

**ALBERTA TRANSPORTATION  
GEOHAZARD ASSESSMENT PROGRAM  
PEACE REGION (PEACE RIVER DISTRICT)  
2022 INSPECTION**



| Site Number        | Location            | Name             | Hwy         | km        |
|--------------------|---------------------|------------------|-------------|-----------|
| SH006-1            | North of Swan Hills | Klumph Creek     | 33:14       | 18.1-18.6 |
| Legal Description  |                     | UTM Co-ordinates |             |           |
| NE28/SE33-70-9-W5M |                     | 11U E 608,502    | N 6,107,107 |           |

|                             | Date   | PF | CF   | Total |
|-----------------------------|--|----|--|-------|
| <b>Previous Inspection:</b> | 1-Jun-2020   | 10 | 4  | 40    |
| <b>Current Inspection:</b>  | 30-May-2022  | 10 | 4  | 40    |
| <b>Road AADT:</b>           | 680  |    | <b>Year:</b>   | 2022  |
| <b>Inspected By:</b>        | Rishi Adhikari, TRANS<br>Ed Szmata, TRANS<br>Max Shannon, TRANS<br>Rodney Johnston, TRANS  |    | Ken Froese, Thurber<br>Mark Gallego, Thurber<br>Rob Cottreau, Thurber (GIS)<br>Trevor Sterling, Thurber (Safety) |       |
| <b>Report Attachments:</b>  | <input checked="" type="checkbox"/> Photographs<br><input checked="" type="checkbox"/> Plans<br><input type="checkbox"/> Maintenance Items |    |  |       |

|                             |   |
|-----------------------------|---|
| <b>Primary Site Issue:</b>  | Highway crosses active slide area approximately 700 m in width over an overall slope height of 57 m. Movement appears to be 6 m to 13 m deep in upper portion of weathered bedrock or bottom of clay overburden at bedrock contact likely triggered initially by toe erosion by the highly mobile Swan River. Movement is manifested on the highway at each end of the scarp: transverse cracking at the north and culvert distress at the south. |
| <b>Dimensions:</b>          | 500 m of highway length with an embankment fill height between 4 m to 10 m in height (north to south).<br>1988: 40 m wide portion of west slope of embankment failed damaging both culverts which was repaired.   |
| <b>Date of Remediation:</b> | 2001: Construction of toe berm (600 m long) with sand subdrains using excavated material (390,000 m <sup>3</sup> ) from upslope areas for off-loading. Outlets of 1200 mm and 900 mm culverts at Klumph Creek were repaired and extended.   |
| <b>Maintenance:</b>         | 2016: ACP patch placed over cracks at north end of site.<br>2017: Overhead powerline installed on east side of highway.<br>2020: Patching at north end of site.   |

| Observations:   | Description  | Worsened?                           |
|---|--|-------------------------------------|
| <input checked="" type="checkbox"/> Pavement Distress       | Crack pattern at north end of site has reflected through patch. Deterioration of driving surface observed over most of the highway length. | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> Slope Movement          | Ongoing movement observed in instruments and confirmed by pavement distress; possible skin slide observed near culvert inlets in 2019.     | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> Erosion                 | Erosion at outlet of north culvert riprap apron noted in 2014 deepened in 2017 and again in 2019.  | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> Seepage                            | Soft/wet areas sometimes observed along ditches in north half of site.   | <input type="checkbox"/>            |
| <input checked="" type="checkbox"/> Bridge/Culvert Distress | Sinkhole (3 m by 2 m) observed in 2013 has not changed in size.  | <input type="checkbox"/>            |
| <input type="checkbox"/> Other                              |  | <input type="checkbox"/>            |

| <b>Instrumentation (Spring 2022):</b>  |   |
|--|---|
| SI10   | Ongoing movement had been present at 10.5 m depth in 2020, the rate of movement had noticeably accelerated in the last year, and it sheared off at 11.0 m in Spring 2021  |
| SI18-30 to -35   | The two deeper movements zones identified in SI18-30 have been combined into one larger zone (13.0 m to 14.8 m depth) which has a cumulative movement of 22 mm representing an increase of 3 mm since Fall 2021. SI18-31 has developed a movement zone at 13.2 m depth with cumulative movement of 20 mm. SI18-32 at 15.5 m depth has a cumulative movement of 11 mm, SI18-33 at 16.4 m depth has a cumulative movement of 16 mm. SI18-34 has developed a potential movement zone at 10.0 m with a cumulative movement of 1 mm. The near-surface movement zone at SI18-35 has not developed further and the movement zone at 5.4 m depth has cumulative movement of 5 mm. Movement rates at SI18-30 and -31 have been steady; -32 has slowed over the last year; -33 had accelerating movement when it first began but has become steady; -34 is steady but at a very low rate; and -35 appears to have stabilized at a low rate over the last two years. |
| SP00-2, SP00-6A, SP00-6B   | SP00-2 and SP00-6A have stabilized in the last year at historical high water levels. SP00-6B has been increasing the last two years and is now at an historical high.   |
| PN18-30 to -35   | Water levels in 2018 piezometers increased from installation to historical highs in Fall 2019 or Spring 2020 and have now begun to decrease with PN18-34 and -35 below initial water levels. PN18-32 has been relatively stable over the last two years. PN18-30, -31, and 33 increased in Spring 2022.   |
| Damaged/<br>Destroyed  | SI10 (11 m depth), SI11 (5.7 m depth), SI00-5, SI00-6, SP00-5 (unable to locate)  |
| <b>Assessment:</b>   |   |
| <p>The landslide is still active, albeit at a slow, creeping rate of movement. Instrumentation installed in March 2018 initially measured slow movements near the highway at about 13 m to 14 m depth and has now, as of 2022, identified movement zones in all inclinometers, including those further downslope from the highway. Asphalt milling and patching (latest in 2020) is still required about every three to four years to maintain the roadway at the north end of the site where it crosses the landslide scarp. Milling may be required in the next couple of years to reduce the humps that will likely form at the north end of the site. The highway was recently patched and not all of the cracks have reflected through yet. For those that have, differential over the cracks was not observed.</p> <p>The instrumentation installed in early 2018 has revealed ongoing creep movement which is impacting the highway surface. However, given the large size of the landslide and slow movement rate, periodic patching of the asphalt at each flank appears to be the most cost-effective method of dealing with the landslide movements. However, continued monitoring of the site (visual and instrumentation) is recommended to manage the risks.</p> |   |
| <b>Recommendations:</b>  |   |
| <b>Short-Term:</b>   |   |
| <ul style="list-style-type: none"> <li>▪ Short-term road maintenance (patching and milling to provide a safe, smooth surface) should continue as required.</li> <li>▪</li> </ul>   |   |
| <b>Ongoing Investigation:</b>  |   |
| <ul style="list-style-type: none"> <li>▪ It is recommended that the twice-per-contract Geohazard inspection and twice-annual instrumentation readings schedule be maintained.</li> </ul>   |   |

**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

Ken Froese, P.Eng.  
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.

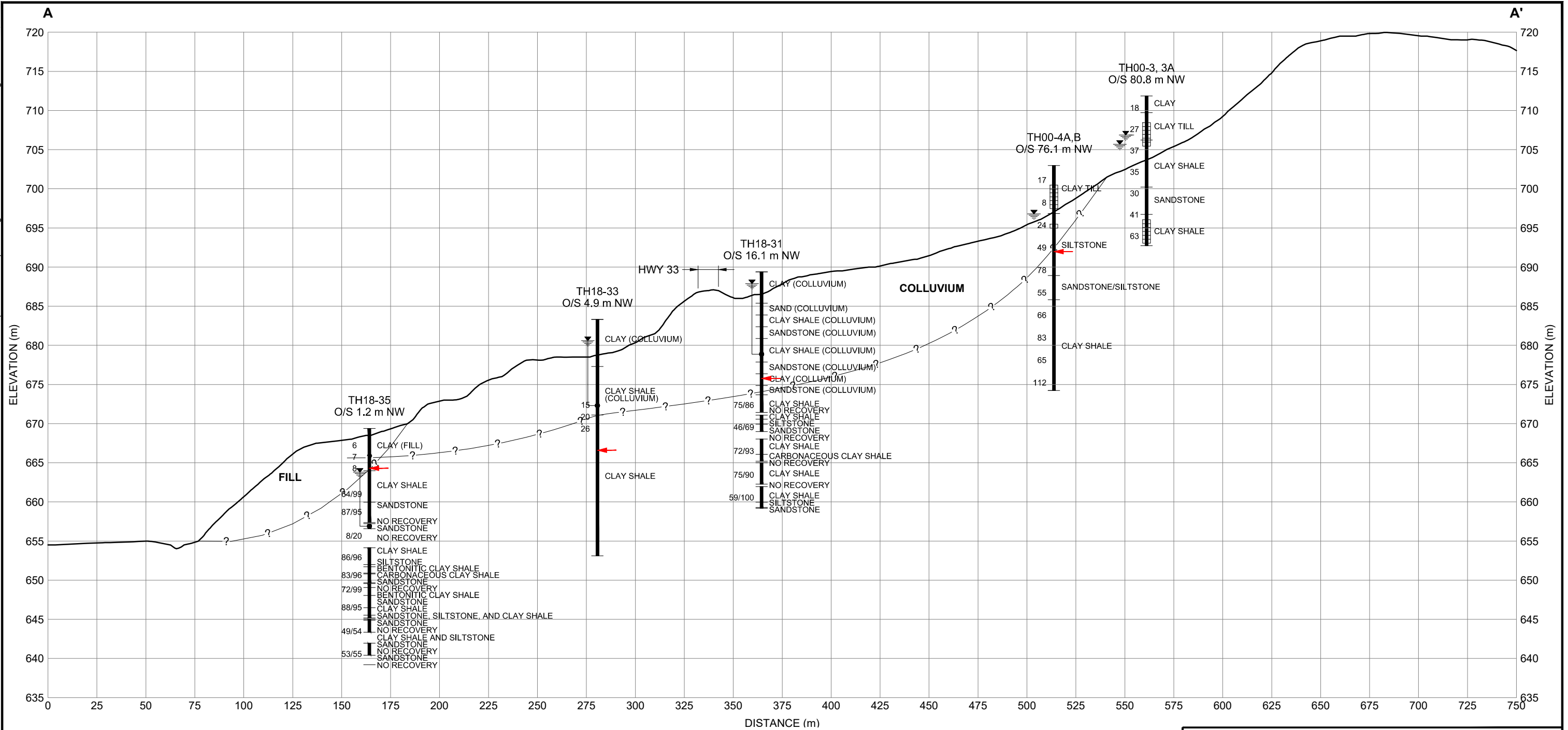
### 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

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

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**LEGEND**

- SPT N VALUE
- WATER LEVEL IN PIEZOMETER
- PIEZOMETER TIP LOCATION
- STANDPIPE PIEZOMETER SCREENED INTERVAL
- ZONE OF MOVEMENT IN SLOPE INCLINOMETER

**NOTES**

1. DATA CONCERNING THE VARIOUS STRATA HAVE BEEN OBTAINED AT THE TEST HOLE LOCATIONS ONLY. THE SOIL STRATIGRAPHY BETWEEN TEST HOLES HAS BEEN INFERRED FROM GEOLOGICAL EVIDENCE AND SO MAY VARY FROM THAT SHOWN.
2. VERTICAL SHIFT OF +172m REQUIRED TO MATCH ORIGINAL GROUND (FROM THURBER DRAWING 15-76-9-1, MAY 2000) TO GEODETIC ELEVATION.



PEACE REGION (SWAN HILLS)

**SH006-1: KLUMPH CREEK SLIDE ON HWY 33:14  
CROSS - SECTION A - A'**

DWG No. 13355-SH006-1-2

|              |                  |
|--------------|------------------|
| DRAWN BY     | KLW              |
| DESIGNED BY  | KEF              |
| APPROVED BY  | DWP              |
| SCALE        | H 1:2000 V 1:500 |
| LAST UPDATED | AUGUST 2018      |
| FILE No.     | 13355            |





Photo 1 – Looking south from east shoulder at main scarp crack and patch at north end of site.



Photo 2 – Looking south from west shoulder at main scarp crack and patch at north end of site. Note powerline installed on east side of highway since 2017 visit.



Photo 3: Looking north at hump over main scrap crack at north end of the site.



Photo 4: Looking south at crack at south end of patch at north end of the site.