ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA & FORT MCMURRAY DISTRICTS
2022 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
NC 62	3.3 km south of the junction between Hwy 881:15 and 55:14	**SOUTH OF BEAVER RIVER**	881:16	29
Legal Description		**UTM Co-ordinates (NAD 83)**		
SE- 12-63-9-W4M		12 N 603423 E 480622		

	Date	PF	CF	Total
Previous Inspection:	June 12, 2019	10	4	40
Current Inspection:	June 08, 2022	10	4	40
Road AADT:	460		**Year:**	2021
Inspected By:	Tarek Abdelaziz, José Pineda (Thurber) Rishi Adhikari, Amy Driessen, Arthur Kavulok (AT)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	Appearance of cracks on the highway surface within the limits of the remediated portion of the highway side slope.
Dimensions:	About 120 m along the highway
Date of any remediation:	Re-construction of the failed slope and the highway section was undertaken in 2004
Maintenance:	Remediated highway section was paved in 2004; pavement overlay placed in November 2008; stepped gabion baskets over geotextile replaced the above-ground culvert in late 2008

Observations:	Description	Worse?
☑ Pavement Distress	Twist on Hwy surface between two sets of diagonal cracks; 15 mm dip within the middle section of the site	☑
☑ Slope Movement	10 - 40 mm landslide reflective cracks on the highway surface; up to 15 mm drop across the cracks	☐
☑ Erosion	Deadfall and significant erosion downstream and around the mouth of the gabion basket channel; erosion created a gap below the gabion basket at the mouth of the channel	☑
☑ Seepage	Sub-drain pipes could not be located	☐
☐ Bridge/Culvert Distress		☐
☑ Other	Five new beaver dams noted at the toe of the landslide	☑
Instrumentation: None		

Assessment (Refer to attached Figure):

The highway condition is slightly worse than observed in 2019, as evidenced by opening/extension of existing highway cracks, and the more distinct dip within the middle section of the site.

The appearance of cracks on the highway surface is probably a reflection of continued creep movement of the repaired slope. Infiltration of surface water into open cracks and rise in groundwater levels within the embankment are likely the main causes for the observed movement.

The rise in groundwater levels within the embankment can be attributed to (a) partial or complete plugging of subdrain pipes located at the bottom of the slope, and (b) presence of multiple large beaver ponds within the creek channel below the highway.

At present, the movement appears to have a moderate impact on the highway condition, except for the twist developed on the highway surface which creates a rough ride to motorists.

It is anticipated that the highway condition will continue to deteriorate progressively unless groundwater levels are reduced within the repaired slope area.

The gap developed below the mouth of the gabion basket channel should be treated; otherwise, it may get bigger and wider, and retrogress to undermine the integrity of the entire channel.

Recommendations:

It is recommended that the site be visited again in 2024.

In the short-term, the local MCI should undertake the following:

- Seal all open cracks in the highway surface to prevent surface water infiltration into the landslide mass.
- Watch closely for new cracks or extension of existing cracks.
- Place ACP patch at the twist location to provide a smooth ride to motorists
- Clear the beaver dam(s) and re-locate the beaver(s) to reinstate proper creek flow and avoid damming of water within the limits of the repaired slope area.
- Locate and clean up the subdrains located at the toe of the slope.
- Monitor erosion developing around the mouth of the gabion basket. If it becomes worse with time, the gap below the gabion basket should be backfilled, and riprap rock should be placed at the mouth of the channel to reduce the likelihood of undermining the entire channel.

It is recommended to install geotechnical instruments to quantify slope movement rates at this site.

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.

Yours very truly,
Thurber Engineering Ltd.
Tarek Abdelaziz, Ph. D, P.Eng.
Principal | Senior Geotechnical Engineer

PROFESSIONAL ENGINEER ALBERTA
JOSÉ G. PINEDA CARDENAS
October 14, 2022
ID 93452

PROFESSIONAL ENGINEER ALBERTA
TAREK ABDELAZIZ
ID 91085
October 14, 2022

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: _____
RM APEGA ID #: 91085
DATE: October 14, 2022
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

José Pineda, M.Eng., P.Eng.
Associate | Geotechnical Engineer

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.

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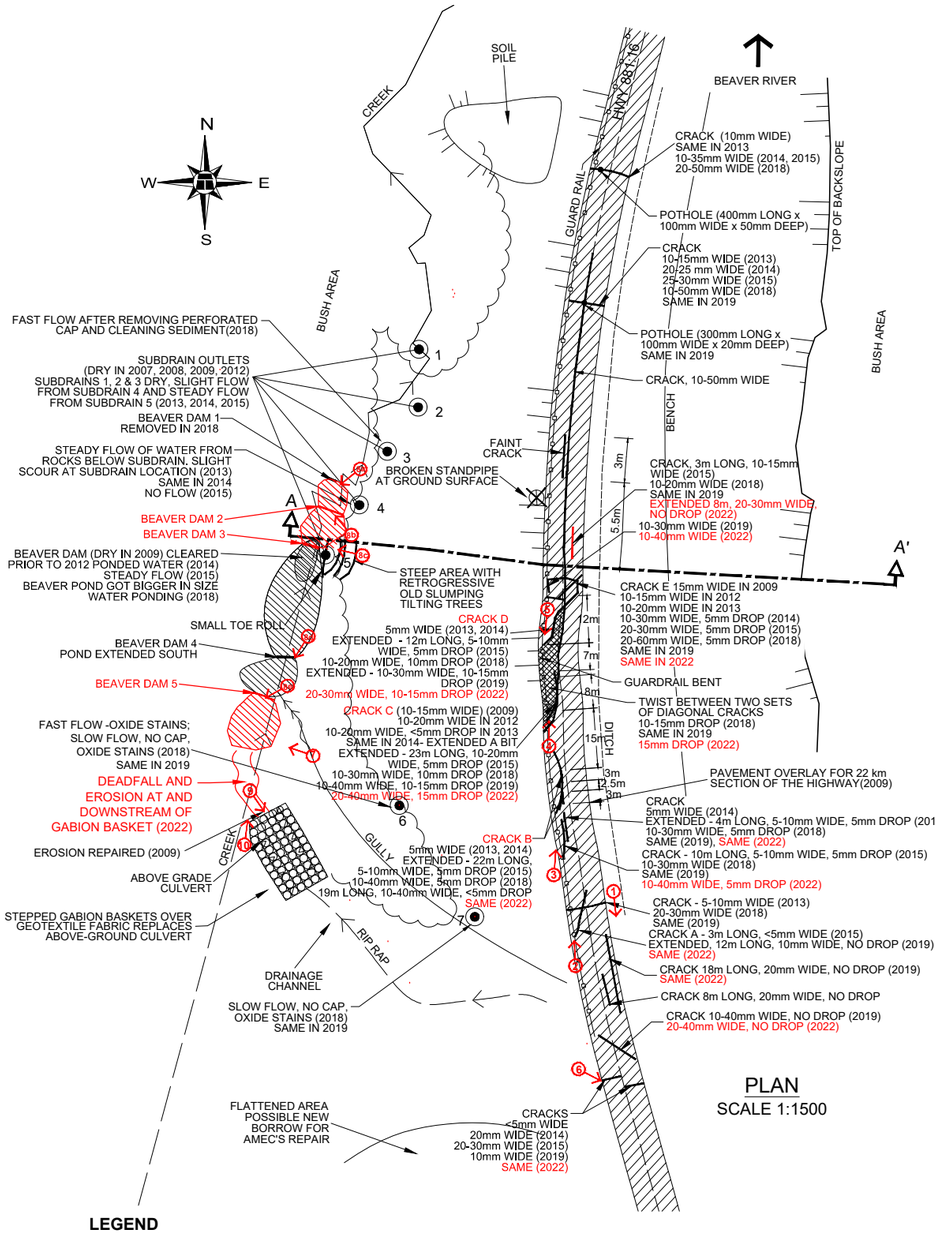
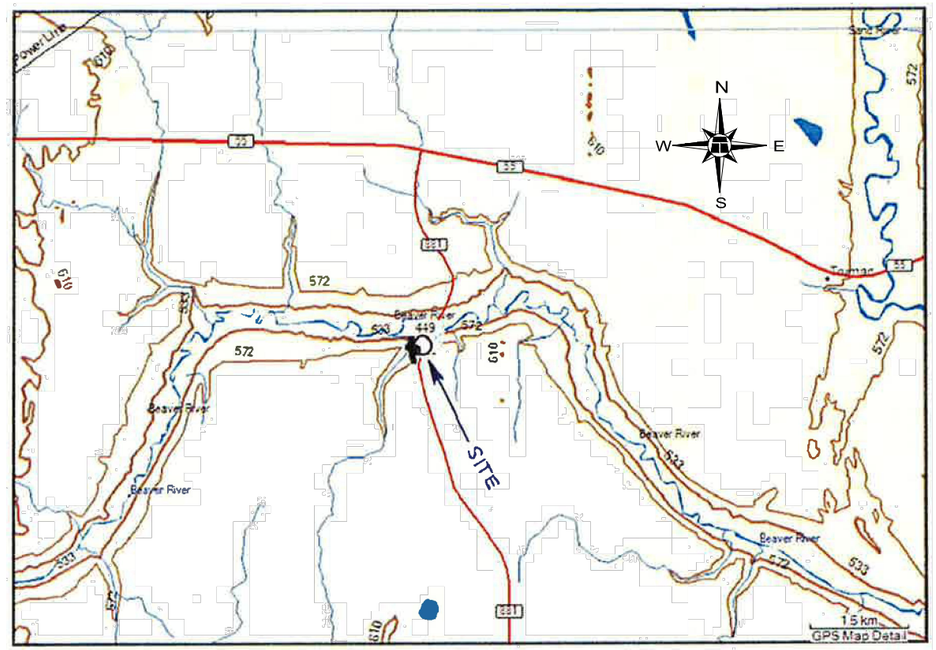
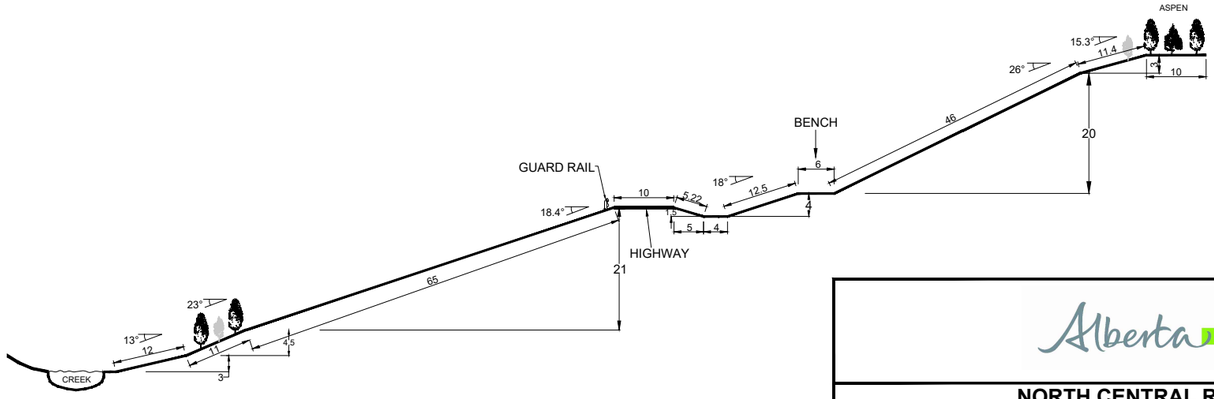


PLAN
SCALE 1:1500



LOCATION MAP
N.T.S.



SECTION A-A'
SCALE 1:1000

LEGEND

- 200mm HDPE PERFORATED SUBDRAIN OUTLET
- GUARDRAIL
- PAVEMENT OVERLAY
- CRACKS
- BUSH LINE
- PHOTOGRAPH NUMBER, AND APPROXIMATE LOCATION AND DIRECTION
- BEAVER POND

SUBDRAIN NO.	EASTING (m)	NORTHING (m)
1	480561	6034350
2	480560	6034336
3	480553	6034325
4	480546	6034311
5	480537	6034299
6	480556	6034236
7	480575	6034208

NOTE: JUNE 8, 2022 OBSERVATIONS SHOWN IN RED

NOTE:

-ALL DIMENSIONS ARE IN METERS.

Alberta

NORTH CENTRAL REGION
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2022 GEOHAZARD ASSESSMENT

NC 62: HWY 881: 16 SOUTH OF BEAVER RIVER (km 3.3)
SITE PLAN AND CROSS - SECTION

DWG NO. 32122-NC062-1

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	AS SHOWN
DATE	OCTOBER 2022
FILE No.	32122

THURBER ENGINEERING LTD.

Photo No.1 - Looking south from the southern limit of the site at longitudinal cracks on the southbound lane

Photo No.2 - Looking north from the southern limit of the site at 10 mm wide diagonal Crack A

Photo No.3 - Looking north from the southern limit of the site at 10 -40 mm wide diagonal Crack B

Photo No.4 – Looking north at a 20-40 mm wide arc-shaped reflective Crack C

Photo No.5 – Looking south at a 20-30 mm wide arc-shaped reflective Crack D

Photo No.6 – Looking east at a 10 mm wide transverse crack near the southern limit of the site

Photo No. 7 – Looking west at fallen trees and creek valley slumping south of Beaver Dam 5

Photo No.8a - Looking at Beaver Dam 1

Photo No.8b - Looking at Beaver Dam 2

Photo No.8c - Looking at Beaver Dam 3

Photo No.8d - Looking at Beaver Dam 4

Photo No.8e - Looking south at Beaver Dam 5

Photo No.9 - Looking at the mouth of the gabion basket channel. Note erosion around and below the base of the gabion basket

Photo No.10 – Looking north at erosion and fallen trees beyond the mouth of the gabion basket channel