PERIODIC INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
391-3-4-.10(5) and 40 C.F.R. PART 257.82
PLANT BOWEN ASH POND 1 (AP-1)
GEORGIA POWER COMPANY

The Federal CCR Rule, and, for Existing Surface Impoundments where applicable, the Georgia CCR Rule (391-3-4-.10) require the owner or operator of a CCR surface impoundment to design, construct, operate and maintain an inflow design flood control system capable of adequately managing flow during and following the peak discharge of the specified inflow design flood. The owner or operator must prepare an inflow design flood system written plan documenting how the inflow design flood control system has been designed and constructed. *See* 40 C.F.R. § 257.82; Ga. Comp. R. & Regs. r. 391.3-4-.10(5)(b). In addition, the Rules require periodic inflow design flood control system plans within 5 years of development of the previous plan. *See* 40 C.F.R. § 257.82(c)(4); Ga. Comp. R. & Regs. r. 391.3-4-.10(5)(b).

The existing CCR surface impoundment known as AP-1 is located west of Cartersville, Georgia on property at Plant Bowen. The Notification of Intent to Initiate Closure was placed in the Operating Record on 12/31/2020 and closure has been designed to have no negative impacts on the inflow design flood control plan. The facility consists of an approximate 254-acre CCR storage area. The northern 125 acres is a dry stack area with ash stacked above the normal full pond elevation. Water does not impound in this area. In the southern portion of the CCR unit, there are areas that have historically impounded water, including the lined gypsum dewatering cells, the lined ash dewatering cells and the recycle pond. Current construction activities include dewatering and removal of lined components in these areas.

A perimeter drainage ditch in the southwestern portion of the pond is lined with a HDPE geomembrane. The inflow design flood consists of the rainfall that falls within the limits of AP-1. Stormwater is temporarily stored within the limits of the Recycle Pond until it is pumped back into the plant as process water. There are also emergency discharge valves located upstream of the pumps that can be manually opened to discharge to a tributary to Euharlee Creek.

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 1,000-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 the National Oceanic and Atmospheric Administration's (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 group "B" should be used to best reflect the characteristics of the soils on site. This information was placed into Hydraflow Hydrographs 2019 and used to generate appropriate precipitation curves, storm basin routing information, and resulting rating curves to evaluate surface impoundment capacity.

The existing water management systems, except for certain sections of the perimeter toe ditch for the northern stack area, are designed, constructed, operated and maintained to adequately manage flow during and following the peak discharge from the 1,000-year storm. The sections that cannot manage the design storm are the perimeter toe ditch Basin Section 1 and Sections 3-7 (basin sections as defined in the calculation). This toe drain ditch receives and manages only stormwater that falls on the outside of the surface impoundment, does not transport water that comes in contact with ash and does not impact the flood routing of stormwater through the interior of the surface impoundment.

This plan is supported by appropriate engineering calculations which are attached.

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

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

10/15/2021

James C. Pegues, P.E.
Licensed State of Georgia, PE No. 17419

Inflow Design Control System Plan:
Hydrologic and Hydraulic Calculation Summary

for

Plant Bowen Ash Pond

Prepared by:

Southern Company Services
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Originator: Jeremy Brown 10/6/21
Jeremy K. Brown Date

Reviewer: Joshua K Myers 10/8/21
Joshua K. Myers Date

Approval: 10/8/21
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 C.F.R. Part 257) and the Georgia Environmental Protection Division's (EPD) Georgia CCR Rule (391-3-4-.10).

2.0 Summary of Conclusions

A hydrologic and hydraulic model was developed for the Plant Bowen Ash Pond to determine the hydraulic capacity of the impoundment. The design storm for the Plant Bowen Ash 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 Bowen Ash Pond

Plant Bowen Ash Pond		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)
Northern Section	Basin 1	NA**	713.00	NA***	713.00	NA	26.65	NA****
	Basin 2	NA**	713.00	NA***	712.46	0.54	40.57	6.83
	Basin 3	NA**	713.00	NA***	713.00	NA	24.40	NA****
	Basin 4	NA**	713.00	NA***	713.00	NA	31.76	NA****
	Basin 5	NA**	714.00	NA***	714.00	NA	17.85	NA****
	Basin 6	NA**	714.00	NA***	714.00	NA	17.52	NA****
	Basin 7	NA**	714.00	NA***	714.00	NA	50.85	NA****
	Basin 8	NA**	714.00	NA***	711.97	2.03	475.12	461.64
Southern Section	Basin 1	701.00	712.00	NA***	703.41	8.59	401.51	NA*****
	Basin 2	721.00	725.00	NA***	723.01	1.99	102.14	NA*****
	Basin 3	722.00	725.00	NA***	723.63	1.37	99.09	NA*****
	Basin 4	732.00	736.00	NA***	733.09	2.91	316.11	NA*****
	Basin 5	707.00	713.00	NA***	713.00	NA	895.87	NA*****

*Freeboard is measured from the top of embankment to the peak water surface elevation.
**These "basins" are perimeter ditches that do not have standing water in them.
***There are no auxiliary spillways for the Ash Pond.
****These basins overtop the embankment.
*****These basins have no outlet structure. Stormwater is pumped out of the basins.

As seen in Table 1, 6 of the 7 perimeter ditches (Basins 1 and 3-7) will overtop during the design storm. However, it is important to note that none of these "basins" contain or come in

contact with CCR. All other basins, particularly those that contain CCR, safely contain and/or pass the 1,000-yr design storm.

3.0 Methodology

3.1 HYDROLOGIC ANALYSES

The Plant Bowen Ash 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 Bowen Ash Pond Storm Distribution

Hazard Classification	Return Frequency (years)	Storm Duration (hours)	Rainfall Total (Inches)	Rainfall Source	Storm Distribution
Significant	1000	24	9.98	NOAA Atlas 14	SCS Type II

The drainage area for the Plant Bowen Ash Pond was delineated based on LiDAR data acquired for the Plant in 2019. 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 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 and Lag Time calculations were also developed based on methodologies prescribed in TR-55 or designated by the user in certain instances in accordance with the current version of the Georgia Stormwater Management Manual.

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

Table 3 - Ash Pond Hydrologic Information

Plant Bowen Ash Pond		Drainage Basin Area (acres)	Hydrologic Curve Number, CN	Hydrologic Methodology	Time of Concentration (min)	Hydrologic Software
Northern Section	Basin 1	2.25	73	SCS Method	5.3	Hydraflow Hydrographs
	Basin 2	3.90	71		7.6	
	Basin 3	2.17	70		6.6	
	Basin 4	3.70	64		8.9	
	Basin 5	1.79	64		6.0	
	Basin 6	1.72	65		6.3	
	Basin 7	6.35	65		11.6	
	Basin 8	106.69	63		26.9	
Southern Section	Basin 1	27.07	100		5.0	
	Basin 2	6.91	97		5.0	
	Basin 3	6.69	98		5.0	
	Basin 4	21.20	98		5.0	
	Basin 5	66.93	82		5.0	

Run-off values were determined by importing the characteristics developed above into a hydrologic model with the Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2019.

Process flows from Plant Bowen were not considered in this analysis as flows ceased being sent to the Ash Pond in December 2019.

3.2 HYDRAULIC ANALYSES

Storage values for the Ash Pond were determined by developing a stage-storage relationship utilizing contour data. Basins 1-8 in the northern section of the Ash Pond do not have spillways but do have outlet pipes. Basins 1-7 represent the perimeter ditches that do not contain ash and Basin 8 represents the northern ash stack. Basins 1-5 in the southern section of the Ash Pond do not have spillways either and are drawn down by pumps.

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)
Northern Section	Basin 1	709.00	708.00	1	1.00%	100*	3.98**
	Basin 2	707.00	706.00	1	1.00%	100*	3.98**
	Basin 3	709.00	708.00	1	1.00%	100*	3.98**
	Basin 4	709.00	708.00	1	1.00%	100*	3.98**
	Basin 5	710.00	709.00	1	1.00%	100*	3.98**
	Basin 6	711.00	710.00	1	1.00%	100*	3.98**
	Basin 7	710.00	709.00	1.25	1.00%	100*	3.98**
	Basin 8	706.00	705.63	4.5	0.50%	75	113.4**
Southern Section	Basin 1	NA***	NA***	NA***	NA***	NA***	NA***
	Basin 2	NA***	NA***	NA***	NA***	NA***	NA***
	Basin 3	NA***	NA***	NA***	NA***	NA***	NA***
	Basin 4	NA***	NA***	NA***	NA***	NA***	NA***
	Basin 5	NA***	NA***	NA***	NA***	NA***	NA***

*Exact length of outlet pipe unknown.
**Spillway capacity is based on outlet pipe capacity.
***No spillway.

Based on the spillway attributes listed above, the data was inserted into Hydraflow Hydrographs to determine the pond performance during the design storm. Results are shown in Table 1.

4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBER

4.1.1 NORTHERN SECTION – BASIN 1

Terrain Type	Area	Curve Number
Grass	1.14	61
Gravel	1.11	85

4.1.2 NORTHERN SECTION – BASIN 2

Terrain Type	Area	Curve Number
Grass	2.28	61
Gravel	1.62	85

4.1.3 NORTHERN SECTION – BASIN 3

Terrain Type	Area	Curve Number
Grass	1.39	61
Gravel	0.77	85
HDPE	0.01	98

4.1.4 NORTHERN SECTION – BASIN 4

Terrain Type	Area	Curve Number
Grass	3.22	61
Gravel	0.48	85

4.1.5 NORTHERN SECTION – BASIN 5

Terrain Type	Area	Curve Number
Grass	1.57	61
Gravel	0.22	85

4.1.6 NORTHERN SECTION – BASIN 6

Terrain Type	Area	Curve Number
Grass	1.43	61
Gravel	0.29	85

4.1.7 NORTHERN SECTION – BASIN 7

Terrain Type	Area	Curve Number
Grass	5.40	61
Gravel	0.95	85

4.1.8 NORTHERN SECTION – BASIN 8

Terrain Type	Area	Curve Number
Grass	98.89	61
Gravel	3.43	85
HDPE	4.37	98

4.1.9 SOUTHERN SECTION – BASIN 1

Terrain Type	Area	Curve Number
Gravel	0.76	85
HDPE/Water	26.31	100

4.1.10 SOUTHERN SECTION – BASIN 2

Terrain Type	Area	Curve Number
Gravel	1.29	85
HDPE/Water	5.62	100

4.1.11 SOUTHERN SECTION – BASIN 3

Terrain Type	Area	Curve Number
Gravel	0.99	85
HDPE/Water	5.70	100

4.1.12 SOUTHERN SECTION – BASIN 4

Terrain Type	Area	Curve Number
Gravel	4.52	85
HDPE/Water	16.86	100

4.1.13 SOUTHERN SECTION – BASIN 5

Terrain Type	Area	Curve Number
Grass	11.87	61
Gravel	18.43	85
Ash (Bare Soil)	31.35	86
HDPE/Water	5.28	100

4.2 STAGE-STORAGE TABLE

4.2.1 NORTHERN SECTION – BASIN 1

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	709.00	00	0	0
1.00	710.00	26	9	9
2.00	711.00	518	220	229
3.00	712.00	2,505	1,387	1,616
4.00	713.00	7,667	4,851	6,467

4.2.2 NORTHERN SECTION – BASIN 2

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	707.00	00	0	0
1.00	708.00	389	130	130
2.00	709.00	934	642	772
3.00	710.00	3,773	2,195	2,966
4.00	711.00	8,114	5,806	8,772
5.00	712.00	13,841	10,850	19,622
6.00	713.00	23,699	18,549	38,170

4.2.3 NORTHERN SECTION – BASIN 3

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	709.00	00	0	0
1.00	710.00	302	101	101
2.00	711.00	1,413	789	890
3.00	712.00	3,731	2,480	3,370
4.00	713.00	7,228	5,383	8,753

4.2.4 NORTHERN SECTION – BASIN 4

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	709.00	00	0	0
1.00	710.00	10	3	3
2.00	711.00	550	211	215
3.00	712.00	1,734	1,087	1,301
4.00	713.00	4,701	3,096	4,398

4.2.5 NORTHERN SECTION – BASIN 5

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	710.00	00	0	0
1.00	711.00	56	19	19
2.00	712.00	940	408	427
3.00	713.00	2,517	1,665	2,092
4.00	714.00	4,847	3,619	5,711

4.2.6 NORTHERN SECTION – BASIN 6

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	711.00	00	0	0
1.00	712.00	936	312	312
2.00	713.00	2,752	1,764	2,076
3.00	714.00	5,716	4,144	6,220

4.2.7 NORTHERN SECTION – BASIN 7

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	710.00	00	0	0
1.00	711.00	209	70	70
2.00	712.00	2,204	1,030	1,100
3.00	713.00	7,496	4,588	5,688
4.00	714.00	21,203	13,767	19,455

4.2.8 NORTHERN SECTION – BASIN 8

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	706.00	00	0	0
1.00	707.00	5,897	1,965	1,965
2.00	708.00	7,165	6,520	8,486
3.00	709.00	8,444	7,795	16,281
4.00	710.00	10,154	9,285	25,565
5.00	711.00	12,965	11,530	37,095
6.00	712.00	16,069	14,488	51,583
7.00	713.00	22,001	18,956	70,539
8.00	714.00	37,375	29,348	99,886

4.2.9 SOUTHERN SECTION – BASIN 1

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	701.00	328,765	0	0
1.00	702.00	394,049	360,879	360,879
2.00	703.00	480,061	436,304	797,183
3.00	704.00	556,300	517,661	1,314,844
4.00	705.00	620,458	588,029	1,902,872
5.00	706.00	720,549	669,813	2,572,685
6.00	707.00	833,554	776,288	3,348,974
7.00	708.00	917,548	875,128	4,224,101
8.00	709.00	971,301	944,203	5,168,304
9.00	710.00	1,005,680	988,342	6,156,646
10.00	711.00	1,023,524	1,014,488	7,171,133
11.00	712.00	1,039,142	1,031,220	8,202,353

4.2.10 SOUTHERN SECTION – BASIN 2

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	721.00	62,643	0	0
1.00	722.00	65,476	64,048	64,048
2.00	723.00	117,039	90,009	154,057
3.00	724.00	163,106	139,423	293,480
4.00	725.00	245,811	203,030	496,510

4.2.10 SOUTHERN SECTION – BASIN 3

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	722.00	65,653	0	0
1.00	723.00	68,563	67,096	67,096
2.00	724.00	221,996	137,963	205,059
3.00	725.00	367,880	291,855	496,914

4.2.11 SOUTHERN SECTION – BASIN 4

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	732.00	581,434	0	0
1.00	733.00	598,738	590,006	590,006
2.00	734.00	657,434	627,795	1,217,800
3.00	735.00	700,257	678,665	1,896,466
4.00	736.00	729,571	714,793	2,611,258

4.2.12 SOUTHERN SECTION – BASIN 5

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	707.00	60,440	0	0
1.00	708.00	152,078	102,787	102,787
2.00	709.00	227,121	188,331	291,117
3.00	710.00	247,642	237,284	528,401
4.00	711.00	275,517	261,430	789,831
5.00	712.00	303,950	289,588	1,079,419
6.00	713.00	365,925	334,425	1,413,844
7.00	714.00	514,979	438,291	1,852,135

4.3 TIME OF CONCENTRATION

4.3.1 NORTHERN SECTION – BASIN 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 77.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.79		0.00		0.00		
Land slope (%)	= 25.00		0.00		0.00		
Travel Time (min)	**= 2.66**	**+**	**0.00**	**+**	**0.00**	**=**	**2.66**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 7.36		0.00		0.00		
Wetted perimeter (ft)	= 8.86		0.00		0.00		
Channel slope (%)	= 0.69		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=3.64						
			0.00				
					0.00		
Flow length (ft)	({0})583.0		0.0		0.0		
Travel Time (min)	**= 2.67**	**+**	**0.00**	**+**	**0.00**	**=**	**2.67**
Total Travel Time, Tc							**5.33 min**

4.3.2 NORTHERN SECTION – BASIN 2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 98.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.79		0.00		0.00		
Land slope (%)	= 23.72		0.00		0.00		
Travel Time (min)	**= 3.29**	**+**	**0.00**	**+**	**0.00**	**=**	**3.29**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 10.59		0.00		0.00		
Wetted perimeter (ft)	= 10.47		0.00		0.00		
Channel slope (%)	= 0.60		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=3.88						
			0.00				
					0.00		
Flow length (ft)	({0})998.0		0.0		0.0		
Travel Time (min)	**= 4.29**	**+**	**0.00**	**+**	**0.00**	**=**	**4.29**
Total Travel Time, Tc							**7.58 min**

4.3.3 NORTHERN SECTION – BASIN 3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 115.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.79		0.00		0.00		
Land slope (%)	= 22.17		0.00		0.00		
Travel Time (min)	**= 3.85**	**+**	**0.00**	**+**	**0.00**	**=**	**3.85**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 6.99		0.00		0.00		
Wetted perimeter (ft)	= 8.63		0.00		0.00		
Channel slope (%)	= 0.68		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=3.56						
			0.00				
					0.00		
Flow length (ft)	({0})587.0		0.0		0.0		
Travel Time (min)	**= 2.75**	**+**	**0.00**	**+**	**0.00**	**=**	**2.75**
Total Travel Time, Tc							**6.60 min**

4.3.4 NORTHERN SECTION – BASIN 4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 106.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.79		0.00		0.00		
Land slope (%)	= 24.76		0.00		0.00		
Travel Time (min)	**= 3.45**	**+**	**0.00**	**+**	**0.00**	**=**	**3.45**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 9.27		0.00		0.00		
Wetted perimeter (ft)	= 9.84		0.00		0.00		
Channel slope (%)	= 0.53		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=3.47						
			0.00				
					0.00		
Flow length (ft)	({0})1127.0		0.0		0.0		
Travel Time (min)	**= 5.41**	**+**	**0.00**	**+**	**0.00**	**=**	**5.41**
Total Travel Time, Tc							**8.85 min**

4.3.5 NORTHERN SECTION – BASIN 5

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 109.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.79		0.00		0.00		
Land slope (%)	= 24.08		0.00		0.00		
Travel Time (min)	**= 3.57**	**+**	**0.00**	**+**	**0.00**	**=**	**3.57**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 5.00		0.00		0.00		
Wetted perimeter (ft)	= 7.47		0.00		0.00		
Channel slope (%)	= 0.92		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=3.64						
			0.00				
					0.00		
Flow length (ft)	({0})541.0		0.0		0.0		
Travel Time (min)	**= 2.48**	**+**	**0.00**	**+**	**0.00**	**=**	**2.48**
Total Travel Time, Tc							**6.04 min**

4.3.6 NORTHERN SECTION – BASIN 6

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 98.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.79		0.00		0.00		
Land slope (%)	= 24.74		0.00		0.00		
Travel Time (min)	**= 3.24**	**+**	**0.00**	**+**	**0.00**	**=**	**3.24**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 6.09		0.00		0.00		
Wetted perimeter (ft)	= 8.14		0.00		0.00		
Channel slope (%)	= 0.51		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=2.92						
			0.00				
					0.00		
Flow length (ft)	({0})541.0		0.0		0.0		
Travel Time (min)	**= 3.09**	**+**	**0.00**	**+**	**0.00**	**=**	**3.09**
Total Travel Time, Tc							**6.32 min**

4.3.7 NORTHERN SECTION – BASIN 7

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 88.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.79		0.00		0.00		
Land slope (%)	= 9.38		0.00		0.00		
Travel Time (min)	**= 4.38**	**+**	**0.00**	**+**	**0.00**	**=**	**4.38**
Shallow Concentrated Flow							
Flow length (ft)	= 174.00		0.00		0.00		
Watercourse slope (%)	= 0.57		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.22		0.00		0.00		
Travel Time (min)	**= 2.38**	**+**	**0.00**	**+**	**0.00**	**=**	**2.38**
Channel Flow							
X sectional flow area (sqft)	= 36.00		0.00		0.00		
Wetted perimeter (ft)	= 24.78		0.00		0.00		
Channel slope (%)	= 0.52		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=4.60						
			0.00				
					0.00		
Flow length (ft)	({0})1348.0		0.0		0.0		
Travel Time (min)	**= 4.88**	**+**	**0.00**	**+**	**0.00**	**=**	**4.88**
Total Travel Time, Tc							**11.65 min**

4.3.8 NORTHERN SECTION – BASIN 8

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.79		0.00		0.00		
Land slope (%)	= 0.75		0.00		0.00		
Travel Time (min)	**= 13.33**	**+**	**0.00**	**+**	**0.00**	**=**	**13.33**
Shallow Concentrated Flow							
Flow length (ft)	= 722.00		0.00		0.00		
Watercourse slope (%)	= 1.97		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.26		0.00		0.00		
Travel Time (min)	**= 5.31**	**+**	**0.00**	**+**	**0.00**	**=**	**5.31**
Channel Flow							
X sectional flow area (sqft)	= 0.38		21.94		39.07		
Wetted perimeter (ft)	= 1.55		15.24		26.95		
Channel slope (%)	= 15.77		0.51		0.70		
Manning's n-value	= 0.013		0.013		0.013		
Velocity (ft/s)	=17.90						
			10.45				
					12.30		
Flow length (ft)	({0})168.0		4137.0		1135.0		
Travel Time (min)	**= 0.16**	**+**	**6.60**	**+**	**1.54**	**=**	**8.29**
Total Travel Time, Tc							**26.94 min**

4.3.9 SOUTHERN SECTION – BASIN 1

Basin 1 only receives stormwater that fall directly in its footprint. Therefore, a Time of Concentration of 5.0 minutes was assigned.

4.3.10 SOUTHERN SECTION – BASIN 2

Basin 2 only receives stormwater that fall directly in its footprint. Therefore, a Time of Concentration of 5.0 minutes was assigned.

4.3.11 SOUTHERN SECTION – BASIN 3

Basin 3 only receives stormwater that fall directly in its footprint. Therefore, a Time of Concentration of 5.0 minutes was assigned.

4.3.12 SOUTHERN SECTION – BASIN 4

Basin 4 only receives stormwater that fall directly in its footprint. Therefore, a Time of Concentration of 5.0 minutes was assigned.

4.3.13 SOUTHERN SECTION – BASIN 5

Basin 5 only receives stormwater that fall directly in its footprint. Therefore, a Time of Concentration of 5.0 minutes was assigned.

4.4 RATING CURVE

4.4.1 NORTHERN SECTION – BASIN 1

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	709.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	9	710.00	2.67 ic	---	---	---	---	---	---	---	---	---	2.674
2.00	229	711.00	4.16 oc	---	---	---	---	---	---	---	---	---	4.156
3.00	1,616	712.00	5.09 oc	---	---	---	---	---	---	---	---	---	5.090
4.00	6,467	713.00	5.88 oc	---	---	---	---	---	---	---	---	---	5.878

4.4.2 NORTHERN SECTION – BASIN 2

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	707.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	130	708.00	2.67 ic	---	---	---	---	---	---	---	---	---	2.674
2.00	772	709.00	4.16 oc	---	---	---	---	---	---	---	---	---	4.156
3.00	2,966	710.00	5.09 oc	---	---	---	---	---	---	---	---	---	5.090
4.00	8,772	711.00	5.88 oc	---	---	---	---	---	---	---	---	---	5.878
5.00	19,622	712.00	6.57 oc	---	---	---	---	---	---	---	---	---	6.572
6.00	38,170	713.00	7.20 oc	---	---	---	---	---	---	---	---	---	7.199

4.4.3 NORTHERN SECTION – BASIN 3

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	709.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	101	710.00	2.67 ic	---	---	---	---	---	---	---	---	---	2.674
2.00	890	711.00	4.16 oc	---	---	---	---	---	---	---	---	---	4.156
3.00	3,370	712.00	5.09 oc	---	---	---	---	---	---	---	---	---	5.090
4.00	8,753	713.00	5.88 oc	---	---	---	---	---	---	---	---	---	5.878

4.4.4 NORTHERN SECTION – BASIN 4

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	709.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	3	710.00	2.67 ic	---	---	---	---	---	---	---	---	---	2.674
2.00	215	711.00	4.16 oc	---	---	---	---	---	---	---	---	---	4.156
3.00	1,301	712.00	5.09 oc	---	---	---	---	---	---	---	---	---	5.090
4.00	4,398	713.00	5.88 oc	---	---	---	---	---	---	---	---	---	5.878

4.4.5 NORTHERN SECTION – BASIN 5

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	710.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	19	711.00	2.67 ic	---	---	---	---	---	---	---	---	---	2.674
2.00	427	712.00	4.16 oc	---	---	---	---	---	---	---	---	---	4.156
3.00	2,092	713.00	5.09 oc	---	---	---	---	---	---	---	---	---	5.090
4.00	5,711	714.00	5.88 oc	---	---	---	---	---	---	---	---	---	5.878

4.4.6 NORTHERN SECTION – BASIN 6

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	711.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	312	712.00	2.67 ic	---	---	---	---	---	---	---	---	---	2.674
2.00	2,076	713.00	4.16 oc	---	---	---	---	---	---	---	---	---	4.156
3.00	6,220	714.00	5.09 oc	---	---	---	---	---	---	---	---	---	5.090

4.4.7 NORTHERN SECTION – BASIN 7

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	710.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	70	711.00	3.58 ic	---	---	---	---	---	---	---	---	---	3.584
2.00	1,100	712.00	6.68 oc	---	---	---	---	---	---	---	---	---	6.680
3.00	5,688	713.00	8.37 oc	---	---	---	---	---	---	---	---	---	8.374
4.00	19,455	714.00	9.78 oc	---	---	---	---	---	---	---	---	---	9.779

4.4.8 NORTHERN SECTION – BASIN 8

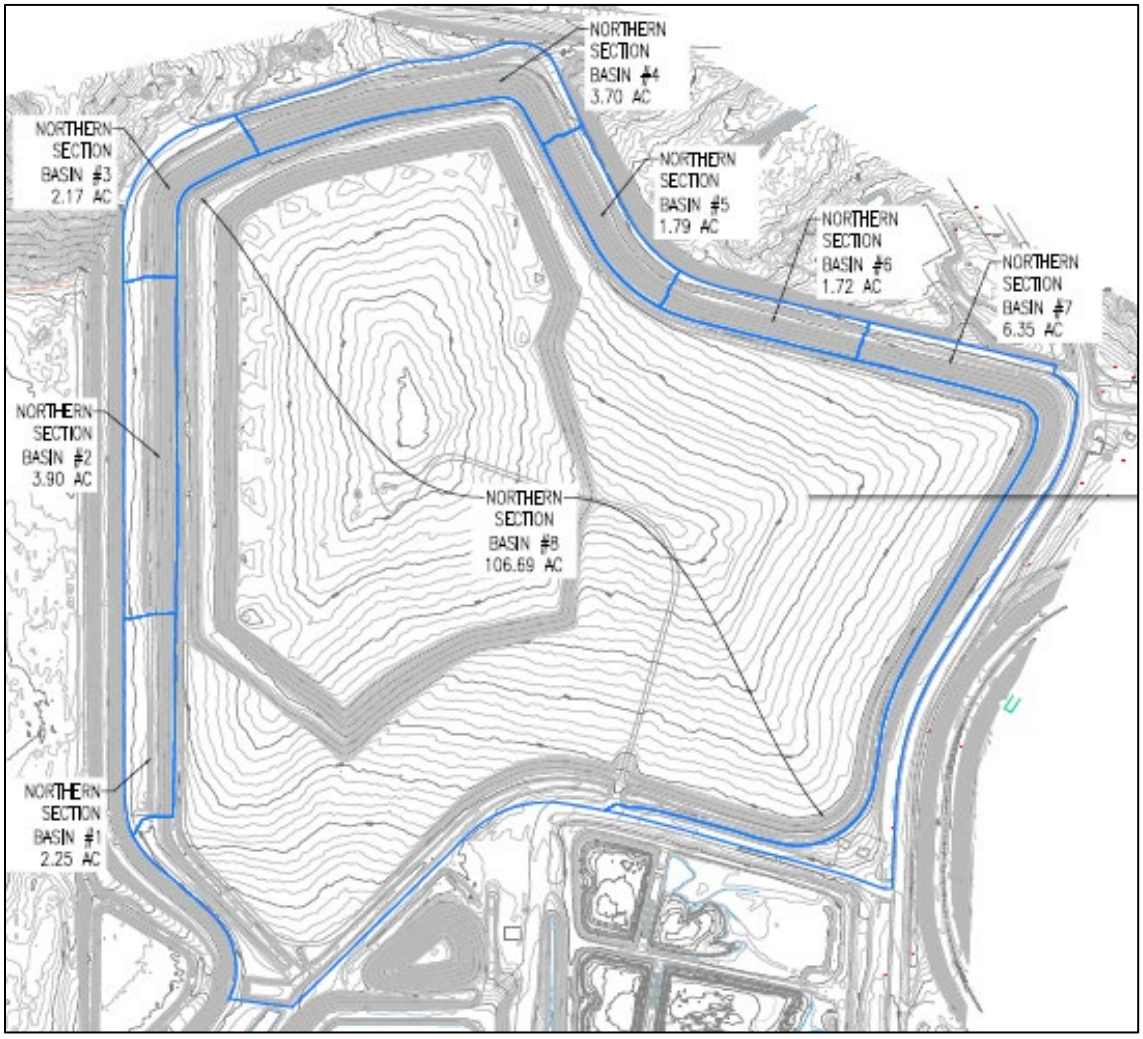
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	706.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	1,965	707.00	32.69 oc	---	---	---	---	---	---	---	---	---	32.69
2.00	8,486	708.00	91.66 oc	---	---	---	---	---	---	---	---	---	91.66
3.00	16,281	709.00	151.61 oc	---	---	---	---	---	---	---	---	---	151.61
4.00	25,565	710.00	188.93 oc	---	---	---	---	---	---	---	---	---	188.93
5.00	37,095	711.00	349.92 oc	---	---	---	---	---	---	---	---	---	349.92
6.00	51,583	712.00	465.17 oc	---	---	---	---	---	---	---	---	---	465.17
7.00	70,539	713.00	557.07 oc	---	---	---	---	---	---	---	---	---	557.07
8.00	99,886	714.00	612.36 ic	---	---	---	---	---	---	---	---	---	612.36

4.4.9 SOUTHERN SECTION – BASINS 1-5

There is no curve rating for Basins 1-5 because there is no outlet control structure in any basin. Stormwater is pumped out of the basins.

4.5 DRAINAGE BASIN

4.5.1 NORTHERN SECTION – BASINS 1-8



4.5.2 SOUTHERN SECTION – BASINS 1-5