

RUN-ON AND RUN-OFF CONTROL PLAN
PLANT GORGAS CCR 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 CCR Landfill is located at Alabama Power Company's Plant Gorgas within the permitted boundaries of the Plant's overall landfill facility. While permitted for a variety of CCR, this facility will primarily store dry ash from the baghouse operations at this time. The CCR Landfill includes two adjoining cells covering 14 acres and 9 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).

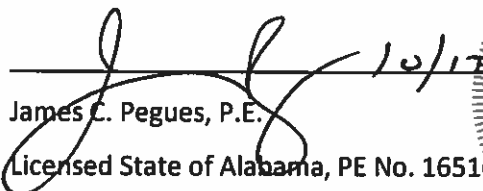
The NRCS provided information on the soil characteristics and hydrologic groups present at the site. It was determined that the site contains areas with hydrological soil groups "A", "B" and "D". A composite curve number was created based on the land use and soil type of the entire drainage area. This 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 back to the plant for reuse.

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 Baghouse CCR Landfill

Prepared by:

Southern Company Services
Technical Services

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

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

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

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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 Baghouse CCR Landfill is located approximately 9 miles west of Birmingham, Alabama on Plant Gorgas property northeast of the plant. The total area occupied by the landfill is approximately 72 acres with additional buffer areas along the perimeter. The landfill is comprised of two ash storage cells along with two sediment ponds. The cells and ponds are lined with a combination of clay and HDPE liner material. There are three 42 inch diameter dual-wall HDPE pipes in each cell which convey water from the cells to their associated sedimentation ponds. The sedimentation ponds are connected with two 36 inch diameter dual-wall HDPE pipes. All runoff eventually drains into Sedimentation Pond 1 where it is pumped back to the Plant for reuse and is not released. The sediment ponds 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	3 42" dia. HDPE pipes	8" HDPE solid wall pipe (Horiz. Pumps) 20' Trapezoidal Spillway (Concrete), 6:1 S.S., (Control Structure – No Discharge)	3 42" dia. HDPE pipes	3 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 runoff that was directed to the landfill area was diverted by the initial design which now prevents any water encroachment.

2.3 Run-off Control System Plan

A hydrologic and hydraulic model was developed for the Plant Gorgas Baghouse CCR 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	501.4	10.6	N/A	102
Cell 2	No Pool	Varies, Low Pt. @ 512.5	504.4	8.1	N/A	119
Sediment Pond 1	483.0	512.0	494.2	17.8	221**	N/A (pumped)
Sediment Pond 2	483.0	512.0	494.2	17.8	221**	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 Baghouse CCR Landfill was delineated based on LiDAR data acquired for the Plant in 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. 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

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

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 Baghouse CCR 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	3-42 inch diameter, HDPE	0.005	112	N/A*
Cell 2	502.4	501.0	3-42 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

The screenshot shows a software window titled "Composite CN" with a close button (X) in the top right corner. The window is divided into six sections, each representing a different area. Each section contains two input fields: "Area (ac)" and "Curve No. CN . =".

- Area 1:** Area (ac) = 3.68, Curve No. CN = 98
- Area 2:** Area (ac) = 12.80, Curve No. CN = 89
- Area 3:** Area (ac) = 3.06, Curve No. CN = 85
- Area 4:** Area (ac) = 0.00, Curve No. CN = 0
- Area 5:** Area (ac) = 0.00, Curve No. CN = 0
- Area 6:** Area (ac) = 0.00, Curve No. CN = 0

At the bottom of the window, there is a section for the "Composite CN" with a "Curve No. CN . =" field containing the value "90". To the right of this field are three buttons: "Ok", "Clear", and "Exit".

4.1.2 CELL 2 AND SEDIMENTATION POND 2 AREA

Composite CN X

<p>Area 1</p> <p>Area (ac) = <input style="width: 100px;" type="text" value="2.91"/></p> <p>Curve No. CN . = <input style="width: 100px;" type="text" value="98"/></p>	<p>Area 4</p> <p>Area (ac) = <input style="width: 100px;" type="text" value="0.00"/></p> <p>Curve No. CN . = <input style="width: 100px;" type="text" value="0"/></p>
<p>Area 2</p> <p>Area (ac) = <input style="width: 100px;" type="text" value="17.51"/></p> <p>Curve No. CN . = <input style="width: 100px;" type="text" value="89"/></p>	<p>Area 5</p> <p>Area (ac) = <input style="width: 100px;" type="text" value="0.00"/></p> <p>Curve No. CN . = <input style="width: 100px;" type="text" value="0"/></p>
<p>Area 3</p> <p>Area (ac) = <input style="width: 100px;" type="text" value="2.72"/></p> <p>Curve No. CN . = <input style="width: 100px;" type="text" value="76"/></p>	<p>Area 6</p> <p>Area (ac) = <input style="width: 100px;" type="text" value="0.00"/></p> <p>Curve No. CN . = <input style="width: 100px;" type="text" value="0"/></p>
<p>Composite CN</p> <p>Curve No. CN . = <input style="width: 100px;" type="text" value="89"/></p>	

4.2 STAGE-STORAGE TABLE

4.2.1 SEDIMENTATION POND 1

Pond Name <input style="float: right;" type="text" value="Pond1"/>						
Row	Stage	Elevation	Contour Area	Incremental Storage	Total Storage	Total Discharge
	(ft)	(ft)	(sqft)	(cuft)	(cuft)	(cfs)
0	0.00	483.00	41,570	0.000	0.000	0.000
1	1.00	484.00	44,633	43,102	43,102	0.000
2	3.00	486.00	51,020	95,653	138,755	0.000
3	5.00	488.00	57,695	108,715	247,470	0.000
4	7.00	490.00	64,658	122,353	369,823	0.000
5	9.00	492.00	71,910	136,568	506,391	0.000
6	11.00	494.00	79,450	151,360	657,751	0.000
7	13.00	496.00	87,259	166,709	824,460	0.000
8	15.00	498.00	95,318	182,578	1,007,037	0.000
9	15.75	498.75	98,410	72,648	1,079,685	0.000
10	17.00	500.00	103,673	126,301	1,205,986	0.000
11	19.00	502.00	112,269	215,942	1,421,928	0.000
12	21.00	504.00	121,050	233,319	1,655,247	0.000
13	23.00	506.00	130,058	251,108	1,906,355	0.000
14	25.00	508.00	139,292	269,351	2,175,706	0.000
15	27.00	510.00	148,752	288,044	2,463,750	0.000
16	29.00	512.00	158,438	307,190	2,770,940	52.00
17						
18						
19						
20						

4.2.2 SEDIMENTATION POND 2

Pond Name <input type="text" value="Pond 2"/>						
Row	Stage	Elevation	Contour Area	Incremental Storage	Total Storage	Total Discharge
	(ft)	(ft)	(sqft)	(cuft)	(cuft)	(cfs)
0	0.00	487.00	21,821	0.000	0.000	0.000
1	1.00	488.00	24,766	23,294	23,294	0.000
2	3.00	490.00	30,838	55,604	78,898	0.000
3	5.00	492.00	37,240	68,078	146,976	0.000
4	7.00	494.00	43,962	81,202	228,178	0.000
5	9.00	496.00	50,982	94,944	323,122	0.000
6	11.00	498.00	58,279	109,261	432,383	0.000
7	13.00	500.00	65,797	124,076	556,459	0.000
8	15.00	502.00	73,523	139,320	695,779	0.000
9	17.00	504.00	81,479	155,002	850,781	0.000
10	19.00	506.00	89,671	171,151	1,021,931	0.000
11	21.00	508.00	98,087	187,758	1,209,689	0.000
12	23.00	510.00	106,724	204,811	1,414,500	0.000
13	25.00	512.00	115,543	222,267	1,636,767	52.00
14						
15						
16						
17						
18						
19						
20						

4.2.3 COMBINED SEDIMENTATION PONDS 1 AND 2

Pond Name <input type="text" value="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

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

Hyd. No. 1

Area to Cell 1 Pond

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
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

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

Hyd. No. 2

Area To Cell 2 Pond

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
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

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

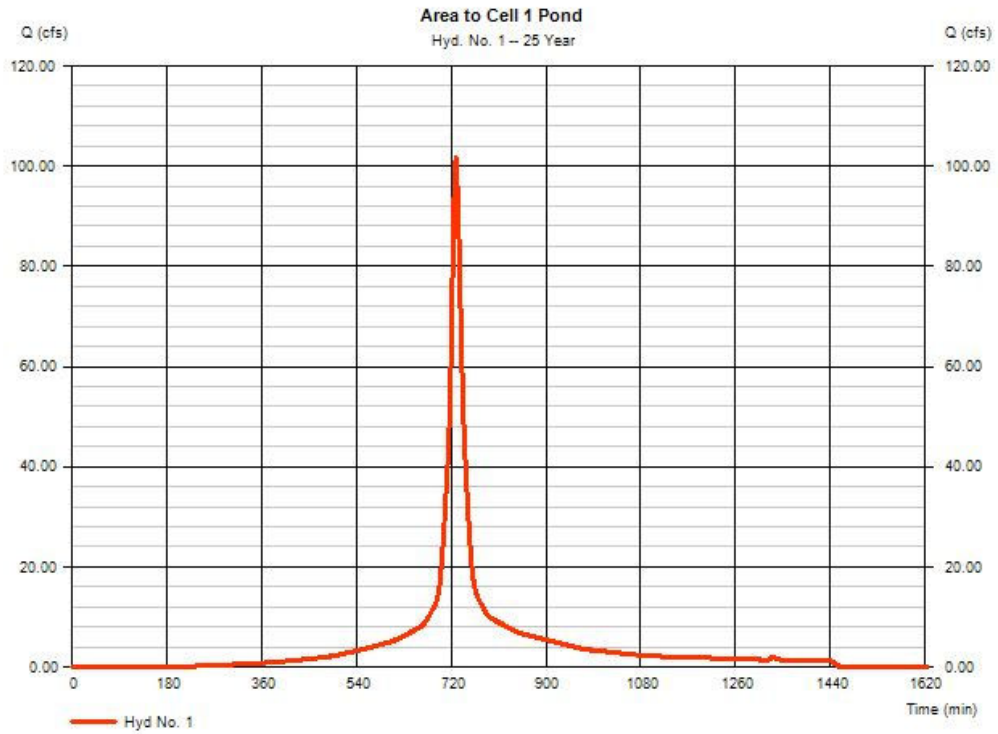
Saturday, 10 / 1 / 2016

Hyd. No. 1

Area to Cell 1 Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 101.69 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 3 min	Hyd. volume	= 423,470 cuft
Drainage area	= 19.540 ac	Curve number	= 90*
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) = [(3.680 x 98) + (12.800 x 85) + (3.060 x 85)] / 19.540



4.4.2 CELL 2 AND SEDIMENTATION POND 2

5

Hydrograph Report

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

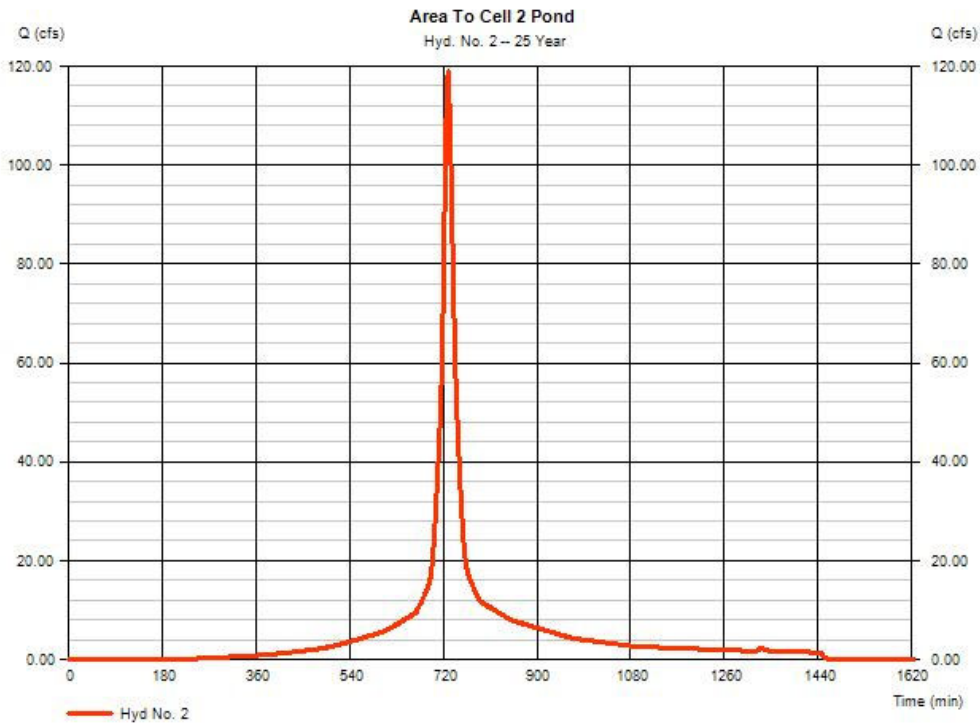
Saturday, 10/1/2016

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 88) + (17.810 x 89) + (2.720 x 76)] / 23.140



4.4.3 SEDIMENTATION POND

Hydrograph Report

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

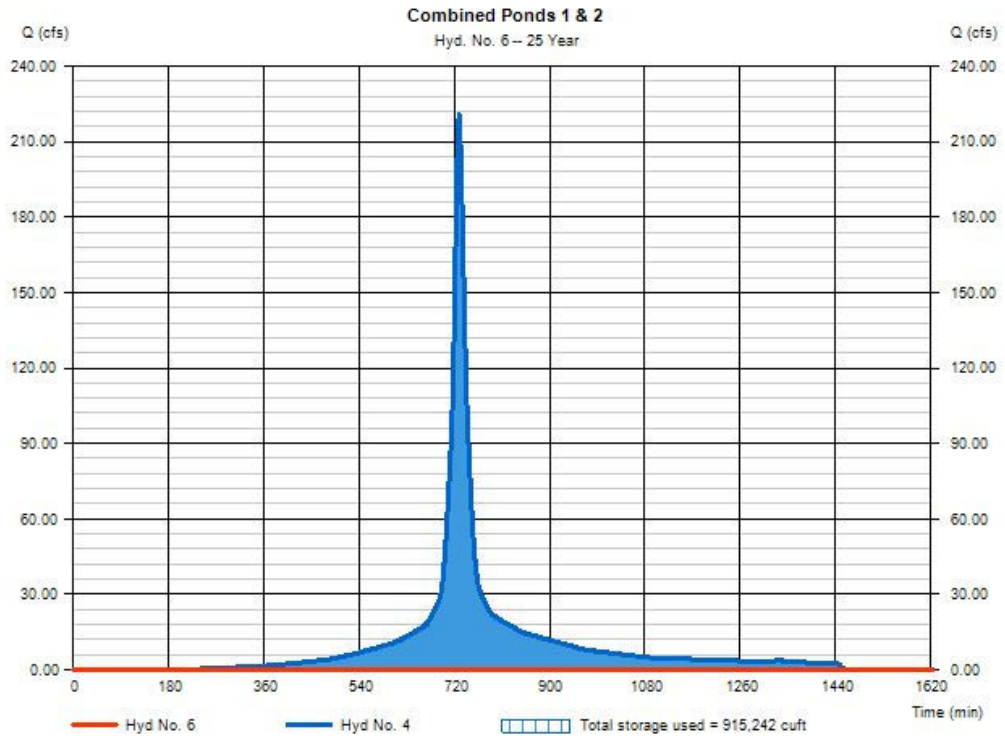
Saturday, 10 / 1 / 2016

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.	= 4 - Total Cells 1 & 2	Max. Elevation	= 494.15 ft
Reservoir name	= Combined Pond Volumes	Max. Storage	= 915,242 cuft

Storage indication method used:



4.4.4 CELL 1 PRIMARY SPILLWAY OUTLET PIPE

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc.

Saturday, Jul 16 2016

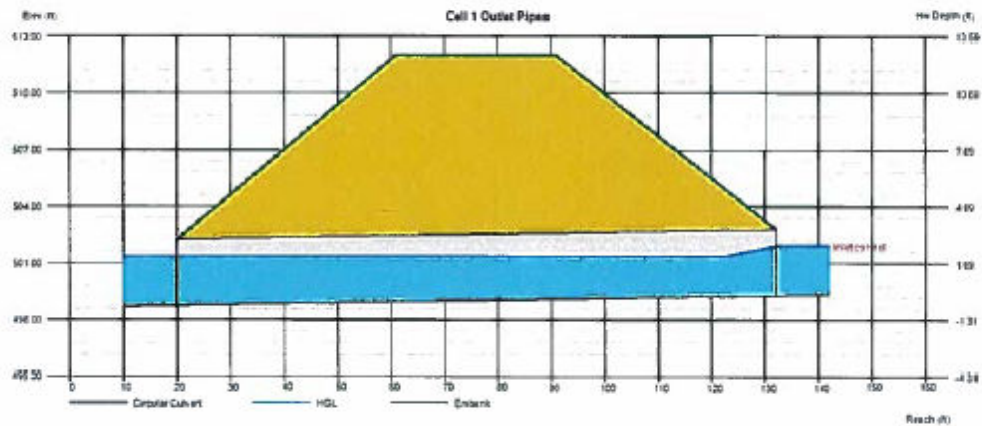
Cell 1 Outlet Pipes

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)	= 101.70
Qpipe (cfs)	= 101.70
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 4.34
Veloc Up (ft/s)	= 5.75
HGL Dn (ft)	= 501.40
HGL Up (ft)	= 501.37
Hw Elev (ft)	= 501.94
Hw/D (ft)	= 0.75
Flow Regime	= Inlet Control



4.4.5 CELL 2 PRIMARY SPILLWAY OUTLET PIPE

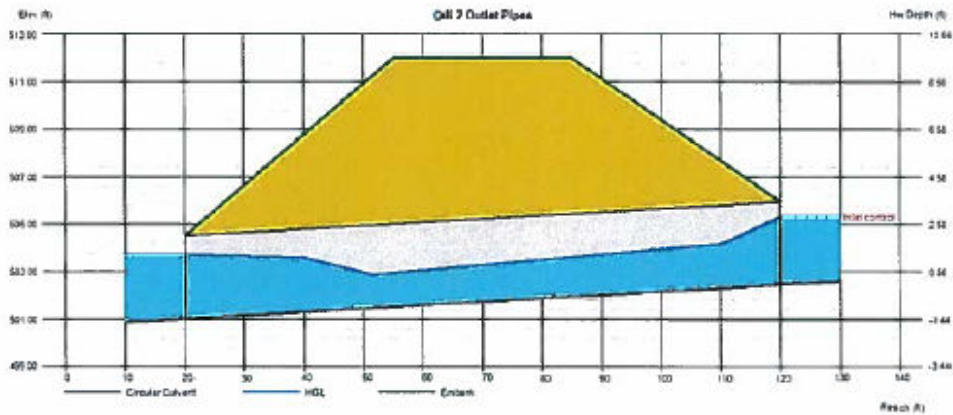
Culvert Report

Hydraulow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc.

Saturday, Jul 16 2016

Cell 2 Outlet Pipes

Invert Elev Dn (ft)	= 501.00	Calculations	
Pipe Length (ft)	= 100.00	Qmin (cfs)	= 118.90
Slope (%)	= 1.44	Qmax (cfs)	= 162.20
Invert Elev Up (ft)	= 502.44	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 42.0		
Shape	= Circular	Highlighted	
Span (in)	= 42.0	Qtotal (cfs)	= 118.90
No. Barrels	= 3	Qpipe (cfs)	= 118.90
n-Value	= 0.012	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 4.93
Culvert Entrance	= Square edge w/headwall (C)	Veloc Up (ft/s)	= 7.17
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5	HGL Dn (ft)	= 503.73
		HGL Up (ft)	= 504.40
Embankment		Hw Elev (ft)	= 505.34
Top Elevation (ft)	= 512.00	Hw/D (ft)	= 0.83
Top Width (ft)	= 30.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 100.00		



4.5 DRAINAGE BASIN

