

**RUN-ON AND RUN-OFF CONTROL PLAN
PLANT GORGAS BOTTOM ASH LANDFILL
ALABAMA POWER COMPANY**

Section 257.81 of EPA's regulations requires the owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill to prepare a run-on and run-off control system plan to document how these control systems have been designed and constructed to meet the applicable requirements of this section of the rule. Each plan is to be supported by appropriate engineering calculations.

The Bottom Ash Landfill is located at Alabama Power Company's Plant Gorgas within the permitted boundaries of the Plant's overall landfill facility. Bottom ash is dry stacked in this area after decanting of the ash at a remote location. The Bottom Ash Stack covers approximately 56 acres.

The storm water flows have been calculated using the Natural Resources Conservation Service method (also known as the Soil Conservation Service (SCS)) method using 24 hour storm events. The storm water detention system has been designed in accordance with the Alabama Soil and Water Conservation Committee requirements as well as other local, city, and government codes. The post developed storm water discharge was designed to be less than the pre-developed storm water discharge in accordance with the requirements of the State of Alabama.

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 site contains areas with hydrological soil groups "A", "B", and "D". A composite curve number was created based on the land use and soil type of the entire drainage area. This information was placed into Hydraflow Hydrographs and used to generate appropriate precipitation curves and storm basin runoff values.

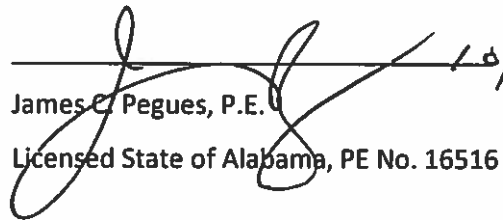
The Plant Gorgas Bottom Ash Landfill is designed and constructed with perimeter berms and drainage ditches around the cells that prevent storm water run-on during the peak discharge of a 24-hr, 25-yr storm from flowing onto the active portion of the landfill.

There are no discharge structures present within the Plant Gorgas Bottom Ash Landfill. Water entering the cell naturally percolates the soil or evaporates so there is not a normal pool within the cell.

Calculations were made to determine if there was sufficient volume available to store the design storm. These calculations indicate that rainfall occurring during a 24-hr, 25-yr storm is safely stored and passed.

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

I hereby certify that the run-on and run-off control system plan meets the requirements of 40 C.F.R. Part 257.81.


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



**Run-on and Run-off Control System Plan for Landfills:
Calculation Summary**

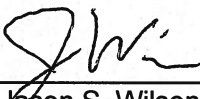
for

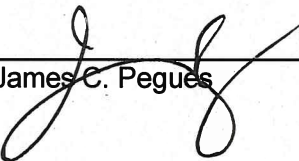
Plant Gorgas CCR Bottom Ash Landfill

Prepared by:

Southern Company Services
Technical Services

Originator:  10/6/16
Curtis R. Upchurch Date

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 run-on and run-off controls of the subject CCR landfill in order to prepare a run-on and run-off control system 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

2.1 Site Overview

The Plant Gorgas CCR Bottom Ash Landfill is located approximately 9 miles west of Birmingham, Alabama on Plant Gorgas property northeast of the plant. The total drain basin area is approximately 78 acres and the area occupied by the CCR landfill is approximately 42 acres. There are no off-site areas draining into the landfill and only stormwater runoff from rain falling directly in the storage area must be collected and controlled. The perimeter of the cell is bounded by high steep slopes on the north, east and west sides and to south by a lower raised roadbed/dike. The storage area is an unlined cell with various soils of hydrologic groups type A, B and D. Water entering the cell naturally percolates the soil or evaporates so there is not a normal pool within the cell.

An overview of Cell 2A is provided in Table 1 below.

Table 1—Landfill site characteristics

Pond Description	Bottom Ash Cell
Size (Acres)	42 +/-
Outlet Type	No spillway structure. Runoff into the site percolates into soil or evaporates.
Outlets To	Subgrade. Overtopping of south road/dike would flow into channel to Black Warrior River

2.2 Run-on Control System Plan

There is no stormwater run-on into the landfill due to the natural hilly terrain surrounding the area. This storage cell is located in a valley and the only stormwater runoff entering the landfill is from rainfall on the outer slopes leading up to the ridge lines or falling directly into the cell. The terrain to the south of the cell falls steeply away preventing any runoff from flowing into the cell.

2.3 Run-off Control System Plan

A hydrologic and hydraulic model was developed for the Plant Gorgas CCR Bottom Ash Landfill to determine the hydraulic capacity of the Cell. The design storm for the purposes of run-off control system plans is the 24-hour, 25-year rainfall event. The

results of routing the design storm event through the landfill are presented in Table 2 below:

Table 2-Flood Routing Results for Plant Gorgas CCR Bottom Ash Landfill

Plant Gorgas	Normal Pool El (ft)	Top of embankment El (ft)	Peak Water Surface Elevation (ft)	Freeboard* (ft)	Peak Inflow (cfs)	Peak Outflow (cfs)
CCR Landfill	N/A No Pool	362.0	360.8	1.2	300	0

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

3.0 Methodology

3.1 HYDROLOGIC ANALYSES

The design storm for all run-on/run-off analyses is a 24-hour, 25-year rainfall event. A summary of the design storm parameters and rainfall distribution methodology for these calculations is summarized below in Table 3.

Table 3. Plant Gorgas CCR Bottom Ash Landfill Design Storm Distribution

Return Frequency (years)	Storm Duration (hours)	Rainfall Total (Inches)	Rainfall Source	Storm Distribution
25	24	7.15	NOAA Atlas 14	SCS Type III

The drainage area for the Plant Gorgas Dry Gypsum Sedimentation Pond was determined based on a composite of Aerial Topo from March 2003, Field Topo August 2008 and Lidar Topo December 2011. 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 methods prescribed in TR-55. Soil types were obtained from the Natural Resources Conservation Service. Land use areas were delineated based on aerial photography. Time of Concentration was also developed based on methodologies prescribed in TR-55.

A table of the pertinent basin characteristics of the landfill is provided below in Table 4.

Table 4—Landfill Hydrologic Information (Bottom Ash Landfill)

Drainage Basin Area (acres)	77.9
Hydrologic Curve Number, CN	74
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	13.4
Hydrologic Software	Hydroflow Hydrographs

Runoff values were determined by importing the characteristics developed above into a hydrologic model in Hydroflow Hydrographs Extension of AutoCad Civil 3D, 2013.

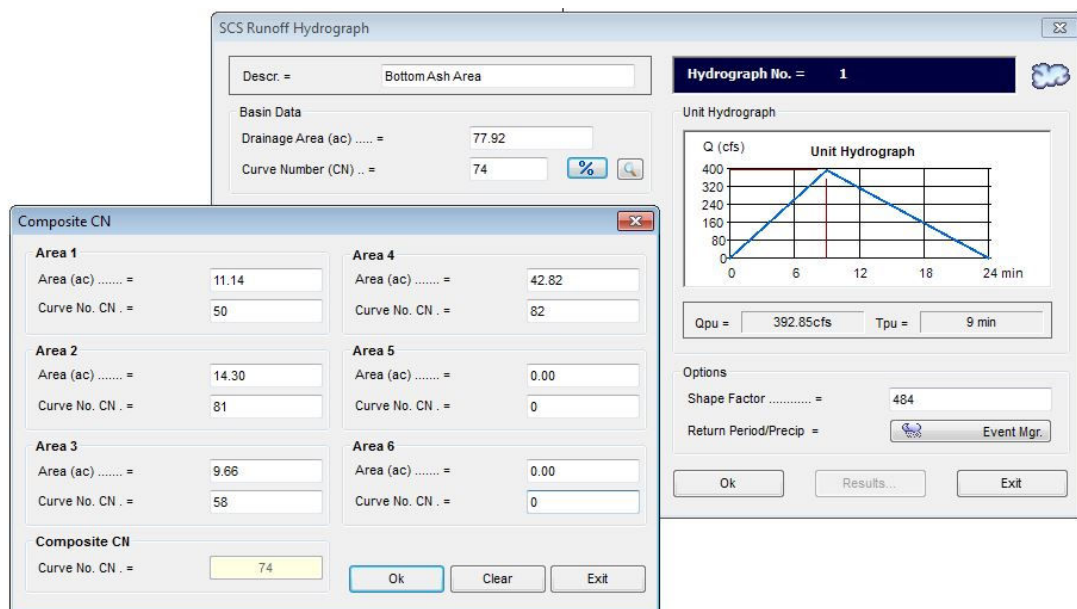
3.2 HYDRAULIC ANALYSES

Storage values for the landfill were determined by developing a stage-storage relationship utilizing contour data. There is no spillway system for runoff leaving the landfill area. All runoff from this drainage basin will flow south to a raised roadbed/dike area. There is no defined channel within the landfill area.

Based on the basin attributes including stage/storage information a rating curve was developed and inserted into Hydraflow Hydrographs software to analyze the depth of possible ponding during the design storm. Exfiltration in the landfill area has not been address in these calculations due to the lack of geotechnical information. Results are shown in Table 2.

4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBER BOTTOM ASH LANDFILL



4.2 STAGE-STORAGE TABLE BOTTOM ASH LANDFILL

Pond Name Bottom Ash Cell Detention Area						
Row	Stage	Elevation	Contour Area	Incremental Storage	Total Storage	Total Discharge
	(ft)	(ft)	(sqft)	(cuft)	(cuft)	(cfs)
0	0.00	355.00	n/a	n/a	0.00	0.000
1	1.00	356.00	n/a	48,492	48,492	0.000
2	2.00	357.00	n/a	176,391	224,883	0.000
3	3.00	358.00	n/a	216,891	441,774	0.000
4	4.00	359.00	n/a	244,161	685,935	0.000
5	5.00	360.00	n/a	253,584	939,519	0.000
6	6.00	361.00	n/a	285,795	1,225,314	0.000
7	7.00	362.00	n/a	300,780	1,526,094	120.84
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

4.3 TIME OF CONCENTRATION BOTTOM ASH LANDFILL

SCS Runoff Hydrograph

Descr. = Bottom Ash Area

Hydrograph No. = 1

Basin Data

Drainage Area (ac) = 77.92

Curve Number (CN) .. = 74

Time of Concentration

☐ Lag ☒ Kirpich ☐ User ☐ TR55

Basin Slope (%) = 4.6

Hydraulic Length (ft) = 3413

Time of Conc. (Min) .. = 13.4

Hydrologic Data

Time Interval (Min) = 3

Storm Distribution = Type III

Storm Duration (Hrs) . = 24

Unit Hydrograph

Q (cfs)

Unit Hydrograph

Qpu = 392.85cfs Tpu = 9 min

Options

Shape Factor = 484

Return Period/Precip = Event Mgr.

Ok Results... Exit

4.4 RESULTS

4.4.1 BOTTOM ASH LANDFILL

Hydrograph Report

4

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

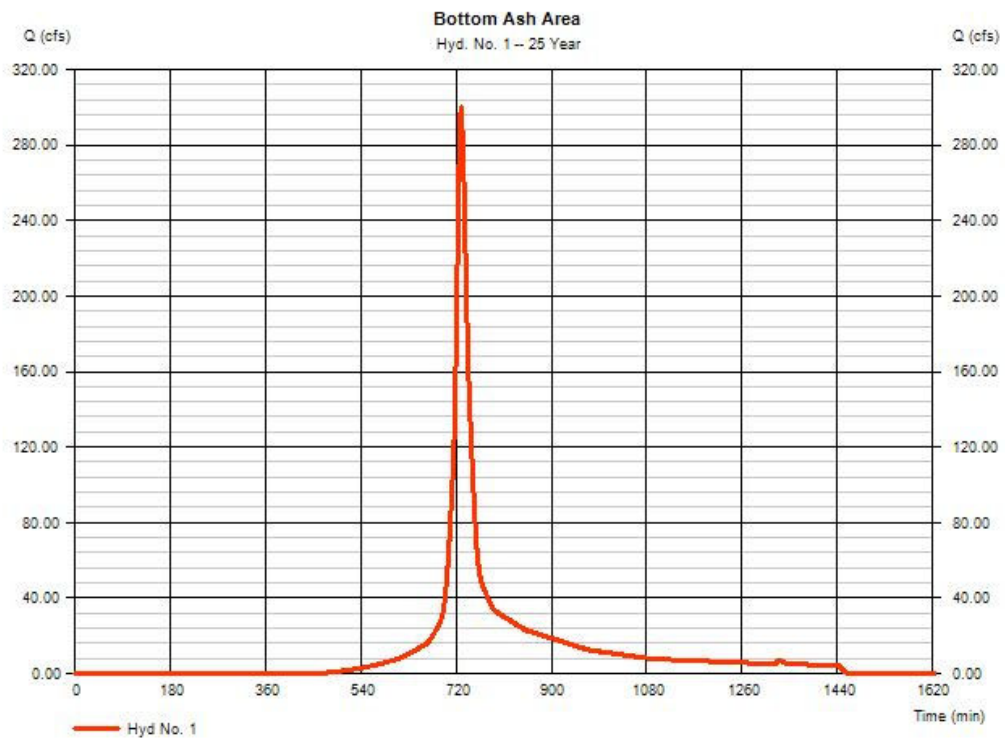
Saturday, 10 / 1 / 2016

Hyd. No. 1

Bottom Ash Area

Hydrograph type	= SCS Runoff	Peak discharge	= 300.06 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 3 min	Hyd. volume	= 1,180,365 cuft
Drainage area	= 77.920 ac	Curve number	= 74*
Basin Slope	= 4.6 %	Hydraulic length	= 3413 ft
Tc method	= KIRPICH	Time of conc. (Tc)	= 13.41 min
Total precip.	= 7.15 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(11.140 \times 50) + (14.300 \times 51) + (9.660 \times 58) + (42.820 \times 52)] / 77.920$



4.4.2 BOTTOM ASH LANDFILL DETENTION (NO DISCHARGE)

Hydrograph Report

5

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

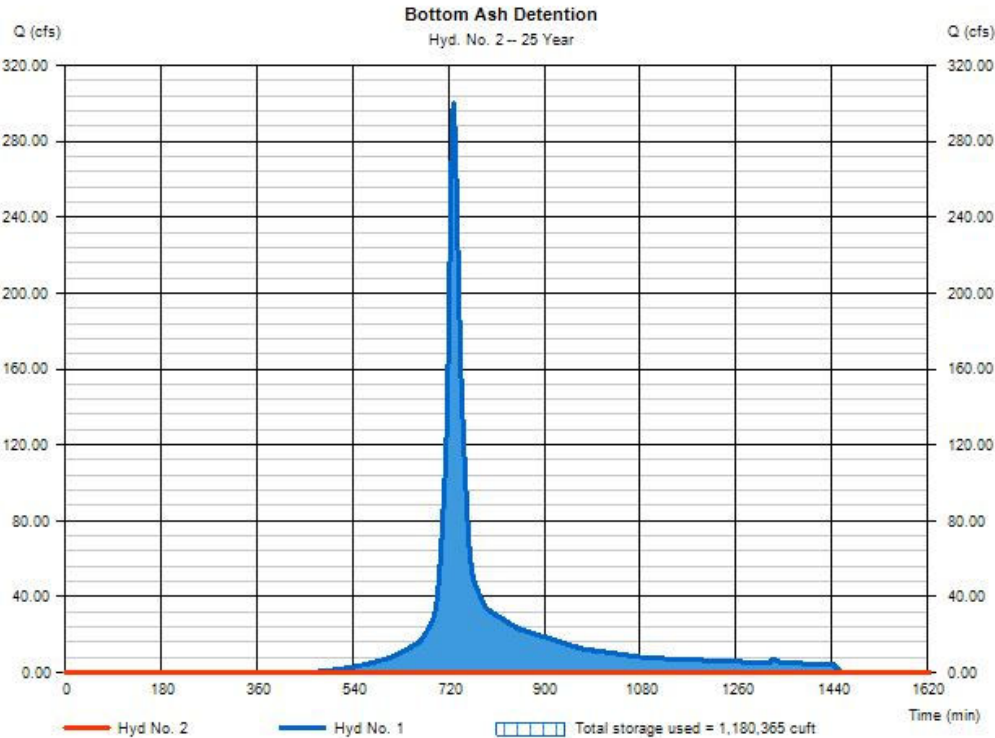
Saturday, 10 / 1 / 2016

Hyd. No. 2

Bottom Ash Detention

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 3 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 1 - Bottom Ash Area	Max. Elevation	= 360.84 ft
Reservoir name	= Bottom Ash Cell Detention Area	Max. Storage	= 1,180,365 cuft

Storage indication method used:



4.5 DRAINAGE BASIN

