

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT
PEACE REGION (PEACE RIVER DISTRICT)
2023 INSPECTION**



THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH011-2	North of Peace River	Whitemud River	743:02	43.2
PH011-3				42.8
Legal Description		UTM Co-ordinates		
PH011-2: SW01-88-21-W5		11U N 6,272,980	E	487,129
PH011-3: SW01-88-21-W5		11U N 6,272,586	E	487,326

	Date	PF	CF	Total
Previous Inspection:	21-June-2017	9	2	PH011-2: 18
	7-July-2021	8	6	PH011-3: 48
Current Inspection:	16-May-2023	9	3	PH011-2: 27
		8	6	PH011-3: 48
Road AADT:	163		Year:	2023
Inspected By:	Max Shannon, TEC Rocky Wang, TEC Pramaya Kannel, TEC		Don Proudfoot, Thurber Ken Froese, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

PH011-2		
Primary Site Issue:	A steep backslope cut has been eroding and depositing material in the ditch and on the highway.	
Dimensions:	85 m wide measured along the shoulder, the slope is approximately 25 m high and inclined at 37°.	
Date of Remediation:	None	
Maintenance:	Ongoing grading to keep the ditch and roadway open	
Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Material accumulating in the east ditch is encroaching onto the shoulder of the road	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	There are fresh scarps opening at the top of the slope.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Material has raveled downward due to erosion with a toe height of about 1.5m.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
PH011-3		
Primary Site Issue:	A landslide scarp has developed in the surface of a two laned gravelled road.	
Dimensions:	100 m wide along the shoulder, approx. 400 m wide at the creek and 170 m long from the highway to the creek.	
Date of Remediation:	2020: Backslope slump at original PH011-1 (km 42.4) site cut back later in the year when crews in the area constructing detours around other failures.	
Maintenance:	July 13, 2020: Highway closed due to landslide movements at other sites and reopened late in the year after detours had been constructed. 2021: Site regraded to remove unevenness from slide movements	

Observations (PH011-3):	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Cracks were crossing both lanes (graded out) and there is a dip in gravel road surface.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Cracks and dip across roadway indicate slope movement. LiDAR indicates historical landslide scarps on slope above and below roadway.	<input type="checkbox"/>
<input type="checkbox"/> Erosion		<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation:		
None.		

Assessment:
<p>PH011-1 was assigned to the bridge culvert (BF77270-2, km 42.49) installed in 2010 and was expanded to include the high backslope cut on the west side of Hwy 743 south of the bridge culvert. PH011-2 (km 43.2) is the raveling shale backslope on the east side of Hwy 743 north of PH011-3 and just south of PH087. At PH011-1, there are no active issues at the bridge culvert; however, there is minor slumping and erosion at the backslope. The slide at PH011-3 was first noticed on August 4, 2020, while driving to undertake the call-out inspections of other sites on Hwy 743. PH011-3 is the active sub-site at this location and located just north of PH011-1 bridge culvert.</p> <p>The PH011 sites are located on Highway 743:02 on a sidehill alignment ascending the valley slope of a tributary to the Whitemud River. LiDAR provided by Alberta Transportation (Figure 1) shows that the valley slope has been affected by historic landslide movements. It is considered that higher groundwater levels in the years leading into 2020 have re-activated a large slide block which is now affecting about 100 m of the road surface. At the centre of the disturbance, the highway is located about 25 m above the creek. The valley slope surface, as shown by the cross-section on Drawing 32121-PH011-3, is hummocky, indicating the presence of several possible retrogressive slide blocks between the creek and the road. Movements are slow enough at this site that routine grading is currently able to maintain a safe highway surface. However, the ditches are narrow and poorly-drained.</p> <p>As part of the site inspection, a brief assessment was undertaken of the PH011-1 backslope cut completed in the fall of 2020. The purpose of that work, which was done in conjunction with the detour constructions, was to remove some of the sloughed material that was blocking the highway ditch and infringing onto the highway surface. The work did not include erosion control measures. The fresh shallow slumping noted at the south end of the cut in 2021 had stabilized in 2023. The backslope will likely continue to slough and require some further maintenance in the future. It would need to be cut back to a flatter angle to improve stability and provide a longer-term solution.</p> <p>The shale backslope at PH011-2 (Drawing 32121-PH011-2) has continued to ravel onto the highway surface and the toe height was about 1.5 m. There was evidence of scarp cracks opening up at the top of the slope so there is a potential for a larger mass to fail at this location.</p>
Recommendations:
<p>Short-Term (<3 months):</p> <ul style="list-style-type: none"> ▪ The cracks and slumping at PH011-3 can be managed with routine grading to provide a safe roadway surface. Nonetheless, frequent visits by the Maintenance Contractor are recommended to ensure that the roadway remains safe for the travelling public as there are several slides in this

valley that could reactivate and further damage the road, especially following heavy periods of precipitation and the coming spring thaw when groundwater levels could be higher. If possible, cutting an upslope ditch that could drain the site could be advantageous for controlling movement rates.

- At the PH011-1 (km 42.4) site, the exposed backslope should be textured (dozer walking up and down the slope), seeded, and covered with a temporary erosion control blanket. Consideration should be given to using a permanent control blanket in the ditch where flow will be concentrated.
- At the PH011-2 (km 43.2) site, the slumped material should be removed from the side of the road and hauled to the disposal area located just south of the valley. Consideration should be given to cutting back the slope to reduce the amount of material that could ravel onto the highway.

Medium-Term:

- A vertical realignment of the roadway through the slide could be carried out if the road condition worsens. The reprofiling could lower the road a few meters through the slide zone by taking out the hump in the road profile starting from south of the site. The slide area itself could be further unloaded by subexcavating some of the soil and replacing it with EPS light-weight fill. A subdrain could also be installed along the upslope side of the road to locally lower the groundwater and the shoulder of the road in the slide zone could be cut down to take a bit of the weight of the slide block.

Long-Term (>5 years):

- The highway could be realigned south of the Whitemud Creek bridge to rise out of the valley perpendicular to the valley slope and then curve back to cross the tributary creek east of PH011-1, as shown approximately on Figure 1 below. The curved alignment is required due to the proximity of the Peace River valley to the east of the Whitemud Creek valley. This re-alignment would be expensive, and as there would be limited fills, the excavated material would need to be hauled out of the valley and stockpiled at least 300 m from the valley crest. This would also require a significant new road segment on the uplands to bring the new alignment back to the existing highway, as well as a new bridge file culvert and embankment fill at the tributary crossing.

Ongoing Investigation:

- It is recommended that the Geohazard inspection should continue as scheduled every second year.
- Should a major re-alignment be considered in the long-term, preliminary engineering design should be conducted to assess the potential alignment and develop ballpark costs. This would include route selection and geometric planning. Once a route has been selected, it is recommended that a geotechnical investigation be undertaken such that detailed design and tender will have that information available immediately should the realignment be suddenly required due to further movements. Slope stability analyses should be carried out to further develop the option and to determine safe cut slopes for the realignment.

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.

Tarek Abdelaziz, Ph.D., P.Eng.
Partner | Senior Geotechnical Engineer

Ken Froese, P.Eng.
Associate | Senior Geotechnical Engineer



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.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

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.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

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.

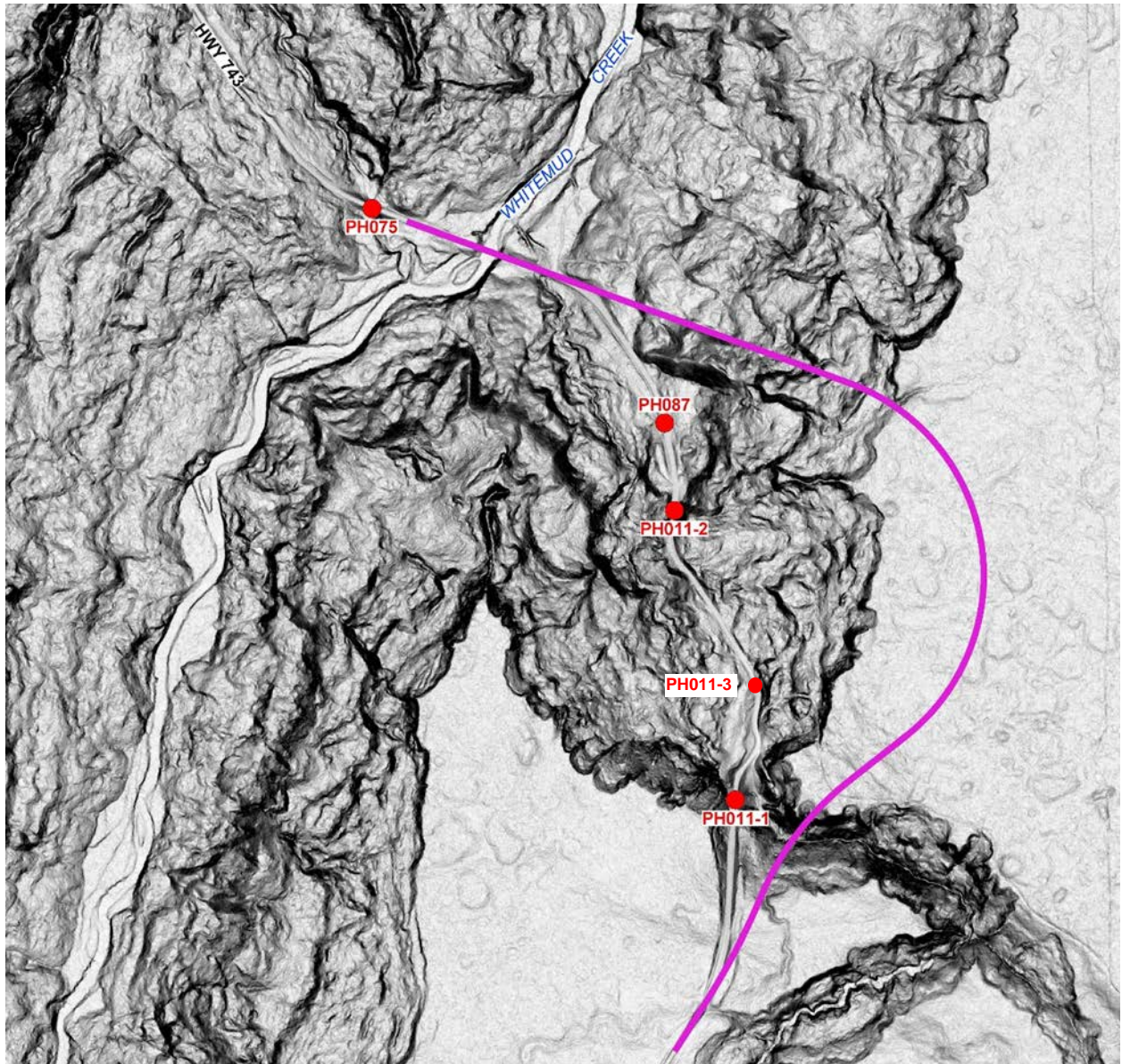
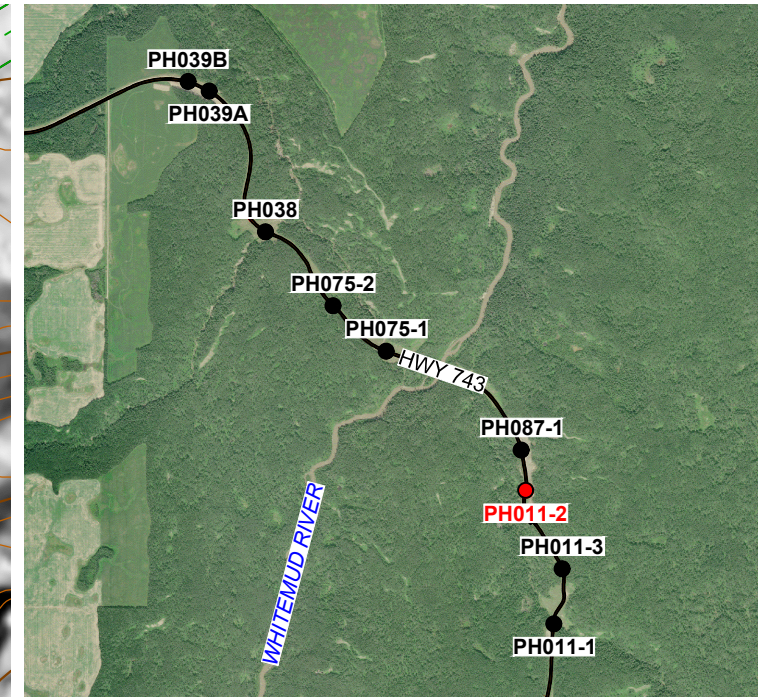
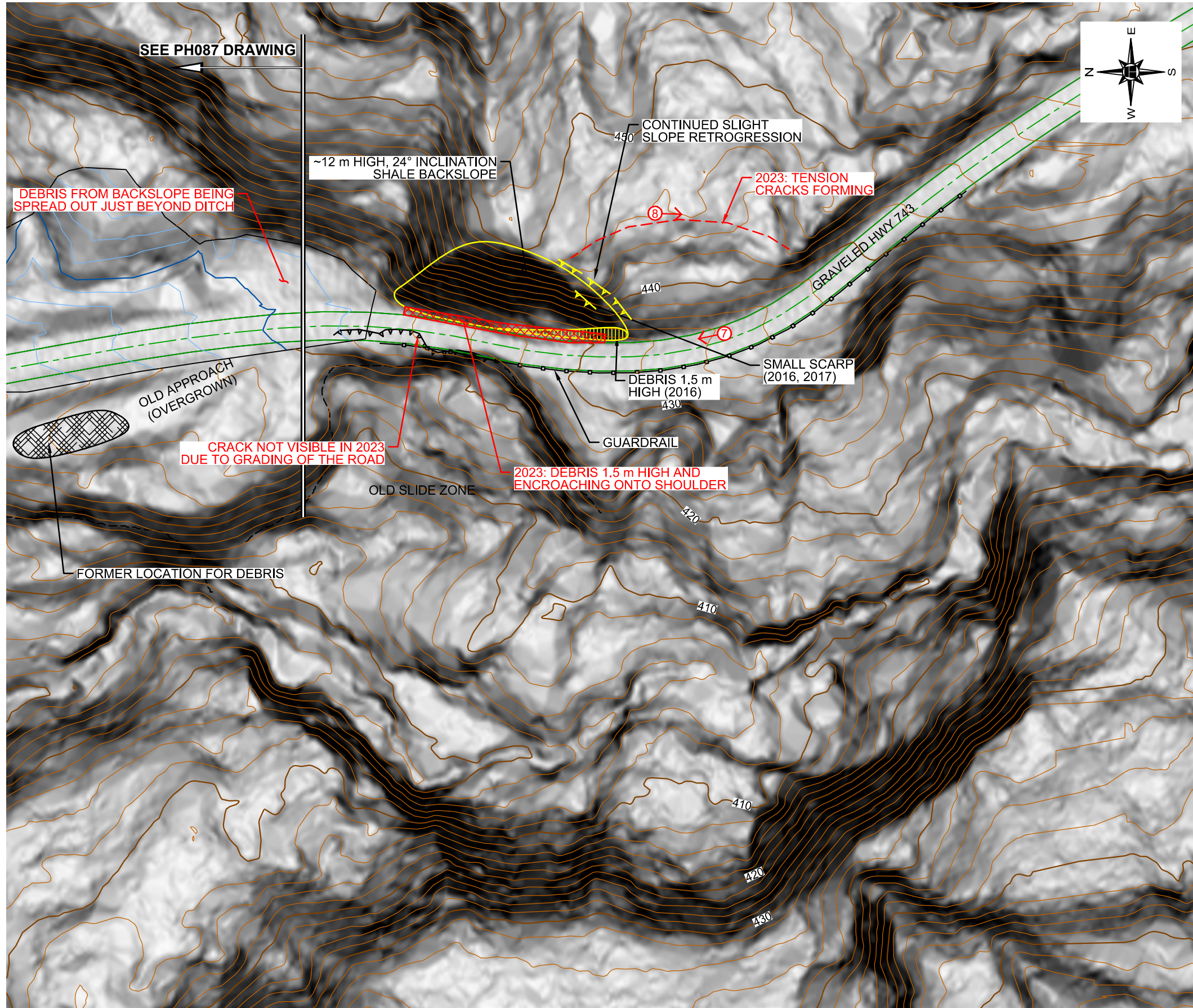


Figure 1: Proposed long-term realignment for Hwy 743:02 south of the Whitemud Creek



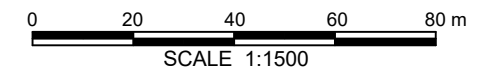
KEY PLAN
SCALE 1:40 000

LEGEND

- ACTIVE LANDSLIDE SCARP
- PHOTOGRAPH NUMBER AND DIRECTION

NOTES

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. MAY 2023 OBSERVATIONS SHOWN IN RED.



LIDAR PROVIDED BY ALBERTA TRANSPORTATION



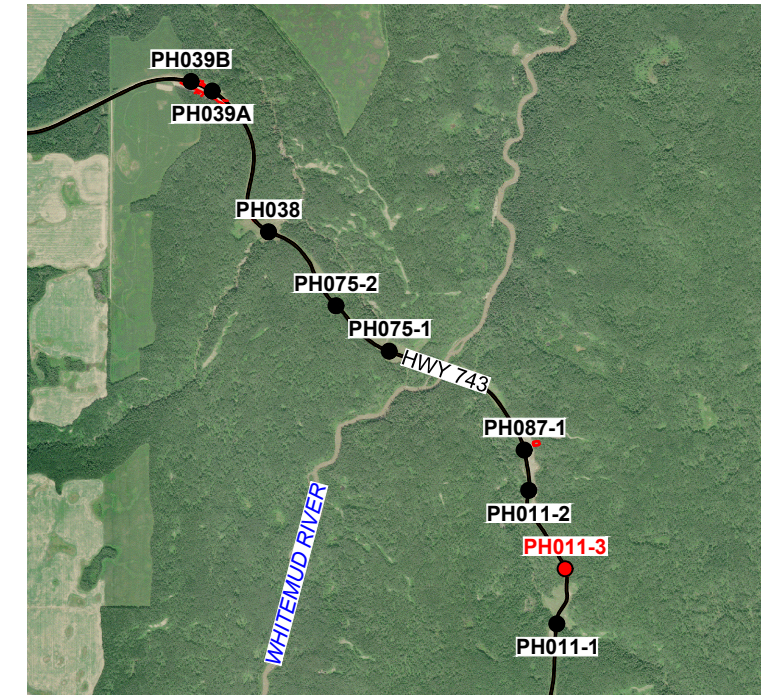
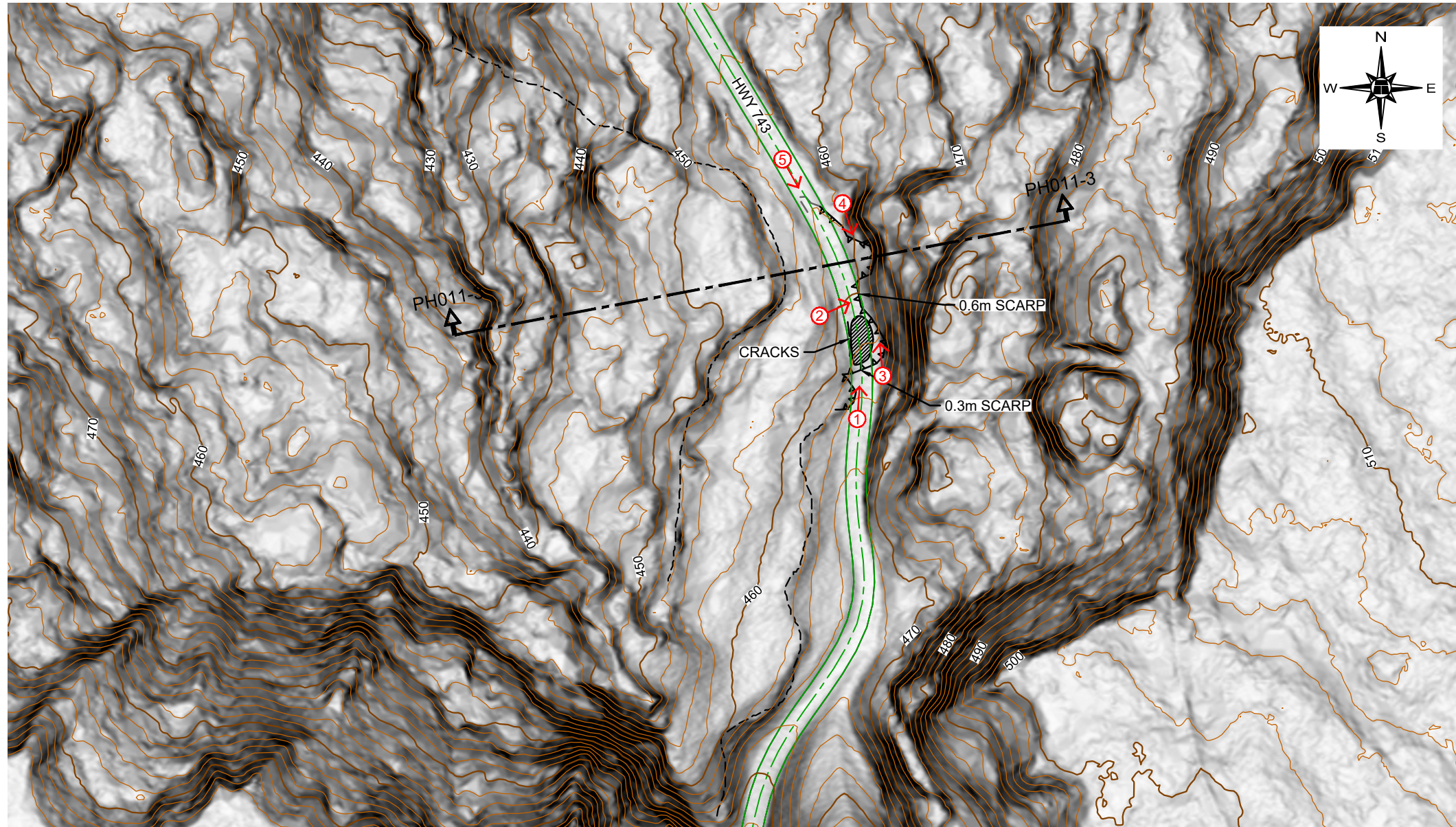
PEACE REGION (PEACE RIVER DISTRICT)

PH011-2: HWY 743:02
2023 SITE INSPECTION PLAN

DWG No. 32121-PH011-2

DRAWN BY	KLP
DESIGNED BY	KEF
APPROVED BY	TSA
SCALE	1:1500
DATE	SEPTEMBER 2023
FILE No.	32121





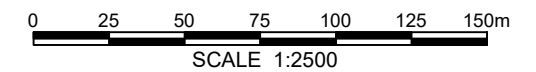
KEY PLAN
SCALE 1:40 000

LEGEND

- ACTIVE LANDSLIDE SCARP
- ANCIENT LANDSLIDE SCARP
- DIP IN ROAD SURFACE
- PHOTOGRAPH NUMBER AND DIRECTION

NOTES

1. FEATURE LOCATIONS ARE APPROXIMATE.
2. MAY 2023 OBSERVATIONS SHOWN IN RED.
3. PHOTO 6 LOCATION NOT SHOWN (AT SITE PH011-1)



LIDAR PROVIDED BY ALBERTA TRANSPORTATION

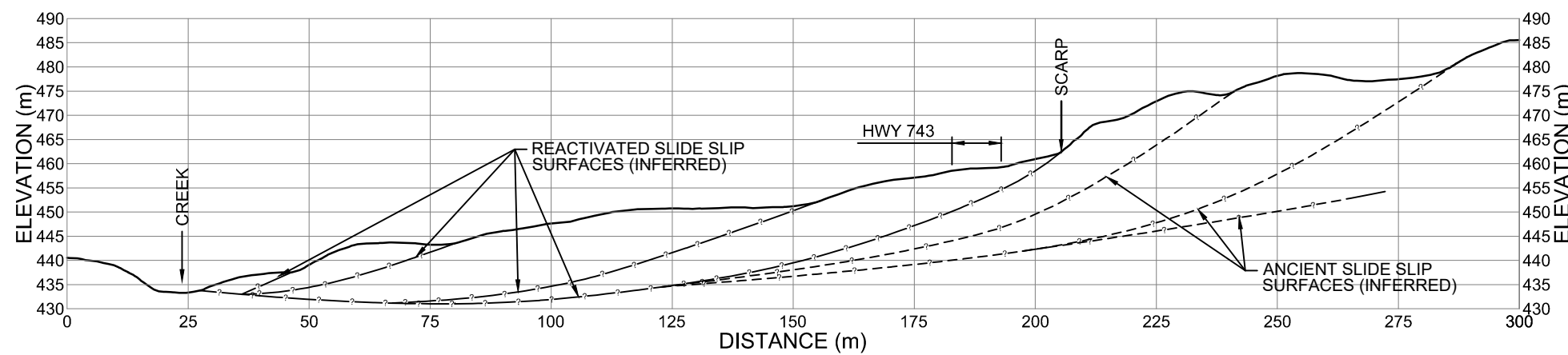


PEACE REGION (PEACE RIVER/HIGH LEVEL AREA)

**PH011-3: HWY 743:02
2023 SITE INSPECTION PLAN**

DWG No. 32121-PH011-3

DRAWN BY	KLP
DESIGNED BY	KEF
APPROVED BY	TSA
SCALE	1:2500
DATE	SEPTEMBER 2023
FILE No.	32121



SECTION
SCALE 1:1250



Photo 1 (PH011-3) – Looking north at landslide site identifiable by the dip in the highway surface.



Photo 2 (PH011-3) – Scarp crack beyond the edge of the road.



Photo 3 (PH011-3) – Looking north along backscarp crack (in the grass).



Photo 4 (PH011-3) – Looking south at where displacement has occurred along backscarp of slide at edge of highway.



Photo 5 (PH011-3) – Looking south toward the landslide.



Photo 6 (PH011-1) – Looking at regraded backslope failure area at PH011-1 site (km 42.4).



Photo 7 (PH011-2) – There has been a recent movement on this backslope resulting in material accumulating onto the east shoulder of the highway.



Photo 8 (PH011-2) – There is an evidence of recent scarp cracks opening behind the top of the slope.