PERIODIC RUN-ON AND RUN-OFF CONTROL PLAN
PLANT GORGAS CCR LANDFILL
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 run-on and run-off control requirements for CCR landfills. Per §257.81 and ADEM Admin. Code r. 335-13-15-.05(2), the owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate and maintain a run-on control system to prevent flow onto the active and/or closed portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm. In addition, the owner or operator must design, construct, operate and maintain a run-off control system from the active and/or closed portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm. The owner or operator also must prepare a written plan documenting how the run-on and run-0ff control system plans have been designed and constructed to meet the requirements of the referenced sections of the rules. Each plan is to be supported by appropriate engineering calculations. In addition, §257.81(c)(4) and ADEM Admin. Code r. 335-13-15-.05(2)(c)4. require periodic run-on and run-off control system plans be prepared every 5 years.

The CCR Landfill is located at Alabama Power Company's Plant Gorgas within the permitted boundaries of the Plant's overall landfill facility. The facility is permitted for storage of a variety of CCR materials. The CCR Landfill includes two adjoining cells covering 13 acres and 18 acres. Each cell has a designated leachate/runoff pond associated with it.

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 CCR Landfill is designed and constructed with perimeter berms and drainage ditches around the cells that prevent stormwater run-on from surrounding areas during the peak discharge of a 24-hr, 25-yr storm from flowing onto the active portion of the landfill.

The leachate/runoff pond collects and controls the calculated amount of leachate generated from the leachate collection system of the disposal cell as well as the quantity of rainfall from a 24-hr, 100-yr storm event that falls directly into the leachate/runoff pond. The water collected in the leachate/runoff pond is pumped to a treatment system prior to discharge through a permitted NPDES discharge point.

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 run-on and run-off control system plan meets the requirements of 40 C.F.R. §257.81 and ADEM Admin. Code r. 335-13-15-.05(2).

James C. Pegues, P.E. 10/15/2021
Licensed State of Alabama, PE No. 16516

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

for

Plant Gorgas CCB Landfill

Prepared by:

Southern Company Services
Technical and Project Solutions

Originator: _____ 9/29/21
Andrew E. Stricklin Date

Reviewer: _____ 10-7-21
Jason S. Wilson Date

Approval: _____ 10/7/21
James C. Pegues Date

1.0 Purpose of Calculation

The purpose of this calculation is to evaluate the Plant Gorgas CCB Landfill storage cells and sedimentation ponds for compliance to EPA's Title 40 CFR Part 257.81 and ADEM's Admin. Code r. 335-13-15-.05(2). In accordance with this regulation, the facility must have run-on controls to prevent flow from the 24-hour, 25-year storm event from reaching the working face and also run-off controls to collect and control the water volume from the storm.

2.0 Summary of Conclusions

2.1 Site Overview

The Plant Gorgas CCB Landfill is located on APC property in the northeast area of the plant. This facility was constructed in 2013-14 and is currently receiving CCR generated by APC at this time. The landfill is sited in an area covering approximately 72 acres and has two storage cells with drainage areas of approximately 19.5 acres (Cell 1 & Sed. Pond 1) and 23.1 acres (Cell 2 & Sed. Pond 2). There are no off-site areas draining into the cells or ponds and only stormwater run-off from rain falling directly in the cells, ponds and aggregate surfaced perimeter roads must be collected and controlled. There are 3-42 inch diameter dual-wall HDPE pipes in each cell which convey water from the cells to the associated ponds. The ponds are connected with two 36 inch diameter dual-wall HDPE pipes. Water collected in the Sediment Basin is pumped to the Low Volume Waste Water (LVWW) Pond. The sediment basins do have spillways which outfall to the Black Warrior River Basin south of the site, however the purpose of these structures is only to maintain dam integrity in the unlikely case of an overflow condition.

An overview of Cells 1 and 2, and Sedimentation Ponds 1 and 2 is provided in Table 1 below.

Table 1—Landfill site characteristics

Pond Description	Cell 1	Sedimentation Pond 1	Cell 2	Sedimentation Pond 2
Size (Acres)	12.8	3.8	17.5	2.9
Outlet Type	three 42” dia. HDPE pipes	8” HDPE solid wall pipe (Horiz. Pumps) 20’ Trapezoidal Spillway (Concrete), 6:1 S.S., (Control Structure – No Discharge)	three 42” dia. HDPE pipes	three 42” dia. HDPE pipes 20’ Trapezoidal Spillway, (Concrete), 6:1 S.S., (Control Structure – No Discharge)
Outlets To	Sedimentation Pond 1	16” SDR11 / 22” SDR17 HDPE dual contained pumped to Plant, spillway to channel then Black Warrior River	Sedimentation Pond 2	Pipes to Sedimentation Pond 1

2.2 Run-on Control System Plan

There is no stormwater run-on into Cells 1 and 2 or Sedimentation Ponds 1 and 2 due to the construction of perimeter berm/roads at the outer boundaries. Any run-off that was directed to the landfill area was diverted by the initial design which now prevents any water encroachment. For further information on this hydraulic design, see SCS Calculation No. DC-GOR-APC70355-001, Plant Gorgas Baghouse Byproducts Storage Facility Plans, Stormwater Management Calculations, 3/22/13.

2.3 Run-off Control System Plan

A hydrologic and hydraulic model was developed for the Plant Gorgas CCB Landfill to determine the hydraulic capacity of the storage cells and sediment ponds. 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 Baghouse CCR 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)
Cell 1	No Pool	Varies, Low Pt. @ 512.0	504.1	7.9	N/A	100
Cell 2	No Pool	Varies, Low Pt. @ 512.5	506.9	5.6	N/A	119
Sediment Pond 1	483.0	512.0	494.1	17.9	219**	N/A (pumped)
Sediment Pond 2	483.0	512.0	494.1	17.9	219**	N/A (pumped)

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

** Combined Cell 1 Sedimentation Pond and Cell 2 Sedimentation Pond

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 Baghouse CCR 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 CCB Landfill was delineated based on LiDAR data acquired for the Plant in 2011. 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. Times of Concentration were also developed based on methodologies prescribed in TR-55.

A table of the pertinent basin characteristics of the landfill is provided below in Tables 4(a) and 4(b).

Table 4(a) - Landfill Hydrologic Information (Cell 1 & Sedimentation Pond 1)

Drainage Basin Area (acres)	19.5
Hydrologic Curve Number, CN	90
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	10.0
Hydrologic Software	Hydraflow Hydrographs

Table 4(b) - Landfill Hydrologic Information (Cell 2 & Sedimentation Pond 2)

Drainage Basin Area (acres)	23.1
Hydrologic Curve Number, CN	89
Hydrologic Methodology	SCS Method
Time of Concentration (minutes)	11.7
Hydrologic Software	Hydraflow Hydrographs

Run-off values were determined by importing the characteristics developed above into a hydrologic model in Hydraflow Hydrographs Extension of AutoCad Civil 3D, 2019.

3.2 HYDRAULIC ANALYSES

Storage values for the sedimentation ponds were determined by developing a stage-storage relationship utilizing contour data. The spillway system at the Plant Gorgas CCB Landfill consists of primary spillways in the cells draining into the sediment ponds and primary trapezoidal weir spillways in each of the sediment ponds outfalling into a grassed drainage channel. The primary spillways for each cell consist of three 42 inch diameter HDPE pipes and the pond weir spillways are reinforced concrete, 20-foot wide crest by 1-foot deep with 6:1 slopes on either end providing access from the top of the pond. A summary of information for each spillway is presented below in Table 5.

Table 5—Spillway Attribute Table

Spillway	US Invert El (feet)	DS Invert El (feet)	Dimension (ft)	Slope (ft/ft)	Length (ft)	Spillway Capacity (cfs)
Cell 1	499.3	498.7	Three 42 inch diameter, HDPE	0.005	112	N/A*
Cell 2	502.4	501.0	Three 42 inch diameter, HDPE	.0144	100	N/A*
Sedimentation Pond 1	511.0	510.7	Trapezoidal (Concrete), Crest L=20', 6:1 S.S.	1.0%	30	N/A*
Sedimentation Pond 2	511.0	510.7	Trapezoidal (Concrete), Crest L=20', 6:1 S.S.	1.0%	30	N/A*

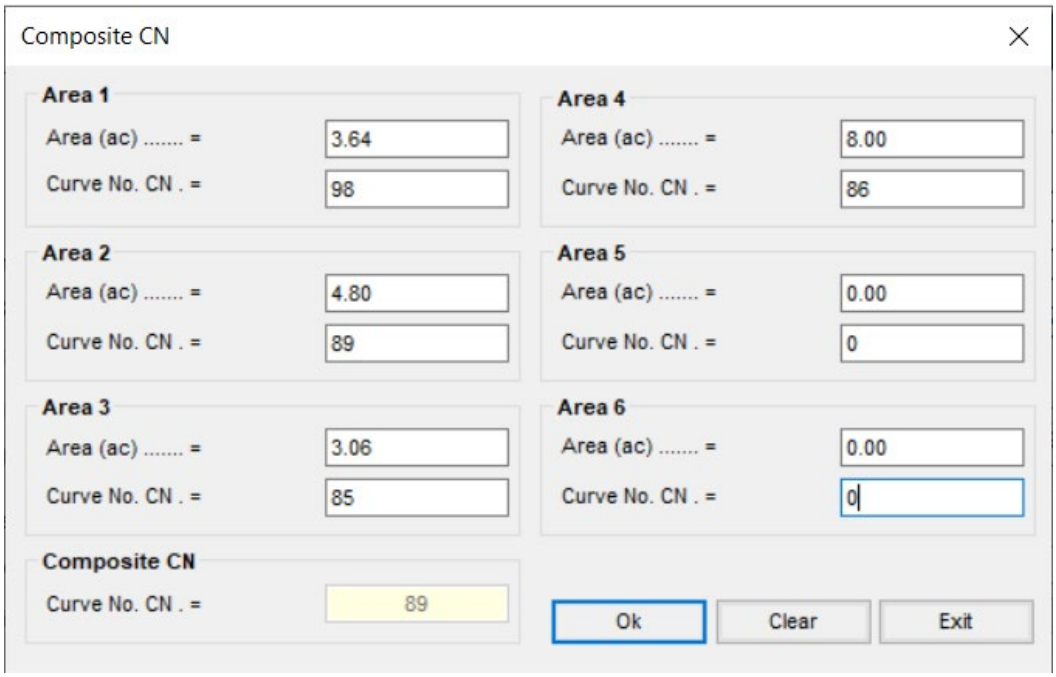
*N/A = Not available

Based on the spillway attributes listed above, a rating curve was developed and inserted into Hydraflow Hydrographs software to analyze pond performance during the design storm. Results are shown in Table 2.

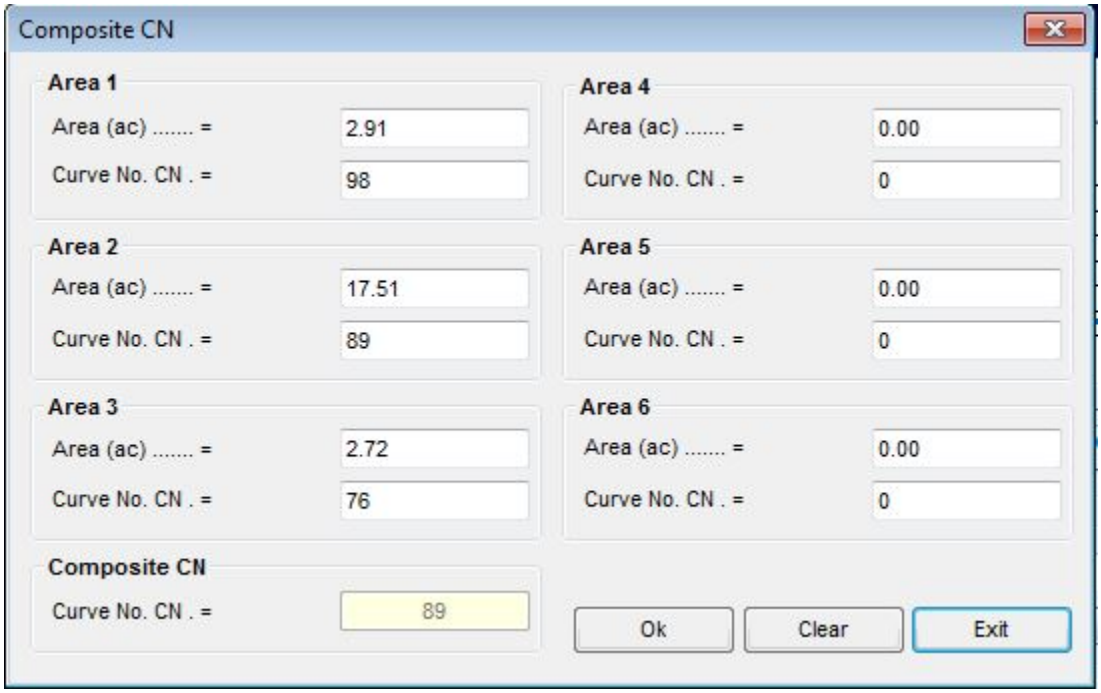
4.0 SUPPORTING INFORMATION

4.1 CURVE NUMBER

4.1.1 CELL 1 AND SEDIMENTATION POND 1 AREA



4.1.2 CELL 2 AND SEDIMENTATION POND 2 AREA



4.2 STAGE-STORAGE TABLE

4.2.1 COMBINED SEDIMENTATION PONDS 1 AND 2

Pond Name: Combined Pond Volumes

Row	Stage	Elevation	Contour Area	Incremental Storage	Total Storage	Total Discharge
	(ft)	(ft)	(sqft)	(cuft)	(cuft)	(cfs)
0	0.00	483.00	41,569	0.000	0.000	0.000
1	1.00	484.00	44,633	43,101	43,101	0.000
2	3.00	486.00	51,020	95,653	138,754	0.000
3	4.00	487.00	75,581	63,301	202,055	0.000
4	5.00	488.00	82,461	79,021	281,076	0.000
5	7.00	490.00	95,496	177,957	459,033	0.000
6	9.00	492.00	109,150	204,646	663,679	0.000
7	11.00	494.00	123,412	232,562	896,241	0.000
8	13.00	496.00	138,241	261,654	1,157,894	0.000
9	15.00	498.00	153,597	291,838	1,449,732	0.000
10	15.75	498.75	159,453	117,393	1,567,125	0.000
11	17.00	500.00	169,470	205,577	1,772,702	0.000
12	19.00	502.00	185,792	355,262	2,127,964	0.000
13	21.00	504.00	202,529	388,321	2,516,285	0.000
14	23.00	506.00	219,729	422,258	2,938,543	0.000
15	25.00	508.00	237,379	457,108	3,395,651	0.000
16	27.00	510.00	255,476	492,855	3,888,506	0.000
17	29.00	512.00	273,981	529,457	4,417,963	104.00
18						
19						
20						

4.3 TIME OF CONCENTRATION

4.3.1 CELL 1 TO SEDIMENTATION POND 1

TR55 Tc Worksheet

Hyd. No. 1

Area to Cell 1 Pond

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 4.00		0.00		0.00		
Land slope (%)	= 0.61		0.00		0.00		
Travel Time (min)	**= 4.20**	**+**	**0.00**	**+**	**0.00**	**=**	**4.20**
Shallow Concentrated Flow							
Flow length (ft)	= 340.00		0.00		0.00		
Watercourse slope (%)	= 0.61		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 1.26		0.00		0.00		
Travel Time (min)	**= 4.50**	**+**	**0.00**	**+**	**0.00**	**=**	**4.50**
Channel Flow							
X sectional flow area (sqft)	= 8.00		0.00		0.00		
Wetted perimeter (ft)	= 11.32		0.00		0.00		
Channel slope (%)	= 0.50		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	= 2.78						
			0.00				
					0.00		
Flow length (ft)	({0})215.0		0.0		0.0		
Travel Time (min)	**= 1.29**	**+**	**0.00**	**+**	**0.00**	**=**	**1.29**
Total Travel Time, Tc							**10.00 min**

4.3.2 CELL 2 TO SEDIMENTATION POND 2

TR55 Tc Worksheet

Hyd. No. 2

Area To Cell 2 Pond

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 4.00		0.00		0.00		
Land slope (%)	= 0.85		0.00		0.00		
Travel Time (min)	**= 3.68**	**+**	**0.00**	**+**	**0.00**	**=**	**3.68**
Shallow Concentrated Flow							
Flow length (ft)	= 290.00		0.00		0.00		
Watercourse slope (%)	= 0.85		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 1.49		0.00		0.00		
Travel Time (min)	**= 3.25**	**+**	**0.00**	**+**	**0.00**	**=**	**3.25**
Channel Flow							
X sectional flow area (sqft)	= 10.20		0.00		0.00		
Wetted perimeter (ft)	= 12.53		0.00		0.00		
Channel slope (%)	= 0.50		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	= 3.06						
			0.00				
					0.00		
Flow length (ft)	({0})875.0		0.0		0.0		
Travel Time (min)	**= 4.77**	**+**	**0.00**	**+**	**0.00**	**=**	**4.77**
Total Travel Time, Tc							**11.70 min**

4.4 RESULTS

4.4.1 CELL 1 AND SEDIMENTATION POND 1

Hydrograph Report

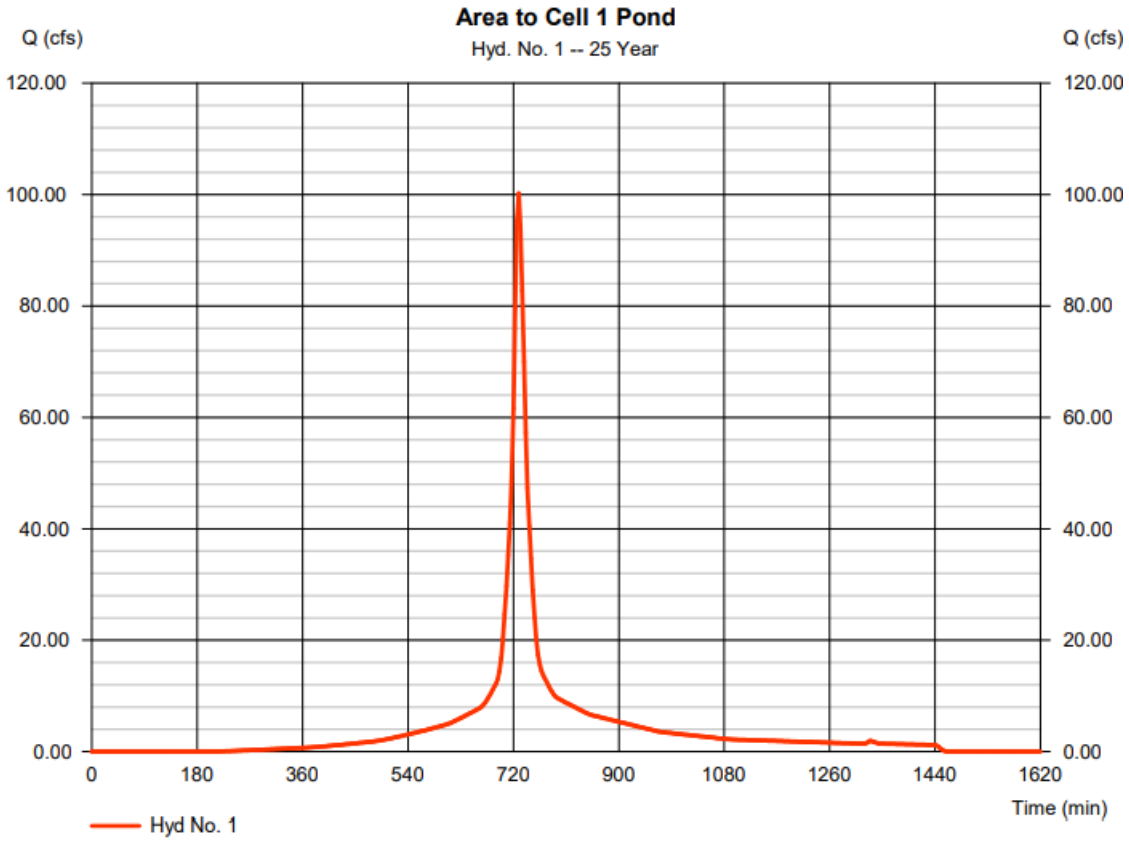
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v12 — Friday, 05 / 21 / 2021

Hyd. No. 1

Area to Cell 1 Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 100.22 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 3 min	Hyd. volume	= 414,414 cuft
Drainage area	= 19.500 ac	Curve number	= 89*
Basin Slope	= 3.2 %	Hydraulic length	= 1721 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.00 min
Total precip.	= 7.15 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.640 x 98) + (4.800 x 89) + (3.060 x 85) + (8.000 x 86)] / 19.500



4.4.2 CELL 2 AND SEDIMENTATION POND 2

Hydrograph Report

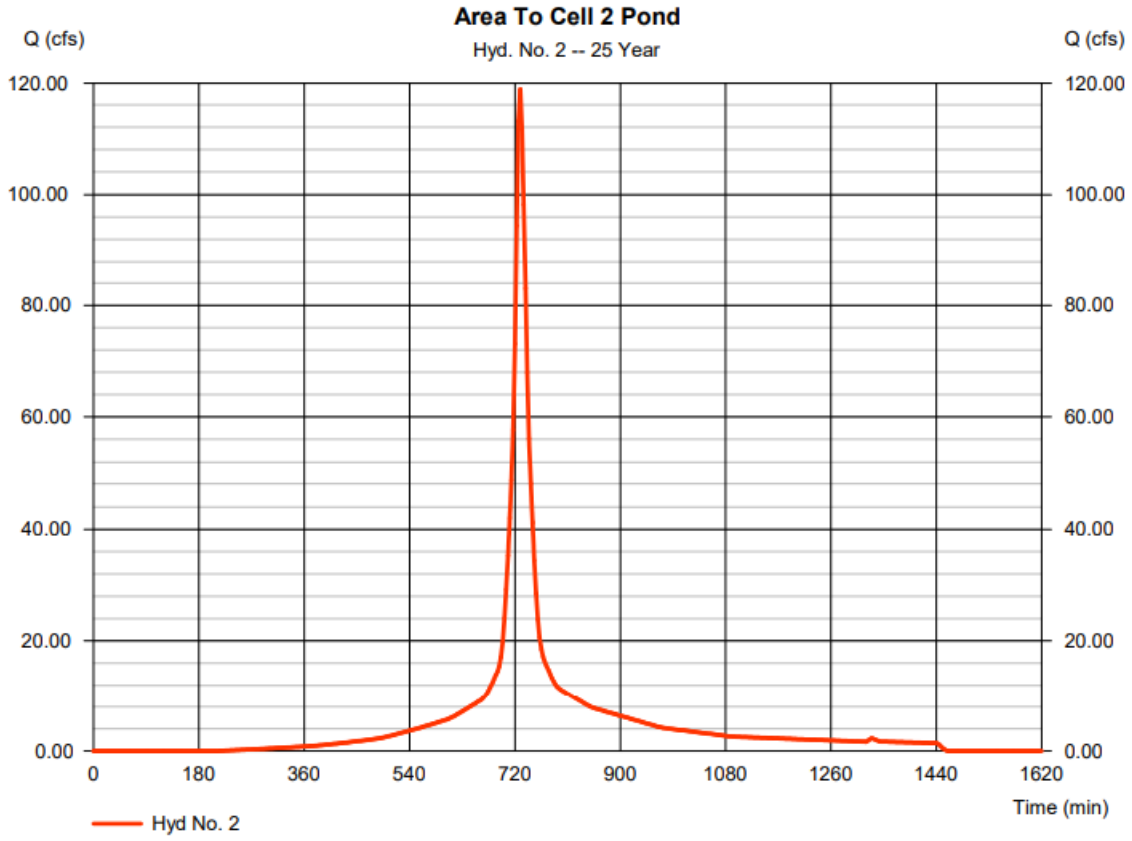
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v12 — Friday, 05 / 21 / 2021

Hyd. No. 2

Area To Cell 2 Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 118.93 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 3 min	Hyd. volume	= 491,771 cuft
Drainage area	= 23.140 ac	Curve number	= 89*
Basin Slope	= 3.9 %	Hydraulic length	= 2150 ft
Tc method	= TR55	Time of conc. (Tc)	= 11.70 min
Total precip.	= 7.15 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.910 x 98) + (17.510 x 89) + (2.720 x 76)] / 23.140



4.4.3 SEDIMENTATION POND

Hydrograph Report

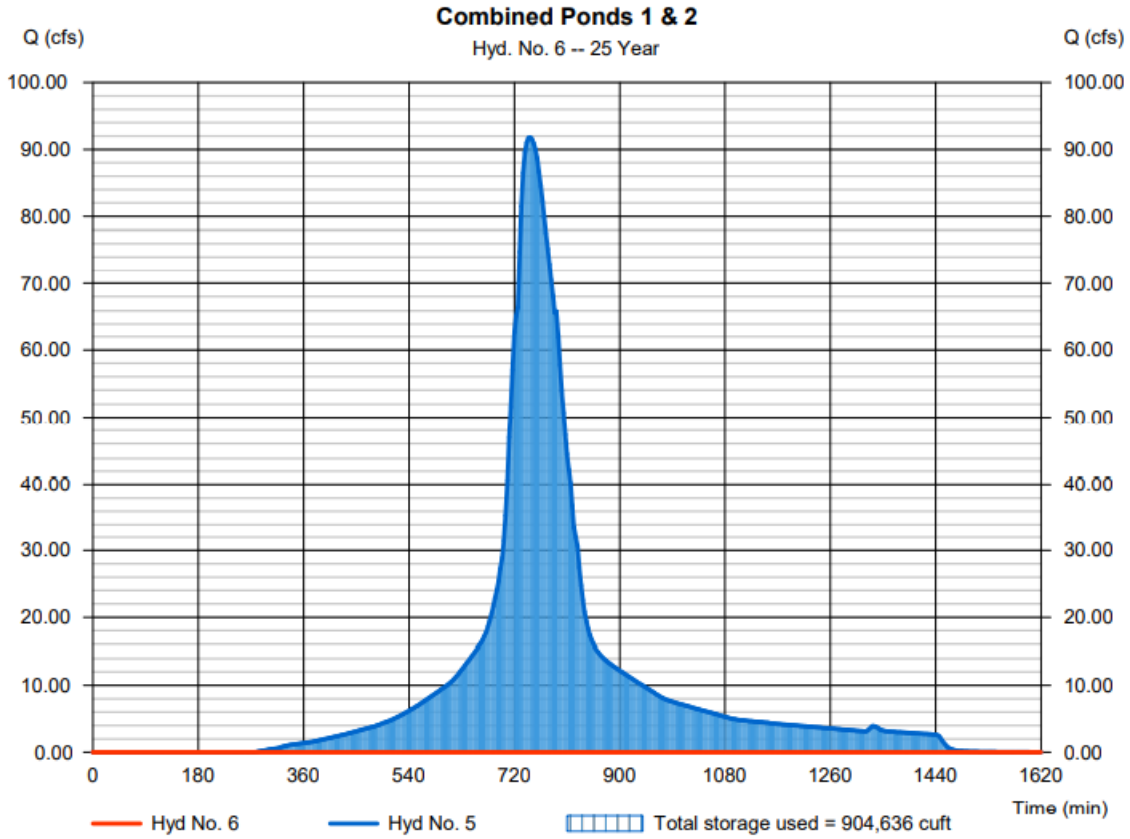
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v12 — Friday, 05 / 21 / 2021

Hyd. No. 6

Combined Ponds 1 & 2

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.	= 5 - Total Cells 1 & 2	Max. Elevation	= 494.06 ft
Reservoir name	= Combined Pond Volumes	Max. Storage	= 904,636 cuft

Storage Indication method used.



4.4.4 CELL 1 PRIMARY SPILLWAY OUTLET PIPE

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, May 21 2021

Cell 1 Outlet Pipes

Invert Elev Dn (ft)	= 498.75
Pipe Length (ft)	= 112.00
Slope (%)	= 0.50
Invert Elev Up (ft)	= 499.31
Rise (in)	= 42.0
Shape	= Circular
Span (in)	= 42.0
No. Barrels	= 3
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

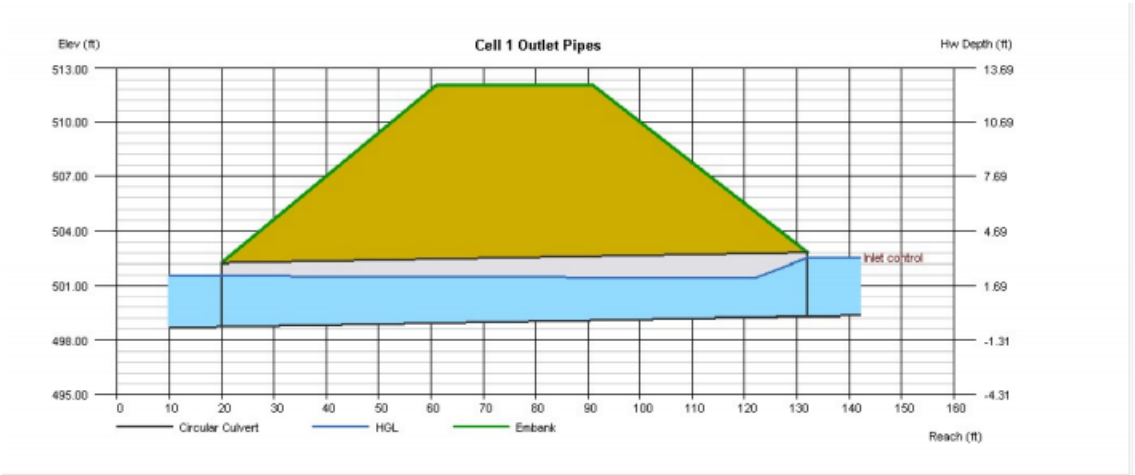
Top Elevation (ft)	= 512.00
Top Width (ft)	= 30.00
Crest Width (ft)	= 100.00

Calculations

Qmin (cfs)	= 101.70
Qmax (cfs)	= 138.10
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 137.70
Qpipe (cfs)	= 137.70
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 5.55
Veloc Up (ft/s)	= 7.53
HGL Dn (ft)	= 501.56
HGL Up (ft)	= 501.43
Hw Elev (ft)	= 502.53
Hw/D (ft)	= 0.92
Flow Regime	= Inlet Control



4.4.5 CELL 2 PRIMARY SPILLWAY OUTLET PIPE

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, May 21 2021

Cell 2 Outlet Pipes

Invert Elev Dn (ft)	= 501.00
Pipe Length (ft)	= 100.00
Slope (%)	= 1.44
Invert Elev Up (ft)	= 502.44
Rise (in)	= 42.0
Shape	= Circular
Span (in)	= 42.0
No. Barrels	= 3
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

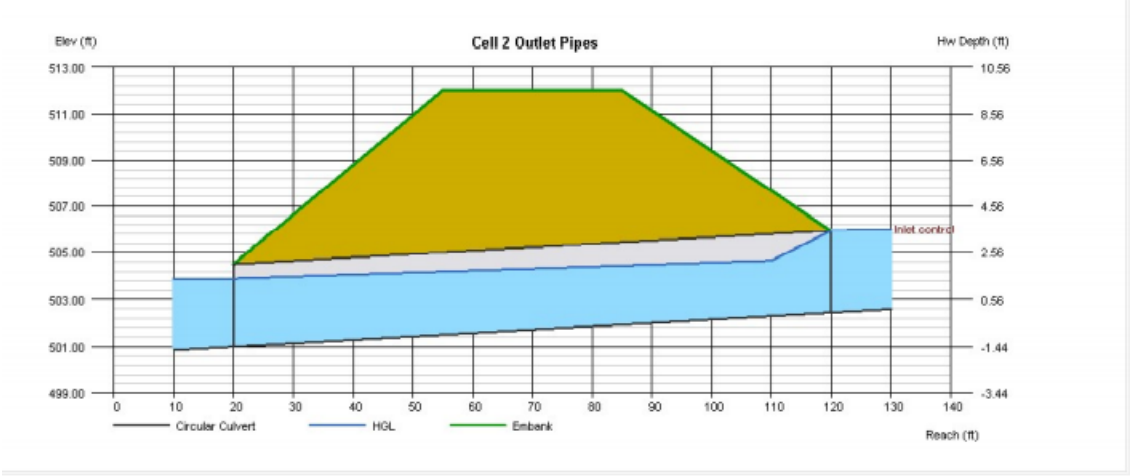
Top Elevation (ft)	= 512.00
Top Width (ft)	= 30.00
Crest Width (ft)	= 100.00

Calculations

Qmin (cfs)	= 118.90
Qmax (cfs)	= 162.20
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 161.90
Qpipe (cfs)	= 161.90
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 6.33
Veloc Up (ft/s)	= 8.06
HGL Dn (ft)	= 503.90
HGL Up (ft)	= 504.74
Hw Elev (ft)	= 506.03
Hw/D (ft)	= 1.03
Flow Regime	= Inlet Control



4.5 DRAINAGE BASIN