

**INITIAL SAFETY FACTOR ASSESSMENT**  
**40 C.F.R. PART 257.73**  
**PLANT HAMMOND ASH POND 1 (AP-1)**  
**GEORGIA POWER COMPANY**

EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" Final Rule (40 C.F.R. Part 257 and Part 261), §257.73(e), requires the owner or operator of an existing CCR surface impoundment to conduct an initial and periodic safety factor assessments. The owner or operator of the CCR unit must conduct an assessment and document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) for the critical embankment section are achieved.

The CCR surface impoundment located at Georgia Power Company's Plant Hammond also referred to as the Plant Hammond Ash Pond 1 (AP-1) is located on Plant Hammond property, in Coosa Georgia, 1 mile west of the Rome, Georgia city limits in Floyd County. The CCR surface impoundment is formed by an engineered perimeter embankment. The critical section of this CCR unit has been determined to be located on the south side of the perimeter embankment.

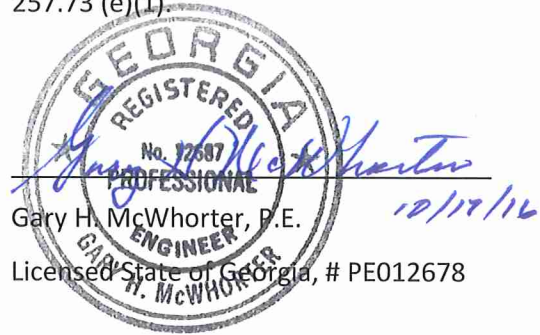
The analyses used to determine the minimum safety factor for the critical section resulted in the following minimum safety factors:

Loading Condition	Minimum Calculated Safety Factor	Minimum Required Safety Factor
Long-term Maximum Storage Pool (Static)	3.9	1.5
Maximum Surcharge Pool (Static)	3.9	1.4
Seismic	2.9	1.0

The embankments are constructed of clays that are not susceptible to liquefaction. Therefore, a minimum liquefaction safety factor determination was not required.

This assessment is supported by appropriate engineering calculations which are attached.

I hereby certify that the safety factor assessment was conducted in accordance with 40 C.F.R. Part 257.73 (e)(1).





## Engineering and Construction Services Calculation

**Calculation Number:**  
TV-HM-GPC607582-001

<b>Project/Plant:</b> Plant Hammond Ash Pond 1	<b>Unit(s):</b> Units 1-4	<b>Discipline/Area:</b> ES&FS
<b>Title/Subject:</b> Slope Stability Analyses of Ash Pond Dike		
<b>Purpose/Objective:</b> Analyze slope stability of Ash Pond Dike		
<b>System or Equipment Tag Numbers:</b> NA	<b>Originator:</b> Rajendra S. Gondhalekar	

### Contents

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Total # of pages including cover sheet & attachments:		52	

### Revision Record

<b>Rev. No.</b>	<b>Description</b>	<b>Originator Initial / Date</b>	<b>Reviewer Initial / Date</b>	<b>Approver Initial / Date</b>
0	Issued for Information	RSG/10-03-16	JAL/10-03-16	JCP/10-03-16

### Notes:

## Purpose of Calculation

Georgia Power Company's Plant Hammond has 4 ash ponds, 1, 2, 3, and 4. Ash Pond 1 was commissioned in 1952, at the time of plant construction. In the early 1970s, the rail tracks were constructed on the dike. At that time the dike stability was evaluated with train loads by Law Engineering. Original design drawings indicate that the original dike was constructed with an outboard slope of 3 horizontal to 1 vertical. More recent surveys of the dike show that the outboard face of the dike is currently about 4.8 horizontal to 1 vertical. Currently, Ash Pond 1 is used for process water, low volume waste, co-treatment and storm-water runoff.

The purpose of this calculation is to check the stability of the dike of Ash Pond 1 using current software.

## Methodology

The calculation was performed using the following methods and software:

GeoStudio 2012 (Version 8.15, Build 11777), Copyright 1991-2016, GEO-SLOPE International, Ltd.

Strata (Version alpha, Revision 0.2.0), Geotechnical Engineering Center, Department of Civil, Architectural, and Environmental Engineering, University of Texas.

Morgenstern-Price analytical method was run and reported.

## Criteria and Assumptions

The slope stability models were run using the following assumptions and design criteria:

- Seismic site response was determined using a one-dimensional equivalent linear site response analysis. The analysis was performed using Strata and utilizing random vibration theory. The input motion consisted of the USGS published 2008 Uniform Hazard Response Spectrum (UHRS) for Site Class B/C at a 2% Probability of Exceedance in 50 years. The UHRS was converted to a Fourier Amplitude Spectrum, and propagated through a representative one dimensional soil column using linear wave propagation with strain-dependent dynamic soil properties. The input soil properties and layer thickness were randomized based on defined statistical distributions to perform Monte Carlo simulations for 100 realizations, which were used to generate a median estimate of the surface ground motions.
- The median surface ground motions were then used to calculate a pseudostatic seismic coefficient for utilization in the stability analysis using the approach suggested by Bray and Tavaslarou (2009). The procedure calculates the seismic coefficient for an allowable seismic displacement and a probability exceedance of the displacement. For this analysis, an allowable displacement of 0.5 ft, and a probability of exceedance of 16% were conservatively selected, providing a seismic coefficient of 0.063g for use as a horizontal acceleration in the stability analysis.



- The current required minimum criteria (factors of safety) were taken from the Structural Integrity Criteria for existing CCR surface impoundment from 40 CFR 257.73, published April 17, 2015.
- The soil properties of unit weight, phi angle, and cohesion were obtained from triaxial shear testing performed on UD samples of the fill and foundation soils obtained during drilling in March 2010. The testing was performed according to ASTM D 4767.
- Properties for ash were based on laboratory testing performed on undisturbed and remolded samples of ash from various plants and on engineering judgment.
- In March 2010, piezometers were installed in the dike fill, the foundation soils and in the ash. These piezometers, in conjunction with survey data, were used to obtain current water elevations within the dike and the foundation soils.
- The COE EM 1110-2-1902, October 2003, allows the use of the phreatic surface established for the maximum storage condition (normal pool) in the analysis for the maximum surcharge loading condition. This is based on the short term duration of the surcharge loading relative to the permeability of the embankment and the foundation materials. This method is used in the analysis for the impoundments at this facility with surcharge loading.
- According to the NOAA website, the flood elevation for the Coosa River at Plant Hammond is elevation 570 feet. This elevation is well below the toe of all ash pond dikes. Therefore, flood cases were not evaluated.

#### Ash Pond 1

- The cross-section of Ash Pond 1 was obtained using the following sources:
  - 1) Original design Drawing No. H-35 for the upstream surface of the dike and the maximum pool elevation.
  - 2) Metro topographic survey drawing from 2000 (post railroad) for the downstream surface of the dike and the toe.
  - 3) Hydrographic survey Drawing H-666-14 from 2006 for the top of ash.
  - 4) Drawing H-30, Plot Plan of Drill Holes, for the approximate top of rock.
- Groundwater elevations through the dike and on the downstream side of the dike were determined from piezometers installed in March 2010. Maximum surcharge pool was based on the SCS Hydro Services 2010 calculation SH-HM10911-02 evaluating the stormwater capacity of Ash Pond 1.

#### **Input Data**

The following soil properties were used in the analyses. This data was obtained from laboratory triaxial testing performed in March 2010 by S&ME. The laboratory testing consisted of classification testing as well as consolidated undrained triaxial tests with pore pressure measurements in order to provide total as well as effective shear strength parameters of the embankment and foundation soils. Sample disturbance during the sampling effort as well as variations in the soil specimens (wide range of void ratios, initial saturation conditions, gravel content, and dry unit weights) resulted in inconsistencies in the test results. This prevented S&ME from reporting the total stresses for five of the tests and to suggest that these inconsistencies be taken into account when interpreting and applying the data. The laboratory data for the five tests were reviewed in order to arrive at total stress parameters that would

conservatively represent the soil types indicated by the classification tests. Failure criteria were established at lower strains occurring near the maximum pore pressures developed during the test procedures. These parameters have been added to the following table and are consistent with the remaining total stress parameters reported by S&ME. The effective stress interpretations provided by S&ME were used in the analyses.

Soil Description	Dry Unit Weight, pcf	Moist Unit Weight, pcf	Effective Stress Parameters		Total Stress Parameters	
			Cohesion, psf	Phi Angle, degrees	Cohesion, psf	Phi Angle, degrees
Sandy Clay Dike Fill	117.6	133	270	32	400	18.5
Sandy Clay Fdn Soil	97.9	123	40	35	500	21.6
Sluiced Ash		80	0	10	0	10

### Hydrologic Considerations

The following hydraulic information, based on the calculation package Schnabel Reference 16C17025.00, Hydrologic and Hydraulic Support Services, Coal Combustion Residuals Storage Analyses, dated August 15, 2016, prepared by Schnabel Engineering, was used in the analyses. This calculation states that Ash Pond 1 is capable of handling the 1000-year 24-hour storm event with a maximum surcharge pool elevation of 585.2.

### Load Conditions

The impoundment dike at Plant Hammond Ash Pond 1 was evaluated for the load conditions indicated in the following table. When appropriate, cases were run both in the ash and the dike.

### Summary of Conclusions

The following table lists the factors of safety for various slope stability failure conditions. All conditions are steady state except where noted. Construction cases were not considered. Based on the results of these analyses all structures are stable.

Load Conditions	Computed Factor of Safety	Required Minimum Factor of Safety
Long-term Maximum Storage (Static)	3.9	1.5
Maximum Surcharge Pool (Static)	3.9	1.4
Seismic	2.9	1.0

The analyses indicate that in all cases the ash pond dike, for Ash Pond 1, the factors of safety are above the required minimums.

## Design Inputs/References

USGS Earthquake Hazards website, <http://earthquake.usgs.gov/hazards/hazmaps/>.

NOAA website, <http://www.srh.noaa.gov/ffc/html/rva.php>.

GPC Drawing H-35, Plant Hammond Units 1 & 2 Ash Basin Area – Excavation and Drainage

GPC Drawing H-30, Plant Hammond Plot Plan of Drill Holes

GPC Land Department Drawing H-666-14, Plant Hammond Ash Pond No. 1 – November 2006 Survey

Metro Topographic Map, Georgia Power Company, Plant Hammond, February 29, 2000

GPC Drawing H-436, Plant Hammond 1973 Ash Pond Plan and Sections

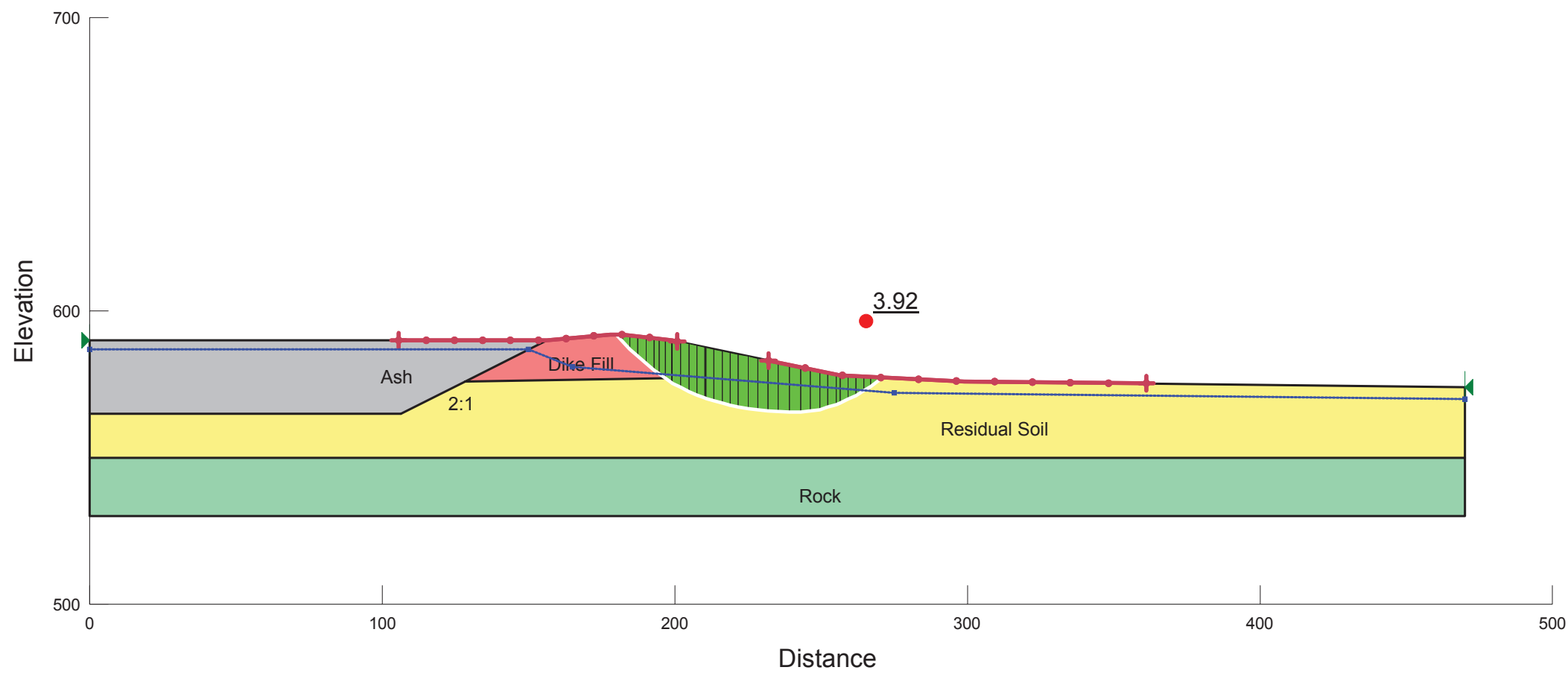
Ref. 16C17025.00 Hydrologic and Hydraulic Support Services, Coal Combustion Residuals Storage Analysis, prepared by Schnabel Engineering, August 15, 2016

Bray, J. D. and Travasarou, T., *Pseudostatic Coefficient for Use in Simplified Seismic Slope Stability Evaluation*, Journal of Geotechnical and Environmental Engineering, American Society of Civil Engineers, September 2009

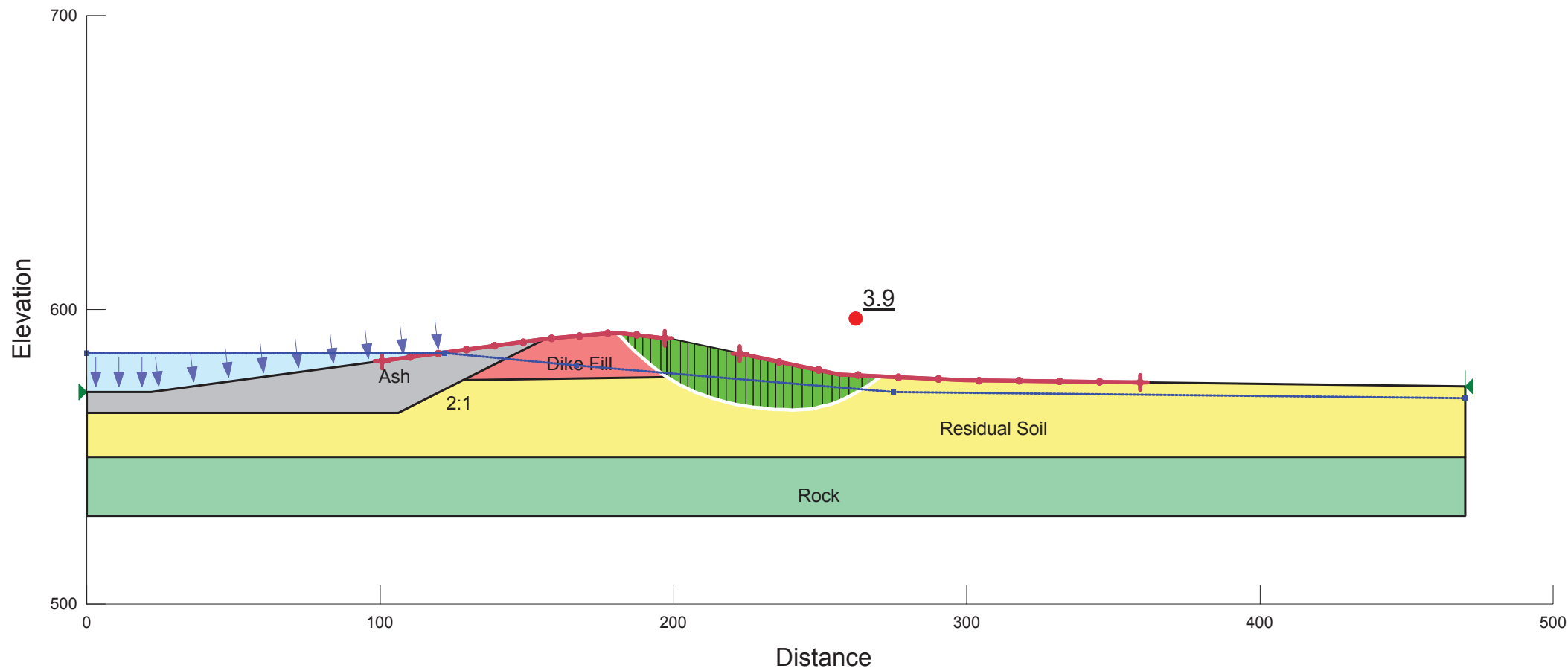
## Body of Calculation

Calculation consists of Slope-W modeling attached.

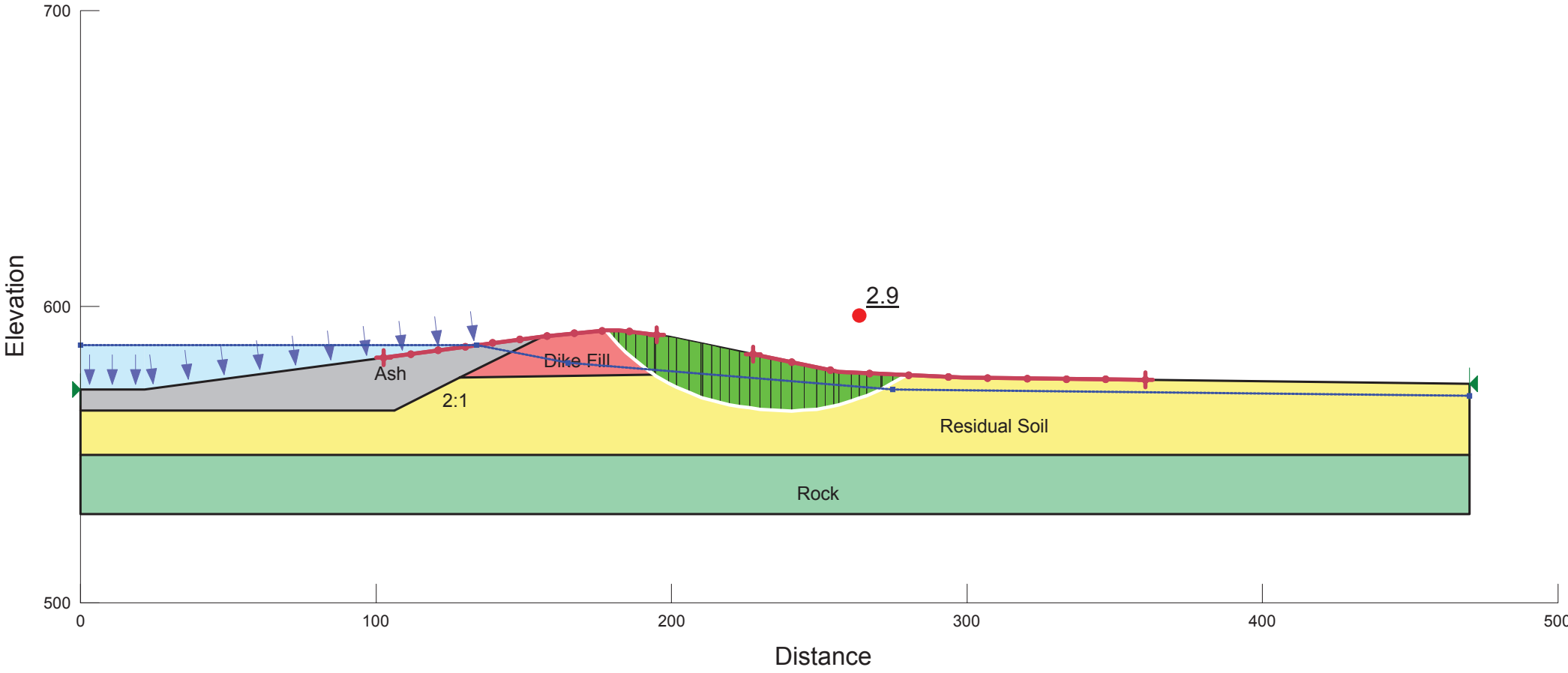
Plant Hammond  
Ash Pond 1  
Downstream - Max Storage  
East Dike  
Section A-A'  
Morgenstern-Price



Plant Hammond Ash Pond 1  
Downstream - Max Surcharge  
East Dike  
Section A-A'  
Morgenstern-Price



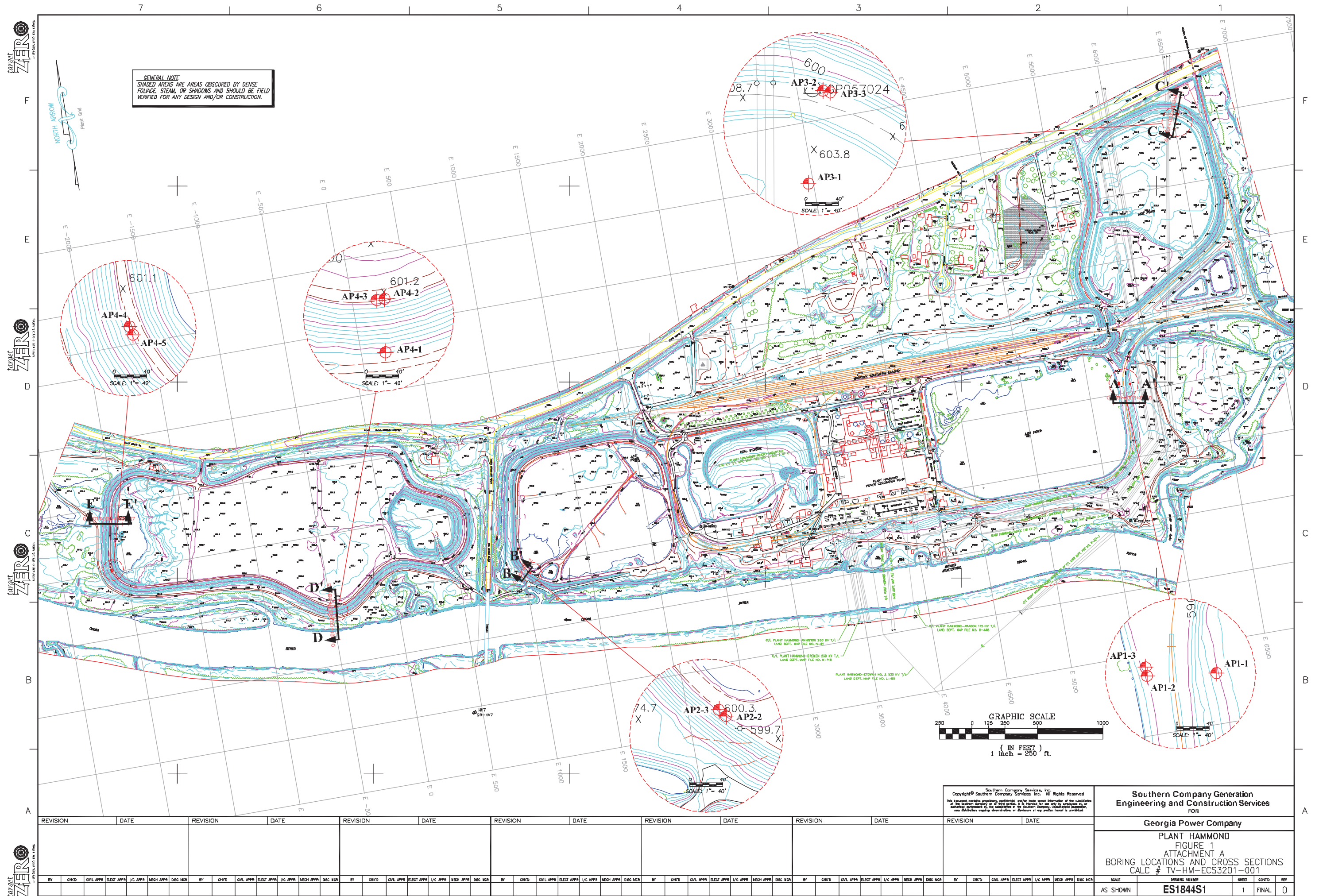
Plant Hammond Ash Pond 1  
Downstream - Seismic  
East Dike  
Section A-A'  
Morgenstern-Price



# **Attachment A**

Figures - Boring Location Plans







# **Attachment B**

## **Boring Logs**

SOUTHERN COMPANY Energy to Serve Your World™		DRILLING LOG GEOLOGICAL SERVICES				Hole No. <b>AP1-1</b>			
						Sheet 1 of 1			
SITE <b>Plant Hammond</b>		HOLE DEPTH <b>20 ft</b>		SURF ELEV. <b>579.00</b>					
LOCATION <b>Rome, GA</b>		COORDINATES: N <b></b>		E <b></b>					
ANGLE <b>Vertical</b>		BEARING <b></b>		CONTRACTOR <b>Ranger Consulting, Inc</b>		DRILL NO. <b>CME 550X</b>			
DRILLING METHOD <b>Hollow stem auger</b>		NO. SAMPLES <b>4</b>		NO. U.D. SAMPLES <b>0</b>					
CASING SIZE <b></b>		LENGTH <b></b>		CORE SIZE <b></b>		TOTAL % REC. <b></b>			
WATER TABLE DEPTH <b></b>		ELEV. <b></b>		TIME AFTER COMP. <b></b>		DATE TAKEN <b></b>			
TYPE GROUT <b>Bentonite</b>		QUANTITY <b></b>		MIX <b></b>		DRILLING START DATE <b>3/16/2010</b>			
DRILLER <b>Justin</b>		RECORDER <b>J Pugh</b>		APPROVED <b></b>		DRILLING COMP. DATE <b>3/16/2010</b>			
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	% Rec	ROD
				From To	Blows	N			
0	579.00	Drilled from toe of dike							
1	578.00						Post hole to 3 ft		
2	577.00								
3	576.00								
4	575.00	Brown sandy clay; moist	1	3.5-5	2-2-3	5	Water table at 4 ft at 24-hr		
5	574.00								
6	573.00								
7	572.00								
8	571.00								
9	570.00	Orange and gray very silty fine to medium grained sand; wet	2	8.5-10	6-8-11	19	Water table at 8 ft at T.O.B.		
10	569.00								
11	568.00						UD #1		
12	567.00								
13	566.00								
14	565.00	Orange and gray very silty fine to medium grained sand with rock fragments; wet	3	13.5-15	8-6-8	14			
15	564.00								
16	563.00								
17	562.00								
18	561.00								
19	560.00	Orange and gray very silty fine to medium grained sand with rock fragments; wet	4	18.5-20	WH-2-2	4			
20	559.00								
		Bottom of hole at 20 ft							

Form GS9901 7-26-2004

SOUTHERN COMPANY Energy to Serve Your World™		DRILLING LOG GEOLOGICAL SERVICES				Hole No. AP1-2		
						Sheet 1 of 2		
SITE <b>Plant Hammond</b>		HOLE DEPTH <b>30 ft</b>		SURF ELEV. <b>589.84</b>				
LOCATION <b>Rome, GA</b>		COORDINATES N <b></b> E <b></b>						
ANGLE <b>Vertical</b> BEARING <b></b>		CONTRACTOR <b>Ranger Consulting, Inc</b>		DRILL NO. <b>CME 550X</b>				
DRILLING METHOD <b>Hollow stem auger</b>		NO. SAMPLES <b>6</b>		NO. U.D. SAMPLES <b>1</b>				
CASING SIZE <b></b> LENGTH <b></b>		CORE SIZE <b></b>		TOTAL % REC. <b></b>				
WATER TABLE DEPTH <b></b> ELEV. <b></b>		TIME AFTER COMP. <b></b>		DATE TAKEN <b>3/16/2010</b>				
TYPE GROUT <b>Bentonite</b>		QUANTITY <b></b> MIX <b></b>		DRILLING START DATE <b>3/16/2010</b>				
DRILLER <b>Justin</b> RECORDER <b>J Pugh</b>		APPROVED <b></b>		DRILLING COMP. DATE <b>3/16/2010</b>				
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test		Comments	% Rec	RQD
				From To	Blows	N		
0	589.84	Begin drilling at dike crest						
1	588.84						Post hole to 3 ft	
2	587.84							
3	586.84							
4	585.84	Light brown and orange clayey sand with gravel; moist	1	3.5-5	3-3-4	7		
5	584.84							
6	583.84							
7	582.84							
8	581.84							
9	580.84	Mottled brown, red and tan sandy clay with gravel; moist	2	8.5-10	5-6-8	14	Water table at 10 ft at 24-hr	
10	579.84						UD #1 (30" rec.)	
11	578.84							
12	577.84							
13	576.84							
14	575.84	Brown and gray clay with minor fine sand; moist	3	13.5-15	4-4-4	8		
15	574.84							
16	573.84						Water table at 16 ft at T.O.B.	
17	572.84							
18	571.84							
19	570.84	Mottled light brown, red and tan clayey sand with gravel; wet	4	18.5-20	9-9-11	20		
20	569.84							
21	568.84							
22	567.84							
23	566.84							
24	565.84	Light brown and gray very silty sand with gravel	5	23.5-25	3-4-7	11		

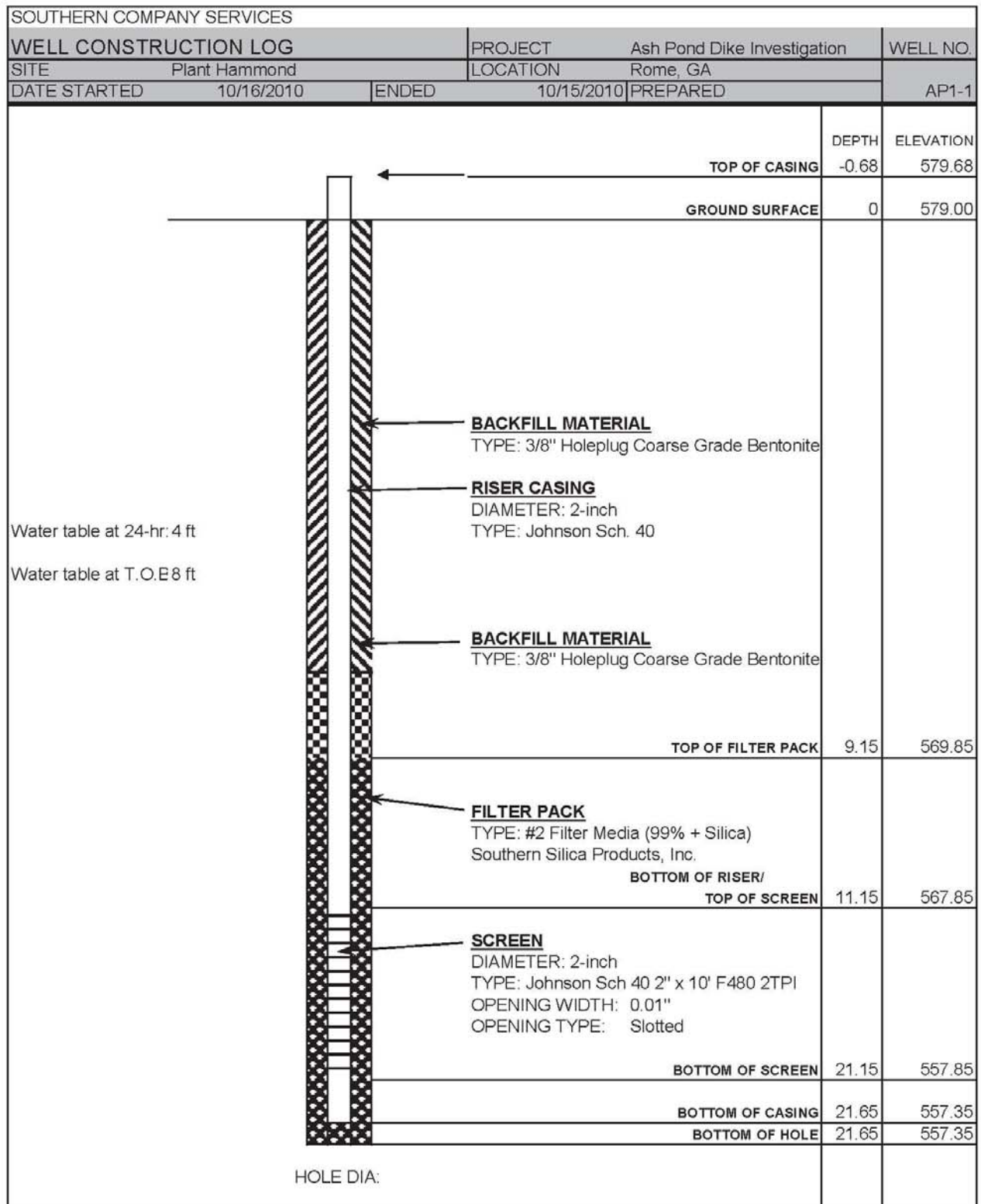
Form GS9901 7-26-2004

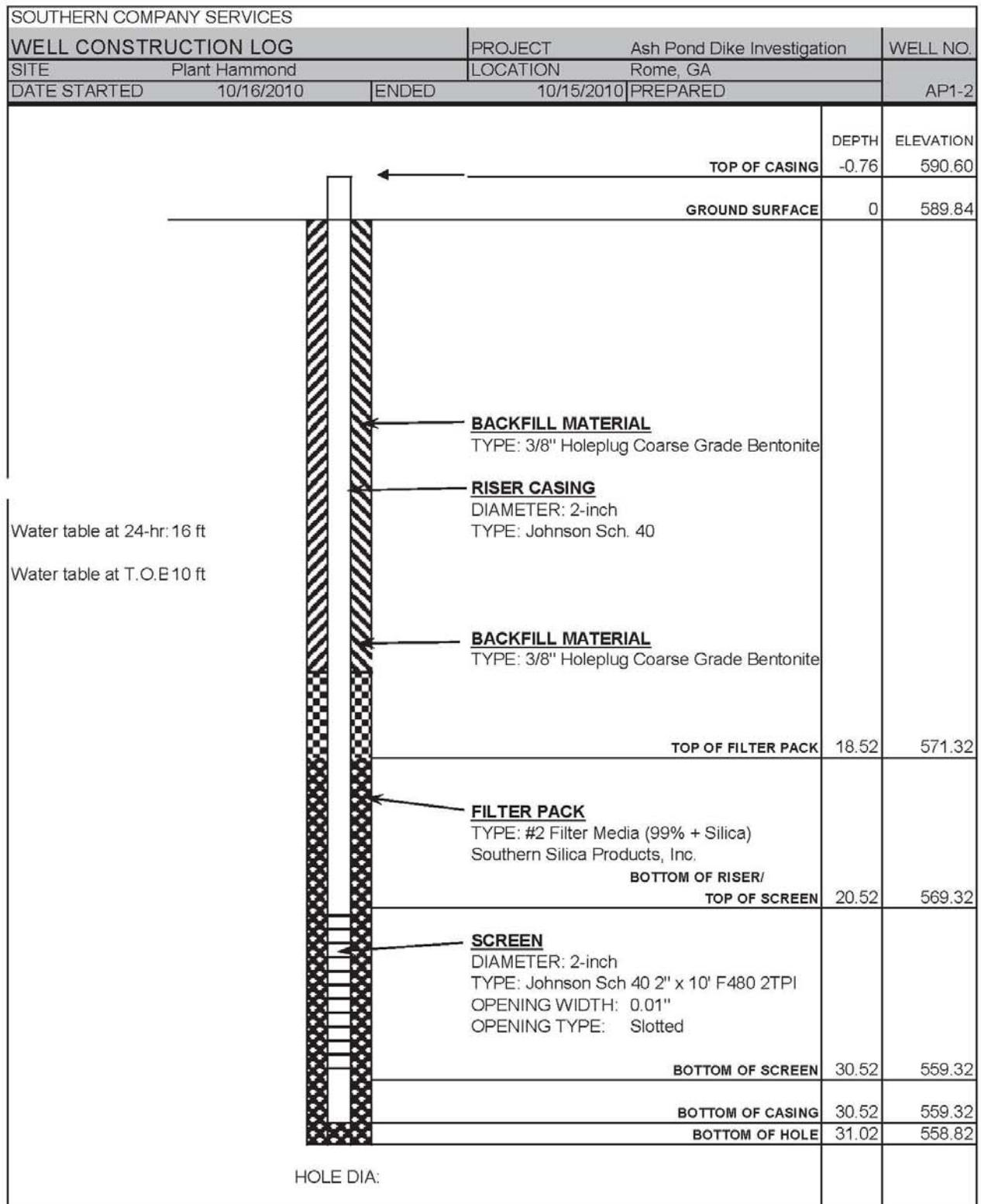
Form GS9901 7-26-2004

Form GS9901 7-26-2004

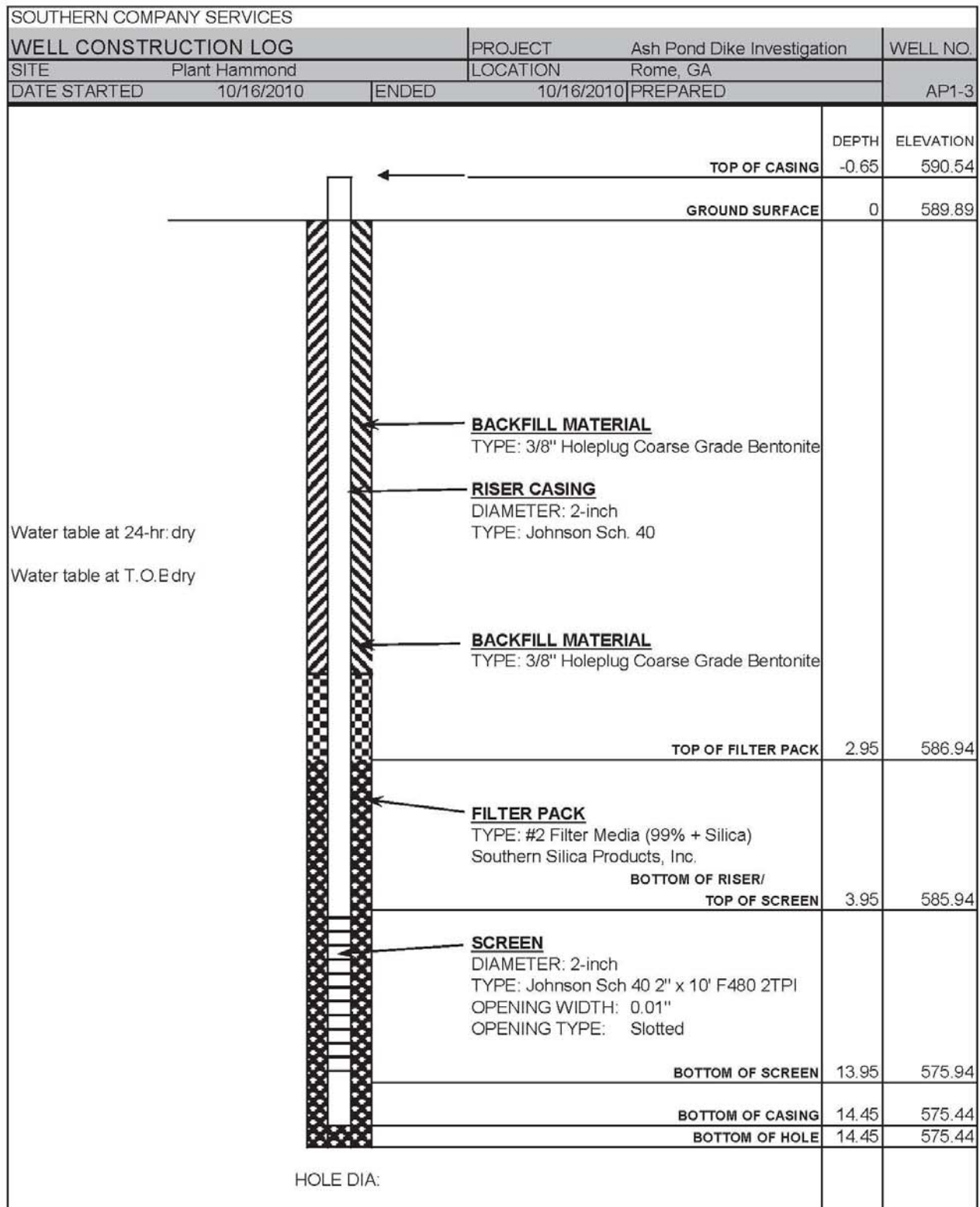
# **Attachment C**

## Piezometer Logs









## **Attachment D**

### Soil Laboratory Analysis

April 21, 2010

Southern Company Services  
241 Ralph McGill Boulevard  
16<sup>th</sup> Floor, Bin 10185  
Atlanta, Georgia 30308

Attention: Mr. Gary H. McWhorter

Subject: Plant Hammond Ash Pond Dikes  
S&ME Job No. 28900

Gentlemen:

S&ME, Inc. has completed the laboratory testing on the soil samples sent by your office. The following tests were performed:

- ◆ Atterberg Limits
- ◆ Sieve Analysis
- ◆ Triaxial Shear

S&ME, Inc. performs soil tests in general accordance with the applicable American Society for Testing and Materials (ASTM) or AASHTO procedures. These procedures are generally recognized as the basis for uniformity and consistency of test results in the geotechnical engineering profession. All the work is supervised by a qualified engineer. Attached are test results for your review. While S&ME is not responsible for the use or interpretation of these data we note that the test results do not appear to be consistent with our expectations for materials with these unified soil classifications.

S&ME, Inc. appreciates the opportunity to provide these laboratory services. Please contact us if you have any questions concerning this report or if we may be of further service.

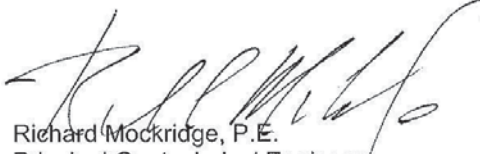
Respectfully submitted,

S&ME, Inc.

  
Ashok K. Mangla  
Geotechnical Laboratory Manager

AKM/RM/pg

Attachment

  
Richard Mockridge, P.E.  
Principal Geotechnical Engineer

S&ME		TRIAXIAL SHEAR TEST REPORT (ASTM D 4767)		AAP ASTM D 1585		
JOB NAME: Plant Hammond Ash Pond Dikes						
JOB NO.: 28900		REPORT NO.: N/A		REVIEWED BY: <i>[Signature]</i>		
BORING / PIT NO.: N/A		DEPTH / ELEV.: N/A		DATE: 4/20/10		
SAMPLE LOCATION: AP1 @ 5'-7', Foundation		SAMPLE NO.: N/A		TYPE: UD		
SOIL DESCRIPTION: Yellowish brown lean clay with sand (CL)						
LL, %: 47		PI, %: 26		FINES, %: 87		
				G <sub>s</sub> : 2.71		
SPECIMEN PROPERTIES			TEST PARAMETERS, TEST TYPE: CU/PP			
INITIAL			AFTER CONSOLIDATION			
SPECIMEN NO.	1	2	3	1	2	3
DIAMETER, INCHES	D <sub>o</sub> 2.89	2.89	2.88	D <sub>c</sub> 2.87	2.88	2.86
HEIGHT, INCHES	H <sub>o</sub> 6.20	6.07	6.07	H <sub>c</sub> 6.16	6.04	6.02
WATER CONTENT, %	W <sub>o</sub> 25.0	25.2	25.9	W <sub>c</sub> 26.1	25.8	25.1
DRY DENSITY, PCF	γ <sub>dryo</sub> 97.2	98.2	98.3	γ <sub>dryc</sub> 99.1	99.5	100.7
SATURATION, %	S <sub>o</sub> 91.7	94.4	97.6	S <sub>c</sub> 100	100	100
VOID RATIO	e <sub>o</sub> 0.741	0.724	0.721	e <sub>c</sub> 0.709	0.701	0.682
			Strain 0.2 % per minute			
			T50, Minutes = 2			
N/A						
N/A						
SHEAR STRENGTH PARAMETERS		TOTAL		EFFECTIVE		
		COHESION, C (ksf) : 0.50		APPARENT COHESION, (ksf) : 0.04		
		ANGLE OF INTER. FRICTION, Φ (DEGREES) : 21.6		ANGLE OF INTER. FRICTION, Φ' (DEGREES) : 35.1		

# PARTICLE-SIZE DISTRIBUTION TEST REPORT

## SIEVE AND HYDROMETER

REV2.080706

AASHTO R 98

JOB NAME : Plant Hammond Ash Pond Dikes

JOB NO. : 28900 REPORT NO. : N/A DATE : 4/20/10 REVIEWED BY : *[Signature]*

BORING / PIT NO. : N/A DEPTH / ELEV. : N/A SAMPLE NO. : N/A SAMPLE TYPE : UD

SAMPLE LOCATION : AP1 @ 5'-7' foundation

SOIL DESCRIPTION : Yellowish brown, lean clay with sand.

LIQUID LIMIT, % : 47 PLASTICITY INDEX, % : 26 MOISTURE, % : N/A SP. GRAVITY, Gs : N/A

D10, MM : N/A D30, MM : N/A D60, MM : N/A FINES, % : 87

CLASSIFICATION UNIFIED : CL AASHTO : N/A COEFF. OF CURVATURE, C<sub>c</sub> : N/A

COEFF. OF UNIFORMITY, C<sub>u</sub> : N/A

GRAVEL SAND FINES

COARSE FINE COARSE FINE COARSE FINE

CLAY

Grain Size (mm)	Sieve / Hydrometer	Percentage of Finer (%)
19.0	3/8" Sieve	100
14.9	No. 10 Sieve	100
11.8	No. 15 Sieve	100
9.5	No. 20 Sieve	100
7.5	No. 25 Sieve	100
6.0	No. 30 Sieve	100
4.75	No. 40 Sieve	100
3.75	No. 40 Sieve	100
3.0	No. 60 Sieve	100
2.5	No. 60 Sieve	100
2.0	No. 75 Sieve	100
1.5	No. 100 Sieve	100
1.18	No. 125 Sieve	100
0.85	No. 175 Sieve	100
0.75	No. 20 Sieve	100
0.60	No. 25 Sieve	100
0.425	No. 40 Sieve	100
0.375	No. 40 Sieve	100
0.30	No. 60 Sieve	100
0.25	No. 60 Sieve	100
0.20	No. 75 Sieve	100
0.15	No. 100 Sieve	100
0.125	No. 125 Sieve	100
0.106	No. 140 Sieve	100
0.075	No. 200 Sieve	100
0.075	Hydrometer	87
0.060	Hydrometer	87
0.050	Hydrometer	87
0.0425	Hydrometer	87
0.0375	Hydrometer	87
0.030	Hydrometer	87
0.025	Hydrometer	87
0.020	Hydrometer	87
0.015	Hydrometer	87
0.0125	Hydrometer	87
0.0106	Hydrometer	87
0.0075	Hydrometer	87





# **ATTERBERG LIMITS** (ASTM D 4318)



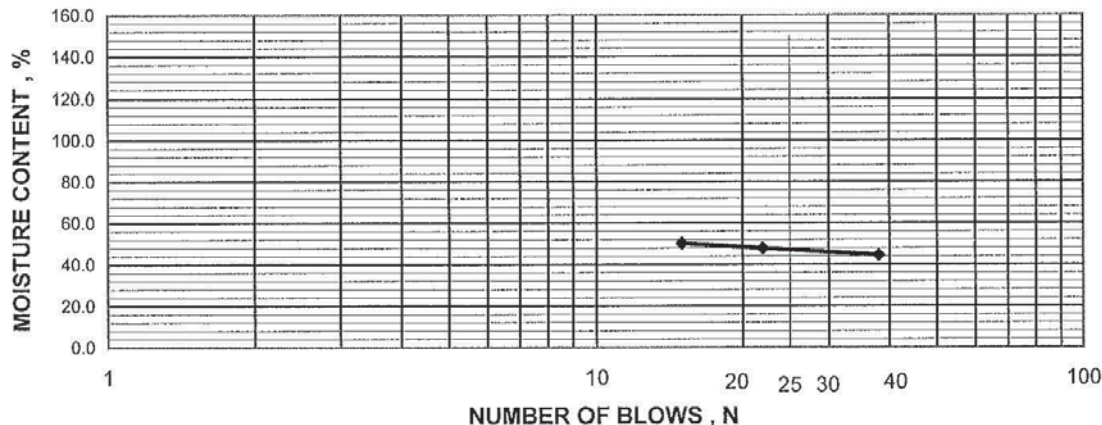
REV. 5/10/06

<b>JOB NAME :</b> Plant Hammond Ash Pond Dikes		<b>REPORT NO. :</b> -		<b>DATE :</b> 04/20/10	<b>REVIEWED BY :</b>
<b>JOB NO. :</b> 28900	<b>DEPTH / ELEV. :</b> N/A	<b>SAMPLE NO. :</b> N/A	<b>SAMPLE TYPE :</b> UD		
<b>SAMPLE LOCATION :</b> AP1 @ 5'-7' foundation					
<b>SOIL DESCRIPTION :</b> Yellowish brown lean clay with sand.					
<b>LIQUID LIMIT, % :</b> 47	<b>PLASTIC LIMIT, % :</b> 21	<b>PLASTICITY INDEX, % :</b> 26	<b>MOISTURE, % :</b> 25		
<b>CLASSIFICATION :</b>	<b>UNIFIED :</b> CL	<b>AASHTO :</b> -	<b>FINES, % :</b> 87		

**LIQUID LIMIT, % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES --**

% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2 ") AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS

TEST NO. :	1	2	3	4	5
CONTAINER NO.	1	2	3	BRAND	MODEL
NUMBER OF BLOWS	38	22	15	BALANCE	PRECISA
WT. WET SOIL + CAN (GRAMS)	32.20	31.59	32.70	LL MACHINE	HUMBOLT
WT. DRY SOIL + CAN ( GRAMS )	26.92	26.31	26.88	BALANCE	OHAUS-3100 G
WT. OF WATER ( GRAMS )	5.28	5.28	5.82	OVEN	DESPATCH-3426
WT. OF CONTAINER ( GRAMS )	15.06	15.27	15.27		1650032533
WT. OF DRY SOIL ( GRAMS )	11.86	11.04	11.61		
WATER CONTENT, (%)	44.52	47.83	50.13		



**PLASTIC LIMIT, % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES --**

% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8" ) IN DIAMETER THREADS WITHOUT CRUMBLING

TEST NO. :	1	2	3	4	5
CONTAINER NO.	4	5			
WT. WET SOIL + CAN (GRAMS)	21.81	21.61			
WT. DRY SOIL + CAN ( GRAMS )	20.63	20.54			
WT. OF WATER ( GRAMS )	1.18	1.07			
WT. OF CONTAINER ( GRAMS )	15.06	15.55			
WT. OF DRY SOIL ( GRAMS )	5.57	4.99			
WATER CONTENT, (%)	21.18	21.44			

**PLASTICITY INDEX - THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -**

THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT  $PI = LL - PL$






# TRIAXIAL SHEAR TEST REPORT (ASTM D 4767)



REV5,3/05/07

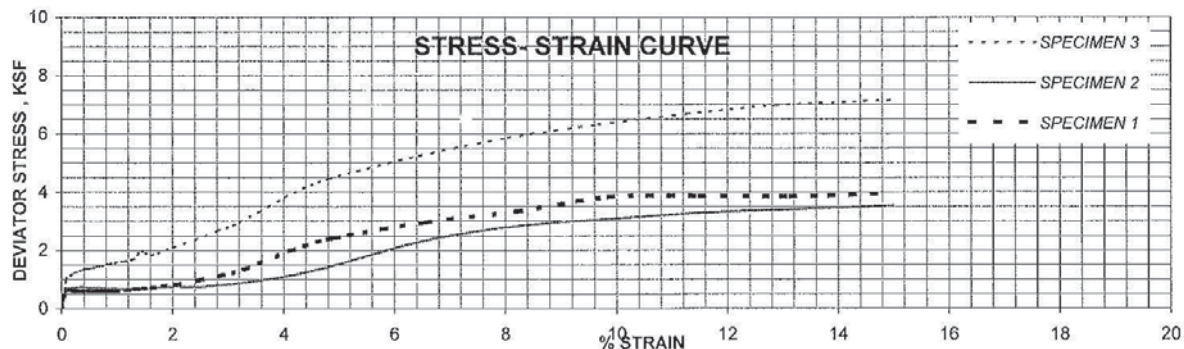
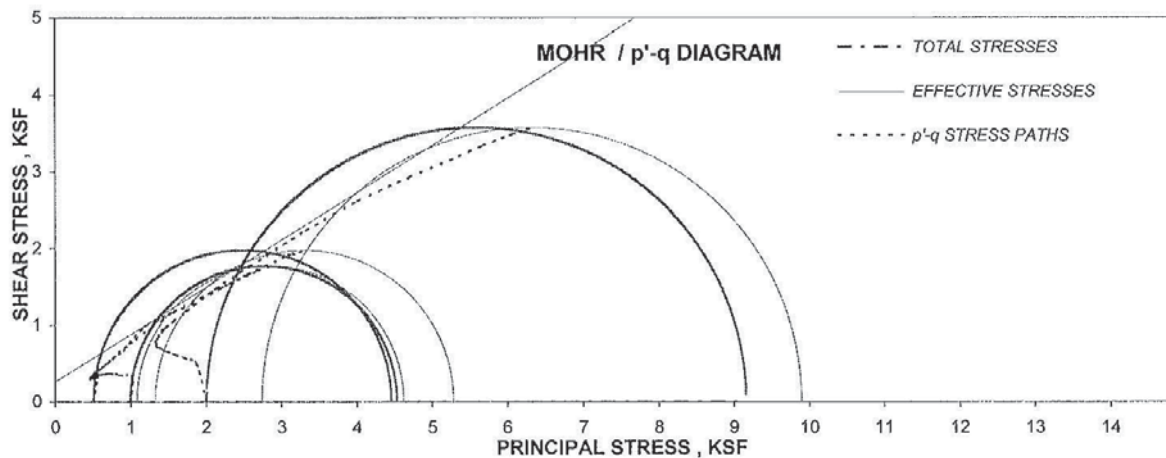
JOB NAME:	Plant Hammond Ash Pond Dikes					
JOB NO.:	28900	REPORT NO.:	N/A	REVIEWED BY:	<i>[Signature]</i>	DATE: 4/20/10
BORING / PIT NO.:	N/A	DEPTH / ELEV.:	N/A	SAMPLE NO.:	N/A	TYPE: UD
SAMPLE LOCATION: AP3 @ 6'-8', foundation						
SOIL DESCRIPTION: Yellowish red lean clay with sand (CL)						
LL, %:	35	PI, %:	17	FINES, %:	80	G <sub>s</sub> : 2.71

SPECIMEN PROPERTIES									TEST PARAMETERS , TEST TYPE : CU/PP						
	INITIAL				AFTER CONSOLIDATION				SPECIMEN NO.		1	2	3		
SPECIMEN NO.		1	2	3		1	2	3	B Value		0.95	0.95	0.95		
DIAMETER , INCHES	D <sub>o</sub>	2.88	2.88	2.89	D <sub>c</sub>	2.86	2.85	2.86	BACK PRESSURE, ksf	U <sub>o</sub>	10.2	10.2	10.1		
HEIGHT , INCHES	H <sub>o</sub>	6.13	6.11	6.26	H <sub>c</sub>	6.09	6.05	6.20	CONFINING PRESSURE , ksf	σ <sub>3</sub>	0.5	1.0	2.0		
WATER CONTENT, %	W <sub>o</sub>	17.4	18.4	17.2	W <sub>c</sub>	18.9	20.6	18.8	MAX. DEVIATOR STRESS ,ksf	σ <sub>1</sub> -σ <sub>3</sub>	4.0	3.5	7.2		
DRY DENSITY, PCF	γ <sub>dryo</sub>	109.5	105.4	108.7	γ <sub>dryc</sub>	111.7	108.4	111.9	ULT. DEVIATOR STRESS , ksf	σ <sub>1</sub> -σ <sub>3</sub>	4.0	3.5	7.2		
SATURATION ,%	S <sub>o</sub>	87.0	82.5	84.0	S <sub>c</sub>	100	100	100	Specimen Shape @ Failure		Bulged				
VOID RATIO	e <sub>o</sub>	0.542	0.603	0.554	e <sub>c</sub>	0.513	0.558	0.510							
									Strain 0.2		% per minute		T50, Minutes = 0.7		


N/A

N/A

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION,	C (ksf) : N/A	APPARENT COHESION,	(ksf) : 0.26
	ANGLE OF INTER. FRICTION, Φ (DEGREES)	N/A	ANGLE OF INTER. FRICTION, Φ' (DEGREES)	31.7








## PARTICLE-SIZE DISTRIBUTION TEST REPORT

SIEVE AND HYDROMETER

ASTM D422 0



AASHTO R18

**JOB NAME:** Plant Hammond Ash Pond Dikes

**JOB NO.:** 28900

**REPORT NO.:** N/A

**DATE:** 4/20/10

**REVIEWED BY:** *[Signature]*

**BORING / PIT NO.:** N/A

**DEPTH / ELEV.:** N/A

**SAMPLE NO.:** -

**SAMPLE TYPE:** UD

**SAMPLE LOCATION:** AP3 @ 6'-8" foundation

**SOIL DESCRIPTION:** Yellowish red, lean clay with sand.

**LIQUID LIMIT, %:** 35

**PLASTICITY INDEX, %:** 17

**MOISTURE, %:** N/A

**FINES, %:** 80

**D10, MM:** N/A

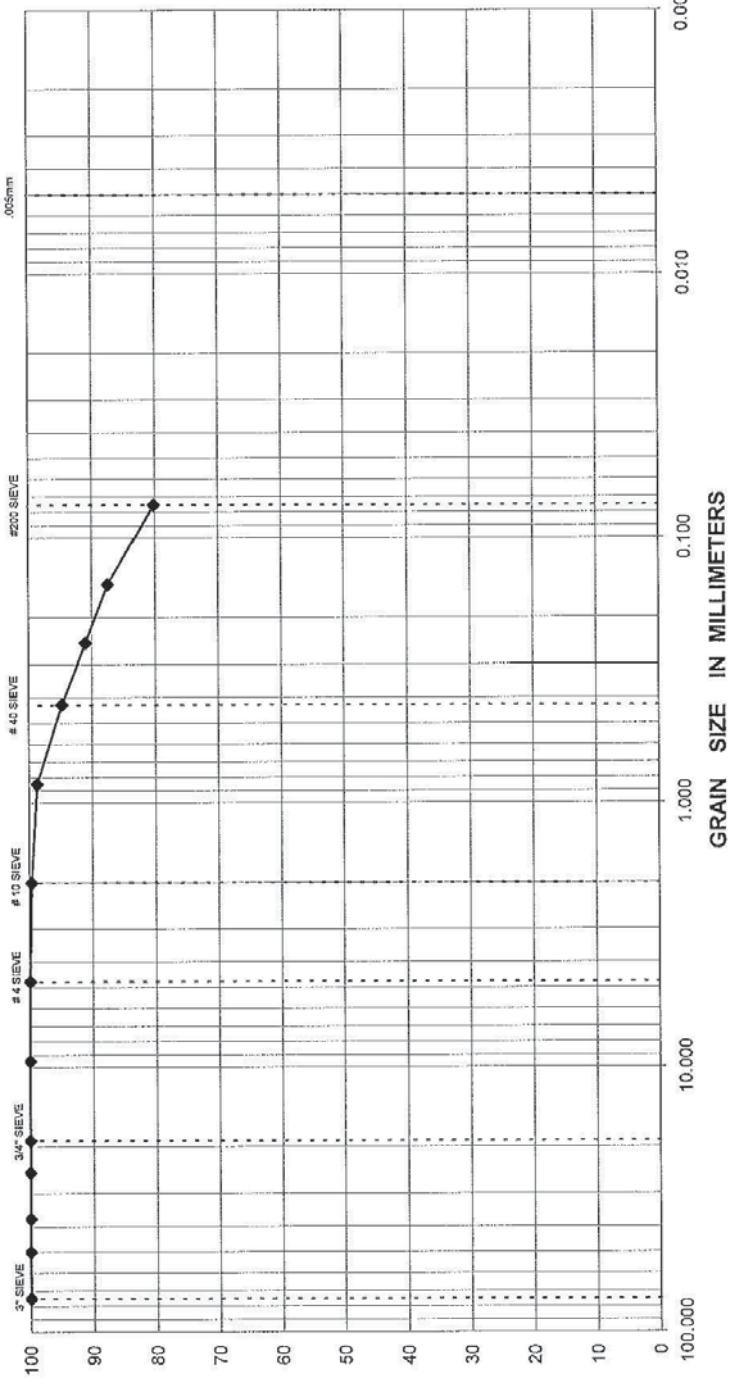
**D30, MM:** N/A

**COEFF. OF CURVATURE, C<sub>c</sub>:** N/A

**COEFF. OF UNIFORMITY, C<sub>u</sub>:** N/A

**CLASSIFICATION:** UNIFIED: CL AASHTO: N/A

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY



The graph plots % Finer by Weight (0 to 100) against Grain Size in Millimeters (log scale from 0.001 to 100.000). The curve starts at 100% finer for 0.075 mm and decreases to approximately 80% finer at 0.075 mm, then continues to decrease more gradually, reaching 0% finer at 75 mm.

Grain Size (mm)	% Finer
0.075	100
0.15	100
0.3	100
0.6	100
1.18	100
2.5	100
4.75	100
7.5	100
15	100
30	100
60	100
75	100



		<b>ATTERBERG LIMITS</b> ( ASTM D 4318 )					
		REV. 5/10/06					
<b>JOB NAME :</b> Plant Hammond Ash Pond Dikes							
<b>JOB NO. :</b> 28900		<b>REPORT NO. :</b> -		<b>DATE :</b> 04/20/10		<b>REVIEWED BY :</b>	
<b>BORING / PIT NO. :</b> N/A		<b>DEPTH / ELEV. :</b> N/A		<b>SAMPLE NO. :</b> N/A		<b>SAMPLE TYPE :</b> UD	
<b>SAMPLE LOCATION :</b> AP3 @ 6'-8' foundation							
<b>SOIL DESCRIPTION :</b> Yellowish red lean clay with sand.							
<b>LIQUID LIMIT , % :</b> 35		<b>PLASTIC LIMIT , % :</b> 18		<b>PLASTICITY INDEX , % :</b> 17		<b>MOISTURE , % :</b> 17	
<b>CLASSIFICATION :</b>		<b>UNIFIED :</b> CL		<b>AASHTO :</b> -		<b>FINES , % :</b> 80	
<b>LIQUID LIMIT , % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID &amp; PLASTIC STATES --</b> <b>% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2" ) AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS</b>							
<b>TEST NO. :</b>	1		2		3		4
<b>CONTAINER NO.</b>	18		19		20		5
<b>NUMBER OF BLOWS</b>	39		20		12		
<b>WT. WET SOIL + CAN (GRAMS)</b>	33.32		34.64		35.29		
<b>WT. DRY SOIL + CAN ( GRAMS )</b>	28.77		29.52		29.81		
<b>WT. OF WATER ( GRAMS )</b>	4.55		5.12		5.48		
<b>WT. OF CONTAINER ( GRAMS )</b>	15.31		15.07		15.48		
<b>WT. OF DRY SOIL ( GRAMS )</b>	13.46		14.45		14.33		
<b>WATER CONTENT, (%)</b>	33.80		35.43		38.24		
<b>PLASTIC LIMIT , % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC &amp; BRITTLE STATES --</b> <b>% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8" ) IN DIAMETER THREADS WITHOUT CRUMBLING</b>							
<b>TEST NO. :</b>	1		2		3		4
<b>CONTAINER NO.</b>	42		43				
<b>WT. WET SOIL + CAN (GRAMS)</b>	21.59		22.58				
<b>WT. DRY SOIL + CAN ( GRAMS )</b>	20.58		21.40				
<b>WT. OF WATER ( GRAMS )</b>	1.01		1.18				
<b>WT. OF CONTAINER ( GRAMS )</b>	15.05		14.98				
<b>WT. OF DRY SOIL ( GRAMS )</b>	5.53		6.42				
<b>WATER CONTENT, (%)</b>	18.26		18.38				
<b>PLASTICITY INDEX - THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -</b> <b>THE DIFFERENCE BETWEEN LIQUID LIMIT &amp; PLASTIC LIMIT      PI = LL - PL</b>							






# TRIAXIAL SHEAR TEST REPORT (ASTM D 4767)



REV5,3/05/07

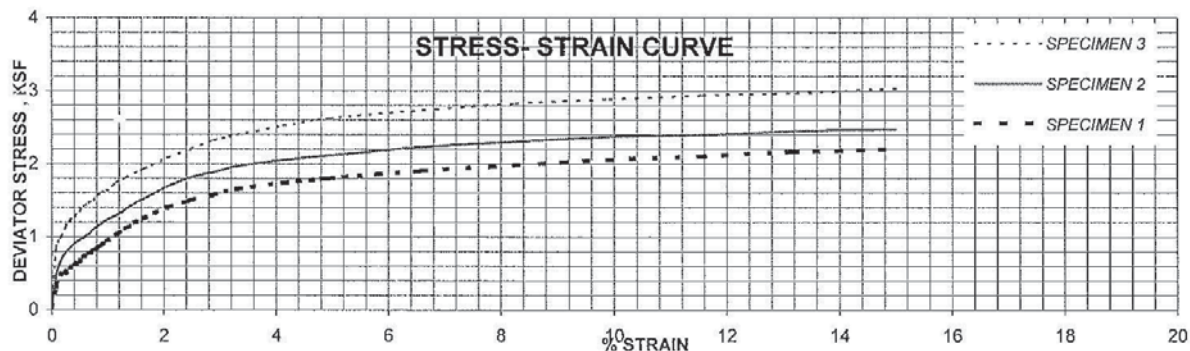
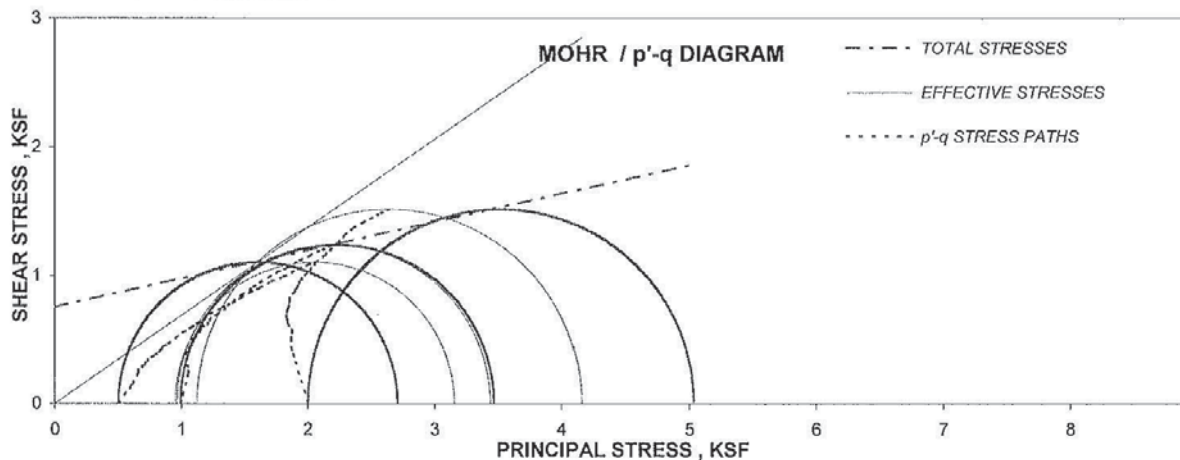
JOB NAME:	Plant Hammond Ash Pond Dikes					
JOB NO.:	28900	REPORT NO.:	N/A	REVIEWED BY:	✓	DATE: 4/20/10
BORING / PIT NO.:	N/A	DEPTH / ELEV.:	N/A	SAMPLE NO.:	N/A	TYPE: UD
SAMPLE LOCATION: AP 4 @ 4'-6', Foundation						
SOIL DESCRIPTION: Gray brown lean clay with sand (CL)						
LL, %:	42	PI, %:	17	FINES, %:	87	G <sub>s</sub> : 2.69

SPECIMEN PROPERTIES									TEST PARAMETERS , TEST TYPE : CU/PP				
	INITIAL				AFTER CONSOLIDATION				SPECIMEN NO.		1	2	3
SPECIMEN NO.		1	2	3		1	2	3	B Value		0.95	0.95	0.95
DIAMETER , INCHES	D <sub>o</sub>	2.89	2.88	2.88	D <sub>c</sub>	2.88	2.86	2.84	BACK PRESSURE, ksf	U <sub>o</sub>	10.2	10.1	10.1
HEIGHT , INCHES	H <sub>o</sub>	6.09	6.02	6.13	H <sub>c</sub>	6.07	5.98	6.05	CONFINING PRESSURE , ksf	σ <sub>3</sub>	0.5	1.0	2.0
WATER CONTENT, %	W <sub>o</sub>	29.0	28.9	33.2	W <sub>c</sub>	31.1	30.0	32.8	MAX. DEVIATOR STRESS ,ksf	σ <sub>1</sub> -σ <sub>3</sub>	2.2	2.5	3.0
DRY DENSITY, PCF	γ <sub>dryo</sub>	90.5	91.1	85.7	γ <sub>dryc</sub>	91.5	93.0	89.2	ULT. DEVIATOR STRESS , ksf	σ <sub>1</sub> -σ <sub>3</sub>	2.2	2.5	3.0
SATURATION ,%	S <sub>o</sub>	91.1	92.2	93.1	S <sub>c</sub>	100	100	100	Specimen Shape @		Bulged   		
VOID RATIO	e <sub>o</sub>	0.856	0.844	0.961	e <sub>c</sub>	0.837	0.808	0.884	Failure				
----- , Strain									0.2	% per minute	T50, Minutes =		0.7

N/A

N/A

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION, C (ksf)	0.75	APPARENT COHESION, (ksf)	0.00
	ANGLE OF INTER. FRICTION, Φ (DEGREES)	12.5	ANGLE OF INTER. FRICTION, Φ' (DEGREES)	34.5





# PARTICLE-SIZE DISTRIBUTION TEST REPORT

## SIEVE AND HYDROMETER

REV 2/28/07/K6

AASHTO R 15

JOB NAME: Plant Hammond Ash Pond Dikes

JOB NO.:	28900	REPORT NO.:	N/A	DATE:	4/20/10	REVIEWED BY:	✓
BORING / PIT NO.:	N/A	DEPTH / ELEV.:	N/A	SAMPLE NO.:	N/A	SAMPLE TYPE:	UD

SAMPLE LOCATION: AP4 @ 4'-6" foundation

SOIL DESCRIPTION: Gray brown lean clay with sand.

LIQUID LIMIT, %:	42	PLASTICITY INDEX, %:	17	MOISTURE, %:	N/A	SP. GRAVITY, Gs:	N/A	
D <sub>10</sub> , MM:	N/A	D <sub>30</sub> , MM:	N/A	D <sub>60</sub> , MM:	N/A	FINES, %:	87	
CLASSIFICATION	UNIFIED:	CL	AASHTO:	N/A	COEFF. OF CURVATURE, C <sub>c</sub> :	N/A	COEFF. OF UNIFORMITY, C <sub>u</sub> :	N/A

GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY

The graph plots % Finer by Weight (Y-axis, 0 to 100) against Grain Size in Millimeters (X-axis, logarithmic scale from 100.000 to 0.001). The data curve shows the following approximate values:

Grain Size (mm)	% Finer
3" Sieve	100
3/4" Sieve	100
#4 Sieve	100
#10 Sieve	100
#20 Sieve	100
#40 Sieve	100
#60 Sieve	100
#100 Sieve	100
#200 Sieve	100
#425 Sieve	100
#600 Sieve	100
#840 Sieve	100
#1180 Sieve	100
#1600 Sieve	100
#2500 Sieve	100
#3540 Sieve	100
#4750 Sieve	100
#6500 Sieve	100
#8900 Sieve	100
#11900 Sieve	100
#16000 Sieve	100
#21900 Sieve	100
#29900 Sieve	100
#40900 Sieve	100
#56000 Sieve	100
#77000 Sieve	100
#106000 Sieve	100
#145000 Sieve	100
#199000 Sieve	100
#274000 Sieve	100
#375000 Sieve	100
#510000 Sieve	100
#690000 Sieve	100
#940000 Sieve	100
#1280000 Sieve	100
#1740000 Sieve	100
#2380000 Sieve	100
#3290000 Sieve	100
#4540000 Sieve	100
#6230000 Sieve	100
#8580000 Sieve	100
#11780000 Sieve	100
#16380000 Sieve	100
#22680000 Sieve	100
#31180000 Sieve	100
#42780000 Sieve	100
#58780000 Sieve	100
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#207780000 Sieve	100
#284780000 Sieve	100
#390780000 Sieve	100
#530780000 Sieve	100
#720780000 Sieve	100
#980780000 Sieve	100
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#1810780000 Sieve	100
#2460780000 Sieve	100
#3350780000 Sieve	100
#4550780000 Sieve	100
#6150780000 Sieve	100
#8350780000 Sieve	100
#11350780000 Sieve	100
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# **ATTERBERG LIMITS** ( ASTM D 4318 )



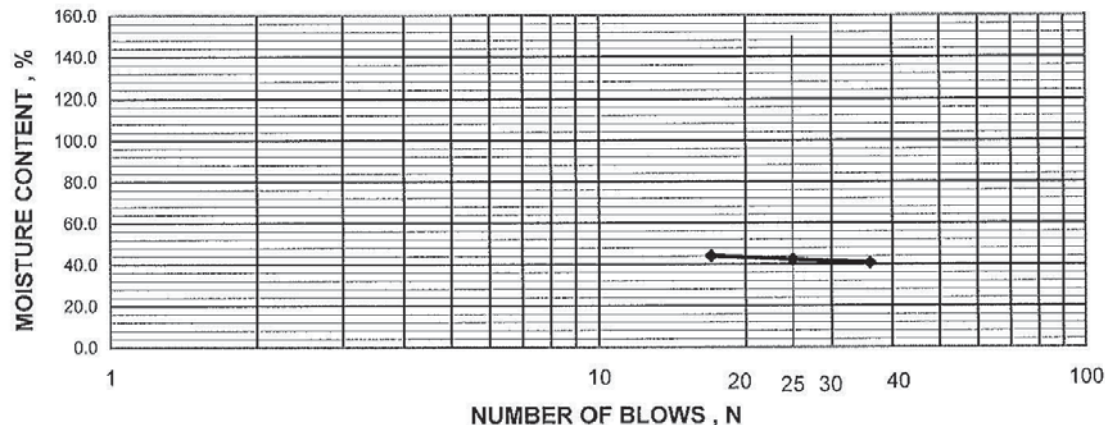
REV. 5/10/06

<b>JOB NAME :</b> Plant Hammond Ash Pond Dikes			
<b>JOB NO. :</b> 28900	<b>REPORT NO. :</b> -	<b>DATE :</b> 04/20/10	<b>REVIEWED BY :</b>
<b>BORING / PIT NO. :</b> N/A	<b>DEPTH / ELEV. :</b> N/A	<b>SAMPLE NO. :</b> N/A	<b>SAMPLE TYPE :</b> UD
<b>SAMPLE LOCATION :</b> AP4 @ 4'-6' foundation			
<b>SOIL DESCRIPTION :</b> Gray brown lean clay with sand.			
<b>LIQUID LIMIT , % :</b> 42	<b>PLASTIC LIMIT , % :</b> 25	<b>PLASTICITY INDEX , % :</b> 17	<b>MOISTURE , % :</b> 30
<b>CLASSIFICATION :</b>	<b>UNIFIED :</b> CL	<b>AASHTO :</b> -	<b>FINES , % :</b> 87

**LIQUID LIMIT , %** MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES --

% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2 ") AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS

TEST NO. :	1	2	3	4	5
CONTAINER NO.	91	92	93	BRAND	MODEL
NUMBER OF BLOWS	36	25	17	BALANCE	PRECISA
WT. WET SOIL + CAN (GRAMS)	31.84	35.25	34.15	LL MACHINE	HUMBOLT
WT. DRY SOIL + CAN ( GRAMS )	27.02	29.27	28.32	BALANCE	OHAUS-3100 G
WT. OF WATER ( GRAMS )	4.82	5.98	5.83	OVEN	DESPATCH-3436
WT. OF CONTAINER ( GRAMS )	15.18	15.13	15.09		1650032593
WT. OF DRY SOIL ( GRAMS )	11.84	14.14	13.23		
WATER CONTENT, (%)	40.71	42.29	44.07		



**PLASTIC LIMIT , %** MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES --

% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8" ) IN DIAMETER THREADS WITHOUT CRUMBLING

TEST NO. :	1	2	3	4	5
CONTAINER NO.	44	54			
WT. WET SOIL + CAN (GRAMS)	21.58	23.22			
WT. DRY SOIL + CAN ( GRAMS )	20.31	21.62			
WT. OF WATER ( GRAMS )	1.27	1.60			
WT. OF CONTAINER ( GRAMS )	15.12	15.43			
WT. OF DRY SOIL ( GRAMS )	5.19	6.19			
WATER CONTENT, (%)	24.47	25.85			

**PLASTICITY INDEX - THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -**  
THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT       $PI = LL - PL$





# TRIAXIAL SHEAR TEST REPORT ( ASTM D 4767 )



REV5.3/05/07

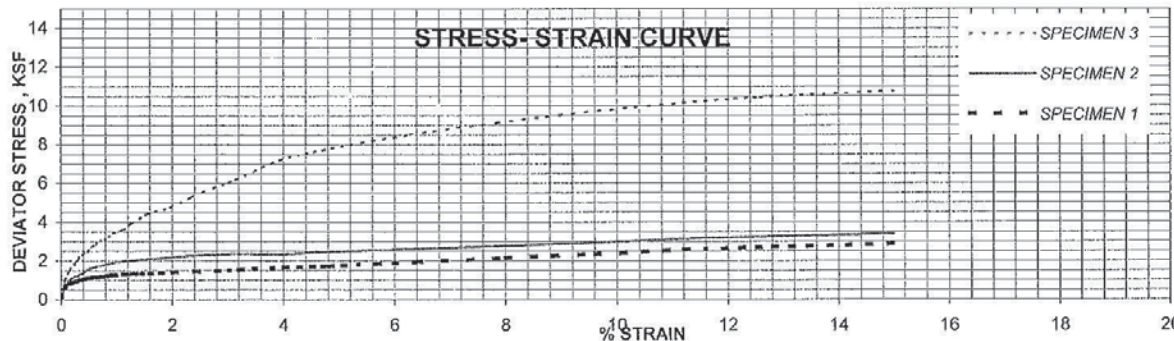
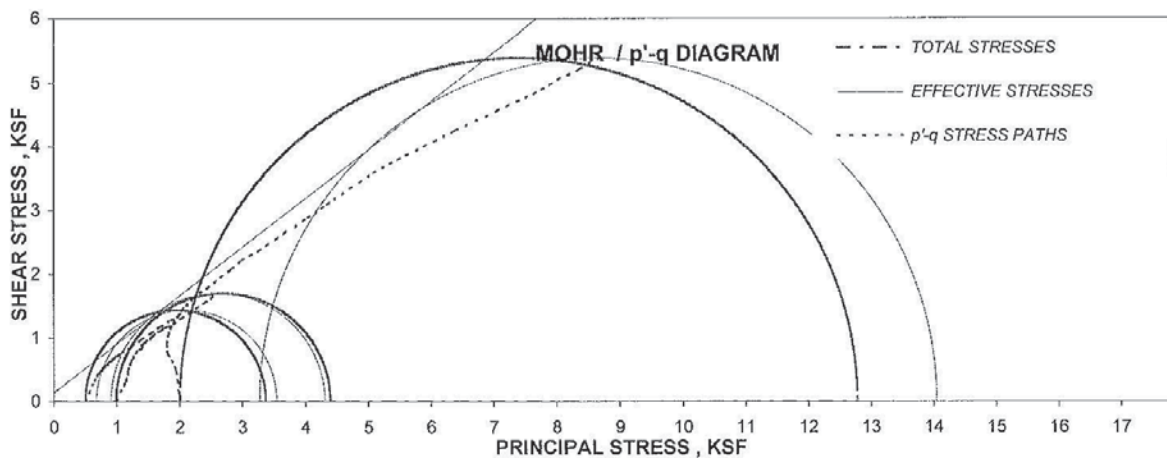
**JOB NAME:** Plant Hammond Ash Pond Dikes  
**JOB NO.:** 28900 **REPORT NO.:** N/A **REVIEWED BY:** **DATE:** 4/20/10  
**BORING / PIT NO.:** N/A **DEPTH / ELEV.:** N/A **SAMPLE NO.:** N/A **TYPE:** UD  
**SAMPLE LOCATION:** AP2 @ 4'-6' & 6'-8' fill  
**SOIL DESCRIPTION:** Yellowish red clayey sand with gravel ( SC )  
**LL, %:** 52 **PI, %:** 26 **FINES, %:** 34 **G<sub>s</sub>:** 2.72

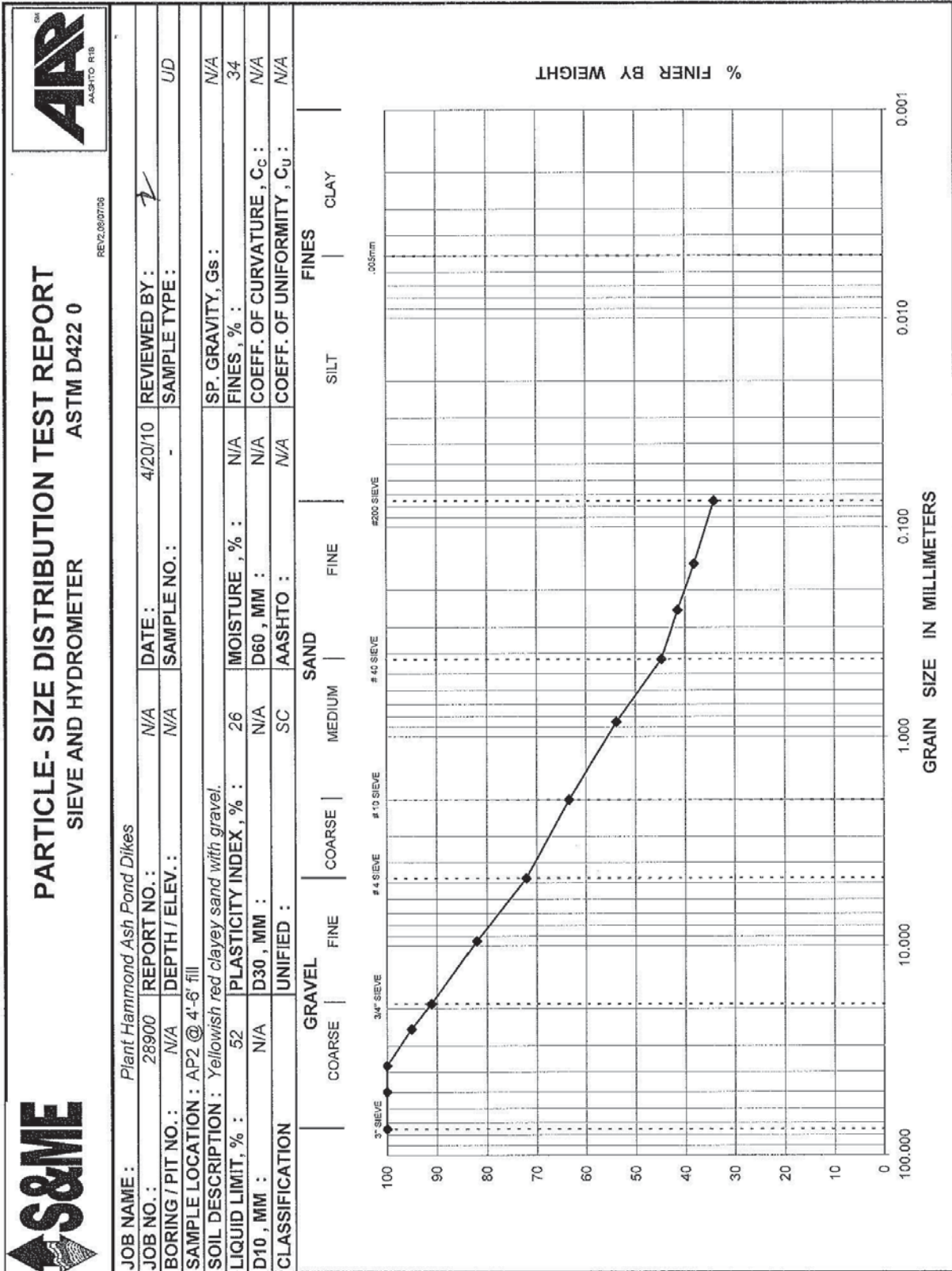
SPECIMEN PROPERTIES								TEST PARAMETERS, TEST TYPE : CU/PP			
SPECIMEN NO.	INITIAL			AFTER CONSOLIDATION			SPECIMEN NO.				
	1	2	3	1	2	3		1	2	3	
DIAMETER, INCHES	D <sub>o</sub>	2.88	2.90	2.90	D <sub>c</sub>	2.87	2.89	2.88	BACK PRESSURE, ksf	U <sub>o</sub>	0.95
HEIGHT, INCHES	H <sub>o</sub>	6.25	6.32	6.39	H <sub>c</sub>	6.24	6.29	6.36	CONFINING PRESSURE, ksf	σ <sub>3</sub>	0.5
WATER CONTENT, %	W <sub>o</sub>	12.7	15.0	15.7	W <sub>c</sub>	18.1	19.7	16.8	MAX. DEVIATOR STRESS, ksf	σ <sub>1</sub> -σ <sub>3</sub>	2.9
DRY DENSITY, PCF	γ <sub>dryo</sub>	113.1	109.4	114.8	γ <sub>dryc</sub>	113.7	110.6	116.5	ULT. DEVIATOR STRESS, ksf	σ <sub>1</sub> -σ <sub>3</sub>	2.9
SATURATION, %	S <sub>o</sub>	69.0	74.0	89.4	S <sub>c</sub>	100	100	100	Specimen Shape @	Bulged	
VOID RATIO	e <sub>o</sub>	0.501	0.551	0.479	e <sub>c</sub>	0.493	0.535	0.458	Failure		
								Strain	0.2	% per minute	T50, Minutes = 0.6

N/A

N/A

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION, C (ksf)	N/A	APPARENT COHESION, (ksf)	0.14
	ANGLE OF INTER. FRICTION, Φ (DEGREES)	N/A	ANGLE OF INTER. FRICTION, Φ' (DEGREES)	37.3









# **ATTERBERG LIMITS** ( ASTM D 4318 )



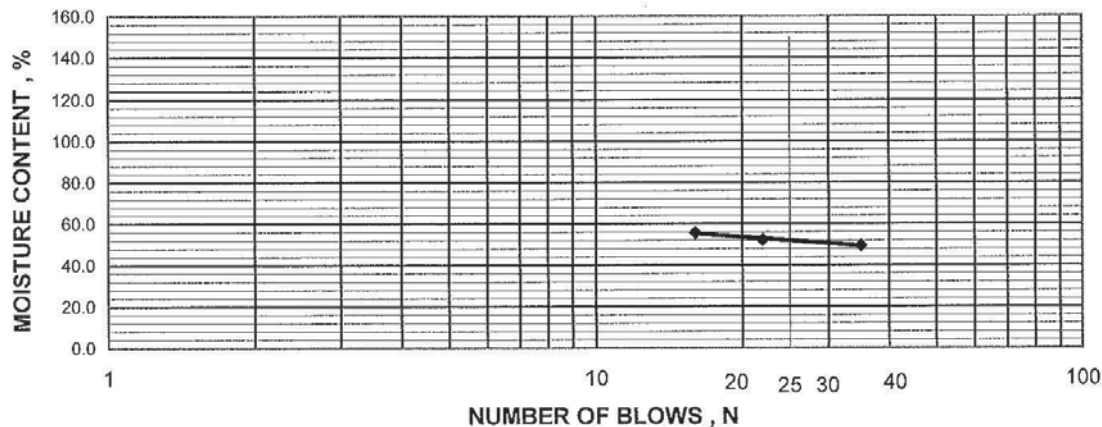
REV. 5/10/06

<b>JOB NAME :</b>	Plant Hammond Ash Pond Dikes				
<b>JOB NO. :</b>	28900	<b>REPORT NO. :</b>	-	<b>DATE :</b>	04/20/10
<b>BORING / PIT NO. :</b>	N/A	<b>DEPTH / ELEV. :</b>	N/A	<b>SAMPLE NO. :</b>	N/A
<b>SAMPLE LOCATION :</b>	AP2 Fill @ 4'-6' & 6'-8'				
<b>SOIL DESCRIPTION :</b>	Yellowish red clayey sand with gravel.				
<b>LIQUID LIMIT, % :</b>	52	<b>PLASTIC LIMIT, % :</b>	26	<b>PLASTICITY INDEX, % :</b>	26
<b>CLASSIFICATION :</b>		<b>UNIFIED :</b>	SC	<b>AASHTO :</b>	-
				<b>MOISTURE, % :</b>	15
				<b>FINES, % :</b>	34

**LIQUID LIMIT, % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES --**

% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2 ") AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS

<b>TEST NO. :</b>	1	2	3	4	5
<b>CONTAINER NO.</b>	18	19	20	BRAND	MODEL
<b>NUMBER OF BLOWS</b>	35	22	16	BALANCE	PRECISA
<b>WT. WET SOIL + CAN (GRAMS)</b>	31.51	30.35	30.84	LL MACHINE	HUMBOLT
<b>WT. DRY SOIL + CAN ( GRAMS )</b>	26.13	25.12	25.35	BALANCE	OHAUS-3100 G
<b>WT. OF WATER ( GRAMS )</b>	5.38	5.23	5.49	OVEN	DESPATCH 3438
<b>WT. OF CONTAINER ( GRAMS )</b>	15.27	15.11	15.47		1650032533
<b>WT. OF DRY SOIL ( GRAMS )</b>	10.86	10.01	9.88		
<b>WATER CONTENT, (%)</b>	49.54	52.25	55.57		



**PLASTIC LIMIT, % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES --**

% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8 ") IN DIAMETER THREADS WITHOUT CRUMBLING

<b>TEST NO. :</b>	1	2	3	4	5
<b>CONTAINER NO.</b>	42	43			
<b>WT. WET SOIL + CAN (GRAMS)</b>	23.42	23.5			
<b>WT. DRY SOIL + CAN ( GRAMS )</b>	21.66	21.74			
<b>WT. OF WATER ( GRAMS )</b>	1.76	1.76			
<b>WT. OF CONTAINER ( GRAMS )</b>	15.03	14.96			
<b>WT. OF DRY SOIL ( GRAMS )</b>	6.63	6.78			
<b>WATER CONTENT, (%)</b>	26.55	25.96			

**PLASTICITY INDEX - THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -**

THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT  $PI = LL - PL$






# TRIAxIAL SHEAR TEST REPORT (ASTM D 4767)



REV5,3/05/07

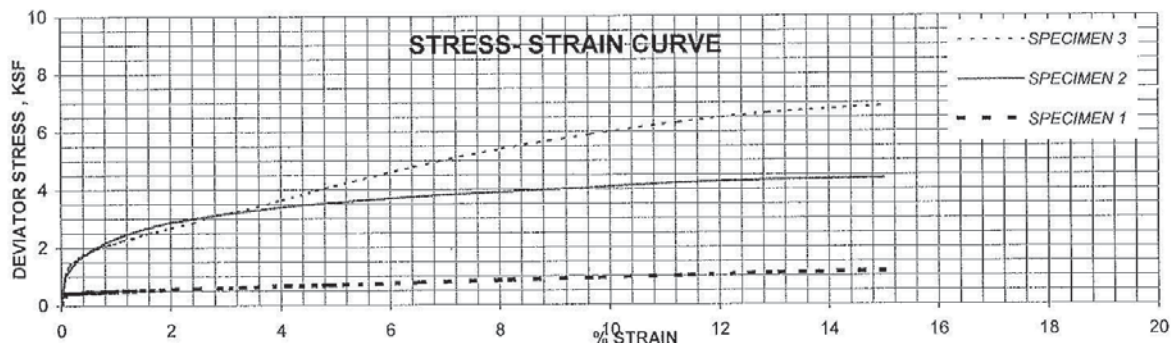
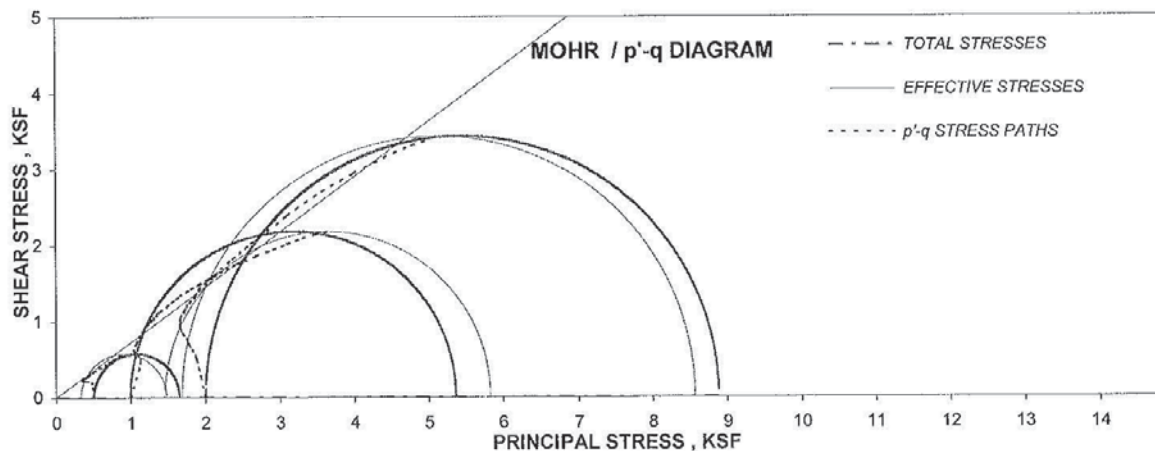
JOB NAME: Plant Hammond Ash Pond Dikes  
 JOB NO.: 28900 REPORT NO.: N/A REVIEWED BY: DATE: 3/12/10  
 BORING / PIT NO.: N/A DEPTH / ELEV.: N/A SAMPLE NO.: N/A TYPE: UD  
 SAMPLE LOCATION: AP3 @ 8'-10' & 10'-12' fill  
 SOIL DESCRIPTION: Reddish yellow sandy fat clay with gravel (CH)  
 LL, %: 53 PI, %: 36 FINES, %: 63 G<sub>s</sub>: 2.70

SPECIMEN PROPERTIES									TEST PARAMETERS , TEST TYPE : CU/PP					
	INITIAL				AFTER CONSOLIDATION				SPECIMEN NO.		1	2	3	
SPECIMEN NO.		1	2	3		1	2	3	B Value		0.95	0.95	0.95	
DIAMETER , INCHES	D <sub>o</sub>	2.87	2.90	2.88	D <sub>c</sub>	2.85	2.90	2.86	BACK PRESSURE, ksf	U <sub>o</sub>	10.1	10.2	10.1	
HEIGHT , INCHES	H <sub>o</sub>	6.13	6.35	6.23	H <sub>c</sub>	6.11	6.34	6.21	CONFINING PRESSURE , ksf	σ <sub>3</sub>	0.5	1.0	2.0	
WATER CONTENT, %	W <sub>o</sub>	15.1	15.3	17.3	W <sub>c</sub>	19.2	17.7	18.0	MAX. DEVIATOR STRESS ,ksf	σ <sub>1</sub> -σ <sub>3</sub>	1.1	4.4	6.9	
DRY DENSITY, PCF	γ <sub>dryo</sub>	109.8	113.4	112.1	γ <sub>dryc</sub>	111.0	113.9	113.3	ULT. DEVIATOR STRESS , ksf	σ <sub>1</sub> -σ <sub>3</sub>	1.1	4.4	6.9	
SATURATION ,%	S <sub>o</sub>	76.3	85.3	92.8	S <sub>c</sub>	100	100	100	Specimen Shape @ Failure		Bulged			
VOID RATIO	e <sub>o</sub>	0.534	0.485	0.502	e <sub>c</sub>	0.517	0.479	0.487						
-----									Strain	0.02	% per minute	T50, Minutes =		20

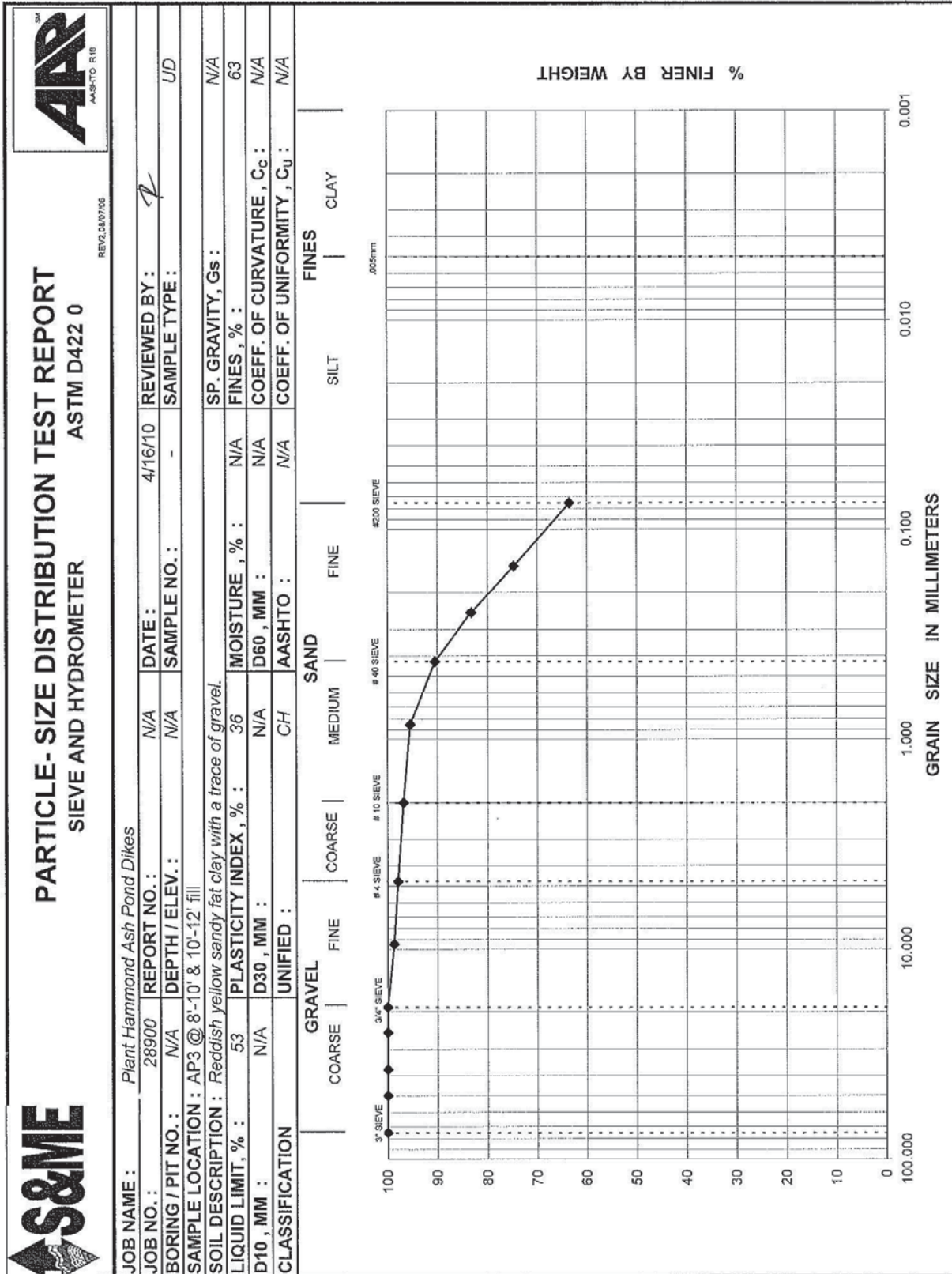
N/A

N/A

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION, C (ksf) :	N/A	APPARENT COHESION, (ksf) :	0.00
	ANGLE OF INTER. FRICTION, Φ (DEGREES) :	N/A	ANGLE OF INTER. FRICTION, Φ' (DEGREES) :	36.0










# **ATTERBERG LIMITS** (ASTM D 4318)



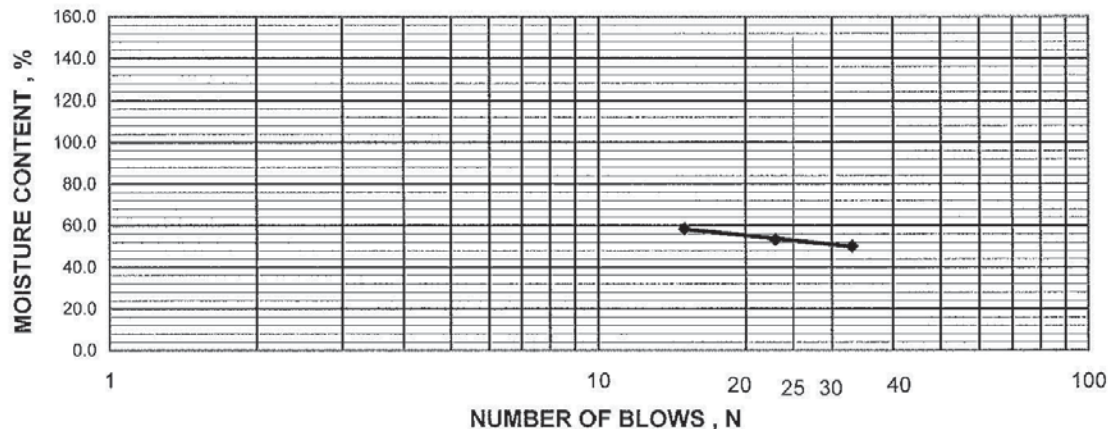
REV. 5/10/06

JOB NAME : Plant Hammond Ash Pond Dikes				
JOB NO. : 28900	REPORT NO. : -	DATE : 04/13/10	REVIEWED BY : 	
BORING / PIT NO. : N/A	DEPTH / ELEV. : N/A	SAMPLE NO. : N/A	SAMPLE TYPE : UD	
SAMPLE LOCATION : AP3 @ 8'-10' & 10'-12' fill				
SOIL DESCRIPTION : Reddish yellow sandy fat clay with gravel.				
LIQUID LIMIT , % : 53	PLASTIC LIMIT ,% : 17	PLASTICITY INDEX ,% : 36	MOISTURE , % : 15	
CLASSIFICATION :	UNIFIED : CH	AASHTO : -	FINES , % : 63	

## **LIQUID LIMIT, % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES --**

% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2 ") AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS

TEST NO. :	1	2	3	4	5
CONTAINER NO.	1	2	3		
NUMBER OF BLOWS	33	23	15		
WT. WET SOIL + CAN (GRAMS)	29.96	29.97	29.01	BRAND	MODEL
WT. DRY SOIL + CAN ( GRAMS )	24.98	24.85	23.93	BALANCE	PRECISA
WT. OF WATER ( GRAMS )	4.98	5.12	5.08	LL MACHINE	HUMBOLT
WT. OF CONTAINER ( GRAMS )	15.04	15.24	15.24	BALANCE	OHAUS-3100 G
WT. OF DRY SOIL ( GRAMS )	9.94	9.61	8.69	OVEN	DESPATCH-3436
WATER CONTENT, (%)	50.10	53.28	58.46		SERIAL
					2200 C
					1
					ARC120
					1650032533



## **PLASTIC LIMIT, % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES --**

% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8" ) IN DIAMETER THREADS WITHOUT CRUMBLING

TEST NO. :	1	2	3	4	5
CONTAINER NO.	4	5			
WT. WET SOIL + CAN (GRAMS)	24.45	24.1			
WT. DRY SOIL + CAN ( GRAMS )	23.13	22.80			
WT. OF WATER ( GRAMS )	1.32	1.30			
WT. OF CONTAINER ( GRAMS )	15.01	15.42			
WT. OF DRY SOIL ( GRAMS )	8.12	7.38			
WATER CONTENT, (%)	16.26	17.62			

## **PLASTICITY INDEX - THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -**

THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT  $PI = LL - PL$








# TRIAXIAL SHEAR TEST REPORT (ASTM D 4767)



REV5,3/05/07

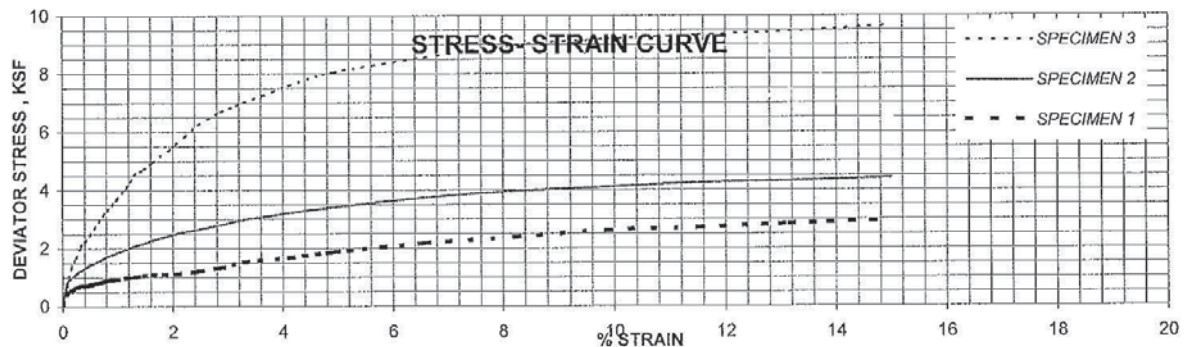
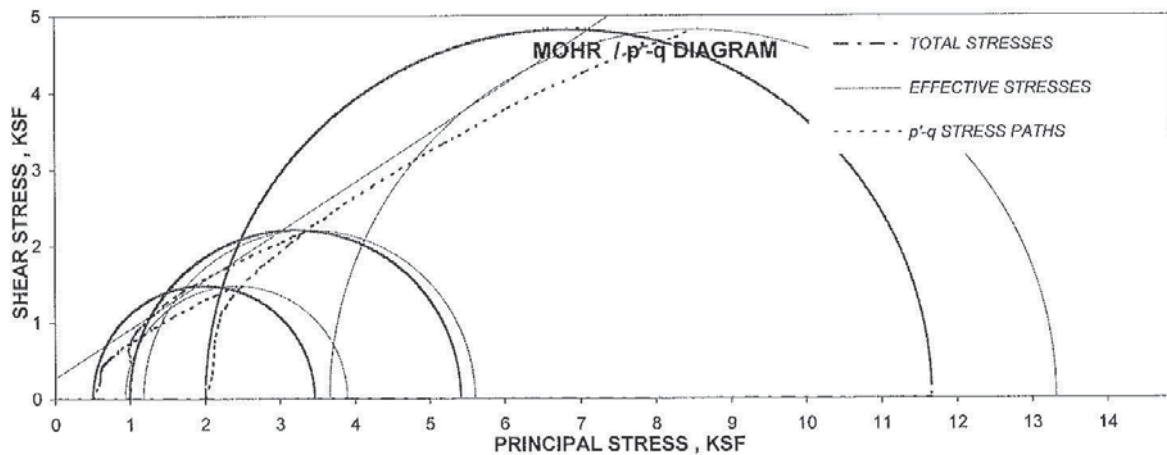
**JOB NAME:** Plant Hammond Ash Pond Dikes  
**JOB NO.:** 28900 **REPORT NO.:** N/A **REVIEWED BY:** *P* **DATE:** 3/24/10  
**BORING / PIT NO.:** N/A **DEPTH / ELEV.:** N/A **SAMPLE NO.:** N/A **TYPE:** UD  
**SAMPLE LOCATION:** AP1-2 @ 10'-12.5'  
**SOIL DESCRIPTION:** Yellowish brown lean clay with sand (CL)  
**LL, %:** 25 **PI, %:** 12 **FINES, %:** 82 **G<sub>s</sub>:** 2.65

SPECIMEN PROPERTIES								TEST PARAMETERS , TEST TYPE : CU/PP					
	INITIAL				AFTER CONSOLIDATION				SPECIMEN NO.		1	2	3
SPECIMEN NO.		1	2	3		1	2	3	B Value		0.95	0.95	0.95
DIAMETER , INCHES	D <sub>o</sub>	2.87	2.88	2.88	D <sub>c</sub>	2.86	2.87	2.87	BACK PRESSURE, ksf	U <sub>o</sub>	10.1	10.2	10.1
HEIGHT , INCHES	H <sub>o</sub>	6.10	6.09	6.11	H <sub>c</sub>	6.08	6.07	6.08	CONFINING PRESSURE , ksf	σ <sub>3</sub>	0.5	1.0	2.0
WATER CONTENT, %	W <sub>o</sub>	14.8	14.5	12.4	W <sub>c</sub>	16.9	14.3	13.3	MAX. DEVIATOR STRESS ,ksf	σ <sub>1</sub> -σ <sub>3</sub>	3.0	4.4	9.7
DRY DENSITY, PCF	γ <sub>dryo</sub>	113.3	118.9	120.5	γ <sub>dryc</sub>	114.3	119.9	122.2	ULT. DEVIATOR STRESS , ksf	σ <sub>1</sub> -σ <sub>3</sub>	3.0	4.4	9.7
SATURATION ,%	S <sub>o</sub>	85.1	98.4	88.4	S <sub>c</sub>	100	100	100	Specimen Shape @	Sheared			
VOID RATIO	e <sub>o</sub>	0.460	0.391	0.372	e <sub>c</sub>	0.447	0.380	0.353	Failure				
								Strain	0.2	% per minute	T50, Minutes =	2	

N/A

N/A

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION, C (ksf) :		APPARENT COHESION, (ksf) :	
	ANGLE OF INTER. FRICTION, Φ (DEGREES) :		ANGLE OF INTER. FRICTION, Φ' (DEGREES) :	
	N/A		0.27	
	N/A		32.6	



S&ME		PARTICLE-SIZE DISTRIBUTION TEST REPORT		ASTM D422 0		REV 2.08/07/06		ANR ASHTO R18	
JOB NAME : Plant Hammond Ash Pond Dikes									
JOB NO. : 28900		REPORT NO. : N/A		DATE : 3/26/10		REVIEWED BY : <i>[Signature]</i>			
BORING / PIT NO. : N/A		DEPTH / ELEV. : N/A		SAMPLE NO. : N/A		SAMPLE TYPE : UD			
SAMPLE LOCATION : AP1-2 @ 10'-12.5'									
SOIL DESCRIPTION : Yellowish brown, lean clay with sand.									
LIQUID LIMIT, % : 25		PLASTICITY INDEX, % : 12		MOISTURE, % : N/A		SP. GRAVITY, Gs : N/A			
D10, MM : N/A		D30, MM : N/A		D60, MM : N/A		COEFF. OF CURVATURE, C <sub>c</sub> : N/A			
CLASSIFICATION		UNIFIED : -		AASHTO : N/A		COEFF. OF UNIFORMITY, C <sub>u</sub> : N/A			
GRAVEL		SAND		FINES					
COARSE   FINE		MEDIUM   FINE		SILT   CLAY					
COARSE   FINE		MEDIUM   FINE		SILT   CLAY					

GRAIN SIZE IN MILLIMETERS

% FINER BY WEIGHT

Grain Size (mm)	Sieve	% Finer
30	3" Sieve	100
7.5	3/4" Sieve	100
4.75	#10 Sieve	100
2.0	#10 Sieve	100
0.85	#20 Sieve	100
0.425	#40 Sieve	100
0.25	#60 Sieve	100
0.15	#100 Sieve	100
0.075	#200 Sieve	82
0.075	#200 Sieve	82






# **ATTERBERG LIMITS** ( ASTM D 4318 )



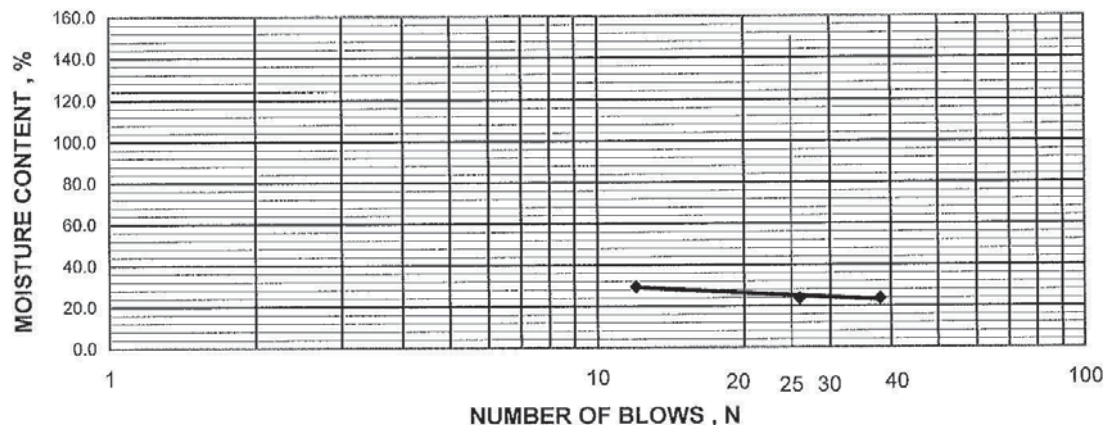
REV. 5/10/06

JOB NAME : Plant Hammond Ash Pond Dikes				
JOB NO. : 28900	REPORT NO. : -	DATE : 03/24/10	REVIEWED BY : 	
BORING / PIT NO. : N/A	DEPTH / ELEV. : N/A	SAMPLE NO. : N/A	SAMPLE TYPE : UD	
SAMPLE LOCATION : AP1-2 @ 10'-12.5'				
SOIL DESCRIPTION : Yellowish brown lean clay with sand.				
LIQUID LIMIT , % : 25	PLASTIC LIMIT , % : 13	PLASTICITY INDEX , % : 12	MOISTURE , % : 14	
CLASSIFICATION :	UNIFIED : CL	AASHTO : -	FINES , % : 82	

## **LIQUID LIMIT, % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES --**

% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2 ") AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS

TEST NO. :	1	2	3	4	5
CONTAINER NO.	42	43	44	BRAND	MODEL
NUMBER OF BLOWS	38	26	12	BALANCE	PRECISA
WT. WET SOIL + CAN (GRAMS)	32.55	28.73	30.87	LL MACHINE	HUMBOLT
WT. DRY SOIL + CAN ( GRAMS )	29.19	26.09	27.28	BALANCE	OHAUS-3100 G
WT. OF WATER ( GRAMS )	3.36	2.64	3.59	OVEN	DESPATCH-3436
WT. OF CONTAINER ( GRAMS )	15.03	14.96	15.10		1650032533
WT. OF DRY SOIL ( GRAMS )	14.16	11.13	12.18		
WATER CONTENT, (%)	23.73	23.72	29.47		



## **PLASTIC LIMIT, % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES --**

% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8" ) IN DIAMETER THREADS WITHOUT CRUMBLING

TEST NO. :	1	2	3	4	5
CONTAINER NO.	53	54			
WT. WET SOIL + CAN (GRAMS)	23.27	23.88			
WT. DRY SOIL + CAN ( GRAMS )	22.40	22.90			
WT. OF WATER ( GRAMS )	0.87	0.98			
WT. OF CONTAINER ( GRAMS )	15.50	15.14			
WT. OF DRY SOIL ( GRAMS )	6.90	7.76			
WATER CONTENT, (%)	12.61	12.63			

**PLASTICITY INDEX - THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -**  
THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT       $PI = LL - PL$



# TRIAxIAL SHEAR TEST REPORT (ASTM D 4767)



REV5,3/05/07

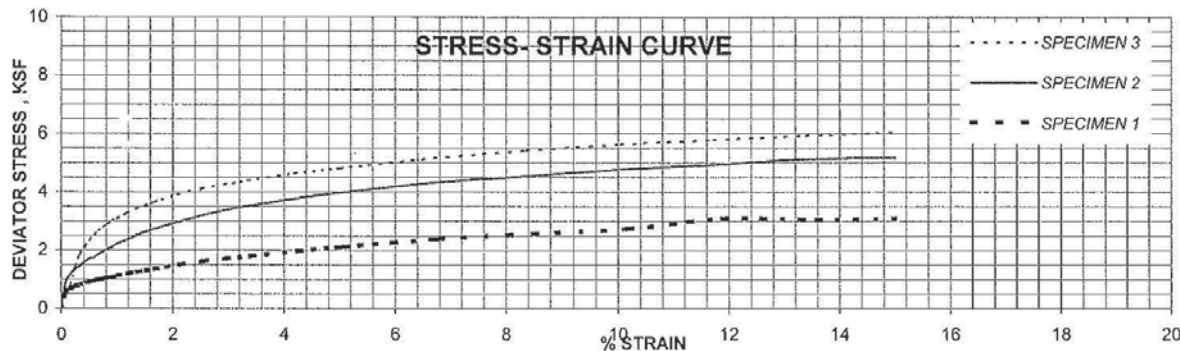
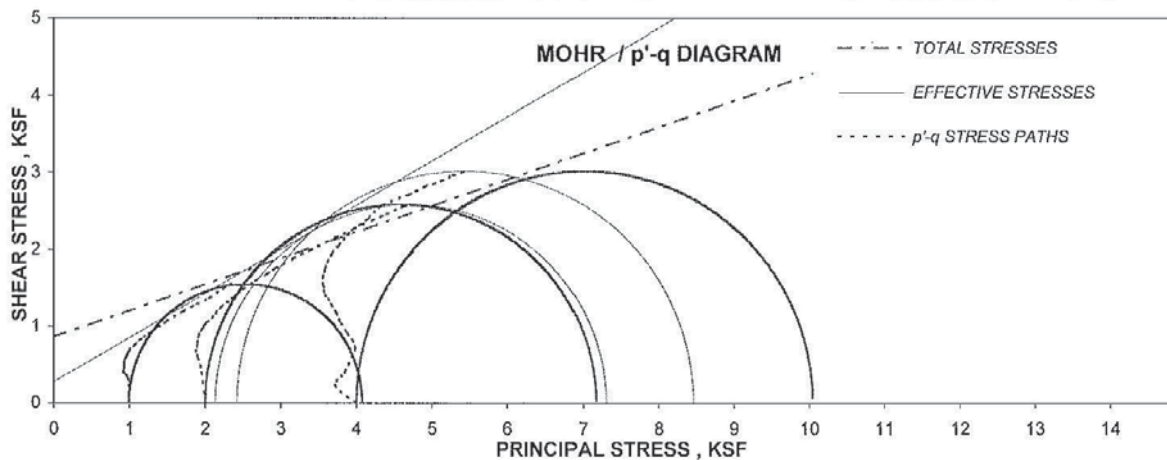
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JOB NO.:	28900	REPORT NO.:	N/A	REVIEWED BY:	7
BORING / PIT NO.:	N/A	DEPTH / ELEV.:	N/A	SAMPLE NO.:	N/A
SAMPLE LOCATION:	AP2-3 @ 35'-37'				
SOIL DESCRIPTION:	Olive brown sandy lean clay (CL)				
LL, %:	40	PI, %:	15	FINES, %:	60
				G <sub>s</sub> :	2.66

SPECIMEN PROPERTIES								TEST PARAMETERS, TEST TYPE : CU/PP		
SPECIMEN NO.	INITIAL			AFTER CONSOLIDATION			SPECIMEN NO.	1	2	3
	1	2	3	1	2	3				
DIAMETER, INCHES	D <sub>o</sub>	2.88	2.88	2.88	D <sub>c</sub>	2.86	2.86	2.86	B Value	0.95
HEIGHT, INCHES	H <sub>o</sub>	5.93	6.03	6.02	H <sub>c</sub>	5.89	5.99	5.97	U <sub>o</sub>	10.2
WATER CONTENT, %	W <sub>o</sub>	25.0	25.4	26.5	W <sub>c</sub>	24.0	24.1	24.9	CONFINING PRESSURE, ksf	σ <sub>3</sub>
DRY DENSITY, PCF	γ <sub>dryo</sub>	99.6	99.4	97.5	γ <sub>dryc</sub>	101.4	101.2	99.9	MAX. DEVIATOR STRESS, ksf	σ <sub>1</sub> -σ <sub>3</sub>
SATURATION, %	S <sub>o</sub>	99.6	100.7	100.1	S <sub>c</sub>	100	100	100	ULT. DEVIATOR STRESS, ksf	σ <sub>1</sub> -σ <sub>3</sub>
VOID RATIO	e <sub>o</sub>	0.667	0.671	0.704	e <sub>c</sub>	0.638	0.641	0.663	Specimen Shape @	Sheared
									Failure	
									Strain	0.2 % per minute
									T50, Minutes =	2

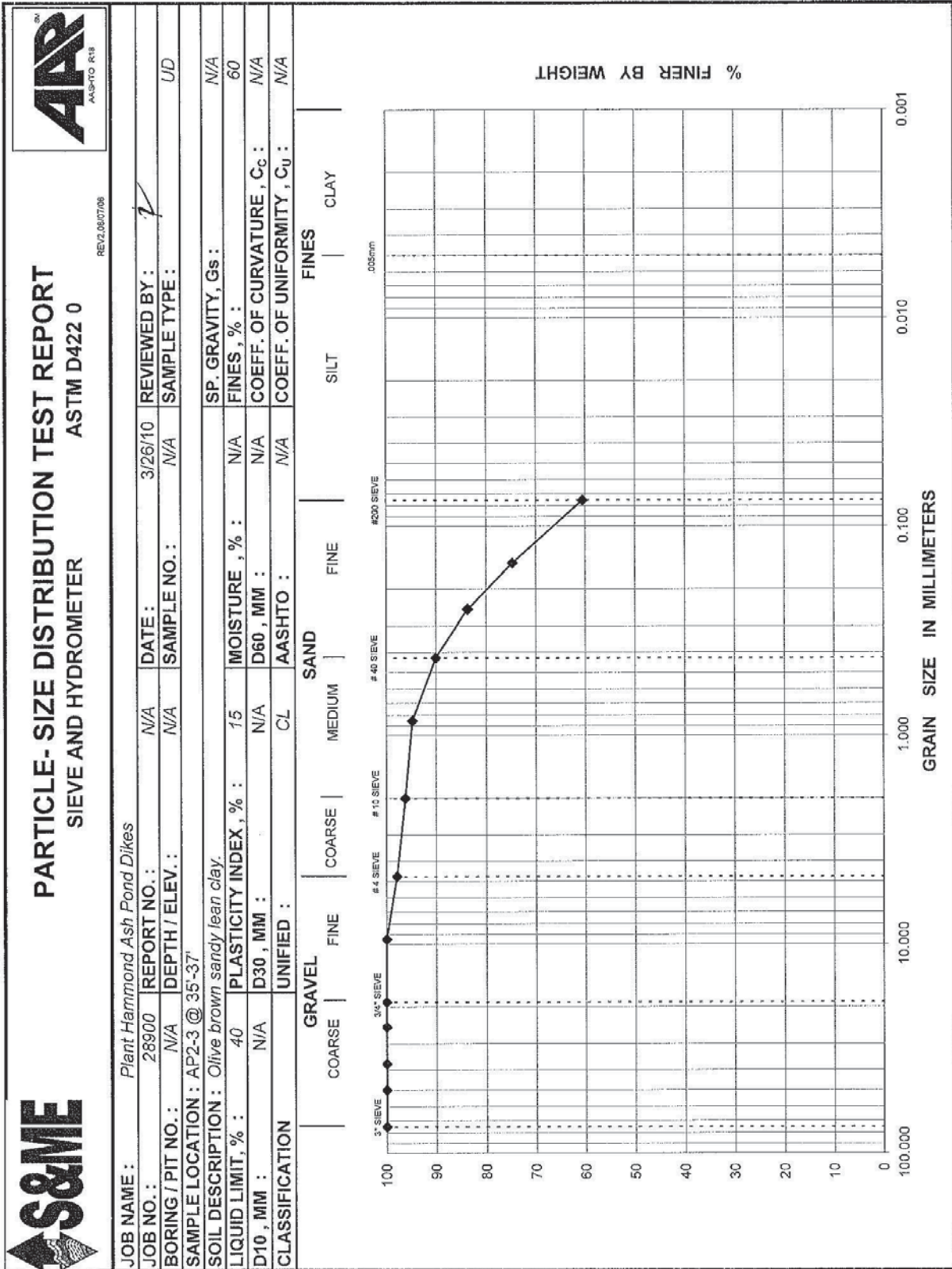
N/A

N/A

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION,	C (ksf) : 0.85	APPARENT COHESION,	(ksf) : 0.28
	ANGLE OF INTER. FRICTION, Φ (DEGREES)	18.9	ANGLE OF INTER. FRICTION, Φ' (DEGREES)	29.9









# **ATTERBERG LIMITS** (ASTM D 4318)



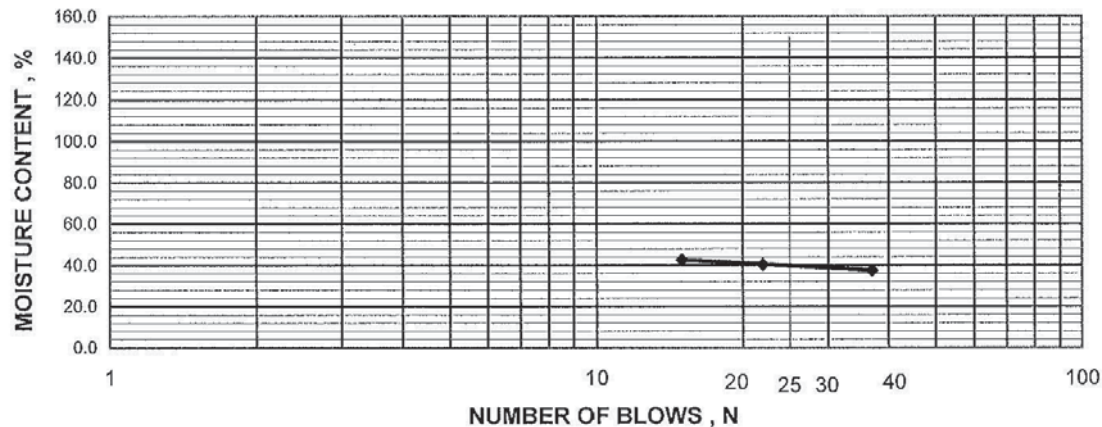
REV. 5/10/06

<b>JOB NAME :</b> Plant Hammond Ash Pond Dikes			
<b>JOB NO. :</b> 28900	<b>REPORT NO. :</b> -	<b>DATE :</b> 03/24/10	<b>REVIEWED BY :</b>
<b>BORING / PIT NO. :</b> N/A	<b>DEPTH / ELEV. :</b> N/A	<b>SAMPLE NO. :</b> N/A	<b>SAMPLE TYPE :</b> UD
<b>SAMPLE LOCATION :</b> AP2-3 @ 35'-37'			
<b>SOIL DESCRIPTION :</b> Olive brown sandy lean clay.			
<b>LIQUID LIMIT, % :</b> 40	<b>PLASTIC LIMIT, % :</b> 25	<b>PLASTICITY INDEX, % :</b> 15	<b>MOISTURE, % :</b> 25
<b>CLASSIFICATION :</b>	<b>UNIFIED :</b> CL	<b>AASHTO :</b> -	<b>FINES, % :</b> 60

**LIQUID LIMIT, %** MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES --

% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2 ") AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS

TEST NO. :	1	2	3	4	5
CONTAINER NO.	91	92	93		
NUMBER OF BLOWS	37	22	15		
WT. WET SOIL + CAN (GRAMS)	28.49	29.57	32.23	BRAND	MODEL
WT. DRY SOIL + CAN ( GRAMS )	24.84	25.42	27.09	BALANCE	PRECISA
WT. OF WATER ( GRAMS )	3.65	4.15	5.14	LL MACHINE	HUMBOLT
WT. OF CONTAINER ( GRAMS )	15.10	15.12	15.05	BALANCE	OHAUS-3100 G
WT. OF DRY SOIL ( GRAMS )	9.74	10.30	12.04	OVEN	DESPATCH-3436
WATER CONTENT, (%)	37.47	40.29	42.69		1650032533



**PLASTIC LIMIT, %** MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES --

% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8 ") IN DIAMETER THREADS WITHOUT CRUMBLING

TEST NO. :	1	2	3	4	5
CONTAINER NO.	94	95			
WT. WET SOIL + CAN (GRAMS)	23.52	22.94			
WT. DRY SOIL + CAN ( GRAMS )	21.84	21.39			
WT. OF WATER ( GRAMS )	1.68	1.55			
WT. OF CONTAINER ( GRAMS )	15.05	15.06			
WT. OF DRY SOIL ( GRAMS )	6.79	6.33			
WATER CONTENT, (%)	24.74	24.49			

**PLASTICITY INDEX -** THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -

THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT  $PI = LL - PL$



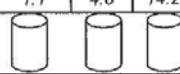
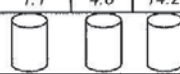
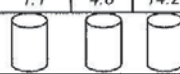


# TRIAXIAL SHEAR TEST REPORT (ASTM D 4767)



REV5.3/05/07

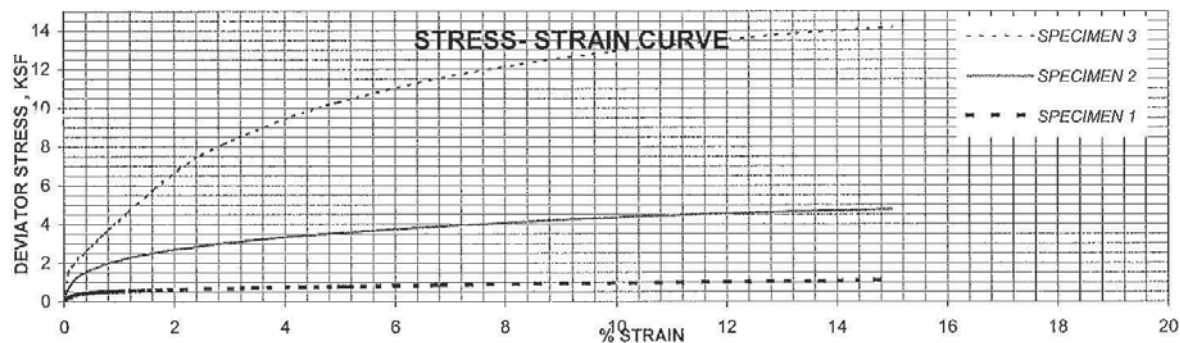
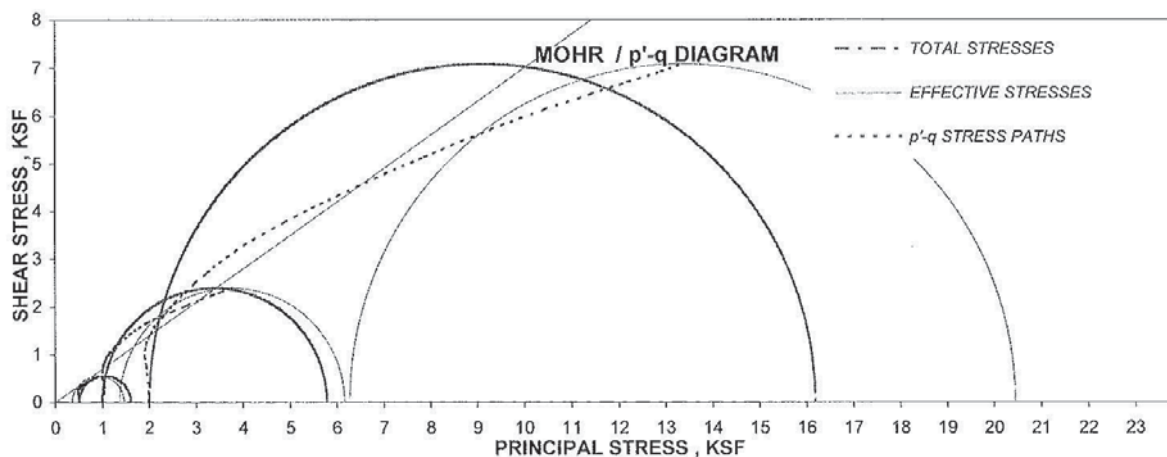
JOB NAME: Plant Hammond Ash Pond Dikes  
 JOB NO.: 28900 REPORT NO.: N/A REVIEWED BY: *[Signature]* DATE: 3/24/10  
 BORING / PIT NO.: N/A DEPTH / ELEV.: N/A SAMPLE NO.: N/A TYPE: UD  
 SAMPLE LOCATION: AP3-1 @ 8'-10'  
 SOIL DESCRIPTION: Specimen 1 & 2: yellow & brown sandy lean clay with gravel, specimen 3: yellow sandy clay.  
 LL, %: 33 PI, %: 17 FINES, %: 67 G<sub>s</sub>: 2.66


SPECIMEN PROPERTIES									TEST PARAMETERS , TEST TYPE : CU/PP					
	INITIAL				AFTER CONSOLIDATION				SPECIMEN NO.		1	2	3	
SPECIMEN NO.		1	2	3		1	2	3	B Value		0.95	0.95	0.95	
DIAMETER , INCHES	D <sub>o</sub>	2.89	2.89	2.88	D <sub>c</sub>	2.86	2.88	2.87	BACK PRESSURE, ksf	U <sub>o</sub>	11.6	11.5	11.6	
HEIGHT , INCHES	H <sub>o</sub>	5.89	6.29	6.06	H <sub>c</sub>	5.85	6.28	6.03	CONFINING PRESSURE , ksf	σ <sub>3</sub>	0.5	1.0	2.0	
WATER CONTENT, %	W <sub>o</sub>	21.8	14.5	18.4	W <sub>c</sub>	22.2	15.4	17.4	MAX. DEVIATOR STRESS ,ksf	σ <sub>1</sub> -σ <sub>3</sub>	1.1	4.8	14.2	
DRY DENSITY, PCF	γ <sub>dryo</sub>	102.0	117.1	111.9	γ <sub>dryc</sub>	104.4	117.7	113.5	ULT. DEVIATOR STRESS , ksf	σ <sub>1</sub> -σ <sub>3</sub>	1.1	4.8	14.2	
SATURATION ,%	S <sub>o</sub>	92.5	92.4	101.4	S <sub>c</sub>	100	100	100	Specimen Shape @ Failure		Sheared			
VOID RATIO	e <sub>o</sub>	0.627	0.417	0.483	e <sub>c</sub>	0.590	0.409	0.462						
----- , Strain 0.04									% per minute		T50, Minutes =		10	

N/A

N/A

SHEAR STRENGTH PARAMETERS	TOTAL		EFFECTIVE	
	COHESION, C (ksf) :	N/A	APPARENT COHESION, (ksf) :	0.00
	ANGLE OF INTER. FRICTION, Φ (DEGREES) :	N/A	ANGLE OF INTER. FRICTION, Φ' (DEGREES) :	35.0






# PARTICLE-SIZE DISTRIBUTION TEST REPORT

## SIEVE AND HYDROMETER

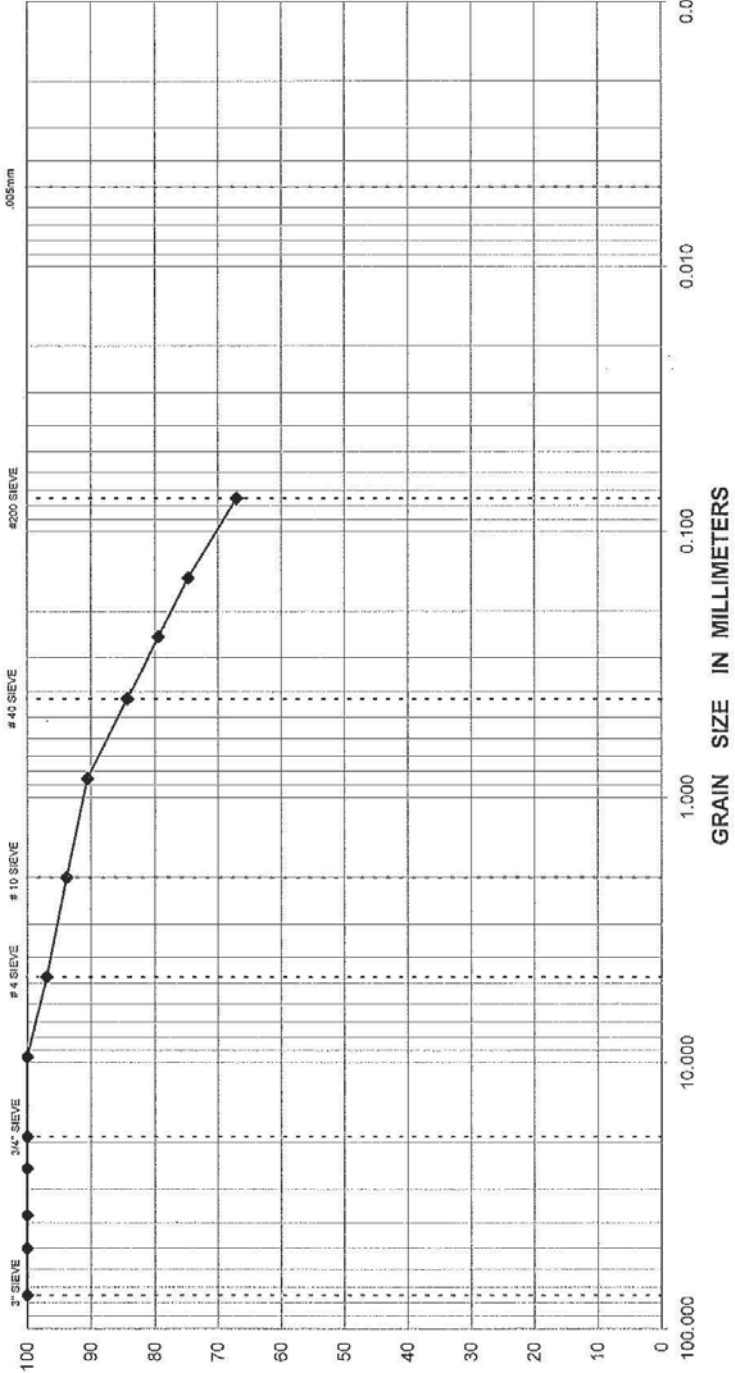
### ASTM D422 0



REV2.09/07/06  
AASHTO R18

<b>JOB NAME :</b> Plant Hammond Ash Pond Dikes			
<b>JOB NO. :</b> 28900	<b>REPORT NO. :</b> N/A	<b>DATE :</b> 3/26/10	<b>REVIEWED BY :</b> <i>[Signature]</i>
<b>BORING / PIT NO. :</b> N/A	<b>DEPTH / ELEV. :</b> N/A	<b>SAMPLE NO. :</b> N/A	<b>SAMPLE TYPE :</b> UD
<b>SAMPLE LOCATION :</b> AP3-1 @ 8'-10'			
<b>SOIL DESCRIPTION :</b> Yellowish brown, sandy lean clay with gravel.			
<b>LIQUID LIMIT, % :</b> 33	<b>PLASTICITY INDEX, % :</b> 17	<b>MOISTURE, % :</b> N/A	<b>SP. GRAVITY, Gs :</b> N/A
<b>D10, MM :</b> N/A	<b>D30, MM :</b> N/A	<b>D60, MM :</b> N/A	<b>FINES, % :</b> 67
<b>CLASSIFICATION</b>	<b>UNIFIED :</b> CL	<b>AASHTO :</b> N/A	<b>COEFF. OF CURVATURE, C<sub>c</sub> :</b> N/A
			<b>COEFF. OF UNIFORMITY, C<sub>u</sub> :</b> N/A

GRAVEL		SAND		FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	CLAY



The graph plots % Finer by Weight (0 to 100) against Grain Size in Millimeters (log scale from 100.000 to 0.001). The curve starts at 100% finer for 100.000 mm and decreases to approximately 67% finer at 0.075 mm (No. 200 sieve).

Sieve / Size (mm)	% Finer (%)
3" Sieve (76.2)	100
3/4" Sieve (19.0)	100
#10 Sieve (2.0)	100
#4 Sieve (4.75)	100
#10 Sieve (2.0)	95
#40 Sieve (0.425)	85
#60 Sieve (0.250)	78
#100 Sieve (0.150)	72
#200 Sieve (0.075)	67





# ATTERBERG LIMITS (ASTM D 4318)



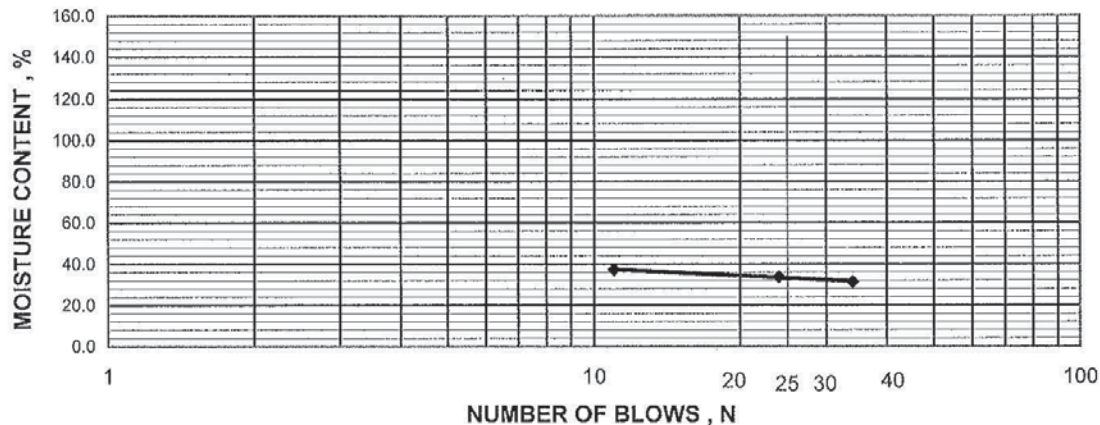
REV. 5/10/06

JOB NAME :	Plant Hammond Ash Pond Dikes						
JOB NO. :	28900	REPORT NO. :	-	DATE :	03/31/10	REVIEWED BY :	P
BORING / PIT NO. :	AP3-1	DEPTH / ELEV. :	8'-10'	SAMPLE NO. :	N/A	SAMPLE TYPE :	UD
SAMPLE LOCATION : -							
SOIL DESCRIPTION : -							
LIQUID LIMIT , % :	33	PLASTIC LIMIT , % :	16	PLASTICITY INDEX , % :	17	MOISTURE , % :	18
CLASSIFICATION :		UNIFIED :	CL	AASHTO :	-	FINES , % :	67

**LIQUID LIMIT** , % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES --

% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2 ") AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS

TEST NO. :	1	2	3		4		5
CONTAINER NO.	42	43	44	BRAND	MODEL	SERIAL	
NUMBER OF BLOWS	34	24	11	BALANCE	PRECISA	2200 C	
WT. WET SOIL + CAN (GRAMS)	29.83	29.12	30.57	LL MACHINE	HUMBOLT	1	
WT. DRY SOIL + CAN ( GRAMS )	26.29	25.54	26.37	BALANCE	OHAUS-3100 G	ARC120	
WT. OF WATER ( GRAMS )	3.54	3.58	4.20	OVEN	DESPATCH-3438	1650032533	
WT. OF CONTAINER ( GRAMS )	15.00	14.93	15.07				
WT. OF DRY SOIL ( GRAMS )	11.29	10.61	11.30				
WATER CONTENT, (%)	31.36	33.74	37.17				



**PLASTIC LIMIT** , % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES --

% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8" ) IN DIAMETER THREADS WITHOUT CRUMBLING

TEST NO. :	1	2	3	4	5
CONTAINER NO.	54	56			
WT. WET SOIL + CAN (GRAMS)	22.5	21.75			
WT. DRY SOIL + CAN ( GRAMS )	21.46	20.83			
WT. OF WATER ( GRAMS )	1.04	0.92			
WT. OF CONTAINER ( GRAMS )	15.11	15.19			
WT. OF DRY SOIL ( GRAMS )	6.35	5.64			
WATER CONTENT, (%)	16.38	16.31			

**PLASTICITY INDEX** - THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -

THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT  $PI = LL - PL$



# **ATTERBERG LIMITS** (ASTM D 4318)



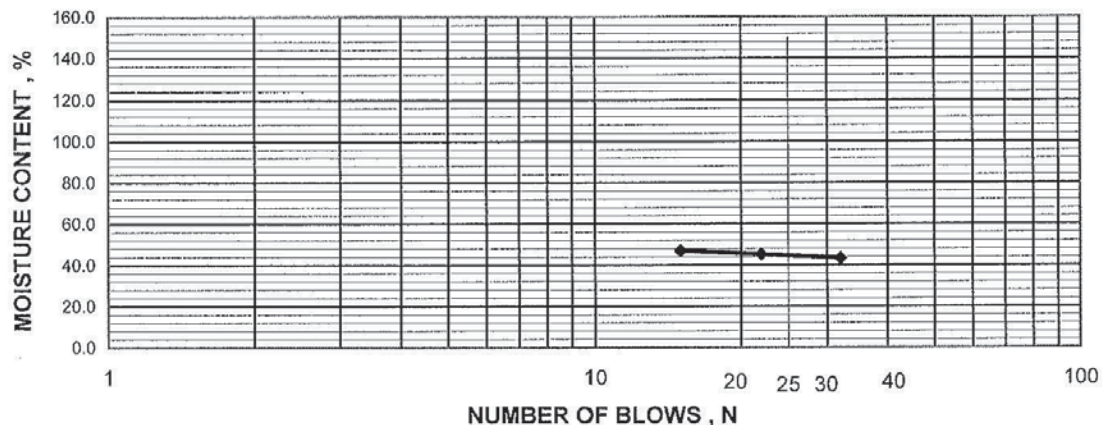
REV., 5/10/06

JOB NAME : Plant Hammond Ash Pond Dikes					
JOB NO. :	28900	REPORT NO. :	N/A	DATE :	03/26/10
BORING / PIT NO. :	N/A	DEPTH / ELEV. :	N/A	SAMPLE NO. :	N/A
SAMPLE LOCATION : AP4-1 @ 10'-12.5'					
SOIL DESCRIPTION : -					
LIQUID LIMIT , % :	45	PLASTIC LIMIT , % :	25	PLASTICITY INDEX , % :	20
CLASSIFICATION :		UNIFIED :	CL	AASHTO :	-
				MOISTURE , % :	30
				FINES , % :	87

## **LIQUID LIMIT , % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES --**

% MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2 ") AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS

TEST NO. :	1	2	3	4	5
CONTAINER NO.	6	7	9		
NUMBER OF BLOWS	32	22	15		
WT. WET SOIL + CAN (GRAMS)	29.18	29.88	30.36	BRAND	MODEL
WT. DRY SOIL + CAN ( GRAMS )	25.04	25.56	25.64	BALANCE	PRECISA
WT. OF WATER ( GRAMS )	4.14	4.32	4.72	LL MACHINE	HUMBOLT
WT. OF CONTAINER ( GRAMS )	15.49	16.00	15.58	BALANCE	OHAUS-3100 G
WT. OF DRY SOIL ( GRAMS )	9.55	9.56	10.06	OVEN	DESPATCH-3436
WATER CONTENT, (%)	43.35	45.19	46.92		1650032533



## **PLASTIC LIMIT , % MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES --**

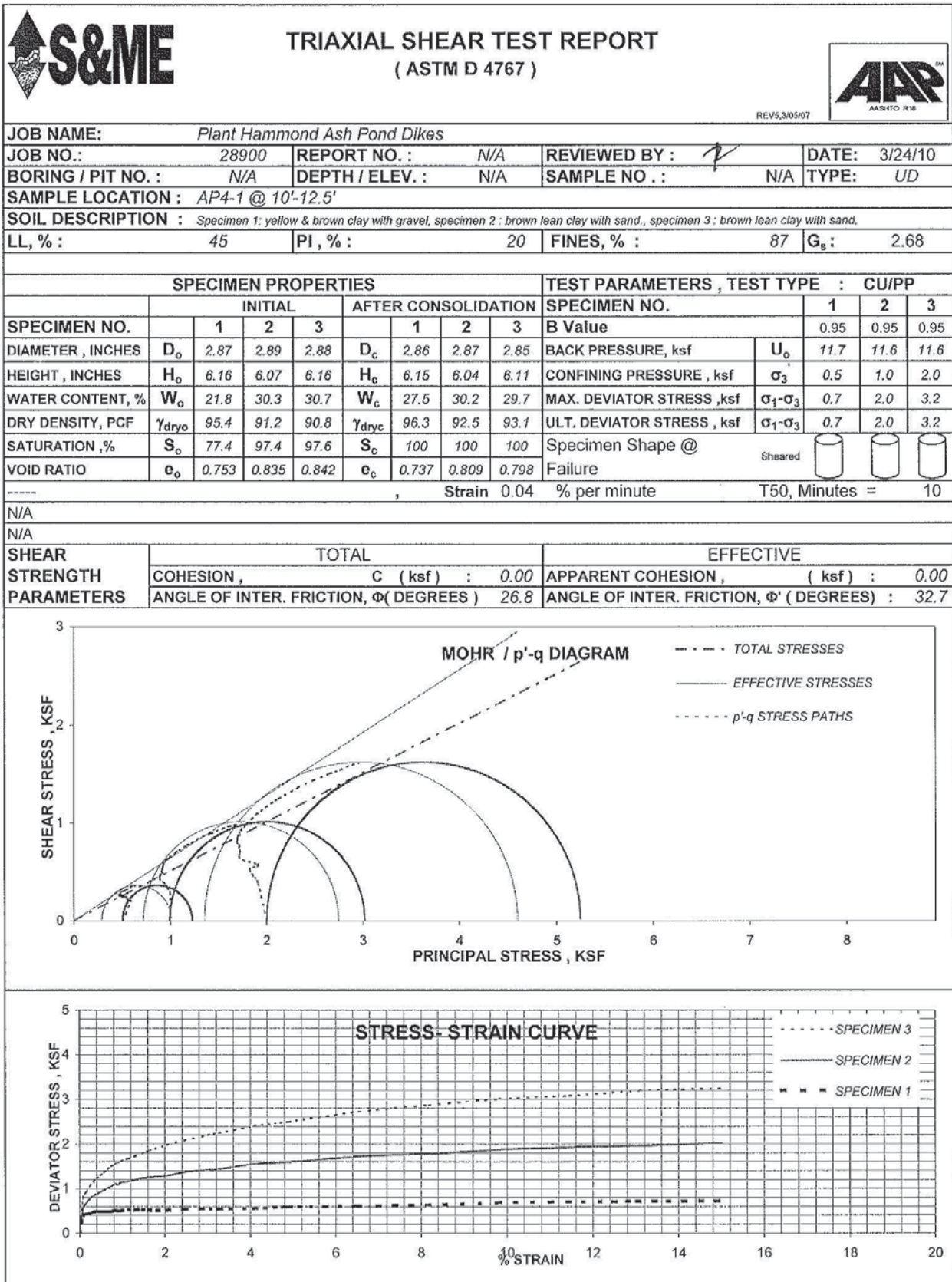
% MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8 ") IN DIAMETER THREADS WITHOUT CRUMBLING


TEST NO. :	1	2	3	4	5
CONTAINER NO.	28	53			
WT. WET SOIL + CAN (GRAMS)	28.13	26.55			
WT. DRY SOIL + CAN ( GRAMS )	25.72	24.29			
WT. OF WATER ( GRAMS )	2.41	2.26			
WT. OF CONTAINER ( GRAMS )	16.08	15.49			
WT. OF DRY SOIL ( GRAMS )	9.64	8.80			
WATER CONTENT, (%)	25.00	25.68			

## **PLASTICITY INDEX - THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY -**

THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT       $PI = LL - PL$








## PARTICLE-SIZE DISTRIBUTION TEST REPORT

### SIEVE AND HYDROMETER



REV2.080706

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**JOB NAME :** Plant Hammond Ash Pond Dikes

**JOB NO. :** 28900    **REPORT NO. :** N/A    **DATE :** 3/26/10    **REVIEWED BY :** *[Signature]*

**BORING / PIT NO. :** N/A    **DEPTH / ELEV. :** N/A    **SAMPLE NO. :** N/A    **SAMPLE TYPE :** UD

**SAMPLE LOCATION :** AP4-1 @ 10'-12'

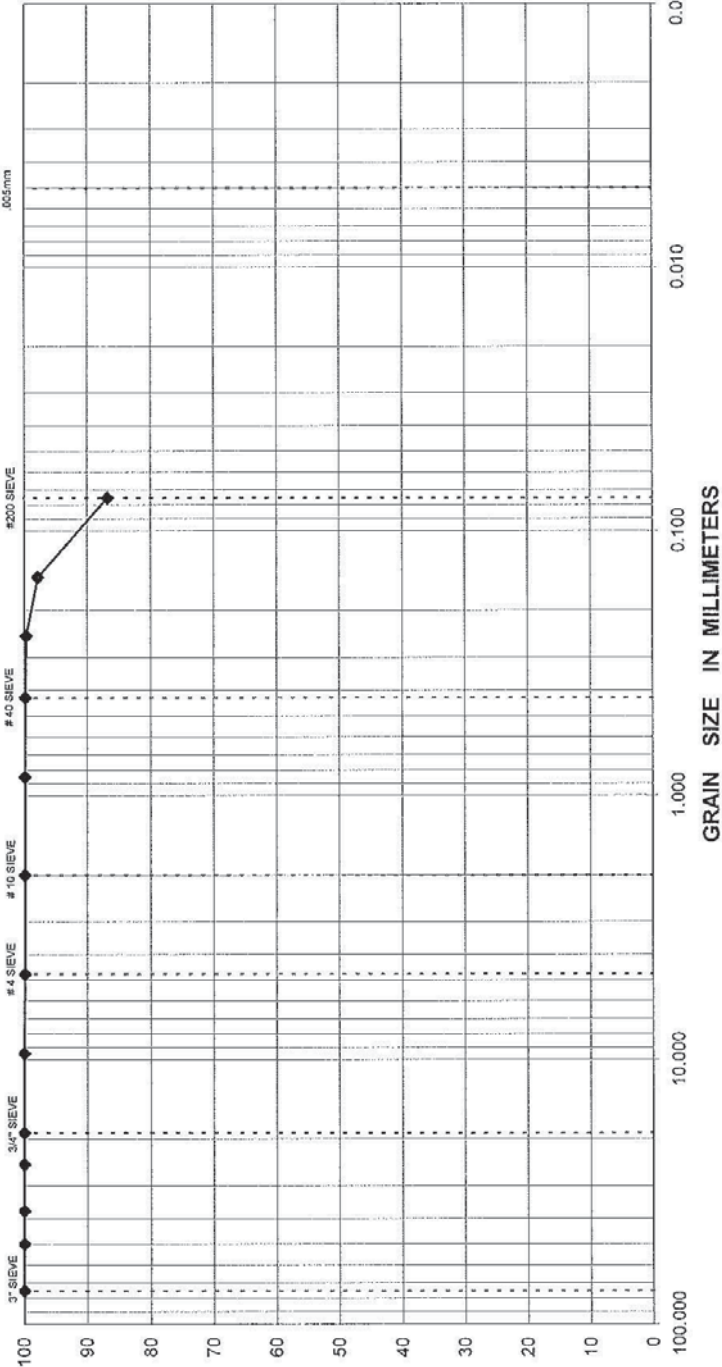
**SOIL DESCRIPTION :** Brown lean clay with sand.

**LIQUID LIMIT, % :** 45    **PLASTICITY INDEX, % :** 20    **MOISTURE, % :** N/A    **SP. GRAVITY, G<sub>s</sub> :** N/A

**D<sub>10</sub>, MM :** N/A    **D<sub>30</sub>, MM :** N/A    **D<sub>60</sub>, MM :** N/A    **FINES, % :** 87

**CLASSIFICATION :** UNIFIED : CL    AASHTO : N/A    **COEFF. OF CURVATURE, C<sub>c</sub> :** N/A    **COEFF. OF UNIFORMITY, C<sub>u</sub> :** N/A

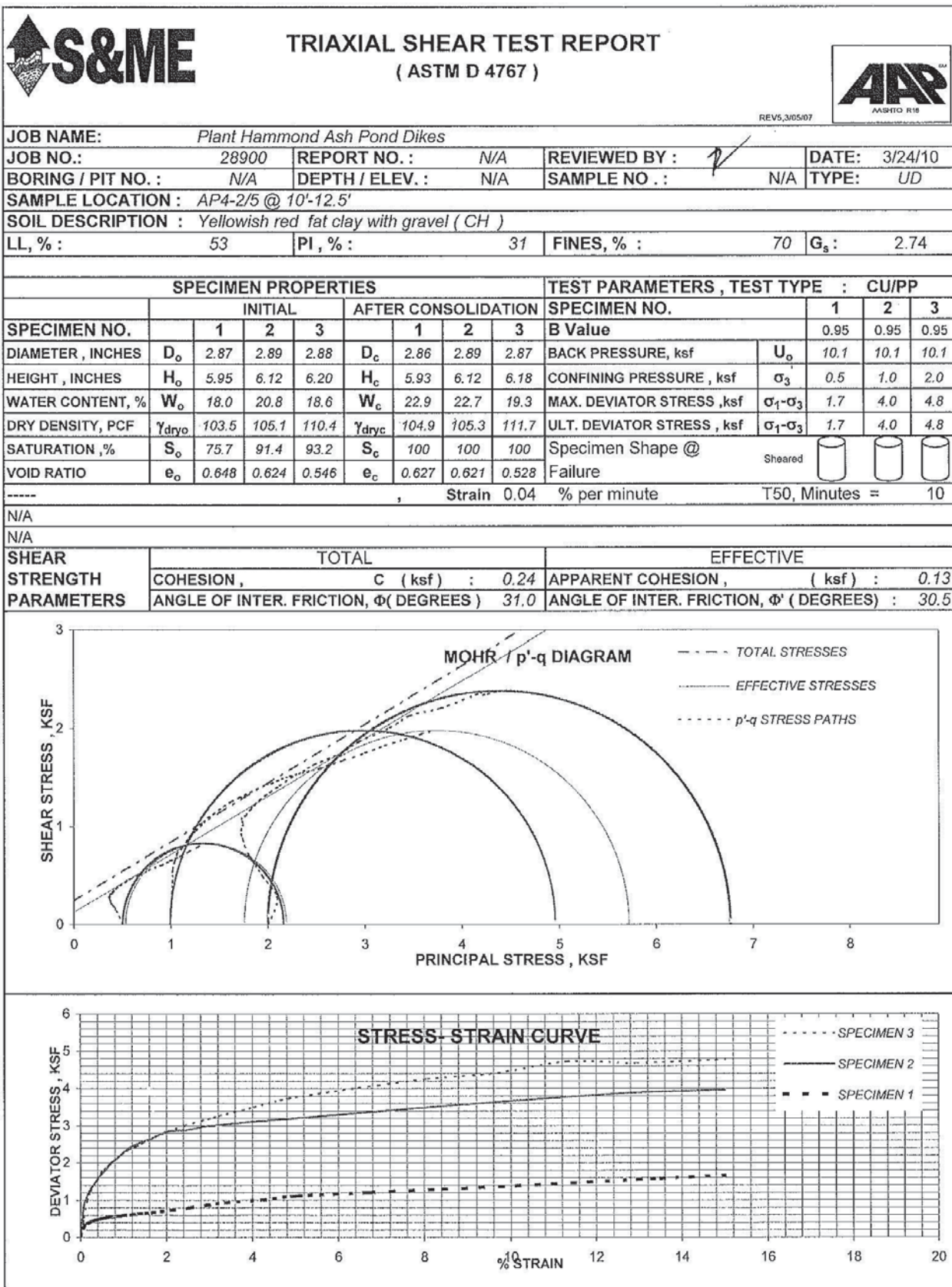
GRAVEL		SAND			FINES	
COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
3" SIEVE		#4 SIEVE	#10 SIEVE	#40 SIEVE	#200 SIEVE	0.075mm



The graph plots % Finer by Weight (0 to 100) against Grain Size in Millimeters (log scale from 100.000 to 0.001). The curve starts at 100% finer for 100.000 mm and decreases to approximately 87% finer at 0.075 mm.

Grain Size (mm)	% Finer
100.000	100
75.000	100
60.000	100
47.500	100
37.500	100
30.000	100
25.000	100
20.000	100
15.000	100
12.500	100
10.000	100
7.500	100
6.000	100
4.750	100
3.750	100
3.000	100
2.500	100
2.000	100
1.500	100
1.180	100
0.850	100
0.600	100
0.425	100
0.300	100
0.250	100
0.200	100
0.150	100
0.106	100
0.075	87





S&ME		PARTICLE-SIZE DISTRIBUTION TEST REPORT				ASTM D422 0		REVISED 07/06		AAS-TO R18	
JOB NAME : Plant Hammond Ash Pond Dikes											
JOB NO. :	28900	REPORT NO. :	N/A	DATE :	3/26/10	REVIEWED BY :	7				
BORING / PIT NO. :	N/A	DEPTH / ELEV. :	N/A	SAMPLE NO. :	N/A	SAMPLE TYPE :	UD				
SAMPLE LOCATION : AP4-2 @ 10'-12'											
SOIL DESCRIPTION : Yellowish red, sandy fat clay with gravel.											
LIQUID LIMIT, % :	53	PLASTICITY INDEX, % :	31	MOISTURE, % :	N/A	SP. GRAVITY, G <sub>s</sub> :	N/A				
D <sub>10</sub> , MM :	N/A	D <sub>30</sub> , MM :	N/A	D <sub>60</sub> , MM :	N/A	COEFF. OF CURVATURE, C <sub>c</sub> :	70				
UNIFIED :	CH	AASHTO :	N/A	COEFF. OF UNIFORMITY, C <sub>u</sub> :	N/A						
CLASSIFICATION											
GRAVEL			SAND			SILT			FINES		
COARSE	FINE	COARSE	MEDIUM	FINE							

GRAIN SIZE IN MILLIMETERS

% FINER BY WEIGHT

Grain Size (mm)	% Finer
3"	100
3/4"	100
#4	100
#10	95
#20	90
#40	85
#60	80
#100	75
#200	70
#425	70
#600	70
#840	70
#1060	70
#1490	70
#2000	70
#2800	70
#3550	70
#4750	70
#6300	70
#8500	70
#11200	70
#14900	70
#19750	70
#25750	70
#33750	70
#43750	70
#56250	70
#71250	70
#89750	70
#111750	70
#137750	70
#168750	70
#214750	70
#276750	70
#354750	70
#450750	70
#566750	70
#704750	70
#876750	70
#1084750	70
#1334750	70
#1634750	70
#2000000	70



		<b>ATTERBERG LIMITS</b> ( ASTM D 4318 )					
		REV. 5/10/05					
<b>JOB NAME :</b> Plant Hammond Ash Pond Dikes							
<b>JOB NO. :</b> 28900		<b>REPORT NO. :</b> -		<b>DATE :</b> 03/25/10		<b>REVIEWED BY :</b>	
<b>BORING / PIT NO. :</b> N/A		<b>DEPTH / ELEV. :</b> N/A		<b>SAMPLE NO. :</b> N/A		<b>SAMPLE TYPE :</b> UD	
<b>SAMPLE LOCATION :</b> AP4-2 @ 10'-12.5'							
<b>SOIL DESCRIPTION :</b> -							
<b>LIQUID LIMIT , % :</b> 53		<b>PLASTIC LIMIT , % :</b> 22		<b>PLASTICITY INDEX , % :</b> 31		<b>MOISTURE , % :</b> 18	
<b>CLASSIFICATION :</b>		<b>UNIFIED :</b> CH		<b>AASHTO :</b> -		<b>FINES , % :</b> 70	
<b>LIQUID LIMIT , %</b> MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN LIQUID & PLASTIC STATES -- % MOISTURE AT WHICH SOIL FLOWS FOR A DISTANCE OF 13 MM ( 1/2" ) AT THE BASE OF GROOVE WHEN SUBJECTED TO 25 BLOWS							
<b>TEST NO. :</b>	1	2	3	4	5		
<b>CONTAINER NO.</b>	25	26	27	BRAND	MODEL	SERIAL	
<b>NUMBER OF BLOWS</b>	33	26	14	BALANCE	PRECISA	2200 C	
<b>WT. WET SOIL + CAN (GRAMS)</b>	28.47	29.15	29.20	LL MACHINE	HUMBOLT	1	
<b>WT. DRY SOIL + CAN ( GRAMS )</b>	24.04	24.66	24.33	BALANCE	OHAUS-3100 G	ARC120	
<b>WT. OF WATER ( GRAMS )</b>	4.43	4.49	4.87	OVEN	DESPATCH-3436	1650032533	
<b>WT. OF CONTAINER ( GRAMS )</b>	15.20	16.00	15.96				
<b>WT. OF DRY SOIL ( GRAMS )</b>	8.84	8.66	8.37				
<b>WATER CONTENT , (%)</b>	50.11	51.85	58.18				
<b>PLASTIC LIMIT , %</b> MOISTURE AT THE ARBITRARY DEFINED BOUNDARY BETWEEN PLASTIC & BRITTLE STATES -- % MOISTURE AT WHICH SOIL CAN NO LONGER BE DEFORMED BY ROLLING INTO 3.2 MM ( 1/8" ) IN DIAMETER THREADS WITHOUT CRUMBLING							
<b>TEST NO. :</b>	1	2	3	4	5		
<b>CONTAINER NO.</b>	18	19					
<b>WT. WET SOIL + CAN (GRAMS)</b>	22.72	23.04					
<b>WT. DRY SOIL + CAN ( GRAMS )</b>	21.37	21.64					
<b>WT. OF WATER ( GRAMS )</b>	1.35	1.40					
<b>WT. OF CONTAINER ( GRAMS )</b>	15.24	15.06					
<b>WT. OF DRY SOIL ( GRAMS )</b>	6.13	6.58					
<b>WATER CONTENT , (%)</b>	22.02	21.28					
<b>PLASTICITY INDEX -</b> THE RANGE OF % MOISTURE CONTENT OVER WHICH SOIL BEHAVES PLASTICALLY - THE DIFFERENCE BETWEEN LIQUID LIMIT & PLASTIC LIMIT $PI = LL - PL$							

# **Attachment E**

## **Groundwater Levels**

### Plant Hammond - Ash Ponds 1, 2, 3 and 4

2016

## Monthly Piezometer/Weir Measurement Log

[illegible]

NOTE: AP3-1/AP3-2/AP3-3 ABANDONED