January 26, 2023 Ecora File No.: 230018-02

Regional District of Okanagan-Similkameen
101 Martin Street,
Penticton, BC
V2A 5J9

Attention: **Mr. Sean Vaisler. MA, DEM, AEM, Manager, Emergency Services**

Reference: **Emergency Geotechnical Assessment for 3169 10th Avenue, Keremeos, BC**

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1. Introduction

1.1 General

The Regional District of Okanagan-Similkameen (RDOS) has retained Ecora Engineering & Resource Group Ltd. (Ecora) to carry out an emergency geotechnical assessment for the property located at 3169 10th Avenue, Keremeos, BC that was impacted by a rock fall event that occurred on January 16th, 2023.

Ecora was initially contacted on the afternoon of January 16th, 2023 by the RDOS, who provided information and photos of the incident. Ecora was also in contact with representatives from the BC MoTI regarding the rock fall event, who coordinated a helicopter reconnaissance of the rock fall source, impacted portion of the highway and private property below.

This report summarizes Ecora's observations and findings made during the site reconnaissance and provides short-term and long-term recommendations regarding the subject property.

The observations and recommendations with respect to this emergency geotechnical assessment contained within this technical memorandum have been developed specifically for the impacted site located at 3169 10th Avenue, Keremeos, BC and are not considered applicable elsewhere.

1.2 Site Description

The impacted subject site is located at the west end of the Village of Keremeos, at 3169 10th Avenue (Eagle Campground & RV Park) as shown in Figure 1.0. The site is situated on the north side of the Similkameen Valley, between Highway 3 to the north and the Similkameen River to the south. The site is relatively flat with slopes located along the northern boundary of the property that were graded approximately 1.5H:1V and 2.5 m to 3.0 m in height. Highway 3 is located above the subject site.

The toe of a pair of talus fans are located approximately 180 m north of the subject site as shown in Figure 1.0. The fans measure approximately 500 m to 600 m in height with multiple bedrock outcrops located above the fans.

2. Background Review

2.1 Bedrock Geology

Reference to iMapBC and the bedrock geology map "Keremeos, Similkameen District, British Columbia" indicates the bedrock geology above the site consists of chert, siliceous argillite, siliciclastic rocks, some tuff and greenstone of the Shoemaker Formation. Figure 2.1 below contains an excerpt of the referenced map with the location of the site impacted by the January 16th rock fall event and the source zone.

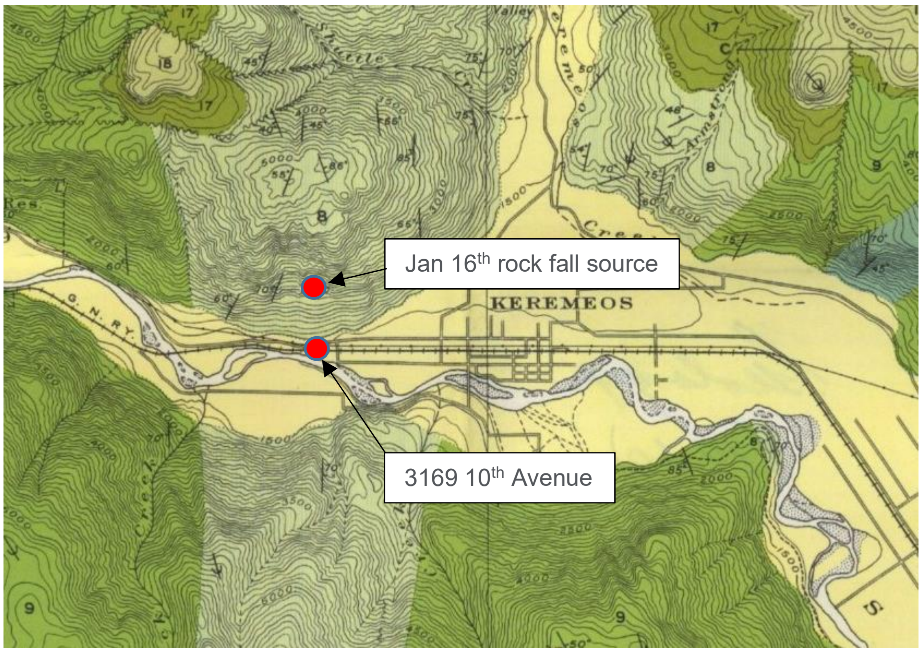

Figure 3.1: Bedrock geology of the Keremeos area.

2.2 Historical Aerial Photography

Aerial photography is available for the subject area for seven decades between 1947 and 2007. Available aerial photographs were reviewed to identify rock fall material near the subject site and nearby properties.

A key observation from the aerial imagery review included what appears to be several large boulders located on the 3169 10th Avenue property and the one situated immediately to the south, 3155 10th Avenue in aerial photograph BC87099 from 1987, indicating that the property had historically been subjected to rock fall prior to development of the Eagle Campground & RV Park. Figure 2.2 below shows an excerpt of the aerial photograph with the boulders (rock fall debris) indicated by red arrows.

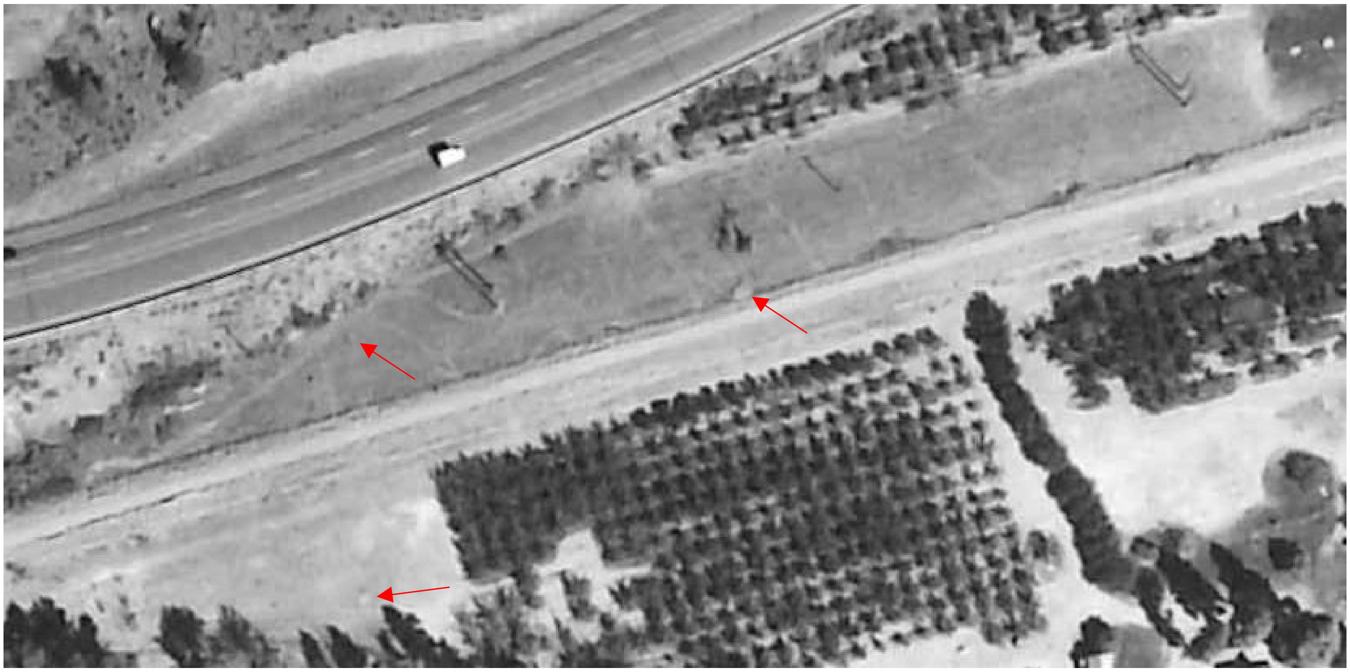

Figure 2.2: View of 3169 10th Avenue and 3155 10th Avenue from aerial photography taken in 1987.

2.3 Local Weather Records

Review of Environment Canada historical weather records for the KEREMEOS 2 weather station located in the Village of Keremeos, indicated a total rainfall of 28.6 mm of rain and 10.0 cm of snow fell on the subject area over approximately one month preceding the rock fall event on February 9th, 1998. The average day-time high temperature from January 8th, 1998 to 13th measured as -9.0 °C with an average overnight-low of -23.0 °C during the same time period. The subject area experienced warmer weather from January 14th to February 1st with an average day-time high of 5.0°C and an average overnight-low of -1.5°C. The seven days leading up to the February 9th rock fall event saw both the average day-time high and overnight-low temperatures above zero, 6.9 °C and 1.7 °C respectively. 18.6 mm of rain was also recorded during this period.

Table 1 Historical Weather Data for the Village of Keremeos

Time Period	Average Day Time High (C°)	Average Overnight Low (C°)	Total Rain (mm)	Total Snow (cm)
January 8th – 13th	-9.0	-23.0	0	9.0
January 14th – February 1st	5.0	-1.5	10.0	1.0
February 2nd – 8th	6.9	1.7	18.6	0

2.4 BC MoTI Records

Based on review of a rock fall report provided by the BC Ministry of Transportation and Infrastructure (BC MoTI) dated February 9, 1998, two documented rock fall events occurred in February 1997 and 1998 that impacted a portion of Highway 3 and the property located at 3125 Highway 3. No report was provided for the 1997 event. The location of the rock fall source for the 1998 event was approximately 500 m above the highway elevation and above the talus fan directly east of the talus fan above 3169 10th Avenue.

The photos below show the location of the rock fall debris and impacted structure (Mariposa fruit stand).

Photo 2.3a Photo of talus fan and rock fall debris locations from February 9th, 1998 rock fall event looking west.

Photo 2.3b View of damage locations on the Mariposa fruit stand building from the February 9th, 1998 rock fall event.

3. Site Reconnaissance

A site reconnaissance to inspect the subject site was undertaken by Mr. Jeff Redwood, P.Eng. with BC MoTI representatives on January 17th, 2023. The reconnaissance included an aerial visual inspection of the talus slopes and potential rock fall source zones and foot traverse of the property located at 3169 10th Avenue, Keremeos, BC as shown on Figure 1.0.

The following key observations were made during the site reconnaissance:

- The subject site is located between Highway 3 and the Similkameen River. A gently sloping bench (~10° to 15°), approximately 150 m wide, separates the highway from the toe of the talus fans north of the subject site. The talus slopes measured approximately 30° to 35°and 500m to 600 m in height. Rock fall source zones in the form of fractured, weathered bedrock were located above and beside the talus fans (Photo 1).
- Numerous rock fall debris (boulders) were observed on the bench between the talus slopes and highway (Photos 2 to 4). Boulders from the January 16th rock fall event were observed on both talus fans (Photos 4 and 5). Multiple linear impact features were observed on the talus slopes indicating the rock fall pathways (Photos 4 and 10) from January 16th.
- The highway was closed from 10th Avenue to Ashnola Road. The maintenance contractor for BC MoTI was cleaning off rock fall debris from the roadway, repairing the road structure and replacing the impacted concrete roadside barriers (CRB) located along the southern side of the

road (Photos 5 to 7). The damage and debris on the highway were located directly above the damaged structures located at 3169 10th Avenue. A soil cut slope located on the north side of the highway was observed. It extends from the east end of 3169 10th Avenue, westward well beyond the subject property as shown in Photos 4 and 5 and Figure 1.0. This feature is considered a launching feature for rock fall originating upslope.

- Three boulders were observed to have impacted the subject site (Rock Fall #1 to #3). All three rock fall debris boulders appeared to have impacted the storage area directly below the highway damage. Rock Fall #1 and #2 impacted a white storage canopy and Rock Fall #3 impacted a wooden storage shed beside the canopy (Photos 6 and 7).
- Rock Fall #3 was observed in the wooden storage shed (Photo 8). The size of the boulder could not be determined due to being covered by debris, however the hole in the shed measured approximately 1.5 m long and 0.5 m wide.
- It appeared that Rock Fall #1 and #2 traveled through the white canopy and came to rest on the west side of two separate recreational vehicles (RV's) (Photos 9 and 10). Rock Fall #2 was located approximately 300 mm from RV #2 and Rock Fall #1 impacted the west side of RV #1.
- Ground impacts from Rock Fall #2 were observed in an empty RV lot (Photo 11). The impact locations were elongated, had steep side slope angles (V-shaped) and measured approximately 100 mm to 300 mm in depth. The Rock Fall #2 boulder measured approximately 2.5 m in length, 2.0 m in width and 1.0 m in height (Photo 12). The bottom appeared relatively flat, while the top formed a convex surface and the sides contained jagged edges.
- Ground impacts from Rock Fall #3 were observed in front of RV #2 (Photo 13). The impact locations were elongated, had steep side slope angles (V-shaped) and measured approximately 200 mm to 300 mm in depth. The Rock Fall #3 boulder was rectangular in shape and measured approximately 2.5 m in length, 2.0 m in width and 1.4 m in height (Photos 14 and 15).
- The rock fall source from the event that occurred January 16th appeared to be located between the talus slopes above the subject property as shown on Figure 1.0. The rock fall source consists of a kinematically unstable (toppling) block along the west side of the bedrock outcrop (Photos 16 to 18). Four distinct joint sets were identified in the rock mass between the talus fans, including two subvertical, perpendicular sets (red and orange in the photos).
- Multiple other rock fall source zones were identified above the talus fans and included similar joint set orientations (i.e.subvertical) (Photos 19 and 20). One particular location, above the January 16th rock source, contained kinematically unstable blocks (Photos 17 and 19).

Annotated photos from the site reconnaissance are provided at the end of this report.

4. Rock Fall Process

Rock fall occurs when a marginally stable mass of rock detaches from a steep bedrock slope due to gravity and/or external forces such as seismic effects. Typical modes of rock slope instability that can lead to rock fall include sliding, wedge and toppling failures. The detached material, or debris, can bounce and roll if a slope exists below the rock fall source location. The velocity and energy of a rock mass increases as it falls and rolls down a slope however, impacts on the ground surface, trees, other rocks and structures act to reduce these variables.

Factors that affect the potential for rock fall may include:

- Geology: strong rock that can survive falling and rolling impacts are a more common source of large, dangerous rock fall debris than weaker rock, which would break into many small pieces.
- Discontinuities: fractured rock that contains joint sets that dip subvertical and/or less that the overall slope angle (daylighting), increase the probability of rock fall.
- Seismic Effects: seismic events such as earthquakes, can mobilize kinematically unstable rock masses due to ground shaking.
- Weather: freeze-thaw cycles can increase the probability of rock falls due to hydro-static pressure from freezing exceeding the tensile strength of a rock mass and expanding existing fractures.
- Vegetation: roots from trees can penetrate deep into the rock discontinuities and expand the existing fractures.

Figure 4.1 below illustrates a typical rockfall slope and run-out zone.

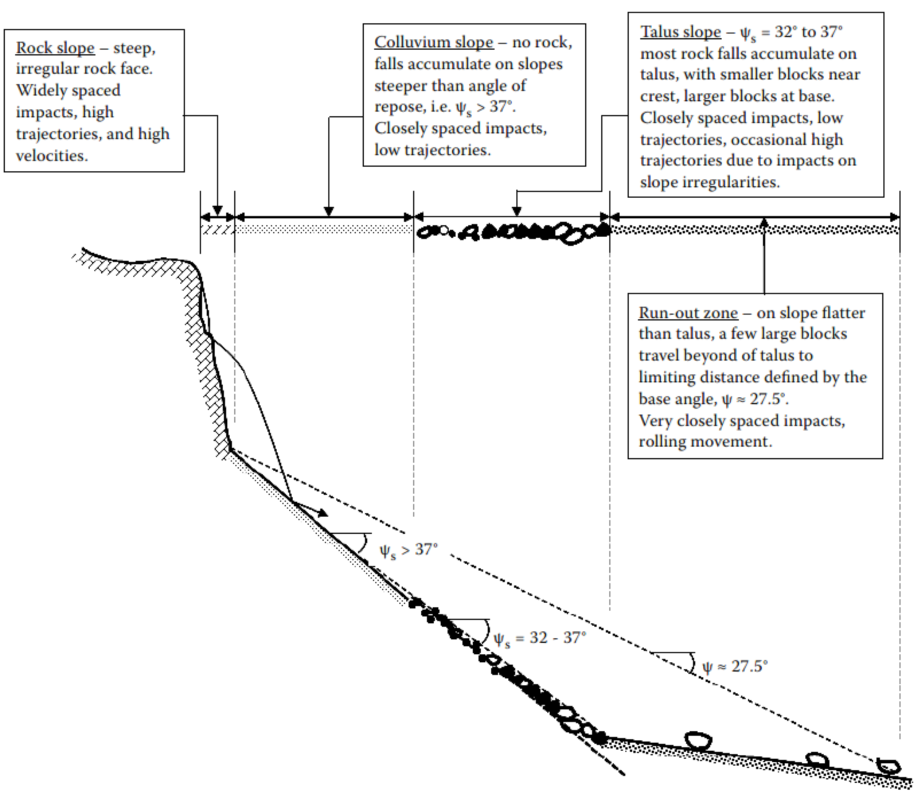

Figure 4.1 Typical rock fall slope configuration (from “Rock Fall Engineering” by Duncan C. Wyllie, 2015).

5. Preliminary Rock Fall Run-Out Analysis

A preliminary analysis was undertaken to estimate the run-out extent of the rock fall hazard originating from the January 16th rock fall source. The estimated run-out extent was determined by projecting an imaginary line, 27.5 degrees from horizontal, from the apex of the talus slope below the observed rock fall source, which is based on review of historical rock fall observations as shown in Figure 4.1. The estimated rock fall run-out zone for the rock fall source from the January 16th event extends approximately to the trail located along the southern aspect of the subject property as shown on the attached Figure 1.0.

Based on the information gathered from the site reconnaissance, the base angle for the rock fall boulders from the January 16th event is estimated to be 27 degrees. This angle plots near the estimated run-out extent for the January 16th rock source location.

The rock fall debris observed in the historical aerial photographs are located at the edge of the estimated run-out zone for the January 16th rock source location.

6. Preliminary Geohazard Assessment

A preliminary geohazard assessment was conducted by Ecora to determine the risk classification of the subject property. The classification system for probability of occurrence utilized three qualitative categories (Low to very Low, Moderate, and High to Very High). The classification categories are based on a 1996 review of terrain stability mapping by the British Columbia Resource Inventory Committee (RIC) and are described in Table 2 below. The annual probability of exceedance and associated relative terms in the table are also applicable for other damaging geohazards, such as rock fall.

Table 2 Relative Terms and Ranges of Annual Probability of Hazard Occurrence

Relative Terms of Probability	Range of Annual Probability of Exceedance (Pa)	Slope Grade	Colour	Comments
High to Very High	>1/100	>1H:1V	Red	Natural instability present. Indicates that the hazard can likely happen within the appropriate lifetime of a person or typical structure. Events are clearly identifiable from deposits and vegetation but may not appear fresh.
Moderate	1/475 to 1/100	2H:1V to 1H:1V	Yellow	Indicates that the slope hazard within a given lifetime is possible. Signs of previous events, such as vegetation damage may not be easily noted.
Low to Very Low	<1/475	<2H:1V	Green	Indicates the slope hazard is of uncertain significance and has a low likelihood of slope instability following development.

Table based on RIC 1996 “Terrain Stability Mapping in BC: A review and Suggested Methods for Landslide Hazard and Risk Mapping”.

Using the rock fall occurrence in 1998 recorded by the BC MoTI, that included property damage, with the January 16th, 2023 event, the annual probability of occurrence for rock fall for the subject area from the talus fans above, is approximately 1/25, which exceeds the 1/100 cut-off and classifies the relative probability as High to Very High. Due to the lack of records for rock fall events at or near the subject site, the annual probability of occurrence could be greater. Based on the reviewed rock fall events from the talus fans, each event generates multiple rock fall debris boulders that are capable of damaging property and are also a threat to life-safety. While it is possible that rock fall debris from a single event may not impact the subject property, the annual probability of occurrence is still considered to exceed the High to Very High classification cut-off of 1/100.

The probability of occurrence for rock fall from the source zones above the subject property is based on the reviewed rock fall events and current site conditions at the time of preparation of this report. The estimated hazard frequencies are subject to change, due to variables such as weathering and erosion, and climate change, and does not account for human activities, such as site regrading (i.e. removal of talus material) and changing of drainage profiles, which may affect rock fall pathways along the talus fans and run-out zones.

Since the subject property is located within an area susceptible to recurring rock fall events, has an annual probability of occurrence grater than 1/475, and no rock fall mitigation measures are in place to protect the subject property, it does not meet the broadly accepted landslide safety criteria with respect to residential development. The 2022 EGBC Professional Practice Guideline, Landslide Assessments in British Columbia, summarizes published accepted geohazard safety criteria in BC and Canada. Multiple local governments utilize the following criteria for slope safety, including rock fall, with respect to approving residential development:

- An annual probability of occurrence for a damaging landslide of 1:475 (10% probability in 50 years);
- An annual probability of occurrence of a life-threatening or catastrophic landslide of 1:10,000 (or 0.5% in 50 years); and,

It is unknown when the subject property was approved for development and what guidelines would have applied at the time of approval.

7. Conclusions and Recommendations

Based on Ecora's preliminary geohazard assessment, the subject property is located in a rock fall hazard zone with a High to Very High probability of occurrence and with no mitigation measures in place to protect the property and those residing on it. Furthermore, kinematically unstable blocks were observed above the property immediately after the January 16th rock fall event, that are of similar or greater volume to the recent event. Based on the observations made during our site reconnaissance and review of historical documentation, the probability of re-occurrence of rock fall from the source zones above the subject property is considered Very High as there are no permanent mitigation works in place and is therefore considered an on-going threat to residents' life-safety.

The likelihood of future rock fall events impacting the subject property is elevated during periods of seasonal freeze-thaw, however, the probability of recurrence exceeds current accepted criteria for exposure to geohazards and therefore permanent long-term rock fall mitigation measures would be required if the property is to be safely occupied.

These rock-fall mitigation measures could include such works as ditch and berm configuration or steel mesh barrier. The type of mitigation measure should be determined with a detailed geohazard assessment and designed by a Qualified Professional Engineer. Considering the size of the observed rock fall debris from the January 16th event, a mitigation measure will likely be substantial in size and cost. Figure 7.1 below illustrates potential mitigation measures based on their energy impact capacity.

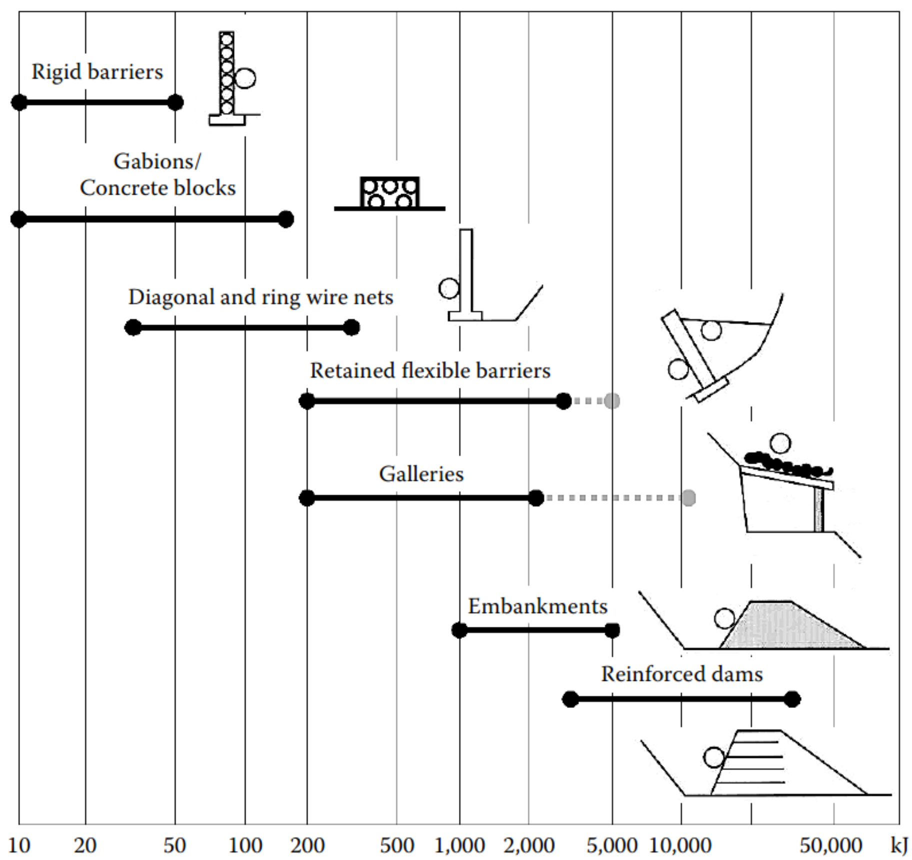

Figure 7.1: Examples of rock fall protection measures based on impact energy (from "Rock Fall Engineering" by Duncan C. Wyllie, 2015).

8. Limitations of Report

This report and its contents are intended for the sole use of the RDOS, their agents and the applicable regulatory authorities. Ecora Engineering & Resource Group Ltd. (Ecora) does not accept any responsibility for the accuracy of any data, analyses, or recommendations contained or referenced in the report when the report is used or relied upon by any Party other than the RDOS, their agents, the applicable regulatory authorities or for any Project other than that described in this report. Any such unauthorized use of this report is at the sole risk of the user.

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Ecora's General Conditions are provided in Appendix A of this report.

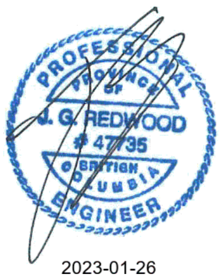
9. Closure

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

Sincerely

Ecora Engineering & Resource Group Ltd.

Prepared by:



2023-01-26

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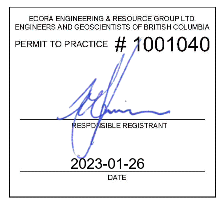

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Version Control and Revision History

Version	Date	Prepared By	Reviewed By	Approved By	Notes/Revisions
0	2023-01-26	JR	MJL	MJL	Issued for Use

Attachments: Figures
Photos
Appendix A General Conditions

References

Cave, P., 1993. “Hazard acceptability thresholds for development approvals by local government.” British Columbia Geological Survey Branch, Open File 1992-15.

Bostock, H.S., “Keremeos, Similkameen District, British Columbia”, Geological Survey of Canada, “A” Series Map 341A, 1940.

Engineers and Geoscientists BC (EGBC), “Professional Practice Guidelines - Landslide Assessments in British Columbia”, Version 4.0, September 2022.

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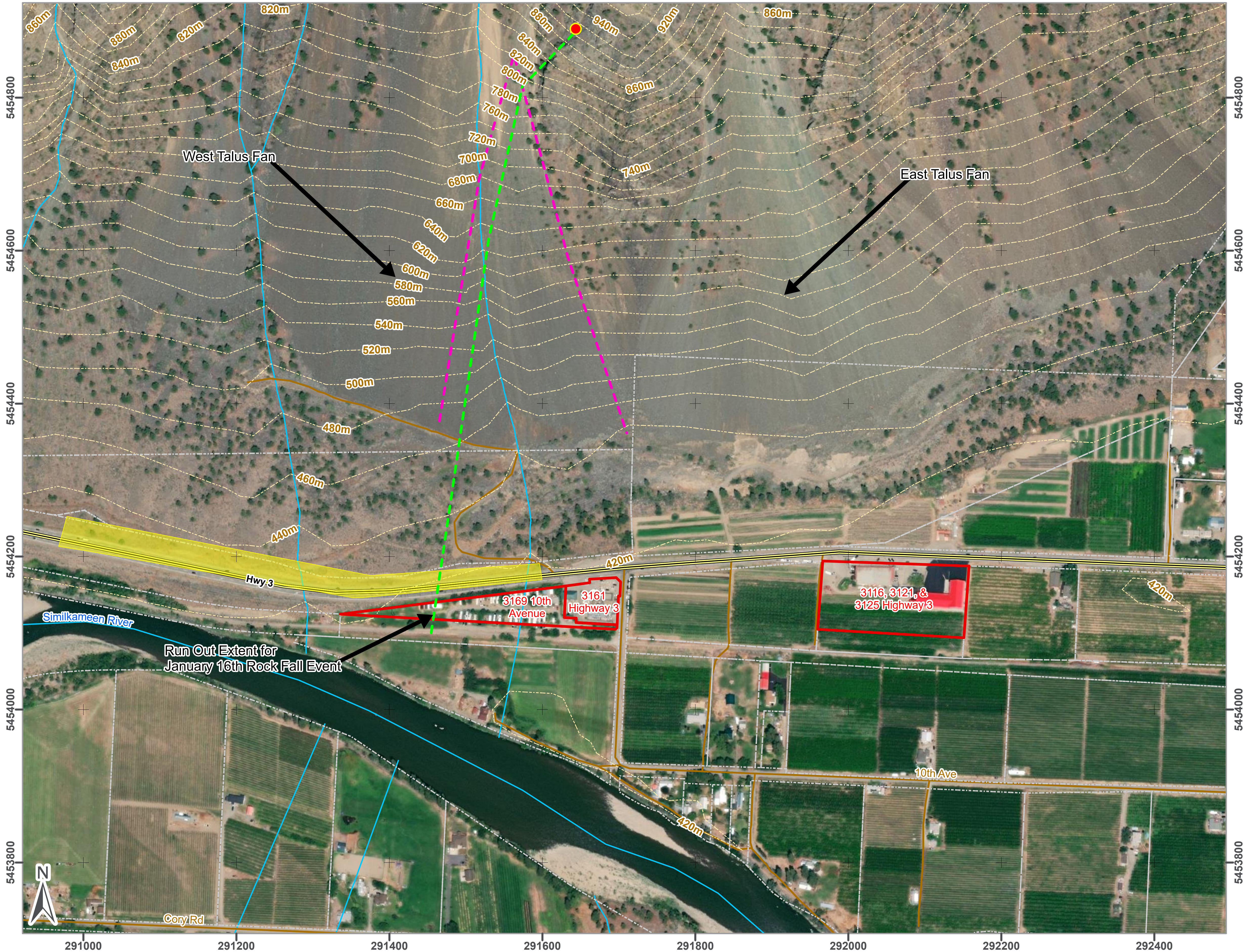
RDOS Public Property Viewer. https://hub-rdos.opendata.arcgis.com/pages/maps

Resource Inventory Committee (RIC) 1996. Terrain Stability Mapping in British Columbia: A Review and Suggested Methods for Landslide Hazard and Risk Mapping. Final Drafting Resource Inventory Committee, Government of British Columbia, Slope Stability Task Group, Earth Sciences Task Force, August 1996.

Wyllie, D.C., 2015. “Rock Fall Engineering”, CRC Press; 1st edition.

Figures

SITE PLAN



EMERGENCY GEOTECHNICAL ASSESSMENT FOR 3169 10TH AVENUE KEREMEOS, BC

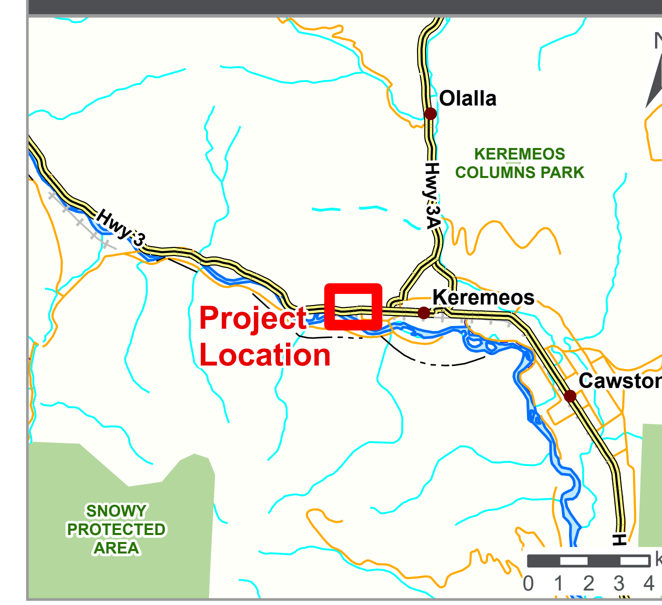
Legend

- Approximate Source Location of January 16th Rock Fall Event
- 20m TRIM Contour Lines
- Fresh Water Atlas Streams
- Highways
- Digital Atlas Roads
- Approximate Pathway Extents of January 16th Rock Fall Event
- Approximate Rock Fall Run Out Extent for January 16th Rock Fall Event Source Location Based on a Base Angle of 27.5 Degrees
- Approximate Extent of Launching Feature
- Property Boundaries
- RDOS Legal Parcels

References

Aerial Imagery: *Maxar, 7/18/2021*

LOCATION MAP



1:5,000

0 100 200 Meters

Project No.: 230018-02
Client: RDOS
Date: 2023/01/26
Drawn: SC Check: JR
NAD 1983 UTM Zone 11N

Figure 1.0

Photographs

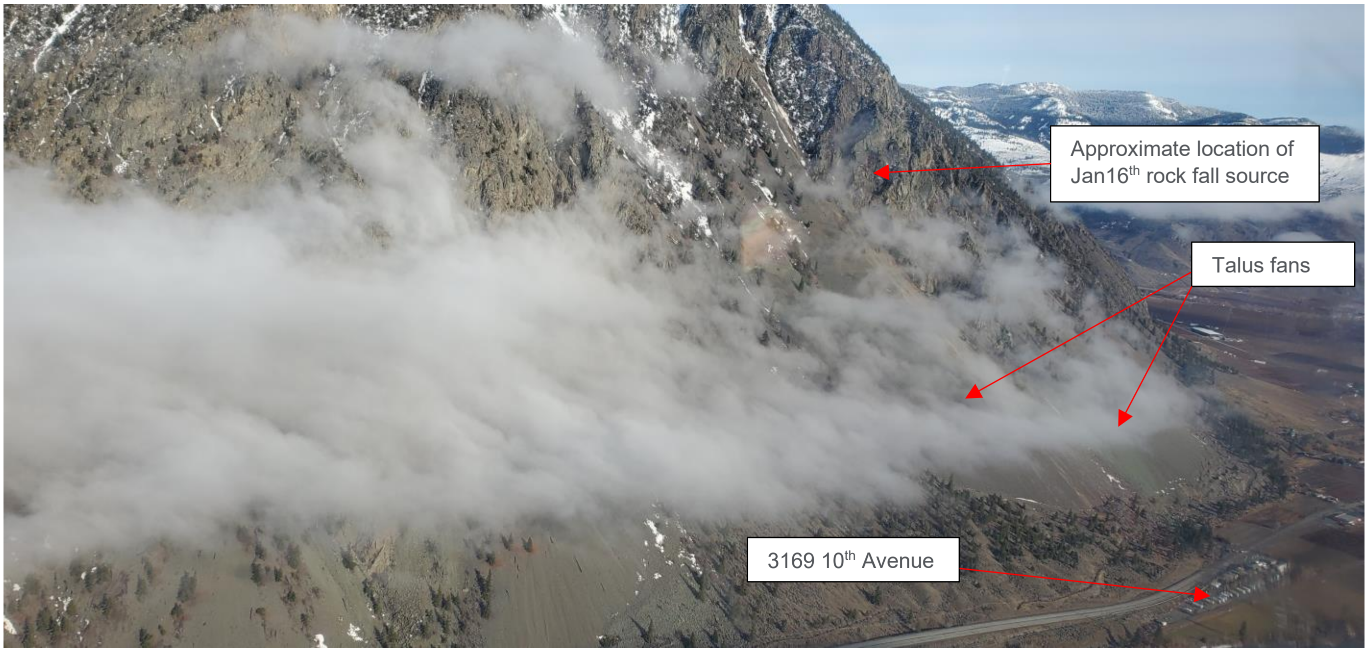


Photo 1 Aerial view of mountain and talus fans above Hwy 3 and 3169 10th Avenue.

Photo 2 Aerial view of Hwy 3 and 3169 10th Avenue and talus fans above.

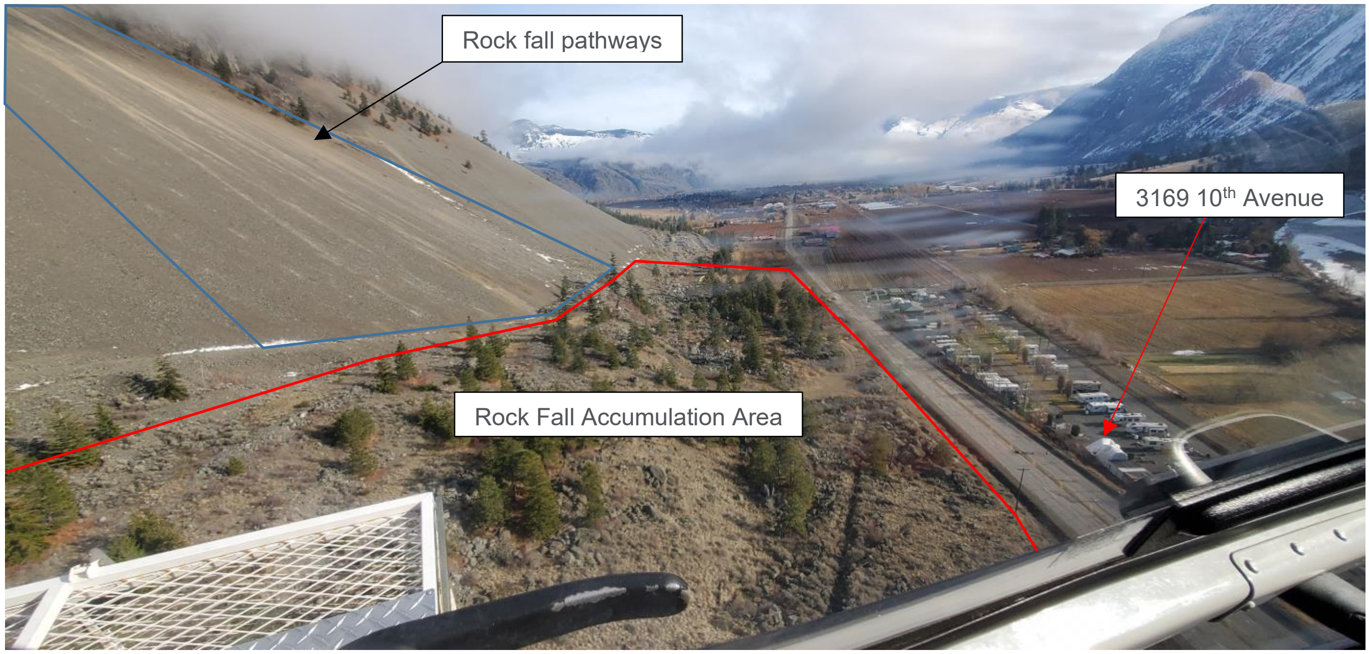


Photo 3 **Aerial view of Hwy 3 and 3169 10th Avenue and talus fans above.**

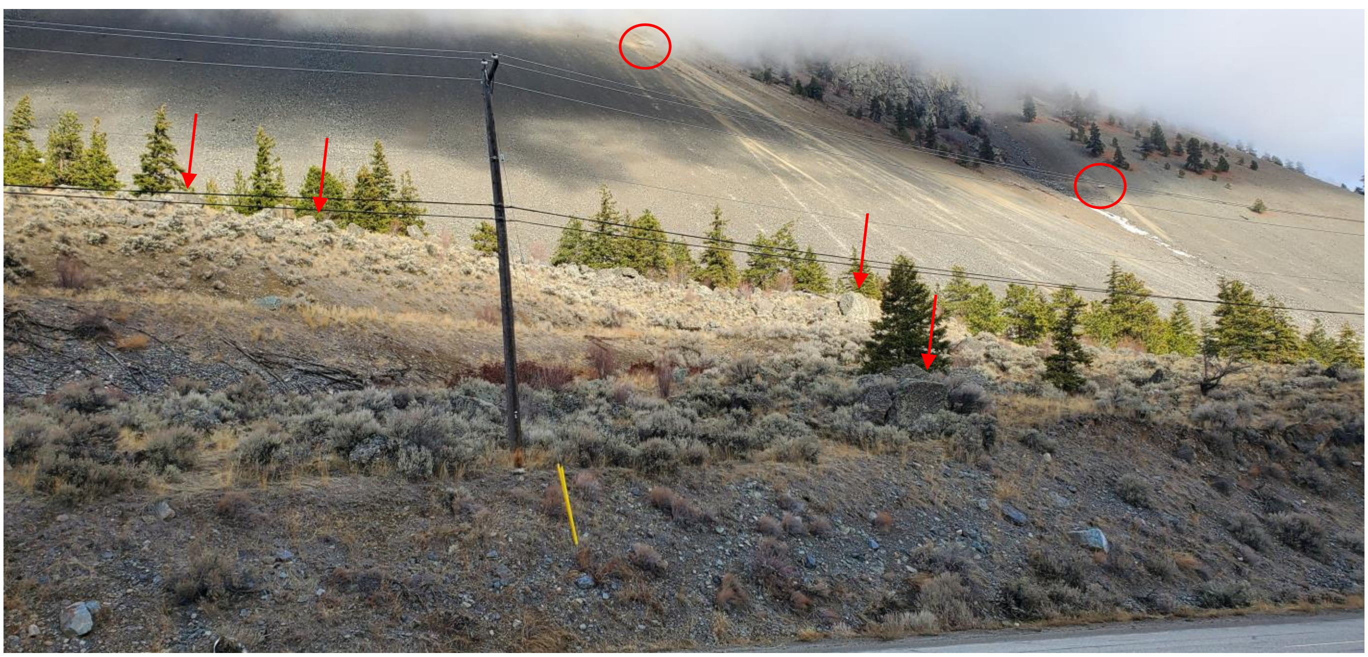


Photo 4 **View of highway cut slope and talus fans above 3169 10th Avenue. Rock fall greater than 1 m diameter indicated by red arrows. A portion of January 16th rock fall boulders indicated by red circles.**

Photo 5 **View of Highway 3 and associated soil cut slope above 3169 10th Avenue. Rock fall impacts located at service equipment. Recent rock fall boulder indicated by red circle.**

Photo 6 **View of rock fall impact locations on concrete barrier and storage structure downslope.**

Photo 7 **View of rock fall impact locations on concrete barrier and storage structures downslope.**

Photo 8 **View of rock fall impact on wooden storage structure. Rock was located inside structure.**

Photo 9 View of impacted storage structure, looking west.

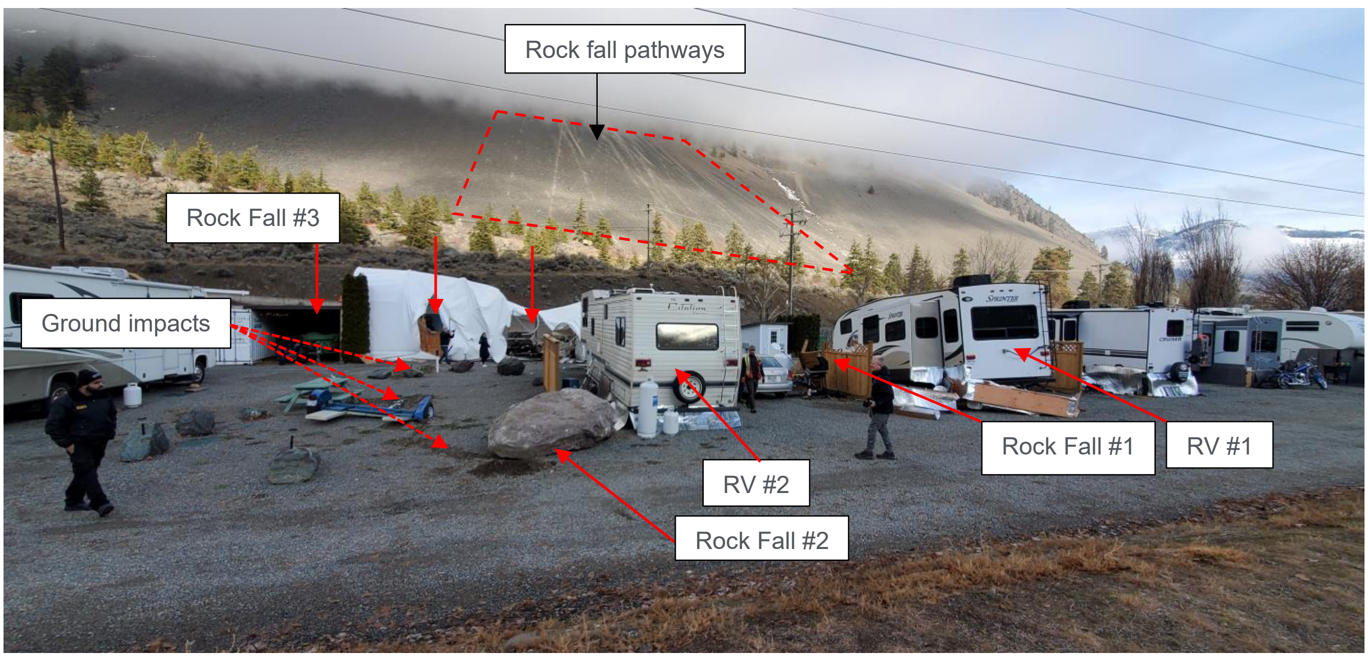


Photo 10 View of rock fall material and impacted structures, looking north.

Photo 11 **View of ground impact from Rock Fall #2, looking south.**

Photo 12 **View of Rock Fall #2 and ground impacts, looking east.**

Photo 13 View of ground impact from Rock Fall #1.

Photo 14 View of Rock Fall #1, looking southeast. Ground impact location on right.

Photo 15 **View of Rock Fall #1, looking south. Ground impact location on right.**

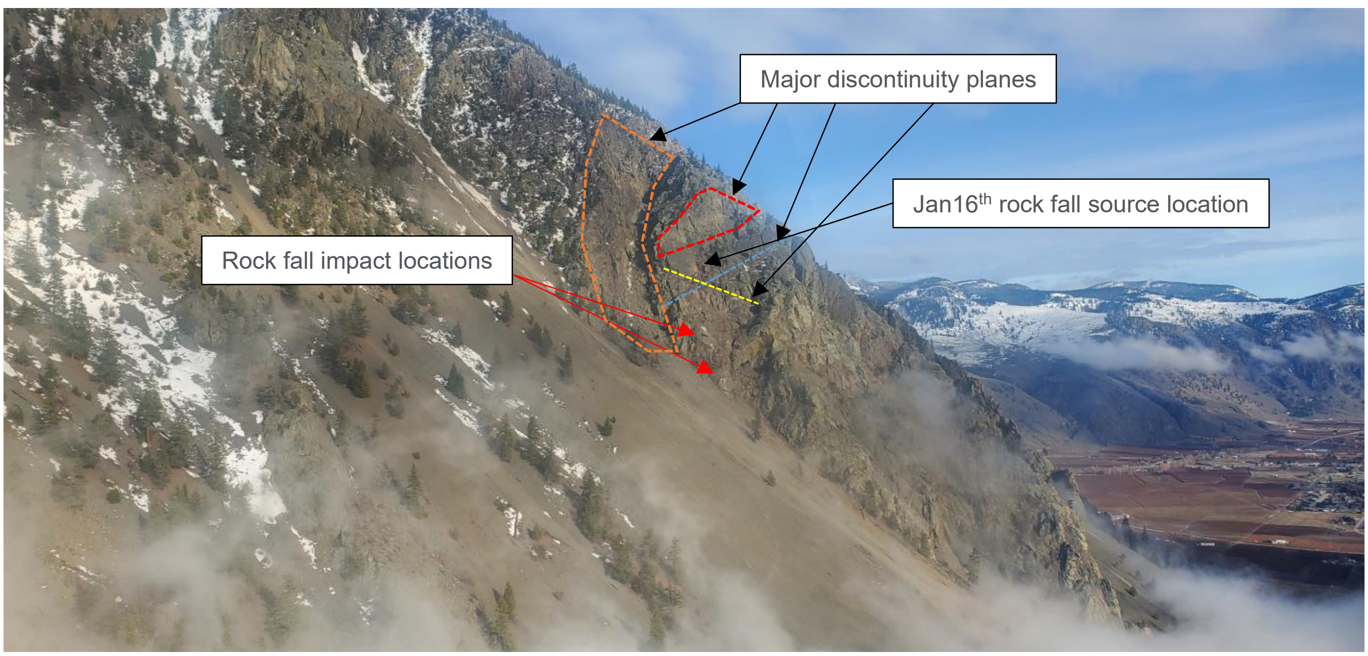


Photo 16 **View of talus slopes above 3169 10th Avenue, January 16th rock fall source and impact locations, looking east.**

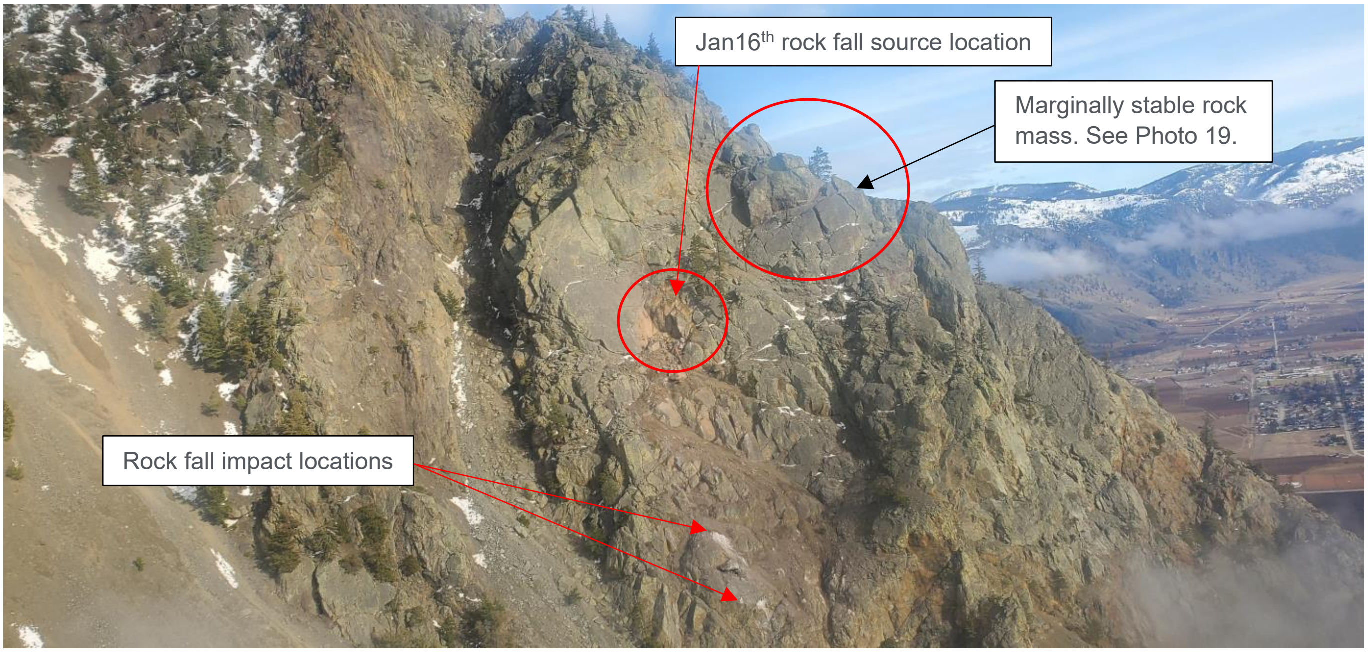


Photo 17 View of current rock fall source and impact locations, looking east.

Photo 18 View of January 16th rock fall source and impact locations, looking east. Discontinuity sets indicated in red, orange, yellow and blue.

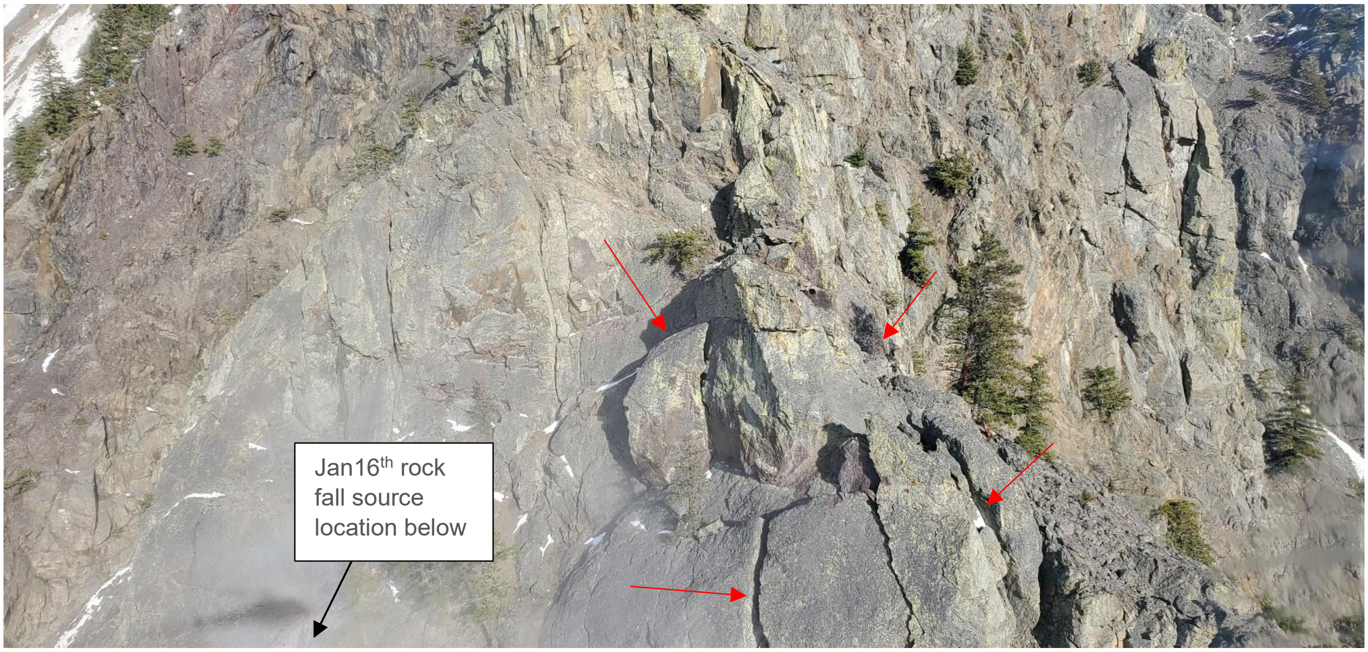


Photo 19 **View of marginally stable rock mass above current rock fall source.**

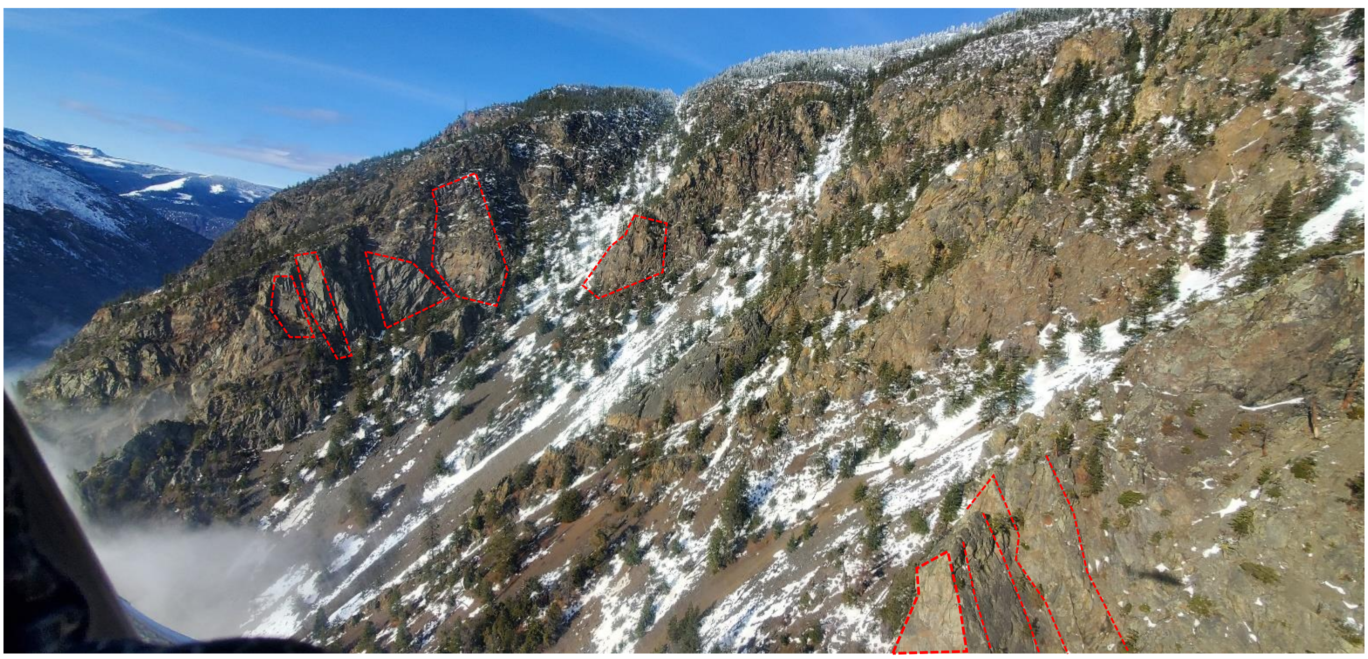


Photo 20 **View of rock fall source zones above the talus fans, looking west from the current rock fall source. Subvertical discontinuity planes with significant rock volumes identified in red.**

Appendix A

General Conditions

Standard of Care

Ecora Engineering and Resource Group Ltd. (Ecora) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report

This report and the recommendations contained in it are intended for the sole use of Ecora's Client. Ecora 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 Ecora's Client unless otherwise authorized in writing by Ecora. Any unauthorized use of the report is at the sole risk of the user. 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.

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Soil, Rock and Groundwater Conditions

Classification and identification of soils, rocks and geological units have been based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Ecora does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities such as traffic, excavation, groundwater level lowering, pile driving, blasting on the site or on adjacent sites. Excavation may expose the soils to climatic elements such as freeze/thaw and wet /dry cycles and/or mechanical disturbance which can cause severe deterioration. Unless otherwise indicated the soil must be protected from these changes during construction.

Environmental and Regulatory Issues

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Sample Disposal

Ecora will dispose all soil and rock samples for 30 days following issue of this report. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

Construction Services

During construction, Ecora should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Ecora's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Ecora's report. Adequate field review, observation and testing during construction are necessary for Ecora to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Ecora's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Job Site Safety

Ecora is responsible only for the activities of our employees on the jobsite. The presence of Ecora's 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 Ecora never occupy a position of control of the site. The Client undertakes to inform Ecora 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.

Changed Conditions and Drainage

Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Ecora be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Ecora be employed to visit the site with sufficient frequency to detect if conditions have changed significantly. Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Ecora takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

Services of Sub consultants 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. Ecora 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 Ecora from and against all claims arising through such hiring's 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.