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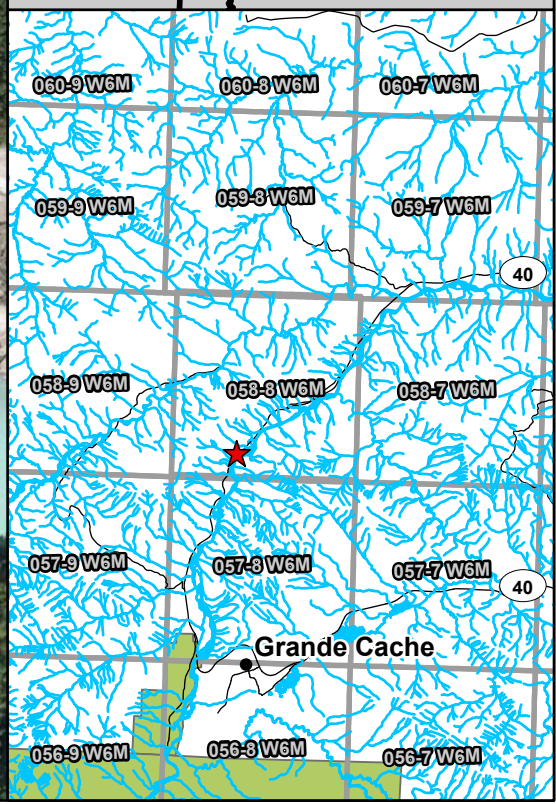
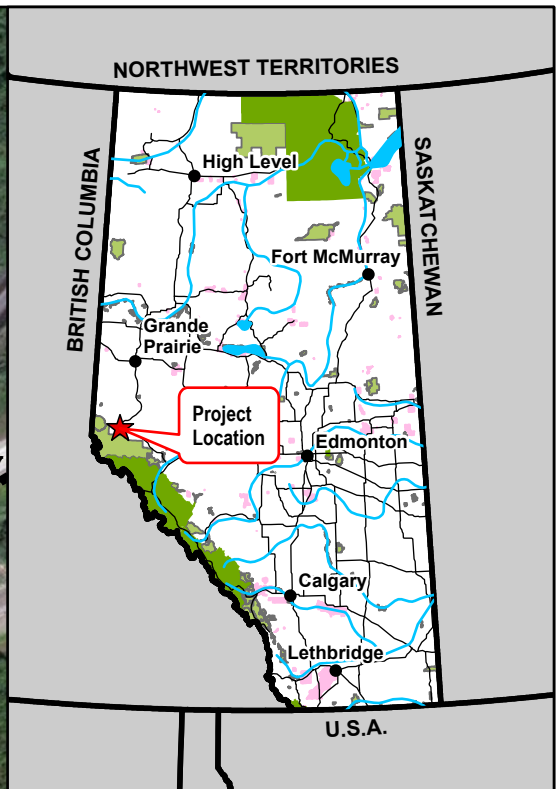
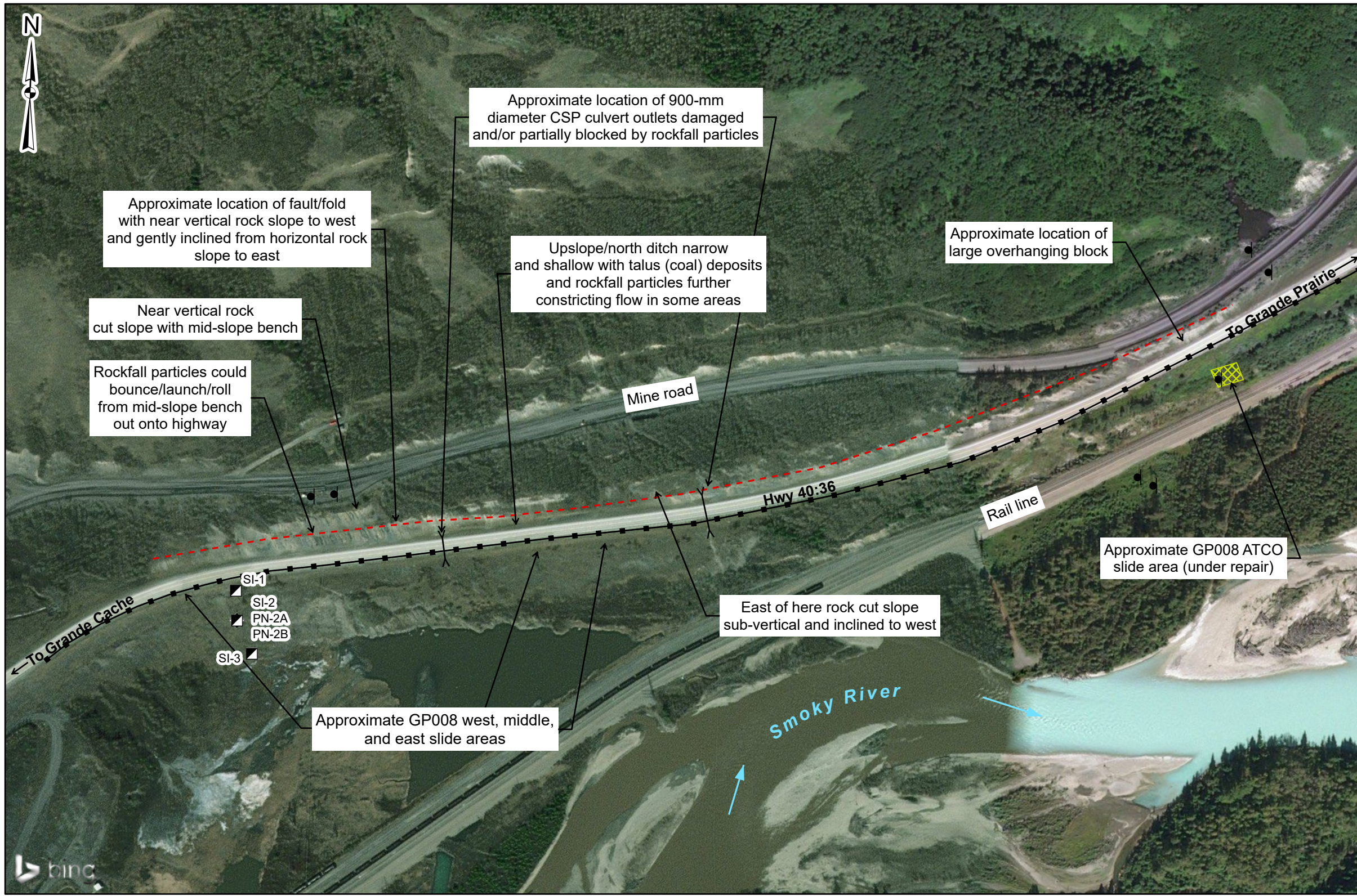
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PEACE REGION
(GRANDE PRAIRIE DISTRICT – SOUTH) GRMP
SITE INSPECTION FORM



<p>Courtney Mulhall, M.Sc., P.Eng. Geotechnical Engineer</p>	
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- Legend**
- Powerpole
 - ◆ Approximate Pneumatic Piezometer Location
 - ▣ Approximate Slope Inclinometer Location
 - Flow Direction
 - > Culvert
 - - - Rockfall Corridor
 - Guardrail
 - ▨ ATCO Excavation

NOTES:
 1. HORIZONTAL DATUM: NAD83
 2. GRID ZONE: UTM ZONE 11N
 3. IMAGE SOURCE: 2022 MICROSOFT CORPORATION, 2022 MAXAR CNES, DISTRIBUTION AIRBUS DS
 4. INSTRUMENTS BEING MONITORED AS PART OF GP008A SITE.
 5. INSTRUMENTS INOPERABLE PRIOR TO 2021 NOT SHOWN.

CLIENT

PROJECT
 PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH)
 GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE
 Site Plan
 GP053 - Rock Slope North of McIntyre Mine
 Hwy 40:36, km 16.295 to 17.161

SCALE 1:4,000 PROJECT No. A05116A01 FIG No. 1



File: Z:\A\EDM\A05116A01\ABT Grande Prairie South GRMP\400 Drawings\GIS\MXD\2024\Section BAT_GP_South_SectionB_241016.aprx Date: Time: Creator: AHarrison

Inspection Photographs

- Photo 1** Rock slope along north side of Hwy 40:36 at GP053-I site. Note bench which could launch rockfall particles from upper slope. Photo taken June 10, 2024, facing northeast near west end of site.



- Photo 2** Rock slope along north side of Hwy 40:36 at GP053-I site. Note talus material mainly from coal seams in ditch. Photo taken June 10, 2024, facing west.



Photo 3 Rock slope along north side of Hwy 40:36 at GP053-I site. Note change in orientation of bedrock structure at fold (circled in white, see next photo), and erosion and hanging rock blocks at crest of slope (some circled in black). Photo taken June 10, 2024, facing northwest.



Photo 4 Fault/fold in bedrock shown in previous photo. Photo taken June 10, 2024, facing north.



Photo 5 Rock slope along north side of Hwy 40:36 at GP053-II site. Note talus material mainly from coal seams and rockfall particles in highway ditch, and overhanging rock blocks (circled in white, see photo below). Photos taken June 10, 2024, facing northwest and north, respectively, near middle of site.



Photo 6 Rockfall particles in ditch on north side of Hwy 40:36 at GP053-II site. Photo taken June 10, 2024, facing northeast.



Photo 7 Rock slope along north side of Hwy 40:36 at GP053-II site. Note large overhanging rock block (circled in white, see next photo). Photos taken June 10, 2024, facing northwest and northeast, respectively, near east end of site.



Photo 8 Large overhanging rock block (circled in white) shown in previous photo. Photo taken June 10, 2024, facing northwest.



Photo 9 Culvert inlet in ditch on north side of Hwy 40:36 at GP053-I site. Culvert inlet damaged and partially blocked by rockfall particles. Photo taken June 10, 2024, facing northeast.



Photo 10 Culvert inlet in ditch on north side of Hwy 40:36 at GP053-I site. Culvert inlet damaged and partially blocked by rockfall particles. Photo taken June 10, 2024, facing south.

