PERIODIC INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
PLANT MILLER ASH 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 establish certain hydrologic and hydraulic capacity requirements for CCR surface impoundments. Per §257.82 and ADEM Admin. Code r. 335-13-15-.05(3), the owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment is required 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 must prepare a written plan documenting how the inflow flood control system has been designed and constructed to meet the requirements of the referenced sections of the rules. In addition, §257.82(f)(4) and ADEM Admin. Code r. 335-13-15-.05(3)(c)4. require a revision to the inflow design flood control system plan be prepared every 5 years.

The existing CCR surface impoundment referred to as the Plant Miller Ash Pond is located at Alabama Power Company's Plant Miller. The facility consists of a 321-acre storage area. The facility is currently undergoing closure in place. The inflow design flood consists of the rainfall that falls within the limits of the surface impoundment as well as runoff from an area adjacent to the Ash Pond that is now included within the area of closure. The total drainage basin now consists of approximately 452 acres. Stormwater is temporarily stored within the limits of the surface impoundment and pumped to a temporary water treatment system that has been installed to support closure activities. All water discharge from the pond flows through the treatment system and is directed to a new energy dissipation outfall before entering the original discharge flume.

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 "B" and "D" should be used to best reflect the characteristics of the soils on site [may require multiple curve numbers depending upon presence of free water, exposed ash and/or vegetation; should be addressed in the calculation]. This information was placed into the AutoCAD Civil 3D Storm and Sanitary Analysis program and used to generate appropriate precipitation curves, storm basin routing information, and resulting rating curves to evaluate surface impoundment capacity.

Calculations indicate the unit can safely store and pass the inflow design storm without overtopping the cross-valley embankment. Supporting calculations are attached for reference.

The facility is operated subject to and in accordance with § 257.3-3 and ADEM Admin. Code r. 335-13-4-.01(2)(a) and (b).

I hereby certify that the inflow design flood control system plan meets the requirements of 40 C.F.R. §257.82 and ADEM Admin. Code r. 335-13-15-.05(3).

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10/15/2021

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Inflow Design Control System Plan:
Hydrologic and Hydraulic Calculation Summary

for

Plant Miller Ash Pond

Prepared by:

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Reviewer: ______________________ 10-7-21
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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 257.81) and ADEM Administrative Code r. 335-13-15-.05(3).

2.0 Summary of Conclusions

A hydrologic and hydraulic model was developed for the Plant Miller Ash Pond to determine the hydraulic capacity of the impoundment. The design storm for the Plant Miller Ash Pond is a 1,000-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 1,000-year, 24-hour rainfall event through the impoundment are presented in Table 1 below:

Table 1-Flood Routing Results for Plant Miller Ash Pond

Plant Miller	Normal Pool El (ft)	Top of embankment El (ft)	Auxiliary Spillway Crest El (ft)	Peak Water Surface Elevation (ft	Freeboard* (ft)	Peak Inflow (cfs)	Peak Outflow (cfs)
Ash Pond	420.0	426.0	N/A	424.0	2.0	3,645	473.0

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

3.0 Methodology

3.1 HYDROLOGIC ANALYSES

The Plant Miller Ash Pond is classified as a significant hazard structure. The design storm for a significant hazard structure is a 1,000-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 Miller Ash Pond Storm Distribution

Hazard Classification	Return Frequency (years)	Storm Duration (hours)	Rainfall Total (Inches)	Rainfall Source	Storm Distribution
Significant	1,000	24	14.40	NOAA Atlas 14	SCS Type III

The drainage area for the Plant Miller Ash Pond was delineated based on a combination of recent (2021) aerial and bathymetric survey data of the ash pond and its surrounding topography. Run-off 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 calculations were developed using the velocity method as described in the National Engineering Handbook Part 630, Chapter 15.

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

Table 3—Ash Pond Hydrologic Information

Drainage Basin Area (acres)	452.06
Hydrologic Curve Number, CN	92
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	31
Hydrologic Software	AutoCAD Civil 3D Storm and Sanitary Analysis 2019

Run-off values were determined by importing the characteristics developed above into a hydrologic model with the AutoCAD Civil 3D Storm and Sanitary Analysis program.

It is important to note that the drainage basin utilized for this analysis includes a drainage area of 452 acres compared to a drainage area of 321 acres utilized in the previous calculation. This increase is due to the inclusion of a CCR area adjacent to the Ash Pond that is now included within the area of closure as well as more accurate topographic survey information.

The Ash Pond ceased receipt of process flows from the plant in 2019. Therefore, no flows other than stormwater were considered in this analysis.

3.2 HYDRAULIC ANALYSES

Storage values for the Ash Pond were determined by developing a stage-storage relationship utilizing contour data. The spillway system at the Plant Miller Ash Pond consists of an overflow concrete riser connected to a discharge pipe. The primary spillway riser has an overtopping elevation of 420.0’ and an invert elevation of 400.0’. 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)	Length (ft)	Spillway Capacity (cfs)
Primary	400.0	394.48	8	2.97%	185.6	592.8

Based on the spillway attributes listed above, a rating curve was developed and inserted into the Storm and Sanitary Analysis program to determine the pond performance during the design storm. Results are shown in Table 1.

4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBER

Land Use Description	Soil Type	CN	Area (Acres)
Water	B/D	100	92.1
Impervious	B/D	98	25.82
Disturbed / Transitional	B/D	92	334.14
Total		92	452.06

4.2 STAGE-STORAGE TABLE

Elevation (ft-msl)	Area (acres)	Storage volume (acre-ft)	Notes
419.0	78.6	0.0	
420.0	79.1	78.9	Normal pool elevation (initial conditions in model)
421.0	81.4	159.1	
422.0	86.7	243.2	
423.0	89.2	331.2	
424.0	93.1	422.3	
425.0	106.0	521.8	
426.0	114.3	632.0	Top of Dam Elevation

Note: Storage volumes below elevation 419.0 ft-MSL were not considered in the pond calculation modeling as they are dead storage volume.

4.3 TIME OF CONCENTRATION

Sheet Flow Travel Time

Travel time for sheet flow is calculated based on NEH Part 630 Chapter 15 equation 15-8 with a flow length maximum determined by equation 15-9.

$$Sheet\ flow\ travel\ time, t_1(hours) = \frac{0.007(nl)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$ NEH 630 Chapter 15 eqn. 15-8

$$Maximum\ sheet\ flow\ length, l\ (feet) = \frac{100\sqrt{S}}{n}$$ NEH 630 Chapter 15 eqn. 15-9

Manning n (woods, light underbrush)	n	0.4	
Flow length	l	25	feet
2-year, 24-hour rainfall	P_{2year}	4.1	inches
Slope	S	0.010	
Sheet flow travel time	t_1	**0.14**	**hours**
	t_1	**8.3**	**minutes**

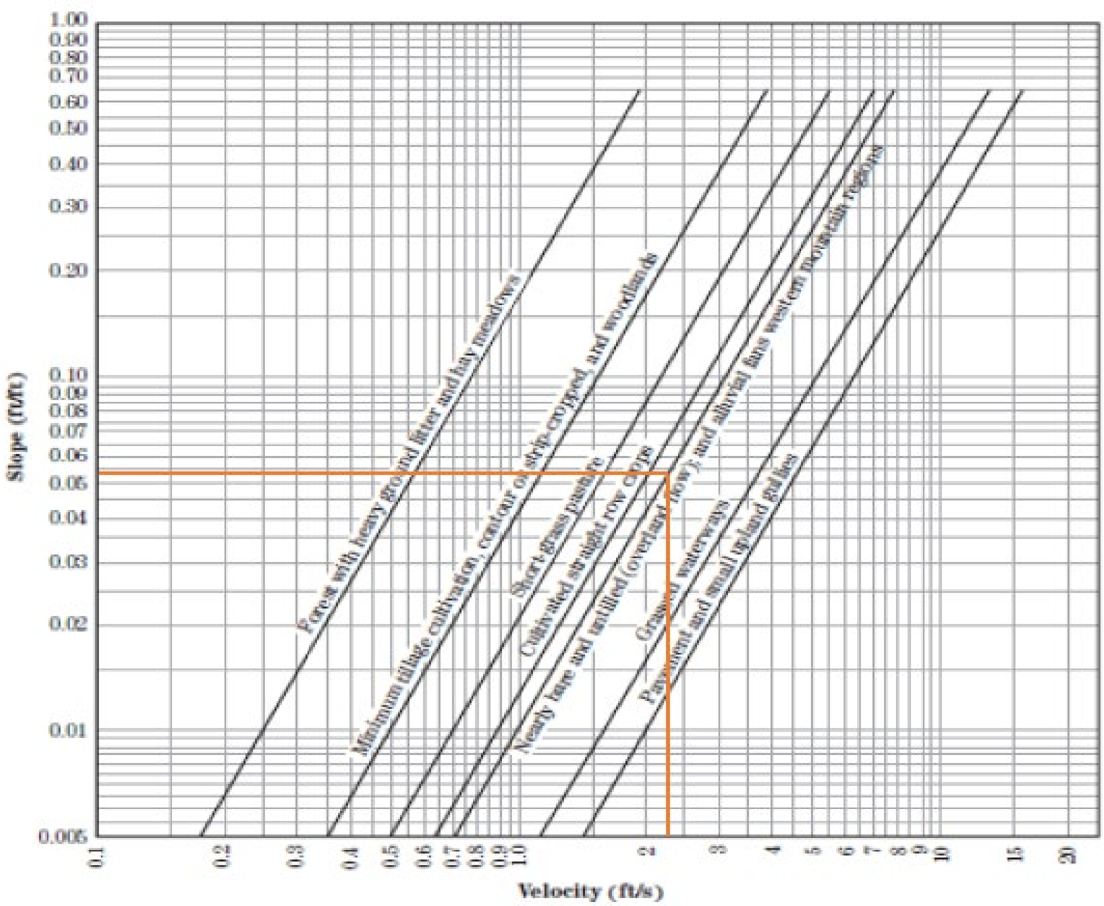
4.3 TIME OF CONCENTRATION CONTINUED

Shallow Concentrated Flow Travel Time

NEH Part 630 Chapter 15 Figure 15-4 (annotated below) was used to determine the average velocity of shallow concentrated flow.

Shallow concentrated flow length	l	3,143	feet
Slope, Forest with ground litter, Fig 15-4	S	0.054	
Ground cover		Nearly bare	
Average Velocity (from Figure 15-4)	v	2.30	feet / second
Shallow concentrated flow time	**t_2**	**0.4**	**hours**
	t_2	**22.8**	**minutes**

Figure 15–4 Velocity versus slope for shallow concentrated flow



Open Channel Flow Travel Time
No areas of open channel flow were identified along the flow path.

Total

Sheet flow travel time	t_1	0.14	hours
Shallow concentrated flow travel time	t_2	0.38	hours
Open channel flow travel time	t_3	0.00	hours
Time of concentration	**TOC**	**0.52**	**hours**
		31.0	**minutes**

4.4 RATING CURVE

Time (hrs)	Water Surface Elevation (feet-msl)	Outlet Discharge (cfs)	Available Feeboard (feet)
1.0	420.0	0	6.0
1.5	420.0	0	6.0
2.0	420.0	0	6.0
2.5	420.0	0	6.0
3.0	420.0	1	6.0
3.5	420.0	1	6.0
4.0	420.0	2	6.0
4.5	420.1	2	5.9
5.0	420.1	3	5.9
5.5	420.1	5	5.9
6.0	420.1	6	5.9
6.5	420.2	7	5.8
7.0	420.2	9	5.8
7.5	420.3	11	5.7
8.0	420.3	13	5.7
8.5	420.4	16	5.6
9.0	420.5	20	5.5
9.5	420.6	26	5.4
10.0	420.7	35	5.3
10.5	420.8	45	5.2
11.0	421.0	57	5.0
11.5	421.2	77	4.8
12.0	421.6	127	4.4
12.5	423.2	346	2.8
13.0	423.6	415	2.4
13.5	423.7	424	2.3
14.0	423.7	422	2.3
14.5	423.6	415	2.4
15.0	423.6	405	2.4
15.5	423.5	394	2.5

4.4 RATING CURVE CONTINUED

Time (hrs)	Water Surface Elevation (feet-msl)	Outlet Discharge (cfs)	Available Feeboard (feet)
16.0	423.4	381	2.6
16.5	423.3	366	2.7
17.0	423.2	351	2.8
17.5	423.1	336	2.9
18.0	423.0	320	3.0
18.5	423.0	305	3.0
19.0	422.9	292	3.1
19.5	422.8	278	3.2
20.0	422.7	266	3.3
20.5	422.6	254	3.4
21.0	422.5	242	3.5
21.5	422.5	232	3.5
22.0	422.4	222	3.6
22.5	422.3	213	3.7
23.0	422.2	204	3.8
23.5	422.2	195	3.8
24.0	422.1	186	3.9
24.5	422.1	177	3.9
25.0	422.0	166	4.0
25.5	421.9	157	4.1
26.0	421.8	148	4.2
26.5	421.7	140	4.3
27.0	421.7	132	4.3
27.5	421.6	125	4.4
28.0	421.6	118	4.4
28.5	421.5	111	4.5
29.0	421.5	106	4.5
29.5	421.4	100	4.6
30.0	421.4	96	4.6
30.5	421.3	91	4.7
31.0	421.3	86	4.7
31.5	421.2	82	4.8
32.0	421.2	78	4.8
32.5	421.1	74	4.9
33.0	421.1	71	4.9
33.5	421.1	67	4.9
34.0	421.0	64	5.0
34.5	421.0	61	5.0
35.0	421.0	58	5.0
35.5	420.9	56	5.1
36.0	420.9	54	5.1
36.5	420.9	52	5.1
37.0	420.9	50	5.1
37.5	420.8	48	5.2

4.4 RATING CURVE CONTINUED

Time (hrs)	Water Surface Elevation (feet-msl)	Outlet Discharge (cfs)	Available Feeboard (feet)
38.0	420.8	46	5.2
38.5	420.8	44	5.2
39.0	420.8	42	5.2
39.5	420.8	41	5.2
40.0	420.7	39	5.3
40.5	420.7	38	5.3
41.0	420.7	36	5.3
41.5	420.7	35	5.3
42.0	420.7	33	5.3
42.5	420.6	32	5.4
43.0	420.6	31	5.4
43.5	420.6	30	5.4
44.0	420.6	28	5.4
44.5	420.6	27	5.4
45.0	420.6	26	5.4
45.5	420.6	25	5.4
46.0	420.5	24	5.5
46.5	420.5	23	5.5
47.0	420.5	22	5.5
47.5	420.5	22	5.5
48.0	420.5	21	5.5

4.5 DRAINAGE BASIN