Appendix A

Distribution List

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Bad Creek Pumped Storage Project (FERC No. 2740) Distribution List

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888 First St, N.E. Room 61-02
Washington, D.C. 20426

Federal Energy Regulatory Commission,
Office of General Council - Energy
888 First St, N.E. Room 101-56
Washington, D.C. 20426

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U.S. Bureau of Land Management
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Milwaukee, WI 53202-4618

U.S. Bureau of Land Management
Jackson District Office
411 Briarwood Dr Ste 404
Jackson, MS 39206-3058

U.S. Department of Agriculture
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U.S. Department of Transportation
United States Coast Guard
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Appendix B

Agency Consultation

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Subject:	Bad Creek Pumped-Storage Project Relicensing Roll-out Call
Location:	Microsoft Teams Meeting
Start:	Fri 2/18/2022 1:00 PM
End:	Fri 2/18/2022 2:00 PM
Recurrence:	(none)
Meeting Status:	Accepted
Organizer:	Stuart, Alan Witten
Required Attendees:	Stuart, Alan Witten; Elizabeth Miller; Olds, Melanie J; hightoCW@dhec.sc.gov; Fritz Rohde; Elizabeth Johnson; afell@scprt.com; SM.FS.aprd@usda.gov; Pace Wilber; John Crutchfield; Kulpa, Sarah; Salazar, Maggie; Settevendemio, Erin; brian.strong@ncparks.gov
Optional Attendees:	Johnson, Elizabeth; Farrell, Christine E; miller.derrick@usda.gov; Miller, Derrick -FS; McCarney-Castle, Kerry; Dan Rankin; Ross Self

Good morning,

You have been identified as agency members who have regulatory authority and/or may have interest in the relicensing of the Bad Creek Pumped-Storage Project. Some of you I've had a the opportunity to speak with already. Please plan to attend this Microsoft Teams meeting as Duke Energy plans to roll-out information regarding the relicensing of our Bad Creek Project. The relicensing process will officially kick-off later this month when Duke Energy files our Notice of Intent to Relicense and Pre-Application Document.

We believe you will find the information we present during the meeting of utmost value to you and your respective agency. General topics to be covered include:

- Bad Creek Project Overview
- Relicensing Process
- Schedule
- Project improvements

We will reserve time at the end of the meeting for Q & A.

If you cannot attend, **please forward** this meeting request to someone on your organization who may be able to make the meeting. Also, please feel free to forward this to other members in your agency who you believe might be interested in attending.
We look forward to seeing you.

Thank you !
Alan

Microsoft Teams meeting

Join on your computer or mobile app
Click here to join the meeting

Join with a video conferencing device

duke-energy@m.webex.com
Video Conference ID: 114 786 949 3
Alternate VTC instructions

Or call in (audio only)

+1 704-659-4701,,566750047# United States, Charlotte

Phone Conference ID: 566 750 047#
Find a local number | Reset PIN

Learn More | Meeting options

Appendix C

Project Boundary Maps

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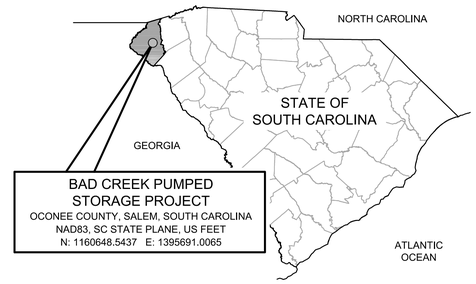
EXHIBIT G-1 — SHEET 1 OF 4

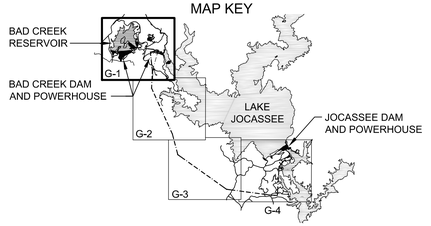
PROJECT LOCATION MAP



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

- LANDS UNDER EASEMENT
- 14 — PROJECT BOUNDARY POINT NUMBER
- PROJECT BOUNDARY
- RIGHT OF WAY
- CITY/COUNTY BOUNDARY
- SHORELINE/STREAM
- OVERHEAD ELECTRICAL
- PRIMARY ROADS
- PRIMARY ROADS

2019 MAG NORTH — 6.32° — TRUE NORTH

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

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://data-oconeesc.opendata.arcgis.com/datasets
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. SEE EXHIBIT G-2 FOR PROJECT BOUNDARY TABLES.

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.

STATE OF MAINE — EXAMPLE — PROFESSIONAL LAND SURVEYOR

EXHIBIT G-1 — SHEET 1 OF 1

BAD CREEK PUMPED STORAGE PROJECT FERC # 2740

PROJECT BOUNDARY MAP

DUKE ENERGY CAROLINAS, LLC

0 500 1000

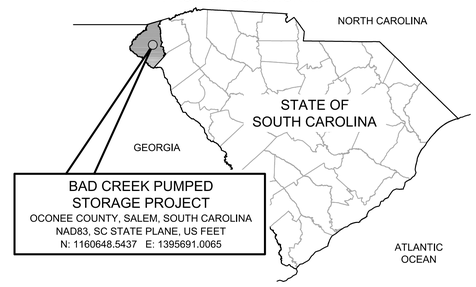
SCALE: 1"=500'

CAD FILENAME: P-2740-XXXX, G-1, PROJECT BOUNDARY MAP, XX-XX-XXXX.DWG

PROJECT BOUNDARY		
POINT	COURSE	DISTANCE (FT)
1-2	ALONG 2315' CONTOUR	22072.4
2-3	N 60d0'0" E	359.0
3-4	ALONG ROAD R.O.W.	8229.7
4-5	N 66d52'13" E	44.0
5-6	ALONG ROAD R.O.W.	8223.1
6-7	N 60d0'0" E	930.0
7-8	N 8d0'0" E	530.0
8-9	N 62d15'0" E	1105.0
9-10	E	703.0
10-11	N 60d0'0" E	1075.0
11-12	ALONG SHORELINE	2172.4
12-13	S 60d30'0" W	3670.0
13-14	ALONG ROAD R.O.W.	822.75
14-15	S 86d0'0" E	2409.0
15-16	S 50d0'0" E	1030.0
16-17	S 30d3'14" W	140.8
17-18	N 59d56'46" W	25.2
18-19	S 30d3'14" W	131.8
19-20	S 59d56'46" E	23.21
20-21	S 16d5'25" E	223.4
21-22	ALONG ROAD R.O.W.	8516.2
22-23	S 15d34'51" W	243.3
23-24	S 0d15'22" W	226.3
24-25	S 2d25'54" W	3273.3
25-26	S 24d22'47" E	9256.6
26-27	S 14d46'58" E	3892.9
27-28	S 54d36'58" E	10920.5
28-29	S 82d25'1" E	8085.8
29-30	N 87d30'26" E	1221.3
30-31	N 3d25'8" E	5071.8
31-32	N 38d46'56" E	635.9
32-33	N 4d0'28" W	854.8
33-34	N 61d3'57" E	1229.8
34-35	N 74d51'55" E	614.6
35-36	S 49d9'24" E	154.0
36-37	S 40d50'36" W	68.0
37-38	N 49d9'24" W	117.9
38-39	S 74d51'55" W	570.2
39-40	S 61d3'57" W	1178.2
40-41	S 4d0'28" E	137.9
41-42	N 38d46'56" E	760.5
42-43	N 85d51'14" E	439.3
43-44	S 4d8'46" E	200.0
44-45	S 85d51'14" W	352.2
45-46	S 38d46'56" W	889.4
46-47	S 4d0'28" E	744.3
47-48	S 3d25'8" W	4696.1
48-49	S 88d54'38" W	361.4
49-50	S 3d25'8" W	282.7
50-51	N 87d10'45" W	1421.2
51-52	N 82d25'1" W	8160.8
52-53	N 54d36'58" W	11075.4
53-54	N 14d46'58" W	3963.6
54-55	N 24d22'47" W	9295.8
55-56	N 2d25'54" E	3290.8
56-57	N 6d9'13" W	1036.8
57-58	ALONG ROAD R.O.W.	4112
58-59	N 83d45'0" W	1657.5
59-60	S 26d50'8" W	375.5
60-61	S 75d0'0" W	280.0
61-62	S 26d41'40" W	420.0
62-63	N 84d17'52" W	356.6
63-64	S 48d4'0" W	2695.0
64-65	N 35d0'0" W	950.0
65-66	N 25d0'0" E	431.3
66-67	N 20d0'0" W	180.0
67-68	S 62d0'0" W	1125.0
68-69	N 70d0'0" W	175.0
69-70	N	572.1
70-1	N 24d11'0" W	1201.3

EXHIBIT G-1 — SHEET 1 OF 4

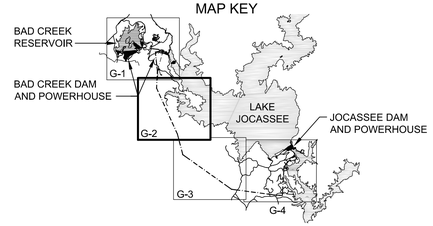
PROJECT LOCATION MAP



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

- LANDS UNDER EASEMENT
- 14 — PROJECT BOUNDARY POINT NUMBER
- PROJECT BOUNDARY
- RIGHT OF WAY
- CITY/COUNTY BOUNDARY
- SHORELINE/STREAM
- OVERHEAD ELECTRICAL
- PRIMARY ROADS
- PRIMARY ROADS

2019 MAG NORTH — 6.32° — TRUE NORTH

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

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://data-oconeesc.opendata.arcgis.com/datasets
BOUNDARY DATA: FERC EXHIBIT K BAD CREEK PUMPED STORAGE PROJECT SHEETS

NOTES

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SURVEYORS STATEMENT

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STATE OF MAINE — EXAMPLE — PROFESSIONAL LAND SURVEYOR

EXHIBIT G-2 — SHEET 2 OF 4

BAD CREEK PUMPED STORAGE PROJECT FERC # 2740

PROJECT BOUNDARY MAP

DUKE ENERGY CAROLINAS, LLC

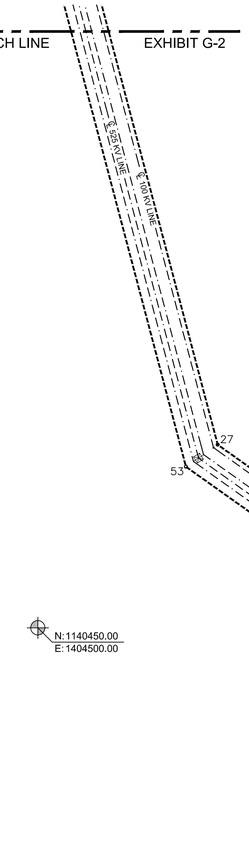
0 500 1000

SCALE: 1"=500'

CAD FILENAME: P-2740-XXXX, G-3, PROJECT BOUNDARY MAP - XX-XX-XXXX.DWG

MATCH LINE

EXHIBIT G-2



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E:1404500.00

N:1144000.00
E:1412000.00

OCONEE
COUNTY

LAKE
JOCASSEE

NATIONAL GEODETIC SURVEY
BENCHMARK PID DO5577
N: 1140699.4590
E: 1416625.6470

JOCASSEE LAKE ROAD

5646.6'±
S 20d22'4" W

PROJECT BOUNDARY

EXHIBIT G-4

MATCH LINE

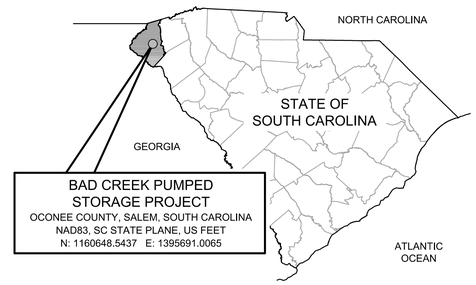
N:1134000.00
E:1413000.00

JOCASSEE LAKE ROAD

CAD FILENAME: P-2740-XXXX, G-3, PROJECT BOUNDARY MAP, XX-XX-XXXX.DWG

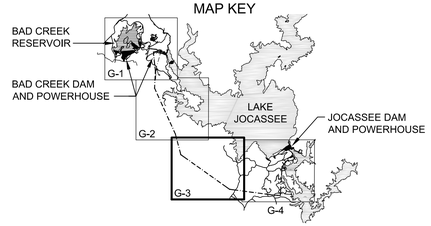
EXHIBIT G-1 — SHEET 1 OF 4

PROJECT LOCATION MAP



APPROXIMATE SCALE: 1"=60 MILES

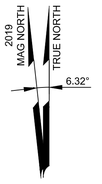
MAP KEY



APPROXIMATE SCALE: 1"=2.5 MILES

LEGEND

- LANDS UNDER EASEMENT
- 14 — PROJECT BOUNDARY POINT NUMBER
- PROJECT BOUNDARY
- RIGHT OF WAY
- CITY/COUNTY BOUNDARY
- SHORELINE/STREAM
- OVERHEAD ELECTRICAL
- PRIMARY ROADS
- PRIMARY ROADS



PROJECT BOUNDARY TIE DATA

THE PROJECT BOUNDARY IS TIED TO NATIONAL GEODETIC SURVEY
BENCHMARK PID DO5577: N: 1140699.459 E: 1416625.6470
TIE POINT 28: 5646.6'±, S 20d22'4" W

REFERENCE COORDINATE METADATA

PROJECTION - SOUTH CAROLINA STATE PLANE
DATUM - NAD83
UNITS - U.S. SURVEY FEET

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://data-oconeesc.opendata.arcgis.com/datasets
BOUNDARY DATA: FERC EXHIBIT K BAD CREEK PUMPED STORAGE PROJECT SHEETS

NOTES

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2. SEE EXHIBIT G-2 FOR PROJECT BOUNDARY TABLES.

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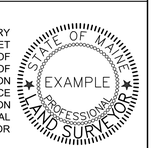


EXHIBIT G-3 — SHEET 3 OF 4

BAD CREEK PUMPED STORAGE PROJECT FERC # 2740

PROJECT BOUNDARY MAP

DUKE ENERGY CAROLINAS, LLC

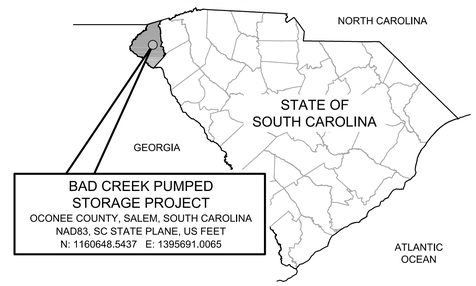
0 500 1000

SCALE: 1"=500'

FERC NO. P-2740-XXXX

EXHIBIT G-1 — SHEET 1 OF 4

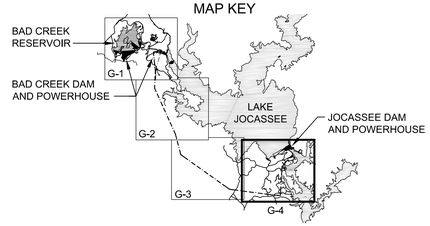
PROJECT LOCATION MAP



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

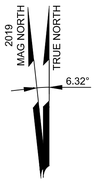
MAP KEY



APPROXIMATE SCALE: 1"=2.5 MILES

LEGEND

- LANDS UNDER EASEMENT
- PROJECT BOUNDARY POINT NUMBER (14)
- PROJECT BOUNDARY
- RIGHT OF WAY
- CITY/COUNTY BOUNDARY
- SHORELINE/STREAM
- OVERHEAD ELECTRICAL
- PRIMARY ROADS
- PRIMARY ROADS



PROJECT BOUNDARY TIE DATA

THE PROJECT BOUNDARY IS TIED TO NATIONAL GEODETIC SURVEY
BENCHMARK PID DO5577: N: 1140699.459 E: 1416625.6470
TIE POINT 28: 5646.6'±, S 20d22'4" W

REFERENCE COORDINATE METADATA

PROJECTION - SOUTH CAROLINA STATE PLANE
DATUM - NAD83
UNITS - U.S. SURVEY FEET

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://data-oconeesc.opendata.arcgis.com/datasets
BOUNDARY DATA: FERC EXHIBIT K BAD CREEK PUMPED STORAGE PROJECT SHEETS

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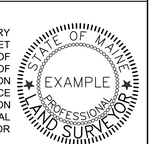

EXHIBIT G-4 — SHEET 4 OF 4

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. XX-XX-XXXX.DWG

FERC NO. P-2740-XXXX

Appendix E

Natural Resources Assessments

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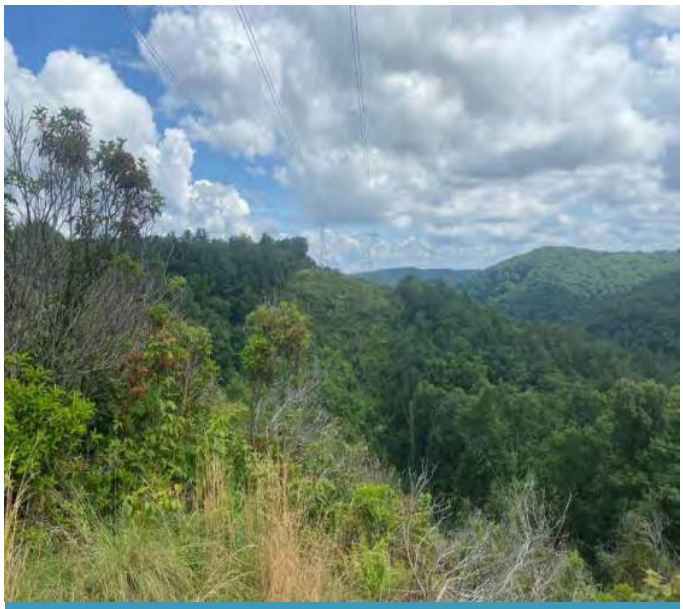

Bad Creek II Power Complex Project

Natural Resources Assessment

Prepared for:

DUKE ENERGY CAROLINAS, LLC
Charlotte, North Carolina

Prepared by:

HDR
Charlotte, North Carolina

November 2021

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TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

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1.0 Potential Impacts Reference Guide

Study Area					
The Bad Creek II Complex Project (Project) Study Area (Study Area) is approximately 1,314 acres located within the footprint of the existing Bad Creek Pumped Storage Project (FERC Project No. 2740), a Duke Energy Carolinas, LLC (Duke Energy) property in Oconee County, South Carolina, approximately eight miles north of Salem. The Study Area consists of Bad Creek Pumped Storage Project infrastructure including the existing powerhouse complex, the Bad Creek Upper Reservoir, the Lower Reservoir (Lake Jocassee), transmission facilities, access roads, maintained right-of-ways, and undeveloped forested land.					
Resource	**Identified Resources within the Study Area**	**Potential Impacts**	**Recommended Action**	**Implementing Agency**	**Website**
Land Cover	Land cover consists of maintained right-of way (ROW) and undisturbed forested areas. The *Ecological Zones in the Southern Blue Ridge Escarpment: 4th Approximation* (Simon 2015) was used to characterize plant communities. Ecological communities included short-leaf pine-oak forest, rhododendron forest, montane oak-hickory cove forest, rich cove forest, and floodplain forest. Palustrine forested, emergent, and scrub-shrub wetlands were also observed. Maintained ROW and fields consisted of herbaceous and shrub vegetation.	Land disturbance during construction.	Land disturbance associated with <2 acres of land requires submittal of a stormwater management and sediment control plan that meets the requirements of R.72-307H (Standards for Stormwater Management and Sediment Reduction Regulation 72-300 through 72-316) and does not require approval of the implementing agency. Land disturbance of ≥2 acres of land requires the submittal and approval of a stormwater management and sediment control plan that meets the requirements of R.72-307I (Standards for Stormwater Management and Sediment Reduction Regulation 72-300 through 72-316).	South Carolina Department of Health and Environmental Control (SCDHEC)	https://www.scdhec.gov/environment/water-quality/water-regulations-standards/water-regulations-standards-standards-0 Biophysical Settings in the North Zone of the Cherokee National Forest Identified from Ecological Zones: First Approximation (conservationgateway.org)
Cultural Resources	A desktop analysis conducted in October 2021 revealed 19 archaeological sites, and one historical area within the Study Area. Two archaeological sites (380C0249 and 380C250) within the Project Study Area are potentially eligible for listing in the National Register of Historic Places (NRHP) and should be preserved in place. Resource 156 Keowee-Toxaway Hydroelectric Development is currently not eligible for listing in the NRHP, but it will be re-evaluated when it reaches 50 years of age in 2023.	Land disturbance during construction.	Coordination with the South Carolina Department of Archives and History (SCDAH) State Historic Preservation Office (SCSHPO) regarding potential impacts with respect to cultural resources.	SCSHPO	https://scdah.sc.gov/historic-preservation
Federally Protected Species	Potential habitat for smooth coneflower, northern long-eared bat (summer habitat), Indiana bat (summer habitat), persistent trillium, and small whorled pogonia is present within the Study Area.	Habitat disturbance related to the construction and placement of proposed infrastructure which may include land disturbance activities (i.e. clearing, grading, and excavation), spoil and staging areas, and proposed temporary and permanent access routes.	Coordination with U.S. Fish and Wildlife Service (USFWS) concerning on-site habitat for northern long-eared bat, Indiana bat, persistent trillium, small whorled pogonia, and smooth coneflower, including a survey for persistent trillium and small whorled pogonia during the recommended optimal window.	USFWS, South Carolina Ecological Field Office South Carolina Department of Natural Resources (SCNDR)	https://www.fws.gov/southeast/charleston/ https://www.dnr.sc.gov/

Study Area					
The Bad Creek II Complex Project (Project) Study Area (Study Area) is approximately 1,314 acres located within the footprint of the existing Bad Creek Pumped Storage Project (FERC Project No. 2740), a Duke Energy Carolinas, LLC (Duke Energy) property in Oconee County, South Carolina, approximately eight miles north of Salem. The Study Area consists of Bad Creek Pumped Storage Project infrastructure including the existing powerhouse complex, the Bad Creek Upper Reservoir, the Lower Reservoir (Lake Jocassee), transmission facilities, access roads, maintained right-of-ways, and undeveloped forested land.					
Resource	**Identified Resources within the Study Area**	**Potential Impacts**	**Recommended Action**	**Implementing Agency**	**Website**
At-Risk Species	Nine At-Risk Species (ARS) are known to be present in Oconee County or the vicinity of the Study Area (Chamberlain's dwarf salamander, golden-winged warbler, Edmund's snaketail, monarch butterfly (candidate species), Smokies needlefly, little brown bat, tri-colored bat, Carolina hemlock, Georgia aster, and sun-facing coneflower).	Habitat disturbance related to the construction and placement of proposed infrastructure which may include land disturbance activities (i.e. clearing, grading, and excavation), spoil and staging areas, and proposed temporary and permanent access routes.	Coordination with USFWS and the SCDNR concerning on-site habitat for Chamberlain's dwarf salamander, golden-winged warbler, Edmund's snaketail, Smokies needlefly, little brown bat, tri-colored bat, Carolina hemlock, Georgia aster, monarch butterfly, and sun-facing coneflower (for species that are federally listed at the time of permit submittal). The resources agencies may request voluntary conservation actions for ARS prior to federal listing.	USFWS, South Carolina Ecological Field Office	https://www.fws.gov/southeast/pdf/fact-sheet/south-carolina-species-list-by-county.pdf
Resource	**Identified Resources within the Study Area**	**Potential Impacts**	**Recommended Action**	**Implementing Agency**	**Website**
Federal Emergency Management Agency (FEMA) Floodplains	A review of the FEMA National Flood Hazard Layer indicated that Special Flood Hazard Areas (i.e. high-risk flood (AE), 100-Year Flood Zones) exist within the Study Area adjacent Lake Jocassee.	Land disturbance and placement of fill within the regulated floodplain during construction.	Coordination with Oconee County, Floodplain Management.	Oconee County Planning and Zoning	https://oconeesc.com/community-dev-home/planning-and-zoning/floodplain-management
South Carolina Surface Water Buffers	The Study Area is located in the Savannah River Basin. A review of SCDHEC Buffer Zone Guidance indicated that a 30-foot natural buffer is recommended for jurisdictional surface waters (including wetlands) with drainage areas greater or equal to 100 acres.	Land disturbance during construction within the natural stream buffers.	Land-disturbing activities associated with construction activities that impact surface waters are exempt, with appropriate Clean Water Act Section 404/401 permits.	SCDHEC	https://www.scdhec.gov/default/files/docs/Environment/docs/lid-Buffers.pdf
South Carolina Water Classifications and Standards	The surface waters within the Study Area Lake Jocassee and Devil's Fork (and their associated tributaries) are classified as Trout; Put, Grow and Take (TPGT); Whitewater River and its tributaries are classified as Outstanding Water Resource (ORW).	Stormwater runoff during land disturbance activities.	Coordination with SCDHEC regarding antidegradation rules at to protect waters of the State.	SCDHEC	https://www.scdhec.gov/sites/default/files/media/document/R.61-68_0.pdf https://www.scdhec.gov/sites/default/files/media/document/R.61-69_0.pdf https://gis.dhec.sc.gov/watersheds/

Study Area					
The Bad Creek II Complex Project (Project) Study Area (Study Area) is approximately 1,314 acres located within the footprint of the existing Bad Creek Pumped Storage Project (FERC Project No. 2740), a Duke Energy Carolinas, LLC (Duke Energy) property in Oconee County, South Carolina, approximately eight miles north of Salem. The Study Area consists of Bad Creek Pumped Storage Project infrastructure including the existing powerhouse complex, the Bad Creek Upper Reservoir, the Lower Reservoir (Lake Jocassee), transmission facilities, access roads, maintained right-of-ways, and undeveloped forested land.					
Resource	**Identified Resources within the Study Area**	**Potential Impacts**	**Recommended Action**	**Implementing Agency**	**Website**
Wetlands and Jurisdictional Waters of the U.S.	Potentially jurisdictional surface waters were identified (but not delineated) including 23 streams, 7 wetlands, and one open water were identified in the Study Area.	Placement of spoil, staging areas, and access routes may result in potential impacts that require the discharge of dredged or fill material into waters of the U.S.	It is recommended to have surface water formally delineated in the field and to submit a Jurisdictional Determination form to the U.S. Army Corps of Engineers (USACE) to verify the boundaries in order to accurately calculate impacts to surface waters regulated by the USACE and SCDHEC. Preliminary facilitate layouts indicate that the Project may result in impacts that would require a Section 404 Individual Permit from the USACE and Section 401 Water Quality Certification from the SCDHEC.	USACE, Charleston District, Greenville Regulatory Field Office SCDHEC – Water Quality Certification and Wetlands Section	https://www.sac.usace.army.mil/ Water Quality Certification Program (Section 401) - Overview | SCDHEC
Navigable Waters	According to the USACE Charleston District's Navigation Study Reports, no federal navigable waters are located within the Study Area. Lake Jocassee is classified as a State Navigable Waters for South Carolina by SCDHEC.	Construction activities in Lake Jocassee.	Any activity, such as construction, dredging, filling or other alterations below the mean high water mark in Jocassee will require a Construction in Navigable Waters Permit from SCDHEC.	SCDHEC – Bureau of Water	http://scdhec/bow/navigable-waters
FERC Boundary Crossings	Lake Jocassee is licensed as part of Duke Energy's Keowee-Towaway Project (FERC No. 2503)	Construction activities in Lake Jocassee and its surrounding shoreline.	Activities within the existing FERC Project Boundary are subject to review under Duke Energy's Shoreline Management Plan. Submittal of a Lake Use Permit to authorize activities within the existing FERC Boundary may be required.	Duke Energy Lake Services	https://www.duke-energy.com/Community/Lakes/Services/Permits-Shoreline-Activities

2.0 Introduction

This report presents the findings of a natural resources assessment performed by HDR for Duke Energy Carolinas, LLC (Duke Energy) for the proposed Bad Creek II Power Complex Project (Project). The Project consists of constructing a new power complex at the existing Bad Creek Pumped Storage Station (Bad Creek) (Federal Energy Regulatory Commission [FERC] Project No. 2740) located approximately eight miles north of Salem in Oconee County, South Carolina. The proposed Project will be located adjacent to Bad Creek and will utilize the existing upper and lower reservoirs (Bad Creek Reservoir and Lake Jocassee, respectively). The Study Area as referenced in this report consists of 1,314 acres including the structures and features of the Bad Creek Project, including the Bad Creek Reservoir and dams, inlet/outlet structures in the upper and lower reservoirs, water conveyance system, underground powerhouse, tailrace tunnels, transmission facilities, driveways, parking lots, maintenance buildings, open areas, access roads, and undisturbed forested areas.

If pursued, the Project would consist of a new upper reservoir inlet/outlet (within the existing upper reservoir), water conveyance system, underground powerhouse, and lower reservoir inlet/outlet (along the shoreline of Lake Jocassee adjacent to the existing inlet/outlet structure). The preliminary estimated excavation and spoil calculations from construction activities indicate that approximately 4 million cubic yards of overburden material will need to be removed, transported, and deposited into storage. Environmental impacts to selected potential on-site spoil locations were considered in this report. A summary of estimated impacts for each spoil location is provided in Section 6.0 of this report.

HDR's approach to this natural resources assessment involved a desktop review of publicly available data and an on-site investigation that included surveys for wetlands and jurisdictional waters of the U.S., federally protected species habitat, and classification of natural/vegetation communities. The following sections provide a summary of HDR's methods and findings of the desktop analysis and on-site environmental surveys. Attached to this report are supporting figures (Appendix A), the S.C. Department of Natural Resources (SCDNR) Threatened and Endangered Species Consultation Report, the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) resources list, and USFWS South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species for Oconee County (Appendix B), and site photographs (Appendix C).

3.0 Description of Study Area

The 1,314-acre Study Area consists of all existing Bad Creek Project facilities, maintained right-of-way (ROW) areas, and undisturbed forested areas in Oconee County, South Carolina (Appendix A, Figures 1 and 2). Predominant land use in the vicinity of the proposed Project is undeveloped forested land.

The Project is located partially within the Blue Ridge Level III ecoregion and the Piedmont Level III ecoregion, and further refined within the Level IV Southern Crystalline Ridges and Mountains ecoregion and the Level IV Southern Inner Piedmont ecoregion (Griffith et al. 2002). The Blue Ridge ecoregion is considered a transitional area between the mountainous ecoregions of the Appalachians to the northwest and the rolling hills of the Piedmont to the southeast. The Piedmont ecoregion is a transitional area between the mostly mountainous ecoregions of the Appalachians/Blue Ridge and the relatively flat coastal plain to the southeast. The Southern Crystalline Ridges and Mountains ecoregion is characterized by crystalline rock types of gneiss and schist and soils tend to be well-drained, acidic, and loamy. This ecoregion is mostly forested with

chestnut oak dominating on most slopes and ridges (Griffith et al. 2002). The Southern Inner Piedmont ecoregion is characterized by rolling to hilly terrain with gneiss and schist bedrock covered with clayey and micaceous saprolite. This ecoregion is generally forested with oak-pine, oak-hickory, and loblolly-shortleaf pine forest throughout (Griffith et al. 2002).

The Southern Crystalline Ridges and Mountains region is a rough, dissected region with elevations generally between 1,200 – 4,500 feet (Griffith et al. 2002) (Appendix A, Figure 3).

4.0 Desktop Analysis

HDR conducted a desktop review of publicly available data from federal and state agencies prior to engaging in field reconnaissance surveys. The following sources were consulted as part of this analysis:

- Ecological Zones in the Southern Blue Ridge (https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/sbr/Pages/SBR_Restoration_items.aspx)
- Federal Emergency Management Agency (FEMA) Map Service Center (https://msc.fema.gov/portal)
- Natural Resources Conservation Service (NRCS) National Hydric Soils List (https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/)
- U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) (http://nhd.usgs.gov/)
- Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database 2016 (NLCD) (https://www.mrlc.gov/data/nlcd-2016-land-cover-conus)
- National Park Service (NPS) National Register of Historic Places (NRHP) GIS Public Dataset (https://www.nps.gov/subjects/nationalregister/data-downloads.htm)
- USFWS National Wetlands Inventory (NWI) (http://www.fws.gov/wetlands)
- South Carolina Institute of Archaeology and Anthropology (SCIAA) and South Carolina Department of Archives and History (SCDAH) online ArchSite database (http://archsite.cas.sc.edu/ArchSite)
- SCDNR Bald Eagles – Nest Locations (https://www.dnr.sc.gov/wildlife/baldeagle/locations.html)
- SCDNR Flood Mitigation Program

  (http://www.dnr.sc.gov/water/flood/floodmaps.html)
- SCDNR Managed Land Data Viewer GIS Dataset (http://www.dnr.sc.gov/land.html)
- SCDNR Natural Heritage Program (https://schtportal.dnr.sc.gov/portal/apps/sites/#/natural-heritage-program)
- South Carolina Department of Health and Environmental Control (SCDHEC) Watershed Atlas (https://gis.dhec.sc.gov/watersheds/)
- USFWS South Carolina List of at Risk, Candidate, Endangered, and Threatened Species for Oconee County (https://www.fws.gov/southeast/pdf/fact-sheet/south-carolina-species-list-by-county.pdf)

- NRCS Soil Survey for Oconee County, South Carolina (https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/south_carolina/oconeeSC1963/oconeeSC1963.pdf)
- USGS Gap Analysis Program (GAP), Protected Areas Database of the United States (PAD-US), version 1.4 Combined Feature Class (https://gapanalysis.usgs.gov/padus/viewer/)
- USGS Topographic Quadrangles Maps (1:24,000-scale); Cashiers, SC (1997), Reid, SC (1997), Tamassee, SC (1996), and Salem, SC (1996).

4.1 NRCS Soils

The NRCS Soil Survey for Oconee County, South Carolina, identified 10 different soil types within the Study Area (Appendix A, Figure 4) (NRCS 2019). The NRCS National Hydric Soils List did not classify any of the soils within the Study Area as hydric. A summary of the soil types within the Study Area is provided in Table 1.

Table 1. NRCS Soil Types Located within the Study Area

Mapping Unit Symbol	Mapping Unit Name	Drainage Class	Hydric Rating
AsF	Ashe sandy loam, 25 to 50 percent slopes	Somewhat excessively drained	Not Hydric
HaD	Halewood fine sandy loam, 10 to 15 percent slopes	Well drained	Not Hydric
HaE	Halewood fine sandy loam, 15 to 25 percent slopes	Well drained	Not Hydric
HaF	Halewood fine sandy loam, 25 to 45 percent slopes	Well drained	Not Hydric
HcC2	Hayesville and Cecil fine sandy loams, 6-10% slopes, eroded	Well drained	Not Hydric
HcD2	Hayesville and Cecil fine sandy loams, 10 to 15 percent slopes, eroded	Well drained	Not Hydric
HcE	Hayesville and Cecil fine sandy loams, 15 to 25 percent slopes	Well drained	Not Hydric
HcF	Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes	Well drained	Not Hydric
Mv	Riverview-Chewacla complex, 0-2% slopes, frequently flooded	Well drained	Hydric
St	Stony land	Well drained	Not Hydric

4.2 Land Cover

HDR reviewed the land cover layer of the MRLC NLCD (NLCD 2016) to identify existing land cover classifications within and immediately adjacent to the Study Area. Land use classifications in the area include barren land, developed, forest, grassland/herbaceous, open water, and planted/cultivated. Developed classifications include open space, as well as low, medium, and high intensity. Forested areas consist of deciduous, evergreen, and mixed forests. Herbaceous classifications include grassland/herbaceous areas. Planted/cultivated land cover includes pasture/hay. Shrub land included scrub/shrub cover.

Land cover classifications within the Study Area include open water, developed open space, developed low intensity, developed medium intensity, developed high intensity, deciduous forest, evergreen forest, mixed forest, scrub/shrub, herbaceous, hay/pasture, and cultivated crops (Appendix A, Figure 5).

4.3 Cultural Resources

HDR reviewed the National Register of Historic Places (NRHP) GIS Public Dataset, North Carolina Office of State Archaeology (NCOSA) data, and the South Carolina Institute of Archaeology and Anthropology (SCIAA) and South Carolina Department of Archives and History (SCDAH) online ArchSite subscriber database for known archaeological sites and architectural resources (cultural resources, historic structures, and historic sites) located within a 1.0-mile radius of the Project. The inquiry revealed a total of 20 previously identified cultural resources within a 1.0-mile buffer of the Project; 19 are archaeological sites and one is classified as an historic area (Table 2 and Figure 6). Four of the archaeological sites (38OC0249, 38OC0250, 38OC0251, and 38OC0691) need additional evaluation for listing in the NHRP; the remaining archaeological sites are either unassessed or not eligible.

Four of the previously recorded resources (Sites 38OC0248, 38OC0249, 38OC0250, and Resource 156) are located within the Study Area. Site 38OC0248, a Native American nondiagnostic lithic scatter, is not eligible for the NRHP and requires no additional management. Site 38OC249 consists of a series of Native American Late Archaic to Late Mississippian rock shelters and ceramic and lithic scatters. This site is potentially eligible for the NRHP and should be preserved in place. Site 38OC250 represents a well-preserved Native American Mississippian period occupation. This site is potentially eligible for the NRHP and should be preserved in place. If Sites 38OC249 and 38OC250 cannot be preserved in place, additional mitigative archaeological investigations should be undertaken at the sites, which will require coordination and consultation with the South Carolina State Historic Preservation Office (SCSHPO).

There is one historic area located partially within the Study Area. Resource 156- Keowee-Toxaway Hydroelectric Development, is currently not eligible for listing in the NRHP, but it will be re-evaluated when it reaches 50 years of age in 2023.

There have been several mapped previous cultural resources surveys within the 1.0-mile buffer of the Bad Creek II Power Complex. Surveys in South Carolina include the Cultural Resources Survey of the Oconee-Bad Creek and Jocassee-Bad Creek Transmission Lines (Brockington 1978), the Cultural Resources Survey of the Jocassee-Bad Creek-Coley Creek Transmission Lines (Gardner et al. 1988), the Cultural Resources Survey of the Bad Creek-Jocassee ReRoute Transmission Lines (Garnder and Espenshade 1989), the Cultural Resource Survey of the Proposed Conservation Fund Land Exchange (Bates and Morgan 1999), Cultural Resources Survey of the FY2018 Andrew Pickens District Southern Pine Beetle Timber Salvage Project (Benson 2018), and Cultural Resources Survey of the Lake Jocassee Shoreline (Grunden 2007). Surveys in North Carolina include Chattooga Watershed Storm Recovery 2004-2005 (ER05-2784) and the Southside Project Phase I Tract (CH 17-0372).

Table 2. Previously Identified Cultural Resources within 1.0-Mile Radius of Study Area

Resource Number	Name	NRHP Eligibility
Historic Areas		
0156*	**NRHP Evaluation of Keowee-Toxaway Hydroelectric Development**	**Needs Evaluation (will be re-evaluated when 50 years of age (in 2023)**
Archaeological Sites		
38OC0050	**Cherokee Mississippian/18th century occupation**	**Eligible (submerged under Lake Jocassee)**
38OC0052	Native American Woodland ceramic and lithic scatter	Not Eligible (submerged under Lake Jocassee)
38OC0053	Native American Woodland ceramic lithic scatter	Not Eligible (submerged under Lake Jocassee)
38OC0054	Native American Archaic ceramic and lithic scatter	Not Eligible (submerged under Lake Jocassee)
380C0101	Native American nondiagnostic lithic scatter	Not Eligible
38OC0248*	Native American nondiagnostic lithic scatter	Not Eligible
38OC0249*	**Native American Late Archaic to Late Mississippian rock shelters and ceramic and lithic scatters**	**Needs Evaluation**
38OC0250*	**Native American Mississippian occupation**	**Needs Evaluation**
38OC0251	**Native American Middle and Late Archaic occupation**	**Needs Evaluation**
38OC0690	Native American nondiagnostic lithic scatter	Not Eligible
38OC0691	**Native American nondiagnostic lithic scatter**	**Needs Evaluation**
38OC0692	Native American nondiagnostic lithic scatter	Not Eligible
38OC0693	Native American nondiagnostic lithic scatter	Not Eligible
38OC0694	Native American nondiagnostic lithic scatter	Not Eligible
38OC0695	Native American nondiagnostic lithic scatter	Not Eligible
31JK299	Native American nondiagnostic lithic scatter	Not Eligible
31JK300	Native American unknown scatter	Not Eligible
31TV766	Native American nondiagnostic lithic scatter	Not Assessed
31TV856	Twentieth century stone and cement building/bridge platforms and supports	Not Eligible

* Resource is located within the Study Area; **Bolded resources** are Eligible or need evaluation for the NRHP

4.4 Managed Lands Assessment

HDR reviewed online GIS datasets from the SCDNR Managed Land Data Viewer and the online USGS Gap Analysis Project (USGS 2016). The inquiry revealed five protected areas within a 1.0-mile radius of the Study Area Francis Marion and Sumter National Forest, SCDNR Wildlife Management Area [WMA] Easement, Jocassee Gorges WMA, and North Carolina National Forest. The SCDNR WMA Easement extends into the southern portion of Study Area (Appendix A, Figure 7).

4.5 Federally Protected Species

HDR utilized the USFWS IPaC database, USFWS South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species for Oconee County, and the SCDNR Natural Heritage Program Threatened and Endangered Species consultation report (SCNHP 2020) to evaluate the

potential occurrence of federally protected species within the Study Area. A summary of the desktop review is provided below, and results are summarized in Table 3.

More detailed descriptions and habitat requirements of federally protected species and results from the on-site field reconnaissance activities are provided in Section 5.5.

4.5.1 Endangered Species Act

The purpose of the Endangered Species Act is to "protect and recover imperiled species and the ecosystems upon which they depend" (USFWS 2013). HDR reviewed the list of federally protected species for Oconee County from the USFWS website, which was last updated on August 31, 2021 (USFWS 2021). In addition, HDR consulted the USFWS IPaC database and the SCDNR Natural Heritage Program database for records of threatened and endangered species documented in the vicinity of the Study Area. The IPaC Resources List summarizes the species and trust resources under the USFWS's jurisdiction that are known or expected to be at or near the Study Area. The query revealed that no proposed threatened or endangered species, critical habitat or proposed critical habitat have been identified within the Study Area. The SCDNR consultation database also summarizes the records of species of concern associated with or near the Study Area (see attached IPaC Resources List, SCDNR consultation report, and USFWS South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species for Oconee County [Appendix B], and Table 3 results).

Table 3. Federally Protected Species for Oconee County, South Carolina

Species	Federal Designation[1]	Preferred Habitat	Survey Window	Habitat Present in Study Area
Birds				
Bald Eagle (*Haliaeetus leucocephalus*)	BGEPA	Nests at tops of large, mature trees near large rivers, lakes, and marshes containing small animals, fish, and carrion.	Year round	No Potential habitat along the coasts of Bad Creek Reservoir and Lake Jocassee where large trees that provide nesting habitat are located.
Mammals				
Indiana bat (*Myotis sodalis*)	E	Indiana bats hibernate in tight clusters on the ceilings and sides of caves and mines. Summer habitat includes small to medium river and stream corridors with well-developed riparian buffers and forested areas within 1 to 3 miles of small to medium rivers and streams.	Year round	Potential Summer Habitat within forested areas adjacent to existing right-of-way and unmaintained low forested valleys. Indiana bat is not a South Carolina resident.
Northern long-eared bat (*Myotis septentrionalis*)	T	Hibernates in caves and mines during winter, roosts under bark, in cavities or crevices in trees and snags during summer.	Year round	Potential Summer Habitat within forested areas adjacent to existing right-of-way and unmaintained low forested valleys.
Plants				
Persistent trillium (*Trillium persistens*)	E	Deciduous or conifer-deciduous forests of ravines or gorges under canopies dominated by hemlock, white pine, beech, black oak, and chestnut oak.	Early March – Mid April	Forested areas adjacent to streams and low forested valleys with open understories.

Species	Federal Designation[1]	Preferred Habitat	Survey Window	Habitat Present in Study Area
Small whorled pogonia (*Isotria medeoloides*)	T	Older hardwood stands of beech, birch, maple, oak, and hickory, sometimes softwoods like hemlock, with an open understory; acidic soils with a thick layer of dead leaves, often on slopes or near small streams.	Mid May – Early July	Forested areas adjacent to streams low forested valleys with open understories.
Smooth coneflower (*Echinacea laevigata*)	E	This species is typically found in meadows, open woodlands, the ecotonal regions between meadows and woodlands, cedar barrens, dry limestone bluffs, clear cuts, and roadside and utility ROWs.	Late May-October	Existing maintained areas such as ROWs and meadows.

[1] BGEPA = Federally protected under the Bald and Golden Eagle Protection Act.
E = Federally Endangered.
T = Federally Threatened.

4.5.2 At-Risk Species

The Southeast Region of the USFWS in conjunction with states, federal agencies and other partners has begun evaluating over 400 animal and plant species for potential listing under the Endangered Species Act (ESA). These species are commonly known as “At-Risk species” and are defined as those that are: (1) Proposed for listing under the ESA by the Service; (2) Candidates for listing under the ESA; or (3) Petitioned by a third part for listing under the ESA. The USFWS’s South Carolina identifies 10 At-Risk species for Oconee County and/or in the vicinity of the Study Area. A list of these species is provided in Table 4.

Table 4. South Carolina List of At-Risk Species – Oconee County

Species	Preferred Habitat	Survey Window	Habitat Present in Study Area
Amphibian			
Chamberlain’s dwarf salamander (*Eurycea chamberlain*)	Under leaf litter and small debris in wet areas, particularly seepages near small streams, and other wetland types.	Spring and Fall	Seepages near small streams and wetlands
Birds			
Golden-winged warbler (*Vermivora chrysoptera*)	Shrubby, tangled thickets and other early successional habitats during breeding. Mature forest habitats after breeding.	April-July (nesting surveys)	Breeding habitat within wetlands with scrub-shrub vegetation and wet disturbed areas. Post-breeding habitat in mature forested habitats.
Insects			
Edmund’s snaketail (*Ophiogomphus Edmundo*)	Larvae are found in medium- to large-sized, clear streams and rivers with moderately fast currents. Adult males are found mostly on rocks in riffles or rapids. while territorial, but appear to spend much of their lives in the treetops	Year round	Habitat for larvae in medium and large streams with substrate that supports riffles or rapids with steep grades. Treetops adjacent to streams are suitable habitat for adults.
Monarch butterfly (*Danaus plexippus*)[+]	Monarchs are typically found in open grass areas during the breeding season. Adults use a wide variety of flowering plants throughout migration and breeding	August-December	Fields, disturbed open areas, and emergent wetlands with a variety of flowering vegetation.
Smokies needlefly	Restricted to high elevation springs and	April-June	High elevation streams

Species	Preferred Habitat	Survey Window	Habitat Present in Study Area
(*Megaleuctra williamsae*)	seeps in relatively undisturbed forested areas. Nymphs sprawl in accumulations of decaying leaves and other debris that is covered with a thin film of flowing water.		with rocky substrate located in relatively undisturbed areas that support high oxygen content.
Mammal			
Little brown bat (*Myotis lucifugus*)	The little brown bat lives along streams and lakes. It forms nursery colonies in buildings. In the winter it hibernates in caves and mines.	Year round	Potential foraging habitat long streams and lakes. One small cave identified provides potential roosting habitat.
Tri-colored bat (*Perimyotis subflavus*)	Forested landscapes, often in open woods. They can also be found over water and adjacent to water edges.	Year round	Potential summer habitat within forested areas adjacent to existing right-of-way and unmaintained low forested valleys.
Plants			
Carolina hemlock (*Tsuga caroliniana*)	Rocky slopes, ridgelines and gorges in the Southern Blue Ridge mountains.	Year round	High elevation rocky slopes and gorges in Short Leaf Pine Oak Forest and Rich Cove Forest community types.
Georgia aster* (*Symphyotrichum georgianum*)	Woodlands or piedmont prairies dominated by native plants, with acidic soils that vary from sand to heavy clay	Early October-mid November	Existing maintained areas such as ROWs and meadows.
Sun-facing coneflower (*Rudbeckia heliopsidis*)	Moist to wet sites and acidic soils such as those found in pine-oak woodlands, peaty seeps in meadows, and sandy alluvium along streams. Occurs in full sun to partial shade.	July - October	Along streams with pine and oak species and wet meadows.

ARS* - Species that are either former Candidate Species or are emergent conservation priority species.
+ Candidate Species

More detailed descriptions and habitat requirements of these At-Risk species and results from the on-site field reconnaissance activities are provided in Section 5.6.

4.5.3 Bald and Golden Eagle Protection Act (BGEPA)

As part of the desktop analysis, species protected under the Bald and Golden Eagle Protection Act (BGEPA) were reviewed for potential presence within the Study Area (USFWS 1978). The BGEPA prohibits the “taking” of bald eagles, parts, nests, or eggs without a permit from the U.S. Department of the Interior.

The bald eagle (*Haliaeetus leucocephalus*) prefers habitat near large rivers, lakes, and marshes containing fish, waterfowl, turtles, rabbits, snakes and other small animals and carrion as food resources. They nest at the top of large, mature trees to which they return every year.

More detailed descriptions and habitat requirements for the bald eagle including results from the on-site field reconnaissance activities are provided in Section 5.5.

4.5.4 Migratory Bird Treaty Act of 1918 (MBTA)

The Migratory Bird Treaty Act of 1918 (MBTA) prohibits the take of migratory birds unless authorized under the terms of a valid federal permit issued by the USFWS (USFWS 2020). As part of the analysis conducted, species protected under the MBTA were reviewed for potential presence within the proposed Project vicinity using the USFWS IPaC database. Based on the IPaC review eleven

species of migratory birds have the probability of presence within the Study Area; (1) bald eagle (*Haliaeetus leucocephalus*), (2) bobolink (*Dolichonyx oryzivorus*), (3) Canada warbler (*Cardellina canadensis*), (4) cerulean warbler (*Dendroica cerulea*), (5) eastern Whip-poor-will (*Antrostomus* vociferus), (6) golden-winged warbler (*Vermivora chrysoptera*), (7) Kentucky warbler (*Oporornis formosus*), (8) prairie warbler (*Dendroica discolor*), and (9) wood thrush (*Hylocichla mustelina*).

4.6 FEMA Floodplains and Regulated Riparian Buffers

The Special Flood Hazard Areas (SFHA) are classified by FEMA as high flood risk (AE) zones and are subject to inundation by the 1-percent-annual-chance flood event being equaled or exceeded in any given year (i.e., 100-year flood).

HDR reviewed the FEMA Map Service Center National Flood Hazard Layer (NFHL) and found that SFHA, Zones AE extends into the Study Area along Whitewater River); however, no Regulatory Floodway areas occur within the Study Area (FEMA Map Numbers 45073C0020C, 45073C0040D, 45073C0100D, and 4507C0105D (Appendix A, Figure 8). Impacts to jurisdictional features, development, or improvements to existing uses within the SFHA may require FEMA compliance.

The SFHA are classified by FEMA as high flood risk zones, that are subject to inundation by the 1-percent-annual-chance flood event (i.e.100-year flood) being determined using approximate methodologies (No Base Flood Elevations) (FEMA 2020).

4.6.1 SCDHEC Water Classifications and Standards

Under the authority of the South Carolina Pollution Control Act, the SCDHEC Water Classification & Standards is responsible for establishing appropriate water uses and protection classifications, as well as general rules and specific water quality criteria in order to protect existing water uses, establish anti-degradation rules, protect public welfare, and maintain and enhance water quality.

State and federal water quality standards are not applicable to waters of the Bad Creek Upper Reservoir. However, under SCDHEC's R. 61-68 Water Classification and Standards, the following water classification apply to other waters and their associated tributaries within the Study Area: Lake Jocassee and Devil's Fork are classified as Trout; Put, Grow and Take (TPGT) while Whitewater River is classified as Outstanding Resource Water (ORW) (Appendix A, Figure 8). According to R. 61-68, Classified Waters. Applicability of Standards 8., where surface waters are not classified by named (unlisted) in R.61-69, Classified Waters, the water quality standard of the stream to which they are a tributary shall apply, therefore tributaries would receive the water classification and standards to which they flow.

- ORW are freshwaters that are of exceptional ecological/recreational importance or are considered unusual waters. These resources may be associated with parks or wildlife refuges, support federally protected species, protected under the National (or South Carolina) Wild and Scenic Rivers Act, are significant nursey areas for commercial species, or are used for scientific research and study.

- TPGT are freshwaters suitable for supporting growth of stocked trout populations and a balanced indigenous aquatic community of fauna and flora. Also suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the SCDNR. Suitable for fishing and the

survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses.

These surface waters are subject to SCDHEC's anti-degradation rules and activities such as discharges to these waters may be prohibited in order to maintain their classification with the exception of water flowing directly from the Bad Creek Upper Reservoir. Discharges from the reservoir to downstream tributaries need to be considered under anti-degradataion rules. New construction activities will be regulated and evaluated by the SCDHEC (SCHDEC 2014).

Surface waters within the Study Area are part of the Savannah River Basin (Hydrologic Unit Code [HUC] 030601), which drains portions of the Blue Ridge, Piedmont, and Coastal Plain. According to the SCDHEC's Buffer Zone Guidance (SCDHEC 2012a), a minimum 30-foot undisturbed natural buffer must be provided and maintained between the surface water and the outermost sediment and erosion controls at the construction site for streams, drainageways, and waterbodies with a drainage area greater than or equal to 100 acres (SCDHEC 2012b, Section 3.2.4.C.I (a)) for constructions adjacent to surface water that are not classified as either Sensitive or Impaired Waters (Sensitive or Impaired Waters require a minimum 45-foot natural buffer) (SCDHEC 2012a). However, it is important to note that with the appropriate Clean Water Act (CWA) Section 404/401 permits, land-disturbing activities are exempt for linear projects, such as the utility constructions that overlap with the Study Area.

4.6.2 Oconee County Regulations

The above-referenced SFHAs are located within unincorporated Oconee County. These flood-prone areas are regulated under the counties' Flood Damage Prevention Ordinance, which seeks to promote public health and safety by minimizing the losses to public and private land within flood-prone areas. Under this ordinance, a Floodplain Development Application Permit is required prior to commencement of any development activities located within the SFHA (Oconee County 2021).

Oconee County Municipal Code 38-11.1 adopted vegetative protection buffer requirements as part of the regulations for the Keowee-Jocassee Overlay (Lakes Keowee and Jocassee) Subdistrict of the Lake Overlay District. Under the Oconee Vegetative Buffer rules a "natural vegetative buffer shall be established on all waterfront parcels of Lakes Jocassee within 25 feet from the full pond level. Full pond level is 1,110 feet above mean sea level on Lake Jocassee. Those parcels not meeting these criteria shall be exempt from this standard. The buffer shall extend to a depth of 25 feet measured along a perpendicular line from the full-pond contour".

Clearing within the vegetative buffer at Lake Jocassee for the proposed Project may be exempt or allowable as an existing use that was permitted or authorized at the time of the adoption of this chapter.

4.7 Other Federal and State Regulations Applicable to the Region

4.7.1 Navigable Waters

According to the U.S. Army Corps of Engineers (USACE) Charleston District's Navigation Study Reports, no federal navigable waters located within the Study Area (USACE 1977).

Lake Jocassee is depicted on the SCDHEC's current map of State Navigable Waters for South Carolina and is classified as a state navigable water (SCDHEC 2019a; 2019b). Activities occurring below or above the Ordinary High Water elevation are regulated by the SCDHEC.

4.7.2 CWA Section 303(d) Impaired Waters

HDR reviewed the SCDHEC Watershed Atlas for Water Quality, Impaired Waters §303(d) records available online. This query revealed one record of §303(d) impaired waters in Lake Jocassee (station SV-313) for exceeding levels of mercury for fish consumption. This station is located approximately 1.2 miles east of the Study Area (SCDHEC 2019b).

4.7.3 Shoreline Management Plan

Duke Energy implements a Shoreline Management Plan (SMP) for both Lake Keowee and Lake Jocassee as part of the FERC Keowee-Toxaway Hydroelectric Project to protect and enhance the scenic, recreational, cultural and environmental resources surrounding the reservoirs while protecting the Project's primary function – electricity production. The SMP is a comprehensive management tool for managing requests for shoreline development activities with the existing FERC Project Boundary in a manner consistent with the Project purposes (Duke Energy 2014). Duke Energy uses a shoreline classification system to categorize the shoreline based on the characteristics of the shoreline. The Lake Jocassee shoreline adjacent to the Study Area is classified Public Infrastructure, Project Operations, and Environmental (Duke Energy Keowee-Toxaway FERC SMP 2021.

The Environmental shoreline classification area is located at the confluence with Whitewater River (within the Study Area) and is protected to provide spawning, rearing, and nursery habitat for fish and habitat for amphibians, reptiles, and birds. No vegetation removal, construction, excavation, or shoreline stabilization is permitted within the Environmental shoreline classification area.

Development within the Project Boundary including lake use activities (e.g., private residential piers/docks, shoreline stabilization and excavation, commercial or residential marina facilities, easements for water discharges and intakes, bridges, and other conveyances) require submittal of a Lake Use Permit and must be authorized in writing by Duke Energy prior to construction. The facilities associated with the proposed Project would typically require the submittal of the Lake Use Permit to Duke Energy's Conveyance Permit Program.

5.0 Field Reconnaissance

5.1 Estimated Wetlands and Surface Waters

On September 1st-3rd, 2021, HDR biologists conducted a precursory survey of the Study Area to identify surface waters including wetlands that may have the potential to be waters of the U.S. regulated under Section 404 of the CWA. The assessment of the Study Area was conducted using a combination of desktop assessments and field assessments while applying methodologies and guidance described in the USACE (1987) Wetland Delineation Manual (USACE 1987), the 2012 USACE Eastern Mountains and Piedmont Regional Supplement (Version 2.0) (USACE 2012), USACE Regulatory Guidance Letter 05-05 Ordinary High Water Mark Identification,, and the North Carolina Division of Water Quality (NCDWQ) Methodology for Identification of Intermittent and Perennial Streams and Their Origins (Version 4.11) (NCDWQ 2010).

Accessible waterbodies were identified and mapped using the ArcCollector application and via desktop analyses. Due to the scope of the project and the extremely challenging conditions within the Study Area (i.e., rugged terrain with precipitous drops in elevation), potentially jurisdictional features were not field delineated; instead, these features were field documented (i.e., photographs, ArcCollector points, and field notes) and potential boundaries were identified via desktop methods. A full water features delineation with a will be executed when advanced construction plans are available.

An additional survey is recommended to survey and accurately delineate and flag surface water boundaries field verification with the use of sub-meter accuracy GPS closer to permitting and construction. A Jurisdictional Determination will be submitted to USACE to verify jurisdictional features.

The on-site reconnaissance activities estimated 23 potentially jurisdictional streams, 7 potentially jurisdictional wetlands, and 7 potentially non-jurisdictional isolated wetlands, and one potentially jurisdictional open water within the Study Area (Appendix A, Figure 9). A summary of estimated surface waterbodies is provided in Tables 5, 6, and 7.

Table 5. Estimated Streams within the Study Area

Feature Name	Latitude/ Longitude	Cowardin Class[1]	§303 (d) (Y/N)	Type of Jurisdiction	Stream Width (ft)	Estimated Amount of Aquatic Resource in Review Area (ft)	Field/ Desktop Identification	SCDHEC Water Classification
Stream 1 Tributary of Whitewater River	35.017309/ -82.996716	R6	No	Non section-10, non-wetland	3	107	Field	ORW
Stream 1a Tributary of Whitewater River	35.017154/ -82.996251	R5UB1	No	Non section-10, non-wetland	3	204	Field	ORW
Stream 2 Tributary of Whitewater River	35.016612/ -83.002729	R5UB1	No	Non section-10, non-wetland	8	314	Field	ORW
Stream 3 Tributary of Whitewater River	35.015567/ -83.003704	R5UB1	No	Non section-10, non-wetland	6	134	Field	ORW
Stream 4 Tributary of Whitewater River	35.010507/ -83.006335	R4SB3	No	Non section-10, non-wetland	3	1705	Field	ORW
Stream 4a Tributary of Whitewater River	35.014573/ -83.007978	R5UB1	No	Non section-10, non-wetland	3	542	Field	ORW
Stream 5 Tributary of Whitewater River	35.014023/ -83.003695	R4SB3	No	Non section-10, non-wetland	4	115	Field	ORW
Stream 6 Tributary of Whitewater River	35.013187/ -83.004582	R5UB1	No	Non section-10, non-wetland	3	1031	Field	ORW
Stream 7 Tributary of Whitewater River	35.012733/ -83.005029	R5UB1	No	Non section-10, non-wetland	4	1556	Field	ORW

Feature Name	Latitude/ Longitude	Cowardin Class[1]	§303 (d) (Y/N)	Type of Jurisdiction	Stream Width (ft)	Estimated Amount of Aquatic Resource in Review Area (ft)	Field/ Desktop Identification	SCDHEC Water Classification
Stream 8 Tributary of Whitewater River	35.010744/ -82.996315	R5UB1	No	Non section-10, non-wetland	4	2065	Field	ORW
Stream 9 Tributary of Whitewater River	35.008408/ -83.004716	R5UB	No	Non section-10, non-wetland	4	217	Field	ORW
Stream 10 Tributary of Whitewater River	35.005939/ -82.007026	R4SB3	No	Non section-10, non-wetland	2	1144	Field	ORW
Stream 11 Tributary of Lake Jocassee	35.006202/ -82.999718	N/A	No	Non section-10, non-wetland	N/A	1250	Field	TPGT
Stream 12 Tributary of Lake Jocassee	35.007454/ -82.999402	N/A	No	Non section-10, non-wetland	N/A	833	Field	TPGT
Stream 13 Tributary of Lake Jocassee	35.004870/ -83.003711	R4SB3	No	Non section-10, non-wetland	2	621	Field	TPGT
Stream 14 Tributary of Lake Jocassee	35.005732/ -82.998758	R3RB1	No	Non section-10, non-wetland	4	3277	Desktop	TPGT
Stream 15 Tributary of Lake Jocassee	35.004001/ -82.997931	R5UB1	No	Non section-10, non-wetland	2	2196	Desktop	TPGT
Stream 16 Tributary of Lake Jocassee	35.002184/ -82.999679	R5UB	No	Non section-10, non-wetland	3	621	Desktop/ Field	TPGT
Stream 17 Tributary of Lake Jocassee	34.999955/ -82.996057	R5UB1	No	Non section-10, non-wetland	2	1151	Field	TPGT
Stream 18 Tributary of Lake Jocassee	34.954374/ -82.98097	N/A	No	Non section-10, non-wetland	N/A	747	Desktop	TPGT
Stream 19 Devil's Fork	34.994273/ -82.993806	R5UB1	No	Non section-10, non-wetland	2	1891	Field	TPGT
Stream 20 Tributary of Devil's Fork Creek	34.995032/ -82.993812	R5UB1	No	Non section-10, non-wetland	2	577	Desktop/ Field	TPGT
Stream 21 Tributary of Devil's Fork Creek	34.994306/ -82.993386	N/A	No	Non section-10, non-wetland	N/A	362	Desktop	TPGT
Total:						**22,660 feet**		

[1] R3RB1 = Riverine, upper perennial, rocky shore, bedrock
R4SB3 = Riverine, intermittent, streambed, cobble-gravel
R5UB = Riverine, unknown perennial, unconsolidated bottom
R5UB1 = Riverine, unknown perennial, unconsolidated bottom, cobble-gravel

R6 = Ephemeral
*N/A = Information Not Available due delineation conducted via desktop.

Table 6. Estimated Wetlands within the Study Area

Feature Name	Latitude/ Longitude	Cowardin Class[1]	Type of Jurisdiction	Estimated Amount of Aquatic Resource in Review Area (acres)	Delineation Field/Desktop
Wetland 1	35.017444/ -82.997152	PFO1A	Non section 10, wetland	0.19	Field/ Desktop
Wetland 2	35.016034/ -83.002669	PFO1A	Non section 10, wetland	0.16	Field/ Desktop
Wetland 3	35.015447/ -83.003539	PFO1B	Non section 10, wetland	0.14	Field/ Desktop
Wetland 4*	35.014031/ -82.998895	PEM1A	Non section 10, wetland	0.37	Field/ Desktop
Wetland 5*	35.013029/ -82.999567	PSS1B	Non section 10, wetland	0.40	Field/ Desktop
Wetland 6	35.012820/ -83.002279	N/A	Non section 10, wetland	0.59	Desktop
Wetland 7*	35.013291/ --82.998458	PFO1A	Non section 10, wetland	1.17	Field/ Desktop
Wetland 8*	35.011612/ -83.000774	PEM1B	Non section 10, wetland	2.08	Field/ Desktop
Wetland 9	35.01188/ -82.997959	PFO1B	Non section 10, wetland	0.11	Field/ Desktop
Wetland 10*	35.009826/ -83.007907	PEM1B	Non section 10, wetland	3.00	Field/ Desktop
Wetland 11*	35.009272/ -83.005815	PEM1B	Non section 10, wetland	1.22	Field/ Desktop
Wetland 12*	35.008874/ -83.005572	PEM1B	Non section 10, wetland	1.04	Field/ Desktop
Wetland 13	35.00748/ -83.00088	N/A	Non section 10, wetland	0.10	Desktop
Wetland 14	35.002013/ .83.000405	N/A	Non section 10, wetland	0.22	Desktop
			Total:	**10.79 acres**	

[1] PEM1A = Palustrine, emergent, persistent, temporarily flooded.
PEM1B = Palustrine, emergent, persistent, saturated.
PFO1A = Palustrine, forested, broad-leaved deciduous, temporarily flooded.
PFO1B = Palustrine, forested, broad-leaved deciduous, saturated.
PSS1B = Palustrine, scrub-shrub, broad-leaved deciduous, saturated.
*Potentially non-jurisdictional isolated wetland

Table 7. Estimated Open Waters within the Study Area

Feature Name	Latitude/ Longitude	Cowardin Class[1]	Type of Jurisdiction	Estimated Amount of Aquatic Resource in Review Area (acres)
Open Water 1 Fire Protection Pond	35.012387 -83.01685	PUBHh	Non section-10, non-wetland	1.70
				1.70 acres

[1] PUBHh = Palustrine, unconsolidated bottom, permanently flooded, diked/impounded
Open waters were delineated from desktop and are approximate acreages.

5.2 Description of Estimated Waterbodies in the Study Area

5.2.1 Relatively Permanent Waters with Perennial Flow

Twelve streams exhibit perennial surface water flow to Traditional Navigable Waters (TNWs). According to the Cowardin Classification hierarchical structure (Cowardin et al. 1979). Stream 14 was identified as a riverine upper perennial feature with rock bottom, and a bedrock bottom (R3RB1). Streams 9 and 16 were identified as unknown perennial features with unconsolidated bottoms (R5UB). Streams 1a, 2, 3, 4a, 6, 7, 8, 15, 17, 19 (Devil's Fork), and 20 were identified as unknown perennial features with unconsolidated bottoms, and a cobble-gravel bottom (R5UB1). Ordinary High Water Mark (OHWM) indicators observed during the assessment included a well-defined natural line impressed on the bank, shelving, absence of vegetation, disturbed and/or washed away leaf litter, sediment deposition, the presence of wrack lines, sediment sorting, and scour.

5.2.2 Relatively Permanent Waters with Seasonal Flow

Streams 4, 5, 10, and 13 were identified as RPWs that exhibit continuous seasonal surface flow to TNWs. According to the Cowardin Classification hierarchical structure (Cowardin et al. 1979), Streams 4, 5, 10, and 13 were identified as having intermittent features with cobble-gravel streambeds (R4SB3). Stream 1 was identified as having ephemeral features (R6). OHWM indicators observed during the assessment include a well-defined natural line impressed on the bank, disturbed or washed away leaf litter, absence of vegetation, sediment deposition, and scour.

5.2.3 Isolated Wetlands

Wetlands 4, 5, 7, 8, 10, 11, and 12 were identified as isolated wetlands that do not appear to have a significant nexus to a TNW or are abutting a RPW. These wetlands were likely formed by impervious spoil. Wetlands 4, 8, and 10-12 were identified as palustrine, emergent, persistent wetlands (PEM1) (Cowardin et al. 1979). Herbaceous species are dominant and consist of arrow-leaved tearthumb (*Polygonum sagittata*), (soft rush (*Juncus effusus*), shallow sedge (*Carex lurida*), cattail (*Typha angustifolia*), Japanese stiltgrass (*Microstegium vimineum*), and woolgrass (*Scirpus cyperinus*). Primary and secondary wetland hydrology indicators observed during the assessment included high water table, saturation, oxidized rhizospheres on living roots, water-stained leaves, and drainage patterns typical of this wetland.

Wetland 5 was identified as palustrine, scrub-shrub, deciduous, saturated wetlands (PSS1B) (Cowardin et al. 1979). Tree species (primarily saplings) consist of black willows, black locust, sawtooth oak, while the herbaceous layer is dominated by Japanese stilt grass, wool grass, and beggar's tick (*Bidens* spp.).

Primary and secondary wetland hydrology indicators observed during the assessment include high water tables, saturation, stunted vegetation, drainage patterns, water-stained leaves, and geomorphic position typical of this wetland. Scrub-shrub vegetation was dominant and consisted of blackberry (*Rubus* spp.), woolgrass (*Scirpus cyperinus*), blueberry (Vaccinium spp.), boneset (*Eupatorium perfoliatum*), soft rush (*Juncus effusus*), and lizard's tail (*Saururus cernuus*).

5.2.4 Forested Wetland

Wetlands 1-3, and 9 were identified as palustrine, forested, broad-leaved deciduous (PFO1) wetlands according to the Cowardin (et al. 1979) hierarchical structure. Wetland 1 was identified as

a temporarily flooded wetland (PFO1A) and 2-3 and 7 are considered saturated. These wetlands exhibit concave surfaces. Tree species are dominant and consist of sawtooth oak *(Quercus acutissima),* basswood *(Tilia americana*), black willow, (*Salix nigra*), green ash (*Fraxinus pennsylvanica*), honey locust (*Gleditsia tricanthos*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), black tupelo (*Nyssa sylvatica*), and green ash (*Fraxinus pennsylvanica*). The herbaceous and shrub layer is dominated by wood fern (*Thelypteris kunthii*), deer-tongue (*Dicanthelium clandestinum*), and witch-hazel (*Hamamelis* spp.). Primary and secondary wetland hydrology indicators include surface water, high water table, saturation, water-stained leaves, aquatic vegetation, and geomorphic position typical of this of wetland.

5.2.5 Open Waters

The fire protection pond located at the junction of Stream 2 and Stream 3 was identified as an open water and was classified as palustrine, unconsolidated bottom, permanently flooded, diked/impounded (PUBHh) features according to the Cowardin hierarchical structure (Cowardin et al. 1979).

5.3 Ecological Groups and Community Types

The onsite terrestrial surveys were conducted concurrently with the streams and wetlands surveys. Applicable reference materials were using during the field assessments including regional field guides and plant identification mobile apps to identify plants to genus and species level. Terrestrial community types varied throughout the Study Area. The Ecological Zones in the Southern Blue Ridge Escarpment: 4th Approximation GIS Dataset (Simon 2015) depicting vegetation cover types, the Natural Communities of South Carolina Initial Classification and Description (Nelson 1986), and NatureServe community classification system (NatureServe 2013) was used to identify and categorize vegetative community types. Terminology in the Ecological Zones in the Southern Blue Ridge Escarpment was used to describe the terrestrial habitats within the Study Area. Five ecological groups and community types were identified within the Study Area: 1) Shortleaf Pine-Oak Forest and Woodland, 2) Rhododendron Forest, 3) Montane Oak- Hickory Forest 4) Cove Forests, and 5) Floodplain Forest (Appendix A, Figure 10).

Open maintained areas and existing ROW areas were also documented. Photographs of terrestrial habitats are located in Appendix C Detailed descriptions of ecological groups and community types and observed vegetation are described below.

Shortleaf Pine-Oak Forest and Woodland

This habitat type is characterized by shortleaf pine (*Pinus echinate)* and oak dominated forested areas on exposed ridges and sideslopes (Simon 2015). Dominant tree canopy cover observed included white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), northern red oak (*Quercus rubra*), chestnut oak (*Quercus montana*), mockernut hickory (*Carya tomentosa*), tulip poplar (*Liriodendron tulipifera*), white pine (*Pinus strobus*), sugar maple (*Acer saccharum*), eastern hemlock (*Tsuga canadensis*), Virginia pine (*Pinus virginiana*), and sourwood (*Oxydendrum arboreum*). Sapling and shrubs consist of similar canopy species as well as American holly (*Ilex opac*a), highbush blueberry (*Vaccinium corymbosum*), lowbush blueberry (*Vaccinium angustifolium*), mountain laurel (*Kalmia latifolia)*, rhododendron (*Rhododendron maximum*), cucumber magnolia (*Magnolia acuminata*), witch-hazel (*Hamamelis* spp.), bear oak (*Quercus ilicifolia*), and sassafras (*Sassafras albium*). Herbaceous and vine species consisted of rattlesnake weed (*Hieracium*

venosum), spotted wintergreen (*Chimaphila maculate*), Christmas fern (*Polystichum acrostichoides* and muscadine grape (*Vitis rotundifolia*).

Mixed Oak/Rhododendron Forest

This habitat type is characterized by rhododendron-dominated thickets found on mountains and upper piedmont with sparse herbaceous cover. Dominant species observed for this habitat type included northern red oak, shortleaf pine, mountain laurel, rhododendron, deerberry (*Vaccinium stamineum*), white pine, sourwood, red maple (*Acer rubrum*), and black gum (*Nyssa sylvatica*).

Montane Oak-Hickory Forest (Cove and Slope)

This habitat type is characterized by a mix of hardwood tree species on lower elevations within mountains and upland slopes between rivers and headwater tributaries. Dominant tree species observed for this habitat type included northern red oak, chestnut oak (pignut hickory (*Carya glabra*), white pine, red maple tulip poplar, mountain laurel, sourwood, black gum, magnolia, and high bush blueberry.

Acidic Cove Forest

This habitat type is characterized by hemlock and mixed hardwood-conifer forests, typically dominated by an evergreen understory occurring in narrow coves (ravines) and extending to adjacent protected, north-facing slopes (Simon 2015). Dominant tree species observed for this habitat type consisted of red maple, sweetgum (*Liquidambar styraciflua*), black gum, eastern hemlock, rhododendron, tulip poplar, sourwood, chestnut oak, sweet birch (*Betula lenta*), and white ash (*Fraxinus americana*). Shrubs consist of mountain doghobble (*Leucothoe fontanesiana*), deerberry, witch hazel, elderberry (*Sambucus nigra*), magnolia, spicebush (*Lindera benzoin*), and pawpaw (*Asimina triloba*). The herbaceous and vine layer is dominated by Galax (*Galax urceolata*), black cohosh (*Actaea racemosa*), black cohosh (*Actaea racemosa*), jewelweed (*Impatiens capensis*), Indian cucumber (*Medeola virginiana*), violets (*Viola* spp.), Christmas fern, wood ferns (*Dryopteris* spp.), and Virginia creeper (*Parthenocissus quinquefolia*).

Floodplain Forest

This habitat type is found in regularly or seasonally flooded areas adjacent to river systems with a diverse herbaceous cover. Dominant trees consisted of white oak, sweetgum, red maple, eastern hemlock, sourwood, red oak, and yellow birch (*Betula alleghaniensis*). The shrub and vine layer consists of pawpaw, alders (*Alnus* spp.), and muscadine. The herbaceous layer consists of black cohosh, Indian cucumber, wild ginger (*Asarum* spp.), running cedar (*Diphasiastrum digitatum)*, partridge berry (*Mitchella repens*), wood fern, Christmas fern, jewelweed (*Impatiens capensis*), and nettled chain fern (*Woodwardia areolata*).

Maintained Right-of-Way and Fields

Maintained ROW areas and fields are comprised of early successional woody, herbaceous, and vine species including red maple, hickories, black cherry, black locust (*Robinia pseudoacacia*), mutilfora rose (*Rosa multiflora*), sawtooth blackberry (*Rubus argutus*), goldenrods (*Solidago* spp.), curly dock (*Rumex crispus*), dogfennel (*Eupatorium capillifolium*), pokeberry (*Phytolacca* spp.), rabbit tobacco (*Pseudognaphalium obtusifolium*), asters (*Aster* spp.), beggars tick (*Bidens* spp.), bushy bluestem (*Andropogon glomeratus*), broomsedge (*Andropogon virginicus*), foxtails (*Seteria* spp.) boneset,

fescue (*Fescue* spp.), crabgrass (*Digitaria* spp.), Johnson grass (*Sorghum halepense*), Japanese stiltgrass, deer-tongue grass, white clover (*Trifolium repens*), morning glory (*Ipomoea* spp.) greenbrier (*Smilax rotundifolia*), ragweeds (*Ambrosia* spp.), Japanese honeysuckle (*Lonicera japonica*), and muscadine grape.

Invasive Species

Disturbed areas within the project site, especially adjacent to existing structures, have been encroached on by invasive species including princess tree (*Catalpa bignonioides*), Japanese stiltgrass, mimosa tree (*Albizia julibrissin*), Japanese honeysuckle, and sawtooth oak. In addition, sounds and visual signs of invasive feral hogs (*Sus scrofa*) such as unrooted plants and hoof prints were identified.

5.4 Terrestrial Wildlife

Terrestrial communities in the Study Area are comprised of mature forested habitats with areas of early successional habitats that may also support a diverse number of wildlife species. Representative mammal, bird, reptile, and amphibian species commonly occurring in these habitats are listed below. Note that individual species and/or evidence of species observed during HDR's field survey are indicated with an asterisk (*). Information on species that typically use these habitats in the Blue Ridge Mountain ecoregion was obtained from relevant literature, mainly the Biodiversity of the Southeastern United States, Upland Terrestrial Communities (Martin et al. 1993). Mammal species that commonly occur in the Appalachian Oak Forest Region include eastern cottontail (*Sylvilagus floridanus*), North American beaver *(Castor canadensis),* black bear (*Ursus americanus*)*, coyote (*Canis latrans*), gray squirrel (*Sciurus carolinensis*)*, white-tailed deer (*Odocoileus virginianus*)*, raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), least weasel (Mustela nivalis). and various vole, rat, and mice species. Bird species that commonly use these habitats include yellow-billed cuckoo (*Coccyzus americanus*), black-billed cuckoo (*Coccyzus erythropthalmus*) wild turkey (*Meleagris gallapava*), American crow (*Corvus brachyrhynchos*), northern cardinal (*Cardinalis cardinalis*), field sparrow (*Spizella pusilla*), prairie warbler, eastern towhee (*Pipilo erythrophthalmus*), wood thrush, ovenbird (*Seiurus aurocapillus*), red-eyed vireo (*Vireo olivaceous*), chickadees (*Parus spp.*), and woodpeckers (Family Picadae). Predatory birds may include American kestrel (*Falco sparverius*), barred owl (*Strix varia*), peregrine falcon (*Falco peregrinus*), red-shouldered hawk (*Buteo lineatus),* red-tailed hawk (*Buteo jamaicensis*), sharp-shinned hawk (*Accipiter striatus*), owl species, and turkey vulture (*Cathartes aura*).

Reptile species that may use these terrestrial communities include the northern scarlet snake (*Cemophoroa coccinea copei*), timber rattlesnake (*Crotalus horridus*), copperhead (*Agkistrodon conttortrix*), eastern ratsnake (*Pantherophis obsoletus*), common five-line skink (*Plestiodon fasciatus*), amphibians include tree toads (*Bufo* spp.), spadefoot (*Scaphiopus holbrooki*), and frog species (*Hyla* spp., *Rana* spp., and *Pseudacris* spp.). The dominant salamander community are the dusky salamanders (*Desmognathus* spp.).

5.5 Federally Protected Species

HDR's on-site survey also served to identify potential habitat and possible individuals of federally protected species listed for Oconee County, as previously described in Section 4.5 and Table 3. The USFWS IPaC database report and the SCDNR Natural Heritage Program (NHP) for threatened and endangered species consultation report, indicate no known occurrences of federally protected

species within a 2.0-mile buffer of the Study Area. The following subsections include a summary of habitat descriptions and the presence/absence of habitat within the Study Area for species that are federally protected under the provisions of the BGEPA and Section 7 and Section 9 of the Endangered Species Act of 1973. In addition, potential habitats for federally protected species documented during the field assessment have been identified on Appendix A, Figure 11.

5.5.1 Birds

Bald eagle (*Haliaeetus leucocephalus*) [Federally Protected under BGEPA]

USFWS Recommended Survey Window: October 1 – May 15

Habitat Description: Bald eagles occur throughout much of the continental U.S. and Canada. The species frequently builds their nests in live pines or cypress trees near large bodies of open water and may congregate around fish processing plants, dumps, and below dams where fish congregate. Nests typically measure 6 to 8 feet deep and 6 feet in diameter and are cone shaped. Bald eagles are opportunistic feeders and consume a variety of prey, which may be self-caught, scavenged, or robbed from other bird species. The threat to this species is attributed to disturbance and destruction of foraging and nesting habitat by urban and residential development (USFWS 1978).

Potential habitat for the bald eagle was identified within the Study Area. This species utilizes super canopy trees isolated from human disturbance for perching or roosting, and large bodies of water for foraging. HDR reviewed the SCDNR Bald Eagles Nest Location database and SCDNR NHP consultation report. One historic nest (N825-Y2019) has been documented approximately 5.5 miles northeast of the Study Area on Lake Jocassee; however, this nest is no longer shown on the Bald Eagle Nest Location database because it is older than five years. Potential habitat is located in large trees surrounding the Bad Creek Reservoir and Lake Jocassee. No individuals or nests were observed during the site visit and no known occurrences of bald eagles have been documented within the Study Area.

5.5.2 Mammals

On-site surveys for protected bat species were conducted by a sub-consultant (Environmental Resources Management [ERM]) and results are summarized in Section 6.

Indiana Bat (*Myotis sodalis*) [Federally Endangered]

USFWS Recommended Survey Window: May 15 to August 15

Habitat Description: Indiana bats hibernate during winter in caves or, occasionally, in abandoned mines. For hibernation, they require cool, humid caves with stable temperatures, under 50° F but above freezing. Very few caves within the range of the species have these conditions. After hibernation, Indiana bats migrate to their summer habitat in wooded areas where they usually roost under loose tree bark on dead or dying trees. Indiana bats eat a variety of flying insects found along rivers or lakes and in uplands. During summer, males roost alone or in small groups, while females roost in larger groups of up to 100 bats or more. Indiana bats also forage in or along the edges of forested areas (USFWS 2019a).

One small cave/den was identified in the Study Area that could be utilized as winter hibernacula, and large trees and snags with suitable cavities or crevices for summer roosting habitat and suitable foraging habitat occur in the Study Area. The USFWS County List states the Indiana bat as “Not a

South Carolina resident". Recommendations for coordination with USFWS concerning potential take of this species are pending the results of the bat survey.

Northern long-eared bat (*Myotis septentrionalis*) [Federally Threatened]

USFWS Recommended Survey Window: Year-Round – Winter Surveys Not as Successful

Habitat Description: Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found roosting in structures such as barns and sheds (USFWS 2015).

One small cave/den was identified in the Study Area that could be utilized as winter hibernacula, and large trees with peeling bark and snags with suitable cavities or crevices suitable for summer roosting habitat and potential foraging habitat occur in the Study Area. In addition, the SCDNR NHP report indicates that a population of this species occurs within a 2.0-mile radius of the Project. It is recommended that tree clearing activities are not conducted during the summer months to avoid impacts to roosting sites for the species Recommendations for coordination with USFWS concerning potential take of this species are pending the results of the bat survey.

5.5.3 Plants

Persistent trillium (*Trillium persistens*) [Federally Endangered]

USFWS Optimal Survey Window: March through mid-April

Habitat Description: It occurs on organic soils in mixed deciduous-pine woodlands, along stream flats and at edges of Rhododendron thickets. The species prefers gorges and steep ravines, but some populations have also been found on slopes less than 45 degrees (USDA 2021).

Potential habitat for persistent trillium is present within the forested areas of the Study Area, specifically adjacent to streams within deep ravines under full mature tree canopies yet with plenty filter light and rich soils. Plants from the trillium genus were identified within the Study Area; coordination with USFWS including a survey for persistent trillium during the recommended optimal window is recommended.

Small whorled pogonia (*Isotria medeoloides*) [Federally Threatened]

USFWS Optimal Survey Window: mid-May through early July

Habitat Description: Small whorled pogonia is an orchid that occurs in young as well as maturing (second to third successional growth) mixed-deciduous or mixed-deciduous/coniferous forests. The species does not appear to exhibit strong affinities for a particular aspect, soil type, or underlying geologic substrate. Sometimes it grows in stands of softwoods with a thick layer of dead leaves, often on slopes near small streams. The species may also be found on dry, rocky, wooded slopes; moist slopes; ravines lacking stream channels; or slope bases near braided channels of vernal

streams. The orchid, often limited by shade, requires small light gaps or canopy breaks, and typically grows under canopies that are relatively open or near features like logging roads or streams that create long-persisting breaks in the forest canopy (USFWS 2019b).

No plants from this species were identified during the field survey. In addition, the USFWS IPaC report, and the SCDNR NHP report did not indicate records for the species within a 2-mile of radius of the Study Area. However, potential habitat is present within the Study Area for the small-whorled pogonia within the forested areas adjacent to streams and moist slopes and a follow up survey of these habitats is recommended during the optimal survey window. Depending on the results of future surveys, coordination with USFWS concerning potential take of this species may be recommended.

Smooth coneflower (*Echinacea laevigata*) [Federally Endangered]

USFWS Optimal Survey Window: Late May – October

Habitat Description: Smooth coneflower, a perennial herb, is typically found in meadows, open woodlands, the ecotonal regions between meadows and woodlands, cedar barrens, dry limestone bluffs, clear cuts, and roadside and utility right-of-ways. In South Carolina, the species normally grows in magnesium- and calcium-rich soils associated with diabase and marble parent material, and typically occurs in Iredell, Misenheimer, and Picture soil series. It grows best where there is abundant sunlight, little competition in the herbaceous layer, and periodic disturbances (e.g., regular fire regime, well-timed mowing, and careful clearing) that prevent encroachment of shade-producing woody shrubs and trees. On sites where woody succession is held in check, it is characterized by several species with prairie affinities (USFWS 2017a).

Potential habitat for smooth coneflower was identified within the maintained right-of-way, maintained fields, and meadows in portions of the Study Area; however, a survey for the species during the optimal survey window did not reveal the presence of any plants from this species within the Study Area. The SCDNR NHP query report indicates that a population for smooth coneflower occurs both within the Study Area, and within a 2.0-mile radius of the Study Area. HDR coordinated with the SCDNR regarding the population indicated on the NHP report and the agency indicated that the population has been extirpated by the filling of Lake Jocassee in the 1970's. Although the types of soils generally associated with the species (Iredell, Misenheimer, and Picture soil series) do not occur within the Study Area, follow up surveys for smooth coneflower are recommended within the proposed limits of disturbance for the proposed spoil areas (as plant surveys are typically valid for five years). Depending on the results of future surveys, coordination with USFWS concerning potential take of this species may be recommended.

5.6 At-Risk Species

HDR conducted on-site surveys for At-Risk plant and animal species including an on-site survey for At-Risk terrestrial plants and results are shown on Appendix A, Figure 11. The survey however was conducted outside the optimal survey window for Georgia aster. The following subsections include a summary of habitat descriptions and the presence/absence of habitat within the Study Area for the At-Risk species previously listed on Table 4.

Proposed impacts to At-Risk Species by spoil location can be found in Table 6.2

5.6.1 Amphibians

Chamberlain's dwarf salamander (*Eurycea chamberlain*)

USFWS Optimal Survey Window: Spring/Fall

Habitat Description: Chamberlain's dwarf salamander is typically found in wet areas, particularly seepages near small streams, and other wetland type areas. This species is typically found under leaf litter and small debris; however, has been observed with leaf or pine straw litter along the edge of seep streams, or small debris piles in the terrestrial uplands adjacent to seepage wetlands (USFWS 2016).

Potential habitat for the Chamberlain's dwarf salamander is present within the Study Area. Coordination with USFWS and SCDNR is recommended regarding potential negative impacts to the Chamberlain's dwarf salamander and opportunities to implement conservation measures to protect the species.

5.6.2 Birds

Golden-winged warbler (*Vermivora chrysoptera*)

USFWS Optimal Survey Window: April-July (nesting surveys)

Habitat Description: Golden-winged warbler uses wet shrubby, tangled thickets and other early successional habitats during breeding. Females select a nest site, which is typically on the ground in a grassy opening or along the shaded edge of a field near a forest border. The nest is typically well concealed by overhead grasses and leafy material. Golden-winged Warblers move into mature forests immediately after fledging. This means that mosaics of shrubby, open areas (for nesting) and mature forest habitats (which offer cover for fledglings from like predators like hawks) are important landscape features (Cornell 2019).

Potential habitat for the golden-winged warbler is present with the Study Area (emergent and scrub/shrub wetland areas surrounded by forested communities). Given that these habitats are particularly important for the conservation of the species, coordination with the USFWS is recommended regarding potential negative impacts to the golden-winged warbler and opportunities to implement conservation measures to protect the species.

5.6.3 Insects

Edmund's snaketail (Ophiogomphus edmundo)

USFWS Optimal Survey Window: Year-round; Active: May-August

Habitat Description: Edmund's snaketail larvae are found in medium- to large-sized, clear streams and rivers with moderately fast currents but spend most of their adult lives in the treetops, only returning to the water to breed. During the breeding stage, males are typically found perched on rocks in riffles or rapids as they patrol their territories. Mating takes place while perched; once fertilized, females deposit their eggs in the water near the same riffles guarded by the male and return to the treetops. This species is restricted to the southern Blue Ridge of North Carolina, Tennessee, South Carolina, and Georgia (USFWS 2019c and GDNR 2021).

Potential habitat for the species is present within the Study Area in medium-large streams with strong currents and in-channel structure. Coordination with the USFWS is recommended regarding potential negative impacts to the Edmund's snaketail and opportunities to implement conservation measures to protect the species.

Monarch butterfly (*Danaus plexippus*)

USFWS Optimal Survey Window: August-December

Habitat Description: The monarch butterfly is a large butterfly that lives in a variety of habitats throughout North America and various additional locations across the globe. They need milkweed (Asclepias spp.) for breeding.

In North America, the eastern population (east of the Rocky Mountains) migrate north to the United States and Canada in March from the mature oyamel fir forests in the mountains of central Mexico. The fall migration back to overwintering sites in Mexico is from August to November. Monarchs are typically found in open grass areas during the breeding season. Adults use a wide variety of flowering plants throughout migration and breeding. Important nectar sources during the spring migration typically include *Coreopsis* spp., *Viburnum* spp., *Phlox* spp., and early blooming milkweeds. Important nectar sources during fall migration include goldenrods (*Solidago* spp.), asters (*Symphyotrichum* spp. and *Eurybia* spp.), gayfeathers (*Liatris* spp.), and coneflowers (*Echinacea* spp.) (USFWS 2019d).

Monarch butterflies were not identified during the on-site survey; however, potential habitat for the monarch butterfly was identified within the Study Area for migrating and breeding adults. The maintained right-of-way and fields offer a variety of flowing plants for nectar, as well as nighttime roosting trees such as willows, oaks, and pines are present within the forested areas of the Study Area. HDR recommends conducting vegetation management activities such as mowing outside the species breeding and migration windows. According to the Monarch Joint Venture, the recommended vegetation management time window for the Project's region is November 1st through April 1st (Monarch Joint Venture 2021).

Smokies needlefly (*Megaleuctra williamsae*)

USFWS Optimal Survey Window: April-June

Habitat Description: These slender, brown to black stoneflies ranging from 4 to 15 mm (0.2 to 0.6 inches) in length are restricted to high elevation springs and seeps with flowing water in relatively undisturbed forested areas and water temperatures below 25° Celsius. Nymphs sprawl in accumulations of decaying leaves and other debris that are covered with a thin film of flowing water (USFWS 2019e).

Potential habitat is present for the Smokies needlefly in the higher elevation steams with flowing water found within the Study Area. Coordination with the USFWS is recommended regarding potential negative impacts to the Smokies needlefly and opportunities to implement conservation measures to protect the species.

5.6.4 Mammals

On-site surveys for protected bat species were conducted by a sub-consultant (ERM) and results are summarized in Section 6.

Little brown bat (*Myotis lucifugus*)

USFWS Optimal Survey Window: Year round

Little brown bats use buildings, caves, trees, rocks, and wood piles as roost sites; however, their habitat use changes over the course of the year and varies based on sex and reproductive status.

During the summer Little brown bats commonly roost in human-made structures but have also been found in the summer under tree bark, in rock crevices, and in tree hollows. Preferring old growth forest over younger stands, as the larger trees offer more crevices, and the reduced understory vegetation of the mature growth forests makes prey easier to find and capture. During winter little brown bats hibernate in humid caves and mines with constant temperatures. They may migrate hundreds of miles to get from their summer habitats to hibernacula (WDNR 2017).

Potential summer habitant is present within the forested areas of the Study Area. It is recommended that tree clearing activities are not conducted during the summer months to avoid impacts to roosting sites for the species. Pending results of the bat survey, coordination with the USFWS may be recommended regarding potential negative impacts to the little brown bat and opportunities to implement conservation measures to protect the species.

Tri-colored bat (*Perimyotis subflavus*)

USFWS Optimal Survey Window: Year round

Tri-colored bats are associated with forested landscapes, often in open woods. They can also be found over water and adjacent to water edges. They hibernate in caves, mines, and tunnels in the same sites as large populations of other bats, such as little brown bats. In the summer, tricolored bats generally roost separately, often in trees (MDNR 2021). In South Carolina, sparse vegetation and early successional stands were found to be the best predictor of foraging habitat use by tricolored bats (USFWS 2019f).

Potential summer habitant is present within the forested areas of the Study Area. It is recommended that tree clearing activities are not conducted during the summer months to avoid impacts to roosting sites for the species. Pending results of the bat survey, coordination with the USFWS may be recommended regarding potential negative impacts to the tricolored bat and opportunities to implement conservation measures to protect the species.

5.6.5 Plants

Carolina hemlock (*Tsuga caroliniana*)

USFWS Optimal Survey Window: Year round

Carolina hemlocks occur in a variety of landscapes ranging from xeric ridgelines to gorges in the Southern Blue Ridge Mountains. These occurrences are mostly on cliffs, rocky slopes and ridges, less commonly on gentle slopes and flat areas in valleys. Soils are usually nutrient-poor and rocky. Carolina hemlocks are very shade tolerant and are often associated with the following species: eastern hemlock (*Tsuga canadensis*), chestnut oak (*Quercus prinus*), northern red oak (*Quercus rubra*), Virginia pine (*Pinus virginiana*) and others (USFWS 2019g).

Potential habitat for Carolina hemlock is found within the Study Area along high elevation forested ridges and gorges. The USFWS recommends avoiding logging and clearing on mountain slopes and in high-elevation habitats. A follow up survey for this recommended once limits of disturbance are determined. Coordination with the USFWS is recommended regarding potential negative impacts to the Carolina hemlock and opportunities to implement conservation measures to protect the species may be needed dependent on results of the survey.

Georgia aster (*Symphyotrichum georgianum*)

USFWS Optimal Survey Window: Early October-mid November

Georgia aster lives in woodlands or piedmont prairies that are dominated by native plants, with acidic soils that vary from sand to heavy clay. The primary controlling factor appears to be the availability of light. The plant tends to compete well for resources until it begins to get shaded out by woody plants. Since the plant prefers open areas, disturbance (fire, native grazers, etc.) is a part of this plant's habitat requirements. The historic sources of disturbance have been virtually eliminated from its range, except where road, railroad, and utility rights-of-way maintenance are mimicking the missing natural disturbances (USFWS 2014).

Potential habitat for the species is present within the maintained portions of the study area such as maintained fields, right-of-way, and meadows however, no individuals were found. HDR recommends conducting a follow up survey within the species optimal surveying window closer to construction. In addition, coordination with the USFWS regarding potential negative impacts to the Georgia aster, and opportunities to implement conservation measures to protect the species is also advised.

Sun-facing coneflower (*Rudbeckia heliopsidis*)

USFWS Optimal Survey Window: July-October

Sun-facing coneflower prefers moist to wet sites such as acidic swales in pine-oak woodlands, peaty seeps in meadows, and sandy alluvium along streams. It occurs in full sun to partial shade. The species can also be found in upland oak-hickory or oak -pine-hickory or open pine-mixed hardwoods. It grows in seeps, bogs, sandy wet clear crop areas or in places with many boulders. The seeps where it is found are acid with grasses, sedges, and herbs (USFWS 2017b).

Potential habitat for the species is present within the wetter portions of maintained portions of the right-of-way, and oak-hickory and pine-mixed hardwood habitats adjacent to streams and wetlands. The USFWS recommends right-of-way management appropriate for the species such as thinning of the overstory. No *Rudbeckia* species were identified during the survey. HDR recommends conducting a follow up survey within the species optimal surveying window closer to construction. In addition, coordination with the USFWS regarding potential negative impacts to the sun-facing coneflower, and opportunities to implement conservation measures to protect the species is also advised.

6.0 Summary of Potential Environmental Impacts and Agency Coordination

Results from HDR's desktop analysis and on-site field reconnaissance indicate that the proposed Project may affect natural resources including surface waters, regulated riparian buffers, protected species habitat, and cultural resources within the Study Area.

Wetlands and Surface Waters

The assessment identified potential surface waters within Study Area, including 23 potentially jurisdictional streams, 7potentially jurisdictional wetlands, 7 potentially non-jurisdictional isolated wetlands, and 1 open water. A formal delineation and the submittal of Jurisdictional Determination to the USACE is recommended to verify the boundaries of water resources (including wetlands) that are regulated under Section 404 of the Clean Water Act.

Dependent on Project design, a CWA Section 404 Permit and a 401 Water Quality Certification may be required for unavoidable impacts to jurisdictional surface waters. A Pre-Construction Notification (PCN) application is required for activities that would result in a discharge of dredged or fill material into waters of the United States.

Construction of the proposed infrastructure including inlet/outlet structures, access roads, laydown areas, equipment buildings, and the proposed 525kV transmission line from Bad Creek powerhouse substation to the Jocassee Pumped Storage Station would be included in the overall Project. Due to the complexity and magnitude of the Project, the proposed impacts will likely not qualify to be authorized under the USACE Nationwide permit program and may require the submittal of an Individual Permit. Once the preliminary design is developed and an estimate of impacts to surface waters is determined, HDR recommends scheduling a pre-application meeting with the environmental regulatory agencies including the USACE and SCDHEC to determine a preferred permitting strategy may include recommendations for other environmental regulatory agencies such as USFWS, SCDNR, and SCSHPO Individual Permits require a detailed alternatives analysis, avoidance and minimization measures, mitigation plan, and a public notice period.

Compensatory mitigation will be required for unavoidable impacts to surface waters to ensure that impacts to aquatic resources are avoided or minimized to the greatest extent possible, which is consistent with the current administration's goal of "no net loss of wetlands." The USACE Charleston District has created worksheets to assess the function and quality of water resources and to determine the required mitigation credits for streams and wetlands. Mitigation options may include on-site restoration or purchase credits from an approved in-lieu fee mitigation bank to offset adverse impacts.

Additionally, according to the preliminary studies and estimates for proposed material removed from underground excavations, approximately 4 million cubic yards of spoil material for the Project infrastructure will need to be deposited into on-site spoil locations or along the submerged weir in Lake Jocassee. Potential spoil locations and estimated impacts to water resources are included in Table 8 and Appendix A, Figure 12. Proposed structure estimated impacts to water resources are included in Table 9 and Appendix A, Figure 12.

Table 8. Estimated Impacts to Water Resources by Potential Spoil Location

Spoil Area ID	Spoil Area Capacity (Million Cubic Yards)	Impacted Streams	Estimated Stream Impact Length (linear feet)	Estimated Wetlands Impacted	Wetland Impact Areas (acres)	Open Waters Impacted	Open Water Impact Amounts (acres)
A*+	1.3	0	0	0	0	Lake Jocassee	13.90
B*	1.3	19 P, 20 P, 21 P	1,865	0	0	0	0
C	0.7	17 P	286	0	0	0	0
D	1.3	13 I, 14 P	996	0	0	0	0
E	0.16	0	0	10 N	2.96	0	0
F*	0.25	0	0	4 N, 7 N	1.52	0	0
G*	1.1	4 I, 4a P	1,484	0	0	0	0
H	1.5	0	0	0	0	Bad Creek Reservoir	19.26
I*	1.1	0	0	0	0	0	0

*Duke Energy Preferred Spoil Area
PPerennial
IIntermittent
NIsolated Wetlands created by Duke Energy, would not be federally regulated or require mitigation
+ Spoil Area A includes spoil placement along the existing submerged weir in Lake Jocassee

Table 9. Estimated Impacts to Water Resources by Potential Structure Locations

Proposed Structure	Impacted Streams	Estimated Stream Impact Length (linear feet)	Estimated Wetlands Impacted	Wetland Impact Areas (acres)	Open Waters Impacted	Open Water Impact Amounts (acres)
525KV Switchyard	6 P, 7 P	425	6 N, 8 N	1.50	0	0
Transformer Yard	0	0	0	0	0	0

PPerennial
NIsolated Wetlands created by Duke Energy, would not be federally regulated or require mitigation

State Navigable Waters

Lake Jocassee is classified as a state navigable waters (SCDHEC 2019a; 2019b). Activities occurring below or above the ordinary high water elevation are regulated under the South Carolina State Regulation 19-450 Permits of Construction in Navigable Waters, and a permit is required by the SCDHEC for any filling or construction or alteration in, on, or over navigable waters, or in, or on the bed under navigable waters, or in, or for any activity significantly affecting the flow of any navigable water.

A separate Construction in State Navigable Waters Permit would not be required for activities that require another SCDHEC permit for certification including but not limited to 401 Water Quality Certifications, water supply permits, and National Pollution Discharge Elimination System (NPDES) stormwater permits. A public notice to a newspaper of local and statewide interested and as well as notification letters inform owners or residents of property adjoining the area of the proposed activities may be required. The applicant shall provide SCDHEC with an affidavit of publication from the newspaper within fifteen (15) days of publication.

Federally Protected Species

The field survey identified potential habitats for five federally threatened and endangered species within the Study Area: northern long-eared bat, Indiana bat, persistent trillium, small whorled pogonia, smooth coneflower, and bald eagle. As a conservation measure for federally protected bat species, it is recommended that tree clearing activities be conducted during the bats inactive season (November 15th through March 31st for northern long-eared bat) to avoid negative impacts to the species. A clearing moratorium may also be required contingent on the results of the ongoing bat surveys onsite. If protected bat species (Indiana/northern long-eared bat) are present, the USFWS would likely impose a tree cutting moratorium between April 15 through October 15.

In addition, coordination with the USFWS concerning potential Project impacts to these species is recommended, including a survey for persistent trillium, smooth coneflower, and small whorled pogonia during the recommended optimal window, and follow up surveys once the proposed transmission line and/or rebuild alignments are determined.

Potential spoil locations and estimated impacts to federal and at-risk species are provided in Table 9 and Appendix A, Figure 13.

At-Risk Species

According to the USFWS list of At-Risk species for South Carolina, and the SCDNR consultation report nine At-Risk species occur in Oconee County and/or in the vicinity of the Study Area. Results from the field assessment indicate that potential habitats for all nine At-Risk Species: Chamberlain's dwarf salamander, golden-winged warbler, Edmund's snaketail, monarch butterfly, Smokies needlefly, little brown bat, tri-colored bat, Carolina hemlock, Georgia aster, and sun-facing coneflower are present within the Study Area. Coordination with USFWS is recommended regarding potential negative impacts as a result of the Project and for opportunities to implement conservation measures that will help protect these species.

Potential spoil locations and estimated impacts to federal and at-risk species are provided in Table 10 and Appendix A, Figure 13.

Table 10. Summary of Estimated Habitat Impacts for Federal and At-Risk Species by Potential Spoil Location

Spoil Area ID	Impacted At-Risk Species	Area of At-Risk Habitat Impacts (acres)	Federally Listed Species Impacted	Area of Federally Listed Habitat Impacted (acres)
A*	N/A	N/A	N/A	N/A
B*	Georgia aster	1.45	Small Whorled Pogonia, Persistent Trillium, Smooth Coneflower	5.47
C	Chamberlain's Dwarf Salamander, Smokie's Needlefly	0.72	Small Whorled Pogonia, Persistent Trillium	0.72
D	Chamberlain's Dwarf Salamander	2.21	Small Whorled Pogonia, Persistent Trillium	2.48
E	Georgia Aster, Monarch Butterfly, Golden-Winged Warbler	2.95	Smooth Coneflower	2.95
F*	Sunfacing Coneflower, Georgia aster, Monarch Butterfly, Golden Warbler Chamberlain's Dwarf Salamander, Smokies needlefly	2	Smooth Coneflower	0.63
G*	N/A	N/A	Small Whorled Pogonia, Persistent Trillium	3.23
H	N/A	N/A	N/A	19.26
I*	N/A	N/A	N/A	N/A

*Preferred Spoil Area

On-site Bat Survey Summary

On behalf of Duke Energy, ERM conducted field surveys in 2021 to assess the presence/likely absence of bat species and their potential habitats within the Project vicinity. Habitat surveys, acoustic surveys, and mist net surveys were carried out to determine the presence and identification of bat species.

Habitat surveys were performed to identify potential roost trees for federally endangered Indiana bat and federally threatened northern long-eared bat, particularly near water resources and forested edges that receive direct solar exposure. Cliffs and talus slopes were visually assessed for cracks and crevices which serve as preferred roosts for eastern small-footed bats (*Myotis leibii)*.

Four acoustic survey site locations with two detectors were placed in preferred habitats including two adjacent to the shoreline of the reservoir, one along the service road extending from the existing transmission line right-of-way, and one along the shoreline of Lake Jocassee. The acoustic analysis suggested the presence of 12 bat species within the Project. The tri-color bat and big brown bat (*Eptesicus fucus*) made up more than 70 percent of the total 6,000 call files to identify species. Manual vetting of the calls confirmed high confidence of five species and medium confidence of an

additional four species. Indiana bat and northern-long-eared bat were determined not likely to be present.

Four mist surveys were conducted including two sites in July 2021 and two sites in October 2021. Each site deployed multiple net sets and sites were surveyed for two nights for a total of 26 net nights. Two sites were located within road corridors adjacent to the reservoir, one site was located on the service road extending from the existing transmission line right-of-way, and one site was located south of the reservoir dam at the intersection of a field and road corridor. A total of 14 bats, representing four different species including big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and eastern small-footed bat were captured during the surveys.

The results of the 2021 bat survey indicated a diversity of bat species present within the Project vicinity. Habitat surveys indicated abundant suitable habitat for Indiana bat and northern long-eared bat but results from the presence/absence survey revealed that these species are not likely to be on-site. Of the 14 bats captured, four of them were eastern small-footed bats; the eastern small-footed bad is considered a species in need of management in the state of South Carolina, which is the equivalent to state-threatened status. Abundant rocky roosting habitat for eastern small-footed bat was found within the Project area, although none could be confirmed to be occupied. Results of the acoustic survey suggest high confidence in the presence of little brown bat and tri-colored bat, which are both currently designated as At-Risk Species and are under review for future listing with the USFWS.

Cultural Resources

Review of the NRHP GIS Public Dataset, NCOSA data, and the SCIAA and SCDAH online ArchSite database revealed a total of 20 previously recorded cultural resources within the Study Area. Two archaeological sites (38OC249 and 38OC250) within the Study Area are potentially eligible for listing in the NRHP and should be preserved in place. If Sites 38OC249 and 38OC250 cannot be preserved in place, additional mitigative archaeological investigations should be undertaken at the sites, which will require coordination and consultation with the SCSHPO.

Resource 156- Keowee-Toxaway Hydroelectric Development, is located partially within the Bad Creek II Power Complex. This resource is currently not eligible for listing in the NRHP, but it will be re-evaluated when it reaches 50 years of age in 2023.

HDR recommends coordination with the SCDAH regarding potential issues with respect to cultural resources that may be located within the Study Area. If federal funding for the Project is anticipated or USACE permits are needed, it is likely that the SCSHPO will require a cultural resources survey of the Project vicinity. A cultural resources survey would likely include an archaeological survey for all non-steep (less than 15 percent slopes) landforms, as well as an architectural survey of any structures on or near the Project that are 40+ years old. Given the landforms within the corridor and their proximity to several creeks, as well as the concentration of previously recorded archaeological sites near the Project on similar landforms, there is an increased probability of archaeological sites across the Study Area.

State Waters Buffers

Per SCDHEC's Buffer Zone Guidance, a minimum 30-foot natural buffer for jurisdictional surface waters (with a drainage area greater than or equal to 100 acres) is required (including wetlands)

within the Study Area; however, this buffer is exempt for land-disturbing activities that propose to impact surface waters with appropriate CWA Section 404/401 permits.

Floodplains

The FEMA Map Service Center's NFHL GIS database identified regulated floodplains located in the Study Area. Coordination with Oconee County's Floodplain Administrator will be required if the proposed Project requires work or placement of fill within the regulated floodplain.

Shoreline Permits

Duke Energy maintains and implements an SMP for Lake Jocassee as part of the FERC Keowee-Toxaway Hydroelectric Project. Development within the existing FERC Project Boundary including lake use activities (e.g., private residential piers/docks, shoreline stabilization and excavation, commercial or residential marina facilities, easements for water discharges and intakes, bridges, and other conveyances) require submittal of a Lake Use Permit and must be authorized in writing by Duke Energy prior to construction. The proposed facilities associated with the proposed Project would likely require the submittal of the Lake Use Permit to Duke Energy's Conveyance Permit Program.

7.0 References

Bates, J. and R. Morgan. 1999. Cultural Resources Survey of the Proposed Conservation Fund Land Exchange. Prepared by the United States Forest Service.

Benson. 2018. Cultural Resources Survey of the FY2018 Andrew Pickens District Southern Pine Beetle Timber Salvage Project. Andrew Pickens Ranger District, Sumter National Forest. Prepared for the United States Forest Service. Prepared by Southeastern Archaeological Services, Inc.

Brockington, Paul E., Jr. 1978. An Archeological Survey of Duke Power's Oconee-Bad Creek 500 kV and Jocassee-Bad Creek 100 kV Transmission Lines, Oconee County, South Carolina. The University of South Carolina, South Carolina Institute of Archaeology and Anthropology Research Manuscript Series Number 130. Columbia, 32 p.

Carolina, South Carolina Institute of Archaeology and Anthropology Research Manuscript Series Number 130. Columbia, 32 p.

CH 17-0372. n.d. Southside Project Phase I Tract.

Cowardin, L.M., Carter, V., Golet, F.C., and LaRoe, E.T. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Washington, D.C.

Cornell University (Cornell). 2019. The Cornell Lab. All About Birds. Golden-winged Warbler. 2019. [URL]: https://www.allaboutbirds.org/guide/Golden-winged_Warbler/lifehistory (Accessed October 2021).

Duke Energy Carolinas, LLC (Duke Energy). 2014. Keowee-Toxaway Project FERC Project No. 2503. Shoreline Management Plan. (Keowee-Toxaway Shoreline Management Plan - Duke Energy (duke-energy.com)

Duke Energy Keowee-Toxaway FERC SMP. 2021. [URL]: https://www.theoremgeo.com/smp/Keowee-Toxaway_FERC_SMP/ (Accessed November 2021)

ER05-2784. n.d. Chattooga Watershed Storm Recovery 2004-2005. (Accessed October 2021).

Federal Emergency Management Agency (FEMA). 2020. Special Flood Hazard Area Definition/Description. [URL]: http://www.fema.gov/special-flood-hazard-area (Accessed October 2021).

Gardner, Jeffrey W., and Christopher T. Espenshade. 1989. Archaeological Survey and Testing on the Bad Creek to Jocassee Transmission Corridors, Oconee County, South Carolina. Prepared for Duke Power Company.

Georgia Department of Natural Resources (GDNR). 2021. Edmund's Snaketail. Ophiogomphus Edmundo. [URL]: https://georgiabiodiversity.org/natels/profile?es_id=21213 (Accessed October 2021).

Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B., and Shelburne, V.B. 2002. Ecoregions of North and South Carolina (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

Grunden, R. 2007. Cultural Resources Survey of the Lake Jocassee Shoreline. Oconee and Pickens Counties, South Carolina. Prepared by TRC.

Martin, W.H., Boyce, S.G., and Echternacht, A.C. 1993. Biodiversity of the Southeastern United States, Upland Terrestrial Communities. Sponsored by the Southeastern Chapter of the Ecological Society of America.

Minnesota Department of Natural Resources (MDNR). 2021. *Perimyotis subflavus*. [URL]: https://www.dnr.state.mn.us/rsg/profile.html?/rsg/profile.html?action=elementDetail&selectedElement=AMACC03020 (Accessed October 2021).

Monarch Joint Venture. 2021. Partnering Across the U.S. to Conserve the Monarch Migration. 2021. [URL]: http://monarchjointventure.org/images/uploads/documents/MowingForMonarchs.pdf (Accessed October 2021).

National Land Cover Database (NLCD). 2016. Multi-Resolution Land Characteristics Consortium (MRLC). [URL]: https://www.mrlc.gov/data/nlcd-2016-land-cover-conus (Accessed October 2021).

Natural Resources Conservation Service (NRCS). 2019. Soils Surveys for Oconee County. [URL]: https://websoilsurvey.nrcs.usda.gov/app/ (Accessed October 2021).

NatureServe. 2013. International Ecological Classifications Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA [URL]: http://natureserve.org/products/terrestrial-ecological -systems-united-states (Accessed October 2021).

Nelson, J.B. 1986. The Natural Communities of South Carolina Initial Classification and Description. South Carolina Wildlife & Marine Resources Department. [URL]: http://www.dnr.sc.gov/wildlife/publications/pdf/natcomm.pdf (Accessed October 2021).

North Carolina Division of Water Quality (NCDWQ). 2010. Methodology for Identification of Intermittent and Perennial Streams and Their Origins (Version 4.11).

Oconee County. 2021. Flood Damage Prevention Ordinance. [URL]: https://library.municode.com/sc/oconee_county/codes/code_of_ordinances?nodeId=COOR_CH16FL (Accessed October 2021).

Simon, Steven A. 2015. Ecological Zones in the Southern Blue Ridge Escarpment: 4th Approximation. [URL]: Biophysical Settings in the North Zone of the Cherokee National Forest Identified from Ecological Zones: First Approximation (conservationgateway.org) (Accessed October 2021).

South Carolina Department of Health and Environmental Control (SCDHEC). 2012a. Buffer Zone Guidance for the 2012 NPDES General Permit for Storm Water Discharges from Construction Activities. [URL]: http://www.scdhec.gov/sites/default/files/docs/Environment/docs/lid-Buffers.pdf. (Accessed October 2021).

_____. 2012b. NPDES General Permit for Stormwater Discharges form Construction Activities. [URL]: https://www.scdhec.gov/sites/default/files/docs/Environment/docs/CGP-permit.pdf. (Accessed October 2021).

_____. 2012c. Regulation 61-69 Water Classifications and Standards. [URL]: https://scdhec.gov/sites/default/files/media/document/R.61-69_0.pdf. (Accessed October 2021).

_____. 2014. Regulation 61-68 Water Classifications and Standards. [URL]: https://www.scdhec.gov/sites/default/files/media/document/R.61-68_0.pdf. (Accessed October 2021).

_____. 2019a. Navigable Waters of South Carolina Map. [URL]: https://scdhec.gov/sites/default/files/docs/Environment/docs/nw_map.pdf. (Accessed October 2021).

_____. 2019b. South Carolina Watershed Atlas. Water Quality Assessment, Impaired Waters – 303(d). [URL]: https://gis.dhec.sc.gov/watersheds/ (Accessed October 2021).

_____. 2021. SC Watershed Atlas. (Accessed July 2021). [URL]: https://gis.dhec.sc.gov/watersheds/ (Accessed October 2021).

South Carolina Natural Heritage Program (SCNHP). 2020. Species of Concern Data Explorer Geographic Information System (GIS). SCDNR, Columbia, SC. [URL]: https://schtportal.dnr.sc.gov/portal/apps/sites/#/natural-heritage-program (Accessed: August 2021).

U.S. Army Corps of Engineers (USACE). 1977. Charleston District Navigable Study Report No.18 Lakes, Greater than 1000 Acres. [URL]: https://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report18Lakes(Greater%20than%201000%20acres).pdf. (Accessed October 2021).

_____. 1987. Wetland Delineation Manual. Vicksburg, MS.

_____. 2012. Regional Supplement of the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0). U.S. Vicksburg, Mississippi. April 2012. [URL]: https://www.mvk.usace.army.mil/Portals/58/docs/regulatory/EMP_Piedmont_v2.pdf?ver=uugGHyr8bGpJ7pSUPoDRag%3D%3D (Accessed October 2021).

U.S. Department of Agriculture (USDA). 2021. Plant of the Week. Persistent Trillium (*Trillium persistens).* (Accessed: August 2021). [URL]:https://www.fs.fed.us/wildflowers/plant-of-the-week/trillium_persistens.shtml (Accessed October 2021).

U.S. Fish and Wildlife Service (USFWS). 1978. Determination of Certain Bald Eagle Populations as Endangered or Threatened. U.S. Fish and Wildlife Service, Washington, D.C. [URL]: https://ecos.fws.gov/docs/federal_register/fr183.pdf. (Accessed October 2021).

_____. 2013. ESA Basics: 40 Years of Conserving Endangered Species. Arlington, VA. [URL]: https://www.fws.gov/endangered/esa-library/pdf/ESA_basics.pdf (Accessed October 2021).

_____. 2014. Georgia Aster (*Symphyotrichum georgianum*). [URL]: https://www.fws.gov/athens/pdf/Georgia_aster_fact_sheet.pdf (Accessed October 2021).

_____. 2015. Threatened Species Status for the Northern Long-eared Bat with 4(d) Rule. April 2015. [URL]: https://www.gpo.gov/fdsys/pkg/FR-2015-04-02/pdf/2015-07069.pdf (Accessed October 2021).

_____. 2016a. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Chamberlain's dwarf salamander. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/chamberlains-dwarf-salamander.pdf (Accessed October 2021).

_____. 2017a. Smooth Coneflower. [URL]: https://www.fws.gov/raleigh/species/es_smooth_coneflower.html (Accessed October 2021).

_____. 2017b. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Sun-facing coneflower (*Rudbeckia heliopsidis).* [URL]: https://www.fws.gov/charleston/pdf/ARS%20fact%20sheets%20for%20web/sun-facing%20coneflower%20fact%20sheet_SC_2017.pdf (Accessed October 2021).

_____. 2019a. Indiana Bat (Myotis sodalis). [URL]: https://www.fws.gov/midwest/endangered/mammals/inba/inbafctsht.html (Accessed October 2021).

_____. 2019b. Small Whorled Pogonia Fact Sheet. [URL]: https://www.fws.gov/midwest/endangered/plants/swpo/smallwhorledpogoniafs.html (Accessed October 2021).

_____. 2019c. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Edmund's snaketail. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/edmunds-snaketail.pdf (Accessed October 2021).

_____. 2019d Pollinators. Featured Pollinator: Monarch butterfly (*Danaus plexippus plexippus*). [URL]: https://www.fws.gov/pollinators/features/Monarch_Butterfly.html (Accessed October 2021).

_____. 2019e. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Smokies needlefly. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/smokies-needlefly.pdf (Accessed October 2021).

_____. 2019f. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Tricolored bat (*Perimyotis subflavus*). [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/tri-colored-bat.pdf (Accessed October 2021).

_____. 2019g. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Carolina hemlock (*Tsuga caroliniana*). [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/carolina-hemlock.pdf (Accessed October 2021).

_____. 2020. Migratory Bird Treaty Act. [URL]: https://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php (Accessed October 2021).

_____. 2021. South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species. Updated August 31, 2021. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/south-carolina-species-list-by-county.pdf (Accessed October 2021).

U.S. Geological Survey (USGS). 2016. Protected Areas Database of the United States (PAD-US), USGS, version 1.4, Gap Analysis Program. Updated August 3, 2016. [URL]: https://gapanalysis.usgs.gov/padus/viewer/ (Accessed July 2021).

Wisconsin Department of Natural Resources (WDNR). 2017. Little Brown Bat (*Myotis lucifugus*) Species Guidance. [URL]: https://dnr.wi.gov/files/PDF/pubs/er/ER0705.pdf (Accessed October 2021).

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Appendix A

Figures

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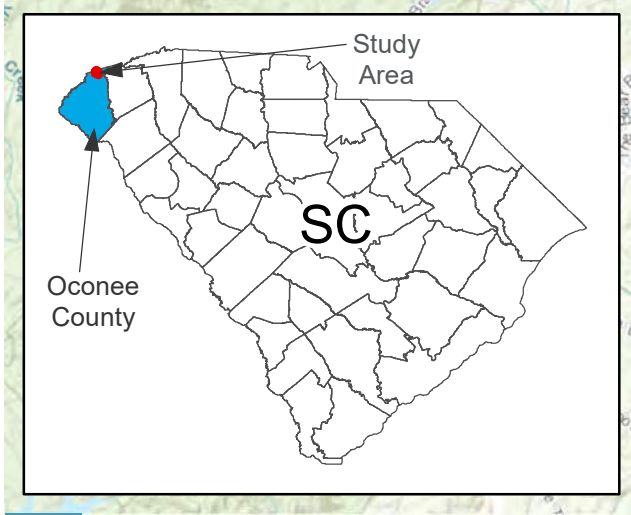
LEGEND

Study Area (1,314 acres)

DATA SOURCE: Esri, OpenStreetMap contributors, and the GIS User Community

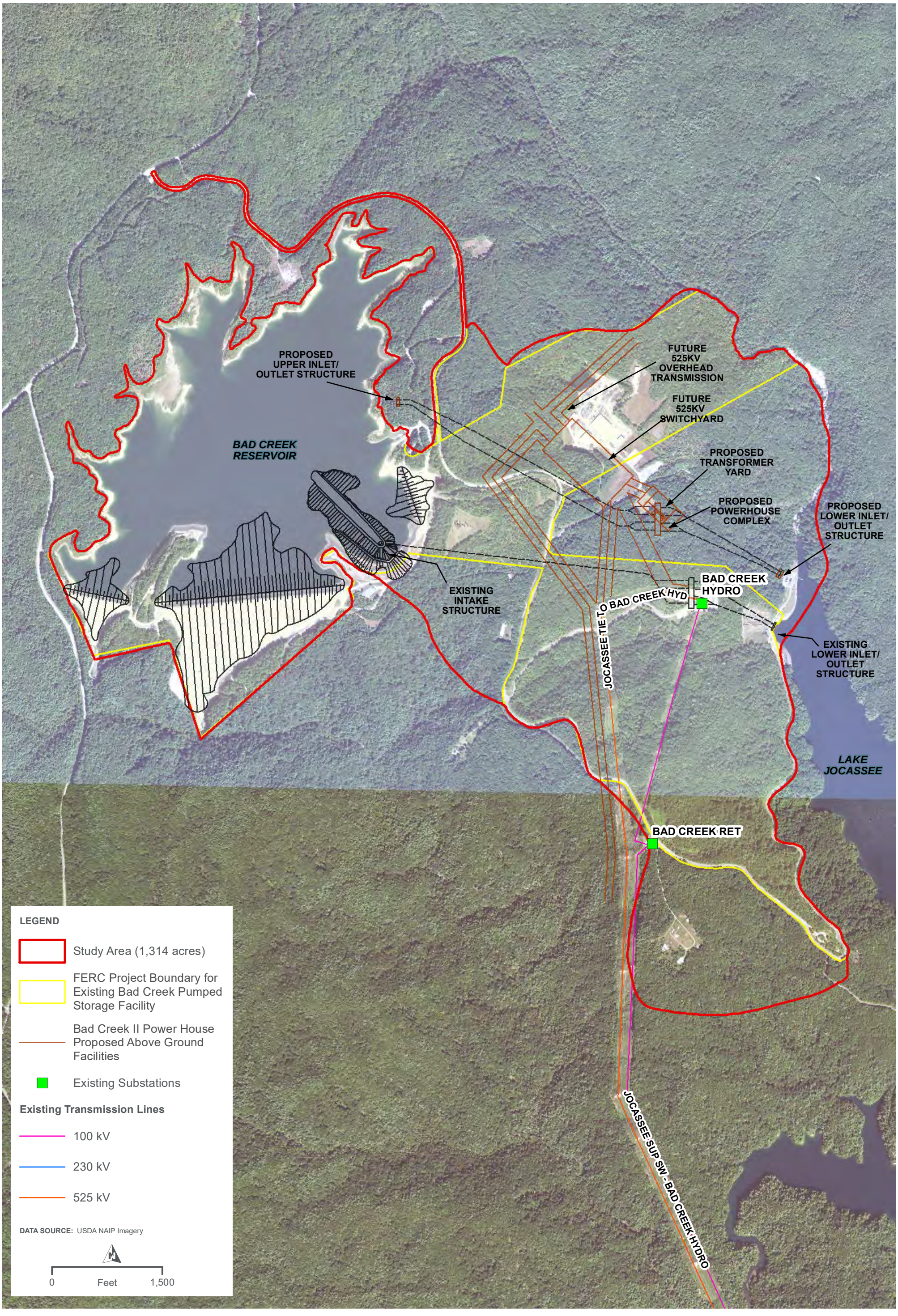
0 Miles 1



BAD CREEK II POWER COMPLEX PROJECT

PROJECT VICINITY

FIGURE 1



BAD CREEK II POWER COMPLEX PROJECT

PROJECT AERIAL

FIGURE 2

CASHIERS QUADRANGLE

REID QUADRANGLE

TAMASSEE QUADRANGLE

SALEM QUADRANGLE

LEGEND

Study Area (1,314 acres)

Topographic Quadrangles

DATA SOURCE: USGS 24K Topographic Maps - Cashiers, SC (1997), Reid, SC (1997), Tamassee, SC (1996), and Salem, SC (1996); USA Topo Maps GIS Service (2019)

0 Feet 2,000

BAD CREEK II POWER COMPLEX PROJECT

USGS TOPOGRAPHIC QUADRANGLES

FIGURE 3

PATH: \\CLT-SRV02\GIS\PROJECTS\DUKE_ENERGY\10304100_BADCREEK_NRA\7.2_WIP\MAP_DOCS\MXD\BADCREEK2_NRA\03_BADCREEK2_TOPO.MXD - USER: GMARCHICA - DATE: 9/17/2021

NATURAL RESOURCES ASSESSMENT

On-Site Soils

AsF	–	Ashe sandy loam, 25 to 50 percent slopes
HaD	–	Halewood fine sandy loam, 10 to 15 percent slopes
HaE	–	Halewood fine sandy loam, 15 to 25 percent slopes
HaF	–	Halewood fine sandy loam, 25 to 45 percent slopes
HcC2	–	Hayesville and Cecil fine sandy loams, 6 to 10 percent slopes, eroded
HcD2	–	Hayesville and Cecil fine sandy loams, 10 to 15 percent slopes, eroded
HcE	–	Hayesville and Cecil fine sandy loams, 15 to 25 percent slopes
HcF	–	Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes
Mv	–	Riverview-Chewacla complex, 0 to 2 percent slopes, frequently flooded
St	–	Stony land

LEGEND

Study Area (1,314 acres)

Soil Map Unit

Hydric Rating (1 - 32%)

DATA SOURCE: USDA NRCS Soil Survey of Oconee County,SC (2019); NAIP Imagery

0 Feet 1,500

BAD CREEK II POWER COMPLEX PROJECT

NRCS SOIL SURVEY OF OCONEE COUNTY, SOUTH CAROLINA

FIGURE 4

PATH: \\CLT-SRV02\GIS\PROJECTS\DUKE_ENERGY\10304100_BADCREEK_NRA\7.2_WIP\MAP_DOCS\MXD\BADCREEK2_NRA\04_BADCREEK2_SOILS.MXD - USER: GMARCHICA - DATE: 9/17/2021

LEGEND

Study Area (1,314 acres)

Land Classification

- Open Water
- Developed, Open Space
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, High Intensity
- Barren Land
- Deciduous Forest
- Evergreen Forest
- Mixed Forest
- Shrub/Scrub
- Herbaceous
- Hay/Pasture
- Cultivated Crops

DATA SOURCE: National Land Cover Database (2016). Multi-Resolution Land Character Consortium (MRLC), U.S. Geological Survey

0 Feet 1,500

N

BAD CREEK II POWER COMPLEX PROJECT

NATIONAL LAND COVER DATABASE 2016 LAND COVER

FIGURE 5

Redacted: Controlled Unclassified Information

North Carolina
National Forest

Jocassee Gorges
(WMA)

Francis Marion and
Sumter National Forest

SCDNR
(WMA)

SCDNR
(WMA)

Francis Marion and
Sumter National Forest

LEGEND

- Study Area (1,314 acres)
- 1-Mile Buffer

SCDNR Managed Lands

- Leased
- Easement

USGS Protected Areas Database

- Conservation Area
- National Forest

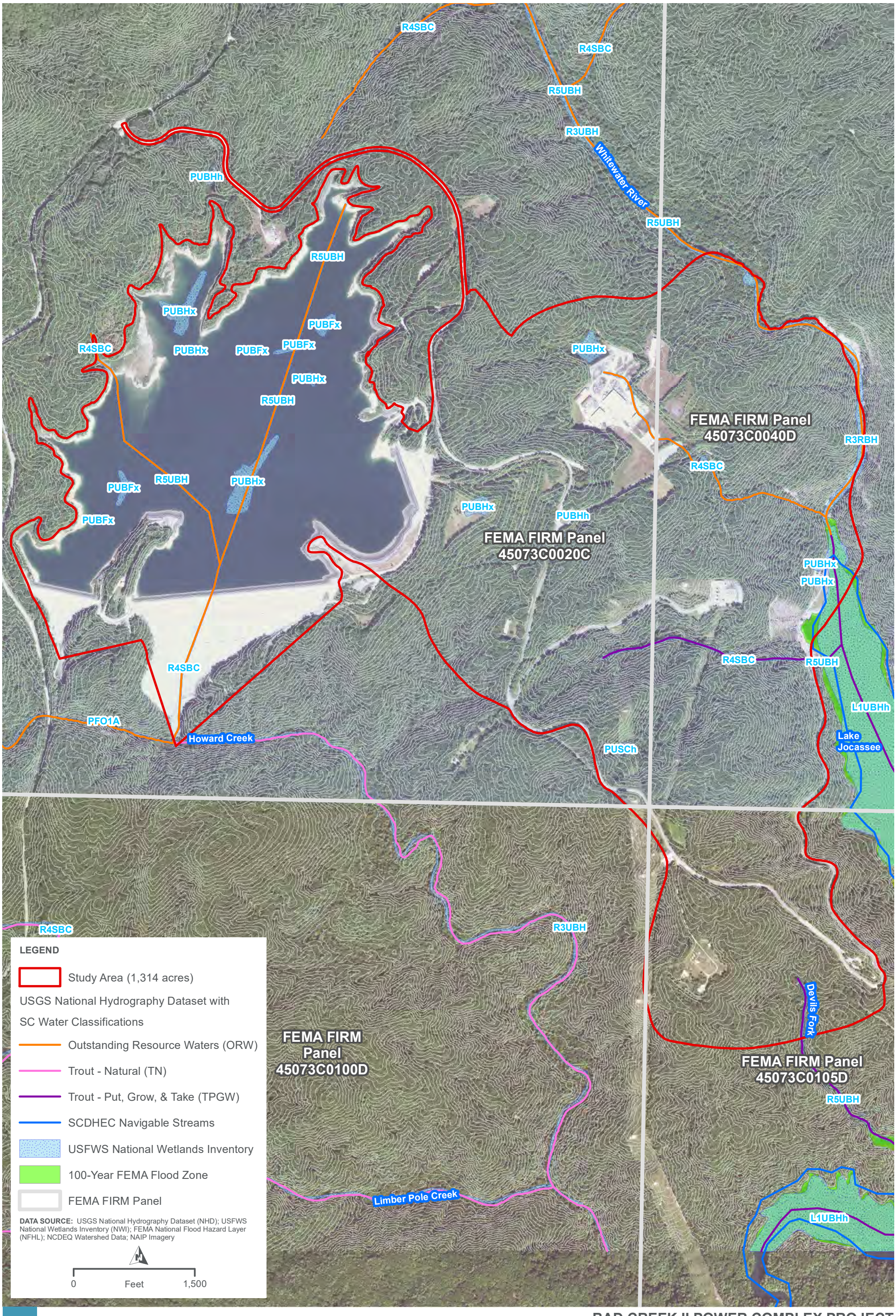
DATA SOURCE: USGS Protected Areas Database; SCDNR Protected Lands Database

0 Feet 2,500

BAD CREEK II POWER COMPLEX PROJECT

MANAGED AREAS

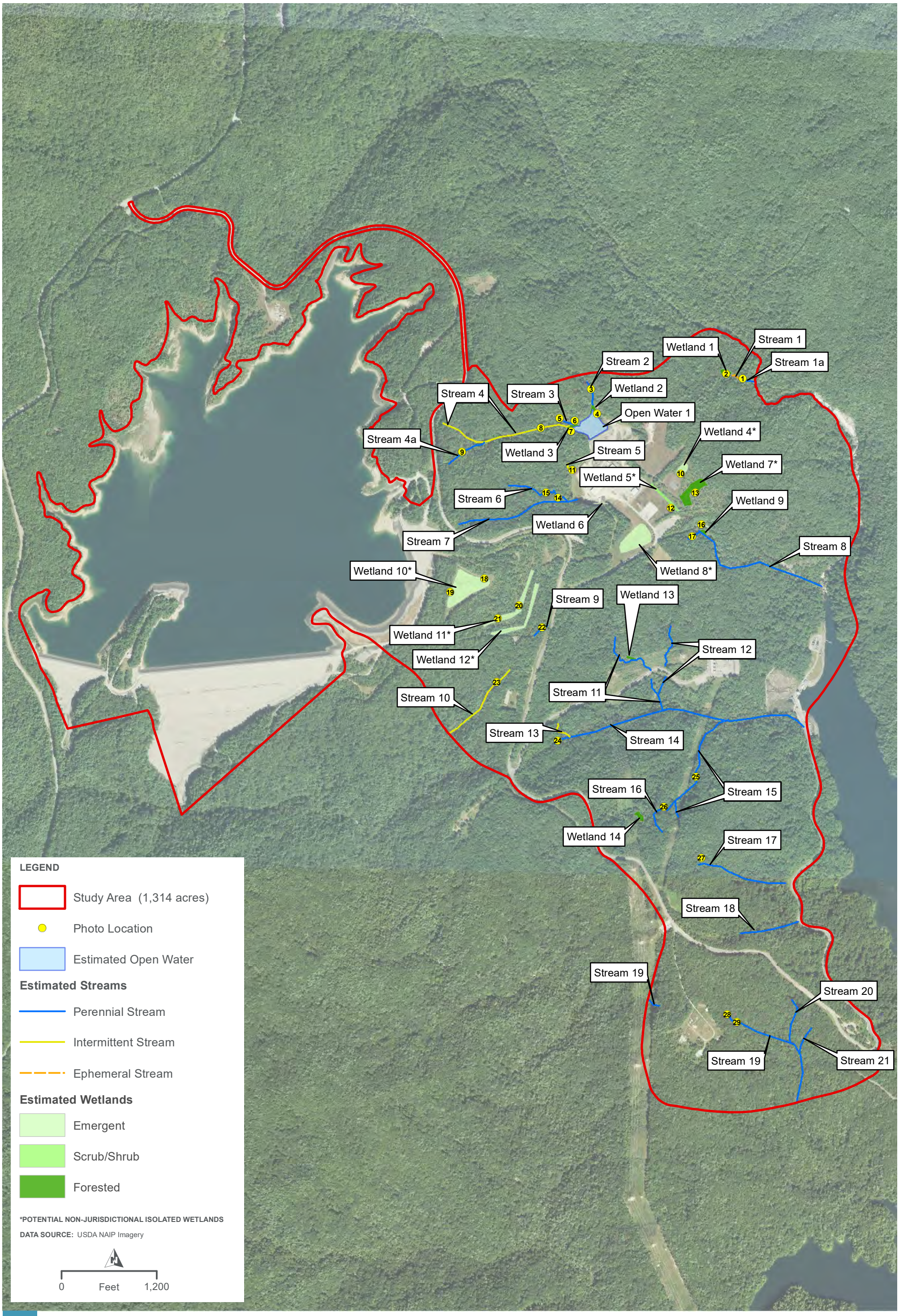
FIGURE 7



BAD CREEK II POWER COMPLEX PROJECT

USGS NATIONAL HYDROGRAPHY DATASET, USFWS NATIONAL WETLANDS INVENTORY, AND FEMA FLOOD ZONES

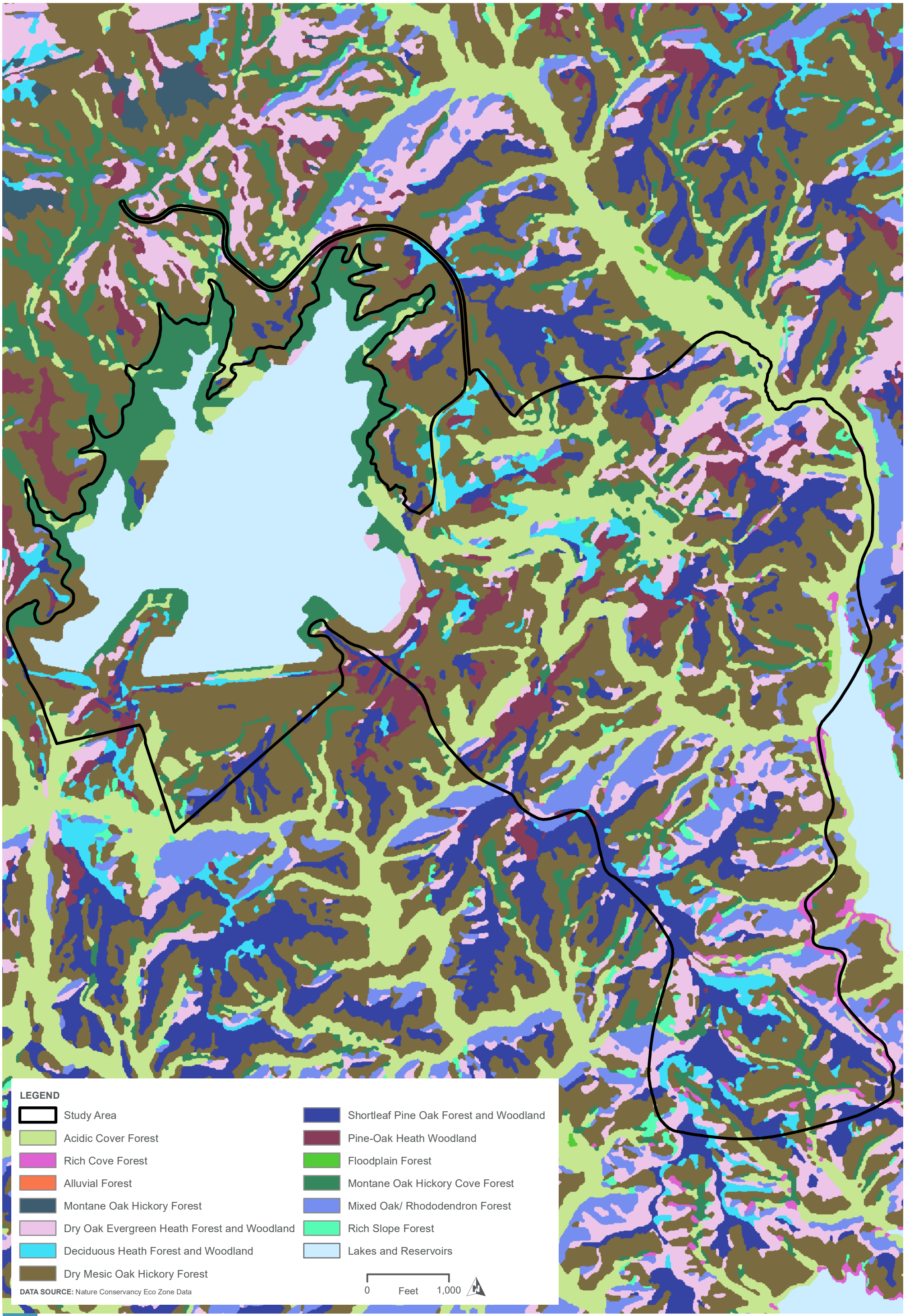
FIGURE 8



BAD CREEK II POWER COMPLEX PROJECT

ESTIMATED WETLANDS AND SURFACE WATERS

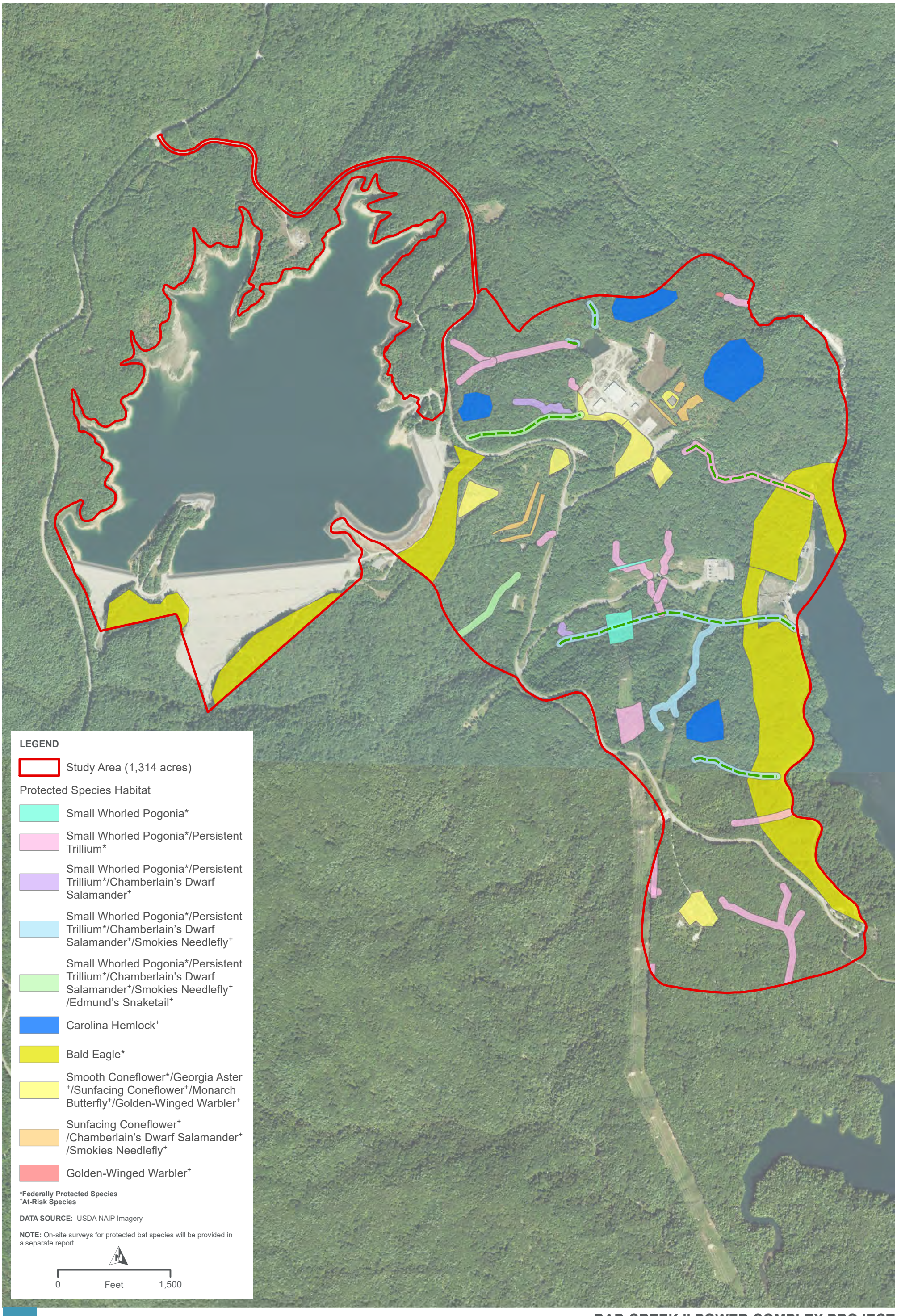
FIGURE 9



BAD CREEK II POWER COMPLEX PROJECT

SOUTHERN BLUE RIDGE ESCARPMENT ECO ZONES

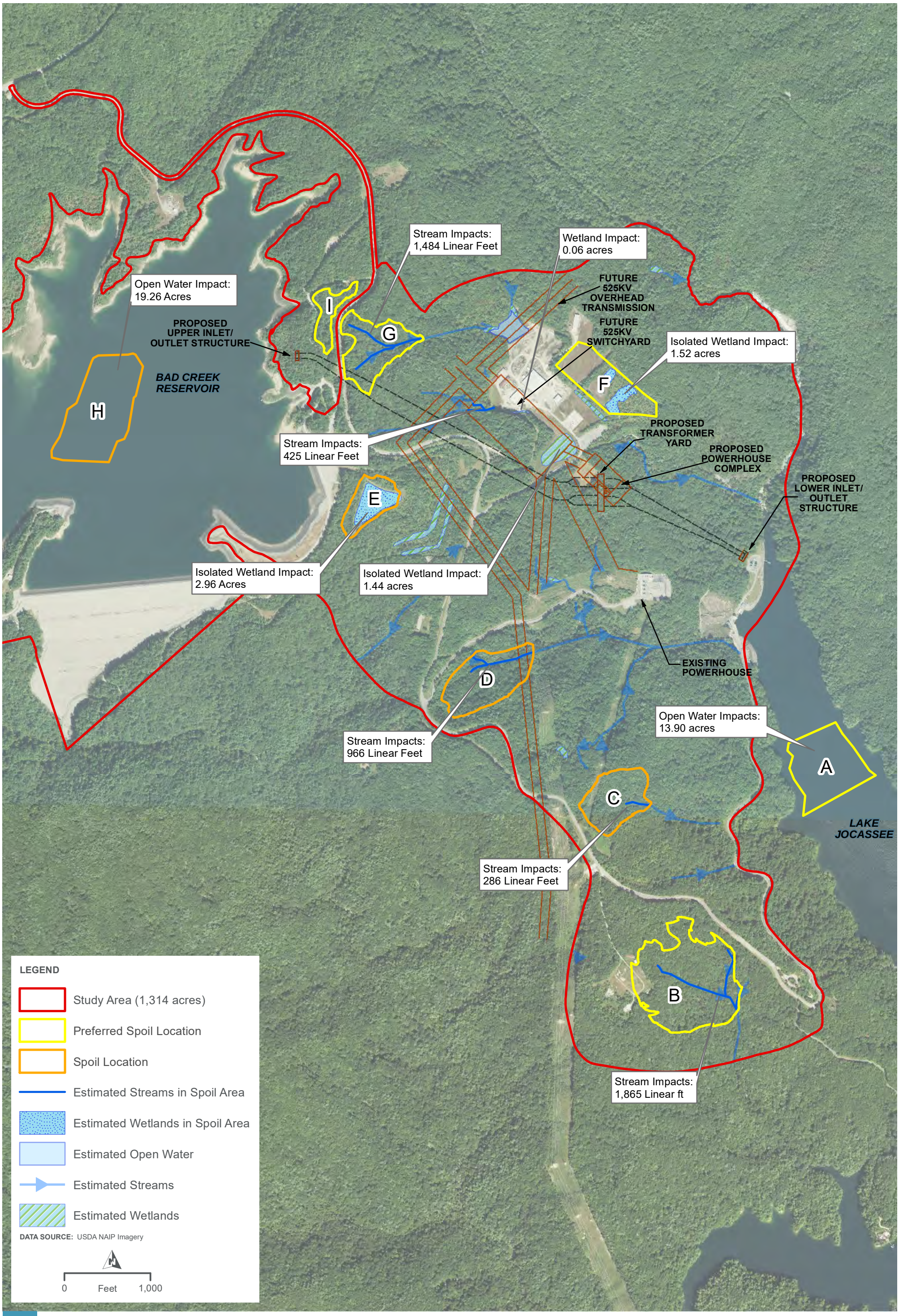
FIGURE 10



BAD CREEK II POWER COMPLEX PROJECT

PROTECTED SPECIES HABITAT

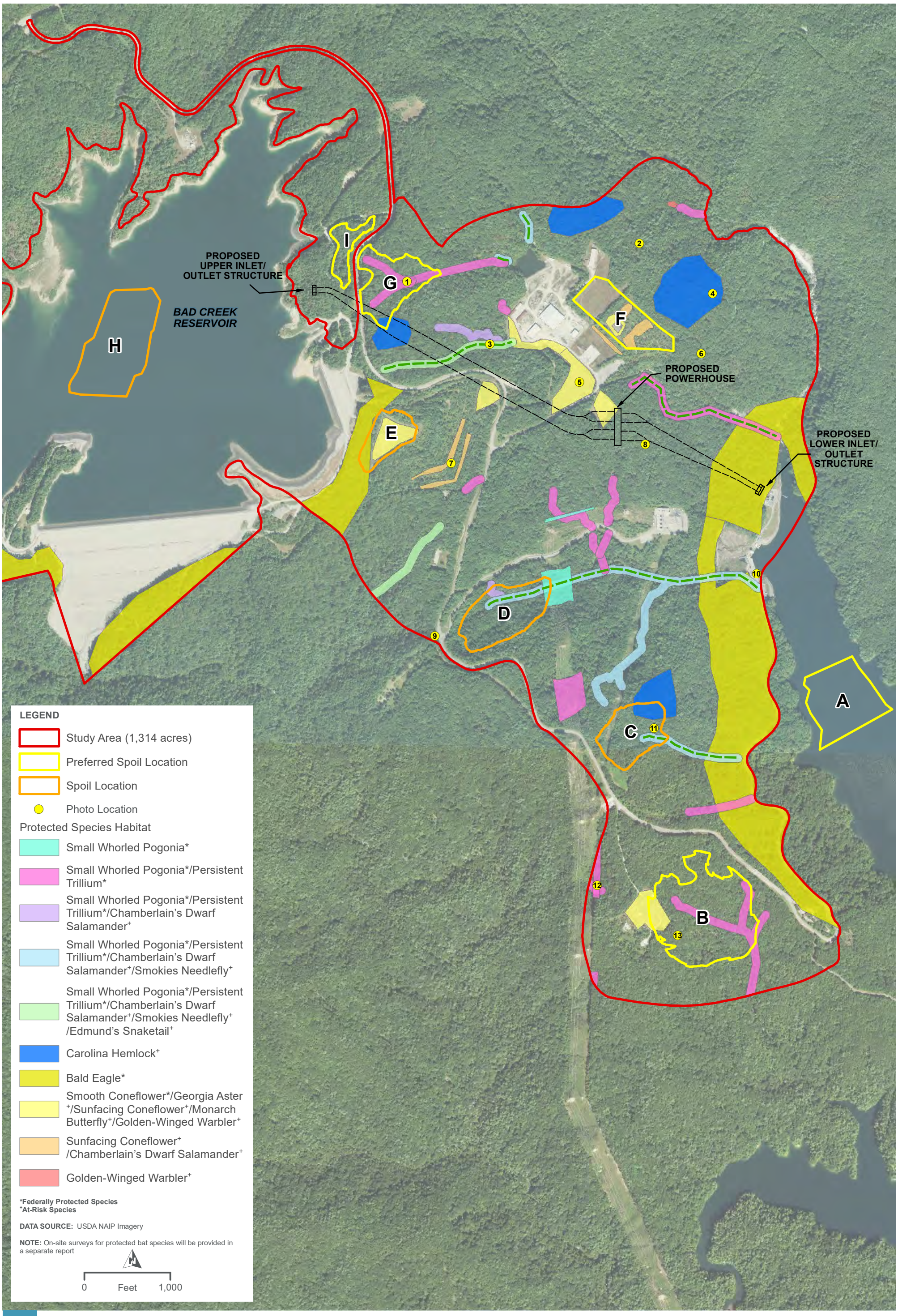
FIGURE 11



BAD CREEK II POWER COMPLEX PROJECT

POTENTIAL SURFACE WATER IMPACTS

FIGURE 12



BAD CREEK II POWER COMPLEX PROJECT

POTENTIAL PROTECTED SPECIES HABITAT IMPACTS

FIGURE 13

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Appendix B

IPaC Resources List

SCDNR Threatened and Endangered Species Consultation Report

SC List of At-Risk, Candidate, Endangered, and Threatened Species for Oconee County

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Carolina Ecological Services
176 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558
Phone: (843) 727-4707 Fax: (843) 727-4218
http://www.fws.gov/charleston/

In Reply Refer To: July 20, 2020
Consultation Code: 04ES1000-2020-SLI-1100
Event Code: 04ES1000-2020-E-02360
Project Name: Duke Energy - Bad Creek II Power Complex

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

South Carolina Ecological Services
176 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558
(843) 727-4707

Project Summary

Consultation Code: 04ES1000-2020-SLI-1100

Event Code: 04ES1000-2020-E-02360

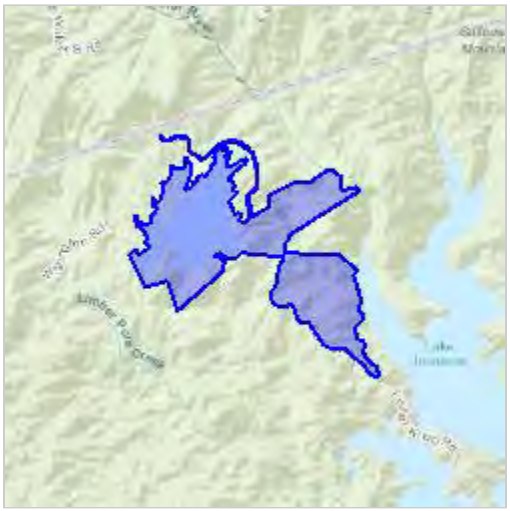
Project Name: Duke Energy - Bad Creek II Power Complex

Project Type: POWER GENERATION

Project Description: Bad Creek 2nd powerhouse pre-feasibility study

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/35.00843986905171N83.02015612505807W



Counties: Oconee, SC

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Flowering Plants

NAME	STATUS
Persistent Trillium *Trillium persistens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3583	Endangered
Small Whorled Pogonia *Isotria medeoloides* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1890	Threatened
Smooth Coneflower *Echinacea laevigata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3473	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Aug 31
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31

NAME	BREEDING SEASON
Canada Warbler *Cardellina canadensis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Cerulean Warbler *Dendroica cerulea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 27 to Jul 20
Eastern Whip-poor-will *Antrostomus vociferus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Golden-winged Warbler *Vermivora chrysoptera* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8745	Breeds May 1 to Jul 20
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31
Yellow-bellied Sapsucker *sphyrapicus varius* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8792	Breeds May 10 to Jul 15

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ “Proper Interpretation and Use of Your Migratory Bird Report” before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

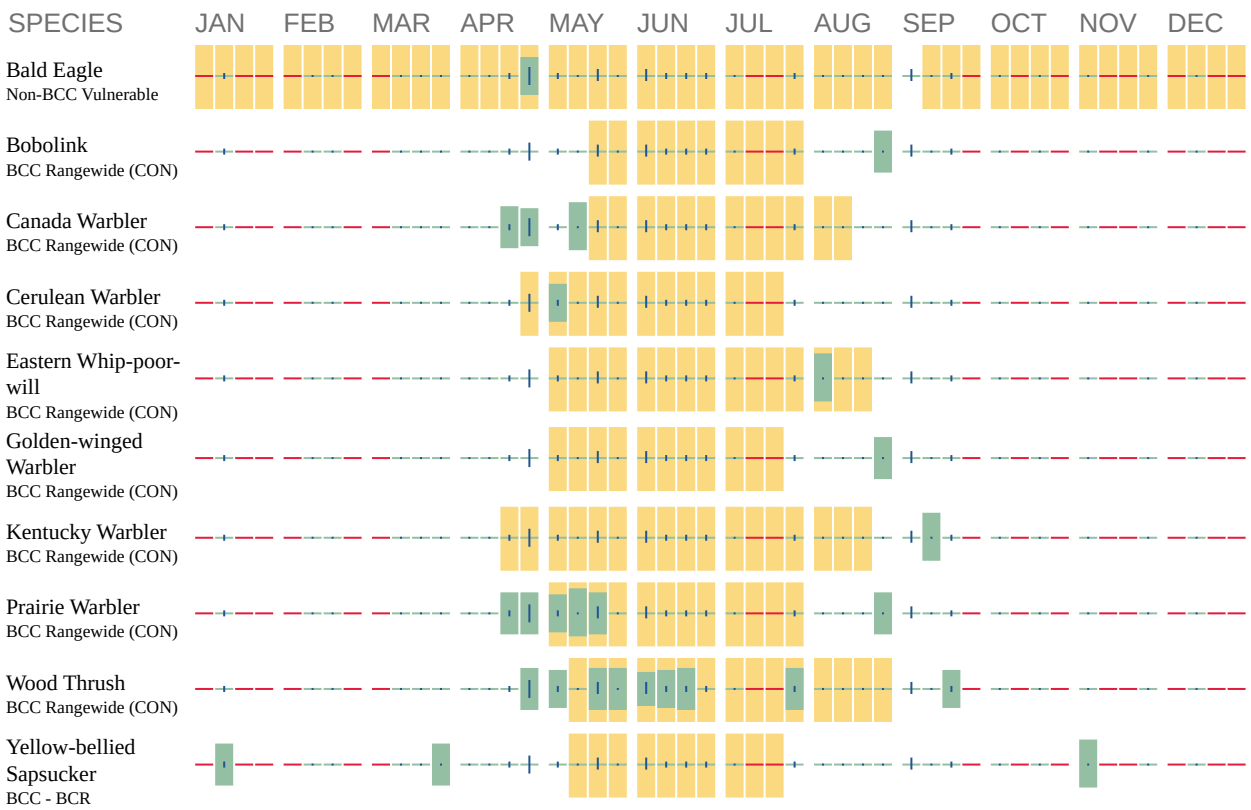
1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.
Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or

permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?
The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ “What does IPaC use to generate the migratory birds potentially occurring in my specified location”. Please be aware this report provides the “probability of presence” of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In

contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ “Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds” at the bottom of your migratory bird trust resources page.

South Carolina Department of

Natural Resources

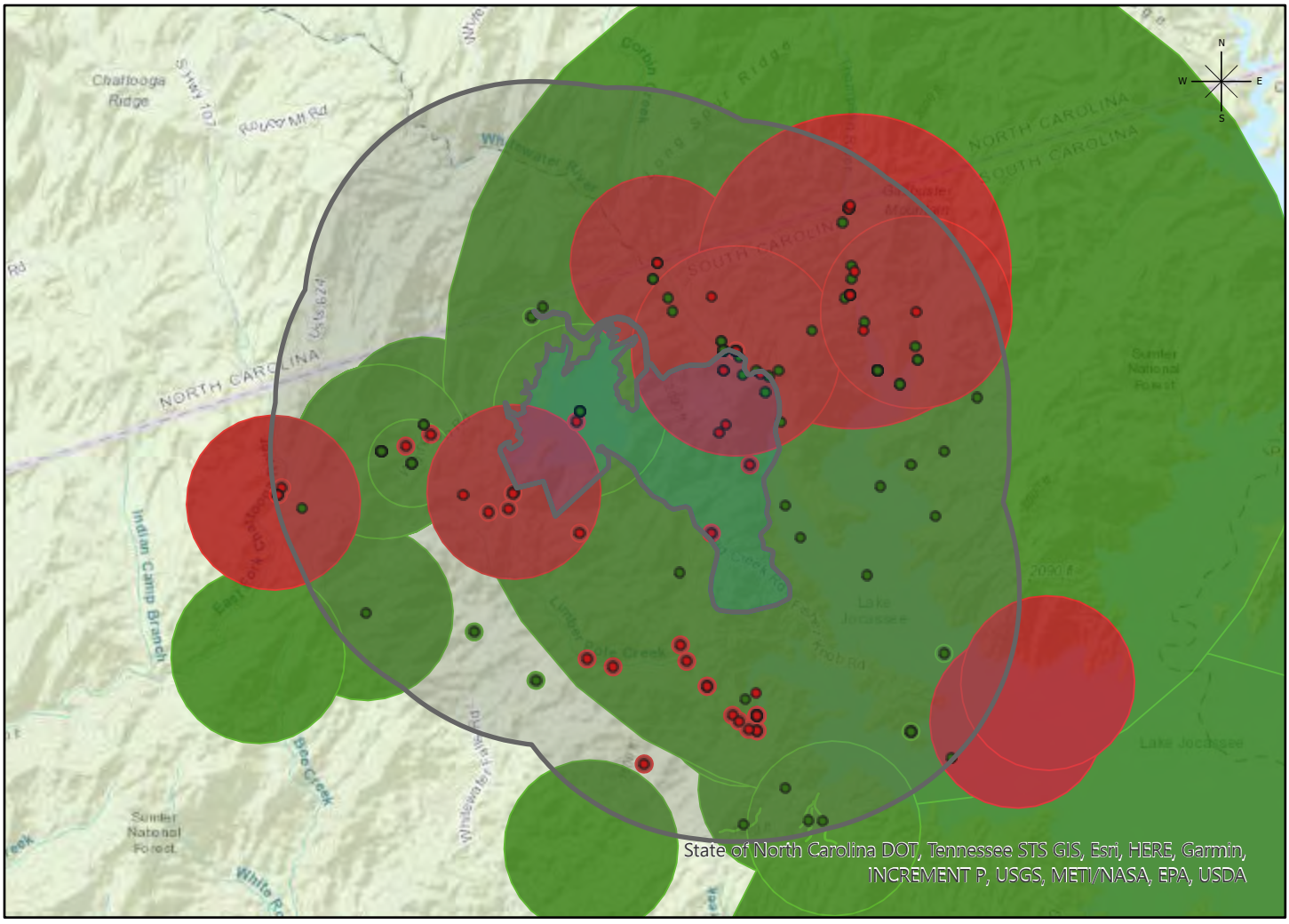
PO Box 167
Columbia, SC 29202
(803) 734-1396
speciesreview@dnr.sc.gov

Robert H. Boyles, Jr.
Director
Emily C. Cope
Deputy Director for
Wildlife and Freshwater Fisheries

Requested on Tuesday, September 14, 2021 by *Eric Mularski*.

Re: Request for Threatened and Endangered Species Consultation
HDR - Bad Creek II Power Complex
Underground Utility Line (Rehab/Repair)
Oconee County, South Carolina

The South Carolina Department of Natural Resources (SCDNR) has received your request for threatened and endangered species consultation of the above named project in Oconee County, South Carolina. The following map depicts the project area and a 2 mile buffer surrounding:



South Carolina Department of
Natural Resources

Robert H. Boyles, Jr.
Director
Emily C. Cope
Deputy Director for
Wildlife and Freshwater Fisheries

This report includes the following items:
A - A report for species which intersect the project area
B - A report for species which intersect the buffer around the project area
C - A list of best management practices relevant to species near to or within the project area
D - A list of best management practices relevant to the project type
E - Instructions to submit new species observation records to the SC Natural Heritage Program

The technical comments outlined in this report are submitted to speak to the general impacts of the activities as described through inquiry by parties outside the South Carolina Department of Natural Resources. These technical comments are submitted as guidance to be considered and are not submitted as final agency comments that might be related to any unspecified local, state or federal permit, certification or license applications that may be needed by any applicant or their contractors, consultants or agents presently under review or not yet made available for public review. In accordance with its policy 600.01, Comments on Projects Under Department Review, the South Carolina Department of Natural Resources, reserves the right to comment on any permit, certification or license application that may be published by any regulatory agency which may incorporate, directly or by reference, these technical comments.

Interested parties are to understand that SCDNR may provide a final agency position to regulatory agencies if any local, state or federal permit, certification or license applications may be needed by any applicant or their contractors, consultants or agents. For further information regarding comments and input from SCDNR on your project, please contact our Office of Environmental Programs by emailing environmental@dnr.sc.gov or by visiting www.dnr.sc.gov/environmental. Pursuant to Section 7 of the Endangered Species Act, requests for formal letters of concurrence with regards to federally listed species should be directed to the USFWS.

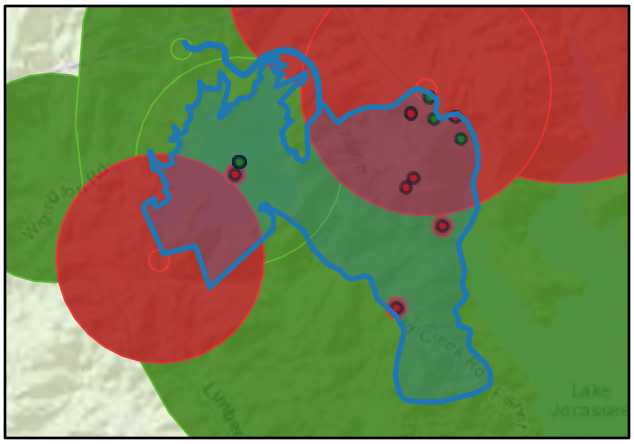
Should you have any questions or need more information, please do not hesitate to contact our office by email at speciesreview@dnr.sc.gov or by phone at 803-734-1396.

Sincerely,

Joseph Lemeris, Jr.
Heritage Trust Program
SC Department of Natural Resources

A. Project Area - Species Report (1 of 2)

There are 45 tracked species records found within the project foot print. The following table outlines occurrences found within the project footprint (if any), sorted by listing status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found on site may be listed in this table but are not represented on the map. Please contact speciesreview@dnr.sc.gov should you have further questions related to sensitive species found within the project area.

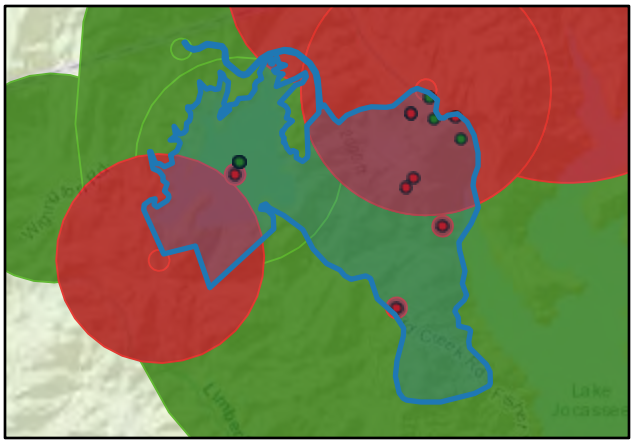


Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority
Tsuga caroliniana	Carolina Hemlock	G2G3	S2	ARS: At-Risk Species	Not Applicable	Not Applicable
Myotis septentrionalis	Northern Long-eared Bat	G1G2	S1	LT: Federally Threatened	Not Applicable	Highest
Agapetus jocassee	a saddlecase caddisfly	G2G3	SNR	Not Applicable	Not Applicable	Not Applicable
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate
Asplenium rhizophyllum	Walking Fern	G5	S2	Not Applicable	Not Applicable	Not Applicable
Betula alleghaniensis	Yellow Birch	G5	S1	Not Applicable	Not Applicable	Moderate
Carex austrocaroliniana	South Carolina Sedge	G4	S3	Not Applicable	Not Applicable	Not Applicable
Carex biltmoreana	Biltmore Sedge	G3	S1	Not Applicable	Not Applicable	High
Carex manhartii	Blue Ridge Purple Sedge, Manhart's Sedge	G3G4	S2	Not Applicable	Not Applicable	Moderate
Caulophyllum thalictroides	Common Blue Cohosh, Green Vivian	G5	S2	Not Applicable	Not Applicable	Not Applicable
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High
Circaea canadensis	Canada Enchanter's-nightshade	G5	S3	Not Applicable	Not Applicable	Not Applicable
Didymoglossum petersii	Dwarf Filmy Fern	G4G5	S2	Not Applicable	Not Applicable	Not Applicable
Diphylleia cymosa	Umbrella-leaf, Pixie-parasol	G4	S2	Not Applicable	Not Applicable	Not Applicable
Fothergilla major	Large Witch-alder	G3	S2	Not Applicable	Not Applicable	High
Heuchera parviflora var. parviflora	Cumberland Grotto Alumroot	G4T4	S2	Not Applicable	Not Applicable	Not Applicable
Juncus subcaudatus	Somewhat-tailed Rush	G5	S1	Not Applicable	Not Applicable	Moderate
Lygodium palmatum	American Climbing Fern, Hartford Fern	G4	S3	Not Applicable	Not Applicable	Not Applicable
Lysimachia fraseri	Fraser's Loosestrife	G3	S3	Not Applicable	Not Applicable	High
Micrasema rickeri	A Caddisfly	G3	SNR	Not Applicable	Not Applicable	Not Applicable
Neotoma floridana haematoreia	Southern Appalachian Woodrat	G5T4Q	S3S4	Not Applicable	Not Applicable	Not Applicable
Ophioglossum pycnostichum	Southern Adder's-tongue	G5	S2	Not Applicable	Not Applicable	Not Applicable
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High
Platanthera psycodes	Small Purple Fringed Orchid, Butterfly Orchid	G5	SH	Not Applicable	Not Applicable	Not Applicable
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhyacophila amicis	Friendly Free-living Caddisfly	G2	SNR	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Smilax biltmoreana	Biltmore Carrionflower	G4	S2	Not Applicable	Not Applicable	Not Applicable
Sorex hoyi	American Pygmy Shrew	G5	S3	Not Applicable	Not Applicable	Moderate

A. Project Area - Species Report (2 of 2)

There are 45 tracked species records found within the project foot print. The following table outlines occurrences found within the project footprint (if any), sorted by listing status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found on site may be listed in this table but are not represented on the map. Please contact speciesreview@dnr.sc.gov should you have further questions related to sensitive species found within the project area.

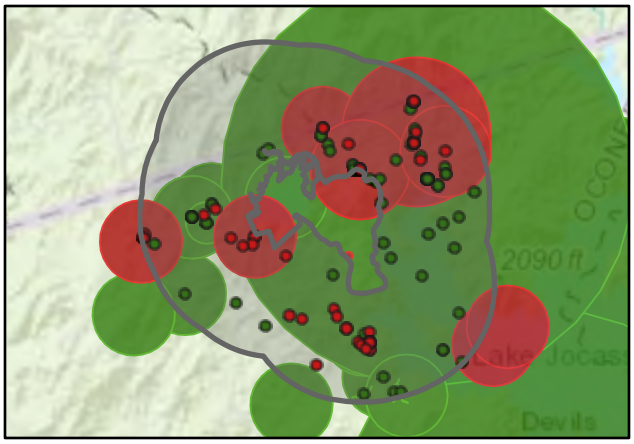


Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, NGA, EPA, USDA

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Helicopsyche paralimnella	a snailcase caddisfly	G2	SNR	Not Applicable	Not Applicable	Not Applicable	2018-01-20
Oxyethira sininsigne	an oxyethiran microcaddisfly	G3G4	SNR	Not Applicable	Not Applicable	Not Applicable	2017-06-12
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3G4	S2	Not Applicable	SE: State Endangered	Highest	1992-07-30
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3G4	S2	Not Applicable	SE: State Endangered	Highest	1992-07-27
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3G4	S2	Not Applicable	SE: State Endangered	Highest	1992-07-26

B. Buffer Area - Species Report (1 of 5)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

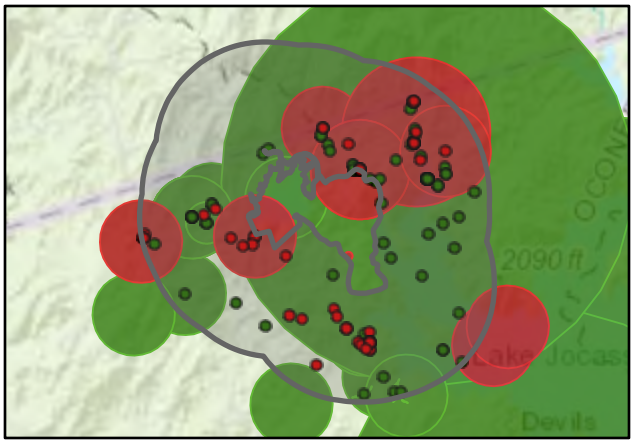


Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status
Tsuga caroliniana	Carolina Hemlock	G2G3	S2	ARS: At-Risk Species	Not Applicable
Echinacea laevigata	Smooth Purple Coneflower	G2G3	S3	LE: Federally Endangered	Not Applicable
Alosa aestivalis	Blueback Herring	G3G4	S5	Not Applicable	Not Applicable
Boykinia aconitifolia	Brook-saxifrage, Aconite-saxifrage, Eastern Boykinia, Allegheny Brookfoam	G4	S2	Not Applicable	Not Applicable
Cambarus chaugaensis	Chauga Crayfish	G2	S2S3	Not Applicable	Not Applicable
Cambarus chaugaensis	Chauga Crayfish	G2	S2S3	Not Applicable	Not Applicable
Cambarus chaugaensis	Chauga Crayfish	G2	S2S3	Not Applicable	Not Applicable
Carex biltmoreana	Biltmore Sedge	G3	S1	Not Applicable	Not Applicable
Carex bushii	Bush's Sedge	G4	S1	Not Applicable	Not Applicable
Carex manhartii	Blue Ridge Purple Sedge, Manhart's Sedge	G3G4	S2	Not Applicable	Not Applicable
Carex manhartii	Blue Ridge Purple Sedge, Manhart's Sedge	G3G4	S2	Not Applicable	Not Applicable
Carex prasina	Drooping Sedge	G4	S2	Not Applicable	Not Applicable
Castilleja coccinea	Eastern Indian-paintbrush	G5	S2	Not Applicable	Not Applicable
Caulophyllum thalictroides	Common Blue Cohosh, Green Vivian	G5	S2	Not Applicable	Not Applicable
Caulophyllum thalictroides	Common Blue Cohosh, Green Vivian	G5	S2	Not Applicable	Not Applicable
Caulophyllum thalictroides	Common Blue Cohosh, Green Vivian	G5	S2	Not Applicable	Not Applicable
Circaea canadensis	Canada Enchanter's-nightshade	G5	S3	Not Applicable	Not Applicable
Didymoglossum petersii	Dwarf Filmy Fern	G4G5	S2	Not Applicable	Not Applicable
Etheostoma zonale	Banded Darter	G5	SX	Not Applicable	Not Applicable
Gaylussacia baccata	Black Huckleberry, Crackleberry	G5	S1	Not Applicable	Not Applicable
Heuchera parviflora var. parviflora	Cumberland Grotto Alumroot	G4T4	S2	Not Applicable	Not Applicable
Heuchera parviflora var. parviflora	Cumberland Grotto Alumroot	G4T4	S2	Not Applicable	Not Applicable
Heuchera parviflora var. parviflora	Cumberland Grotto Alumroot	G4T4	S2	Not Applicable	Not Applicable
Juglans cinerea	Butternut, White Walnut	G3	S2	Not Applicable	Not Applicable
Juglans cinerea	Butternut, White Walnut	G3	S2	Not Applicable	Not Applicable
Juglans cinerea	Butternut, White Walnut	G3	S2	Not Applicable	Not Applicable
Lygodium palmatum	American Climbing Fern, Hartford Fern	G4	S3	Not Applicable	Not Applicable
Lygodium palmatum	American Climbing Fern, Hartford Fern	G4	S3	Not Applicable	Not Applicable
Micranthes micranthidifolia	Branch-lettuce	G5	S2	Not Applicable	Not Applicable
Micrasema rickeri	A Caddisfly	G3	SNR	Not Applicable	Not Applicable
Micropterus sp. 1 (Savannah)	Bartram's Bass	GNR	S1	Not Applicable	Not Applicable
Monotropsis odorata	Appalachian Pigmy Pipes	G3	S2	Not Applicable	Not Applicable
Myodes gapperi carolinensis	Carolina Red-backed Vole	G5T4	S2	Not Applicable	Not Applicable
Osmorhiza claytonii	Bland Sweet Cicely, Hairy Sweet Cicely	G5	S2	Not Applicable	Not Applicable
Pycnanthemum montanum	Appalachian Mountain-mint	G3G5	S3	Not Applicable	Not Applicable
Salvelinus fontinalis	Brook Trout	G5	S2S3	Not Applicable	Not Applicable
Salvelinus fontinalis	Brook Trout	G5	S2S3	Not Applicable	Not Applicable
Smilax biltmoreana	Biltmore Carrionflower	G4	S2	Not Applicable	Not Applicable

B. Buffer Area - Species Report (2 of 5)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

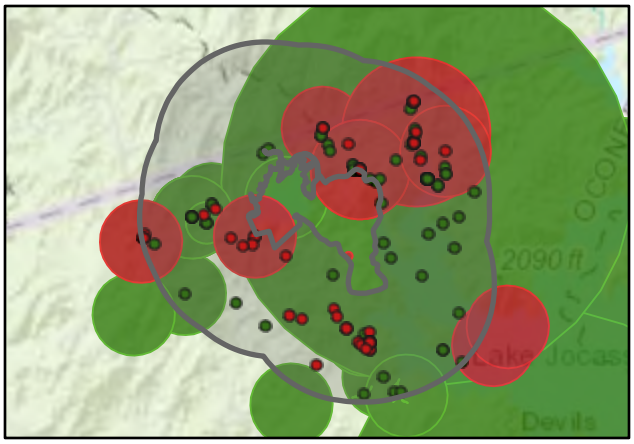


Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Ameiurus platycephalus	Flat Bullhead	G4	S4	Not Applicable	Not Applicable	Moderate	1977-10-19
Ameiurus platycephalus	Flat Bullhead	G4	S4	Not Applicable	Not Applicable	Moderate	1970-12-02
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest	1983-01-01
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest	1953
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest	1953
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest	1991-10-19
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest	2016-5-21
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest	2016-6-3
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest	2016-6-3
Aneides aeneus	Green Salamander	G3G4	S1	Not Applicable	Not Applicable	Highest	2016-6-17
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1980
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1980
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1995-08-09
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1980
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1994-08-19
Cottus bairdii	Mottled Sculpin	G5	S3	Not Applicable	Not Applicable	High	1962-07-10
Cottus bairdii	Mottled Sculpin	G5	S3	Not Applicable	Not Applicable	High	1970-12-02
Cypripedium parviflorum var. pubescens	Large Yellow Lady's-slipper, Whippoorwill Shoes	G5T5	S3	Not Applicable	Not Applicable	Not Applicable	1998
Dryopteris intermedia	Fancy Fern, Evergreen Woodfern	G5	S2	Not Applicable	Not Applicable	Not Applicable	1991-07-07
Fothergilla major	Large Witch-alder	G3	S2	Not Applicable	Not Applicable	High	1973-06-10
Fothergilla major	Large Witch-alder	G3	S2	Not Applicable	Not Applicable	High	1991-07-07
Lysimachia fraseri	Fraser’s Loosestrife	G3	S3	Not Applicable	Not Applicable	High	1973
Lysimachia fraseri	Fraser’s Loosestrife	G3	S3	Not Applicable	Not Applicable	High	1998-06-10
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1973
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1973-05-26
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1991-07-07
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1998
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	2013-06-18
Plagiochila caduciloba	Gorge Leafy Liverwort	G3	S2	Not Applicable	Not Applicable	High	1958-08-23
Plagiochila caduciloba	Gorge Leafy Liverwort	G3	S2	Not Applicable	Not Applicable	High	1994
Plagiochila caduciloba	Gorge Leafy Liverwort	G3	S2	Not Applicable	Not Applicable	High	1994
Plagiomnium carolinianum	Mountain Wavy-leaf Moss	G3	S2	Not Applicable	Not Applicable	High	1987-10-29
Plagiomnium carolinianum	Mountain Wavy-leaf Moss	G3	S2	Not Applicable	Not Applicable	High	1994-08-21
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1973-05-22
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1988-10-11
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1986-01-13
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1991-10-07
Rhyacophila amicis	Friendly Free-living Caddisfly	G2	SNR	Not Applicable	Not Applicable	Not Applicable	2018-01-20

B. Buffer Area - Species Report (3 of 5)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

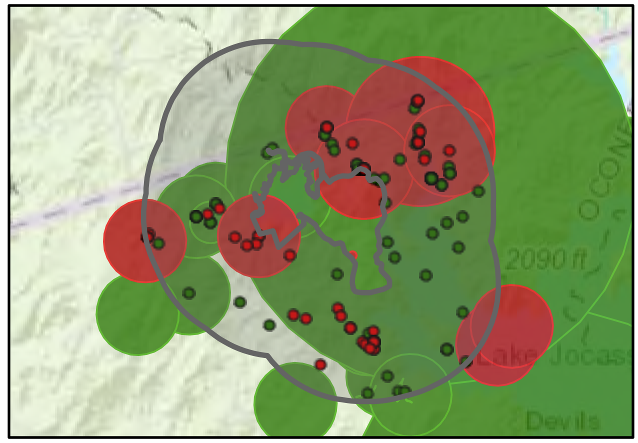


Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1986-02-06
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1977-10-19
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1984-12-10
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	1985-04
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	2006-08-26
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	1987-06-01
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	1947-06-02
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	2006-08-27
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	2006-08-27
Carex austrocaroliniana	South Carolina Sedge	G4	S3	Not Applicable	Not Applicable	Not Applicable	1950-06-06
Carex austrocaroliniana	South Carolina Sedge	G4	S3	Not Applicable	Not Applicable	Not Applicable	1984-04-12
Carex tonsa	Shaved Sedge	G5	S2	Not Applicable	Not Applicable	Not Applicable	2011-05-16
Galearis spectabilis	Showy Orchis	G5	S3	Not Applicable	Not Applicable	Not Applicable	1991-07-07
Hepatica acutiloba	Sharp-lobed Hepatica, Sharp-lobed Liverleaf	G5T5	S3	Not Applicable	Not Applicable	Not Applicable	1998
Hybopsis rubrifrons	Rosyface Chub	G4	S4	Not Applicable	Not Applicable	Moderate	1962-07-10
Hybopsis rubrifrons	Rosyface Chub	G4	S4	Not Applicable	Not Applicable	Moderate	1970-12-02
Isotrema macrophyllum	Pipevine, Dutchman's-pipe	G5	S2	Not Applicable	Not Applicable	Not Applicable	1973-01-01
Isotrema macrophyllum	Pipevine, Dutchman's-pipe	G5	S2	Not Applicable	Not Applicable	Not Applicable	1985-04-30
Isotrema macrophyllum	Pipevine, Dutchman's-pipe	G5	S2	Not Applicable	Not Applicable	Not Applicable	1991-07-07
Juncus gymnocarpus	Seep Rush	G4	S3	Not Applicable	Not Applicable	Not Applicable	1973-01-01
Juncus gymnocarpus	Seep Rush	G4	S3	Not Applicable	Not Applicable	Not Applicable	1987-06-22
Juncus subcaudatus	Somewhat-tailed Rush	G5	S1	Not Applicable	Not Applicable	Moderate	1956-09-02
Juncus subcaudatus	Somewhat-tailed Rush	G5	S1	Not Applicable	Not Applicable	Moderate	1956-09-02
Neotoma floridana haematoreia	Southern Appalachian Woodrat	G5T4Q	S3S4	Not Applicable	Not Applicable	Not Applicable	1993-11-13
Neotoma floridana haematoreia	Southern Appalachian Woodrat	G5T4Q	S3S4	Not Applicable	Not Applicable	Not Applicable	1954-03
Nocomis micropogon	River Chub	G5	S3	Not Applicable	Not Applicable	Not Applicable	1977-10-19
Nocomis micropogon	River Chub	G5	S3	Not Applicable	Not Applicable	Not Applicable	1977-10-19
Ophioglossum pycnostichum	Southern Adder's-tongue	G5	S2	Not Applicable	Not Applicable	Not Applicable	1998
Platanthera psycodes	Small Purple Fringed Orchid, Butterfly Orchid	G5	SH	Not Applicable	Not Applicable	Not Applicable	1973-06-09
Rhododendron catawbiense	Pink Laurel, Catawba Rhododendron, Mountain Rosebay	G5	S1	Not Applicable	Not Applicable	Moderate	1991-03-25
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1979
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1952-03-28
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1973-PRE
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1900
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1976-09-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1940-08-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01

B. Buffer Area - Species Report (4 of 5)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

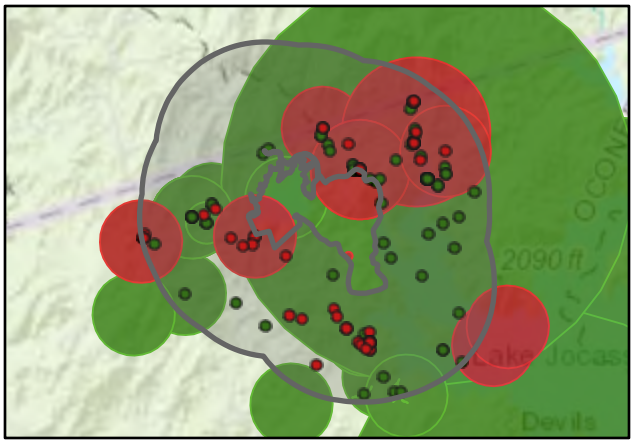


Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority
Asplenium rhizophyllum	Walking Fern	G5	S2	Not Applicable	Not Applicable	Not Applicable
Carex aestivalis	Summer Sedge	G4	S2	Not Applicable	Not Applicable	Not Applicable
Comptonia peregrina	Sweet-fern	G5	S1	Not Applicable	Not Applicable	Moderate
Diphylleia cymosa	Umbrella-leaf, Pixie-parasol	G4	S2	Not Applicable	Not Applicable	Not Applicable
Diphylleia cymosa	Umbrella-leaf, Pixie-parasol	G4	S2	Not Applicable	Not Applicable	Not Applicable
Etheostoma inscriptum	Turquoise Darter	G4	S2S3	Not Applicable	Not Applicable	High
Gaultheria procumbens	Teaberry, Wintergreen, Checkerberry	G5	S3	Not Applicable	Not Applicable	Not Applicable
Gaultheria procumbens	Teaberry, Wintergreen, Checkerberry	G5	S3	Not Applicable	Not Applicable	Not Applicable
Luxilus coccogenis	Warpaint Shiner	G5	S3	Not Applicable	Not Applicable	Moderate
Luxilus coccogenis	Warpaint Shiner	G5	S3	Not Applicable	Not Applicable	Moderate
Notropis leuciodus	Tennessee Shiner	G5	S3	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Trautvetteria caroliniensis	Tassel-rue, False Bugbane	G5	S3	Not Applicable	Not Applicable	Not Applicable
Triphora trianthophoros var. trianthophoros	Three Birds Orchid, Nodding Pogonia, Nodding Ettercap	G4?T4?	S2	Not Applicable	Not Applicable	Moderate

B. Buffer Area - Species Report (5 of 5)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

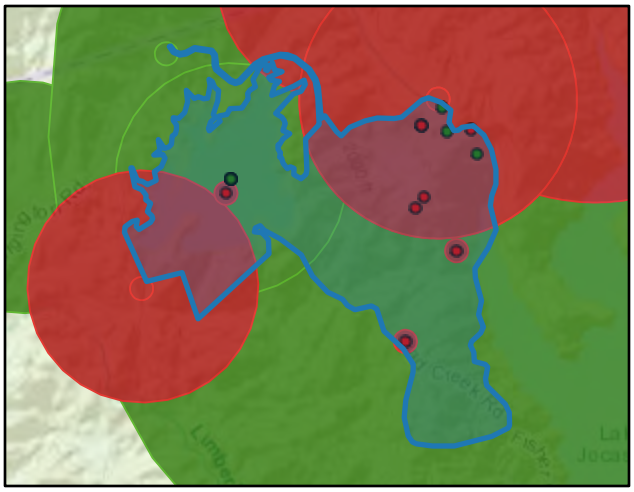


Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Agapetus jocassee	a saddlecase caddisfly	G2G3	SNR	Not Applicable	Not Applicable	Not Applicable	1986-06-11
Betula alleghaniensis	Yellow Birch	G5	S1	Not Applicable	Not Applicable	Moderate	1979
Cyprinella galactura	Whitetail Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1976-05-27
Cyprinella galactura	Whitetail Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1977-10-10
Dicentra eximia	Wild Bleeding Heart	G4	S1	Not Applicable	Not Applicable	Moderate	1981-08-11
Helicopsyche paralimnella	a snailcase caddisfly	G2	SNR	Not Applicable	Not Applicable	Not Applicable	2018-01-20
Lithobates sylvaticus	Wood Frog	G5	S3	Not Applicable	Not Applicable	High	1995-01-21
Oxyethira sininsigne	an oxyethiran microcaddisfly	G3G4	SNR	Not Applicable	Not Applicable	Not Applicable	2017-06-12
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1977-08-25
Wormaldia oconee	a caddisfly	G1G2	SNR	Not Applicable	Not Applicable	Not Applicable	1987-07-20

C. Species Best Management Practices (1 of 1)

SCDNR offers the following comments and best management practices (BMPs) regarding this project's potential impacts to species of concern which may be found on or near to the project area. Please contact speciesreview@dnr.sc.gov should you have further questions with regard to survey methods, consultation, or other species-related concerns.



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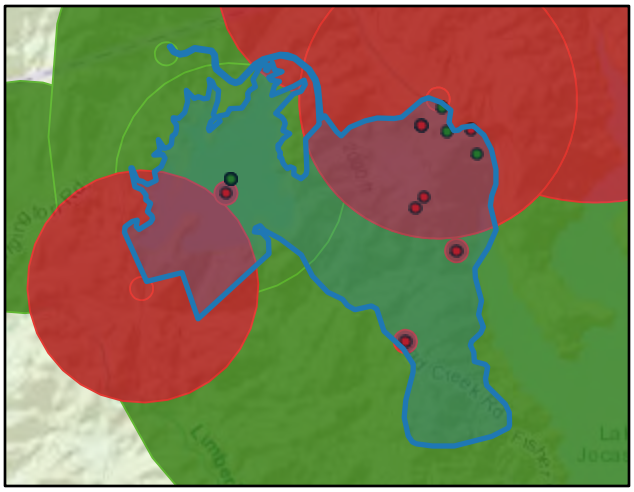
The SCDNR recommends that water construction-related activities such as dredging or piling installation be avoided during the months of February through April to limit disturbance to american shad, hickory shad, or blueback herring migrations that occur during this time.
Smooth coneflower is a federally endangered flowering plant species and are typically found in open woods, roadsides, clearcuts, and power line rights-of-way. Surveys to rule out smooth coneflower within the project footprint is recommended. Should smooth coneflower be found within the project footprint, please consult with the U.S. Fish & Wildlife Service before proceeding with any construction activities.
The Rafinesque's big eared bat is a state endangered South Carolina conservation priority species listed in the state's Wildlife Action Plan. Take of this state listed species is prohibited under S.C. Code of Laws §50-15-30. If this species is found within the project area, the SCDNR recommends an avoidance window of April 1 through August 15 for construction or repair activities. If an avoidance window cannot be observed, the SCDNR recommends that a permanent concrete bat tower installation 200-600 ft from the roost site that has at least six hours of direct sunlight. The tower should be completed at least two months prior to construction or repair activities.
Cavity- and tree-roosting bat species including the federally threatened northern long-eared bat (Myotis septentrionalis), state-endangered Rafinesque's big-eared bat (Corynorhinus rafinesquii), and the federally at-risk tricolored bat (Perimyotis subflavus) have been known to occur in the county of the proposed site. As a conservation measure, it is recommended that any tree clearing activities be conducted during the inactive season for Northern long-eared bat (November 15th through March 31st) to avoid negative impacts to the species. If any of the above species are found on-site, please contact the USFWS and SCDNR.
In the interest of preserving plant diversity, the South Carolina Plant Conservation Alliance performs native plant rescues in order to protect and preserve our diversity of native plants. If you are interested in assisting with this important endeavor please contact Mrs. April Punsalan at (843) 727-4707 ext. 218, or by email: scpca@lists.fws.gov before any development occurs onsite. There may be plants of interest on the project site that the Alliance would like to preserve.
Species in the above table with SWAP priorities of High, Highest or Moderate are designated as having conservation priority under the South Carolina State Wildlife Action Plan (SWAP). SWAP species are those species of greatest conservation need not traditionally covered under any federal funded programs. Species are listed in the SWAP because they are rare or designated as at-risk due to knowledge deficiencies; species common in South Carolina but listed rare or declining elsewhere; or species that serve as indicators of detrimental environmental conditions. SCDNR recommends that appropriate measures should be taken to minimize or avoid impacts to the aforementioned species of concern.

D. Project Best Management Practices (1 of 3)

SCDNR offers the following comments and best management practices (BMPs) regarding this project's potential impacts to natural resources within or surrounding the project area. Please contact our Office of Environmental Programs at environmental@dnr.sc.gov should you have further questions with regard to best management practices related to this project area.



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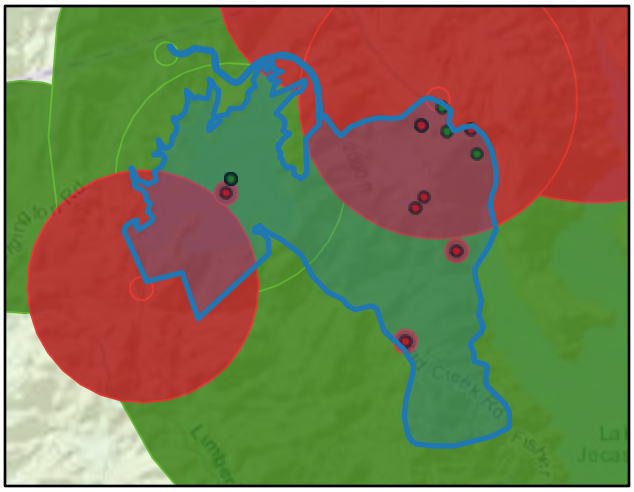
If this project is associated with the Federal Government and the project area is or once was used as farmland, we recommend that consultation occur with the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS) per the Farmland Protection Policy Act; areas of the site are classified as prime farmland or farmland of statewide importance.

- All necessary measures must be taken to prevent oil, tar, trash and other pollutants from entering the adjacent offsite areas/wetlands/ water.
- Once the project is initiated, it must be carried to completion in an expeditious manner to minimize the period of disturbance to the environment.
- Upon project completion, all disturbed areas must be permanently stabilized with vegetative cover (preferable), riprap or other erosion control methods as appropriate.
- The project must be in compliance with any applicable floodplain, stormwater, land disturbance, shoreline management guidance or riparian buffer ordinances.
- Prior to beginning any land disturbing activity, appropriate erosion and siltation control measures (e.g. silt fences or barriers) must be in place and maintained in a functioning capacity until the area is permanently stabilized.
- Materials used for erosion control (e.g., hay bales or straw mulch) will be certified as weed free by the supplier.
- Inspecting and ensuring the maintenance of temporary erosion control measures at least:
  a. on a daily basis in areas of active construction or equipment operation;
  b. on a weekly basis in areas with no construction or equipment operation; and
  c. within 24 hours of each 0.5 inch of rainfall.
- Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts.
- Land disturbing activities must avoid encroachment into any wetland areas (outside the permitted impact area).Wetlands that are unavoidably impacted must be appropriately mitigated.
- Your project may require a Stormwater Permit from the SC Department of Health & Environmental Control, please visit https://www.scdhec.gov/environment/water-quality/stormwater

- If clearing must occur, riparian vegetation within wetlands and waters of the U.S. must be conducted manually and low growing, woody vegetation and shrubs must be left intact to maintain bank stability and reduce erosion.
- Construction activities must avoid and minimize, to the greatest extent practicable, disturbance of woody shoreline vegetation within the project area. Removal of vegetation should be limited to only what is necessary for construction of the proposed structures.
- Where necessary to remove vegetation, supplemental plantings should be installed following completion of the project. These plantings should consist of appropriate native species for this ecoregion.

D. Project Best Management Practices (2 of 3)

SCDNR offers the following comments and best management practices (BMPs) regarding this project's potential impacts to natural resources within or surrounding the project area. Please contact our Office of Environmental Programs at environmental@dnr.sc.gov should you have further questions with regard to best management practices related to this project area.



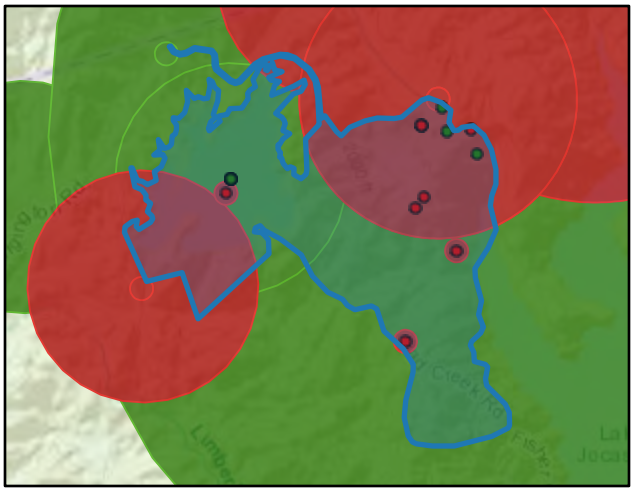
Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, INCREMENT P, USGS, METI/ NASA, NGA, EPA, USDA

- Review of available data, National Hydrography Dataset, indicates that streams or waters of the United States are present within your project area. These areas may require a permit from the U.S. Army Corps of Engineers (USACE), as well as a compensatory mitigation plan. SCDNR advises that you consult with the USACE Regulatory to determine if jurisdictional waters are present and if a permit and mitigation is required for any activities impacting these areas. For more information, please visit their website at www.sac.usace.army.mil/Missions/Regulatory. Additionally, a 401 Water Quality Certification or a State Navigable Waters permit may also be required from the SC Department of Health & Environmental Control. For more information, please visit the following websites:
    - https://www.scdhec.gov/environment/water-quality/water-quality-certification-section-401-clean-water-act
    - https://www.scdhec.gov/environment/water-quality/navigable-waters
- Excavation/Construction activities must not occur during fish spawning season from March through June due to its negative impacts on eggs and reproduction activities.
- If clearing must occur, riparian vegetation within wetlands and waters of the U.S. must be conducted manually and low growing, woody vegetation and shrubs must be left intact to maintain bank stability and reduce erosion.
- Construction activities must avoid and minimize, to the greatest extent practicable, disturbance of woody shoreline vegetation within the project area. Removal of vegetation should be limited to only what is necessary for construction of the proposed structures.
- Where necessary to remove vegetation, supplemental plantings should be installed following completion of the project. These plantings should consist of appropriate native species for this ecoregion.

Your project area includes a FEMA special flood hazard area and may require a permit from the County National Floodplain Insurance Program Manager before impacts occur to aquatic resources and the associated floodplains on site. Please refer to https://www.dnr.sc.gov/water/flood/documents/nfipadmindirectory.pdf to find your appropriate contact information.

D. Project Best Management Practices (3 of 3)

SCDNR offers the following comments and best management practices (BMPs) regarding this project's potential impacts to natural resources within or surrounding the project area. Please contact our Office of Environmental Programs at environmental@dnr.sc.gov should you have further questions with regard to best management practices related to this project area.

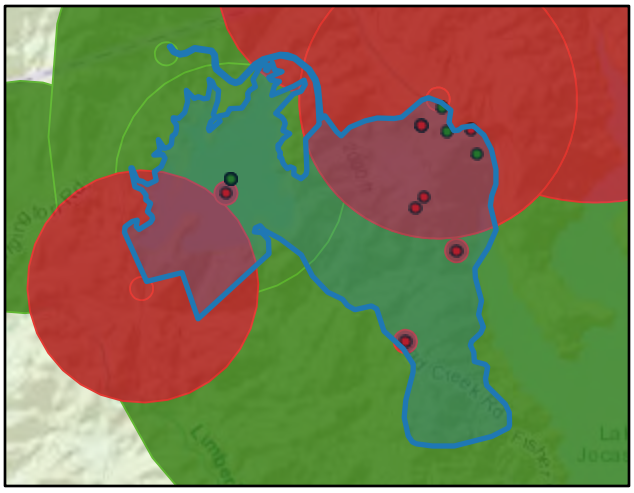


Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, INCREMENT P, USGS, METI/ NASA, NGA, EPA, USDA

- Maintenance clearing or mowing of rights-of-way should not occur between April 15 and August 1 of a given year to avoid nesting season for a majority of migratory birds. The mower deck should be set no lower than 6 inches high so native herbaceous vegetation will not be damaged.
- With the exception of areas where it is necessary to create a safe and level work surface, trees and shrubs will be cut flush with the ground surface with root structures left intact. Cleared vegetation will be chipped and spread across the work area or hauled off-site to a commercial disposal facility. Spreading of chipped vegetation will be controlled so as not to impact the ability to re-establish herbaceous cover within the ROW during restoration.
- All excavations should be backfilled with the excavated material after installation of the appropriate structures. Where practicable, sidecast spoil material from trench excavation should be placed on the side of the trench opposite streams and wetlands. Spoil material from trench excavation should be placed on the side of the trench to be reused as back fill with the A-horizon placed back in its original position. Excess spoil material must be removed to an approved upland disposal site.
- Pipeline construction must be accomplished in existing disturbance corridors where practicable. Upon completion, preconstruction contours must be restored along pipelines and all disturbed areas must be permanently stabilized with vegetative cover (preferable) and/or riprap, as appropriate. Right-of-ways should be no wider than that necessary for access and maintenance.
- Stream banks at crossings must be restored after construction has been completed. Disturbed stream banks can be restored by planting woody vegetation and by using bioengineering techniques for stream bank stabilization.
- Rights-of-way through and adjacent to streams should be maintained in low growing, woody vegetation to minimize stream bank erosion and sedimentation. Maintenance of this right-of-way should be conducted with mowing rather than with chemicals to reduce the potential for contamination and negative impacts on aquatic resources. If chemicals are used, a 50-foot buffer on either side of the stream crossing should be established where no herbicide treatments would be allowed. This will serve to retain the riparian vegetation while reducing the amount of chemical runoff into the aquatic environment.

E. Instructions for Submitting Species Observations

The SC Natural Heritage Dataset relies on continuous monitoring and surveying for species of concern throughout the state. Any records of species of concern found within this project area would greatly benefit the quality and comprehensiveness of the statewide dataset for rare, threatened and endangered species. Below are instructions for how to download the SC Natural Heritage Occurrence Reporting Form through the Survey123 App.



Map Credits: State of North Carolina DOT, Tennessee STS GIS, Esri, HERE, Garmin, INCREMENT P, USGS, METI/ NASA, NGA, EPA, USDA

Instructions for accessing the SC Natural Heritage Occurrence Reporting Form

For use in a browser (on your desktop/PC):

1) Follow https://bit.ly/scht-reporting-form
2) Select 'Open in browser'
3) The form will open and you can begin entering data!

This method of access will also work on a browser on a mobile device, but only when connected to the internet. To use the form in the field without relying on data/internet access, follow the steps below.

For use on a smartphone or tablet using the field app:

1) Download the Survey123 App from the Google Play store or the Apple Store. This app is free to download. Allow the app to use your location.

2) No need to sign in. However, you will need to provide the app with our Heritage Trust GIS portal web address. You will only need to do this once: (this is a known bug with ESRI's software, and future releases of the form should not require the below steps. Bear with us in the meantime!).

a. Tap 'Sign in'
b. Tap the settings (gear symbol) in the upper right corner
c. Tap 'Add Portal'
d. After the 'https://', type schtportal.dnr.sc.gov/portal
e. Tap 'Add Portal'
f. Tap the back-arrow icon (upper left corner) twice to return to the main sign in page.

3) Use the camera app (or other QR Reader app) to scan the QR code on this page from your smartphone or tablet. Click on the 'Open in the Survey123 field app'. This will prompt a window to allow Survey123 to download the SC Natural Heritage Occurrence Reporting Form. Select 'Open.'

4) The form will automatically open in Survey123, and you can begin entering data! This form will stay loaded in the app on your device until you manually delete it, and you can submit as many records as you like.

OCONEE COUNTY

CATEGORY	COMMON NAME/STATUS	SCIENTIFIC NAME	SURVEY WINDOW/ TIME PERIOD	COMMENTS
Amphibians	Chamberlain's dwarf salamander (ARS)	*Eurycea chamberlaini*	Spring/Fall surveys	Breeding survey: November to February
Birds	Golden-winged warbler (ARS)	*Vermivora chrysoptera*	April-July (nesting surveys)	Spring/Fall migration; variable throughout State
Crustaceans	None Found			
Fishes	None Found			
Insects	Edmund's snaketail (ARS)	*Ophiogomphus edmundo*	Year round	Active: May-August
	Monarch butterfly (C)	*Danaus plexippus*	August-December	Overwinter population departs: March-April
	Smokies needlefly (ARS)	*Megaleuctra williamsae*	April-June	
Mammals	Indiana bat (E)	*Myotis sodalis*	Year round	Not a South Carolina resident
	Little brown bat (ARS)	*Myotis lucifugus*	Year round	Found in trees, rock crevices, and under bridges
	Northern long-eared bat (T)	*Myotis septentrionalis*	Year round	Winter surveys not as successful
	Tri-colored bat (ARS)	*Perimyotis subflavus*	Year round	Found in mines and caves in the winter
Mollusks	None Found			
Plants	Carolina hemlock (ARS)	*Tsuga caroliniana*	Year round	
	Georgia aster (ARS*)	*Symphyotrichum georgianum*	Early October-mid November	
	Persistent trillium (E)	*Trillium persistens*	Early March-mid April	
	Small whorled pogonia (T)	*Isotria medeoloides*	Mid May-early July	
	Smooth coneflower (E)	*Echinacea laevigata*	Late May-October	
	Sun-facing coneflower (ARS)	*Rudbeckia heliopsidis*	July-October	
Reptiles	None Found			

Appendix C

Photographs

Surface Waters Photos

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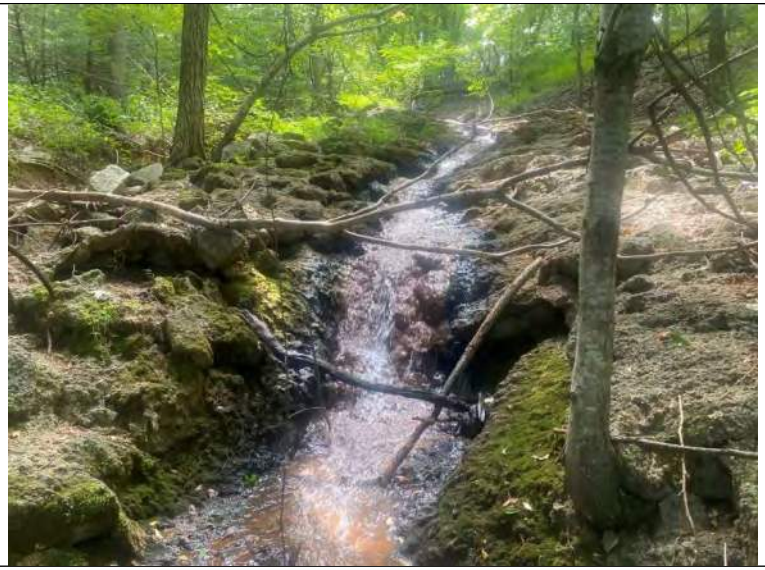

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Bad Creek Transmission Line Expansion Project

Natural Resources Assessment

Prepared for:

DUKE ENERGY CAROLINAS, LLC
Charlotte, North Carolina

Prepared by:

HDR
Charlotte, North Carolina

September 2021

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The Bad Creek Transmission Line Expansion Project consists of a Duke Energy Carolinas, LLC (Duke Energy) maintained right-of-way and surrounding 50-foot buffer that extends for approximately 9.25 miles between the Bad Creek Hydro Station and the Jocassee Powerhouse Switchyard in Oconee County, South Carolina.					
Resource	**Identified Resources within the Study Area**	**Potential Impacts**	**Recommended Action**	**Implementing Agency**	**Website**
Land Cover	Maintained right-of-way consisting of herbaceous and shrub vegetation, a 50-foot forested area on either side of the maintained right-of-way, as well as areas the unmaintained within low valleys, and emergent wetlands.	Land disturbance during construction.	Land disturbance associated with <2 acres of land requires the submittal of a stormwater management and sediment control plan that meets the requirements of R.72-307H (Standards for Stormwater Management and Sediment Reduction Regulation 72-300 through 72-316) and does not require approval of the implementing agency. Land disturbance of ≥2 acres of land requires the submittal and approval of a stormwater management and sediment control plan that meets the requirements of R.72-307I (Standards for Stormwater Management and Sediment Reduction Regulation 72-300 through 72-316).	South Carolina Department of Health and Environmental Control (SCDHEC)	https://www.scdhec.gov/environment/water-quality/water-regulations-standards/water-regulations-standards-standards-0
Vegetation Management	Wetlands, vegetated stream buffers within the Study Area, forested areas within the 50-foot buffer on either side of the maintained right-of-way, and forested areas within the low valleys.	Right-of-way vegetation management.	Herbicide application or mowing during flowering and fruiting stages from May through September should be avoided. Right-of-ways through and adjacent to wetlands should be maintained by hand clearing rather than with chemicals to reduce the potential for contamination and negative impacts on aquatic resources. If chemicals are used, a 50-foot buffer on either side of stream/wetland crossings should be established where no herbicide treatments would be allowed. This will serve to retain the riparian vegetation while reducing the amount of chemical runoff into the aquatic environment.	N/A	https://schtportal.dnr.sc.gov/portal/apps/sites/#/natural-heritage-program

Study Area					
The Bad Creek Transmission Line Expansion Project consists of a Duke Energy Carolinas, LLC (Duke Energy) maintained right-of-way and surrounding 50-foot buffer that extends for approximately 9.25 miles between the Bad Creek Hydro Station and the Jocassee Powerhouse Switchyard in Oconee County, South Carolina.					
Resource	**Identified Resources within the Study Area**	**Potential Impacts**	**Recommended Action**	**Implementing Agency**	**Website**
			Removal of vegetation should be limited to only what is necessary for construction of the proposed structures.		
Cultural Resources	A desktop analysis conducted in July 2021 revealed four archaeological sites, and two historical architectural resources within the Study Area. Archeological sites within the Study Area were determined not eligible for listing in the National Register of Historic Places (NRHP). Historical architectural resources sites within the Study Area are potentially eligible for the NRHP.	Land disturbance during construction.	Coordination with the South Carolina Department of Archives and History (SCDAH) State Historic Preservation Office (SCSHPO) regarding potential impacts with respect to cultural resources.	SCSHPO	https://scdah.sc.gov/historic-preservation
Federally Protected Species	Potential habitat for smooth coneflower, northern long-eared bat (summer habitat), Indiana bat (summer habitat), persistent trillium, and small whorled pogonia is present within the Study Area.	Habitat disturbance such as clearing during construction activities.	Coordination with U.S. Fish and Wildlife Service (USFWS) concerning on-site habitat for northern long-eared bat, Indiana bat, persistent trillium, and small whorled pogonia, including a survey for persistent trillium during the recommended optimal window.	USFWS, South Carolina Ecological Field Office	https://www.fws.gov/southeast/charleston/
At-Risk Species	Eleven At-Risk species are known to be present in Oconee County or in the vicinity of the Study Area (Chamberlain's dwarf salamander, green Salamander, golden-winged warbler, Edmund's snaketail, monarch butterfly, smokies needlefly, little brown bat, tri-colored bat, Carolina hemlock, Georgia aster, and sun-facing coneflower).	Habitat disturbance such as clearing during construction activities.	Coordination with USFWS concerning potential negative impacts for the At-Risk, and opportunities to implement conservation measures to protect the species is also advised including conducting a follow up survey within the optimal surveying window for Georgia aster, and sun-facing coneflower.	USFWS, South Carolina Ecological Field Office	https://www.fws.gov/southeast/charleston/
Federal Emergency Management Agency (FEMA) Floodplains	A review of the FEMA National Flood Hazard Layer indicated that Special Flood Hazard Areas (i.e., high-risk flood (AE), FEMA Floodway, 100-year Floodplain and 500-year Floodplain zones) exist within the Study Area adjacent to McKinneys Creek (Stream	Land disturbance within the FEMA floodplain during construction.	Coordination with Oconee County, Floodplain Management.	Oconee County Planning and Zoning	https://oconeesc.com/community-dev-home/planning-and-zoning/floodplain-management

Study Area					
The Bad Creek Transmission Line Expansion Project consists of a Duke Energy Carolinas, LLC (Duke Energy) maintained right-of-way and surrounding 50-foot buffer that extends for approximately 9.25 miles between the Bad Creek Hydro Station and the Jocassee Powerhouse Switchyard in Oconee County, South Carolina.					
Resource	**Identified Resources within the Study Area**	**Potential Impacts**	**Recommended Action**	**Implementing Agency**	**Website**
	37) and Lake Keowee (Open Water 1).				
South Carolina Surface Water Buffers	The Study Area is located in the Savannah River Basin. A review of SCDHEC Buffer Zone Guidance indicated that a 30-foot natural buffer is recommended for jurisdictional surface waters (including wetlands) with drainage areas greater or equal to 100 acres.	Land disturbance during construction within the natural stream buffers.	Land-disturbing activities associated with construction activities that impact surface waters are exempt, with appropriate Clean Water Act Section 404/401 permits.	SCDHEC	https://www.scdhec.gov/environment
South Carolina Water Classifications and Standards	The surface waters within the Study Area (Lake Jocassee and Bad Creek) are classified as Trout; Put, Grow and Take (TPGT); Howard Creek and associated tributaries are classified as Trout Natural (TN); Lake Keowee, McKinneys Creek, and its tributaries are classified as Freshwater (FW).	Stormwater runoff during land disturbance activities.	Coordination with SCDHEC.	SCDHEC	https://www.scdhec.gov/sites/default/files/media/document/R.61-68_0.pdf https://gis.dhec.sc.gov/watersheds/
Wetlands and Jurisdictional Waters of the U.S.	47 jurisdictional streams, 17 jurisdictional wetlands, and 1 open water were identified in the Study Area.	Staging areas and access routes may result in potential impacts that require the discharge of dredged or fill material into waters of the U.S.	Potential impacts would require a Section 404 Nationwide Permit 57 (Electric Utility Line and Telecommunications Activities) from the U.S. Army Corps of Engineers (USACE) and Section 401 Water Quality Certification from the SCDHEC.	USACE, Charleston District, Greenville Regulatory Field Office SCDHEC	https://www.sac.usace.army.mil/ https://scdhec.gov/environment/water-quality/water-regulations-standards/water-regulations-standards-water-quality

2.0 Introduction

This report presents the findings of a natural resources assessment performed by HDR for Duke Energy Carolinas, LLC (Duke Energy) for the Bad Creek Transmission Line Expansion Project (Project). The Project is associated with the Bad Creek Pumped Storage Station (Federal Energy Regulatory Commission [FERC] Project No. 2740) located approximately eight miles north of Salem in Oconee County, South Carolina. The Study Area as referenced in this report covers an area of approximately 436 acres, and 9.25 miles long comprised of a Duke Energy maintained right-of-way, and a 50-foot buffer of forested land on either side. The Project proposes the potential expansion of the right-of-way to accommodate a new transmission line between the Bad Creek powerhouse substation and Jocassee powerhouse switchyard. The Jocassee Pumped Storage Station is located on Lake Jocassee and is part of the Keowee-Toxaway Hydroelectric Project (FERC Project No. 2503).

HDR's approach to this assessment involved a desktop review of publicly available data and an on-site investigation that included surveys for wetlands and jurisdictional waters of the U.S., federally protected species habitat, and classification of natural/vegetation communities. The following sections provide a summary of HDR's methods and findings of the desktop analysis and on-site environmental surveys. Attached to this report are supporting figures (Appendix A), stream identification and wetland determination data forms (Appendix B), the S.C. Department of Natural Resources (SCDNR) Threatened and Endangered Species Consultation Report, the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) resources list, and USFWS South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species for Oconee County (Appendix C), and site photographs (Appendix D).

3.0 Description of Study Area

The 436-acre Study Area consists of a maintained utility line right-of-way (approximately 9.25 miles long, and 400-feet wide) with two transmission lines (a single-circuit, 100-kilovolt (kV) line [Esto Line, Line Index 1J2672] and a 525 kV line [Whitewater Line, Line Index 5J2817]), and a 50-foot unmaintained buffer. The linear Project area extends for approximately 7.9 miles in a southeasterly direction form the Bad Creek Hydro Station transformer yard and continues north for approximately 1.3 miles to the Jocassee Powerhouse Switchyard (Appendix A, Figures 1 and 2). Land use in the vicinity of the proposed Project is undeveloped forested land.

The Study Area is situated between two Level IV Ecoregions, the Southern Inner Piedmont and the Southern Crystalline Ridges and Mountains. The Southern Inner Piedmont is part of the larger Level III Piedmont ecoregion, while the Crystalline Ridges and Mountains form part of the Blue Ridge Level III Ecoregion.

The Piedmont ecoregion is generally considered a transitional area between the mountainous ecoregions of the Appalachians Mountains to the northwest and the relatively flat Coastal Plain to the southeast. The Blue Ridge ecoregion is a narrow strip of mountainous ridges to hilly plateaus transitioning to more massive mountainous areas with high peaks.

The Southern Outer Piedmont is characterized by "lower elevations, less relief, and less precipitation than the Southern Inner Piedmont", while the Southern Crystalline Ridges and Mountains region is a rough, dissected region with elevations generally between 1,200 – 4,500 feet (Griffith et al. 2002) (Appendix A, Figure 3).

4.0 Desktop Analysis

HDR conducted a desktop review of publicly available data from federal and state agencies prior to engaging in field reconnaissance surveys. The following sources were consulted as part of this analysis:

- Federal Emergency Management Agency (FEMA) Map Service Center (https://msc.fema.gov/portal)
- Natural Resources Conservation Service (NRCS) National Hydric Soils List (https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/use/hydric/)
- U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) (http://nhd.usgs.gov/)
- Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database 2016 (NLCD) (https://www.mrlc.gov/data/nlcd-2016-land-cover-conus)
- National Park Service (NPS) National Register of Historic Places (NRHP) GIS Public Dataset (https://www.nps.gov/subjects/nationalregister/data-downloads.htm)
- USFWS National Wetlands Inventory (NWI) (http://www.fws.gov/wetlands)
- South Carolina Institute of Archaeology and Anthropology (SCIAA) and South Carolina Department of Archives and History (SCDAH) online ArchSite database (http://archsite.cas.sc.edu/ArchSite)
- SCDNR Flood Mitigation Program (http://www.dnr.sc.gov/water/flood/floodmaps.html)
- SCDNR Managed Land Data Viewer GIS Dataset (http://www.dnr.sc.gov/land.html)
- SCDNR Natural Heritage Program (https://schtportal.dnr.sc.gov/portal/apps/sites/#/natural-heritage-program)
- South Carolina Department of Health and Environmental Control (SCDHEC) Watershed Atlas (https://gis.dhec.sc.gov/watersheds/)
- USFWS South Carolina List of at Risk, Candidate, Endangered, and Threatened Species for Oconee County (https://www.fws.gov/southeast/pdf/fact-sheet/south-carolina-species-list-by-county.pdf)
- NRCS Soil Survey for Oconee County, South Carolina (https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/south_carolina/oconeeSC1963/oconeeSC1963.pdf)
- USGS Gap Analysis Program (GAP), Protected Areas Database of the United States (PAD-US), version 1.4 Combined Feature Class (https://gapanalysis.usgs.gov/padus/viewer/)
- USGS Topographic Quadrangles Maps (1:24,000-scale); Cashiers, SC (1997), Reid, SC (1997), Tamassee, SC (1996), and Salem, SC (1996).

4.1 NRCS Soils

The NRCS Soil Survey for Oconee County, South Carolina, identified 14 different soil types within the Study Area (Appendix A, Figure 4) (NRCS 2019). The NRCS National Hydric Soils List did not classify any of the soils within the Study Area as hydric. A summary of the soil types within the Study Area is provided in Table 1.

Table 1. NRCS Soil Types Located within the Study Area in Oconee County

Mapping Unit Symbol	Mapping Unit Name	Drainage Class	Hydric Rating
AsF	Ashe sandy loam, 25 to 50 percent slopes	Somewhat excessively drained	Not Hydric
HaD	Halewood fine sandy loam, 10 to 15 percent slopes	Well drained	Not Hydric
HaE	Halewood fine sandy loam, 15 to 25 percent slopes	Well drained	Not Hydric
HaF	Halewood fine sandy loam, 25 to 45 percent slopes	Well drained	Not Hydric
HcB	Hayesville and Cecil fine sandy loams, 2 to 6 percent slopes	Well drained	Not Hydric
HcD2	Hayesville and Cecil fine sandy loams, 10 to 15 percent slopes, eroded	Well drained	Not Hydric
HcE	Hayesville and Cecil fine sandy loams, 15 to 25 percent slopes	Well drained	Not Hydric
HcE2	Hayesville and Cecil fine sandy loams, 15 to 25 percent slopes, eroded	Well drained	Not Hydric
HcF	Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes	Well drained	Not Hydric
HcF2	Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes, eroded	Well drained	Not Hydric
HhF	Hayesville, Cecil, and Halewood sandy loams, shallow, 25 to 60 percent slopes	Well drained	Not Hydric
HsE2	Hiwassee sandy loam, 15 to 25 percent slopes, eroded	Well drained	Not Hydric
MfE	Madison fine sandy loam, high, 15 to 25 percent slopes	Well drained	Not Hydric
TcF	Talladega and Chandler loams, 25 to 60 percent slopes	Well drained	Not Hydric

4.2 Land Cover

HDR reviewed the land cover layer of the MRLC NLCD (NLCD 2016) to identify existing land cover classifications within and immediately adjacent to the Study Area. Land use classifications in the area include barren land, developed, forest, grassland/herbaceous, open water, and planted/cultivated. Developed classifications include open space, as well as low, medium, and high intensity. Forest areas consist of deciduous, evergreen, and mixed forests. Herbaceous classifications include grassland/herbaceous areas. Planted/cultivated land cover includes pasture/hay. Shrub land included scrub/shrub cover.

Land cover classifications within the Study Area include open water, developed open space, developed low intensity, developed medium intensity, developed high intensity, deciduous forest, evergreen forest, mixed forest, scrub/shrub, herbaceous, and hay/pasture (Appendix A, Figure 5).

4.3 Cultural Resources

HDR reviewed the NRHP GIS Public Dataset and the SCIAA and SCDAH online ArchSite subscriber database for known archaeological sites and architectural resources (cultural resources, historic structures, and historic sites) located within 1-mile radius of the Study Area. The inquiry revealed four previously identified archaeological sites determined not eligible for listing in the National Register of Historic Places (NRHP) within the Study Area (38OC0101, 38OC0242, 38OC0244, and 38OC0247).

In addition, there are two historical architectural resources sites (0155 and 0156) located within the Study Area and are listed as potentially eligible for listing in the NRHP. An NRHP evaluation of the Keowee-Toxaway Hydroelectric Project, which includes both SHPO Site Numbers 0155 and 0156, was delayed due to the age of the facilities (less than 50 years old). A formal determination of eligibility for the Keowee-Toxaway Hydroelectric Project can proceed in 2022 given the construction year of 1972.

A total of 28 cultural resources records have been identified within a 1-mile radius of the Project corridor (Appendix A, Figure 6). A summary of these cultural resources is provided in Table 2.

Table 2. Previously Identified Cultural Resources within the 1-Mile of Study Area

Resource Number	Name	NRHP Eligibility
Historic Areas		
0155*	NRHP Evaluation of Keowee-Toxaway Hydroelectric Development	Potentially Eligible
0156*	NRHP Evaluation of Keowee-Toxaway Hydroelectric Development	Potentially Eligible
Archaeological Sites		
38OC3	Cherokee- Toxaway village site	Eligible (submerged under Lake Keowee)
38OC52	Native American Woodland camp site	Eligible (submerged under Lake Jocassee)
380C101*	Native American nondiagnostic lithic scatter	Not Eligible
38OC102	Native American nondiagnostic lithic scatter	Not Eligible
38OC103	Native American nondiagnostic lithic scatter	Not Eligible
38OC217	Native American Archaic lithic scatter	Not Eligible
38OC222	Native American Archaic and Woodland ceramic and lithic scatter	Eligible
38OC223	Native American Early Archaic lithic scatter	Not Eligible
38OC240	Native American nondiagnostic lithic scatter	Not Eligible
38OC241	Native American nondiagnostic lithic scatter	Not Eligible
38OC242*	Native American Middle Archaic lithic scatter	Not Eligible
38OC243	Native American nondiagnostic lithic scatter	Not Eligible
38OC244*	Native American nondiagnostic lithic scatter	Not Eligible
38OC245	Native American nondiagnostic lithic scatter	Not Eligible
38OC246	Native American nondiagnostic lithic scatter	Not Eligible
38OC247*	Native American nondiagnostic lithic scatter	Not Eligible
38OC248	Native American nondiagnostic lithic scatter	Not Eligible
38OC249	Native American Late Archaic to Late Mississippian rock shelters and ceramic and lithic scatters	Potentially Eligible
38OC250	Native American Mississippian occupation	Potentially Eligible
38OC251	Native American Middle and Late Archaic occupation	Potentially Eligible
38OC252	Native American nondiagnostic lithic scatter	Not Eligible
38OC258	Native American nondiagnostic lithic scatter; 19th to 20th century homesite	Not Eligible
38OC260	Native American nondiagnostic lithic scatter; 19th to 20th century homesite	Not Eligible
38OC467	Native American Early Archaic to Middle Woodland occupation	Potentially Eligible-mostly submerged beneath Lake Keowee
38OC468	19th to 20th century standing homesite	Potentially Eligible
38OC469	Native American nondiagnostic lithic scatter	Not Eligible

* Resource is located within the Study Area

4.4 Managed Lands Assessment

HDR reviewed online GIS datasets from the SCDNR Managed Land Data Viewer and the online USGS Gap Analysis Project (USGS 2016). The inquiry revealed five protected areas within a 1.0-

mile radius of the Study Area (SCDNR Wildlife Management Area [WMA] Leased, Francis Marion and Sumter National Forest, SCDNR WMA Easement, Jocassee Gorges WMA, and Devils Fork State Park). The SCDNR WMA Easement extends into the southern portion of Study Area (Appendix A, Figure 7).

4.5 Federally Protected Species

HDR utilized the USFWS IPaC database, USFWS South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species for Oconee, and the SCDNR Natural Heritage Program for Threatened and Endangered Species consultation report (SCNHP 2020) to evaluate the potential occurrence of federally protected species within the Study Area. A summary of the desktop review is provided below, and results are summarized in Table 3.

More detailed descriptions and habitat requirements of federally protected species and results from the on-site field reconnaissance activities are provided in Section 5.5.

4.5.1 Endangered Species Act

The purpose of the Endangered Species Act is to "protect and recover imperiled species and the ecosystems upon which they depend" (USFWS 2013). HDR reviewed the list of federally protected species for Oconee County from the USFWS website, which was last updated on May 3, 2021 (USFWS 2021). In addition, HDR consulted the USFWS IPaC database and the SCDNR Natural Heritage Program database for records of threatened and endangered species documented in the vicinity of the Study Area. The IPaC Resources List summarizes the species and trust resources under the USFWS's jurisdiction that are known or expected to be at or near the Study Area. The query revealed that no proposed threatened or endangered species, critical habitat or proposed critical habitat have been identified within the Study Area. The SCDNR consultation database also summarizes the records of species of concern associated with or near the Study Area (see attached IPaC Resources List, SCDNR consultation report, and USFWS South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species for Oconee County [Appendix C], and Table 3 results).

Table 3. Federally Protected Species for Oconee County, South Carolina

Species	Federal Designation[1]	Preferred Habitat	Survey Window	Habitat Present in Study Area
Birds				
Bald Eagle (*Haliaeetus leucocephalus*)	BGEPA	Nests at tops of large, mature trees near large rivers, lakes, and marshes containing small animals, fish, and carrion.	Year round	No
Mammals				
Indiana bat (*Myotis sodalis*)	E	Indiana bats hibernate in tight clusters on the ceilings and sides of caves and mines. Summer habitat includes small to medium river and stream corridors with well-developed riparian buffers and forested areas within 1 to 3 miles of small to medium rivers and streams.	Year round	Potential Summer Habitat within forested areas adjacent to existing right-of-way and unmaintained low forested valleys.

Species	Federal Designation[1]	Preferred Habitat	Survey Window	Habitat Present in Study Area
Northern long-eared bat (*Myotis septentrionalis*)	T	Hibernates in caves and mines during winter, roosts under bark, in cavities or crevices in trees and snags during summer.	Year round	Potential Summer Habitat within forested areas adjacent to existing right-of-way and unmaintained low forested valleys.
Plants				
Persistent trillium (*Trillium persistens*)	E	Deciduous or conifer-deciduous forests of ravines or gorges under canopies dominated by hemlock, white pine, beech, black oak, and chestnut oak.	Early March – Mid April	Forested areas adjacent to existing right-of-way and unmaintained low forested valleys.
Small whorled pogonia (*Isotria medeoloides*)	T	Older hardwood stands of beech, birch, maple, oak, and hickory, sometimes softwoods like hemlock, with an open understory; acidic soils with a thick layer of dead leaves, often on slopes or near small streams.	Mid May – Early July	Forested areas adjacent to existing right-of-way and unmaintained low forested valleys.
Smooth coneflower (*Echinacea laevigata*)	E	This species is typically found in meadows, open woodlands, the ecotonal regions between meadows and woodlands, cedar barrens, dry limestone bluffs, clear cuts, and roadside and utility rights-of-way.	Late May-October	Existing maintained right-of-way

[1] BGEPA = Federally protected under the Bald and Golden Eagle Protection Act.
E = Federally Endangered.
T = Federally Threatened.

4.5.2 At Risk Species

The Southeast Region of the U.S. Fish and Wildlife Service (Service) in conjunction with states, federal agencies and other partners has begun evaluating over 400 animal and plant species for potential listing under the Endangered Species Act (ESA). These species are commonly known as "At-Risk species" and are defined as those that are: (1) Proposed for listing under the ESA by the Service; (2) Candidates for listing under the ESA; or (3) Petitioned by a third part for listing under the ESA. The USFWS's South Carolina identifies eleven At-Risk species that are known to be present in Oconee County or in the vicinity of the Study Area. A list of these species is provided in Table 4.

Table 4. South Carolina List of At-Risk Species – Oconee County

Species	Preferred Habitat	Survey Window	Habitat Present in Study Area
Amphibian			
Chamberlain's dwarf salamander (*Eurycea chamberlain*)	Under leaf litter and small debris in wet areas, particularly seepages near small streams, and other wetland types	Spring and Fall	Yes
Green Salamander (*Aneides aeneus*)	Rock outcrop formations that contain moist, but not wet crevices, as well as arboreal habitats such as beneath loose bark and in cracks of	October to March	Yes

Species	Preferred Habitat	Survey Window	Habitat Present in Study Area
	trees, or under logs on the ground.		
Birds			
Golden-winged warbler (*Vermivora chrysoptera*)	Shrubby, tangled thickets and other early successional habitats during breeding. Mature forest habitats after breeding.	April-July (nesting surveys)	Yes
Insect			
Edmund's snaketail (*Ophiogomphus Edmundo*)	Larvae are found in medium- to large-sized, clear streams and rivers with moderately fast currents but spend most of their adult lives in the treetops, only returning to the water to breed. During the breeding stage, males are typically found perched on rocks in riffles or rapids as they patrol their territories.	Year round	Yes
Monarch butterfly (*Danaus plexippus*)	Monarchs are typically found in open grass areas during the breeding season. Adults use a wide variety of flowering plants throughout migration and breeding.	August-December	Yes
Smokies needlefly (*Megaleuctra williamsae*)	Restricted to high elevation springs and seeps in relatively undisturbed forested areas. Nymphs sprawl in accumulations of decaying leaves and other debris that is covered with a thin film of flowing water.	April-June	Yes
Mammal			
Little brown bat (*Myotis lucifugus*)	The little brown bat lives along streams and lakes. It forms nursery colonies in buildings. In the winter it hibernates in caves and mines.	Year round	Yes
Tri-colored bat (*Perimyotis subflavus*)	Forested landscapes, often in open woods. They can also be found over water and adjacent to water edges.	Year round	Yes
Plants			
Carolina hemlock (*Tsuga caroliniana*)	Rocky slopes, ridgelines and gorges in the Southern Blue Ridge mountains.	Year round	Yes
Georgia aster (*Symphyotrichum georgianum*)	Woodlands or piedmont prairies dominated by native plants, with acidic soils that vary from sand to heavy clay	Early October-mid November	Yes
Sun-facing coneflower (*Rudbeckia heliopsidis*)	Moist to wet sites and acidic soils such as those found in pine-oak woodlands, peaty seeps in meadows, and sandy alluvium along streams. Occurs in full sun to partial shade.	July - October	Yes

More detailed descriptions and habitat requirements of these At-Risk species and results from the on-site field reconnaissance activities are provided in Section 5.6.

4.5.3 Bald and Golden Eagle Protection Act (BGEPA)

As part of the desktop analysis, species protected under the Bald and Golden Eagle Protection Act (BGEPA) were reviewed for potential presence within the Study Area (USFWS 1978). The BGEPA prohibits the "taking" of bald eagles, parts, nests, or eggs without a permit from the U.S. Department of the Interior.

The bald eagle (*Haliaeetus leucocephalus*) prefers habitat near large rivers, lakes, and marshes containing fish, waterfowl, turtles, rabbits, snakes and other small animals and carrion as food resources. They nest at the top of large, mature trees to which they return every year.

More detailed descriptions and habitat requirements for the bald eagle including results from the on-site field reconnaissance activities are provided in Section 5.5.

4.5.4 Migratory Bird Treaty Act of 1918 (MBTA)

The Migratory Bird Treaty Act of 1918 (MBTA) prohibits the take of migratory birds unless authorized under the terms of a valid federal permit issued by the USFWS (USFWS 2020). As part of the analysis conducted, species protected under the MBTA were reviewed for potential presence within the proposed Project vicinity using the USFWS IPaC database. Based on the IPaC review eleven species of migratory birds have the probability of presence within the Study Area; (1) bald eagle (Haliaeetus leucocephalus), (2) bobolink (*Dolichonyx oryzivorus*), (3) Canada warbler (*Cardellina canadensis*), (4) cerulean warbler (*Dendroica cerulea*), (5) eastern Whip-poor-will (*Antrostomus* vociferus), (6) golden-winged warbler (*Vermivora chrysoptera*), (7) Kentucky warbler (*Oporornis formosus*), (8) prairie warbler (*Dendroica discolor*), (9) red-headed woodpecker (*Melanerpes erythrocephalus*), (10) wood thrush (*Hylocichla mustelina*), and yellow-bellied Sapsucker (S*phyrapicus varius*).

4.6 FEMA Floodplains and Regulated Riparian Buffers

The Special Flood Hazard Areas (SFHA) are classified by FEMA as high flood risk (AE) zones and are subject to inundation by the 1-percent-annual-chance flood event being equaled or exceeded in any given year (i.e., 100-year flood).

HDR reviewed the FEMA Map Service Center National Flood Hazard Layer (NFHL) and found that SFHA, Zones AE extends into the Study Area along the McKinneys Creek (Stream 37), and Lake Keowee (Open Water 1); however, no Regulatory Floodway areas occur within the Study Area (FEMA Map Numbers 45073C0020C, 45073C0040D, 45073C0100D, 45073C0105D, 45073C0115D, 45073C0120D, and 45073C0110D) (Appendix A, Figure 8). Impacts to jurisdictional features, development, or improvements to existing uses within the SFHA may require FEMA compliance.

The SFHA are classified by FEMA as high flood risk zones, that are subject to inundation by the 1-percent-annual-chance flood event (i.e., 100-year flood) being determined using approximate methodologies (No Base Flood Elevations) (FEMA 2020).

4.6.1 SCDHEC Water Classifications and Standards

Under the authority of the South Carolina Pollution Control Act, the SCDHEC Water Classification & Standards is responsible for establishing appropriate water uses and protection classifications, as well as general rules and specific water quality criteria in order to protect existing water uses, establish anti-degradation rules, protect public welfare, and maintain and enhance water quality.

Under SCDHEC's R. 61-68 Water Classification and Standards, the following water classification occur within the Study Area: Lake Jocassee, and Bad Creek are classified as Trout; Put, Grow and Take (TPGT); Howard Creek, Burgess Creek, Smeltzer Creek, and their associated tributaries are

classified as Trout Natural (TN); and Lake Keowee, McKinneys Creek, and its tributaries are classified as Freshwater (FW).

- TN are freshwaters suitable for supporting reproducing trout populations and a cold water balanced indigenous aquatic community of fauna and flora. Also suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses.

- TPGT are freshwaters suitable for supporting growth of stocked trout populations and a balanced indigenous aquatic community of fauna and flora. Also suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. Suitable also for industrial and agricultural uses.

- FW are described as suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. Suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora (SCDHEC 2014 and 2021).

Surface waters within the Study Area are part of the Savannah River Basin (Hydrologic Unit Code [HUC] 030601), which drains portions of the Blue Ridge, Piedmont, and Coastal Plain (Appendix A, Figure 8).

According to the SCDHEC's Buffer Zone Guidance (SCDHEC 2012a), a minimum 30-foot undisturbed natural buffer must be provided and maintained between the surface water and the outermost sediment and erosion controls at the construction site for streams, drainageways, and waterbodies with a drainage area greater than or equal to 100 acres (SCDHEC 2012b, Section 3.2.4.C.I (a)) for constructions adjacent to surface water that are not classified as either Sensitive or Impaired Waters (Sensitive or Impaired Waters require a minimum 45-foot natural buffer) (SCDHEC 2012a). However, it is important to note that land-disturbing activities are exempt for linear projects such as utility constructions with the appropriate Clean Water Act (CWA) Section 404/401 permits.

4.6.2 Oconee County Regulations

The above-referenced SFHAs are located within unincorporated Oconee County. These flood-prone areas are regulated under the counties' Flood Damage Prevention Ordinance, which seeks to promote public health and safety by minimizing the losses to public and private land within flood-prone areas. Under this ordinance, a Floodplain Development Application Permit is required prior to commencement of any development activities located within the SFHA (Oconee County 2021).

Oconee County Municipal Code 38-11.1 adopted vegetative protection buffer requirements as part of the regulations for the Keowee-Jocassee Overlay (Lakes Keowee and Jocassee) Subdistrict of the Lake Overlay District. Under the Oconee Vegetative Buffer rules a "natural vegetative buffer shall be established on all waterfront parcels of Lakes Jocassee and Keowee within 25 feet from the full pond level. Full pond level is, 800 feet above mean sea level on Lake Keowee, and 1,110 feet above mean sea level on Lake Jocassee. Those parcels not meeting these criteria shall be exempt from

this standard. The buffer shall extend to a depth of 25 feet measured along a perpendicular line from the full-pond contour".

Clearing within the vegetative buffer at Lake Keowee for the proposed Project may be exempt or allowable as an existing use that was permitted or authorized at the time of the adoption of this chapter.

4.7 Other Federal and State Regulations Applicable to the Region

4.7.1 Navigable Waters

According to the USACE's Current Section 10 Waters for South Carolina, there are no federal navigable waters located within the Study Area (USACE 1977). In addition, the SCDHEC's current map of State Navigable Waters for South Carolina, indicates that Lake Jocassee, and Lake Keowee are state navigable waters located within the Study Area (SCDHEC 2019a; 2019b).

4.7.2 CWA Section 303(d) Impaired Waters

HDR reviewed the SCDHEC Watershed Atlas for Water Quality, Impaired Waters §303(d) records available online. This query revealed one record of §303(d) impaired waters in Lake Jocassee (station SV-313) for exceeding levels of mercury. This station is located approximately 1.2 miles east of the Study Area, and the station type was Fish (SCDHEC 2019b).

5.0 Field Reconnaissance

5.1 Wetlands and Jurisdictional Waters of the U.S.

On June 8th – 10th, 2021, HDR biologists surveyed the Study Area for wetlands and jurisdictional waters of the U.S. regulated under Section 404 of the CWA. The assessment of the Study Area was conducted according to the methodologies and guidance described in the U.S. Army Corps of Engineers (USACE) 1987 Wetland Delineation Manual (USACE 1987), the 2012 USACE Eastern Mountains and Piedmont Regional Supplement (Version 2.0) (USACE 2012), the 2020 Navigable Waters Protection Rule, and the North Carolina Division of Water Quality (NCDWQ) Methodology for Identification of Intermittent and Perennial Streams and Their Origins (Version 4.11) (NCDWQ 2010).

Accessible jurisdictional waters of the U.S. were delineated and mapped using a Trimble® Geo7X GPS unit capable of sub-meter accuracy. GPS points were post-processed utilizing Trimble® GPS Pathfinder Office software. Due to the extremely challenging conditions within the Study Area (i.e., rugged terrain with precipitous drops in elevation), some potentially jurisdictional features were not field delineated (flagged in the field); instead, these features were field documented (i.e., photographs, GPS points, and field notes) and delineated via desktop methods.

The on-site reconnaissance activities identified 47 jurisdictional streams, 17 jurisdictional wetlands, and 1 open water within the Study Area (Appendix A, Figure 9). A summary of jurisdictional waters of the U.S. is provided in Table 4 through Table 6.

Table 5. Summary of Delineated Jurisdictional Waters of the U.S. within the Study Area

Feature Name	Latitude/ Longitude	Cowardin Class[1]	§303 (d) (Y/N)	Type of Jurisdiction	Stream Width (ft)	Estimated Amount of Aquatic Resource in Review Area (ft)	Delineation Field/ Desktop	SCDHEC Water Classification
Stream 1 Tributary to Lake Jocassee	35.007605/ -82.999465	R5UB	No	Non section-10, non-wetland	4	292	Field	TPGT
Stream 2 Tributary to Lake Jocassee	35.007471/ -83.000856	R5UB	No	Non section-10, non-wetland	N/A	105	Field	TPGT
Stream 3 Tributary to Lake Jocassee	35.007427/ -83.00065	R5UB	No	Non section-10, non-wetland	6	518	Field	TPGT
Stream 4 Tributary to Lake Jocassee	35.005426/ -83.001804	R5UB	No	Non section-10, non-wetland	2	118	Field	TPGT
Stream 5 Tributary to Lake Jocassee	35.005456/ -83.001424	R5UB	No	Non section-10, non-wetland	6	492	Field	TPGT
Stream 6 Tributary to Lake Jocassee	35.004004/ -83.000687	R4SB3	No	Non section-10, non-wetland	2	77	Desktop	TPGT
Stream 7 Tributary to Howard Creek	34.998808/ -83.000566	R4SB3	No	Non section-10, non-wetland	1	305	Field	TN
Stream 8 Tributary to Howard Creek	34.996033/ -83.000017	R4SB3	No	Non section-10, non-wetland	1	363	Field	TN
Stream 9 Tributary to Howard Creek	34.995722/ -83.000043	R5UB	No	Non section-10, non-wetland	2	406	Field	TN
Stream 10 Howard Creek	34.979904/ -82.995071	R3RB1	No	Non section-10, non-wetland	30	744	Desktop	TN
Stream 11 Bad Creek	34.973516/ -82.991385	R3RB1	No	Non section-10, non-wetland	N/A	388	Desktop	TPGT
Stream 12 Tributary to Bad Creek	34.969395/ -82.989084	R4SB3	No	Non section-10, non-wetland	2	426	Desktop	TPGT
Stream 13 Tributary to Bad Creek	34.967167/ -82.987982	R5UB	No	Non section-10, non-wetland	5	950	Desktop	TPGT
Stream 14 Tributary to Burgess Creek	34.963408/ -82.986504	R5UB	No	Non section-10, non-wetland	2	638	Field	TN
Stream 15 Tributary to Burgess Creek	34.961486/ -82.985501	R5UB	No	Non section-10, non-wetland	4	555	Desktop	TN
Stream 16 Tributary to Burgess Creek	34.960094/ -82.985267	R4SB3	No	Non section-10, non-wetland	2	364	Desktop	TN
Stream 17 Tributary to Burgess Creek	34.959568/ -82.985056	R5UB	No	Non section-10, non-wetland	2	410	Desktop	TN
Stream 18* Tributary to McKinneys Creek	34.956222/ -82.983014	N/A	No	Non section-10, non-wetland	N/A	116	Desktop	FW
Stream 19 Tributary to McKinneys Creek	34.954374/ -82.98097	R4SB3	No	Non section-10, non-wetland	1	135	Desktop	FW
Stream 20 Tributary to Smeltzer Creek	34.950466/ -82.974798	R4SB3	No	Non section-10, non-wetland	1	232	Desktop	TN

Feature Name	Latitude/ Longitude	Cowardin Class[1]	§303 (d) (Y/N)	Type of Jurisdiction	Stream Width (ft)	Estimated Amount of Aquatic Resource in Review Area (ft)	Delineation Field/ Desktop	SCDHEC Water Classification
Stream 21 Tributary to Smeltzer Creek	34.950178/ -82.974556	R5UB	No	Non section-10, non-wetland	2	266	Desktop	TN
Stream 22 Tributary to Smeltzer Creek	34.950232/ -82.974548	R4SB3	No	Non section-10, non-wetland	1	93	Desktop	TN
Stream 23 Tributary to McKinneys Creek	34.947858/ -82.969656	R4SB3	No	Non section-10, non-wetland	5	198	Field	FW
Stream 24 Tributary to McKinneys Creek	34.947375/ -82.969274	R4SB3	No	Non section-10, non-wetland	4	400	Field	FW
Stream 25 Tributary to McKinneys Creek	34.946827/ -82.967671	R5UB1	No	Non section-10, non-wetland	4	228	Field	FW
Stream 26 Tributary to McKinneys Creek	34.94593/ -82.96611	R4SB3	No	Non section-10, non-wetland	3	218	Field	FW
Stream 27 Tributary to McKinneys Creek	34.944548/ -82.963566	R4SB3	No	Non section-10, non-wetland	2	181	Desktop	FW
Stream 28 Tributary to McKinneys Creek	34.944078/ -82.963383	R5UB1	No	Non section-10, non-wetland	8	393	Desktop	FW
Stream 29 Tributary to McKinneys Creek	34.943604/ -82.961675	R4SB4	No	Non section-10, non-wetland	5	53	Field	FW
Stream 30 Tributary to McKinneys Creek	34.943499/ -82.961551	R4SB4	No	Non section-10, non-wetland	5	78	Desktop	FW
Stream 31 Tributary to McKinneys Creek	34.942654/ -82.960143	R4SB3	No	Non section-10, non-wetland	4	121	Field	FW
Stream 32 Tributary to McKinneys Creek	34.942443/ -82.959684	R4SB3	No	Non section-10, non-wetland	3	92	Field/Desktop	FW
Stream 33 Tributary to McKinneys Creek	34.939394/ -82.954482	R4SB3	No	Non section-10, non-wetland	3	193	Field	FW
Stream 34 Tributary to McKinneys Creek	34.939177/ -82.954722	R5UB	No	Non section-10, non-wetland	20	923	Field/Desktop	FW
Stream 35 Tributary to McKinneys Creek	34.938624/ -82.952141	R4SB4	No	Non section-10, non-wetland	3	143	Desktop	FW
Stream 36 Tributary to McKinneys Creek	34.937162/ -82.945579	R4SB3	No	Non section-10, non-wetland	1	131	Desktop	FW
Stream 37 McKinneys Creek	34.937468/ -82.943401	R3RB1	No	Non section-10, non-wetland	35	1667	Desktop	FW
Stream 38 Tributary to McKinneys Creek	34.936968/ -82.934986	R4SB4	No	Non section-10, non-wetland	5	126	Desktop	FW
Stream 39 Tributary to McKinneys Creek	34.936725/ -82.934224	R5UB	No	Non section-10, non-wetland	5	337	Field/Desktop	FW
Stream 40 Tributary to McKinneys Creek	34.936397/ -82.932557	R4SB3	No	Non section-10, non-wetland	4	502	Field/Desktop	FW

Feature Name	Latitude/ Longitude	Cowardin Class[1]	§303 (d) (Y/N)	Type of Jurisdiction	Stream Width (ft)	Estimated Amount of Aquatic Resource in Review Area (ft)	Delineation Field/ Desktop	SCDHEC Water Classification
Stream 41 Tributary to McKinneys Creek	34.935929/ -82.928646	R4SB3	No	Non section-10, non-wetland	2	474	Field/Desktop	FW
Stream 42 Tributary to Keowee River	34.935294/ -82.923879	R5UB	No	Non section-10, non-wetland	5	474	Field	FW
Stream 43 Tributary to McKinneys Creek	34.937773/ -82.921347	R4SB3	No	Non section-10, non-wetland	4	294	Field	FW
Stream 44 Tributary to McKinneys Creek	34.941303/ -82.921558	R5UB	No	Non section-10, non-wetland	4	502	Field	FW
Stream 45 Tributary to McKinneys Creek	34.943124/ -82.921786	R4SB3	No	Non section-10, non-wetland	4	75	Field	FW
Stream 46 Tributary to Keowee River	34.947967/ -82.920913	R4SB3	No	Non section-10, non-wetland	0	176	Field	FW
Stream 47 Tributary to Keowee River	34.953631/ -82.917938	R5UB1	No	Non section-10, non-wetland	4	43	Field	FW
					Total:	**16,015 feet**		

[1] R3RB = Riverine, upper perennial, rocky shore, bedrock
R4SB3 = Riverine, intermittent, streambed, cobble-gravel
R4SB4 = Riverine, intermittent, streambed, sand
R5UB = Riverine, unknown perennial, unconsolidated bottom
R5UB1 = Riverine, unknown perennial, unconsolidated bottom, cobble-gravel
*N/A = Information Not Available

Table 6. Summary of Delineated Jurisdictional Wetlands of the U.S. within the Study Area

Feature Name	Latitude/ Longitude	Cowardin Class[1]	Type of Jurisdiction	Estimated Amount of Aquatic Resource in Review Area (acres)	Delineation Field/Desktop
Wetland 1	35.002006/ -83.000426	PFO1A	Non section 10, wetland	0.21	Field
Wetland 2	34.964528/ -82.986422	PEM1B	Non section 10, wetland	0.20	Field
Wetland 3	34.946697/ -82.968198	PEM1B	Non section 10, wetland	0.09	Field/Desktop
Wetland 4	34.946288/ -82.967052	PEM1B	Non section 10, wetland	0.09	Desktop
Wetland 5	34.946105/ -82.966438	PEM1B	Non section 10, wetland	0.04	Desktop
Wetland 6	34.939473/ -82.954447	PSS1B	Non section 10, wetland	0.03	Field
Wetland 7	34.938974/ -82.953543	PEM1B	Non section 10, wetland	0.08	Field/Desktop
Wetland 8	34.938626/ -82.952386	PEM1B	Non section 10, wetland	0.08	Field
Wetland 9	34.937447/ -82.947585	PEM1B	Non section 10, wetland	0.94	Desktop
Wetland 10	34.93611/ -82.932187	PEM1A	Non section 10, wetland	0.10	Desktop
Wetland 11	34.935799/ -82.928469	PEM1B	Non section 10, wetland	0.05	Desktop
Wetland 12	34.935572/ -82.924748	PEM1B	Non section 10, wetland	0.09	Field
Wetland 13	34.935551/ -82.922075	PEM1B	Non section 10, wetland	0.51	Desktop
Wetland 14	34.937813/ -82.921394	PEM1A	Non section 10, wetland	0.02	Field
Wetland 15	34.941097/ -82.921763	PSS1B	Non section 10, wetland	0.04	Field
Wetland 16	34.941877/ -82.921115	PSS1B	Non section 10, wetland	0.07	Field
Wetland 17	34.953551/ -82.917925	PFO1B	Non section 10, wetland	0.03	Field
			Total:	**2.67 acres**	

[1] PEM1A = Palustrine, emergent, persistent, temporarily flooded.
PEM1B = Palustrine, emergent, persistent, saturated.
PFO1A = Palustrine, forested, broad-leaved deciduous, temporarily flooded.
PFO1B = Palustrine, forested, broad-leaved deciduous, saturated.
PSS1B = Palustrine, scrub-shrub, broad-leaved deciduous, saturated.

Table 7. Summary of Delineated Jurisdictional Open Waters of the U.S within the Study Area

Feature Name	Latitude/ Longitude	Cowardin Class[1]	Type of Jurisdiction	Estimated Amount of Aquatic Resource in Review Area (acres)
Open Water 1 Lake Keowee	34.951090/ -82.920118	PUBHh	Non section-10, non-wetland	2.3

[1] PUBHh = Palustrine, unconsolidated bottom, permanently flooded, diked/impounded

5.2 Description of Waters of the U.S.

5.2.1 Relatively Permanent Waters with Seasonal Flow

Streams 1 – 5, 9, Stream 10 (Howard Creek), Stream 11 (Bad Creek), Streams 13 – 15, 17, 21, 25, 28, 34, Stream 37 (McKinneys Creek), Streams 39, 41, 42, 44, and 47 were identified as Relatively Permanent Waters (RPWs) that exhibit perennial surface water flow to Traditional Navigable Waters (TNWs). According to the Cowardin Classification hierarchical structure (Cowardin et al. 1979), Streams 10, 11, and 37 were identified as riverine upper perennial feature with rock bottom, and a bedrock bottom (R3RB1). Streams 1 – 5, 9, 13 – 15, 17, 21, 25, 28, 34, 39, 41, 42, 44, and 47 were identified as unknown perennial features with unconsolidated bottoms (R5UB). Streams 25, 28, and 47 were identified as unknown perennial features with unconsolidated bottoms, and a cobble-gravel bottom (R5UB1). Ordinary High Water Mark (OHWM) indicators observed during the assessment included a well-defined natural line impressed on the bank, shelving, absence of vegetation, disturbed and/or washed away leaf litter, sediment deposition, the presence of wrack lines, sediment sorting, and scour.

5.2.2 Relatively Permanent Waters with Seasonal Flow

Streams 6 – 8, 12, 16, 19, 20, 22 – 24, 26, 27, 29, 30, 31 – 33, 35, 36, 38, 40, 41, 43, 45, and 46 were identified as RPWs that exhibit continuous seasonal surface flow to TNWs. According to the Cowardin Classification hierarchical structure (Cowardin et al. 1979), Streams 6, 7, 8, 16, 12, 19, 20, 22 – 24, 26, 27, 31 – 33, 36, 40, 41, 43, 45, and 46 were identified as intermittent features with cobble-gravel streambeds (R4SB3). Streams 29, 30, 35, and 38 were identified as intermittent features sandy bottom streambeds (R4SB4). OHWM indicators observed during the assessment include a well-defined natural line impressed on the bank, disturbed or washed away leaf litter, absence of vegetation, sediment deposition, and scour.

5.2.3 Emergent Wetland

Wetlands 2 through 5, and 7 through 14 were identified as palustrine, emergent, persistent wetlands (PEM1) (Cowardin et al. 1979). Herbaceous species are dominant and consist of soft rush (*Juncus effusus*), shallow sedge (*Carex lurida*), cattail (*Typha angustifolia*) and woolgrass (*Scirpus cyperinus*). Primary and secondary wetland hydrology indicators observed during the assessment include high water table, saturation, oxidized rhizospheres on living roots, water-stained leaves, and drainage patterns. Hydric soil indicators include a depleted matrix within the upper 12 inches of the soil profile, prominent redox concentrations and indicators consistent with hydric soils.

5.2.4 Forested Wetland

Wetlands 1 and 17 were identified as palustrine, forested, broad-leaved deciduous (PFO1) wetlands according to the Cowardin (et al. 1979) hierarchical structure. Wetland 1 was identified as a temporarily flooded wetland (PFO1A). These wetlands exhibit sparsely vegetated concave surfaces. Tree species are dominant and consist of black willow (*Salix nigra*), red maple (*Acer rubrum*), persimmon (*Diospyros virginiana*), black tupelo (*Nyssa sylvatica*), and green ash (*Fraxinus pennsylvanica*). Primary and secondary wetland hydrology indicators include surface water, high water table, saturation, sediment deposits, water-stained leaves, the presence of oxidized rhizospheres on living roots, and geomorphic position. Hydric soil indicators include a depleted matrix within the upper 12 inches of the soil profile and distinct redox concentration starting at 4 inches of the soil profile.

5.2.5 Scrub/Shrub Wetland

Wetlands 6, 15, and 16 were identified as palustrine, scrub-shrub, deciduous, saturated wetlands (PSS1B) (Cowardin et al. 1979).

Primary and secondary wetland hydrology indicators observed during the assessment include high water tables, drainage patterns, water-stained leaves, and geomorphic position. Hydric soil indicators include a depleted matrix below the surface, and a gleyed matrix within the upper 12 inches of the soil profile. Scrub-shrub vegetation was dominant and consisted of black tupelo and American hophornbeam (*Ostrya virginiana*)

5.2.6 Open Waters

Open waters consisted of one freshwater impoundment, Lake Keowee (Open Water 1), and was identified as palustrine, unconsolidated bottom, permanently flooded, diked/impounded (PUBHh) features according to the Cowardin hierarchical structure (Cowardin et al. 1979).

5.3 Natural Communities

According to the Natural Communities of South Carolina Initial Classification and Description (Nelson 1986), four natural communities were identified within the Study Area: Cove Forest, Chestnut Oak Forest, High Elevation Seep, and Mesic Mixed Hardwood Forests. These natural communities were observed within the 50-foot buffer on either side of the transmission corridor and within the unmaintained areas of the right-of-way.

Chestnut Oak Forest

Chestnut Oak Forest is predominantly present within the northern portion of the Project with higher mountains and ridges. Plant species observed within these communities include Virginia pine (*Pinus virginiana*), shortleaf pine (*Pinus echinate*), white pine (*Pinus strobus*), chestnut oak (*Quercus prinus*), black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*), white oak (*Quercus alba*), mockernut hickory (*Carya tomentosa*), pignut hickory (*Carya glabra*), sourwood (*Oxydendrum arboreum*), black cherry (*Prunus serotina*), Piedmont rhododendron (*Rhododendron minus*), mountain laurel (*Kalmia latifolia*), doghobble (*Leuothoe fontanesiana*), sassafras (*Sassafras* albidum) and huckleberry (*Vaccinium stamineum*). Mesic Mixed Hardwood Forests were dominant in on areas of less steep terrain, the canopy was comprised of hardwood species such as red maple, eastern red cedar (*Juniperus virginiana*), tulip poplar (*Liriodendron tulipifera*), sweetgum (*Liquidambar styraciflua*), ironwood (C*arpinus caroliniana*), and pignut hickory (*Carya glabra*).

Cove Forests

Cove Forests were observed in ravines and steep slopes adjacent to stream channels in forested areas outside of the maintained right-of-way. Plant species observed within this community included American basswood (*Tilia heterophylla*), American beech (*Fagus grandifolia*), eastern hemlock (*Tsuga canadensis*), silver maple (*Acer saccharinum*), birch (*Betula lenta*), rhododendron, mountain laurel, spicebush (*Lindera benzoin*), flowering dogwood (*Cornus florida*), galax (*Galax* spp.), maiden hair fern (*Adiantum* sp.) and woodferns (*Dryopteris* sp.)

High Elevation Seeps

High Elevation Seep communities were observed throughout the Study Area and were mostly associated with ephemeral or intermittent streams down gradient. Plant species identified within these areas are umbrella leaf (*Diphylleia cymosa*), beaksedge (*Rhynchospora capitellata*), mountain laurel, jewelweed (*Impatiens capensis*), and sphagnum.

Maintained right-of-way areas are comprised of early successional woody, herbaceous, and vine species including red maple, hickories, black cherry, black locust (*Robinia pseudoacacia*), mutilfora rose (*Rosa multiflora*), sawtooth blackberry (*Rubus argutus*), horseweed (*Conyza canadensis*), goldenrods (*Solidago* sp.), New York ironweed (*Vernonia noveboracensis*), curly dock (*Rumex crispus*), dogfennel (*Eupatorium capillifolium*), pokeberry (*Phytolacca* sp.), bushy bluestem (*Andropogon glomeratus*), broomsedge (*Andropogon virginicus*), fescue (*Fescue* sp.), Johnson grass (*Sorghum halepense*), Japanese stiltgrass (*Microstegium vimineum*), deer-tongue grass (*Dichanthelium clandestinum*), white clover (*Trifolium repens*),morning glory (*Ipomoea* sp.) greenbrier (*Smilax rotundifolia*), devil's walking stick (*Aralia spinosa*), Japanese honeysuckle (*Lonicera japonica*), muscadine grape (*Vitis rotundifolia*), bracken fern (*Pteridium aquilinum*), and nettled chain fern (*Woodwardia areolata*).

5.4 Terrestrial Wildlife

Terrestrial communities in the Study Area are comprised of mature forested habitats with areas of early successional habitats that may also support a diverse number of wildlife species. Representative mammal, bird, reptile, and amphibian species commonly occurring in these habitats are listed below. Note that individual species and/or evidence of species observed during HDR's field survey are indicated with an asterisk (*). Information on species that typically use these habitats in the Piedmont ecoregion was obtained from relevant literature, mainly the Biodiversity of the Southeastern United States, Upland Terrestrial Communities (Martin et al. 1993). Mammal species that commonly occur in the Appalachian Oak Forest Region include eastern cottontail (*Sylvilagus floridanus*), North American beaver *(Castor canadensis),* black bear (*Ursus americanus*)*, coyote (*Canis latrans*), gray squirrel (*Sciurus carolinensis*)*, white-tailed deer (*Odocoileus virginianus*)*, raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), least weasel (Mustela nivalis). and various vole, rat, and mice species. Bird species that commonly use these habitats include yellow-billed cuckoo (*Coccyzus americanus*), black-billed cuckoo (*Coccyzus erythropthalmus*) wild turkey (*Meleagris gallapava*), American crow (*Corvus brachyrhynchos*), northern cardinal (*Cardinalis cardinalis*), field sparrow (*Spizella pusilla*), prairie warbler, eastern towhee (*Pipilo erythrophthalmus*), wood thrush, ovenbird (*Seiurus aurocapillus*), red-eyed vireo (*Vireo olivaceous*), chickadees (*Parus sp*), and woodpeckers (Family Picadae). Predatory birds may include American kestrel (*Falco sparverius*), barred owl (*Strix varia*), peregrine falcon (*Falco peregrinus*), red-shouldered hawk (*Buteo lineatus),* red-tailed hawk (*Buteo jamaicensis*), sharp-shinned hawk (*Accipiter striatus*), owl species, and turkey vulture (*Cathartes aura*).

Reptile species that may use these terrestrial communities include the northern scarlet snake (*Cemophoroa coccinea copei*), timber rattlesnake (*Crotalus horridus*), copperhead (*Agkistrodon conttortrix*), eastern ratsnake (*Pantherophis obsoletus*), common five-line skink (*Plestiodon fasciatus*), amphibians include tree toads (*Bufo* spp.), spadefoot (*Scaphiopus holbrooki*), and frog species (*Hyla* spp., *Rana* spp., and *Pseudacris* spp.). The dominant salamander community are the dusky salamanders (*Desmognathus* spp.).

5.5 Federally Protected Species

HDR's on-site survey also served to identify potential habitat and possible individuals of federally protected species listed for Oconee County, as previously described in Section 4.5 and Table 3. The USFWS IPaC database report and the SCDNR Natural Heritage Program (NHP) for threatened and endangered species consultation report, indicate no known occurrences of federally protected species within a 2.0-mile buffer of the Study Area. The following subsections include a summary of habitat descriptions and the presence/absence of habitat within the Study Area for species that are federally protected under the provisions of Section 7 and Section 9 of the Endangered Species Act of 1973. In addition, potential habitats for federally protected species documented during the field assessment have been identified on Appendix A, Figure 11.

5.5.1 Birds

Bald eagle (*Haliaeetus leucocephalus*) [Federally Protected under BGEPA]

USFWS Recommended Survey Window: October 1 – May 15

Habitat Description: Bald eagles occur throughout much of the continental U.S. and Canada. The species frequently builds their nests in live pines or cypress trees near large bodies of open water and may congregate around fish processing plants, dumps, and below dams where fish congregate. Nests typically measure 6 to 8 feet deep and 6 feet in diameter and are cone shaped. Bald eagles are opportunistic feeders and consume a variety of prey, which may be self-caught, scavenged, or robbed from other bird species. The threat to this species is attributed to disturbance and destruction of foraging and nesting habitat by urban and residential development (USFWS 1978).

Potential habitat for the bald eagle was not identified within the Study Area. In addition, HDR reviewed the SCDNR Bald Eagles Nest Location database (SCDNR 2020), and SCDNR NHP consultation report, and did not find any records of bald eagle's nests documented within a 2-miles radius of the Study Area. No known occurrences of bald eagles have been documented within the Study Area. No impacts to this species are anticipated.

5.5.2 Mammals

Indiana Bat (Myotis sodalis) [Federally Endangered]

USFWS Recommended Survey Window: May 15 to August 15

Habitat Description: Indiana bats hibernate during winter in caves or, occasionally, in abandoned mines. For hibernation, they require cool, humid caves with stable temperatures, under 50° F but above freezing. Very few caves within the range of the species have these conditions. After hibernation, Indiana bats migrate to their summer habitat in wooded areas where they usually roost under loose tree bark on dead or dying trees. Indiana bats eat a variety of flying insects found along rivers or lakes and in uplands. During summer, males roost alone or in small groups, while females roost in larger groups of up to 100 bats or more. Indiana bats also forage in or along the edges of forested areas (USFWS 2019a).

No winter hibernacula were observed in the Study Area; however, large trees and snags with suitable cavities or crevices for summer roosting habitat and suitable foraging habitat occur in the Study Area. The USFWS County List states the Indiana bat as "Not a South Carolina resident". Coordination with USFWS concerning potential take of this species; however, is recommended.

Northern long-eared bat (*Myotis septentrionalis*) [Federally Threatened]

USFWS Recommended Survey Window: Year-Round – Winter Surveys Not as Successful

Habitat Description: Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures such as barns and sheds (USFWS 2015).

No winter hibernacula were observed in the Study Area; however, trees with peeling bark and snags with suitable cavities or crevices suitable for summer roosting habitat and potential foraging habitat occur in the Study Area. In addition, the SCDNR NHP report indicates that a population for the species occurs within a 2-mile radius of the Project. Coordination with USFWS concerning potential take of this species is recommended.

5.5.3 Plants

Persistent trillium (*Trillium persistens*) [Federally Endangered]

USFWS Optimal Survey Window: March through mid-April

Habitat Description: It occurs on organic soils in mixed deciduous-pine woodlands, along stream flats and at edges of Rhododendron thickets. The species prefers gorges and steep ravines, but some populations have also been found on slopes less than 45 degrees (USDA 2021).

Potential habitat for persistent trillium is present within the forested areas of the Study Area, specifically adjacent to streams within deep ravines under full mature tree canopies yet with plenty filter light and rich soils. Plants from the trillium genus were identified within the Study Area; coordination with USFWS including a survey for persistent trillium during the recommended optimal window is recommended.

Small whorled pogonia (*Isotria medeoloides*) [Federally Threatened]

USFWS Optimal Survey Window: mid-May through early July

Habitat Description: Small whorled pogonia is an orchid that occurs in young as well as maturing (second to third successional growth) mixed-deciduous or mixed-deciduous/coniferous forests. The species does not appear to exhibit strong affinities for a particular aspect, soil type, or underlying geologic substrate. Sometimes it grows in stands of softwoods with a thick layer of dead leaves, often on slopes near small streams. The species may also be found on dry, rocky, wooded slopes; moist slopes; ravines lacking stream channels; or slope bases near braided channels of vernal streams. The orchid, often limited by shade, requires small light gaps or canopy breaks, and typically grows under canopies that are relatively open or near features like logging roads or streams that create long-persisting breaks in the forest canopy (USFWS 2019b).

No plants from this species were identified during the field survey. In addition, the USFWS IPaC report, and the SCDNR NHP report did not indicate records for the species within a 2-mile of radius of the Study Area. However, potential habitat is present within the Study Area for the small-whorled pogonia within the forested areas adjacent to streams and moist slopes; therefore, coordination with USFWS concerning potential take of this species is recommended.

Smooth coneflower (*Echinacea laevigata*) [Federally Endangered]

USFWS Optimal Survey Window: Late May – October

Habitat Description: Smooth coneflower, a perennial herb, is typically found in meadows, open woodlands, the ecotonal regions between meadows and woodlands, cedar barrens, dry limestone bluffs, clear cuts, and roadside and utility right-of-ways. In South Carolina, the species normally grows in magnesium- and calcium-rich soils associated with diabase and marble parent material, and typically occurs in Iredell, Misenheimer, and Picture soil series. It grows best where there is abundant sunlight, little competition in the herbaceous layer, and periodic disturbances (e.g., regular fire regime, well-timed mowing, and careful clearing) that prevent encroachment of shade-producing woody shrubs and trees. On sites where woody succession is held in check, it is characterized by several species with prairie affinities (USFWS 2017a).

Potential habitat for smooth coneflower was identified within the maintained right-of-way, specifically within the open and regularly maintained portions of the Study Area; however, a survey for the species during the optimal survey window did not reveal the presence of any plants from this species within the Study Area. The SCDNR NHP query report indicates that a population for smooth coneflower occurs both within the Study Area, and within a 2-mile radius of the Study Area. HDR coordinated with the SCDNR regarding the population indicated on the NHP report and the agency indicated that the population has been extirpated by the filling of Lake Jocasee in the 1970's. Although the types of soils generally associated with the species (Iredell, Misenheimer, and Picture soil series) are not found within the Study Area, follow up surveys for smooth coneflower are recommended within the proposed limits of disturbance for the proposed transmission line (as plant surveys are typically valid for 5 years). Depending on the results of futures surveys, coordination with USFWS concerning potential take of this species may be recommended.

5.6 At-Risk Species

HDR conducted on-site surveys for At-Risk plant and animal species including an on-site survey for At-Risk terrestrial plants. The survey however was conducted outside the optimal survey window for Georgia aster and sun-facing coneflower. The following subsections include a summary of habitat descriptions and the presence/absence of habitat within the Study Area for the At-Risk species previously listed on Table 4.

5.6.1 Amphibians

Chamberlain's dwarf salamander (*Eurycea chamberlain*)

USFWS Optimal Survey Window: Spring/Fall

Habitat Description: Chamberlain's dwarf salamander is typically found in wet areas, particularly seepages near small streams, and other wetland type areas. This species is typically found under

leaf litter and small debris; however, has been observed with leaf or pine straw litter along the edge of seep streams, or small debris piles in the terrestrial uplands adjacent to seepage wetlands (USFWS 2016a).

Potential habitat for the Chamberlain's dwarf salamander is present within the Study Area. Coordination with USFWS is recommended regarding potential negative impacts to the Chamberlain's dwarf salamander and opportunities to implement conservation measures to protect the species.

Green salamander (*Aneides aeneus*)

USFWS Optimal Survey Window: October to March

Habitat Description: The green salamander occupies rock outcrop formations that contain moist, but not wet, crevices. Occasionally they are found on dry rock outcrops. Rock types include sandstone, limestone, dolomite, granite, and quartzite. Type of rock may be less important than crevice size and moisture. Green salamanders can also be found beneath loose bark and in cracks of standing or fallen trees, and sometimes in or under logs on the ground. Previously, arboreal habitat was deemed secondary to rock outcrops as preferred habitat. However, recent studies indicate that woody and arboreal habitats play a much larger role in the life history than originally thought (USFWS 2016b). Results from a study conducted between 2001 and 2004 in Pickens County, South Carolina, revealed that the salamander size influenced the use of arboreal habitat; however, gender and reproductive stage did not. The study also indicated that green salamanders favor trees with larger diameter at breast height close the rock outcrops. Although the study did not reveal a tree species preference, it did indicate that green salamanders favored hardwoods over conifers, and that arboreal habitat and rock outcrop habitat use are dependent on the seasons. According to the study, salamanders overwinter in rock outcrops and move into trees and logs at the onset of spring. Salamanders observed during summer were primarily arboreal, but they returned to rock outcrops in late fall (Waldron and Humphries 2005).

Potential habitat for the green salamanders is present with the Study Area (rock outcrops near mature hardwood trees). Given that these habitats are particularly important for the conservation of the species, coordination with the USFWS is recommended regarding potential negative impacts to the green salamanders and opportunities to implement conservation measures to protect the species.

5.6.2 Birds

Golden-winged warbler (*Vermivora chrysoptera*)

USFWS Optimal Survey Window: April-July (nesting surveys)

Habitat Description: Golden-winged warbler uses wet shrubby, tangled thickets and other early successional habitats during breeding. Females select a nest site, which is typically on the ground in a grassy opening or along the shaded edge of a field near a forest border. The nest is typically well

concealed by overhead grasses and leafy material. Golden-winged Warblers move into mature forests immediately after fledging. This means that mosaics of shrubby, open areas (for nesting) and mature forest habitats (which offer cover for fledglings from like predators like hawks) are important landscape features (Cornell 2019).

Potential habitat for the golden-winged warbler is present with the Study Area (emergent and scrub/shrub wetland areas surrounded by forested communities). Given that these habitats are particularly important for the conservation of the species, coordination with the USFWS is recommended regarding potential negative impacts to the golden-winged warbler and opportunities to implement conservation measures to protect the species.

5.6.3 Insects

Edmund's snaketail (Ophiogomphus Edmundo)

USFWS Optimal Survey Window: Year round

Habitat Description: Edmund's snaketail larvae are found in medium- to large-sized, clear streams and rivers with moderately fast currents but spend most of their adult lives in the treetops, only returning to the water to breed. During the breeding stage, males are typically found perched on rocks in riffles or rapids as they patrol their territories. Mating takes place while perched; once fertilized, females deposit their eggs in the water near the same riffles guarded by the male and return to the treetops. This species is restricted to the southern Blue Ridge of North Carolina, Tennessee, South Carolina, and Georgia (USFWS 2019c and GDNR 2021).

Potential habitat for the species is present within the Study Area. Specifically, in or surrounding treetops near Howard Creek, McKinneys Creek and Bad Creek. Coordination with the USFWS is recommended regarding potential negative impacts to the Edmund's snaketail and opportunities to implement conservation measures to protect the species.

Monarch butterfly (*Danaus plexippus*)

USFWS Optimal Survey Window: August-December

Habitat Description: The monarch butterfly is a large butterfly that lives in a variety of habitats throughout North America and various additional locations across the globe. They need milkweed (Asclepias spp.) for breeding.

In North America the eastern population (east of the Rocky Mountains) migrate north to the United States and Canada in March from the mature oyamel fir forests in the mountains of central Mexico. The fall migration back to overwintering sites in Mexico is from August to November. Monarchs are typically found in open grass areas during the breeding season. Adults use a wide variety of flowering plants throughout migration and breeding. Important nectar sources during the spring migration typically include Coreopsis spp., Viburnum spp., Phlox spp., and early blooming milkweeds. Important nectar sources during fall migration include goldenrods (Solidago spp.), asters (Symphyotrichum spp. and Eurybia spp.), gayfeathers (Liatris spp.), and coneflowers (Echinacea spp.) (USFWS 2019d).

Monarch butterflies were not identified during the on-site survey; however, the site investigation was not conducted during the recommended survey window. Nonetheless, potential habitat for the monarch butterfly was identified within the Study Area for migrating and breeding adults. The

maintained right-of-way offers a variety of flowing plants for nectar, including plants from the milkweed genus (*Asclepias spp.*), as well as nighttime roosting trees such as willows and pines are present within the forested areas of the Study Area. HDR recommends conducting vegetation management activities such as mowing outside the species breeding and migration windows. According to the Monarch Joint Venture, the recommended vegetation management time window for the Project's region is November 1st through April 1st (Monarch Joint Venture 2021).

Smokies needlefly (*Megaleuctra williamsae*)

USFWS Optimal Survey Window: April-June

Habitat Description: These slender, brown to black stoneflies ranging from 4 to 15 mm (0.2 to 0.6 inches) in length are restricted to high elevation springs and seeps in relatively undisturbed forested areas and water temperatures below 25°C. Nymphs sprawl in accumulations of decaying leaves and other debris that are covered with a thin film of flowing water (USFWS 2019e).

Potential habitat is present for the Smokies needlefly in the higher elevation seeps and steams found within the Study Area. Coordination with the USFWS is recommended regarding potential negative impacts to the Smokies needlefly and opportunities to implement conservation measures to protect the species.

5.6.4 Mammals

Little brown bat (*Myotis lucifugus*)

USFWS Optimal Survey Window: Year round

Little brown bats use buildings, caves, trees, rocks, and wood piles as roost sites; however, their habitat use changes over the course of the year and varies based on sex and reproductive status.

During the summer Little brown bats commonly roost in human-made structures but have also been found in the summer under tree bark, in rock crevices, and in tree hollows. Preferring old growth forest over younger stands, as the larger trees offer more crevices, and the reduced understory vegetation of the mature growth forests makes prey easier to find and capture. During winter Little brown bats hibernate in humid caves and mines with constant temperatures. They may migrate hundreds of miles to get from their summer habitats to hibernacula. (WDR 2017).

Potential summer habitant is present within the forested areas of the Study Area. It is recommended that tree clearing activities are not conducted during the summer months to avoid impacts to roosting sites for the species. Coordination with the USFWS is recommended regarding potential negative impacts to the little brown bat and opportunities to implement conservation measures to protect the species.

Tri-colored bat (*Perimyotis subflavus*)

USFWS Optimal Survey Window: Year round

Tricolored bats are associated with forested landscapes, often in open woods. They can also be found over water and adjacent to water edges. They hibernate in caves, mines, and tunnels in the same sites as large populations of other bats, such as little brown bats. In the summer, tricolored bats generally roost separately, often in trees (MDNR 2021). In South Carolina, sparse vegetation

and early successional stands were found to be the best predictor of foraging habitat use by tricolored bats (USFWS 2019f).

Potential summer habitant is present within the forested areas of the Study Area. It is recommended that tree clearing activities are not conducted during the summer months to avoid impacts to roosting sites for the species. Coordination with the USFWS is recommended regarding potential negative impacts to the tricolored bat and opportunities to implement conservation measures to protect the species.

5.6.5 Plants

Carolina hemlock (*Tsuga caroliniana*)

USFWS Optimal Survey Window: Year round

Carolina hemlocks occur in a variety of landscapes ranging from xeric ridgelines to gorges in the Southern Blue Ridge Mountains. These occurrences are mostly on cliffs, rocky slopes and ridges, less commonly on gentle slopes and flat areas in valleys. Soils are usually nutrient-poor and rocky. Carolina hemlocks are very shade tolerant and are often associated with the following species: eastern hemlock (*Tsuga canadensis*), chestnut oak (*Quercus prinus*), northern red oak (*Quercus rubra*), Virginia pine (*Pinus virginiana*) and others (USFWS 2019g).

Potential habitat for Carolina hemlock is found in the northern portion of the Study Area along the forested ridges and gorges. The USFWS recommends avoiding logging and clearing on mountain slopes and in high-elevation habitats. Coordination with the USFWS is recommended regarding potential negative impacts to the Carolina hemlock and opportunities to implement conservation measures to protect the species.

Georgia aster (*Symphyotrichum georgianum*)

USFWS Optimal Survey Window: Early October-mid November

Georgia aster lives in woodlands or piedmont prairies that are dominated by native plants, with acidic soils that vary from sand to heavy clay. The primary controlling factor appears to be the availability of light. The plant tends to compete well for resources until it begins to get shaded out by woody plants. Since the plant prefers open areas, disturbance (fire, native grazers, etc.) is a part of this plant's habitat requirements. The historic sources of disturbance have been virtually eliminated from its range, except where road, railroad, and utility rights-of-way maintenance are mimicking the missing natural disturbances (USFWS 2014).

Potential habitat for the species is present within the maintained portions of the right-of-way. HDR recommends conducting a follow up survey within the species optimal surveying window. In addition, coordination with the USFWS regarding potential negative impacts to the Georgia aster, and opportunities to implement conservation measures to protect the species is also advised.

Sun-facing coneflower (*Rudbeckia heliopsidis*)

USFWS Optimal Survey Window: July-October

Sun-facing coneflower prefers moist to wet sites such as acidic swales in pine-oak woodlands, peaty seeps in meadows, and sandy alluvium along streams. It occurs in full sun to partial shade. The

species can also be found in upland oak-hickory or oak -pine-hickory or open pine-mixed hardwoods. It grows in seeps, bogs, sandy wet clear crop areas or in places with many boulders. The seeps where it is found are acid with grasses, sedges, and herbs (USFWS 2017b).

Potential habitat for the species is present within the maintained portions of the right-of-way near adjacent to streams and wetlands. The USFWS recommends right-of-way management appropriate for the species such as thinning of the overstory. HDR recommends conducting a follow up survey within the species optimal surveying window. In addition, coordination with the USFWS regarding potential negative impacts to the sun-facing coneflower, and opportunities to implement conservation measures to protect the species is also advised.

6.0 Conclusions

Results from HDR's desktop analysis and on-site field reconnaissance indicate that the proposed Project may affect natural resources including jurisdictional waters of the U.S. and regulated riparian buffers within the Study Area.

The assessment identified a total of identified 47 jurisdictional streams, 17 jurisdictional wetlands, and 1 open water within the Study Area. Depending on Project design, a CWA Section 404 Permit and a 401 Water Quality Certification may be required for the proposed Project based on the design and potential impacts to on-site waters of the U.S. A Pre-Construction Notification (PCN) is required for activities that would result in a discharge of dredged or fill material into waters of the United States. Discharges that would require a PCN include but are not limited to: the loss of 1/10 acre of jurisdictional waters of the U.S. (permanent and temporary); for the loss of stream bed >0.02 acres (permanent and temporary); work within a FEMA designated floodway; and for work that will require the placement of temporary mats within jurisdictional waters of the U.S.

Construction of the new transmission line would like be part of the overall Bad Creek 2 Powerhouse project. Depending on the final project design, the overall project may trigger an Individual Permit.

The field survey also identified potential habitats for five federally threatened and endangered species within the Study Area: northern long-eared bat, Indiana bat, persistent trillium, small whorled pogonia, and smooth coneflower. As a conservation measure for federally protected bat species, it is recommended that tree clearing activities be conducted during the bats inactive season (November 15th through March 31st for northern long-eared bat) to avoid negative impacts to the species. A clearing moratorium may also be required contingent on the results of the ongoing bat surveys onsite. If protected bat species (Indiana/NLEB) are present, the USFWS would likely impose a tree cutting moratorium between April 15 through October 15.

In addition, coordination with the USFWS concerning potential Project impacts to these species is recommended, including a survey for persistent trillium during the recommended optimal window, and follow up surveys once the proposed transmission line and/or rebuild alignments are determined.

According to the USFWS list of At-Risk species for South Carolina, and the SCDNR consultation report 11 At-Risk species occur in Oconee County and/or in the vicinity of the Study Area. Results from the field assessment indicate that potential habitats for the Chamberlain's dwarf salamander, green salamander, golden-winged warbler, Edmund's snaketail, monarch butterfly, Smokies needlefly, little brown bat, tri-colored bat, Carolina hemlock, Georgia aster, and sun-facing coneflower are present within the Study Area. Coordination with USFWS is recommended regarding

potential negative impacts as a result of the Project and for opportunities to implement conservation measures that will help protect these species.

Review of the NPS NRHP GIS Public Dataset and the SCIAA and SCDAH online ArchSite database revealed a total of 6 cultural resources within the Study Area. Previously identified archaeological sites within the Study Area (4 sites) were determined not eligible for listing in the NRHP.

Historical architectural resources sites within the Study Area (2 sites: 0155 and 0156) are potentially eligible for the NRHP. A formal determination of eligibility for these resources could proceed in 2022, after the Keowee-Toxaway Project facilities reach 50 years of age.

HDR recommends coordination with the SCDAH regarding potential issues with respect to cultural resources that may be located within the Study Area. If federal funding for the project is anticipated or USACE permits are needed, it is likely that the SC SHPO will require a cultural resources survey of the Project tract. A potential cultural resources survey may likely include archaeological survey for of all non-steep (less than 15 percent slopes) landforms, as well as architectural survey of any structures on or near the Project corridor that are 40+ years old. Given the landforms within the corridor and their proximity to several creeks, as well as the concentration of previously recorded archaeological sites near the Project on similar landforms, there is an increased probability of archaeological sites across the Study Area.

Per SCDHEC's Buffer Zone Guidance, a minimum 30-foot natural buffer for jurisdictional surface waters (with a drainage area greater than or equal to 100 acres) is required (including wetlands) within the Study Area; however, this buffer is exempt for land-disturbing activities that propose to impact surface waters with appropriate CWA Section 404/401 permits.

The FEMA Map Service Center's NFHL GIS database identified regulated floodplains located in the Study Area. Coordination with Oconee County's Floodplain Administrator will be required if the proposed Project requires work or placement of fill within the regulated floodplain.

7.0 References

Cowardin, L.M., Carter, V., Golet, F.C., and LaRoe, E.T. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Washington, D.C.

Cornell University. The Cornell Lab. All About Birds. Golden-winged Warbler. 2019. [URL]: https://www.allaboutbirds.org/guide/Golden-winged_Warbler/lifehistory

Federal Emergency Management Agency (FEMA). 2020. Special Flood Hazard Area Definition/Description. [URL]: http://www.fema.gov/special-flood-hazard-area (Accessed August 2020).

Georgia Department of Natural Resources (GDNR) 2021. Edmund's Snaketail. Ophiogomphus Edmundo. [URL]: https://georgiabiodiversity.org/natels/profile?es_id=21213

Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B., and Shelburne, V.B. 2002. Ecoregions of North and South Carolina (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

Martin, W.H., Boyce, S.G., and Echternacht, A.C. 1993. Biodiversity of the Southeastern United States, Upland Terrestrial Communities. Sponsored by the Southeastern Chapter of the Ecological Society of America.

Minnesota Department of Natural Resources (MDNR). 2021. Perimyotis subflavus. [URL]: https://www.dnr.state.mn.us/rsg/profile.html?/rsg/profile.html?action=elementDetail&selectedElement=AMACC03020

Monarch Joint Venture. Partnering Across the U.S. to Conserve the Monarch Migration. 2021. [URL]: http://monarchjointventure.org/images/uploads/documents/MowingForMonarchs.pdf

National Land Cover Database (NLCD). 2016. Multi-Resolution Land Characteristics Consortium (MRLC). [URL]: https://www.mrlc.gov/data/nlcd-2016-land-cover-conus (Accessed January 2021).

Natural Resources Conservation Service (NRCS). 2019. Soils Surveys for Oconee County. [URL]: https://websoilsurvey.nrcs.usda.gov/app/ (Accessed July 2021).

Nelson, J.B. 1986. The Natural Communities of South Carolina Initial Classification and Description. South Carolina Wildlife & Marine Resources Department. [URL]: http://www.dnr.sc.gov/wildlife/publications/pdf/natcomm.pdf

North Carolina Division of Water Quality (NCDWQ). 2010. Methodology for Identification of Intermittent and Perennial Streams and Their Origins (Version 4.11).

Oconee County. 2021. Flood Damage Prevention Ordinance. [URL]: https://library.municode.com/sc/oconee_county/codes/code_of_ordinances?nodeId=COOR_CH16FL

South Carolina Department of Health and Environmental Control (SCDHEC). 2012a. Buffer Zone Guidance for the 2012 NPDES General Permit for Storm Water Discharges from Construction Activities. [URL]: http://www.scdhec.gov/sites/default/files/docs/Environment/docs/lid-Buffers.pdf.

_____. 2012b. NPDES General Permit for Stormwater Discharges form Construction Activities. [URL]: https://www.scdhec.gov/sites/default/files/docs/Environment/docs/CGP-permit.pdf.

_____. 2014. Regulation 61-68 Water Classifications and Standards. [URL]: https://www.scdhec.gov/sites/default/files/media/document/R.61-68_0.pdf.

_____. 2019a. Navigable Waters of South Carolina Map. [URL]: https://scdhec.gov/sites/default/files/docs/Environment/docs/nw_map.pdf.

_____. 2019b. South Carolina Watershed Atlas. Water Quality Assessment, Impaired Waters – 303(d). [URL]: https://gis.dhec.sc.gov/watersheds/ (Accessed July 2021).

_____. 2021. SC Watershed Atlas. (Accessed July 2021). [URL]: https://gis.dhec.sc.gov/watersheds/

South Carolina Natural Heritage Program (SCNHP). 2020. Species of Concern Data Explorer Geographic Information System (GIS). SCDNR, Columbia, SC. [URL]: https://schtportal.dnr.sc.gov/portal/apps/sites/#/natural-heritage-program (Accessed: August 2021).

U.S. Army Corps of Engineers (USACE). 1977. Charleston District Navigable Study Report No.18 Lakes, Greater than 1000 Acres. [URL]: https://www.sac.usace.army.mil/Portals/43/docs/regulatory/Report18Lakes(Greater%20than%201000%20acres).pdf.

_____. 1987. Wetland Delineation Manual. Vicksburg, MS.

_____. 2012. Regional Supplement of the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0). U.S. Vicksburg, Mississippi. April 2012. [URL]: https://www.mvk.usace.army.mil/Portals/58/docs/regulatory/EMP_Piedmont_v2.pdf?ver=uugGHyr8bGpJ7pSUPoDRag%3D%3D

U.S. Department of Agriculture (USDA). 2021. Plant of the Week. Persistent Trillium (Trillium persistens). (Accessed: August 2021). [URL]:https://www.fs.fed.us/wildflowers/plant-of-the-week/trillium_persistens.shtml

U.S. Fish and Wildlife Service (USFWS). 1978. Determination of Certain Bald Eagle Populations as Endangered or Threatened. U.S. Fish and Wildlife Service, Washington, D.C. [URL]: https://ecos.fws.gov/docs/federal_register/fr183.pdf.

_____. 2013. ESA Basics: 40 Years of Conserving Endangered Species. Arlington, VA. [URL]: https://www.fws.gov/endangered/esa-library/pdf/ESA_basics.pdf

_____. 2014. Georgia Aster (Symphyotrichum georgianum). [URL]: https://www.fws.gov/athens/pdf/Georgia_aster_fact_sheet.pdf

_____. 2015. Threatened Species Status for the Northern Long-eared Bat with 4(d) Rule. April 2015. [URL]: https://www.gpo.gov/fdsys/pkg/FR-2015-04-02/pdf/2015-07069.pdf

_____. 2016a. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Chamberlain's dwarf salamander. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/chamberlains-dwarf-salamander.pdf

_____. 2016b. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Green salamander. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/green-salamander.pdf

_____. 2017a. Smooth Coneflower. [URL]: https://www.fws.gov/raleigh/species/es_smooth_coneflower.html

_____. 2017b. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Sun-facing coneflower (Rudbeckia heliopsidis). [URL]: https://www.fws.gov/charleston/pdf/ARS%20fact%20sheets%20for%20web/sun-facing%20coneflower%20fact%20sheet_SC_2017.pdf

_____. 2019a. Indiana Bat (Myotis sodalis). [URL]: https://www.fws.gov/midwest/endangered/mammals/inba/inbafctsht.html

_____. 2019b. Small Whorled Pogonia Fact Sheet. [URL]: https://www.fws.gov/midwest/endangered/plants/swpo/smallwhorledpogoniafs.html

_____. 2019c. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Edmund's snaketail. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/edmunds-snaketail.pdf

_____. 2019d Pollinators. Featured Pollinator: Monarch butterfly (Danaus plexippus plexippus). [URL]: https://www.fws.gov/pollinators/features/Monarch_Butterfly.html

_____. 2019e. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Smokies needlefly. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/smokies-needlefly.pdf

_____. 2019f. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Tricolored bat (Perimyotis subflavus). [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/tri-colored-bat.pdf

_____. 2019g. Conserving South Carolina's At-Risk Species: Species facing threats to their survival. Carolina hemlock (Tsuga caroliniana). [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/carolina-hemlock.pdf

_____. 2020. Migratory Bird Treaty Act. [URL]: https://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php

_____. 2021. South Carolina List of At-Risk, Candidate, Endangered, and Threatened Species. Updated January 4, 2021. [URL]: https://www.fws.gov/southeast/pdf/fact-sheet/south-carolina-species-list-by-county.pdf

U.S. Geological Survey (USGS). 2016. Protected Areas Database of the United States (PAD-US), USGS, version 1.4, Gap Analysis Program. Updated August 3, 2016. [URL]: https://gapanalysis.usgs.gov/padus/viewer/ (Accessed July 2021).

Wisconsin Department of Natural Resources (WDNR). 2017. Little Brown Bat (Myotis lucifugus) Species Guidance. [URL]: https://dnr.wi.gov/files/PDF/pubs/er/ER0705.pdf

Waldron, J.L. and W.J. Humphries. 2005. Arboreal Habitat Use by the Green Salamander, Aneides aeneus, in South Carolina. Journal of Herpetology, 39(3), 486-492. (https://bioone.org/journals/journal-of-herpetology/volume-39/issue-3/228-04A.1/Arboreal-Habitat-Use-by-the-Green-Salamander-Aneides-aeneus-in/10.1670/228-04A.1.short).

Appendix A

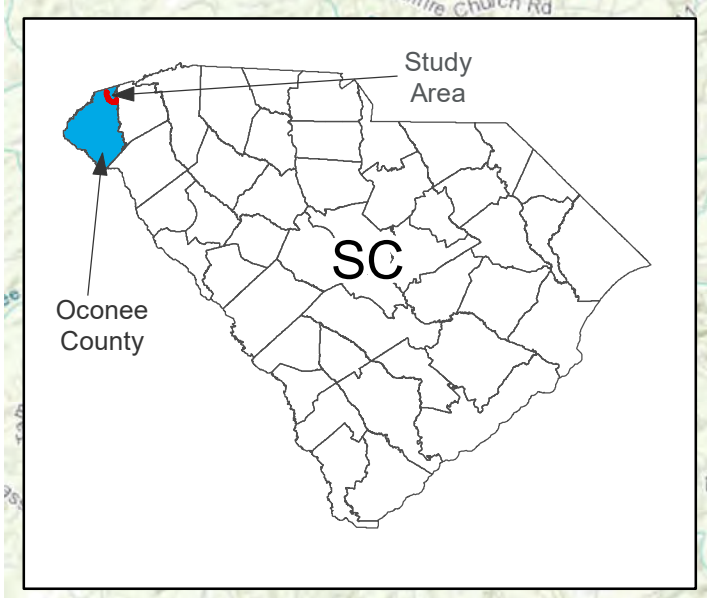
Figures

LEGEND

Study Area (436 acres)

DATA SOURCE: Esri, OpenStreetMap contributors, and the GIS User Community

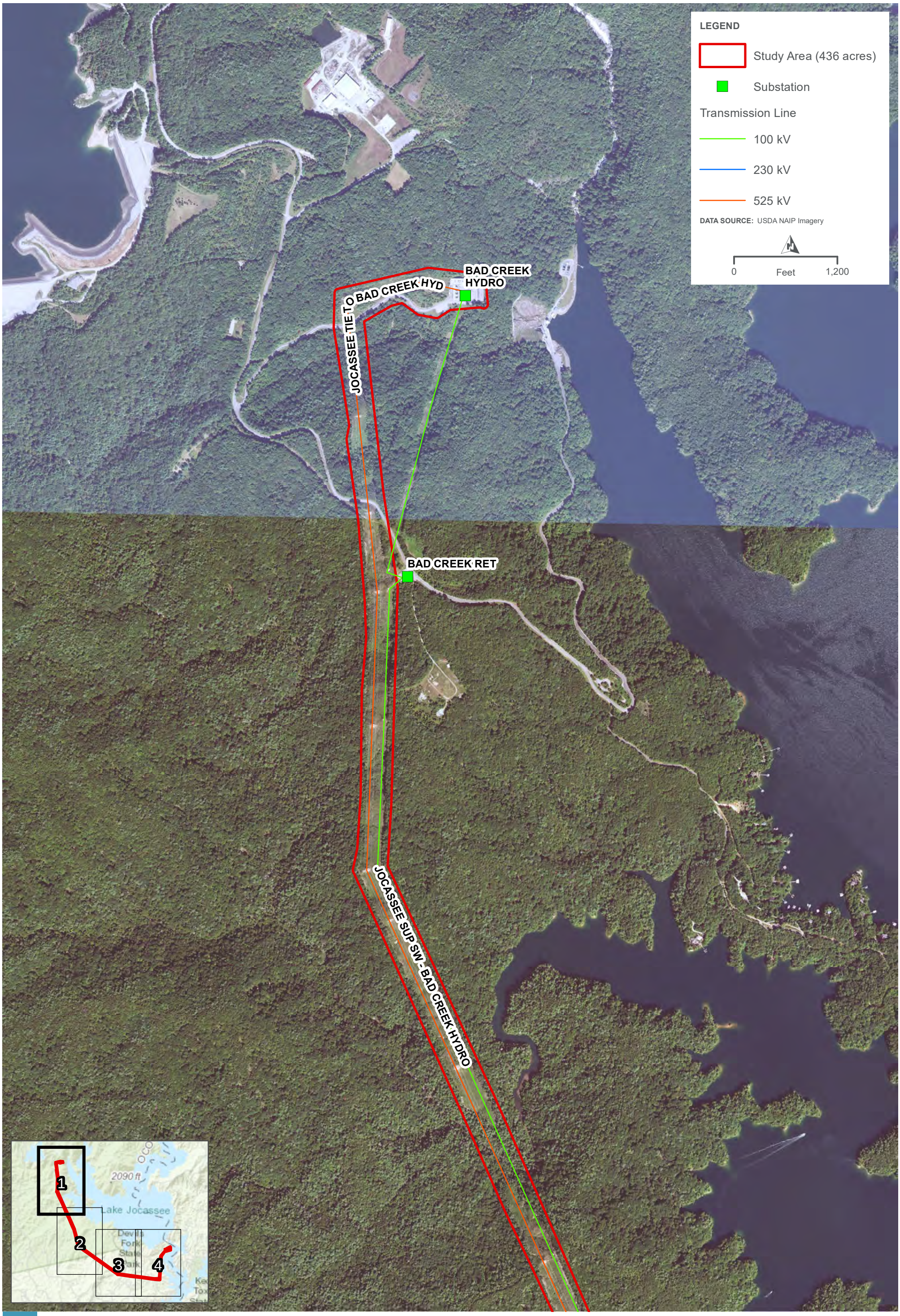
0 Miles 1



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROJECT VICINITY

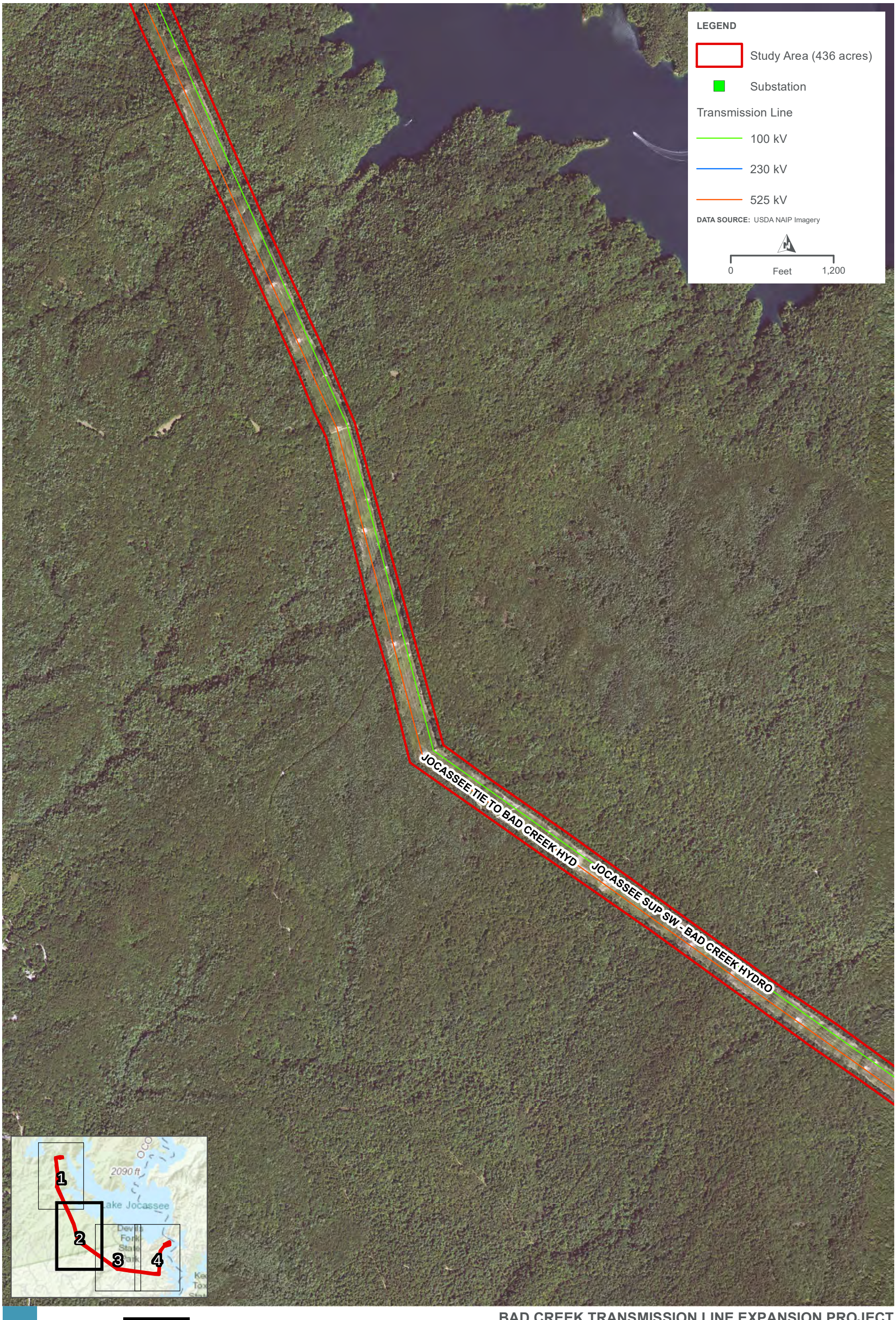
FIGURE 1



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROJECT AERIAL

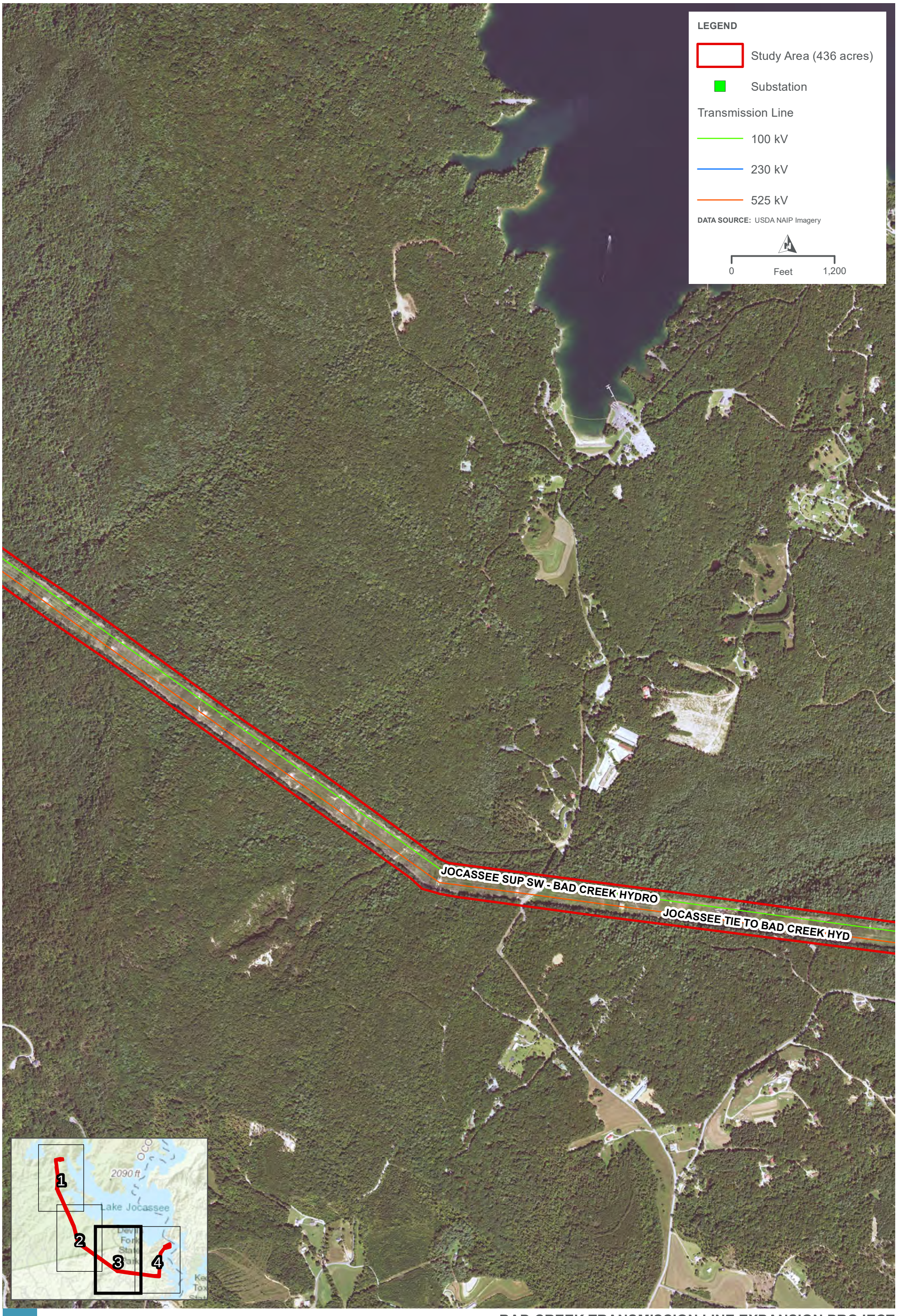
FIGURE 2 PAGE 1 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROJECT AERIAL

FIGURE 2 PAGE 2 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROJECT AERIAL

FIGURE 2 PAGE 3 OF 4

LEGEND

Study Area (436 acres)

Substation

Transmission Line

100 kV

230 kV

525 kV

DATA SOURCE: USDA NAIP Imagery

0 Feet 1,200

JOCASSEE HYDRO

JOCASSEE HYD UNIT 1 BUS

JOCASSEE SW TO TUCKASEGEE TIE

PICKENS T TO JOCASSEE SUP SW

JOCASSEE SW STA

JOCASSEE TIE TO CLIFFSIDE TIE

OCONEE NUCLEAR TO JOCASSEE TIE

JOCASSEE SS

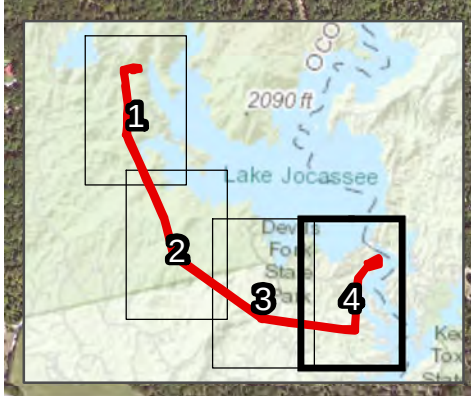
JOCASSEE TIE

OCONEE NUC TO JOCASSEE SW

JOCASSEE TIE TO BAD CREEK HYD

JOCASSEE SUP SW - BAD CREEK HYDRO

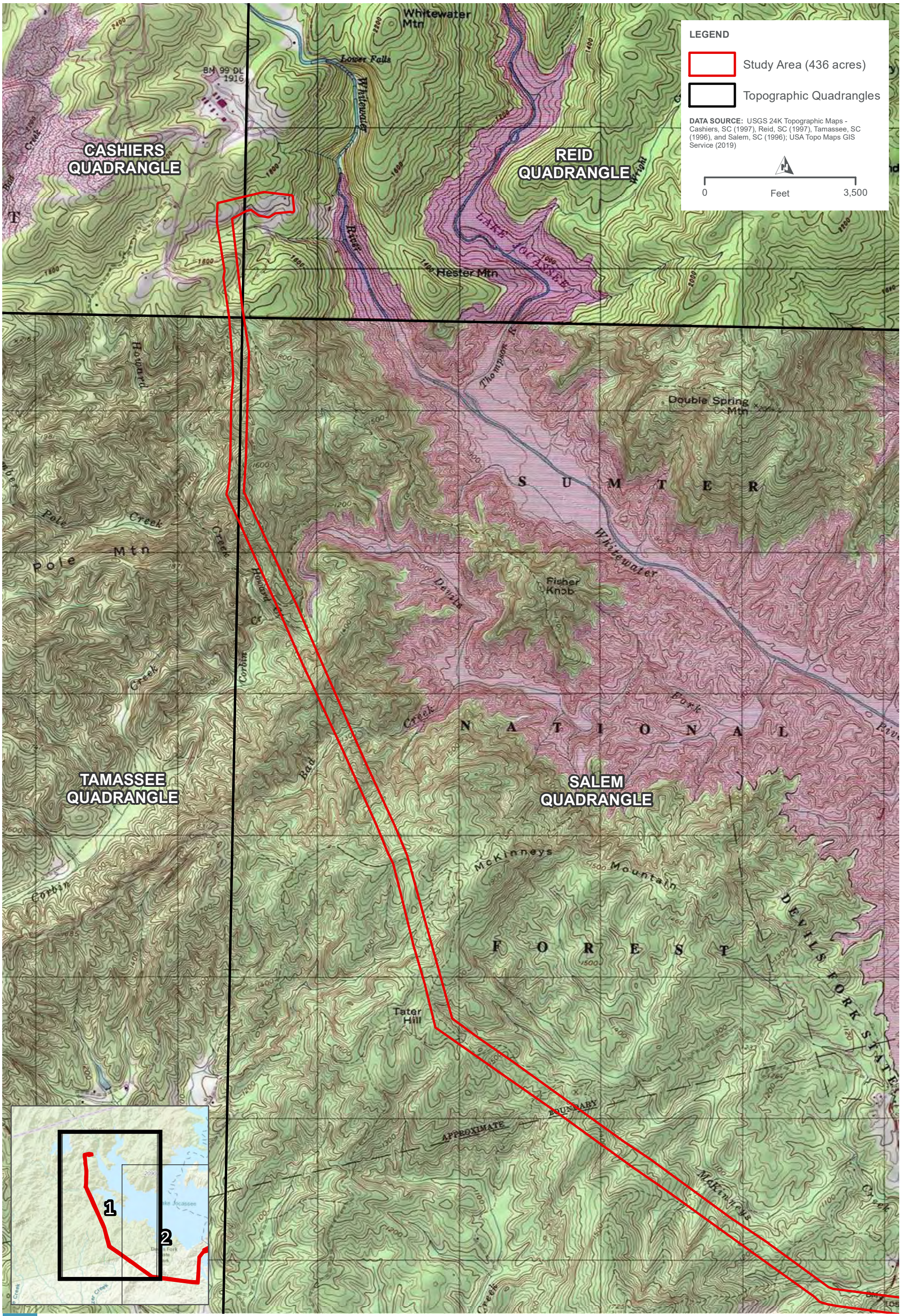
EASTATOE RET 100KV TAP



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROJECT AERIAL

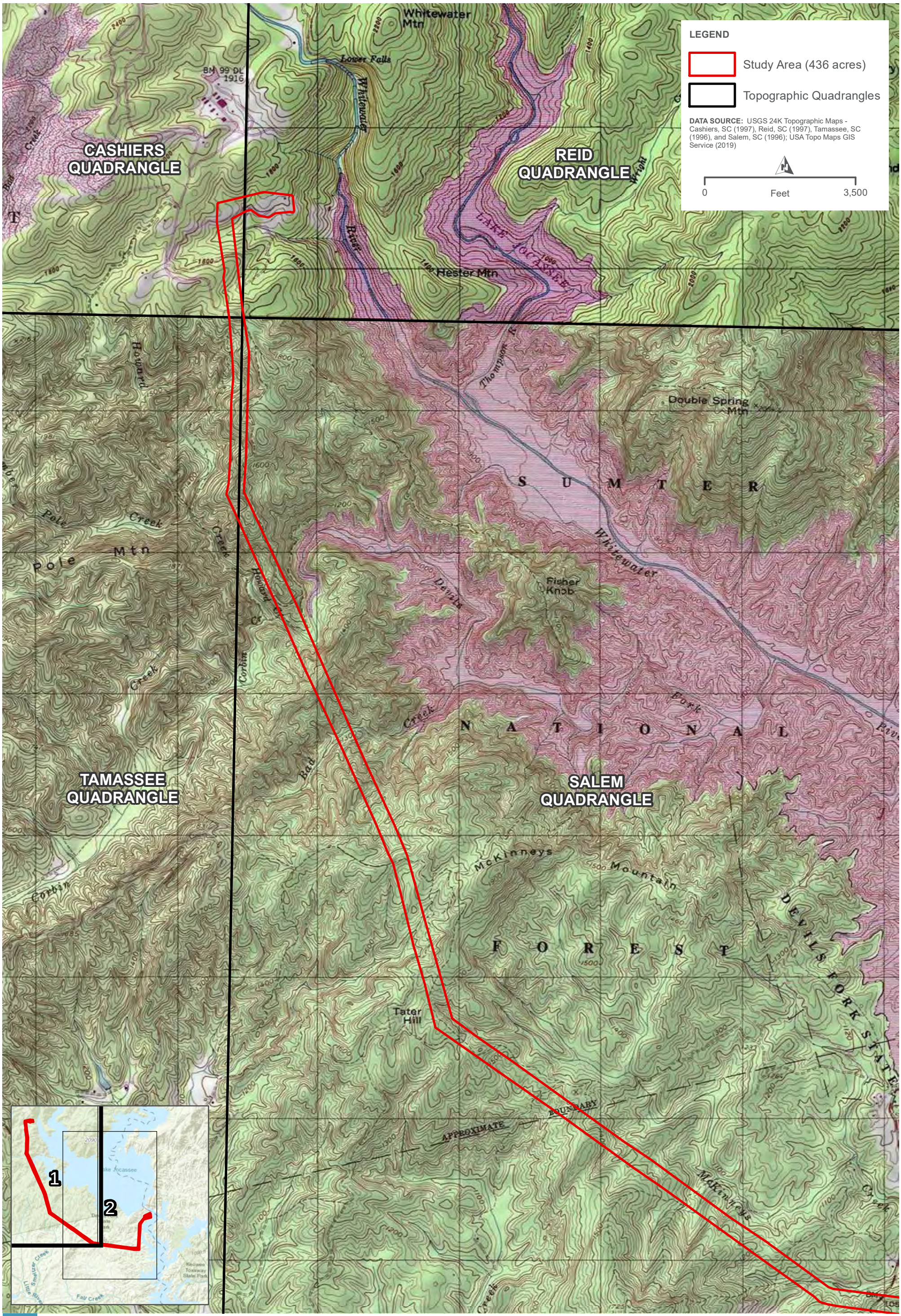
FIGURE 2 PAGE 4 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

USGS TOPOGRAPHIC QUADRANGLES

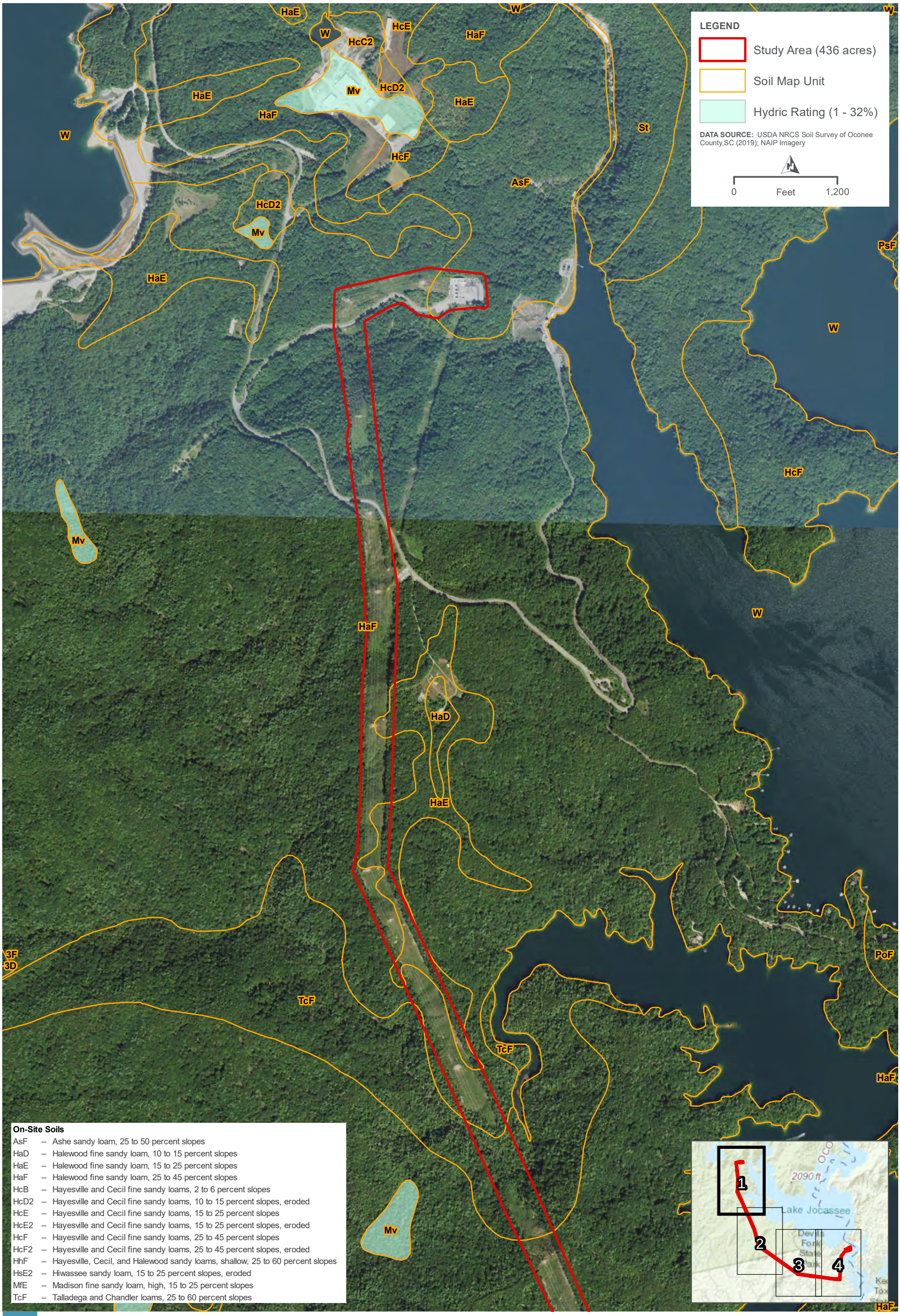
FIGURE 3 PAGE 1 OF 2



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

USGS TOPOGRAPHIC QUADRANGLES

FIGURE 3 PAGE 2 OF 2



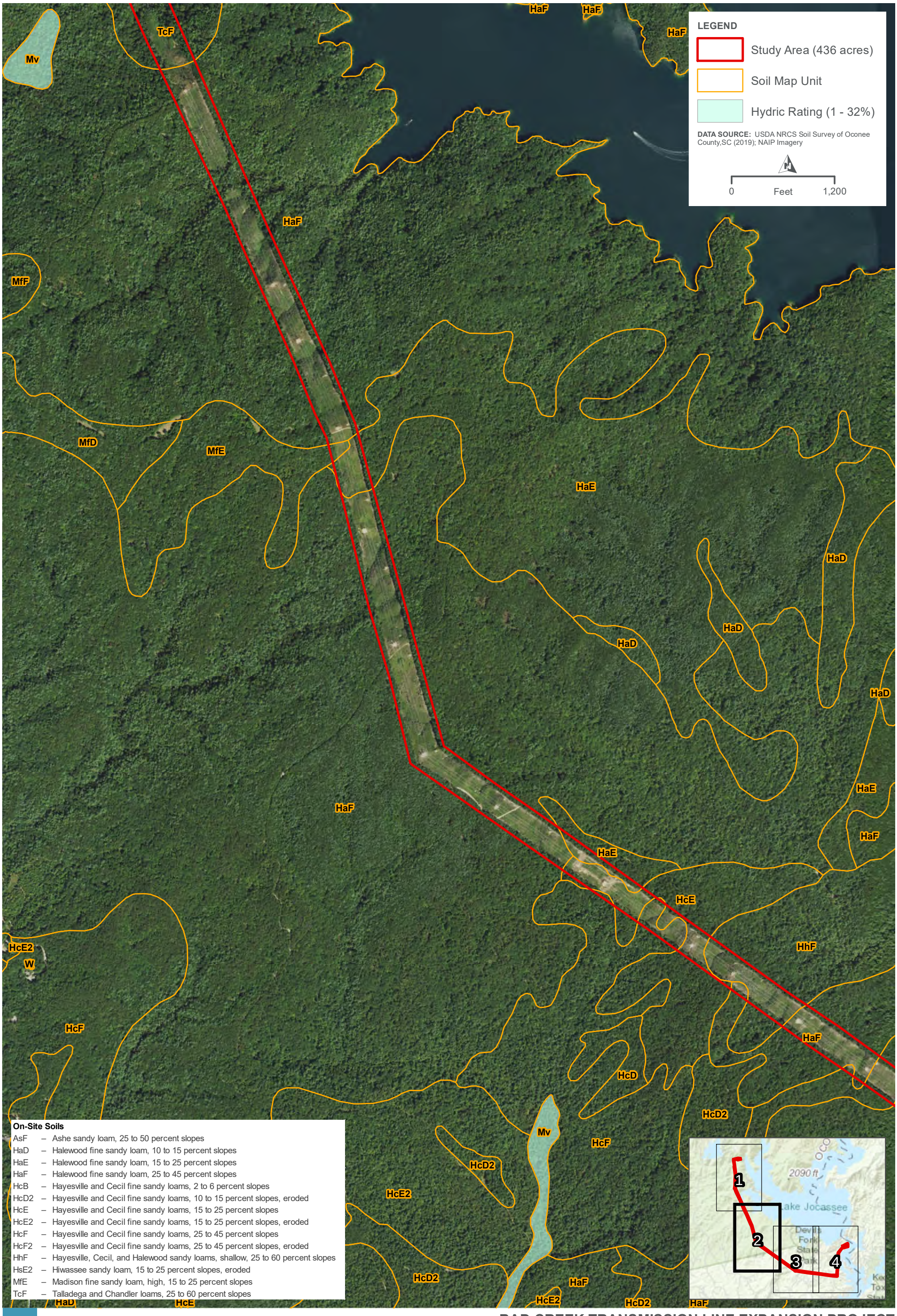
On-Site Soils

AsF	–	Ashe sandy loam, 25 to 50 percent slopes
HaD	–	Halewood fine sandy loam, 10 to 15 percent slopes
HaE	–	Halewood fine sandy loam, 15 to 25 percent slopes
HaF	–	Halewood fine sandy loam, 25 to 45 percent slopes
HcB	–	Hayesville and Cecil fine sandy loams, 2 to 6 percent slopes
HcD2	–	Hayesville and Cecil fine sandy loams, 10 to 15 percent slopes, eroded
HcE	–	Hayesville and Cecil fine sandy loams, 15 to 25 percent slopes
HcE2	–	Hayesville and Cecil fine sandy loams, 15 to 25 percent slopes, eroded
HcF	–	Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes
HcF2	–	Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes, eroded
HhF	–	Hayesville, Cecil, and Halewood sandy loams, shallow, 25 to 60 percent slopes
HsE2	–	Hiwassee sandy loam, 15 to 25 percent slopes, eroded
MfE	–	Madison fine sandy loam, high, 15 to 25 percent slopes
TcF	–	Talladega and Chandler loams, 25 to 60 percent slopes

BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NRCS SOIL SURVEY OF OCONEE COUNTY, SOUTH CAROLINA

FIGURE 4 PAGE 1 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NRCS SOIL SURVEY OF OCONEE COUNTY, SOUTH CAROLINA

FIGURE 4 PAGE 2 OF 4

LEGEND

Study Area (436 acres)

Soil Map Unit

Hydric Rating (1 - 32%)

DATA SOURCE: USDA NRCS Soil Survey of Oconee County,SC (2019); NAIP Imagery

0 Feet 1,200

On-Site Soils

AsF	–	Ashe sandy loam, 25 to 50 percent slopes
HaD	–	Halewood fine sandy loam, 10 to 15 percent slopes
HaE	–	Halewood fine sandy loam, 15 to 25 percent slopes
HaF	–	Halewood fine sandy loam, 25 to 45 percent slopes
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HcF2	–	Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes, eroded
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HsE2	–	Hiwassee sandy loam, 15 to 25 percent slopes, eroded
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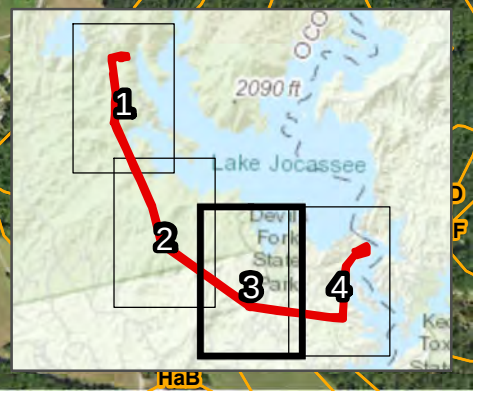

BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NRCS SOIL SURVEY OF OCONEE COUNTY, SOUTH CAROLINA

FIGURE 4 PAGE 3 OF 4

LEGEND

Study Area (436 acres)

Soil Map Unit

Hydric Rating (1 - 32%)

DATA SOURCE: USDA NRCS Soil Survey of Oconee County,SC (2019); NAIP Imagery

0 Feet 1,200

On-Site Soils

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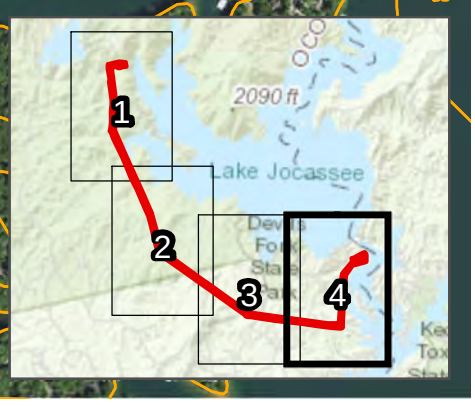
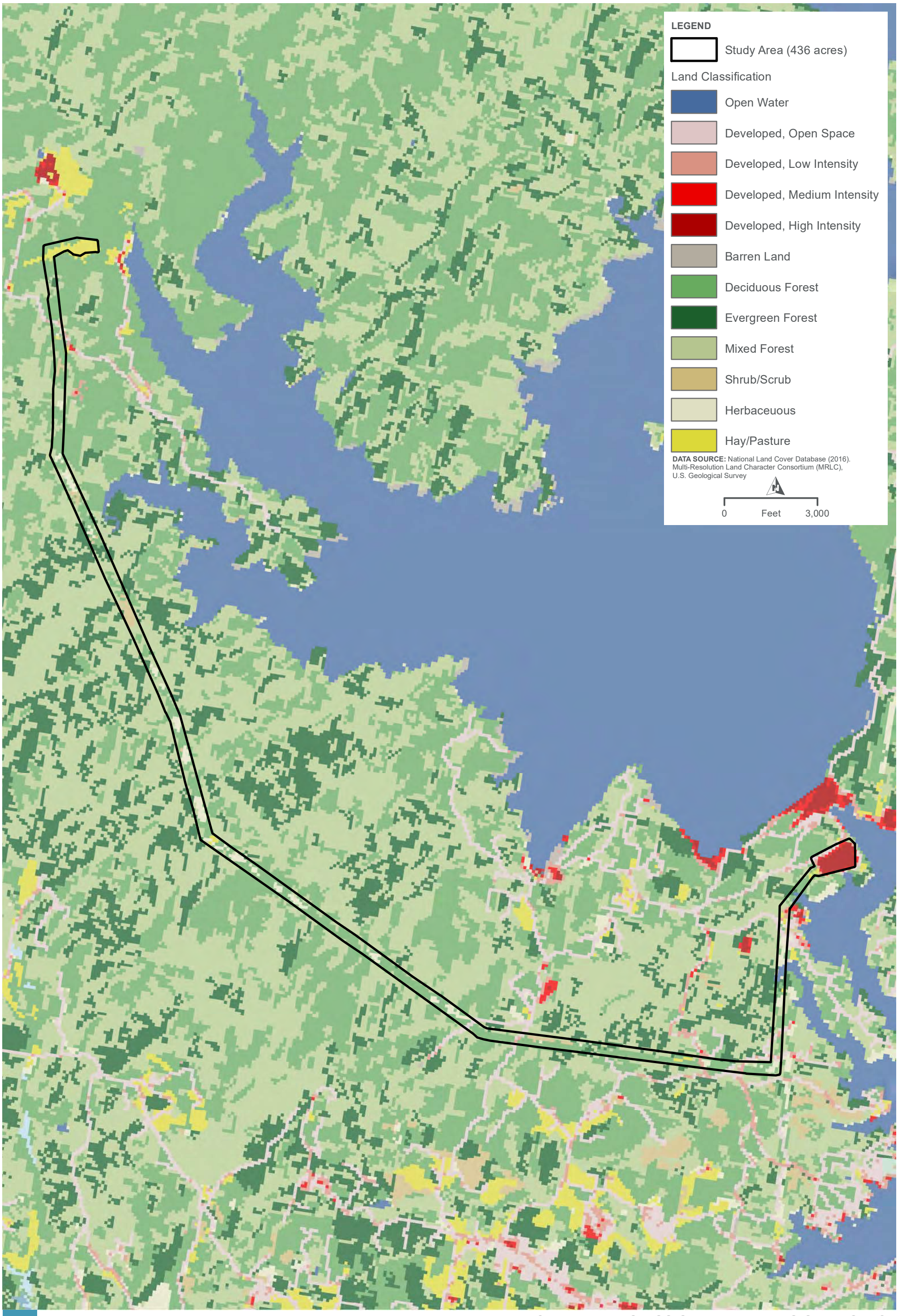


BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NRCS SOIL SURVEY OF OCONEE COUNTY, SOUTH CAROLINA

FIGURE 4 PAGE 4 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NATIONAL LAND COVER DATABASE 2016 LAND COVER

FIGURE 5

Redacted: Controlled Unclassified Information

LEGEND

Study Area (436 acres)

1-Mile Buffer

SCDNR Managed Lands

Leased

Easement

USGS Protected Areas Database

Conservation Area

National Forest

State Conservation Area

State Park

DATA SOURCE: USGS Protected Areas Database; SCDNR Protected Lands Database

0 Feet 5,000

Jocassee Gorges (WMA)

Bad Creek Reservoir

Francis Marion and Sumter National Forest

SCDNR (WMA)

Devils Fork State Park

Lake Jocassee

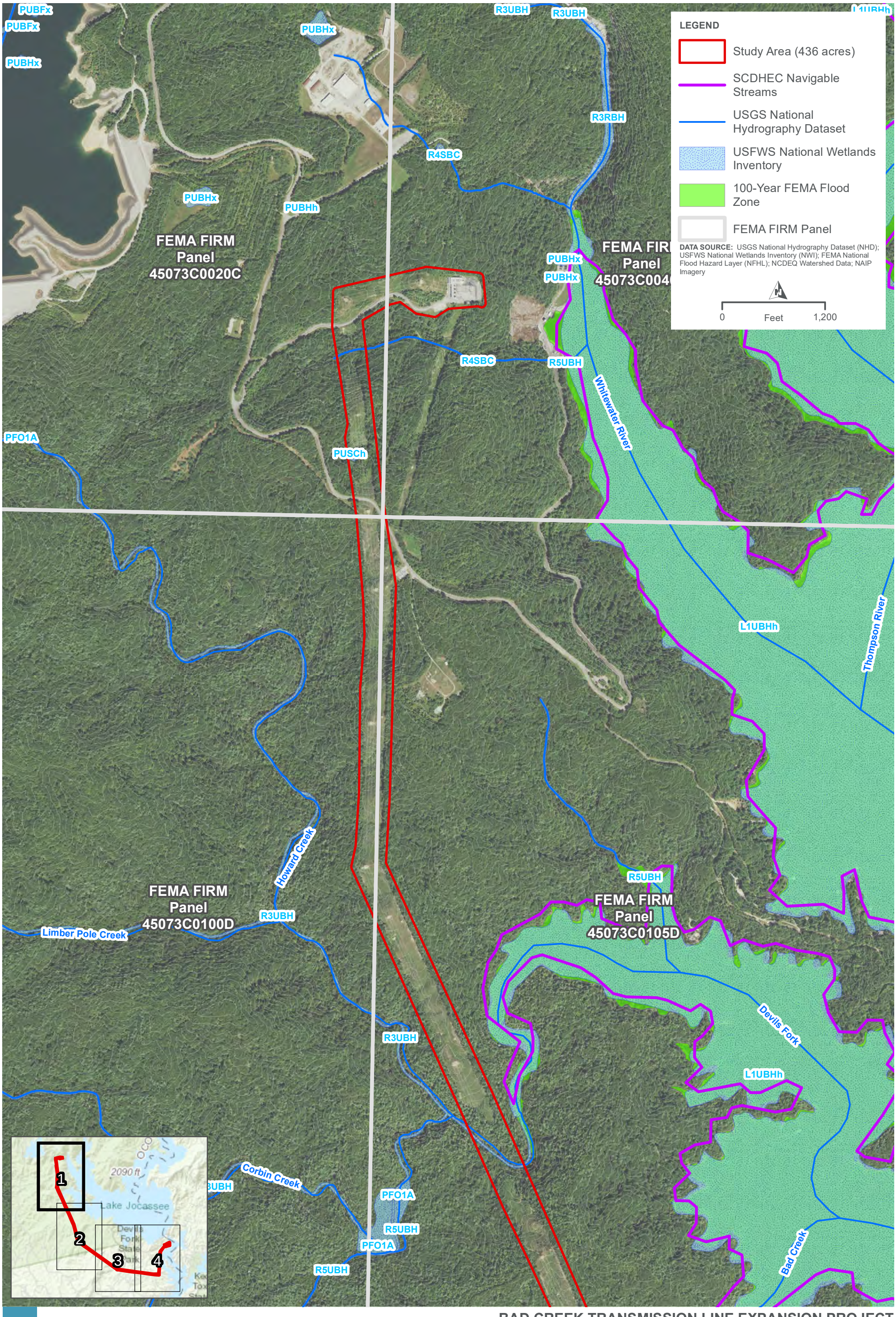
Lake Keowee

BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

MANAGED AREAS

FIGURE 7

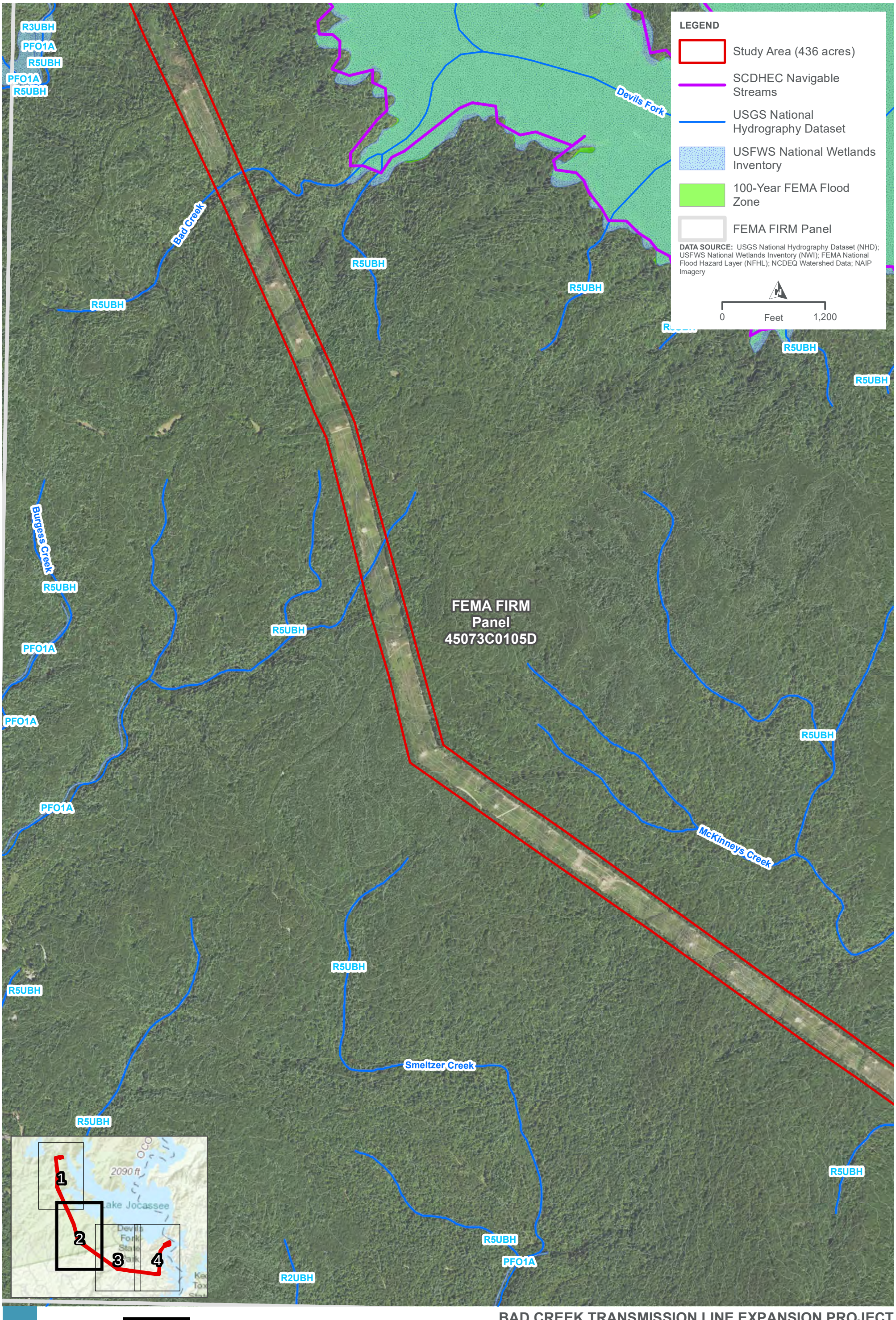
PATH: \\CLT-SRV02\GIS\PROJECTS\DUKE_ENERGY\10304100_BADCREEK_NRA\7.2_WIP\MAP_DOCS\MXD\NRA\07_BADCREEK_MANAGEDAREAS.MXD - USER: GMARCHICA - DATE: 8/6/2021



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NHD, NWI, AND FEMA FLOOD ZONES

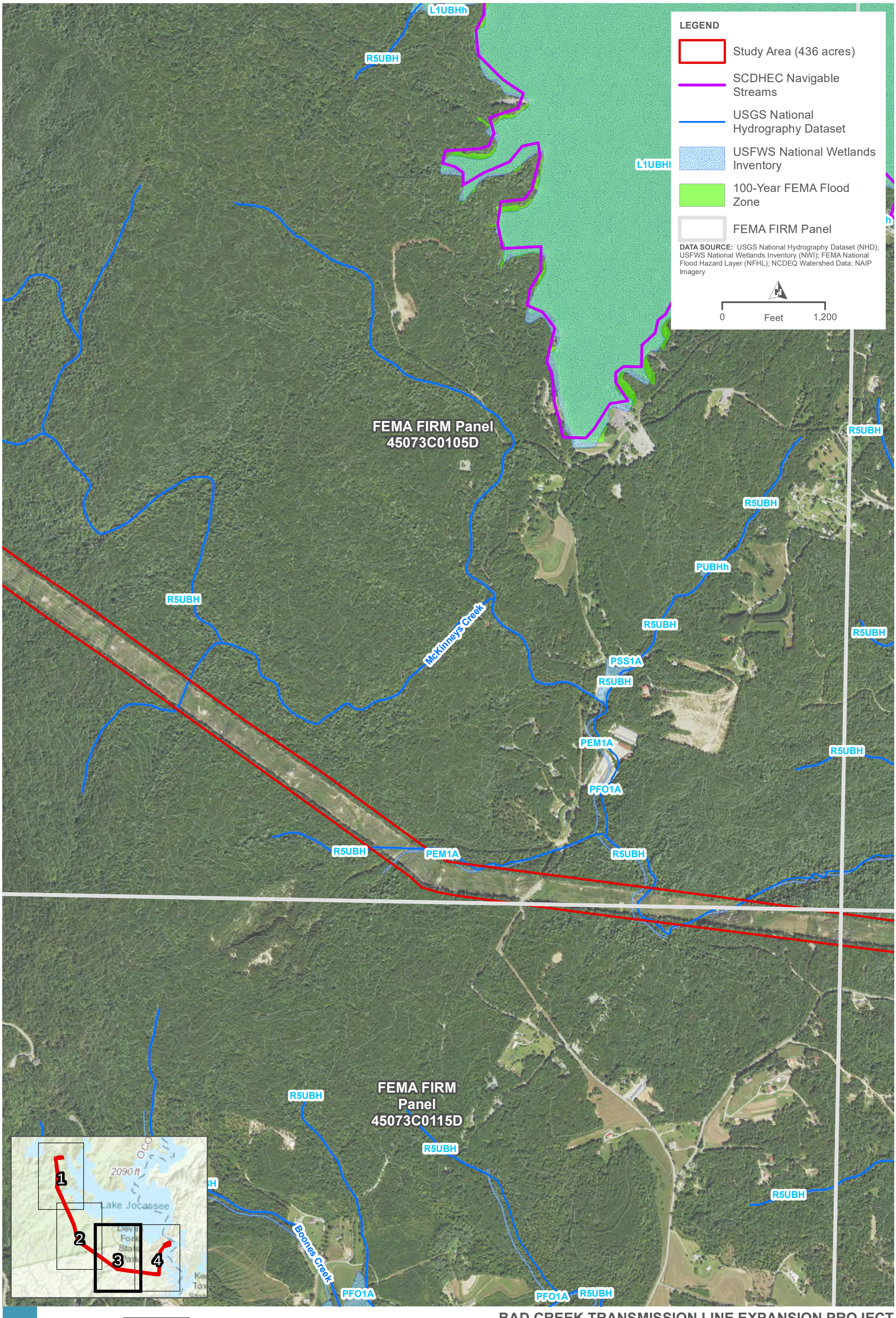
FIGURE 9 PAGE 1 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NHD, NWI, AND FEMA FLOOD ZONES

FIGURE 9 PAGE 2 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NHD, NWI, AND FEMA FLOOD ZONES

FIGURE 9 PAGE 3 OF 4

LEGEND

- Study Area (436 acres)
- SCDHEC Navigable Streams
- USGS National Hydrography Dataset
- USFWS National Wetlands Inventory
- 100-Year FEMA Flood Zone
- FEMA FIRM Panel

DATA SOURCE: USGS National Hydrography Dataset (NHD); USFWS National Wetlands Inventory (NWI); FEMA National Flood Hazard Layer (NFHL); NCDEQ Watershed Data; NAIP Imagery

0 Feet 1,200

FEMA FIRM Panel 45073C0110D

FEMA FIRM Panel 45073C0120D

Toxaway River

Cane Creek

Keowee River

McKinneys Creek

L1UBHh

R5UBH

R4SBC

PEM1Ah

L2USAh

PEM1Ch

PFO1A

PUBHh

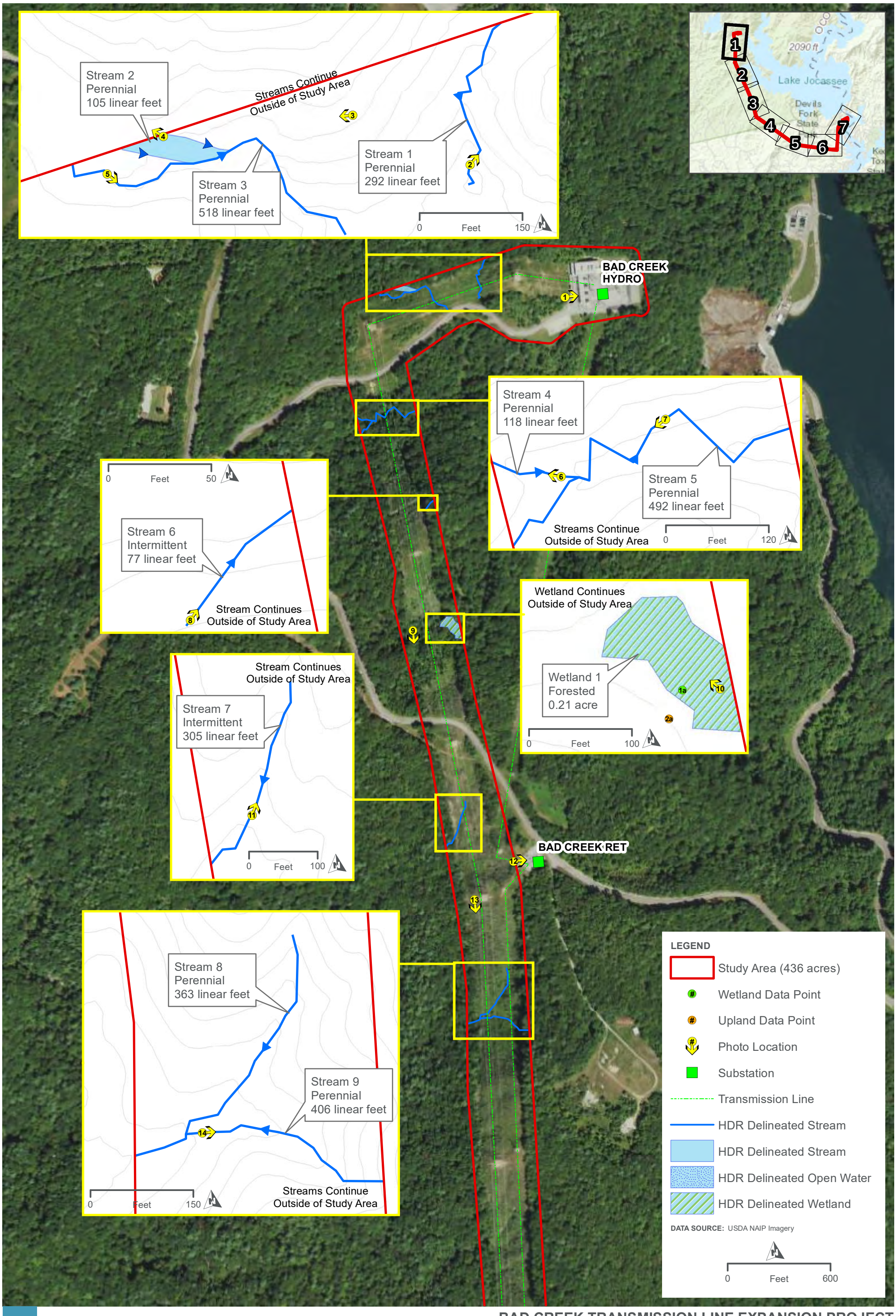
2090 ft

Lake Jocassee

BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

NHD, NWI, AND FEMA FLOOD ZONES

FIGURE 9 PAGE 4 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

DELINEATED WATERS OF THE U.S.

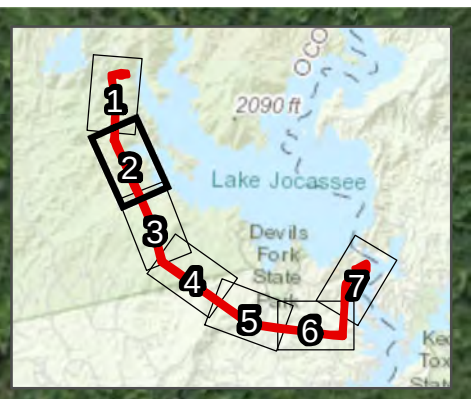
FIGURE 10 PAGE 1 OF 7

LEGEND

- Study Area (436 acres)
- Wetland Data Point
- Upland Data Point
- Photo Location
- Substation
- Transmission Line
- HDR Delineated Stream
- HDR Delineated Stream
- HDR Delineated Open Water
- HDR Delineated Wetland

DATA SOURCE: USDA NAIP Imagery

0 Feet 600



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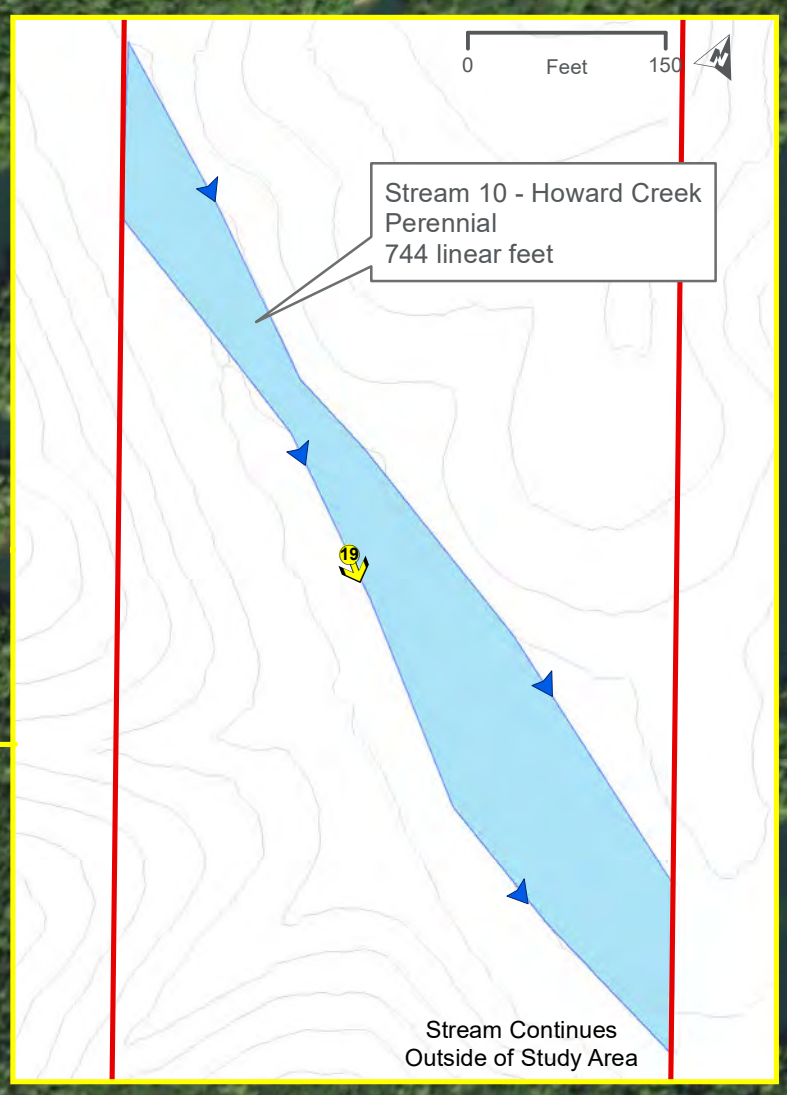
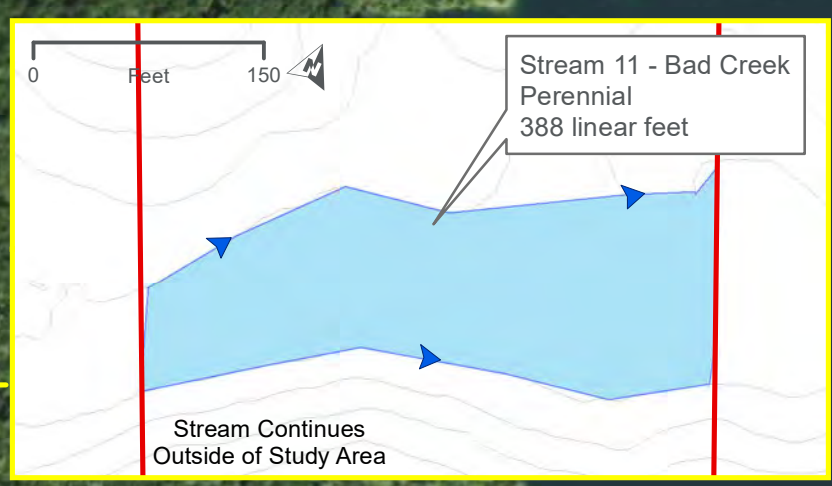




BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

DELINEATED WATERS OF THE U.S.

FIGURE 10 PAGE 2 OF 7

PATH: \\CLT-SRV02\GIS\PROJECTS\DUKE_ENERGY\10304100_BADCREEK_NRA\7.2_WIP\MAP_DOCS\MXD\NRA\10.2_BADCREEK_WOUS.MXD - USER: GMARCHICA - DATE: 8/31/2021

NATURAL RESOURCES ASSESSMENT

LEGEND

- Study Area (436 acres)
- Wetland Data Point
- Upland Data Point
- Photo Location
- Substation
- Transmission Line
- HDR Delineated Stream
- HDR Delineated Stream
- HDR Delineated Open Water
- HDR Delineated Wetland

DATA SOURCE: USDA NAIP Imagery

0 Feet 600

0 Feet 150

Stream 11 - Bad Creek
Perennial
388 linear feet

Stream Continues
Outside of Study Area

0 Feet 150

L21

Stream 12
Perennial
426 linear feet

Stream Continues
Outside of Study Area

0 Feet 200

22

Stream 13
Perennial
950 linear feet

23

Stream Continues
Outside of Study Area

0 Feet 200

Wetland Continues
Outside of Study Area

24

Wetland 2
Emergent
0.2 acre

3a 4a

25

Stream 14
Perennial
638 linear feet

Stream Continues
Outside of Study Area

Stream Continues
Outside of Study Area

Stream 15
Perennial
555 linear feet

0 Feet 200

27

28

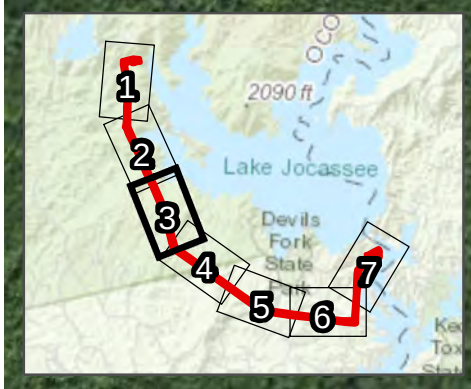
Stream 16
Intermittent
364 linear feet

26

Stream 17
Perennial
410 linear feet

0 Feet 150

Streams Continue
Outside of Study Area



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

DELINEATED WATERS OF THE U.S.

FIGURE 10 PAGE 3 OF 7

LEGEND

- Study Area (436 acres)
- Wetland Data Point
- Upland Data Point
- Photo Location
- Substation
- Transmission Line
- HDR Delineated Stream
- HDR Delineated Stream
- HDR Delineated Open Water
- HDR Delineated Wetland

DATA SOURCE: USDA NAIP Imagery

0 Feet 600

Stream 18
Stream type not available
116 linear feet

Stream Continues
Outside of Study Area

0 Feet 100

Stream 19
Intermittent
135 linear feet

Stream Continues
Outside of Study Area

0 Feet 100

Stream 20
Intermittent
232 linear feet

Stream 22
Intermittent
93 linear feet

Stream 21
Perennial
266 linear feet

Stream 21 Continues
Outside of Study Area

0 Feet 100

Stream 23
Intermittent
198 linear feet

Stream 24
Intermittent
400 linear feet

Streams Continue
Outside of Study Area

Stream 25
Perennial
228 linear feet

Wetland 3
Emergent
0.09 acre

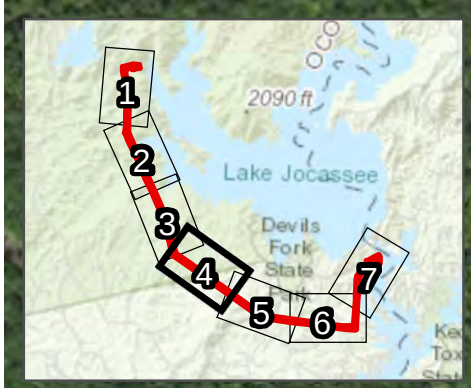
Wetland 4
Emergent
0.09 acre

Wetland 5
Emergent
0.04 acre

Stream 26
Intermittent
218 linear feet

Streams and Wetland 4 Continue
Outside of Study Area

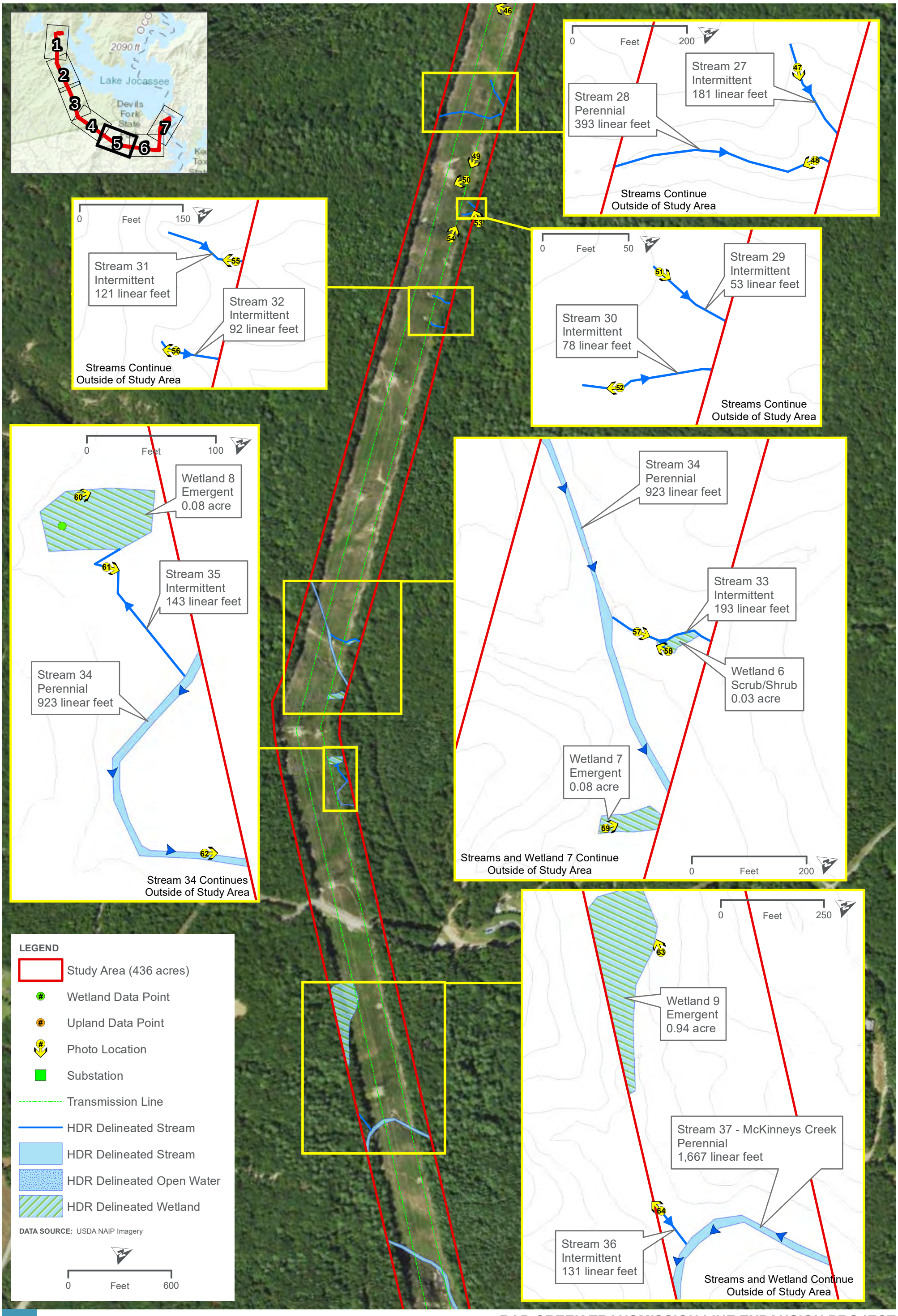
0 Feet 200



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

DELINEATED WATERS OF THE U.S.

FIGURE 10 PAGE 4 OF 7



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

DELINEATED WATERS OF THE U.S.

FIGURE 10 PAGE 5 OF 7

Stream 37 - McKinneys Creek
Perennial
1,667 linear feet

Stream Continues
Outside of Study Area

Stream 38
Intermittent
126 linear feet

Stream 39
Perennial
337 linear feet

Stream 40
Intermittent
502 linear feet

Streams Continue
Outside of Study Area

Wetland 10
Emergent
0.1 acre

Stream Continues
Outside of Study Area

Wetland 12
Emergent
0.09 acre

Stream 42
Perennial
474 linear feet

Stream 41
Intermittent
474 linear feet

Wetland 11
Emergent
0.05 acre

Stream Continues
Outside of Study Area

Wetland 13
Emergent
0.51 acre

Wetland Continues
Outside of Study Area

Wetland 15
Scrub/Shrub/Emergent
0.04 acre

Stream 44
Perennial
502 linear feet

Wetland 16
Scrub/Shrub
0.07 acre

Stream and Wetland 16 Continue
Outside of Study Area

Stream 43
Intermittent
294 linear feet

Wetland 14
Emergent
0.02 acre

Lake Jocassee
Devils Fork State

LEGEND

- Study Area (436 acres)
- Wetland Data Point
- Upland Data Point
- Photo Location
- Substation
- Transmission Line
- HDR Delineated Stream
- HDR Delineated Stream
- HDR Delineated Open Water
- HDR Delineated Wetland

DATA SOURCE: USDA NAIP Imagery

BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

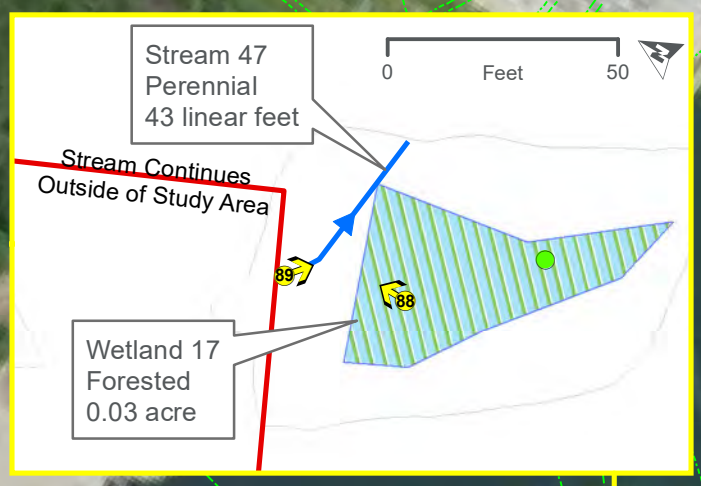
DELINEATED WATERS OF THE U.S.

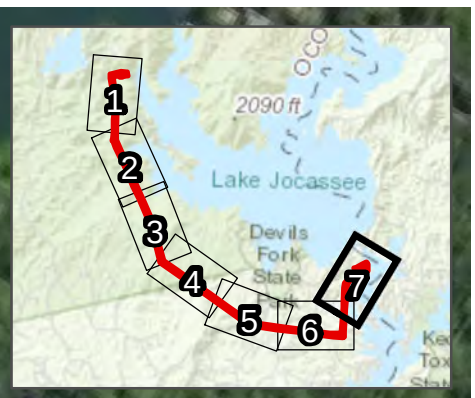
FIGURE 10 PAGE 6 OF 7

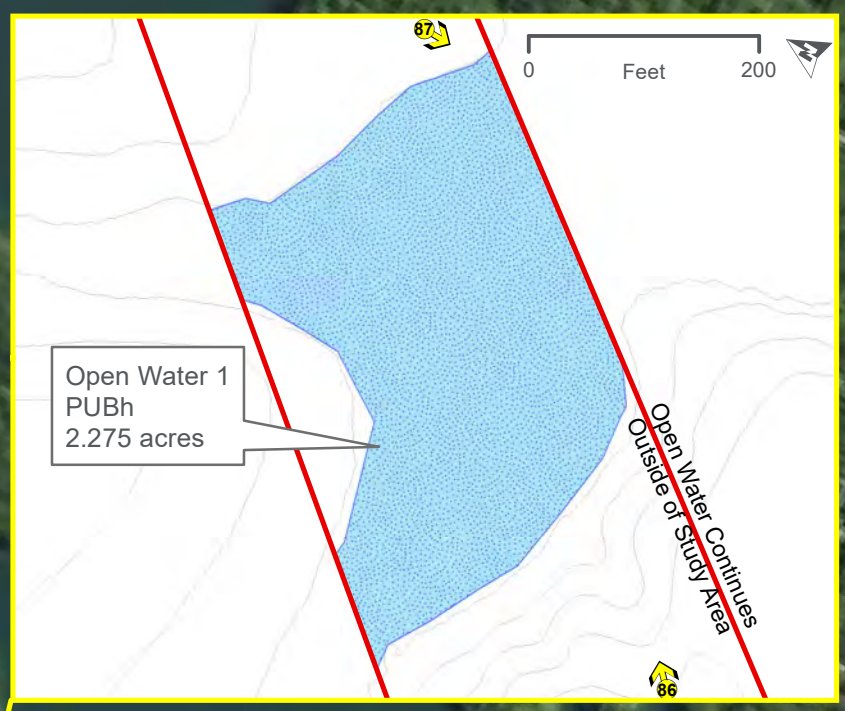
JOCASSEE SW STA

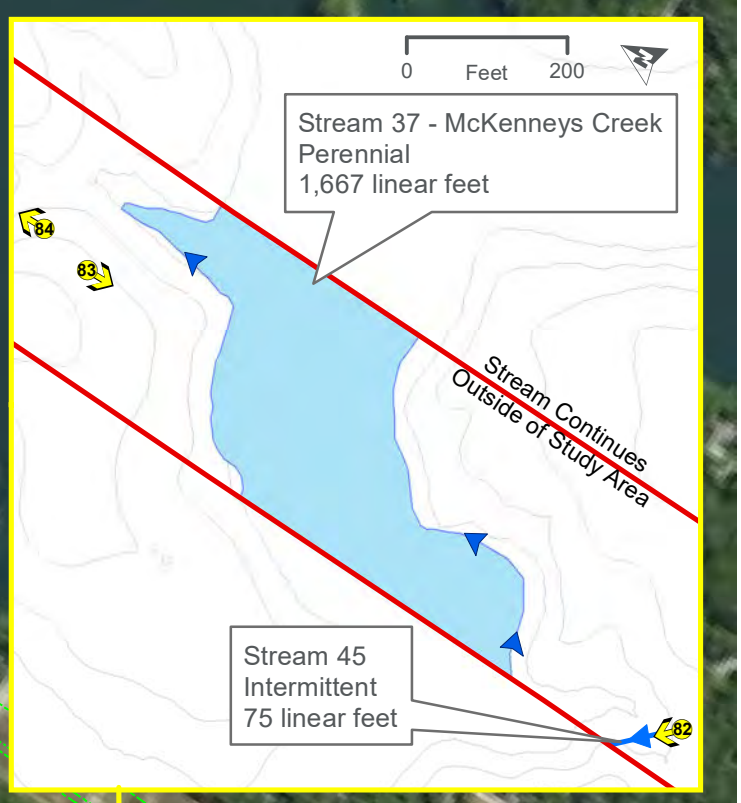
JOCASSEE SS

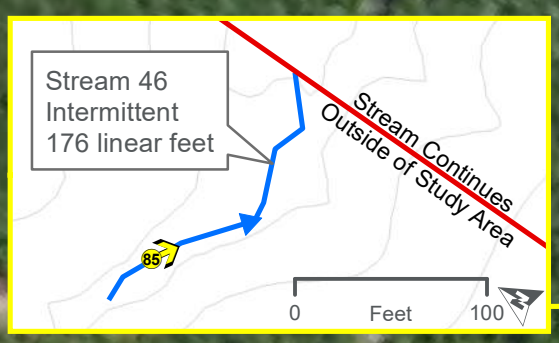
JOCASSEE TIE











LEGEND

- Study Area (436 acres)
- Wetland Data Point
- Upland Data Point
- Photo Location
- Substation
- Transmission Line
- HDR Delineated Stream
- HDR Delineated Stream
- HDR Delineated Open Water
- HDR Delineated Wetland

DATA SOURCE: USDA NAIP Imagery

0 Feet 600

HDR

[redacted]

BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

DELINEATED WATERS OF THE U.S.

FIGURE 10 PAGE 7 OF 7

LEGEND

Study Area (436 acres)

Protected Species Habitat

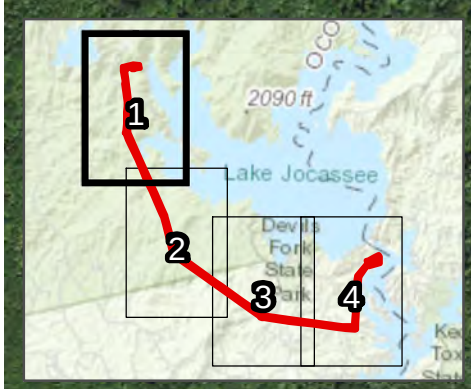
Small Whorled Pogonia

Small Whorled Pogonia/Persistent Trillium

Smooth Coneflower/Aster Sunfacing Coneflower

DATA SOURCE: USDA NAIP Imagery

0 Feet 1,200



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROTECTED SPECIES HABITAT

FIGURE 11 PAGE 1 OF 4

LEGEND

Study Area (436 acres)

Protected Species Habitat

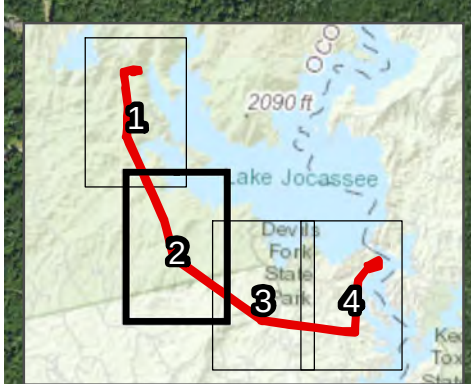
Small Whorled Pogonia

Small Whorled Pogonia/Persistent Trillium

Smooth Coneflower/Aster Sunfacing Coneflower

DATA SOURCE: USDA NAIP Imagery

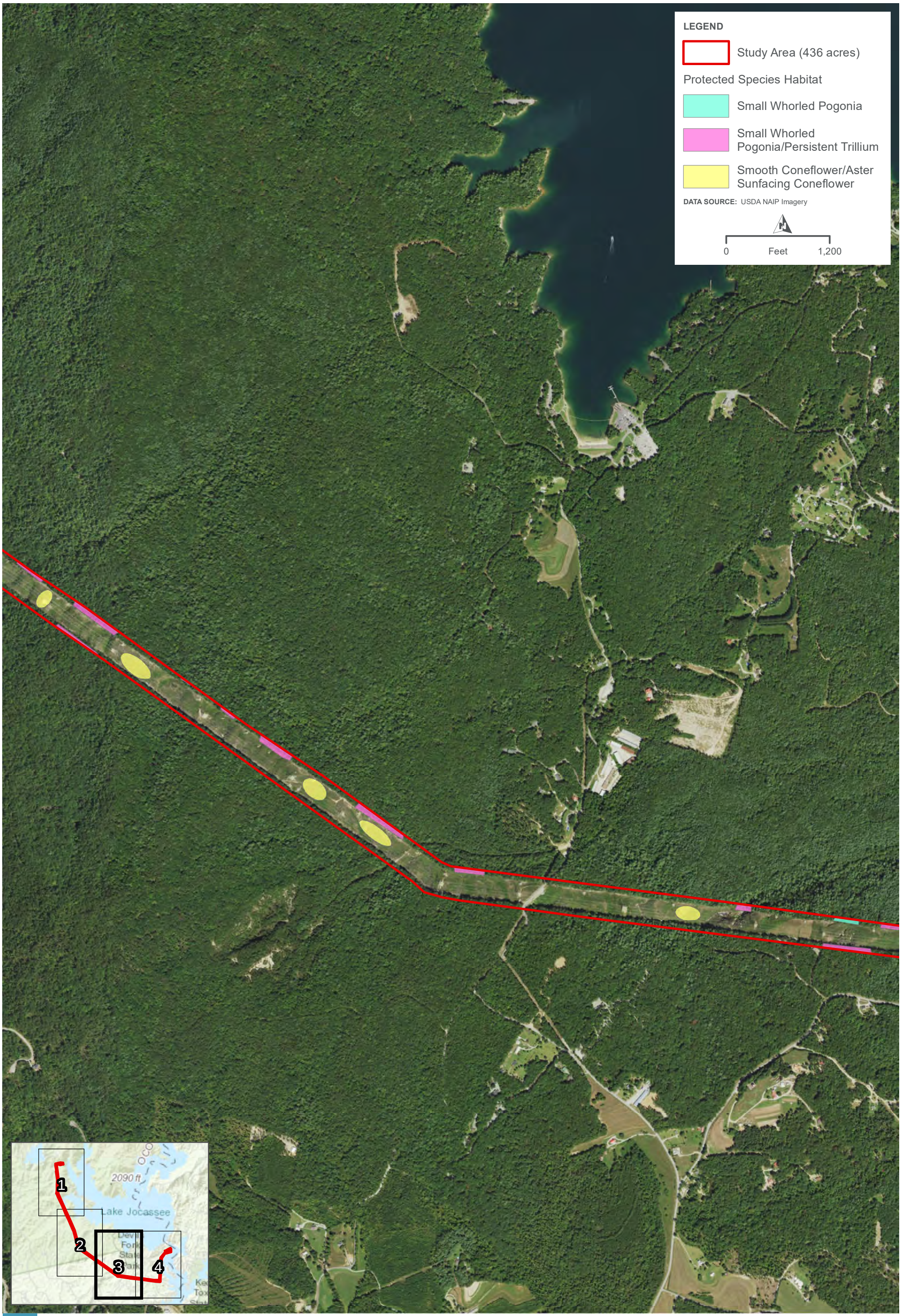
0 Feet 1,200



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROTECTED SPECIES HABITAT

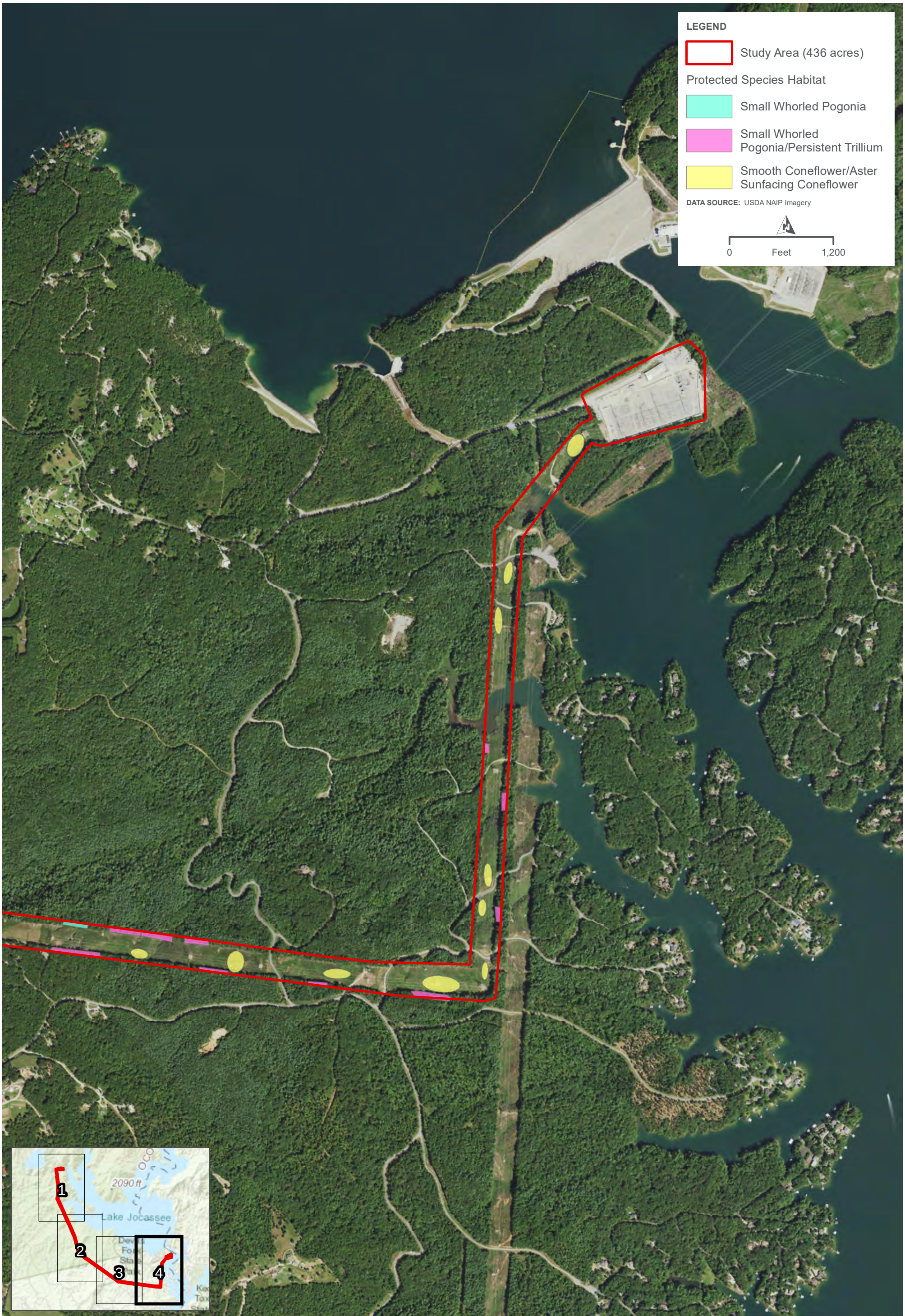
FIGURE 11 PAGE 2 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROTECTED SPECIES HABITAT

FIGURE 11 PAGE 3 OF 4



BAD CREEK TRANSMISSION LINE EXPANSION PROJECT

PROTECTED SPECIES HABITAT

FIGURE 11 PAGE 4 OF 4

Appendix B

Data Forms

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/8/21

Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP1A_Wet

Investigator(s): Eric Mularski, Jenessa Kay Section, Township, Range:

Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): concave Slope (%): 2-4

Subregion (LRR or MLRA): LRR N, MLRA 130B Lat: 35.001929 Long: -83.000400 Datum: NAD83

Soil Map Unit Name: HaF - Halewood fine sandy loam, 25 to 45 percent slopes NWI classification: PFO

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP1A_Wet is representative of Wetland 1. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP1A_Wet

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix nigra*	20	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
	20 =Total Cover		
50% of total cover: 10	20% of total cover: 4		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Quercus michauxii*	20	Yes	FACW
2. *Diospyros virginiana*	10	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	30 =Total Cover		
50% of total cover: 15	20% of total cover: 6		
Herb Stratum (Plot size: 5)			
1. *Microstegium vimineum*	60	Yes	FAC
2. *Lycopus americanus*	20	Yes	OBL
3. *Boehmeria cylindrica*	10	No	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90 =Total Cover		
50% of total cover: 45	20% of total cover: 18		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant.

SOIL

Sampling Point: DP1A_Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/1	100					Loamy/Clayey	
3-20	5Y 4/1	95	5Y 5/6	5	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/8/21

Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP2A_UPL

Investigator(s): Eric Mularski, Jenessa Kay Section, Township, Range:

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): none Slope (%): 10

Subregion (LRR or MLRA): LRR N, MLRA 130B Lat: 35.001877 Long: -83.000440 Datum: NAD83

Soil Map Unit Name: HaF - Halewood fine sandy loam, 25 to 45 percent slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
DP2A_UPL is representative of uplands. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: DP2A_UPL

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus michauxii*	40	Yes	FACW
2. *Liriodendron tulipifera*	20	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	60 =Total Cover		
50% of total cover: 30	20% of total cover: 12		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Elaeagnus angustifolia*	20	Yes	FACU
2. *Acer rubrum*	10	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	30 =Total Cover		
50% of total cover: 15	20% of total cover: 6		
Herb Stratum (Plot size: 5)			
1. *Microstegium vimineum*	40	Yes	FAC
2. *Laportea canadensis*	30	Yes	FAC
3. *Parthenocissus quinquefolia*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 =Total Cover		
50% of total cover: 40	20% of total cover: 16		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant.

SOIL

Sampling Point: DP2A_UPL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 2/1	100					Loamy/Clayey	
2-6	2.5Y 3/3	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Bedrock

Depth (inches): 6

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

No hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/9/2021

Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP3A_Wet

Investigator(s): Eric Mularski, Jenessa Kay Section, Township, Range:

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): concave Slope (%): 6-8

Subregion (LRR or MLRA): LRR N, MLRA 130B Lat: 34.964247 Long: -82.986610 Datum: NAD83

Soil Map Unit Name: HaE - Halewood fine sandy loam, 15 to 25 percent slopes NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP3A_Wet is representative of Weltand 2. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 2
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary and secondary wetland hydrology indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/9/2021

Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP3A_Wet

Investigator(s): Eric Mularski, Jenessa Kay Section, Township, Range:

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): concave Slope (%): 6-8

Subregion (LRR or MLRA): LRR N, MLRA 130B Lat: 34.964247 Long: -82.986610 Datum: NAD83

Soil Map Unit Name: HaE - Halewood fine sandy loam, 15 to 25 percent slopes NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP3A_Wet is representative of Weltand 2. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 2
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary and secondary wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP3A_Wet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Aralia spinosa*	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	10 =Total Cover		
50% of total cover: 5	20% of total cover: 2		
Herb Stratum (Plot size: 5)			
1. *Juncus effusus*	40	Yes	FACW
2. *Carex lurida*	30	Yes	OBL
3. *Persicaria sagittata*	10	No	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 =Total Cover		
50% of total cover: 40	20% of total cover: 16		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	40	x 2 =	80
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		150 (B)

Prevalence Index = B/A = 1.67

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetaion is dominant.

SOIL

Sampling Point: DP3A_Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR 5/2	90	7.5YR 5/6	10	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date:

Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP4a_Upl

Investigator(s): Eric Mularski, Jenessa Kay Section, Township, Range:

Landform (hillside, terrace, etc.): Hillslope Local relief (concave, convex, none): none Slope (%): 2-3

Subregion (LRR or MLRA): LRR N, MLRA 130B Lat: 34.964225 Long: -82.986577 Datum: NAD83

Soil Map Unit Name: HaE - Halewood fine sandy loam, 15 to 25 percent slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
DP4A_Upl is representative of uplands. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP4a_Upl

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Robinia pseudoacacia*	10	Yes	FACU
2. *Kalmia latifolia*	10	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	20 =Total Cover		
50% of total cover: 10	20% of total cover: 4		
Herb Stratum (Plot size: 5)			
1. *Rubus argutus*	50	Yes	FACU
2. *Vernonia noveboracensis*	40	Yes	FACW
3. *Vitis rotundifolia*	10	No	FAC
4. *Eupatorium capillifolium*	10	No	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	110 =Total Cover		
50% of total cover: 55	20% of total cover: 22		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is not dominant

SOIL

Sampling Point: DP4a_Upl

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/4	100					Loamy/Clayey	
3-20	5YR 5/3	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

Hydric soil indicators are not present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/8/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP1b_wet
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.953520 Long: -82.917887 Datum: NAD83
Soil Map Unit Name: HcF - Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes NWI classification: PFO
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP1b-wet is representative of Wetland 17. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 0
Water Table Present?	Yes X	No ____	Depth (inches): 8
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP1b_wet

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Acer rubrum*	40	Yes	FAC
2. *Liriodendron tulipifera*	20	Yes	FACU
3.			
4.			
5.			
6.			
7.			
	60	=Total Cover	
50% of total cover: 30		20% of total cover:	12
Sapling/Shrub Stratum (Plot size: 15)			
1. *Alnus serrulata*	60	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	60	=Total Cover	
50% of total cover: 30		20% of total cover:	12
Herb Stratum (Plot size: 5)			
1. *Microstegium vimineum*	60	Yes	FAC
2. *Azolla filiculodies*	40	Yes	
3. *Smilax rotundifolia*	10	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	110	=Total Cover	
50% of total cover: 55		20% of total cover:	22
Woody Vine Stratum (Plot size: 5)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetaton is dominant

SOIL

Sampling Point: DP1b_wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR 4/1	80	5YR 4/6	20	C	PL	Loamy/Clayey	Prominent redox concentrations
6-20	10YR 5/1	90	10YR 4/6	10	C	PL	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ? Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ____

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/8/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP2b_Upl
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): none Slope (%): 15-20
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.953478 Long: -82.918095 Datum: NAD83
Soil Map Unit Name: HcF - Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes NWI classification: Upland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
DP2b_Upland is representative of uplands. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP2b_Upl

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Ilex montana*	40	Yes	FACU
2. *Quercus alba*	30	Yes	FACU
3. *Juniperus virginiana*	20	Yes	FACU
4.			
5.			
6.			
7.			
	90	=Total Cover	
50% of total cover: 45		20% of total cover: 18	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is not dominant.

SOIL

Sampling Point: DP2b_Upl

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20	5Y 5/4	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

No hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/8/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP3b_wet
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Valley Local relief (concave, convex, none): concave Slope (%): 0-1
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.941889 Long: -82.921044 Datum: NAD83
Soil Map Unit Name: HcD2 - Hayesville and Cecil fine sandy loams, 10 to 15 percent slopes, eroded NWI classification: PEM/PSS
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP3b_wet is representative of wetland 15 and 16. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary and secondary wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP3b_wet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Nyssa sylvatica*	30	Yes	FAC
2. *Ostrya virginiana*	20	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	50 =Total Cover		
50% of total cover: 25	20% of total cover: 10		
Herb Stratum (Plot size: 5)			
1. *Microstegium vimineum*	15	Yes	FAC
2. *Impatiens capensis*	15	Yes	FACW
3. *Woodwardia areolata*	10	Yes	FACW
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	40 =Total Cover		
50% of total cover: 20	20% of total cover: 8		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant.

SOIL

Sampling Point: DP3b_wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	5YR 2.5/2	100					Loamy/Clayey	
1-20	10Y 5/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/8/2021

Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP4b_Upl

Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): none Slope (%): 5-10

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.941829 Long: -82.921037 Datum: NAD83

Soil Map Unit Name: HcD2 - Hayesville Cecil fine sandy loams, 10 to 15 percent slopes, eroded NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
DP4b_upl is representative of uplands. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP4b_Upl

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Kalmia latifolia*	50	Yes	FACU
2. *Acer rubrum*	30	Yes	FAC
3. *Quercus rubra*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
	90 =Total Cover		
50% of total cover: 45	20% of total cover: 18		
Herb Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is not dominant.

SOIL

Sampling Point: DP4b_Upl

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 3/4	100					Loamy/Clayey	
1-2	10YR 3/2	100					Loamy/Clayey	
2-20	10YR 6/3	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

No hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/8/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP5b-Wet
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): none Slope (%): 0-1
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.937818 Long: -82.921385 Datum: NAD83
Soil Map Unit Name: HcF - Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes NWI classification: PSS
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP5b_wet is representative of Wetland 14. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary and secondary wetland hydrology indicators are present

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP5b-Wet

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Alnus serrulata*	40	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	40 =Total Cover		
50% of total cover: 20	20% of total cover: 8		
Herb Stratum (Plot size: 5)			
1. *Juncus effusus*	30	Yes	FACW
2. *Ludwigia alternifolia*	20	Yes	FACW
3. *Carex lupulina*	10	No	OBL
4. *Woodwardia areolata*	10	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70 =Total Cover		
50% of total cover: 35	20% of total cover: 14		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant.

SOIL

Sampling Point: DP5b-Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	7.5YR 3/2	100					Loamy/Clayey	
2-10	7.5YR 3/2	80	7.5YR 5/6	20	C	M	Loamy/Clayey	Prominent redox concentrations
10-20	7.5YR 5/2	85	2.5YR 4/8	15	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** ____

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/8/2021

Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP6b_Upl

Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:

Landform (hillside, terrace, etc.): Hillslope Local relief (concave, convex, none): none Slope (%): 3-4

Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.937768 Long: -82.921397 Datum: NAD83

Soil Map Unit Name: HcF - Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
DP6b_upl is representative of uplands. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP6b_Upl

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Liriodendron tulipifera*	25	Yes	FACU
2. *Eupatorium capillifolium*	20	Yes	FACU
3. *Rubus argutus*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
	55 =Total Cover		
50% of total cover: 28	20% of total cover: 11		
Herb Stratum (Plot size: 5)			
1. *Glechoma hederacea*	20	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	20 =Total Cover		
50% of total cover: 10	20% of total cover: 4		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is not present.

SOIL

Sampling Point: DP6b_Upl

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR 6/6	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

No hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/9/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP7b_wet
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Valley Local relief (concave, convex, none): concave Slope (%): 1-2
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.935820 Long: -82.922082 Datum: NAD83
Soil Map Unit Name: HcF - Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes NWI classification: PEM1B
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP7b_wet is representative of Wetland 13. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary and secondary wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP7b_wet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Carex lupulina*	70	Yes	OBL
2. *Rhynchospora corniculata*	40	Yes	OBL
3. *Ludwigia alternifolia*	30	No	FACW
4. *Juncus effusus*	30	No	FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	170 =Total Cover		
50% of total cover: 85	20% of total cover: 34		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant

SOIL

Sampling Point: DP7b_wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	7.5YR 4/2	30	7.5YR 5/8	20	C	M	Loamy/Clayey	Prominent redox concentrations
3-20	5Y 4/1	90	7.5YR 5/8	10	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/9/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP8_wet
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-3
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.935707 Long: -82.928378 Datum: NAD83
Soil Map Unit Name: HcF - Hayesville and Cecil fine sandy loams, 25 to 45 percent slopes NWI classification: PEM1b
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP8b_wet is representative of Wetland 11. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary and secondary wetland hydrology is present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP8_wet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Scirpus cyperinus*	40	Yes	FACW
2. *Juncus effusus*	20	Yes	FACW
3. *Impatiens capensis*	20	Yes	FACW
4. *Typha angustifolia*	10	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90 =Total Cover		
50% of total cover: 45	20% of total cover: 18		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant

SOIL

Sampling Point: DP8_wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	7.5YR 4/1	60	2.5YR 5/6	10	C	PL/M	Loamy/Clayey	Prominent redox concentrations
			7.5YR 6/3	30				
10-20	7.5YR 5/1	80	7.5YR 6/8	20	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/9/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP9b_wet
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 0-1
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.936009 Long: -82.932130 Datum: NAD83
Soil Map Unit Name: HaF - Halewood fine sandy loam, 25 to 45 percent slopes NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP9_wet is representative of Wetland 9 and 10. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP9b_wet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Scirpus cyperinus*	40	Yes	FACW
2. *Juncus effusus*	20	Yes	FACW
3. *Impatiens capensis*	20	Yes	FACW
4. *Typha angustifolia*	10	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90 =Total Cover		
50% of total cover: 45	20% of total cover: 18		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals: (A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant.

SOIL

Sampling Point: DP9b_wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	95	7.5YR 5/8	5	C	PL	Loamy/Clayey	Prominent redox concentrations
3-20	2.5Y 5/1	85	10YR 6/8	15	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/9/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP10b_upl
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Swale Local relief (concave, convex, none): concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.937751 Long: -82.950562 Datum: NAD83
Soil Map Unit Name: HhF - Hayesville, Cecil, and Halewood sandy loams, shallow, 25 to 60% slopes NWI classification: Upland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ____ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:
DP10_upl is representative of uplands. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP10b_upl

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Dichanthelium clandestinum*	80	Yes	FAC
2. *Juncus effusus*	60	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	140 =Total Cover		
50% of total cover: 70	20% of total cover: 28		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant

SOIL

Sampling Point: DP10b_upl

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-3	7.5YR 3/2	100		100			Loamy/Clayey	
3-20	10YR 6/4	90	7.5YR 6/8	10	C	PL	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

Hydric soil indicators are not present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/9/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP11b_wet
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Valley Local relief (concave, convex, none): concave Slope (%): 0-1
Subregion (LRR or MLRA): LRR P, MLRA 136 Lat: 34.938545 Long: -82.952398 Datum: NAD83
Soil Map Unit Name: HhF - Hayesville, Cecil, and Halewood sandy loams, shallow, 25 to 60% slopes NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP11b_wet is represnetative of wetland 8. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary and secondary wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP11b_wet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5)			
1. *Juncus effusus*	60	Yes	FACW
2. *Carex lurida*	40	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 =Total Cover		
50% of total cover: 50	20% of total cover: 20		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant.

SOIL

Sampling Point: DP11b_wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	7.5YR 3/2	100					Loamy/Clayey	
4-20	10YR 5/2	80	10YR 6/8	20	C	M	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Hydric soil indicators are present.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Eastern Mountains and Piedmont Region
See ERDC/EL TR-07-24; the proponent agency is CECW-CO-R

OMB Control #: 0710-xxxx, Exp: Pending
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Bad Creek City/County: Oconee County Sampling Date: 6/10/2021
Applicant/Owner: Duke Energy Carolinas LLC State: SC Sampling Point: DP12b_wet
Investigator(s): Blake Hartshorn, Johanna Velasquez Section, Township, Range:
Landform (hillside, terrace, etc.): Valley Local relief (concave, convex, none): concave Slope (%): 0-2
Subregion (LRR or MLRA): LRR N, MLRA 130B Lat: 34.946702 Long: -82.968070 Datum: NAD83
Soil Map Unit Name: HaF - Halewood fine sandy loam, 25 to 45 percent slopes NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:
DP12b_wet is representative of Wetland 3. Climatic/hydrologic conditions were normal as determined by the Antecedent Precipitation Tool.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- X Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches): 1
Water Table Present?	Yes X	No ____	Depth (inches): 3
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Primary wetland hydrology indicators are present.

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: DP12b_wet

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	=Total Cover		
50% of total cover:	20% of total cover:		
Sapling/Shrub Stratum (Plot size: 15)			
1. *Alnus serrulata*	10	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	10 =Total Cover		
50% of total cover: 5	20% of total cover: 2		
Herb Stratum (Plot size: 5)			
1. *Juncus effusus*	30	Yes	FACW
2. *Carex lurida*	30	Yes	OBL
3. *Carex scoparia*	20	Yes	FACW
4. *Dichanthelium clandestinum*	20	Yes	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 =Total Cover		
50% of total cover: 50	20% of total cover: 20		
Woody Vine Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)
Hydrophytic vegetation is dominant.

SOIL

Sampling Point: DP12b_wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 4/4	100					Loamy/Clayey	Vegetation mat
1-5	7.5YR 5/1	100					Loamy/Clayey	
5-20	7.5YR 4/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Mucky Mineral (F1) **(MLRA 136)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 122, 136)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147, 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (F21) **(outside MLRA 127, 147, 148)**
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Hydric soil indicators are present.

NC DWQ Stream Identification Form Version 4.11 Stream 1 (S1a)

Date: 6/7/2021	**Project/Site:** Bad Creek	**Latitude:** 35.007617
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -82.999434
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29.5	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Reid

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	1	(2)	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 9.5)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	(2)	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	1	(1.5)
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 2-8'
Bank Width: 2-4'

High gradient w/ bed rock, salamanders were observed.

NC DWQ Stream Identification Form Version 4.11 Stream 2 (S2a)

Date: 6/7/2021	**Project/Site:** Bad Creek	**Latitude:** 35.00748
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -83.00088
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29.5	**Stream Determination (circle one)** Ephemeral Intermittent **(Perennial)**	**Other** *e.g. Quad Name*: Cashiers

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 9)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	(2)	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 2-4'
Bank Width: Varied

NC DWQ Stream Identification Form Version 4.11 Stream 3 (s3a)

Date: 6/7/2021	**Project/Site:** Bad Creek	**Latitude:** -83.000663
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** 35.007423
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Cashiers

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	1	(2)	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 9)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	(2)	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: High gradient with waterfalls
Bank Height: 2-8'
Bank Width: 4-10'

NC DWQ Stream Identification Form Version 4.11 Stream 4 (S4a)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 35.005426
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -83.005426
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Cashiers

A. Geomorphology (Subtotal = 17)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = 0		Yes = (3)	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 8)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 1-2'
Bank Width: 4-6'

NC DWQ Stream Identification Form Version 4.11 Stream 5 (S5a)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 35.005493
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -83.001395
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name*: Cashiers

A. Geomorphology (Subtotal = 16.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 8)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	(1)	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11 Stream 6 (s6a)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 35.004018
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -83.000674
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 21	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Cashiers

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	**3**
2. Sinuosity of channel along thalweg	0	**1**	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	**1**	2	3
4. Particle size of stream substrate	0	**1**	2	3
5. Active/relict floodplain	**0**	1	2	3
6. Depositional bars or benches	0	**1**	2	3
7. Recent alluvial deposits	0	**1**	2	3
8. Headcuts	0	1	**2**	3
9. Grade control	0	**0.5**	1	1.5
10. Natural valley	0	0.5	**1**	1.5
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 3)				
12. Presence of Baseflow	0	**1**	2	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	**1**	0.5	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	**0.5**	1	1.5
17. Soil-based evidence of high water table?	No = **0**		Yes = 3	

C. Biology (Subtotal = 6.5)				
18. Fibrous roots in streambed	**3**	2	1	0
19. Rooted upland plants in streambed	**3**	2	1	0
20. Macrobenthos (note diversity and abundance)	**0**	1	2	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	0	**0.5**	1	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = **0**			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 6-8'
Bank Width: 1-2'

NC DWQ Stream Identification Form Version 4.11 Stream 8 (S8a)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 34.996034
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -83.000017
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 22	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name*: Tamasee/Salem

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 3.5)				
12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 3-6'
Bank Width: 1'

NC DWQ Stream Identification Form Version 4.11

Stream 9 (s9a)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** -83.00003
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** 34.99572
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27.5	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Tmasee/Salem

A. Geomorphology (Subtotal = 14.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Width: 5'
Bank Height:3-4'

High gradient throughout tributary

NC DWQ Stream Identification Form Version 4.11 Stream 13 (s10a)

Date: 6/9/2021	**Project/Site:** Bad Creek	**Latitude:** 34.967154
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -82.987979
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 13)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	1	(1.5)
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 2-6'
Bank Width: 5'

This stream form is also representative of Stream 12

NC DWQ Stream Identification Form Version 4.11 Stream 14 (s12a)

Date: 6/9/2021	**Project/Site:** Bad Creek	**Latitude:** 34.963409
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -82.986504
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 28.25	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 12.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 7.75)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = (0.75) OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11 Stream 16 (s14a)

Date: 6/10/2021	**Project/Site:** Bad Creek	**Latitude:** 34.960095
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -82.985267
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 21	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	**2**	3
2. Sinuosity of channel along thalweg	0	**1**	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	**1**	2	3
4. Particle size of stream substrate	0	**1**	2	3
5. Active/relict floodplain	**0**	1	2	3
6. Depositional bars or benches	0	**1**	2	3
7. Recent alluvial deposits	0	**1**	2	3
8. Headcuts	0	1	**2**	3
9. Grade control	0	**0.5**	1	1.5
10. Natural valley	0	0.5	1	**1.5**
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 3.5)				
12. Presence of Baseflow	0	**1**	2	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	**1**	0.5	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	0.5	**1**	1.5
17. Soil-based evidence of high water table?	No = **0**		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	**3**	2	1	0
19. Rooted upland plants in streambed	**3**	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	**1**	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = **0**			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Stream 17 (s13a)

NC DWQ Stream Identification Form Version 4.11

Date: 6/10/2021	**Project/Site:** Bad Creek	**Latitude:** 34.959568
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -82.985057
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 21.5	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 11)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	(0)	1	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 3.5)				
12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = (0)		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 6-8'
Bank Width:3-4'

NC DWQ Stream Identification Form Version 4.11 Stream 20 (s16a)

Date: 6/10/2021	**Project/Site:** Bad Creek	**Latitude:** 34.950467
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -82.974799
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 22.75	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	**1**	2	3
2. Sinuosity of channel along thalweg	0	**1**	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	**1**	2	3
4. Particle size of stream substrate	0	1	**2**	3
5. Active/relict floodplain	0	**1**	2	3
6. Depositional bars or benches	0	**1**	2	3
7. Recent alluvial deposits	0	**1**	2	3
8. Headcuts	0	1	**2**	3
9. Grade control	0	**0.5**	1	1.5
10. Natural valley	0	0.5	**1**	1.5
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	**1**	2	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	**1**	0.5	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	0.5	**1**	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = **3**	

C. Biology (Subtotal = 4.75)				
18. Fibrous roots in streambed	**3**	2	1	0
19. Rooted upland plants in streambed	**3**	2	1	0
20. Macrobenthos (note diversity and abundance)	**0**	1	2	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	0	0.5	**1**	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = **0.75** OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Width: 1'
Bank Height: 3'

Stream 21 (s18a)

NC DWQ Stream Identification Form Version 4.11

Date: 6/10/2021	**Project/Site:** Bad Creek	**Latitude:** 34.950178
Evaluator: Eric Mularski, Jenessa Kay	**County:** Oconee	**Longitude:** -82.974556
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	1	(2)	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Width: 5'
Bank Height: 6'

NC DWQ Stream Identification Form Version 4.11

Stream 23 (s14b)

Date: 6/10/2021	**Project/Site:** Bad Creek	**Latitude:** 34.947881
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.969638
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 13.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	**2**	3
2. Sinuosity of channel along thalweg	0	1	**2**	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	**1**	2	3
4. Particle size of stream substrate	0	1	**2**	3
5. Active/relict floodplain	0	**1**	2	3
6. Depositional bars or benches	0	**1**	2	3
7. Recent alluvial deposits	0	1	**2**	3
8. Headcuts	**0**	1	2	3
9. Grade control	0	0.5	**1**	1.5
10. Natural valley	0	0.5	1	**1.5**
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	**1**	2	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	**1**	0.5	0
15. Sediment on plants or debris	0	0.5	**1**	1.5
16. Organic debris lines or piles	0	**0.5**	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = **3**	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	**3**	2	1	0
19. Rooted upland plants in streambed	**3**	2	1	0
20. Macrobenthos (note diversity and abundance)	**0**	1	2	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	**0**	0.5	1	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = **0**			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 4-6'
Bank Width: 3-6'

NC DWQ Stream Identification Form Version 4.11

Stream 24 (s15b)

Date: 6/10/2021	**Project/Site:** Bad Creek	**Latitude:** 34.947363
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.96928
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Width: 1-3'
Bank Height: 2-4'

NC DWQ Stream Identification Form Version 4.11

Stream 33 (s24b)

Date: 610/2021	**Project/Site:** Bad Creek	**Latitude:** 34.939409
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.954471
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25.25	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 12.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	(1)	2	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 5.75)				
18. Fibrous roots in streambed	3	(2)	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = (0.75) OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 1'
Bank Width: 2-3'

NC DWQ Stream Identification Form Version 4.11 Stream 35 (s13b)

Date: 6/10/2021	**Project/Site:** Bad Creek	**Latitude:** 34.938624
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.952142
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	**2**	3
2. Sinuosity of channel along thalweg	0	1	**2**	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	**2**	3
4. Particle size of stream substrate	0	1	**2**	3
5. Active/relict floodplain	0	**1**	2	3
6. Depositional bars or benches	0	1	**2**	3
7. Recent alluvial deposits	0	1	**2**	3
8. Headcuts	**0**	1	2	3
9. Grade control	0	0.5	**1**	1.5
10. Natural valley	0	0.5	1	**1.5**
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	**2**	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	**1.5**	1	0.5	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	**0.5**	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = **3**	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	**3**	2	1	0
19. Rooted upland plants in streambed	**3**	2	1	0
20. Macrobenthos (note diversity and abundance)	**0**	1	2	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	**0**	0.5	1	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = **0**			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 2-4'
Bank Width: 1-3'

NC DWQ Stream Identification Form Version 4.11 Stream 39 (s9b)

Date: 6/9/2021	**Project/Site:** Bad Creek	**Latitude:** 34.936746
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.934199
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 32.5	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 17.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	0.5	(0)
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 8)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	(2)	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Width: 4-7'
Bank Height: 3-6'

Stream in deep valley, veg covering stream

NC DWQ Stream Identification Form Version 4.11 Stream 40 (s8b)

Date: 6/9/2021	**Project/Site:** Bad Creek	**Latitude:** 34.936381
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.932548
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23.25	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	**2**	3
2. Sinuosity of channel along thalweg	0	**1**	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	**1**	2	3
4. Particle size of stream substrate	0	**1**	2	3
5. Active/relict floodplain	0	1	**2**	3
6. Depositional bars or benches	0	**1**	2	3
7. Recent alluvial deposits	0	**1**	2	3
8. Headcuts	0	**1**	2	3
9. Grade control	0	**0.5**	1	1.5
10. Natural valley	**0**	0.5	1	1.5
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)				
12. Presence of Baseflow	0	1	**2**	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	**1**	0.5	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	**0.5**	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = **3**	

C. Biology (Subtotal = 5.75)				
18. Fibrous roots in streambed	3	**2**	1	0
19. Rooted upland plants in streambed	**3**	2	1	0
20. Macrobenthos (note diversity and abundance)	**0**	1	2	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	**0**	0.5	1	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = **0.75** OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 1-2'
Bank Width: 2-6'

NC DWQ Stream Identification Form Version 4.11 Stream 41 (s7b)

Date:	**Project/Site**:	**Latitude:**
Evaluator:	**County:**	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal =_____)	**Absent**	**Weak**	**Moderate**	**Strong**
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = _____)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = _____)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Ephemeral at the top, R4 after headcut
Bank Width: 2-3'
Bank Height: 1-2'

NC DWQ Stream Identification Form Version 4.11 Stream 42 (s6b)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 34.935284
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.923826
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 32.5	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 17)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	**3**
2. Sinuosity of channel along thalweg	0	1	**2**	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	**2**	3
4. Particle size of stream substrate	0	1	**2**	3
5. Active/relict floodplain	0	1	**2**	3
6. Depositional bars or benches	0	1	**2**	3
7. Recent alluvial deposits	0	1	**2**	3
8. Headcuts	**0**	1	2	3
9. Grade control	0	0.5	**1**	1.5
10. Natural valley	0	0.5	**1**	1.5
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	**2**	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	**1**	0.5	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	0.5	**1**	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = **3**	

C. Biology (Subtotal = 8)				
18. Fibrous roots in streambed	**3**	2	1	0
19. Rooted upland plants in streambed	**3**	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	**2**	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	**0**	0.5	1	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = **0**			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 1-6'
Bank Width: 4-6'

NC DWQ Stream Identification Form Version 4.11 Stream 43 (s5b)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 34.937773
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.921348
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23.75	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 12)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	**1**	2	3
2. Sinuosity of channel along thalweg	0	**1**	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	**2**	3
4. Particle size of stream substrate	0	1	**2**	3
5. Active/relict floodplain	0	1	**2**	3
6. Depositional bars or benches	0	**1**	2	3
7. Recent alluvial deposits	0	**1**	2	3
8. Headcuts	**0**	1	2	3
9. Grade control	0	0.5	**1**	1.5
10. Natural valley	0	0.5	**1**	1.5
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)				
12. Presence of Baseflow	0	1	**2**	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	**1**	0.5	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	**0.5**	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = **3**	

C. Biology (Subtotal = 4.75)				
18. Fibrous roots in streambed	3	**2**	1	0
19. Rooted upland plants in streambed	3	**2**	1	0
20. Macrobenthos (note diversity and abundance)	**0**	1	2	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	**0**	0.5	1	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = **0.75** OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 1-2'
Bank Width: 2-6'

NC DWQ Stream Identification Form Version 4.11 Stream 44 (s4b)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 34.941302
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.92156
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral Intermittent **Perennial**	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	1	(2)	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	0	0.5	(1)	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 1-4'
Bank Width: 3-5'

NC DWQ Stream Identification Form Version 4.11 Stream 45 (s3b)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 34.943134
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.921798
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27.5	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 14.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 8-10'
Bank Width: 4-6'

Stream 46 (s2b)

NC DWQ Stream Identification Form Version 4.11

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 34.947967
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.920914
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 21	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 10)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	**2**	3
2. Sinuosity of channel along thalweg	0	**1**	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	**1**	2	3
4. Particle size of stream substrate	0	**1**	2	3
5. Active/relict floodplain	0	**1**	2	3
6. Depositional bars or benches	0	**1**	2	3
7. Recent alluvial deposits	0	**1**	2	3
8. Headcuts	**0**	1	2	3
9. Grade control	0	**0.5**	1	1.5
10. Natural valley	0	0.5	1	**1.5**
11. Second or greater order channel	No = **0**		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7)				
12. Presence of Baseflow	0	1	**2**	3
13. Iron oxidizing bacteria	**0**	1	2	3
14. Leaf litter	1.5	**1**	0.5	0
15. Sediment on plants or debris	0	**0.5**	1	1.5
16. Organic debris lines or piles	0	**0.5**	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = **3**	

C. Biology (Subtotal = 4)				
18. Fibrous roots in streambed	3	**2**	1	0
19. Rooted upland plants in streambed	3	**2**	1	0
20. Macrobenthos (note diversity and abundance)	**0**	1	2	3
21. Aquatic Mollusks	**0**	1	2	3
22. Fish	**0**	0.5	1	1.5
23. Crayfish	**0**	0.5	1	1.5
24. Amphibians	**0**	0.5	1	1.5
25. Algae	**0**	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = **0**			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Height: 0-1'
Bank Width: 1-6'

NC DWQ Stream Identification Form Version 4.11

Stream 47 (s1b)

Date: 6/8/2021	**Project/Site:** Bad Creek	**Latitude:** 34.953633
Evaluator: Blake Hartshorn, Johanna Velasquez	**County:** Oconee	**Longitude:** -82.917947
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral Intermittent **(Perennial)**	**Other** *e.g. Quad Name*: Salem

A. Geomorphology (Subtotal = 16.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	0.5	1	(1.5)
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = (0)		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = (3)	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Bank Width: 2-4'
Bank Height: 2-3'

Appendix C

IPaC Resources List

SCDNR Threatened and Endangered Species Consultation Report

SC List of At-Risk, Candidate, Endangered, and Threatened Species for Oconee County

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Carolina Ecological Services
176 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558
Phone: (843) 727-4707 Fax: (843) 727-4218
http://www.fws.gov/charleston/

In Reply Refer To: July 26, 2021
Consultation Code: 04ES1000-2021-SLI-0939
Event Code: 04ES1000-2021-E-02106
Project Name: Jocassee-Bad Creek Transmission Line and the Bad Creek Pumped Storage Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

South Carolina Ecological Services
176 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558
(843) 727-4707

Project Summary

Consultation Code: 04ES1000-2021-SLI-0939
Event Code: 04ES1000-2021-E-02106
Project Name: Jocassee-Bad Creek Transmission Line and the Bad Creek Pumped Storage Project
Project Type: POWER GENERATION
Project Description: Potential expansion of right-of-way for transmission line and pump station upgrades
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@34.97157995,-82.99033926313726,14z

Counties: Oconee County, South Carolina

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Flowering Plants

NAME	STATUS
Persistent Trillium *Trillium persistens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3583	Endangered
Small Whorled Pogonia *Isotria medeoloides* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1890	Threatened
Smooth Coneflower *Echinacea laevigata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3473	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

REFUGE INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Aug 31
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31

NAME	BREEDING SEASON
Canada Warbler *Cardellina canadensis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Cerulean Warbler *Dendroica cerulea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 27 to Jul 20
Eastern Whip-poor-will *Antrostomus vociferus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Golden-winged Warbler *Vermivora chrysoptera* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8745	Breeds May 1 to Jul 20
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31
Yellow-bellied Sapsucker *sphyrapicus varius* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8792	Breeds May 10 to Jul 15

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

▪ probability of presence ▪ breeding season | survey effort – no data

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your

project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no

data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

South Carolina Department of
Natural Resources

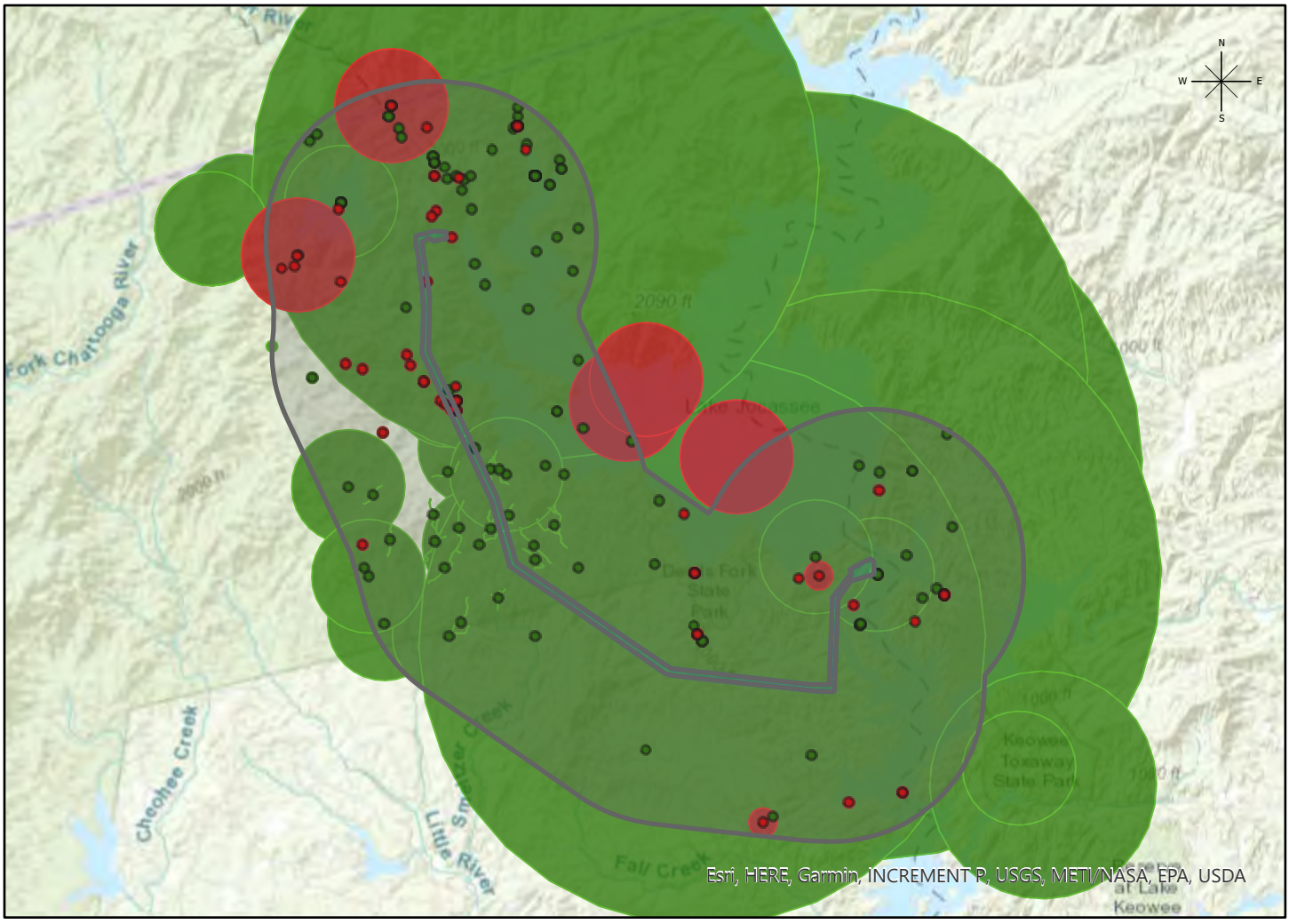
PO Box 167
Columbia, SC 29202
(803) 734-1396
speciesreview@dnr.sc.gov

Robert H. Boyles, Jr.
Director
Emily C. Cope
Deputy Director for
Wildlife and Freshwater Fisheries

Requested on Monday, July 26, 2021 by *Johanna Velasquez*.

Re: Request for Threatened and Endangered Species Consultation
Johanna Velasquez, HDR, Inc. - Jocassee-Bad Creek Transmission Line and the Bad Creek Pumped Storage Project
Overhead Utility Line (Rehab/Repair)
Oconee County, South Carolina

The South Carolina Department of Natural Resources (SCDNR) has received your request for threatened and endangered species consultation of the above named project in Oconee County, South Carolina. The following map depicts the project



South Carolina Department of
Natural Resources

Robert H. Boyles, Jr.
Director
Emily C. Cope
Deputy Director for
Wildlife and Freshwater Fisheries

This report includes the following items:
A - A report for species which intersect the project area
B - A report for species which intersect the buffer around the project area
C - A list of best management practices relevant to species near to or within the project area
D - A list of best management practices relevant to the project type
E - Instructions to submit new species observation records to the SC Natural Heritage Program

The technical comments outlined in this report are submitted to speak to the general impacts of the activities as described through inquiry by parties outside the South Carolina Department of Natural Resources. These technical comments are submitted as guidance to be considered and are not submitted as final agency comments that might be related to any unspecified local, state or federal permit, certification or license applications that may be needed by any applicant or their contractors, consultants or agents presently under review or not yet made available for public review. In accordance with its policy 600.01, Comments on Projects Under Department Review, the South Carolina Department of Natural Resources, reserves the right to comment on any permit, certification or license application that may be published by any regulatory agency which may incorporate, directly or by reference, these technical comments.

Interested parties are to understand that SCDNR may provide a final agency position to regulatory agencies if any local, state or federal permit, certification or license applications may be needed by any applicant or their contractors, consultants or agents. For further information regarding comments and input from SCDNR on your project, please contact our Office of Environmental Programs by emailing environmental@dnr.sc.gov or by visiting www.dnr.sc.gov/environmental. Pursuant to Section 7 of the Endangered Species Act, requests for formal letters of concurrence with regards to federally listed species should be directed to the USFWS.

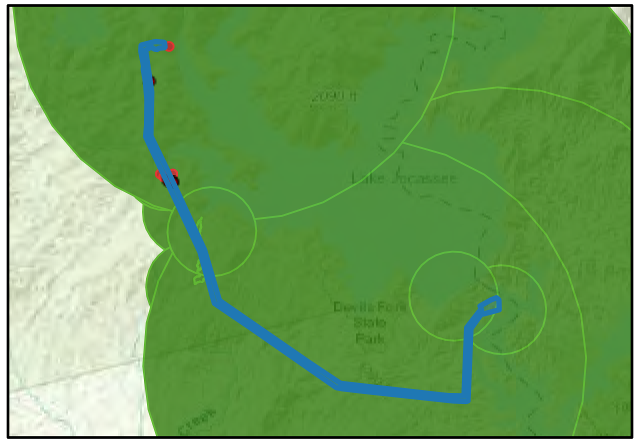
Should you have any questions or need more information, please do not hesitate to contact our office by email at speciesreview@dnr.sc.gov or by phone at 803-734-1396.

Sincerely,

Joseph Lemeris, Jr.
Heritage Trust Program
SC Department of Natural Resources

A. Project Area - Species Report

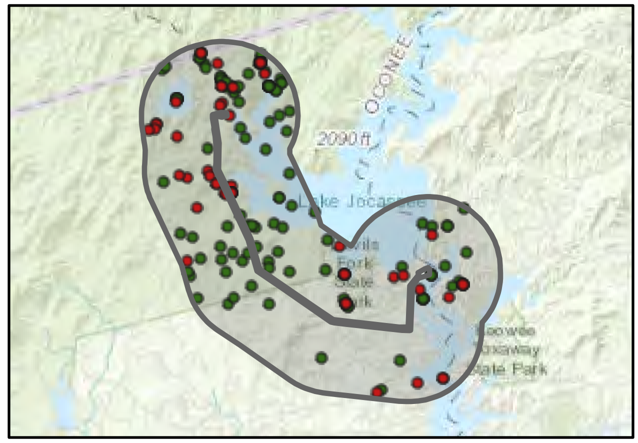
There are 34 tracked species records found within the project foot print. The following table outlines occurrences found within the project footprint (if any), sorted by listing status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found on site may be listed in this table but are not represented on the map. Please contact speciesreview@dnr.sc.gov should you have further questions related to sensitive species found within the project area.



Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Echinacea laevigata	Smooth Purple Coneflower	G2G3	S3	LE: Federally Endangered	Not Applicable	Highest	No Date
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1986-02-06
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1977-10-19
Ameiurus platycephalus	Flat Bullhead	G4	S4	Not Applicable	Not Applicable	Moderate	1977-10-19
Cyprinella galactura	Whitetail Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1976-05-27
Cyprinella galactura	Whitetail Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1977-10-10
Juncus subcaudatus	Somewhat-tailed Rush	G5	S1	Not Applicable	Not Applicable	Moderate	1956-09-02
Luxilus coccogenis	Warpaint Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1977-10-19
Lygodium palmatum	American Climbing Fern, Hartford Fern	G4	S3	Not Applicable	Not Applicable	Not Applicable	1987-12-06
Lysimachia fraseri	Fraser's Loosestrife	G3	S3	Not Applicable	Not Applicable	High	1950-07-01
Monotropsis odorata	Appalachian Pigmy Pipes	G3	S2	Not Applicable	Not Applicable	High	1965-03-20
Monotropsis odorata	Appalachian Pigmy Pipes	G3	S2	Not Applicable	Not Applicable	High	NO DATE
Monotropsis odorata	Appalachian Pigmy Pipes	G3	S2	Not Applicable	Not Applicable	High	1953-03-08
Nocomis micropogon	River Chub	G5	S3	Not Applicable	Not Applicable	Not Applicable	1977-10-19
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1991-09-26
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1988-10-11
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1986-01-13
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1977-10-19
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1977-08-24
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1976-09-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1957-03-09
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1970-04-04
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1970-04-02
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	2013-01-12
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	2013-02-11
Xerophyllum asphodeloides	Turkeybeard, Beargrass, Mountain-asphodel	G4	S2	Not Applicable	Not Applicable	Not Applicable	1973-10-06
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3G4	S2	Not Applicable	SE: State Endangered	Highest	1992-07-27

B. Buffer Area - Species Report (1 of 6)



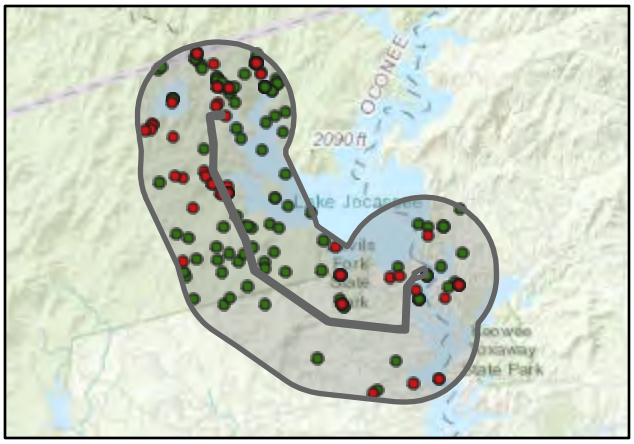
The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status
Aneides aeneus	Green Salamander	G3G4	S1	ARS: At-Risk Species	Not Applicable
Aneides aeneus	Green Salamander	G3G4	S1	ARS: At-Risk Species	Not Applicable
Aneides aeneus	Green Salamander	G3G4	S1	ARS: At-Risk Species	Not Applicable
Aneides aeneus	Green Salamander	G3G4	S1	ARS: At-Risk Species	Not Applicable
Aneides aeneus	Green Salamander	G3G4	S1	ARS: At-Risk Species	Not Applicable
Aneides aeneus	Green Salamander	G3G4	S1	ARS: At-Risk Species	Not Applicable
Aneides aeneus	Green Salamander	G3G4	S1	ARS: At-Risk Species	Not Applicable
Cambarus chaugaensis	Chauga Crayfish	G2	S2S3	ARS: At-Risk Species	Not Applicable
Cambarus chaugaensis	Chauga Crayfish	G2	S2S3	ARS: At-Risk Species	Not Applicable
Cambarus chaugaensis	Chauga Crayfish	G2	S2S3	ARS: At-Risk Species	Not Applicable
Cambarus chaugaensis	Chauga Crayfish	G2	S2S3	ARS: At-Risk Species	Not Applicable
Tsuga caroliniana	Carolina Hemlock	G2G3	S2	ARS: At-Risk Species	Not Applicable
Echinacea laevigata	Smooth Purple Coneflower	G2G3	S3	LE: Federally Endangered	Not Applicable
Myotis septentrionalis	Northern Long-eared Bat	G1G2	S1	LT: Federally Threatened	Not Applicable
Alosa aestivalis	Blueback Herring	G3G4	S5	Not Applicable	Not Applicable
Alosa aestivalis	Blueback Herring	G3G4	S5	Not Applicable	Not Applicable
Boykinia aconitifolia	Brook-saxifrage, Aconite-saxifrage, Eastern Boykinia, Allegheny Brookfoam	G4	S2	Not Applicable	Not Applicable
Carex biltmoreana	Biltmore Sedge	G3	S1	Not Applicable	Not Applicable
Carex manhartii	Blue Ridge Purple Sedge, Manhart's Sedge	G3G4	S2	Not Applicable	Not Applicable
Carex manhartii	Blue Ridge Purple Sedge, Manhart's Sedge	G3G4	S2	Not Applicable	Not Applicable
Etheostoma zonale	Banded Darter	G5	SX	Not Applicable	Not Applicable
Gaylussacia baccata	Black Huckleberry, Crackleberry	G5	S1	Not Applicable	Not Applicable
Juglans cinerea	Butternut, White Walnut	G3	S2	Not Applicable	Not Applicable
Lygodium palmatum	American Climbing Fern, Hartford Fern	G4	S3	Not Applicable	Not Applicable
Lygodium palmatum	American Climbing Fern, Hartford Fern	G4	S3	Not Applicable	Not Applicable
Lygodium palmatum	American Climbing Fern, Hartford Fern	G4	S3	Not Applicable	Not Applicable
Micranthes micranthidifolia	Branch-lettuce	G5	S2	Not Applicable	Not Applicable
Micranthes micranthidifolia	Branch-lettuce	G5	S2	Not Applicable	Not Applicable
Micropterus sp. 1 (Savannah)	Bartram's Bass	GNR	S1	Not Applicable	Not Applicable
Micropterus sp. 1 (Savannah)	Bartram's Bass	GNR	S1	Not Applicable	Not Applicable
Micropterus sp. 1 (Savannah)	Bartram's Bass	GNR	S1	Not Applicable	Not Applicable
Monotropsis odorata	Appalachian Pigmy Pipes	G3	S2	Not Applicable	Not Applicable
Monotropsis odorata	Appalachian Pigmy Pipes	G3	S2	Not Applicable	Not Applicable
Monotropsis odorata	Appalachian Pigmy Pipes	G3	S2	Not Applicable	Not Applicable
Osmorhiza claytonii	Bland Sweet Cicely, Hairy Sweet Cicely	G5	S2	Not Applicable	Not Applicable
Pycnanthemum montanum	Appalachian Mountain-mint	G3G5	S3	Not Applicable	Not Applicable
Smilax biltmoreana	Biltmore Carrionflower	G4	S2	Not Applicable	Not Applicable
Sorex hoyi	American Pygmy Shrew	G5	S3	Not Applicable	Not Applicable

B. Buffer Area - Species Report (2 of 6)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

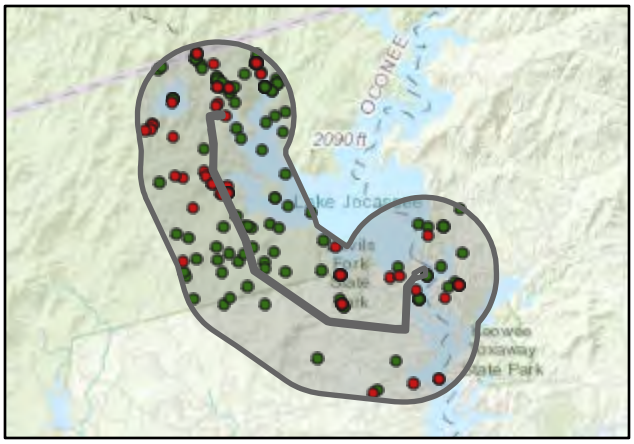


Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Ameiurus platycephalus	Flat Bullhead	G4	S4	Not Applicable	Not Applicable	Moderate	1977-10-19
Ameiurus platycephalus	Flat Bullhead	G4	S4	Not Applicable	Not Applicable	Moderate	1987-08-26
Ameiurus platycephalus	Flat Bullhead	G4	S4	Not Applicable	Not Applicable	Moderate	1968-12-16
Bommeria hispida	Hispid Bommer Fern, Copper Fern, Hairy Bommer	G4	S1	Not Applicable	Not Applicable	Not Applicable	2017-12-13
Carex prasina	Drooping Sedge	G4	S2	Not Applicable	Not Applicable	Not Applicable	1973-01-01
Castilleja coccinea	Eastern Indian-paintbrush	G5	S2	Not Applicable	Not Applicable	Not Applicable	1973-06-10
Caulophyllum thalictroides	Common Blue Cohosh, Green Vivian	G5	S2	Not Applicable	Not Applicable	Not Applicable	1973-06-04
Caulophyllum thalictroides	Common Blue Cohosh, Green Vivian	G5	S2	Not Applicable	Not Applicable	Not Applicable	1991-07-07
Caulophyllum thalictroides	Common Blue Cohosh, Green Vivian	G5	S2	Not Applicable	Not Applicable	Not Applicable	1998
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1980
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1980
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1995-08-09
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1980
Cheilolejeunea evansii	Evan's Cheilolejeunea	G1G2	S1	Not Applicable	Not Applicable	High	1995-08-08
Circaea canadensis	Canada Enchanter's-nightshade	G5	S3	Not Applicable	Not Applicable	Not Applicable	1986-01-01
Circaea canadensis	Canada Enchanter's-nightshade	G5	S3	Not Applicable	Not Applicable	Not Applicable	2012-04
Didymoglossum petersii	Dwarf Filmy Fern	G4G5	S2	Not Applicable	Not Applicable	Not Applicable	1960-08-24
Didymoglossum petersii	Dwarf Filmy Fern	G4G5	S2	Not Applicable	Not Applicable	Not Applicable	1991-09-16
Dryopteris intermedia	Fancy Fern, Evergreen Woodfern	G5	S2	Not Applicable	Not Applicable	Not Applicable	1991-07-07
Heuchera parviflora var. parviflora	Cumberland Grotto Alumroot	G4T4	S2	Not Applicable	Not Applicable	Not Applicable	1974-10-19
Heuchera parviflora var. parviflora	Cumberland Grotto Alumroot	G4T4	S2	Not Applicable	Not Applicable	Not Applicable	1973-PRE
Heuchera parviflora var. parviflora	Cumberland Grotto Alumroot	G4T4	S2	Not Applicable	Not Applicable	Not Applicable	1951-08-21
Juglans cinerea	Butternut, White Walnut	G3	S2	Not Applicable	Not Applicable	Not Applicable	1973-01-01
Juglans cinerea	Butternut, White Walnut	G3	S2	Not Applicable	Not Applicable	Not Applicable	1965-08-26
Lysimachia fraseri	Fraser’s Loosestrife	G3	S3	Not Applicable	Not Applicable	High	1973
Lysimachia fraseri	Fraser’s Loosestrife	G3	S3	Not Applicable	Not Applicable	High	1950-07-01
Lysimachia fraseri	Fraser’s Loosestrife	G3	S3	Not Applicable	Not Applicable	High	1937-06-01
Lysimachia fraseri	Fraser’s Loosestrife	G3	S3	Not Applicable	Not Applicable	High	1995-07-05
Lysimachia fraseri	Fraser’s Loosestrife	G3	S3	Not Applicable	Not Applicable	High	1998-06-10
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1973
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1973-05-26
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1991-09-26
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1991-07-07
Panax quinquefolius	Ginseng, Sang, American Ginseng	G3G4	S4	Not Applicable	Not Applicable	High	1998
Plagiochila caduciloba	Gorge Leafy Liverwort	G3	S2	Not Applicable	Not Applicable	High	1958-08-23
Plagiochila caduciloba	Gorge Leafy Liverwort	G3	S2	Not Applicable	Not Applicable	High	1994
Plagiochila caduciloba	Gorge Leafy Liverwort	G3	S2	Not Applicable	Not Applicable	High	1994
Terrapene carolina	Eastern Box Turtle	G5	S3S4	Not Applicable	Not Applicable	Moderate	2016-09-14

B. Buffer Area - Species Report (3 of 6)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

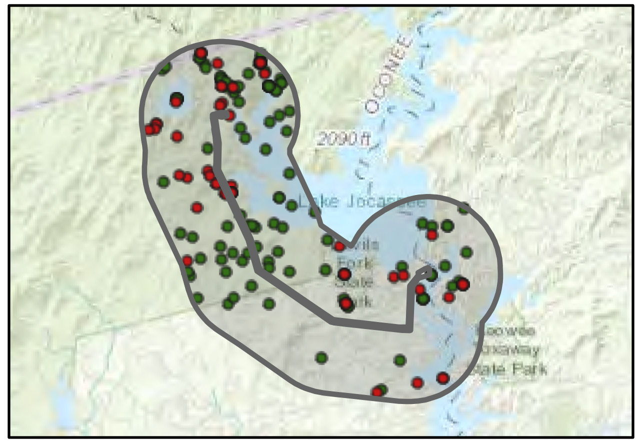


Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1986-02-06
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1977-10-19
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	1954-11-12
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	1985-04
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	2006-08-26
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	1987-06-01
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	1947-06-02
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	2006-08-27
Asplenium monanthes	Single-sorus Spleenwort	G4	S1	Not Applicable	Not Applicable	Moderate	2006-08-27
Carex jamesii	James's Sedge	G5	S1	Not Applicable	Not Applicable	Moderate	2012-04
Carex tonsa	Shaved Sedge	G5	S2	Not Applicable	Not Applicable	Not Applicable	2011-05-16
Cottus bairdii	Mottled Sculpin	G5	S3	Not Applicable	Not Applicable	High	1962-07-10
Cottus bairdii	Mottled Sculpin	G5	S3	Not Applicable	Not Applicable	High	1968-12-16
Cypripedium parviflorum var. pubescens	Large Yellow Lady's-slipper, Whippoorwill Shoes	G5T5	S3	Not Applicable	Not Applicable	Not Applicable	1998
Fothergilla major	Large Witch-alder	G3	S2	Not Applicable	Not Applicable	High	1973-06-10
Fothergilla major	Large Witch-alder	G3	S2	Not Applicable	Not Applicable	High	1991-07-07
Galearis spectabilis	Showy Orchis	G5	S3	Not Applicable	Not Applicable	Not Applicable	1991-07-07
Hepatica acutiloba	Sharp-lobed Hepatica, Sharp-lobed Liverleaf	G5T5	S3	Not Applicable	Not Applicable	Not Applicable	1974-03-29
Hepatica acutiloba	Sharp-lobed Hepatica, Sharp-lobed Liverleaf	G5T5	S3	Not Applicable	Not Applicable	Not Applicable	1998
Hybopsis rubrifrons	Rosyface Chub	G4	S4	Not Applicable	Not Applicable	Moderate	No Date
Hybopsis rubrifrons	Rosyface Chub	G4	S4	Not Applicable	Not Applicable	Moderate	1962-07-10
Hybopsis rubrifrons	Rosyface Chub	G4	S4	Not Applicable	Not Applicable	Moderate	1970-07-21
Isotrema macrophyllum	Pipevine, Dutchman's-pipe	G5	S2	Not Applicable	Not Applicable	Not Applicable	1973-01-01
Isotrema macrophyllum	Pipevine, Dutchman's-pipe	G5	S2	Not Applicable	Not Applicable	Not Applicable	1985-04-30
Isotrema macrophyllum	Pipevine, Dutchman's-pipe	G5	S2	Not Applicable	Not Applicable	Not Applicable	1991-07-07
Juncus gymnocarpus	Seep Rush	G4	S3	Not Applicable	Not Applicable	Not Applicable	1973-01-01
Lithobates palustris	Pickerel Frog	G5	S3S4	Not Applicable	Not Applicable	High	1965-04
Nestronia umbellula	Nestronia, Conjurer's-nut, Leechbrush, Indian-olive	G4	S3	Not Applicable	Not Applicable	Not Applicable	1987-06-21
Nocomis micropogon	River Chub	G5	S3	Not Applicable	Not Applicable	Not Applicable	1977-10-19
Nocomis micropogon	River Chub	G5	S3	Not Applicable	Not Applicable	Not Applicable	1977-10-19
Pachysandra procumbens	Mountain Pachysandra, Allegheny-spurge	G4G5	S2	Not Applicable	Not Applicable	Not Applicable	2012-04
Plagiomnium carolinianum	Mountain Wavy-leaf Moss	G3	S2	Not Applicable	Not Applicable	High	1987-10-29
Plagiomnium carolinianum	Mountain Wavy-leaf Moss	G3	S2	Not Applicable	Not Applicable	High	1994-08-21
Platanthera psycodes	Small Purple Fringed Orchid, Butterfly Orchid	G5	SH	Not Applicable	Not Applicable	Not Applicable	1973-06-09
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1988-10-11
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1986-01-13
Rhinichthys cataractae	Longnose Dace	G5	S3	Not Applicable	Not Applicable	Not Applicable	1991-10-07
Stewartia ovata	Mountain Camellia, Mountain Stewartia	G4	S2	Not Applicable	Not Applicable	Not Applicable	1979-06-15

B. Buffer Area - Species Report (4 of 6)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

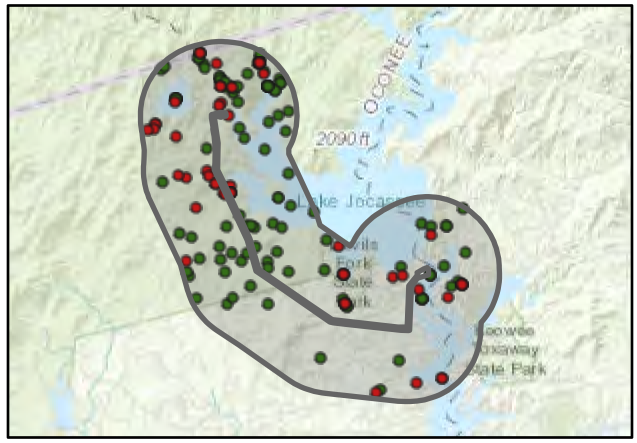


Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1984-12-10
Ameiurus brunneus	Snail Bullhead	G4	S3S4	Not Applicable	Not Applicable	Moderate	1987-08-26
Carex austrocaroliniana	South Carolina Sedge	G4	S3	Not Applicable	Not Applicable	Not Applicable	1950-06-06
Carex austrocaroliniana	South Carolina Sedge	G4	S3	Not Applicable	Not Applicable	Not Applicable	1984-04-12
Juncus subcaudatus	Somewhat-tailed Rush	G5	S1	Not Applicable	Not Applicable	Moderate	1956-09-02
Juncus subcaudatus	Somewhat-tailed Rush	G5	S1	Not Applicable	Not Applicable	Moderate	1956-09-02
Neotoma floridana haematoreia	Southern Appalachian Woodrat	G5T4Q	S3S4	Not Applicable	Not Applicable	Not Applicable	1991-09-26
Neotoma floridana haematoreia	Southern Appalachian Woodrat	G5T4Q	S3S4	Not Applicable	Not Applicable	Not Applicable	1954-03
Ophioglossum pycnostichum	Southern Adder's-tongue	G5	S2	Not Applicable	Not Applicable	Not Applicable	1998
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1979
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1952-03-28
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1973-PRE
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1973-PRE
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1900
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1976-09-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1940-08-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1937-08-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1998
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1977-02-01
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1957-03-09
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable	1970-04-04

B. Buffer Area - Species Report (5 of 6)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.

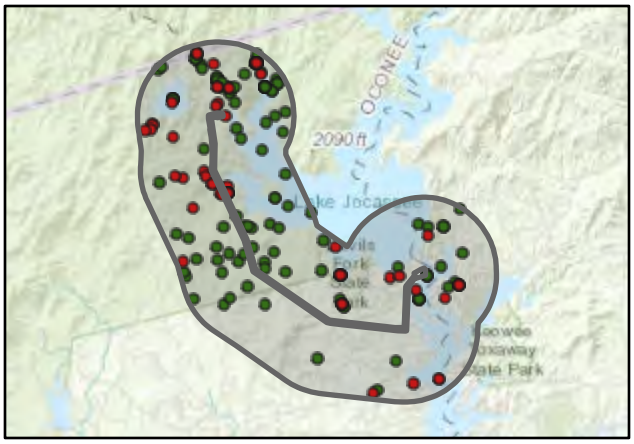


Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority
Asplenium rhizophyllum	Walking Fern	G5	S2	Not Applicable	Not Applicable	Not Applicable
Asplenium rhizophyllum	Walking Fern	G5	S2	Not Applicable	Not Applicable	Not Applicable
Diphylleia cymosa	Umbrella-leaf, Pixie-parasol	G4	S2	Not Applicable	Not Applicable	Not Applicable
Diphylleia cymosa	Umbrella-leaf, Pixie-parasol	G4	S2	Not Applicable	Not Applicable	Not Applicable
Etheostoma inscriptum	Turquoise Darter	G4	S2S3	Not Applicable	Not Applicable	High
Etheostoma inscriptum	Turquoise Darter	G4	S2S3	Not Applicable	Not Applicable	High
Etheostoma inscriptum	Turquoise Darter	G4	S2S3	Not Applicable	Not Applicable	High
Etheostoma inscriptum	Turquoise Darter	G4	S2S3	Not Applicable	Not Applicable	High
Gaultheria procumbens	Teaberry, Wintergreen, Checkerberry	G5	S3	Not Applicable	Not Applicable	Not Applicable
Gaultheria procumbens	Teaberry, Wintergreen, Checkerberry	G5	S3	Not Applicable	Not Applicable	Not Applicable
Gaultheria procumbens	Teaberry, Wintergreen, Checkerberry	G5	S3	Not Applicable	Not Applicable	Not Applicable
Luxilus coccogenis	Warpaint Shiner	G5	S3	Not Applicable	Not Applicable	Moderate
Mitella diphylla	Two-leaved Miterwort	G5	S1	Not Applicable	Not Applicable	Moderate
Notropis leuciodus	Tennessee Shiner	G5	S3	Not Applicable	Not Applicable	Moderate
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Shortia galacifolia	Southern Shortia, Oconee Bells	G3	S3	Not Applicable	Not Applicable	Not Applicable
Trautvetteria caroliniensis	Tassel-rue, False Bugbane	G5	S3	Not Applicable	Not Applicable	Not Applicable
Triphora trianthophoros var. trianthophoros	Three Birds Orchid, Nodding Pogonia, Nodding Ettercap	G4?T4?	S2	Not Applicable	Not Applicable	Moderate

B. Buffer Area - Species Report (6 of 6)

The following table outlines rare, threatened or endangered species found within 2 miles of the project footprint, arranged in order of protection status and species name. Please keep in mind that this information is derived from existing databases and do not assume that it is complete. Areas not yet inventoried may contain significant species or communities. You can find more information about global and state rank status definitions by visiting Natureserve's web page. Please note that certain sensitive species found within the buffer area may be listed in this table but are not represented on the map.



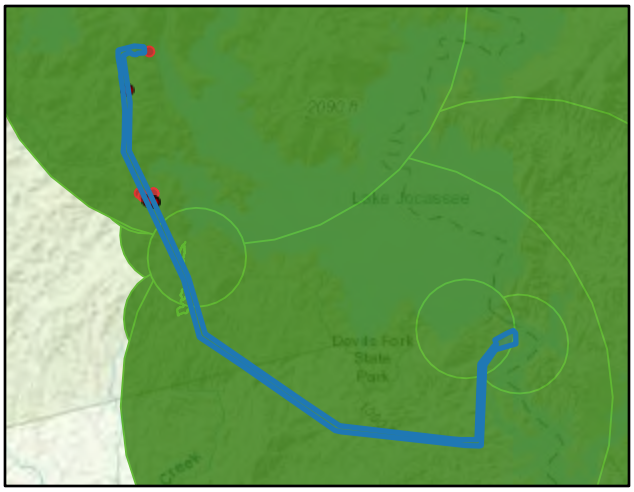
Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Scientific Name	Common Name	G Rank	S Rank	Fed. Status	State Status	SWAP Priority	Last Obs. Date
Ameiurus catus	White Catfish	G5	SU	Not Applicable	Not Applicable	Moderate	1987-08-26
Betula alleghaniensis	Yellow Birch	G5	S1	Not Applicable	Not Applicable	Moderate	1979
Collinsonia verticillata	Whorled Horsebalm	G3G4	S3	Not Applicable	Not Applicable	Moderate	2012-04
Cyprinella galactura	Whitetail Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1970-07-21
Cyprinella galactura	Whitetail Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1976-05-27
Cyprinella galactura	Whitetail Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1977-10-10
Lithobates sylvaticus	Wood Frog	G5	S3	Not Applicable	Not Applicable	High	1995-01-21
Lithobates sylvaticus	Wood Frog	G5	S3	Not Applicable	Not Applicable	High	1995-02-16
Luxilus coccogenis	Warpaint Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1962-07-10
Luxilus coccogenis	Warpaint Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1970-07-21
Luxilus coccogenis	Warpaint Shiner	G5	S3	Not Applicable	Not Applicable	Moderate	1977-10-19
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1973-05-22
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1973-05-22
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1982-10-01
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1986-03-27
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1980-05-21
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1975-08-28
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1975-09-27
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1975-04-30
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1990-10-30
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1977-10-19
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1965-08-02
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1977-08-24
Rhinichthys obtusus	Western Blacknose Dace	G5	S2	Not Applicable	Not Applicable	Moderate	1965-09-09
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3G4	S2	Not Applicable	SE: State Endangered	Highest	1992-07-30
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3G4	S2	Not Applicable	SE: State Endangered	Highest	1992-07-27
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3G4	S2	Not Applicable	SE: State Endangered	Highest	1992-07-26
Falco peregrinus anatum	American Peregrine Falcon	G4T4	S1B,S1N	Not Applicable	ST: State Threatened	Moderate	1999

C. Species Best Management Practices (1 of 1)

SCDNR offers the following comments and best management practices (BMPs) regarding this project's potential impacts to species of concern which may be found on or near to the project area. Please contact speciesreview@dnr.sc.gov should you have further questions with regard to survey methods, consultation, or other species-related concerns.

Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

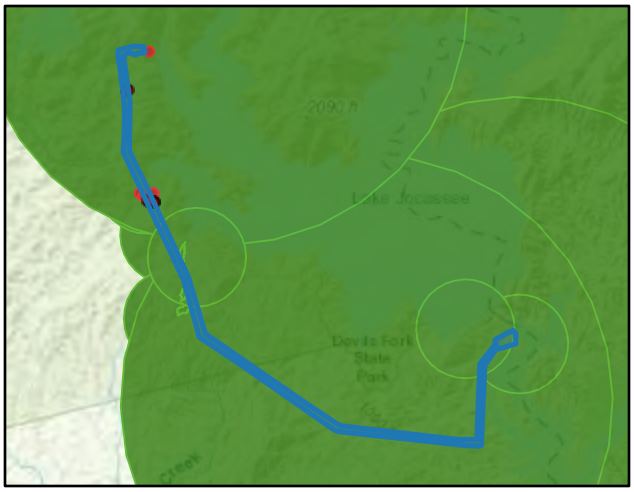


The SCDNR recommends that water construction-related activities such as dredging or piling installation be avoided during the months of February through April to limit disturbance to american shad, hickory shad, or blueback herring migrations that occur during this time.
Smooth coneflower is a federally endangered flowering plant species and are typically found in open woods, roadsides, clearcuts, and power line rights-of-way. Surveys to rule out smooth coneflower within the project footprint is recommended. Should smooth coneflower be found within the project footprint, please consult with the U.S. Fish & Wildlife Service before proceeding with any construction activities.
The Rafinesque's big eared bat is a state endangered South Carolina conservation priority species listed in the state's Wildlife Action Plan. Take of this state listed species is prohibited under S.C. Code of Laws §50-15-30. If this species is found within the project area, the SCDNR recommends an avoidance window of April 1 through August 15 for construction or repair activities. If an avoidance window cannot be observed, the SCDNR recommends that a permanent concrete bat tower installation 200-600 ft from the roost site that has at least six hours of direct sunlight. The tower should be completed at least two months prior to construction or repair activities.
Cavity- and tree-roosting bat species including the federally threatened northern long-eared bat (Myotis septentrionalis), state-endangered Rafinesque's big-eared bat (Corynorhinus rafinesquii), and the federally at-risk tricolored bat (Perimyotis subflavus) have been known to occur in the county of the proposed site. As a conservation measure, it is recommended that any tree clearing activities be conducted during the inactive season for Northern long-eared bat (November 15th through March 31st) to avoid negative impacts to the species. If any of the above species are found on-site, please contact the USFWS and SCDNR.
In the interest of preserving plant diversity, the South Carolina Plant Conservation Alliance performs native plant rescues in order to protect and preserve our diversity of native plants. If you are interested in assisting with this important endeavor please contact Mrs. April Punsalan at (843) 727-4707 ext. 218, or by email: scpca@lists.fws.gov before any development occurs onsite. There may be plants of interest on the project site that the Alliance would like to preserve.
Species in the above table with SWAP priorities of High, Highest or Moderate are designated as having conservation priority under the South Carolina State Wildlife Action Plan (SWAP). SWAP species are those species of greatest conservation need not traditionally covered under any federal funded programs. Species are listed in the SWAP because they are rare or designated as at-risk due to knowledge deficiencies; species common in South Carolina but listed rare or declining elsewhere; or species that serve as indicators of detrimental environmental conditions. SCDNR recommends that appropriate measures should be taken to minimize or avoid impacts to the aforementioned species of concern.

D. Project Best Management Practices (1 of 3)

SCDNR offers the following comments and best management practices (BMPs) regarding this project's potential impacts to natural resources within or surrounding the project area. Please contact our Office of Environmental Programs at environmental@dnr.sc.gov should you have further questions with regard to best management practices related to this project area.

Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS



If this project is associated with the Federal Government and the project area is or once was used as farmland, we recommend that consultation occur with the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS) per the Farmland Protection Policy Act; areas of the site are classified as prime farmland or farmland of statewide importance.

- All necessary measures must be taken to prevent oil, tar, trash and other pollutants from entering the adjacent offsite areas/wetlands/water.
- Once the project is initiated, it must be carried to completion in an expeditious manner to minimize the period of disturbance to the environment.
- Upon project completion, all disturbed areas must be permanently stabilized with vegetative cover (preferable), riprap or other erosion control methods as appropriate.
- The project must be in compliance with any applicable floodplain, stormwater, land disturbance, shoreline management guidance or riparian buffer ordinances.
- Prior to beginning any land disturbing activity, appropriate erosion and siltation control measures (e.g. silt fences or barriers) must be in place and maintained in a functioning capacity until the area is permanently stabilized.
- Materials used for erosion control (e.g., hay bales or straw mulch) will be certified as weed free by the supplier.
- Inspecting and ensuring the maintenance of temporary erosion control measures at least:
  a. on a daily basis in areas of active construction or equipment operation;
  b. on a weekly basis in areas with no construction or equipment operation; and
  c. within 24 hours of each 0.5 inch of rainfall.
- Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification, or as soon as conditions allow if compliance with this time frame would result in greater environmental impacts.
- Land disturbing activities must avoid encroachment into any wetland areas (outside the permitted impact area).Wetlands that are unavoidably impacted must be appropriately mitigated.
- Your project may require a Stormwater Permit from the SC Department of Health & Environmental Control, please visit https://www.scdhec.gov/environment/water-quality/stormwater

- If clearing must occur, riparian vegetation within wetlands and waters of the U.S. must be conducted manually and low growing, woody vegetation and shrubs must be left intact to maintain bank stability and reduce erosion.
- Construction activities must avoid and minimize, to the greatest extent practicable, disturbance of woody shoreline vegetation within the project area. Removal of vegetation should be limited to only what is necessary for construction of the proposed structures.
- Where necessary to remove vegetation, supplemental plantings should be installed following completion of the project. These plantings should consist of appropriate native species for this ecoregion.

D. Project Best Management Practices (2 of 3)

SCDNR offers the following comments and best management practices (BMPs) regarding this project's potential impacts to natural resources within or surrounding the project area. Please contact our Office of Environmental Programs at environmental@dnr.sc.gov should you have further questions with regard to best management practices related to this project area.

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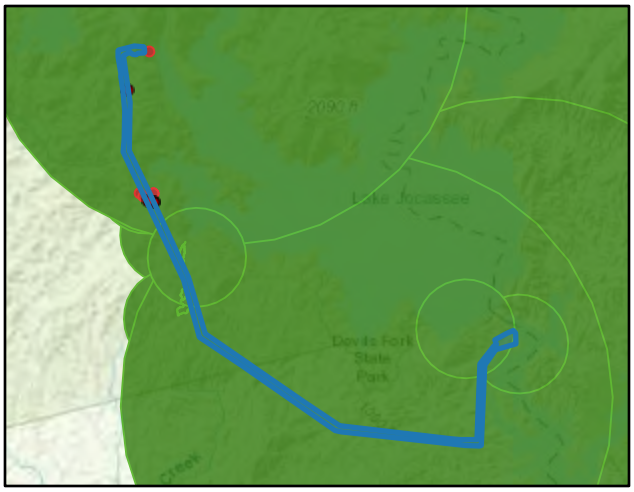

- Review of available data, National Hydrography Dataset, indicates that streams or waters of the United States are present within your project area. These areas may require a permit from the U.S. Army Corps of Engineers (USACE), as well as a compensatory mitigation plan. SCDNR advises that you consult with the USACE Regulatory to determine if jurisdictional waters are present and if a permit and mitigation is required for any activities impacting these areas. For more information, please visit their website at www.sac.usace.army.mil/Missions/Regulatory. Additionally, a 401 Water Quality Certification or a State Navigable Waters permit may also be required from the SC Department of Health & Environmental Control. For more information, please visit the following websites:
    - https://www.scdhec.gov/environment/water-quality/water-quality-certification-section-401-clean-water-act
    - https://www.scdhec.gov/environment/water-quality/navigable-waters
- Excavation/Construction activities must not occur during fish spawning season from March through June due to its negative impacts on eggs and reproduction activities.
- If clearing must occur, riparian vegetation within wetlands and waters of the U.S. must be conducted manually and low growing, woody vegetation and shrubs must be left intact to maintain bank stability and reduce erosion.
- Construction activities must avoid and minimize, to the greatest extent practicable, disturbance of woody shoreline vegetation within the project area. Removal of vegetation should be limited to only what is necessary for construction of the proposed structures.
- Where necessary to remove vegetation, supplemental plantings should be installed following completion of the project. These plantings should consist of appropriate native species for this ecoregion.

D. Project Best Management Practices (3 of 3)

SCDNR offers the following comments and best management practices (BMPs) regarding this project's potential impacts to natural resources within or surrounding the project area. Please contact our Office of Environmental Programs at environmental@dnr.sc.gov should you have further questions with regard to best management practices related to this project area.

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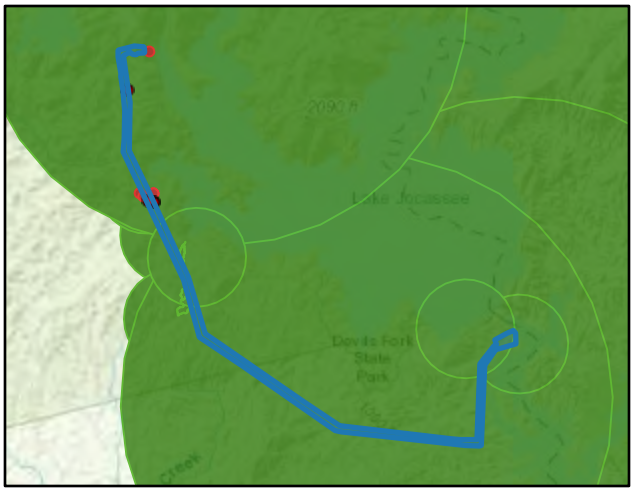
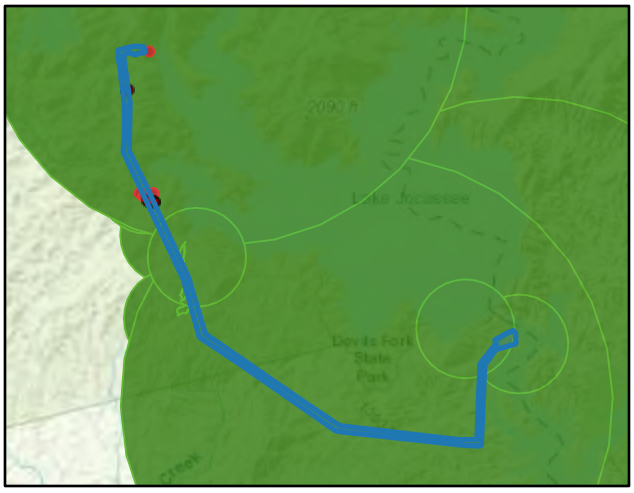


- Maintenance clearing or mowing of rights-of-way should not occur between April 15 and August 1 of a given year to avoid nesting season for a majority of migratory birds. The mower deck should be set no lower than 6 inches high so native herbaceous vegetation will not be damaged.
- With the exception of areas where it is necessary to create a safe and level work surface, trees and shrubs will be cut flush with the ground surface with root structures left intact. Cleared vegetation will be chipped and spread across the work area or hauled off-site to a commercial disposal facility. Spreading of chipped vegetation will be controlled so as not to impact the ability to re-establish herbaceous cover within the ROW during restoration.
- Rights-of-way through and adjacent to wetlands should be maintained by hand clearing rather than with chemicals to reduce the potential for contamination and negative impacts on aquatic resources. If chemicals are used, a 50-foot buffer on either side of stream/wetland crossings should be established where no herbicide treatments would be allowed. This will serve to retain the riparian vegetation while reducing the amount of chemical runoff into the aquatic environment. (wetlands=maintenance by hand clearing; streams=maintenance by mowing)
- Stream banks at crossings must be restored after construction has been completed. Disturbed stream banks can be restored by planting woody vegetation and by using bioengineering techniques for stream bank stabilization.
- Transmission line construction must be accomplished in existing disturbance corridors where practicable. Construction activities must avoid to the greatest extent practicable, encroachment into any wetland areas outside the transmission line right-of-way.

E. Instructions for Submitting Species Observations

The SC Natural Heritage Dataset relies on continuous monitoring and surveying for species of concern throughout the state. Any records of species of concern found within this project area would greatly benefit the quality and comprehensiveness of the statewide dataset for rare, threatened and endangered species. Below are instructions for how to download the SC Natural Heritage Occurrence Reporting Form through the Survey123 App.



Map Credits: Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Instructions for accessing the SC Natural Heritage Occurrence Reporting Form

For use in a browser (on your desktop/PC):

1) Follow http://bit.ly/scht-reporting-form-point
2) Select 'Open in browser'
3) The form will open and you can begin entering data!

This method of access will also work on a browser on a mobile device, but only when connected to the internet. To use the form in the field without relying on data/internet access, follow the steps below.

For use on a smartphone or tablet using the field app:

1) Download the Survey123 App from the Google Play store or the Apple Store. This app is free to download. Allow the app to use your location.

2) No need to sign in. However, you will need to provide the app with our Heritage Trust GIS portal web address. You will only need to do this once: (this is a known bug with ESRI's software, and future releases of the form should not require the below steps. Bear with us in the meantime!).

a. Tap 'Sign in'
b. Tap the settings (gear symbol) in the upper right corner
c. Tap 'Add Portal'
d. After the 'https://', type schtportal.dnr.sc.gov/portal
e. Tap 'Add Portal'
f. Tap the back-arrow icon (upper left corner) twice to return to the main sign in page.

3) Use the camera app (or other QR Reader app) to scan the QR code on this page from your smartphone or tablet. Click on the 'Open in the Survey123 field app'. This will prompt a window to allow Survey123 to download the SC Natural Heritage Occurrence Reporting Form. Select 'Open.'

4) The form will automatically open in Survey123, and you can begin entering data! This form will stay loaded in the app on your device until you manually delete it, and you can submit as many records as you like.

OCONEE COUNTY

CATEGORY	COMMON NAME/STATUS	SCIENTIFIC NAME	SURVEY WINDOW/ TIME PERIOD	COMMENTS
Amphibians	Chamberlain's dwarf salamander (ARS)	*Eurycea chamberlaini*	Spring/Fall surveys	Breeding survey: November to February
Birds	Golden-winged warbler (ARS)	*Vermivora chrysoptera*	April-July (nesting surveys)	Spring/Fall migration; variable throughout State
Crustaceans	None Found			
Fishes	None Found			
Insects	Edmund's snaketail (ARS)	*Ophiogomphus edmundo*	Year round	Active: May-August
	Monarch butterfly (C)	*Danaus plexippus*	August-December	Overwinter population departs: March-April
	Smokies needlefly (ARS)	*Megaleuctra williamsae*	April-June	
Mammals	Indiana bat (E)	*Myotis sodalis*	Year round	Not a South Carolina resident
	Little brown bat (ARS)	*Myotis lucifugus*	Year round	Found in trees, rock crevices, and under bridges
	Northern long-eared bat (T)	*Myotis septentrionalis*	Year round	Winter surveys not as successful
	Tri-colored bat (ARS)	*Perimyotis subflavus*	Year round	Found in mines and caves in the winter
Mollusks	None Found			
Plants	Carolina hemlock (ARS)	*Tsuga caroliniana*	Year round	
	Georgia aster (ARS*)	*Symphyotrichum georgianum*	Early October-mid November	
	Persistent trillium (E)	*Trillium persistens*	Early March-mid April	
	Small whorled pogonia (T)	*Isotria medeoloides*	Mid May-early July	
	Smooth coneflower (E)	*Echinacea laevigata*	Late May-October	
	Sun-facing coneflower (ARS)	*Rudbeckia heliopsidis*	July-October	
Reptiles	None Found			

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Appendix F

Desktop Entrainment Analysis

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Desktop Entrainment Analyses

Bad Creek Pumped Storage Project
(FERC No. P-2740)

Prepared for:
Duke Energy

Prepared by:
Kleinschmidt Associates

December 2021

Kleinschmidt

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1.0 INTRODUCTION

The Bad Creek Pumped Storage Project (Project) (Figure 1) is a 1,400 megawatt[1] pumped-storage hydroelectric facility that has served the Duke Energy Carolinas' (Duke Energy) customer base for nearly 30 years. Duke Energy is currently beginning the Federal Energy Regulatory Commission (FERC) relicensing process to obtain a new 40 to 50-year federal operating license for the Project. This process involves the consideration of environmental, social and operating resources of the Project and the applicable surrounding area. To that end, the fisheries resources of Jocassee Reservoir, the Project's lower reservoir for pumped-storage operations, and the potential impacts of Project operations on these resources, will be reviewed during the relicensing process in consultation with state and federal resource agencies and other interested parties.

The Project's configuration and Project use of the waterways for power generation is also a subject of consideration during relicensing; specifically, when weighing the benefits of power and non-power resources. Recent developments in the regional power grid provide a strategic rationale for considering Project capacity increases. This was reviewed most recently when the original license for the Project was amended in 2018 to accommodate turbine upgrades. The resulting improved pump-turbine, motor-generator design will increase the Project's life expectancy and provide a cost-effective option for adding an additional 290 MW of generating capacity and 240 MW of pumping capacity to the plant at the historical average available gross head. Once complete, Project upgrades provide for an environmentally sound method for adding capacity to support intermittent renewable resources, such as solar energy, as the upgrades only affect the rate at which water flows through the Project units. The upgrades will not affect the quantity of water pumped or discharged or impoundment levels or the ultimate magnitude of fluctuations.

Duke Energy is additionally considering the construction of a new powerhouse equal in size and capacity to augment the existing powerhouse through the relicensing process. The storage capacity of the upper reservoir would not change. Thus, pumping capacity would increase from 3019 cfs to 6038 cfs, meaning pumping time would be cut in half to more efficiently support intermittent renewable energy sources and stability of the regional power grid.

[1] Upgraded capacity per 164 FERC ¶ 62,066.

The issue of fish entrainment at a hydroelectric facility is a subject typically reviewed during a FERC relicensing process. Fish entrainment at the existing Bad Creek Project has been a subject of extensive studies throughout the Project's history. Therefore, a significant baseline of entrainment information is currently available for review. This report was developed in support of the relicensing and proposed Project expansion (i.e., the addition of a second powerhouse, identical in size and capacity to the existing powerhouse and within the same geographic area of the existing powerhouse). More specifically, this report considers the potential for the entrainment of Lake Jocassee fishes through the Project under the proposed action (i.e., two powerhouses).

1.1 Background

Fish entrained through hydroelectric facilities, like the Bad Creek Project (Figure 1) are exposed to turbine passage mortality stressors. While mortality and entrainment rates are separately a well-studied occurrence, the cumulative effects on aquatic populations are not well-reviewed. Researchers often lack the necessary parameters to accurately model the fate of all impacted species (natural mortality, recruitment, etc.), yet they are routinely required to assess the cumulative population-level effects of those species impacted. Another approach to assess cumulative system-wide effects to the suite of species impacted by hydroelectric development is needed.

Risk analysis offers a potential solution to this need. An entrainment risk assessment (ERA) will identify and analyze potential future entrainment mortality events while making judgements on the resiliency of the population (i.e., its ability to tolerate the expected level of mortality). Applying a risk assessment framework to evaluate impacts to fisheries is not new. Patrick et al. (2009) developed the expanded productivity and susceptibility assessment (ePSA) to understand data-poor stocks. The ePSA assesses the risk of a pelagic fish stock becoming overfished as a function of its productivity (replenish rate) and susceptibility to the fishery. The ePSA incorporates demographic parameters like the maximum age and size of a fish, individual growth rates, natural mortality, fecundity, breeding strategy, recruitment pattern, and age at maturity. The ePSA has been used to assess fishing risks for other species including elasmobranchs (Cortés et al. 2010; Furlong-Estrada, Galván-Magaña, and Tovar-Ávila 2017) and grouper (Pontón-Cevallos et al. 2020). The ePSA is one of a broad class of applications that assess anthropogenic sources of risk on fishery populations.

The ERA method is not new to assessing entrainment risk at hydropower projects. In 2021, van Treeck et al. developed the European Fish Hazard Index to assess entrainment risk at hydropower projects. This tool considered plant design and operation, the sensitivity and mortality of species due to entrainment, and overarching conservation goals for the river. It assessed entrainment mortality with empirically derived functions for Kaplan and Francis turbines. The United States has seen development of ERA methods as well. In 2012, Cada and Schweizer developed the qualitative traits-based assessment to evaluate the entrainment risk of data-poor species.

The rate at which fish are entrained through hydroelectric facilities is also a well-studied phenomenon. Entrainment rates for this assessment have been developed from observed entrainment via a Didson camera at the Bad Creek intake. Entrainment rates are typically expressed in fish per million cubic feet (fish/Mft^3). Therefore, the number of hours Bad Creek is expected to run each day and the total volume of water pumped in Mft^3 is known, an estimate can be made for the number of fish expected to be entrained. The analysis employed to assess entrainment risk at the Bad Creek Pumped Storage Project is therefore quantitative.

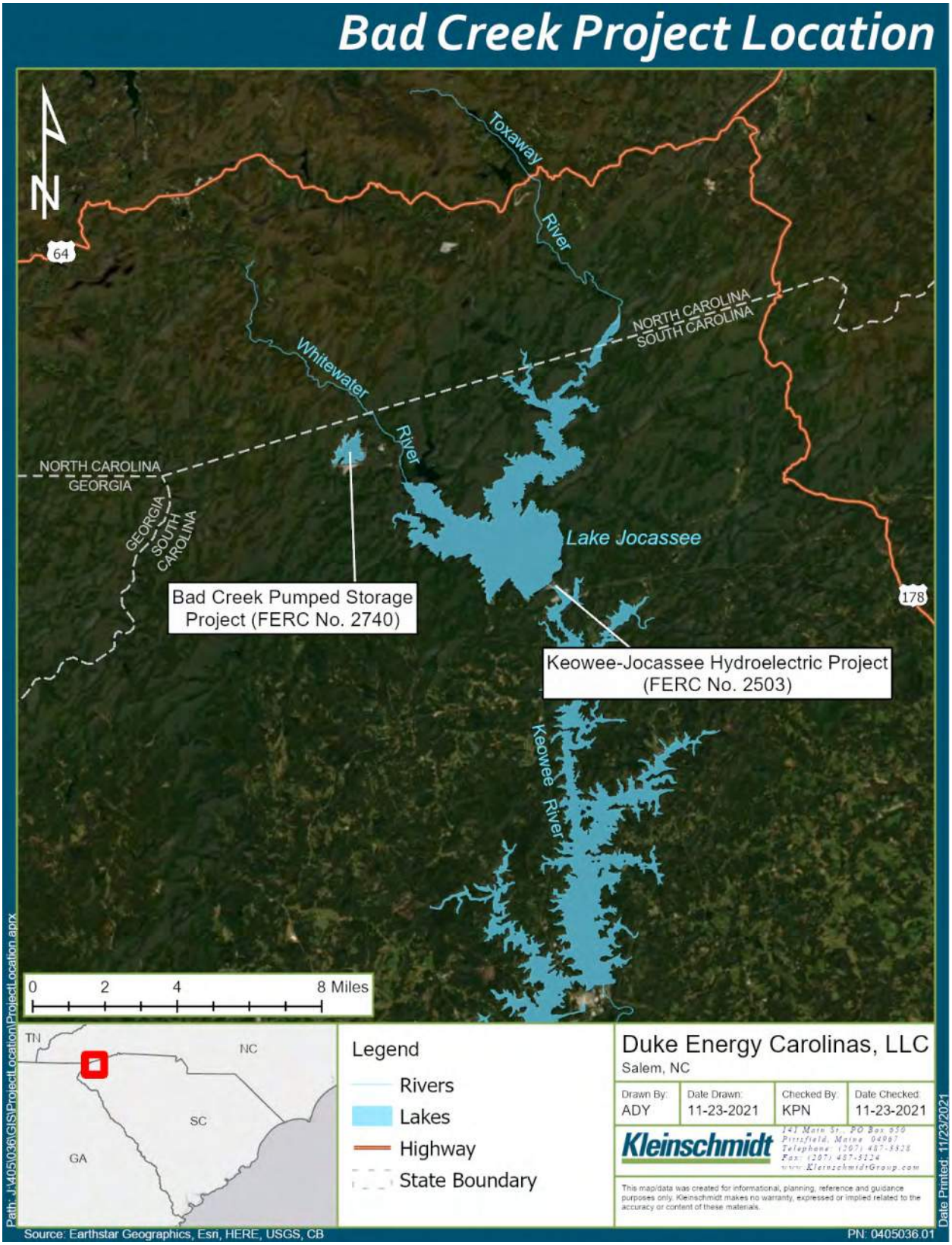

Figure 1 Bad Creek Project Location Map

2.0 METHODS

An ERA consists of two major components: (1) a Monte-Carlo simulation model that estimates the number of fish entrained and the number of expected mortalities; and (2) an objective method of ranking the relative vulnerability of those species subjected to entrainment.

2.1 Selection of Target Species

The species assemblage for this analysis was determined from prior empirical entrainment studies conducted at the Bad Creek project. From 1991 to 1993, full discharge netting was employed at Bad Creek, where researchers calculated the relative abundance of entrained species (Table 1). These proportions were then applied to entrainment rates measured in fish per million ft^3.

Table 1 Monthly Sum of Entrainment at Bad Creek from 1991 to 1993

Species	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Black crappie				18	73	1						4
Blackbanded darter					134	9		5				
Blueback herring	2086	2093	1267	2885	1753	5837	5955	1854	7836	7736	9170	5466
Bluegill	8		30	116	2537	796	6626	1388	3941	2399	68	80
Brown trout	5			56	149	41						14
Channel catfish			1		60	9		5				
Common carp					277	54			11			
Flat bullhead					55			98				
Golden shiner			2	18	153	9		2				
Green sunfish								3	111	181		
Hybrid sunfish									37			
Largemouth bass					37	17	97	5	97	410		
Quillback					18							
Rainbow trout	27					6						
Redbreast sunfish				18	220	15	1392	547	611	480	1	16
Redear sunfish					18							
Redeye bass							14	2	48	62		
Spottail shiner					18							
Striped jumprock												14

Species	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Threadfin shad	3033	4072	5290	8656	2302	1588	3485	425	24365	41867	71009	134314
Warmouth				124	311	63	419	4	49	113		
White bass					2	16			113		1	
White catfish	3		6	207	2961	196	2723	1765	1679	1339	68	2
Whitefin shiner					20				49			
Yellow perch	140	64	54	177	385			55	75		1	7
Yellowfin shiner					18							

2.2 Entrainment Mortality Event Simulation

Kleinschmidt simulated entrainment mortality events with the open-source software package Stryke[2]. Stryke is an individual based model (IBM), which follows the fate of a population of fish as they migrate past a hydroelectric project. Movement and survival are simulated with Monte Carlo methods. The software is written in Python 3.7.x and utilizes Networkx[3] to simulate routes of passage and Numpy[4] and Scipy[5] for pseudo-random probability distribution draws. Kleinschmidt has validated Stryke with the USFWS Turbine Blade Strike Model or TBSM[6]. Stryke is scalable, such that it is possible to model complex movement through multiple facilities.

The assessment at Bad Creek was less complex than most entrainment analyses. There are only three states within the model: lower reservoir, Bad Creek powerhouses, and upper reservoir. Also, it is assumed that all fish simulated are routed through the Project and that there is 100% mortality through the Bad Creek powerhouses. This rather simple case means that Stryke is only used to simulate the relative frequency and magnitude of entrainment events.

2.2.1 Seasonal Entrainment Rate

An investigation of the 1997 EPRI entrainment database found that the overall pattern of entrainment rates (expressed as fish per million cubic feet [Mft^3]) for different species

[2] https://github.com/knebiolo/stryke
[3] https://networkx.github.io/
[4] https://numpy.org/
[5] https://scipy.org/
[6] https://www.fws.gov/northeast/fisheries/fishpassageengineering.html

across the eastern United States were very similar. Across species, regions, and watersheds of all sizes, a very small proportion of observations comprised most of the overall impact, while the majority of entrainment events constituted only a limited number of individuals. What leads to these large entertainment events is of no concern for our model, we only need be able to simulate their relative magnitude and frequency of occurrence. Distributions with such inequality are often modeled with a Pareto distribution, which has been used to describe income inequality (Arnold 2014), the population of cities (Rosen and Resnick 1980), and the distribution of stock returns among investors (Malevergne, Pisarenko, and Sornette 2006) among many other inequalities.

Scipy.stats provides two more extreme value distributions that could be used to model entrainment rates. The Weibull Max distribution is equivalent to a Frechet, which has been used to model extreme rain events (Koutsoyiannis 2004, Hawkes et al. 2008, Ramos et al. 2020) and river flows (El Adlouni, Bobée, and Ouarda 2008.). *Scipy.stats* also has support for the Generalized Extreme Value distribution. In either case, the fit of the distribution is compared to actual EPRI observations with a two-sided Kolmogorov Smirnov (KS) test implemented with *scipy.stats.ks_test*.

Kleinschmidt incorporated historic hourly entrainment data collected from 1991 to 1993 (A. Stuart, personal communication, October 2021) at the Bad Creek intake during Project operations. Fish per hour measurements were enumerated with the aid of a Didson camera. Assuming a constant flow rate of 3,019 cfs, fish per hour is converted into fish per million cubic feet. When we plot entrainment rates (Figure 2), the overall pattern of the distribution matches that of more traditional entrainment estimates, such as the EPRI entrainment database (EPRI 1997). With this confirmation, the assumption was made that entrainment rates at Bad Creek can be simulated with one of the aforementioned probability distributions supported by Stryke.

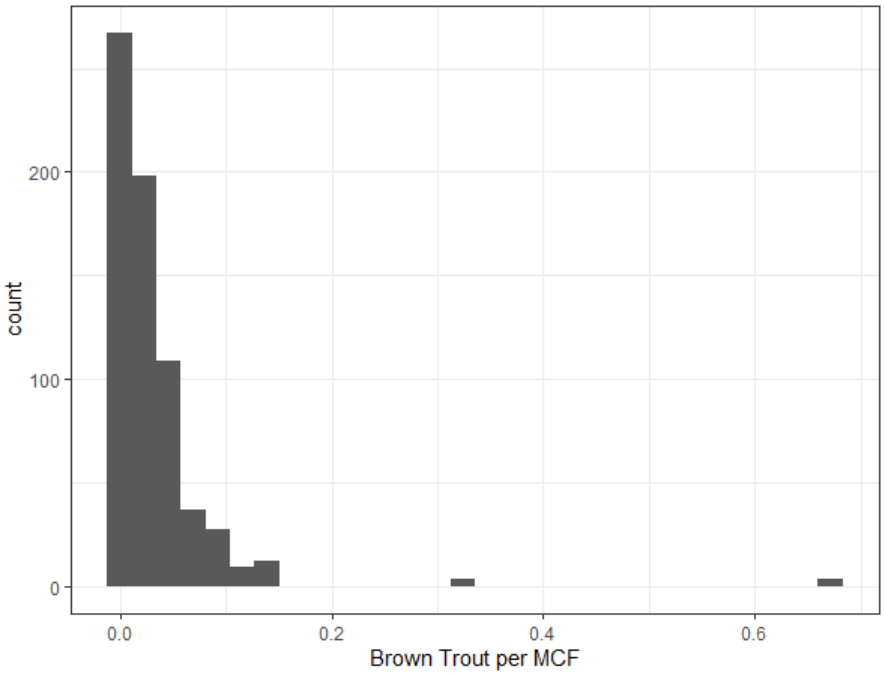

Figure 2 Historic Entrainment Rates of Brown Trout at the Bad Creek Project

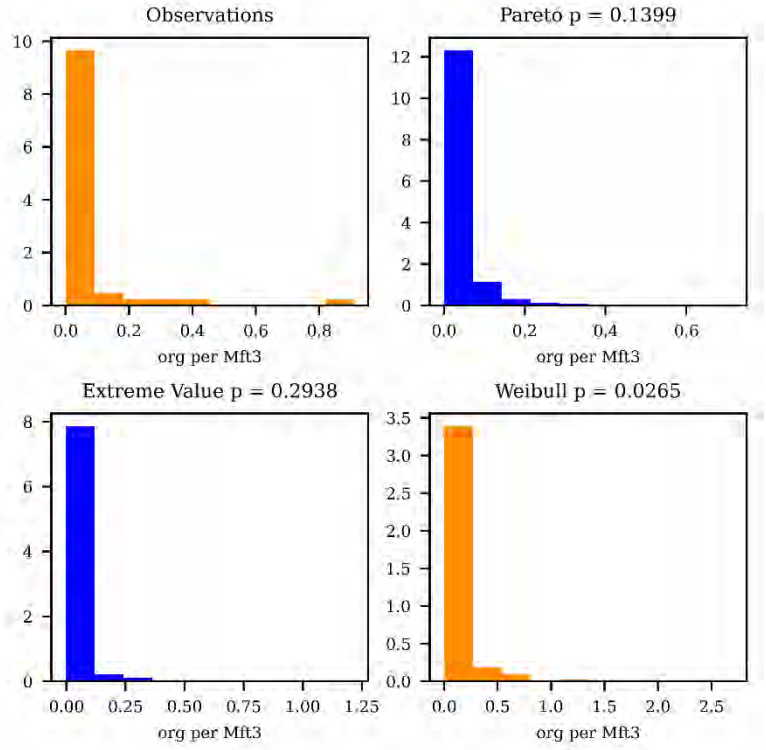

Figure 3 Observed and Sampled Entrainment Rates for Yellow Perch in the Months of March, April, and May

2.2.2 Scenario Development

Monthly entrainment rates were described with either a Pareto, Weibull Max, or Generalized Extreme Value distribution. Bad Creek, under the proposed action of adding the additional twin powerhouse, is intended to be operated up to 6 hours per day on weekdays and 2 hours per day on weekends. To simplify, the simulation is for 6 hours per day, 30 days per month, which produced a more conservative estimate.

For every month, Stryke simulated daily entrainment events (fish per M ft^3) for 30 model-days. Then expanded that to a daily entrainment estimate (fish) by multiplying the entrainment rate by the total amount of water pumped (million ft^3) during a six-hour period. Stryke simulates a daily entrainment event as a function of species and season; after iterating through each scenario and species combination, it then summarizes results and fits daily survival rates to a beta distribution to estimate median survival and 95% credible interval for the scenario.

2.3 Vulnerability to Entrainment

The second component of an ERA is to objectively assess the vulnerability of those species subjected to entrainment. Large impacts to highly vulnerable species carry the most risk. As such, an assessment of species vulnerability characteristics becomes an important component of this analysis. Cada and Schweizer (2012) developed a traits-based assessment (TBA) to estimate fish population sustainability for data poor fish populations. This qualitative assessment extended experimental results from tested fish species to predict passage survival of other untested species based on phylogenic relationships or ecological similarities. Kleinschmidt used the concepts of the Cada and Schweizer (2012) TBA and the Patrick et al. (2009) PSA as a framework for assessing vulnerability. However, a straightforward quantitative approach was used for assessing fish population sustainability. Specifically, fish population growth rates were used for each species to evaluate a population's ability to make up for turbine passage losses with compensatory mechanisms. If these compensatory mechanisms are not enough to overcome losses, the fish population is vulnerable to entrainment stressors.

The sustainability of fish populations is influenced by a number of demographic traits. These traits include natural life span, natural mortality rates, generation time or interval between reproductive events, the number of reproductive events per year, and the number of offspring per reproductive event (Cada and Schweizer 2012). Species that have

a low natural mortality rate, short generation time, and produce a large number of eggs are less likely to experience population level effects. Patrick et. al. (2009) also incorporated the individual growth rate (von Bertanlaffy) and trophic level in their assessment of vulnerability. These mentioned traits all impact how quickly a population will increase in number when it is depleted, meaning when the population is not nearing the carrying capacity in the local environment.

Both the PSA and TBA methods used a set of traits and combined them into a qualitative categorization of vulnerability. However, quantitative estimates of the combined impact of these population traits are available in the literature for many species in the form of population growth rates or doubling rates for depleted populations. By using these estimates directly, subjective selection of traits to include and subjective methodology for weighting the importance of each individual traits can be avoided. Rather, the traits have been incorporated into well-established population modeling techniques and the overall estimate has been objectively and quantitatively derived.

Population growth for a harvested (or in this case, potentially entrained) population of fish can be described on annual increments using the Schaeffer Model:

$$N_{t+1} = N_t + r\left(1 - \frac{N_t}{K}\right)N_t - E_t,$$

where

N_t = population size in year t;
K = carrying capacity of population;
E_t = entrainment losses in year t; and
r = discrete population growth rate

If it is assumed the population is depleted relative to the carrying capacity, then this equation simplifies to:

$$N_{t+1} \approx N_t(1 + r) - E_t.$$

If entrainment loss as the fraction of the population lost (PL; E_t = PL x N_t,) is reparametrized, then:

$$N_{t+1} \approx N_t(1 + r - PL).$$

Thus, if the entrainment loss rate (PL) is greater than the discrete population growth rate (r), the local population may decline over time.

The discrete population growth rate (r) for each species of concern was derived from information on FishBase (Froese and Pauly 2021), from model-derived resilience factors for the exact or in some cases, a surrogate species (Table 5). In the FishBase "Estimates based on models" section, we used:

1) "K", which is presumed to be the intrinsic population growth rate for depleted populations. The intrinsic growth rate (K) is related to the discrete growth rate as follows:

$$\exp(K) = (1 + r).$$

K is not reported for all species; when not reported for a species of concern, Kleinschmidt identified surrogates that were primarily based upon taxonomic linkages (Table 5).

2) "Population doubling time", which is reported as a categorical range for all species (i.e., three presumed ranges for low resilient, moderate resilient, and high resilient species)[7]. The population doubling time (D) is related to the discrete population growth rate as follows:

$$(1 + r) = \exp\left(\frac{\ln(2)}{D}\right).$$

Both of these estimates are reported for (1+r) in Table 5, and the most conservative result from each range of values, the lower discrete population growth rate, was used as an estimate for species vulnerability.

2.4 Swim Speed Analysis

Kleinschmidt sourced swimming performance metrics of those species impacted at Bad Creek from relevant material and compared them against the intake velocities. The water velocity at the current intake structure was measured at 5.8 ft/s, and given that the cross-sectional area of the intake and pumping capacity will stay the same, it is assumed that

[7] FishBase defines resilience as "the capacity of a system to tolerate impacts without irreversible changes in its outputs or structure. In species or populations, often understood as the capacity to withstand exploitation." (Froese and Pauly 2021). FishBase reports resiliency as very low, low medium, or high. Resiliency ranges for species analyzed within this report were sourced directly from FishBase.

intake velocities will also be similar if not the same at the new intake (A. Stuart, personal communication, October 2021). Not all species were found within relevant source material, therefore surrogates were used (Table 2). It was assumed that any fish within Lake Jocassee that has a burst speed of less than 5.8 ft/s is susceptible to entrainment.

Table 2 Swim Speed Surrogates

Species	Surrogate
Black crappie	White Crappie
Blackbanded darter	Rio Grande Darter
Flat bullhead	Ictaluridae
Golden shiner	Cyprinidae
Green sunfish	Lepomis
Hybrid sunfish	Lepomis
Quillback	Catostomidae
Redear sunfish	Bluegill
Redeye bass	Largemouth Bass
Striped jumprock	Catostomidae
Threadfin shad	Clupeidae
Warmouth	Lepomis
White bass	Morone
White catfish	Ictaluridae
Whitefin shiner	Cyprinella
Yellowfin shiner	Notropis

2.5 Assigning Risk

With quantitative measures estimating the number of fish entrained and the expected number of mortalities, and a quantitative index expressing the relative vulnerability of those species impacted, it is possible to objectively assign risk categories and identify the species most at risk.

In order to estimate the annual proportion of the population in Lake Jocassee lost to entrainment (PL), an estimate of the local population size of each species (i.e., the denominator of PL) is needed. Annual baseline population estimates of Blueback Herring and Threadfin Shad were sourced from Didson camera pelagic surveys conducted by Duke from 1989 to 2020 (A. Stuart, personal communication, October 2021). With 30 years of

observations, any evidence of long-term trends was assessed that may indicate Bad Creek having an effect on the population. From 2013 to 2015, Duke conducted purse seine sampling to characterize the pelagic population of fish and quantify the proportion of the pelagic population comprised of Blueback Herring *vs* Threadfin Shad.

The combined annual population size estimates are skewed with more variance apparent for higher estimates. On the log-scale, there appears to be an approximate 20-year population cycle within Lake Jocassee (Figure 4). The median population estimate over the past 20 years (2001-2020) was estimated to capture an expected population size for a random future year. Estimated PL for each species was the annual estimated entrainment mortality divided by this population size estimate.

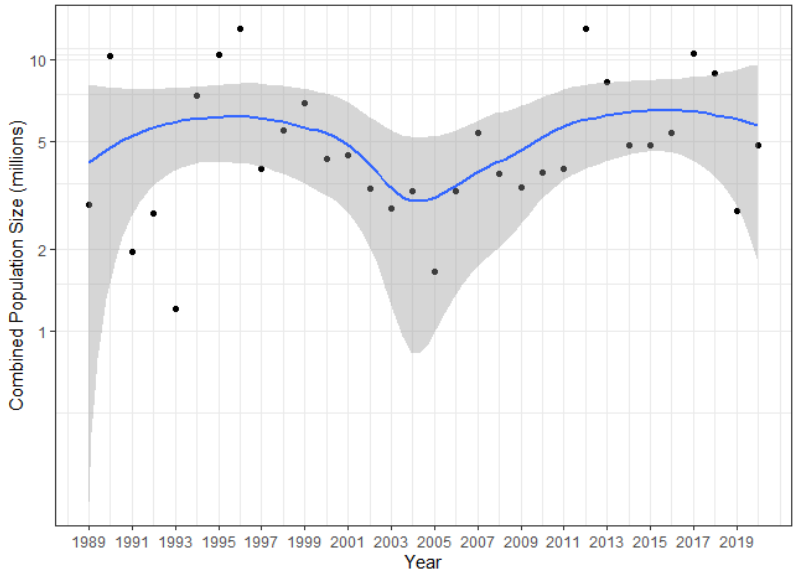

Figure 4 Estimated Local Population Size (Combined Species) 1989-2020, with Local Regression Smoother Trend Estimate Overlaid

A tabular form of (1+r-PL) is reported for each facility and flow scenario. Values of (1+r-PL) of exactly one would indicate steady population, >1 indicates population growth, and <1 would indicate the population is being impacted by entrainment.

3.0 RESULTS

3.1 Entrainment Impact

Table 3 shows the expected (median) entrainment impact by month and species. Bad Creek, under the proposed action, had the largest impact on Blueback herring and Threadfin Shad, with large entrainment events, some greater than 10k Threadfin Shad, expected to occur during cold weather months (November through January). Entrainment was most diverse in May, with 14 species entrained (Table 3). Important cold water sport fish (Brown Trout and Rainbow Trout) are anticipated to be impacted, with up to 117 Brown Trout (Table 3) expected to be entrained in May. The median of the annual sum of entrainment for each iteration was used for estimating risk to fish populations.

Table 3 Median Monthly Entrainment Estimates by Species

Species	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Black crappie				9	56							
Blackbanded darter					107	4		1				
Blueback herring	5,189	2,056	1,038	1,770	1,520	4,922	3,272	1,040	1,356	1,151	1,361	678
Bluegill	13		23	80	2,095	644	3,349	743	708	358	7	9
Brown trout	7			36	117	32						1
Channel catfish					49	4		1				
Common carp					232	43			1			
Flat bullhead					45			54				
Golden shiner				9	118	3						
Green sunfish									18	24		
Hybrid sunfish									4			
Largemouth bass					30	11	53	1	14	61		
Quillback					13							
Rainbow trout	57					2						
Redbreast sunfish				9	175	10	711	309	101	71		1
Redear sunfish					12							
Redeye bass							4		5	6		
Spottail shiner					13							
Striped jumprock												1
Threadfin shad	6,456	4,008	3,932	5,591	1,899	1,323	1,805	232	4,144	6,558	8,910	15,933
Warmouth				80	258	49	218	1	5	14		
White bass					1	11			17.5			
White catfish	3		2	136	2443	159	1465	895	274	196	8	

Species	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Whitefin shiner					13				5			
Yellow perch	300	62	39	117	307			29	10			
Yellowfin shiner					12							

3.2 Swim Speed Analysis

Of the 26 species entrained at Bad Creek, 19 have mean burst swim speeds below 5.8 ft/s (Table 4). Burst speed was estimated as 2 * the sustained swim speed (USFWS 2019). Surprisingly, Threadfin Shad have a burst speed of 22.651 ft/s and sustained swim speed of 11.325 ft/s, which suggests they would not be entrained at Bad Creek. However, Threadfin Shad had the largest impact. Considering the largest entrainment events happen during cold weather months, water temperature may be a driver.

Table 4 Swim Speed Analysis of Those Species Impacted at Bad Creek.

Species	Length (ft)			Sustained Speed (ft/s)			Burst Speed (ft/s)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Black crappie	0.558	0.558	0.558	1.188	1.138	1.270	2.375	2.277	2.539
Blackbanded darter	0.118	0.118	0.118	1.312	1.312	1.312	2.625	2.625	2.625
Blueback herring	0.719	0.719	0.719	11.640	5.902	15.978	23.281	11.804	31.955
Bluegill	0.164	0.164	0.164	1.329	1.329	1.329	2.657	2.657	2.657
Brown trout	0.502	0.157	1.312	3.560	1.037	5.866	7.119	2.073	11.732
Channel catfish	0.748	0.656	0.906	2.628	1.969	3.937	5.256	3.937	7.874
Common carp	0.535	0.161	1.444	2.556	1.421	4.593	5.112	2.841	9.186
Flat bullhead	0.741	0.171	0.909	2.595	1.969	3.937	5.190	3.937	7.874
Golden shiner	0.358	0.069	1.480	2.838	0.427	8.645	5.676	0.853	17.290
Green sunfish	0.266	0.157	0.338	2.175	2.297	3.609	4.350	4.593	7.218
Hybrid sunfish	0.266	0.157	0.338	2.175	2.297	3.609	4.350	4.593	7.218
Largemouth bass	0.420	0.105	0.853	1.230	0.656	2.133	2.461	1.312	4.265
Quillback	0.581	0.075	1.706	4.101	0.515	21.611	8.202	1.030	43.222
Rainbow trout	0.381	0.079	1.345	1.339	0.361	4.823	2.677	0.722	9.646
Redbreast sunfish	0.157	0.157	0.157	1.161	1.161	1.161	2.323	2.323	2.323
Redear sunfish	0.164	0.164	0.164	1.329	1.329	1.329	2.657	2.657	2.657
Redeye bass	0.420	0.105	0.853	1.230	0.656	2.133	2.461	1.312	4.265
Spottail shiner	0.167	0.161	0.171	0.722	0.719	0.725	1.444	1.437	1.450
Striped jumprock	0.581	0.075	1.706	4.101	0.515	21.611	8.202	1.030	43.222
Threadfin shad	1.076	0.719	1.371	11.325	2.461	22.014	22.651	4.921	44.029
Warmouth	0.266	0.157	0.338	2.175	2.297	3.609	4.350	4.593	7.218
White bass	1.322	0.866	1.568	10.512	1.673	31.004	21.024	3.346	62.008

Species	Length (ft)			Sustained Speed (ft/s)			Burst Speed (ft/s)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
White catfish	0.741	0.171	0.909	2.595	1.969	3.937	5.190	3.937	7.874
Whitefin shiner	0.174	0.115	0.354	2.221	1.112	3.107	4.442	2.224	6.214
Yellow perch	0.338	0.164	0.495	1.122	0.591	1.401	2.244	1.181	2.802
Yellowfin shiner	0.138	0.115	0.171	1.690	0.719	2.671	3.379	1.437	5.341

3.3 Relative Vulnerability to Entrainment

A summary of FishBase parameters used for the entrainment vulnerability assessment are provided in Table 5. Both Blueback Herring and Threadfin Shad are considered moderately vulnerable species with population doubling times in the 1.4-4.4 year range. The intrinsic growth rate estimated for Blueback Herring indicates that this species is moderately vulnerable, with a discrete annual increase of about 20% per year. The intrinsic growth rate was not available for Threadfin Shad, but surrogate Alosines have estimated discrete annual increases of approximately 15-35% per year (Table 5).

Table 5 Population Growth Rates Used for Vulnerability Assessment

	Parameters from FishBase				Derived discrete growth rate (r)			
	Intrinsic Population Growth Rate (K)		Categorical population doubling time (D)		Species-specific		Categorical	
Species	Min	Max	Min	Max	Min	Max	Min	Max
Blueback Herring	0.18	0.18	1.4	4.4	1.20	1.20	1.17	1.64
Threadfin Shad*			1.4	4.4			1.17	1.64
American Shad	0.14	0.14			1.15	1.15		
Alewife	0.2	0.2			1.22	1.22		
Blueback Shad	0.18	0.18			1.20	1.20		
Hickory Shad	0.3	0.3			1.35	1.35		

*Intrinsic rate was not available in FishBase for Threadfin Shad but was available for the four North American Freshwater Alosines listed here.

3.4 Entrainment Risk

The risk results for Bad Creek for Blueback Herring and Threadfin Shad are presented in Table 6. The losses to Blueback Herring are relatively small compared to the population numbers, and the risk estimate is low (i.e., discrete population annual growth is estimated

to be 16-19% after accounting for entrainment). Threadfin Shad is more heavily impacted, with approximately 12% of the estimated population lost each year to entrainment. According to our estimates, the population should still be sustainable, with estimated discrete annual increases in population ranging from 3% (based on American shad population growth estimates) to 23% (based on Hickory shad population growth estimates). The low end of this range, a 3% population growth rate, is low and corresponds to a population doubling rate of more than 20 years.

Table 6 Bad Creek Entrainment Risk

Species	Categorical discrete growth rate (min)	Species-specific discrete growth rate (min)	Estimated Population 2001-2020 (millions)	Annual Entrainment Loss Estimate	Proportion of Annual Population Lost to Entrainment (PL)	Annual population multiplier including entrainment (categorical)	Annual population multiplier including entrainment (species-specific)
Blueback Herring	1.17	1.20	3.7	0.026	0.0070	1.16	1.19
Threadfin Shad	1.17		0.52	0.063	0.12	1.05	
American Shad		1.15					1.03
Alewife		1.22					1.10
Blueback Shad		1.20					1.08
Hickory shad		1.35					1.23

4.0 DISCUSSION

The estimated rates of entrainment mortality at the Bad Creek Pumped Storage Project are not expected to affect the long-term sustainability of Lake Jocassee fish populations. The species with the largest impact, Blueback Herring and Threadfin Shad, have relatively high fecundity, meaning that population-level compensatory mechanisms would likely offset the entrainment losses in terms of effects on these fish populations. In addition, while some level of entrainment mortality will inevitably occur, many natural populations have excess reproductive capacity that will compensate for some losses of individuals (Sale et al. 1989).

Using a risk assessment framework allows us to objectively evaluate risks to fish populations from entrainment by combining two components, an estimate of entrainment loss and an estimate of population vulnerability to that expected loss for each species impacted. The risk estimate used was the expected population increase in each year after accounting for the entrainment losses. The population increases were based on minimum discrete population growth rates for each species sourced from FishBase.

No expected risk to Blueback Herring was found because the estimated entrainment rate of 0.7% per year is substantially below the expected recovery rate of the species. We anticipate moderate potential risk to Threadfin Shad, with entrainment losses predicted to be approximately 12% of the median population estimate for the past 20 years. Threadfin Shad is considered to be a moderately vulnerable species with moderate population recovery, and this category of fish is expected to have discrete population growth rates of 17-64% per year. Although no species-specific growth rates were found for Threadfin Shad, the estimated rates for the surrogate species ranged from 15% per year for American Shad to 35% per year for Hickory Shad. The expected entrainment rate of 12% for Threadfin Shad is close to the expected annual increase for the slowest recovery surrogate, American Shad, indicating that entrainment mortality may keep the population from substantial increase. However, it is not expected to reduce the population, unless it is combined with other impacts.

5.0 REFERENCES

Arnold, Barry C. 2014. "Pareto distribution." Wiley StatsRef: Statistics Reference Online (Wiley Online Library) 1-10.

Cada, G.F., C.C. Coutant, and R.R. Whitney. 1997. Development of biological criteria for the design of advanced hydropower turbines. DOE/ID-10578. Prepared for the U.S. Department of Energy, Idaho Operations Office, Idaho Falls, Idaho.

Cada G.F. and Schweizer P.E. 2012. The Application of Traits Based Assessment Approaches to Estimate the Effects of Hydroelectric Turbine Passage on Fish Populations. Oak Ridge, TN: Oak Ridge National Laboratory Technical Report. 36 pp.

Cortés, Enric, Freddy Arocha, Lawrence Beerkircher, Felipe Carvalho, Andrés Domingo, Michelle Heupel, Hannes Holtzhausen, Miguel N. Santos, Marta Ribera, and Colin Simpfendorfer. 2010. Ecological risk assessment of pelagic sharks caught in Atlantic pelagic longline fisheries. Aquatic Living Resources (EDP Sciences) 23: 25-34.

Coutant, C.C. and R.R. Whitney. 2000. Fish behavior in relation to passage through hydropower turbines: a review. Transactions of the American Fisheries Society 129:351-380.

El Adlouni, S., B, Bobée, and T.B.M.J. Ouarda. 2008. On the tails of extreme event distributions in hydrology. Journal of Hydrology (Elsevier) 355: 16-33.

Electric Power Research Institute (EPRI). 1997. Turbine entrainment and survival database – field tests. Prepared by Alden Research Laboratory, Inc., Holden, Massachusetts. EPRI Report No. TR-108630. October 1997.

Electric Power Research Institute (EPRI). 2000. Technical evaluation of the utility of intake approach velocity as an indicator of potential adverse environmental impact under Clean Water Act section 316(b). EPRI. Palo Alto, California.

Federal Energy Regulatory Commission (FERC). 1995. Preliminary Assessment of Fish Entrainment at Hydropower Projects – volume 1 (Paper No. DPR-10). Office of Hydropower Licensing, FERC. Washington, DC

Franke, G.F., D.R. Webb, R.K. Fisher, Jr., D. Mathur, P.N. Hopping, P.A. March, M.R. Headrick, I.T. Laczo, Y. Ventikos, and F. Sotiropoulos. 1997. Development of environmentally advanced hydropower turbine system design concepts. Prepared for U.S. Department of Energy, Idaho Operations Office Contract DE-AC07-94ID13223.

Frimpong, E.A and P.L. Angermeier. 2009. Fish Traits: A Database of Ecological and Life-history Traits of Freshwater Fishes of the United States. Fisheries 34(10): 487-495.

Froese, R. and D. Pauly (Editors). 2021. FishBase. World wide web publication. www.fishbase.org, version (06/2021).

Furlong-Estrada, Emmanuel, Felipe Galván-Magaña, and Javier Tovar-Ávila. 2017. Use of the productivity and susceptibility analysis and a rapid management-risk assessment to evaluate the vulnerability of sharks caught off the west coast of Baja California Sur, Mexico. Fisheries Research 194: 197-208.

Hawkes, Peter J., Daniel Gonzalez-Marco, Agustin Sánchez-Arcilla, and Panayotis Prinos. 2008. Best practice for the estimation of extremes: A review. Journal of Hydraulic Research 46: 324-332.

Koutsoyiannis, D. 2004. Statistics of extremes and estimation of extreme rainfall: II. Empirical investigation of long rainfall records/Statistiques de valeurs extrêmes et estimation de précipitations extrêmes: II. Recherche empirique sur de longues séries de précipitations. Hydrological Sciences Journal 49.

Malevergne, Y., V. Pisarenko, and D. Sornette. 2006. On the power of generalized extreme value (GEV) and generalized Pareto distribution (GPD) estimators for empirical distributions of stock returns. Applied Financial Economics 16: 271-289.

Patrick, W.S., P. Spencer, O. Ormseth, J. Cope, J. Field, D. Kobayashi, T. Gedamke, E. Cortés, K. Bigelow, W. Overholtz, J. Link, and P. Lawson. 2009. Use of productivity and susceptibility indices to determine stock vulnerability, with example applications to six U.S. fisheries. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-101. 90 pp.

Pontón-Cevallos, José F., Stijn Bruneel, Mar\´in and José, R. Jarr\´in, Jorge Ram\´irez-González, Jorge R. Bermúdez-Monsalve, and Peter L. M. Goethals. 2020. Vulnerability and decision-making in multispecies fisheries: A risk assessment of bacalao (Mycteroperca olfax) and related species in the Galapagos' handline fishery. Sustainability 12: 6931.

Ramos, Pedro L., Francisco Louzada, Eduardo Ramos, and Sanku Dey. 2020. The Fréchet distribution: Estimation and application-An overview. Journal of Statistics and Management Systems 23: 549-578.

Rosen, K.T., and M. Resnick. 1980. The size distribution of cities: an examination of the Pareto law and primacy. Journal of urban economics 8: 165-186.

Sale, M.J., S.F. Railsback, S.Y Chang, C.C. Coutant, R.E. Spath, and G.H Taylor. 1989. Balancing hydropower development in the Ohio River basin. US Department of Energy. Report No. CONF-890876-1.

van Treeck, Ruben, Johannes Radinger, Richard A. A. Noble, Franz Geiger, and Christian Wolter. 2021. "The European Fish Hazard Index – An assessment tool for screening hazard of hydropower plants for fish." Sustainable Energy Technologies and Assessments. P. 43.

Von Raben, K. 1957. Zur Frage der Beschadigung von Fischen durch Turbinen. Die Wasserwirtschaft 4:97-100. (Fisheries Research Board of Canada Translation Series 448).

Von Ruben, T., J. Radinger, R.A.A. Noble, F. Geiger, and C. Wolter. 2021. The European Fish Hazard Index – An assessment tool for screening hazard of hydropower plants for fish. Sustainable Energy Technologies and Assessments 43.

Winemiller, K.O. and K.A. Rose. 1992. Patterns of life history diversification in North American Fishes: Implications for population regulation. Canadian Journal of Fisheries and Aquatic Sciences 49(10): 2196-2218.

Appendix G

2021 Bat Survey Report

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Duke Energy: Bad Creek Pumped Storage Station

2021 Bat Survey Report

December 2021

Project No.: 0606065

The business of sustainability

ERM

CONTENTS

List of Tables

Acronyms and Abbreviations

BCPS	Bad Creek Pumped Storage
Duke Energy	Duke Energy Carolinas, LLC
ERM	ERM NC, Inc.
FERC	Federal Energy Regulatory Commission
Guidelines	Range-Wide Indiana Bat Survey Guidelines
SCDNR	South Carolina Department of Natural Resources
SWAP	South Carolina State Wildlife Action Plan
USFWS	U.S. Fish and Wildlife Service
WNS	white-nose syndrome

1. INTRODUCTION

Duke Energy Carolinas, LLC (Duke Energy) is the Licensee (owner and operator) of the Bad Creek Pumped Storage (BCPS) Project (Project; Federal Energy Regulatory Commission [FERC] No. 2740). The facility provides up to 1,065 megawatts of power production and includes a powerhouse with four pump-turbine generating units, utilizing waters from Lake Jocassee. The facility is located on a 1,860-acre tract in upstate South Carolina in Oconee County, approximately 8 miles northwest of Salem, South Carolina. The pump turbines pump water from Lake Jocassee (elevation 1,110 feet) to the Bad Creek Reservoir (362.6 acres) at an elevation of 2,130 feet through a 1.0-mile tunnel. The Bad Creek Reservoir impounds the Bad Creek and West Bad Creek tributaries of Howard Creek. The Existing License for the Project was issued on August 1, 1977, and will expire on July 31, 2027. Based on the upcoming relicensing, Duke Energy is interested in obtaining initial resource information on Project resources including bats.

2. SCOPE OF THE BAT SURVEY EFFORT

On behalf of Duke Energy, ERM NC, Inc. (ERM) conducted a bat survey in summer and fall 2021 consisting of three field tasks: habitat surveys, acoustic surveys, and mist net surveys. The habitat surveys included an assessment of likely bat habitat (potential roost trees and rock crevices) within the Project area. ERM also conducted a review of available records within and immediately adjacent to the Project, including a review of an acoustic survey conducted at Lake Jocassee in 2015, a review of South Carolina Natural Heritage Program data, and a brief literature review.

Protected bat species potentially occurring within the Project area include the federally threatened northern long-eared bats (*Myotis septentrionalis*), state-listed endangered Rafinesque's big-eared bats (*Corynorhinus rafinesquii*), and state-listed threatened eastern small-footed bats (*Myotis leibii*).

Additionally, the Project area is at the edge of the range of the federally endangered Indiana bats (*Myotis sodalis*). No known records for the species exist in Oconee County, South Carolina. The species has been documented in the winter in Jackson County, North Carolina (USFWS 2007), although the population may no longer be present after declines from white-nose syndrome (WNS). The most recent survey to document Indiana bats in North Carolina was 2013 (USFWS 2019). Although Indiana bats may not be present within the Project area, they were included as a target species during surveys as a conservative measure.

Finally, both the little brown bat (*Myotis lucifugus*) and tricolored bat (*Perimyotis subflavus*) are under review for listing with the U.S. Fish and Wildlife Service (USFWS). Although under review statuses have no formal protection under the Endangered Species Act, if listing status were to change prior to relicensing, impacts to these species may require additional coordination or consultation with the USFWS. Both species are potentially present within the Project area.

3. STUDY METHODS

Current survey protocols for determining potential presence or probable absence of Indiana bats and northern long-eared bats are outlined in the 2020 *Range-Wide Indiana Bat Summer Survey Guidelines* (Guidelines) (USFWS 2020). The Guidelines were used as a baseline for survey methodology; however, several modifications were made in response to specific Project objectives. As this was a preliminary study to gather baseline data, a lower level of effort was used than is recommended by the Guidelines. Additionally, mist netting was conducted outside of the dates recommended by the Guidelines, in order to

collect additional information about the use of the site by migratory bat species, which could be absent during the summer.

3.1 Survey Area

The Project site encompasses approximately 1,860 acres. Locations within flyways and near water resources were selected for acoustic and mist net survey sites. Locations with exposed talus slopes or mixed forest were selected for habitat assessments.

3.2 Records Review

ERM conducted a review of available records within and immediately adjacent to the Project. This included a review of an acoustic survey conducted at Lake Jocassee in 2015, a review of South Carolina Natural Heritage Program data, and a brief literature review.

3.3 Habitat Surveys

Indiana bats and northern long-eared bats roost within live trees and/or snags greater than or equal to 5 inches diameter at breast height that have exfoliating bark, cracks, crevices, and/or hollows. Northern long-eared bats have been found in smaller trees, including as small as 3 inches diameter at breast height. Potential roosts are typically along forest edges, in areas likely to receive direct solar exposure. The Project was visually assessed for potential presence of suitable roost trees, particularly near water resources.

Eastern small-footed bats roost within rock crevices, often along cliffs, talus slopes, or riprap (Moosman, et al. 2015). Visual searches of crevices in six exposed talus slopes in the Project area were performed from August 26 to 27, 2021, using flashlights to search accessible cracks and crevices of the type that eastern small-footed bats use as roosts. Rocks near the talus slopes were also checked for bats roosting underneath. Standard habitat evaluation forms were used to collect data on potential roosts.

3.4 Acoustic Surveys

Acoustic surveys were conducted from July 22 to 25, 2021, using full spectrum bat detectors (Wildlife Acoustics SM3BAT detectors with SMM-U1 microphones). Detectors were placed within potential foraging habitat, including locations adjacent to water resources and along forest edges. Detectors were programmed to start recording 30 minutes prior to sunset and to stop recording 30 minutes following sunrise.

Analysis of recorded bat calls was conducted using the Wildlife Acoustics 2019 software program Kaleidoscope Pro, version 5.1.8. The call library used was version 5.1.0, and files were processed on the “0 Balanced (Neutral)” setting. Other signal parameters were left at default values. Kaleidoscope has a built-in call library for North American species that runs auto-identification on recorded calls, based on clustering analyses. While the automated species identification is generally accurate, variation in recording quality and overlap in species calls requires additional manual review to assess confidence in species presence.

Recorded files were reviewed by an experienced bat biologist, and calls were not identified to species unless they contained clear pulses indicative of search phase behavior. Presence of species was determined according to confidence levels, where high confidence in presence was given to species identified in multiple clear recordings with clear diagnostic features. Because of diagnostic overlap between species, some species can still only be considered possibly present, and in these cases, a lower confidence level was assigned.

3.5 Mist Net Surveys

Mist net surveys were conducted from July 22 to 25 and from October 18 to 21, 2021. Prior to conducting surveys, ERM biologists applied for and received scientific handling permits from the South Carolina Department of Natural Resources (SCDNR). Appendix A contains relevant agency correspondence, permit applications, and the received Scientific Collection Permits (authorization to conduct the surveys) for the Project.

Nets were placed in the best available locations within the Project area to maximize the likelihood of capturing foraging or commuting bats. Specifically, nets were places within likely flight corridors (along roads or near water sources), and if possible, where forest canopy would overhang at least part of the upper net. Nets were deployed at sunset and monitored every 10 minutes for a total of 5 hours. Current WNS decontamination protocols (USFWS 2016) were followed for all capture and handling equipment.

4. RESULTS

4.1 Records Review

ERM conducted a review of available records within and immediately adjacent to the Project. This included a review of an acoustic survey conducted at Lake Jocassee in 2015, a review of South Carolina Natural Heritage Program data, and a brief literature review.

A comprehensive mammalian fauna study, including acoustic surveys for bats, was conducted by Dr. David Webster of the University of North Carolina at Wilmington for Duke Energy in 2012 (Webster 2013). The surveys were conducted during spring, summer, and autumn in a six-county area surrounding the Keowee-Toxaway Hydroelectric Project site, an area that includes the BCPS Project site.

Seven bat species were assessed in this study, including: eastern small-footed bat, little brown bat, Indiana bat, southeastern Myotis (*Myotis austroriparius*), northern long-eared bat, tricolored bat, and Rafinesque's big-eared bat. The 2012 surveys confirmed the presence of hoary bats (*Lasiurus cinereus*), eastern red bats (*Lasiurus borealis*), tricolored bats, eastern small-footed bats, little brown bats, and Rafinesque's big-eared bats in the area surrounding Lake Jocassee. Additionally, the report notes the recorded presence of little brown bat colonies at Devils Fork State Park, located approximately 2 miles from the Project site.

SCDNR conducted winter bat counts at hibernacula statewide in March 2017 (SCDNR 2018). Twelve Rafinesque's big-eared bats were recorded in Stumphouse Tunnel in Oconee County, approximately 14 miles from Project site.

SCDNR conducted acoustic surveys at 12 major bridges over Lake Hartwell, Lake Keowee, and the Chattooga River in the summer of 2020 in a study to evaluate bridge habitat usage by species of concern (SCDNR 2020c). Notably, calls of the federally endangered gray bat (*Myotis grisescens*) were recorded at several sites on Lake Keowee in Oconee County. However, only the calls recorded at a single location, approximately 9 miles from the Project site, were able to be manually verified by a qualified bat surveyor. This is the first potential record of gray bat presence in South Carolina.

SCDNR conducted extensive mist netting, radio tracking, and hibernacula surveys from 2018 to 2020 to support the South Carolina Bat Monitoring and Research Project (SCDNR 2020a). The project also included bat box surveys across the state. Notably, the project reports records of five Seminole bats (*Lasiurus seminolus*) at Stumphouse Mountain Heritage Preserve, located approximately 20 miles from the Project site in Oconee County. The Seminole bat is listed as a Highest Priority species in the 2015 South Carolina State Wildlife Action Plan (SWAP), and these records suggest that their range may be expanding in the area (SCDNR 2015).

Five eastern small-footed bats, a Highest Priority species under the SWAP, were recorded in mist net surveys at the Chestnut Ridge Heritage Preserve, which is located more than 60 miles from the Project site but within the same Blue Ridge ecoregion. Despite the low number of captures, eastern small-footed bats may be utilizing a large area within the ecoregion. The state conservation status of eastern small-footed bats, as well as their greater vulnerability to WNS than other bat species, makes them a conservation priority of the SCDNR (SCDNR 2020b).

Little brown bats were recorded in bat boxes at Oconee State Park, approximately 15 miles from the Project site. While no federally listed northern long-eared bats were found near the Project site, the recent discovery of the summer presence of pregnant females in the South Carolina coastal plain may indicate a migratory presence in more upland regions of the state. Finally, bats with signs of WNS were recorded at two locations in Oconee County, making the area a location of conservation focus for the SCDNR under the SWAP (SCDNR 2020a; SCDNR 2015).

4.2 Habitat Surveys

The Project area was visually assessed for suitable Indiana bat and northern long-eared bat habitat in areas near water sources. Potentially suitable habitat was found to be abundant; however, given the results of the presence/likely absence surveys, Indiana bats and northern long-eared bats are not likely to be onsite, and so potential habitat is likely unoccupied.

Abundant rocky roosting habitat for eastern small-footed bats was found within the Project area, although none could be confirmed to be occupied. Surveys identified nine potential eastern small-footed bat roost sites; site locations are provided in Appendix B. In total, these areas represented approximately 8 acres within the Project site.

Within accessible areas, no eastern small-footed bats were observed, but large numbers of additional potential roost crevices were noted that were inaccessible from the ground. Eastern small-footed bat habitat surveys are often complicated by their habit of roosting alone in small groups and in small microsites; roosting sites for eastern small-footed bats include loose rocks on the ground, which resulted in vast numbers of potential roosting sites in the riprap around the reservoir area and dam.

Emergence surveys were conducted on August 26 and 27, 2021, within two representative habitat areas using an EchoMeter Touch 2 bat detector to identify emerging bats. While multiple species of bat (evening bats [*Nycticeius humeralis*], eastern red bats, tricolored bats, and hoary bats) were detected in the area during emergence surveys, no eastern small-footed bats were observed or detected leaving rock roosts.

4.3 Acoustic Surveys

Acoustic surveys were conducted at four sites from July 22 through July 25, 2021, with two detectors placed at each site (total of 32 detector nights). Two sites (Site 1 and Site 2) were placed adjacent to the shoreline of the reservoir, one site was placed on the service road extending from the existing transmission line right-of-way (Site 3), and one site was placed along the shoreline of Lake Jocassee. Additional survey detail on acoustic setups is included in Appendix C; site locations are provided in Appendix D. The acoustic survey results are summarized in Table 4-1.

Results from Kaleidoscope Pro analysis suggested the potential presence of 12 species within the Project area (Table 4-1). A total of 6,000 files were identified to species. The most commonly detected species was the tricolored bat, followed by the big brown bat. These two species make up more than 70 percent of the identified call files. Bats within the *Myotis* genus accounted for less than 5 percent of call files, with the little brown bat the most commonly recorded.

Manual vetting confirmed with high confidence the presence of five species, and medium confidence in the likely presence of an additional four species. Confidence in silver-haired bat (*Lasionycteris noctivagans*) presence was low. Silver-haired bats and big brown bats share significant overlap in call types, particularly where big brown bats are foraging in wide, open areas. Although the calls recorded by the program are consistent with the typical silver-haired bat characteristics, caution in the interpretation in presence is appropriate given the large amount of big brown bat activity at all sites.

The northern long-eared bat and Indiana bat were determined not likely to be present following manual vetting. For these species, nearly all calls identified by the program were feeding pulses from other bats; when identifiable, these calls were little brown bats or eastern small-footed bats.

Finally, all files were reviewed by the manual vetter to evaluate potential presence of gray bats. Gray bats share relatively little overlap with other *Myotis* species, as their calls are often low slope and higher frequency than the other bats within their genus. No acoustic call files were identified as gray bats.

Table 4-1: Acoustic Survey Results

Species	Results from Kaleidoscope Pro									Confidence in Presence after Manual Review
	Site 1a	Site 1b	Site 2a	Site 2b	Site 3a	Site 3b	Site 4a	Site 4b	Total Files	
Eptesicus fuscus (big brown bat)	576	71	843	123	22	36	34	9	1,714	High
Lasiurus borealis (eastern red bat)	92	181	28	2	4	16	171	107	601	High
Lasiurus cinereus (hoary bat)	13	18	7	25	12	0	27	6	108	High
Lasionycteris noctivagans (silver-haired bat)	8	7	13	19	8	2	6	2	65	Low
Lasiurus seminolus (Seminole bat)	97	71	54	26	16	3	162	75	504	Medium
Myotis leibii (eastern small-footed bat)	0	1	1	0	0	0	2	2	6	Medium
Myotis lucifugus (little brown bat)	27	43	16	4	0	19	34	10	153	High
Myotis septentrionalis (northern long-eared bat)	1	6	4	0	0	2	2	0	15	Not likely present
Myotis sodalis (Indiana bat)	3	7	6	8	2	5	13	9	53	Not likely present
Nycticeius humeralis (evening bat)	15	39	9	4	4	2	69	32	174	Medium

Species	Results from Kaleidoscope Pro									Confidence in Presence after Manual Review
	Site 1a	Site 1b	Site 2a	Site 2b	Site 3a	Site 3b	Site 4a	Site 4b	Total Files	
Perimyotis subflavus (tricolored bat)	179	181	214	72	7	17	414	1,457	2,541	High
Tadarida brasiliensis (Brazilian [Mexican] free-tailed bat)	12	8	17	7	2	3	12	5	66	Medium

4.4 Mist Net Surveys

Mist net surveys of four sites were completed from July 22 to 25 and from October 18 to 21, 2021. Each site received six to eight net nights of survey, resulting in a total of 28 net nights of effort. A total of 14 bats of four species were captured, including four eastern small-footed bats (state-listed as threatened). Additional survey detail on mist net setups and captures is included in Appendix C; site locations are provided in Appendix D.

The average of 1.8 bats per net night is low but typical for post-WNS areas in the eastern United States. Species diversity was also as expected for a post-WNS landscape, with eastern red bats being the predominant capture. Table 4-2 includes a summary of demographics for the species captured. Appendix B includes complete demographic and morphometric data for all bats captured.

Table 4-2: Mist Net Capture Results

Species	Adult Male		Adult Female	Juvenile Male	Escaped	Total
	Non-reproductive	Scrotal	Post-lactating	Non-reproductive		
Eptesicus fuscus (big brown bat)	1	1	1			3
Lasiurus borealis (eastern red bat)	3			2	1	6
Myotis leibii (eastern small-footed bat)	4					4
Lasiurus cinereus (hoary bat)		1				1
Total						14

5. EVALUATION OF RESULTS

Bat surveys conducted in 2021 suggest that a diversity of bat species is likely present within the Project site; however, the Indiana bat (federally endangered) and northern long-eared bat (federally threatened) were not recorded or captured within the Project area.

The records search yielded presence records of additional species of concern near the Project area, which were not detected during ERM's 2021 field surveys (Rafinesque's big-eared bats and gray bats).

Previous surveys found validated calls of gray bats were recorded at a single site in Oconee County. However, the most recent 5-year review for the species does not list any known priority roosts within South Carolina, North Carolina, or Georgia (USFWS 2009). Therefore, the probability of their presence within the Project area is low. However, Rafinesque's big-eared bats may be present onsite in the Project area; although not detected, this species can be difficult to detect acoustically, as it is a "whispering" bat (produces low amplitude acoustic calls).

The eastern small-footed bat is considered a species in need of management in South Carolina (the equivalent to state threatened). Eastern small-footed bats were captured and detected at multiple sites, and abundant roosting habitat was found within the Project area. The bat habitat survey conducted within the Project identified nine potential eastern small-footed bat roost sites encompassing approximately 8 acres. No bats were observed by shining flashlights in potential roosts or during 2 nights of emergence surveys; however, additional effort is likely to be needed to determine with confidence where eastern small-footed bats roost within the area.

Finally, little brown bats and tricolored bats were detected acoustically during the survey, and manual review of these files suggests a high confidence in presence. These species are both currently under review for future listing with the USFWS, with additional updates from the USFWS is expected late in 2022. The Existing License for the Project will expire on July 31, 2027; therefore, the facility's license renewal may require additional survey efforts focused on these species due to their listing status and the recent discovery of WNS-positive bats within Oconee County.

6. REFERENCES

Moosman, Paul, Daniel P. Warner, R. Hardy Hendren, and Micah. J. Hosler. 2015. "Potential for Monitoring Eastern Small-footed Bats on Talus Slopes." *Northeastern Naturalist*, 22(1):NENHC-1–NENHC-13. Available online at https://www.researchgate.net/profile/Paul-Moosman/publication/276835386_Potential_for_Monitoring_Eastern_Small-footed_Bats_on_Talus_Slopes.

SCDNR (South Carolina Department of Natural Resources). 2015. *South Carolina's State Wildlife Action Plan.* Available online at https://www.dnr.sc.gov/swap/index.html.

SCDNR (South Carolina Department of Natural Resources). 2018. *Final Report: White-nose Syndrome Grants to States SC-E-F16AP00833 (South Carolina WNS State Support).* Available online at https://www.dnr.sc.gov/swap/grants/F16AP00833.pdf.

SCDNR (South Carolina Department of Natural Resources). 2020a. *Final Report: South Carolina State Wildlife Grant SC-T-F17AF01195 (South Carolina Bat Monitoring and Research Project).* Available online at https://www.dnr.sc.gov/swap/grants/SC-T-F17AF01195.pdf.

SCDNR (South Carolina Department of Natural Resources). 2020b. *South Carolina Bat Conservation Plan.* Available online at https://www.dnr.sc.gov/wildlife/bats/batconsplan.html.

SCDNR (South Carolina Department of Natural Resources). 2020c. *Final Report: South Carolina State Wildlife Grant SC-T-F19AF00722 (Upstate Bridge Use by Highest Priority Bat Species).* Available online at https://www.dnr.sc.gov/swap/grants/F19AF00722.pdf.

USFWS (U.S. Fish and Wildlife Service). 2007. *2019 Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision.* Available online at https://www.fws.gov/midwest/endangered/mammals/inba/pdf/inba_fnldrftrecpln_apr07.pdf

USFWS (U.S. Fish and Wildlife Service). 2009. *Gray Bat (Myotis grisescens) 5-Year Review: Summary and Evaluation.* Available online at https://ecos.fws.gov/docs/tess/species_nonpublish/1502.pdf.

USFWS (U.S. Fish and Wildlife Service). 2016. *National White-Nose Syndrome Decontamination Protocol*. Available online at https://www.fws.gov/arkansas-es/docs/National%20WNS%20Decon%20Protocol_04.12.2016.pdf.

USFWS (U.S. Fish and Wildlife Service). 2019. *2019 Indiana Bat (Myotis sodalis) Population Status Update*. Available online at https://www.fws.gov/midwest/endangered/mammals/inba/pdf/2019_IBat_Pop_Estimate_6_27_2019a.pdf.

USFWS (U.S. Fish and Wildlife Service). 2020. *Range-Wide Indiana Bat Survey Guidelines.* March. Available online at https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/FINAL%20Range-wide%20IBat%20Survey%20Guidelines%203.23.20.pdf.

Webster, David. 2013. *Mammalian Survey for Keowee-Toxaway Relicensing Project (FERC Project No. 2503).* March.

APPENDIX A AGENCY CORRESPONDENCE AND PERMITS

From:	Kathleen McDaniel
To:	kearsee@dnr.sc.gov; KindelJ@dnr.sc.gov
Cc:	Bonnie Porter
Bcc:	Bill Johnsen
Subject:	SCDNR Collection Permit Application
Date:	Tuesday, June 29, 2021 3:58:00 PM
Attachments:	image001.png Porter_SCDNR_Permit_20210629.pdf McDaniel_SCDNR_Permit_20210629.pdf

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Hello Emily and Jennifer,

Please see attached applications for scientific collection permits (to handle bats) for myself and my colleague, Bonnie Porter.

I will submit a hard copy of these with the application fee, but I wanted to get these applications in front of you for review. Would you please let me know the approximate turnaround times on these permit applications?

Please feel free to give me a call on my cell phone (315-214-9174) if you have any questions or need additional information.

Thanks so much,

Katie

Katie McDaniel
Senior Project Scientist

ERM
5784 Widewaters Parkway | Syracuse, NY | 13214
M 315 214 9174
E Kathleen.McDaniel@erm.com | **W** www.erm.com

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife and Freshwater Fisheries
PO Box 167, Columbia, SC 29202
Wildlife Scientific Collection Permit Request
www.dnr.sc.gov

Scientific Collection Permit Application Form Date: Jun 29, 2021

1. Kathleen McDaniel (Name of applicant) | 219C Hawley Ave, Syracuse NY 13203 (Address)

315-214-9174 (Telephone) | 33 (Age) | kathleen.mcdaniel@erm.com (E-mail)

ERM (Institution represented) | Senior Scientist (Official position of applicant)

2. Categories requested: ☐ A ☒ B(1) ☐ B(2)

3. Professional Qualifications of Applicant:
(Attach supplementary sheet if necessary)

Education: B.S. in Biology - Union College, 2010

Experience: Over 11 years conducting mist net and acoustic surveys for bats (see attached resume)

4. References:

Carl Herzog
Name | Address

Albany, NY
City | State | Zip Code

518-461-4582 (Telephone) | carl.herzog@dec.ny.gov (E-Mail)

Al Hicks
Name | Address

Albany, NY
City | State | Zip Code

518-860-8805 (Telephone) | achicks10@gmail.com (E-Mail)

5. Description of Research Activities: (attach supplementary sheet or proposal and maps if necessary)

A. Objective:

Conduct a baseline survey for bats, in order to assess potential impacts for upcoming relicensing of the Bad Creek Reservoir Facility (existing license will expire in 2027). Based on the upcoming relicensing, Duke Energy is interested in obtaining initial information regarding project resources such as bats.

B. Need and Justification:

Scientific collection permits are needed to handle bats. Mist net surveys will be conducted following the methods outlined in the USFWS Indiana Bat Survey Guidelines (although level of effort and time of year will be adjusted to meet project needs). As the survey is not intended to be presence/likely absence for Indiana bats, additional net sets may be deployed in suitable locations to capture a diversity of species.

C. Duration:

Mist net surveys will be conducted for 1 week in July, August, and Sept.

D. & E. Species, Number and Sampling, Frequency of Sampling

Species	# or Range	Frequency of Sampling
as captured in mist nets		

F. Procedures & Methods:

Mist nets will be deployed following the USFWS Guidelines for Indiana bats. All bats will be handled by a biologist holding a federal permit. Bats will be sexed, aged, and weighed. All bats will be released promptly after processing. If any federally protected species are captured, they will be photographed and SCDNR and USFWS will be notified. The USFWS report for all captures will be submitted before January 31, 2022.

G. Location:

Oconee County

H. Specimen Disposition:

All bats will be released immediately after processing

I. Information Exchange:

A summary report of findings will be provided to SCDNR after the survey is complete. The USFWS reporting spreadsheet for bats will be completed and submitted to USFWS (this can also be provided to SCDNR upon request).

6. Federal Permit Numbers and Types: TE83013B-0

7. Application Fee Enclosed yes

I have read the terms for issuance of this permit on the permit application form instructions for use and agree to abide by them.

Signature  Date 6/29/2021

KATHLEEN E. MCDANIEL

315-214-9174 (cell)
Kathleen.McDaniel@erm.com

EDUCATION: **UNION COLLEGE,** *Schenectady, New York* **June 2010**
B.S. in Biology

CURRENT EMPLOYMENT:

Bat Biologist, Environmental Resources Management April 2015

- Lead bat biologist (federal permit number TE83013B-0) for mist-net and acoustic surveys for Indiana bat and northern long-eared bat.
- Lead acoustic vetter on multiple major projects.
- Acoustic instructor for multiple workshops teaching individuals the mechanics of acoustic surveys and analysis.
- Experience with federally endangered gray bats (*Myotis grisescens*) during a harp trap survey in Arkansas, summer 2015, including handling of approximately 100 individuals and recording of acoustic voucher calls.
- Training and supervision of technicians as they assist with bat surveys.
- Compilation and organization of relevant data for reports, including acoustic analysis, organization of photos and datasheets, presentation of results and relevant figures.

RECENT WORK HISTORY:

Wildlife Technician, Department of Environmental Conservation August 2010-April 2015

- Performed duties for the Endangered Species Unit, with work focused on bats.
- *Winter hibernacula surveys:*
    - Participated in all major New York hibernacula surveys from winter 2010-2011 through winter of 2014-2015, over 70 surveys in total.
    - Led crews, photographed bats, assisted in sampling efforts, and counted bat photographs.
    - Personally observed tens of thousands of bats and have been responsible for accurate identification of all northeast cave bat species, including Indiana bats (endangered) and northern long-eared bats (threatened).
- *Acoustic surveys:*
    - Coordinated the state-wide acoustic program summers of 2011-2014, which included assisting and overseeing the efforts of approximately 80 volunteers.
    - Ensured over 50 routes were run throughout the state in just over six weeks during the summer.
    - Performed data analysis on all files (roughly 5,000 each year, all manually vetted for species identification).
    - Trained approximately a dozen volunteers, technicians and biologists on acoustic analysis.
- *Mist net surveys:*
    - Responsible for selection of appropriate net locations, setup and breakdown of triple-high nets, extraction bats from net, identify to species.
    - Processed bats including: taking measurements, sex, band bats.
    - Managed datasheets, stored equipment, and decontaminated nets.
- *Other bat research skills:*

    - Attachment of radio-transmitters to bats, radio-tracking to roost trees, and emergence counts.
    - Taking wing tissue samples from live animals, swabbing bats for WNS, and identification of wind-turbine mortality bats to species.
- *Writing/Presentation skills:*
    - Generated yearly reports on acoustic surveys, winter surveys, and other projects for both volunteer and technical audiences.
    - Maintained databases and manage data in Microsoft Excel, Microsoft Access, and ArcGIS.
    - Assisted in the organization of relevant data for presentations at regional meetings.
- Rabies vaccinated, September 2010. Titer check fall 2014.

Consultant, Vesper Environmental LLC **Summers 2011, 2012, 2013, and 2014**

- Performed mist net surveys and acoustical surveys, as described above.
- *Additional acoustic experience:*
    - Trained Vesper staff in how to conduct acoustic surveys, including placement of detectors as well as strategies for efficient data analysis.
    - Became proficient with all automated species identification programs, including Sonobat, Kaleidoscope, Echoclass, and BatCallID.
- Assisted in the generation of reports for clients, including production of maps, analysis of data, and summarizing results in a clear format.
- *Specific project experience:*
    - During summer of 2013, was solely responsible for acoustic analysis on a 24-site project.
    - In 2014, coordinated field teams and performed all analysis on a 33 acoustic site project.

SELECTED PRESENTATIONS AND POSTERS:

Common Manual Vetting Mistakes Every Novice Makes. Kathleen O'Connor, Lisa Kleinschmidt, Prescott Weldon, Michael Fishman, Leslie Rodman-Jaramillo, and Zoe Bryant. JBWG 2018. [poster]

Acoustic False Positives for Myotis Driven by Feeding Behavior of Lasiurus borealis. Kathleen O'Connor, Leslie Rodman-Jaramillo, and Prescott Weldon. NEBWG 2016.

Forty Years of Bat Speciation in a Rabies Diagnostic Laboratory: Prospects for data Analysis. Robert Rudd, Carl Herzog, Kathleen O'Connor, Anne Clobridge. NEBWG 2014.

What Makes a Summer Home? An Analysis of Indiana Bat Roosts in New York. Kathleen O'Connor and Carl Herzog. NEBWG 2012.

Hey You…Take the Darn Pictures! Why Adequate WNS Surveillance Demands Photography. Al Hicks, Carl Herzog, Ryan von Linden, Kathleen O'Connor. NEBWG 2012.

Quantifying White Noses: Patterns of Visible Fungus on Photographed Bats in New York. Kathleen O'Connor, Al Hicks, Carl Herzog, Ryan von Linden. USFWS WNS Workshop, 2011. [poster]

Using Mist Net Results to Assess Impact of White Nose Syndrome on New York Bat Populations. Kathleen O'Connor, Carl Herzog, Al Hicks, Michael Fishman, Ryan von Linden. NEBWG 2011. [poster]

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES
Division of Wildlife and Freshwater Fisheries
PO Box 167, Columbia, SC 29202
Wildlife Scientific Collection Permit Request
www.dnr.sc.gov

Scientific Collection Permit Application Form Date: 6/29/2021

1. Bonnie Porter (Name of applicant) 4310 N. Rampart St., New Orleans, LA 70117 (Address)

504-331-5614 (Telephone) 35 (Age) bonnie.porter@erm.com (E-mail)

ERM, Inc. (Institution represented) Consultant II - Scientist (Official position of applicant)

2. Categories requested: ☐ A ☒ B(1) ☐ B(2)

3. Professional Qualifications of Applicant:
(Attach supplementary sheet if necessary)

Education: B.S. in conservation biology, Louisiana State University, 2014

Experience: 5 field seasons conducting mist net, acoustic, and roost surveys for bats (see attached resume)

4. References:

Prescott Weldon
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Kim Livengood
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Columbia, MO
City State Zip Code
573-442-8745 Kim.Livengood@Titley-Scientific.us
Telephone E-Mail

5. Description of Research Activities: (attach supplementary sheet or proposal and maps if necessary)

A. Objective:

Conduct a baseline survey for bats, in order to assess potential impacts for upcoming relicensing of the Bad Creek Reservoir Facility (existing license will expire in 2027). Based on the upcoming relicensing, Duke Energy is interested in obtaining initial information regarding project resources such as bats.

B. Need and Justification:

Scientific collection permits are needed to handle bats. Mist net surveys will be conducted following the methods outlined in the USFWS Indiana Bat Survey Guidelines (although level of effort and time of year will be adjusted to meet project needs). As the survey is not intended to be presence/likely absence for Indiana bats, additional net sets may be deployed in suitable locations to capture a diversity of species.

C. Duration:

Mist net surveys will be conducted for 1 week in July, August, and Sept.

D. & E. Species, Number and Sampling, Frequency of Sampling

Species	# or Range	Frequency of Sampling
as captured in mist nets		

F. Procedures & Methods:

Mist nets will be deployed following the USFWS Guidelines for Indiana bats. All bats will be handled by a biologist holding a federal permit. Bats will be sexed, aged, and weighed. All bats will be released promptly after processing. If any federally protected species are captured, they will be photographed and SCDNR and USFWS will be notified. The USFWS report for all captures will be submitted before January 31, 2022.

G. Location:

Oconee County

H. Specimen Disposition:

All bats will be released immediately after processing.

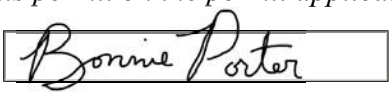
I. Information Exchange:

A summary report of findings will be provided to SCDNR after the survey is complete. The USFWS reporting spreadsheet for bats will be completed and submitted to USFWS (this can also be provided to SCDNR upon request).

6. Federal Permit Numbers and Types: N/A

7. Application Fee Enclosed yes

I have read the terms for issuance of this permit on the permit application form instructions for use and agree to abide by them.

Signature  Date 6/29/2021

Bonnie Porter

Cell: (504) 331-5614
Email: bporter6@gmail.com
4310 N. Rampart St., New Orleans, LA 70117

Professional Experience

Environmental Specialist, DR-1603/DR-1607 — **July 2017 – present**
Federal Emergency Management Agency (FEMA), New Orleans, LA

- Demonstrating knowledge and understanding of the National Environmental Policy Act (NEPA) process, relevant executive orders, and environmental protection laws.
- Drafting NEPA documents including Environmental Assessments, Biological Evaluations, Records of Environmental Consideration (CATEXes/STATEXes), and floodplain/wetland review documents.
- Reviewing recovery and mitigation projects for compliance with state/federal environmental laws and regulations, including the Endangered Species Act, Clean Air Act, Clean Water Act, Coastal Zone Management Act, Resource Conservation and Recovery Act, and Executive Orders 11988 (Floodplains), 11990 (Wetlands), and 12898 (Environmental Justice).
- Managing projects throughout the environmental review process. Coordinating project reviews with input from the historic/archaeological/floodplain teams, senior leadership, and the FEMA Office of Chief Counsel. Triaging projects, tracking progress of reviews, and maintaining project deadlines. Providing project support to colleagues.
- Consulting with resource agencies for concurrence on permitting/compliance needs. Conducting background research to support findings. Compiling and managing supporting data and documentation from resource mappers and agency databases.
- Providing environmental project guidance and technical assistance to applicants.
- Converting NEPA documents into Section 508 accessible formats for public notice.

Lead Bat Technician (Seasonal) — **May – June 2017**
Environmental Resources Management (ERM), Syracuse, NY

- Managed and trained a small crew of bat technicians on acoustic surveys. Supported senior biologists with fieldwork including acoustic, habitat, and mist net surveys, radio-tracking of bats, and roost emergence counts.

Environmental Specialist, DR-4263/DR-4277 — **October 2016 — April 2017**
Federal Emergency Management Agency (FEMA), Baton Rouge, LA

- Reviewed FEMA-funded flood recovery projects for compliance with applicable environmental laws, regulations, and executive orders.
- Drafted NEPA documents including Records of Environmental Consideration (CATEXes, STATEXes) and eight-step floodplain/wetland review documents.
- Conducted environmental outreach and provided technical assistance to applicants.

Bat Technician (Seasonal) — **August – September 2016**
Deep South Eco Group, Jackson, MS

- Assessed and selected survey sites using GIS resources. Conducted habitat assessments, acoustic surveys, and mist net surveys. Maintained and managed equipment.

Bat Technician (Seasonal) — **May – August 2016**
Environmental Resources Management (ERM), Syracuse, NY

- Supported habitat assessments, mist net surveys, radio-tracking of bats, and roost emergence counts. Equipment maintenance.

Herpetology Researcher (Seasonal) — **September 2015 – January 2016**
USFWS Grant, Mississippi and Louisiana
- Fieldwork including transect, trap, and call surveys for reptiles and amphibians on three national wildlife refuges. Collection of habitat data and specimen samples.
- Field map creation, data entry, and QAQC.

Lead Acoustic Technician (Seasonal) — **May – August 2015**
Normandeau Associates, Inc., Gainesville, FL
- Trained, managed, and scheduled a team of three technicians for acoustic bat surveys.
- Fieldwork including habitat surveys and acoustic bat surveys across three states.
- GIS analysis, data management, and equipment troubleshooting and maintenance.

Environmental Quality Technician — **September 2014 – April 2015**
Balance Consulting, Inc., Mandeville, LA
- Conducted environmental sampling, development of Phase I environmental site assessments, environmental and permitting data management.
- Procured analytical instruments for mobile environmental labs, drafted lab proposal bid sheets, and compiled specs for design team.

Biological Technician (Seasonal) — **May – August 2014**
Western Ecosystems Technology, (WEST) Inc., Cheyenne, WY
- Fieldwork including acoustic surveys, habitat surveys, and mist net surveys, radio-tracking of bats, and roost emergence counts.
- Field data management including bat, habitat, and GPS data.
- Communication and coordination with landowners and client representatives.

Education

B.S. in Natural Resource Ecology and Management, Conservation Biology concentration — **Graduated 2014**
Louisiana State University School of Renewable Natural Resources, Baton Rouge, LA
- Graduated May 2014. Dean's List.

Volunteer work

Louisiana Books 2 Prisoners — **2014 – Present**
New Orleans, LA
- Community organizer. Grant writing, volunteer training, facilitating volunteer events, administrative management. I also built and maintain our website.

Louisiana Master Naturalist Program — **Fall 2015**
New Orleans, LA
- Completed fall course on Louisiana's coastal ecology. Volunteered on coastal restoration projects in the Mississippi River delta.

Audubon Society Invasive Species Advocacy Workshop — **June 2012**
Washington, D.C.
- Was selected to attend annual environmental advocacy workshop and meet with Louisiana legislators to discuss invasive species legislation.

References Available upon request.

SCDNR
Scientific Collection Permit

Permit #SC-80-2021 **Date Issued: July 13, 2021**

This Permit Authorizes

Kathleen McDaniel, Senior Scientist ERM
(name)

219 Hawley Ave, Syracuse, NY 13203
(address)

Signed:

Emily Cope

Emily Cope, Deputy Director
Division of Wildlife & Freshwater Fisheries

Species: Bats

Objective: Conduct a baseline survey for bats, in order to assess potential impacts for upcoming relicensing of the Bad Creek Reservoir Facility (existing license will expire in 2027). Duke energy is interested in obtaining initial information regarding project resources such as bats.

Authorized to: Deploy mist nets or other appropriate net sets following USFWS guidelines. Bats can be sexed, aged, and weighed. Bats will be released promptly after processing. Any federally protected species will be photographed and SCDNR, USFWS will be notified

Location: Oconee County

Conditions: This permit does not authorize the capture/take of any bats on any property, public or private, without the consent of the owner or custodian thereof. This permit, neither directly nor by implication, grants the right of trespass. This permit does not authorize the collection of voucher specimens. Permittee must have a copy of this permit and any required federal permits while engaged in the permitted activities. This permit is invalid unless accompanied by Federal Permits ES02373A-15, TE02365A-4, TE56749B-4, TE075913-5, TE89558A-1, TE88227B-0, TE02167C-0, TE171545-3, TE38085B-1, and TE81492B-0. This state permit abides by all conditions and restrictions stated in federal permits. **Permittee shall credit the SCDNR in all publications and presentations related to this study. Study results must be shared with SCDNR.**

Expiration Date: October 10, 2021

Cc: Jennifer Kindel

SCDNR
Scientific Collection Permit

Permit #SC-81-2021 **Date Issued: July 13, 2021**

This Permit Authorizes

Bonnie Porter, Consultant Scientist ERM
(name)

4310 N. Rampart St, New Orleans, LA 70117
(address)

Signed:

Emily Cope/KP

Emily Cope, Deputy Director
Division of Wildlife & Freshwater Fisheries

Species: Bats

Objective: Conduct a baseline survey for bats, in order to assess potential impacts for upcoming relicensing of the Bad Creek Reservoir Facility (existing license will expire in 2027). Duke energy is interested in obtaining initial information regarding project resources such as bats.

Authorized to: Deploy mist nets or other appropriate net sets following USFWS guidelines. Bats can be sexed, aged, and weighed. Bats will be released promptly after processing. Any federally protected species will be photographed and SCDNR, USFWS will be notified

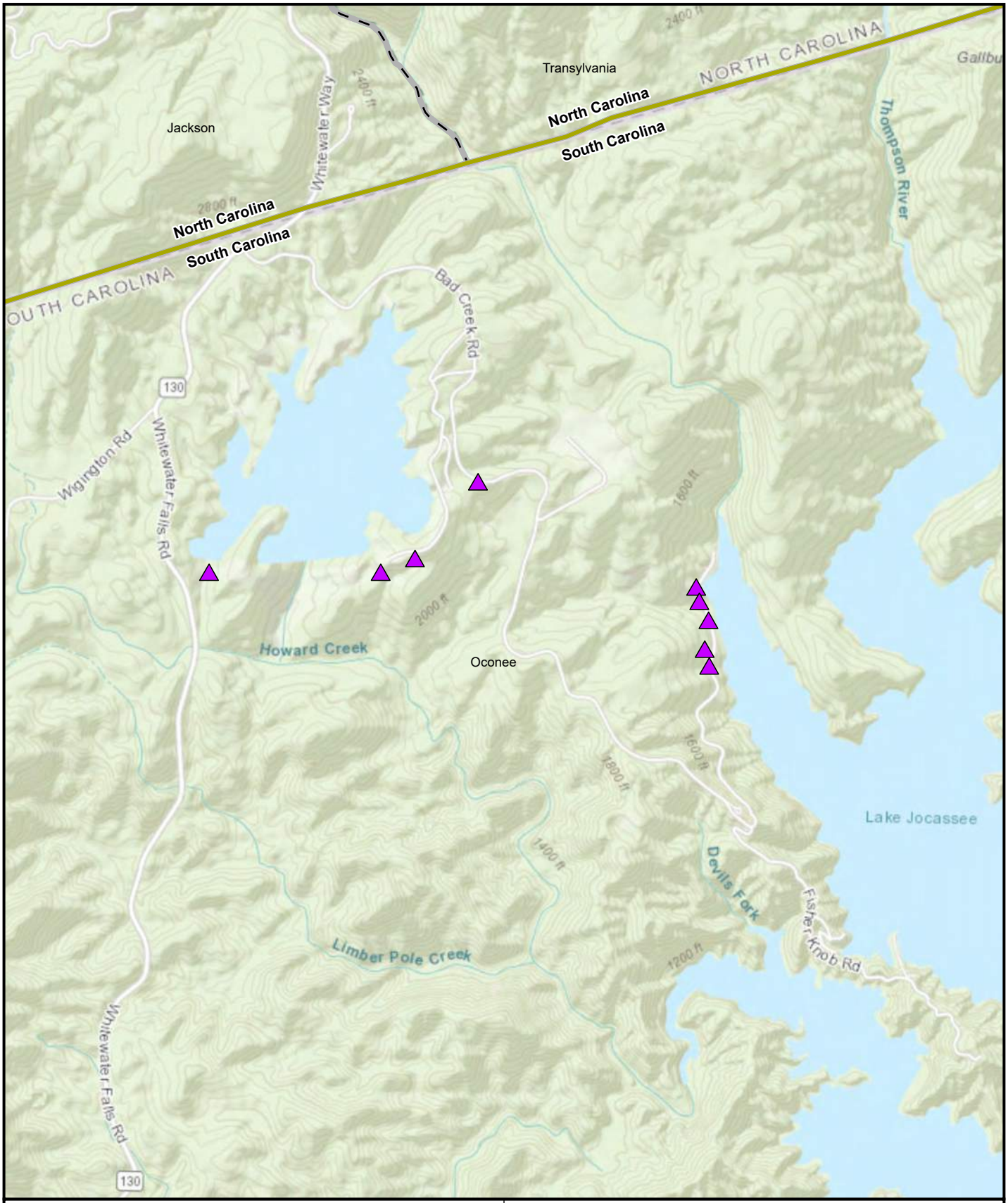
Location: Oconee County

Conditions: This permit does not authorize the capture/take of any bats on any property, public or private, without the consent of the owner or custodian thereof. This permit, neither directly nor by implication, grants the right of trespass. This permit does not authorize the collection of voucher specimens. Permittee must have a copy of this permit and any required federal permits while engaged in the permitted activities. This permit is invalid unless accompanied by Federal Permits ES02373A-15, TE02365A-4, TE56749B-4, TE075913-5, TE89558A-1, TE88227B-0, TE02167C-0, TE171545-3, TE38085B-1, and TE81492B-0. This state permit abides by all conditions and restrictions stated in federal permits. **Permittee shall credit the SCDNR in all publications and presentations related to this study. Study results must be shared with SCDNR.**

Expiration Date: October 10, 2021

Cc: Jennifer Kindel

APPENDIX B HABITAT SITE LOCATIONS



Habitat Locations

County Boundary

State Boundary

1:30,000

0 1,000 2,000 Feet

Habitat Overview Map

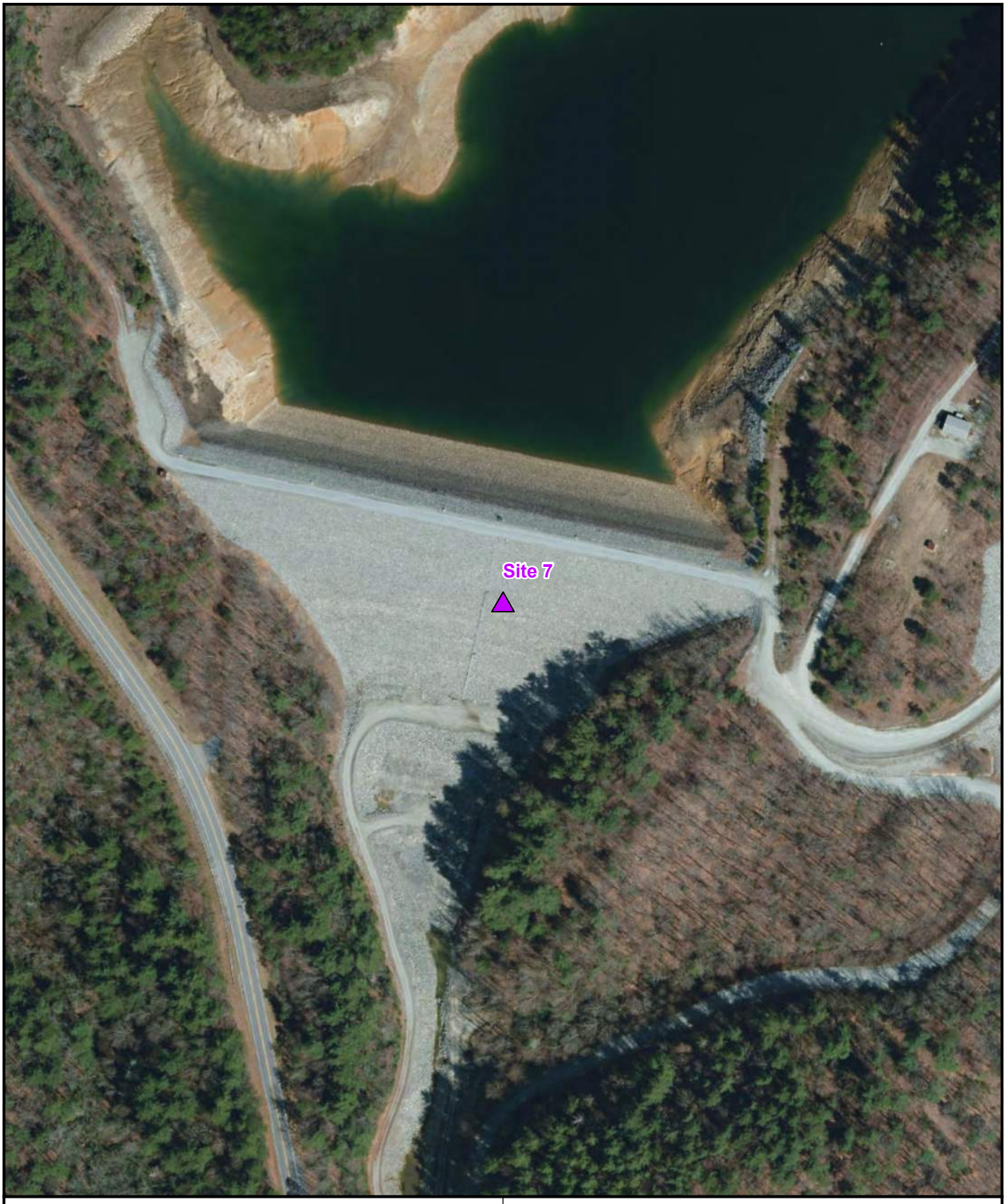
Bad Creek - 2021 Bat Surveys

Duke Energy

Oconee County South Carolina,
and Transylvania County, North Carolina

ERM

MPLS M:\Clients\D-F\DUK\Bad Creek_ArcGIS\2021\11\Bat_Survey\DUK_Bat_Survey_Figure.aprx\Habitat Overview | REVISED: 12/03/2021 | SCALE: 1:30,000 DRAWN BY: KMH



Habitat Survey Points

N

1:2,400

0 50 100

Feet

Habitat Figures

Bad Creek - 2021 Bat Surveys

Duke Energy

Oconee County, South Carolina

ERM

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Habitat Survey Points

1:2,400

0 50 100 Feet

Habitat Figures
Bad Creek - 2021 Bat Surveys
Duke Energy
Oconee County, South Carolina

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Habitat Survey Points

1:2,400

0 50 100 Feet

Habitat Figures
Bad Creek - 2021 Bat Surveys
Duke Energy
Oconee County, South Carolina

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Habitat Survey Points

N

1:2,400

0 50 100

Feet

Habitat Figures

Bad Creek - 2021 Bat Surveys

Duke Energy

Oconee County, South Carolina

ERM

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APPENDIX C SURVEY DATA AND PHOTOS

Table C-1: Acoustic Setup Details

Site Name	Detector Number	Habitat Type	Detector	Microphone	Microphone Height (meters)	Distance to Clutter (meters)
1a	3221	Near/Over Still Water	Wildlife Acoustics SM3BAT	SMM-U1	3	5
1b	3074	Near/Over Still Water	Wildlife Acoustics SM3BAT	SMM-U1	3	3
2a	3234	Road Corridor	Wildlife Acoustics SM3BAT	SMM-U1	3	4
2b	3231	Near/Over Still Water	Wildlife Acoustics SM3BAT	SMM-U1	3	5
3a	3077	Woodland Edge	Wildlife Acoustics SM3BAT	SMM-U1	3	4
3b	3267	Woodland Edge	Wildlife Acoustics SM3BAT	SMM-U1	3	7
4a	3219	Near/Over Still Water	Wildlife Acoustics SM3BAT	SMM-U1	3	4
4b	3251	Near/Over Still Water	Wildlife Acoustics SM3BAT	SMM-U1	3	3

Table C-2: Mist Net Setup Details

Site Name	Net Set Code	Net Width	Number of Nets in Set	Habitat Type
1	A	9	2	Road Corridor
1	B	4	2	Road Corridor
1	C	4	1	Road Corridor
2	A	9	2	Road Corridor
2	B	6	1	Road Corridor
2	C	4	2	Road Corridor
3	A	4	3	Road Corridor
3	B	9	3	Road Corridor
3	C	9	3	Road Corridor
3	D	6	2	Road Corridor
4	A	12	3	Field/Forest Edge
4	B	6	3	Road Corridor
4	C	4	2	Road Corridor

Table C-3: Bat Capture Details

Site ID	Net Night	Date	Capture Time	Net	Species	Sex	Age	Reproductive Status	Mass (g)	Forearm Length (mm)	Comments
Site 1	Night 1	2021-07-23	21:16:00	A	LABO	M	Juvenile	NR	8.5	37.6	
Site 1	Night 1	2021-07-23	21:41:00	A	EPFU	M	Adult	NR	15	47.5	
Site 2	Night 1	2021-07-25	21:10:00	B	EPFU	M	Adult	SCR	14.5	42.5	
Site 2	Night 2	2021-07-26	22:06:00	A	LABO	M	Juvenile	NR	10	38.8	
Site 2	Night 2	2021-07-26	01:07:00	A	MYLE	M	Adult	NR	4.5	31.9	
Site 3	Night 1	2021-10-11	22:21:00	D	MYLE	M	Adult	UNK	6	33	
Site 3	Night 1	2021-10-11	22:20:00	D	LACI	M	Adult	SCR	23	50.8	Few pinholes in wing
Site 3	Night 2	2021-10-12	20:30:00	C	EPFU	F	Adult	PL	18	46.8	Bat bugs
Site 3	Night 2	2021-10-12	22:55:00	C	LABO	M	Adult	NR	9	38.9	
Site 4	Night 1	2021-10-13	19:30:00	A	LABO	E	Escaped	UNK			Bat escaped from net
Site 4	Night 2	2021-10-14	19:15:00	C	MYLE	M	Adult	NR	7.5	30.5	
Site 4	Night 2	2021-10-14	19:20:00	C	MYLE	M	Adult	NR	5	32	
Site 4	Night 2	2021-10-14	19:20:00	C	LABO	M	Adult	NR	12	40.2	Small pinholes in wing
Site 4	Night 2	2021-10-14	21:10:00	A	LABO	M	Adult	NR	8.5	37.5	

Acoustic Site Setup – Site 2b.

Acoustic Site Setup – Site 4b.

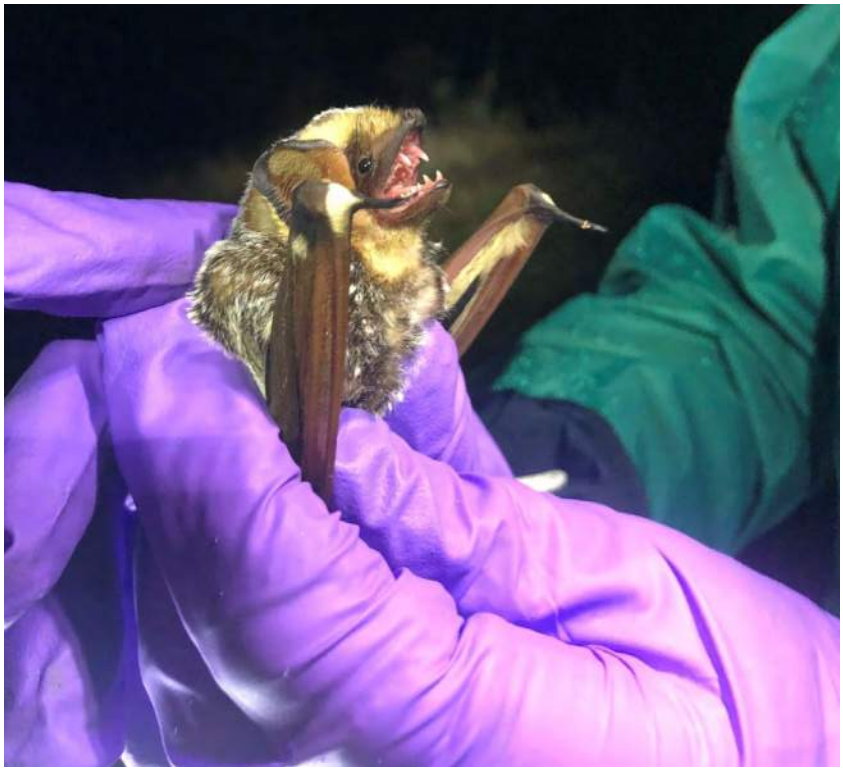
Mist Net Site Setup – Site 3a.

Mist Net Site Setup – Site 4b.

BAT SURVEY 2021
REPRESENTATIVE PHOTOS

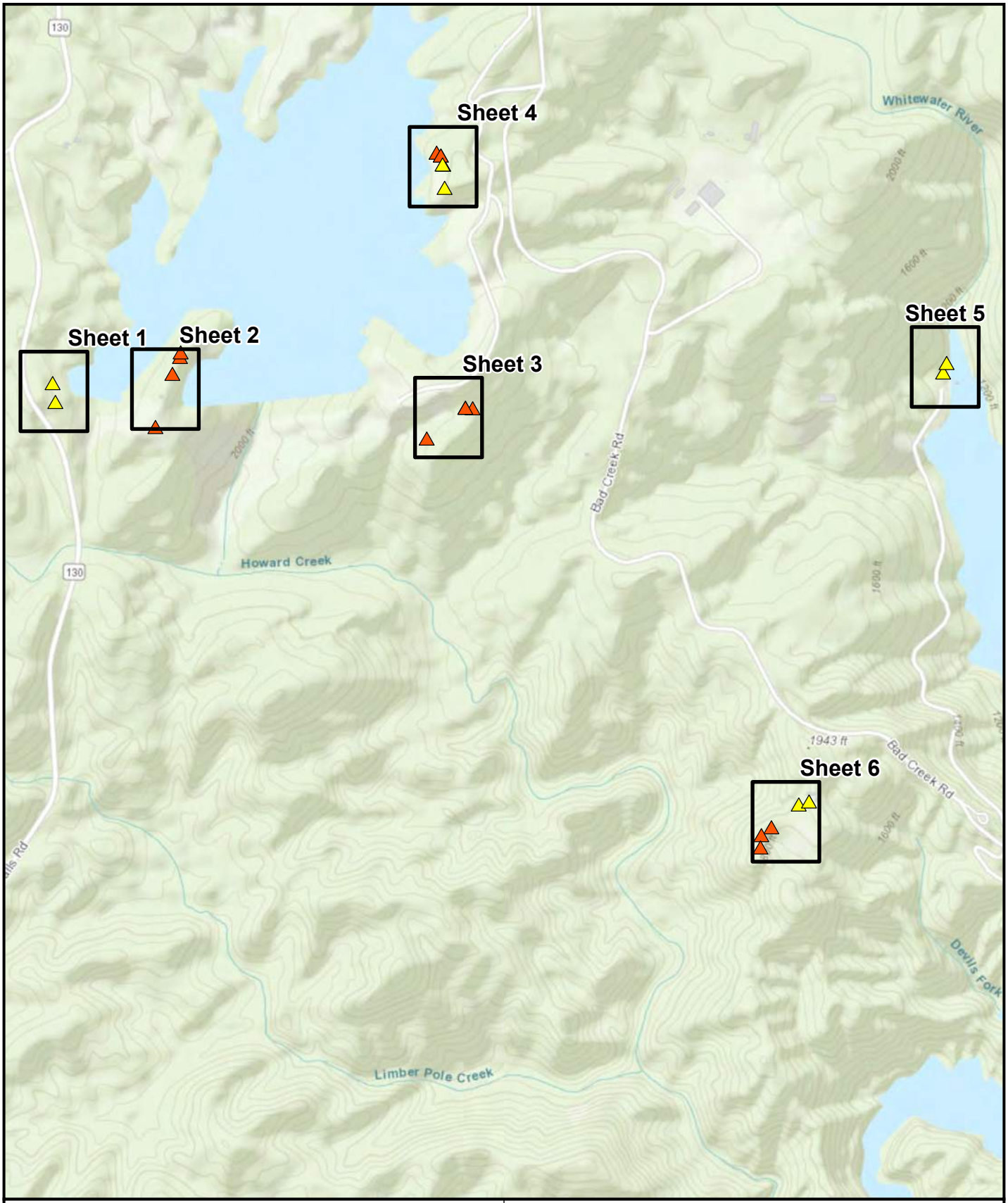
ERM

Eastern small-footed bat captured at Site 2 on 7/26/21.



Hoary bat captured at Site 3 on 10/11/21.

APPENDIX D ACOUSTIC AND MIST NET SITE LOCATIONS



Acoustic Locations

Net Locations

Index Sheets

1:18,000

0 1,000 2,000 Feet

Acoustic and Net Overview Map

Bad Creek - 2021 Bat Surveys

Duke Energy

Oconee County, South Carolina

ERM

MPLS M:\Clients\D-F\DUK\Bad Creek_ArcGIS\2021\11\Bat_Survey\DUK_Bat_Survey_Figure.aprx\Acoustic and Net Overview | REVISED: 11/02/2021 | SCALE: 1:18,000 DRAWN BY: KMH

Acoustic Locations

N

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Acoustic and Net Figures

Bad Creek - 2021 Bat Surveys

Duke Energy

Oconee County, South Carolina

ERM

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Net Locations

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Acoustic and Net Figures
Bad Creek - 2021 Bat Surveys
Duke Energy
Oconee County, South Carolina

ERM

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Net Locations

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Acoustic and Net Figures
Bad Creek - 2021 Bat Surveys
Duke Energy
Oconee County, South Carolina

ERM

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Acoustic Locations

Net Locations

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Acoustic and Net Figures

Bad Creek - 2021 Bat Surveys

Duke Energy

Oconee County, South Carolina

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Acoustic Locations

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1:1,200

0 50 100 Feet

Acoustic and Net Figures

Bad Creek - 2021 Bat Surveys

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Oconee County, South Carolina

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Acoustic Locations

Net Locations

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0 50 100 Feet

Acoustic and Net Figures

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Oconee County, South Carolina

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