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Our File: 107-2049

CITY OF NORTH VANCOUVER
141 West 14th Street
North Vancouver, BC V7M 1H9

Attention: Mr Tony Barber, P.Eng.

Re: Slope Stabilization
1845 Bewicke Avenue, North Vancouver, BC
Final Assessed Partial Risk - Geotechnical

INTRODUCTION

This document provides a summary of the Final Assessed Partial Risk to the above-noted subject property subsequent to carrying out slope stabilization works that consisted of constructing a slope buttress adjacent to the west side of the subject property.

BACKGROUND

Horizon Engineering has provided a geotechnical report dated December 14, 2007 regarding slope stability at the above-noted site and a report dated January 14, 2008 regarding permanent underpinning for the existing house on the subject property. On July 13, August 13, August 18, August 24, and September 15, 2010; Horizon Engineering personnel carried out field reviews at the subject property during slope excavation earthworks and construction of the slope buttress.

It is understood that the recommended permanent underpinning of the existing house foundation was initiated but has not been completed. Horizon Engineering has not been retained to provide geotechnical engineering services for this permanent underpinning. It is also understood that completion of the foundation underpinning is the responsibility of the property owner and not part of the City of North Vancouver's project scope.

RESIDUAL RISK ANALYSIS

Based on the Mosquito Creek East Ravine Landslide Risk Analysis Phase II - Detailed Study prepared by Westrek Geotechnical Services Ltd and dated May 8, 2007; the risk to the house on the subject property is high only near the northwest corner and is attributed to the high potential for a landslide initiating on the adjacent slope. It should be noted that information regarding the presence of tension cracks in the foundation soil beneath the house footprint was not available at the time of publishing the Westrek report; therefore, a revised risk analysis is provided for

comparison in Table 1. The presence of this existing tension crack beneath the house foundation would increase the Partial Risk to Structure rating to Very High which is defined as having a Factor of Safety at the structure of less than 1.1.

The City of North Vancouver determined that an acceptable level of risk per the Westrek risk assessment methodology would be moderate or better (Letter from The Corporation of the City of North Vancouver dated August 31, 2007; File No:. 4037-03-M1-03).

Subsequent to completion of the slope stabilization works, a residual risk analysis based on the aforementioned Landslide Risk Analysis Phase II document has been carried out for the current site conditions. The results of this residual risk analysis are presented in the following tables.

Table 1: Landslide Hazard and Risks

Site Condition	Probability of a Landslide	Partial Risk to House	Vulnerability of House	Specific Risk to House
Pre-Remediation (Westrek analysis)	High	High	Moderate	High
Pre-Remediation (updated analysis)	High	High	High	Very High
Post-Remediation	Low	Moderate*	Moderate*	Moderate

* based on having the slope buttress completed to reduce the potential for landslide initiation but without having completed the recommended foundation underpinning.

Table 2: Seismic Slope Hazard

Site Condition	Probability of a Landslide	Partial Risk to House	Vulnerability of House	Specific Risk to House
Pre-Remediation (Westrek analysis)	High	High	Moderate	High
Pre-Remediation (updated analysis)	High	Very High	High	Extreme
Post-Remediation	Low	Moderate*	Moderate*	Moderate

* based on having the slope buttress completed to reduce the potential for landslide initiation but without having completed the recommended foundation underpinning.

CONCLUSIONS

It is concluded that construction of the slope buttress was carried out in general accordance with design drawings provided by Horizon Engineering. As-built drawings dated November 16, 2010 have been completed for this project.

It is also concluded that the Final Assessed Partial Risk to the house with respect to having implemented only the slope stabilization works is considered to be "Moderate" and may satisfy the City of North Vancouver acceptable level of risk as previously discussed. However, it should be emphasized that the permanent underpinning is required to be completed in an effort to reduce the

potential for performance issues (such as excessive settlement of the building foundation and structural impact to the existing building) with respect to the house foundation in the area of the existing tension crack.

CLOSURE

This document has been prepared for the sole use of our client, **The City of North Vancouver**, and other consultants for this project, as described. Permission has been granted to the City of North Vancouver to publish this document for public information. Any use or reproduction of this report or the information provided in this document for other than the stated intended purpose is prohibited without the written permission of Horizon Engineering Inc. The information provided in this document is only valid under the site and surrounding conditions as described and present at the time of publishing this report.

We are pleased to be of assistance to you on this project and we trust that our comments are sufficient for your current purposes. If you have any questions or if we can provide additional service, please do not hesitate to contact us.

For
HORIZON ENGINEERING INC

Sept 20, 2011

Karim Karimzadegan, M.A.Sc., P.Eng.
Principal

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