

PROJECT NO.: 2020-161-G

February 12, 2021

Capital Contracting Group
c/o 1872283 Ontario Inc.
3976 Portage Road Unit 2
Niagara Falls, Ontario
L2J 2K9

Attention: Mr. Mitch Williams

**PRELIMINARY SLOPE STABILITY ASSESSMENT
PROPOSED COMMERCIAL DEVELOPMENT
353 TOWNLINE ROAD, NIAGARA-ON-THE-LAKE, ONTARIO**

Dear Mr. Williams,

As requested Bendigo Consulting Inc. undertook slope stability assessment work at the above noted site. The purpose of this site assessment work was to examine the condition of the east side slope towards a small creek and to provide our comments with regard to its long-term stability from a geotechnical point of view pertaining to the foundations of the proposed commercial development. Our comments and recommendations, based on our field evaluation work, review of the borehole logs undertaken for the geotechnical investigation and a desk top study, are presented in the following paragraphs.

INTRODUCTION

We understand that the project will consist of the construction of four low rise commercial buildings with surrounding asphaltic concrete roadways and parking areas. The subject slope is located on the east side of the property. The subject slope is covered with numerous mature and immature trees, as well as some other surficial vegetation and at the time of our site reconnaissance a veneer of fallen leaves. The subject slope is between about 6.6 meters [Section A-A], 8.9 metres [Section B-B] and 9.5 metres [Section C-C] metres in height. The lower height for Section A-A of the toe of slope being 'set-bank' from the toe of bank as per Table 6.1 Valleyland Erosion Hazard found in the Niagara Peninsula Conservation Authority Policy Document.

PROCEDURE

A slope stability rating chart, Table 8.1 found in the Ontario Ministry of Natural Resources publication "Geotechnical Principle for Stable Slopes [November 1997], was completed as part of the slope stability analysis. The completed slope stability rating chart is attached and found a

**PRELIMINARY SLOPE STABILITY ASSESSMENT
PROPOSED COMMERCIAL DEVELOPMENT
353 TOWNLINE ROAD, NIAGARA-ON-THE-LAKE, ONTARIO**

rating of 27, which indicates a slight potential and therefore the need for a site inspection, surveying, preliminary study and a report letter. Three slope profiles were measured across the property at the locations illustrated in Drawing No. 1 Slope Profile Location Plan and presented in Drawing Nos. 2, 3 and 4, Slope Profile Sections A-A, B-B and C-C, respectively.

All surveying associated with determining the ground surface elevations for Slope Profiles A-A [north end], B-B [centre section] and C-C [south end] was carried out by Bendigo Consulting Inc. personnel. The ground surface elevations at the three selected physical top of slopes were referenced to geodetic datum by representatives of J.D. Barnes Limited [Reference No. 20-16-376-00 dated plotted January 11, 2021].

SITE CONDITIONS

The slope profiles, undertaken on November 6, 2020, found that the overall angle of the subject slopes [between slope 'toe' and top of physical slope] are about 3.2, 2.2 and 2.3 Horizontal to 1 Vertical for Slope Profiles A-A, B-B and C-C, respectively. The upper slope sections [physical top of slope to the western surveyed limit] were found to be about 16.5, 16.8 and 20.0 Horizontal to 1 Vertical for Slope Profiles A-A, B-B and C-C, respectively. There were no significant erosion issues found over the crest the subject slope. In addition, there was found to be some erosion issues at the 'toe' of the subject slope at the bank of the creek.

The slope is covered with numerous mature and immature trees, as well as some other surficial vegetation and fallen leaves. The majority of the mature trees were found to have a 'straight' preference. There were no significant slope failure 'scars' observed across the subject slope and there were no 'tension' cracks observed near the 'crest' of the slope. In addition, there was no signs of significant fill materials having been deposited onto the subject slope. The subject slope has evidently remained stable for a very long period of time with only imperceptibly slow flattening of the slope associated with a reduction in surficial resistance attributed with natural weathering process, freeze-thaw, solifluction, wetting-drying, burrowing animals, etc. This degeneration of the slope is a very slow process spanning multiple years to decades.

DISCUSSION OF SLOPE CONDITION AND STABILITY

The Ontario Ministry of Natural Resources publication "Geotechnical Principles for Stable Slopes [November 1997] outlines for Glacial Tills that are natural vegetated slopes the Steepest Stable Inclination Observed is between 1.5 and 2.0 Horizontal to 1.0 Vertical. The publication notes that "Competent soils with high friction resistance [sand, glacial tills] have relatively steep

**PRELIMINARY SLOPE STABILITY ASSESSMENT
PROPOSED COMMERCIAL DEVELOPMENT
353 TOWNLINE ROAD, NIAGARA-ON-THE-LAKE, ONTARIO**

natural slope inclinations". Most natural slopes of silty clay till have weathered to a stable inclination. Table 4.3 of this publication outlines that the design minimum Factor of Safety for "Active" land use [habitable structures near slope, residential] is 1.3 to 1.5.

We note that a site specific geotechnical investigation was undertaken for the proposed commercial development. The boreholes in the area of the subject slope encountered a native, brown to greyish brown silty clay, described as having a 'till-like' structure. The silty clay ['till-like' structure] was found to be very stiff to hard in consistency. The silty clay was proven to the termination of these boreholes. Further, we have reviewed the Quaternary Geology [Niagara-Welland Area Map 2496] which indicates that the subject site is in an area of Halton Till: silty and clayey till.

The Stable Top of Slopes were evaluated following the guidelines in the referenced MNR documents. Specifically this involves applying an allowance for toe erosion, and a long-term stable slope inclination. In this case the toe of the slope is in the very stiff to hard silty clay, which is considered to be rather competent in terms of its strength properties and resistance to erosion. A conservative toe erosion allowance of 5.0 metres has been applied in this case. The selected slope inclination was assessed from observation methodology [assessment of the subject slope from visual observations and surveying measurements] and geotechnical analysis. Based on the current slope profiles and the presence of the native very stiff silty clay, Halton Till material, in the subject slope an inclination of 2.3 Horizontal to 1 Vertical has been used in Slope Profiles B-B and C-C. A slope inclination of 2.5 Horizontal to 1 Vertical has been used for Slope Profile A-A so that it does not 'daylight' into the existing slope. Applying the erosion allowance and stable slope allowances from the existing toe of the slope profiles provides the locations for the long-term Stable Top of Slopes at about 0.9 metres, 12.4 metres and 5.3 metres west of the Physical Top of Slope for Profiles A-A, B-B and C-C, respectively.

Given the condition of the slope, the slope profiles and the relatively condition of the very stiff to hard silty clay, Halton Till material, the slope, as it exists, is considered to be stable in both the short and long term and more than satisfies the "active" land use requirement. It is our opinion, that the proposed construction of the proposed four commercial buildings will not have a negative impact on the subject slope. The footings for the proposed commercial buildings will be founded below an imaginary line drawn up from the toe of slope at 3.0 Horizontal to 1.0 Vertical. The construction of the proposed four commercial buildings will have essentially no impact on the stability of the slope. It is recommended that this office be retained to undertake footing base evaluations during construction.

**PRELIMINARY SLOPE STABILITY ASSESSMENT
PROPOSED COMMERCIAL DEVELOPMENT
353 TOWNLINE ROAD, NIAGARA-ON-THE-LAKE, ONTARIO**

We trust that this information is satisfactory for your purposes. Should you have any questions please do not hesitate to contact the undersigned directly.

Yours very truly,
Bendigo Consulting Inc.



John Monkman, P.Eng.
Project Engineer



Enclosures: Slope Stability Rating Chart
Drawing No. 1: Slope Profile Location Plan
Slope Profiles A-A, B-B and C-C

Distribution: Capital Contracting Group [1, plus pdf copy]
Hallex Environmental Ltd. [pdf copy]

TABLE 8.1 - SLOPE STABILITY RATING CHART

Site Location: 353 Townline Road		File No. 2029-161-6	
Property Owner: Capital Contracting Group		Inspection Date: Nov 6/20	
Inspected By: John Menkman		Weather: 18C Partly Cloudy	
1.	SLOPE INCLINATION degrees a) 18 or less b) 18 - 26 c) more than 26	horiz. : vert. 3 : 1 or flatter 2 : 1 to more than 3 : 1 steeper than 2 : 1	Rating Value 0 6 16
2.	SOIL STRATIGRAPHY a) Shale, Limestone, Granite (Bedrock) b) Sand, Gravel c) Glacial Till d) Clay, Silt e) Fill f) Leda Clay		0 6 9 12 16 24
3.	SEEPAGE FROM SLOPE FACE a) None or Near bottom only b) Near mid-slope only c) Near crest only or, From several levels		0 6 12
4.	SLOPE HEIGHT a) 2 m or less b) 2.1 to 5 m c) 5.1 to 10 m d) more than 10 m		0 2 4 8
5.	VEGETATION COVER ON SLOPE FACE a) Well vegetated; heavy shrubs or forested with mature trees b) Light vegetation; Mostly grass, weeds, occasional trees, shrubs c) No vegetation, bare		0 4 8
6.	TABLE LAND DRAINAGE a) Table land flat, no apparent drainage over slope b) Minor drainage over slope, no active erosion c) Drainage over slope, active erosion, gullies		0 2 4
7.	PROXIMITY OF WATERCOURSE TO SLOPE TOE a) 15 metres or more from slope toe b) Less than 15 metres from slope toe		0 6
8.	PREVIOUS LANDSLIDE ACTIVITY a) No b) Yes		0 6
	SLOPE INSTABILITY RATING	RATING VALUES	INVESTIGATION REQUIREMENTS
		TOTAL	TOTAL
			27
1	Low potential	< 24	Site inspection only, confirmation, report letter.
2	Slight potential	25-35	Site inspection and surveying, preliminary study, detailed report.
3	Moderate potential	> 35	Boreholes, piezometers, lab tests, surveying, detailed report.
NOTES:	a) Choose only one from each category; compare total rating value with above requirements. b) If there is a water body (stream, creek, river, pond, bay, lake) at the slope toe; the potential for toe erosion and undercutting should be evaluated in detail and, protection provided if required.		



LEGEND

NOTES:

1. This report must be read in conjunction with Bendigo Consulting Inc. Report No.: 20120-161-G dated February 12, 2021.
2. Slope Profile locations are approximate.
3. Ground surface elevations at the three physical top of slope were referenced to geodetic datum by representatives of J.D. Barnes Limited [Reference No. 20-16-376-00 dated plotted January 11, 2021.
4. Image obtained from Niagara Navigator

Bendigo Consulting Inc.

Client

Capital Contracting Group

Project Description

Preliminary Slope Stability Study
 Proposed Commercial Development
 353 Townline Road, Niagara-on-the-Lake, Ontario

Slope Profile Location Plan

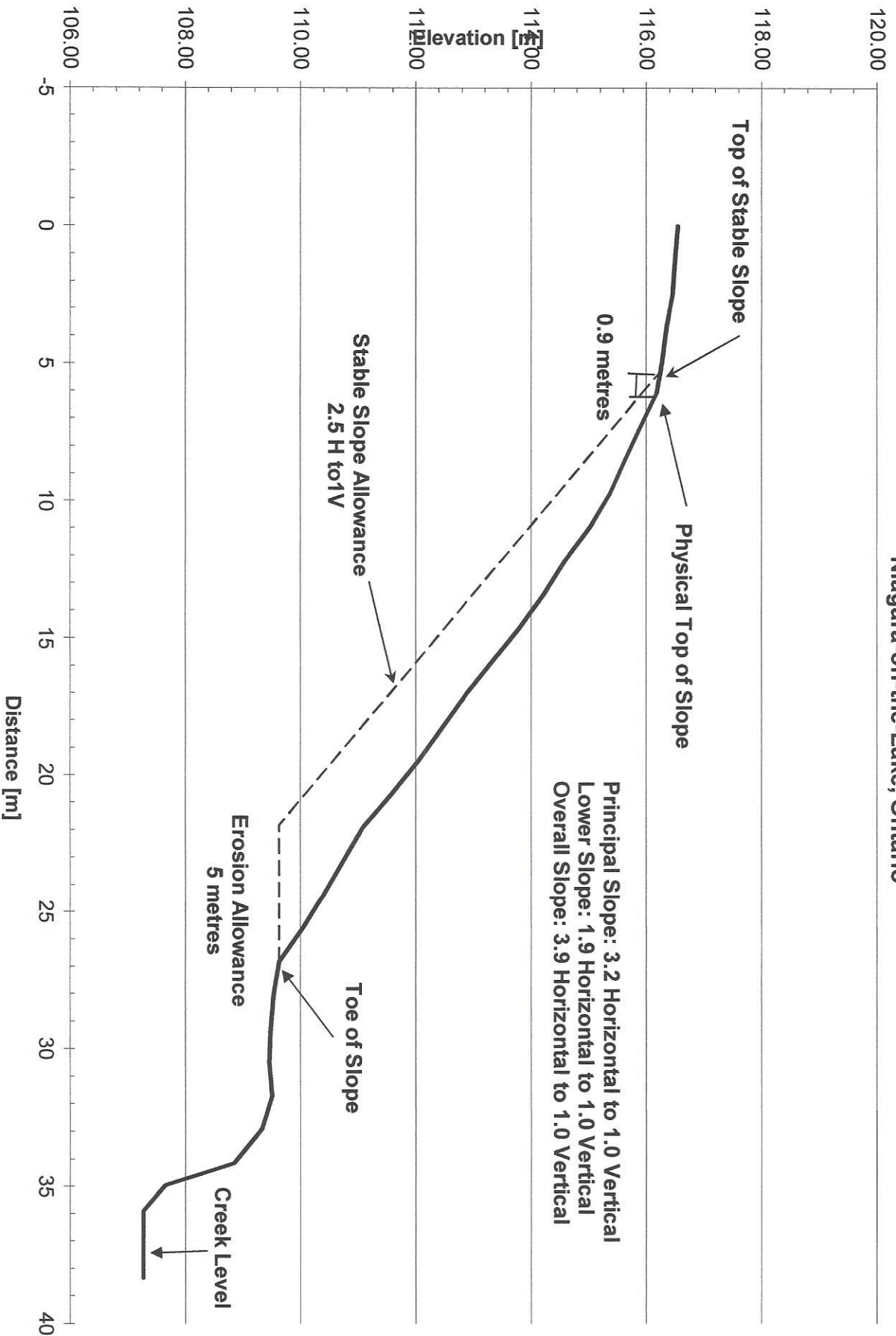
Project No.: 2020-161-G

Scale: NTS

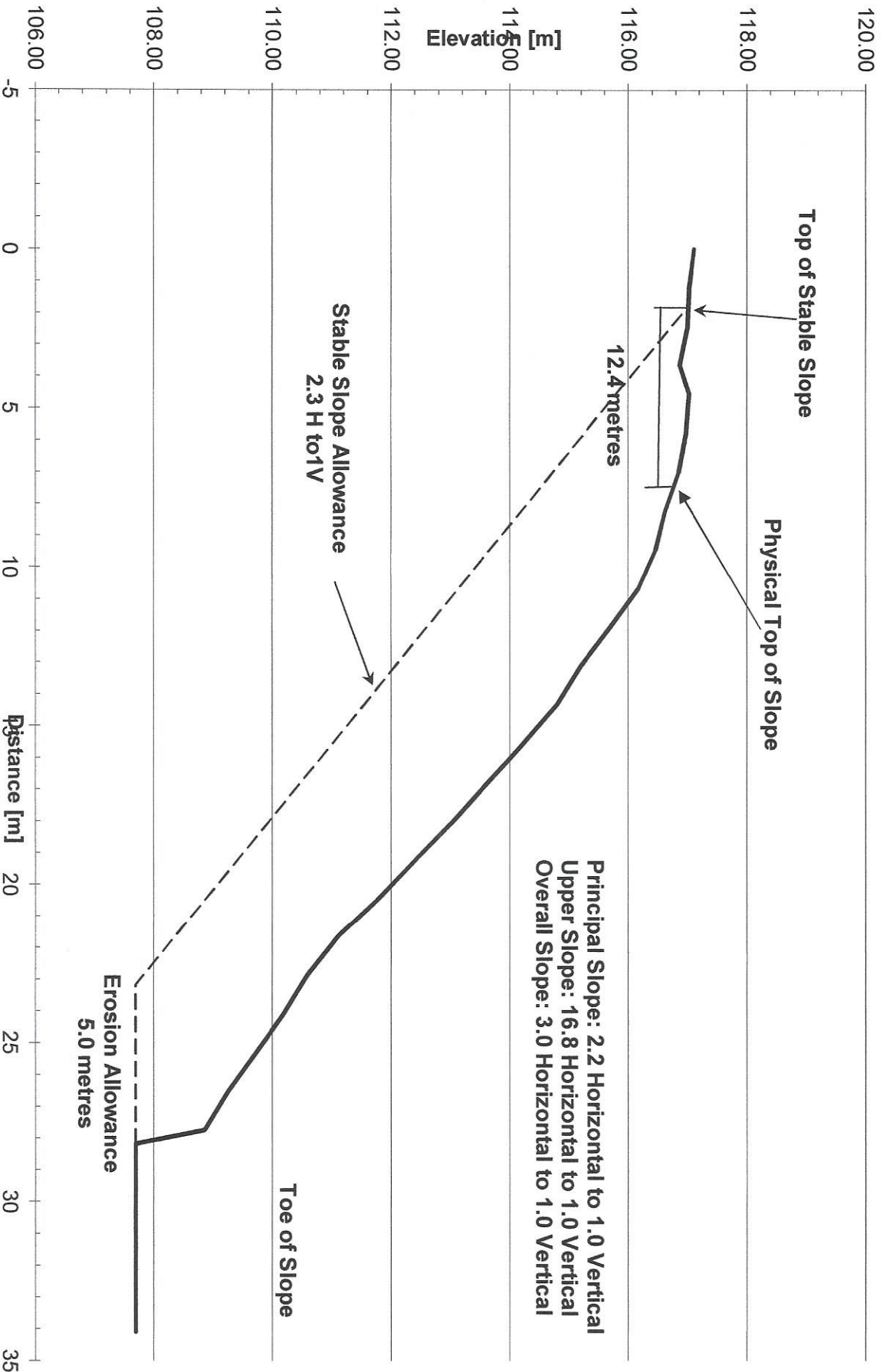
Date: February 2021

Drawing No. 1

Slope Profile Section A-A
Townline Road
Niagara-on-the-Lake, Ontario



Slope Profile Section B-B
Townline Road
Niagara-on-the-Lake, Ontario



**Slope Profile Section C-C
Townline Road
Niagara-on-the-Lake, Ontario**

