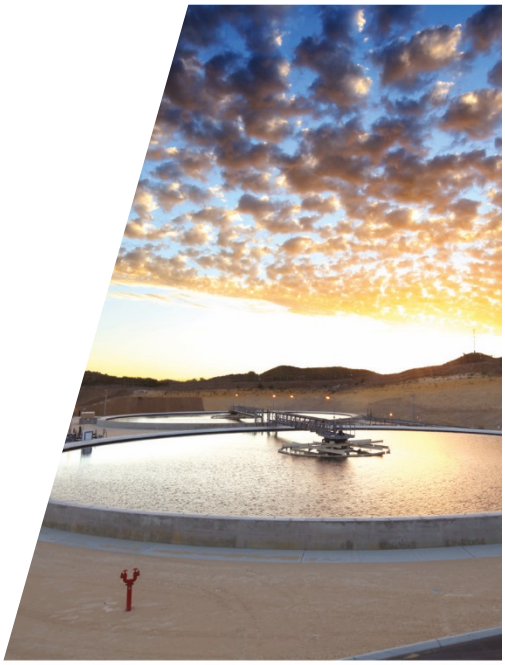
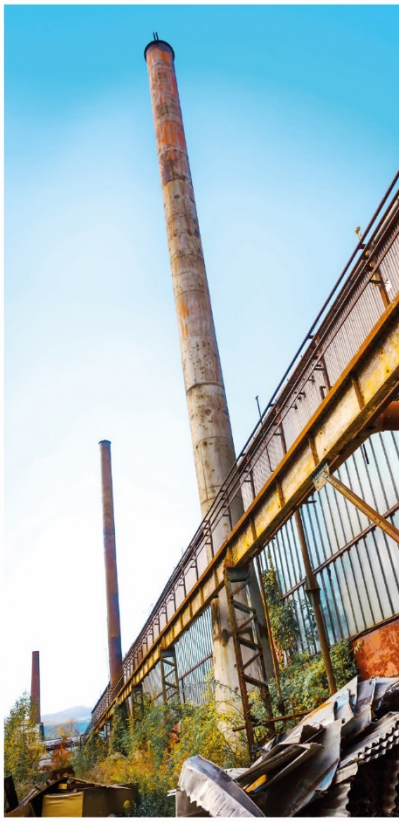


Geotechnical Investigation

Cell 20, Subcell 1
Clean Harbors Lambton Facility Landfill
Corunna, Ontario

Clean Harbors Canada, Inc.



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1. Introduction

Clean Harbors Canada, Inc. (Clean Harbors) operates a hazardous waste landfill facility (Facility or Site) in Corunna, Lambton County, Ontario. Hazardous solid waste, select non-hazardous waste, liquid waste, and untreated and pre-treated hazardous waste is accepted at the Facility. The Facility is located on Lots 8 and 9 of Concession 10, in St. Clair Township, Lambton County. The Site has a total property area of 140 hectares (ha). The layout of the existing Facility is shown on Figure 1.

GHD is currently designing a below-grade landfill expansion cell identified as Cell 20-1, at the location shown on Figure 2. The geotechnical division of GHD carried out a geotechnical investigation in the Fall of 2020 to support the design of the cell.

The following report summarizes the results of our geotechnical investigation, associated laboratory testing, subsurface soil and groundwater conditions encountered at the borehole locations. This information was used to carry out slope stability modelling of the proposed Cell 20-1 excavation, and to provide recommendations to aid in the design of the excavation and sides slopes for the new cell.

2. Field and Laboratory Work Program

2.1 Field Investigation

The scope of work (SOW) for the geotechnical investigation comprised drilling a total of four geotechnical boreholes BH20-1 through BH20-4 (one borehole approximately at each corner of the proposed rectangular shaped Cell). The boreholes were advanced to a depth of 25.0 metres (m) below the existing ground surface (bgs). The boreholes were located in the field by GHD staff with the assistance of Murphy Contracting, Clean Harbor's earthworks contractor present at Site. Murphy Contracting provided the coordinates and ground surface elevations of the staked borehole location. The borehole locations are shown on Figure 2.

A Site-specific Health and Safety Plan (HASP) was developed by GHD for implementation prior to commencement of any field activities and associated investigation program. Prior to commencement of field drilling activities, underground utility locates through Ontario One Call and a private utility locating company were arranged. The boreholes were advanced by Geo-Environmental Drilling Inc., a Ministry of the Environment, Conservation and Parks (MECP) licensed driller between October 5 to 8, 2020, using a rubber-track mounted drill rig equipped with hollow stem augers, and mud-rotary drilling arrangements under the full time supervision of GHD field personnel.

The boreholes were installed using 70 mm inside diameter hollow stem augers up to a depth of 4.5 m bgs, and mud rotary drilling techniques below this depth, by advancing a 100 mm diameter steel casing. Representative samples of the strata penetrated were obtained during drilling at depth intervals of 0.75 m and 1.5 m, as appropriate, utilizing a 50 mm diameter split-barrel sampler, advanced by dropping a 63.5 kg hammer from a height of 760 mm in accordance with the standard penetration test method (ASTM D1586). Undisturbed thin walled tube (Shelby tube) samples in accordance with ASTM D1587 were also collected at select depths for geotechnical lab testing. The

results of the Standard Penetration Tests (SPT) are reported as 'N' values at the corresponding depths on the respective borehole logs presented in Appendix A.

Groundwater observations were made in the boreholes as drilling progressed up to the 4.5 m depth. Groundwater observations in the borehole could not be made below 4.5 m due to the use of mud rotary drilling. Each borehole was dry with no groundwater present to a depth of 4.5 m bgs during drilling as noted on the borehole logs. Following completion of drilling, each borehole was backfilled using the cement-bentonite grout, and hydrated bentonite pellets in accordance with Ontario Regulation 903.

2.2 Geotechnical Laboratory Testing

The geotechnical laboratory testing program consisted of moisture content tests on all recovered split spoon samples. Eight Shelby tube samples (two samples from each of the four boreholes at select depths) were also collected for further geotechnical testing as noted below.

- Grainsize distribution analysis (ASTM D6913-17) and Atterberg limits tests (ASTM D4318) on five Shelby tube samples.
- Unconfined compressive strength test (ASTM D2166) on eight Shelby tubes samples.
- Dry density (unit weight) test (ASTM D7263) on all eight Shelby tube samples.
- Consolidated undrained (CU) triaxial compression tests (ASTM D4767) on three Shelby tube samples.

The laboratory test results are discussed in Section 3, and shown at their corresponding depths on the individual borehole logs provided in Appendix A. Detailed laboratory test results are provided in Appendix B.

3. Subsurface Conditions

Details of the subsurface conditions encountered at the Site are summarized in the following sections of the report. Detailed borehole stratigraphic logs are provided in Appendix A.

The Facility is located in the low-relief physiographic region of the approximately 5,800 square kilometres (km^2) St. Clair Clay Plains[1]. The clay till deposits are ablation till deposits left by retreating ice lobes, smoothed over by shallow lacustrine clays deposited by the early Lake Warren. The clay overburden thickness at the Facility consists of 42 to 50 m thick firm to very stiff clayey still deposited over Paleozoic black Shale bedrock of the Kettle Point formation.

The clay till has an over-consolidated crust underlain by lightly over-consolidated clay stratum becoming normally consolidated with depth. Based on the physical characteristics and shear strength parameters, the clay till deposits can be subdivided into four sublayers shown on the computer models.

1 Chapman L.J., Putnam D.F. (1984): The Physiography of Southern Ontario; Ontario Geological Survey, Special Volume 2, 270p. accompanied by Map P.2715 (coloured), scale 1:600,0000

3.1 Surficial Fill

A thin veneer of surficial fill (surface soils reworked from grading activities) was encountered in the four boreholes. The thickness of the fill was noted to be 0.9 m, 2.2 m, 0.1 m, and 0.1 m in BH1-20, BH2-20, BH3-20 and BH4-20 respectively. The fill deposit in general comprise clayey silt, trace to some sand, trace gravel, and include topsoil roots at the location of BH1-20 and BH3-20.

The natural moisture content of the samples recovered from fill deposits generally ranged from 11 percent to 18 percent indicating a moist condition, except in BH1-20 where 31 percent moisture was noted, which indicates a moist-wet condition.

3.2 Clayey Silt Deposits

The surficial clayey fill deposits in all boreholes are further underlain by native clayey soils, which extend to the termination depth of the borehole. The native clayey deposits comprise clayey silt/ clay and silt/ silt and clay, and include a trace or some sand, and trace gravel.

SPT 'N' values recorded in the native clayey soils generally ranged from 5 to 23. The native deposits have a brown crust that is typically stiff to very stiff, and slightly desiccated from natural groundwater table variations. SPT values in the crust material tend to be in the range of 10 to 20. The crust extends to a depth of 3 to 4 m in the boreholes, and transitioned into a firm to stiff grey clayey silt deposit, with SPT values typically less than 12, and decreasing to as low as 3 in BH4-20 at 23 m depth bgs. The natural moisture content of the samples recovered from the native deposits generally ranged from 10 percent to 28 percent, indicating moist to moist-wet conditions.

Undisturbed samples of the clayey silt were collected with eight Shelby tubes for geotechnical laboratory testing, consisting of grain size distribution analyses, Atterberg limits, unconfined compressive strength tests, unit weight, and consolidated undrained (CU) triaxial compression tests. The test results are summarized and presented in the attached Table 3.1.

The laboratory results performed on the Shelby tube samples show that the clayey silt deposit is generally consistent in nature in the boreholes. The grain size analyses show a sand content of typically 6 to 8 percent (with one result of 17 percent), silt content of 42 to 57 percent, and a clay content of 36 to 49 percent. Atterberg limit results for the clayey silt samples show a liquid limit in the range of 30 to 41, and a plasticity index of 15 to 20, indicating low to medium plastic clay. Shear strengths were obtained from unconfined compressive strength testing on the clayey silt samples and range from 26 to 144 kPa. The shear strengths results confirm that the clayey silt deposits are stiff to very stiff to a depth of about 10 to 15 m and become softer below these depths. These shear strength values are generally consistent with the SPT values obtained in the boreholes. The three CU triaxial compressive strength tests were used to determine the effective strength parameters of the deposit, for use in the slope stability modelling.

3.3 Groundwater Observations

Groundwater observations were made in the boreholes as they were advanced. Mud rotary drilling techniques were used below a depth of 4.5 m bgs, and groundwater observations could not be obtained due to the presence of the mud slurry in the boreholes. The boreholes were backfilled with cement bentonite upon completion of drilling. These deposits generally do not have significant

groundwater bearing layers, due to the low permeability of the clayey silt materials. However, the stabilized groundwater table can generally be considered at the depth of the transition between the upper brown clay (desiccated crust), and the lower grey clay deposits. Seepage may occur from pockets of sandy soils within these clayey deposits.

4. Discussion and Recommendations

The purposes of this geotechnical investigation was to assist with GHD's design of the excavation and side slopes for Cell 20-1. The proposed draft design is shown on Figure 2. The Cell will be excavated to a depth of approximately 20 m below existing grades, and will have a base elevation of 182 m. The excavation side slopes have been preliminarily designed to have an excavation angle of 1 horizontal to 1 vertical (1H:1V), with horizontal benching part way down the slope to provide sufficient slope stability against sidewall collapse. GHD's geotechnical group utilized the subsurface information obtained from the recent geotechnical boreholes to evaluate the stability of the proposed excavation slopes. The following sections of the report describe the analyses and the results of the slope stability modelling, and provides recommendations based on the modelling.

4.1 Slope Stability Methodology and Approach

GHD utilized the Geo-Studio 2019 R2 suite of Software developed by Geo-Slope International of Calgary, Alberta for the slope stability modelling. The software comprises three modules-SEEP/W, SLOPE/W and SIGMA/W.

The SLOPE/W module employs mainly limit-equilibrium methods such as Bishop, Janbu, Spencer, or Morgenstern & Price methods. The slope stability analyses for this study were carried out using the Morgenstern & Price Method, which is a general method of slices developed on the basis of limit equilibrium that requires satisfying equilibrium of forces and moments acting on individual blocks. The blocks are created by dividing the soil above the slip surface by dividing planes.

4.2 Cross-Sections Analyzed

Four cross-sections were reviewed prior to commencing the slope stability models. The cross-section locations are shown on Figure 2. Section B-B' was selected for the detailed modelling analyses, as the other sections (A-A', C-C', and D-D') were considered to be similar, or more conservative (safer against slope stability issues) than Section B-B'.

4.3 Stratigraphy and Material Properties

The properties required for the stability analyses of the slopes are the bulk densities and shear strength parameters of the materials involved. Relevant geotechnical properties comprising bulk density and shear strength of the different subsurface units have been determined from the field investigation, laboratory test results, and GHD's previous experience with the subsurface conditions at this site. The material properties, including bulk density and effective shear strength parameters, assumed in the slope stability analyses are summarized in Table 4.1. The clayey silt units have been divided into geologic subunits based on their geotechnical properties. These are referred to as the St. Joseph Till, and Black Shale Till, based on historical geotechnical reports and geologic

descriptions. Lower bound and upper bound shear strength parameters were used in the model sections based on previous studies at the site, and the laboratory data obtained from the 2020 lab testing.

4.4 Piezometric Conditions

The stabilized piezometric (groundwater table) surface in the model was assumed to be at elevation 195 m, or about 5 to 6 m below grade. The excavation for the cell is therefore mainly in the saturated clay deposits. The response of the clay during unloading was modelled using SIGMA/W module using the material model category of 'Effective stress with Porewater Changes'. This material category carried out a fully coupled volumetric consolidation analysis where deformation and porewater pressures are computed simultaneously using the effective stress parameters. The post-excavation phreatic surface is shown on the output computer models. When a saturated clay (clay below the groundwater table) is loaded, at time t=0, all the load goes into the porewater pressure i.e., $\Delta p = \Delta u$ where Δp is the load increment and Δu is the excess porewater pressure. Conversely, if saturated clay is unloaded due to its low hydraulic conductivity, it cannot release porewater pressure fast enough to maintain equilibrium through release of porewater, and therefore to maintain equilibrium, negative porewater pressure develops, which acts as a pseudo-reinforcement.

4.5 Minimum Factors of Safety

The FS in slope stability analysis can be defined as the ratio of the available shear strength to that of the applied stresses along a potential failure plane. An FS of 1 or greater indicates stable conditions and a value of less than 1 represents unstable conditions and failure. Given the variability and uncertainty in the selection of strength parameters for natural soil and waste material, an FS above 1 is usually required to provide confidence in the model results. The Canadian Foundation Engineering Manual provides recommendations for typical accepted FS for various structures, depending on the risks associated with the failure. Generally, for landfills, the accepted FS for excavation side slopes is a minimum of 1.3.

4.6 Slope Stability Evaluation Results and Conclusions

The slope stability modelling is based on the following design assumptions for the Cell 20-1 excavation:

- The entire cell will be excavated to a base elevation of 182 m.
- Side slopes will be excavated at a slope of 1H:1V.
- A horizontal intermediate bench, 5 m wide, will be left unexcavated at elevation 192 m to provide side slope stability.
- An optional additional 5 m wide bench may be left at elevation 186 m, if required, to improve the overall slope stability.

The graphical outputs of the slope stability analyses for these conditions are provided on Figures 3 to 6 and are summarized in Table 4.1. The following conclusions can be made from the modelling:

1. Based on previous experience at the site and the modelling, excavation side slopes of 1H:1V will be stable, however, horizontal benches are required to improve the side slope stability. With one 5 m wide bench at elevation 192 m, the FS values are 1.27 and 1.31 for the lower bound, and upper bound parameters, respectively. These FS values are considered marginal, especially when it is expected that the cell will remain open (unfilled) for an extended period of time (months).

2. The use of an additional horizontal bench at elevation 186 m improves the FS value, to 1.37 and 1.41 for the lower bound and upper bound parameters, respectively. For slopes that are going to be open for an extended period (months), it is recommended that the lower bench is incorporated into the design.

5. Limitations of the Report

This report is intended solely for GHD's internal design purposes. This report cannot be used by others without GHD's prior written consent. This report is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse, redistribution of or reliance on the report shall be at the third party's sole risk, without liability to GHD. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. 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.

All of Which is Respectfully Submitted,

GHD

January 19, 2021

Bruce Polan, M.A.Sc., P.Eng.
Associate- Geotechnical Group

Hassan Gilani, M.Sc., P.Eng.

SOURCE:

EXISTING TOPOGRAPHY AND SITE FEATURES PER DRAWING NO. 5, STORMWATER MANAGEMENT, DATED FEBRUARY 23, 2015, PREPARED BY TETRA TECH.

FINAL COVER CONTOURS PER DRAWING NO. 20, FINAL COVER CONTOURS, DATED FEBRUARY 23, 2015, PREPARED BY TETRA TECH.

BUTTERNUT TREES PER DRAWING NO. 13, LANDFILL EXPANSION SUBCELL FILL PROGRESSION PLAN, DATED FEBRUARY 23, 2015, PREPARED BY TETRA TECH.

LEGEND:

- EXISTING MAJOR CONTOUR (5m INTERVAL)
- EXISTING MINOR CONTOUR (1m INTERVAL)
- PROPOSED CONTOUR (2m INTERVAL)
- PROPOSED CONTOUR (1m INTERVAL)
- PROPERTY BOUNDARY
- LIMIT OF WASTE
- LEACHATE COLLECTION SYSTEM
- EXISTING DRAINAGE SWALE
- PROPOSED DRAINAGE SWALE
- FENCELINE
- STORM WATER DRAINAGE DIVIDE
- PAVED ROADWAY
- GRAVEL ROADWAY
- BUILDING / STRUCTURE
- TREELINE
- STORM WATER POND
- PROCESSED WATER
- PROPOSED ACCESS ROAD

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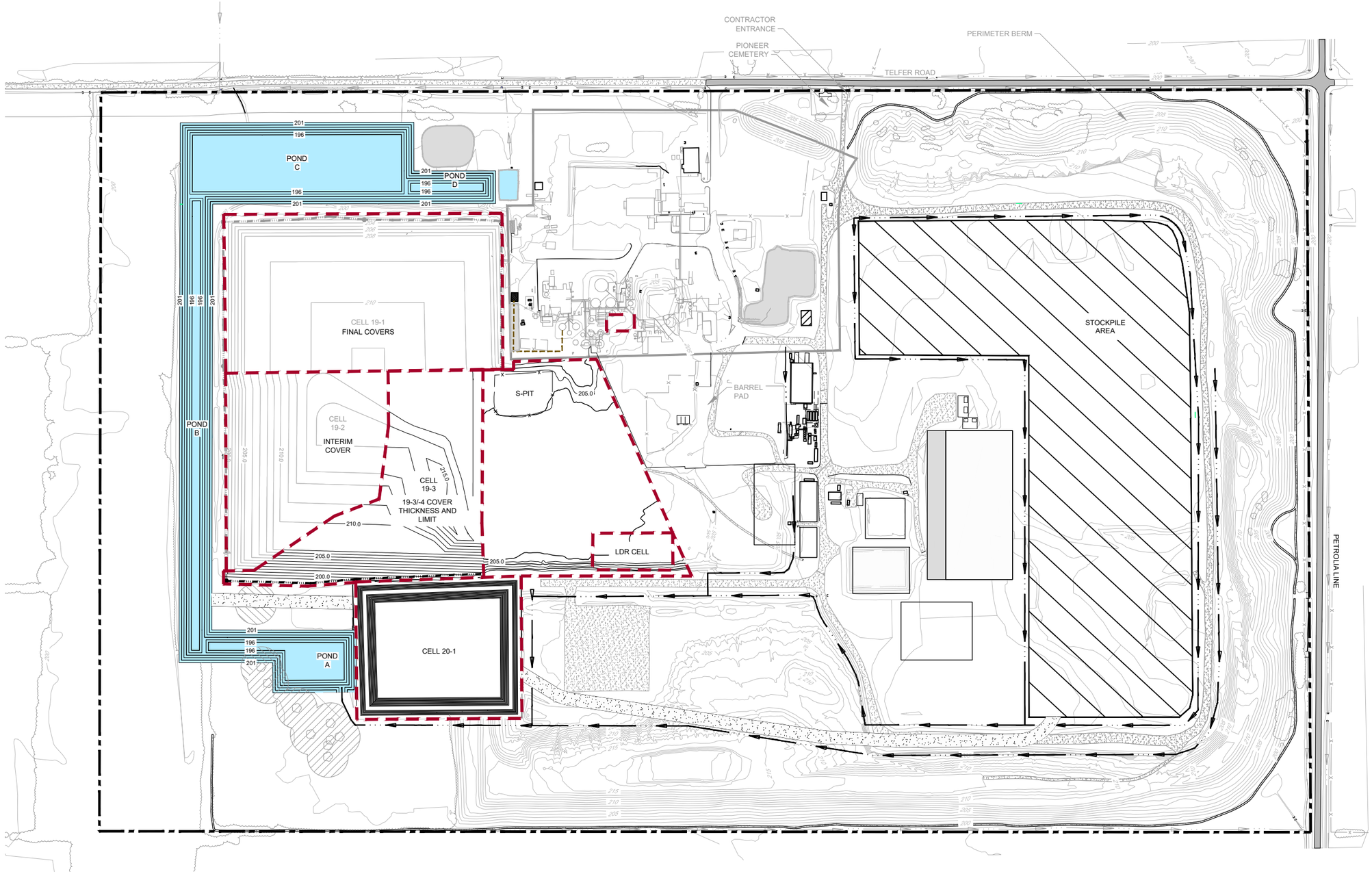

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Client
CLEAN HARBORS CANADA, INC. LAMBTON COUNTY, ONTARIO

Project
2021 CAPITAL WORKS CELL DESIGN ECA 1065-9VVJSW

No.	Issue	Drawn	Approved	Date

Drawn	K. DHALIWAL	Designer	
Drafting Check	J. YARDLEY	Design Check	J. YARDLEY
Project Manager	J. YARDLEY	Date	-
This document shall not be used for construction unless signed and sealed for construction.		Scale	1:750
Original Size	ANSI D	Bar is 20mm on original size drawing	0 20mm

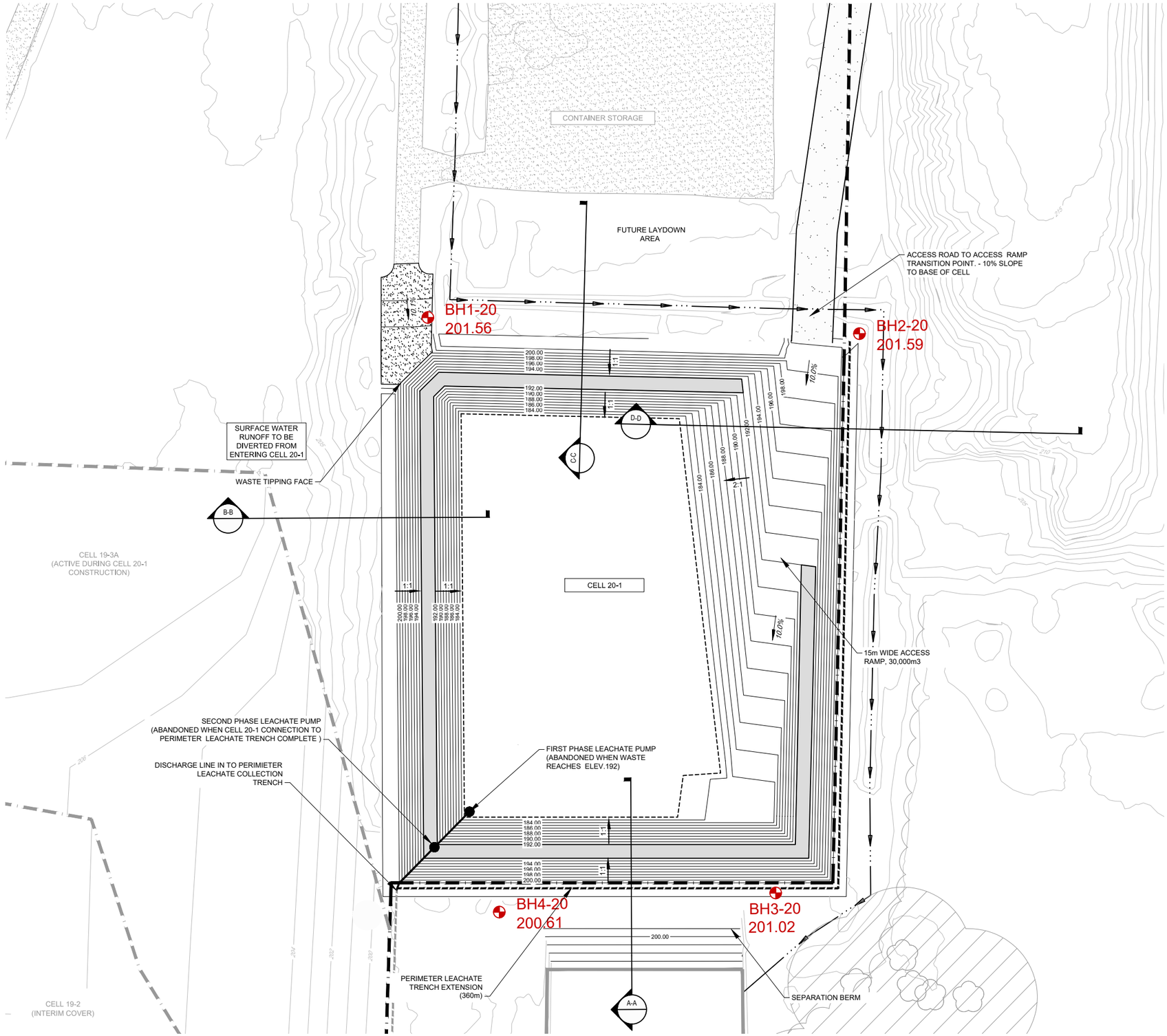
Project No. **44985-50**

Title
2020 CAPITAL WORKS PHASING PLANS

Sheet No.
FIGURE 1

Sheet 1 of 2

Plot Date: 18 January 2021 - 1:00 PM Plotted By: Akram Yusuf CAD File: P:\drawings\44000s\44985\44985-REPORTS\44985-98(045)\44985-98(045)CI-WA001.dwg



0 6 12 18 24m

LEGEND:

- LIMIT OF WASTE
- CELL BOUNDARIES
- CELL 20-1 TOE OF SLOPE (ELEV. 182)
- EXISTING MAJOR CONTOUR (2m INTERVAL)
- EXISTING MINOR CONTOUR (1m INTERVAL)
- MAJOR CONTOUR (PROPOSED BASE GRADES)
- MINOR CONTOUR (PROPOSED BASE GRADES)
- EXISTING LEACHATE COLLECTION TRENCH
- EXISTING DRAINAGE DITCH
- EXISTING ACCESS ROADS
- LEACHATE COLLECTION TRENCH EXTENSION
- ACCESS ROAD/TIPPING FACE
- CELL 20-1 BENCH (ELEV, 192)
- BH2-20 201.59 GEOTECHNICAL BOREHOLE AND GROUND SURFACE ELEVATION

SOURCE:

EXISTING TOPOGRAPHICAL AND SITE FEATURES FROM MAY 22, 2020 GHD SURVEY. EXISTING TOPOGRAPHICAL SURVEY ADJUSTED 0.510m TO MATCH HISTORICAL VERTICAL DATUM.

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LAMBTON COUNTY, ONTARIO

Project
2021 CAPITAL WORKS CELL DESIGN

No.	Issue	Drawn	Approved	Date

Drawn	K. DHALIWAL	Designer	
Drafting Check	J. YARDLEY	Design Check	J. YARDLEY
Project Manager	J. YARDLEY	Date	-
This document shall not be used for construction unless signed and sealed for construction.		Scale	1:750
Original Size	ANSI D	Bar is 20mm on original size drawing	0 20mm

Project No. **44985-50**

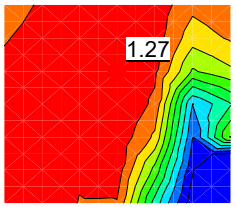
Title
BOREHOLE LOCATION PLAN- CELL 20-1

Sheet No.
FIGURE 2

Sheet **2** of **2**

Plot Date: 18 January 2021 - 1:24 PM Plotted By: Akram Yusuf CAD File: P:\drawings\44000s\44985\44985-REPORTS\44985-98(045)\44985-98(045)CI-WA002.dwg

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Bedrock			
	Black Shale Till, Sub-unit 2A	20	13	26
	Black Shale Till, Sub-unit 2B	18.2	13	26
	St. Joseph Till, Sub-unit 1A	21.5	24	25
	St. Joseph Till, Sub-unit 1B	21	15	28



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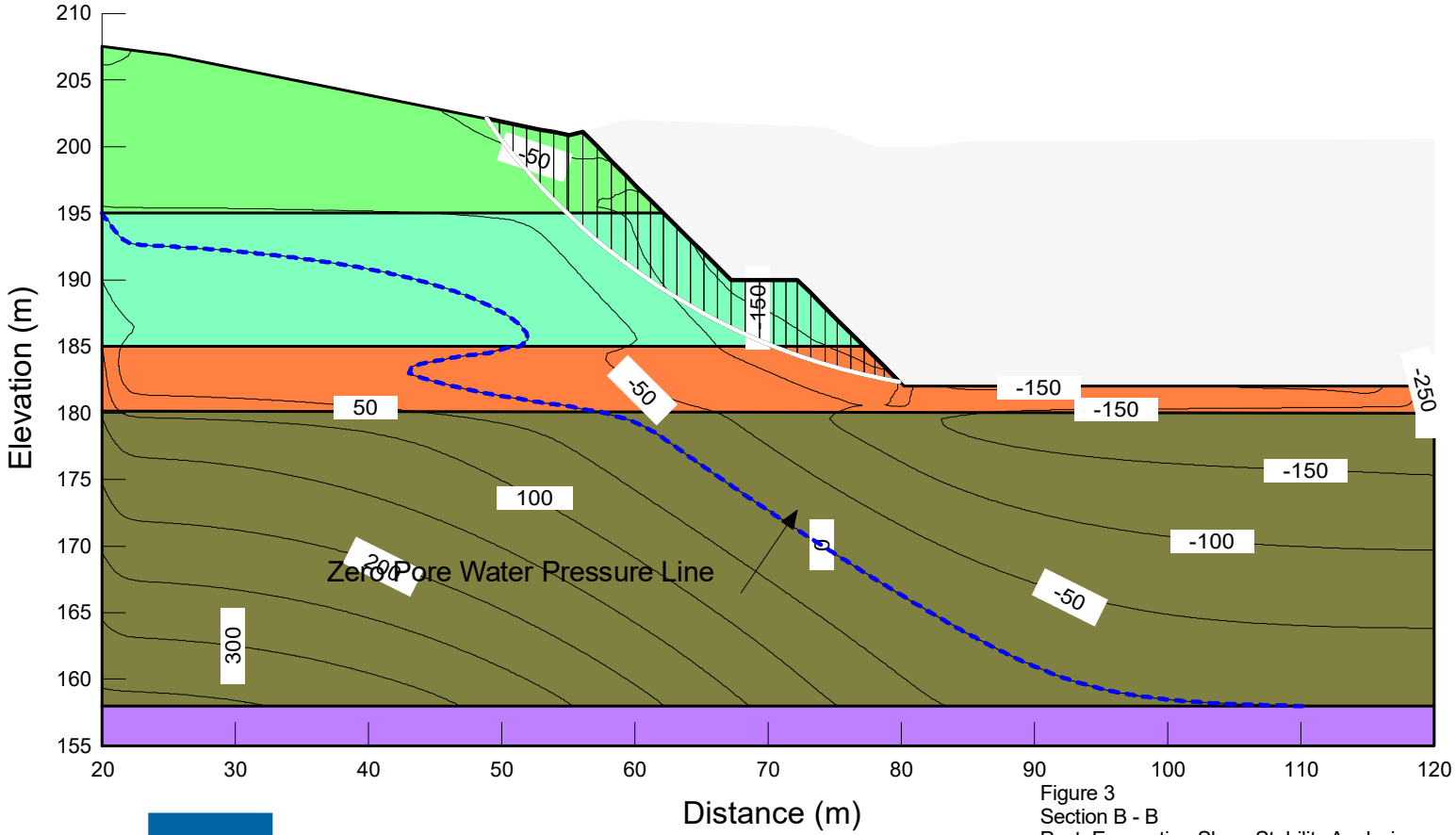


Figure 3
Section B - B
Post_Excavation Slope Stability Analysis
Cell 20-1 Side Slopes
044985

Clean Harbors Canada Inc.

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Bedrock			
	Black Shale Till, Sub-unit 2A	20	24	21
	Black Shale Till, Sub-unit 2B	18.2	24	21
	St. Joseph Till, Sub-unit 1A	21.5	24	25
	St. Joseph Till, Sub-unit 1B	21	27	26

UPPER BOUND

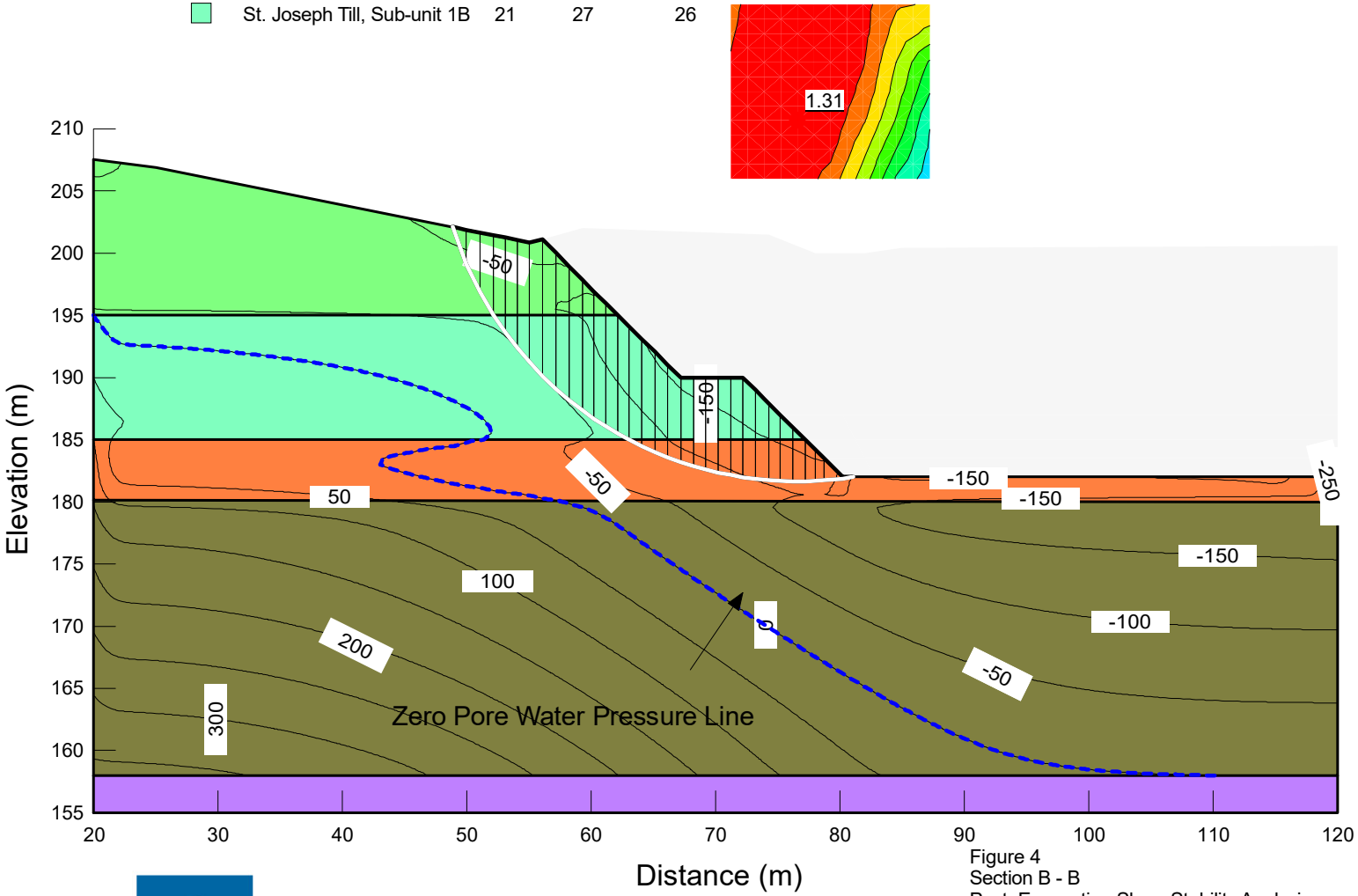
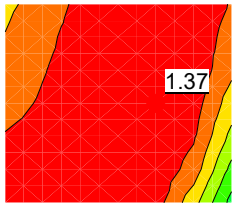


Figure 4
Section B - B
Post_Excavation Slope Stability Analysis
Cell 20-1 Side Slopes
044985

Clean Harbors Canada Inc.

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Bedrock			
	Black Shale Till, Sub-unit 2A	20	13	26
	Black Shale Till, Sub-unit 2B	18.2	13	26
	St. Joseph Till, Sub-unit 1A	21.5	24	25
	St. Joseph Till, Sub-unit 1B	21	15	28

LOWER BOUND



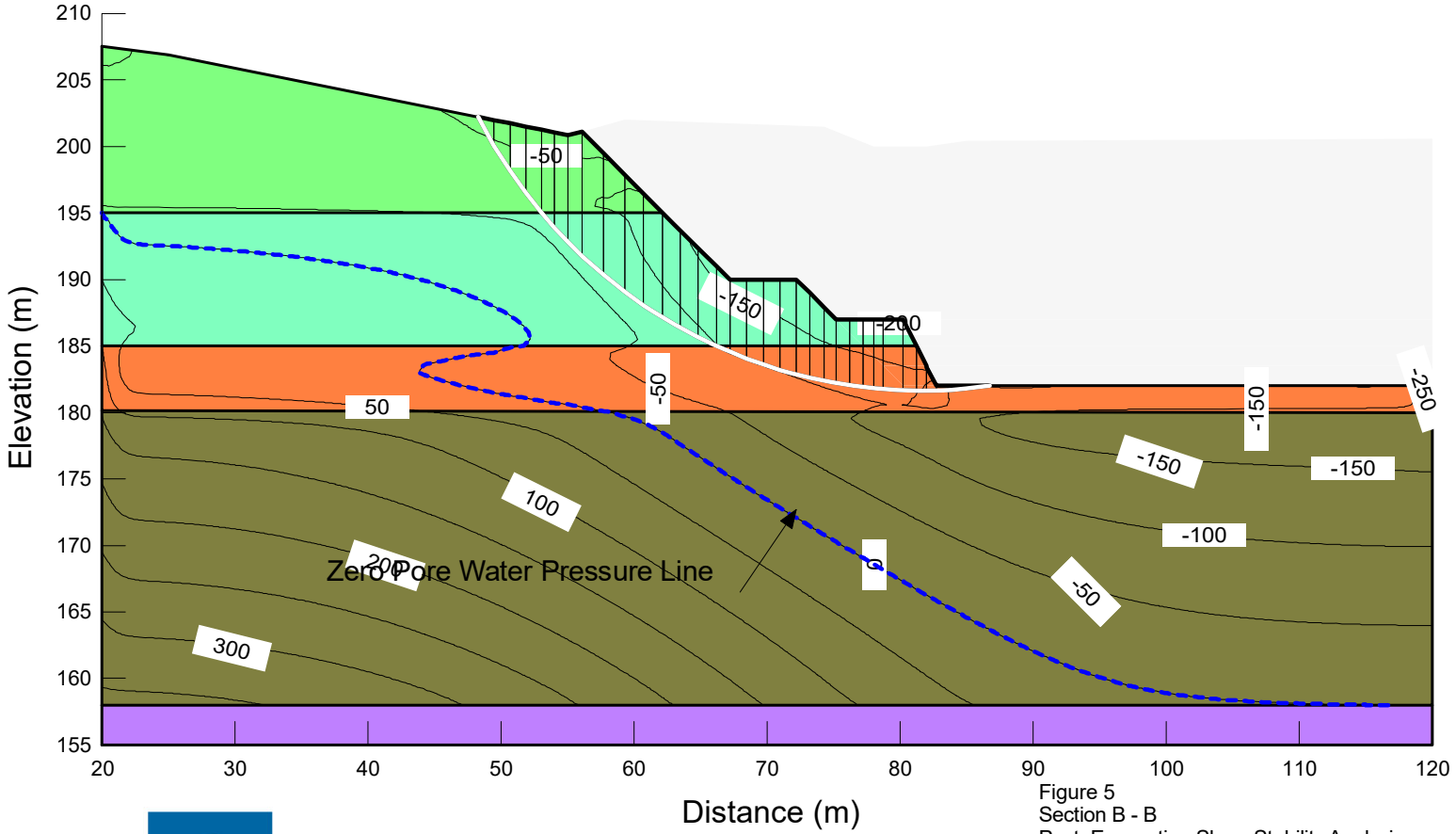
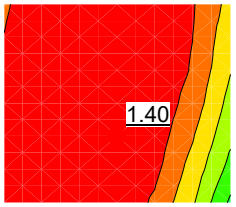


Figure 5
Section B - B
Post_Excavation Slope Stability Analysis
Cell 20-1 Side Slopes
044985

Clean Harbors Canada Inc.

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Bedrock			
	Black Shale Till, Sub-unit 2A	20	24	21
	Black Shale Till, Sub-unit 2B	18.2	24	21
	St. Joseph Till, Sub-unit 1A	21.5	24	25
	St. Joseph Till, Sub-unit 1B	21	27	26

UPPER BOUND



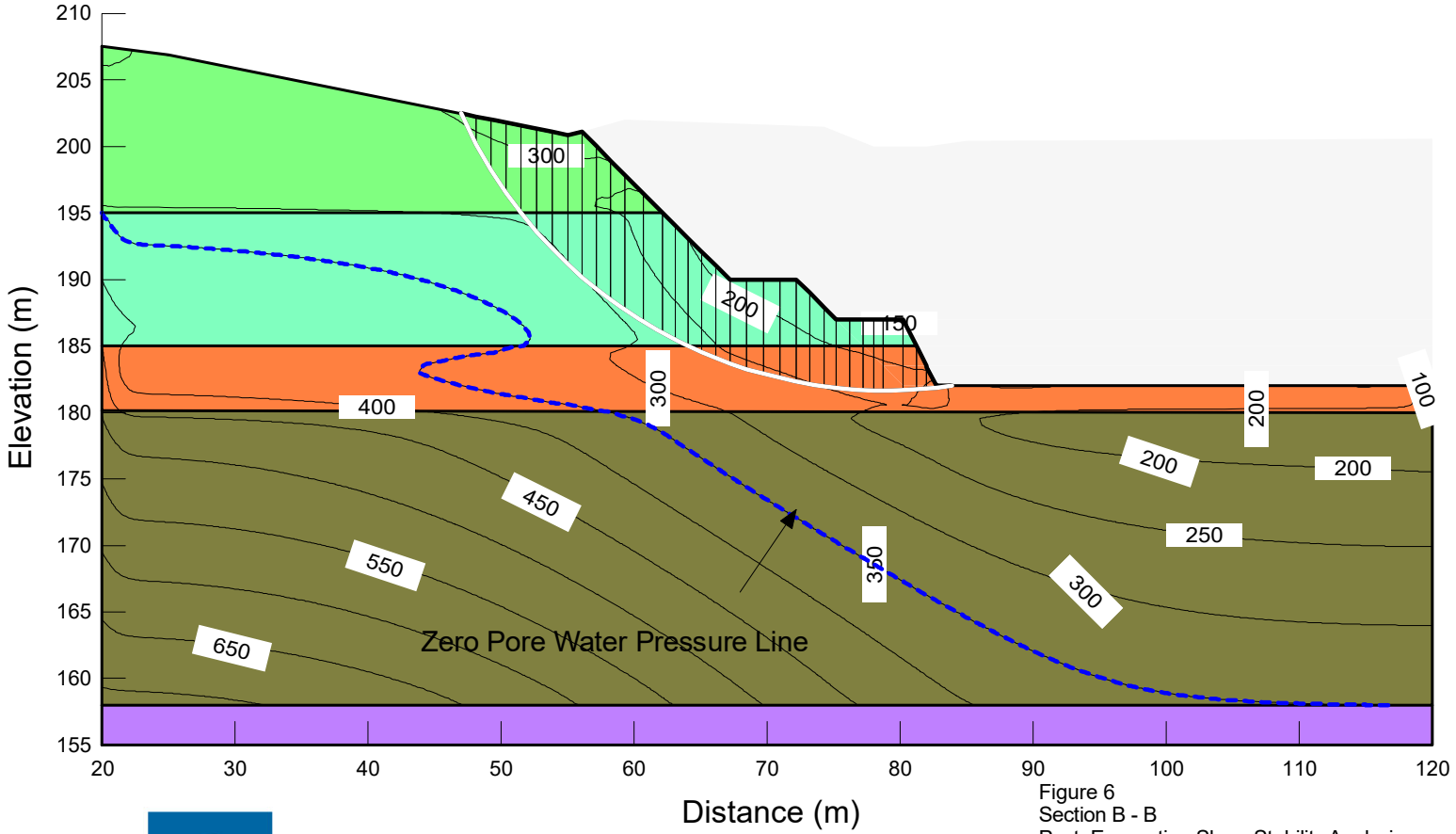


Figure 6
Section B - B
Post_Excavation Slope Stability Analysis
Cell 20-1 Side Slopes
044985

Clean Harbors Canada Inc.

TABLE 3.1

SUMMARY OF GEOTECHNICAL LABORATORY TEST RESULTS
CELL 20-1 GEOTECHNICAL INVESTIGATION
CLEAN HARBORS LAMBTON FACILITY, CORUNNA, ON

Sample Number	Sample Location	Sample Date	Sample Type	Material Description	Sample Depth (metres below grade)	Laboratory Sample No.	Particle Size Distribution (%)					As Received Moisture Content (%)	Atterberg Limits (%)			Unconfined Strength	Bulk Unit Weight	CU Compression Test	
							Gravel	Sand	Silt	Passing No. 200 Sieve	Clay (< 0.002 mm)		Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Shear Strength (kPa)	(kN/m^3)	Effective Strength (kPa)	Effective Angle of Internal Friction (degree)
1	BH1-20, ST-1	5-Oct-20	Shelby Tube	Silt and Clay, trace sand, trace gravel	13.0 m - 13.6 m	WLT 453-1	1	6	57	93	36	19	32	17	15	143.9	20.1		
2	BH1-20, ST-2	5-Oct-20	Shelby Tube	Clay and Silt, trace sand, trace gravel	22.9 m - 23.5 m	WLT 453-2	1	7	43	92	49	24	41	21	20	32.6	20.0	22	25
3	BH2-20, ST-1	8-Oct-20	Shelby Tube	Silt and Clay, some sand, trace gravel	10.7 m - 11.3 m	WLT 453-3	1	17	46	82	36	19	30	15	15	63.5	21.0	27	26
4	BH2-20, ST-2	8-Oct-20	Shelby Tube	Clayey Silt	21.3 m - 21.9 m	WLT 453-4										64.3	18.1		
5	BH3-20, ST-1	7-Oct-20	Shelby Tube	Clayey Silt	10.7 m - 11.3 m	WLT 453-5										105.0	21.0		
6	BH3-20, ST-2	7-Oct-20	Shelby Tube	Clay and Silt, trace sand, trace gravel	21.3 m - 21.9 m	WLT 453-6	2	7	42	91	49	25	41	21	20	42.9	19.9		
7	BH4-20, ST-1	6-Oct-20	Shelby Tube	Clayey Silt	10.7 m - 11.3 m	WLT 453-7										104.6	21.1		
8	BH4-20, ST-2	6-Oct-20	Shelby Tube	Clay and Silt, trace sand, trace gravel	21.3 m - 21.9 m	WLT 453-8	1	8	44	91	47	27	41	20	21	26.2	20.0	24	21

Notes:
(1) NP denotes Non Plastic

TABLE 4.1

SUMMARY OF PARAMETERS AND SLOPE STABILITY ANALYSES RESULTS
CELL 20-1
CLEAN HARBORS LAMBTON FACILITY
CORUNNA, ONTARIO

Material Properties for Slope Stability Analyses

Unit	Unit Weight (kN/m^3)			Cohesion (kPa)				Friction Angle (degrees)			
	Previous Studies	2020 Geotechnical Lab Result	2021 Model Input	Previous Studies	2020 Geotechnical Lab Result	2021 Model Input- Lower Bound	2021 Model Input- Upper Bound	Previous Studies	2020 Geotechnical Lab Result	2021 Model Input- Lower Bound	2021 Model Input- Upper Bound
St. Joseph Till- Unit 1A- Elevation 201 to 194 m	21.5		21.5	24		24	24	25		25	25
St. Joseph Till- Unit 1B- Elevation 194 to 185 m	21.0	20.8	21.0	15	27	15	27	28	26	28	26
Black Shale Till- Unit 1A- Elevation 185 to 180 m	20.5	19.5	20.0	13	22 to 24	13	24	26	21 to 25	26	21
Black Shale Till- Unit 1B- Elevation 180 m and below	18.2	19.5	18.2	13	22 to 24	13	24	26	21 to 25	26	21

Slope Stability Analyses Results

Slope Condition Analyzed	Slope Stability Factor of Safety (FS)	Reference Figure	Comments
Cross-Section B-B'- Lower Bound Strength Parameters, Bench at 192 m	1.27	Figure 3	Marginally Stable
Cross-Section B-B'- Upper Bound Strength Parameters, Bench at 192 m	1.31	Figure 4	Marginally Stable
Cross-Section B-B'- Lower Bound Strength Parameters, Bench at 192 m and Optional Lower Bench at 186 m	1.37	Figure 5	Stable
Cross-Section B-B'- Upper Bound Strength Parameters, Bench at 192 m and Optional Lower Bench at 186 m	1.40	Figure 6	Stable

Appendices

Appendix A
Borehole Logs

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-1

BOREHOLE No.: BH1-20
ELEVATION: 201.56 m

BOREHOLE REPORT

Page: 1 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 5 October 2020 DATE (FINISH): 5 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
0		201.56		GROUND SURFACE						
0 to 0.9	0 to 0.9	201.56 to 200.66		FILL: CLAYEY SILT - brown, trace sand, trace gravel, inclusion of topsoil, roots, moist-wet to moist		SS-1	75	31	3-3-3-3	6
0.9 to 1.4	0.9 to 1.0	200.66 to 200.16		NATIVE: CLAYEY SILT - grey/brown mottled, stiff, trace sand, trace gravel, moist		SS-2	96	17	3-5-7-9	12
1.4 to 2.9	1.4 to 2.0	200.16 to 198.66		becoming brown		SS-3	83	16	4-6-8-10	14
						SS-4	96	15	4-7-8-11	15
2.9 to 3.7	2.9 to 3.0	198.66 to 197.86		becoming greyish brown, very stiff		SS-5	92	15	7-8-12-15	20
3.7 to 4.5	3.7 to 4.0	197.86 to 197.06		becoming stiff		SS-6	100	18	3-5-4-9	9
4.5 to 5.2	4.5 to 5.0	197.06 to 196.36		becoming grey, some sand		SS-7	100	16	3-4-5-7	9
5.2 to 6.0	5.2 to 6.0	196.36 to 195.56		mud rotary drilling with 100 mm diameter casing some gravel becoming grey		SS-8	33	15	3-5-6-6	11
						SS-9	75	18	2-4-6-7	10
6.0 to 7.3	6.0 to 7.0	195.56 to 194.26		becoming sandy to some sand		SS-10	100	14	3-4-5-6	9
7.3 to 8.8	7.3 to 8.0	194.26 to 192.76		trace sand, occasional gravel, moist-wet		SS-11	100	19	3-4-6-7	10
8.8 to 10.5	8.8 to 10.0	192.76 to 191.06		some gravel						
10.5 to 10.7	10.5 to 10.7	191.06 to 190.86		Attempted Shelby tube sampling at 10.7		GS-1	--	19	--	--

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

220 195 195 225 122

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-1

BOREHOLE No.: BH1-20
ELEVATION: 201.56 m

BOREHOLE REPORT

Page: 2 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 5 October 2020 DATE (FINISH): 5 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS 201.56	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
	11.4	190.16		m bgs, with zero recovery. Grabbed split spoon sample at 10.7 m bgs without SPT count						
	11.9	189.66		Attempted Shelby tube sampling at 11.4 m bgs, with zero recovery						
	12.0			trace gravel		SS-12	100	20	3-4-7-8	11
	13.0	188.56		Shelby tube sample at 12.96 m bgs **Grainsize Analysis:** Gr =1%, Sa =6%, Cl & Si =93%		ST-1	100	20	--	--
	13.6	187.96		becoming very stiff						
	14.0					SS-13	100	21	5-8-11-15	19
	15.0					SS-14	100	23	5-8-12-15	20
	16.0									
	16.5	185.06		occasional gravel		SS-15	58	23	4-8-10-14	18
	17.0									
	17.8	183.76		becoming stiff						
	18.0					SS-16	100	25	3-7-8-10	15
	19.0									
	19.5	182.06		becoming firm						
	20.0					SS-17	100	26	1-2-4-5	6
	21.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

152 122 137

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-1

BOREHOLE No.: BH1-20
ELEVATION: 201.56 m

BOREHOLE REPORT

Page: 3 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 5 October 2020 DATE (FINISH): 5 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
		201.56								
75	22.9	178.69		Shelby tube sample at 22.87 m bgs **Grainsize Analysis:** Gr =1%, Sa =7%, Cl & Si =92%		ST-2	96	24	--	--
78	23.8	177.76		becoming moist-wet						
81						SS-18	100	27	3-3-4-6	7
82	25.0	176.56		END OF BOREHOLE AT 25.0 m bgs Borehole drilled using 70 mm inside diameter hollow stem augers up to 4.5 m bgs. Mud rotary drilling using 100 mm diameter casing below 4.5 m bgs. Borehole dry to 4.5 m bgs prior to switching to mud rotary drilling. Borehole backfilled with cement-bentonite grout to drilled depth, using tremie pipe. Surface sealed with hydrated bentonite pellets. m bgs - refers to meters below ground surface Gr =gravel; Sa =sand; Cl & Si =clay & silt						

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-2

BOREHOLE No.: BH2-20
ELEVATION: 201.59 m

BOREHOLE REPORT

Page: 1 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 8 October 2020 DATE (FINISH): 8 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
0		201.59		GROUND SURFACE						
0				FILL: CLAYEY SILT - brown, some sand, trace gravel, moist		SS-1	12	11	3-6-6-5	12
3	1.0					SS-2	63	15	3-3-4-5	7
6	2.0					SS-3	54	18	4-4-6-11	10
7	2.2	199.39		NATIVE: CLAYEY SILT - grey/brown mottled, stiff, some sand, trace gravel, moist		SS-4	79	17	3-4-7-11	11
9	2.9	198.69		becoming rust-stained, to greyish brown, very stiff		SS-5	100	16	6-10-12-12	22
10	3.0									
12	3.7	197.89		becoming stiff		SS-6	100	15	4-6-8-12	14
13	4.0									
15	4.5	197.09		trace sand		SS-7	95	16	3-5-7-7	12
16	5.0									
17	5.2	196.39		mud rotary drilling with 100 mm diameter casing		SS-8	100	16	3-4-5-7	9
19	6.0									
20	6.1	195.49		becoming firm		SS-9	100	19	2-3-5-5	8
23	7.0									
26	8.0					SS-10	75	20	3-3-4-5	7
29	8.8	192.79		becoming grey						
30	9.0					SS-11	83	19	W-3-3-4	6
33	10.0									
35	10.7	190.92		Shelby tube sample at 10.67 m bgs						

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

159 159 147 220 171 △

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-2

BOREHOLE No.: BH2-20
ELEVATION: 201.59 m

BOREHOLE REPORT

Page: 2 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 8 October 2020 DATE (FINISH): 8 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
		201.59								
37				**Grainsize Analysis:** Gr =1%, Sa =17%, Cl & Si =82%		ST-1	92	15	--	--
38										
39	12.0									
40										
41						SS-12	96	23	1-3-5-5	8
42										
43	13.0									
44										
45										
46	14.0					SS-13	100	21	3-3-4-6	7
47										
48										
49	14.9	186.69								
50	15.0			becoming stiff, occasional gravel						
51						SS-14	100	22	4-5-8-10	13
52										
53	16.0									
54										
55										
56	17.0					SS-15	83	25	4-4-5-6	9
57										
58										
59	18.0									
60										
61						SS-16	100	24	3-4-6-7	10
62										
63	19.0									
64										
65										
66	20.0					SS-17	--	26	3-4-5-6	9
67										
68										
69	21.0									
70	21.3	180.25		Shelby tube sample at 21.34 m bgs						
71						ST-2	100	--	--	--

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-2

BOREHOLE No.: BH2-20
ELEVATION: 201.59 m

BOREHOLE REPORT

Page: 3 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 8 October 2020 DATE (FINISH): 8 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
		201.59								
	23.0					SS-18	--	27	2-4-6-8	10
	24.0									
	24.2	177.39		becoming firm						
						SS-19	--	27	4-3-5-6	8
	25.0	176.59		END OF BOREHOLE AT 25.0 m bgs						
	26.0									
	27.0									
	28.0									
	29.0									
	30.0									
	31.0									
	32.0									

Borehole drilled using 70 mm inside diameter hollow stem augers up to 4.5 m bgs. Mud rotary drilling using 100 mm diameter casing below 4.5 m bgs. Borehole dry to 4.5 m bgs prior to switching to mud rotary drilling.

Borehole backfilled with cement-bentonite grout to drilled depth, using tremie pipe. Surface sealed with hydrated bentonite pellets.

W - refers to sampler penetration under self weight
m bgs - refers to meters below ground surface
Gr =gravel; Sa =sand; Cl & Si =clay & silt

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-3

BOREHOLE No.: BH3-20
ELEVATION: 201.02 m

BOREHOLE REPORT

Page: 1 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 7 October 2020 DATE (FINISH): 7 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
		201.02		GROUND SURFACE						
0	0.1	200.92		FILL: CLAYEY SILT - dark brown, trace sand, trace gravel, inclusion of topsoil, moist		SS-1	33	16	2-1-2-7	3
1	0.7	200.32		NATIVE: CLAYEY SILT - grey/brown mottled, soft, some sand, trace gravel, moist		SS-2	79	16	6-8-9-12	17
2	1.0			becoming very stiff						
3	1.4	199.62		becoming brown, rust-stained		SS-3	88	15	5-7-10-14	17
4	2.0					SS-4	--	16	5-8-12-12	20
5	3.0									
6	3.1	197.92		becoming grey, stiff, trace sand		SS-5	100	15	3-5-6-8	11
7	4.0					SS-6	100	17	3-4-6-9	10
8	5.0					SS-7	100	14	3-4-6-8	10
9	5.2	195.82		mud rotary drilling with 100 mm diameter casing						
10	6.0	195.02		becoming very stiff		SS-8	100	17	6-9-9-11	18
11	7.0			becoming stiff		SS-9	100	18	3-4-7-8	11
12	7.3	193.72		reddish brown moist sand seems						
13	8.0					SS-10	100	10	2-4-6-8	10
14	8.8	192.22		becoming firm, occasional gravel						
15	9.0					SS-11	100	20	3-3-5-8	8
16	10.0									
17	10.7	190.35		Shelby tube sample at 10.67 m bgs						

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

175 208 220 220 137 122

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-3

BOREHOLE No.: BH3-20
ELEVATION: 201.02 m

BOREHOLE REPORT

Page: 2 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 7 October 2020 DATE (FINISH): 7 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
		201.02				ST-1	100	--	--	--
	11.8	189.22		becoming stiff						
	12.0					SS-12	75	21	3-5-8-12	13
	13.0									
	14.0					SS-13	--	21	3-5-8-11	13
	15.0					SS-14	88	22	3-5-8-11	13
	16.0									
	17.0					SS-15	75	26	3-5-8-9	13
	18.0					SS-16	58	26	3-4-6-6	10
	19.0									
	19.5	181.52		becoming firm, trace sand, trace gravel						
	20.0					SS-17	100	27	W-2-3-4	5
	21.0									
	21.3	179.68		Shelby tube sample at 21.34 m bgs **Grainsize Analysis:** Gr =2%, Sa =7%, Cl & Si =91%		ST-2	100	21	--	--

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-3

BOREHOLE No.: BH3-20
ELEVATION: 201.02 m

BOREHOLE REPORT

Page: 3 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 7 October 2020 DATE (FINISH): 7 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- ▼ - WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
		201.02								
	22.5	178.52		becoming moist-wet						
	23.0					SS-18	46	28	1-3-5-7	8
	24.0					SS-19	100	28	1-3-5-6	8
	25.0	176.02		END OF BOREHOLE AT 25.0 m bgs						
	26.0			Borehole drilled using 70 mm inside diameter hollow stem augers up to 4.5 m bgs. Mud rotary drilling using 100 mm diameter casing below 4.5 m bgs. Borehole dry to 4.5 m bgs prior to switching to mud rotary drilling.						
	27.0			Borehole backfilled with cement-bentonite grout to drilled depth, using tremie pipe. Surface sealed with hydrated bentonite pellets.						
	28.0			W - refers to sampler penetration under self weight m bgs - refers to meters below ground surface Gr =gravel; Sa =sand; Cl & Si =clay & silt						
	29.0									
	30.0									
	31.0									
	32.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-4

BOREHOLE No.: BH4-20
ELEVATION: 200.61 m

BOREHOLE REPORT

Page: 1 of 3

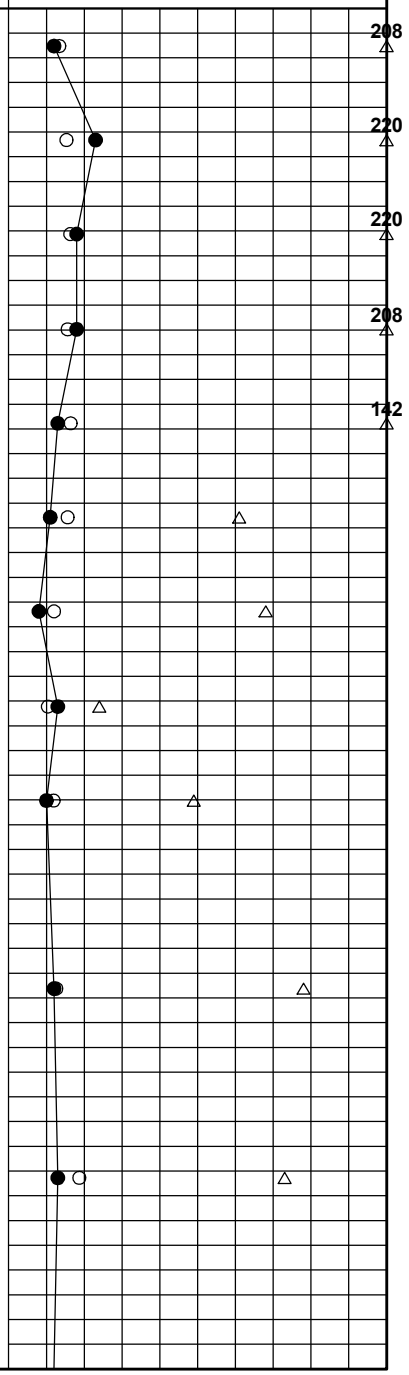
CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 6 October 2020 DATE (FINISH): 6 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
		200.61		GROUND SURFACE						
0	0.1	200.51		FILL: CLAYEY SILT - dark brown, some sand, some gravel, trace topsoil, moist		SS-1	63	13	5-5-7-9	12
1										
2	0.7	199.91		NATIVE: CLAYEY SILT - grey/brown mottled, stiff, trace sand, trace gravel, moist						
3	1.0			becoming brown, very stiff		SS-2	67	15	11-11-12-12	23
4	1.4	199.21		becoming brown						
5										
6						SS-3	100	16	5-7-11-13	18
7	2.0									
8	2.2	198.41		rust-stained, some sand		SS-4	100	16	5-8-10-14	18
9										
10	3.0	197.61		becoming stiff, embedded brown moist sand seams		SS-5	100	16	4-6-7-11	13
11										
12	3.7	196.91		becoming grey						
13	4.0					SS-6	100	16	4-5-6-7	11
14										
15	4.5	196.11		becoming firm						
16						SS-7	100	12	3-4-4-5	8
17	5.0									
18	5.2	195.41		mud rotary drilling with 100 mm diameter casing becoming grey-brown, stiff		SS-8	100	10	5-6-7-8	13
19										
20	6.0	194.61		becoming grey, some sand						
21						SS-9	100	12	3-4-6-8	10
22										
23	7.0									
24	7.3	193.31		trace sand						
25										
26	8.0					SS-10	100	13	3-5-7-9	12
27										
28										
29										
30	9.0									
31						SS-11	100	19	3-5-8-10	13
32										
33	10.0									
34										
35	10.7	189.94		Shelby tube sample at 10.67 m bgs						

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)



SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-4

BOREHOLE No.: BH4-20
ELEVATION: 200.61 m

BOREHOLE REPORT

Page: 2 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 6 October 2020 DATE (FINISH): 6 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet / Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
	200.61				ST-1	100	--	--	--
12.0					SS-12	100	21	3-4-7-10	11
13.0									
14.0					SS-13	100	23	4-6-10-12	16
15.0									
16.0					SS-14	75	18	4-5-8-10	13
17.0					SS-15	88	26	3-4-7-10	11
17.8	182.81		becoming firm, moist-wet						
18.0					SS-16	100	22	2-3-4-5	7
19.0									
20.0					SS-17	--	25	1-2-4-5	6
21.0									
21.3	179.27		Shelby tube sample at 21.34 m bgs **Grainsize Analysis:** Gr =1%, Sa =8%, Cl & Si =91%		ST-2	100	27	--	--

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

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SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

REFERENCE No.: 044985-50-04 ENCLOSURE No.: A-4

BOREHOLE No.: BH4-20
ELEVATION: 200.61 m

BOREHOLE REPORT

Page: 3 of 3

CLIENT: Clean Harbors - Lambton Facility
PROJECT: Geotechnical Investigation - Cell 20-1
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON
DESCRIBED BY: Ahmed Mneina CHECKED BY: Abdul Hafeez Khan
DATE (START): 6 October 2020 DATE (FINISH): 6 October 2020

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- GS - GRAB SAMPLE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm or RQD	Penetration Index N
		200.61								
	22.5	178.11		becoming soft, wet						
	23.0					SS-18	--	30	1-2-1-W	3
	23.8	176.81		becoming firm, moist-wet						
	24.0					SS-19	--	26	1-2-3-5	5
	25.0	175.61		END OF BOREHOLE AT 25.0 m bgs						

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

Borehole drilled using 70 mm inside diameter hollow stem augers up to 4.5 m bgs. Mud rotary drilling using 100 mm diameter casing below 4.5 m bgs. Borehole dry to 4.5 m bgs prior to switching to mud rotary drilling.

Borehole backfilled with cement-bentonite grout to drilled depth, using tremie pipe. Surface sealed with hydrated bentonite pellets.

W - refers to sampler penetration under self weight
m bgs - refers to meters below ground surface
Gr =gravel; Sa =sand; Cl & Si =clay & silt

SOIL LOG WITH GRAPH 044985-50-04 - BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 12/1/21

Notes on Borehole and Test Pit Reports

Soil description :

Each subsurface stratum is described using the following terminology. The relative density of granular soils is determined by the Standard Penetration Index ("N" value), while the consistency of clayey sols is measured by the value of undrained shear strength (Cu).

Classification (Unified system)

Clay	< 0.002 mm		
Silt	0.002 to 0.075 mm		
Sand	0.075 to 4.75 mm	fine	0.075 to 0.425 mm
		medium	0.425 to 2.0 mm
		coarse	2.0 to 4.75 mm
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm
		coarse	19 to 75 mm
Cobbles	75 to 300 mm		
Boulders	>300 mm		

Terminology

"trace"	1-10%
"some"	10-20%
adjective (silty, sandy)	20-35%
"and"	35-50%

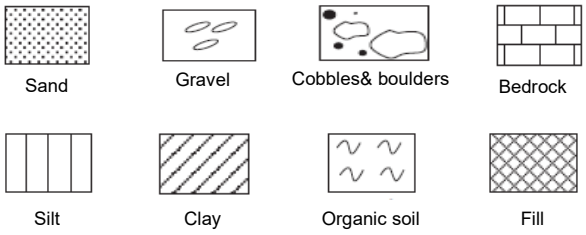
Relative density of granular soils	Standard penetration index "N" value (BLOWS/ft – 300 mm)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Consistency of cohesive soils	Undrained shear strength (Cu) (P.S.F)	(kPa)
Very soft	<250	<12
Soft	250-500	12-25
Firm	500-1000	25-50
Stiff	1000-2000	50-100
Very stiff	2000-4000	100-200
Hard	>4000	>200

Rock quality designation

"RQD" (%) Value	Quality
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

STRATIGRAPHIC LEGEND



Samples:

Type and Number

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
ST: Shelby tube
AG: Auger
SSE, GSE, AGE: Environmental sampling
PS: Piston sample (Osterberg)
RC: Rock core
GS: Grab sample

Recovery

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil

RQD

The "Rock Quality Designation" or "RQD" value, expressed as percentage, is the ratio of the total length of all core fragments of 4 inches (10 cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration
N_c: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressure meter
k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

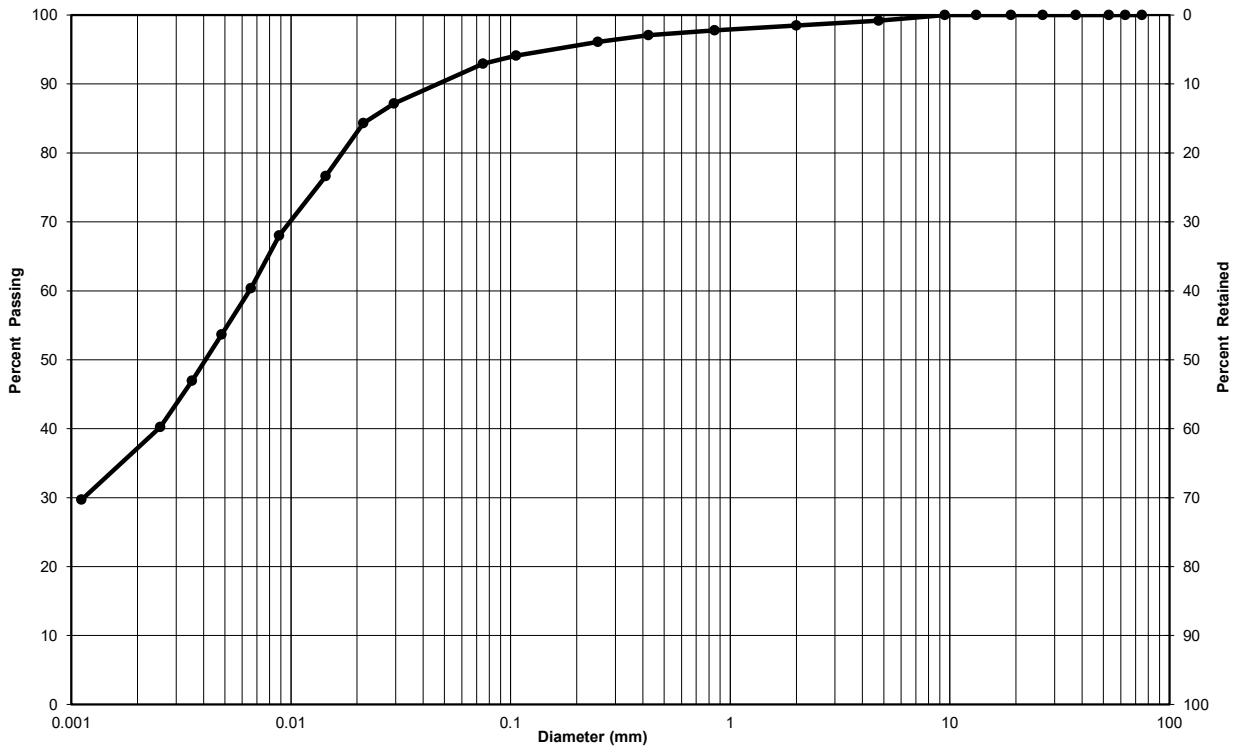
I_p: Plasticity index
W_l: Liquid limit
Wp: Plastic limit
H: Hydrometer analysis
GSA: Grain size analysis
A: Atterberg limits
w: Water content
γ: Unit weight
C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis
O.V.: Organic vapor

Appendix B
Geotechnical Laboratory Test Results

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Clean Harbors - Lambton Facility	**Lab No.:**	WLT 453-1
Project, Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project No.:**	044985-50-04

Borehole No.:	BH1-20	Sample No.:	ST-1
Depth:	42.5 ft. - 44.5 ft. (13.0 m - 13.6 m)	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt and Clay, trace sand, trace gravel	1	6	93
Clay-size particles (<0.002 mm):			36 %

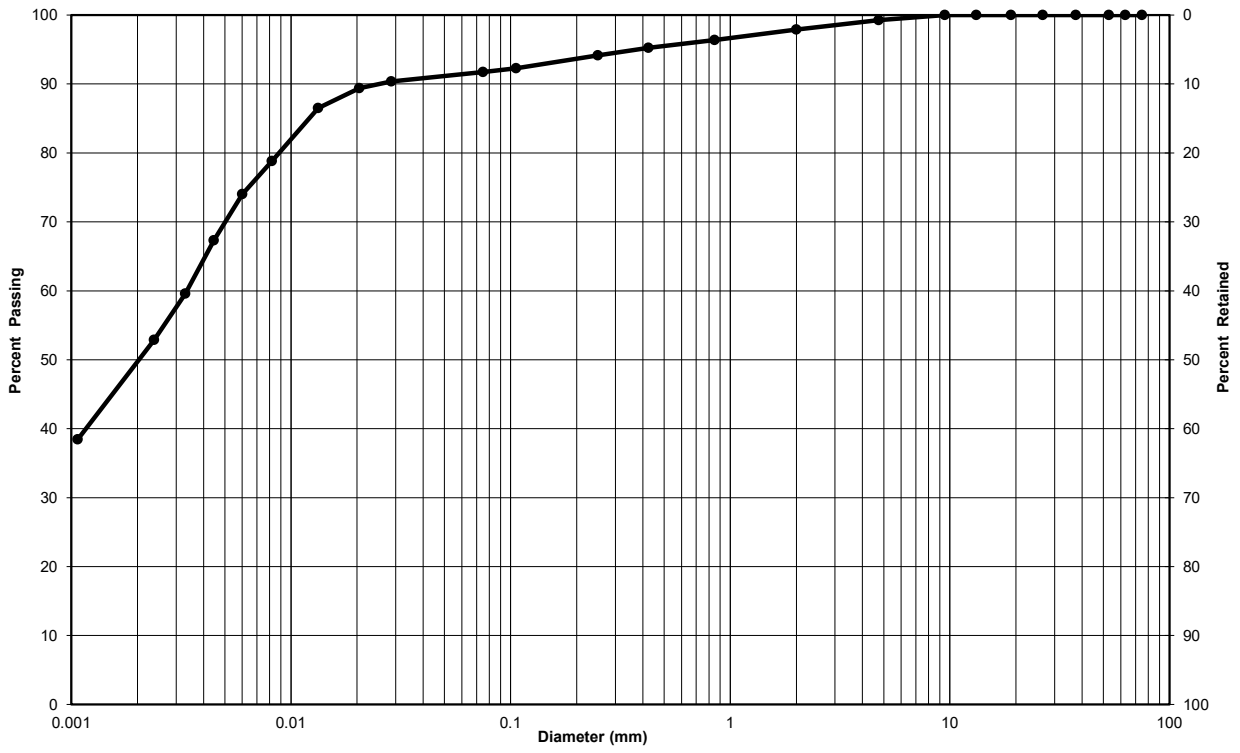
Remarks:

Performed by:	Melanie Mitchell / Matt Flood	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Clean Harbors - Lambton Facility	**Lab No.:**	WLT 453-2
Project, Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project No.:**	044985-50-04

Borehole No.:	BH1-20	Sample No.:	ST-2
Depth:	75.0 ft. - 77.0 ft. (22.9 m - 23.5 m)	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Clay and Silt, trace sand, trace gravel	1	7	92
Clay-size particles (<0.002 mm):			49 %

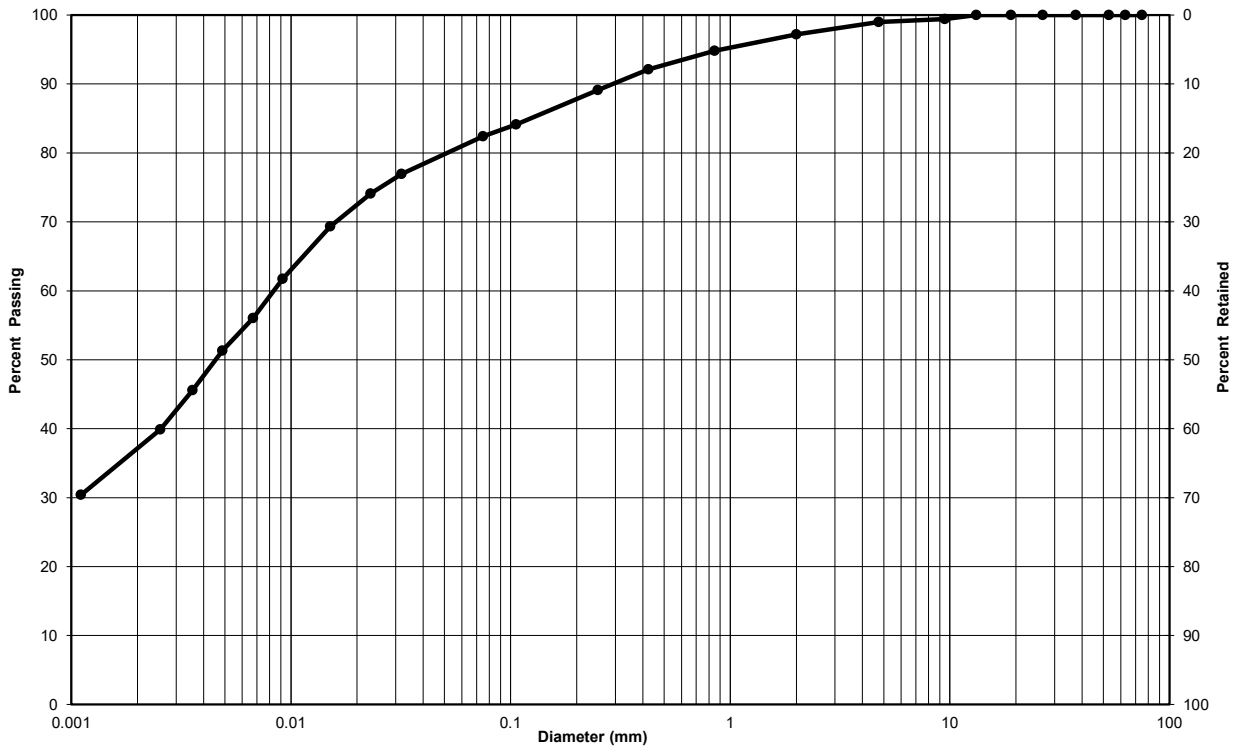
Remarks:

Performed by:	Melanie Mitchell / Matt Flood	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Clean Harbors - Lambton Facility	**Lab No.:**	WLT 453-3
Project, Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project No.:**	044985-50-04

Borehole No.:	BH2-20	Sample No.:	ST-1
Depth:	35.0 ft. - 37.0 ft. (10.7 m - 11.3 m)	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt and Clay, some sand, trace gravel	1	17	82
Clay-size particles (<0.002 mm):			36 %

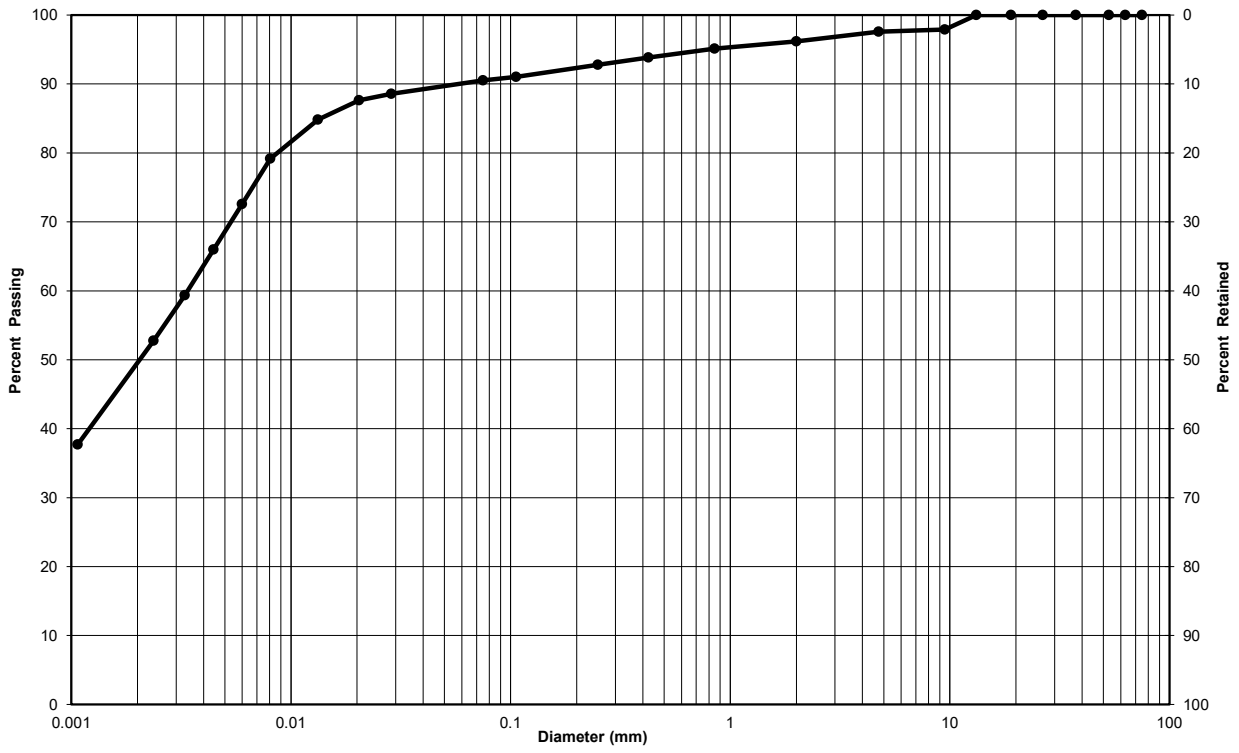
Remarks:

Performed by:	Melanie Mitchell / Matt Flood	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Clean Harbors - Lambton Facility	**Lab No.:**	WLT 453-6
Project, Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project No.:**	044985-50-04

Borehole No.:	BH3-20	Sample No.:	ST-2
Depth:	70.0 ft. - 72.0 ft. (21.3 m - 21.9 m)	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Clay and Silt, trace sand, trace gravel	2	7	91
Clay-size particles (<0.002 mm):			49 %

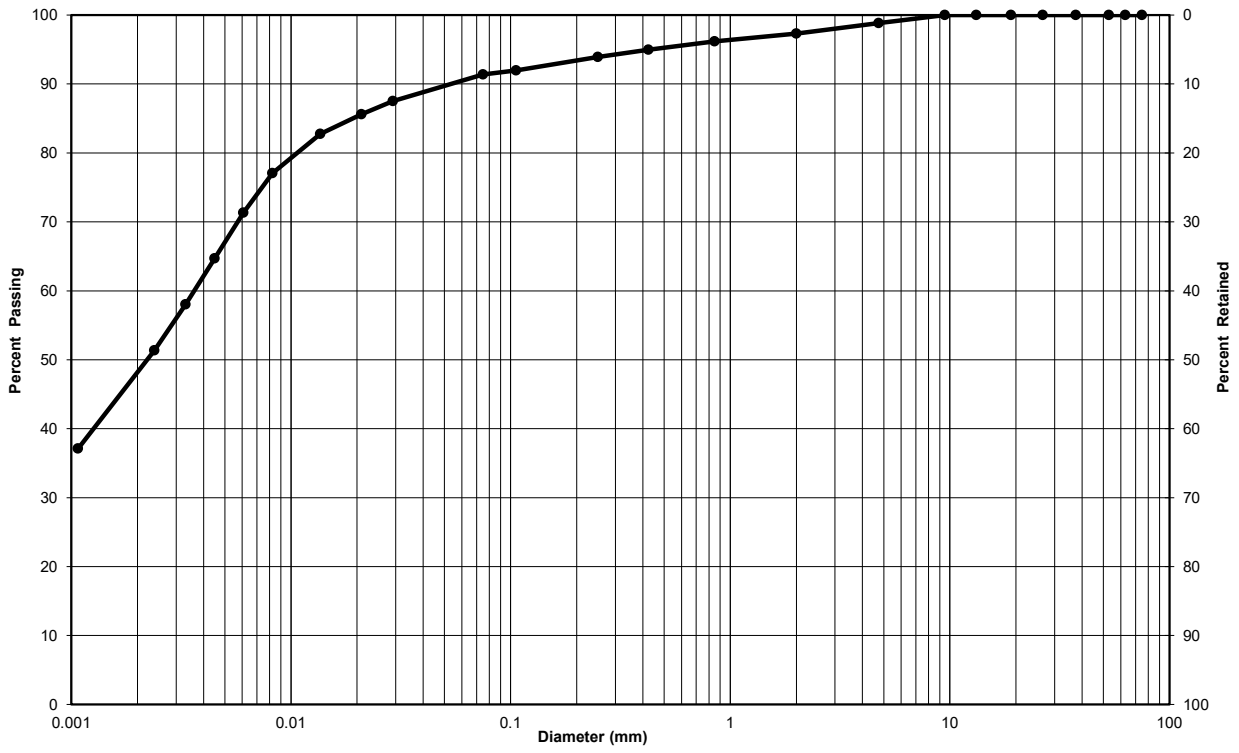
Remarks:

Performed by:	Melanie Mitchell / Matt Flood	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Clean Harbors - Lambton Facility	**Lab No.:**	WLT 453-8
Project, Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project No.:**	044985-50-04

Borehole No.:	BH4-20	Sample No.:	ST-2
Depth:	70.0 ft. - 72.0 ft. (21.3 m - 21.9 m)	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Clay and Silt, trace sand, trace gravel	1	8	91
Clay-size particles (<0.002 mm):			47 %

Remarks:

Performed by:	Melanie Mitchell / Matt Flood	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Clean Harbors - Lambton Facility	**Lab no.:**	WLT 453-1
Project/Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project no.:**	044985-50-04
Borehole no.:	BH1-20	Sample no.:	ST-1
Depth:	42.5 ft. - 44.5 ft. (13.0 m - 13.6 m)		
Soil description:	Silt and Clay, trace sand, trace gravel	Date sampled:	October 5, 2020
Apparatus:	Hand Crank	Balance no.:	WLG-15
Porcelain bowl no.:	Br-12		
Liquid limit device no.:	WLSA-3B	Oven no.:	WLG-2
Spatula no.:	2		
Sieve no.:	WLS-47	Glass plate no.:	1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	35	22	16
Water Content:			
Tare no.	11	12	23
Wet soil+tare, g	32.04	30.86	31.93
Dry soil+tare, g	30.54	29.10	30.20
Mass of water, g	1.50	1.76	1.73
Tare, g	25.53	23.62	24.98
Mass of soil, g	5.01	5.48	5.22
Water content %	29.9%	32.1%	33.1%

Plastic Limit (PL) - Water Content:

Tare no.	123	135
Wet soil+tare, g	20.45	15.35
Dry soil+tare, g	19.45	14.15
Mass of water, g	1.00	1.20
Tare, g	13.65	7.17
Mass of soil, g	5.80	6.98
Water content %	17.2%	17.2%
Average water content %	17.2%	

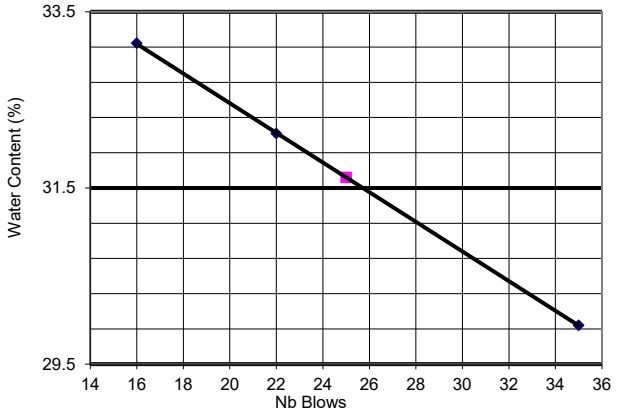
Natural Water Content (W^n):

Tare no.	99	
Wet soil+tare, g	64.40	
Dry soil+tare, g	54.60	
Mass of water, g	9.80	
Tare, g	4.30	
Mass of soil, g	50.30	
Water content %	19.5%	

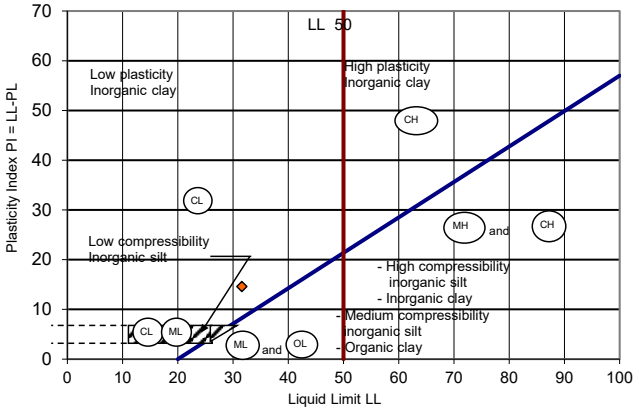
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
32	17	15	19

Remarks:

Performed by:	Melanie Mitchell	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Clean Harbors - Lambton Facility	**Lab no.:**	WLT 453-2
Project/Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project no.:**	044985-50-04
Borehole no.:	BH1-20	Sample no.:	ST-2
Depth:	75.0 ft. - 77.0 ft. (22.9 m - 23.5 m)		
Soil description:	Clay and Silt, trace sand, trace gravel	Date sampled:	October 5, 2020
Apparatus:	Hand Crank	Balance no.:	WLG-15
Porcelain bowl no.:	15		
Liquid limit device no.:	WLSA-3B	Oven no.:	WLG-2
Spatula no.:	2		
Sieve no.:	WLS-47	Glass plate no.:	1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	32	25	19
Water Content:			
Tare no.	125	18	104
Wet soil+tare, g	20.01	33.65	20.78
Dry soil+tare, g	18.24	31.47	18.68
Mass of water, g	1.77	2.18	2.10
Tare, g	13.71	26.06	13.67
Mass of soil, g	4.53	5.41	5.01
Water content %	39.1%	40.3%	41.9%

Plastic Limit (PL) - Water Content:

Tare no.	2	7
Wet soil+tare, g	30.80	29.88
Dry soil+tare, g	29.61	28.59
Mass of water, g	1.19	1.29
Tare, g	23.88	22.30
Mass of soil, g	5.73	6.29
Water content %	20.8%	20.5%
Average water content %	20.6%	

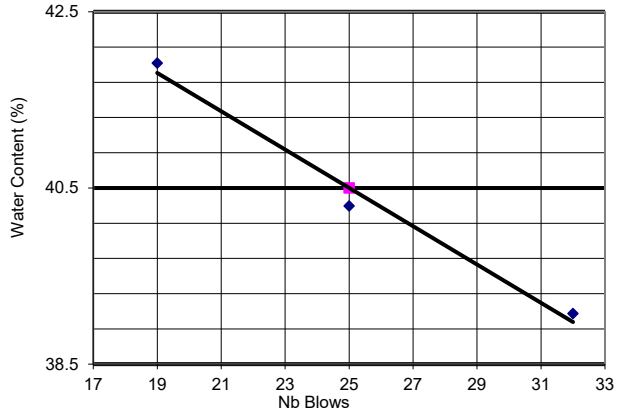
Natural Water Content (W^n):

Tare no.	KH28	
Wet soil+tare, g	74.00	
Dry soil+tare, g	60.40	
Mass of water, g	13.60	
Tare, g	4.50	
Mass of soil, g	55.90	
Water content %	24.3%	

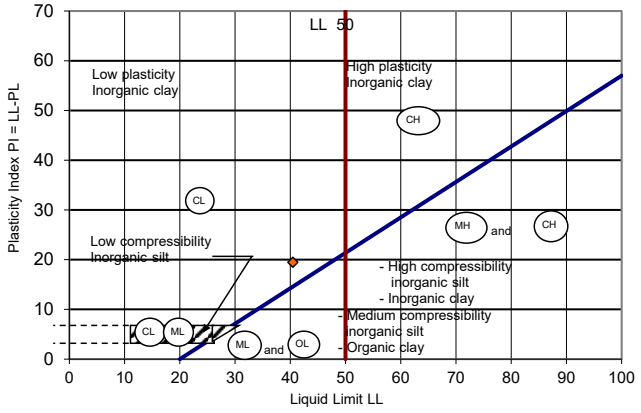
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
41	21	20	24

Remarks:

Performed by:	Melanie Mitchell	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Clean Harbors - Lambton Facility	**Lab no.:**	WLT 453-3
Project/Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project no.:**	044985-50-04
Borehole no.:	BH2-20	Sample no.:	ST-1
Depth:	35.0 ft. - 37.0 ft. (10.7 m - 11.3 m)		
Soil description:	Silt and Clay, some sand, trace gravel	Date sampled:	October 8, 2020
Apparatus:	Hand Crank	Balance no.:	WLG-15
Porcelain bowl no.:	Bts		
Liquid limit device no.:	WLSA-3B	Oven no.:	WLG-2
Spatula no.:	2		
Sieve no.:	WLS-47	Glass plate no.:	1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	34	28	20
Water Content:			
Tare no.	Q6	5	1
Wet soil+tare, g	22.40	33.01	31.55
Dry soil+tare, g	20.70	31.38	29.90
Mass of water, g	1.70	1.63	1.65
Tare, g	14.89	25.91	24.56
Mass of soil, g	5.81	5.47	5.34
Water content %	29.3%	29.8%	30.9%

Plastic Limit (PL) - Water Content:

Tare no.	25	138
Wet soil+tare, g	34.05	20.71
Dry soil+tare, g	33.04	18.91
Mass of water, g	1.01	1.80
Tare, g	26.50	7.20
Mass of soil, g	6.54	11.71
Water content %	15.4%	15.4%
Average water content %	15.4%	

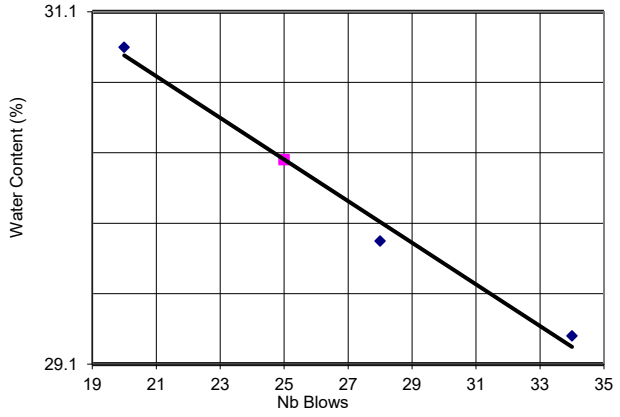
Natural Water Content (W^n):

Tare no.	HA51	
Wet soil+tare, g	76.10	
Dry soil+tare, g	64.60	
Mass of water, g	11.50	
Tare, g	4.30	
Mass of soil, g	60.30	
Water content %	19.1%	

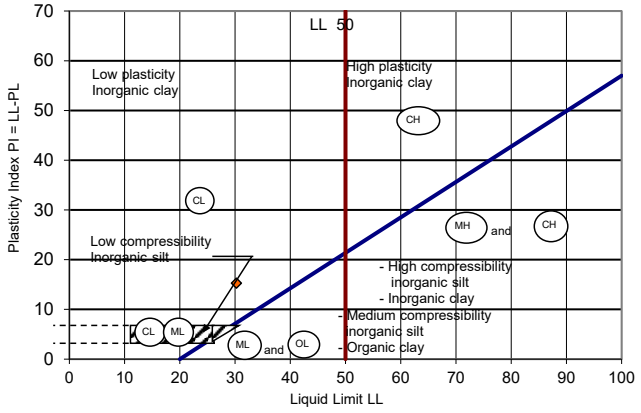
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
30	15	15	19

Remarks:

Performed by:	Melanie Mitchell	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Clean Harbors - Lambton Facility	**Lab no.:**	WLT 453-6
Project/Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project no.:**	044985-50-04
Borehole no.:	BH3-20	Sample no.:	ST-2
Depth:	70.0 ft. - 72.0 ft. (21.3 m - 21.9 m)		
Soil description:	Clay and Silt, trace sand, trace gravel	Date sampled:	October 7, 2020
Apparatus:	Hand Crank	Balance no.:	WLG-15
Porcelain bowl no.:	12		
Liquid limit device no.:	WLSA-3B	Oven no.:	WLG-2
Spatula no.:	2		
Sieve no.:	WLS-47	Glass plate no.:	1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	28	22	18
Water Content:			
Tare no.	17	14	146
Wet soil+tare, g	30.99	31.72	20.51
Dry soil+tare, g	29.12	29.83	18.49
Mass of water, g	1.87	1.89	2.02
Tare, g	24.42	25.26	13.69
Mass of soil, g	4.70	4.57	4.80
Water content %	39.8%	41.4%	42.1%

Plastic Limit (PL) - Water Content:

Tare no.	3	24
Wet soil+tare, g	31.68	34.34
Dry soil+tare, g	30.46	32.66
Mass of water, g	1.22	1.68
Tare, g	24.62	24.62
Mass of soil, g	5.84	8.04
Water content %	20.9%	20.9%
Average water content %	20.9%	

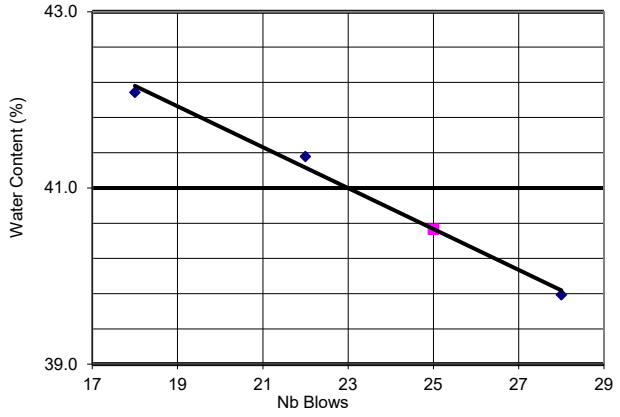
Natural Water Content (W^n):

Tare no.	KH12	
Wet soil+tare, g	89.90	
Dry soil+tare, g	72.60	
Mass of water, g	17.30	
Tare, g	4.30	
Mass of soil, g	68.30	
Water content %	25.3%	

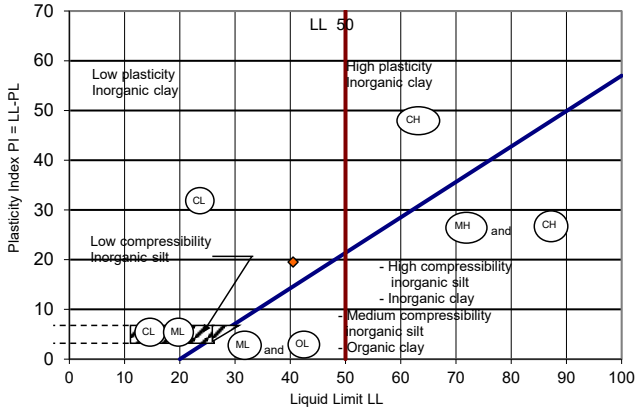
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
41	21	20	25

Remarks:

Performed by:	Melanie Mitchell	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Clean Harbors - Lambton Facility	**Lab no.:**	WLT 453-8
Project/Site:	Geotechnical Investigation - Cell 20-1 Clean Harbors, 4090 Telfar Road, Corunna, ON	**Project no.:**	044985-50-04
Borehole no.:	BH4-20	Sample no.:	ST-2
Depth:	70.0 ft. - 72.0 ft. (21.3 m - 21.9 m)		
Soil description:	Clay and Silt, trace sand, trace gravel	Date sampled:	October 6, 2020
Apparatus:	Hand Crank	Balance no.:	WLG-15
Porcelain bowl no.:	B3		
Liquid limit device no.:	WLSA-3B	Oven no.:	WLG-2
Spatula no.:	2		
Sieve no.:	WLS-47	Glass plate no.:	1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	32	29	22
Water Content:			
Tare no.	8	135	115
Wet soil+tare, g	29.08	19.56	20.49
Dry soil+tare, g	27.46	17.91	18.46
Mass of water, g	1.62	1.65	2.03
Tare, g	23.27	13.76	13.53
Mass of soil, g	4.19	4.15	4.93
Water content %	38.7%	39.8%	41.2%

Plastic Limit (PL) - Water Content:

Tare no.	122	127
Wet soil+tare, g	19.30	21.32
Dry soil+tare, g	18.34	20.04
Mass of water, g	0.96	1.28
Tare, g	13.60	13.71
Mass of soil, g	4.74	6.33
Water content %	20.3%	20.2%
Average water content %	20.2%	

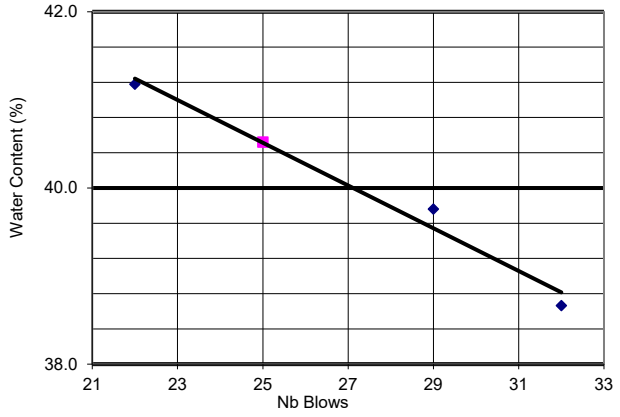
Natural Water Content (W^n):

Tare no.	JA	
Wet soil+tare, g	91.20	
Dry soil+tare, g	72.80	
Mass of water, g	18.40	
Tare, g	4.50	
Mass of soil, g	68.30	
Water content %	26.9%	

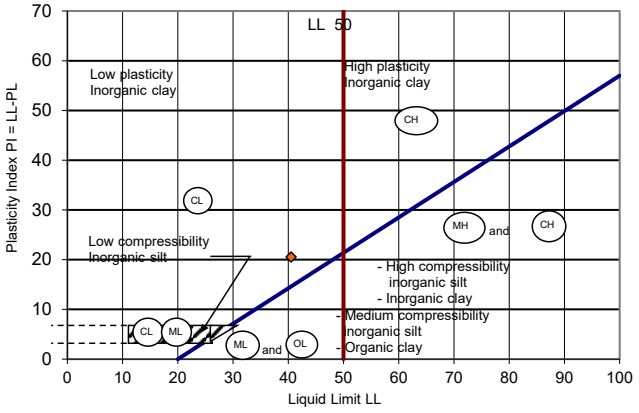
Soil Preparation:

- ☑ Cohesive <425 µm
- ☑ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
41	20	21	27

Remarks:

Performed by:	Melanie Mitchell	**Date:**	November 3, 2020
Verified by:	Abdul Hafeez Khan, P.Eng.; Laboratory Manager	**Date:**	November 4, 2020

UNCONFINED COMPRESSIVE STRENGTH OF
COHESIVE SOIL (ASTM D2166)

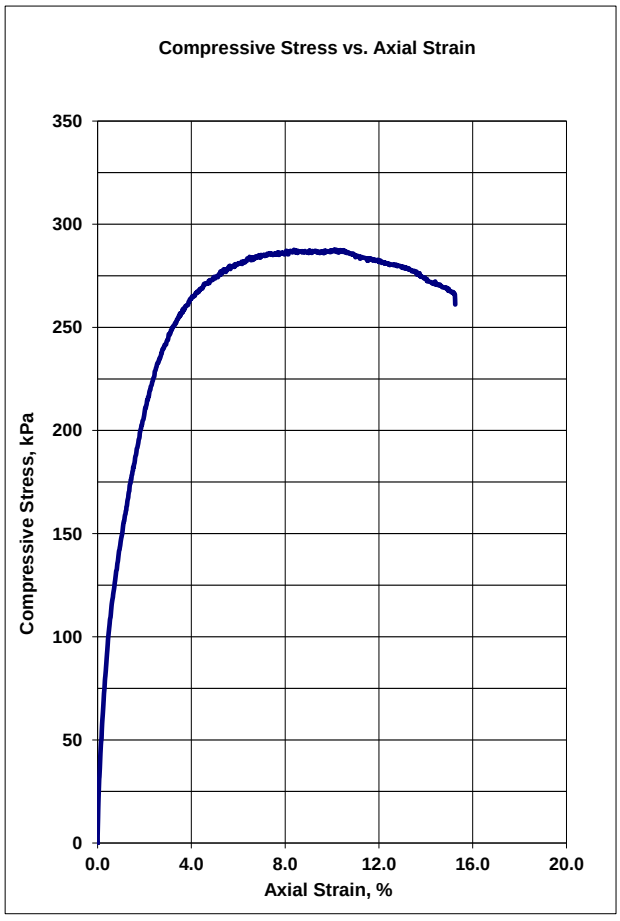
CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-1
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

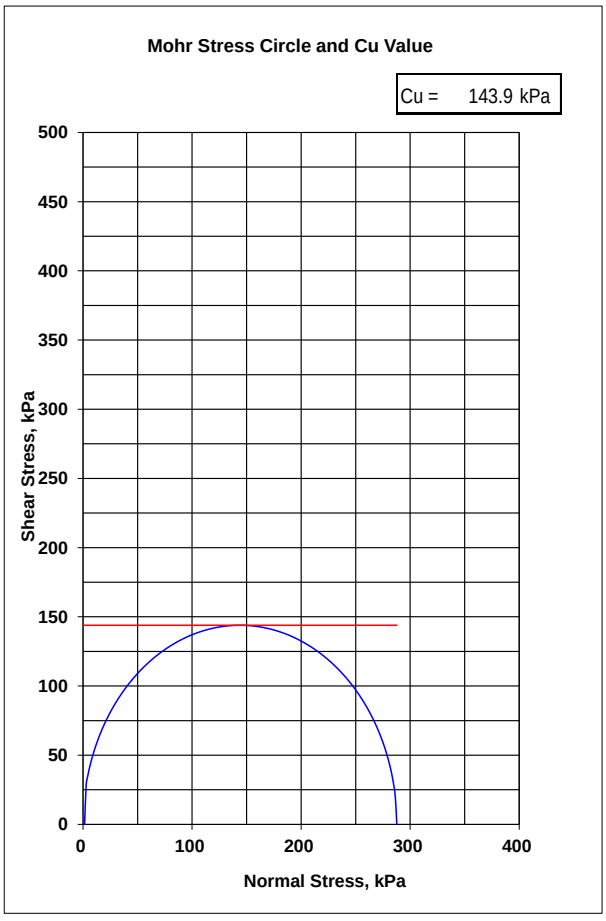
Borehole No.:	BH1-20	Sample No.:	ST 1
Depth:	13.0-13.6 m	Sample description	Silt and Clay, trace sand, trace gravel

Initial Sample Parameters		
Diameter	cm	*4.93*
Height	cm	*10.48*
Volume	cm^3	*200.1*
Height-to-Diameter Ratio		*2.1*
Wet Mass	g	*410.7*
Dry Density	kg/m^3	*1692*
*Water Content	%	*21.3*
Specific Gravity	assumed	*2.65*
Void Ratio		*0.57*
Degree of Saturation		*99.7*

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	287.8
Shear Strength	kPa	143.9
Rate of Strain	%/min	0.9
Strain at Failure	%	10.1
Maximum strain reached	%	15.3





REMARKS:

PERFORMED BY:	O.Reynolds	**DATE:**	28-Oct-20
VERIFIED BY:	Michael Braverman	**DATE:**	9-Nov-20

UNCONFINED COMPRESSIVE STRENGTH OF
COHESIVE SOIL (ASTM D2166)

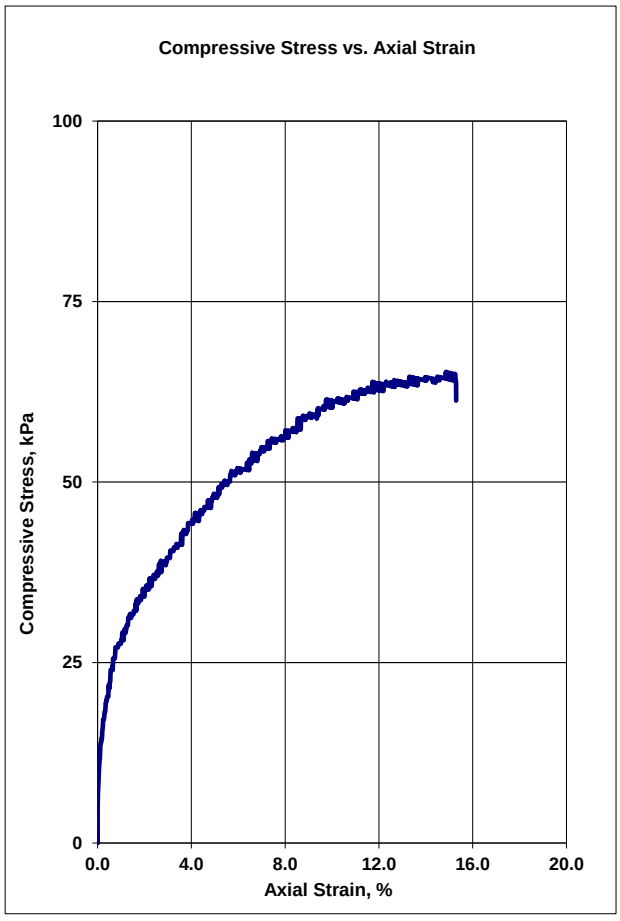
CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-2
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

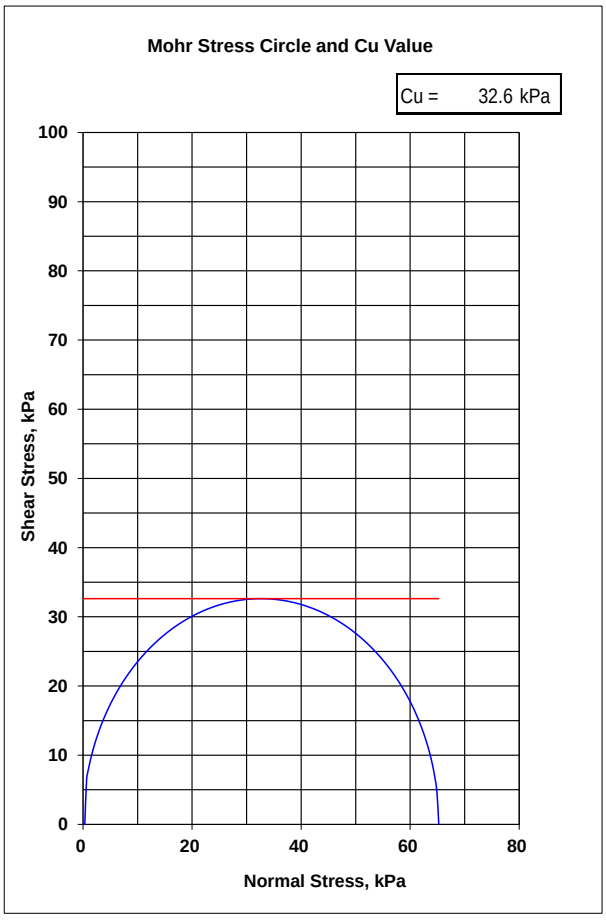
Borehole No.:	BH1-20	Sample No.:	ST 2
Depth:	22.9-23.5 m	Sample description	Clay and Silt, trace sand, trace gravel

Initial Sample Parameters		
Diameter	cm	*4.87*
Height	cm	*10.45*
Volume	cm^3	*195.0*
Height-to-Diameter Ratio		*2.1*
Wet Mass	g	*396.5*
Dry Density	kg/m^3	*1649*
*Water Content	%	*23.3*
Specific Gravity	assumed	*2.65*
Void Ratio		*0.61*
Degree of Saturation		*1.0*

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	65.2
Shear Strength	kPa	32.6
Rate of Strain	%/min	0.9
Strain at Failure	%	14.9
Maximum strain reached	%	15.3





REMARKS:

PERFORMED BY:	O.Reynolds	**DATE:**	28-Oct-20
VERIFIED BY:	Michael Braverman	**DATE:**	9-Nov-20

UNCONFINED COMPRESSIVE STRENGTH OF
COHESIVE SOIL (ASTM D2166)

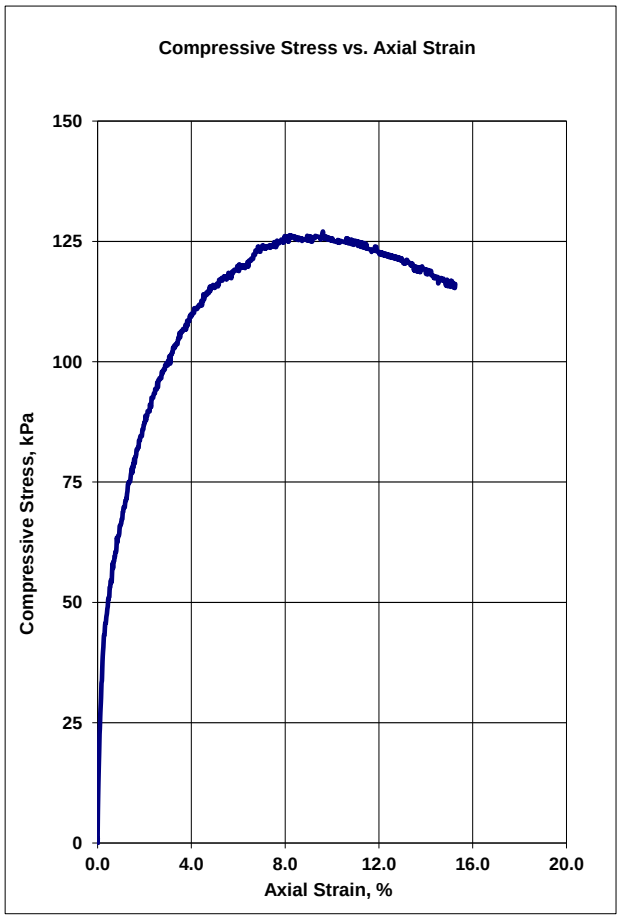
CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-3
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

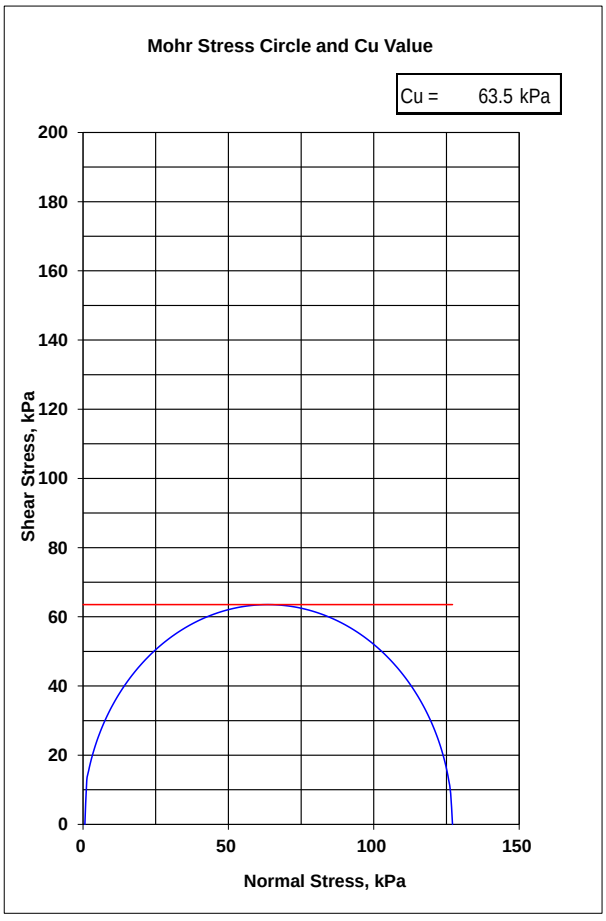
Borehole No.:	BH2-20	Sample No.:	ST 1
Depth:	10.7-11.3 m	Sample description	Silt and Clay, some sand, trace gravel

Initial Sample Parameters		
Diameter	cm	*5.03*
Height	cm	*10.46*
Volume	cm^3	*207.6*
Height-to-Diameter Ratio		*2.1*
Wet Mass	g	*444.9*
Dry Density	kg/m^3	*1800*
*Water Content	%	*19.1*
Specific Gravity	assumed	*2.68*
Void Ratio		*0.49*
Degree of Saturation		*1.0*

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	127.1
Shear Strength	kPa	63.5
Rate of Strain	%/min	0.9
Strain at Failure	%	9.6
Maximum strain reached	%	15.3





REMARKS:

PERFORMED BY:	O.Reynolds	**DATE:**	28-Oct-20
VERIFIED BY:	Michael Braverman	**DATE:**	9-Nov-20

UNCONFINED COMPRESSIVE STRENGTH OF
COHESIVE SOIL (ASTM D2166)

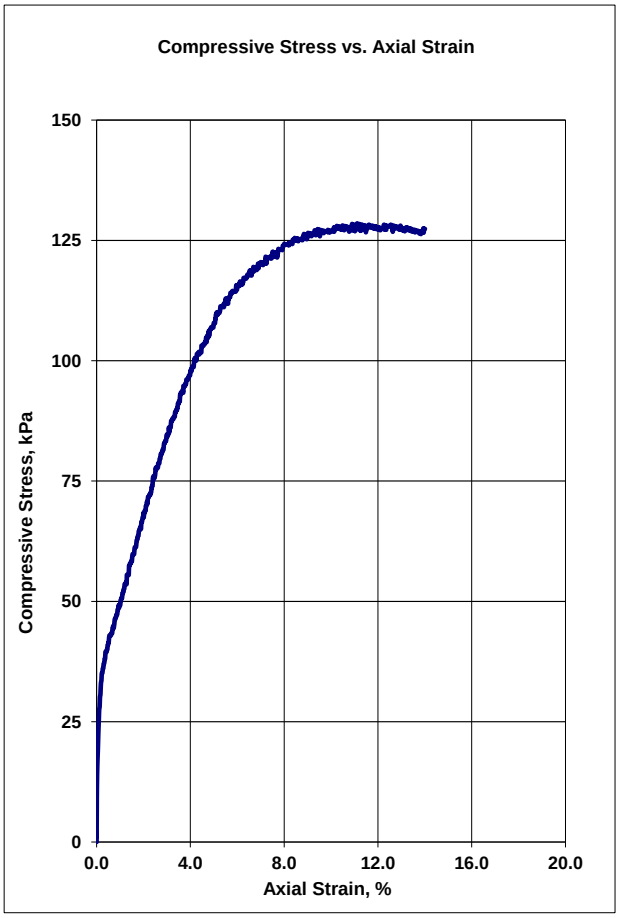
CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-4
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

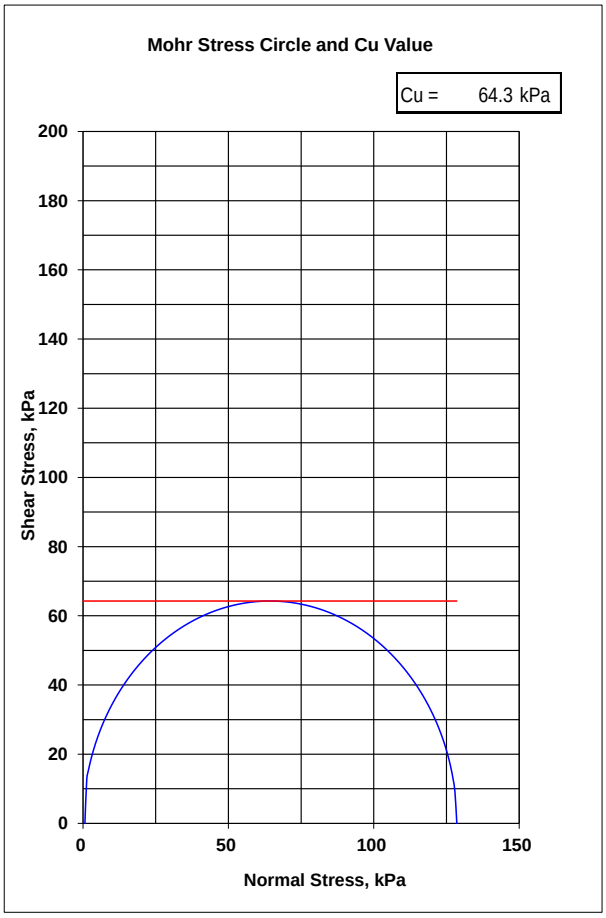
Borehole No.:	BH2-20	Sample No.:	ST 2
Depth:	21.3-21.9 m	Sample description	Clay and Silt, trace sand, trace gravel

Initial Sample Parameters		
Diameter	cm	*5.04*
Height	cm	*11.38*
Volume	cm^3	*226.6*
Height-to-Diameter Ratio		*2.3*
Wet Mass	g	*419.0*
Dry Density	kg/m^3	*1466*
*Water Content	%	*26.1*
Specific Gravity	assumed	*2.65*
Void Ratio		*0.81*
Degree of Saturation		*0.9*

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	128.6
Shear Strength	kPa	64.3
Rate of Strain	%/min	0.8
Strain at Failure	%	11.1
Maximum strain reached	%	14.0





REMARKS:

PERFORMED BY:	O.Reynolds	**DATE:**	28-Oct-20
VERIFIED BY:	Michael Braverman	**DATE:**	9-Nov-20

UNCONFINED COMPRESSIVE STRENGTH OF
COHESIVE SOIL (ASTM D2166)

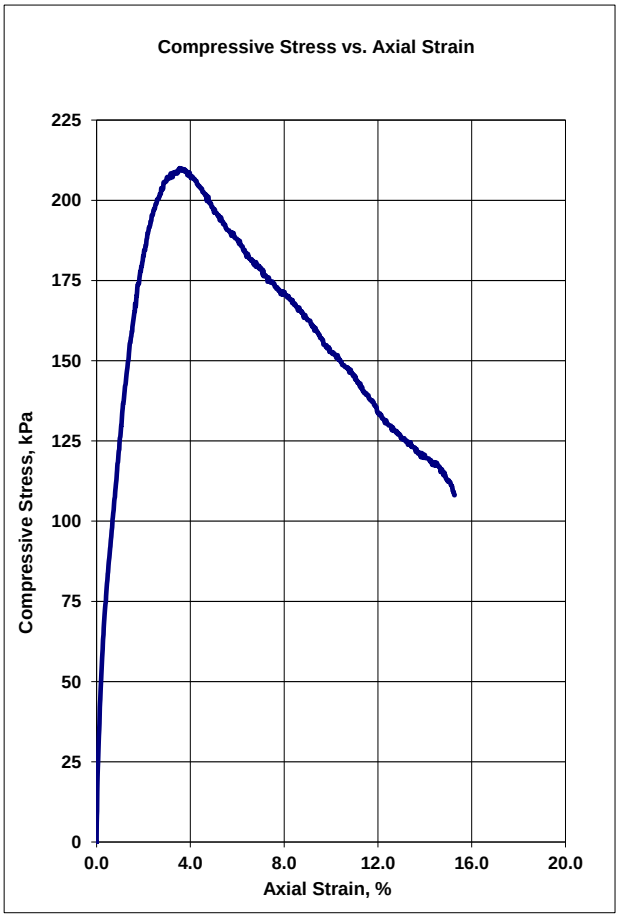
CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-5
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

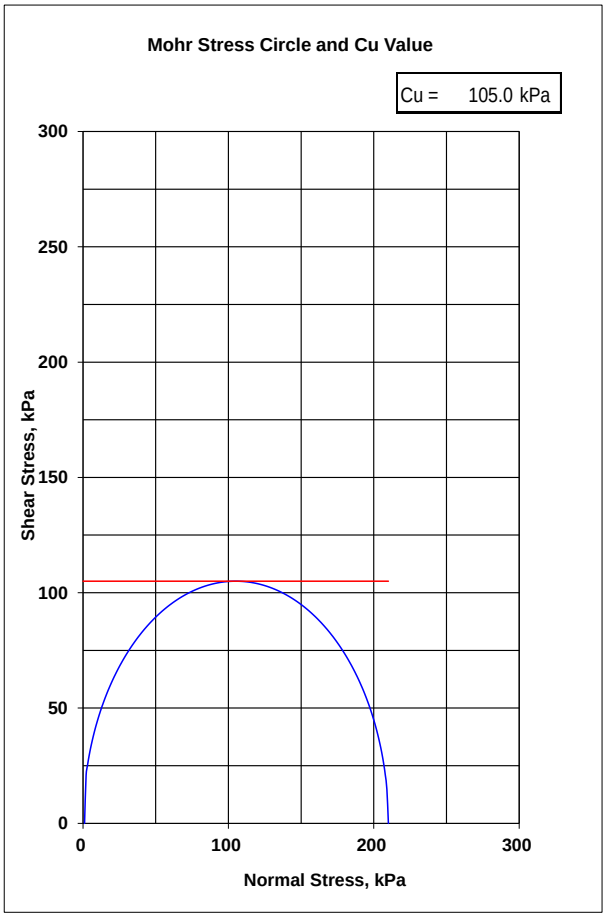
Borehole No.:	BH3-20	Sample No.:	ST 1
Depth:	10.7-11.3 m	Sample description	Clay and Silt, trace sand, trace gravel

Initial Sample Parameters		
Diameter	cm	*5.01*
Height	cm	*10.46*
Volume	cm^3	*206.5*
Height-to-Diameter Ratio		*2.1*
Wet Mass	g	*440.4*
Dry Density	kg/m^3	*1795*
*Water Content	%	*18.8*
Specific Gravity	assumed	*2.65*
Void Ratio		*0.48*
Degree of Saturation		*1.0*

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	210.0
Shear Strength	kPa	105.0
Rate of Strain	%/min	0.9
Strain at Failure	%	3.5
Maximum strain reached	%	15.3





REMARKS:

PERFORMED BY:	O.Reynolds	**DATE:**	28-Oct-20
VERIFIED BY:	Michael Braverman	**DATE:**	9-Nov-20

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

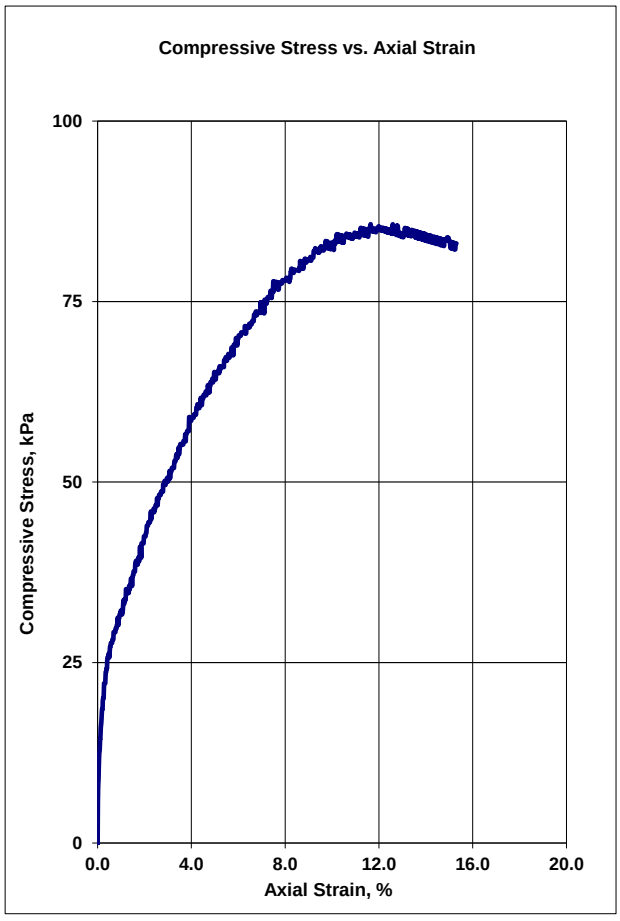
CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-6
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

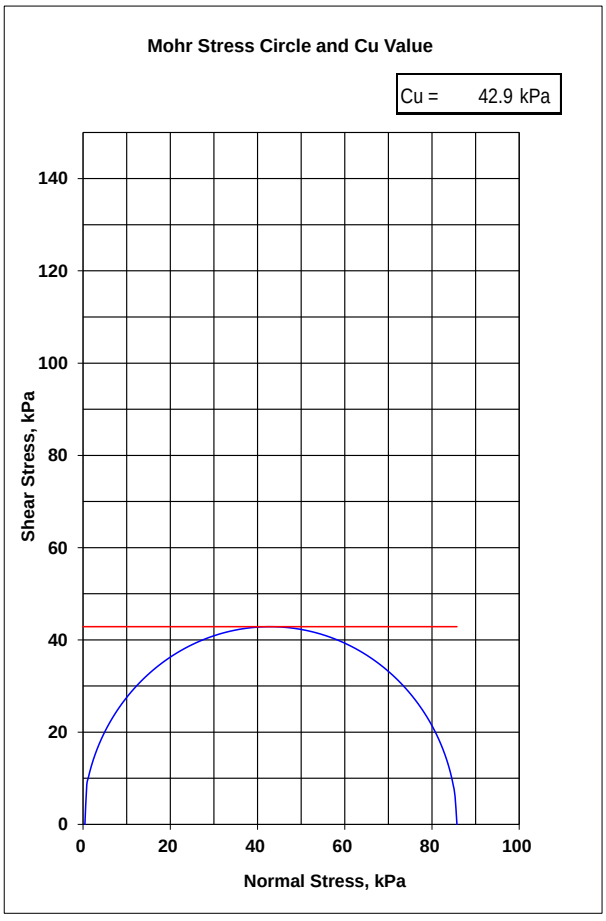
Borehole No.:	BH3-20	Sample No.:	ST 2
Depth:	21.3-21.9 m	Sample description	Clay and Silt, trace sand, trace gravel

Initial Sample Parameters		
Diameter	cm	*4.97*
Height	cm	*10.44*
Volume	cm^3	*202.3*
Height-to-Diameter Ratio		*2.1*
Wet Mass	g	*410.4*
Dry Density	kg/m^3	*1635*
*Water Content	%	*24.1*
Specific Gravity	assumed	*2.65*
Void Ratio		*0.62*
Degree of Saturation		*1.0*

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	85.7
Shear Strength	kPa	42.9
Rate of Strain	%/min	0.9
Strain at Failure	%	11.6
Maximum strain reached	%	15.3





REMARKS:

PERFORMED BY:	O.Reynolds	**DATE:**	28-Oct-20
VERIFIED BY:	Michael Braverman	**DATE:**	9-Nov-20

UNCONFINED COMPRESSIVE STRENGTH OF
COHESIVE SOIL (ASTM D2166)

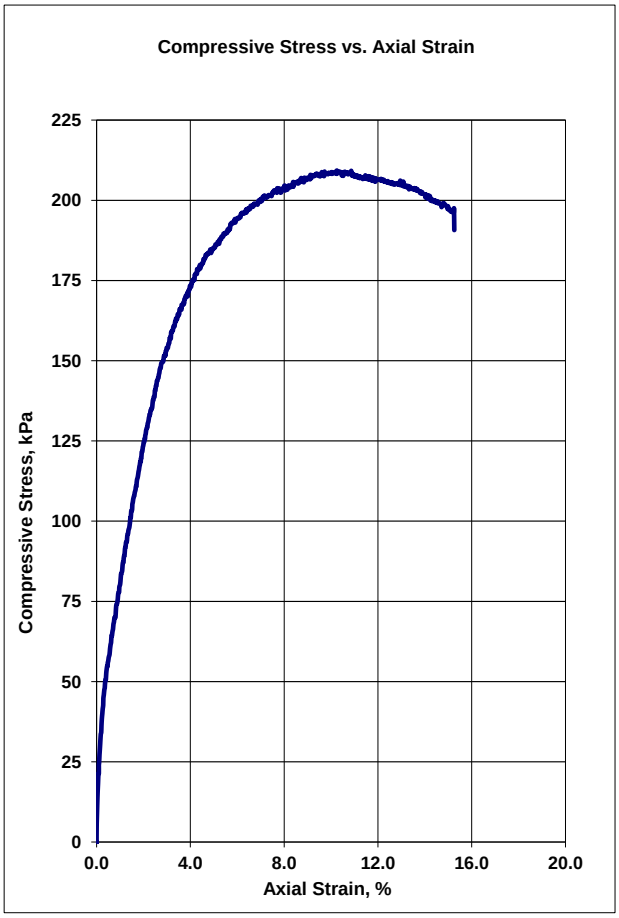
CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-7
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

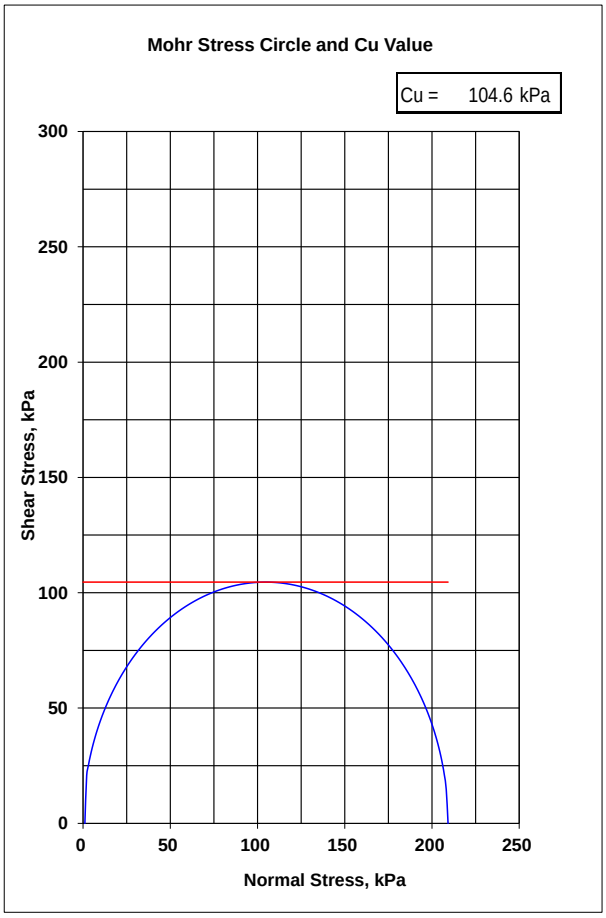
Borehole No.:	BH4-20	Sample No.:	ST 1
Depth:	10.7-11.3 m	Sample description	Clay and Silt, trace sand, trace gravel

Initial Sample Parameters		
Diameter	cm	*4.88*
Height	cm	*10.43*
Volume	cm^3	*195.2*
Height-to-Diameter Ratio		*2.1*
Wet Mass	g	*419.6*
Dry Density	kg/m^3	*1823*
*Water Content	%	*17.9*
Specific Gravity	assumed	*2.65*
Void Ratio		*0.45*
Degree of Saturation		*1.0*

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	209.2
Shear Strength	kPa	104.6
Rate of Strain	%/min	0.9
Strain at Failure	%	10.2
Maximum strain reached	%	15.3





REMARKS:

PERFORMED BY:	O.Reynolds	**DATE:**	28-Oct-20
VERIFIED BY:	Michael Braverman	**DATE:**	9-Nov-20

UNCONFINED COMPRESSIVE STRENGTH OF
COHESIVE SOIL (ASTM D2166)

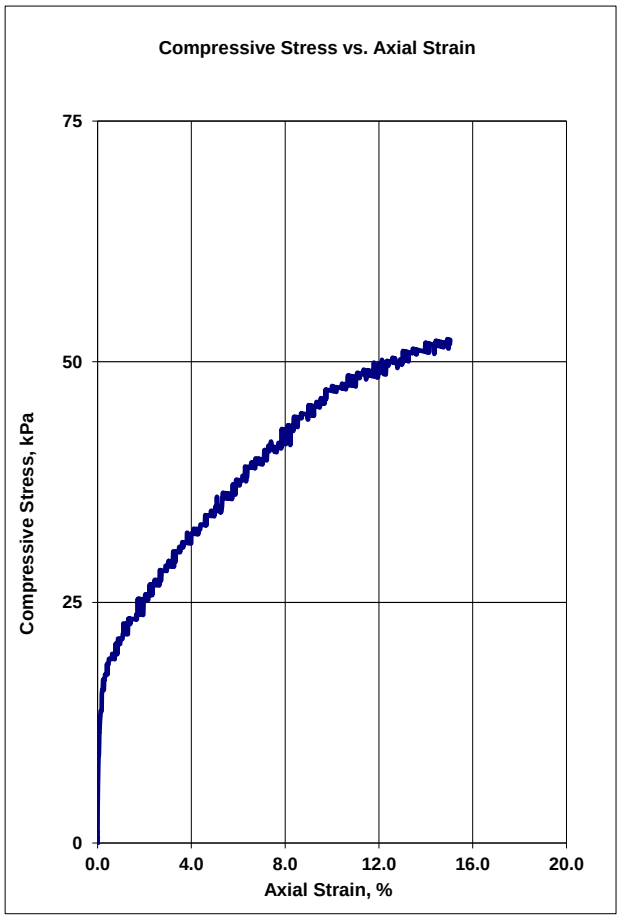
CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-8
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

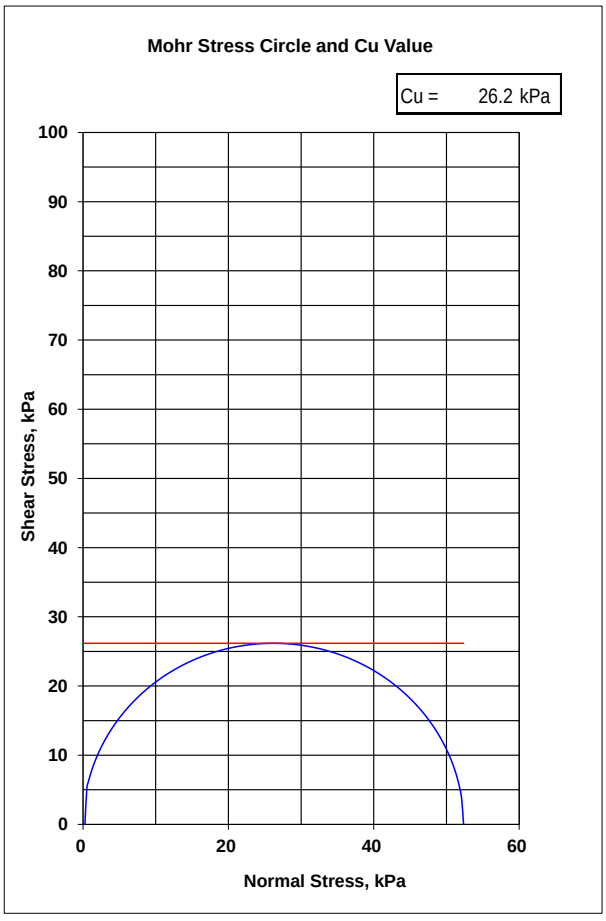
Borehole No.:	BH4-20	Sample No.:	ST2
Depth:	21.3-21.9 m	Sample description	Clay and Silt, trace sand, trace gravel

Initial Sample Parameters		
Diameter	cm	*4.81*
Height	cm	*10.43*
Volume	cm^3	*189.9*
Height-to-Diameter Ratio		*2.2*
Wet Mass	g	*386.3*
Dry Density	kg/m^3	*1632*
*Water Content	%	*24.7*
Specific Gravity	assumed	*2.65*
Void Ratio		*0.62*
Degree of Saturation		*1.0*

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	52.3
Shear Strength	kPa	26.2
Rate of Strain	%/min	1.0
Strain at Failure	%	14.9
Maximum strain reached	%	15.0





REMARKS:

PERFORMED BY:	O.Reynolds	**DATE:**	28-Oct-20
VERIFIED BY:	Michael Braverman	**DATE:**	9-Nov-20

LABORATORY DETERMINATION OF DENSITY
(UNIT WEIGHT) OF SOIL SPECIMENS
(ASTM D 7263)

CLIENT: Clean Harbors - Lambton Facility **LAB No.:** WLT 453

PROJECT/SITE: Geotechnical Investigation - Cell 20-1/Clean Harbors, 4090 Telfar Road, Corunna, ON **PROJECT No.:** 044985-50-04

Lab No.	Sample I.D.	Sample Depth (m)	Sample Description (visual)	Moisture Content %	Bulk Density (kg/m^3)	Bulk Unit Weight (kN/m^3)	Dry Bulk Density (kg/m^3)	Dry Unit Weight (kN/m^3)
WLT 453-1	BH1-20 ST-1	13.0-13.6	Clay and Silt, trace sand, trace gravel	21.3	2054	20.1	1694	16.6
WLT 453-2	BH1-20 ST-2	22.9-23.5	Clay and Silt, trace sand, trace gravel	23.3	2038	20.0	1653	16.2
WLT 453-3	BH2-20 ST-1	10.7-11.3	Clay and Silt, some sand, trace gravel	19.1	2142	21.0	1798	17.6
WLT 453-4	BH2-20 ST-2	21.3-21.9	Clay and Silt, trace sand, trace gravel	26.1	1846	18.1	1464	14.4
WLT 453-5	BH3-20 ST-1	10.7-11.3	Clay and Silt, trace sand, trace gravel	18.8	2137	21.0	1799	17.6
WLT 453-6	BH3-20 ST-2	21.3-21.9	Clay and Silt, trace sand, trace gravel	24.1	2027	19.9	1634	16.0
WLT 453-7	BH4-20 ST-1	10.7-11.3	Clay and Silt, trace sand, trace gravel	17.9	2152	21.1	1825	17.9
WLT 453-8	BH4-20 ST-2	21.3-21.9	Clay and Silt, trace sand, trace gravel	24.7	2039	20.0	1636	16.0

TESTED BY: M.Mitchell **TEST DATE:** November 4, 2020

APPROVED BY: M. Braverman **APPROVED DATE:** November 13, 2020

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-2
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	**BH1-20**
Sample ID	**ST-2**
Depth, m	**22.9-23.5 m (75'-77')**
Sampling Date	**-**
Sample Description	**Silt and Clay, trace sand, trace gravel**

Vertical strain at failure taken based on Maximum Deviator Stress Ratio

Specimen Parameters

Initial Specimen Parameters		***Specimen A***	***Specimen B***	***Specimen C***
Diameter	cm	*3.69*	*3.68*	*3.65*
Height	cm	*7.84*	*7.95*	*7.95*
Height-to-Diameter Ratio		*2.1*	*2.2*	*2.2*
Volume	cm^3	84.0	84.6	83.0
Wet Mass	g	*161.9*	*167.3*	*171.9*
Dry Density	kg/m^3	*1526*	*1577*	*1679*
Water Content	%	*26.2*	*25.4*	*23.3*
Specific Gravity		*2.75*	*2.75*	*2.75*
Void Ratio		*0.80*	*0.74*	*0.64*
Degree of Saturation	%	*90*	*94*	*100*
B-Value at end of Saturation		*0.99*	*0.99*	*0.97*
Volume change due to the consolidation, cm^3		*4.2*	*6.8*	*8.7*
Before Shear				
Volume	cm^3	79.8	77.8	74.3
Wet Mass	g	*159.5*	*162.9*	*163.0*
Dry Density	kg/m^3	*1606*	*1715*	*1876*
Water Content	%	*24.4*	*22.0*	*16.9*
Void Ratio		*0.71*	*0.60*	*0.47*
Degree of Saturation	%	*94*	*100*	*100*

		Specimen A	***Specimen B***	***Specimen C***
Cell pressure	kPa	802.4	800.1	807.2
Back pressure	kPa	403.4	602.3	158.4
Consolidation stress	kPa	399	197.8	648.8
Rate of strain	%/hour	0.6	0.6	0.6
Vertical strain at failure	%	5.70	5.70	14.00
Deviator stress at failure	kPa	347	240	532
Excess pore pressure at failure	kPa	195.2	82.8	329.1
A_f coefficient		0.56	0.35	0.62

Total Stresses		***Specimen A***	***Specimen B***	***Specimen C***
Minor principal stress, σ_3	kPa	399	197.8	648.8
Major principal stress, σ_1	kPa	745.7	437.6	1180.8
Radius, $(\sigma_1-\sigma_3)/2$	kPa	173.4	119.9	266.0
Intersection point, $(\sigma_1+\sigma_3)/2$	kPa	572.4	317.7	914.8

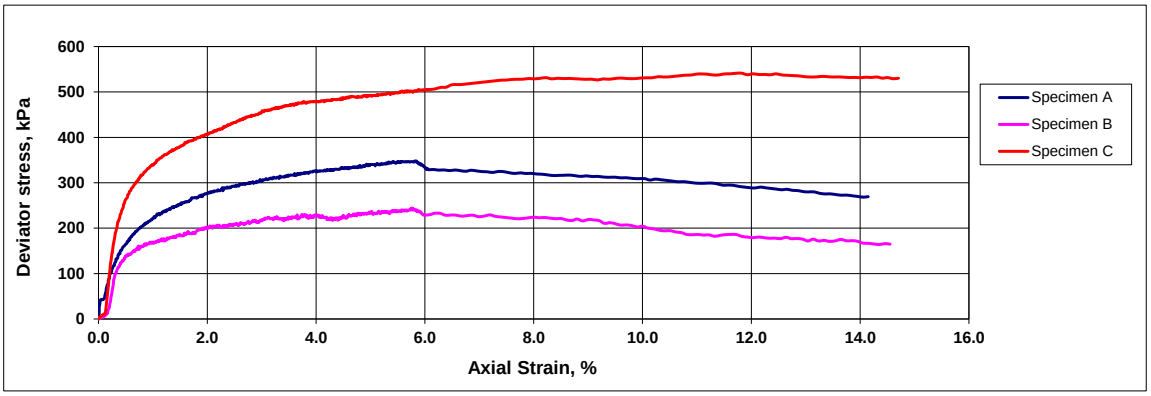
Effective Stresses		***Specimen A***	***Specimen B***	***Specimen C***
Minor principal stress, σ'_3	kPa	203.8	115	319.7
Major principal stress, σ'_1	kPa	550.5	354.8	851.7
Radius, $(\sigma'_1-\sigma'_3)/2$	kPa	173.4	119.9	266.0
Intersection point, $(\sigma'_1+\sigma'_3)/2$	kPa	377.2	234.9	585.7
Shear Termination Criteria		Maximum Deviator Stress Ratio		

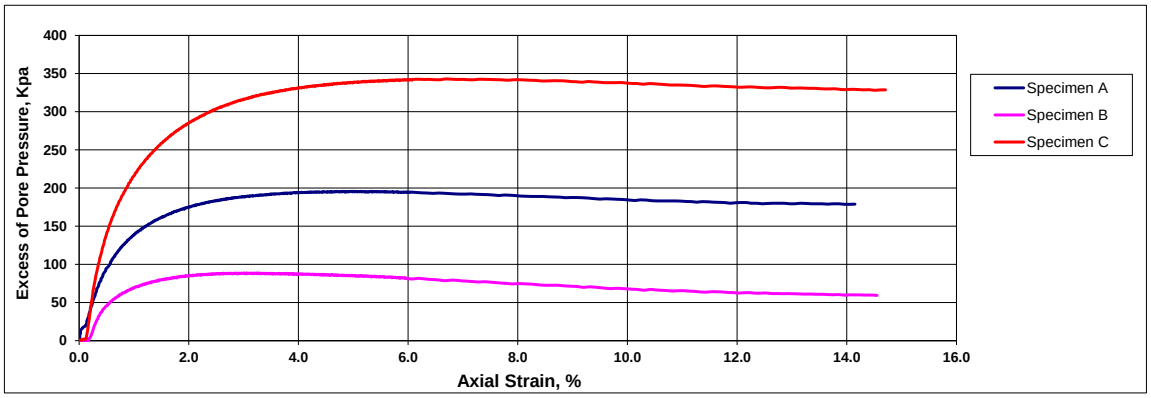
REMARKS: Sample Reconstituted

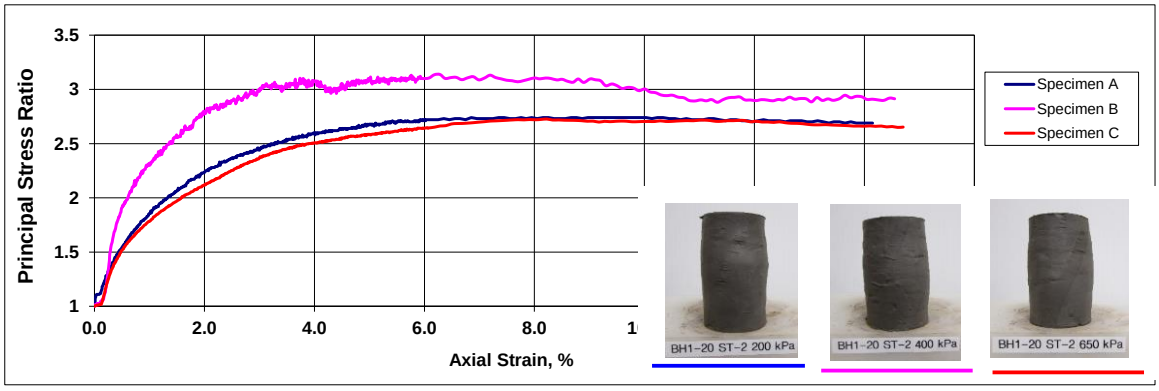
PERFORMED BY:	C.Ackley	**DATE:**	Oct 28 -Nov 5, 2020
VERIFIED BY:	Michael Braverman	**DATE:**	11-Nov-20

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-2
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	**BH1-20**
Sample ID	**ST-2**
Depth, m	**22.9-23.5 m (75'-77')**
Sampling Date	**-**
Sample Description	**Silt and Clay, trace sand, trace gravel**





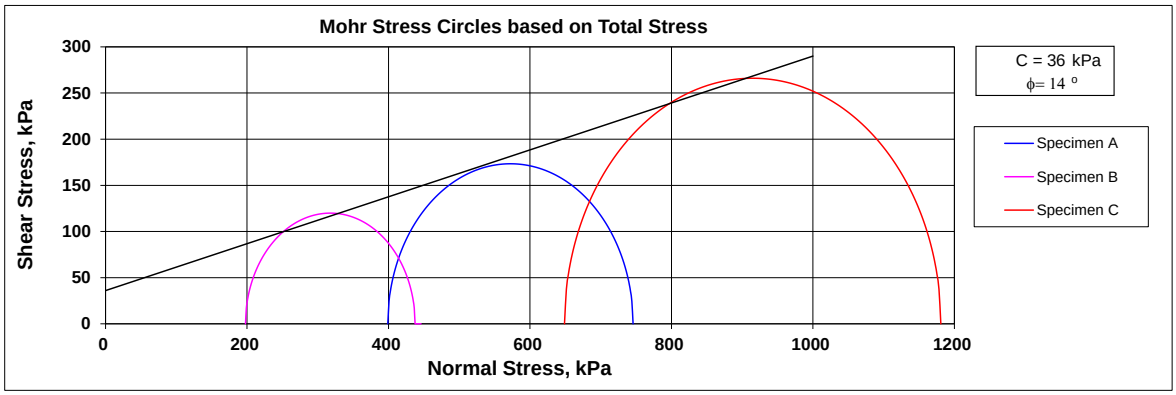


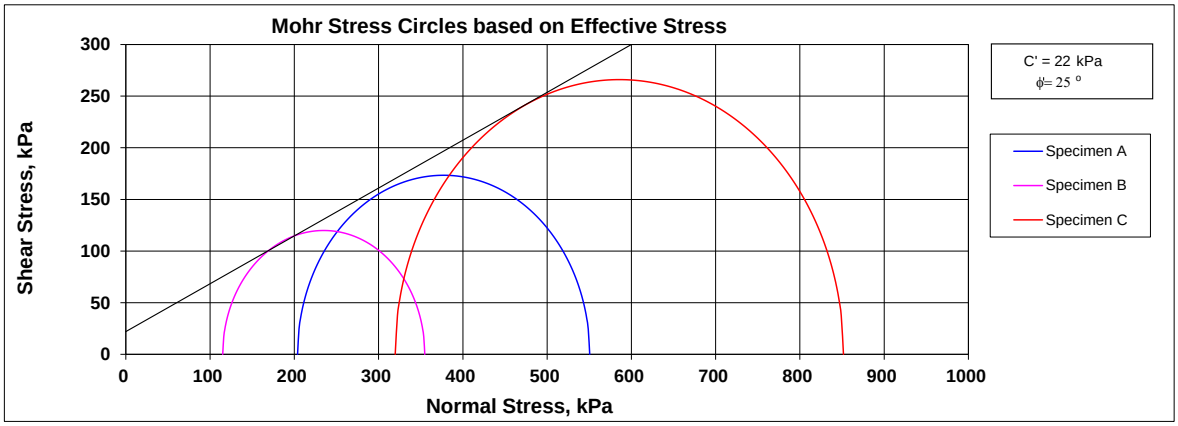
REMARKS:

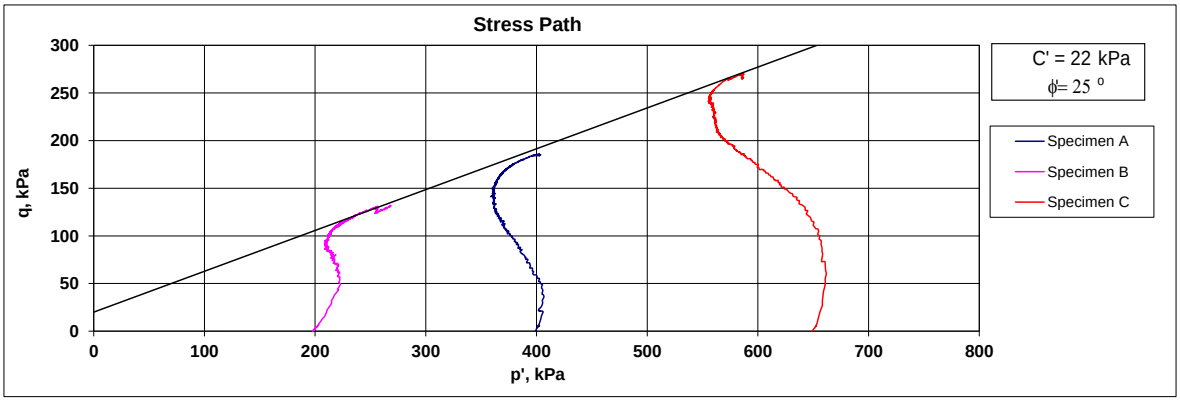
PERFORMED BY:	C.Ackley	**DATE:**	Oct 28 -Nov 5, 2020
VERIFIED BY:	Michael Braverman	**DATE:**	11-Nov-20

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-2
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	**BH1-20**
Sample ID	**ST-2**
Depth, m	**22.9-23.5 m (75'-77')**
Sampling Date	**-**
Sample description	**Silt and Clay, trace sand, trace gravel**







REMARKS:

PERFORMED BY:	C.Ackley	**DATE:**	Oct 28 -Nov 5, 2020
VERIFIED BY:	Michael Braverman	**DATE:**	11-Nov-20

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
FOR COHESIVE SOILS (ASTM D4767 - 11)

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-3
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	**BH2**
Sample ID	**ST-1**
Depth, m	**10.7-11.3m (35'-37')**
Sampling Date	**-**
Sample Description	**Silt and Clay, some sand, trace gravel**

Vertical strain at failure taken based on		**Maximum Principal Stress Ratio**		
Specimen Parameters				
Initial		***Specimen A***	***Specimen B***	***Specimen C***
Diameter	cm	*4.98*	*4.99*	*4.99*
Height	cm	*10.43*	*10.44*	*10.42*
Height-to-Diameter Ratio		*2.1*	*2.1*	*2.1*
Volume	cm^3	203.2	204.0	204.1
Wet Mass	g	*435.4*	*439.6*	*441.8*
Dry Density	kg/m^3	*1816*	*1813*	*1838*
Water Content	%	*18.0*	*18.9*	*17.8*
Specific Gravity (Assumed)		*2.75*	*2.75*	*2.75*
Void Ratio		*0.51*	*0.52*	*0.50*
Degree of Saturation	%	*96*	*100*	*99*
B-Value at end of Saturation		*0.95*	*0.95*	*1.00*
Volume change due to the consolidation, cm^3		*6.2*	*9.3*	*8.6*
Before Shear				
Volume	cm^3	197.0	194.7	195.5
Wet Mass	g	*429.1*	*435.1*	*440.2*
Dry Density	kg/m^3	*1873*	*1899*	*1918*
Water Content	%	*16.3*	*17.6*	*17.4*
Void Ratio		*0.47*	*0.45*	*0.43*
Degree of Saturation	%	*96*	*100*	*100*

		Specimen A	***Specimen B***	***Specimen C***
Cell pressure	kPa	400.6	600.4	601.7
Back pressure	kPa	306	400.2	203.5
Consolidation stress	kPa	94.6	200.2	398.2
Rate of strain	%/hour	0.5	0.6	0.6
Vertical strain at failure	%	4.00	4.00	5.00
Deviator stress at failure	kPa	178	256	394
Excess pore pressure at failure	kPa	31.6	80.5	199.9
A_f coefficient		0.18	0.31	0.51

Total Stresses		***Specimen A***	***Specimen B***	***Specimen C***
Minor principal stress, σ_3	kPa	94.6	200.2	398.2
Major principal stress, σ_1	kPa	272.6	455.8	792.2
Radius, $(\sigma_1-\sigma_3)/2$	kPa	89.0	127.8	197.0
Intersection point, $(\sigma_1+\sigma_3)/2$	kPa	183.6	328.0	595.2

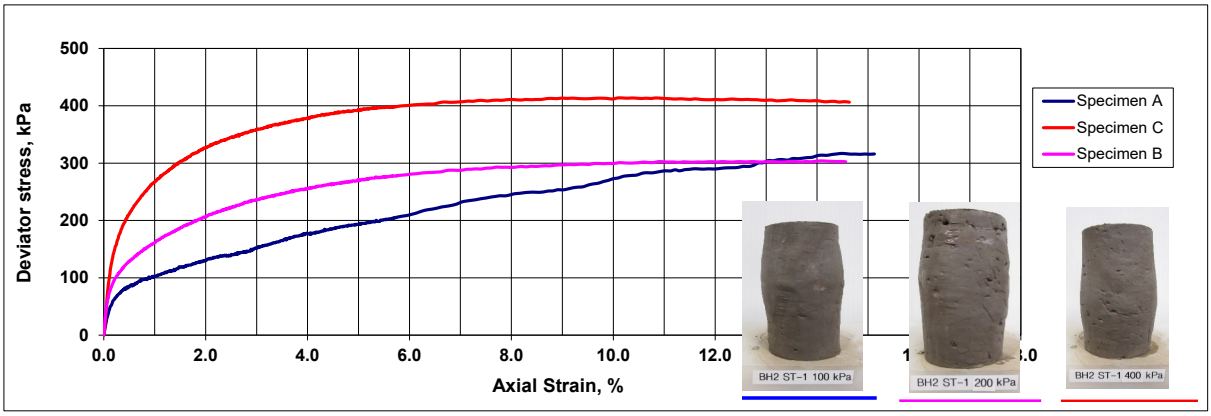
Effective Stresses		***Specimen A***	***Specimen B***	***Specimen C***
Minor principal stress, σ'_3	kPa	63	119.7	198.3
Major principal stress, σ'_1	kPa	241.0	375.3	592.3
Radius, $(\sigma'_1-\sigma'_3)/2$	kPa	89.0	127.8	197.0
Intersection point, $(\sigma'_1+\sigma'_3)/2$	kPa	152.0	247.5	395.3
Shear Termination Criteria		Maximum Principal Stress Ratio		

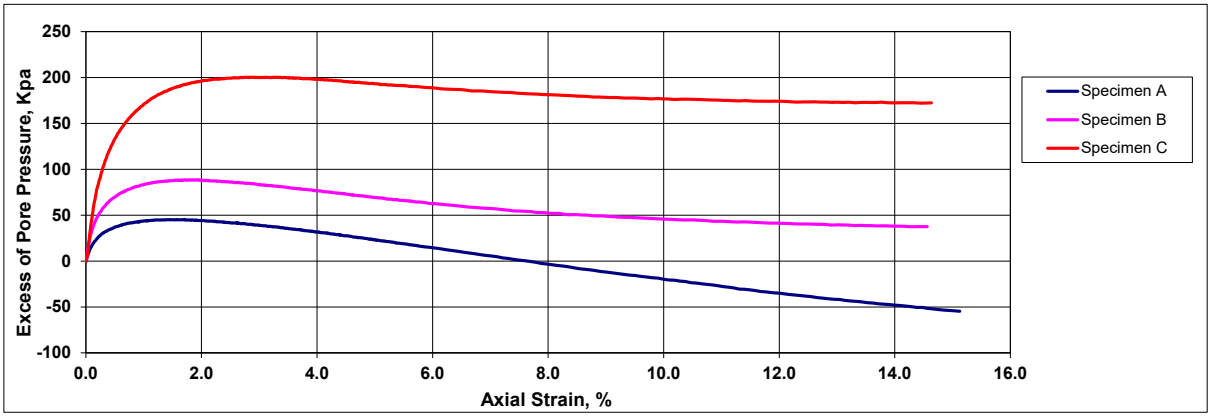
REMARKS:

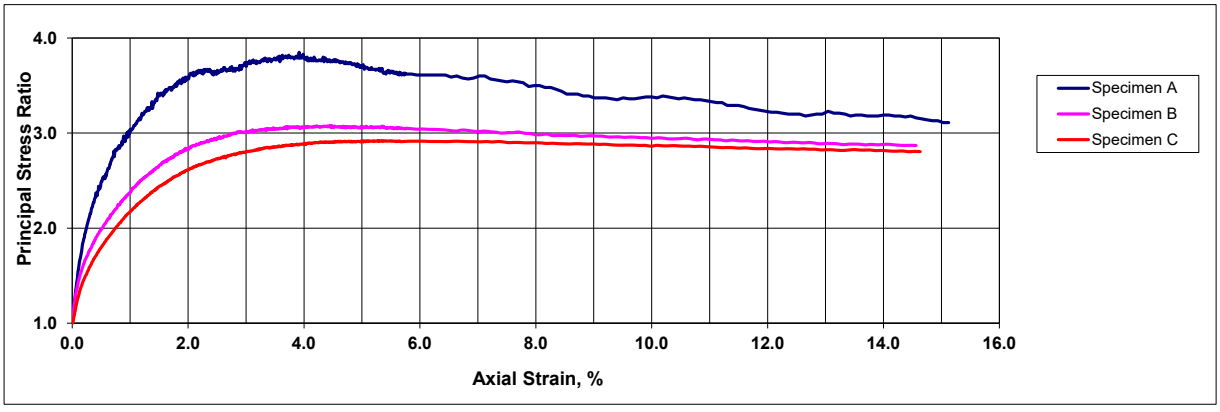
PERFORMED BY:	O. Reynolds	**DATE:**	Oct 28 -Nov 6, 2020
VERIFIED BY:	Michael Braverman	**DATE:**	24-Nov-20

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-3
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	BH2
Sample ID	ST-1
Depth, m	10.7-11.3m (35'-37')
Sampling Date	-
Sample description	Silt and Clay, some sand, trace gravel







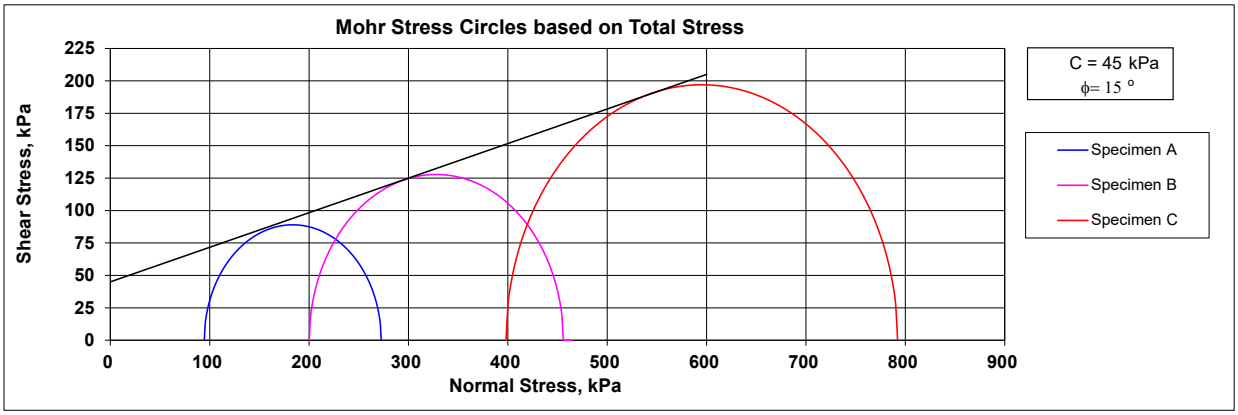
REMARKS:

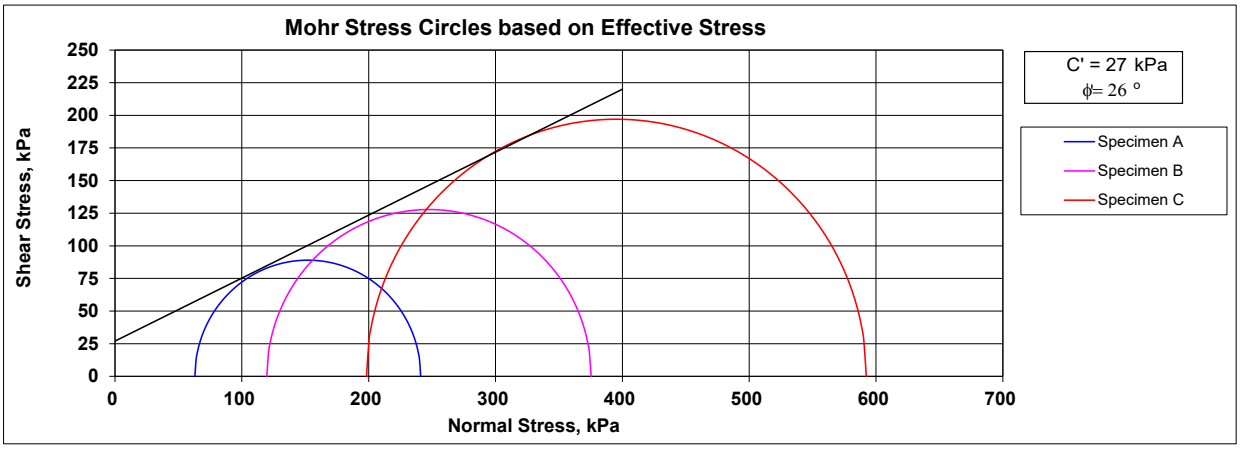
PERFORMED BY:	O. Reynolds	**DATE:**	Oct 28 -Nov 6, 2020
VERIFIED BY:	Michael Braverman	**DATE:**	24-Nov-20

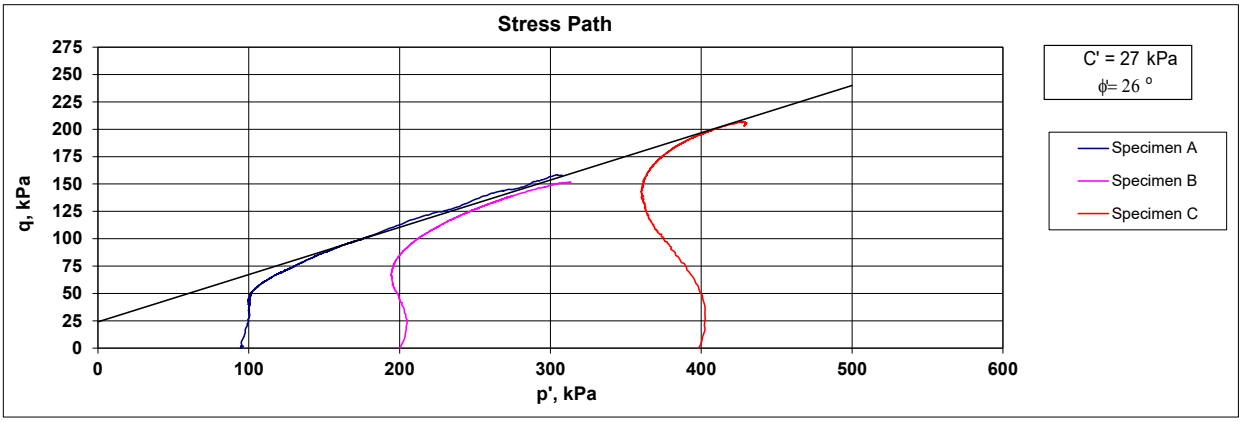
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
FOR COHESIVE SOILS (ASTM D4767 - 11)

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-3
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	**BH2**
Sample ID	**ST-1**
Depth, m	**10.7-11.3m (35'-37')**
Sampling Date	**-**
Sample description	**Silt and Clay, some sand, trace gravel**







REMARKS:

PERFORMED BY:	O. Reynolds	**DATE:**	Oct 28 -Nov 6, 2020
VERIFIED BY:	Michael Braverman	**DATE:**	November 24, 2020

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
FOR COHESIVE SOILS (ASTM D4767 - 11)

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-8
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	**BH4**
Sample ID	**ST2**
Depth, m	**21.3-21.9 (70'-72')**
Sampling Date	**-**
Sample Description	**Clay and Silt, trace sand, trace gravel**

Vertical strain at failure taken based on Maximum Stress Ratio

Specimen Parameters

Initial		***Specimen A***	***Specimen B***	***Specimen C***
Diameter	cm	*5.03*	*4.99*	*5.01*
Height	cm	*10.41*	*10.42*	*10.39*
Height-to-Diameter Ratio		*2.1*	*2.1*	*2.1*
Volume	cm^3	206.5	203.7	205.2
Wet Mass	g	*409.3*	*404.5*	*412.0*
Dry Density	kg/m^3	*1593*	*1564*	*1589*
Water Content	%	*24.4*	*27.0*	*26.3*
Specific Gravity (Assumed)		*2.78*	*2.78*	*2.78*
Void Ratio		*0.74*	*0.78*	*0.75*
Degree of Saturation	%	*91*	*96*	*98*
B-Value at end of Saturation		*0.99*	*0.99*	*1.00*
Volume change due to the consolidation, cm^3		*7.4*	*12.5*	*14.5*
Before Shear				
Volume	cm^3	199.1	191.2	190.7
Wet Mass	g	*409.4*	*395.2*	*399.7*
Dry Density	kg/m^3	*1653*	*1666*	*1710*
Water Content	%	*24.4*	*24.0*	*22.6*
Void Ratio		*0.68*	*0.67*	*0.63*
Degree of Saturation	%	*99*	*100*	*100*

		Specimen A	***Specimen B***	***Specimen C***
Cell pressure	kPa	799.8	800.4	801.6
Back pressure	kPa	600.9	407.4	200.3
Consolidation stress	kPa	198.9	393	601.3
Rate of strain	%/hour	0.6	0.6	0.6
Vertical strain at failure	%	6.00	7.50	9.00
Deviator stress at failure	kPa	193	288	386
Excess pore pressure at failure	kPa	91.1	188.3	299.4
A_f coefficient		0.47	0.65	0.78

Total Stresses		***Specimen A***	***Specimen B***	***Specimen C***
Minor principal stress, σ_3	kPa	198.9	393	601.3
Major principal stress, σ_1	kPa	392.0	681.1	987.0
Radius, $(\sigma_1-\sigma_3)/2$	kPa	96.5	144.1	192.8
Intersection point, $(\sigma_1+\sigma_3)/2$	kPa	295.4	537.1	794.1

Effective Stresses		***Specimen A***	***Specimen B***	***Specimen C***
Minor principal stress, σ'_3	kPa	107.8	204.7	301.9
Major principal stress, σ'_1	kPa	300.9	492.8	687.6
Radius, $(\sigma'_1-\sigma'_3)/2$	kPa	96.5	144.1	192.8
Intersection point, $(\sigma'_1+\sigma'_3)/2$	kPa	204.3	348.8	494.7
Shear Termination Criteria		Maximum Stress Ratio		

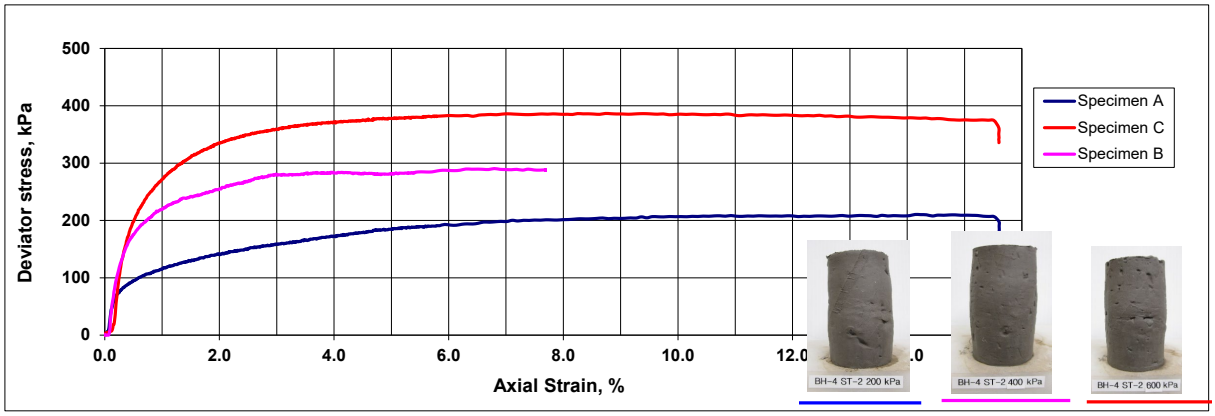
REMARKS:

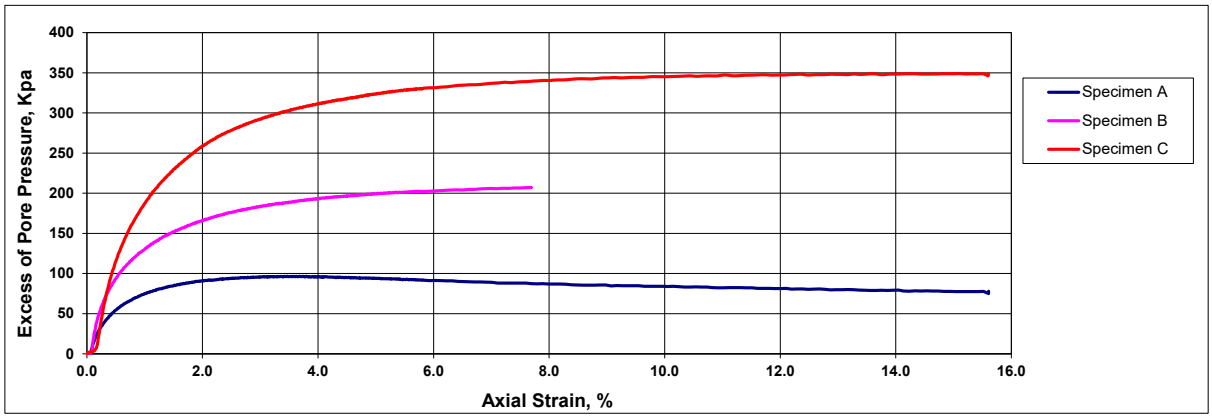
PERFORMED BY:	M. R. Metupalli	**DATE:**	Oct 28 - Nov 10 , 2020
VERIFIED BY:	Michael Braverman	**DATE:**	24-Nov-20

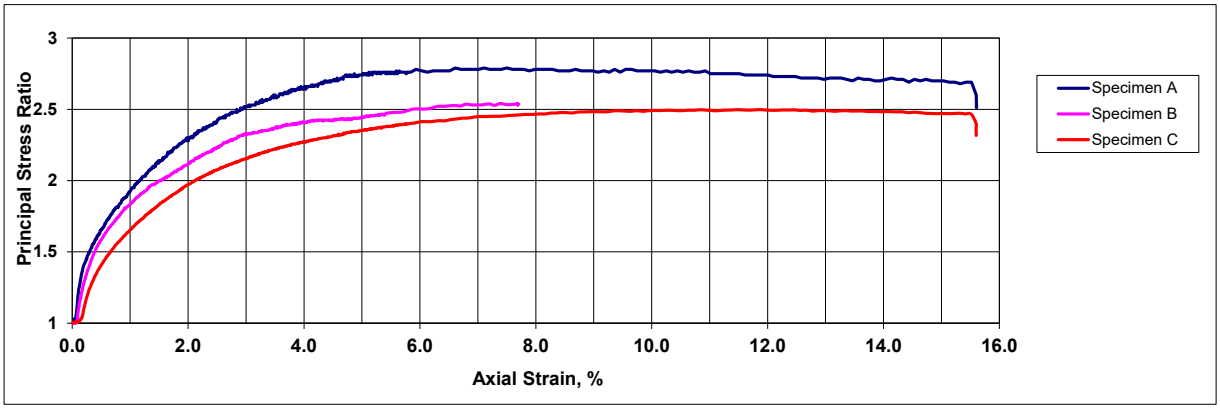
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
FOR COHESIVE SOILS (ASTM D4767 - 11)

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-8
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	**BH4**
Sample ID	**ST2**
Depth, m	**21.3-21.9 (70'-72')**
Sampling Date	**-**
Sample description	**Clay and Silt, trace sand, trace gravel**







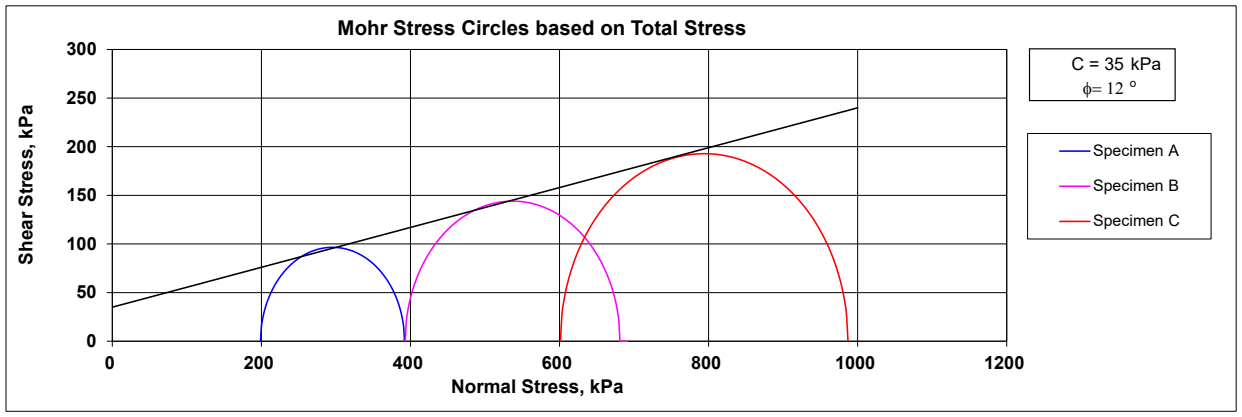
REMARKS:

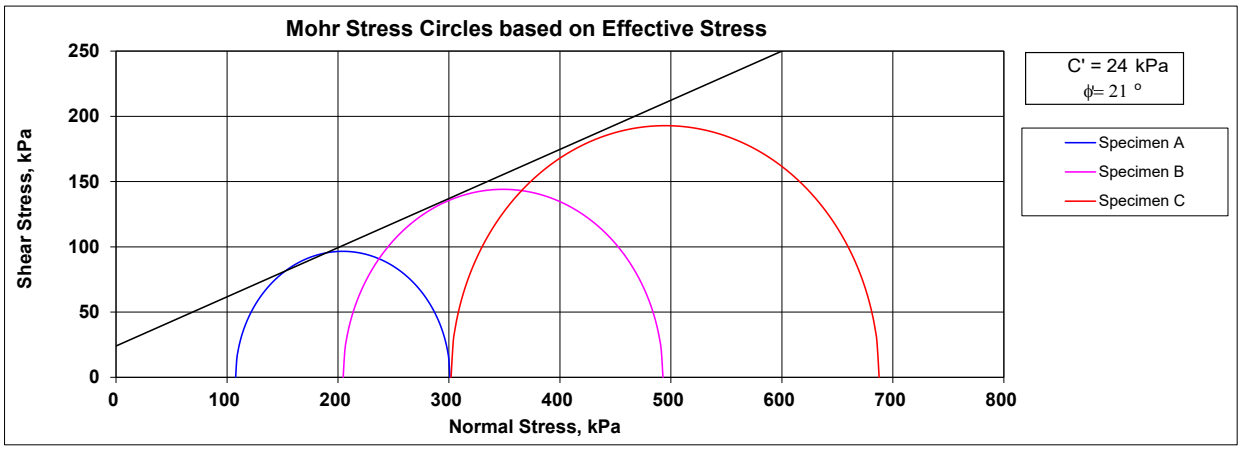
PERFORMED BY:	M. R. Metupalli	**DATE:**	Oct 28 - Nov 10 , 2020
VERIFIED BY:	Michael Braverman	**DATE:**	24-Nov-20

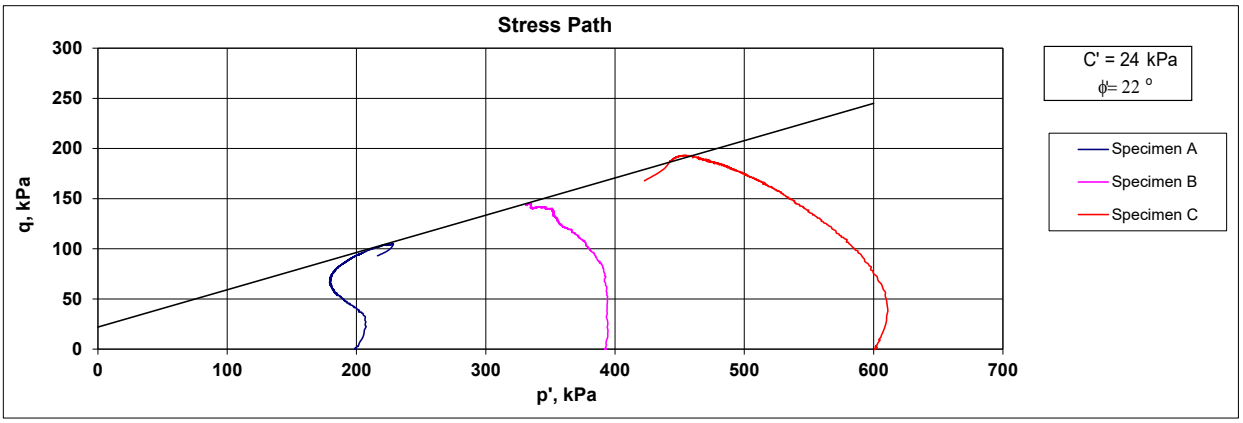
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
FOR COHESIVE SOILS (ASTM D4767 - 11)

CLIENT:	Clean Harbors - Lambton Facility	**LAB No.:**	WLT 453-8
PROJECT/ SITE:	Geotechnical Investigation Cell 20-1, Clean Harbors, 4090 Telfar Rd. Corunna, ON	**PROJECT No.:**	044985-50-04

BH No.	**BH4**
Sample ID	**ST2**
Depth, m	**21.3-21.9 (70'-72')**
Sampling Date	**-**
Sample description	**Clay and Silt, trace sand, trace gravel**







REMARKS:

PERFORMED BY:	M. R. Metupalli	**DATE:**	Oct 28 - Nov 10 , 2020
VERIFIED BY:	Michael Braverman	**DATE:**	November 24, 2020

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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