2023-09-28

Mr. Ken Szekely
Astra Property Group
2213 North Sheridan Way
Mississauga, ON L5K 1A3

Subject: Supplementary Assessment of Regulatory Setbacks
1450 King Road
Client ref.: WW21012079-L01

Dear Mr. Szekely:

As part of Conservation Halton's (CH's) review of the Zoning By-law Amendment application for 1450 & 0000 King Road, Burlington, a meeting was held with representatives from WSP E&I Canada Limited (WSP) to discuss delineation of the stable top of bank (STOB). This meeting was held via MS Teams on August 10, 2023. In the meeting and in a subsequent email of the same date, CH requested that:

1. *"...additional cross-sections be analyzed to accurately define the stable slope line and associated setbacks."*
2. Work was to be carried out in accordance with the following two documents:
    - *Conservation Halton Guidelines for Slope Stability Assessments for Valleys*, Version 1.0 Final, dated September 2022 (hereby known as the 2022 CH Guidelines); and
    - *Geotechnical Principles for Stable Slopes,* prepared by Terraprobe Limited and Aqua Solutions dated June 1998.

This letter presents the results of this results of the supplementary assessment as described above and should be considered an addendum to the geotechnical report prepared by Wood Environment and Infrastructure Solutions, A Division of Wood Canada Limited (Wood), titled:

- *Geotechnical Investigation Report, 1450 King Road, Burlington*, Project No. WW21012079 dated January 24, 2022 (hereby known as the geotechnical report).

Wood's Environmental and Infrastructure division was acquired by WSP Global Inc. in September 2022 and operates as WSP E&I Canada Limited (WSP), a fully owned subsidiary of WSP Global Inc.

BACKGROUND

Reference should be made to the geotechnical report for project details including project description, site description and location, topographic survey, subsurface conditions and engineering properties of soils. The east valley slope of the Indian Creek tributary is situated along the west boundary of the subject property. As noted in Section 6.0 of the geotechnical report, the anticipated subsurface conditions along the east valley slope are surficial topsoil over very stiff to hard silty clay till. In localized areas, the glacial till may be overlain by layers of cohesive fill and native, very stiff silty clay of limited thickness.

The subject section of slope was visually assessed in August 2021 with a site visit in general accordance with the 2002 Ontario Ministry of Natural Resources *Technical Guide River & Stream Systems: Erosion Hazard Limit* (2002 MNR Technical Guide). The visual assessment was

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augmented with WSP's September 2021 geotechnical explorations and subsequent slope stability analyses. The results of the visual assessment and slope stability analyses are presented in Sections 7.1 and 7.2 and Appendices C and D of the geotechnical report.

The approach taken for the geotechnical report was to define three subsections of slope, Areas A, B and C, with two representative cross sections, A-A' and B-B' as shown on Figure 1. The characteristics of slope Areas A and C were considered sufficiently similar that they could be represented by a single cross section, A-A'. The overall slopes of Areas A and C were well vegetated and covered with either heavy scrub or forested with matured trees. No signs of slope instability, seepage or erosion were observed in Areas A and C. In localized parts of Area B, toe erosion, bare spots and zones of light vegetation were noted. Seepage was not observed in Area B.

In general, the slope inclination of Areas A and C were flatter than 2 horizontal to 1 vertical (2H:1V) with no active erosion along the toe. The slope stability rating chart score for Section A-A' was such that no further investigation was required beyond site inspection. The results of the slope stability analysis for Section A-A' indicated that a 2H:1V slope was stable with a factor of safety (FOS) of 1.5. Area B is the steepest of the three areas being typically inclined greater than 2H:1V with active erosion observed at the toe in localized areas. The slope stability rating chart score for Section B-B' required surveying and preliminary slope stability analysis. The results of the slope stability analysis for Section B-B' indicated that although the slope at 1.5H:1V slope was stable with a FOS of 1.3, it did not meet the selected minimum recommended design FOS of 1.4 for 'Active Use' (commercial building and stormwater management facility) as defined in the 2002 MNR Technical Guide.

Based on the above the following setbacks for the erosion hazard limit were recommended in the geotechnical report:

AREA	TOE EROSION ALLOWANCE[1] (M)	ALLOWANCE FOR STABLE SLOPE[2]	EROSION ACCESS ALLOWANCE[3] (M)
A	1	The physical top of slope can be considered the long-term stable top of slope.	7.5
B	5	Based on the results of the slope stability analysis, an additional setback of 3 m is required as an allowance for stable slope. This setback was applied throughout area B. It is based on a stable slope inclination of 2H:1V applied to the steepest section of Area B, which is inclined at approximately 1.5H:1V.	7.5
C	1	The physical top of slope can be considered the long-term stable top of slope.	7.5

Notes:

1. Based on Table 3 of the 2002 MNR Technical Guide.
2. Based on results of slope stability analysis as reported in the geotechnical report.
3. Based on CH requirements.

SLOPE AREAS AND ADDITIONAL CROSS-SECTIONS

The results of the topographic survey were re-examined and the division of the slope along the western boundary was considered satisfactory. The subject section of slope was divided into five (5) reaches along the western property line as shown on Figure 1. Reaches 1 and 2 represent the northern 25 m and southern 35 m, respectively of Area A. Reach 3 is effectively Area B. Reaches 4 and 5 represent the northern 25 m and southern 40 m, respectively of Area C. Reach lengths are

approximate distances along the western property boundary and each reach represents a zone within which the topography is generally similar. Three additional sections, X-X', Y-Y' and Z-Z', were added to the assessment. The sections are shown in plan on Figure 1 and on Figures 2 to 4.

Characteristics of each reach are summarized in Table A. The bankful width of the Indian Creek tributary within the study area is less than 5 m based on the review of the site topography and notes from the August 2021 site visit. The reaches are briefly described as follows:

- Reach 1 – sloping at 3.7H:1V to 5.6H:1V, 3.5 to 5 m in height with a broad area between the watercourse and the toe of the east valley slope 6 to 32 m in width.
- Reach 2 – sloping between 2H:1V and 4H:1V at an average height of 5 m. The area between the watercourse and the toe of the east valley slope is approximately 6 m to 7 m in width at the north end, diminishing to 0 m within 5 m of Reach 3.
- Reach 3 – steepest reach sloping typically between 1.4H:1V and 2H:1V and ranging from 3.5 to 5.5 m in height. In localized areas, the slope ranges between 2H:1V and 3.5H:1V. The watercourse is generally situated at the slope toe.
- Reach 4 – slopes ranging from 2.2H:1V to 3.5H:1V with valley wall heights of 4.5 to 6.5 m. The width of the area between the watercourse and the toe of the east valley slope increases southwards from 0 m to approximately 6 m.
- Reach 5 – slopes ranging from 3.3H:1V to 7.3H:1V with valley wall heights of 4.5 to 5.5 m. The area between the watercourse and the toe of the east valley slope is about 6 to 18 m wide.

STABLE TOP OF BANK ASSESSMENT

The tributary of Indian Creek within the project area is considered to be a confined valley system according to the 2022 CH Guidelines and the 2002 MNR Technical Guide. A summary of the details of the stable top of bank assessment is presented in Table A. The applicable setbacks are illustrated on Figure 1. The Toe Erosion Allowance, Toe of Slope, Stable Slope Allowance, Top of Bank (as staked by CH) and 7.5 m Regulatory Allowance are illustrated on Figures 2 to 4. The following subsections briefly describe the various components of the setbacks.

The recommended setbacks supersede those of Wood's January 2022 report.

Toe Erosion Allowance

A setback for toe erosion is required wherever a watercourse is within 15 m of the toe of slope. The toe of slope is within 15 m of the watercourse bank for Reaches 2 to 5 and the southern part of Reach 1. The Toe Erosion Allowance for these locations were determined from Table 3 of the 2002 MNR Technical Guide. A toe erosion allowance of 1 m is applicable to Reach 2 approximately 3 m north of the Reach 3, and Reaches 1, 4 and 5 due to the absence of observed active toe erosion. A Toe Erosion Allowance of 5 m is recommended for Reach 3 as toe erosion was observed in localized areas.

Stable Slope Allowance

The Stable Slope allowance should begin from the physical toe of slope for Reaches 1, 2, 4 and 5 where the distance between the watercourse and the toe of slope exceeds 1 m and from the end of the toe erosion allowance where toe of slope is 1 m or less from the watercourse. For Reach 3, the Stable Slope Allowance should begin from the 5 m Toe Erosion Allowance.

The Stable Slope Allowance for Reaches 1, 2, 4 and 5 conforms to the existing slopes, which are inclined at 2H:1V or flatter. As shown in the slope stability analysis for Section A-A' (See Figure D.1 of the geotechnical report), a 2H:1V slope is stable with a FOS of 1.5. The 2022 CH Guidelines state that a FOS of 1.5 is the minimum acceptable FOS for normal groundwater conditions.

A slope inclination of 2H:1V has been applied to Reach 3 for defining the Stable Slope Allowance. The resulting offset between the Top of Slope (staked by CH) and the STOB across Reach 3 varies

from approximately 2 m for slope segments inclined at 2H:1V or flatter (represented by Section A-A') and up to approximately 11 m for the segment sloped at 1.4H to 1.5H:1V (represented by Section B-B').

Regulatory Allowance

The tributary to Indian Creek is a minor valley system. According to CH requirements, a 7.5 m Regulatory Allowance is required. This is applicable to all five reaches.

CLOSING

We trust the above is sufficient for your needs. If you have any questions or require further clarification, please contact the undersigned.

Yours sincerely,



Dirka U. Prout, P.Eng.,
Associate Engineer - Geotechnical

Mauro Cortes, P.Eng.
Senior Associate Engineer - Geotechnical

DUP/MC/dup

Encl. Table A – Summary of Slope Assessment
Figure 1 – Location Plan
Figure 2 – A-A' and B-B' Slope Stability Section
Figure 3 – X-X' and Y-Y' Slope Stability Section
Figure 4 – Z-Z' Slope Stability Section

WSP ref.: WW21012079-L01

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SUMMARY OF SLOPE ASSESSMENT

1450 KING ROAD
BURLINGTON, ONTARIO

Slope Reach	Area[1]	Section[2]	Bankful Width (< 5m)?	Approx. Distance of Toe of Valley Slope From Watercourse (m)	Minimum Valley Slope Height (m)	Maximum Valley Slope Height (m)	Horizontal Slope Length at Mininum Slope Height (m)	Horizontal Slope Length at Maxinum Slope Height (m)	Inclination at Minimum Valley Slope Height (^{o})	Inclination at Maximum Valley Slope Height (^{o})	Slope Inclination (H:1V)	Toe Erosion Allowance[3] (m)	Stable Slope Allowance[4]	Regulatory Allowance[5]
R1	A	X-X'	Y	14 - 30	3.5	5	19.5	20	10.18	14.04	3.7 to 5.6	1, southern section only (no active erosion of toe observed)	As per CH guidelines; slope is considered stable without further analysis.	7.5 m for minor valley system
R2	A	A-A'	Y	0 - 14	5	5	10	20	26.57	14.04	2.0 to 4.0	1 (no active erosion of toe observed)	Stable based on stability analysis (see Figure D.1 of 2022 Wood Report)	7.5 m for minor valley system
R3	B	B'B'	Y	0 to 5.5	3	5.5	6.5	8	24.78	34.51	1.4 to 3.5	5 (localized active erosion of toe observed)	Based on 2H:1V as existing slope unstable based on slope stability analysis (See Figure D.2 of 2022 Wood Report.	7.5 m for minor valley system

SUMMARY OF SLOPE ASSESSMENT

1450 KING ROAD
BURLINGTON, ONTARIO

Slope Reach	Area[1]	Section[2]	Bankful Width (< 5m)?	Approx. Distance of Toe of Valley Slope From Watercourse (m)	Minimum Valley Slope Height (m)	Maximum Valley Slope Height (m)	Horizontal Slope Length at Mininum Slope Height (m)	Horizontal Slope Length at Maxinum Slope Height (m)	Inclination at Minimum Valley Slope Height (°)	Inclination at Maximum Valley Slope Height (°)	Slope Inclination (H:1V)	Toe Erosion Allowance[3] (m)	Stable Slope Allowance[4]	Regulatory Allowance[5]
R4	C	Y-Y'	Y	0 - 6	3	4.5	6.5	15	24.78	16.70	2.2 to 3.5	1 (no active erosion of toe observed)	As per CH guidelines; slope is considered stable without further analysis.	7.5 m for minor valley system
R5	C	Z-Z'	Y	~10	4.5	5.5	15	40	16.70	7.83	3.3 to 7.3	1 (no active erosion of toe observed)	As per CH guidelines; slope is considered stable without further analysis.	7.5 m for minor valley system

Notes:

1. Area as defined in Section 7.1 of Wood Environmental & Infrastructure Solutions geotechnical report dated January 24, 2022 and depicted in Figure 1 of this technical memorandum
2. Typical section for each reach as shown in Figure 1.
3. Toe Erosion Allowance based on Section 2.5 of 2022 *Conservation Halton Guidelines for Slope Stability Assessments for Valleys* (2022 CH Guidelines) and Section 3.1 of 2002 Ontario Ministry of Natural Resources Technical Guide River & Stream Systems: Erosion Hazard Limit (2002 MNR Technical Guide).
4. Stable Slope Allowance based on Section 2.6 of 2022 CH Guidelines and Section 3.2 of 2002 MNR Technical Guide.
5. Regulatory Allowance (including 6 m Erosion Access Allowance as defined in 2002 MNR Technical Guide) based on Section 2.1 of 2022 CH Guidelines.
6. Table to be read in conjunction with accompanying letter.



LEGEND:

- APPROXIMATE PROPERTY LINE
- TOP OF SLOPE (STAKED BY CH)
- STABLE TOP OF SLOPE
- 7.5m REGULATORY ALLOWANCE
- REACH 1
- REACH 2
- REACH 3
- REACH 4
- REACH 5
- BOREHOLE LOCATION
- BOREHOLE/MONITORING WELL LOCATION
- AREA: A
- AREA: B
- AREA: C

NOTES:
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WSP E&I CANADA LIMITED LETTER No. WW21012079.L01

ALL LOCATIONS ARE APPROXIMATE ONLY.

REFERENCES:
BING IMAGERY AS OF NOVEMBER 22, 2021 (IMAGE DATE UNKNOWN), BING IMAGERY USED FOR ILLUSTRATION PURPOSES ONLY AND NOT TO BE USED FOR MEASUREMENTS.

CLIENT:
QUANTUM REALTY MANAGEMENT
2213 N SHERIDAN WAY
MISSISSAUGA, ONTARIO L5K 1A3

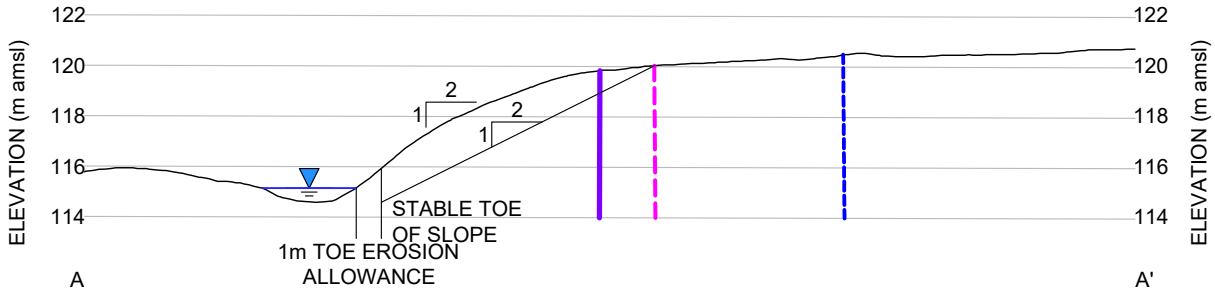
WSP E&I Canada Limited
110 JAMES STREET, SUITE 301
ST. CATHARINES, ONTARIO, L2R 7E8
905-687-6616

DWN BY: LMK
CHK'D BY: DUP
DATUM: NAD83
PROJECTION: UTM Zone 17
SCALE: 1:1,500

PROJECT:
SLOPE STABILITY
1450 KING ROAD
BURLINGTON, ONTARIO

TITLE:
LOCATION PLAN

DATE: AUG 2023
PROJECT No: WW21012079
REV. No: 0
FIGURE No: 1



HORIZONTAL SCALE IN METRES

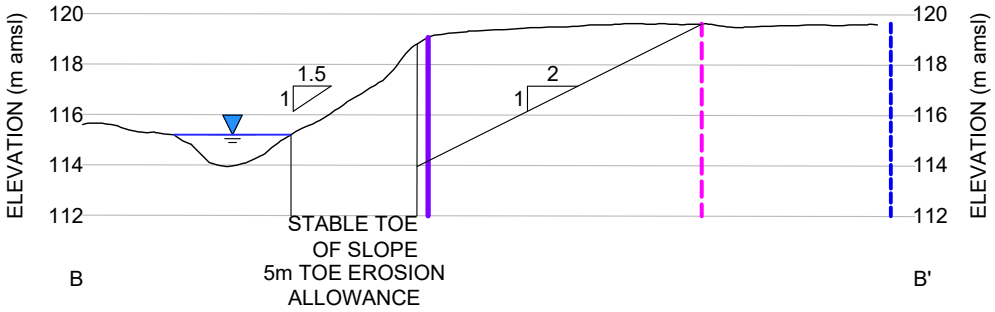
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VERTICAL SCALE IN METRES

0 5 10m

1:300



LEGEND:

- TOP OF SLOPE (STAKED BY CH)
- STABLE TOP OF SLOPE
- 7.5m REGULATORY ALLOWANCE

NOTES:
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FOR SECTION LOCATION, REFER TO FIGURE 1.

ALL LOCATIONS ARE APPROXIMATE ONLY.

CLIENT:
QUANTUM REALTY MANAGEMENT
2213 N SHERIDAN WAY
MISSISSAUGA, ONTARIO L5K 1A3

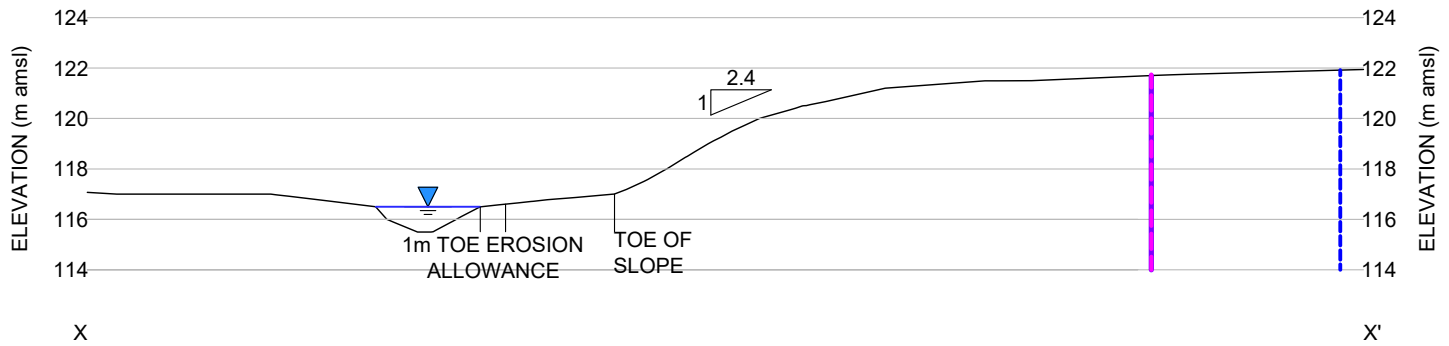
WSP E&I Canada Limited
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CHK'D BY: DUP
DATUM: NAD83
PROJECTION: UTM Zone 17
SCALE: AS SHOWN

PROJECT:
SLOPE STABILITY
1450 KING ROAD
BURLINGTON, ONTARIO

TITLE:
A-A' AND B-B' SLOPE STABILITY SECTION

DATE: AUG 2023
PROJECT No: WW21012079
REV. No: 0
FIGURE No: 2



HORIZONTAL SCALE IN METRES

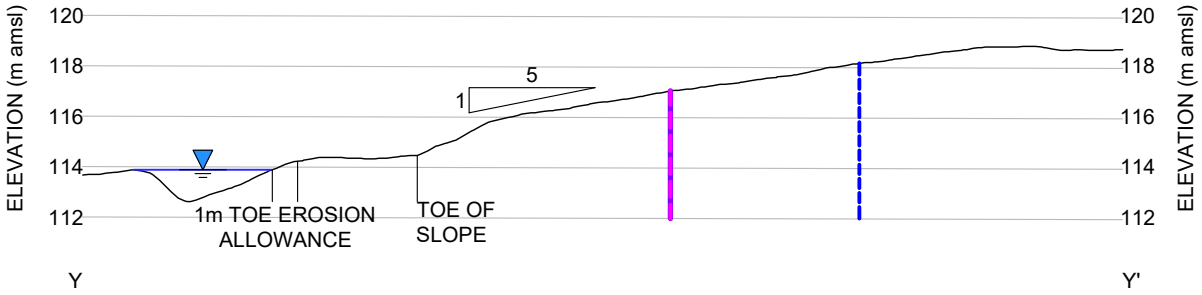
0 5 10m

1:300

VERTICAL SCALE IN METRES

0 5 10m

1:300



LEGEND:

- TOP OF SLOPE (STAKED BY CH)
- STABLE TOP OF SLOPE
- 7.5m REGULATORY ALLOWANCE

NOTES:
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WSP E&I CANADA LIMITED LETTER No. WW21012079.L01.

FOR SECTION LOCATION, REFER TO FIGURE 1.

ALL LOCATIONS ARE APPROXIMATE ONLY.

CLIENT:
QUANTUM REALTY MANAGEMENT
2213 N SHERIDAN WAY
MISSISSAUGA, ONTARIO L5K 1A3

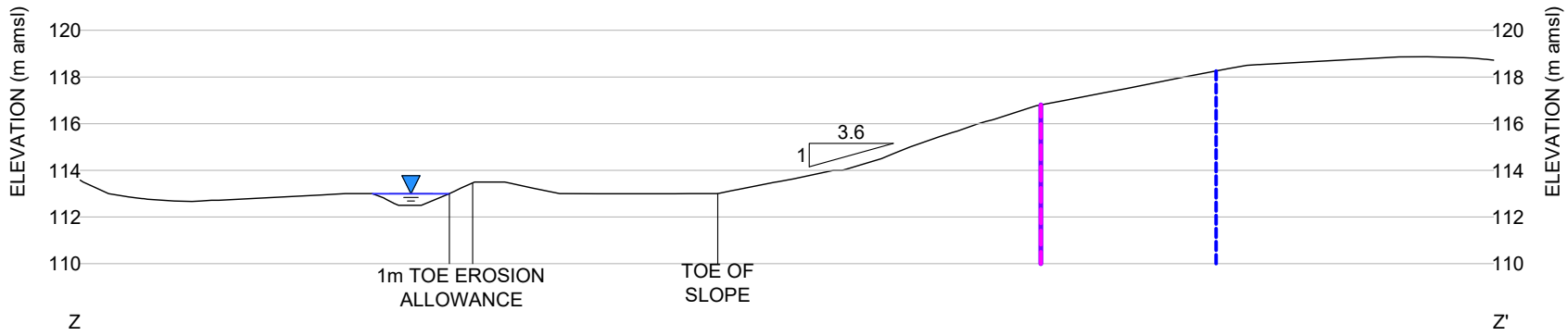
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DWN BY: LMK
CHK'D BY: DUP
DATUM: NAD83
PROJECTION: UTM Zone 17
SCALE: AS SHOWN

PROJECT:
SLOPE STABILITY
1450 KING ROAD
BURLINGTON, ONTARIO

TITLE:
X-X' AND Y-Y' SLOPE STABILITY SECTION

DATE: AUG 2023
PROJECT No: WW21012079
REV. No: 0
FIGURE No: 3



LEGEND:

- TOP OF SLOPE (STAKED BY CH)
- STABLE TOP OF SLOPE
- 7.5m REGULATORY ALLOWANCE

NOTES:
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE WSP E&I CANADA LIMITED LETTER No. WW21012079.L01.

FOR SECTION LOCATION, REFER TO FIGURE 1.

ALL LOCATIONS ARE APPROXIMATE ONLY.

HORIZONTAL SCALE IN METRES
0 5 10m
1:300

VERTICAL SCALE IN METRES
0 5 10m
1:300

CLIENT:
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2213 N SHERIDAN WAY
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DWN BY: LMK
CHK'D BY: DUP
DATUM: NAD83
PROJECTION: UTM Zone 17
SCALE: AS SHOWN

PROJECT:
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1450 KING ROAD
BURLINGTON, ONTARIO

TITLE:
Z-Z' SLOPE STABILITY SECTION

DATE: AUG 2023
PROJECT No: WW21012079
REV. No: 0
FIGURE No: 4