INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
PLANT GORGAS GYPSUM POND
ALABAMA POWER COMPANY

Section 257.82 of EPA's regulations requires the owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment to design, construct, operate and maintain an inflow design flood control system capable of safely managing flow during and following the peak discharge of the specified inflow design flood. The owner or operator also has to prepare a written plan documenting how the inflow flood control system has been designed and constructed to meet the requirements of this section of the rule.

The existing CCR surface impoundment referred to as the Plant Gorgas Gypsum Pond is located at Alabama Power Company's Plant Gorgas. The facility consists of an 18 acre CCR storage area, two sedimentation ponds, and a recycle pond. The inflow design flood consists of the rainfall that falls within the limits of the surface impoundment as well as runoff from approximately 12 acres of adjoining watershed. Process flows into the Gypsum Pond were determined to be negligible. Stormwater is temporarily stored within the limits of the surface impoundment and discharged through spillway structures that consist of a 48-inch HDPE riser structure and a 36" HDPE pipe that serves to dewater the perimeter ditches. These two structures combine into a 36" outlet pipe that serves to discharge water to the sedimentation ponds. There are no other spillways or discharge structures serving the Plant Gorgas Gypsum Pond.

The inflow design flood has been calculated using the Natural Resources Conservation Service method (also known as the Soil Conservation Service (SCS) method) using the 1000-yr storm event required for a Significant hazard potential facility. Runoff curve number data was determined using Table 2-2A from the Urban Hydrology for Small Watersheds (TR-55). Appendix A and B from the TR-55 were used to determine the rainfall distribution methodology. Precipitation values were determined from NOAA's Precipitation Frequency Data Server (Atlas-14).

The NRCS provided information on the soil characteristics and hydrologic groups present at the site. It was determined that the hydrological groups A, B, and D should be used to best reflect the characteristics of the soils on site. Curve numbers values for each land use (determined from aerial photography) and soil combination were taken from the National Engineering Handbook Part 630,

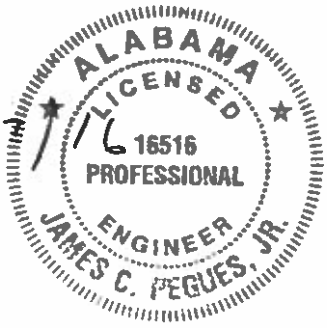
Chapter 9. This information was placed into Hydrologic Engineering Center - Hydrologic Modeling System and used to generate appropriate precipitation curves, storm basin routing information, and rating curves to evaluate surface impoundment capacity.

The facility is operated subject to and in accordance with § 257.3-3 of EPA's regulations.

Calculations indicate the unit can safely store and pass the inflow design storm. Supporting calculations are attached for reference.

I hereby certify that the inflow design flood control system plan meets the requirements of 40 C.F.R. Part 257.82.

10/17/16



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Inflow Design Control System Plan:
Hydrologic and Hydraulic Calculation Summary

for

Plant Gorgas Gypsum Pond

Prepared by:

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Reviewer: _____ 10/11/16
Jason S. Wilson Date

Approval: _____ 10/12/16
James C. Pegues Date

1.0 Purpose of Calculation

The purpose of this report is to demonstrate the hydraulic capacity of the subject CCR impoundment in order to prepare an inflow design flood control plan as required by the United States Environmental Protection Agency's (EPA) final rule for Disposal of CCR from Electric Utilities (EPA 40 CFR 257).

2.0 Summary of Conclusions

A hydrologic and hydraulic model was developed for the Plant Gorgas Gypsum Pond to determine the hydraulic capacity of the impoundment. The design storm for the Plant Gorgas Gypsum Pond is a 1000-year rainfall event. Southern Company has selected a storm length of 24-hours for all inflow design flood control plans. The results of routing a 1000-year, 24-hour rainfall event through the impoundment are presented in Table 1 below:

Table 1-Flood Routing Results for Plant Gorgas Gypsum Pond

Plant Gorgas	Normal Pool El (ft)	Top of embankment El (ft)	Emergency Spillway Crest El (ft)	Peak Water Surface Elevation (ft	Freeboard* (ft)	Peak Inflow (cfs)	Peak Outflow (cfs)
Gypsum Pond	428.0	440.0	N/A	439.0	1.0	332.5	98.3

*Freeboard is measured from the top of embankment to the peak water surface elevation

3.0 Methodology

3.1 HYDROLOGIC ANALYSES

The Plant Gorgas Gypsum Pond is classified as a significant hazard structure. The design storm for a significant hazard structure is a 1000-year rainfall event. A summary of the design storm parameters and rainfall distribution methodology for these calculations is summarized below in Table 2.

Table 2. Plant Gorgas Gypsum Pond Storm Distribution

Hazard Classification	Return Frequency (years)	Storm Duration (hours)	Rainfall Total (Inches)	Rainfall Source	Storm Distribution
Significant	1000	24	14.3	NOAA Atlas 14	SCS Type III

The drainage area for the Plant Gorgas Gypsum Pond was delineated based on LiDAR data acquired for the Plant in 2016. Runoff characteristics were developed based on the Soil Conservation Service (SCS) methodologies as outlined in TR-55. An overall SCS curve number for the drainage area was developed based on the National Engineering

Handbook Part 630, Chapter 9 which provides a breakdown of curve numbers for each soil type and land use combination. Soil types were obtained from the USGS online soils database. Land use areas were delineated based on aerial photography. Time of Concentration and Lag Time calculations were developed based on the overland flow method as described in the National Engineering Handbook Part 630, Chapter 15.

A table of the pertinent basin characteristics of the Gypsum Pond is provided below in Table 3.

Table 3—Gypsum Pond Hydrologic Information

Drainage Basin Area (acres)	30
Hydrologic Curve Number, CN	92
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	12.6
Lag Time (minutes)	7.6
Hydrologic Software	USACE HEC-HMS

Runoff values were determined by importing the characteristics developed above into a hydrologic model with the US Army Corps of Engineers HEC-HMS program.

Process flows from Plant Gorgas were not considered in this analysis as they were determined to be negligible when compared to the 1000-year rainfall event.

3.2 HYDRAULIC ANALYSES

Storage values for the Gypsum Pond were determined by developing a stage-storage relationship utilizing contour data. The spillway system at the Plant Gorgas Gypsum Pond consists of a primary spillway that discharges to a sedimentation pond. There is a headwall with an elevation of 428.0’ along the perimeter that connects with a riser box with an invert of 392.0’. At the junction of the riser to the outlet there is a 48-inch discharge pipe with an invert of 378.0’. A summary of spillway information is presented below in Table 4.

Table 4—Spillway Attribute Table

Spillway Component	US Invert El (feet)	DS Invert El (feet)	Dimension (ft)	Slope (ft/ft)	Spillway Capacity (cfs)
Perimeter Ditch Pipe	428.0	392.0	3	14.0%	98.3
Discharge Pipe	392.0	378.0	4	4.3	98.3*

*controlled by perimeter ditch pipe capacity

Based on the spillway attributes listed above, a rating curve was developed within HEC-HMS to determine the pond performance during the design storm. Results are shown in Table 1.

4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBER

	Soil	Area (acres)	Curve Number
Forest	A	0.2	45
	B	0.5	66
	D	6.8	83
Roadway	A	0.2	83
	B	0.0	89
	D	0.6	93
Graded Area	A	2.0	77
	B	0.0	86
	D	1.7	94
Surface Water/Liner		18.1	98
	Total	**30.0**	**92**

4.2 STAGE-STORAGE TABLE

Stage	Area (acre)	Volume (acre-ft)
428	0.01	0.00
430	0.01	0.02
432	0.11	0.14
434	0.57	0.82
436	1.00	2.38
438	1.37	4.75
439	1.58	6.23
440	1.72	7.87

4.3 TIME OF CONCENTRATION

Sheet Flow

**Mannings coefficient*	*n*	*0.4*	
Sheet Flow Length	*l*	*55*	*ft*
2 yr, 24 hr Rainfall	P_2	*4.11*	*in*
***Slope of Land Surface*	*S*	*0.04*	*ft/ft*
Travel Time	T_{t1}	*0.09*	*hr*

Shallow Concentrated Flow

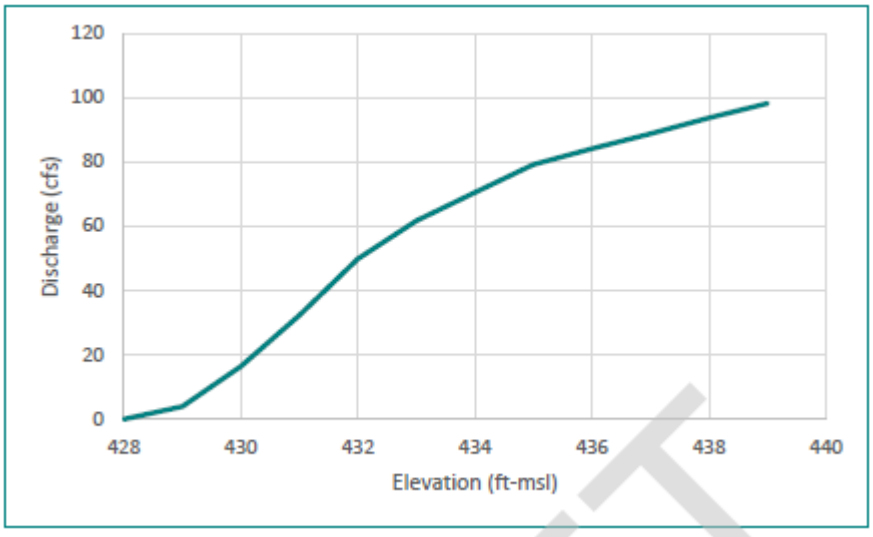
Segment Length	*l*	*587*	*ft*
Slope of Land Surface	*S*	*0.10*	*ft/ft*
Woodland Landuse			
**Flow Velocity*	*V*	*1.5*	*ft/s*
Travel Time	T_{t2}	*0.10*	*hr*

Lake Flow 1

Mean Lake Depth	*Dm*	*5*	*ft*
Flow Length	*L*	*1194*	*ft*
Wave Velocity	*V*	*12.7*	*ft/s*
Travel Time	T_{t3}	*0.03*	*hr*

Total TOC	*0.21*	*hr*
Lag Time	*7.6*	*mins*

4.4 RATING CURVE



4.5 DRAINAGE BASIN