

**INITIAL 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), §257.73(e), requires the owner or operator of an existing CCR surface impoundment to conduct periodic safety factor assessments. The owner or operator must document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) for the critical embankment section are achieved.

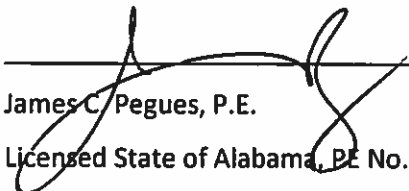
The CCR surface impoundment located at Alabama Power Company's Plant Gorgas also referred to as the Plant Gorgas Gypsum Pond is located on Plant Gorgas property, southeast from Parrish, Alabama. The CCR surface impoundment is formed by an engineered cross-valley embankment. The critical section of this CCR unit has been determined to be located 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	2.3	1.0

The embankments are constructed of silts, clays, clean sands and rip-rap 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. Part 257.73 (e)(1).


James C. Pegues, P.E.
Licensed State of Alabama, PE No. 16516





Engineering and Construction Services Calculation

**Calculation Number:
TV-GO-APC389153-002**

Project/Plant: Plant Gorgas Gypsum Pond	Unit(s): Units 6-7	Discipline/Area: ESFS
Title/Subject: Slope Stability Analysis of Plant Gorgas Gypsum Pond Dam		
Purpose/Objective: Analyze slope stability of the Plant Gorgas Gypsum Pond Dam		
System or Equipment Tag Numbers: NA	Originator: Stacey H. Simpson, P.E.	

Contents

Topic	Page	Attachments <small>(Computer Printouts, Tech. Papers, Sketches, Correspondence)</small>	# of Pages
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Body of Calculation	5		
Total # of pages including cover sheet & attachments:	49		

Revision Record

Rev. No.	Description	Originator Initial / Date	Reviewer Initial / Date	Approver Initial / Date
0	Issued for Information	SHS 10/06/16	JAL 10/10/16	JCP 10/10/16

Notes:

Purpose of Calculation

The William C. Gorgas Electric Generating Plant is a 5-unit electric generating facility, all of which are coal-fired units. The Plant Gorgas Gypsum Pond is 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 is wet-sluciced to the gypsum storage area. The gypsum is allowed to settle and the water decants to the sedimentation pond.

The purpose of this calculation is to provide a slope stability assessment of the Plant Gorgas Gypsum Pond dam under conditions prescribed by the EPA CCR rule.

Methodology

The calculation was performed using the following methods and software:

GeoStudio 2012 (Version 8.15.5.11777), August 2015 Release, Copyright 1991-2016, GEO-SLOPE International, Ltd.

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

The Morgenstern-Price analytical method with an entry-exit slip surface was used for slope stability calculation.

Criteria and Assumptions

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

- Seismic site response was determined using a one-dimensional equivalent linear site response analysis. The analysis was performed using Strata and utilizing random vibration theory. The input motion consisted of the USGS published 2008 Uniform Hazard Response Spectrum (UHRS) for Site Class B/C at a 2% Probability of Exceedance in 50 years. The UHRS was converted to a Fourier Amplitude Spectrum, and propagated through a representative one dimensional soil column using linear wave propagation with strain-dependent dynamic soil properties. The input soil properties and layer thickness were randomized based on defined statistical distributions to perform Monte Carlo simulations for 100 realizations, which were used to generate a median estimate of the surface ground motions.
- The median surface ground motions were then used to calculate a pseudostatic seismic coefficient for utilization in the stability analysis using the approach suggested by Bray and 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 0.053g for use as a horizontal acceleration in the stability analysis.

- The Corps of Engineers (COE) EM 1110-2-1902 standard, October 2003, allows the use of the phreatic surface established for the maximum storage condition (normal pool) in the analysis for the maximum surcharge loading condition. This is based on the short term duration of the surcharge loading relative to the permeability of the embankment and the foundation materials. This method is used in the analysis for the impoundments at this facility with surcharge loading.
- The current required minimum criteria (factors of safety) were taken from the Structural Integrity Criteria for Existing CCR Surface Impoundments, 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 following sources:
 - 1) 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.

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

Summary of Conclusions

The following table summarizes the factors of safety resulting from the slope stability analyses. The results indicate the safety factors of the Plant Gorgas Gypsum Pond dam meet or exceed the minimum criteria set forth in the structural integrity criteria for existing CCR surface impoundments, 40 CFR 257.73.

Factor of Safety Summary Table

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	2.3	1.0

Design Inputs/References

- 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

Name: Gypsum
Unit Weight: 100 pcf
Cohesion: 100 psf
Phi: 34 °

Name: Coal Mine Spoil
Unit Weight: 104 pcf
Cohesion: 0 psf
Phi: 36 °

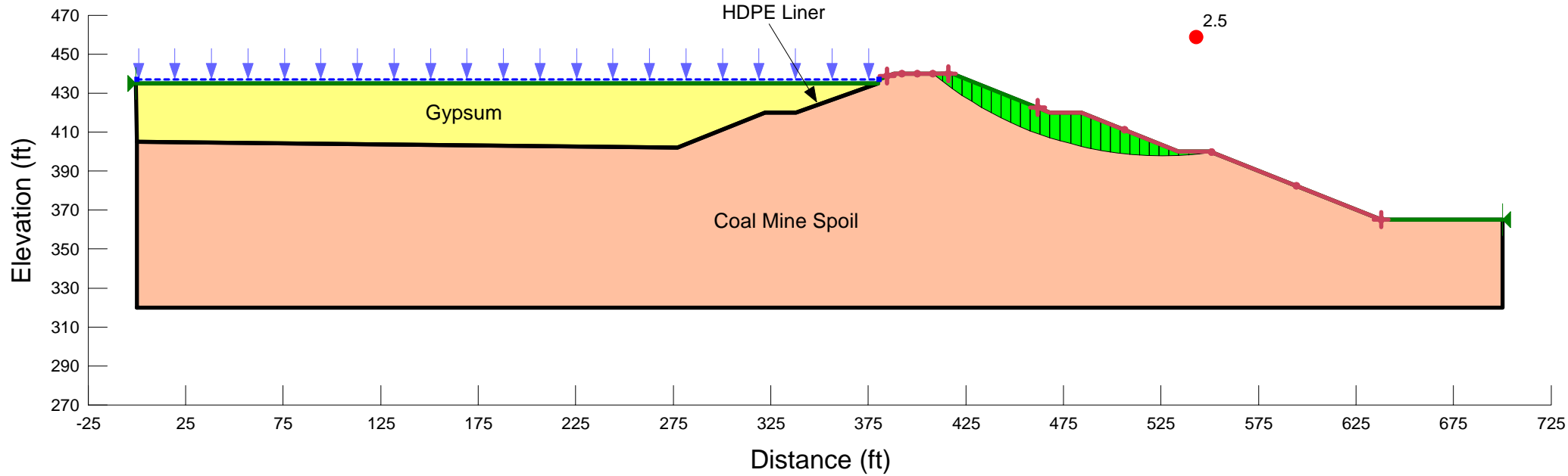
Materials

- Gypsum
- Coal Mine Spoil

Plant Gorgas

Gypsum Storage Pond

Long Term Maximum Storage



Name: Gypsum
Unit Weight: 100 pcf
Cohesion: 100 psf
Phi: 34 °

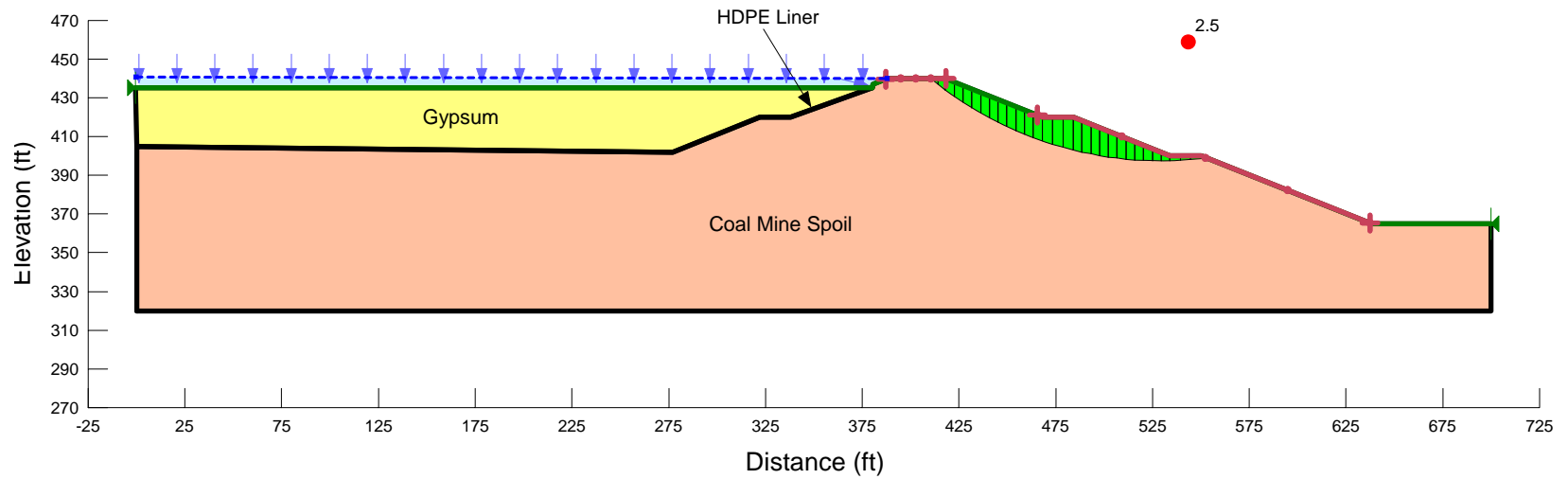
Name: Coal Mine Spoil
Unit Weight: 104 pcf
Cohesion: 0 psf
Phi: 36 °

Plant Gorgas

Gypsum Storage Pond

Maximum Surcharge

Materials	
■	Gypsum
■	Coal Mine Spoil



Name: Gypsum
Unit Weight: 100 pcf
Cohesion': 100 psf
Phi': 34 °

Name: Coal Mine Spoil
Unit Weight: 104 pcf
Cohesion': 0 psf
Phi': 36 °

Plant Gorgas

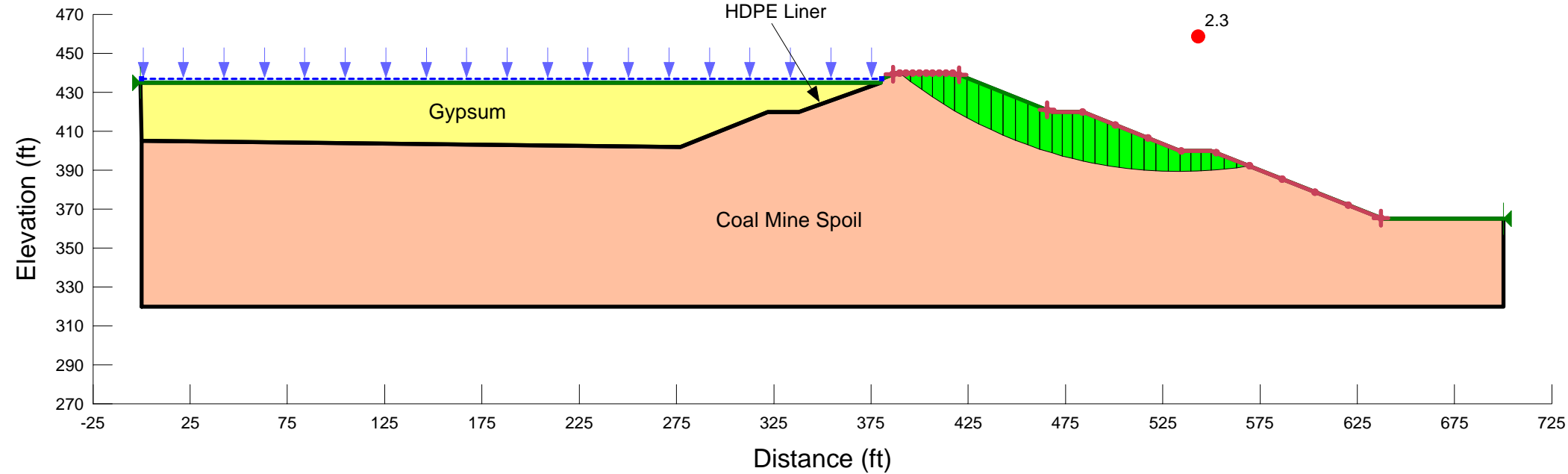
Gypsum Storage Pond

Seismic

Horizontal Seismic Coefficient.: 0.053

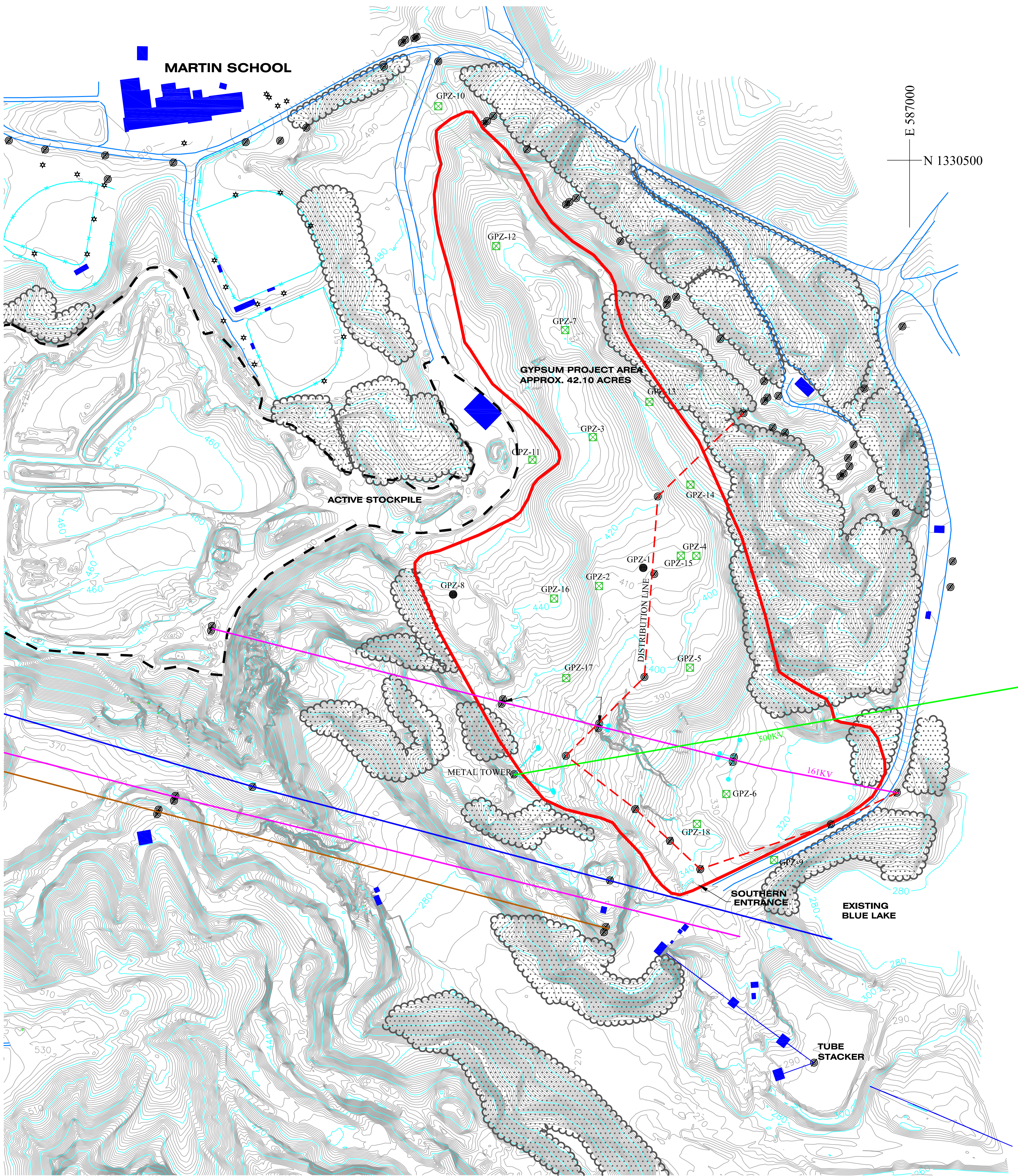
Materials

- Gypsum
- Coal Mine Spoil



ATTACHMENTS

Attachment A - Boring Location Plan

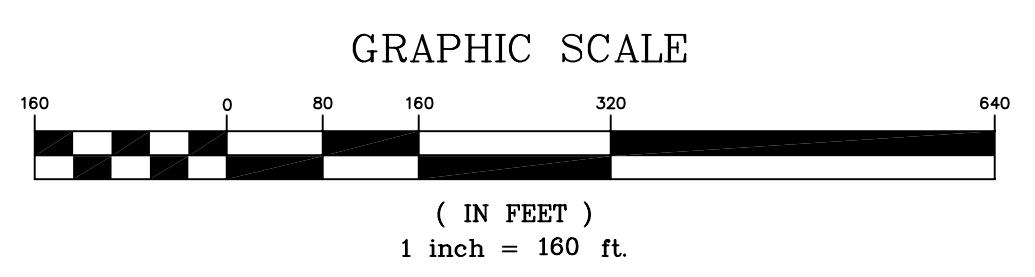


E 587000
N 1330500

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**

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**

- 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.

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								
	1		Coal Mine Spoils 0 - 66.5' Dark gray-black 10YR3/1 very dark gray						
	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'						
	68		No water encountered. Hole backfilled with auger spoils.						
	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
TYPE GROUT			QUANTITY			MIX	
DRILLER	B. Filipovich		RECORDER	J. Chitwood		APPROVED	
						DRILLING START DATE	4/29/2003
						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		Coal Mine Spoils 0 - 46'						
	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		
	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' Dark gray-black 10YR3/1 very dark gray No Rock Encountered. No water.					
	3							
	4							
	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' Dark gray-black 10YR3/1 very dark gray Augered through mine spoils No rock encountered. No water.					
	3							
	4							
	5							
	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		
	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		Augered through coal mine spoils 0 - 25'					
	2							
	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		1' - 30' Gray gravelly silt - weathered SS with intermediate soft Sandstone layers					
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	.							
	.		Tan to brown back to gray around 30'					
	30							
	.							
	.							
	.							
	43							
	44							
	45							
	46							
	47							
	48		Rock encountered - Auger refusal 45-50' Cored gray SS					
	49							
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							
	31		SAA	30.0-31.5	4-3-3	6	6	
	32							
	33							
	34							
	35							
	36		SAA	35.0-36.5	2-3-4	7	7	
	37							
	38							
	39							
	40							
	41		SAA - Wet @ 41'	40.0-41.5	2-3-4	7	8	
	42							
	43							
	44							
	45							
	46		Wet Coal Mine Spoils	45.0-46.5	1-1-5	6	9	
	47							
	48							
	49							
	50							
	51		SAA	50.0-51.5	woh-3-5	8	10	
	52							
	53							
	54							
	55							
	56		SAA	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							
	58							
	59							
	60							
	61		Coal Mine Spoils					
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	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			
25		SAA	SS-6	25-26.5	6-6-7	13			
26									
27									
28									
29		SAA	SS-7	30-31.5	6-6-7	13			
30									
31									
32									
33		SAA	SS-8	35-36.5	6-4-3	7			
34									
35									
36									
37		SAA	SS-9	40-41.5	6-9-11	20			
38									
39									
40									
41		Tan to gray, moist, stiff, silty CLAY (CL) with SANDSTONE and SHALE fragments, FILL	SS-10	45-46.5	4-5-6	11			
42									
43									
44									
45	442.87	SAA	SS-11	50-51.5	4-7-14	21			
46									
47									
48									
49		Tan to gray, moist, very stiff to very hard, silty CLAY (CL) with weathered SANDSTONE residuum	SS-12	55-56.5	50/3"	50+			
50	437.87								
51									
52									
53		SAA							
54									
55									
56									
56.5		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.** _____ **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

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
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 **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			
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**

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									
58									
59									
60									
61		SAA	SS-13	60-61.5	14-19-17	36			
62									
63.0	410.36								
64									
65									
66		Tan to gray, moist, very stiff, clayey SILT (ML) with highly weathered SHALE residuum	SS-14	65-66.5	11-15-14	29			
67									
68									
69									
70.0	403.36								
71		Tan, soft to medium hard, weathered SANDSTONE	SS-15	70-71.5	9-13-14	27			
72									
73									
74									
75									
76		SAA	SS-16	75-76.5	9-14-16	30			
76.5	396.86	Boring Terminated @ 76.5' (Not Auger Refusal)							
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 _____
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	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	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								
20.0	20	401.61							
	21	SAA	SS-5	20-21.5	50/2"	50+			
	22								
	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.** _____ **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	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 _____ 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	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								
	20								
	21	SAA	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 **GORGAS 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	SS-6	25-26.5	5-8-6	14			
26									
27									
28									
29									
30.0	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									
35.0	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. _____
TYPE GROUT _____		QUANTITY _____	MIX _____
DRILLER B. Filipovich		RECORDER S. Sprayberry	APPROVED _____
		DRILLING START DATE 3/29/2005	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 **GORGAS 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									
26		SAA	SS-6	25-26.5	4-16-33	49			
27									
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									
48									
49									
50									
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			

SITE **GORGAS 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**

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
89									
90									
91		SAA	SS-19	90-91.5	5-8-9	17			
92									
93									
94									
95									
96		SAA	SS-20	95-96.5	WOR	WOR			
97									
98									
99									
100									
101.0	310.18		SS-21	100-101.5	6-9-12	21			
101.5	309.68	Tan, moist, stiff, sandy SILT (ML)							
		Boring Terminated @ 101.5'							
102									
103									
104									
105									



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

Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test			Comments	%Rec	RQD
				From To	Blows	N			
0.0	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 **GORGAS 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									
26		SAA	SS-6	25-26.5	4-9-11	20			
27									
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									
43.0	397.65								
44									
45									
46		Gray, soft, weathered SHALE residuum	SS-10	45-46.5	18-50/4"	50+			
47									
48									
49									
50.0	390.65								
51		Tan, soft to medium hard, weathered SANDSTONE	SS-11	50-51.5	50/3"	50+			
52									
53									
54									
55									
55.5	385.15	Boring Terminated @ 55.5' (Not Auger refusal)	SS-12	55-55.5'	50/3"	50+			



**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 _____	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			
0.0	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								

SITE **GORGAS 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	389.27								
26		Gray, soft, weathered SHALE	SS-6	25-26.5	19-50/4"	50+			
27									
28									
29									
30									
30.5	383.77	SAA							
31		Boring Terminated @ 30.5' (not auger refusal)	SS-7	30-31.5	50/3"	50+			
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
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48									
49									
50									
51									
52									
53									
54									
55									
56									

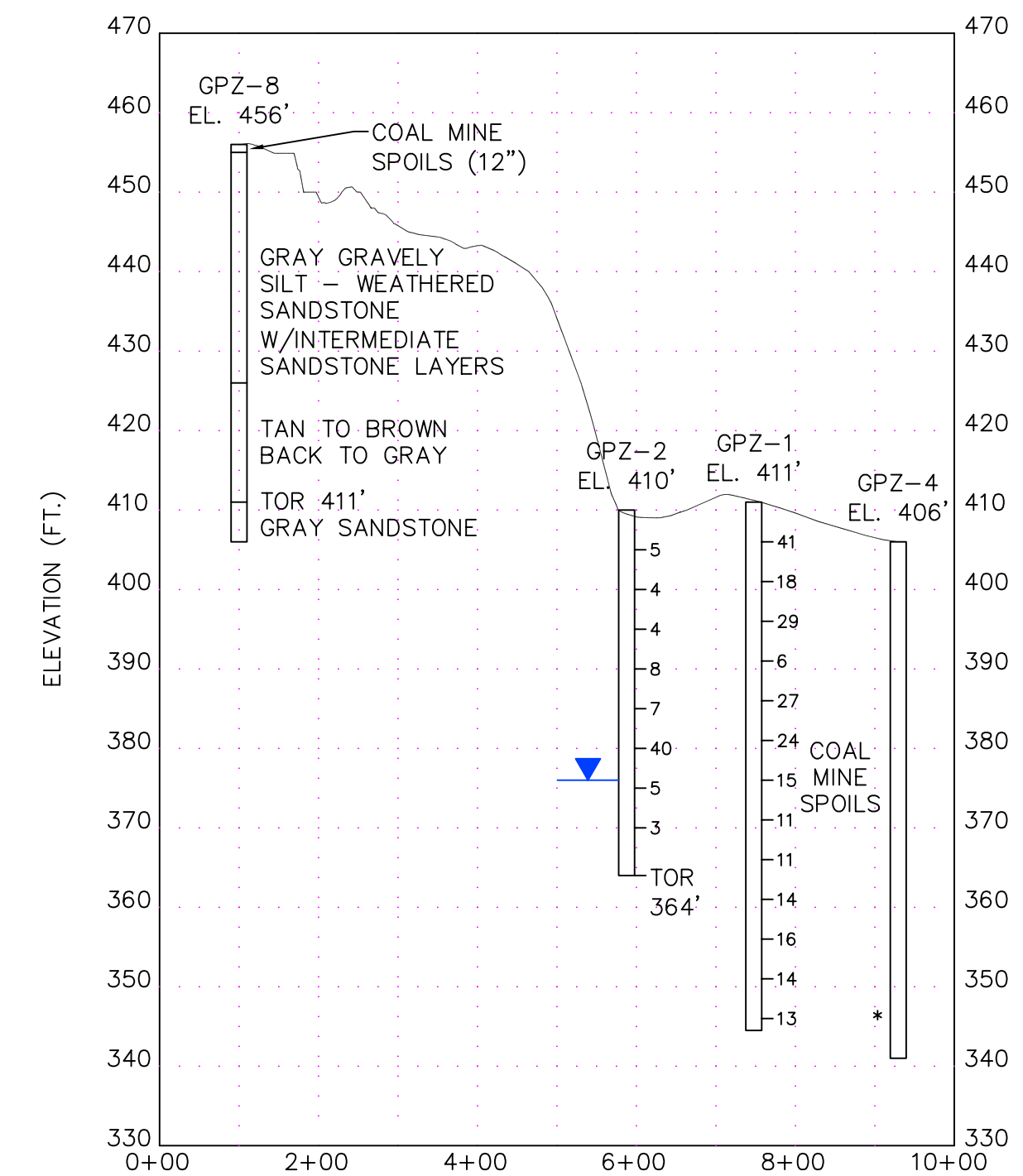
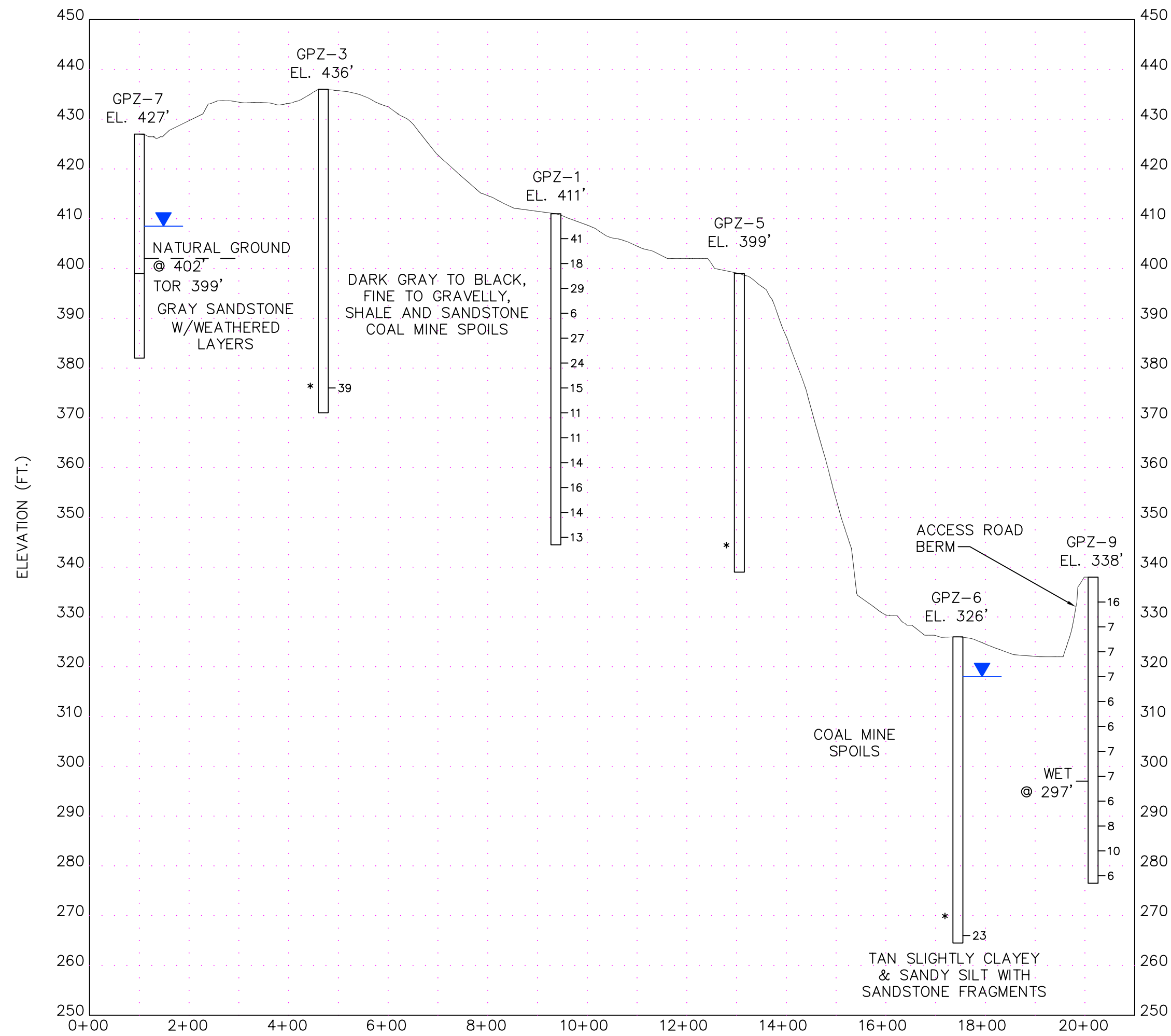


**DRILLING LOG
GEOLOGICAL SERVICES**

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 _____
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	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	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		Auger Refusal @ 15.5'							
16	322.52		SS-4	15-16.5	50+/6"	50+			
17									
18									
19									
20									
21									
22									
23									
24									



* 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.

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 – Drawing Used to Develop Critical Section Profile

