ECOSYSTEMS & WATERSHED MANAGEMENT
420 Hwy 28, PO Box 70
Langley, OK 74350-0070
918-256-5545. 918-256-0906 Fax

November 13, 2024

VIA ELECTRONIC FILING

Debbie-Anne A. Reese
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: Pensacola Hydroelectric Project, FERC Project No. 1494-455
Flood Frequency Analysis and Envelope Curve

Dear Secretary Reese:

Grand River Dam Authority (GRDA), licensee for the Pensacola Hydroelectric Project No. 1494 (Project), is pleased to file the enclosed Flood Frequency Analysis and Envelope Curve, which the Federal Energy Regulatory Commission (FERC or Commission) required in its January 18, 2024 Order on Remand.[1]

The Commission's January 2024 Order on Remand directed GRDA to:

> File a report according to the following methodology: (1) develop a flood-frequency analysis for the peak inflow into Grand Lake that estimates the 2-, 5-, 10-, 25-, and 50-year peak inflow into Grand Lake; (2) develop inflow hydrographs by scaling a range of historic inflow events to match the peak inflows estimated for the 2-, 5-, 10-,25-, and 50-year peak inflow estimated above; (3) develop water surface profiles for the Neosho River and major tributaries for with- and without-dam conditions for each of the scaled frequency floods; (4) determine for each flood frequency, the point of intersection where the with-dam and without-dam water surface profiles are within one foot of each other—the point of intersection should be placed at the elevation of the higher of the two profiles; and (5) develop a backwater envelope curve connecting the high points of intersection of the with-dam and

[1] *Grand River Dam Auth.*, 186 FERC ¶ 61,045, at PP 65–66 (2024).

> without-dam water surface elevation profiles for each of the flood frequencies and map these elevations on the best available topographic data to determine the spatial extent of flooding due to the project.[2]

The Order on Remand also required GRDA to develop "an analysis of each parcel or lot on lands upstream of the Pensacola Dam affected by flooding due to the existence of the project" and to identify:

> (1) The specific project purpose(s), including flowage, that is served by each individual parcel/lot and whether the parcel/lot is within the current project boundary; and (2) GRDA's current property rights (i.e., fee title, easement, lease, or other types.) for each property. The report must also include detailed maps and/or geographic information system data to visualize the above information, including current project boundary location.[3]

As required by the Order on Remand, Mead & Hunt, Inc. (Mead & Hunt) performed the analysis as required by the Order on Remand. First, it completed a flood frequency analysis that estimated the 2-, 5-, 10-, 25-, and 50-year peak inflows into Grand Lake and developed inflow hydrographs for each event to model the inundation from the backwater curve using both with-dam and without-dam models.[4] Mead & Hunt next completed an analysis of each parcel that is intersected by the envelope inundation, including the specific purpose served by each parcel and GRDA's associated property rights, including flowage easements, as required by the Order on Remand.[5]

As discussed in the enclosed report, Mead & Hunt's analysis found that there are approximately 880 acres of land which lie outside GRDA's flowage easements but within the spatial extent of the envelope inundation. While these approximately 880 acres are within the envelope inundation, they are not needed for Project purposes, i.e., to meet the Commission's regulatory responsibilities under the Federal Power Act (FPA) or GRDA's corresponding obligations under its FERC-issued Project license. As discussed in the report—and in accordance with the FPA,[6] the Pensacola Act,[7] and various Flood Control Acts[8]—GRDA's current property rights are sufficient to meet all of its regulatory obligations under the Commissioned-issued license.

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[2] *Id.* at P 65 (internal citations omitted).

[3] *Id.* at P 66 (internal citations omitted).

[4] *Id.* at P 65 n.147 (requiring GRDA to use the upstream hydraulic model submitted with GRDA's May 30, 2023 final license application for the with-dam model geometry and to use the same model with the dam removed to represent the without-dam model geometry).

[5] *Id.* at P 66.

[6] 16 U.S.C. § 796 *et seq.*

[7] National Defense Authorization Act for 2020, Pub. L. No. 116-92. § 116-92, 133 Stat. 1198, 2312 (2019).

[8] *See, e.g.,* Flood Control Act of 1938, Pub. L. No. 75-761, § 2, 52 Stat. at 1215-16 (1938); Flood Control Act of 1941, Pub. L. No. 77-228, 55 Stat. 638 (1941); 33 U.S.C. § 709.

Should you have any questions or comments regarding this report, please do not hesitate to contact Jacklyn Smittle at 918-981-8473 or by email at jacklyn.smittle@grda.com.

Sincerely,

Brian N. Edwards
Executive Vice President
Law Enforcement and Lake Operations

Enclosures

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person identified below pursuant to Rule 2010 of the Rules of Practice and Procedure of the Federal Energy Regulatory Commission.

Dated at Washington, DC, this 13th day of November 2024.

Respectfully submitted,

/s/ Sahara D. Shrestha
Sahara D. Shrestha
Troutman Pepper Hamilton Sanders, LLP
401 9th St. NW, Suite 1000
Washington, D.C. 20004
(202) 274-1941
sahara.shrestha@troutman.com

Craig Gannett
Davis Wright Tremaine LLP
920 Fifth Ave.
Suite 3300
Seattle, WA 98104-1610
(206) 605-3638
craiggannett@dwt.com

Walker C. Stanovsky
Davis Wright Tremaine LLP
920 Fifth Ave.
Suite 3300
Seattle, WA 98104-1610
(206) 757-8259
walkerstanovsky@dwt.com

Shannon E. O'Neil
Davis Wright Tremaine LLP
1301 K St. NW
Suite 500 East
Washington, D.C. 20005
(202) 973-4209
shannononeil@dwt.com

PREPARED BY

Mead & Hunt

Flood Frequency Analysis and Envelope Curve

Pensacola Hydroelectric Project
Project No. 1494

November 13, 2024

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Executive Summary

On January 18, 2024, the Federal Energy Regulatory Commission (FERC or the Commission) issued an Order on Remand, directing Grand River Dam Authority (GRDA) to perform a flood frequency analysis for the Pensacola Hydroelectric Project (Project) that estimated the 2-, 5-, 10-, 25-, and 50-year peak inflows into Grand Lake and to develop inflow hydrographs for each event by scaling a range of historic inflow events to match the flood frequency peak inflows. GRDA was instructed to model with- and without-dam conditions for the area upstream of Pensacola Dam. The Commission specifically noted that the hydraulic model submitted with GRDA's May 30, 2023 Final License Application would meet the criterion for the with-dam geometry, and that same model—with a singular change of removing the dam from the model—would meet the criterion for the without-dam model. GRDA was instructed to compute water surface elevation profiles for each flood frequency event, develop a backwater envelope curve from the points of intersection where the with-dam and without-dam water surface elevation profiles were within one foot of each other, and map the inundation from the backwater curve on the best-available topographic data to determine the spatial extent of flooding. The Commission's instructions for hydraulic modeling follow best practices documented by the United States Army Corps of Engineers (USACE or Corps). The Commission also instructed GRDA to analyze the property parcels intersected by the envelope inundation, develop maps and tables that describe ownership and the specific project purpose(s) served by each parcel, and compare the envelope inundation to GRDA's current property rights, including flowage easements.

On behalf of GRDA, Mead & Hunt, Inc. (Mead & Hunt) has performed the analysis as specified by the Commission. As documented herein, there are approximately 880 acres of land which lie outside GRDA's flowage easements but within the spatial extent of the envelope inundation. Although these approximately 880 acres are within the envelope inundation, none are needed for Project purposes, i.e., to meet FERC's regulatory responsibilities under the Federal Power Act and GRDA's corresponding obligations under the FERC-issued license for the Project.

List of Abbreviations and Terms

FERC or the Commission .... Federal Energy Regulatory Commission
FPA .... Federal Power Act
FPC .... Federal Power Commission
FRM/OM .... Flood Routing/Operations Model
GIS .... Geographic Information System
GRDA .... Grand River Dam Authority
HEC-RAS .... Hydrologic Engineer Center's River Analysis System
ILP .... Integrated Licensing Process
NAVD88 .... North American Vertical Datum of 1988
NGVD29 .... National Geodetic Vertical Datum of 1929
PD .... Pensacola Datum
PWA .... Public Works Administration
RM .... River Mile
RMC .... Risk Management Center
SMP .... Shoreline Management Plan
TIN .... Triangular Irregular Network
USACE or Corps .... United States Army Corps of Engineers
USGS .... United States Geological Survey
WSE .... Water Surface Elevation

1. Introduction

1.1 Study Area and Previous Modeling

The Pensacola Hydroelectric Project (Project) is owned and operated by Grand River Dam Authority (GRDA), licensed by the Federal Energy Regulatory Commission (Commission or FERC), and regulated by both the Commission and the U.S. Army Corps of Engineers (USACE or Corps). The Pensacola Dam is in Mayes County, Oklahoma on the Grand-Neosho River. Pensacola Dam impounds Grand Lake. Construction of Pensacola Dam was completed in 1940.

Upstream of Pensacola Dam, the Corps stores water at three upstream reservoirs: John Redmond Reservoir, Council Grove Lake, and Marion Reservoir. Downstream of Pensacola Dam, GRDA owns and operates the Robert S. Kerr Dam as the Markham Ferry Hydroelectric Project. Kerr Dam impounds Lake Hudson, also known as Markham Ferry Reservoir. The Fort Gibson Dam is downstream of Kerr Dam and is the last Corps water control facility on the Neosho River. Flood control operations at these dams are regulated exclusively by the Corps' Tulsa District under various Flood Control Acts passed by Congress during the 1938-1944 period. In all, the Tulsa District manages 35 water control facilities—including the dams mentioned above. The Corps' water control plan attempts to balance the percentage of storage contained in individual flood pools above the shared control point at United States Geological Survey (USGS) gage no. 07250500 at Van Buren, Arkansas. When flows at Van Buren are projected to exceed the seasonal guide curve, the Corps stores water at upstream reservoirs to limit flow at Van Buren. Thus, the Corps balances and manages reservoir levels throughout the system to limit flooding systemwide. **Figure 1** displays how Grand Lake, which is impounded by Pensacola Dam, is situated between the three upstream and three downstream water control facilities in the Neosho River watershed.

Mead & Hunt, Inc. (Mead & Hunt) has assisted GRDA through the ongoing Integrated Licensing Process (ILP) for Pensacola Dam. As part of the ILP, Mead & Hunt developed a hydraulic model of the area upstream of Pensacola Dam, using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) software. **Figure 2** displays the study area and displays the components of Mead & Hunt's HEC-RAS model.

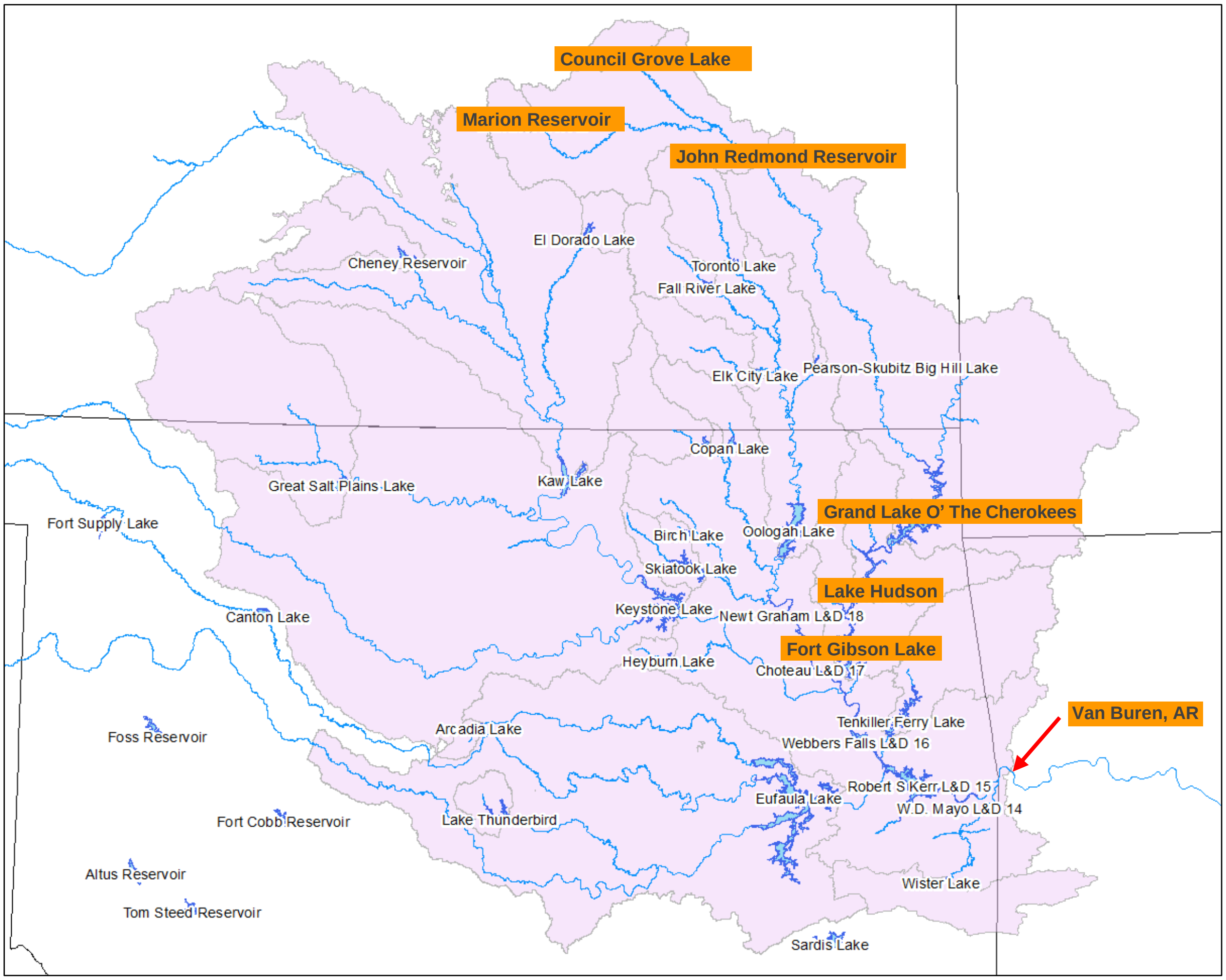


Figure 1. Location of Pensacola Dam in relation to other Corps water control facilities.

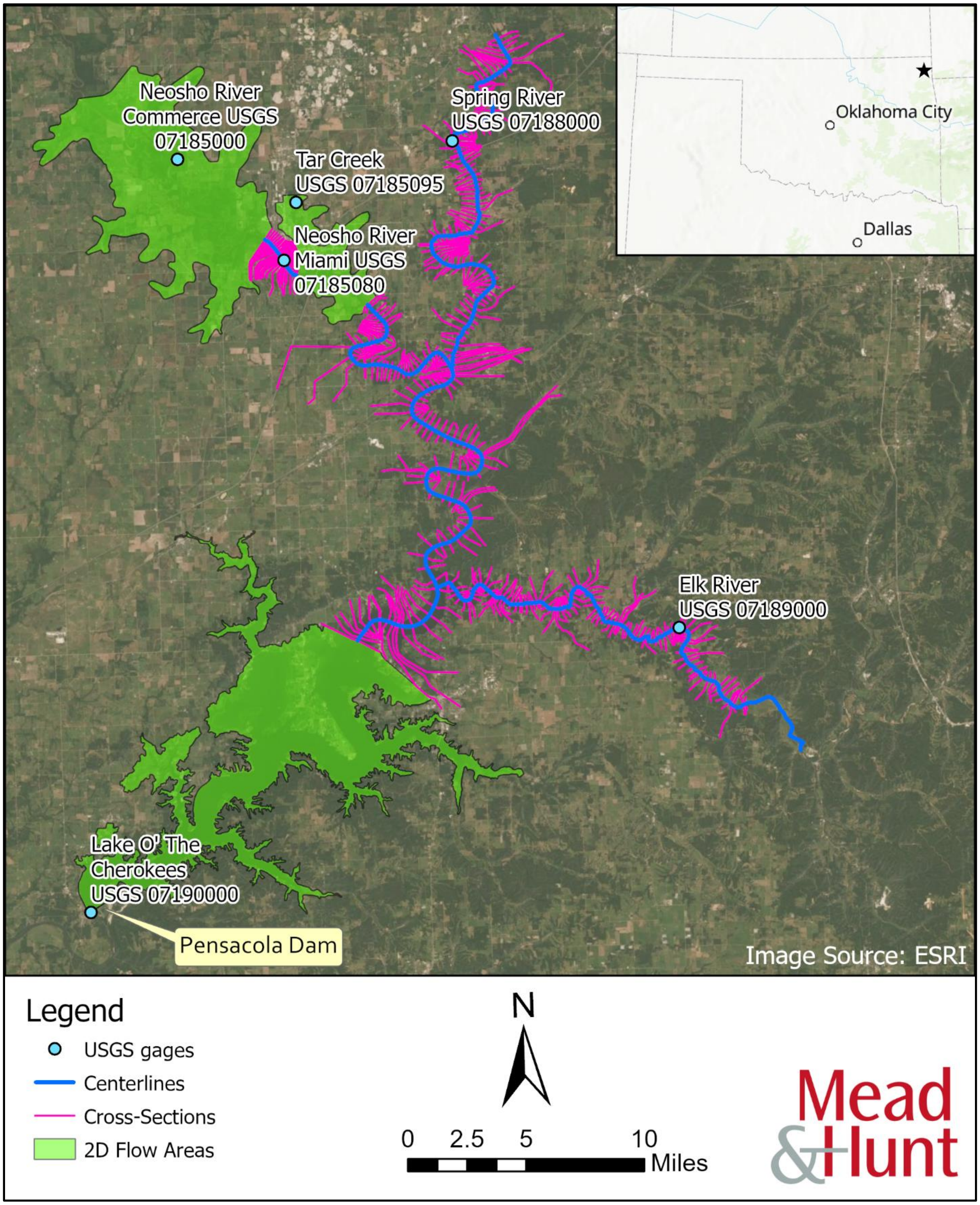
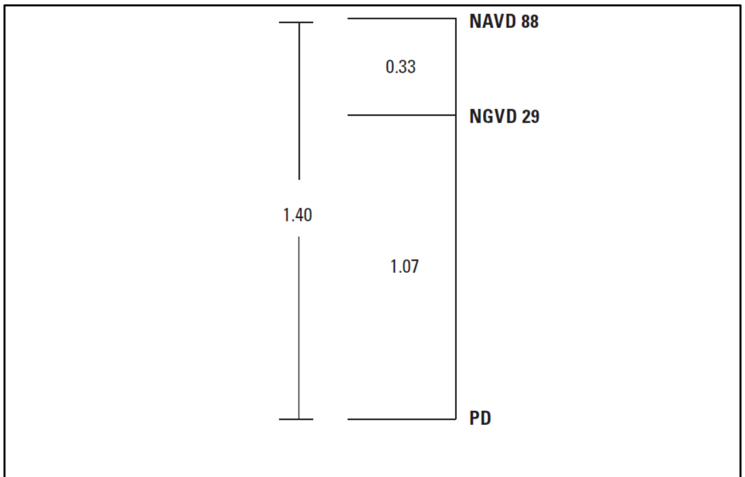


Figure 2. Study area and HEC-RAS model components.

1.2 Vertical Datums

Multiple vertical datums are discussed in this report. Flowage easements upstream of Pensacola Dam reference the National Geodetic Vertical Datum of 1929 (NGVD29), while pool elevations at Pensacola Dam reference Pensacola Datum (PD). To convert from PD to NGVD29, add 1.07 feet. To convert from NGVD29 to the North American Vertical Datum of 1988 (NAVD88), add 0.33 feet. **Figure 3** displays the relationships between the vertical datums.[1] The HEC-RAS model discussed in this report was developed in NGVD29. Water surface elevation (WSE) values are presented in NGVD29.



	Elevations, in feet		
	NAVD 88	NGVD 29	PD
Conservation pool	743.40	743.07	742.00
Top of the dam	758.40	758.07	757.00

Figure 3. Vertical datums in the study area.

2. Order on Remand

On January 18, 2024, the Commission issued an Order on Remand, directing GRDA as follows:

> GRDA must file a report with the Commission that includes: (1) a flood-frequency analysis for the peak inflow into Grand Lake that estimates the 2-, 5-, 10-, 25-, and 50-year peak inflow into Grand Lake; (2) inflow hydrographs by scaling a range of historic inflow events to match the peak inflows estimated for the 2-, 5-, 10-, 25-, and 50-year peak inflows estimated above; (3) water surface profiles for the Neosho River and major tributaries for with- and without-dam conditions for each of the scaled frequency floods; (4) for each flood frequency, the point of intersection where the with-dam and without-dam water surface profiles are within one foot of each other—the point of intersection should be placed at the elevation of the higher of the two profiles; and (5) a backwater envelope curve connecting the high points of intersection of the with-dam and without-dam water surface elevation

[1] Hunter, S.L., Ashworth, C.E., and Smith, S.J., 2017, Bathymetric surveys of the Neosho River, Spring River, and Elk River, northeastern Oklahoma and southwestern Missouri, 2016–17: U.S. Geological Survey Scientific Investigations Report 2017–5101, 59 p., *available at* https://doi.org/10.3133/sir20175101.

> profiles for each of the flood frequencies and map these elevations on the best-available topographic data to determine the spatial extent of flooding due to the project.
>
> GRDA must include in its report an analysis of each parcel or lot on lands upstream of the Pensacola Dam affected by flooding due to the existence of the project and develop a table with a unique identifier for each parcel/lot and provide the acreage amount of the parcel/lot. For each parcel/lot GRDA must identify: (1) the specific project purpose(s), including flowage, that is served by each individual parcel/lot and whether the parcel/lot is within the current project boundary; and (2) GRDA's current property rights (i.e., fee title, easement, lease, or other types) for each property. GRDA must compare the results in step (5) above (backwater envelope curve) to its existing property rights, including flowage easements, as identified in the analysis above. The report must also include detailed maps and/or geographic information system data to visualize the above information, including the current project boundary location. The Commission reserves the right to require changes to the report and/or require additional actions based on the report and any comments and recommendations by interested parties.[2]

On behalf of GRDA, Mead & Hunt has completed the analysis as directed by the Commission.

3. Hydrologic Analysis

Mead & Hunt performed a hydrologic analysis which satisfied two elements of the Commission's Order on Remand. The Commission's order stated that GRDA's report must include:

> (1) a flood-frequency analysis for the peak inflow into Grand Lake that estimates the 2-, 5-, 10-, 25-, and 50-year peak inflow into Grand Lake; (2) inflow hydrographs by scaling a range of historic inflow events to match the peak inflows estimated for the 2-, 5-, 10-, 25-, and 50-year peak inflows estimated above;[3]

These elements are described in the subsections below.

3.1 Flood Frequency Analysis

In accordance with the Commission's directive, Mead & Hunt performed "a flood-frequency analysis for the peak inflow into Grand Lake that estimates the 2-, 5-, 10-, 25-, and 50-year peak inflow into Grand Lake."[4] As the Commission noted, "The flood frequency analysis included in the May 30, 2023 final license application for the Pensacola Project would meet this criterion."[5] The flood frequency analysis to which the Commission refers is included in Appendix E-12 of GRDA's Final License Application, specifically in Section

[2] *Grand River Dam Auth.*, 186 FERC ¶ 61,045 (2024) (Ordering Paragraphs).

[3] *Id*.

[4] *Id*.

[5] *Id.* at P 65 n.145.

4 of GRDA's Updated Study Report titled *Hydrologic and Hydraulic Modeling: Upstream Hydraulic Model*.[6] Therefore, in accordance with the Commission's directive, Mead & Hunt used this existing flood frequency analysis.

The flood frequency analysis included in GRDA's Upstream Hydraulic Model report computed the 2-, 5-, 10-, and 50-year peak inflows but did not include the 25-year peak inflow. The original analysis used the graphical approach, and therefore the same approach was used to add the 25-year peak inflow to the flood frequency analysis. The flood frequency analysis results are plotted in **Figure 4** and are listed in **Table 1**. The plotted line is virtually identical to the figure presented in GRDA's Upstream Hydraulic Model report because the added 25-year peak inflow falls on the existing curve.[7]

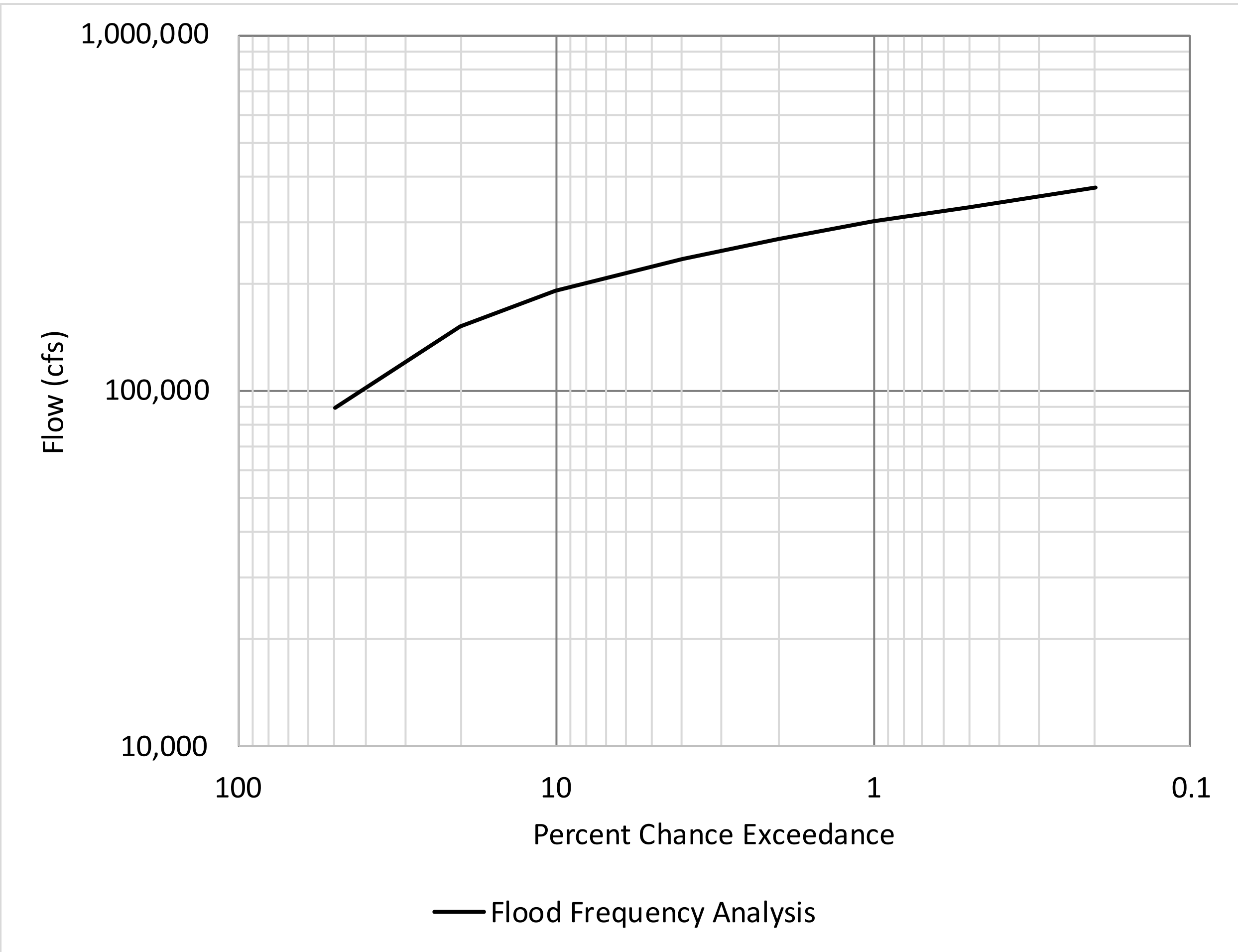


Figure 4. Flood frequency analysis results in graphical form.

[6] Final License Application for the Pensacola Hydroelectric Project, Project No. 1494-438, Accession No. [20230530-5192](20230530-5192) (filed May 30, 2023).

[7] Updated Study Report for Hydrologic and Hydraulic Modeling: Upstream Hydraulic Model (hereinafter, Upstream Hydraulic Model report) at pg. 30.

Table 1. Flood frequency analysis results in tabular form.

Return Interval	Flow (cfs)
2-year	90,000
5-year	152,000
10-year	192,000
25-year	236,000
50-year	266,000

3.2 Inflow and Stage Hydrographs

In accordance with the Commission's directive, Mead & Hunt developed "inflow hydrographs by scaling a range of historic inflow events to match the peak inflows estimated for the 2-, 5-, 10-, 25-, and 50-year peak inflows."[8] As the Commission noted, "The range of historic events and method of scaling used for the 100-year event in the May 30, 2023 final license application's upstream hydraulic model would meet this criterion."[9]

The methodology recommended by the Commission—scaling a range of inflow events to create representative inflow hydrographs—matches best practices documented by USACE's Risk Management Center (RMC). As part of its best practices for Semi-Quantitative Risk Assessment for dam safety, USACE RMC recommends that three to five representative inflow hydrographs be used to define the resulting inflow hydrograph shape, to account for uncertainty in simulations.[10] FERC offers Hydrologic Hazard Assessment training which directly uses USACE RMC's training materials, including the recommendation to select three to five representative inflow hydrographs to account for uncertainty.[11]

Mead & Hunt followed this best practice when developing the inflow hydrographs to Pensacola Dam for the current analysis. In brief, Mead & Hunt performed the following steps:

1. Selected five historic inflow events with peak flows that most closely matched the return interval peak flow,
2. Scaled each of the historic inflow hydrographs so that the peak inflow into Grand Lake matched the return interval peak flow,
3. Aligned the five sets of hydrographs to ensure that timing of the peaks matched, while maintaining the watershed-specific timing of each individual historic flow event,
4. Developed a resulting inflow hydrograph for each modeled flooding source (i.e., the Neosho River, the Spring River, the Elk River, and Tar Creek), and
5. Computed a Pensacola Dam stage hydrograph for each return interval using the Operations Model.

These steps are discussed below in detail.

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[8] 186 FERC ¶ 61,045 (Ordering Paragraphs).

[9] *Id.* at P 65 n.146.

[10] Risk Management Center Training DLS-114, Flood Hazard Analysis Using RMC-BestFit and RMC-RFA Software (USACE, 2023) (hereinafter, RMC DLS-114) at module 2.2.

[11] Hydrologic Hazard Analysis for Level 2 Risk Analysis (FERC, 2023) at module 3.3.

3.2.1 Selection of Historic Inflow Events

The “range of historic events” to which the Commission refers is the record of inflow events from 1940—the year Pensacola Dam was constructed—up through the end of 2019.[12] This period of record (80 years) exceeds the maximum flood return interval specified by the Commission (50 years). As documented in GRDA’s Upstream Hydraulic Model report, the flood frequency analysis used the Corps’ Riverware model data, which includes the total inflow into Grand Lake. The Corps Riverware data was also used for the analysis herein, because the Commission directed GRDA to compute “peak inflow into Grand Lake.”[13]

To select historic events for inflow hydrograph development, Mead & Hunt sorted the 80-year record of peak inflows into Grand Lake in descending order, and then—for each return interval—selected the five historic inflow events with peak flows that most closely matched the return interval peak flow. The sorted records are presented in **Table 2** and the five selected historic events for each return interval are highlighted in grey.

The number of historic hydrographs—five for each return interval—was selected based on USACE RMC guidance discussed above, and with consideration of the available data. USACE RMC recommends that three to five representative inflow hydrographs should be used to define the resulting inflow hydrograph shape. USACE RMC specifically recommends multiple hydrographs to account for uncertainty in watershed response.[14] Selecting fewer events increases the bias a single historic event has on the resulting hydrograph shape, while selecting more events decreases that bias and results in a shape which is more representative of the historic record. Therefore, Mead & Hunt selected five hydrographs to develop each return interval flood hydrograph.

Mead & Hunt also considered selecting more than five historic events to further decrease the bias a single event has on the resulting hydrograph shape. Selecting more than five events would have resulted in an identical set of historic hydrographs used for multiple return interval floods. This is because there are few historic events with peak flows into Grand Lake that are equal to or greater than the return interval peaks. For example, if seven events were selected, the same historic events would have been selected for the 50-year and the 25-year event. If eleven events were selected, the same historic events would have been selected for the 50-year, 25-year, and 10-year events. Furthermore, selecting more than five historic events would mean—for the higher return interval floods—that a greater quantity of historic events would need to be scaled up, rather than scaled down, to match the return interval peak flow. This would have biased the analysis by relying more heavily on lower flow events to develop the inflow hydrographs. As **Table 2** shows, overlap of selected events between return intervals was inevitable, given the available historical data. If only three events were selected for each return interval, two of the three same events would have been selected for the 50-year and 25-year return interval events. As discussed above, selecting only three events would have increased the bias a single historic event has on the resulting hydrograph shape. Therefore, given the inevitable overlap of selected events, and to decrease the bias which a single historic event has on the resulting hydrograph shape, Mead & Hunt selected five historic events per return interval flood.

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[12] Upstream Hydraulic Model report at pg. 29.

[13] 186 FERC ¶ 61,045 at P 65.

[14] RMC DLS-114 at module 2.2.

In summary, selecting five historic hydrographs for each return interval flood follows best practices and minimizes bias. Selecting fewer than five events would have biased the analysis by allowing single historic events to have too much weight in shaping the resulting hydrograph. Selecting more than five events would have biased the analysis by relying more heavily on lower flow events to develop the inflow hydrographs.

Table 2. Historic flow events selected for scaling.

Date of Historic Peak Inflow	Peak Inflow to Grand Lake (cfs)	Ratio of Historic Peak Inflow to Return Interval Peak Inflow				
		50-Year	25-Year	10-Year	5-Year	2-Year
19May1943	285,607	1.07	1.21	1.49	1.88	3.17
28Dec2015	262,818	0.99	1.11	1.37	1.73	2.92
26Sep1993	241,752	0.91	1.02	1.26	1.59	2.69
13Apr1994	207,516	0.78	0.88	1.08	1.37	2.31
15Jul1951	207,137	0.78	0.88	1.08	1.36	2.30
30Apr2017	191,387	0.72	0.81	1.00	1.26	2.13
24Feb1985	188,985	0.71	0.80	0.98	1.24	2.10
08May1961	187,937	0.71	0.80	0.98	1.24	2.09
19Apr1941	184,390	0.69	0.78	0.96	1.21	2.05
24May2019	177,265	0.67	0.75	0.92	1.17	1.97
02Oct1986	175,756	0.66	0.74	0.92	1.16	1.95
03Nov1974	174,435	0.66	0.74	0.91	1.15	1.94
24May2011	174,047	0.65	0.74	0.91	1.15	1.93
11Jun1995	169,222	0.64	0.72	0.88	1.11	1.88
04Jul1976	159,911	0.60	0.68	0.83	1.05	1.78
24May1957	146,992	0.55	0.62	0.77	0.97	1.63
24Jun1948	145,263	0.55	0.62	0.76	0.96	1.61
12Mar1974	144,270	0.54	0.61	0.75	0.95	1.60
04Jul2007	143,512	0.54	0.61	0.75	0.94	1.59
01Nov1941	143,502	0.54	0.61	0.75	0.94	1.59
…	…	…	…	…	…	…
11Mar1973	93,487	0.35	0.40	0.49	0.62	1.04
25Nov1987	92,311	0.35	0.39	0.48	0.61	1.03
20May2017	90,781	0.34	0.38	0.47	0.60	1.01
02Jun2013	90,394	0.34	0.38	0.47	0.59	1.00
25Nov1973	89,589	0.34	0.38	0.47	0.59	1.00
13Oct1961	89,554	0.34	0.38	0.47	0.59	1.00
03May2009	89,449	0.34	0.38	0.47	0.59	0.99
21May1990	85,150	0.32	0.36	0.44	0.56	0.95
08Apr1986	84,710	0.32	0.36	0.44	0.56	0.94

Some of the historic events listed in **Table 2**—September 1993, July 2007, and December 2015—were presented in GRDA's Upstream Hydraulic Model report with estimated return intervals. As part of the current analysis, return intervals were recomputed for all historic events. All simulations in GRDA's 2022 Upstream Hydraulic Model report were in support of relicensing and therefore only modeled a with-dam scenario. The Commission's 2024 Order on Remand required the comparison of a with-dam scenario to a without-dam scenario.[15] This key scenario difference necessitates the re-computation of return intervals. In GRDA's Upstream Hydraulic model report, all flows were reported at Pensacola Dam and include attenuation as the flow moves through Grand Lake. In a without-dam scenario, the attenuation of Grand Lake is not included because Grand Lake would not exist. Therefore, the most equitable way to compare peak inflows is to compare "the peak inflow into Grand Lake" as directed by the Commission in its 2024 Order on Remand and not the peak inflow at Pensacola Dam, as was reported in GRDA's 2022 Upstream Hydraulic Model report. The Corps' Riverware model output reports total inflow into Grand Lake, which is why these data can be used to compute the ratio of historic peak inflow to return interval peak inflow, as presented in **Table 2**.

3.2.2 Scaling of Historic Inflow Hydrographs

The historic inflow hydrographs were scaled so that the peak inflow into Grand Lake matched the return interval peak flow. For each return interval, the selected historic flood hydrographs were multiplied by scaling factors, which are the inverse of the ratios presented in **Table 2**. The scaling factors and resulting scaled peak flows are presented in **Table 3**. As presented in the last column of **Table 3**, the scaled peak flows match the return interval peak flows from **Table 1**.

Table 3. Scaling factors applied to historic event hydrographs.

	Date of Historic Peak Inflow	Peak Inflow to Grand Lake (cfs)	Scaling Factor	Scaled Peak flow (cfs)
50-year	19May1943	285,607	0.93	266,000
	28Dec2015	262,818	1.01	266,000
	26Sep1993	241,752	1.10	266,000
	13Apr1994	207,516	1.28	266,000
	15Jul1951	207,137	1.28	266,000
25-year	28Dec2015	262,818	0.90	236,000
	26Sep1993	241,752	0.98	236,000
	13Apr1994	207,516	1.14	236,000
	15Jul1951	207,137	1.14	236,000
	30Apr2017	191,387	1.23	236,000
10-year	13Apr1994	207,516	0.93	192,000
	15Jul1951	207,137	0.93	192,000
	30Apr2017	191,387	1.00	192,000
	24Feb1985	188,985	1.02	192,000
	08May1961	187,937	1.02	192,000
5-year	24May2011	174,047	0.87	152,000
	11Jun1995	169,222	0.90	152,000
	04Jul1976	159,911	0.95	152,000
	24May1957	146,992	1.03	152,000
	24Jun1948	145,263	1.05	152,000
2-year	20May2017	90,781	0.99	90,000
	02Jun2013	90,394	1.00	90,000
	25Nov1973	89,589	1.00	90,000
	13Oct1961	89,554	1.00	90,000
	03May2009	89,449	1.01	90,000

[15] 186 FERC ¶ 61,045 at P 65 n.147.

In its 2024 Order on Remand, the Commission noted that the "method of scaling used for the 100-year event in the May 30, 2023 final license application's upstream hydraulic model" would meet the Commission's criterion for the development of inflow hydrographs.[16] In GRDA's Upstream Hydraulic Model report, two types of scaling were performed to create a synthetic 100-year hydrograph:

1. The historic peak inflow was scaled by a factor of 2.26 to match the computed 100-year peak flow into Grand Lake.
2. Because the peak inflow scaling factor of 2.26 was substantial, the volume of the resulting, scaled-to-peak inflow hydrograph was scaled down using statistical analysis. The volume scaling was performed so that the 100-year hydrograph volume would not be overestimated but would rather be representative of a natural incoming flood.

In the current analysis:

1. Historic peak inflows were scaled to match the 2-, 5-, 10-, 25-, and 50-year peak inflows. The scaling factors are all close to 1.0, as **Table 3** presents.
2. Because the peak inflow scaling factors are close to 1.0, volume scaling was not necessary. The inflow hydrographs are already representative of a natural incoming flood.

Hourly hydrograph values were only available for a portion of the 80-year period of record, from 1990 onward. Therefore, for consistency between historic events, daily values—which were available for the entire period of record—were used to define the historic hydrographs. Mead & Hunt analyzed the daily flow data to determine if a second scaling factor was required to account for the fact that daily—not hourly—flow data were being used to define the inflow hydrographs. The Corps' Riverware model output includes flow data at the USGS Commerce gage on the Neosho River (USGS gage no. 07185000). The Riverware data were compared to the Commerce gage daily flow data for the period of record (1940 to 2019). The median ratio of Riverware flow to daily flow was 1.00. In other words, no scaling factor should be applied to the daily flow values. As a second check, the water year maximum flow values were compared for the portion of the USGS Commerce gage record where both daily and hourly flow values were available—1990 onward. The ratio of hourly peak to daily peak was 1.07. In other words, the second check confirmed that no scaling factor should be applied to the daily flow values.

In summary, the selected historic inflow hydrographs were scaled so that the peak inflow into Grand Lake matched the return interval peak flow, in accordance with the Commission's 2024 Order on Remand. Mead & Hunt used daily USGS data to define the historic inflow hydrographs and confirmed that a second scaling factor—to account for the fact that the available flow values are daily and not hourly—should not be applied.

3.2.3 Alignment of Historic Hydrographs

For each return interval flood, the five selected historic events were aligned to ensure that the timing of the peaks matched. This process is described below in detail.

All historic hydrographs occurred, of course, at different dates and times. For example, the floods selected to develop the 50-year return interval flood occurred in May 1943, December 2015, September 1993, April

[16] *Id.* at P 65 n.146.

1994, and July 1951. The inflow hydrographs were aligned on a single timeline. When aligning the hydrographs, all hydrographs from a given historic event were shifted by the same amount of time, so that the relative timing of the peaks between the different flooding sources (the Neosho River, the Spring River, the Elk River, and Tar Creek) was not modified, which maintained the hydrologic integrity of the individual historic events selected.

The Neosho River and the Spring River are quantifiably the primary flooding sources in the study area; these two flooding sources had the highest peak inflows. Therefore, the hydrograph alignment focused on these two flooding sources. It was not possible to align the historic hydrographs so that the peak inflows for all five selected historic events occurred at exactly the same time on both the Neosho River and the Spring River. For the peaks to align exactly on both the Neosho River and the Spring River for all five events for a given return interval flood, the five historic flood events would need to have had the exact same hydrologic timing. In other words, the same exact storm pattern and same exact hydrologic response would have had to occur five times in two watersheds. In reality, while the two watersheds react similarly from event to event, especially for similar peak flows into Grand Lake, the hydrologic response varies slightly from event to event. This unavoidable imperfection in hydrograph alignment was mitigated using the results of a statistical analysis of the historical flow distribution between the Neosho River and the Spring River, as discussed in the following section.

Figure 5 and **Figure 6** present the hydrograph alignment for the Neosho River and Spring River, respectively, for the 50-year flood event. The figures show the imperfections in hydrograph alignment. A full set of hydrograph alignment figures is included in **Appendix A**.

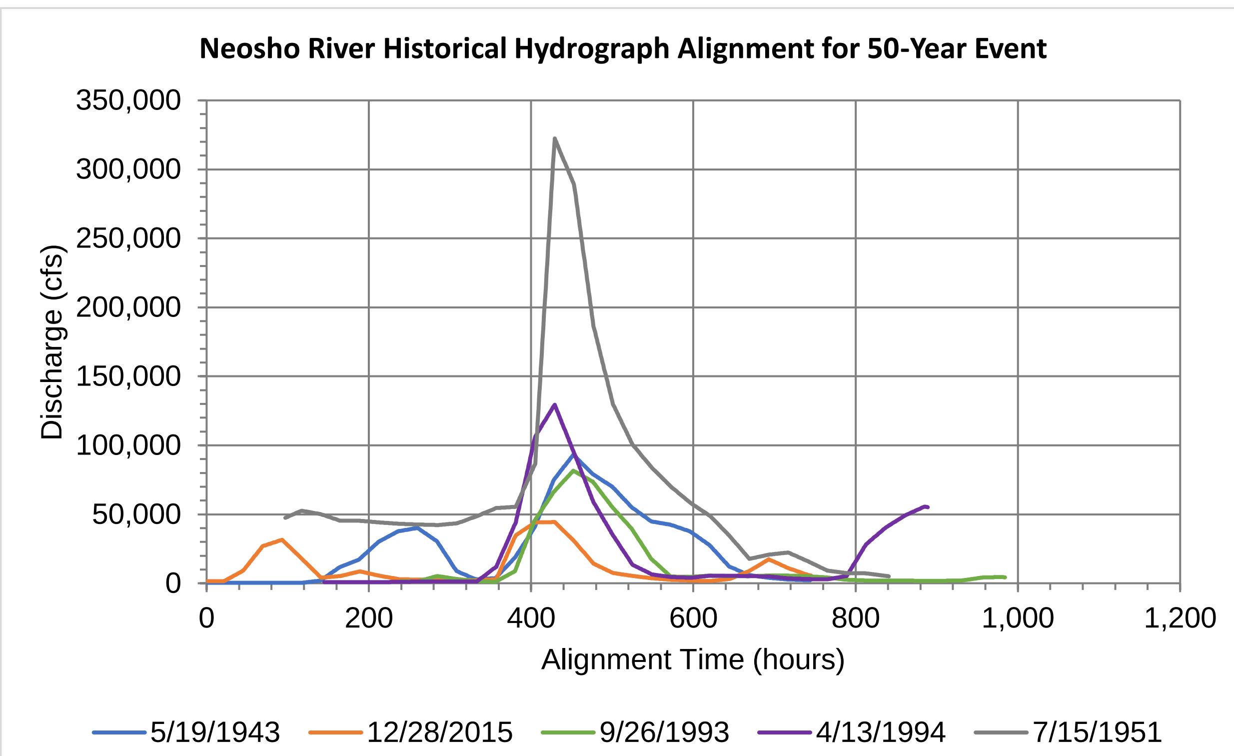

Figure 5. Alignment of historic inflow hydrographs on the Neosho River for the 50-year return interval event.

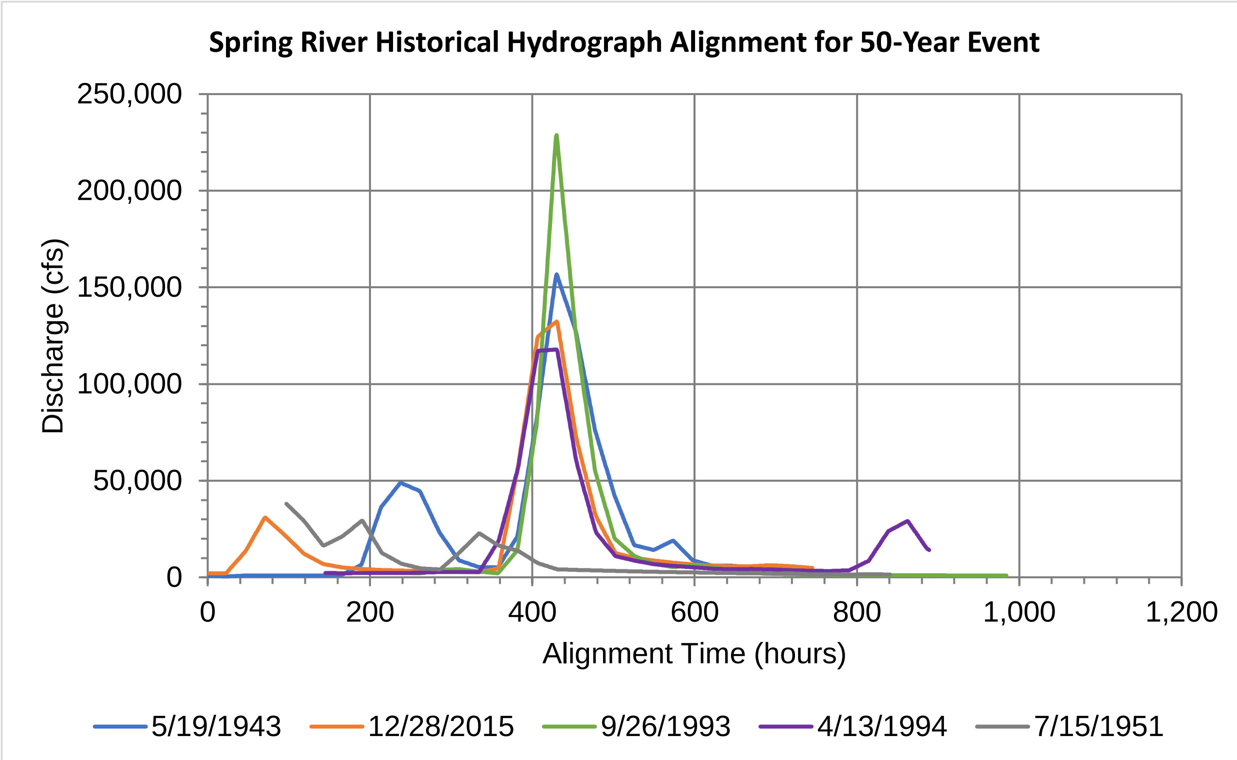

Figure 6. Alignment of historic inflow hydrographs on the Spring River for the 50-year return interval event.

3.2.4 Development of Inflow Hydrographs

For each return interval event, a set of inflow hydrographs was developed. For each modeled flooding source, the aligned hydrographs were averaged, creating a single representative inflow hydrograph which was the result of "scaling a range of historic inflow events" as directed by the Commission.

As discussed above, for a given return interval event, it was not possible to align the historic hydrographs so that the peak inflows—for all five selected historic events—occurred at exactly the same time on both the Neosho River and the Spring River. Practically, this means that one river could have a resulting hydrograph with a higher peak than what the historical record supports and conversely that the other river could have a hydrograph with a lower peak than what the historical record supports. To mitigate this issue, Mead & Hunt performed a statistical analysis of the historical flow distribution between the Neosho River and the Spring River for flood flows (greater than 10,000 cfs). The resulting analysis showed a 1.0-to-0.7 ratio of peak flows between the Neosho River and the Spring River.

To ensure that this statistical distribution of flow between the two rivers was maintained, the hydrographs for the Neosho River and the Spring River were both multiplied by a factor—determined through a goal-seek computation—which resulted in the 1.0-to-0.7 ratio of peak flows between the Neosho River and the Spring River, in accordance with the result from the statistical analysis, while still maintaining the summation of the peak flows between the two rivers.

In summary, inflow hydrographs were developed for each flooding source, for each return interval event. Statistical flow distribution between the two primary flooding sources—the Neosho River and the Spring River—was preserved by applying an adjustment factor which was computed from the historical record. In this way, representative hydrographs were developed "by scaling a range of historic inflow events to match the peak inflows estimated for 2-, 5-, 10-, 25-, and 50-year peak inflows" as directed by the Commission. The inflow hydrographs for each return interval flood are included in **Appendix B**.

3.2.5 Computation of Pensacola Dam Stage Hydrograph

For each return interval flood, the Flood Routing/Operations Model (FRM/OM) was used to compute a stage hydrograph for Pensacola Dam. In addition to upstream inflows to Grand Lake and an evaporation rate in Grand Lake, the FRM/OM requires evaporation rates and lateral inflows to Hudson and Fort Gibson. For each return interval flood, a time series was developed for each of the needed variables. Each time series was developed by averaging the historical time series—which were queried from the period of record—for the five floods selected for each return interval flood. The FRM/OM also requires a starting stage, which was calculated by averaging the initial stage from the aligned historic hydrographs.

In this way, the other variable inputs to the FRM/OM are—like the Grand Lake inflow hydrographs—representative of multiple historic events which closely match the given return interval flood and are not biased by a single historic event. The resulting stage hydrographs for each return interval flood are included in **Appendix B**.

4. Hydraulic Analysis

Mead & Hunt performed hydraulic analyses which satisfied three elements of the Commission's Order on Remand. The Commission's order stated that GRDA's report must include:

> (3) water surface profiles for the Neosho River and major tributaries for with- and without-dam conditions for each of the scaled frequency floods; (4) for each flood frequency, the point of intersection where the with-dam and without-dam water surface profiles are within one foot of each other—the point of intersection should be placed at the elevation of the higher of the two profiles; and (5) a backwater envelope curve connecting the high points of intersection of the with-dam and without-dam water surface elevation profiles for each of the flood frequencies and map these elevations on the best-available topographic data to determine the spatial extent of flooding due to the project.[17]

These elements are described in the subsections below.

[17] 186 FERC ¶ 61,045 (Ordering Paragraphs).

4.1 Water Surface Elevation Profiles

In accordance with the Commission's order, Mead & Hunt developed "water surface profiles for the Neosho River and major tributaries for with- and without-dam conditions for each of the scaled frequency floods."[18] As the Commission noted:

> The upstream hydraulic model submitted with GRDA's May 30, 2023 final license application would meet the criterion for the with-dam model geometry. For the without-dam model geometry, remove the dam from the model and instead use normal depth as the downstream boundary condition.[19]

Therefore, as directed by the Commission, Mead & Hunt used the HEC-RAS model developed in support of GRDA's Upstream Hydraulic Model report, which was included in GRDA's May 30, 2023 Final License Application. The Upstream Hydraulic Model was used as follows:

1. For the with-dam simulations, the Upstream Hydraulic Model was used "as is" with no modifications.
2. For the without-dam simulations, the Upstream Hydraulic Model was used with one single modification: the dam was removed from the model and normal depth was used as the downstream boundary condition.

Mead & Hunt simulated the five return interval floods discussed in **Section 3** in each of these two models, for a total of ten simulations. The resulting water surface elevation profiles for each return interval flood are included in **Appendix C**.

4.2 Points of Intersection

In accordance with the Commission's order, Mead & Hunt computed "the point of intersection where the with-dam and without-dam water surface profiles are within one foot of each other" and followed the Commission's instruction that "the point of intersection should be placed at the elevation of the higher of the two profiles."[20] This computation was performed for each return interval flood, and along each modeled flooding source. **Figure 7** displays the water surface elevation profiles and the point of intersection for the 50-year return interval flood. The full set of the water surface elevation profiles, included in **Appendix C**, displays the points of intersection for all flood frequencies specified in the Commission's order.

The quantified points of intersection, which are placed at the elevation of the higher of the two water surface elevation profiles, are presented in **Table 4**. Both the river mile (RM) and water surface elevation of each point of intersection are listed. As noted in the table, there are no points of intersection along Tar Creek. This is because the with-dam and without-dam water surface elevation profiles are within 1 foot of each other along Tar Creek. Therefore, according to the Corps' methodology documented in *Engineering and Design Manual 1110-2-1420: Hydrologic Engineering Requirements for Reservoirs*—which the Commission relied upon in its Order on Remand—there is no backwater impact along Tar Creek.

[18] *Id*.

[19] *Id.* at P 65 n.147.

[20] *Id.* at Ordering Paragraphs.

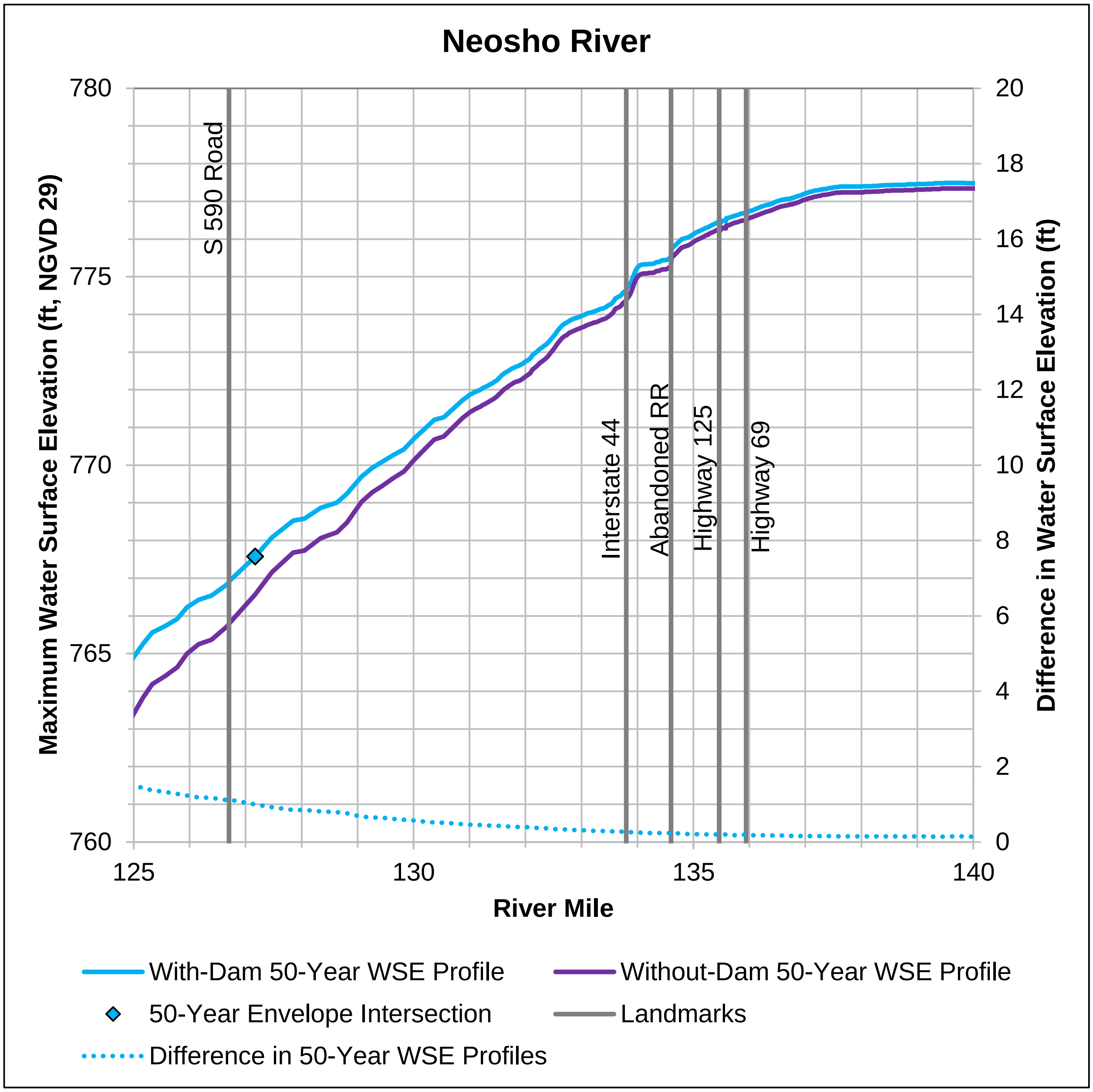

Figure 7. Water surface elevation profiles and point of intersection for the 50-year return interval flood on the Neosho River.

Table 4. Points of intersection for all return interval floods and all modeled flooding sources.

Return Interval Event	Neosho River		Spring River		Elk River		Tar Creek	
	River Mile	WSE (feet, NGVD29)	River Mile	WSE (feet, NGVD29)	River Mile	WSE (feet, NGVD29)	River Mile	WSE (feet, NGVD29)
50-year	127.17	767.57	6.94	763.22	11.01	756.16	n/a	n/a
25-year	129.15	768.04	6.98	761.89	10.88	756.07	n/a	n/a
10-year	130.01	765.86	7.35	760.18	11.18	756.05	n/a	n/a
5-year	132.37	762.06	7.57	756.76	10.76	754.07	n/a	n/a
2-year	133.72	756.39	8.02	755.34	10.78	749.86	n/a	n/a

Note: where the River Mile and WSE are listed as "n/a", the with-dam and without-dam profiles are not more than 1 foot apart from each other along the flooding source, and therefore there is no backwater impact according to the Commission's order, which follows the Corps' methodology documented in Engineering and Design Manual 1110-2-1420.

4.3 Backwater Envelope Curve Computation

In accordance with the Commission's order, Mead & Hunt computed "a backwater envelope curve connecting the high points of intersection of the with-dam and without-dam water surface elevation profiles for each of the flood frequencies."[21] Mead & Hunt computed an envelope curve for each modeled flooding source, which are discussed below individually.

The points of intersection and envelope curve for the Neosho River are displayed in **Figure 8**. The peak of the Neosho River envelope curve—which is the point of intersection for the 25-year flood—occurs at RM 129.15 and at an elevation of 768.04 feet NGVD29. The most-upstream point of intersection is the 2-year return interval flood and is just downstream of Interstate 44. The point of intersection for the 2-year return interval flood is at RM 133.72 and at an elevation of 756.39 feet NGVD29. All the points of intersection are downstream of Miami. In other words, the backwater effect from the presence of Pensacola Dam does not reach Miami. This study result agrees with the findings presented by Dr. Forrest M. Holly Jr., PhD, who developed a computational model of the Neosho River. Regarding the impact of increasing the conservation pool elevation at Pensacola Dam, Dr. Holly concluded the following:

> It is apparent from the analysis and the resulting Figures that ***Miami is located just upstream of the zone of significant flood-level effects*** that would result from raising the Pensacola Dam power pool to 745 ft PD. Indeed, the river steepens significantly upstream of about RM 139, effectively eliminating significant backwater effects upstream of that point. The effect of raising the power pool by three feet (to 745 ft PD) is less than about 0.2 feet of maximum flood level just downstream of Miami, and progressively less at upstream locations and for lesser changes in power pool level.[22]

Dr. Holly used a different river mile numbering system which deviates from USGS river miles. The location described by Dr. Holly where "the river steepens significantly upstream of about RM 139" is estimated to be USGS RM 130.8. As displayed in **Figure 8**, RM 130.8 is just upstream of the 10-year point of intersection from the envelope curve analysis. The 5-year and 2-year points of intersection are upstream of this location. It is logical that Dr. Holly found no "significant backwater effects" upstream of USGS RM 130.8, because he was studying the impact of increasing the conservation pool elevation. In the current analysis, the impact of the presence of Pensacola Dam itself is studied, and it is unsurprising that the computed backwater impact extends slightly further upstream to RM 133.72. In both Dr. Holly's analysis and the current analysis, the backwater impact of Pensacola Dam does not extend upstream into Miami.

Regarding the downstream end of the envelope curve, as displayed in **Figure 8**, the maximum elevation of the Corps' flood control pool, 756.07 feet NGVD29 (755 feet PD), was used as the most-downstream point of intersection for the envelope curve at RM 122.25, between the BN Railroad Bridge and Highway 60 (Twin Bridges). There must be a connection between the envelope curve, which computes a backwater profile

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[21] *Id*.

[22] Analysis of Effect of Grand Lake Power-Pool Elevations on Neosho River Levels During a Major Flood, prepared for Robert Sullivan, AGM of Risk Management and Regulatory Compliance, Grand River Dam Authority, prepared by Forrest M. Holly Jr., PhD (Jan. 27, 2004) at pg. 5, emphasis added.

higher than the maximum pool elevation, and the maximum pool elevation itself. The envelope curve cannot continue downstream at an elevation higher than the maximum flood pool. The envelope curve elevation must intersect with the flood pool elevation where the Neosho River transitions into the Grand Lake flood pool. Furthermore, as discussed below in **Section 4.4**, the downstream end of the inundation presented in the City's 2018 complaint is at RM 128, which is upstream of S 590 Road (Connor Bridge, RM 126.7). The connection between the envelope curve and the flood pool is almost 6 miles downstream of the most-downstream inundation presented in the City's 2018 complaint.[23]

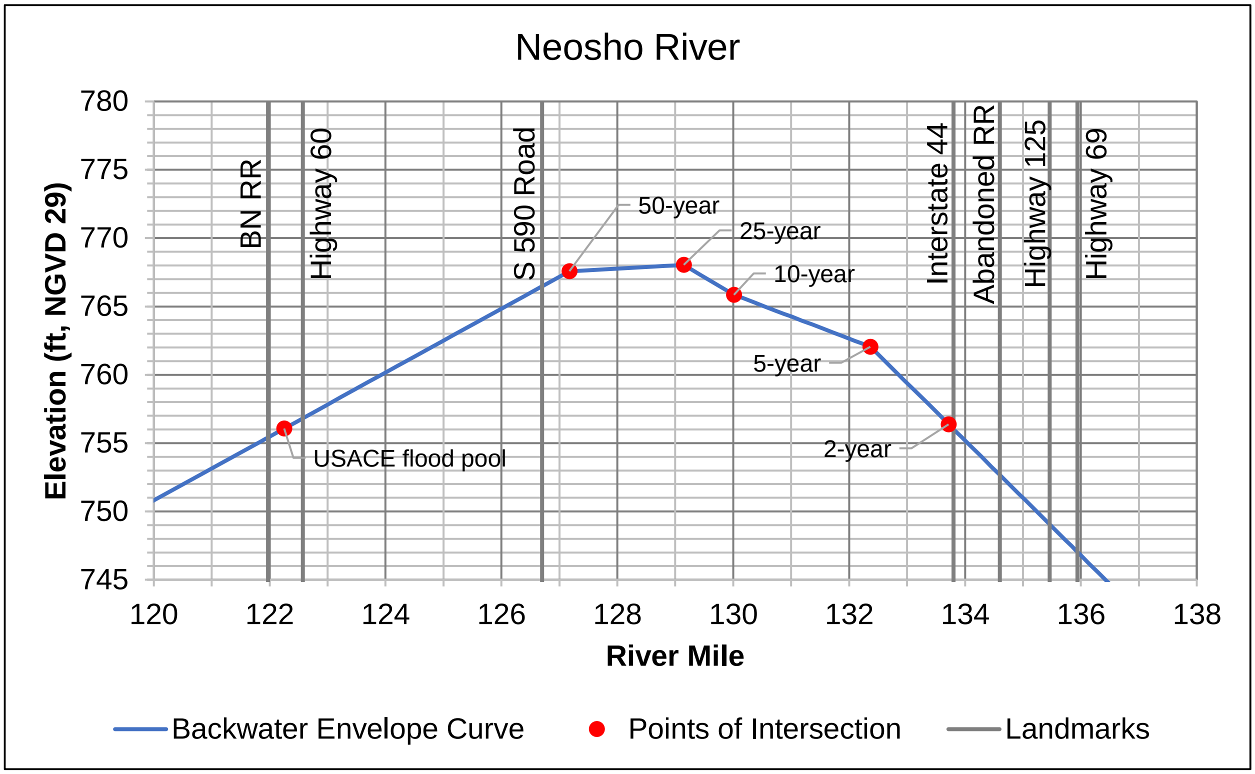

Figure 8. Backwater envelope curve for the Neosho River.

The points of intersection and envelope curve for the Spring River are displayed in **Figure 9**. At the confluence of the Spring and Neosho Rivers, the Neosho River envelope elevation is displayed as the most-downstream point of intersection. The envelopes for the two rivers must be coincident at this location for inundation mapping to be performed; differing envelopes at the confluence would result in a mapping discontinuity. The peak of the Spring River envelope curve—which is the point of intersection for the 50-year flood—occurs at RM 6.94 and at an elevation of 763.22 feet NGVD29. The most-upstream point of intersection is the 2-year return interval flood and occurs at the OK Highway 10 bridge. The point of intersection for the 2-year return interval flood is at RM 8.02 at an elevation of 755.34 feet NGVD29.

[23] *See* Formal Complaint of the City of Miami, Oklahoma, Project No. 1494-445, Accession No. 20181226-5186, at Attachment D (filed Dec. 26, 2018) (hereinafter, City's 2018 Complaint).

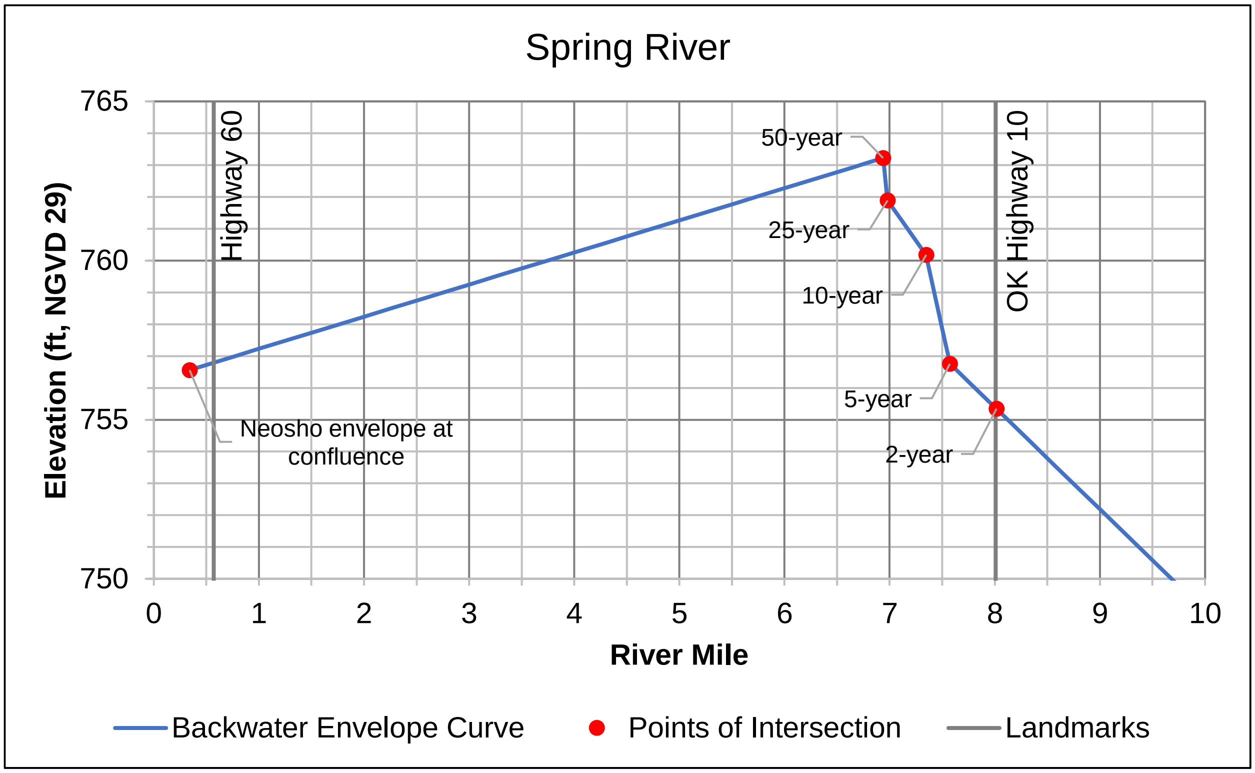

Figure 9. Backwater envelope curve for the Spring River.

The points of intersection and envelope curve for the Elk River are displayed in **Figure 10**. Note that the figure focuses on RM 10 to 12. This is because the points of intersection all occur within a small reach of the Elk River. The peak of the Elk River envelope curve—which is the point of intersection for the 25-year flood—occurs at RM 10.88 and at an elevation of 756.07 feet NGVD29 (755 feet PD). Coincidentally, that peak elevation is equal to the maximum elevation of the Corps' flood control pool. None of the points of intersection exceed the maximum pool elevation. In other words, the backwater envelope analysis shows no flooding impact on the Elk River.

As discussed in the previous section, and as presented in **Table 4**, there are no points of intersection along Tar Creek. This is because the with-dam and without-dam water surface elevation profiles are within 1 foot of each other along Tar Creek. Therefore, according to the Corps' methodology documented in *Engineering and Design Manual 1110-2-1420: Hydrologic Engineering Requirements for Reservoirs*—which the Commission relied upon in its Order on Remand—there is no backwater impact along Tar Creek. All mapping of the envelope curve which extends along Tar Creek—as presented in the following section—is based on Neosho River points of intersection and envelope curve mapping.

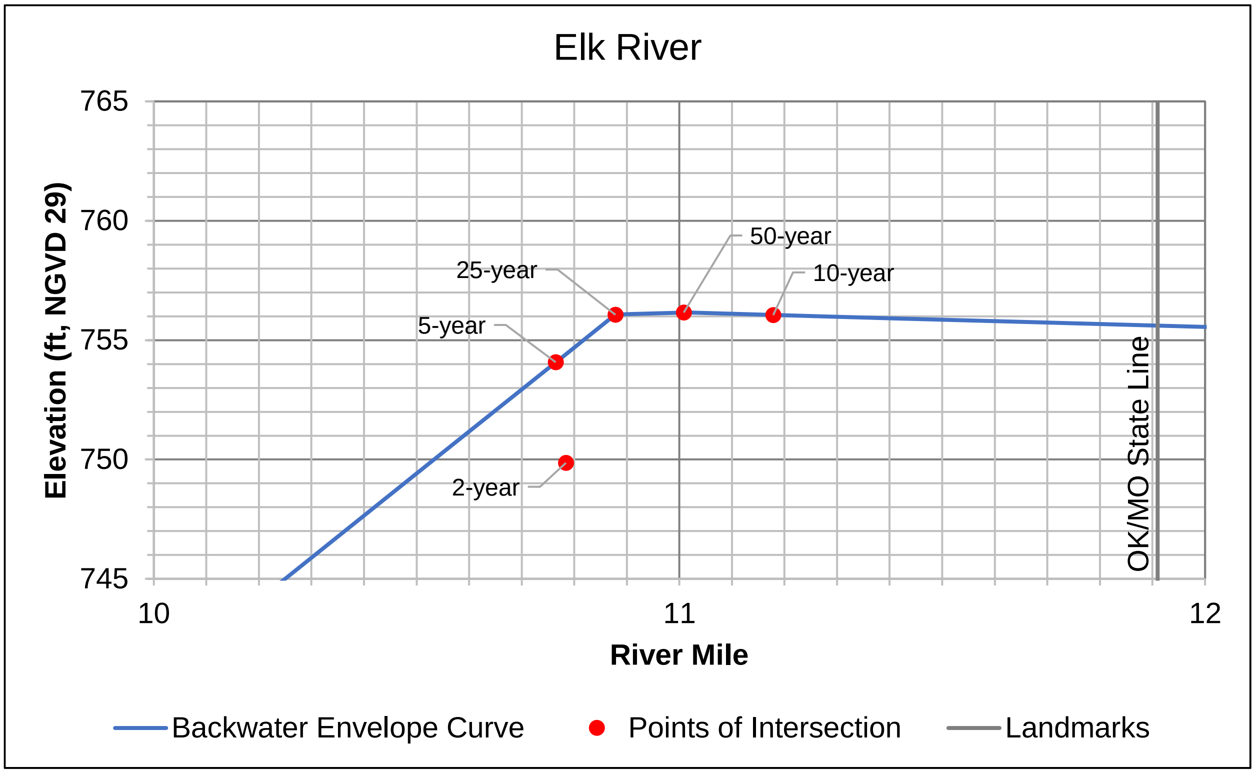

Figure 10. Backwater envelope curve for the Elk River.

4.4 Envelope Curve Mapping

In accordance with the Commission's Order on Remand, Mead & Hunt "map[ped] these elevations [i.e., the backwater envelope curve] on the best-available topographic data to determine the spatial extent of flooding due to the project."[24] As discussed in the previous section, the results of the backwater envelope curve analysis showed no flooding impact caused by Pensacola Dam on the Elk River or on Tar Creek. Mapping was performed on the Neosho and Spring rivers.

Inundation mapping is a post-simulation process performed either with hydraulic modeling software or with Geographic Information System (GIS) software. From the output of a single hydraulic simulation, HEC-RAS can automatically generate an inundation map for a user-selected output time step, or the maximum inundation. Because the envelope analysis resulting elevations are not from a single hydraulic simulation, but rather a series of simulations, inundation mapping cannot be automatically performed in HEC-RAS. Instead, ArcGIS Pro software was used to map the results of the envelope analysis. The mapping methodology used by Mead & Hunt in ArcGIS Pro is fundamentally the same process that HEC-RAS automatically performs when creating inundation maps. HEC-RAS first creates a continuous water surface from the model output data. Then HEC-RAS compares the water surface elevation to the associated topographic surface, determining where the water surface elevation is higher than the topography. Areas with positive values are classified as wet/inundated, and all other areas are classified as dry. Mead & Hunt's mapping methodology followed the same steps. Mead & Hunt first created a Triangular Irregular Network

[24] 186 FERC ¶ 61,045 (Ordering Paragraphs).

(TIN) of the envelope curve water surface elevations.[25] The TIN was converted to a raster, with the same resolution and pixel alignment as the combined land and bathymetry surface used during the relicensing process, which is, in accordance with the Commission's Order on Remand, "the best-available topographic data"[26] of the study area. The topographic data raster was subtracted from the envelope water surface elevation raster. The resulting raster was reclassified so that all positive values (i.e., wet or inundated areas, where the water surface elevation raster was higher than the topographic data raster) were classified as inundated area. The raster was then converted to a polygon to delineate the extent of inundation.

The resulting polygon represents the land area "upstream of the Pensacola Dam affected by flooding due to the existence of the project"[27] as specified in the Commission's Order on Remand and is displayed in **Figure 11**. This inundation map was used in the parcel analysis, which is discussed in **Section 5**. As **Figure 11** displays, inundation is mapped on the Neosho and Spring Rivers. As discussed in the previous section, the results of the backwater envelope curve analysis showed no flooding impact caused by Pensacola Dam on the Elk River or on Tar Creek.

The inundation polygon was not extended downstream of the BN Railroad Bridge at RM 121.97. As discussed in the previous section, the point of intersection between the envelope curve and the flood pool was set at RM 122.25, between the BN Railroad Bridge and Highway 60 (Twin Bridges). The area downstream of this location is not "affected by flooding due to the existence of the project"[28] because it is part of the reservoir, and the water surface elevation is a function of the Corps' flood control operations. Furthermore, the inundation mapping provided in the City's 2018 Complaint does not extend downstream of RM 128, which is upstream of S 590 Road (Connor Bridge, RM 126.7).[29] To visualize the focus of the City's 2018 Complaint, **Figure 12** presents the same information as **Figure 11**—the inundation mapping based on the envelope analysis discussed herein—but with the map extent shifted and scaled to match the extent and scale presented in Attachment D of the City's 2018 Complaint. As **Figure 12** presents, the City's complaint focused on the area upstream of the confluence of the Neosho and Spring rivers.

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[25] To perform this task, Mead & Hunt used the cross-section alignments from the "1D UHM", a version of the Upstream Hydraulic Model included in GRDA's May 30, 2023 Final License Application. The 1D UHM includes cross-sections throughout the entire study area and is therefore the optimal tool for creating a TIN of water surface elevations within the study area.

[26] 186 FERC ¶ 61,045 (Ordering Paragraphs).

[27] *Id*.

[28] *Id*.

[29] City's 2018 Complaint at Attachment D.

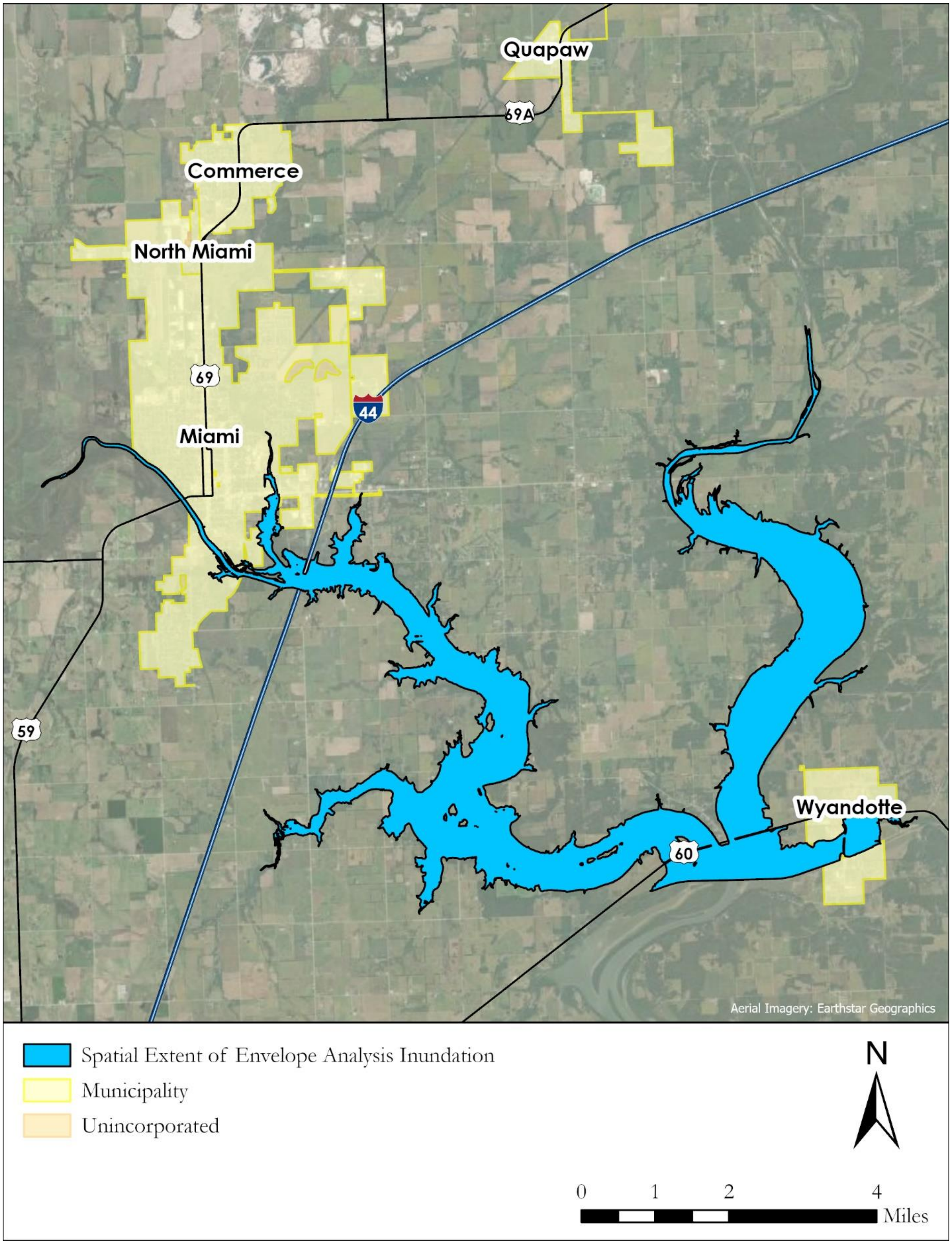

Figure 11. Spatial extent of inundation based on the envelope analysis.

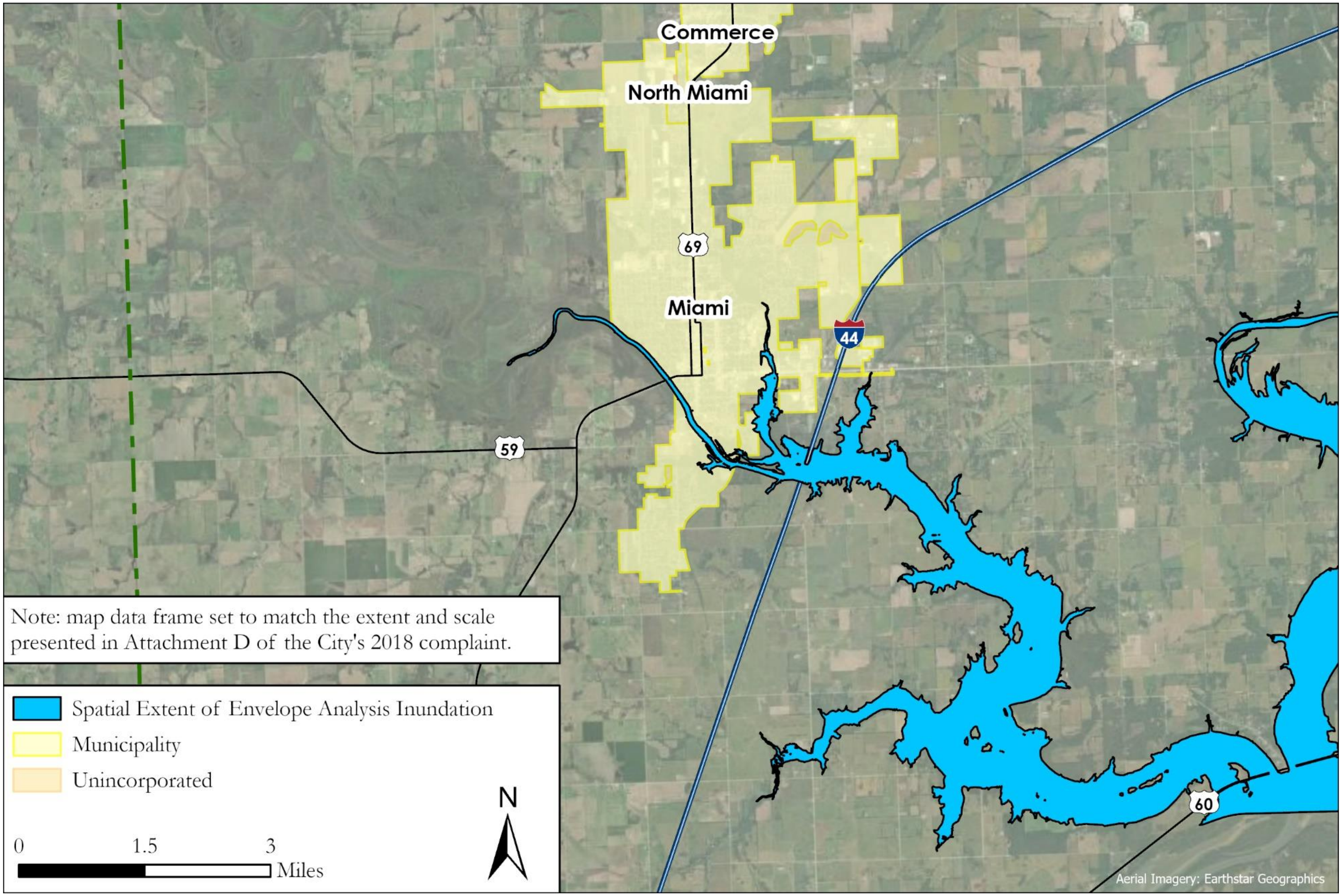

Figure 12. Spatial extent of inundation based on the envelope analysis, displayed on the map extent and scale presented in Attachment D of the City's 2018 complaint.

5. Parcel Analysis

Mead & Hunt performed a spatial analysis of parcel data which satisfied the mapping directives of the Commission's Order on Remand. The Commission's order stated the following:

> GRDA must include in its report an analysis of each parcel or lot on lands upstream of the Pensacola Dam affected by flooding due to the existence of the project and develop a table with a unique identifier for each parcel/lot and provide the acreage amount of the parcel/lot. For each parcel/lot GRDA must identify: (1) the specific project purpose(s), including flowage, that is served by each individual parcel/lot and whether the parcel/lot is within the current project boundary; and (2) GRDA's current property rights (i.e., fee title, easement, lease, or other types) for each property. GRDA must compare the results in step (5) above (backwater envelope curve) to its existing property rights, including flowage easements, as identified in the analysis above. The report must also include detailed maps and/or geographic information system data to visualize the above information, including the current project boundary location.[30]

Mead & Hunt's data collection, analysis methodology, and results are discussed below.

5.1 Data Collection and Processing

To perform the parcel analysis, Mead & Hunt compiled multiple sources of data. The data sources are as follows:

1. Ottawa County parcel data, available in GIS format at request for a nominal delivery fee,
2. Scanned versions of tract map, deed, and flowage easement documents, provided to Mead & Hunt by GRDA, and
3. Online, scanned versions of the land records which reside in the county clerk offices.[31]

To create a comprehensive coverage of parcel data, Mead & Hunt used the county parcel GIS data as a starting point. Mead & Hunt selected all parcels which intersected the envelope curve inundation map, in accordance with the Commission's directive that "GRDA must include in its report an analysis of each parcel or lot on lands upstream of the Pensacola Dam affected by flooding due to the existence of the project."[32] Not all digitized county parcels included ownership information, and not all areas of the county were covered by parcel data. Mead & Hunt filled in data gaps with information from tract map, deed, and flowage easement documents provided by GRDA. This work was time and labor intensive. Information from ownership and flowage easement documents—described via coordinate bearings and horizontal distances—was manually entered into ArcGIS Pro as a traverse. **Figure 13** displays sample text from a deed document. After data was manually entered into ArcGIS Pro, a second individual performed quality control. Whenever an adjustment was recommended and performed, a backcheck was completed as well.

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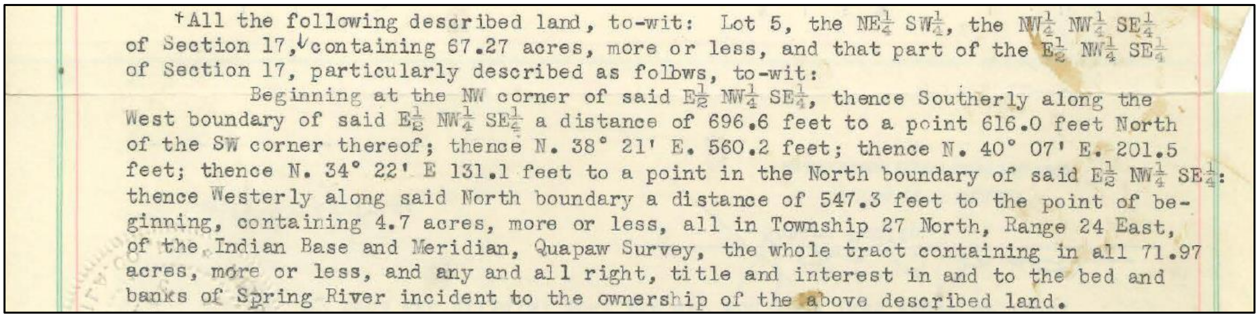
[30] 186 FERC ¶ 61,045 (Ordering Paragraphs).

[31] Available at https://okcountyrecords.com.

[32] 186 FERC ¶ 61,045 (Ordering Paragraphs).



†All the following described land, to-wit: Lot 5, the NE¼ SW¼, the NW¼ NW¼ SE¼ of Section 17,✓containing 67.27 acres, more or less, and that part of the E½ NW¼ SE¼ of Section 17, particularly described as folbws, to-wit:

Beginning at the NW corner of said E½ NW¼ SE¼, thence Southerly along the West boundary of said E½ NW¼ SE¼ a distance of 696.6 feet to a point 616.0 feet North of the SW corner thereof; thence N. 38° 21' E. 560.2 feet; thence N. 40° 07' E. 201.5 feet; thence N. 34° 22' E 131.1 feet to a point in the North boundary of said E½ NW¼ SE¼: thence Westerly along said North boundary a distance of 547.3 feet to the point of beginning, containing 4.7 acres, more or less, all in Township 27 North, Range 24 East, of the Indian Base and Meridian, Quapaw Survey, the whole tract containing in all 71.97 acres, more or less, and any and all right, title and interest in and to the bed and banks of Spring River incident to the ownership of the above described land.

Figure 13. Sample text from a deed document.

Scanned versions of plat maps were not directly used to digitize parcel boundaries but were rather used to create a geographic frame of reference in areas where the county data did not include parcel boundaries or did not include descriptive information (e.g., lot numbers). In such situations, the scanned plat map was georeferenced, and then cross-referenced when digitizing coordinate bearings and horizontal distances from GRDA's documents.

5.2 Mapping Methodology and Development

As directed by the Commission, Mead & Hunt developed "a table with a unique identifier for each parcel/lot and provide[d] the acreage amount of the parcel/lot," listed "the specific project purpose(s), including flowage, that is served by each individual lot," and listed "GRDA's current property rights (i.e., fee title, easement, lease, or other types) for each property."[33] The following subsections describe the methodology used to populate this table. Tabulation and mapping of results is discussed in **Section 5.3**.

5.2.1 Identification of Project and Non-Project Purposes

To identify the specific Project or non-Project purposes served by individual parcels/lots which are intersected by the envelope inundation, Mead & Hunt reviewed the conditions outlined in the ordering paragraphs of the current license issued on April 24, 1992, and subsequent orders amending the license, as discussed below.[34]

The current license is granted—as stated in ordering paragraph (A)—to operate and maintain the Pensacola Hydroelectric Project. No specific name for the land rights associated with the electric generation component of the comprehensive Project purpose of operating and maintaining the Project is named in the license.

The specific Project purpose regarding land rights for the Project was first established in the October 16, 1937 letter from the Public Works Administration (PWA) to GRDA; a copy of the letter is included in **Appendix D**. The letter outlined the conditions under which the PWA would provide funds and loans to support the original construction and operation of the Project. The conditions had to be met to the satisfaction of the PWA Administrator before any PWA financial assistance would be provided. The letter

[33] *Id*.

[34] *Grand River Dam Auth.*, 59 FERC ¶ 62,073 (1992).

listed three conditions. The first two conditions applied to the organization of GRDA and construction—only the third condition applied to land rights and operation. The third condition stated:

> [t]he Administrator shall be satisfied as to the extent and validity of the water rights of the Applicant [GRDA], including the right of the Applicant ***to store the necessary waters for the operation of the Project, and use such waters for irrigation and for the development of electric energy***.[35]

Irrigation is no longer a specific subject of the current license and therefore no longer a specific Project purpose. Development of electric energy is not named as a specific Project purpose in the current license—it is inferred within "operating and maintaining the Pensacola Project." As discussed below, development of electric energy is used as an operational Project purpose for the parcels in this analysis.

At the time of the October 16, 1937 PWA letter, the extent of land rights required for the operation of the Project was unclear because the exact height of the dam—along with the reservoir elevation required for the development of electric energy (power pool elevation)—was not yet determined. The original license issued by the Federal Power Commission (FPC) in 1939 was the first document to determine the extent (elevation) of land rights needed for the development of electric energy, and set the top of the power pool at elevation 745 feet. The Project purpose of development of electric energy (power pool elevation), regarding land rights is specified in Articles 12, 13, and 14 of the July 26, 1939 license:

> <u>Article 12.</u> The Licensee shall acquire all necessary lands, easements, and rights-of-way up to elevation 750; and, without regard to provisions of Article 13 below, shall raise all railroads affected by the project to such elevation above 755 as may be necessary to provide for operation of the railroads when the reservoir is raised to elevation 755.
>
> <u>Article 13.</u> The Licensee is hereby authorized to operate the reservoir in such manner as to utilize storage space below elevation 745 for power production purposes [development of electric energy] but not to utilize any storage space above said elevation 745 for power production purposes except during periods when the reservoir is being operated for the control of floods. The storage capacity between elevations 745 and 755 shall be expressly reserved for the control of floods. The Licensee shall impound flood waters in the storage space between elevations 745 and 755, and release flood waters therefrom, when, as, and in the manner directed by the Secretary of War, or his authorized representative; provided, that the Licensee shall not be required to impound any water above elevation 750 until the United States has acquired the necessary flowage rights above that elevation.
>
> <u>Article 14.</u> Subject to the provisions of Article 13, the operation of the project by the Licensee, so far as such operation may affect the use, storage, and discharge from storage, of waters, shall at all times be subject to the control of the Secretary of War under

[35] Section III of *A History of the Grand River Dam Authority, State of Oklahoma, 1935-1968, Volume I*, W.R. Holway, Consulting Engineer (located in the Oklahoma State University's Edmon Low Library, Government Documents, 5th Floor Stacks) (emphasis added); copy of the PWA letter is included in **Appendix D**.

> such rules and regulations as he may prescribe in the interests of navigation and flood control, and subject to the control of the Commission under such rules and regulations as it may prescribe for the safety of the dam and for the protection of life, health, and property.[36]

Articles 12, 13, and 14 of the original license required GRDA to purchase land rights up to 750 feet. Thus, as set forth in these articles, the license did not grant GRDA the authority to operate the Project for the purpose of development of electric energy at an elevation greater than 745 feet because the authority to establish reservoir levels at elevations greater than 745 feet is held exclusively by the Secretary of War or their authorized representative under rules they prescribe. The Commission's authority above an elevation of 745 feet is limited to "the safety of the dam and for the protection of life, health, and property."[37] Therefore, the maximum elevation where the Project purpose under the FERC-issued license can be stated as the development of electric energy is limited to 745 feet.

Independent and separate from Project purposes under the FERC license, the Corps is the authorized representative of the Secretary of War and has exclusive authority for Pensacola Dam operations above 745 feet.[38] The current requirements for the Project operations are documented in the Corps' 1992 Grand River Oklahoma Water Control Manual (Water Control Manual), which states:

> The Grand River Dam Authority is the regulatory agency for Pensacola Reservoir when the pool elevation is at 745.0 Pensacola Datum, top of power pool, or below. The Corps of Engineers, by authority of Section 7 of the Flood Control Act of 1944 (Public Law 78-534, 58 Stat. 890, 33 U.S.C. 709) is responsible for prescribing regulations for the use of the flood control storage in the lake between elevations 745.0 and 755.0 feet.[39]

Table 7-1 of the Corps' 1992 Water Control Manual states that flood control operation by the Corps begins when the lake stage is below 745.0 feet and the pool condition is rising:

> Hydropower release[s] will be made by G.R.D.A. to meet its power requirements. If the pool is forecasted to exceed elevation 745, the Corps may direct that flood control releases

[36] License Affecting Navigable Waters and Reservations of the United States, Project No. 1494 - Oklahoma-Missouri, Grand River Dam Authority (Jul. 26, 1939) at pg. 10-11.

[37] *See* 1939 License at Ord. Para (B)(vi). Protection of "life, health, and property" is not a specific project purpose—it is a requirement of operating and maintaining the Pensacola Project. [Protection of] life, health, or property is part of the definition of "Condition affecting the safety of a project or project works" contained in 18 C.F.R. § 12.3(b)(4), which states: "Condition affecting the safety of a project or project works means any condition, event, or action at the project which might compromise the safety, stability, or integrity of any project work or the ability of any project work to function safely for its intended purposes, including navigation, water power development, or other beneficial public uses, including recreation; or which might otherwise adversely affect **life, health, or property**" (emphasis added). The requirements of 18 C.F.R. Part 12 are implemented by FERC's Department of Dam Safety and Inspections.

[38] *See* 33 U.S.C. § 709; 33 C.F.R. § 208.25; Dep't of Army, *Pensacola Reservoir Grand (Neosho) River, Oklahoma Water Control Manual*, at 3-3 (Aug. 1992) ("*Water Control Manual*").

[39] *Water Control Manual* at pg. 1-2.

be made, provided that there is a sufficient volume of water indicated by stages at the upstream gages to fill the power pool.[40]

Consistent with the Corps' 1992 Water Control Manual, the 1992 license describes flood control operation in Section III.A.6 of the Environmental Assessment:

> In addition to power generation, Grand Lake reservoir is used for flood control. The flood storage allocation lies between elevations 745 feet PD and 755 feet PD. Whenever the reservoir elevation is within the limits of the flood pool, the Department of the Army, Tulsa District, Corps of Engineers (Corps) directs the water releases from the dam.[41]

Also consistent with the Corps' 1992 Water Control Manual, the 1992 license describes operations in Section V.B.2 of the Environmental Assessment:

> In operating the Pensacola Project for hydropower, GRDA controls use of the pool up to 745 feet PD. Between 745 feet PD and 755 feet PD, the Corps controls releases, managing for flood control.[42]

Section V.B.5.iv of the Environmental Assessment in the 1992 license also describes operations consistent with the 1992 Water Control Manual:

> The GRDA's use of reservoir storage in Grand Lake up to 745 feet PD for hydropower purposes and the Corps' use of Grand Lake for flood control storage between elevations 745 feet and 750 feet PD contribute to the potential inundation of Beaver Dam Cave and may affect the gray bat.[43]

The maximum elevation where the development of electric energy occurs is not specifically defined in any of the ordering paragraphs of the 1992 license but the section titled "*The Plans of the Applicant to Manage, Operate, and Maintain the Project Safely (Section 15(a)(2)(B))"* states:

> In response to staff's data request of March 2, 1987, GRDA described in detail how it operates the project under flood conditions and under normal conditions. Under flood conditions, GRDA follows instructions from the U.S. Army Corps of Engineers (Corps) with respect to operating the reservoir. When the reservoir surface rises to [Elevation 745 feet Pensacola Datum], the Corps takes charge of releasing water from the flood pool and issues instructions regarding the rates of release, times to start the release, and times to stop the release. GRDA makes releases at Pensacola Dam using the Taintor gates at both

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[40] *Id*. at pg. 7-4.

[41] *Grand River Dam Auth.*, 59 FERC ¶ 62,073, at p. 63,234 (citing the Environmental Assessment, which FERC staff issued on Nov. 19,1991).

[42] *Id*. at p. 63,237.

[43] *Id*. at p. 63,250.

> the main and the auxiliary spillways. GRDA personnel operate the gates to comply with the Corps' instructions.
>
> GRDA's operating personnel communicate with the Corps' personnel on a daily basis, providing the Corps with streamflow information for the tributaries flowing into the Grand Lake O' the Cherokees. The streamflow data from the inflow tributaries can be retrieved on command from a computer terminal, which is located at the powerhouse and utilizes a satellite communications system.[44]

The rule curve contained within Article 401 of the license has changed several times, yet the initial language remains the same:

> *Article 401.* The Licensee shall operate the Pensacola Project to control fluctuations of the reservoir surface elevation for the protection of fish, wildlife, and recreational resources associated with the Grand Lake O' the Cherokees (Grand Lake) reservoir. The Licensee shall act, to the extent practicable (except as necessary for the Department of the Army, Tulsa District, Corps of Engineers to provide flood protection in the Grand (Neosho) River), to maintain the reservoir surface elevations, as measured immediately upstream of the project dam.[45]

Thus, while Pensacola Dam is used for flood control, because that use is administered exclusively by the Corps outside the Commission's jurisdiction under the Federal Power Act (FPA), flood control is not considered a Project purpose for purposes of the FPA and GRDA's FERC-issued license. The FPA defines a "project" as including "all water-rights, rights-of-way, ditches, dams, reservoirs, ***lands, or interest in lands*** the use and occupancy of ***which are necessary or appropriate*** in the maintenance and operation of" a unit of development.[46] The Commission has repeatedly interpreted this statutory definition as encompassing only those lands that are needed "to enable the Commission, through the licensee, to carry out its regulatory responsibilities with respect to the project."[47] Because the Commission has many times determined that it has no regulatory responsibilities related to flood control at the Project,[48] the "Project," as defined under the FPA and FERC precedent, does not extend to lands that are associated with Pensacola Dam only with respect to the Corps' flood control operations.

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[44] *Id*. at pp. 63,223-24.

[45] *Id*. at p. 63,228; *see also Grand River Dam Auth*., 160 FERC ¶ 61,001 (2017).

[46] 16 U.S.C. § 796(11) (emphasis added).

[47] *Grand River Dam Auth.*, 186 FERC ¶ 61,045 at P 8 (2024) (citing *Seneca Falls Power Corp.*, 129 FERC ¶ 61,132 at P 9 (2009)); *see also City of Holyoke Gas & Elec. Dep't*, 115 FERC ¶ 62,295, at p. 64,299 (2006); *PECO Energy Co., L.L.C.*, 94 FERC ¶ 62,174, at p. 64,264 (2001); *Holliday Historic Restoration Assocs.*, 75 FERC ¶ 61,054, at p. 61,195, *order on reh'g*, 95 FERC ¶ 61,129 (2001); *N.Y. Irrig. Dist.*, 58 FERC ¶ 61,271, at p. 61,854–55 (1992).

[48] *Grand River Dam Auth.*, 186 FERC ¶ 61,045, at P 50 n.105 ("The Commission has been clear over the years that the Corps has jurisdiction over flood control operations above 745 feet PD and does not dispute this . . . ."); *Grand River Dam Auth.*, 160 FERC ¶ 61,001, at P 49 n.67 (2017) (holding that "the Corps maintains exclusive jurisdiction over operations within the flood pool, i.e., from 745 to 755 feet PD"); *Grand River Dam Auth.*, 59 FERC ¶ 62,073, at p. 63,247 (1992) (stating that the flood pool is "controlled by the Corps for flood control storage, as mandated by the Flood Control Act of 1944, and not subject to Commission authority").

Importantly, the Flood Control Acts of 1938,[49] 1941,[50] and 1944,[51] together with the Corps' flood control regulations for the Project and its *Water Control Manual*, provide no authority to the Commission to regulate this particular Project for flood control.[52] Prior to its Order on Remand, in fact, the Commission itself recognized repeatedly that it lacks authority to regulate flood control at the Project. In addition to the provisions of the Original License discussed above, the Commission has held:

> Under flood conditions, GRDA follows instructions from the U.S. Army Corps of Engineers (Corps) with respect to operating the reservoir. When the reservoir surface rises to elevation [Elevation 745 feet Pensacola Datum], the Corps takes charge of releasing water from the flood pool and issues instructions regarding the rates of release, times to start the release, and times to stop the release. GRDA makes releases at Pensacola Dam using the Taintor gates at both the main and auxiliary spillways. GRDA personnel operate the gates to comply with the Corps' instructions.[53]

Consistent with this analysis, Congress in the 2019 Pensacola Act expressly excluded from the Project all lands outside the then-approved FERC Project boundary and once again reiterated that the Corps—not the Commission—has exclusive jurisdiction for regulating flood control.[54]

Accordingly, the analysis of parcels in this report identifies the Corps' Flood Control Flowage as a non-Project purpose.[55] Thus, the two operational purposes in the parcel analysis are defined in detail as:

1. Development of Electric Energy is the operational Project purpose for elevations less than or equal to 745 feet PD.
2. USACE Flood Control Flowage is the operational non-Project purpose for elevations greater than 745 feet PD.

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[49] Flood Control Act of 1938, Pub. L. No. 75-761, § 2, 52 Stat. at 1215-16 (1938) ("Notwithstanding any restrictions, limitations, or requirement of prior consent provided by any other Act, the Secretary of War is hereby authorized and directed to acquire in the name of the United States title to all lands, easements, and rights-of-way necessary for any dam and reservoir project or channel improvement or channel rectification project for flood control…").

[50] Flood Control Act of 1941, Pub. L. No. 77-228, 55 Stat. 638 (1941).

[51] 33 U.S.C. § 709 ("it shall be the duty of the Secretary of the Army to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations.").

[52] *See* GRDA's February 16, 2024 Request for Rehearing at 19–27.

[53] *Grand River Dam Auth.*, 59 FERC ¶ 62,073 at pp. 63,223-24 (1992). Commission staff reiterated this principle throughout its Environmental Assessment for the Project's prior relicensing. *Id.* at p. 63,237 ("In operating the Pensacola Project for hydropower, GRDA controls use of the pool up to 745 feet PD. Between 745 feet PD and 755 feet PD, the Corps controls releases, managing for flood control"); *id.* at p. 63,247 (stating that the flood pool is "controlled by the Corps for flood control storage, as mandated by the Flood Control Act of 1944, and not subject to Commission authority").

[54] National Defense Authorization Act for 2020, Pub. L. No. 116-92. § 116-92, 133 Stat. 1198, 2312 (2019).

[55] GRDA recognizes that interpretation of the Pensacola Act and other issues related to the extent of Project lands are currently pending before the U.S. Court of Appeals for the D.C. Circuit in Grand River Dam Auth. v. FERC, Nos. 24-1071, 24-1238 (consolidated). The analyses and conclusions of this report are subject to change based on the final disposition by the court.

GRDA also reviewed the current license to determine what other Project purposes should be listed for parcels included in this analysis. The 1992 license lists other potential specific Project purposes in Articles 402 through 410 such as fish and wildlife studies, water quality, waterfowl habitat, gray bat cave protection, wildlife management, Commission-approved recreation sites, and cultural resource management.[56] Each requirement in Articles 402 through 410 is a Project purpose, yet only Article 410 requires specific actions on parcels that intersect the envelope analysis required by the Order on Remand. All other articles include Project purposes which are not specific to parcels included in the envelope analysis.

As part of the requirements of Article 410, GRDA filed a Shoreline Management Plan (SMP). Final maps were filed with the Commission on January 19, 2017,[57] and were approved by the Commission on June 27, 2017.[58] Of the shoreline classifications approved by the Commission, the following categories are specific Project purposes that intersect parcels included in the envelope analysis:

1. Shoreline Management: Public,
2. Shoreline Management: Wildlife Management,
3. Shoreline Management: Stewardship,
4. Shoreline Management: Responsible Growth, and
5. Shoreline Management: Responsible Growth-Wetlands Inventory

These specific Project purposes are applied to shoreline parcels at or below 745 feet PD. On maps and in tables, the abbreviation “SM” is used for shoreline management.

5.2.2 Summary of Project and non-Project Purposes

In summary, the following operational purposes are mapped and tabulated:

1. Development of Electric Energy (Project purpose), and
2. USACE Flood Control Flowage (non-Project purpose).

And the following shoreline management Project purposes are also mapped and tabulated:

1. SM: Public,
2. SM: Wildlife Management,
3. SM: Stewardship,
4. SM: Responsible Growth, and
5. SM: Responsible Growth-Wetlands Inventory.

In the tables discussed in **Section 5.3**, each parcel identified in the envelope analysis lists all applicable specific purposes (i.e., the above-identified Project and non-Project purposes). Similarly, the maps

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[56] 59 FERC ¶ 62,073 at Art. 402–410.

[57] *See* GIS Data for Shoreline Management Plan Maps, Project No. 1494-434, Accession No. 20170119-5119 (filed Jan. 19, 2017).

[58] *Grand River Dam Auth.*, 159 FERC ¶ 62,341, Project No. 1494-434, Accession No. 20170627-3051 (filed Jun. 27, 2017).

discussed in **Section 5.3** show how multiple specific Project (and non-Project) purposes exist on the same parcel.

5.2.3 GRDA's Current Property Rights

GRDA's current property rights fall into two categories: flowage easement and fee title. Regarding GRDA's flowage easement, some parcels were completely within the easement, some parcels were completely outside the easement, and some parcels were partially within the easement. These three sub-categories of flowage easement were tabulated and mapped, as discussed in **Section 5.3**.

Similarly, for parcels where GRDA's property rights are specified as fee title, further granularity is provided. Some parcels are owned entirely by GRDA and are classified as such: fee simple. For other parcels, best available data—from Ottawa County and GRDA—indicates partial fee simple ownership by GRDA but does not specify the geographic extent of GRDA's ownership on each parcel. Additionally, these parcels are intersected by GRDA's flowage easement. These parcels are classified as follows: "fee title, portion and flowage easement, portion." Lastly, for some geographic areas, best available data indicates GRDA ownership in fee simple, but ownership is still being researched. These parcels are classified as follows: "fee simple*."

In summary, GRDA's current property rights are mapped and tabulated as follows:

1. Fee title,
2. Fee title*,
3. Fee title, portion and flowage easement, portion,
4. Flowage easement, completely within,
5. Flowage easement, partially within, and
6. Flowage easement, completely outside.

As discussed in **Section 5.3**, the result table which documents GRDA's current property rights lists one of these categories for each individual parcel.

5.3 Table and Map Results

Tabulated parcel data is presented in **Appendix E**. To assist the Commission, two tables are provided:

1. **Table E-1** lists all parcels intersected by the envelope curve, and
2. **Table E-2** lists only the parcels which are intersected by the envelope curve and are outside GRDA's current property rights.

Table E-1 lists the following, as directed in the Commission's order:

1. Parcel unique ID,
2. Total parcel acreage,
3. Specific Project (and non-Project) purpose(s) served by the parcel, and
4. GRDA's current property rights.

Table E-2 is presented to quantify, parcel by parcel, the additional acreage affected by the Corps' flood control operations. **Table E-2** lists the following:

1. Parcel unique ID,
2. Total parcel acreage, and
3. Acreage of the parcel which lies outside GRDA's current property rights but are necessary for the Corps' flood control (a non-Project purpose), based on the envelope analysis.

Detailed maps are presented in **Appendix F**.

1. **Map F-1** displays GRDA's current property rights, and
2. **Map F-2** displays the specific Project (and non-Project) purposes.

As directed by the Commission, **Map F-1** indicates "whether the parcel/lot is within the current project boundary," displays "GRDA's current property rights (i.e., fee title, easement, lease, or other types) for each property," and compares "the…backwater envelope curve [inundation boundary] … to [GRDA's] existing property rights."[59] **Map F-2** identifies "the specific project purpose(s), including flowage, that is served by each individual parcel/lot.[60] As discussed in **Sections 5.2.1** and **5.2.2**, multiple specific Project (and non-Project) purposes can exist on the same parcel. For example, if the 745 feet PD contour crosses through a parcel, a specific operational Project purpose and a non-Project operational purpose might both exist on that same parcel. Furthermore, for parcels subject to the shoreline management plan, multiple shoreline management classifications can exist within a single parcel. The unique parcel IDs on the maps can be correlated with the rows in **Table E-1** for a comprehensive list of specific Project (and non-Project) purposes for each parcel.

In addition to the detailed maps in **Appendix F**, summary figures are presented herein. GRDA's flowage rights and fee simple ownership, as discussed in **Section 5.2.3**, are presented in **Figure 14**. For clarity, rather than display parcels for which GRDA has flowage rights that cover part—but not all—of the parcel, the extent of GRDA's flowage rights is displayed. Combining the information presented in **Figure 11** and **Figure 14**—specifically the extent of GRDA's flowage rights and the extent of the envelope analysis inundation—**Figure 15** presents the inundation area from the envelope analysis which is outside GRDA's flowage easement. As **Figure 15** displays, none of the inundated area outside GRDA's flowage easement extends upstream into the City of Miami. In accordance with the Pensacola Act, GRDA does not lack any property rights. The area outside GRDA's flowage easement and inside the envelope inundation boundary, which is approximately 880 acres, would be needed to support the Corps' flood control operations—but again, these areas serve only a non-Project purpose pursuant to the Pensacola Act, the FPA, and various Flood Control Acts.

[59] 186 FERC ¶ 61,045 (Ordering Paragraphs).

[60] *Id*.

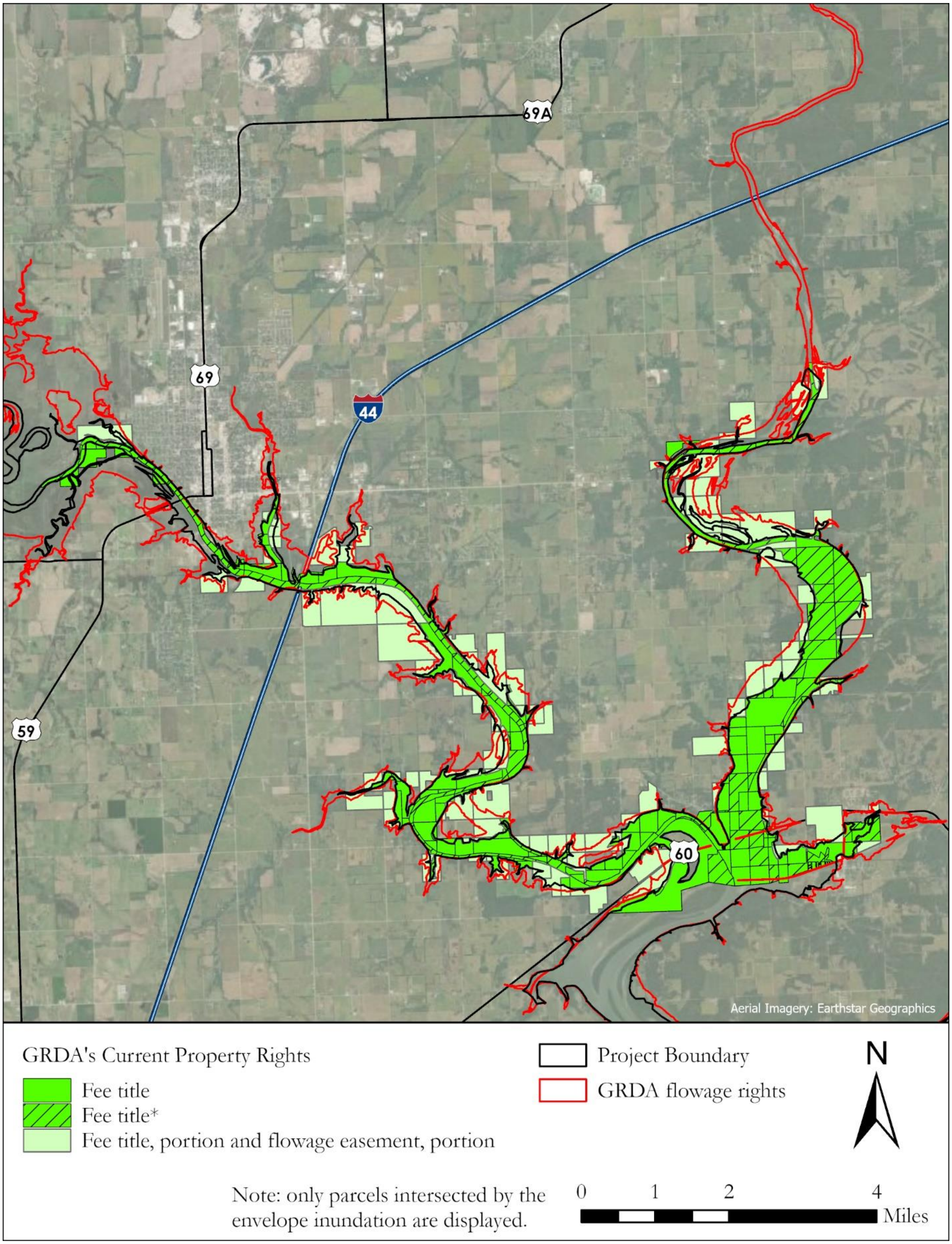

Figure 14. Extent of GRDA's flowage rights and fee title property rights.

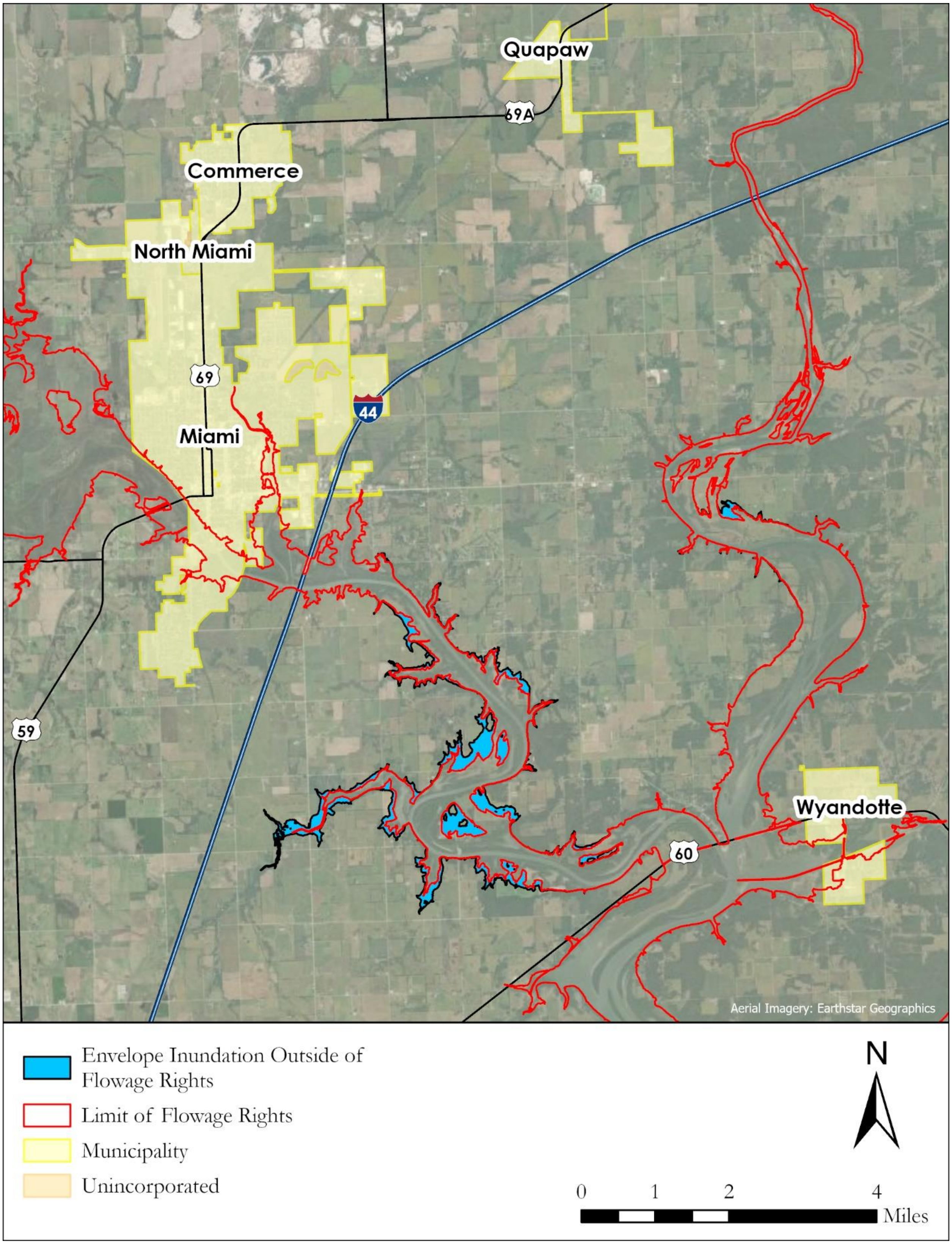

Figure 15. Area of envelope inundation outside GRDA's flowage rights.

6. Conclusion

The Commission's Order on Remand directed GRDA to perform a flood frequency analysis, develop inflow hydrographs, model with- and without-dam conditions, and perform a backwater envelope curve analysis.[61] FERC also directed GRDA to analyze the property parcels intersected by the spatial extent of flooding resulting from the envelope curve analysis.[62] On behalf of GRDA, Mead & Hunt has performed the Commission-specified analysis.

As documented herein, there are approximately 880 acres of land which lie outside GRDA's flowage easements but within the spatial extent of the envelope inundation. In accordance with the Pensacola Act, FPA, and various Flood Control Acts, GRDA does not lack any property rights for purposes of complying with its FERC-issued license. Although these approximately 880 acres are within the envelope inundation, none are needed for Project purposes, i.e., to meet FERC's regulatory responsibilities under the FPA and GRDA's corresponding obligations under the FERC-issued license for the Project.

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[61] *Grand River Dam Auth.*, 186 ¶ FERC 61,045, at P 65 (2024).

[62] *Id.* at P 66.