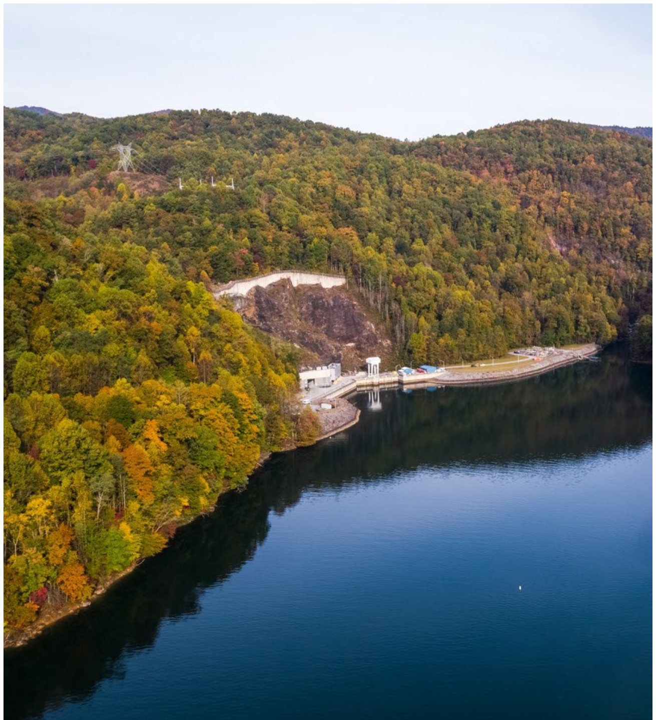

Final LICENSE APPLICATION

Volume III of V

Exhibit F – General Design Drawings
Exhibit G – Project Boundary Maps
Exhibit H – Plans and Ability to Operate

Bad Creek Pumped Storage Project
(FERC No. 2740)

July 2025

Prepared by:

HDR

Prepared for:

Duke Energy Carolinas, LLC

DUKE ENERGY

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Bad Creek Pumped Storage Project
FERC Project No. 2740
FINAL LICENSE APPLICATION

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Acronyms and Abbreviations

Bad Creek Project or Project	Bad Creek Pumped Storage Project (FERC No. 2740)
Bad Creek II	Bad Creek II Power Complex
CFR	Code of Federal Regulations
CUI//CEII	Controlled Unclassified Information//Critical Energy Infrastructure Information
Duke Energy	Duke Energy Carolinas, LLC
EAP	Emergency Action Plan
DSSMP	Dam Safety Surveillance and Monitoring Plan
FERC or Commission	Federal Energy Regulatory Commission
KT	Keowee Toxaway Hydroelectric Project
LROL	Lowest Reliability Operating Limit
MW	megawatts
NPV	net present value
PM&E	Protection, Mitigation, and Enhancement
SDR	Supporting Design Report
SEPA	Southeastern Power Administration
SERC	SERC Reliability Corporation
STID	Supporting Technical Information Document
USACE	United States Army Corps of Engineers

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FINAL LICENSE APPLICATION

BAD CREEK PUMPED STORAGE PROJECT (FERC NO. 2740)

EXHIBIT F

GENERAL DESIGN DRAWINGS

Exhibit F - General Design Drawings (18 CFR §4.41(g))

F.1 List of General Design Drawings

The General Design Drawings showing overall plan views, elevations, and sections of the Bad Creek Pumped Storage Project (Bad Creek Project or Project) works in sufficient detail to provide a complete understanding of the Project are listed below in Table F-1. In accordance with 18 Code of Federal Regulations (CFR) § 4.32(k), the Federal Energy Regulatory Commission (FERC or Commission) and Duke Energy Carolinas, LLC (Duke Energy) treat Exhibit F General Design Drawings as Controlled Unclassified Information//Critical Energy Infrastructure Information (CUI//CEII) under § 388.113 of FERC's regulations because the drawings contain detailed design information about existing critical infrastructure. Therefore, Duke Energy is not filing the drawings as public information. The Exhibit F drawings are being filed with the Commission under Volume IV. Procedures for the public to obtain access to CUI//CEII may be found at 18 CFR § 388.113. Requests for access should be made to FERC's CUI//CEII Coordinator.

Table F-1. Bad Creek Pumped Storage Project General Design Drawings

Drawing Number	Title
Sheet F-1	Bad Creek Units 1 through 4 General Plan
Sheet F-2	Bad Creek Units 1 through 4 Powerplant and Tunnels Plan and Sections
Sheet F-3	Bad Creek Units 1 through 4 Dams, Intake and Discharge Structures Plans and Sections
Sheet F-4	Bad Creek Units 1 through 4 Powerhouse and Stream Augmentation System Sections
Sheet F-5	Bad Creek II Power Complex (Bad Creek II) Units 5 through 8 General Plan
Sheet F-6	Bad Creek II Units 5 through 8 Power Complex Plan and Profile
Sheet F-7	Bad Creek II Units 5 through 8 Shafts, Tunnels and Submerged Weir Plan and Sections
Sheet F-8	Bad Creek II Units 5 through 8 Upper and Lower Inlet/Outlet Structures Plans and Sections
Sheet F-9	Bad Creek II Units 5 through 8 Powerhouse Transverse Section Power Complex 3D Rendering

F.2 Supporting Design Report

18 CFR § 4.41(g)(3) and (4) require an applicant for a new license file with FERC two copies of a Supporting Design Report (SDR) with the license application. The purpose of the SDR is to demonstrate the existing structures are safe and adequate to fulfill their stated functions. The SDR also includes preliminary information and drawings for Bad Creek II.

Consistent with the request associated with the General Design Drawings and in accordance with 18 CFR § 4.32(k), FERC and Duke Energy treat the SDR as CUI//CEII under § 388.113 of FERC's regulations because the report contains detailed design information about existing critical infrastructure. Therefore, Duke Energy is not filing the SDR as public information. The SDR is being filed with the Commission under Volume IV. Procedures for the public to obtain access to CUI//CEII may be found at 18 CFR § 388.113. Requests for access should be made to FERC's CUI//CEII Coordinator.

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FINAL LICENSE APPLICATION

BAD CREEK PUMPED STORAGE PROJECT (FERC NO. 2740)

EXHIBIT G

PROJECT BOUNDARY MAPS

Exhibit G - Project Maps (18 CFR §4.41(h))

G.1 Overview

The Project Boundary was defined in Exhibits J and K during the initial license period, so there is no existing FERC-approved Exhibit G.

Project Boundary Maps depicting the proposed expanded Project Boundary, prepared in accordance with the requirements of 18 CFR §§4.39 and 4.51(h), are included herein. The Project Boundary Maps show the Project vicinity, location, and boundary in sufficient detail to provide a full understanding of the Project and are listed in Table G-1. The electronic files used to develop Project Boundary maps are being filed concurrently with the FLA.

Table G-1. Project Boundary Maps

Drawing Number	Title
Exhibit G – Sheet 1 of 4	Project Boundary Map
Exhibit G – Sheet 2 of 4	Project Boundary Map
Exhibit G – Sheet 3 of 4	Project Boundary Map
Exhibit G – Sheet 4 of 4	Project Boundary Map

G.2 Project Boundary Modifications

The proposed Project Boundary reflects changes to incorporate additional lands needed for the construction and operation of a second powerhouse. This includes additional lands for a new primary 525kV transmission line adjoining the existing primary transmission line as shown on Figure G-1 through Figure G-6. The expansion will increase the Project Boundary by approximately 467 acres.

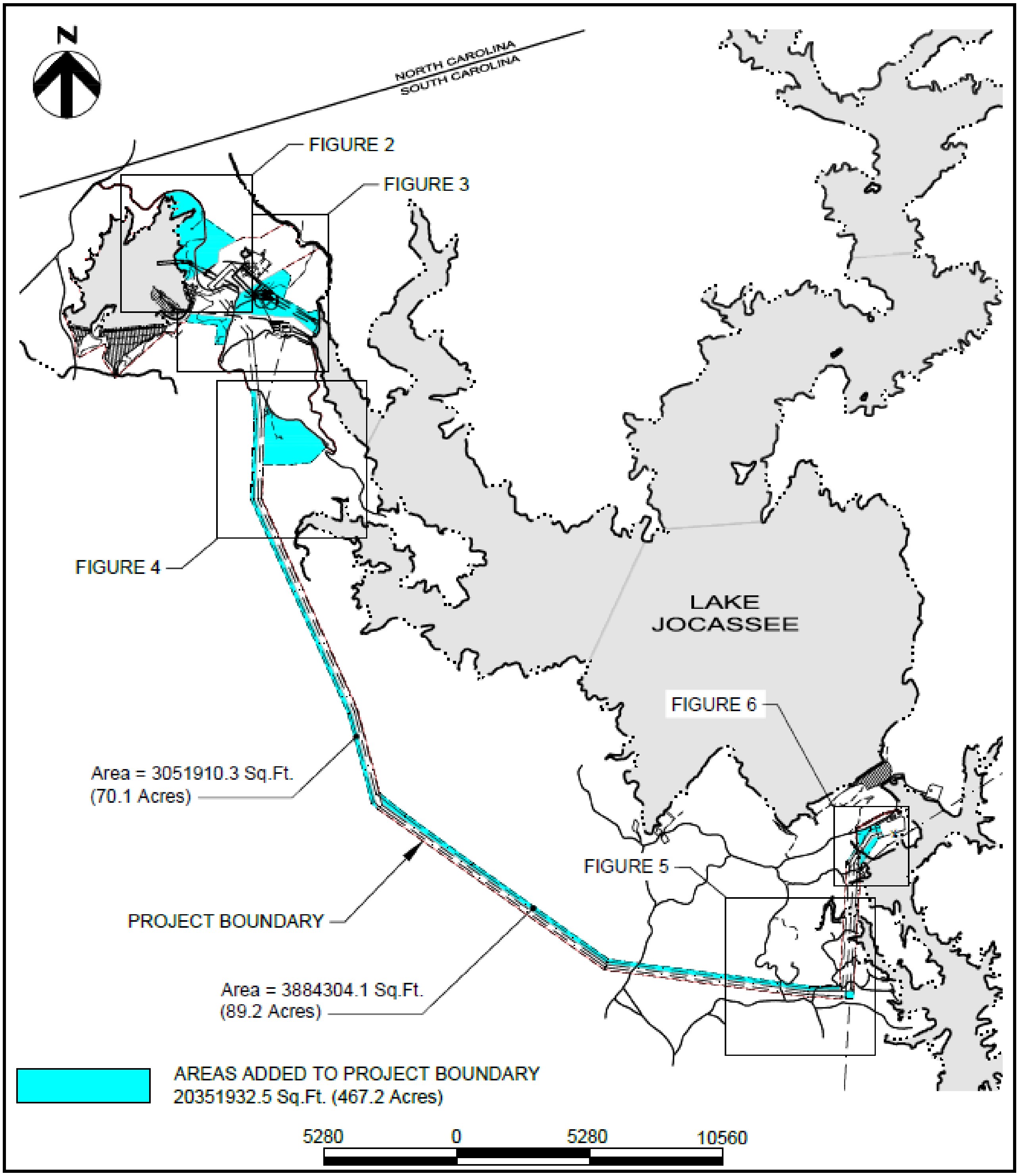

Figure G-1. Project Boundary Modifications (Figure 1 of 6)

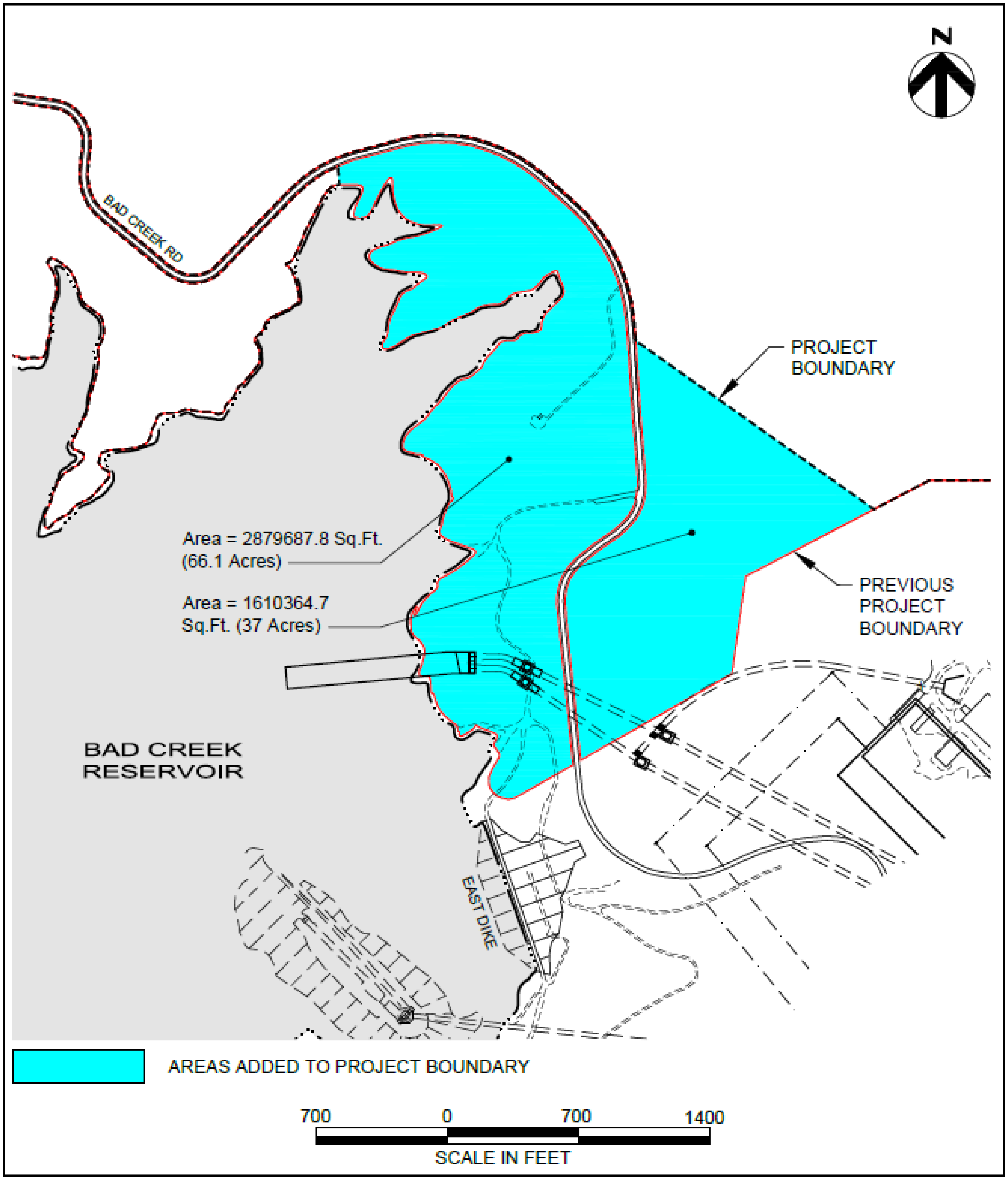

Figure G-2. Project Boundary Modifications (Figure 2 of 6)

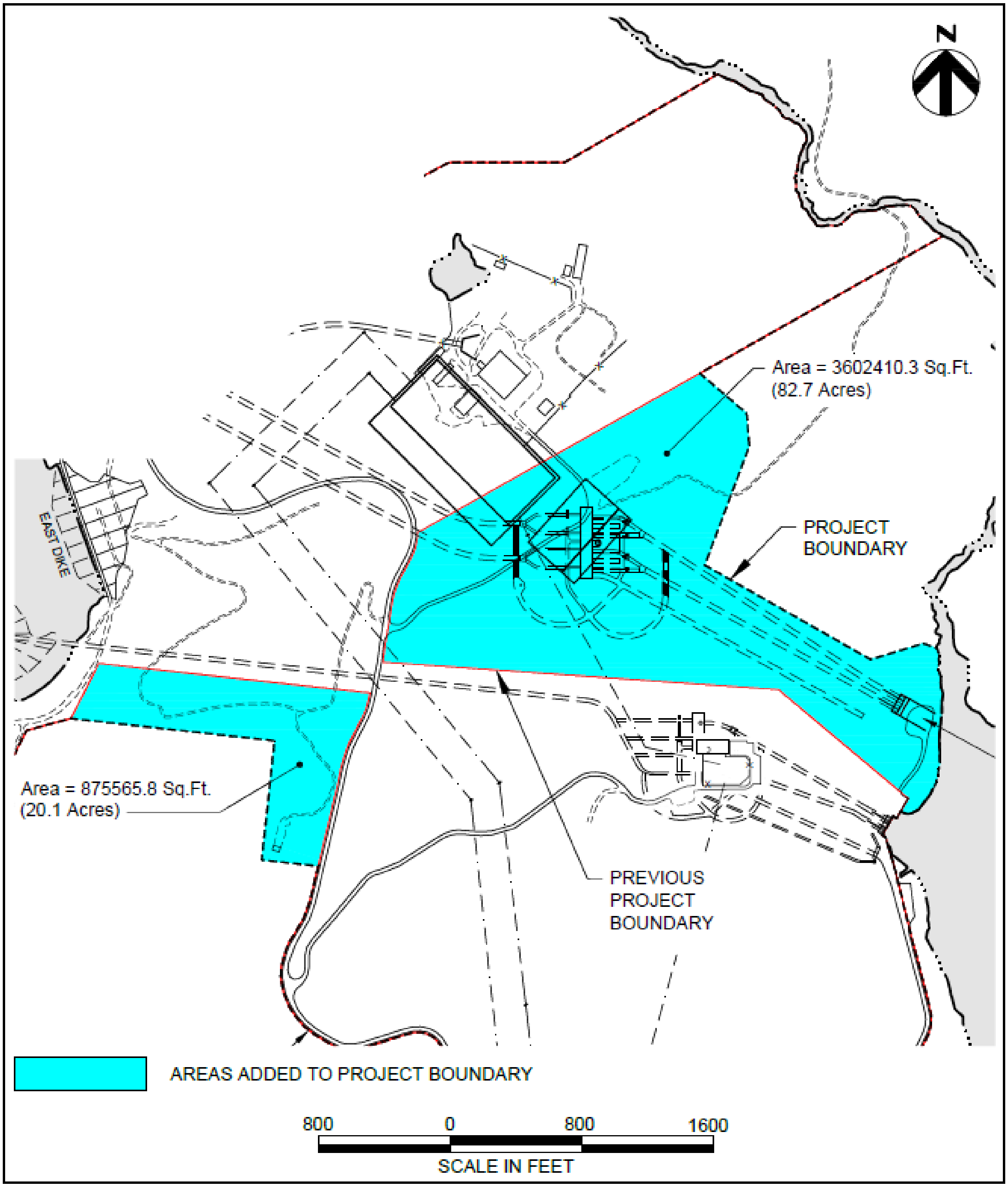

Figure G-3. Project Boundary Modifications (Figure 3 of 6)

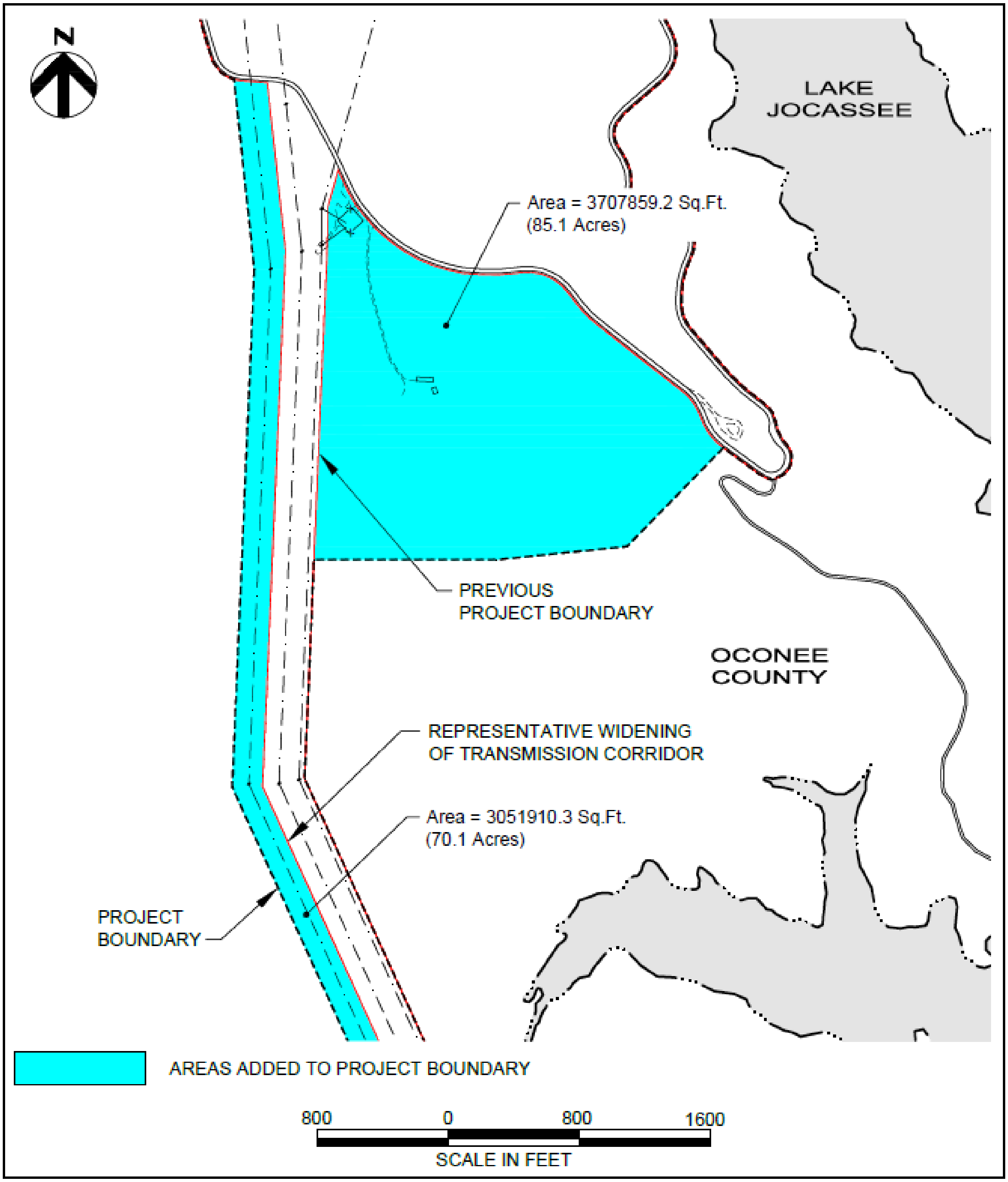

Figure G-4. Project Boundary Modifications (Figure 4 of 6)

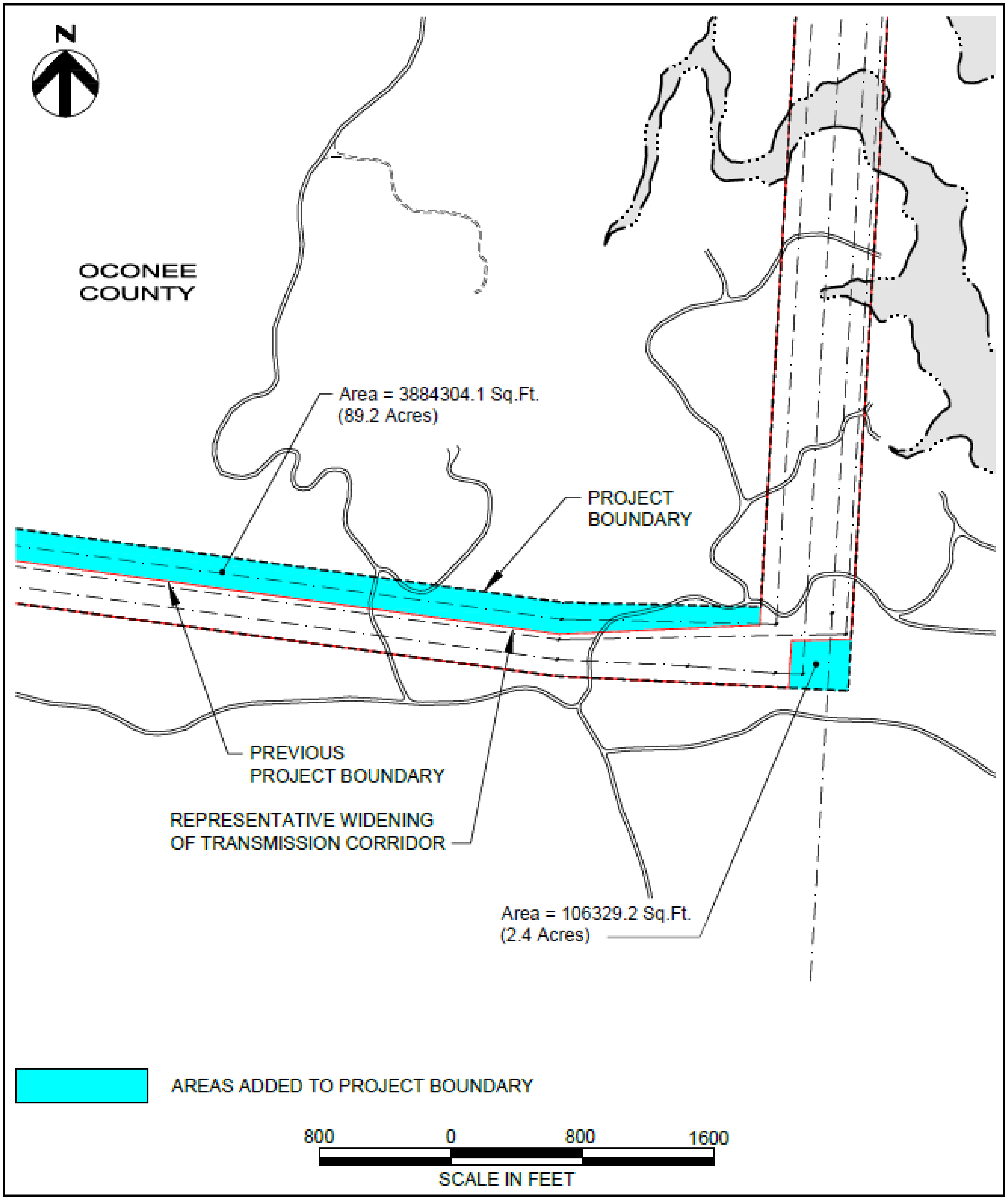

Figure G-5. Project Boundary Modifications (Figure 5 of 6)

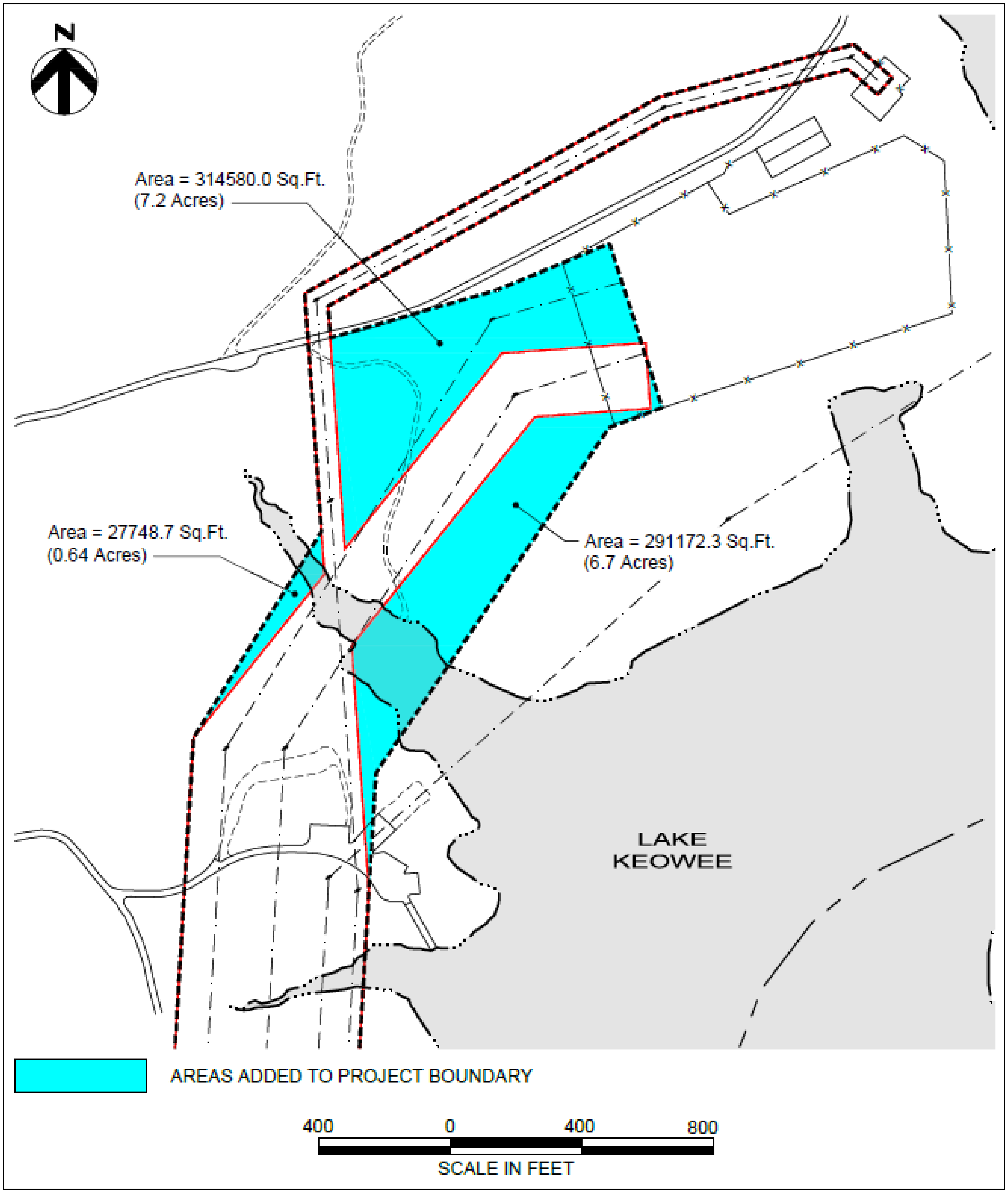

Figure G-6. Project Boundary Modifications (Figure 6 of 6)

The Licensee anticipates there could be changes in design or shoreline contours associated with the construction of the upper and lower reservoir inlet/outlet structures. Accordingly, the Licensee will file updated Exhibit G drawings reflecting as-built conditions following construction.

G.3 Federal Lands Within Project Boundary

There are no federal lands within the Project Boundary.

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Project Maps

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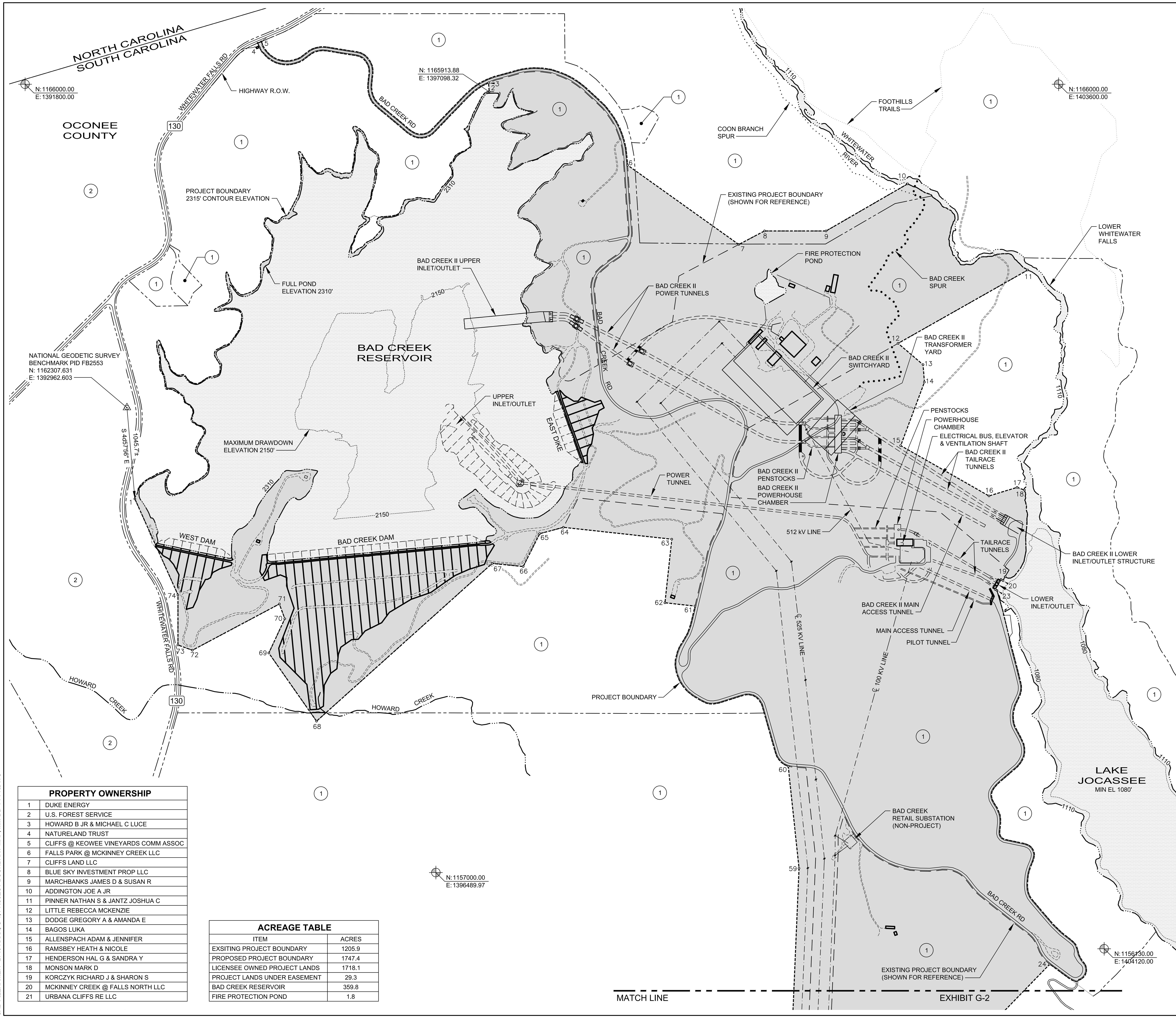

PROJECT LOCATION MAP

APPROXIMATE SCALE: 1"=60 MILES

MAP KEY

APPROXIMATE SCALE: 1"=2.5 MILES

LEGEND

- PROJECT LANDS UNDER EASEMENT
- LICENSEE OWNED PROJECT LANDS
- PROPERTY OWNERSHIP
- PROJECT BOUNDARY POINT NUMBER
- PROJECT BOUNDARY (PROPOSED)
- PROJECT BOUNDARY (EXISTING)
- FOOTHILLS TRAILS
- RIGHT OF WAY
- CITY/COUNTY BOUNDARY
- SHORELINE/STREAM
- TRANSMISSION LINE (PROJECT)
- TRANSMISSION LINE (NON-PROJECT)
- PRIMARY ROADS
- SECONDARY ROADS

2019 MAG NORTH
TRUE NORTH
6.32°

PROJECT BOUNDARY TIE DATA

THE PROJECT BOUNDARY IS TIED TO NATIONAL GEODETIC SURVEY BENCHMARK PID FB2553: N: 1162307.631 E: 1392962.603
TIE POINT 1: 1045.7'±, S 4d57'56" E

REFERENCE COORDINATE METADATA

PROJECTION - SOUTH CAROLINA STATE PLANE
DATUM - NAD83
UNITS - U.S. SURVEY FEET
VERTICAL DATUM - NGVD29 (NATIONAL GEODETIC VERTICAL DATUM OF 1929)

GEOREFERENCE SOURCE DATA

DIGITIZED DATA: PICTOMETRY ORTHOIMAGERY https://www.pictometry.com
REPORTED ACCURACY EXCEEDING NMAS (12.3FT) 1:4800
LIDAR ELEVATION DATA: U.S. GEOLOGICAL SURVEY, USGS LIDAR POINT CLOUD (LPC) SOUTH CAROLINA, OCONEE COUNTY 2011. [DATA ACCESSED 11/06/2019]
PROPERTY DATA: OCONEE COUNTY, https://oconeesc.com/assessor-home [ACCESSED 06/05/2025]
BOUNDARY DATA: FERC EXHIBIT K BAD CREEK PUMPED STORAGE PROJECT SHEETS

NOTES

1. THE LICENSEE EITHER OWNS IN SIMPLE FEE OR POSSESSES FLOWAGE EASEMENTS OVER ALL LANDS WITHIN THE PROJECT BOUNDARY REQUIRED TO OPERATE THE FACILITY.
2. FOR PROJECT BOUNDARY TABLE SEE EXHIBIT G-2.

SURVEYORS STATEMENT

I HEREBY CERTIFY TO THE FEDERAL ENERGY REGULATORY COMMISSION (FERC) THAT THIS PLAN MEETS THE CONDITIONS SET FORTH BY FERC FOR ITS EXPRESSED PURPOSE. THE PURPOSE OF THIS MAP IS TO PROVIDE A GEOREFERENCED VISUAL DEPICTION OF THE LOCATION OF PROJECT FEATURES AND BOUNDARIES BASED ON THE BEST AVAILABLE HISTORICAL DRAWINGS AND DIGITAL REFERENCE SOURCES INCORPORATED INTO THE GEOGRAPHIC INFORMATION SYSTEM (GIS). LOCATIONS HAVE NOT BEEN VERIFIED BY PHYSICAL FIELD SURVEYS AND THIS DRAWING SHOULD NOT BE USED FOR PURPOSES OF DEVELOPING PROPERTY BOUNDARY DESCRIPTIONS.

SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR NO. 27730 TRACY THANE BISHOP
7/17/2025

EXHIBIT G-1 SHEET 1 OF 4
BAD CREEK PUMPED STORAGE PROJECT FERC # 2740
PROJECT BOUNDARY MAP
DUKE ENERGY CAROLINAS, LLC

0 500 1000
SCALE: 1"=500'

PROPERTY OWNERSHIP

1	DUKE ENERGY
2	U.S. FOREST SERVICE
3	HOWARD B JR & MICHAEL C LUCE
4	NATURELAND TRUST
5	CLIFFS @ KEOWEE VINEYARDS COMM ASSOC
6	FALLS PARK @ MCKINNEY CREEK LLC
7	CLIFFS LAND LLC
8	BLUE SKY INVESTMENT PROP LLC
9	MARCHBANKS JAMES D & SUSAN R
10	ADDINGTON JOE A JR
11	PINNER NATHAN S & JANTZ JOSHUA C
12	LITTLE REBECCA MCKENZIE
13	DODGE GREGORY A & AMANDA E
14	BAGOS LUKA
15	ALLENSPACH ADAM & JENNIFER
16	RAMSBEY HEATH & NICOLE
17	HENDERSON HAL G & SANDRA Y
18	MONSON MARK D
19	KORCZYK RICHARD J & SHARON S
20	MCKINNEY CREEK @ FALLS NORTH LLC
21	URBANA CLIFFS RE LLC

ACREAGE TABLE

ITEM	ACRES
EXSITING PROJECT BOUNDARY	1205.9
PROPOSED PROJECT BOUNDARY	1747.4
LICENSEE OWNED PROJECT LANDS	1718.1
PROJECT LANDS UNDER EASEMENT	29.3
BAD CREEK RESERVOIR	359.8
FIRE PROTECTION POND	1.8

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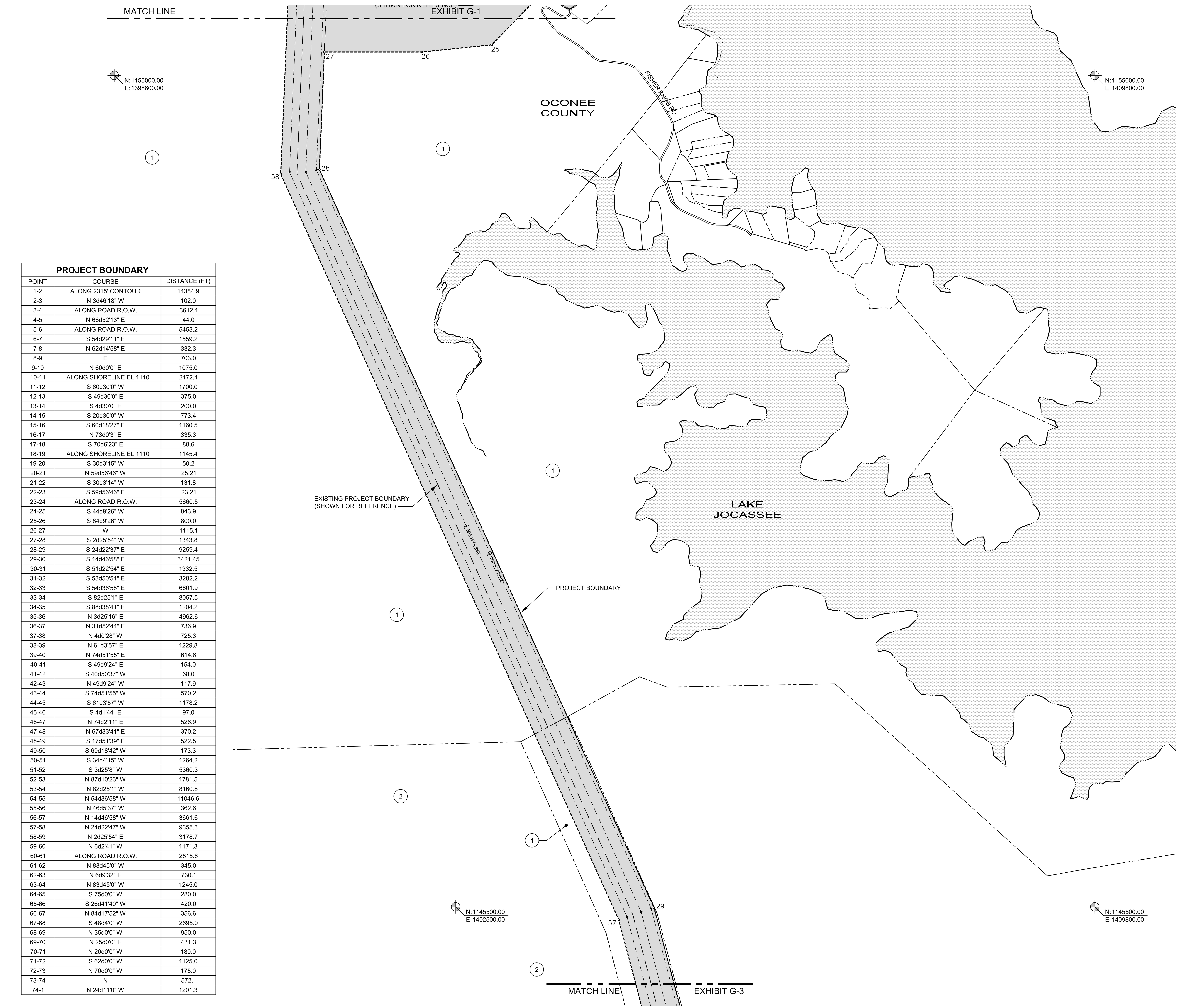

PROJECT BOUNDARY		
POINT	COURSE	DISTANCE (FT)
1-2	ALONG 2315' CONTOUR	14384.9
2-3	N 3d46'18" W	102.0
3-4	ALONG ROAD R.O.W.	3612.1
4-5	N 66d52'13" E	44.0
5-6	ALONG ROAD R.O.W.	5453.2
6-7	S 54d29'11" E	1559.2
7-8	N 62d14'58" E	332.3
8-9	E	703.0
9-10	N 60d0'0" E	1075.0
10-11	ALONG SHORELINE EL 1110'	2172.4
11-12	S 60d30'0" W	1700.0
12-13	S 49d30'0" E	375.0
13-14	S 4d30'0" E	200.0
14-15	S 20d30'0" W	773.4
15-16	S 60d18'27" E	1160.5
16-17	N 73d0'3" E	335.3
17-18	S 70d6'23" E	88.6
18-19	ALONG SHORELINE EL 1110'	1145.4
19-20	S 30d3'15" W	50.2
20-21	N 59d56'46" W	25.21
21-22	S 30d3'14" W	131.8
22-23	S 59d56'46" E	23.21
23-24	ALONG ROAD R.O.W.	5660.5
24-25	S 44d9'26" W	843.9
25-26	S 84d9'26" W	800.0
26-27	W	1115.1
27-28	S 2d25'54" W	1343.8
28-29	S 24d22'37" E	9259.4
29-30	S 14d46'58" E	3421.45
30-31	S 51d22'54" E	1332.5
31-32	S 53d50'54" E	3282.2
32-33	S 54d36'58" E	6601.9
33-34	S 82d25'1" E	8057.5
34-35	S 88d38'41" E	1204.2
35-36	N 3d25'16" E	4962.6
36-37	N 31d52'44" E	736.9
37-38	N 4d0'28" W	725.3
38-39	N 61d3'57" E	1229.8
39-40	N 74d51'55" E	614.6
40-41	S 49d9'24" E	154.0
41-42	S 40d50'37" W	68.0
42-43	N 49d9'24" W	117.9
43-44	S 74d51'55" W	570.2
44-45	S 61d3'57" W	1178.2
45-46	S 4d1'44" E	97.0
46-47	N 74d2'11" E	526.9
47-48	N 67d33'41" E	370.2
48-49	S 17d51'39" E	522.5
49-50	S 69d18'42" W	173.3
50-51	S 34d4'15" W	1264.2
51-52	S 3d25'8" W	5360.3
52-53	N 87d10'23" W	1781.5
53-54	N 82d25'1" W	8160.8
54-55	N 54d36'58" W	11046.6
55-56	N 46d5'37" W	362.6
56-57	N 14d46'58" W	3661.6
57-58	N 24d22'47" W	9355.3
58-59	N 2d25'54" E	3178.7
59-60	N 6d2'41" W	1171.3
60-61	ALONG ROAD R.O.W.	2815.6
61-62	N 83d45'0" W	345.0
62-63	N 6d9'32" E	730.1
63-64	N 83d45'0" W	1245.0
64-65	S 75d0'0" W	280.0
65-66	S 26d41'40" W	420.0
66-67	N 84d17'52" W	356.6
67-68	S 48d4'0" W	2695.0
68-69	N 35d0'0" W	950.0
69-70	N 25d0'0" E	431.3
70-71	N 20d0'0" W	180.0
71-72	S 62d0'0" W	1125.0
72-73	N 70d0'0" W	175.0
73-74	N	572.1
74-1	N 24d11'0" W	1201.3

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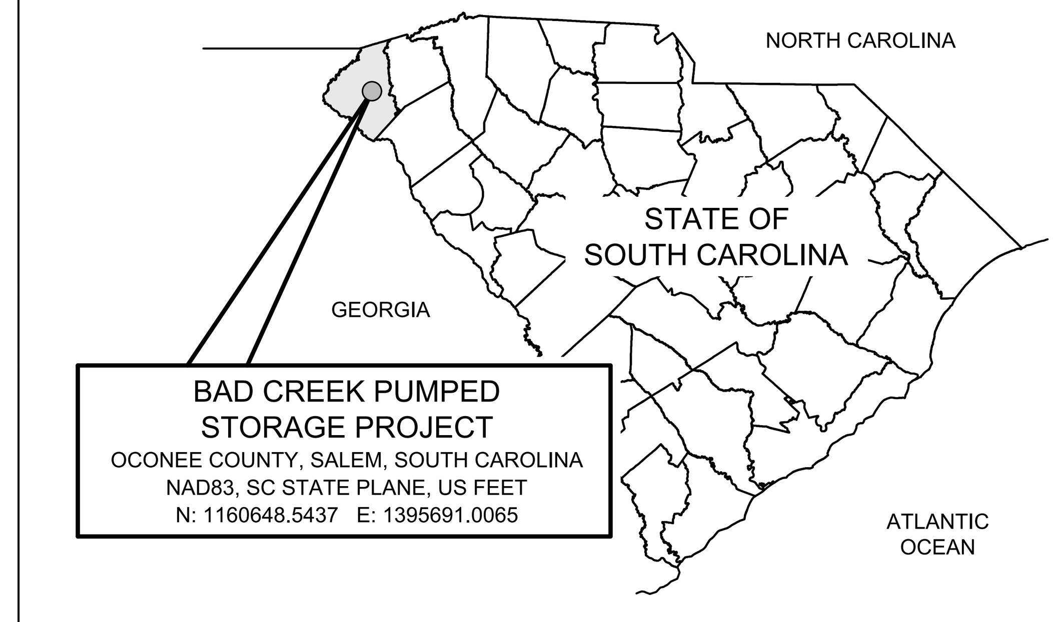
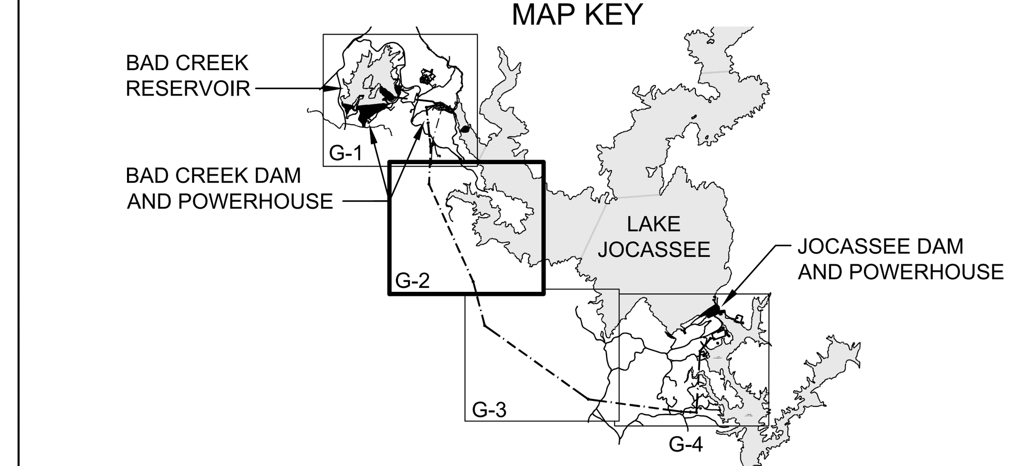
PROJECT LOCATION MAP



APPROXIMATE SCALE: 1"=60 MILES

MAP KEY



APPROXIMATE SCALE: 1"=2.5 MILES

LEGEND

PROJECT LANDS UNDER EASEMENT
LICENSEE OWNED PROJECT LANDS
PROPERTY OWNERSHIP
PROJECT BOUNDARY POINT NUMBER
PROJECT BOUNDARY (PROPOSED)
PROJECT BOUNDARY (EXISTING)
RIGHT OF WAY
CITY/COUNTY BOUNDARY
SHORELINE/STREAM
TRANSMISSION LINE (PROJECT)
TRANSMISSION LINE (NON-PROJECT)
PRIMARY ROADS
SECONDARY ROADS

2019 MAG NORTH
TRUE NORTH
6.32°

PROJECT BOUNDARY TIE DATA

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VERTICAL DATUM - NGVD29
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SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR NO. 27730 TRACY THANE BISHOP
6/17/2025

EXHIBIT G-2 SHEET 2 OF 4

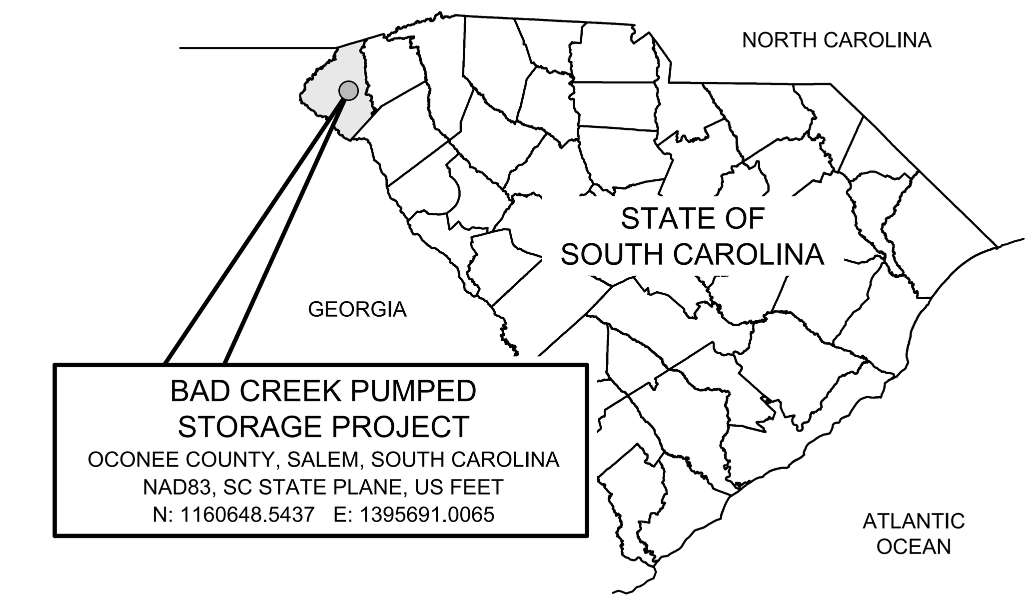
BAD CREEK PUMPED STORAGE PROJECT FERC # 2740

PROJECT BOUNDARY MAP

DUKE ENERGY CAROLINAS, LLC

0 500 1000
SCALE: 1"=500'

PROJECT LOCATION MAP



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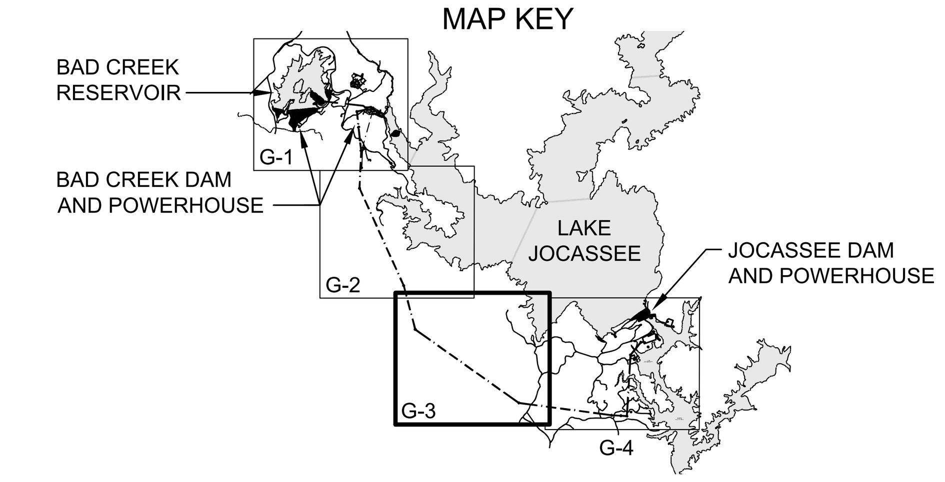
MAP KEY



APPROXIMATE SCALE: 1"=2.5 MILES

LEGEND

PROJECT LANDS UNDER EASEMENT
LICENSEE OWNED PROJECT LANDS
PROPERTY OWNERSHIP
PROJECT BOUNDARY POINT NUMBER
PROJECT BOUNDARY (PROPOSED)
PROJECT BOUNDARY (EXISTING)
RIGHT OF WAY
CITY/COUNTY BOUNDARY
SHORELINE/STREAM
TRANSMISSION LINE (PROJECT)
TRANSMISSION LINE (NON-PROJECT)
PRIMARY ROADS
SECONDARY ROADS

2019 MAG NORTH
TRUE NORTH
6.32°

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GEOREFERENCE SOURCE DATA

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2. FOR PROPERTY OWNERSHIP AND PROJECT BOUNDARY TABLES SEE EXHIBITS G-1 AND G-2.

SURVEYORS STATEMENT

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SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR NO. 27730 TRACY THANE BISHOP

EXHIBIT G-3 SHEET 3 OF 4

BAD CREEK PUMPED STORAGE PROJECT FERC # 2740

PROJECT BOUNDARY MAP

DUKE ENERGY CAROLINAS, LLC

0 500 1000
SCALE: 1"=500'

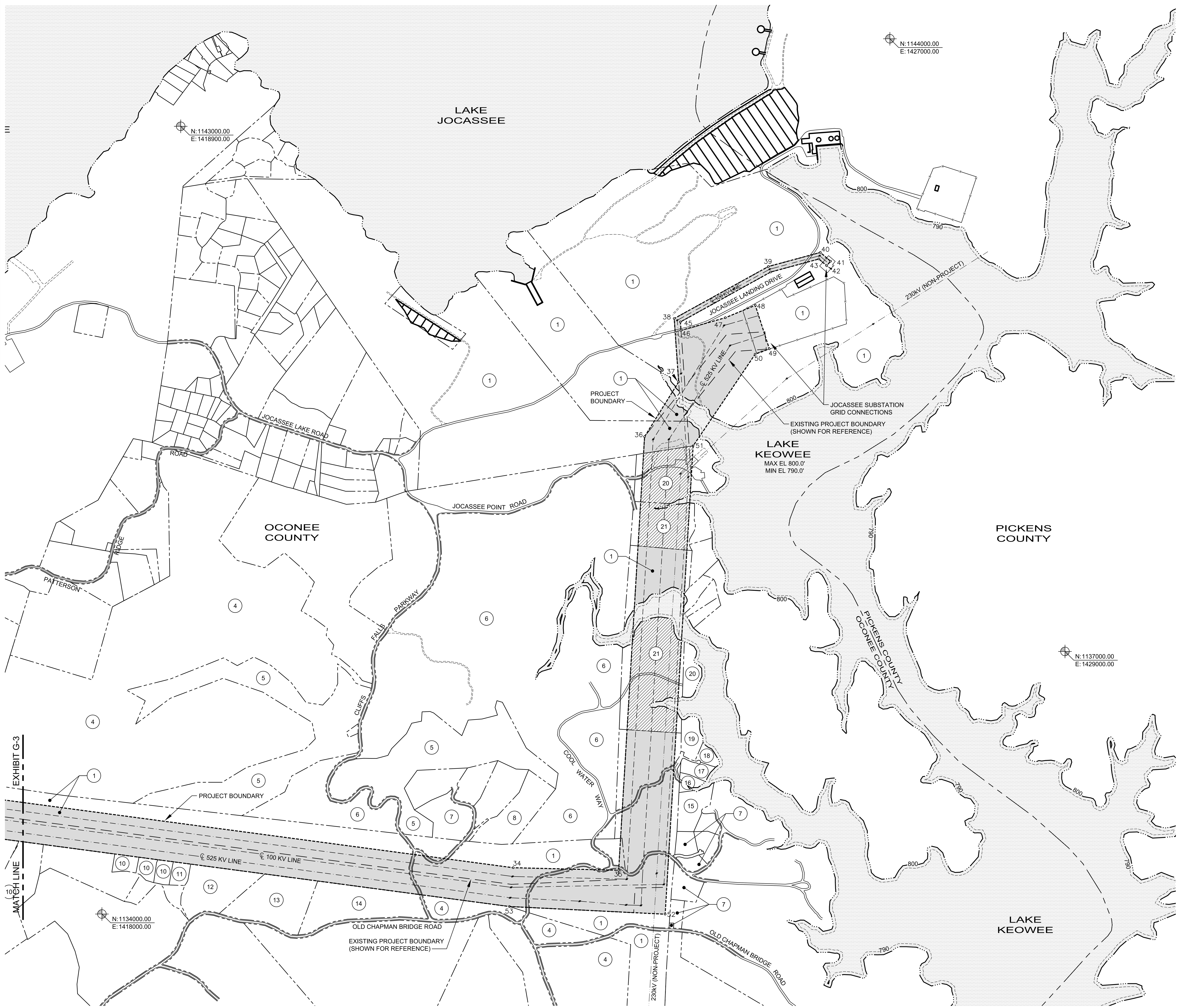
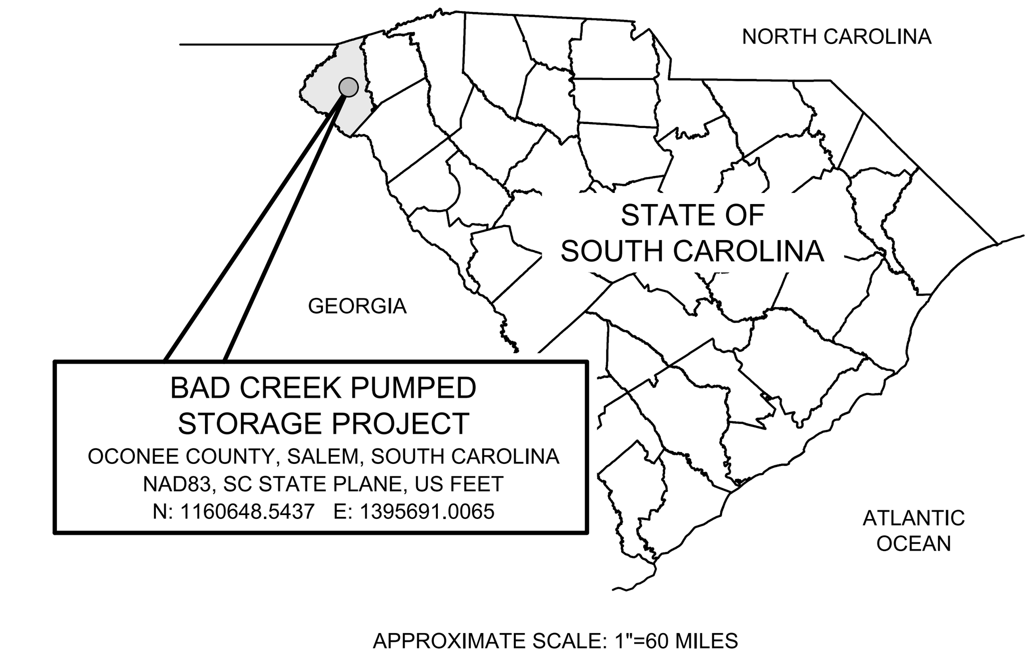


EXHIBIT G-4 **SHEET 4 OF 4**

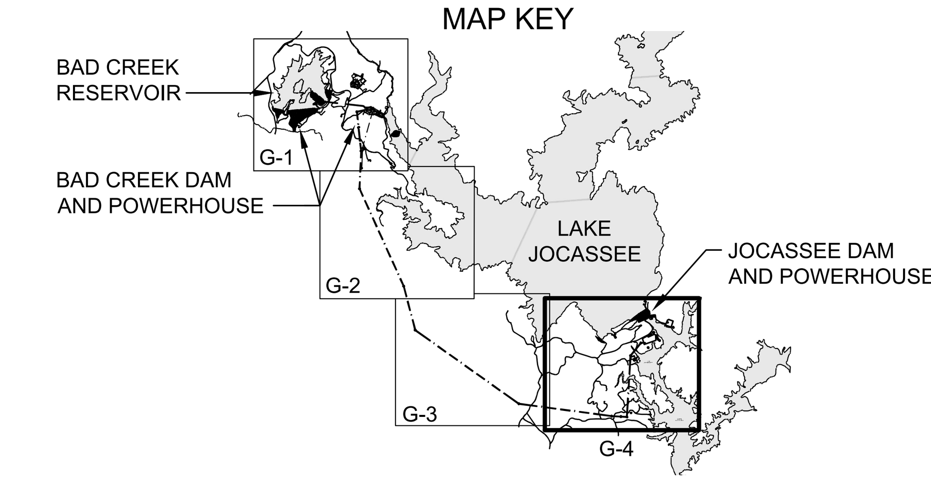
PROJECT LOCATION MAP



BAD CREEK PUMPED STORAGE PROJECT
OCONEE COUNTY, SALEM, SOUTH CAROLINA
NAD83, SC STATE PLANE, US FEET
N: 1160648.5437 E: 1395691.0065

APPROXIMATE SCALE: 1"=60 MILES

MAP KEY



APPROXIMATE SCALE: 1"=2.5 MILES

LEGEND

- PROJECT LANDS UNDER EASEMENT
- LICENSEE OWNED PROJECT LANDS
- PROPERTY OWNERSHIP
- PROJECT BOUNDARY POINT NUMBER
- PROJECT BOUNDARY (PROPOSED)
- PROJECT BOUNDARY (EXISTING)
- RIGHT OF WAY
- CITY/COUNTY BOUNDARY
- SHORELINE/STREAM
- TRANSMISSION LINE (PROJECT)
- TRANSMISSION LINE (NON-PROJECT)
- PRIMARY ROADS
- SECONDARY ROADS

2019 MAG NORTH — TRUE NORTH — 6.32°

PROJECT BOUNDARY TIE DATA

THE PROJECT BOUNDARY IS TIED TO NATIONAL GEODETIC SURVEY BENCHMARK PID FB2553: N: 1162307.631 E: 1392962.603
TIE POINT 1: 1045.7'±, S 4d57'56" E

REFERENCE COORDINATE METADATA

PROJECTION - SOUTH CAROLINA STATE PLANE
DATUM - NAD83
UNITS - U.S. SURVEY FEET
VERTICAL DATUM - NGVD29 (NATIONAL GEODETIC VERTICAL DATUM OF 1929)

GEOREFERENCE SOURCE DATA

DIGITIZED DATA: PICTOMETRY ORTHOIMAGERY https://www.pictometry.com
REPORTED ACCURACY EXCEEDING NMAS (12.3FT) 1:4800
LIDAR ELEVATION DATA: U.S. GEOLOGICAL SURVEY, USGS LIDAR POINT CLOUD (LPC) SOUTH CAROLINA, OCONEE COUNTY 2011. [DATA ACCESSED 11/06/2019]
PROPERTY DATA: OCONEE COUNTY, https://oconeesc.com/assessor-home [ACCESSED 06/05/2025]
BOUNDARY DATA: FERC EXHIBIT K BAD CREEK PUMPED STORAGE PROJECT SHEETS

NOTES

1. THE LICENSEE EITHER OWNS IN SIMPLE FEE OR POSSESSES FLOWAGE EASEMENTS OVER ALL LANDS WITHIN THE PROJECT BOUNDARY REQUIRED TO OPERATE THE FACILITY.
2. FOR PROPERTY OWNERSHIP AND PROJECT BOUNDARY TABLES SEE EXHIBITS G-1 AND G-2.

SURVEYORS STATEMENT

I HEREBY CERTIFY TO THE FEDERAL ENERGY REGULATORY COMMISSION (FERC) THAT THIS PLAN MEETS THE CONDITIONS SET FORTH BY FERC FOR ITS EXPRESSED PURPOSE. THE PURPOSE OF THIS MAP IS TO PROVIDE A GEOREFERENCED VISUAL DEPICTION OF THE LOCATION OF PROJECT FEATURES AND BOUNDARIES BASED ON THE BEST AVAILABLE HISTORICAL DRAWINGS AND DIGITAL REFERENCE SOURCES INCORPORATED INTO THE GEOGRAPHIC INFORMATION SYSTEM (GIS). LOCATIONS HAVE NOT BEEN VERIFIED BY PHYSICAL FIELD SURVEYS AND THIS DRAWING SHOULD NOT BE USED FOR PURPOSES OF DEVELOPING PROPERTY BOUNDARY DESCRIPTIONS.

SOUTH CAROLINA PROFESSIONAL LAND SURVEYOR NO. 27730 TRACY THANE BISHOP 6/17/25

EXHIBIT G-4 **SHEET 4 OF 4**

BAD CREEK PUMPED STORAGE PROJECT FERC # 2740

PROJECT BOUNDARY MAP

DUKE ENERGY CAROLINAS, LLC

0 500 1000 SCALE: 1"=500'

CAD FILENAME: P-2740-XXXX_G-4_PROJECT BOUNDARY MAP, MM-DD-YYYY.DWG

FERC NO. P-2740-XXXX

FINAL LICENSE APPLICATION

BAD CREEK PUMPED STORAGE PROJECT (FERC NO. 2740)

EXHIBIT H

PLANS AND ABILITY OF THE APPLICANT TO OPERATE THE PROJECT

Exhibit H - Plans and Ability of the Applicant to Operate the Project (18 CFR §5.18(c))

Duke Energy is pursuing a New License from the Commission for the Project. In accordance with 18 CFR §5.18(c), the FERC requires applicants for a new license to provide certain information regarding the applicant's abilities and plans to operate, maintain, and improve a project. The FERC also requires current licensees to describe their record of safely operating, maintaining, and managing the project.

This exhibit is divided into two sections: Section H1 presents the information required of all applicants and Section H2 presents information required of an applicant that is an existing licensee (18 CFR §5.18(c)(1)(ii)).

H.1 Information Required of All Applicants (18 CFR §5.18(c)(1)(i))

H.1.1 Licensee's Ability to Provide Efficient and Reliable Electric Service

H.1.1.1 Increase in Capacity or Generation

During the new license term, the Licensee proposes to construct a new underground powerhouse for four pump-turbine/motor-generator units. The second powerhouse and associated facilities (Bad Creek II) is a unique opportunity for the Licensee to add new long-duration, large-scale pumped storage hydropower without construction of a new reservoir. Bad Creek II would add four additional variable speed units with an authorized installed capacity of 1,400 megawatts (MW) that would be similar to the existing four units at the Project, essentially doubling the hourly capacity at the site. Even though available duration would decrease since there would be higher energy output, the approximately 10 hours (of all eight units at full load) would still significantly exceed the duration of Lithium-Ion batteries currently available. The increased capacity provides system stability and critical flexibility to respond to system peaks and steep system ramps, as well as additional support for high penetrations of variable energy resources on the Duke Energy Carolinas, LLC and Duke Energy Progress, LLC combined system.

H.1.1.2 Coordination of Operation with Upstream and Downstream Projects

Article 43 of the Existing License required the Licensee to enter into a reservoir filling agreement with the United States Army Corps of Engineers (USACE). Said agreement was executed on May 23, 1990, and filed with FERC on June 11, 1990.

Because the Project is in the headwaters of the Savannah River Basin, there are no upstream dams. Table H-1 lists hydropower dams downstream of the Project.

Table H-1. Hydropower Facilities Downstream of the Project

Downstream Water Resources Projects	Owner
Jocassee Pumped Storage Station	Licensee
Keowee Dam and Lake	Licensee
Hartwell Dam and Lake	USACE
Richard B. Russell Dam and Lake	USACE
J. Strom Thurmond Dam and Lake	USACE
Stevens Creek Dam	Dominion Energy SC
Augusta Canal and Diversion Dam	City of Augusta, GA
Sibley Mill Project	August Canal Authority
Enterprise Mill Project	Enterprise Mill, LLC
King Mill Hydroelectric Project	Augusta Canal Authority

In 1968, the USACE and the Southeastern Power Administration (SEPA) entered into an Operating Agreement (1968 Agreement) with the Licensee's predecessor company, Duke Power Company. The purpose of this agreement was to ensure the upstream Keowee-Toxaway (KT) Hydroelectric Project (FERC Project No. 2503) was operated such that USACE and SEPA would be able to meet their hydropower generating requirements at the downstream Hartwell and Thurmond dams. Neither the Project nor its operations were considered in the 1968 Agreement.

In parallel with KT Project relicensing in 2014, the Licensee, USACE, and SEPA modified the 1968 Agreement to reflect changes in both the Licensee's and the USACE's hydropower facilities in the Savannah River Basin. Bad Creek Reservoir storage volume and Project operations are now incorporated in the new operating agreement (2014 Operating Agreement).

The operating principles of the 2014 Operating Agreement are summarized below.

- The objective of the 2014 Operating Agreement is to equalize the percentage of remaining usable storage between the USACE's Hartwell, Richard B. Russell, and J. Strom Thurmond Projects combined (USACE System) and the Project and KT Project combined (Duke Energy System).

- The 2014 Operating Agreement is invoked only when the combined remaining usable storage in the USACE System is less than 90 percent of full capacity.
- The required release amount from the Keowee Development (the most downstream dam in the Duke Energy System) is calculated such that projected equivalent percentages of remaining usable storage in each system are equal.
- No water release is required from the Keowee Development if the combined remaining usable storage percentage in the USACE System is greater than or equal to the combined remaining usable storage percentage in the Duke Energy System or if the release would cause Lake Jocassee or Lake Keowee to fall below the Stage Minimum Elevations in the KT Project Low Inflow Protocol.

Continued operation of the Project and the addition of Bad Creek II would have no effect on implementation of the 2014 Operating Agreement or downstream water resources projects. The Licensee would continue to comply with the terms of the 2014 Operating Agreement and the requirements of the KT Project license.

H.1.1.3 Coordination of Project Operation with Electrical Systems

The Project’s primary purpose is pumped storage hydroelectric generation. The electricity generated satisfies the power requirements of the Duke Energy service area and the SERC Reliability Corporation (SERC) (formerly called the Southeast Electric Reliability Council). SERC is a non-profit corporation responsible for promoting and improving the reliability, adequacy, and critical infrastructure of the bulk power supply systems in all or portions of 16 central and southeastern states in an area of approximately 560,000 square miles.

H.1.2 Need for Project Power

The Project is an important component of Duke Energy’s generating system in the Carolinas and plays a critical role in supporting the regional electric transmission grid as described below.

- **Peak Demand Capability:** Peak demand for electricity on Duke Energy’s system historically occurred on hot summer afternoons and cold winter mornings, but the increase of solar energy on the system has shifted the demand curve. Pumped storage facilities like the Project effectively respond quickly to short-term increases in demand or excess generation.
- **Quick Start Capability:** Normal operation can go from shut-down, through start-up, to full power, and back to shut-down in less than 15 minutes. This compares to two hours for new combustion turbines, six to eight hours for coal-fired plants, and 72 hours or longer for

nuclear-fueled plants. This quick response time helps manage rapid shifts in electric system loading.

- **Load-Following Capability:** Hydroelectric units including the Project typically allow greater incremental adjustments to help follow electric system load than do fossil- or nuclear-fueled generating units. Hydroelectric units on automatic generation control increase and decrease water flow to the turbines, automatically absorbing the 75-to-150-MW customer demand swings typically seen every hour. The Project can also respond to sudden decreases in demand on the system or highly variable renewable generation by very quickly changing from either generation mode or shutdown to pumping mode, thereby utilizing the surplus capacity.

- **Spinning Reserve:** Duke Energy is required to guarantee a specified amount of generation, or "spinning reserve," that can be brought online within 10 minutes of notification of unexpected increases in demand or generation deficits on the transmission system. Duke Energy often uses its hydropower assets to fill the spinning reserve requirement.

- **Energy Storage**: Pumped storage stations like the Project are historically the only commercially available technology to provide long-duration storage for large quantities of electric energy. This capability allows Duke Energy to utilize surplus electricity from its fossil- and nuclear-fueled generating facilities as well as renewable sources like solar and wind when demand is low, for pumping water from Lake Jocassee to Bad Creek Reservoir.

Continued operation of the Project and the addition of Bad Creek II over the new license term would continue and increase the Project's ability to provide the above system benefits.

H.1.2.1 Cost and Availability of Alternative Sources of Power

If the Licensee is not granted a New License to continue operating the Project, it would immediately need to acquire replacement power from market purchases, construction of alternate power plants and significant battery energy storage systems, or some combination thereof. These alternatives have substantial additional costs, very likely resulting in significant, cumulative cost repercussions for electric customers through rate base adjustments. Power plants likely to be utilized for replacement power would likely not represent the full extent of renewable energy as represented by the Project and the loss of pumped storage generation would have substantial, further negative implications for electric load curve management.

Applying SEPA electric rates and annual average capacity factors for the existing Project, the respective annual values in 2025 dollars[1] for lost power would be $14,884,598 ($120,077,057 for generation reduced by $105,192,459 for pumping).

If the Licensee is not granted approval to construct Bad Creek II, it will have to acquire additional generation and energy storage capabilities by 2034 from market purchases, delay of the retirement of coal-fired generation, construction of alternate power plants and significant battery energy storage systems, or some combination thereof. Power plants likely to be utilized for replacement of the needed generation and pumped storage benefits would likely not represent the full extent of renewable energy as represented by the proposed additional pumped storage units and the loss of pumped storage generation would have substantial, further negative implications for electric load curve management, particularly as additional renewable resources are incorporated into the Licensee's system.

Applying SEPA electric rates and annual average capacity factors for Bad Creek II as detailed in Exhibit D, the respective annual values for lost power would be $4,700,316 ($277,708,764 for generation reduced by $273,008,448 for pumping.

H.1.2.2 Increase in Fuel, Capital, and Other Costs to Purchase or Generate Replacement Power

Alternative sources of power would in all foreseeable scenarios be significantly less cost effective compared to power derived from continued operation of the existing Project and construction and operation of Bad Creek II.

Replacement of the Project and expanded Project would require construction of a new generation facility, likely a combustion turbine, and additional energy storage, in the form of batteries. The installation costs of a combustion turbine station of a capacity comparable to the existing Project would be approximately $1.9 billion. Replacement of the existing energy storage capacity of the existing Project would require batteries at a cost of approximately $8.6 billion. These costs would double for replacement of the expanded Project. These costs do not account for the fact that combustion turbines and battery facilities have shorter lifespans than pumped storage hydroelectric facilities and would likely require replacement during the 50-year license term.

However, due to the pumped storage capabilities of the Project, an in-kind replacement with one or more pumped storage facilities similar to the existing or proposed expanded Project matching the

[1] Unless otherwise noted, dollar amounts in Exhibit H are 2025 dollars.

existing capacity and located within the Licensee's system would be most suitable in providing a replacement cost estimate. Based on current cost estimates, installation prices for replacement pumped storage facilities at the Limber Pole or Coley Creek sites could be expected to cost approximately $24 billion to $39 billion.

H.1.2.3 Effect of Alternative Power Sources

H.1.2.3.1 Effects on Customers

In order to replace the anticipated average 4,815,496 MW-hours that would be generated annually by the expanded Project, the Licensee would need to shore up the system capacity deficit in the short-term using appreciably greater purchases of power in the marketplace, delaying the retirement of existing generating facilities, and by employing substantially less cost-efficient assets on the system. Longer term, Duke Energy would need to construct new generation on an accelerated schedule compared to current plans to address forecasted load growth and anticipated generation unit replacements. Given the time required to site, permit, and construct new generating facilities, short-term solutions would have to remain in place for several years before a longer-term solution would be viable. These approaches would have immediate and continued implications for sustained higher costs to wholesale, industrial, commercial, and residential consumers due to the reduction of readily available, cost-effective renewable power from Duke Energy's generation mix, and the very likely subsequent escalation effects on the rate base from inclusion of capital projects for new alternative power generation.

H.1.2.3.2 Effects on the Applicant's Operating and Load Characteristics

As discussed above, diminishment of Duke Energy's generation capacity by the amount of typical annual (gross) generation that would be supplied by the existing or expanded Project would have a variety of effects, all negative, on Duke Energy's ability to operate successfully and in a cost-effective manner. Besides simply adding to costs immediately for replacement wholesale power purchases, and accelerating the needed construction of costly new generation, pumped storage generation provides distinct advantages over other conventional generation sources. These advantages include availability for quick start-up for load peaking (load management), availability for providing critical system voltage support, and load curve smoothing to significantly reduce the need for added, costly generation or off-system purchases.

H.1.2.3.3 Effects on Communities Served

Should the Licensee not be granted a New License to continue operation of the Project, existing and proposed agreements concerning maintenance and operations as well as capital investments by the Licensee to increase and improve public recreational properties and amenities, as well as cultural and wildlife resources, could be negated. Presently, the Project contributes to the surrounding counties through workforce employment and the resulting integration of employee wages and income into all aspects of the local economies.

Should the Licensee not be granted approval to construct and operate the expanded Project, proposed agreements regarding protection, mitigation, and enhancement measures would be negated. Additionally, benefits to the local economy associated with labor, services, accommodations, and goods, as well as additional tax revenue, would not be realized.

Surrender of the License to a non-taxpaying authority would reduce local property tax revenues collectively by about $10 million annually. In addition, the Licensee annually pays business taxes to the states of North Carolina and South Carolina. These benefits to the regional economy will continue when the Project is relicensed and increase with construction of the expanded Project.

H.1.3 Need, Reasonable Cost, and Availability of Alternative Sources of Power

H.1.3.1 Average Annual Cost of Project Power

The estimated average annual cost of power and the methodology used to derive the estimate for the Project are presented in Exhibit D, Section D.3. Estimated Average Annual Cost of Project. The estimated annual cost average is $71,676,114 in 2025 dollars. This cost estimate is based on four years of historical costs as presented in Table H-2.

Table H-2. Project Current Average Annual Cost

Expense	2021	2022	2023	2024	2021-2024 Average (2025 $)
O&M Expenses					
Operation Supervision & Engineering	1,240,665	1,395,656	1,247,526	1,140,870	1,256,179
Electric Expenses	966,132	1,308,947	1,286,733	1,453,905	1,253,929
Miscellaneous Pumped Storage Power Generation Expenses	2,718,780	2,858,898	2,721,664	2,882,990	2,795,583
Maintenance Supervision & Engineering	648,781	747,763	936,804	938,603	817,988
Maintenance of Structures	122,729	57,232	107,371	191,162	119,624
Maintenance of Reservoirs, Dams, and Waterways	554,733	266,372	459,465	292,478	393,262
Maintenance of Electric Plant	696,658	857,524	911,552	1,038,800	876,134
Maintenance of Miscellaneous Pumped Storage Plant	1,180,537	1,871,098	1,079,763	1,433,614	1,391,253
Taxes and Fringes Cost on Labor	3,129,395	2,166,844	2,398,170	3,219,617	2,728,507
Property Taxes	10,336,031	10,116,762	10,012,682	10,192,415	10,164,472
Estimate of Depreciation Expense	16,004,341	16,153,589	16,563,842	16,563,842	16,321,404
PM&E O&M Cost	205,555	210,069	220,080	219,438	213,786
PM&E Capital Cost	2,428,571	2,428,571	2,428,571	2,428,571	2,428,571
Cost of Capital					
Current Plant Balance	1,076,573,444	1,086,613,042	1,114,209,730	1,154,709,730	1,108,026,487
Accumulated Depreciation Estimate	476,606,960	500,665,319	505,332,120	521,895,962	501,125,090
Net Plant Investment	599,966,484	585,947,724	608,877,610	648,851,874	610,910,923
Annual Capital Cost	38,760,669	28,365,173	21,335,822	43,819,846	33,070,378
Annual Cost of Capital Charge	509,362	482,965	576,379	380,905	487,403
Bad Creek Total Annual Cost	76,868,813	66,648,823	59,637,774	83,549,048	71,676,114

H.1.3.2 Projected Resources Required by the Licensee to Meet Short- and Long-Term Capacity and Energy Requirements

As a regulated electric utility, Duke Energy is required to maintain acceptable reserve capacity to accommodate scheduled maintenance and unplanned outages and to compensate for higher than projected peak demand due to forecast uncertainty and weather extremes. Customers expect to have electricity during all times of the year but especially during extreme weather conditions such as cold winter days when resource adequacy[1] is at risk for Duke Energy's electrical system[2]. In addition, some capacity is required to be maintained as a spinning reserve to maintain the balance between supply and demand on an ongoing basis.

To ensure reliability during these peak periods, Duke Energy maintains a minimum reserve margin level of 15% - 22% to manage unexpected conditions including extreme weather, unanticipated changes in economic load growth, and significant forced outages. When performing resource adequacy studies, shifting neighbor resource portfolios including coal retirements and the buildout of solar, wind, and storage resources on other utilities' systems is an important consideration. Duke Energy's neighboring utilities' changing resource mixes along with the cold weather load response has shifted the resource adequacy risk of the Duke Energy's neighbors to the winter. Because of this, there is now less market assistance available to Duke Energy during extreme winter weather periods which increases the resources Duke Energy needs to carry to maintain a reliable system (Duke Energy 2023).

Continued operation of the Project and the addition of Bad Creek II will allow Duke Energy to integrate other renewables and more zero-carbon resources into the grid and provide customers savings by storing excess energy during times of low demand or excess renewable energy, and then providing generation when demand is high, as well as providing ancillary services to ensure system balance, frequency and reliability. During times when the system is generating the highest amount of solar energy between the hours of 10 a.m. and 3 p.m., net demand can fall below the Lowest Reliability Operating Limit (LROL). The LROL is the point at which the system reaches the minimum

[1] North American Electric Reliability Corporation's definition of "Adequacy" - The ability of the electric system to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and expected unscheduled outages of system components. Source: https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2019.pdf, at 9.

[2] Section (b)(4)(iv) of North Carolina Utilities Commission Rule R8-61 (Certificate of Public Convenience and Necessity for Construction of Electric Generation Facilities) requires the utility to provide "… a verified statement as to whether the facility will be capable of operating during the lowest temperature that has been recorded in the area using information from the National Weather Service Automated Surface Observing System First Order Station in Asheville, Charlotte, Greensboro, Hatteras, Raleigh or Wilmington, depending upon the station that is located closest to where the plant will be located."

level of regulating resources required for system reliability and all dispatchable resources on the system have been reduced to their minimum safe operating limits. Instead of curtailing solar and cycling down system regulation reserves, this excess energy can be stored at the Project for later use, such as the evening system peak.

Unique relative to inverter-based battery storage alternatives, the Bad Creek II generators will provide physical inertia to the system which helps maintain optimal frequency and voltage levels.

Both demand side management and customer energy efficiency programs implemented by Duke Energy contribute to lessening system demand. Existing demand side management programs include load control curtailment programs, interruptible power service, standby generator control, and residential service-controlled water heating. Load control curtailment programs include both residential air conditioning and residential water heating direct load control. Additionally, time-of-use rates available for industrial and large commercial customers are structured such that customers can reduce their energy bills by shifting load from on-peak hours to off-peak hours, helping Duke Energy avoid the need for new generation. Energy efficiency measures include promotion of Residential Energy Star ratings for new construction, promoting energy efficiency upgrades to existing residential customers by provision of low interest loans, encouraging through free appliance recycling the replacement of inefficient household appliances, and offering free discounted compact fluorescent light bulbs to residential customers. For example, the combined effect of energy efficiency and demand side management programs in 2027 are projected to reduce overall demand, including line losses, by 2,388,000 MW-hours (Duke Energy 2023).

Conservation Voltage Reduction: The loss of Project-associated generating capacity due to the Licensee not being issued a New License or not being issued approval for Bad Creek II would require Duke Energy to contract for replacement power and potentially rely on market purchases. Subsequently, accelerated construction of alternate power plants and battery energy storage systems would be warranted. Power plants likely to be used for replacement power would likely not replace the full extent of renewable energy provided or potentially provided by the Project, and if not replaced in kind, the loss of the pumped storage generation would have substantial negative repercussions.

Solar Paired with Storage: As Duke Energy procures solar power to meet the growing need for zero-carbon and fuel-free energy resources, it is evaluating the operational relationship between solar and energy storage. Storage paired with solar provides a way to further increase the energy output of a solar resource, as well as an enhanced contribution to peak. The storage element paired to a solar resource also helps enable flexibility and load following capabilities. This can help mitigate the risk and variability associated with solar power's intermittency and help with operational challenges resulting from current and pending solar penetration. Specifically, Duke Energy experiences periods where the installed solar energy causes the system to reach its LROL. The only options at the point of LROL are to move the excess energy off-system or curtail solar energy production (Duke Energy 2023).

As Duke Energy transitions its portfolio to a cleaner energy resource mix, integrating and operating solar resources will be an essential part of the transition. As greater amounts of solar power are connected to Duke Energy's systems, there will be an increased likelihood of curtailment needed to avoid reaching the LROL. Energy storage can help minimize solar curtailment in these situations and enable the excess energy to instead be utilized when there are limitations in solar energy production.

H.1.4 Supply at Industrial Facility

Since the Project is not used to supply power to an applicant-owned and operated industrial facility, this section is not applicable.

H.1.5 Native American Tribe as Applicant

Since the Applicant is not a Native American Tribe, this section is not applicable.

H.1.6 Impacts of Receiving or not Receiving a License on Licensee's Operations of the Transmission Facility

The inability of the Licensee to obtain a New License for the Project and the Project License being assigned to an alternate licensee would lead to severance damages. The magnitude of severance damages would be dependent upon the details of the system separation, assets involved, the characteristics of the replacement power source(s), and the compensation mechanism used to reimburse Duke Energy for the system value lost due to removing the power and reliability provided by the Project as described in Exhibit D.

Duke Energy's transmission system could maintain reliable and functional service assuming Project severance, as defined by continuance of acceptable thermal and voltage properties, including during peak load power flow scenarios, assuming the alternate Project licensee would interconnect with the existing Duke Energy transmission infrastructure. A simplified methodology was used to arrive at cost estimates for damages due to required changes in the transmission infrastructure, as described in Exhibit D. Using this methodology, severance damages were estimated to be $54,815,287.

The denial of the Licensee's application to expand the Project would not adversely affect the existing electrical system but would impair Duke Energy's ability to meet growing customer needs and system reliability requirements as discussed above.

H.1.6.1 Single Line Diagrams

The single-line diagrams for the Project, which present system transmission elements in relation to the Project, are provided in Volume IV (CUI//CEII).

H.1.7 Modifications to Project Facilities and Consistency with Comprehensive Plans

The Licensee proposes to construct a new powerhouse with four additional pump-turbines and appurtenant structures and modify the existing Project Boundary as shown in Exhibit G. The effects of these modifications are discussed in detail in Exhibit E. The Licensee has reviewed FERC's List of Comprehensive Plans dated May 2025 and identified certain plans as topically or geographically relevant to Project relicensing. A statement of the need for, or usefulness of these modifications, projected costs, alternate plans, and the consistency of these modifications with the Comprehensive Plans is discussed in further detail in Exhibit E.

H.1.8 Impacts of Plan Not to Modify the Project

Because the Licensee is proposing to modify the Project, this section is not applicable.

H.1.9 Financial and Personnel Resources

Duke Energy Corporation, the Licensee's parent company, is a Fortune 150 company and one of America's largest energy holding companies. Its electric utilities serve 8.2 million customers in North Carolina, South Carolina, Florida, Indiana, Ohio and Kentucky, and collectively own 50,000 MW of energy capacity. During the term of the Existing License, the Licensee has successfully and prudently operated the Project, funding required capital, operational, and maintenance costs, including initiatives above and beyond the Existing License requirements. Project funding is generally supported by revenue from electric sales, with major capital projects also obtaining funding from bonds issued for such corporate purposes from time to time. Due to a history of strong financial management, Duke Energy has continued to maintain an investment grade credit rating in the capital markets. Duke Energy employs more than 27,000 people.

H.1.10 Expansion of Project Lands

The Licensee is proposing to expand the Project to encompass additional Licensee-owned or controlled lands necessary for the construction and operation of Bad Creek II. These additions are discussed further in Exhibit E (Section E.6.2.1, Proposed Project Facilities) and Exhibit G. Under separate cover, the Licensee is notifying, by certified mail, property owners on or abutting the additional lands to be encompassed by the project and governmental agencies and subdivisions likely to be interested in or affected by the proposed boundary expansion.

H.1.11 Electricity Consumption Efficiency Improvement Program

Duke Energy offers a variety of routinely updated programs and approaches to assist electric customers, both residential and business, to better understand their electrical usage characteristics, and evaluate options to conserve and to improve efficiency. Details of the implementation and where applicable, the cost savings and fee structures for these programs are included in the Carolinas Resource Plan submitted to the North Carolina Utilities Commission and South Carolina Public Service Commission (Duke Energy 2023). An overview of some of these programs is provided below.

- Duke Energy offers residential customers a free in-home energy assessment designed to help customers learn how a residence uses energy and how the customer can save on costs. The program provides personalized information on energy usage and focuses on applicable areas or improvement. Residential customers in the several regulated jurisdictions can earn a credit for participating in such an in-home evaluation, upgrading insulation, or installing a new, qualifying heat pump or electric air conditioner, and can earn a credit for recycling an older household appliance.

- With program details dependent on the regulated jurisdiction, Duke Energy business customers are offered free on-line energy analyses, assistance with the development of energy efficient business strategies, technical advice on energy efficient equipment options, and monetary incentives for installing high-efficiency lighting, HVAC, pumps, and other qualifying equipment.

- Residential customers in certain geographic areas can enroll in a free load management program where the customer agrees to the installation of a radio-controlled device outside of the residence. On days when demand for power is especially high, the device can turn the outdoor air conditioning unit off for a portion of each half-hour and then automatically turn it back on.

- Duke Energy offers customers, both residents and property managers, energy efficient light bulbs to reduce energy consumption.

H.1.12 Names and Addresses of Native American Tribes with land on Which the Project is located or Tribes that May Be Affected by the Project as Proposed

The Project is not located on Native American lands and no impacts to tribal resources associated with the Project are anticipated from continued operation of the Project or the construction, operation, or maintenance of Bad Creek II. The cultural resources section of Exhibit E describes in detail tribal and other historic cultural resources in the Project area of potential effects and discusses potential impacts arising from the implementation of the Historic Properties Management Plan.

The Licensee consulted with the Catawba Indian Nation, the Cherokee Nation, the Eastern Band of Cherokee Indians, the Muscogee (Creek) Nation, and the United Keetoowah Band of Cherokee Indians regarding tribal resources potentially affected by the continued operation and maintenance of the Project.

No concerns or comments with regard to Traditional Cultural Properties were provided by the tribes, and none are known to be present within the Project area of potential effects.

The contact information for the federally listed Indian tribes potentially affected by the Project is as follows:

Wenonah Haire and Caitlyn Rogers
Tribal Historic Preservation Office
Catawba Indian Nation
1536 Tom Steven Rd
Rock Hill, SC 29730

William Harris
Chief
Catawba Indian Nation
996 Avenue of the Nations
Rock Hill, SC 29730

Elizabeth Toombs
Tribal Historic Preservation Officer
Cherokee Nation
22361 Bald Hill Road
Tahlequah, OK 74464

Chief Richard Sneed
Eastern Band of Cherokee Indians
88 Council House Loop Rd
Cherokee, NC 28719

Russell Townsend
Tribal Historic Preservation Officer
Eastern Band of Cherokee Indians, Qualla Boundary
P.O. Box 455
Cherokee, NC 28719

LeeAnne Wendt
Tribal Archaeologist
Department of Culture and Humanities
Muscogee (Creek) Nation
1801 E 4th St.
Okmulgee, OK 74447

Savannah Waters
Tribal Historic Preservation Officer
Muscogee (Creek) Nation
P.O. Box 580
Okmulgee, OK 74447

Acee Watt
Tribal Historic Preservation Officer
United Keetoowah Band of Cherokee Indians
18263 W. Keetoowah Circle
Tahlequah, OK 74465

H.2 Information Required for Existing Licensees (18 CFR §5.18(c)(1)(ii))

H.2.1 Safe Management, Operation, and Maintenance of the Project

The Licensee is committed to the safe management, operation, and maintenance of the Project. Safety features are designed to minimize risks to the community, public, operating personnel, environment, and the physical plant. In compliance with Existing License requirements for the Project, the Licensee maintains rigorous dam safety, operations and maintenance, and emergency preparedness programs. These programs include Part 12D Comprehensive Assessment and Periodic Independent Consultant Safety Inspections, a Dam Safety Surveillance and Monitoring Plan (DSSMP), annual Dam Safety Surveillance and Monitoring Reports, a Potential Failure Mode Analysis, FERC safety inspections, FERC environmental inspections, a Public Safety Plan, an Emergency Action Plan (EAP) and associated functional exercises, and employee safety programs.

The Licensee operates its Project facilities in a manner to ensure safe and reliable operations for its employees and the public. Employee and public safety components of the Licensee's Project operations include the following.

- Training of operations and maintenance personnel
- Regular inspection of Project facilities and monitoring indicators of Project condition and safety
- Providing warning signs of and limiting public access to areas where Project operations could endanger the public
- Compliance with applicable local, state, and federal laws and regulations regarding the safe operation of industrial and electric utility facilities

These measures have been consistently applied to assure the safe operation of the Project. A complete description of the dam safety surveillance and monitoring equipment and procedures as related to safe maintenance and operations is provided in the Project's DSSMP, which is updated periodically.

H.2.1.1 Operating During Flood Conditions

The Project drainage basin is small (approximately 1.36 square miles) and flooding is generally not a concern. There are no spillway gates at the Project and flood inflow is passed via the generating units. The 1996 Probable Maximum Flood analysis determined only one unit is required to discharge the Probable Maximum Flood inflows and avoid overtopping (HDR 2018).

H.2.1.2 Warning Devices for Downstream Public Safety

The Project has warning signs and lights on lower reservoir inlet/outlet structure warning of hazardous conditions. Warning sirens sound and red beacons flash prior to generation releases and pumping operations. These devices are described in the FERC-approved Public Safety Plan.

During construction of Bad Creek II, the Licensee will install a temporary boating barrier downstream of the lower reservoir inlet/outlet area to eliminate public boating access to construction areas. Following Bad Creek II construction, the Licensee will update the Public Safety Plan to reflect new warning devices associated with Bad Creek II operations.

H.2.1.3 Proposed Changes that Could Affect the Emergency Action Plan

Development of Bad Creek II could affect the EAP. Accordingly, the Licensee plans to submit a Temporary Construction EAP to address the period during which Bad Creek II is constructed. Following construction, the Licensee will submit an updated EAP for FERC approval.

There are no proposed changes to the operation of the Project or downstream development that would affect the existing EAP on file with the Commission.

H.2.1.4 Monitoring Devices

Monitoring instrumentation consists of redundant pressure transducers, fixed cameras with views of a staff gage, piezometers, flumes, weirs, leakage monitoring pipes, inclinometers, borehole extensometers, deformation monuments, and seismographs. Additional instrumentation includes rainfall monitoring devices.

This instrumentation is monitored by knowledgeable and experienced Licensee personnel and is well-maintained. Additional details regarding Project instrumentation and monitoring methods and frequencies are contained in the Dam Safety Surveillance Monitoring Plan included in the Supporting Technical Information Document (STID) filed with the FERC. The Licensee will update both the DSSMP and STID as needed following construction of Bad Creek II.

H.2.1.5 Employee Safety and Public Safety Record

The Licensee manages the Project consistent with its long-standing commitment to employee safety. This commitment begins with compliance with applicable local, state, and federal regulations regarding the safe operation of industrial and electrical facilities. Electronic records of employee lost-time injuries are available dating back to 1998; no lost-time injuries occurred for the period 1998 - 2024.

Public access to the Project is limited and boating, fishing, and swimming within the Bad Creek Reservoir is not allowed. One fatality is known to have occurred near the Project Boundary. As reported to FERC on June 5, 2018, a woman slipped and fell into the Whitewater River upstream of the Project Boundary. The river's current carried her over a series of waterfalls and her body was recovered the next day at the bottom of falls within the Project Boundary. This event was unrelated to Project activities. No other public fatalities or serious injuries are known to have occurred at the Project.

H.2.2 Current Operation of the Project

The Project has been operated in a manner consistent with the requirements of the current license. Details regarding operation and constraints of the Project are discussed in Exhibits A, B, and E of this Application. The Project will continue to operate in a manner consistent with the requirements of the current license until the New License is issued, after which time the Project will be operated in accordance with the requirements and conditions of the New License.

H.2.3 Project History

Planning and licensing activities for the Project began in the early 1970s and the Licensee received the original Project License in 1977. The construction of the Bad Creek Project took roughly 10 years and cost $1 billion. Construction was completed one year ahead of schedule and $90 million under budget when it began operations in 1991 (Moore 2016).

See Exhibit C for a list of Project modifications since original construction. The most recent modification was the upgrade of the original pump-turbines. On April 23, 2018, the Licensee filed a Non-Capacity License Amendment Application to upgrade and refurbish the four Francis-type pump-turbines in the powerhouse, replace existing runners with Francis-type pump-turbine runners, and rehabilitate and/or upgrade the remaining components of the pump-turbine runners at the Bad Creek Project. The upgrades were approved by FERC in an amendment order dated August 6, 2018. Construction was completed in 2024 at a cost of approximately $212.6 million, a significant measure which Duke Energy is requesting be considered when determining the new license term. This upgrade increased the authorized installed capacity from 1,065 MW to 1,400 MW and hydraulic capacity from 17,234 cubic feet per second to 19,760 cubic feet per second.

H.2.4 Summary of Generation Lost at the Project Due to Unscheduled Outages

Table H-4 presents the unscheduled outages for the Project between 2019 through 2024. In order to maximize energy production from the facility, the Licensee addresses unscheduled outages immediately, assesses the specific causes of such outages following restoration, and implements preventative measures to prevent recurrence.

Table H-3. Unscheduled Outage History for the Project (2019 through 2024)

Unit	Outage Start Date	Outage End Date	Outage Duration (hr.min)	Cause of / Reason for Outage
Bad Creek Hydro 1	10/20/2020 17:42	10/21/2020 0:30	6.8	Draft tube pressure issue
Bad Creek Hydro 1	10/22/2020 23:39	10/29/2020 10:20	154.68	Draft tube pressure issue
Bad Creek Hydro 1	1/2/2022 23:55	1/3/2022 1:55	2	Generator breaker issue
Bad Creek Hydro 1	1/7/2022 8:16	1/7/2022 11:45	3.48	Unit 1 generator breaker major alarm due to pole disagreement.
Bad Creek Hydro 1	1/18/2022 9:01	1/18/2022 19:29	10.47	Switchyard relay caused station outage
Bad Creek Hydro 1	5/2/2022 17:57	5/2/2022 20:03	2.1	U1 Thrust Bearing oil level transmitter issue.
Bad Creek Hydro 1	5/9/2022 0:44	5/9/2022 13:13	12.48	Shear pin issue
Bad Creek Hydro 1	7/27/2022 15:45	7/27/2022 18:41	2.93	12 second gov logic testing
Bad Creek Hydro 1	9/25/2022 22:58	9/25/2022 23:31	0.55	Turbine bearing oil level low Trip
Bad Creek Hydro 1	2/5/2023 18:23	2/5/2023 18:48	0.42	Thrust bearing oil level low.
Bad Creek Hydro 1	2/7/2023 16:03	2/7/2023 19:38	3.58	U2 Trip Coil Failure for generator breaker
Bad Creek Hydro 1	2/12/2023 16:47	2/12/2023 17:20	0.55	Low oil level in thrust bearing pot
Bad Creek Hydro 1	5/31/2023 11:15	5/31/2023 15:00	3.75	Transmission reliability issue
Bad Creek Hydro 1	11/20/2023 7:26	11/20/2023 7:50	0.4	System shutdown after other unit tripped.
Bad Creek Hydro 1	9/24/2024 21:15	9/25/2024 0:10	2.92	Transmission outage due to storms in the area
Bad Creek Hydro 1	9/27/2024 9:00	9/29/2024 19:05	58.08	Line outage due to hurricane
Bad Creek Hydro 1	11/27/2024 22:27	11/28/2024 0:38	2.18	Turbine Bearing Level Low alarm due to faulty indication
Bad Creek Hydro 2	11/16/2020 20:59	11/17/2020 9:35	12.6	Forced outage due to generator breaker problems
Bad Creek Hydro 2	12/13/2020 23:22	12/14/2020 16:08	16.77	Shear pin air pressure
Bad Creek Hydro 2	12/21/2020 6:56	12/21/2020 10:03	3.12	Gate position calibration issue
Bad Creek Hydro 2	12/26/2020 10:31	12/26/2020 15:25	4.9	Main breaker trip

Unit	Outage Start Date	Outage End Date	Outage Duration (hr.min)	Cause of / Reason for Outage
Bad Creek Hydro 2	2/12/2021 0:04	2/12/2021 0:20	0.27	Bearing oil level indication false
Bad Creek Hydro 2	5/13/2021 12:00	5/14/2021 22:30	34.5	Whitewater line out of service
Bad Creek Hydro 2	5/27/2021 22:55	5/27/2021 23:05	0.17	Controls issues caused trip
Bad Creek Hydro 2	5/29/2021 14:47	5/29/2021 15:35	0.8	Capacitance probe for the turbine bearing oil pot/false indicator
Bad Creek Hydro 2	6/10/2021 5:59	6/10/2021 7:16	1.28	Calibration issue on switch for low level alarm on oil
Bad Creek Hydro 2	10/25/2021 20:22	10/25/2021 22:05	1.72	Forced Outage - Nitrogen Accumulator on draft tube issue
Bad Creek Hydro 2	12/7/2021 11:37	12/8/2021 13:10	25.55	Exciter - fan louver switch/bad contact
Bad Creek Hydro 2	1/18/2022 9:01	1/18/2022 19:27	10.43	Switchyard relay caused station outage
Bad Creek Hydro 2	4/12/2022 6:34	4/12/2022 8:50	2.27	U2 spherical valve cam motor E-stop alarm
Bad Creek Hydro 2	6/16/2022 2:46	6/16/2022 4:20	1.57	Y and Z phase cond. temp alarm. Buss card issue
Bad Creek Hydro 2	7/27/2022 11:44	7/27/2022 15:30	3.77	12 sec delay gov system testing
Bad Creek Hydro 2	2/7/2023 16:03	2/9/2023 17:28	49.42	Trip Coil Failure for generator breaker
Bad Creek Hydro 2	5/3/2023 6:35	5/3/2023 11:50	5.25	5 pole issue
Bad Creek Hydro 2	5/3/2023 11:50	5/4/2023 0:45	12.92	5 pole issue
Bad Creek Hydro 2	5/31/2023 11:15	5/31/2023 15:00	3.75	Transmission Reliability Issue
Bad Creek Hydro 2	11/20/2023 7:18	11/20/2023 11:54	4.6	Contractor error tripped unit
Bad Creek Hydro 2	12/11/2023 17:15	12/11/2023 18:35	1.33	5 Pole Failure
Bad Creek Hydro 2	1/5/2024 17:51	1/5/2024 18:50	0.98	Bad relay on phase reversing switch.
Bad Creek Hydro 2	8/19/2024 21:37	8/20/2024 3:16	5.65	Generator breaker trouble. Charging motor gear teeth damaged.
Bad Creek Hydro 2	9/10/2024 23:24	9/11/2024 4:00	4.6	Turbine bearing heat exchanger inlet flow low.
Bad Creek Hydro 3	3/17/2020 2:00	3/17/2020 18:08	16.13	Pump and Gen PD related
Bad Creek Hydro 3	9/13/2020 0:39	9/13/2020 1:18	0.65	Thrust bearing oil level low lockout
Bad Creek Hydro 3	11/14/2020 10:52	11/14/2020 11:43	0.85	Thrust bearing oil level low trip
Bad Creek Hydro 3	5/13/2021 12:00	5/14/2021 22:30	34.5	Whitewater line out of service
Bad Creek Hydro 3	6/16/2021 1:11	6/16/2021 1:41	0.5	Thrust bearing oil level low
Bad Creek Hydro 3	7/24/2021 21:20	7/25/2021 2:02	4.7	Gate position on draft tube gates issue
Bad Creek Hydro 3	7/25/2021 2:09	7/25/2021 10:50	8.68	Gate position on draft tube gates causing blown fuse
Bad Creek	9/24/2021	9/24/2021	1.38	Thrust bearing oil level low

Unit	Outage Start Date	Outage End Date	Outage Duration (hr.min)	Cause of / Reason for Outage
Hydro 3	0:35	1:58		
Bad Creek Hydro 3	5/18/2023 13:51	5/18/2023 16:17	2.43	Draft tube indication false
Bad Creek Hydro 3	5/18/2023 19:29	5/18/2023 20:37	1.13	Draft tube indication false
Bad Creek Hydro 3	5/31/2023 11:15	5/31/2023 15:00	3.75	Transmission Reliability Issue
Bad Creek Hydro 3	6/8/2023 11:05	6/8/2023 12:45	1.67	PLC Controller Failure
Bad Creek Hydro 3	10/10/2023 18:10	10/10/2023 18:21	0.18	Draft tube gate position indication false
Bad Creek Hydro 3	1/13/2024 8:12	1/13/2024 10:30	2.3	Thrust bearing oil level low
Bad Creek Hydro 3	2/19/2024 18:23	2/19/2024 20:02	1.65	gate position signal failure
Bad Creek Hydro 3	5/21/2024 2:49	5/21/2024 3:21	0.53	Faulted level transmitter
Bad Creek Hydro 3	7/31/2024 12:50	7/31/2024 13:18	0.47	Spherical valve failure
Bad Creek Hydro 3	8/27/2024 19:13	8/28/2024 12:41	17.47	Bus ground issue
Bad Creek Hydro 3	8/28/2024 13:04	9/4/2024 20:07	175.05	IPB buss duct issue
Bad Creek Hydro 3	9/4/2024 20:11	9/4/2024 20:38	0.45	I PB Buss duct issue
Bad Creek Hydro 3	9/24/2024 21:15	9/25/2024 0:10	2.92	Transmission outage due to storms
Bad Creek Hydro 3	9/27/2024 9:00	9/29/2024 19:05	58.08	Line outage during hurricane
Bad Creek Hydro 4	3/17/2020 2:00	3/17/2020 18:08	16.13	Pump and Gen PD related
Bad Creek Hydro 4	5/30/2020 12:15	5/30/2020 13:00	0.75	Start up failure due to 5 pole relay issue
Bad Creek Hydro 4	11/13/2020 9:22	11/13/2020 23:16	13.9	Phase reversing switch issue
Bad Creek Hydro 4	11/18/2020 23:20	11/19/2020 15:35	16.25	Forney Controls issue
Bad Creek Hydro 4	12/23/2020 6:55	12/23/2020 14:00	7.08	Draft tube pressure issue
Bad Creek Hydro 4	12/26/2020 10:31	12/26/2020 15:25	4.9	Main breaker trip
Bad Creek Hydro 4	2/18/2021 17:56	2/18/2021 22:35	4.65	Broken weld on shaft seal
Bad Creek Hydro 4	2/19/2021 6:27	2/19/2021 13:48	7.35	Shaft seal flow issue due to low head
Bad Creek Hydro 4	5/13/2021 12:00	5/14/2021 22:30	34.5	Whitewater line out of service
Bad Creek Hydro 4	1/18/2022 9:01	1/18/2022 19:27	10.43	Switchyard relay caused station outage
Bad Creek Hydro 4	7/27/2022 13:20	7/27/2022 16:00	2.67	Governor delay system issue found during testing
Bad Creek Hydro 4	7/27/2022 18:54	7/27/2022 21:12	2.3	Repair governor delay system
Bad Creek Hydro 4	3/29/2024 17:36	3/30/2024 16:39	23.05	Oil leak on turbine bearing

Unit	Outage Start Date	Outage End Date	Outage Duration (hr.min)	Cause of / Reason for Outage
Bad Creek Hydro 4	7/5/2024 3:02	7/5/2024 5:18	2.27	Heat Exchanger Flow transmitter fault.
Bad Creek Hydro 4	8/27/2024 19:13	8/28/2024 12:41	17.47	Bus ground issue
Bad Creek Hydro 4	8/28/2024 13:04	9/4/2024 20:21	175.28	IPB Bus duct issue
Bad Creek Hydro 4	9/24/2024 21:15	9/25/2024 0:10	2.92	Transmission outage related to storms
Bad Creek Hydro 4	9/27/2024 7:59	9/27/2024 9:00	1.02	Blown exciter fuse
Bad Creek Hydro 4	9/27/2024 9:00	9/29/2024 19:05	58.08	Line outage during storm
Bad Creek Hydro 4	9/30/2024 0:20	9/30/2024 2:27	2.12	Phase Reversing Switch relay issue

H.2.5 Record of Compliance

To the best of the Licensee's knowledge and based on a review of historical records, the Licensee has been and continues to be in compliance with the applicable terms and conditions of the FERC license, and there have been no license violations or recurring situations of noncompliance over the license term.

H.2.6 Actions that Affect the Public

The Licensee's operation of the Project produces affordable electric energy without emission of pollutants, which benefits both members of the public who are Duke Energy customers and the public at large. Construction of Bad Creek II will increase this benefit and support the addition of additional clean renewable electric generation on the electrical system.

H.2.7 Ownership and Operating Expenses Affected by Transfer of License

The Licensee is applying for a long-term license to continue to maintain and operate an expanded Project. There is no competing application to take over the Project. Because there is no proposal to transfer the Project license, this section is not applicable to the Project.

H.2.8 Annual Fees Under Part I of Federal Power Act

Given there are no federal or Native American lands associated with the Project, the Licensee does not pay annual fees under Part I of the Federal Power Act.

H.3 References

Duke Energy Carolinas, LLC and Duke Energy Progress, LLC (Duke Energy). 2023. 2023 Carolinas Resource Plan. [URL]: https://www.duke-energy.com/our-company/about-us/irp-carolinas. Accessed September 19, 2024.

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Moore, S. 2016. The Marvel in the Mountain. Duke Energy, Illumination. [URL]: https://illumination.duke-energy.com/articles/the-marvel-inside-the-mountain-4608936. Accessed February 12, 2025.