ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS GEOHAZARD ASSESSMENT PROGRAM PEACE REGION – GRANDE PRAIRIE DISTRICT - NORTH 2025 INSPECTION

Site Number	Location	Name	Hwy	km
PH001	Dunvegan	Dunvegan Hill, North	2:68	12.60
Legal Description		**UTM Co-ordinates**		
NE¼ 08-080-04 W6M		11U E 400694	N 6198867	

	Date	PF	CF	Total
Previous Inspection:	May 24, 2024	11	4	44 (Rock Fall)
Current Inspection:	May 8, 2025	11 11	4 6	44 (Rock Fall) 66 (Landslide)
Road WAADT:	2,730		**Year:**	2024
Inspected By:	Chris Newman, TEC		José Pineda, Thurber Don Proudfoot, Thurber	
Report Attachments:	☒ Photographs	☒ Plans	☒ Maintenance Items	

Primary Site Issue:	A landslide in the highway backslope. Upslope debris flow/rock fall hazard. The landslide debris consisted primarily of small chunks and small to large sized slabs of silty weathered sandstone bedrock and colluvium mixed with organics.	
Dimensions:	Extends 90 m wide and 90 m north from the highway into the backslope. The lower 30 m of the backslope, where bedrock is exposed is inclined at 1H:1V. The upper 25 m of the backslope where the landslide is located in the colluvium, is inclined at 2H:1V.	
Maintenance:	Debris from upslope slides was removed from the highway surface and north side ditches and shoulders in July 2018 and lock block and jersey barrier walls were erected along the shoulder of the highway to protect the highway from the rockfall hazard. The landslide debris has historically accumulated in the SBL ditch was cleaned in 2022.	
Observations:	**Description**	**Worsened?**
☒ Slope Movement	The approximate plan outline of the landslide is shown on Figure 1. The exposed backscarp height at the center of the landslide was about 6 m. A graben had formed along the base of the scarp. The soil exposed in the backscarp, and slide mass appears to consist mainly of silty sand, with some clay and hard/strong sandstone pieces embedded within it.	☐
☒ Other	Currently, the slide material is toppling over the edge of the steep bedrock slope at a relatively slow rate. Broken pieces of sandstone ledge continue to accumulate between the toe of the backslope and the concrete blocks. Concrete blocks in contact with landslide debris are disintegrating. Larger overhanging sandstone ledges noted in 2025. Lower sandstone ledge starting to crumble 20 m east of the jersey barrier resulting in sandstone blocks (0.9 m diameter by 0.15 m thick) accumulating on the backslope and ditch.	☒

Instrumentation:

There are no available records of previous geotechnical investigations and there are currently no instruments installed at the site.

Assessment:

In the past, debris flows in this area have typically occurred in the gullies due to the concentration of surface runoff water from heavy rain fall events and buildup of debris from sloughing slopes.

The inferred slip surface for the landslide is in the base of the soil colluvium layer, just above the upper sandstone bedrock layer at an approximate elevation 423 m (Refer to Figure 2). This landslide is considered to have been triggered by either a temporary rise in groundwater perched in the colluvium or a concentration of surface water runoff at this location. The primary concern for this site is the potential for further colluvium and weathered sandstone bedrock debris accumulating along the edge of the upper sandstone ledge debris to continue to fall onto the highway causing a risk to public safety. Furthermore, there is also a risk that the cascading landslide debris can dislodge undermined sandstone slabs from the two sandstone layers below that might travel faster and further out into the highway and possibly strike a vehicle.

The maintenance contractor has installed concrete lock blocks and jersey barriers to help contain debris and prevent it from reaching the highway. The biggest threat remains that the remaining slide debris—estimated at approximately 20,000 m^3—could be mobilized in a rapid mudslide during a heavy rainfall event. If this material were to come down all at once, it could displace the concrete barriers and flow onto the highway, potentially leading to a full closure. Another risk is falling blocks from the undermined sandstone ledge that has now extended beyond the protective reach of these barriers.

The provision of the concrete barriers has reduced but not eliminated the risk of further rock falls and landslide debris affecting the safety of the travelling public.

Recommendations:	**Cost**
In the short-term:	
A warning sign should be posted at the top and bottom of the hill section of the highway to warn of higher risk of rockfall and mudslide activity particularly during wet weather conditions.	
The slide material in contact with the concrete lock blocks should be removed and disposed of offsite. Any lock blocks that have deteriorated should be replaced with new ones. Additionally, the coverage of the concrete lock blocks should be extended to align with the observed rockfall area beyond the eastern end of the existing jersey barrier.	
In the long-term:	
If possible, the remaining slide mass should be carefully removed from the top of the slope to reduce the potential for further debris to fall onto the highway below. Due to the possibility of crumbling of the edge of the sandstone bedrock layer, equipment should be kept back at a minimum distance of 3 m from the crest of the steep backslope. This could be accomplished using a long reach excavator that would access the site from privately owned land to the north of the landslide. The excavator would push the failed material over the crest of the slope. This would need to be monitored with spotters equipped with two-way radios positioned at the top of the steep backslope section and along the highway. Once the outer 15 m of the landslide debris has been removed, the backscarp should be flattened to an inclination of 2.5H:1V and the remaining slide debris should be cut-down and flattened as a buttress with a slope angle of 5H:1V. Depending on the extent of the backscarp, this may require the acquisition of privately-owned land above the current landslide.	$250,000
An alternate plan would be to leave the landslide mass to tumble down the backslope at its own rate and complete regular maintenance to remove the fallen debris during dry weather conditions to maintain a storage capacity behind the barriers and allow the ditch to pass runoff drainage. This option is what is currently being done at site but carries a higher risk of injury to the public if an extended period of heavy rain fall occurs.	

CLOSURE

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement for Use and Interpretation of Report.

Don Proudfoot, P.Eng.
Partner | Senior Geotechnical Engineer

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: October 2, 2025
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Jose Pineda, P.Eng.
Associate | Senior Geotechnical Engineer

THURBER

STATEMENT FOR USE AND INTERPRETATION OF REPORT

1. STANDARD OF CARE

This Report has been prepared in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances at the same time and in the same or similar locality and in compliance with all applicable laws.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment, including this Statement For Use and Interpretation of Report, 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.

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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.

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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 is inherently judgement-based. 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 parties making use of such documents or records with or without our express written consent need to 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 parties. Some conditions are subject to change over time and those making use of the Report need to be aware of this possibility and understand that the Report only presents the interpreted conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client must 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 based on conditions in evidence at the time of site inspections and based on 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 resulting from misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other parties 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 is recommended to 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 need to 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 to confirm and document that the site conditions do not materially differ from those 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.

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BACKSCARP 6m HIGH (2021, 2023, 2024)

EXTENT OF ACTIVE LANDSLIDE (2025)

SANDSTONE BLOCKS

GULLY WITH ERODED FALLEN SLABS (2024, 2025)

GULLY: 1m WIDE, 0.3m DEEP
SAME (2024, 2025)

GULLY UNDERMINING SANDSTONE BLOCKS; MORE GULLY EROSION UNDERMINING SANDSTONE BLOCKS; DRY (2023)
MORE EROSION AND LARGER OVERHANGING OF SANDSTONE LEDGES (2025)

OVERHANGING SANDTONE LEDGE - 0.9 m DIAMETER BY 0.15 m THICK FLAT ROCKS FELL (2025)

SLOUGHING SANDSTONE SLAB

SANDSTONE LEDGES

ACTIVE TOE ROLL

FOUR ROCK BLOCKS
UP TO 3 m LONG X 1.2 m WIDE
X 0.8 m DEEP(2024, 2025)

TALUS

FRESH SLUMPING AND BARE OF VEGETATION (2025)

1.2m x1.2m x 2.3m ROCK BLOCK

ROCK BLOCK
0.8m x 0.6m x 0.3m
(SAME 2024)

JERSEY BARRIERS

SOME VEGETATION GROWTH (2021)

TO FAIRVIEW

12.5 km

EROSION ZONE UP TO 5.5m
WIDE x 8.8m LONG, APPROX
3.9m AWAY FROM WHITE LINE

HIGHWAY NO. 2

TO RYCROFT

12.7 km

12.6 km

JERSEY BARRIERS

150 mm SUBDRAIN
PIPE OUTLET

TWO LEVELS
OF CONCRETE
LOCK BLOCKS

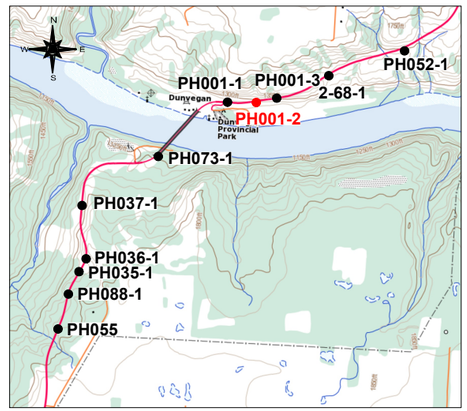
3 BROKEN BARRIERS CAUSED BY ROCK SLIDING; SAME (2023, 2024, 2025)
CONCRETE BLOCKS IN CONTACT WITH LANDSLIDE DEBRIS STARTING TO DISINTEGRATE

600 mm CSP CULVERT -
300 mm BURIED UNDER
SEDIMENT

GABION BASKET - GOOD
CONDITION IN 2024, 2025

450
440
430
420
410
400
390
380
370
360

N
S
E
W



KEY PLAN
SCALE: 1:75 000

LEGEND

- SCARP
- SLOPE BREAK
- GULLY
- DIRECTION AND PHOTO NUMBER
- BARBED WIRE FENCE
- ELECTRIC FENCE

NOTE:

1. MAY 8, 2025 OBSERVATIONS SHOWN IN RED

0 10 20 30 40 50 60m
SCALE 1:1000

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PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)

PH001: DUNVEGAN HILL - NORTH
2025 PH001 INSPECTION PLAN

FIGURE 1

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	DWP
SCALE	1:1000
DATE	SEPTEMBER 2025
FILE No.	32123

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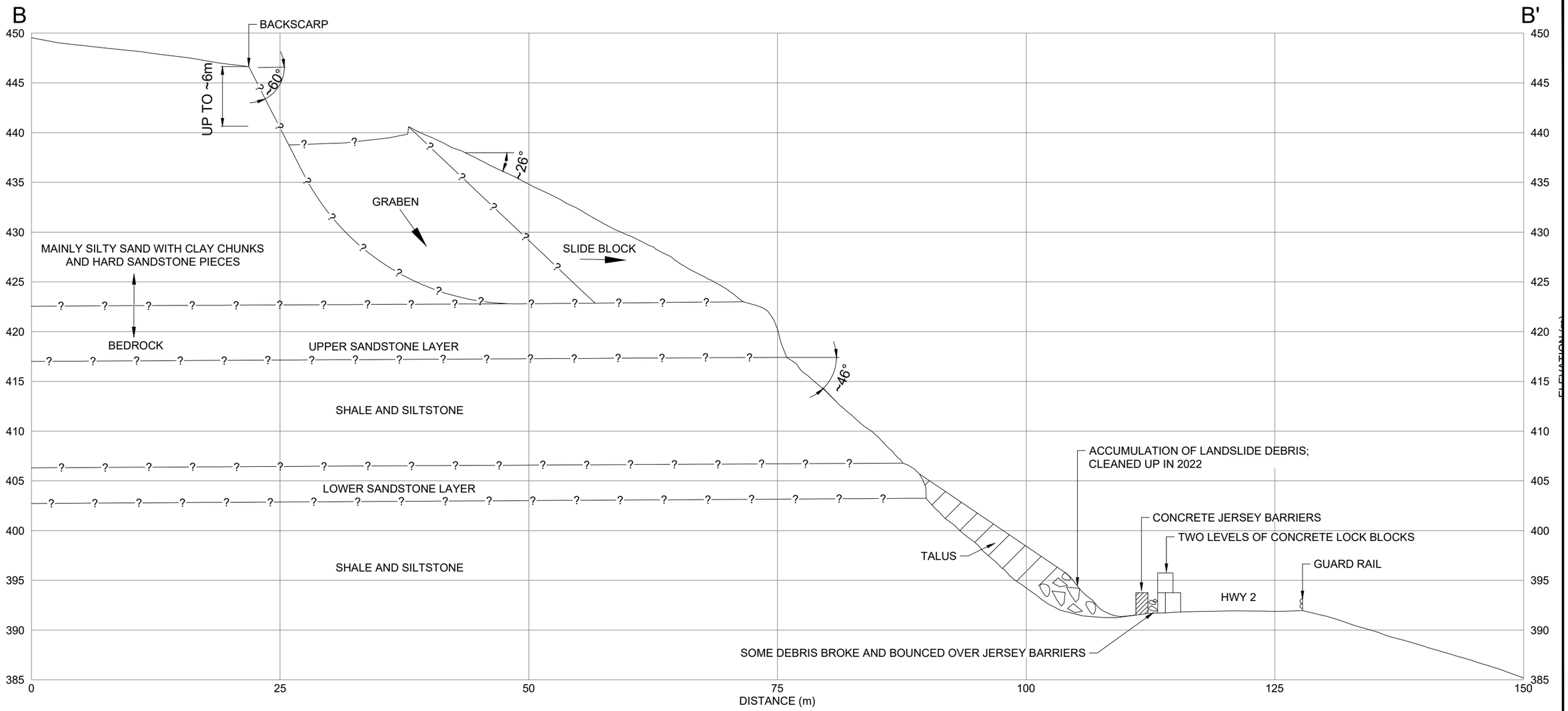

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PEACE REGION (GRANDE PRAIRIE DISTRICT - NORTH)

CROSS - SECTION B - B'

FIGURE 2

DRAWN BY	ML
DESIGNED BY	JGP
APPROVED BY	DWP
SCALE	1:400
DATE	SEPTEMBER 2025
FILE No.	32123

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Aerial Photo 1: Looking west at the landslide site and surrounding area

Photo 2: Looking west at the highway backslope and concrete barriers below the landslide

Photo 3: Looking west at accumulated debris in the ditch below the landslide.

Photo 4: Area where sandstone slabs, talus, boulders accumulated the most prior to the 2022 clean up. Note fresh slumping on the lower backslope on the right of the photo. Concrete blocks that are in contact with landslide debris are starting to disintegrate.

Aerial Photo 5: Looking northwest where landslide debris has been toppling over the edge of the steep bedrock slope

Photo 6: Landslide backscarp showing movements since 2023.

Aerial Photo 7: Few sandstone rock slabs accumulating behind the Concrete Jersey Barrier

Photo 8: Looking east at steep rock backslope and a few sandstone blocks accumulating behind the Concrete Jersey Barrier

Photo 9: Subdrain outlet located upslope from gabion basket. Dry in 2025

Photo 10: Gabion Basket. Acceptable condition in 2024

Photo 11: Lower sandstone ledge starting to crumble 20 m east of Jersey barrier.