Recycle Ponds Inflow Design Flood Control System Plan

White Bluff Steam Electric Station
Redfield, Jefferson County, Arkansas

October 2018
Revised October 2021

Prepared For:

Entergy Arkansas, LLC
White Bluff Plant
1100 White Bluff Road
Redfield, Arkansas 72132

Prepared By:

TRC
8550 United Plaza Blvd
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Baton Rouge, Louisiana 70809

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Senior Scientist

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Senior Engineer

Jason House
Project Manager

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Revision History

Revision Number	Revision Date	Section Revised	Summary of Revisions
0	10/11/2018		Initial Inflow Design Flood Control System Plan.
1	10/13/2021	1 through 6	Updated text and figures for five-year periodic revision.

1.0 Introduction

Entergy Arkansas, LLC (Entergy) operates the White Bluff 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: A and B (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)
- Design drawings by Chas. T. Main, Inc. for the White Bluff Steam Electric Station: 1977 - 1980 – 2800MW (Net) Installation – Units 1 Thru 4: Surge Pond Overflow:
  - Holding Pond No. 2 and Water Treating Area – Plan. Rev. 8, 1/24/83. Drawing 3022-00.
  - Holding Pond No. 2 and Water Treating Area – Section and Details. Rev. 2, 10/27/81. Drawing No. 3022-01.
- Entergy's Flow Diagram drawing for Ash Disposal for White Bluff Units 1, 2, 3, and 4. Rev. 0, 1/4/95. Drawing 2028-00.
- Topographic Survey performed by B&F Engineering, Inc. 10/4/18
  - Recycle Ponds Plan View. Drawing EX 1/3.
  - Recycle Ponds Profiles. Drawings EX 2/3, EX 3/3.
- Notification of Intent to Initiate Closure of Recycle Pond A
- Notification of Intent to Initiate Closure of Recycle Pond B

1.2 Existing Conditions

The Plant is located on the west bank of the Arkansas River, near Redfield, Jefferson County, Arkansas, as shown on Figure 1. The site is 3,400 acres and situated on a bluff overlooking the relatively flat alluvial plain on the other (east) side of the Arkansas River. The Plant is located at 1100 White Bluff Road, Redfield, Arkansas 72132.

The Ponds are located to the southeast of the Plant. Pond A has an approximate surface area of 7.0 acres and Pond B has an approximate surface area of 6.5 acres. The Ponds operated with a typical water level elevation in each pond is approximately 278 feet (ft) North American Vertical Datum of 1988 (NAVD88). The top of berm elevation surrounding the ponds ranges from 281 ft to 284 ft NAVD88. Topography surrounding the immediate vicinity of the Ponds is generally flat-lying, with existing ground surface elevations ranging from approximately 277 to 285 ft NAVD88.

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 southeast. A topographic survey completed by B&F Engineering, Inc. in October 2018 confirmed the elevations of the top of berm and surrounding areas.

Closure of Pond A and Pond B was initiated in October 2018 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, Pond A was classified as low hazard, in accordance with 40 CFR § 257.73, due to the low berm height and the anticipated capacity of the adjacent plant water retention structures on the Plant property to safely receive a discharge from a potential berm failure. Pond B is incised, and a hazard potential classification is not required per 40 CFR § 257.73(a), according to the same report. Based on the low hazard potential classification for Pond A, both ponds were evaluated to determine if the flow into the units during and following the peak discharge of the 100-year flood was adequately managed [40 CFR § 257.82(a)(3)(iii)].

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 40 CFR § 257.73(a)(2) or 40 CFR § 257.74(a)(2), the probable maximum flood;

(ii) For a significant hazard potential CCR surface impoundment, as determined under 40 CFR § 257.73(a)(2) or 40 CFR § 257.74(a)(2), the 1000-year flood;

(iii) For a low hazard potential CCR surface impoundment, as determined under 40 CFR § 257.73(a)(2) or 40 CFR § 257.74(a)(2), the 100-year flood (Pond A);

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

The Flood Insurance Rate Map for the Plant (Federal Emergency Management Agency, 2009) indicates that the Ponds are located in an area determined to be outside the 1 percent annual chance flood, refer to Appendix A. Figure 2 shows the extents of the 100-year flood. The Ponds are located in an area that is above the 100-year flood elevation; therefore, a dedicated system to control flood waters is not required. The Ponds have been designed with several inflow control features presented in the sections below to mitigate and control stormwater inflows during a 100-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 § 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.

2.1 Recycle Ponds Operation

2.1.1 Recycle Pond-Current Operation

Site infrastructure enables the Ponds to be operated either singularly, in parallel, or in series. Each pond has a 24" inlet pipe from the Plant. Additionally, Pond A has an inlet from an overflow weir in Pond B at elevation 273 ft NAVD88. 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 2 feet of freeboard, height difference from the top of the surrounding ground surface to the design water level.

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

- An overflow weir at elevation 273 ft NAVD88 in Pond B that drains to Pond A.
- The ability to divert flow from Pond B to Pond A if water levels become higher than anticipated.
- Operate pumps as needed to control the pond water levels.
- An 18-inch diameter emergency overflow pipe at elevation 279.65 ft NAVD88 that drains to the Surge Pond.
- 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 100-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 100-year, 24-hour storm event, refer to Appendix B.

2.3 Pumping Capacity

It is assumed that the pump station is equipped with three pumps with a rated pumping capacity of 2,475 gallons per minute (gpm) at 320 feet of head. A calculation was performed to determine length of time required to remove the anticipated run-on due to a 100-year, 24-hour storm event assuming an outflow rate of 4,950 gpm, refer to Appendix B. The calculations resulted with a 13-hour time requirement to remove the anticipated storm water inflow. 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 outside of the 100-year floodplain.
- The Ponds were adequately designed to manage precipitation from a 100-year, 24-hour storm event.
- The pumping rates are sufficient to control 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. White Bluff Recycle Ponds Entergy Arkansas. October 1, 2018. Topographic Survey Drawing.

B&F Engineering, Inc. 2018. White Bluff Recycle Ponds Entergy Arkansas. October 4, 2018. Plan and Profile Drawing.

Chas. T. Main, Inc. 1981. White Bluff Steam Electric Station: 1977-1980 – 2800MW (Net) Installation – Units 1 Thru 4: Surge Pond Overflow: Holding Pond No. 2 & Water Treating Area – Section and Details. Rev. 2, 10/27/81. Chas. T. Main, Inc. Drawing No. 3022-01.

Chas. T. Main, Inc. 1983. White Bluff Steam Electric Station: 1977-1980 – 2800MW (Net) Installation – Units 1 Thru 4: Surge Pond Overflow: Holding Pond No. 2 & Water Treating Area – Plan. Rev. 8, 1/24/83. Drawing 3022-00.

ERM. 2018. Summary of Site Visit and Review of CCR Structural Integrity Criteria Requirements for White Bluff Steam Electric Station Recycle Ponds. October 2018.

Federal Emergency Management Agency. 2009. Flood Insurance Rate Map: Jefferson County Arkansas Panel 25 of 600. Map Number 05069C0025D. Effective Date March 16, 2009. National Flood Insurance Program. Washington, D.C.

TRC. 2018. Recycle Ponds - Initial Inflow Flood Control System Plan for Water Recycle Ponds: Entergy Arkansas, Inc. White Bluff Plant, Redfield, Jefferson 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 recognized and generally accepted good 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 a guarantee or a warranty of the analysis herein.

Michael J. Amstadt, P.E.
Name

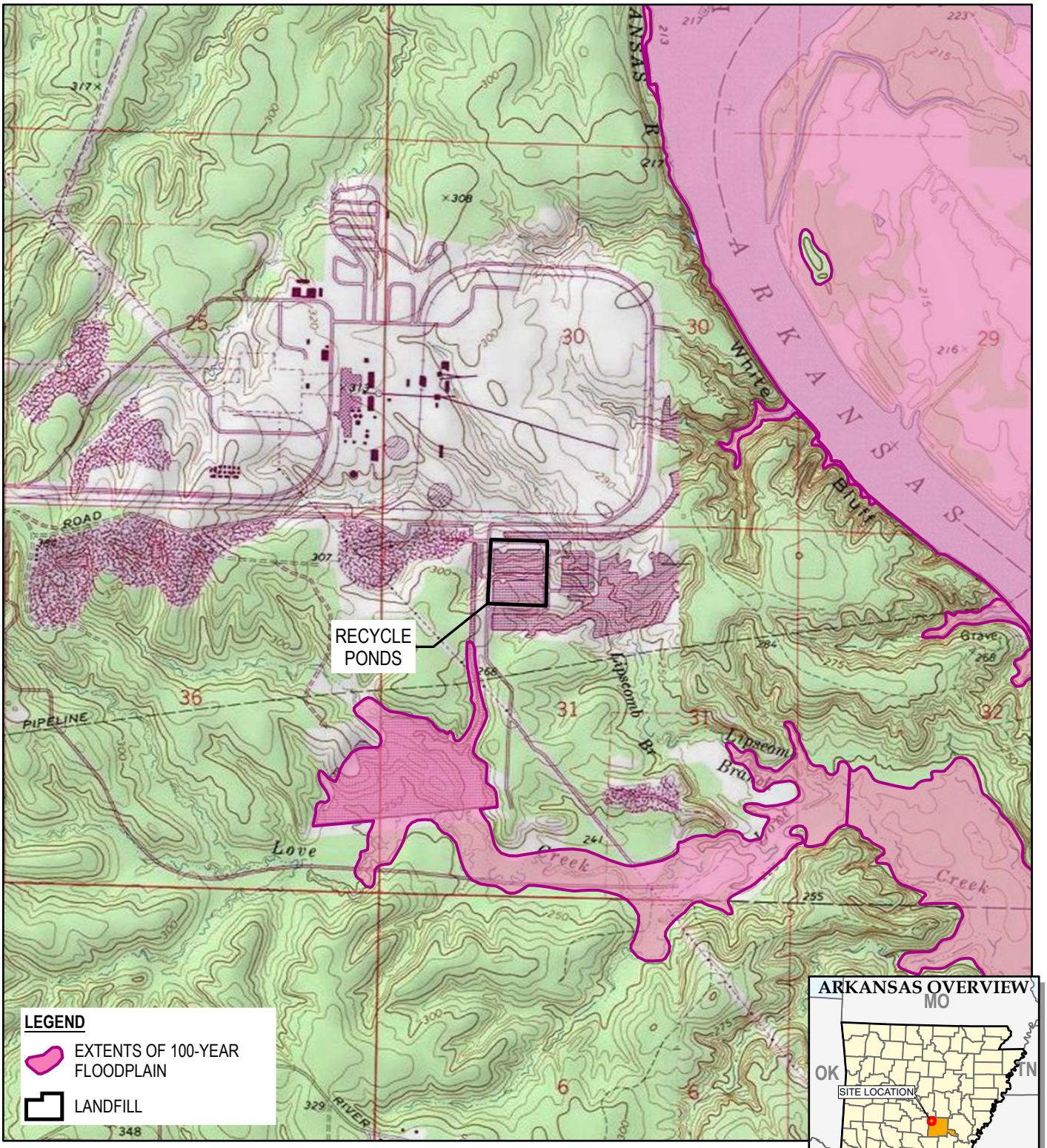
14474
Engineer License Number

Michael Amstadt

Digitally signed by Michael Amstadt
Date: 2021.10.13 14:45:27 -05'00'

Signature of Professional Engineer

10/13/2021
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 WHITE BLUFF STEAM ELECTRIC STATION
RECYCLE PONDS
REDFIELD, JEFFERSON COUNTY, ARKANSAS

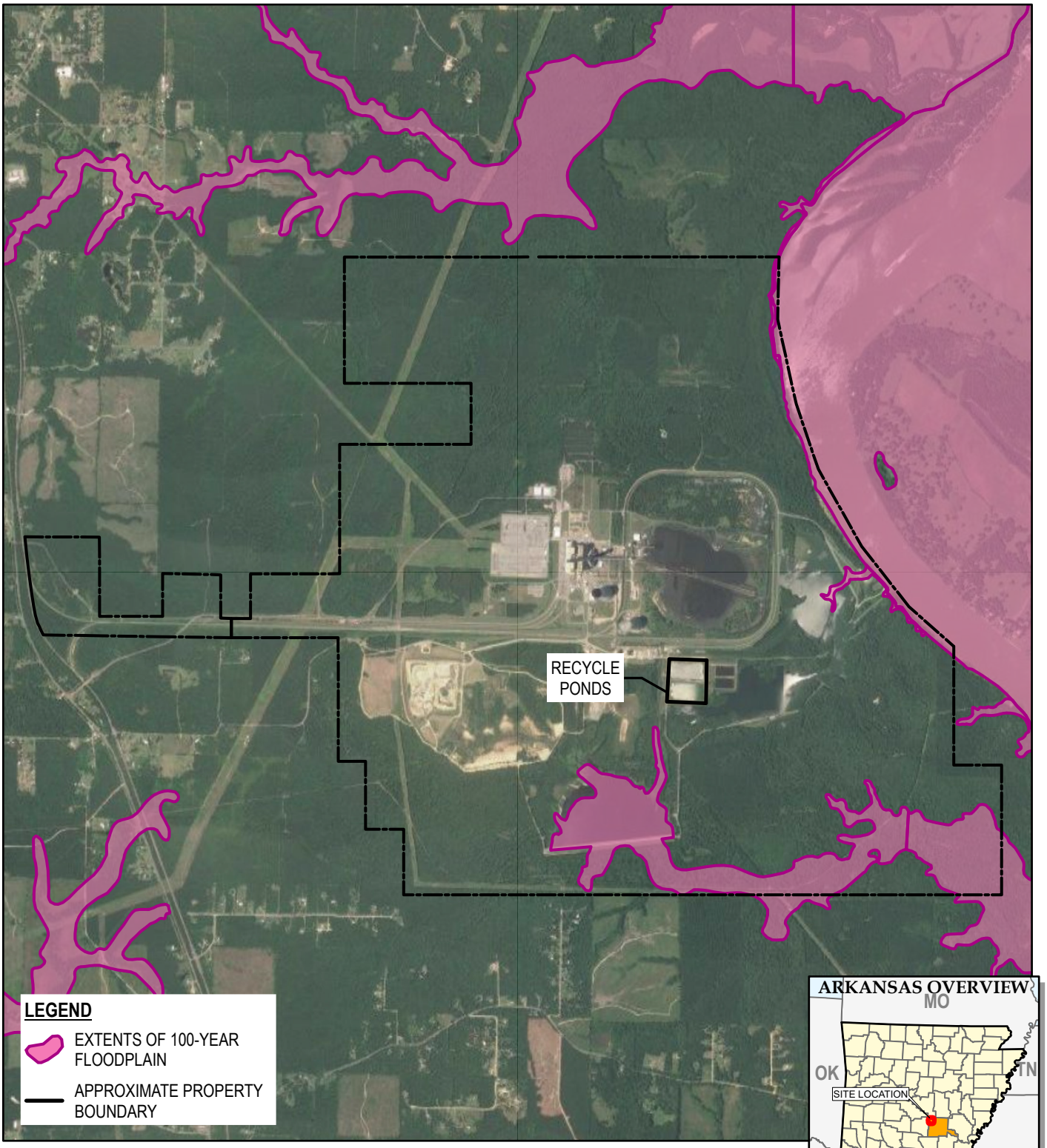
TITLE:

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.:	419733
FILE:	419733_White_Bluff.mxd

FIGURE 1

T:\1-PROJECTS\ENTERGY\419733_White_Bluff\2-APRX\419733_White_Bluff.aprx -- Saved By: BTRACY on 10/12/2021, 09:08:56 AM



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 WHITE BLUFF STEAM ELECTRIC STATION
RECYCLE PONDS
REDFIELD, JEFFERSON 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.:	419733
FILE:	419733_White_Bluff.mxd

FIGURE 2

T:\1-PROJECTS\ENTERGY\419733_White_Bluff\2-APRX\419733_White_Bluff.aprx -- Saved By: BTRACY on 10/12/2021, 09:08:56 AM

Appendix A: Flood Information

- Flood Insurance Rate Map

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 south zone (FIPSZONE 0302). 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 this FIRM was provided in digital format by Arkansas Geographic Information Office.

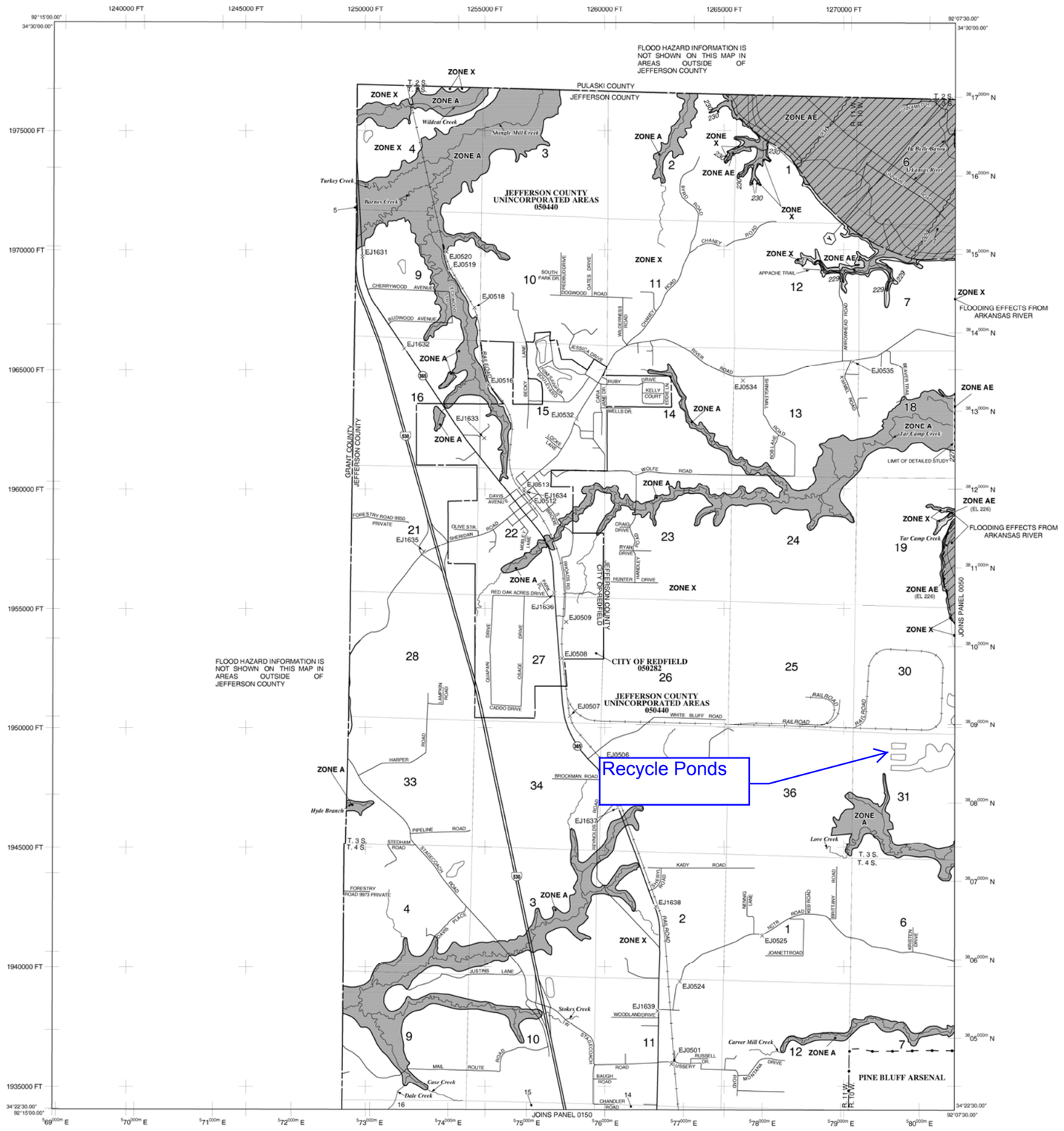
This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a 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 undermined, 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, south zone (FIPSZONE 0302), 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 16, 2009
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 0025D

FIRM
FLOOD INSURANCE RATE MAP

JEFFERSON COUNTY, ARKANSAS
AND INCORPORATED AREAS

PANEL 25 OF 600
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
JEFFERSON COUNTY	050440	0025	D
REDFIELD, CITY OF	050282	0025	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
05069C0025D

EFFECTIVE DATE
MARCH 16, 2009

Federal Emergency Management Agency

Appendix B: Storm Water Calculations

- Storm Water Run-On Estimate
- Pumping Time Estimate

Storm Water Run-On Estimate

PROJECT / LOCATION: Entergy White Bluff Plant		PROJECT / PROPOSAL NO.
SUBJECT: Storm Water Capacity of North and South Recycle Ponds		419733.0000
PREPARED BY: J. Bell	DATE: 8/23/2018	FINAL ☐
CHECKED BY: J. Hotstream	DATE: 9/9/2018	REVISION ☐

Purpose: Determine if 2 feet of freeboard is capable of containing the runon volume from the 100 year, 24 hour storm event.

Methodology:

1.) Determine the storage capacity of 2 feet Freeboard

- Storage Capacity of North Pond between ELE 277' and ELE 279'

S_{FB} Storage Volume at Freeboard

S_{TFB} Total Freeboard Storage Volume

Freeboard Storage Capacity (Volumes are from the Civil 3D model, refer to attached sheets)

S_{FB} = 19,946 Cubic Yards - from Cut/Fill Report

S_{FB} = 538,529 ft^3

- Storage Capacity of South Pond between ELE 277' and ELE 279'

S_{FB} Storage Volume at Freeboard

Freeboard Storage Capacity (Volumes are from the Civil 3D model, refer to attached sheets)

S_{FB} = 21,745 Cubic Yards - from Cut/Fill Report

S_{FB} = 587,124 ft^3

-Total Freeboard Storage Capacity of North Pond and South Pond Combined

S_{TFB} = 1,125,652 ft^3

PROJECT / LOCATION: Entergy White Bluff Plant		PROJECT / PROPOSAL NO.
SUBJECT: Storm Water Capacity of North and South Recycle Ponds		419733.0000
PREPARED BY: J. Bell	DATE: 8/23/2018	FINAL ☐
CHECKED BY: J. Hotstream	DATE: 9/9/2018	REVISION ☐

2.) Determine the storm water runoff volume that flows into the basins from the 100 year, 24 hour storm event, assuming no infiltration

V_R = Volume of Runon

Contributing Drainage Area = 17.7 ac

Rainfall Rate = 8.08 in Design storm data from NOAA, refer to attached sheets

V_R = Area * Rainfall Rate

V_R = 519,148 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 Adjusted $S_{FB} > V_R$, then the Freeboard design is OK

S_{TFB} = 1,125,652 ft^3

V_R = 519,148 ft^3

$S_{FB} > V_R$

Conclusion: Because the $S_{FB} > V_R$, the 2 feet of freeboard is capable of containing the runon volume of the 100 year, 24 hour storm event

NOAA Atlas 14, Volume 9, Version 2
Location name: Mountain Home, Arkansas, USA*
Latitude: 36.232°, Longitude: -92.3057°
Elevation: 627.7 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	**0.410** (0.345-0.493)	**0.469** (0.395-0.565)	**0.565** (0.473-0.681)	**0.643** (0.536-0.778)	**0.749** (0.603-0.925)	**0.829** (0.654-1.04)	**0.907** (0.694-1.16)	**0.986** (0.725-1.29)	**1.09** (0.772-1.45)	**1.16** (0.807-1.58)
10-min	**0.600** (0.505-0.722)	**0.687** (0.578-0.827)	**0.827** (0.693-0.997)	**0.941** (0.785-1.14)	**1.10** (0.883-1.36)	**1.21** (0.958-1.52)	**1.33** (1.02-1.70)	**1.44** (1.06-1.88)	**1.59** (1.13-2.13)	**1.70** (1.18-2.31)
15-min	**0.732** (0.616-0.880)	**0.838** (0.705-1.01)	**1.01** (0.845-1.22)	**1.15** (0.957-1.39)	**1.34** (1.08-1.65)	**1.48** (1.17-1.85)	**1.62** (1.24-2.07)	**1.76** (1.30-2.30)	**1.94** (1.38-2.59)	**2.08** (1.44-2.82)
30-min	**1.02** (0.862-1.23)	**1.17** (0.988-1.41)	**1.42** (1.19-1.71)	**1.61** (1.35-1.95)	**1.88** (1.52-2.32)	**2.08** (1.64-2.60)	**2.28** (1.74-2.91)	**2.48** (1.82-3.23)	**2.73** (1.94-3.64)	**2.92** (2.03-3.96)
60-min	**1.33** (1.12-1.60)	**1.51** (1.27-1.82)	**1.82** (1.53-2.19)	**2.08** (1.73-2.51)	**2.43** (1.96-3.01)	**2.70** (2.13-3.38)	**2.97** (2.27-3.79)	**3.24** (2.39-4.24)	**3.61** (2.56-4.82)	**3.88** (2.69-5.26)
2-hr	**1.63** (1.38-1.95)	**1.85** (1.57-2.22)	**2.23** (1.88-2.66)	**2.54** (2.13-3.05)	**2.97** (2.42-3.66)	**3.31** (2.64-4.13)	**3.66** (2.82-4.65)	**4.01** (2.97-5.21)	**4.48** (3.21-5.96)	**4.84** (3.38-6.52)
3-hr	**1.84** (1.56-2.18)	**2.08** (1.77-2.48)	**2.49** (2.11-2.97)	**2.85** (2.39-3.41)	**3.35** (2.74-4.12)	**3.74** (2.99-4.66)	**4.15** (3.22-5.27)	**4.58** (3.41-5.94)	**5.15** (3.70-6.84)	**5.60** (3.93-7.52)
6-hr	**2.25** (1.92-2.66)	**2.55** (2.17-3.01)	**3.06** (2.60-3.62)	**3.50** (2.96-4.16)	**4.14** (3.41-5.08)	**4.66** (3.75-5.77)	**5.20** (4.06-6.57)	**5.77** (4.33-7.45)	**6.56** (4.75-8.66)	**7.18** (5.06-9.57)
12-hr	**2.76** (2.37-3.24)	**3.14** (2.69-3.68)	**3.79** (3.24-4.46)	**4.36** (3.71-5.15)	**5.18** (4.30-6.32)	**5.85** (4.74-7.20)	**6.55** (5.14-8.22)	**7.29** (5.51-9.35)	**8.31** (6.06-10.9)	**9.11** (6.47-12.1)
24-hr	**3.31** (2.86-3.85)	**3.81** (3.28-4.44)	**4.65** (3.99-5.43)	**5.37** (4.59-6.29)	**6.40** (5.33-7.74)	**7.23** (5.89-8.82)	**8.08** (6.38-10.1)	**8.98** (6.82-11.4)	**10.2** (7.48-13.3)	**11.2** (7.97-14.7)
2-day	**3.87** (3.36-4.48)	**4.49** (3.90-5.20)	**5.53** (4.78-6.41)	**6.41** (5.51-7.46)	**7.64** (6.38-9.14)	**8.61** (7.04-10.4)	**9.60** (7.61-11.9)	**10.6** (8.11-13.4)	**12.0** (8.85-15.5)	**13.1** (9.41-17.1)
3-day	**4.23** (3.69-4.88)	**4.89** (4.25-5.64)	**5.99** (5.19-6.92)	**6.93** (5.98-8.03)	**8.25** (6.92-9.85)	**9.31** (7.64-11.2)	**10.4** (8.27-12.8)	**11.5** (8.82-14.5)	**13.0** (9.64-16.8)	**14.2** (10.3-18.5)
4-day	**4.52** (3.94-5.19)	**5.19** (4.52-5.96)	**6.32** (5.49-7.28)	**7.29** (6.31-8.43)	**8.68** (7.31-10.3)	**9.79** (8.07-11.8)	**10.9** (8.74-13.4)	**12.1** (9.34-15.2)	**13.8** (10.2-17.7)	**15.1** (10.9-19.6)
7-day	**5.20** (4.56-5.94)	**5.90** (5.17-6.75)	**7.11** (6.21-8.14)	**8.16** (7.09-9.38)	**9.68** (8.21-11.5)	**10.9** (9.05-13.1)	**12.2** (9.82-14.9)	**13.6** (10.5-17.0)	**15.5** (11.6-19.8)	**17.0** (12.4-21.9)
10-day	**5.82** (5.12-6.62)	**6.55** (5.75-7.46)	**7.81** (6.84-8.91)	**8.92** (7.78-10.2)	**10.5** (8.97-12.5)	**11.9** (9.88-14.2)	**13.3** (10.7-16.2)	**14.7** (11.5-18.4)	**16.8** (12.6-21.4)	**18.4** (13.5-23.7)
20-day	**7.67** (6.78-8.66)	**8.52** (7.53-9.63)	**9.99** (8.80-11.3)	**11.3** (9.89-12.8)	**13.2** (11.3-15.4)	**14.7** (12.3-17.4)	**16.3** (13.2-19.7)	**18.0** (14.1-22.2)	**20.3** (15.3-25.7)	**22.2** (16.3-28.4)
30-day	**9.26** (8.22-10.4)	**10.3** (9.11-11.6)	**12.0** (10.6-13.5)	**13.5** (11.8-15.2)	**15.6** (13.4-18.2)	**17.3** (14.5-20.4)	**19.0** (15.5-22.9)	**20.9** (16.4-25.7)	**23.4** (17.7-29.5)	**25.4** (18.8-32.3)
45-day	**11.3** (10.1-12.7)	**12.6** (11.2-14.1)	**14.7** (13.0-16.5)	**16.5** (14.5-18.6)	**19.0** (16.3-21.9)	**20.9** (17.6-24.5)	**22.9** (18.7-27.3)	**24.9** (19.6-30.4)	**27.6** (21.0-34.6)	**29.7** (22.0-37.7)
60-day	**13.1** (11.7-14.6)	**14.6** (13.0-16.3)	**17.1** (15.2-19.2)	**19.2** (17.0-21.6)	**22.1** (18.9-25.4)	**24.2** (20.4-28.2)	**26.4** (21.6-31.4)	**28.6** (22.5-34.8)	**31.4** (23.9-39.1)	**33.6** (25.0-42.5)

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

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

Please refer to NOAA Atlas 14 document for more information.

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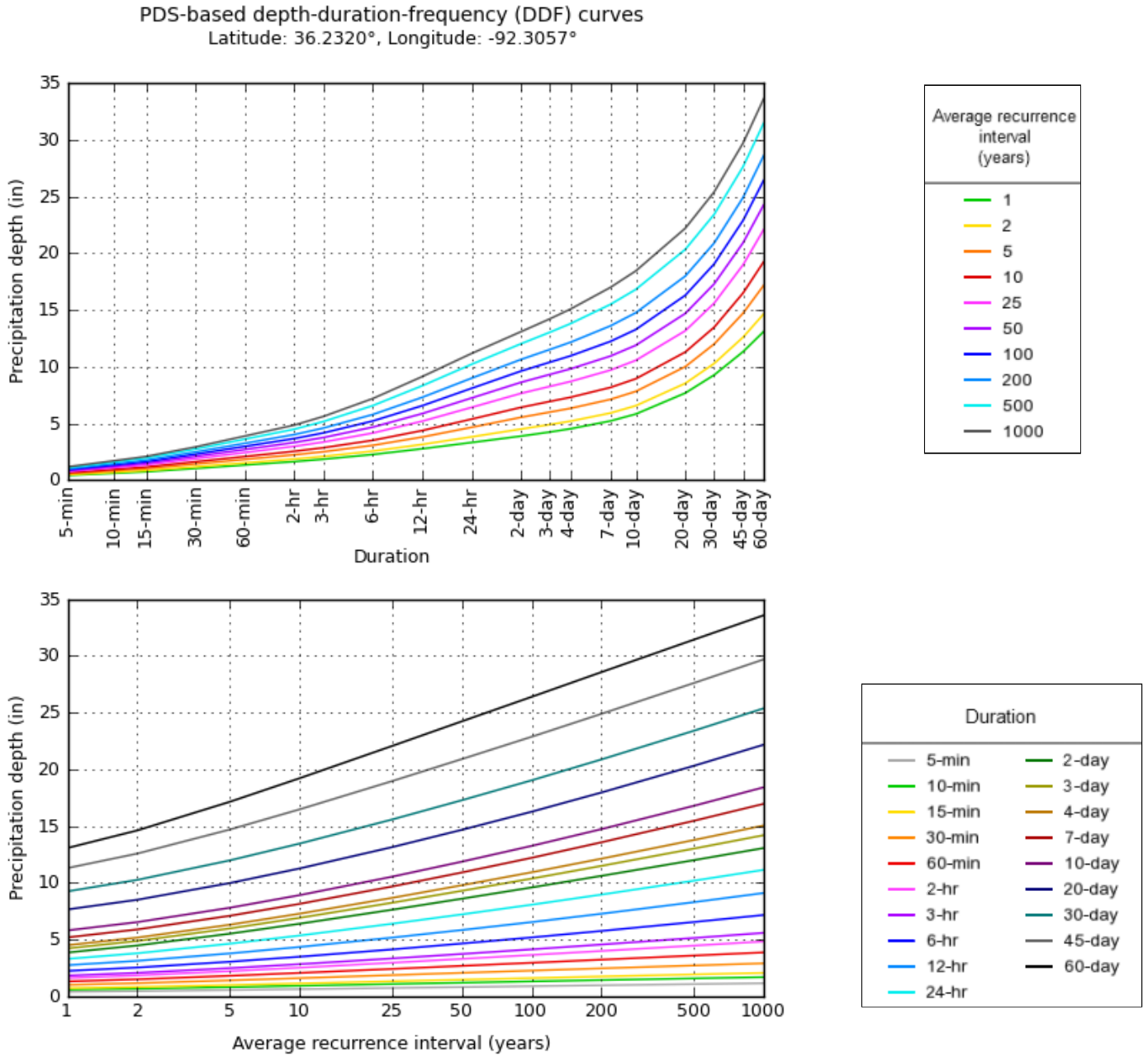
PF graphical



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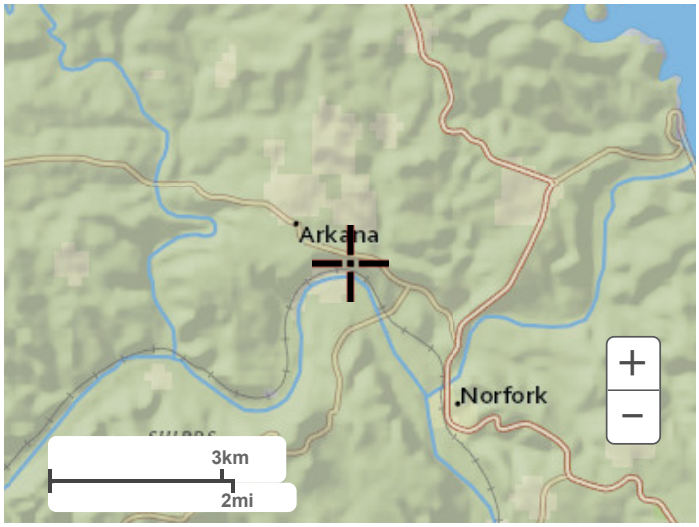
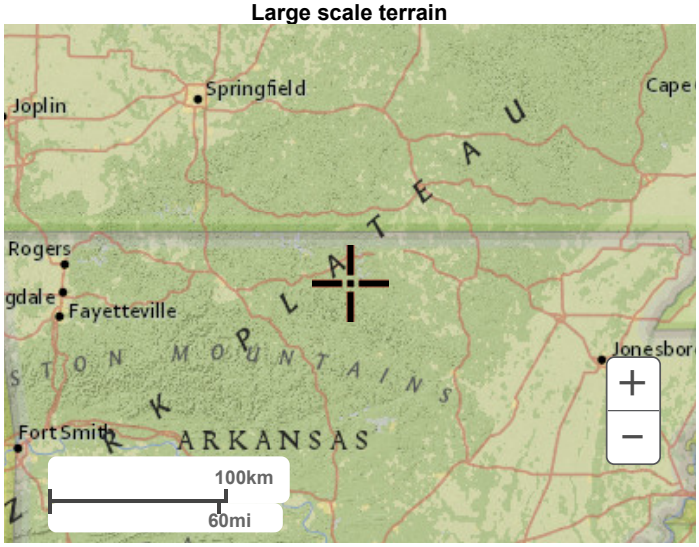
Maps & aerials

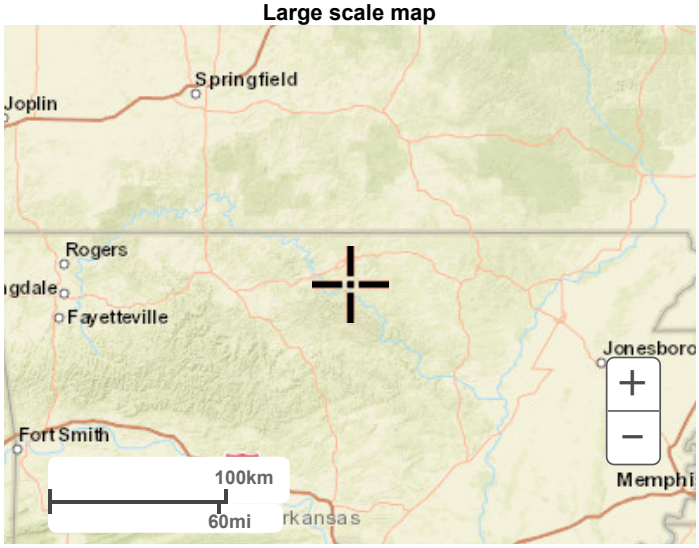
Small scale terrain



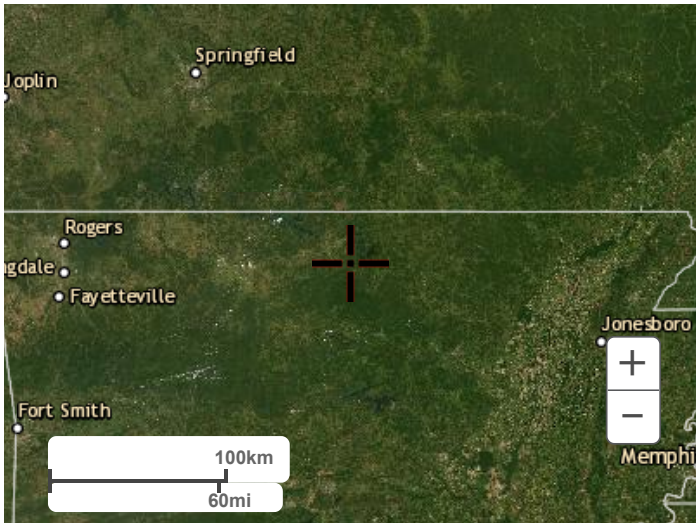
Large scale terrain



Large scale map



Large scale aerial



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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

Cut/Fill Report

Generated: 2018-08-29 15:53:45

By user: JBell

Drawing: J:\Entergy\302967 - White Bluff Plant\0000\Source Files\XREF\J:\Entergy\302967 - White Bluff Plant\0000\Source Files\XREF\Pond Freeboard Volume.dwg

Volume Summary

Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
North Pond - Freeboard Volume	full	1.000	1.000	279631.43	0.00	19945.50	19945.50<Fill>
South Pond - Freeboard Volume	full	1.000	1.000	303650.46	0.00	21745.33	21745.33<Fill>

Totals

	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Total	583281.89	0.00	41690.83	41690.83<Fill>

* Value adjusted by cut or fill factor other than 1.0

Pumping Time Estimate

PROJECT / LOCATION: Entergy White Bluff Plant - Redfield, AR		PROJECT / PROPOSAL NO.
SUBJECT: Estimated Pump Down Time		419733.0000
PREPARED BY: J. Bell	DATE: 8/27/2018	FINAL ☐
CHECKED BY: J. Hotstream	DATE: 9/9/18; 10/12/21	REVISION ☐

Purpose: Determine the amount of time needed for the pump to remove the storm water collected during the 100 year, 24 hour storm event to design operation elevation (ELE 277)

Methodology:

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

- 100 Year, 24 Hour Storm Volume

V_R = 519,148 ft^3

2.) Use pump capacity rating to determine amount of time to lower the water level in both basins to ELE 372

-Assume outflow at 2 times 2,475 gpm based on Unit 1 and Unit 2 LP ash water pumps, flow diagram-ash disposal (01/04/1995)

Pump Rate = 4,950 gallons per minute (gpm)

V_R = 3,883,498 gallons

$$\text{Time} = \frac{V_R}{\text{Pump Rate}}$$

Time = 785 min
= 13.1 hr
= 0.5 days

Conclusion: It will take approximately 0.5 days to pump out the storm water to reestablish freeboard after the 100 year, 24 hour storm event.
This calculation assumes that two pumps operating at 2,475 gallons per minute will be in operation to remove stormwater.