Pensacola Hydroelectric Project
FERC Project No. 1494

Exhibit A
Description of Project

Final License Application

Prepared for

GRDA
Grand River Dam Authority

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APPENDICES

LIST OF ABBREVIATIONS

cfs	cubic feet per second
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
Grand Lake	Grand Lake O' the Cherokees
GRDA	Grand River Dam Authority
hp	horsepower
kW	Kilowatts
kV	Kilovolts
kVA	Kilovolt Amperes
Licensee	Grand River Dam Authority
MOD	Motor-Operated Disconnect
MVA	Megavolt Amperes
MW	Megawatts
NAVD	North American Vertical Datum 1988
NGVD	National Geodetic Vertical Datum 1929
PD	Pensacola datum
Pensacola Project	Pensacola Hydroelectric Project
Project	Pensacola Hydroelectric Project
rpm	revolutions per minute
USACE	United States Army Corps of Engineers

1. Description of Facilities

The Pensacola Hydroelectric Project (Pensacola Project or Project) is located on the Grand (Neosho) River in Craig, Delaware, Mayes, and Ottawa Counties, Oklahoma. **Appendix A-1** of this application includes a map showing the general location of the Pensacola Project. **Appendix A-2** presents an aerial photograph showing the Pensacola Project facilities, which include the dam with a gated main spillway, middle gated spillway, east gated spillway, powerhouse, tailrace, electrical switching station, transmission, Grand Lake O' the Cherokees (Grand Lake), arch toe pump station, and surrounding land extending landward to an approximate elevation of 750 feet Pensacola Datum (PD).[1] From right to left looking downstream, the principal Project works consist of the intake structure for the powerhouse, main gated spillway adjoining to the dam, middle gated spillway, and east gated spillway.[2] The Project has an authorized capacity of 105.176 megawatts (MW).

1.1 Dam

The Pensacola Project's dam is a multi-section structure. The different sections, from right to left looking downstream, consist of: West Non-Overflow Section, Multiple Arch Section, Main Spillway Section, East Non-Overflow Section, Middle Spillway Section, and East Spillway Section. A non-Project highway bridge comprised of two lanes and a pedestrian sidewalk, State Highway 28, runs along the top of the dam. The grade elevation of the lanes is approximately 763.5 feet PD at the multiple arch section and 768.5 feet PD at the east and middle spillway segments.

1.1.1 West Non-Overflow Section

The west abutment is connected to the west end of the west non-overflow section of the dam which is a concrete gravity section approximately 28 feet long. The east side of the west non-overflow section is connected to the multiple arch section. The cross-sectional width is approximately 43 feet and the height from the base of the section to the top of the roadbed is approximately 75 feet. The width and height measurements are scaled from the Exhibit F drawings**.**

1.1.2 Multiple Arch Section

The main portion of the dam is a reinforced concrete multiple-arch structure consisting of 52 buttresses spaced 84 feet apart. The buttresses are hollow except for the first and last. There are 51 free span concrete arches resulting in an approximate length of 4,284 feet. A typical buttress has a length of 84 feet. The dam has a crest elevation of 757 feet PD. An arch section has a cross sectional width varying from approximately 185 to 130 feet. The height from the base of the section to the top of the roadbed varies from approximately 100 to 155 feet. The width and height measurements are scaled from the Exhibit F drawings.

Seepage through the Pensacola Dam and runoff from the surrounding area result in standing water in the ditch at the toe of the dam. The pump station is located outside of Arch 6, which consists of two 6-inch submersible pumps and a single 12-inch vertical turbine pump. The pumps are connected to a 20-inch diameter pipe that discharges into the tailrace below the powerhouse.

[1] Unless otherwise noted on the Project Boundary Map contained in Exhibit G of this application.
[2] Unless otherwise cited, all facility description attributes are from the Supporting Technical Information Document filed with the FERC January 2021 (GRDA, 2021).

1.1.3 Main Spillway Section

The main spillway section is described in Section 1.2.

1.1.4 East Non-Overflow Section

The east end of the main spillway is connected to the east non-overflow section of the dam which is a concrete gravity section approximately 451 feet long. The east side of the non-overflow is connected to the east abutment. The section has a cross-sectional width varying from approximately 70 feet to 40 feet. The height from the base of the section to the top of the roadbed varies from approximately 85 feet to 55 feet. The width and height measurements are scaled from the Exhibit F drawings.

1.1.5 Middle Spillway Section

The middle spillway section is described in Section 1.2.

1.1.6 East Spillway Section

The east spillway section is described in Section 1.2.

1.2 Spillway Sections

The Pensacola Project is comprised of three spillways: Main spillway, Middle spillway, and East spillway.

1.2.1 Main Spillway Section

The main spillway section is integral to the dam on its west end and connected to the east non-overflow section at the other end. The structure is mass concrete with an ogee-shaped spillway with a crest elevation of 730 feet PD. The spillway is comprised of 21 radial gates that are 36 feet wide by 25 feet tall resulting in a structure length of approximately 860 feet. The top of the gate elevation is 755 feet PD. The approximate cross-sectional width is 90 feet and height from the base of the section to the top of the roadbed of a typical section of the spillway is 100 feet. The width and height measurements are scaled from the Exhibit F drawings. The gates are operated by two traveling gate hoists located above the main spillway. Water flows into the main spillway channel below the spillway. The spillway channel merges with the east spillway channel and flows into the tailrace further downstream.

1.2.2 Middle Spillway Section

The middle spillway section is situated about 0.9 miles east of the dam’s east abutment. The structure is mass concrete with an ogee-shaped spillway, which has a crest elevation of 740 feet PD. The spillway is comprised of 11 radial gates that are 37 feet wide and 15 feet tall resulting in a structure length of approximately 450 feet. The typical cross-sectional width and height of the middle spillway from the base of the section to the top of the roadbed is approximately 45 feet and 40 feet, respectively. The width and height measurements are scaled from the Exhibit F drawings. Gates are operated by a traveling hoist located at the middle spillway section. Water flows for approximately 0.5 miles within the middle spillway channel until it joins with the east spillway channel.

1.2.3 East Spillway Section

The East spillway section is located approximately 700 feet east of the middle spillway section. The structure is mass concrete with an ogee-shaped spillway, which has a crest elevation of 740 feet PD.

The east spillway is comprised of 10 radial gates that are 37 feet wide and 15 feet tall resulting in a structure length of approximately 410 feet. The typical cross-sectional width and height of the east spillway from the base of the section to the top of the roadbed is approximately 45 feet and 40 feet respectively. The width and height measurements are scaled from the Exhibit F drawings. Gates are operated by a traveling hoist located at the east spillway section. Water flows into the east spillway channel below the spillway. The east spillway channel is approximately 1.5 miles long and 850 feet wide. The east spillway channel merges with the tailrace further downstream.

1.3 Powerhouse and Intake Structure

The powerhouse is located below Arches 2 through 4 of the Pensacola Dam (Arch 1 is the western-most arch). The powerhouse is a multi-story, reinforced concrete building and is 87.75 feet wide in the upstream to downstream direction, 279 feet long in the west to east direction, and approximately 45 feet tall. The elevation of the generator floor is 652.0 feet PD.

The intake structure supplies water to the penstocks that supply flow to the powerhouse's six hydropower units and the house unit. The reinforced concrete structure is located on top of Arches 2 through 4. The intake structure has a length of 246 feet, a cross-sectional width of 23 feet, and a height of 75 feet. The minimum intake elevation is 682 feet PD and the top deck elevation is 757 feet PD. The intake includes vertical trash racks that are 73 feet high with 3.75-inch spacing to catch debris and bulkhead gates that are used to isolate and dewater individual penstocks (Grand River Dam Authority, 2017) (Grand River Dam Authority, 2021). The gates are operated by a traveling gantry crane mounted on the top deck on the intake structure.

Six separate steel penstocks transfer flow from the intake structure to the powerhouse hydroelectric units. The length of the penstocks is approximately 195 feet long. The six main penstocks have a 15-foot diameter and flow is controlled by wicket gates at the entrance of each turbine. Two (2) draft tubes per hydroelectric unit located below the powerhouse discharge the flow in the tailrace. The draft tubes are 12 feet tall by 14 feet wide with an invert elevation of 602.5 feet PD. Slots in the draft tube opening can be utilized to install stoplogs to dewater a unit using a traveling hoist. A separate 3-foot diameter penstock transfers flow to the house unit.[3]

The draft tubes of the powerhouse discharge in the tailrace located below the powerhouse. The tailrace is approximately 1.5 miles long and 300 feet wide. The tailwater elevations for the Pensacola Project typically range between 620 and 625 feet PD at normal reservoir elevations depending on the conditions at the downstream Lake Hudson Project.

A bypass system, on the west end of the powerhouse, consists of a 30-inch diameter pipe. The system has not been operated in years. It is unknown if any flow could pass through the system due to sedimentation at the intake.

A 30-inch diameter bypass flow pipe was included in the Project's design to provide a means of releasing water from the Project at all times, even when none of the hydropower units are operating or none of the spillway gates are open. It is not needed for the operation of the Project (Grand River Dam Authority, 2021).

[3] The house unit is currently inoperable and is scheduled to be returned to service in 2025.

2. Description of Reservoir

Grand Lake O' the Cherokees (Grand Lake) is impounded by the Pensacola Dam and was created in 1940 with the completion of the Pensacola Project. During GRDA's normal Project operations, GRDA anticipates operating the reservoir for power generation purposes between 742 and 745 feet PD during the new license term. Pursuant to section 7 of the Flood Control Act of 1944 and section 7612 of the National Defense Authorization Act for Fiscal Year 2020, GRDA controls the operation of the Project until the reservoir elevation is expected to exceed 745 feet PD, at which time the United States Army Corps of Engineers (USACE) has exclusive jurisdiction over Project operations, for purposes of flood control. The reservoir contains approximately 1.44 million acre-feet in water storage and has a surface area of approximately 45,056 acres at an elevation of 745 feet PD. The reservoir contains approximately 1.31 million acre-feet in water storage and has a surface area of approximately 41,581 acres at an elevation of 742 feet PD (Hunter, S.L., et. al., 2020). The usable water storage between 742 and 745 feet PD is 130,000 acre-feet.

3. Description of Generating Units

The powerhouse has six main hydroelectric units with Francis-style hydraulic turbines and associated generators. The six main hydroelectric units have an as-built turbine head of 117.5 feet. One additional hydroelectric unit, the house unit, has an as-built turbine head of 115 feet.

Each of the 6 main turbines has a nameplate capacity of 17,446 kilowatts (kW) or 23,395 horsepower (hp) at a nameplate flow of 1,950 cubic feet per second (cfs). Each turbine operates at 150 rpm and the normal maximum flow for each turbine is 2,317 cfs (Grand River Dam Authority, 2004). The house turbine has a nameplate capacity of 563 kW or 750 hp.[4] It has a maximum hydraulic capacity of 60 cfs (Grand River Dam Authority, 2017), and operates at 720 rpm.

Each of the 6 generating units has a generator nameplate rating of 21.60 MW and 24 megavolt Amperes (MVA) at 90% nameplate power factor. The generators are Westinghouse A/C, 60-cycle models generating at 13.8 Kilovolts (kV).

The 500-kW house unit generator has a nameplate rating of 500 kW and 625 kilovolt amperes (kVA) at 80% nameplate power factor. The generator is a Westinghouse A/C, 60-cycle model which operates at 480 volts. The house unit is generator capacity limited to 500 kW.

The combined generation capacity for the Project is 105.176 MW.[5]

Pictures of the nameplates for the six main hydroelectric units were filed with the Commission on May 19, 2010. For reference purposes, the May 2010 filing, and pictures of the nameplates of the house unit have been incorporated into this exhibit as **Appendix A-3**.

[4] Watts are calculated from horsepower: 750 watts equals 1 hp.
[5] Output is turbine-limited for the six main units.

4. Tailrace

The Project tailrace is approximately 270 feet wide and under normal water elevations approximately 18 feet deep at the downstream end of the powerhouse. The portion of the tailrace immediately downstream of the powerhouse was originally excavated from the chert bedrock during the construction of the project. The entire tailrace extends approximately 7,500 feet downstream of the powerhouse until it merges with the spillway channel.

5. Switching Station and Transmission Equipment

The Pensacola Project's switching station is located on the bluff west of the powerhouse downstream of the arch dam. The primary transmission lines terminate at 15 kV breakers at the non-Project switching station. There are 6 generator leads made of parallel 500k circular mils copper, medium voltage cable operating at 13.8 kV that vary in length from 450 to 650 feet (Grand River Dam Authority, 2017). The 13.8 kV disconnects are the point of interconnect for the Project. A diagram of principal electrical circuits associated with the Pensacola Project is included in **Appendix A-4**.

6. Appurtenant Equipment

Accessory electrical equipment, such as relay devices and sensors, switchgear, switchboards, panels, control equipment, and associated wiring required for the safe, self-protected, operation of the turbine-generator units is included as a part of the Project. Additional equipment includes, but is not limited to, bearing lubrication systems, gate hoist equipment, hoisting equipment for maintenance and repair of the turbine generators, protective devices, and metering devices.

7. United States Land within the Pensacola Project Boundary

Historically, the Project has never occupied any lands of the United States. In the last relicensing, for example, no federal lands were identified at the Project, and the Commission imposed no federal land use annual charges requirement in the license (Federal Energy Regulatory Commission, 1992). As recently as 2017, the Commission concluded that the Project "does not occupy federal lands" (Grand River Dam Authority, 2017).

At the outset of the relicensing effort, however, the U.S. Department of the Interior, Bureau of Indian Affairs (BIA) on March 6, 2018 filed with the Commission Trust Maps based on land inventory data contained in the BIA's Trust Asset and Accounting Management System (TAAMS), which contains trust and restricted fee lands of federally-recognized Native American Nations and Native American individuals (Bureau of Indian Affairs, 2018). In response, the Commission cited GRDA's responsibility under federal regulations to identify all lands of the United States as part of its Application for New License:

> As the Commission's regulations require, in its final license application, GRDA must provide exhibit G maps that show a project boundary enclosing all project works and lands necessary for operation and maintenance of the project and other project purposes including recreation, shoreline control, and protection of environmental resources (see 18 C.F.R section 4.41(h)(2)). Further, the Commission's regulations require that GRDA provide an exhibit A that describes all lands of the United States that are enclosed within

> the project boundary, identified and tabulated by legal subdivisions of a public land survey of the affected area or, in the absence of a public land survey, by the best available legal description (see 18 C.F.R. section 4.51(b)(6)) (Federal Energy Regulatory Commission, 2018).

Accordingly, GRDA over the past several years has completed a comprehensive review and legal analysis of all lands identified by BIA from its TAAMS report and map provided to the Commission in 2018. **Appendix A-5** contains GRDA's report of this effort, together with title work conducted on all parcels that BIA identified as occurring within or immediately adjacent to the current Project boundary.

As a result of this effort GRDA has concluded that 65.812 acres of United States lands, including 57.69 acres of wetland easements, are included within the Project boundary.[6]

8. Works Cited

Bureau of Indian Affairs. (2018). *Submittal of Tribal Lands Maps for the Pensacola Project, FERC Accession Nos. 20180306-5100, 20180306-5111, 20180306-5112.* March 6, 2018.

Federal Energy Regulatory Commission. (1992). *Grand River Dam Authority, Project No. 1494-002-Oklahoma, Order Issuing New License. 59 FERC ¶62,073.* April 24, 1992.

Federal Energy Regulatory Commission. (2018). *Study Plan Determination of the Pensacola Project Under P-1494, FERC Accession No. 20181108-3052.* November 8, 2018.

Grand River Dam Authority. (2004). *As Built Exhibit A Under P-1494, FERC Accession No. 20040624-0097.* June 24, 2004.

Grand River Dam Authority. (2017). *Pensacola Project (FERC No. 1494) Notice of Intent to File License Application and Pre-Application Document, Grand River Dam Auth., 159 FERC ¶ 62,341 .* February 1, 2021.

Grand River Dam Authority. (2021). *Supporting Technical Information Document - Revision 3, FERC Accession No. 20210205-5148.* February 5, 2021.

Hunter, S.L., et. al. (2020). *Bathymetric Map, Surface Area and Capacity of Grand Lake O' the Cherokees, Northeastern Oklahoma, 2019.* Denver, USGS.

[6] This acreage figure is based upon the shape files provided to the BIA and DOI on March 15, 2023. See also Appendix A-5.