



**PEACE REGION  
(GRANDE PRAIRIE DISTRICT – SOUTH) GRMP**



**SITE INSPECTION FORM**

|  |   |   |   |   |
|--|---|---|---|---|
| <b>SITE NUMBER AND NAME:</b><br>GP036 Rockfall 2.0 km South of McIntyre Mine                         |   | <b>HIGHWAY &amp; KM:</b><br>40:36, 12.061 | <b>PREVIOUS INSPECTION DATE:</b><br>June 12, 2023 | <b>INSPECTION DATE:</b><br><b>June 10, 2024</b> |
| <b>LEGAL DESCRIPTION:</b><br>NW 04-58-08-W6M   | <b>NAD 83 COORDINATES:</b><br>UTM Northing Easting<br>11 5984469 359856 |   | <b>RISK ASSESSMENT:</b><br>PF: 16 CF: 5 TOTAL: 80 |   |
| <b>AVERAGE ANNUAL DAILY TRAFFIC (AADT):</b><br>760 (north) & 960 (south) (Reference No. 25592, 2023) |   |   | <b>CONTRACT MAINTENANCE AREA (CMA):</b><br>504    |   |

|   |   |
|---|---|
| <b>SUMMARY OF SITE INSTRUMENTATION:</b><br><br>There is no instrumentation at the GP036 site.<br><br>LAST READING DATE: N/A | <b>INSPECTED BY:</b><br>Chris Gräpel (KCB)<br>Courtney Mulhall (KCB)<br>Robert Senior (TEC)<br>Rishi Adhikari (TEC)<br>Babatunde Awokunle (TEC) |
|---|---|

**PRIMARY SITE ISSUE:** Rockfall hazards from rock slope along/above west side of Hwy 40:36. Talus deposits and rockfall particles from rock slope constrict west highway ditch and falling rocks are a traffic hazard. The site is located along the west valley slope of the Smoky River. In 2022, previous debris flow component of this site was separated into its own GRMP site (GP054).

**APPROXIMATE DIMENSIONS:** Rock slope is approximately 376 m long and 15 m to 50 m high above pavement surface with an approximate cut angle ranging from 50° to 70°. Ditch ranges from 4 m to 11 m wide and 0.1 m to 1.0 m deep.

**DATE OF ANY REMEDIAL ACTION:** Around 2010 – Lock blocks placed adjacent to guardrail on west side of Hwy 40:36. Ongoing highway ditch cleaning and removal of rockfall particles from pavement surface.

| ITEM              | CONDITION EXISTS |    | DESCRIPTION AND LOCATION   | NOTICABLE CHANGE FROM LAST INSPECTION |    |
|-------------------|------------------|----|--|---------------------------------------|----|
|                   | YES              | NO |  | YES                                   | NO |
| Pavement Distress |                  | X  | None observed at time of 2024 inspection (Photo 11).   |                                       | X  |
| Slope Movement    | X                |    | Previously fallen rockfall particles and talus materials between toe of slope and lock blocks on west side of highway (Photo 5). Some rockfall particles on east side of highway, but they may have been cleaned off highway (Photo 12). Since previous inspection, two large rockfall particles near middle of site (up to 1.5 m x 1.0 m x 0.8 m) (Photos 4 and 5) and one rockfall event near north end of site (Photos 8 and 9) which likely occurred in June 2023 after a heavy rainfall event. Relaxations of joints on rock slope appeared to be increasing. | X                                     |    |
| Erosion           | X                |    | Differential weathering, freeze thaw, ice jacking, and seepage eroding rock mass. Some erosion along crest of slope.   | X                                     |    |
| Seepage           | X                |    | Seepage sometimes observed flowing from rock slope.  |                                       | X  |
| Culvert Distress  | X                |    | Culvert inlet on west side of highway partially blocked with rock fall particles (Photo 10). Some rockfall particles removed by KCB during 2024 inspection by hand.  | X                                     |    |

| <b>COMMENTS</b>  |
|--|
| Site is partially downslope/east of the former McIntyre Mine (now CST Canada Coal Ltd.).   |
| 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 is treed with a relatively thin layer of soil (Photo 3).  |
| Bedrock structure consists of non-planar bedrock planes with some evidence of limited folding and faulting dipping generally to the south or southwest (dip estimated between 60° to 70°). The bedrock bedding planes have been distorted during mountain building and are not planar. The degree of non-planar distortion in bedding planes varies across the rock slope, dipping from 32° to 64° to near vertical at the top of the slope. The bedding layers in the bedrock vary in thickness from quite thin (tens of centimeters) to several meters thick. Some of the bedding layers in the bedrock mass are coal seams which appear to have been disrupted by faulting.   |
| 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 2 to 9). 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). Whereas flat platy shaped rockfall particles appear to get hung up in the talus.  |
| Several hanging rock blocks with some close to falling, including one potentially large rock block (Photos 3, 4, and 8). A bedrock discontinuity “plane” (distorted and non-planar) appears to underlie the large rock block (Photo 4). Along the north side of the large rock block is a layer of fractured rock and a coal seam which is weathering faster than the rest of the slope. The discontinuity between the undulating discontinuity and the large rock block appears to be dilated. Continued weathering of the coal seam could result in loss of confinement, resulting in overstressing the remainder of the attachments for the large rock block to the slope, causing a large rockfall event that would likely cover the section of highway below. |
| Mid-slope ledges and talus cones/slope could potentially bounce/launch/roll rockfall particles out onto highway (Photo 7).   |
| TEC says that some rock particles make it to the highway, and some are large enough to require a front-end loader to remove.   |
| Possible fault structure located between rock slopes that is infilled with soil (Photo 1).   |
| Decommissioned coal mine shaft entrance approximately midway up rock slope (Photo 7).  |
| Ponded water is sometimes observed in the highway ditch at the toe of the rock slope, which could be due to seepage and/or poor ditch drainage. During the 2024 inspection, the ditch channel was wet.   |
| A TransCanada Pipelines Ltd. high-pressure natural-gas pipeline is located below the west highway ditch.   |
| Segment of guardrail deflected and pushed towards south/westbound traffic from rockfall strike (Photo 11).   |
| “Watch for fallen rock” signs on either side of site, located on the east shoulder before the site for northbound traffic and on the west shoulder before the site for southbound traffic. Also, no parking sign on the east side of the highway at the northern site limit (end of guardrail) for northbound traffic.   |
| Swallows have been observed at the site. Construction would need to be outside nesting period.   |

Maintenance/Repair/Monitoring Recommendations:

- Short-term:
  - Clean highway ditch regularly to maintain rockfall storage volume (i.e., keep ditch as wide and deep as possible to retain material within the ditch) and reduce the potential for material reaching the highway. A buried gas line and fiber optics cable along the ditch limits the depth the ditch can be excavated or cleaned out. Estimated cost: approximately \$25,000 to \$40,000.
  - Some of the concrete lock blocks are deteriorating and have been damaged by rock strikes. They will eventually need to be replaced.
  - Inlet of culvert which is blocked with rockfall particles should also be cleaned 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. For the sites, like GP036, that have buried utilities along the ditch, KCB recommended installing protection measures above the utilities to facilitate regularly scheduled ditch cleaning. Estimated cost: approximately \$270,000.
    - To provide a 95% rockfall catchment, installing a 250 m long barrier with a minimum height of 1.3 m measured from highway shoulder and shotcrete protection over fractured coal seams. The rockfall barrier shall be installed using one (1) row of two (2) stacked engineer concrete blocks placed side by side. TEC could consider removing or leaving the current row of concrete blocks which have deteriorated. Estimated cost: approximately \$2.7 Million.
    - To provide a 90% rockfall catchment, replacing the current concrete blocks with one (1) row of engineered concrete blocks and extending the length towards south end of site and shotcrete over fractured coal seams. Estimated cost: approximately \$2.4 Million.

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

**SITE INSPECTION FORM**

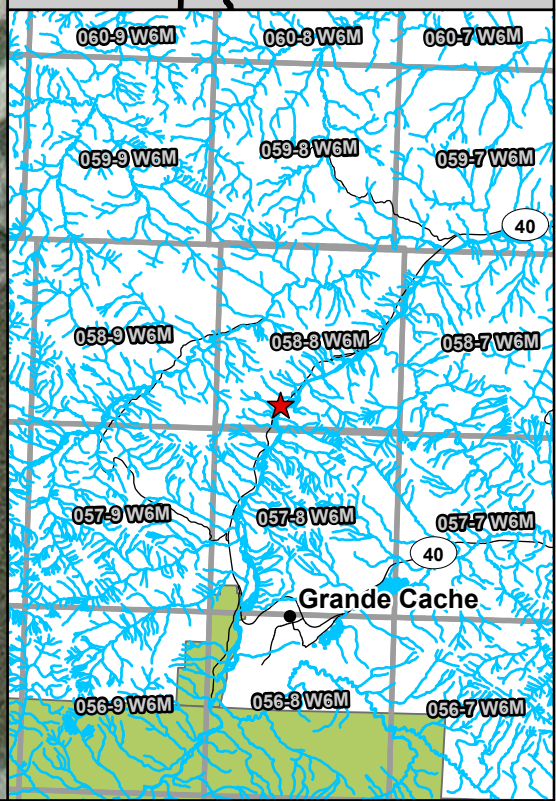
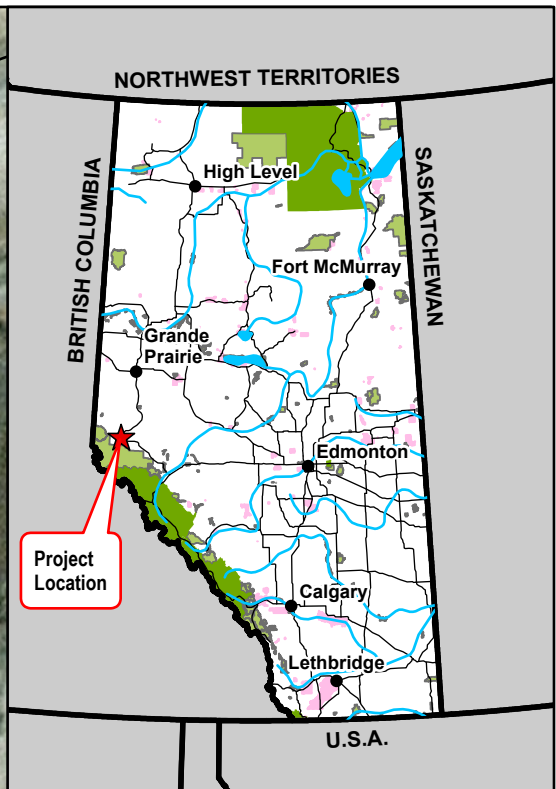
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

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- (ii) The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
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Courtney Mulhall, M.Sc., P.Eng.  
Geotechnical Engineer



**Legend**

-  Flow Direction
-  Concrete Lock Block
-  Guardrail
-  Culvert
-  Pipeline



NOTES:  
 1. HORIZONTAL DATUM: NAD83  
 2. GRID ZONE: UTM ZONE 11N  
 3. IMAGE SOURCE: 2022 MICROSOFT CORPORATION, 2022 MAXAR CNES, DISTRIBUTION AIRBUS DS

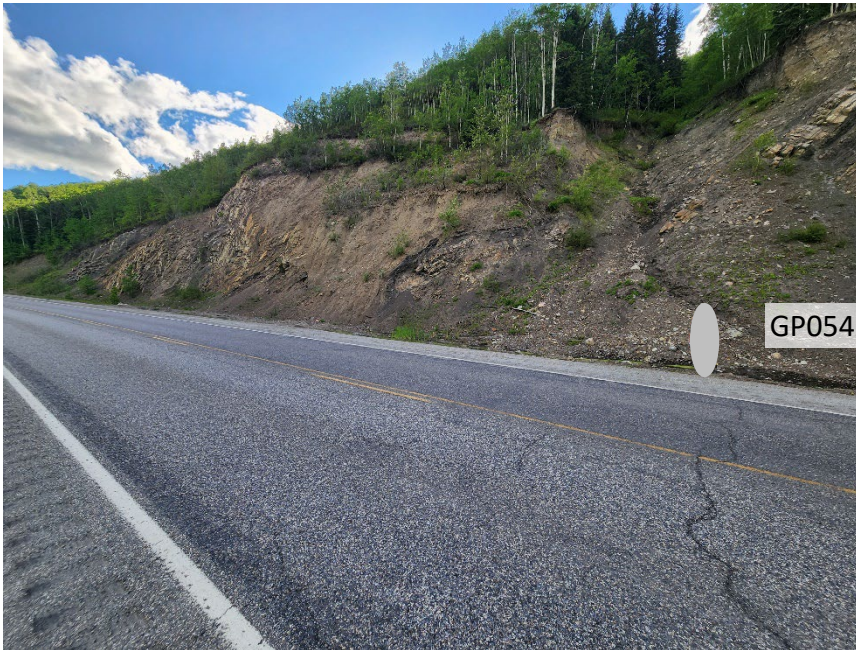
CLIENT




|         |   |         |
|---------|---|---------|
| PROJECT | PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH)<br>GEOHAZARD RISK MANAGEMENT PROGRAM   |         |
| TITLE   | Site Plan<br>GP036 - Rockfall 2.0 km South of McIntyre Mine<br>Hwy 40:36, km 12.061 |         |
| SCALE   | PROJECT No.   | FIG No. |
| 1:1,500 | A05116A01   | 1       |

## Inspection Photographs

**Photo 1** Rock slope along west side of Hwy 40:36. Note soil infilling of possible fault feature and GP054 km 12.1 debris flow site on right. Photo taken June 10, 2024, facing southwest



**Photo 2** Rock slope along west side of Hwy 40:36. Note GP054 km 12.1 debris flow site on left and talus material mainly from coal seams in ditch. Photo taken June 10, 2024, facing northeast.



**Photo 3** Rock slope along west side of Hwy 40:36. Note potential rock block on upper slope (circled in white, see photo below) and thin layer of soil at crest of slope. Photo taken June 10, 2024, facing northwest.



**Photo 4** Potential rock block on upper slope shown in previous photo. Note dilated or open joints below rock block (indicated with white arrow), joints or shear planes to left and below rock block (circled in white), and rock and coal to right of rock block which is eroding. Photo taken June 10, 2024, facing northwest.



**Photo 5** Rock slope along west side of Hwy 40:36. Note two large particles circled in white (see next photo) which fell between 2023 and 2024 inspections, and near-vertical bedding orientation of bedrock. Photo taken June 10, 2024, facing northwest.

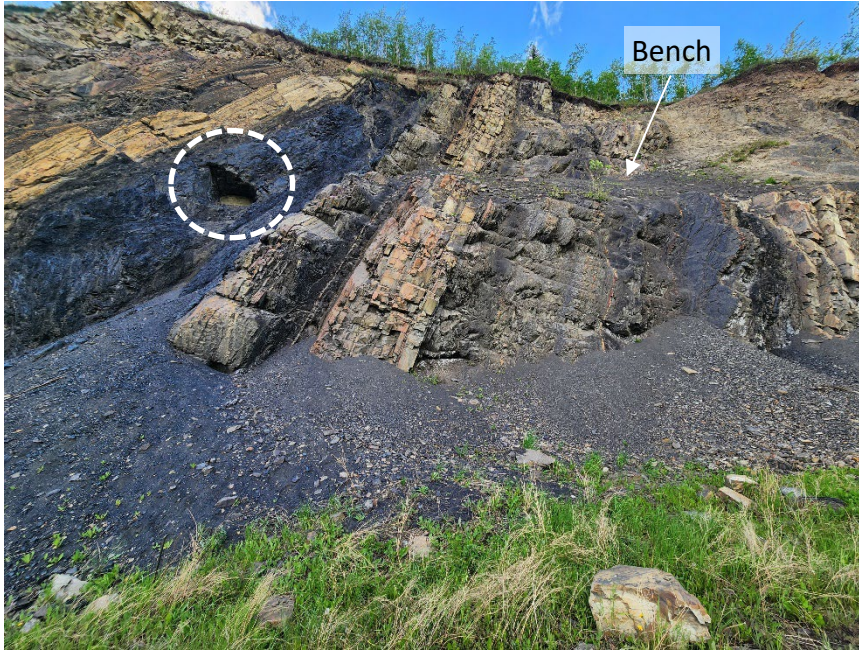


**Photo 6** Rockfall particles in ditch on west side of Hwy 40:36. Note two larger particles circled in white fell between 2023 and 2024 inspections. Photo taken June 10, 2024, facing northeast.





**Photo 7** Rock slope along west side of Hwy 40:36. Note talus material mainly from coal seams in ditch, bench which could launch rockfall particles from mid slope, and decommissioned coal mine shaft entrance (circled in white). Photo taken June 10, 2024, facing north.



**Photo 8** Rock slope along west side of Hwy 40:36 near north end of site. Note hanging rock block (circled in white) and rockfall that occurred between 2023 and 2024 inspections (circled in black, see next photo). Photo taken June 10, 2024, facing north.



**Photo 9**      **Rockfall at north end of site that occurred between 2023 and 2024 inspections near north end of site. Photo taken June 10, 2024, facing northwest.**



**Photo 10**      **Culvert inlet in ditch on west side of Hwy 40:36 partially blocked with rockfall particles. Some rockfall particles removed from culvert inlet by KCB by hand during 2024 inspection. Photo taken June 10, 2024, facing southeast.**



**Photo 11** Pavement surface of Hwy 40:36. Note segment of guardrail deflected and pushed towards southbound lane from rockfall strike and lock blocks are deteriorating. Photos taken June 10, 2024, facing northeast and northwest, respectively.



**Photo 12** East side of Hwy 40:36. Some rockfall particles on east side of highway but they may have been cleaned off highway. Photos taken June 10, 2024, facing northeast and northwest, respectively.

