

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



Site Number	Location	Name	Hwy	km
PH038-1	North of Town of Peace River	Whitemud River (km 45.5)	743:02	45.3
Legal Description		UTM Co-ordinates		
S11-88-21-5		11V N 6,274,373	E 485,755	

	Date	PF	CF	Total
Previous Inspection:	7-July-2021	9	3	27 (erosion scale)
Current Inspection:	16-May-2023	7	2	14 (erosion scale)
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 type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	Site repaired in 2009. Original issue was erosion and sliding affecting the highway sideslope and culvert outlet. Current issue is ongoing erosion of riprap swale.		
Dimensions:	85 m of erosion along rip-rap drainage swale.		
Date of any remediation:	2009: The culvert was replaced with a larger, longer culvert, the embankment sideslopes were flattened, and slide areas around the culvert outlet were removed or unloaded. 2011: The swale on the east embankment was re-lined with larger Class 2-3 riprap.		
Maintenance:	Highway closed on July 13, 2020, due to landslide movements at other sites and was reopened late in the year after some detours were constructed around those landslides	Worsened?	
Observations:	Description	Yes	No
<input type="checkbox"/> Pavement Distress	Highway is gravel surfaced. Grading of the roadway is undertaken weekly.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	No noticeable signs of movement of embankment. Slumping occurring along east swale and near both the culvert inlet and outlet.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	Erosion has occurred along the east swale causing slumping along the entire length. Voids forming below concrete headwalls at inlet and outlet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	Minor seepage was noted in the riprap apron at the culvert outlet. Seepage also noted along the highway west ditch which was become quite pronounced since 2020 and the grader operator related it flows year-round.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/> Culvert Distress	The 2.43 m dia. culvert (BF77273-2) was installed in 2009 and is in good condition. There is a 900 mm dia. culvert at the north side of the site: the inlet is sunken well below ditch level and an erosion bowl has formed at the outlet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<input type="checkbox"/> Other		<input type="checkbox"/>	<input type="checkbox"/>
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Instrumentation:
None – destroyed during construction
Assessment:
<p>Significant landslide movements on both sides of the valley closed the highway in July 2020 until detours were in place in Fall 2020. This site is located on a relatively flatter section of the roadway and was unaffected by these other movements.</p> <p>The embankment fill slopes appeared to be in good condition with no signs of global instability and is well vegetated.</p> <p>Significant erosion and settlement have developed especially in the upper, steeper, 30 m of the east swale where tension cracks and slumping have formed on both sides of the swale and have worsened yearly since 2016. Erosion, settlement, and cracking was also present at several other locations along the swale and have continued to worsen each year. Erosion and settlement along the drainage swale also extends closer to the toe of the bank (near the culvert outlet). The deterioration of this rock swale is likely a result of poor compaction, poor fill quality, and possible gaps in geotextile. Water flow is getting outside of the channel upslope so can erode behind the riprap for the remainder. Pins to monitor regression of this feature were installed in 2019 at 2 m from the main scarps and the distance had dropped to 1 m or less in 2020 but were not measured in 2021. In 2021, it also appeared that some of this erosion had stabilized with vegetation becoming established. The overall width of this erosion slumping had increased in 2023.</p> <p>Some erosion and shallow slump cracks are present in the fill at the culvert outlet but have not worsened noticeably since the previous inspection with the exception of an erosion void noted in 2019 forming at the culvert outlet. In 2020, voids were also documented below the concrete headwall at the inlet as well. Based on the height of deposited sediment at the inlet, the flows in the spring of 2020 were significant. No further deterioration was observed in 2021 (site not inspected in 2022). Some minor deterioration was noted in 2023 as ongoing erosion continues to affect the stability of the swale and river valley slopes.</p> <p>Newer, but not fresh, scarps were noted on the north side of the creek (left bank) west of the inlet and at the east side of the outlet. These features should be inspected in the future to assess if there is continued movement.</p> <p>The seepage along the west ditch has continued to become more pronounced at each visit. The grader operator has been cutting a shallow v-ditch to control this flow and limiting how much gets out on the roadway surface as it can cause icing in the winter. In 2023, it was noted that there had been significant erosion in the spring as evidenced by the deposits on the west slope of the embankment.</p>
Recommendations:
<p>Short-Term:</p> <ul style="list-style-type: none"> ▪ Periodic visits by the AT Maintenance Contractor are recommended to ensure that the erosion at the west end of the swale is not adversely affecting the highway. ▪ The silt fences installed on both sides of the embankment are no longer required and should be removed to minimize the potential for channelized flow. <p>Long-Term:</p> <ul style="list-style-type: none"> ▪ A subdrain should be installed at the spring along the west ditch discharging into the riprap apron at the culvert inlet. ▪ The east swale should be completely reconstructed: remove and salvage the existing riprap, excavate the wet or soft subgrade at the base of the channel to a depth of 1 m over a 10 m width, place and compact borrow material, flatten the sideslopes, install new non-woven geotextile, and replace the rock riprap. The subgrade should be compacted with a sheepsfoot compactor. Borrow material could be taken from the knoll located northeast of the channel.

- The voids forming below the concrete headwalls should be grouted if the other repairs are undertaken at the site.
- Similarly, if other repairs are being done, consideration should be given to adding additional riprap along the creek banks at the outlet to replace that lost to water erosion as well as at both headwalls.

Ongoing Investigation:

- It is recommended that the Geohazard inspection should continue as scheduled (every other year).

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

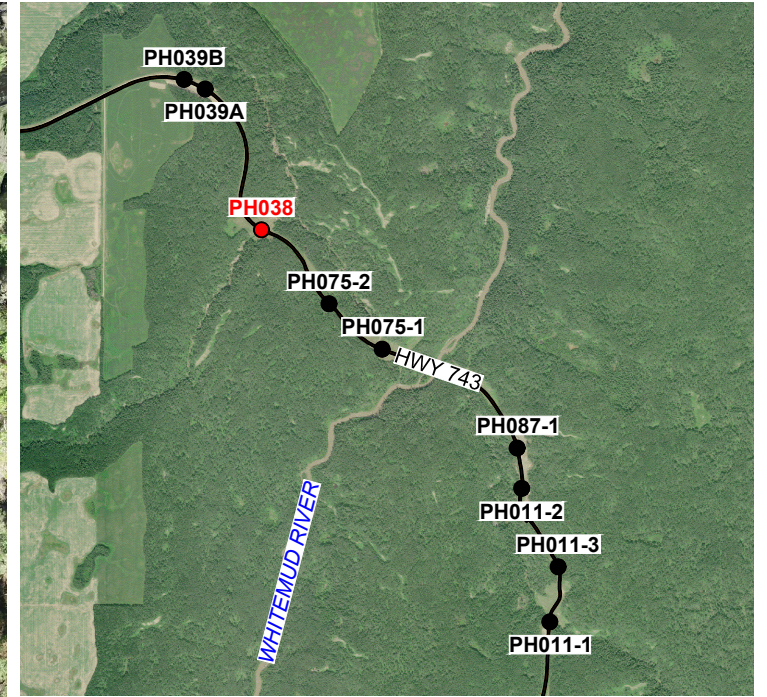
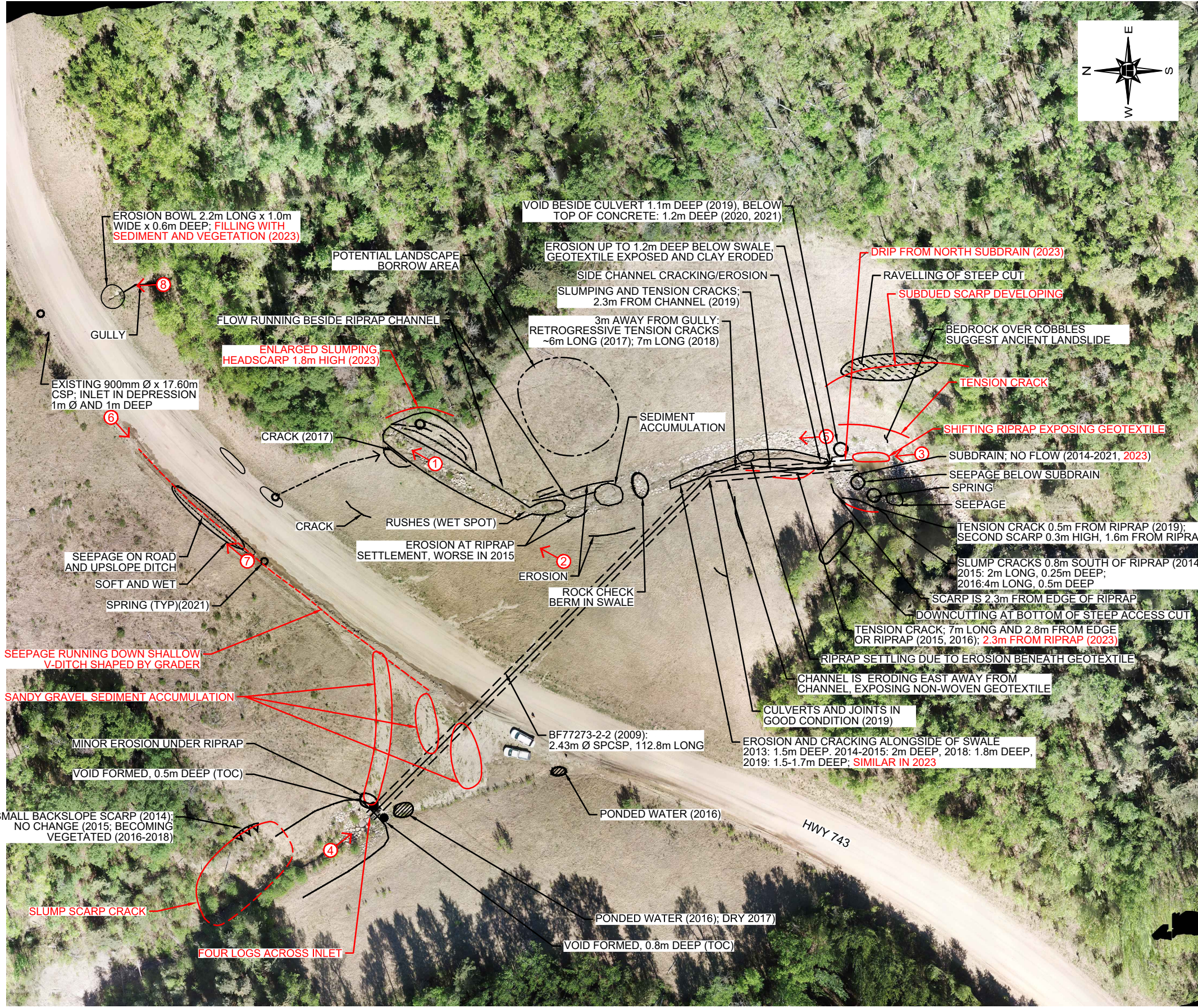
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification 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

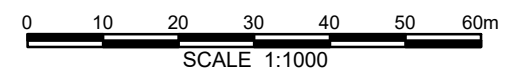
The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or 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.



KEY PLAN
SCALE 1:40 000

LEGEND
① PHOTOGRAPH NUMBER AND DIRECTION

NOTES
1. FEATURE LOCATIONS ARE APPROXIMATE.
2. MAY 2023 OBSERVATIONS SHOWN IN RED.
3. MANY HISTORICAL NOTATIONS REMOVED IN 2023 - CONSULT 2021 DRAWING



ORTHOMOSAIC DERIVED FROM THURBER UAV FLIGHT IN 2023



PEACE REGION (PEACE RIVER DISTRICT)

PH038-1: HWY 743:02 WHITEMUD RIVER, km 45.3
2023 SITE INSPECTION PLAN

DWG No. 32121-PH038-1

DRAWN BY	KLP
DESIGNED BY	KEF
APPROVED BY	TSA
SCALE	1:1000
DATE	SEPTEMBER 2023
FILE No.	32121





Photo 1 – Looking at the north end of drainage swale.



Photo 2 – Looking northeast at drainage swale.



Photo 3 – Looking northwest at culvert outlet.



Photo 4 – Looking southeast at culvert inlet.



Photo 5 – Looking north at swale near the culvert outlet.



Photo 6 – Looking southwest at road and seepage along west ditch.



Photo 7 – Looking at seepage along west side of road near the north end of the site.



Photo 8 – 900 mm-dia. culvert outlet at the north end of the site.



UAV 2023 Orthomosaic: Seepage can be seen along the left side of the highway; the eroding and slumping channel is to the right of the highway.



UAV 2023 UAV Image – Slumping at the north end of the of the riprap-lined channel on the east embankment.