



July 30, 2007

File: 15-85-72

Alberta Infrastructure and Transportation
Room 301, Provincial Building
9621 - 96 Avenue
Peace River, AB T8S 1T4

Attention: Mr. Ed Szmata

**PEACE REGION (PEACE – HIGH LEVEL AREA) GEOHAZARD ASSESSMENT
SHAFTSBURY TRAIL (SOUTH SITE)
2007 CALLOUT INSPECTION REPORT**

Dear Sir:

This letter documents the 2007 callout site inspection of an area of slope instability located below Shaftsbury Trail (Hwy 2A:36) within the Town of Peace River. The site is located 2.2 km south of the intersection of Shaftsbury Trail and Highway 2.

Thurber Engineering Ltd. (Thurber) undertook this inspection in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE047/2004) with Alberta Infrastructure and Transportation (AIT).

Simon Cullum-Kenyon, P.Eng. of Thurber undertook the inspection on July 5, 2007 with Ed Szmata of AIT and representatives of the Town of Peace River. Two sites were assessed at this time. The second site (designated as the North Site) is reported in a separate call-out letter.

1. BACKGROUND

This site has not been visited before, and no site binder currently exists. Rapid flow of mud, water and debris (mainly trees) has occurred from the slope below the highway onto the properties at the toe of the slope. This was reported to have occurred at least 3 times in the last three years at this location, with each event associated with heavy rain fall. Town of Peace River personnel also reported that

during heavy rainfall events water runs off the highway and towards the slope in this area.

2. SITE OBSERVATIONS

Selected photographs taken during the visit are attached.

In this area, Shaftsbury Trail runs north-south along the crest of a slope over a terrace of the Peace River, with several residences located on the terrace below the road. The slope has a height of about 15 m to 20 m and an overall slope angle steeper than 40°. The crest of the slope is approximately 10 m from the highway. The area between the highway and the slope is well vegetated, and has a very shallow slope.

The upper portion of the slope (estimated as 3 m to 5 m vertically) is comprised of a silty sandy clay, containing clasts ranging from gravel size to boulders. This portion of the slope was well vegetated and less steep. Beneath this, the slope was comprised of sandstone, forming a steeper, but well treed cliff over the remainder of the slope. There appears to be a gravelly horizon above the sandstone. Some organic colluvial soils have developed on the slope. Some of the trees on the slope appear to be dead (no leaves).

As shown in Photos 1 and 2, the failed materials have a relatively small volume, but appear to be very mobile, flowing from the slope to the terrace below. There does not appear to be a threat to the highway at this time.

3. ASSESSMENT

These failures can be described as small debris flows. They would have been triggered by saturation of the colluvial soils by either an increase in groundwater or a concentration of surface water at this location. Either of these could have been caused by the reported heavy rainfall prior to the slides. The clay soils would have essentially liquefied and flowed down the slope. The sandstone appears to be relatively intact. The vegetation and soil on the slope flowed with the failures, but remains intact on adjacent portions of the slope.

The main concern at this site is the potential for further debris flows affecting the use and safety of the properties below the slope. The highway does not appear to be at risk at this time.

4. RISK LEVEL

The risk level for this site (relative to highway issues) has been assessed as follows:

$$PF(7) * CF(1) = 7$$

A Probability Factor of 7 is considered appropriate since the slides have been reported to have occurred in each of the past three years and additional movement could occur following heavy or prolonged rainfall. A Consequence Factor of 1 is considered appropriate since loss of a portion of the roadway is unlikely, as is a threat to driver safety.

5. RECOMMENDATIONS

The two general methods used to mitigate debris flow hazards are to remove the source material and/or manage the debris (i.e. stop or direct the debris away from downslope facilities, often with a berm or other structure). Due to the small scale of this site, managing surface and/or groundwater flow may also be beneficial.

Removal of the source material would involve flattening of the slope and would require removal of the existing vegetation and soils on the sandstone cliffs, combined with stabilisation of the soils on the upper portion of the slope. Removal of the vegetation on the upper portion of the slope would be detrimental to the stability, and therefore this would not be a preferred solution.

Managing the debris from potential future slides by construction of a berm along the toe of the slope to collect it should be feasible. Such a berm would have to be properly designed in terms of height and "storage" capacity. Note that periodic "cleaning out" of the berm would be required. As an initial estimate, we would expect the cost of such a berm to be in the order of \$50,000, but would depend on access, which may require the use of small equipment.

Installation of a curb along the highway may be beneficial, to direct surface water to a controlled location. Note that surface water from the road is only considered as a possible contributor to the slide(s) and hence should not be relied upon as the sole solution. A catch basin is located 150 m south of the site, which may be an appropriate point to direct surface water – grades and elevations should be checked to confirm this. The estimated cost of constructing a 200 m long asphalt curb in this area is \$10,000.

6. CLOSURE

We trust this assessment and recommendations meet with your needs at this time. Please contact the undersigned should questions arise or if the slide condition worsens.

Yours very truly,
Thurber Engineering Ltd.
Simon Cullum-Kenyon, P.Eng.
Review Engineer

<p>PERMIT TO PRACTICE THURBER ENGINEERING LTD.</p> <p>Signature _____</p> <p>Date _____</p> <p>PERMIT NUMBER: P 5186 The Association of Professional Engineers, Geologists and Geophysicists of Alberta</p>
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Chris Workman, P.Eng.
Principal Engineer

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is 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 us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which 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. WE CANNOT BE 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 us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this Report expressly addresses proposed development, design objectives and purposes, and then only to the extent there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation or to consider such representations, information and instructions.

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 OUR WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS WE MAY EXPRESSLY APPROVE. The contents of the Report remain our copyright property. The Client may not give, lend or, sell the Report, or otherwise make the Report, or any portion thereof, available to any person without our prior written permission. Any use which a third party makes of the Report, are the sole responsibility of such third parties. Unless expressly permitted by us, no person other than the Client is entitled to rely on this Report. We accept no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without our 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 this report is delivered on 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. Where 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 us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot 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 us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

INTERPRETATION OF THE REPORT *(continued)*

- c) Design Services: The Report may form part of the design and construction documents for information purposes even though it may have been issued prior to the final design being completed. We should be retained to review the final design, project plans and documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the report recommendations and the final design detailed in the contract documents should be reported to us immediately so that we can address potential conflicts.
- d) Construction Services: During construction we must 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 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. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Client's benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot 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.



Photo 1.
Cartier residence slide.
Debris from the slope has entered the developed area below. Note some apparently dead trees on the slope.



Photo 2.
Slide to the south of the
Cartier residence.



Photo 3.
Crest of the slope above the
Cartier residence slide.



Photo 4.
Highway upslope of the failure area. The edge of pavement is roughly 10 m away from the crest of the slope.