HYDROLOGIC AND HYDRAULICS CAPACITY REQUIREMENTS

OWENSBORO MUNICIPAL UTILITIES
ELMER SMITH STATION ASH POND
OWENSBORO KENTUCKY

Prepared for:

Owensboro Municipal Utilities
Elmer Smith Station
4301 State Rt. 144
Owensboro, Kentucky 42303

Prepared by:

Civil & Environmental Consultants, Inc.
333 Baldwin Road
Pittsburgh, PA 15205

CEC Project 164-014.0003

October 2016

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1.0   PURPOSE

On behalf of Owensboro Municipal Utilities (OMU), Civil & Environmental Consultants, Inc. (CEC) has evaluated the Hydrologic and Hydraulic Capacity Requirements for the Ash Pond at the Elmer Smith Station in accordance with the United States Environmental Protection Agency (USEPA) Code of Federal Regulations, Title 40, Parts 257 and 261 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule, dated April 17, 2015 (CCR Rule). This evaluation specifically addresses the requirements in Section 257.82 (§257.82) – Hydrologic and Hydraulic Capacity Requirements for CCR Surface Impoundments. The Ash Pond at the Elmer Smith Station is classified as an existing CCR surface impoundment by definition in §257.53.

2.0   SITE DESCRIPTION

OMU owns and operates the Elmer Smith Station (Station), which is located in Owensboro, Kentucky. The Station is a coal-burning facility that consists of two units with a combined capacity of 433 MW. The two units of the Station have been in operation since 1964 and 1974. The Ash Pond is located to the northwest of the Station. The Ash Pond is less than 10 acres in size and consists of three separate unlined ash settling basins (Ponds 1, 2, and 3). The Ash Pond receives flow from the Station and runoff from areas surrounding the Station. The Ash Pond is continuously dredged. The dredged materials are allowed to dewater from the piles and drain back into the ponds. The materials are either sold for beneficial use or transported to offsite disposal.

The location of the Station and the Ash Pond is shown on Figure 1 – Site Location Map. The existing conditions are shown on Figure 2 – Existing Conditions.

3.0   §257.82(a) INFLOW DESIGN FLOOD

The applicable sections of §257.82(a) are reprinted below in bold, italic font. The responses follow each section of the rule and are provided in normal font.

§257.82(a) states:

(a) The owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (2) of this section.

(a)(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.

(a)(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.

(a)(3) The inflow design flood is:

(a)(3)(i) For a high hazard potential CCR surface impoundment, as determined under § 257.73(a)(2) or § 257.74(a)(2), the probable maximum flood;
(a)(3)(ii) For a significant hazard potential CCR surface impoundment, as determined under §257.73(a)(2) or §257.74(a)(2), the 1,000-year flood;
(a)(3)(iii) For a low hazard potential CCR surface impoundment, as determined under §257.73(a)(2) or §257.74(a)(2), the 100-year flood;
(a)(3)(iv) For an incised CCR surface impoundment, the 25-year flood.

The Ash Pond hazard classification was evaluated in accordance with §257.73 using the definitions in §257.53. §257.53 defines an incised CCR surface impoundment as a CCR surface impoundment that is constructed by excavating entirely below the adjacent natural ground surface, and does not consist of any constructed diked portion. Based on a review of aerial images, contour data from the USGS National Map, Owensboro East Quadrangle, and a site map prepared by Black & Veatch labeled "Structural Fill Finish Grading" dated 8-28-62, the Ash

Pond appears to be incised. This was confirmed through knowledge of site personnel. Since the Ash Pond is incised, the inflow design flood is the 25-year flood (25-year, 24-hour storm event).

4.0 §257.82(b) SURFACE WATER REQUIREMENTS

§257.82(b) is reprinted below in bold, italic font. The responses follow in normal font.

§257.82(b) states:

(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.

In accordance with §257.3-3, discharges from the Site are authorized by and in compliance with Kentucky Pollutant Discharge Elimination System (KPDES) Permit No. KY001295. Dredged material or fill material is not discharged from the Site to waters of the United States in violation of the requirements under Section 404 of the Clean Water Act. Site operations have not caused non-point source pollution to waters of the United States in violation of the requirements under Section 208 of the Clean Water Act.

5.0 §257.82(c) INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

The applicable sections of §257.82(c) are reprinted below in bold, italic font. The responses follow each section of the rule and are provided in normal font.

§257.82(c) states:

(c) Inflow design flood control system plan

(c)(1) Content of the plan. The owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (4) of this section. These plans must document how the inflow design

flood control system has been designed and constructed to meet the requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator of the CCR unit has completed the inflow design flood control system plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(4).

This Initial Inflow Design Flood Control System Plan evaluates the Ash Pond based on the requirements of this section. The Ash Pond receives flow from the Station and runoff from areas surrounding the Station. Pond 1 receives boiler slag sluice and FGD blowdown. Pond 2 receives sluiced fly ash and discharge from the Cavin Water Plant Sludge Lagoon (Cavin Sludge Lagoon). Pond 3 receives no direct flow from the Station and is used for final settling prior to discharge. Other Station discharges are routed through the Ash Pond, including discharge from roof drains and floor drains, etc. Runoff from various other ponds at the site is routed through the Ash Pond. Additionally, the Ash Pond receives runoff directly from adjacent areas. Pond 3 discharges into a canal to the south of the site, which discharges to the Ohio River through an outlet permitted under KPDES Permit No. KY001295.

The Hydrologic and Hydraulic Capacity Calculation presented in Appendix A considers the inflow to the Ponds 1, 2, and 3 of the Ash Pond, and evaluates the capacity of the Ash Pond. The calculation considers inflow from the 25-year, 24-hour storm event as required for an incised impoundment. Additionally, the calculation considers the flow from the Station to the Ash Pond. HydroCAD was used to route inflow from runoff during the 25-year, 24-hour storm event and flow from the Station through the Ash Pond.

Two scenarios were modeled for Pond 1 because limited information was available for the North Pond and the Coal Pile Runoff Ponds, which attenuate flow prior to discharge into Pond 1. The required pond capacity above the pool is based on the conservative model for Pond 1. CEC recommends maintaining the following capacities above the normal pool elevation.

Estimated Required Capacity above Pool	
Pond	Capacity (Ac-feet)
Pond 1	9.3
Pond 2	4.5
Pond 3	7.8

Alternately, a total capacity of 21.6 acre-feet can be maintained above all three ponds, since the ponds are interconnected. A table showing the approximate areas and depths above the pool that are needed to maintain these capacities is presented in Attachment 7 of Appendix A. CEC is basing the above requirements on a conservative assumption regarding the flow to Pond 1. CEC notes that incorporating more information about the North Ponds and the Coal Runoff Ponds into the model could reduce the required capacity above the pool elevation.

(c)(2) Amendment of the plan. The owner or operator of the CCR unit may amend the written inflow design flood control system plan at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(g)(4). The owner or operator must amend the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.

OMU will amend the Inflow Design Flood Control System Plan as needed and place it in the operating record.

(c)(3) Timeframes for preparing the initial plan-(i) Existing CCR surface impoundments. The owner or operator of the CCR unit must prepare the initial inflow design flood control system plan no later than October 17, 2016.

The Inflow Design Flood Control System Plan will be placed in the operating record no later than October 17, 2016.

(c)(4) Frequency for revising the plan. The owner or operator must prepare periodic inflow design flood control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first periodic plan. The owner or operator may complete any required plan prior to the

required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph (c)(4), the owner or operator has completed an inflow design flood control system plan when the plan has been placed in the facility's operating record as required by § 257.105(g)(4).

Periodic Inflow Design Flood Control System Plans will be prepared and added to the operating record by this date every five years. The Periodic Inflow Design Flood Control System Plan will be considered complete once placed in the operating record within a reasonable amount of time.

(c)(5) The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plans meet the requirements of this section.

The certification statement provided by a qualified professional engineer states that this Initial Inflow Design Flood Control System Plan meets the requirements stated in §257.82(c).

6.0   CONCLUSIONS

For this plan, a hydraulic and hydrologic capacity calculation was performed. The calculation considers the inflow to the Ponds 1, 2, and 3 of the Ash Pond, and evaluates the capacity of the Ash Pond. The calculation considers inflow from the 25-year flood (25-year, 24-hour storm event) as required for an incised impoundment. Additionally, the calculation considers the flow from the Station to the Ash Pond. Based on the calculations, CEC recommends maintaining the following capacities above the pool of the ponds.

Estimated Required Capacity above Pool	
Pond	Capacity (Ac-feet)
Pond 1	9.3
Pond 2	4.5
Pond 3	7.8

Alternately, a total capacity of 21.6 acre-feet can be maintained above all three ponds, since the ponds are interconnected. CEC is basing the above requirements on a conservative assumption about the flow to Pond 1. Incorporating more information about the North Ponds and the Coal Runoff Ponds into the model could reduce the required capacity above the pools.

7.0   CERTIFICATION

I, Rick J. Buffalini, P.E., a registered professional engineer certify that Elmer Smith Station Ash Pond fulfils the Initial Inflow Design Flood Control System Plan requirements of §257.82(c). This certification is based on my review of the Initial Inflow Design Flood Control System Plan. This Initial Inflow Design Flood Control System Plan will be placed in the operating record by October 17, 2016.

Rick J. Buffalini, P.E.
Printed Name of Professional Engineer

Signature

041196-E
Registration No.

10-17-16
Date

Stamp/Seal:

8.0   REFERENCES

1.   United States Department of Agriculture. Natural Resources Conservation Service. Web Soil Survey. http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

2.   National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Hydrometeorological Design Studies Center, Precipitation Frequency Data Server (PFDS). http://hdsc.nws.noaa.gov/hdsc/pfds/

3.   10-foot contour data provided by USGS National Map from the National Elevation Dataset (NED), Owensboro East Quadrangle, Publication Date – 05/27/2016

4.   Site Map labeled prepared by Black & Veatch labeled "Structural Fill Finish Grading" dated 8-28-62.

FIGURES

NORTH

SITE

REFERENCE

1. U.S.G.S. 7.5' TOPOGRAPHIC QUADRANGLE, OWENSBORO EAST, KENTUCKY—INDIANA. DATED 2016.

SCALE IN FEET

0	2000	4000

CEC
Civil & Environmental Consultants, Inc.
333 Baldwin Road · Pittsburgh, PA 15205
412-429-2324 · 800-365-2324
www.cecinc.com

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ELMER SMITH STATION
OWENSBORO, KENTUCKY

SITE LOCATION MAP

DRAWN BY:	RJB	CHECKED BY:	AMR	APPROVED BY:	RJB	FIGURE NO.:
DATE:	10/07/2016	DWG SCALE:	1"=2000'	PROJECT NO:	164-014.0003	**1**

NORTH

OHIO RIVER

COAL PILE RUNOFF POND

POND 3 POND 2 POND 1

COAL PILE

ASH POND

POWER STATION

NORTH PONDS

CALVIN SLUDGE LAGOON

CONCRETE POND

LEGEND

- - - ASH POND LIMITS
- - - APPROXIMATE FOOTPRINT OF PONDS 1, 2, AND 3 (SEE NOTE 1)
- - - OTHER SITE FEATURES

NOTES

1. THE APPROXIMATE FOOTPRINT OF PONDS 1, 2, AND 3 IS BASED ON DRAWING NO. S-7 " STRUCTURAL FILL FINISH GRADING" PREPARED BY BLACK AND VEACH, DATED 8-28-62 AND THE AERIAL PHOTOGRAPHY (SEE REFERENCE 1).

SCALE IN FEET

0   300   600

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Civil & Environmental Consultants, Inc.

333 Baldwin Road · Pittsburgh, PA 15205
412-429-2324 · 800-365-2324
www.cecinc.com

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EXISTING CONDITIONS

DRAWN BY:	RJB	CHECKED BY:	AMR	APPROVED BY:	RJB	FIGURE NO.:
DATE:	10/06/2016	DWG SCALE:	1"=300'	PROJECT NO:	164-014.0003	2

REFERENCE

1. AERIAL PHOTOGRAPHY COPYRIGHT GOOGLE EARTH PRO VERSION 6.2, IMAGERY DATE 3-25-2016.

P:\2016\164-014\-CADD\Dwg\SW01\164014-SW01-FIG2-EXISTING CONDITIONS.dwg[LAYOUT1] LS:(10/17/2016 - swhite) - LP: 10/17/2016 4:11 PM

APPENDIX A

HYDROLOGIC AND HYDRAULIC CAPACITY CALCULATIONS

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PROJECT	**Owensboro Municipal Utilities**		PROJECT NO.	**164-014.0003**	
	Elmer Smith Station Ash Pond		PAGE	**1** OF **11**	
Hydrologic and Hydraulic Capacity Calculation					
MADE BY **AMR**	DATE **10/14/2016**	CHECKED BY **AAW**	DATE **10/14/2016**		

OBJECTIVE:

This calculation is being performed to evaluate the Hydrologic and Hydraulic Capacity of the Ash Pond at the Elmer Smith Station in accordance with CCR Rule §257.82. The Ash Pond at the Elmer Smith Station is classified as an existing CCR surface impoundment by definition in §257.53.

METHOD:

Use HydroCAD 10.0 to route the design storm through the Ash Pond.

REFERENCES:

1. HydroCAD Stormwater Modeling 10.0, HydroCAD Software Solutions, LLC., 2015.

2. United States Department of Agriculture. Natural Resources Conservation Service. Web Soil Survey. http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

3. National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Hydrometeorological Design Studies Center, Precipitation Frequency Data Server (PFDS). http://hdsc.nws.noaa.gov/hdsc/pfds/

4. 10-foot contour data provided by USGS National Map from the National Elevation Dataset (NED), Owensboro East Quadrangle, Publication Date – 05/27/2016

5. Site Map labeled prepared by Black & Veatch labeled "Structural Fill Finish Grading" dated 8-28-62.

DESCRIPTION:

The Ash Pond at the Elmer Smith Station (Station) receives flow from the Station and runoff from areas surrounding the Station. The Ash Pond is less than 10 acres in size and consists of three separate unlined ash settling basins (Ponds 1, 2, and 3). Pond 1 receives boiler slag sluice and FGD blowdown. Pond 2 receives fly ash sluice and discharge from the Cavin Water Plant Sludge Lagoon (Cavin Sludge Lagoon). Pond 3 receives no direct flow from the Station and is used for final settling prior to discharge. Other Station discharges are routed through the Ash Pond, including discharge from roof drains and floor drains, etc. Runoff from various ponds at the site is routed through the Ash Pond. Additionally, the Ash Pond receives runoff directly from adjacent areas. Pond 3 discharges into a canal to the south of the site, which discharges to the Ohio River through an outlet permitted under Kentucky Pollutant Discharge Elimination System (KPDES) Permit No. KY001295. Figure 1 shows the approximate location of the Station and Ash Pond and Figure 2 show the existing conditions.

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Hydrologic and Hydraulic Capacity Calculation					
MADE BY	**AMR** DATE **10/14/2016**	CHECKED BY	**AAW**	DATE	**10/14/2016**

This calculation is being performed to evaluate the Hydrologic and Hydraulic Capacity of the Ash Pond at the Elmer Smith Station. Flow from the Station and runoff are considered in this evaluation.

ANALYSIS:

HYDROLOGIC EVALUATION

CCR Rule §257.82 bases the design flood (storm event) on the hazard potential of the CCR surface impoundment. Based on a review of aerial images, contour data from the USGS National Map, Owensboro East Quadrangle, and a site map prepared by Black & Veatch labeled "Structural Fill Finish Grading" dated 8-28-62, the Ash Pond appears to be incised. This was confirmed through knowledge of site personnel. Since the Ash Pond is incised, the inflow design flood is the 25-year flood (25-year, 24-hour design storm event). HydroCAD uses the 2-year, 24-hour storm event when calculating the time of concentration. The rainfall from the 2-year, 24-hour storm event and the 25-year, 24-hour storm event is presented below in inches:

Table 1 – Storm Information	
Storm Event	**24-Hour Rainfall (inches)**
2-YEAR	3.26
25-YEAR	5.67

The rainfall values for the storm events were determined by referencing the National Oceanic and Atmospheric Administration's (NOAA) Precipitation Frequency Estimates for Owensboro, Kentucky. The NOAA data is presented in Attachment 1. The Type II Storm event was modeled, which represents the most intense short duration rainfall in most regions of the United States.

Runoff:

HydroCAD was used to model the runoff and route the flow through the system of ponds. The rate of runoff is based on the relationships between the amount of rainfall, soil type, infiltration, land cover, travel time, and the size of the drainage area. The land cover over the site varies, and includes areas with poor grass cover, unpaved parking areas with no aggregate cover, unpaved roadways with no aggregate cover, soil stockpile areas, coal stockpile areas, paved parking areas, rooftops, and the pond surface. The Soil Conservation Service (SCS) Technical Release No. 20 (TR20) segmental approach methodology within HydroCAD was used to calculate the time of concentration and peak discharge in each drainage area.

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Hydrologic and Hydraulic Capacity Calculation

MADE BY	**AMR**	DATE	**10/14/2016**	CHECKED BY	**AAW**	DATE	**10/14/2016**

The times of concentration were estimated as the sum of sheet flow, shallow concentrated flow, and culverted flow. The times of concentration depend on the surface. Sheet flow calculations use a roughness of 0.15 for short grass, a roughness of 0.011 for smooth dirt surfaces, a roughness of 0.050 for rough dirt surfaces (fallow). The pipe calculations use a roughness of 0.010 for plastic pipe, a roughness of 0.025 for steel pipe (assumed corrugated metal), and a roughness of 0.012 for concrete pipe. Shallow flow calculations use a velocity factor of 16.1 ft/sec for unpaved surfaces.

The curve number was determined based on the hydrologic soil group for soils at the site and the land cover. The hydrologic soil group for the soils at the site was determined by referencing the United States Department of Agriculture – Natural Resources Conservation Service (USDA NRCS) soil survey map. The local soils at the site are generally classified in soils group B. The output from the USDA NRCS soil survey map is provided in Attachment 2. The following table summarizes the curve numbers used for each of the different land covers.

Table 2 – CN Data	
Land Cover	**CN**
Poor Grass Cover	79
Unpaved Parking Areas (dirt)	82
Unpaved Roadways (dirt)	82
Soil Stockpile Areas (bare soil)	86
Coal Stockpile Areas (bare soil)	86
Paved Parking Areas	98
Rooftops	98
Pond Surface	98

The drainage areas to the Ash Pond were delineated and entered into HydroCAD. A table with the drainage areas is below:

Table 3 – Drainage Areas			
Drainage Area ID	**Drainage Area (acres)**	**Description/Assumptions**	**Curve Number**
DA-1	1.93	Unpaved roadway, pond surface	82, 98
DA-2	1.17	Unpaved roadway, pond surface	82, 98
DA-3	2.55	Soil stockpile area	86
DA-4	9.25	Coal stockpile, soil stockpile Unpaved roadway, rooftops	86, 82, 98
DA-5	4.71	Coal stockpile, pond surface	86, 98
DA-6	2.39	Coal stockpile, pond surface	86, 98
DA-7	19.59	Coal stockpile, ash pond surface,	86, 82,

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		unpaved parking, rooftops and paved parking	98
DA-8	6.22	Pond surface, rooftops, poor grass, unpaved parking	98,79, 82
DA-9	5.14	Pond surface, unpaved parking	98, 82
Cavin Sludge Lagoon Area	1.59	Bare soil, pond surface	86, 98
Concrete Pond Area	0.10	Pond surface	98

Runoff from drainage areas DA-1 and DA-2 is drained to ponds labeled the North Ponds. Runoff from stockpile drainage areas DA-3 and DA-4 is drained to open channels. Runoff from the coal stockpile drainage areas DA-5 and DA-6 is drained to ponds labeled the Coal Pile Runoff Ponds. Discharge from the North Ponds is routed through the open channels to the Coal Pile Runoff Ponds. Discharge from the Coal Pile Runoff Ponds is routed into Pond 3.

Runoff from drainage area DA-7 is assumed to drain directly to Pond 1. Runoff from drainage area DA-8 is assumed to drain directly to Pond 2. Additionally, runoff and flow from the Cavin Sludge Lagoon area and the Concrete Pond area are assumed to drain directly to Pond 2.

Runoff from drainage area DA-9 is assumed to drain directly to Pond 3. Additionally, discharge from Pond 1 and Pond 2 is routed through Pond 3. A figure showing the drainage areas and a schematic of a drainage diagram is presented in Figure 3.

Flow from Station:

As discussed above, in addition to runoff, the Ash Pond receives flow from the Station. CCR is sluiced from the Station to the Ash Pond. Pond 1 receives boiler slag sluice, FGD blowdown, and flow from the coal pile runoff ponds. Pond 2 receives fly ash sluice and discharge from the Cavin Water Plant Lagoon. Pond 3 receives no direct flow from the Station and is used for final settling prior to discharge. Personnel at the site provided the approximate flows from the Station to Ponds 1 and 2. Below is a summary of the flow rates from the Station to the Ash Pond:

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Table 4 – Pond 1 Flow Data		
Flow Description	**Flow (GPD)**	**Flow (cfs)**
Boiler Slag Sluice	250,000	0.39
FGD Blowdown	66,400	0.10
Coal Pile Runoff	55,000	0.085
Total:	**371,400**	**0.58**

The flow into Pond 1 is approximately 371,400 gallons per day (GPD) or 0.58 cfs based on these flows provided from personnel at the Station.

Table 5 – Pond 2 Flow Data		
Flow Description	**Flow (GPD)**	**Flow (cfs)**
Fly Ash Sluice	375,000	0.58
Cavin Water Plant Lagoon Sludge Discharge	40,000	0.062
Total:	**415,000**	**0.64**

The flow into Pond 2 is approximately 415,000 gallons per day (GPD) or 0.64 cubic feet per second (cfs) based on these flows provided from personnel at the Station. Correspondence with site personnel regarding the flow is provided in Attachment 3.

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HYDRAULIC EVALUATION

Preliminary Evaluation:

A preliminary evaluation of the Ash Pond was performed to compare the pond capacity with the inflow from runoff and flow from the Station. For this evaluation, the Ash Pond capacity was obtained from Drawing No. S-7 labeled "Structural Finish Grading", which was prepared by Black & Veatch and is dated 8-28-62. This drawing shows contours for Ponds 1, 2, and 3. This drawing shows the maximum footprint of the ponds, and the maximum available pond capacity. The drawing is presented on a site specific coordinate and elevation system, indicated by a reference arrow and a true north area. Based on the drawing, the crest of the ponds are at elevation 95-feet and the bottom of the ponds are at elevation 87-feet, which provides approximately 8-feet of total storage depth. Based on current information from the site, the normal pool of the pond is approximately 6-feet below the pond crest, or at approximate elevation 89-feet. Since the pool elevations are assumed to be at elevation 89-feet, the inlet of the discharge structures in Ponds 1 and 2 were assumed to be at elevation 89-feet, and the inlet of the discharge structure in Pond 3 was assumed to be at elevation 88-feet. It was assumed that the pond capacity above the pool and above the inlet of the discharge structure is available for routing inflow. The contours as presented in the "Structural Finish Grading" drawing were used to obtain stage storage curves to calculate the available pond volume above the pool. The drawing with the contours used for the evaluation is presented in Attachment 4 with the stage storage curves for the ponds. The maximum available capacity above the pool (elevation 89-feet) for each of the ponds is summarized in the table below:

Table 6 – Available Capacity above Pool (Maximum Pond Footprint)	
Pond	**Capacity (Ac-feet)**
Pond 1	19.0
Pond 2	19.3
Pond 3	15.4

Preliminary evaluations were performed using the available capacity above the normal pool using the maximum pond footprint. The preliminary evaluation considered the flows into Ponds 1 and 2 separately, with no assumed discharge structures, which is conservative. Two scenarios were evaluated for Pond 1 because limited information was available about the North Pond and Coal Pile Runoff Ponds, which attenuate flow prior to discharge into Pond 1. Pond 3 was also considered in the preliminary evaluations, which are described below:

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Pond 1, Scenario1:

For Pond 1, the normal pool elevation of approximately 89-feet was used as the starting elevation for the analysis. The inflow from runoff and flow from the Station was routed above the pool elevation. The flow from the boiler slag sluice, FGD blowdown, and coal pile runoff ponds as presented in Table 4 was set as a base flow of 0.58 cfs for Pond 1. Runoff from drainage areas DA-1 through DA-6 is routed through the coal pile runoff ponds. Since a flow was provided from the coal pile runoff ponds, drainage areas DA-1 through DA-6 were not included in the analysis. Runoff from drainage area DA-7 during the 25-year, 24-hour storm event was routed through Pond 1 with the base flow. Refer to Table 3 for the summary of drainage areas. The peak elevation was 91.8-feet, which is below the crest elevation of the pond.

Pond 1, Scenario 2:

An additional analysis was performed for Pond 1 which included the runoff from drainage areas DA-1 through DA-6 and DA-7. Again, the normal pool elevation of approximately 89-feet was used as the starting elevation for the analysis. The inflow from runoff and flow from the Station was routed above the pool elevation. The flow from the boiler slag sluice and blowdown as presented in Table 4 was sent as a base flow of 0.50 cfs for Pond 1. The base flow was reduced from 0.58 cfs to 0.50 cfs in this analysis, since 0.085 cfs is from the coal pile runoff ponds. The runoff from DA-1 through DA-7 during the 25-year, 24-hour storm event was routed through Pond 1 with the base flow. Refer to Table 3 for the summary of drainage areas. The peak elevation was 94.1-feet, which is below the crest elevation of the pond. This is conservative because it assumes drainage from DA-1 through DA-6 directly to Pond 1, when the flow is actually attenuated in ponds prior to discharge into Pond 1.

Pond 2:

For Pond 2, the normal pool elevation of approximately 89-feet was used as the starting elevation for the analysis. The inflow from runoff and flow from the Station was routed above the pool elevation. The flow from the fly ash sluice and the Cavin Sludge Lagoon as presented in Table 5 was set as a base flow of 0.64 cfs for Pond 2. Runoff from drainage area DA-8, from the Cavin Sludge Lagoon, and from the Concrete Pond was routed through Pond 2 with the base flow. The peak elevation was 90.5-feet, which is below the crest elevation of the pond.

Pond 3:

Discharge from Pond 1 and Pond 2 is routed through Pond 3. Based on information from site personnel, the discharge culvert from Pond 1 is a 30-inch diameter plastic pipe. The discharge culvert from Pond 2 is two 16-inch diameter steel pipes. As stated above, the inlet of the discharge structures in Ponds 1 and 2 were assumed to be at elevation 89-feet. Based on information from site personnel,

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	Elmer Smith Station Ash Pond		PAGE	**8** OF **11**	

Hydrologic and Hydraulic Capacity Calculation

MADE BY	**AMR**	DATE	**10/14/2016**	CHECKED BY	**AAW**	DATE	**10/14/2016**

the discharge culverts slope approximately 1 to 2-feet. Based on this, the outlets of the discharge culverts were assumed to be at 88-feet. The lengths of the discharge culverts were approximated, and the approximate locations are shown on Figure 3. For each discharge pipe, an entrance coefficient (Ke) of 0.90 was used for projecting pipe with no headwall. This information was used in the HydroCAD model to route the flow from Ponds 1 and 2 into Pond 3.

For Pond 3, a normal pool elevation of 89-feet was used as the starting elevation for the analysis. The inflow from runoff and flow from the Station was routed above the pool elevation. Based on information from site personnel, the discharge culvert from Pond 3 is a 24-inch diameter concrete pipe. As stated above, the inlet of the discharge structure in Pond 3 was assumed to be at elevation 88-feet. The discharge structure is assumed to slope approximately 1-foot. Based on this, the outlet of the discharge structure was assumed to be at 87-feet. The length of the discharge structure was approximated, and the approximate location is shown on Figure 3. For this discharge pipe, an entrance coefficient (Ke) of 0.50 was used for a square edge headwall for concrete pipe. Based on information from site personnel, the emergency spillway is a 24-inch diameter metal pipe and is approximately 2-feet higher than the primary discharge structure. For this discharge structure, an entrance coefficient (Ke) of 0.90 was used for projecting pipe with no headwall. This information was used in the HydroCAD model.

The conservative analysis of Pond 1 (Pond 1, Scenario 2) was used when routing discharges from Pond 1 and Pond 2 through Pond 3. In addition to the flow from Ponds 1 and 2, drainage area DA-9 from Table 3 drains directly to Pond 3. During the analysis, the sim-route routing procedure was used, which allows reverse flow through ponds. Additionally, reverse culverts were added to model reverse flow from Pond 3 to Ponds 1 and 2. Using this method, the peak elevation in Pond 1 was 91.9-feet, the peak elevation in Pond 2 was 90.1-feet, and the peak elevation in Pond 3 was 90.1-feet. The peak elevations in the ponds are below the crest elevations of the ponds.

This preliminary evaluation indicates that the ponds have the required capacity for the 25-year, 24-hour storm event above the normal pool, using the maximum footprint of the ponds. In reality, the footprint of the pond and therefore, the pond capacity is reduced because CCR is temporarily stored in the ponds. An additional evaluation was performed to estimate the required capacity in the ponds assuming that the capacity is reduced due to CCR storage.

Additional Evaluation:

An additional evaluation was performed to estimate the required capacity of Ponds 1, 2, and 3. To perform this evaluation, the surface area of the existing pool was approximated using the aerial image. The sideslopes of the ponds are assumed to be approximately 2.5H:1V based on information provided by site personnel. Using the sideslopes and an assumed depth of approximately 8-feet, the approximate existing available pond capacity was estimated. Based on current information from the

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Hydrologic and Hydraulic Capacity Calculation

MADE BY	**AMR**	DATE	**10/14/2016**	CHECKED BY	**AAW**	DATE	**10/14/2016**

site, the normal pool of the pond is approximately 6-feet below the pond crest, or at approximate elevation 89-feet. It was assumed that the pond capacity above the pool and above the inlet of the discharge structure is available for routing inflow. A figure showing the contours used to estimate the existing capacity above the pool is presented in Attachment 5 with the stage storage curves for the ponds. The existing capacity above the pool (elevation 89-feet) for each of the ponds is summarized in the table below:

Table 7 – Estimated Existing Capacity above Pool	
Pond	**Capacity (Ac-feet)**
Pond 1	4.6
Pond 2	4.5
Pond 3	7.8

The estimated capacity was entered into HydroCAD. An analysis was performed using the 25-year, 24-hour storm event. A starting elevation of approximately 89-feet was assumed in all ponds. The inflow from runoff and flow from the Station was routed above the normal pool elevation. When using the less conservative scenario for Pond 1 (Pond 1, Scenario 1), the existing capacity above the pool was sufficient. The peak elevation in Pond 1 was 93.0-feet, the peak elevation in Pond 2 was 91.7-feet, and the peak elevation in Pond 3 was 90.9-feet. The peak elevations in the ponds are below the crest elevations of the pond.

When using the conservative scenario for Pond 1 (Pond 1, Scenario 2), the existing capacity of Pond 1 above the pool was insufficient. The capacity of Ponds 2 and 3 were sufficient. The storage capacity of Pond 1 was increased in the HydroCAD model, until sufficient capacity was achieved. The estimated required pond capacity based on the conservative HydroCAD model for each pond is summarized in the table below:

Table 8 – Estimated Required Capacity above Pool	
Pond	**Capacity (Ac-feet)**
Pond 1	9.3
Pond 2	4.5
Pond 3	7.8

The peak elevation in Pond 1 was 93.9-feet, the peak elevation in Pond 2 was 91.8-feet, and the peak elevation in Pond 3 was 91.3-feet. The peak elevations in the ponds are below the crest elevations of the pond, and approximately 1-foot of freeboard is maintained.

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	Elmer Smith Station Ash Pond	PAGE	**10**	OF	**11**

Hydrologic and Hydraulic Capacity Calculation

| MADE BY | **AMR** | DATE | **10/14/2016** | CHECKED BY | **AAW** | DATE | **10/14/2016** |

CONCLUSIONS:

Calculations were performed to compare the pond capacity with the inflow from runoff resulting from the 25 year, 24 hour storm, and flow from the Station. The HydroCAD routing for each evaluation is provided in Attachment 6. For Pond 1, two scenarios were analyzed. The first scenario included flow from the Coal Pile Runoff Ponds in the base flow, as provided by site personnel (Pond 1, Scenario 1). The second scenario used drainage areas to model runoff into Pond 1 (Pond 1, Scenario 2). This is conservative because it assumes drainage from DA-1 through DA-6 directly to Pond 1, when the flow is actually attenuated in ponds prior to discharge into Pond 1.

During the preliminary evaluation, the available capacity above the pool using the maximum footprint of the ponds was used. This preliminary evaluation indicates that the ponds have the required capacity for the 25-year, 24-hour storm event. In reality, the footprint of the pond and therefore, the pond capacity is reduced because CCR is temporarily stored in the ponds. An additional evaluation was performed to estimate the required capacity in the ponds assuming that the capacity is reduced due to CCR storage. When using the less conservative scenario for Pond 1 (Pond 1, Scenario 1), the existing capacity above the normal pool was sufficient. The estimated existing pond capacity above the pool is as follows:

Table 7 – Estimated Existing Capacity above Pool	
Pond	**Capacity (Ac-feet)**
Pond 1	4.6
Pond 2	4.5
Pond 3	7.8

Based on a conservative estimate of inflow into Pond 1 (Pond 1, Scenario 2), the estimated required pond capacity above the normal pool is as follows:

Table 8 – Estimated Required Capacity above Pool	
Pond	**Capacity (Ac-feet)**
Pond 1	9.3
Pond 2	4.5
Pond 3	7.8

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	Elmer Smith Station Ash Pond	PAGE	**11** OF **11**	

Hydrologic and Hydraulic Capacity Calculation

MADE BY	**AMR**	DATE	**10/14/2016**	CHECKED BY	**AAW**	DATE	**10/14/2016**

RECOMMENDATIONS:

CEC recommends maintaining the following capacities above the normal pool.

Table 8 – Estimated Required Capacity above Pool	
Pond	**Capacity (Ac-feet)**
Pond 1	9.3
Pond 2	4.5
Pond 3	7.8

Alternately, a total capacity of 21.6 acre-feet can be maintained above all three ponds, since the ponds are interconnected. A table showing the approximate areas and depths above the pool that are needed to maintain these capacities is presented in Attachment 7.

During these evaluations, limited information about Ponds 1, 2, and 3 of the Ash Pond was available, so assumptions were made by CEC. CEC is basing the above requirements on a conservative assumption about the flow to Pond 1. CEC notes that incorporating more information about the North Ponds and the Coal Runoff Ponds into the model could reduce the required capacity above the pool elevation.

FIGURES

NORTH

SITE

Ohio River

Yellow Cr

White Chapel
Memorial
Gardens

RIVERSIDE DR

EASTWOOD DR

DANIELS LN

REID RD

STURBRIDGE PL

GRANDVIEW DR

GLENN CT

PLEASANT VALLEY RD

Byp
60

REFERENCE

1.   U.S.G.S. 7.5' TOPOGRAPHIC QUADRANGLE, OWENSBORO EAST, KENTUCKY–INDIANA. DATED 2016.

SCALE IN FEET

0   2000   4000

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Civil & Environmental Consultants, Inc.

333 Baldwin Road · Pittsburgh, PA 15205
412-429-2324 · 800-365-2324
www.cecinc.com

OWENSBORO MUNICIPAL UTILITIES
ELMER SMITH STATION
OWENSBORO, KENTUCKY

SITE LOCATION MAP

DRAWN BY:	RJB	CHECKED BY:	AMR	APPROVED BY:	RJB	FIGURE NO.:
DATE:	10/07/2016	DWG SCALE:	1"=2000'	PROJECT NO:	164-014.0003	**1**

NORTH

OHIO RIVER

COAL PILE RUNOFF POND

POND 3 POND 2 POND 1

COAL PILE

ASH POND

POWER STATION

NORTH PONDS

CALVIN SLUDGE LAGOON

CONCRETE POND

LEGEND

- - - ASH POND LIMITS

- - - APPROXIMATE FOOTPRINT OF PONDS 1, 2, AND 3 (SEE NOTE 1)

- - - OTHER SITE FEATURES

NOTES

1. THE APPROXIMATE FOOTPRINT OF PONDS 1, 2, AND 3 IS BASED ON DRAWING NO. S-7 " STRUCTURAL FILL FINISH GRADING" PREPARED BY BLACK AND VEACH, DATED 8-28-62 AND THE AERIAL PHOTOGRAPHY (SEE REFERENCE 1).

SCALE IN FEET

0   300   600

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EXISTING CONDITIONS

REFERENCE

DRAWN BY:	RJB	CHECKED BY:	AMR	APPROVED BY:	RJB	FIGURE NO.:
DATE:	10/06/2016	DWG SCALE:	1"=300'	PROJECT NO:	164-014.0003	**2**

NORTH

OHIO RIVER

DISCHARGE 4-12" PLASTIC PIPE

DISHCARGE 30" PLASTIC PIPE

COAL PILE RUNOFF POND

DISCHARGE 2-16" STEEL PIPE

DISCHARGE 24" CONCRETE PIPE

EMERGENCY DISCHARGE 24" METAL PIPE

CANAL

POND 3 POND 2 POND 1

DA-5

DA-6

CHANNEL 2

DA-3

OPEN FLOW DITCH

DISCHARGE 24" CONCRETE PIPE

ASH POND

DA-9 DA-8

COAL PILE DA-4

CHANNEL 1

PUMP DISCHARGE 2-6" PLASTIC PIPES

DA-7

CALVIN SLUDGE LAGOON

DA-2 NORTH POND 2

POWER STATION

DISCHARGE 8" PLASTIC PIPE

DISCHARGE 8" PLASTIC PIPE

DISCHARGE 4" PLASTIC PIPE

CONCRETE POND

DA-1 NORTH POND 1

LEGEND

— 400 — EXISTING TOPOGRAPHIC CONTOUR (SEE REFERENCE 2)

———— EXISTING DISCHARGE PIPE (SEE NOTE 1)

——▷···— EXISTING OPEN FLOW DITCH (SEE NOTE 1)

———— TIME OF CONCENTRATION PATH

▭ DRAINAGE AREA BOUNDARY

NOTES

1. THE LOCATIONS AND SIZES OF THE EXISTING DISCHARGE PIPES AND THE LOCATIONS OF OPEN FLOW DITCHES ARE APPROXIMATED BASED ON INFORMATION PROVIDED BY SITE PERSONNEL AND THE AERIAL PHOTOGRAPHY (SEE REFERENCE 1).

SCALE IN FEET

0   300   600

REFERENCE

1. AERIAL PHOTOGRAPHY COPYRIGHT GOOGLE EARTH PRO VERSION 6.2, IMAGERY DATE 3-25-2016.

2. 10' CONTOUR DATA PROVIDED BY USGS NATIONAL MAP FROM THE NATIONAL ELEVATION DATASET (NED), OWENSBORO EAST QUADRANGLE, PUBLICATION DATE – 05/27/2016

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333 Baldwin Road · Pittsburgh, PA 15205
412-429-2324 · 800-365-2324
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DRAINAGE DIAGRAM

DRAWN BY:	RJB	CHECKED BY:	AMR	APPROVED BY:	RJB	FIGURE NO.:
DATE:	10/06/2016	DWG SCALE:	1"=300'	PROJECT NO:	164-014.0003	**3**

P:\2016\164-014\-CADD\Dwg\SW01\164014-SW01-FIG3-H&H FLOW DIAGRAM.dwg[LAYOUT1] LS:(10/17/2016) - swhite) - LP: 10/17/2016 4:12 PM

ATTACHMENTS

ATTACHMENT 1

NOAA DATA FOR OWENSBORO, KENTUCKY
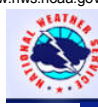
NOAA's National Weather Service
Hydrometeorological Design Studies Center
Precipitation Frequency Data Server (PFDS)

Home	Site Map	News	Organization

Search [   ] ● NWS ○ All NOAA Go

General Info
Homepage
Current Projects
FAQ
Glossary

Precipitation Frequency (PF)
PF Data Server
PF in GIS Format
PF Maps
Temporal Distr.
Time Series Data
PFDS Perform.
PF Documents

Probable Maximum Precipitation (PMP)
PMP Documents

Miscellaneous
Publications
AEP Storm Analysis
Record Precipitation

Contact Us
Inquiries
List-server

USA.gov
Government Made Easy

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: KY

Data description

Data type: Precipitation depth ▼ **Units:** English ▼ **Time series type:** Partial duration ▼
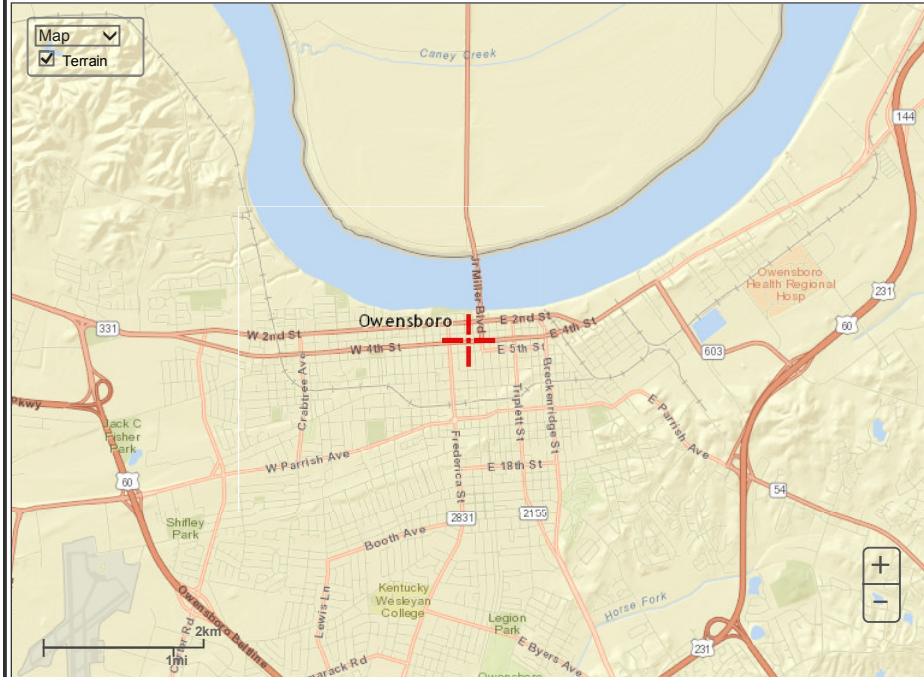
Select location

1) Manually:

    a) By location (decimal degrees, use "-" for S and W): Latitude: [   ] Longitude: [   ] Submit

    b) By station (List of KY stations): Select station ▼

    c) By address [4301 State Route 144, Owensbc ✕] 🔍

2) Use map:

a) Select location
  Move crosshair or double click

b) Click on station icon
  ☐ Show stations on map

Location information:
Name: Owensboro, Kentucky, USA*
Latitude: 37.7728°
Longitude: -87.1104°
Elevation: 399.44 ft **

* Source: ESRI Maps
** Source: USGS

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES
WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 2, Version 3

    PF tabular   PF graphical   Supplementary information   🖨 Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.358 (0.327–0.393)	0.421 (0.385–0.462)	0.491 (0.449–0.539)	0.544 (0.496–0.597)	0.615 (0.558–0.673)	0.667 (0.602–0.730)	0.718 (0.645–0.785)	0.771 (0.688–0.846)	0.838 (0.742–0.919)	0.886 (0.779–0.975)
10-min	0.568 (0.518–0.622)	0.669 (0.612–0.734)	0.778 (0.712–0.855)	0.862 (0.785–0.945)	0.968 (0.878–1.06)	1.05 (0.946–1.15)	1.13 (1.01–1.23)	1.20 (1.07–1.32)	1.30 (1.15–1.42)	1.37 (1.20–1.50)
15-min	0.707 (0.646–0.775)	0.834 (0.763–0.916)	0.976 (0.893–1.07)	1.08 (0.986–1.19)	1.22 (1.11–1.33)	1.32 (1.19–1.44)	1.42 (1.27–1.55)	1.51 (1.35–1.66)	1.63 (1.44–1.79)	1.71 (1.50–1.88)
30-min	0.959 (0.876–1.05)	1.14 (1.05–1.26)	1.37 (1.26–1.51)	1.55 (1.42–1.70)	1.78 (1.62–1.95)	1.96 (1.77–2.14)	2.14 (1.92–2.34)	2.31 (2.06–2.53)	2.54 (2.25–2.79)	2.71 (2.39–2.99)
60-min	1.19 (1.09–1.31)	1.43 (1.31–1.57)	1.75 (1.60–1.93)	2.01 (1.83–2.20)	2.36 (2.14–2.58)	2.64 (2.38–2.89)	2.92 (2.62–3.19)	3.21 (2.87–3.52)	3.61 (3.20–3.96)	3.92 (3.45–4.32)
2-hr	1.43 (1.31–1.56)	1.72 (1.58–1.88)	2.14 (1.96–2.33)	2.47 (2.26–2.69)	2.92 (2.66–3.18)	3.28 (2.98–3.56)	3.65 (3.30–3.97)	4.04 (3.62–4.39)	4.57 (4.04–4.98)	4.98 (4.38–5.45)
3-hr	1.54 (1.42–1.68)	1.86 (1.71–2.03)	2.30 (2.11–2.52)	2.67 (2.44–2.91)	3.17 (2.89–3.45)	3.58 (3.24–3.89)	4.00 (3.61–4.35)	4.44 (3.98–4.83)	5.06 (4.47–5.52)	5.56 (4.86–6.07)
6-hr	1.90 (1.74–2.07)	2.28 (2.09–2.49)	2.82 (2.59–3.08)	3.28 (3.00–3.58)	3.92 (3.57–4.27)	4.45 (4.02–4.84)	5.02 (4.50–5.45)	5.61 (4.99–6.10)	6.46 (5.67–7.03)	7.15 (6.20–7.81)
12-hr	2.27 (2.08–2.49)	2.73 (2.51–3.00)	3.39 (3.10–3.71)	3.93 (3.58–4.30)	4.70 (4.26–5.14)	5.33 (4.81–5.82)	6.01 (5.38–6.56)	6.72 (5.97–7.35)	7.74 (6.79–8.48)	8.57 (7.42–9.41)
24-hr	2.71	3.26	4.07	4.72	5.67	6.45	7.28	8.17	9.43	10.5

	(2.54–2.90)	(3.06–3.49)	(3.80–4.35)	(4.41–5.05)	(5.25–6.05)	(5.94–6.89)	(6.65–7.79)	(7.39–8.77)	(8.40–10.2)	(9.21–11.3)
2-day	**3.26** (3.04–3.50)	**3.91** (3.64–4.20)	**4.88** (4.53–5.24)	**5.68** (5.27–6.09)	**6.83** (6.30–7.33)	**7.79** (7.14–8.39)	**8.83** (8.02–9.52)	**9.94** (8.94–10.8)	**11.5** (10.2–12.6)	**12.9** (11.3–14.1)
3-day	**3.47** (3.24–3.72)	**4.16** (3.89–4.47)	**5.19** (4.83–5.57)	**6.04** (5.61–6.48)	**7.28** (6.72–7.81)	**8.32** (7.63–8.95)	**9.43** (8.58–10.2)	**10.6** (9.58–11.5)	**12.4** (11.0–13.5)	**13.8** (12.1–15.2)
4-day	**3.68** (3.44–3.95)	**4.41** (4.13–4.74)	**5.50** (5.13–5.90)	**6.40** (5.96–6.87)	**7.73** (7.15–8.29)	**8.84** (8.12–9.51)	**10.0** (9.14–10.8)	**11.3** (10.2–12.3)	**13.2** (11.7–14.4)	**14.8** (13.0–16.2)
7-day	**4.28** (3.98–4.62)	**5.13** (4.77–5.55)	**6.42** (5.96–6.94)	**7.55** (6.98–8.16)	**9.24** (8.47–9.98)	**10.7** (9.74–11.6)	**12.3** (11.1–13.4)	**14.2** (12.6–15.5)	**16.9** (14.7–18.6)	**19.2** (16.5–21.3)
10-day	**4.82** (4.49–5.20)	**5.77** (5.37–6.23)	**7.19** (6.67–7.75)	**8.40** (7.78–9.05)	**10.2** (9.38–11.0)	**11.8** (10.7–12.7)	**13.5** (12.1–14.6)	**15.3** (13.7–16.7)	**18.1** (15.9–19.9)	**20.5** (17.7–22.7)
20-day	**6.65** (6.27–7.06)	**7.90** (7.44–8.39)	**9.51** (8.94–10.1)	**10.8** (10.1–11.5)	**12.7** (11.8–13.5)	**14.1** (13.1–15.0)	**15.6** (14.4–16.7)	**17.2** (15.8–18.4)	**19.4** (17.6–20.9)	**21.2** (19.0–22.9)
30-day	**8.20** (7.76–8.66)	**9.70** (9.17–10.3)	**11.5** (10.9–12.2)	**12.9** (12.2–13.7)	**14.9** (14.0–15.8)	**16.5** (15.4–17.4)	**18.0** (16.8–19.1)	**19.6** (18.2–20.9)	**21.8** (19.9–23.3)	**23.4** (21.3–25.2)
45-day	**10.4** (9.85–10.9)	**12.2** (11.6–12.8)	**14.2** (13.5–14.9)	**15.8** (15.0–16.6)	**17.8** (16.8–18.7)	**19.3** (18.2–20.3)	**20.8** (19.6–22.0)	**22.3** (20.9–23.6)	**24.2** (22.5–25.7)	**25.6** (23.7–27.3)
60-day	**12.4** (11.8–13.0)	**14.6** (13.9–15.3)	**16.8** (16.0–17.6)	**18.5** (17.5–19.3)	**20.5** (19.5–21.5)	**22.1** (20.9–23.2)	**23.5** (22.2–24.7)	**24.9** (23.4–26.2)	**26.6** (24.9–28.1)	**27.8** (25.9–29.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: [Precipitation frequency estimates ▾] [Submit]
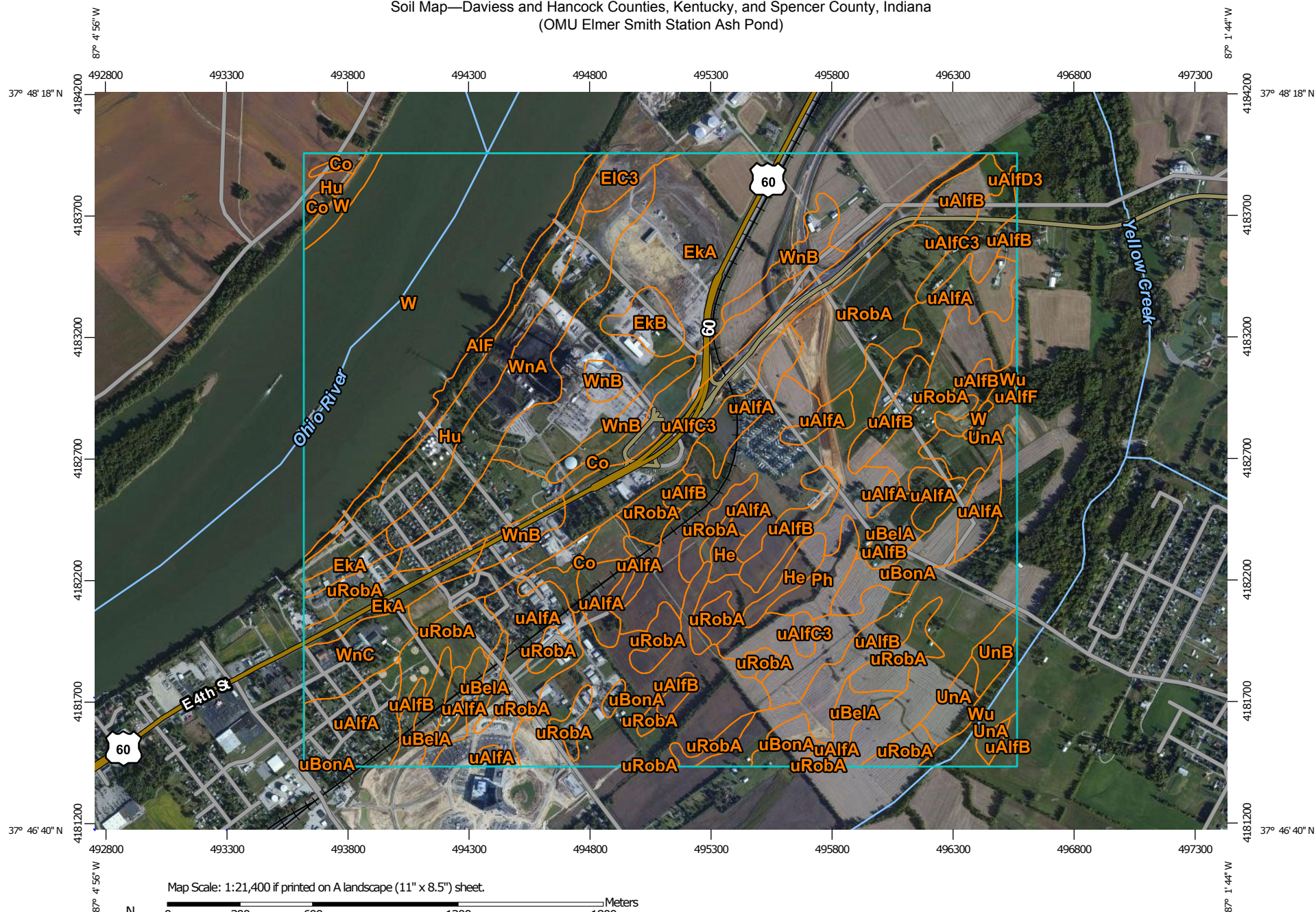
Main Link Categories:
Home | OWP(OHD)

ATTACHMENT 2
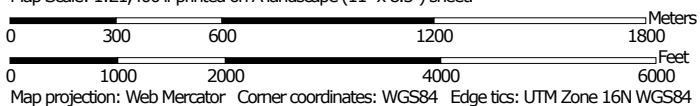
USDA NRCS SOIL SURVEY MAP

Soil Map—Daviess and Hancock Counties, Kentucky, and Spencer County, Indiana
(OMU Elmer Smith Station Ash Pond)

Map Scale: 1:21,400 if printed on A landscape (11" x 8.5") sheet.

Meters
0   300   600   1200   1800

Feet
0   1000   2000   4000   6000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

USDA **Natural Resources**
     Conservation Service

Web Soil Survey
National Cooperative Soil Survey

10/6/2016
Page 1 of 4

MAP LEGEND

Area of Interest (AOI)

☐ Area of Interest (AOI)

Soils

☐ Soil Map Unit Polygons

🔶 Soil Map Unit Lines

◼ Soil Map Unit Points

Special Point Features

⊚ Blowout

⊠ Borrow Pit

✖ Clay Spot

◇ Closed Depression

✂ Gravel Pit

⋰ Gravelly Spot

⊛ Landfill

⋀ Lava Flow

⊥ Marsh or swamp

⊗ Mine or Quarry

◎ Miscellaneous Water

◎ Perennial Water

⌄ Rock Outcrop

✛ Saline Spot

⋰ Sandy Spot

⊜ Severely Eroded Spot

◇ Sinkhole

⋗ Slide or Slip

⌀ Sodic Spot

⊟ Spoil Area

⋀ Stony Spot

⊗ Very Stony Spot

♈ Wet Spot

△ Other

▰▬ Special Line Features

Water Features

〜 Streams and Canals

Transportation

╫ Rails

〜 Interstate Highways

〜 US Routes

〜 Major Roads

〜 Local Roads

Background

▨ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,800 to 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Daviess and Hancock Counties, Kentucky
Survey Area Data: Version 14, Sep 15, 2015

Soil Survey Area: Spencer County, Indiana
Survey Area Data: Version 16, Sep 11, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 3, 2011—Oct 4, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

USDA Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

10/6/2016
Page 2 of 4

Map Unit Legend

Daviess and Hancock Counties, Kentucky (KY615)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AlF	Alluvial land, steep (wheeling flooded)	25.9	1.4%
Co	Collins silt loam	74.9	4.1%
EkA	Elk silt loam, 0 to 2 percent slopes, rarely flooded	221.1	12.0%
EkB	Elk silt loam, 2 to 6 percent slopes, rarely flooded	13.7	0.7%
ElC3	Elk silty clay loam, 6 to 12 percent slopes, severely eroded	11.3	0.6%
He	Henshaw silt loam	14.5	0.8%
Hu	Huntington silt loam	50.6	2.7%
Ph	Patton silt loam, overwash, 0 to 2 percent slopes, occasionally flooded	14.0	0.8%
uAlfA	Alford silt loam, 0 to 2 percent slopes	170.1	9.2%
uAlfB	Alford silt loam, 2 to 6 percent slopes	171.5	9.3%
uAlfC3	Alford silt loam, 6 to 12 percent slopes, severely eroded	100.7	5.5%
uAlfD3	Alford silt loam, 12 to 20 percent slopes, severely eroded	0.6	0.0%
uAlfF	Alford silt loam, 30 to 60 percent slopes	0.1	0.0%
uBelA	Belknap silt loam, 0 to 2 percent slopes, occasionally flooded	185.1	10.0%
uBonA	Bonnie silt loam, 0 to 2 percent slopes, occasionally flooded	122.0	6.6%
UnA	Uniontown silt loam, 0 to 2 percent slopes	30.2	1.6%
UnB	Uniontown silt loam, 2 to 6 percent slopes	8.4	0.5%
uRobA	Robbs silt loam, 0 to 2 percent slopes	206.6	11.2%
W	Water	251.5	13.6%
WnA	Wheeling loam, 0 to 2 percent slopes	68.1	3.7%
WnB	Wheeling loam, 2 to 6 percent slopes	44.3	2.4%
WnC	Wheeling loam, 6 to 12 percent slopes	25.2	1.4%
Wu	Wilbur silt loam	15.9	0.9%

Daviess and Hancock Counties, Kentucky (KY615)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Subtotals for Soil Survey Area		**1,826.4**	**99.0%**
Totals for Area of Interest		**1,845.2**	**100.0%**

Spencer County, Indiana (IN147)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Co	Combs fine sandy loam, frequently flooded, brief duration	5.2	0.3%
Hu	Huntington silt loam, frequently flooded, brief duration	5.9	0.3%
W	Water	7.7	0.4%
Subtotals for Soil Survey Area		**18.8**	**1.0%**
Totals for Area of Interest		**1,845.2**	**100.0%**

Huntington

   Percent of map unit: 5 percent
   Hydric soil rating: No

Elk

   Percent of map unit: 3 percent
   Hydric soil rating: No

Wheeling, (hydric-green river)

   Percent of map unit: 1 percent
   Landform: Flood plains
   Landform position (two-dimensional): Backslope
   Landform position (three-dimensional): Rise
   Down-slope shape: Linear
   Across-slope shape: Convex
   Hydric soil rating: Yes

Wheeling, (hydric-ohio river)

   Percent of map unit: 1 percent
   Landform: Flood plains
   Landform position (two-dimensional): Backslope
   Landform position (three-dimensional): Rise
   Down-slope shape: Linear
   Across-slope shape: Convex
   Hydric soil rating: Yes

Co—Collins silt loam

Map Unit Setting

   National map unit symbol: lfnq
   Elevation: 350 to 600 feet
   Mean annual precipitation: 36 to 52 inches
   Mean annual air temperature: 46 to 68 degrees F
   Frost-free period: 174 to 210 days
   Farmland classification: All areas are prime farmland

Map Unit Composition

   Collins, occasionally flooded, and similar soils: 90 percent
   Minor components: 10 percent
   Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collins, Occasionally Flooded

Setting

   Landform: Flood plains
   Down-slope shape: Linear
   Across-slope shape: Linear
   Parent material: Coarse-silty alluvium

Typical profile

   H1 - 0 to 7 inches: silt loam

H2 - 7 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Very high (about 13.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Hydric soil rating: No

Minor Components

Belknap

Percent of map unit: 4 percent
Hydric soil rating: No

Collins, (hydric)

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Other soils

Percent of map unit: 2 percent
Hydric soil rating: No

Grenada

Percent of map unit: 2 percent
Hydric soil rating: No

EkA—Elk silt loam, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 2s2c7
Elevation: 320 to 640 feet
Mean annual precipitation: 36 to 61 inches
Mean annual air temperature: 42 to 70 degrees F
Frost-free period: 154 to 232 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Elk, rarely flooded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elk, Rarely Flooded

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

Ap - 0 to 8 inches: silt loam
BA - 8 to 12 inches: silty clay loam
Bt - 12 to 36 inches: silty clay loam
C - 36 to 80 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Other vegetative classification: Deep Well Drained Upland Soils 0-30% (PHG-5)
Hydric soil rating: No

Minor Components

Wheeling, rarely flooded

Percent of map unit: 4 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Sciotoville, rarely flooded

Percent of map unit: 4 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Weinbach, rarely flooded
Percent of map unit: 2 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

EkB—Elk silt loam, 2 to 6 percent slopes, rarely flooded

Map Unit Setting
National map unit symbol: 2slf6
Elevation: 300 to 700 feet
Mean annual precipitation: 36 to 61 inches
Mean annual air temperature: 42 to 70 degrees F
Frost-free period: 154 to 232 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Elk, rarely flooded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elk, Rarely Flooded

Setting
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile
Ap - 0 to 8 inches: silt loam
BA - 8 to 12 inches: silty clay loam
Bt - 12 to 36 inches: silty clay loam
C - 36 to 80 inches: loam

Properties and qualities
Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Other vegetative classification: Deep Well Drained Upland Soils 0-30% (PHG-5)
Hydric soil rating: No

Minor Components

Sciotoville, rarely flooded

Percent of map unit: 4 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Wheeling, rarely flooded

Percent of map unit: 4 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Weinbach, rarely flooded

Percent of map unit: 2 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

ElC3—Elk silty clay loam, 6 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: lfnw
Elevation: 360 to 420 feet
Mean annual precipitation: 36 to 52 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 174 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Elk, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Other soils

Percent of map unit: 3 percent
Hydric soil rating: No

Hu—Huntington silt loam

Map Unit Setting

National map unit symbol: lfp7
Elevation: 350 to 440 feet
Mean annual precipitation: 36 to 52 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 174 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Huntington, occasionally flooded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huntington, Occasionally Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed fine-silty alluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Lindside

Percent of map unit: 3 percent
Hydric soil rating: No

Ashton

Percent of map unit: 3 percent
Hydric soil rating: No

Other soils

Percent of map unit: 2 percent
Hydric soil rating: No

Huntington, (hydric green river)

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Huntington, (hydric ohio river)

Percent of map unit: 1 percent
Landform: Flood plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Ph—Patton silt loam, overwash, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2r14l
Elevation: 350 to 470 feet
Mean annual precipitation: 36 to 52 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 174 to 215 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Patton, occasionally flooded, overwash, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Patton, Occasionally Flooded, Overwash

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Estimates are based on observations, descriptions, and transects of the mapunit.

WnA—Wheeling loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: lfqt
Elevation: 350 to 420 feet
Mean annual precipitation: 36 to 52 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 174 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wheeling, rarely flooded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheeling, Rarely Flooded

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy alluvium

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 25 inches: loam
H3 - 25 to 60 inches: fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Elk
Percent of map unit: 2 percent
Hydric soil rating: No

Sciotoville
Percent of map unit: 2 percent
Hydric soil rating: No

Wheeling, (hydric ohio river)
Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Wheeling, (hydric green river)
Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

WnB—Wheeling loam, 2 to 6 percent slopes

Map Unit Setting
National map unit symbol: lfqv
Elevation: 350 to 430 feet
Mean annual precipitation: 36 to 52 inches
Mean annual air temperature: 46 to 68 degrees F
Frost-free period: 174 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Wheeling, rarely flooded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheeling, Rarely Flooded

Setting
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Fine-loamy alluvium

Typical profile
H1 - 0 to 7 inches: loam
H2 - 7 to 25 inches: loam

H3 - 25 to 72 inches: fine sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Elk

Percent of map unit: 2 percent
Hydric soil rating: No

Sciotoville

Percent of map unit: 2 percent
Hydric soil rating: No

Wheeling, (hydric green river)

Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: Yes

Wheeling, (hydric ohio river)

Percent of map unit: 1 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: Yes

ATTACHMENT 3

CORRESPONDENCE

From:	Buffalini, Rick
Sent:	Friday, October 07, 2016 3:05 PM
To:	Ramirez, Angela
Subject:	Fwd: OMU Ash pond runoff

Sent from my iPhone

Begin forwarded message:

> **From:** Jim Roberts <RobertsJM@omu.org>
> **Date:** October 7, 2016 at 9:26:15 AM EDT
> **To:** "Buffalini, Rick" <rbuffalini@cecinc.com>, "Dixon, Stephen" <sdixon@cecinc.com>
> **Subject: RE: OMU Ash pond runoff**
>
> Rick:
> Water flows to the ash ponds, from plant use and not including any direct rainfall, total as follows:
> Pond #1 inflow: Slag sluice is 250,000 GPD, FGD Blowdown is 66,400 GPD, Coal Pile Runoff Pond is 55,000 GPD.
> Pond #2 inflow: Ash sluice is 375,000 GPD, Cavin Water Plant Sludge Discharge is 40,000 GPD.
> Jim
> James M. Roberts, P E
> Owensboro Municipal Utilities
> Fuels & By-Products Manager
> robertsjm@omu.org
> Office: 270-691-4221
> Cell: 270-313-2999
>
>
>
> **From:** Buffalini, Rick [mailto:rbuffalini@cecinc.com]
> **Sent:** Thursday, October 06, 2016 7:32 AM
> **To:** Jim Roberts; Dixon, Stephen
> **Subject:** RE: OMU Ash pond runoff
>
> Thank you James
>
> **Rick J. Buffalini, P.E.** / Vice President
> Civil & Environmental Consultants, Inc.
> 333 Baldwin Road · Pittsburgh, PA 15205-1751
> Toll-Free: 800-365-2324 · Direct: 412-249-3169
> Mobile: 412-760-9133 · http://www.cecinc.com
> Senior Leadership · Integrated Services · Personal Business Relationships
>
> **From:** Jim Roberts [mailto:RobertsJM@omu.org]
> **Sent:** Wednesday, October 05, 2016 5:24 PM
> **To:** Dixon, Stephen; Buffalini, Rick
> **Subject:** OMU Ash pond runoff

Attached maps should depict runoff area into ash pond system.
I will soon forward water balance for amounts of water OMU discharges into ponds under normal operating mode.
Let me know if you have questions.
THANKS
Jim
James M. Roberts, P E
Owensboro Municipal Utilities
Fuels & By-Products Manager
robertsjm@omu.org
Office: 270-691-4221
Cell: 270-313-2999

From:	Jim Roberts <RobertsJM@omu.org>
Sent:	Tuesday, October 11, 2016 3:59 PM
To:	Ramirez, Angela
Cc:	Buffalini, Rick; Dixon, Stephen
Subject:	Re: OMU Ash pond runoff

Ash ponds 1 and 2 inlets are at least 1 ft higher than outlet.
Approx 6 feet of freeboard.
Water depth is 12 to 14 feet.
Emergency outfall from pond 3 is 2 feet higher than primary. Water can back up in all 3 ponds.
Pond side slopes are 2.5 to 1.
Ditch flow channels are 3 to 4 feet wide at flow line.
Incised ponds.
Jim

On Oct 11, 2016, at 9:00 AM, "Ramirez, Angela" <aramirez@cecinc.com> wrote:

> James,
>
> Thanks for the information that you have provided up to this point. Can you please also provide/confirm the following information:
>
> ·   We assume the total pond capacity for Pond 1, 2, and 3 can be obtained based on the contours for the ponds in the attached pdf labeled 'Flow diagram questions'. Please confirm.
>
> ·   Provide approximate elevations of the beginning and ends of the discharge structures for Ponds 1, 2, and 3. The dimensions of the pipe were previously provided.
>
> ·   Provide the approximate depth of water (if available) in the ponded areas in Ponds 1, 2, and 3. The approximate extents of the ponded areas are shown on the attached pdf labeled 'Existing Conditions questions'. Additionally, provide the depth to water from the crest of the ponds.
>
> ·   Provide the approximate depth of the additional ponds that drain to Ponds 1, 2, and 3. Additionally, provide the depth to water from the crest of the ponds.
>
> ·   What is the approximate interior sideslopes of the additional ponds at the site that drain to Ponds 1, 2, and 3?
>
> ·   Provide the approximate elevations of the beginning and ends of the discharge structures for the additional ponds. The dimensions of the pipe were previously provided.
>
> ·   Please provide the approximate dimensions of the open channels. The channels are shown on the pdf labeled 'Flow diagram questions'.
>
> ·   Please confirm whether the ponds are incised. Are there any structural fill embankments for the ponds? The CCR Rules define an incised CCR surface impoundment as follows:
>

> Incised CCR surface impoundment means a CCR surface impoundment which is constructed by excavating entirely below the natural ground surface, holds an accumulation of CCR entirely below the adjacent natural ground surface, and does not consist of any constructed diked portion.
>
> Let me know if you have time for a call to discuss these questions. Thanks!
>
> Angela M. Ramirez / Project Manager
> Civil & Environmental Consultants, Inc.
> 333 Baldwin Road · Pittsburgh, PA 15205-1751
> Toll-Free: (800) 365-2324 · Direct: (412) 249-2291 · Fax: (412)
> 429-2114
> Mobile: (724) 600-4880 · http://www.cecinc.com Senior Leadership ·
> Integrated Services · Personal Business Relationships
>
> From: Buffalini, Rick
> Sent: Friday, October 07, 2016 3:05 PM
> To: Ramirez, Angela
> Subject: Fwd: OMU Ash pond runoff
>
>
>
> Sent from my iPhone
>
> Begin forwarded message:
> From: Jim Roberts <RobertsJM@omu.org<mailto:RobertsJM@omu.org>>
> Date: October 7, 2016 at 9:26:15 AM EDT
> To: "Buffalini, Rick"
> <rbuffalini@cecinc.com<mailto:rbuffalini@cecinc.com>>, "Dixon,
> Stephen" <sdixon@cecinc.com<mailto:sdixon@cecinc.com>>
> Subject: RE: OMU Ash pond runoff
> Rick:
> Water flows to the ash ponds, from plant use and not including any direct rainfall, total as follows:
> Pond #1 inflow: Slag sluice is 250,000 GPD, FGD Blowdown is 66,400 GPD, Coal Pile Runoff Pond is 55,000 GPD.
> Pond #2 inflow: Ash sluice is 375,000 GPD, Cavin Water Plant Sludge Discharge is 40,000 GPD.
> Jim
> James M. Roberts, P E
> Owensboro Municipal Utilities
> Fuels & By-Products Manager
> robertsjm@omu.org<mailto:robertsjm@omu.org>
> Office: 270-691-4221
> Cell: 270-313-2999
>
>
>
> From: Buffalini, Rick [mailto:rbuffalini@cecinc.com]
> Sent: Thursday, October 06, 2016 7:32 AM
> To: Jim Roberts; Dixon, Stephen
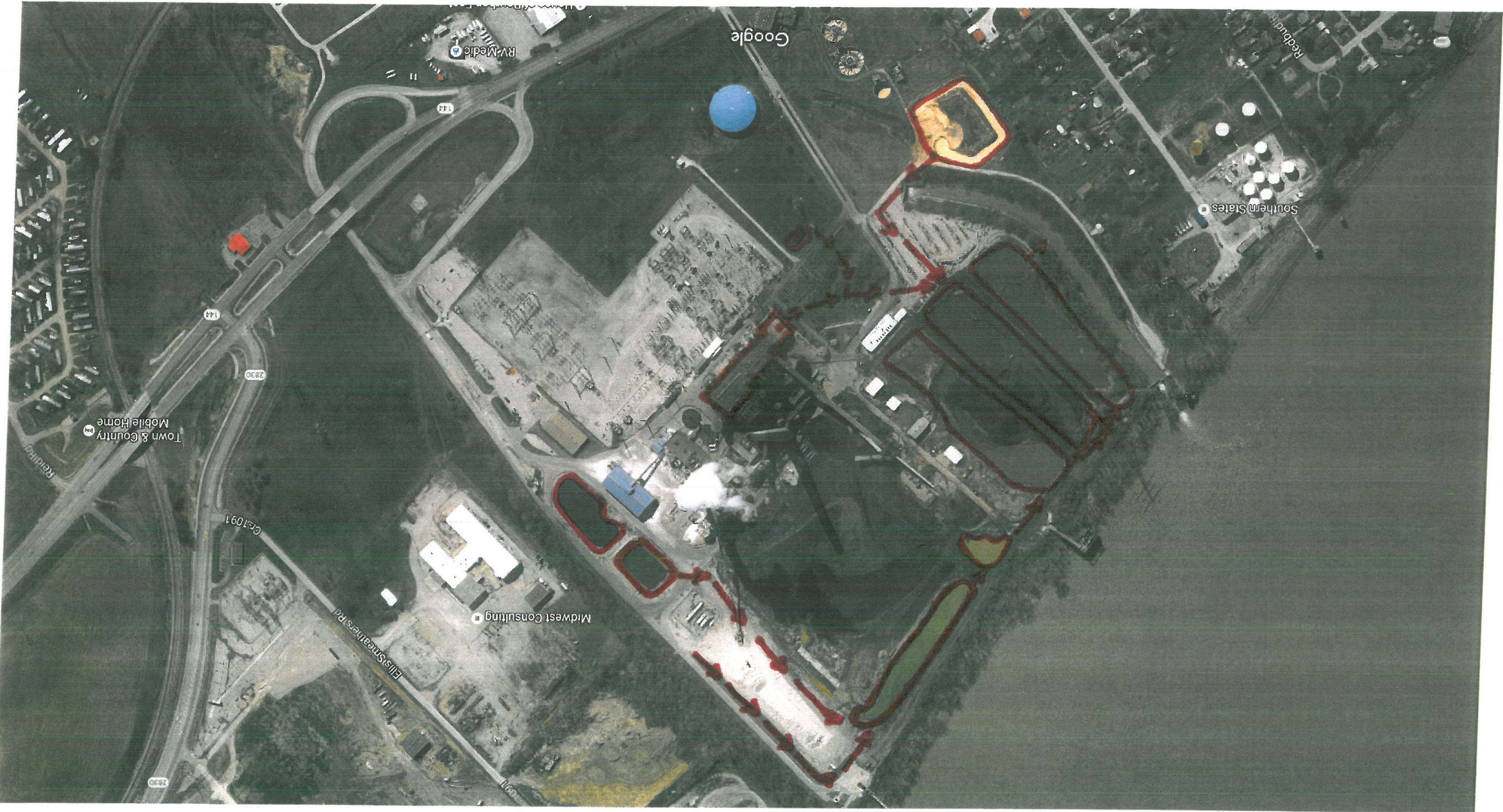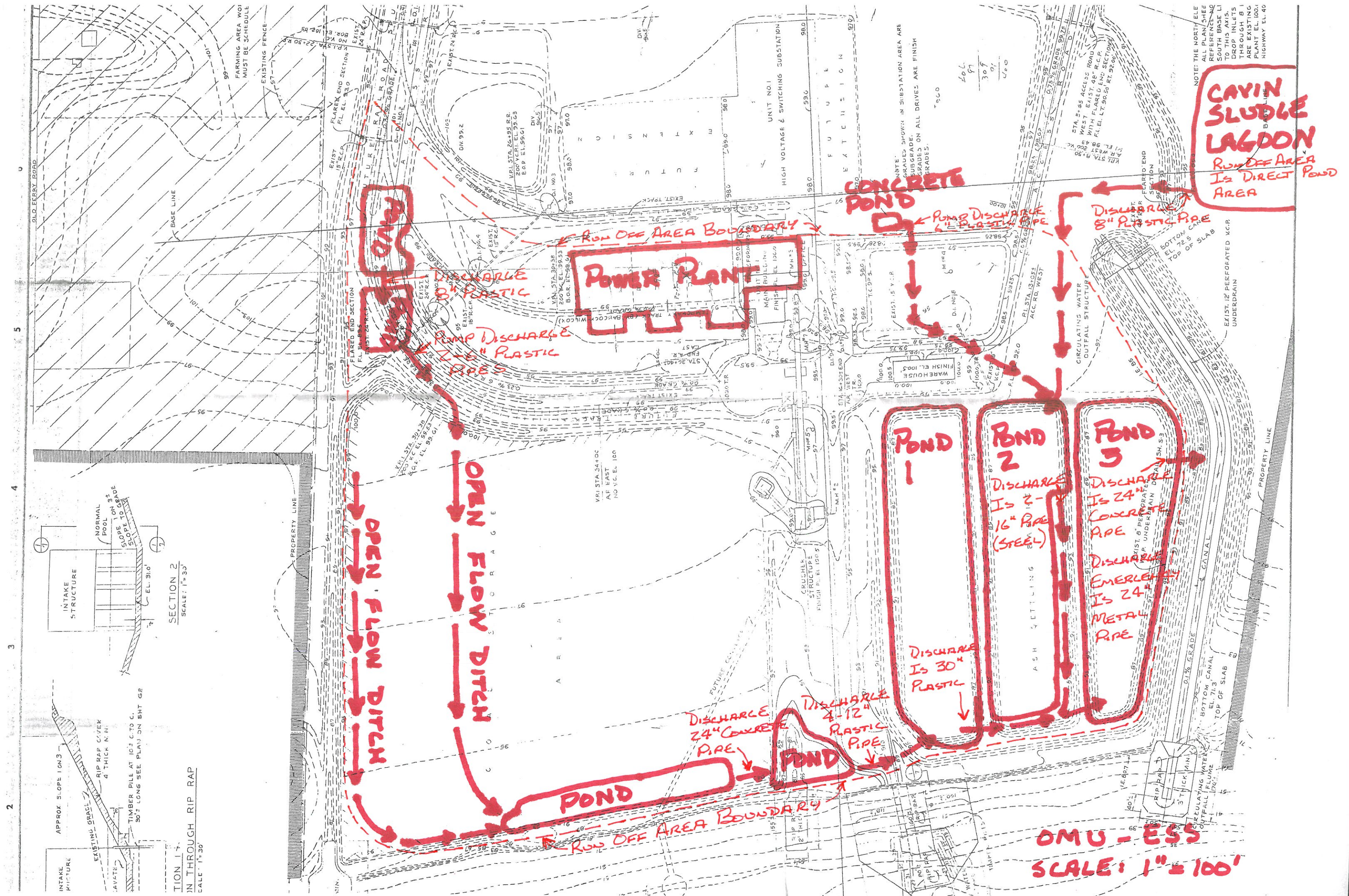> Subject: RE: OMU Ash pond runoff
>
> Thank you James
>
> Rick J. Buffalini, P.E. / Vice President Civil & Environmental

> Consultants, Inc.
> 333 Baldwin Road · Pittsburgh, PA 15205-1751
> Toll-Free: 800-365-2324 · Direct: 412-249-3169
> Mobile: 412-760-9133 · http://www.cecinc.com Senior Leadership ·
> Integrated Services · Personal Business Relationships
>
> From: Jim Roberts [mailto:RobertsJM@omu.org]
> Sent: Wednesday, October 05, 2016 5:24 PM
> To: Dixon, Stephen; Buffalini, Rick
> Subject: OMU Ash pond runoff
>
>
> Attached maps should depict runoff area into ash pond system.
> I will soon forward water balance for amounts of water OMU discharges into ponds under normal operating mode.
> Let me know if you have questions.
> THANKS
> Jim
> James M. Roberts, P E
> Owensboro Municipal Utilities
> Fuels & By-Products Manager
> robertsjm@omu.org<mailto:robertsjm@omu.org>
> Office: 270-691-4221
> Cell: 270-313-2999
>
>
> CONFIDENTIALITY NOTICE: This email message and any attachments are for the sole use of the intended recipient(s) and may contain proprietary, confidential, trade secret or privileged information. Any unauthorized review, use, disclosure or distribution is prohibited and may be a violation of law. If you are not the intended recipient or a person responsible for delivering this message to an intended recipient, please contact the sender by reply email and destroy all copies of the original message.
> <Flow Diagram questions.pdf>
> <Existing Conditions questions.pdf>

CAVIN SLUDGE LAGOON
Run Off Area Is Direct Pond Area

CONCRETE POND

Run Off Area Boundary

Pump Discharge 6" Plastic Pipe

Discharge 8" Plastic Pipe

Discharge 8" Plastic

POWER PLANT

Pump Discharge 2-6" Plastic Pipe

OPEN FLOW DITCH

OPEN FLOW DITCH

OPEN FLOW DITCH

POND 1

POND 2

POND 3

Discharge Is 2-16" Pipe (Steel)

Discharge Is 24" Concrete Pipe

Discharge Emergency Is 24" Metal Pipe

Discharge Is 30" Plastic

Discharge 24" Concrete Pipe

Discharge 4-12" Plastic Pipe

POND

Run Off Area Boundary

OMU-ESS
SCALE: 1" = 100'

SECTION 2
SCALE: 1" = 33'

Photograph 1: Ash Pond 1 – View Reference North (True North West)

Photograph 2: Ash Pond 1 – View Reference South (True South East)

Photograph 3: Ash Pond 2

Photograph 4: Ash Pond 3

Civil & Environmental Consultants, Inc.
Pittsburgh, Pennsylvania
Phone: 412-429-2324   Toll Free: 800-365-2324

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
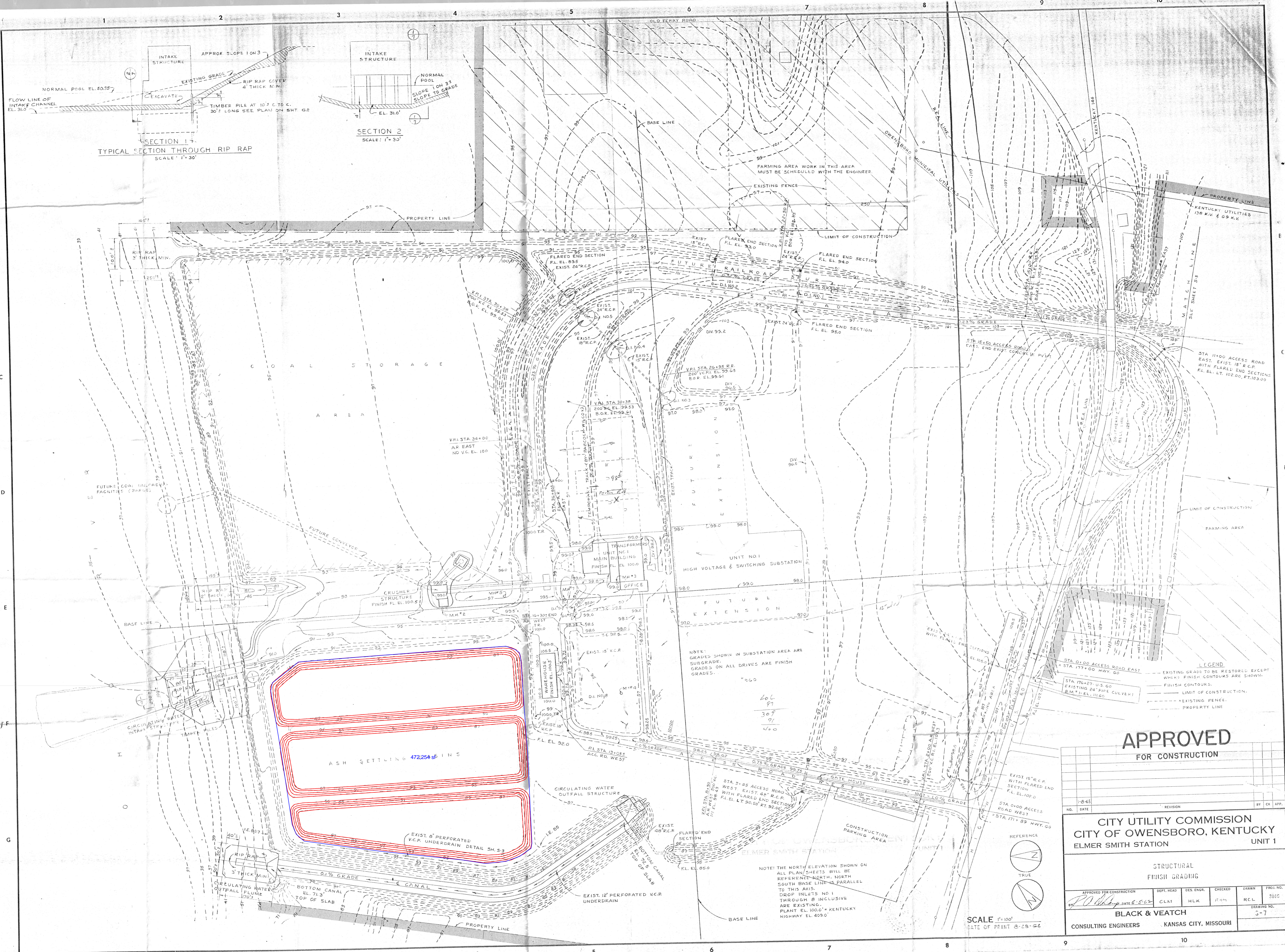CEC Project: 164-014

Photographs provided by Owensboro Municipal Utilities

Photograph 5: Ash Pond 1, 2, and 3 – Sign

Civil & Environmental Consultants, Inc.
Pittsburgh, Pennsylvania
Phone: 412-429-2324   Toll Free: 800-365-2324

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
CEC Project: 164-014

Photographs provided by Owensboro Municipal Utilities

ATTACHMENT 4

STAGE STORAGE CURVES FOR MAXIMUM POND FOOTPRINTS

SECTION 1
SCALE 1" = 30'
TYPICAL SECTION THROUGH RIP RAP
SCALE 1" = 30'

SECTION 2
SCALE 1" = 30'

COAL STORAGE AREA

ASH SETTLING BASINS 472,254 SF

			REVISION		BY	CK	APP.
NO.	DATE						

CITY UTILITY COMMISSION
CITY OF OWENSBORO, KENTUCKY
ELMER SMITH STATION   UNIT 1

STRUCTURAL
FINISH GRADING

APPROVED FOR CONSTRUCTION	DEPT. HEAD	DES. ENGR.	CHECKED	DRAWN	PROJ. NO.
	CLAS	HLK		RCL	2800

BLACK & VEATCH
CONSULTING ENGINEERS   KANSAS CITY, MISSOURI

DRAWING NO.
5-7

SCALE 1"=100'
DATE OF PRINT 8-23-66

REFERENCE
TRUE

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
**Hydrologic and Hydraulic Capacity Requirments (CCR Rule §257.82)**
Pond 1 - Maximum Available Capacity

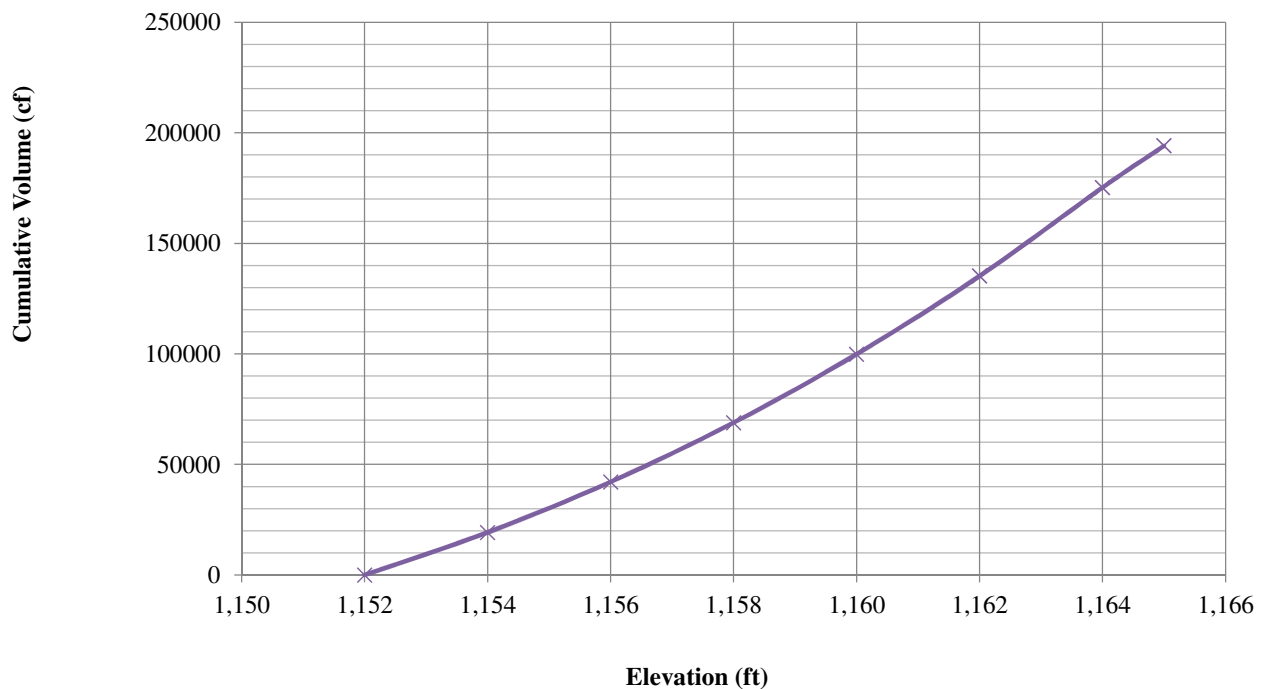| Elevation (ft)	Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume (ac-ft)
87.00	110,823	0	0	0	0.0
89.00	121,712	116,268	232,535	232,535	5.3
91.00	132,375	127,044	254,087	486,622	11.2
93.00	143,325	137,850	275,700	762,322	17.5
95.00	154,200	148,763	297,525	1,059,847	24.3
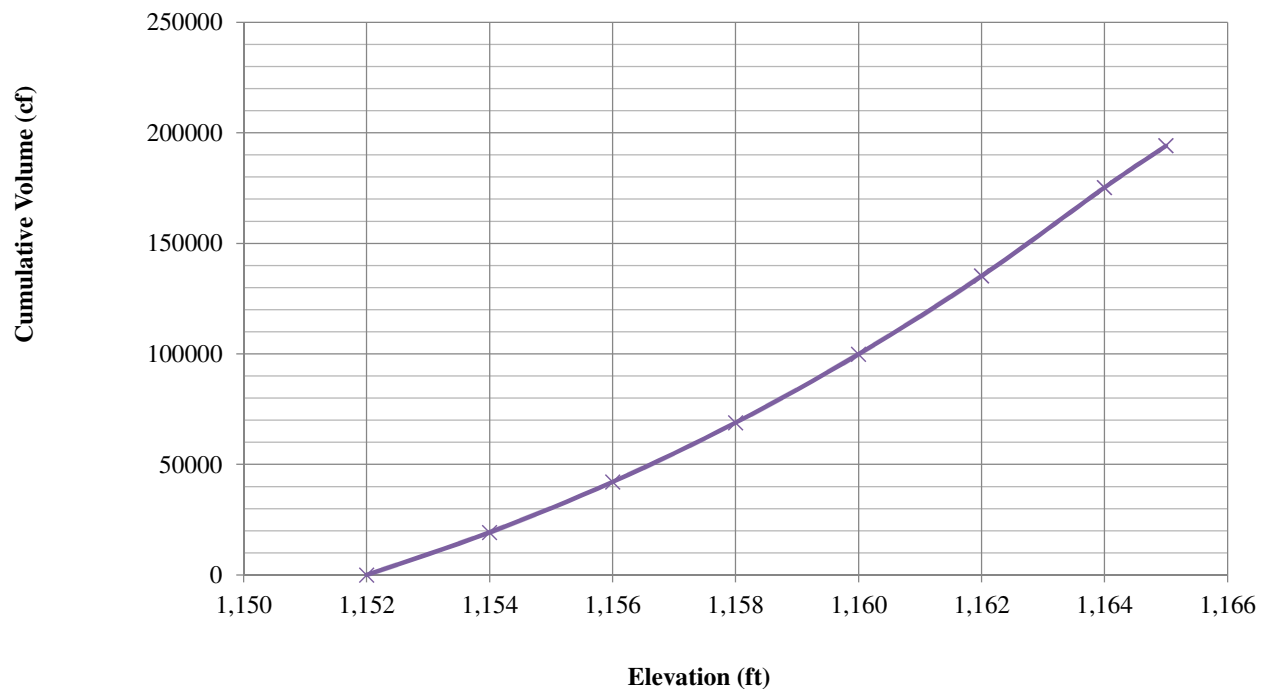
Pond Capacity Above Pool

Elevation (ft)	Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume above Pool (ac-ft)
89.00	121,712	0	0	0	0.0
91.00	132,375	127,044	254,087	254,087	5.8
93.00	143,325	137,850	275,700	529,787	12.2
95.00	154,200	148,763	297,525	827,312	19.0

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
Hydrologic and Hydraulic Capacity Requirments (CCR Rule §257.82)
Pond 2 - Maximum Available Capacity

Elevation (ft)	Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume (ac-ft)
87.00	114,037	0	0	0	0.0
89.00	124,376	119,207	238,413	238,413	5.5
91.00	135,056	129,716	259,432	497,845	11.4
93.00	145,369	140,213	280,425	778,270	17.9
95.00	156,745	151,057	302,114	1,080,384	24.8
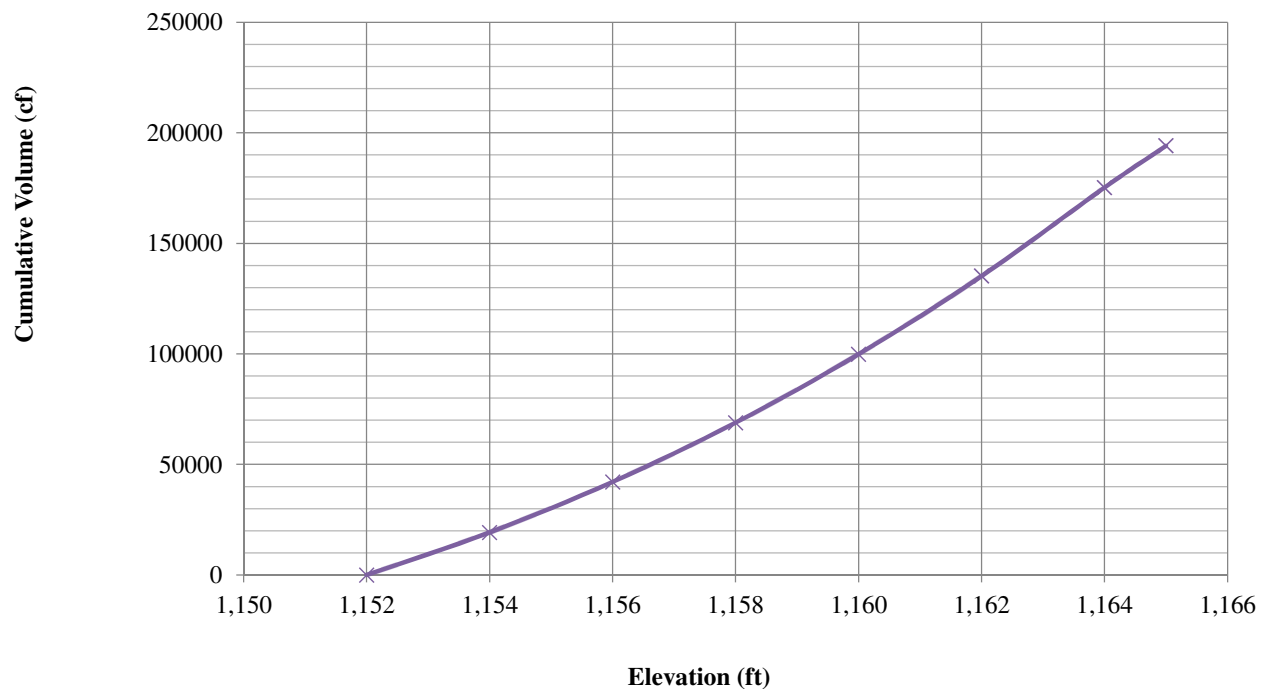
Pond Capacity Above Pool

Elevation (ft)	Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume above Pool (ac-ft)
89.00	124,376	0	0	0	0.0
91.00	135,056	129,716	259,432	259,432	6.0
93.00	145,369	140,213	280,425	539,857	12.4
95.00	156,745	151,057	302,114	841,971	19.3

Elevation (ft)	Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume (ac-ft)
87.00	89,885	0	0	0	0.0
89.00	100,460	95,173	190,345	190,345	4.4
91.00	100,228	100,344	200,688	391,033	9.0
93.00	120,231	110,230	220,459	611,492	14.0
95.00	130,317	125,274	250,548	862,040	19.8

Pond Capacity Above Pool

Elevation (ft)	Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume above Pool (ac-ft)
89.00	100,460	0	0	0	0.0
91.00	100,228	100,344	200,688	200,688	4.6
93.00	120,231	110,230	220,459	421,147	9.7
95.00	130,317	125,274	250,548	671,695	15.4

ATTACHMENT 5

STAGE STORAGE CURVES FOR EXISTING POND FOOTPRINTS

NORTH

ASH POND

POND 3

POND 2

POND 1

LEGEND

– – – – ASH POND LIMITS

– – – – APPROXIMATE FOOTPRINT OF PONDS 1, 2, AND 3 (SEE NOTE 1)

—— 90 —— ESTIMATED EXISTING POND CAPACITY CONTOUR (SEE NOTE 2)

NOTES

1. THE APPROXIMATE FOOTPRINT OF PONDS 1, 2, AND 3 IS BASED ON DRAWING NO. S-7 " STRUCTURAL FILL FINISH GRADING" PREPARED BY BLACK AND VEACH, DATED 8-28-62 AND THE AERIAL PHOTOGRAPHY (SEE REFERENCE 1).

2. THE ESTIMATED EXISTING POND CAPACITY IS BASED ON THE SURFACE AREA OF THE EXISTING POOL FROM THE AERIAL PHOTOGRAPHY, APPROXIMATE SIDE SLOPES OF 2.5H:1V, AND AN ASSUMED DEPTH OF 8-FT.

SCALE IN FEET

0   100   200

REFERENCE

1. AERIAL PHOTOGRAPHY COPYRIGHT GOOGLE EARTH PRO VERSION 6.2, IMAGERY DATE 3-25-2016.

CEC
Civil & Environmental Consultants, Inc.
333 Baldwin Road · Pittsburgh, PA 15205
412-429-2324 · 800-365-2324
www.cecinc.com

OWENSBORO MUNICIPAL UTILITIES
ELMER SMITH STATION
OWENSBORO, KENTUCKY

ESTIMATED EXISTING POND CAPACITY

| DRAWN BY:	RJB	CHECKED BY:	AMR	APPROVED BY:	RJB	FIGURE NO.:
DATE:	10/13/2016	DWG SCALE:	1"=100'	PROJECT NO.:	164-014.0003	4

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
**Hydrologic and Hydraulic Capacity Requirments (CCR Rule §257.82)**
Pond 1 - Estimated Existing Capacity

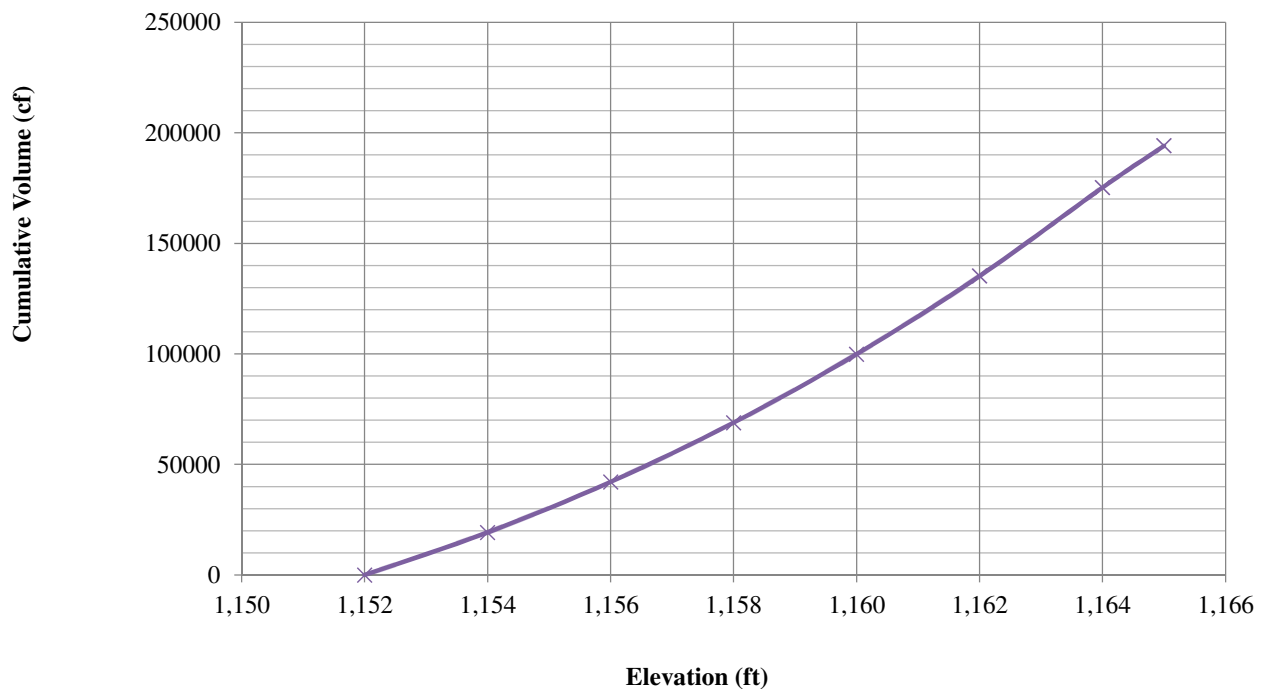| Elevation (ft)	Pool Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume (ac-ft)
87.00	21,286	0	0	0	0.0
89.00	26,050	23,668	47,336	47,336	1.1
91.00	31,061	28,556	57,111	104,447	2.4
93.00	36,237	33,649	67,298	171,745	3.9
95.00	41,576	38,907	77,813	249,558	5.7
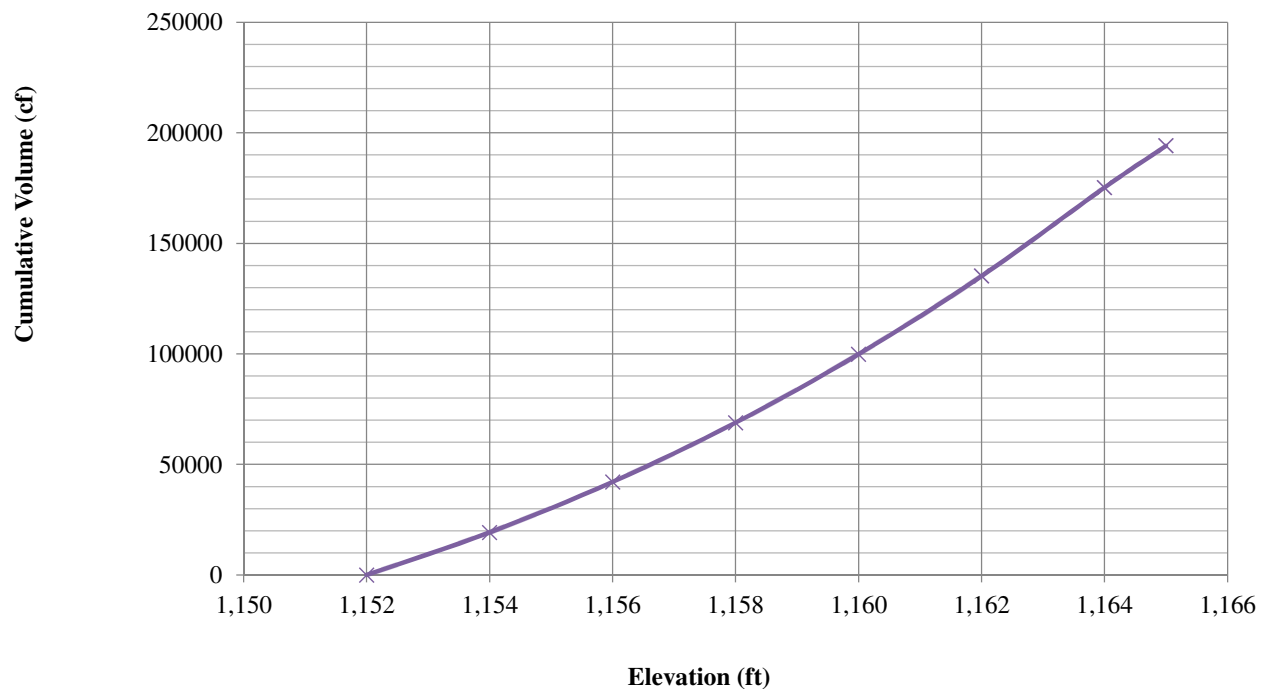
Pond Capacity Above Pool

Elevation (ft)	Pool Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume above Pool (ac-ft)
89.00	26,050	0	0	0	0.0
91.00	31,061	28,556	57,111	57,111	1.3
93.00	36,237	33,649	67,298	124,409	2.9
95.00	41,576	38,907	77,813	202,222	4.6

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
Hydrologic and Hydraulic Capacity Requirments (CCR Rule §257.82)
Pond 2 - Estimated Existing Capacity

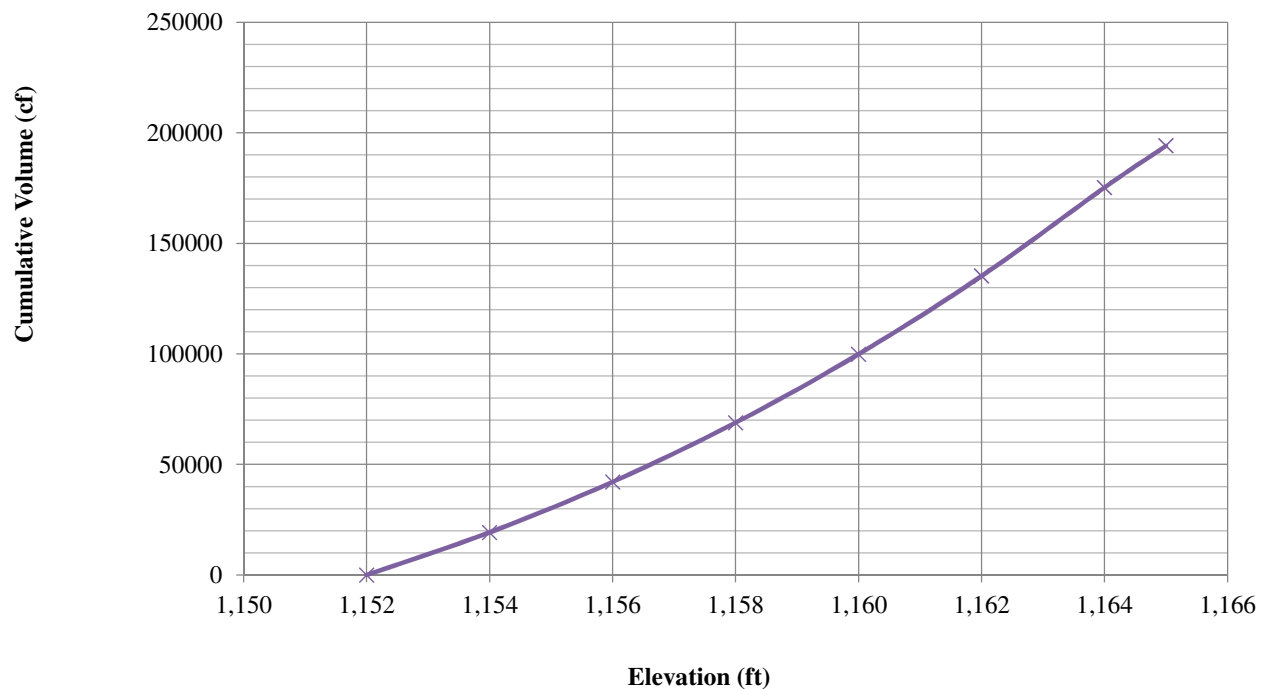| Elevation (ft)	Pool Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume (ac-ft)
87.00	22,225	0	0	0	0.0
89.00	26,085	24,155	48,310	48,310	1.1
91.00	30,139	28,112	56,224	104,535	2.4
93.00	34,382	32,261	64,521	169,056	3.9
95.00	38,815	36,599	73,197	242,253	5.6
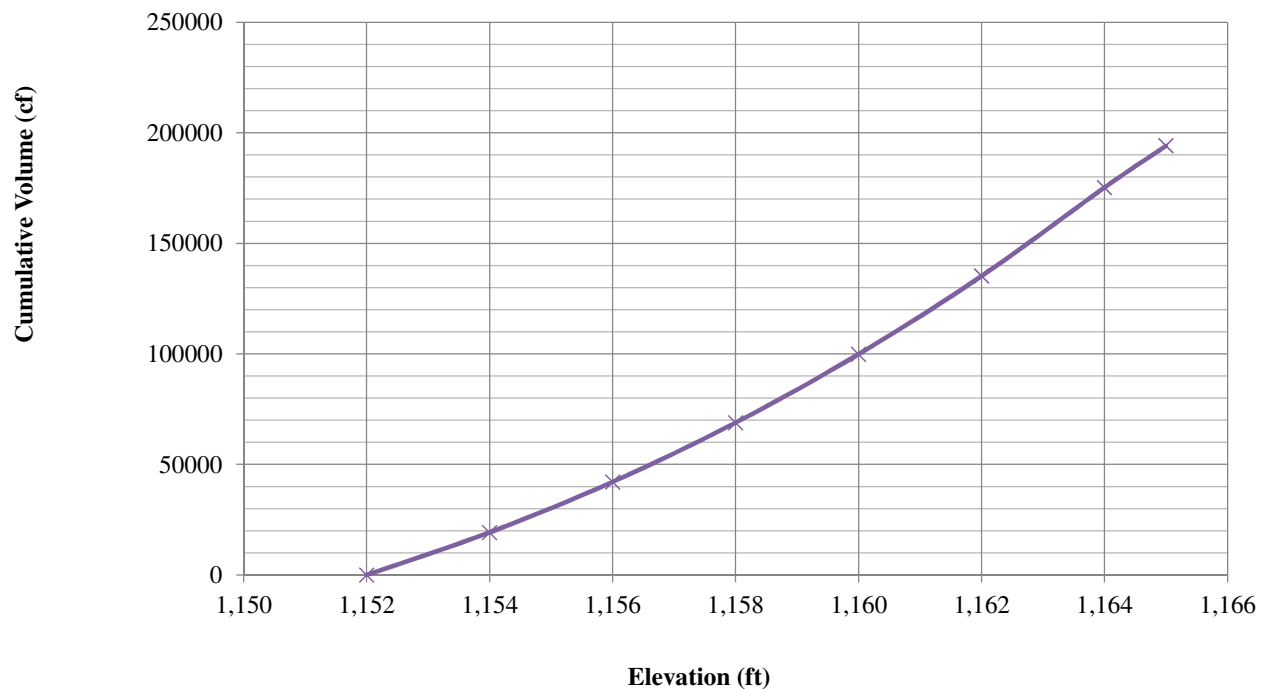
Pond Capacity Above Pool

Elevation (ft)	Pool Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume above Pool (ac-ft)
89.00	26,085	0	0	0	0.0
91.00	30,139	28,112	56,224	56,224	1.3
93.00	34,382	32,261	64,521	120,745	2.8
95.00	38,815	36,599	73,197	193,942	4.5

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
Hydrologic and Hydraulic Capacity Requirments (CCR Rule §257.82)
Pond 3 - Estimated Existing Capacity

Elevation (ft)	Pool Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume (ac-ft)
87.00	38,391	0	0	0	0.0
89.00	45,585	41,988	83,976	83,976	1.9
91.00	52,960	49,273	98,545	182,521	4.2
93.00	60,515	56,738	113,475	295,996	6.8
95.00	68,252	64,384	128,767	424,763	9.8

Pond Capacity Above Pool

Elevation (ft)	Pool Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume above Pool (ac-ft)
89.00	45,585	0	0	0	0.0
91.00	52,960	49,273	98,545	98,545	2.3
93.00	60,515	56,738	113,475	212,020	4.9
95.00	68,252	64,384	128,767	340,787	7.8

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
Hydrologic and Hydraulic Capacity Requirments (CCR Rule §257.82)
Pond 1 - Estimated Required Capacity

Elevation (ft)	Pool Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume (ac-ft)
87.00	42,572	0	0	0	0.0
89.00	52,100	47,336	94,672	94,672	2.2
91.00	62,122	57,111	114,222	208,894	4.8
93.00	72,474	67,298	134,596	343,490	7.9
95.00	83,152	77,813	155,626	499,116	11.5

Pond Capacity Above Pool

Elevation (ft)	Pool Area (sf)	Average Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)	Cumulative Volume above Pool (ac-ft)
89.00	52,100	0	0	0	0.0
91.00	62,122	57,111	114,222	114,222	2.6
93.00	72,474	67,298	134,596	248,818	5.7
95.00	83,152	77,813	155,626	404,444	9.3

ATTACHMENT 6

HYDROCAD ANALYSES

**PRELIMINARY EVALUATION
(MAXIMUM POND FOOTPRINT)**

POND 1, SCENARIO 1
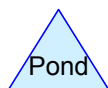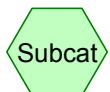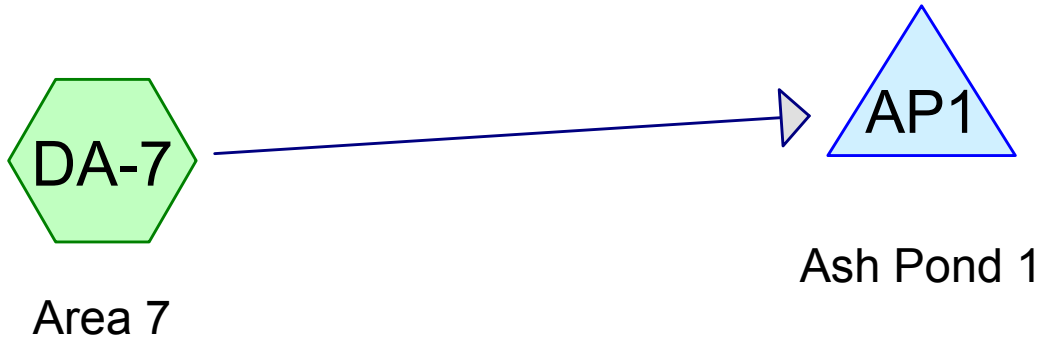
DA-7

Area 7

AP1

Ash Pond 1

Subcat   Reach   Pond   Link

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
9.770	82	Dirt roads, HSG B (DA-7)
3.920	86	Fallow, bare soil, HSG B (DA-7)
3.920	98	Unconnected roofs, HSG B (DA-7)
1.980	98	Water Surface, HSG B (DA-7)
19.590	**88**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
19.590	HSG B	DA-7
0.000	HSG C	
0.000	HSG D	
0.000	Other	
19.590		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	9.770	0.000	0.000	0.000	9.770	Dirt roads	DA-7
0.000	3.920	0.000	0.000	0.000	3.920	Fallow, bare soil	DA-7
0.000	3.920	0.000	0.000	0.000	3.920	Unconnected roofs	DA-7
0.000	1.980	0.000	0.000	0.000	1.980	Water Surface	DA-7
0.000	**19.590**	**0.000**	**0.000**	**0.000**	**19.590**	**TOTAL AREA**	

Ponds 1 and 2 - Max. Capacity (Scen.1)
Prepared by CEC, Inc.
HydroCAD® 10.00-14 s/n 01006 © 2015 HydroCAD Software Solutions LLC

Type II 24-hr 25yr-24hr Rainfall=5.67"
Printed 10/17/2016
Page 5

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DA-7: Area 7
Runoff Area=19.590 ac   30.12% Impervious   Runoff Depth=4.31"
Flow Length=1,335'   Slope=0.0100 '/'   Tc=14.4 min   CN=88   Runoff=107.47 cfs 7.034 af

Pond AP1: Ash Pond 1
Peak Elev=91.82' Storage=13.772 af   Inflow=108.05 cfs 8.472 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 19.590 ac   Runoff Volume = 7.034 af   Average Runoff Depth = 4.31"
69.88% Pervious = 13.690 ac   30.12% Impervious = 5.900 ac

Ponds 1 and 2 - Max. Capacity (Scen.1)
Prepared by CEC, Inc.
HydroCAD® 10.00-14 s/n 01006 © 2015 HydroCAD Software Solutions LLC

Type II 24-hr 25yr-24hr Rainfall=5.67"
Printed 10/17/2016
Page 6

Summary for Subcatchment DA-7: Area 7

Runoff   =   107.47 cfs @ 12.06 hrs, Volume=   7.034 af, Depth= 4.31"
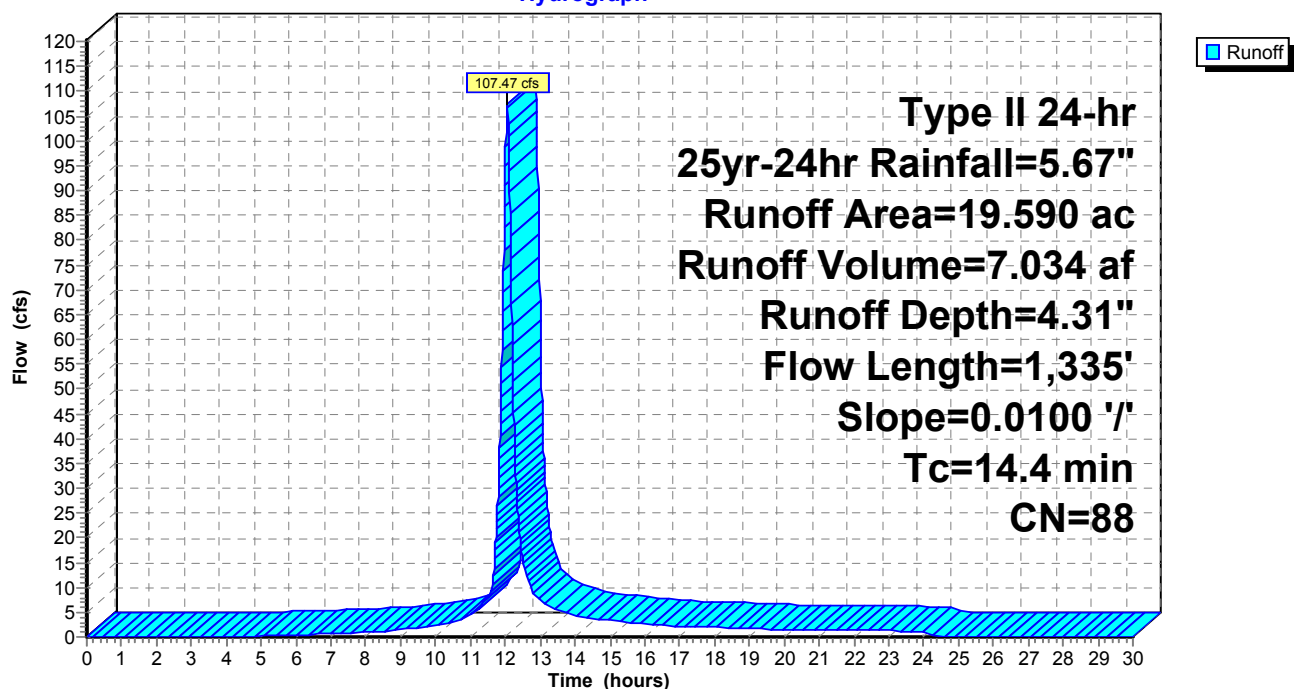
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.980	98	Water Surface, HSG B
3.920	86	Fallow, bare soil, HSG B
3.920	98	Unconnected roofs, HSG B
9.770	82	Dirt roads, HSG B
19.590	88	Weighted Average
13.690		69.88% Pervious Area
5.900		30.12% Impervious Area
3.920		66.44% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
12.8	1,235	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.4	1,335				Total

Subcatchment DA-7: Area 7

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=19.590 ac
Runoff Volume=7.034 af
Runoff Depth=4.31"
Flow Length=1,335'
Slope=0.0100 '/'
Tc=14.4 min
CN=88

Ponds 1 and 2 - Max. Capacity (Scen.1)
Prepared by CEC, Inc.
HydroCAD® 10.00-14 s/n 01006 © 2015 HydroCAD Software Solutions LLC

Type II 24-hr 25yr-24hr Rainfall=5.67"
Printed 10/17/2016
Page 7

Summary for Pond AP1: Ash Pond 1

Inflow Area =   19.590 ac, 30.12% Impervious, Inflow Depth > 5.19"   for 25yr-24hr event
Inflow   =   108.05 cfs @   12.06 hrs, Volume=   8.472 af, Incl. 0.58 cfs Base Flow
Outflow   =   0.00 cfs @   0.00 hrs, Volume=   0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 5.300 af
Peak Elev= 91.82' @ 30.00 hrs Surf.Area= 0.000 ac Storage= 13.772 af (8.472 af above start)
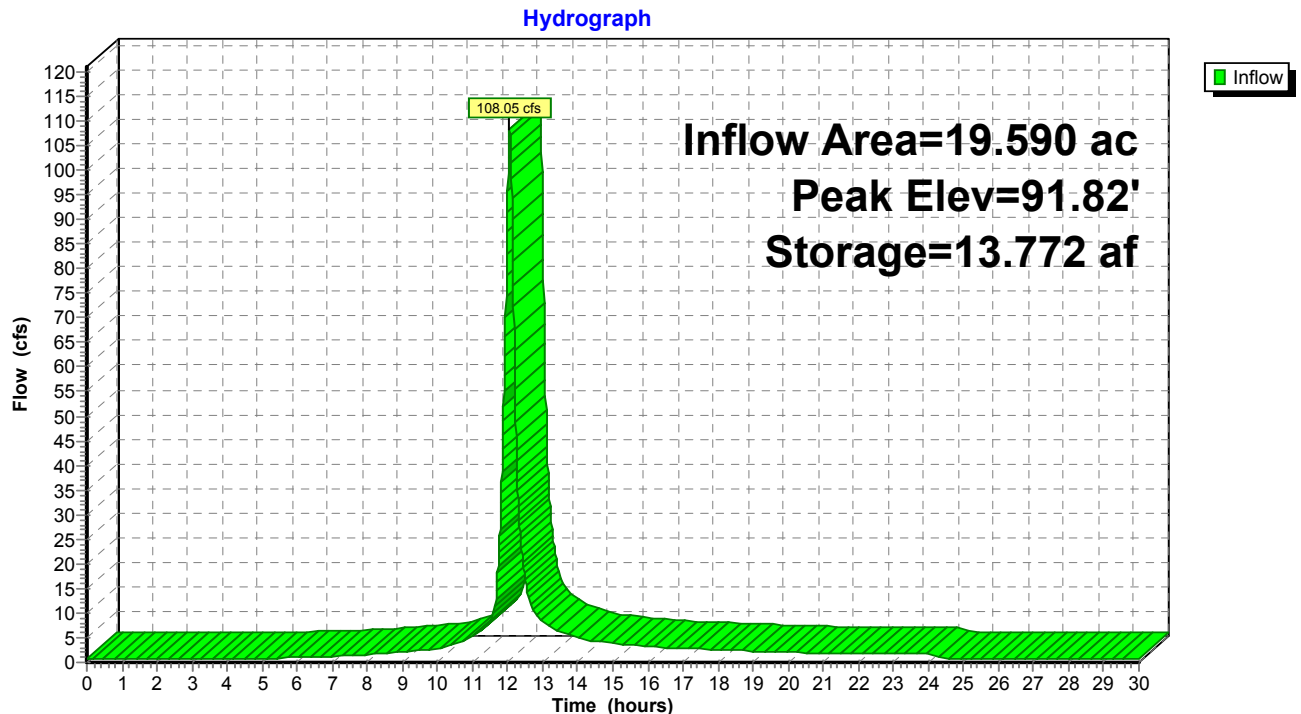
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	24.300 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	5.300
91.00	11.200
93.00	17.500
95.00	24.300

Pond AP1: Ash Pond 1

Hydrograph

Inflow Area=19.590 ac
Peak Elev=91.82'
Storage=13.772 af

**PRELIMINARY EVALUATION
(MAXIMUM POND FOOTPRINT)**

POND 1, SCENARIO 2

DA-3

Area 3

DA-4

Area 4

DA-2

Area 2

DA-5

Area 5

DA-1

Area 1

DA-6

Area 6
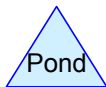
AP1

DA-7

Ash Pond 1

Area 7

| Subcat | Reach | Pond | Link |

Routing Diagram for Ponds 1 and 2 - Max. Capacity (Scen.2)
Prepared by CEC, Inc., Printed 10/17/2016
HydroCAD® 10.00-14 s/n 01006 © 2015 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
13.360	82	Dirt roads, HSG B (DA-1, DA-2, DA-4, DA-7)
19.320	86	Fallow, bare soil, HSG B (DA-3, DA-4, DA-5, DA-6, DA-7)
4.290	98	Unconnected roofs, HSG B (DA-4, DA-7)
4.620	98	Water Surface, HSG B (DA-1, DA-2, DA-5, DA-6, DA-7)
41.590	**87**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
41.590	HSG B	DA-1, DA-2, DA-3, DA-4, DA-5, DA-6, DA-7
0.000	HSG C	
0.000	HSG D	
0.000	Other	
41.590		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	13.360	0.000	0.000	0.000	13.360	Dirt roads	DA-1, DA-2, DA-4, DA-7
0.000	19.320	0.000	0.000	0.000	19.320	Fallow, bare soil	DA-3, DA-4, DA-5, DA-6, DA-7
0.000	4.290	0.000	0.000	0.000	4.290	Unconnected roofs	DA-4, DA-7
0.000	4.620	0.000	0.000	0.000	4.620	Water Surface	DA-1, DA-2, DA-5, DA-6, DA-7
0.000	**41.590**	**0.000**	**0.000**	**0.000**	**41.590**	**TOTAL AREA**	

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentDA-1: Area 1   Runoff Area=1.930 ac 34.20% Impervious Runoff Depth=4.20"
Flow Length=210' Slope=0.0100 '/' Tc=2.7 min CN=87 Runoff=15.27 cfs 0.676 af

SubcatchmentDA-2: Area 2   Runoff Area=1.170 ac 28.21% Impervious Runoff Depth=4.20"
Flow Length=65' Slope=0.3300 '/' Tc=0.3 min CN=87 Runoff=9.87 cfs 0.410 af

SubcatchmentDA-3: Area 3   Runoff Area=2.550 ac 0.00% Impervious Runoff Depth=4.10"
Flow Length=210' Slope=0.0100 '/' Tc=2.7 min CN=86 Runoff=19.82 cfs 0.871 af

SubcatchmentDA-4: Area 4   Runoff Area=9.250 ac 4.00% Impervious Runoff Depth=4.10"
Flow Length=590' Slope=0.0100 '/' Tc=6.7 min CN=86 Runoff=62.90 cfs 3.158 af

SubcatchmentDA-5: Area 5   Runoff Area=4.710 ac 28.24% Impervious Runoff Depth=4.42"
Flow Length=400' Tc=3.7 min CN=89 Runoff=37.28 cfs 1.733 af

SubcatchmentDA-6: Area 6   Runoff Area=2.390 ac 13.39% Impervious Runoff Depth=4.31"
Flow Length=510' Tc=5.3 min CN=88 Runoff=17.66 cfs 0.858 af

SubcatchmentDA-7: Area 7   Runoff Area=19.590 ac 30.12% Impervious Runoff Depth=4.31"
Flow Length=1,335' Slope=0.0100 '/' Tc=14.4 min CN=88 Runoff=107.47 cfs 7.034 af

Pond AP1: Ash Pond 1   Peak Elev=94.11' Storage=21.279 af Inflow=230.02 cfs 15.979 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 41.590 ac   Runoff Volume = 14.739 af   Average Runoff Depth = 4.25"
78.58% Pervious = 32.680 ac   21.42% Impervious = 8.910 ac

Ponds 1 and 2 - Max. Capacity (Scen.2)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-1: Area 1
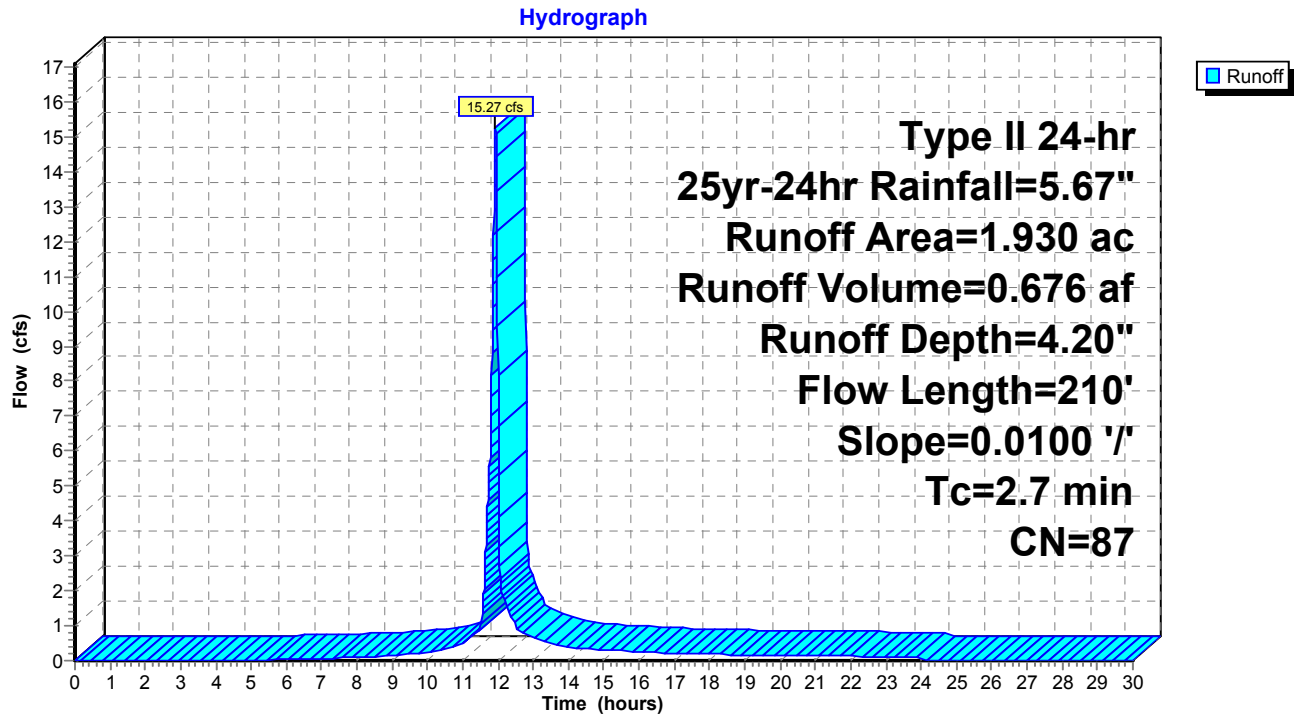
Runoff   =   15.27 cfs @ 11.93 hrs, Volume=   0.676 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.270	82	Dirt roads, HSG B
0.660	98	Water Surface, HSG B
1.930	87	Weighted Average
1.270		65.80% Pervious Area
0.660		34.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
1.1	110	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.7	210	Total			

Subcatchment DA-1: Area 1

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.930 ac
Runoff Volume=0.676 af
Runoff Depth=4.20"
Flow Length=210'
Slope=0.0100 '/'
Tc=2.7 min
CN=87

Summary for Subcatchment DA-2: Area 2

Runoff   =   9.87 cfs @ 11.90 hrs, Volume=   0.410 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.840	82	Dirt roads, HSG B
0.330	98	Water Surface, HSG B
1.170	87	Weighted Average
0.840		71.79% Pervious Area
0.330		28.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	65	0.3300	3.91		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"

Subcatchment DA-2: Area 2

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.170 ac
Runoff Volume=0.410 af
Runoff Depth=4.20"
Flow Length=65'
Slope=0.3300 '/'
Tc=0.3 min
CN=87

Ponds 1 and 2 - Max. Capacity (Scen.2)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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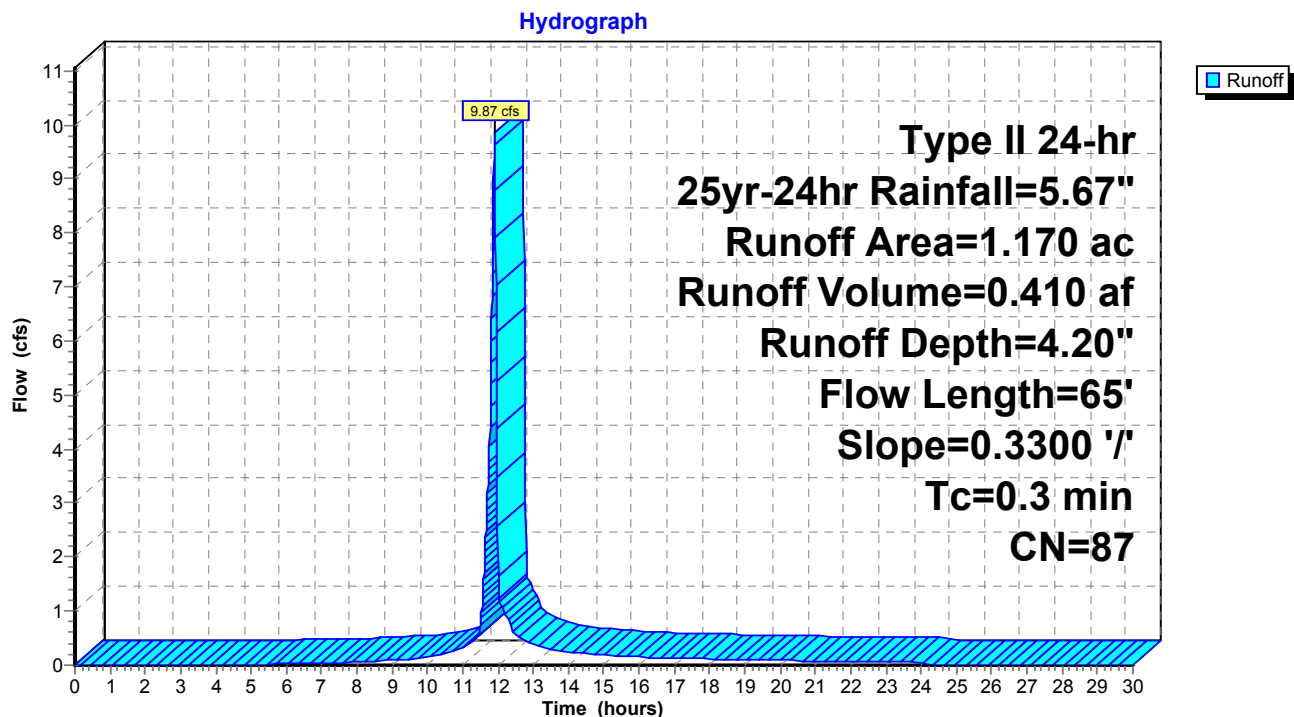
Summary for Subcatchment DA-3: Area 3

Runoff   =   19.82 cfs @ 11.93 hrs, Volume=   0.871 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.550	86	Fallow, bare soil, HSG B
2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,**
					Smooth surfaces n= 0.011 P2= 3.26"
1.1	110	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
2.7	210	Total			

Subcatchment DA-3: Area 3

Hydrograph

Summary for Subcatchment DA-4: Area 4

Runoff   =   62.90 cfs @ 11.98 hrs, Volume=   3.158 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
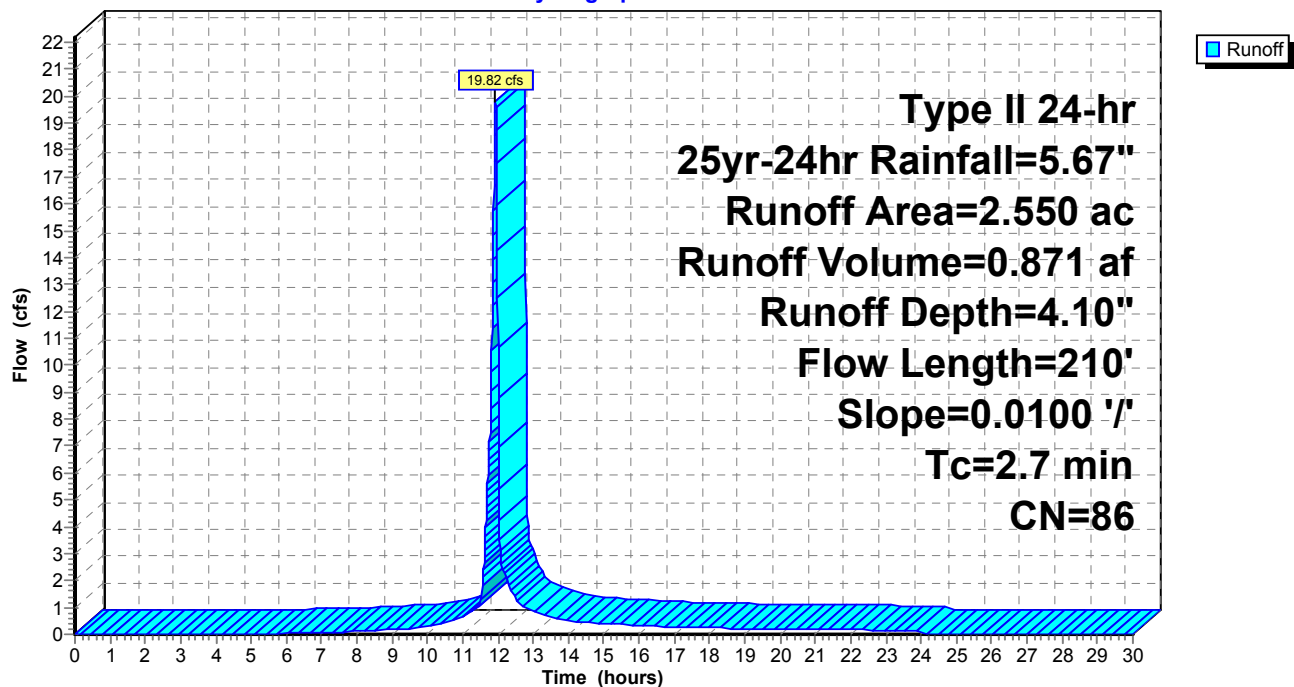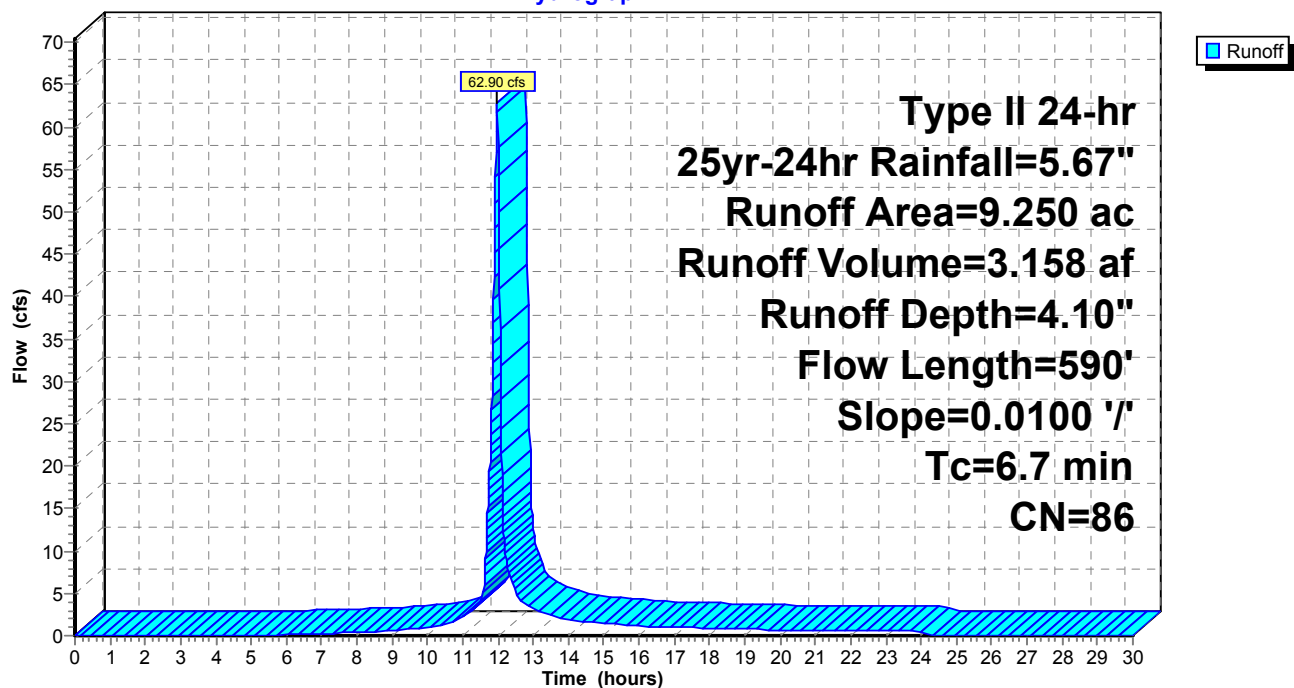Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.480	82	Dirt roads, HSG B
7.400	86	Fallow, bare soil, HSG B
0.370	98	Unconnected roofs, HSG B
9.250	86	Weighted Average
8.880		96.00% Pervious Area
0.370		4.00% Impervious Area
0.370		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
5.1	490	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.7	590				Total

Subcatchment DA-4: Area 4

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=9.250 ac
Runoff Volume=3.158 af
Runoff Depth=4.10"
Flow Length=590'
Slope=0.0100 '/'
Tc=6.7 min
CN=86

Ponds 1 and 2 - Max. Capacity (Scen.2)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-5: Area 5

Runoff   =   37.28 cfs @ 11.94 hrs, Volume=   1.733 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
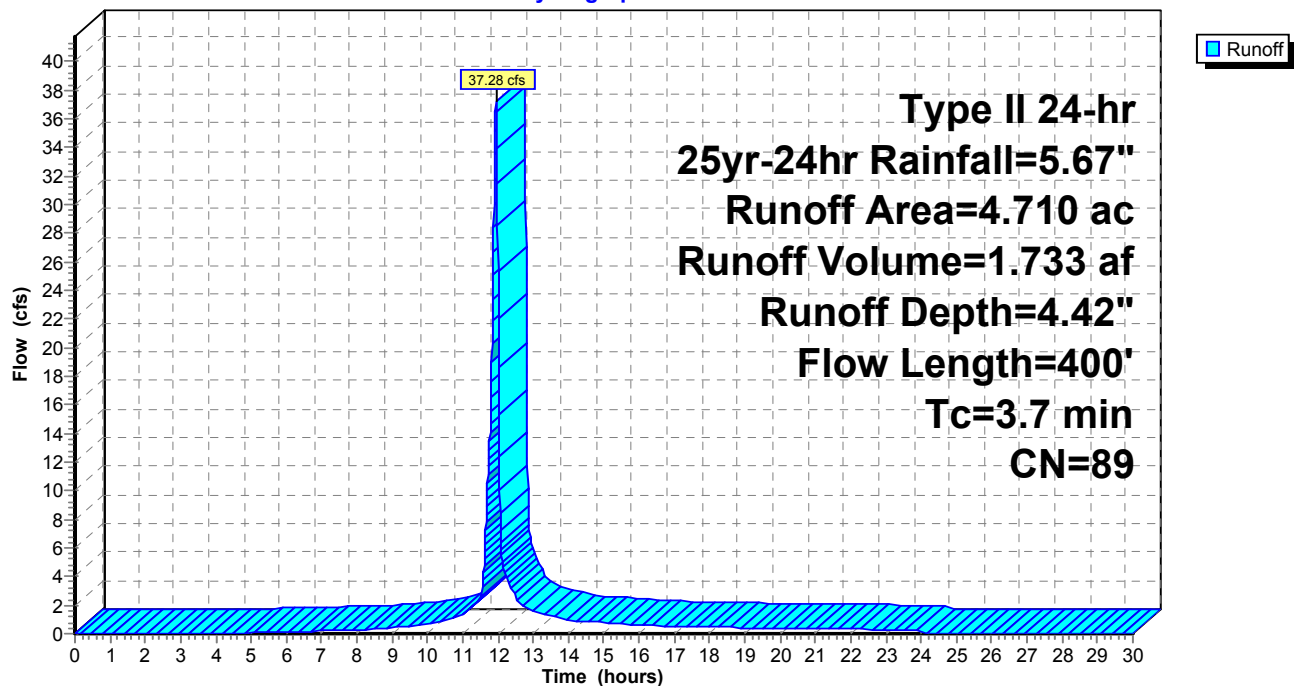Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
3.380	86	Fallow, bare soil, HSG B
1.330	98	Water Surface, HSG B
4.710	89	Weighted Average
3.380		71.76% Pervious Area
1.330		28.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3300	1.27		**Sheet Flow,** Fallow n= 0.050 P2= 3.26"
0.1	80	0.3300	9.25		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.3	220	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.7	400		Total		

Subcatchment DA-5: Area 5

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=4.710 ac
Runoff Volume=1.733 af
Runoff Depth=4.42"
Flow Length=400'
Tc=3.7 min
CN=89

Ponds 1 and 2 - Max. Capacity (Scen.2)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-6: Area 6

Runoff   =   17.66 cfs @ 11.96 hrs, Volume=   0.858 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.070	86	Fallow, bare soil, HSG B
0.320	98	Water Surface, HSG B
2.390	88	Weighted Average
2.070		86.61% Pervious Area
0.320		13.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3300	1.27		**Sheet Flow,**
					Fallow n= 0.050 P2= 3.26"
0.1	30	0.3300	9.25		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
3.9	380	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
5.3	510				Total

Subcatchment DA-6: Area 6

Hydrograph

Summary for Subcatchment DA-7: Area 7

Runoff   =   107.47 cfs @ 12.06 hrs, Volume=   7.034 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
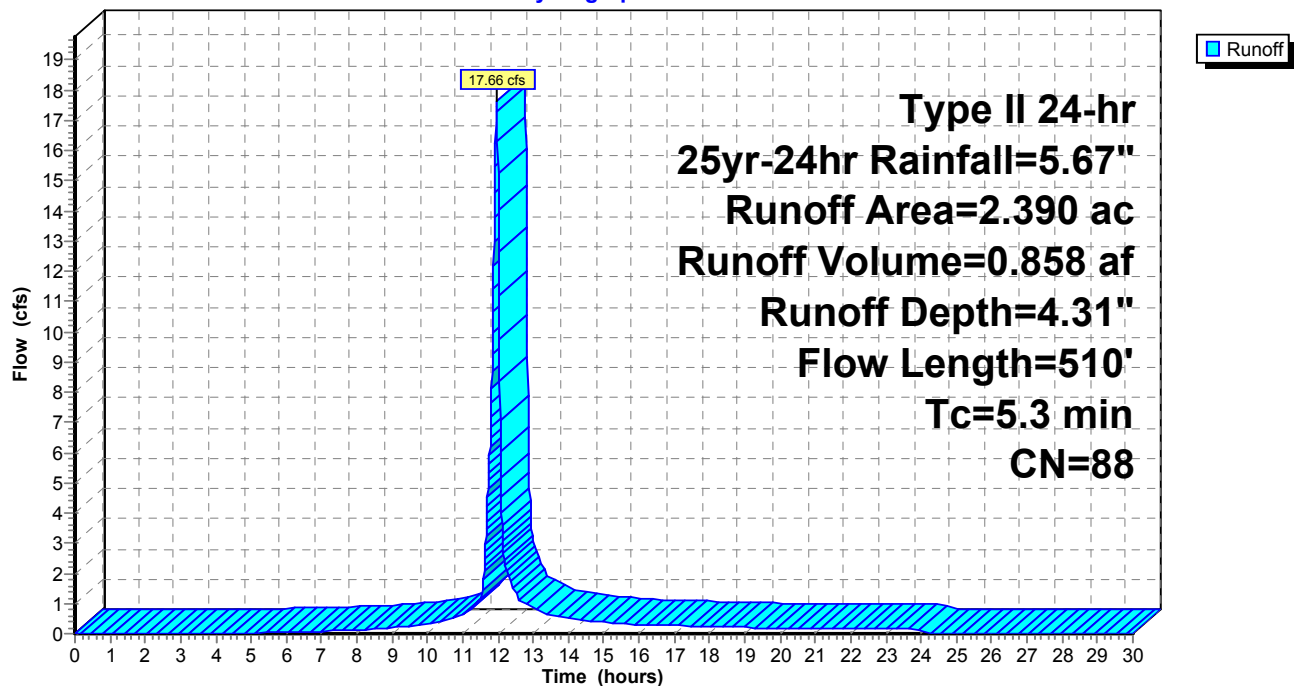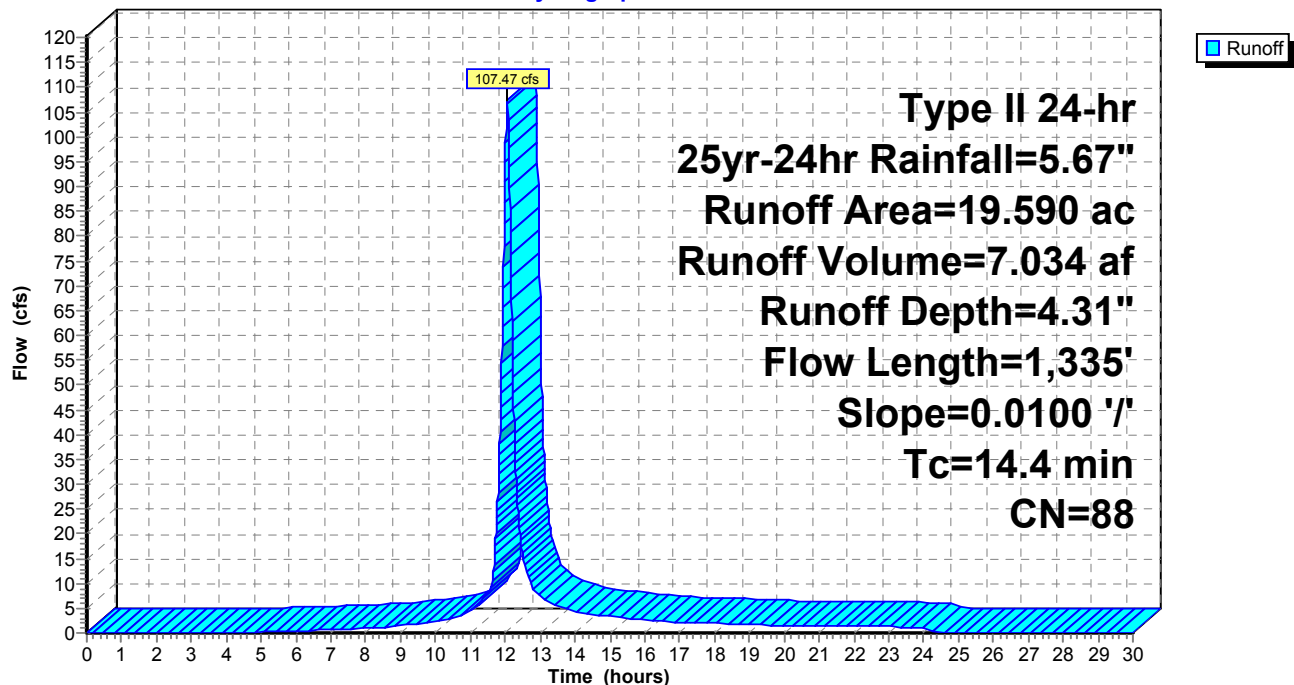Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.980	98	Water Surface, HSG B
3.920	86	Fallow, bare soil, HSG B
3.920	98	Unconnected roofs, HSG B
9.770	82	Dirt roads, HSG B
19.590	88	Weighted Average
13.690		69.88% Pervious Area
5.900		30.12% Impervious Area
3.920		66.44% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
12.8	1,235	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.4	1,335	Total			

Subcatchment DA-7: Area 7

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=19.590 ac
Runoff Volume=7.034 af
Runoff Depth=4.31"
Flow Length=1,335'
Slope=0.0100 '/'
Tc=14.4 min
CN=88

Ponds 1 and 2 - Max. Capacity (Scen.2)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Pond AP1: Ash Pond 1

Inflow Area =   41.590 ac, 21.42% Impervious, Inflow Depth > 4.61"   for 25yr-24hr event
Inflow   =   230.02 cfs @   11.96 hrs, Volume=   15.979 af, Incl. 0.50 cfs Base Flow
Outflow   =   0.00 cfs @   0.00 hrs, Volume=   0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 5.300 af
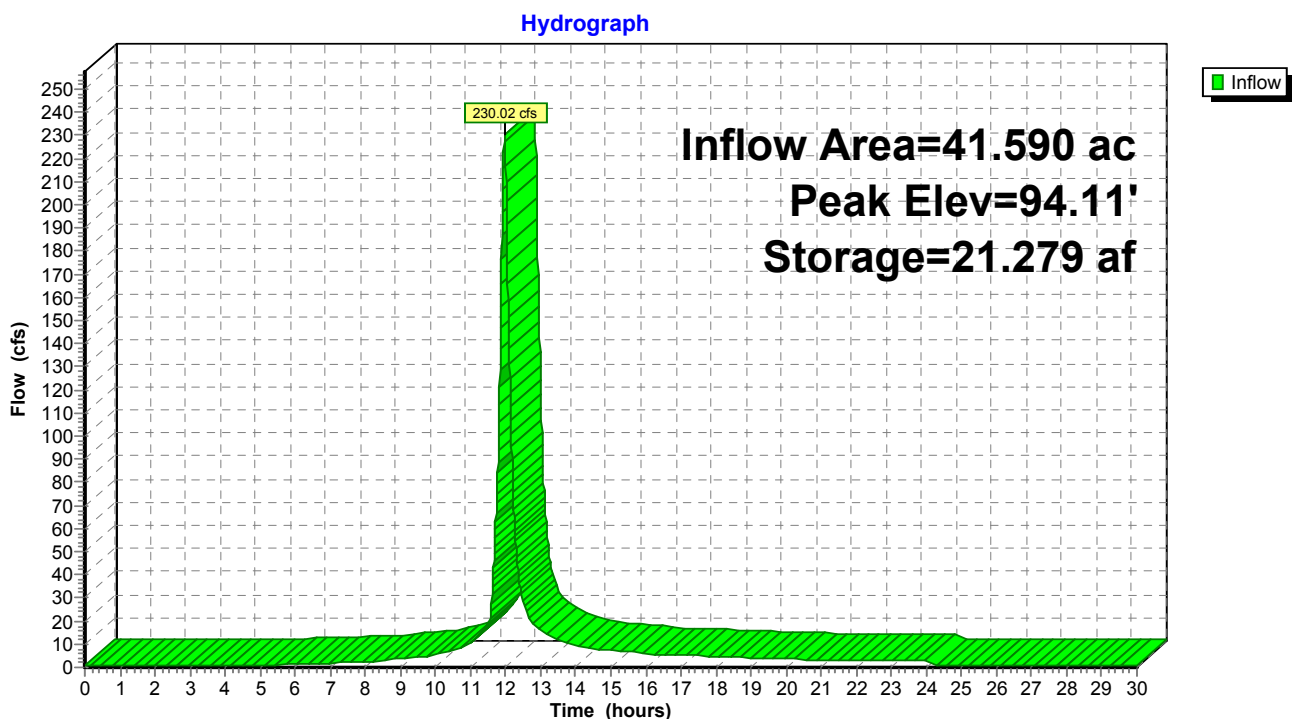Peak Elev= 94.11' @ 30.00 hrs Surf.Area= 0.000 ac Storage= 21.279 af   (15.979 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	24.300 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	5.300
91.00	11.200
93.00	17.500
95.00	24.300

Pond AP1: Ash Pond 1

Hydrograph

Inflow Area=41.590 ac
Peak Elev=94.11'
Storage=21.279 af

PRELIMINARY EVALUATION
(MAXIMUM POND FOOTPRINT)

POND 2

DA-8

Area 8

CP1

Concrete Pond

AP2

Ash Pond 2

L1

Lagoon Area

| Subcat | Reach | Pond | Link |

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.410	79	<50% Grass cover, Poor, HSG B (DA-8)
1.280	82	Dirt roads, HSG B (DA-8)
0.950	86	Fallow, bare soil, HSG B (L1)
0.120	98	Unconnected roofs, HSG B (DA-8)
3.150	98	Water Surface, HSG B (CP1, DA-8, L1)
7.910	**88**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
7.910	HSG B	CP1, DA-8, L1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
7.910		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	2.410	0.000	0.000	0.000	2.410	<50% Grass cover, Poor	DA-8
0.000	1.280	0.000	0.000	0.000	1.280	Dirt roads	DA-8
0.000	0.950	0.000	0.000	0.000	0.950	Fallow, bare soil	L1
0.000	0.120	0.000	0.000	0.000	0.120	Unconnected roofs	DA-8
0.000	3.150	0.000	0.000	0.000	3.150	Water Surface	CP1, DA-8, L1
0.000	**7.910**	**0.000**	**0.000**	**0.000**	**7.910**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	CP1	0.00	0.00	550.0	0.0200	0.010	6.0	0.0	0.0
2	L1	0.00	0.00	710.0	0.0200	0.010	8.0	0.0	0.0

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment CP1: Concrete Pond   Runoff Area=0.100 ac   100.00% Impervious   Runoff Depth=5.43"
Flow Length=550'   Slope=0.0200 '/'   Tc=1.7 min   CN=98   Runoff=0.92 cfs 0.045 af

Subcatchment DA-8: Area 8   Runoff Area=6.220 ac   40.68% Impervious   Runoff Depth=4.20"
Flow Length=475'   Slope=0.0100 '/'   Tc=16.7 min   CN=87   Runoff=31.28 cfs 2.178 af

Subcatchment L1: Lagoon Area   Runoff Area=1.590 ac   40.25% Impervious   Runoff Depth=4.63"
Flow Length=710'   Slope=0.0200 '/'   Tc=1.9 min   CN=91   Runoff=13.71 cfs 0.614 af

Pond AP2: Ash Pond 2   Peak Elev=90.50' Storage=9.924 af Inflow=33.68 cfs 4.425 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 7.910 ac   Runoff Volume = 2.837 af   Average Runoff Depth = 4.30"
58.66% Pervious = 4.640 ac   41.34% Impervious = 3.270 ac

Ponds 1 and 2 - Max. Capacity (Scen.1)
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Summary for Subcatchment CP1: Concrete Pond

Runoff   =   0.92 cfs @ 11.92 hrs, Volume=   0.045 af, Depth= 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.100	98	Water Surface, HSG B
0.100		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	550	0.0200	5.25	1.03	**Pipe Channel,** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior

Subcatchment CP1: Concrete Pond

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=0.100 ac
Runoff Volume=0.045 af
Runoff Depth=5.43"
Flow Length=550'
Slope=0.0200 '/'
Tc=1.7 min
CN=98

0.92 cfs

Runoff

Ponds 1 and 2 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
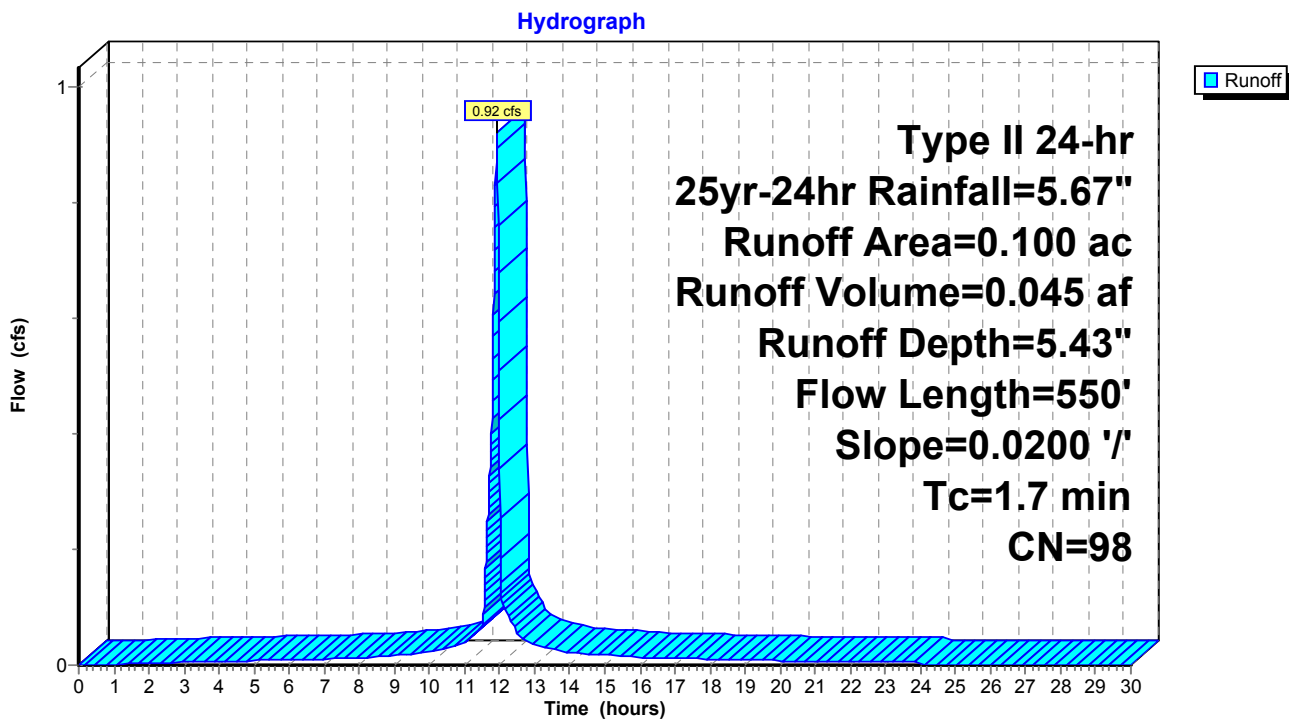Printed 10/17/2016
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Summary for Subcatchment DA-8: Area 8

Runoff   =   31.28 cfs @ 12.08 hrs, Volume=   2.178 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.410	98	Water Surface, HSG B
2.410	79	<50% Grass cover, Poor, HSG B
1.280	82	Dirt roads, HSG B
0.120	98	Unconnected roofs, HSG B
6.220	87	Weighted Average
3.690		59.32% Pervious Area
2.530		40.68% Impervious Area
0.120		4.74% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
3.9	375	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
16.7	475				Total

Subcatchment DA-8: Area 8

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=6.220 ac
Runoff Volume=2.178 af
Runoff Depth=4.20"
Flow Length=475'
Slope=0.0100 '/'
Tc=16.7 min
CN=87

Ponds 1 and 2 - Max. Capacity (Scen.1)
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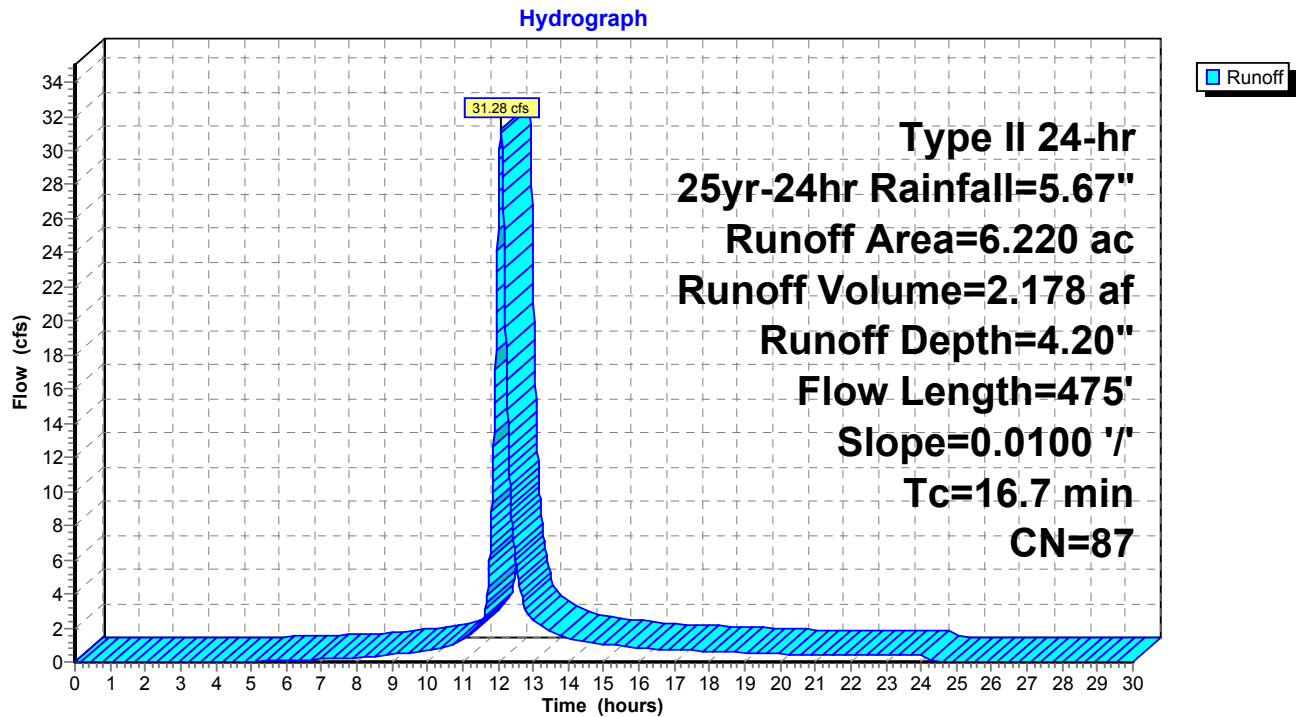*Type II 24-hr 25yr-24hr Rainfall=5.67"*
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Summary for Subcatchment L1: Lagoon Area

Runoff   =   13.71 cfs @ 11.92 hrs, Volume=   0.614 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.640	98	Water Surface, HSG B
0.950	86	Fallow, bare soil, HSG B
1.590	91	Weighted Average
0.950		59.75% Pervious Area
0.640		40.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	710	0.0200	6.36	2.22	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.010 PVC, smooth interior

Subcatchment L1: Lagoon Area

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.590 ac
Runoff Volume=0.614 af
Runoff Depth=4.63"
Flow Length=710'
Slope=0.0200 '/'
Tc=1.9 min
CN=91

Ponds 1 and 2 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Pond AP2: Ash Pond 2

Inflow Area =   7.910 ac, 41.34% Impervious, Inflow Depth > 6.71"   for 25yr-24hr event
Inflow   =   33.68 cfs @   12.08 hrs, Volume=   4.425 af, Incl. 0.64 cfs Base Flow
Outflow   =   0.00 cfs @   0.00 hrs, Volume=   0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 5.500 af
Peak Elev= 90.50' @ 30.00 hrs Surf.Area= 0.000 ac Storage= 9.924 af (4.424 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	24.800 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	5.500
91.00	11.400
93.00	17.900
95.00	24.800

Pond AP2: Ash Pond 2

Hydrograph

**PRELIMINARY EVALUATION
(MAXIMUM POND FOOTPRINT)**

POND 3

DA-3
Area 3

DA-2
Area 2

DA-4
Area 4

DA-1
Area 1

DA-5
Area 5

DA-8
Area 8

DA-6
Area 6

CP1
Concrete Pond

AP1
Ash Pond 1

DA-9
Area 9

L1
Lagoon Area

DA-7
Area 7

AP3
Ash Pond 3

AP2
Ash Pond 2

Subcat   Reach   Pond   Link
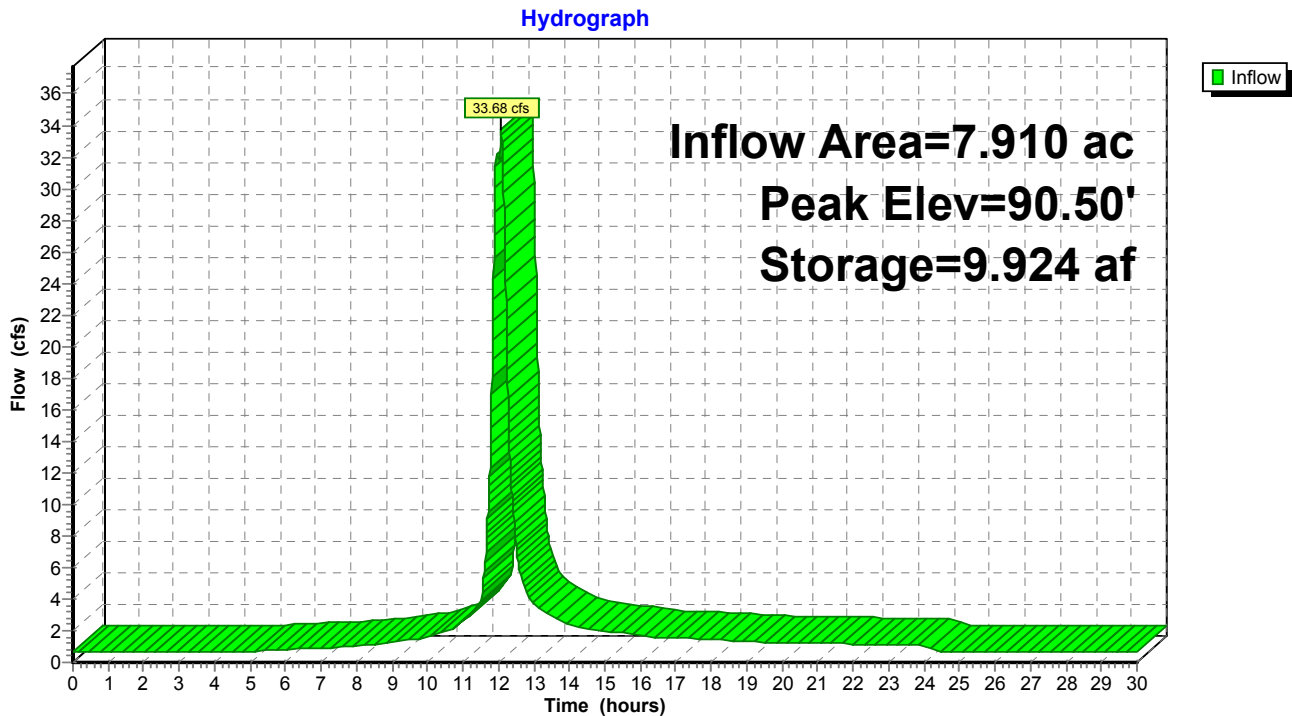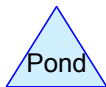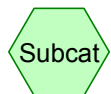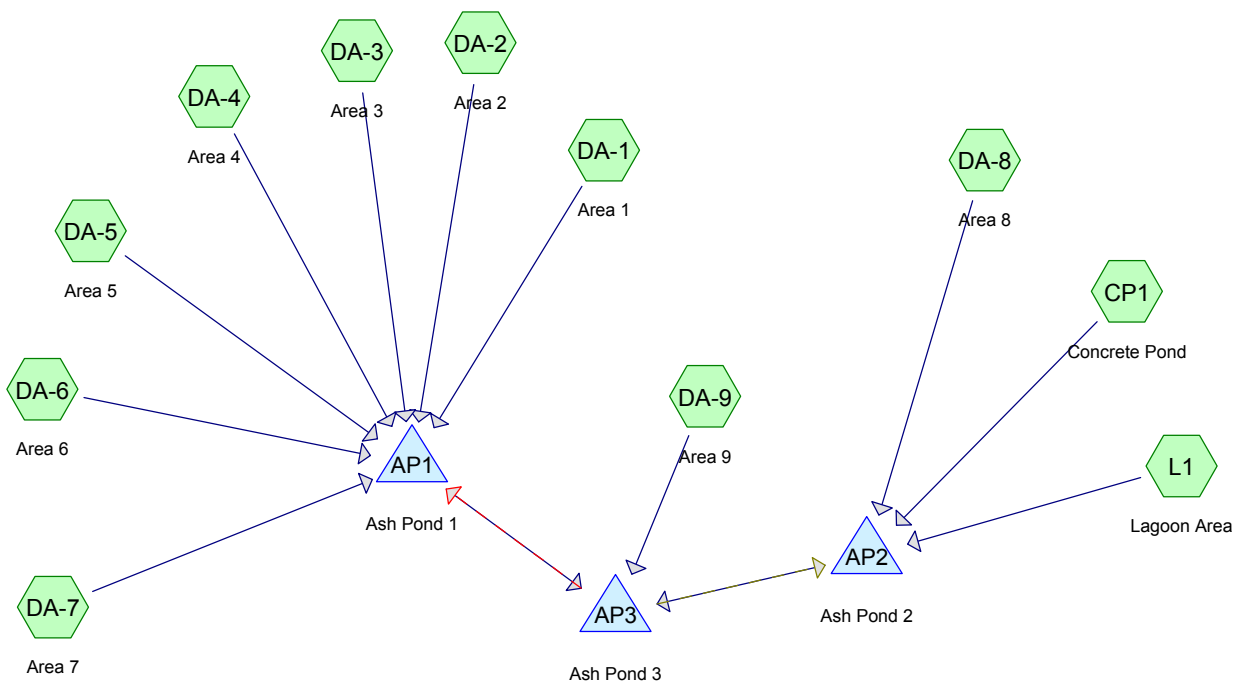
Routing Diagram for Pond 3 - Max. Capacity (Scen.1)
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.410	79	<50% Grass cover, Poor, HSG B (DA-8)
17.990	82	Dirt roads, HSG B (DA-1, DA-2, DA-4, DA-7, DA-8, DA-9)
20.270	86	Fallow, bare soil, HSG B (DA-3, DA-4, DA-5, DA-6, DA-7, L1)
4.410	98	Unconnected roofs, HSG B (DA-4, DA-7, DA-8)
9.560	98	Water Surface, HSG B (CP1, DA-1, DA-2, DA-5, DA-6, DA-7, DA-8, DA-9, L1)
54.640	**87**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
54.640	HSG B	CP1, DA-1, DA-2, DA-3, DA-4, DA-5, DA-6, DA-7, DA-8, DA-9, L1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
54.640		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	2.410	0.000	0.000	0.000	2.410	<50% Grass cover, Poor	DA-8
0.000	17.990	0.000	0.000	0.000	17.990	Dirt roads	DA-1, DA-2, DA-4, DA-7, DA-8, DA-9
0.000	20.270	0.000	0.000	0.000	20.270	Fallow, bare soil	DA-3, DA-4, DA-5, DA-6, DA-7, L1
0.000	4.410	0.000	0.000	0.000	4.410	Unconnected roofs	DA-4, DA-7, DA-8
0.000	9.560	0.000	0.000	0.000	9.560	Water Surface	CP1, DA-1, DA-2, DA-5, DA-6, DA-7, DA-8, DA-9, L1
0.000	**54.640**	**0.000**	**0.000**	**0.000**	**54.640**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	CP1	0.00	0.00	550.0	0.0200	0.010	6.0	0.0	0.0
2	L1	0.00	0.00	710.0	0.0200	0.010	8.0	0.0	0.0
3	AP1	89.00	88.00	280.0	0.0036	0.010	30.0	0.0	0.0
4	AP2	89.00	88.00	540.0	0.0019	0.025	16.0	0.0	0.0
5	AP3	88.00	87.00	100.0	0.0100	0.012	24.0	0.0	0.0
6	AP3	88.00	89.00	280.0	-0.0036	0.010	30.0	0.0	0.0
7	AP3	88.00	89.00	540.0	-0.0019	0.025	16.0	0.0	0.0
8	AP3	90.00	89.00	100.0	0.0100	0.025	24.0	0.0	0.0

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment CP1: Concrete Pond   Runoff Area=0.100 ac   100.00% Impervious   Runoff Depth=5.43"
Flow Length=550' Slope=0.0200 '/' Tc=1.7 min CN=98 Runoff=0.92 cfs 0.045 af

Subcatchment DA-1: Area 1   Runoff Area=1.930 ac   34.20% Impervious   Runoff Depth=4.20"
Flow Length=210' Slope=0.0100 '/' Tc=2.7 min CN=87 Runoff=15.27 cfs 0.676 af

Subcatchment DA-2: Area 2   Runoff Area=1.170 ac   28.21% Impervious   Runoff Depth=4.20"
Flow Length=65' Slope=0.3300 '/' Tc=0.3 min CN=87 Runoff=9.87 cfs 0.410 af

Subcatchment DA-3: Area 3   Runoff Area=2.550 ac   0.00% Impervious   Runoff Depth=4.10"
Flow Length=210' Slope=0.0100 '/' Tc=2.7 min CN=86 Runoff=19.82 cfs 0.871 af

Subcatchment DA-4: Area 4   Runoff Area=9.250 ac   4.00% Impervious   Runoff Depth=4.10"
Flow Length=590' Slope=0.0100 '/' Tc=6.7 min CN=86 Runoff=62.90 cfs 3.158 af

Subcatchment DA-5: Area 5   Runoff Area=4.710 ac   28.24% Impervious   Runoff Depth=4.42"
Flow Length=400' Tc=3.7 min CN=89 Runoff=37.28 cfs 1.733 af

Subcatchment DA-6: Area 6   Runoff Area=2.390 ac   13.39% Impervious   Runoff Depth=4.31"
Flow Length=510' Tc=5.3 min CN=88 Runoff=17.66 cfs 0.858 af

Subcatchment DA-7: Area 7   Runoff Area=19.590 ac   30.12% Impervious   Runoff Depth=4.31"
Flow Length=1,335' Slope=0.0100 '/' Tc=14.4 min CN=88 Runoff=107.47 cfs 7.034 af

Subcatchment DA-8: Area 8   Runoff Area=6.220 ac   40.68% Impervious   Runoff Depth=4.20"
Flow Length=475' Slope=0.0100 '/' Tc=16.7 min CN=87 Runoff=31.28 cfs 2.178 af

Subcatchment DA-9: Area 9   Runoff Area=5.140 ac   34.82% Impervious   Runoff Depth=4.31"
Flow Length=435' Slope=0.0100 '/' Tc=5.1 min CN=88 Runoff=38.23 cfs 1.846 af

Subcatchment L1: Lagoon Area   Runoff Area=1.590 ac   40.25% Impervious   Runoff Depth=4.63"
Flow Length=710' Slope=0.0200 '/' Tc=1.9 min CN=91 Runoff=13.71 cfs 0.614 af

Pond AP1: Ash Pond 1   Peak Elev=91.86' Storage=13.913 af   Inflow=230.02 cfs 15.979 af
30.0" Round Culvert n=0.010 L=280.0' S=0.0036 '/' Outflow=23.69 cfs 13.969 af

Pond AP2: Ash Pond 2   Peak Elev=90.14' Storage=8.854 af   Inflow=33.68 cfs 4.569 af
16.0" Round Culvert x 2.00 n=0.025 L=540.0' S=0.0019 '/' Outflow=1.87 cfs 1.985 af

Pond AP3: Ash Pond 3   Peak Elev=90.11' Storage=6.964 af   Inflow=52.32 cfs 17.796 af
Primary=16.01 cfs 17.754 af Secondary=0.00 cfs 0.000 af Tertiary=1.06 cfs 0.145 af Outflow=17.00 cfs 17.898 af

Total Runoff Area = 54.640 ac   Runoff Volume = 19.422 af   Average Runoff Depth = 4.27"
74.43% Pervious = 40.670 ac   25.57% Impervious = 13.970 ac

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
Printed 10/17/2016
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Summary for Subcatchment CP1: Concrete Pond

Runoff   =   0.92 cfs @ 11.92 hrs, Volume=   0.045 af, Depth= 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.100	98	Water Surface, HSG B
0.100		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	550	0.0200	5.25	1.03	**Pipe Channel,** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior

Subcatchment CP1: Concrete Pond

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=0.100 ac
Runoff Volume=0.045 af
Runoff Depth=5.43"
Flow Length=550'
Slope=0.0200 '/'
Tc=1.7 min
CN=98

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
Printed 10/17/2016
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Summary for Subcatchment DA-1: Area 1
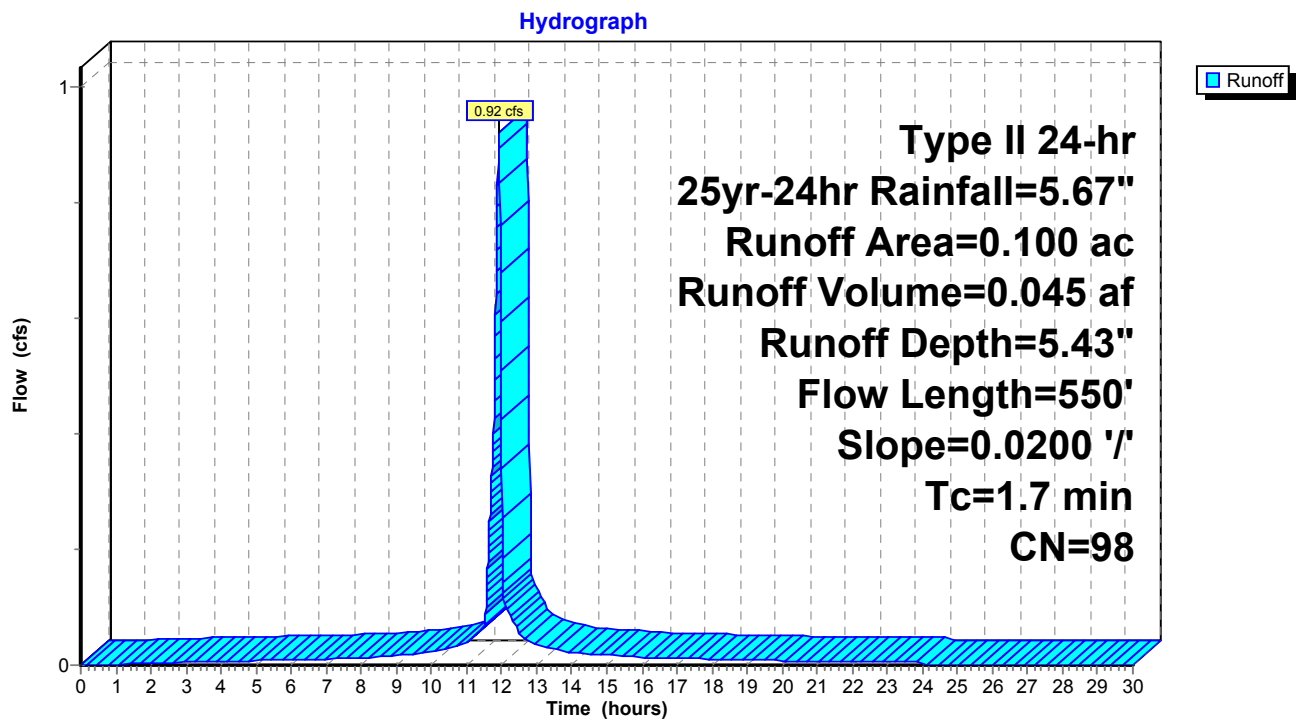
Runoff   =   15.27 cfs @ 11.93 hrs, Volume=   0.676 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.270	82	Dirt roads, HSG B
0.660	98	Water Surface, HSG B
1.930	87	Weighted Average
1.270		65.80% Pervious Area
0.660		34.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,**
					Smooth surfaces n= 0.011 P2= 3.26"
1.1	110	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
2.7	210	Total			

Subcatchment DA-1: Area 1

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.930 ac
Runoff Volume=0.676 af
Runoff Depth=4.20"
Flow Length=210'
Slope=0.0100 '/'
Tc=2.7 min
CN=87

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-2: Area 2

Runoff   =   9.87 cfs @ 11.90 hrs, Volume=   0.410 af, Depth= 4.20"
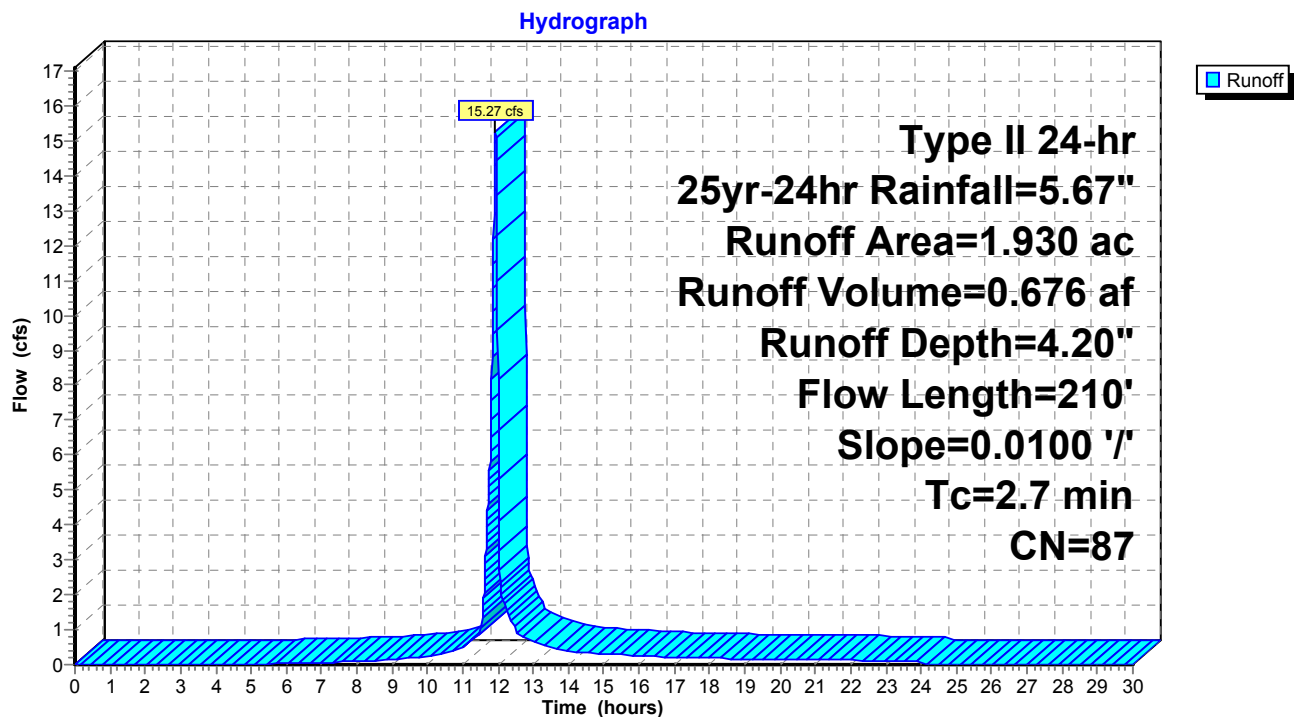
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.840	82	Dirt roads, HSG B
0.330	98	Water Surface, HSG B
1.170	87	Weighted Average
0.840		71.79% Pervious Area
0.330		28.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	65	0.3300	3.91		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"

Subcatchment DA-2: Area 2

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.170 ac
Runoff Volume=0.410 af
Runoff Depth=4.20"
Flow Length=65'
Slope=0.3300 '/'
Tc=0.3 min
CN=87

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
Printed 10/17/2016
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Summary for Subcatchment DA-3: Area 3

Runoff   =   19.82 cfs @ 11.93 hrs, Volume=   0.871 af, Depth= 4.10"
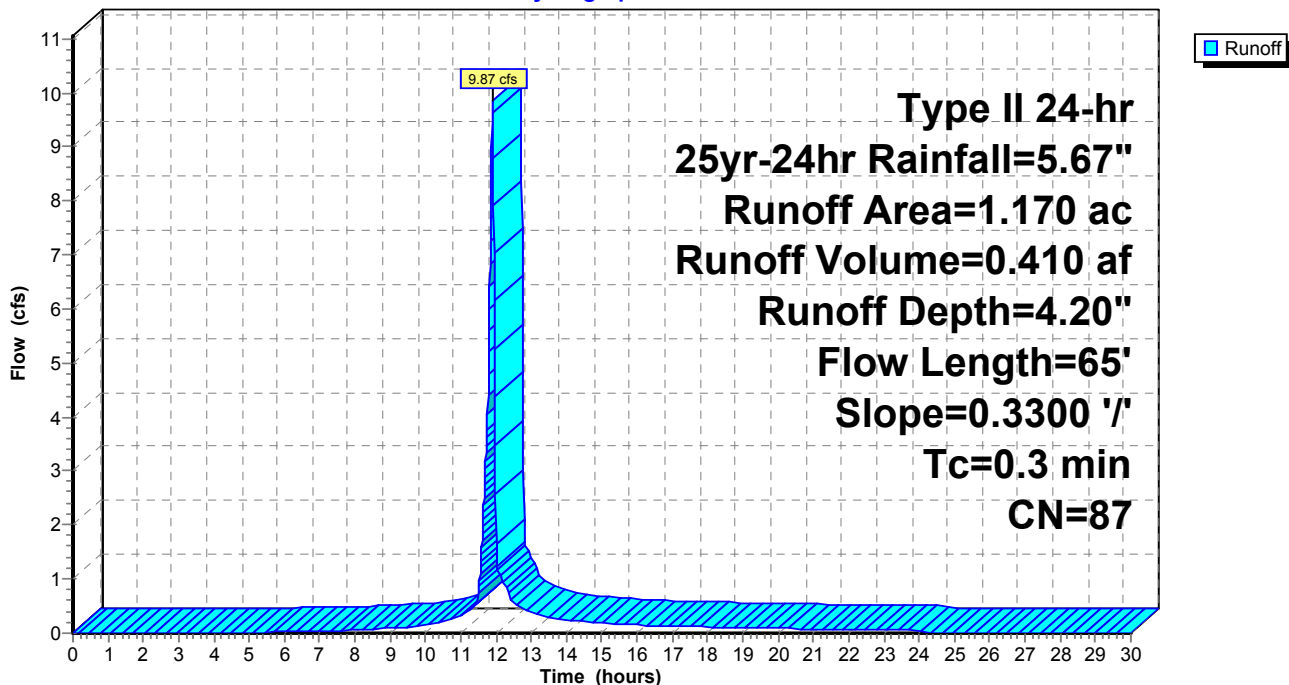
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.550	86	Fallow, bare soil, HSG B
2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
1.1	110	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.7	210				Total

Subcatchment DA-3: Area 3

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=2.550 ac
Runoff Volume=0.871 af
Runoff Depth=4.10"
Flow Length=210'
Slope=0.0100 '/'
Tc=2.7 min
CN=86

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-4: Area 4

Runoff   =   62.90 cfs @ 11.98 hrs, Volume=   3.158 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
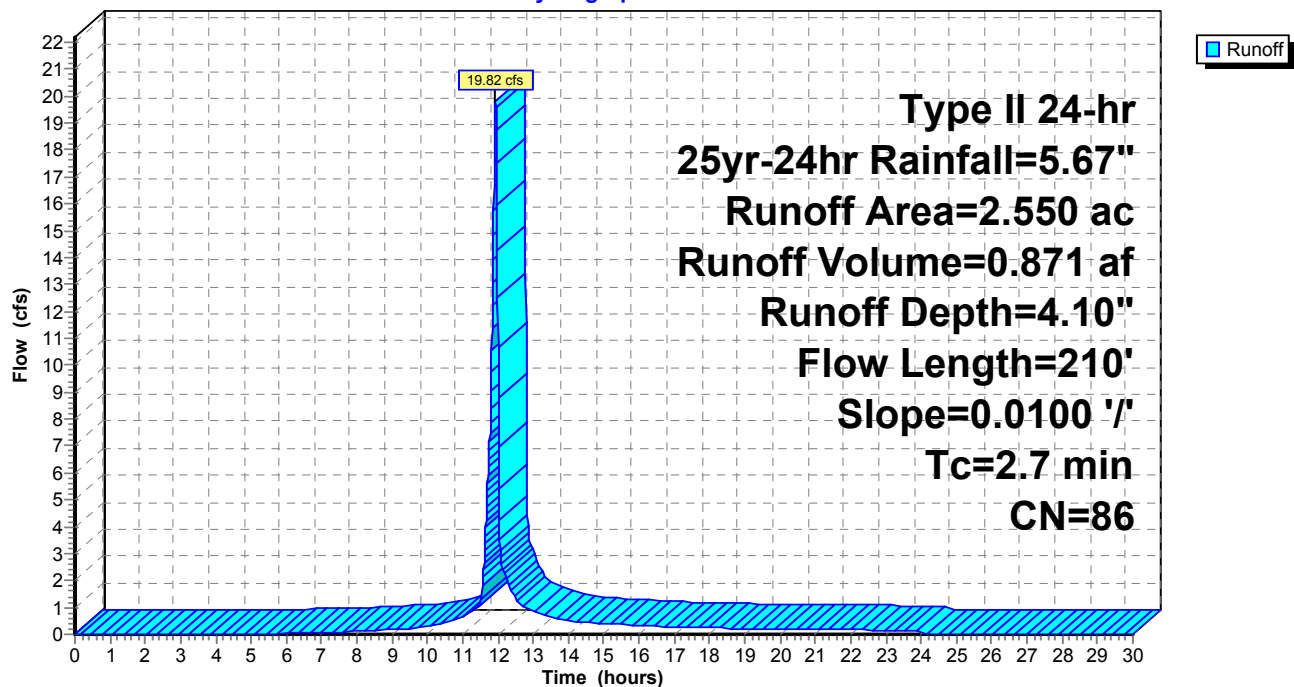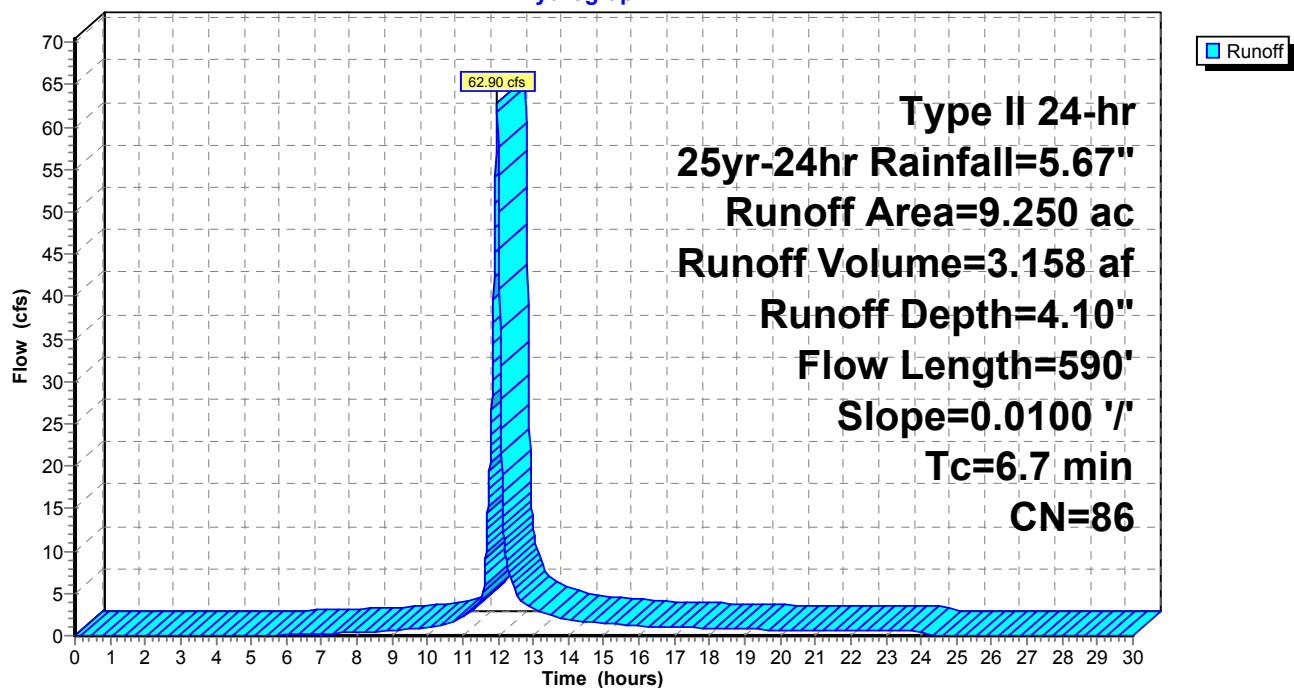Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.480	82	Dirt roads, HSG B
7.400	86	Fallow, bare soil, HSG B
0.370	98	Unconnected roofs, HSG B
9.250	86	Weighted Average
8.880		96.00% Pervious Area
0.370		4.00% Impervious Area
0.370		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
5.1	490	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.7	590				Total

Subcatchment DA-4: Area 4

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=9.250 ac
Runoff Volume=3.158 af
Runoff Depth=4.10"
Flow Length=590'
Slope=0.0100 '/'
Tc=6.7 min
CN=86

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-5: Area 5

Runoff   =   37.28 cfs @ 11.94 hrs, Volume=   1.733 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
3.380	86	Fallow, bare soil, HSG B
1.330	98	Water Surface, HSG B
4.710	89	Weighted Average
3.380		71.76% Pervious Area
1.330		28.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3300	1.27		**Sheet Flow,** Fallow n= 0.050 P2= 3.26"
0.1	80	0.3300	9.25		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.3	220	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.7	400	Total			

Subcatchment DA-5: Area 5

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=4.710 ac
Runoff Volume=1.733 af
Runoff Depth=4.42"
Flow Length=400'
Tc=3.7 min
CN=89

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-6: Area 6

Runoff   =   17.66 cfs @ 11.96 hrs, Volume=   0.858 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
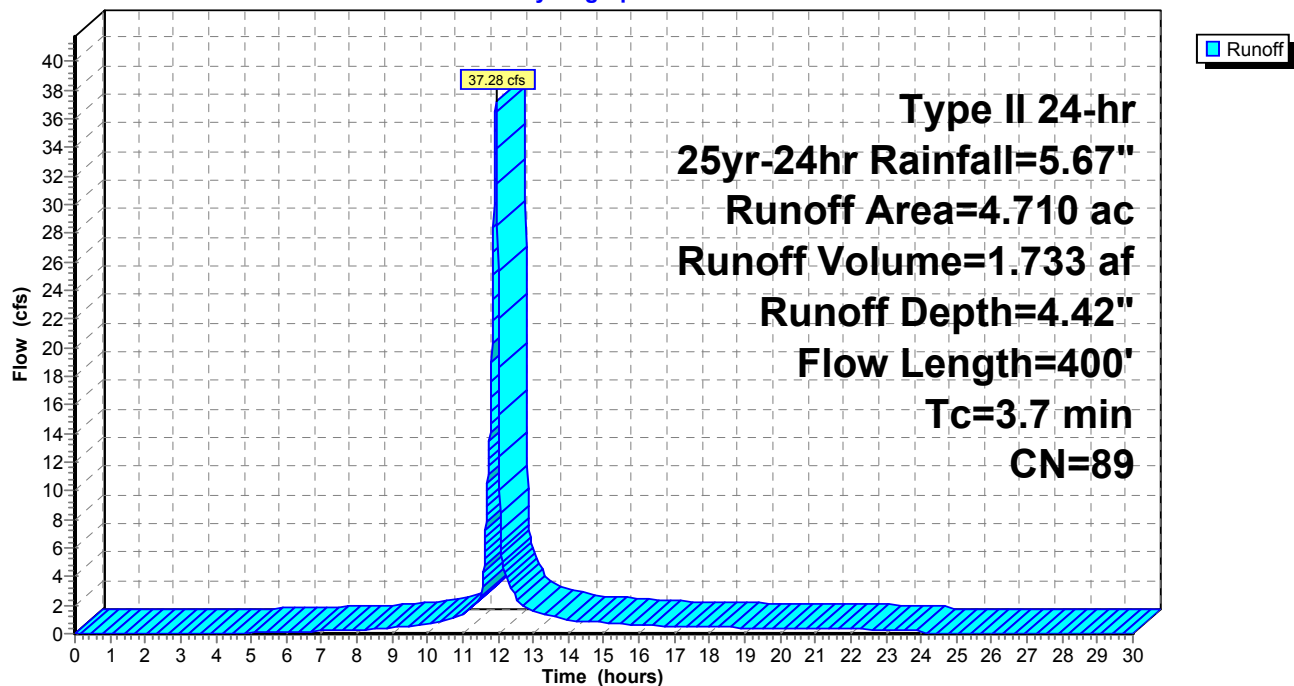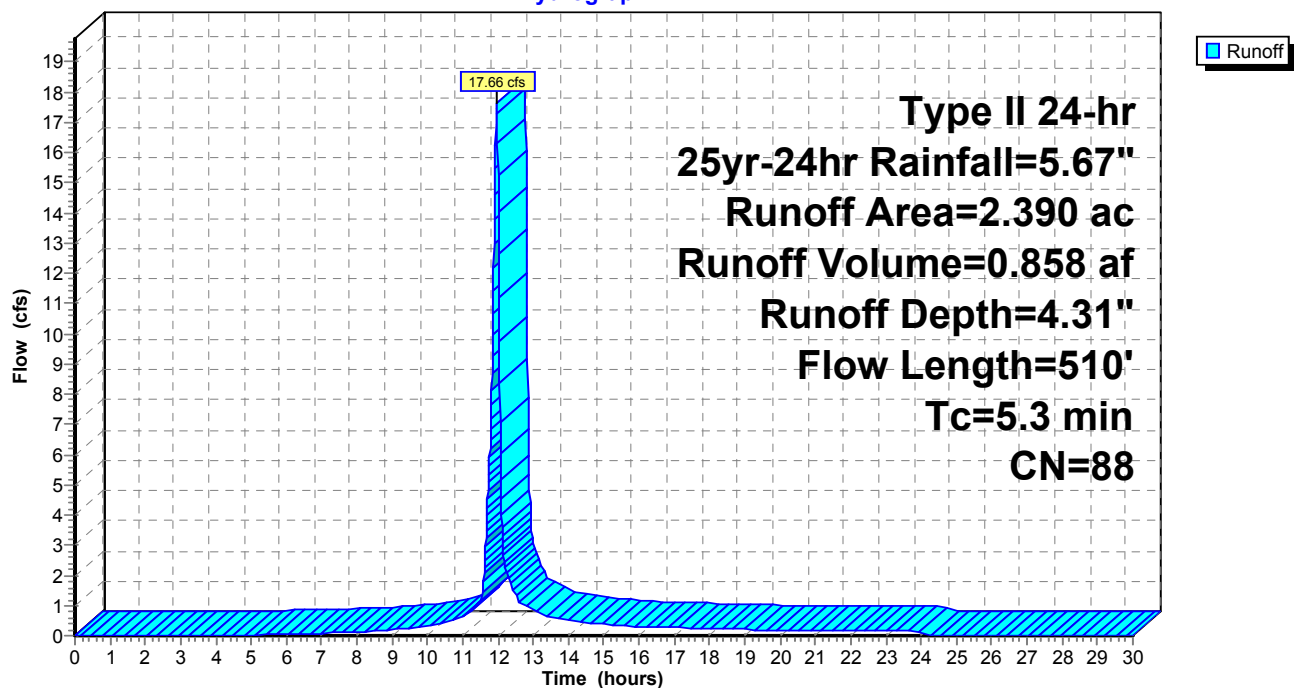Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.070	86	Fallow, bare soil, HSG B
0.320	98	Water Surface, HSG B
2.390	88	Weighted Average
2.070		86.61% Pervious Area
0.320		13.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3300	1.27		**Sheet Flow,** Fallow n= 0.050 P2= 3.26"
0.1	30	0.3300	9.25		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	380	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	510	Total			

Subcatchment DA-6: Area 6

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=2.390 ac
Runoff Volume=0.858 af
Runoff Depth=4.31"
Flow Length=510'
Tc=5.3 min
CN=88

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-7: Area 7

Runoff   =   107.47 cfs @ 12.06 hrs, Volume=   7.034 af, Depth= 4.31"
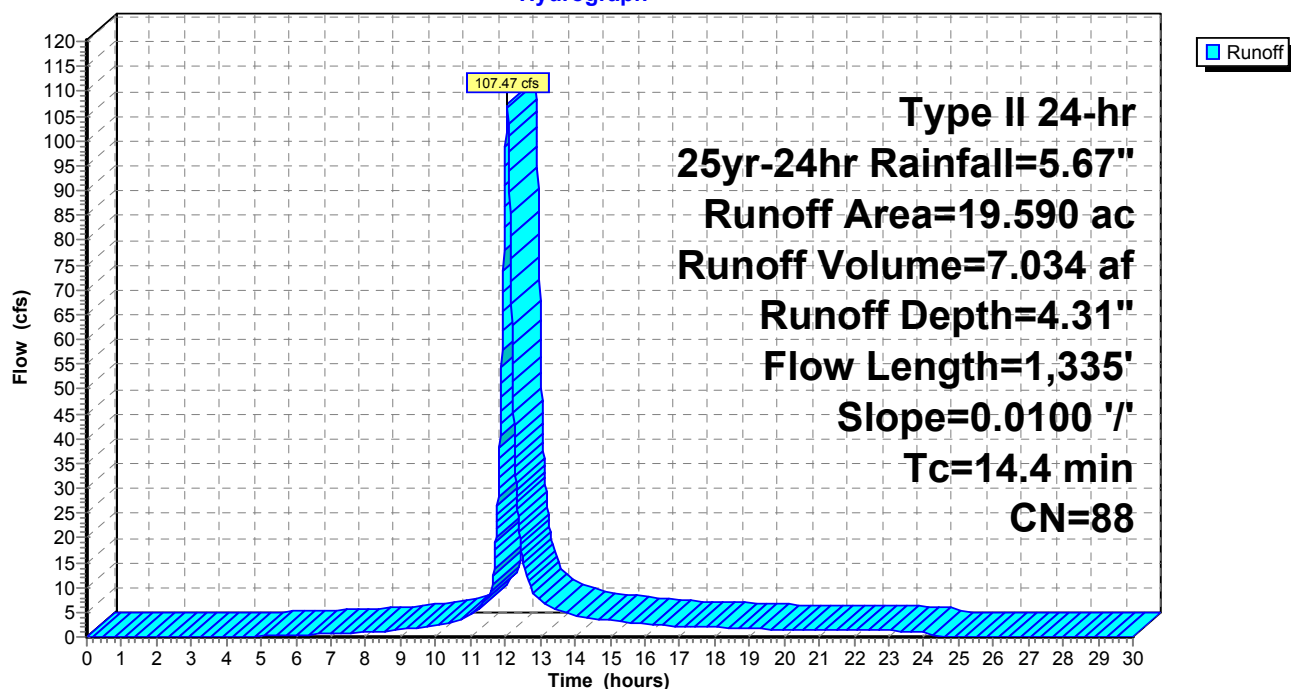
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.980	98	Water Surface, HSG B
3.920	86	Fallow, bare soil, HSG B
3.920	98	Unconnected roofs, HSG B
9.770	82	Dirt roads, HSG B
19.590	88	Weighted Average
13.690		69.88% Pervious Area
5.900		30.12% Impervious Area
3.920		66.44% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
12.8	1,235	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.4	1,335				Total

Subcatchment DA-7: Area 7

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=19.590 ac
Runoff Volume=7.034 af
Runoff Depth=4.31"
Flow Length=1,335'
Slope=0.0100 '/'
Tc=14.4 min
CN=88

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-8: Area 8

Runoff   =   31.28 cfs @ 12.08 hrs, Volume=   2.178 af, Depth= 4.20"
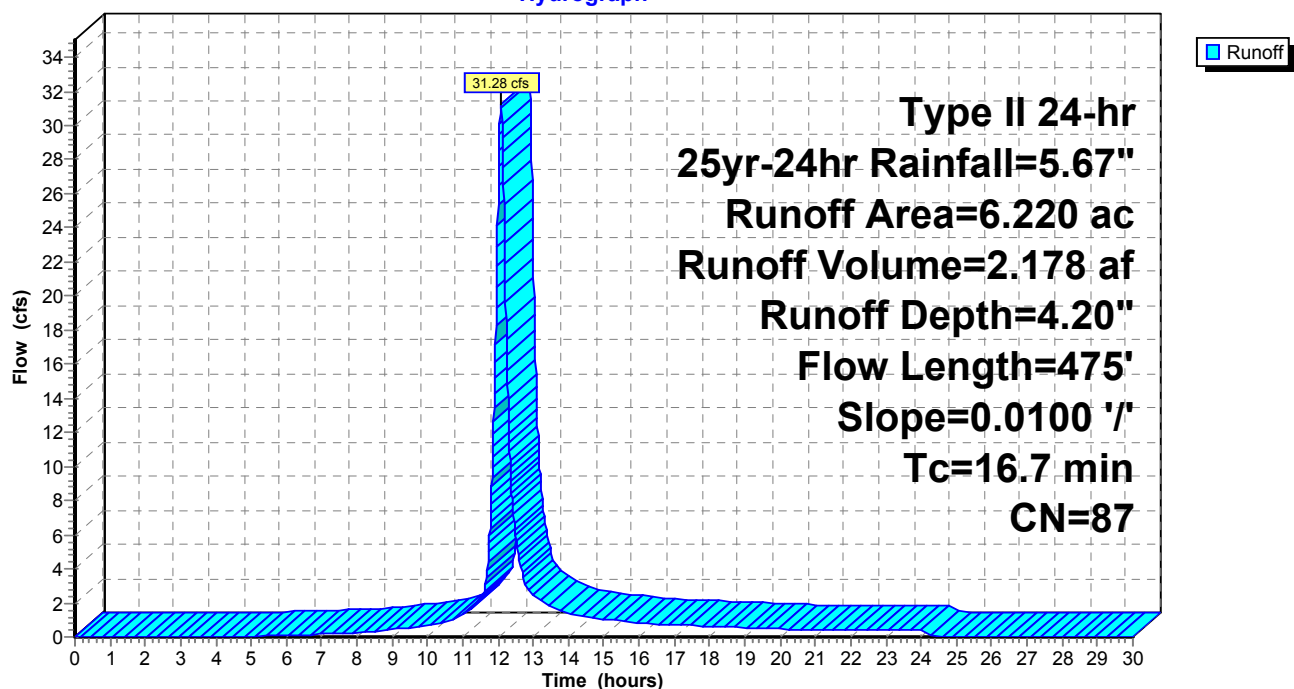
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.410	98	Water Surface, HSG B
2.410	79	<50% Grass cover, Poor, HSG B
1.280	82	Dirt roads, HSG B
0.120	98	Unconnected roofs, HSG B
6.220	87	Weighted Average
3.690		59.32% Pervious Area
2.530		40.68% Impervious Area
0.120		4.74% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	100	0.0100	0.13		**Sheet Flow,**
					Grass: Short n= 0.150 P2= 3.26"
3.9	375	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
16.7	475				Total

Subcatchment DA-8: Area 8

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=6.220 ac
Runoff Volume=2.178 af
Runoff Depth=4.20"
Flow Length=475'
Slope=0.0100 '/'
Tc=16.7 min
CN=87

Summary for Subcatchment DA-9: Area 9
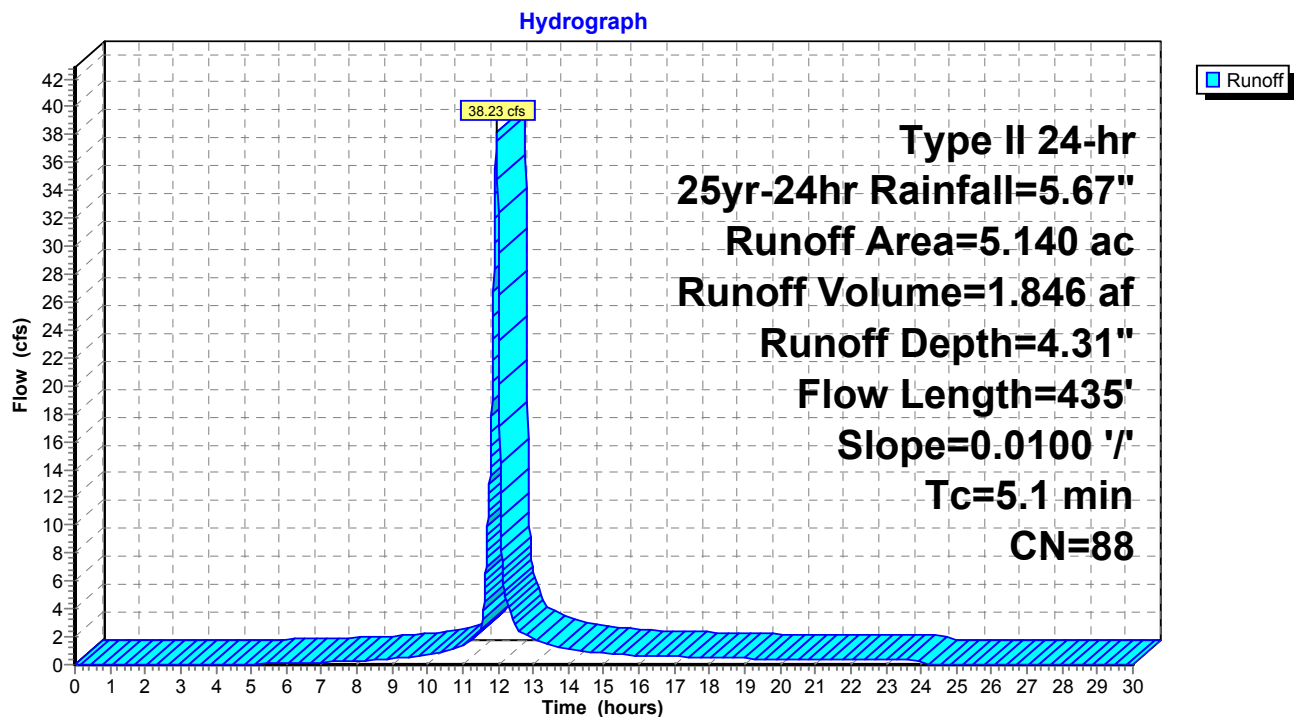
Runoff   =   38.23 cfs @ 11.96 hrs, Volume=   1.846 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.790	98	Water Surface, HSG B
3.350	82	Dirt roads, HSG B
5.140	88	Weighted Average
3.350		65.18% Pervious Area
1.790		34.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,**
					Smooth surfaces n= 0.011 P2= 3.26"
3.5	335	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
5.1	435	Total			

Subcatchment DA-9: Area 9

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=5.140 ac
Runoff Volume=1.846 af
Runoff Depth=4.31"
Flow Length=435'
Slope=0.0100 '/'
Tc=5.1 min
CN=88

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment L1: Lagoon Area

Runoff   =   13.71 cfs @ 11.92 hrs, Volume=   0.614 af, Depth= 4.63"
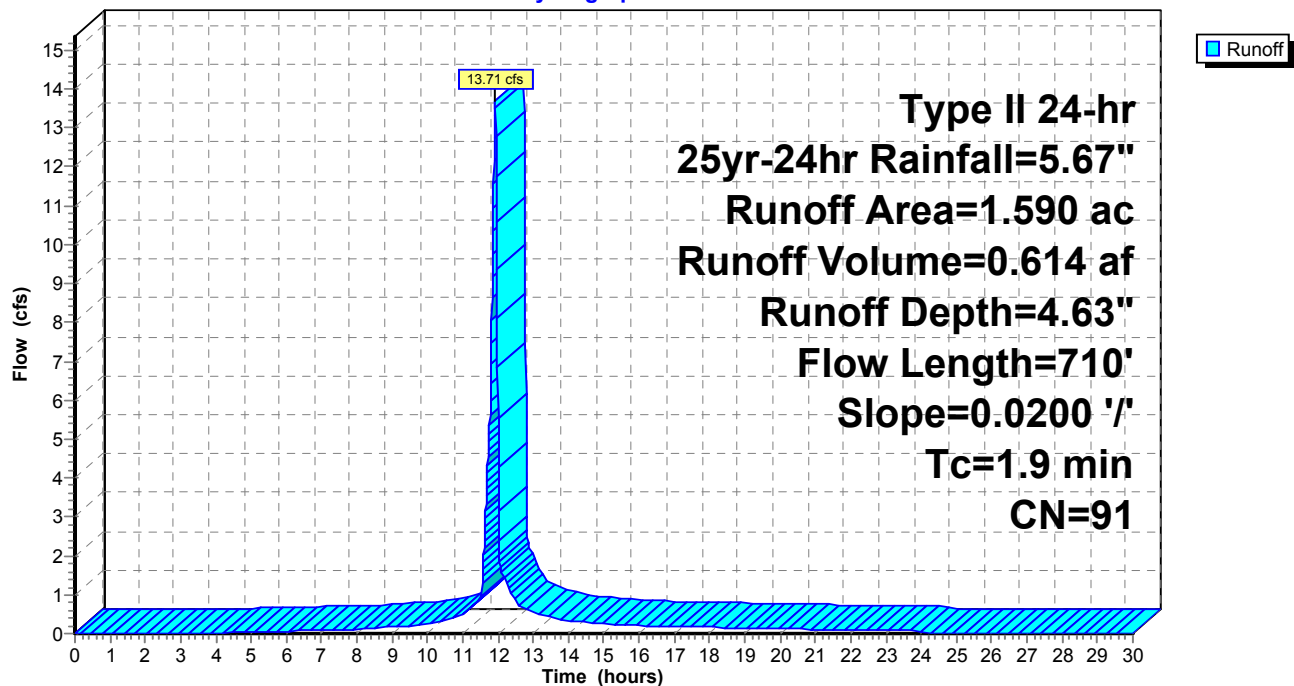
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description			
0.640	98	Water Surface, HSG B			
0.950	86	Fallow, bare soil, HSG B			
1.590	91	Weighted Average			
0.950		59.75% Pervious Area			
0.640		40.25% Impervious Area			

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	710	0.0200	6.36	2.22	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.010 PVC, smooth interior

Subcatchment L1: Lagoon Area

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.590 ac
Runoff Volume=0.614 af
Runoff Depth=4.63"
Flow Length=710'
Slope=0.0200 '/'
Tc=1.9 min
CN=91

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Pond AP1: Ash Pond 1

Inflow   =   230.02 cfs @ 11.96 hrs, Volume=   15.979 af, Incl. 0.50 cfs Base Flow
Outflow   =   23.69 cfs @ 12.59 hrs, Volume=   13.969 af, Atten= 90%, Lag= 37.8 min
Primary   =   23.69 cfs @ 12.59 hrs, Volume=   13.969 af

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 5.300 af
Peak Elev= 91.86' @ 12.59 hrs Surf.Area= 0.000 ac Storage= 13.913 af (8.613 af above start)

Plug-Flow detention time= 521.6 min calculated for 8.669 af (54% of inflow)
Center-of-Mass det. time= 231.6 min (1,034.7 - 803.1)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	24.300 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	5.300
91.00	11.200
93.00	17.500
95.00	24.300

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	**30.0" Round Culvert** L= 280.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0036 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=23.69 cfs @ 12.59 hrs HW=91.86' TW=89.36' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 23.69 cfs @ 4.83 fps)

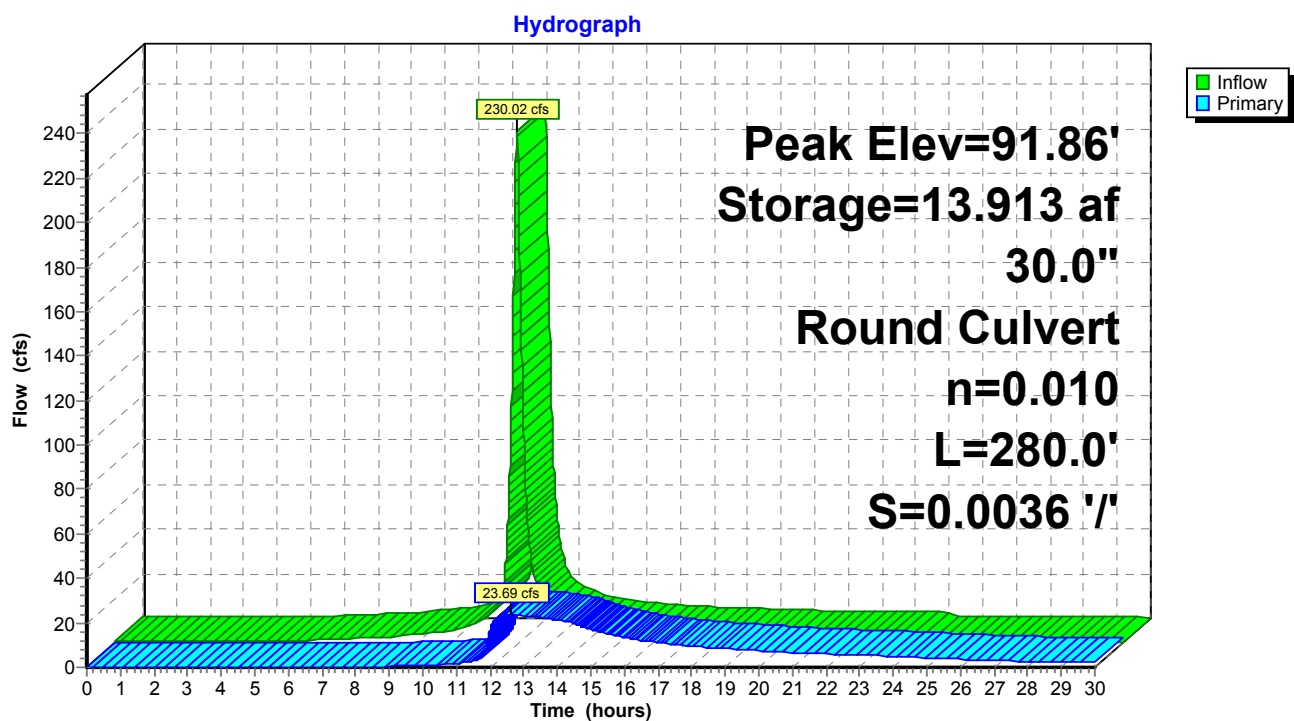**Pond 3 - Max. Capacity (Scen.1)**
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Pond AP1: Ash Pond 1

Hydrograph

Peak Elev=91.86'
Storage=13.913 af
30.0"
Round Culvert
n=0.010
L=280.0'
S=0.0036 '/'

Legend: Inflow / Primary

230.02 cfs

23.69 cfs

Flow (cfs) vs Time (hours)

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Pond AP2: Ash Pond 2

Inflow	=	33.68 cfs @ 12.08 hrs, Volume=		4.569 af,	Incl. 0.64 cfs Base Flow
Outflow	=	1.87 cfs @ 23.85 hrs, Volume=		1.985 af,	Atten= 94%, Lag= 705.9 min
Primary	=	1.87 cfs @ 23.85 hrs, Volume=		1.985 af	

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 5.500 af
Peak Elev= 90.14' @ 18.64 hrs Surf.Area= 0.000 ac Storage= 8.854 af (3.354 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 523.5 min (1,358.7 - 835.2)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	24.800 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	5.500
91.00	11.400
93.00	17.900
95.00	24.800

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	**16.0" Round Culvert X 2.00**
			L= 540.0' CMP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0019 '/' Cc= 0.900
			n= 0.025 Corrugated metal, Flow Area= 1.40 sf

Primary OutFlow Max=1.87 cfs @ 23.85 hrs HW=90.06' TW=89.36' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.87 cfs @ 1.07 fps)

Pond 3 - Max. Capacity (Scen.1)
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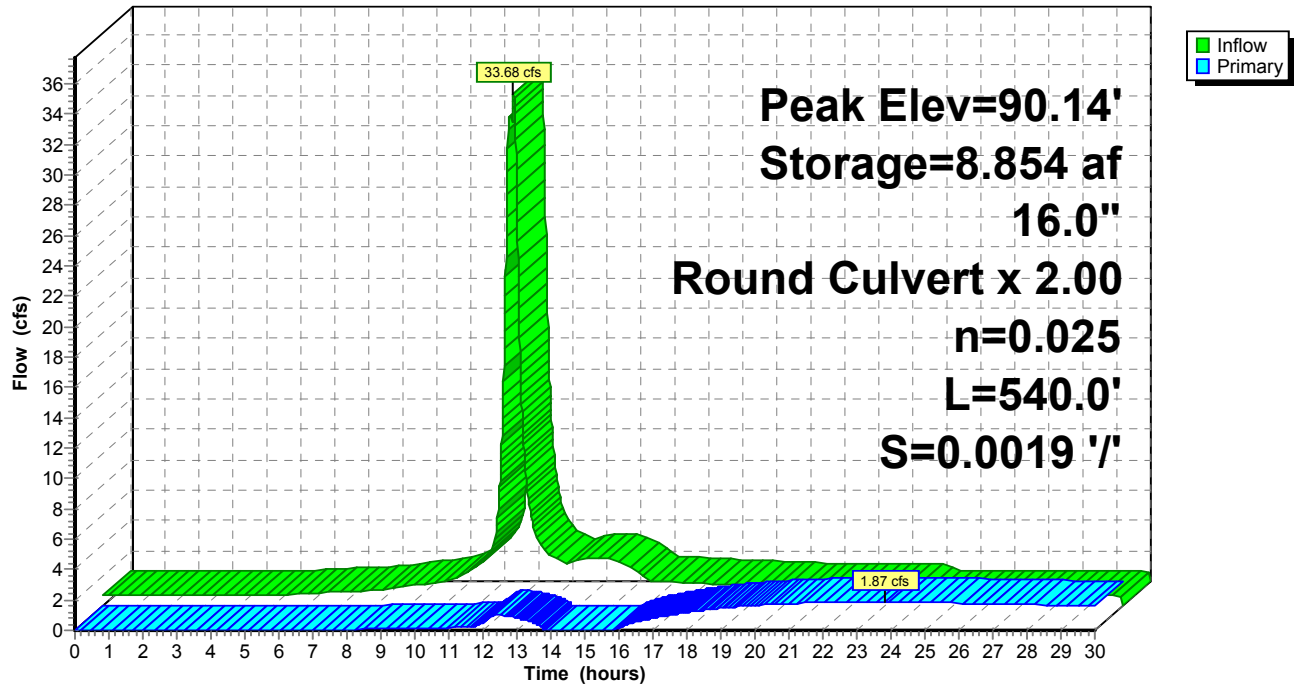
Type II 24-hr 25yr-24hr Rainfall=5.67"
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Pond AP2: Ash Pond 2

Hydrograph

Peak Elev=90.14'
Storage=8.854 af
16.0"
Round Culvert x 2.00
n=0.025
L=540.0'
S=0.0019 '/'

Inflow
Primary

33.68 cfs

1.87 cfs

Flow (cfs)

Time (hours)

Summary for Pond AP3: Ash Pond 3

Inflow   =   52.32 cfs @ 11.97 hrs, Volume=   17.796 af
Outflow   =   17.00 cfs @ 14.98 hrs, Volume=   17.898 af, Atten= 68%, Lag= 180.7 min
Primary   =   16.01 cfs @ 15.21 hrs, Volume=   17.754 af
Secondary =   0.00 cfs @   0.00 hrs, Volume=   0.000 af
Tertiary =   1.06 cfs @ 14.71 hrs, Volume=   0.145 af

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac   Storage= 4.400 af
Peak Elev= 90.11' @ 15.21 hrs Surf.Area= 0.000 ac   Storage= 6.964 af (2.564 af above start)

Plug-Flow detention time= 341.4 min calculated for 13.498 af (76% of inflow)
Center-of-Mass det. time= 37.6 min (1,082.9 - 1,045.3)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	19.800 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	4.400
91.00	9.000
93.00	14.000
95.00	19.800

Device	Routing	Invert	Outlet Devices
#1	Primary	88.00'	**24.0" Round Principal Spillway Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.00' / 87.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Secondary	89.00'	**30.0" Round Culvert to AP1** L= 280.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.00' / 89.00' S= -0.0036 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 4.91 sf
#3	Tertiary	89.00'	**16.0" Round Culvert to AP2 X 2.00** L= 540.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.00' / 89.00' S= -0.0019 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.40 sf
#4	Primary	90.00'	**24.0" Round Emergency Spillway Culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.00' S= 0.0100 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Pond 3 - Max. Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Primary OutFlow Max=16.01 cfs @ 15.21 hrs HW=90.11'   (Free Discharge)
└─**1=Principal Spillway Culvert** (Inlet Controls 15.97 cfs @ 5.08 fps)
└─**4=Emergency Spillway Culvert** (Barrel Controls 0.04 cfs @ 0.87 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.00' TW=89.00'   (Dynamic Tailwater)
└─**2=Culvert to AP1** (Controls 0.00 cfs)

Tertiary OutFlow Max=1.05 cfs @ 14.71 hrs HW=90.09' TW=90.00'   (Dynamic Tailwater)
└─**3=Culvert to AP2** (Outlet Controls 1.05 cfs @ 0.38 fps)

Pond AP3: Ash Pond 3

Hydrograph

Peak Elev=90.11'
Storage=6.964 af

Legend:
- Inflow
- Outflow
- Primary
- Secondary
- Tertiary

52.32 cfs
17.00 cfs
16.01 cfs
0.00 cfs
1.06 cfs

Flow (cfs) — Time (hours)
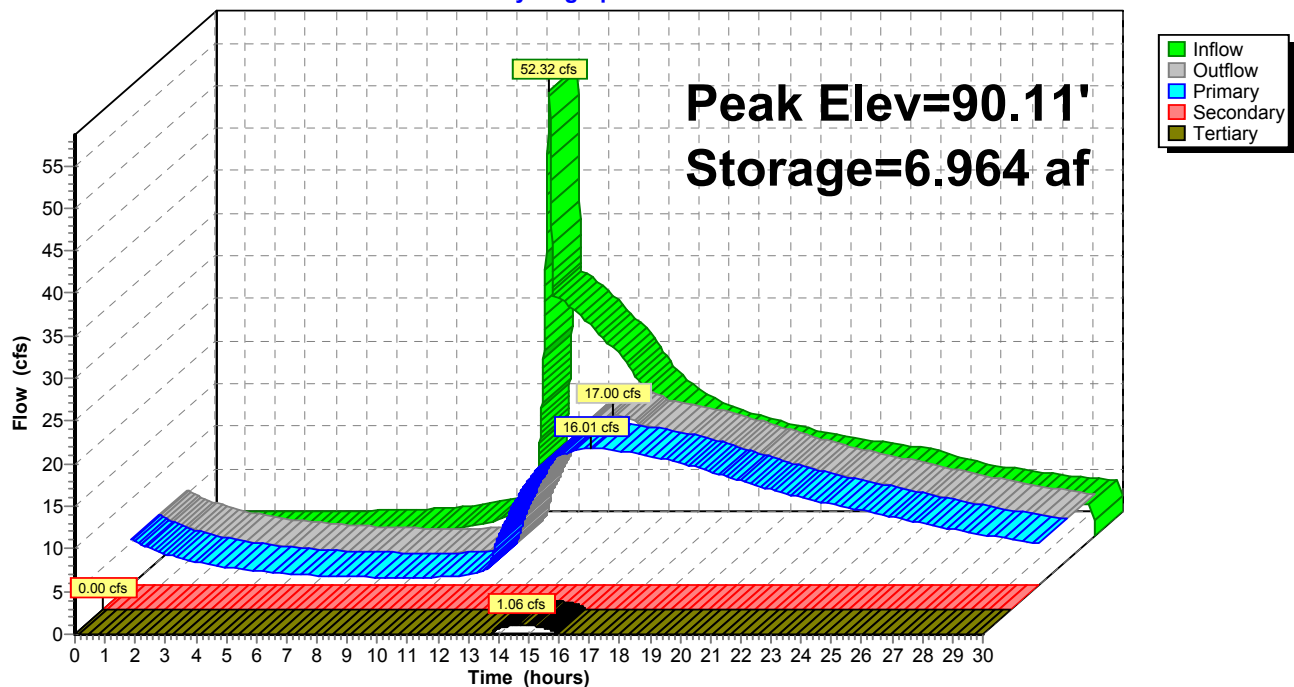
**ADDITIONAL EVALUATION
(EXISTING POND FOOTPRINT)**

**PONDS 1, 2, AND 3
(POND 1, SCENARIO 1)**
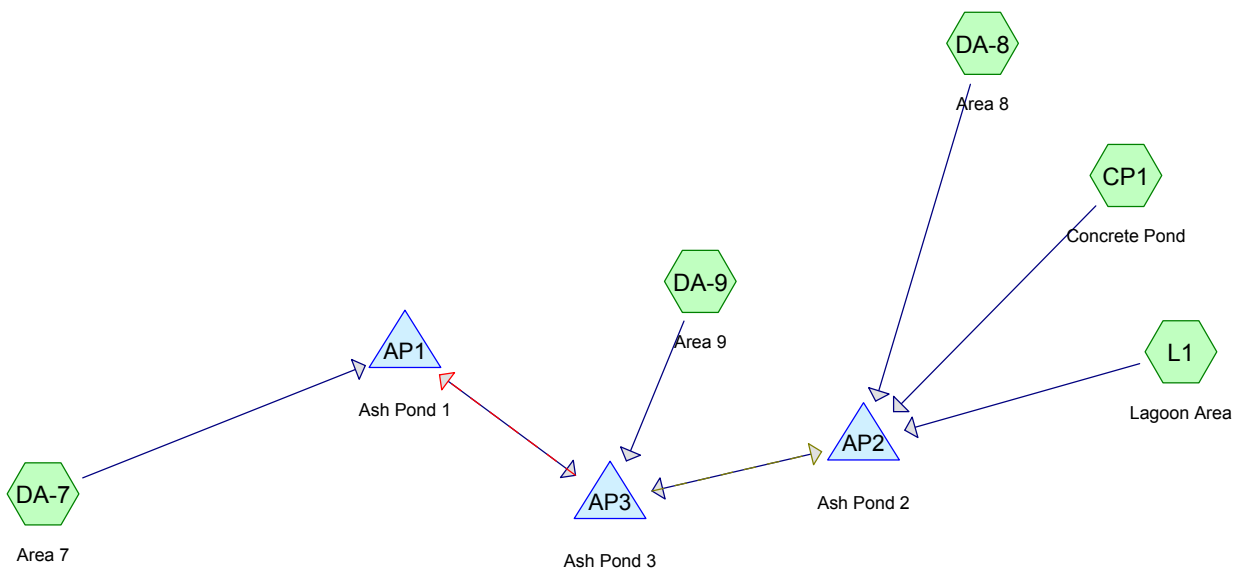
DA-8
Area 8

CP1
Concrete Pond

DA-9
Area 9

AP1
Ash Pond 1

L1
Lagoon Area

DA-7
Area 7

AP2
Ash Pond 2

AP3
Ash Pond 3

Subcat   Reach   Pond   Link

Routing Diagram for Ponds 1, 2, and 3 - Reduced Capacity (Scen.1)
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.410	79	<50% Grass cover, Poor, HSG B (DA-8)
14.400	82	Dirt roads, HSG B (DA-7, DA-8, DA-9)
4.870	86	Fallow, bare soil, HSG B (DA-7, L1)
4.040	98	Unconnected roofs, HSG B (DA-7, DA-8)
6.920	98	Water Surface, HSG B (CP1, DA-7, DA-8, DA-9, L1)
32.640	**88**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
32.640	HSG B	CP1, DA-7, DA-8, DA-9, L1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
32.640		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	2.410	0.000	0.000	0.000	2.410	<50% Grass cover, Poor	DA-8
0.000	14.400	0.000	0.000	0.000	14.400	Dirt roads	DA-7, DA-8, DA-9
0.000	4.870	0.000	0.000	0.000	4.870	Fallow, bare soil	DA-7, L1
0.000	4.040	0.000	0.000	0.000	4.040	Unconnected roofs	DA-7, DA-8
0.000	6.920	0.000	0.000	0.000	6.920	Water Surface	CP1, DA-7, DA-8, DA-9, L1
0.000	**32.640**	**0.000**	**0.000**	**0.000**	**32.640**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	CP1	0.00	0.00	550.0	0.0200	0.010	6.0	0.0	0.0
2	L1	0.00	0.00	710.0	0.0200	0.010	8.0	0.0	0.0
3	AP1	89.00	88.00	280.0	0.0036	0.010	30.0	0.0	0.0
4	AP2	89.00	88.00	540.0	0.0019	0.025	16.0	0.0	0.0
5	AP3	88.00	87.00	100.0	0.0100	0.012	24.0	0.0	0.0
6	AP3	88.00	89.00	280.0	-0.0036	0.010	30.0	0.0	0.0
7	AP3	88.00	89.00	540.0	-0.0019	0.025	16.0	0.0	0.0
8	AP3	90.00	89.00	100.0	0.0100	0.025	24.0	0.0	0.0

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment CP1: Concrete Pond   Runoff Area=0.100 ac   100.00% Impervious   Runoff Depth=5.43"
                                Flow Length=550' Slope=0.0200 '/' Tc=1.7 min CN=98 Runoff=0.92 cfs 0.045 af

Subcatchment DA-7: Area 7   Runoff Area=19.590 ac   30.12% Impervious   Runoff Depth=4.31"
                                Flow Length=1,335' Slope=0.0100 '/' Tc=14.4 min CN=88 Runoff=107.47 cfs 7.034 af

Subcatchment DA-8: Area 8   Runoff Area=6.220 ac   40.68% Impervious   Runoff Depth=4.20"
                                Flow Length=475' Slope=0.0100 '/' Tc=16.7 min CN=87 Runoff=31.28 cfs 2.178 af

Subcatchment DA-9: Area 9   Runoff Area=5.140 ac   34.82% Impervious   Runoff Depth=4.31"
                                Flow Length=435' Slope=0.0100 '/' Tc=5.1 min CN=88 Runoff=38.23 cfs 1.846 af

Subcatchment L1: Lagoon Area   Runoff Area=1.590 ac   40.25% Impervious   Runoff Depth=4.63"
                                Flow Length=710' Slope=0.0200 '/' Tc=1.9 min CN=91 Runoff=13.71 cfs 0.614 af

Pond AP1: Ash Pond 1   Peak Elev=93.02' Storage=3.921 af Inflow=108.05 cfs 8.472 af
                        30.0" Round Culvert n=0.010 L=280.0' S=0.0036 '/' Outflow=31.08 cfs 8.235 af

Pond AP2: Ash Pond 2   Peak Elev=91.74' Storage=2.957 af Inflow=33.68 cfs 4.424 af
                        16.0" Round Culvert x 2.00 n=0.025 L=540.0' S=0.0019 '/' Outflow=4.05 cfs 4.055 af

Pond AP3: Ash Pond 3   Peak Elev=90.85' Storage=4.023 af Inflow=58.96 cfs 14.135 af
Primary=23.06 cfs 14.575 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=23.06 cfs 14.575 af

Total Runoff Area = 32.640 ac   Runoff Volume = 11.717 af   Average Runoff Depth = 4.31"
66.42% Pervious = 21.680 ac   33.58% Impervious = 10.960 ac

Summary for Subcatchment CP1: Concrete Pond
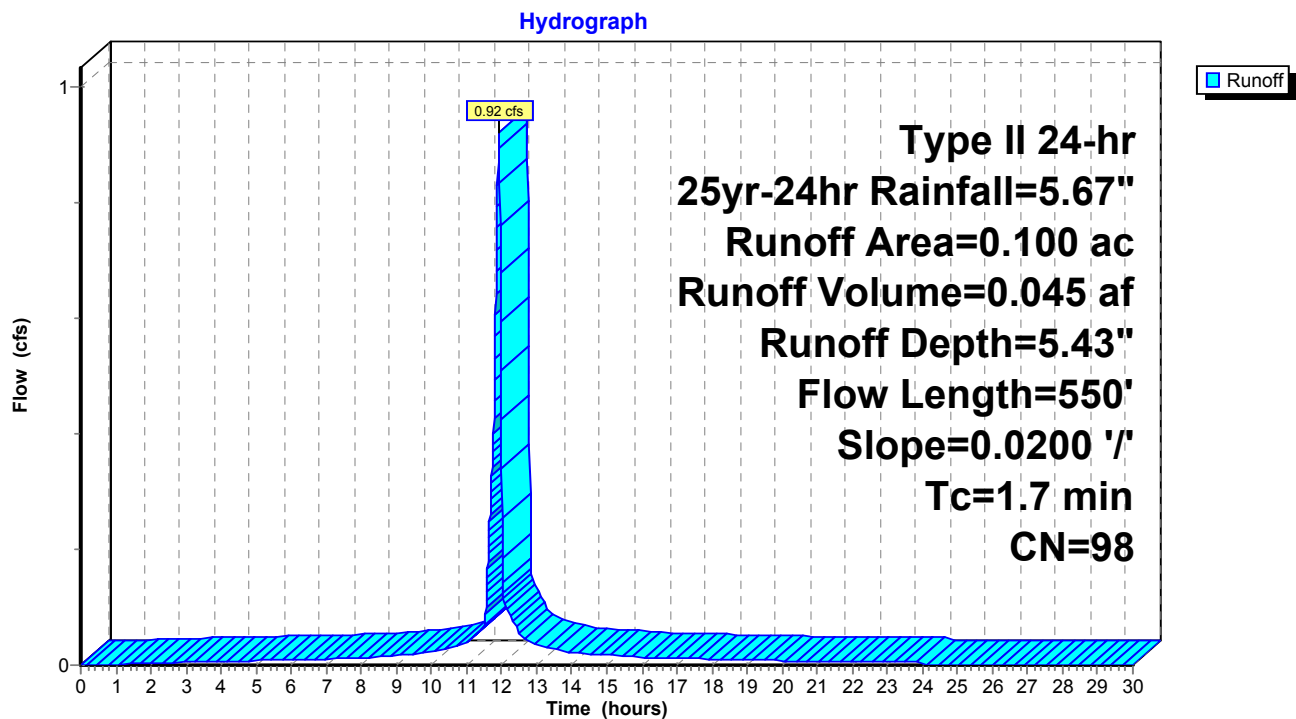
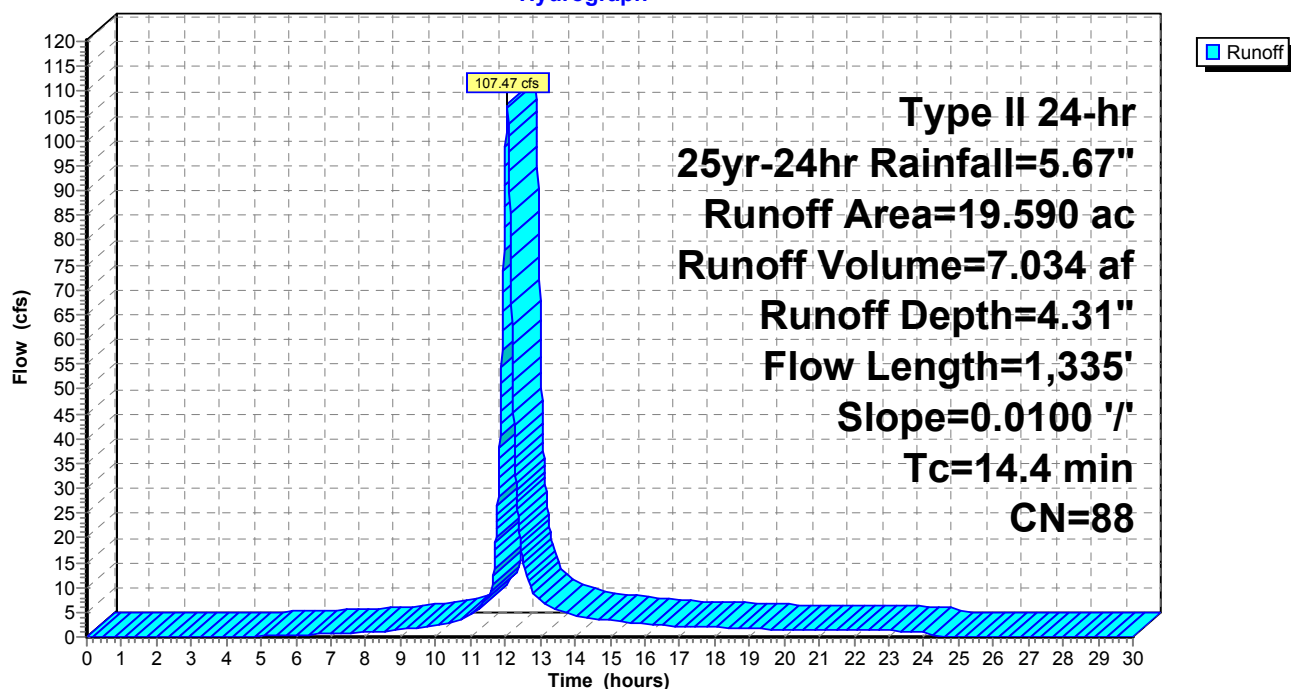Runoff   =   0.92 cfs @ 11.92 hrs, Volume=   0.045 af, Depth= 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.100	98	Water Surface, HSG B
0.100		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	550	0.0200	5.25	1.03	**Pipe Channel,** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior

Subcatchment CP1: Concrete Pond

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=0.100 ac
Runoff Volume=0.045 af
Runoff Depth=5.43"
Flow Length=550'
Slope=0.0200 '/'
Tc=1.7 min
CN=98

Summary for Subcatchment DA-7: Area 7

Runoff   =   107.47 cfs @ 12.06 hrs, Volume=   7.034 af, Depth= 4.31"
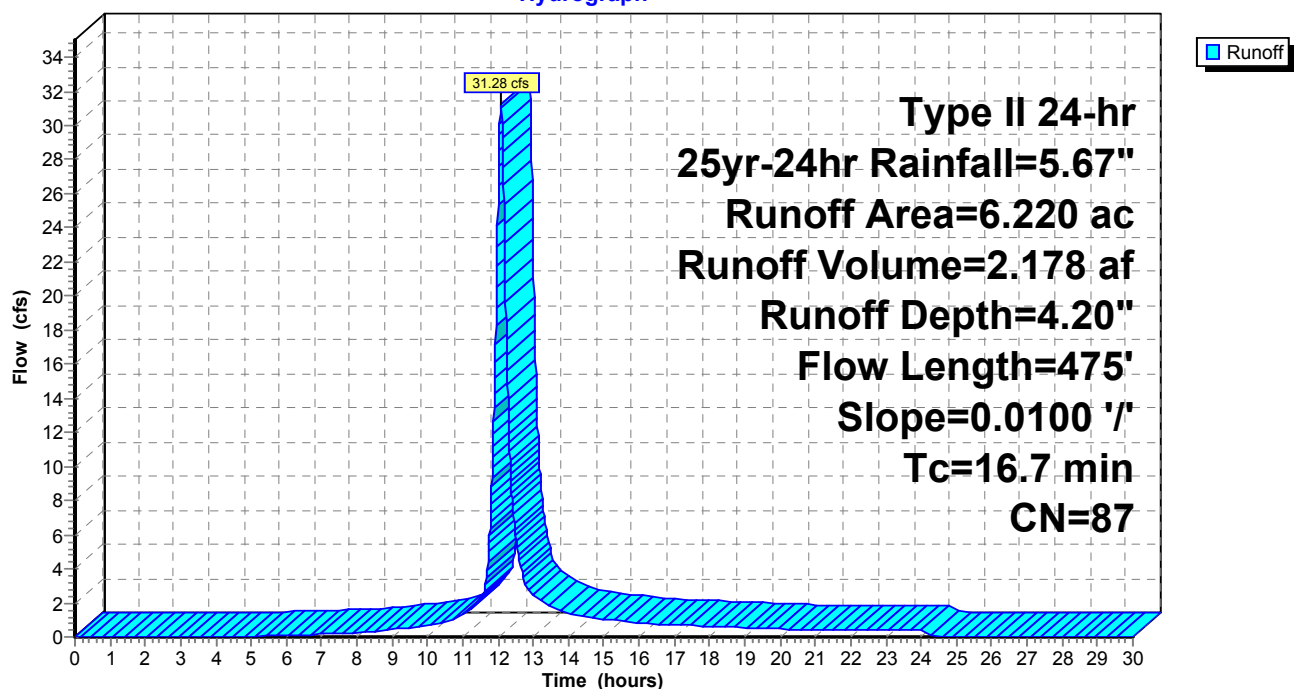
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.980	98	Water Surface, HSG B
3.920	86	Fallow, bare soil, HSG B
3.920	98	Unconnected roofs, HSG B
9.770	82	Dirt roads, HSG B
19.590	88	Weighted Average
13.690		69.88% Pervious Area
5.900		30.12% Impervious Area
3.920		66.44% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,**
					Smooth surfaces n= 0.011 P2= 3.26"
12.8	1,235	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
14.4	1,335	Total			

Subcatchment DA-7: Area 7

Hydrograph

Ponds 1, 2, and 3 - Reduced Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Summary for Subcatchment DA-8: Area 8

Runoff   =   31.28 cfs @ 12.08 hrs, Volume=   2.178 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.410	98	Water Surface, HSG B
2.410	79	<50% Grass cover, Poor, HSG B
1.280	82	Dirt roads, HSG B
0.120	98	Unconnected roofs, HSG B
6.220	87	Weighted Average
3.690		59.32% Pervious Area
2.530		40.68% Impervious Area
0.120		4.74% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	100	0.0100	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.26"
3.9	375	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
16.7	475				Total

Subcatchment DA-8: Area 8

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=6.220 ac
Runoff Volume=2.178 af
Runoff Depth=4.20"
Flow Length=475'
Slope=0.0100 '/'
Tc=16.7 min
CN=87

Summary for Subcatchment DA-9: Area 9
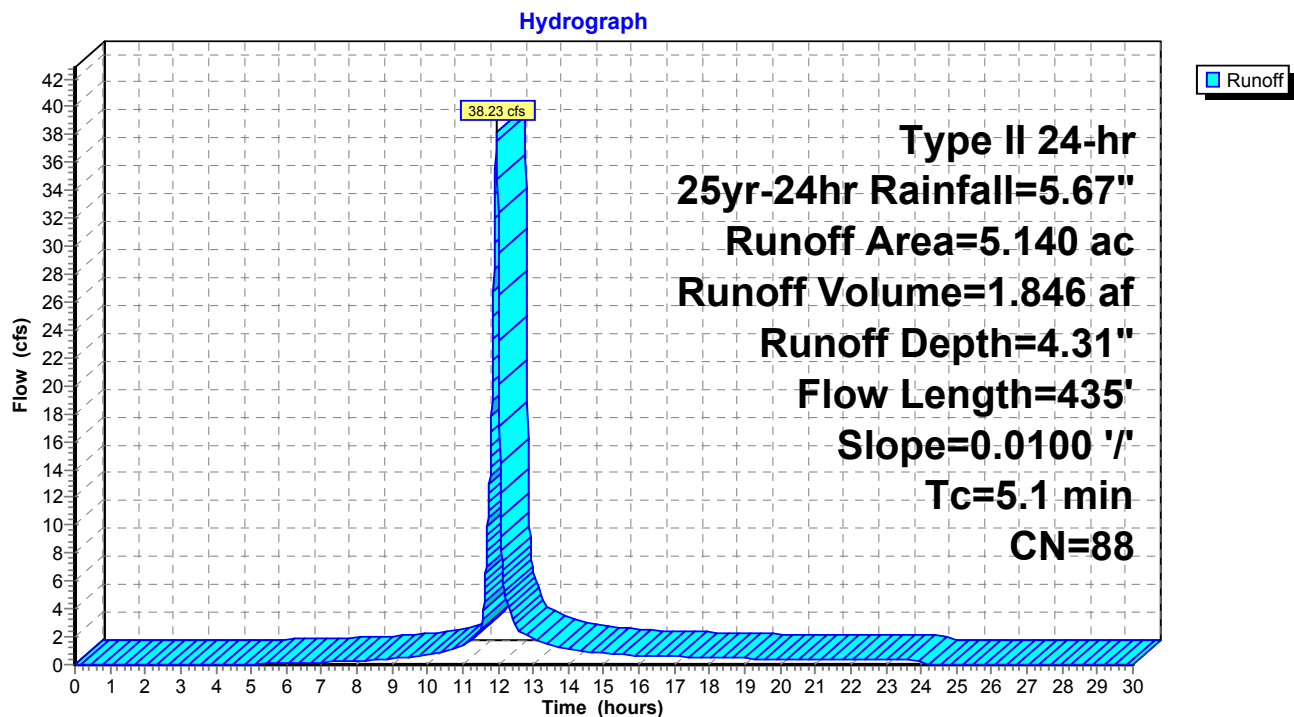
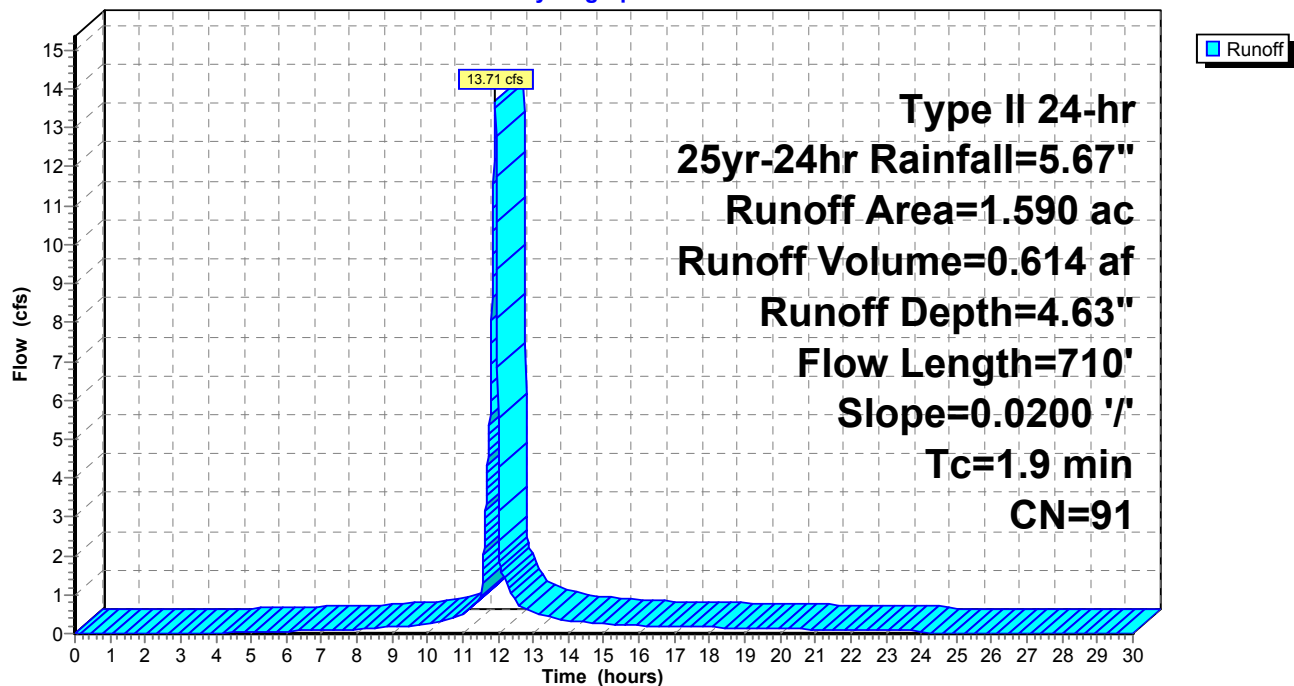Runoff   =   38.23 cfs @ 11.96 hrs, Volume=   1.846 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.790	98	Water Surface, HSG B
3.350	82	Dirt roads, HSG B
5.140	88	Weighted Average
3.350		65.18% Pervious Area
1.790		34.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,**
					Smooth surfaces n= 0.011 P2= 3.26"
3.5	335	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
5.1	435	Total			

Subcatchment DA-9: Area 9

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=5.140 ac
Runoff Volume=1.846 af
Runoff Depth=4.31"
Flow Length=435'
Slope=0.0100 '/'
Tc=5.1 min
CN=88

Summary for Subcatchment L1: Lagoon Area

Runoff   =   13.71 cfs @ 11.92 hrs, Volume=   0.614 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.640	98	Water Surface, HSG B
0.950	86	Fallow, bare soil, HSG B
1.590	91	Weighted Average
0.950		59.75% Pervious Area
0.640		40.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	710	0.0200	6.36	2.22	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.010 PVC, smooth interior

Subcatchment L1: Lagoon Area

**Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.590 ac
Runoff Volume=0.614 af
Runoff Depth=4.63"
Flow Length=710'
Slope=0.0200 '/'
Tc=1.9 min
CN=91**

Summary for Pond AP1: Ash Pond 1

Inflow	=	108.05 cfs @	12.06 hrs, Volume=	8.472 af,	Incl. 0.58 cfs Base Flow
Outflow	=	31.08 cfs @	12.32 hrs, Volume=	8.235 af,	Atten= 71%, Lag= 15.7 min
Primary	=	31.08 cfs @	12.32 hrs, Volume=	8.235 af	

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 1.100 af
Peak Elev= 93.02' @ 12.32 hrs Surf.Area= 0.000 ac Storage= 3.921 af (2.821 af above start)

Plug-Flow detention time= 231.8 min calculated for 7.133 af (84% of inflow)
Center-of-Mass det. time= 86.1 min (901.4 - 815.3)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	5.700 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	1.100
91.00	2.400
93.00	3.900
95.00	5.700

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	**30.0" Round Culvert** L= 280.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0036 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=31.08 cfs @ 12.32 hrs HW=93.02' TW=90.23' (Dynamic Tailwater)
└—**1=Culvert** (Inlet Controls 31.08 cfs @ 6.33 fps)

Pond AP1: Ash Pond 1

**Peak Elev=93.02'
Storage=3.921 af
30.0"
Round Culvert
n=0.010
L=280.0'
S=0.0036 '/'**
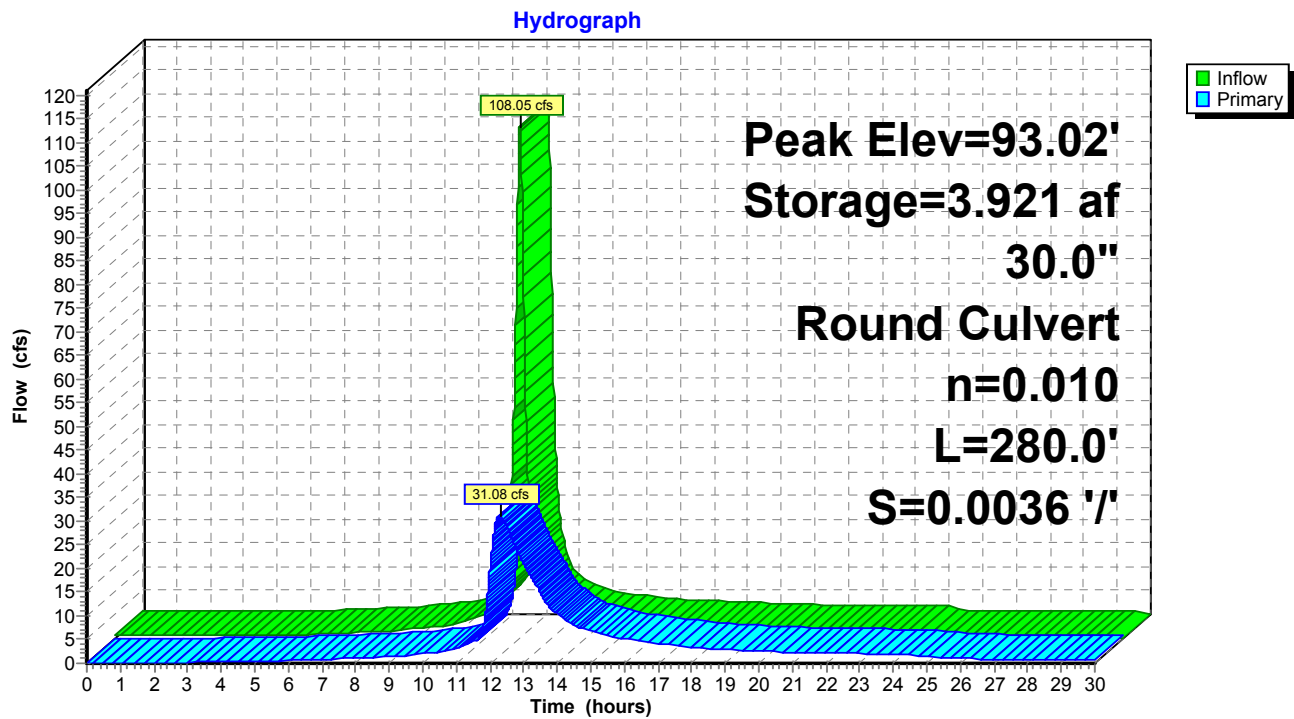
Summary for Pond AP2: Ash Pond 2

Inflow   =   33.68 cfs @ 12.08 hrs, Volume=   4.424 af, Incl. 0.64 cfs Base Flow
Outflow =   4.05 cfs @ 18.05 hrs, Volume=   4.055 af, Atten= 88%, Lag= 357.9 min
Primary =   4.05 cfs @ 18.05 hrs, Volume=   4.055 af

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 1.100 af
Peak Elev= 91.74' @ 13.28 hrs Surf.Area= 0.000 ac Storage= 2.957 af   (1.857 af above start)

Plug-Flow detention time= 536.9 min calculated for 2.955 af (67% of inflow)
Center-of-Mass det. time= 205.0 min (1,038.4 - 833.4)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	5.600 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	1.100
91.00	2.400
93.00	3.900
95.00	5.600

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	**16.0" Round Culvert X 2.00** L= 540.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0019 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.40 sf

Primary OutFlow Max=4.05 cfs @ 18.05 hrs HW=90.71' TW=89.43' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 4.05 cfs @ 1.47 fps)

Ponds 1, 2, and 3 - Reduced Capacity (Scen.1)
Prepared by CEC, Inc.
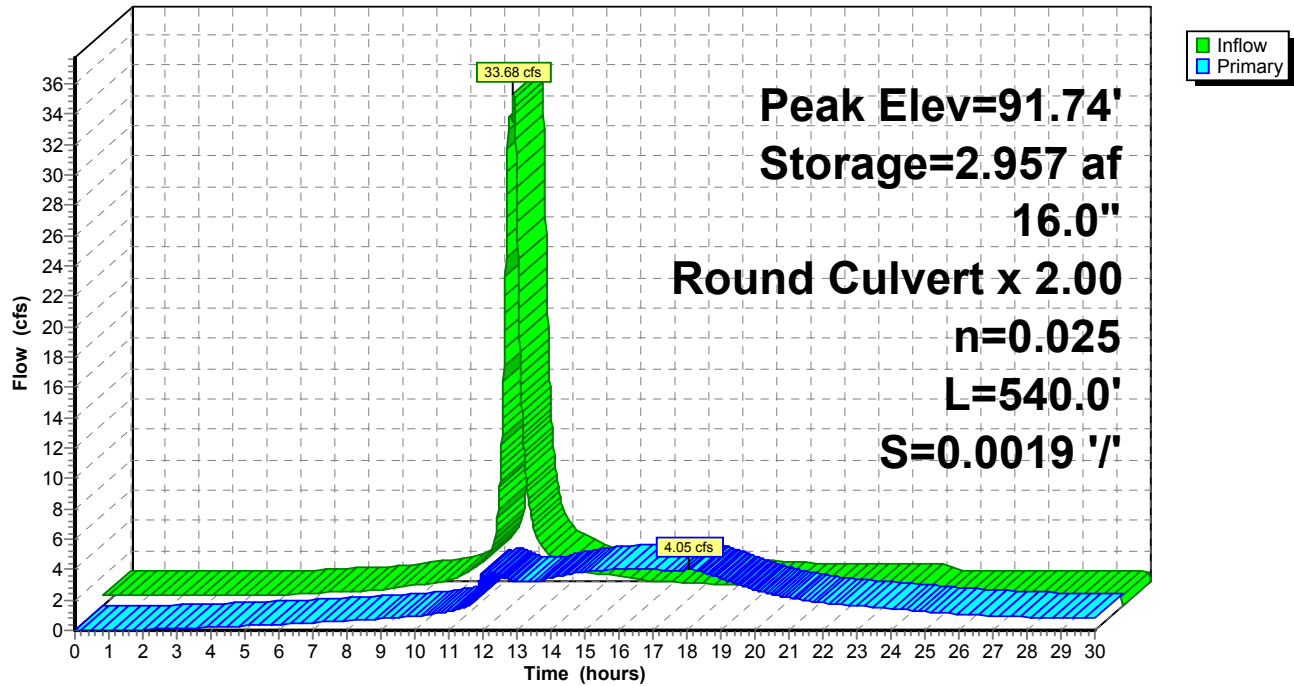HydroCAD® 10.00-14 s/n 01006 © 2015 HydroCAD Software Solutions LLC

Type II 24-hr 25yr-24hr Rainfall=5.67"
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Pond AP2: Ash Pond 2

Hydrograph

Legend: Inflow, Primary

33.68 cfs

4.05 cfs

Peak Elev=91.74'
Storage=2.957 af
16.0"
Round Culvert x 2.00
n=0.025
L=540.0'
S=0.0019 '/'

Flow (cfs) — vertical axis: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36

Time (hours) — horizontal axis: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Summary for Pond AP3: Ash Pond 3

Inflow   =   58.96 cfs @ 11.97 hrs, Volume=   14.135 af
Outflow   =   23.06 cfs @ 13.22 hrs, Volume=   14.575 af, Atten= 61%, Lag= 75.3 min
Primary   =   23.06 cfs @ 13.22 hrs, Volume=   14.575 af
Secondary =   0.00 cfs @   0.00 hrs, Volume=   0.000 af
Tertiary   =   0.00 cfs @   0.00 hrs, Volume=   0.000 af

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 1.900 af
Peak Elev= 90.85' @ 13.22 hrs Surf.Area= 0.000 ac Storage= 4.023 af (2.123 af above start)

Plug-Flow detention time= 185.6 min calculated for 12.671 af (90% of inflow)
Center-of-Mass det. time= 33.1 min (959.1 - 926.0)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	9.800 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	1.900
91.00	4.200
93.00	6.800
95.00	9.800

Device	Routing	Invert	Outlet Devices
#1	Primary	88.00'	**24.0" Round Principal Spillway Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.00' / 87.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Secondary	89.00'	**30.0" Round Culvert to AP1** L= 280.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.00' / 89.00' S= -0.0036 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 4.91 sf
#3	Tertiary	89.00'	**16.0" Round Culvert to AP2 X 2.00** L= 540.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.00' / 89.00' S= -0.0019 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.40 sf
#4	Primary	90.00'	**24.0" Round Emergency Spillway Culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.00' S= 0.0100 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Ponds 1, 2, and 3 - Reduced Capacity (Scen.1)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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Primary OutFlow Max=23.06 cfs @ 13.22 hrs HW=90.85'   (Free Discharge)
└─**1=Principal Spillway Culvert** (Inlet Controls 20.55 cfs @ 6.54 fps)
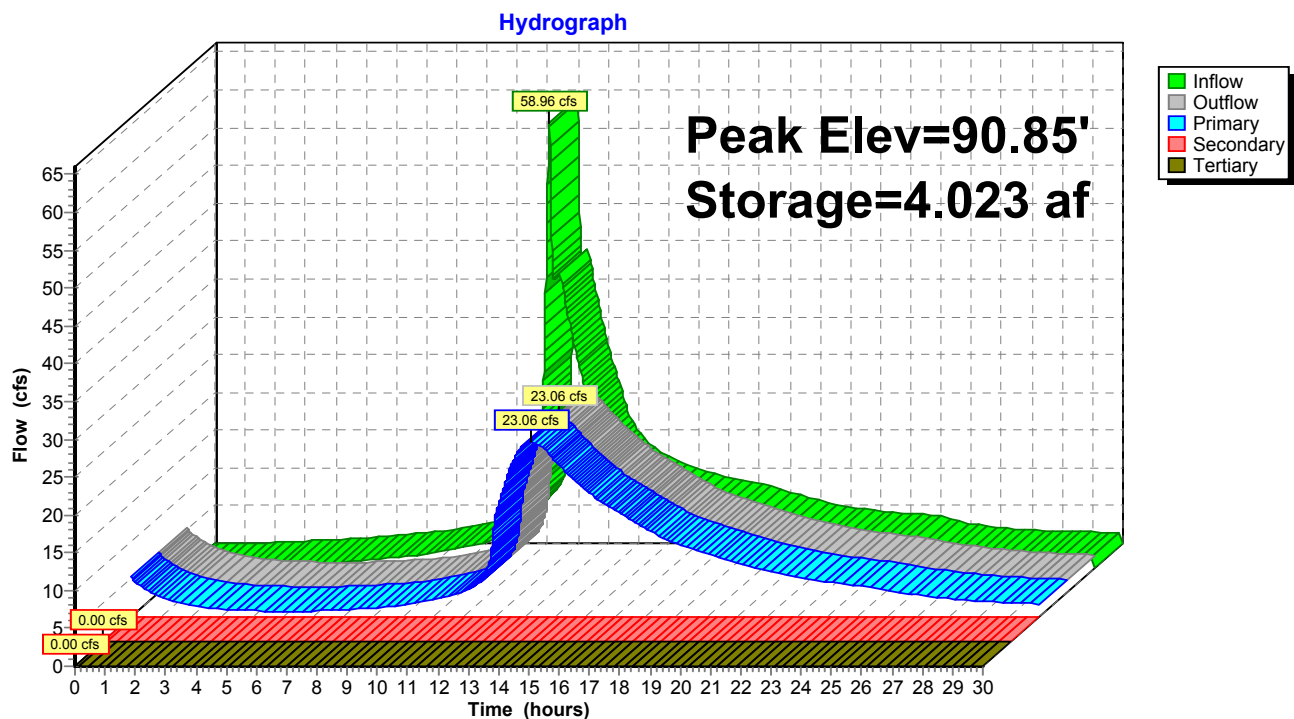└─**4=Emergency Spillway Culvert** (Barrel Controls 2.51 cfs @ 2.93 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.00' TW=89.00'   (Dynamic Tailwater)
└─**2=Culvert to AP1** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.00' TW=89.00'   (Dynamic Tailwater)
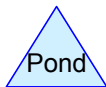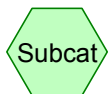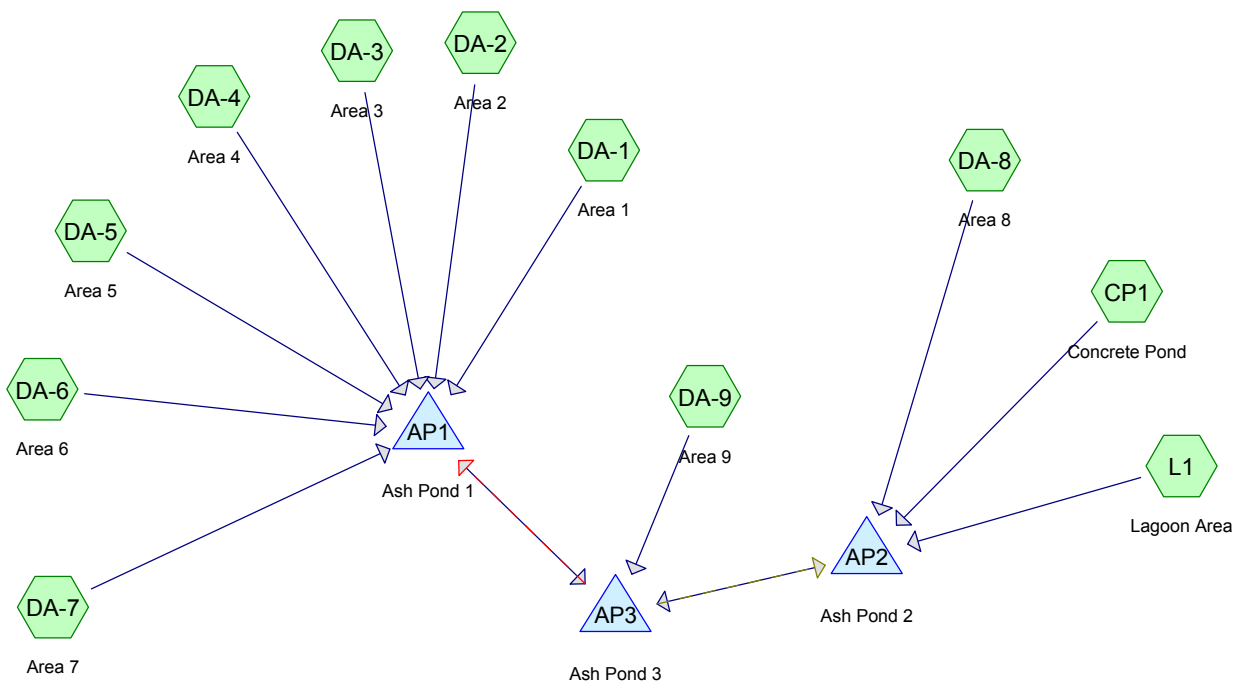└─**3=Culvert to AP2** (Controls 0.00 cfs)

Pond AP3: Ash Pond 3

Hydrograph

Peak Elev=90.85'
Storage=4.023 af

Legend: Inflow, Outflow, Primary, Secondary, Tertiary

58.96 cfs
23.06 cfs
23.06 cfs
0.00 cfs
0.00 cfs

Flow (cfs) — Time (hours)

ADDITIONAL EVALUATION
(REQUIRED POND FOOTPRINT)

PONDS 1, 2, AND 3
(POND 1, SCENARIO 2)

Subcat Reach Pond Link

Routing Diagram for Ponds 1, 2, and 3 - Reduced Capacity (Scen.2)
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.410	79	<50% Grass cover, Poor, HSG B (DA-8)
17.990	82	Dirt roads, HSG B (DA-1, DA-2, DA-4, DA-7, DA-8, DA-9)
20.270	86	Fallow, bare soil, HSG B (DA-3, DA-4, DA-5, DA-6, DA-7, L1)
4.410	98	Unconnected roofs, HSG B (DA-4, DA-7, DA-8)
9.560	98	Water Surface, HSG B (CP1, DA-1, DA-2, DA-5, DA-6, DA-7, DA-8, DA-9, L1)
54.640	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
54.640	HSG B	CP1, DA-1, DA-2, DA-3, DA-4, DA-5, DA-6, DA-7, DA-8, DA-9, L1
0.000	HSG C	
0.000	HSG D	
0.000	Other	
54.640		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	2.410	0.000	0.000	0.000	2.410	<50% Grass cover, Poor	DA-8
0.000	17.990	0.000	0.000	0.000	17.990	Dirt roads	DA-1, DA-2, DA-4, DA-7, DA-8, DA-9
0.000	20.270	0.000	0.000	0.000	20.270	Fallow, bare soil	DA-3, DA-4, DA-5, DA-6, DA-7, L1
0.000	4.410	0.000	0.000	0.000	4.410	Unconnected roofs	DA-4, DA-7, DA-8
0.000	9.560	0.000	0.000	0.000	9.560	Water Surface	CP1, DA-1, DA-2, DA-5, DA-6, DA-7, DA-8, DA-9, L1
0.000	**54.640**	**0.000**	**0.000**	**0.000**	**54.640**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	CP1	0.00	0.00	550.0	0.0200	0.010	6.0	0.0	0.0
2	L1	0.00	0.00	710.0	0.0200	0.010	8.0	0.0	0.0
3	AP1	89.00	88.00	280.0	0.0036	0.010	30.0	0.0	0.0
4	AP2	89.00	88.00	540.0	0.0019	0.025	16.0	0.0	0.0
5	AP3	88.00	87.00	100.0	0.0100	0.012	24.0	0.0	0.0
6	AP3	88.00	89.00	280.0	-0.0036	0.010	30.0	0.0	0.0
7	AP3	88.00	89.00	540.0	-0.0019	0.025	16.0	0.0	0.0
8	AP3	90.00	89.00	100.0	0.0100	0.025	24.0	0.0	0.0

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment CP1: Concrete Pond   Runoff Area=0.100 ac 100.00% Impervious Runoff Depth=5.43"
Flow Length=550' Slope=0.0200 '/' Tc=1.7 min CN=98 Runoff=0.92 cfs 0.045 af

Subcatchment DA-1: Area 1   Runoff Area=1.930 ac 34.20% Impervious Runoff Depth=4.20"
Flow Length=210' Slope=0.0100 '/' Tc=2.7 min CN=87 Runoff=15.27 cfs 0.676 af

Subcatchment DA-2: Area 2   Runoff Area=1.170 ac 28.21% Impervious Runoff Depth=4.20"
Flow Length=65' Slope=0.3300 '/' Tc=0.3 min CN=87 Runoff=9.87 cfs 0.410 af

Subcatchment DA-3: Area 3   Runoff Area=2.550 ac 0.00% Impervious Runoff Depth=4.10"
Flow Length=210' Slope=0.0100 '/' Tc=2.7 min CN=86 Runoff=19.82 cfs 0.871 af

Subcatchment DA-4: Area 4   Runoff Area=9.250 ac 4.00% Impervious Runoff Depth=4.10"
Flow Length=590' Slope=0.0100 '/' Tc=6.7 min CN=86 Runoff=62.90 cfs 3.158 af

Subcatchment DA-5: Area 5   Runoff Area=4.710 ac 28.24% Impervious Runoff Depth=4.42"
Flow Length=400' Tc=3.7 min CN=89 Runoff=37.28 cfs 1.733 af

Subcatchment DA-6: Area 6   Runoff Area=2.390 ac 13.39% Impervious Runoff Depth=4.31"
Flow Length=510' Tc=5.3 min CN=88 Runoff=17.66 cfs 0.858 af

Subcatchment DA-7: Area 7   Runoff Area=19.590 ac 30.12% Impervious Runoff Depth=4.31"
Flow Length=1,335' Slope=0.0100 '/' Tc=14.4 min CN=88 Runoff=107.47 cfs 7.034 af

Subcatchment DA-8: Area 8   Runoff Area=6.220 ac 40.68% Impervious Runoff Depth=4.20"
Flow Length=475' Slope=0.0100 '/' Tc=16.7 min CN=87 Runoff=31.28 cfs 2.178 af

Subcatchment DA-9: Area 9   Runoff Area=5.140 ac 34.82% Impervious Runoff Depth=4.31"
Flow Length=435' Slope=0.0100 '/' Tc=5.1 min CN=88 Runoff=38.23 cfs 1.846 af

Subcatchment L1: Lagoon Area   Runoff Area=1.590 ac 40.25% Impervious Runoff Depth=4.63"
Flow Length=710' Slope=0.0200 '/' Tc=1.9 min CN=91 Runoff=13.71 cfs 0.614 af

Pond AP1: Ash Pond 1   Peak Elev=93.85' Storage=9.435 af Inflow=230.02 cfs 15.979 af
30.0" Round Culvert n=0.010 L=280.0' S=0.0036 '/' Outflow=34.21 cfs 15.390 af

Pond AP2: Ash Pond 2   Peak Elev=91.84' Storage=3.032 af Inflow=33.68 cfs 4.424 af
16.0" Round Culvert x 2.00 n=0.025 L=540.0' S=0.0019 '/' Outflow=3.61 cfs 4.030 af

Pond AP3: Ash Pond 3   Peak Elev=91.31' Storage=4.601 af Inflow=67.47 cfs 21.264 af
Primary=28.51 cfs 21.610 af Secondary=0.00 cfs 0.000 af Tertiary=0.00 cfs 0.000 af Outflow=28.51 cfs 21.610 af

Total Runoff Area = 54.640 ac   Runoff Volume = 19.422 af   Average Runoff Depth = 4.27"
74.43% Pervious = 40.670 ac   25.57% Impervious = 13.970 ac

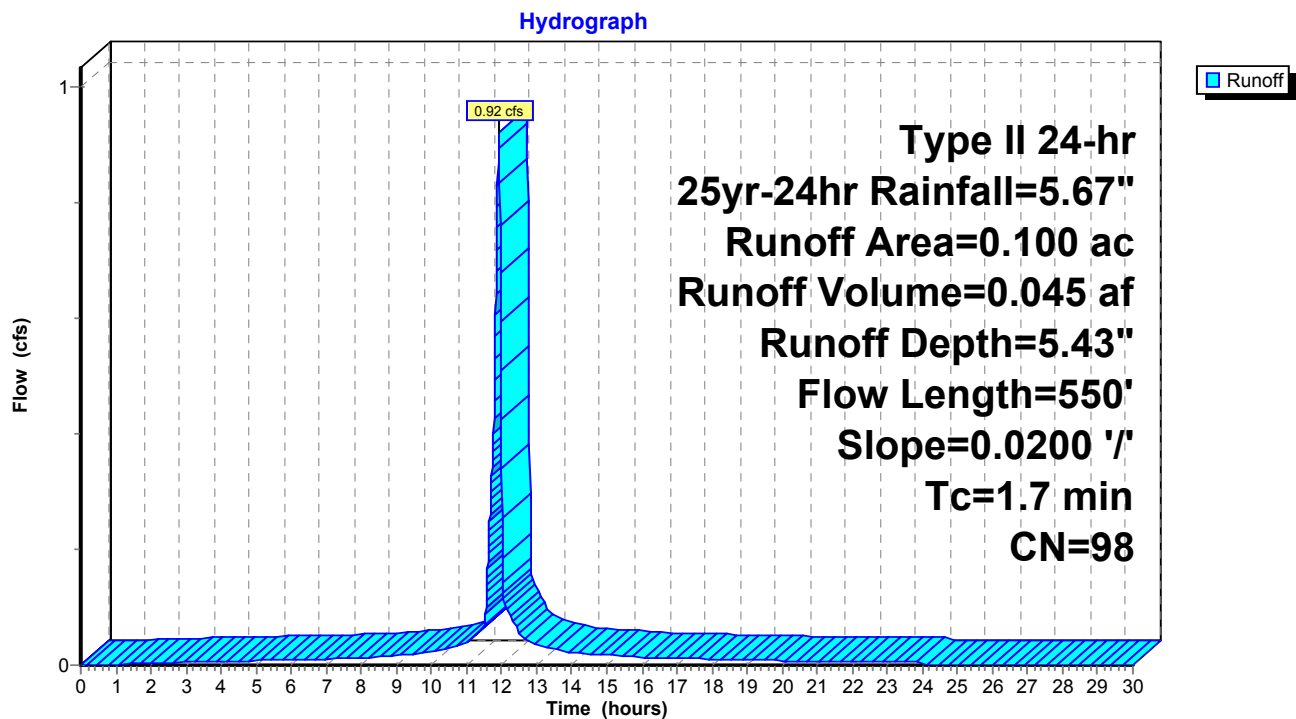## Summary for Subcatchment CP1: Concrete Pond

Runoff   =   0.92 cfs @ 11.92 hrs, Volume=   0.045 af, Depth= 5.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.100	98	Water Surface, HSG B
0.100		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	550	0.0200	5.25	1.03	**Pipe Channel,** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior

Subcatchment CP1: Concrete Pond

Hydrograph

Summary for Subcatchment DA-1: Area 1
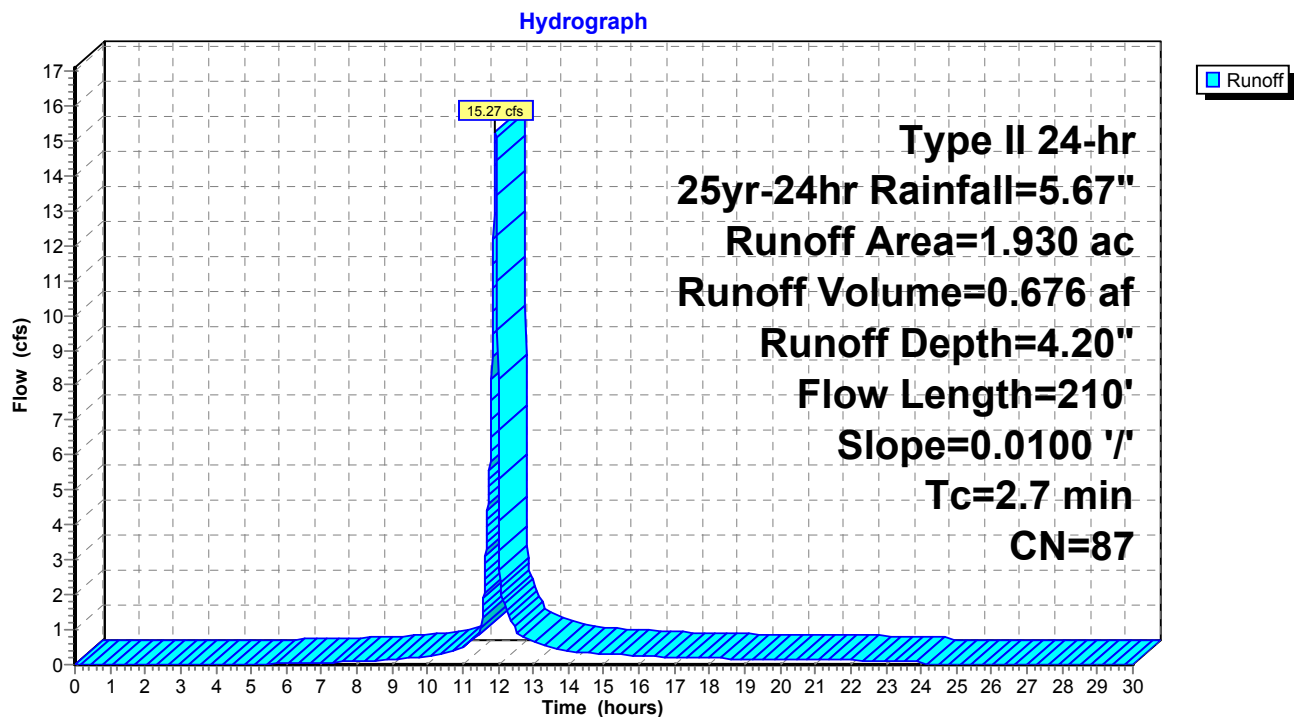
Runoff   =   15.27 cfs @ 11.93 hrs, Volume=   0.676 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.270	82	Dirt roads, HSG B
0.660	98	Water Surface, HSG B
1.930	87	Weighted Average
1.270		65.80% Pervious Area
0.660		34.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,**
					Smooth surfaces n= 0.011 P2= 3.26"
1.1	110	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
2.7	210	Total			

Subcatchment DA-1: Area 1

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.930 ac
Runoff Volume=0.676 af
Runoff Depth=4.20"
Flow Length=210'
Slope=0.0100 '/'
Tc=2.7 min
CN=87

Summary for Subcatchment DA-2: Area 2

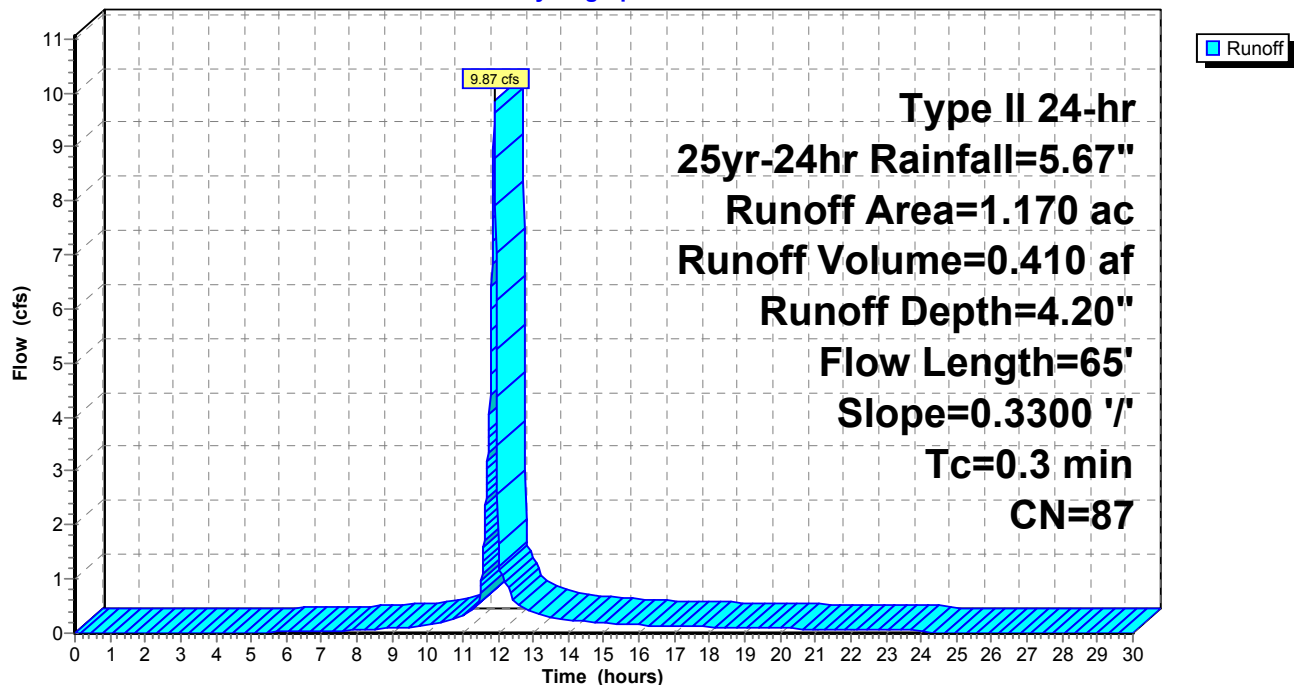Runoff   =   9.87 cfs @ 11.90 hrs, Volume=   0.410 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.840	82	Dirt roads, HSG B
0.330	98	Water Surface, HSG B
1.170	87	Weighted Average
0.840		71.79% Pervious Area
0.330		28.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	65	0.3300	3.91		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"

Subcatchment DA-2: Area 2

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.170 ac
Runoff Volume=0.410 af
Runoff Depth=4.20"
Flow Length=65'
Slope=0.3300 '/'
Tc=0.3 min
CN=87

Summary for Subcatchment DA-3: Area 3

Runoff   =   19.82 cfs @ 11.93 hrs, Volume=   0.871 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.550	86	Fallow, bare soil, HSG B
2.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
1.1	110	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.7	210				Total

Subcatchment DA-3: Area 3

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=2.550 ac
Runoff Volume=0.871 af
Runoff Depth=4.10"
Flow Length=210'
Slope=0.0100 '/'
Tc=2.7 min
CN=86

Summary for Subcatchment DA-4: Area 4

Runoff   =   62.90 cfs @ 11.98 hrs, Volume=   3.158 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
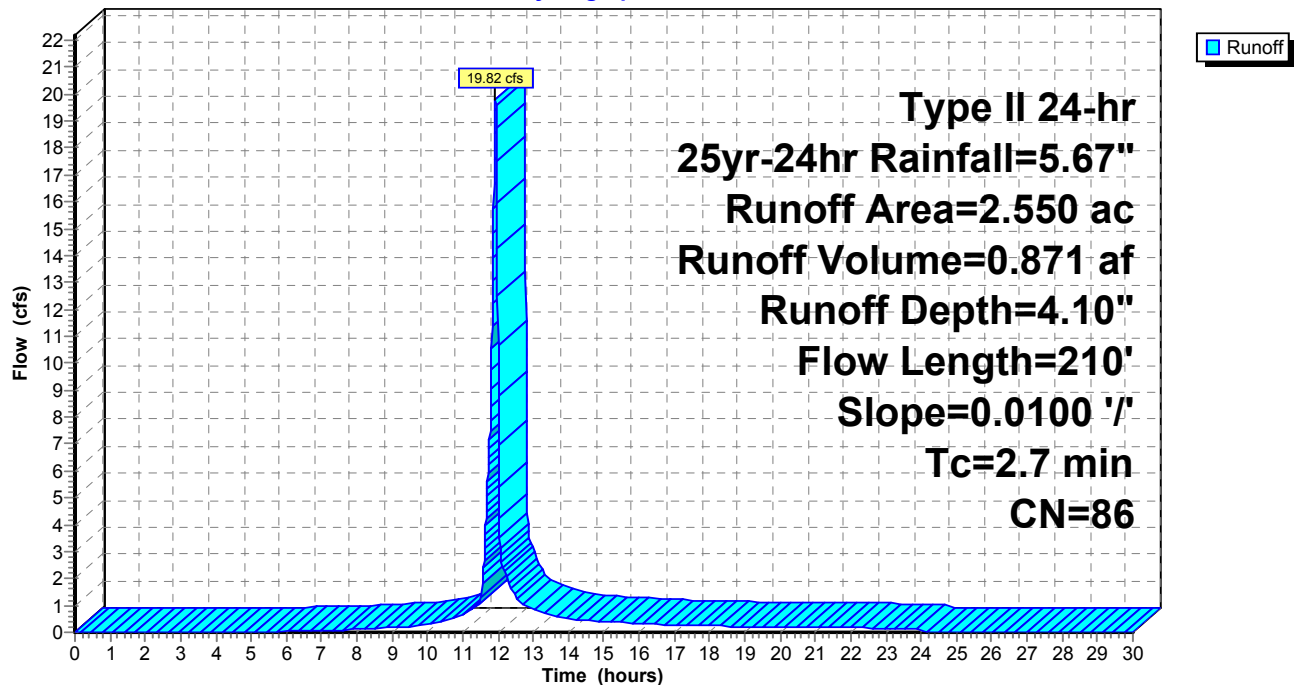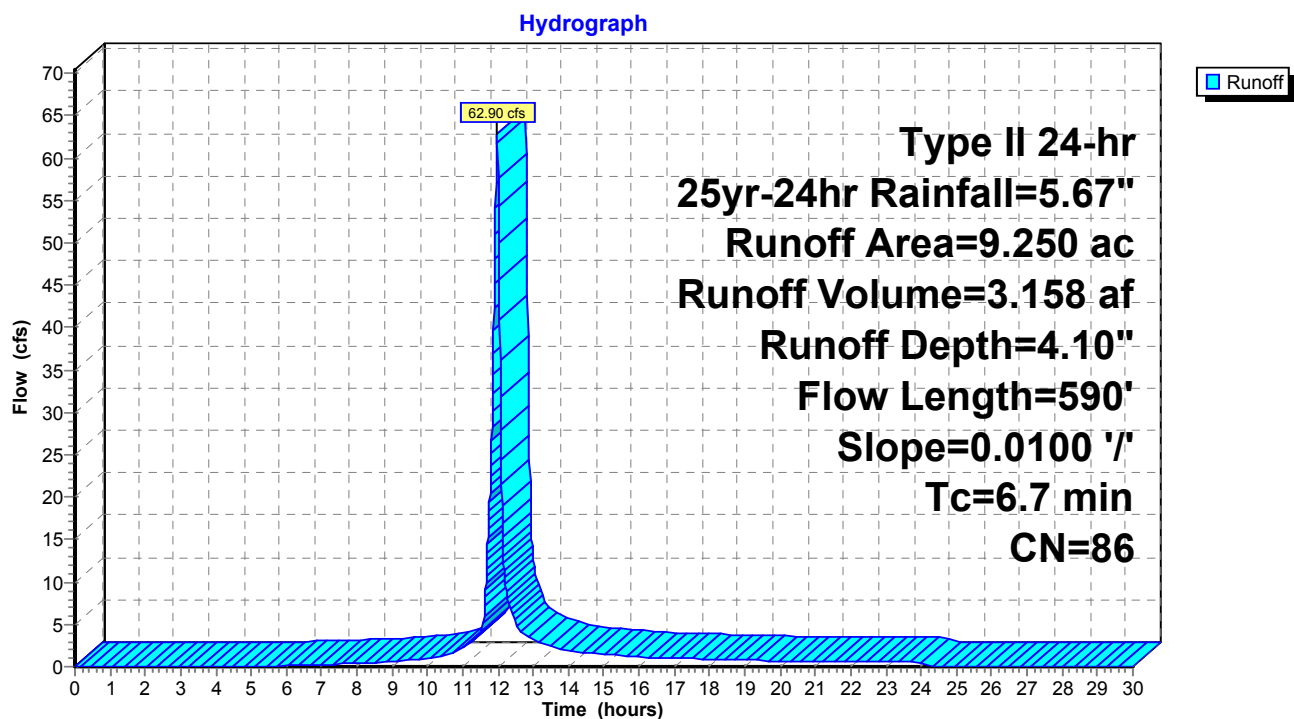Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.480	82	Dirt roads, HSG B
7.400	86	Fallow, bare soil, HSG B
0.370	98	Unconnected roofs, HSG B
9.250	86	Weighted Average
8.880		96.00% Pervious Area
0.370		4.00% Impervious Area
0.370		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
5.1	490	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.7	590				Total

Subcatchment DA-4: Area 4

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=9.250 ac
Runoff Volume=3.158 af
Runoff Depth=4.10"
Flow Length=590'
Slope=0.0100 '/'
Tc=6.7 min
CN=86

Summary for Subcatchment DA-5: Area 5

Runoff   =   37.28 cfs @ 11.94 hrs, Volume=   1.733 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
3.380	86	Fallow, bare soil, HSG B
1.330	98	Water Surface, HSG B
4.710	89	Weighted Average
3.380		71.76% Pervious Area
1.330		28.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3300	1.27		**Sheet Flow,** Fallow n= 0.050 P2= 3.26"
0.1	80	0.3300	9.25		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.3	220	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.7	400	Total			

Subcatchment DA-5: Area 5

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=4.710 ac
Runoff Volume=1.733 af
Runoff Depth=4.42"
Flow Length=400'
Tc=3.7 min
CN=89

Summary for Subcatchment DA-6: Area 6

Runoff   =   17.66 cfs @ 11.96 hrs, Volume=   0.858 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
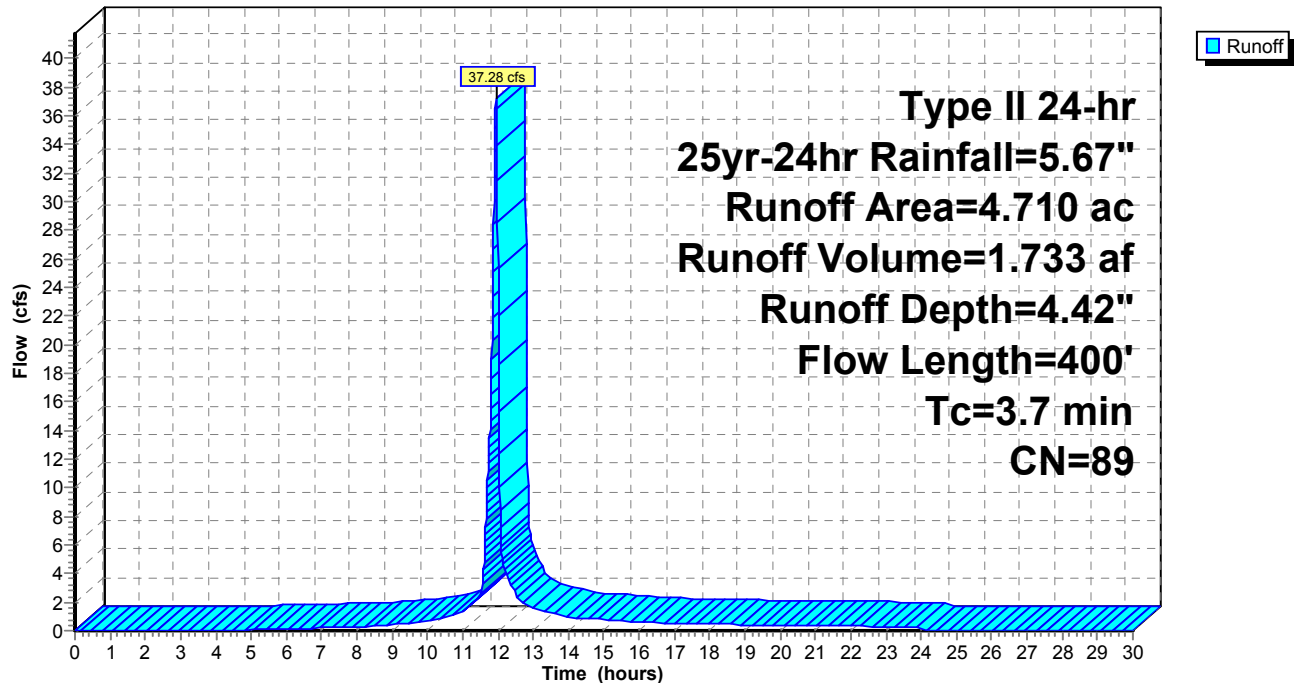Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.070	86	Fallow, bare soil, HSG B
0.320	98	Water Surface, HSG B
2.390	88	Weighted Average
2.070		86.61% Pervious Area
0.320		13.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.3300	1.27		**Sheet Flow,** Fallow n= 0.050 P2= 3.26"
0.1	30	0.3300	9.25		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	380	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	510	Total			

Subcatchment DA-6: Area 6

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=2.390 ac
Runoff Volume=0.858 af
Runoff Depth=4.31"
Flow Length=510'
Tc=5.3 min
CN=88

Summary for Subcatchment DA-7: Area 7

Runoff   =   107.47 cfs @ 12.06 hrs, Volume=   7.034 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
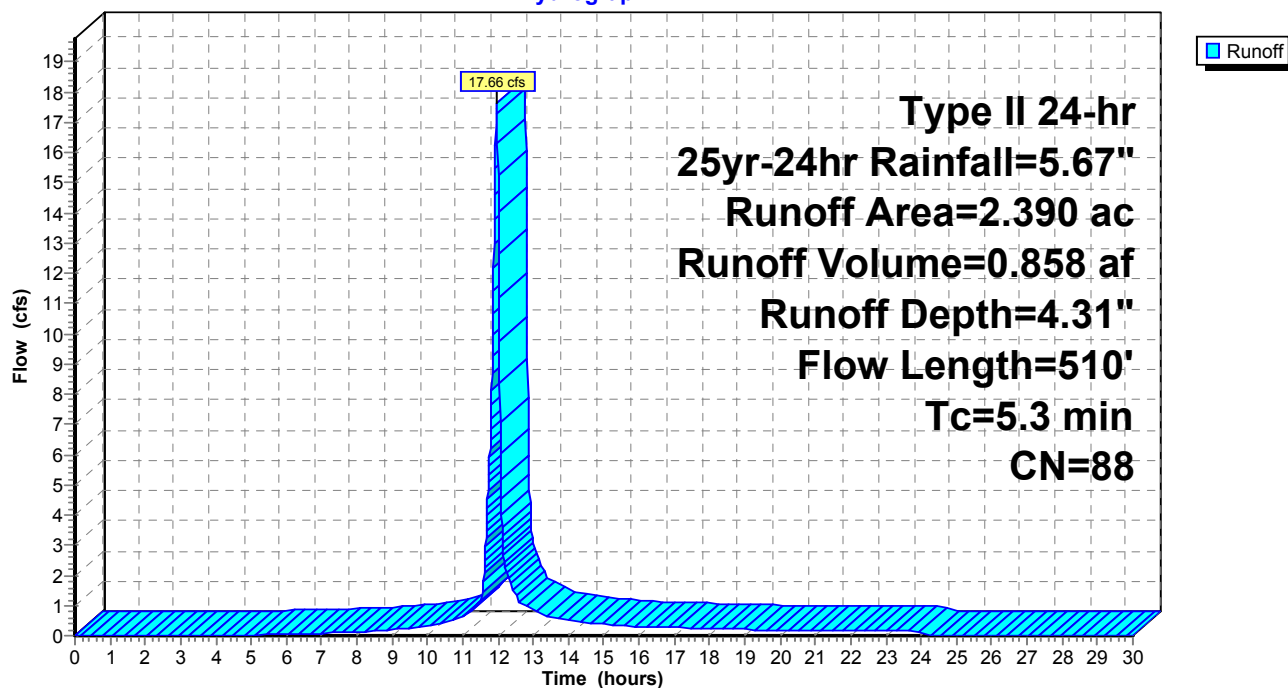Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.980	98	Water Surface, HSG B
3.920	86	Fallow, bare soil, HSG B
3.920	98	Unconnected roofs, HSG B
9.770	82	Dirt roads, HSG B
19.590	88	Weighted Average
13.690		69.88% Pervious Area
5.900		30.12% Impervious Area
3.920		66.44% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,**
					Smooth surfaces n= 0.011 P2= 3.26"
12.8	1,235	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
14.4	1,335				Total

Subcatchment DA-7: Area 7

Hydrograph

Summary for Subcatchment DA-8: Area 8

Runoff   =   31.28 cfs @ 12.08 hrs, Volume=   2.178 af, Depth= 4.20"
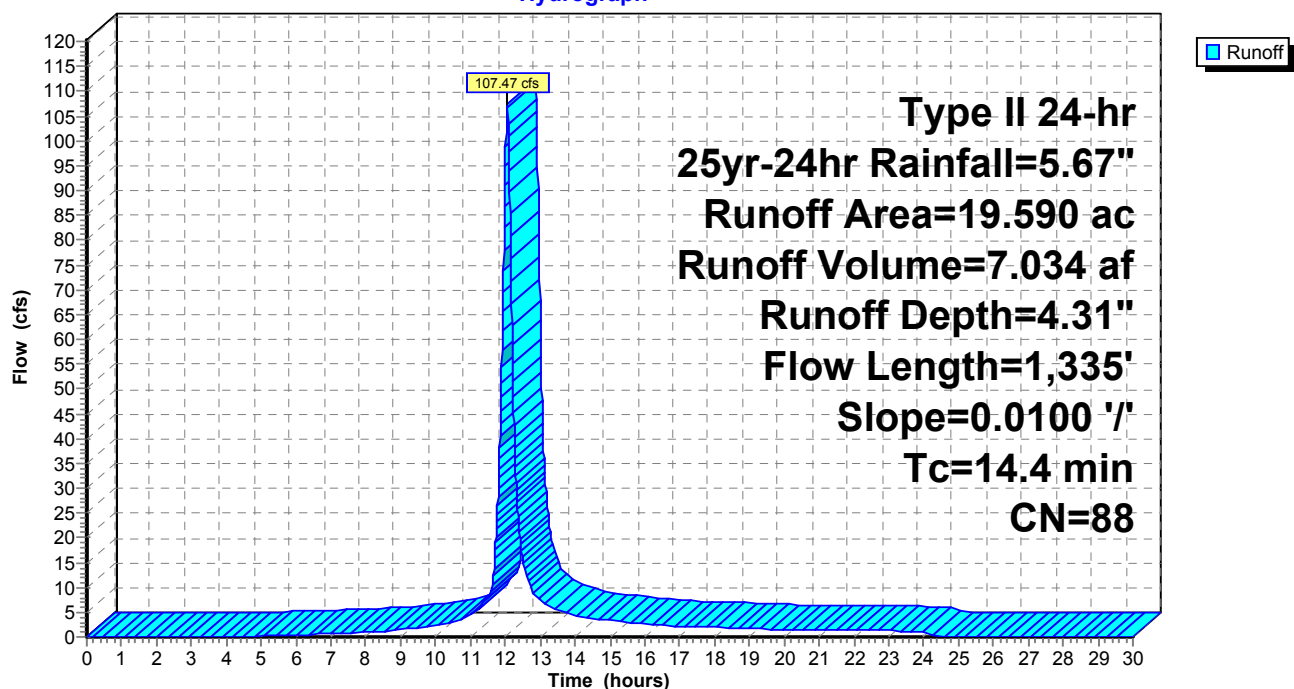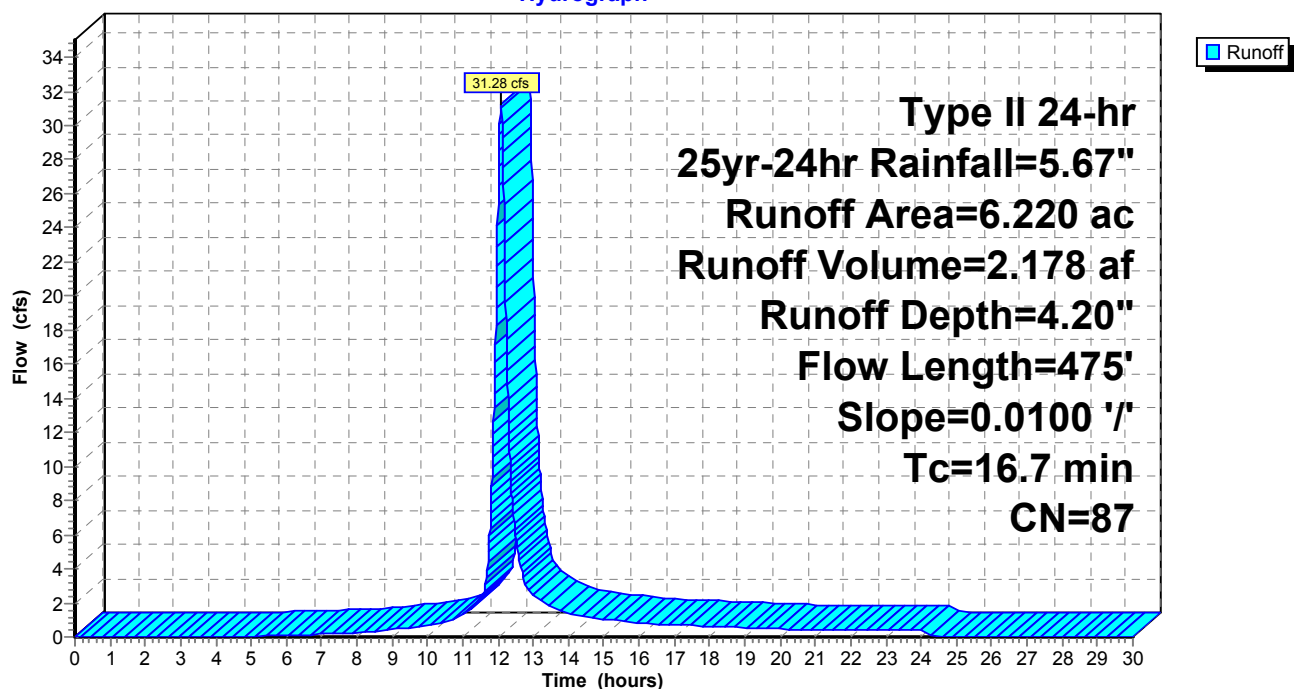
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
2.410	98	Water Surface, HSG B
2.410	79	<50% Grass cover, Poor, HSG B
1.280	82	Dirt roads, HSG B
0.120	98	Unconnected roofs, HSG B
6.220	87	Weighted Average
3.690		59.32% Pervious Area
2.530		40.68% Impervious Area
0.120		4.74% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	100	0.0100	0.13		**Sheet Flow,**
					Grass: Short n= 0.150 P2= 3.26"
3.9	375	0.0100	1.61		**Shallow Concentrated Flow,**
					Unpaved Kv= 16.1 fps
16.7	475				Total

Subcatchment DA-8: Area 8

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=6.220 ac
Runoff Volume=2.178 af
Runoff Depth=4.20"
Flow Length=475'
Slope=0.0100 '/'
Tc=16.7 min
CN=87

Ponds 1, 2, and 3 - Reduced Capacity (Scen.2)
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Type II 24-hr 25yr-24hr Rainfall=5.67"
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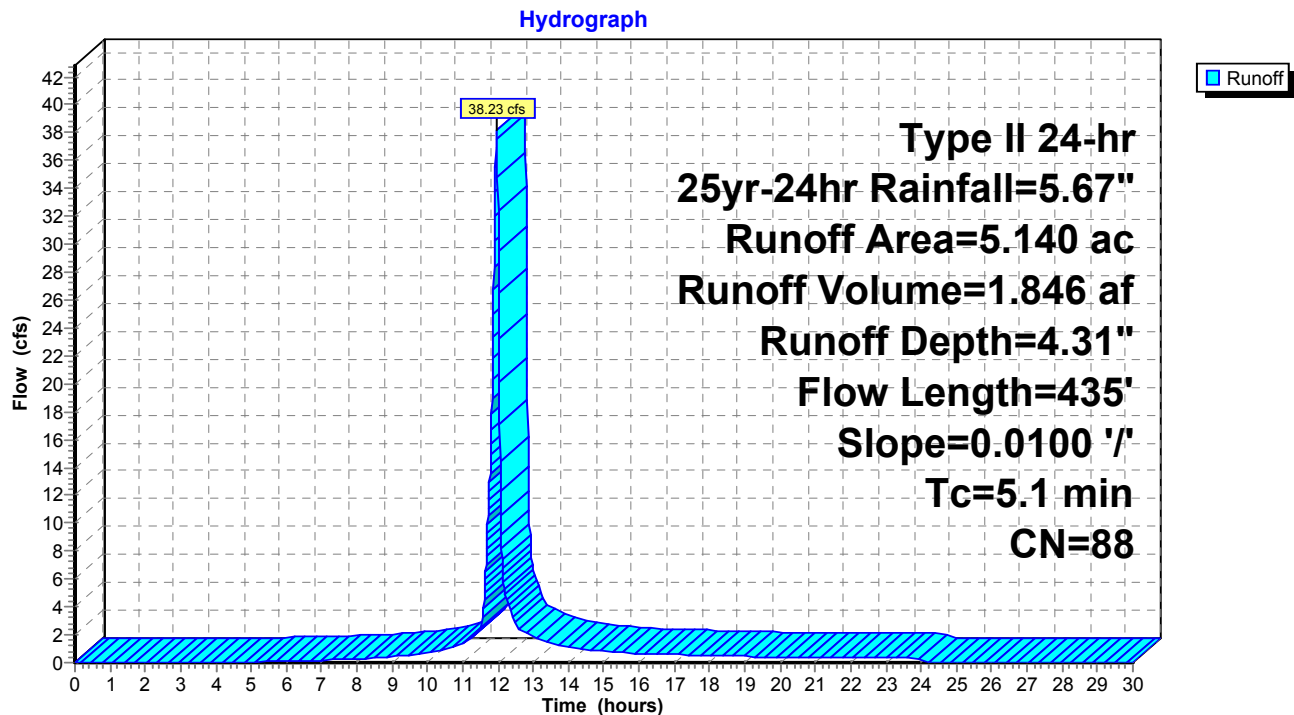## Summary for Subcatchment DA-9: Area 9

Runoff   =   38.23 cfs @ 11.96 hrs, Volume=   1.846 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
1.790	98	Water Surface, HSG B
3.350	82	Dirt roads, HSG B
5.140	88	Weighted Average
3.350		65.18% Pervious Area
1.790		34.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.05		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.26"
3.5	335	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.1	435	Total			

Subcatchment DA-9: Area 9

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=5.140 ac
Runoff Volume=1.846 af
Runoff Depth=4.31"
Flow Length=435'
Slope=0.0100 '/'
Tc=5.1 min
CN=88

Summary for Subcatchment L1: Lagoon Area

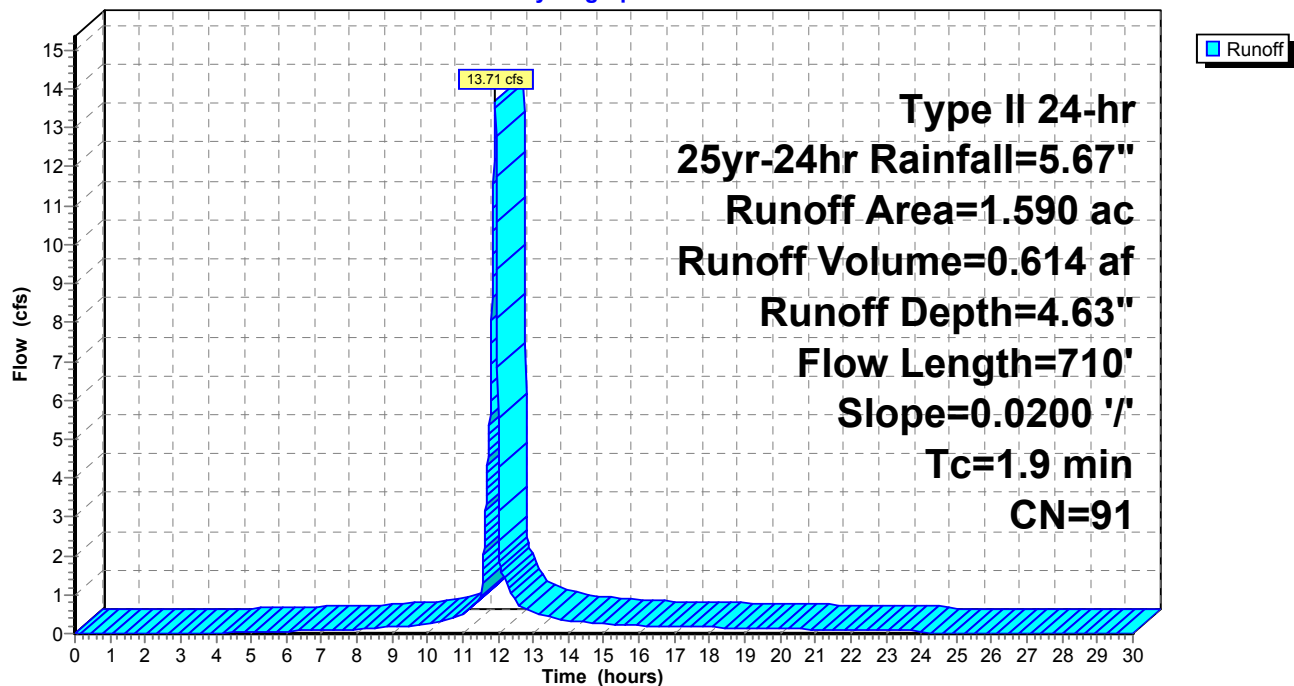Runoff   =   13.71 cfs @ 11.92 hrs, Volume=   0.614 af, Depth= 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type II 24-hr 25yr-24hr Rainfall=5.67"

Area (ac)	CN	Description
0.640	98	Water Surface, HSG B
0.950	86	Fallow, bare soil, HSG B
1.590	91	Weighted Average
0.950		59.75% Pervious Area
0.640		40.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	710	0.0200	6.36	2.22	**Pipe Channel,** 8.0" Round Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.010 PVC, smooth interior

Subcatchment L1: Lagoon Area

Hydrograph

Type II 24-hr
25yr-24hr Rainfall=5.67"
Runoff Area=1.590 ac
Runoff Volume=0.614 af
Runoff Depth=4.63"
Flow Length=710'
Slope=0.0200 '/'
Tc=1.9 min
CN=91

Summary for Pond AP1: Ash Pond 1

Inflow   =   230.02 cfs @ 11.96 hrs, Volume=   15.979 af, Incl. 0.50 cfs Base Flow
Outflow   =   34.21 cfs @ 12.22 hrs, Volume=   15.390 af, Atten= 85%, Lag= 15.6 min
Primary   =   34.21 cfs @ 12.22 hrs, Volume=   15.390 af

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 2.200 af
Peak Elev= 93.85' @ 12.44 hrs Surf.Area= 0.000 ac Storage= 9.435 af (7.235 af above start)

Plug-Flow detention time= 288.7 min calculated for 13.186 af (83% of inflow)
Center-of-Mass det. time= 152.8 min (955.9 - 803.1)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	11.500 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	2.200
91.00	4.800
93.00	7.900
95.00	11.500

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	**30.0" Round Culvert** L= 280.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0036 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=34.12 cfs @ 12.22 hrs HW=93.71' TW=90.37' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 34.12 cfs @ 6.95 fps)

Ponds 1, 2, and 3 - Reduced Capacity (Scen.2)
Prepared by CEC, Inc.
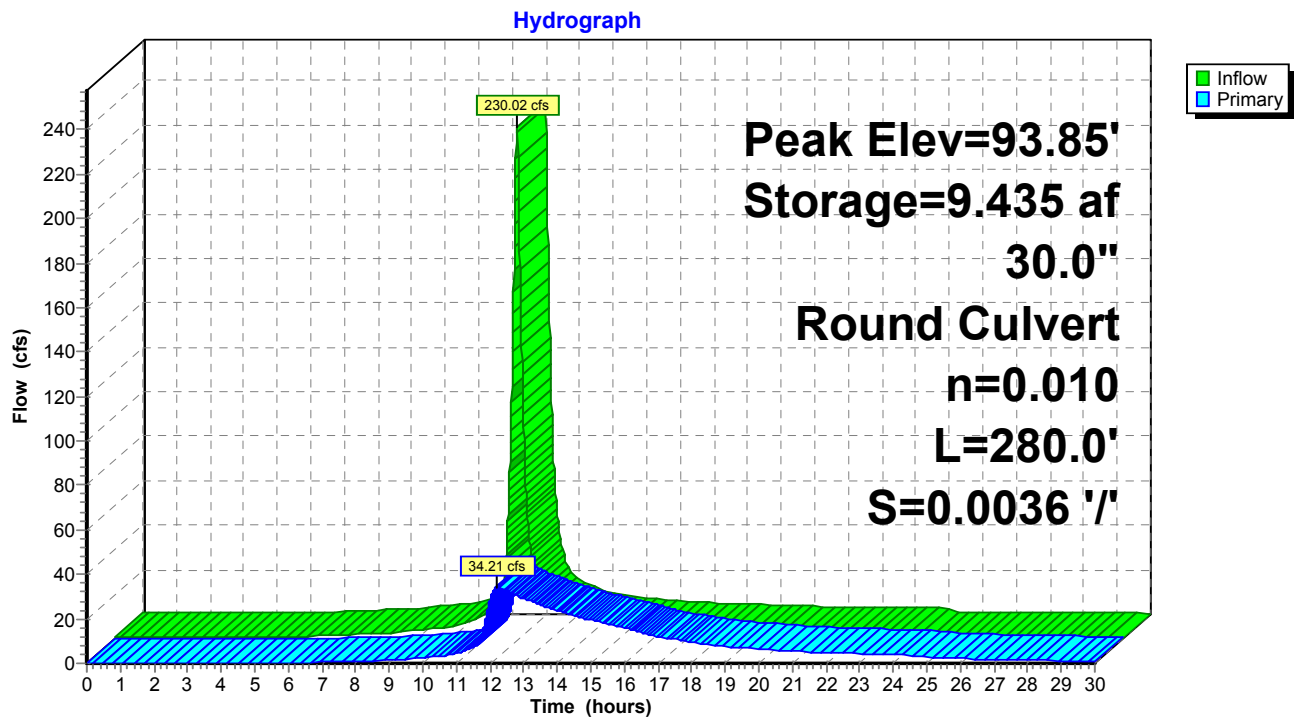HydroCAD® 10.00-14 s/n 01006 © 2015 HydroCAD Software Solutions LLC

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Pond AP1: Ash Pond 1

Hydrograph

Legend: Inflow (green), Primary (blue)

230.02 cfs

34.21 cfs

Peak Elev=93.85'
Storage=9.435 af
30.0"
Round Culvert
n=0.010
L=280.0'
S=0.0036 '/'

Flow (cfs) vs. Time (hours)

Ponds 1, 2, and 3 - Reduced Capacity (Scen.2)
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Summary for Pond AP2: Ash Pond 2

Inflow	=	33.68 cfs @ 12.08 hrs,	Volume=	4.424 af,	Incl. 0.64 cfs Base Flow
Outflow	=	3.61 cfs @ 20.39 hrs,	Volume=	4.030 af,	Atten= 89%, Lag= 498.3 min
Primary	=	3.61 cfs @ 20.39 hrs,	Volume=	4.030 af	

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 1.100 af
Peak Elev= 91.84' @ 13.93 hrs Surf.Area= 0.000 ac Storage= 3.032 af (1.932 af above start)

Plug-Flow detention time= 599.8 min calculated for 2.929 af (66% of inflow)
Center-of-Mass det. time= 250.5 min (1,083.9 - 833.4)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	5.600 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	1.100
91.00	2.400
93.00	3.900
95.00	5.600

Device	Routing	Invert	Outlet Devices
#1	Primary	89.00'	**16.0" Round Culvert X 2.00** L= 540.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 89.00' / 88.00' S= 0.0019 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.40 sf

Primary OutFlow Max=3.62 cfs @ 20.39 hrs HW=90.71' TW=89.69' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 3.62 cfs @ 1.31 fps)

Pond AP2: Ash Pond 2

Hydrograph

Peak Elev=91.84'
Storage=3.032 af
16.0"
Round Culvert x 2.00
n=0.025
L=540.0'
S=0.0019 '/'

Legend: ■ Inflow ■ Primary

33.68 cfs

3.61 cfs

Flow (cfs)

Time (hours)

Summary for Pond AP3: Ash Pond 3

Inflow	=	67.47 cfs @ 11.97 hrs, Volume=	21.264 af	
Outflow	=	28.51 cfs @ 13.79 hrs, Volume=	21.610 af,	Atten= 58%, Lag= 109.3 min
Primary	=	28.51 cfs @ 13.79 hrs, Volume=	21.610 af	
Secondary	=	0.00 cfs @ 0.00 hrs, Volume=	0.000 af	
Tertiary	=	0.00 cfs @ 0.00 hrs, Volume=	0.000 af	

Routing by Sim-Route method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Starting Elev= 89.00' Surf.Area= 0.000 ac Storage= 1.900 af
Peak Elev= 91.31' @ 13.79 hrs Surf.Area= 0.000 ac Storage= 4.601 af (2.701 af above start)

Plug-Flow detention time= 150.8 min calculated for 19.710 af (93% of inflow)
Center-of-Mass det. time= 45.3 min (1,010.9 - 965.6)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	9.800 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
87.00	0.000
89.00	1.900
91.00	4.200
93.00	6.800
95.00	9.800

Device	Routing	Invert	Outlet Devices
#1	Primary	88.00'	**24.0" Round Principal Spillway Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.00' / 87.00' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf
#2	Secondary	89.00'	**30.0" Round Culvert to AP1** L= 280.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.00' / 89.00' S= -0.0036 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 4.91 sf
#3	Tertiary	89.00'	**16.0" Round Culvert to AP2 X 2.00** L= 540.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 88.00' / 89.00' S= -0.0019 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.40 sf
#4	Primary	90.00'	**24.0" Round Emergency Spillway Culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 90.00' / 89.00' S= 0.0100 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Ponds 1, 2, and 3 - Reduced Capacity (Scen.2)
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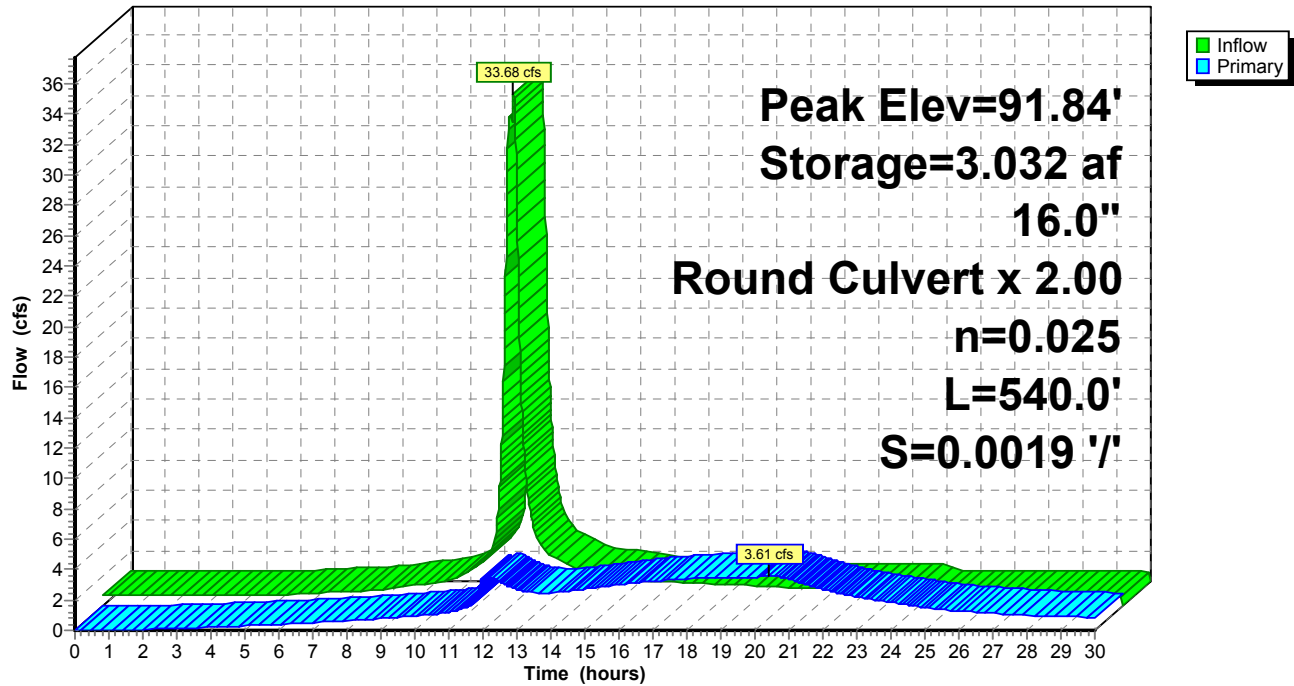HydroCAD® 10.00-14 s/n 01006 © 2015 HydroCAD Software Solutions LLC

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Primary OutFlow Max=28.51 cfs @ 13.79 hrs HW=91.31' (Free Discharge)
└─**1=Principal Spillway Culvert** (Inlet Controls 22.98 cfs @ 7.32 fps)
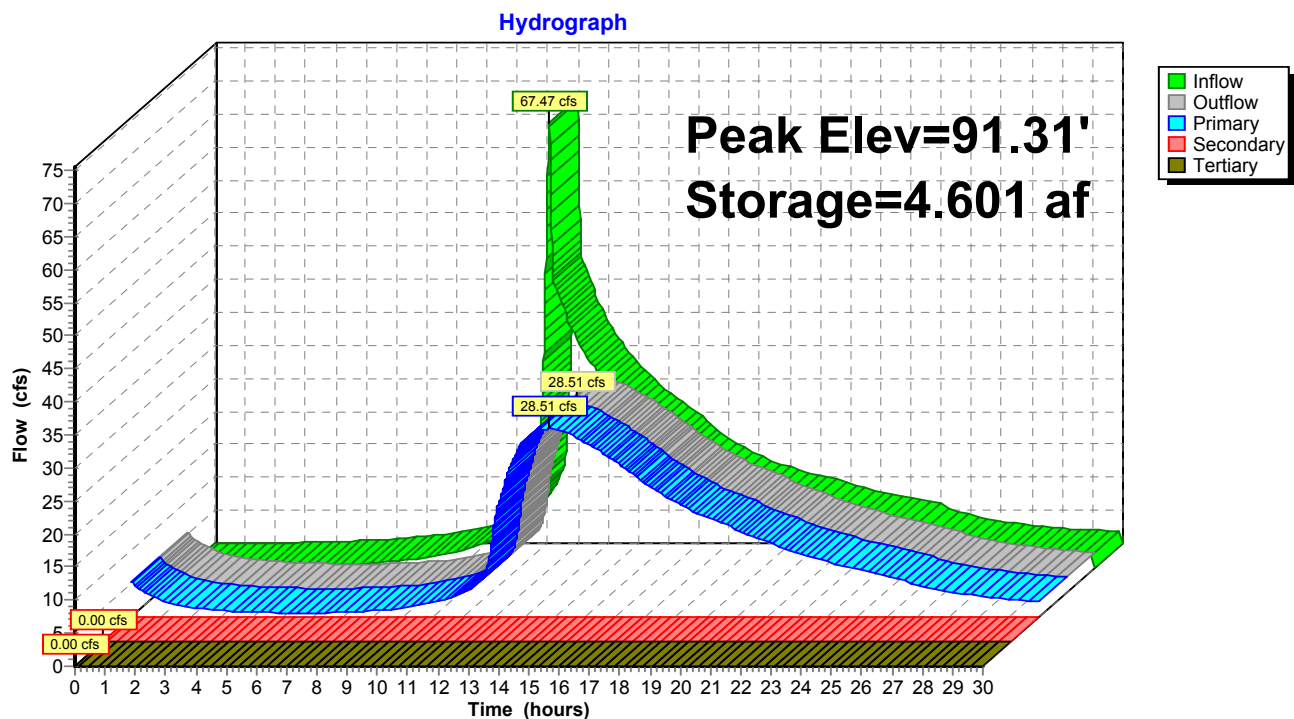└─**4=Emergency Spillway Culvert** (Barrel Controls 5.53 cfs @ 3.60 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.00' TW=89.00' (Dynamic Tailwater)
└─**2=Culvert to AP1** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=89.00' TW=89.00' (Dynamic Tailwater)
└─**3=Culvert to AP2** (Controls 0.00 cfs)

Pond AP3: Ash Pond 3

Hydrograph

Peak Elev=91.31'
Storage=4.601 af

Legend:
- Inflow
- Outflow
- Primary
- Secondary
- Tertiary

67.47 cfs
28.51 cfs
28.51 cfs
0.00 cfs
0.00 cfs

ATTACHMENT 7

STORAGE CAPACITY ABOVE POOL
FOR VARYING POOL AREAS AND DEPTHS

Owensboro Municipal Utilities
Elmer Smith Station Ash Pond
Hydrologic and Hydraulic Capacity Requirments (CCR Rule §257.82)
Storage Capacity above Pool (Ac-Ft) for Varying Pool Areas (Ac) and Depths (feet)

Pool Area (Acres)

Depth to Pool (feet)	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
1	0.25	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
2	0.5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3	0.75	1.5	3	4.5	6	7.5	9	10.5	12	13.5	15	16.5	18	19.5	21	22.5	24	25.5	27	28.5	30
4	1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
5	1.25	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	32.5	35	37.5	40	42.5	45	47.5	50
6	1.5	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60

1. This tables shows the approximate storage capacity (ac-feet) for varying pool areas (ac) and depth to the pools (feet). This table can be used to estimate whether the required capacity is available in the pools based on the pool area and the depth to the pool (or freeboard).