

May 21, 2014

City of Whitehorse
2121 2nd Avenue
Whitehorse, YT Y1A 1C2

ISSUED FOR USE

FILE: W14103395-01

Via Email: Wayne.Tuck@whitehorse.ca

Attention: Wayne Tuck, P.Eng.
City Engineer

Subject: Slope Stability Assessment South of Hawkins Street
Whitehorse, YT

1.0 INTRODUCTION

The City of Whitehorse retained Tetra Tech EBA Inc. (Tetra Tech EBA) to complete a stability assessment of the silt bank slope below the airport south of Hawkins Street in Whitehorse, Yukon. An instability occurred on May 13, 2014 that resulted in downslope movement of soil that was sufficiently large to close the hiking trails in this area. The purpose of Tetra Tech EBA's assessment was to describe and comment on the movement processes occurring at the site, with specific reference to differences between this site and the slope stability assessment completed at Lots 706 and 708 Ogilvie Street. This report summarizes the observations from a site visit on May 15, 2014.

2.0 OBSERVATIONS

Mr. Richard Trimble, P.Eng. and Ms. Kathleen Jarvis, EIT visited the subject site and noted the following observations regarding the recent instability:

- This landslide is considered a surface mudflow, rather than a classic "landslide" with a deep seated rotational failure plane.
- Four back scarps were observed, all of which contributed to the recent mudflow. Photo 1 shows three of the four back scarps.
- Evidence of previous instabilities was observed north and south of the recent landslide (see Photo 2).
- The general soil stratigraphy in this area is eolian sand overlying glaciolacustrine silt. The landscape of the study site south of Hawkins Street is a natural gully created by erosion and previous slope instability processes. It is believed that seasonal snowmelt water from the airport above permeated the surficial sand layer and then seeped horizontally out towards the cliff face on top of the less permeable silt. This additional water would further contribute to a reduction in shear strength of the naturally thawing soil on the slope, resulting in a wet mudflow flowing down the slope.
- The sand/silt contact is shown in Photo 3. Water is evident (looks shiny in the picture) just below the top of the back scarp where the silt layer begins.
- This instability is considered to be a natural process and can be expected during the seasonal thaw and possibly large precipitation events.

3.0 STABILITY AT LOTS 706 AND 708, OGILVIE STREET

The conclusions and recommendations in the “Detailed Terrain Stability Hazard Assessment” report submitted to the City of Whitehorse on June 19, 2013 for Lots 706 and 708, Ogilvie Street are still valid. Although there is evidence of creep (trees on the cliff are slightly bending at the base), the cliff face is dry indicating less water and effects from seasonal thawing. The lack of moisture helps prevent movement processes similar to those observed south of Hawkins Street.

4.0 PREVIOUS DETAILED TERRAIN EVALUATIONS

The recommendations presented in previous detailed terrain stability evaluations for the sites at the end of Main Street and Lambert Street are still valid and should be considered.

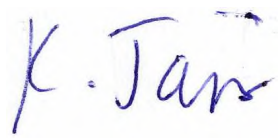
5.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the City of Whitehorse and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than the City of Whitehorse, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA’s Services Agreement. Tetra Tech EBA’s General Conditions are provided in Appendix A of this report.

6.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.



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PHOTOGRAPHS

- Photo 1 Three of four back scarps contributing to the recent landslide south of Hawkins Street
- Photo 2 Evidence of previous instabilities north of the recent landslide
- Photo 3 Back scarps showing sand/silt contact



Photo 1: Three of the four back scarps at the site (May 15, 2014)

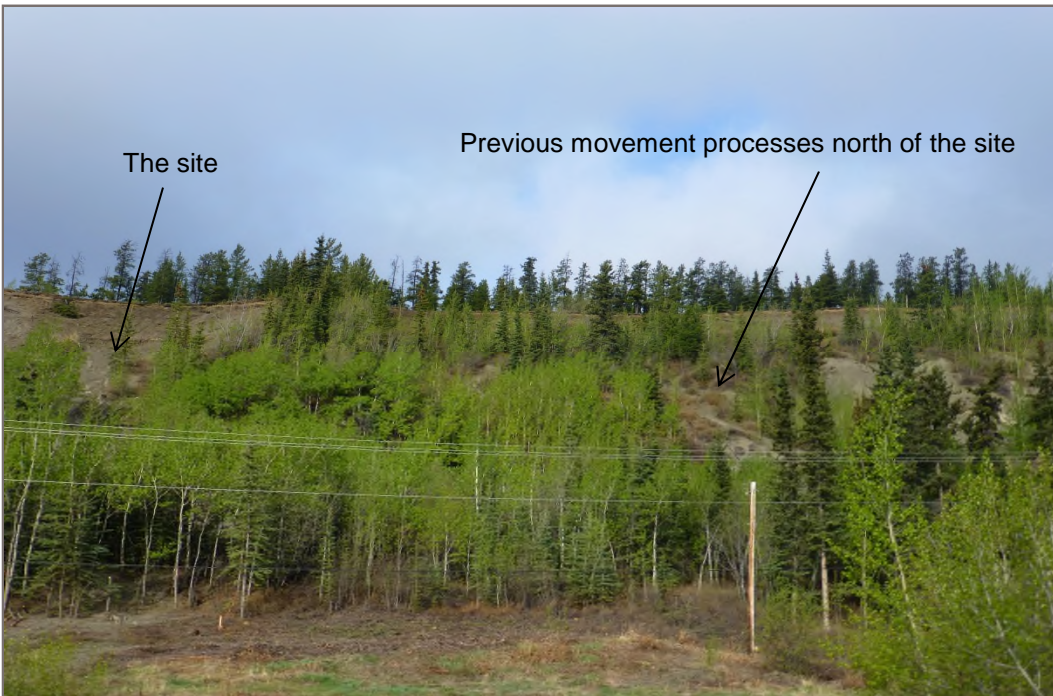


Photo 2: Evidence of previous movement processes north of the site (May 20, 2014)



Photo 3: Sand/Silt contact (May 15, 2014)

APPENDIX A

TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Tetra Tech EBA's Client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA's Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. Tetra Tech EBA's instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, Tetra Tech EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. Tetra Tech EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. Tetra Tech EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

Tetra Tech EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.