



2023-02-27

Michael Flis, P.Eng.
The Jones Consulting Group Ltd.
229 Mapleview Drive East, Unit 1 Barrie, ON
L4N 0W5

Subject: Slope Erosion Hazard Assessment - Deltini Subdivision, Primrose, Ontario

Dear Sir:

WSP Canada Inc. is pleased to provide this letter detailing our slope erosion hazard assessment recommendations regarding the existing slope at the northwestern portion of the above noted development. Based on the topographic drawings provided to our office by Jones Consulting Inc., at the northwestern area of the site the topography slopes down toward the west; a stream (Primrose Creek) lies at the base of the slope. A Storm Water Management (SWM) Pond is proposed to be constructed at the northwest corner of the property, in proximity to the existing slope.

As per the cross-section data provided to our office, it is noted that the slope is very gradual and relatively flat at the site, with slope percentages generally ranging between 5% to 12% (about 20H:1V to 8H:1V), but also flat in areas (0%). The steepest portion of the slope, in only one area, has an inclination of about 20.1% (4.8H:1V).

In accordance with the Ministry of Natural Resources document entitled “Technical Guide – River and Stream Systems: Erosion Hazard Limit” (Guidelines), a site visit was completed on February 21, 2023, to visually observe the state of the slope, the existing vegetation, and observe any examples of toe erosion, or any past instability. Tables 4.1 and 4.2 from the Guidelines were completed during our site visit to document the conditions of the slope. A copy of the completed Tables is attached to this letter.

Based on the results of our site visit and the completed Tables 4.1 and 4.2 from the Guidelines, the Slope Instability Rating Values Investigation Rating Summary total was determined to be 21. This value takes into account items such as the existing slope condition, the slope inclination, the subsurface conditions, the condition of the existing vegetation, among other items. Based on this rating, which is less than the threshold value of 24, there is a low potential for slope instability and as such, no further investigation is needed.

In regard to the design of the SWM Pond, based on the grading plans provided to our office, the western berm will be required to be constructed using engineering fill. It is critical that a geotechnical stability assessment be completed once the design of the pond is finalized; the assessment should include both slope stability and settlement assessments, as well as a seepage assessment, to provide input toward the potential need for a clay core and/or shear keys to mitigate the potential for sliding failure.

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We trust this letter provides the information required at this time. Do not hesitate to contact our office if there are any questions.

Kind regards,

A handwritten signature in black ink, appearing to read 'N. La Posta'.



Nick La Posta, P.Eng.
Team Lead, Ground Engineering East

TABLE 4.1 - Slope Inspection Record1. FILE NAME / NO. **181-01582-04**INSPECTION DATE (DDMMYY): **21/02/23**

WEATHER (circle):

• sunny • **partly cloudy** • cloudy

• calm • breeze • windy

• clear • fog • rain • **snow**• **cold** • cool • warm • hotestimated air temperature: **0 Degrees (-5 with Windchill)**INSPECTED BY (name): **Sunduss Asghar**2. SITE LOCATION (describe main roads, features) **Vacant Farmland just North of Intersection of Highway 10 and Prince of Wales Road.**

SKETCH

3. WATERSHED **Primary - Great Lakes - St. Lawrence River, Secondary - Eastern Georgian Bay, Tertiary - Nottawasaga River, Quaternary - Boyne River**4. PROPERTY OWNERSHIP (name, address, phone): **Deltini Commercial Developments Inc.**

LEGAL DESCRIPTION

Lot **Lot 1 and 2**
 Concession **Concession 2**
 Township **Township of Mulmur**
 County **Dufferin County**

CURRENT LAND USE (circle and describe)

• **vacant -field, bush, woods, forest, wilderness, tundra,****Vacant Farmland. Forest and creek at rear (west) of site. No structures noted on site.**

• passive -recreational parks, golf courses, non-habitable structures, buried utilities, swimming pools,

• active -habitable structures, residential, commercial, industrial, warehousing and storage,

• infra-structure or public use - stadiums, hospitals,
schools, bridges, high voltage power lines, waste management sites,

5. SLOPE DATA

HEIGHT • **3 - 6 m** • **6 - 10 m** • 10 - 15 m • 15 - 20 m **5m - 6m average height.**
 • 20 - 25 m • 25 - 30 m • > 30 m

estimated height (m):

INCLINATION AND SHAPE

• **4:1 or flatter**
25 % 14°• up to 3:1
33 % 18°• up to 2:1
50 % 26°• up to 1:1
100 % 45°• up to :1
200 % 63°• steeper than :1
> 63°

6. SLOPE DRAINAGE (describe)

TOP **No seepage or slope drainage noted at the top of slope.**FACE **No seepage or slope drainage noted on the face of the slope.**BOTTOM **Isolated locations where active creek had caused some minor seepage at bottom of slope.**

7. SLOPE SOIL STRATIGRAPHY (describe, positions, thicknesses, types) **Not visible due to snow/ice. Refer to Borehole data.**

TOP

FACE

BOTTOM

8. WATER COURSE FEATURES (circle and describe)

SWALE, CHANNEL

GULLY **One (1) gully observed, extending from toe of slope to top of slope. Water in gully flowing down towards creek.**

STREAM, **CREEK**, RIVER **Confined creek at base of slope. Tributary of the Boyne River. Flows from south to north.**

POND, BAY, LAKE

SPRINGS

MARSHY GROUND

9. VEGETATION COVER(grasses, weeds, shrubs, saplings, trees)

TOP **Top of slope is densely covered with young to mature trees and other vegetation.**

FACE **Slope face is densely covered with young to mature trees and other vegetation.**

BOTTOM **Toe of slope is densely covered with young to mature trees and other vegetation.**

10. STRUCTURES(buildings, walls, fences, sewers, roads, stairs, decks, towers,)

TOP **Old wooden fence observed at top of slope, spanning entire length in N-S direction. One (1) old wooden outdoor toilet structure noted at top of slope near South end.**

FACE **No structures noted on slope face.**

BOTTOM **No structures noted at toe of slope.**

11. EROSION FEATURES(scour, undercutting, bare areas, piping, rills, gully)

TOP **No erosion noted across top of slope, with the exception of One (1) gully which extended from the creek to top of slope.**

FACE **No erosion noted across face of slope, with the exception of One (1) gully which extended from the creek to top of slope.**

BOTTOM **Generally no erosion at the toe of the slope. One (1) gully extending from the creek to the top of slope was observed. Some isolated locations were slightly eroded due to the active watercourse, with tilted/fallen trees observed.**

12. SLOPE SLIDE FEATURES(tension cracks, scarps, slumps, bulges, grabens, ridges, bent trees)

TOP **No slope slide features observed during review.**

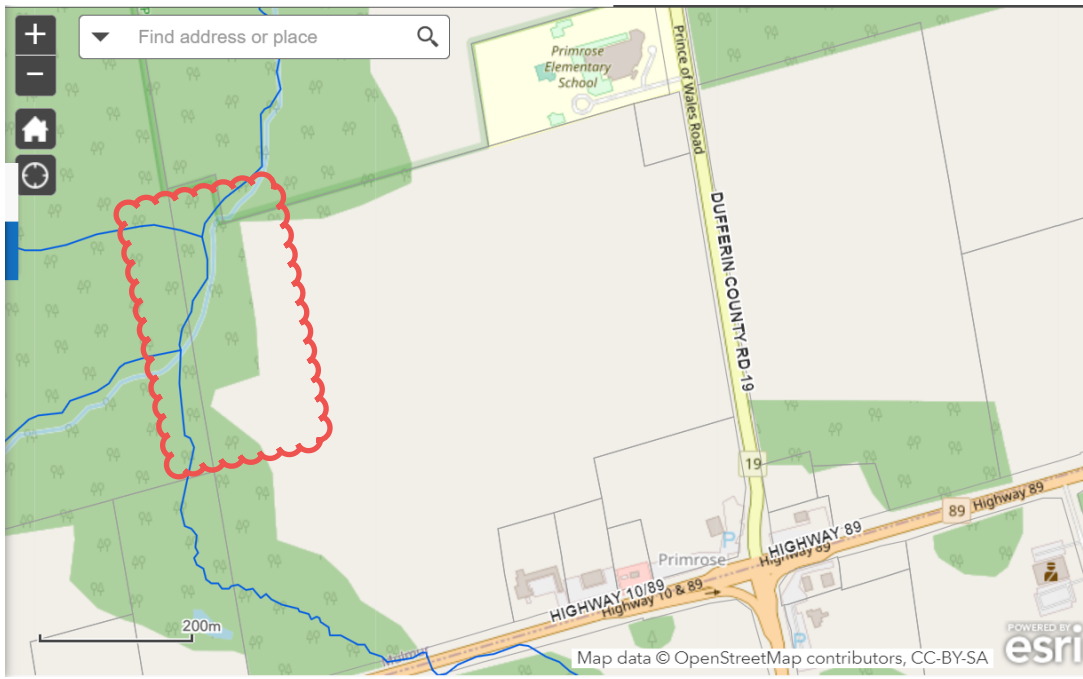
FACE **No slope slide features observed during review.**

BOTTOM **No slope slide features observed during review.**

13. PLAN SKETCH OF SLOPE

14. PROFILE SKETCH OF SLOPE

13. Plan Sketch of Slope



14. Profile Sketch of Slope

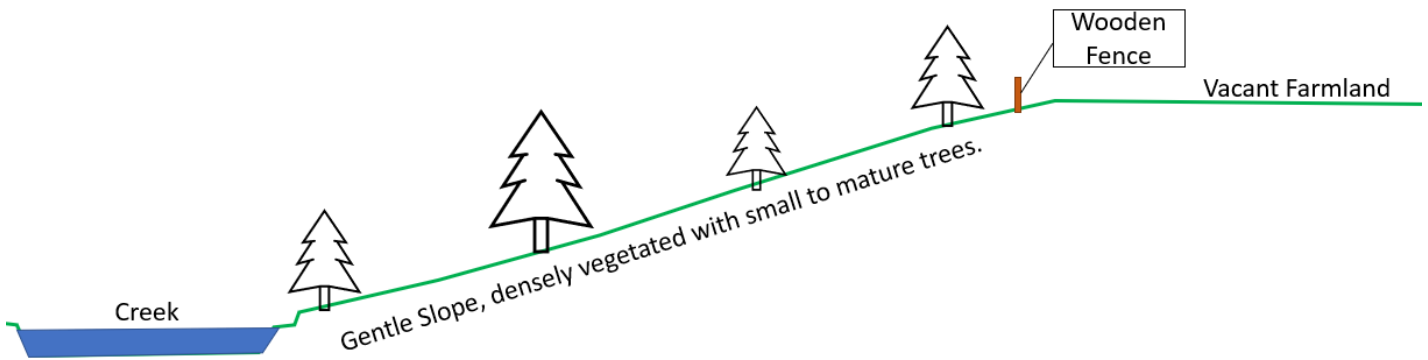


TABLE 4.2 - SLOPE STABILITY RATING CHART

Site Location: 636040 PRINCE OF WALES ROAD File No. 181-01582-04
 Property Owner: Deltini Commercial Developments Inc. Inspection Date: February 21, 2023
 Inspected By: Sunduss Asghar Weather: 0 Degrees (-5 with windchill).

1. SLOPE INCLINATION

degrees	horiz. : vert.	
a) 18 or less	3 : 1 or flatter	0
b) 18 - 26	2 : 1 to more than 3 : 1	6
c) more than 26	steeper than 2 : 1	16

2. SOIL STRATIGRAPHY

a) Shale, Limestone, Granite (Bedrock)	0
b) Sand, Gravel	6
c) Glacial Till	9
d) Clay, Silt	12
e) Fill	16
f) Leda Clay	24

3. SEEPAGE FROM SLOPE FACE

a) None or Near bottom only	0
b) Near mid-slope only	6
c) Near crest only or, From several levels	12

4. SLOPE HEIGHT

a) 2 m or less	0
b) 2.1 to 5 m	2
c) 5.1 to 10 m	4
d) more than 10 m	8

5. VEGETATION COVER ON SLOPE FACE

a) Well vegetated; heavy shrubs or forested with mature trees	0
b) Light vegetation; Mostly grass, weeds, occasional trees, shrubs	4
c) No vegetation, bare	8

6. TABLE LAND DRAINAGE

a) Table land flat, no apparent drainage over slope	0
b) Minor drainage over slope, no active erosion	2
c) Drainage over slope, active erosion, gullies	4

7. PROXIMITY OF WATERCOURSE TO SLOPE TOE

a) 15 metres or more from slope toe	0
b) Less than 15 metres from slope toe	6

8. PREVIOUS LANDSLIDE ACTIVITY

a) No	0
b) Yes	6

SLOPE INSTABILITY RATING VALUES INVESTIGATION RATING SUMMARY

TOTAL 21

SUMMARY OF RATING VALUES AND RESULTING INVESTIGATION REQUIREMENTS

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.

The Rating Chart identifies 3 levels of stability and associated investigation requirements. The three levels are:

1. Stable / Site Inspection Only

A rating of 24 or less, suggests stable slope conditions,

- no toe erosion,
- good vegetation cover
- no evidence of past instability
- no structures within (slope height) of the crest

and that no further investigation (beyond visual inspection) is needed. This should be simply confirmed through a visual site inspection and estimate of the slope configuration and slope stratigraphy and drainage (i.e. no measurements). Confirmation of the slope stability should be provided in the form of a letter (signed and sealed with A.P.E.O. stamp) from an experienced and qualified geotechnical engineer. The letter should include a summary of the site inspection observations which could be recorded on a Slope Inspection Form (see enclosed) and should clearly identify;

- slope height and inclination,
- vegetation cover on slope face,
- toe erosion, or surface erosion on slope,
- structures near slope crest or on slope,
- drainage features near slope crest, on slope face, or near slope toe.

2. Slight Potential / Site Inspection, Preliminary Study

A rating between 25-35 suggests the presence of several surface features that could create an unstable slope situation. The stability of the slope should be confirmed through a visual site inspection only, without boreholes. In addition to recording the visual observations outlined in the section above, some direct measurements of site features are required.

The slope height and inclination should be determined either with a hand inclinometer, or by 'breaking slope', or from mapping, or by surveying. As well, more information about the soil stratigraphy of the slope, should be obtained (without drilling boreholes) based on either previous or nearby subsurface investigations, or geologic mapping, or hand augering or test pits to determine shallow depth soil type(s). Measurements should be taken (by hand tape or surveying) of the locations of structures relative to the crest, and other features such as vegetation, past slide features (tension cracks, scarps, slumps, bulges, ridges), and erosion features. If available, historical

air photographs should be examined for evidence of any past instability over the long-term. Confirmation of the slope stability should be provided in the form of a detailed report (signed and sealed with A.P.E.O. stamp) from an experienced and qualified geotechnical engineer.

This report will include:

- Slope Inspection Record (Appendix)
- a Site Plan and a Slope Profile indicating the positions of the various measurements taken on site (slope crest, slope toe, location of structures relative to crest, drainage features, erosion features, vegetation cover, indicators of past instability or movements)
- photographs of the site and slope conditions
- a discussion of the site inspection and measurements taken, review of previous information
- preliminary engineering analysis of slope stability (i.e., calculation of Factor of Safety) based on the above information and measurements, but utilizing conservative soil strength parameters and groundwater conditions since boreholes were not carried out.

3. Moderate Potential / Borehole Investigation

A rating of more than 35 suggests a moderate potential for instability. This may result if the slope is either steep, high and/or has several features that could create an unstable slope situation. The stability of the slope should be assessed more precisely through topographic survey of slope configuration and boreholes for slope stratigraphy and penetration resistance tests. Piezometers must be installed in the boreholes and measurements must be taken for groundwater levels. Laboratory testing on the borehole samples must be conducted to measure Basic Index Properties (water contents, unit weights, grain size distribution, Atterberg Limits) described in Appendix D, or other properties as required.

A detailed engineering stability analysis must be conducted to determine if the Factor of Safety for the original slope conditions equals or exceeds a design minimum Factor of Safety. The analysis should be based on the information obtained from the site survey and the borehole information. Historical data such as air photographs should also be reviewed. Confirmation of the slope stability or instability (and the stable slope inclination) should be provided in the form of a detailed report (signed and sealed with A.P.E.O. stamp) from an experienced and qualified geotechnical engineer. This