HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2016
File No. 40616-108

SUBJECT: Initial Run-on and Run-off Control Plan
Associated Electric Cooperative, Inc.
New Madrid Power Plant – Utility Waste Landfill
New Madrid, MO

Haley & Aldrich, Inc. (Haley & Aldrich) was retained by Associated Electric Cooperative, Inc. (AECI) to develop this Initial Run-on and Run-off Control Plan for the coal combustion residuals (CCR) Utility Waste Landfill (UWL) at the New Madrid Power Plant (NMPP) to comply with the requirements of the U.S. Environmental Protection Agency (USEPA) 40 CFR Parts 257 and 261 "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities" (CCR Rule) section §257.81. The existing conditions of the UWL active portion (Phase I) run-on and run-off control system has been reviewed and associated stormwater modeling and analysis performed to meet the requirements of the Run-on and Run-off Control System Plan (Plan) requirement of CCR Rule Section §257.81 as described in the sections below. Once additional phases become active, this Plan will be updated accordingly.

§257.81(a): The owner or operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must design, construct, operate, and maintain:

§257.81(a)(1): A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm;

The UWL is located approximately 1.7 miles southwest of the New Madrid Power Plant, in New Madrid County, Missouri. Phase I of the Landfill is currently active, with Phase III being an existing phase of the landfill not currently receiving CCR as of the date of this Plan. The UWL was constructed with a perimeter berm around each side above existing grades. The perimeter berm, which also serves as an access road, is roughly 6 feet in height when measured to the existing topography outside of the UWL and prevents run-on to the active portion of the UWL. It is not feasible for the 24-hour, 25-year storm (6.62 inches) to flow over the berm and into the active portion of the UWL.

§257.81(a)(2): A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

Stormwater runoff from the UWL is managed by the perimeter berms. Stormwater is conveyed in ditches that drain from a high point in the northeast corner of the UWL towards the low point

in the southwest corner. Stormwater is collected in the southwest corner of the landfill footprint, in accordance with the intended design, and passes through the landfill berm and into a clay-lined ditch via a 24-inch HDPE pipe. The ditch drains to the east and empties into a clay-lined sedimentation pond via a 24-inch HDPE pipe. AECI maintains a water level in the pond at approximately El. 281 by periodically pumping water to the existing CCR impoundments. AECI also pumps water to the existing CCR impoundments throughout large storm events to limit peak water surface elevations.

Haley & Aldrich analyzed the existing stormwater run-on and run-off for the UWL for the 24-hour, 25-year storm event in HydroCAD 10.00-15. The rainfall data for the analysis was obtained from NOAA Atlas 14 for the site. The rainfall for the 24-hour 25-year storm event was 6.62 inches. The Soil Conservation Service Type-II rainfall distribution pattern was used to distribute the total rainfall over a 24-hour period. Appendix A includes rainfall data used in the hydrologic model. The existing conditions and drainage areas for the unit are shown in Figure 1.

The results of the HydroCAD model are included in Appendix B. The results of the model indicate that the stormwater conveyance system for the UWL adequately handle the volume of the 24-hour, 25-year storm event. The pipe from the UWL footprint to the conveyance ditch and the pipe from the ditch to the sedimentation pond convey stormwater without causing a peak water surface elevation above the landfill and ditch berm elevations. Additionally, the sedimentation pond collects and controls the water volume resulting from the 24-hour, 25-year storm event below berm elevations.

§257.81(b): Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirement under §257.3-3.

§257.3-3(a): For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.

§257.3-3(b): For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended.

§257.3-3(c): A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an areawide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.

Stormwater from the UWL is managed on-site for the 24-hour, 25-year storm event, and the only discharge from the sedimentation pond is pumped to existing CCR impoundments. Those impoundments either discharge via evaporation or through permitted NPDES outfalls.

§257.81(c)(1): Contents of plan. The owner or operator must prepare initial and periodic run-on and run-off 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 run-on and run-off control systems have been designed and constructed to meet the applicable requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator has completed the initial run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(3).

This document and all attachments serve as the initial Run-on Run-off Control Plan and will be placed in the facility's operating record. Periodic Run-on and Run-off control plans will be prepared at 5-year increments or whenever determined necessary if there is a change in conditions that would affect the Plan.

§257.81(c)(2): Amendment of the plan. The owner or operator may amend the written run-on and run-off control plan at any time provided the revised plan is placed in the facility's operating record as required by §257.105 (g) (3). The owner or operator must amend the written run-on and run-off control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.

The Run-on and Run-off Control Plan will be amended if conditions change that substantially affect the written plan in effect. Any amendments to the Plan will include written certification from a qualified professional engineer that any amendments to the Plan meet the requirements of the CCR Rule.

A record of amendments to the Plan will be tracked below. The latest version of the Run-on and Run-off Control Plan will be noted on the first page of the Plan.

Version	Date	Description of Changes Made
1	16 October 2016	Initial Submittal

§257.81(c)(3): Timeframes for preparing the initial plan

(i) Existing CCR landfills. The owner or operator of the CCR unit must prepare an initial run-on and run-off control system plan no later than October 17, 2016

The Run-on and Run-off Control Plan has been prepared within the specified time.

(ii) New CCR landfills and any lateral expansion of a CCR landfill. The owner or operator must prepare the initial run-on and run-off control system plan no later than the date of initial receipt of CCR in the CCR unit.

Not Applicable. This Plan will also be updated when existing phases of the landfill that are not actively receiving CCRs begin to receive CCRs.

§257.81(c)(4): Frequency of revising the plan. The owner or operator of a CCR unit must prepare periodic run-on and run-off 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 subsequent 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 a periodic run-on and run-off control system plan when the plan has been placed in the facility's operating record as required by §257.105(g)(3).

The Run-on and Run-off Control System Plan or any subsequent Plan will be assessed and amended whenever there is a change in operation of the CCR landfill that would substantially affect the Run-on and Run-off Control System Plan or when unanticipated events necessitate a revision of the Plan.

Professional Engineer Certification

§257.81(c)(5): The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of this section.

I certify that the above-referenced initial Run-on and Run-off Control System Plan for AECI's Utility Waste Landfill at the New Madrid Power Plant (NMPP) meets the USEPA's CCR Rule requirements of §257.81.

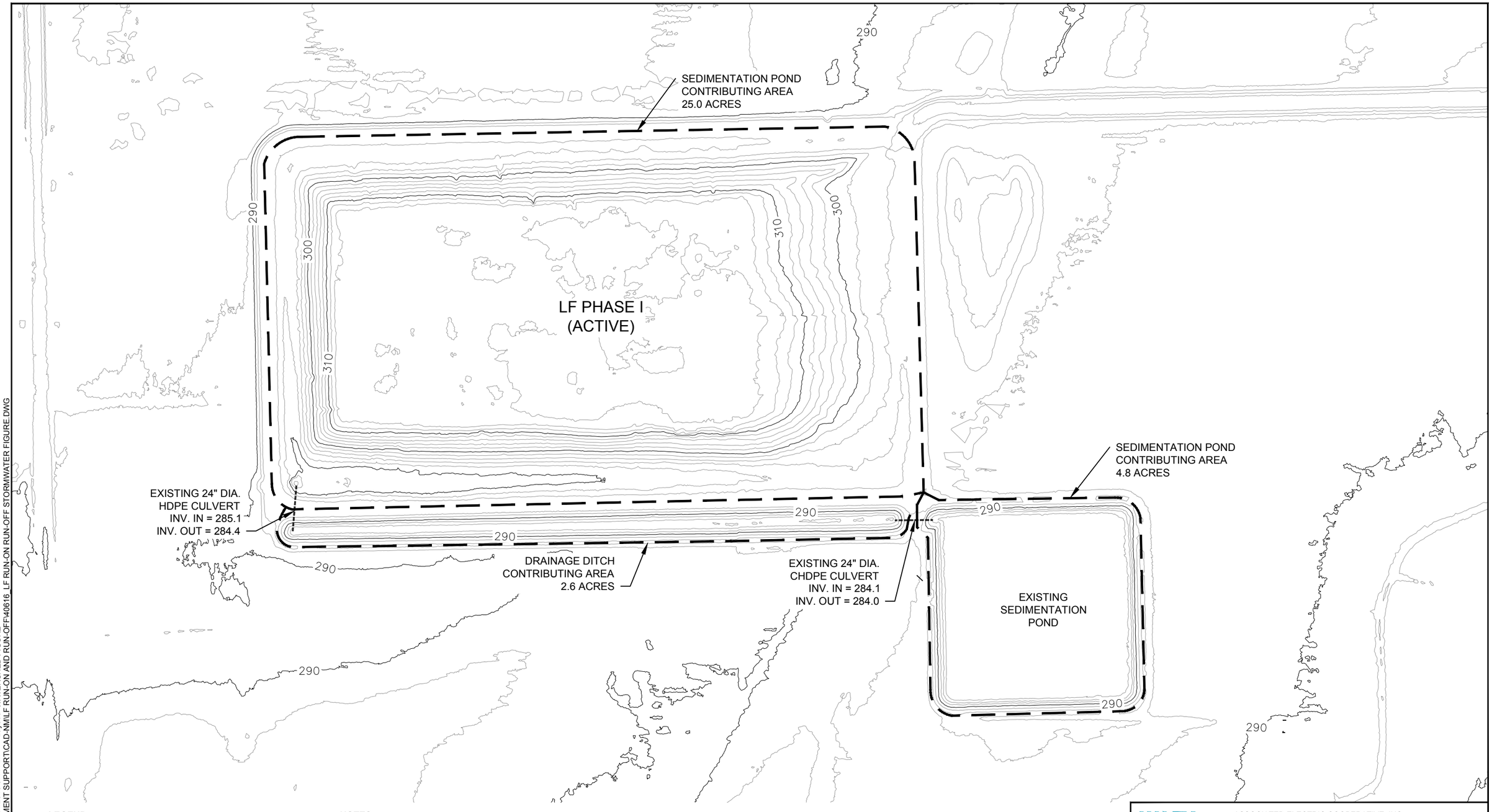
Signed:_____
Certifying Engineer

Print Name: Steven F. Putrich
Missouri License No.: 2014035813
Title: Project Principal
Company: Haley & Aldrich, Inc.

Professional Engineer's Seal:

Cc: Jenny Burns-AECI; Jason Pokorny-Haley & Aldrich

HALEY ALDRICH



LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING CULVERT
- DRAINAGE AREA

NOTES

1. EXISTING TOPOGRAPHY BASED ON LIDAR DATA RECEIVED FROM AECI CONDUCTED BY PICTOMETRY INTERNATIONAL CORP. AERIAL SURVEY CONDUCTED BETWEEN 10/4/14 AND 10/8/14.
2. EXISTING CULVERT INFORMATION FROM "AS-BUILT PIPE & DRAINS", BE-03, BY BLOOMSDALE EXCAVATING, DATED 10/12/07.

N

0 200 400
SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
UTILITY WASTE LANDFILL

DRAINAGE FIGURE

SCALE: AS SHOWN
SEPTEMBER 2016

FIGURE 1

BLEVINS, BRETT Printed: 9/21/2016 9:44 AM Layout: WATERSHED FIGURE
G:\40616_AECI-CCR ELG MANAGEMENT SUPPORT\CAD-NM\LF RUN-ON AND RUN-OFF\40616_LF RUN-ON RUN-OFF STORMWATER FIGURE.DWG

Appendix A
NOAA Rainfall Data

NOAA Atlas 14, Volume 8, Version 2
Location name: Portageville, Missouri, US*
Latitude: 36.4945°, Longitude: -89.5877°
Elevation: 312 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point 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	**0.412** (0.329-0.515)	**0.476** (0.379-0.596)	**0.582** (0.462-0.729)	**0.670** (0.530-0.842)	**0.792** (0.609-1.02)	**0.888** (0.668-1.15)	**0.984** (0.719-1.29)	**1.08** (0.762-1.45)	**1.21** (0.825-1.66)	**1.31** (0.873-1.81)
10-min	**0.603** (0.481-0.754)	**0.697** (0.556-0.872)	**0.851** (0.677-1.07)	**0.981** (0.776-1.23)	**1.16** (0.891-1.49)	**1.30** (0.978-1.68)	**1.44** (1.05-1.90)	**1.58** (1.12-2.12)	**1.77** (1.21-2.42)	**1.92** (1.28-2.65)
15-min	**0.735** (0.587-0.920)	**0.850** (0.678-1.06)	**1.04** (0.826-1.30)	**1.20** (0.946-1.50)	**1.42** (1.09-1.82)	**1.58** (1.19-2.05)	**1.76** (1.28-2.31)	**1.93** (1.36-2.59)	**2.17** (1.47-2.96)	**2.34** (1.56-3.23)
30-min	**1.05** (0.840-1.32)	**1.22** (0.974-1.53)	**1.50** (1.19-1.88)	**1.73** (1.37-2.17)	**2.04** (1.57-2.62)	**2.29** (1.72-2.97)	**2.54** (1.85-3.34)	**2.79** (1.96-3.74)	**3.12** (2.13-4.26)	**3.38** (2.25-4.66)
60-min	**1.39** (1.11-1.74)	**1.60** (1.28-2.00)	**1.96** (1.56-2.46)	**2.26** (1.79-2.84)	**2.69** (2.07-3.46)	**3.03** (2.28-3.93)	**3.37** (2.47-4.45)	**3.73** (2.63-5.01)	**4.22** (2.88-5.77)	**4.60** (3.06-6.35)
2-hr	**1.73** (1.39-2.13)	**1.98** (1.60-2.45)	**2.42** (1.95-3.00)	**2.79** (2.24-3.47)	**3.33** (2.60-4.25)	**3.76** (2.87-4.84)	**4.21** (3.12-5.50)	**4.68** (3.34-6.22)	**5.32** (3.67-7.21)	**5.82** (3.92-7.96)
3-hr	**1.95** (1.59-2.39)	**2.23** (1.81-2.74)	**2.71** (2.20-3.34)	**3.14** (2.53-3.87)	**3.75** (2.95-4.76)	**4.25** (3.27-5.44)	**4.78** (3.57-6.21)	**5.33** (3.84-7.07)	**6.11** (4.24-8.24)	**6.72** (4.55-9.13)
6-hr	**2.38** (1.96-2.88)	**2.71** (2.23-3.29)	**3.29** (2.70-4.00)	**3.81** (3.11-4.64)	**4.56** (3.64-5.74)	**5.19** (4.05-6.57)	**5.85** (4.42-7.53)	**6.55** (4.77-8.60)	**7.54** (5.30-10.1)	**8.32** (5.70-11.2)
12-hr	**2.87** (2.39-3.43)	**3.28** (2.73-3.93)	**3.99** (3.31-4.78)	**4.61** (3.81-5.55)	**5.52** (4.46-6.85)	**6.27** (4.95-7.84)	**7.05** (5.39-8.97)	**7.88** (5.81-10.2)	**9.04** (6.43-12.0)	**9.96** (6.90-13.3)
24-hr	**3.40** (2.87-4.02)	**3.92** (3.31-4.63)	**4.79** (4.03-5.67)	**5.54** (4.64-6.59)	**6.62** (5.39-8.09)	**7.48** (5.96-9.22)	**8.37** (6.47-10.5)	**9.30** (6.92-11.9)	**10.6** (7.60-13.8)	**11.6** (8.11-15.3)
2-day	**3.98** (3.40-4.64)	**4.61** (3.94-5.38)	**5.67** (4.83-6.63)	**6.56** (5.56-7.69)	**7.80** (6.42-9.39)	**8.78** (7.08-10.7)	**9.78** (7.63-12.1)	**10.8** (8.12-13.6)	**12.2** (8.83-15.7)	**13.2** (9.37-17.3)
3-day	**4.37** (3.77-5.06)	**5.06** (4.36-5.86)	**6.20** (5.32-7.19)	**7.16** (6.12-8.34)	**8.51** (7.05-10.2)	**9.56** (7.76-11.5)	**10.6** (8.36-13.1)	**11.7** (8.89-14.7)	**13.2** (9.66-16.9)	**14.4** (10.2-18.6)
4-day	**4.68** (4.05-5.38)	**5.40** (4.67-6.22)	**6.60** (5.70-7.62)	**7.62** (6.54-8.82)	**9.04** (7.54-10.7)	**10.2** (8.30-12.2)	**11.3** (8.95-13.8)	**12.5** (9.52-15.6)	**14.1** (10.4-18.0)	**15.3** (11.0-19.8)
7-day	**5.40** (4.73-6.15)	**6.19** (5.42-7.06)	**7.53** (6.57-8.60)	**8.68** (7.53-9.94)	**10.3** (8.70-12.1)	**11.6** (9.58-13.8)	**12.9** (10.3-15.7)	**14.3** (11.0-17.8)	**16.2** (12.0-20.5)	**17.7** (12.8-22.6)
10-day	**6.07** (5.35-6.86)	**6.92** (6.09-7.83)	**8.35** (7.33-9.46)	**9.57** (8.37-10.9)	**11.3** (9.62-13.3)	**12.7** (10.6-15.0)	**14.2** (11.4-17.1)	**15.7** (12.1-19.3)	**17.7** (13.2-22.3)	**19.3** (14.1-24.6)
20-day	**8.17** (7.30-9.11)	**9.15** (8.17-10.2)	**10.8** (9.59-12.1)	**12.1** (10.8-13.6)	**14.1** (12.1-16.2)	**15.6** (13.1-18.1)	**17.1** (13.9-20.3)	**18.6** (14.6-22.6)	**20.7** (15.7-25.8)	**22.4** (16.5-28.1)
30-day	**9.98** (8.99-11.0)	**11.1** (10.0-12.3)	**12.9** (11.6-14.3)	**14.4** (12.9-16.1)	**16.5** (14.2-18.8)	**18.0** (15.3-20.8)	**19.6** (16.1-23.0)	**21.1** (16.7-25.4)	**23.2** (17.6-28.6)	**24.7** (18.4-30.9)
45-day	**12.3** (11.2-13.5)	**13.6** (12.4-15.0)	**15.8** (14.3-17.4)	**17.5** (15.8-19.4)	**19.8** (17.2-22.3)	**21.5** (18.3-24.5)	**23.1** (19.0-26.9)	**24.7** (19.6-29.4)	**26.6** (20.4-32.5)	**28.1** (21.0-34.9)
60-day	**14.2** (13.0-15.6)	**15.8** (14.5-17.3)	**18.3** (16.7-20.1)	**20.3** (18.4-22.3)	**22.8** (19.9-25.5)	**24.6** (21.1-27.9)	**26.3** (21.8-30.4)	**28.0** (22.3-33.1)	**29.9** (23.0-36.3)	**31.3** (23.5-38.7)

[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.

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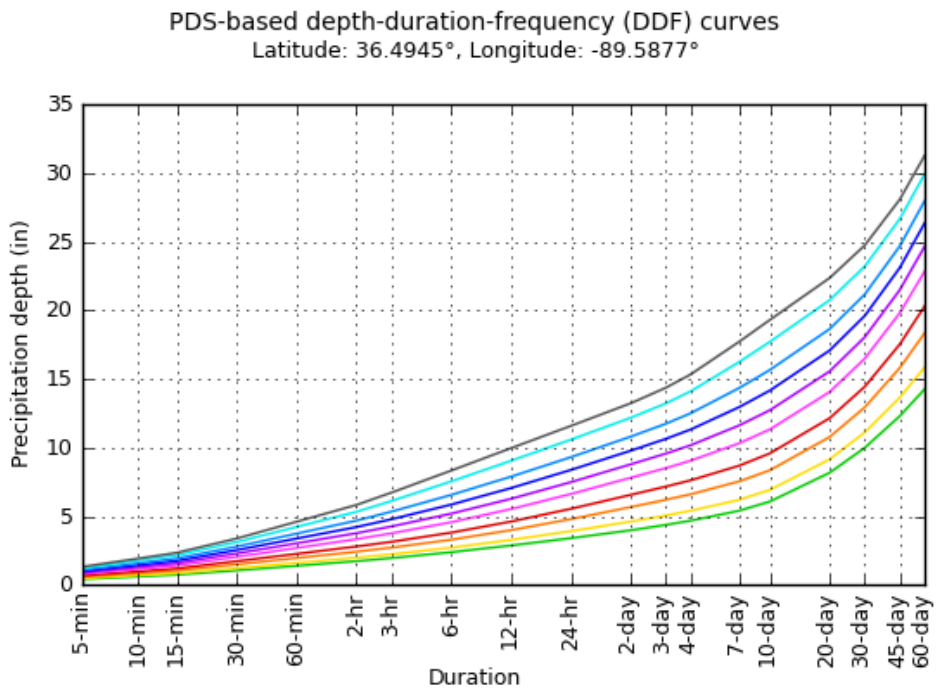
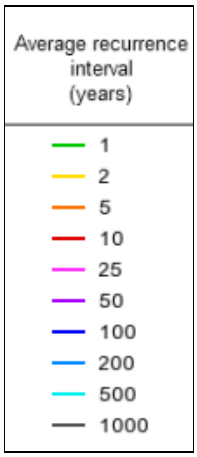
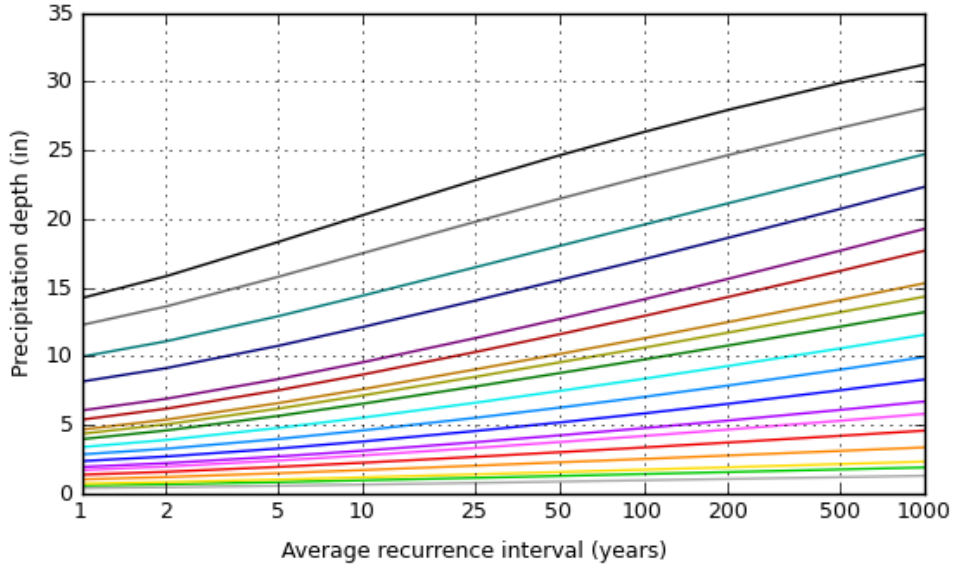
PF graphical







NOAA Atlas 14, Volume 8, Version 2

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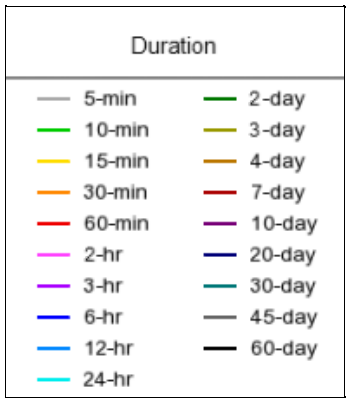

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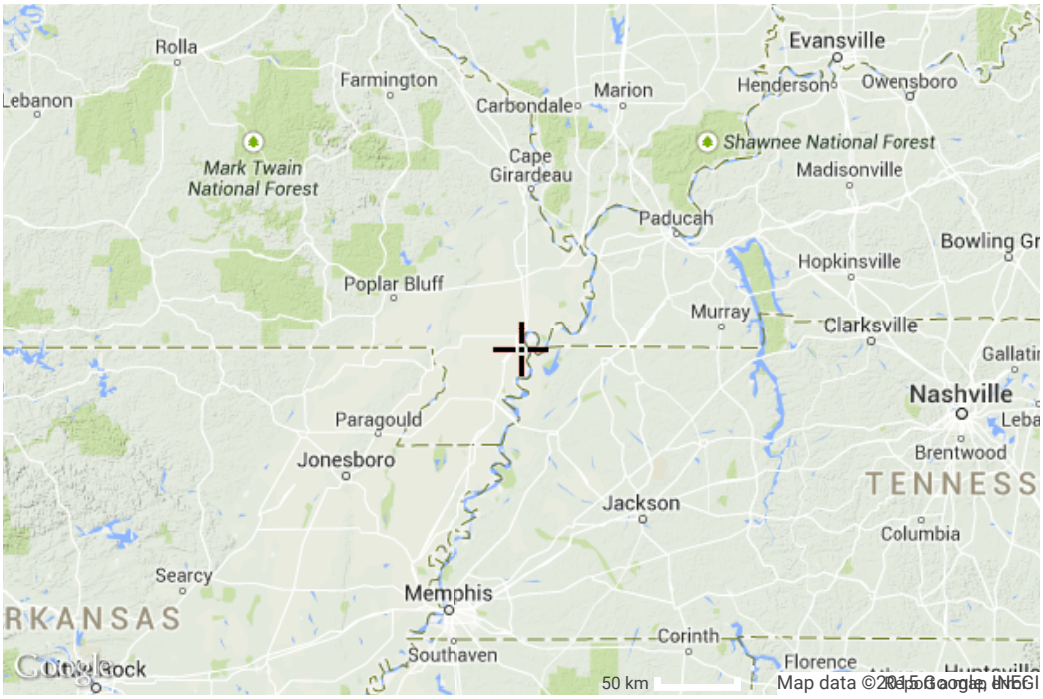
Maps & aerials

Small scale terrain



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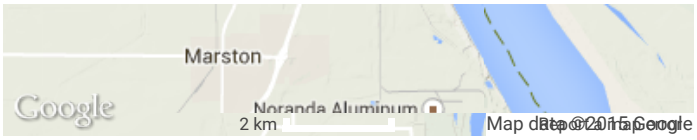

Large scale map

Large scale aerial

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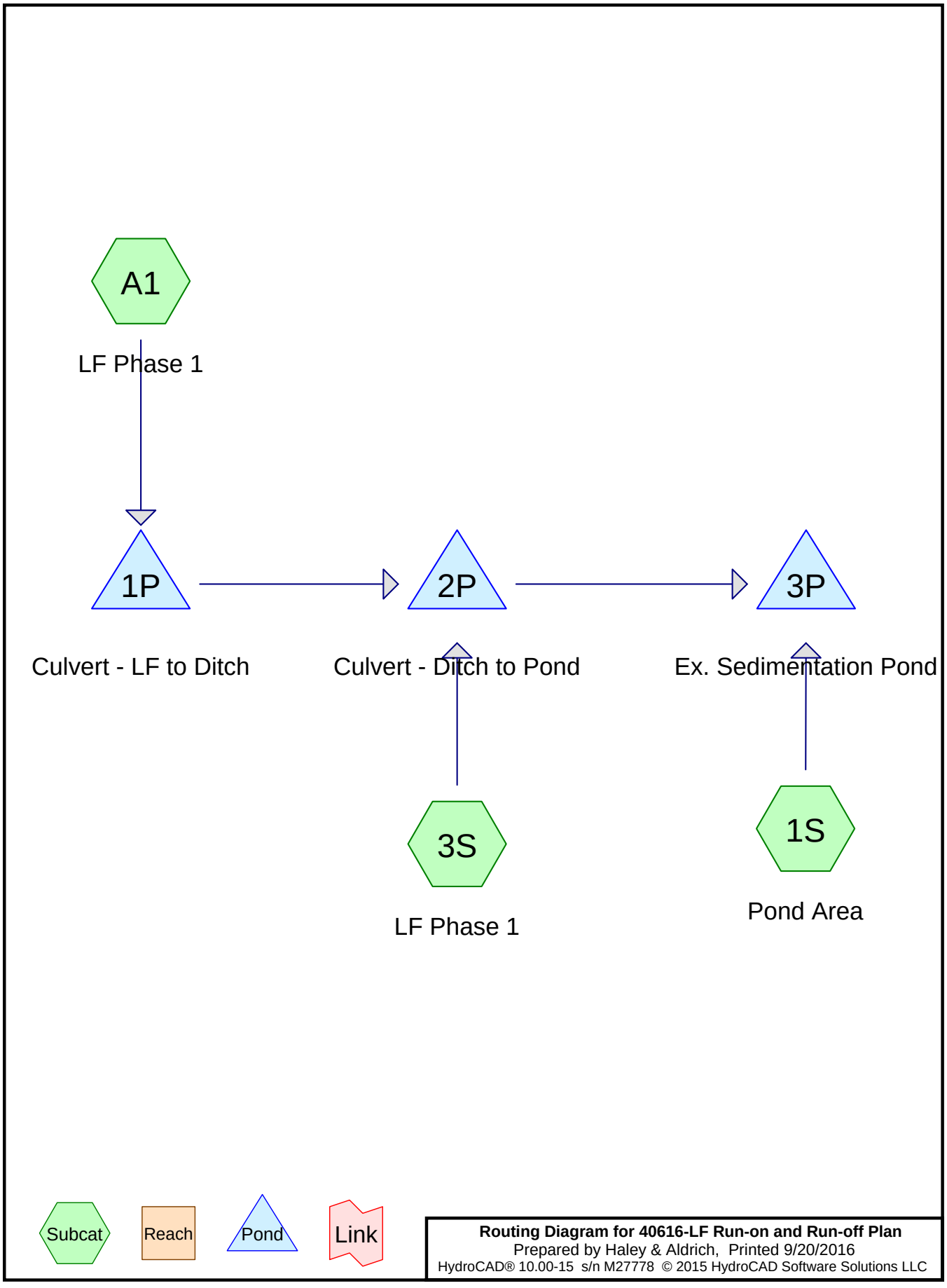
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix B
HydroCAD Results



Routing Diagram for 40616-LF Run-on and Run-off Plan
Prepared by Haley & Aldrich, Printed 9/20/2016

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.618	98	(3S)
25.000	89	(A1)
4.766	98	Water Surface, HSG A (1S)
32.384	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
4.766	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
27.618	Other	3S, A1
32.384		**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	0.000	0.000	0.000	27.618	27.618		3S, A1
4.766	0.000	0.000	0.000	0.000	4.766	Water Surface	1S
4.766	**0.000**	**0.000**	**0.000**	**27.618**	**32.384**	**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	1P	285.10	284.40	96.3	0.0073	0.013	24.0	0.0	0.0
2	2P	284.10	284.00	80.0	0.0013	0.013	24.0	0.0	0.0

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
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 1S: Pond Area Runoff Area=4.766 ac 100.00% Impervious Runoff Depth=6.38"
Tc=0.0 min CN=98 Runoff=53.52 cfs 2.534 af

Subcatchment 3S: LF Phase 1 Runoff Area=2.618 ac 100.00% Impervious Runoff Depth=6.38"
Tc=0.0 min CN=98 Runoff=29.40 cfs 1.392 af

Subcatchment A1: LF Phase 1 Runoff Area=25.000 ac 0.00% Impervious Runoff Depth=5.34"
Flow Length=1,954' Tc=26.7 min CN=89 Runoff=120.93 cfs 11.120 af

Pond 1P: Culvert - LF to Ditch Peak Elev=292.62' Storage=154,800 cf Inflow=120.93 cfs 11.120 af
24.0" Round Culvert n=0.013 L=96.3' S=0.0073 '/' Outflow=26.41 cfs 11.120 af

Pond 2P: Culvert - Ditch to Pond Peak Elev=288.38' Storage=95,302 cf Inflow=47.38 cfs 12.512 af
24.0" Round Culvert n=0.013 L=80.0' S=0.0013 '/' Outflow=21.64 cfs 12.432 af

Pond 3P: Ex. Sedimentation Pond Peak Elev=285.05' Storage=781,897 cf Inflow=66.99 cfs 14.966 af
Outflow=0.98 cfs 2.369 af

Total Runoff Area = 32.384 ac Runoff Volume = 15.047 af Average Runoff Depth = 5.58"
77.20% Pervious = 25.000 ac 22.80% Impervious = 7.384 ac

Summary for Subcatchment 1S: Pond Area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

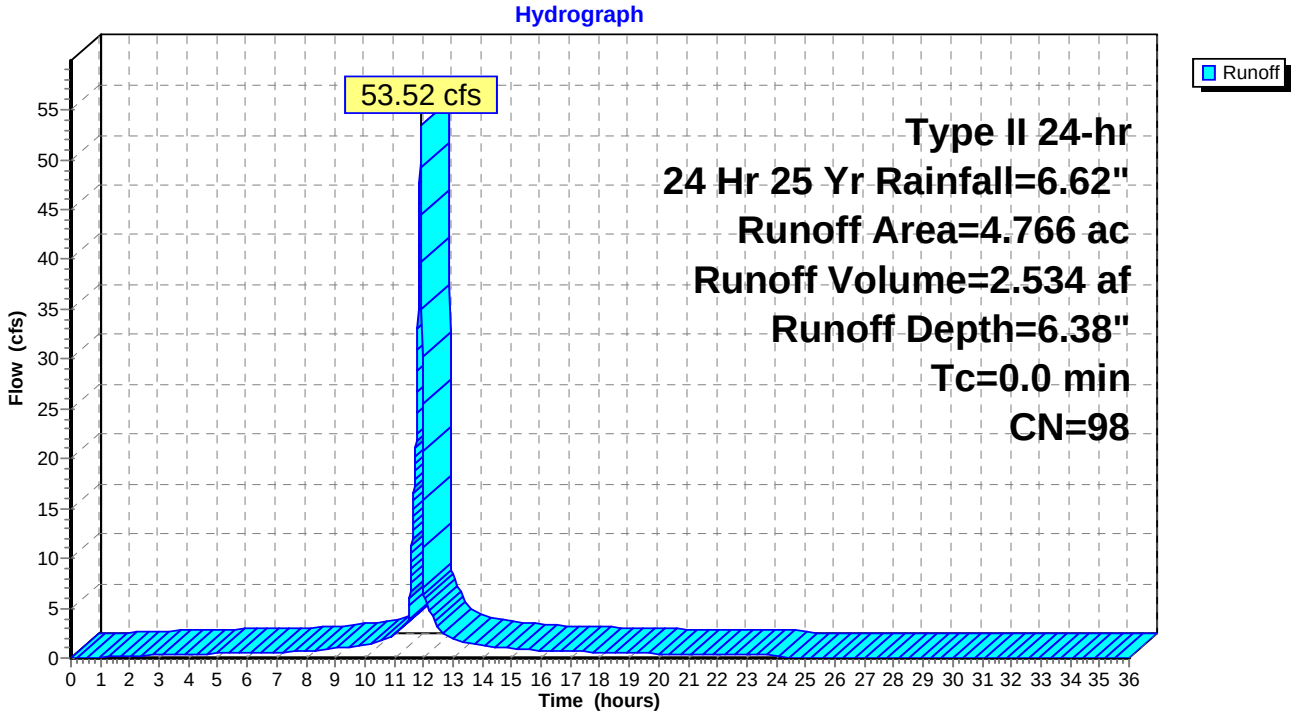
Runoff = 53.52 cfs @ 11.90 hrs, Volume= 2.534 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 24 Hr 25 Yr Rainfall=6.62"

Area (ac)	CN	Description
4.766	98	Water Surface, HSG A
4.766		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 1S: Pond Area



Summary for Subcatchment 3S: LF Phase 1

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

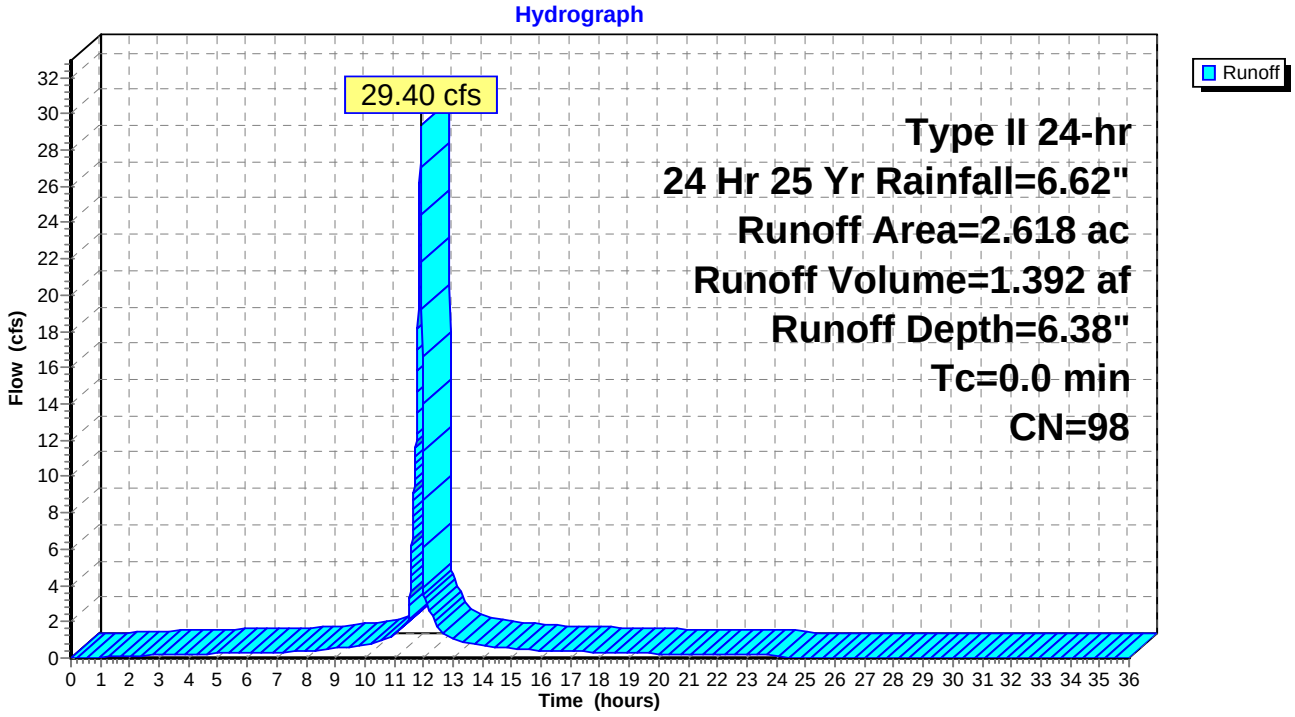
Runoff = 29.40 cfs @ 11.90 hrs, Volume= 1.392 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 24 Hr 25 Yr Rainfall=6.62"

	Area (ac)	CN	Description
*	2.618	98	
	2.618		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry,**

Subcatchment 3S: LF Phase 1



Summary for Subcatchment A1: LF Phase 1

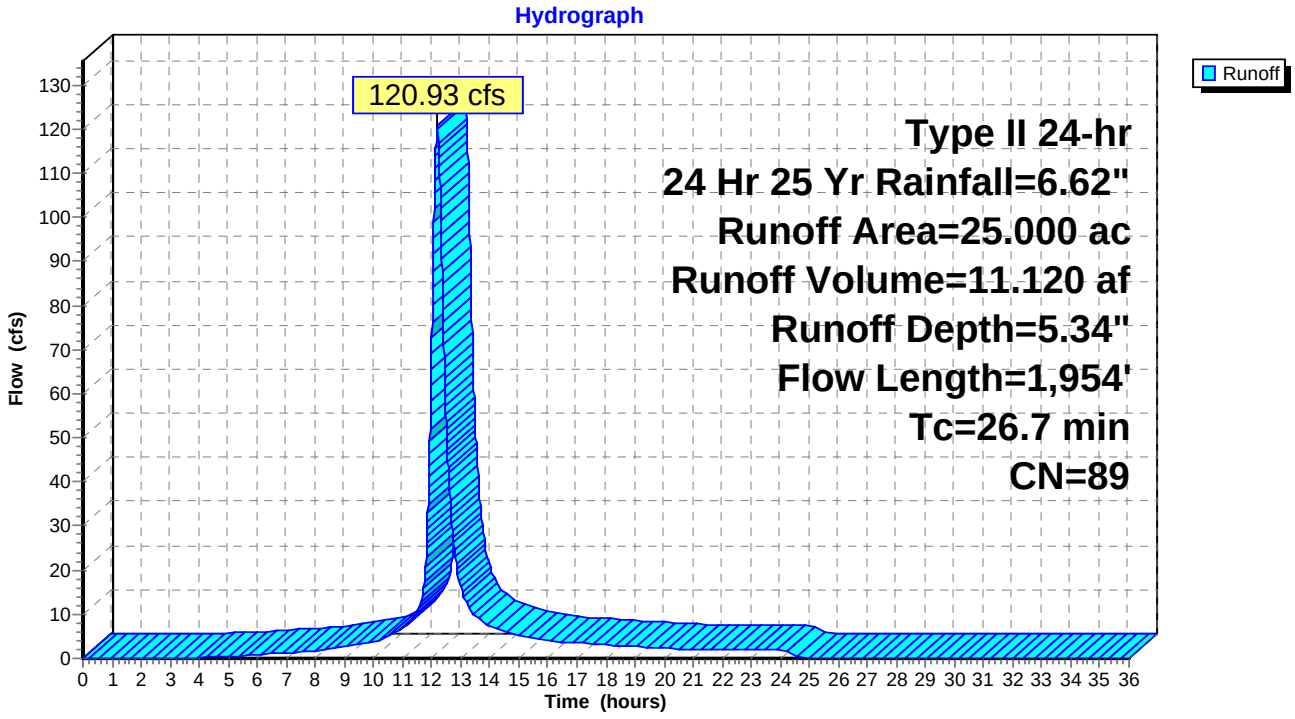
Runoff = 120.93 cfs @ 12.19 hrs, Volume= 11.120 af, Depth= 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type II 24-hr 24 Hr 25 Yr Rainfall=6.62"

	Area (ac)	CN	Description
*	25.000	89	
	25.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.4	214	0.0133	1.51		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.92"
0.5	117	0.1700	3.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.92"
23.8	1,623	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
26.7	1,954	Total			

Subcatchment A1: LF Phase 1



Summary for Pond 1P: Culvert - LF to Ditch

Inflow Area = 25.000 ac, 0.00% Impervious, Inflow Depth = 5.34" for 24 Hr 25 Yr event
Inflow = 120.93 cfs @ 12.19 hrs, Volume= 11.120 af
Outflow = 26.41 cfs @ 12.54 hrs, Volume= 11.120 af, Atten= 78%, Lag= 20.7 min
Primary = 26.41 cfs @ 12.54 hrs, Volume= 11.120 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 292.62' @ 12.75 hrs Surf.Area= 86,465 sf Storage= 154,800 cf

Plug-Flow detention time= 43.3 min calculated for 11.120 af (100% of inflow)
Center-of-Mass det. time= 43.2 min (844.1 - 800.9)

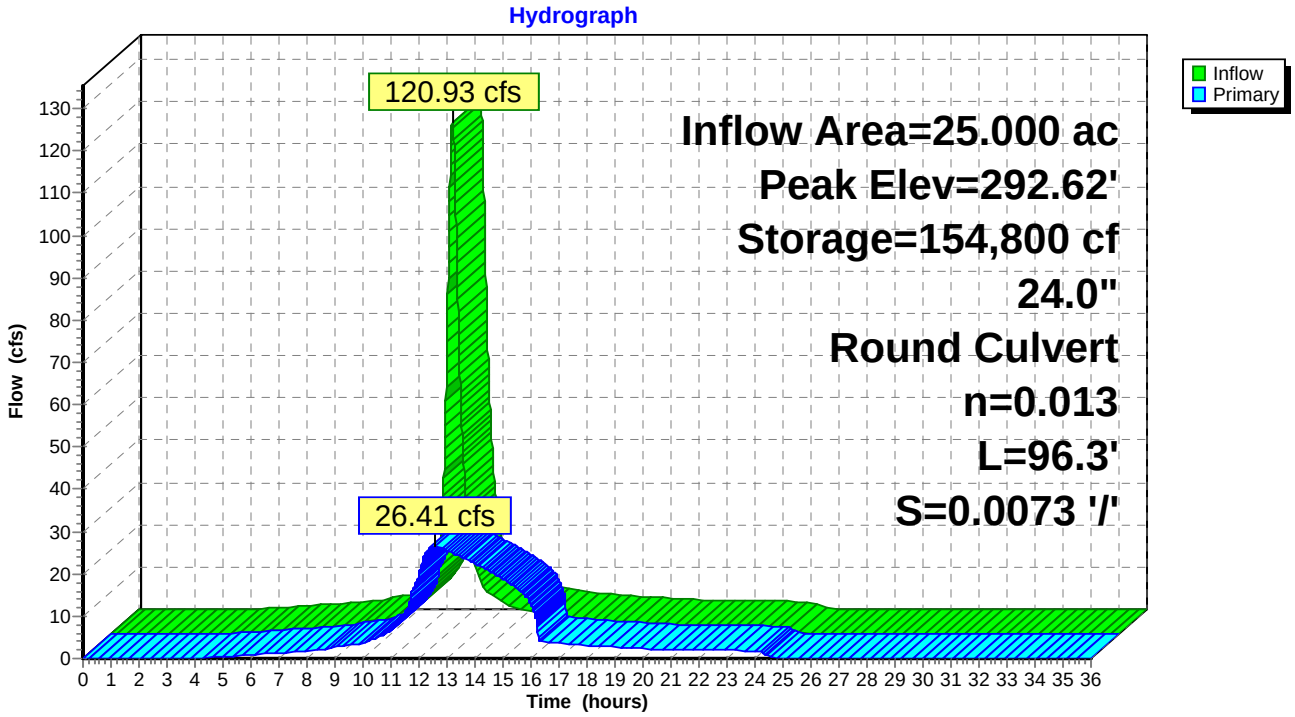
Volume	Invert	Avail.Storage	Storage Description
#1	285.00'	320,463 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
285.00	0	0	0
286.00	63	32	32
287.00	234	149	180
288.00	441	338	518
289.00	8,791	4,616	5,134
290.00	25,092	16,942	22,075
291.00	42,540	33,816	55,891
292.00	62,635	52,588	108,479
293.00	100,988	81,812	190,290
294.00	159,357	130,173	320,463

Device	Routing	Invert	Outlet Devices
#1	Primary	285.10'	**24.0" Round Culvert** L= 96.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 285.10' / 284.40' S= 0.0073 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=26.38 cfs @ 12.54 hrs HW=292.54' TW=287.66' (Dynamic Tailwater)
1=Culvert (Inlet Controls 26.38 cfs @ 8.40 fps)

Pond 1P: Culvert - LF to Ditch



Summary for Pond 2P: Culvert - Ditch to Pond

Inflow Area = 27.618 ac, 9.48% Impervious, Inflow Depth = 5.44" for 24 Hr 25 Yr event
Inflow = 47.38 cfs @ 11.90 hrs, Volume= 12.512 af
Outflow = 21.64 cfs @ 14.40 hrs, Volume= 12.432 af, Atten= 54%, Lag= 149.9 min
Primary = 21.64 cfs @ 14.40 hrs, Volume= 12.432 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 288.38' @ 14.40 hrs Surf.Area= 39,851 sf Storage= 95,302 cf

Plug-Flow detention time= 59.7 min calculated for 12.432 af (99% of inflow)
Center-of-Mass det. time= 55.7 min (887.6 - 831.8)

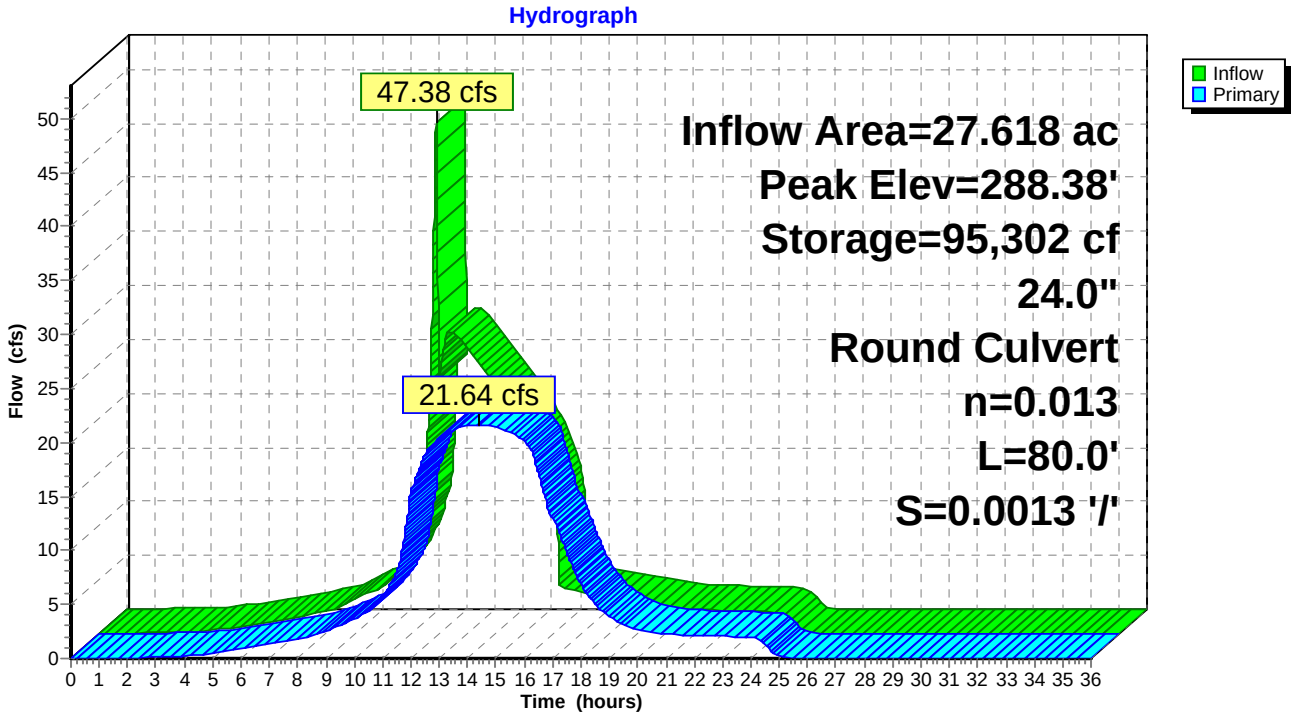
Volume	Invert	Avail.Storage	Storage Description
#1	284.00'	360,959 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
284.00	0	0	0
285.00	10,595	5,298	5,298
286.00	21,636	16,116	21,413
287.00	29,788	25,712	47,125
288.00	37,073	33,431	80,556
289.00	44,319	40,696	121,252
290.00	51,733	48,026	169,278
291.00	59,757	55,745	225,023
292.00	67,956	63,857	288,879
293.00	76,204	72,080	360,959

Device	Routing	Invert	Outlet Devices
#1	Primary	284.10'	**24.0" Round Culvert** L= 80.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 284.10' / 284.00' S= 0.0013 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=21.64 cfs @ 14.40 hrs HW=288.38' TW=283.29' (Dynamic Tailwater)
1=Culvert (Inlet Controls 21.64 cfs @ 6.89 fps)

Pond 2P: Culvert - Ditch to Pond



Summary for Pond 3P: Ex. Sedimentation Pond

Inflow Area = 32.384 ac, 22.80% Impervious, Inflow Depth > 5.55" for 24 Hr 25 Yr event
Inflow = 66.99 cfs @ 11.90 hrs, Volume= 14.966 af
Outflow = 0.98 cfs @ 24.60 hrs, Volume= 2.369 af, Atten= 99%, Lag= 762.1 min
Primary = 0.98 cfs @ 24.60 hrs, Volume= 2.369 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Starting Elev= 281.00' Surf.Area= 133,951 sf Storage= 196,036 cf
Peak Elev= 285.05' @ 24.60 hrs Surf.Area= 157,710 sf Storage= 781,897 cf (585,862 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 417.4 min (1,278.9 - 861.5)

Volume	Invert	Avail.Storage	Storage Description
#1	279.50'	1,263,371 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
279.50	127,449	0	0
280.00	129,597	64,262	64,262
281.00	133,951	131,774	196,036
282.00	138,367	136,159	332,195
283.00	142,847	140,607	472,802
284.00	151,086	146,967	619,768
285.00	157,516	154,301	774,069
286.00	161,415	159,466	933,535
287.00	164,847	163,131	1,096,666
288.00	168,564	166,706	1,263,371

Device	Routing	Invert	Outlet Devices
#1	Primary	281.10'	**Pump** Discharges@307.00' Turns Off@281.00' 6.0" Diam. x 8,413.0' Long Discharge, Hazen-Williams C= 140 Flow (gpm)= 100.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 Head (feet)= 156.00 154.00 150.00 144.00 137.00 122.00 105.00 72.00 -Loss (feet)= 7.65 27.62 58.52 99.70 150.72 211.25 281.04 359.88 =Lift (feet)= 148.35 126.38 91.48 44.30 -13.72 -89.25 -176.04 -287.88

Primary OutFlow Max=0.98 cfs @ 24.60 hrs HW=285.05' (Free Discharge)
1=Pump (Pump Controls 0.98 cfs)

Pond 3P: Ex. Sedimentation Pond