REPORT ON

Slope Stability Assessment
150 Steeles Avenue East
Milton, Ontario

PREPARED FOR:

NEATT Communities

Project No. 21-122-103
January 17, 2023

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Table of Contents

1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by NEATT Communities (the client) to undertake a slope stability assessment for the property located at 150 Steeles Avenue East in Milton, Ontario.

A ravine slope is located at the south part of the site. It is understood that Conservation Halton (CH) requires an assessment of the slope to define the long-term stable top of slope (LTSTOS).

Site visits were made on April 22 & 28, 2022 by a senior geotechnical engineer from DS Consultants Ltd. to visually inspect the slope conditions.

The purpose of this study was to obtain subsurface conditions at the borehole location and from the findings in the borehole to assess the stability of the existing slope and determine the location of the long-term stable top of slope (LTSTOS) line.

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for NEATT Communities, their designers and Conservation Halton (CH). Third party use of this report without DS consent is prohibited.

2. FIELD AND LABORATORY WORK

One borehole (BH22-1, see **Drawing 1B** for borehole location) was drilled by DS at the slope site by drilling sub-contractors under the direction and supervision of DS personnel. The borehole was drilled on the existing road near the top of the slope to a depth of 17.9 m with hollow stem continuous flight augers equipment and mud rotary method. Samples were retrieved with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to the DS laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples were tested for moisture contents. Grain size analyses and Atterberg Limits tests of selected soil samples were conducted and the results are presented in **Drawings 3** and **4** and on the borehole log.

Water level observations were made during drilling and in the open borehole at the completion of the drilling operations. A monitoring well was installed in BH22-1 for stabilized groundwater level monitoring.

The ground surface elevations at the borehole locations were undertaken by DS personnel, using the differential GPS unit. The elevation surveying of the borehole locations was undertaken by DS personnel, using the differential GPS unit. It should be noted that the elevations at the as-drilled borehole locations were not provided by a professional surveyor and should be considered approximate. Contractors performing any work referenced to the borehole elevations should confirm the borehole elevations for their work.

3. SUBSURFACE CONDITIONS

The borehole location plan is shown on **Drawing 1B**. General notes on sample description are provided on **Drawing 1C**. The subsurface conditions in the borehole are presented in the individual borehole log presented on **Drawing 2**.

In BH22-1, the native soils below the fill consisted of silty clay till and cohesionless deposits, overlying shale bedrock.

<u>Fill Materials</u>:

In Borehole BH22-1, the road surface was covered with 430 mm of compact granular fill (sand and gravel), overlying very stiff clayey silt fill extending to a depth of 0.8 m.

<u>Silty Clay Till</u>:

The native soil at depth of 0.8 to 3.2 m consisted of stiff to hard silty clay till, with measured SPT 'N' values of 13 to 32 blows per 300 mm penetration. Grain size analyses of a silty clay till sample (BH22-1/SS4) were conducted and the results are presented on **Drawing 3** and on the borehole log, with the following fractions:

Clay:	20%
Silt:	45%
Sand:	26%
Gravel:	9%

Atterberg Limits test analyses of a silty clay sample (BH22-1/SS4) were conducted and the results are presented on **Drawing 4** and on the borehole log, and are summarized as follows:

Liquid limit (WL):	26.9%
Plastic limit (WP):	16.5%
Plasticity index (PI):	10.4

Cohesionless Deposits:

The native soils at depth of 3.2 to 17.1 m consisted of cohesionless deposits of silt, sandy silt to silty sand, sand and gravel. The measured SPT 'N' values ranged from 35 to more than 50 blows per 300 mm penetration, indicating the cohesionless deposits were in a dense to very dense state.

Grain size analyses of 3 silt and sand and gravel samples (BH22-1/SS6, SS9 & SS11) were conducted and the results are presented on **Drawing 3** and on the borehole log, with the following fractions:

Clay:	3 to 10%
Silt:	12 to 82%
Sand:	7 to 38%
Gravel:	up to 47%

Shale Bedrock:

Shale bedrock belonging to Queenston Formation was found in the borehole at a depth of 17.1 m, extending to the maximum explored depth of 17.9 m of the borehole.

Groundwater Conditions:

The groundwater table measured in the monitoring well in BH22-1 was at a depth of 8.6 m, corresponding to Elev. 197.8 m. It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

4. SLOPE STABILITY ASSESSMENT

Based on the borehole information, our site observations and the derived slope profiles, a detailed slope stability study was carried out to determine the long-term stable top of slope (LTSTOS) line, as presented in the following.

4.1 Slope Conditions and Slope Profiles

Site visits were made on April 22 and 28, 2022 by a senior geotechnical engineer from DS Consultants Ltd. to visually inspect the slope conditions. Selected photographs (Photos 1 to 22) taken during our site visits are presented in **Appendix I**. A Google image showing the general site and surrounding area conditions is also included in **Appendix I**. Site Slope Inspection Record and Slope Stability Rating Chart are presented in **Appendix II**.

The location plan of Borehole BH22-1 and the slope is shown on **Drawing 1B**. Slope profiles at Cross-Sections A-A, D-D to I-I are obtained from the topographic map shown **Drawing 1A**. Slope profile at Cross-Section B-B where slope erosions had occurred was measured in the field by DS. Slope profile at Cross-Section C-C where slope erosion had not occurred was also measured in the field by DS. The slope profiles at Cross-Sections A-A to J-J are presented in **Drawings 5 to 14**.

Site survey drawing and locations of slope profiles at Cross-Sections A-A to J-J are shown in **Drawing 1A**.

Based on our site observations, the site and slope conditions are described as follows:

- The height of the slope ranges approximately from 6 to 8 m. The existing slopes at Cross-Sections A-A, and C-C to J-J are approximately 1.5H:1V to 2.8H:1V in steepness. However, the existing slope at Cross-Section B-B where erosions had occurred was about 1H:1V in steepness at the upper portion of the slope.

- Except for the area at Cross-Section B-B, the slope at the site was well covered with trees and other vegetation. No seepage from the slope surface was found during the site visits. No evidence of slope failure was observed during our site visits.

- In the area of **Cross Section B-B** (see **Drawings 1A** and **1B** for location), severe slope erosions had occurred (see Photos 5 to 8 in **Appendix I**). The erosions of the slope appeared to be caused by the flow from the broken concrete sewer pipe. However, no water flow was observed from the sewer pipe during our site visits.

  The erosion (failure of slope) was about 6 to 10 m wide and was about 4 m deep below the original slope surface (as compared to the adjacent slope that was not eroded). The erosion of the slope extended into the top of slope area and the founding pier of the existing fence was exposed due to erosions.

- The toe of the slopes was in a flood plain (wet area). A creek is located at more than 15 m away from the toe of the slope (see Google Image in **Appendix I**). No river, creek or other water courses were observed within 15 m from the toe of the slope.

4.2 Erosion Considerations

A creek is located at more than 15 m away from the toe of the slope. There is no river, creek or other water course within 15 m from the toe of the slope. In accordance with the Provincial Guidelines entitled "Understanding Natural Hazards" and according to the soil and creek conditions, erosion allowance at the toe of the slope is not required for the setback of the long-term stable slope.

As discussed in Section 4.1 above, severe erosions of the slope in the area of Cross-Section B-B had occurred. Stability of the slope in the erosion area will be further discussed in detail in the following sections of this report.

4.3 Soil Parameters

Based on the borehole (BH22-1) information, soil parameters used in the slope stability analyses are given on **Table 1**.

Table 1: Soil Parameters for Long-term Slope Stability Analyses

Soil Type	Elevation (m)	Unit Weight (kN/m³)	Cohesion c' (kPa)	Friction Angle ϕ' (degree)
Surface layer	Slope surface	19.5	4	30
Clayey silt fill (very stiff)	Above 205.6	19.5	3	28
Silty clay till (stiff to hard)	205.6 to 203.2	20.5	6	29
Silt (dense to very dense)	203.3 to 200.3 197.3 to 195.7	21	0	33
Sandy silt (very dense)	200.3 to 198.8	21	0	34
Silty sand (dense)	198.8 to 197.3 195.7 to 194.2	21	0	35
Sand and gravel (dense to very dense)	194.2 to 189.3	21	0	37

In order to take into consideration the vegetation and tree roots and to prevent shallow surficial failures in the slope stability analyses, a soil layer of about 0.3 m thick along the slope surface is assumed to have a cohesion value of 4 kPa.

4.4 Stability Analyses of Existing Slopes and Long-term Stable Slopes

Eight slope profiles at Cross-Sections A-A, D-D to J-J are obtained from the topographic map shown **Drawing 1A**. Slope profile at Cross-Section B-B where slope erosions had occurred was measured in the field by DS. Slope profile at Cross-Section C-C where slope erosion had not occurred but adjacent to Cross-Section B-B was also measured in the field by DS. The slope profiles at Cross-Sections A-A to J-J are presented in **Drawings 5 to 14**.

The existing slopes at Cross-Sections A-A, and C-C to J-J are approximately 1.5H:1V to 2.8H:1V in steepness. The existing slope at Cross-Section B-B where erosions had occurred was about 1H:1V in steepness at the upper portion of the slope.

Long-term stability analysis of the existing slope at the typical Cross-Section C-C has been carried out with the computer program SLIDE (Version 2018) using the Simplified Bishop method, Simplified Janbu method and Morgenstern-Price method.

The stability analysis results of the existing slope at Cross-Section C-C are presented in **Drawing 15**. The calculated factor of safety (FS) value of the existing slope at Cross-Section C-C is FS=1.398 (see **Drawing 15**), which is less than the minimum acceptable value of 1.5. Therefore, the existing slope at Cross-Section C-C is considered not stable in terms of long-term stability as per CH's requirements.

In order to determine the long-term stable slope at the site, analysis of the modified 2H:1V slope at Cross-Section C-C has been carried out. The results are presented on **Drawing 16**. The calculated factor of safety of the 2H:1V slope on **Drawing 16** is FS=1.590, which is greater than the minimum acceptable value of 1.5. The 2H:1V slope shown on **Drawing 16** is considered stable in terms of long-term stability.

Based on the analysis results, it can be concluded that a slope of 2H:1V or flatter in steepness at the site is stable in terms of long-term stability. A slope of steeper than 2H:1V at the site is considered not stable in terms of long-term stability.

The existing slopes at Cross-Sections A-A, H-H, I-I and J-J (see **Drawings 5, 12, 13** and **14**, respectively) are flatter than 2H:1V, and are considered stable in terms of long-term stability.

The existing slopes at Cross-Sections B-B through G-G (see **Drawings 6** to **11**) are steeper than 2H:1V. Accordingly, the long-term stable slopes of 2H:1V at Cross-Sections B-B through G-G are presented on **Drawings 6** to **11**, respectively.

4.5 Slope Stabilization in Area of Cross-Section B-B

As discussed in **Section 4.1** of this report, severe erosions of the slope in the area of Cross-Section B-B (see **Drawing 1B** for location) had occurred. The erosions of the slope appeared to be caused by the flow from the broken concrete sewer pipe. However, no water flow was observed from the sewer pipe during our site visits.

Without stabilization (repair) of the eroded slope, the stable top of slope at Cross-Section B-B is at Point "S2a" as shown in **Drawing 6**, assuming there would be no further erosion in the area (i.e. no more discharge from the broken sewer pipe, or the sewer pipe will be repaired and extended to beyond the slope toe area).

Without stabilization (repair) of the eroded slope at Cross-Section B-B, the stability of the adjacent slope, such as at Cross-Section C-C, will also be affected in future.

It is recommended that the eroded/failed slope in the area of Cross-Section B-B be stabilized/repaired. Based on the site conditions, **rip-rap rock fill or reinforced slope** can be adopted to stabilize the slope in the area of Cross-Section B-B.

4.5.1 Slope Stabilization using Rip-rap Rock Fill

Rip-rap rock fill of max. 200 mm in size can be used to stabilize the eroded slope in the area of Cross-Section B-B, to be placed below Line S2a-S2-B1 as conceptually illustrated on **Drawing 6**. The rip-rap rock fill slope (Line S2-B1) should be 2H:1V to ensure the rock fill slope is stable in terms of long-term stability.

Prior to the placement of rip-rap rock fill, all disturbed/loose materials in the eroded area must be removed. A geotextile (such as Terrafix 420R) should be placed at the excavation base and the sides of the eroded ditch, and rip-rap rock fill can then be placed above the geotextile.

4.5.2 Slope Stabilization using Reinforced Slope

Alternatively, reinforced slope instead of rip-rap rock fill can be adopted to stabilize the eroded slope in the area of Cross-Section B-B, to be placed below Line S2a-S2-B1 as conceptually illustrated on **Drawing 6**. The reinforced slope (Line S2-B1) of 2H:1V in steepness is considered stable in terms of long-term stability, provided the final design of the reinforced slope is to be reviewed by DS consultants Ltd. to confirm its stability.

The reinforced slope must be designed by a specialty contractor. The reinforced slope can consist of Sierra Slope Retention System by Tensar or a similar system, with vegetation on the slope surface. More details of this system can be found from the link below:

https://www.tensarcorp.com/solutions/wall-slope-systems/sierra-slope-retention-system

4.5.3 Other Comments on Slope Stabilization

Both using rip-rap rock fill and using reinforced slope to stabilize the failed/eroded slope as discussed above are considered sound solutions from an engineering perspective.

The reinforced slope solution is a more naturalized approach that will provide a repaired slope with vegetation at the slope surface. While a reinforced slope solution does provide opportunity to establish vegetation in the short term, such products may not be compatible with tree root growth and the long-term objective of establishing a treed slope. This should be further reviewed by others. Considering the failed/eroded slope area is small (about 6 to 10 m wide), the cost to implement the reinforced slope will be relatively high. It is expected that some more excavation and disturbance to the adjacent natural slopes will occur for the installation of the reinforced slope. This can be further consulted with the specialty contractor who will design and build the reinforced slope. It is also assumed that machinery will be required within the valley in order to install the reinforced slope and to compact the backfill. There is currently no available access for machinery into the valley and it is assumed that a new access route would need to be created with additional impacts to the valley and associated vegetation.

The rip-rap rock fill solution is considered more conventional and more cost-effective solution. With this method, the loose/disturbed materials at the bottom of the failed area should be removed and then geotextile and rip-rap rock fill can be placed. This will cause minimum disturbance to the natural slopes beyond the failed area. As observed during our site visits, the failed/eroded area is not so visible to the public. Therefore, a rip-rap rock fill solution in this area might be more acceptable, compared to other sites that are visible to the public. It is our understanding that the placement of the rip-rap could take place from the top of bank with no need for heavy equipment within the valley.

We can provide more comments and recommendations during the design stage of slope stabilization with rip-rap rock fill or reinforced slope.

A site survey in and near the slope failure area must be carried out for the design of the slope stabilization using rip-rap rock fill or reinforced slope, in order to determine the extent of the slope stabilization and the amount of construction materials.

With the stabilization of the eroded slope using rip-rap rock fill or reinforced slope in the area of Cross-Section B-B, no more discharge from the broken sewer pipe should be allowed, or the sewer pipe must be repaired and extended to beyond the toe of the stabilized slope. The existing pipe can be abandoned and left in place, provided it is well capped.

With the stabilization of the eroded slope using **rip-rap rock fill or reinforced slope** in the area of Cross-Section B-B, Point "S2" will be the long-term stable top of slope at Cross-Section B-B, as shown in **Drawing 6**.

4.6 Long-term Stable Top of Slope (LTSTOS)

Conservation Halton (CH) had staked out the top of slope line on July 16, 2021, as shown on **Drawing 1A**. Based on the slope stability analysis results, the long-term stable slopes at Section A-A through Section J-J are presented on **Drawing 5** through **Drawing 14**. Therefore, the points representing the LTSTOS at the cross sections are determined using the following criteria:

- If the stable top of slope determined in the slope stability analysis is further away from the slope than CH staked top of slope, then the stable top of slope determined in the slope stability analysis is considered as the LTSTOS.
- If the stable top of slope determined in the slope stability analysis is closer to the slope than CH staked top of slope, then CH staked top of slope is considered as the LTSTOS.

4.6.1 Long-term Stable Top of Slope (LTSTOS) at West Part (Cross-Sections A-A to D-D)

Based on the analysis results presented above, the points representing the LTSTOS at the west part of the site (the area of Cross-sections A-A to D-D, see **Drawing 1B**) are as follows:

(1) If the eroded/failed slope in Cross-section B-B area <u>is to be</u> stabilized/repaired as recommended in Section 4.5 of this report, then

- Point "S1" on **Drawing 5** represents the LTSTOS at Cross-Section A-A.
- Point "S2" on **Drawing 6** represents the LTSTOS at Cross-Section B-B.
- Point "S3" on **Drawing 7** represents the LTSTOS at Cross-Section C-C.
- Point "S4" on **Drawing 8** represents the LTSTOS at Cross-Section D-D.

(2) If the eroded/failed slope in Cross-section B-B area <u>is not to be</u> stabilized/repaired, then

- Point "S1" on **Drawing 5** represents the LTSTOS at Cross-Section A-A.
- Point "S2a" on **Drawing 6** represents the LTSTOS at Cross-Section B-B.

- Point “S3a” on **Drawing 7** represents the LTSTOS at Cross-Section C-C.
- Point “S4” on **Drawing 8** represents the LTSTOS at Cross-Section D-D.

If the eroded/failed slope in Cross-section B-B area is not to be stabilized/repaired, the slope at Cross-Section C-C is not stable, because it was just adjacent to the failed/eroded area. Point “S3a” at Cross-Section C-C is just on the straight line between Point “S2a” and Point “S4” as shown on Drawing 1B.

(3) Summary of LTSTOS Lines at West Part of Site at Cross-Sections A-A to D-D

If the eroded/failed slope in the area of Cross-Section B-B **is to be** stabilized/repaired as recommended in Section 4.5 of this report, the LTSTOS at the west part of the site is Line S1-S2-S3-S4, as shown on **Drawing 1B**.

If the eroded/failed slope in the area of Cross-Section B-B **is not to be** stabilized/repaired, the LTSTOS at the west part of the site is Line S1-S2a-S3a-S4, as shown on **Drawing 1B.**

This long-term stable top of slope (LTSTOS) lines must be reviewed by Conservation Halton (CH) for their approval.

4.6.2 Long-term Stable Top of Slope (LTSTOS) from Cross-Sections D-D through J-J

As indicated in Section 4.6.1 of this report, Point “S1” on **Drawing 5** represents the LTSTOS at Cross-Section D-D, which is at CH Staked Top of Bank.

For most part of the subject slope (slope from Cross-sections D-D to J-J, see **Drawing 1A** for location plan), the LTSTOS is located at the top of bank as staked out by Conservation Halton on July 16, 2021 (i.e. CH Staked Top of Bank), as summarized in the follows:

- Point “S4” on **Drawing 8** represents the LTSTOS at Cross-Section D-D, which is at CH Staked Top of Bank.
- Point “S5” on **Drawing 9** represents the LTSTOS at Cross-Section E-E, which is at CH Staked Top of Bank.
- Point “S6” on **Drawing 10** represents the LTSTOS at Cross-Section F-F, which is at CH Staked Top of Bank.
- Point “S7” on **Drawing 11** represents the LTSTOS at Cross-Section G-G, which is at CH Staked Top of Bank.
- Point “S8” on **Drawing 12** represents the LTSTOS at Cross-Section H-H, which is at CH Staked Top of Bank.
- Point “S9” on **Drawing 13** represents the LTSTOS at Cross-Section I-I, which is at CH Staked Top of Bank.
- Point “S10” on **Drawing 14** represents the LTSTOS at Cross-Section J-J, which is at CH Staked Top of Bank.

Therefore, from Cross-section D-D through Cross-Section J-J (see **Drawing 1A** for location plan), the top of bank as staked out by Conservation Halton on July 16, 2021, i.e. Line S4-S5-S6-S7-S8-S9-S10 as shown on **Drawing 1A**, represents the LTSTOS.

5. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

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Drawings

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Top of Bank Staked out by Conservation Halton on July 16, 2021

Long-Term Stable Top of Slope (LTSTOS) Line - S4- S5 - S6 - S7 - S8 - S9 - S10
(See Drawing 1B for LTSTOS Lines in Sections A-A to D-D area)

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Project:	SLOPE STABILITY ASSESSMENT 150 Steeles Avenue East, Milton, ON
Title:	**SLOPE PROFILE LOCATION PLAN**
Client:	NEATT COMMUNITIES

Size: 11 X 17	Approved By: A.S	Drawn By: S.Y	Date: July 2022
Rev.	Scale: AS Shown	Project No: 21-122-103	Drawing No. 1A

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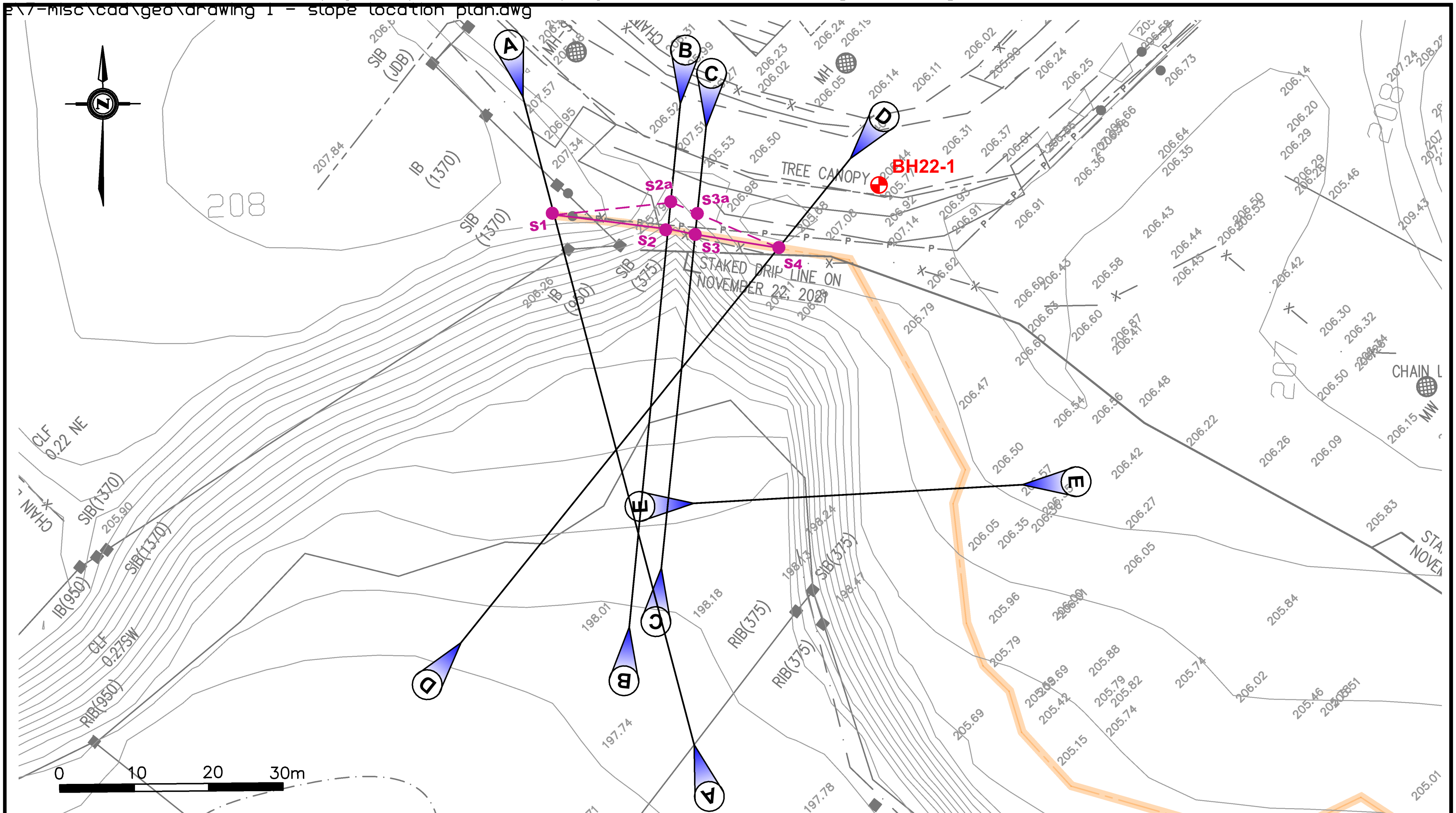

Long-Term Stable Top of Slope (LTSTOS) Line (S1- S2 - S3 - S4) with Slope Repair at Section B-B

Long-Term Stable Top of Slope (LTSTOS) Line (S1- S2a - S3a- S4) without Slope Repair at Section B-B

Borehole Location

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Project: SLOPE STABILITY ASSESSMENT
150 Steeles Avenue East, Milton, ON

Title: **BOREHOLE AND SLOPE LOCATION PLAN**

Client: NEATT COMMUNITIES	Size: 8.5 x 11	Approved By: A.S	Drawn By: S.Y	Date: December 2022
	Rev.	Scale: As Shown	Project No: 21-122-103	Drawing No. 1B

Drawing 1C: Notes on Soil Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by DS also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH22-1

PROJECT: Slope Stability Assessment
CLIENT: NEATT Communities
PROJECT LOCATION: 150 Steeles Ave E, Milton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4818779.91 E 589370.42

DRILLING DATA
Method: Hollow Stem Auger/Mud Rotary
Diameter: 200mm
Date: Apr-01-2022

REF. NO.: 21-122-103
ENCL NO.: 2

ELEV (m) / DEPTH	DESCRIPTION	Sample NUMBER	TYPE	"N" BLOWS/0.3 m	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
206.4					
206.0 / 0.0	**GRANULAR FILL:** sand and gravel, crusher limestone, 430mm	1	SS	18	
205.6 / 0.4	**FILL:** clayey silt, trace gravel, trace sand, brown, moist, very stiff				
0.8	**SILTY CLAY TILL:** some sand to sandy, trace gravel, occasional cobble, brown, moist, stiff to hard	2	SS	13	
		3	SS	20	
		4	SS	32	9 26 45 20
203.2 / 3.2	**SILT:** trace sand, trace to some clay, trace gravel, brown, moist, dense	5	SS	38	Switched to Mud Rotary at 4.6m
		6	SS	36	1 7 82 10
200.3 / 6.1	**SANDY SILT:** some clay, sand seams, trace gravel, occasional cobble, brown, moist, very dense	7	SS	50/ 150mm	
198.8 / 7.6	**SILTY SAND:** trace gravel, trace clay, brown, moist to wet, dense	8	SS	35	
197.3 / 9.1	**SILT:** some sand, trace clay, brown, saturated, very dense	9	SS	64	0 14 82 4
195.7 / 10.7	**SILTY SAND:** trace clay, trace gravel, reddish brown, wet, dense	10	SS	36	
194.2 / 12.2	**SAND AND GRAVEL:** trace clay, some silt, occasional cobbles/boulder, brown to reddish brown, wet, dense to very dense	11	SS	76	47 38 12 3
		12	SS	39	
		13	SS	50/ 100mm	
	shale pieces below 16.8m	14	SS	50/ 100mm	
189.3 / 17.1	**SHALE BEDROCK:** reddish brown, weathered				
188.5 / 17.9	**END OF BOREHOLE:**	15	SS	50/ 25mm	

W. L. 197.8 m
May 10, 2022

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date: Water Level(mbgl):
May 10, 2022 8.6

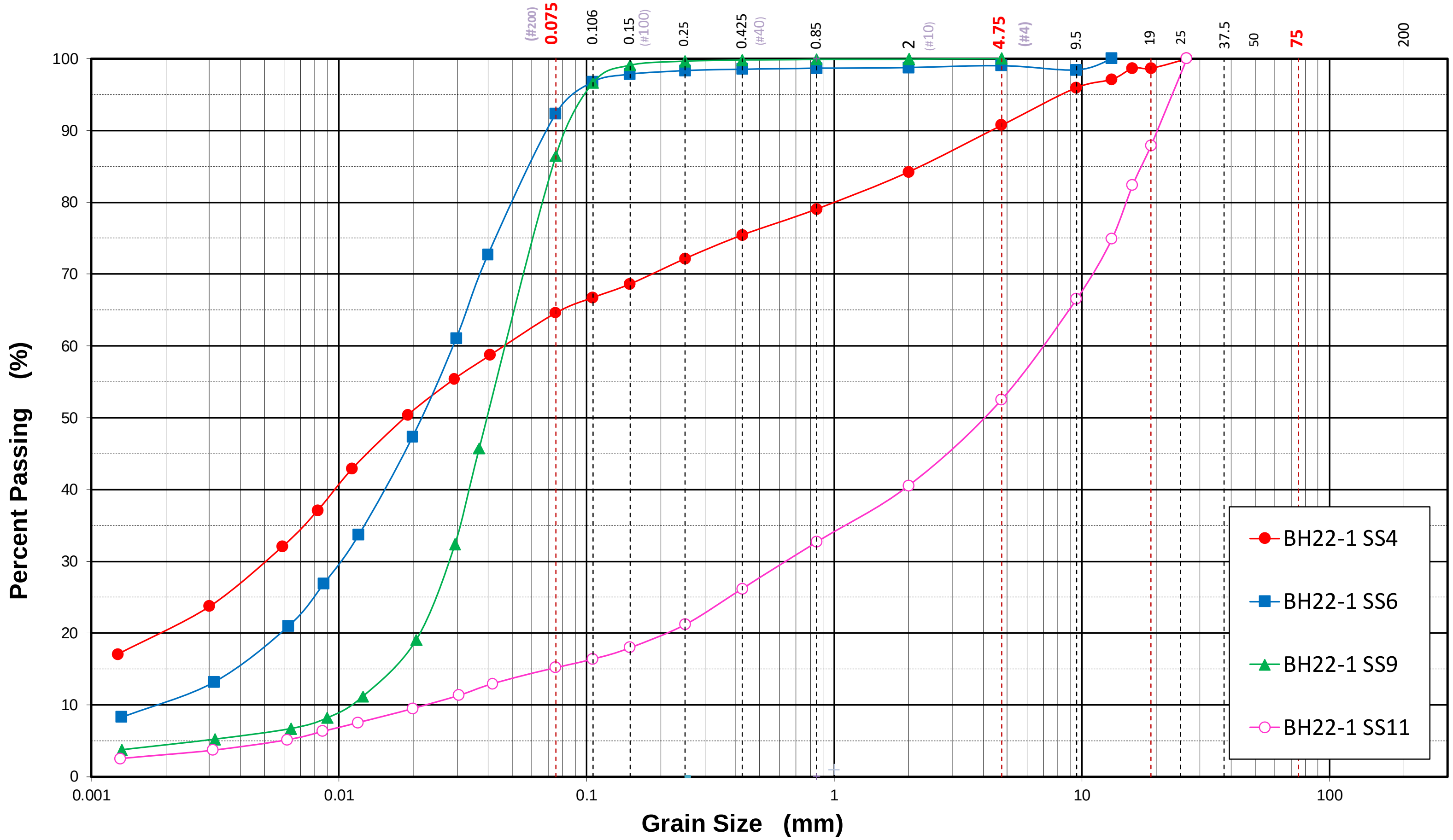
DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE: 20 40 60 80 100
PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m^3)

ELEVATION: 206, 205, 204, 203, 202, 201, 200, 199, 198, 197, 196, 195, 194, 193, 192, 191, 190, 189

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3 =3% Strain at Failure

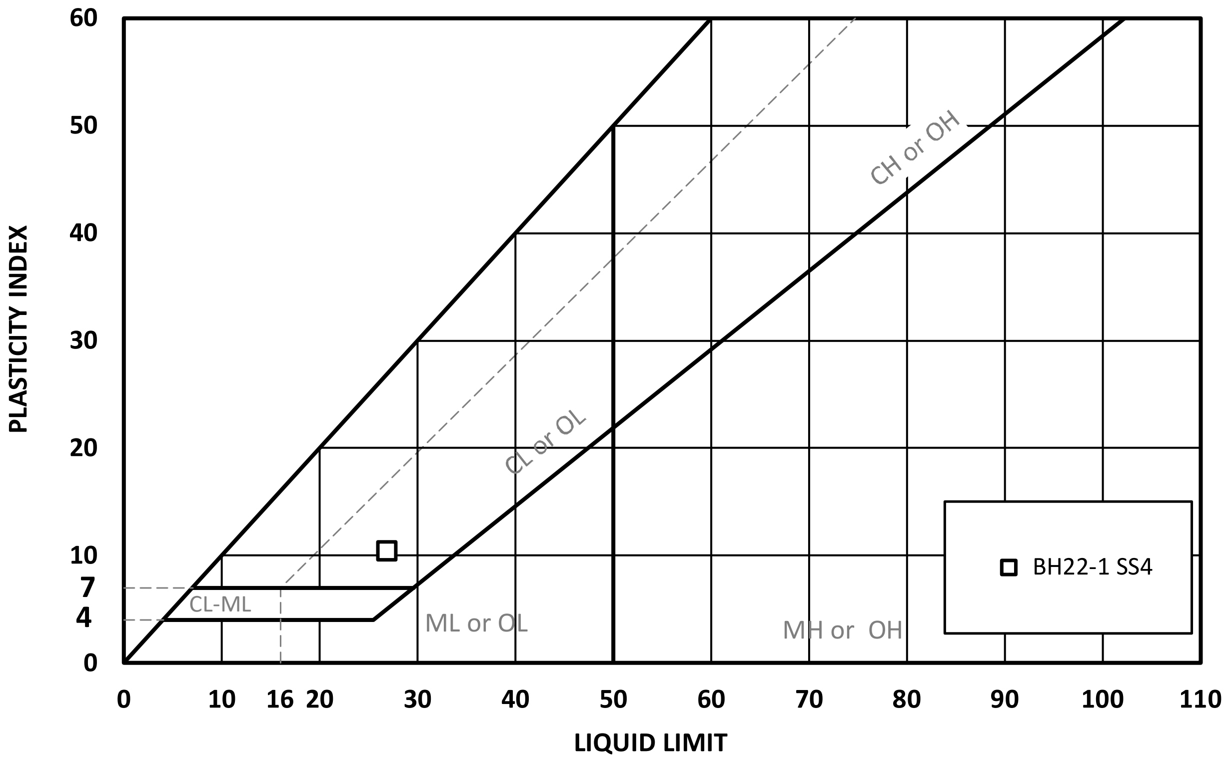
Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	

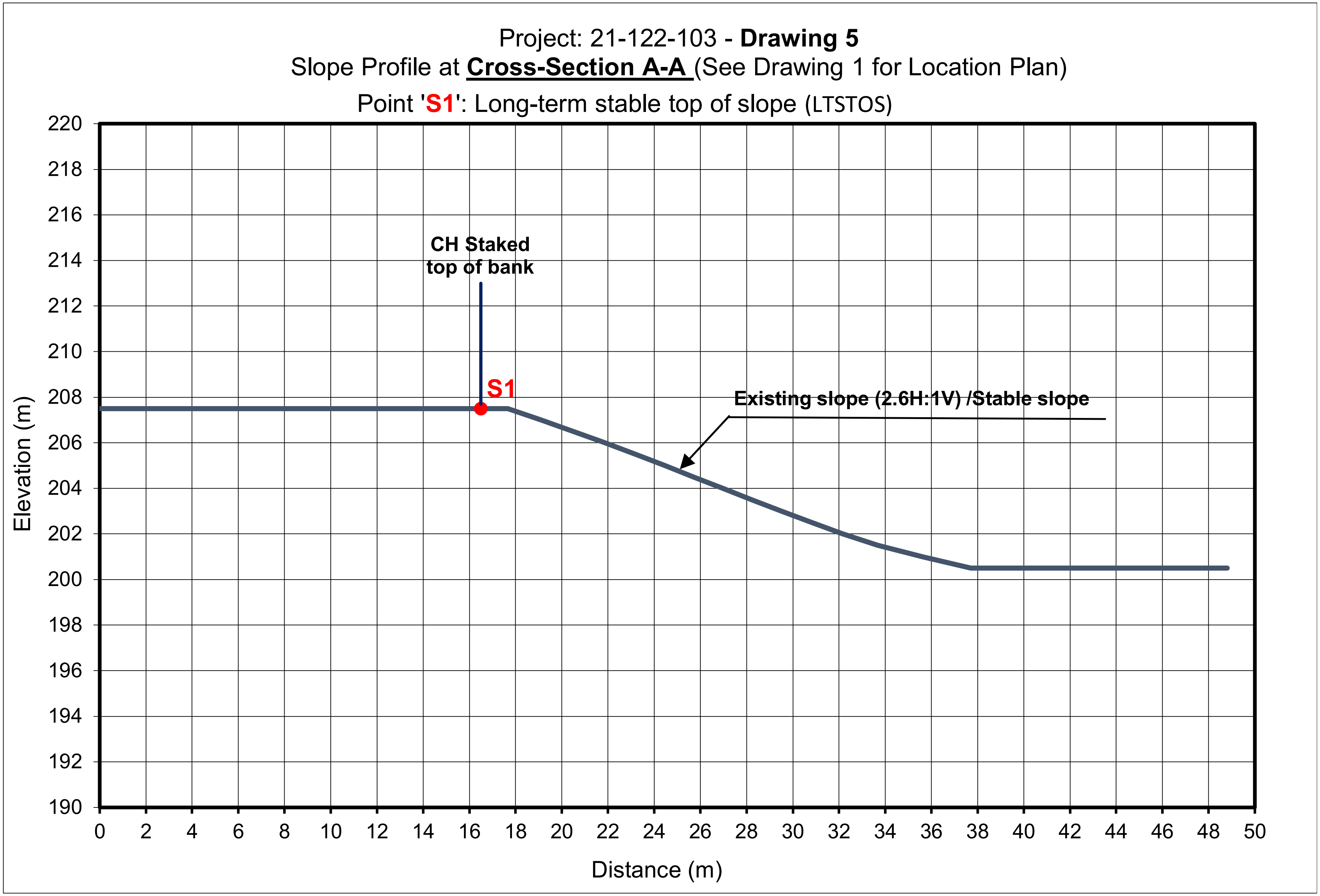
DS CONSULTANTS LTD. 6221 Highway 7, Unit 16 Vaughan, Ontario, L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca	Project	**Slope Stability Assessment**	Project No	**21-122-103**
	Location	**150 Steeles Avenue East, Milton, ON.**	Date	**Apr/06/2022**
	Client	**Neatt Communities**	Drawing No	3

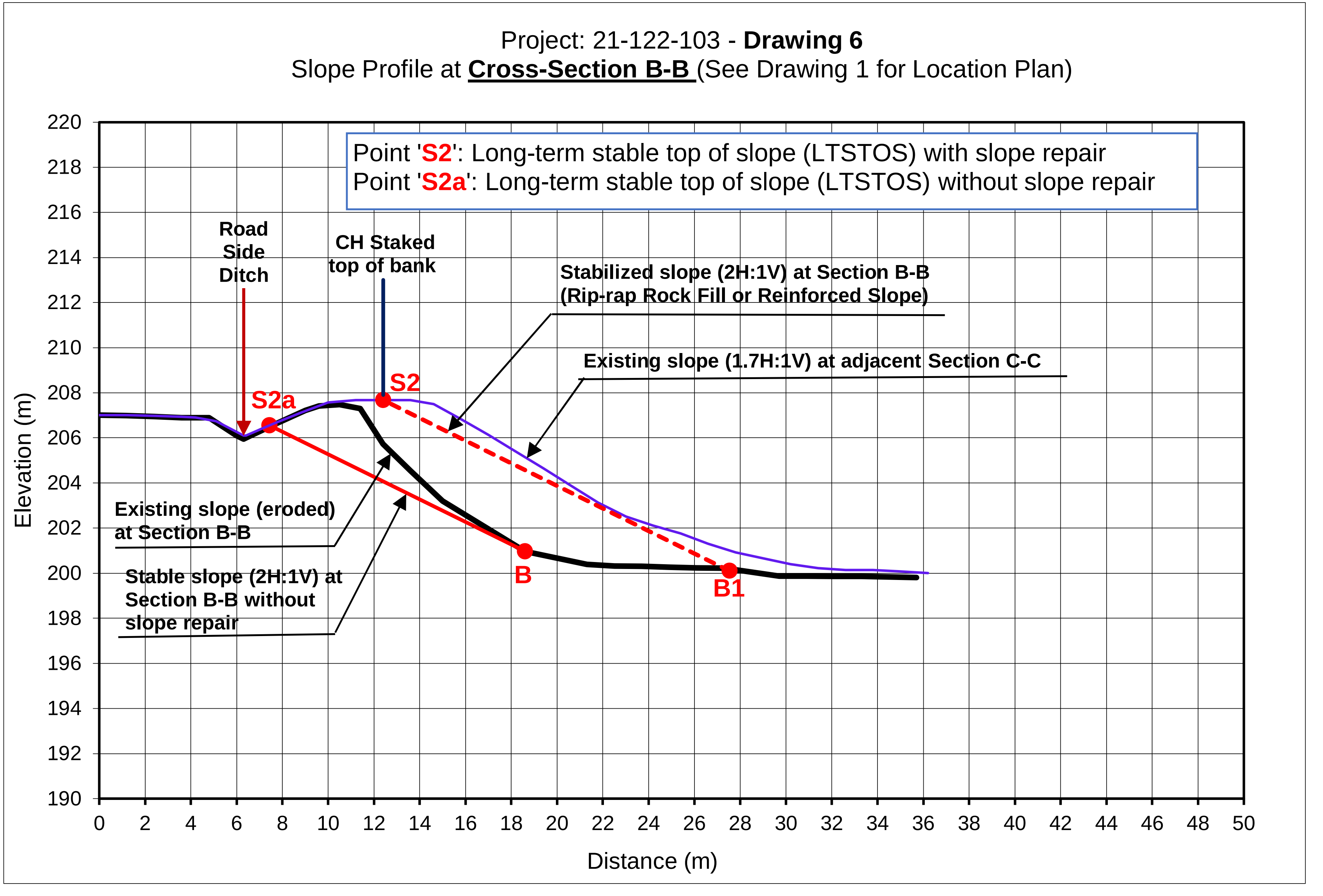
Atterberg Test (ASTM D-4318)

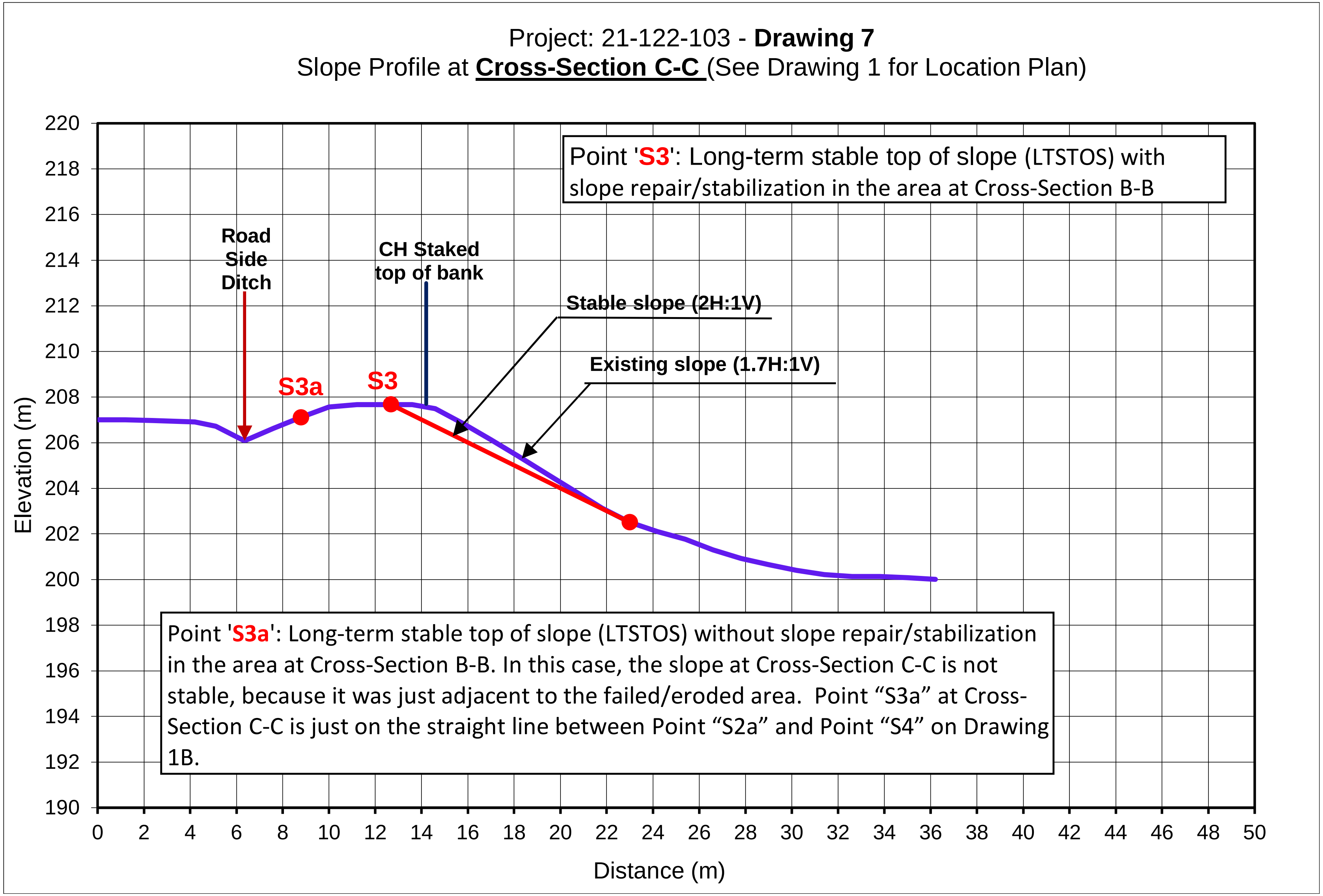


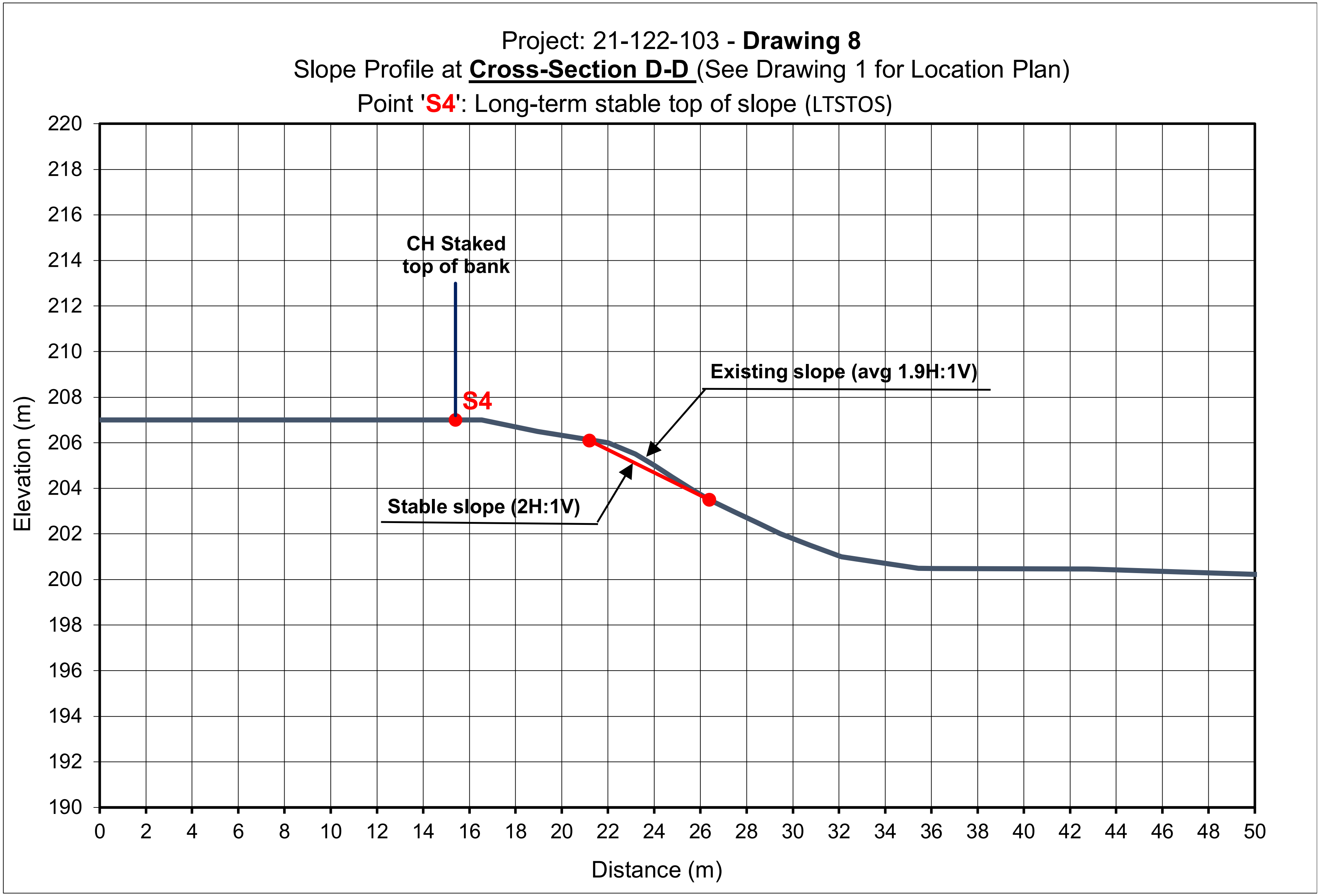
Code	Sample ID	Sample No.		Moisture Contant (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	**USCS Symbol**
1	□	BH22-1	SS4	13	26.9	16.5	10.4	CL

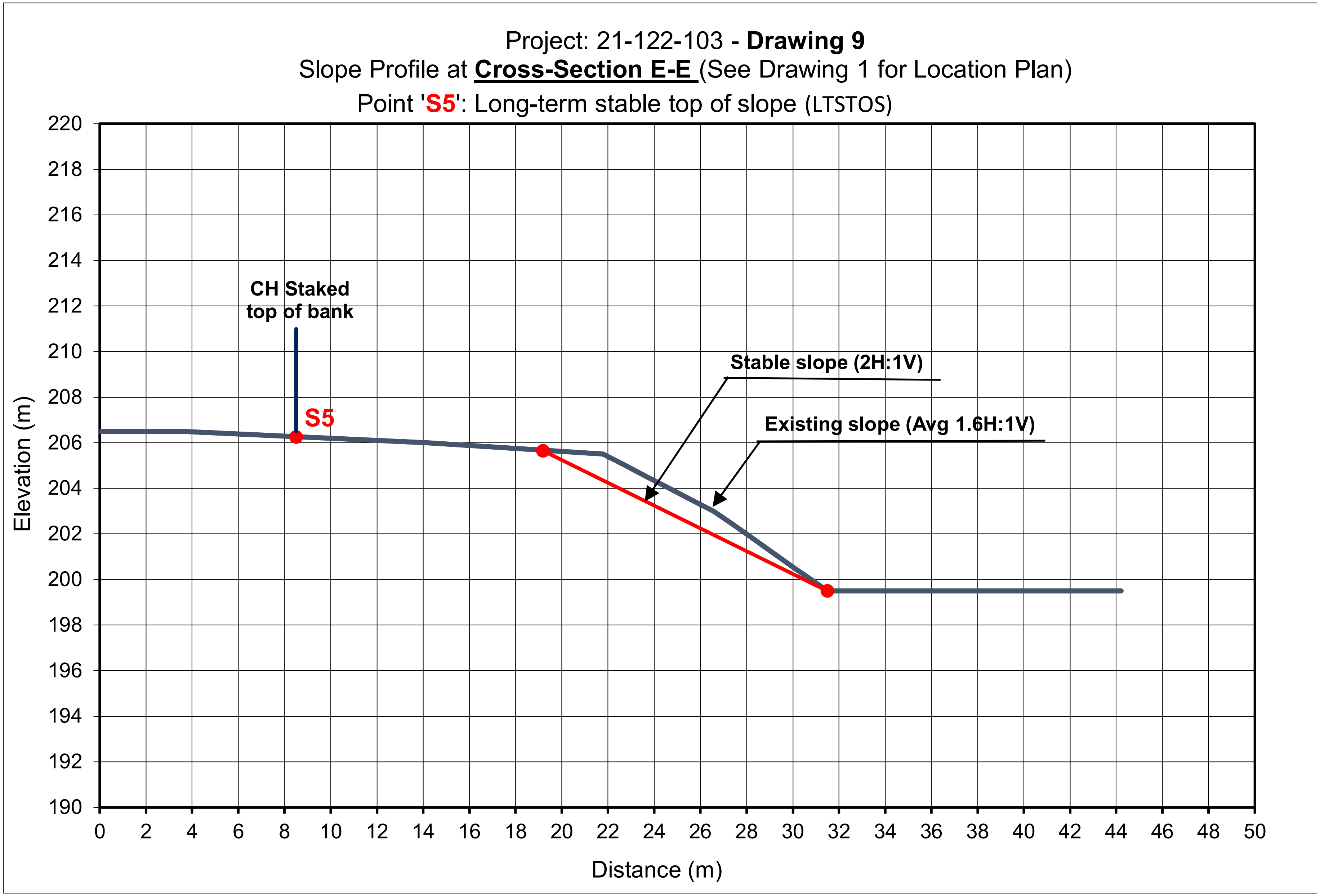
DS CONSULTANTS LTD. 6221 Highway 7, Unit 16 Vaughan, Ontario, L4H 0K8 Telephone: (905) 264-9393 www.dsconsultants.ca	Project	**Slope Stability Assessment**	Project No	**21-122-103**
	Location	**150 Steeles Avenue East, Milton, ON.**	Date	**Apr/06/2022**
	Client	**Neatt Communities**	Drawing No	4


Project: 21-122-103 - **Drawing 5**
Slope Profile at **Cross-Section A-A** (See Drawing 1 for Location Plan)
Point 'S1': Long-term stable top of slope (LTSTOS)
CH Staked top of bank
S1
Existing slope (2.6H:1V) /Stable slope
Elevation (m)
Distance (m)
220
218
216
214
212
210
208
206
204
202
200
198
196
194
192
190
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50


Project: 21-122-103 - Drawing 6
Slope Profile at Cross-Section B-B (See Drawing 1 for Location Plan)
Point 'S2': Long-term stable top of slope (LTSTOS) with slope repair
Point 'S2a': Long-term stable top of slope (LTSTOS) without slope repair
Road Side Ditch
CH Staked top of bank
Stabilized slope (2H:1V) at Section B-B (Rip-rap Rock Fill or Reinforced Slope)
Existing slope (1.7H:1V) at adjacent Section C-C
Existing slope (eroded) at Section B-B
Stable slope (2H:1V) at Section B-B without slope repair
S2a
S2
B
B1
Elevation (m)
Distance (m)
220
218
216
214
212
210
208
206
204
202
200
198
196
194
192
190
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50


Project: 21-122-103 - Drawing 7
Slope Profile at Cross-Section C-C (See Drawing 1 for Location Plan)
Point 'S3': Long-term stable top of slope (LTSTOS) with slope repair/stabilization in the area at Cross-Section B-B
Road Side Ditch
CH Staked top of bank
Stable slope (2H:1V)
Existing slope (1.7H:1V)
S3a
S3
Point 'S3a': Long-term stable top of slope (LTSTOS) without slope repair/stabilization in the area at Cross-Section B-B. In this case, the slope at Cross-Section C-C is not stable, because it was just adjacent to the failed/eroded area. Point "S3a" at Cross-Section C-C is just on the straight line between Point "S2a" and Point "S4" on Drawing 1B.
Elevation (m)
220
218
216
214
212
210
208
206
204
202
200
198
196
194
192
190
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
Distance (m)


Project: 21-122-103 - Drawing 8
Slope Profile at Cross-Section D-D (See Drawing 1 for Location Plan)
Point 'S4': Long-term stable top of slope (LTSTOS)
CH Staked
top of bank
S4
Existing slope (avg 1.9H:1V)
Stable slope (2H:1V)
Elevation (m)
220
218
216
214
212
210
208
206
204
202
200
198
196
194
192
190
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
Distance (m)



Project: 21-122-103 - Drawing 9
Slope Profile at Cross-Section E-E (See Drawing 1 for Location Plan)
Point 'S5': Long-term stable top of slope (LTSTOS)
CH Staked top of bank
S5
Stable slope (2H:1V)
Existing slope (Avg 1.6H:1V)
Elevation (m)
Distance (m)
220
218
216
214
212
210
208
206
204
202
200
198
196
194
192
190
0
2
4
6
8
10
12
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18
20
22
24
26
28
30
32
34
36
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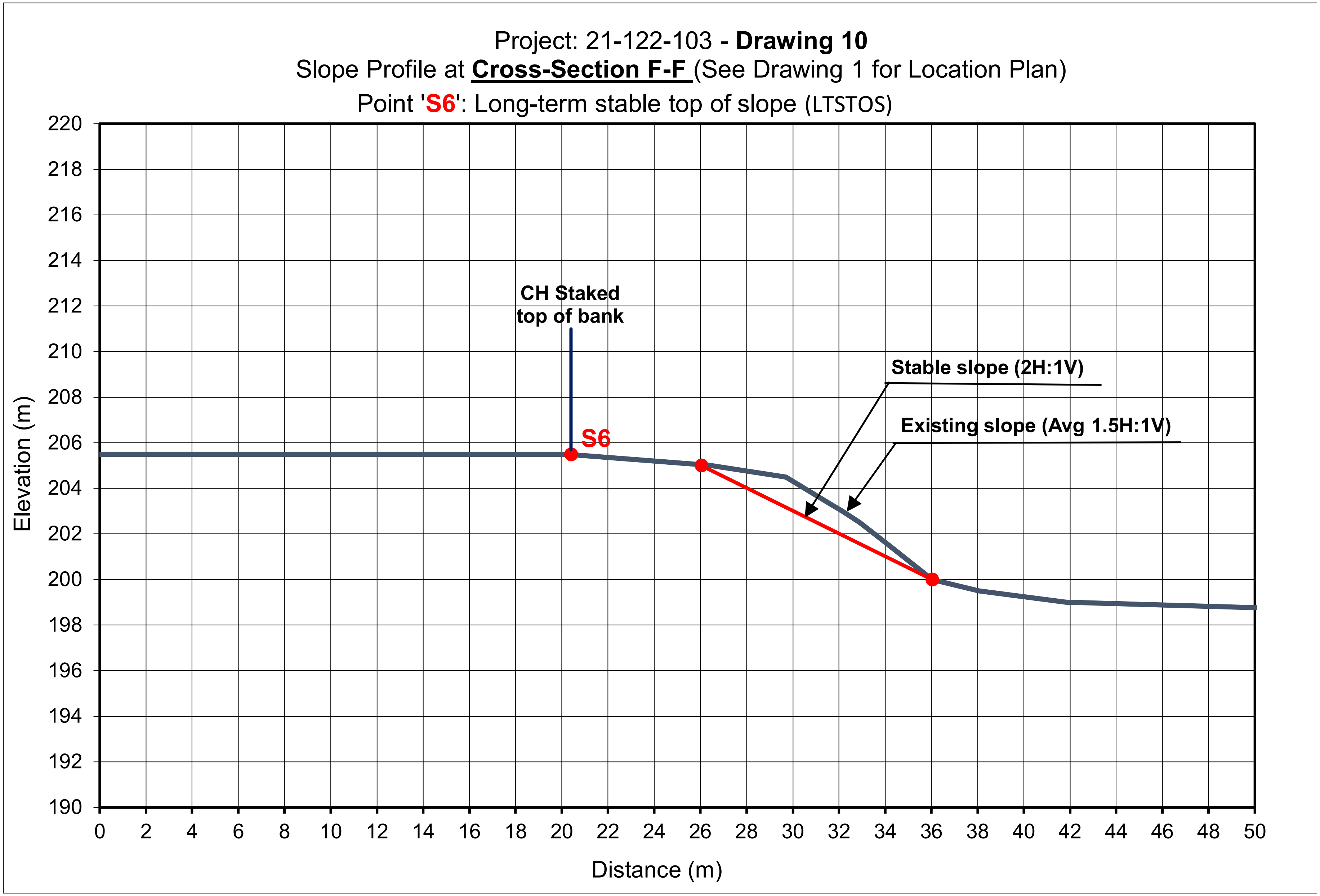
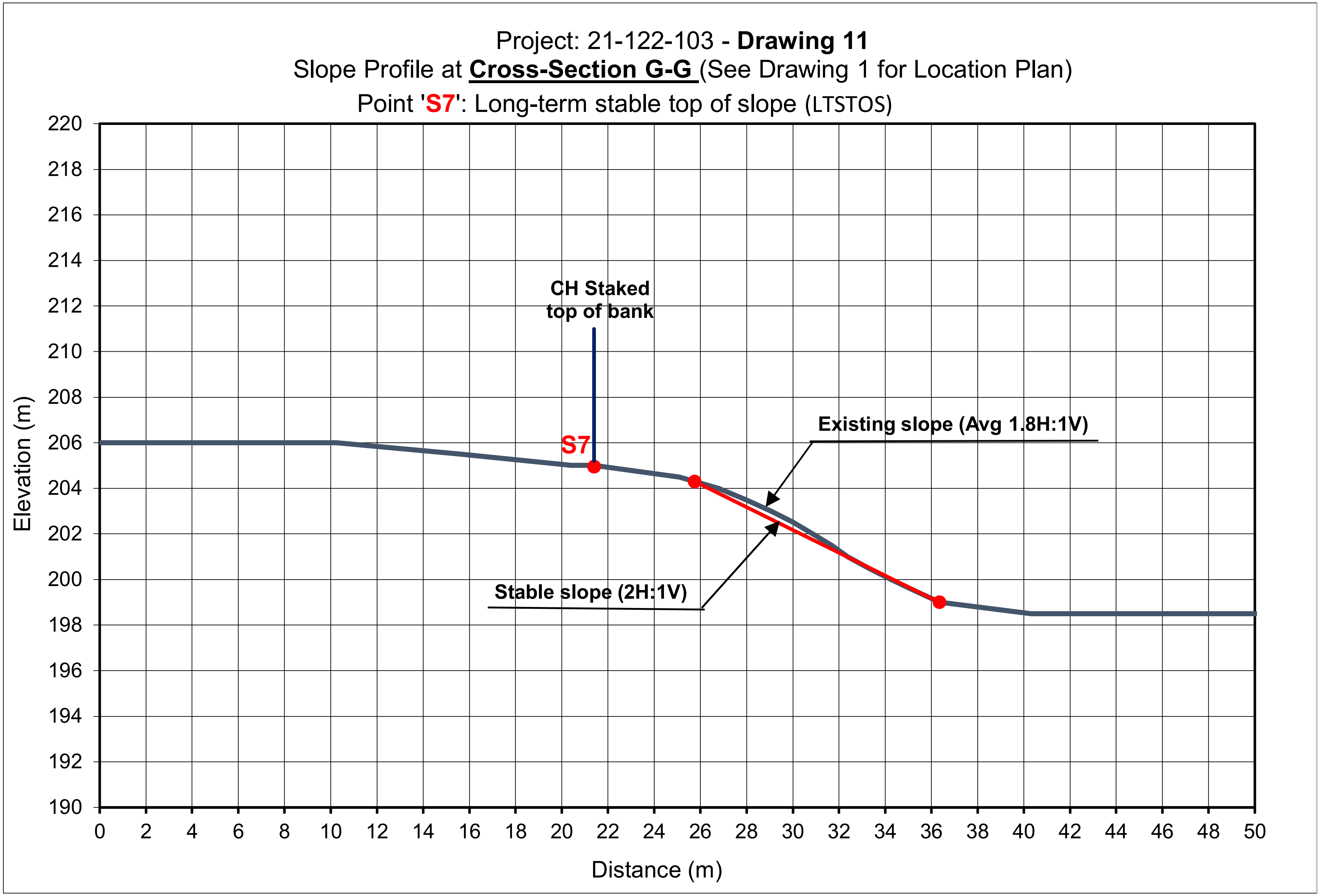
40
42
44
46
48
50



Project: 21-122-103 - **Drawing 10**
Slope Profile at **Cross-Section F-F** (See Drawing 1 for Location Plan)
Point 'S6': Long-term stable top of slope (LTSTOS)
CH Staked top of bank
S6
Stable slope (2H:1V)
Existing slope (Avg 1.5H:1V)
Elevation (m)
Distance (m)
220
218
216
214
212
210
208
206
204
202
200
198
196
194
192
190
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50

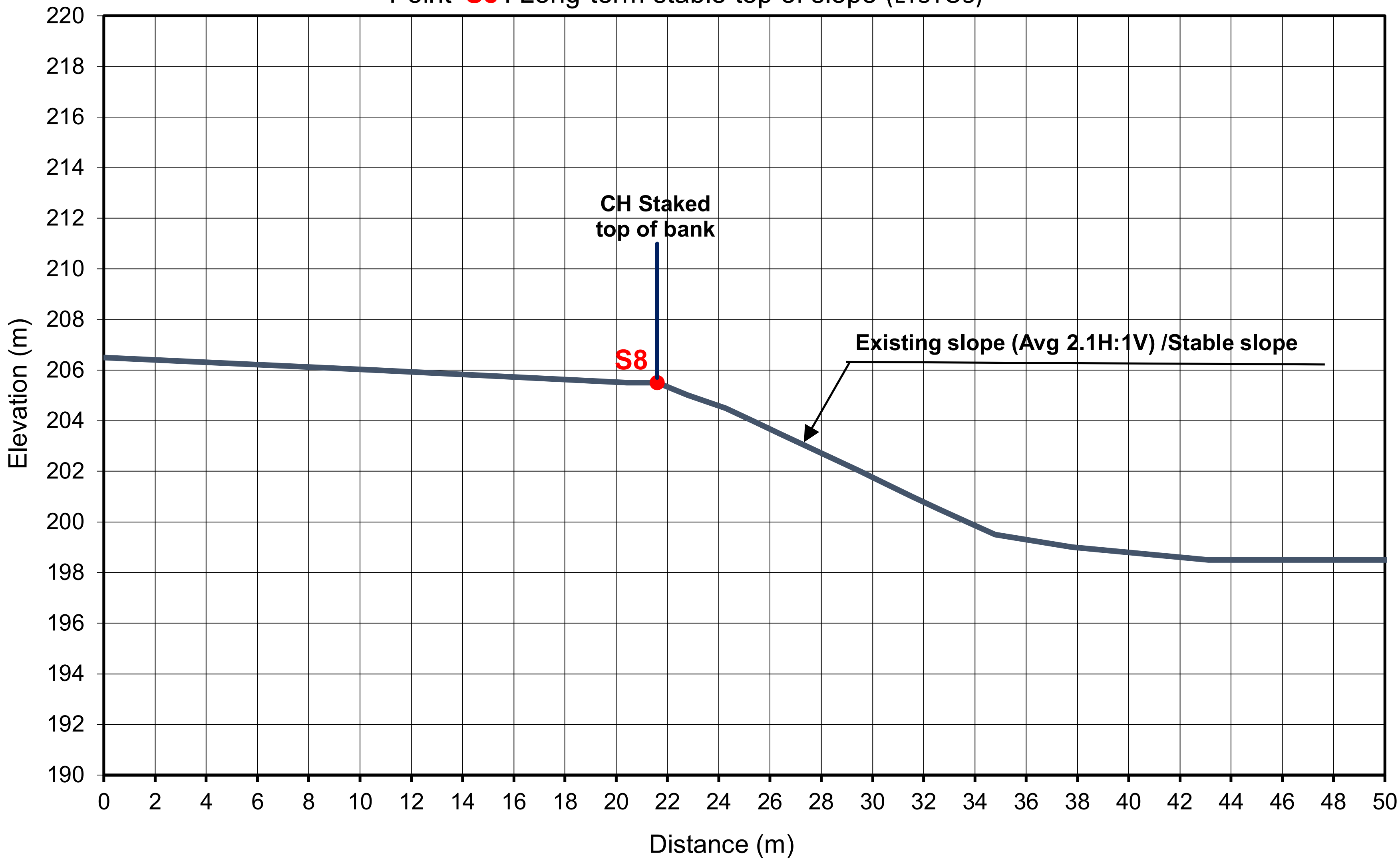


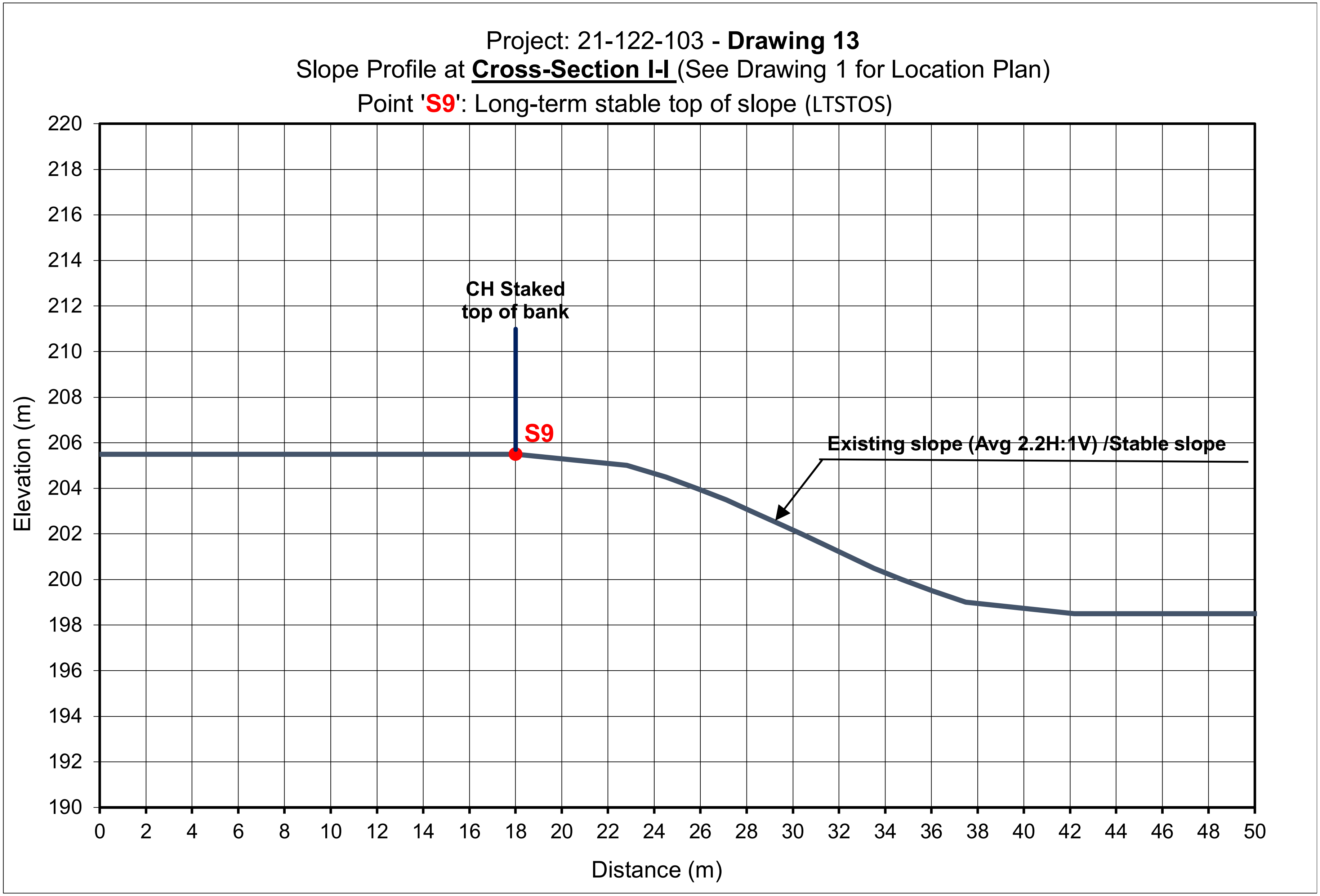
Project: 21-122-103 - Drawing 11
Slope Profile at Cross-Section G-G (See Drawing 1 for Location Plan)
Point 'S7': Long-term stable top of slope (LTSTOS)
CH Staked
top of bank
S7
Existing slope (Avg 1.8H:1V)
Stable slope (2H:1V)
Elevation (m)
Distance (m)
220
218
216
214
212
210
208
206
204
202
200
198
196
194
192
190
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50

Project: 21-122-103 - **Drawing 12**

Slope Profile at **Cross-Section H-H** (See Drawing 1 for Location Plan)

Point '**S8**': Long-term stable top of slope (LTSTOS)



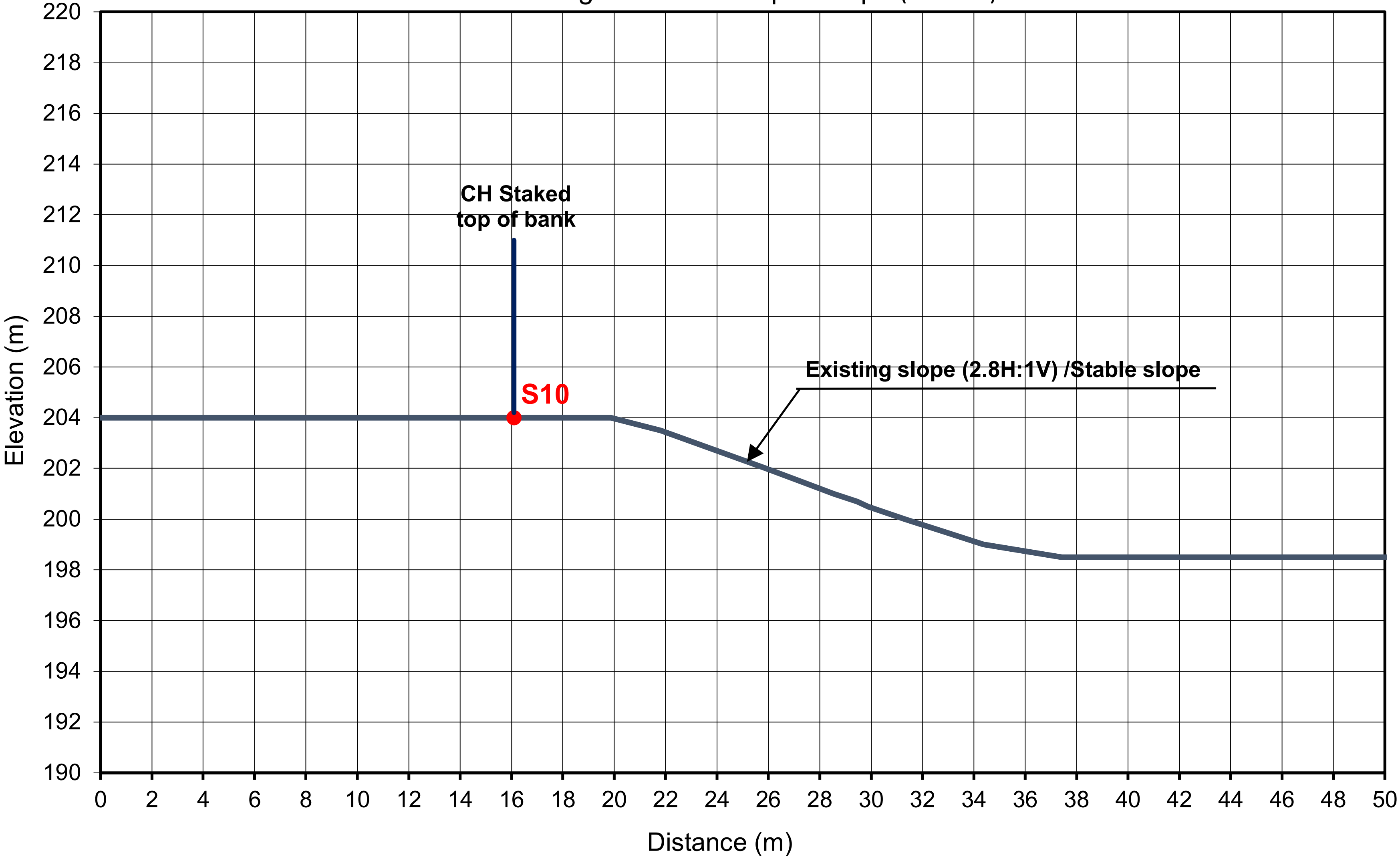


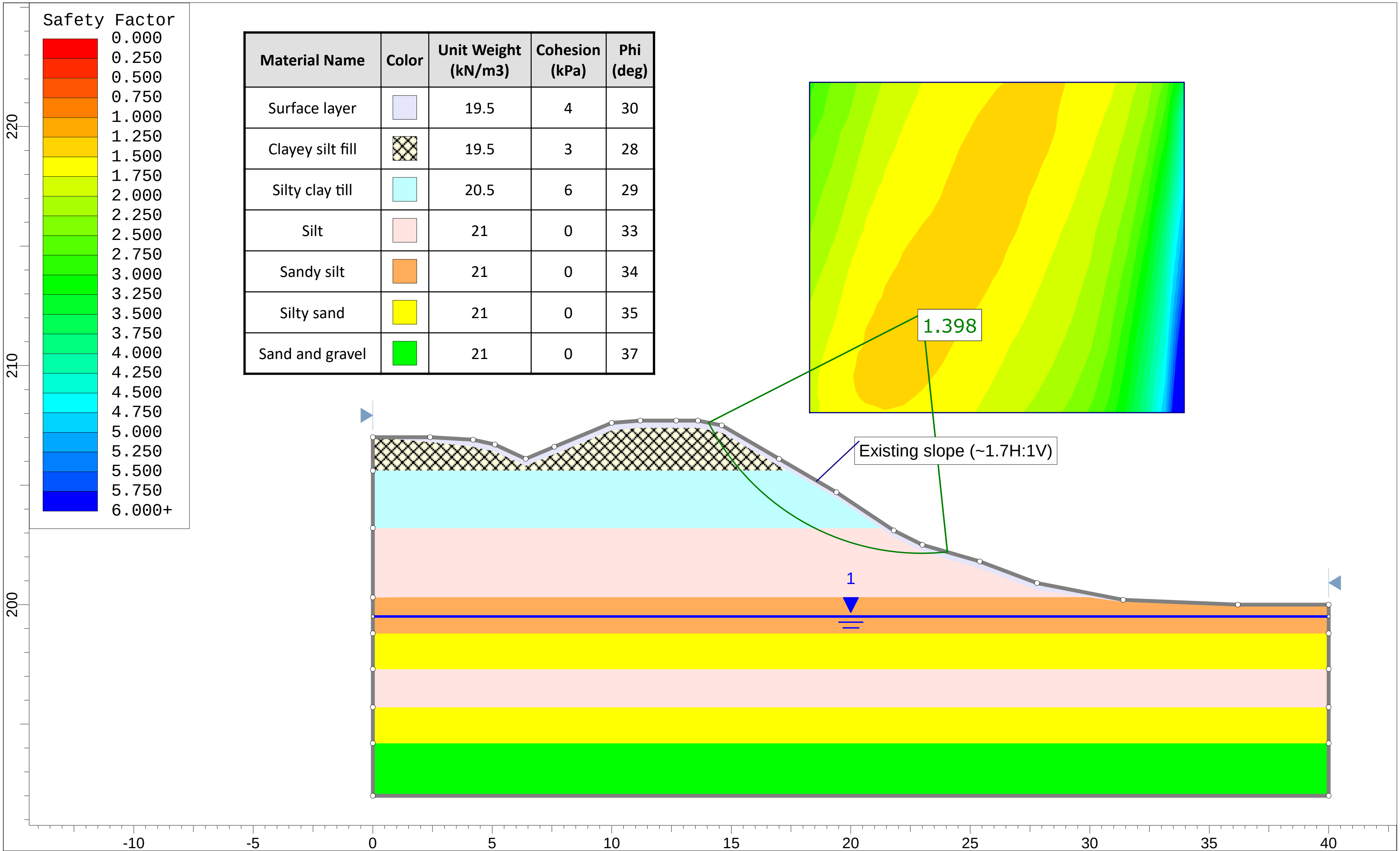
Project: 21-122-103 - Drawing 13
Slope Profile at Cross-Section I-I (See Drawing 1 for Location Plan)
Point 'S9': Long-term stable top of slope (LTSTOS)
CH Staked top of bank
S9
Existing slope (Avg 2.2H:1V) /Stable slope
Elevation (m)
Distance (m)
220
218
216
214
212
210
208
206
204
202
200
198
196
194
192
190
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50

Project: 21-122-103 - **Drawing 14**

Slope Profile at **Cross-Section J-J** (See Drawing 1 for Location Plan)

Point '**S10**': Long-term stable top of slope (LTSTOS)



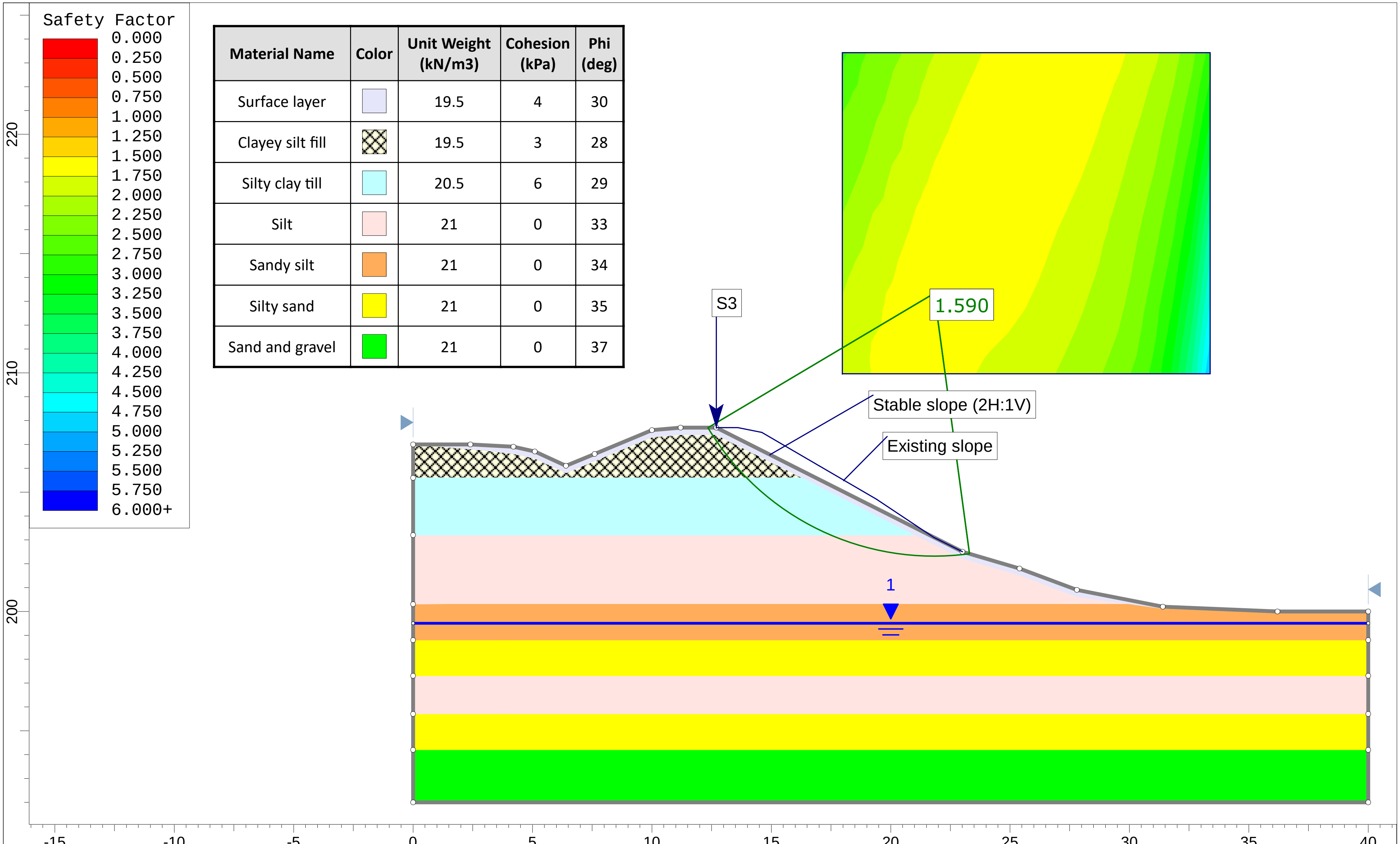


Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Surface layer		19.5	4	30
Clayey silt fill		19.5	3	28
Silty clay till		20.5	6	29
Silt		21	0	33
Sandy silt		21	0	34
Silty sand		21	0	35
Sand and gravel		21	0	37

rocscience

SLIDEINTERPRET 8.024

Project	21-122-103 - Slope Stability Assessment, 150 Steeles Avenue East, Milton, ON
Analysis Description	Long-term Stability Analysis of Existing Slope at Section C-C
Drawn By	DS
Scale	1:225
Company	DS Consultants Ltd.
Date	June 2022
File Name	Drawing 15 - Existing Slope at Section C-C.slmd



Material Name	Color	Unit Weight (kN/m3)	Cohesion (kPa)	Phi (deg)
Surface layer		19.5	4	30
Clayey silt fill		19.5	3	28
Silty clay till		20.5	6	29
Silt		21	0	33
Sandy silt		21	0	34
Silty sand		21	0	35
Sand and gravel		21	0	37

rocscience

SLIDEINTERPRET 8.024

Project	21-122-103 - Slope Stability Assessment, 150 Steeles Avenue East, Milton, ON
Analysis Description	Long-term Stability Analysis of Stable Slope at Section C-C
Drawn By	DS
Scale	1:225
Company	DS Consultants Ltd.
Date	June 2022
File Name	Drawing 16 - Stable Slope at Section C-C.slmd

Appendix I

Site Google Image and Photographs

(Photos 1 to 22, taken on April 22 & 28, 2022)

Google Image of Surrounding Area of Subject Slope (within the Red line)

Photo 1: Top of Slope Area in Cross-Section B-B and C-C (looking east)

Photo 2: Slope Condition in Cross-Section B-B and C-C Area (looking east)

Photo 3: Slope Conditions (looking east from top of slope at Cross-Section A-A)

Photo 4: Slope Conditions in Area of Cross-Sections A-A to C-C (looking northwest from toe area of slope)

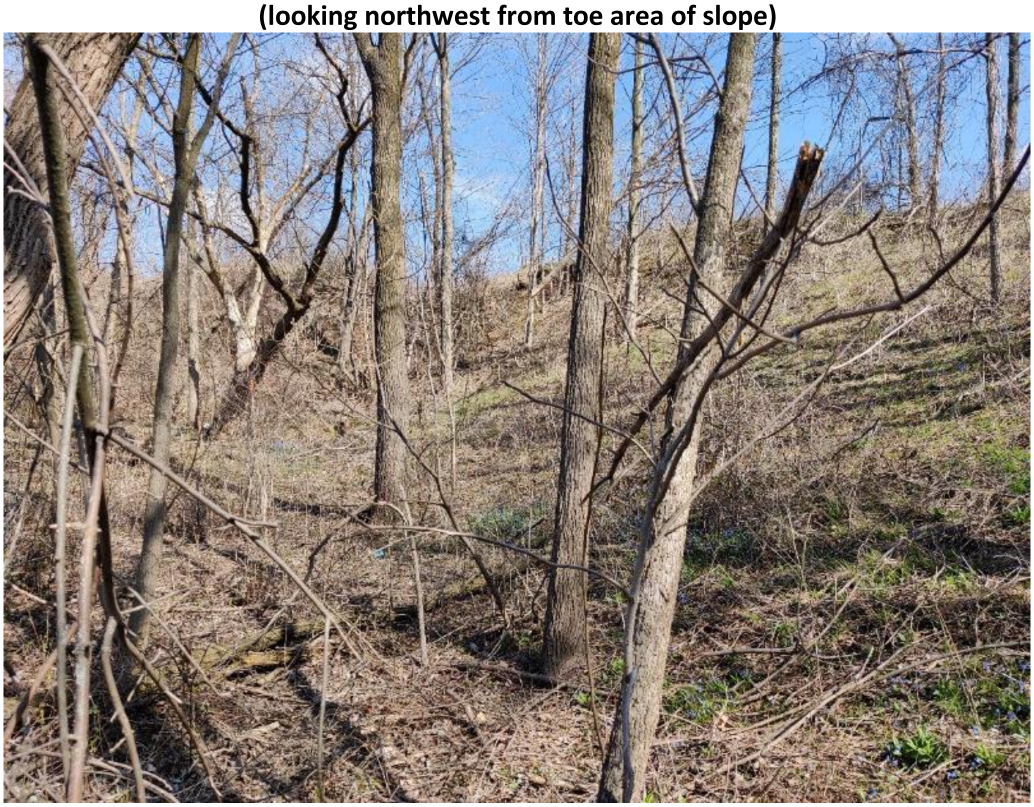


Photo 5: Slope conditions and erosion/failure in Cross-Section B-B area (looking north from toe of slope)

Photo 6: Erosion/Failure of Slope in Cross-Section B-B Area (looking north)

Photo 7: Slope failure at Cross-Section B-B (looking east at top of slope)

Photo 8: Slope failure in Cross-Section B-B area (looking southeast from top of slope)

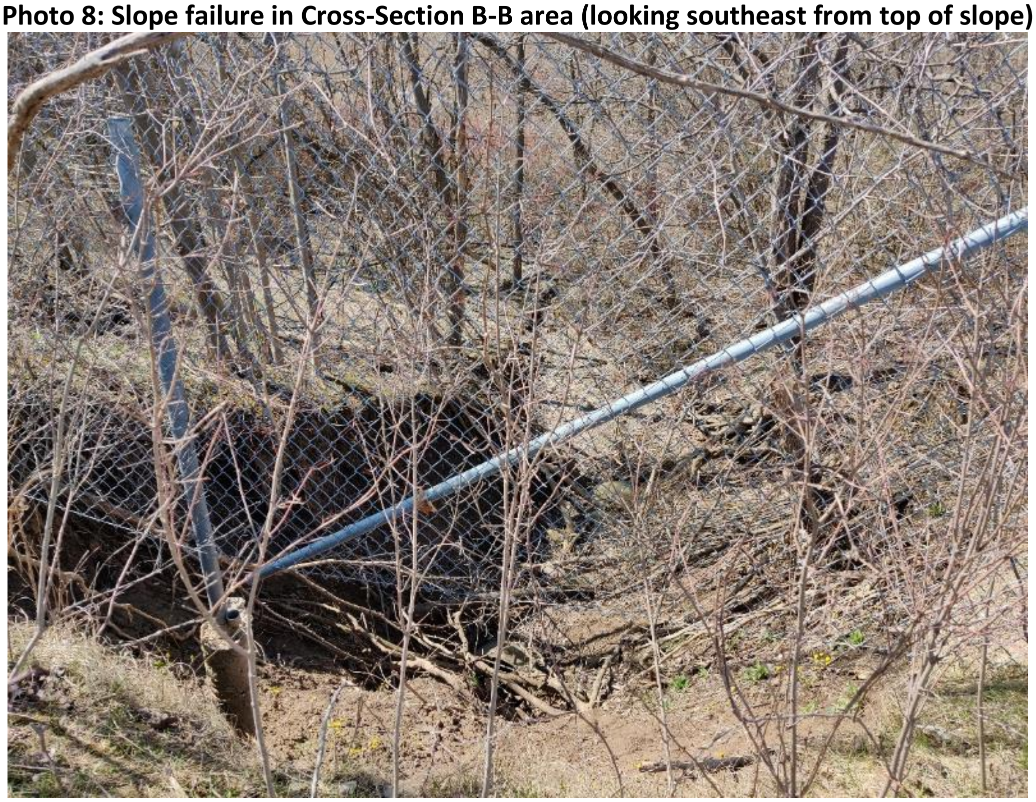


Photo 9: Slope conditions from Cross-Section C-C to Cross-Section D-D
(looking northeast from toe of slope)

Photo 10: Slope conditions from Cross-Section D-D to Cross-Section E-E
(looking northeast from toe of slope)

Photo 11: Top of slope conditions in Cross-Sections D-D to E-E area (looking northwest from east of Cross-Section E-E)

Photo 12: Slope conditions in Cross-Sections D-D to E-E area (looking northwest from toe of slope at east of Cross-Section E-E)

Photo 13: Top of slope conditions
(looking northwest from west of Cross-Section F-F)

Photo 14: Slope conditions
(looking northwest from toe of slope at west of Cross-Section F-F)

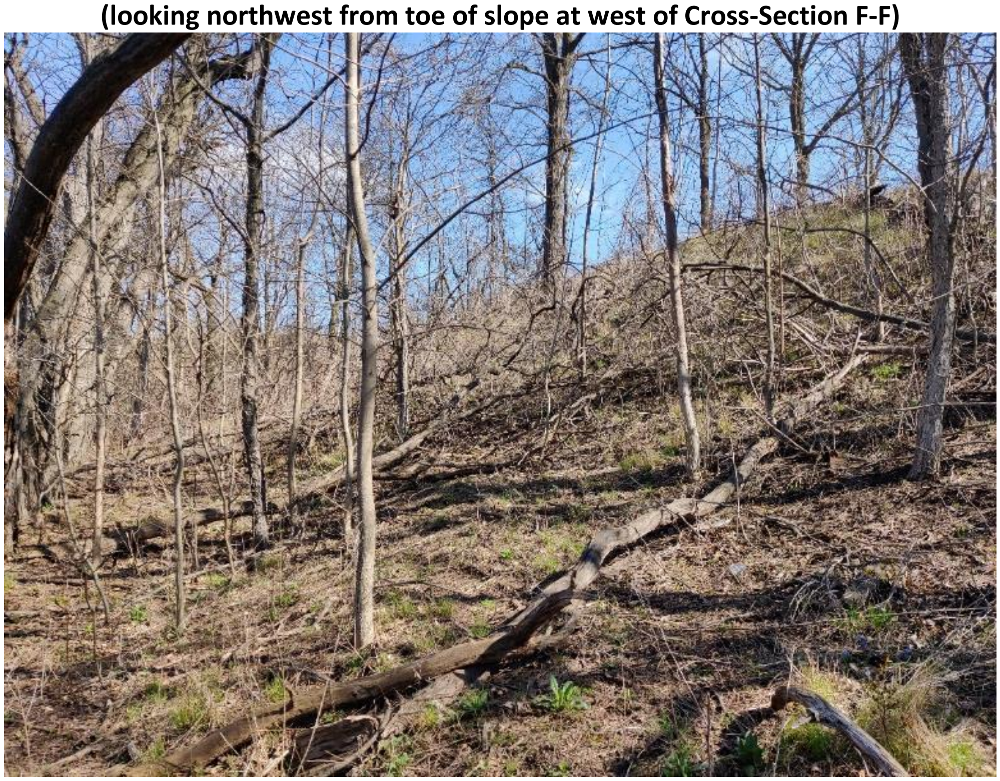


Photo 15: Slope conditions
(looking southeast from top of slope at west of Cross-Section G-G)

Photo 16: Slope conditions
(looking north/upward from toe of slope at west of Cross-Section G-G)

Photo 17: Top of slope conditions in middle area between Cross-Sections G-G and H-H (looking east from top of slope)

Photo 18: Slope and toe conditions in middle area between Cross-Sections G-G and H-H (looking northeast from toe level of slope)

Photo 19: Top of slope conditions in area to east of Cross-Section I-I (looking west at top of slope)

Photo 20: Slope and toe conditions in area to west of Cross-Section I-I (looking east at toe level of slope)

Photo 21: Top of slope conditions in area of Cross-Section J-J at the east part of slope (looking northwest at top of slope)

Photo 22: Slope conditions at the east part of slope (looking northwest from toe of slope in area of Section J-J)

Appendix II

Site Slope Inspection Record and Slope Stability Rating Chart

TABLE 4.1 - Slope Inspection Record

1. FILE NAME / NO.

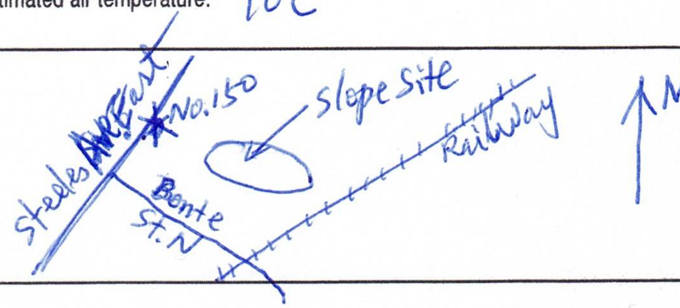
INSPECTION DATE (DDMMYY): Apr. 22, 2022

WEATHER (circle): • sunny • partly cloudy • cloudy
• calm • breeze • windy
• clear • fog • rain • snow
• cold • cool • warm • hot
estimated air temperature: 10°C

INSPECTED BY (name):

2. SITE LOCATION (describe main roads, features)

SKETCH



3. WATERSHED

4. PROPERTY OWNERSHIP (name, address, phone):

LEGAL DESCRIPTION
Lot
Concession
Township
County

150 Steeles Avenue East, Milton, ON

CURRENT LAND USE (circle and describe)

• vacant -field, bush, woods, forest, wilderness, tundra,

• 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
• 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
FACE
BOTTOM

No seepage

7. SLOPE SOIL STRATIGRAPHY (describe, positions, thicknesses, types)

TOP
FACE
BOTTOM

Clayey silt, silt, sandy silt

8. WATER COURSE FEATURES (circle and describe)

SWALE, CHANNEL
GULLY
STREAM, CREEK, RIVER
POND, BAY, LAKE
SPRINGS
MARSHY GROUND

No creek/river within 15m from toe of slope.
Slope toe area is wet area.

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

TOP Road, grasses/trees
FACE grasses/trees
BOTTOM grasses/trees

except for area at cross-section B-B where erosions occurred on slope (see Drawing 1A/1B for location plan in report).

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

TOP – with fences in some areas
FACE
BOTTOM

N/A.

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

TOP – No
FACE – No
BOTTOM – No

except for area at cross-section B-B where erosions occurred.

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

TOP
FACE
BOTTOM

No slide features, except for area at cross-section B-B where erosions had occurred.

13. PLAN SKETCH OF SLOPE

See drawings in report

14. PROFILE SKETCH OF SLOPE

See drawings in report.

TABLE 4.2 - SLOPE STABILITY RATING CHART

Site Location: 150 Steeles Ave E. File No. 21-122-103
Property Owner: NEATT Communities Inspection Date: April 22, 2022
Inspected By: Fanyu Zhu, P. Eng. Weather: Sunny, 10°C

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	– Except for area at cross-section B-B, where erosions had occurred.	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	– Except for area at cross-section B-B where erosions had occurred.	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 (Erosions in area of cross-section B-B, see Drawing 1A/1B for location in report.)		6
SLOPE INSTABILITY RATING VALUES INVESTIGATION RATING SUMMARY		**TOTAL**	44

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