ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (PEACE RIVER DISTRICT)
2024 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH012	Judah Hill	Heart River Slides	744:04	57.114
Legal Description		**UTM Co-ordinates (NAD 83)**		
SE¼ 20-083-21 W5M		11V E 483284	N 6229209	

	Date	PF	CF	Total
Previous Inspection:	May 17, 2023	15	2	30 (Slide Risk Rating)
Current Inspection:	May 28, 2024	15	2	30 (Slide Risk Rating)
Road WAADT:	630		**Year:**	2023
Inspected By:	Don Proudfoot, Tyler Clay, Cole Szakacs (Thurber). Rocky Wang, Robert Senior (TEC)			
Report Attachments:	☒ Photographs	☒ Plans	☐ Maintenance	

Primary Site Issue:	Prior to 2014, there were four slide features on the east side of Hwy 744, adjacent to a layby (brake check lane). Slide 1 was previously repaired in March 1998. Slides 2, 3 and 4 were active and had retrogressed into the northbound layby lane. During the summer of 2011, the northbound layby lane was closed, and the guardrail was moved to the edge of the northbound lane (NBL). In 2013 and the Spring of 2014, Slides 2, 3 and 4 continued to retrogress, coalescing into a larger single landslide feature with the resulting backscarp encroaching into the southbound lane (SBL) of the highway. Slides 2, 3 and 4 were repaired by excavation and reconstruction with a uniaxial geogrid reinforced crushed gravel backfill under Contract 15153 during the summer of 2014. New landslide scarps have appeared between the location of Slide 1 and the former Slide 2 (referred to as 'Main Slide 1A'), and to the south of the sheet pile repair at former Slide 2. The "Y" connector to the solid pipe below the sheet pile wall became disconnected between 2017/2018. The sheet pile wall has deflected from slide movement / earth flows and is no longer effectively retaining the slope at its north end. Mud flow scour channels have appeared and continue to grow at the bases of former slides 2, 3 and 4.
Dimensions:	Refer to attached Figure.
Date of any remediation:	Gravel road realignment was constructed in Fall 2022.
Maintenance:	None.

Observations:	**Description:**	**Worsened?**	
		Yes	**No**

☐ Pavement		☐	☐
☒ Slope Movement	Main Slide 1A (57+175) had approximately 0.5 m of retrogression along the flank and southern half of the main scarp. The main scarp was offset 35 m from the gravel realignment. Tension cracks were located approximately 0.8 m behind the current scarp. There was increased downslope movement of the disturbed slide mass within the upper slide bowl. (Photos 12-01 to 12-03) There were ongoing but slow, shallow earth flow movements within the lower slide masses of Main Slide 2 (north of the sheet pile wall) and 2.1. There was minor scarp erosion at these slide areas but no major retrogression or increase in sheet wall deflection relative to the 2023 condition. (Photos 12-04 to 12-06) No signs of movement observed within the repaired area of former Slide 4. (Photo 12-08). At Main Slide 4, a new tension crack had developed 2 m upslope from the erosion gully headwall. (Photo 12-10)	☒	☐
☒ Erosion	Scouring has been previously observed below the disconnected “Y” connector pipe below the sheet pile wall and is likely ongoing concurrently within disturbed slide materials and earth flow processes. An active scour channel is getting progressively deeper and retrogressing towards the road at the south end of the site, south of former Slide 4. (Photo 12-10). Erosion observed within ditch on west side (0.2 m deep and 0.2 m wide) near KM 57+025 from culvert outlet flow was vegetated and did not significantly expand relative to the 2023 condition.	☒	☐
☒Seepage	A wet layer and white mineral deposits were observed in the scarp of Main Slide 1A in similar location to previous inspections. There was no ponded water at the top of the slide as has been observed previously.	☐	☒
☐ Bridge/Culvert		☐	☐
☒ Other	The solid “Y” connector pipe is disconnected below the sheet pile wall. Relatively good grass growth was occurring in the disturbed soils of the old alignment and within the ditches of the new alignment. (Photo 12-09). Borrow pit area used for realignment work, located in field southwest of site, is now a low-lying area that will be susceptible to ponding. Potential risk for northbound traffic to follow the previous highway alignment at bend in gravel	☐	☒

	realignment near KM 56+000 to 57+000 (corner delineators are currently installed). (Photo 12-09)		

Instrumentation:

No instruments are currently installed at the site.

As part of the preliminary engineering assessment for Contract 15153, Thurber had previously installed five standpipe piezometers in June 2013 at locations shown on Drawing PH012-1-1. Some of these piezometers were destroyed by landslide movement and the remainder were removed as part of the excavation work for the landslide repair.

Seepage was encountered in all the test holes at about 5 m to 6 m below the existing ground surface during drilling in 2013.

The last water level readings taken in the standpipe piezometers (Fall 2013) varied between 1.1 m to 4.9 m below ground surface in standpipes installed to a depth of 10 m (SP13-1A, SP13-2A and SP13-3) and from 23.3 m to 25.2 m in standpipes (SP13-1 and SP13-2), installed to a depth of 26 m.

Assessment (Refer to Drawing PH012-1-1)**:**

A combination of weathering, heavy precipitation, and active seepage beneath the old highway embankment fill, which was built through a slough, and surface water drainage in the ditch appears to have caused the retrogression of Slides 2, 3 and 4 before they were repaired. The previous repair at Slide 1 continues to perform well. No new cracking noted on the slope above these slide areas has been observed to date.

The main scarp of Main Slide 1A (formed between Slide 1 and the former Slide 2) continues to retrogress but at a reduced rate since the large increment of movement that occurred in September 2020. The rate of retrogression will be highly dependent on groundwater and precipitation conditions. Signs of active seepage have been noted at the exposed scarp face and appear to be a driving factor in the loss of soil strength and rapid retrogression. The current offset from the main scarp and toe of the new gravel realignment embankment is approximately 35 m and therefore the consequence factor for this site has been reduced. However, if nothing is done to curb the rate of the Slide 1A retrogression, it is expected to encroach into the plateau area and might eventually become a threat to the new gravel alignment. The rate of retrogression towards the new realignment could be significantly reduced by buttressing or reinforcing the vertical scarp face.

The sheet pile wall has been compromised from slope movements and is deflected and ineffective at its north end. Ongoing slide movement and loss of material upslope from the wall due to earth flows are expected in the following years. Loss of material here and further south of the sheetpile wall could begin to undermine the upslope repairs above former slides 2 and 3.

Scour in seepage zones in the till underlying the 2014-2015 repair from Contract CON0015153 continue to develop resulting in shallow earth flows on the colluvium slope below the locations of the former slides 2, 3 and 4.

Recommendations:

Monitoring:
Annual inspections should continue with the next inspection occurring in the Spring of 2025.

Maintenance:

- Any areas with poor grass growth within the ditches on either side of the new alignment should have topsoil placed and seeded.
- Ditch is poorly defined on the west side of the realignment and should be re-shaped to better convey water flow and prevent ponding.

- Consider armouring the inlet and outlet areas with TRM or equivalent for the ditch culvert at the residence access crossing (KM 57+010).

Medium-term to Long-term Measures:
Thurber has previously recommended that the backscarp of the Main Slide 1A area be cut back at the top and buttressed at the bottom with a gravel wedge to reduce the rate of scarp retrogression. It is recommended to cut a ramp down the SE corner of the slide and clear out the base of the slide bowl of disturbed material. The removed slide material should be placed at the low lying borrow pit area SW of the site to avoid water ponding. The upper third of the main scarp should be excavated and a wedge of gravel backfill should be placed against the lower two thirds of the scarp (TEL can provide design drawings). ($300k-500k)

CLOSURE

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

Don Proudfoot, P.Eng.
Principal | Senior Geotechnical Engineer

PROFESSIONAL ENGINEER ALBERTA
TYLER T. CLAY
ID: 120965
October 15, 2024

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: October 15, 2024
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Tyler Clay, P.Eng.
Geological Engineer

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

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The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

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5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

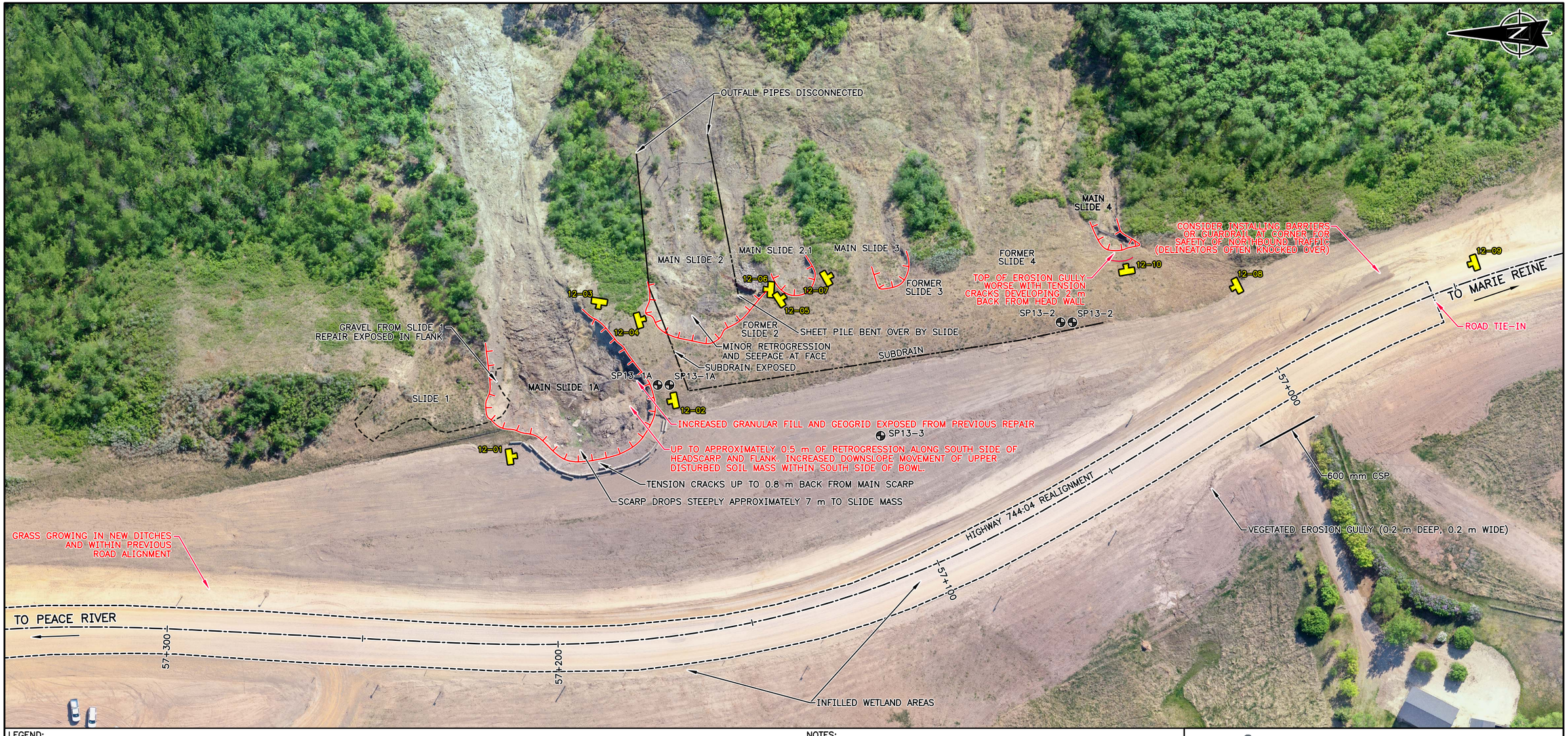
d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



LEGEND:

2013 TEST HOLE (INSTRUMENTS NO LONGER ACTIVE)	⊕
DIRECTION AND NUMBER OF PHOTO	
150 mm DIA. PERFORATED SUBDRAIN	
150 mm DIA. OUTFALL PIPE	

NOTES:

1 FIGURE MUST BE USED IN CONJUNCTION WITH THE ATTACHED REPORT REFERENCE 32121 DATED MAY 2024 AND IS SUBJECT TO ANY LIMITATIONS DESCRIBED THEREIN.

2 LOCATION DATA RECORDED USING HAND HELD GPS RECEIVER. ALL LOCATIONS ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.

3 MAY 28, 2024 OBSERVATIONS SHOWN IN RED.

4 BASE PHOTO FROM MAY 17, 2023 THURBER DRONE IMAGERY.

0 10 20 30 40 50 m

3TM 114°W NAD83

Alberta Transportation

PEACE REGION (PEACE RIVER DISTRICT)

PH012 JUDAH HILL HEART RIVER SLIDES 2024 SITE INSPECTION PLAN

FIGURE PH012-1-1

DRAWN BY	CHN
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:1 000
DATE	OCTOBER 1, 2024
FILE No.	32121-A8B

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PHOTOS

	**Photo 12-01.** Looking south from north side of Main Slide 1A. There is ongoing retrogression and erosion primarily within the southern half of the main scarp and south flank. Tension cracks were observed 0.8 m behind the main scarp. Main scarp offset from the edge if the gravel realignment is approximately 35 m (unchanged from 2023).
	**Photo 12-02.** Looking north towards the main scarp of Main Slide 1A. Disturbed slide mass within the upper slide bowl appeared to have increased downslope movement relative to the 2023 condition. Note dark seepage horizon visible in the main scarp and white mineral buildup.

	**Photo 12-03.** Looking upslope towards the west at the main scarp and slide runout area of Main Slide 1A from the lower south flank.
	**Photo 12-04.** Looking south at Main Slide 2 and 2.1 from the north end of Heart River Landslide repair excavation (Former Slide 2). Ongoing downslope movement and minor scarp erosion but no major retrogression / expansion of the scarp relative to the 2023 condition.

	**Photo 12-05.** Looking south at Main Slide 2.1 south of the sheet pile wall. No major retrogression of the scarp at this location since 2023.
	**Photo 12-06.** Looking north at the former Slide 2 area with ongoing downslope slide movement and erosion of the upper scarp. No major changes observed since 2023. Deflection of the sheet piles appears similar to the 2023 condition.

	**Photo 12-07.** Looking south at earth flow at Main Slide 3. No significant retrogression or expansion of the main scarp since 2023.
	**Photo 12-08.** Looking north from south end of the former Slide 4 repair area. Overall repairs from 2014 are performing well. Overall slope is well vegetated and with no visible indications of new slide development within the granular backfill slope. Old highway alignment has grass development.

	**Photo 12-09.** Standing within the gravel realignment looking north from the south end of the site. Barriers or a guardrail should be considered at the road bend here (KM 56+000 to 57+000) for northbound traffic to reduce potential for drivers to maintain a course into the old alignment.
	**Photo12- 10.** Active gully erosion within the top of Main Slide 4**.** Erosion damage at the gully headwall appeared worse relative to the 2023 condition and a new tension crack had developed 2 m upslope from the gully headwall.