

June 11, 2020

DST Ref. No.: 01937029.001

AIM Recycling Ottawa East  
A Division of American Iron and Metal Company Inc.  
2555 Sheffield Road  
Ottawa, Ontario  
K1B 3V6

Attn.: Mr. Christian Brisbois, Eng.  
Director, Engineering and Construction

Re.: Evaluation of Anticipated Settlement of Footings with  
Proposed Grade Raise around New Building  
2555 Sheffield Road, Ottawa, ON  
City of Ottawa File No: D07-12-19-124

## **1. INTRODUCTION**

DST Consulting Engineers Inc., a Division of Englobe Corporation (DST) is pleased to present this letter to AIM Recycling Ottawa East (Client) documenting the results of our latest laboratory consolidation testing and estimation of potential settlement of footings for Building A and B at the above-referenced Site.

In February 2020, DST reviewed the "Grading and Erosion and Sediment Control" plan (Dwg No. 119007-GR, dated January 31, 2020). The geotechnical investigation for this Site limited proposed grade raises on the Site to a maximum of 0.5 meters. In several localized areas around the north portion of Building A and Building B grade raises of up to 1.3 m were proposed, with a final floor slab elevation of 67.5 masl. These grade raises were not consistent with the recommendations of the original geotechnical investigation.

On April 1, 2020, DST was retained to perform an additional scope of Phase II ESA along with additional laboratory consolidation testing and evaluate the effects of the proposed grade raise on the potential settlement of the proposed Building A and Building B foundations. This current letter is intended to summarize the results of the recently performed laboratory consolidation testing and settlement analysis.

The analysis performed and the results presented in this letter are based on our review of the following project documentation that has been provided to DST by the Client:

- Novatech, "Grading Erosion and Sediment Control Plan", Dwg. No. 119007-GR, Rev. 3, dated March 26, 2020.
- Nicholas Caragianis Architect Inc., "Building A Elevations", Dwg. No. A3.01a, Rev. 02, dated March 10, 2020.

This letter must be read in conjunction with DST's previous submissions for this project (DST Ref. No. TS-SO-37029), including the following:

- “Response to City of Ottawa Comments March 3, 2020 – Geotechnical Investigation and Environmental Site Assessments (ESA) – New Building, Truck Scales, and Pavement – 2555 Sheffield Road, Ottawa, ON”, dated April 7, 2020.
- “Geotechnical Review of Grading Plan – New Building, Truck Scales, and Pavement – 2555 Sheffield Road, Ottawa, ON”, dated February 5, 2020.
- “Preliminary Geotechnical Investigation for Proposed New Buildings, Truck Scales, and Pavement – 2555 Sheffield Road, Ottawa, ON”, dated May 21, 2019.

## 2. ADDITIONAL LABORATORY CONSOLIDATION TESTING

DST obtained two undisturbed samples of the silty clay deposit using a thin-walled tube sampler (Shelby Tube) in BH20-3, which was performed as part of the Phase II ESA. The undisturbed soil samples were submitted to a reputable geotechnical laboratory to undergo one-dimensional consolidation (oedometer method), Atterberg Limits, and unit weight testing. The results of the consolidation testing are presented in Table 1 below.

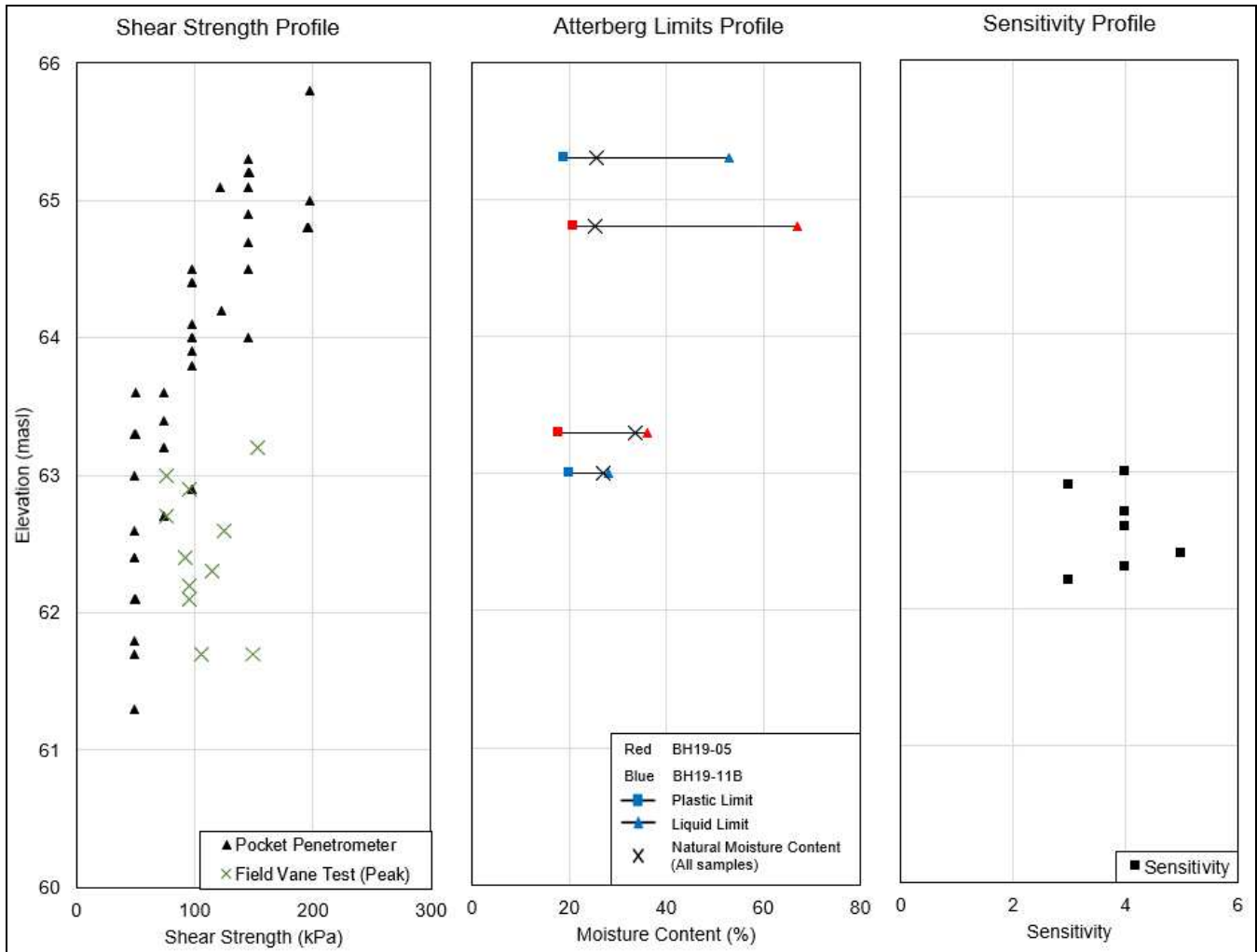
Table 1 Summary of laboratory one-dimensional consolidation tests results

Variation of Consolidation Parameters of Silty Clay Deposit with Depth					
Sample ID	Interpreted Soil Layer	Initial Void Ratio, $e_o$	$\sigma'_p$ (kPa)	$C_c$	$C_r$
BH20-3, ST 1 (2.3 – 2.9 mbgs)	Desiccated Silty Clay Crust (El. 62.9 to 66.8 masl)	1.388	500	0.63	0.08
BH20-03, ST 2 (3.0 – 3.7 mbgs)	Unweathered Grey Silty Clay (El. 61.2 to 65.5 masl)	0.980	380	0.35	0.05

## 3. EVALUATION OF ANTICIPATED SETTLEMENT

DST performed a settlement evaluation for the proposed footings for Building A and B based on the Site conditions observed during our site investigations and the results of the recent laboratory consolidation testing.

Given the findings of our original investigation and the proposed grade raise, the native silty clay deposit below the new footings is expected to undergo both elastic short-term settlement and long-term consolidation settlement over time. Therefore, further characterization of the silty clay deposit was required via supplementary in-situ field vane tests, pocket penetrometer tests, Atterberg Limits tests, and one-dimensional laboratory consolidation tests. The detailed results of the characterization of silty clay deposit are presented on Figure below. This figure depicts the variations of measured shear strength, natural moisture content, Atterberg Limits, and sensitivity with elevation.



**Figure 1** Shear strength, Atterberg Limits and sensitivity profiles with respect to elevation

Based on the results of the original geotechnical investigation, the more competent desiccated brown upper crust identified at the Site is of variable thickness and is underlain by a grey unweathered firm to stiff silty clay.

The results of the one-dimensional consolidation tests were used to carry out a settlement analysis of the proposed new footings. DST understands that a Structural Engineer has not yet been retained for this Project, and as such, the required bearing pressures and footing dimensions have not been finalized. Therefore, the settlement analysis was conducted using the assumed footing loads and dimensions in the Preliminary Geotechnical Investigation, which are subject to confirmation during detailed design stage of the project. Based on the assumed foundation geometries and loads, the following magnitudes of potential settlements were estimated.

**Table 3** Summary of Settlement Evaluations

Assumed Design Parameters	Estimated Values	
Design bearing pressure under serviceability conditions	100 kPa	100 kPa
Assumed footing dimensions	1.0 m strip footing	2.0 m x 2.0 m pad footing
Footing elevation (founded on Engineered Fill or native undisturbed silty clay)	65.5 masl	65.5 masl
<b>Estimated settlement based on footing loading (including the maximum 0.5 m grade raise limit as per the geotechnical investigation)</b>	<b>24 mm</b>	<b>25 mm</b>
Finished grade elevation	67.5 masl	67.5 masl
Proposed grade raise	0.7 to 1.5 m	0.7 to 1.5 m
<b>Estimated additional settlement due to the proposed grade raise</b>	<b>9 to 28 mm</b>	<b>9 to 28 mm</b>
<b>Estimated total settlement</b>	<b>33 to 52 mm</b>	<b>34 to 53 mm</b>

Using the consolidation testing results and the assumed footing dimensions and applied pressures, **anticipated total long-term settlement is estimated up to 55 mm under the applied loading from the proposed grade raise.**

It is important to emphasize that the originally recommended design bearing pressure of 100 kPa at the Serviceability Limit State (SLS) is specific to the allowable total settlement limit of 25 mm. Typical tolerances for structures such as Building A and B supported on shallow spread footings would be about 19 mm of differential settlement and 25 mm of total settlement. Therefore, the estimated total settlement has the potential to exceed the conventional settlement limit of 25 mm and is therefore not recommended under 100 kPa SLS loading.

Again, DST understands that this structure has not been designed yet. Based on the structural design of the building, consideration may be given to design the structure as a flexible structure to tolerate settlements up to 55 mm, or reduce the applied SLS design pressure for the footings (or mat foundation) to the extent necessary to keep the anticipated total settlement below the tolerable limit. However, these options would need to be evaluated by the Structural Design Engineer during detailed design stage of the project. In summary, the proposed building foundation and utilities will need to be designed in such a way to accommodate the estimated potential settlements herein.

If the structure cannot be structurally designed to accommodate the estimated settlements, then grade raises will need to be reduced to conform to the 0.5 m grade raise limit proposed in the original Geotechnical Investigation, or alternatively, the building design will need to incorporate light weight fill beneath the floor slab and around the foundations of the buildings. Further geotechnical consultations are recommended during detailed design stage of the project.

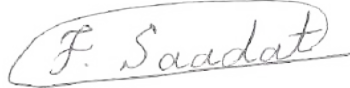
#### 4. CLOSURE

We trust the settlement evaluations presented above meets the requirements of Engineering Comments B.2 and B.3 from the City of Ottawa. Further geotechnical consultations are recommended during detailed design stage of the project. If there are any questions, please do not hesitate to contact the undersigned at your convenience.

Yours truly,  
DST Consulting Engineers Inc.



Shane Dunstan, P.Eng.  
Project Manager



Farbod Saadat, Ph.D., P.Eng.  
Senior Geotechnical Project Manager, Associate

# **APPENDIX A**

## **Statement of Limitations**

## **Limitations of Report Geotechnical Studies**

The data, conclusions, and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the Client. Note that no scope of work, no matter how exhaustive, can identify all conditions below ground. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the specific locations tested. Conditions may also become apparent during construction which were not detected and could not be anticipated at the time of the site investigation. Conditions can also change with time. It is recommended practice that DST Consulting Engineers Inc. be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the boreholes.

The design recommendations given in this report are applicable only to the project described in the test and then only if constructed substantially in accordance with details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid. Unless otherwise noted, the information contained herein in no way reflects on environmental aspects of either the site or the subsurface conditions.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs, e.g. 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 conclusion as to how the subsurface conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the Client.

## **APPENDIX B**

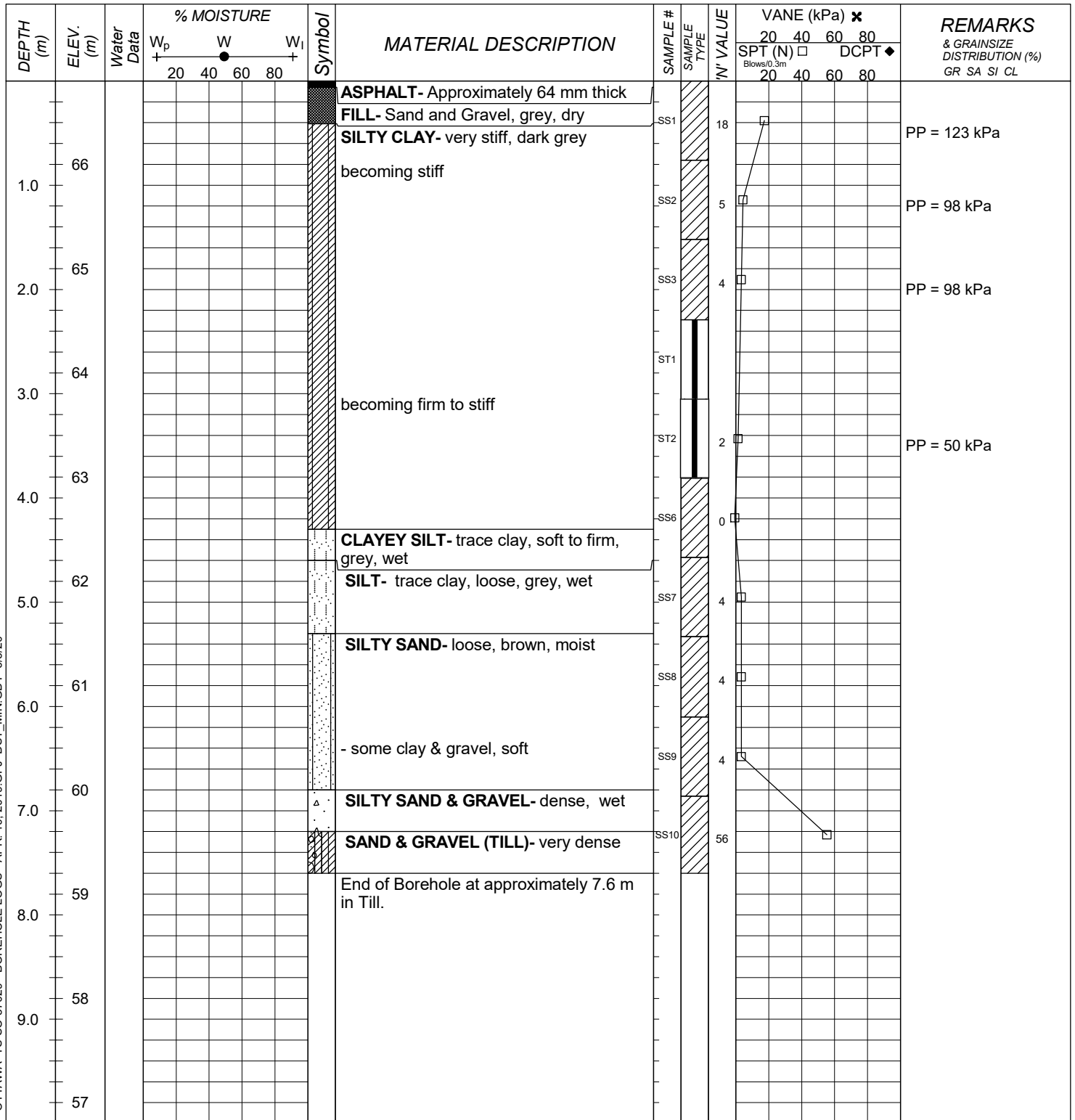
# **Laboratory Testing Results**



# LOG OF BOREHOLE BH20-3

DST REF. No.: 01937029.001  
 CLIENT: AIM Recycling Ottawa East  
 PROJECT: Limited Phase II Environmental Site Assessment  
 LOCATION: 2555 Sheffield Road, Ottawa, ON  
 SURFACE ELEVATION: 66.80m

Drilling Data  
 METHOD: Hollow Stem Auger  
 DIAMETER: 200 mm  
 DATE: May 4, 2020  
 COORDINATES: 5028369.3 m N, 452491.2 m E



BOREHOLE (STANDARD) - OTTAWA TS-SO-37029 - BOREHOLE LOGS - APR. 10, 2019.GPJ DST\_MIN.GDT 6/3/20



DST Consulting Engineers Inc.  
 203 - 2150 THURSTON DRIVE  
 OTTAWA, ONTARIO, K1G 5T9  
 PH: (613)748-1415  
 FX: (613)748-1356  
 Email: ottawa@dstgroup.com  
 Web: www.dstgroup.com

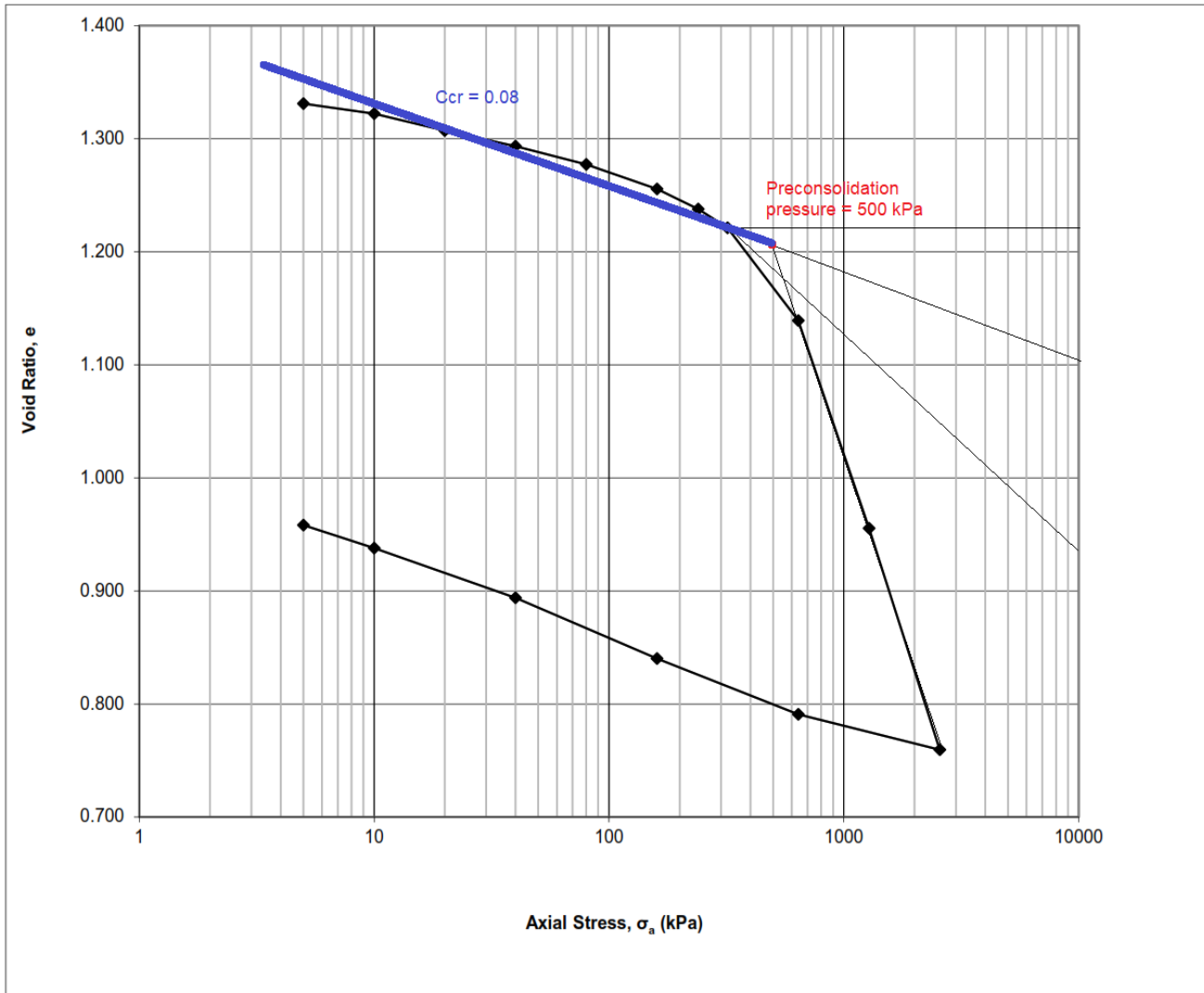
### SAMPLE TYPE LEGEND

- |                    |                     |           |
|--------------------|---------------------|-----------|
| Auger Sample       | Rock Core           | Bentonite |
| Split Spoon Sample | Hiller Peat Sampler | Sand      |
| Bulk Sample        | 70mm Thin Wall Tube |           |

**ENCLOSURE 1**

Project  
Project No.  
Borehole No.  
Sample No.  
Sample Depth

DST Consulting Engineers, File#01937029.001  
122411080  
20-3  
ST 1  
10-12 ft



Project  
Project No.  
Borehole No.  
Sample No.  
Sample Depth

DST Consulting Engineers, File#01937029.001  
122411080  
20-3  
ST 2  
12.5-14.5 ft

