



Soil Engineers Ltd.

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

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November 14, 2024

Reference No. 2404-S012A

Page 1 of 6

RGA Masonry Ltd.
10 Hillavon Drive
Toronto, Ontario
M9B 2P5

Attention: Mr. Roman Lichak

**Re: Slope Stability Assessment
Proposed Townhouse Development
50 and 60 Harborn Road
City of Mississauga**

Dear Sir:

Further to your written authorization dated April 27, 2024, we have completed the geotechnical investigation at the captioned site and herein present our slope stability assessment for the captioned site. The purpose of the assessment is to establish the erosion hazard limit along the valley land for the proposed Townhouse Development. The geotechnical report for the proposed development is presented under separate cover, Reference No. 2404-S012, dated June 2024. This report only deals with the slope stability assessment carried out along the valley land at the captioned site.

The proposed development is located adjacent to Mary Fix Creek within the Credit Valley Conservation (CVC) regulated area. This slope stability assessment is being carried out in accordance to the Ontario Ministry of Natural Resource Guideline to determine the erosion hazard limit.

Site Visit

A site inspection was carried out by Soil Engineers Ltd. on June 14, 2024. The inspection revealed that the valley land is vegetated with mature trees. It is undulated with variable slope gradients, extending down towards the creek. A stone wall is present within a section of the valley land within 68 Harborn Road. The growth pattern of the trees does not indicate any instability on the slope, and no deep-seated failures or seepages were observed along the surface of the valley land.



At the base of the valley land, a well-defined channel is apparent. It is approximately 1 m wide and is lined with river stones along the entirety of the channel. The channel is flowing with water towards the southeast direction to Premium Way.

Topographic Survey Review

A topographic survey containing spot elevations and partial contour lines was provided on the survey titled “Surveyor’s Real Property Report and Topography” prepared by C. Wahba Surveying Ltd., dated October 4, 2023.

No staked top of slope has been completed; however, a surveyed top of slope has been identified on the survey plan by the surveyor within the accessible area east of the chain-link fence of 68 Harborn Road. A flood plain limit of El. 97.27 m has been identified along the valley land.

The survey details indicate that the valley land is approximately 2.7 to 4 m in height. Based on the available topographic information, the estimated gradients of the valley slope range between 1 vertical (V): 1.7 to 2.4 horizontal (H), with local gradient as steep as 1V:1.3H. The details from the topographic survey are presented on Drawing No. 1.

Four cross-sections along the valley slope have been chosen as representative sections for the slope stability assessment. The interpreted cross-sections, are presented in Drawing Nos. 2 to 9.

Slope Stability Assessment

With reference to the OMNR Technical Guide for River and Streams Systems: Erosion Hazard Limits, the appropriate setback/allowance necessary to define the erosion hazard limit for a confined system consists of the following:

- Toe Erosion Allowance
- Stable Slope Allowance/Stable Slope Setback
- Erosion Access Allowance

Toe Erosion Allowance

Mary Fix Creek has been rehabilitated by the City of Mississauga as part of an erosion control initiative. The channel between Harborn Road and Premium Way, within the property limit of 68 Harborn Road has been lined with river stones as an erosion control measure.



Based on the CVC document, “Slope Stability Definition & Determination Guideline”, dated February 2014, “where erosion protection is in place and maintained along the bank”, toe erosion allowance is not required; therefore, no toe erosion setback is recommended.

Stable Slope Allowance

Slope stability analyses of the cross-sections were carried out using Bishop Method in Slide 6.0, developed by Rocscience Inc. The results are provided in their respective cross-sections. The soil parameters used in the analyses are presented in the following table:

Soil Type	Unit Weight γ (kN/m³)	Cohesion c (kPa)	Internal Friction Angle ϕ (degrees)
Earth Fill	20.5	0	26
Sand (loose)	20.5	0	28
Sand (compact)	20.5	0	30
Silty Clay Till	22.0	5	30
Shale Bedrock	24.0	50	45

The soil stratigraphy and groundwater condition are interpreted based on the borehole findings presented in our Geotechnical Investigation Report, Reference No. 2404-S012, and the recorded groundwater level of El. 97.2 m from June 14, 2024.

The results of the analyses for the existing slope condition are presented on Drawing Nos. 2, 4, 6 and 8; the minimum factors of safety (FOS) are summarized in the table below:

Slope Section	Height of Slope (m)	Slope Gradient	Factor of Safety
A-A	3.3	1V:1.28 to 2.2H	1.213
B-B	2.8	1V:1.91 to 2.4H	1.492
C-C	3.4	1V:1.40H to 1.47H	0.962
D-D	2.6	1V:1.62 to 2.38H	1.420

* Height of slope refers to surveyed top of slope and bottom of slope

The analytical results indicate that all cross-sections are less than the minimum FOS of 1.5 required by the CVC and OMNR for active land uses. Accordingly, a stable slope gradient, with a FOS exceeding 1.5, will need to be determined for the slope sections.



The slope stability analyses, incorporating stable slope gradients ranging from 1V:2.52 to 2.62H, which satisfies the minimum FOS requirement of 1.5 for active land use are presented in Drawing Nos. 3, 5, 7 and 9 and the obtained minimum FOS are summarized in the following table:

Slope Section	Height of Slope (m)	Slope Gradient	Factor of Safety
A-A	3.9	1V:2.60H	1.509
B-B	2.8	1V:2.54H	1.549
C-C	3.2	1V:2.62H	1.520
D-D	3.1	1V:2.52H	1.505

Erosion Access allowance (Development Setback Component)

Based on the CVC guideline, an erosion access allowance of 10.0 m is to be applied at the stable top of slope.

Long-Term Stable Top of Slope

Based on the characteristic of the valley land, i.e. the height of the slope, the geology, and the stable gradient requirement, the Long-Term Stable Top of Slope (LTSTOS) is located approximately 7.3 to 10.6 m from the surveyed toe of slope. The erosion hazard limit, including the erosion access allowance of 10 m will range from 17.3 to 20.6 m measured from the surveyed toe of slope.

Since the topographic survey does not contain the full elevation contour of the entire extent of the valley land, the LTSTOS has been established where the elevation contours are available and a Projected Long-Term Stable Top of Slope is extrapolated into the area where the elevation contours are not available. The LTSTOS is plotted on Drawing No. 1.

Additional Considerations

In order to prevent disturbance of the existing slope, the following geotechnical constraints should be stipulated:

1. The prevailing vegetative cover on the slope must be maintained, since its extraction would deprive the slope of the rooting system that is reinforcement against soil erosion by weathering. If, for any reason, the vegetative cover is stripped, it must be reinstated to its original, or better than its original, protective condition. Restoration with



- selected native plantings including deep rooting systems which would penetrate the original topsoil must be carried out after the development to ensure bank stability.
2. Any leafy topsoil cover on the slope face should not be disturbed, since this provides an insulation and screen against frost wedging and rainwash erosion. Any bare slope surface must be adequately vegetated.
 3. Grading of the land adjacent to the slope must be such that concentrated runoff is not allowed to drain onto the slope face. Landscaping features which may cause runoff to pond at the top of the slope, such as infiltration trenches, as well as saturating the crown of the bank, must not be permitted.
 4. Where development is carried out adjacent to the slope, there are other factors to be considered related to possible human environmental abuse. These include soil saturation stripping of topsoil or vegetation, dumping of loose fill, and material storage close to the top of slope; none of these should be permitted.

The above recommendations are subject to the approval and requirements of the CVC.

Conclusion

Based on the slope stability analyses completed along the valley slope, the erosion hazard limit incorporating the Toe Erosion Allowance, Stable Slope Allowance and Erosion Access Allowance has been established.

It should be noted that the established setback has been completed based the limited topographic information provided; however, every effort is made to ensure the established long-term stable top of slope, including the projected long-term stable top of slope, have been reviewed to ensure it meets geotechnical requirements based on the subsurface condition encountered in the vicinity of the valley slope.

We trust this letter is to your satisfaction; however, should any queries arise, please feel free to contact this office.

Yours very truly,
SOIL ENGINEERS LTD.

Kelvin Hung, P. Eng.
KH/BL



Bernard Lee, P. Eng.



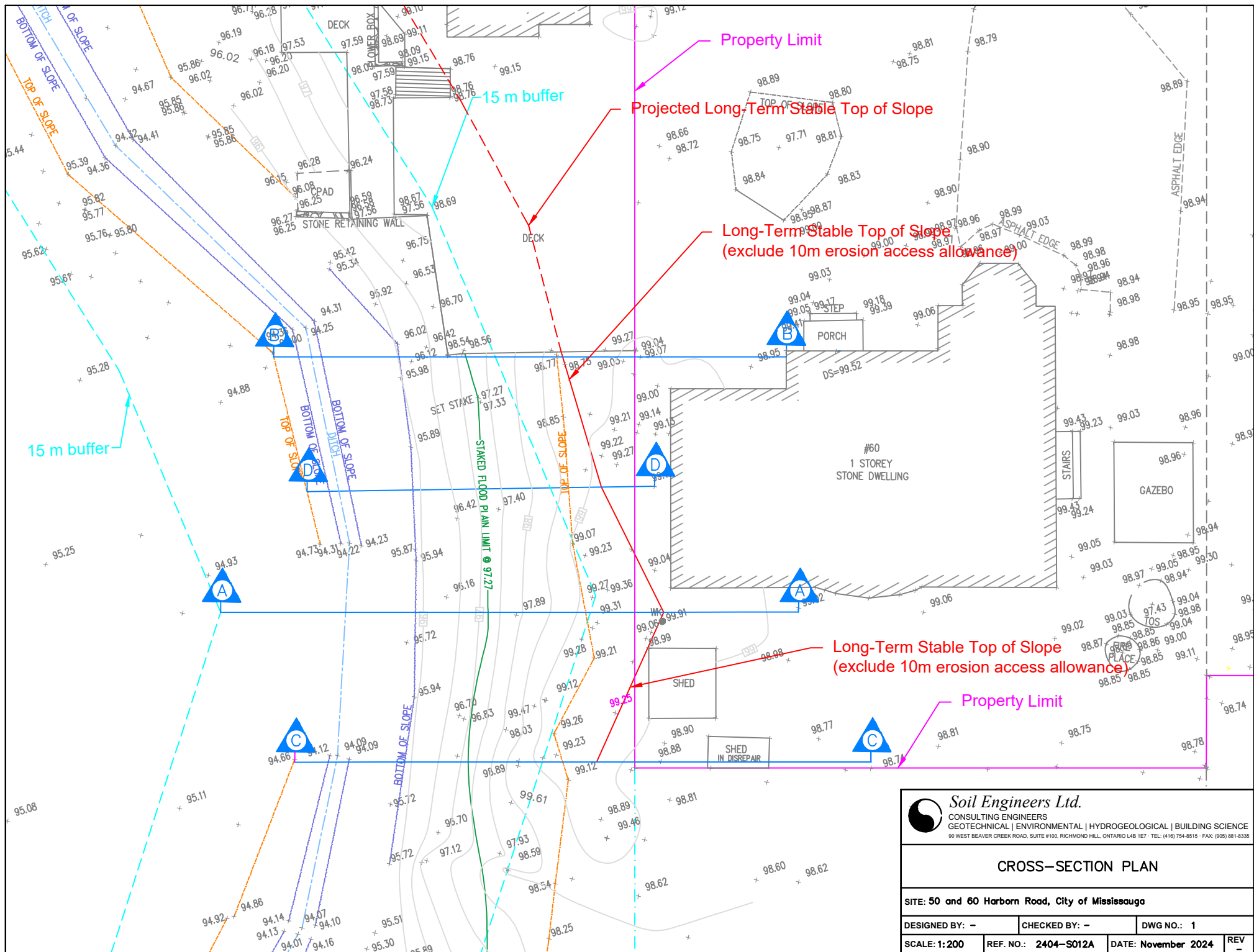
- c. Skira & Associates Ltd.
Attention: Mr. Zenon Skira, P.Eng.

W.E. Oughtred & Associates Inc.
Attention: Mr. Bill Oughtred

ENCLOSURES

Cross-Section Plan.....	Drawing No. 1
Cross-Sections A-A (Existing Condition)	Drawing No. 2
Cross-Sections A-A (LTSTOS).....	Drawing No. 3
Cross-Sections B-B (Existing Condition)	Drawing No. 4
Cross-Sections B-B (LTSTOS)	Drawing No. 5
Cross-Sections C-C (Existing Condition)	Drawing No. 6
Cross-Sections C-C (LTSTOS)	Drawing No. 7
Cross-Sections D-D (Existing Condition).....	Drawing No. 8
Cross-Sections D-D (LTSTOS).....	Drawing No. 9

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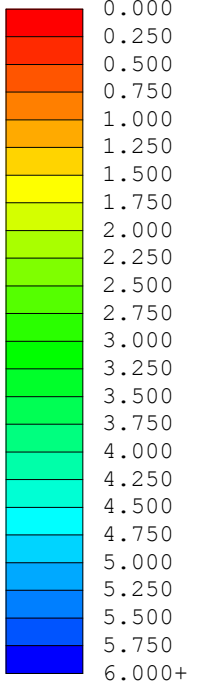
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CROSS-SECTION PLAN

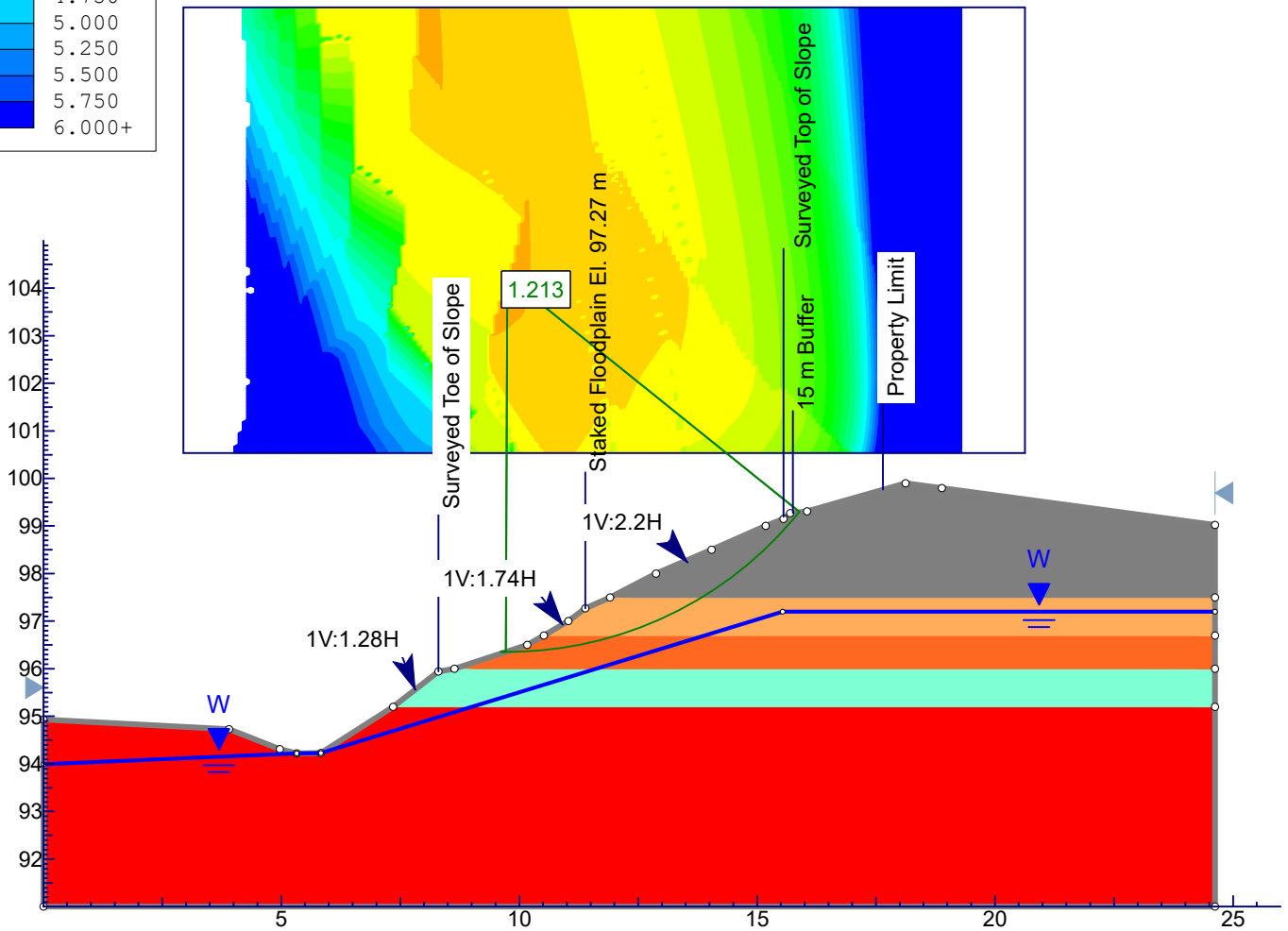
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DESIGNED BY: -	CHECKED BY: -	DWG NO.: 1
SCALE: 1:200	REF. NO.: 2404-S012A	DATE: November 2024
REV -		

Safety Factor



Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Earth Fill	Grey	20.5	0	26
Sand (Loose)	Orange	20.5	0	28
Silty Clay Till	Light Green	20	5	30
Shale	Red	24	50	45
Sand (Compact)	Dark Orange	20	0	30



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Project Title

Cross-Section A-A

Load Case

Existing Condition

Location

50 and 60 Harbourn Road, City of Mississauga

Drawn By KH

Checked By BL

Scale

1:150

Revision

-

Date

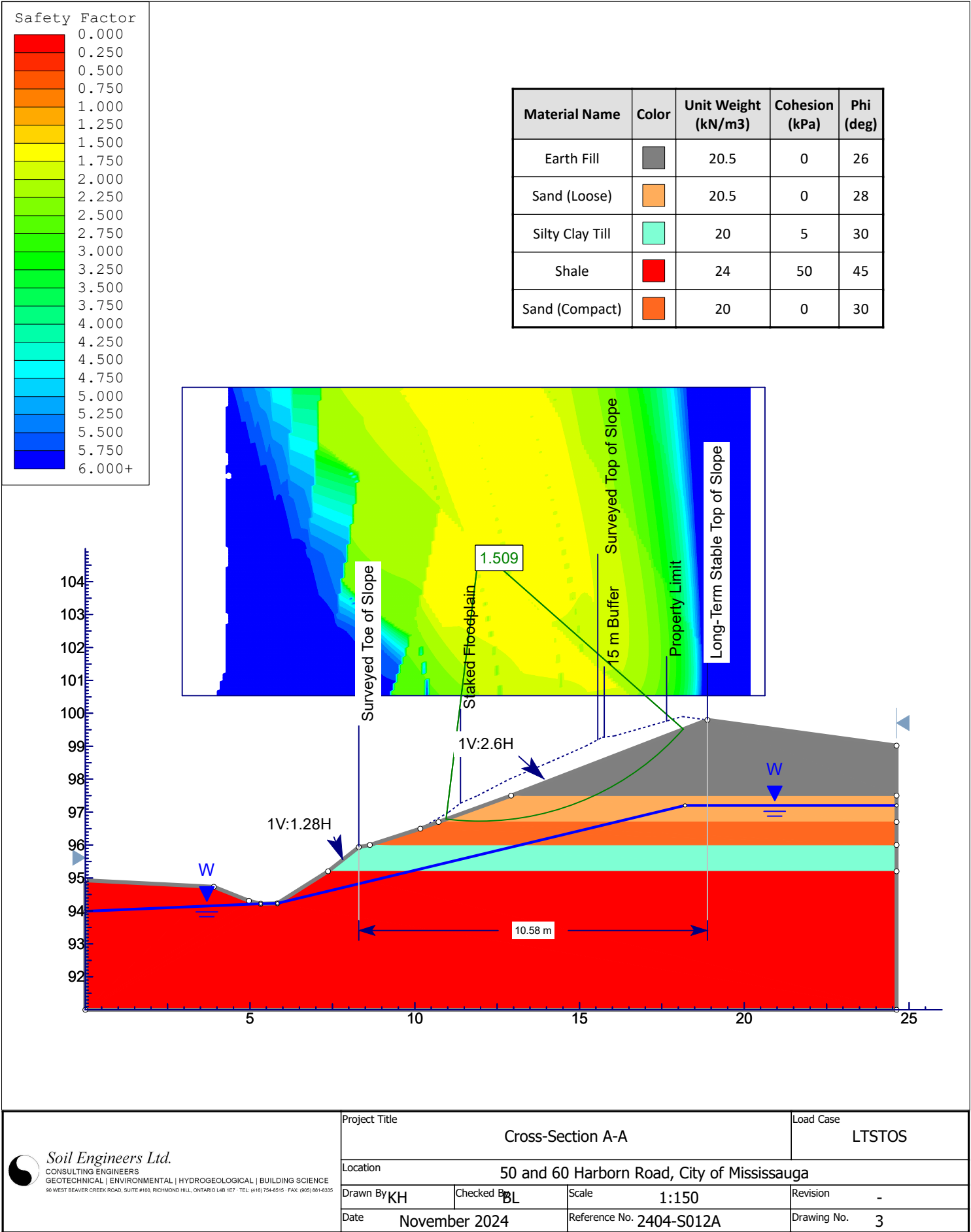
November 2024

Reference No.

2404-S012A

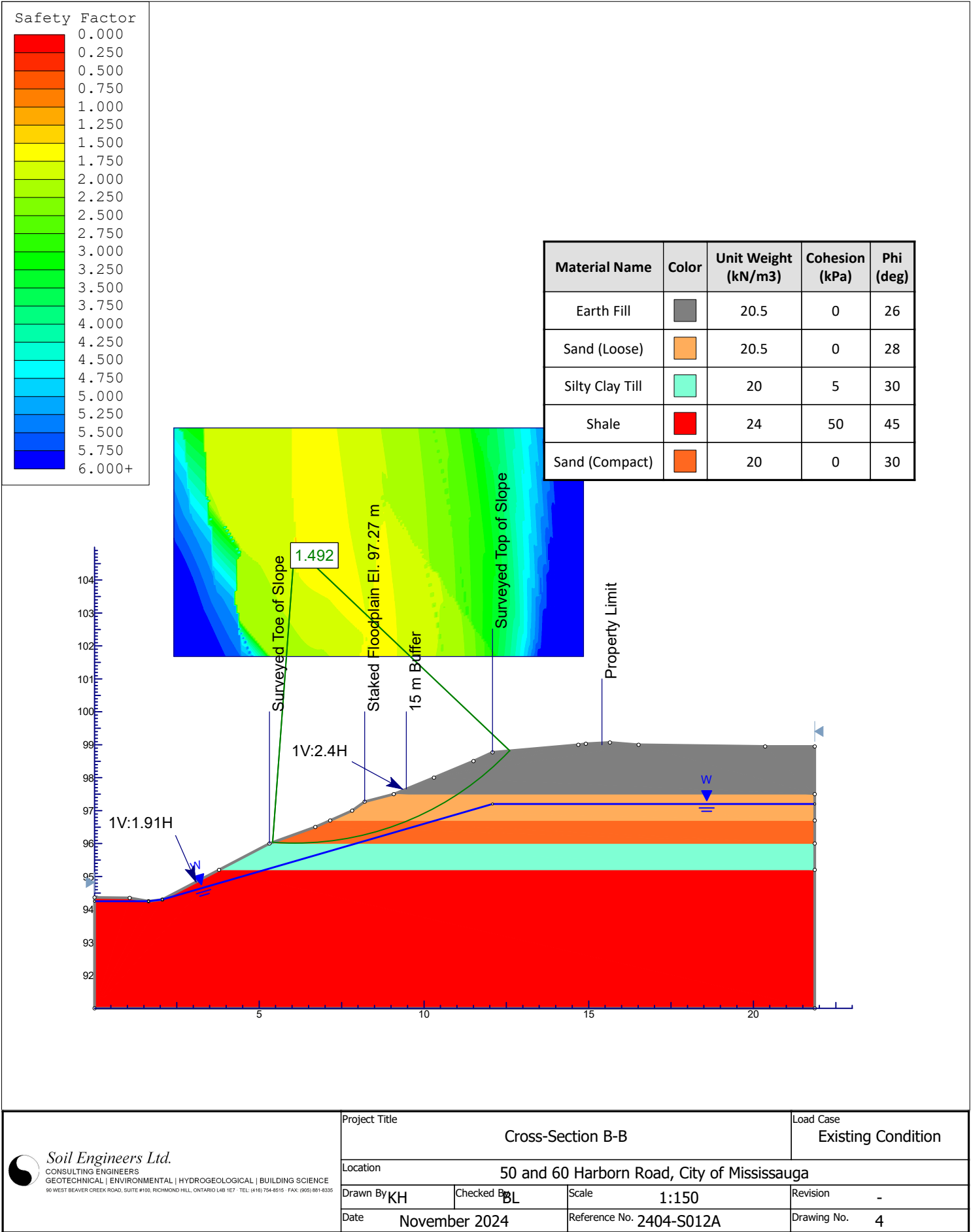
Drawing No.

2



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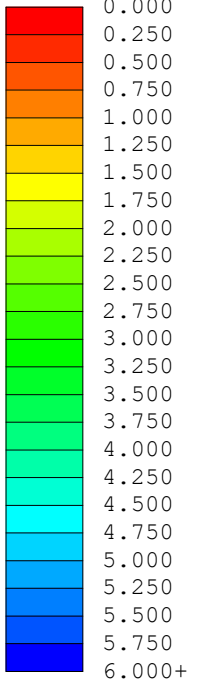
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Date	November 2024			Reference No.	2404-S012A
				Revision	-
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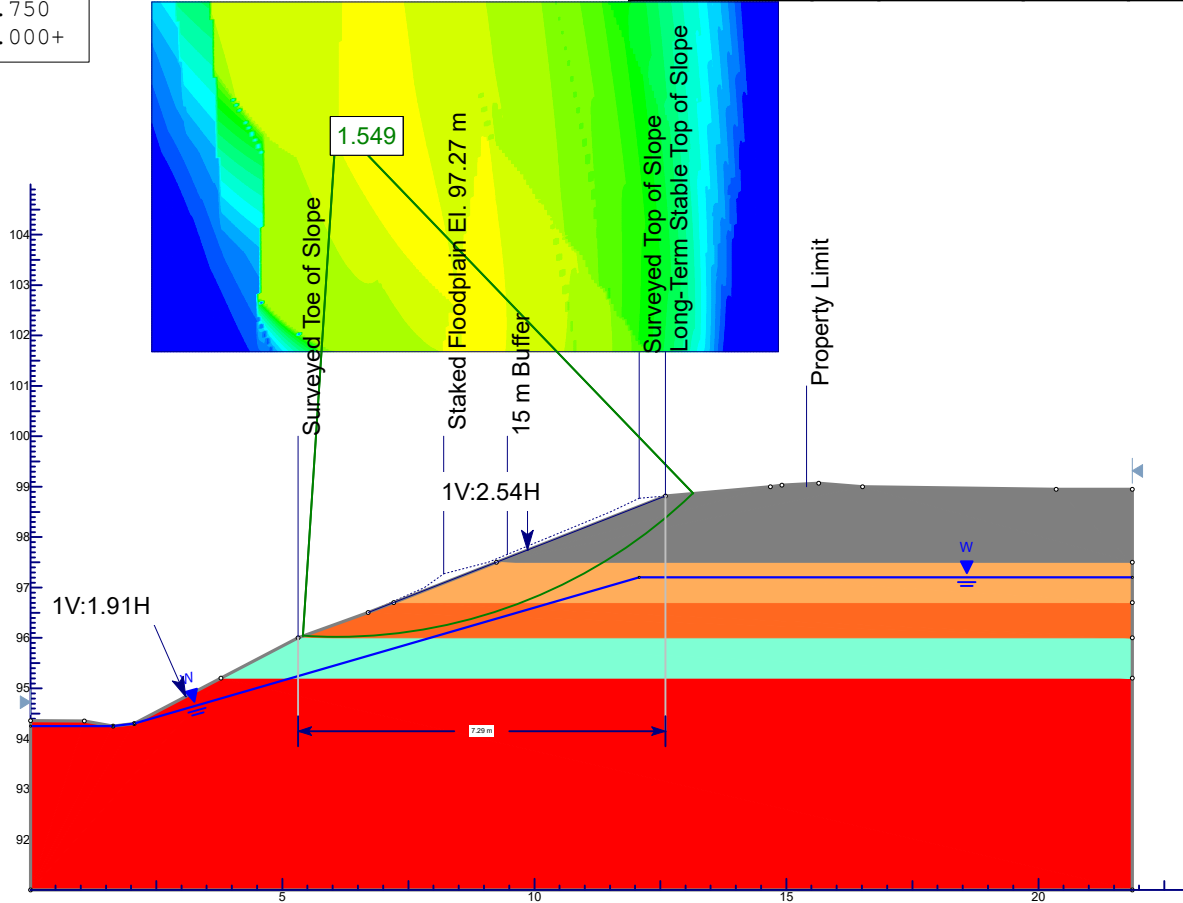
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Project Title		Cross-Section B-B		Load Case	
				Existing Condition	
Location					
50 and 60 Harborn Road, City of Mississauga					
Drawn By KH		Checked By BL		Scale 1:150	
Date		November 2024		Revision -	
Reference No. 2404-S012A				Drawing No. 4	

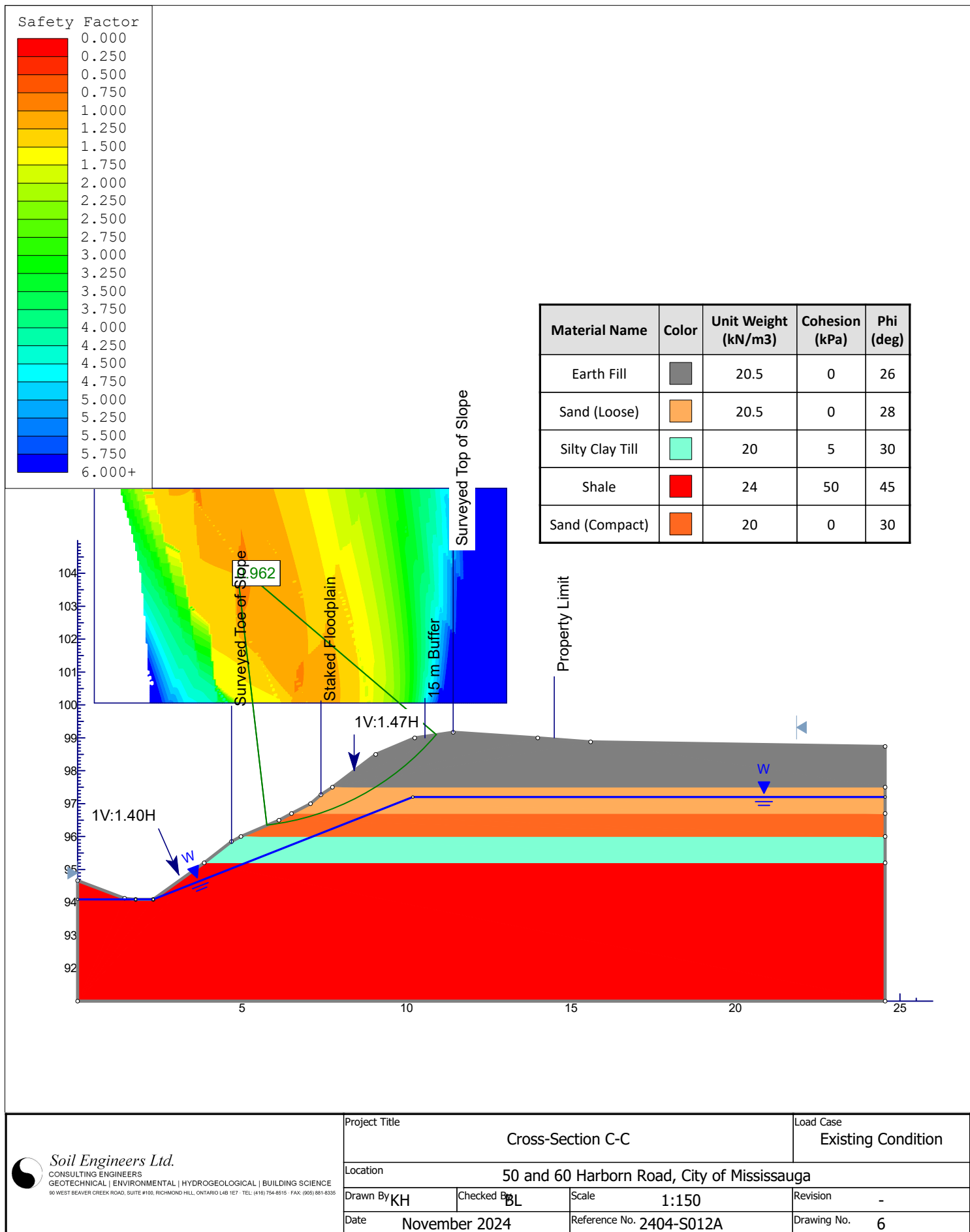
Safety Factor



Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Earth Fill		20.5	0	26
Sand (Loose)		20.5	0	28
Silty Clay Till		20	5	30
Shale		24	50	45
Sand (Compact)		20	0	30



Project Title			Load Case		
Cross-Section B-B			LTSTOS		
Location					
50 and 60 Harborn Road, City of Mississauga					
Drawn By		Checked By		Scale	
KH		BL		1:150	
Date		Reference No.		Revision	
November 2024		2404-S012A		-	
				Drawing No.	
				5	



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Project Title

Cross-Section C-C

Location

50 and 60 Harborn Road, City of Mississauga

Drawn By

KH

Checked By

BL

Date

November 2024

Scale

1:150

Reference No.

2404-S012A

Load Case

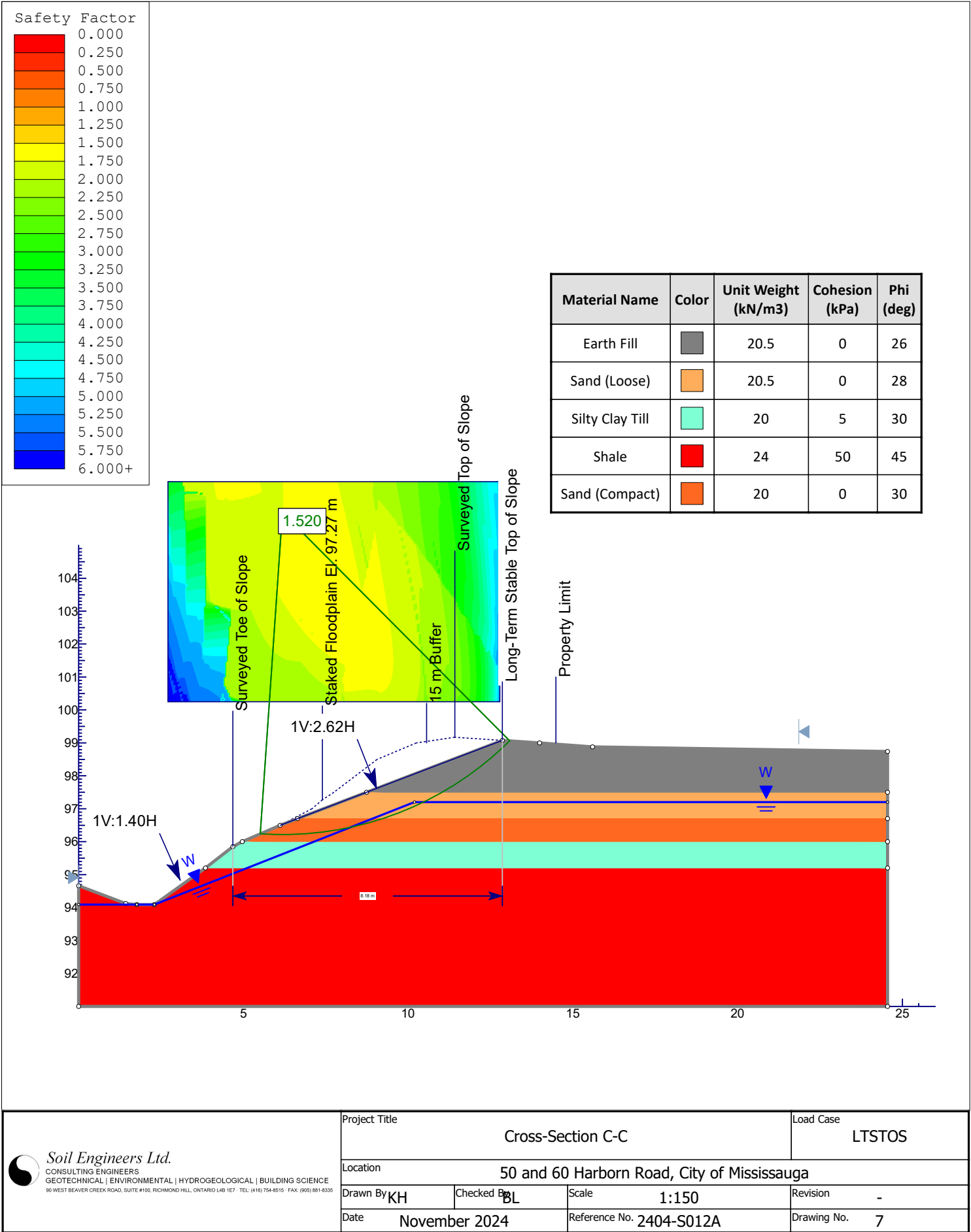
Existing Condition

Revision

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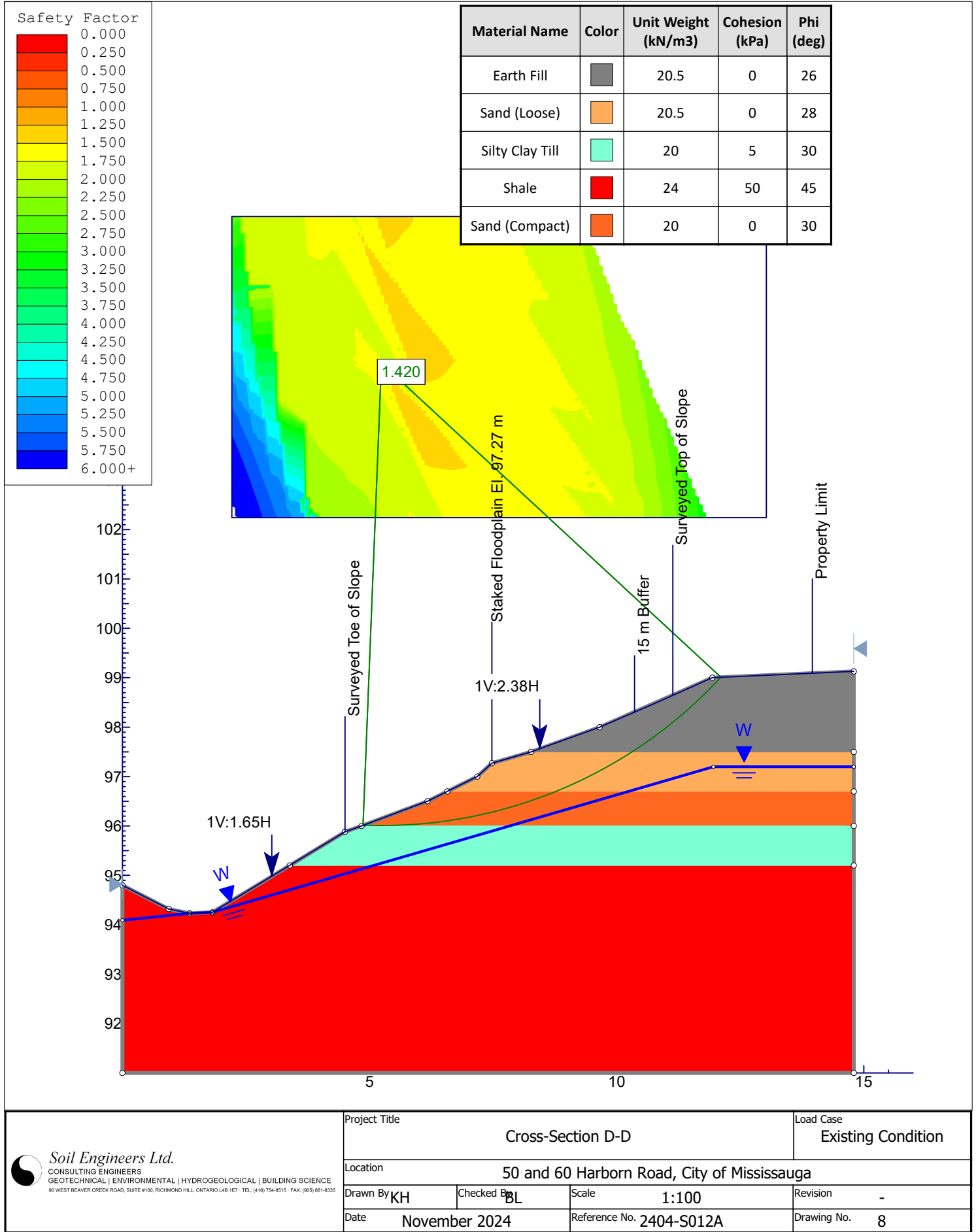
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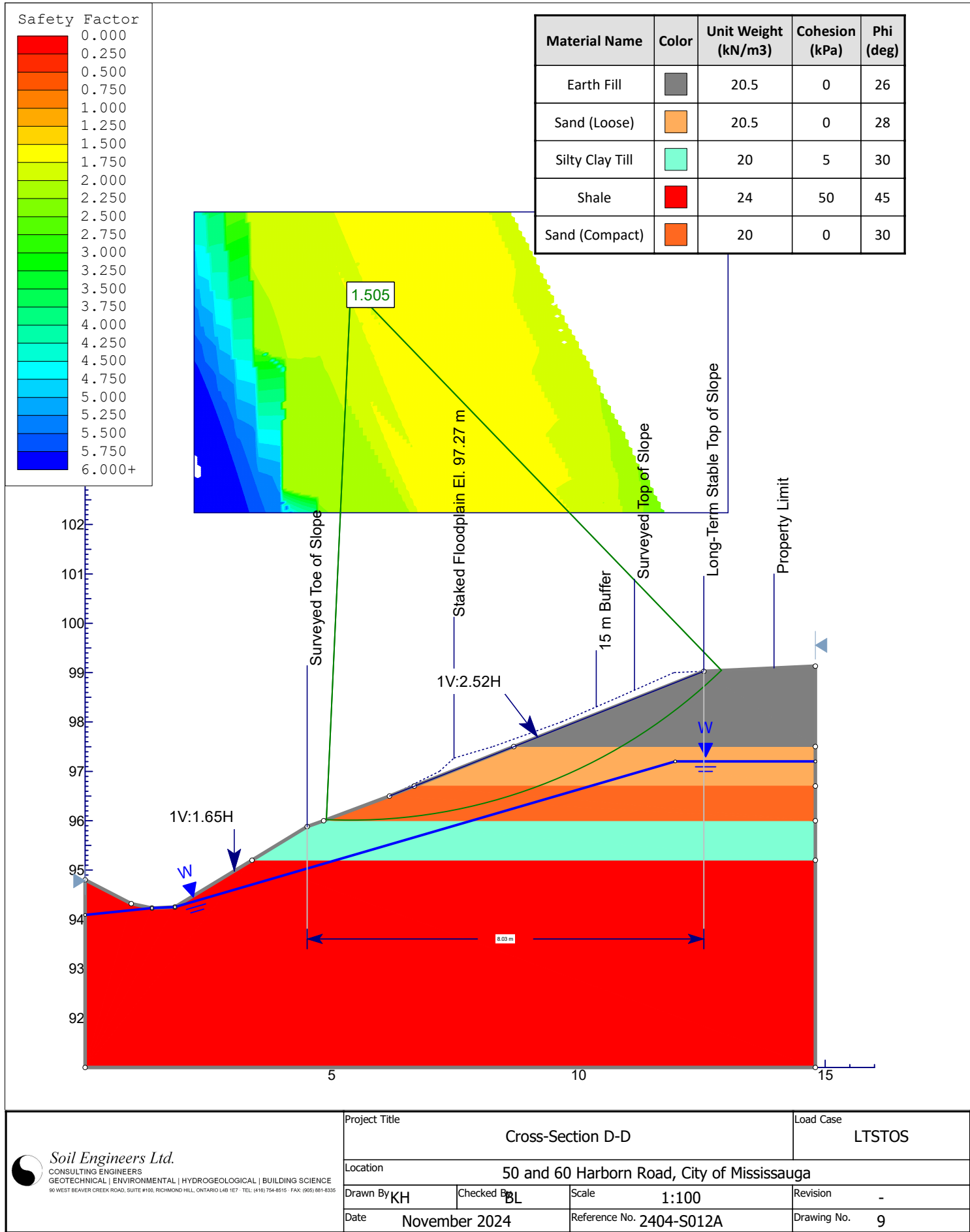
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Project Title		Cross-Section C-C		Load Case	
Location		50 and 60 Harborn Road, City of Mississauga		LTSTOS	
Drawn By	KH	Checked By	BL	Scale	1:150
Date	November 2024			Reference No.	2404-S012A
				Revision	-
				Drawing No.	7





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Project Title		Cross-Section D-D		Load Case	
Location		50 and 60 Harborn Road, City of Mississauga			
Drawn By	KH	Checked By	BL	Scale	1:100
Date	November 2024			Reference No.	2404-S012A
				Revision	-
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