

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION–GRANDE PRAIRIE
2021 INSPECTION REPORT**



Site Number	Location	Name	Hwy	km
GP35	Hwy 733:04	Bad Heart River North	733:04	8.938
Legal Description		UTM Coordinates (NAD 83)		
LSD-1-33-75-3 W6M		E 412,161	N 6,155,446	

	Date	PF	CF	Total
Previous Inspection:	28-May-2020	13	4	52
Current Inspection:	12-July-2021	9	6	54
Road AADT:	610		Year:	2020
Inspected by:	Ed Szmata, AT Roger Skirrow, AT Rocky Wang, AT Max Shannon, AT		Don Proudfoot, Thurber Nicole Wilder, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	<p>Sliding movements of Hwy 733:04 along the north valley slope of Bad Heart River Valley. The roadway is located within an active landslide area and previously the site was identified by having an upper slide area and a lower slide area which were active since the early 1980's.</p> <p>Based on the recent observations of ground subsidence and head scarp cracking over the period between 2010 and 2020, it appears that the upper and lower slides have gradually coalesced into one major slide.</p> <p>Slide can be classified as slow movement based on the rate of movement.</p>
Dimensions:	<p>The upper slide was initially estimated to be about 80 m long and the lower slide was estimated to be about 150 m long along the roadway alignment. The extents along the valley slope for both could not be defined and require further investigation.</p> <p>The upper and lower slides appear to have merged and developed into a large slide about 380 m in length along roadway alignment.</p>
Maintenance:	ACP patching and crack sealing takes place every 1 to 2 years.

Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Cracks and dips on the pavement within the landslide impact area with cracks open to 100 mm wide and differential drop up to 50 mm were observed during the 2021 inspection. The pavement was patched in summer 2019 and these same scarp cracks have reflected through the patch and some of the cracks have become braided.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Slope Movement	The lower (south) and upper (north) slides have merged into a larger slide. Tension cracks up to 80 mm wide were observed extending along the west ditch near the northeast portion of the slide. The scarp was also more defined in the northwest ditch.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	A drainage gully was observed just south of the 500 mm diameter CSP culvert during previous inspections and	<input checked="" type="checkbox"/>

	had worsened into an erosion gully in 2020. The gully appeared in similar condition in 2021 and remains 6 m from the culvert outlet.	
<input checked="" type="checkbox"/> Seepage	A gully which channels runoff flow from the farmland to the north to the slide area exists approximately 50 northeast of site. Some ponded water was observed at the base of the gully and seepage was previously observed along the west ditch and in a tension crack in the shoulder; seepage was not present in 2021.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	The existing centerline culvert (about 500 mm in diameter) appeared to be functioning well at the time of inspection; however, the culvert was partially obstructed by overgrown vegetation at inlet and outlet locations.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation:		
<p>Previous reports indicated that 5 slope inclinometers (SI) and 3 standpipe piezometer (PZ) were installed at this site. Results of the slope movement monitoring from SI readings indicated that the depth of slip surface varied from 7 m to 12 m below the existing ground surface. The instruments at this site are no longer operational and are not being read anymore.</p>		
Assessment:		
<p>No major slope movement was observed at this site; however, ongoing slope creep is occurring since cracks have shown through new patch. Further details of the background information about this site can be obtained from the previous reports in the site Geohazard Binder and are not repeated herein.</p> <p>The ongoing creep movements appear to be occurring at this site since 1998. To keep the roadway surface in a relatively good driving condition, AT has been milling and patching the pavement every 1 to 2 years. The addition of several asphalt overlays in the past has steepened the shoulder of the northbound lane, which may create traffic hazards to vehicles.</p> <p>A mid to long term remediation measure could consist of realigning highway towards the backslope to minimize/avoid the impacts from the active landslide.</p>		
Recommendations:		Ballpark Cost
<p>As AT has been doing over the years, as a short-term mitigation measure, it is recommended that sealing of pavement cracks and patching of roadway be undertaken in the slide impacted area. The differential drops along the backscarps should be milled to improve driving conditions. The site should continue to be monitored to provide a history and trend of potential slide activity.</p>		Maintenance (currently about \$100,000 every year)
<p>Consideration should be given to install guard-rails (+/-150 m) along the northbound lane to eliminate the potential hazard of the sharp shoulder as a result of successive overlay patches. In addition, the inlet and outlet areas of the existing 500 mm centreline culvert should be cleared of vegetation and debris to improve its performance. The erosion gully should be monitored for retrogression. The possible tension crack and scour should be backfilled with clay material to minimize the surface water infiltration.</p>		\$70,000

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.

Renato Clementino, Ph.D., P.Eng.
Principal | Senior Geotechnical Engineer

Nicole Wilder, M.Eng., P.Eng.
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

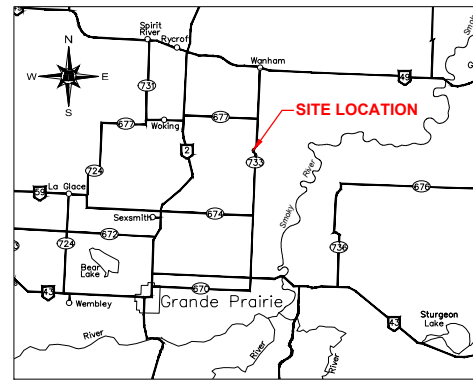
- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification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

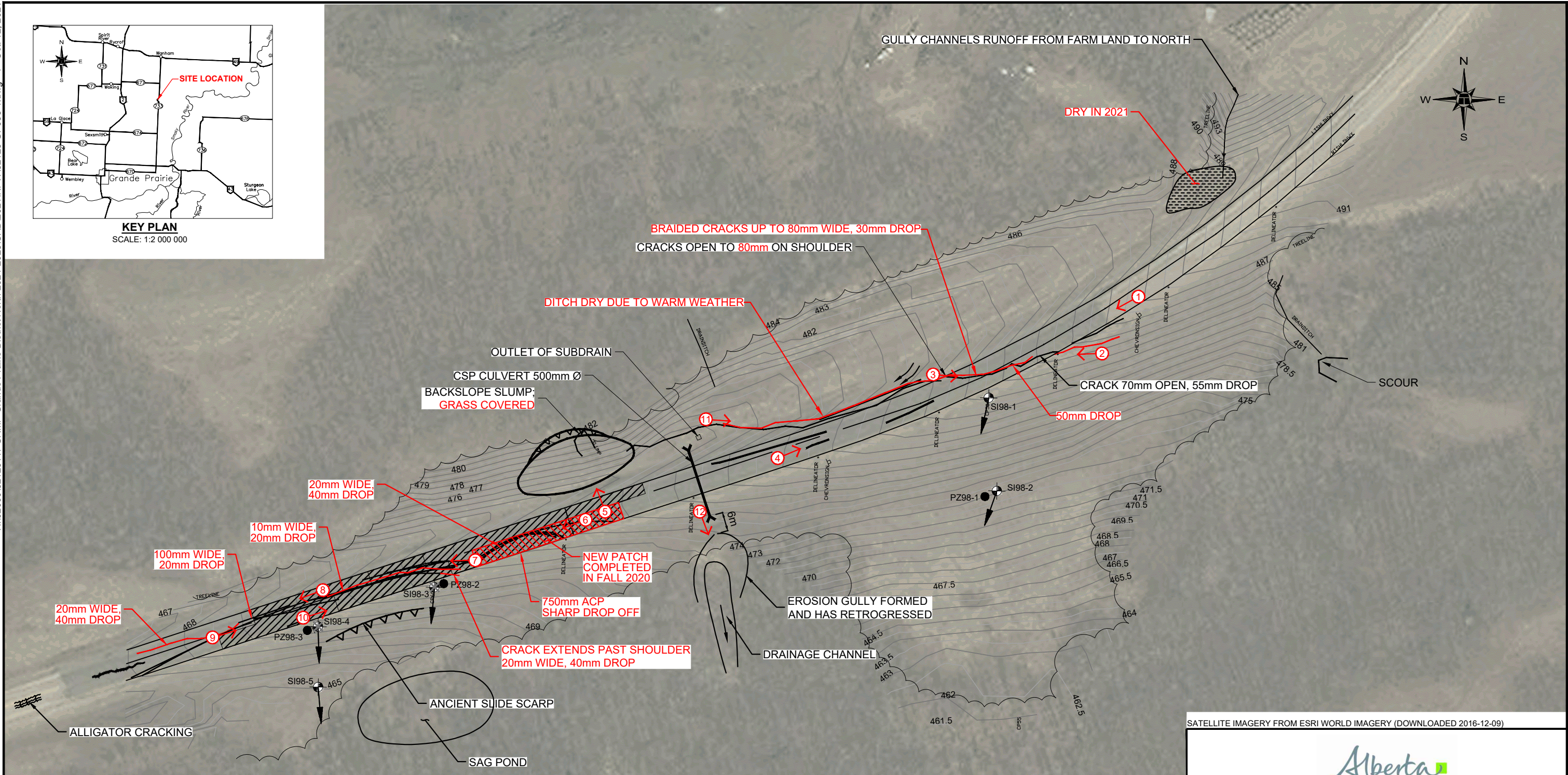
Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, 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: 1:2 000 000



SATELLITE IMAGERY FROM ESRI WORLD IMAGERY (DOWNLOADED 2016-12-09)



PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
GP035-1: HWY 733:04 BAD HEART RIVER NORTH

2021 SITE INSPECTION

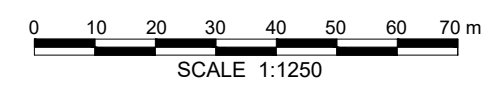
DWG No. 32123-GP035-1

LEGEND

- CRACKS (APPROXIMATE)
- PREVIOUS SLOPE INCLINOMETER (NON-OPERATIONAL)
- PREVIOUS STANDPIPE PIEZOMETER (NON-OPERATIONAL)
- DIRECTION AND NUMBER OF PHOTO
- SLOPE INCLINOMETER DAMAGED

NOTES:

1. PREVIOUS OBSERVATIONS SHOWN IN BLACK.
2. JULY 12, 2021 OBSERVATIONS SHOWN IN RED



DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	RVC
SCALE	1:1250
DATE	OCTOBER 2021
FILE No.	32123





Photo 1.
Looking southwest
along Hwy (former
north slide)



Photo 2.
Looking southwest
along Hwy 733 at
sharp shoulder
from successive
overlays (former
north slide).



Photo 3.
Looking northeast
along Hwy 733 at
scarp crack which
extends into
shoulder and
embankment
(former north slide)



Photo 4.
Looking northeast
along Hwy 733
(former north slide).



Photo 5.
Looking northwest
at backslope slump



Photo 6.
Looking southwest
(former south
slide).



Photo 7.
Looking southwest
(end of the former
south slide).



Photo 8.
Looking southwest
(end of the former
south slide).



Photo 9.
Looking northeast
near the south end
of the former south
slide.



Photo 10.
Looking northeast
near the middle of
the former south
slide.



Photo 11.
Looking east at what appears to be the scarp meandering off on the northwest side of the highway



Photo 12.
Looking south at erosion gully.