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

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH030	Judah Hill	Lookout Slides	744:04	57.43
Legal Description		**UTM Co-ordinates (NAD 83)**		
SE¼ 20-083-21 W5M		11V E 483194	N 6229425	

	Date	PF	CF	Total
Previous Inspection:	May 17, 2023	11	4	44 (Slide Risk Rating)
Current Inspection:	May 28, 2024	11	5	55 (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:	Several old slides on the steep slope west of the Sagitawa Lookout and north on Hwy 744:04. Highway was closed from May 2013 to January 2014, due to the occurrence of the Sunshine Landslide further north. Highway section through the area was realigned as part of Contract CON0015153 in 2015/2016 due to a landslide located near SI10-3 that retrogressed into the SBL in June 2015. A temporary detour had to be built in the NBL ditch and the traffic was re-instated on the current alignment in mid-November 2015. Failures in the sideslope are retrogressing toward the re-aligned road north of the Lookout slide.
Dimensions:	Three slide areas each 15 m to 40 m wide. Refer to attached Figure.
Date of any remediation:	Realignment 2015. As part of the fall 2022 PH012 Heart River site road realignment work; the highway within the southern end of site was shifted to the west and was converted to gravel. Previous parking area for the lookout was closed and a new parking area was created to the south of the lookout area.
Maintenance:	Highway realignment paved in 2016.

Observations:	**Description:**	**Worsened?**	
		Yes	**No**
☒ Pavement	Longitudinal arc-shaped cracking that extends just past the centreline into the NBL occurring upslope from the extents of Slide 1A (km 57.65). The cracks are open up to 40 mm at the north end and there is a more pronounced dip relative to the 2023 condition. Hairline shoulder cracks are occurring within the slide area. Increased cracking was extending into the NBL. (Photos 30-4 and 30-7).	☒	☐

☒ Slope Movement	No changes have been observed at Slide 4 over the last several years. (Photo 30-1) Increased retrogression and flank expansion within the southern end of Slide 2A. Slide 2A main scarp offset 0.45 m from the guardrail (unchanged from 2023) and upper slide area was well vegetated. Tension cracks behind the main scarp now extend below the guardrail. (Photos 30-2 and 30-3) The main scarp of Slide 1A (km 57.65) appears to be actively moving with increased downdrop, and erosion along the exposed scarp faces but no significant retrogression since 2023. Main scarp is offset a minimum of 2.0 m from the guardrail, unchanged from the 2023 condition. (Photos 30-5 and 30-6)	☒	☐
☒ Erosion	Erosion gully approximately 50 m south of Slide 4 at the southern end of the site has actively eroding flank walls but no retrogression of the headwall (Photo 30-8). Traffic is entering the new lookout parking area (km 57.45) by driving through the ditch on the west side of the new alignment which could limit grass growth and exacerbate any development of future ditch erosion.	☐	☒
☐Seepage		☐	☐
☐ Bridge/Culvert		☐	☐
☒ Other	Potential ponding area due to high ditch profile from realignment construction downstream of new culvert outlet (km 57.52. No ponding was observed in 2024.	☐	☒

Instrumentation:
The operational instruments were read on September 21, 2024.

Slope Inclinometers (SI10-1, SI10-2, and SI10-3)
SI10-1 showed a rate of movement of 2.1 mm/yr over 1.4 m to 6.3 m depth and 0.2 mm/yr over 14.2 m to 15.4 m depth since the spring of 2024 readings.

SI10-2 showed no discernible movement over 0.4 m to 4.1 m depth and a rate of movement of 11.8 mm/yr over 4.1 m to 8.3 m depth since the spring of 2024 readings. This is the maximum rate of movement recorded in this SI since initialization in 2010.

A trend of increased and accelerating movement rates has been observed at approximately 6 m depth since the fall 2021 readings. Total cumulative movement in both SI's is at or below 40 mm.

Pneumatic Piezometers (PN10-1 and PN10-2)
Since the spring of 2024 readings, pneumatic piezometer PN10-1 showed a decrease in groundwater level of 0.01 m, while PN10-2 showed no change since 2022. The current groundwater level in PN10-1 is the lowest measured in the instrument since initialization in 2010. A trend of lower groundwater readings has been observed in PN10-1 since approximately spring 2021.

Assessment (Refer to Drawing PH030-1-1)**:**

The existing slides occurred on steep slopes (36° to 38°) and are similar in appearance to the Heart River slides. The previous repairs at Slide 1 (shredded tire fill wedge) appear to be effective, although there may be some ongoing movement in the backscarp causing minor pavement distress.

The October 2015 landslide at SI10-3 was remediated as part of Contract CON0015153 with a realignment of the affected highway section into the backslope further to the east. The extent of the realignment was limited by the presence of the ATCO natural gas pipeline right-of way which flanked the highway alignment along the NBL. The ATCO pipeline has since been abandoned within this section which could provide some additional space for future realignments, if required.

There is continuing slide activity in Slide 2A (formerly Slides 2 and 3) and in Slide 1A located in the newly regraded highway sideslope below the SBL at km 57.65. This movement could be in response to natural groundwater drainage and seepage locations. Retrogression of the main scarps at these slides has generally been slow with larger increments that could be linked to seasonal affects.

At Slide 1A (km 57.65), the visible main scarp continues to retrogress towards the SBL and is only offset 2 m from the guardrail. Based on the arc-shaped cracking pattern within the pavement upslope from this slide area, a slide plane appears to have developed beneath the highway, and it encompasses the SBL and an increasing part of the NBL. Although the movements within the road have been relatively small to date, a large increment of movement within this slide block could negatively impact both lanes of the driving surface. The operating SI near this area (SI10-2) appears to be outside of the main movement zone; however, a trend of accelerating movement rates has been observed at approximately 6 m depth. The largest movement rate (~12 mm/yr) was recorded at SI10-2 since initialization during the Fall 2024 readings This could reflect progressive loss of toe support below the highway at km 57.65, resulting in the observed pavement damage.

Recommendations:

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

Maintenance:

- The ditches on either side of the new gravel alignment should have topsoil placed, seeded and TRM installed. The east ditch profile should be lowered a bit to avoid ponding for an approximately 20 m length north of the ditch outlet at the new culvert near km 57.52.
- Install barriers or fencing on the east side of the new lookout parking area to prevent traffic driving across ditch.

Short-term Measures:

- Movement at Slide 1A (57.65) is expected to continue to move and retrogress toward the new highway alignment. In the short-term, if the southbound lane was lost an emergency repair would likely involve a realignment into the hillside and conversion to gravel. ($350k – $500k)
- Sub-excavation of the Slide 1A mass and replacement with light weight fill could be considered as a shorter-term, cost-effective solution. ($500k - $750k)

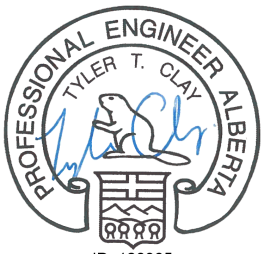
Long-term Measures:

- Long-term option for Slide 1A would likely involve a tied-back pile wall. The wall will need to be in the order of 35 m to 40 m wide with two rows of tie-back anchors. ($1.5M - $3M)

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



ID: 120965
October 15, 2024

Tyler Clay, P.Eng.
Geological Engineer

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)

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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3. BASIS OF REPORT

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.

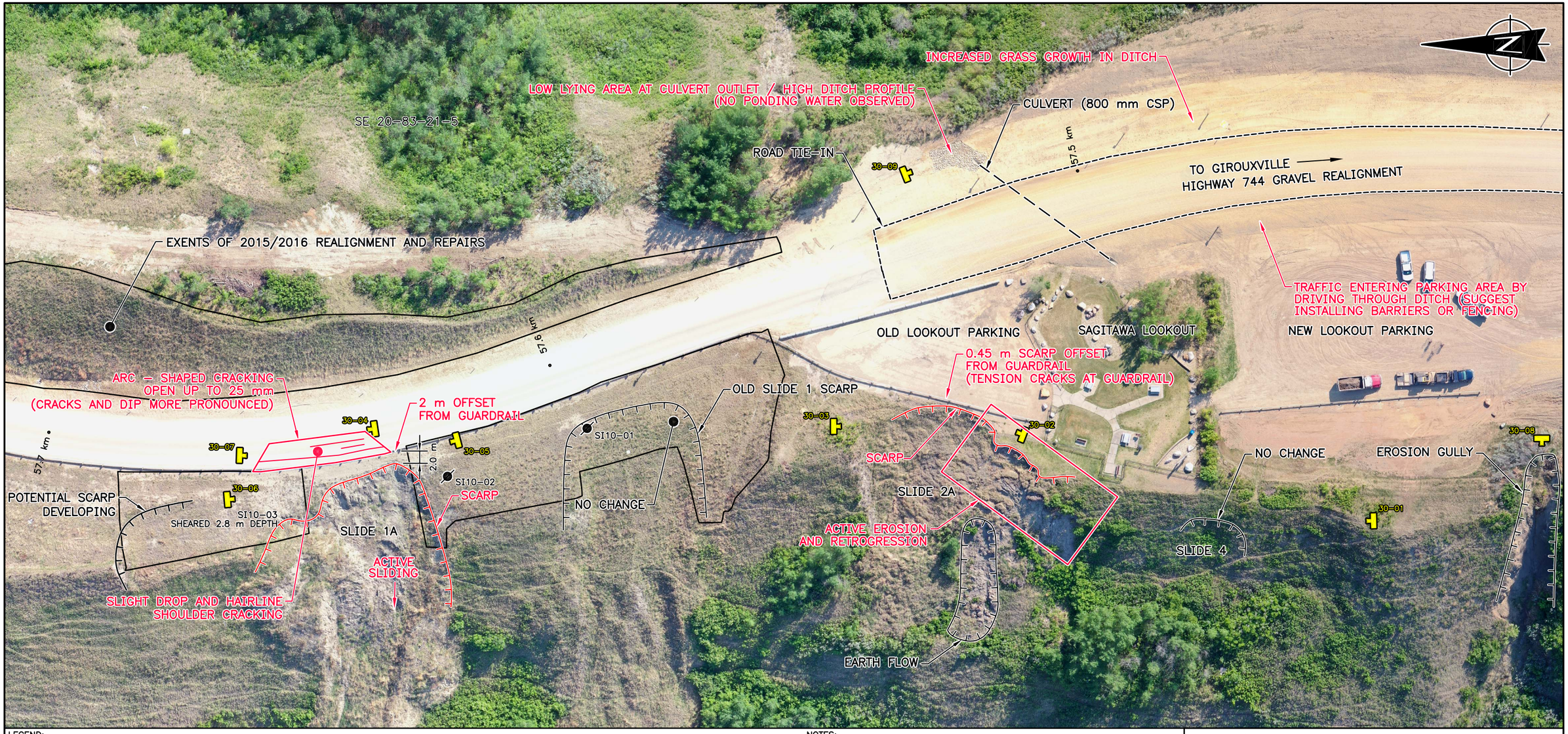
d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted 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:

- SLOPE INDICATOR
- SLOPE INDICATOR (DESTROYED)
- DIRECTION AND NUMBER OF PHOTO (30-01)

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)

PH030 LOOKOUT SLIDES
2024 SITE INSPECTION PLAN

FIGURE PH030-1-1

DRAWN BY	CHN/ICB
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:750
DATE	SEPTEMBER 28, 2023
FILE No.	32121-A9B

THURBER ENGINEERING LTD.

	**Photo 30-01.** Looking north towards the Slide 4 area from the south end of the site. No change to the slide in this area has been observed over the last several years and it is well vegetated.
	**Photo 30-02.** Looking north along backscarp of Slide 2A (previously Slides 2 and 3) which has a minimum offset of 0.45 m from the parking lot guardrail. Some localized main scarp retrogression at south end, flank erosion and additional pavement cracking since 2023. Tension cracks are now at the guardrail.

	**Photo 30-03.** Looking south towards the upper part of Slide 2A. South flank had most activity since 2023 within increased erosion and minor retrogression. Ongoing movements occurring further downslope, primarily involving shallow earth flows.
	**Photo 30-04.** Looking north along the SBL of Hwy 744:04 near km 57.65 at south end of 2015 realignment. Transverse cracks have formed joining the previous longitudinal crack in the NBL to form arc-shaped crack within the downslope extents of Slide 1A. Cracks have extended into the NBL.

	**Photo 30-05.** Looking north from downslope of the SBL of Hwy 744:04 near km 57.63. Increased down drop within the disturbed slide mass of Slide 1A. Main scarp had minor retrogression since 2023 and is offset a minimum of 2.0 m from the guardrail (unchanged from 2023).
	**Photo 30-06.** Looking south at Slide1A (near KM 57.65). Ongoing downslope movement and erosion at the main scarp and south flank; however, no major change from the 2023 condition.

	**Photo 30-07.** Looking south along SBL of Hwy 744:04 at km 57.68. Arc-shaped cracking more prominent in SBL within the downslope extents of Slide 1A. Dip was more pronounced relative to the 2023 condition and cracks have started to extend into NBL.
	**Photo 30-08.** Looking at the top of an erosion gully located at the southern edge of the site, approximately 50 m south of the Slide 4 area. Gully is offset approximately 50 m west of the new highway realignment. No headwall retrogression since 2023.

Photo 30-09.
Looking south along the east ditch of the new gravel realignment and new culvert outlet (km 57.52). There is a low spot within the ditch that should be fixed by regrading for an approximately 20 m section north of the outlet to prevent ponding. No ponding was observed in 2024.