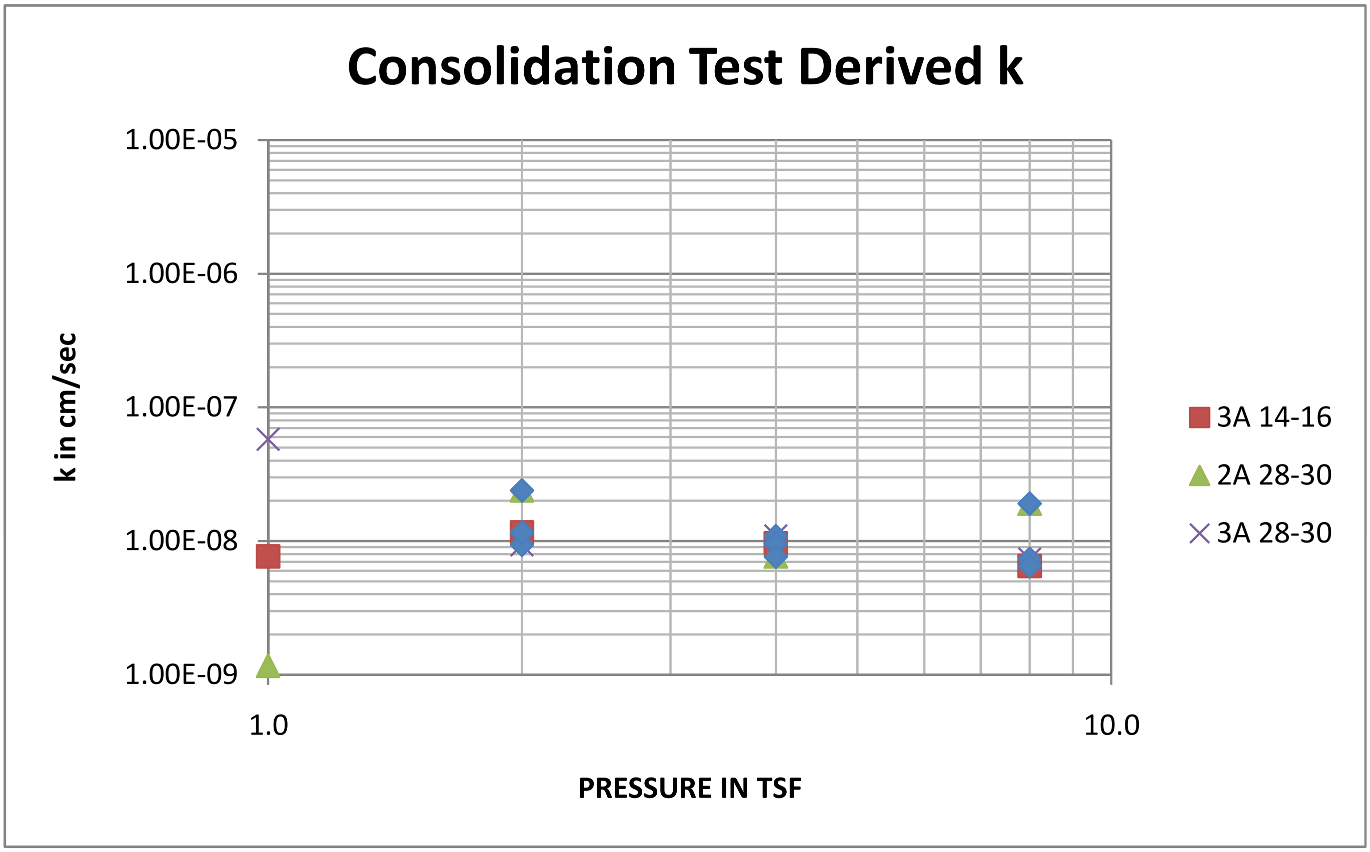
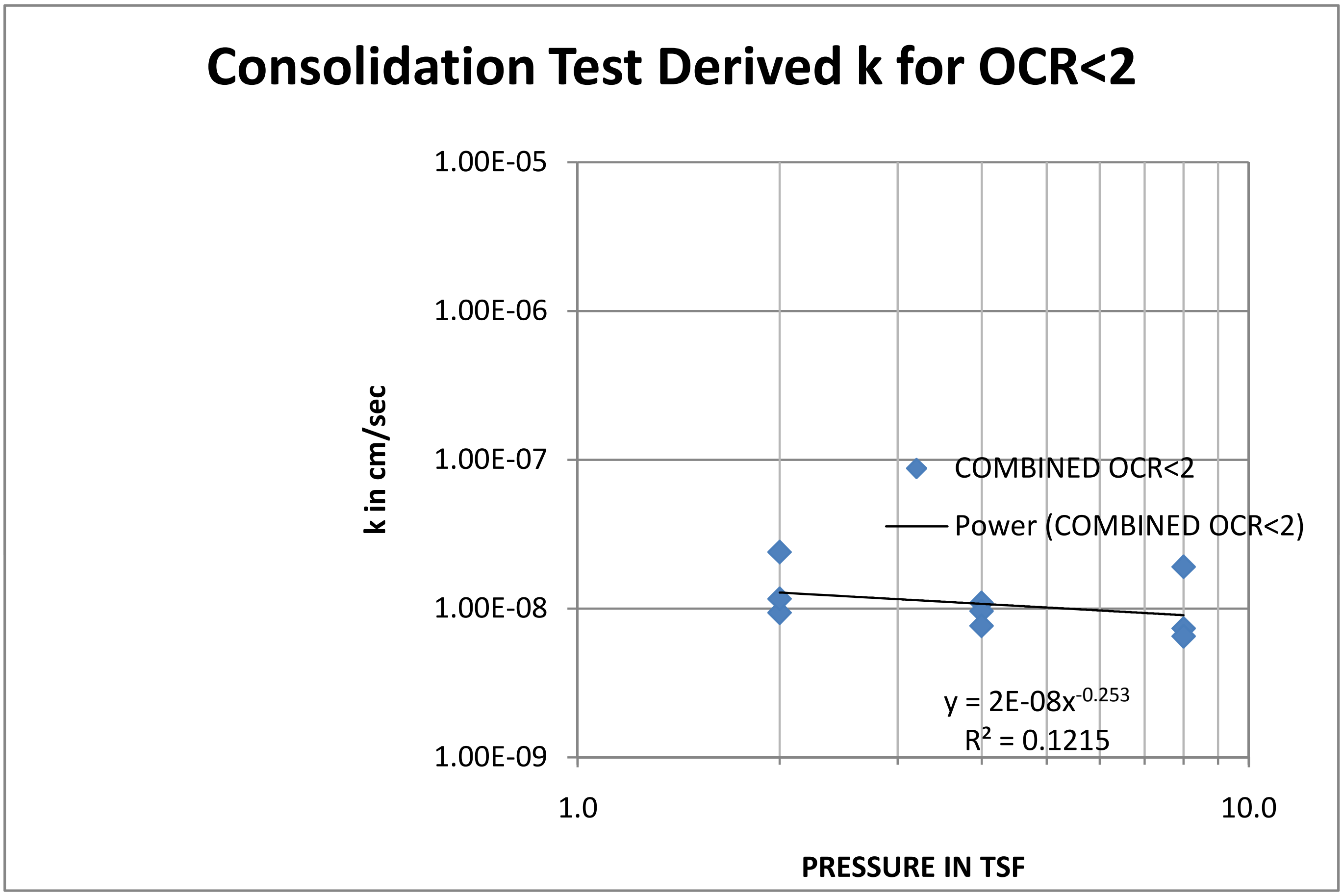
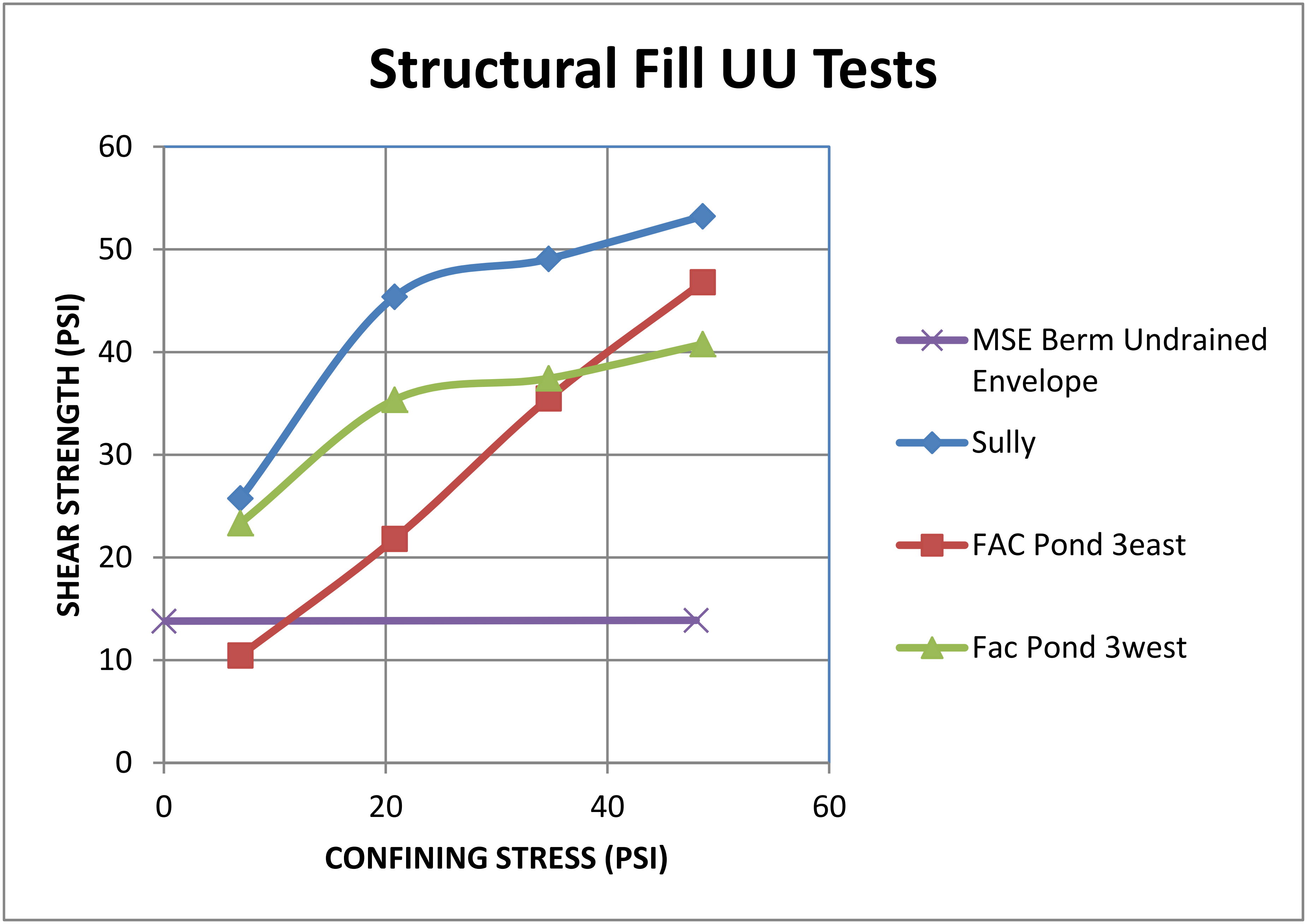
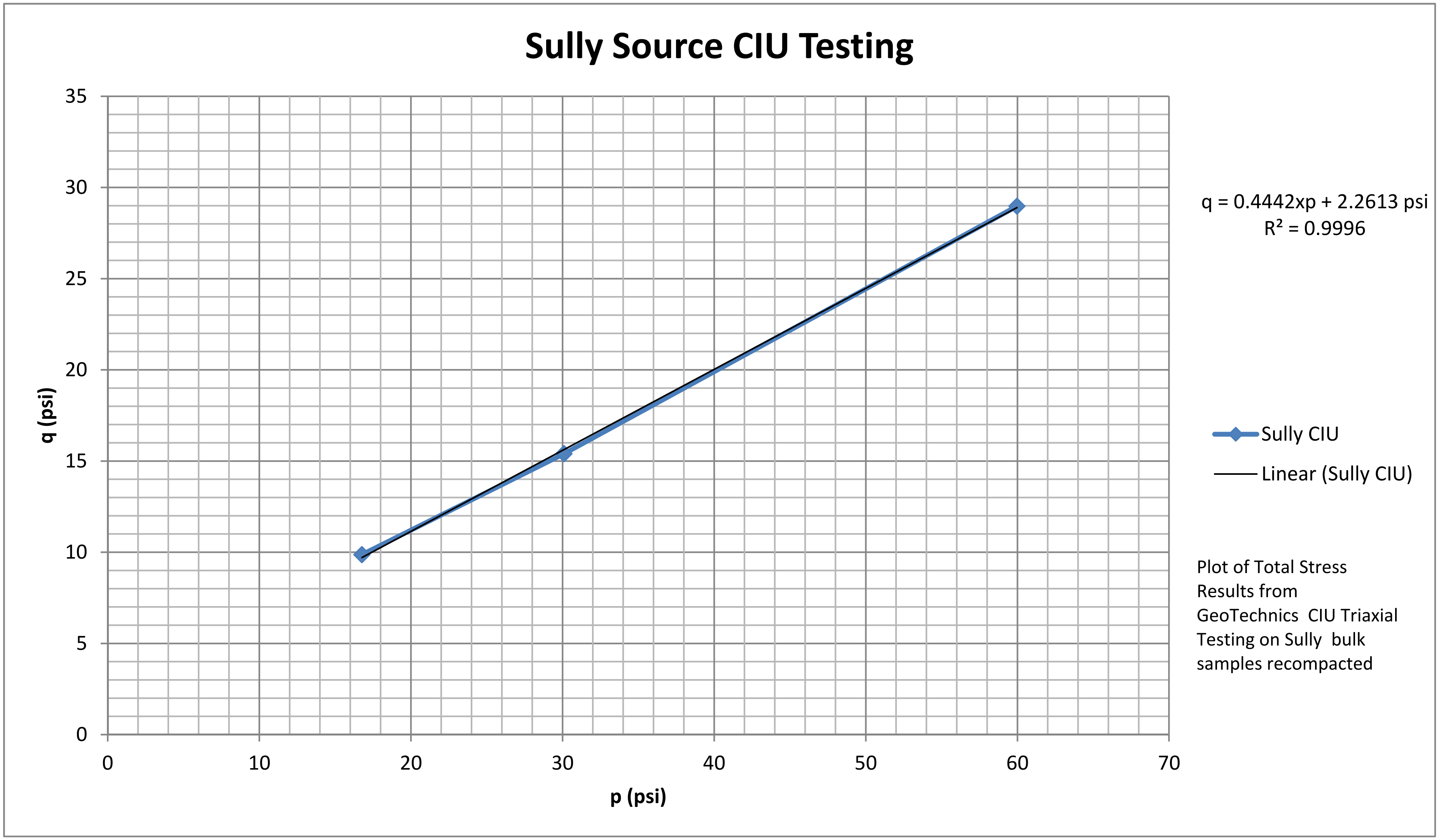
FIGURES


Consolidation Test Derived k
1.00E-05
1.00E-06
1.00E-07
1.00E-08
1.00E-09
k in cm/sec
1.0
10.0
PRESSURE IN TSF
3A 14-16
2A 28-30
3A 28-30


Consolidation Test Derived k for OCR<2
k in cm/sec
1.00E-05
1.00E-06
1.00E-07
1.00E-08
1.00E-09
1.0
10.0
PRESSURE IN TSF
COMBINED OCR<2
Power (COMBINED OCR<2)
y = 2E-08x^-0.253
R² = 0.1215

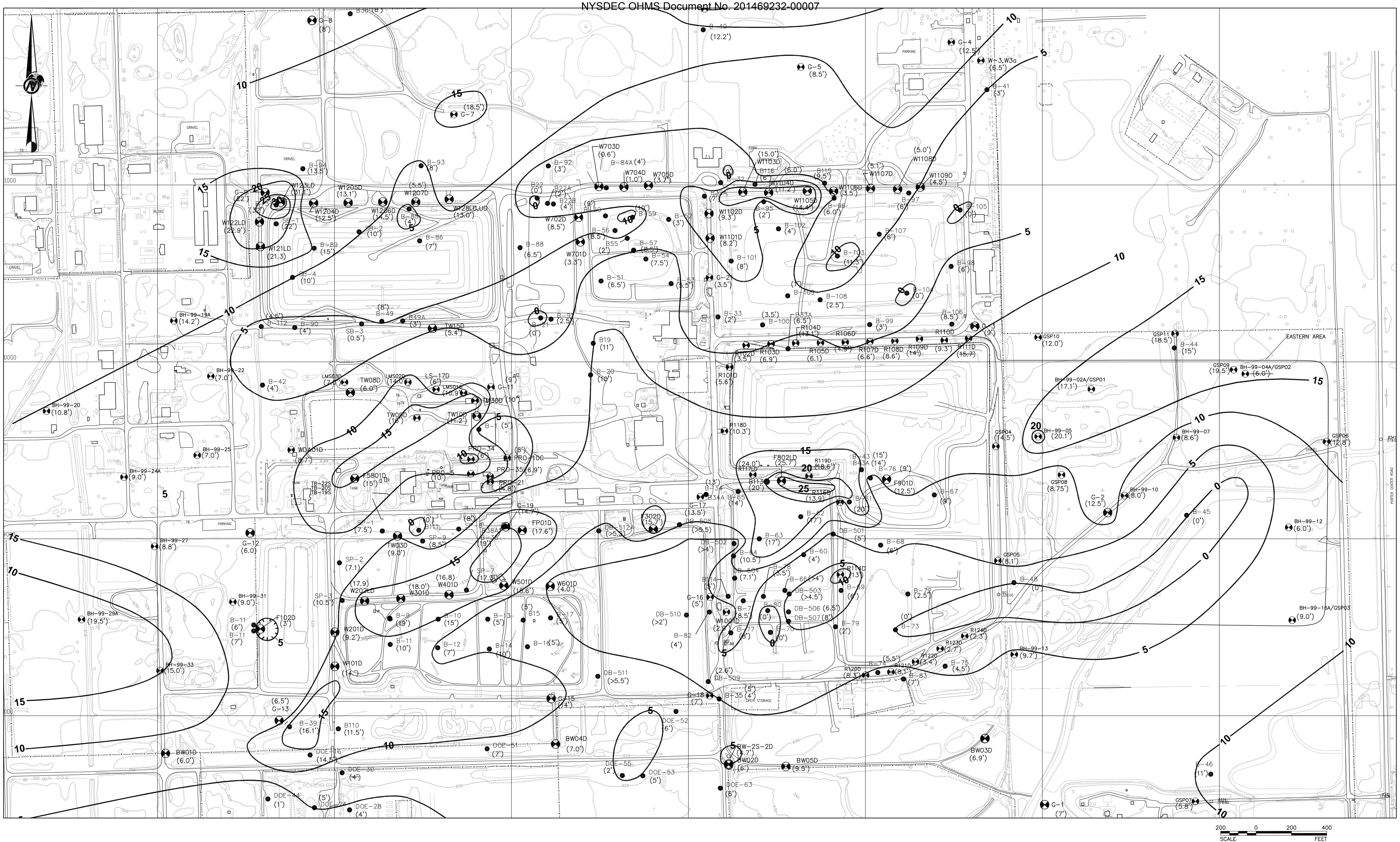

Structural Fill UU Tests
SHEAR STRENGTH (PSI)
60
50
40
30
20
10
0
0
20
40
60
CONFINING STRESS (PSI)
MSE Berm Undrained Envelope
Sully
FAC Pond 3east
Fac Pond 3west



q = 0.4442xp + 2.2613 psi
R^2 = 0.9996

Plot of Total Stress Results from GeoTechnics CIU Triaxial Testing on Sully bulk samples recompacted

ATTACHMENT 1



LEGEND

—— 10 ——	THICKNESS CONTOUR IN FEET SITE DATUM
BW01D	BORING/WELL DESIGNATION
(10.0)	THICKNESS OF GLACIOLACUSTRINE SILT/SAND UNIT IN FEET
⊗	BORINGS BY GOLDER ASSOCIATES
●	BORINGS BY OTHERS

NOTES

1.) CONTOUR INTERPRETATION IS BASED ON BORING DATA FROM THE 1985 HYDROGEOLOGIC CHARACTERIZATION AND SUBSEQUENT STUDIES AT THE MODEL CITY FACILITY CONDUCTED BY GOLDER ASSOCIATES AND OTHERS.

2.) DATA CONCERNING THE VARIOUS STRATAS HAVE BEEN OBTAINED FROM THE BOREHOLES LOCATION ONLY. CONSISTENT WITH GLACIAL ENVIRONMENTS, ABRUPT CHANGES IN SOIL STRATIGRAPHY HAVE BEEN OBSESRVED BETWEEN BOREHOLES OVER SHORT DISTANCES. CONSEQUENTLY, ALTHOUGH CONTOUR INTERPRETATION HAVE BEEN INFERRED FROM THE BOREHOLE DATA, THE ACTUAL CONTOURS MAY VARY FROM THAT SHOWN.

3.) DATA WITH A LINE THROUGH THE VALUE ARE NOT USED IN THE INTERPRETATION DUE TO UNCERTAINTY OF DEPTH PICKS OR CONFLICTING LOCAL STRATIGAPHY INFORMATION.

REFERENCES

1.) BASE MAP COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED MAY 31, 2001 BY AIR SURVEY CORP., DULLES, VIRGINIA.

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

CWM CHEMICAL SERVICES, L.L.C.
MODEL CITY, NEW YORK

TITLE

THICKNESS CONTOURS OF GLACIOLACUSTRINE SILT/SAND UNIT

Golder Associates
Buffalo USA

PROJECT No.		013-9309	FILE No.	0139309B151
DESIGN	JPR	01/07/02	SCALE AS SHOWN	REV. 0
CADD	AM/JPR	10/03/02		
CHECK				
REVIEW				

FIGURE 3

ATTACHMENT 2

CLIENT: CWM

PROJECT RMU-2

JOB No: 154.002

DATE: 8/21/09

CALCULATION BY Peter Carey

ATTATCHMENT 1 OF APPENDIX A-1

OBJECT: Use 1d consolidation data to obtain consolidation related k values from c_v using Terzaghi's consolidation theory.

using the definition of c_v $$k(c_v) = \frac{G_s \cdot a_v \cdot c_v \cdot \gamma_w}{1 + e_0}$$ for a given stress range

where the definitions of terms are

definitions :=

	1	2
1	"Term"	"Definition"
2	"k"	"permeability"
3	"Gs"	"soil specific gravity"
4	"cv"	"Coefficient of consolidation"
5	"γ.w"	("initial void ratio")ater"
6	"a.v"	coefficient of compressibility, -de/dp'"
7	"e0"	"initial void ratio"

using consolidation data one can determine the c_v and strain corresponding to each load and initial void ratio and specific gravity (measured for supporting data information). Data is available for eacl load in an array providing load, strain, and c_v. Importing the data from the test

Sample 28-30 from SB-02-3A

$e_{0rep} := .5597$ $G_s := 2.75$ $r := \frac{2.5}{2}\text{in}$ $w_{d0} := 103.24\text{gm}$ $h_0 := 0.75\text{in}$

$V_0 := \pi r^2 \cdot h_0$ $v_s := \frac{w_{d0}}{G_s \cdot \gamma_w}$ $v_s = 2.292 \cdot \text{in}^3$ $e_0 := \frac{V_0 - v_s}{v_s} = 0.606$

$V_0 = 3.682 \cdot \text{in}^3$

note the deviation from that report, incorrect specific gravity (2.8) was used in report

$MC_0 := \frac{22.8gm}{w_{d0}} = 0.221$ based on the intial wet and final dry weigths reported

$\gamma_{d0} := \frac{w_{d0}}{V_0} = 106.83 \frac{lb}{ft^3}$

$\gamma_{t0} := \left(1 + MC_0\right)\gamma_{d0} = 130.423 \frac{lb}{ft^3}$

data :=

	1	2	3	4
1	"load tsf"	"strain"	'cv if ft^2/day"	
2	0	0	0	
3	0.25	0.024	0.008	
4	0.5	0.0392	0.02	
5	1	0.0528	0.007	
6	2	0.0683	0.02	
7	1	0.0703	0.08	
8	2	0.0731	0.07	
9	4	0.0911	0.04	
10	8	0.1235	0.03	
11				
12				
13				

$n := rows(data) = 10$ $\quad i := 2..n$

$j := 2..n - 1$

$e_i := e_0 - \text{data}_{i,2} \cdot (1 + e_0)$ $\quad$ $p_i := \text{data}_{i,1}\, 2000 \frac{lb}{ft^2}$

$c_{v_i} := \text{data}_{i,3} \cdot \frac{ft^2}{day}$ $\quad$ $a_{v_1} := 0$ $\quad$ $a_{v_j} := \frac{e_0 - \text{data}_{j+1,2} \cdot (1 + e_0) - e_j}{p_{j+1} - p_j}$

$z := 2..9$

$k_z := \frac{G_s \cdot a_{v_z} \cdot c_{v_{z+1}} \cdot \gamma_w}{1 + e_0}$

$$k = \begin{pmatrix} 0 \\ -2.325 \times 10^{-8} \\ -3.681 \times 10^{-8} \\ -5.763 \times 10^{-9} \\ -9.383 \times 10^{-9} \\ 4.843 \times 10^{-9} \\ -5.933 \times 10^{-9} \\ -1.09 \times 10^{-8} \\ -7.355 \times 10^{-9} \end{pmatrix} \cdot \frac{cm}{sec}$$

this data can be used to generate a k vs overburden function, but needs to be corrected for the likelyhood of vertical drainage being better in the field.

Sample 14-16 ftfrom SB-02-3A

$e_{0rep} := .501$ $\quad$ $G_s := 2.75$ $\quad$ $r := \frac{2.5}{2} in$ $\quad$ $w_{d0} := 111.16gm$ $\quad$ $h_0 := 0.75in$

$V_0 := \pi r^2 \cdot h_0$ $\quad$ $v_s := \frac{w_{d0}}{G_s \cdot \gamma_w}$ $\quad$ $v_s = 2.468 \cdot in^3$ $\quad$ $e_0 := \frac{V_0 - v_s}{v_s} = 0.492$

$V_0 = 3.682 \cdot in^3$

note the deviation from that report, incorrect specific gravity (2.8) was used in report

$MC_0 := \frac{20.81gm}{w_{d0}} = 0.187$based on the intial wet and final dry weigths reported

$\gamma_{d0} := \frac{w_{d0}}{V_0} = 115.026 \frac{lb}{ft^3}$

$\gamma_{t0} := (1 + MC_0)\gamma_{d0} = 136.56 \frac{lb}{ft^3}$

data :=

	1	2	3	4
1	"load tsf"	"strain"	'cv if ft^2/day"	
2	0	0	0	
3	0.25	0.0068	0.0401	
4	0.5	0.0136	0.0143	
5	1	0.0213	0.0165	
6	2	0.0342	0.0298	
7	1	0.0357	0.0743	
8	2	0.0377	0.132	
9	4	0.0509	0.0482	
10	8	0.0743	0.0368	
11				
12				
13				

$n := \mathrm{rows}(\mathrm{data}) = 10 \qquad i := 2 .. n$

$j := 2 .. n - 1$

$$e_i := e_0 - \mathrm{data}_{i,2} \cdot \left(1 + e_0\right) \qquad p_i := \mathrm{data}_{i,1}\, 2000 \frac{\mathrm{lb}}{\mathrm{ft}^2}$$

$$c_{v_i} := \mathrm{data}_{i,3} \cdot \frac{\mathrm{ft}^2}{\mathrm{day}} \qquad a_{v_1} := 0 \qquad a_{v_j} := \frac{e_0 - \mathrm{data}_{j+1,2} \cdot \left(1 + e_0\right) - e_j}{p_{j+1} - p_j}$$

$z := 2 .. 9$

$$k_z := \frac{G_s \cdot a_{v_z} \cdot c_{v_{z+1}} \cdot \gamma_w}{1 + e_0} \qquad k = \begin{pmatrix} 0 \\ -3.301 \times 10^{-8} \\ -1.177 \times 10^{-8} \\ -7.691 \times 10^{-9} \\ -1.164 \times 10^{-8} \\ 3.373 \times 10^{-9} \\ -7.991 \times 10^{-9} \\ -9.629 \times 10^{-9} \\ -6.516 \times 10^{-9} \end{pmatrix} \cdot \frac{\mathrm{cm}}{\mathrm{sec}}$$

Sample 28-30 ftfrom SB-02-2A

$e_{0rep} := 1.202 \quad G_s := 2.75 \quad r := \frac{2.5}{2}\text{in} \quad w_{d0} := 77.04\text{gm} \quad h_0 := 0.75\text{in}$

$V_0 := \pi r^2 \cdot h_0 \quad v_s := \frac{w_{d0}}{G_s \cdot \gamma_w} \quad v_s = 1.71 \cdot \text{in}^3 \quad e_0 := \frac{V_0 - v_s}{v_s} = 1.153$

$V_0 = 3.682 \cdot \text{in}^3$

note the deviation from that report, incorrect specific gravity (2.8) was used in report

$MC_0 := \frac{33.12\text{gm}}{w_{d0}} = 0.43$ based on the intial wet and final dry weigths reported

$\gamma_{d0} := \frac{w_{d0}}{V_0} = 79.719 \frac{\text{lb}}{\text{ft}^3}$

$\gamma_{t0} := \left(1 + MC_0\right)\gamma_{d0} = 113.991 \frac{\text{lb}}{\text{ft}^3}$

data :=

	1	2	3	4
1	"load tsf"	"strain"	'cv if ft^2/day"	
2	0	0	0	
3	0.25	0.0063	0.053	
4	0.5	0.0252	0.0131	
5	1	0.0365	0.017	
6	2	0.0576	0.0375	
7	1	0.0607	0.0295	
8	2	0.0645	0.0398	
9	4	0.0943	0.017	
10	8	0.1311	0.0394	
11				
12				
13				

$n := \text{rows(data)} = 10 \quad i := 2 .. n$

$j := 2 .. n - 1$

$e_i := e_0 - \text{data}_{i,2} \cdot \left(1 + e_0\right) \quad p_i := \text{data}_{i,1}\, 2000 \frac{\text{lb}}{\text{ft}^2}$

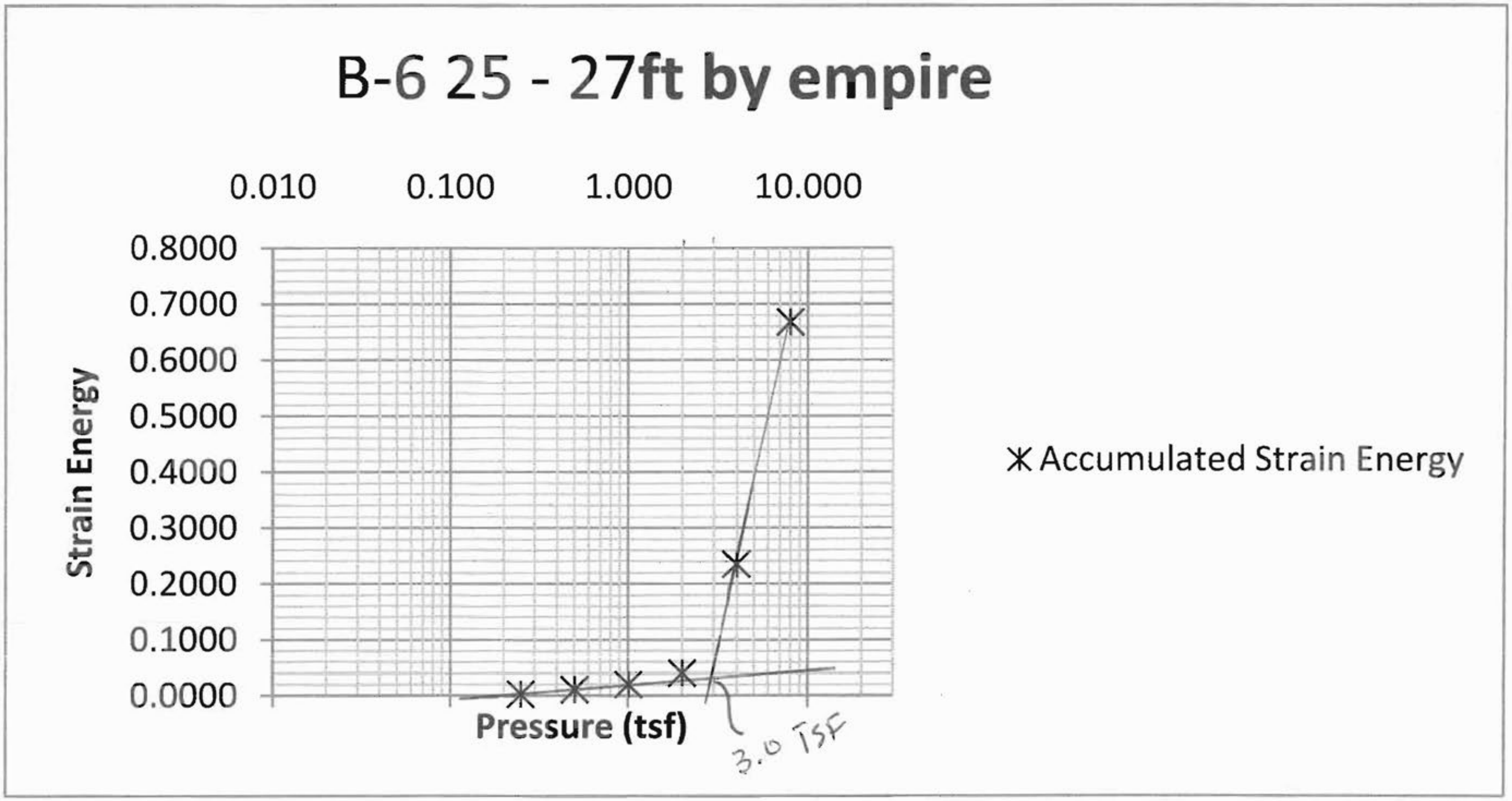
$c_{v_i} := \text{data}_{i,3} \cdot \frac{\text{ft}^2}{\text{day}} \quad a_{v_1} := 0 \quad a_{v_j} := \frac{e_0 - \text{data}_{j+1,2} \cdot \left(1 + e_0\right) - e_j}{p_{j+1} - p_j}$

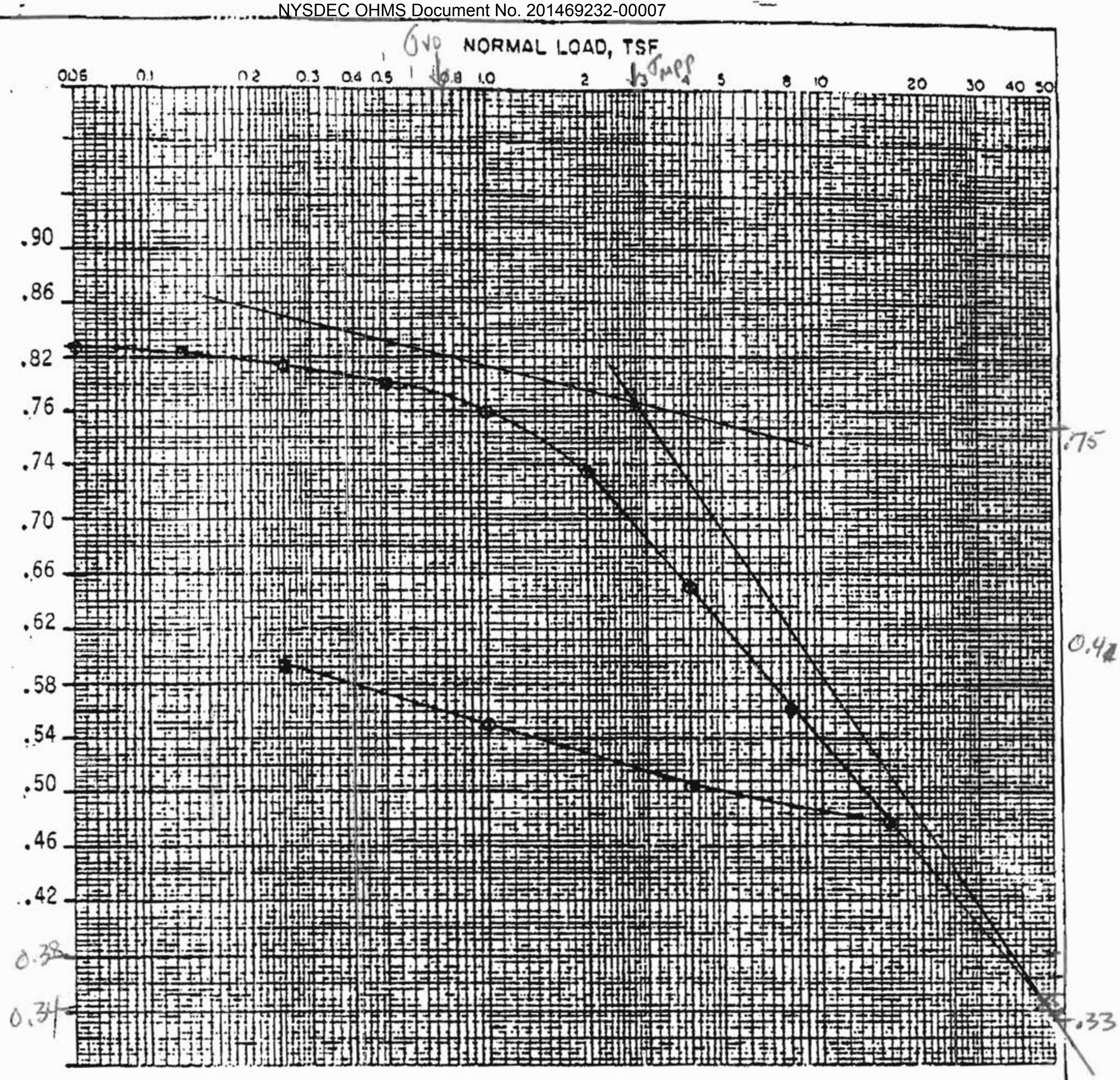
$z := 2 .. 9$

$$k_z := \frac{G_s \cdot a_{v_z} \cdot c_{v_{z+1}} \cdot \gamma_w}{1 + e_0}$$

$$k = \begin{pmatrix} 0 \\ -4.043 \times 10^{-8} \\ -2.998 \times 10^{-8} \\ -1.163 \times 10^{-8} \\ -2.395 \times 10^{-8} \\ 2.768 \times 10^{-9} \\ -4.578 \times 10^{-9} \\ -7.667 \times 10^{-9} \\ -1.097 \times 10^{-8} \end{pmatrix} \cdot \frac{cm}{sec}$$

ATTACHMENT 3


B-6 25 - 27ft by empire
0.010
0.100
1.000
10.000
0.8000
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
Strain Energy
Pressure (tsf)
3.0 TSF
Accumulated Strain Energy



SPECIMEN DATA	INITIAL	FINAL
MOISTURE CONTENT, %	31.8	27.4
VOID RATIO, e	.8260	.6592
DEGREE OF SATURATION, %	102.2	110.0
DRY DENSITY, pcf	90.6	——
HEIGHT, INCHES	1.000	0.909
DIAMETER, INCHES	2.50	——

TEST ANALYSIS:

EFFECTIVE IN-SITU PRESSURE, tsf -

PRECONSOLIDATION PRESS., tsf 1.6

NET PRECONSOLIDATION PRESS., tsf -

COMPRESSION INDEX, C_c ~~.28~~ .42

RECOMPRESSION INDEX, C_r ~~.036~~ .06

RELATED TESTS:

SPECIFIC GRAVITY 2.65

ORGANIC CONTENT, % ____

LIQUID LIMIT, % -

PLASTIC LIMIT, % -

PLASTICITY INDEX -

LIQUIDITY INDEX -

PERCENT CLAY SIZE -

ACTIVITY -

UNDRAINED SHEAR STRENGTH, s_u, psf -

DRAWN BY: TH

CHECKED BY CK

SAMPLE DATA:

BORING NO. B-6 SURF ELEV. ____

SAMPLE NO ____ DEPTH-FT. 25-27'

VISUAL DESCRIPTION: See Tube Log

EMPIRE

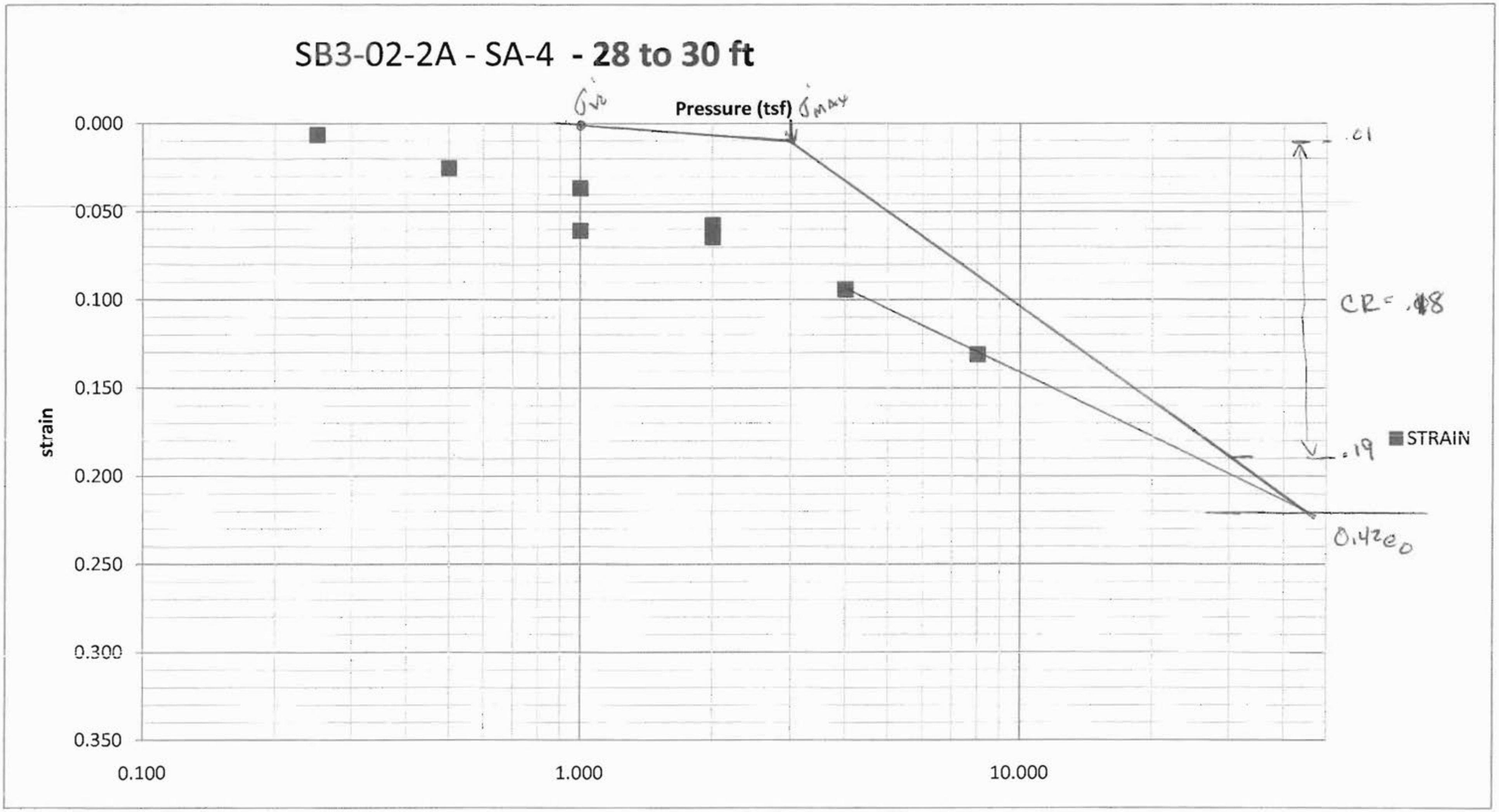
CONSOLIDATION TEST REPORT

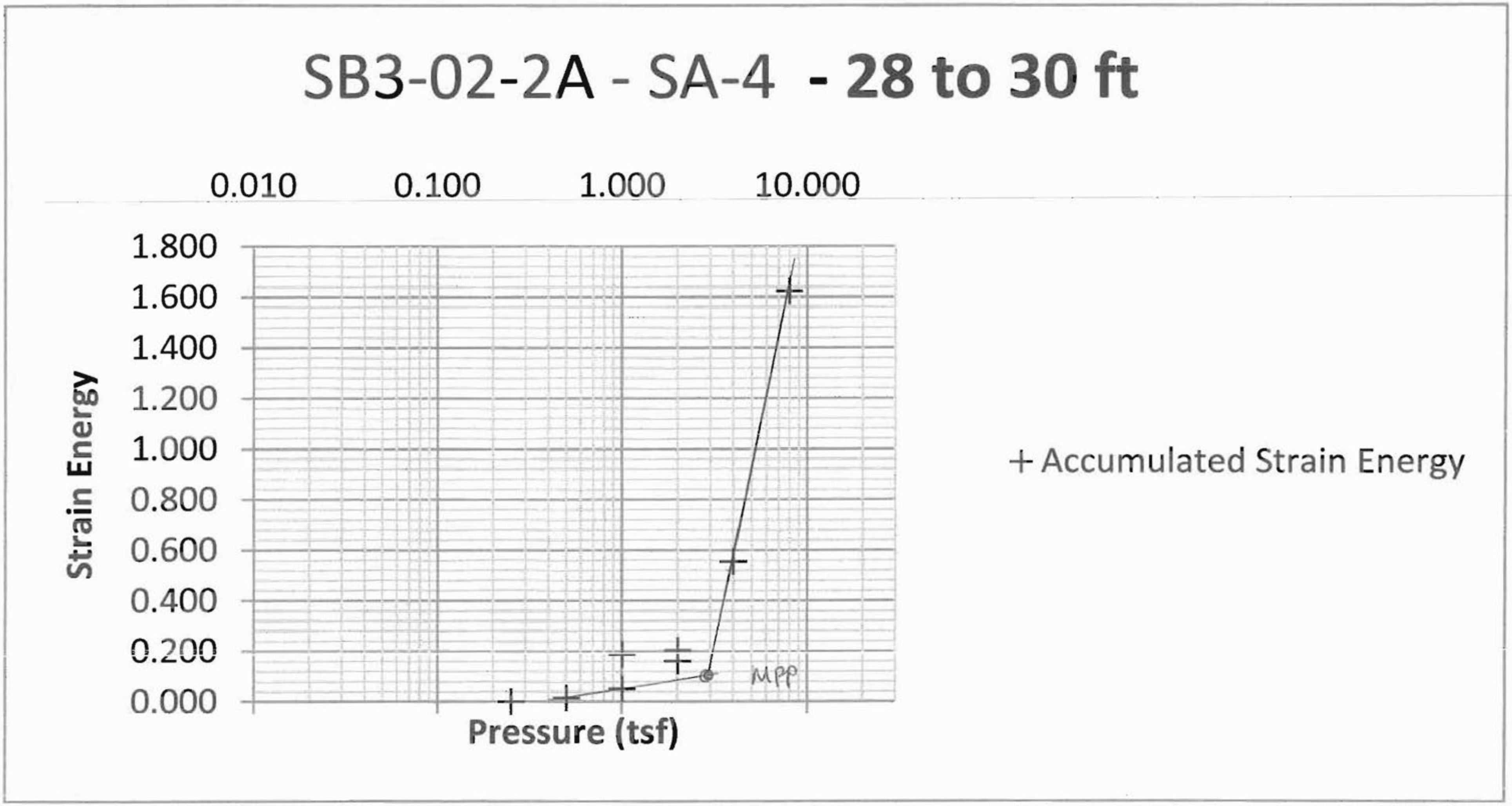
SCA-Model
SLF - 13
Donahue Associates

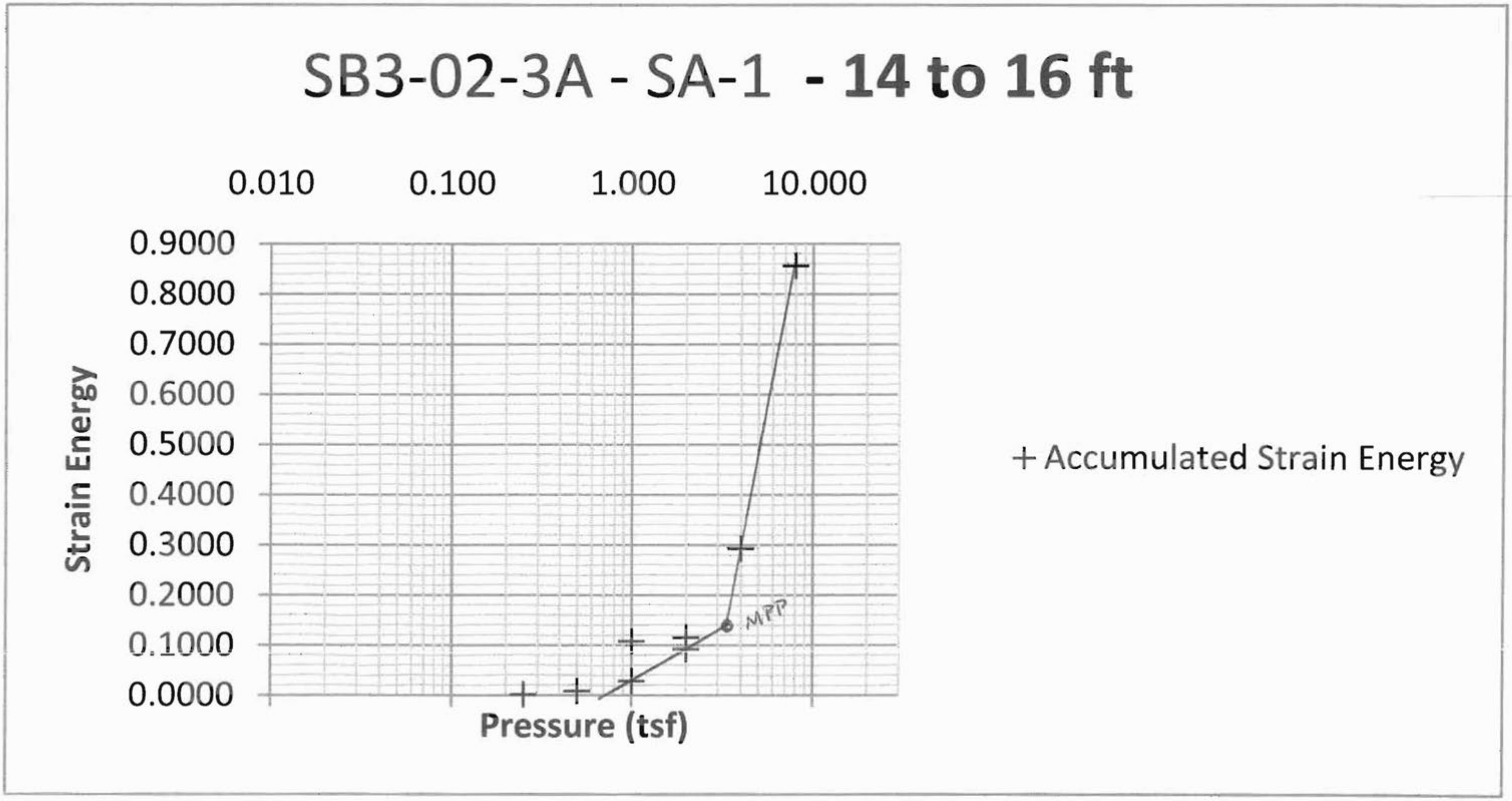
REPORT NO: L-4

DATE: 7-21-88

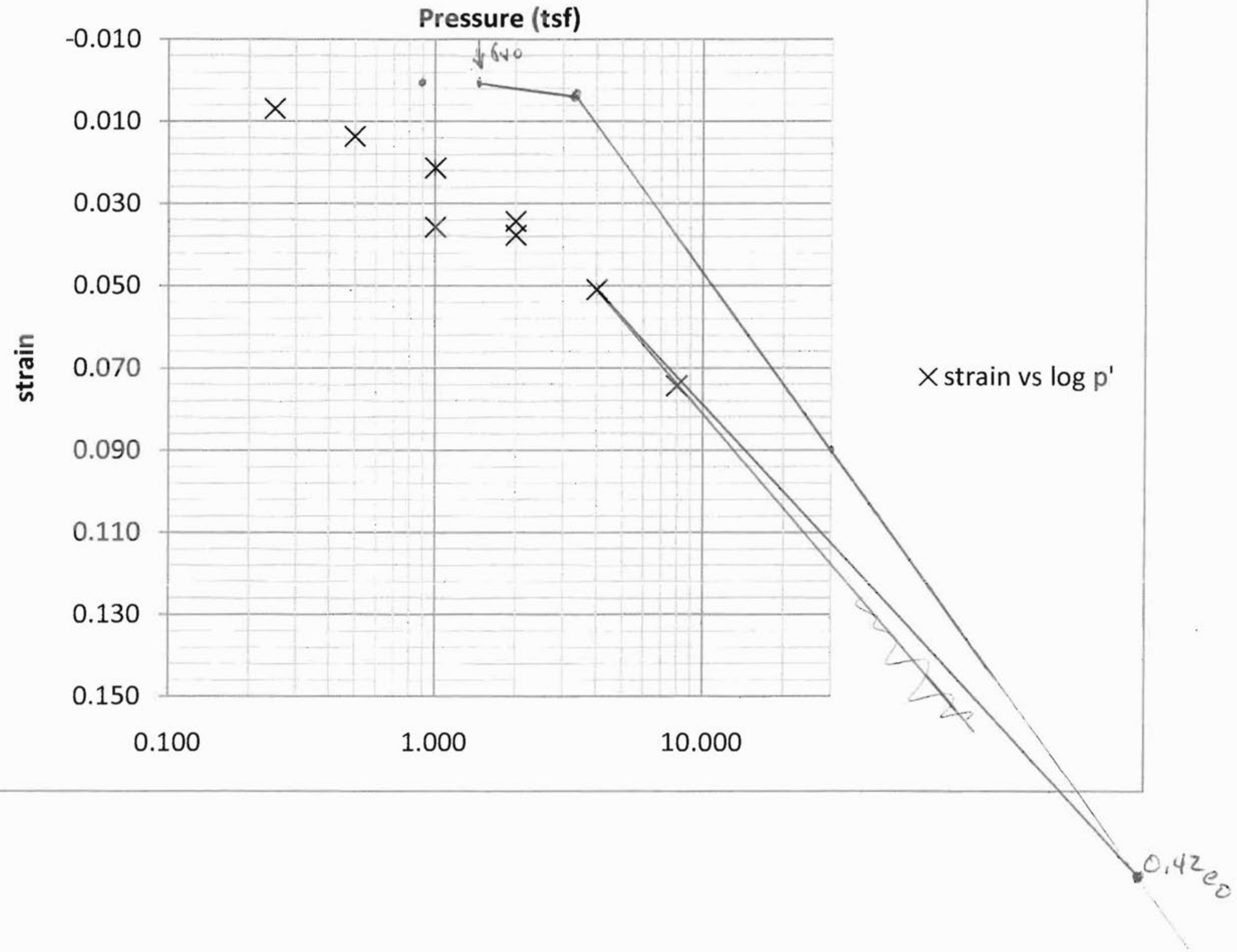
PROJ. NO.: BD-88-52

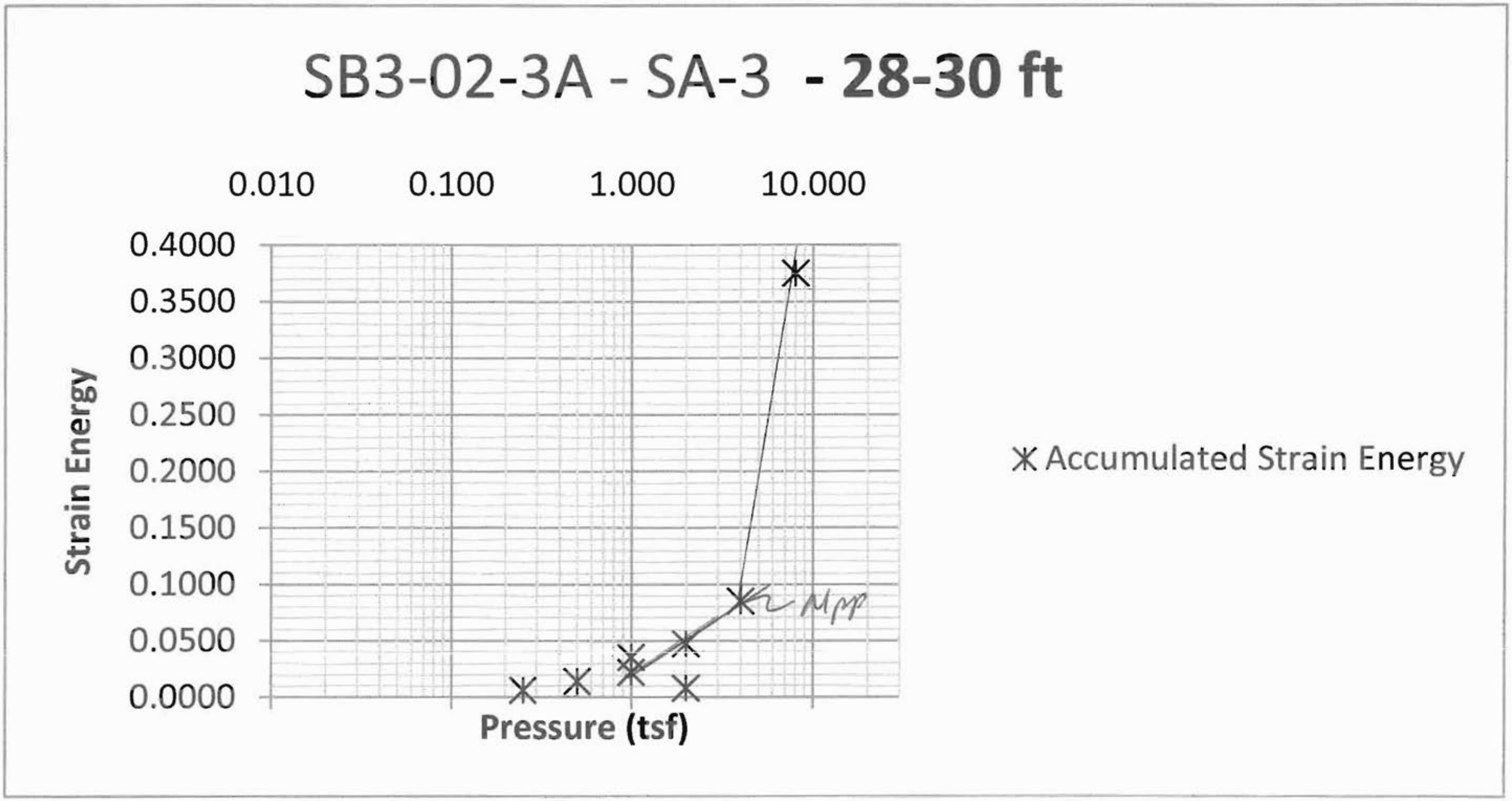

SB3-02-2A - SA-4 - 28 to 30 ft
Pressure (tsf)
σ'vo
σ'max
strain
0.000
0.050
0.100
0.150
0.200
0.250
0.300
0.350
0.100
1.000
10.000
STRAIN
.01
CR = .18
.19
0.42e0


SB3-02-2A - SA-4 - 28 to 30 ft
0.010
0.100
1.000
10.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Strain Energy
Pressure (tsf)
MPP
+ Accumulated Strain Energy


SB3-02-3A - SA-1 - 14 to 16 ft
0.010
0.100
1.000
10.000
0.9000
0.8000
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
Strain Energy
Pressure (tsf)
MPP
+ Accumulated Strain Energy

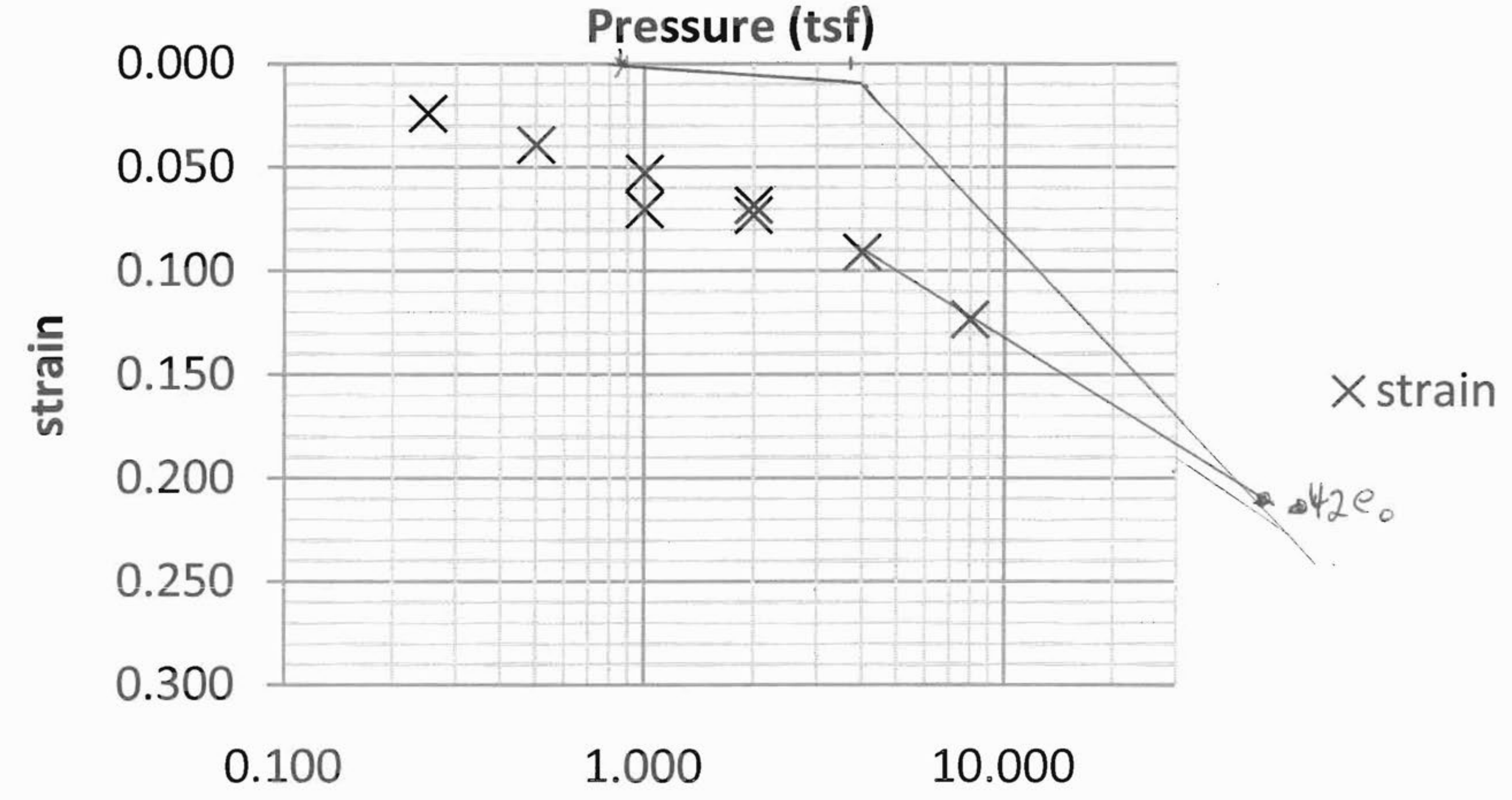
SB3-02-3A - SA-1 - 14 to 16 ft





SB3-02-3A - SA-3 **- 28-30 ft**

SB3-02-3A - SA-3 - **28-30ft**



ATTACHMENT 4

TABLE 1
SUMMARY OF STRATIGRAPHIC UNITS TYPICAL INDEX PROPERTIES AND HYDRAULIC CONDUCTIVITY VALUES
ANNUAL GROUNDWATER INTERPRETATION REPORT
MODEL CITY TSD FACILITY
MODEL CITY, NEW YORK

LITHOSTRATIGRAPHIC UNIT	NATURAL MOISTURE CONTENT Wn (%)	ATTERBERG LIMITS			HYDRAULIC CONDUCTIVITY K(CM/S)			HYDROSTRATIGRAPHIC UNIT
		LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	VERTICAL	HORIZONTAL		
UPPER ALLUVIUM (UA) - Stiff to hard, gray, brown to yellow-brown, laminatec fine SAND and/or SILT and/or SILTY CLAY (SM, ML, or CL). Stratified	--	--	--	--	1x10-5	3x10-6		Aquitard
UPPER CLAY TILL (UCT) - Stiff to hard, brown to purple-brown CLAYEY SILT, some coarse to fine sand, little fine gravel (CL). Gravel as limestone and shale clasts. Non-stratified to faintly laminated. Contains occasiona cobbles and discontinuous, wet sand and silt layers.	15	29	16	13	6x10-7 (See text Sections 6.1.7 and 7.4)	2x10-6 3x10-6* 3x10-6**		Aquitard
UPPER SILT TILL (UST) - Compact to very dense, brown to purple-brown SILT and coarse to fine SAND, little fine gravel (ML). Gravel as limestone and shall clasts. Contains occassional discontinuous, wet sand and silt layers	12	NON-PLASTIC						
MIDDLE SILT TILL (MST) - Compact to very dense, gray to gray-brown, SILT and coarse to fine SAND, little fine gravel (ML). Gravel as limestone and shale clasts. Dilatant.	12	NON-PLASTIC			1x10-7	3x10-6		Aquitard
GLACIOLACUSTRINE CLAY (GC) - Very soft to firm, gray to gray-brown, CLAY to SILTY CLAY, some fine sand (CL). Occasional gravel sized dropstones throughout. Laminated. Occasional red-brown to gray silt and fine sanc layers. Occasional vertical tubular voids (mollusk burrows).	28	35	19	16	2x10-8	5x10-8		Aquitard
GLACIOLACUSTRINE SILT/SAND (GSS) 1. Stratified coarse sand: Very dense, brown to multi-colored coarse to fine SAND, little silt, little fine gravel (SP-SM). Occasional coarse to fine SAND, and coarse to fine GRAVEL layers. Gravel as limestone clasts. Wet.	13	NON-PLASTIC			--	2x10-4 1x10-4*	3x10-5 1x10-5* 1.6x10-5*	Aquifer
2. Non-stratified silt and fine sand: Compact to very dense, brown, SILT and coarse to fine SAND, little fine gravel (ML). Gravel as limestone clasts. Wet. Poorly sorted (well graded).	11	NON-PLASTIC			--	3x10-5 7x10-6*		Aquifer
3. Stratified silt and fine sand: Compact, brown-gray to brown, SILT, some fine sand (ML) to fine SAND and SILT (SM). Dilatant. Wet. Well sorted (uniformly graded).	16	NON-PLASTIC			--	1x10-5 1x10-5*		Aquifer
4. Interlayered silt, sand, and clay: Soft, gray, SILTY CLAY (CL) laminatec with ½-inch to 6-inch thick SILT (ML) or fine SAND, some SILT (SM) layers spaced 0.1 feet to 0.5 feet apart.	--	--	--	--	--	3x10-6 2x10-6*		Aquifer
BASAL RED TILL (BRT) - Very dense, red-brown, SILT and coarse to fine SAND, little fine gravel (ML). Gravel as limestone and red and green shale clasts Dry. Indurated.	11	NON-PLASTIC			3x10-8	4x10-8		Aquitard

NOTES:

Values are for tests reported in the 1985 "Hydrogeologic Characterization" Report unless otherwise noted

* Values shown for results obtained in 1988 "Hydrogeologic Characterization Update" Report

** Values shown for results obtained in 1993 "Hydrogeologic Characterization Update" Report

ATTACHMENT 5

UGT - Blow count information

Boring	depth	N	strata	Ln N
B-17	11	23	1	3.135494
B-18	6	28	1	3.332205
B-18	11	33	1	3.496508
B-18	16	16	1	2.772589
B-19	6	31	1	3.433987
B-19	11	13	1	2.564949
B-20	6	29	1	3.367296
B-34	6	35	1	3.555348
B-34	11	19	1	2.944439
B-43	6	63	1	4.143135
B-43	11	80	1	4.382027
43	6	63	1	4.143135
43	11	80	1	4.382027
B-60	6	45	1	3.806662
B-60	11	32	1	3.465736
B-61	6	39	1	3.663562
B-61	11	29	1	3.367296
B-62	6	30	1	3.401197
B-62	14	56	1	4.025352
B-62	16	33	1	3.496508
B-63	5	38	1	3.637586
B-63	10	13	1	2.564949
B-68	6	16	1	2.772589
B-68	11	47	1	3.850148
B-68	14	56	1	4.025352
B-68	16	20	1	2.995732
B-71	6	16	1	2.772589
B-71	11	47	1	3.850148
B-71	14	56	1	4.025352
B-71	16	20	1	2.995732
G-11	5	10	1	2.302585
G-11	7	20	1	2.995732
G-11	9	30	1	3.401197
G-11	11	20	1	2.995732
G-15	5	27	1	3.295837
G-15	7	25	1	3.218876
G-15	9	19	1	2.944439
G-15	11	28	1	3.332205
G-15	13	25	1	3.218876
G-16	7	32	1	3.465736
G-16	9	5	1	1.609438
G-16	11	8	1	2.079442
G-18	5	39	1	3.663562
G-18	7	31	1	3.433987
G-18	9	41	1	3.713572
G-18	11	12	1	2.484907
G-21	5	19	1	2.944439
G-21	7	61	1	4.110874
G-21	9	29	1	3.367296
G-21	11	61	1	4.110874
G-21	13	27	1	3.295837
G-21	15	40	1	3.688879
PRO-21	5	26	1	3.258097
PRO-21	7	42	1	3.73767

Statistics

	LN (N) destribution	N
Mean	3.297638191	27.04868
Standard Error	0.051704126	
Median	3.36729583	
Mode	3.465735903	
Standard Deviatior	0.568745385	
Sample Variance	0.323471313	
Kurtosis	0.322995733	
Skewness	-0.525897249	
Range	2.995732274	
Minimum	1.609437912	
Maximum	4.605170186	
Sum	399.0142212	
Count	121	

Boring	depth	N	strata	Ln N
PRO-21	9	11	1	2.397895
PRO-21	11	12	1	2.484907
PRO-21	13	13	1	2.564949
PRO-21	15	10	1	2.302585
PRO-21	17	12	1	2.484907
PRO-21	19	10	1	2.302585
PRO-21	21	10	1	2.302585
PRO-35	5	6	1	1.791759
PRO-35	7	36	1	3.583519
PRO-35	9	20	1	2.995732
PRO-35	11	15	1	2.70805
SB-02-01	4.5	32	1	3.465736
SB-02-01	6.5	34	1	3.526361
SB-02-01	8.5	25	1	3.218876
SB-02-01	10.5	38	1	3.637586
SB-02-01	12.5	37	1	3.610918
SB-02-01	14.5	32	1	3.465736
SB-02-02	4.5	24	1	3.178054
SB-02-02	6.5	31	1	3.433987
SB-02-02	8.5	14	1	2.639057
SB-02-02	10.5	6	1	1.791759
SB-02-02	12.5	13	1	2.564949
SB-02-02	18.5	63	1	4.143135
SB-02-02	20.5	35	1	3.555348
SB-02-02	22.5	26	1	3.258097
SB-02-03	4.5	31	1	3.433987
SB-02-03	6.5	56	1	4.025352
SB-02-03	8.5	27	1	3.295837
SB-02-03	10.5	17	1	2.833213
SB-02-03	12.5	30	1	3.401197
SB-02-03	18.5	15	1	2.70805
SB-02-03	20.5	27	1	3.295837
SB-02-03	22.5	53	1	3.970292
SB-02-04	4.5	34	1	3.526361
SB-02-04	16.5	61	1	4.110874
SB-02-04	18.5	27	1	3.295837
SB-02-04	20.5	24	1	3.178054
SB-02-05	4.5	40	1	3.688879
SB-02-05	6.5	35	1	3.555348
SB-02-05	8.5	12	1	2.484907
SB-02-06	4.5	28	1	3.332205
SB-02-06	6.5	39	1	3.663562
SB-02-06	8.5	13	1	2.564949
SB-02-06	10.5	32	1	3.465736
SB-02-06	12.5	29	1	3.367296
SB-02-06	14.5	18	1	2.890372
SB-02-07	4.5	32	1	3.465736
SB-02-07	6.5	50/6	1	#VALUE!
SB-02-07	8.5	20	1	2.995732
SB-02-07	10.5	29	1	3.367296
SB-02-08	4.5	46	1	3.828641
SB-02-08	6.5	35	1	3.555348
SB-02-08	8.5	32	1	3.465736
SB-02-08	12.5	29	1	3.367296
SB-02-08	14.5	41	1	3.713572

Boring	depth	N	strata	Ln N
SB-02-08	16.5	50	1	3.912023
SB-02-08	18.5	37	1	3.610918
SB-02-08	20.5	38	1	3.637586
SB-02-08	22.5	32	1	3.465736
SB-02-03	12.5	30	1	3.401197
SB-02-03	18.5	15	1	2.70805
SB-02-03	20.5	27	1	3.295837
SB-02-03	22.5	53	1	3.970292
SB-02-04	4.5	34	1	3.526361
SB-02-04	16.5	61	1	4.110874
SB-02-04	18.5	27	1	3.295837
SB-02-04	20.5	24	1	3.178054

GC Transition Material

Boring	**depth**	**N**	**strata**	**Ln(N)**
B-19	16	30	2	3.401197
B-20	16	23	2	3.135494
B-20	21	21	2	3.044522
B-20	26	17	2	2.833213
B-34	2	40	2	3.688879
B-34	3.5	50	2	3.912023
B-62	11	29	2	3.367296
G-11	13	33	2	3.496508
G-11	15	54	2	3.988984
G-11	17	30	2	3.401197
G-11	19	39	2	3.663562
G-11	21	25	2	3.218876
G-11	23	18	2	2.890372
G-11	25	17	2	2.833213
G-16	5	16	2	2.772589
G-16	13	29	2	3.367296
G-16	15	17	2	2.833213
G-16	17	26	2	3.258097
G-16	19	36	2	3.583519
G-16	21	16	2	2.772589
G-16	23	23	2	3.135494
G-21	17	42	2	3.73767
G-21	19	57	2	4.043051
G-21	21	25	2	3.218876
G-21	23	55	2	4.007333
G-21	25	41	2	3.713572
G-21	27	45	2	3.806662
SB-02-01	16.5	33	2	3.496508
SB-02-01	18.5	17	2	2.833213
SB-02-01	20.5	24	2	3.178054
SB-02-01	22.5	17	2	2.833213

geometric

	Ln(N)	N
Mean	3.335502956	28.09251
Standard Error	0.075095908	
Median	3.312696184	
Mode	2.833213344	
Standard Deviation	0.411317227	
Sample Variance	0.169181861	
Kurtosis	-1.195617848	
Skewness	0.17438244	
Range	1.270462546	
Minimum	2.772588722	
Maximum	4.043051268	
Sum	100.0650887	
Count	30	

GSS Blow Counts

Boring	Depth	N	strata	N effective	Ln(N)
B-17	31	17	4	17	2.833213
B-18	36	95	4	95	4.553877
B-18	41	115	4	100	4.60517
B-19	31	85	4	85	4.442651
B-19	36	80	4	80	4.382027
B-20	36	33	4	33	3.496508
B-34	36	45	4	45	3.806662
B-34	41	46	4	46	3.828641
B-43	31	26	4	26	3.258097
B-43	36	100/.5	4	100	4.60517
B-43	41	34	4	34	3.526361
43	31	26	4	26	3.258097
43	36	100/.5	4	100	4.60517
43	41	34	4	34	3.526361
B-60	36	160	4	100	4.60517
B-61	26	13	4	13	2.564949
B-61	31	81	4	81	4.394449
B-61	36	70	4	70	4.248495
B-61	41	63	4	63	4.143135
B-62	31	29	4	29	3.367296
B-62	36	100	4	100	4.60517
B-62	41	100	4	100	4.60517
B-63	27	52	4	52	3.951244
B-63	29	36	4	36	3.583519
B-63	31	36	4	36	3.583519
B-63	33	65	4	65	4.174387
B-63	35	230	4	100	4.60517
B-63	37	230	4	100	4.60517
B-63	38.5	600	4	100	4.60517
B-63	40	600	4	100	4.60517
B-68	35	29	4	29	3.367296
B-68	36	16	4	16	2.772589
B-71	35	29	4	29	3.367296
B-71	36	16	4	16	2.772589
G-11	27	68	4	68	4.219508
G-11	29	54	4	54	3.988984
G-11	31	61	4	61	4.110874
G-11	33	85	4	85	4.442651
G-11	35	37	4	37	3.610918
G-16	29	6	4	6	1.791759
G-16	31	8	4	8	2.079442
G-16	33	19	4	19	2.944439
G-18	31	17	4	17	2.833213
G-18	33	44	4	44	3.78419
G-18	35	19	4	19	2.944439
G-18	37	54	4	54	3.988984
G-21	39	41	4	41	3.713572
G-21	41	64	4	64	4.158883
PRO-21	25	24	4	24	3.178054
PRO-21	31	10	4	10	2.302585
PRO-21	33	51	4	51	3.931826
PRO-35	27	19	4	19	2.944439
PRO-35	29	33	4	33	3.496508
PRO-35	31	33	4	33	3.496508
SB-02-01	24.5	23	4	23	3.135494

Ln(Neff)		N
Mean	3.825974	45.87746
Standard Error	0.078716	
Median	3.951244	
Mode	4.60517	
Standard Deviation	0.708443	
Sample Variance	0.501892	
Kurtosis	-0.28294	
Skewness	-0.67816	
Range	2.813411	
Minimum	1.791759	
Maximum	4.60517	
Sum	309.9039	
Count	81	

Boring	Depth	N	strata	N effective	Ln(N)
SB-02-01	26.5	32	4	32	3.465736
SB-02-01	28.5	52	4	52	3.951244
SB-02-01	30.5	50/6	4	100	4.60517
SB-02-01	32.5	80	4	80	4.382027
SB-02-01	34.5	50/6	4	100	4.60517
SB-02-02	34.5	15	4	15	2.70805
SB-02-02	36.5	33	4	33	3.496508
SB-02-02	38.5	50	4	50	3.912023
SB-02-02	40.5	50/6	4	100	4.60517
SB-02-02	44	50/3	4	100	4.60517
SB-02-03	34.5	17	4	17	2.833213
SB-02-04	35.5	23	4	23	3.135494
SB-02-04	37.5	33	4	33	3.496508
SB-02-04	39.5	56	4	56	4.025352
SB-02-04	41	55/6	4	100	4.60517
SB-02-05	26.5	59/8	4	100	4.60517
SB-02-05	28.5	74	4	74	4.304065
SB-02-06	24.5	22	4	22	3.091042
SB-02-06	26.5	50/6	4	100	4.60517
SB-02-06	28.5	74	4	74	4.304065
SB-02-07	26.5	69	4	69	4.234107
SB-02-07	28.5	50	4	50	3.912023
SB-02-07	30.5	50/6	4	100	4.60517
SB-02-07	32.5	50/6	4	100	4.60517
SB-02-07	34.5	70	4	70	4.248495
SB-02-07	36	60/6	4	100	4.60517

ATTACHMENT 6

P.J.Carey & Associates, P.C.

CLIENT : CWM SHEET 1 OF 3

PROJECT: RMU-2 DATE:6/17/09

PJCA-JOB No.:

PERFORMED BY: Peter J. Carey

SUBJECT: RMU-2 Triaxial Data

Object of Worksheet:Determine information from test forms of triaxial compression tests with pore pressure

B -5 20-22ft B-6 25-27ft B -9 at 20-22 ft
tests by empire

$$data\_a := \begin{pmatrix} 22.1 & 15.4 & 15 \\ 34.6 & 21.9 & 30 \\ 61.4 & 37.2 & 60 \end{pmatrix} \qquad data\_b := \begin{pmatrix} 20.6 & 13.4 & 15 \\ 36 & 22.4 & 30 \\ 67 & 40.5 & 60 \end{pmatrix} \qquad data\_c := \begin{pmatrix} 19.7 & 12.7 & 15 \\ 38.4 & 23.4 & 30 \\ 74.4 & 43.4 & 60 \end{pmatrix}$$

$data := stack(data\_a, data\_b, data\_c)$ combines the data from the three tests

$$\sigma'_1 := data^{\langle 1 \rangle}\,psi \qquad q := \frac{data^{\langle 2 \rangle}}{2}\,psi \qquad p' := \left(data^{\langle 1 \rangle} - \frac{data^{\langle 2 \rangle}}{2}\right)psi$$

$$data1^{\langle 1 \rangle} := \frac{p'}{psf}$$

array of p' and q and σ'_3 taken at maximum obliquity

$$data1^{\langle 2 \rangle} := \frac{q}{psf}$$

$$fit := line\left(data1^{\langle 1 \rangle}, data1^{\langle 2 \rangle}\right) \qquad fit = \begin{pmatrix} 211.836 \\ 0.393 \end{pmatrix} \qquad stderr\left(data1^{\langle 1 \rangle}, data1^{\langle 2 \rangle}\right) = 57.334$$

$$\varphi' := asin\left(fit_2\right) \qquad \varphi' = 23.166 \cdot deg$$

$$c' := \frac{fit_1}{\cos(\varphi')}\,psf \qquad c' = 230.415 \cdot psf$$

for a linear fit, note the significant cohesion intercept which is not indicative of actual behavior at very low effective stress

if a function is used that is based on ϕ and normal stress, the p and q information must first be converted to N and τ on the plane of failure at the time of failure

$$\varphi_L := \operatorname{asin}\left(\frac{\text{data1}^{\langle 2\rangle}}{\text{data1}^{\langle 1\rangle}}\right)$$

$$\varphi_L = \begin{pmatrix}32.325\\27.581\\25.759\\28.817\\26.847\\25.668\\28.402\\25.989\\24.316\end{pmatrix}\cdot\text{deg}$$

$$\sigma'_n := \overrightarrow{\frac{\text{data1}^{\langle 2\rangle}}{\tan(\varphi_L)}}$$

$$\sigma'_n = \begin{pmatrix}1.752\times10^{3}\\3.019\times10^{3}\\5.551\times10^{3}\\1.754\times10^{3}\\3.186\times10^{3}\\6.068\times10^{3}\\1.691\times10^{3}\\3.456\times10^{3}\\6.916\times10^{3}\end{pmatrix}$$

$$q_f := \text{data1}^{\langle 2\rangle}$$

$$q_f = \begin{pmatrix}1.109\times10^{3}\\1.577\times10^{3}\\2.678\times10^{3}\\964.8\\1.613\times10^{3}\\2.916\times10^{3}\\914.4\\1.685\times10^{3}\\3.125\times10^{3}\end{pmatrix}$$

determine the fit of the data to the model

$$100\text{kPa} = 2.089\times10^{3}\cdot\text{psf}$$

$$q(\sigma'_n) = \sigma'_n\cdot\tan(\varphi_{p100})\cdot\left(\frac{100\text{kPa}}{\sigma'_n}\right)^{1-m_p}$$

where the 100 refers to the values at 100 kPa
(based on work by Mesri and others)

define genfit vectors, to allow the generic equation fit function built into Mathcad to be utilized. Vectors are the function, and the partial derivatives of the function for each of the constants being sought. The function is redined so that tan ϕ_{p100} is A and 1-m_p is b

$$F(n, A, b) := \begin{bmatrix} A\cdot n\cdot\left(\frac{2089}{n}\right)^{b} \\ n\cdot\left(\frac{2089}{n}\right)^{b} \\ A\cdot n\cdot\ln\left(\frac{2089}{n}\right)\cdot\left(\frac{2089}{n}\right)^{b} \end{bmatrix}$$

$$\text{guess} := \begin{pmatrix}.53\\.5\end{pmatrix}$$ values of a and b

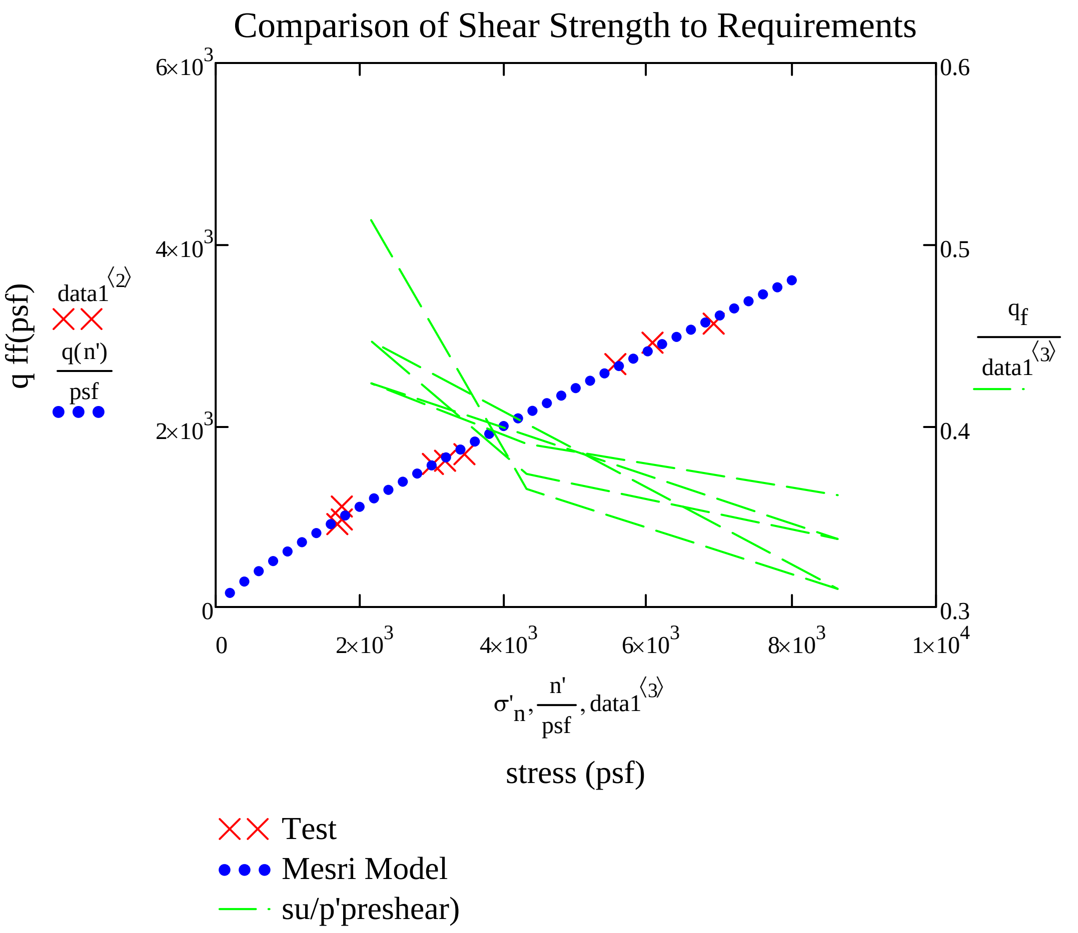
define cg as the matrix containing the best fits for data and the model

$$cg := \mathrm{genfit}\left(\sigma'_n, q_f, guess, F\right) = \begin{pmatrix} 0.549 \\ 0.147 \end{pmatrix} \qquad \varphi_{p100} := \mathrm{atan}\left(cg_1\right) = 28.766 \cdot deg$$

$$m_p := 1 - cg_2 = 0.853$$

$data1^{\langle 3 \rangle} := data^{\langle 3 \rangle} \cdot 144$ converting values to psf

$$q(n') := n' \cdot cg_1 \cdot \left(\frac{2089psf}{n'}\right)^{cg_2}$$



note that the data fits well with the model based on phi at a reference pressure and a reduction in the secant ϕ based on the ratio of the reference pressure/normal stress raised to a power. Also it predicts significantly lower drained strengths at very low effective stress, consistent with actual behavior. It should be noted that the consolidated undrained tests from the SB-02 borings experienced leakage during the testing resulting in unuseable results.

P.J.Carey & Associates, P.C.

CLIENT : CWM　　　　　　　　　　SHEET 1 OF 3

PROJECT: RMU-2　　　　　　　　　DATE:6/19/09

PJCA-JOB No.:

PERFORMED BY: Peter J. Carey

SUBJECT: RMU-2 Triaxial Data

Object of Worksheet:Determine information from test forms of triaxial compression tests with pore pressure FOR GC

Evaluation of Sample SB-02-4 28-30ft, shear strength only

$$\mathrm{data1} := \begin{pmatrix} 3153.9 & 1339.5 & 3600 \\ 4812.2 & 2090.6 & 7200 \\ 6933.2 & 2872.4 & 10800 \end{pmatrix} \cdot \mathrm{psf}$$

array of p' and q and σ'_3 taken at maximum obliquity

$$\mathrm{fit} := \mathrm{line}\left(\frac{\mathrm{data1}^{\langle 1\rangle}}{\mathrm{psf}}, \frac{\mathrm{data1}^{\langle 2\rangle}}{\mathrm{psf}}\right) \qquad \mathrm{fit} = \begin{pmatrix} 94.804 \\ 0.404 \end{pmatrix} \qquad \mathrm{stderr}\left(\mathrm{data1}^{\langle 1\rangle}, \mathrm{data1}^{\langle 2\rangle}\right) = 63.924 \cdot \mathrm{psf}$$

$$\varphi' := \mathrm{asin}\left(\mathrm{fit}_2\right) \qquad \varphi' = 23.823 \cdot \mathrm{deg}$$

for a linear fit

$$c' := \frac{\mathrm{fit}_1}{\cos(\varphi')} \mathrm{psf} \qquad c' = 103.634 \cdot \mathrm{psf}$$

if a phi function is used, the p and q information must first be converted to N and τ on the plane of failure at the time of failure

$$\varphi_L := \mathrm{asin}\left(\frac{\mathrm{data1}^{\langle 2\rangle}}{\mathrm{data1}^{\langle 1\rangle}}\right) \qquad \varphi_L = \begin{pmatrix} 25.132 \\ 25.75 \\ 24.475 \end{pmatrix} \cdot \mathrm{deg} \qquad \sigma'_n := \overrightarrow{\frac{\mathrm{data1}^{\langle 2\rangle}}{\tan\left(\varphi_L\right)}}$$

$$\sigma'_n = \begin{pmatrix} 19.829 \\ 30.1 \\ 43.821 \end{pmatrix} \mathrm{psi} \qquad q_f := \mathrm{data1}^{\langle 2\rangle} \qquad q_f = \begin{pmatrix} 9.302 \\ 14.518 \\ 19.947 \end{pmatrix} \mathrm{psi}$$

try a fit using the generic form of the hyperbolic where the 100 refers to the values at 100 kPa

$$q(\sigma'_n) = \sigma'_n \cdot \tan(\varphi_{p100}) \cdot \left(\frac{100\text{kPa}}{\sigma'_n}\right)^{1-m_p}$$

$\tan(\varphi_{p100})$ can be redined as A and 1-m_p as b

define genfit vectors

$$F(n, A, b) := \begin{bmatrix} A \cdot n \cdot \left(\frac{2089}{n}\right)^b \\ n \cdot \left(\frac{2089}{n}\right)^b \\ A \cdot n \cdot \ln\left(\frac{2089}{n}\right) \cdot \left(\frac{2089}{n}\right)^b \end{bmatrix}$$

$$\text{guess} := \begin{pmatrix} .5 \\ .1 \end{pmatrix}$$

$$cg := \text{genfit}\left(\frac{\sigma'_n}{\text{psf}}, \frac{q_f}{\text{psf}}, \text{guess}, F\right) = \begin{pmatrix} 0.492 \\ 0.065 \end{pmatrix}$$

$$\varphi_{p100} := \text{atan}(cg_1) = 26.216 \cdot \text{deg}$$

$$m_p := 1 - cg_2 = 0.935$$

EMPIRE RESULTS

$$q_e(n') := n' \cdot \tan(28.776\text{deg}) \cdot \left(\frac{2089\text{psf}}{n'}\right)^{1-.853}$$

CONTINUOUS FOR THIS TEST

$$q(n') := n' \cdot \left[cg_1 \cdot \left(\frac{2089\text{psf}}{n'}\right)^{cg_2}\right]$$

PJCA
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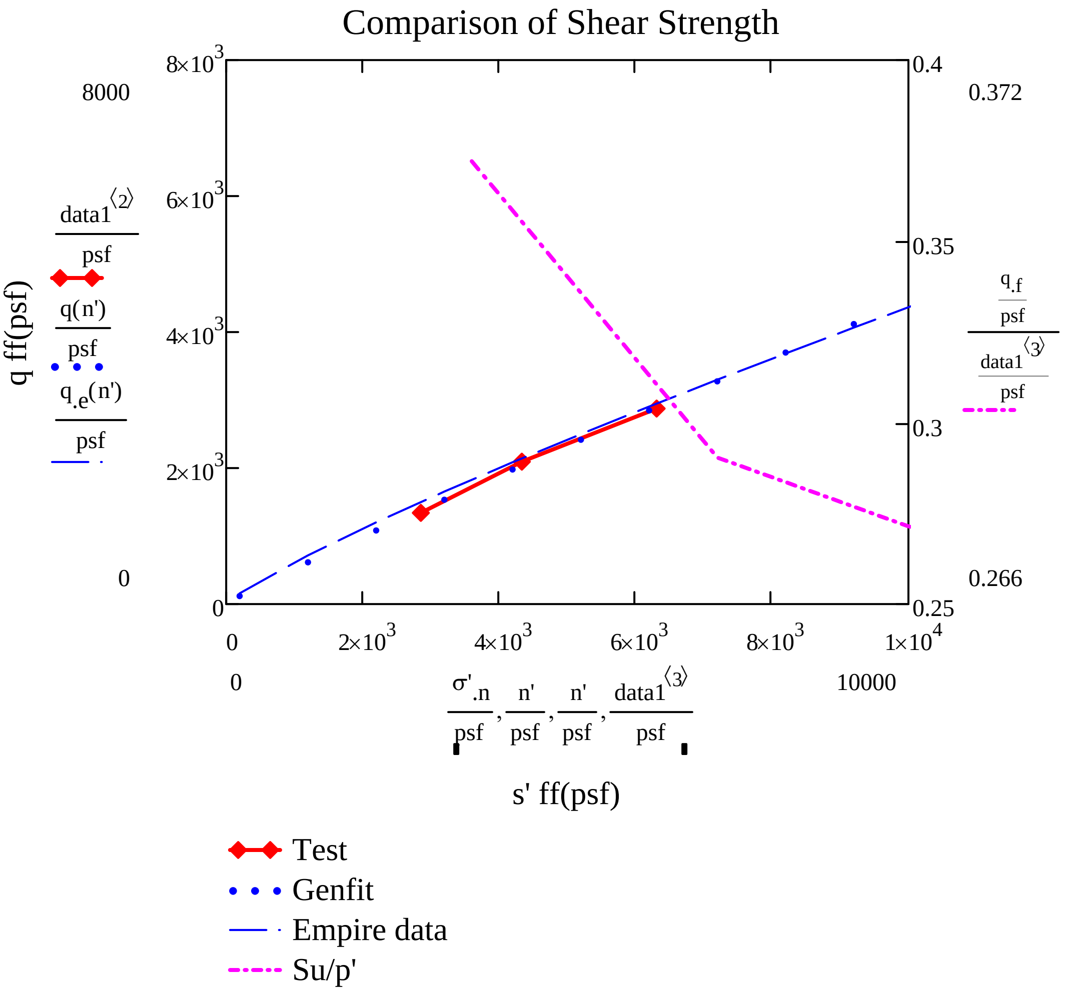

Comparison of Shear Strength
q ff(psf)
8000
0
8×10^3
6×10^3
4×10^3
2×10^3
0
data1⟨2⟩ / psf
q(n') / psf
q.e(n') / psf
0.4
0.35
0.3
0.25
0.372
0.266
q.f / psf
data1⟨3⟩ / psf
0
2×10^3
4×10^3
6×10^3
8×10^3
1×10^4
0
10000
σ'.n / psf, n' / psf, n' / psf, data1⟨3⟩ / psf
s' ff(psf)
Test
Genfit
Empire data
Su/p'

CLIENT : CWM SHEET 1 OF 3

PROJECT: RMU-2 DATE:6/17/09

PJCA-JOB No.:

PERFORMED BY: Peter J. Carey

SUBJECT: RMU-2 Triaxial Data

Object of Worksheet:Determine information from test forms of triaxial compression tests with pore pressure

Evaluation of Sample SB-02-4 10-12 ft, shear strength only

$$\text{data1} := \begin{pmatrix} 4959.5 & 2741 & 3600 \\ 8099.7 & 4226.1 & 7200 \\ 9787.6 & 5251.6 & 10800 \end{pmatrix} \cdot \text{psf}$$

array of p' and q and σ'_3 taken at maximum obliquity

$$\text{fit} := \text{line}\left(\frac{\text{data1}^{\langle 1\rangle}}{\text{psf}}, \frac{\text{data1}^{\langle 2\rangle}}{\text{psf}}\right) \qquad \text{fit} = \begin{pmatrix} 158.188 \\ 0.514 \end{pmatrix} \qquad \text{stderr}\left(\text{data1}^{\langle 1\rangle}, \text{data1}^{\langle 2\rangle}\right) = 118.895 \cdot \text{psf}$$

$$\varphi' := \text{asin}\left(\text{fit}_2\right) \qquad \varphi' = 30.933 \cdot \text{deg}$$

$$c' := \frac{\text{fit}_1}{\cos(\varphi')}\text{psf} \qquad c' = 184.418 \cdot \text{psf}$$

for a linear fit

if a polynomial function is used, the p and q information must first be converted to N and τ on the plane of failure at the time of failure

$\varphi_L := \text{asin}\left(\dfrac{\text{data1}^{\langle 2\rangle}}{\text{data1}^{\langle 1\rangle}}\right)$ $\qquad \varphi_L = \begin{pmatrix} 33.551 \\ 31.45 \\ 32.45 \end{pmatrix} \cdot \text{deg}$

$$\sigma'_n := \overrightarrow{\frac{\text{data1}^{\langle 2\rangle}}{\tan(\varphi_L)}}$$

$\sigma'_n = \begin{pmatrix} 28.703 \\ 47.985 \\ 57.357 \end{pmatrix} \text{psi}$ $\qquad q_f := \text{data1}^{\langle 2\rangle}$ $\qquad q_f = \begin{pmatrix} 19.035 \\ 29.348 \\ 36.469 \end{pmatrix} \text{psi}$

try a fit using the generic form of the hyperbolic where the 100 refers to the values at 100 kPa

$$q(\sigma'_n) = \sigma'_n \cdot \tan(\varphi_{p100}) \cdot \left(\frac{100\text{kPa}}{\sigma'_n}\right)^{1-m_p}$$

$\tan(\varphi_{p100})$ can be redined as A and $1\text{-}m_p$ as b

define genfit vectors

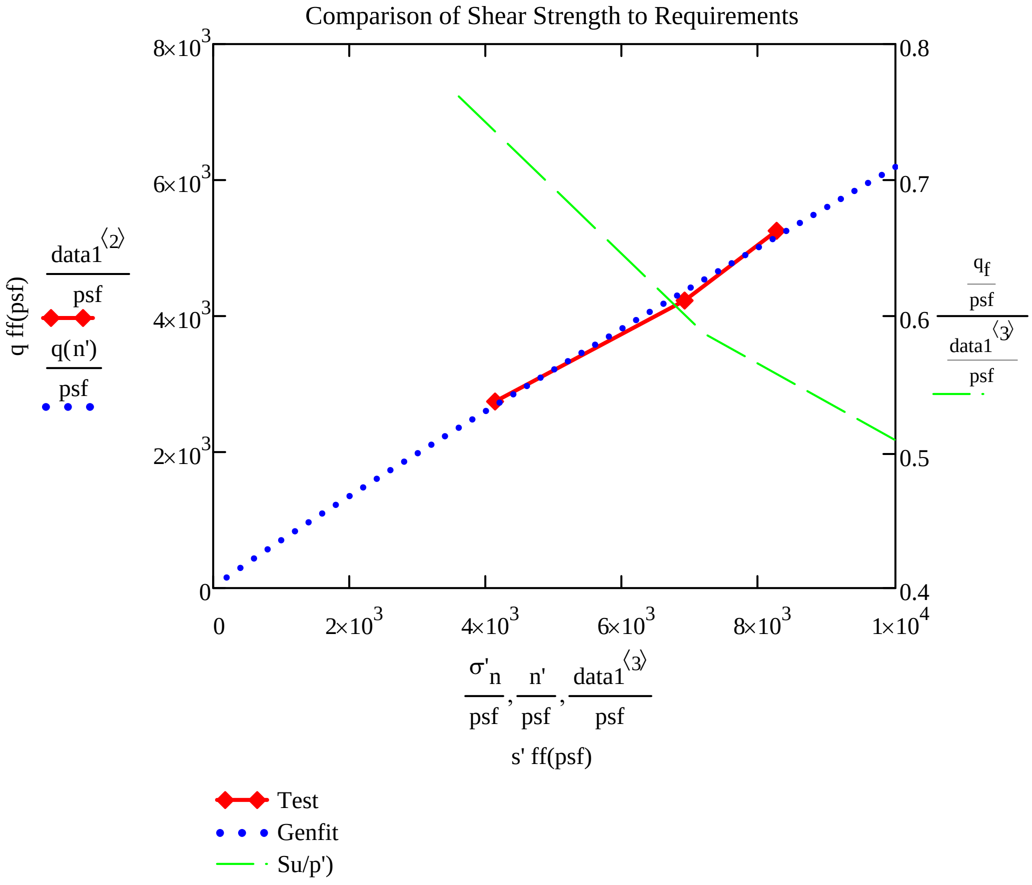
$$F(n, A, b) := \begin{bmatrix} A \cdot n \cdot \left(\dfrac{2089}{n}\right)^b \\ n \cdot \left(\dfrac{2089}{n}\right)^b \\ A \cdot n \cdot \ln\left(\dfrac{2089}{n}\right) \cdot \left(\dfrac{2089}{n}\right)^b \end{bmatrix} \qquad \text{guess} := \begin{pmatrix} .5 \\ .1 \end{pmatrix}$$

$$cg := \text{genfit}\left(\frac{\sigma'_n}{\text{psf}}, \frac{q_f}{\text{psf}}, \text{guess}, F\right) = \begin{pmatrix} 0.674 \\ 0.054 \end{pmatrix}$$

$$\varphi_{p100} := \text{atan}(cg_1) = 33.965 \cdot \text{deg}$$

$$m_p := 1 - cg_2 = 0.946$$

$$q(n') := n' \cdot \left[cg_1 \cdot \left(\frac{2089\text{psf}}{n'}\right)^{cg_2}\right]$$


Comparison of Shear Strength to Requirements
8×10^3
6×10^3
4×10^3
2×10^3
0
0.8
0.7
0.6
0.5
0.4
0
2×10^3
4×10^3
6×10^3
8×10^3
1×10^4
q ff(psf)
data1⟨2⟩ / psf
q(n') / psf
q_f / psf / data1⟨3⟩ / psf
σ'_n / psf , n' / psf , data1⟨3⟩ / psf
s' ff(psf)
Test
Genfit
Su/p')

CLIENT : CWM

SHEET 1 OF 3

PROJECT: RMU-2

DATE:6/17/09

PJCA-JOB No.:

PERFORMED BY: Peter J. Carey

SUBJECT: RMU-2 Triaxial Data

Object of Worksheet:Determine information from test forms of triaxial compression tests with pore pressure

Evaluation of Sample SB-02-4 12-14 ft, shear strength only

$$\text{data1} := \begin{pmatrix} 3971.9 & 2215 & 3600 \\ 7030.3 & 3919.9 & 7200 \\ 10316.2 & 5492 & 10800 \end{pmatrix} \cdot \text{psf}$$

array of p' and q and σ'_3 taken at maximum obliquity

$$\text{fit} := \text{line}\left(\frac{\text{data1}^{\langle 1 \rangle}}{\text{psf}}, \frac{\text{data1}^{\langle 2 \rangle}}{\text{psf}}\right) \qquad \text{fit} = \begin{pmatrix} 208.476 \\ 0.516 \end{pmatrix} \qquad \text{stderr}\left(\text{data1}^{\langle 1 \rangle}, \text{data1}^{\langle 2 \rangle}\right) = 102.167 \cdot \text{psf}$$

$$\varphi' := \text{asin}\left(\text{fit}_2\right) \qquad \varphi' = 31.068 \cdot \text{deg}$$

for a linear fit

$$c' := \frac{\text{fit}_1}{\cos(\varphi')} \text{psf} \qquad c' = 243.389 \cdot \text{psf}$$

if a polynomial function is used, the p and q information must first be converted to N and τ on the plane of failure at the time of failure

$$\varphi_L := \mathrm{asin}\left(\frac{\mathrm{data1}^{\langle 2\rangle}}{\mathrm{data1}^{\langle 1\rangle}}\right) \qquad \varphi_L = \begin{pmatrix}33.895\\33.888\\32.165\end{pmatrix}\cdot \mathrm{deg}$$

$$\sigma'_n := \overrightarrow{\frac{\mathrm{data1}^{\langle 2\rangle}}{\tan(\varphi_L)}}$$

$$\sigma'_n = \begin{pmatrix}22.895\\40.528\\60.644\end{pmatrix}\mathrm{psi} \qquad q_f := \mathrm{data1}^{\langle 2\rangle} \qquad q_f = \begin{pmatrix}15.382\\27.222\\38.139\end{pmatrix}\mathrm{psi}$$

try a fit using the generic form of the hyperbolic where the 100 refers to the values at 100 kPa

$$q(\sigma'_n) = \sigma'_n\cdot\tan(\varphi_{p100})\cdot\left(\frac{100\mathrm{kPa}}{\sigma'_n}\right)^{1-m_p}$$

$\tan(\varphi_{p100})$ can be redined as A and $1\text{-}m_p$ as b

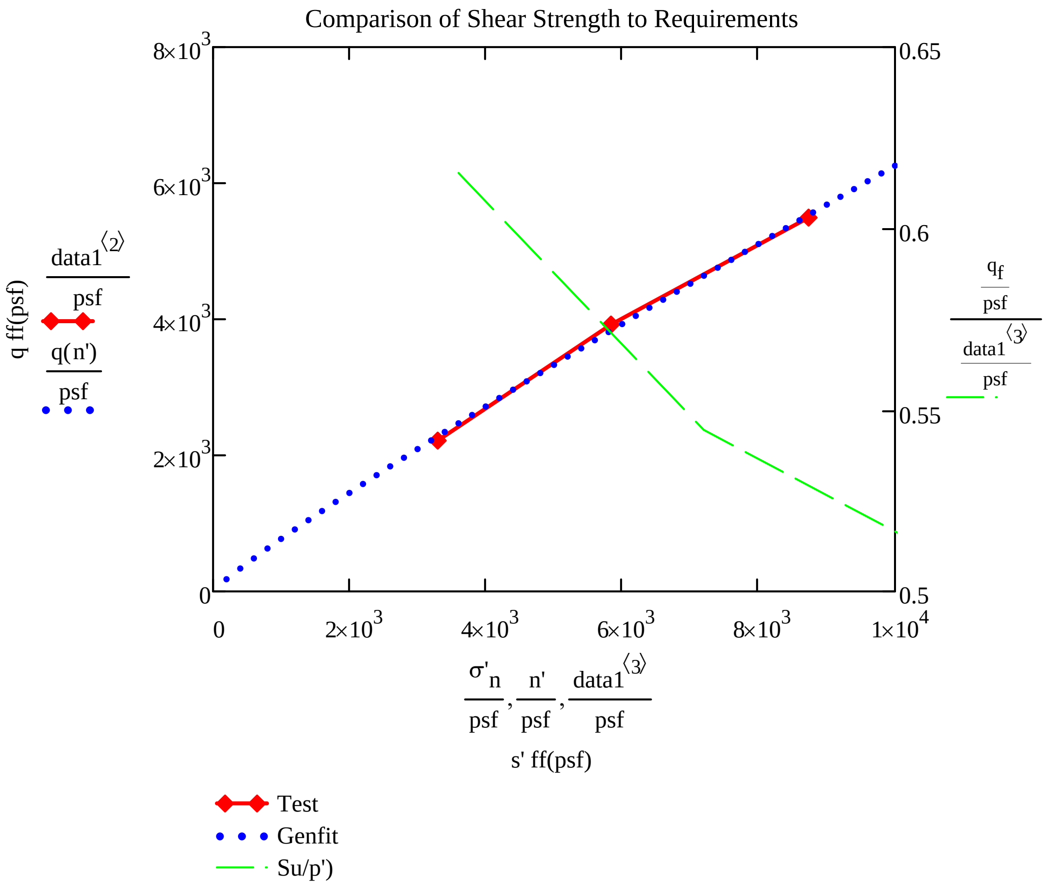
define genfit vectors

$$F(n, A, b) := \begin{bmatrix} A\cdot n\cdot\left(\frac{2089}{n}\right)^{b} \\ n\cdot\left(\frac{2089}{n}\right)^{b} \\ A\cdot n\cdot\ln\left(\frac{2089}{n}\right)\cdot\left(\frac{2089}{n}\right)^{b} \end{bmatrix} \qquad \mathrm{guess} := \begin{pmatrix}.5\\.1\end{pmatrix}$$

$$cg := \mathrm{genfit}\left(\frac{\sigma'_n}{\mathrm{psf}}, \frac{q_f}{\mathrm{psf}}, \mathrm{guess}, F\right) = \begin{pmatrix}0.72\\0.09\end{pmatrix} \qquad \varphi_{p100} := \mathrm{atan}(cg_1) = 35.$$

$$m_p := 1 - cg_2 = 0.91$$

$$q(n') := n'\cdot\left[cg_1\cdot\left(\frac{2089\mathrm{psf}}{n'}\right)^{cg_2}\right]$$


Comparison of Shear Strength to Requirements
8×10^3
6×10^3
4×10^3
2×10^3
0
0.65
0.6
0.55
0.5
0
2×10^3
4×10^3
6×10^3
8×10^3
1×10^4
q ff(psf)
data1⟨2⟩ / psf
q(n') / psf
q_f / psf / data1⟨3⟩ / psf
σ'_n / psf , n' / psf , data1⟨3⟩ / psf
s' ff(psf)
Test
Genfit
Su/p')

ATTACHMENT 7

P.J.Carey & Associates, P.C.

CLIENT : CWM

PROJECT: RMU-2 DATE:6/17/09

PJCA-JOB No.:

PERFORMED BY: Peter J. Carey

SUBJECT: RMU-2 Triaxial Data

Object of Worksheet:Determine information from test forms of triaxial compression tests with pore pressure

B -5 20-22ft

B -9 at 20-22 ft test by empire

$$\text{data\_a} := \begin{pmatrix} 22.1 & 15.4 & 15 \\ 34.6 & 21.9 & 30 \\ 61.4 & 37.2 & 60 \end{pmatrix} \qquad \text{data\_b} := \begin{pmatrix} 20.6 & 13.4 & 15 \\ 36 & 22.4 & 30 \\ 67 & 40.5 & 60 \end{pmatrix} \qquad \text{data\_c} := \begin{pmatrix} 19.7 & 12.7 & 15 \\ 38.4 & 23.4 & 30 \\ 74.4 & 43.4 & 60 \end{pmatrix}$$

$$\text{data} := \text{stack}(\text{data\_a}, \text{data\_b}, \text{data\_c})$$

$$\sigma'_1 := \text{data}^{\langle 1 \rangle}\,\text{psi} \qquad q := \frac{\text{data}^{\langle 2 \rangle}}{2}\,\text{psi} \qquad p' := \left(\text{data}^{\langle 1 \rangle} - \frac{\text{data}^{\langle 2 \rangle}}{2}\right)\text{psi}$$

$$\text{data1}^{\langle 1 \rangle} := \frac{p'}{\text{psf}}$$

array of p' and q and σ'_3 taken at maximum obliquity

$$\text{data1}^{\langle 2 \rangle} := \frac{q}{\text{psf}}$$

$$\text{fit} := \text{line}\left(\text{data1}^{\langle 1 \rangle}, \text{data1}^{\langle 2 \rangle}\right) \qquad \text{fit} = \begin{pmatrix} 211.836 \\ 0.393 \end{pmatrix} \qquad \text{stderr}\left(\text{data1}^{\langle 1 \rangle}, \text{data1}^{\langle 2 \rangle}\right) = 57.334$$

$$\varphi' := \text{asin}\left(\text{fit}_2\right) \qquad \varphi' = 23.166 \cdot \text{deg}$$

for a linear fit

$$c' := \frac{\text{fit}_1}{\cos(\varphi')}\,\text{psf} \qquad c' = 230.415 \cdot \text{psf}$$

if a polynomial function is used, the p and q information must first be converted to N and τ on the plane of failure at the time of failure

$$\varphi_L := \operatorname{asin}\left(\frac{data1^{\langle 2\rangle}}{data1^{\langle 1\rangle}}\right)$$

$$\varphi_L = \begin{pmatrix} 32.325 \\ 27.581 \\ 25.759 \\ 28.817 \\ 26.847 \\ 25.668 \\ 28.402 \\ 25.989 \\ 24.316 \end{pmatrix} \cdot deg$$

$$\sigma'_n = \begin{pmatrix} 1.752 \times 10^3 \\ 3.019 \times 10^3 \\ 5.551 \times 10^3 \\ 1.754 \times 10^3 \\ 3.186 \times 10^3 \\ 6.068 \times 10^3 \\ 1.691 \times 10^3 \\ 3.456 \times 10^3 \\ 6.916 \times 10^3 \end{pmatrix}$$

$$q_f := data1^{\langle 2\rangle}$$

$$\sigma'_n :=$$

$$q_f = \begin{pmatrix} 1.109 \times 10^3 \\ 1.577 \times 10^3 \\ 2.678 \times 10^3 \\ 964.8 \\ 1.613 \times 10^3 \\ 2.916 \times 10^3 \\ 914.4 \\ 1.685 \times 10^3 \end{pmatrix}$$

try a fit using the generic form of the hyperbolic

where the 100 refers to the values at 100 kPa

$$q(\sigma'_n) = \sigma'_n \cdot \tan(\varphi_{p100}) \cdot \left(\frac{100kPa}{\sigma'_n}\right)^{1-m_p}$$

$\tan(\varphi_{p100})$ can be redined as A and $1\text{-}m_p$ as b

define genfit vectors

$$F(n, A, b) := \begin{bmatrix} A \cdot n \cdot \left(\frac{2089}{n}\right)^b \\ n \cdot \left(\frac{2089}{n}\right)^b \\ A \cdot n \cdot \ln\left(\frac{2089}{n}\right) \cdot \left(\frac{2089}{n}\right)^b \end{bmatrix}$$

$$guess := \begin{pmatrix} .53 \\ .5 \end{pmatrix}$$

$$cg := \text{genfit}(\sigma'_n, q_f, guess, F) = \begin{pmatrix} 0.549 \\ 0.147 \end{pmatrix}$$

$$\varphi_{p100} := \text{atan}(cg_1) = 28.766\cdot deg$$

$$m_p := 1 - cg_2 = 0.853$$

$$data1^{\langle 3\rangle} := data^{\langle 3\rangle}\cdot 144$$

$$q(n') := n'\cdot cg_1\cdot\left(\frac{2089psf}{n'}\right)^{cg_2}$$

SHANSEP Su Model

$$\frac{S_u}{\sigma'_v} = S\cdot OCR^m$$

use a fitting technique for a shansep approach for modeling su for the soft clay

$i := 1 .. 9$

$MPP := 5000psf$

$\sigma_m := data^{\langle 3\rangle}\,psi$

$$OCR_i := \text{if}\left(\sigma_{m_i} > MPP, 1, \frac{MPP}{\sigma_{m_i}}\right) \quad p := .7$$

$$S_u(\sigma_v) := \overrightarrow{\left(.34\cdot\sigma_m\cdot OCR^p\right)}$$

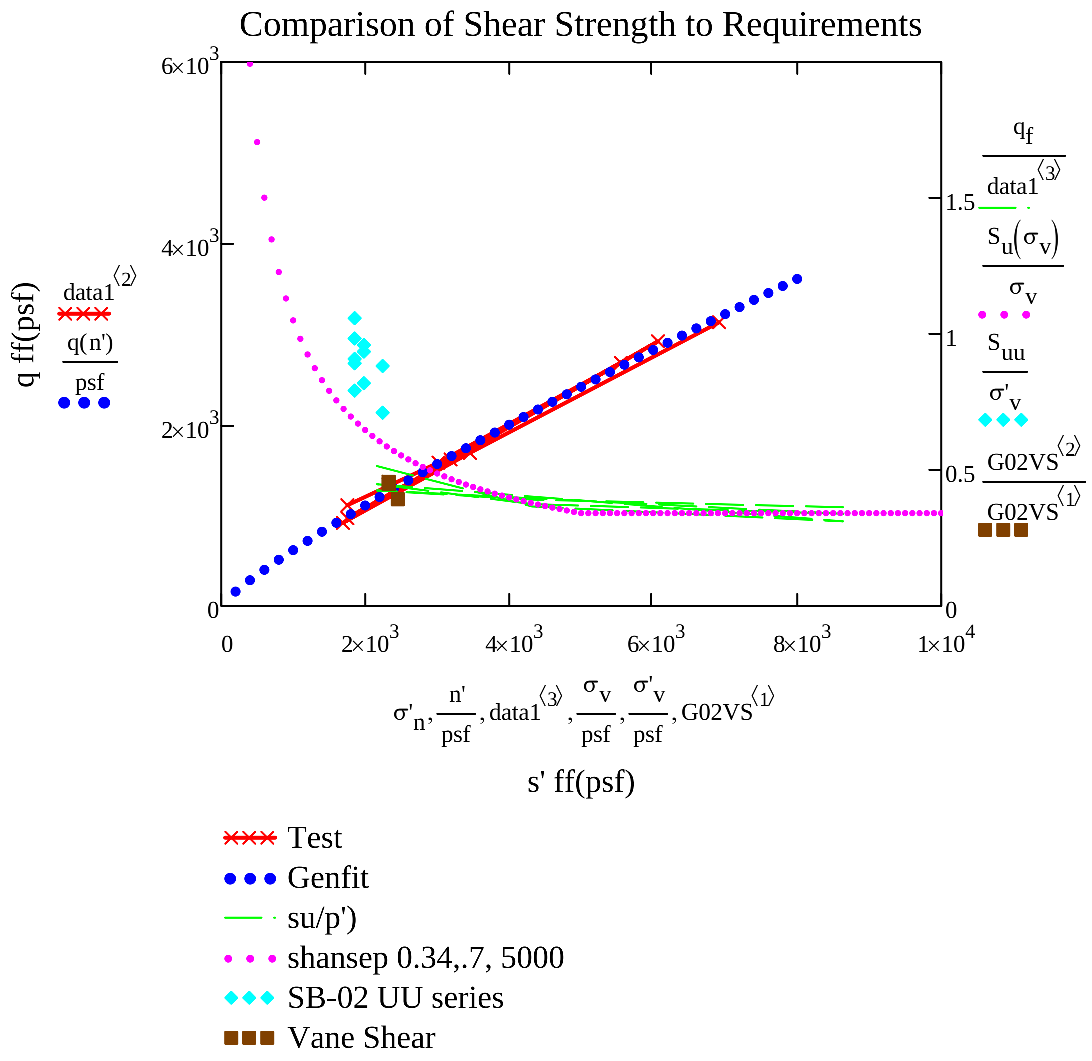
adding in the Golder UU data from the SB-02 series for samples not exhibiting strains greater thar 10% at failure (a sign of significant disturbance for this type of soil)

$$gsb02UU := \begin{pmatrix} 1854 & 1682 \\ 1854 & 1821 \\ 1854 & 1960 \\ 2242 & 1976 \\ 1982 & 1899 \\ 1982 & 1852 \\ 1854 & 1652 \\ 1982 & 1621 \\ 1854 & 1466 \\ 2242 & 1590 \end{pmatrix} psf \qquad \sigma'_v := gsb02UU^{\langle 1\rangle} \qquad S_{uu} := gsb02UU^{\langle 2\rangle}$$

adding the golder vane shear data

$$G02VS := \begin{pmatrix} 2.327 \times 10^{3} & 1040 \\ 2.327 \times 10^{3} & 1060 \\ 2.454 \times 10^{3} & 960 \end{pmatrix}$$

matrix of approx vert eff stress and su from v.shea



February 13, 2013 123-89491

Via Electronic Mail

CWM Chemical Services, L.L.C
Model City TSD Facility
1550 Balmer Road
Youngstown, New York 14174

Attention: Mr. Jonathan Rizzo

RE: LETTER REPORT ON RMU-2 GLACIOLACUSTRINE CLAY SAMPLING & LAB TESTING RESULTS
CWM CHEMICAL SERVICES, L.L.C., MODEL CITY, NEW YORK

Dear Mr. Rizzo:

Golder Associates Inc. (Golder) is pleased to submit this letter report for geotechnical soil sampling and laboratory testing associated with the proposed construction of Residuals Management Unit Number 2 (RMU-2), located at the Model City Treatment, Storage, and Disposal (TSD) Facility, Model City, New York.

1.0 INTRODUCTION

CWM owns and operates a permitted commercial hazardous waste TSD facility in Model City, Niagara County, New York. In May 2003, CWM submitted a permit application and design for RMU-2 to the New York State Department of Environmental Conservation (NYSDEC). RMU-2 has recently been redesigned and the planned boundary of the footprint of RMU-2 has been modified from that presented in the RMU-2 Preliminary Groundwater Monitoring Plan (PGWMP) prepared by Golder in 2003. This letter report presents the field work results and laboratory testing results for the geotechnical sampling of the underlying Glaciolacustrine Clay unit beneath a portion of the proposed RMU-2 and laboratory testing of the samples as part of the RMU-2 permit application process.

2.0 SCOPE OF WORK

2.1 Boring Layout

Two (2) borings were installed at select drilling locations (provided by CWM) within the proposed footprint of RMU-2:

- 1 north of Facultative Pond 3 (FAC Pond 3), SB12-01, and,
- 1 south of FAC Pond 3,SB12-02

The borings were laid out by CWM and approved by CWM prior to the commencement of drilling to obtain utility clearance. A layout survey was performed following the field program.

2.2 Boring Installation and Sampling

Initially, geotechnical test borings (pilot holes) at both drilling locations (SB12-01 and SB12-02) were installed using hollow stem auger (HSA) drilling techniques with continuous soil sampling through to the total depth of the boring. The total borehole depth in the pilot holes was approximately the top of the Glaciolacustrine Silt and Sand (GSS) horizon (determined from the SB12-01 pilot hole location to be at a depth of approximately 32 feet below ground surface [bgs] and from the SB12-02 pilot hole location to be at a depth of approximately 33.6 feet bgs in these areas).

Once the pilot hole was completed to target depth, a sample borehole at each location was offset approximately 5-feet and auger drilled without sampling (10-feet bgs) to the target depth based on the drilling results at each of the pilot hole locations. The target sampling depth in the sample boreholes was the upper and lower Glaciolacustrine Clay (GC) horizon (determined from the SB12-01 pilot hole to be at a depth of approximately 12 feet bgs and from the SB12-02 pilot hole to be to be at a depth of approximately 14 feet bgs). Once the select sampling depths were reached with HSAs, the drill rods were removed and a specialized sampling device, a Gregory undisturbed sampler (GUS), was attached and reinserted into the ancillary borehole and lowered to select depths to collect an approximate 30-inch sample of the GC horizon, utilizing a thinned walled sampling tube (Shelby tube). The above drilling technique was repeated in the ancillary borehole to collect a sample of the lower GC unit at each of the two drilling locations.

Air monitoring and screening of soil for volatile organic compounds was performed using a photoionization detector (PID) during drilling. EnSol, Inc. (under contract to CWM) screened the soil cores and drill cuttings and monitored the breathing zone for indications of volatile organic compounds.

Prior to and during boring installation procedures, EnSol also performed radiation surveying and screening according to the “Radiological Survey Plan for RMU-2 Groundwater Well Installation”, dated April 2005 (revised March 2006), and the “Generic Small Project Soil Excavation Monitoring and Management Plan”, dated September 2005 (revised November 2006), which were approved by the NYSDEC on August 24, 2007. An area survey of each drilling location was performed prior to boring installation and radiation surveying was also performed during boring installation. The survey and soil screening was performed using a Ludlum Model 2221 ratemeter with Ludlum Model 44-10 detector. The results were submitted to Golder by EnSol and are presented in Attachment B. Site survey radiation screening results were well below CWM’s site investigation value of 16,000 counts per minute (cpm) and soil core readings were less than two times background with the background level ranging from approximately 3125 cpm to 5115 cpm.

2.3 Laboratory Analysis

Golder coordinated with the contracted analytical laboratory, Geotesting Express, for transfer of collected samples midway en-route to the lab, located in Acton, Massachusetts. All field samples collected were handled and preserved according to American Society for Testing and Materials (ASTM) D4220, “Standard Practices for Preserving and Transporting Soil Samples”, using a combination of paraffin wax and select packing materials to ensure minimization of disturbance during transport on site. The samples were hand delivered to an analytical laboratory courier off-site and transferred utilizing correct chain of custody methods according to the D4220 standard.

A total of 2 soil samples were analyzed for various engineering properties, including moisture content (ASTM D2216), density of soil specimens (ASTM D7263), Atterberg limits (ASTM D4318) and directional simple shear testing (ASTM D6528). The laboratory data is presented in Attachment C.

3.0 CLOSURE

Golder appreciates the continued opportunity to provide CWM with engineering services. If you have any questions or comments, please call the undersigned at (716) 204-5880.

Very truly yours,

GOLDER ASSOCIATES INC.

Russell J. Marchese
Senior Project Geologist

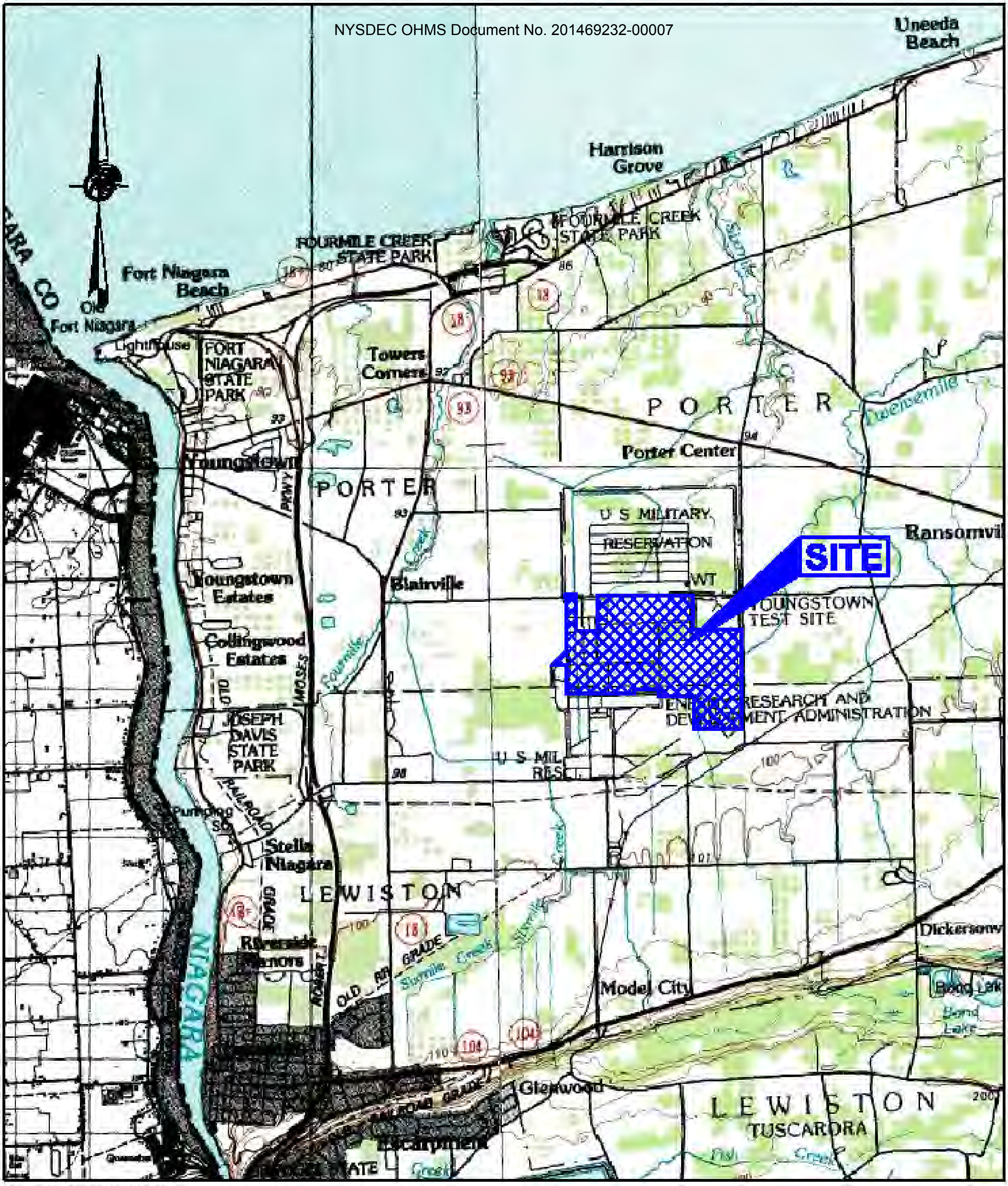
David C. Wehn
Associate and Office Manager

cc: R. Zayatz, WMNY

Attachments:
- Figure 1 – Site Location Map
- Figure 2 – Investigation Sample Location Map
- Attachment A – Investigation Boring Logs
- Attachment B – Investigation Radiation Screening & Air Monitoring
- Attachment C – Investigation Laboratory Results

RJM/DCW:dmp

FIGURES



REFERENCE

1.) DRAWING WAS ADAPTED FROM THE USGS TOPOGRAPHIC QUADRANGLE OF RANSOMVILLE, NEW YORK, OBTAINED FROM www.topozone.com.

Golder Associates
Buffalo, New York

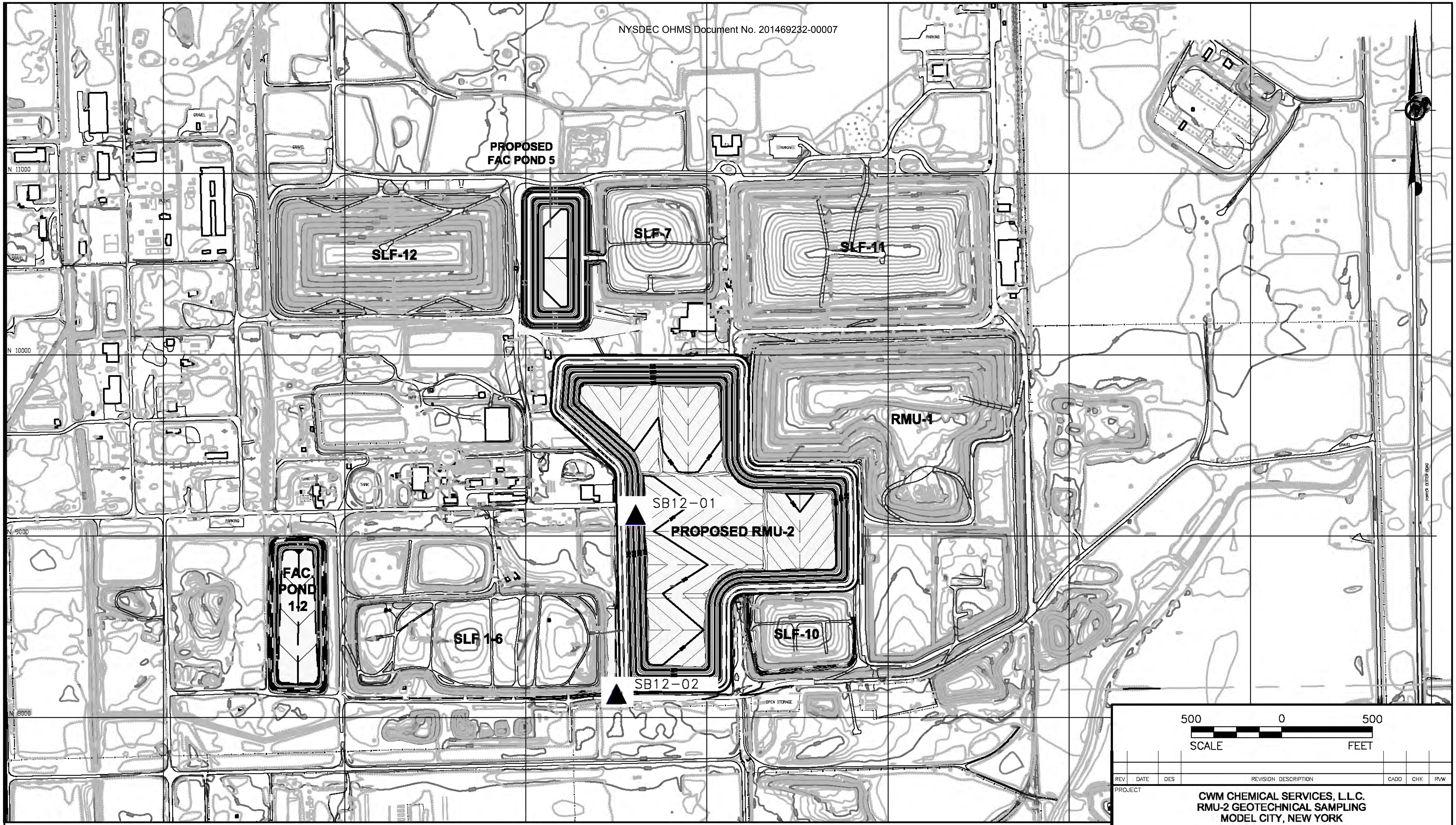
FILE No.	12389491A413	CHECK	RJM
PROJECT No.	123-89491 REV. 0	REVIEW	DCW
SCALE	1:28,000	DATE	02/12/13
DESIGN	AJN	CADD	AJN

TITLE

SITE LOCATION MAP

CWM CHEMICAL SERVICES, L.L.C.MODEL CITY TSD FACILITY

FIGURE 1



REFERENCES

1.) BASE MAP COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED MAY 31, 2001 BY AIR SURVEY CORP., DULLES, VIRGINIA.

2.) RMU-2 SUBGRADES FROM DIGITAL CAD FILE 23725G03.DWG ENTITLED "SUBGRADE GRADES," DATED AUGUST 2009, PREPARED BY ARCADIS.

3.) FAC POND 5 AND FAC POND 1-2 FROM DIGITAL CAD FILE 23725G39.DWG ENTITLED "FAC POND GRADING PLAN," DATED AUGUST 2009, PREPARED BY ARCADIS.

NOTES

▲ SB12-02 GEOTECHNICAL SAMPLE BOREHOLE LOCATION

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

CWM CHEMICAL SERVICES, L.L.C.
RMU-2 GEOTECHNICAL SAMPLING
MODEL CITY, NEW YORK

TITLE

INVESTIGATION SAMPLE LOCATIONS

NJ Authorization #24GA28029100

Golder Associates
Mt. Laurel, New Jersey

PROJECT No.		123-89491
DESIGN	RJM	10/25/12
CADD	RJM	2/12/13
CHECK	RJM	2/12/13
REVIEW	DCW	2/13/13

FILE No. 12389491A414
SCALE AS SHOWN
REV. 0

FIGURE 2

ATTACHMENT A

INVESTIGATION BORING LOGS

SOIL BOREHOLE LOG

SITE NAME AND LOCATION

CWM CHEMICAL SERVICES
MODEL CITY, NEW YORK
RMU-2 GEOTECHNICAL SAMPLING

DATUM MSL
ELEVATION 320.0

DRILLING METHOD: 4 1/4" ID HOLLOW STEM AUGER

SAMPLING METHOD: 24" SPLIT SPOON (S.S)

BORING NO. SB12-01(PILOT)

SHEET 1 OF 1

WATER LEVEL	N/A			
TIME	N/A			
DATE	N/A			
CASING DEPTH	N/A			

DRILLING	
START	FINISH
TIME 0940	TIME 1600
DATE 10/22/12	DATE 10/22/12

DRILL RIG CME-45C
SURFACE CONDITIONS GRASS
ANGLE VERTICAL BEARING
SAMPLE HAMMER TORQUE 140 lb. 30 in.

DRILLING CONTR ART KOSKE
SJB SERVICES, INC.

DEPTH IN FEET	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	VANE (TSF)
0.0			320.0 AUGERED WITH NO SAMPLING 0.0–10.0' bgs.								
10.0			310.0								
	3-3-4-5 38%		1 **UPPER CLAY TILLS** Firm, gray brown-brown SILTY CLAY, trace to little subangular fine gravel, occasional coarse gravel, occasional thin sand lenses, low plasticity, v. moist. (CL)	24" S.S.							
	5-4-3-3 83%		2	24" S.S.							
			306.35								
15.0	1-2-2-2 28%		3	24" S.S.							
	WH-2-2-2 100%		4 **GLACIOLACUSTRINE CLAY** Soft to very soft, brown-gray CLAY, trace fine gravel, with occasional zones (0.2–0.7-ft) of compact, red-brown silty clayey SAND, occasional silt seams, occasional c-gravel, medium to high plasticity, very moist to wet. (CL)	24" S.S.							
	WH-2-1-1 100%		5	24" S.S.							
20.0	1-3-5-5 38%		6	24" S.S.							
	5-3-3-2 100%		7	24" S.S.							
25.0	WH-WH-WH-1 100%		8	24" S.S.							
	WH-11-17-14 100%		9	24" S.S.							
	WH-2-11-4 63%		10	24" S.S.							
30.0	1-1-1-3 0%		11	24" S.S.							
			288.0								
	31-75-100/.3 100%		12 **GLACIOLACUSTRINE SILT/SAND** Compact, gray-brown sandy SILT, little fine gravel, little coarse sand, little clay content, wet. (SM)	24" S.S.							
			286.0 END OF BORING @ 34.0 FT. bgs.								
35.0											

LOGGED BY RUSSELL J. MARCHESE CHKD BY DCW
DATE 10/22/2012

Golder Associates

SOIL BOREHOLE LOG

SITE NAME AND LOCATION CWM CHEMICAL SERVICES MODEL CITY, NEW YORK RMU-2 GEOTECHNICAL SAMPLING	DRILLING METHOD: 4 1/4" ID HOLLOW STEM AUGER	BORING NO. SB12-02 (PILOT)	
	SAMPLING METHOD: 24" SPLIT SPOON (S.S)	SHEET 1 OF 1	
		DRILLING START	FINISH
		TIME 0820	TIME 1245
DATUM MSL ELEVATION 321.50		DATE 10/23/12	DATE 10/23/12

WATER LEVEL	N/A				
TIME	N/A				
DATE	N/A				
CASING DEPTH	N/A				

DRILL RIG CME-45C

SURFACE CONDITIONS GRAVEL ROADWAY

ANGLE VERTICAL BEARING

SAMPLE HAMMER TORQUE 140 lb. 30 in.

DEPTH IN FEET	BLOWS/ 6 IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTIC INDEX	VANE (TSF)
0.0			321.50 AUGERED WITH NO SAMPLING 0.0–10.0' bgs.								
10.0	4–5–8–12 70%		311.5 1 UPPER CLAY TILLS	24" S.S.							
	11–12–14–11 15%		2 Firm, gray brown SILTY CLAY, little subangular fine gravel, occasional coarse gravel, moist. (ML–CL)	24" S.S.							
15.0	2–2–4–2 85%		306.6 3	24" S.S.							
	2–1–2–2 100%		4	24" S.S.							
	WH–WH–3–6 55%		5 GLACIOLACUSTRINE CLAY	24" S.S.							
20.0	4–3–3–1 35%		6 Soft to very soft, brown–gray CLAY, trace fine gravel, with occasional lenses of compact red–brown CLAYEY SILT to SILT and fine to medium SAND, occasional c–gravel, medium to high plasticity, very moist to wet. (CL)	24" S.S.							
	WH–WH–2–1 70%		7	24" S.S.							
25.0	WH–WH–WH–WH 100%		8	24" S.S.							
	WH–WH–2–2 100%		9	24" S.S.							
	WH–WH–WH–WH 100%		10	24" S.S.							
30.0	WH–WH–WH–WH 95%		11 GLACIOLACUSTRINE SILT/SAND	24" S.S.							
	WH–3–12–25 90%		12 Compact brown SILTY SAND, little fine gravel, little coarse sand, trace clay, wet. (SM–ML) 287.9 287.5	24" S.S.							
			END OF BORING @ 34.0 FT. bgs.								
35.0											

DRILLING CONTR ART KOSKE
SJB SERVICES, INC.

LOGGED BY RUSSELL J. MARCHESE CHKD BY DCW
DATE 10/23/2012

ATTACHMENT B

INVESTIGATION RADIATION SCREENING (PROVIDED BY OTHERS)

DAILY CONSTRUCTION INSPECTION REPORT

PROJECT: Generic Small Project - Soil Borings @ FAC Pond 3

DATE: 10/22/12

PROJECT NO.: 08 7027

CLIENT: CWM

ARRIVE TIME:

DEPART TIME:

WEATHER CONDITIONS: Sunny, Breezy 60-70° F

CONTRACTOR PERSONNEL AND EQUIPMENT:

Golder Assoc.
SJB

WORK IN PROGRESS:

Soil Boring for sample collection

INSPECTIONS/TESTS/SAMPLES:

Rad/PID scanning

MATERIALS RECEIVED:

N/A

CONSTRUCTION ACTIVITIES:

Scanned Material ~~as~~ continuously as it came out of the hole. Scanned Samples that came out of the pilot SB 12-01 Boring. Scanned the Spoils as the auger was removed. Augered 2 Holes, 1 pilot hole and SB-12-01 to a depth of 25-35 feet.

OBSERVER: Justin Darling Jr.

SIGNATURE:

WASTE MANAGEMENT

Page 1 of ____

CWM Chemical Services, LLC.

Generic Small Project
Soil Excavation Monitoring and Management Report

Prepared By: Justin Darling

Date of Report: 10/22/12

Description of Excavation Location: North of FAC Pond 3; west side of shed; South Side of FAC Pond 3 on the west side of truck traffic

GPSNorthing:

GPS Eastern:

Elevation:

Purpose of Excavation: Soil borings

1. RADIOLOGICAL SURVEY SCAN

Date of Rad Survey: 10/22/12

Rad Scan Performed By: J. Darling

Date of Calibration: 8/3/12

Rad Instrument Used: Ludlum 2221/44-10

SN# of Instrumentation: 262345/226924

Documentation of QC checks performed before and after survey (describe): Background & Source Checks.

Pre-Op Daily QC Bkg: 4607

Pre-Op Daily QC Source Check: 27404

Post-Op Daily QC Bkg: 4601

Post-Op Daily QC Source Check: 26845

Pre-Op Field Location Bkg: 5530

Post-Op Field Location Bkg: 6504

Description of Rad Survey performed: Scanned material in 6" lifts, continuous scan as the soil Exits the Boring and the soil sample

Rad Scan Survey Results:

Time	Scan Survey Data	Units	Scan Location (Layer, Lift, Bottom)
8:10	5400-6200	CPM	Surface Scan by west side of Gray shed.
8:30	3700-4500		Surface Scan by the SE Corner of SLF 1-6
9:40	4760-5300		0-5' Continuous scan pilot SB 12-01
9:51	4900-6200		5-10' continuous scan pilot SB 12-01
9:57	3397		1 min Count 10-12' sample pilot SB 12-01
10:03	3208		1 min count 12-14 sample pilot SB 12-01
10:07	5200-6100		10-15' continuous scan pilot SB 12-01
10:15	3002		1 min Count 14-16' sample pilot SB 12-01
10:19	3157		1 min Count 16-18' sample pilot SB 12-01
10:23	4200-58		15'-20' Continuous scan pilot SB 12-01

Note: Attach sketches, maps or drawings of scan and sample locations as necessary to document exact location of excavation activities.

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Page 2 of ____

If soil or other media samples are collected, complete the following:

Sample ID#	Sample Location			1 Minute Static Count within 1 inch of Sample Location		Estimated Sample Volume (Include Units)
	Northing	Easting	Elevation (msl)	Before	After	

Note: Attach analytical analysis of samples to this report when results are obtained.

2. CHEMICAL CONTAMINATION SCREENING

Date of PID Survey: 10/22/72

PID Scan Performed By: J. Darling

Date of Calibration: 10/11/12

PID Instrument Used: Mini Rae Lite

SN# of Instrumentation: 590-001471

Level of PPE Required: D

Visible Evidence of Chemical Contamination: Yes [✓ No] (Circle One)

Description of PID Survey performed: Scanned material in 6" lifts, Continuous scan as the soil Exits the boring and the soil sample

Time	VOC Screening Data	Units	Scan Location (Layer, Lift, Bottom)
8:10	0	PPM	Surface scan by west side of shed
8:30	0		Surface Scan by SE corner of SLF
9:40	0		0-5 continuous scan pilot SB 12-01
9:54	0		5-10 continuous scan pilot SB 12-01
9:57	0		1 min Count 10-12' sample pilot SB 12-01
10:03	0		1 min Count 12-14 sample pilot SB 12-01
10:07	0		10-15' Continuous scan pilot SB 12-01
10:15	0		1 min Count 14-16 sample pilot SB 12-01
10 19	0		1 min Count 16-18 sample pilot SB 12-01
10:23	0		15-20' Continuous scan

Comments:

Attach chain of custody and any analytical results of soil samples collected.

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Page 3 of ____

CWM Chemical Services, LLC.

Generic Small Project
Soil Excavation Monitoring and Management Report Extension

Prepared By: Justin Darling

Date of Report: 10/22/12

Rad Instrument Used: Ludlum 2221/4410

Rad Instrument Used: Mini Rae Lite

SN# of Instrumentation 262345/226924

SN# of Instrumentation: 590-001471

Date of Calibration: 8/3/12

Date of Calibration: 10/11/12

Pre-Op Daily QC Source Check: 27404

Post-Op Daily QC Source Check: 26845

Pre-Op Field Location Bkg: ~~553~~ 4607

Post-Op Field Location Bkg: ~~6~~ 4601

Pre-Op Field Location Bkg: 5530

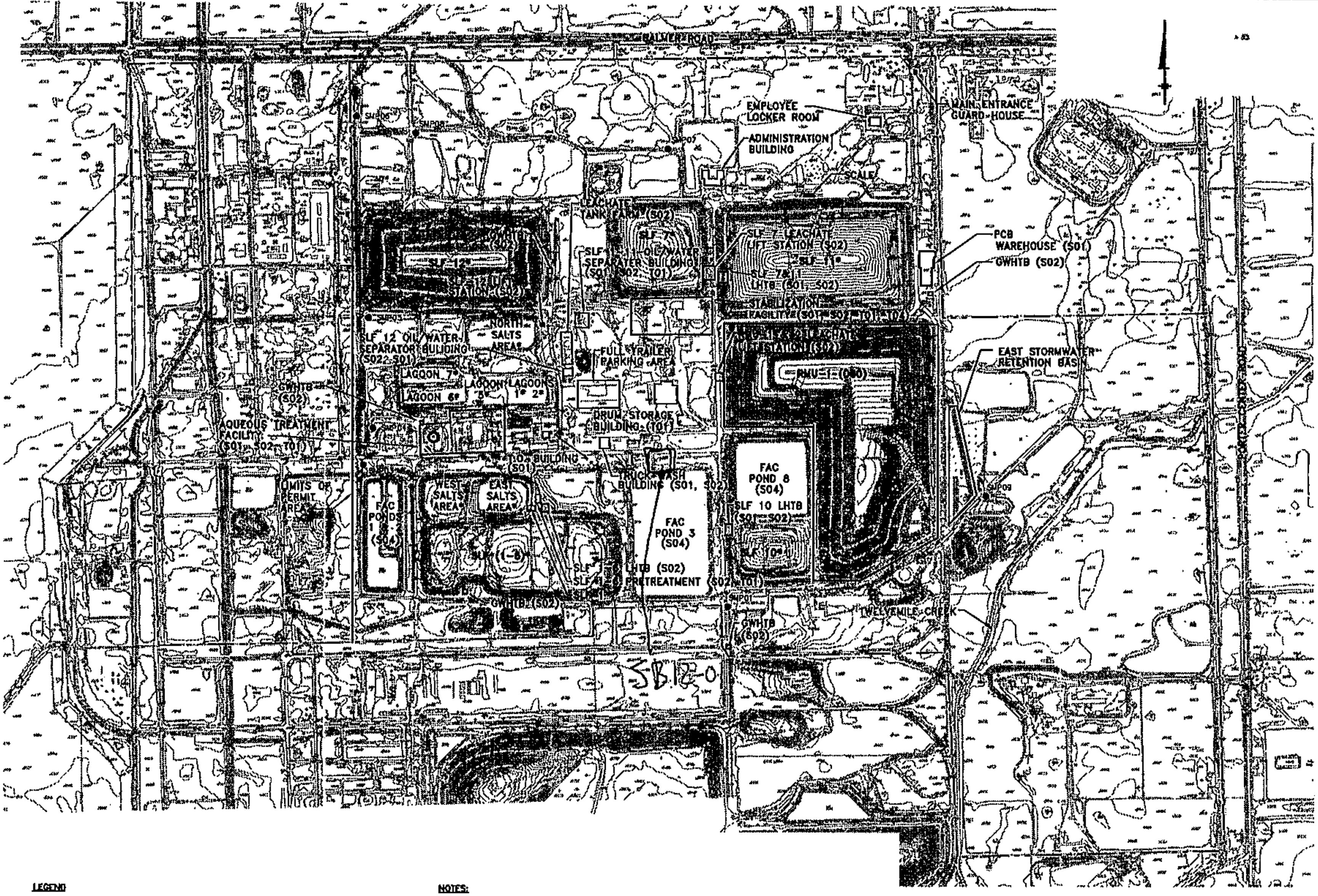
Post-Op Field Location Bkg: 6504

Rad Scan Survey Results:

Time	Scan Survey Data	Units	V.O.C (PPM)	Scan Location
10:34	2957	CPM	0	1 Min Count 18-20' sample pilot SB 12-0
10:38	3320	CPM	0	1 min Count 20-22' Sample pilot SB 1
10:44	3313	CPM	0	1 min Count 22-24 sample pilot SB 12-
10:47	4800 - 5600	CPM	0	20-25' continuous Scan pilot SB 12
10:50	3245	CPM	0	1 min Count 24-26 sample pilot SB 12-01
11:00	3162	CPM	0	1 min Count 26-28 sample pilot SB 12-01
11:06	4900 - 6000	CPM	0	25-30' Continuous Scan
11:14	3298	CPM	0	1 min Count 28-30 sample pilot SB-12-01
12:20	3410	CPM	0	1 min Count 30-34 sample pilot SB 12-01
12:30	5000 - 6700	CPM	0	Spoils of pilot SB 12-01
1:12	5200 - 6200	CPM	0	Surface Scan
1:18	4700 - 5900	CPM	0	0-5' Continuous Scan SB 12-01
1:28	4300 - 6100	CPM	0	5-10 Continuous Scan SB 12-01
1:33	5200 - 6200	CPM	0	10-15' Continuous Scan SB 12-01
2:15	4800 - 6100	CPM	0	15-20 Continuous Scan SB 12-01
2:55	4900 5600	CPM	0	20-23' Continuous Scan SB 12-
3:13	4900 - 5900	CPM	0	23-25' Continuous Scan SB 12-01
3:31	5900 - 6600	CPM	0	Sample tubes
4:08	5300 - 6300	CPM	0	Spoils of SB 12-01
4:15	5200 - 6500		0	Final Scan

Note: Attach sketches, maps or drawings of scan and sample locations as necessary to document exact location of excavation activities.

4/5



LEGEND

SLF = SECURE LANDFILL
FAC = FACULTATIVE
LAG = LAGOON
* = INACTIVE
LHTB = LEACHATE HOLDING TANK BUILDING
GWHTB = GROUNDWATER COLLECTION HOLDING TANK BUILDING
080 = LANDFILL
S01 = CONTAINER STORAGE

——— - - ——— PROPERTY LINE
————————— LIMITS OF ACTIVE LANDFILL
S02 = TANK STORAGE
S04 = SURFACE IMPOUNDMENTS
T01 = TANK TREATMENT
T04 = OTHER TREATMENT
SMP09 ● = SURFACE MONITORING POINT (SMP)

NOTES:

1. THIS MAP COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 5-31-01. (AIR SURVEY CORP. PROJECT NO.71010503)
2. VERTICAL DATUM BASED ON NGS MEAN SEA LEVEL.
3. GRID BASED ON LOCAL COORDINATE SYSTEM.
4. CONTOUR INTERVAL 2 FT.
5. DASHED CONTOURS INDICATE THAT GROUND IS PARTIALLY OBSCURED BY VEGETATION OR SHADOWS. THESE AREAS MAY NOT MEET STANDARD ACCURACY AND REQUIRE FIELD TESTING COMPLETION.
6. PROPERTY LINES ARE APPROXIMATE.
7. 630 PERMITTED ACRES.
8. 710 TOTAL ACRES.
9. LOCATION OF SMPs ARE APPROXIMATE.

500' 0' 500' 1000'

EnSol, Inc.
Environmental Solutions
661 MAIN STREET
NIAGARA FALLS, NY 14301
PHONE (716) 285-3920
FAX (716) 285-3928

FACILITY LAYOUT PLAN

CWM CHEMICAL SERVICES, LLC.
MODEL CITY, NY

FIGURE
3

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ENSOL, INC.
NIAGARA FALLS, NEW YORK

DAILY CONSTRUCTION INSPECTION REPORT

PROJECT: Generic Small Project - Soil Borings

DATE: 10/23/12

PROJECT NO.: 08-2027

CLIENT: CWM

ARRIVE TIME:

DEPART TIME:

WEATHER CONDITIONS: Cloudy, Rainy 50-60°F

CONTRACTOR PERSONNEL AND EQUIPMENT:

Golder
SJB

WORK IN PROGRESS:

Rad/PID Scanning of Soil Boring

INSPECTIONS/TESTS/SAMPLES:

Rad/PID Scanning

MATERIALS RECEIVED:

N/A

CONSTRUCTION ACTIVITIES: Scanned material in 6" lifts and Continuously as it came out of the hole. Scanned Samples that came out of the pilot SB12-02 Boring Scanned the spoils as the auger was removed Augered 2 holes, 1 pilot and SB12-02 to a depth of 25-30 feet

OBSERVER: Justin Darling

SIGNATURE:

PAGE ___ **OF** ___

Page 1 **of** 3

WASTE MANAGEMENT

CWM Chemical Services, LLC.

Generic Small Project
Soil Excavation Monitoring and Management Report

Prepared By: Justin Darling **Date of Report:** 10/23/12

Description of Excavation Location: South East Corner of SLF 1-6 next to truck traffic Road

GPSNorthing:
GPS Eastern:
Elevation:

Purpose of Excavation: Soil Boring SB 12-02

1. RADIOLOGICAL SURVEY SCAN **Date of Rad Survey:** 10/23/12

Rad Scan Performed By: J. Darling **Date of Calibration:** 8/3/12

Rad Instrument Used: Ludlum 2221/44-10 **SN# of Instrumentation:** 262345/226934

Documentation of QC checks performed before and after survey (describe): Background & Source Checks.

Pre-Op Daily QC Bkg: 4726 **Pre-Op Daily QC Source Check:** 28119
Post-Op Daily QC Bkg: 5090 **Post-Op Daily QC Source Check:** 27337
Pre-Op Field Location Bkg: 5674
Post-Op Field Location Bkg: 5210

Description of Rad Survey performed: Scanned material in 6" lifts w/ Probe held 4-6" above grade. Continuous scan as Soil exit Boring and 1 minute count of soil sample

Rad Scan Survey Results:

Time	Scan Survey Data	Units	Scan Location (Layer, Lift, Bottom)
8:00	3700 - 4500	CPM	Surface Scan by SLF 1-6 SE Corner
8 30	5300 - 7200		0-5' Continuous Scan pilot SB 12-02
845	5600 - 7100		5-10' continous Scan pilot SB 12-02
8:50	5552		1 min count for 10-12' sample pilot SB12-02
8:55	5264		1 min count for 12-14' sample pilot SB 12-02
9:01	5800 - 7700		10-15' Continuous scan pilot SB 12-02
9:10	5080		1 min Count for 14-16' sample pilot SB12-02
9:16	4828		1 min Count for 16 - 18' sample pilot SB12-02
9:18	5200 - 6200		15-20' Continuous scan pilot SB 12-02
9:25	4539		1 min Count for 18-20' Sample pilot SB 12-02

Note: Attach sketches, maps or drawings of scan and sample locations as necessary to document exact location of excavation activities.

Page 2 **of** 3

WASTE MANAGEMENT

If soil or other media samples are collected, complete the following:

Sample ID#	Sample Location			1 Minute Static Count within 1 inch of Sample Location		Estimated Sample Volume (Include Units)
	Northing	Easting	Elevation (msl)	Before	After	

Note: Attach analytical analysis of samples to this report when results are obtained.

2. CHEMICAL CONTAMINATION SCREENING

Date of PID Survey: 10/23/12

PID Scan Performed By: J. Darling

Date of Calibration: 10/11/12

PID Instrument Used: Mini Rae Lite

SN# of Instrumentation: 590-001471

Level of PPE Required: D

Visible Evidence of Chemical Contamination: Yes [✓ No] (Circle One)

Description of PID Survey performed: Scanned material in 6" lifts. Continuous scann as soil exit Boring and 1 minute counts

Time	VOC Screening Data	Units	Scan Location (Layer, Lift, Bottom)
8:00	0	PPM	Surface Scan by SLF 1-6 SE Corner
8:30	0		0-5 continuous scan pilot SB12-02
8:45	0		5-10 Continuous scan pilot SB12-02
8:50	0		1 minute-count for 10-12' sample ~~sp~~ pilot SB12-02
8:55	0		1 Minute Count for 12-14' sample pilot SB12-02
9:01	0		10-15 continuous Scan pilot SB12-02
9:10	0		1 minute count for 14-16' Sample pilot SB12-02
9:16	0		1 minute count for 16-18' Sample pilot SB12-02
9:18	0		15-20 continuous scan pilot SB12-02
9:25	0		1 minute Count for 18-20' sample pilot SB-12-02

Comments:

Attach chain of custody and any analytical results of soil samples collected.

WASTE MANAGEMENT

Page 3 of 3

CWM Chemical Services, LLC.

Generic Small Project
Soil Excavation Monitoring and Management Report Extension

Prepared By: Justin Darling

Date of Report: 10/23/12

Rad Instrument Used: Ludlum 2221/4410

Rad Instrument Used: Mini Rae Lite

SN# of Instrumentation 262345/226924

SN# of Instrumentation: 590-001471

Date of Calibration: 8/3/12

Date of Calibration: 10/11/12

Pre-Op Daily QC Source Check: 28149

Post-Op Daily QC Source Check: 27337

Pre-Op Field Location Bkg: 4726

Post-Op Field Location Bkg: 5090

Pre-Op Field Location Bkg: 5674

Post-Op Field Location Bkg: 5210

Rad Scan Survey Results:

Time	Scan Survey Data	Units	V.O.C (PPM)	Scan Location
9:31	4448.	CPM	0	1min Count for 20-22' sample pi
9:37	4319		0	1min count for 22-24 sample
9:40	4900-6500		0	20-25 Continuous scan pilot
9:48	4033		0	1min count for 24-26 sample
9 52	3981		0	1 min count for 26-28 Sample
958	4200-6100		0	25-30 continuous scan pilot SB12-
10:08	4730		0	1min count for 28-30' sample
10:15	3779		0	1 min count for 30-32 sample
10:07	3868		0	1 min count for 32-34 sample
10:35	5500-6100		0	Spoils of pilot hole
11:36	4800-5900		0	0-5' Continuous Scan SB12-0
11:46	4800-6800		0	5-10 Continuous Scan SB12-02
11:53	5500-6300		0	10-15 Continuous Scan SB 12-02
11:58	5300-6400		0	15-20 Continuous scan SB12-02
12:18	4700-6100		0	20-25 Continuous scan SB12-02
12:48	4800-5200		0	Samples
1:10	5100-6600		0	Spoils of SB12-02
1:29	4300-6700		0	Final walkover

Note: Attach sketches, maps or drawings of scan and sample locations as necessary to document exact location of excavation activities.

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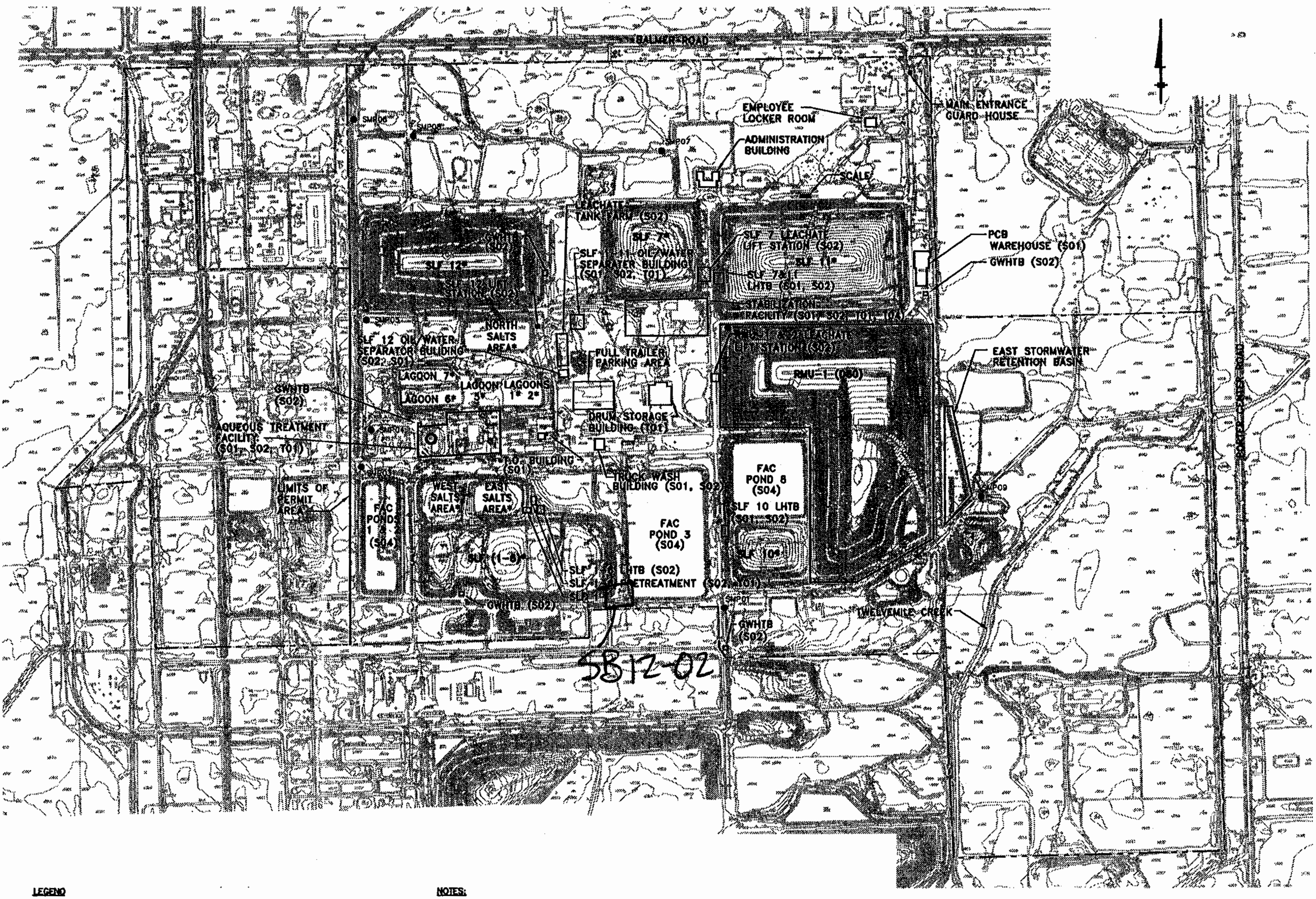

LEGEND

SLF =	SECURE LANDFILL	——— – – ———	PROPERTY LINE
FAC =	FACULTATIVE	———————	LIMITS OF ACTIVE LANDFILL
LAG =	LAGOON	S02 =	TANK STORAGE
* =	INACTIVE	S04 =	SURFACE IMPOUNDMENTS
LHTB =	LEACHATE HOLDING TANK BUILDING	T01 =	TANK TREATMENT
GWHTB =	GROUNDWATER COLLECTION HOLDING TANK BUILDING	T04 =	OTHER TREATMENT
080 =	LANDFILL	SMP09 ● =	SURFACE MONITORING POINT (SMP)
S01 =	CONTAINER STORAGE		

NOTES:

1. THIS MAP COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 5-31-01. (AIR SURVEY CORP. PROJECT NO.71010503)
2. VERTICAL DATUM BASED ON NGS MEAN SEA LEVEL.
3. GRID BASED ON LOCAL COORDINATE SYSTEM.
4. CONTOUR INTERVAL 2 FT.
5. DASHED CONTOURS INDICATE THAT GROUND IS PARTIALLY OBSCURED BY VEGETATION OR SHADOWS. THESE AREAS MAY NOT MEET STANDARD ACCURACY AND REQUIRE FIELD TESTING COMPLETION.
6. PROPERTY LINES ARE APPROXIMATE.
7. 630 PERMITTED ACRES.
8. 710 TOTAL ACRES.
9. LOCATION OF SMPs ARE APPROXIMATE.

500' 0' 500' 1000'

EnSol, Inc.
Environmental Solutions

661 MAIN STREET
NIAGARA FALLS, NY 14301
PHONE (716) 285-3920
FAX (716) 285-3928

FACILITY LAYOUT PLAN

CWM CHEMICAL SERVICES, LLC.
MODEL CITY, NY

FIGURE
3

ATTACHMENT C

INVESTIGATION LABORATORY RESULTS

GeoTesting
EXPRESS

Technologies to manage risk
for infrastructure

Atlanta
Boston
Chicago
New York
San Francisco

www.geotesting.com

February 7, 2013

Russell Marchese
Golder Associates, Inc.
2430 North Forest Road, Suite 100
Getzville, NY 14068

RE: CWM/RMU-2 GC Sampling, Lewiston, NY (GTX-12376)

Dear Russell:

Enclosed are the test results you requested for the above referenced project. GeoTesting Express, Inc. (GTX) received five samples from you on 10/24/2012. These samples were labeled as follows:

Boring	Sample	Depth
SB12-01	SB12-01	16-17 ft.
SB12-01	SB12-01	22-24 ft.
SB12-01	SB12-01	24-26 ft.
SB12-02	SB12-02	18-20 ft.
SB12-02	SB12-02	24-26 ft.

GTX performed the following tests on these samples:

2 ASTM D2216 - Moisture Contents
2 ASTM D4318 - Atterberg Limits
2 ASTM D7263 - Density (Unit Weight) of Soil Specimens
3 ASTM D6528 - Direct Simple Shear Tests

As requested, the Direct Simple Shear tests were performed with a horizontal stress applied to the test specimen during the consolidation phase of the test. First, a normal load of 2 tsf was applied on the specimen. Then the application of the horizontal stress began, proportionally in increasing steps along with the rest of the requested normal load until a ratio of 0.2 of the requested normal load was reached. The test specimen was then allowed to reach equilibrium before the shear phase of the test was started.

The results presented in this report apply only to the items tested. This report shall not be reproduced except in full, without written approval from GeoTesting Express. The remainder of these samples will be retained for a period of sixty (60) days and will then be discarded unless otherwise notified by you. Please call me if you have any questions or require additional information. Thank you for allowing GeoTesting Express the opportunity of providing you with testing services. We look forward to working with you again in the future.

Respectfully yours,

Joe Tomei
Laboratory Manager

GeoTesting EXPRESS

Technologies to manage risk for infrastructure

Atlanta
Boston
Chicago
New York
San Francisco
www.geotesting.com

Geotechnical Test Report

2/6/2013

GTX-12376
CWM/RMU-2 GC Sampling

Lewiston, NY

Client Project No.: 123-89491

Prepared for:

Golder Associates, Inc.

GeoTesting
EXPRESS

Client:	Golder Associates, Inc.				
Project:	CWM/RMU-2 GC Sampling				
Location:	Lewiston, NY			Project No:	GTX-12376
Boring ID:	SB12-01	Sample Type:	tube	Tested By:	cam
Sample ID:	SB12-01	Test Date:	11/09/12	Checked By:	jdt
Depth :	22-24 ft.	Test Id:	253671		

Test Comment: ---
Sample Description: Moist, brown clay
Sample Comment: ---

Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
SB12-01	SB12-01	22-24 ft.	Moist, brown clay	33.8

Notes: Temperature of Drying : 110° Celsius

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GeoTesting EXPRESS

Client:	Golder Associates, Inc.
Project Name:	CWM/RMU-2 GC Sampling
Project Location:	Lewiston, NY
GTX #:	12376
Test Date:	11/04/12
Tested By:	md
Checked By:	jdt

Density (Unit Weight) of Soil by ASTM D 7263

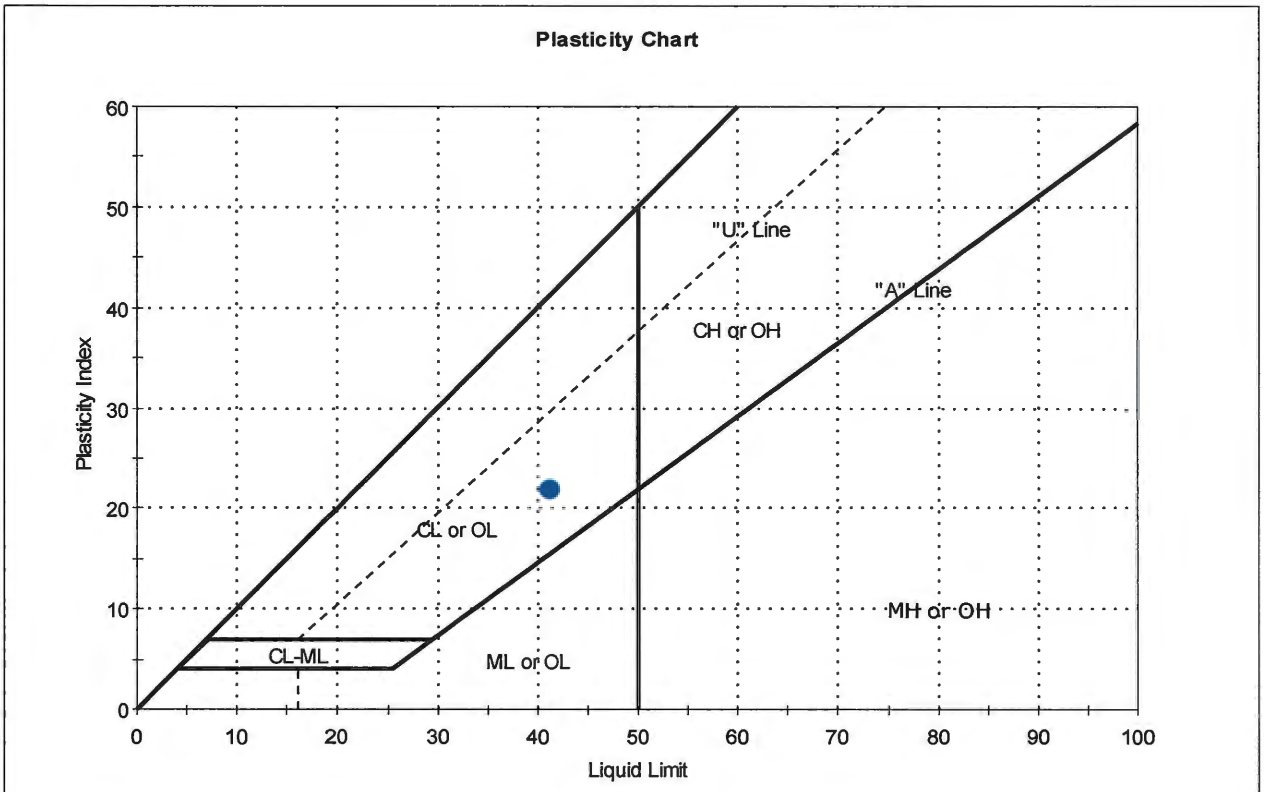
Boring ID	Sample ID	Depth, ft	Visual Description	Bulk Density, lb/ft^3	Moisture Content, %	Dry Density, lb/ft^3
SB12-01	SB12-01	22-24	Moist, brown clay	114	33.8	85.6

Notes: Density determined on undisturbed tube sample provided to GeoTesting Express in tubes
Moisture content determined by ASTM D 2216 at 110° C

Client:	Golder Associates, Inc.				
Project:	CWM/RMU-2 GC Sampling				
Location:	Lewiston, NY			Project No:	GTX-12376
Boring ID:	SB12-01	Sample Type:	tube	Tested By:	cam
Sample ID:	SB12-01	Test Date:	11/07/12	Checked By:	jdt
Depth :	22-24 ft.	Test Id:	253667		

Test Comment: ---
Sample Description: Moist, brown clay
Sample Comment: ---

Atterberg Limits - ASTM D 4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
●	SB12-01	SB12-01	22-24 ft.	34	41	19	22	1	

Sample Prepared using the WET method

Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

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GeoTesting EXPRESS

Client: Golder Associates, Inc.
Project: CWM/RMU-2 GC Sampling
Location: Lewiston, NY
Project No: GTX-12376
Boring ID: SB12-02
Sample Type: tube
Tested By: cam
Sample ID: SB12-02
Test Date: 11/12/12
Checked By: jdt
Depth : 24-26 ft.
Test Id: 253672
Test Comment: ---
Sample Description: Moist, brown clay
Sample Comment: ---

Moisture Content of Soil and Rock - ASTM D 2216-10

Boring ID	Sample ID	Depth	Description	Moisture Content,%
SB12-02	SB12-02	24-26 ft.	Moist, brown clay	33.1

Notes: Temperature of Drying : 110° Celsius

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GeoTesting EXPRESS

Client:	Golder Associates, Inc.
Project Name:	CWM/RMU-2 GC Sampling
Project Location:	Lewiston, NY
GTX #:	12376
Test Date:	10/29/12
Tested By:	md
Checked By:	jdt

Density (Unit Weight) of Soil by ASTM D 7263

Boring ID	Sample ID	Depth, ft	Visual Description	Bulk Density, lb/ft^3	Moisture Content, %	Dry Density, lb/ft^3
SB12-02	SB12-02	24-26	Moist, brown clay	120	33.1	89.9

Notes: Density determined on undisturbed tube sample provided to GeoTesting Express in tubes

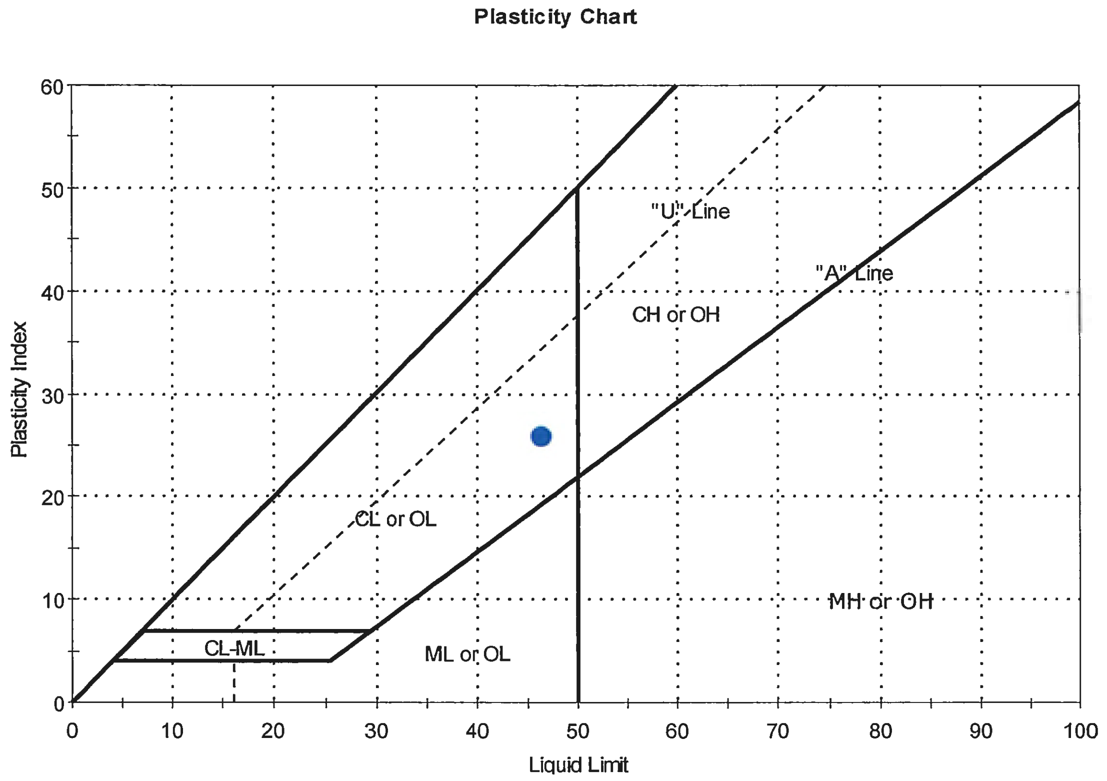
Moisture content determined by ASTM D 2216 at 110° C

GeoTesting EXPRESS

Client:	Golder Associates, Inc.				
Project:	CWM/RMU-2 GC Sampling				
Location:	Lewiston, NY			Project No:	GTX-12376
Boring ID:	SB12-02	Sample Type:	tube	Tested By:	cam
Sample ID:	SB12-02	Test Date:	10/31/12	Checked By:	jdt
Depth :	24-26 ft.	Test Id:	253668		

Test Comment: ---
Sample Description: Moist, brown clay
Sample Comment: ---

Atterberg Limits - ASTM D 4318-10



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
●	SB12-02	SB12-02	24-26 ft.	33	46	20	26	0	

Sample Prepared using the WET method

Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

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GeoTesting EXPRESS

Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils by ASTM D 6528

Client:	Golder Associates, Inc.	GTX#:	12376
Project Name:	CWM/RMU-2 GC Sampling	Test Date:	1/2/13-1/11/13
Project Location:	Lewiston, NY		

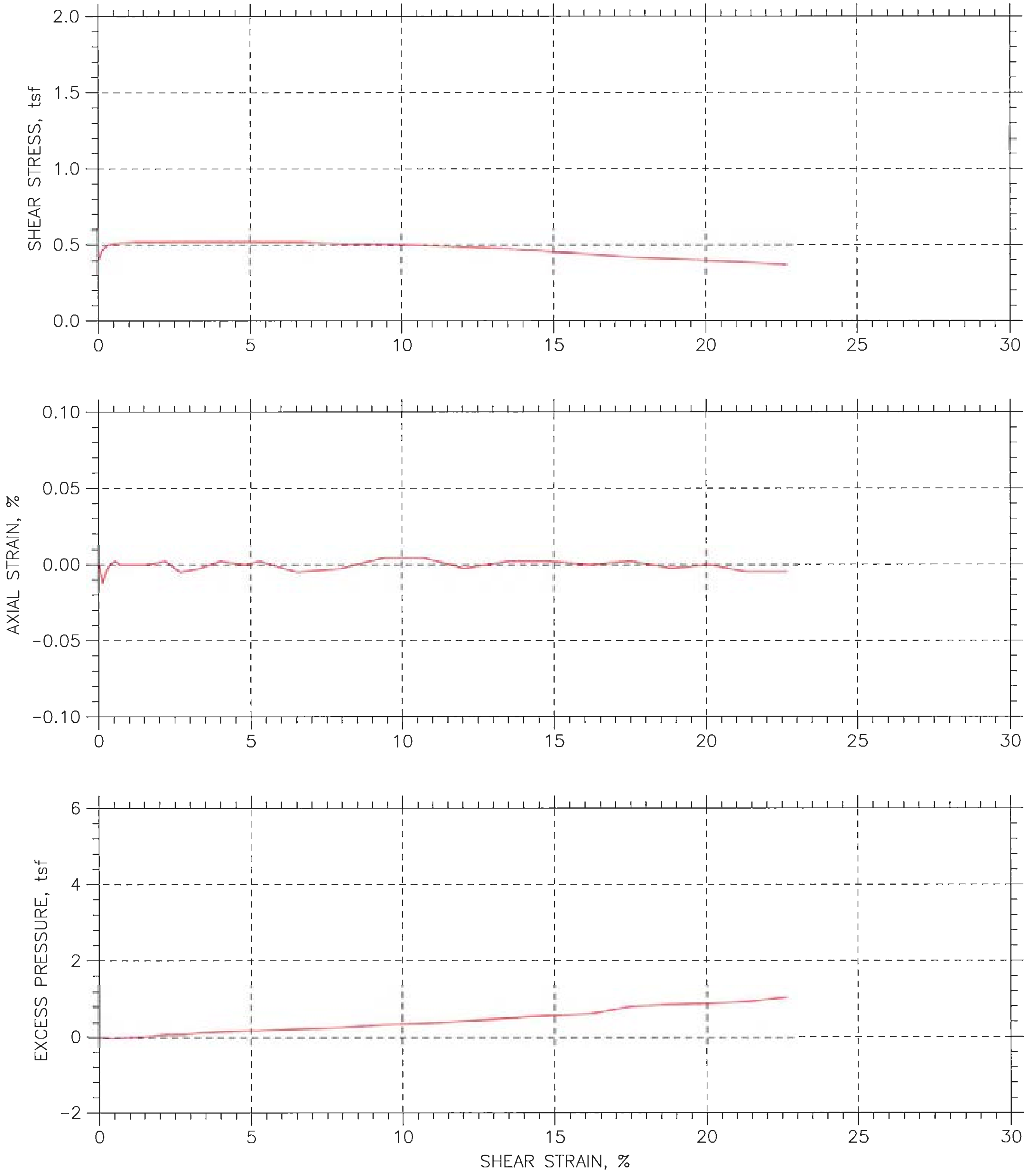
Boring ID:	SB12-01
Sample ID:	SB12-01
Depth, ft:	22-24
Visual Description:	Moist, brown clay
Test Equipment:	Top and bottom box (circular) = 2.62 in diameter. Load cells and LVDT's connected to data acquisition system for shear force, normal load, horizontal and vertical displacement; surface area = 5.39 in^2, soil height = 1 inch. Reinforced Membrane used. Set up included porous stones with pins.
Test Condition:	Inundated prior to consolidation
Sample Type and Preparation:	Extruded from tube, cut, trimmed and placed into apparatus at as-received density and moisture content.

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5
Test No.	DSS-13	DSS-12	DSS-11		
Initial Moisture Content, %	32.8	30.6	30.9		
Initial Dry Density, pcf	92.2	90.7	93.4		
Nominal Rate of Shear Strain, /hr	0.08	0.08	0.08		
Vertical Consolidation Stress, tsf	2	4	6		
Initial Horizontal Stress, tsf	0.4	0.8	1.2		
Final Moisture Content, %	30.2	27.9	23.1		
Measured Peak Shear Stress, tsf	0.52	0.97	1.46		
Shear Strain at Peak Shear Stress, %	4.0	1.3	2.2		
Membrane Correction, tsf	0.02	0.01	0.01		
Corrected Peak Shear Stress, tsf	0.50	0.96	1.45		
S_u / σ'_{vc}	0.25	0.24	0.24		

Comments: Normal load applied to 2 tsf, then initial horizontal stress applied in steps at a ratio of 0.2 until reaching the target loads prior to shearing.

Tested By: md/njh Checked By: jdt

DIRECT SIMPLE SHEAR TEST



Project: CWM/RMU 2 GC	Location: Lewiston, NY	Project No.: GTX-12376
Boring No.: SB12-01	Tested By: md/njh	Checked By: jdt
Sample No.: SB12-01	Test Date: 1/9/13	Depth: 22-24 ft
Test No.: DSS-13	Sample Type: intact	Elevation: ---
Description: Moist, brown clay		
Remarks: System J		
File: \\Geocompdb1\Projects\GTX12376\CDSS\12376-DSS-13n.dat		Page 2 of 7

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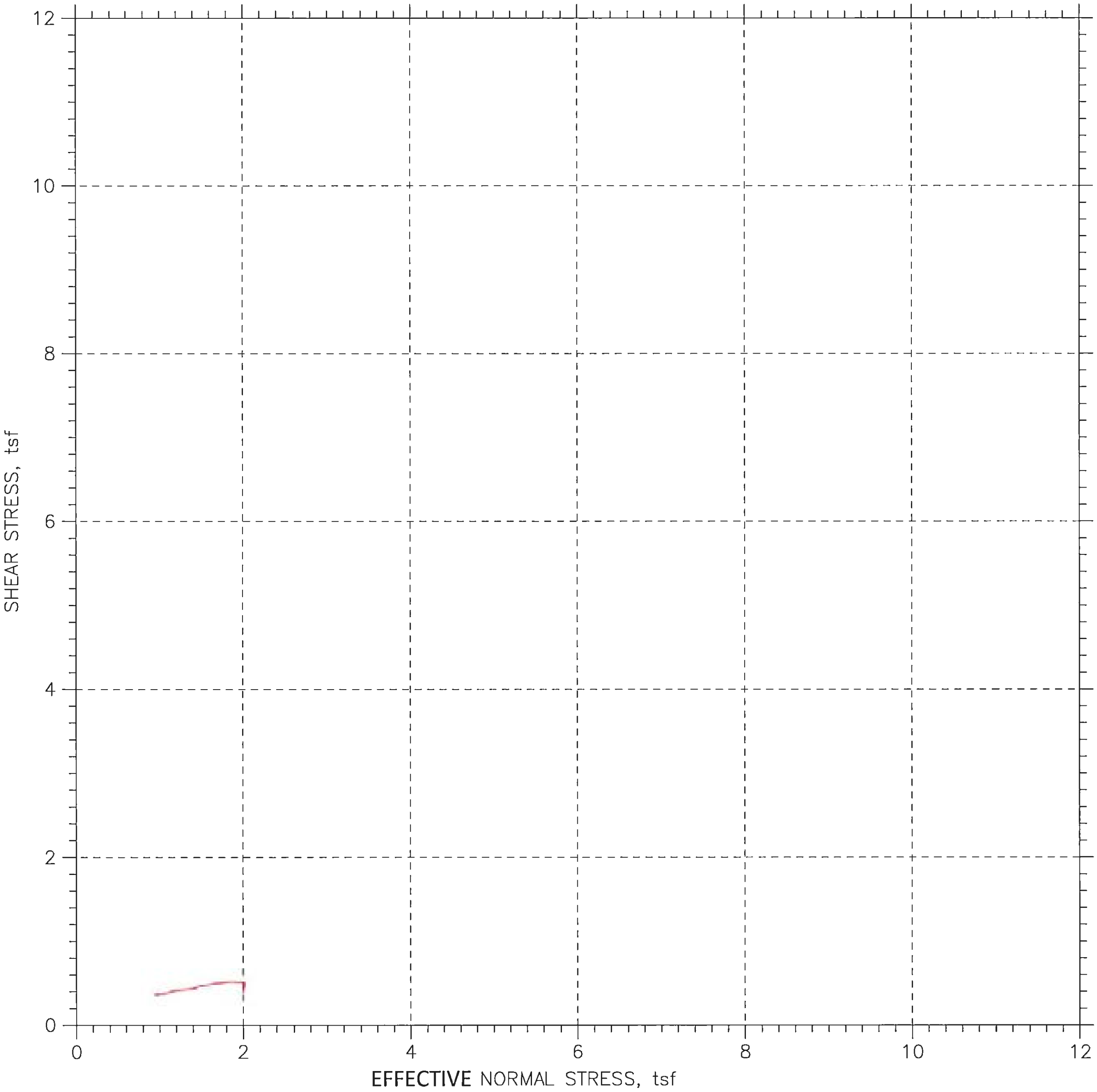
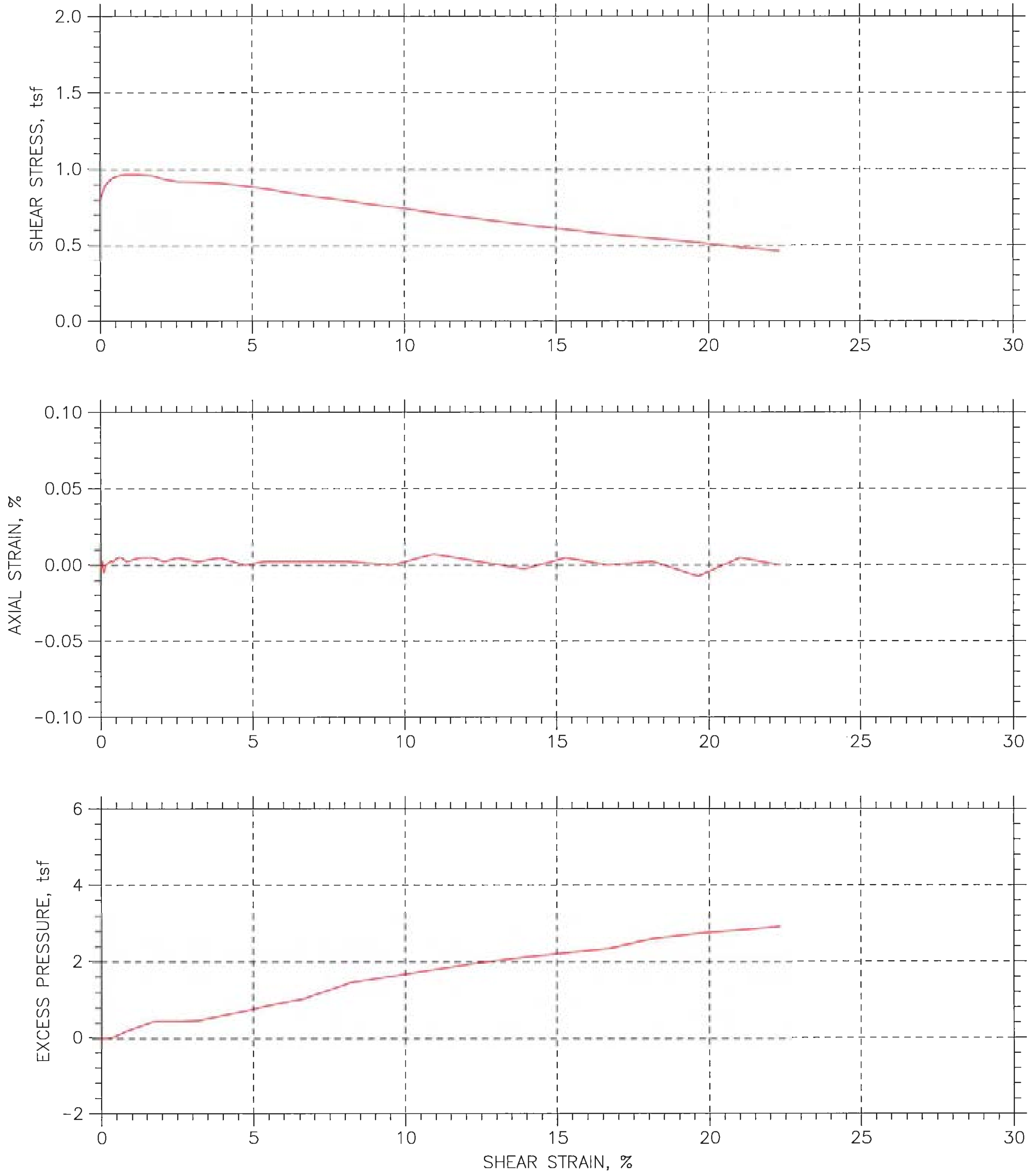
DIRECT SIMPLE SHEAR TEST



Project: CWM/RMU 2 GC	Location: Lewiston, NY	Project No.: GTX-12376
Boring No.: SB12-01	Tested By: md/njh	Checked By: jdt
Sample No.: SB12-01	Test Date: 1/9/13	Depth: 22-24 ft
Test No.: DSS-13	Sample Type: intact	Elevation: ---
Description: Moist, brown clay		
Remarks: System J		
File: \\Geocompdb1\Projects\GTX12376\CDSS\12376-DSS-13n.dat		Page 3 of 7

Fri, 11-JAN-2013 12:08:43

DIRECT SIMPLE SHEAR TEST



Project: CWM/RMU 2 GC	Location: Lewiston, NY	Project No.: GTX-12376
Boring No.: SB12-01	Tested By: md/njh	Checked By: jdt
Sample No.: SB12-01	Test Date: 1/7/13	Depth: 22-24 ft
Test No.: DSS-12	Sample Type: intact	Elevation: ---
Description: Moist, brown clay		
Remarks: System J		
File: \\Geocompdb1\Projects\GTX12376\CDSS\12376-DSS-12n.dat		Page 4 of 7

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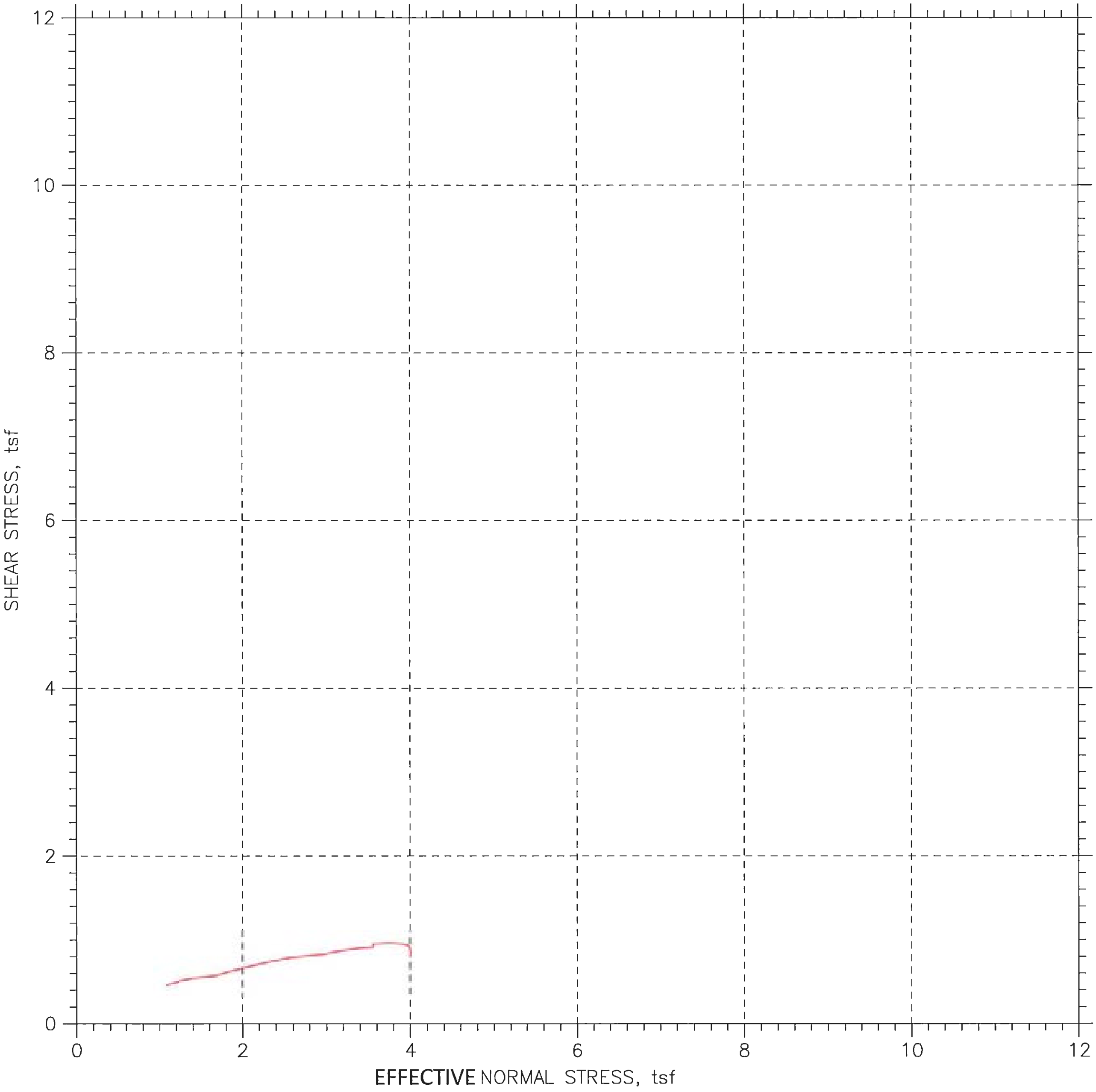
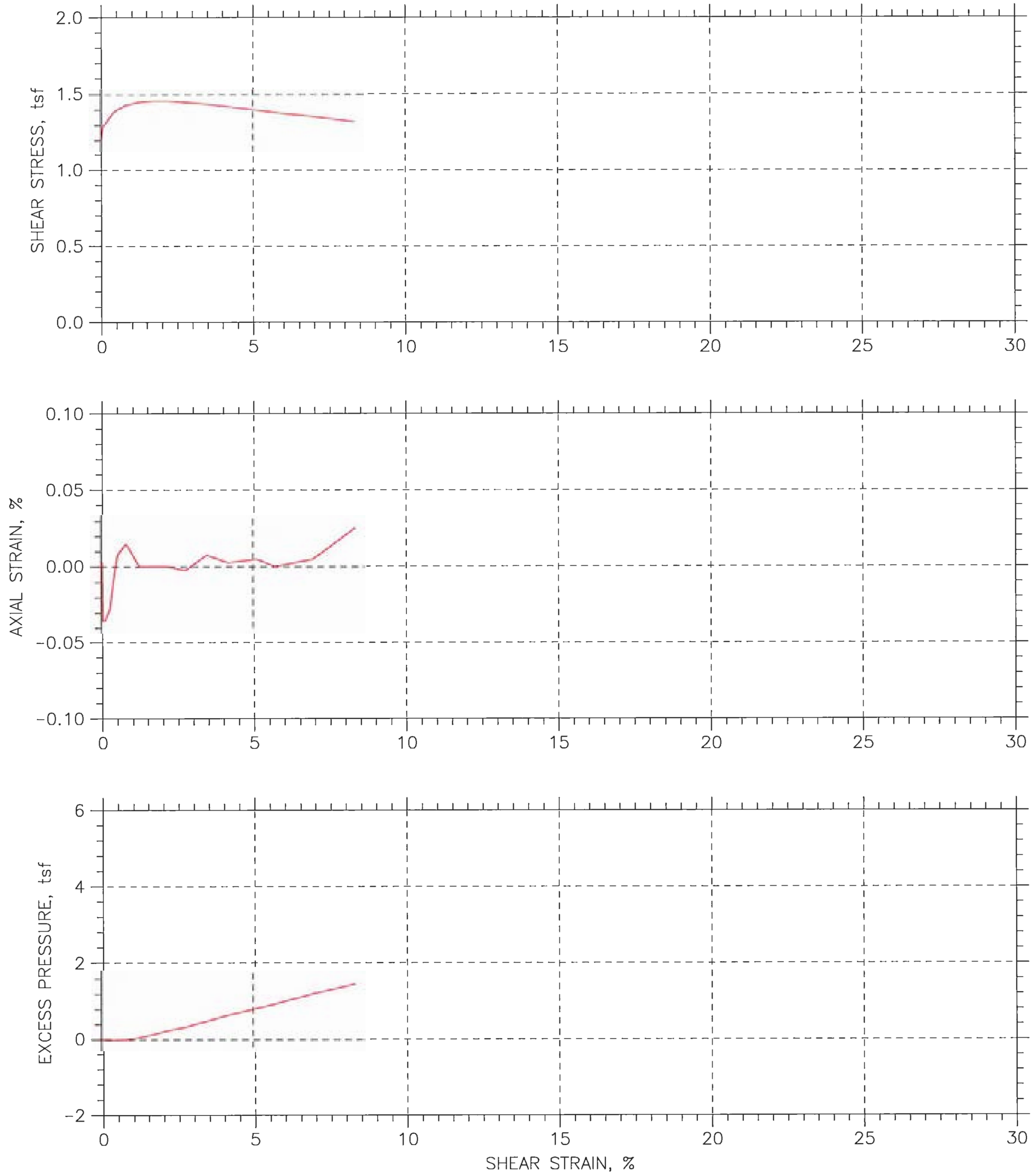
DIRECT SIMPLE SHEAR TEST



Project: CWM/RMU 2 GC	Location: Lewiston, NY	Project No.: GTX-12376
Boring No.: SB12-01	Tested By: md/njh	Checked By: jdt
Sample No.: SB12-01	Test Date: 1/7/13	Depth: 22-24 ft
Test No.: DSS-12	Sample Type: intact	Elevation: ---
Description: Moist, brown clay		
Remarks: System J		
File: \\Geocompdb1\Projects\GTX12376\CDSS\12376-DSS-12n.dat		Page 5 of 7

DIRECT SIMPLE SHEAR TEST



Project: CWM/RMU 2 GC	Location: Lewiston, NY	Project No.: GTX-12376
Boring No.: SB12-01	Tested By: md/njh	Checked By: jdt
Sample No.: SB12-01	Test Date: 1/2/13	Depth: 22-24 ft
Test No.: DSS-11	Sample Type: intact	Elevation: ---
Description: Moist, brown clay		
Remarks: System J		
File: \\Geocompdb1\Projects\GTX12376\CDSS\12376-DSS-11.dat		Page 6 of 7

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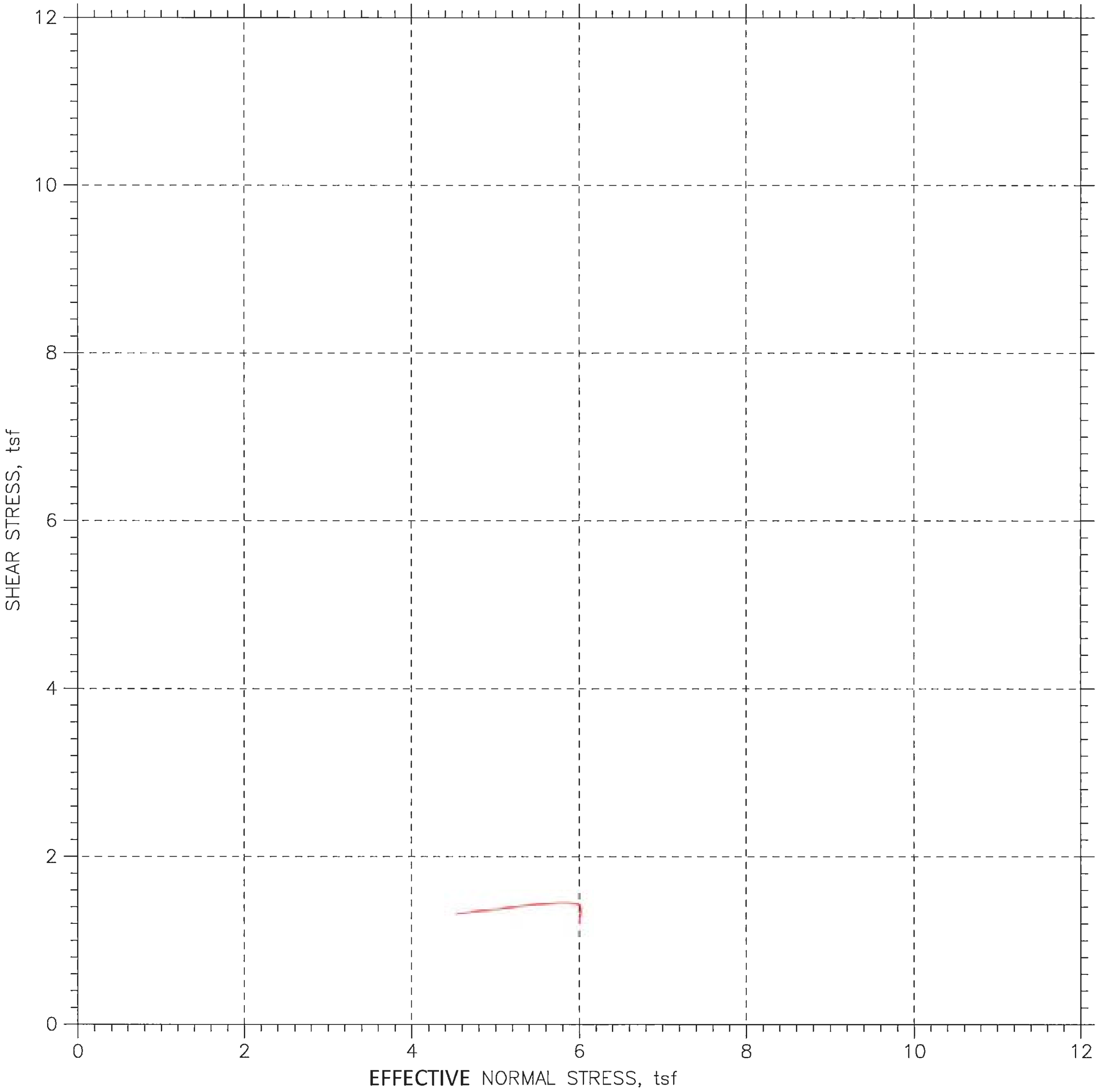
DIRECT SIMPLE SHEAR TEST



Project: CWM/RMU 2 GC	Location: Lewiston, NY	Project No.: GTX-12376
Boring No.: SB12-01	Tested By: md/njh	Checked By: jdt
Sample No.: SB12-01	Test Date: 1/2/13	Depth: 22-24 ft
Test No.: DSS-11	Sample Type: intact	Elevation: ---
Description: Moist, brown clay		
Remarks: System J		
File: \\Geocompdb1\Projects\GTX12376\CDSS\12376-DSS-11.dat		Page 7 of 7

Fri, 11-JAN-2013 12:18:13

WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX's liability will be limited to correcting or repeating a test which fails our warranty. GTX's liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$
B	pore pressure parameter for $\Delta\sigma_3$
CIU	isotropically consolidated undrained triaxial shear test
CR	compression ratio for one dimensional consolidation
C_c	coefficient of curvature, $(D_{30})^2 / (D_{10} \text{ x } D_{60})$
C_u	coefficient of uniformity, D_{60}/D_{10}
C_c	compression index for one dimensional consolidation
C_α	coefficient of secondary compression
c_v	coefficient of consolidation
c	cohesion intercept for total stresses
c'	cohesion intercept for effective stresses
D	diameter of specimen
D_{10}	diameter at which 10% of soil is finer
D_{15}	diameter at which 15% of soil is finer
D_{30}	diameter at which 30% of soil is finer
D_{50}	diameter at which 50% of soil is finer
D_{60}	diameter at which 60% of soil is finer
D_{85}	diameter at which 85% of soil is finer
d_{50}	displacement for 50% consolidation
d_{90}	displacement for 90% consolidation
d_{100}	displacement for 100% consolidation
E	Young's modulus
e	void ratio
e_c	void ratio after consolidation
e_o	initial void ratio
G	shear modulus
G_s	specific gravity of soil particles
H	height of specimen
PI	plasticity index
i	gradient
K_o	lateral stress ratio for one dimensional strain
k	permeability
LI	Liquidity Index
m_v	coefficient of volume change
n	porosity
PI	plasticity index
P_c	preconsolidation pressure
p	$(\sigma_1 + \sigma_3) / 2$, $(\sigma_v + \sigma_h) / 2$
p'	$(\sigma'_1 + \sigma'_3) / 2$, $(\sigma'_v + \sigma'_h) / 2$
p'_c	p' at consolidation
Q	quantity of flow
q	$(\sigma_1 - \sigma_3) / 2$
q_f	q at failure
q_o, q_i	initial q
q_c	q at consolidation
S	degree of saturation
SL	shrinkage limit
s_u	undrained shear strength
T	time factor for consolidation

T	temperature
t	time
U, UC	unconfined compression test
UU, Q	unconsolidated undrained triaxial test
u_a	pore gas pressure
u_e	excess pore water pressure
u, u_w	pore water pressure
V	total volume
V_g	volume of gas
V_s	volume of solids
V_v	volume of voids
V_w	volume of water
V_o	initial volume
v	velocity
W	total weight
W_s	weight of solids
W_w	weight of water
w	water content
w_c	water content at consolidation
w_f	final water content
w_l	liquid limit
w_n	natural water content
w_p	plastic limit
w_s	shrinkage limit
w_o, w_i	initial water content
α	slope of q_f versus p_f
α'	slope of q_f versus p_f'
γ_t	total unit weight
γ_d	dry unit weight
γ_s	unit weight of solids
γ_w	unit weight of water
ε	strain
ε_{vol}	volume strain
ε_h, ε_v	horizontal strain, vertical strain
μ	Poisson's ratio, also viscosity
σ	normal stress
σ'	effective normal stress
σ_c, σ'_c	consolidation stress in isotropic stress system
σ_h, σ'_h	horizontal normal stress
σ_v, σ'_v	vertical normal stress
σ_1	major principal stress
σ_2	intermediate principal stress
σ_3	minor principal stress
τ	shear stress
φ	friction angle based on total stresses
φ'	friction angle based on effective stresses
φ'_r	residual friction angle
φ_{ult}	φ for ultimate strength

GeoTesting
EXPRESS

Client: Golder Associates, Inc.
Project: CWM/RMU-2 GC Sampling
Location: Lewiston, NY
Project No: GTX-12376
Boring ID: SB12-01
Sample Type: tube
Tested By: cam
Sample ID: SB12-01
Test Date: 11/12/12
Checked By: jdt
Depth : 22-24 ft.
Test Id: 253671
Test Comment: ---
Sample Description: Moist, dark grayish brown clay
Sample Comment: ---

Moisture Content of Soil and Rock - ASTM D 2216-10

Boring ID	Sample ID	Depth	Description	Moisture Content,%
SB12-01	SB12-01	22-24 ft.	Moist, dark grayish brown clay	33.8

Notes: Temperature of Drying : 110° Celsius

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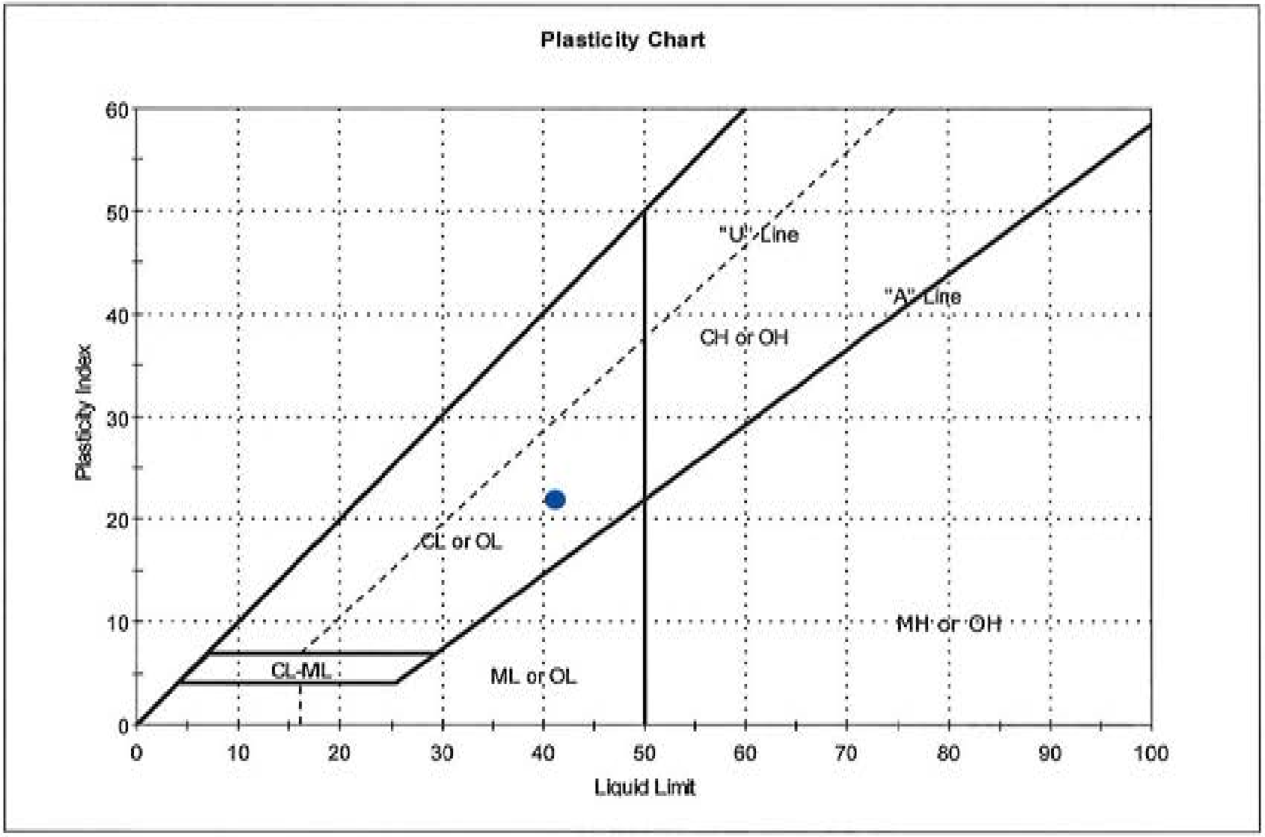
GeoTesting
EXPRESS

Client:	Golder Associates, Inc.				
Project:	CWM/RMU-2 GC Sampling				
Location:	Lewiston, NY			Project No:	GTX-12376
Boring ID:	SB12-01	Sample Type:	tube	Tested By:	cam
Sample ID:	SB12-01	Test Date:	11/06/12	Checked By:	jdt
Depth :	22-24 ft.	Test Id:	253667		

Test Comment: ---
Sample Description: Moist, dark grayish brown clay
Sample Comment: ---

Atterberg Limits - ASTM D 4318-10



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
●	SB12-01	SB12-01	22-24 ft.	34	41	19	22	1	

Sample Prepared using the WET method

Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

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GeoTesting
EXPRESS

Client:	Golder Associates, Inc.				
Project:	CWM/RMU-2 GC Sampling				
Location:	Lewiston, NY			Project No:	GTX-12376
Boring ID:	SB12-02	Sample Type:	tube	Tested By:	cam
Sample ID:	SB12-02	Test Date:	11/12/12	Checked By:	jdt
Depth :	24-26 ft.	Test Id:	253672		

Test Comment: ---
Sample Description: Moist, brown clay
Sample Comment: ---

Moisture Content of Soil and Rock - ASTM D 2216-10

Boring ID	Sample ID	Depth	Description	Moisture Content,%
SB12-02	SB12-02	24-26 ft.	Moist, brown clay	33.1

Notes: Temperature of Drying : 110º Celsius

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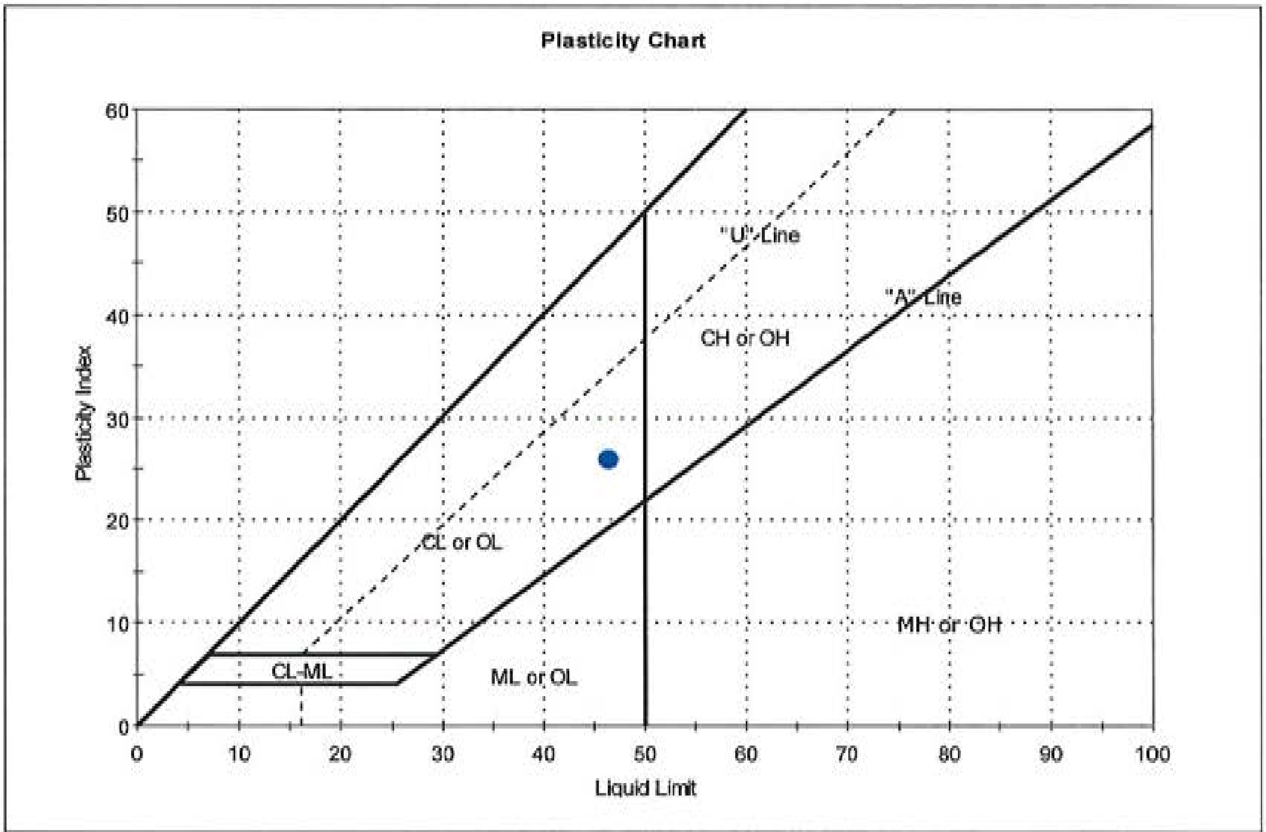
Client:	Golder Associates, Inc.		
Project:	CWM/RMU-2 GC Sampling		
Location:	Lewiston, NY	Project No:	GTX-12376

Boring ID: SB12-02 Sample Type: tube Tested By: cam
Sample ID: SB12-02 Test Date: 10/31/12 Checked By: jdt
Depth : 24-26 ft. Test Id: 253668

Test Comment: ---
Sample Description: Moist, brown clay
Sample Comment: ---

Atterberg Limits - ASTM D 4318-10



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
●	SB12-02	SB12-02	24-26 ft.	33	46	20	26	0	

Sample Prepared using the WET method

Dry Strength: VERY HIGH
Dilatancy: SLOW
Toughness: LOW

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