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Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

17 April 2018
File No. 129342-015

SUBJECT: Inflow Design Flood Control System Plan
Inactive Lined Pond
Associated Electric Cooperative, Inc.
New Madrid Power Plant
New Madrid, Missouri

Haley & Aldrich, Inc. (Haley & Aldrich) has developed this Inflow Design Flood (IDF) Control System Plan (Plan) on behalf of Associated Electric Cooperative, Inc. (AECI) for the inactive coal combustion residuals (CCR) surface impoundment referred to as the Inactive Lined Pond (Lined Pond) at the New Madrid Power Plant (NMPP) in New Madrid, Missouri. This has been completed based on requirements of the Environmental Protection Agency (EPA) 40 CFR Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities" (CCR Rule), specifically section §257.82. Based on the USEPA's issued CCR Rule Partial Vacatur in 2016, the Lined Pond impoundment at NMPP is subject to applicable requirements of the CCR Rule. The inactive status of the impoundment is understood to no longer make the unit exempt from several portions of the CCR Rule. The Lined Pond existing conditions and supporting documentation has been reviewed and associated storm water modeling and analysis performed to satisfy the Inflow Design Flood Control System Plan requirements of CCR Rule section §257.82 as described below.

§257.82(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 (a)(2) of this section.

§257.82(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.

The Lined Pond is a surface impoundment with an approximate footprint of 78 acres located south of Pond 003 and constructed in 1994. Access roads run along the perimeter of the pond and the approximate crest elevation is 307 feet msl. The impoundment is located on the east side of the US Army Corps of Engineers levee system of the Mississippi River. Immediately adjacent to the east side of the Lined Pond is the Raw Water Pond that exists as an overflow for high water elevation conditions and was initially intended as a future expansion of the Lined Pond. Since all four sides of the impoundment consist of embankments constructed above natural grades, no overland inflow discharges into the unit.

AECI managed CCR by directing fly ash and process water to the Lined Pond from 1994 to approximately 2007 when the plant converted to dry fly ash handling. The impoundment relied on evaporation as the main source of discharge from the unit, with no primary spillway existing (emergency flows can be diverted to the Raw Water Pond, Pond 003, or the 003 Outfall discharge channel in accordance with the plant NPDES permit). Since the unit has ceased receiving CCRs, process water is no longer discharged into the unit.

§257.82(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.

As previously discussed, the Lined Pond does not have an existing outlet control structure (e.g., primary spillway), and relies on manual pumping and evaporation as the main source of discharge from the pond. Pumped flows are discharged to Pond 003 in accordance with the plant NPDES permit. The majority of the Lined Pond is full and contains an unused area in the southeastern corner that collects runoff. For purposes of this model, it is assumed that the plant operating level of 293 ft msl is maintained and that all routing occurs above that elevation.

Hydrologic and hydraulic modeling for this Lined Pond IDF Control System Plan was performed using HydroCAD Stormwater Modeling System, version 10.00-12 (HydroCAD) in conjunction with the appropriate IDF as dictated by the CCR Rule in section §257.82(a)(3).

When the Lined Pond is maintained at its normal water surface elevation (WSEL) (El. 293.0), the results of the HydroCAD analysis confirm the IDF control system for the Lined Pond adequately manages flow into and from the impoundment during and following the IDF peak storm discharge. The output from the HydroCAD model simulation is provided as **Appendix A** with a summary of results provided in **Table I** below. See **Figure 1** for the Lined Pond existing site plan.

Table I: HydroCAD Output Summary – 1,000-yr Flood

	Normal Operating Conditions
Peak flood level (ft)	300.4
Minimum Dike Elevation	307.0
Minimum freeboard (ft)	6.6
Peak inflow (cfs)	929

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

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;

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;

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; or

iv. For an incised CCR surface impoundment, the 25-year flood.

The Lined Pond was determined to be a significant hazard potential as determined per the Hazard Potential Classification Assessment performed under separate cover; therefore, the design event is the 1,000-year, 24-hour storm. The basis of the determination is discussed in Initial Hazard Potential Classification Assessment for the Lined Pond. The 1,000-year storm characteristics were detailed in the NOAA Atlas 14, Volume 8, Version 2 Point Precipitation Frequency Estimates: TN dated 15 September 2016 and prepared by the National Weather Service. Pertinent pages providing the required information have been provided as **Appendix B**.

§257.82(b): Discharge from the CCR unit must be handled in accordance with the surface water requirements 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 pollutants into 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.

Discharge from the Lined Pond is subject to the Missouri State Operating Permit issued by the Missouri Department of Natural Resources.

§257.82(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 document and all attachments serve as the Initial Inflow Design Flood Control Plan and will be placed in the facility's operating record. Periodic Plans will be prepared and placed in the facility operating record at 5-year increments or whenever there is a change in conditions that would affect the Plan.

§257.82(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.

The IDF Plan will be amended at least 60 days prior to a planned change in the operation of the facility or the CCR impoundment, or no later than 60 days after an unanticipated event requires the need to revise the IDF Plan. If the Plan needs to be revised after closure activities have commenced, the Plan will be revised no later than 30 days following the triggering event.

Any amendments to the Plan will include written certification from a qualified professional engineer that the initial and any amendments to the IDF Plan meet the requirements of the CCR Rule.

A record of amendments to the Plan will be tracked below. The latest version of the IDF Plan will be noted on the front cover of the Plan.

Version	Date	Description of Changes Made
1	17 April 2018	Initial Issuance

§257.82(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.

Per EPA 40 CFR Part 257 – "Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Extension of Compliance Deadlines for Certain Inactive Surface Impoundments; Response to Partial Vacatur" October 17, 2016 deadline is not applicable. See excerpt below:

257.100(e)(4)(ii): No later than April 17, 2018, prepare the initial inflow design flood control system plan as set forth in § 257.82(c).

This Plan has been prepared within the specified timeframe.

ii. *New CCR surface impoundments and any lateral expansion of a CCR surface impoundment. The owner or operator must prepare the initial inflow design flood control system plan no later than the date of initial receipt of CCR in the CCR unit.*

Not Applicable – the Lined Pond is an existing inactive CCR impoundment.

§257.82(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).

This IDF Plan or any subsequent IDF Plan will be assessed and amended whenever there is a change in operation of the CCR impoundment that would substantially affect the IDF Plan or when unanticipated events necessitate a revision of the Plan either before or after closure activities have commenced.

Professional Engineer Certification

§257.82(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.

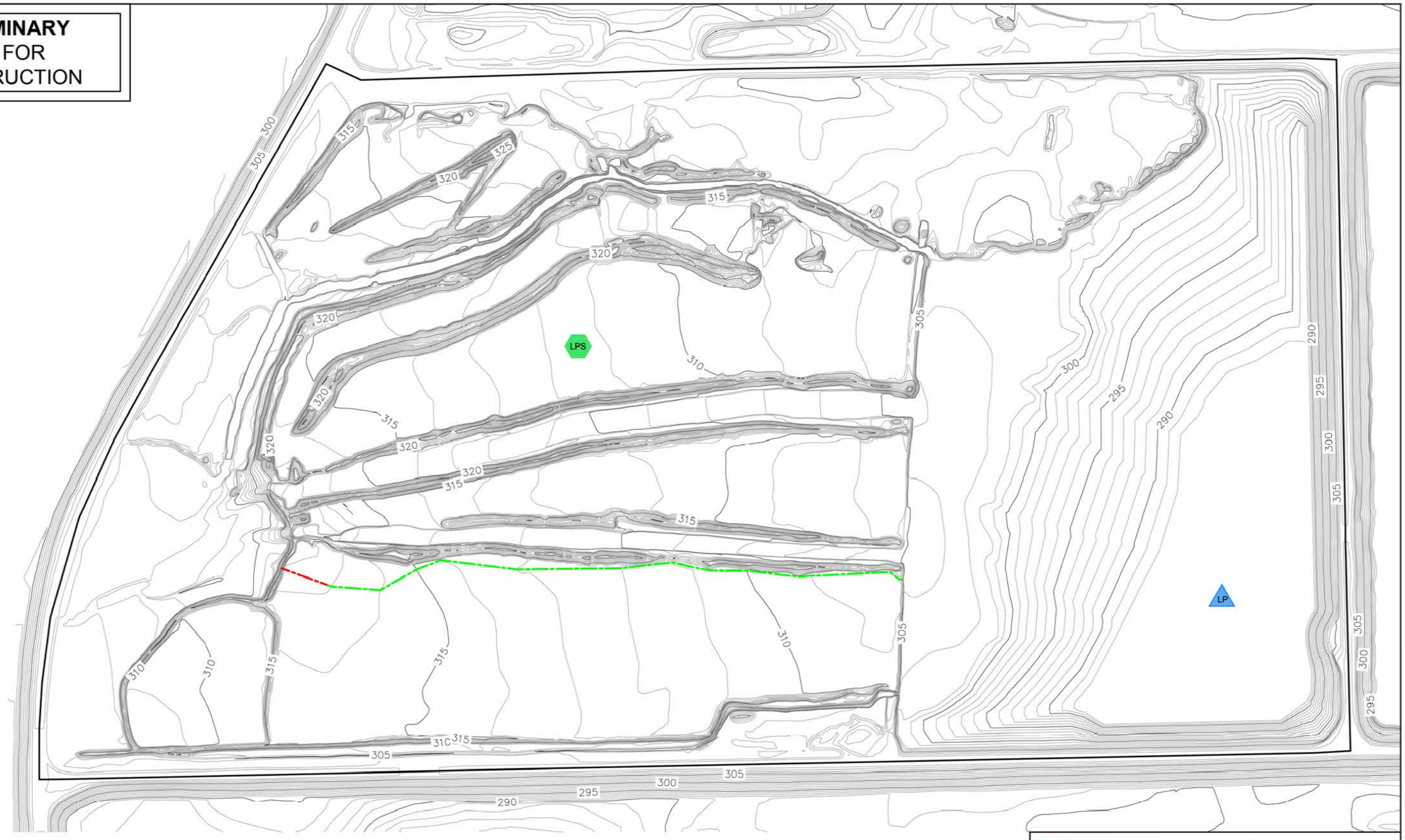
I certify that the design of the flood control system referenced in this Inflow Design Flood Control System Plan for AECI's Inactive Lined Pond at the New Madrid Power Plant meets the USEPA's CCR Rule requirements of §257.82.

Signed: _____
Certifying Engineer

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

Professional Engineer's Seal and date:

PRELIMINARY
NOT FOR
CONSTRUCTION



LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- HYDROCAD SHEET FLOW
- HYDROCAD SHALLOW CONCENTRATED FLOW
- HYDROCAD WATERSHED BOUNDARY
- LPS — HYDROCAD SUBCATCHMENT
- LP — HYDROCAD POND

NOTES

1. EXISTING TOPOGRAPHY BASED ON LIDAR DATA RECEIVED FROM AECI CONDUCTED BY PICTOMETRY INTERNATIONAL CORP. AERIAL SURVEY CONDUCTED BETWEEN 4-8 OCTOBER 2014. COMBINED WITH EDGE OF LINED POND WATER SURVEY POINTS TAKEN IN SEPTEMBER 2017.

N

0 200 400
SCALE IN FEET

HALEY ALDRICH

AECI, NEW MADRID POWER PLANT
MARSTON, MISSOURI

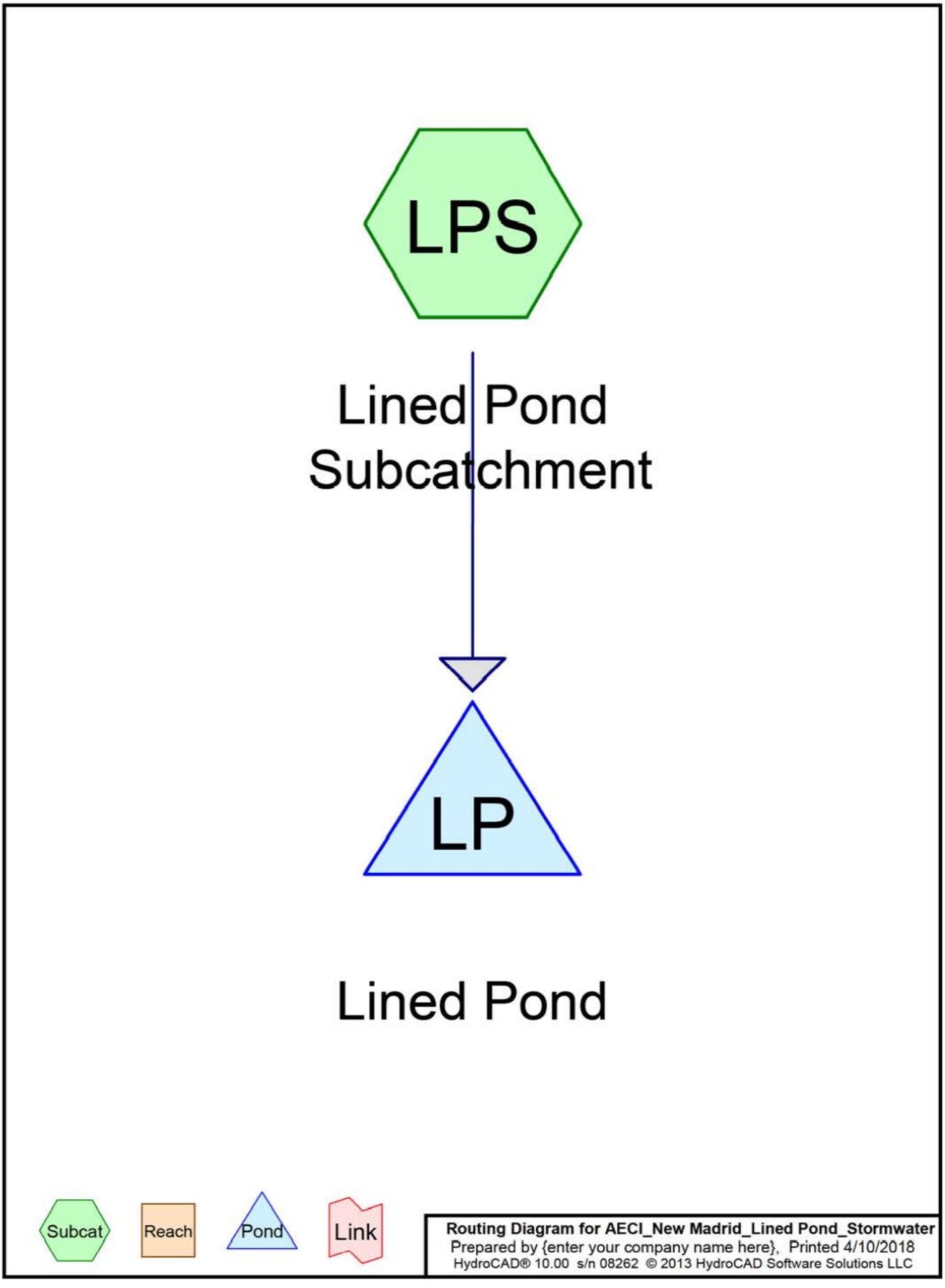
LINED POND
INFLOW FLOOD CONTROL PLAN
EXISTING CONDITIONS DRAINAGE

SCALE: AS SHOWN
APRIL 2018

FIGURE 1

LUCAS, ANDY Printed: 4/9/2018 12:23 PM Layout: ISO
\\HALEYALDRICH.COM\SHARE\CLE_COMMON\PROJECTS\129342_AECI-NMPP\-015_LINED POND CCR COMPLIANCE\INFLOW FLOOD CONTROL PLAN\CALCULATIONS\REFERENCE DOCUMENTS\129342_AECI_NMPP_LINED POND_STORMWATER.DWG

Appendix A



Routing Diagram for AECI_New Madrid_Lined Pond_Stormwater
Prepared by {enter your company name here}, Printed 4/10/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
80.819	93	Urban industrial, 72% imp, HSG D (LPS)
26.315	98	Water Surface, HSG A (LPS)
107.134	**94**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
26.315	HSG A	LPS
0.000	HSG B	
0.000	HSG C	
80.819	HSG D	LPS
0.000	Other	
107.134		**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	80.819	0.000	80.819	Urban industrial, 72% imp	LPS
26.315	0.000	0.000	0.000	0.000	26.315	Water Surface	LPS
26.315	**0.000**	**0.000**	**80.819**	**0.000**	**107.134**	**TOTAL AREA**	

Time span=0.00-144.00 hrs, dt=0.01 hrs, 14401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment LPS: Lined Pond Runoff Area=4,666,755 sf 78.88% Impervious Runoff Depth=10.87"
Flow Length=1,314' Tc=29.5 min CN=94 Runoff=929.00 cfs 97.025 af

Pond LP: Lined Pond Peak Elev=300.36' Storage=5,882,319 cf Inflow=929.00 cfs 97.025 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 107.134 ac Runoff Volume = 97.025 af Average Runoff Depth = 10.87"
21.12% Pervious = 22.629 ac 78.88% Impervious = 84.505 ac

Summary for Subcatchment LPS: Lined Pond Subcatchment

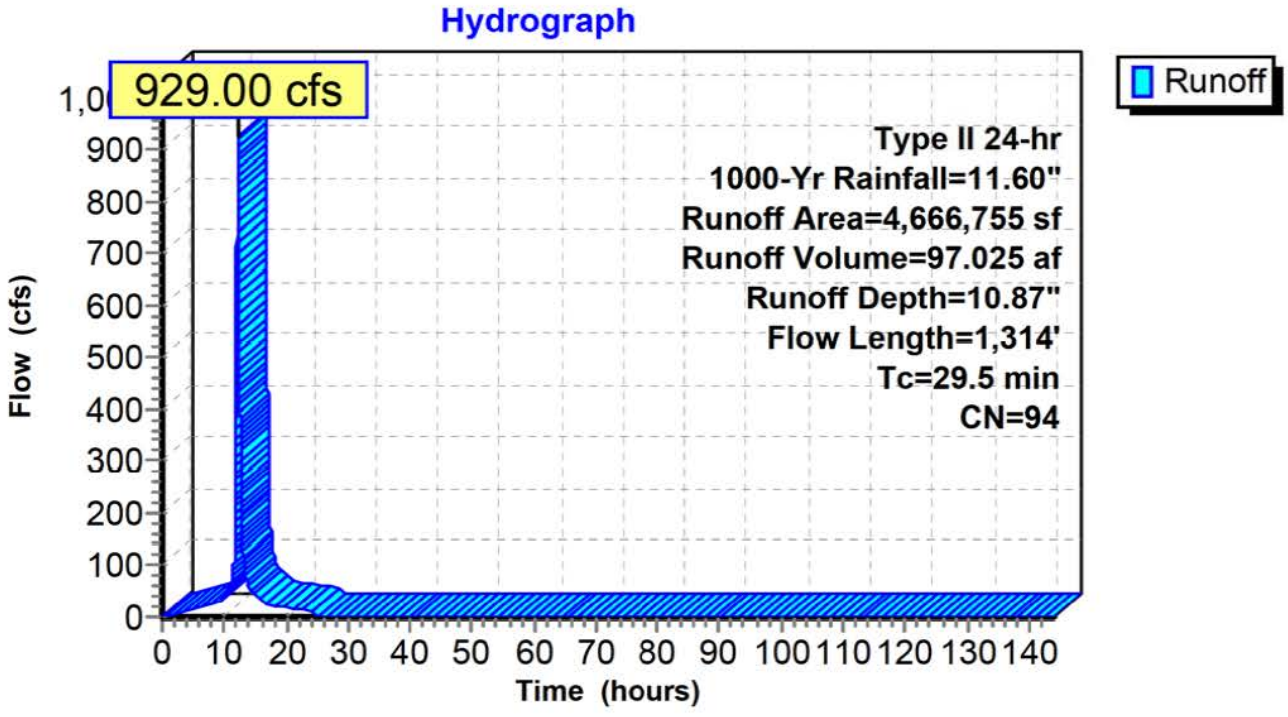
Runoff = 929.00 cfs @ 12.22 hrs, Volume= 97.025 af, Depth=10.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs
Type II 24-hr 1000-Yr Rainfall=11.60"

Area (sf)	CN	Description
1,146,263	98	Water Surface, HSG A
3,520,492	93	Urban industrial, 72% imp, HSG D
4,666,755	94	Weighted Average
985,738		21.12% Pervious Area
3,681,017		78.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0388	0.20		**Sheet Flow, Sheet** Grass: Short n= 0.150 P2= 2.56"
21.1	1,214	0.0092	0.96		**Shallow Concentrated Flow, Shallow Concentrated** Nearly Bare & Untilled Kv= 10.0 fps
29.5	1,314	Total			

Subcatchment LPS: Lined Pond Subcatchment



Summary for Pond LP: Lined Pond

Inflow Area = 107.134 ac, 78.88% Impervious, Inflow Depth = 10.87" for 1000-Yr event
Inflow = 929.00 cfs @ 12.22 hrs, Volume= 97.025 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-144.00 hrs, dt= 0.01 hrs
Starting Elev= 293.00' Surf.Area= 424,429 sf Storage= 1,656,068 cf
Peak Elev= 300.36' @ 25.71 hrs Surf.Area= 727,596 sf Storage= 5,882,319 cf (4,226,251 cf above start)

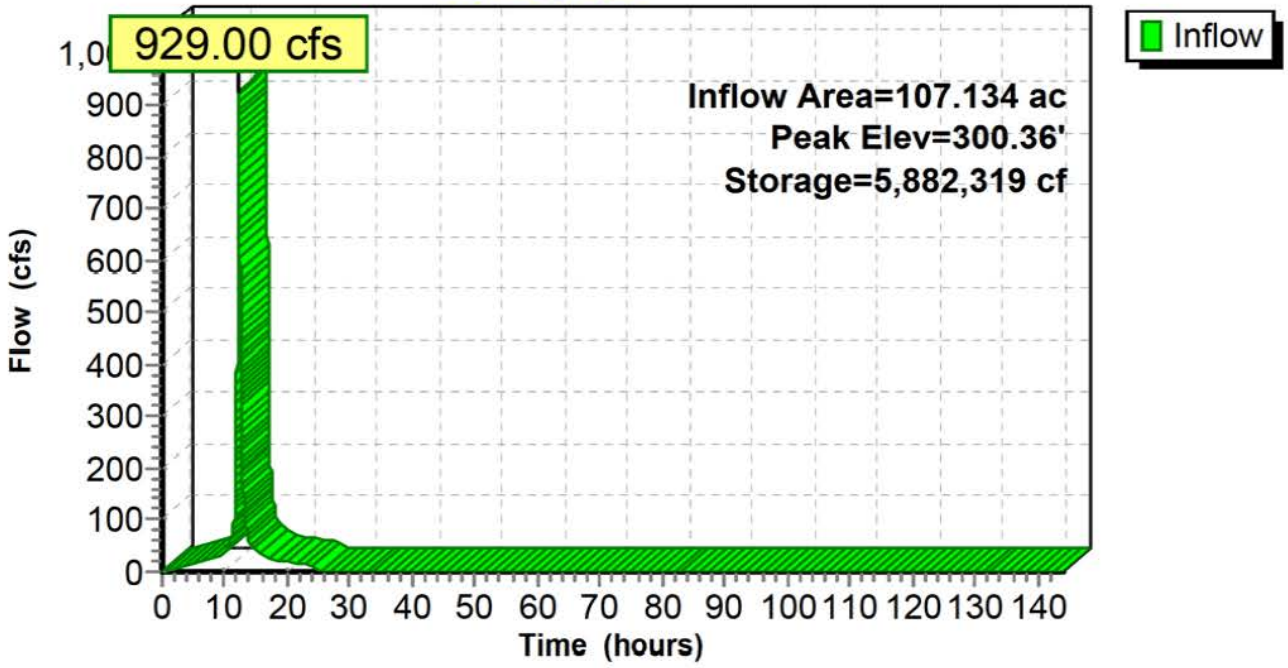
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	288.00'	11,079,072 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
288.00	241,153	0	0
289.00	276,448	258,801	258,801
290.00	312,100	294,274	553,075
291.00	348,660	330,380	883,455
292.00	386,069	367,365	1,250,819
293.00	424,429	405,249	1,656,068
294.00	463,699	444,064	2,100,132
295.00	503,858	483,779	2,583,911
296.00	544,919	524,389	3,108,299
297.00	586,640	565,780	3,674,079
298.00	628,400	607,520	4,281,599
299.00	670,161	649,281	4,930,879
300.00	712,226	691,194	5,622,073
301.00	754,743	733,485	6,355,557
302.00	801,753	778,248	7,133,805
303.00	906,277	854,015	7,987,820
304.00	1,001,549	953,913	8,941,733
305.00	1,063,433	1,032,491	9,974,224
306.00	1,146,263	1,104,848	11,079,072

Pond LP: Lined Pond

Hydrograph



Appendix B

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

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: TN

Data description

Data type: Precipitation depth | Units: English | Time series type: Partial duration

Select location

1) Manually:

a) By location

Decimal degrees | Degrees, decimal minutes | Degrees, minutes, seconds

Latitude: 36.5072° N Longitude: -89.5571° E Submit

b) By station

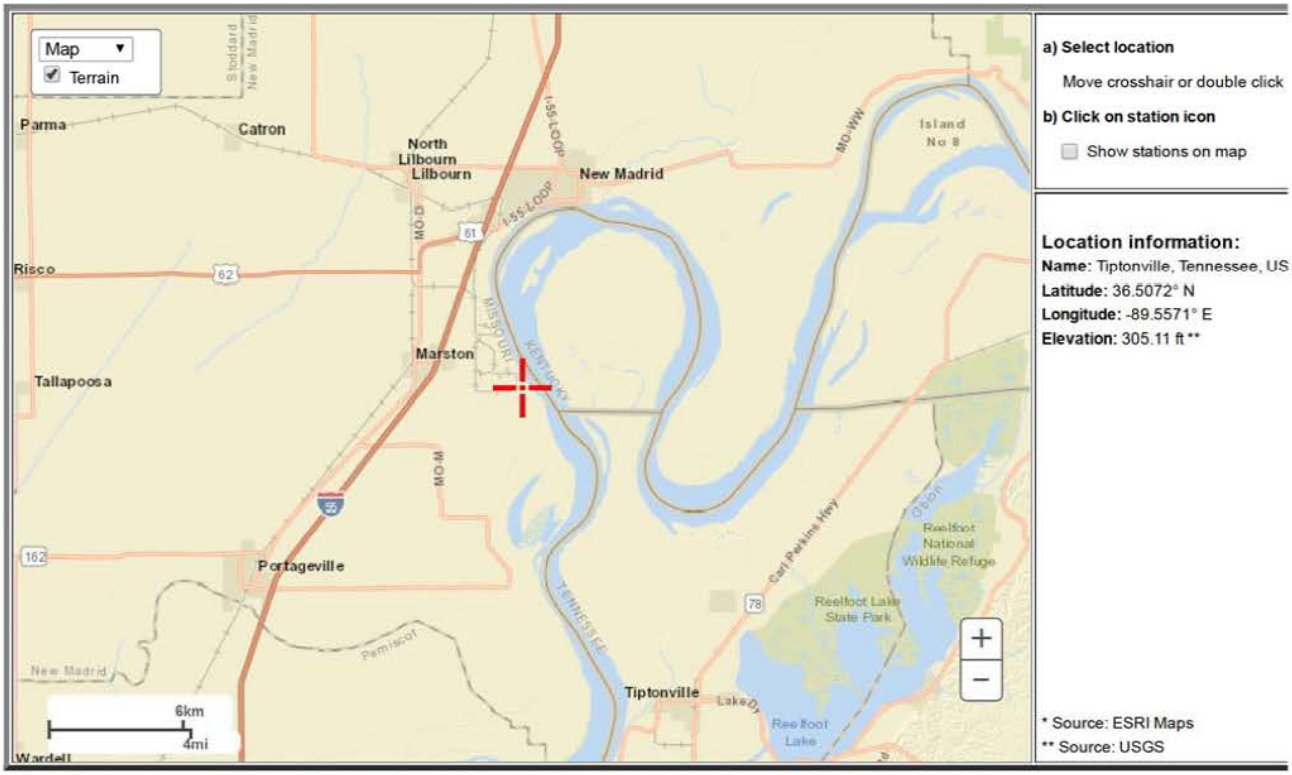
Click here for a list of stations used in frequency analysis for TN:

Select station

c) By address

Search

2) Use map:



POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 8, Version 2

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	**0.411** (0.330-0.515)	**0.476** (0.382-0.596)	**0.581** (0.465-0.730)	**0.669** (0.533-0.843)	**0.792** (0.611-1.02)	**0.886** (0.670-1.15)	**0.982** (0.719-1.30)	**1.08** (0.761-1.45)	**1.21** (0.823-1.66)	**1.31** (0.870-1.82)
10-min	**0.602** (0.484-0.754)	**0.696** (0.559-0.873)	**0.851** (0.681-1.07)	**0.980** (0.780-1.23)	**1.16** (0.894-1.49)	**1.30** (0.981-1.69)	**1.44** (1.05-1.90)	**1.58** (1.11-2.13)	**1.77** (1.21-2.43)	**1.92** (1.27-2.66)
15-min	**0.735** (0.590-0.920)	**0.849** (0.681-1.06)	**1.04** (0.830-1.30)	**1.20** (0.951-1.50)	**1.41** (1.09-1.82)	**1.58** (1.20-2.06)	**1.75** (1.28-2.32)	**1.93** (1.36-2.59)	**2.16** (1.47-2.96)	**2.33** (1.55-3.24)

30-min	**1.05** (0.846-1.32)	**1.22** (0.981-1.53)	**1.50** (1.20-1.88)	**1.73** (1.38-2.18)	**2.05** (1.58-2.63)	**2.29** (1.73-2.98)	**2.54** (1.86-3.35)	**2.79** (1.97-3.75)	**3.12** (2.13-4.28)	**3.37** (2.25-4.68)
60-min	**1.39** (1.12-1.74)	**1.61** (1.29-2.01)	**1.96** (1.57-2.46)	**2.27** (1.80-2.85)	**2.69** (2.08-3.48)	**3.03** (2.29-3.95)	**3.38** (2.48-4.47)	**3.73** (2.64-5.04)	**4.22** (2.88-5.80)	**4.59** (3.05-6.38)
2-hr	**1.73** (1.41-2.14)	**1.99** (1.61-2.46)	**2.43** (1.97-3.01)	**2.81** (2.26-3.49)	**3.34** (2.62-4.27)	**3.77** (2.89-4.86)	**4.22** (3.13-5.52)	**4.68** (3.35-6.25)	**5.31** (3.67-7.23)	**5.81** (3.91-7.98)
3-hr	**1.96** (1.60-2.40)	**2.24** (1.83-2.75)	**2.73** (2.22-3.35)	**3.15** (2.56-3.89)	**3.77** (2.98-4.78)	**4.26** (3.29-5.46)	**4.78** (3.58-6.24)	**5.33** (3.85-7.09)	**6.09** (4.24-8.26)	**6.69** (4.54-9.14)
6-hr	**2.39** (1.98-2.90)	**2.72** (2.25-3.30)	**3.31** (2.73-4.02)	**3.82** (3.14-4.66)	**4.58** (3.67-5.75)	**5.20** (4.07-6.59)	**5.85** (4.44-7.54)	**6.54** (4.78-8.61)	**7.51** (5.29-10.1)	**8.29** (5.68-11.2)
12-hr	**2.88** (2.42-3.44)	**3.29** (2.76-3.94)	**4.00** (3.34-4.80)	**4.62** (3.84-5.56)	**5.53** (4.48-6.86)	**6.27** (4.97-7.84)	**7.05** (5.41-8.97)	**7.87** (5.81-10.2)	**9.01** (6.42-11.9)	**9.92** (6.88-13.3)
24-hr	**3.41** (2.90-4.03)	**3.93** (3.33-4.64)	**4.80** (4.06-5.68)	**5.55** (4.67-6.59)	**6.63** (5.42-8.09)	**7.49** (5.99-9.23)	**8.37** (6.50-10.5)	**9.30** (6.94-11.9)	**10.6** (7.61-13.8)	**11.6** (8.12-15.3)
2-day	**3.98** (3.43-4.64)	**4.62** (3.97-5.39)	**5.68** (4.87-6.64)	**6.58** (5.60-7.70)	**7.83** (6.47-9.40)	**8.81** (7.13-10.7)	**9.80** (7.68-12.1)	**10.8** (8.17-13.7)	**12.2** (8.88-15.7)	**13.3** (9.42-17.3)
3-day	**4.38** (3.79-5.05)	**5.07** (4.38-5.86)	**6.21** (5.36-7.20)	**7.18** (6.16-8.34)	**8.53** (7.10-10.2)	**9.59** (7.81-11.6)	**10.7** (8.42-13.1)	**11.8** (8.94-14.8)	**13.3** (9.72-17.0)	**14.4** (10.3-18.7)
4-day	**4.68** (4.08-5.38)	**5.41** (4.71-6.21)	**6.61** (5.74-7.62)	**7.63** (6.59-8.82)	**9.07** (7.59-10.8)	**10.2** (8.36-12.2)	**11.3** (9.01-13.9)	**12.5** (9.58-15.7)	**14.1** (10.4-18.1)	**15.4** (11.1-19.9)
7-day	**5.41** (4.76-6.14)	**6.21** (5.46-7.06)	**7.55** (6.62-8.61)	**8.71** (7.59-9.95)	**10.3** (8.77-12.2)	**11.6** (9.65-13.8)	**13.0** (10.4-15.7)	**14.4** (11.1-17.8)	**16.3** (12.1-20.6)	**17.8** (12.9-22.7)
10-day	**6.08** (5.39-6.86)	**6.93** (6.14-7.83)	**8.37** (7.39-9.47)	**9.61** (8.43-10.9)	**11.4** (9.70-13.3)	**12.8** (10.7-15.1)	**14.2** (11.5-17.1)	**15.7** (12.2-19.3)	**17.8** (13.3-22.3)	**19.4** (14.2-24.6)
20-day	**8.19** (7.35-9.10)	**9.17** (8.23-10.2)	**10.8** (9.66-12.0)	**12.2** (10.8-13.6)	**14.1** (12.2-16.2)	**15.6** (13.2-18.1)	**17.1** (14.0-20.3)	**18.7** (14.7-22.7)	**20.8** (15.8-25.8)	**22.4** (16.6-28.2)
30-day	**10.0** (9.05-11.0)	**11.1** (10.1-12.3)	**13.0** (11.7-14.3)	**14.5** (13.0-16.1)	**16.5** (14.3-18.7)	**18.1** (15.4-20.8)	**19.6** (16.2-23.0)	**21.2** (16.8-25.5)	**23.2** (17.8-28.6)	**24.8** (18.5-31.0)
45-day	**12.3** (11.2-13.5)	**13.7** (12.5-15.0)	**15.8** (14.4-17.4)	**17.6** (15.9-19.3)	**19.8** (17.3-22.3)	**21.5** (18.4-24.5)	**23.1** (19.2-26.9)	**24.7** (19.7-29.4)	**26.7** (20.5-32.5)	**28.1** (21.1-34.9)
60-day	**14.3** (13.1-15.5)	**15.9** (14.6-17.3)	**18.4** (16.8-20.0)	**20.3** (18.5-22.3)	**22.9** (20.0-25.4)	**24.7** (21.2-27.9)	**26.4** (22.0-30.4)	**28.0** (22.4-33.1)	**30.0** (23.1-36.2)	**31.3** (23.7-38.7)

[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.

Estimates from the table in CSV format: Precipitation frequency estimates ▼ Submit

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