THURBER ENGINEERING LTD.

June 13, 2023 File No.: 32123

Alberta Transportation and Economic Corridors
Provincial Building
9621 – 96 Avenue
Peace River, Alberta
T8S 1T4

Attention: Max Shannon, Project Administrator

GEOHAZARD RISK MANAGEMENT PROGRAM
PEACE REGION – GRANDE PRAIRIE DISTRICT - NORTH
SECTION D CALL-OUT INSPECTION
HWY 719:02 KM 4.9 BACKSLOPE FAILURE WITH TOE EROSION

Dear Mr. Shannon,

This report presents the results of a call-out for the above-noted site located on Hwy 719:02 at km 4.9. The legal description of this site is NW-28-79-12-W6M. The AADT (average annual daily traffic) on the highway is 380 vehicles per day (verified in September 2022).

Ms. Nicole Wilder, P.Eng. of Thurber Engineering Ltd. (Thurber) undertook a call-out inspection on May 31, 2023.

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

1. BACKGROUND

A slump occurred in the **sou**theast back slope of Highway 719:02 in the east side of a tributary valley to Henderson Creek. The slump is located approximately 250 m north of the bridge over the creek, at km 4.63. The bridge, BF73982-2 on Henderson Creek, is a single span bridge constructed in 2009 and it appears that it is far enough away that the slide does not affect the bridge.

From AT correspondence, the slumping began in 2021 and in 2022 it remained in similar condition as first observed in 2021 and was not affecting the road. Then in May 2023 when there was a period of heavy precipitation the slump moved further into and blocking the ditch causing water to pool and eventually erode the pavement around the sloughed toe material. It is understood that the road was overlayed about five to six years ago. This site was brought to Thurber's attention during the 2023 annual GRMP tour and was assessed during this time.

A brief review of publicly available mapping indicates that the bedrock at this site is in the order of 10 m to 20 m deep (Alberta Geological Survey DIG 2013 0018) and consists of marine clay shale and siltstone of the Kaskapau Formation (Alberta Geological Survey DIG 2013 0018). Surficial geology maps indicate that the site is located near the Henderson creek valley containing colluvium deposits and to the north of the site lies clay and silt plain sediments (University of Alberta Surficial Geology of Grande Prairie Map Sheet).

2. OBSERVATIONS

Observations made during the site visit are illustrated on Figure 1, attached. Selected photographs of the site visit are also attached to this letter.

At the time of the call-out inspection, the main slump on the east side of the highway was approximately 65 m in width, 42 m in length down to the ditch with several internal scarp cracks throughout and an area where the pavement edge has eroded. There was a visible toe roll which was between 0.2 m and 0.3 m in height. The slump extended up past the top of the backslope to the crest of the tributary valley, approximately 16 m above the highway. The backslope was inclined at approximately 2H:1V in the slumped zone and the valley slope above the backslope was generally heavily treed with deciduous and coniferous trees. Relatively flat farmland is present in the plateau outside/above the Henderson Creek valley.

The erosion into the pavement is affecting approximately 4 m in length (measured at the edge of asphalt), was about 75 mm into the asphalt and slightly encroaching into the northbound lane. There appeared to be at least three layers of asphalt exposed in the eroded scarp. There were parallel cracks observed further to the south in the outer wheel path of the north lane but they did not appear to be associated with the toe erosion.

3. INSTRUMENTATION

There is no instrumentation at this site.

4. ASSESSMENT

The likely mechanism of failure at this site is the initial over-steepening of the relatively weak clay slope caused by the 2H:1V backslope cut, followed by a gradual loss of cohesion due to stress relief and weathering, reduing the factor safety against instability to close to unity. In addition to this, concentration of surface runoff flow from the flatter plain above during heavy rain events may have contributed. Creek erosion is likely not a contributing factor to the current landslide condition as the creek angles away from the highway and is over 250 m away from the site.

5. RISK LEVEL

Based on the AT's Risk level rating system, the risk level for this site has been assessed as follows:

Risk (33) = PF (11) x CF (3)

This risk level was based on a Probability Factor (PF) of 11 (active with moderate but increasing rate of movement) and a Consequence Factor (CF) of 3 (site where partial closure of the road could be a result of slide occurrence from a relatively high adjacent cut/valley slope and/or erosion of the road lane by a high rainfall event). Given the relatively low height of the embankment, it is anticipated that the worst case would involve the closure of only the north lane.

6. RECOMMENDATIONS

In the short to intermediate term, it is recommended that the local MCI slightly grade the highway ditch at the slump location to promote surface drainage and allow the built-up ponded water to drain. To accomplish this, a culvert should be installed parallel to the highway under the landslide mass that is toeing out along the east ditch, extending approximately 90 m from northern to southern flanks, to allow unrestricted flow of surface drainage. Excavated material from the ditch should be placed back over the ditch culvert to form a shallow toe berm. It should be noted that excessive removal of material from the toe of the slope could result in accelerated landslide movement.

Potential long-term repairs may include cutting back the backslope and tributary valley slope at the landslide location to a flatter inclination, possibly together with the installation of French drains in the flattened slope as well as surface drainage enhancements (like a catchwater ditch at the crest of the slope). Slope flattening would likely require acquisition of additional right-of-way. A detailed topographic survey, a few test holes with standpipe piezometers in them and some slope stability analyses should be undertaken to design the details of suitable long term repair measures.

THURBER ENGINEERING LTD.

7. CLOSURE

We trust that this information is sufficient for your present requirements. We would be pleased to answer any questions that you may have regarding this letter report.

Yours truly,
Thurber Engineering Ltd.
Don Proudfoot, P.Eng., M.Eng.
Review Principal

PROFESSIONAL ENGINEER ALBERTA
NICOLE WILDER
ID 174073
June 13, 2023

PROFESSIONAL ENGINEER ALBERTA
DONALD PROUDFOOT
ID 51674
June 13, 2023

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: June 13, 2023
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Nicole Wilder, M.Eng., P.Eng.
Geotechnical Engineer
/ak

Attachments
- Statement of Limitations and Conditions
- Figure 1
- Selected Photos

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.

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.

H:\32000\32123 AT GRMP Grande Prairie District North 2021-2025\CAD\2023\32123 HWY 719 CALLOUT.dwg - 1nnn - Jun. 13, 2023

TOE ROLLS

PONDED WATER

PONDED WATER (>1m DEEP)

4m LENGTH OF PAVEMENT AFFECTED AND 0.75m INTO HIGHWAY
PAVEMENT HAS BEEN ERODED

EROSION GULLY UP TO 2.2m WIDTH AND 1.3m DEEP

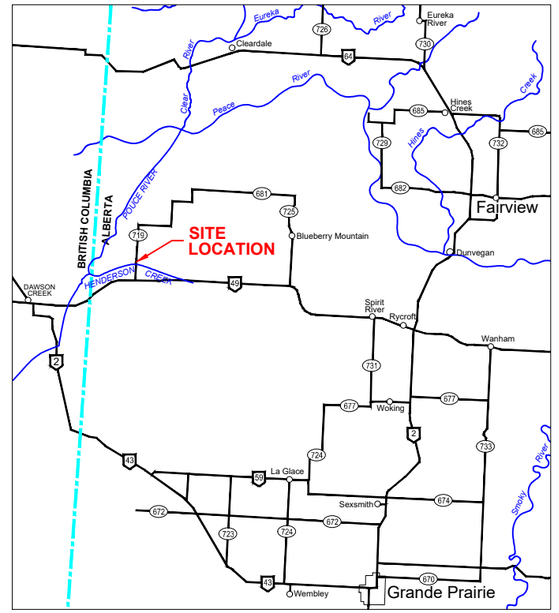
1.5m HIGH BACKSCARP

SOIL SLAB THAT SLOUGHED DOWNSLOPE

3.5m HIGH BACKSCARP

HWY 719:02

N
W E
S



KEY PLAN
SCALE 1:1 500 000

LEGEND

- SCARP CRACK
- INTERNAL SCARP CRACK
- WATER COURSE
- DIRECTION AND NUMBER OF PHOTO
- FENCE LINE

0 10 20 30 40 50m
SCALE 1:750

AIR PHOTO FROM ESRI WORLD IMAGERY EXPORTED ON JUNE 5, 2023

Alberta

PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)
HWY 719:02, km 4.9

SITE PLAN
FIGURE 1

DWG NO. 32123-HWY 719-CALLOUT-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:750
DATE	JUNE 2023
FILE No.	32123

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PHOTOS

Photo 1. Looking northeast at where water has eroded the highway. Photo credit: Nicole Wilder.

Photo 2. Looking southwest at where water has eroded the highway. Photo credit: Nicole Wilder.

Photo 3. Looking northeast at where water has ponded north of where pavement was affected. Photo credit: Nicole Wilder.

Photo 4. Looking southwest at where water has ponded north of where pavement was affected. Photo credit: Nicole Wilder.

Photo 5. Looking northeast at where noticeable toe roll is. Photo credit: Nicole Wilder.

Photo 6. Looking south at farm fence above the slope failure. Photo credit: Nicole Wilder.

Photo 7. Looking south at the 3.5 m high backscarp. Photo credit: Nicole Wilder.

Photo 8. Looking northeast at 1.5 m high backscarp. Photo credit: Nicole Wilder.

Photo 9. Looking southeast at scarps above ponded water near toe of the landslide. Photo credit: Nicole Wilder.

Photo 10. Looking southwest at highway and yellow marker. Photo credit: Nicole Wilder.

Photo 11. Looking north at erosion gully just south of where pavement was affected. Photo credit: Nicole Wilder.

Photo 12. Looking north at where erosion continues south of main area. Photo credit: Nicole Wilder.

Photo 13. Looking west at where pavement has been eroded. Photo credit: Nicole Wilder.

Photo 14. Looking southwest at highway towards Henderson Creek bridge. Photo credit: Nicole Wilder.