PERIODIC SAFETY FACTOR ASSESSMENT PLANT GORGAS GYPSUM POND ALABAMA POWER COMPANY

EPA's "Disposal of Coal Combustion Residuals from Electric Utilities" Final Rule (40 C.F.R. Part 257 and Part 261) and the State of Alabama's ADEM Admin. Code Chapter 335-13-15, require the owner or operator of an existing CCR surface impoundment to conduct periodic safety factor assessments. Per §257.73(e) and ADEM Admin. Code r. 335-13-15-.04(4)(e), the owner or operator must document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) and ADEM Admin. Code r. 335-13-15-.04(4)(e)(1)(i) through (iv) for the critical embankment section are achieved. In addition, §257.73(f)(3) and ADEM Admin. Code r. 335-13-15-.04(4)(f)3. require a subsequent assessment be performed within 5 years of the previous assessment.

The CCR surface impoundment located at Alabama Power Company's Plant Gorgas also referred to as the Plant Gorgas Gypsum Pond is located on Plant Gorgas property, southeast from Parrish, Alabama. The CCR surface impoundment is formed by an engineered cross-valley embankment. The Plant Gorgas Gypsum Pond is currently undergoing closure by removal and a substantial portion of the gypsum has been removed. However, the cross-section has been modeled for maximum storage conditions as all gypsum has not yet been removed and surface elevations within the unit vary. The critical section of this CCR unit had previously been determined to be located, and remains, at the highest portion of the embankment in the area holding sluiced gypsum.

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

Loading Condition	Minimum Calculated	Minimum Required
	Safety Factor	Safety Factor
Long-term Maximum Storage Pool (Static)	2.5	1.5
Maximum Surcharge Pool (Static)	2.5	1.4
Seismic	2.1	1.0

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

I hereby certify that the safety factor assessment was conducted in accordance with 40 C.F.R. §257.73 (e)(1) and ADEM Admin. Code r. 335-13-15-.04(4)(e)(1).

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Technical and Project Solutions Calculation

Calculation Number: TV-GO-APC962011-002

Project/Plant:	Unit(s):	Discipline/Area:				
Plant Gorgas Gypsum Pond		Env. Solutions				
Title/Subject: Periodic Factor of Safety Assessn	nent for CCR Rule					
Purpose/Objective: Determine the Factor of Sa	fety of the Gypsum Po	nd Dike				
System or Equipment Tag Numbers: n/a	Originator: Jacob A.	Jordan, P.E.				

Contents

Topic	Page	Attachments (Computer Printouts, Tech. Papers, Sketches, Correspondence)	# of Pages
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Design Inputs/References	3	·	
Body of Calculation	4-7		
Total # of pages including			

Total # of pages including cover sheet & attachments:

Revision Record

Rev. No.	Description	Originator Initial / Date	Reviewer Initial / Date	Approver Initial / Date
0	Issued for Information	JAJ/07-12-21	JCP/07-13-21	JCP/07-13-21

Notes:

Purpose of Calculation

Plant Gorgas was a coal-fired electric generating facility, consisting of 10 units over its lifetime. The Plant Gorgas Gypsum Pond was designed to receive and store coal combustion residuals (gypsum) produced during the electric generating process at Plant Gorgas. The gypsum slurry from the flue gas desulfurization operation was wet-sluiced to the gypsum storage area, where it was either allowed to settle in the pond or was dewatered and stacked. The last operating units at the plant, Units 8-10, were shut down in April 2019, along with the Gypsum Pond.

Stability analyses were previously performed in 2016 for the CCR Rule. The purpose of this calculation is to update the 2016 stability analysis of Gypsum Pond.

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. The analyses indicate that in all cases the factor of safety is at or above the require minimum.

Load Conditions	Computed Factor of Safety	Required Minimum Factor of Safety
Long-term Maximum Storage (Static)	2.5	1.5
Maximum Surcharge Pool (Static)	2.5	1.4
Seismic	2.1	1.0

Methodology

The calculation was performed using the following methods and software:

- GeoStudio 2021 R2 version 11.1.1.22085 Copyright 1991-2021, GEO-SLOPE International, Ltd.
- Strata (Version 0.8.0), University of Texas, Austin
- Morgenstern-Price analytical method

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 2014 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 Tavasarou (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 0.080g 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 critical section was selected at the location having the apparent maximum dam height and gypsum storage. The cross-section of the Plant Gorgas Gypsum Pond dam was modeled using the Alabama Power Company (APC) Drawing D-591423, Plant Gorgas Gypsum Storage Area Cell, Sections and Details Sheet 1.
- A phreatic surface within the dam was not modeled because the cell is lined with 60-mil HDPE, which for purposes of this analysis is considered to be impermeable.
- The Gypsum Pond is currently undergoing closure by removal, with the gypsum being reclaimed for beneficial use purposes. However, the facility was modeled for maximum storage as all gypsum has not been removed and surface elevations vary.

Input Data

- Soil Properties: The soil properties (unit weight, phi angle, and cohesion) of coal mine spoils comprising the dam used in the analysis were conservatively estimated from evaluating average blow counts of the material encountered during drilling operations, and from laboratory testing of the coal mine spoils.
- The soil properties (unit weight, phi angle, and cohesion) of the gypsum were derived from laboratory testing of gypsum similar to what is produced and stored at Plant Gorgas.

		Effective Stress Parameters			
Soil Description	Unit Weight, pcf	Cohesion, psf Phi Angle, degree			
Gypsum	100	100	34		
Coal Mine Spoil	104	0	36		

Design Inputs/References

- SCS Calculation TV-GO-APC389153-002
- USGS Earthquake Hazards website, earthquake.usgs.gov/hazards/interactive
- US Corps of Engineers Manual EM 1110-2-1902, October 2003
- 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
- D-591423, Plant Gorgas Gypsum Storage Area Cell Sections and Details Sheet 1, 2006

• Subsurface Investigation Report, Gypsum Storage Area at Alabama Power Company's Gorgas Steam Plant, Southern Company Technical Services, 2005

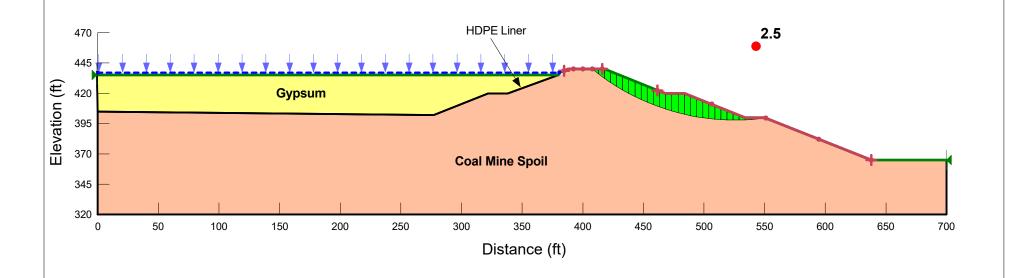
Body of Calculation

SLOPE/W modeling attached.

Plant Gorgas Gypsum Pond Factor of Safety Assessment

Maximum Storage

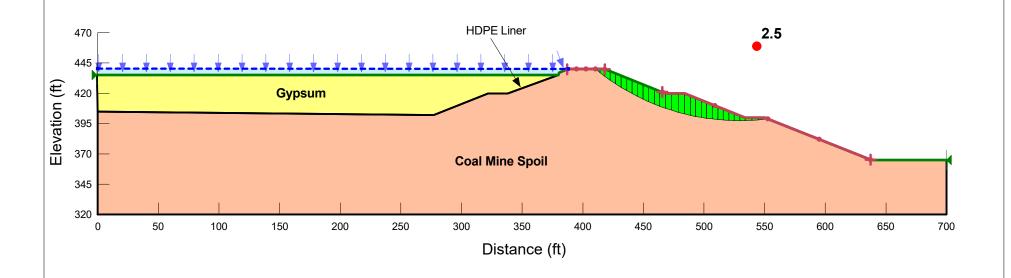
Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Coal Mine Spoil	Mohr-Coulomb	104	0	36
Gypsum		Mohr-Coulomb	100	100	34



Plant Gorgas Gypsum Pond Factor of Safety Assessment

Maximum Surcharge Pool

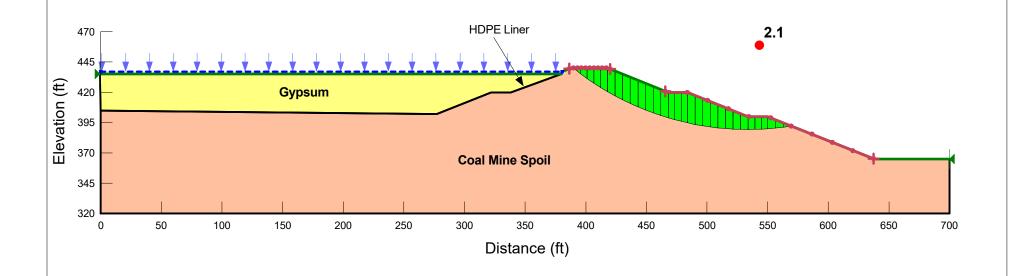
Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Coal Mine Spoil	Mohr-Coulomb	104	0	36
	Gypsum	Mohr-Coulomb	100	100	34



Plant Gorgas Gypsum Pond Factor of Safety Assessment

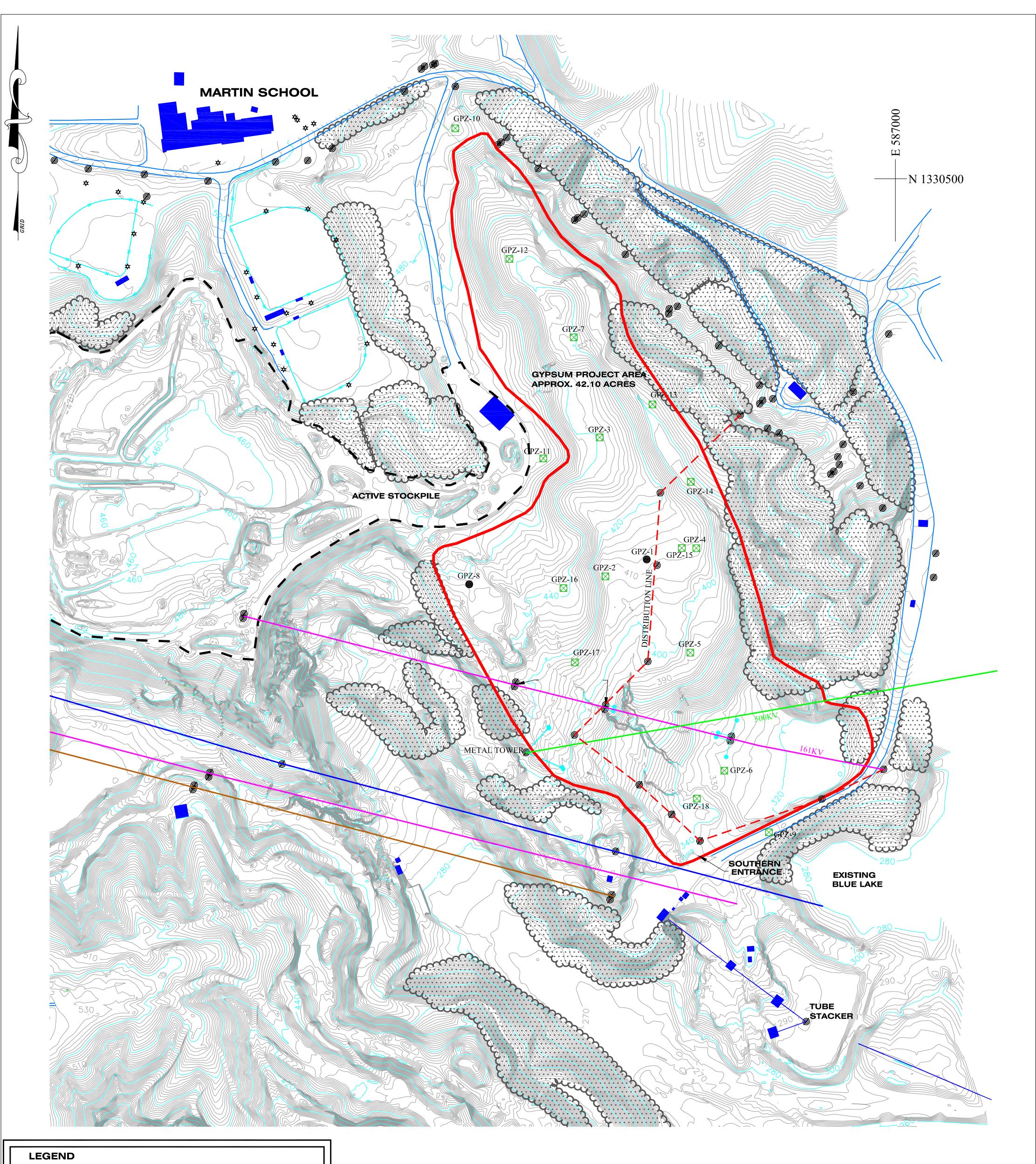
Seismic Loading Horizontal Coefficient: 0.08g

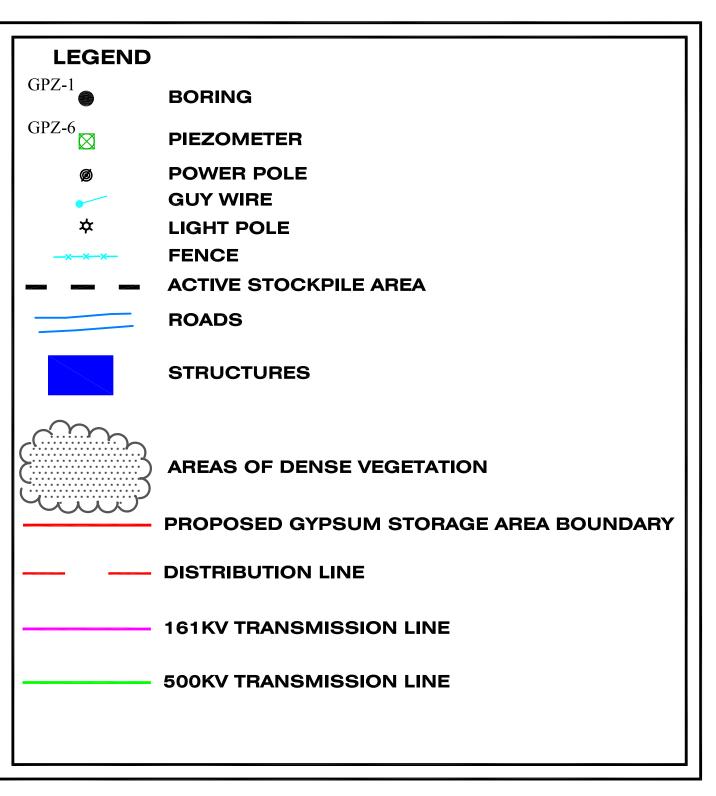
Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Coal Mine Spoil	Mohr-Coulomb	104	0	36
	Gypsum	Mohr-Coulomb	100	100	34



Attachment A

Boring Location Plan





Hole	Surf. Elev	NORTHING	EASTING
GPZ-1	411.178	1329138.532	586110.801
GPZ-2	409.046	1329077.785	585962.932
GPZ-3	439.133	1329575.014	585942.474
GPZ-4	411.275	1329178.652	586288.212
GPZ-5	392.77	1328805.159	586266.769
GPZ-6	327.628	1328383.099	586388.351
GPZ-7	420.215	1329932.761	585850.253
GPZ-8	456.921	1329049.647	585475.962
GPZ-9	336.852	1328162.636	586547.693
GPZ-10	487.87	1330608.47	585426.44
GPZ-11	473.36	1329499.75	585740.85
GPZ-12	421.61	1330213.32	585619.97
GPZ-13	402.64	1329692.80	586131.45
GPZ-14	394.93	1329416.45	586268.34
GPZ-15	411.18	1329179.05	586236.28
GPZ-16	440.65	1329035.86	585813.17
GPZ-17	414.27	1328770.35	585853.67
GPZ-18	338.02	1328283.18	586290.18

(IN FEET)
1 inch = 160 ft.

PHOTOGRAMMETRIC SURVEY
GRID COORDINATES NAD 27
ALABAMA STATE PLANE

WEST ZONE

GRAPHIC SCALE

Southern Company Generation

ALABAMA POWER COMPANY

FIGURE 2
PLANT GORGAS
GYPSUM STORAGE AREA
BORING & PIEZOMETER LOCATIONS

SCALE: 1:160

160 ES1341S2

$\mathbf{D} \mathbf{A} \mathbf{T} \mathbf{E} \mathbf{O}$		PHOTOGRAP	1111/1/02/2	$\alpha\alpha$
IJA IE.U	F AFRIAL P	1911 11 11 11 11 11 11 11 11 11 11 11 11	'H Y U4/U//	いいいう

2) PHOTOGRAMMETRIC DATA COLLECTED 05/13/2003

7) DRAWING IS ACCURATE ONLY AT ORIGINAL SCALE.

3) CONTOURS WERE PRODUCED BY DIGITAL TERRAIN MODEL 4) CONTOUR INTERVAL 2 FEET

5) CONTOURS APPROXIMATE IN AREAS OF DENSE VEGETATION6) RASTER OVERLAY OF GOODSPRINGS 7 1/2 Min. USGS QUAD SHEET

NOTES:

Attachment B

Boring Logs

SOUT	THERI	DRILLING LOG		Hole No).	GPZ-1		
Energy 1	o Serve Y	our World				Sheet 1 of 3		
_			Plant Gorgas Gypsum Disposal Area	HOLE DEPTH	66.5'		SURF.ELEV.	411
	_		Plant Gorgas in Coal Mine Spoil Storage Area COORDINATES N					
			BEARING CONTRACTOR					
OVERB	URDEN D	EPTH _	NO. SAMPLES 13	NO. U.D. SAMPLES				
			LENGTH CORE SIZE					
			Backfilled Hole ELEV TIME AFTER COMP		DATE	TAKEN _		
			uger Spoils QUANTITY MIX		LLING STAR	_	4 /	29/2003
		B. Filipovich RECORDER J. Chitwood APPROVED			LLING COMF	_		29/2003
Graphic Log		Elev.	Material Description, Classification and Remarks	From To	rd Penetration Blows	l est N	Sample No.	Comments
	0							
	4							
	1							
	2		Coal Mine Spoils 0 - 66.5' Dark gray-black 10YR3/1 very dark gray					
	3		Dark gray black for its it very dark gray					
	4							
	5							
	6			5.0-6.5	2-34-7	41	1	
	7							
	8							
	9							
	10							
	11			10.0-11.5	23-11-7	18	2	
	12							
	13							
	14							
	15							
	16			15.0-16.5	13-19-10	29	3	
	17							
	18							
	19							
	20							
				62.2.2.	0.0.0	_	_	
	21			20.0-21.5	9-3-3	6	4	
	22							
	23							
						Ī	1	

DRILLING LOG GEOLOGICAL SERVICES

Hole No.

Sheet 2 of 3

GPZ-1

Plant Gorgas Gypsum Disposal Area 66.5 SITE TOTAL DEPTH SURF.ELEV. Graphic Material Description, Sample Log Classification and Remarks Comments Coal Mine Spoils 25.0-26.5 11-14-13 30.0-31.5 9-11-13 35.0-36.5 5-7-8 6-6-5 40.0-41.5 45.0-46.5 5-5-6 50.0-51.5 9-7-7 55.0-56.5 4-7-9

Form GS9902 4/10/2003

Form GS9902 4/10/2003

DRILLING LOG GEOLOGICAL SERVICES

Hole No. GPZ-1

Sheet 3 of 3

Plant Gorgas Gypsum Disposal Area 66.5 SITE TOTAL DEPTH SURF.ELEV. 411 Graphic Material Description, Sample Log From To Comments 57 58 59 60 Coal Mine Spoils 60.0-61.5 4-7-7 14 61 12 62 63 64 65 65.0-66.5 9-7-6 66 13 13 66.5 344.5 67 Boring terminated @ 66.5' No water encountered. Hole backfilled with auger spoils. 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

SOUTHERN AS			DRILLING LOG			Hole N	lo.	GPZ-2
		PANY our World	GEOLOGICAL SERVICES				Sheet	
				HOLE DEPTH	46'		SURF.ELEV.	410
LOCATION	ON	North o	of Plant Gorgas in Coal Mine Spoil Storage Area COORDINATES N			E _		
ANGLE			BEARING CONTRACTOR	SCS	DF	RILL NO.		
			LENGTH CORE SIZE					/2/2003
			34 ELEV. 376 TIME AFTER COMP					29/2003
			QUANTITY MIX		ILLING STAF			30/2003
Graphic		Б. ГІІІРІ	ovich RECORDER J. Chitwood APPROVED	Standa				
Log	Depth	Elev.	Classification and Remarks	From To	Blows	N	No.	Comments
	0							
	1							
	2		Coal Mine Spoils 0 - 46'					
	3							
	4							
	5							
	6			5.0-6.5	2-2-3	5	1	
	7							
	8							
	9							
	10							
	11			10.0-11.5	2-2-2	4	2	
				10.0 11.0				
	12							
	13							
	14							
	15			45.0.40.5	0.00		_	
	16			15.0-16.5	2-2-2	4	3	
	17							
	18							
	19							
	20							
	21			20.0-21.5	5-4-4	8	4	
	22							
	23							
	24						1	

DRILLING LOG GEOLOGICAL SERVICES

Hole No.

GPZ-2

Sheet 2 of 2

Plant Gorgas Gypsum Disposal Area 46' SITE TOTAL DEPTH SURF.ELEV. 410 Graphi Material Description, Sample Log Classification and Remarks Comments 25 26 Coal Mine Spoils 25.0-26.5 2-4-3 7 5 27 28 29 30 30.0-31.5 2-20-20 40 31 6 32 33 34 Wet around 34' 35 36 Saturated @ 36' 35.0-36.5 2-2-3 7 37 38 39 40 40.0-41.5 1-1-2 3 8 41 42 43 44 45 46.0 46 364.00 Boring terminated @ 46' - 10' of auger broke off in the hole. Offset 5' and cored 5' of rock. 47 48 49 50 51 52 53 54 55

Form GS9902 4/10/2003

SOUTHER	PANY	DRILLING LOG				0.		
Energy to Serve Y	our World™				Shee			
		Plant Gorgas Gypsum Disposal Area						
LOCATION	North of	Plant Gorgas in Coal Mine Spoil Storage Area COORDINATES N	·		E _			
ANGLE		BEARING CONTRACTOR	SCS	DR	ILL NO.			
OVERBURDEN [DEPTH _	NO. SAMPLES1	NO	D. U.D. SAMPI	_ES			
		LENGTH CORE SIZE						
		Dry ELEV TIME AFTER COMP						
		QUANTITY MIX					30/2003	
	B. Filip	ovich recorder H. Hill approved	DR	ILLING COMF	P. DATE		30/2003	
Graphic Log Depth	Elev.	Material Description, Classification and Remarks	Standa From To	ard Penetration Blows	Test N	Sample No.	Comments	
0								
- 0								
1								
2		Coal Mine Spoils 0 - 65'						
3		Dark gray-black 10YR3/1 very dark gray						
4								
5								
6								
7								
8								
9								
10								
.								
58								
59								
60								
61			60.0-61.5	11-15-24	39	1		
62								
63								
64								
65	371.00	Boring Terminated @ 65'. Set Piezometer.						

SOUTHERN COMF		DRILLING LOG		No.			
Energy to Serve Yo	ur World"	GEOLOGICAL SERVICES			Sheet 1 o		
SITE		Plant Gorgas Gypsum Disposal Area	HOLE DEPTH 65	·	SURF.ELEV.	406	
LOCATION	North of	Plant Gorgas in Coal Mine Spoil Storage Area COORDINATES	N	E			
ANGLE		BEARING CONTRACTOR	SCS	DRILL NO.			
OVERBURDEN DE	EPTH _	NO. SAMPLES	NO. U.D. S	SAMPLES			
		LENGTH CORE SIZE					
		Dry ELEV TIME AFTER COMP					
		QUANTITY MIX				0/2003	
	B. Filipo	ovich recorder H. Hill APPROVED		COMP. DATE		0/2003	
Graphic Log Depth	Elev.	Material Description, Classification and Remarks	Standard Pene From To Blow	tration Test vs N		Commer	
0							
1							
2		Coal Mine Spoils 0 - 65' Dark gray-black 10YR3/1 very dark gray					
3		No Rock Encountered. No water.					
4]						
5							
6							
7							
8							
9							
10							
 							
<u> </u>							
58							
59							
60							
61							
62							
63							
64							
65	341.00	Boring Terminated @ 65'. Set Piezometer.					

SOUTHERN ZOMPANY		DRILLING LOG	Hole N	lo.	GPZ-		
Energy to Serve	Your World	GEOLOGICAL SERVICES		Sheet 1			
		Plant Gorgas Gypsum Disposal Area					
LOCATION _	North o	f Plant Gorgas in Coal Mine Spoil Storage Area COORDINATES	N		E		
ANGLE		BEARING CONTRACTOR	SCS	DRI	LL NO.		
OVERBURDEN	DEPTH	NO. SAMPLES	N	O. U.D. SAMPL	.ES		
CASING SIZE		LENGTH CORE SIZE		TOTAL %	% REC.		
WATER TABLE	DEPTH	Dry ELEV TIME AFTER COMP	24 hrs	DATE	TAKEN	5/2/	2003
TYPE GROUT		QUANTITY MIX	DI	RILLING START	DATE	5/1/	2003
DRILLER	B. Filip	ovich recorder H. Hill APPROVED	DI	RILLING COMP	. DATE		2003
Graphic	Elev.	Material Description, Classification and Remarks	Stand From To	lard Penetration Blows	Гest N	Sample	Commer
0							
1							
2		Coal Mine Spoils 0 - 60'					
3		Dark gray-black 10YR3/1 very dark gray Augered through mine spoils					
		No rock encountered. No water.					
4							
5							
6							
7							
8							
9							
10							
-							
- -							
<u> </u>							
53							
54							
		1					
55		1					
56							
57							
58							
59		-					
60	339.00	Boring Terminated @ 60'. Set Piezometer.					

SOUTHER CON	N A	DRILLING LOG	Hole N	lo.	GPZ-		
Energy to Serve	Your World GEOLOGICAL SERVICES						1 of 1
		Plant Gorgas Gypsum Disposal Area					
LOCATION _	North o	f Plant Gorgas in Coal Mine Spoil Storage Area COORDINATES N			E		
ANGLE		BEARING CONTRACTOR	SCS	DR	ILL NO.		
OVERBURDEN	DEPTH _	NO. SAMPLES1	No	D. U.D. SAMPI	LES		
CASING SIZE		LENGTH CORE SIZE		TOTAL	% REC.		
		8 ELEV318 TIME AFTER COMP					2/2003
TYPE GROUT		QUANTITY MIX	DF	RILLING STAR	T DATE		1/2003
DRILLER	B. Filip	OVICH RECORDER H. HIII APPROVED	DF	RILLING COMF	P. DATE	5/	1/2003
Graphic Log Depth	Elev.	Material Description, Classification and Remarks	Stand From To	ard Penetration Blows	Test N	Sample No.	Commer
0							
0						1	
1							
2		Coal Mine Spoils 0 - 61'					
3							
4							
5							
6							
7							
8							
9							
10							
		Water encountered around 15'.					
		Lots of water around 25'.					
55							
56							
57							
58							
59							
60		Top clightly clayou and condu ails with Condatana fragments @ Cd.				+	
61		Tan slightly clayey and sandy silt with Sandstone fragments @ 61'	60.0-61.5	5-13-10	23	1	
62	204.00	Boring Terminated @ 61.5'. Set Piezometer 30' - 35'.				\perp	

SOUTHERN		DRILLING LOG	Hole	No.	GPZ-7	
COMP Energy to Serve You	ur World™	GEOLOGICAL SERVICES		Sheet		
SITE		Plant Gorgas Gypsum Disposal Area	HOLE DEPTH 45	5'	SURF.ELEV.	427
LOCATION	North of F	Plant Gorgas in Coal Mine Spoil Storage Area COORDINATES	N		<u> </u>	
ANGLE		BEARING CONTRACTOR NO. SAMPLES	SCS	_ DRILL NO)	
		LENGTH CORE SIZE				2/2003
		18.5 ELEV. 408.5 TIME AFTER COMP.				1/2003
		QUANTITY MIX			-	1/2003
Graphic		/ich RECORDER H. Hill APPROVED		etration Test		.,
Log Depth	Elev.	Classification and Remarks		ows N		Comment
0						
2		sugered through coal mine spoils 0 - 25'				
3						
4						
5						
6						
7						
8						
9						
10	N	Noist around 10'.				
 • 						
25		Original ground around 25'. Refusal @ 28'.				
		Cored through rock 28'-45' - Gray Sandstone with weathered layer	s			
38						
39						
40						
41						
42						
43						
44						
45	382.00 E	Boring Terminated @ 45'. Set Piezometer 40-45'				

COMPANY				Hole No. GPZ-8						
Energy to Serve Your World			GEOLOGICAL SERVICES					Sheet 1		
SITE			Plant Gorgas Gypsum	Disposal Area	HOLE DEPTH	50'		SURF.ELEV.	456	
LOCATIO	ON	North of	f Plant Gorgas in Coal Mine Spo	oil Storage Area COORDINATE	S N		E			
ANGLE			BEARING	CONTRACTOR	SCS	DF	RILL NO.			
OVERBL	JRDEN D	EPTH _		NO. SAMPLES		NO. U.D. SAMP	LES			
				CORE SIZE						
				TIME AFTER COMP.			TAKEN	5/2	2/2003	
TYPE GI	ROUT		Backfilled QUANTITY	MIX		DRILLING STAF	RT DATE		1/2003	
DRILLER	·	B. Filip	ovich RECORDER H. H.	Hill APPROVED		DRILLING COM	P. DATE	5/	1/2003	
Graphic Log	Depth	Elev.		aterial Description, ification and Remarks	From To	Standard Penetration Blows	Test N	Sample No.	Commen	
-										
	0									
	1	455.00	Coal Mine Spoils (1')							
	2									
	3		1' - 30' Gray gravely silt - west	hered SS with intermediate soft						
			Sandstone layers							
	4									
	5									
	6									
	7									
	7									
	8									
	9									
	10									
	-									
	•									
	30		Tan to brown back to gray aro	und 30'						
	_									
	-		1							
	r									
	43									
	44									
	45		Rock encountered - Auger refu 45-50' Cored gray SS	usal						
	46		g.w, cc							
	47									
	40									
	48									
	49									
	50	406.00	Boring terminated @ 50'. No v	water. Hole Backfilled.						

SOUTHERN A			DRILLING LOG	Hole No		GPZ-9		
Energy to	o Serve Yo	our World™				1 of 3		
			Plant Gorgas in Coal Mine Spoil Storage Area COORDINATES N			E		
ANGLE			BEARING CONTRACTOR	SCS	DR	RILL NO.		
			NO. SAMPLES 12	NC	D. U.D. SAMPI	LES		
			LENGTH CORE SIZE					
			41 ELEV. 297 TIME AFTER COMP.					/2/2003
			uger Spoils QUANTITY MIX		ILLING STAR			/2/2003
DRILLER Graphic		B. Filipe	DVICH RECORDER H. Hill APPROVED Material Description,		ILLING COMF ard Penetration		Sample	212000
Log	Depth	Elev.	Classification and Remarks	From To	Blows	N	No.	Comments
	0	_						
	1]		
	2							
	3							
	4							
	5			<u></u>				
	6		Road base Mine Spoils	5.0-6.5	18-8-8	16	1	
				0.0 0.0	.5 5-5			
	7							
	8							
	9							
	10							
	11		Coal mine spoils	10.0-11.5	7-4-3	7	2	
			Coar mino apolio	. 5.5 11.5				
	12							
	13							
	14							
	15							
	16		SAA	15.0-16.5	10-4-3	7	3	
				10.0	.5 70			
	17							
	18							
	19							
	20							
	21			20.0-21.5	7-4-3	7	4	
			SAA	20.0-21.5	1-4-3		4	
	22							
	23							
	24							
Form GS99	901 4/10/2	2003						

SOUTHERN AS
En annu de Canna Verna Ward J

DRILLING LOG GEOLOGICAL SERVICES

Hole No. GPZ-9

Sheet 2 of 3

Plant Gorgas Gypsum Disposal Area 61.5' SITE TOTAL DEPTH SURF.ELEV. 338 Material Description, Classification and Remarks Graphic Log Standard Penetration Test Sample No. Depth Elev. From To Blows Comments 25 25.0-26.5 3-3-3 6 5 26 Coal Mine Spoils 27 28 29 30 30.0-31.5 4-3-3 6 6 31 SAA 32 33 34 35 35.0-36.5 2-3-4 7 7 36 SAA 37 38 39 40 SAA - Wet @ 41' 40.0-41.5 2-3-4 7 8 41 42 43 44 45 46 Wet Coal Mine Spoils 45.0-46.5 1-1-5 6 9 47 48 49 50 SAA 50.0-51.5 woh-3-5 8 51 10 52 53 54 55 55.0-56.5 2-4-6 11

SOUTHERN AS COMPANY
Emangar to Canna Vous World"

DRILLING LOG

Hole No. GPZ-9

GEOLOGICAL SERVICES Sheet 3 of 3 Plant Gorgas Gypsum Disposal Area 61.5' SURF.ELEV. TOTAL DEPTH 338 SITE Material Description, Classification and Remarks Graphic Standard Penetration Test Sample Depth Elev. From To Log Blows Comments 57 58 59 60 Coal Mine Spoils 60.0-61.5 1-2-4 6 61 12 61.5 276.5 Boring terminated @ 61.5'. Piezometer set. 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

Form GS9902 4/10/2003

		THERN COMP	PANY _	LLING LO				Hole No	o	GPZ-	10
		o Serve You		GICAL SERV			F0 F	<u> </u>	Sheet 1		
			GORGAS STEAM PLANT								
				COORDINA						426.44	
			90 BEARING								
			NO. SAN)	
		SIZE	LENGTH								
			PTH NA ELEV.				D.	ATE TAKEN	2/2	9/200E	
			QUANTITY				DRILLING S	TART DATE	3/2	9/2005 9/2005	
	DRILLEI	R	Billy Spivey RECORDER S. Sprayberry A	PPROVED		ard Penetration		OMP. DATE	3/2	0/2003	ı
	Depth	Elev.	Material Description, Classification and Remarks	Sample No.		Blows	N	Comr	ments	%Rec	RQD
0.0	0	487.87									
	4		Cool Mine angile (0.451)	SS-1	0-1.5	4-5-5	10				
	1		Coal Mine spoils (0-45')	33-1	0-1.5	4-5-5	10				
	2										
	3										
	4										
	5										
	6		SAA	SS-2	5-6.5	3-7-9	16				
	7										
	8										
	9										
	10										
	11		SAA	SS-3	10-11.5	7-17-21	38				
	12										
	13										
	14										
	15										
			SAA	SS-4	15-16.5	5-5-7	12				
	16		SAA	33-4	10-10.5	J-5-1	12				
	17										
	18										
	19										
	20										
	21		SAA	SS-5	20-21.5	10-10-8	18				
	22										
	23										
	24	901 7-26-20									

Boring Terminated @ 56.5'

Form GS9901 7-26-2004

DRILLING LOG GEOLOGICAL SERVICES

Hole No.

GPZ-10

Sheet 2 of 2

GORGAS STEAM PLANT 56.5 487.87 SITE TOTAL DEPTH SURF.ELEV. RQD Depth Elev Material Description, Classification and Remarks From To Sample No Blows Ν Comments %Rec 25 SS-6 26 SAA 25-26.5 6-6-7 13 27 28 29 30 SS-7 30-31.5 31 SAA 6-6-7 13 32 33 34 35 36 SAA SS-8 35-36.5 6-4-3 7 37 38 39 40 SS-9 40-41.5 6-9-11 20 41 SAA 42 43 44 442.87 45.0 45 **SS-10** 45-46.5 46 4-5-6 11 Tan to gray, moist, stiff, silty CLAY (CL) with SANDSTONE and SHALE fragments, FILL 47 48 49 50.0 50 437.87 Tan to gray, moist, very stiff to very hard, silty CLAY (CL) with weathered SANDSTONE residuum SS-11 50-51.5 4-7-14 21 51 52 53 54 55 SAA SS-12 55-56.5 50/3" 50+ 56

sou	JTHERN COME	PANY _	DRILLING					Hole No		GPZ-1	11
Energ	y to Serve Yo	ur World"	GEOLOGICAL S						Sheet 1		
SITE			AM PLANT								.36
	ATION				_						
ANGL	.E	90 BEARING									
DRILI	LING METHO		NO. SAMPLES		16		NO. U.D. SA	MPLES)	
CASI	NG SIZE										
WATE	ER TABLE DE	EPTH NA ELEV	TIME AF	TER COM	MP						
TYPE	GROUT	QUANTIT	Y	MIX				TART DATE		4/2005	
DRILI	LER	Billy Spivey RECORDER S. Sp	prayberry APPROVED					OMP. DATE	3/2	4/2005	
Depth	n Elev.	Material Description, Classification	and Remarks Sam	ple No.	Standa From To	rd Penetration T Blows	N N	Comm	ents	%Rec	RQD
.0 0	473.36										
0	473.30										
1		Coal Mine spoils (0-63')	S	S-1	0-1.5	2-2-7	9				
2											
3											
		1									
4											
5		_	<u> </u>								
6		SAA	S	S-2	5-6.5	6-6-13	19				
_			<u> </u>								
7		-									
8		_									
9											
10											
10		1									
11		SAA	S	S-3	10-11.5	6-6-8	14				
12											
13											
14		-									
15		_	<u> </u>								
16		SAA	S	S-4	15-16.5	3-8-19	27				
17			<u> </u>								
17		1									
18		_									
19											
20											
		1	<u> </u>	2 -							
21		SAA	S	S-5	20-21.5	10-12-13	25				
22		_	<u> </u>								
23											
		1									
Eorm G	S9901 7-26-20	004									

DRILLING LOG GEOLOGICAL SERVICES

Hole No.

GPZ-11

Sheet 2 of 3

SITE _		GORGAS STEAM PLANT			TOTAL DEPTH ard Penetration T		SURF.ELEV.	473	3.36
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	From To	Blows	est N	Comments	%Rec	RQD
25									
26		SAA	SS-6	25-26.5	2-6-13	19			
27									
28									
29									
30									
31		SAA	SS-7	30-31.5	10-14-12	26			
32									
33									
34									
35									
36		SAA	SS-8	35-36.5	8-17-32	49			
37									
38									
39									
40									
41		SAA	SS-9	40-41.5	5-9-10	19			
42									
43									
44									
45									
46		SAA	SS-10	45-46.5	4-8-10	18			
47									
48									
49									
50									
51		SAA	SS-11	50-51.5	2-8-9	17			
52									
53									
54									
55									
56		SAA	SS-12	55-56.5	7-13-14	27			

DRILLING LOG GEOLOGICAL SERVICES

Hole No.

GPZ-11

AL SERVICES Sheet 3 of 3

	SITE _	0 36106 104	GORGAS STEAM PLANT			TOTAL DEPTH	76	SURF.ELEV.	473	3.36
	Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standa From To	ard Penetration T Blows	est N	Comments	%Rec	RQD
	57									
	58									
	59									
	60									
	61		SAA	SS-13	60-61.5	14-19-17	36			
	62									
63.0	63	410.36								
	64									
	65		Tan to gray, moist, very stiff, clayey SILT (ML)							
	66		with highly weathered SHALE residuum	SS-14	65-66.5	11-15-14	29			
	67									
	68									
	69									
70.0	70	403.36								
	71		Tan, soft to medium hard, weathered SANDSTONE	SS-15	70-71.5	9-13-14	27			
	72									
	73									
	74									
	75									
76.5	76	396.86	SAA	SS-16	75-76.5	9-14-16	30			
	77		Boring Terminated @ 76.5' (Not Auger Refusal)							
	78									
	79									
	80									
	81									
	82									
	83									
	84									
	85									
	86									
	87									
	88 Form GS9	901 7-26-200)4							

	SOUT	THERN COMP	ANY _					Hole No	D.	GPZ-	12
	Energy to	o Serve You	r World" GEOLOGIC						Sheet 1		
	SITE _		GORGAS STEAM PLANT								.61
		ON									
			90 BEARING								
	DRILLIN	IG METHOI	NO. SAMPLES	S	5		NO. U.D. SA	MPLES)	
			LENGTH								
	WATER	TABLE DE	PTH NA ELEV TI	ME AFTER CO	OMP		D	ATE TAKEN			
			QUANTITY								
	DRILLE	R	Billy Spivey RECORDER S. Sprayberry APPRO	OVED				OMP. DATE	3/2	8/2005	
	Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standa From To	Blows	Test N	Comi	ments	%Rec	RQD
0.0	0	421.61									
	1		Coal Mine spoils (0-15')	SS-1	0-1.5	2-3-2	5				
	2		. , ,								
	3										
	4										
	5										
	6		SAA	SS-2	5-6.5	2-2-2	4				
	7										
	8										
	9										
	10										
	11		SAA	SS-3	10-11.5	2-3-3	6				
	12										
	13										
	14										
15.0		406.61									
10.0	16	100.01	Tan to gray, moist, very hard, silty CLAY (CL)	SS-4	15-16 5	10-12-50/3'	50+				
	17		to clayey SILT (ML) with weathered SANDSTONE residuum	004	10 10.0	.0 12 00/0	001				
			residualii								
	18										
	19										
20.0	20	401.61									
	21		SAA	SS-5	20-21.5	50/2"	50+				
	22										
	23										
	24		Auger Refusal @ 24'								
	Form GS9	901 7-26-20)4								

	SOUT	HERN	DRILLII	NG LO	G			Hole No).	GPZ-	13
		o Serve You	r World GEOLOGICA						Sheet 1	of 1	
	SITE _		GORGAS STEAM PLANT						SURF.ELEV		
			GYPSUM STORAGE								
	ANGLE		90 BEARING								
	DRILLIN	IG METHOI								0	
			LENGTH								
		TABLE DE									
		ROUT	QUANTITY						3/2	28/2005	
	DRILLE		Billy Spivey RECORDER S. Sprayberry APPRO	VED		rd Penetration		OMP. DATE		T	T
	Depth	Elev.	Material Description, Classification and Remarks	Sample No.	From To	Blows		Comn	nents	%Rec	RQD
0.0	0	402.64									
	1		Coal Mine spoils (0-5')	SS-1	0-1.5	2-3-2	5				
	2		, ,								
	3										
	4										
5.0	5	397.64									
	6		Red, Coal Mine spoils (5-10')	SS-2	5-6.5	9-10-8	18				
	7										
	8										
	9										
10.0	10	392.64									
	11		Tan to gray, moist to wet, stiff, silty CLAY (CL)	SS-3	10-11.5	2-5-5	10				
	12		with weathered SANDSTONE residuum								
	13										
	14										
15.0	15	387.64	Augus Defused @ 451								
	16		Auger Refusal @ 15'	SS-4	15-16.5	50/2"	50+				
	17										
	18										
	19										
	20										
	21										
	22										
	23										

	COMPANY _			NG LO		Hole No. GPZ-14					
	Energy to	o Serve Yor	ur World™ GEOLOGICA						Sheet 1		
	SITE _		GORGAS STEAM PLANT						SURF.ELEV.		
			GYPSUM STORAGE				9416.45	E	586	268.34	
	ANGLE		90 BEARING								
	DRILLIN	IG METHOI	D NO. SAMPLES		8		NO. U.D. SA	MPLES	()	
			LENGTH								
	WATER	TABLE DE	PTH NA ELEV TIN	ME AFTER C	OMP						
	TYPE G	ROUT	QUANTITY	MIX				START DATE		8/2005	
	DRILLE	R	Billy Spivey RECORDER S. Sprayberry APPRO	VED				OMP. DATE	3/28	8/2005	
			Material Description, Classification and Remarks		Standa From To	rd Penetration Blows	Test N	Comm	nents	%Rec	RQD
0.0	0	394.93									
	1		Crow major madium atiff to atiff allow CLAV (CL)	SS-1	0-1.5	4-3-5	8				
	'		Gray, moist, medium stiff to stiff, silty CLAY (CL) with SANDSTONE fragments, FILL	35-1	0-1.5	4-3-3					
	2										
	3										
	4										
	5										
			1	00.0		0.05	,				
	6		SAA	SS-2	5-6.5	6-6-5	11				
	7										
	8										
	9										
	10										
	10										
	11		SAA	SS-3	10-11.5	6-7-5	12				
	12										
13.0	13	381.93									
	14										
	15		Gray to tan, moist, stiff, silty CLAY (CL) with								
	16		SANDSTONE and SHALE fragments, FILL	SS-4	15-16.5	3-4-6	10				
	17										
	18										
	19										
	20										
				60.5	00.04.5	4.5.0					
	21		SAA	SS-5	20-21.5	4-5-6	11				
	22										
	23										
	24	_									
	Form GS9	901 7-26-20	004								

SOUTHERN AS COMPANY

DRILLING LOG

Hole No.

GPZ-14

31 Gray, moist, stiff, silty CLAY (CL/CH) with highly weathered SANDSTONE residuum 32 33 34 34 5-8 13		Energy to Serve Your World GEOLOGICAL SERVICES							Sheet 2 of 2		
Paper Pape		SITE		GORGAS STEAM PLANT				SURF.ELEV.	SURF.ELEV. 394.		
26	[Depth	Elev.	Material Description, Classification and Remarks	Sample No.				Comments	%Rec	RQD
27		25									
28		26		SAA	SS-6	25-26.5	5-8-6	14			
29		27									
30.0 30 364.93		28									
31		29									
32 weathered SANDSTONE residuum 33 34 35 35 35 35 35 35	30.0	30	364.93								
32		31		Gray, moist, stiff, silty CLAY (CL/CH) with highly	SS-7	30-31.5	4-5-8	13			
35.0 35 359.93 Auger Refusal @ 35' 36		32		weathered SANDSTONE residuum							
35.0 35 359.93 Auger Refusal @ 35' SS-8 35-36.5 10-50/2' 50+ 37		33									
Auger Refusal @ 35' SS-8 35-36.5 10-50/2' 50+ 10-50/2' 50+ 50+ 10-50/2' 50+ 50+ 50+ 50+ 50- 51- 52- 53- 54- 55- 56- 56- 10-50/2' 50+ 10-50/2' 10-50/2' 10-50/2' 1		34									
36 35-36.5 10-50/2* 50+	35.0	35	359.93								
38		36		Auger Refusal @ 35'	SS-8	35-36.5	10-50/2"	50+			
39		37									
40		38									
41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56		39									
42 43 44 45 46 47 48 49 50 51 52 53 54 55 56		40									
43 44 45 46 47 48 49 50 51 52 53 54 55 56		41									
44 45 46 47 48 49 50 51 52 53 54 55 56		42									
45 46 47 48 49 50 51 52 53 54 55 56		43									
46 47 48 49 50 51 52 53 54 55 56		44									
47 48 49 50 51 52 53 54 55 56		45									
48 49 50 51 52 53 54 55 56		46									
49 50 51 52 53 54 55 56		47									
50 51 52 53 54 55 56	ļ	48									
51 52 53 54 55 56		49									
52 53 54 55 56		50									
53 54 55 56	ļ	51									
54 55 56		52									
55 56		53									
56		54									
		55									
19111 007791 1 49 4997			901 7-26-200	44							

OU 1	HERN	DRI	LLING LO	3			Hole No) .	GPZ-	15
	o Serve You		GICAL SERV					Sheet 1		
SITE _		GORGAS STEAM PLANT							411	.18
		GYPSUM STORAGE							236.28	
ANGLE		90 BEARING	CONTRACT	OR	SCS		DRILL NO.	CN	IE-550	
DRILLIN	IG METHOI									
	SIZE	LENGTH								
		PTH NA ELEV.					START DATE			
	ROUT	B. Filipovich RECORDER S. Sprayberry A					COMP. DATE		0/2005	
DIVILLE		B. I inpovion Recorded O. Oprayberry			dard Penetration		COMF. DATE			
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	From To	Blows	N	Comr	nents	%Rec	RQD
0	411.18									
1		Coal Mine spoils (0-101')	SS-1	0-1.5	4-11-10	21				
2										
3										
4										
5			22.2							
6		SAA	SS-2	5-6.5	21-22-19	41				
7										
8										
9										
10										
11		SAA	SS-3	10-11.5	7-11-25	36				
12										
13										
14										
15			22.1	45 40 -	4.0.40	6.4				
16		SAA	SS-4	15-16.5	4-9-12	21				
17										
18										
19										
20		CAA	CC 5	20.04.5	7 40 40	20				
21		SAA	SS-5	20-21.5	7-16-13	29				
22										
23										

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DRILLING LOG GEOLOGICAL SERVICES

Hole No.

GPZ-15

Sheet 2 of 4

SITE _		GORGAS STEAM PLANT			TOTAL DEPTH		SURF.ELEV.	411	.18
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Stand From To	ard Penetration Blows	Test N	Comments	%Rec	RQD
25									
26		SAA	SS-6	25-26.5	4-16-33	49			
27				20 20.0	1 10 00	10			
28									
29									
30									
31		SAA	SS-7	30-31.5	11-13-17	30			
32									
33									
34									
35									
36		SAA	SS-8	35-36.5	6-5-6	11			
37									
38									
39									
40									
41		SAA	SS-9	40-41.5	3-4-5	9			
42									
43									
44									
45									
46		SAA	SS-10	45-46.5	3-5-6	11			
47		O.A.		10 10.0					
48									
49									
50			00.44	F0 54 5	0.5.5	40			
51		SAA	SS-11	50-51.5	2-5-5	10			
52									
53									
54									
55									
56		SAA	SS-12	55-56.5	3-4-7	11			

SOUTHERN A
COMPANY _
Energy to Serve Your World™

DRILLING LOG GEOLOGICAL SERVICES

Hole No. GPZ-15

Sheet 3 of 4

GORGAS STEAM PLANT 101.5 411.18 SITE SURF.ELEV. TOTAL DEPTH Standard Penetration Test RQD Depth Elev. Sample No. Comments Material Description, Classification and Remarks From To Blows %Rec 57 58 59 60 SS-13 60-61.5 5-5-6 SAA 11 61 62 63 64 65 SAA SS-14 65-66.5 5-6-6 12 66 67 68 69 70 SAA 71 SS-15 70-71.5 5-6-9 15 72 73 74 75 75-76.5 76 SAA SS-16 WOR-3-7 10 77 78 79 80 SS-17 81 SAA 80-81.5 6-8-15 23 82 83 84 85 SS-18 85-86.5 6-8-13 21 86 SAA 87 88

DRILLING LOG Hole No. GPZ-15 SOUTHERN COMPANY
Energy to Serve Your World **GEOLOGICAL SERVICES** Sheet 4 of 4 **GORGAS STEAM PLANT** 101.5 411.18 SITE TOTAL DEPTH SURF.ELEV. Standard Penetration Test Depth Elev. Material Description, Classification and Remarks Comments RQD Sample No. From To %Rec 89 90 SAA SS-19 90-91.5 5-8-9 17 91 92 93 94 95 96 SAA SS-20 95-96.5 WOR WOR 97 98 99 100 101.0 101.5 101 310.18 SS-21 100-101.5 6-9-12 21 309.68 Tan, moist, stiff, sandy SILT (ML) 102 Boring Terminated @ 101.5' 103 104 105

Form GS9901 7-26-2004

ļ	_		PANY _	DRILLING					Hole No		GPZ-	16
		to Serve You		GEOLOGICAL						Sheet 1		
			GORGAS STEAM									.65
			GYPSUM STORAGE	cc							813.17	
			90 BEARING									
			D)	
		SIZE	LENGTH									
			PTH NA ELEV.									
		ROUT	QUANTITY _					DRILLING S	TART DATE	3/2	4/2005	
ļ	DRILLE	R	Billy Spivey RECORDER S. Sprayb	erry APPROVED	<u> </u>		rd Penetration		OMP. DATE	3/2	4/2003	ı
	Depth	Elev.	Material Description, Classification and Re	emarks Sa	ample No.	From To	Blows	N	Comr	nents	%Rec	RQD
0.0	0	440.65										
	1		Cool Mine engile (0.421)		SS-1	0-1.5	6-10-12	22				
ŀ	'		Coal Mine spoils (0-43')		33-1	0-1.5	0-10-12	22				
ŀ	2		-									
	3											
	4											
	5		1									
ŀ	5		1	<u> </u>								
	6		SAA		SS-2	5-6.5	22-25-33	58				
	7		_									
	8											
			1									
ŀ	9		1									
	10		-	<u> </u>								
	11		SAA		SS-3	10-11.5	4-6-10	16				
	12			H								
			1									
	13		1									
ŀ	14		-									
	15			<u>L</u>								
	16		SAA		SS-4	15-16.5	3-7-7	14				
Ì			1									
ŀ	17		1									
ŀ	18		-	1								
	19											
	20			1								
Ì					SS 5	00.04.5	4040	40				
ŀ	21		SAA	1	SS-5	20-21.5	4-9-10	19				
ŀ	22		-									
	23											
	24			1								
Ļ		901 7-26-20	004									<u> </u>

SOUTHERN COMPANY
Energy to Serve Your World

DRILLING LOG GEOLOGICAL SERVICES

Hole No.

GPZ-16

Sheet 2 of 2

SITE _		GORGAS STEAM PLANT			TOTAL DEPTH		SURF.ELEV.	440	0.65
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Stand: From To	ard Penetration T Blows	est N	Comments	%Rec	R
25									
26		SAA	SS-6	25-26.5	4-9-11	20			
27		O.A.		20 20.0	1011	20			
28									
29									
30									
31		SAA	SS-7	30-31.5	5-6-12	18			
32									
33									
34									
35									
36		SAA	SS-8	35-36.5	9-14-19	33			
37									
38									
39									
40									
41		SAA	SS-9	40-41.5	10-11-23	34			
42									
43	397.65								
44									
45									
46		Gray, soft, weathered SHALE residuum	SS-10	45-46.5	18-50/4"	50+			
47									
48									
49									
	390.65								
51		Tan, soft to medium hard, weathered SANDSTONE	SS-11	50-51.5	50/3"	50+			
52									
53									
54									
55	385.15	1							

	SOUT	THERN	DRILLI	NG LO	G			Hole No).	GPZ-	17
		o Serve You	r World GEOLOGICA						Sheet 1		
	SITE _		GORGAS STEAM PLANT								
			GYPSUM STORAGE								
	ANGLE		90 BEARING	CONTRACT	OR Chris	stian Testir	ig Lab.	DRILL NO.	CM		
	DRILLIN	IG METHOI								0	
			LENGTH								
			PTH NA ELEV TIP				D	ATE TAKEN	3/2	3/2005	
		ROUT	QUANTITY					OMP. DATE	3/2	3/2005	
	DRILLE	K	Billy Spivey RECORDER S. Sprayberry APPRO	VED		rd Penetration		OMP. DATE		1	1
	Depth	Elev.	Material Description, Classification and Remarks	Sample No.	From To	Blows	N	Comn	nents	%Rec	RQD
0.0	0	414.27									
	1		Coal Mine spoils (0-5')	SS-1	0-1.5	8-8-9	17				
	2										
	3										
	4										
5.0	5	409.27									
	6		Tan to gray, moist, very stiff to very hard, clayey SILT (ML) with highly weathered SHALE and SANDSTONE	SS-2	5-6.5	26-26-36	62				
	7		residuum								
	8										
	9										
	10										
	11		SAA	SS-3	10-11.5	9-9-14	23				
	12										
	13										
	14										
15.0	15	399.27									
	16		Tan, dry to moist, very hard, clayey SILT (ML)	SS-4	15-16.5	25-50/3"	50+				
	17		with weathered SANDSTONE								
	18										
	19										
	20										
	21		Tan, soft, weathered SANDSTONE	SS-5	20-21.5	27-29-50	79				
	22										
	23										

SOUTHERN COMPANY

DRILLING LOG GEOLOGICAL SERVICES

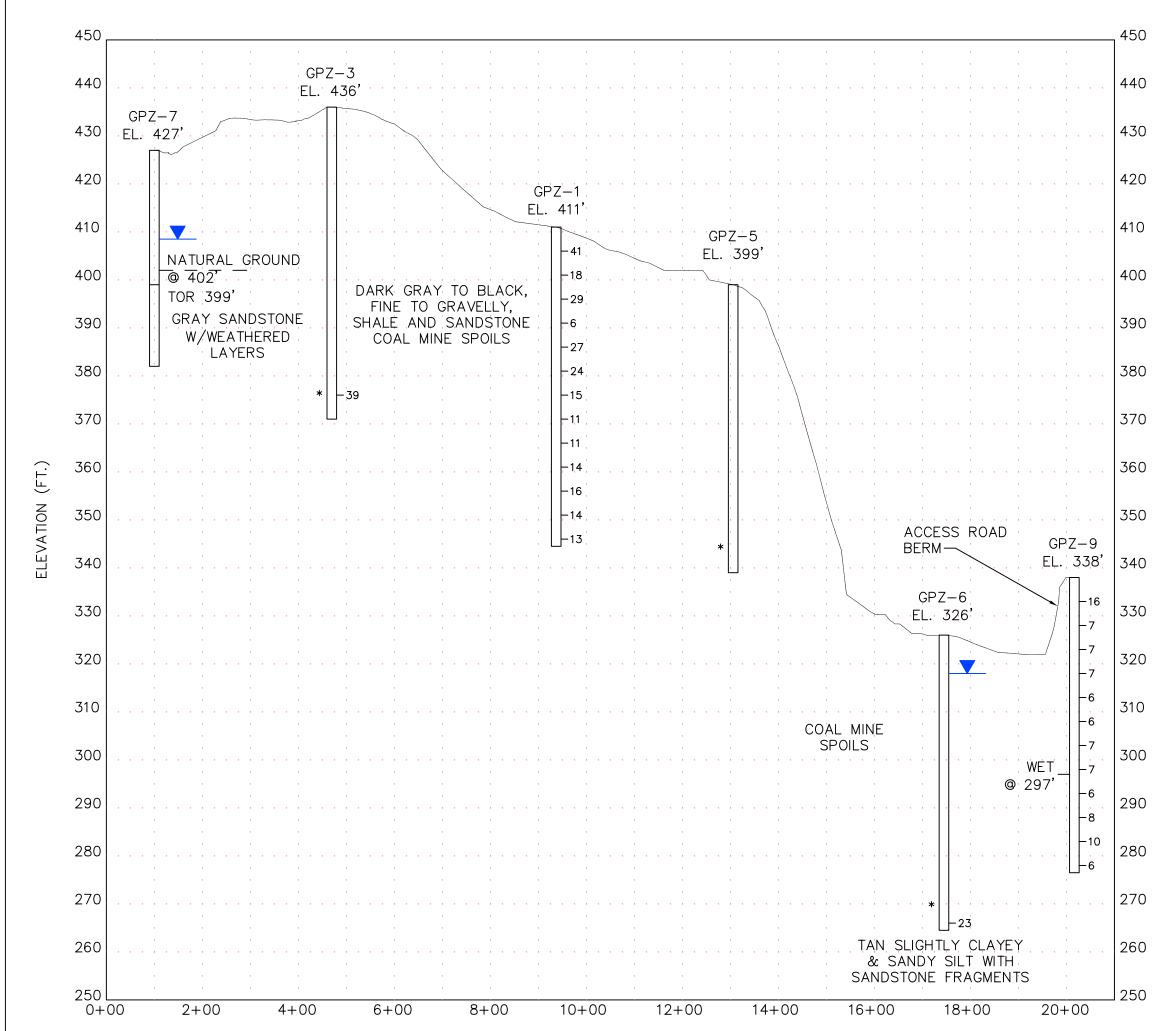
Hole No.

GPZ-17

Sheet 2 of 2

GORGAS STEAM PLANT 30.5 414.27 SURF.ELEV. TOTAL DEPTH Standard Penetration Test RQD Depth Elev Material Description, Classification and Remarks Sample No Comments %Rec 25.0 25 389.27 SS-6 25-26.5 26 Gray, soft, weathered SHALE 19-50/4" 50+ 27 28 29 30 30.5 383.77 SAA SS-7 30-31.5 50/3" 31 Boring Terminated @ 30.5' (not auger refusal) 50+ 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56

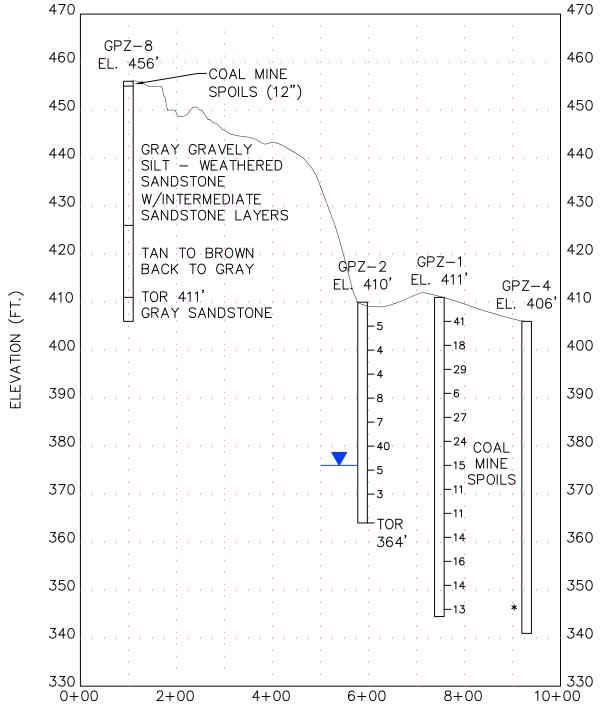
Second S	so	UTHER	DRILLI	NG LO	G).		18
LOCATION GYPSUM STORAGE	Ener	rgy to Serve 1	four World GEOLOGIC								
ANSIE 90 BEARING CONTRACTOR Christian Testing Lab. DRILL NO. CME-850 DRILLING METHOD NO. SAMPLES 4 NO. U.D. SAMPLES 0 CASING SIZE LENGTH CORE SIZE TOTAL W. REC. WATER TABLE DEPTH NA ELEV. TIME AFTER CORP. DRILLING START DATE 3/23/2005 DRILLER BIIIV Spivey RECORDER S. Sprayberry APPROVED DRILLING START DATE 3/23/2005 DRILLER BIIIV Spivey RECORDER S. Sprayberry APPROVED Standard Presentation Visa Number of Sample No. From To. Blows N. Comments Valle 1 Coal Mine spoils (0-11) SS-1 0-1.5 5-5-8 13 4 Coal Mine spoils (0-11) SS-1 0-1.5 5-5-8 13 4 Tan to brown, moist, stiff, clayey SILT (ML) 3 Tan to gray, moist, very hard, clayey SILT (ML) 5.0 5 333.02 6 Tan to gray, moist, very hard, clayey SILT (ML) 7 With highly weathered SHALE residuum 15 SAA SS-3 10-11.5 31-50/5 50+ 15 322.52 Auger Refusal @ 15.5' SS-4 15-16.5 50+/6' 50+											3.02
DRILLING METHOD LENGTH CASING SIZE LENGTH CORE SIZE TOTAL \$ REC. WATER TABLE DEPTH NA ELEV. TIME AFTER COMP. MIX DRILLING START DATE 3/23/2005 DRILLER Billy Spivey RECORDER S. Sprayberry APPROVED Depth Flex. Material Description. Classification and Remarks Sample No. From To SS-1 Coal Mine spoils (0-1') 2 Tan to brown, moist, stiff, clayey SILT (ML) 4 4 4 5.0 5 333.02 Tan to gray, moist, very hard, clayey SILT (ML) 7 8 9 10 11 SAA SS-3 10-11.5 31-50/5' 50+ 15.5 322.52 Auger Refusal @ 15.5' SS-4 15-16.5 50+/6' 50+ TOTAL \$ REC. TIME AFTER COMP. DATE TAKEN 3/23/2005 SBundood Pacentision Text SIRGE No. LOT DRILLING COMP. DATE 3/23/2005 SS-1 10-11.5 SS-2 To 1-15.5 SS-4 To 1-15.5 To 5-8 To 10-11.5 To 10-15.5 To 1					_						
CASING SIZE LENGTH NA ELEV. TIME AFTER COMP: DATE TAKEN DATE TAKEN TYPE GROUT OUANTITY MIX DRILLING START DATE 3/23/2005 DRILLER BIJLY Spivey RECORDER S. Sprayberry APPROVED Standard Peneristron Flat DEPTH Elev. Material Description, Classification and Remarks Sample No. From To 81 to 18 to											
WATER TABLE DEPTH											
TYPE GROUT DRILLER Billy Spivey RECORDER S. Sprayberry APPROVED SILITING COMP. DATE 3/23/2005											
DRILLER Billy Spivey RECORDER S. Sprayberry APPROVED Standard Prenetration Test Standard Penetration							DRILLING S	TART DATE	3/2	3/2005	
Depth Elev. Material Description, Classification and Remarks Sample No. From To Blows N Comments 56,Rec From To Blows N Comments Sample No. From To Blows N Comments Sometime of No. S	DRI	ILLER									
0 338.02 1 Coal Mine spoils (0-1') 2 Tan to brown, moist, stiff, clayey SILT (ML) 3 Tan to gray, moist, very hard, clayey SILT (ML) 4 SS-2 6 Tan to gray, moist, very hard, clayey SILT (ML) with highly weathered SHALE residuum 7 With highly weathered SHALE residuum 8 SS-2 10 -11.5 11 SAA SS-3 10 -11.5 31 -50/5* 50+ 15 SS-4 15 SS-4 15 SO+/6* 50+	Der	oth Elev.	Material Description. Classification and Remarks	Sample No.				Comm	nents	%Rec	RQD
1										7011CC	
Tan to brown, moist, stiff, clayey SILT (ML) 3 4 5.0 6 Tan to gray, moist, very hard, clayey SILT (ML) with highly weathered SHALE residuum 7 8 9 10 11 SAA SS-3 10-11.5 31-50/5* 50+ 15.5 16 322.52 Auger Refusal @ 15.5* SS-4 15-16.5 50+/6* SS-6.5 30-26-50 76 76 88-2 10-11.5 31-50/5* 50+		338.0		 							
3	1		Coal Mine spoils (0-1')	SS-1	0-1.5	5-5-8	13				
5.0 5 333.02 6 Tan to gray, moist, very hard, clayey SILT (ML) with highly weathered SHALE residuum 7 8 9 10 11 SAA 12 13 14 15 15 16 322.52 Auger Refusal @ 15.5' SS-4 15-16.5 50+/6" 50+	2	2	Tan to brown, moist, stiff, clayey SILT (ML)								
5.0 5 333.02	3	3									
6 Tan to gray, moist, very hard, clayey SILT (ML) with highly weathered SHALE residuum 7 8 9 10 11 SAA SS-3 10-11.5 31-50/5* 50+ 12 13 14 15 322.52 Auger Refusal @ 15.5' SS-4 15-16.5 50+/6" 50+	4										
6 Tan to gray, moist, very hard, clayey SILT (ML) with highly weathered SHALE residuum 7 8 9 10 11 SAA SS-3 10-11.5 31-50/5* 50+ 12 13 14 15 322.52 Auger Refusal @ 15.5' SS-4 15-16.5 50+/6" 50+	5.0 5	333.0	2								
With highly weathered SHALÉ residuum				SS-2	5-6 5	30-26-50	76				
8 9 10 11 SAA SS-3 10-11.5 31-50/5" 50+ 12 13 14 15 15 322.52 Auger Refusal @ 15.5' SS-4 15-16.5 50+/6" 50+					5-0.5	30 20 30	70				
9 10	7	,	-								
10	8	3	4								
11 SAA SS-3 10-11.5 31-50/5" 50+ 12 13 14 15 15 16 322.52 Auger Refusal @ 15.5' SS-4 15-16.5 50+/6" 50+	9)									
12	10	0									
13	1	1	SAA	SS-3	10-11.5	31-50/5"	50+				
13	1	2									
14											
15.5 322.52 SS-4 15-16.5 50+/6" 50+											
15.5 322.52 SS-4 15-16.5 50+/6" 50+	14	4	-								
16 Auger Refusal @ 15.5' SS-4 15-16.5 50+/6" 50+			2								
	1(SS-4	15-16.5	50+/6"	50+				
	1	7									
18	18	8									
	19	9									
20			7								
			1								
	2	1	+								
	22	2	-								
23	2	3	4								
24 Form GS9901 7-26-2004											



NORTH - SOUTH CROSS SECTION

HORIZONTAL SCALE: 1"= 200' VERTICAL SCALE: 1"= 20'

* GPZ-4&5 WERE DRILLED WITH NO STANDARD PENETRATION VALUES TAKEN. GPZ-3&6 WERE DRILLED WITH SPT VALUES TAKEN AT 60' - 61.5' BELOW GROUND SURFACE.



WEST - EAST CROSS SECTION

HORIZONTAL SCALE: 1"= 200' VERTICAL SCALE: 1"= 20'

> INTERPRETATIONS OF RESIDUAL SOILS, ROCK TYPES, ROCK CHARACTERISTICS, AND DEGREE OF WEATHERING ARE TRUE ONLY AT THE BORING LOCATION. PROFESSIONAL JUDGEMENT HAS BEEN USED TO EVALUATE THE DATA COLLECTED. HOWEVER, ANY INTERPOLATION OF CONDITIONS BETWEEN BORINGS IS CONJECTURE AND THE ACCURACY OF SUCH INTERPOLATION IS NOT GUARANTEED. THE LINES DESIGNATING THE INTERFACES BETWEEN VARIOUS STRATA ARE APPROXIMATE ONLY, AS TRANSITIONS BETWEEN MATERIALS MAY BE GRADUAL.

Southern Company Services, Inc.

FIGURE 8 PLANT GORGAS PROPOSED GYPSUM STORAGE AREA GEOLOGICAL CROSS SECTIONS NORTH - SOUTH & WEST - EAST

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ES1218S8

Attachment C

Laboratory Analyses

Testing results of the coal mine spoil samples are summarized below.

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Table 1 Laboratory Results for Coal Mine Spoils

Sample		Grain Size	Max Dry Density	Optimum Moisture	
	% Gravel	% Sand	% Fines	(pcf)	(%)
Mine Spoil #1	45.3	31.8	22.9	105.8	13.0
Mine Spoil #2	37.5	31.7	30.8	103.3	12.6
Mine Spoil #3	39.0	34.2	26.8	103.9	14.0
#3 Recompacted*	21.0	40.6	38.4	103.9	14.0

^{*} Mine Spoil #3 was retested after the proctor test to determine how much the material would break down in the compacting and placement process.

Attachment D

Critical Section Profile Used in Analysis

