

**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 Safety Factor	Minimum Required 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).





Technical and Project Solutions Calculation

Calculation Number:
TV-GO-APC962011-002

Project/Plant: Plant Gorgas Gypsum Pond	Unit(s): --	Discipline/Area: Env. Solutions
Title/Subject: Periodic Factor of Safety Assessment for CCR Rule		
Purpose/Objective: Determine the Factor of Safety of the Gypsum Pond 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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Criteria and Assumptions	2	Attachment D - Critical Section Profile Used in Analysis	1
Design Inputs/References	3		
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Total # of pages including cover sheet & attachments:	47		

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-slucied 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 Tavasrou (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.

Soil Description	Unit Weight, pcf	Effective Stress Parameters	
		Cohesion, psf	Phi Angle, degrees
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 Tavasrou, 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

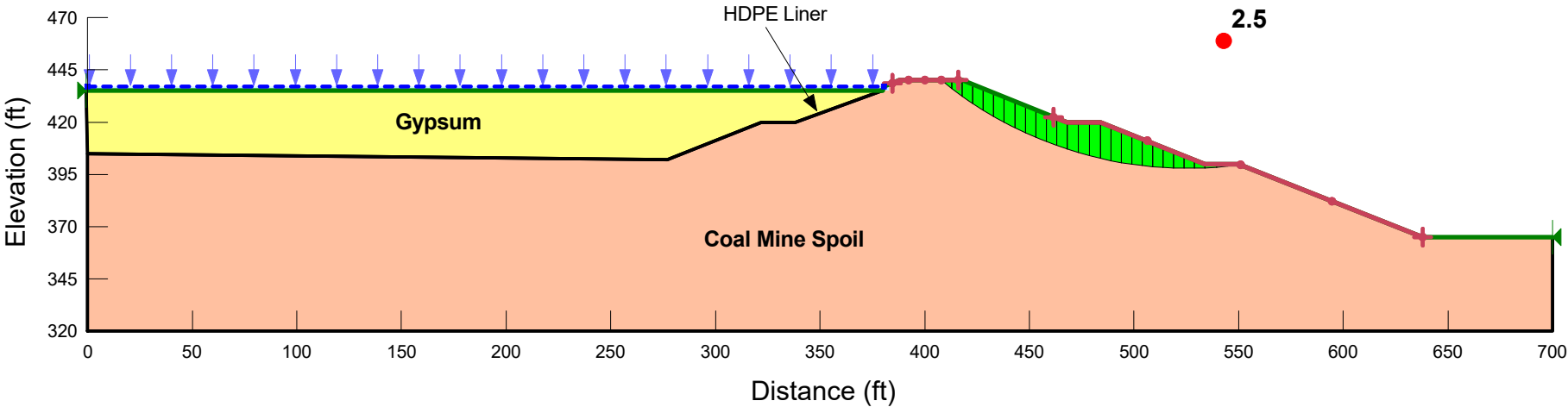
Body of Calculation

SLOPE/W modeling attached.

Plant Gorgas Gypsum Pond
Factor of Safety Assessment

Maximum Storage

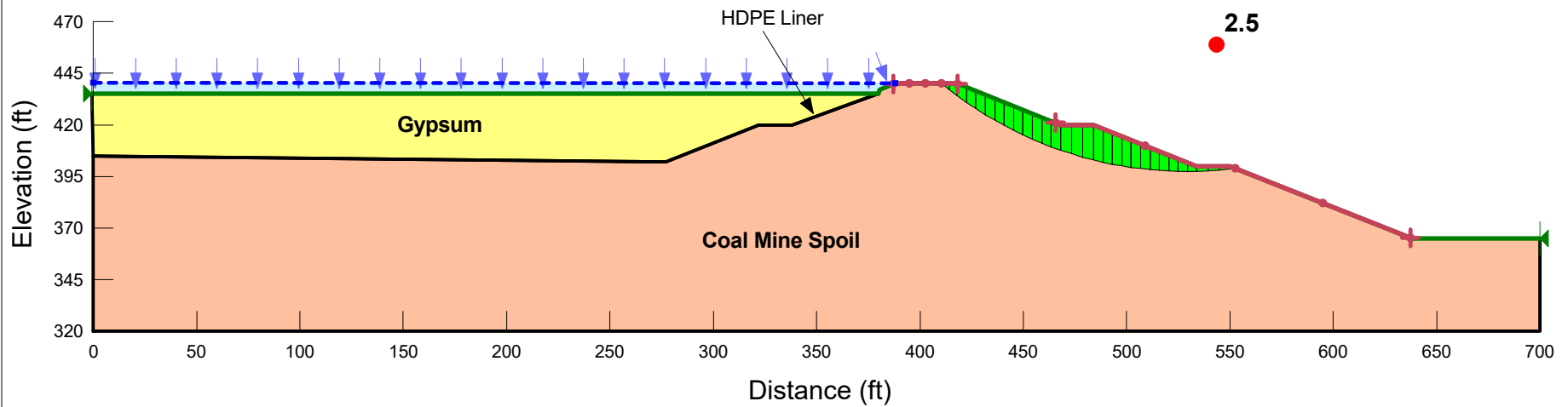
Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Coal Mine Spoil	Mohr-Coulomb	104	0	36
	Gypsum	Mohr-Coulomb	100	100	34



Plant Gorgas Gypsum Pond Factor of Safety Assessment

Maximum Surcharge Pool

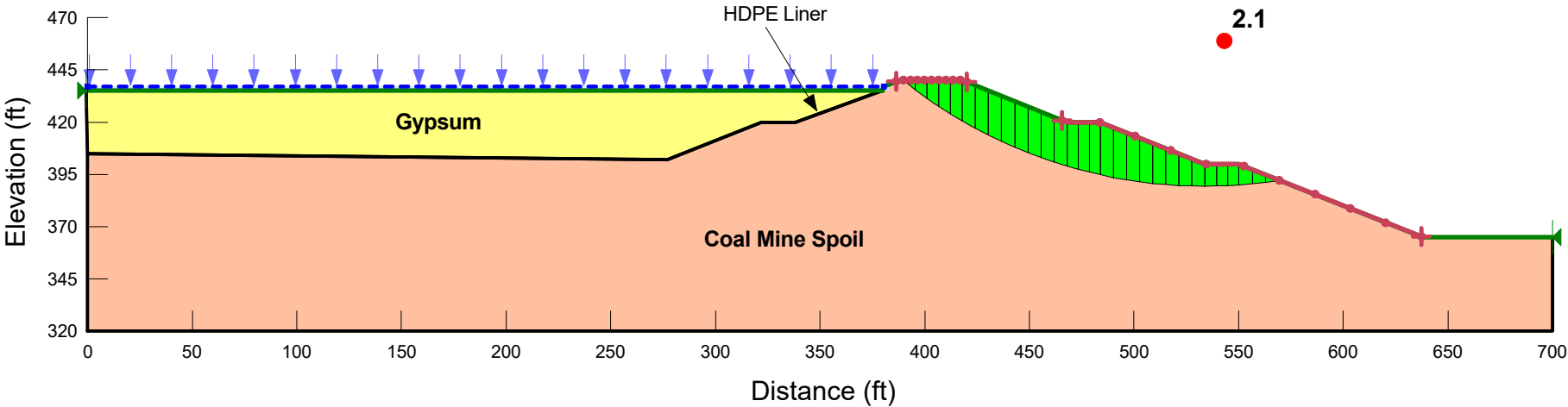
Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Coal Mine Spoil	Mohr-Coulomb	104	0	36
	Gypsum	Mohr-Coulomb	100	100	34



Plant Gorgas Gypsum Pond
Factor of Safety Assessment

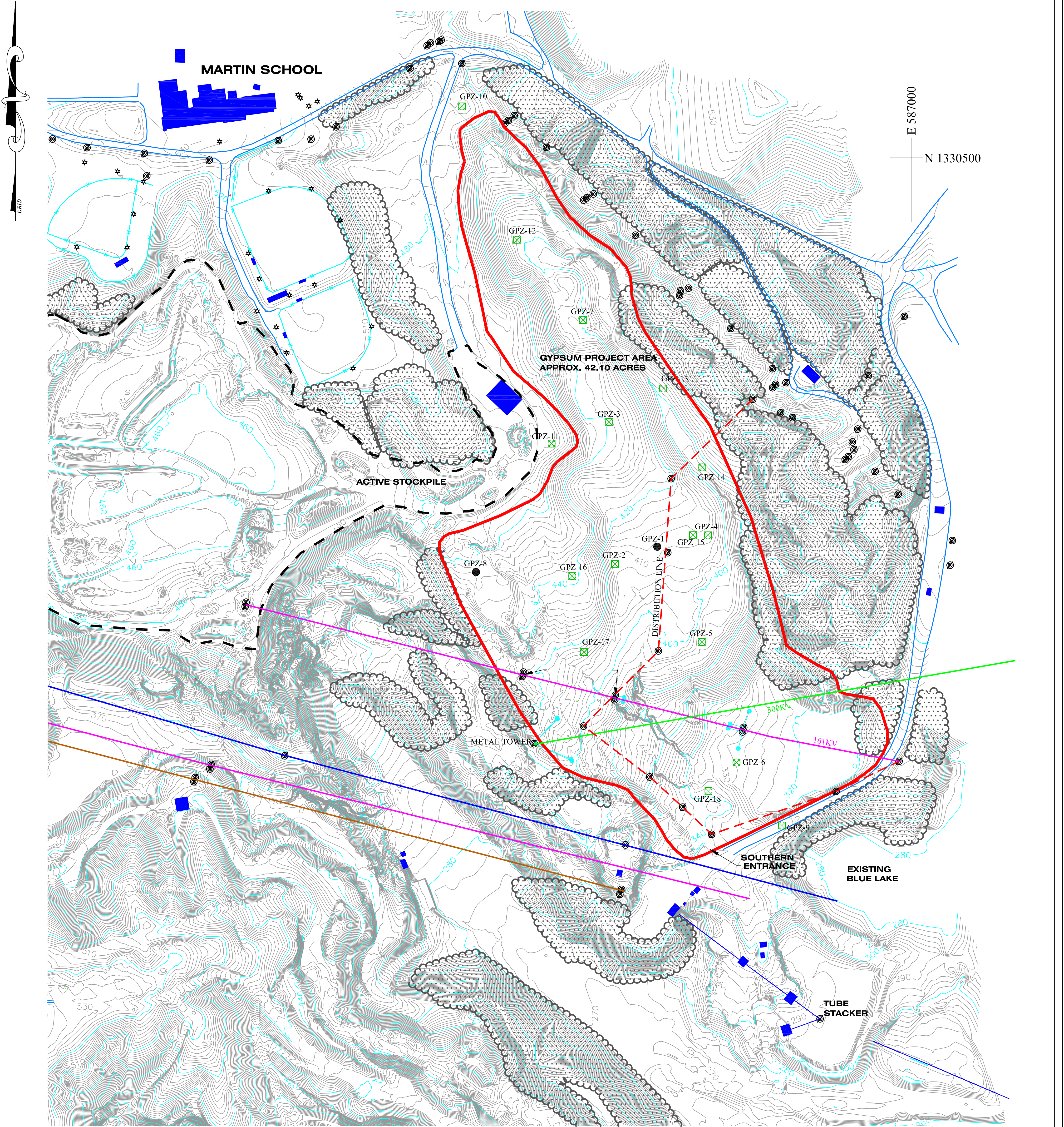
Seismic Loading
Horizontal Coefficient: 0.08g

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



LEGEND

GPZ-1

●

BORING

GPZ-6

⊠

PIEZOMETER

●

⊙

POWER POLE

●

⊙

GUY WIRE

☆

LIGHT POLE

FENCE

ACTIVE STOCKPILE AREA

ROADS

■

STRUCTURES

⬢

AREAS OF DENSE VEGETATION

PROPOSED GYPSUM STORAGE AREA BOUNDARY

DISTRIBUTION LINE

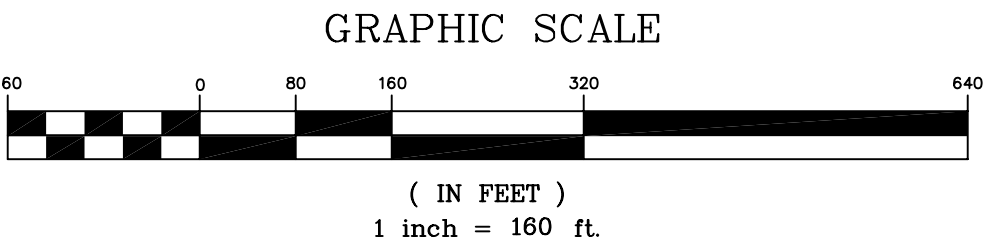
161KV TRANSMISSION LINE

500KV TRANSMISSION LINE

NOTES:

- 1) DATE OF AERIAL PHOTOGRAPHY 04/02/2003
- 2) PHOTOGRAMMETRIC DATA COLLECTED 05/13/2003
- 3) CONTOURS WERE PRODUCED BY DIGITAL TERRAIN MODEL
- 4) CONTOUR INTERVAL 2 FEET
- 5) CONTOURS APPROXIMATE IN AREAS OF DENSE VEGETATION
- 6) RASTER OVERLAY OF GOODSPRINGS 7 1/2 Min. USGS QUAD SHEET
- 7) DRAWING IS ACCURATE ONLY AT ORIGINAL SCALE.

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



PHOTOGRAMMETRIC SURVEY
GRID COORDINATES NAD 27
ALABAMA STATE PLANE
WEST ZONE

Southern Company Generation
for

ALABAMA POWER COMPANY

FIGURE 2
PLANT GORGAS
GYPSUM STORAGE AREA
BORING & PIEZOMETER LOCATIONS

SCALE: 1:160

ES1341S2

Attachment B

Boring Logs

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-1**

Sheet 1 of 3

SITE **Plant Gorgas Gypsum Disposal Area** HOLE DEPTH **66.5'** SURF.ELEV. **411**

LOCATION **North of Plant Gorgas in Coal Mine Spoil Storage Area** COORDINATES N E

ANGLE BEARING CONTRACTOR **SCS** DRILL NO.

OVERBURDEN DEPTH NO. SAMPLES **13** NO. U.D. SAMPLES

CASING SIZE LENGTH CORE SIZE TOTAL % REC.

WATER TABLE DEPTH **Backfilled Hole** ELEV. TIME AFTER COMP. DATE TAKEN

TYPE GROUT **Auger Spoils** QUANTITY MIX DRILLING START DATE **4/29/2003**

DRILLER **B. Filipovich** RECORDER **J. Chitwood** APPROVED DRILLING COMP. DATE **4/29/2003**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	0		Coal Mine Spoils 0 - 66.5' Dark gray-black 10YR3/1 very dark gray					
	1							
	2							
	3							
	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							
	21			20.0-21.5	9-3-3	6	4	
	22							
	23							
	24							

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-1**

Sheet 2 of 3

SITE **Plant Gorgas Gypsum Disposal Area** TOTAL DEPTH **66.5'** SURF.ELEV. **411**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	25		Coal Mine Spoils					
	26			25.0-26.5	11-14-13	27	5	
	27							
	28							
	29							
	30							
	31			30.0-31.5	9-11-13	24	6	
	32							
	33							
	34							
	35							
	36			35.0-36.5	5-7-8	15	7	
	37							
	38							
	39							
	40							
	41			40.0-41.5	6-6-5	11	8	
	42							
	43							
	44							
	45							
	46			45.0-46.5	5-5-6	11	9	
	47							
	48							
	49							
	50							
	51			50.0-51.5	9-7-7	14	10	
	52							
	53							
	54							
	55							
	56			55.0-56.5	4-7-9	16	11	

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. GPZ-1

Sheet 3 of 3

SITE Plant Gorgas Gypsum Disposal Area TOTAL DEPTH 66.5' SURF.ELEV. 411

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	57		Coal Mine Spoils					
	58							
	59							
	60							
	61			60.0-61.5	4-7-7	14	12	
	62							
	63							
	64							
	65							
	66			65.0-66.5	9-7-6	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							
	88							

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-2**

Sheet 1 of 2

SITE **Plant Gorgas Gypsum Disposal Area** HOLE DEPTH **46'** SURF.ELEV. **410**

LOCATION **North of Plant Gorgas in Coal Mine Spoil Storage Area** COORDINATES N **_____** E **_____**

ANGLE **_____** BEARING **_____** CONTRACTOR **SCS** DRILL NO. **_____**

OVERBURDEN DEPTH **_____** NO. SAMPLES **8** NO. U.D. SAMPLES **_____**

CASING SIZE **_____** LENGTH **_____** CORE SIZE **_____** TOTAL % REC. **_____**

WATER TABLE DEPTH **34** ELEV. **376** TIME AFTER COMP. **48 hrs** DATE TAKEN **5/2/2003**

TYPE GROUT **_____** QUANTITY **_____** MIX **_____** DRILLING START DATE **4/29/2003**

DRILLER **B. Filipovich** RECORDER **J. Chitwood** APPROVED **_____** DRILLING COMP. DATE **4/30/2003**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	0		Coal Mine Spoils 0 - 46'					
	1							
	2							
	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	
	12							
	13							
	14							
	15							
	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							

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-2**

Sheet 2 of 2

SITE **Plant Gorgas Gypsum Disposal Area** TOTAL DEPTH **46'** SURF.ELEV. **410**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	25		Coal Mine Spoils					
	26			25.0-26.5	2-4-3	7	5	
	27							
	28							
	29							
	30							
	31			30.0-31.5	2-20-20	40	6	
	32							
	33							
	34		Wet around 34'					
	35							
	36		Saturated @ 36'	35.0-36.5	2-2-3	5	7	
	37							
	38							
	39							
	40							
	41			40.0-41.5	1-1-2	3	8	
	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							
	56							



DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **GPZ-3**

Sheet 1 of 1

SITE **Plant Gorgas Gypsum Disposal Area** HOLE DEPTH **65'** SURF.ELEV. **436**
LOCATION **North of Plant Gorgas in Coal Mine Spoil Storage Area** COORDINATES N E
ANGLE BEARING CONTRACTOR **SCS** DRILL NO.
OVERBURDEN DEPTH NO. SAMPLES **1** NO. U.D. SAMPLES
CASING SIZE LENGTH CORE SIZE TOTAL % REC.
WATER TABLE DEPTH **Dry** ELEV. TIME AFTER COMP. **48 hrs** DATE TAKEN **5/2/2003**
TYPE GROUT QUANTITY MIX DRILLING START DATE **4/30/2003**
DRILLER **B. Filipovich** RECORDER **H. Hill** APPROVED DRILLING COMP. DATE **4/30/2003**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	0							
	1							
	2		Coal Mine Spoils 0 - 65' Dark gray-black 10YR3/1 very dark gray					
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	.							
	.							
	.							
	.							
	.							
	.							
	58							
	59							
	60							
	61			60.0-61.5	11-15-24	39	1	
	62							
	63							
	64							
65.0	65	371.00	Boring Terminated @ 65'. Set Piezometer.					



DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **GPZ-4**

Sheet 1 of 1

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 DEPTH _____ NO. SAMPLES _____ NO. U.D. SAMPLES _____
CASING SIZE _____ LENGTH _____ CORE SIZE _____ TOTAL % REC. _____
WATER TABLE DEPTH **Dry** ELEV. _____ TIME AFTER COMP. **48 hrs** DATE TAKEN **5/2/2003**
TYPE GROUT _____ QUANTITY _____ MIX _____ DRILLING START DATE **4/30/2003**
DRILLER **B. Filipovich** RECORDER **H. Hill** APPROVED _____ DRILLING COMP. DATE **4/30/2003**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From	To	Blows		
	0							
	1							
	2		Coal Mine Spoils 0 - 65'					
	3		Dark gray-black 10YR3/1 very dark gray					
	4		No Rock Encountered. No water.					
	5							
	6							
	7							
	8							
	9							
	10							
	.							
	.							
	.							
	.							
	.							
	.							
	58							
	59							
	60							
	61							
	62							
	63							
	64							
65.0	65	341.00	Boring Terminated @ 65'. Set Piezometer.					



DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **GPZ-5**

Sheet 1 of 1

SITE **Plant Gorgas Gypsum Disposal Area** HOLE DEPTH **60'** SURF.ELEV. **399**

LOCATION **North of Plant Gorgas in Coal Mine Spoil Storage Area** COORDINATES N E

ANGLE BEARING CONTRACTOR **SCS** DRILL NO.

OVERBURDEN DEPTH NO. SAMPLES NO. U.D. SAMPLES

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 DRILLING START DATE **5/1/2003**

DRILLER **B. Filipovich** RECORDER **H. Hill** APPROVED DRILLING COMP. DATE **5/1/2003**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From	To	Blows		
	0							
	1							
	2		Coal Mine Spoils 0 - 60'					
	3		Dark gray-black 10YR3/1 very dark gray					
	4		Augered through mine spoils					
	5		No rock encountered. No water.					
	6							
	7							
	8							
	9							
	10							
	.							
	.							
	.							
	.							
	.							
	.							
	53							
	54							
	55							
	56							
	57							
	58							
	59							
60.0	60	339.00	Boring Terminated @ 60'. Set Piezometer.					



DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **GPZ-6**

Sheet 1 of 1

SITE Plant Gorgas Gypsum Disposal Area		HOLE DEPTH 61.5'	SURF.ELEV. 326
LOCATION North of Plant Gorgas in Coal Mine Spoil Storage Area		COORDINATES N 	E
ANGLE 	BEARING 	CONTRACTOR SCS	DRILL NO.
OVERBURDEN DEPTH 		NO. SAMPLES 1	NO. U.D. SAMPLES
CASING SIZE 	LENGTH 	CORE SIZE 	TOTAL % REC.
WATER TABLE DEPTH 8	ELEV. 318	TIME AFTER COMP. 24 hrs	DATE TAKEN 5/2/2003
TYPE GROUT 	QUANTITY 	MIX 	DRILLING START DATE 5/1/2003
DRILLER B. Filipovich	RECORDER H. Hill	APPROVED 	DRILLING COMP. DATE 5/1/2003

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	0							
	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							
	61		Tan slightly clayey and sandy silt with Sandstone fragments @ 61'	60.0-61.5	5-13-10	23	1	
62.0	62	264.00	Boring Terminated @ 61.5'. Set Piezometer 30' - 35'.					



DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **GPZ-7**

Sheet 1 of 1

SITE **Plant Gorgas Gypsum Disposal Area** HOLE DEPTH **45'** SURF.ELEV. **427**
LOCATION **North of Plant Gorgas in Coal Mine Spoil Storage Area** COORDINATES N _____ E _____
ANGLE _____ BEARING _____ CONTRACTOR **SCS** DRILL NO. _____
OVERBURDEN DEPTH _____ NO. SAMPLES _____ NO. U.D. SAMPLES _____
CASING SIZE _____ LENGTH _____ CORE SIZE _____ TOTAL % REC. _____
WATER TABLE DEPTH **18.5** ELEV. **408.5** TIME AFTER COMP. **24 hrs** DATE TAKEN **5/2/2003**
TYPE GROUT _____ QUANTITY _____ MIX _____ DRILLING START DATE **5/1/2003**
DRILLER **B. Filipovich** RECORDER **H. Hill** APPROVED _____ DRILLING COMP. DATE **5/1/2003**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From	To	Blows		
	0							
	1							
	2		Augered through coal mine spoils 0 - 25'					
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10		Moist around 10'.					
	.							
	.							
	25		Original ground around 25'. Refusal @ 28'. Cored through rock 28'-45' - Gray Sandstone with weathered layers					
	.							
	.							
	.							
	38							
	39							
	40							
	41							
	42							
	43							
	44							
45.0	45	382.00	Boring Terminated @ 45'. Set Piezometer 40-45'					



DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **GPZ-8**

Sheet 1 of 1

SITE **Plant Gorgas Gypsum Disposal Area** HOLE DEPTH **50'** SURF.ELEV. **456**

LOCATION **North of Plant Gorgas in Coal Mine Spoil Storage Area** COORDINATES N **_____** E **_____**

ANGLE **_____** BEARING **_____** CONTRACTOR **SCS** DRILL NO. **_____**

OVERBURDEN DEPTH **_____** NO. SAMPLES **_____** NO. U.D. SAMPLES **_____**

CASING SIZE **_____** LENGTH **_____** CORE SIZE **_____** TOTAL % REC. **_____**

WATER TABLE DEPTH **dry** ELEV. **_____** TIME AFTER COMP. **tod** DATE TAKEN **5/2/2003**

TYPE GROUT **Backfilled** QUANTITY **_____** MIX **_____** DRILLING START DATE **5/1/2003**

DRILLER **B. Filipovich** RECORDER **H. Hill** APPROVED **_____** DRILLING COMP. DATE **5/1/2003**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From	To	Blows		
	0							
1.0	1	455.00	Coal Mine Spoils (1')					
	2							
	3		1' - 30' Gray gravelly silt - weathered SS with intermediate soft Sandstone layers					
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	.							
	.							
	30		Tan to brown back to gray around 30'					
	.							
	.							
	.							
	43							
	44							
	45							
	46							
	47							
	48							
	49		Rock encountered - Auger refusal 45-50' Cored gray SS					
50.0	50	406.00						
			Boring terminated @ 50'. No water. Hole Backfilled.					

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-9**

Sheet 1 of 3

SITE **Plant Gorgas Gypsum Disposal Area** HOLE DEPTH **61.5'** SURF.ELEV. **338**

LOCATION **North of Plant Gorgas in Coal Mine Spoil Storage Area** COORDINATES N **_____** E **_____**

ANGLE **_____** BEARING **_____** CONTRACTOR **SCS** DRILL NO. **_____**

OVERBURDEN DEPTH **_____** NO. SAMPLES **12** NO. U.D. SAMPLES **_____**

CASING SIZE **_____** LENGTH **_____** CORE SIZE **_____** TOTAL % REC. **_____**

WATER TABLE DEPTH **41** ELEV. **297** TIME AFTER COMP. **tod** DATE TAKEN **5/2/2003**

TYPE GROUT **Auger Spoils** QUANTITY **_____** MIX **_____** DRILLING START DATE **5/2/2003**

DRILLER **B. Filipovich** RECORDER **H. Hill** APPROVED **_____** DRILLING COMP. DATE **5/2/2003**

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	0							
	1							
	2							
	3							
	4							
	5							
	6		Road base Mine Spoils	5.0-6.5	18-8-8	16	1	
	7							
	8							
	9							
	10							
	11		Coal mine spoils	10.0-11.5	7-4-3	7	2	
	12							
	13							
	14							
	15							
	16		SAA	15.0-16.5	10-4-3	7	3	
	17							
	18							
	19							
	20							
	21			20.0-21.5	7-4-3	7	4	
	22		SAA					
	23							
	24							

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. GPZ-9

Sheet 2 of 3

SITE			Plant Gorgas Gypsum Disposal Area			TOTAL DEPTH		61.5'		SURF.ELEV.		338	
Graphic Log	Depth	Elev.	Material Description, Classification and Remarks			Standard Penetration Test			Sample No.	Comments			
						From To	Blows	N					
	25		Coal Mine Spoils										
	26					25.0-26.5	3-3-3	6	5				
	27												
	28												
	29												
	30		SAA										
	31					30.0-31.5	4-3-3	6	6				
	32												
	33												
	34												
	35		SAA										
	36					35.0-36.5	2-3-4	7	7				
	37												
	38												
	39												
	40		SAA - Wet @ 41'										
	41					40.0-41.5	2-3-4	7	8				
	42												
	43												
	44												
	45		Wet Coal Mine Spoils										
	46					45.0-46.5	1-1-5	6	9				
	47												
	48												
	49												
	50		SAA										
	51					50.0-51.5	woh-3-5	8	10				
	52												
	53												
	54												
	55		SAA										
	56					55.0-56.5	2-4-6	10	11				

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. GPZ-9

Sheet 3 of 3

SITE Plant Gorgas Gypsum Disposal Area TOTAL DEPTH 61.5' SURF.ELEV. 338

Graphic Log	Depth	Elev.	Material Description, Classification and Remarks	Standard Penetration Test			Sample No.	Comments
				From To	Blows	N		
	57		Coal Mine Spoils					
	58							
	59							
	60							
	61							
61.5		276.5	Boring terminated @ 61.5'. Piezometer set.	60.0-61.5	1-2-4	6	12	
	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							
	88							

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-10**

Sheet 1 of 2

SITE GORGAS STEAM PLANT		HOLE DEPTH 56.5'	SURF.ELEV. 487.87
LOCATION GYPSUM STORAGE	COORDINATES N 1330680.47	E 585426.44	
ANGLE 90	BEARING	CONTRACTOR Christian Testing Lab.	DRILL NO. CME-850
DRILLING METHOD	NO. SAMPLES 12	NO. U.D. SAMPLES 0	
CASING SIZE	LENGTH	CORE SIZE	TOTAL % REC.
WATER TABLE DEPTH NA	ELEV.	TIME AFTER COMP.	DATE TAKEN
TYPE GROUT	QUANTITY	MIX	DRILLING START DATE 3/28/2005
DRILLER Billy Spivey	RECORDER S. Sprayberry	APPROVED	DRILLING COMP. DATE 3/28/2005

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
0.0	0	487.87							
1		Coal Mine spoils (0-45')	SS-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									
16		SAA	SS-4	15-16.5	5-5-7	12			
17									
18									
19									
20									
21		SAA	SS-5	20-21.5	10-10-8	18			
22									
23									
24									

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. GPZ-10

Sheet 2 of 2

SITE **GORGAS STEAM PLANT** TOTAL DEPTH **56.5'** SURF.ELEV. **487.87**

	Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD	
					From To	Blows	N				
45.0	25		SAA		25-26.5	6-6-7	13				
	26	SS-6									
	27										
	28										
	29										
	30										
	31	SAA		SS-7	30-31.5	6-6-7	13				
	32										
	33										
	34										
	35										
	36	SAA	SS-8	35-36.5	6-4-3	7					
	37										
	38										
	39										
	40										
	41	SAA	SS-9	40-41.5	6-9-11	20					
	42										
	43										
	44										
	45	442.87									
	50.0	46		Tan to gray, moist, stiff, silty CLAY (CL) with SANDSTONE and SHALE fragments, FILL	SS-10	45-46.5	4-5-6				11
		47									
		48									
		49									
50		437.87									
56.5	51		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				
	52										
	53										
	54										
	55										
	56	SAA		SS-12				55-56.5	50/3"	50+	
			Boring Terminated @ 56.5'								

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-11**

Sheet 1 of 3

SITE GORGAS STEAM PLANT		HOLE DEPTH 76.5	SURF.ELEV. 473.36
LOCATION GYPSUM STORAGE		COORDINATES N 1329499.75	E 585740.85
ANGLE 90	BEARING	CONTRACTOR Christian Testing Lab.	DRILL NO. CME-850
DRILLING METHOD		NO. SAMPLES 16	NO. U.D. SAMPLES 0
CASING SIZE	LENGTH	CORE SIZE	TOTAL % REC.
WATER TABLE DEPTH NA		ELEV.	TIME AFTER COMP.
TYPE GROUT		QUANTITY	MIX
DRILLER Billy Spivey		RECORDER S. Sprayberry	APPROVED
		DRILLING START DATE 3/24/2005	
		DRILLING COMP. DATE 3/24/2005	

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
0.0	0	473.36							
1		Coal Mine spoils (0-63')	SS-1	0-1.5	2-2-7	9			
2									
3									
4									
5									
6		SAA	SS-2	5-6.5	6-6-13	19			
7									
8									
9									
10									
11		SAA	SS-3	10-11.5	6-6-8	14			
12									
13									
14									
15									
16		SAA	SS-4	15-16.5	3-8-19	27			
17									
18									
19									
20									
21		SAA	SS-5	20-21.5	10-12-13	25			
22									
23									
24									

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **GPZ-11**

Sheet 2 of 3

SITE		GOR GAS STEAM PLANT				TOTAL DEPTH	76.5	SURF.ELEV.	473.36
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
25		SAA							
26			SS-6	25-26.5	2-6-13	19			
27									
28									
29		SAA							
30									
31			SS-7	30-31.5	10-14-12	26			
32									
33		SAA							
34									
35									
36			SS-8	35-36.5	8-17-32	49			
37		SAA							
38									
39									
40									
41		SAA	SS-9	40-41.5	5-9-10	19			
42									
43									
44									
45		SAA							
46			SS-10	45-46.5	4-8-10	18			
47									
48									
49		SAA							
50									
51			SS-11	50-51.5	2-8-9	17			
52									
53		SAA							
54									
55									
56			SS-12	55-56.5	7-13-14	27			

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. GPZ-11

Sheet 3 of 3

SITE		GORGAS STEAM PLANT				TOTAL DEPTH	76.5	SURF.ELEV.	473.36
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
57		SAA		60-61.5	14-19-17	36			
58									
59									
60									
61			SS-13						
62		Tan to gray, moist, very stiff, clayey SILT (ML) with highly weathered SHALE residuum		65-66.5	11-15-14	29			
63	410.36								
64									
65									
66			SS-14						
67									
68									
69									
70	403.36	Tan, soft to medium hard, weathered SANDSTONE		70-71.5	9-13-14	27			
71			SS-15						
72									
73									
74									
75									
76									
76.5	396.86	Boring Terminated @ 76.5' (Not Auger Refusal)	SS-16	75-76.5	9-14-16	30			
77									
78									
79									
80									
81									
82									
83									
84									
85									
86									
87									
88									

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-12**

Sheet 1 of 1

SITE GORGAS STEAM PLANT				HOLE DEPTH 24		SURF.ELEV. 421.61	
LOCATION GYPSUM STORAGE				COORDINATES N 1330213.32		E 585619.97	
ANGLE 90		BEARING		CONTRACTOR Christian Testing Lab.		DRILL NO. CME-850	
DRILLING METHOD		NO. SAMPLES 5		NO. U.D. SAMPLES		0	
CASING SIZE		LENGTH		CORE SIZE		TOTAL % REC.	
WATER TABLE DEPTH NA		ELEV.		TIME AFTER COMP.		DATE TAKEN	
TYPE GROUT		QUANTITY		MIX		DRILLING START DATE 3/28/2005	
DRILLER Billy Spivey		RECORDER S. Sprayberry		APPROVED		DRILLING COMP. DATE 3/28/2005	

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
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								
	14								
15.0	15	406.61							
	16	Tan to gray, moist, very hard, silty CLAY (CL) to clayey SILT (ML) with weathered SANDSTONE residuum	SS-4	15-16.5	10-12-50/3"	50+			
	17								
	18								
	19								
	19								
20.0	20	401.61							
	21	SAA	SS-5	20-21.5	50/2"	50+			
	22								
	23								
	23								
	24	Auger Refusal @ 24'							

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-13**

Sheet 1 of 1

SITE GORGAS STEAM PLANT		HOLE DEPTH 15	SURF.ELEV. 402.64
LOCATION GYPSUM STORAGE		COORDINATES N 1329692.8	E 586131.45
ANGLE 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 % REC.
WATER TABLE DEPTH NA		ELEV.	TIME AFTER COMP.
TYPE GROUT		QUANTITY	MIX
DRILLER Billy Spivey		RECORDER S. Sprayberry	APPROVED
		DRILLING START DATE 3/28/2005	
		DRILLING COMP. DATE 3/28/2005	

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
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) with weathered SANDSTONE residuum	SS-3	10-11.5	2-5-5	10			
	12								
	13								
	14								
15.0	15	387.64							
	16	Auger Refusal @ 15'	SS-4	15-16.5	50/2"	50+			
	17								
	18								
	19								
	20								
	21								
	22								
	23								
	24								

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-14**

Sheet 1 of 2

SITE GORGAS STEAM PLANT		HOLE DEPTH 35	SURF.ELEV. 394.93
LOCATION GYPSUM STORAGE		COORDINATES N 1329416.45	E 586268.34
ANGLE 90	BEARING	CONTRACTOR Christian Testing Lab.	DRILL NO. CME-850
DRILLING METHOD		NO. SAMPLES 8	NO. U.D. SAMPLES 0
CASING SIZE	LENGTH	CORE SIZE	TOTAL % REC.
WATER TABLE DEPTH NA	ELEV.	TIME AFTER COMP.	DATE TAKEN
TYPE GROUT		QUANTITY	MIX
DRILLER Billy Spivey		RECORDER S. Sprayberry	APPROVED
		DRILLING START DATE 3/28/2005	DRILLING COMP. DATE 3/28/2005

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
0.0	0	394.93							
	1	Gray, moist, medium stiff to stiff, silty CLAY (CL) with SANDSTONE fragments, FILL	SS-1	0-1.5	4-3-5	8			
	2								
	3								
	4								
	5								
	6	SAA	SS-2	5-6.5	6-6-5	11			
	7								
	8								
	9								
	10								
	11	SAA	SS-3	10-11.5	6-7-5	12			
	12								
13.0	13	381.93							
	14	Gray to tan, moist, stiff, silty CLAY (CL) with SANDSTONE and SHALE fragments, FILL							
	15								
	16		SS-4	15-16.5	3-4-6	10			
	17								
	18								
	19	SAA							
	20								
	21		SS-5	20-21.5	4-5-6	11			
	22								
	23								
	24								

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. GPZ-14

Sheet 2 of 2

SITE		GOR GAS STEAM PLANT			TOTAL DEPTH		35		SURF.ELEV.		394.93	
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD			
				From To	Blows	N						
25		SAA		25-26.5	5-8-6	14						
26			SS-6									
27												
28												
29												
30	364.93											
31		Gray, moist, stiff, silty CLAY (CL/CH) with highly weathered SANDSTONE residuum	SS-7	30-31.5	4-5-8	13						
32												
33												
34												
35	359.93											
36		Auger Refusal @ 35'	SS-8	35-36.5	10-50/2"	50+						
37												
38												
39												
40												
41												
42												
43												
44												
45												
46												
47												
48												
49												
50												
51												
52												
53												
54												
55												
56												

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-15**

Sheet 1 of 4

SITE GORGAS STEAM PLANT				HOLE DEPTH 101.5		SURF.ELEV. 411.18	
LOCATION GYPSUM STORAGE				COORDINATES N 1329179.05		E 586236.28	
ANGLE 90		BEARING		CONTRACTOR SCS		DRILL NO. CME-550	
DRILLING METHOD		NO. SAMPLES 21		NO. U.D. SAMPLES		0	
CASING SIZE		LENGTH		CORE SIZE		TOTAL % REC.	
WATER TABLE DEPTH NA		ELEV.		TIME AFTER COMP.		DATE TAKEN	
TYPE GROUT		QUANTITY		MIX		DRILLING START DATE 3/29/2005	
DRILLER B. Filipovich		RECORDER S. Sprayberry		APPROVED		DRILLING COMP. DATE 3/30/2005	

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
0	411.18								
1		Coal Mine spoils (0-101')	SS-1	0-1.5	4-11-10	21			
2									
3									
4									
5									
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									
16		SAA	SS-4	15-16.5	4-9-12	21			
17									
18									
19									
20									
21		SAA	SS-5	20-21.5	7-16-13	29			
22									
23									
24									

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. GPZ-15

Sheet 2 of 4

SITE		GOR GAS STEAM PLANT				TOTAL DEPTH	101.5	SURF.ELEV.	411.18
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
25		SAA		25-26.5	4-16-33	49			
26			SS-6						
27									
28									
29		SAA		30-31.5	11-13-17	30			
30									
31			SS-7						
32									
33		SAA		35-36.5	6-5-6	11			
34									
35									
36			SS-8						
37		SAA		40-41.5	3-4-5	9			
38									
39									
40			SS-9						
41		SAA		45-46.5	3-5-6	11			
42									
43									
44									
45		SAA		50-51.5	2-5-5	10			
46			SS-10						
47									
48									
49		SAA		55-56.5	3-4-7	11			
50									
51			SS-11						
52									
53		SAA							
54									
55									
56			SS-12						

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. GPZ-15

Sheet 3 of 4

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

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. GPZ-15

Sheet 4 of 4

SITE **GORGAS STEAM PLANT**

TOTAL DEPTH	101.5
-------------	--------------

SURF.ELEV. 411.18

[illegible]

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-16**

Sheet 1 of 2

SITE GORGAS STEAM PLANT				HOLE DEPTH 55.5		SURF.ELEV. 440.65	
LOCATION GYPSUM STORAGE				COORDINATES N 1329035.86		E 585813.17	
ANGLE 90		BEARING		CONTRACTOR Christian Testing Lab.		DRILL NO. CME-850	
DRILLING METHOD		NO. SAMPLES 12		NO. U.D. SAMPLES		0	
CASING SIZE		LENGTH		CORE SIZE		TOTAL % REC.	
WATER TABLE DEPTH NA		ELEV.		TIME AFTER COMP.		DATE TAKEN	
TYPE GROUT		QUANTITY		MIX		DRILLING START DATE 3/24/2005	
DRILLER Billy Spivey		RECORDER S. Sprayberry		APPROVED		DRILLING COMP. DATE 3/24/2005	

0.0

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
0	440.65								
1		Coal Mine spoils (0-43')	SS-1	0-1.5	6-10-12	22			
2									
3									
4									
5									
6		SAA	SS-2	5-6.5	22-25-33	58			
7									
8									
9									
10									
11		SAA	SS-3	10-11.5	4-6-10	16			
12									
13									
14									
15									
16		SAA	SS-4	15-16.5	3-7-7	14			
17									
18									
19									
20									
21		SAA	SS-5	20-21.5	4-9-10	19			
22									
23									
24									

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. GPZ-16

Sheet 2 of 2

SITE		GOR GAS STEAM PLANT			TOTAL DEPTH		55.5	SURF.ELEV.		440.65
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD	
				From To	Blows	N				
25		SAA		25-26.5	4-9-11	20				
26			SS-6							
27										
28										
29										
30		SAA		30-31.5	5-6-12	18				
31			SS-7							
32										
33										
34										
35		SAA		35-36.5	9-14-19	33				
36			SS-8							
37										
38										
39										
40		SAA		40-41.5	10-11-23	34				
41			SS-9							
42										
43	397.65									
44										
45		Gray, soft, weathered SHALE residuum		45-46.5	18-50/4"	50+				
46			SS-10							
47										
48										
49										
50	390.65	Tan, soft to medium hard, weathered SANDSTONE		50-51.5	50/3"	50+				
51			SS-11							
52										
53										
54										
55		Boring Terminated @ 55.5' (Not Auger refusal)		55-55.5'	50/3"	50+				
56	385.15		SS-12							

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. **GPZ-17**

Sheet 1 of 2

SITE GORGAS STEAM PLANT		HOLE DEPTH 30.5	SURF.ELEV. 414.27
LOCATION GYPSUM STORAGE		COORDINATES N 1328770.35	E 585853.67
ANGLE 90	BEARING	CONTRACTOR Christian Testing Lab.	DRILL NO. CME-850
DRILLING METHOD		NO. SAMPLES 7	NO. U.D. SAMPLES 0
CASING SIZE	LENGTH	CORE SIZE	TOTAL % REC.
WATER TABLE DEPTH NA	ELEV.	TIME AFTER COMP.	DATE TAKEN
TYPE GROUT		QUANTITY	MIX
DRILLER Billy Spivey		RECORDER S. Sprayberry	APPROVED
		DRILLING START DATE 3/23/2005	DRILLING COMP. DATE 3/23/2005

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
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 residuum	SS-2	5-6.5	26-26-36	62			
	7								
	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) with weathered SANDSTONE	SS-4	15-16.5	25-50/3"	50+			
	17								
	18								
	19								
	20								
	21	Tan, soft, weathered SANDSTONE	SS-5	20-21.5	27-29-50	79			
	22								
	23								
	24								

**DRILLING LOG
GEOLOGICAL SERVICES**

Hole No. GPZ-17

Sheet 2 of 2

SITE		GOR GAS STEAM PLANT				TOTAL DEPTH	30.5	SURF.ELEV.	414.27
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
25.0	25	389.27							
	26		SS-6	25-26.5	19-50/4"	50+			
	27								
	28								
	29								
	30								
30.5	31	383.77	SAA						
	31		SS-7	30-31.5	50/3"	50+			
	32								
	33								
	34								
	35								
	36								
	37								
	38								
	39								
	40								
	41								
	42								
	43								
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	55								
	56								

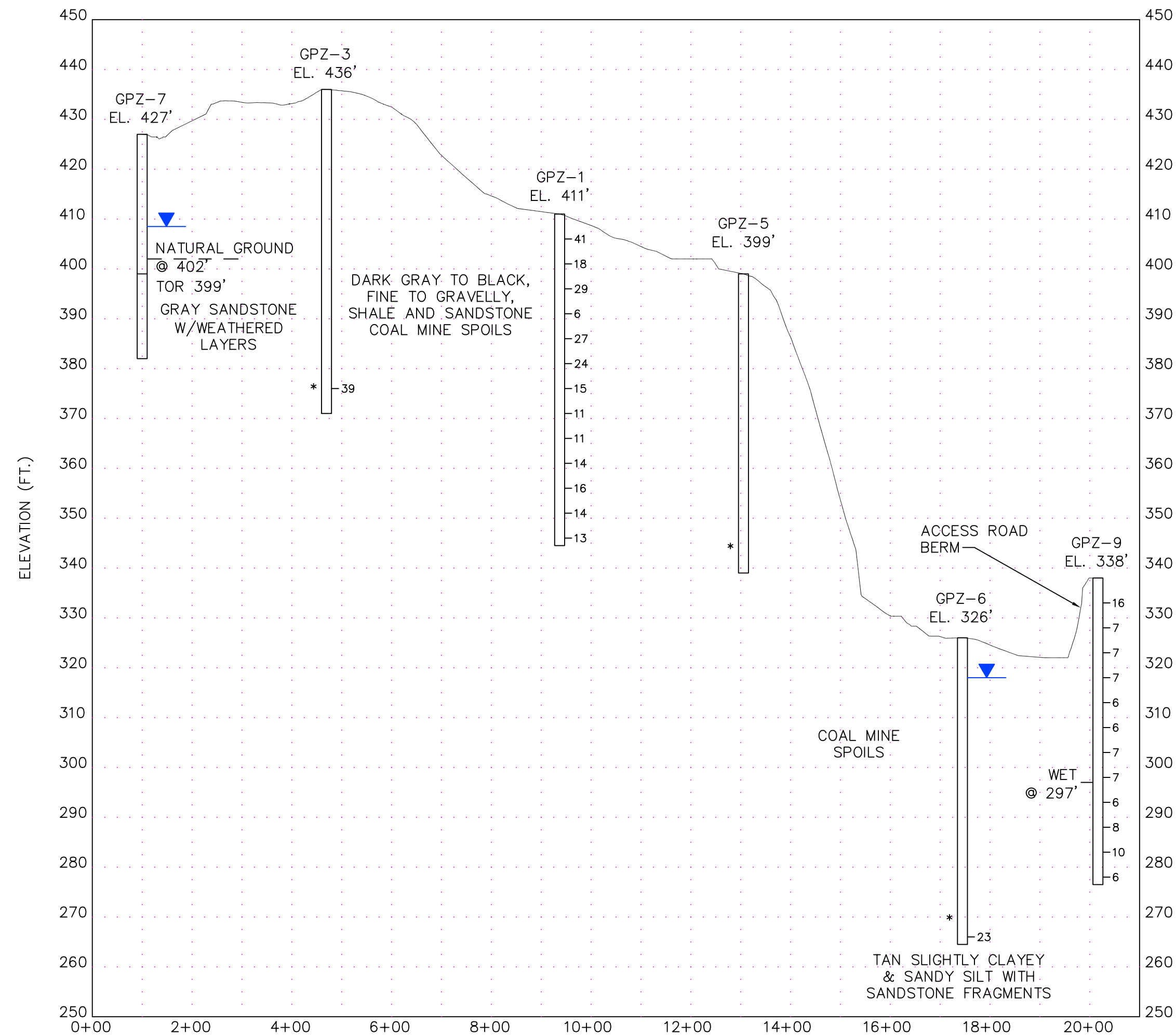
DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **GPZ-18**

Sheet 1 of 1

SITE GORGAS STEAM PLANT				HOLE DEPTH 15.5		SURF.ELEV. 338.02	
LOCATION GYPSUM STORAGE				COORDINATES N 1328283.18		E 586290.18	
ANGLE 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 % REC.	
WATER TABLE DEPTH NA		ELEV.		TIME AFTER COMP.		DATE TAKEN	
TYPE GROUT		QUANTITY		MIX		DRILLING START DATE 3/23/2005	
DRILLER Billy Spivey		RECORDER S. Sprayberry		APPROVED		DRILLING COMP. DATE 3/23/2005	

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
0	338.02								
1		Coal Mine spoils (0-1')	SS-1	0-1.5	5-5-8	13			
2		Tan to brown, moist, stiff, clayey SILT (ML)							
3									
4									
5.0	333.02								
6		Tan to gray, moist, very hard, clayey SILT (ML) with highly weathered SHALE residuum	SS-2	5-6.5	30-26-50	76			
7									
8									
9									
10									
11		SAA	SS-3	10-11.5	31-50/5"	50+			
12									
13									
14									
15									
15.5	322.52	Auger Refusal @ 15.5'	SS-4	15-16.5	50+/6"	50+			
16									
17									
18									
19									
20									
21									
22									
23									
24									

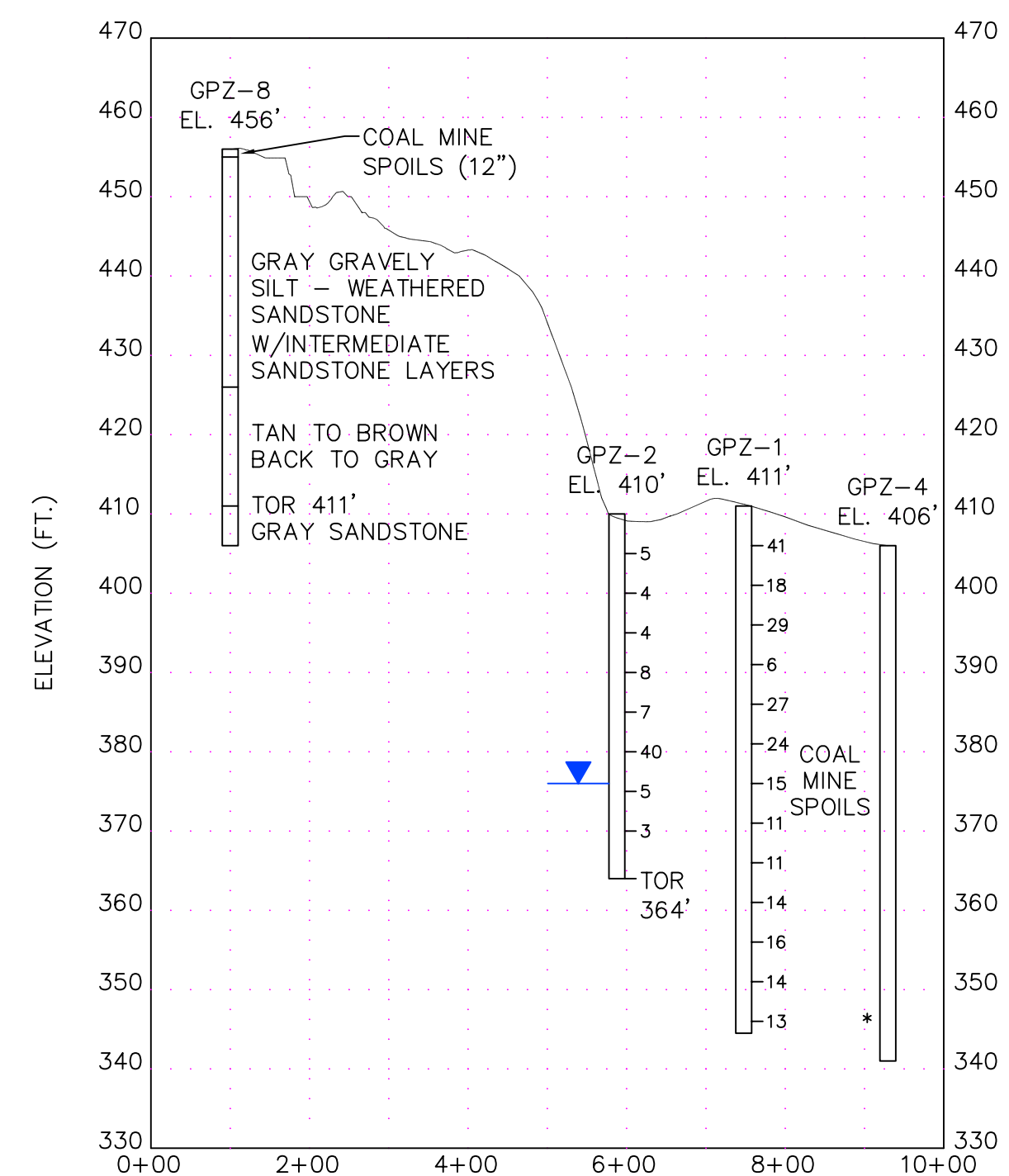


NORTH - SOUTH CROSS SECTION

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'

NOTE:
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

Attachment C

Laboratory Analyses

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



Table 1
Laboratory Results for Coal Mine Spoils

<i>Sample</i>	<i>Grain Size</i>			<i>Max Dry Density (pcf)</i>	<i>Optimum Moisture (%)</i>
	<i>% Gravel</i>	<i>% Sand</i>	<i>% Fines</i>		
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 Recompact*	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

