Recycle Ponds Inflow Design Flood Control System Plan

Independence Steam Electric Station
Newark, Independence County, Arkansas

October 2018
Revised October 2021

Prepared For:

Entergy Arkansas, LLC
Independence Plant
555 Point Ferry Road
Newark, Arkansas 72562

Prepared By:

TRC
8550 United Plaza Blvd
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Baton Rouge, Louisiana 70809

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Senior Engineer

Jason House
Project Manager

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APPENDICES

Revision History

Revision Number	Revision Date	Section Revised	Summary of Revisions
0	10/24/2018		Initial issue.
1	10/12/2021	1 through 6	Updated text and figures for five-year periodic revision.

1.0 Introduction

Entergy Arkansas, LLC (Entergy) operates the Independence Steam Electric Station (Plant). The purpose of this Inflow Design Flood Control System Plan (Plan) is to present the flood control features of the two Recycle Ponds, East and West (Ponds), as required by the United States Environmental Protection Agency's (USEPA) final coal combustion residual (CCR) rule Title 40 Code of Federal Regulations (40 CFR) Part 257 Subpart D - "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments." The requirements for Inflow Design Flood Control System Plans for surface impoundments are presented in 40 CFR § 257.82. The initial Inflow Design Flood Control System Plan was developed in October 2018 (TRC) and placed in the Plant's operating record. The periodic inflow design flood control system plan revisions are required every 5 years pursuant to 40 CFR § 257.82(c)(4).

This Plan is revised based on review of the initial Plan, review of design documents, and a site visit by TRC to observe existing conditions.

1.1 Documents Reviewed

To develop this plan the following documents were reviewed by TRC:

- Initial Inflow Design Flood Control System Plan (TRC, 2018)
- Entergy's Independence Steam Electric Station Bottom Ash Work Plan. Document SD - 1204.05A. Rev 2. November 10, 2008.
- Outfall Locations and Drainage Plan developed by Woodward Clyde Consultants, File No. 92T156C-A106. Rev 1. August 23, 2016.
- Topographic Survey performed by B&F Engineering, Inc. October 4, 2018.
  - Recycle Ponds Plan View. Drawings EX 1 and EX 2
- Notice of Intent to Initiate Closure of the West Recycle Pond
- Notice of Intent to Initiate Closure of the East Recycle Pond

1.2 Existing Conditions

The Plant is located at 555 Point Ferry Rd, Newark, Independence County, Arkansas (Figure 1). The Ponds are located on the southern side of the Plant. The East and West Ponds have an approximate surface area of 7.0 acres each. The Ponds operated with a typical water level elevation of approximately 235 feet (ft) North American Vertical Datum of 1988 (NAVD88). The top of berm elevation ranges between elevation 238 ft and 239 ft NAVD 88. Topography surrounding the immediate vicinity of the Ponds is generally flat-lying, with existing ground surface elevations ranging from approximately 235 to 239 ft NAVD88. Natural topography in the vicinity of the ponds is relatively flat to gently sloping.

Water contained in the Ponds is part of the Plant's bottom ash transport system. There are storm water swales around the Ponds to control storm water and limit the volume of run-on. The natural ground beyond the ponds gently slopes to the southwest. A topographic survey completed by

B&F Engineering, Inc. in October 2018 confirmed the elevations of the top of ground surface surrounding the ponds and the other surrounding areas.

Closure of West and East Ponds was initiated in August 2020 and February 2021, respectively. The closure plan for the Ponds indicates that closure will be performed by dewatering, removal of the CCR, and grading the former Pond area so that stormwater is not impounded. At the time of the site visit, the Ponds had been dewatered and removal of CCR was in progress.

2.0 Inflow Design Flood Control

40 CFR § 257.82 specifies requirements for hydrologic and hydraulic capacity of CCR units. The purpose of this report is to demonstrate the hydrologic and hydraulic capacity of the Ponds meet the requirement of the CCR Rule. Per ERM's Report, the Ponds are incised, therefore, a hazard potential classification is not needed per 40 CFR § 257.73(a). Based on the incised potential classification, the CCR surface impoundment unit must adequately manage flow into the unit during and following the peak discharge of the 25-year flood (40 CFR § 257.82(a)(3)(iv)).

The Ponds were designed and utilized as part of the Plant's bottom ash transport water system. The design meets the requirements of 40 CFR § 257.82(a)(1), (2) and (3), which states:

(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.

(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.

(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 1000-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;

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

The Flood Insurance Rate Map (Federal Emergency Management Agency, 2010) indicates that the Ponds are located in an area mapped in Zone A of the special flood hazard areas subject to inundation by the 1 percent annual chance flood, refer to Appendix A. Figures 1 and 2 show the extents of the 100-year flood plain. Zone A is an area on the Flood Insurance Rate Map where the base flood elevation has not been determined. Therefore, to estimate the elevation of the 25-year flood for this Plan, an interpolation was performed using the nearest upstream and downstream locations where the flood elevations had been determined in the Flood Insurance Study (Federal Emergency Management Agency, 2012). This estimate resulted in a 25-year flood elevation of approximately elevation 235 in the vicinity of the Ponds. Based on this result and the survey information, the Ponds are assumed to be above the elevation of the 25-year flood; therefore, a dedicated system to control flood waters is not required. The Ponds have been designed with inflow features presented in the sections below to mitigate and control stormwater inflows during a 25-year storm event.

In addition to the flood control requirements above, 40 CFR § 257.82(b) addresses discharges:

- *Discharge from the CCR unit must be handled in accordance with the surface water requirements under 40 CFR §257.3-3.*

The Ponds were designed and utilized as part of the Plant's bottom ash transport water system and comply with the requirements of 40 CFR § 257.82(b). Water discharges from the Plant are permitted through the Arkansas Department of Environmental Quality (ADEQ) for the National Pollutant Discharge Elimination System (NPDES).

2.1 Recycle Ponds Operation

The Ponds are utilized as part of the Plant's bottom ash transport water system. Site infrastructure enables the Ponds to be operated either singularly, in parallel, or in series. The Ponds can be drained via pumps in a pump house located between the ponds with a 30-inch intake pipe from each pond. The Ponds were designed to operate with two feet of freeboard height difference from the top of the surrounding ground surface to the design water level. In the event that both Ponds reach capacity, overflow from the Ponds flows through a culvert and ditch located in the northwest corner of the West Pond. The ditch discharges to the surge pond which is permitted to receive discharge from the Ponds in accordance with the NPDES permit.

The following control measures are implemented during operation to control the water levels in the Ponds:

- Operate pumps as needed to control the pond water levels.
- Regularly check and maintain grades surrounding the ponds to minimize the area contributing to storm water run-on.

2.2 Run-On Control System

As designed, the Ponds meet the requirement to control the storm water run-on from a 25-year, 24-hour storm event based upon the Precipitation Frequency Estimates from the National Oceanic and Atmospheric Administration. The perimeter berm surrounding the ponds reduces the run-on volume during precipitation events. The stormwater run-on volume calculated for the design storm was compared to the storage capacity above the Ponds design operating elevation. The evaluation determined that there is sufficient capacity in the Ponds when operating with two feet of freeboard to accept run-on volume from a 25-year, 24-hour storm event, refer to Appendix B.

2.3 Pumping Capacity

The pump station is equipped with six (three per unit) Gould single stage centrifugal pumps with a rated pumping capacity of 2,750 gallons per minute (gpm) at 307 feet of head in the LP Ash Water Pump house. A calculation was performed to determine the length of time required to remove the anticipated run-on due to a 25-year, 24-hour storm event, refer to Appendix B. The calculation was performed assuming only two operational pumps and resulted in a required time of 10 hours, or approximately 0.5 days, to remove the anticipated storm water run-on collected in both Ponds. This calculation shows that pumping rates are sufficient in controlling water levels in the Ponds. The peak discharge from the Ponds is dependent on the pump capacity which is controlled by the Plant.

2.4 Conclusions

The Ponds meet the requirements of 40 CFR § 257.82 of adequately controlling the inflows and outflows of peak discharge at the Plant for the following reasons:

- The Ponds are located above the 25-year flood elevation.
- The Ponds were adequately designed to manage precipitation from a 25-year, 24-hour storm event.
- The pumping rates are sufficient to manage the water levels in the Ponds in a controlled manner.
- The discharge from the Ponds is permitted under a NPDES permit which was issued in accordance with the provisions of the Federal Clean Water Act.

3.0 Notifications

In accordance with 40 CFR § 257.105(g), Entergy will post to the Plant's Facility Operating Record (FOR) the revised Inflow Design Flood Control System Plan. The Director of the ADEQ will be notified when documents are available as per 40 CFR § 257.106(g), and notices and documents will be placed on Entergy's CCR website consistent with 40 CFR § 257.107(g).

4.0 Amendment and Periodic Plan Revision

In accordance with 40 CFR § 257.82(c)(2), Entergy may amend this Inflow Design Flood Control System Plan at any time. Specifically, Entergy will amend the inflow design flood control system plan whenever there is a change in the operation of the CCR unit that would substantially affect the written plan in effect.

A periodic inflow design flood control system plan must also be prepared every 5 years from the completion date of this plan.

5.0 References

B&F Engineering, Inc. 2018. Topographic Survey: Independence Recycle Ponds Entergy Arkansas. October 4, 2018. Drawing.

ERM. 2018. Summary of Site Visit and Review of CCR Structural Integrity Criteria Requirements for Entergy Independence Steam Electric Station (ISES) Recycle Pond. October 2018.

Federal Emergency Management Agency. 2010. Flood Insurance Rate Map: Independence County, Arkansas and Incorporated Areas. Panel 400 of 550. Map Number 05063C0400D. Effective Date March 17, 2010. National Flood Insurance Program. Washington, D.C.

Federal Emergency Management Agency. 2012. Flood Insurance Study: Independence County, Arkansas and Incorporated Areas. Flood Insurance Study Number 05063CV000B. Revised March 15, 2012. United States Department of Homeland Security. Washington, D.C.

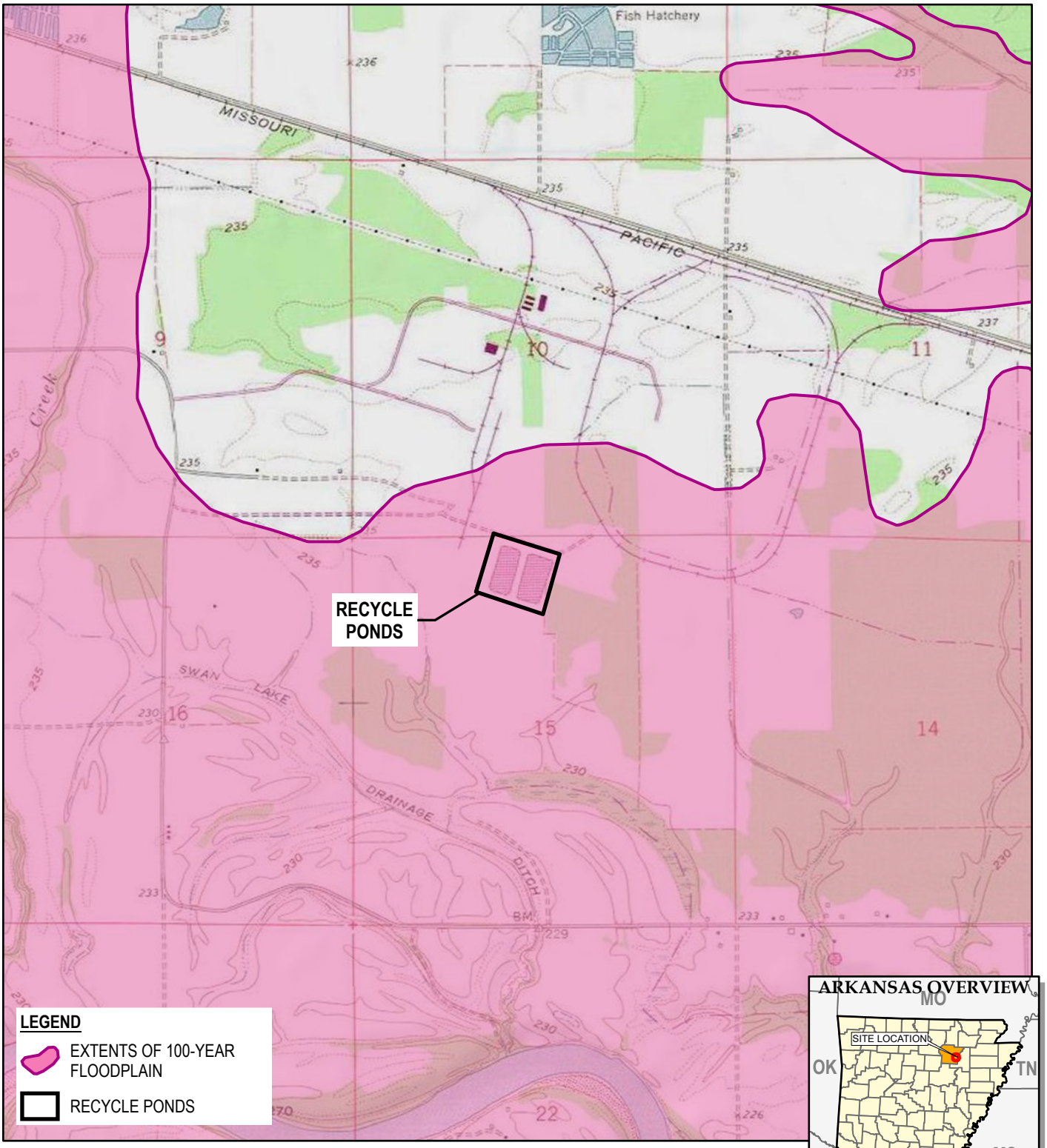
TRC. 2018. Recycle Ponds - Initial Inflow Flood Control System Plan: Independence Steam Electric Station, Newark, Independence County, Arkansas. October 2018.

6.0 Certification

I, the undersigned Arkansas Professional Engineer, hereby certify that I am familiar with the technical requirements of 40 CFR § 257.82. I also certify that it is my professional opinion that, to the best of my knowledge, information, and belief, that the information in this inflow design flood control system plan is in accordance with current good and accepted engineering practice(s) and standard(s) and meets the technical requirements of 40 CFR § 257.82(c).

For the purpose of this document, "certify" and "certification" shall be interpreted and construed to be a "statement of professional opinion." The certification is understood and intended to be an expression of my professional opinion as an Arkansas Licensed Professional Engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be or a warranty of the analysis herein.

Michael J. Amstadt, P.E.	14474
Name	Engineer License Number
Michael Amstadt — Digitally signed by Michael Amstadt Date: 2021.10.12 13:41:17 -05'00'	10/12/2021
Signature of Professional Engineer	Date



BASE MAP FROM USA TOPO MAPS; NATIONAL GEOGRAPHIC SOCIETY, i-cubed 2013
FLOOD DATA ACQUIRED FROM FEMA NATIONAL FLOOD HAZARD LAYER (NFHL).

N

1" = 2,000 '
1:24,000

0 2,000 4,000 FEET

TRC

8550 United Plaza
Suite 502
Baton Rouge, LA 70809
Phone: 225.216.7483

TRC - GIS

PROJECT:
ENTERGY INDEPENDENCE STEAM ELECTRIC STATION
RECYCLE PONDS
NEWARK, INDEPENDENCE COUNTY, ARKANSAS

TITLE:
INFLOW DESIGN
FLOOD CONTROL SYSTEM PLAN
SITE LOCATION MAP

DRAWN BY:	B. TRACY
CHECKED BY:	S. EDWARDS
APPROVED BY:	J. HOTSTREAM
DATE:	OCTOBER 2021
PROJ. NO.:	419735
FILE:	419735_Independence.mxd

FIGURE 1

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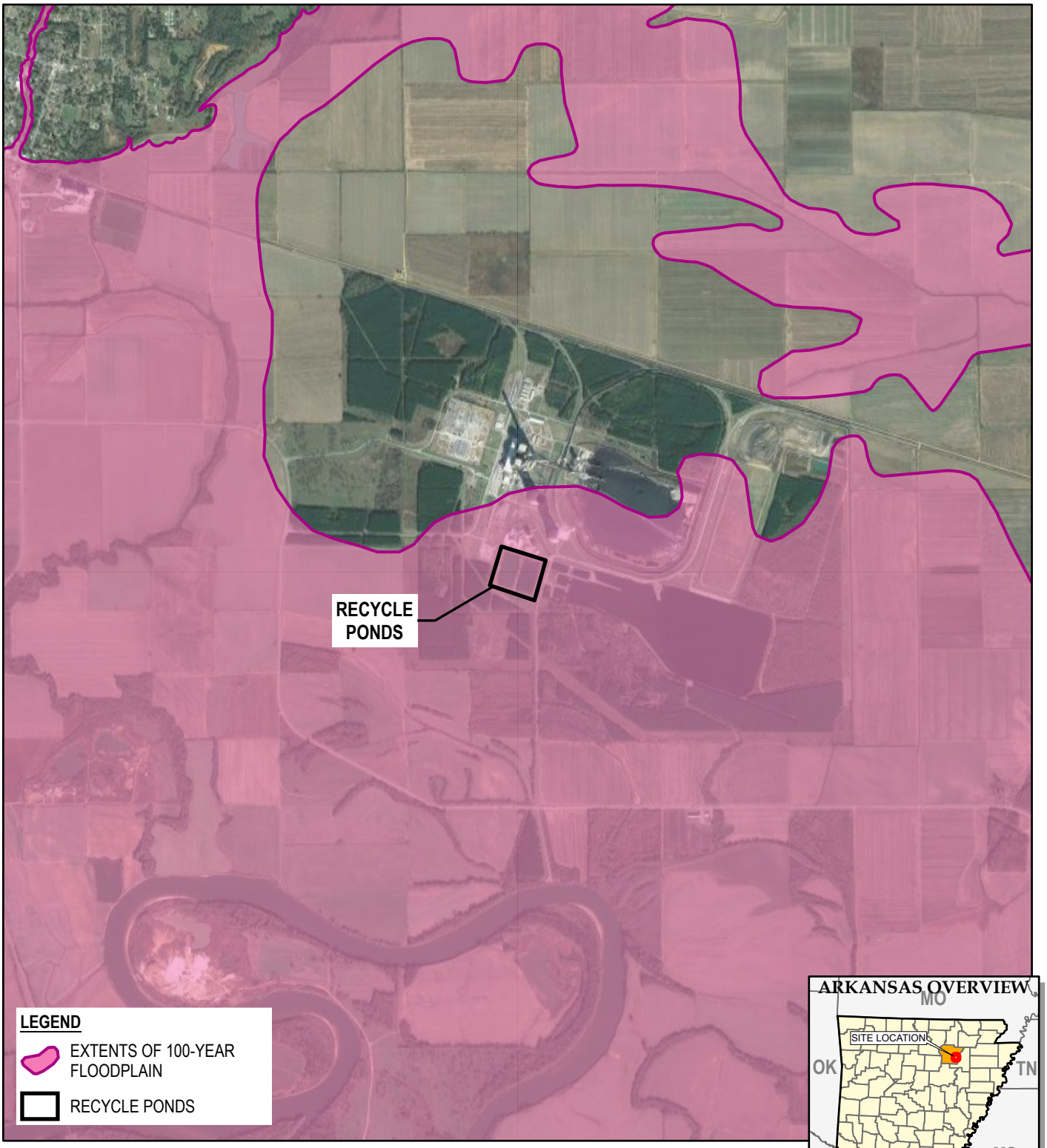

BASE MAP FROM GOOGLE SATELLITE, 2021
FLOOD DATA ACQUIRED FROM FEMA NATIONAL FLOOD HAZARD LAYER (NFHL).

N

1" = 3,000 '
1:36,000

0 3,000 6,000
FEET

TRC

8550 United Plaza
Suite 502
Baton Rouge, LA 70809
Phone: 225.216.7483

TRC - GIS

PROJECT:
ENTERGY INDEPENDENCE STEAM ELECTRIC STATION
RECYCLE PONDS
NEWARK, INDEPENDENCE COUNTY, ARKANSAS

TITLE:
INFLOW DESIGN
FLOOD CONTROL SYSTEM PLAN
SITE DETAIL

DRAWN BY:	B. TRACY
CHECKED BY:	S. EDWARDS
APPROVED BY:	J. HOTSTREAM
DATE:	OCTOBER 2021
PROJ. NO.:	419735
FILE:	419735_Independence.mxd

FIGURE 2

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Appendix A: Flood Information

- Flood Insurance Rate Map
- 25-Year Flood Elevation Estimate

Flood Insurance Rate Map

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Arkansas State Plane north zone (FIPSZONE 0301). The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on the FIRM was provided in digital format by the Arkansas Geographic Information Office, 2007.

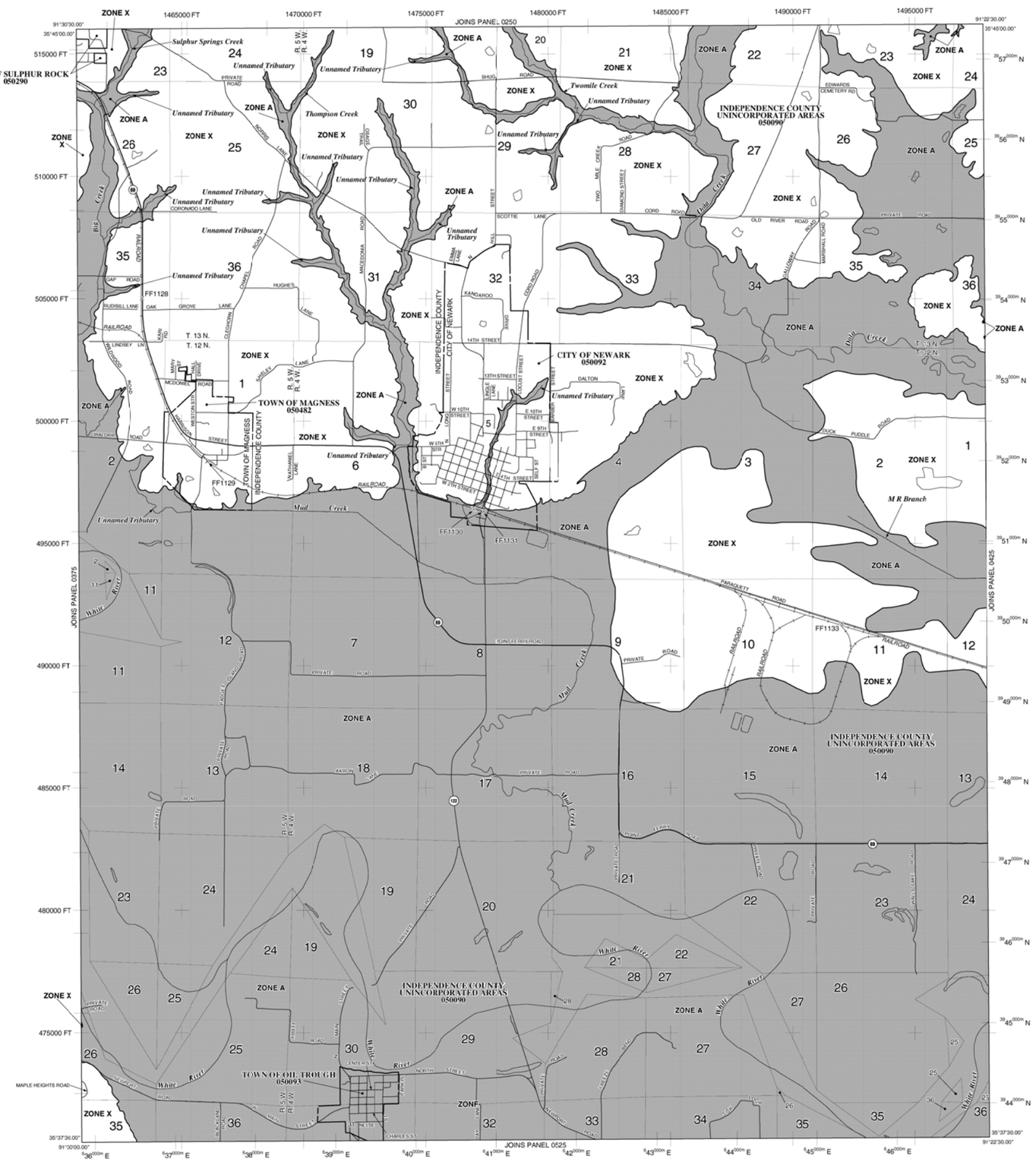
This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data* may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de- annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1- 800- 358- 9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1- 800- 358- 9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1- 877- FEMA MAP** (1- 877- 336- 2627) or visit the FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275 000m N — 1000-meter Universal Transverse Mercator grid ticks, zone 15
- 6000000 FT — 5000-foot grid ticks: Arkansas State Plane coordinate system, north zone (FIPSZONE 0301), Lambert Conformal Conic
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
March 17, 2010
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1- 800- 638- 6620.

MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
600 0 600 1200 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0400D

FIRM
FLOOD INSURANCE RATE MAP

INDEPENDENCE COUNTY, ARKANSAS
AND INCORPORATED AREAS

PANEL 400 OF 550
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
INDEPENDENCE COUNTY	050090	0400	D
MAGNESS, TOWN OF	050482	0400	D
NEWARK, CITY OF	050092	0400	D
OIL TROUGH, TOWN OF	050093	0400	D
SULPHUR ROCK, TOWN OF	050290	0400	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
05063C0400D

EFFECTIVE DATE
MARCH 17, 2010

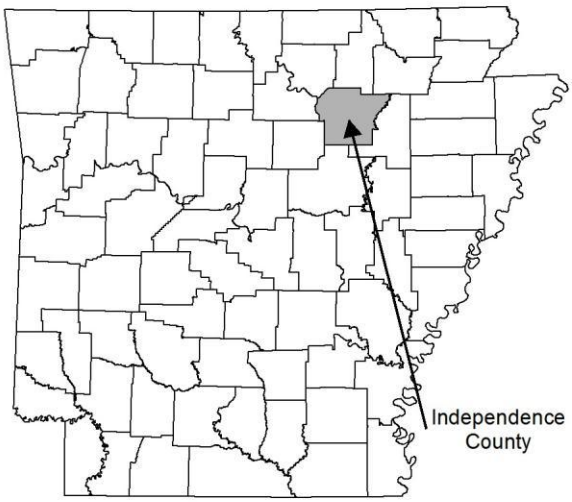
Federal Emergency Management Agency

25-Year Flood Elevation Estimate

FLOOD INSURANCE STUDY

INDEPENDENCE COUNTY, ARKANSAS
AND INCORPORATED AREAS

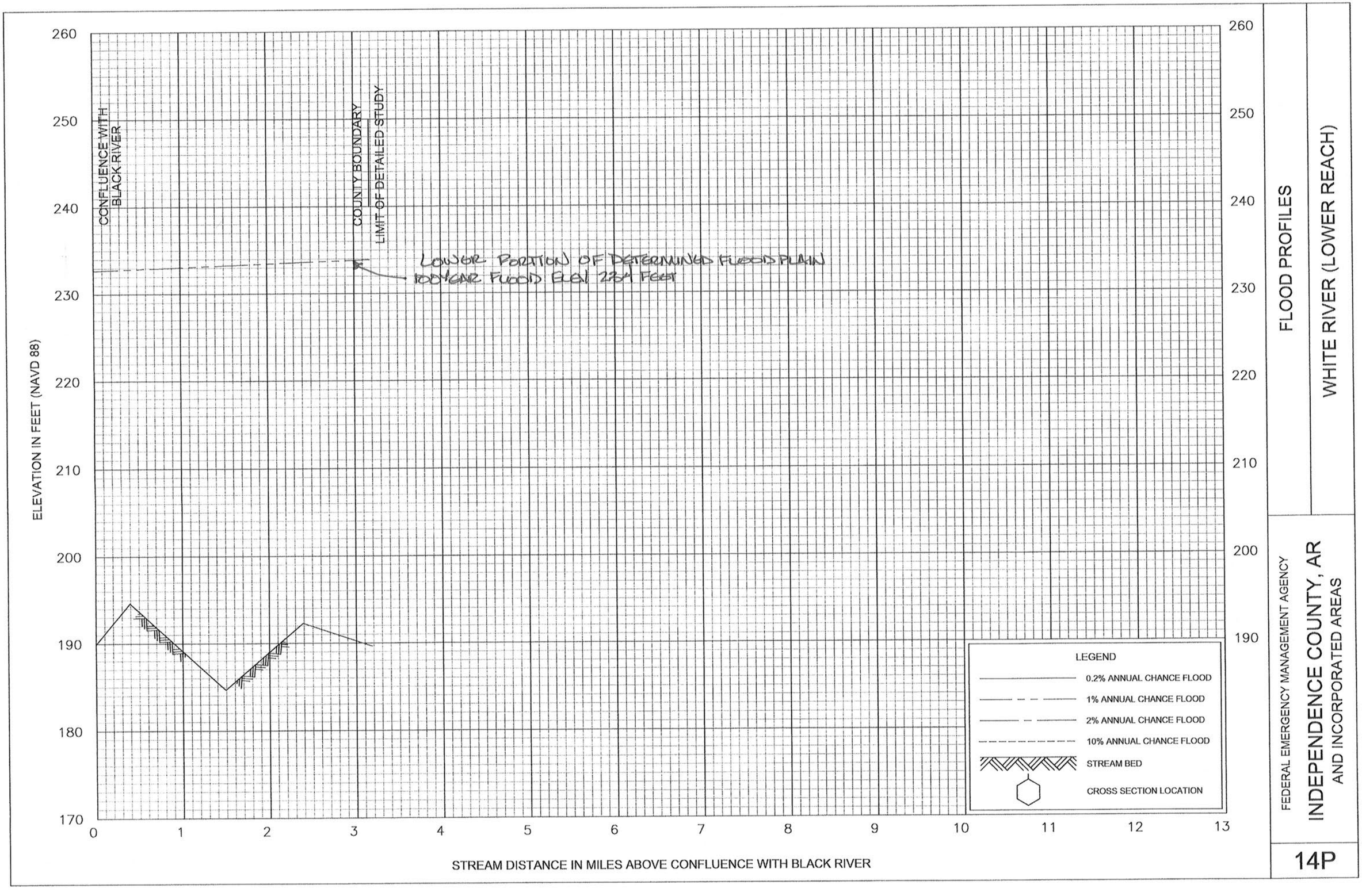
Community Name	Community Number
BATESVILLE, CITY OF	050091
CAVE CITY, CITY OF	050313
CUSHMAN, TOWN OF	050403
MAGNESS, TOWN OF	050482
MOOREFIELD, TOWN OF	050483
NEWARK, CITY OF	050092
OIL TROUGH, TOWN OF	050093
PLEASANT PLAINS, TOWN OF	050484
SULPHUR ROCK, TOWN OF	050290
INDEPENDENCE COUNTY (UNINCORPORATED AREAS)	050090



REVISED: March 15, 2012

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
05063CV000B

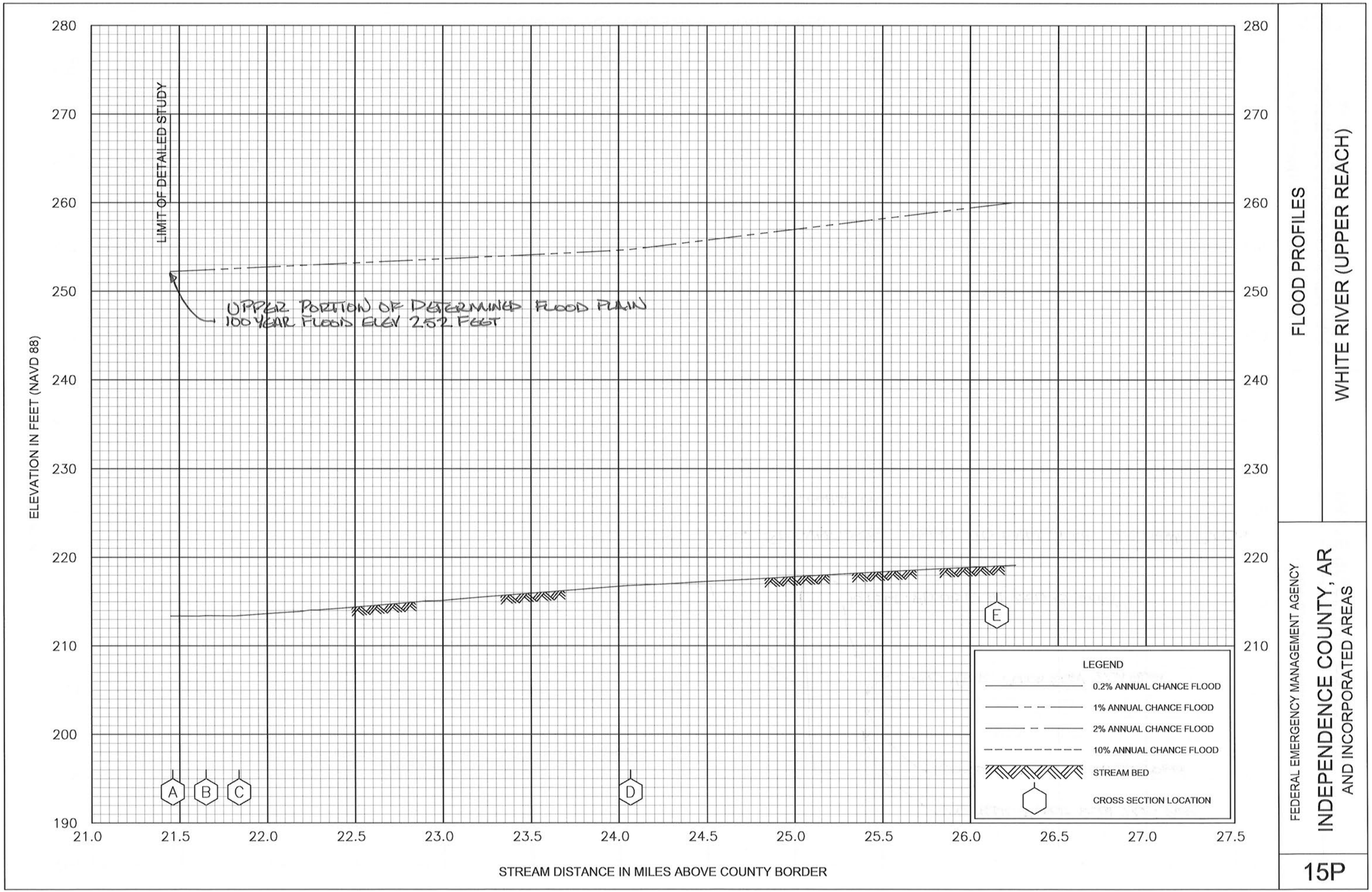


FLOOD PROFILES

WHITE RIVER (LOWER REACH)

FEDERAL EMERGENCY MANAGEMENT AGENCY

INDEPENDENCE COUNTY, AR
AND INCORPORATED AREAS



FLOOD PROFILES

WHITE RIVER (UPPER REACH)

FEDERAL EMERGENCY MANAGEMENT AGENCY

INDEPENDENCE COUNTY, AR
AND INCORPORATED AREAS

15P

INFORMATION FOR THE 10-, 2-, AND
0.2-PERCENT ANNUAL CHANCE FLOODS NOT COMPUTED

500 YEAR FLOOD ELEV 265 FEET

100 YEAR FLOOD ELEV. 262 FEET

50 YEAR FLOOD ELEV 261 FEET

10 YEAR FLOOD ELEV 256.5 FEET

ELEVATIONS USED TO EVALUATE 25 YEAR FLOOD ELEVATION

ELEVATION IN FEET (NAVD 88)

280
270
260
250
240
230
220
210
200
190

26.2 26.4 26.6 26.8 27.0 27.2 27.4 27.6 27.8 28.0 28.2 28.4 28.6 28.8

STREAM DISTANCE IN MILES ABOVE COUNTY BORDER

F

G

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

WHITE RIVER (UPPER REACH)

FEDERAL EMERGENCY MANAGEMENT AGENCY

INDEPENDENCE COUNTY, AR
AND INCORPORATED AREAS

16P

Appendix B: Storm Water Calculations

- Storm Water Run-On Estimate
- Pumping Time Estimate

Storm Water Run-On Estimate

PROJECT / LOCATION: Entergy Independence Steam Electric Station - Newark, AR		PROJECT / PROPOSAL NO.
SUBJECT: Storm Water Capacity of West and East Recycle Ponds		419735.0000
PREPARED BY: A. Sampson	DATE: 9/5/2018	FINAL ☐
CHECKED BY: J. Hotstream	DATE: 9/9/2018	REVISION ☐

Purpose: Determine if 2 feet of freeboard is capable of containing the runoff volume from the 25-year, 24-hour storm event

Methodology:

1.) Determine the storage capacity of 2 feet Freeboard

- Storage Capacity of West Pond between EL. 235' and EL. 237'

S_{FB} Storage Volume at Freeboard (from attached HydroCAD model)

S_{TFB} Total Freeboard Storage Volume

S_{FB} = 587,616 ft^3

- Storage Capacity of East Pond between EL. 235' and EL. 237'

Freeboard Storage Capacity (Volumes are from attached HydroCAD model)

S_{FB} = 533,824 ft^3

-Total Freeboard Storage Capacity of West Pond and East Pond Combined

S_{TFB} = 1,121,440 ft^3

		PROJECT / PROPOSAL NO.
SUBJECT: Storm Water Capacity of West and East Recycle Ponds		419735.0000
PREPARED BY: A. Sampson	DATE: 9/5/2018	FINAL ☐
CHECKED BY: J. Hotstream	DATE: 9/9/2018	REVISION ☐

2.) Determine the storm water runon volume that flows into the basins from the 25-year, 24-hour storm event

V_R	=	Volume of Runon		
Area	=	19.8	ac	
Rainfall Rate	=	6.35	in	Design storm data from NOAA, refer to attached sheets

V_R = Area * Rainfall Rate

V_R = 456,400 ft^3

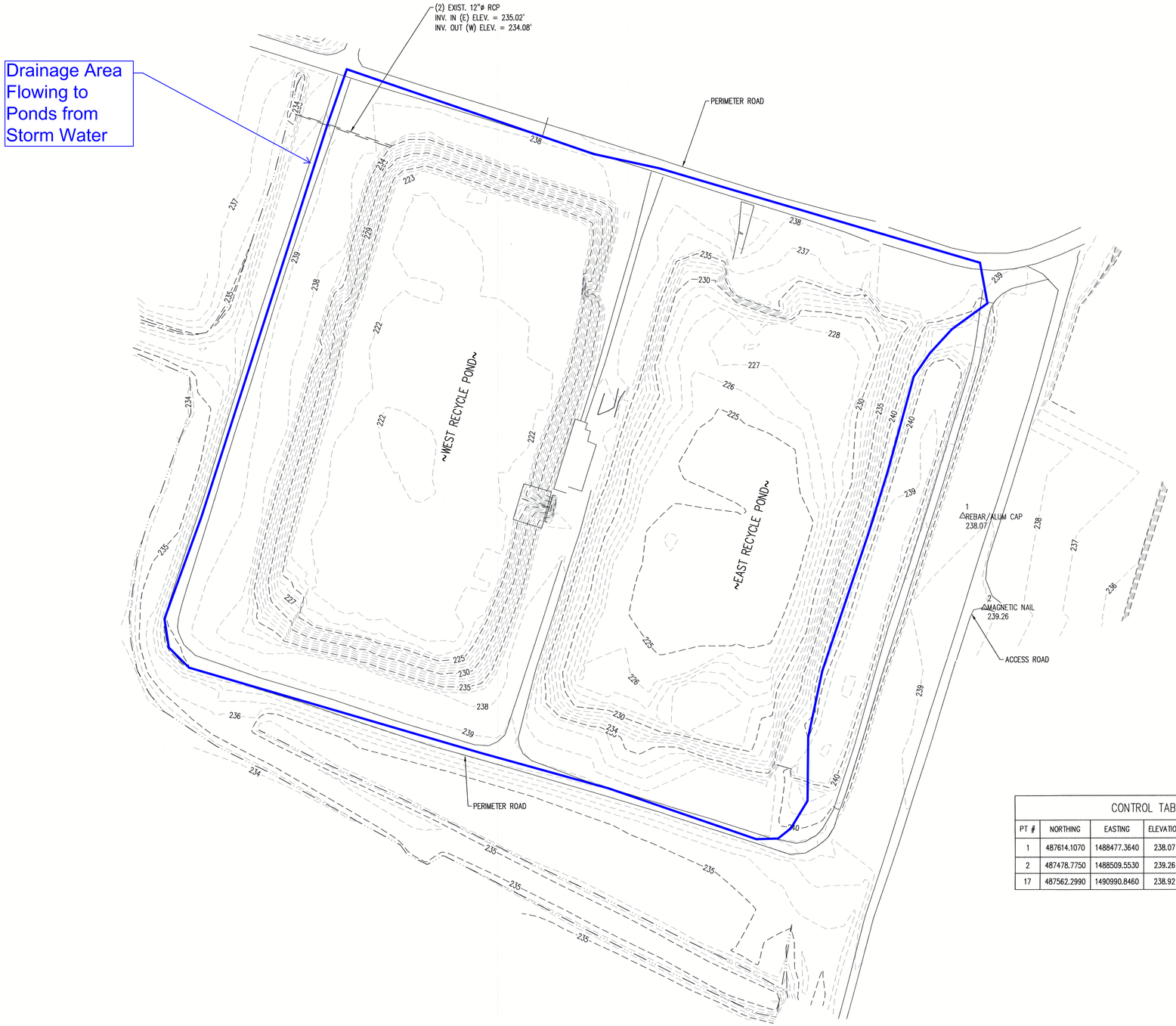
3.) Compare Freeboard Capacity to Volume of Runoff to determine if the Freeboard is capable of containing 100-year, 24-hour storm event.

- If $S_{TFB} > V_R$, then the Freeboard design is OK

S_{TFB}	=	1,121,440	ft^3
V_R	=	456,400	ft^3

$S_{FB} > V_R$

Conclusion: Because the $S_{TFB} > V_R$, the 2 feet of freeboard is capable of containing the runoff volume of the 25-year, 24-hour storm event



SEE SURVEYOR'S NOTE #2

GENERAL NOTES:

1. THIS SURVEY REPRESENTS A TOPOGRAPHIC SURVEY OF THE INDEPENDENCE RECYCLE PONDS.
2. COORDINATES ARE NAD83(2011) ARKANSAS NORTH ZONE (0301 US SURVEY FEET) PROVIDED BY ENTERGY. ELEVATIONS ARE BASED ON FOUND MONUMENT SC-1 (LOCAL CONTROL).
3. FIELD SURVEY WAS PERFORMED ON JULY 9TH, 10TH, 11TH, AND AUGUST 9TH, 2018.

CONTROL TABLE

PT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	487614.1070	1488477.3640	238.07	REBAR/ALUM CAP
2	487478.7750	1488509.5530	239.26	MAGNETIC NAIL
17	487562.2990	1490990.8460	238.92	BRASS DISK IN CONC. SC-1

LEGEND

235 MAJOR CONTOUR INDEX

236 MINOR CONTOUR

80 80 60 20 0 40 80 160

SCALE: 1" = 80'

REV. #	REV. DATE	BY	REVISIONS

B&F
ENGINEERING, INC.
928 AIRPORT ROAD
HOT SPRINGS, AR 71913
(PH) 501-767-2366
(FAX) 501-767-6859
(EMAIL) info@bnfeng.com

CERTIFICATE OF AUTHORIZATION
B & F ENGINEERING, INC.
No. 110
ARKANSAS

LICENSED PROFESSIONAL SURVEYOR
STATE OF ARKANSAS
NO. 1120
SIGNATURE
JAMES W. MONTGOMERY
10-01-18

TOPOGRAPHIC SURVEY
555 POINT FERRY ROAD, NEWARK, AR
INDEPENDENCE RECYCLE PONDS
INDEPENDENCE COUNTY ARKANSAS

	BY	DATE
Design		
Drawn	RLS	7/18
Checked		
Survey	TAW	7/18
Fld.Bk. #	2177	
Rev. #		

B&F PROJ. 7-4183-0201
FILE NAME: 001-FINAL
ISSUE DATE: 10/01/18

SCALE: 1"=80'

1
1

Subcat Reach Pond Link

Routing Diagram for Independence Recycle Ponds
Prepared by TRC, Printed 9/5/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.000	**0**	**TOTAL AREA**

Soil Listing (all nodes)

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

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond E: East Pond Peak Elev=0.00' Storage=0 cf

Pond W: West Pond Peak Elev=0.00' Storage=0 cf

Summary for Pond E: East Pond

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	235.00'	834,622 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
235.00	253,568	0	0
236.00	264,923	259,246	259,246
237.00	284,234	274,579	533,824
238.00	317,361	300,798	834,622

Summary for Pond W: West Pond

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	235.00'	907,352 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
235.00	286,201	0	0
236.00	293,688	289,945	289,945
237.00	301,655	297,672	587,616
238.00	337,817	319,736	907,352

NOAA Atlas 14, Volume 9, Version 2
Location name: Newark, Arkansas, USA*
Latitude: 35.6717°, Longitude: -91.4017°
Elevation: 238.17 ft**
* source: ESRI Maps
** source: USGS

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	**0.415** (0.355-0.489)	**0.472** (0.403-0.556)	**0.564** (0.481-0.665)	**0.640** (0.544-0.756)	**0.744** (0.620-0.889)	**0.823** (0.677-0.990)	**0.902** (0.728-1.10)	**0.981** (0.773-1.21)	**1.09** (0.836-1.35)	**1.16** (0.884-1.46)
10-min	**0.608** (0.520-0.716)	**0.691** (0.591-0.814)	**0.826** (0.705-0.974)	**0.937** (0.797-1.11)	**1.09** (0.908-1.30)	**1.21** (0.992-1.45)	**1.32** (1.07-1.61)	**1.44** (1.13-1.77)	**1.59** (1.22-1.98)	**1.70** (1.29-2.14)
15-min	**0.741** (0.634-0.873)	**0.842** (0.720-0.993)	**1.01** (0.860-1.19)	**1.14** (0.972-1.35)	**1.33** (1.11-1.59)	**1.47** (1.21-1.77)	**1.61** (1.30-1.96)	**1.75** (1.38-2.15)	**1.94** (1.49-2.41)	**2.08** (1.58-2.61)
30-min	**1.08** (0.922-1.27)	**1.23** (1.05-1.44)	**1.47** (1.25-1.73)	**1.66** (1.41-1.97)	**1.93** (1.61-2.31)	**2.14** (1.76-2.57)	**2.35** (1.89-2.85)			80)
60-min	**1.42** (1.21-1.67)	**1.60** (1.37-1.89)	**1.90** (1.62-2.24)	**2.16** (1.83-2.55)	**2.51** (2.10-3.01)	**2.79** (2.30-3.36)	**3.06** (2.48-3.73)	**3.35** (2.65-4.13)	**3.73** (2.88-4.66)	**4.03** (3.06-5.06)
2-hr	**1.76** (1.52-2.05)	**1.98** (1.71-2.31)	**2.34** (2.02-2.73)	**2.65** (2.27-3.10)	**3.09** (2.61-3.67)	**3.43** (2.86-4.10)	**3.78** (3.09-4.58)	**4.15** (3.31-5.08)	**4.64** (3.62-5.76)	**5.03** (3.86-6.27)
3-hr	**1.98** (1.72-2.29)	**2.22** (1.92-2.57)	**2.61** (2.26-3.04)	**2.96** (2.55-3.44)	**3.45** (2.93-4.09)	**3.84** (3.22-4.58)	**4.25** (3.49-5.12)	**4.67** (3.75-5.70)	**5.25** (4.12-6.49)	**5.71** (4.41-7.09)
6-hr	**2.41** (2.11-2.76)	**2.70** (2.36-3.10)	**3.19** (2.78-3.66)	**3.61** (3.14-4.16)	**4.22** (3.62-4.96)	**4.71** (3.99-5.56)	**5.21** (4.33-6.23)	**5.75** (4.66-6.96)	**6.48** (5.14-7.95)	**7.05** (5.50-8.70)
12-hr	**2.92** (2.58-3.32)	**3.30** (2.91-3.75)	**3.93** (3.46-4.47)	**4.46** (3.92-5.09)	**5.22** (4.52-6.07)	**5.83** (4.97-6.81)	**6.44** (5.40-7.63)	**7.08** (5.80-8.50)	**7.96** (6.37-9.69)	**8.63** (6.80-10.6)
24-hr	**3.49** (3.11-3.92)	**3.97** (3.54-4.46)	**4.76** (4.24-5.36)	**5.42** (4.81-6.12)	**6.35** (5.54-7.29)	**7.07** (6.08-8.17)	**7.79** (6.59-9.13)	**8.54** (7.05-10.1)	**9.53** (7.70-11.5)	**10.3** (8.19-12.5)
2-day	**4.09** (3.69-4.55)	**4.67** (4.20-5.19)	**5.61** (5.04-6.24)	**6.38** (5.72-7.13)	**7.45** (6.56-8.46)	**8.28** (7.19-9.47)	**9.10** (7.76-10.6)	**9.94** (8.28-11.7)	**11.0** (9.00-13.2)	**11.9** (9.55-14.3)
3-day	**4.49** (4.07-4.96)	**5.11** (4.62-5.64)	**6.11** (5.52-6.76)	**6.94** (6.25-7.70)	**8.08** (7.15-9.12)	**8.96** (7.83-10.2)	**9.85** (8.45-11.4)	**10.7** (9.01-12.6)	**11.9** (9.78-14.2)	**12.8** (10.4-15.4)
4-day	**4.82** (4.38-5.30)	**5.45** (4.96-6.00)	**6.50** (5.90-7.16)	**7.37** (6.66-8.14)	**8.57** (7.61-9.63)	**9.49** (8.33-10.8)	**10.4** (8.98-12.0)	**11.4** (9.58-13.3)	**12.6** (10.4-15.0)	**13.6** (11.0-16.3)
7-day	**5.61** (5.14-6.12)	**6.30** (5.78-6.87)	**7.45** (6.81-8.14)	**8.41** (7.67-9.21)	**9.74** (8.74-10.9)	**10.8** (9.55-12.1)	**11.8** (10.3-13.5)	**12.9** (11.0-15.0)	**14.4** (12.0-17.0)	**15.5** (12.7-18.5)
10-day	**6.32** (5.83-6.85)	**7.06** (6.50-7.66)	**8.28** (7.61-9.00)	**9.31** (8.53-10.1)	**10.7** (9.69-11.9)	**11.9** (10.6-13.3)	**13.0** (11.4-14.8)	**14.2** (12.1-16.4)	**15.8** (13.2-18.6)	**17.0** (14.0-20.2)
20-day	**8.43** (7.85-9.04)	**9.30** (8.65-9.98)	**10.7** (9.97-11.5)	**11.9** (11.1-12.9)	**13.6** (12.4-15.0)	**14.9** (13.4-16.5)	**16.2** (14.4-18.3)	**17.6** (15.2-20.2)	**19.4** (16.4-22.7)	**20.8** (17.3-24.5)
30-day	**10.2** (9.57-10.9)	**11.2** (10.5-12.0)	**12.9** (12.1-13.8)	**14.3** (13.3-15.3)	**16.2** (14.8-17.7)	**17.6** (16.0-19.4)	**19.1** (17.0-21.4)	**20.6** (17.9-23.4)	**22.5** (19.1-26.1)	**23.9** (20.1-28.1)
45-day	**12.5** (11.8-13.2)	**13.8** (13.0-14.6)	**15.8** (14.9-16.8)	**17.5** (16.4-18.6)	**19.7** (18.1-21.3)	**21.4** (19.4-23.3)	**23.0** (20.5-25.5)	**24.5** (21.4-27.8)	**26.6** (22.7-30.7)	**28.0** (23.7-32.8)
60-day	**14.5** (13.7-15.2)	**16.0** (15.1-16.9)	**18.4** (17.4-19.4)	**20.3** (19.1-21.5)	**22.9** (21.1-24.5)	**24.7** (22.5-26.8)	**26.5** (23.7-29.2)	**28.1** (24.6-31.7)	**30.2** (25.9-34.7)	**31.7** (26.9-37.0)

25-year, 24-hour storm event

[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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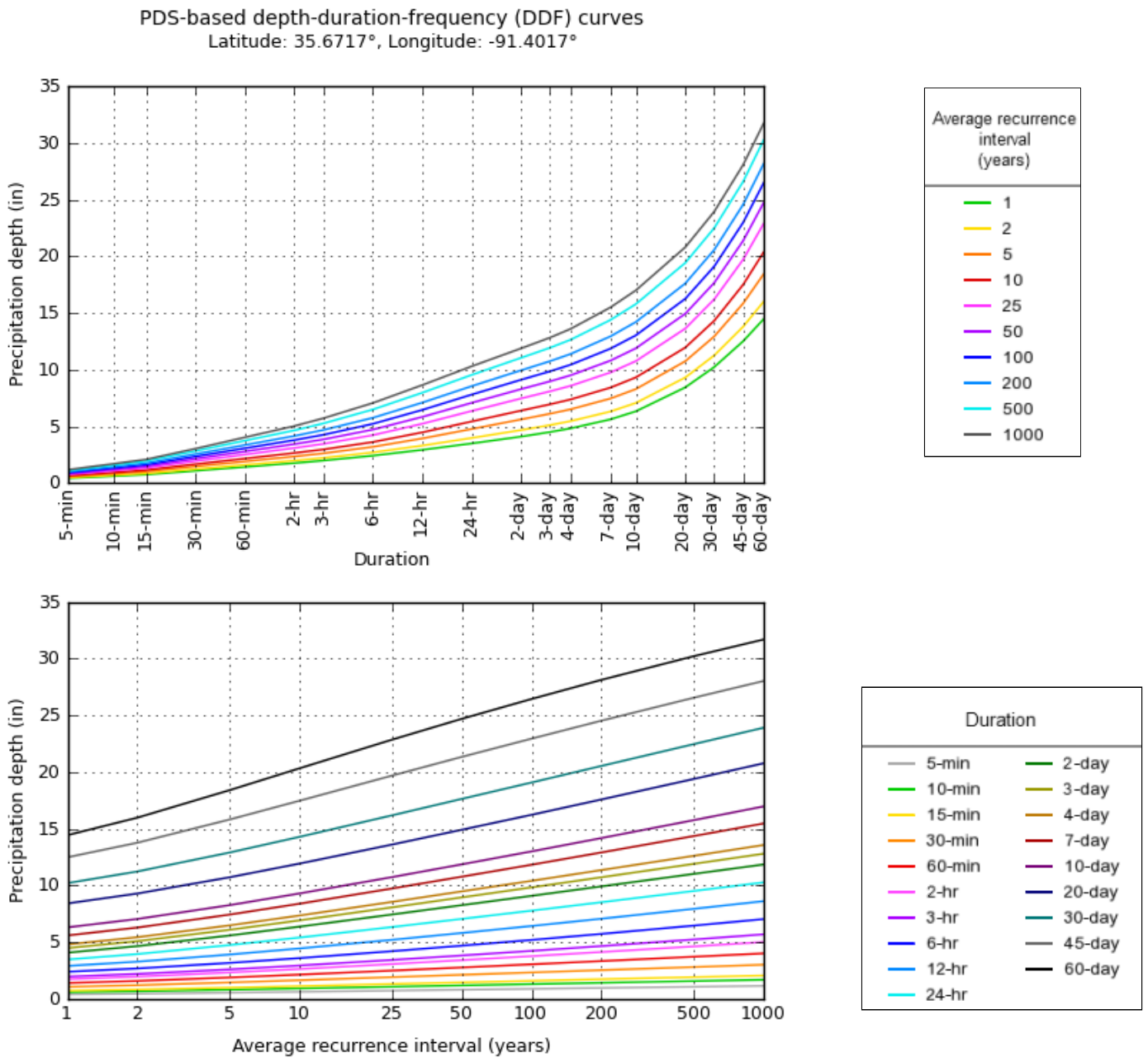
PF graphical



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Created (GMT): Tue Aug 28 15:43:47 2018

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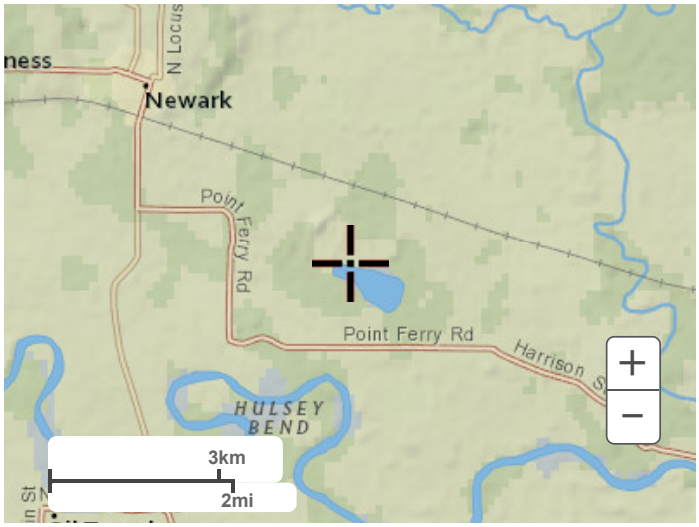
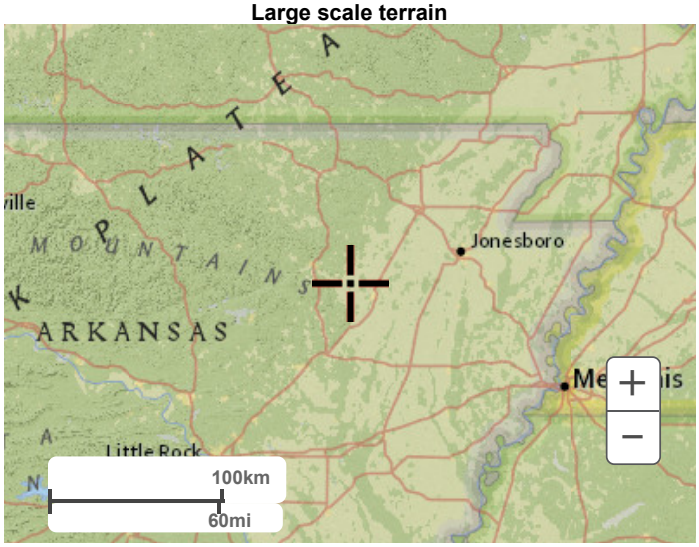
Maps & aerials

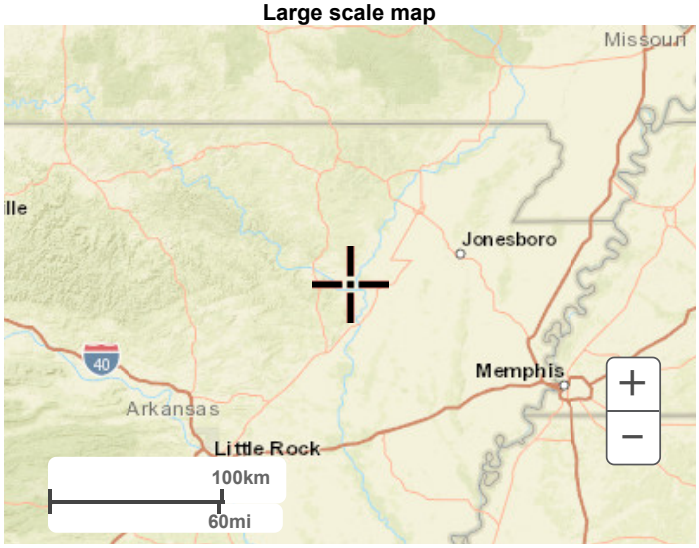
Small scale terrain



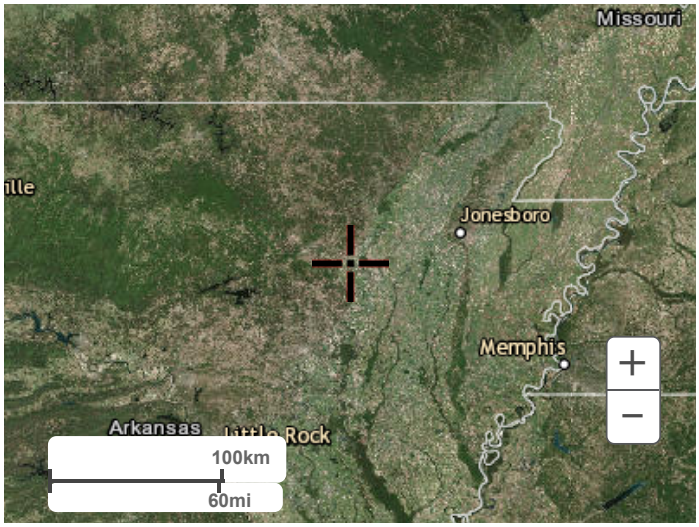
Large scale terrain



Large scale map



Large scale aerial



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

Disclaimer

Pumping Time Estimate

PROJECT / LOCATION: Entergy Independence Steam Electric Station - Newark, AR		PROJECT / PROPOSAL NO.
SUBJECT: Estimated Pump Down Time		419735.0000
PREPARED BY: J. Bell	DATE: 8/27/2018	FINAL ☐
CHECKED BY: J. Hotstream	DATE: 9/9/2018	REVISION ☐

Purpose: Determine the amount of time needed for the pump to remove the storm water collected during the 25-year, 24-hour storm event to design operation elevation (EL. 235)

Methodology:

1.) Use the volume of runon (V_R) from the Freeboard Volume Calculation (Refer to attached calculation sheet)

V_R = 456,400 ft^3

2.) Use pump capacity rating to determine amount of time to lower the water level in both basins to EL. 235

-Assume one pump is operational for each pond

Pump Rate = 2,750 gallons per minute (gpm)

V_R = 3,414,109 gallons

$$\text{Time} = \frac{V_R}{(\text{Pump Rate})*2}$$

Time = 621 min

= 10.3 hr

= 0.4 days

Conclusion: It will take approximately 10 hours to pump out the storm water to reestablish freeboard after the 25-year, 24-hour storm event.