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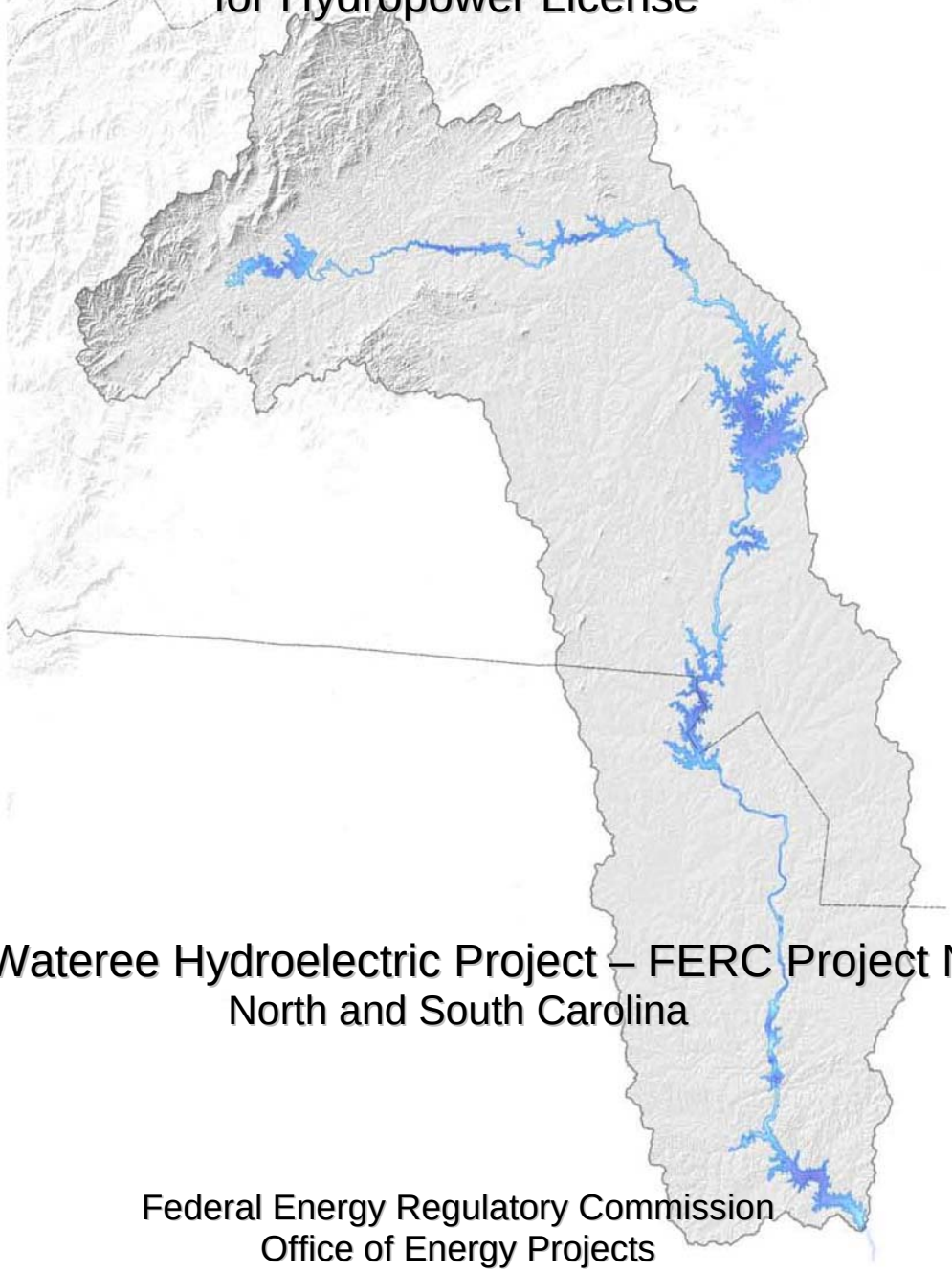
FERC/DEIS-0228D

Draft Environmental Impact Statement for Hydropower License



Catawba-Wateree Hydroelectric Project – FERC Project No. 2232

North and South Carolina

Federal Energy Regulatory Commission
Office of Energy Projects
888 First Street, NE
Washington, DC 20426

14573.01

FERC/DEIS-0228D

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSE

Catawba-Wateree Hydroelectric Project—FERC Project No. 2232
North Carolina and South Carolina

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, DC 20426

March 2009

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426
OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Draft Environmental Impact Statement

Attached is the draft environmental impact statement (EIS) for the Catawba-Wateree Hydroelectric Project (Project No. 2232) which is located on the Catawba and Wateree Rivers in the North Carolina counties of Burke, McDowell, Caldwell, Catawba, Alexander, Iredell, Mecklenburg, Lincoln, and Gaston, and the South Carolina counties of York, Lancaster, Chester, Fairfield, and Kershaw..

The draft EIS documents the views of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and staff. It contains staff evaluations of the applicant's proposal and the alternatives for licensing the Catawba-Wateree Project.

You are invited to file comments on the draft EIS. Any comments, conclusions, or recommendations that draw upon studies, reports, or other working papers should be supported by appropriate documentation. Your comments will be considered in staff's preparation of the final EIS.

Comments should be filed with Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 888 First Street NE, Washington, DC 20426. All comments must be filed within 60 days of the notice date in the Federal Register and should reference Project No. 2232. The Commission strongly encourages electronic filing. See 18 CFR 385.2001(a)(1)(iii) and instructions at http://www.ferc.gov under the eLibrary link.

Before the Commission makes a licensing decision, it will take into account concerns relevant to the public interest. The draft EIS will be part of the record from which the Commission will make its decision. The final EIS is expected to be issued in November 2009.

Copies of the draft EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street NE, Washington, DC 20426. An electronic copy of the draft EIS also may be viewed on FERC's website at http://www.ferc.gov using the "eLibrary" link. Please call (202) 502-8222 or TTY (202) 208-1659 for assistance.

Attachment: Draft Environmental Impact Statement.

COVER SHEET

a. Title: Relicensing the Catawba-Wateree Hydroelectric Project, Federal Energy Regulatory Commission (FERC or Commission) Project No. P-2232

b. Subject: Draft Environmental Impact Statement

c. Lead Agency: FERC

d. Abstract: The Catawba-Wateree Hydroelectric Project is located on the Catawba and Wateree rivers in Burke, McDowell, Caldwell, Catawba, Alexander, Iredell, Mecklenburg, Lincoln, and Gaston Counties, North Carolina, and York, Lancaster, Chester, Fairfield, and Kershaw Counties in South Carolina. There are no federal lands affected by the project.

e. Contact: Environmental Staff

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f. Transmittal: This draft environmental impact statement prepared by the staff on the hydroelectric license application filed by Duke Power Company, LLC, doing business as Duke Energy Carolinas, LLC for the new license for the existing Catawba-Wateree Hydroelectric Project (FERC No. P-2232) is being made available to the public on or about March 2009, as required by the National Environmental Policy Act of 1969.[1]

[1] National Environmental Policy Act of 1969, amended (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act,[3] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

> That the project...shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(3)...[4]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[5] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[6]

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[2] 16 U.S.C. §791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986) and the Energy Policy Act of 1992, Public Law 102-486 (1992), and the Energy Policy Act of 2005, Public Law 109-58 (2005).

[3] Public Law 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. §803(a) (2008).

[5] 16 U.S.C. §803(g) (2008).

[6] 18 CFR §385.206 (2008).

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ACRONYMS AND ABBREVIATIONS

AAII	Access Area Improvement Initiative
ADA	Americans With Disabilities Act
AES	Alderman Environmental Services, Inc.
AIP	Agreement in Principle
APE	area of potential effects
AR/CCL	American Rivers/Coastal Conservation League
BIA	Bureau of Indian Affairs
°C	degrees Celsius
CA	critical area
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
CHEOPS	Computer Hydro Electric Operations and Planning Software
CIN	Catawba Indian Nation
Commission	Federal Energy Regulatory Commission
CR	Catawba Riverkeeper
CRA	Comprehensive Relicensing Agreement
Cultural Committee	Cultural Resources Resource Committee
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DO	dissolved oxygen
DTA	Devine Tarbell and Associates, Inc.
EBCI	Eastern Band of Cherokee Indians
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
ft	Foot or Feet
FWCA	Fish and Wildlife Coordination Act
FWQIP	flow and water quality implementation plan
FWS	U.S. Fish and Wildlife Service
HDR	HDR Engineering, Inc. of the Carolinas
HEP	Habitat Enhancement Program
HPMP	historic preservation management plan
HSI	Habitat Suitability Index
IBI	Index of Biological Integrity
in.	inch(es)
Interior	U.S. Department of the Interior
kg/km	kilogram(s) per kilometer
kV	kilovolt(s)
kWh	kilowatt hour(s)
Lake Policy	Lake Use Policy Statements
LBG	Louis Berger Group

mg/l	milligram(s) per liter
mgd	million gallon(s) per day
ml	milliliter(s)
MOU	memorandum of understanding
msl	mean sea level
MW	megawatt
MWh	megawatt hours
NA	not applicable
N.AC.	North Carolina Administrative Code
National Register or historic properties	National Register of Historic Places
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Council
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	U.S. Department of Commerce, National Marine Fisheries Service
North Carolina DENR	North Carolina Department of Environment and Natural Resources
North Carolina DFR	North Carolina Division of Forest Resources
North Carolina DOT	North Carolina Department of Transportation
North Carolina DPR	North Carolina Division of Parks and Recreation
North Carolina DWQ	North Carolina Department of Water Quality
North Carolina DWR	North Carolina Division of Water Resources
North Carolina NHP	North Carolina Natural Heritage Program
North Carolina WF	North Carolina Wildlife Federation
North Carolina WRC	North Carolina Wildlife Resources Commission
NTU	nephelometric turbidity units
O&M	operation and maintenance
PA	programmatic agreement
Park Service	National Park Service
PM&E	proposed mitigation and enhancement
Revised CRA	Revised Comprehensive Relicensing Agreement
RM	river mile(s)
RMP	recreation management plan
RTE	rare, threatened, and endangered
RV	recreational vehicle
SC	State Concern
SERC	Southeastern Electric Reliability Council
SHPO	State Historic Preservation Officer
SMG	shoreline management guidelines
SMP	shoreline management plan
South Carolina DAH	South Carolina Department of Archives and History
South Carolina DHEC	South Carolina Department of Health and Environmental Control
South Carolina DNR	South Carolina Department of Natural Resources
South Carolina DPRT	South Carolina Department of Parks, Recreation, and Tourism
South Carolina WF	South Carolina Wildlife Federation
sq mi	square mile(s)
T&T	trap and transport
THPO	Tribal Historic Preservation Office

TMDL	total maximum daily load
TS&T	trap, sort, and transport
µg/l	microgram(s) per liter
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WQC	water quality certificate
WQMP	water quality monitoring plan
WUA	weighted usable area

EXECUTIVE SUMMARY

This draft environmental impact statement (EIS) evaluates the potential effects on the environment associated with relicensing the 11 reservoirs and 13 developments that make up the 831-megawatt (MW) Catawba-Wateree Hydroelectric Project No. 2232 (the project). The Catawba River joins Big Wateree Creek to form the Wateree River downstream of the project. The project is located on the Catawba River[7] in the counties of Burke, McDowell, Caldwell, Catawba, Alexander, Iredell, Mecklenburg, Lincoln, and Gaston in North Carolina, and the counties of York, Lancaster, Chester, Fairfield, and Kershaw in South Carolina. The current license expired on August 31, 2008. Since that time, the project has operated under an annual license.

On August 29, 2006, Duke Power Company, LLC, doing business as Duke Energy Carolinas, LLC (Duke Energy or the applicant) filed a new license application with the Federal Energy Regulatory Commission (FERC or the Commission) for the Catawba-Wateree Project using the Traditional Licensing Process. A supplement and clarification to the application was filed on March 8, 2007.

On December 28, 2006, Duke Energy filed the Catawba-Wateree Revised Comprehensive Relicensing Agreement (Revised CRA), which replaced the CRA filed August 29, 2006, with the application. Duke Energy requested that the measures included in the Revised CRA be considered by the Commission as their proposed action, which Commission staff did in its scoping documents. Duke Energy proposes no new capacity or operating changes, but does propose measures for the protection and enhancement of environmental resources, including increased minimum flows, measures to improve aquatic habitat and protect threatened and endangered species, and measures to maintain and enhance recreational opportunities.

The Commission staff initiated the public scoping process for the project on February 28, 2007, with the release of Scoping Document 1. Based on the verbal comments received during scoping meetings and written comments received throughout the scoping process, the staff issued Scoping Document 2 on February 28, 2008. Scoping Document 2 serves as the current guide to the issues and alternatives considered in this draft EIS.

In this draft EIS, we analyze and evaluate the environmental effects of continued project operation and recommend conditions for inclusion in a new license for the project. For any license issued, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing the waterway. In addition to the power and development purposes for which the license is issued, the Commission must give equal consideration to energy conservation and the protection and enhancement of fish and wildlife, aesthetics, cultural resources, and recreational opportunities. This draft EIS reflects the staff's consideration of these factors for the project.

In addition to a no-action alternative, under which Duke Energy would continue to operate as it does now, we consider two alternatives: (1) the applicant's proposal; and (2) the applicant's proposal with additional measures recommended by staff (staff alternative).

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[7] The Catawba River joins Big Wateree Creek to form the Wateree River downstream of the project.

Duke Energy's Proposal

Under the applicant's proposed action for the project, Duke Energy would:

- protect water supplies during drought conditions with the development of a Low Inflow Protocol;
- modify developments to help meet state water quality standards, including aquatic habitat flow releases, dissolved oxygen compliance, implementation schedules, mitigation plans, and monitoring plans;
- define reservoir normal target levels and normal minimum and maximum ranges;
- increase minimum continuous flows in order to improve aquatic habitat;
- participate in formal protection plans for federal and state listed species including rocky shoals spider lily, Schweinitz's sunflower, dwarf-flowered heartleaf, bald eagle, wood stork, American alligator, shortnose sturgeon, and freshwater mussels including the Carolina heelsplitter;
- develop and implement a protection plan for heron rookeries;
- implement a historic properties management plan;
- develop a schedule for recreational flows;
- develop and enhance recreational facilities;
- enhance public information systems;
- modify shoreline management classifications, lake use restrictions, and Shoreline Management Guidelines; and
- develop instream flow mitigation packages, in locations where the new minimum continuous flows would fall short of resource agency goals for aquatic habitat.

These environmental measures are described in detail in table 4 in section 2.2.3.1, Catawba-Wateree Project (P-2232) proposed license articles, of this draft EIS.

Staff Alternative

Under the staff alternative, the project would be operated as proposed by Duke Energy, but would include additional measures identified by staff. These measures include:

- install a bladder dam modification of Wateree dam to improve management of flood events;
- achieve normal target elevations and maintain reservoir levels within newly established normal minimum and normal maximum elevations unless operating in the Low Inflow Protocol or Maintenance and Emergency Protocol and implement the elevations within 60 days of the issuance of a new license;
- add the U.S. Department of Commerce, National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) and the U.S. Fish and Wildlife Service (FWS) as agencies to consult with the Drought Management Advisory Group;
- consult with NOAA Fisheries on Maintenance and Emergency Protocol implementation;

- implement ramping of flows during the increase and decrease in recreational flow releases to minimize risk to aquatic resources;
- establish an advisory group of stakeholders to evaluate and recommend appropriate mitigation for fish losses resulting from abnormal conditions;
- develop and implement a terrestrial invasive plant species management plan for Catawba-Wateree Project lands within the development boundaries in consultation with applicable agencies;
- reassess the Cowans Ford Development for eligibility for listing on the National Register of Historic Places when the development reaches 50 years of age; include the Mountain Creek Park measure in the project boundary for the Cowans Ford Development;
- provide two additional recreational enhancements that would be included in the project boundary and in the Recreation Management Plan: East Wateree Access and Lake Cornelius Access;
- consult with FWS, state agencies, and other stakeholders to evaluate the feasibility and locations for placement of wildlife viewing platforms at recreation access sites and file a plan within 1 year of license issuance for implementation;
- include all Duke Energy-owned islands that serve a project purpose or are affected by the project within the project boundary;
- expand the project boundary at all Duke Energy-owned recreation access areas to include any adjacent bank fishing areas provided by Duke Energy, except those minimal shoreline areas where bank fishing is restricted;
- provide public information related to river flow via a web site or other electronic broadcast in a manner that provides the most up-to-date information possible; and
- revise public safety plans, considering the need for warning devices, multi-lingual signage, and facility exclusion zones.

Staff's additional recommended measures are described in section 5.1, *Comprehensive Development and Recommended Alternative* of this draft EIS.

The Revised CRA includes several measures that are not currently license articles, but will be considered for possible inclusion as license articles, as well as several measures that are not included in the Staff Alternative because they affect lands that are currently outside the project boundary and are not needed for project purposes.

Under section 18 of the Federal Power Act, FWS filed preliminary fishway prescriptions that were developed in collaboration with the applicant. FWS and the applicant entered a settlement agreement known as the Santee River Basin Accord, which addresses diadromous fish protection, restoration, and enhancement in the Santee River Basin, tributaries of which include the Catawba and Wateree rivers. FWS states that the prescription for fishways, the Santee River Basin Accord, and the *Santee-Cooper Basin Diadromous Fish Passage Restoration Plan* (2001) are consistent, complementary, and mutually supportive. We discuss the proposed, preliminary, and alternative fish passage measures in section 3.3.3, *Aquatic Resources*, of this draft EIS.

Also under section 18, NOAA Fisheries reserved its authority to provide fishway prescriptions at such times as it may subsequently determine are necessary to provide for safe,

timely, and effective upstream passage of diadromous fish through Catawba-Wateree Project facilities.

We conclude that the measures proposed by Duke Energy under the terms of the Revised CRA, along with additional staff recommended measures, would adequately protect and enhance existing water use, water quality, fish and wildlife, land use, aesthetics, recreational resources, and cultural resources.

The No Action Alternative is the existing project which generates an average of 1,441,950 megawatt-hours (MWh) annually, valued at $83,148,504 (57.68 mills per kilowatt hour [mills/kWh]). The annual cost of producing this energy is $57,159,248 (39.65 mills/kWh). Under Duke Energy's proposal, the project would generate about 1,283,010 MWh annually, valued at $76,297,848 (59.47 mills/kWh). The annual cost of producing this energy would be $66,068,715 (51.50 mills/kWh).

The staff alternative would generate an average of 1,283,010 MWh of electricity annually, have an annual power value of $76,297,848 (59.47 mills/kWh), and have total annual costs of $63,089,564 (49.17 mills/kWh). As proposed, the staff alternative would result in an annual net benefit of $13,208,284.

Based on our independent analysis of the project, including our consideration of all relevant economic and environmental concerns, we conclude that the proposed Catawba-Wateree Project, with staff's modifications and additional measures, would be best adapted to a comprehensive plan for use, conservation, and development of the Catawba-Wateree River Basin.

1.0 PURPOSE AND NEED FOR ACTION

On August 29, 2006, Duke Power Company, LLC, doing business as Duke Energy Carolinas, LLC (Duke Energy or the applicant) filed an application for a new license for the Catawba-Wateree Hydroelectric Project (the project) with the Federal Energy Regulatory Commission (FERC or the Commission) under the Traditional Licensing Process. The existing license for the project was issued in 1958 and expired on August 31, 2008. A supplement and clarification to the application was filed on March 8, 2007.

The project is located on the Catawba River in the counties of Burke, McDowell, Caldwell, Catawba, Alexander, Iredell, Mecklenburg, Lincoln, and Gaston in North Carolina, and the counties of York, Lancaster, Chester, Fairfield, and Kershaw in South Carolina. The Catawba River joins Big Wateree Creek to form the Wateree River (figure 1). The project is composed of 13 hydroelectric stations and 11 reservoirs located on a 225-mile stretch of the Catawba River and a 75-mile stretch of the Wateree River downstream from Lake Wateree to its confluence with the Congaree River (figure 1). The Santee River is formed by the confluence of the Wateree and Congaree Rivers. The project has a drainage area of 4,750 square miles (sq mi) and is capable of generating up to 831 megawatts (MW) of hydroelectric power, and providing cooling water for more than 8,100 MW of nuclear and fossil-fueled power generation. There are no federal or tribal lands affected by the project.

1.1 PURPOSE OF ACTION

The Commission must decide whether to relicense the project and what conditions should be placed on any license issued. In deciding whether to authorize the continued operation of hydroelectric projects and related facilities in compliance with the Federal Power Act (FPA)[8] and other applicable laws, the Commission must give equal consideration to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), as well as the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

In this draft environmental impact statement (EIS), we, the staff, assess the environmental and economic effects of (1) continuing to operate the projects as they are currently operated (no-action alternative); (2) operating the projects with the environmental measures proposed in the Revised Comprehensive Relicensing Agreement (Revised CRA); and (3) operating the projects, as proposed in the Revised CRA, with additional or modified environmental measures recommended by staff.

[8] 16 United States Code (U.S.C.) §§791(a)-825(r), as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986), and the Energy Policy Act of 1992, Public Law 102- 486.

Figure 1. General vicinity of the Catawba-Wateree Project.

This draft EIS addresses the following major issues: the potential effects of the proposed actions and alternatives, particularly the effects of project operations (including reservoir level fluctuations and minimum flows) on sedimentation, flood elevations, river flows, water quality, aquatic resources, terrestrial resources, threatened and endangered species, cultural and recreational resources, land use, aesthetics, and socioeconomic resources.

1.2 NEED FOR POWER

The Catawba-Wateree Hydroelectric Project would provide hydroelectric generation to meet part of North and South Carolina's power requirements, resource diversity, and capacity needs. The project has an installed capacity of 831 MW and generates approximately 1,121,525 megawatt-hours (MWh) per year.

The project is located within the Southeastern Electric Reliability Council (SERC) region of the North American Electric Reliability Council (NERC). NERC annually provides public information relative to projected increases in capacity demand and energy demand for 10 years out. NERC's most recent reliability report (October 2007) indicates that the capacity demand grew an average of 2.4 percent for the previous 7 years including membership additions to SERC in 2006 and 2007. Without the impact of new membership in 2006 and 2007, the growth rate for the region was 1.7 percent. The forecast annual growth rate in energy usage for the SERC region over the next 10 years is 1.9 percent.

We conclude that the power from the project would continue to help meet a need for power in the SERC region in both the short- and long-term. The project provides low-cost power that displaces non-renewable, fossil-fired generation and contributions to a diversified generation mix. Displacing the operation of fossil-fueled facilities may avoid some power plant emissions and creates an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the project is subject to requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are summarized in table 1 and described below.

Table 1. Major statutory and regulatory requirements.

Requirement	Agency	Status
Section 10(a) of the FPA (comprehensive development)	U.S. Fish and Wildlife Service (FWS); U.S. Department of Commerce, National Marine Fisheries Service (NOAA Fisheries); U.S. Department of Agriculture, Forest Service (Forest Service); North Carolina Department of Environment and Natural Resources (DENR); South Carolina Department of Natural Resources (DNR)	
Section 18 of the FPA (fishway prescriptions)	FWS, NOAA Fisheries	FWS and the applicant entered a settlement agreement known as the Santee River Basin Accord on April 9, 2008. NOAA Fisheries reserves its authority to make prescriptions in the future.
Section 4(e) of the FPA (land management conditions)	Forest Service	
Section 10(j) of the FPA	FWS, NOAA Fisheries	
Clean Water Act (CWA) (water quality certification)	North Carolina DENR, Department of Water Quality (DWQ); South Carolina Department of Health and Environmental Control (DHEC)	Duke Energy filed a request for section 401 water quality certification with North Carolina DWQ and South Carolina DHEC on June 6, 2008.
Endangered Species Act (ESA) Consultation	NOAA Fisheries, FWS	Species protection plans for endangered and threatened species in the area have been written and will be implemented within 60 days of license issuance. Plans include monitoring programs and/or habitat protection.

Requirement	Agency	Status
Fish and Wildlife Coordination Act (FWCA)	U.S. Department of the Interior (Interior), FWS, NOAA Fisheries, North Carolina DENR, South Carolina DNR	
Coastal Zone Management Act (CZMA) Consistency	North Carolina DENR, South Carolina DHEC	Project is not within the states' defined Coastal Zone.
National Historic Preservation Act (NHPA)	North Carolina State Historic Preservation Officer (SHPO), South Carolina SHPO	To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the continued operation of the Catawba-Wateree Project. The Commission intends to execute the PA with the North Carolina and South Carolina SHPOs, and invite the Advisory Council on Historic Preservation to participate. The Commission would also invite the Catawba Indian Nation (CIN), the Eastern Band of Cherokee Indians (EBCI), and Duke Energy to be concurring parties to the PA.

1.3.1 Federal Power Act

1.3.1.1 Section 10 (a) Comprehensive Development Standard

Section 10(a) provides assurance that the project proposed for licensing is best adapted to a comprehensive plan for developing the applicable waterway(s) for beneficial public purposes. The Commission considers comprehensive plans prepared by federal and state entities, and the recommendations of federal and state resource agencies, Indian tribes, and the public during the licensing process, including comprehensive plans that are resource-specific.

1.3.1.2 Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission shall require construction, operation, and maintenance by an applicant of such fishways as may be prescribed by the Secretaries of Commerce or the Interior.

1.3.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and

wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

1.3.2 Clean Water Act

Under the section 401 of the CWA, a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. On June 6, 2008, Duke Energy filed a request for section 401 water quality certification with North Carolina DWQ and South Carolina DHEC.

1.3.3 Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species.

FWS lists several species known to occur or potentially occurring within the Catawba-Wateree Project area that are federally listed as endangered or threatened and, therefore, protected under the ESA. Species listed as endangered include Schweinitz's sunflower, wood stork, shortnose sturgeon, and Carolina heelsplitter. Dwarf-flowered heartleaf and the American alligator are listed as threatened under the ESA. No critical habitat has been designated for federal listed species within the Catawba-Wateree Project area.

Our analysis of Catawba-Wateree Project effects on these species are presented in section 3.3.5, *Threatened and Endangered Species*.

We conclude that relicensing the Catawba-Wateree Project, with fish and wildlife habitat protection and enhancement measures proposed in the Revised CRA, is likely to adversely affect Schweinitz's sunflower during periodic flooding and spill events (see section 3.3.5, *Threatened and Endangered Species*). American alligator, wood stork, shortnose sturgeon, and Carolina heelsplitter have historic or limited occurrence in the Catawba-Wateree Project area; project operations as proposed would provide potential enhancement of habitat for these species and result in a potential beneficial effect. We conclude that relicensing the Catawba-Wateree Project, with fish and wildlife habitat protection and enhancement measures proposed in the Revised CRA, would not be likely to adversely affect the remaining federally listed species.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the CZMA, 16 U.S.C. §1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The Catawba-Wateree Project area is not located within the South Carolina Coastal Zone or the North Carolina Coastal Zone as designated in the South Carolina Code of Laws, section

48-39-10 (South Carolina Legislature, 2008) and the North Carolina Administrative Code, Title 15A, Chapter 7, nor does it affect resources within the designated coastal zone boundaries.

1.3.5 National Historic Preservation Act

Section 106 of the NHPA requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register or historic properties).

As described in section 3.3.6, Cultural Resources, Duke Energy proposes to implement the Historic Properties Management Plan for the Catawba-Wateree Hydroelectric Project (FERC #2232) North and South Carolina (HPMP), which was filed with the license application, to protect historic properties in the Catawba-Wateree Project's area of potential effects (APE). To meet the requirements of section 106, the Commission would execute a PA for the protection of historic properties from the effects of the continued operation of the Catawba-Wateree Project. The terms of the PA would ensure that Duke Energy address any adverse effects to historic properties identified within the project's APE through the HPMP, along with any staff recommendations.

1.4 SCOPING

The National Environmental Policy Act (NEPA) scoping process was completed as part of the Traditional Licensing Process. To support and assist the environmental review, the Commission formally initiated the public scoping process for the project on February 28, 2007, with the release of Scoping Document 1. The Commission held four public scoping meetings to receive comments on the project. Evening meetings were held in Morganton, North Carolina; Mooresville, North Carolina; Rock Hill, South Carolina; and Camden, South Carolina, on March 26 through 29, 2007, to receive oral comments on the project. A fifth meeting was held during the day on March 28, 2007, in Rock Hill to focus on resource agency concerns. Any person who was unable to attend a public scoping meeting, or desired to provide further comment, was encouraged to submit written comments and information to the Commission by April 30, 2007. In addition to the comments received at the scoping meetings, the following entities filed written comments on Scoping Document 1:

Commenting entity	Date of filing
Katawba Valley Land Trust	January 4, 2007
South Carolina Department of Archives and History (DAH)	April 9, 2007
North Carolina Wildlife Federation (WF)	April 16, 2007
Bowater, Inc.	April 25, 2007
American Whitewater	April 26, 2007
Interior, Office of the Solicitor, Bureau of Indian Affairs (BIA) and FWS	April 27, 2007
Duke Energy Carolinas, LLC	April 30, 2007

Commenting entity	Date of filing
South Carolina Department of Parks, Recreation, and Tourism (DPRT), Recreation, Planning, and Engineering Office	April 27, 2007
Catawba County, North Carolina	April 27, 2007
North Carolina Wildlife Resources Commission (WRC)	April 30, 2007
South Carolina DNR	April 30, 2007
American Rivers and the Coastal Conservation League	April 30, 2007
Lancaster County Water & Sewer District and Union County, North Carolina	April 30, 2007
City of Morganton, North Carolina	April 30, 2007
Catawba Regional Council of Governments	April 30, 2007
U.S. Environmental Protection Agency (EPA)	May 1, 2007
Catawba-Wateree Relicensing Coalition	May 1, 2007

In Scoping Document 1, we requested clarification of preliminary issues concerning the project and identification of any new issues to be addressed in the EIS, as well as any information that would assist in an accurate and comprehensive analysis of the effects of licensing the project. On April 30, 2007, Duke Energy filed its comments on Scoping Document 1, which consisted of clarifications and corrections of factual errors, and its reply to comments made during the scoping process.

Based on the verbal comments received during scoping meetings and written comments received throughout the scoping process, the Commission issued Scoping Document 2 on February 28, 2008. Scoping Document 2 serves as the current guide to the issues and alternatives considered in this draft EIS.

1.5 INTERVENTIONS

On November 9, 2006, the Commission issued a notice accepting the Duke Energy license application and setting a deadline of 60 days from the date of the notice, for filing protests and motions to intervene. The following entities filed motions to intervene:

Intervenor	Date of filing
Jackson County, Macon County, the Town of Franklin, and the Friends of Lake Glenville Association, Inc.	October 12, 2006
Tony Dotson and Susan Johnson	October 27, 2006
Catawba-Wateree Relicensing Coalition	November 12, 2006
South Carolina DNR	November 29, 2006
Interior	December 1, 2006
American Whitewater Association	December 6, 2006

Intervenor	Date of filing
North Carolina WRC	December 14, 2006
North Carolina DENR	December 20, 2006
South Carolina DPRT	December 21, 2006
Lake Wateree Association	January 4, 2007
Wateree Homeowners Association	January 4, 2007
American Rivers and the Coastal Conservation League	January 5, 2007
NOAA Fisheries	January 8, 2007
Catawba County, North Carolina	January 8, 2007
Bowater, Inc.	January 8, 2007
Catawba Riverkeepers Foundation	January 8, 2007
City of Charlotte, North Carolina	January 8, 2007
Foothills Conservancy	January 8, 2007
Lancaster County Water & Sewer District	January 8, 2007
Town of Cornelius, North Carolina	January 8, 2007
North Carolina Electric Membership Corporation	May 21, 2008

On June 3, 2008, the North Carolina Electric Membership Corporation filed a withdrawal of their motion to intervene.

1.6 CONSULTATION AND COMPLIANCE

1.6.1 Ready for Environmental Analysis Notice

On April 7, 2008, the Commission issued a notice that the project was ready for environmental analysis and solicited comments, recommendations, terms and conditions, and prescriptions to be filed within 60 days of the date of the notice. The following entities filed comments and recommendations:

Commenting entity	Date of filing
Community of Lake James, Inc.	April 8, 2008
Jean McKinley (U.S. Representative Patrick McHenry and U.S. Senator Elizabeth Dole, on behalf of Jean McKinley)	April 10, 2008
Community of Lake James, Inc.	May 23, 2008
North Carolina DENR	June 3, 2008
North Carolina WRC	June 5, 2008
Interior	June 6, 2008
Town of Cornelius, North Carolina	June 6, 2008

Commenting entity	Date of filing
American Rivers and the Coastal Conservation League	June 6, 2008
Catawba Riverkeepers Foundation	July 11, 2008
Community of Lake James, Inc.	July 12, 2008
Interior	July 16, 2008
Community of Lake James, Inc.	August 12, 2008

The following entities filed preliminary terms and conditions:

Commenting entity	Date of filing
Interior	June 4, 2008
NOAA Fisheries	June 5, 2008

1.6.2 Comprehensive Relicensing Agreements

In the Notice of Settlement Agreement and Soliciting Comments issued September 13, 2006, the Commission set a deadline of 60 days after the CRA filing date for comments, and 75 days after the CRA filing date for reply comments. The following entities filed comments or reply comments on the CRA:

Commenting entities on the CRA	Date of filing
Mitchell J. Williams	September 12, 2006
Kershaw County, South Carolina	September 13, 2006
Sarah Williams	September 14, 2006
Centralia Council of Governments	September 18, 2006
Catawba-Wateree Relicensing Coalition	October 9, 2006
North Carolina WRC	October 10, 2006
Tony Dotson	October 12, 2006
Town of Valdese, North Carolina	October 13, 2006
Sarah Williams	October 23, 2006
Carolina Canoe Club, Inc.	October 24, 2006
South Carolina DPRT	October 24, 2006
NOAA Fisheries	October 26, 2006
South Carolina DNR	October 26, 2006
Town of Cornelius, North Carolina	October 27, 2006
Interior	October 27, 2006
American Rivers and the Costal Conservation League	October 30, 2006

Commenting entities on the CRA	Date of filing
Burke County, North Carolina	October 30, 2006
Lancaster Water & Sewer District and Union County, North Carolina	October 30, 2006
North Carolina WF	October 30, 2006
North Carolina DENR	October 30, 2006
Iredell County, North Carolina	November 1, 2006
City of Rock Hill, South Carolina	November 9, 2006
Lugoff-Elgin Water Authority	November 9, 2006
City of Conover, North Carolina	November 10, 2006
City of Hickory, North Carolina	November 10, 2006
City of Charlotte, North Carolina	November 13, 2006
City of Morganton, North Carolina	November 13, 2006
Foothills Conservancy	November 13, 2006
Lancaster Water & Sewer District and Union County, North Carolina	November 13, 2006
North Carolina DENR	November 13, 2006
Catawba County, North Carolina	November 14, 2006
154 Individual Wateree Reservoir Residents	September 9 – 29, 2006

In letters filed by 154 individuals in South Carolina, the county of Kershaw, and Mitchell J. Williams, requests were made for the Committee to carefully consider the increased risk of flooding in the Wateree reservoir that would result from the changes proposed in the CRA. The town of Cornelius was concerned with a lack of recreational opportunities and safety measures to match projected growth for the area.

NOAA Fisheries, American Rivers and the Coastal Conservation League, and Interior (representing FWS) expressed several concerns, including: (1) proposed minimum continuous flows do not provide sufficient aquatic habitat, (2) proposed mitigation packages are ineffective, (3) protection of federal and state listed species is incomplete and based on flawed studies, and (4) water quality concerns are not met. After these comments had been filed, the governments of Charlotte, Rock Hill, Valdese, Hickory, Morganton, Conover, Lancaster County, Union County, and Catawba County, along with North Carolina DENR, filed reply comments in answer to the listed concerns, urging the acceptance of the CRA as submitted.

On December 28, 2006, Duke Energy filed the Catawba-Wateree Revised Comprehensive Relicensing Agreement (Revised CRA), which was accepted by a majority of participants in the stakeholder track of the licensing process. The Revised CRA was signed by representatives of the federal and state agencies, nongovernmental organizations, and individuals listed below.

Signatories to the Revised CRA
Agencies
North Carolina Division of Forest Resources
North Carolina Division of Parks and Recreation
North Carolina Division of Water Resources (DWR)
North Carolina DWQ
North Carolina WRC
South Carolina DAH
South Carolina DNR
South Carolina DPRT
Indian Tribes
CIN
CIN Tribal Historic Preservation Office (THPO)
Other Governmental Entities
Alexander County, North Carolina
Burke County, North Carolina
Caldwell County, North Carolina
Catawba County, North Carolina
Catawba Regional Council of Governments
Centralina Council of Governments
City of Belmont, North Carolina
City of Camden, North Carolina
City of Charlotte, North Carolina
City of Gastonia, North Carolina
City of Hickory, North Carolina
City of Morganton, North Carolina
City of Mount Holly, North Carolina
City of Rock Hill, South Carolina
Gaston County, North Carolina
Iredell County, North Carolina
Kershaw County, South Carolina
Lincoln County, North Carolina

Signatories to the Revised CRA
McDowell County, North Carolina
Mecklenburg County, North Carolina
Town of Davidson, North Carolina
Town of Great Falls, South Carolina
Town of Valdese, North Carolina
Union County, North Carolina
Western Piedmont Council of Governments
York County, South Carolina
Nongovernmental Entities
Bowater, Inc.
Carolina Canoe Club
Catawba-Wateree Relicensing Coalition
Chester Metropolitan District
Crescent Resources, LLC
Duke Energy Corporation
Duke Power Company, LLC
Great Falls Hometown Association
Harbortowne Marina
International Paper
Lake James Homeowners
Lugoff-Elgin Water Authority
R & N Marina
South Carolina Electric and Gas
Springs Global US Inc.
Wateree Homeowners Association – Fairfield County
Conservation Groups
American Whitewater
Area II Soil & Water Conservation Districts
Catawba Lands Conservancy
Catawba Valley Heritage Alliance
Foothills Conservancy

Signatories to the Revised CRA
Kershaw County Conservation District
Lake Wateree Association
Lake Wylie Marine Commission
Mountain Island Lake Association
Mountain Island Lake Marine Commission
North Carolina WF
South Carolina WF
Trout Unlimited
Trout Unlimited, Inc.
York County Culture and Heritage Commission

The Revised CRA replaces a CRA filed August 29, 2006, and an Agreement In Principle (AIP) filed on April 13, 2006, and resolves outstanding issues associated with the relicensing of the project. Major issues covered in the Revised CRA include:

- protection of water supplies during drought conditions with the development of a low inflow protocol;
- station modifications to help meet state water quality standards, including aquatic habitat flow releases, dissolved oxygen compliance, implementation schedules, mitigation plans, and monitoring plans;
- definition of reservoir normal target levels and normal minimum and maximum ranges;
- increase in minimum continuous flows in order to improve aquatic habitat;
- participation in formal protection plans for federal and state listed species including rocky shoals spider lily, Schweinitz's sunflower, dwarf-flowered heartleaf, bald eagle, wood stork, shortnose sturgeon, and mussels;
- implementation of an HPMP;
- dedication of scheduled recreational flows;
- development and enhancement of recreational facilities;
- enhancement of public information systems;
- modifications to shoreline management classifications, lake use restrictions, and shoreline management guidelines; and
- development of instream flow mitigation packages, in locations where the new minimum continuous flows would fall short of resource agency goals for aquatic habitat.

We consider the Revised CRA to represent the proposed action for this project.

2.0 PROPOSED ACTIONS AND ALTERNATIVES

This section describes each of the alternatives analyzed in detail in this EIS and summarizes the alternatives considered but eliminated from detailed study. The three alternatives analyzed in detail included the applicant's proposals as described in the Revised CRA (proposed actions), the applicant's proposals with additional staff-recommended measures (staff alternatives), and the no-action alternative, which is the baseline against which the other alternatives are compared.

2.1 NO-ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing licenses, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish baseline environmental conditions for comparison with other alternatives and to judge the benefits and costs of any measures that might be required under a new license.

2.1.1 Existing Project Facilities

The existing project consists of 13 developments and 11 impoundments on the Catawba-Wateree River as it flows through North and South Carolina. In North Carolina, in upstream to downstream order, are Bridgewater (Lake James), Rhodhiss (Lake Rhodhiss), Oxford (Lake Hickory), Lookout Shoals (Lookout Shoals Lake), Cowan's Ford (Lake Norman), and Mountain Island (Mountain Island Lake). In South Carolina, in upstream to downstream order, are Wylie (Lake Wylie), Fishing Creek (Fishing Creek reservoir), Great Falls and Dearborn (Great Falls reservoir), Rocky Creek and Cedar Creek (Cedar Creek reservoir), and Wateree (Lake Wateree). The project encompasses more than 300 river miles (RM) as measured from the confluence of the Wateree and Congaree Rivers, and a total of 81,688 reservoir surface acres at full pond. Descriptions of each development are presented in sections 2.1.1.1 through 2.1.1.11. Existing project operations for each development are presented in sections 2.1.2.1 through 2.1.2.11.

State Route 1233 (Powerhouse Road) runs through the Bridgewater Development, across the crest of the Linville and Paddy Creek dams and across a bridge over the Linville-Paddy Creek spillway. No other public-access roads are within the project boundaries. No primary transmission lines exist within the project boundary. Land resources and uses in the Catawba-Wateree Project area of influence vary greatly and do not include any federal or tribal lands

2.1.1.1 Bridgewater Development

The Bridgewater Development is the uppermost development at RM 279.6 and includes three dams that form Lake James: Linville, Paddy Creek, and Catawba. The Linville and Paddy Creek dams are semi-hydraulic fill earthen embankments, and the Catawba dam is a combination of semi-hydraulic fill earthen embankments and concrete gravity. Linville dam is 160 feet (ft) high and 1,325 ft long, Paddy Creek dam is 165 ft high and 1,610 ft long, and Catawba dam is 120 ft high and 3,155 ft long. There are two spillways, one for the Catawba dam and one located midway between the Linville and Paddy Creek dams. The Catawba spillway is an uncontrolled concrete gravity ogee spillway about 300 ft wide. The Linville-Paddy Creek spillway is a 430-ft-wide low overflow weir, without crest control, with a paved channel extending about 464 ft downstream. The 6,754-acre reservoir has a full pond elevation of 1,200 ft mean sea level (msl)

and a usable storage capacity of 57,349 acre-feet. A trapezoidal-shaped canal connects the Catawba River arm of the reservoir with the Paddy Creek and Linville River arms to form Lake James. The canal has an excavated bottom width of 30 ft, and is about 216 ft wide at elevation 1,200 ft msl. The intake and powerhouse for this development are located at the Linville dam on the right abutment. The reinforced concrete intake tower is founded on an excavated rock shelf at elevation 1,070 ft ms), and has three 18-ft-wide by 22-ft-high openings with structural steel trash racks. The tower is connected with the powerhouse by a tunnel about 900 ft long. The powerhouse contains two vertical Francis turbine-generator units with a total installed capacity of 20 MW. As part of a dam safety seismic remediation project being implemented at the Bridgewater Development, the current powerhouse will be demolished and replaced with a new powerhouse.

The two bypassed reaches associated with this development include the Catawba River bypassed reach and the Paddy Creek bypassed reach. The Catawba River bypassed reach (also known as Old Catawba River) starts at the Catawba dam and runs about 5.65 miles to the confluence with the Linville River. The Paddy Creek bypassed reach starts at the Paddy Creek dam and runs about 0.64 mile to the confluence with the Catawba bypassed reach. There are no required flows for the bypassed channels.

The power generated at the site is conveyed to two step-up transformers located in the switchyard directly behind the powerhouse (within the project boundary) via 100-ft-long generator leads. The power is then connected to a Duke Energy Carolinas' 100-kilovolt (kV) transmission system.

2.1.1.2 Rhodhiss Development

The Rhodhiss Development is located 32 RM downstream from the Bridgewater Development at RM 248.00. The Rhodhiss dam is composed of rolled earth embankments and concrete gravity with an ungated mass-concrete ogee spillway. The dam measures 72 ft high and 1,517 ft long, and the spillway is about 800 ft long with a crest elevation of 995.1 ft msl. The 2,724-acre reservoir (Lake Rhodhiss) has a full pond elevation of 995.1 ft msl and a usable storage capacity of 7,097 acre-feet. The intake and powerhouse are integral structures, constructed from reinforced and mass concrete. There are three separate intakes, one for each turbine. Each intake has two sets of structural steel trash racks measuring 15.5 ft wide by 21.5 ft high. The powerhouse contains three vertical Francis turbine-generator units with a total installed capacity of 28.4 MW. The power generated at the site is conveyed to three step-up transformers located in the switchyard immediately adjacent to the powerhouse located within the project boundary. The 44-kV power is further transmitted to the Rhodhiss Tie substation some 916 ft away, for distribution and transmission. The distribution and transmission is controlled by Duke Energy Carolinas.

2.1.1.3 Oxford Development

The Oxford Development is located at RM 230.00 and includes the dam forming Lake Hickory. The dam is concrete gravity and rolled earth with a concrete ogee spillway. The dam measures 133 ft high and 1,336 ft long, and the main spillway is about 550 ft long with a crest elevation of 910 ft msl. An emergency spillway was constructed in 2003 by removing the top 14 ft from the left bulkhead. The main spillway has 10 Stoney-type vertical lift gates, 25 ft by 45 ft. The intake and powerhouse are integral structures, constructed from reinforced and mass concrete. The 4,072-acre reservoir (Lake Hickory) has a full pond elevation of 935 ft msl and a

usable storage capacity of 9,834 acre-feet. There are two separate intakes, one for each turbine. Each intake has two sets of structural steel trash racks measuring 15.5 ft wide by 21.5 ft high. The powerhouse contains two vertical Francis turbine-generator units with a total installed capacity of 35.7 MW.

The power generated at the site is conveyed to two step-up transformers located in the switchyard adjacent to the powerhouse (within the project boundary) via 40-ft-long generator leads. The power is then connected to Duke Energy Carolinas 100-kV transmission system.

2.1.1.4 Lookout Shoals Development

The Lookout Shoals Development is located at RM 220.3. The dam is concrete gravity and semi-hydraulic earth fill with an ungated concrete ogee spillway. The dam measures 88 ft high and 2,731 ft long, and the spillway is about 933 ft long with a crest elevation of 838.1 ft msl. The 1,155-acre reservoir (Lookout Shoals Lake) has a full pond elevation of 838.1 ft msl and a usable storage capacity of 2,138 acre-feet. The intake and powerhouse are integral structures, constructed from reinforced and mass concrete. There are four separate intakes, one for each of the three main turbines and a fourth for the two junior turbines. Each intake has one set of structural steel trash racks measuring 18 ft wide by 22 ft high, and 7 ft wide by 14 ft high for the main and junior intakes, respectively. The powerhouse contains three large vertical Francis turbine-generator units and two small vertical Francis turbine-generator units with a total installed capacity of 25.7 MW.

The power generated at the site is conveyed to two step-up transformers located in the switchyard adjacent to the powerhouse (within the project boundary) via 130-ft-long generator leads. The 100-kV power is further transmitted to the Lookout Tie substation some 1,081 ft away, for distribution and transmission by Duke Energy Carolinas.

2.1.1.5 Cowans Ford Development

The Cowans Ford Development is the largest in the project, is located at RM 186.9, and forms Lake Norman. The dam is concrete gravity and rolled earth with a concrete ogee spillway. The dam measures 130 ft high and 8,738 ft long, and the spillway is about 465 ft long with a crest elevation of 732 ft msl and 760 ft msl on top of the closed gates. The spillway has 11 Taintor gates, 28 ft high by 35 ft wide. The 32,339-acre reservoir (Lake Norman) has a full pond elevation of 760 ft msl and a usable storage capacity of 298,142 acre-feet. The intake and powerhouse are integral structures, constructed from reinforced and mass concrete. There are four separate intakes, one for each turbine. Each intake has three sets of trash gates measuring 17.7 ft wide by 49 ft high. The powerhouse contains four adjustable-blade Kaplan propellers with a total installed capacity of 332.5 MW. The power generated at the site is conveyed to two step-up transformers located on top of the powerhouse. The 230-kV power is further transmitted to the McGuire switching station some 1.67 miles, for distribution and transmission by Duke Energy Carolinas.

2.1.1.6 Mountain Island Development

The Mountain Island Development is located at RM 171.5. The dam is concrete gravity and semi-hydraulic fill earth with a concrete ogee spillway. The dam measures 140 ft high and 670 ft long, and the spillway is about 997 ft long with a crest elevation of 647.5 ft msl. A 0.7-mile bypassed reach is located beneath the spillway. There are no required flows for the bypassed channels. The 3,117-acre reservoir (Mountain Island Lake) has a full pond elevation of

647.5 ft msl and a usable storage capacity of 10,146 acre-feet. The intake and powerhouse are integral structures, constructed from reinforced and mass concrete. There are four separate intakes, one for each turbine. Each intake has two sets of trash gates measuring 15.5 ft wide by 21.5 ft high. The powerhouse contains four vertical Francis turbine-generator units with a total installed capacity of 55.1 MW. The power generated at the site is conveyed to four step-up transformers located on a deck at generator floor level immediately downstream from the powerhouse. The 44-kV power is then connected to Duke Energy Carolinas distribution and transmission system.

2.1.1.7 Wylie Development

The Wylie Development is located at RM 143.5. The dam is concrete gravity and rolled earth with a concrete ogee spillway that consists of two gated sections separated by a curved, uncontrolled section. The gated section on the right is about 355 ft long, the uncontrolled section is 157 ft, and the left gated section is 265 ft. The dam measures 119 ft high and 3,165 ft long, and the spillway is about 793 ft long with a crest elevation of 539.4 ft msl across the gated sections and 569.4 ft msl across the uncontrolled section. The spillway has 11 steel, Stoney-type floodgates, 30 ft by 45 ft. The 12,177-acre reservoir (Lake Wylie) has a full pond elevation of 569.4 ft msl and a usable storage capacity of 40,145 acre-feet. The intake and powerhouse are integral structures, constructed from reinforced and mass concrete. There are four separate intakes, one for each turbine. Each intake has two sets of trash gates measuring 17.7 ft wide by 24.8 ft high. The powerhouse contains four vertical Francis turbine-generator units with a total installed capacity of 69 MW.

The power generated at the site is conveyed to four step-up transformers located in the switchyard adjacent to the powerhouse located within the project boundary. The 44-kV transmission system is operated by Duke Energy Carolinas.

2.1.1.8 Fishing Creek Development

The Fishing Creek Development is located at RM 104.0. The dam is concrete gravity with a concrete ogee spillway. The dam measures 97 ft high and 1,770 ft long, and the spillway is about 1,210 ft long with a crest elevation of 392.2 ft msl and 417.2 ft msl at the top of its gates. The spillway has 22 steel, Stoney-type floodgates, 25 ft by 45 ft. The 3,431-acre reservoir (Fishing Creek) has a full pond elevation of 417.2 ft msl and a usable storage capacity of 11,159 acre-feet. There are five separate intakes, one for each turbine. Each intake has one set of trash gates measuring 26 ft wide by 20 ft high. The intake and powerhouse are integral structures, constructed from reinforced and mass concrete. The powerhouse contains five vertical Francis turbine-generator units with a total installed capacity of 48.1 MW.

The power generated at the site is conveyed to two step-up transformers located in the switchyard adjacent to the powerhouse (within the project boundary) via 100-ft-long generator leads. The 100-kV transmission system is operated by Duke Energy Carolinas.

2.1.1.9 Great Falls and Dearborn Developments

The Great Falls and Dearborn Developments are located at RM 101.5, only 3 miles downstream from the Fishing Creek dam. The Great Falls-Dearborn dam is concrete gravity with a concrete ogee spillway. The dam measures 103 ft high and 835 ft long. There are two bypassed reaches associated with Great Falls and Dearborn. The Great Falls Long bypassed reach (Great Falls diversion dam side) is about 2.25 miles long, and runs along the east side of

Mountain Island. The Great Falls Short bypassed reach (Great Falls headworks) is about 0.75 mile long, runs east and parallel to the canal spillway, and empties into the north end of Cedar Creek reservoir. The development also includes two large islands: Mountain Island and Big Island. Mountain Island separates the Great Falls reservoir from the Great Falls Long bypassed reach, and Big Island separates the Great Falls-Dearborn canal spillway from Cedar Creek reservoir.

The Great Falls-Dearborn diversion dam is located about 1,500 ft downstream of the Fishing Creek dam. The diversion spillway is 1,500 ft long with a crest elevation of 355.8 ft msl. It diverts the flow of the Catawba River to a canal parallel to and west of the original Catawba River channel. The new canal flows into the Great Falls reservoir, and the Great Falls Long bypassed reach follows the original path of the river. The canal headworks, located 1.4 miles upstream of the Great Falls-Dearborn dam, mark the boundary between the Great Falls reservoir and the canal that feeds water to the Great Falls and Dearborn powerhouses. The headworks include a trash rack structure for the canal intake and two mass concrete overflow spillways. The main spillway is upstream of the headworks, and the canal spillway is immediately downstream of the headworks. The canal spillway is equipped with flashboards, and the elevation of the top of the flashboards, 355.8 ft msl, is the same elevation as the crest of the main spillway. Flow into the canal leading to the powerhouse is regulated by submerged openings in the canal intake structure. Floodwater is released to the Catawba River by these two spillways and the upstream diversion spillway. The 353-acre reservoir (Great Falls reservoir) has a full pond elevation of 355.8 ft msl and a usable storage capacity of 1,966 acre-feet.

The Great Falls intake and bulkhead are integral structures constructed from reinforced and mass concrete. There are nine separate intakes: one for each turbine, and one for the exciter unit. Each intake has a set of structural steel trash racks, eight 16-ft-wide by 18.5-ft-high oval openings and one 6-ft-wide by 9-ft-high oval for the turbines and exciter, respectively. The Great Falls and Dearborn Developments consist of two powerhouses, with the Great Falls powerhouse on the west side of the river and the Dearborn powerhouse on the east side. The Great Falls powerhouse contains eight horizontal-shaft Francis turbine-generator units with a total installed capacity of 24.0 MW. The Dearborn intake and powerhouse are integral structures, constructed from reinforced and mass concrete. There are three separate intakes, one for each turbine. Each intake has two sets of structural steel trash racks, 15.5 ft wide by 21.5 ft high. The powerhouse contains three vertical Francis turbine-generator units with an installed capacity of 42.0 MW.

The power generated at Great Falls is conveyed to four step-up transformers located in a building situated over the tailrace just downstream from the main generator room located within the powerhouse area. The 44-kV power is further transmitted to the Great Falls switching station some 200 ft downstream of the powerhouse for distribution and transmission by Duke Energy Carolinas.

The power generated at Dearborn is conveyed to two 100-kV step-up transformers and one 44-kV step-up transformer located on a deck at generator floor level immediately downstream of the generator room located within the powerhouse area. The two 443-ft-long 100-kV transmission lines and the 402-ft-long 44-kV transmission line transmit power to the Great Falls Switching Station. All lines are operated by Duke Energy Carolinas.

2.1.1.10 Rocky Creek and Cedar Creek Developments

The Rocky Creek and Cedar Creek Developments are located at RM 99.3 immediately downstream of the Great Falls and Dearborn Developments. The dam is concrete gravity with a concrete ogee spillway. The dam measures 69 ft high and 1,219 ft long, and the U-shaped spillway is about 1,145 ft long with a crest elevation of 284.4 ft msl and 295.4 ft msl at the top of its gates. The U-shaped spillway has two Stoney-type floodgates, 25 ft by 45 ft. The developments consist of two powerhouses: the Rocky Creek powerhouse on the west side of the river and the Cedar Creek powerhouse on the east side. The Rocky Creek intake and bulkhead are integral structures, constructed from reinforced and mass concrete. There are nine separate intakes: one for each turbine, and one for the exciter unit. Each intake has a set of structural steel trash racks, eight 18-ft-wide by 21.5-ft-high oval openings and one 6-ft-wide by 9-ft-high oval for the turbines and exciter, respectively. The Rocky Creek powerhouse contains eight horizontal-shaft Francis turbine-generator units with a total installed capacity of 25.8 MW. The Cedar Creek intake and powerhouse are integral structures, constructed from reinforced and mass concrete. There are three separate intakes, one for each turbine. Each intake has two sets of structural steel trash racks measuring 17.8 ft wide by 24.8 ft high. The Cedar Creek powerhouse contains three vertical Francis turbine-generator units with a total installed capacity of 43.0 MW. The 748-acre reservoir (Cedar Creek reservoir) has a full pond elevation of 284.4 ft msl and a usable storage capacity of 2,190 acre-feet.

The power generated at Rocky Creek is conveyed to four step-up transformers located in a building situated over the tailrace just downstream from the main generator room located within the powerhouse area. The 44-kV power is further transmitted by Duke Energy Carolinas for distribution and transmission to the Great Falls Switching Station.

The power generated at Cedar Creek is conveyed to three step-up transformers located in the switchyard adjacent to the powerhouse located within the project boundary. The 6.6-kV power is stepped up to 100 kV where it is then transmitted to the Great Falls switching station for distribution and transmission by Duke Energy Carolinas.

2.1.1.11 Wateree Development

The Wateree Development is located at RM 76.9. The dam is concrete gravity and semi-hydraulic fill earth with a concrete ogee spillway. The dam measures 76 ft high and 1,753 ft long, and the spillway is about 1,450 ft long with a crest elevation of 225.5 ft msl. The 13,025-acre reservoir (Lake Wateree) has a full pond elevation of 225.5 ft msl and a usable storage capacity of 65,568 acre-feet. The intake and powerhouse are integral structures, constructed from reinforced and mass concrete. There are five separate intakes, one for each turbine. Each intake has two sets of structural steel trash racks, five 18-ft-wide by 22-ft-high and five 12-ft-wide by 22-ft-high. The powerhouse contains five vertical Francis turbine-generator units with a total installed capacity of 82 MW. The power generated the site is conveyed to five step-up transformers located on an extension of the generator floor over the draft tubes (within the powerhouse area) via 100-ft-long generator leads. The 100-kV power is further transmitted to the Great Falls switching station for distribution and transmission by Duke Energy Carolinas.

2.1.2 Existing Project Operations

The Catawba-Wateree Project's hydroelectric operations are under the control of Duke Energy's hydroelectric operations center known as Hydro Central, which uses computer-based

tools to monitor project operations and watershed inflow. The generating facilities of the project are currently operated to meet the peak and load-following energy demands of Duke Energy's transmission and distribution systems in coordination with their other generating facilities (including fossil-fueled and nuclear-fueled generating facilities). Consistent with meeting electrical demands, the project developments are operated to achieve development-specific downstream flow requirements, including the minimum average daily flow license requirement that provide a minimum daily flow; and development-specific continuous minimum flow releases. Operations of project developments are in accordance with the reservoir level guide curves which are not required by the current license.

Although not a requirement of the existing license and in addition to regular project operations, the reservoirs of the Bridgewater, Cowans Ford, Wylie, and Wateree Developments have been part of a voluntary Spring Lake Level Stabilization Program. The Spring Lake Level Stabilization Program limits the fluctuation of reservoir levels during a 3-week spring fish-spawning period to support fish spawning in the reservoirs. The spring spawning period is initiated by a sequence of four consecutive noontime forebay temperature readings of at least 65 degrees Fahrenheit (°F) or observed bass spawning in Lake Wateree. Once initiated, the reservoir level is maintained within a range of 1 ft below and 2 ft above the level on the day of the fourth 65°F temperature reading. The level is maintained within the limits for 3 weeks. The initiation of the Spring Lake Level Stabilization Program at the other Catawba-Wateree Project reservoirs participating in the program is keyed to the start date on Lake Wateree. The Spring Lake Level Stabilization Program starts on Lake Wylie 2 days after it starts on Lake Wateree; 8 days after it starts on Lake Wateree it begins on Lake Norman; and on Lake James it starts 14 days after it begins on Lake Wateree.

2.1.2.1 Bridgewater Development

The normal operating target elevation for Lake James varies during the year from a low elevation of 1,192 ft on March 1 to a high elevation of 1,198 ft msl from June through September 1, with the full pond water surface elevation at 1,200 ft. At any given time, the reservoir level may fluctuate within a normal operating range from 2 ft below to 2 ft above the normal operating target elevation.

In addition to operating for peak demand, the Bridgewater Development operations are conducted to maintain the reservoir level within its normal operating range; the number of units and daily duration of operation are adjusted based on demand and reservoir level. One unit is run at efficiency load at least once each day, generating about 10 MWh to provide the minimum average daily flow license requirement of 66 cubic feet per second (cfs). The development currently has a license requirement for a continuous flow of 25 cfs that is met through wicket gate leakage during times of non-generation. There are no required releases into the bypassed portions of the original Catawba River channel. Generation from the Bridgewater Development is dispatched primarily for peaking energy needs. In addition to providing for Bridgewater powerhouse's generating demands, the reservoir's large storage capacity is used to augment the much smaller storage capacities of the downstream Rhodhiss, Oxford, and Lookout Shoals Developments.

2.1.2.2 Rhodhiss Development

The normal operating target elevation for Rhodhiss reservoir is 992.1 ft msl with the full pond water surface elevation at 995.1 ft. At any given time, the reservoir level may vary within

a normal operating range from 2 ft below to 2 ft above the normal operating target elevation. Municipal water withdrawals from Lake Rhodhiss include the towns of Valdese, Lenoir, and Granite Falls, North Carolina, and details of withdrawals are found in section 3.3.2, *Water Resources*.

Like Bridgewater, the Rhodhiss Development operates to maintain the reservoir level within its normal operating range and to provide flows for its minimum average daily flow license requirement. One unit is run at efficiency load at least once each day, generating about 21 MWh to meet the minimum average daily flow requirement of 225 cfs. The development currently has a license requirement for a continuous flow of 40 cfs that is met through wicket gate leakage during times of non-generation.

2.1.2.3 Oxford Development

The normal operating target elevation for Oxford reservoir is 932 ft msl with the full pond water surface elevation at 935 ft. At any given time, the reservoir level may vary within a normal operating range from 0.5 ft below to 2 ft above the normal operating target elevation. Municipal water withdrawals from Lake Hickory include the towns of Longview and Hickory, North Carolina.

Oxford generates electricity to meet peak demand and to maintain the reservoir level within its normal operating range. One unit is run at efficiency load at least once each day, generating about 35 MWh to meet the minimum average daily flow license requirement of 261 cfs. The development currently has a license requirement for a continuous flow of 40 cfs that is met through wicket gate leakage during times of no power generation. The Oxford generating units have black start capability, which enables operation of the station's floodgates even under emergency conditions.

2.1.2.4 Lookout Shoals Development

The normal operating target elevation for Lookout Shoals reservoir is 836.1 ft msl with the full pond water surface elevation at 838.1 ft. At any given time, the reservoir level may vary within a normal operating range from 1.5 ft below to 1 ft above the normal operating target elevation. The city of Statesville, North Carolina, has an intake on Lookout Shoals Lake.

Lookout Shoals Development is operated to provide electricity and to maintain its reservoir level within its normal operating range. Minimum release requirements are met by operating one of two former exciter units that have been converted to small generating units. One exciter unit is run at efficiency load 24 hours a day, generating about 9 MWh each day while meeting the current license continuous release requirement of 60 cfs. One of the three large units is run each day, generating 31 MWh to meet the minimum average daily flow license requirement of 278 cfs. Additional generation from the three large units at Lookout Shoals is dispatched primarily for peaking energy needs.

2.1.2.5 Cowans Ford Development

The normal operating target elevation for the Cowans Ford reservoir varies during the year from elevation 752 ft msl in March to 758 ft msl from June through September with a full pond water surface elevation of 760 ft. At any given time, the reservoir level may fluctuate within the normal operating range from 2 ft below to 2 ft above the normal operating target elevation.

Duke Power's Marshall Steam Station and McGuire Nuclear Station are located on the Cowans Ford reservoir. The reservoir level may not be drawn down more than 15 ft below full pond, which is elevation 745 ft msl, without violating Nuclear Regulatory Commission limits set for the McGuire Nuclear Station. Thermal effects further limit the draw-down to 750 ft, 10 ft below full pond. In addition, there is an underwater weir in front of the Cowans Ford powerhouse intakes with a crest elevation of 725 ft, which presents a physical limitation on the draw-down of the reservoir. There are a number of public water supply withdrawals on Lake Norman including Charlotte-Mecklenburg Utilities Department; Lincoln County, North Carolina; and the city of Mooresville, North Carolina.

Cowans Ford Development operates to provide electricity during peak energy demands and to maintain the reservoir level within its normal operating range. One unit is run at efficiency load at least once each day, generating about 44 MWh to meet the minimum average daily flow license requirement of 311 cfs. In addition, the development currently has a license requirement to maintain a continuous flow of 80 cfs that is met through wicket gate leakage when the facility is not generating electricity.

The Cowans Ford Development is the largest development of the Catawba-Wateree Project, and its reservoir, Lake Norman, has the largest storage capacity of this project. In addition to meeting its own requirements as described above, Lake Norman's large storage capacity is used to augment generation flows for the downstream Catawba-Wateree developments. Too much water released in too short a period of time would cause Mountain Island downstream of Cowans Ford to spill; therefore, when Cowans Ford generates, care must be taken not to overwhelm the Mountain Island Development and cause excessive spill.

2.1.2.6 Mountain Island Development

The normal operating target elevation for the Mountain Island reservoir is 643.5 ft msl, with 647.5 ft being the full pond water surface elevation. At any given time, the reservoir level may vary within a normal operating range from 0.5 ft below to 3.5 ft above the normal operating target elevation. The Mountain Island reservoir level is operated to provide sufficient storage for the operation of Cowans Ford without spilling from Mountain Island. Consequently, Mountain Island often starts generation in anticipation of Cowans Ford generating. Duke Power's Riverbend Steam Station is located on the Mountain Island reservoir, and its minimum lake level requirement limits the Mountain Island draw-down to 641.8 ft. Municipal water withdrawals from Mountain Island Lake include the Charlotte-Mecklenburg Utilities Department; the city of Gastonia, North Carolina; and the town of Mount Holly, North Carolina.

Duke Energy operates its generators at Mountain Island to provide electricity during peak energy demand and to maintain the reservoir level within its normal operating range. One unit is run at efficiency load at least once each day, generating about 33 MWh to meet the minimum average daily flow license requirement of 314 cfs. The development currently has a license requirement for a continuous flow of 80 cfs that is met through wicket gate leakage when the facility is not generating electricity. These releases are made into the tailrace channel below the powerhouse, which flows into the downstream reservoir.

2.1.2.7 Wylie Development

The normal operating target elevation for Wylie reservoir is 566.4 ft msl with the full pond water surface elevation at 569.4 ft. At any given time, the reservoir level may vary within

a normal operating range from 2 ft below to 2 ft above the normal operating target elevation. Duke Power's Catawba Nuclear Station and Allen Steam Station are located on the reservoir. In addition, the municipal withdrawals for Belmont, North Carolina, and Rock Hill, South Carolina, are located on Lake Wylie.

Wylie Development generates electricity on a daily basis to provide flow for the benefit of downstream industrial water users (approximately 700 cfs) and to maintain the reservoir level within its normal operating range. Any additional electrical generation from the Wylie Development is used to meet peak energy demands. One unit is run at efficiency load at least once each day, generating about 49 MWh to meet the minimum average daily flow license requirement of 411 cfs. The Wylie generating units have black start capability, which enables operation of the station's floodgates even under emergency conditions. The city of Rock Hill, South Carolina; the town of Fort Mill, South Carolina; the water department of Union County, North Carolina; and the water department of Lancaster County, South Carolina, all have intakes on the river downstream of the development.

2.1.2.8 Fishing Creek Development

The normal operating target elevation for the Fishing Creek reservoir is 414.2 ft msl with the full pond water surface elevation at 417.2 ft. At any given time, the reservoir level may vary within a normal operating range from 2 ft below to 2 ft above the normal operating target elevation. Chester Metropolitan Water and Sewer District withdraws water from the reservoir of the Fishing Creek Development.

Fishing Creek generates electricity to maintain the reservoir level within its normal operating range. One unit is run at efficiency load at least once each day, generating about 46 MWh to meet the minimum average daily flow license requirement for a flow of 440 cfs. In addition, the Fishing Creek powerhouse releases into the upper end of the reservoir for the downstream developments at Great Falls and Dearborn. The structures that contain this downstream reservoir include a Great Falls diversion dam immediately downstream of Fishing Creek and the Great Falls headworks farther downstream. In order not to cause a spill from the downstream development, the Fishing Creek tailrace elevation cannot exceed the top of the diversion dam or downstream headworks. This tailrace elevation limitation and the flow-through rate of the downstream generating facility result in a maximum run time of about 6 hours at five units' flow to avoid downstream spilling. Once this generating limit is reached, the output has to be reduced to four units' output for 2 hours before returning the fifth unit to operation. Consistent with these tailrace limitations, the flow from the Fishing Creek Development is used to refill the reservoirs for the next four downstream developments (Great Falls, Dearborn, Rocky Creek, and Cedar Creek) prior to their generating runs. This practice results in more efficient use of the generating capabilities of the four downstream developments. After the above-listed operational constraints are satisfied, all remaining Fishing Creek generation is dispatched primarily for peaking energy needs. The generating units at Fishing Creek have black start capability, which enables operation of the station's floodgates even under emergency conditions.

2.1.2.9 Great Falls and Dearborn Developments

The normal operating target elevation for the Great Falls and Dearborn Developments' reservoir is 353.3 ft msl with the full pond water surface elevation of 355.8 ft. At any given time, the reservoir level may vary within a normal operating range from 3.5 ft below to 2 ft

above the normal operating target elevation. No municipal water withdrawal facilities are located on the reservoir.

Great Falls and Dearborn operate to provide electrical generation primarily to maintain the reservoir level within its normal operating range and for peak energy demand. Since the three units at the Dearborn powerhouse are more efficient than the eight units at the Great Falls powerhouse, the Great Falls units are only run to avoid spilling or during periods of high peaking energy demand. One Dearborn unit is run at efficiency load at least once each day, generating about 53 MWh to meet the minimum average daily flow license requirement of 444 cfs flow.

2.1.2.10 Rocky Creek and Cedar Creek Developments

The normal operating target elevation for the reservoir is 281.9 ft msl with the full pond water surface elevation at 284.4 ft. At any given time, the reservoir level may vary within a normal operating range from 1 ft below to 2 ft above the normal operating target elevation. No municipal water withdrawal facilities are located on the reservoir for the Rocky Creek and Cedar Creek Developments.

The Rocky Creek and Cedar Creek Developments generate electricity to maintain the reservoir level within its normal operating range, to provide required flow under the minimum average daily flow license requirement, and to provide electricity to meet peak energy demands. Since the three units at the Cedar Creek powerhouse are more efficient than the eight units at the Rocky Creek powerhouse, the Rocky Creek units are only run to avoid spilling or during periods of high peaking energy demand. One Cedar Creek unit is run at efficiency load at least once each day, generating about 40 MWh to meet the minimum average daily flow requirement of 445 cfs. The generating units at the Cedar Creek powerhouse have black start capability, which enables operation of the station's floodgates even under emergency conditions.

2.1.2.11 Wateree Development

The normal operating target elevation for the Wateree reservoir varies during the year from elevation 220.5 ft in December and January to 222.5 ft msl for most of the year excepting a 3-week fill period in January to February and a 6-week draw-down period in November to December. Full pond water surface elevation for the Wateree reservoir is 225.5 ft. At any given time, the reservoir level may fluctuate within a normal operating range from 2 ft below to 2 ft above the normal operating target elevation. The city of Camden and the Lugoff-Elgin Water Authority in South Carolina have municipal water withdrawal facilities on the reservoir.

The Wateree Development maintains its reservoir level within its normal operating range by generating electricity as needed. Additionally, one unit is operated at efficiency load at least once each day, generating about 60 MWh to meet the minimum average daily flow license requirement of 446 cfs. In the spring, the station continuous release is increased to support fish spawning as part of the voluntary Spring Lake Level Stabilization Program. From March 15 to May 31, the station releases a continuous flow that results in electrical generation of about 312 MWh per day. The continuous release to support fish spawning is sometimes reduced depending on water availability. Additional daily voluntary releases are made as needed throughout the year to support several large industrial water users downstream including a large steam-electric generating station. Except for continuous releases, generation from the Wateree Development is dispatched primarily for peaking energy needs.

2.1.3 Project Safety

The Catawba-Wateree Project has been operating for almost 50 years under the existing license and, during this time, staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the licenses, and proper maintenance. In addition, the project has been inspected and evaluated every 5 years by an independent consultant, and a consultant's safety report has been submitted for Commission review.

As part of the relicensing process, the staff would evaluate the continued adequacy of the proposed project's facilities under new licenses. Special articles would be included in any licenses issued, as appropriate. Staff would continue to inspect the project during the new license terms to ensure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.4 Existing Project Boundaries

The project boundary generally follows the normal full pond elevation of each of the 11 project reservoirs. The 55 project-related recreational facilities at the reservoirs are included in the project boundary and represent a total area of 1,992 acres.

2.2 APPLICANT'S PROPOSALS (SETTLEMENTS)

2.2.1 Proposed Project Facilities

The applicant does not propose to add new hydroelectric generating capacity to the Catawba-Wateree Project; however, there are physical and operational modifications proposed for five of the developments to support the implementation of the Revised CRA. Operational modifications are discussed in section 2.2.2, *Proposed Operations*. Physical modifications to support the implementation of the Revised CRA include: (1) the installation of flow compliance gauges at Bridgewater, Oxford, and Great Falls and Dearborn; (2) the installation of aerating runners at Rhodhiss (Unit 3), Oxford (on one existing unit), Wylie, and Wateree; and (3) the installation of dissolved oxygen and groundwater compliance monitors at all 11 developments. In addition, the following would be installed: a BW Bypass Flow valve at Bridgewater, a minimum flow valve at Oxford, a maintenance flow valve at Lookout Shoals, and a minimum flow hydro unit at Wylie. Great Falls and Dearborn Developments would undergo modifications to the Great Falls diversion dam and Great Falls headworks, and the Wateree Development would have a portion of the dam crest removed to support the installation of a bladder dam

In addition to these modifications, a new powerhouse at the Bridgewater Development is being constructed as part of seismic modifications to the Linville dam.

2.2.2 Proposed Operations

Duke Energy proposes to operate the project similar to its current operation with the following changes.

2.2.2.1 Required Minimum Flows

Except when operating under the Low Inflow Protocol or the Hydro Project Maintenance and Emergency Protocol, minimum continuous flows from the Bridgewater, Oxford, Lookout

Shoals, Wylie, Great Falls, Dearborn, and Wateree Developments would be proposed as shown in table 2.

Table 2. Minimum continuous flows when operating under the Low Inflow Protocol or Hydro Project Maintenance and Emergency Protocol.

Minimum continuous flows		
Development(s)/location	**Date**	**Minimum continuous flows (cfs)**
Bridgewater Development/Bridgewater Tailrace	Jan – Mar	145
	Apr – Jul	95
	Aug – Nov	75
	Dec	145
Bridgewater Development/Catawba River Bypassed Reach	Jan – Jun	75
	Jul – Nov	50
	Dec	75
Oxford Development/NA[1]	Jan – Dec	150
Lookout Shoals Development/NA	Jan – Dec	80
Wylie Development/NA	Jan – Dec	1,100
Great Falls and Dearborn Developments/ Long Bypassed Reach	Jan – Feb 14	450
	Feb 15 – May 15	850
	May 15 – Dec	450
Great Falls and Dearborn Developments/ Short Bypassed Reach	Jan – Dec	100
Wateree Development/NA	Jan – Feb 14	930
	Feb 14 – Feb 29	2,400
	Mar – Apr	2,700
	May 1 – May 15	2,400
	May 16 – May 31	1,250
	Jun – Dec	930

[1] Not applicable.

In addition, Duke Energy proposes to maintain the following minimum average daily flow unchanged from the current license requirements: 225 cfs from the Rhodhiss Development; 311 cfs from the Cowans Ford Development; 314 cfs from the Mountain Island Development;

440 cfs from the Fishing Creek Development; and 445 cfs from the Rocky Creek and Cedar Creek Developments.

Recreational Flows

Duke Energy proposes to provide additional recreational flows from the Bridgewater, Oxford, Wylie, Great Falls, Dearborn, and Wateree Developments in accordance with the schedule included in table 3, extracted from the Revised CRA.

Table 3. Catawba-Wateree Project (P-2232) proposed recreational flows and schedule. (Source: Duke Energy, 2006a)

Recreational flows					
	Dates (inclusive)	**Days/description**	**Flows (≥ cfs)**	**Hour start**	**Hour end**
Bridgewater Development Recreational Flow Schedule	Apr 1 – Apr 30	Last full weekend – Saturday and Sunday	900	10:00 AM	3:00 PM
	May 1 – Jul 15	Each Friday, Saturday, and Sunday plus Memorial Day and Independence Day	900	10:00 AM	3:00 PM
	Jul 16 – Aug 31	Each Saturday and Sunday	900	10:00 AM	3:00 PM
	Sep 1 – Sep 30	Each Friday, Saturday, and Sunday plus Labor Day	900	10:00 AM	3:00 PM
	Oct 1 – Oct 31	Each Saturday and Sunday	900	10:00 AM	3:00 PM
	Dates (inclusive)	**Days/description**	**Flows (≥ cfs)**	**Hour start**	**Hour end**
Oxford Development Recreational Flow Schedule	May 1 – Sep 30	Each Saturday and Sunday plus Memorial, Independence, and Labor Days	2,600	10:00 AM	3:00 PM
	Oct 1 – Oct 31	First 4 Saturdays	2,600	10:00 AM	3:00 PM

Recreational flows					
Wylie Development Recreational Flow Schedule	**Dates (inclusive)**	**Days/description**	**Flows (≥ cfs)**	**Hour start**	**Hour end**
	Apr 1 – Apr 30	Last full weekend – Saturday and Sunday	3,000	10:00 AM	4:00 PM
	May 1 – Jun 15	Each Friday, Saturday, and Sunday plus Memorial Day	3,000	10:00 AM	4:00 PM
	Jun 16 – Jul 15	Each Friday, Saturday, and Sunday plus Independence Day	6,000	10:00 AM	4:00 PM
	Jul 16 – Aug 31	Each Saturday and Sunday	6,000	10:00 AM	4:00 PM
	Sep 1 – Sep 30	Each Friday, Saturday, and Sunday plus Labor Day	6,000	10:00 AM	4:00 PM
	Oct 1 – Oct 31	Each Saturday and Sunday	3,000	10:00 AM	4:00 PM
Great Falls and Dearborn – Long Bypassed Reach	**Dates (inclusive)**	**Days/description**	**Flows (≥ cfs)**	**Hour start**	**Hour end**
	Mar 1 – Oct 31	Two Saturdays per month	2,940	10:00 AM	3:00 PM
		A total of 4 Sundays	2,940		
Great Falls and Dearborn – Short Bypassed Reach	Mar 1 – Apr 30	One Saturday per month to correspond with Long Bypassed releases	2,860	10:00 AM	3:00 PM
	May 1 – Oct 31	Two weekends (Saturday and Sunday) per month	2,860		
Wateree Development Recreational Flow Schedule	**Dates (inclusive)**	**Days/description**	**Flows (≥ cfs)**	**Hour start**	**Hour end**
	Apr 1 – Apr 30	Last full weekend – Saturday and Sunday	2,760	10:00 AM	3:00 PM
	May 1 – Jul 31	Each Saturday and Sunday plus Memorial and Independence Days	2,760	10:00 AM	3:00 PM
	Sep 1 – Sep 30	Each Saturday and Sunday plus Labor Day	2,760	10:00 AM	3:00 PM
	Oct 1 – Oct 31	Each Saturday and Sunday	2,760	10:00 AM	3:00 PM

Bridgewater Development

In addition to the schedule of flows proposed for the developments presented in table 3, Duke Energy would provide flows to support float angling and paddling. The flows for float angling at the Bridgewater Development would be provided as close as feasible to 900 cfs, without exceeding 1,200 cfs, and the flows for paddling would be at least 900 cfs. Scheduled recreational flows should be divided about equally between flow releases for float angling and flow releases for paddling. Scheduling of specific dates each year that are focused on float angling or paddling would be determined at the annual recreational flow schedule planning meeting. If the applicant is not operating in accordance with the Maintenance and Emergency Protocol and needs to operate the Bridgewater Development to release more than 1,200 cfs for three or more hours during any of the scheduled flow release periods to support float angling, then Duke Energy would endeavor in good faith to add equivalent hours of replacement recreational flow releases for float angling at the Bridgewater Development within the same calendar year.

Oxford Development

At the Oxford Development, Duke Energy would provide up to 10 additional hours of recreational flow releases per calendar year in addition to the recreational flow releases identified in table 3. Flows would be provided in increments of no less than 1 hour each of at least 2,600 cfs. Scheduling for additional recreational flow releases would be determined at the annual recreational flow schedule planning meeting.

Wylie Development

In addition to the scheduled recreational flow releases, Duke Energy would provide a release of 1,300 cfs for 6 hours prior to the scheduled start times for the recreational flow release from May 1 to July 15, inclusive, to ensure suitable water levels at Landsford Canal State Park. Duke Energy also would provide up to 10 additional hours of recreational flow releases per calendar year, in increments of no less than 1 hour each of 3,000 cfs. Scheduling for additional recreational flow releases would be determined at the annual recreational flow schedule planning meeting.

Great Falls and Dearborn Developments

Duke Energy would provide up to 10 additional hours of recreational flow releases per calendar year, in increments of no less than 1 hour each, of at least 2,860 cfs at the Great Falls Short bypassed reach and at least 2,940 cfs the Great Falls Long bypassed reach. Scheduling for additional recreational flow releases would be determined at the annual recreational flow schedule planning meeting.

Wateree Development

Duke Energy would provide up to 10 additional hours of recreational flow releases per calendar year, in increments of no less than 1 hour each, of at least 2,760 cfs. Scheduling for additional recreational flow releases would be determined at the annual recreational flow schedule planning meeting.

The flows and schedules for the recreational flow releases identified in the tables for identified developments may be temporarily modified if Duke Energy is operating in accordance with the Commission-approved Low Inflow Protocol or the Maintenance and Emergency

Protocol. Duke Energy would notify the Commission, the resource agencies, and other interested parties of any modifications necessary in accordance with either operational protocol.

Wylie High Inflow Protocol

In order to provide additional protection and enhancement of aquatic habitat downstream of the Wylie Development when above-average inflow is available, Duke Energy proposes to increase the minimum continuous flow from 1,100 to 1,300 cfs from February 15 through May 15. The increase would occur if the median flows at the U.S. Geological Survey (USGS) streamflow gages on the Catawba River (USGS #02137727), Johns River (USGS #02140991), and South Fork Catawba River (USGS #02145000) are at or above 105 percent of the 3-month (November to January) median flows for the periods of record for these gages. If, when operating in the Wylie High Inflow Protocol, the February median flow for any one of these three streamflow gages is below the February median flow for the period of record of that gage, then the minimum flow requirement for the Wylie Development would be reduced on April 1 to 1,100 cfs. Duke Energy may suspend the Wylie High Inflow Protocol if operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol.

Reservoir Elevations

Duke Energy would meet operating elevations for each reservoir except as provided under the Low Inflow Protocol, Maintenance and Emergency Protocol, or Spring Reservoir Level Stabilization Program. Reservoir elevations as proposed for each development in the proposed license articles are presented in table 4. The Low Inflow and Maintenance and Emergency Protocol are included in appendices C and D of the Revised CRA (Duke Energy, 2006a).

Spring Reservoir Level Stabilization Program

Lake James, Lake Norman, Lake Wylie, and Lake Wateree would continue to participate in the Spring Reservoir Level Stabilization Program. This program would limit the fluctuation of the reservoir level during the 3-week spring fish spawning period to support fish spawning in the reservoir, unless operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol. The program would initiate at each reservoir when (a) surface water temperatures reach 65°F for four consecutive days, (b) bass spawning is observed in the reservoir by an applicant representative, or (c) a Resource Agency representative notifies the applicant that bass spawning has been observed in the reservoir, whichever happens first. Once initiated, the reservoir level is maintained within a range of 1 ft below and 2 ft above the level at the time when the program is triggered. The level is maintained within the limits for 3 weeks. The only significant difference between the current voluntary program and the proposed Spring Reservoir Level Stabilization Program is that the program would trigger for each reservoir individually. Currently, the program initiates based on conditions at Lake Wateree, and stabilization in the other reservoirs initiates at set intervals after that point.

2.2.3 Proposed Environmental Measures

2.2.3.1 Proposed License Articles

Under the Revised CRA, Duke Energy proposes to continue operating the project with the proposed protection and enhancement measures summarized in table 4.

Table 4. Catawba-Wateree Project (P-2232) proposed license articles. (Source: Duke Energy, 2006a)

Article Proposed in Revised CRA	Measure	Elements
WQQ 1.0	Reservoir Elevations	Operate reservoirs at or above the normal minimum elevations given below, except as needed to maintain minimum flows or as provided under the Low Inflow Protocol, Maintenance and Emergency Protocol, or Spring Reservoir Level Stabilization Program:

Reservoir	Month	Normal min. (ft)	Normal target (ft)	Normal* max. (ft)
Lake James (Full Pond: 1,200.0 ft msl)	Jan	93.00	96.00	100
	Feb	92.00	94.00	100
	Mar	92.00	95.00	100
	Apr	92.00	96.00	100
	May-Oct	95.00	98.00	100
	Nov-Dec	93.00	96.00	100
Lake Rhodhiss (Full Pond: 995.1 ft msl)	Jan-Dec	94.00	97.00	100
Lake Hickory (Full Pond: 935.0 ft msl)	Jan-Feb	94.00	96.00	100
	Mar-Dec	94.00	97.00	100
Lookout Shoals Lake (Full Pond: 838.1 ft msl)	Jan-Dec	94.00	97.00	100
Lake Norman (Full Pond: 760.0 ft msl)	Jan	93.00	96.00	100
	Feb	91.00	94.00	100
	Mar	92.26	95.26	100
	Apr	93.65	96.65	100
	May-Oct	95.00	98.00	100
	Nov	93.98	97.00	100
	Dec	93.00	96.00	100
Mountain Island Lake (Full Pond: 647.5 ft msl)	Jan-Dec	94.30	96.00	100
Lake Wylie Reservoir (Full Pond: 569.4 ft msl)	Jan-Dec	94.00	97.00	100

			Reservoir	Month	Normal min. (ft)	Normal target (ft)	Normal* max. (ft)
			Fishing Creek Reservoir (Full Pond: 417.2 ft msl)	Jan-Dec	95.00	98.00	100
			Great Falls Reservoir (Full Pond: 355.8 ft msl)	Jan-Dec	95.00	97.50	100
			Cedar Creek Reservoir (Full Pond: 284.4 ft msl)	Jan-Dec	96.00	97.50	100
			Lake Wateree Reservoir (Full Pond: 225.5 ft msl)	Jan	93.00	94.50	100
				Feb	93.00	95.00	100
				Mar-Oct	94.00	97.00	100
				Nov	93.00	97.00	100
				Dec	93.00	95.00	100
			* 100 ft = Full Pond				
WQQ 2.0	Spring Reservoir Level Stabilization Program	Implement the Spring Reservoir Level Stabilization Program at Lakes James, Wylie, Norman, and Wateree, unless operating under the Low Inflow Protocol or Maintenance and Emergency Protocol. Begin stabilization period for each reservoir when (a) surface water temperatures reach 65°F for four consecutive days, (b) bass spawning is observed in the reservoir by an applicant representative, or (c) a resource agency representative notifies the applicant that bass spawning has been observed in the reservoir, whichever happens first. Observe surface water temperatures in at least one location at each reservoir in the program. Maintain the water level in the subject reservoir within a range of 1 ft below to 2 ft above the elevation at the time that the stabilization period is triggered. Stabilize the subject reservoir for 3 weeks once initiated.				
WQQ 3.0	Low Inflow Protocol	Operate in accordance with the Low Inflow Protocol included as appendix C of the Revised CRA.					
WQQ 4.0	Maintenance and Emergency Protocol	Operate in accordance with the Maintenance and Emergency Protocol included as appendix D of the Revised CRA.					

WQQ 5.0	Flow and Reservoir Elevation Monitoring and Reporting	By June 30 of each full calendar year for the term of the new license, file a report with the Commission to verify compliance with reservoir elevations, Spring Reservoir Level Stabilization Program, recreational flows, minimum flows, and the Wylie High Inflow Protocol as set forth in the new license.
WQQ 5.1	Funding for USGS Stream Gages	Fund the installation of one new USGS streamflow gage to be located on the Linville River, between the Linville dam and the confluence of the Linville and Catawba River, just downstream of the Bridgewater Development. In addition, provide funding for the annual maintenance cost of the new gage and six additional gages for the term of the new license.
WQQ 8.0	Minimum Flows for Aquatic Habitat	Provide releases that improve aquatic habitat according to the schedules for affected developments. Provide minimum continuous flows from the Bridgewater, Oxford, Lookout Shoals, Wylie, Great Falls, Dearborn, and Wateree Developments as described in section 2.2.2.1, *Required Minimum Flows*. Provide minimum average daily flows from the Rhodhiss, Cowans Ford, Mountain Island, Fishing Creek, Rocky Creek and Cedar Creek Developments as described in section 2.2.2.1, *Required Minimum Flows*.
WQQ 8.2	Wylie High Inflow Protocol	Increase the minimum continuous flow from the Wylie Development from 1,100 to 1,300 cfs from February 15 through May 15 if the median flows at the USGS streamflow gages on the Catawba River (#02137727), Johns River (#02140991), and South Fork Catawba River (#02145000) are at or above 105 percent of the 3-month (November to January) median flows for the periods of record for these gages. While operating under the Wylie High Inflow Protocol, if the February median flow for any of these three gages is below the median February flow for the period of record of that gage, then the minimum continuous flow will be dropped back to 1,100 cfs on April 1. The applicant may suspend the Wylie High Inflow Protocol if it is operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol.

WQQ 10.1	Flows Supporting Public Water Supply and Industrial Processes	Provide the following flow releases to support downstream withdrawal requirements. (Flows may be modified when operating under the Maintenance and Emergency Protocol or stage 4 of the Low Inflow Protocol)

Development	**Required flow (cfs)**	**Water user**	**RM**
Bridgewater	90 continuous minimum	City of Morganton	264.0
Wylie	619 weekly average	Charlotte-Mecklenburg Utilities	137.6
	619 weekly average	City of Rock Hill	137.0
	619 weekly average	Celanese Acetate	136.0
	619 weekly average	Nations Ford Chemical	135.0
	Up to 71 above existing flow	Union and Lancaster Counties	122.0
	600 continuous minimum	Bowater Pulp and Paper Mill	120.0
	1,000 minimum	Bowater Pulp and Paper Mill for continuous 16 hours/day	120.0
Wateree	800 continuous minimum	International Paper Facility	17.0
	800 continuous minimum	South Carolina Electric and Gas Company	12.0

WQQ 16.0	Annual Recreational Flow Schedule Planning	Convene an annual recreational flow schedule planning meeting with North Carolina DENR, North Carolina WRC, South Carolina DNR, South Carolina DPRT, and other entities with recreational experience and expertise to make improvements to the recreational flow release schedule, establish a schedule for additional recreational flows, and identify potential dates for replacement flows.

WQQ 16.1 – 16.11	Recreational Flow Releases	Provide recreational flows from the Bridgewater, Oxford, Wylie, Great Falls, Dearborn, and Wateree Developments as outlined in section 2.2.2.1, *Required Minimum Flows*, unless operating under the Low Inflow Protocol or Maintenance and Emergency Protocol
WQQ 6.0	Compliance with Water Quality Standards	Develop and file a water quality monitoring plan to monitor compliance with water quality requirements, and file an annual report with the Commission to verify compliance with any applicable 401 Water Quality Certifications for the previous calendar year.
WQQ 7.0	Flow and Water Quality Implementation Plan	Develop and file a flow and water quality implementation plan (FWQIP) for completing the modifications necessary to satisfy the flow and water quality requirements at project developments, to be prepared in consultation with FWS, NOAA Fisheries, North Carolina DENR, North Carolina WRC, South Carolina DNR, and South Carolina DHEC.
SMP 18.0	Shoreline Management Plan	Implement the revised shoreline management plan (SMP) as filed with the application for new license (Book 5), with the understanding that the applicant has the right to make changes in order to protect newly discovered resources including archaeological or historical sites, threatened or endangered species, special concern species, or correct errors.
SMP 18.1	Review and Update Procedures	File a revised SMP every 10 years after the issuance of the new license for the term of the license, to be prepared in consultation with FWS, NOAA Fisheries, North Carolina DENR, North Carolina WRC, South Carolina DNR, South Carolina DHEC, and other interested parties.
CR 12.0	Historic Properties Management Plan	Implement the historic properties management plan as filed with the application for new license (Book 4).
CR 12.3	Bridgewater Development	Offer to lease an island containing a historic gravesite to the North Carolina Division of Parks and Recreation (DPR) for management as part of Lake James State Park. Require North Carolina DPR to monitor the site at least annually and report any disturbances.

CR 12.7	Fishing Creek Development	Offer to lease sites 38LA467, 38LA468, 38LA469, 38LA470, 38LA471, 38LA473, 38LA474 to South Carolina DPRT for the term of the new license and require a management plan for these sites in consultation with CIN THPO and South Carolina DAH.
FWBR 11.0	Federal Threatened and Endangered Species Protection Plans	Implement the Federal Threatened and Endangered Species Protection Plans for Schweinitz's sunflower, dwarf-flowered heartleaf, bald eagle, wood stork, American alligator, shortnose sturgeon, and freshwater mussels including the Carolina heelsplitter as filed with the application for new license (Books 2 and 3). The applicant also must annually update the list of threatened and endangered species, after consultation with FWS, North Carolina DENR, North Carolina WRC, and South Carolina DNR.
REC 13.0	Recreation Management Plan	Develop and file a recreation management plan (RMP) that describes the implementation of the measures identified in article 14.0 and proposes a schedule in 5-year increments.
REC 14.0	Recreation Facility Enhancements	Specific recreational sites and elements at each site are described in detail in section 3.3.7, *Recreational Resources*.
		Bridgewater Development Develop restrooms, shade trees, trails, picnic facilities, primitive camping sites, canoe/kayak access sites, boat ramps, or other improvements to Black Bear Access Area, Linville Access Area, Bridgewater Access Area, and Muddy Creek. Offer North Carolina DENR nominal-cost lease for the term of the new license for the Lake James State Park management zone along the shoreline adjoining the state park, including three islands. Develop a 10-acre pocket park near the Linville dam with parking facilities, picnic facilities, photographic overlooks, and a bank fishing trail.

Rhodhiss Development

Develop restrooms, parking, a boat ramp, or trails at the Corpening Bridge, Sawmills Veterans Park, Rhodhiss Access Area, and Castle Bridge Area.

Evaluate the condition of the existing portage trail and signage at the Rhodhiss dam canoe portage and develop needed improvements.

Oxford Development

Develop restrooms, parking, swimming areas, trails, canoe/kayak access, primitive campground, or other improvements at the Wittenburg Access Area, Dusty Ridge Access Area, Lovelady Access Area, Long Shoals Access Area, Oxford Access Area, Oxford Tailrace Fishing Area, and Oxford dam canoe portage.

Lookout Shoals Development

Develop parking, restrooms, public fishing area, portage trail or other improvements at the Upper Lookout Shoals Access Area, Riverbend Park/Upper Lookout Shoals Trail, Lookout Shoals Access Area, Lookout Shoals Tailrace Fishing Area, and Lookout Shoals dam canoe portage.

Cowans Ford Development

Develop picnic facilities, parking, trails, shade trees, swimming areas, portage trail, or other improvements at Beatty's Ford Access Area, Hagers Creek Access Area, Stumpy Creek Access Area, Little Creek Access Area, Island Point Access Area, and Cowans Ford dam portage and overlook.

Offer North Carolina DENR nominal-cost lease for the term of the new license for the Lake Norman State Park management zone along the shoreline adjoining the state park, including one island.

Mountain Island Development

Develop canoe/kayak access, parking, restrooms, swimming area, fishing pier, or other improvements at the Highway 73 Access Area, Lucia Access Area, Riverbend Access Area, and Mountain Island dam canoe portage.

Wylie Development

Develop canoe/kayak access, parking, trails, picnic facilities, restrooms, a fishing pier, or other improvements at Dutchmans Creek Access Area, South Point Access Area, Buster Boyd Access Area, Allison Creek Access Area, Rock Hill Park, and Fort Mill Access Area.

Offer an Access Area Improvement Initiative (AAII) lease of the 37-acre island to the U.S. National Whitewater Center for individual and group environmental education and outdoor recreation programming.

Fishing Creek Development

Develop parking, picnic facilities, a fishing pier, boat docks, bank fishing trail, or other improvements at Springs Park, Fishing Creek Access Area, and Fishing Creek Tailrace Fishing Area. The existing Cane Creek Access Park will be relocated to an 18-acre portion of Springs Park.

Great Falls and Dearborn Developments

Develop canoe/kayak access, restrooms, parking, portage trail, or other improvements at the Highway 200 Bridge Access Area, Great Falls diversion dam portage, Great Falls headworks portage, Great Falls headworks to Cedar Creek reservoir portage, and Lower Great Falls reservoir canoe/kayak launch.

Evaluate the safety concerns associated with boating near the Great Falls diversion dam, the Great Falls headworks, and the Great Falls-Dearborn dam. Determine the need for constructing boating safety devices and report conclusions to the Commission along with a revised public safety plan if necessary.

Rocky Creek and Cedar Creek Developments

Acquire 1 acre of property and develop a canoe/kayak access facility with 10 gravel parking spaces at the Mudcat Inn Access Area.

Offer an AAII lease of the islands associated with the Great Falls, Dearborn, Rocky Creek, and Cedar Creek Developments to South Carolina DPRT to establish and maintain a new state park centered on the Dearborn Armory site.

		Wateree Development Develop picnic facilities, pier fishing, restrooms, trails, parking, swimming area, or other improvements at Wateree Creek Access Area, Molly Creek Park, Colonels Creek Access Area, Taylors Creek Access Area, and Lugoff Access Area. Offer South Carolina DENR nominal-cost lease for the term of the new license for the Lake Wateree State Park management zone along the shoreline adjoining the state park.
REC 15.0 – 15.1	Recreation Planning	Review the project's recreation needs 20 years after the issuance of the new license and every 10 years afterwards for the term of the new license. File a supplement to the RMP to describe any additional activities or facilities to be developed, in consultation with North Carolina DENR, North Carolina WRC, South Carolina DPRT, and South Carolina DNR.
REC 17.0 – 17.3	Public Information to Support Recreational Use of the Project	Provide the following information on the internet: normal minimum elevation, normal maximum information, normal target elevation, actual reservoir level, recent reservoir level history, 13-month reservoir level history, projections, points of contact for additional information, and special messages. Provide the following information on the telephone: special messages and actual levels for each project reservoir via a toll-free telephone system. Provide the Annual Scheduled Flow Release Calendar on the project's website showing all scheduled flow releases from the Bridgewater, Oxford, Wylie, and Wateree Developments and into the Great Falls bypassed reaches. Provide 2-day flow release forecasts on the website and toll-free telephone system for the Oxford, Wylie, and Wateree Developments and the Great Falls bypassed reaches. Provide 3-day flow release forecasts on the website and toll-free telephone system for the Bridgewater Development.

2.2.3.2 Not Proposed License Articles

The proposed protection and enhancement measures shown in Table 5 are not currently license articles, but will be considered for possible inclusion as license articles.

Table 5. Catawba-Wateree Project (P-2232) not proposed license articles. (Source: Duke Energy, 2006a)

Article Proposed in Revised CRA	Measure	Elements
WQQ 8.3	Wateree Spring Stable Flows	If inflows are sufficient, implement a Spring Stable Flow Periods Protocol in the Wateree Development. The applicant will endeavor in good faith to provide two 10-day periods of stable flow sometime between February 15 and May 15 from the Wateree Development, unless operating under the Low Inflow Protocol or Maintenance and Emergency Protocol. Suspend the Spring Reservoir Level Stabilization Program if necessary to provide stable flows. Provide South Carolina DNR, FWS, and NOAA Fisheries with an annual report documenting flow releases from the Wateree Development between February 15 and May 15. Ten years after the FWQIP modifications are implemented, the applicant will consult with FWS, NOAA Fisheries, and South Carolina DNR on a proposed license article for the Wateree Spring Stable Flow Periods.
WQQ 9.0	Flow Mitigation Package	Provide conservation easements on 28.6 bank miles of stream in North Carolina and 5.5 bank miles of stream in South Carolina in exchange for reduced releases in the Oxford, Lookout Shoals, and Wylie regulated river reaches and no releases in the Paddy Creek, Mountain Island, and Wateree bypassed reaches. Within 1 year of issuance of the new license, the applicant would provide a one-time contribution of $1 million to South Carolina DNR to create the Catawba-Wateree Hydroelectric Project Fish and Wildlife Mitigation and Enhancement Fund.

Article Proposed in Revised CRA	Measure	Elements
WQQ 6.1	Additional Water Quality Monitoring and Compliance Report	Prepare a quality assurance project plan as part of any section 401 water quality certifications to describe the processes and procedures to be used to ensure accuracy of water quality data. Develop a groundwater monitoring plan for inclusion in the Low Inflow Protocol that includes determination of and funding for new groundwater wells.
WQQ 7.1	Additional Flow and Water Quality Implementation Plan Agreements	Initiate interim measures for providing aquatic flow or dissolved oxygen enhancement as identified in the FWQIP, to be continued until the physical modifications specified in the FWQIP are complete. Document any chronic noncompliance with the section 401 water quality certification in the annual water quality compliance report, if it occurs as a result of project operations.
WQQ 10.2	Water Use Agreements	Any entities wishing to close or abandon large water intakes within the project will be required to find another entity to take over the intake or to file a plan for its removal or retirement. Any application for the expansion, modification, replacement, or addition of water intakes must receive comments from the applicant within 90 days of submission. All large intake owners must report annually their average monthly water withdrawals and returns to the project. The applicant will maintain a database of this information. Easements and permits will continue to be the mechanism for granting approval for the use of project property.

Article Proposed in Revised CRA	Measure	Elements
WQQ 8.4	Wateree Flood Plain Inundation	Following periods of high inflow between February 1 and May 31, the applicant must endeavor in good faith to gradually reduce flood plain inundation in the Wateree regulated river reach to approximate natural inflow conditions until the Lake Wateree water level returns to 1 ft above or below the normal target elevation, unless operating under Maintenance and Emergency Protocol or Low Inflow Protocol. Ten years after the FWQIP modifications are implemented, the applicant will consult with FWS, NOAA Fisheries, and South Carolina DNR on a proposed license article for the Wateree flood plain inundation.
WQQ 19.4	Wateree Flooding	Contingent upon the issuance of a 50-year license, the Wateree dam will be modified to improve the management of flooding events by removing a section of existing concrete from the dam's crest and installing a bladder dam of sufficient height and length to provide 10,000 cfs of flow release capacity with the reservoir at full pond elevation.
FWBR 11.1	State Threatened and Endangered Species Protection Plans	In addition to the species protection plans for threatened and endangered species, file species protection plans for the following: rocky shoals spider lily; Rafinesque's big-eared bat; mussels—creeper, Eastern floater, paper pondshell, Eastern creekshell, notched rainbow, brook floater, rayed-pink fatmucket; flat and snail bullheads; robust redhorse; and heron rookeries .
FWBR 11.2	Fish and Wildlife Enhancements	Provide a one-time contribution of $1 million each to North Carolina Habitat Enhancement Program (HEP), South Carolina HEP, or both, provided that the existing HEP memorandum of agreement is extended without modification in North Carolina, South Carolina, or both to cover the term of the new license.

Article Proposed in Revised CRA	Measure	Elements
SMP 18.2	Implementing Shoreline Management Plan and Guidelines Changes	File an SMP consisting of shoreline management guidelines (SMG) and shoreline classification maps with the applicant's application for a new license for the project. The applicant would begin implementing the revised SMP on September 1, 2006.
SMP 18.3	SMP Workgroup	During the first year after issuance of the new license and annually for the term of the new license, convene a workgroup of interested stakeholders for a status-reviewing meeting to discuss implementation of the SMP including SMP classification mapping and SMP permitting criteria.
SMP 18.4	Evaluation of SMG Effectiveness	In the first year after the issuance of the new license, consult with the SMP Workgroup, and prepare a basic study methodology and list of baseline review parameters with which to evaluate the effectiveness of the SMG permitting criteria in protecting nearshore and riparian habitats. Nine years after the first consultation and every 10 years thereafter for the term of the new license, complete the SMG effectiveness evaluation as a part of the SMP and RMP update cycles.
SMP 18.5	Coordination of 20-year SMG and RMP Updates	Complete the 20-year shoreline classifications map update and consider changes to the SMP, pursuant to the proposed SMP review and update procedures license article, simultaneously with the recreation use and needs assessment pursuant to the proposed recreation planning license article.
SMP 18.6	Memorandum of Understanding	In September 2006, begin contacting the counties shown in table 1 of appendix K (memorandum of understanding [MOU] between applicant, states, counties, and municipalities) of the Revised CRA and the states of North and South Carolina with an offer to jointly develop a voluntary MOU substantially in the form of the MOU template in appendix K.

Article Proposed in Revised CRA	Measure	Elements
		Complete the construction of all public recreation facilities required under the Revised CRA during the first 20 years following the Commission's approval of the RMP. Negotiate an agreement with North Carolina WRC for the maintenance of boat launching, public fishing areas, and parking facilities at the applicant's access areas in North Carolina, similar to the existing agreement, which will expire on August 31, 2008. Evaluate the need and feasibility of including wildlife viewing facilities at appropriate applicant-owned public access areas. Ensure that the shoreline of all applicant-owned access areas remains open for bank fishing, except for areas where it is restricted for safety reasons, management problems, or to avoid conflicts with other access area users.
REC 13.1 – 13.12	Additional Recreation Plan Agreements	Perform a cultural resources field evaluation of any property identified for the North Bend Recreation Land, North Access Area, Catawba-Linville River Confluence Recreation Land, Paddy Creek Recreation Land, or Overmountain Victory National Historic Trail prior to its conveyance to the state of North Carolina. The evaluation will be performed in consultation with the Park Service, Burke County, North Carolina SHPO, North Carolina DENR, and North Carolina WRC. Ensure that all applicant-owned islands located on the project reservoirs or in the regulated river reaches will remain open for the term of the new license for any permissible day-use public recreation activity such as fishing, picnicking, or hiking, except for islands that are specifically designated otherwise, or islands that are restricted by state or local public health, safety or law enforcement protection, wildlife protection, or islands that the applicant determines should be off limits due to issues related to cultural resource protection, wildlife protection or safety, or security or management concerns. Camping is authorized only on specific applicant-owned islands as noted in the applicant's SMG or RMP, or as specifically provided

Article Proposed in Revised CRA	Measure	Elements
		in any AAII lease. Provide appropriate signage at applicant-owned access areas and trails. Ensure that all facilities constructed at the applicant-owned access areas comply with Americans with Disabilities Act (ADA) requirements. A total of 3,450 acres of land owned by Crescent Resources, LLC is expected to be purchased by entities other than the applicant, with support from Duke Energy in accordance with the Revised CRA. These land areas are being purchased for public recreation purposes, or for permanent land conservation uses, or both. All lands identified to be acquired from Crescent Resources, LLC by other entities with support from Duke Energy would be under purchase option by December 31, 2007, and the purchase completed by August 1, 2009. File all AAII lease requests for applicant-owned access areas that are within the FERC project boundaries with the Commission for approval. A plan to address waterfowl hunting in the Catawba River in the vicinity of the North Bend Recreation Land, North Bend Access Area, Catawba-Linville River Confluence Recreation Land, and the Paddy Creek Recreation Land has been developed by Duke Energy, North Carolina DENR, North Carolina WRC, and North Carolina WF.

Article Proposed in Revised CRA	Measure	Elements
REC 14.0	Recreation Facility Enhancements	**Bridgewater Development** Support efforts by McDowell County to obtain trail easements to connect the Black Bear Access Area to the Lake James Loop Trail, and provide $500,000 to either Burke County or North Carolina DENR to construct up to 5 miles of the Lake James Loop Trail. Transfer or cause to be transferred 550 acres of property adjoining the Bridgewater regulated river reach, 420 acres adjoining the Catawba River downstream of the Bridgewater Development, and 275 acres downstream of the Paddy Creek and Linville dams to North Carolina DENR for public recreation and permanent conservation. Transfer 10 acres of property at the second Powerhouse Road bridge to North Carolina WRC. Provide up to $225,000 to North Carolina WRC, $125,000 to the city of Morganton, $600,000 to Burke County or North Carolina DENR, and $65,000 to the town of Glen Alpine to develop and maintain various recreational improvements, including a trailered boat access, fishing area, parking area, and a section of the Overmountain Victory National Historic Trail. **Rhodhiss Development** Acquire 50 to 100 acres of land along Wilson Creek and offer it to Caldwell County through the AAII. If leased, develop bank fishing and picnic facilities, and fund the installation of a USGS streamflow gage on Wilson Creek if the County agrees to pay for annual maintenance. Provide $125,000 to Caldwell County to develop recreational enhancements. Support the acquisition of up to 2,882 acres of property by the Foothills Conservancy or North Carolina WRC for public recreation and permanent conservation.

Article Proposed in Revised CRA	Measure	Elements
		Lookout Shoals Development Provide up to $220,000 to Catawba County or North Carolina DENR to support easement, acquisition, and development of a 50-ft-wide, 1.5-mile-long trail between Catawba County's Riverbend Park and the new Upper Shoals Access Area. **Cowans Ford Development** Offer an AAII lease to the town of Catawba or other public entity for property on the south side of Lyle Creek near Hunsucker Park. If the lease is accepted, develop picnic facilities, trail, boat access, and parking. Support Catawba County's acquisition of up to 600 acres of property at the mouth of Mountain Creek. If the property is not acquired by the County, the applicant will acquire 20 to 30 acres and develop recreational enhancements including restrooms, fishing pier, and parking. Provide technical assistance to facilitate bicycle route crossings of the FERC project boundaries and use of the applicant's access areas along the proposed Lake Norman bike route. Provide $130,000 each to the town of Davidson to develop recreational enhancements including canoe/kayak launches and fishing piers. **Mountain Island Development** Provide trails, planning, and assistance to state and local governments to connect existing multi-use trail systems in the vicinity of Mountain Island Lake.

Article Proposed in Revised CRA	Measure	Elements
		Wylie Development Provide $435,000 to Mecklenburg, North Carolina, $165,000 to CIN THPO, and $265,000 to South Carolina DPRT for the development of recreational enhancements, including parking areas and canoe/kayak access. Offer AAII leases or other leases to York County and South Carolina DPRT for various small parcels of land for marine law enforcement, sections of trail (to be developed), a recreational vehicle park, and additions to Landsford Canal State Park. Retain ownership of Simpson Island for the term of the new license. If York County acquires and develops a park on land adjoining the island, offer an AAII lease and provide up to $265,000 to York County for recreational enhancements on the land adjoining the island. **Fishing Creek Development** Provide up to $215,000 to an entity that will provide 1 to 5 acres of suitable property for a new trailered boat access area near the existing Highway 9 Access Area. **Rocky Creek and Cedar Creek Developments** Provide up to $1 million to support the development and management of the new state park on Dearborn Island if South Carolina DPRT enters into an AAII lease for the Great Falls and Cedar Creek Islands. Also offer a nominal-cost lease with South Carolina DPRT for the Great Falls/Heritage Tract complex lake management zone. **Wateree Development** Provide up to $900,000 to Kershaw County or other governmental entities to construct boat ramps, parking, and a swimming area on the east side of Lake Wateree. Transfer 800 acres of land adjoining the Heritage Tract to South Carolina DNR for public recreation and permanent conservation.

Article Proposed in Revised CRA	Measure	Elements
REC 17.4 – 17.9	Additional Public Information	Provide the following information in addition to that proposed in the public information license article: explanation that reservoir levels can vary depending on the location on the reservoir; deviations in reservoir level other than those described in the Low Inflow Protocol and Maintenance And Emergency Protocol; updates to the near-term flow forecast; frequently updated approximate times for flow release arrival and recession at Watermill Road Access Area, Morganton Greenway, Rock Hill River Park, Catawba Indian Reservation, Landsford Canal State Park, and Highway 1/Highway 601 Landing; links to USGS websites for applicable streamflow gages and groundwater monitoring wells; and adjustment of available data when operating under Low Inflow Protocol or Maintenance and Emergency Protocol.
REC 17.10	Additional Public Recreational Facility Information	Provide information to the public to support safe and effective use of public recreation facilities at the project, including signage at project access areas. Information will include maps, descriptions, schedules, safety messages, contact information, and links to weather service and state resource agency fishing, hunting, and boating regulations websites.
REC 17.11	Historic Canoe Trail Map	Develop a historic canoe trail map of the South Carolina portion of the Catawba River in consultation with CIN THPO, South Carolina DPRT, South Carolina DAH, local governments, and others.

Article Proposed in Revised CRA	Measure	Elements
REC 17.12 – 17.16	Miscellaneous Requirements	Provide public information in English and universal signage unless otherwise specified. Provide annual media advisory for newspapers to promote public awareness of the project website and toll-free phone line. Make biennial recreational activities status reports and FERC Form 80 reports available on the applicant's website. Make meeting summaries for the Catawba-Wateree Drought Management Advisory Group available on the website. At least every 5 years, review use of phone and web-based communication to determine if new, commonly accepted, reliable, and cost-effective technologies should be added or replace communications tools.
REC 17.17	Emergency Notification	Provide links with advisory topic titles to local and state government and marine commission websites that provide advisories related to reservoir or river-related issues, when requested.
REC 17.18 – 17.23	Enhancements to the FERC Public Safety Plans	Maintain appropriate warning devices for project structures, in accordance with its FERC public safety plans. Plans may be modified from time to time throughout the term of the new license. Install signage written in Spanish in the tailrace areas warning of the potential for rapidly rising water. Modify existing horns or install new horns at the Bridgewater and Oxford Developments to improve warnings of changes in river flow due to hydro station operation. Fund, install, and maintain the warning system in the vicinity of Catawba County's Riverbend Park as part of the FERC public safety plan. Consult with the park staff, revise its public safety plan, and submit it to the Commission for approval, prior to making physical changes.

Article Proposed in Revised CRA	Measure	Elements
		Revise public safety plans to incorporate Spanish signage and warning system improvements at the Bridgewater and Oxford Developments and submit to the Commission for approval. Design and install all signage at project access areas consistent with the applicant's Access Area Signage Program Guidelines.
REC 19.0	Land Conservation Support	Provide $4 million to North Carolina WRC, North Carolina DENR, or both to support purchase of agency-selected land in the Catawba-Wateree River Basin for public recreation, gamelands, or compatible permanent conservation. Provide $5.32 million to South Carolina DNR or South Carolina DPRT to support the purchase of agency-selected land in the Catawba-Wateree River Basin for public recreation, game management, or compatible permanent conservation.
REC 19.1	Facility Exclusion Zones	North Carolina WRC and South Carolina DNR will jointly evaluate each of the project dams and powerhouses to consider the user safety and project security issues associated with public use of the area in the immediate vicinity of these structures. The evaluation will determine where suitable exclusion zones within all or a portion of this area at each location can be developed to improve recreational safety and security.
REC 19.2	Trash and Debris Management	Minimize the amount of non-biodegradable trash and large woody floating debris in project reservoirs by sponsoring an annual cleanup event, installing a trashrake at Fishing Creek Development, and ensuring that non-biodegradable trash and large woody debris are disposed properly.
REC 19.3	Aquatic Weed Management	Work cooperatively with partners to manage invasive aquatic weeds in project reservoirs by providing scientific and technical assistance.

Article Proposed in Revised CRA	Measure	Elements
REC 19.4	Additional Resource Enhancements in the Event of a 50-Year License	Establish permanent conservation easements on the roughly 12.5 total bank miles of selected tributaries to the Johns River and contribute an additional $1.5 million for land conservation. Establish permanent conservation easements on 5.5 bank miles of selected portions of McDowell Creek, Cedar Creek, and Rocky Creek and their tributaries, and contribute an additional $1.5 million for land conservation. Establish permanent conservation easements, restrictive covenants, or a combination of the two for 4.7 miles on the east shoreline of Lake Wateree. Modify Lake Wateree dam to improve its ability to manage flooding events by removing a portion of the existing concrete from the dam's crest and installing a bladder dam. If the dam modification does not occur, distribute $4 million between the HEP fund and the Catawba-Wateree Basin Water Management Group fund.

2.2.4 Proposed Project Boundaries

Under the new license, Duke Energy proposes to include all of the existing and proposed project-related recreation areas in the project boundary for the Catawba-Wateree Project. The proposed boundary would include all of the facilities located within the project-related recreation areas as shown on the recreation area maps filed on October 20, 2006, in the Revised CRA. Tiles 1 through 10 of the Catawba-Wateree Public Recreation Amenities and Other Key Land Areas show the locations of these recreational facilities.

2.3 MODIFICATIONS TO THE APPLICANT'S PROPOSAL

2.3.1 Mandatory Conditions

2.3.1.1 Water Quality Certification

Under section 401 of the Clean Water Act (33 U.S.C. §1341), the Commission may not issue a license for a hydroelectric project unless the state certifying agency has either issued a water quality certification for the project or has waived certification by failing to act on a request for certification within a reasonable period of time, not to exceed 1 year. Duke Energy filed a request for certification with North Carolina DWQ and South Carolina DHEC on June 6, 2008.

2.3.1.2 Section 18 Agency Fishway Prescriptions

Section 18 of the FPA states that the Commission shall require the construction, maintenance, and operation by a license of such fishways as the Secretaries of NOAA Fisheries and Interior may prescribe.

FWS provided preliminary fishway prescriptions by letter filed on June 4, 2008, for the Catawba-Wateree Project pursuant to section 18 of the FPA. FWS reserves the authority to prescribe fishways for existing riverine fish species, any fish species (including American shad, blueback herring, American eel, shortnose sturgeon, and Atlantic sturgeon) to be managed, enhanced, protected, or restored in the Santee River Basin during the term of the license.

FWS developed the preliminary prescription for fishways in collaboration with the applicant. FWS and the applicant entered a settlement agreement know as the Santee River Basin Accord on April 9, 2008. The accord is a collaboration among utilities with licensed hydroelectric projects and federal and state natural resource agencies to address diadromous fish protection, restoration, and enhancement in the Santee River Basin. FWS states that the prescription for fishways, the Santee River Basin Accord, and the *Santee-Cooper Basin Diadromous Fish Passage Restoration Plan* (2001) are consistent, complementary, and mutually supportive. Activities developed in the accord are contained in a diadromous fish restoration plan that will enhance fishway prescription measures employed to restore diadromous fish species in the Santee River Basin. Included in the diadromous fish restoration plan are fish passage measures, enhancement activities, and supporting studies to be accomplished during the term of the new license. Target species include American shad, blueback herring, and American eel. Implementation of the diadromous fish restoration plan will be supported by FWS, South Carolina DNR, North Carolina WRC, and a technical committee.

In a letter dated June 5, 2008, NOAA Fisheries reserved its authority under section 18 of the FPA, as amended, to prescribe fishways, or such additional fishways, or to modify existing fishways at those locations and at such times as it may subsequently determine are necessary to provide for safe, timely, and effective upstream passage of diadromous fish through Catawba-Wateree Project facilities.

2.3.1.3 Section 18 Applicant's Alternative Fishways Prescriptions

The Energy Policy Act of 2005 provides parties to the Catawba-Wateree relicensing proceeding the opportunity to propose alternatives to preliminary prescriptions.

The applicant presented alternative designs and approaches to fish passage at the Catawba-Wateree Project in their document *Fish Passage Assessment, January* (2005). Alternatives designs and approaches presented by the applicant were reviewed and considered by FWS during the development of the preliminary prescriptions that were filed on June 4, 2008.

2.3.1.4 Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or cause the destruction or adverse modification of the critical habitat of such species. FWS lists several species known to occur or potentially occurring within the Catawba-Wateree Project area that are federally listed as endangered or threatened and, therefore, protected under the ESA. Species protection plans for these species have been written or updated and would be implemented within 60 days of the issuance of the license for the Catawba-Wateree Project. The species protection plans

have specific methods for monitoring each species, and determination of the effectiveness of management and conservation measures proposed for each species, including annual communication and consultation with the appropriate state and federal agencies. Our analysis of Catawba-Wateree Project effects on these species are presented in section 3.3.5, *Threatened and Endangered Species*.

2.3.2 Other Recommendations by Agencies and Interested Parties

2.3.2.1 Section 10(j) Recommendations

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project's operations. Additionally, section 10(j) states that, whenever the Commission concludes that any fish and wildlife agency recommendation is inconsistent with the purpose and the requirements of the FPA or other applicable laws, the Commission and agency must attempt to resolve any such inconsistency, giving weight to the recommendations, expertise, and statutory responsibility of the agency.

NOAA Fisheries included 10(j) recommendations in their comments in response to the Commission's ready for environmental analysis notice issued on April 7, 2008. NOAA Fisheries thinks the following recommendations are necessary: low inflow protocol; maintenance and emergency protocol; flow and water quality implementation plan; minimum flows for aquatic habitat; and the establishment of a Catawba-Wateree Project Fisheries Technical Committee and annual coordination meetings. Details of these proposed mitigation and enhancement (PM&E) measures are located in section 5.0, *Conclusions and Recommendations*, which summarizes our recommendations for adoption under the staff alternative.

North Carolina WRC filed comments and recommendations pursuant to section 10(j) of the FPA stating that they recommend the following specific proposed license articles found in appendix A of the Revised CRA as their terms and conditions: reservoir elevations; Spring Reservoir Level Stabilization Program; minimum flows; flow and water quality implementation plan; Low Inflow Protocol for the Catawba-Wateree Project; Maintenance and Emergency Protocol for the Catawba-Wateree Project; water quality monitoring plan; flow and reservoir elevation monitoring; funding for USGS streamflow gages; federal threatened and endangered species protection plans; SMP; and SMP review and update procedures. Detail of the PM&E measures are located in section 5.0, *Conclusions and Recommendations*, which summarizes our recommendation for adoption under the staff alternative.

2.3.3 Staff's Modification to the Proposed Actions

After evaluating the proposed actions, including the terms, conditions, and recommendations filed by agencies and interested parties under sections 10(a), 10(j), and 18 of the FPA, we considered what, if any, additional measures would be necessary or appropriate for the continued operation of the Catawba-Wateree Project. In addition to the applicant's proposed project-related environmental measures, we evaluate the following staff-identified measures for the Catawba-Wateree Project:

- install a bladder dam modification at Wateree dam designed as recommended in the Revised CRA;

- achieve normal target elevations and maintain reservoir levels within newly established normal minimum and normal maximum elevations unless operating in the Low Inflow Protocol or the Maintenance and Emergency Protocol to be implemented within 60 days of the issuance of a new license;
- add NOAA Fisheries and FWS as consultants for the Drought Management Advisory Group;
- consult with NOAA Fisheries on Maintenance and Emergency Protocol implementation;
- implement ramping during the increase and decrease in recreational flow releases within the time period of the scheduled recreational flows to minimize the risk to aquatic resources;
- establish an advisory group in which representatives of Duke Energy consult with federal and state resource managers and other stakeholders to evaluate and recommend appropriate mitigation for fish losses resulting from abnormal conditions;
- develop and implement a terrestrial invasive plant species management plan for Catawba-Wateree Project lands within the development boundaries in consultation from applicable agencies. The management plan would provide for (a) baseline inventory; (b) management and control for invasive terrestrial species threatening special status and rare, threatened, and endangered (RTE) species; (c) control recommendations; and (d) periodic review and consultation;
- reassess the Cowans Ford Development for eligibility for listing on the National Register when the development reaches 50 years of age. The reassessment would occur as part of the process of review for the HPMP;
- provide two additional recreational enhancements that would be included in the project boundary and in the RMP: (1) East Wateree Access, and (2) Lake Cornelius Access
- consult with FWS, state agencies, and other stakeholders to evaluate feasibility and locations for placement of wildlife viewing platforms at recreation access sites and file a plan within 1 year of license issuance for implementation;
- include all Duke Energy-owned islands that serve a project purpose or are affected by the project within the project boundary;
- expand the project boundary at all Duke Energy-owned recreation access areas to include any adjacent bank fishing areas provided by Duke Energy, except those minimal shoreline areas where bank fishing is restricted;
- provide public information related to river flow as a web page or other electronic broadcast format in a manner that provides the most up-to-date information possible; and
- revise public safety plans, while considering the need for warning devices; Spanish, English, and universal language signage; and facility exclusion zones.

2.4 OTHER ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

2.4.1 Federal Government Takeover

We do not consider federal takeover to be a reasonable alternative for the Catawba-Wateree Project. Federal takeover of the Catawba-Wateree Project would require Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is currently no evidence showing that a federal takeover should be recommended to Congress. No federal agency has suggested that federal takeover would be appropriate, and no federal agency has expressed an interest in operating the Catawba-Wateree Project.

2.4.2 Non-power License

A non-power license is a temporary license the Commission would terminate whenever it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this time, no agency has suggested a willingness or ability to do so. No party has recommended a non-power license for the Catawba-Wateree Project, and we have no basis for concluding that the project should no longer be used to generate power. Thus, we do not consider a non-power license a realistic alternative to relicensing in this circumstance.

2.4.3 Project Retirement

Project retirement could be accomplished with or without dam removal. Either alternative would require denying the relicense application and surrender or termination of the existing license with appropriate conditions. The Catawba-Wateree Project provides a viable, safe, and clean renewable source of power to the region. Catawba-Wateree Project retirement would remove this source of power. No party has suggested project retirement, and we have no basis for recommending it. Therefore, project retirement is not a reasonable alternative to the relicensing of the Catawba-Wateree Project with the appropriate enhancement measures.

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3.0 ENVIRONMENTAL EFFECTS

In this section, we first describe the general environmental setting in the Catawba-Wateree Project vicinity and any environmental resources that could be cumulatively affected by relicensing the project. Then, we address each affected environmental resource. Figures presenting each development, found in appendix A, also show land use and unique natural resources. For each resource, we first describe the existing conditions as a baseline against which to measure the effects of the proposed project and any alternative actions. After the existing conditions description, we then describe the environmental effects of the proposed project, including the proposed measure(s) discussed in section 2.2.3, *Proposed Environmental Measures*. Unless otherwise identified, the source of our information is the license application for the Catawba-Wateree Project (Duke Energy, 2007). We provide citations for information obtained from other sources including subsequent filings related to the Catawba-Wateree Project.

3.1 GENERAL DESCRIPTION OF THE CATAWBA-WATEREE RIVER BASIN

The Catawba-Wateree Project lies on the east side of the Blue Ridge Mountains in North and South Carolina and is located along an approximately 300-mile-long stretch of the Catawba River, which is a major tributary of the Wateree River. The Catawba River begins in western North Carolina and flows generally from northwest to southeast from its headwaters in the steep, mountainous Blue Ridge Province through the Piedmont Province. The Catawba River joins Big Wateree Creek to form the Wateree River in the Coastal Plain physiogeographic region of South Carolina. The drainage basin is relatively narrow, ranging from 11 to 39 miles wide (average 27 miles) and has a watershed of approximately 4,750 sq mi.

The Catawba-Wateree Project area and the surrounding region can be characterized generally as rolling hills, with elevations ranging from 1,200 ft msl at the Bridgewater Development, to approximately 80 ft msl at the confluence of the Wateree and Congaree Rivers, which is the downstream terminus of the project's operational influence.

The Blue Ridge scarp varies in elevation from 1,200 to 2,500 ft in the upper drainages of the Catawba-Wateree Project at the Bridgewater Development and is the eastern boundary of the Blue Ridge physiogeographic province. The Blue Ridge is a mountain plateau bounded by two mountain chains. The Blue Ridge Mountains on the east range from 3,000 to 4,000 ft in elevation, although a few peaks reach almost 6,000 ft. On the western boundary are the Unaka and Great Smoky Mountains with elevations that range from 3,000 to 6,000 ft. Transverse ridges and broad valley floors are located between the two mountain chains. In this region of the watershed, the majority of the Catawba-Wateree Project area is generally characterized by oak-hickory forests and valleys interspersed with scattered homes and small farms; although it is predominantly rural, development in this region of the watershed is increasing.

The Piedmont Province is located between the Blue Ridge scarp to the west and the Fall Line to the east, descending gradually in elevation to 600 to 800 ft at the Fall Line. The terrain is composed of gently rolling, well-rounded hills, and long, low ridges. The Piedmont was intensively farmed in the past, and former agricultural fields are in various stages of succession or have been converted to managed pine plantations. The Piedmont portion of the watershed is more extensively developed than the Blue Ridge scarp region. Considerable development is centered around the city of Charlotte, with additional development clustered in and around the cities of Morganton, Hickory, Mooresville, and Gastonia in North Carolina, and Rock Hill and

Lancaster in South Carolina. All of the major structures of the Catawba-Wateree Project lie within the Piedmont Province.

The Coastal Plain meets the Piedmont along the Fall Line where soft sedimentary rocks of the Coastal Plain intersect with the harder, crystalline rocks of the higher elevation Piedmont. Along the Catawba River, the Fall Line occurs at the Wateree Development, and the Coastal Plain lies south and east of the Wateree Development. The Coastal Plain contains the majority of the Wateree regulated river reach to the confluence with the Congaree River. From this point downstream, the Catawba River passes through a relatively short stretch of the Carolina Sandhills region before it continues into the lower elevations of the Coastal Plain. In general, topography within the Coastal Plain is relatively flat, resulting in slow-flowing streams and poor drainage. The lower portion of the watershed supports some development, but is generally more rural in character than the Piedmont region.

The forested areas bordering Catawba-Wateree developments have been logged or burned at least once and consist of secondary growth. Land use within the Catawba River Basin varies greatly, but is generally a mix of timber harvesting, forest, agricultural, and developed lands. Large scale residential development, or commercial development, or both have occurred at the Cowans Ford, Wylie, Fishing Creek, and Wateree Developments.

Based on average meteorological data for Charlotte, North Carolina, and Columbia, South Carolina, the Catawba River Basin region has hot summers and cool winters with precipitation distributed evenly throughout the year (rssWeather, 2008a and 2008b). Summer high temperatures are normally near or above 90°F, and winter high temperatures near 55°F. Low temperatures are generally near 70°F in the summer and 35°F during the winter. Average precipitation ranges from 3 to 4 inches (in.) in Charlotte, North Carolina, to 3 to 6 in. in Columbia, South Carolina. There is not a distinct dry or wet season, although fall is normally the driest period of the year. On occasion in the summer or fall, hurricanes or their remnants from the Atlantic Ocean and the Gulf of Mexico can produce high rainfall events that result in high flows.

3.2 CUMULATIVELY AFFECTED RESOURCES

According to the Council on Environmental Quality's regulations for implementing the NEPA (50 Code of Federal Regulations [C.F.R.] §1508.7), an action may cause cumulative impacts on the environment if its impacts overlap in space or time with the impacts of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

The Catawba-Wateree Project is operated as a coordinated, "stair-step" system and flows released from the upstream Catawba-Wateree Project developments in turn influence the water level, quality, and aquatic resources of the downstream developments. This influence is felt throughout the length of the Catawba-Wateree Project to the confluence with the Congaree River in South Carolina. Operations are primarily based on prevailing hydrologic conditions, license requirements, and regional power needs.

Based on information in the license application, agency comments, other filings related to the Catawba-Wateree Project, and preliminary staff analysis, we identified the following

resources that have the potential to be cumulatively affected by the continued operation of the Catawba-Wateree Project, in combination with other activities: water, geology and soils, aquatic resources, fisheries, recreational, and land use and aesthetics.

3.2.1 Geographic Scope

The geographic scope of analysis defines the physical limits of the Catawba-Wateree Project and encompasses the project boundary (the main stem of the Catawba and Wateree Rivers and lands adjacent to the Catawba-Wateree Project) including all mainstem reaches between project developments and the 77 miles of the Wateree River downstream of the Wateree development to the confluence with the Congaree River. We chose this geographic scope because this reach of the Catawba and Wateree Rivers encompasses the entire set of project facilities, plus those reaches of the river and other facilities on the river that affect or are affected by the operation of this project.

3.2.2 Temporal Scope

The temporal scope of our cumulative analysis in the EIS includes a discussion of past, present, and future actions and their effects on each resource that could be cumulatively affected. Based on the terms of the new license requested by Duke, the temporal scope looks 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion is limited by the amount of information available for each resource.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

3.3.1 Geology and Soils

3.3.1.1 Affected Environment

Geology

From northwest to southeast, the geologic belts crossing the Catawba-Wateree drainage basin are Blue Ridge, Chauga, Inner Piedmont, Kings Mountain, Charlotte, and Carolina slate belts. Inner Piedmont, Charlotte, and Carolina slate belts underlie the major structures and reservoirs of the majority of the Catawba-Wateree Project. Sediments of the Coastal Plain overlap the Carolina slate belt south and east of the Wateree Development and underlie the majority of the Wateree regulated river reach to the Congaree River.

The Bridgewater, Rhodhiss, Oxford, and Lookout Shoals Developments are located within the Inner Piedmont belt in North Carolina. The western and northwestern reaches of Lake James are underlain by rocks of the Chauga and Blue Ridge belts. Rock units mapped in the vicinity of the developments include a variety of medium- to coarse-grained types that include granitic gneiss, augen gneiss, biotite gneiss, mica schist, garnet mica schist, sillimanite-mica schist, Toluca granite, amphibolite, ultramafic rocks, quartz-feldspar gneiss, and pegmatite. Alluvium in the Bridgewater and Lookout Shoals Developments consists of sand and silt deposits in the flood plains of major streams.

The Cowans Ford, Mountain Island, Wylie, Fishing Creek, Great Falls, Dearborn, Rocky Creek, and Cedar Creek Developments are located in South Carolina within the Charlotte belt, with the exception of the northern reaches of Lake Norman, which is underlain by rocks of the

Kings Mountain belt. Rock units mapped in the vicinity of the developments include granite, granitic gneiss, metagranite, diorite, gabbro, ultramafic rocks, mafic dikes (diabase), gabbro, metagabbro, metadiorite, meta-quartz monzonite, metatonalite, and felsic and mafic metavolcanics.

The Wateree Development is located in South Carolina within the Carolina slate belt. Rocks in the vicinity are felsic and mafic tuffs, argillite, flood plain deposits, and the Middendorf formation of the Coastal Plain Province.

Details on the geology found within each development are included in the license application (Duke Energy, 2007).

Seismicity

Historically, earthquakes have occurred within all three physiogeographic provinces. Within the Blue Ridge Province, three major earthquakes have occurred: Giles County, Virginia; Skyland, North Carolina; and Mitchell County, North Carolina in 1897, 1916, and 1926, respectively. Microearthquakes related to seismic activity in an epicentral zone related to an 1897 Giles County, Virginia, earthquake continue to the present. Most activity is located at mid-crust depths of approximately 5 to 9 miles.

Earthquakes in the Piedmont Province have occurred in central Virginia and South Carolina, though South Carolina has been seismically less active than Virginia. The largest earthquakes in the Piedmont occurred in 1861 in Wilkesboro, North Carolina, and in Union County, South Carolina, in 1913. Seismic activity in the Piedmont occurs at shallow depths in the upper crust from near surface to approximately 9 miles, with an average of 5 miles.

The Coastal Plain Province has experienced one major earthquake: the Charleston, South Carolina, earthquake of 1886. Only a few scattered earthquakes have occurred outside of Charleston.

Soils on slopes can be subject to flow or settling (liquefaction) during major earthquakes causing structures on the soils to move or fail. Generally, only alluvial soils are susceptible to liquefaction associated with earthquakes. The southeastern United States has experienced induced seismic activity related to Piedmont reservoirs and liquefaction. Although no reservoir-induced seismicity has occurred at any of the lakes or reservoirs of the Catawba-Wateree Project, several semi-hydraulic embankment structures at the Bridgewater, Lookout Shoals, Mountain Island, and Wateree Developments are partially underlain by alluvial soils. Stability berms have been constructed at the Wateree and Bridgewater Developments. Lookout Shoals and Mountain Island Developments will be scheduled for future analysis and stability construction projects if the embankments at the developments do not meet the Commission's criteria. The structures of remaining developments have no risk due to liquefaction. The current or future seismic stability construction for the applicable Catawba-Wateree projects is not a part of the analysis for this license application and is not addressed further in this document.

Soils

In general, soils within the Catawba-Wateree Project are well-drained, clayey or loamy soils and subsoils formed from the weathering of metamorphic or igneous rocks such as granite, gneiss, and schist. Appendix C provides a list of dominant soil types within each development, their composition, and their erosion factors. Most soil types are found in uplands with gentle to steep sloped topography or ridges. The Middle Catawba River Basin is characterized by flatter

terrain, highly erodible soils, and moderate river gradients. The Wateree Development and the Wateree regulated river reach are within the Carolina slate belt and have clayey soils that are primarily derived from slate, or alluvial deposits, or both on the flood plain. These soils and soils along streams and drainages are generally poorly drained.

The Bridgewater, Cowans Ford, and Wylie Developments have recently seen a steady increase in the number of non-project-related leases and docks built along the shoreline. Analysis of cultural resources has revealed severe erosion along the island shorelines in Lake James and Lake Wylie.

Reservoir Sedimentation

Historically, the river has carried a heavy sediment load, as evidenced by the numerous mid-channel islands found in the Piedmont and Coastal Plain sections of the river. Land use has been a major factor in affecting the sediment yield of the river. The undeveloped, forested watershed draining to Lake James in the Bridgewater Development has typically exhibited the lowest sediment yields. Increased agricultural land use in the Piedmont and Coastal Plain creates a greater sediment yield to the Catawba River in those regions. More erodible, alluvial soils of the Coastal Plain exacerbate sediment loading in the southern section of the river where the Wateree Development, as the lowest reservoir in the system, typically has the highest sediment yield.

Each of the 11 reservoirs along the Catawba-Wateree Project operates as a silt trap, disrupting the normal stream sediment continuity. Downstream of each dam, the upper tailwaters are typically scoured, with sand and fine sediment carried downstream and deposited in the lower riverine stretches of the next downstream impoundment. Lake James is an exception due to low seepage flows, frequent beaver dams, and sedimentation occurring downstream of the dam. Despite the sediment trapping action of the dams, the Catawba River has been stable over the project's existence, exhibiting only localized aggradation (sediment deposition) or degradation (stream bed erosion). The high sediment yield from Piedmont and Coastal Plain watersheds prevents excess erosion and lowering of the river profile. Dam operations have typically provided adequate flows to maintain stable channel morphology.

Some dredging operations have occurred around public water intake structures outside of project boundaries.

3.3.1.2 Environmental Effects

Geology

Because the issuance of the new license would not involve new construction or ground-disturbing activities, we have not identified substantive issues related to geology. Seismic stability construction projects have occurred or may occur at developments within the Catawba-Wateree Project, and analysis of those activities occurs outside of the relicensing process.

Shoreline Erosion

A 4-ft winter draw-down has been proposed for the Bridgewater Development and a 2.5-ft winter draw-down has been proposed for the Wateree Development. Sediments exposed during the draw-down are susceptible to erosion when exposed to wind and wave action.

Our Analysis

The SMP and North Carolina's 50-ft buffer rule, which requires maintaining and protecting existing 50-ft-wide vegetated riparian (shoreline) areas along the mainstem Catawba River below Lake James and around the seven lakes in North Carolina, would minimize non-project-related erosion of shorelines and resulting sedimentation of the reservoirs. The planned winter draw-downs have the potential to expose non-vegetated shorelines in the lake. These non-vegetated shorelines are susceptible to erosion, and routine monitoring is recommended. Boat traffic and recreational use would be low during the draw-down period. Exposed shoreline soil would be subject to wind-wave erosion. Slowly reducing the rate of the flow ("ramping") during the draw-down period will reduce the likelihood of erosion downstream of the reservoirs by reducing the force of water on the stream banks. Avoiding winter drawdowns, while appropriate at some reservoirs, would have a drastic impact on hydropower operations and other aspects of the agreement, in this case. We conclude that developing ramping rates and a shoreline monitoring plan would provide for adequate protection from shoreline erosion. Where erosion appears, a more detailed investigation should be undertaken, and if necessary, an erosion repair and control plan should be developed.

Sediment Deposition

Duke Energy's model of the reservoir system, which we discuss in section 3.3.2.2., *Water Resources Environmental Effects*, shows that the current rate of sedimentation of project reservoirs would not adversely affect project operations during the next 50-years. Duke Energy has proposed in the Revised CRA, but not as license articles, to provide the following measures in order to protect water quality and aquatic resources, but they would also contribute to a reduction in reservoir sedimentation.

- Provide $9.32 million for North Carolina and South Carolina resource agencies to purchase land in the Catawba-Wateree River Basin for public recreation, gamelands, or permanent conservation.
- Contribute $154,000 annually through the Water Management Group to a water quality and quantity improvement fund, which can include sedimentation reduction projects.
- Protect 34 bank miles of the Johns, Linville and Catawba Rivers by providing 100-ft riparian buffers as perpetual conservation easements.
- Provide $1 million of funding to each state's HEP that can be used for land conservation.

Duke Energy has also teamed with the Muddy Creek Watershed Restoration Initiative to reduce sedimentation to Lake Rhodhiss.

Our Analysis

The applicant is involved in efforts that could help reduce sediment loads to the impoundments. The measures proposed by Duke Energy primarily for water quality and aquatic resources protection would provide minor ancillary benefits for erosion and sediment control. Otherwise, there is little that Duke Energy can do independently or directly to reduce sedimentation because the sources are largely outside of the project boundary. Duke's modeling indicates that sedimentation rates are not a threat to the uses outlined in the Revised CRA. If

sedimentation affects safe yield for water suppliers in the future, the Water Management Group and CHEOPS model[9] provide effective tools for addressing the issue.

River Bank Erosion

Bank erosion has been raised as an issue downstream of the Wylie and Wateree Developments. Downstream of Lake Wylie, stream banks along tribal lands owned by CIN are described by Interior as undercut and destabilized. Duke Energy has proposed continuous minimum seasonal flow and pulsing operations at the Wylie dam for recreational flows. Pulsing operations have the potential to increase stream bank erosion due to fluctuating river flows, velocities, and water level. Interior considers, "continued project operations without concurrent protection of these federal lands…a gradual, inevitable taking of Indian Lands." Interior has requested that Duke Energy consult with CIN and BIA to develop a stream bank erosion study and management plan within 1 year of license issuance or effective date, whichever is later. Interior recommends that the plan require stream bank stabilization and restoration measures by Duke Energy to a degree acceptable to CIN and BIA.

The South Carolina SHPO has reported on active erosion at several historic Native American sites. The most important of these is the Mulberry Site, a privately owned historic village and complex of mounds listed in the National Register, which is located downstream of the Lake Wateree dam. We discuss Duke Energy's proposed mitigation for the Mulberry Site, in section 3.3.7, *Cultural Resources*.

Our Analysis

The existing operations of the Catawba-Wateree Project are not directly or adversely altering downstream river morphology. Recreational flows proposed for the Wylie and Wateree Developments could adversely affect stream bank erosion at these sites discussed above; however, the proposed recreational flows are well within the historic range of operational releases and storm flows and are unlikely to further affect a system which has adapted to river level fluctuations over the past 70 years. Initiating recreational flows with a gradual increase in flow eventually achieving the target recreational flow over time (ramping) would reduce the force of the water flow on stream banks and result in reducing the potential for erosion.

3.3.1.3 Cumulative Effects

Sedimentation of reservoirs will continue through the next 50-years for the Catawba-Wateree Project. Development and urbanization within the Catawba-Wateree watershed, particularly along shorelines of reservoirs, rivers, and their tributaries, will continue to have the potential to increase sediment yield where erosion of disturbed, unvegetated, erodible soils occurs in association with human activities. The applicant is a participant in several efforts (described above) that may result in modest reductions in sediment delivery.

3.3.1.4 Unavoidable Adverse Effects

Erosion of shoreline soils resulting from wind-driven waves and high rainfall that will occur as isolated meteorological events will continue. Implementation and enforcement of the SMP will lessen shoreline erosion through improved shoreline protection by means of vegetated

[9] CHEOPS™ (Computer Hydro Electric Operations and Planning Software) is a proprietary software program that assesses the effects of simulated hydroelectric project operating conditions on flows and reservoir levels.

buffers and development restrictions. To some degree this process is unavoidable given the nature of hydropower operations. Because this process can be ubiquitous, only the significant erosion problems identified through monitoring are likely to be addressed. Much of the sedimentation affecting the reservoirs will be unavoidable given the complexity and cost of addressing the problem and the fact that most of the sediment originates from outside of the project boundary.

3.3.2 Water Resources

3.3.2.1 Affected Environment

3.3.2.1.1 Water Quantity

The Catawba-Wateree Project uses water from the Catawba River and Wateree River Basins to generate electricity (see figures 1 and 2). The Catawba River drains a portion of the eastern slopes of the Blue Ridge Mountains in western North Carolina and some of the Piedmont area of North Carolina and South Carolina, including most of the urban area of Charlotte, North Carolina. The Catawba River merges with several creeks south of Great Falls, South Carolina, to form the Wateree River, which drains the sand hills and upper Coastal Plain of South Carolina. The total project drainage area at the furthest downstream development, Wateree, is 4,750 sq mi. Below the Wateree Development, the Wateree River flows for 77 miles to the confluence of the Congaree River, which flows into the headwaters of Lake Marion on the Cooper River, which flows to the Atlantic Ocean. Flow at each development is highly influenced by the flow at the upstream development, as illustrated by the flow duration curves in figure 3.

Table 6 summarizes the characteristics of the 11 project reservoirs considered in this draft EIS. There are no existing license restrictions for water surface elevations in any of the reservoirs. Within the limitations of available streamflow, Duke Energy operates the reservoirs in accordance with voluntary guide curves, which are constant throughout the year for most reservoirs (see table 7) but vary seasonally at Lake James (figure 4), Lake Norman (figure 5), and Lake Wateree figure 6. Minimum flow requirements under the existing license are summarized in table 8.

Lake James, the uppermost reservoir, is one of four storage reservoirs in the project, Lake Norman, Lake Wylie, and Lake Wateree being the other three. Duke Energy operates the Bridgewater Development in a store-and-release mode to meet reservoir elevation targets in Lake James (see the guide curves in figure 4 and table 8) and to provide flow to meet elevation targets in downstream reservoirs. Under the Spring Lake Level Stabilization Program, Duke Energy voluntarily attempts to maintain water levels in Lake James during the spring spawning period for bass within a range of 1 ft below to 2 ft above the level on the first day of the program. Duke Energy initiates the program on Lake James 14 days after the program begins on Lake Wateree and continues the program for 3 weeks. Figure 7 shows water level elevations in Lake James for a dry year, 1986, normal year, 1993, and wet year, 1983, as selected for hydrologic modeling conducted by Duke Energy. Table 9 provides monthly inflow exceedances for the Bridgewater Development; that is, the percent of time during a month that flows exceed a given rate (cfs). Water released from the Bridgewater powerhouse travels about 0.85 mile down the Linville River before entering the Catawba River, which then flows for about 13 miles to Lake Rhodhiss.

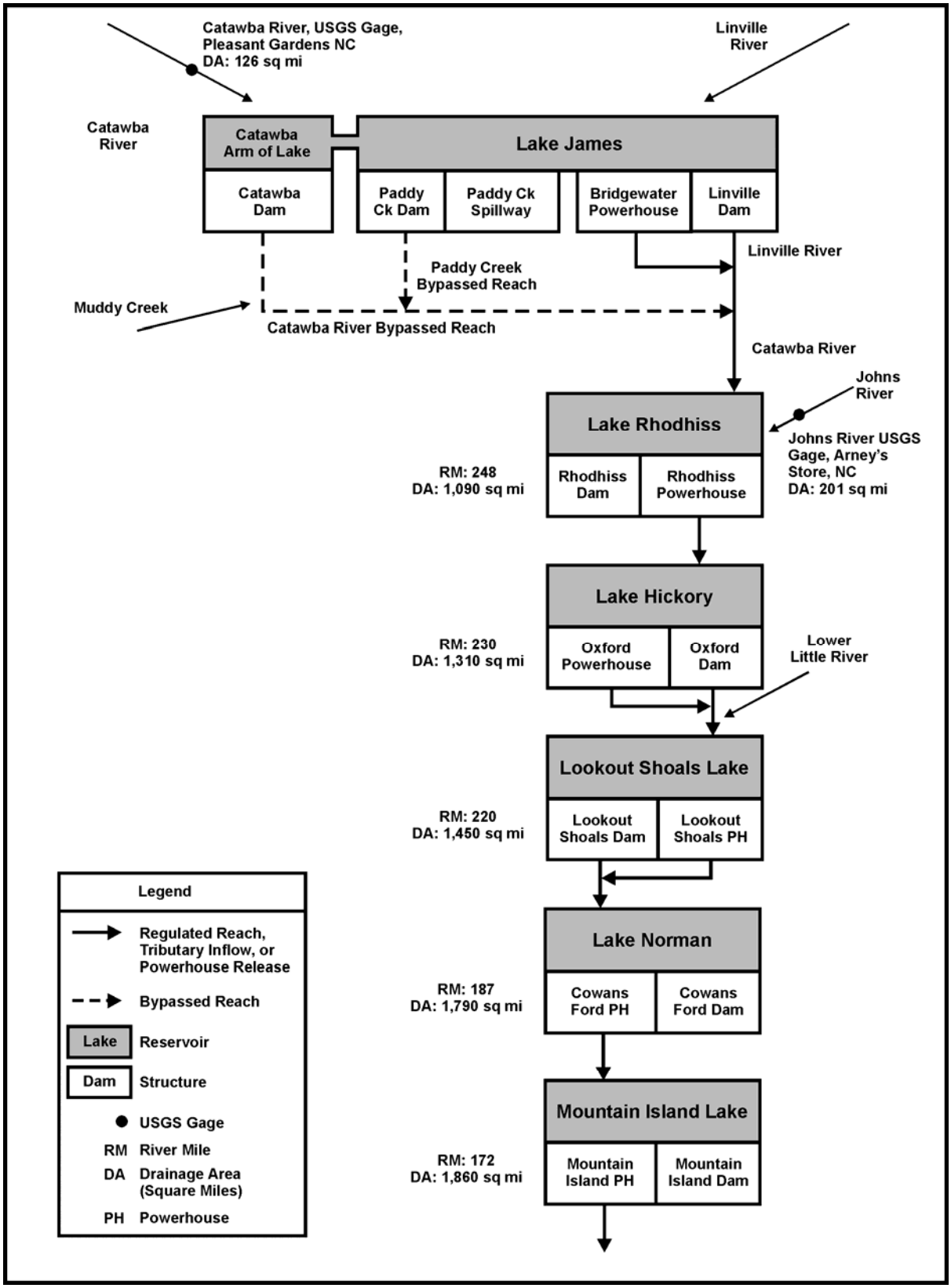

Figure 2. Catawba-Wateree Project (P-2232) facilities flow diagram.

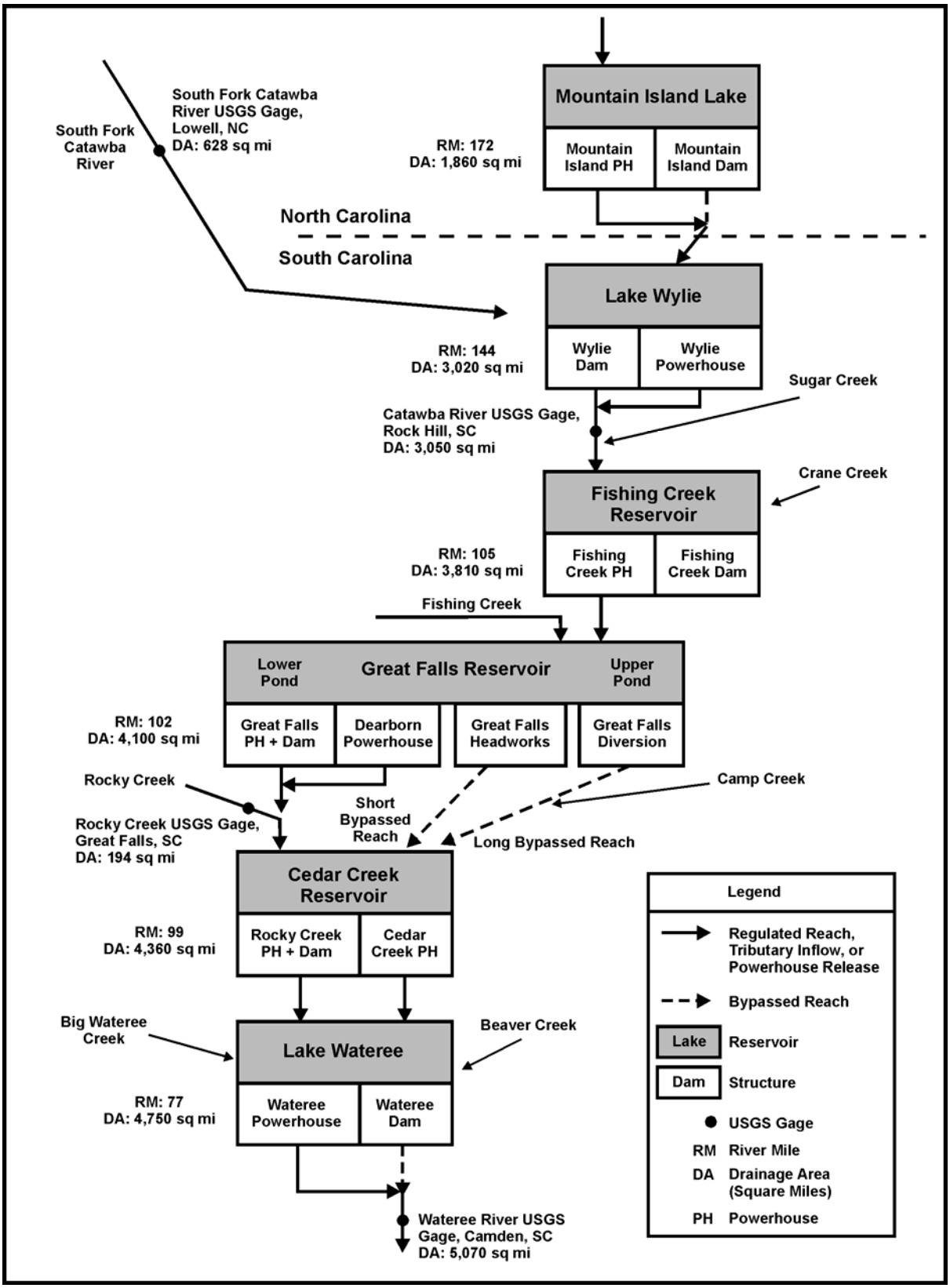

Figure 2. Catawba-Wateree Project (P-2232) facilities flow diagram (continued).

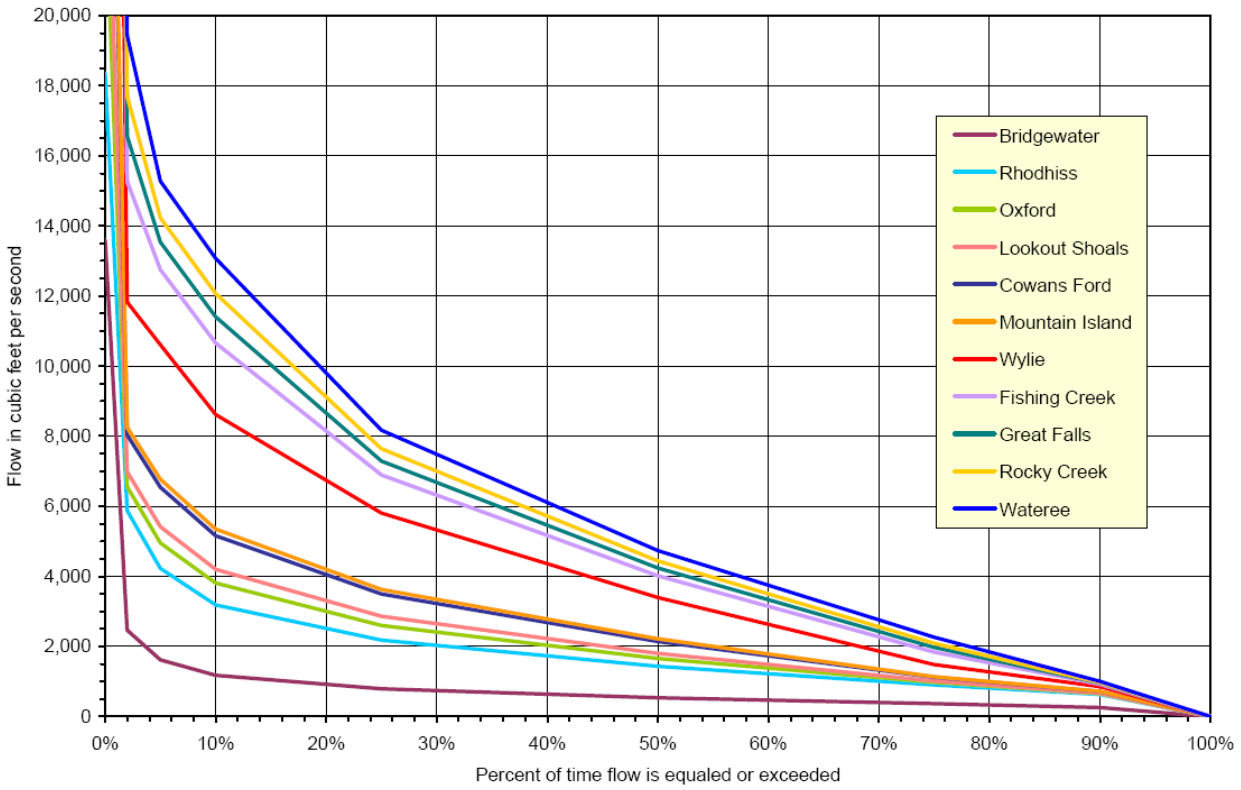

Figure 3. Flow duration curves for project developments (Source: Duke Energy, 2007).

Table 6. Reservoir characteristics for the Catawba-Wateree Project (P-2232). (Source: Duke Energy, 2007)

Lake/reservoir	River mile of dam[1]	Drainage area (sq mi)	Normal maximum water surface elevation (ft USGS)	Normal minimum water surface elevation (ft USGS)	Surface area[2] (acres)	Average and maximum depths (ft)	Usable storage[3] (acre-feet)	Average annual release (cfs)
James	279.60	380	1,200.0	1,190.0	6,754	44/141	57,349	676
Rhodhiss	248.00	1,090	994.1	990.1	2,724	21/48	7,097	1,760
Hickory	230.00	1,310	934.0	931.5	4,072	31/85	9,834	2,022
Lookout Shoals	220.30	1,450	837.1	834.6	1,155	25/79	2,138	2,189
Norman	186.90	1,790	760.0	750.0	32,339	33/110	298,142	2,594
Mountain Island	171.50	1,860	647.0	643.5	3,117	18/58	10,146	2,677
Wylie	143.50	3,020	568.4	564.4	12,177	23/93	40,145	4,059
Fishing Creek	104.80	3,810	416.2	412.2	3,431	24/90	11,159	4,878
Great Falls	101.50	4,100	355.3	349.8	353	5/75	1,966	5,177
Cedar Creek	99.30	4,360	283.9	280.9	748	29/35	2,190	5,444
Wateree	76.85	4,750	224.5	218.5	13,025	23/64	65,568	5,846

[1] Measured from the confluence of the Wateree and Congaree Rivers.
[2] At normal maximum water surface elevation.
[3] Between normal maximum and normal minimum water surface elevations.

Table 7. Target reservoir water surface elevations (ft msl) for Catawba-Wateree Project. (Source: Duke Energy, 2007)

Reservoir	**Full pond elevation**	**Normal minimum**	**Normal target**	**Normal maximum**
James	See figure 4			
Rhodhiss	995.1	990.1	992.1	994.1
Hickory	935.0	931.5	932.0	934.0
Lookout Shoals	838.1	834.6	836.1	837.1
Norman	See figure 5			
Mountain Island	647.5	643.5	644.5	647.0
Lake Wylie	569.4	564.4	566.4	568.4
Fishing Creek	417.2	412.2	414.2	416.2
Great Falls	355.8	349.6	353.3	355.3
Cedar Creek	284.4	280.9	281.9	283.9
Wateree	See figure 6			

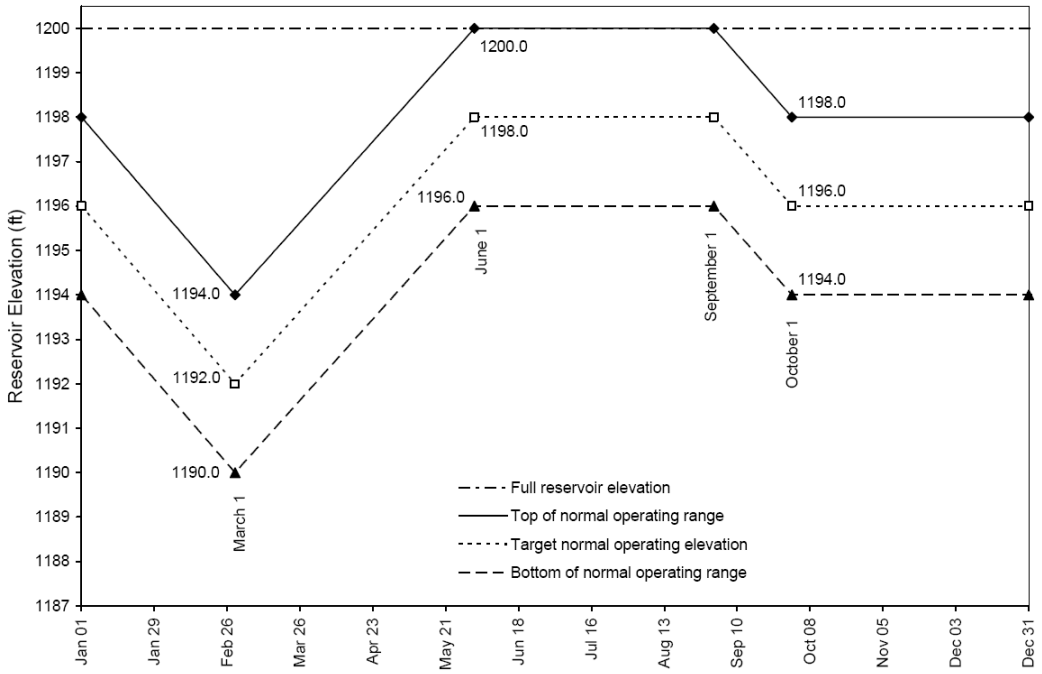

Figure 4. Lake James existing guide curves (Source: Duke Energy, 2007).

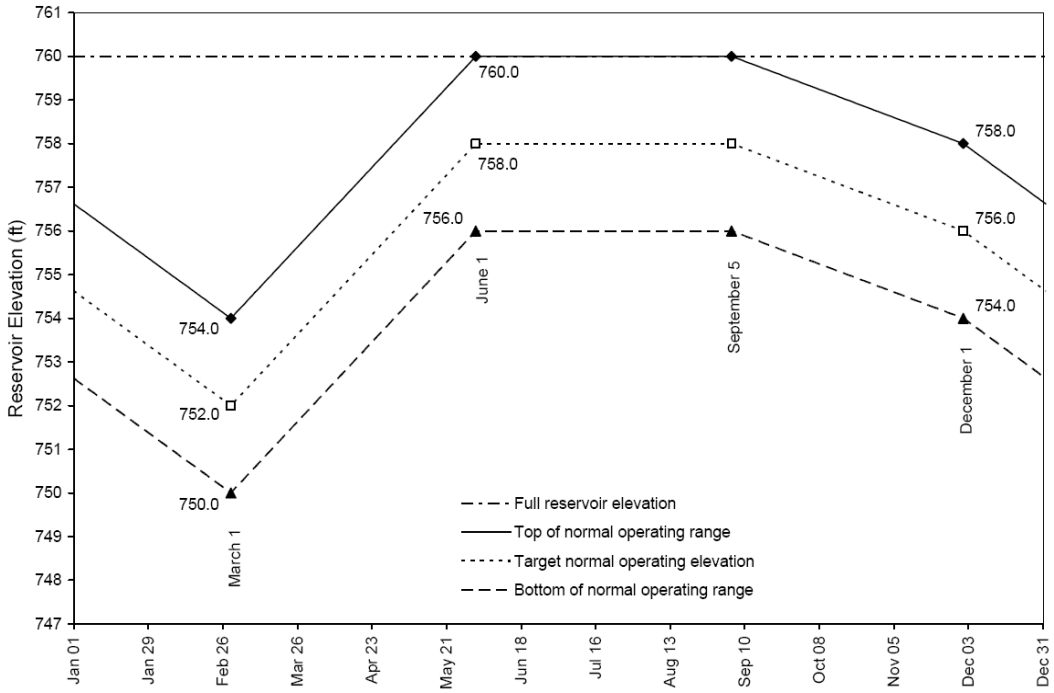

Figure 5. Lake Norman existing guide curves (Source: Duke Energy, 2007).

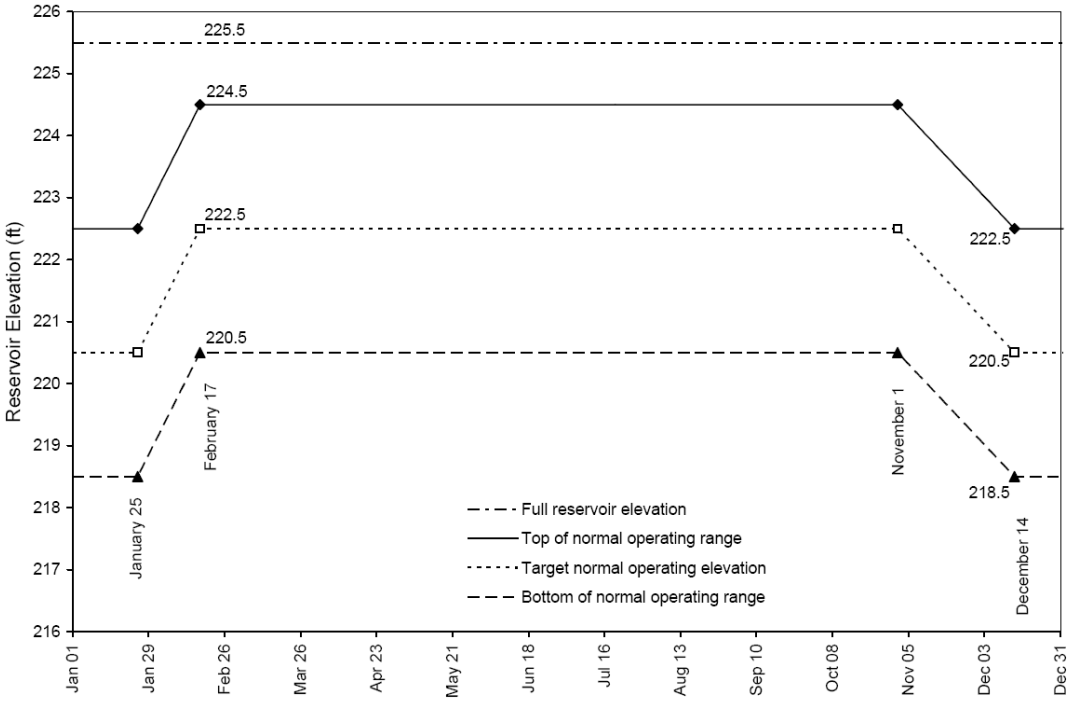

Figure 6. Lake Wateree existing guide curves (Source: Duke Energy, 2007).

Table 8. Existing License discharge requirements for Catawba-Wateree Project (P-2232). (Source: Duke Energy, 2007)

Development(s)	Reach	Length (miles)	Minimum flow (cfs)	Duke Energy's mechanism for meeting flow requirement
Bridgewater	Linville/Catawba River	13.8	25 continuous	wicket gate leakage
			66 daily average	one unit run at efficiency load as necessary
	Catawba Bypassed Reach	5.6	NA	
	Paddy Creek Bypassed Reach	0.5	NA	
Rhodhiss	Tailwater/backwater	--	40 continuous	wicket gate leakage
			225 daily average	one unit run at efficiency load as necessary
Oxford	Tailwater	2.8	40 continuous	wicket gate leakage
			261 daily average	one unit run at efficiency load as necessary
Lookout Shoals	Tailwater	0.3-1.3 [1]	60 continuous	one small generating unit run all day
			278 daily average	one unit run at efficiency load as necessary
Cowans Ford	Tailwater/backwater	--	80 continuous	wicket gate leakage
			311 daily average	one unit run at efficiency load as necessary
Mountain Island	Tailwater/backwater	--	80 continuous	wicket gate leakage
			314 daily average	one unit run at efficiency load as necessary
	Bypass	0.6	NA	
Wylie	Tailwater/regulated reach	25.6	411 daily average[2]	one unit run at efficiency load as necessary
	Lansford Canal	1.4	NA	
Fishing Creek	Tailwater/backwater	--	440 daily average	one unit run at efficiency load as necessary
Great Falls and Dearborn	Tailwater/backwater	--	444 daily average	one unit run at efficiency load as necessary
	Great Falls Long Bypassed Reach	2.2	NA	
	Great Falls Short Bypassed Reach	0.8	NA	
Cedar Creek and Rocky Creek	Tailwater/backwater	--	445 daily average	one unit run at efficiency load as necessary

Development(s)	Reach	Length (miles)	Minimum flow (cfs)	Duke Energy's mechanism for meeting flow requirement
Wateree	Tailwater/regulated reach	76.8	446 daily average[3]	one unit run at efficiency load as necessary
	Spillway channel bypass	0.4	NA	

[1] Depending on Lake Norman drawdown.
[2] Duke Energy also voluntarily provides 700 cfs continuous flow for industrial users.
[3] Duke Energy also voluntarily provides 200 cfs continuous flow, March 15 – May 31, to support fish spawning.
NA = not applicable, i.e., no existing license requirement.

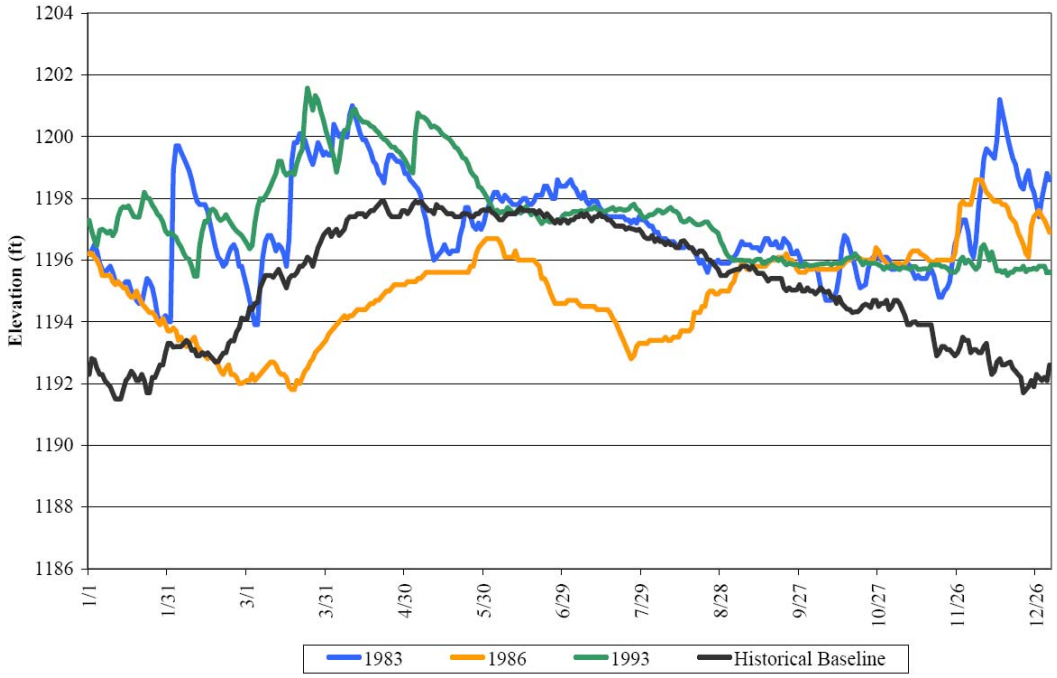

Figure 7. Lake James water surface elevations for representative dry (1986), normal (1993), and wet (1983) years (Source: Duke Energy, 2007).

Table 9. Rates of inflow (cfs) to Lake James that are equaled or exceeded given percentages of time.[1] (Source: Duke Energy, 2007)

Month	10%	25%	50%	75%	90%
January	1,314	878	626	452	344
February	1,430	973	687	513	382
March	1,571	1,046	749	562	429
April	1,481	999	720	540	419
May	1,088	795	586	449	339
June	946	670	498	363	266
July	764	565	415	307	224
August	793	533	391	288	201
September	767	486	354	254	181
October	989	562	366	249	168
November	983	637	429	309	225
December	1,048	734	530	375	273

[1] For 1930 through 2000.

Rhodhiss dam is 32 miles downstream from Linville dam. Sixty-five percent of the drainage area to Lake Rhodhiss enters the system below the Bridgewater Development. Flow to the Rhodhiss Development is proportionately higher, therefore, than flow to the Bridgewater Development (see figure 3). Lake Rhodhiss is a long, narrow reservoir with limited storage capacity; figure 8 displays water elevations in representative years. Water released from the Rhodhiss Development flows directly into Lake Hickory and provides about 87 percent of the lake's inflow. Lake Hickory is also a long, narrow reservoir with limited storage capacity; typical operating elevations are displayed in figure 9. Water released from the Oxford Development flows for 2 miles in the Catawba River before entering the headwaters of Lookout Shoals Lake. Inflow to Lookout Shoals Lake consists primarily of the outflow of the Oxford Development, which controls 90 percent of the Lookout Shoals drainage area. Discharge from Lookout Shoals flow 0.3 -1.3 miles to the head of Lake Norman depending on the water surface elevation in Lake Norman.

Lake Norman is the largest project reservoir, with a usable storage capacity that exceeds the combined capacities of all the other reservoirs. Releases from Cowans Ford Development, therefore, are used to augment generation flows for downstream project developments. About 85 percent of the inflow to Lake Norman comes from the Lookout Shoals discharge. Under the existing guide curves for Lake Norman, the normal operating target elevation is highest during the summer, after which it drops gradually throughout the fall to the beginning of the winter draw-down on December 1 (figure 5). The target elevation then drops by 4 ft throughout the winter to March 1, providing storage for spring runoff. Under the voluntary Spring Lake Level Stabilization Program, Duke Energy maintains water levels in Lake Norman during the spring spawning period for bass within a range of 1 ft below to 2 ft above the level on the first day of the program. Duke Energy initiates the program on Lake Norman 8 days after the program begins on Lake Wateree and continues it for 3 weeks. Figure 10 shows water surface elevations on Lake Norman in representative years. Water released from the Cowans Ford dam or powerhouse flows directly into the tailrace of Mountain Island Lake.

Inflow to Mountain Island Lake is highly regulated by the Cowans Ford Development, which controls 96 percent of its drainage area. Water is released from the Mountain Island powerhouse into the tailrace channel constructed in a secondary channel of the Catawba River. The Mountain Island Development controls about 62 percent of the drainage area of the Wylie Development, with Dutchman's Creek, South Fork Catawba, Crowders Creek, and Allison Creek and other minor tributaries draining the incremental area. Table 10 provides monthly inflow exceedance statistics, and figure 11 shows water surface elevations on Lake Wylie in representative years. Duke Energy maintains water levels in Lake Wylie during the spring spawning period for bass within a range of 1 ft below to 2 ft above the level on the first day of the voluntary Spring Lake Level Stabilization Program. Duke Energy initiates the program on Lake Wylie 2 days after the program begins on Lake Wateree and continues it for 3 weeks. Water is released from Lake Wylie to the Catawba River about 25 miles above the headwaters of the Fishing Creek Development.

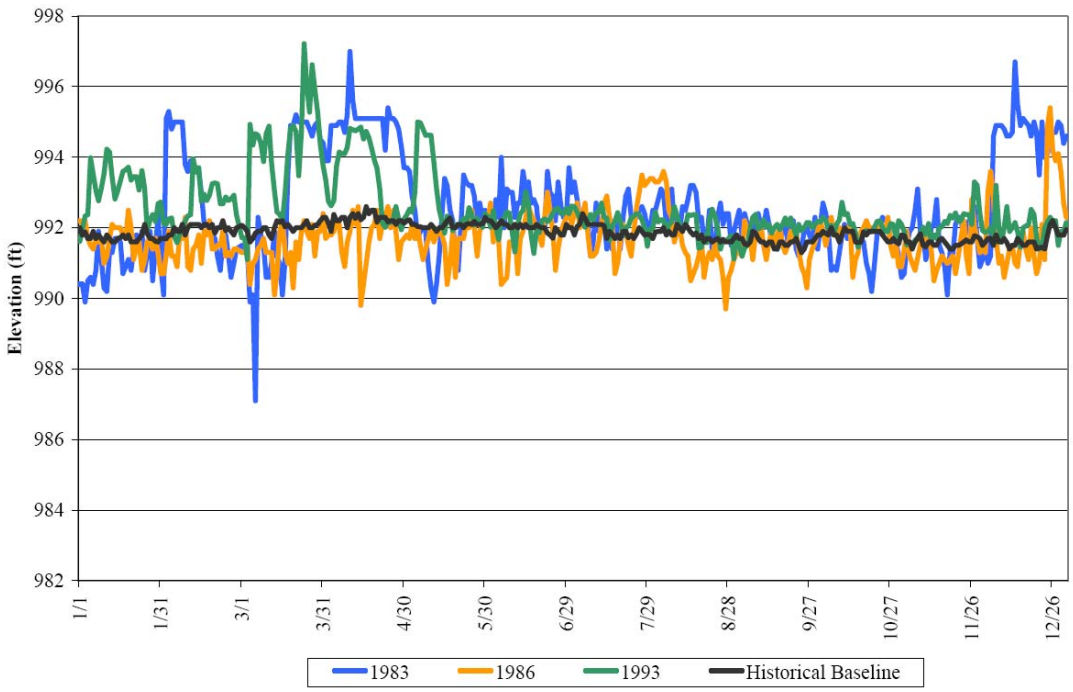

Figure 8. Lake Rhodhiss water surface elevations for representative dry (1986), normal (1993), and wet (1983) years (Source: Duke Energy, 2007).

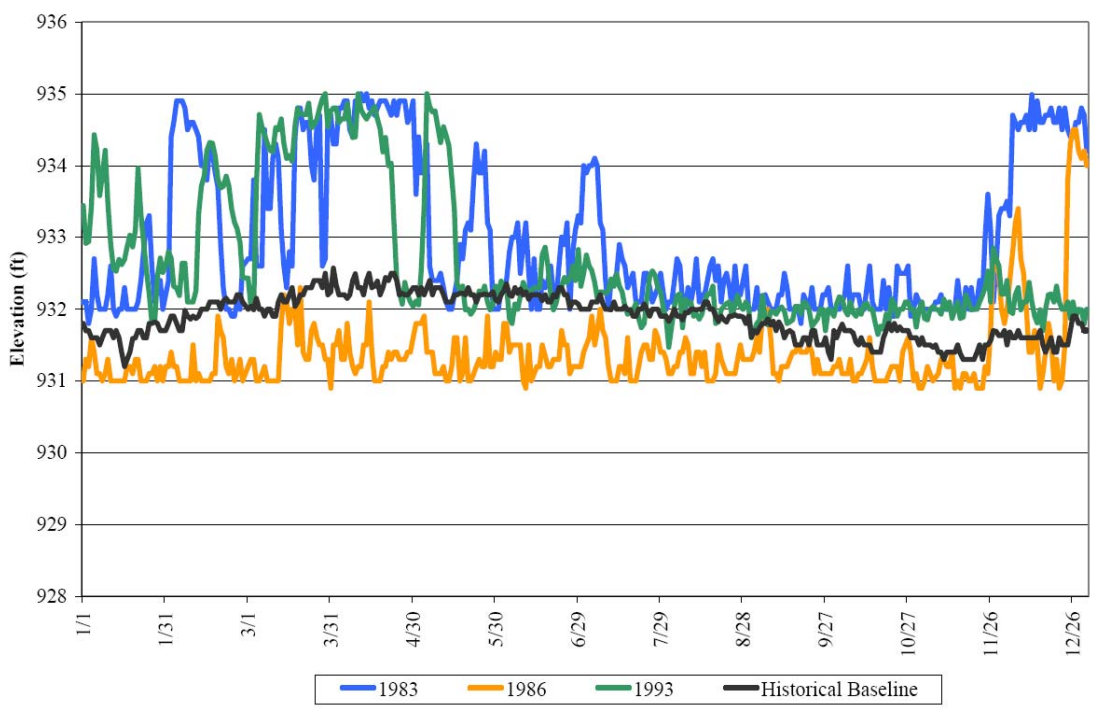

Figure 9. Lake Hickory water surface elevations for representative dry (1986), normal (1993), and wet (1983) years (Source: Duke Energy, 2007).

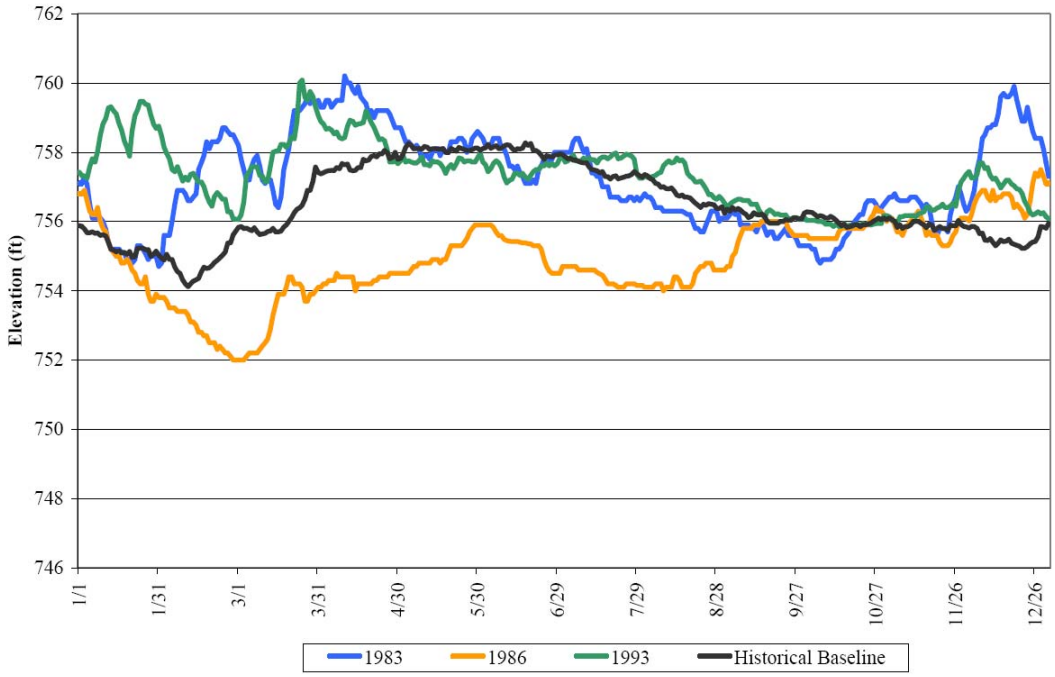

Figure 10. Lake Norman water surface elevations for representative dry (1986), normal (1993), and wet (1983) years (Source: Duke Energy, 2007).

Table 10. Rates of inflow (cfs) to Lake Wylie that are equaled or exceeded given percentages of time .[1] (Source: Duke Energy, 2007)

Month	10%	25%	50%	75%	90%
January	9,469	6,901	4,797	2,559	1,218
February	9,846	7,614	5,140	2,718	1,324
March	10,107	7,488	5,132	2,837	1,177
April	10,006	7,358	4,487	2,196	994
May	7,696	5,459	3,579	1,691	840
June	6,720	4,774	3,162	1,392	835
July	5,951	4,071	2,420	1,124	756
August	6,050	4,149	2,468	1,173	800
September	5,783	3,911	2,053	1,073	556
October	6,796	4,357	2,221	1,132	597
November	6,686	4,712	2,598	1,223	756
December	7,458	5,437	3,212	1,688	922

[1] For 1930 through 2000.

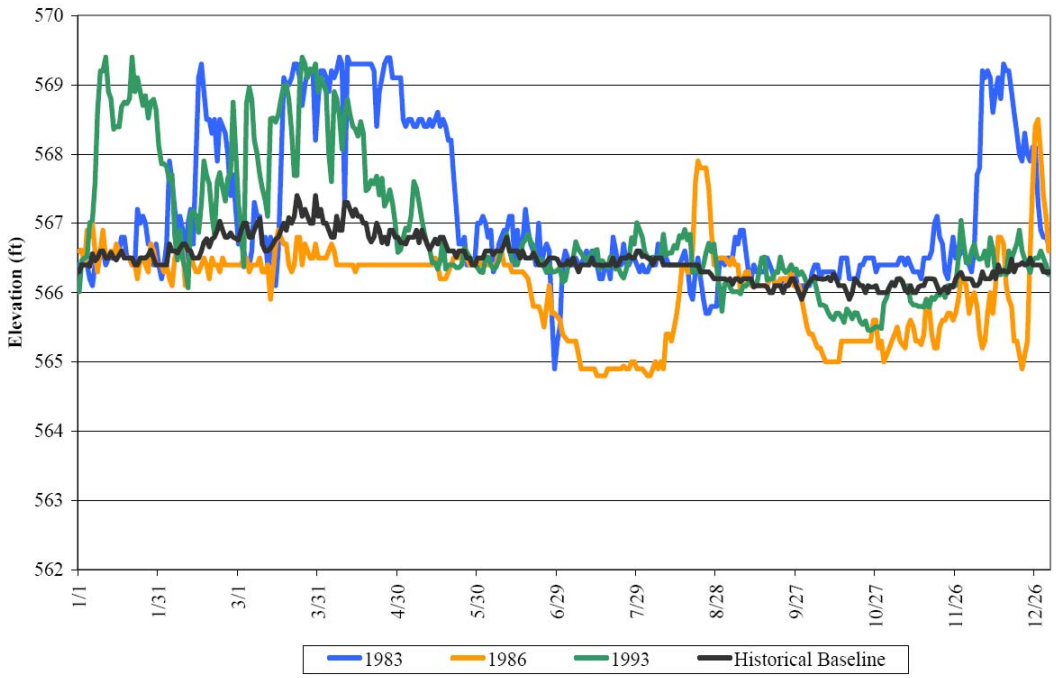

Figure 11. Lake Wylie water surface elevations for representative dry (1986), normal (1993), and wet (1983) years (Source: Duke Energy, 2007).

Sugar Creek, Twelve Mile Creek, Waxhaw Creek, Cane Creek, and other minor tributaries drain the 21 percent of Fishing Creek Development drainage area that is not controlled by Lake Wylie. Duke Energy operates the generating units at Fishing Creek Development primarily to refill the two downstream reservoirs for the Great Falls, Dearborn, Rocky Creek, and Cedar Creek Developments, before their generating runs begin, but the units in the Fishing Creek powerhouse also must be balanced to avoid overfilling and spilling from the Developments. After meeting these operational constraints, Duke Energy operates the Fishing Creek units for peaking supply. Water is released from the Fishing Creek powerhouse directly into Great Falls reservoir, which is the smallest project reservoir. Releases from the Dearborn and Great Falls powerhouses enter directly into the Cedar Creek reservoir. The diversion dam at the upstream end of Great Falls reservoir creates the Great Falls long bypass east of Mountain Island. The headworks structure, located in the middle of the reservoir, creates the Great Falls short bypass reach west of the island. The existing license has no requirement for releases to these two bypassed reaches.

Lake Wateree is the second largest project reservoir and is the last (most downstream) of the 11 reservoirs that compose the Catawba-Wateree River system. Normal operation is characterized by a high reservoir level from late winter to mid fall and a modest winter draw-down (figure 6). Under the Spring Lake Level Stabilization Program, Duke Energy voluntarily attempts to maintain water levels in Lake Wateree during the spring spawning period for bass within a range of 1 ft below to 2 ft above the level on the first day of the program. Duke Energy initiates the program on the fourth consecutive day of a noontime forebay temperature of at least

65°F and continues the program for 3 weeks. Figure 12 shows water surface elevations in representative dry, normal, and wet years. Table 11 lists monthly inflow exceedances.

High intensity rainfall events have been shown to cause Lake Wateree to rise above the normal full reservoir elevation (225.5 ft). Water can be discharged from Lake Wateree through the five turbine-generators, which have a total maximum hydraulic capacity of 15,880 cfs, and the uncontrolled overflow spillway. Discharge through the overflow spillway occurs when the water surface elevation reaches full pond at 225.5 ft and increases as lake level rises above that elevation. *Operations Study 02—Reservoir Level Study* (Duke Energy, 2005a) assembled and evaluated historic lake levels. These data show that Lake Wateree exceeds full pond infrequently and that the frequency of higher water surface levels has decreased over time. The historic peak lake level at Wateree was approximately 9 ft above full pond in 1929. The recent peak reservoir elevation was 8 ft above full pond, which occurred in 1989 during Hurricane Hugo. Lake levels have never exceeded Duke Energy's flood easement of 235.5 ft (10.0 ft above full pond).

The potential for such occurrences is exacerbated if the rainfall events occur within the portion of the Catawba watershed downstream of Lake Wylie because the five developments between Wylie and Wateree have limited storage capacity and very short residence times. Lake Norman and Lake James are the only upstream reservoirs with significant storage capacity in the Catawba-Wateree River Basin. The increased system storage capacity created by construction of the Cowans Ford Development impounding of Lake Norman in 1963 resulted in partial mitigation of high water events at Lake Wateree. Lake Norman more than doubled the usable storage capacity in project reservoirs upstream of Lake Wateree. The influence of Lake Norman is demonstrated by comparing the percentage of time that lake levels exceeded full pond in the data record for 1929-1963 to the data representing 1963-2003. Since 1963, levels at Lake Wateree have exceeded full pond approximately 3 percent of the time, whereas prior to 1963, this level was exceeded approximately 10 percent of the time.

Historically, development has occurred within the lower portion of the flood zone easement that was established on Lake Wateree. Much of this shore zone, particularly in the lower portion of Lake Wateree, has minimal topographic relief and, therefore, is prone to flooding during periodic major storm events.

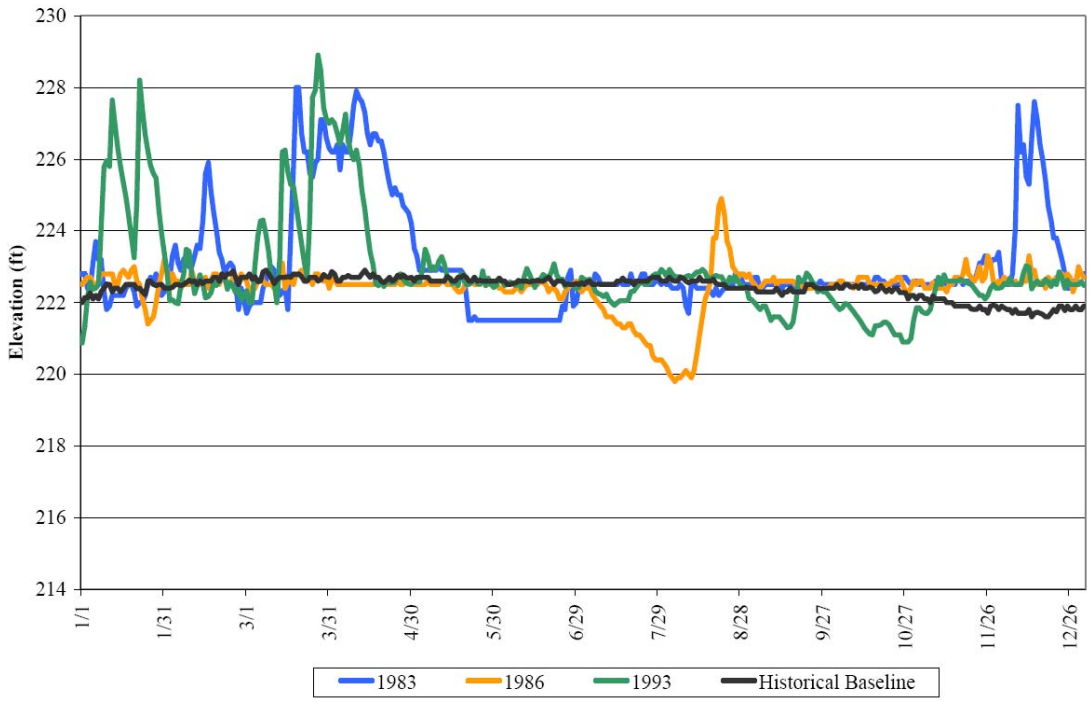

Figure 12. Lake Wateree water surface elevations for representative dry (1986), normal (1993), and wet (1983) years (Source: Duke Energy, 2007).

Table 11. Rates of inflow (cfs) to Lake Wateree that are equaled or exceeded given percentages of time.[1] (Source: Duke Energy, 2007)

Month	10%	25%	50%	75%	90%
January	15,064	10,867	7,054	4,272	2,012
February	14,872	11,738	7,685	4,878	2,651
March	15,586	12,222	7,974	4,694	2,543
April	14,897	10,771	6,537	3,514	1,622
May	9,449	6,591	4,281	2,204	944
June	8,817	5,990	4,032	1,955	995
July	7,752	5,313	3,282	1,568	841
August	8,088	5,595	3,500	1,702	883
September	7,574	5,263	2,874	1,450	661
October	9,587	5,603	3,082	1,519	723
November	9,464	6,241	3,727	1,836	863
December	10,871	7,417	4,696	2,550	1,216

[1] For 1930 through 2000.

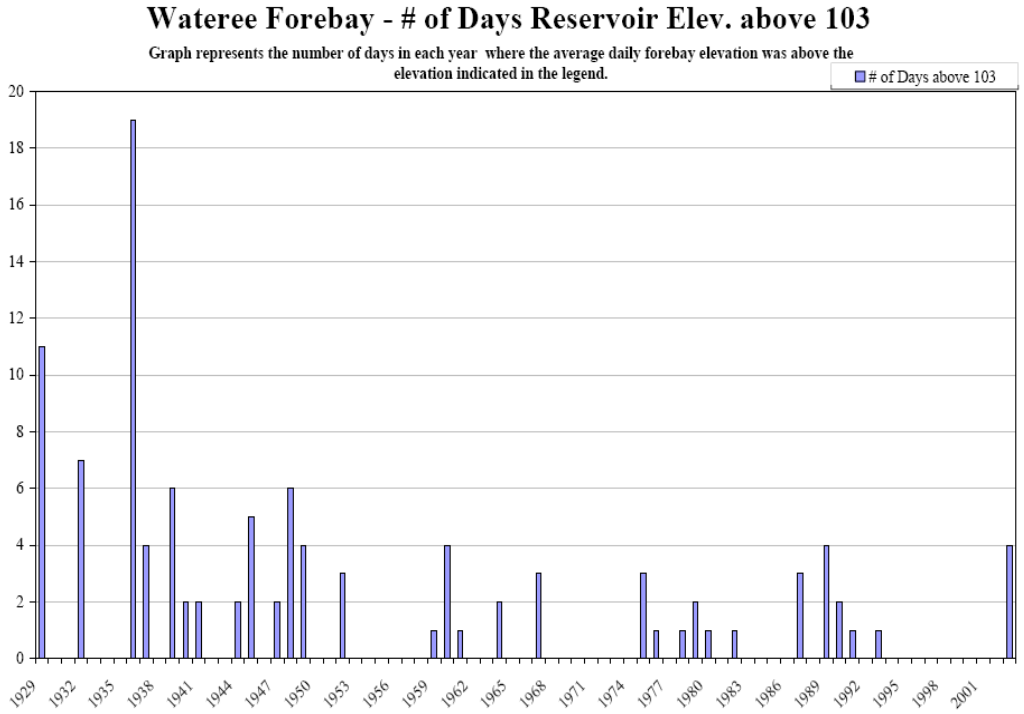

Figure 13. Number of days that the water surface elevation in Lake Wateree was above 228.5 ft (3 ft above full pond) (Source: Duke Energy, 2007).

CHEOPS Operations Model

CHEOPS™ (Computer Hydro Electric Operations and Planning Software) is a software tool for evaluating a wide range of physical changes and operational constraints associated with relicensing or upgrading single and multiple-development hydroelectric projects. CHEOPS has been applied to accurately evaluate physical and operational changes considered during the relicensing of more than 25 hydroelectric projects. The model was developed for use as a decision support tool. One of the strengths of CHEOPS is that the model is tailored to meet the unique characteristics and demands of the particular system being evaluated. Because each project is unique, the ability of the model to accurately simulate proposed physical and operational modifications needs to be verified by comparison of simulated operation to historic project data. The *Operations 01—CHEOPS Model* report describes the analyses that were conducted to test the model's ability to simulate operation of the 11 reservoir and 13 powerhouses that make up the Catawba-Wateree Development.

The Catawba-Wateree Model was custom configured for the project based on the specific Project constraints, such as environmental and recreational releases, target reservoir elevations, municipal and industrial water withdrawals, and powerhouse equipment constraints. The model was designed to be capable of simulating the complex interaction between the hydrology, hydraulics, reservoir elevation operating limits, minimum flows, turbine unit variable efficiencies, and the cumulative effects of project operations on the natural flow regimen and proposed operational alternatives associated with the requirements of 18 C.F.R §4.51, Exhibit E.

Prior to use in the stakeholder and negotiation process leading to the Revised CRA, the model was verified to demonstrate that it is capable of providing realistic results associated with the cumulative effects of project operations on the natural flow regimen and historic operational. The Water Resources Workgroup including agency representatives, stakeholders, and Duke Energy worked together to monitor the setup and testing of the model and selection of historic input data for the Catawba-Wateree Project. The consultation worksheet documents this group's review, input during development of the model, and preparation and acceptance of the final *Operations 01—CHEOPS Model* report

The objective of calibration and verification of the model is to reasonably characterize current operations, not perfectly match or mimic historical operations. Comparison of model results with historical data provides a basis for evaluation of the model's ability to react in a manner consistent with "real" operations. The caveat to all these comparisons is that it is impossible to account for the multitude of outside influences and conditions that combined to determine the historic operational decisions or the degree of error in the input or historical data. The goal of verification of the Catawba-Wateree model was to demonstrate the ability of the model to produce results that were within approximately 5 percent of historic generation data on an annual basis. The qualitative component of the verification process is to compare the hydrographs of modeled results to historic data to verify whether the model provides a reasonable representation of project operations at each development and throughout the year (e.g., the timing, magnitude and duration of operations)**.**

The validation was conducted by comparing the model simulation of power generation for three specific historic years and the average of 1974 to 2003 historic data with the individual plant and total Catawba-Wateree Project historic generation data. Calendar year 1993 was selected as a representative normal year, 1983 as a wet year, and 1986 as a dry year based on a hydrologic ranking using the 1929 to 2003 CHEOPS inflow data set. For the 1983, 1986, and 1993 scenarios, the simulated differences in system-wide annual generation were 5.54, 5.48, and 3.26 percent, respectively.

The *Operations 01—CHEOPS Model* report concluded that model verification results indicate the Catawba-Wateree CHEOPS Model provides a good overall comparison to historic data, verifies that it reasonably characterizes project operations, and is adequate for use in evaluating the impacts of operating scenarios considered in the relicensing proceedings.

After verification, the CHEOPS model was used in *Operations 04—Water Supply Study* (HDR, 2006) to estimate the safe yield of each of the project reservoirs given the operational constraints and flow requirements detailed in the Revised CRA. The model used regional growth projections and estimates of increased water use to assess the capacity of the system to support expanding water use in conjunction with other downstream release requirements. Safe yield is used to describe the amount of water theoretically available at a given location in a watershed and is a commonly used measure of the dependability of a water supply source. The safe yield of a water supply source depends on many factors, including the availability of water; storage, diversion, and the water supply infrastructure system; operation of the infrastructure system; and level of certainty of the system demand.

CHEOPS used the operating depth of the shallowest water supply intake in each reservoir as the critical reservoir level elevation (table 12); that is, the lowest elevation to which the reservoir can be drawn down while all major intakes remain submerged and operational. To

estimate safe yield, a water budget was calculated that allocated and accounted for all significant sources and uses of water, given the constraints imposed by the system infrastructure and operations. Safe yield analyses were completed for several operating scenarios including the following.

- ***Baseline Safe Yield*—**This analysis calculated safe yields for the project's reservoirs using current operating conditions in Duke Energy's existing FERC license, other agreements honored by Duke Energy, and other relevant operating practices.
- ***Mutual Gains Safe Yield*—**This analysis calculated safe yields for the project's reservoirs using the mutual gains operating conditions (dated November 28, 2006) negotiated during the relicensing stakeholder consultation process and outlined in the Revised CRA. The mutual gains operating conditions are the basis of the operating parameters and constraints proposed in the license application, including, but not limited to:
  - downstream flow requirements from each reservoir for protection and enhancement of aquatic resources and recreation,
  - proposed normal minimum and target reservoir elevations,
  - and implementation of the Low Inflow Protocol.

Table 12. Critical intake elevation and water user type for each project reservoir. (Source: Duke Energy, 2007)

Reservoir	Critical reservoir elevation (ft) and feet below full pool	First controlling type
James	1,161 (39 ft below full pond)	Power Production
Rhodhiss	984.5 (10.6 ft below full pond)	Municipal Intake
Hickory	929 (6 ft below full pond)	Municipal Intake
Lookout Shoals Lake	813 (25.1 ft below full pond)	Municipal Intake
Norman	750 (10 ft below full pond)	Power Production
Mountain Island	641.8 (5.7 ft below full pond)	Power Production
Wylie	562 (7.4 ft below full pond)	Industrial Intake
Fishing Creek	412.2 (5 ft below full pond)	Municipal Intake
Great Falls	343 (12.8 ft below full pond)	Power Production
Cedar Creek	264.7 (19.7 ft below full pond)	Power Production
Wateree	218 (7.5 ft below full pond)	Municipal Intake

The reservoirs in the Catawba-Wateree Project are generally operated as an integrated system. In simple terms, increased demand on a downstream reservoir results in water being released from a number of upstream reservoirs to keep system water levels in a reasonably

balanced state. The model also serves as a tool to assess the ability of the system to balance power, industrial, agricultural, and public water system demands while supporting stream flows for recreation and aquatic resources included in the proposed license articles over the duration of the license. To assess the ability to maintain this balance under conditions that would require implementation of the Low Inflow Protocol, historic low flow conditions for these model runs were extracted from the hydrologic period of record; selected periods were 1998-2003 and 1949-1959.

The CHEOPS model produced project simulations in 10-year time steps from 2008 to 2078; at each time step a determination was made as to whether any critical constraint was violated for each reservoir. The safe yield for a given reservoir is estimated at the time-step prior to that at which a critical constraint is reached and cannot be balanced out using upstream water surplus. Through this incremental process the model simulates the future time increment at which water demand associated with regional growth projections surpasses the storage capacity for each reservoir given other specified system constraints.

Baseline Safe Yield

The lower end of the safe yield value range was determined as the withdrawal flows that were modeled in the 10-year time-step just prior to the simulated drawdown that caused a violation of the critical reservoir level. The upper end of the safe yield value range was the withdrawal flow that was modeled in the 10-year time-step when a reservoir violation was projected. For example, Mountain Island Lake had a no critical intake constraint violation in 2038, while the 2048 simulation predicted violations of critical intake constraints. The 2038 time-step and associated reservoir water demand (192 mgd) was determined as the safe yield for this reservoir under baseline conditions. The safe yield values obtained from two low inflow period simulations under the critical intake constraint scenario are presented in tables 13 and 14.

Table 13. Baseline safe yield value range obtained from critical intake constraints low-inflow period 1998-2003 simulations based on existing license conditions. (Source: Duke Energy, 2007).

Reservoir	**Year**	**Withdrawal flow**	
		(mgd)[1]	**(cfs)[1]**
James	2058-2068[2]	36-40	56-62
Rhodhiss	2058-2068[2]	44-47	68-73
Hickory	2058-2068[2]	44-49	68-76
Lookout Shoals	2058-2068[2]	12-13	19-21
Norman	2038-2048	133-169	206-261
Mountain Island	2038-2048	192-207	297-320
Wylie	> 2078	> 189	> 292
Fishing Creek	> 2078	> 225	> 348
Great Falls	> 2078	> 3	> 5
Cedar Creek	> 2078	> 1	> 2
Wateree	> 2078	> 74	> 114

[1] Withdrawal flows associated with years given may not match exactly with flows outlined in section 3 and appendix C of the license application. Baseline safe yield analysis was completed in January 2005, prior to minor updates of the withdrawal/return projections.

[2] Failure pending to support downstream reservoirs.

Table 14. Safe yield value range obtained from critical intake level constraints low-inflow period 1949-1959 simulations based on existing license conditions. (Source: Duke Energy, 2007)

Reservoir	Year	Withdrawal flow	
		(mgd)[1]	(cfs)[1]
James	2048-2058	32-34	50-53
Rhodhiss	2048-2058	40-44	62-68
Hickory	2048-2058	37-44	57-68
Lookout Shoals	2048-2058	12	19
Norman	> 2078	> 223	> 346
Mountain Island	2048-2058	207-224	320-347
Wylie	2068-2078	171-189	265-292
Fishing Creek	> 2078	> 225	> 348
Great Falls	2058-2068	2-3	3-5
Cedar Creek	2058-2068	1	2
Wateree	> 2078	> 74	> 114

[1] Withdrawal flows associated with years given may not match exactly with flows outlined in section 3 and appendix C of the license application. Baseline safe yield analysis was completed in January 2005, prior to minor updates of the withdrawal/return projections.

The *Water Supply Study* baseline safe yield analysis presented the following conclusions.

- Low inflow periods 1949-1959 and 1998-2003 are the key droughts in the hydrologic period of record for determination of safe yield.
- Upstream reservoirs in the Catawba-Wateree Project are integrally linked to supplying downstream reservoirs during periods of drought, given the relative size of the reservoirs and their location relative to water withdrawals and net outflows.
- Using the water demand based on regional growth projections, the safe yield ranges are most limiting for Mountain Island Lake and Lake Norman; yields are approximately 133-169 mgd and 192-207 mgd, respectively. These values equate to water use projected to occur between years 2038 and 2048, and represent the earliest time at which one of the project reservoirs can no longer meet increasing net outflows.
- Other reservoirs have safe yield values that would support projected net outflows beyond the year 2038.
- Fishing Creek reservoir, Great Falls reservoir, Cedar Creek reservoir, and Lake Wateree did not exceed safe yield estimates within the simulation period.

Mutual Gains Safe Yield Analysis

The baseline safe yield analysis was performed, in part, to establish a benchmark for comparison to the proposed license conditions (mutual gains safe yield values). The mutual gains safe yield analysis focused on determining safe yields for each of the project's reservoirs under the proposed license conditions; that is, a simulation of how Duke Energy would operate the system under its new FERC license, assuming acceptance by the Commission of the operating conditions proposed in the license application.

This simulation was used to assess the project's capacity to support regional water supply during extended drought periods over the next 50 years, the duration of the license requested by Duke Energy. Under the proposed operating conditions, Duke Energy would manage the system to maintain a new set of target, normal minimum, and normal maximum water surface elevation for each reservoir. During periods of low inflow, Duke Energy would work to maintain storage in the system, and, as reservoir levels drop, water from upstream reservoirs would be transferred downstream to maintain minimum reservoir elevations for as long as possible similar to existing operating protocols. Unlike the existing license, the proposed Low Inflow Protocol allows for minimum reservoir elevations to be adjusted for more effective management of water storage inventory throughout the project as low inflow or drought conditions continue to worsen.

Two safe yield reservoir constraints were modeled.

- ***Critical Intake Elevation*****—**The first constraint was similar to the baseline scenario establishing the location of the shallowest water intake in each of the project's reservoirs as the critical reservoir elevation. The available water storage inventory can be utilized until that level is reached, thereby defining the safe yield value for that reservoir.
- ***Critical Boat Access*****—**The second scenario used access to public boat ramps in each of the reservoirs for recreational use as the critical constraint. This scenario is very conservative given the relatively shallow location of most boat ramps compared to water supply intakes. The critical boat access levels were defined as the level that maintains two Duke Energy-owned access areas open on larger lakes, and one open on smaller lakes.

Table 15 summarizes the critical constraints based on intake location and boat access and indicates the percentage of total storage available based on the critical intake constraint elevations.

Table 15. Critical constraint elevation summaries. (Source: Duke Energy, 2007)

Reservoir	**Critical intake constraint elevation (feet relative to local datum)**[1]	**Estimated percentage of total available storage provided based on critical intake constraint**[2]	**Critical boat access constraint elevation (feet relative to local datum)**
James	61.0	25%	92.0
Rhodhiss	89.4	2%	91.0
Hickory	94.0	3%	91.0
Lookout Shoals	74.9	2%	92.0
Norman	90.0	40%	91.0
Mountain Island	94.3	2%	91.0
Wylie	92.6	10%	95.5
Fishing Creek	95.0	2%	95.0
Great Falls	87.2	1%	87.2[3]
Cedar Creek	80.3	2%	96.0
Wateree	92.5	11%	93.0
Total		100%	

1 All elevations listed are measured in feet relative to the full pond contour with 100.00 ft corresponding to full pond.
2 Total available storage estimated at 707,000 acre-feet.
3 Hydro operations limitation.

The same low inflow periods used for the baseline analysis were used in the CHEOPS model to determine the critical reservoir level exceedances and safe yield results for the mutual gains analysis. Table 16 outlines the safe yield values for critical intake levels that were derived from this analysis and the corresponding period that projected demand would exceed safe yield. The safe yield for reservoirs from Lake James downstream to Lake Wylie would be exceeded between 2058 and 2068.

Table 16. Safe yield value range obtained from critical intake level constraint low-inflow periods 1998-2003 and 1949-1959 simulations based on proposed license conditions (mutual gains). (Source: Duke Energy, 2007)

Reservoir	Year	Withdrawal flow (mgd)	Withdrawal flow (cfs)
James	2048 – 2058	32 – 34	50 – 53
Rhodhiss	2048 – 2058	40 – 44	62 – 68
Hickory	2048 – 2058	37 – 44	57 – 68
Lookout Shoals	2048 – 2058	12	19
Norman	2048 – 2058	169 – 179	261 – 277
Mountain Island	2048 – 2058	207 – 224	320 – 347
Wylie	2068 – 2078	141 – 155	218 – 240
Fishing Creek	> 2078	> 238	> 368
Great Falls	> 2078	> 3	> 4
Cedar Creek	> 2078	> 1	> 2
Wateree	> 2078	> 74	> 114

The two low inflow periods were also used to simulate safe yield results under the mutual gains operating conditions using very conservative critical boat access constraints. This analysis indicated early and frequent violation of the boat access constraint at many of the reservoirs. Using projected 2008 net outflows in the model, the following five reservoirs immediately violated the boat access constraint level based on both low inflow periods:

- Lake James,
- Lake Hickory,
- Mountain Island Lake,
- Lake Wylie, and
- Cedar Creek reservoir.

These widespread reservoir violations are due primarily to the location of the boat access constraint levels relative to the proposed normal minimum lake levels. Table 15 summarizes the critical boat access constraint elevation for each reservoir; several of the reservoirs have relatively high boat access constraint elevations. In particular, Lake Wylie's critical boat access constraint elevation is 95.5 ft (relative to local datum), which is above the normal minimum elevation for this reservoir. In this simulation, a relatively large downstream flow requirement at Lake Wylie and a relatively high boat access constraint stresses the storage capacity for most of the upper basin reservoir system. Other reservoirs in the system also approach critical levels attempting to meet downstream water demands or maintaining relatively high critical boat access

constraint elevations. Based on this analysis, table 17 presents the safe yield values associated with the boat access constraint levels. It can be assumed that under drought conditions, access for recreational boating in selected reservoirs might provide an early trigger for water management decisions; however, boat access at these developments would be a minor secondary concern relative to critical intake constraints during a drought.

Table 17. Safe yield value range obtained from critical boat access constraints, low-inflow periods 1998-2003 and 1949-1959 simulations based on proposed license conditions (mutual gains). (Source: Duke Energy, 2007)

Reservoir	**Year**	**Withdrawal flow**	
		(mgd)	**(cfs)**
James	< 2008	< 12	< 19
Rhodhiss	> 2078	> 52	> 80
Hickory	< 2008	< 17	< 26
Lookout Shoals	> 2078	> 15	> 23
Norman	2068-2078	202-223	312-346
Mountain Island	< 2008	< 131	< 203
Wylie	< 2008	< 95	< 147
Fishing Creek	> 2078	> 238	> 368
Great Falls	> 2078[1]	> 3	> 5
Cedar Creek	< 2008	< 1	< 2
Wateree	> 2078	> 74	> 114

[1] No critical boat access constraint elevation.

3.3.2.1.2 Water Use

While water in the project reservoirs is used primarily for hydropower production, the reservoirs also are used to provide water withdrawals for municipal and industrial purposes.

Duke Energy reports that 1.3 million people rely on the system for their domestic water. Table 18 summarizes the major water withdrawals from the Catawba-Wateree Project reservoirs. Other users withdraw water for agriculture and recreational uses. Some of the water withdrawn for municipal or industrial water supply is returned to the project reservoirs as discharges from wastewater treatment plants, and the water withdrawn for power plant cooling is returned to the reservoirs minus losses from evaporative cooling. Net water withdrawal (the difference between water withdrawals and return flows) from project reservoirs is projected to increase by 178 percent by 2058 (table 19). Each reservoir has municipal, industrial, or power plant intakes as well as the project hydroelectric intakes. Table 20 lists the critical water surface elevations for the shallowest intake in each reservoir. When lake levels fall below these critical elevations, one of the major uses would be restricted or shut down.

Table 18. Summary of major water withdrawals [1] from the Catawba-Wateree Project (P-2232). (Source: Duke Energy, 2007)

Water User	**Type**	**Source of withdrawal**	**Maximum instantaneous withdrawal capacity (million gallons per day [mgd])**
Town of Granite Falls, North Carolina	Municipal	Lake Rhodhiss	2.5
City of Lenoir, North Carolina	Municipal	Lake Rhodhiss	12
Town of Valdese, North Carolina	Municipal	Lake Rhodhiss	12
City of Hickory, North Carolina	Municipal	Lake Hickory	32
Town of Longview, North Carolina	Municipal	Lake Hickory	2
City of Statesville, North Carolina	Municipal	Lookout Shoals Lake	15
City of Charlotte, North Carolina (North Mecklenburg Water Treatment Plant)	Municipal	Lake Norman	108[2]
Duke Energy's Marshall Steam Station	Industrial cooling water	Lake Norman	1,463
Duke Energy's McGuire Nuclear Station	Industrial cooling water	Lake Norman	2,908
The Pointe Golf Club	Landscape Irrigation	Lake Norman	1
The Peninsula (Homeowner's Association – golf course)	Landscape Irrigation	Lake Norman	1[3]
Cowans Ford Country Club	Landscape Irrigation	Lake Norman	1[3]
Lincoln County, North Carolina	Municipal	Lake Norman	12
Town of Mooresville, North Carolina	Municipal	Lake Norman	12
City of Charlotte, North Carolina (Franklin and Vest Water Treatment Plant)	Municipal	Mountain Island Lake	330[4]
City of Gastonia, North Carolina	Municipal	Mountain Island Lake	75

Water User	Type	Source of withdrawal	Maximum instantaneous withdrawal capacity (million gallons per day [mgd])
City of Mount Holly, North Carolina	Municipal	Mountain Island Lake	13.5
Duke Energy's Riverbend Steam Station	Industrial cooling water	Mountain Island Lake	622.1
American & Efird, Inc.	Industrial	Lake Wylie	3.45
Clariant Corporation	Industrial	Lake Wylie	4.75
City of Belmont, North Carolina	Municipal	Lake Wylie	10
City of Rock Hill, South Carolina	Municipal	Lake Wylie	30
Duke Energy's Allen Steam Station	Industrial cooling water	Lake Wylie	784
Duke Energy's Catawba Nuclear Station	Industrial cooling water	Lake Wylie	231
Siemens Westinghouse	Industrial	Lake Wylie	21.6
Springs Industries' Grace Complex	Industrial	Fishing Creek	18
Chester Metropolitan District	Municipal	Fishing Creek	15
City of Camden, South Carolina	Municipal	Lake Wateree	12
Lugoff-Elgin Water Authority	Municipal	Lake Wateree	10

[1] Withdrawals of 1 mgd or greater.
[2] When withdrawals reach an average of 36 mgd, a plan to evaluate the effects of lower lake levels caused by the water withdrawals approved in this order is required to be filed with the Commission.
[3] Assigned value of 1 mgd by Duke Energy.
[4] Restricted to 165 mgd during drought conditions.

Table 19. Current and projected net water withdrawals from project reservoirs. (Source: Duke Energy, 2007)

Reservoir	Current (mgd)	Projected for 2058 (mgd)	Percent Increase (%)
James	2.0	19.4	870
Rhodhiss	11.7	20.0	71
Hickory	12.1	28.0	131
Lookout Shoals	0.4	10.8	2,600
Norman	57.9	175.0	202
Mountain Island	95.1	205.3	116
Wylie	47.8	66.4	39
Fishing Creek	-61.9	-96.0	-55
Great Falls	0.4	-6.8	-1,800
Cedar Creek	-0.3	-2.5	-733
Wateree	5.7	55.8	879
Total	170.9	475.4	178

Note: Negative net withdrawal indicates return flow exceeds withdrawal and reservoir is a net receiver of flow.

Table 20. Critical lake level elevations.[1] (Source: Duke Energy, 2007)

Reservoir	Full Pond Elevation (ft)	Depth Below Full Pond (ft)			
		Municipal Intake[2]	Industrial Intake[2]	Power Production[3]	Critical Lake Elevation (ft)[4]
James	1200.0	---	---	39.0	1161.0
Rhodhiss	995.1	10.6	---	20.9	984.5
Hickory	935.0	6.0	---	27.0	929.0
Lookout Shoals	838.1	25.1	---	27.1	813.0
Norman	760.0	15.0	25.0	10.0	750.0
Mountain Island	647.5	12.0	---	5.7	641.8
Wylie	569.4	8.0	7.4	10.0	562.0
Fishing Creek	417.2	5.0	9.2	22.1	412.2
Great Falls	355.8	---	---	12.8	343.0
Cedar Creek	284.4	---	---	19.7	264.7
Wateree	225.5	11.5	---	26.0	214.0

1 As of November 2004.
2 Draw-down depth below which at least one intake of the particular type on the lake begins to have its operations restricted.
3 Draw-down depth below which power production facilities (either hydroelectric stations, fossil-fueled stations, or nuclear-fueled stations) cannot operate.
4 Water surface elevation at which one of the uses would be shut down or restricted.

3.3.2.1.3 Water Quality

Water Quality Standards

The North Carolina DWQ regulates water quality under the North Carolina Administrative Code (N.A.C.) subchapter 2B (15A N.A.C. 02B.0100, .0200, and .0300), and South Carolina regulates water quality under South Carolina Regulation 61-68. All surface waters are assigned classifications, which determine the water quality standards that apply to support designated best uses.

There are four primary classes of water within the North Carolina portion of the project area, C, B, WS-IV, and WS-V, and one supplemental class, Tr. Class C waters are designated as the best uses of aquatic life propagation and maintenance of biological integrity (including fishing and fish), wildlife, secondary recreation, agriculture, and any other usage except for primary recreation or as a source of water supply for drinking, culinary, or food processing purposes. Class B waters have the designated beneficial uses of primary recreation, which includes swimming on a frequent or organized basis, and the best usages specified for Class C

waters. The study area includes two classes for water supply (WS-IV and WS-V). The best uses for WS-IV waters are sources of water supply for drinking, culinary, or food-processing purposes. WS-V waters are protected as water supplies that are generally upstream and draining to Class WS-IV waters, or waters previously used for drinking water supply purposes, or waters used by industry to supply their employees, but not municipalities or counties, with a raw drinking water supply source. Class Tr waters are freshwaters protected for natural trout propagation and survival of stocked trout. Classifications for surface waters in the project area within North Carolina include:

- C – Catawba River from the dam at Old Fort Finishing Plant water supply intake to North Fork Catawba River;
- B – Catawba River from North Fork Catawba River to Bridgewater dam; Catawba River from Johns River to Oxford dam; Catawba River from Elk Shoal Creek to Lookout Shoals dam; Catawba River from Lyle Creek to Cowans Ford dam; Catawba River from the water intake at the River Bend Steam Station to Mountain Island dam; Catawba River from the Interstate 85 bridge to the North Carolina/South Carolina state line;
- Tr – Catawba River from 0.6 mile upstream of Muddy Creek to 0.7 mile upstream of Canoe Creek[10]; and
- WS-IV or WS-V – Catawba River from North Fork Catawba River to the North Carolina/South Carolina state line.

In addition to these classes, the water quality regulations designate a critical area (CA) around certain WS waters. These are the areas adjacent to a water supply intake or reservoir where risk associated with poor water quality is greater than from the remaining portions of the watershed. The requirements for CA designation generally focus on limiting land use within 0.5 mile upstream, and draining to a water supply rather than setting numeric criteria for water quality parameters.

There is only one class of water within the South Carolina portion of the project area, FW. Class FW waters are freshwaters that are suitable for primary and secondary contact recreation, and for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. This class is suitable also as a source for drinking water supply after conventional treatment and for industrial and agricultural uses.

Table 21 summarizes selected water quality criteria that are applicable to Class B, C, WS, and Tr waters in North Carolina and FW waters in South Carolina. Each of these parameters has been identified as the cause for impaired water quality at one or several locations within the project.

[10] This reach of the Catawba River was re-classified as Tr by North Carolina DWQ in May 2005, after submittal of the Duke Energy application.

Table 21. Selected water quality criteria. (Sources: N.A.C. subchapter 2B, 2008; South Carolina Regulation 61-68, 2008)

Parameter	North Carolina[1]	South Carolina[2]
Temperature	Classes B, C, and WS: ≤2.8 degrees Celsius (°C) above natural temperature, and ≤29.0°C for mountain and upper Piedmont waters (Lake James, or ≤32.0°C for lower Piedmont waters Class Tr: ≤20.0°C and ≤0.5°C above natural temperature	≤32.2°C and ≤2.8°C above natural temperature at all times for streams and as a weekly average for lakes
Total dissolved gas	≤110 percent of saturation	---
Dissolved oxygen	Classes B, C, and WS: ≥5.0 milligrams per liter (mg/l) as daily average and ≥4.0 mg/l as instantaneous Class Tr: ≥6.0 mg/l at all times	≥5.0 mg/l as daily average and ≥4.0 mg/l as instantaneous
pH	Normal for waters in the area, generally between 6.0 and 9.0 standard units	6.0 to 8.5
Chlorophyll-*a*	Classes B, C, and WS: ≤40 micrograms per liter (µg/l) Class Tr: ≤15 µg/l	≤40 µg/l
Turbidity	Classes B, C, and WS: ≤25 nephelometric turbidity units (NTU) in reservoirs, ≤50 NTU in streams Class Tr: ≤10 NTU	≤25NTU in reservoirs, ≤50 NTU in streams
Copper	7 µg/l action level	≤2.9 µg/l (chronic exposure of aquatic organisms) and ≤3.8 µg/l (acute exposure)
Mercury	≤0.012 µg/l	≤0.91 µg/l (chronic exposure of aquatic organisms) and ≤1.6 µg/l (acute exposure)

Parameter	North Carolina[1]	South Carolina[2]
Fecal coliform	Class C: Geometric mean of ≤200/100 milliliters (ml) (membrane filtration) based on at least 5 consecutive samples during any 30-day period, and >400/100 ml in no more than 20 percent of the samples examined during such period; violations of the fecal coliform standard are expected during rainfall events and, in some cases, this violation is expected to be caused by uncontrollable non-point source pollution. Class B: Geometric mean of ≤200/100 ml (membrane filtration) based upon at least 5 consecutive samples examined during any 30-day period, and >400/100ml in no more than 20 percent of the samples examined during such period.	Geometric mean of ≤200/100 ml (membrane filtration) based on 5 consecutive samples during any 30-day period, and >400/100 ml in no more than 10 percent of the samples examined during any 30-day period.
Total nitrogen	---	≤1.50 mg/l
Ammonia nitrogen	---	Criteria are pH and temperature dependent; equations to calculate site-specific criteria are given in the regulations.
Nitrate nitrogen	Class WS only: ≤10.0 mg/l	---
Total phosphorus	---	≤0.06 mg/l
Total dissolved solids	Class WS only: ≤500 mg/l	---
Total hardness	Class WS only: ≤100 mg/l as $CaCO_3$	---

[1] Criteria applicable to Class C (Aquatic Life), Class B (Primary Recreation), and Class WS (Water Supply) unless otherwise noted

[2] Criteria applicable to Class FW (Fresh Water)

General Water Quality

Reservoir water quality is determined by several factors including the water quality of inflows, hydraulic retention times, reservoir depth, depth at which water is withdrawn in a reservoir, and industrial and power plant withdrawals or discharges. Natural thermal stratification varies substantially among developments; it is strong in four reservoirs (Lake

James, Lake Hickory, Lake Norman, and Cedar Creek reservoir), moderate in one reservoir (Lake Wateree), and weak or negligible in the other reservoirs, which have short retention times.

North Carolina DWQ (2008b) sampled five project lakes in 2007: Lake James, Lake Rhodhiss, Lake Hickory, Lake Norman, and Lake Wylie. Surface water temperature in Lake James exceeded the state criterion for mountain lakes in the summer when air temperatures are high. Although nutrient concentrations in Lake James were elevated relative to other mountain lakes, and chlorophyll-*a* concentrations exceeded the state standard for trout waters on occasion, the lake had oligotrophic, low productivity conditions. Lake Rhodhiss had elevated nutrient concentrations and eutrophic, high productivity conditions. Algal blooms dominated by blue-green algae occurred in the upper arm of the lake and near the dam in the summer. Lake Hickory had low to moderate nutrient and chlorophyll-*a* concentrations and mesotrophic, moderate productivity conditions. Algal blooms, dominated by euglenoid algae, were present in the lower end of the reservoir from July through September. Although Lake Norman had elevated concentrations of nitrate nitrogen, it had low concentrations of other nutrients, moderate to low concentrations of chlorophyll-*a*, and oligotrophic, low productivity conditions. Lake Wylie had elevated nutrient concentrations, mild to severe algal blooms throughout the summer, and eutrophic, high productivity conditions.

North Carolina DWQ (2007) listed Lake Rhodhiss from the Johns River to the Rhodhiss dam as water-quality limited on the 2006 303(d) list. The list specified high pH values as the impairment but gave the source of impairment as unknown. In the 2007 lake assessment report, North Carolina DWQ (2008b) considered high algal activity as the source of elevate pH. In the draft 303(d) list for 2008, North Carolina DWQ (2008a) proposes to list three additional segments of project waters: the backwaters of Lake James from the dam at the Old Fort finishing plant water supply intake to the North Fork Catawba River for violations of the state's turbidity criterion; Lake Wylie from Mountain Island dam to the Interstate 85 bridge for pH values below the state criterion; and the South Fork Catawba River arm of Lake Wylie for violations of the state's turbidity criterion. North Carolina DWQ (2008c) has not scheduled total maximum daily load (TMDL) studies for any segments of the Catawba River.

South Carolina DHEC (2005) made the following findings about water quality conditions in the Catawba River basin based on sampling data from 1998 and 2002:

- Nutrient concentrations in Lake Wylie were decreasing, which suggested improving water quality conditions.
- Cedar Creek reservoir, Fishing Creek reservoir, and Lake Wateree had elevated concentrations of total phosphorus and chlorophyll-a, possibly indicating eutrophic, high productivity conditions.
- DO concentrations were below state standards in Cedar Creek reservoir and decreasing at the Wateree dam. Downstream of the Wateree dam, DO concentrations were below the state criterion, but they were increasing over the assessment period, suggesting improving conditions.

South Carolina DHEC (2008a) listed specific sampling stations in Lake Wylie, Fishing Creek reservoir, Cedar Creek reservoir, Great Falls reservoir, and Lake Wateree as water-quality limited on the 2008 303(d) list. The list specified fecal coliform and copper as causes of impairment in Lake Wylie; total nitrogen, total phosphorus, ammonia, chlorophyll-*a*, and pH as causes in Fishing Creek reservoir; total nitrogen, total phosphorus, and turbidity as causes in

Great Falls reservoir; dissolved oxygen (DO), total nitrogen, total phosphorus, chlorophyll-*a*, turbidity, and copper as causes in Cedar Creek reservoir; and DO, total phosphorus, chlorophyll-*a*, turbidity, and pH as causes in Lake Wateree. South Carolina DHEC (2008a) listed the Wateree River downstream of the Wateree dam as water-quality limited because of high mercury concentrations and low DO. To address the 303(d) listings for phosphorus in Fishing Creek and Cedar Creek reservoirs, South Carolina DHEC began TMDL studies for each reservoir in 2005 (South Carolina DHEC, 2008b). South Carolina DHEC also began TMDL studies in 2005 for Lake Wateree to address listings for phosphorus, chlorophyll-*a*, and pH. These TMDL studies plus future studies for the other causes of impairment are scheduled for completion in 2008 through 2020 (South Carolina DHEC, 2008a).

Water quality conditions were identified as the cause one fish kill in project waters during the period 2003 through 2007 (North Carolina DWQ, 2008d). In the summer of 2004, low concentrations of DO resulted in fish kills in Lake Norman, totaling 2,500 striped bass. North Carolina DWQ concluded that the fish were trapped in the low DO waters of the hypolimnion during thermal stratification of the lake.

North Carolina DWQ (2002, 2003) identified 13 monitoring stations in the Catawba River Basin with elevated fecal coliform levels, which were attributed to urbanization. None of the sites are on waters classified for primary recreational contact, however, and all of the sites are on tributaries to the Catawba River, not in the project reservoirs or the main stem of the Catawba River influenced by the project. South Carolina DHEC (2005) found that recreation uses were not supported or only partially supported because of high fecal coliform concentrations in the Crowders Creek arm of Lake Wylie, the Catawba River downstream of the Wylie dam, and the Rocky Creek arm of Cedar Creek reservoir.

North Carolina DWQ (2003, 2007, 2008a, 2008b, 2008d) did not list metals as a cause for impairment in any project waters or report high metals concentrations in its basin and lake assessments. North Carolina has issued a statewide fish advisory for the consumption of fish because of high mercury concentrations, but there are no site-specific advisories in project waters (North Carolina WRC, 2008a). South Carolina DHEC (2005) found copper concentrations above the state criterion (see table 21) at a site in the upper region of Lake Wylie; the state removed this site from the 303(d) list in 2008 because copper concentrations had fallen below the water quality standard, but another site near the dam remained on the list because of high copper concentrations (South Carolina DHEC, 2008a). Additionally, copper concentrations exceeded the state criterion at a station on the Catawba River about halfway between Wylie dam and the headwaters of Fishing Creek reservoir (South Carolina DHEC, 2005). No source was identified for these elevated copper concentrations. South Carolina DHEC (2008c) issued a fish consumption advisory for bowfin (mudfish) and flathead catfish in the Wateree River below the Wateree dam because of high mercury concentrations in fish tissue from the river.

Tailwaters

Duke Energy conducted studies to evaluate water temperature, pH, and DO conditions in project tailwaters. Studies included continuous monitoring of temperature and DO starting in 1995 (Bridgewater, Rhodhiss, Oxford, Lookout Shoals, Cowans Ford, Mountain Island, Wylie, Fishing Creek, and Wateree), 1996 (Great Falls, Dearborn, and Cedar Creek), or 1997 (Rocky Creek) and ending in 2004 (Duke Energy, 2007).

Duke Energy's studies showed that temperatures remain cooler than the 32°C criterion in all project tailraces. The coldwater release from the Bridgewater powerhouse has allowed a coldwater fishery to develop in the Catawba River below the dam, but the river is not classified as a trout stream by the state in this reach. During summers with high flows, however, high reservoir inflows deplete the cold water reserve in Lake James, and water temperature in the tailwaters in late fall may exceed the 20°C standard for trout waters by a few degrees.

Tailrace pH was below the upper criterion, 9.0 in North Carolina and 8.5 in South Carolina, in all project tailraces, and it was above the lower criterion, 6.0 in both states, in the tailraces below the Oxford, Cowans Ford, Fishing Creek, Great Falls, Dearborn, Rocky Creek, Cedar Creek, and Wateree Developments. At the Rhodhiss Development, tailrace pH was below the lower criterion 2.2 percent of the time, and at the other developments, tailrace pH was below the lower criterion less than 0.5 percent of the time. Duke attributes low pH values, which tended to occur in summer and early fall, to the release of carbon dioxide from biological decomposition in the deeper reservoir waters and the discharge of deeper water through the turbine intakes.

The downstream water releases from each development exhibit the same general seasonal trends over the 10-year monitoring period as the lakes and reservoirs: highest DO concentrations in January or February and lowest in July and August. During the warmer periods when many of the reservoirs are stratified (usually May through November), DO concentrations downstream of the dams and powerhouses were often less than the North and South Carolina (5.0 mg/l daily average) state standards.

The Bridgewater tailrace experiences DO concentrations less than 4 mg/l, 29 percent of the time from May 1 through November 30 as a direct result of drafting low-DO water from deeper areas at the turbine intakes in Lake James. Years with higher winter and spring flows tend to have lower tailrace DO concentrations because of higher nutrient and organic loadings from the upstream watershed. Warm fall weather can delay lake mixing, which can extend the low-DO period further into the fall. DO increases rapidly downstream when there is no generation. High generation flows push low-DO water farther downstream, reaching about 7 miles in the worst cases. There is no supplemental aeration capability at the existing Bridgewater powerhouse, but the three turbines to be installed in the new powerhouse will have aeration capability.

There are two bypassed reaches below Lake James: the Catawba River bypassed reach and the Paddy Creek bypassed reach. Both bypassed reaches merge with flows from Muddy Creek before joining the Linville River downstream of the Bridgewater powerhouse. Tributaries to these bypassed reaches contribute water of good quality, but the reaches are not currently meeting state water use designations for support of aquatic life because of limited flow resulting from the hydrologic modification created by the development. Overall, the water quality of the bypassed reaches is good. Concentrations of most constituents are typical of streams draining the upper Piedmont (i.e., near saturated DO). Coldwater releases from the Bridgewater powerhouse have enabled the establishment of a downstream trout fishery in the Linville River. During low flows and no generation at the Bridgewater powerhouse, DO increases moving downstream from the dam. Conversely, when turbine flow is high, low DO from the Linville dam releases extends farther downstream. However, even at high turbine flow, DO is typically at least 5 mg/l to about 7 miles below the dam.

DO concentrations in the Rhodhiss tailrace are highly variable because of the deep-water withdrawal from a reservoir with a moderate retention time, 21 days, and a highly productive algal community from enriched conditions. DO concentrations are less than 4 mg/l, 13 percent of the time in May through November. When there is no generation, bottom water with low DO leaks through the turbines. As turbine flows increase, the withdrawal zone extends into the upper layers of the lake, resulting in higher DO concentrations. Rhodhiss Unit 2 has stay vane[11] aeration capability.

The Oxford tailrace shows low DO concentrations of less than 4 mg/l, 29 percent of the time from May through November. The Oxford turbines withdraw water from the middle depths of Lake Hickory, where DO concentrations are highly variable because of algal activity in the surface water, daily mixing, and flow-through of the discharge from Lake Rhodhiss. Both turbines at the Oxford Development have hub-venting[12] capability, which has been used intermittently for DO enhancement.

DO concentrations in the Lookout Shoals tailrace are typically higher than those in the upstream Oxford Development because of a short retention time and lack of stratification in Lookout Shoals Lake. In May through November, tailrace DO is below 4 mg/l, 8 percent of the time. There is no supplemental aeration capability at the Lookout Shoals powerhouse. The length of the affected regulated reach between Lookout Shoals and Lake Norman varies from 0.3 to 1.3 miles depending on the draw-down level of Lake Norman downstream.

The Cowans Ford tailrace has DO concentrations less than 4 mg/l only 1 percent of the time from May through November. DO in the tailrace is relatively high because the withdrawal zone is restricted to the top 10 meters of the lake by a skimmer weir upstream of the intakes. There is no supplemental aeration capability at the Cowans Ford powerhouse.

Water quality in Mountain Island Lake is highly influenced by the discharge from the Cowans Ford Development. Consequently, DO concentrations in the Mountain Island tailrace also are below 4 mg/l only 1 percent of the time from May through November. Mountain Island Lake discharges directly into Lake Wylie and has a short 0.6-mile bypassed reach. Between May and November the daily average DO concentrations typically meet water quality standards approximately 87 percent of the time. There is no supplemental aeration capability at the Mountain Island powerhouse.

The Wylie Development releases water with DO below 4 mg/l, 29 percent of the time from May through November. DO may remain below 4 mg/l for up to 6 miles below Wylie dam, after which it improves because of re-aeration and photosynthesis by aquatic plants. Wylie turbines 2 and 3 have hub-venting capability, unit 1 has minimal aeration capability, and unit 4 has no venting capability. The 25.6-mile river reach from Lake Wylie to Fishing Creek reservoir is one of the longest free-flowing reaches in the project area. DO in the regulated reach immediately downstream of the Wylie Development primarily is controlled by Wylie power generation; progressively downstream, DO is primarily affected by photosynthesis and

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[11] Stay vanes are fixed metal vanes fitted to the inner periphery of the scroll case that guide the water from the scroll case to the turbine runner.

[12] Hub venting is an air flow enhancing measure that draws air into the turbines and mixes it with the water.

respiration of extensive aquatic vegetation. DO concentrations are frequently not in compliance with South Carolina water quality standards.

DO concentrations in the Fishing Creek tailrace fall below 4 mg/l, 13 percent of the time from May through November. Highly variable DO concentrations are attributed by Duke Energy to high loadings of organics and nutrients from wastewater discharges, high algal productivity, non-point source runoff, and short retention time and weak stratification in the reservoir. Fishing Creek units 1, 2, and 3 have minimal aerating capability, and units 4 and 5 have none. Great Falls reservoir has a very short retention time, 1 day, and is highly influenced by the discharge from Fishing Creek reservoir. Fishing Creek reservoir discharges directly to the Great Falls reservoir downstream.

Releases from the Great Falls and Dearborn Developments, however, are lower than those from the Fishing Creek Development because of continued biological decomposition in Great Falls reservoir. DO concentrations in the Great Falls tailrace are below 4 mg/l, 29 percent of the time from May through November. There is no supplemental aeration capability at the Great Falls powerhouse. South Carolina DHEC has no long-term monitoring sites on Great Falls reservoir and has not assessed water quality in Great Falls reservoir. Great Falls and Dearborn powerhouses discharge directly into Cedar Creek reservoir. Releases from the Great Falls powerhouse flow directly into Cedar Creek reservoir, which also has a short retention time of 2 days. DO concentrations in the Cedar Creek tailrace fall below 4 mg/l, 18 percent of the time from May through November. Cedar Creek units 2 and 3 have some aeration capability.

DO concentrations in the release from Lake Wateree are influenced by high nutrient and organic loadings to the reservoir from Cedar Creek reservoir, high biological productivity in the surface waters and decomposition of organic matter in the bottom waters, stable thermal stratification during the summer, and a moderate retention time of 29 days. The Wateree tailrace is reported to have DO below 4 mg/l, 31 percent of the time from May through November. Wateree turbines 1 and 3 have auto-venting runners that provide good aeration, but the other units have limited venting capability. The Wateree River below the Wateree dam is the longest riverine reach (79 miles) downstream of Lake James and the Bridgewater Development.

3.3.2.2 Environmental Effects

3.3.2.2.1 Water Quantity

The Catawba-Wateree Project Revised CRA covers a wide range of measures related to water use, reservoir level management, proposed minimum streamflow schedules, a Low Inflow Protocol, and a Maintenance and Emergency Protocol for project-influenced reaches and reservoirs. Because measures related to streamflow primarily pertain to protecting and enhancing aquatic and riparian habitat and recreational opportunities, we discuss these measures in sections 3.3.3.2, *Aquatic Resources, Environmental Effects*; 3.3.4.2, *Terrestrial Resources, Environmental Effects*; and 3.3.7.2, *Recreational Resources, Environmental Effects*. In this section we discuss the effects of the proposed project operations on current and future water uses, reservoir water level regimes, the ability to meet minimum streamflow requirements, and the needs of project operations, as well as measures to ensure compliance with the proposed minimum streamflow schedules and water level regimes. In addition, in this section we discuss the effects of project operations on shoreline flooding in the Wateree reservoir.

Reservoir Level Fluctuations

Duke Energy proposes to endeavor to meet normal target elevations at all the reservoirs, which is not required by the existing license (see Revised CRA proposed license article WQQ 1.0 listed in table 4 in section 2.2.3.1). It also proposes to operate each reservoir within a range between full pond and the normal maximum draw-down unless operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol.

Under the Spring Reservoir Level Stabilization Program (see Revised CRA proposed license article WQQ 2.0 in table 4), Duke Energy proposes to limit the operating range to 3 ft for 3 weeks during bass spawning season at Lake James, Lake Norman, Lake Wylie, and Lake Wateree. Because the purpose of this program would be to enhance littoral fish spawning habitat, and it would operate well within Duke Energy's proposed operating guides, we discuss it further in section 3.3.3.2, *Aquatic Resources, Environmental Effects*.

No stakeholders or the public proposed alternative operating guides, although there were comments about flood elevations at Lake Wateree, which we discuss below in *Lake Wateree Flooding*, and critical elevations for Lake James, which we discuss below in *Low Inflow Protocol*. Donna Lisenby, the Catawba Riverkeeper, commented that Duke Energy's proposed normal target elevations would not be enforceable and that the proposed maximum draw-downs at some of the reservoirs are lower than the existing maximum draw-downs.

Our Analysis

Reservoir operating guides are tools to help manage reservoir operations that affect reservoir levels. The goal is to maintain water levels as close as possible to the normal target elevation, but within the envelope of normal minimum and normal maximum elevations. Table 22 compares Duke Energy's proposed operating guides to the voluntary guides under which it has operated historically. The table also compares maximum draw-down fluctuations and usable storage area in each of the project reservoirs.

Under Duke Energy's proposal, normal maximum operating elevation would increase to full pond year-round at all project reservoirs, and maximum draw-down would change at all reservoirs except Fishing Creek. Duke Energy expects that daily reservoir elevation fluctuations would increase over current conditions because the requirements for minimum flow, which we discuss below in *Minimum Flow Releases*, would necessitate discharging water that would now be held for generation on a daily basis under the existing license. These daily fluctuations would still occur within the range of normal maximum draw-down.

Duke Energy modeled the ability to operate the project with the proposed reservoir operating guides plus flow and other water use requirements, which we describe in the section, *Water Balance Simulation Modeling*. The model (CHEOPS) has been reviewed and accepted by the major federal, state, and local stakeholders. We conclude that the reservoir operating guides proposed by Duke Energy are reasonable and achievable and a good balance between often conflicting demands.

However, as proposed, the Duke Energy proposal would not clearly require that reservoir elevations be maintained on average at the normal target elevations, which would be goals only and not conditions. While all scenarios cannot be anticipated and some flexibility is essential to a project, the development of the Low Inflow Protocol and the Maintenance and Emergency Protocol provides adequate flexibility for the applicant to adjust to extreme conditions. Staff

proposes that the normal target elevations proposed by Duke Energy be made conditions of the license to be enforceable as an annual average, and the proposed minimum elevations (maximum draw-downs) be made conditions of the license to be enforceable at all times except when operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol. In *Flow and Reservoir Elevation Monitoring and Reporting* below, we discuss requirements for reporting reservoir elevations that will ensure that the Commission and resource agencies are able to assess Duke Energy's compliance with these proposed license conditions.

Reservoir level management affects aquatic, terrestrial, and recreational resources, which we discuss in sections 3.3.3.2, *Aquatic Resources, Environmental Effects*; 3.3.4.2, *Terrestrial Resources, Environmental Effects*; and 3.3.7.2, *Recreational Resources, Environmental Effects*.

Table 22. Existing[1] and proposed draw-downs, maximum reservoir fluctuation, and usable storage (Source: Duke Energy, 2007)

	Normal maximum draw-down (ft)		Normal target draw-down (ft)		Normal minimum draw-down (ft)		Maximum fluctuation (ft)		Usable storage (acre-feet)	
Reservoir	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**	**Existing**	**Proposed**
James	4 to 10	5 to 8	2 to 8	2 to 6	0 to 6	0	10	8	57,349	51,936
Rhodhiss	5	6	3	3	1	0	4	6	7,097	10,645
Hickory	3.5	6	3	3 to 4	1	0	2.5	6	9,834	23,222
Lookout Shoals	3.5	6	2	3	1	0	2.5	6	2,138	5,049
Norman	4 to 10	5 to 9	2 to 8	2 to 6	0 to 6	0	10	9	298,142	271,628
Mountain Island	4	5.7	3	4	0.5	0	3.5	6	10,146	15,859
Wylie	5	6	3	3	1	0	4	6	40,145	60,217
Fishing Creek	5	5	3	2	1	0	4	5	11,159	14,320
Great Falls	6	5	2.5	2.5	0.5	0	5.5	5	1,966	1,888
Cedar Creek	3.5	4	2.5	2.5	0.5	0	3	4	2,190	2,920
Wateree	5 to 7	6 to 7	3 to 5	3 to 5.5	1 to 3	0	6	7	65,568	77,130

[1] The existing license has no limitations on reservoir levels; Duke Energy voluntarily operates under these existing draw-down guides.

Minimum Flows for Aquatic Life

Reservoir level management is also tied directly into the ability to meet minimum flow requirements. See section 2.2.2.1 for proposed minimum continuous flows and minimum average daily flows outlined in the Revised CRA. See section 3.3.3.2 for alternative minimum flows proposed by Interior, NOAA Fisheries, American Rivers and the Coastal Conservation League jointly, and the Catawba Riverkeeper. The Lancaster County Water and Sewer District in Union County, North Carolina, commented that these alternative minimum flows could result in earlier triggering of the Low Inflow Protocol under low inflow conditions, which could result in more frequent drought restrictions on its customers. The proponents of additional flows for diadromous fish responded to the District's comments by stipulating that the proposed flows would not be required if they would induce a Stage 0 condition of the Low Inflow Protocol. In their recommendations filed after the Commission's ready for environmental analysis notice, however, these proponents did not include this stipulation.

Our Analysis

In our analysis of the proposed minimum instream flows and alternatives for fish in section 3.3.3.2, *Aquatic Resources, Environmental Effects*, we conclude that Duke Energy's proposal is appropriate and adequate to support existing aquatic resources. The negotiation of minimum instream flows at each development proposed by the Aquatic Resources Committee relied on the CHEOPS model to assess the effects of instream flow options on the system balance of water among the project developments. The stepwise process of this analysis is documented in the consultation record for the aquatic resources, book 2 of the license application. Beginning with the goal of 80 percent of the estimated maximum habitat available at unregulated flows (without the project), recommended flows were tested for sustainability using CHEOPS simulation runs; flow recommendations were adjusted as necessary until sustainable flows as close to the goal as possible were identified.

After review of the consultation record and the CHEOPS model simulations, we conclude that the recommended minimum flows in the Revised CRA are sustainable through 2048 to 2058 under critical extended low inflow periods typical of the hydrologic record since 1930. The higher flows recommended by some non-agency stakeholders for anadromous fish spawning at several of the lower basin developments upset the system water balance simulated through CHEOPS.

The ability to meet these minimum flows may be compromised during extended periods of severe low inflow when regional growth and associated water demand projected beyond the year 2048 may tax the ability of operating protocols to balance and maintain system storage capacity. The Revised CRA provides a mechanism for temporary variance from continuous minimum flows when conditions trigger implementation of the Low Inflow Protocol or Maintenance and Emergency Protocol. Annual reporting by the applicant and review by the Commission and resource agencies provide the means to ensure that minimum flows for aquatic resources are satisfied and to evaluate the operational experience managing the interaction of various competing system demands and flows that were simulated using CHEOPS.

Recreational Flows

The Revised CRA proposes a schedule of augmented releases to support recreational paddling and float angling and a system for communication of information related to recreational

releases from the Bridgewater, Oxford, Wylie, Great Falls, Dearborn, and Wateree Developments. These releases are scheduled for daylight hours on selected days of the week beginning in March, April, or May, depending on the development, and running through October. See table 3 in section 2.2.2.1 for Duke Energy's proposed recreational flows. We evaluate recreational flows in section 3.3.7.2, *Recreational Resources, Environmental Effects*, and the potential effects of these flows on aquatic resources in section 3.3.3.2, *Aquatic Resources, Environmental Effects*.

Our Analysis

Similar to continuous minimum flows for aquatic resources, the effect of recreational flow proposals on system water balance and operations were tested using the CHEOPS model. The ability to manage reservoir capacity at target water levels in conjunction with minimum flows and proposed recreational releases was verified with CHEOPS. We are satisfied that the CHEOPS model is a reliable tool for simulation of the balance of proposed recreational flows with other water uses proposed in the Revised CRA. The model simulations indicate that system storage and proposed operating protocols would allow Duke Energy to meet projected water demand and satisfy downstream flow requirements for recreation and aquatic resources through at least the year 2048 under extended low inflow conditions typical of the hydrologic record since 1930. During periods of drought or emergency maintenance, the capacity to provide the recreational flows may be compromised; the Revised CRA provides for a mechanism for temporary variance from recreational flow releases when conditions trigger implementation of the Low Inflow Protocol or Maintenance and Emergency Protocol.

Lake Wateree Flooding

High water concerns identified by property owners on Lake Wateree included the following issues:

- flooding of roads resulting in emergency access restriction;
- damage to structures, land, septic systems, and other items;
- damage to docks and the interruption of recreational opportunities; and
- shoreline erosion.

The Revised CRA proposes an alternative 10,000 cfs (4-ft deep by 300- to 400-ft wide) bladder dam for the Wateree spillway at a cost of $6,000,000. Based on the analysis (Duke Energy, 2006b) of the significant 2003 flood event presented in Figure 14, it appears that the 10,000-cfs-capacity bladder dam would have reduced the peak flood elevation at the Wateree dam from 4.9 ft above to full pond to approximately 4 ft above, and would have reduced the time that water surface elevation exceeded 3 ft above full pond from 20.5 to 15 hours.

In its response to the Commission's additional information request (dated June 27, 2008), Duke Energy indicated that simulation of flood conditions for a 50-year period demonstrates that existing conditions result in 257 days (5.1 days per year on average) above full pond and 9 days (less than 1 day every 5 years) greater than 3 ft above full pond. The reduction in turbine capacity (to provide aeration and minimum downstream flows) without additional discharge capacity over the 50-year simulation would result in 653 days (13 days per year) above full pond and 28 days (less than 1 day per year) greater than 3 ft above full pond. By comparison, the operating conditions in the Revised CRA with a 10,000-cfs-capacity bladder dam over the

50-year simulation would result in 157 days (3.1 days per year) above full pond and 10 days greater than 3 ft above full pond (1 day every 5 years), a negligible change from existing conditions.

Based on hydraulic/hydrologic modeling, *Operations 08—Wateree High Water Level Management Study* (Duke Energy, 2006b) concluded that no reasonable adjustments to current operational practices would result in substantial mitigation of high water levels associated with major storm events in the watershed. The model simulation demonstrated that a lower water elevation at the beginning of inflow from a storm event would not significantly lower the peak level of high water events. This is due to the relatively small storage volume that can be created as compared to the volume of inflow during high intensity rainfall events. The effectiveness of operational changes is also made more difficult by the inherent uncertainty in meteorological forecasting which limits reaction time to adjust lake levels in anticipation of inflow.

For additional storage to be available in Lake Wateree (or upstream reservoirs) to assist in controlling high water events, lake levels would have to be lowered prior to increased inflows. Maintaining lower lake levels long term is not considered a viable option given the impacts to recreation, water supply, and aquatic species. Lowering lake levels in anticipation of intense rainfall and high water is dependent on meteorological forecasting and the associated uncertainty of forecasting tools. Such forecasting does not provide sufficient lead time to make lake level adjustments with the certainty that the forecast would be accurate and the decision to lower lake levels correct. Changes in the operation of upstream hydroelectric developments are also dependent on rainfall forecast. If rain is primarily centered in the Lower Catawba River Basin downstream of Lake Wylie, limited storage exists and operational options are even more limited.

Discharges for Lake Wateree are limited to powerhouse releases through the turbine-generator units and spillway discharges after the lake level reaches full pond at 225.5 ft. Normal operating procedure is to maximize powerhouse discharge to prevent water levels in excess of full pond. The Revised CRA proposes to replace one of the existing turbine runners with a smaller runner in order to provide aeration and more efficiently provide the minimum continuous flows for aquatic resources. This change is likely to result in no more than a 10 percent reduction in the maximum hydraulic capacity of 15,900 cfs at the Wateree powerhouse. At a flood elevation of 228.5 ft, 3 ft above full pond, the estimated spillway capacity at Wateree is 24,331 cfs; thus, the total discharge capacity at 228.5-ft lake elevation is 40,231 cfs. The decreased capacity as a result of the downsized turbine capacity would be less than 5 percent.

A broad range of options to provide additional discharge capacity were evaluated in the *Operations 08* studies. The Wateree Development hydraulic/hydrologic model (Duke Energy, 2006b) indicated that an increased capacity of 40,000 cfs would be necessary to significantly mitigate most flooding above 228.5 ft. The additional capacity would both reduce the maximum lake elevation as well as the decrease the duration that the lake is above full pond (Figure 14). The resource committee charged with evaluating alternatives for alleviating Lake Wateree flooding reached the consensus that the cost for the additional 40,000 cfs capacity ($9,600,000) was not justified by the low frequency of flood events that exceed the 228.5-ft lake elevation (less than 1 day per year on average).

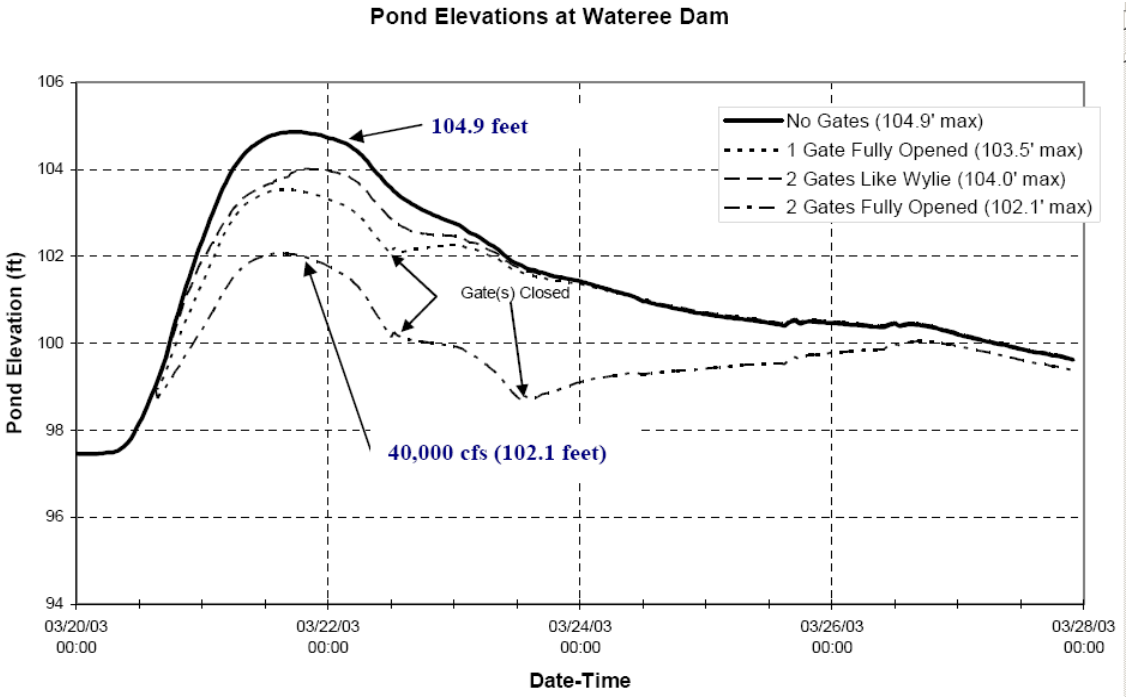

Figure 14. Water surface elevation at Wateree dam with varying discharge conditions (March 2003 storm) (100 ft is full pond at elevation of 225.5 ft) (Source: Duke Energy, 2007).

Duke had alternatively proposed to support road upgrades to improve access and egress for residents and emergency responders during flood events. Stakeholders identified 18,500 ft of road segments between 225.5 and 228.5 ft that could be raised to 230.0 ft in order to reduce flooding; the estimated cost for these infrastructure upgrades exceeded $3,435,000, without additional costs for purchase of easements and restoration of private property following construction. Upgrading and raising public roads would reduce the frequency and duration that these segments are flooded; however, the frequency and duration of flooding of private property, structures, and septic systems lower than 228.5 ft would not be alleviated. Given the relative costs of road reconstruction and other damage to private property from flooding versus construction of a 10,000-cfs bladder dam, the stakeholders concluded that the reduction in frequency and duration of flooding associated with the bladder dam was a more cost-effective measure for mitigation of flooding effects on property and infrastructure.

Comments submitted by residents during the public review of the Revised CRA suggested that flood gates be examined as an alternative to the bladder dam. There are a wide variety of flood gate designs that could be considered and may be more or less cost effective at a given location; a variety of these structures were evaluated by Duke Energy. A bladder dam acts as one of several flood-gate-type designs that were considered (Duke Energy, 2006b) and was selected as most appropriate to address the Lake Wateree flooding issues. Another commenter suggested lowering the entire spillway by 2 ft.

Our Analysis

The flood elevation has never risen above the applicant's easement. Also, the applicant's proposal improves upon the existing condition in terms of flooding while overcoming a reduction in hydraulic capacity associated with providing for downstream minimum flows. For these reasons and our analysis of the alternatives below we recommend approval of the proposal in the Revised CRA employing the 10,000-cfs bladder. Though staff concludes that the 10,000-cfs bladder is the appropriate measure. Commission policy is to analyze projects for 30-year terms in NEPA documents, and staff does not pre-determine the duration of the license before it is issued and cannot link any measure to granting a 50-year license.

Although lowering the entire spillway would significantly reduce flooding, this option is not practical. This approach would significantly reduce the water storage inventory in Lake Wateree, thus reducing the ability to meet downstream flow requirements for aquatic resources and recreation; reduce hydraulic head and generating capacity; reduce recreational access to Lake Wateree; and require significant upgrades to maintain access from public and private docks, piers, and boat access points.

The 40,000-cfs bladder also would mitigate many of the problems. This proposal was not supported by the resource committee advising the applicant on the matter because of the cost estimate of $9,600,000. Staff also concludes that adding an additional 50 percent to the project component cost to further improve upon the existing condition is not appropriate.

Given the reductions in frequency and duration of flooding that can be attained with the proposed bladder dam compared to the public infrastructure upgrades within the existing flood easement, it is our conclusion that the proposal for high water management via the increased discharge capacity provided by a 10-ft bladder dam provides an adequate and reasonable effort toward mitigation of effects of the occasional flood events, particularly those events reaching a height of less than 3 ft above full pond, but occurring more frequently.

To reduce future increases in the number of properties affected by the high water periods, we also recommend that, to the extent possible, Duke Energy partner with local governments to develop and implement adequate and appropriate building codes/zoning to limit the types of development and construction within the Lake Wateree shoreline flood easement in order to minimize future property losses related to typical flood events.

Wateree Development Discharge

Regulated releases coinciding with annual spring flooding events at the Wateree dam result in a lateral expansion of inundation on the flood plain downstream of the dam, beginning when the discharge exceeds 6,000 cfs. The Revised CRA contains two non-license conditions for enhancing flood plain habitat, Wateree Spring Stable Flows and the Wateree Flood Plain Inundation. See table 5 in section 2.2.2.2, *Not Proposed License Articles*, for descriptions of these conditions. The purpose of these conditions is to improve flood plain habitat for anadromous fish spawning, wetlands, and terrestrial species, and we discuss the effects of these conditions on those resources in section 3.3.3.2, *Aquatic Resources, Environmental Effects*, and section 3.3.4.2, *Terrestrial Resources, Environmental Effects*. In this section we discuss the effects of these conditions on project water flow.

Under the Spring Stable Flows Protocol, when inflows are adequate without unreasonably affecting the project operations, Duke Energy would provide two 10-day periods of

sustained stable flows to stabilize river water levels in the Wateree River and its flood plain downstream of the Wateree dam between mid-February and mid-May. If operational conditions require a flow change during one of these 10-day periods, Duke Energy would attempt to maintain the new flow for at least 8 hours before any further change is made. Under the Wateree Flood Plain Inundation Protocol, when high natural inflow during the spring (February to May) causes spill conditions at the Wateree dam, Duke Energy, in good faith, would attempt to approximate natural flow conditions until the reservoir is within 1 ft of the normal target level; 95 ft in February and 97 ft in March to May. The objective of this protocol would be to simulate the natural hydrograph of the river following high-flow events in the Catawba-Wateree River Basin; i.e., a gradual decline in the river stage over a period of time, rather than the sharp drop in river level more commonly associated with discontinuing turbine discharges over a short time interval when the reservoir returns to full pool. This hydrograph would create a more natural rate of dewatering in the habitat complex of the flood plain, which provides spawning habitat for the target anadromous fish. During periods of drought or emergency maintenance, when the system's capacity to provide flow stability and natural hydrograph conditions may be compromised, the Revised CRA provides for a mechanism for relief from these goals under the Low Inflow Protocol or the Maintenance and Emergency Protocol. The protocols also set priorities allowing suspension of the Reservoir Level Stabilization Program if necessary to achieve the flood plain inundation and flow stabilization downstream.

Because the volume of water available at the Wateree dam and the extent of inundation are dependent on seasonal weather patterns in both the Catawba-Wateree River Basin and the Congaree River Basin, the Revised CRA recommends a flexible approach to attaining the flood plain habitat and function objectives. *Terrestrial 02—Wateree River Flood Plain Inundation Study Report* (Devine Tarbell and Associates, Inc. [DTA], 2006) states that the extent of inundation for a given release at the Wateree dam increases as the discharge in the Congaree River increases and the lower Wateree River exhibits a backwater effect. The greatest backwater effect occurs at releases at the Wateree dam reach 25,000 cfs with concurrent flows in the Congaree River at approximately 40,000 cfs.

Duke Energy proposes that neither of these conditions be included as license articles, but that based on a decade of operating experience and consultation with the involved agencies and other stakeholders, enforceable license articles may be drafted as an amendment to the license in 10 years.

Our Analysis

The ability to meet the goals of flood plain inundation is highly dependent upon weather conditions in the Catawba-Wateree River Basin, natural inflows, and regulated flows into the Wateree Development. The various Revised CRA conditions affecting inflow and discharge of water at Lake Wateree create a complex set of goals that encompass minimum continuous releases, flood plain inundation, lake level stabilization, and lake flood-management. Staff finds that the flexibility of an adaptive management approach is needed to implement these programs and optimize the success of each. This can be accomplished through the reporting and consultation process described in the Revised CRA. We agree that a 10-year period is appropriate to test and refine these protocols within the operating constraints and uncertainties of weather prediction before determining whether enforceable articles can be incorporated into the license.

Low Inflow Protocol

Duke Energy proposes that the Low Inflow Protocol contained in the Revised CRA be incorporated in the license. The Low Inflow Protocol would provide a formal set of procedures to conserve and protect water resources and storage capacity on the Catawba-Wateree River Basin during extended low inflow periods or droughts. These procedures would be based on weather and watershed inflow triggers that would advance through four stages of conservation and management as the duration and severity of drought conditions increase. The Low Inflow Protocol was developed on the basis that all parties with interests in water quantity would share the responsibility to establish priorities and conserve the limited water supply. During times that inflow is not adequate to meet all of the normal demands for water and maintain normal target reservoir levels, Duke Energy would progressively reduce hydro generation. If hydrologic conditions worsen until specific trigger points are reached, Duke Energy would declare a Stage 0 Low Inflow Watch and begin meeting with the applicable agencies and water users to discuss the Low Inflow Protocol. If hydrologic conditions continue to worsen, Duke Energy would declare subsequent stages of a Low Inflow Condition as defined in the protocol. Each progressive stage of the Low Inflow Condition would require greater reductions in hydro station releases and water withdrawals and allow additional use of available water storage inventory. Waivers would be provided for the prioritization, reduction, or elimination of the normal operating requirements for spring reservoir stabilization, recreational flows, minimum flows for aquatic resources, flows for flood plain inundation, and spring downstream flow stabilization as drought conditions worsen. The goal of the staged Low Inflow Protocol would be to take actions needed in the Catawba-Wateree River Basin to delay the point at which the project's usable water storage inventory is fully depleted. The Low Inflow Protocol would also provide for waivers of downstream releases required for recreation and aquatic resources during extended low inflow periods to conserve water storage inventory in the Catawba-Wateree River Basin. The Low Inflow Protocol also provides procedures for recovery of the system when the drought conditions that initiated the Low Inflow Protocol end.

The Low Inflow Protocol would establish the Drought Management Advisory Group to meet at least annually throughout the life of the license to discuss river flows and water user data and to review and, if necessary, revise the protocol every 5 years. Under the Revised CRA, members of the advisory group would be the applicant, North Carolina DENR, North Carolina WRC, South Carolina DNR, South Carolina DHEC, USGS, and owners of large water intakes on project reservoirs, the main stems of the Catawba and Wateree Rivers, and tributaries in the Catawba-Wateree Basin above the Wateree dam.

Interior and NOAA Fisheries recommend implementation of the Revised CRA Low Inflow Protocol, and NOAA Fisheries recommends that it be added to the Drought Management Advisory Group. The Community of Lake James requests revisions to the Low Inflow Protocol including increased total usable storage in Lake Norman, changes to target storage index, more-consistent water restrictions, higher water use reduction targets, and expanded membership on the Drought Management Advisory Group. Suzanne Johnson recommends revisions to increase Lake James elevations, cap inter-basin transfers, and protect wells. George Johnson questions the validity of the CHEOPS model in predicting future low-inflow events because of understated population growth, more-severe droughts resulting from climate change, and underestimation of inter-basin transfers. He recommends raising critical intake elevations at Lake James and

lowering them at other reservoirs and increasing water use reduction targets or replacing them with water supply targets.

Our Analysis

Elements and triggers of the Low Inflow Protocol were incorporated into the CHEOPS model simulations. After review of water supply intake information, we find that the critical lake elevation inputs used in the CHEOPS model are appropriate for evaluation of the system water balance constraints and the Low Inflow Protocol. Growth and water demand inputs to the model are based on projections from recent available Census data.

These simulations indicate that the Low Inflow Protocol in combination with other proposed downstream flow requirements in the license application can be effective for managing water storage inventory in the project reservoirs. Comparison of simulations for existing baseline conditions and proposed new license conditions demonstrate that safe yield limits during low inflow periods would be sustained throughout the system for approximately 10 years longer under the proposed conditions with the Low Inflow Protocol in place. Under existing baseline conditions, safe yields would be exceeded between 2038 and 2048, while under proposed license conditions, safe yields would be exceeded between 2048 and 2058 at some reservoirs in the upper Catawba-Wateree Basin. The number of days per year when critical reservoir levels for public water supply would be violated would be reduced if the Low Inflow Protocol were implemented under the proposed new license conditions.

Adaptive management methods are built into the Low Inflow Protocol with provisions for review and revision of the Low Inflow Protocol by the Drought Management Advisory Group at least every 5 years for the life of the license; revisions would be subject to formal review and approval by North Carolina DWQ, South Carolina DHEC, or both as may be required by the respective state's Section 401 water quality certification, and would be incorporated into the license as modifications if accepted by the Commission.

We conclude that the proposed Low Inflow Protocol provides an effective, cooperative management tool for protection and conservation of water resources during extended low inflow periods. Adaptive management procedures inherent in the Low Inflow Protocol ensure that the protocol would be refined as operating experience dictates through cooperative input of all water users and managers. We find that the Low Inflow Protocol was developed through extensive modeling reviewed and accepted by all resource agencies and do not recommend any of the changes to the protocol proposed by other entities. We recommend that NOAA Fisheries and FWS be represented on the Drought Management Advisory Group to ensure that the federal interest in aquatic resources is incorporated to the extent possible during extended low inflow periods.

Maintenance and Emergency Protocol

Duke Energy proposes that the Low Inflow Protocol contained in the Revised CRA be incorporated in the license. The Revised CRA includes a Maintenance and Emergency Protocol for the Catawba-Wateree Project recognizing that under some emergency or other abnormal situations, and in the event of equipment failure and maintenance, it may be impractical or impossible to meet certain license conditions, and Duke Energy may need to temporarily suspend or modify some conditions to avoid taking unnecessary risks. The objectives of this protocol are to define the most likely situations of this type, identify the potentially affected license

conditions, and outline the general approach that Duke Energy would take to mitigate the impacts to the license conditions and to communicate with the resource agencies and other potentially affected parties. Specific details would vary and would be determined on a case-by-case basis as the protocol is being implemented for a given event.

Interior and NOAA Fisheries recommend implementation of the Revised CRA Maintenance and Emergency Protocol. Interior recommends that the applicant be required to consult with BIA and CIN for sections of the protocol related to the Wylie dam and the river below the dam because of potential effects on tribal lands and activities along the river; these two consultations are already provided for in the Maintenance and Emergency Protocol. NOAA Fisheries recommends that it be consulted during development and implementation of the protocol.

Our Analysis

A key goal of a Maintenance and Emergency Protocol is to establish the general approach for handling maintenance and emergency situations and communicating appropriate information to all potentially affected stakeholders. We find that the proposed Maintenance and Emergency Protocol accomplishes this goal. The protocol also directs Duke Energy to re-evaluate the Maintenance and Emergency Protocol each time that it is invoked and consult with affected federal and state agencies and stakeholders if revisions to the Maintenance and Emergency Protocol are necessary or recommended. The revised Maintenance and Emergency Protocol would be filed with the Commission and, if necessary, an application for a license modification would be submitted. We find that these steps would ensure that the Maintenance and Emergency Protocol is routinely refined and updated based on operating experience and that resource managers and stakeholders are involved in the process. We agree that the applicant should include NOAA Fisheries in consultations during implementation of the protocol.

Flow and Reservoir Elevation Monitoring and Reporting

Duke Energy proposes implementation of a variety of streamflow and lake level requirements on project operations. Flow level monitors are in place at all of Duke Energy's reservoirs to allow monitoring of normal target elevations and maximum draw-down limitations. There are currently six streamflow gaging stations operated by USGS in the Catawba-Wateree Basin, as shown on figure 2. Duke Energy is to fund USGS installation of a stream gage station on the Linville River between the Linville dam and the confluence of the Catawba River to monitor compliance with flow release requirements from the Bridgewater Development. To assure their continuing availability, Duke Energy would also fund USGS for operation and maintenance costs associated with the new gage and the six existing gages in the watershed.

CRA Section A-6.0 details the annual monitoring and reporting requirements that would be necessary to document compliance with these license articles and to provide the Commission and federal and state agencies with the data necessary to evaluate the effectiveness of these articles for protection and enhancement of the affected resources. The annual report would provide data and summaries of high frequency monitoring of lake levels and downstream flow releases for recreation and aquatic habitat, and it would identify times and locations of any noncompliance events.

Our Analysis

We find that the stream gages are essential to monitoring and evaluating compliance with the proposed downstream flow requirements, and we recommend that the applicant install and maintain a new gage conforming to specifications of the USGS at the location proposed on the Linville River. We also recommend that the applicant operate and maintain this gage and six other gages at or in similar locations to the six gages currently in operation in the watershed, as shown on figure 2. Duke Energy may choose to implement the installation and maintenance for these gages via whatever contractual or funding mechanism they deem appropriate, but Duke Energy is the responsible party for compliance with the license article.

We also conclude that the proposed monitoring and reporting requirements for lake levels and downstream flows are adequate to provide the Commission and other federal and state agencies with the information necessary to determine and ensure compliance with and assess the effectiveness of these license articles. Based on review of these annual reports, the Commission reserves the right to require changes to project operations or project facilities. Federal and state resource agencies may also act on the basis of these reports.

3.3.2.2.2 Water Use

Duke Power proposes to operate under a water agreement established as part of their relicensing process built around use of their CHEOPS model applied to water supply and use issues and the formation of a Water Management Team. Several of the major public water suppliers and industrial water users are signatories to the settlement. The locations of major water withdrawals are shown in figure 15. Net water use associated with public water supply is expected to increase from 32 percent of the net water use at present (figure 16) to 52 percent in 2058 (figure 17); i.e., from 55 to 243 mgd. *Operations 04—Water Supply Study* (HDR Engineering, Inc. of the Carolinas [HDR], 2006) presented projections for increases of water usage by development in 10-year increments for the next 50-years (table 23). The totals of all withdrawals across all reservoirs are projected to increase by 125 percent by 2058. Except at the Fishing Creek Development, water returns are less than withdrawals; net water use in the Catawba-Wateree River Basin is projected to increase approximately 180 percent by 2058 from 170 mgd at present. Depending on the development, outflow ranges from 0 to 12 percent of the mean river flow (figure 18).

Figure 15. Water withdrawals and returns in the Catawba-Wateree River Basin (Source: Duke Energy, 2007).

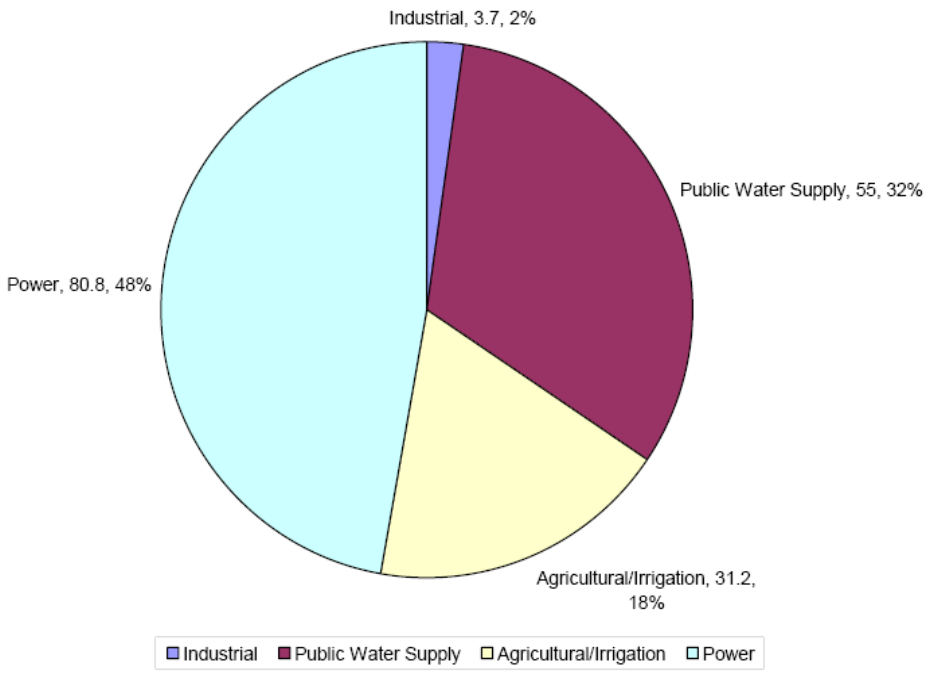

Figure 16. Current net water use in the Catawba-Wateree River Basin (in mgd) and percent of total (Source: Duke Energy, 2007).

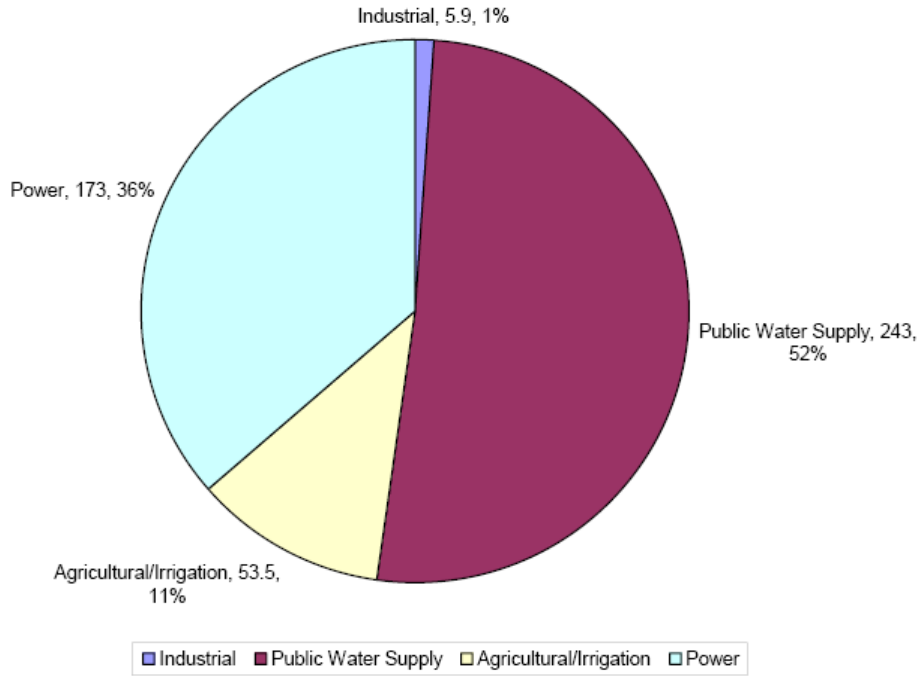

Figure 17. Projected net water use in the Catawba-Wateree River Basin in 2058 (in mgd) and percent of total (Source: Duke Energy, 2007).

Table 23. Projected annual average withdrawal, return, and net water use by watershed (in mgd). (Source: Duke Energy, 2007)

Reservoir	Year						
	Current[1]	**2008**	**2018**	**2028**	**2038**	**2048**	**2058**
Withdrawals							
James	11	12	13	14	15	32	34
Rhodhiss	26	28	30	33	36	40	44
Hickory	18	17	21	25	30	37	44
Lookout Shoals	1	6	7	9	10	12	12
Norman	60	66	99	118	133	169	179
Mountain Island	101	131	153	172	192	207	224
Wylie	92	95	101	120	130	141	155
Fishing Creek	103	132	146	159	172	183	195
Great Falls	1	2	2	2	2	2	2
Cedar Creek	1	1	1	1	1	1	1
Wateree	6	8	9	11	26	27	56
Subtotal	***420***	***498***	***582***	***664***	***747***	***851***	***946***
Returns							
James	9	10	11	12	12	13	14
Rhodhiss	14	15	17	18	20	21	23
Hickory	6	7	8	9	11	14	16
Lookout Shoals	1	1	1	1	1	1	1
Norman	2	2	2	3	3	4	4
Mountain Island	6	8	12	14	16	18	18
Wylie	45	46	52	59	68	77	89
Fishing Creek	165	192	213	234	254	272	291
Great Falls	1	1	2	3	5	7	9
Cedar Creek	1	1	1	2	2	3	3
Wateree	0	0	0	0	0	0	0
Subtotal	***250***	***283***	***319***	***355***	***392***	***430***	***468***

Reservoir	Year						
	Current[1]	**2008**	**2018**	**2028**	**2038**	**2048**	**2058**
Net Water Use							
James	2	2	2	2	3	19	20
Rhodhiss	12	13	13	15	16	19	21
Hickory	12	10	13	16	19	23	28
Lookout Shoals	0	5	6	8	9	11	11
Norman	58	64	97	115	130	165	175
Mountain Island	95	123	141	158	176	189	206
Wylie	47	49	49	61	62	64	66
Fishing Creek	-62	-60	-67	-75	-82	-89	-96
Great Falls	0	1	0	-1	-3	-5	-7
Cedar Creek	0	0	0	-1	-1	-2	-2
Wateree	6	8	9	11	26	27	56
Subtotal	***170***	***215***	***263***	***309***	***355***	***421***	***478***

[1] Current rates were based on the most recent available years for which withdrawals and returns were recorded. The most recent year for a given water user ranged between 1999 and 2003.

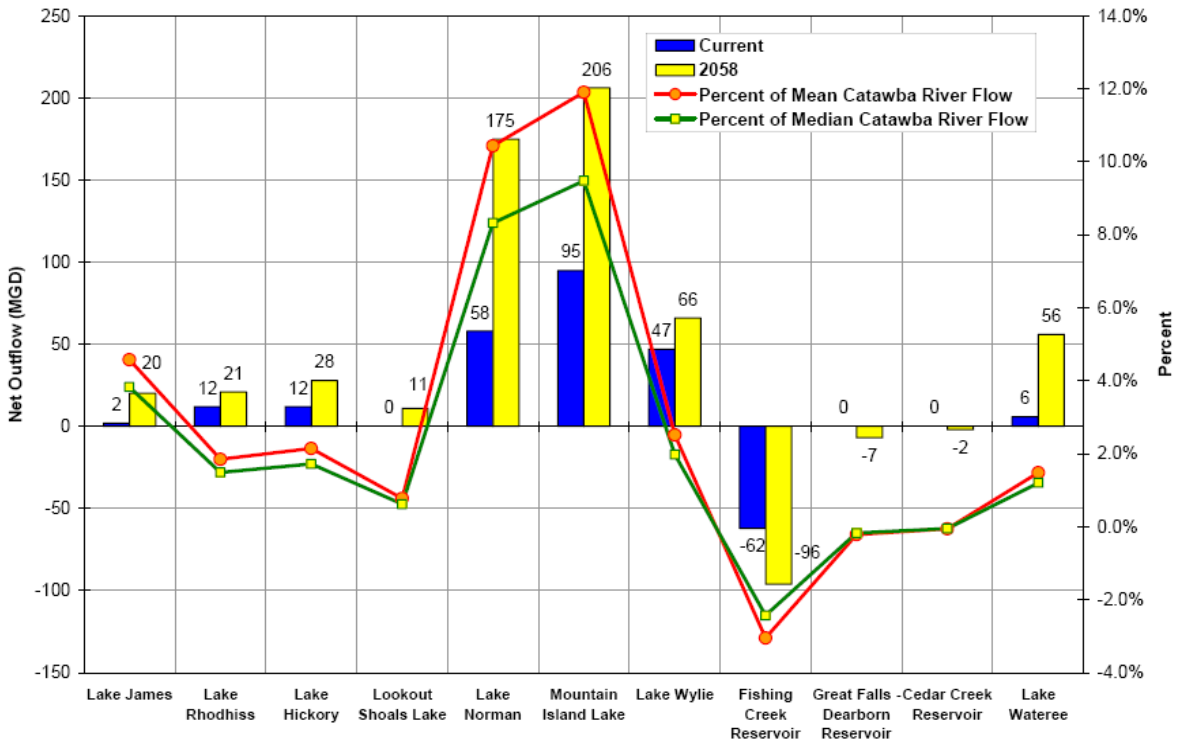

Figure 18. Current versus projected 2058 net water use (net outflow) (Source: Duke Energy, 2007).

Interior commented that an appropriate balance of water uses including for aquatic resources and diadromous fish restoration in the Catawba-Wateree basin should be analyzed to provide the baseline for future water needs studies. They requested that impacts of inter-basin water transfers also need to be analyzed. Interior also recommended that consideration be given to adjustment of flows over life of the license as withdrawal and discharge permits are modified.

NOAA Fisheries has requested that it be represented on the Drought Management Advisory Committee established in the Low Inflow Protocol.

The Catawba Riverkeeper, the Valdes Town Manager, S. Williams, S. Johnson, and G. Johnson all expressed concern relative to the impact of inter-basin water transfer and how those transfers have been handled in the CHEOPS model. Mr. G. Johnson commented that population growth and future inter-basin transfers were not accurately modeled in CHEOPS. Various of these stakeholders requested that inter-basin transfer flows modeled in excess of those currently authorized be used for aquatic habitat flows and that inter-basin transfers be capped in the future.

Our Analysis

Existing and future water withdrawal and discharge for public water supply and industrial use within the project are not directly impacted or controlled by the project, but require cautioned and reasoned balance of available water with other uses. Public water supply, inter-basin transfers, wastewater, and industrial discharges are regulated by the states; the only control Duke Energy has in this process is the granting of easements on project lands. Existing inter-basin

transfers represent a very small proportion of the water demand on the project. Future applications for inter-basin transfers should be evaluated in terms of the effect on the balance of other water users within the Catawba-Wateree Basin, but are not within the scope of this licensing process.

We conclude that Duke Energy, in conjunction with the stakeholder consultation process, has performed an adequate evaluation of existing and future projected water use and balancing of competing uses based on the CHEOPS modeling exercise in support of the license application. Existing withdrawal and discharge have been documented from permits and monitoring report data. Appropriate, critical existing intake elevations have been identified for each development. Future water uses have been estimated from appropriate census and population growth projections. The model scenarios used to balance water uses recognize the uncertainty associated with projections of future growth, making conservative assumption related to growth and water availability using the two driest periods in the historic record as a baseline.

The model simulations indicate that the system may be unable to meet future water demand 40-50 years into the future. However, the Low Inflow Protocol proposed as an article for the new license provides the mechanism for progressive water conservation and management of limited water resources during periods of low inflow including cooperative management through the Water Group. The Water Group is representative of the array of water users and should include interested regulatory and resource management agencies such as NOAA Fisheries.

The water users group, Water Group, and Low Inflow Protocol provide the mechanisms and incentive to conserve and manage the water resource over the duration of the new license to resolve and avert future stress on the water resource projected by the applicant's analysis of water use.

3.3.2.2.3 Water Quality

Dissolved Oxygen Management and Monitoring

Duke Energy proposes to develop and implement an FWQIP for completing the modifications necessary to satisfy the flow and water quality requirements at the project developments. The FWQIP would be prepared in consultation with FWS, NOAA Fisheries, North Carolina DENR, North Carolina WRC, South Carolina DNR, and South Carolina DHEC. Also, in the Revised CRA, Duke Energy proposed to operate the project in accordance with the conditions of the section 401 water quality certificates (WQCs) and to implement any DO monitoring requirements that may be contained in them.

FWQIP agreements identified elsewhere in the Revised CRA, but related to water quality, are important as well:

1. Duke Energy will initiate interim measures for providing aquatic flow, DO enhancement, or both as identified in the FWQIP within 60 days following the issuance of the new license and closure of all rehearing and administrative challenge periods related to water quantity and quality. The interim measures would continue until the physical modifications specified in the FWQIP are complete unless Duke Energy is operating in accordance with the Low Inflow Protocol or the Maintenance and Emergency Protocol.

2. Following implementation of the physical modifications specified in the FWQIP, Duke Energy will operate the project in accordance with the 401 WQC.
3. If TMDLs are developed for waters within the project boundaries, Duke Energy will actively consult with the appropriate state agency to determine what, if any, role project operations play in managing the pollutant(s) specified.
4. After implementation of the physical modifications specified in the FWQIP, if regular noncompliance with the WQC occurs as a result of project operations, Duke Energy shall document the noncompliance in the annual water quality compliance report; assess the reasons for noncompliance and propose corrective actions; consult with South Carolina DHEC and North Carolina DWQ, as appropriate; and implement the state-approved plan for corrective action. If Duke Energy concludes that its ability to comply with the WQC is not attributable to project operations, Duke Energy will assist South Carolina DHEC, North Carolina DWQ, or both in determining the sources of the noncompliance.

To assess the success of the water quality measures, Duke Energy proposes to develop and implement a water quality monitoring plan (WQMP) to monitor compliance with water quality standards. The WQMP would be prepared in consultation with North Carolina DWQ and South Carolina DHEC. By June 30 following each full calendar year for the term of the new license, Duke Energy proposes to file a report with the Commission verifying compliance with applicable WQCs.

The specific measures for improvement of DO conditions in the tailwaters involve provision of minimum flows and the implementation of tailwater aeration strategies. Duke Energy would provide continuous minimum flows at the Bridgewater, Oxford, Lookout Shoals, Wylie, Great Falls, Dearborn, and Wateree Developments to protect and enhance aquatic habitat and water quality in the downstream riverine sections. Duke Energy proposes to perform the following physical modifications to increase tailwater DO:

- Under a previously authorized project at the Bridgewater Development, Duke Energy is building a new powerhouse at the Linville dam that will include aeration capability on all units. Duke Energy proposes to install a new flow valve with aerating capability that would support minimum flow releases and enhance aeration at the Bridgewater Development Catawba River dam.
- A new aerating runner would be installed on unit 3 at the Rhodhiss Development to provide a continuous minimum flow that supports public water supply and industrial processes.
- A minimum flow valve and a new aerating runner would be installed at an existing unit at the Oxford dam to provide a year-round continuous minimum flow of at least 150 cfs.
- A year-round continuous minimum flow of at least 80 cfs would be provided from the Lookout Shoals Development. Anticipating enhanced DO conditions as a result of improved releases from the upstream Oxford Development, DO management at Lookout Shoals would be controlled initially by operation of the existing vacuum breakers. Additional aeration may be accomplished, if necessary, by adding aeration capacity to auxiliary units at Lookout Shoals.

- An existing hydro unit at the Wylie Development would be replaced with a small aerating hydro unit to provide year-round continuous minimum flows.
- Existing stay vanes and hub venting would be used to manage DO in downstream releases at the Fishing Creek Development.
- A flow release structure would be installed at the Great Falls headworks and the Great Falls diversion dam to provide continuous minimum flows to the bypassed reaches, and operation of existing vacuum breakers would be used to enhance DO as needed.
- Existing hub venting at the Cedar Creek and Rocky Creek Developments would be used to manage DO in downstream releases.
- An existing hydro unit at the Wateree Development would be replaced with a small aerating hydro unit to provide year-round continuous minimum flows.
- No changes to the equipment or operations were proposed at the Cowans Ford and Mountain Island Developments.

Duke Energy proposes to develop and implement a WQMP to monitor compliance with water quality standards, a draft of which appears in appendix F of the Revised CRA. The WQMP would be prepared in consultation with North Carolina DWQ and South Carolina DHEC. The plan would include potential locations for continuous DO monitors, which were selected in consultation with the water quality resource committee and have been submitted to the state agencies for approval. By June 30 following each full calendar year for the term of the new license, Duke Energy proposes to file a report with the Commission verifying compliance with applicable WQCs.

Interior commented that the application does not provide for compliance with basic water quality standards (e.g., temperature and DO) prior to issuance of the license. Interior also requested that permanent water quality monitors be included as part of the WQMP for each of the project tailwaters, bypassed reaches, and reservoirs. They specifically indicate the need for monitoring temperature, turbidity, pH, DO, and total dissolved gas and recommended that real-time monitoring be included in the license. Interior expressed concern that Duke Energy's proposed enhancements to project equipment and facilities do not provide adequate assurance that DO standards will be met in a timely manner. They asked that the commission consider the following: the adequacy of Duke Energy's proposed measures for DO; development of an alternative plan to provide timely compliance with water quality standards in project reservoirs, bypassed reaches, and regulated tailwaters; and the need for a backup plan with adequate redundancy in critical equipment to ensure compliance with water quality standards at all times, including during maintenance or emergency shut-down of oxygen-enhancing equipment.

EPA asked that the DO enhancement program be evaluated with respect to the goal of increasing DO concentrations below all dams to meet state water quality standards. Specifically, EPA recommended that the program include contingencies for making additional modifications if the proposed modifications are not successful in meeting water quality standards. The agency also indicated that empirical evidence should be evaluated to determine the aeration capability of existing units and the effectiveness of existing technologies to increase DO levels in project tailwaters. EPA recommended that the capability of existing equipment to meet DO standards be determined before license approval. The agency also commented that the continuous water

quality monitoring program should be evaluated under the FWQIP. Finally, EPA requested that they be included as a consulting party in the development of the FWQIP and WQMP.

North Carolina DENR and North Carolina WRC recommended that development of the WQMP in conjunction with the state agencies be included as a license article. American Rivers, Coastal Conservation League, and the Catawba Riverkeeper commented in response to the Ready for Environmental Analysis Notice that it has not yet been demonstrated that the project will meet either North Carolina's or South Carolina's DO standards, particularly below Lake Wylie. These stakeholders also requested that the WQMP require that all elements of the project meet all applicable state water quality standards under all operating conditions.

The Catawba Riverkeeper stated that to provide redundancy, particularly in the event of maintenance and emergency events, every turbine should be able to meet water quality standards for DO. The Lake Wateree Lakekeeper requested an evaluation of the aerating capability of the turbines to ensure water quality standards will be met, and if not, that Duke Energy should be required to provide further mitigation. Mr. G. Knox (Mayor of Cornelius) requested that Duke Energy maintain its environmental monitoring section rather than turn it over to a government agency.

Our Analysis

There are no water quality requirements in the existing license for the Catawba-Wateree Project. The project was originally licensed in 1958, prior to the implementation of the Clean Water Act; therefore, the project has never been required to obtain a WQC. Operating the developments consistent with the Revised CRA would generally increase the rate of water moving through the system and lower the effects of biochemical oxygen demand on DO concentration in affected reaches of the Catawba-Wateree project area,

Operation of existing equipment at some developments and installation of proposed aerating capacity at other developments have a potential to enhance DO. The extent of this capacity is a function of site-specific conditions. Several of the regulatory and resource agencies and other stakeholders have requested a mechanism for further action in the event that proposed equipment and operational modifications are not adequate to bring all of the developments into compliance with state DO standards. The proposed WQMP, which will be finalized in consultation with the agencies, provides an adaptive management framework for monitoring water quality improvements and making necessary modifications when and where non-compliance related to project operations has not be adequately addressed by the elements of the FWQIP. The WQMP provides for real-time data collection, monthly and annual data summaries and analyses, identification of non-compliance events, corrective measures and further mitigation. Inclusion of the WQMP and FWQIP by reference in the 401 WQC ensures ongoing consultation and provides the states with a mechanism for enforcement of water quality standards. It is our conclusion that the measures in the FWQIP have a reasonable potential to enhance DO to meet state water quality standards in the affected reaches and that the WQMP and 401 WQC will provide for monitoring, documentation, and compliance; identify failures to meet the water quality criteria; and provide the means to ensure that necessary modifications can be implemented where FWQIP measures are not adequate.

We agree that the state and federal agencies with responsibilities for regulation and protection of water quality related to this project should be included as part of the consultation team for development and review of the FWQIP and WQMP and the monthly and annual review

of data specified in the WQMP. We recommend inclusion of EPA in the consultation list. EPA's request for more evidence that the aeration methods will work, and a similar request by the Coastal Conservation League, American Rivers, and Catawba Riverkeeper, is most affordably met by deploying the devices and beginning the monitoring, some of it continuous as requested in the EPA comments, as soon as possible.

Regarding the request by the state agencies, the Coastal Conservation League, American Rivers, and Catawba Riverkeeper that the license include the provisions of the state's 401 certifications, the proposed FWQIP and WQMP are included as proposed license articles in the PM&E and as part of the application for the 401 certification. North Carolina DWQ issued a letter (November 18, 2008) granting the 401 certification (No. 3767) and incorporating by reference the conditions of the Revised CRA and the included WQMP and FWQIP. PM&E 6.1 includes a requirement for preparation of a quality assurance project plan as part of the 401 certification application; North Carolina DENR and North Carolina WRC requested that this be included as a license article. The quality assurance project plan requested by North Carolina was submitted as part of the complete 401 certification application; North Carolina DWQ subsequently issued the 401 certification.

The new license would place responsibility on Duke Energy for compliance with all license articles including those related to water quality monitoring described in the WQMP and the state 401 certifications. The mechanism (e.g., in-house staff, consultants, agency) by which Duke Energy implements the monitoring requirements including sampling, operation and maintenance, quality assurance/quality control, and reporting is their option and not specified in the license. If they choose to do so, they can use their own staff to do the monitoring, as Mayor Knox recommends, or they can contract the work. Regarding Interior's request for specific parameters in the WQMP, much of the request can be found in the draft plan, and determination of the additional specific parameters and measurement frequency for each development should be determined among the stakeholders, including Interior, as part of review and finalization of the WQMP.

The Catawba Riverkeeper's request for redundancy is unnecessary. To some degree redundancy is built into the system through the ability to spill water if aeration systems fail. Also, while low DO events are to be avoided to protect water quality and habitat, natural reaeration often limits low DO conditions to a modest area below the dams relative to the habitat available, or the releases are directly to downstream impoundments.

Temperature

To manage temperature in the Catawba River bypassed reach and the Linville River reach, Duke Energy proposes to balance three measures. They are:

1. Managing the storage in Lake James to avoid depletion of the cold water reserve in summer and early fall.
2. Providing coldwater minimum flows in the Linville River to support the trout fishery below the Bridgewater Powerhouse.
3. Providing continuous minimum flows at warmer temperatures which would support and enhance freshwater mussel populations in the Catawba River bypassed reach. Increased warmer flows in the bypassed reach, however, should not cause water temperatures to

rise too much to affect the trout community's survivability in the Catawba River below the confluence of the bypassed reach and the Linville River.

Under the WQMP, Duke Energy would monitor water temperature downstream at all developments.

American Rivers, the Coastal Conservation League, and the Catawba Riverkeeper commented that alternatives should be evaluated to assure adequate temperatures for trout in the Linville River and Catawba River bypass reaches downstream of the Bridgewater development.

Our Analysis

During the stakeholder negotiations leading to the Revised CRA, extensive modeling was performed to simulate the response of the storage capacity of Lake James to various downstream release scenarios at the Bridgewater powerhouse and the Catawba dam to provide minimum flows for support of aquatic resources, in particular trout and freshwater mussels. Implementing Duke Energy's proposal would have little potential effect at any of the project developments except Bridgewater and the three bypassed reaches, the Catawba River bypassed reach, and Great Falls Long and Short bypassed reaches, that would now receive continuous minimum flows. It is our conclusion that the balance of flows struck in the Revised CRA between the Catawba River bypassed reach and the Linville River below the Bridgewater powerhouse would provide water temperatures and flows that continue to support the existing trout fishery in the Linville/Catawba River and other aquatic resources in both of these reaches. North Carolina DWQ has issued a 401 WQC for the project that includes the continuous flow modifications for this reach to protect the designated uses for these reaches including trout management. With negligible flows in the existing bypass, water temperatures fluctuate widely and summer water temperatures can frequently exceed the tolerance of many aquatic organisms. The proposed continuous minimum flows would provide a natural range of water temperatures in these reaches that meet water quality standards and would support and enhance aquatic resources in these bypassed reaches. Monitoring for temperatures that will support trout, a request of American Rivers, the Coastal Conservation League, and the Catawba Riverkeeper, would be addressed as an element of the WQMP.

3.3.2.3 Cumulative Effects

Water Quantity and Quality

The hydrology of the Catawba-Wateree system is altered by the project itself and by changes in the character of the watershed, which falls mostly outside of the project boundary. An obvious characteristic of the hydroelectric power system is the fact that it has resulted in the transformation of much of the river system into reservoir systems. The existing condition for this analysis is the system under the current license, with the impoundments in place. However, though the pre-project condition is not the focus here, there are characteristic of impoundments that tie into other water quantity and quality issues. For example, cumulatively, a large amount of water evaporates from the surface area of the impounded lakes. This process has been accounted for in the Duke Energy hydrologic models.

The impounding of water brings changes in water quality. The fact that temperature and sediment content are altered is somewhat obvious. Less obvious is the re-suspension of some chemicals when low oxygen conditions trigger certain chemical reactions in the bottom sediments where those chemicals have settled. Another factor is that the stillness and long

retention time of the impoundments gives algal populations better conditions for growth for longer periods of time than occurs in moving waters, leading to algal blooms. When the algae die and sink to the bottom, the bacteria that break them down require a great deal of oxygen and can cause low DO conditions. These are very difficult aspects of water quality to manage and are, to some degree, outside of the control of Duke Energy. Seasonal temperature stratification is another physical characteristic of many impoundments that contributes to the depletion of DO in deeper waters in the impoundments and the discharge of poorly oxygenated water downstream of the powerhouses.

Outside of the project boundary, the watershed hydrology has changed and will continue to change over the years. As the watershed is developed, flows to the reservoirs are altered, often becoming "flashier," or more extreme in character. Urban and suburban storm runoff brings increased sediment and nutrient loads. Ongoing development in the watershed, and particularly along shorelines, typically results in increased runoff, erosion, turbidity, nutrient loading, and fecal coliform. Discharge of treated wastewater from public treatment facilities often increases nutrient loads to the system. Agricultural practices also increase nutrient loads and fecal coliform. These watershed scale processes are, for the most part, beyond the control of Duke Energy.

American Rivers, the Coastal Conservation League, and the Catawba Riverkeeper stakeholders request that the FWQIP require that all elements of the project meet all applicable state water quality standards under all operating conditions. Given that many of the water quality factors above are largely out of the control of the power company, this may not be realistic for all parameters. However, Duke Power is involved in multiple efforts that could lead to modest improvements or prevent declines in overall water quality. These include:

1. Participating in the states' TMDL processes.
2. Working with the water suppliers to apply some of the funds raised through the Water Management Group to carry out water quality improvement projects.
3. Purchasing riparian easements (along waterways) in North and South Carolina to meet state mitigation requirements for flow alterations. These easements will preserve streamside vegetation that will help filter water before it reaches streams flowing to the reservoirs.
4. Providing $1,000,000 to South Carolina for improvement of fish and wildlife habitat including water quality. (This fund also provides for other habitat and fish and wildlife enhancement activities not directly related to water quality.)

Another water quantity factor with potential cumulative effects would be inter-basin transfers. Major inter-basin transfers are typically for public water supply outside of the basin or where the discharge of treated wastewater occurs outside of the basin. Predictions of new or expanded future inter-basin transfers are based on general regional growth projections and have an inherent high level of uncertainty. Inter-basin transfers require state approval and permitting, and the effect on project water quantity and availability of increases in inter-basin transfers can be evaluated on a case-by-case basis within the context of project water management and using the CHEOPS model as necessary. The CHEOPS model has been used extensively for these types of analyses and has developed a documented track record as a reliable tool for hydroproject

water management. Existing and proposed, near-term transfers represent a very small portion of the available flow in the system.

3.3.2.4 Unavoidable Adverse Effects

Throughout much of the water column in most of the reservoirs, stratification of temperature and DO would continue to occur seasonally. Given the accumulation of sediments and associated contaminants, and continued input of sediments and nutrients in runoff and point source discharges to the Catawba-Wateree River Basin, near-bottom waters would continue to have elevated concentrations of ammonia. It is unlikely that pollution from watershed runoff will be avoided, though regional efforts by partners including Duke Energy may help. Finally, because the purpose of impounding water is to alter the timing of its availability for use, the flow regime is altered at each dam, affecting physical processes and organisms. However, the proposals in the Revised CRA would improve flows, particularly relative to the existing condition.

3.3.3 Aquatic Resources

3.3.3.1 Affected Environment

Aquatic Habitat

The project area within the Catawba-Wateree River Basin encompasses an elevation change of 1,113 ft msl and is defined by a complex hydrologic system of riverine habitats interspersed among the 11 project impoundments.

Reservoirs

The 11 impoundments of the Catawba-Wateree Project range in size from the 353-acre Great Falls reservoir to the 32,399-acre Lake Norman (table 24). The shoreline length varies from 13.1 miles on the Great Falls reservoir to 603.1 miles on Lake Norman. The shoreline development index is a measure of the complexity of the shoreline (length of shoreline divided by the circumference of a circle with the area of the lake); the higher the number, the more dendritic or irregular the shoreline or more arms and coves. For the Catawba-Wateree Project, the impoundments range from 5 (Great Falls reservoir) to 23.9 (Lake Norman), reflecting the relative complexity of the shoreline and potential shallow water habitat. Morphometric and hydraulic characteristics of these reservoirs range from small, fairly shallow reservoirs with short retention times and low shoreline development indices such as Great Falls and Cedar Creek reservoirs, to large, deep, reservoirs with long retention times and highly dendritic shorelines such as Lake Norman.

Table 24. Dimensional characteristics of Catawba-Wateree Project impoundments. (Source: Duke Energy, 2007)

Impoundment	Full pool (+msl ft)	Shoreline (miles)	Surface area (acres)	Shoreline complexity
Lake James	1,200.0	153.0	6,754	13.3
Rhodhiss Lake	995.1	106.8	2,724	14.6
Lake Hickory	935.0	115.7	4,072	12.9
Lookout Shoals Lake	838.1	35.2	1,155	7.4
Lake Norman	760.0	603.1	32,339	23.9
Mountain Island Lake	647.5	96.5	3,117	12.3
Lake Wylie	569.4	348.5	12,177	22.5
Fishing Creek Reservoir	417.2	85.1	3,431	10.4
Great Falls Reservoir	355.8	13.1	353	5.0
Cedar Creek Reservoir	284.4	23.2	748	6.1
Lake Wateree	225.5	214.3	13,025	13.4

The mean surface water temperatures on the Catawba-Wateree impoundments (1993-2002) ranged from 25.0 to 33.9°C in summer and from 6.1 to 12.5°C in winter. All reservoirs remained vertically mixed throughout winter. During the summer, deep reservoirs with long detention times maintained fairly stable thermal stratification, while stratification in shallower reservoirs with short detention times tended to be transient. Great Falls and Cedar Creek reservoirs, small reservoirs with retention times less than 3 days, did not stratify. All of the project reservoirs with the exception of Great Falls and Cedar Creek exhibit some degree of oxygen depletion in the hypolimnetic waters.

Duke Energy conducted mapping of primary shallow aquatic habitat types over the normal range of pool elevations for each reservoir except Great Falls (Duke Energy, 2005b). Surveys were conducted using hydroacoustic and LiDAR technologies and habitat sampling along survey transects. The data were used to estimate fish habitat available at various levels of draw-down from normal full pool to minimum pool and to evaluate the amount of habitat lost during draw-down.

Seven shallow water aquatic habitat types were mapped in each impoundment: cobble, riprap and piers, vegetation and tributary confluence, mud flats, sand, clay, and woody debris. Littoral zone areas where submerged and emergent aquatic vegetation grow, aside from the tributary confluence areas, can be vital cover and nursery habitat for various fish species at different life stages. These areas further add to the complexity of fish habitat. The types of shallow-water habitat that provide significant habitat complexity (i.e., cobble, riprap/piers, vegetated confluences, woody debris, and water willow) are a major determinant in fish diversity, fish distribution, predator-prey interactions, and survival of young.

The most abundant habitat types across all impoundments were riprap and piers, vegetation and tributary confluence, and clay (table 25). The other habitat types were nearly an order of magnitude less abundant. Except in Lake James, cobble accounted for less than 10 acres of habitat between normal maximum and minimum pool elevation. The greatest acreage between maximum and minimum pool elevation occurs in Lake Norman, Lake Wylie, and Lake Wateree.

Each of the project impoundments has a specific guide curve that determines ideal water levels for a given time of year. Water levels within the Catawba-Wateree River reservoirs vary more than 3 ft from the existing guide curves typically less than 10 percent of the time. The normal range of draw-down between maximum and minimum pool elevation ranges from 7.5 ft at Lake James and Lake Norman to 3.5 ft at Cedar Creek reservoir; the range for six of the impoundments is 4.5 ft (Rhodhiss Lake, Lake Hickory, Lookout Shoals Lake, Lake Wylie, Fishing Creek reservoir, and Great Falls reservoir). The quantity of shallow water habitats generally declines as water levels recede. The greatest declines in habitat usually occur at draw-downs of 1 to 3 ft, which is the range at which the reservoirs have historically been operated. Vegetation and stream confluence habitats are most affected by draw-downs, while other habitats are generally available to fish even at normal minimum pool elevations.

On a seasonal basis, reservoir levels are typically lowest from November to February when most fish in these reservoirs are least active and concentrated in deep areas of the reservoir beyond the shore zone. One important fish habitat type for spring/summer spawning and nursery functions is the vegetated stream-confluence type. Reservoir level changes after spawning activities have begun can be critically important, especially for nest-building fish species. If reservoir levels decrease appreciably after nests have been constructed and eggs have been deposited, nests and eggs can be dewatered, which can lead to stranding, exposure, desiccation, and death of the developing embryos and hatching larvae.

Table 25. Summary of aquatic habitat available between normal maximum and normal minimum water surface elevation in Catawba-Wateree Project impoundments. (Source: Duke Energy, 2005b)

Impoundment	Pool elevation relative to 100-ft maximum			Aquatic habitat between maximum and minimum pool elevation (acres)							
	Normal maximum	Normal minimum	Survey min. pool	Cobble	Ripra p piers	Vegetation confluences	Mud flats	sand	clay	Woody debris	
Lake James	99.5	92.0	93.0	20.0	82.0	55.0	71.0	79.0	224.0	82.00	613.00
Rhodhiss Lake	99.5	95.0	95.0	5.0	5.0	82.0	17.0	14.0	141.0	38.10	302.10
Lake Hickory	99.5	95.0	96.0	0.8	149.0	123.0	0.0	2.7	51.0	10.10	336.60
Lookout Shoals Lake	99.5	95.0	95.0	2.1	28.0	13.4	5.0	8.1	31.0	0.80	88.40
Lake Norman	99.5	92.0	93.0	6.3	2,064.0	555.0	157.0	210.0	1,586.0	8.70	4,587.00
Mountain Island Lake	99.5	94.5	95.0	2.1	67.0	507.0	29.0	4.2	73.0	0.50	682.80
Lake Wylie	99.5	95.0	95.0	2.7	863.0	891.0	107.0	10.0	600.0	10.20	2,483.90
Fishing Creek Reservoir	99.5	95.0	95.0	1.5	53.0	928.0	5.3	7.6	189.0	57.00	1,241.40
Great Falls Reservoir	99.5	95.0									
Cedar Creek Reservoir	99.5	96.0	96.0	0.0	3.3	28.0	2.1	2.1	28.0	0.06	63.56
Lake Wateree	99.5	94.0	95.0	3.8	1,302.0	401.0	71.0	45.0	365.0	0.76	2,188.56
				44.3	4,616.3	3,583.4	464.4	382.7	3,288.0	208.22	12,587.32

Riverine

Much of what was once lotic (riverine) habitat in the main stem Catawba-Wateree River prior to construction of the project has been transformed into lentic habitat discussed in the previous section. There are approximately 119 miles of riverine habitat interspersed between the project impoundments. The longest reaches of riverine habitat (table 26) are the regulated reaches below Bridgewater (12.5 miles), Wylie (25.6 miles), and Wateree (76.8 miles). The regulated reach below Oxford is 2.8 miles long. The Lookout Shoals regulated river reach varies from 0.3 to 1.3 miles in length depending on the draw-down of Lake Norman downstream. The tailraces from the other eight developments (Rhodhiss, Cowans Ford, Mountain Island, Fishing Creek, Great Falls, Dearborn, Rocky Creek, and Cedar Creek) enter the backwater of the impoundment of the next development downstream.

Flows in these reaches vary through the day, depending on power generation operations, and seasonally depending on weather conditions and power generation. The existing operating conditions require minimum average daily flows (table 26) from each development, which generally can be met with several hours of generation and flows throughout the rest of the day limited to leakage. The minimum average daily flow at Bridgewater is 66 cfs, and progressively increases downstream to 446 cfs at Wateree. Minimum continuous flows are maintained at the six most upstream developments ranging from 25 cfs at Bridgewater to 80 cfs and Cowans Ford and Mountain Island.

Table 26. Summary of flows and length of riverine reaches associated with each development in the Catawba-Wateree Project. (Source: Duke Energy, 2007)

Development(s)	**Regulated reach (miles)**	**Minimum average daily flow (cfs)**	**Minimum continuous flow (cfs)**	**Bypassed reach (miles)**
Bridgewater	12.5	66	25	5.6/0.5
Rhodhiss	NA	225	40	NA
Oxford	2.8	261	40	NA
Lookout Shoals	0.3–1.3	278	60	NA
Cowans Ford	NA	311	80	NA
Mountain Island	NA	318	80	0.6
Wylie	25.6	411		NA
Fishing Creek	NA	440		NA
Great Falls and Dearborn	NA	444		2.2/0.8
Rocky Creek and Cedar Creek	NA	445		NA
Wateree	76.8	446		0.4

Based on the habitat mapping information collected as part of the *Instream Flow Study* (DTA, 2005), the regulated reaches are comprised of a diversity of habitat and substrate (table 27). Habitat types include riffles, runs, glides, pools, shoals, islands and braided channels, bends, and scour pools. Substrate is generally coarse; bedrock outcrops and ledges overlain by varying thicknesses of sand, gravel, cobble, and boulder; finer substrates limited in extent within the regulated reaches; and finer sediments that settle in the various project impoundments.

Table 27. Description of primary substrate and aquatic habitat of riverine and bypassed reaches in the Catawba-Wateree Project from the instream flow study. (Source: DTA, 2005a)

Reach	**Substrate**	**Habitat types**
Bridgewater Regulated River Reach	Bedrock overlain by varying thickness of sand, gravel, cobble, boulder	Riffle, run, glide, pool, islands
Catawba River Bypass	Bedrock overlain by varying thickness of sand, gravel, cobble, boulder, rubble	Riffles, glides, pools beaver ponds
Paddy Creek Bypass	Bedrock, sand, gravel cobble	Riffle, pool, split channel
Oxford Regulated River Reach	Bedrock overlain by varying thickness of sand, gravel, cobble, boulder, some silt	Run, glide, pool, shoal, island
Lookout Shoals Regulated River Reach	Sand, gravel, cobble, boulder	Riffle, glide, pool, island
Mountain Island Bypass	Bedrock, boulder, cobble, sand, gravel	
Wylie Regulated River Reach	Bedrock, boulder, gravel, cobble, some fines	Pool, shoal, glide, vegetated island, riffle
Great Falls Long Bypass	Bedrock boulder	Pool, run
Great Falls Short Bypass	Bedrock boulder	Pool, run
Wateree Regulated River Reach	Bedrock boulder	Pool, run
Wateree Spillway Channel Bypass	Bedrock, boulder, sand, gravel, vegetated islands	Glide, bend, scour pool, run, riffle, flood plain, bars, shoals

Bypassed Reaches

The project includes six bypassed reaches approximately 10 miles in total length, two each associated with the Bridgewater and Great Falls and Dearborn Developments and one each at the Mountain Island and Wateree Developments (table 26). The Catawba River bypassed

reach below the Bridgewater Development is the longest bypass at 5.6 miles; the Paddy Creek bypassed reach, also at Bridgewater, is 0.5 mile. The Mountain Island bypassed reach is approximately 0.6 mile, and the two Great Falls bypassed reaches are 2.2 and 0.8 mile. The Wateree spillway bypass is 0.4 mile long.

Substrate in these bypassed reaches is generally bedrock with boulder, cobble, sand, and gravel. Runs, glides, pools, and riffles appear to predominate in the bypassed reaches. Beaver dams have created ponds in the Catawba River bypassed reach.

Except during spill periods, the flow through these bypassed reaches is generally limited to leakage, groundwater inflow, and tributary inflow. Muddy Creek provides significant flow to the lower portion of the Catawba River bypassed reach. Except for the Catawba River bypassed reach, downstream of the confluence of Muddy Creek, most of the bypassed reaches do not contain reliable flows and dry out between spill events. Thus, bypass habitat is typically marginal for fish and other biological resources with elevated water temperatures and depleted DO.

Biological Resources

Freshwater Mussels

Freshwater mussel surveys were conducted in 2004 for the Catawba-Wateree relicensing projects (Alderman Environmental Services, Inc. [AES], 2005). Many species were collected during these surveys, including relic shell material. For purposes of this document, only species collected live during the survey will be discussed in detail.

Sixteen live freshwater mussel species were collected in 2004 within 114 study reaches of the Catawba-Wateree River Basin (table 28). These mussel surveys indicated that Eastern elliptio and Carolina lance were the most common species collected among the survey sites. Mussel diversity was highest at the Wylie Development (including sites surveyed in the South Fork Catawba River, Lake Wylie, Wylie River, and Waxhaw Creek) and the Wateree Development (including sites surveyed in the Wateree River and Grannies Quarter Creek), each having 10 mussel species including state and federally listed species. The exotic bivalve, Asian clam, was identified at most of the 114 reaches, with some stations having significantly higher densities of the invasive species than others.

Federally listed species include one endangered species (Carolina heelsplitter) and two species of concern (brook floater and yellow lampmussel). Eleven state listed (North Carolina and South Carolina) species were collected during the surveys. Relic shell material (no live specimens) of the rayed-pink fatmucket, a South Carolina species of special concern, was collected downstream of the Wylie Development in the Wylie regulated river reach, and just below the Wateree dam. Federal species of concern and state-listed mussel species are discussed in this section; Carolina heelsplitter, an endangered species, is discussed in section 3.3.5, *Threatened and Endangered Species.*

Five mussel species collected during the 2004 survey are considered common in North Carolina and South Carolina watersheds and include the Eastern elliptio, variable spike, Carolina lance, Atlantic spike, and the pondhorn. Descriptions of the shells of these species, their distribution, habitat preference, and life history are well documented in *Mussel Surveys for Catawba-Wateree Relicensing* report (AES, 2005).

Bridgewater Development—Six mussel species were collected in the Bridgewater Development, including the Eastern elliptio, variable spike, brook floater, creeper/squawfoot, Eastern creekshell, and notched rainbow. The Eastern elliptio dominated the collection (181 individuals) with nearly 83 percent of the total catch. Most of the individuals were collected from Lake James, the Catawba River bypassed reach, and Muddy Creek. Two species (brook floater and Eastern creekshell) were collected from the Linville River. Four species from the Bridgewater Development are protected by North Carolina, and one species (brook floater, 12 individuals) is considered a species of special concern by FWS.

Rhodhiss Development—Eight mussel species were collected in the Rhodhiss Development, including the Eastern elliptio, variable spike, Carolina lance, Atlantic spike, brook floater, Eastern floater, Eastern creekshell, and the notched rainbow. The Eastern elliptio dominated the collection (281+ individuals) with nearly 82 percent of the total catch. All of the individuals were collected from Warriors Fork and the Johns River, with the exception of the Eastern floater, which was collected in the Rhodhiss regulated river reach. Four of the species from the Rhodhiss Development are protected by North Carolina, and one species (brook floater, three individuals) is considered a species of special concern by FWS.

Oxford Development—One mussel species, the Eastern floater, was collected from the Oxford regulated river reach of the Oxford Development. Only 13 individuals of this species were collected at this development. The Eastern floater is considered a species of special concern by the state of South Carolina, but is not currently protected by the state of North Carolina or FWS.

Lookout Shoals Development—One mussel species, the creeper/squawfoot, was collected from the Lookout Shoals regulated river reach of the Lookout Shoals Development. Only one individual of this species was collected at this development. This species is not currently protected by North Carolina or by FWS.

Cowans Ford Development—Three mussel species were collected in the Cowans Ford Development, including the Eastern elliptio, pondhorn, and Eastern floater. While relatively few individuals of these species were collected, the Eastern elliptio dominated the collection (11 individuals) with 79 percent of the total catch. All of the individuals were collected from the Cowans Ford tailrace. The Eastern floater is considered a species of special concern by the state of South Carolina, but is not currently protected by the state of North Carolina or FWS.

Mountain Island Development—Eight mussel species were collected in the Mountain Island Development, including the Eastern elliptio, Carolina lance, Atlantic spike, pondhorn, paper pondshell, Eastern floater, creeper/squawfoot, and Eastern creekshell. The Carolina lance dominated the collection (204 individuals) with 73 percent of the total catch. Most of the individuals were collected from the Mountain Island bypassed reach, but a few (Carolina lance, paper pondshell, and pondhorn) were collected from the Mountain Island tailrace. Four of the species from the Mountain Island Development are protected by the state of North Carolina or South Carolina, or both.

Table 28. Sixteen freshwater mussel species collected in the vicinity of 11 relicensing developments on the Catawba-Wateree River basins. Mussels listed were collected live during the 2004 surveys. (AES, 2005)

Common name	CATAWBA-WATEREE PROJECT DEVELOPMENTS[1]									
	Bridgewater	**Rhodhiss**	**Oxford**	**Lookout Shoals**	**Cowans Ford**	**Mt. Island**	**Wylie**	**Fishing Creek**	**Great Falls and Dearborn**	**Wateree**
Eastern elliptio	X	X			X	X	X	X		X
Variable spike	X	X					X			X
Carolina slabshell[SSC(SC)]										X
Carolina lance		X				X	X	X	X	X
Atlantic spike		X				X	X			
Roanoke slabshell[ST(NC)]							X			X
Pondhorn					X	X	X	X	X	X
Carolina heelsplitter[FE/SE(NC&SC)]							X			
Brook floater[FSC/SE(NC)/SSC(SC)]	X	X								
Eastern pondmussel[ST(NC)]										X
Paper pondshell[SSC(SC)]						X	X	X	X	X
Eastern floater[SSC(SC)]		X	X		X	X	X			X
Creeper/Squawfoot[ST(NC)/SSC(SC)]	X			X		X	X			
Eastern creekshell[SSC(SC)]	X	X				X	X			
Notched rainbow[SSC(NC&SC)]	X	X								
Yellow lampmussel[FSC/SE(NC)/SSC(SC)]										X

[1] No live mussels were collected at the Rocky Creek and Cedar Creek Developments; therefore, the developments were not included in this summary table.

[2] FSC: federal species of concern.
FE: federally endangered.
SE: state endangered.
ST: state threatened.
SSC: state species of concern.
Sources: North Carolina WRC, 2008b; South Carolina DNR, 2008; FWS, 2008.

Wylie Development—Eleven mussel species were collected in the Wylie Development, including the Eastern elliptio, variable spike, Carolina lance, Atlantic spike, Roanoke slabshell, pondhorn, Carolina heelsplitter, paper pondshell, Eastern floater, creeper/squawfoot, and Eastern creekshell. The Eastern elliptio dominated the collection (424+ individuals) with 52 percent of the total catch, followed by the Carolina lance with 35 percent of the total catch. Most of the individuals were collected from the Wylie regulated river reach, with fewer collected from Waxhaw Creek. Six of the species from the Wylie Development are protected by the state of North Carolina or South Carolina, or both, and one species (Carolina heelsplitter, two individuals) is federally listed as endangered by FWS. The Carolina heelsplitter was collected from Waxhaw Creek during the 2004 surveys and is discussed further in section 3.3.5, *Threatened and Endangered Species*.

Fishing Creek Development—Four mussel species were collected in the Fishing Creek Development, including the Eastern elliptio, Carolina lance, pondhorn, and paper pondshell. Surveys for the paper pondshell did not indicate specific numbers collected, but did report that this species was very common in the Catawba River (downstream of the Fishing Creek tailrace). The remaining three species were collected from the same location, but in much lower abundance (less than eight individuals each). The paper pondshell is the only species from this collection protected by South Carolina, but it is not currently protected by the state of North Carolina or FWS.

Great Falls and Dearborn Developments—Three mussel species were collected in the Great Falls and Dearborn Developments, including the Carolina lance, pondhorn, and paper pondshell. Abundance for each species was very low (less than four individuals each). The pondhorn and Carolina lance were collected from the Great Falls reservoir. The paper pondshell, which is the only species from this collection protected by South Carolina, was collected in the Great Falls bypassed reach.

Rocky Creek and Cedar Creek Developments—Surveys within the Rocky Creek and Cedar Creek Developments were limited due to health and safety considerations. Two stations in Cedar Creek and Cedar Creek reservoir were surveyed with no live mussels collected at either station.

Wateree Development—Ten mussel species were collected in the Wateree Development, including the Eastern elliptio, variable spike, Carolina slabshell, Carolina lance, Roanoke slabshell, pondhorn, Eastern pondmussel, paper pondshell, Eastern floater, and yellow lampmussel. The Roanoke slabshell, which is listed as threatened by North Carolina, dominated the collection (65 individuals) with 42 percent of the total catch. Most of the individuals were collected from the Wateree regulated river reach, with the exception of the variable spike and some of Eastern elliptio specimens, which were collected in Grannies Quarter Creek. Six of the species from the Wateree Development are protected by the state of North Carolina or South Carolina, or both, and one species (yellow lampmussel, 15 individuals) is considered a species of special concern by FWS. The yellow lampmussel was collected from the Wateree regulated river reach during the 2004 surveys.

Most of the mussel species collected during the 2004 survey are assumed to require intermediate fish hosts to complete their life cycles, and conservation of these mussel populations requires the protection of both the fish host and bivalve. Among the common mussels collected, no fish hosts have been specifically identified for the Carolina lance or

Atlantic spike. The Eastern elliptio, variable spike, pondhorn, and Eastern floater, however, have several reported fish host species. The Eastern elliptio has at least four reported hosts including the green sunfish, largemouth bass, orangespotted sunfish, and white crappie (Cummings and Watters, 2004). Nine other fish species have been collected in the wild with Eastern elliptio glochidia lifestage attached to their gills, but transformation of the glochidia off the gill was not reported (Kneeland and Rhymer, 2008). During Duke Energy's fish surveys, largemouth bass were collected more often than any other fish host species. Largemouth bass was collected from all 13 locations in which live Eastern elliptio were collected. Green sunfish was collected at eight of the locations in which live Eastern elliptio were collected. White crappie was collected in low abundance at one location (Bridgewater regulated river reach), and orangespotted sunfish was not collected from any of the 13 locations in which Eastern elliptio were collected.

The variable spike has two reported fish hosts including the bluegill and largemouth bass (Keller and Ruessler, 1997). During Duke Energy's fish surveys, bluegill was collected in relatively low abundance from most of the locations in which live variable spike also was collected, including the Catawba River bypassed reach, Wylie regulated river reach, Waxhaw Creek, and Grannies Quarter Creek (Duke Energy, 2005a). Bluegill was not collected in the Johns River during these same surveys. Largemouth bass also was collected from these same five locations.

The pondhorn has one reported fish host, which is the golden shiner (Cummings and Watters, 2004). During Duke Energy's fish surveys, golden shiner was collected in only three of the six locations in which live pondhorn were collected, including the Mountain Island tailrace (1 individual), Fishing Creek (10 individuals), and Wateree regulated river reach (27 individuals) (Duke Energy, 2005a). Golden shiner was not collected during fish surveys in the Cowans Ford tailrace, Wylie regulated river reach, or Great Falls reservoir. Historic records, also reported in table 25 of Duke Energy's fish survey, indicate that the golden shiner has not been collected in the Wylie regulated river reach since 1973. Given that the pondhorn mussel had the greatest abundance (48 individuals) at the Wylie Development compared to any other survey location, it appears that other fish host species, not yet reported in the scientific literature, are likely supporting this small mussel population.

Resident Fish

A comprehensive reservoir investigation program was designed and initiated in the early 1990s to characterize the fishery resources of the Catawba-Wateree River Basin. Conducted annually from 1993 through 1997 and every 3 years subsequently (with the exception of Lake Norman, Mountain Island Lake, and Lake Wylie, which were conducted annually), the program included creel surveys, fish health assessments, littoral (shoreline) fish community assessments using electrofishing, and limnetic (open water) fish community assessments using hydroacoustics and purse seine sampling (Duke Energy, 2003). As part of relicensing studies, Duke Energy has conducted a survey and assessment of freshwater fish communities in various locations in the Catawba-Wateree River Basin, within and adjacent to the project area (Coughlan et al., 2005a). The objectives of this study were to conduct fish community surveys in bypassed river reaches, regulated river reaches, tailrace areas, and major tributaries of the Catawba-Wateree Project. Additionally, this study involved field sampling to assess the presence and relative abundance of several rare members of the sucker family, robust redhorse, Carolina

redhorse, and highfin carpsuckers in the regulated reaches downstream of the Bridgewater, Wylie, and Wateree Developments.

The reservoir studies found relatively high fish species diversity in the project's reservoirs, ranging from 25 species in Great Falls reservoir to 38 species in Lake James. Reservoir characteristics such as high nutrient content and long retention times influence the high fish diversity observed in the reservoirs. Based on electrofishing data, total littoral (shore zone) fish biomass averaged 88.5 kilograms per kilometer (kg/km), ranging from 20.3 kg/km in the forebay area of Lake Norman to 191.1 kg/km in the upper Catawba River arm of Lake James. A total of 56 different species and a hybrid sunfish complex were collected by littoral electrofishing throughout the project area. Black basses averaged 37 percent of total littoral biomass, primarily consisting of largemouth bass. Sunfish (bluegill, redear, and redbreast) numerically dominated total fish catches throughout the project's reservoirs, accounting for 70 percent of fish sampled on average (Duke Energy, 2003). Based on hydroacoustic data collected by Duke Energy, 1997 to 2003, mean density of limnetic (open water) forage fish ranged from 887 fish per hectare on the Linville River arm of Lake James to 29,252 fish per hectare on Lake Wateree. Purse seine sampling conducted from 1993 to 2003 indicated that both threadfin and gizzard shad were important components of the limnetic forage fish communities on Lakes James, Rhodhiss, Hickory, and Lookout Shoals; relative abundance of these species was quite variable among years. On Lake Norman and downstream reservoirs, threadfin shad dominated limnetic forage fish communities. Alewife were first collected in purse seine samples on Lake Norman and Mountain Island Lake in 1999, presumably introduced by release of angler bait fish. The relative abundance of alewife has increased rapidly on both lakes since 1999, and the species appeared downstream in Lake Wylie purse seine samples in 2001. Management of the fisheries in these reservoirs has included frequent stocking of forage fishes such as threadfin shad and sunfish, and game fishes such as striped bass and white bass.

Bypassed river reaches (Catawba River, Paddy Creek, Mountain Island, and the Great Falls Long bypassed reaches) exhibited marginal fish communities likely related to restricted flows and impaired water quality. The fish community and water quality further downstream in the Catawba River bypassed reach improved dramatically after the confluence of Muddy Creek. Regulated river reaches below Bridgewater, Oxford, Wylie, and Wateree dams were subject to altered flows and seasonal reductions in DO. Reduced water temperatures in the Bridgewater regulated river reach as a result of releases of cooler deep water from the dam have allowed North Carolina WRC to effectively manage this reach as a coldwater trout fishery including a stocking program. Fish communities in the Oxford, Wylie, and Wateree regulated river reaches are typical of Piedmont and Coastal Plain rivers in the Southeast, but could benefit from improved flows and seasonal enhancement of DO concentrations. Tailraces had generally better fish populations (i.e., more species and higher numbers of individuals) in both spring and summer than the downstream reservoir locations. Tailrace data indicated diverse fish populations in the vicinity of the dams. Fish populations in tributary streams upstream of the Catawba-Wateree Project boundary are typical of fish communities in these order streams regionally; water quality and watershed impacts at locations upstream of the sampling site appeared to be the main determinants of the health and diversity of stream fish communities. Robust and Carolina redhorses and highfin carpsucker were not collected in these surveys or other studies in the recent past on the Catawba or Wateree Rivers.

The following findings relative to the resident fish resources are presented in exhibit E 3.1 of the relicensing application.

Bypassed River Reaches

- *All bypassed reaches exhibited marginal fish habitat and communities.*
- *The Catawba River bypassed reach, downstream of its confluence with Muddy Creek, exhibited a diverse fish community.*
- *The majority of the Paddy Creek, Mountain Island, and Great Falls bypassed reaches do not contain water; where flow is available, the fish community is marginal.*
- *Between spill events in the Great Falls bypassed reach, the channel dries out, isolated pools become inhospitable to aquatic life due to adverse water quality conditions such as increased temperatures, and low dissolved oxygen.*

Regulated River Reaches

- *Stream segments downstream of the Bridgewater, Oxford, Wylie, and Wateree dams were subject to altered flows, seasonal reductions in dissolved oxygen (DO), and for the Bridgewater regulated river reach, reduced water temperatures.*
- *Fish communities in the Oxford, Wylie, and Wateree regulated river reaches were representative of southeastern fish communities, but communities were not sampled during periods of low DO.*
- *Enabled by the cool water discharged from the bottom of Lake James, the Bridgewater regulated river reach is managed as a trout fishery by the NCWRC.*

Tailraces (Non-Regulated River Reaches)

- *In general, more fish species were collected in each tailrace than in the immediate downstream reservoir.*
- *Catches of fish per hour of sampling time were higher in tailraces than in the immediate downstream reservoir in the spring and summer.*

Wadeable Tributary Streams

- *Index of Biological Integrity (IBI) ratings for all sampled tributary streams ranged from Poor to Excellent.*
- *North Carolina streams were rated Good to Excellent, except for the location below the Catawba Dam on the Catawba River bypassed reach, which rated as Poor.*
- *The Catawba River bypassed reach, immediately downstream of the Catawba Dam (Bridgewater Development), had low DO, elevated conductivity, and limited fish habitat.*
- *IBI ratings in South Carolina streams ranged from Poor to Excellent.*

- *All SC tributary streams except Grannies Quarter Creek exhibited elevated conductivities indicative of man-induced impacts.*
- *In general, IBI ratings reflected local upstream conditions and activities in the watershed.*

Rare Suckers

- *Surveys for robust and Carolina redhorse and highfin carpsucker in the vicinity of gravel bars, cobble, and boulders in spring (when fish should be concentrated in spawning aggregations) were conducted, but none of these rare sucker species was collected.*
- *These results indicate that the rare sucker species may be extremely uncommon or absent, which is consistent with other river basins.*
- *Five species of suckers were collected in the Catawba River below the Wylie Dam and six species were collected in the Wateree River, but no individuals of the three targeted species were collected.*

Reservoir Fishery

- *The number of fish species, age class distributions, and abundances varied substantially among the Catawba-Wateree Reservoirs.*
- *Total fish abundance, as measured by weight, tended to increase in downstream reservoirs as reservoir fertility increased, suggesting that food abundance was a significant factor.*
- *Largemouth bass, sunfish, crappie, and catfish abundance tended to increase with reservoir fertility.*
- *Factors other than fertility may also be regulating fish abundance in Fishing Creek Reservoir and the upper reaches of Lake Wateree.*
- *Open water forage fish communities of Lakes James, Rhodhiss, Hickory, and Lookout Shoals consisted of gizzard and threadfin shad; the relative abundance of these two species was extremely variable among years, potentially due to the susceptibility of threadfin shad to winter die-offs at water temperatures below 9°C.*
- *The open water forage fish communities of Lakes Norman, Mountain Island, Wylie, and Wateree consisted almost entirely of threadfin shad.*
- *Alewife, an exotic and mobile species that affects fish population dynamics, was found in Lake Norman initially and has since spread to Mountain Island Lake and Lake Wylie; the relative abundance of alewife on Lakes Norman and Mountain Island has increased rapidly since its suspected introduction by fishermen.*
- *The reservoirs provide important sport fisheries for a number of fish species.*
- *Sunfish were the most frequently harvested (by number) fish in Lake James*

- *Striped bass constituted the largest percentage of total sport fish harvest (by weight) on Lakes Rhodhiss and Hickory, and are important on Lakes Wateree and Norman as well.*
- *Crappie constituted the largest percentage of total harvest by weight on Lake Norman, Mountain Island Lake, Fishing Creek Reservoir, Cedar Creek Reservoir, and Lake Wateree.*
- *On Lake Wylie, both largemouth bass and crappie were major components of total harvest in terms of weight and numbers harvested, respectively.*

Diadromous Fish

Relicensing of the Catawba-Wateree Project must consider the status of diadromous fish species in the Catawba-Wateree River and the potential for restoration of the runs of these species to their historic spawning grounds. Diadromous fish species migrate between freshwater and marine environments and include anadromous and catadromous species. Anadromous species of concern (i.e., those that spend the majority of their life cycle in saltwater and spawn in freshwater) include: shortnose sturgeon, Atlantic sturgeon, blueback herring, hickory shad, and American shad. Restoration of the catadromous American eel (i.e., a species that spends the majority of its life cycle in freshwater and spawns in saltwater) also will be considered throughout its historic range in the drainage basin. Historic distributions of American shad are well documented in the vicinity of the Great Falls and Dearborn Developments. Blueback herring distributions are not well documented. American eel have been documented throughout the Catawba-Wateree River Basin upstream as far as Marion, North Carolina. Sturgeon also have been documented (without clear differentiation between species) upstream to the vicinity of the Great Falls and Dearborn Developments, but not further upstream (Newcomb and Fuller, 2001) and are discussed further in section 3.3.5, *Threatened and Endangered Species*.

Diadromous species restoration throughout the Santee-Cooper Basin is a goal of South Carolina DNR, FWS, and NOAA. A restoration plan entitled *Santee-Cooper Basin Diadromous Fish Passage Restoration Plan* has been submitted to the Commission (FWS et al., 2001) and approved as a comprehensive plan. This plan calls for the majority of fish restoration to occur in the Broad River drainage of the Congaree River. The Congaree River and the Wateree River join to form the Santee River in central South Carolina. While fish restoration in the Wateree River, and by inference the Catawba River, is a lesser goal of the restoration plan, the Commission's relicensing process provides resource agencies a valuable opportunity to implement various sections of the plan. The Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement is a cooperative partnership among Duke Energy, South Carolina Electric and Gas, South Carolina DNR, North Carolina WRC, and FWS for implementation of a 10-year action plan that includes no-sooner-than dates and biological triggers for fish passage to support restoration of these species. In conjunction with this accord, preliminary prescriptions for fish passage to support upstream migration of diadromous species at the Catawba-Wateree Project have been submitted to staff by FWS.

An evaluation of diadromous fish use of the Wateree River was made during spring 2004 and 2005 (Coughlan et al., 2005b). Five locations in the Wateree River, from the confluence of the Wateree and Congaree Rivers to the Wateree hydro tailrace, were electrofished biweekly from March 3 through July 1, 2004. Fifty-four hours of electrofishing time were expended in the Wateree River in 2004. Six locations were electrofished on the Wateree River in 2005, with

much of the sampling occurring weekly, for a total of 79.4 hours of electrofishing time. Gillnets were fished at five locations in 2005 for a total of 538 hours of soak time. Eel traps were deployed in 2005 at six locations, for a total effort of 116 trap-weeks, to estimate American eel abundance.

American eel were infrequently collected in 2004 and 2005, by both electrofishing and baited traps, and previous sampling studies have demonstrated similarly low success rates. Installation of an eel ramp and trap at the Wateree hydro in 2005 was more productive, resulting in the collection of 59 elvers from March 15 to June 23. Eel ramp sampling from February to June 2006 produced 24 elvers.

Anadromous blueback herring typically spawn within inundated flood plains such as found in the lower part of the Wateree River. Blueback herring adults were collected in low numbers in 2004 and 2005. During 2004 they were generally found in the Wateree Development tailrace in late March and April; in 2005 blueback herring were found throughout the river in early April. Freshwater resident blueback herring and alewife were found in the both the Wateree and Congaree Rivers and probably originated from upstream reservoirs. No hickory shad were observed during 2004 and 2005 and previous sampling exercises have documented few individuals of this species in the Wateree River.

Approximately 200,000 to 500,000 American shad are passed above the Santee-Cooper dams (approximately 105 miles downstream of Wateree dam) each spring. The overall numbers of American shad and blueback herring collected in the Wateree River were lower than expected, given the numbers passed into the basin at the Santee-Cooper dams. Relatively low numbers of adult American shad (119 to 258) were found predominantly in the lower Coastal Plain reach of the Wateree River, and fewer shad were found in the lower Piedmont during both 2004 and 2005. Adult American shad usage of the upper portion of the Wateree regulated river reach with typical spawning substrates of gravel, cobble, and rock were limited in both years. Yearling American shad were observed in similar abundance to adults in 2004 during the same time frame that adult spawners were present in the Wateree regulated river reach; few yearling American shad were captured in 2005. Most yearlings were collected in the Wateree tailrace.

Anadromous striped bass enter the Santee-Cooper Basin, and landlocked populations are present in several of the impoundments of the Catawba-Wateree Project. The landlocked striped bass populations in the project area are not self-sustaining, but are managed by the states through a stocking program.

Special Status Species

American Eel—American eel is currently a federal species of concern and was proposed for listing as threatened or endangered by FWS in 2005. The *Federal Register* listed the following as reasons for American eel decline: seaweed harvest in spawning areas of the Atlantic Ocean, loss of wetlands, alterations of streamflow, loss of upper tributary habitat, disease, predation, hydropower turbines, contaminants, changes in oceanographic conditions, and overutilization for commercial, recreational, scientific, or educational purposes. Other acts protecting the American eel include the Anadromous Fish Conservation Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the Atlantic Coastal Fisheries Cooperative Management Act. American eels spawn in the Atlantic Ocean. During the first year of life, early lifestages drift with ocean currents towards the coast. Juveniles known as elvers migrate into estuaries and ascend rivers. Eels mature to the yellow eel stage in these rivers

and streams before maturing to adults. American eels are known to live as long as 40 years before transforming into the silver eel stage and returning to the ocean to spawn. Their utilization and distribution in the Catawba-Wateree River Basin is discussed above in the section entitled *Diadromous Fish*. As part of the license application, Duke Energy has prepared a species protection plan for American eel. Preliminary prescriptions for upstream and downstream passage of eels have been filed by FWS. NOAA has reserved its authority to submit additional prescriptions if needed at a later time.

Flat Bullhead and Snail Bullhead—The flat bullhead and snail bullhead are small catfish species distributed throughout North Carolina, South Carolina, and Georgia, but are listed as state species of concern due to population declines in many southeastern rivers. Duke Energy has drafted a species protection plan for these two species to provide information for the continued maintenance of bullhead habitat and protection from human disturbance. The two species are similar in appearance and have overlapping geographic ranges and habitat preference. Flat bullhead inhabit low to medium gradient streams primarily in pools and slow water, while snail bullhead prefer medium to high gradient streams residing in pools and riffles. No specific threats to populations of these species have been identified. Both species are distributed throughout the project area.

Snail bullhead were collected during fish community surveys from the Catawba River bypassed reach (above and below Muddy Creek), Rhodhiss tailrace, Oxford regulated river reach, Wylie regulated river reach, Fishing Creek tailrace, Great Falls and Dearborn tailraces, lower Great Falls Long bypassed reach, Rocky Creek and Cedar Creek tailraces, and Wateree regulated river reach immediately downstream of the dam.

Flat bullhead were collected in the Catawba River bypassed reach below Muddy Creek, Paddy Creek bypassed reach, Rhodhiss tailrace, Oxford regulated river reach, Mountain Island tailrace, Wylie regulated river reach, Fishing Creek tailrace, Great Falls and Dearborn tailraces, Great Falls Long bypassed reach, Rocky Creek and Cedar Creek tailraces, and Wateree regulated river reach immediately downstream of the dam. Flat bullheads also were collected in 9 of 11 wadeable tributaries sampled from upstream of Lake James to Lake Wateree.

Robust Redhorse—The robust redhorse has been determined to be significantly rare by the North Carolina Heritage Program and the South Carolina Heritage Trust, and is a federal species of concern, but has no specific regulatory protection. Habitat modification appears to be a primary factor affecting the decline of the species. Watershed disturbances that result in erosion have had a negative effect on the species by increasing sediment load to streams which bury gravel substrate essential to robust redhorse for spawning and larval development. Freshwater mollusks are a major source of food for the redhorse and also are sensitive to sedimentation; many native populations of freshwater mussel species are in decline through much of their range. Populations of robust redhorse exist in the Oconee, Ocmulgee, Savannah, and Pee Dee Rivers. Sampling conducted during 2004 to 2005 specifically for rare catastomid species did not collect robust redhorse or another rare redhorse species, Carolina redhorse; a third rare catastomid, highfin carpsucker, was captured in the Congaree, but not in the Catawba-Wateree River Basin. The highfin carpsucker and Carolina redhorse are listed in the states of North Carolina and South Carolina as species of special concern. An intensive 2-year effort to search for spawning aggregations of suckers in 2004 and 2005 in the Wateree River yielded no robust redhorse or two other target rare suckers, the highback carpsucker and the Carolina redhorse. South Carolina DNR has undertaken a project to introduce robust redhorse into the

Wateree and Broad Rivers of South Carolina. Approximately 7,100 juvenile robust redhorse were released into the Wateree River in November and December 2005, with more to follow in subsequent years. The Robust Redhorse Conservation Strategy (2003) was written to encourage partnerships between public and private sectors in the conservation of the redhorse and its habitat; Duke Energy is a member of the Robust Redhorse Conservation Committee. Duke Energy has indicated that it will continue to support the Robust Redhorse Conservation Committee as it has since the inception of the Committee in 1995. Duke Energy has prepared a species protection plan for the robust redhorse as part of this relicensing process.

Freshwater Mussels—Twenty-four species of freshwater mussels have been documented from the Santee-Cooper River Basin during the past two centuries; 17 of these species were collected in the Catawba-Wateree Project area during the relicensing studies (AES, 2005). Seven of the 17 species found in the project area are either federally or state (North or South Carolina, or both) listed as endangered, threatened, or special concern. These include the following: creeper/squawfoot, Eastern creekshell, paper pondshell, Roanoke slabshell, yellow lampmussel, Eastern pondmussel, notched rainbow, and rayed pink fatmucket. According to AES (2005), approximately 500 river/stream reaches have been surveyed within the Catawba-Wateree River Basin during the last 20 years. Approximately 60 percent of these sampled reaches provided no evidence of an extant mussel fauna, and less than 25 percent provided habitat suitable for the Eastern elliptio or the variable spike, two of the most tolerant and abundant mussel species in the region. Generally, the healthier populations of North and South Carolina freshwater mussels occur in clean water flowing through forested landscapes. Because mature mussels are predominantly sessile organisms incapable of avoidance or escape, freshwater mussels are very susceptible to changes in their environment. Various threats to the viability of their populations include agriculture, wood harvesting, and other land use practices that increase erosion and sediment load to streams; impoundment of free-flowing streams and rivers; competition from exotic species introductions (e.g., Asiatic clam); changes in water temperature, water level, and DO; nutrient loading; and toxic chemicals from point and non-point sources. More detailed information on the distribution of these species within the project area was provided in the discussion in the section above entitled *Freshwater Mussels*.

Seven species of freshwater mussel listed as species of concern by North Carolina, South Carolina, or both have been documented during recent sampling from the Catawba-Wateree Project area. These include the following:

- Yellow lampmussel is listed as a state endangered species by North Carolina, a species of special concern by South Carolina, and a federal species of concern. Fifteen individuals of this species were collected only from the regulated reach below the Wateree Development during the AES (2005) surveys.
- Creeper/squawfoot is listed as state threatened in North Carolina and a species of special concern in South Carolina. AES (2005) collected the species at the Bridgewater, Lookout Shoals, Mountain Island bypass, and Wylie Developments.
- Eastern creekshell is listed as a species of special concern in South Carolina. AES (2005) collected the Eastern creekshell at the Bridgewater, Rhodhiss, Mountain Island, and Wylie Developments.

- Paper pondshell is listed as a species of special concern by South Carolina. AES (2005) collected the paper pondshell at six developments from Mountain Island downstream to Wateree with the exception of Rocky Creek and Cedar Creek.
- Roanoke slabshell is listed as state threatened in North Carolina. AES (2005) collected Roanoke slabshell at the Wylie and Wateree Developments; no specimens were collected in North Carolina. The Roanoke slabshell was the most abundant mussel collected (65 individuals) at Wateree, mostly in the regulated reach.
- Eastern pondmussel, state threatened in North Carolina, was collected only at the Wateree regulated river reach (AES, 2005).
- Notched rainbow is listed as a species of special concern in both North and South Carolina. AES (2005) collected the species at the Bridgewater and Rhodhiss Developments. At Bridgewater they were collected in Lake James, Catawba River bypassed reach, and Muddy Creek; at Rhodhiss they were collected in the Johns River and Warrior Forks.

In addition, the rayed pink fatmucket is a species of special concern in South Carolina. Although several relic shells were found below the Wateree dam, no live specimens were collected at any sampling locations. No species-specific management plan for any of these mussels has been prepared by either state. Duke Energy has prepared species protection plans for each of these species and proposed to continue monitoring freshwater mussels at selected locations influenced by hydro operations at 5-year intervals for the duration of the license.

3.3.3.2 Environmental Effects

Reservoir Fluctuations

The Catawba-Wateree Project developments are typically operated for load-following peaking power generation. Reservoir surface elevations fluctuate daily and seasonally in response to power generation operations, and seasonal and long-term weather conditions and associated natural inflow. Water surface fluctuations can affect the amount and quality of shallow water shoreline habitat available to aquatic resources including growth and distribution of aquatic vegetation, benthic invertebrates, and spawning, nursery, and feeding habitat for fish. The spawning success of fish species that utilize shallow bottom habitat for spawning (e.g., nest building sunfish and bass) can be particularly affected by water level fluctuations.

To enhance lake spawning habitat, the Revised CRA proposes a new license article (PM&E 2.0), the Spring Reservoir Level Stabilization Program. The proposed new license article formalizes a voluntary program currently in effect at the four reservoirs subject to winter draw-down and the most variable water surface elevations. In consultation with state agencies in North and South Carolina, Duke Energy has proposed to implement a program to protect and enhance near-shore spawning habitat by providing stable water surface elevations during 3 weeks in the spring at Lake James, Lake Norman, Lake Wylie, and Lake Wateree. These are the primary storage reservoirs within the project; spring water levels in the other project reservoirs are more stable than these four. The range of lake level fluctuations proposed in the Revised CRA are generally larger than occur under current operations, but are necessary to balance the use of the reservoir, generating operations and downstream interests. The proposed Spring Reservoir Level Stabilization Program for Catawba-Wateree developments will provide

more stable reservoir levels from early spring through early summer, reducing the risk of reservoir level decreases during the spring/early summer spawning season.

The programs at each of the four developments will be implemented based on a water temperature trigger or observation of bass spawning activity. A surface water temperature monitoring station will be established at each reservoir to provide real-time temperature trigger data. Lake levels will be held within 1 ft below and 2 ft above the level existing at that time the stabilization program is initiated.

Our Analysis

The Spring Reservoir Level Stabilization Program has been proposed to enhance spawning habitat for fish, such as black bass, crappie, and sunfish, which spawn in near-shore habitat during spring. These species are well established in the project reservoirs and support a significant recreational fishery. The license application includes study reports for the *Fish Community Assessment* (*Aquatics 01*) and *Reservoir Fish Habitat Assessment* (*Aquatics 02*). These reports indicate the success of these littoral spawners. Black bass (primarily largemouth bass) averaged 37 percent of the total littoral biomass; sunfish (bluegill and redbreast) numerically dominated the total fish catches throughout the project's reservoirs, accounting for 70 percent of the fish sampled on average.

We conclude that the actions formalized in the Revised CRA to stabilize spring reservoir levels will improve and enhance spawning habitat for important sport fish species that utilize the littoral zone for spawning in the spring. The effectiveness of this program and fine-tuning the trigger temperatures for each reservoir will be accomplished by Duke Energy in consultation with the involved state agencies from North and South Carolina.

Instream Flow Through Regulated Reaches

Eight of the developments (Rhodhiss, Cowans Ford, Mountain Island, Fishing Creek, Great Falls, Dearborn, Rocky Creek, and Cedar Creek) discharge generation flows directly into the backwater of the next downstream impoundment. These projects have requirements for minimum average daily flow and, in the case of Cowans Ford and Mountain Island, continuous minimum releases in the existing license. No changes to these discharge requirements are proposed in the Revised CRA, and no alternative flows for aquatic resources have been recommended by any agency or other commentor. FWS did not list a minimum average daily flow for Rhodhiss in its June 4, 2008, comments on the Notice of Application Ready for Environmental Analysis; we assume that this may have been an oversight and have maintained the same minimum average daily flow for Rhodhiss. Given that there are generally no riverine reaches below each of these developments during the normal operating range of water surface elevations, the proposed continuation of minimum average daily flows will ensure the same flow conditions that have supported the existing aquatic resources in the downstream impoundments under the existing license.

The Revised CRA proposes new minimum continuous releases for the Bridgewater, Oxford, Lookout Shoals, Wylie, and Wateree Developments that are generally higher than under the existing license. The proposed minimum continuous flows for the Oxford (150 cfs), Lookout Shoals (80 cfs), and Wylie (1,100 cfs) Developments are constant throughout the year. During specific high inflow conditions, the Wylie High Inflow Protocol will be implemented, increasing the minimum continuous flow from 1,100 to 1,300 cfs during the period of February 15 to

May 15. The Revised CRA proposes seasonally variable minimum continuous flows at the Bridgewater and Wateree Developments to support fish spawning.

American Rivers/Coastal Conservation League (AR/CCL) and the Catawba Riverkeeper (CR) have recommended alternative seasonal continuous minimum flows for resident and anadromous fish that are generally higher than the Revised CRA for the Wylie and Wateree Developments to support anadromous fish spawning (tables 29 and 30). In order to spawn in the Wylie regulated river reach, anadromous fish will first need to pass the six downstream developments, which, based on the preliminary section 18 fish passage prescriptions, is not likely to occur during the first 10 years of the new license. FWS and NOAA Fisheries have agreed with the minimum continuous flows recommended in the Revised CRA for Wylie and Wateree including implementation of the Wylie High Inflow Protocol and the Wateree Spring Stable Flow Protocol. We agree that Duke Energy, FWS, NOAA Fisheries, and South Carolina DNR consult during the first 10 years following implementation of the FWQIP on a license article to be included as an amendment for the Wateree Spring Stable Flow Protocol. NOAA Fisheries has indicated that supplemental flows to support diadromous fish should be re-evaluated in the future after implementation of fish passage prescriptions. For completeness we provide the following analysis of the recommended alternative flows to assess their benefit to anadromous fish relative to those proposed in the Revised CRA.

Table 29. Summary of proposed minimum continuous flow (cfs) alternatives to support anadromous fish spawning and maturation in the Wylie regulated river reach.

Time period	**CRA**	**FWS, NOAA Fisheries**	**AR/CCL, CR**
January	1,100	1,100	1,100
February	1,100 (High inflow 1,300)	Wylie	1,400
Mar-April	1,100 (High inflow 1,300)	High Inflow	1,800
May	1,100 (High inflow 1,300)	Protocol	1,400
June-December	1,100	1,100	1,100

Table 30. Summary of proposed minimum continuous flow (cfs) alternatives to support anadromous fish spawning and maturation in the Wateree regulated river reach.

Time period	CRA	FWS, NOAA Fisheries	AR/CCL, CR
January	930	930	2,400
February 1-14	930	930	3,700
February 15 -29	2,400	Wateree	3,700
March	2,700	Spring	3,700
April	2,700	Stable	2,700
May 1-15	2,400	Flow	2,400
May 16-31	1,250	Protocol	2,400
June-December	930	930	930

Minimum continuous flows proposed in the Revised CRA for these two developments were based on analysis of the relationship between flow and aquatic habitat using Index C as a metric of habitat based on weighted useable area (WUA). Model simulations were presented in the instream flow assessment report for existing conditions, unregulated flows (without the dam), leakage flow, critical flow, and the modified mutual gains scenario for proposed operations. The proposed flows for the modified mutual gains scenario attempt to balance the varying and sometimes conflicting optimum flow requirements for the range of resident and diadromous aquatic species that utilize the reach. Data for alternate flow scenarios are not available in the instream flow assessment report. In order to evaluate the alternative flow recommendations, we have analyzed the underlying WUA curves for the target species and lifestages, in this case, spawning and maturation habitat for American shad at both developments and spawning habitat for sturgeon at Wateree.

Our analysis for the Wylie Development is based on data interpolated from the WUA simulation curves weighted for four study sites as presented in the instream flow assessment report: subreach 1, study sites 1 (5.5 percent) and 2 (23 percent); subreach 2 (27.3 percent); and subreach 3 (44.1 percent). The proposed flow-associated WUA for American shad spawning and percent of maximum WUA for each time period are summarized in table 31 for the Revised CRA proposal and alternative recommendations. The model simulation estimates that the maximum WUA for American shad spawning in the Wylie regulated river reach occurs at approximately 3,750 cfs.

During the peak spawning period of March to April, the 1,100 cfs proposed in the Revised CRA would provide 56 percent of the maximum WUA, while the 1,300 cfs proposed during high inflow at the Wylie Development would achieve 64.5 percent of the maximum WUA. The alternatives recommend 1,800 cfs during March to April providing 77.4 percent of the maximum WUA. This is an increase of 21.4 percent, or 12.9 percent compared to the Revised CRA proposal at normal and high inflow, respectively. During the early (January to February) and late (May) portion of the American shad spawning migration, the effect is less; the alternative recommendations result in an increase of 11.6 percent relative to the Revised CRA.

The flow scenario for the Wateree Development proposed in the Revised CRA would achieve more than 97 percent of the maximum WUA for the Wateree regulated river reach during peak American shad spawning (table 32). The increase in continuous minimum discharge from 2,700 to 3,700 cfs between the beginning of February and the end of March as recommended in the alternatives would increase spawning habitat by 17.3 percent during the first half of February, but would slightly reduce the WUA from mid-February through March.

Table 31. Summary of WUA analysis for American shad spawning based on Revised CRA and alternative flow scenarios recommended by AR/CCL and CR for the Wylie regulated river reach. (Source: Duke Energy, 2006a)

	CRA			AR/CCL, CR			
Time period	**Flow (cfs)**	**WUA (ft^2/1,000 ft)**	**% of Max.**	**Flow (cfs)**	**WUA (ft^2/1,000 ft)**	**% of Max.**	**% change from Revised CRA**
January	1,100	221,815	56.0	1,100	221,815	56.0	0.0
February 1-14	1,100	221,815	56.0	1,400	267,550	67.6	11.6
February 15-29	1,100 1,300	221,815 255,280	56 .0 64.5	1,400	267,550	67.6	11.6 3.1
March	1,100 1,300	221,815 255,280	56.0 64.5	1,800	306,255	77.4	21.4 12.9
April	1,100 1,300	221,815 255,280	56.0 64.5	1,800	306,255	77.4	21.4 12.9
May 1-15	1,100 1,300	221,815 255,280	56.0 64.5	1,400	267,550	67.6	11.6 3.1
May 16-31	1,100	221,815	56.0	1,400	267,550	67.6	11.6
Maximum	3,750	395,895		3,750	395,895		

Table 32. Summary of WUA analysis for American shad spawning based on Revised CRA and alternative flow scenarios recommended by FWS, NOAA Fisheries, and AR/CCL for the Wateree regulated river reach. (Source: Duke Energy, 2006a)

	CRA			**AR/CCL, CR**			
Time period	**Flow (cfs)**	**WUA (ft^2/1,000 ft)**	**% of Max.**	**Flow (cfs)**	**WUA (ft^2/1,000 ft)**	**% of Max.**	**% change from Revised CRA**
January	930	136,802	75.6	2,400	176,542	97.6	22.0
February 1-14	930	136,802	75.6	3,700	167,988	92.9	17.3
February 15-29	2,400	176,542	97.6	3,700	167,988	92.9	-4.7
March	2,700	175,708	97.2	3,700	167,988	92.9	-4.3
April	2,700	175,708	97.2	2,700	175,708	97.2	0.0
May 1-15	2,400	176,542	97.6	2,400	176,542	97.6	0.0
May 16-31	1,250	160,120	88.5	2,400	176,542	97.6	9.1
Maximum		180,843			180,843		

Maintenance and Emergency Protocol

The Maintenance and Emergency Protocol appropriately provides for replacement of resources lost during a Maintenance and Emergency Protocol event such as recreational flows and aquatic resources. It is recognized that during certain maintenance events, and particularly in an emergency, unavoidable fish mortality may occur. The protocol indicates that if critical flows cannot be maintained during the Maintenance and Emergency Protocol, Duke Energy would monitor any potential aquatic species impacts in the affected stream segment and replace any aquatic species mortalities that are identified.

NOAA Fisheries has recommended the establishment of a Catawba-Wateree Project Fisheries Technical Committee comprised of NOAA Fisheries, FWS, North Carolina DENR, North Carolina WRC, South Carolina DNR, South Carolina DHEC, Duke Energy, and non-governmental conservation organizations to review monitoring and evaluation studies, operating plans, and maintenance issues within the project.

Our Analysis

We conclude that mitigation for the loss of resources may be necessary in some situations; however, we find that the second requirement, as included, may be vague, unnecessary, and for given situations may be impractical or impossible to comply with. For example, replacement of a threatened and endangered species may not be possible if breeding programs are not available. Where an adequate forage base is present and the resource is otherwise healthy, replacement of forage species and a diversity of "minnows" also may not be necessary. The FPA does not require 100 percent mitigation for fish losses at hydro facilities. We conclude that mitigation for fish losses that result from a Maintenance and Emergency Protocol event be evaluated on a case-by-case basis considering the species affected, the number of organisms affected, and the habitat, population, and community characteristics at the affected location. Where the populations and community are robust and healthy, monitoring or other habitat and resource management activities may be more beneficial than direct mitigation of the fish losses. We agree that an advisory group as recommended by NOAA Fisheries be established with representatives of Duke Energy, federal and state resource managers, and other stakeholders to evaluate and recommend appropriate mitigation for fish losses.

Instream Flow Through Bypassed Reaches

Except for spillage during periods of high inflow, flow through existing bypassed reaches generally consists of leakage, groundwater seepage, and, in some cases, tributary inflow. As a result of these reduced flows and associated water quality constraints (for example, significant fluctuations in water temperatures), aquatic habitat is generally limited compared to conditions in an unregulated or regulated stream reach. There are six bypassed reaches at five developments within the Catawba-Wateree Project under the existing conditions. The Revised CRA proposes to implement continuous minimum flows for aquatic resources at three of these bypassed reaches (the Catawba River bypassed reach at the Bridgewater Development; the Long and Short bypassed reaches at the Great Falls and Dearborn Developments) as part of relicensing. The flow recommendations in the Revised CRA are based on analysis and review by the Instream Flow Study Team of the studies conducted for these reaches.

There are differing flow recommendations for the long bypassed reach at the Great Falls and Dearborn Developments. Under the Catawba-Wateree Revised CRA, the minimum

continuous flow in the Long bypassed reach would be 450 cfs year-round with an increase to 850 cfs to accommodate spring spawning for approximately 8 weeks from mid-February to mid-May. FWS and NOAA Fisheries have recommended adoption of these minimum continuous flows for the Great Falls Long bypassed reach. AR/CCL and CR have recommended of 850 cfs in February, 1,500 cfs in March to mid-May, and 450 cfs for the rest of the year to accommodate resident and anadromous fish.

Flow diversion from the Paddy Creek, Mountain Island, and Great Falls Short bypassed reaches would continue under normal operating conditions proposed in the Revised CRA. The Paddy Creek bypassed reach is only 0.5 mile long and approximately 2 acres in area. The Revised CRA considered the potential aquatic habitat gain by implementing minimum flows in the Paddy Creek bypassed reach to be minimal. Additionally, the Revised CRA determined that distribution of flows to the Catawba River bypassed reach and the regulated Linville River below the Linville dam was the most effective use of the water available for minimum releases at the Bridgewater Development to meet management goals for the trout fishery and protection of existing mussel populations. Water diverted to the Paddy Creek bypassed reach would be taken from the other two reaches.

The Mountain Island bypassed reach provides habitat for an established population of the federally listed endangered Schweinitz's' sunflower. The bypassed reach is approximately 0.6 mile long and 22 acres in area. The potential lotic habitat available by inundation of this reach is relatively small and would likely be less than the 0.6-mile length as flows in the bypassed reach would back up from the downstream impoundment. The Revised CRA determined that introduction of minimum flows necessary to enhance aquatic habitat would reduce habitat and threaten at least a portion of the established Schweinitz's sunflower population. There is little benefit and high risk in transplanting the sunflower population that has established under existing conditions in the Mountain Island bypassed reach. It is our conclusion that the potential benefit of the increase in aquatic habitat associated with requiring continuous minimum flows would be outweighed by the risk to the population of the endangered Schweinitz's' sunflower.

Instream flow and demonstration turbine flow studies at the bypassed reach below the Wateree spillway were conducted to assess potential aquatic habitat and spawning habitat available at various flows for resident and diadromous fish. The Revised CRA proposes minimum continuous flows from the powerhouse to the spillway channel and installation of a 10,000-cfs-capacity bladder dam in the spillway to provide flexibility for high flow and flood management in Lake Wateree. Based on the results of instream flow studies, the Revised CRA found that flows necessary to provide adequate conditions for sturgeon spawning in the bypassed reach are not sustainable under average flow conditions without excessive draw-down of Lake Wateree and other upstream impoundments. The Revised CRA proposes that the Wateree River bypassed reach continue as a bypass under normal operating conditions. FWS and NOAA Fisheries have accepted these recommendations. AR/CCL and CR have requested that flows be provided to accommodate sturgeon spawning during late winter and spring. NOAA Fisheries pointed out that spawning populations of shortnose sturgeon are not likely to be present in the vicinity of the Wateree bypass during the life of the new license.

The Revised CRA proposes protection and preservation of riparian buffer within the watershed to enhance water quality as mitigation for continued flow diversion at these three

bypassed reaches. FWS, EPA, and AR/CCL question the appropriateness and adequacy of the proposed mitigation for aquatic habitat.

Our Analysis

Our analysis focuses on the bypassed reaches of the Catawba-Wateree River where there is disagreement on the minimum flows proposed, or where the adequacy of proposed mitigation has been questioned.

We conclude that the allocation of available water resources to the Linville regulated river reach and the Catawba River bypassed reach provides the most benefit to resident fish and that allocation of a portion of that water to the relatively small Paddy Creek bypassed reach would provide negligible new aquatic habitat at the cost of reducing the potential benefits to the other two reaches.

No specific recommendations for alternate minimum flows have been submitted for the Catawba River bypassed reach or the Great Falls Short bypassed reach. FWS and NOAA Fisheries, in their comments on the Notice of Application Ready for Environmental Assessment, both accept the minimum continuous flows proposed in the Revised CRA to enhance aquatic habitat in the Great Falls Long bypassed reach. Both agencies request that flows for spring spawning of anadromous American shad be re-evaluated at a future time when implementation of fish passage prescriptions make this bypass accessible to this species. Additionally, AR/CCL and CR requested higher spring flows to support resident and anadromous fish. The most significant changes in minimum flows (from 850 to 1,500 cfs) were requested for the peak periods of spawning migration in March and April.

Table 33. Summary of proposed minimum continuous flow (cfs) alternatives to support anadromous fish spawning and maturation in the Great Falls Long bypassed reach.

Time period	**CRA**	**FWS, NOAA Fisheries**	**AR/CCL, CR**
January	450	450	450
February 1-14	450	450	850
February 15-29	850	850	850
Mar-April	850	850	1500
May 1-15	850	850	850
May 16-31	450	450	850
June-December	450	450	450

We reviewed the results of Duke Energy's instream flow study for the 2.2-mile-long Great Falls Long bypassed reach and analyzed the differences in available spawning habitat for American shad estimated for each of these flow scenarios. Duke Energy's study provided model simulations of WUA, total wetted area, and wetted perimeter. WUA is an index of available habitat (square feet per 1,000 linear feet of river) and was simulated over a range of discharge

conditions (150 to 2,000 cfs) at the Long bypassed reach. Similarly, total wetted area simulated the total area inundated within the bypassed reach over a range of flows. Wetted perimeter provides an index of available habitat in terms of length of inundated substrate at specific transects across the reach. Increasing the flow from 850 to 1,500 cfs for March through mid-May as proposed by AR/CCL and CR would result in an increase in wetted perimeter of 1.7 to 11 percent based on the four transects simulated in Duke Energy's analysis. The average depth at these transects increased approximately 0.4 to 0.7 ft (10 percent) over this flow range where average depths ranged from 4 to 7 ft. Total wetted area increased approximately 8 percent with a simulated increase in flow from 850 to 1,500 cfs.

We analyzed the WUA figures presented in appendix I-2 of Duke Energy's instream flow study report, to evaluate the potential benefit to American shad spawning habitat in the Great Falls Long bypassed reach by implementation of the alternate flows recommended by AR/CCL and CR.

During the peak period of spawning for American shad in March and April, an increase of flow from 850 to 1,500 cfs would increase the WUA by 8.3 percent. Given an increase of more than 76 percent in flow, the associated 8.3 percent increase in habitat is negligible. The changes recommended for early in the season (early February) and late in the season (early May) would result in a 21 percent increase in WUA.

Preliminary prescriptions for fish passage proposed by FWS require Duke Energy to provide fishways for anadromous American shad and blueback herring at the Wateree Development no later than January 1, 2018. FWS has recommended the design of a trap and transport (T&T) system for passage of anadromous fish at the Wateree dam. Until the number of American shad trapped exceeds 10,000, trapped fish will be released upstream into Lake Wateree; when the number of fish collected exceeds 10,000, they will be distributed to upstream reaches of the Catawba-Wateree River Basin within South Carolina.

NOAA Fisheries recommended that the new license include provisions for the re-evaluation and implementation of revised instream flows to support protection of anadromous fish spawning and maturation habitat if fish passage prescriptions provide access for American shad to this reach.

Given this time table, it is clear that significant numbers of American shad are not likely to have access to the Great Falls Long bypassed reach for at least 10 years. Based on our review of the instream flow studies conducted by Duke Energy in support of the Revised CRA, we conclude that the minimum continuous flows proposed in the Revised CRA are adequate to enhance and protect aquatic resources in the Great Falls Long bypassed reach. The benefits of these minimum flows through the Great Falls Long bypassed reach should be adequately demonstrated during the intervening 10 years until the T&T program is implemented at the Wateree Development. Information related to availability of and utilization of habitat by resident and diadromous fish and operational experience of the project to provide these flows during that time will provide a stronger empirical basis for evaluation of the most appropriate flows to support anadromous fish spawning and maturation habitat within the operational constraints of the project.

Table 34. Summary of WUA analysis for American shad spawning based on Revised CRA and alternative flow scenarios recommended by AR/CCL and CR for the Great Falls Long bypassed reach.

	CRA			NOAA Fisheries, AR/CCL			
Time period	**Flow (cfs)**	**WUA (ft^2/1,000 ft)**	**% of Max.**	**Flow (cfs)**	**WUA (ft^2/1,000 ft)**	**% of Max.**	**% change from Revised CRA**
Jan	450	103,000	61.3	450	103,000	61.3	0.0
February 1-14	450	103,000	61.3	850	139,000	82.7	21.4
February 15-29	850	139,000	82.7	850	139,000	82.7	0.0
March	850	139,000	82.7	1,500	153,000	91.1	8.3
Apr	850	139,000	82.7	1,500	153,000	91.1	8.3
May 1-15	850	139,000	82.7	850	139,000	82.7	0.0
May 16-31	450	103,000	61.3	850	139,000	82.7	21.4
Maximum		168,000			168,000		

We conclude that minimum flows during the spring spawning season for anadromous fish proposed in the Revised CRA are adequate to support initial use of the Great Falls Long bypassed reach by spawning American shad, which is not likely to occur in significant numbers before the T&T program is initiated in 2018. The effectiveness of these flows to create spawning and nursery habitat can be most effectively re-evaluated at such time that the prescriptions under FPA section 18 for fish passage at the downstream Wateree Development result in the presence of significant numbers of adult American shad in the Great Falls Long bypassed reach. Modifications to the license articles stipulating revised minimum continuous flows can be made as appropriate at that time.

AR/CCL and CR have requested additional flows to the Wateree tailrace and spillway channel to provide habitat in the Wateree bypassed reach to support sturgeon spawning. Minimum continuous flows proposed for the Wateree Development in the license application will not be adequate to inundate the Wateree bypassed reach adjacent to the spillway channel. The demonstration flow study showed that operation of at least four turbines is required to inundate significant portions of the bypass and that, under these discharge conditions, the water depths preferred by sturgeon for spawning habitat were generally not achieved in most of the Wateree bypassed reach. Alternative structural modifications to the bypass to redirect flows were evaluated by the Aquatic Resources Committee, but were not found to be effective and feasible given the configuration and slope of the bypass area. During periods of high inflow or in anticipation of major storm events, the proposed bladder dam at the Wateree spillway may provide up to 10,000 cfs additional flow to the spillway channel; however, availability of these discharges is weather dependent and cannot be relied on or generated within the project outside of such weather events. During the design and determination of the location for construction of the bladder dam, consideration should be given to whether the device could be used to effectively inundate the bypassed reach at least during high flow events. Given that neither Atlantic nor shortnose sturgeon currently utilize the Wateree River, it is our conclusion that it is not necessary or feasible to provide flows adequate to inundate the Wateree bypassed reach at this time in order to support sturgeon spawning. At such time as significant numbers of sturgeon are found in the vicinity of the Wateree Development, these findings may warrant re-evaluation along with consideration of fish passage options.

Flow Mitigation Package for Less Than Target Streamflow for Aquatic Habitat

The consultation records presented in the license application for the Instream Flow and Aquatic Resources committees document the iterative process undertaken to reach agreement on minimum flows in bypassed and regulated reaches of the Catawba-Wateree Project. The CHEOPS model was used to evaluate the effect of recommended flows at various reaches on reservoir storage in the project, and on water surface elevation, critical reservoir levels, power generation, and operating flexibility. Optimum flows for target aquatic resources were selected based on WUA and Index C simulations from the instream flow study and used as input to the CHEOPS model. These flow recommendations were identified regardless of whether or not the existing equipment and configuration at the developments could actually operate at the recommended flows or whether the flows could be reliably balanced among the developments. If CHEOPS indicated that flow recommendations would result in excessive draw-down, or earlier or more frequent implementation of the Low Inflow Protocol, alternative recommendations or rebalancing flows among regulated and bypassed reaches were considered and CHEOPS was rerun.

EPA stated that minimum flow proposals must demonstrate consistency with the traditional approach of avoidance, minimization, and then mitigation to address less than optimal flows or reaches with no proposed minimum flow. We conclude that the process documented in the consultation record clearly demonstrates the effort to avoid and minimize impacts in balance with other competing demands on the resources. The flows proposed in the Revised CRA represent the consensus of the Aquatic Resource Committee for the seasonal allocation of available water among bypassed and regulated reaches at the project developments for support of aquatic resources. Continuous minimum flows will be provided in three bypassed reaches providing the greatest aquatic habitat gain for the first time in more than 80 years. Five regulated reaches will receive continuous minimum flows for the first time or flows significantly higher than under the existing license. Stable spring flows and gradual reductions in operations at the end of high spring flow events will enhance inundation and spawning habitat in the flood plain downstream of the Wateree Development.

The Revised CRA proposes mitigation for project effects on aquatic habitat in riverine reaches that will continue to be bypassed by flow under normal operation in the proposed relicensing conditions (Paddy Creek bypassed reach, Mountain Island bypassed reach, and Wateree Spillway Channel bypassed reach). Also, the Revised CRA includes mitigation for regulated reaches (Oxford regulated river reach, Lookout Shoals regulated river reach, Great Falls Long and Short bypassed reaches, and Wylie regulated river reach) where proposed minimum flows will not achieve the agency target for aquatic habitat area equivalent to 80 percent of that available under unregulated streamflow conditions. For the Wylie regulated river reach and the Great Falls bypassed reaches, shortfalls from target flows were particularly focused on habitat available for spring spawning anadromous fish, which do not presently have access to these reaches.

The three bypassed reaches account for approximately 1.5 miles (approximately 66 acres) of potential stream habitat that will not receive minimum flows for aquatic resources under the proposed new licensing articles. The regulated reach below the Oxford dam is 2.8 miles long, and below the Lookout Shoals dam is 0.3 to 1.3 miles, depending on the draw-down level of Lake Norman downstream. The regulated reach between the Wylie Development and Fishing Creek reservoir is 25.6 miles long. These reaches will receive an increase in minimum flows compared to the existing license, but fell short of the habitat target of 80 percent of unregulated flow conditions.

For most of the developments in the Catawba-Wateree Project, the upper end of the impoundment from one development backs up to the tailwater of the next upstream development with little or no intervening lotic habitat, except under low inflow or winter draw-down conditions. Except for the 76.8 miles between the Wateree dam and the Congaree River and the 25.6 miles between the Wylie dam and Fishing Creek reservoir, the existing condition of most of the mainstem riverine habitat in the Catawba-Wateree River basin has become lentic habitat, inundated by the 11 project impoundments. Consequently, outside of the existing bypassed reaches there is minimal opportunity for in-kind mitigation within the basin. We have concluded that, where feasible, the Revised CRA has proposed to re-establish continuous minimum flows to support aquatic resources. The Revised CRA presents valid rationale for not providing continuous minimum flows to the three remaining proposed bypassed reaches: (1) additional water is not available for the bypass without adversely affecting operating flexibility or lake water surface elevations; (2) water for these bypassed reaches would have to be subtracted from

the allocation to another bypass or the regulated reach, thus affecting its habitat; and (3) the potential habitat gain in the bypasses is very small compared to the effects on operations and aquatic habitat elsewhere.

The Revised CRA has proposed mitigation for flows based on *Stream Mitigation Guidelines* (U.S. Army Corps of Engineers [USACE] et al., 2003). For riparian preservation proposed in the Revised CRA, the *Guidelines* recommend multiplying the length of the affected reach by a factor of 2.5 to 5, depending on the quality of the reach. The state agencies agreed to use a multiplication factor of 4 for this mitigation package. The preservation length of stream bank was further adjusted on regulated reaches for which an increase in minimum flow was proposed at less than target habitat levels; the adjustment was a function of the percent below target habitat achieved by the proposed minimum flows.

The proposed mitigation package consists of protection of riparian lands on mainstem and first and second order tributaries to the Johns, Catawba, and Linville Rivers in North and South Carolina portions of the Catawba-Wateree River Basin. Mitigation proposed in the Revised CRA is comprised of 28.6 miles (343 acres) of riparian stream bank protection in North Carolina and 5.5 miles (67 acres) in South Carolina. These conservation easements will provide permanent protection to 100-ft-wide buffers to these reaches and downstream water quality protection. Protection of riparian buffers to ensure natural filtration of nutrients and sediment from runoff is a widely accepted best management practice for protection of downstream water quality within watersheds and is cited in the *Guidelines* as an appropriate mitigation action.

In addition, Duke Energy will contribute $1 million to South Carolina DNR to create the Catawba-Wateree Hydroelectric Project Fish and Wildlife Mitigation and Enhancement Fund. Mitigation packages of this type cannot be included as license requirements as the Commission does not have any authority over resource agencies. This agreement is considered as part of the cumulative effects of licensing the project.

The Catawba Riverkeeper commented that there is an imbalance in the proposed mitigation with too little mitigation in South Carolina. We conclude that preservation of upstream riparian habitat will provide permanent protection to water quality in the watershed downstream of the mitigation sites. The benefit to the overall watershed is not limited by the political boundary.

It is our finding that the mitigation package proposed in the license application makes an adequate effort to be onsite and in kind, and is appropriate to meet the goal to avoid, minimize, and then mitigate for project effects. In this case mitigation occurs upstream of project effects improving the starting conditions. This conclusion is in agreement with North Carolina's established interagency mitigation *Guidelines* and the record of consultation for determination of minimum flows for aquatic habitat and mitigation requirements.

AR/CCL and CR recommended that mitigation be included as a license article to provide an enforcement mechanism. The mitigation requirements will be enforced by North and South Carolina through the section 401 certification.

Freshwater Mussels

Freshwater mussels generally require habitat in clean, free-flowing streams and rivers with coarse-grained substrate (sand and gravel). Seventeen species of freshwater mussel, including seven federal or state, or federal and state listed species have been collected in the

Catawba-Wateree Project, primarily in the tailraces and regulated reaches below project developments and upstream tributaries. Bypassed reaches typically provide marginal habitat for mussels due to restricted flows, elevated water temperatures, and low DO. Fragmentation and reduction of free-flowing stream and river habitat by impoundments have affected the distribution and abundance of mussel populations in the regulated reaches, tailraces, and tributaries. Nutrient loading and sedimentation related to land use in the Catawba-Wateree River Basin also have affected the survival and distribution of mussels within streams and rivers in the project boundaries.

Our Analysis

Most specimens of freshwater mussel species of concern were collected from the tailwater and regulated reaches below the project developments or in tributaries to the impoundments or regulated reaches. The proposed continuous minimum flows to the bypassed and regulated reaches are higher than under the existing license and should benefit these species. Minimum continuous flows proposed for the Catawba River bypassed reach at the Bridgewater Development, the Lookout Shoals bypassed reach, and the Great Falls Long and Short bypassed reaches will open new aquatic habitat for potential use by freshwater mussels. Expanded use of these reaches by fish species that serve as hosts for the glochidia mussel lifestage also will potentially expand the distribution of mature mussels into these reaches. Negotiations by the Instream Flow Study and Aquatic Resources Committees to determine the appropriate distribution of increased flows to the regulated reach and the Catawba River bypassed reach at the Bridgewater Development were specifically focused on the appropriate balance of water to protect and enhance conditions for the cold-water trout populations in the Bridgewater regulated river reach and existing mussel populations in the bypassed reach. Too much water discharged to the Catawba River bypassed reach at warmer temperatures preferred by mussels will increase water temperatures above the tolerance levels for trout in the reach below the confluence of the Linville regulated river reach and the Catawba River bypassed reach; too much cold water discharged to the Linville regulated river reach reduces the quantity of water available for discharge to the bypassed reach.

Improved conditions in regulated reaches as a result of proposed continuous minimum flows and equipment modifications to improve DO below the dams and powerhouses also will provide improved habitat conditions for survival of mussel populations and movement of their fish hosts. Turbine aeration modifications at powerhouses should improve DO and overall water quality, which should benefit these species. Although there will continue to be daily cycling of flows between generation and minimum continuous flows, fluctuations in tailwater levels should be less than under the existing license and benefit mussel populations. Fish passage required by the FWS preliminary prescriptions and the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement will eventually provide opportunity for movement of resident glochidia-host fish species upstream, further expanding the potential for range expansion of extant mussel populations. The goal of the protection and preservation of riparian buffers in the Catawba-Wateree River Basin included in the mitigation package for less than target instream flows is to protect water quality (particularly nutrients, sediment, and turbidity) in the watershed. These actions also should enhance habitat conditions for mussels.

It is our conclusion that the distribution, diversity, and abundance of freshwater mussels in tributaries upstream of the project boundaries are not directly affected by the individual project developments. Furthermore, proposed increased flows to the bypassed and regulated

reaches will increase and enhance aquatic habitat for both mussels and the host fish for the glochidia early lifestage of mussels. The results from the monitoring program outlined in the *Species Protection and Management Plan for Freshwater Mussels* (2006) will provide periodic information to evaluate the condition of populations and the benefits to mussels from improvements to water quality and quantity in the tailwater and regulated reaches based on 35 selected stations from the AES (2005) surveys.

Diadromous Fish Passage and Restoration

The Catawba-Wateree River currently supports several anadromous species downstream of the Wateree Development including American shad and blueback herring. Hickory shad have occasionally been collected in very low numbers below the Wateree Development. Atlantic sturgeon and the federally endangered shortnose sturgeon utilize portions of the Santee-Cooper system, but are not established in the Catawba-Wateree River above the confluence with the Congaree River. Historic records (Newcomb and Fuller, 2001; DTA and LEI, 2005) document the use of portions of the Catawba-Wateree River at least upstream to Great Falls by these species. It appears that American shad may have occurred historically upstream to the present location of the Wylie dam. The catadromous American eel (a species that spends the majority of its life in freshwater and spawns in saltwater) may have been distributed upstream in the watershed into North Carolina above Lake James and the Bridgewater Development.

The Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement (effective April 15, 2008) is a cooperative partnership among the applicant, South Carolina Electric and Gas, FWS, South Carolina DNR, and North Carolina WRC; NOAA Fisheries and South Carolina DHEC also were involved in the development of the accord, but are not signatories. The accord moves to implement a 10-year action plan for diadromous fish in the basin drafted January 24, 2007. Agreements specific to fish passage at the Catawba-Wateree Project are reinforced in the preliminary section 18 prescriptions for fishways pursuant to the FPA issued by FWS (May 23, 2008). In comments on the Notice of Application Ready for Environmental Analysis, NOAA Fisheries concurred with the FWS prescriptions, but reserved its own authority to issue additional prescriptions in the future relative to species within its jurisdiction.

FWS indicates that the prescriptions were developed in concert with Duke Energy and considered alternative designs and approaches to fish passage presented in Duke Energy's *Fish Passage Assessment* (DTA and LEI, 2005). We consider the preliminary prescriptions and associated elements of the accord to be part of the license application for the Catawba-Wateree Project. Table 35 summarizes the key milestones and schedule for implementation of fish passage at the Catawba-Wateree Project defined in the preliminary prescriptions.

Our Analysis

We acknowledge that any license issued for the Catawba-Wateree Project would include the provisions of any final fishway prescriptions made by NOAA Fisheries and FWS. However, we provide our independent analysis of the preliminary prescriptions for completeness of this environmental review. Our analysis is focused on the primary issues of whether fish passage should be required at the project, the types of fish passage facilities that should be required, and the approximate timeframe for design and implementation of fish passage.

Upstream (American Shad, American Eel, Atlantic and Shortnose Sturgeon)—The Wateree Development is the upstream limit of diadromous fish passage in the Catawba-Wateree Basin, although some American eels may move past this blockage. American eel, American shad, and blueback herring currently utilize the lower Wateree River in relatively low numbers up to the tailrace of the Wateree dam. The accord and preliminary fish passage prescriptions recognize that successful restoration of fish passage may be limited initially and have created a phased approach and restoration goals.

The prescriptions call for implementation of a trap, sort, and transport (TS&T) facility for alosines (American shad and blueback herring) at the Wateree dam by January 1, 2018. The draft design plans and construction schedule are to be submitted for agency approval by December 31, 2015. This approximate 10-year period appears adequate for study, design, and construction of this facility to be operational by the beginning of the 2018 spring spawning season. Initially alosines captured are to be released into Lake Wateree; at such time that the number of alosines equals or exceeds 10,000 fish, Duke Energy will begin to distribute fish upstream within the South Carolina portion of the basin. Effectiveness studies are to be conducted during the first 3 years of operation of the TS&T provided FWS determines that sufficient numbers of fish are available. The results of these studies will be used in consultation with the agency to improve the design and effectiveness of the TS&T facility.

FWS has prescribed conducting 3-year eelway siting studies moving sequentially upstream beginning with the Wateree dam in 2009 (table 35). During siting studies, eels will be passed to the immediate upstream reservoir. These studies will support the design and construction of semi-permanent or permanent upstream eelway passage facilities at all of the project developments over a 34-year period, progressively re-opening the Catawba-Wateree River Basin to catadromous American eel for growth and development. The upstream eelway will be constructed within 2 years of completion of the siting study at each dam. Annual reports will be prepared for each year of operation describing the population and characteristics of eels passed at each facility.

It is our conclusion that the preliminary prescriptions provided by FWS are consistent with the Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement signed by the applicant and provide a reasonable and flexible approach for development of effective upstream passage for the target diadromous fish. The schedule outlined in the prescriptions appears to provide adequate time for site-specific studies and design of TS&T facilities for alosines, evaluation of their effectiveness, and modification as necessary. The schedule for study, design, and construction of upstream eelways moving sequentially upstream from Wateree to Bridgewater over a 34-year period is a reasonable approach to expand the geographic range of American eel in the Catawba-Wateree River Basin and provides a means to evaluate the effectiveness of the passage facilities and success of the restoration program.

Table 35. Schedule for implementation of FWS fish passage prescriptions.

	Wateree	Rocky Creek/Cedar Creek	Great Falls/Dearborn	Fishing Creek	Wylie	Mountain Island	Cowans Ford	Island Shoals	Oxford	Rhodhiss	Bridgewater
2008											
2009											
2010	American eel site study										
2011											
2012	Design, Construct,operate										
2013		American eel site study									
2014											
2015	Draft TS&T design, construction schedule	Design, Construct,operate									
2016			American eel site study								
2017											
2018	Implement Alosine TS&T no later than 1 January 2018		Design, Construct,operate	American eel site study							
2019											
2020											
2021				Design, Construct, operate							
2022					American eel site study						
2023	Eel Downstream Study Plan										
2024	Downstream Passage Study				Design, Construct, operate	American eel site study					
2025											
2026											
2027						Design, Construct, operate	American eel site study				
2028											
2029											
2030							Design, Construct, operate	American eel site study			
2031											
2032											
2033								Design, Construct, operate	American eel site study		
2034											
2035											
2036											
2037									Design, Construct, operate	American eel site study	
2038											
2039										Design, Construct, operate	American eel site study
2040											
2041											
2042											Design, Construct,operate
2043											

Downstream (American Shad, American Eel)—The preliminary prescriptions concur with the findings by Duke Energy (2005b) that existing design of the turbines, bypasses, spill gates, and spillways at the South Carolina developments are adequate for downstream passage of juvenile alosines without site-specific downstream fish passage facilities. FWS has reserved the authority to prescribe downstream passage at some time in the future, if necessary.

FWS does have concern about downstream passage of out-migrating American eel. FWS has prescribed downstream passages studies to be initiated in 2024, 10 years following beginning of operations of the upstream eelway at Wateree dam. A study plan for downstream passage is to be submitted to the agency the year prior for approval. The study will evaluate operational modification, passage devices, and trapping methods for moving eels downstream.

It is our conclusion that this schedule provides time for upstream eelway facilities at the first six developments to become operational and eels to begin to expand their geographic range in the basin, and to evaluate the effectiveness of the operational eelways and the progress of restoration efforts. With the decline in eel populations returning to river systems throughout the east coast, considerable attention and research is ongoing to identify the causes of the decline and approaches to protect and improve their status. During the time allotted for study of downstream passage for eels in the Catawba-Wateree Project, more effective, new technologies and procedures may be identified that could be implemented for the Catawba-Wateree Project to improve downstream passage.

Fish Entrainment

The presence of the 13 hydroelectric powerhouses of the project currently results in some fish entrainment and associated mortality of resident species in the 11 reservoirs. We agree with the conclusions in *Fish Entrainment Evaluation (Aquatics 05) Catawba-Wateree Project (FERC No. 2232)* (Geosyntec Consultants, 2005). The majority of entrainment that occurs is likely to be young fish, which generally exhibit higher survival rates following passage through the Francis and Kaplan turbines installed at these developments. The level of entrainment that has occurred historically is not likely to change significantly under the new license. Under these rates of entrainment and survival, the reservoirs currently support quality sport fisheries. Thus, entrainment does not appear to adversely affect survival and growth of young of target sport and forage species populations.

The FWS preliminary prescriptions for fish passage do not require specific new downstream fish passage facilities or operational changes for passage of juvenile American shad and blueback herring following construction and operation of TS&T facilities to move spawning adults upstream past the Wateree dam because the existing facility equipment and design are likely to allow downstream passage of these species with minimal mortality. The prescriptions do require downstream passage studies for American eel 10 years after construction of the first upstream passage eelway at the Wateree dam and subsequent passage provided upstream through the Fishing Creek Development. Eel downstream passage will be evaluated, because the shape and size of out-migrating adult eels make them more susceptible to injury during turbine passage and their preference for near-bottom habitat reduces their likelihood of using other passage routes at spill gates, trash sluices, and spillways.

In regards to the lifecycle of most freshwater mussels which rely on fish hosts for dispersal. The larval lifestage (glochidia) attach to the gills and fins of host fish species; when

they eventually mature into juvenile mussels, they detach and begin their characteristic benthic habit. Fish entrainment does not likely have an adverse affect on the mussel lifecycle. Not all entrained fish are likely to carry glochidia larvae, and a high percentage of fish that may be hosts are likely to survive entrainment.

If FWS exercises its reserved authority to make further prescription for downstream passage of diadromous species, such facilities also would likely benefit resident species further reducing the effects of entrainment.

3.3.3.3 Cumulative Effects

Recreation Flows on Aquatic Habitat

The Revised CRA has proposed a schedule of periodic increased discharges at six developments to support use by recreational paddlers and float anglers in selected regulated reaches and the two bypassed reaches at the Great Falls and Dearborn Developments. The proposed recreational releases will be provided during daylight hours on the scheduled dates and the schedule will be reviewed by committee on an annual basis.

FWS, NOAA Fisheries, and AR/CCL have raised questions related to the potential effects of the rapid changes in flow on the aquatic resources in those reaches. The proposed recreational releases are within and generally similar to the mean and median flow conditions and well within the frequency distribution of flows for each development reported in *Exhibit B—Project Operation and Utilization of Resources*. Flows higher than the proposed recreational flows typically occur in the historical record 20-80 percent of the time, except during July-September when higher flows may occur less than 10 percent of the time. It is our assessment that the aquatic resources in these reaches are adapted to this range of flows; however, the rate at which the flows increase and decrease for these recreational releases may be more rapid than typically experienced by aquatic organisms in these reaches. In particular, rapid decreases in the flow from peak recreational flows to minimum continuous flows designated for a reach have the potential to strand fish in isolated small pools as water levels recede. Water temperatures and DO can become inhospitable for fish in these isolated pools. We propose that the feasibility of gradually increasing and decreasing flow over a period of several hours before and after each recreational release be evaluated to minimize the risk to aquatic resources.

Habitat and Population Fragmentation

Fragmentation of aquatic habitat and populations occurs when impoundments form following dam construction in a river corridor: riverine aquatic habitat is reduced and broken into disconnected sections with intervening lentic habitat; tributaries may flow into lakes losing the continuity of the former downstream connection with the next order stream; dams block movement of resident lotic populations to upstream river and tributary reaches; and formerly continuous riverine populations are fragmented and isolated within the remaining discontinuous lotic habitat. In the case of the Catawba-Wateree Project, over as much as a century following construction of some individual developments, the aquatic communities have shifted and adapted to the new distribution of habitat conditions. Resident aquatic communities continue to utilize those remaining riverine reaches; some populations disperse seasonally into the downstream impoundments; new lentic communities have evolved in each impoundment; some impoundment populations utilize tributary habitat for portions of their life history; some species may have been lost or marginalized while others are introduced or expand their range; resource management

initiatives (stocking game and forage fish) also have reshaped some of these communities and the predator-prey interactions. The effect of multiple impoundments along nearly 280 miles of the Catawba-Wateree River has been to significantly alter the ecosystem, both the type and distribution of physical habitat and the distribution and character of the biotic resources associated with that habitat. The system has changed to the benefit of some species and the detriment of others. Among the more significant changes is that the geographic range and habitat available to diadromous species typically are now restricted to areas below the first blockage, the Wateree Development.

It is our conclusion that the FWS preliminary prescriptions for fish passage will progressively re-open access to essential habitat for diadromous fish consistent with the goals of the applicable restoration plans. Proposed increases in continuous minimum flows in regulated reaches and several bypassed reaches also will increase and enhance available riverine habitat.

Fish Entrainment Mortality

As restoration of diadromous fish populations progresses in the Catawba-Wateree River Basin with implementation of the FWS fish passage prescriptions, out-migrating diadromous fish will need to negotiate multiple dams and powerhouses in the system. Although through-turbine entrainment mortality for most species is relatively low, there could be an incremental effect from losses of fish at successive developments. The preliminary fish passage prescriptions require downstream passage studies and facilities targeted for American eel as access to additional habitat progresses upstream. It is our assessment that these studies should consider the potential cumulative impact of serial entrainment at successive downstream developments during out-migration.

Fish Passage and Restoration

The restoration of diadromous fish populations to their historic ranges in the Catawba-Wateree River Basin will require negotiating upstream passage at two or three developments for American shad and sturgeon that have been documented as far upstream as the Great Falls reach and eventually all 13 developments for American eel.

The fish passage prescriptions propose a trap-and-truck facility at the Wateree dam with release of spawning adult American shad into Lake Wateree until the number of shad trapped exceeds 10,000, at which time shad will be trucked and distributed to impoundments farther upstream. This will, for the immediate future, eliminate the need for American shad passage facilities at multiple developments and speed movement of adults to potential spawning habitat upstream.

In contrast, young American eel elvers move into the Catawba-Wateree River Basin and will spend most of their life (as much as 40 years) growing to mature adults before returning to the ocean to spawn. The FWS fish passage prescriptions require installation of fish passage facilities at all of the dams, progressing upstream from the Wateree Development at several-year intervals. These multiple fish passage facilities will allow the species to disperse farther upstream into available habitat as utilization increases. The sequential implementation of fish passage for eels also will permit advances in our knowledge of the mechanisms of eel migration in freshwater habitat and the technologies for upstream and downstream passage at dams to be integrated into the design of subsequent facilities.

3.3.3.4 Unavoidable Adverse Effects

Reservoir Effects on Fragmentation

In the Catawba-Wateree River Basin, the dynamic integration of impoundment communities and interspersed riverine communities has become well established during the operation of the Catawba-Wateree Project. The Catawba-Wateree River Basin ecosystem has developed into a complex mosaic of riverine and impoundment habitat and communities and must be viewed as the existing condition for the assessment of project effects on aquatic resources. This represents an unavoidable effect at this time of the project on the pre-construction riverine resources and an irretrievable commitment of selected aquatic resources. While certain pre-construction aquatic resources have been unavoidably altered, reduced, or lost, extensive new resources have been created, associated with the ecosystems that have developed in the 11 project impoundments.

The Santee Basin Accord and preliminary prescription from FWS for fish passage provide a progressive process that will provide access to the Catawba-Wateree River Basin for upstream migration and expansion of spawning or nursery habitat of diadromous fish. Fish passage facilities also may provide the potential for upstream movement of resident species between developments.

Fluctuation of Reservoir and Tailwater Levels

The primary purpose for the existence of the project is to help meet the energy needs of the rapidly developing region. The load-following nature of power generation from the project, other users (e.g., drinking water supply) of the resource, regional climatic conditions (e.g., wet and dry weather cycles), topography and morphology of the subwatershed for each impoundment, and storage capacity of each impoundment result in inevitable and unavoidable fluctuations in water level within each impoundment and in the downstream tailrace. The complexity of the sequence of impoundments and powerhouses and the system constraints related to management of inflow, outflow, power generation, and protection of aquatic resources and other uses is reflected by the complexity of the CHEOPS model used to assess operating alternatives and flow releases as part of the negotiations the lead to the Revised CRA.

These fluctuations are an unavoidable effect of the project, but it is our conclusion that the operating scenario proposed in the Revised CRA provides an optimal balance of a wide range of conflicting demands on the resources. The PM&Es proposed provide significant benefits, protections, and enhancement to the aquatic resources compared to conditions under the existing operating license for the Catawba-Wateree Project. The range of reservoir draw-down has been reduced; draw-down restrictions and criteria are established for stabilization of reservoir water levels to protect and enhance littoral fish spawning habitat in the spring; and management criteria for spring discharges from the Wateree Development will enhance inundation and spawning habitat in the downstream flood plain of the Wateree River.

Fish Entrainment Mortality

The presence of the 13 developments and powerhouses in the Catawba-Wateree River Basin currently results in some fish entrainment and associated mortality for resident fish species and for diadromous species as restoration of these migratory populations progresses. Outside of spill events, the primary route for passage of fish downstream at each development is by entrainment through the turbines. The numbers of fish entrained will vary among

impoundments, turbine and forebay configuration, season, and species. Mortality of entrained fish varies with the turbine design and the species involved. With some clear exceptions, survival for most species entrained at the Catawba-Wateree developments is relatively high. One exception is the diadromous American eel, which passes downstream as an adult to return to the ocean to spawn. The FWS preliminary prescriptions for fish passage set a schedule for studies and implementation of a program to begin following establishment of upstream passage facilities for American eel that will enhance survival of this species during downstream passage. FWS concurred with the assessment prepared for the license application (Geosyntec Consultants, 2005), which concluded that entrainment mortality for most other species is minimal and did not warrant additional prescription at this time.

It is our conclusion that the level of entrainment mortality currently experienced by most fish species does not adversely affect resident fish populations. In fact, many of the populations susceptible to entrainment support quality recreational sport fisheries either as target species or forage for those species.

Bypassed Reaches

The Revised CRA proposes to re-establish continuous minimum flows in three of the project bypassed reaches: Catawba River bypassed reach at the Bridgewater Development, and the Short and Long bypassed reaches at the Great Falls and Dearborn Developments. Three other reaches will continue to be bypassed except during spill events: Paddy Creek bypassed reach at the Bridgewater Development, Mountain Island bypassed reach, and Wateree Spillway Channel bypassed reach. The proposed operation of the Bridgewater Development provides use of available water resources to increase minimum flow in the Linville regulated river reach and provides continuous minimum flow to the Catawba River bypassed reach while balancing cold water habitat for trout and warmer water requirements of freshwater mussels. With the limited water available to distribute to the three downstream reaches, this configuration provides the greatest gain and enhancement of aquatic habitat, despite leaving the relatively short Paddy Creek bypassed reach without a continuous flow of water. Flows to the Mountain Island bypassed reach adequate to create significant fish habitat could jeopardize the population of the federally listed Schweinitz's sunflower. The volume of discharge necessary to inundate the Wateree Spillway Channel bypass and create significant additional habitat for anadromous fish spawning does not appear to be sustainable based on system simulations from the CHEOPS model.

It is our assessment that Duke Energy has provided a reasonable and defensible rationale for operation of these three developments in a manner that will continue to bypass water around these three reaches. These operating scenarios will allow protection and enhancement of other aquatic resources, or terrestrial resources, or both, and PM&Es have proposed adequate measures to mitigate these unavoidable effects.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

Vegetation

The Catawba-Wateree Project and the large geographical area it encompasses contain a wide variety of natural communities and vegetation cover types. Most of the Catawba-Wateree Project is located within the Piedmont Province, with the exception of the headwaters of Lake

James, which are located in the Blue Ridge Province, and the Wateree River downstream of the Wateree Development to the Congaree River, which is located in the Coastal Plain Province.

The original forested areas bordering Catawba-Wateree developments have been logged or burned at least once and consist of secondary growth. Within 1 mile of each of the developments, varying degrees of forest clearing have occurred for private residential or commercial development. Large-scale residential or commercial development has occurred at the Cowans Ford, Wylie, Fishing Creek, and Wateree Developments. Remaining wooded areas are generally represented by sweet gum, red maple, river birch, green ash, as well as white pine, sycamore, and box elder. Riparian vegetation has been left intact in most areas, although within several developments (Oxford, Wylie, and Wateree), riparian vegetation has been degraded and fragmented due to the extent of development. Riparian vegetation at Mountain Island Development has been left largely intact due to existing watershed protection measures including natural area preserves and a county park. Open fields, pastures, and fallow fields are present within each development.

Vegetation cover mapping was conducted within the general Catawba-Wateree Project vicinity to approximately 2,000 ft beyond the Catawba-Wateree Project boundaries. Eleven vegetation cover types were identified within the general Catawba-Wateree Project area and are described in detail in the license application (Duke Energy, 2007). Many of the vegetation cover types are the result of past or current human activities (grass/pasture, shrub/scrub, cropland, project works, residential, urban). Forested vegetation cover (hardwood forest, mixed hardwood/pine forest) are typically located in areas away from roads, dwellings, and human activity. Three other cover types can be naturally occurring or influenced by human activities (water [including reservoirs], pine forest [including planted plantations], and barren areas devoid of vegetation).

A botanical study of the Great Falls bypassed reaches in 2001 and 2004 resulted in the identification of nine plant community types and 300 plant species (Gaddy, 2005). Three plant communities (Wet Natural Shoals, Flood Plain Forest, and Bogs and Seepages) were determined to be high quality, natural communities. The Wet Natural Shoals community occurs only where a reliable supply of fast-flowing water is present most of the year. Indicator species are water willow and rocky shoals spider lily, a special status species listed in South Carolina as a species of "National Concern."

Water willow is a perennial herbaceous species that grows colonially from rhizomes along the banks or in shallow waters of rivers, ponds and lakes. It appears to grow best in 6 to 20 in. of water on coarse substrates of sand and fine gravel, but can growth in depths of up to 4 ft and on fine textured sediments. It provides stabilization to shorelines and stream beds as well as aquatic habitat for small fish and invertebrates and some small aquatic mammals (DTA, 2005a). Water willow can be affected by erosion and sedimentation, and can itself cause problems for recreational boating as it impedes propellers.

The Flood Plain Forest community was dominated by sweet gum and red maple with other canopy tree species including water oak, green ash, sycamore, river birch, and American elm. Giant cane and river oats are found in the shrub and herbaceous layers. A few bogs and seepages were found along the margins of the shoals, generally draining water from adjoining uplands into the shoals. One other community, the Shoals Forest natural community, is a rare, possibly unique plant community in South Carolina that has become established in the central

portions of the long bypassed reach. Eastern red cedar is dominant on dry shoals and boulder piles (Gaddy, 2005).

A total of 300 plant species were identified during the Great Falls bypassed reach botanical surveys. Of the 300 species identified, approximately 29 percent were determined to be weedy, invasive (out of range or out of habitat), or exotic plant species, and were the most commonly encountered species of the surveys. A number of out of range Coastal Plain plant species were found in the Great Falls bypassed reaches, including ti-ti growing as a small shrub or tree, cypress-swamp sedge, American bulrush, mosquito-fern, and pond-pennywort (Gaddy, 2005).

Wetlands/Riparian Habitat

Wetland types were identified within the Catawba-Wateree Project area as part of a wetland mapping and characterization study focused on only those wetland areas directly affected by the project operations, from the wetlands upstream of Lake James, downstream through the Lake Wateree Development, and including the potential downstream zone of influence associated with Lake Wateree to the confluence of the Congaree River (DTA, 2005a). Initial determination of wetland areas used several procedures including review of existing information (National Wetland Inventory maps, Federal Emergency Management Agency [FEMA] flood plain maps, topographic maps, soil surveys, and aerial photography interpretation). Field surveys verified information derived from the initial review and resulted in surveys of approximately 345 wetlands characterized into three primary wetland types: palustrine forested (217), palustrine scrub/shrub (73), and palustrine emergent (55), including areas recommended by the agencies such as water willow beds along Lake Wateree and Lake Wylie. Wetland types and acreages found within Catawba-Wateree Project developments are listed in table 36.

Within the Bridgewater Development, forested wetlands were the dominant wetland type and were comprised of red maple and sweet gum. Scrub/shrub wetlands within the Bridgewater Development were primarily black willow stands; one wetland was dominated by silky dogwood.

Forested wetlands dominate the Rhodhiss Development and are characterized by river birch, green ash, and black willow. Two scrub/shrub wetlands identified within the Rhodhiss Development were each dominated by different plant communities; one was primarily a mix of tag alder and buttonbush while the other was principally comprised of green ash and black willow. One emergent wetland was characterized as a mixture of wool-grass, soft rush, and *Panicum* grass and appeared to be a result of relatively recent sediment accretion from non-project-related disturbances on upstream tributaries that feed into Lake Rhodhiss.

Oxford Development forested wetlands were similar in composition to those found at the Rhodhiss Development. Scrub/shrub wetlands at the Oxford Development were dominated by tag alder, silky dogwood, and saplings of sycamore and river birch. Buttonbush was present within the scrub/shrub wetlands at the Oxford Development, but was not the dominant plant species as found at the other developments. Two emergent wetlands associated with Lake Hickory were distinctive, one dominated by an abundance of water lily and the second by cattail.

Table 36. Wetland types and acreages associated with Catawba-Wateree Project reservoirs and tailraces. (Source: Duke Energy, 2007)

	Wetland acres by type		
	Emergent	**Scrub/Shrub**	**Forested**
Bridgewater	0.0	40.8	185.6
Rhodhiss	9.1	8.2	139.6
Oxford	1.3	6.7	33.5
Lookout Shoals	0.72	2.4	82.4
Cowans Ford	34.9	217.9	257.2
Mountain Island	38.7	167.7	288.5
Wylie	22.1	74.3	597.7
Fishing Creek	33.2	32.4	220.0
Great Falls and Dearborn	2.7	17.3	58.4
Rocky Creek and Cedar Creek	0.9	1.3	36.6
Wateree	181.4	346.6	1,343.4
Wateree River	1,113.8	13,378.1	54,726.2
Total Acreage	1,438.82	14,293.7	57,969.1

The five wetlands identified at the Lookout Shoals Development were relatively small in acreage. Four of the wetlands were characterized as forested and one was an emergent wetland. The forested wetlands were associated with the drainage of tributaries into the reservoir and were comprised primarily of river birch, sycamore, box elder, and sweet gum. The emergent wetland was characterized as a fringe wetland along the shoreline of the reservoir comprised solely of swamp rosemallow.

Several of the forested wetlands at the Cowans Ford Development had been cleared or filled due to land development activities unrelated to Catawba-Wateree Project operations. Scrub/shrub wetlands were typically buttonbush or young black willow. Sediment accretion due to disturbances upstream on tributaries feeding into Lake Norman was observed near the confluences of tributary streams with the reservoir and has resulted in the buildup of sediments on surfaces near the shoreline and in shallow water. Several of the emergent wetlands in the stream cove areas have been modified by sediment loading and removal transitioning through succession toward scrub/shrub type wetlands or subject to long periods of inundation as a result of sediment activity.

Mountain Island Development forested wetlands were characterized by species such as green ash, river birch, sweet gum, and red maple. Several areas of forested wetland had been cleared due to land management activities unrelated to project activities. Scrub/shrub wetlands were dominated by young black willow, speckled alder, river birch, silky dogwood, and buttonbush. Emergent wetlands contained swamp rosemallow, lizard's tail, arrow arum, broad-

leaf arrowhead, and broad-leaf cattail. Some emergent and scrub/shrub wetlands were observed as undergoing successional transitioning into more mature communities. Identified emergent wetlands were usually associated with protected coves but were small inclusions within forested or scrub/shrub dominated wetlands.

The characteristics of the Wylie Development wetlands were similar to those of the Mountain Island Development. Some emergent and scrub/shrub wetlands had transitioned into more mature communities, and some forested wetlands had been cleared due to land management activities unrelated to project operations. Emergent wetlands were located in protected coves, disturbed areas, or located as small inclusions within other wetland types.

Wetlands at the Fishing Creek Development were similar in characterization and condition to those of the Mountain Island and Wylie Developments. Scrub/shrub wetlands identified at Fishing Creek Development were often observed to be in successional transition. Water willow beds, located along the shoreline of the Fishing Creek reservoir, have developed under the current operating regime and appear to be stable and vigorous in growth.

Forested and scrub/shrub wetlands at the Great Falls and Dearborn Developments were both characterized as Bottomland Hardwood natural community. Forested wetlands were found to be affected by land management practices such as silviculture; scrub/shrub wetlands were often noted as undergoing successional transition due to the dynamics of tributary stream flow that may cause accretion or scouring. Emergent wetlands were most frequently located in protected coves or in small openings within forested or scrub/shrub wetlands.

Two forested wetlands and one emergent wetland were identified within the Rocky Creek and Cedar Creek Developments. Emergent wetlands were characterized in protected areas removed from the main portion of the reservoir with the exception of water willow beds that were located along the main lake shoreline.

The dominant wetland types located within the Wateree Development were characterized as Bottomland Hardwood forests (green ash, American elm, sweet gum, and red maple) and scrub/shrub wetlands (young black willow, red maple, and buttonbush). Emergent wetlands were typically located in backwater coves, disturbed areas, or in small inclusions in the forested or scrub/shrub wetlands. Water willow beds were found along the shoreline of Lake Wateree. Unique to Lake Wateree are several large southern wild rice dominated wetlands.

Along the Wateree River, forested wetlands included natural communities of Bottomland Hardwoods and Bald Cypress-Tupelo Gum Swamp. Bottomland hardwoods were dominated by green ash and silver maple. Scrub/shrub wetlands were characterized as Shoal and Stream Bar and Levee natural communities dominated by young black willow and water-elm. The scrub/shrub wetlands are in a state of successional transitioning due to the river dynamics. Emergent wetlands along the Wateree River are generally located in disturbed areas, including main rights-of-way, or small inclusions within scrub/shrub or forested wetlands, and were dominated by herbaceous species including sedges, rushes, smartweed, and false nettle.

Ten areas have been identified as high-value wetland areas that provide or contribute directly to the maintenance and support of exceptional value natural resources (DTA, 2005b). These areas were selected based on important wetland functions (e.g., wildlife habitat, nutrient retention, aquatic habitat, unique/heritage), wetland hydrology, wetland vegetation and

interspersion, and value as wildlife habitat. These areas include the following and are presented on figures in appendix B. (River miles provided as guidance are approximate.)

- Wateree River Hardwood Bottomlands (RM 0.0-66.0) is a wetland complex of several thousand acres. The bottomlands are contiguous with the Congaree Swamp National Park (figure B-1).
- Great Falls bypassed reach-long bypass (RM-GF 1.0-2.0) is composed primarily of forested wetland and wet shoal communities forming bottomland wetlands (figure B-2).
- Cane Creek Confluence Area (RM 112.5) is a 527-acre forested/shrub wetland near the confluence of Cane Creek upstream of the Fishing Creek reservoir (figure B-3).
- Big Allison Creek Cove Area (RM 146.0) includes 71 acres located in the back of Big Allison Creek Cove of Lake Wylie (figure B-4).
- Paw Creek Cove Area (RM 162.0) includes 118 acres of forested/shrub wetlands in the back of Paw Creek Cove of Lake Wylie (figure B-4).
- Reed's Creek Cove Area (RM199.1), located in the back of Reed's Creek Cove of Lake Norman, is a 21-acre wetland (figure B-5).
- Johns River Area (RM 261.5) is located near the confluence of Johns River and Catawba River and totals 124 acres (figure B-6).
- Warrior Fork Area (RM 264.0) includes 115 acres near the confluence of Warrior Fork and the Catawba River (figure B-6).
- Catawba River bypassed reach (RM 283.3) includes the majority of the reach and is 167 acres (figure B-7).
- Lake James/Catawba River Confluence Area (RM 294.5) includes 126 acres near the confluence of the Catawba River and Lake James (figure B-7).

Vegetation was characterized during a flood plain inundation study for the Wateree River flood plain (DTA, 2006). The study focused on the zone of project operational influence on the Wateree River downstream of Lake Wateree to the confluence of the Congaree River, which included the Wateree River flood plain. The Wateree River and the Congaree River interact at higher flow levels, especially flows greater than 9,000 cfs, to inundate the flood plain adjacent to Congaree Swamp National Park. Most of the riparian corridor of the Wateree River is undeveloped bottomland swamp, although timber-cutting is practiced in some areas. Forested wetlands dominated the flood plain and included Bottomland Hardwood and Bald Cypress-Tupelo Gum Swamp communities. Bald Cypress-Tupelo Gum Swamp is a natural community that exists in the most deeply flooded habitats, and is habitat that potentially could provide post-nesting foraging areas for wood stork as well as expanded habitat for American alligators, both RTE species observed in the area. More detailed information on wood stork and American alligator is found in section 3.3.5, *Threatened and Endangered Species*.

Noxious Weeds

Five invasive exotic terrestrial plants have been identified within the Catawba-Wateree Project area during botanical surveys: Autumn olive, Chinese privet, Chinese wisteria, Japanese

honeysuckle, and Vietnamese grass. Autumn olive is located at only one site adjacent to Lake Wylie, and Chinese wisteria is located at only one site adjacent to Dearborn Lake. Chinese privet, Japanese honeysuckle, and Vietnamese grass are abundant and well distributed within the Catawba-Wateree Project area. These species were found at a total of 79 survey sites within or adjacent to project shorelines extending from Lake James to Lake Wateree. In addition, Chinese privet and Japanese honeysuckle are common in the Great Falls bypasses; Vietnamese grass is present but uncommon in the same areas. Kudzu is known to be widely distributed within and adjacent to the Catawba-Wateree Project, and along with Japanese honeysuckle may be the most abundant of all invasive exotic terrestrial plant species within the Catawba-Wateree Project (letter from Duke Energy, June 26, 2008). In all cases, these invasive plants grow and spread aggressively and can overwhelm native species.

Three aquatic invasive plant species, hydrilla, parrotfeather, and Brazilian elodea, have been documented within the Catawba-Wateree Project. Hydrilla is considered one of the worst submerged aquatic invasive species in the United States and can impair water flow, displace native species, and impair small boat navigation. It tolerates low light conditions and has a fast rate of growth that allows it to grow at greater depths and overwhelm other species. It can shade out other aquatic plants by forming a dense canopy beneath the surface of the water body and can reproduce by four different methods, including fragmentation and tubers. Tubers can remain viable in the soil for several years, allowing the species to survive seasonal cold temperatures and drought conditions (USACE, 2008a). Hydrilla was found in the Catawba arm of Lake James in 1999; in Lake Norman in 1999, where it had spread as far upstream as the North Carolina Route 150 bridge; and in Mountain Island Lake and in Lake Wateree in 2000. It has since been found in Lake Wylie in 2006 (Duke Energy, 2006c). Parrotfeather is present at Oxford and Lookout Shoals reservoirs and was discovered in Lake Hickory in 2001. It has spread in Lake Hickory from the original 10-acre infestation to 84 acres. Parrotfeather grows in slow flowing water at the edges of streams, lakes, ponds, and other water bodies, and spreads via rhizomes. It overwhelms other aquatic plant species because of its vigorous growth habits (USACE, 2008b). Duke Energy is currently in consultation with the municipalities of Hickory and Longview, North Carolina; North Carolina DENR; and North Carolina WRC to design a management plan for parrotfeather on Lake Hickory and Lookout Shoals Lake. Brazilian elodea has been found in the tailwaters of Lake Hickory in the Oxford Development in association with parrotfeather. It grows in both still and flowing water and is fast growing, often shading out other aquatic and vegetation resulting in pure stands of Brazilian elodea (USACE, 2008c). Sterile grass carp have been stocked in the affected reservoirs by North Carolina WRC to control the spread of these invasive aquatic plants, and Duke Energy, along with North Carolina WRC, South Carolina DNR, and North Carolina State University, have formed a task force to jointly work on the aquatic invasive plant species issue.

In addition to the three aquatic invasive plant species above, marsh dewflower is found at the Oxford, Cowans Ford, Mountain Island, and Wylie Developments and is among the dominant herbaceous species present in riparian habitat. Marsh dewflower prefers damp soil at the edge of ponds and along slow moving streams. Its aggressive growth enables it to out-compete native plants by forming dense mats. Seeds are dispersed by wildlife, and spreading can occur when floods distribute root fragments to new locations (Park Service, 2008). Alligator weed is found at the Oxford Development and within the Great Falls bypassed reach, where it is among the most dominant exotic species.

Special Status Plant Species

Two federally listed plant species—Schweinitz's sunflower, an endangered species, and dwarf-flowered heartleaf, a threatened species—were documented within the Catawba-Wateree Project. Four state-listed plant species—rocky shoals spider lily, Canada moonseed, ovate-leaved catchfly, and prairie trillium—were also documented from within the Catawba-Wateree Project (table 37). Of the four state-listed species, three are listed in South Carolina, and one is listed in North Carolina; these species are discussed below. The two federally listed species are discussed in section 3.3.5, *Threatened and Endangered Species*.

Table 37. RTE plant species documented in the Catawba-Wateree Project area. (Source: Gaddy, 2005)

Species	**Common name**	**State status**[1]	**Federal status**[1]	**Location**
Helianthus schweinitzii	Schweinitz's sunflower	South Carolina and North Carolina—E	E	Mountain Island bypassed reach
Hexastylis naniflora	dwarf-flowered heartleaf	North Carolina—T	T	Paddy Creek, Linville dam, Lake Hickory
Hymenocallis coronaria	rocky shoals spider lily	South Carolina—NC		Great Falls long bypassed reach; Sugar Creek; Landsford canal
Symphyotrichum georgianum	Georgia aster	North Carolina–T South Carolina—SC	FC	Unknown
Menispermum canadense	Canada moonseed	South Carolina—SC		Unknown
Silene ovata	ovate-leaved catchfly	North Carolina—SR-T	FSC	Unknown
Trillium recurvatum	prairie trillium	South Carolina—SC		Unknown

[1] SR-T = Significantly Rare Throughout
SC = Special Concern
NC = National Concern
E = Endangered
T = Threatened
FSC = Federal Species of Concern
FC = Federal Candidate

The status of rocky shoals spider lily is listed by South Carolina DNR as "imperiled because of factor(s) making it vulnerable" however, this status provides no legal protection. Rocky shoals spider lily occurs in limited habitat of river shoals and on rocky islands in Piedmont rivers. The plant was once widespread in the southeastern United States, but is currently known from small, scattered populations in two or three states. In South Carolina it is known from small populations on the Catawba River near Sugar Creek (RM 131.4) and the lower Great Falls long bypassed reach (RM 102.4); a large population (thousands of plants) is located at Landsford canal on the Catawba River (RM 119.0).

Flat rock formations within rocky shoals appear to provide the best habitat for rocky shoals spider lilies, often occurring in association with riverweed or water willow (Duke Energy, 2006d). Sedimentation, inundation frequency, flow, water depth, exposure, substrate type, temperature, and DO are all factors that affect the survival of the species. As part of the Catawba-Wateree Project relicensing discussions related to the protection of rocky shoals spider lily, a Habitat Suitability Index (HSI) was developed with limiting factors for depth, velocity, and substrate. The HSI indicated that the most suitable habitat for rocky shoals spider lily contains water depth of between 2 and 11 in., flow velocity of 0.1 and 0.2 ft per second, and a substrate of broken bedrock. In addition, low water levels can provide access to the plant colonies by herbivores such as white-tailed deer.

Canada moonseed is a South Carolina species of Special Concern (SC). The conservation status of Canada moonseed is currently listed as "unknown" due to incomplete information about the species in South Carolina. Canada moonseed is a woody, deciduous vine found growing in moist woodlands and beside streams from Canada south to Arkansas (Flora of North America, 2008a). Threats to the species appear to be primarily from loss of habitat due to development (Nelson, 1986). Canada moonseed has been identified from within the Catawba-Wateree Project area, but specific locations are not identified in survey reports (Gaddy, 2005).

Prairie trillium is a South Carolina SC species that is considered to be critically imperiled because of extreme rarity or otherwise very vulnerable to extirpation in the state. It is found in rich clayey flood plain soils, where plants are often inundated during their flowering period in late March to late May. It is a perennial wildflower growing from horizontal rhizomes (Flora of North American, 2008b).

Ovate-leaved catchfly is a perennial herb found in clumps growing from rhizomes on rich, moist slopes, cove forests, and montane oak-hickory forests. Its status in North Carolina is SR-T (Significantly Rare-Throughout) with fewer than 100 populations throughout its range, and is a federal species of concern. It is considered vulnerable because it is endemic to North American with a limited range, found in 11 of the southeastern United States (Forest Service, 2003).

FWS describes the Georgia aster as a plant species that was historically associated with post oak savanna/prairie communities once common throughout the southeast where fires and animal grazing maintained appropriate habitat. Current populations are known from areas adjacent to roads, utility rights-of-way, and openings where land management activities maintain disturbed habitat (FWS 2007). One population of Georgia aster has been documented on a transmission line approximately one-half mile from the Mountain Island Development dam outside of the project boundary.

Georgia aster is found in dry oak-pine flatwoods and uplands where soils can vary from sandy to heavy clay. Adequate sunlight appears to be the most important factor in the success of the species. Because the populations are small and relatively isolated, threats to the populations are associated with herbicide applications, fire suppression, invasive species, and development. Recent information indicates that the species is more abundant than when initially listed as an FWS candidate species (FWS 2007).

Wildlife

The study area for wildlife observations was defined as all Catawba-Wateree Project developments, associated bypassed reaches, zone of influence, major tributaries, associated shorelines, and adjacent uplands. Documented observations resulted from specific wildlife surveys, as well as opportunistic sightings, and review of existing databases and literature.

Mammals

The various habitats associated with the Catawba-Wateree Project area and surrounding vicinity provide excellent resident, migratory/transient, and seasonal habitat for a high diversity of wildlife species. Mammal species are well represented by large and small game species, fur-bearers, rodents, and bats that reside in many different habitats such as woodland, scrub/shrub or early successional areas, grasslands, and wetlands. Species typically found within the Catawba-Wateree Project area include species such as white-tailed deer, coyote, red fox, Virginia opossum, gray squirrel, striped skunk, southern flying squirrel, eastern cottontail, and raccoon. Beaver, muskrat, and mink are found typically in wetland areas. Small mammals commonly found in the Catawba-Wateree Project area include white-footed deer mouse, eastern mole, meadow-jumping mouse, and southeastern shrew. Black bears are thought to be present as transients within some developments (Bridgewater) where heavily forested areas are present. Several species of bats are considered seasonally common in habitats associated with most of the Catawba-Wateree developments. Species such as eastern pipistrelle, big brown bat, and eastern red bat are considered common and wide-ranging throughout the 14 counties comprising the project area. Seminole bat and Brazilian free-tailed bat are more common in the area around the lower projects primarily from Cowans Ford south to Wateree (Webster, 2005a). Many wildlife species are found in multiple habitat types due to their generalized requirements for food, shelter, and breeding (e.g., coyotes).

A mammal survey of the Great Falls bypassed reaches area of the Catawba-Wateree Project was conducted in 2005 and resulted in the documentation of 38 species of mammals. All of the species observed were considered common throughout the Piedmont; 33 of the species have wide geographic distributions in the eastern United States and the entire Catawba-Wateree Project area including representative species such as Virginia opossum, eastern mole, eastern red bat, eastern cottontail, eastern gray squirrel, white-footed deer mouse, common gray fox, raccoon, and white-tailed deer (Webster, 2005a). The southeastern myotis, a federal species of concern and a North Carolina species of concern, was documented via SONOBAT recordings and is discussed further in the following section *Special Status Wildlife Species*.

Birds

Information from Mecklenburg County Park and Recreation Department avian surveys, National Audubon Christmas Counts, Cowan's Ford Wildlife Refuge, the South Carolina Breeding Bird Atlas, and Partners in Flight provided baseline and historic information to

supplement field surveys conducted in 2004 and 2005. Field surveys characterized the existing breeding, migratory, and resident bird communities of the Catawba-Wateree Project area. The variety of habitats within the Catawba-Wateree Project contributes to a wide variety of resident, migratory, and seasonal avian species. The transition between forested and open water habitat types of Piedmont alluvial, bottomland, and levee forests adjacent to project reservoirs or rivers and Coastal Plain levee forest/river associations resulted in the highest avian species richness and abundance during the 2004 and 2005 surveys. A total of 147 bird species were observed during the surveys including waterbirds (36), game birds (2), raptors (12), woodpeckers (7), swifts/swallows (6), hummingbirds (1), and perching birds (83) (DTA, 2005b).

The five most commonly observed species throughout the year were Carolina chickadee, tufted titmouse, Carolina wren, northern cardinal, and American goldfinch. These species are generalists that use a variety of habitats for foraging and nesting (DTA, 2005b).

Species diversity was highest during spring migration and summer breeding seasons for all habitat types. During migration and the summer breeding season, resident species are joined by north-bound migrants and species that stay to nest in appropriate available habitats. Summer breeding and migratory species include neotropical migrants[13] such as vireos, flycatchers, and warblers (DTA, 2005b).

Several special status bird species were observed within the Catawba-Wateree Project area during the survey. Wood stork was the only federally listed (endangered) species observed and is discussed in section 3.3.5, *Threatened and Endangered Species*. Brown creeper, hermit thrush, and sharp-shinned hawk were observed only during migratory or winter seasons and are likely to use appropriate habitat in the Catawba-Wateree Project area for food and shelter during migration or as winter residents. Species discussed further in the section, *Special Status Wildlife Species,* include bald eagle, little blue heron, Mississippi kite, red-headed woodpecker, and Swainson's warbler.

In addition to the seasonal avian surveys, a study was conducted to determine habitat usage and movement of great blue heron and great egret during different flow stages at the Wateree dam tailrace. Results of the study indicate that the great blue heron and the great egret utilize the tailrace area as foraging habitat when the development is operating, but move elsewhere when no flow conditions occur. Each species used a different area of the tailrace with great blue herons using the backwater area and great egrets foraging in fast flowing water just downstream of the initial tailrace water release. Twenty-four other species used the tailrace area for foraging including large groups of double-crested cormorant and Bonaparte's gull (DTA, 2005b).

Reptiles and Amphibians

Reptiles and amphibians are common within the Catawba-Wateree Project area and include both terrestrial and aquatic species. Distribution of reptiles and amphibians within the Catawba-Wateree Project area is dependent upon food and reproductive requirements, but generally representative species of both groups may be found in a variety of habitat types including grasslands, scrub/shrub or early successional, woodland, wetland, or open water habitats.

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[13] Neotropical migrants are species that migrate from wintering areas in the Caribbean, and Central and South America to North America to breed.

Reptile species representative of grassland habitat in the Catawba-Wateree Project area include northern fence lizard and eastern garter snake. In scrub/shrub habitat southern ringneck snake, rough green snake, northern black racer, and black rat snake are typical species encountered. Woodland reptile species include eastern box turtle, five-lined skink, northern redbelly snake, corn snake, and northern copperhead. Reptile species typically encountered in aquatic habitats include snapping turtle, eastern painted turtle, northern water snake, and queen snake.

Amphibians are most frequently found in wetland and open water habitat, but several are found in woodland habitats. Amphibians found in woodland areas in the Catawba-Wateree Project area typically include spotted salamander, American toad, and Fowler's toad. Typical amphibians of wetlands in the Catawba-Wateree Project area include red-spotted newt, southern two-lined salamander, three-lined salamander, green frog, bullfrog, and pickerel frog.

Surveys documenting reptile and amphibian species in the Great Falls bypassed reach were conducted in 2004 (Dorcas, 2005a). The surveys resulted in the documentation of 12 frog/toad, 6 salamander, 7 turtle, 6 lizard, and 11 snake species. None of the species observed during the survey were identified as species of special status (Dorcas, 2005a).

Special Status Wildlife Species

Surveys conducted throughout the Catawba-Wateree Project area resulted in the identification of 11 North Carolina State, South Carolina State, or federally listed wildlife species. Four federally listed species—Rafinesques' big-eared bat, wood stork, and American alligator, bog turtle—are discussed further in section 3.3.5, *Threatened and Endangered Species*. The remaining special status species are North Carolina or South Carolina listed species and are discussed below. Table 38 presents each species, their status, and survey occurrence.

Table 38. RTE terrestrial wildlife species identified in the Catawba-Wateree Project area.

Species	**Common Name**	**State Status[1]**	**Federal Status[1]**	**Survey Occurrence**
Lasiurus cinereus	hoary bat	North Carolina—SR		Widely distributed throughout the Catawba-Wateree Project area
Lasionycteris noctivagans	silver-haired bat	North Carolina—SR (SU)		Uncommon to common throughout the Catawba-Wateree Project area except in winter
Myotis austroriparius	southeastern myotis (bat)	North Carolina—SC	FSC	Wateree River (RM 69.4); Catawba River at Great Falls bypassed reaches (Mile 1.2)
Corynorhinus rafinesquii	Rafinesque's big-eared bat	North Carolina—T; South Carolina—E	FSC	Specimens from the vicinity of the Wateree River below the Catawba-Wateree Project area
Egretta caerula	little blue heron	South		Multiple observations from the

Species	Common Name	State Status[1]	Federal Status[1]	Survey Occurrence
		Carolina—SC		confluence of Wateree and Congaree Rivers
Mycteria americana	wood stork	South Carolina—E	E	1 Observation of 25 foraging individuals west of the study area adjacent to the Congaree River
Ictinia mississippiensis	Mississippi kite	South Carolina—SC		Confluence of Wateree and Congaree Rivers in migration and during breeding season
Accipiter striatus	sharp-shinned hawk	North Carolina—SR		Lake James/Bridgewater Development – 1 fall observation
Haliaeetus leucocephalus	bald eagle	North Carolina—T; South Carolina—E	D	Lake James, Mountain Island Lake, Lookout Shoals Lake, Cedar Creek reservoir, Fishing Creek reservoir, Lake Wateree, as well as Catawba and Wateree Rivers
Melanerpes erythrocephalus	red-headed woodpecker	South Carolina—SC		Winter visitor, Lake Wateree
Certhia americana	brown creeper	North Carolina—SR		Fall migrant; winter visitor only
Catharus guttatus	hermit thrush	North Carolina—SR		Fall migrant; winter visitor only. Observed at the Bridgewater, Cowans Ford, and Mountain Island Developments
Limnothylpis swainsonii	Swainson's warbler	South Carolina—SC		One breeding season observation near the confluence of the Wateree and Congaree Rivers
Alligator mississippiensis	American alligator		E	Wateree River downstream of the Catawba-Wateree Project area
Glyptemys muhlenburgii	bog turtle	North Carolina—T	T	Specimens from Bristol Creek (2003) tributary to Lake Rhodhiss

[1] E = Endangered
D = Delisted
T = Threatened
SC = Species of Concern
SR = Significantly Rare

Mammals

Hoary Bat—Hoary bats typically occur throughout North and South Carolina during the fall, winter, and spring months. This species is widely distributed throughout the Catawba-Wateree Project area where it is absent in the summer months to rare or uncommon during migration (Webster, 2005b).

Silver-Haired Bat—Silver-haired bats inhabit forested areas throughout much of Canada and the United States and are distributed throughout much of both North and South Carolina. The silver-haired bat is a highly migratory species and its abundance in the Carolinas varies throughout the year. Generally, it is considered uncommon to common throughout the Catawba-Wateree area where it has been recorded in 10 of the 14 counties that comprise the study area. The silver-haired bat is present in the Catawba-Wateree Project area outside of the breeding season, arriving in late summer and staying through mid-spring. Although the species' status is defined as "unknown," North Carolina lists the silver-haired bat as significantly rare during the breeding season. It has no special status in South Carolina (Webster, 2005b).

Southeastern Myotis—The southeastern myotis is a bat found exclusively in riverine habitats in the southeastern United States and along the Mississippi River and lower Ohio River Basins in the Midwest. In both North and South Carolina its range is limited to the Coastal Plain Province. The southeastern myotis is found in cypress-gum swamps and abandoned buildings adjacent to permanent water sources. In the Catawba-Wateree Project area it was documented foraging over the Wateree River and over the Catawba River at the Great Falls bypassed reaches (Webster, 2005b).

Birds

Little Blue Heron—Little blue heron is considered a species of concern in South Carolina. The little blue heron is a colonial nesting species of the Coastal Plain that can occur inland during post-breeding dispersal from July to September. They feed in shallow water on fish and small aquatic organisms (Potter, Parnell, and Teulings, 1980). Multiple observations of little blue herons occurred from Lake Wateree to the confluence of the Congaree River during the 2004-2005 avian surveys.

Mississippi Kite—Mississippi kites are a long distance migrant found throughout the southern Midwest and eastern United States as a breeding species, with the largest portion of their population occurring in the southern Great Plains. In North and South Carolina they are a breeding species on the Coastal Plain, but their population is expanding into the Piedmont. Nest sites in the southeast are found commonly in mature, undisturbed stands of lowland and flood plain forests and along major rivers where they use trees at least 100 ft in height (Potter, Parnell and Teulings, 1980). Foraging habitat consists of fields adjacent to nesting sites where it can prey on large insects such as cicadas, grasshoppers, and dragonflies in flight. All observations of Mississippi kites within the Catawba-Wateree Project area were documented from the Wateree River riparian areas below the Wateree dam. The Mississippi kite is listed in South Carolina, where it is a species of concern (DTA, 2005b).

Sharp-shinned Hawk—The sharp-shinned hawk is considered significantly rare in North Carolina. It is considered a fairly common fall migrant, an uncommon winter resident, and a rare to absent breeding species throughout the Carolinas. A bird of prey found primarily in forests

and woodlands, the sharp-shinned hawk actively pursues small birds, up to the size of a thrush, as its major food source (Potter, Parnell and Teulings, 1980). One individual was observed during fall avian surveys adjacent to Lake James, and it is likely that it was a migrant based on time of year of observation (DTA, 2005b).

Bald Eagle—The bald eagle, formerly listed as a threatened species, has been removed from the federal endangered species list as of 2007 (FWS, 2007). It is currently listed as a threatened species in North Carolina and as an endangered species in South Carolina. Avian surveys in 2004-2005 documented 64 observations of bald eagles on 7 of the 11 lakes, reservoirs, and river sections within the Catawba-Wateree Project. A nest survey in 2005 resulted in the identification of 16 known bald eagle nests within the Catawba-Wateree Project area or 2 miles of the Catawba-Wateree Project area; 5 of the nests were active in 2005. Bald eagles concentrate at the Wateree dam tailrace on a seasonal basis using the area for foraging.

Red-Headed Woodpecker—The red-headed woodpecker can be found in all sections of both North and South Carolina during all months of the year and is a common permanent resident within the Congaree Swamp National Park (Carter, 2005). On the Coastal Plain it is fairly common in summer, but at other seasons and inland it is considered uncommon to fairly common. The species constructs a nest hole in standing dead trees and telephone poles (Potter, Parnell, and Teulings, 1980). The red-headed woodpecker is considered a species of concern in South Carolina. Observations of red-headed woodpecker occurred only during winter surveys within the Catawba-Wateree Project study area (DTA, 2005b).

Swainson's Warbler—The Swainson's warbler is known to breed in the mountains and in the Coastal Plain physiogeographic regions of North and South Carolina. In the mountains, the species is associated with rhododendron thickets and woodlands with closed canopies. In the Coastal Plain it uses thickets that occur in forest gaps and edges, primarily along bottomland forests. It appears to use damp forests with cane species but will not use inundated areas (South Carolina DNR, 2005). The species generally nests from 1 to 10 ft above the ground in cane brakes and thickets from early May through early July (Potter, Parnell, and Teulings, 1980). Swainson's warbler is a watchlist species of highest priority according to the Partners In Flight Bird Conservation Plan for the South Atlantic Coastal Plain (American Bird Conservancy, 2001) and it has also been identified by the South Carolina Comprehensive Wildlife Conservation Strategy as needing a specific monitoring program (South Carolina DNR, 2005). An observation during the breeding season on the Wateree River during relicensing surveys near the confluence of the Congaree River suggests the presence of breeding individuals, but breeding is not confirmed (DTA, 2005b). The Swainson's warbler is a common summer resident of the Congaree Swamp National Park (Carter, 2005).

Brown Creeper—The brown creeper is considered significantly rare in North Carolina where it is a fairly common winter resident from mid-October to mid-April in the Coastal Plain and Piedmont and a permanent resident of the mountains. In the mountains, it breeds in the high altitude spruce-fir forests. It feeds on insects gleaned from crevices in tree bark and from spider webs (Potter, Parnell, and Teulings, 1980). The brown creeper was observed only during fall migration and winter inventory surveys in the project area (DTA, 2005b).

Hermit Thrush—Hermit thrush is designated as a significantly rare species in North Carolina and is found as a fairly common winter resident of woodlands throughout the Carolinas from mid-October to early May. It is less abundant in the mountains than the coastal areas. Like

other thrushes, it is primarily insectivorous, but will also eat a wide variety of fruits and berries (Potter, Parnell, and Teulings, 1980). It was observed only during fall migration and winter inventory surveys within the project area (DTA, 2005b)

Priority Wildlife Habitat

Lake Norman Colonial Waterbird Nesting—A great blue heron rookery established on lower Lake Norman (Hero Island) and unique to the Catawba River has been designated a Priority Habitat (Duke Energy, 2007). The rookery population appears to vary from 60 to 90 individuals and 30 to 40 nests each year. Although green herons are observed on the island on occasion, no other species are known to use the rookery. The shoreline of the island is classified as a Natural Area and the island is part of the North Carolina WRC James Parnell Colonial Waterbird Sanctuary System, a network of colonial waterbird conservation lands. Other rookeries have been identified in association with the Wylie and Oxford Developments. Duke Energy currently has a management and protection plan in place for rookeries that is jointly implemented with the North Carolina WRC to protect the habitat and the great blue herons occupying the rookeries during the breeding season.

In addition to the heron rookery on lower Lake Norman, the Catawba-Mountain Island Lake Watershed, which includes the Catawba River corridor from Lake Norman to Mountain Island Lake, has been designated an Important Bird Area by Audubon North Carolina (Audubon North Carolina, 2008). The Catawba River is a well-known migratory corridor, making it an important stopover site during spring and fall migration and a wintering site for 21 species of waterfowl. According to Audubon North Carolina, key avian habitat in the Piedmont Province includes reservoirs that provide open water habitat in a region without natural lakes except for beaver-created impoundments. Reservoirs provide migratory and wintering habitat for waterfowl; migrating shorebirds use exposed mudflats in late summer and fall; and bald eagle, osprey, and double-crested cormorants nest on several reservoirs (Audubon North Carolina, 2008).

Congaree Swamp National Park—Congaree National Park, located downstream of the Wateree River Regulated Reach, is the largest old growth bottomland hardwood forest in the United States and represents one of the few intact examples of freshwater swamps in the United States. It is designated as an UNESCO International Biosphere Reserve, a National Natural Landmark, and a Globally Important Bird Area. Congaree Swamp National Park supports high densities of migrating and wintering landbirds and high densities of bottomland hardwood resident species such as pileated woodpecker, red-headed woodpecker, barred owl, prothonotary warbler, and Swainson's warbler (American Bird Conservancy, 2003).

3.3.4.2 Environmental Effects

Reservoir Levels and Minimum Flows

Project operations can affect wetlands, riparian, and wildlife habitat within the Catawba-Wateree Project area including the Wateree River downstream to its confluence with the Congaree River. Reservoir fluctuations can adversely affect the distribution, species composition, and productivity of wetland and riparian habitat. Reservoir draw-downs during the growing and reproductive seasons can limit wetland growth in the fluctuation zone, flood waterfowl nesting areas, strand amphibian eggs and tadpoles, and reduce foraging and cover habitat for a variety of other wildlife species that are resident or migrate through the project area.

The proposed reservoir levels and minimum continuous flows will provide wetland areas with more dependable water levels and flows that are more consistent. Winter draw-downs will occur in Lake James, Lake Norman, Lake Wylie, and Lake Wateree, but will provide a smaller drop in elevation and for a shorter time period than under existing license conditions. Daily water fluctuations will be more frequent, but within a reduced range of fluctuation. The new increased minimum continuous flow regime proposed for the Catawba-Wateree Project will provide a consistently wetted channel in the Great Falls bypassed reaches and for the Wylie regulated river reach. Although no specific public comments on proposed reservoir levels and flow regimes in regard to wetland, riparian, and wildlife habitat were received, the proposed reservoir levels and flow regimes were supported by approximately 66 parties who signed the Revised CRA.

Our Analysis

Duke Energy's proposed water elevations at project reservoirs are presented in section 3.3.2.1.1 *Water Quantity.* Currently, the range of water levels in Lake James and Lake Norman directly related to the Catawba-Wateree Project operations do not appear to adversely affect the hydrology for adjacent wetlands. Minor lake level fluctuations occur at both reservoirs during the growing season. Wetlands associated with Lake Rhodhiss, Lake Hickory, Lookout Shoals Lake, Mountain Island Lake, Lake Wylie, Fishing Creek reservoir, Great Falls reservoir, Cedar Creek reservoir, and Lake Wateree do not experience any reservoir level fluctuations during the growing season under the current operating regime.

The proposed reservoir levels, in concert with the Spring Reservoir Level Stabilization Program (section 3.3.2.1.1, *Water Quantity*), would provide beneficial enhancement of the existing emergent wetlands by stabilizing and potentially increasing the extent of shallow water habitat that could be occupied consistently by emergent wetland plant species. There would be a corresponding reduction in the probability and extent of periodic desiccation during the growing season as a result of the proposed reservoir levels. More consistently stable lake levels would in turn increase the potential for establishment of new emergent plant species and could result in a beneficial increase in the diversity of plant species within emergent wetland habitat at development reservoirs. Shrub/scrub and forested wetlands species diversity may be altered by the proposed stabilization in water levels and flows. Emergent plants found along the margin or as understory within these wetland types would continue to benefit from the new regime while some species requiring drier episodic conditions potentially would be reduced or replaced. Water willow beds that have existed under the current regime of reservoir level fluctuations along the shoreline of Lake Wylie, Fishing Creek reservoir, Cedar Creek reservoir, and Lake Wateree would not be adversely affected by the proposed changes in reservoir water levels since water levels would be more stable than previous regimes. As a result of the proposed reservoir levels and Spring Reservoir Level Stabilization Program, an increase in the establishment of emergent wetland vegetation within the Catawba-Wateree Project reservoirs would provide beneficial protection of reservoir shorelines by increasing attenuation of storm flows entering the reservoirs from tributaries and reducing the potential for erosion and increase wetland functions for sediment and nutrient retention.

In general, wildlife species, including special status species, have lived successfully in existing habitats and with the current Catawba-Wateree River Project operating regimes. Wildlife species associated with wetlands and reservoir shoreline areas would benefit from more stable, available foraging habitat and reduced incidents of stranding or flooding within the

fluctuation zone where nests or nursery habitat occurs. Waterfowl species that nest close to or on the ground adjacent to the water's edge would be provided with increased potential for breeding success as the chance of nest inundation is reduced through more stable water levels. Semi-aquatic organisms such as frogs, toads, and salamanders would have a higher probability for successful reproduction as stable water levels provide less chance of stranding of eggs and tadpoles as well as reduced opportunistic predation of eggs and young in shallow pools and on sand or mud bars. Migrating and wintering waterfowl using the reservoirs for food and shelter would benefit from the potential for enhanced wetland habitat in which to rest and feed.

The rocky shoals spider lily would be beneficially affected by flow rates high enough to prevent silt from covering the plant seeds. The ability of the plant to reproduce from viable seeds is critical to survival of the species; however, long-term high flow events can be destructive, causing scouring of substrate or prolonged inundation. Long-term low-flow events can expose plants to high temperatures and desiccation. Short-term intermittent and flood flows can be tolerated.

Flow regimes proposed for the Great Falls bypassed reaches, and the Wylie regulated river reach that includes minimum continuous and critical flows will provide appropriate conditions for the protection and enhancement of rocky shoals spider lily. The new increased minimum continuous flows proposed for the Catawba-Wateree Project Great Falls bypassed reaches and Wylie regulated river reach would provide consistent channel flows that would in turn provide consistent and relatively stable conditions for the rocky shoals spider lily colonies and would prevent excessive sediment accumulation in and around the colonies. Flows would provide a barrier to access for white-tailed deer and reduce opportunistic grazing on plants within the colonies. Rocky shoals spider lily colonies will continue to be susceptible to detrimental impacts from flooding and spills that may cause scouring and uprooting of existing plants and bulbs; however, current populations of rocky shoals spider lily have survived despite flooding and spills that have occurred to date. Some loss of plants and bulbs is likely during periodic flood events, but the losses will be offset by the overall benefit to the species from the implementation of minimum continuous and critical flows and the species protection plan.

Canada moonseed, which grows in low woods and bottomland forests, can be affected by desiccation during periods of low water. Canada moonseed would benefit from proposed releases from Catawba-Wateree Project impoundments, which would prevent desiccation during periods of low water flows. Ovate-leaved catchfly and prairie trillium are found in moist woodlands in upland areas where proposed water levels and flows would not affect the species' viability.

Flood Plain Inundation

Duke Energy has proposed to extend the duration of flood plain inundation in the Wateree River flood plain to seasonally and temporarily increase the flood plain by coinciding regulated releases from the Wateree dam with annual spring flood events using two proposed measures: Wateree Spring Stable Flows and the Wateree Flood Plain Inundation (section 3.3.2, *Water Resources*). Two 10-day periods of flows between mid-February and mid-May would be provided to enhance aquatic habitat primarily for spawning anadromous fish species. Inundation of the flood plain would be gradually reduced in the Wateree regulated river reach to approximate natural conditions. Based on the results from the Wateree River flood plain inundation study, the greatest backwater effect of the Congaree River is caused when releases of

approximately 25,000 cfs from Lake Wateree and 40,000 cfs within the Congaree River occur. At this level, inundation expands across a majority of Fork Swamp adjacent to the Congaree Swamp National Park and north to Gum Swamp.

FWS states that enhancement and protection of the Wateree flood plain is vitally important on an ecosystem level because it contains habitat similar to the Congaree flood plain and contiguous Congaree Swamp National Park, and because seasonal inundation is important for flood plain vegetation health and growth. Interior recommends the implementation of the Wateree flood plain inundation provision and suggests that Duke Energy develop an implementation and operation plan. Interior recommends that the plan provide clear details into when the provision will be initiated, how the Catawba-Wateree Project will be operated during the inundation period, how operations will produce the desired effects of prolonged flood plain inundation and be measured for compliance, and include a provision for Duke to prepare an annual report for review by Interior and the Park Service.

Our Analysis

Seasonal inundation of the Wateree River flood plain would result in a lateral expansion of the flood plain and provide beneficial enhancement of flood plain natural communities such as the Bald Cypress-Tupelo Gum Swamp and Bottomland Hardwood forests in the flood plain and contiguous with Congaree Swamp National Park. The proposed cycle of inundation will remove some flood intolerant plant species from the flood plain and favor the growth of species adapted to the natural bottomland hardwood plant community, resulting in enhancement of the bottomland hardwood habitat. Seasonal inundation also would restore a natural seasonal fluctuation that would help to maintain habitat health and vitality. Seasonal inundation would provide habitat that wetland wildlife species, including RTE species such as wood stork and American alligator, require for reproduction, foraging, and shelter (section 3.3.5, *Rare, Threatened, and Endangered Species*). Special status wildlife species such as little blue heron, wood stork, and other wading birds would benefit from the habitat enhancement provided by seasonal inundation with an increase in foraging habitat containing macroinvertebrates and other prey organisms they rely on for food. As a result of seasonal flood plain inundation, we conclude that unique natural communities and the wildlife that use the habitats within the natural communities would benefit from better quality habitat and increased forage that would be further restored and enhanced with a long-term commitment to the proposed flood plain regime during the life of the new license.

Flood plain inundation has the potential to adversely affect Swainson's warblers that may choose to nest in cane brakes and thickets within the flood plain. Depending on inundation and because of their mobility, Swainson's warbler could relocate to appropriate upland habitat if traditional nesting areas are inundated during the nesting season. We conclude that, although Swainson's warblers have the potential to be adversely affected by seasonal inundation of the Wateree River flood plain, their ability to use other habitat and their mobility would minimize any adverse effects potentially occurring as a result of the implementation of a program for inundation of the Wateree flood plain.

Rare Species Management

Review of wildlife survey results and life requisites for special status wildlife species precluded a number of species from being carried forward for analysis of potential project effects. The species removed from further analysis are Mississippi kite, sharp-shinned hawk,

brown creeper, and hermit thrush. These species are not considered due to their limited presence in the project area resulting from the absence or inadequate provision of habitat, food, or reproduction in the Catawba-Wateree Project area.

Several rare plant and wildlife species occur within the Catawba-Wateree Project area and may have the potential to be affected by project operations, maintenance, or project-related activities. South Carolina DNR agrees that species protection plans be filed with South Carolina DNR and North Carolina WRC, as appropriate, for the rocky shoals spider lily, Rafinesque's big-eared bat, mussel species, flat and snail bullheads, and heron rookeries. North Carolina WF states that species protection plans provide strong protection for specific unique flora and fauna in the region. Species protection plans have been created and filed with the license application for special status species of North Carolina or South Carolina, or both, and one priority habitat occurring within the Catawba-Wateree Project area. Those plans not already approved and implemented would be implemented within 60 days of the issuance of the new license. Annually, the list of special status species for the Catawba-Wateree Project will be reviewed in consultation with federal and state agencies. Mutually agreed upon management actions and alternatives would occur for any changes in status, and newly listed or de-listed species. Any changes in management strategy based on new information would require consultation with the appropriate agencies. Terrestrial species with proposed protection plans are discussed within this section. Aquatic species that have proposed species protection plans were discussed further in section 3.3.3, *Aquatic Resources*.

Rocky Shoals Spider Lily

The rocky shoals spider lily occurs in small populations on the Catawba River near Sugar Creek (RM 131.4) and the lower Great Falls long bypassed reach (RM 102.4); a large population (thousands of plants) is located at Landsford canal on the Catawba River (RM 119.0). Duke Energy has donated approximately 2 miles of shoreline to the state of South Carolina at Landsford canal, providing the population located there with permanent protection. With assistance from the Catawba-Wateree Relicensing Aquatic and Terrestrial Resource Committee, Duke Energy has prepared a species protection and management plan for the rocky shoals spider lily populations within the Catawba-Wateree Project area as part of the Catawba-Wateree relicensing agreement. The purpose of the plan is to provide information for the continued maintenance of rocky shoals spider lily habitat and protection from human disturbance. Low-level aerial photographs have been taken of colonies of rocky shoals spider lily to provide baseline data for long-term monitoring. Additional baseline information on HSI requirements for depth and flow will be established using generation records and USGS gaging data, and current physical condition of existing populations will be documented prior to the initiation of minimum flows (3 to 5 years after license issuance). South Carolina DNR and South Carolina DPRT have agreed to monitor the population within the Great Falls long bypassed reach. Potential relocation of rocky shoals spider lily bulbs from Landsford Canal to three sites selected in the Great Falls long bypassed reach has been proposed and a protocol including a separate monitoring plan is included in the species protection plan.

Georgia Aster

Interior requested the development and implementation of a species protection plan for the known population of Georgia aster that occurs along a transmission line approximately one-half mile from the Mountain Island Development dam. The population is located outside of the

project area defined as the geographic scope of this EIS. Operation of the Catawba-Wateree Project developments would not adversely affect the existing population; however, should a population of Georgia aster be found within the project boundary, the development and implementation of a species protection plan in conjunction with state and federal agency consultations would be appropriate at that time.

Rafinesque's Big-eared Bat

Although there is no evidence that Rafinesque's big-eared bat habitat exists in the Catawba-Wateree Project area, two individuals observed nearby suggest that the species may use the Catawba-Wateree Project area to some extent. In association with Duke Energy's Catawba-Wateree relicensing agreement, Duke Energy has prepared a species protection plan for Rafinesque's big-eared bat within the Catawba-Wateree Project area. Habitat management (maintaining forested natural communities, especially pine flatwoods and riverine forests), selective tree removal where harvesting occurs, keeping dead standing timber intact, and placement of artificial roosts would be implemented through the protection plan. Roost surveys, mist netting, and acoustic surveys would be conducted for 2 years, then once every 3 years to determine presence and use of habitat within the Catawba-Wateree Project.

Bald Eagle

Bald eagles nest within the Catawba-Wateree Project and regularly use the power plant tailrace areas, rivers, tributaries and open water of reservoirs as forage sites. Individuals may be seasonal migrants or residents in the Catawba-Wateree Project area and all are subject to disturbance from human activities along the shoreline of the developments. As of 2005, five active bald eagle nests were known from the Catawba-Wateree Project area. Interior recommends Duke Energy provide an annual bald eagle monitoring report to the Commission, FWS, and the state wildlife agencies that will include methodology for monitoring bald eagles and nest trees; transient bald eagle occurrences; and the location of resident or nesting bald eagles within the Catawba-Wateree Project boundary. Interior further recommends that Duke Energy be required to develop and implement management guidelines for the bald eagle and include them in the species protection plan. The guidelines should use the most current version of the federal bald eagle management guidelines to develop management objectives and actions.

Duke Energy proposes a bald eagle species protection plan that will provide for the collection of data on existing status, new nest sites, and recruitment estimates within the Catawba-Wateree Project boundary and the zone of operational influence every 3 years. Information from the surveys would be shared with FWS and state agencies concerning any bald eagle nests within or adjoining the Catawba-Wateree Project boundaries. Consultation with FWS and appropriate state agencies would provide assistance in the development of management plans for bald eagle nest sites following the FWS *National Bald Eagle Management Guidelines* (2006). The management plan for bald eagle may include implementation of distance buffers and avoidance of certain activities during the breeding season to minimize disturbance, and the conservation and maintenance of habitat. As part of the bald eagle species protection plan, Duke Energy proposes to place approximately 25 acres of applicant-owned property located on the east side of the Wateree tailrace in a conservation easement. The easement would be in effect for the term of the new license and would protect a fairly large, seasonal concentration of adult and juvenile bald eagles that use the tailrace for foraging.

Rookeries/Colonial Waterbirds

Heron rookeries, specifically great blue heron rookeries, have been documented on islands within the lakes and adjacent shorelines of the Cowans Ford, Wylie, and Oxford Developments. Duke Energy, in accordance with the SMP, is implementing a protection plan for the heron rookeries found within the Catawba-Wateree Project boundary. The primary concern for the rookeries is human disturbance created by residential and commercial use of project lands adjacent to the heron rookeries. The specific rookeries are protected under a Colonial Waterbird Nesting Area Program and the boundaries of the island rookeries are posted "No Entry" to restrict public access during the nesting season from April through August. North Carolina WRC Enforcement Division provides patrol and enforcement of the regulation. In addition, Duke Energy would continue management and protection of any colonial waterbird rookeries and nesting areas on all lands and waters within the Catawba-Wateree Project boundary or any applicant-owned lands adjoining the boundary. After 2 years of inactivity during the nesting season, a rookery would be considered abandoned and protection would be removed. Should any new rookeries be located within the Catawba-Wateree Project boundaries, Duke Energy would consult with federal and state agencies to develop appropriate management and protection strategies. Rookery data would be collected concurrent with bald eagle nest surveys and provided to the pertinent federal and state agencies. Data would include existing status, new nest sites, and recruitment estimates within the Catawba-Wateree Project boundaries and zone of operational influence at 3-year intervals.

Our Analysis

Rocky Shoals Spider Lily—The new increased minimum continuous flow regimes associated with the proposed mitigation and enhancement measures for the Wylie and Great Falls bypassed reaches of the Catawba-Wateree Project will provide a consistent channel flow and habitat conditions appropriate for the continued survival and potential expansion of existing rocky shoals spider lily colonies. The new flows will reduce the accumulation of sediment within the shoals, preventing suffocation of the plant bulbs. In addition, increased flows and consistent watering of the channel would reduce accessibility to the colonies by white-tailed deer and possible opportunistic grazing on plants and bulbs. Monitoring of the Great Falls long bypassed reach colonies of rocky shoals spider lily and comparison with baseline information will provide guidance for long-term management of the population including an auxiliary program for transplanting and monitoring rocky shoals spider lily plants originating from the Landsford Canal State Park population. Transplanting plants from Landsford Canal State Park could be implemented should negative effects of Catawba-Wateree Project operations be observed during monitoring. However, protecting and enhancing the colonies in the existing locations would be preferable to requiring relocation efforts. Duke Energy should continue open dialogue with the appropriate agencies during all aspects of monitoring and management.

Rafinesque's Big-eared Bat—Although Rafinesque's big-eared bat has not been definitively observed within the Catawba-Wateree Project, Duke Energy has prepared a species protection plan that provides for protection and enhancement of potentially suitable habitat within the Catawba-Wateree Project area. Initiation of monitoring for a 2-year period would provide information on Rafinesque's big-eared bats (whether or not they established colonies within the Catawba-Wateree Project area) that would be useful to federal and state agencies in conservation and management of the species. The SMP and the species protection plan provide for the protection of forested riparian habitat with limited tree removal, and the provision for

keeping dead standing trees in place provides appropriate habitat for roosting colonies. Protected habitat will be supplemented with artificial roost boxes that will create habitat for the possible establishment of roost colonies within the Catawba-Wateree Project. These measures are proactive, beneficial, and result in adequate protection and enhancement of habitat for a species that can become established within the Catawba-Wateree Project, providing additional opportunities for the species' conservation and protection. Measures to protect and enhance potential habitat for Rafinesque's big-eared bat would also provide protection and enhancement of habitat for other special status bat species known to occur in the project area, including southeastern myotis, silver-haired bat, and hoary bat. We recommend that Duke Energy continue to consult with agencies and make any appropriate revisions to the species protection plan as the plan is implemented if any special status bat species are observed within the Catawba-Wateree Project area.

Bald Eagle—Implementation of the species protection plan for the bald eagle as proposed would provide data on the status of resident and nesting bald eagles as well as transient bald eagles using the Catawba-Wateree Project area for foraging and roosting. Annual bald eagle surveys performed during the winter nesting season would continue to provide the most current data on bald eagle nesting, fledging success, and transient use of the Catawba-Wateree Project area. Sharing of information and consultation with the appropriate agencies would provide Duke Energy with the ability to adjust protective measures should adverse impacts to bald eagle be observed. The proposed conservation easement on approximately 25 acres of property located on the east side of the Wateree tailrace would protect the large seasonal concentration of adult and juvenile bald eagles that forage in the tailrace area for the duration of the license. As a result of the implementation of the species protection plan for bald eagle, bald eagles using Catawba-Wateree Project reservoirs and terrestrial habitat would continue to receive beneficial protection from human activities and intrusions as well as protected nesting and foraging habitat. Duke Energy's management guidelines should be consistent with the most current version of the FWS *National Bald Eagle Management Guidelines* (currently the 2008 version), and be updated as newer versions are implemented by FWS. Coordination with agencies including FWS for bald eagle management recommendations would provide opportunities to update and adjust protective measures for bald eagles using the Catawba-Wateree Project area, resulting in continued protection and potential enhancement of the bald eagle population. We conclude that with monitoring and agency consultation, SMP guidelines, and riparian land conservation opportunities, Duke Energy would provide quality roosting, foraging, and nesting habitat for bald eagles resulting in a long-term benefit to the species.

Heron Rookeries—The proposed species protection plan for heron rookeries located within the Catawba-Wateree Project area provides conservation and protection for nesting and roosting great blue herons that is not provided on either the state or federal level. Disturbance from human activities and intrusions, especially during the breeding and nesting season, can cause abandonment of individual nests or an entire colony. In association with its SMP, Duke Energy has developed a species protection plan that would suspend public access to the rookeries during the nesting season (April-August) and would be enforced by the North Carolina WRC Enforcement Division. Data gathered through monitoring of the rookeries, and identification of new or abandoned sites in partnership with appropriate agency personnel would maximize the protection and enhancement of colonial nesting heron habitat within the Catawba-Wateree Project. The proposed protection plan and SMP guidelines would provide adequate protection for existing and future heron rookeries; however, enforcement of the access restrictions lies with

state agency personnel and not with Duke Energy. As part of the species protection plan, consultation between Duke Energy and the agencies could include enforcement personnel to provide information on the successful application of access restrictions during the breeding season.

Noxious Plant Species

Terrestrial invasive plant species can affect the quality of natural plant communities within the Catawba-Wateree Project boundary. Invasive species successfully compete against and overtake native species by means of reproductive mechanisms and growth characteristics that result in crowding and shading out of native species. As recreation and development continues to increase around project reservoirs, disturbance and fragmentation of riparian and terrestrial plant communities can provide increased opportunities for terrestrial invasive plant species to colonize or expand. Terrestrial invasive plant species have become established in the project area primarily due to human activities that include planting for erosion control and development that results in fragmentation and/or disturbance of natural plant communities. Invasive plant species such as autumn olive, Chinese privet, Chinese wisteria, Japanese honeysuckle, Vietnamese grass, and kudzu occur in the project area. Autumn olive and Chinese wisteria appear to have limited distributions within or adjacent to the project area. The remaining species are considered abundant and more widely distributed along shorelines from Lake James to Lake Wateree. Kudzu and Japanese honeysuckle may be the most abundant of all the species occurring within the project area and the species that may have the potential to be dispersed by project operations. For all species identified, spill flows have the ability to transport seeds and uprooted plants downstream where they have the potential to become established.

Duke Energy does not have a specific management policy or plan for management of invasive exotic terrestrial plants, but does have vegetation management requirements outlined within the SMG. Under the guidelines, adjacent property owners are allowed to selectively manage non-native invasive plants or poisonous plants with written concurrence from Duke Energy. Applicant personnel and contractors provide routine vegetation maintenance at all facilities including access areas, dams, powerhouses, and rights-of-way. Maintenance includes mowing and spraying of herbicides according to the EPA-approved directions found on the specific herbicide label. Interior is concerned with the possibility of existing invasive plant species being dispersed by project operations and recommends that Duke Energy develop an invasive terrestrial and riparian vegetation management program to help manage invasive exotic terrestrial plants that occur on Catawba-Wateree Project lands and to restore native plants on these lands. FWS further recommends the development of a public education program that would include a brochure, signage, and implementation of an active invasive terrestrial and riparian species management program in consultation with FWS and the Park Service.

Aquatic nuisance plant species have the potential to reduce boating and recreation access and reduce the aesthetic value of the recreational experience on any of the affected reservoirs. Hydrilla, parrotfeather, and Brazilian elodea all have reproductive mechanisms that allow the plants to spread vegetatively as well as by seed. Fragmentation of existing plants by cutting with a boat propeller is a means for all three species to be spread. Seasonal flooding and resulting high flows can wash fragments or seeds into new areas of an affected reservoir or downstream into other reservoirs. Currently, Duke Energy, in cooperation with North Carolina WRC, South Carolina DNR, and North Carolina DENR, uses public education and stakeholder outreach as the

primary mechanism to prevent aquatic nuisance plant species from establishing and spreading in Catawba-Wateree Project waters. Presentations to local governmental, lake interest groups, and schools have helped to increase public awareness of the problem of invasive aquatic plant species. FWS recommends Duke Energy provide additional measures to reduce the spread of aquatic invasive plant species by including a "Stop Aquatic Hitchhikers" public education campaign. Signage using the trademarked logo of the campaign and education specifically focused on the procedures to be used in cleaning all water-based recreational equipment should be included and placed at all launch sites.

Our Analysis

Public education and awareness programs are an easy, low cost, and beneficial method for disseminating information on the prevention of exotic plant species introductions in both terrestrial and aquatic habitats and would be supported and implemented by Duke Energy.

Aquatic—Current consultation with FWS for aquatic invasive species management should continue, but in addition Duke Energy should expand consultation to include the Aquatic Nuisance Species Task Force and the Coast Guard, both sponsors of the Stop Aquatic Hitchhikers Campaign with FWS. South Carolina DNR is a partnering agency to the campaign, and as a current consulting agency with Duke Energy, would continue to ensure the implementation of successful invasive aquatic weed management and prevention efforts by Duke Energy in development reservoirs and lakes. The Stop Aquatic Hitchhikers Campaign (www.ProtectYourWaters.net) provides educational materials and specific procedures to be used in cleaning all aquatic recreational equipment guidelines to prevent the spread of aquatic invasive species from one water body to another. The education of visitors and residents on how they can help manage the introduction and/or spread of aquatic invasive species through their own actions would assist Duke Energy in actively preventing and managing aquatic nuisance species in an effective, efficient, and inexpensive manner. We agree with FWS that Duke Energy should consult with agencies and sponsors of the Stop aquatic Hitchhikers Campaign which would provide a beneficial mechanism to assistance Duke Energy with preventing and managing aquatic nuisance species in the project reservoirs.

Duke Energy has stocked grass carp in affected project reservoirs (Lake James, Lake Norman, Lake Hickory, Mountain Island Lake) to control aquatic invasive plant species in cooperation with North Carolina DENR. Grass carp have been used as an effective means for managing aquatic nuisance plants, but they can also reduce or eliminate native aquatic vegetation and can be spread to other bodies of water via connecting rivers and streams during periods of flooding. Some states are now prohibiting the use of grass carp as a control mechanism. Continued consultation through the life of the license with agencies would provide Duke Energy with opportunities to determine alternative methods for aquatic nuisance plant management.

Terrestrial—Terrestrial invasive plant species such as autumn olive, Chinese privet, Chinese wisteria, Japanese honeysuckle, Vietnamese grass, and kudzu have become established in the project area primarily due to human activities that result in fragmentation and/or disturbance of natural plant communities. Autumn olive and Chinese wisteria occur in single locations (Lake Wylie and Dearborn Lake, respectively) and appear to have limited distributions within or adjacent to the project area and do not appear to be distributed or affected by project operations. The remaining species are considered abundant and more widely distributed along reservoir shorelines from Lake James to Lake Wateree. Kudzu and Japanese honeysuckle may

be the most abundant of all the species occurring within the project area and the species that may have the potential to be dispersed by project operations. Vietnamese grass would be most likely to adversely affect rocky shoals spider lily if left untreated. Spill flows have the ability to transport seeds and uprooted plants downstream where they have the potential to become established.

Under the current management procedures for noxious weed control, routine management of terrestrial species surrounding development facilities includes active mowing and use of herbicides approved by EPA and/or the North Carolina and South Carolina Departments of Agriculture. Adjacent property owners are allowed to selectively control invasive exotic terrestrial species or poisonous plants with written concurrence from Duke Energy as stated in the SMP. Land owners are encouraged to plant native plant species instead of exotic species in the SMP and thereby preventing the introduction and spread of invasive species. In terrestrial and riparian areas that are not the property of the landowner or adjacent to development facilities, invasive exotic species are not currently managed and may continue to spread through vegetative growth or a variety of mechanisms (wind, water, wildlife, etc.).

The development and implementation of a terrestrial invasive plant species management plan would provide enhancement of existing natural plant communities and protection for special status species. The terrestrial invasive species management plan would include the following measures: (1) baseline surveys to identify the range and extent of terrestrial invasive plant species within the Catawba-Wateree Project boundary; (2) methods for management to be used (e.g., herbicide treatment, mechanical removal, mowing); (3) requirement that applicant staff involved in herbicide use be trained as a certified herbicide applicator; (4) a schedule for treatments, follow-up surveys, and additional treatments; and (5) estimated costs for management.. Consultation with FWS, the Park Service, and other appropriate agencies would assist in the development of a management plan and the selection of appropriate management procedures for existing invasive species. Herbicide treatments would be employed by certified applicators and could be used in combination with other methods such as mechanical removal. Mechanical methods such as cutting and physical removal of plants in combination with stump/root crown spraying can be effective for kudzu, Chinese privet, and large isolated stands of wisteria or Japanese honeysuckle. Vietnamese grass can be managed by physical pulling of plants before seed production or spraying. Depending on the species and treatment methods adopted, follow-up treatments may be necessary on an annual basis for 1 to 2 years after the initial treatment. If management efforts result in the elimination of invasive species especially in areas where invasive species formerly threatened special status habitats, wetlands or other unique habitats, planting of native vegetation to reestablish natural habitat and prevent soil erosion would be beneficial. Partnership with other organizations to implement the active removal and restoration process would provide additional support to Duke Energy.

To address invasive terrestrial plant species occurring outside of its project boundary, Duke Energy would develop an educational brochure that would be made available to adjacent landowners for management of invasive terrestrial plant species on their property. Information contained in the brochure would be developed in consultation with FWS and the Park Service and would provide information on terrestrial invasive plant species found within the project area, methods for mechanical removal and licensed herbicide application, and the estimated costs per acre. The brochure also would be made available for download through the Duke Energy website and would be incorporated into the next revision of the SMP guidelines. The

development of an educational brochure would result in long-term benefits to native plant species and habitats in the project vicinity.

We present the estimated cost of development and implementation of a terrestrial invasive plant species management plan, and make our final recommendations regarding this measure, in section 5, *Comprehensive Development and Recommended Alternative*.

Recreation Enhancements

Shoreline recreational enhancements have been proposed (section 3.3.7, *Recreational Resources*) that may have minor temporary or permanent impacts on terrestrial resources, including disturbance or removal of vegetation and wildlife habitat to provide access, parking, or other facilities. As a rule, improvements at existing facilities will require the removal of small amounts of vegetation that would not adversely affect wildlife habitat, RTE species, or natural communities. Construction of new facilities will potentially require the removal or disturbance of larger amounts of vegetation. Knowledge of existing plant communities and the presence of any RTE or special status plant within the footprint of the construction site will be necessary prior to the initiation of construction. Prior to the construction of any new proposed recreation sites, Duke Energy would need to review existing information from prior surveys and consult with FWS, South Carolina DNR, or North Carolina DENR on the possible presence of RTE species in the vicinity of the proposed construction. If species are identified as occurring or potentially occurring in the project vicinity, additional consultation with the appropriate agencies would provide expertise to assist with the development of protection measures if the species does not have an existing species protection plan.

Improvements to existing, or construction of new, public recreation facilities can cause short-term disturbance to wildlife during construction activities. New or improved recreation facilities create the potential for long-term increases in disturbance as activity by users of the new or improved facilities increases. Restrictions on access and enforcement of the restrictions will prevent access and limit human-related disturbance to heron rookeries and bald eagle nesting and foraging concentration sites especially if new heron rookeries or bald eagle nests are established within the Catawba-Wateree Project area that may be adversely impacted by construction or new recreational activity.

Our Analysis

Continued consultation with applicable agencies and monitoring via species protection plans will provide the information necessary to avoid any adverse impacts to wildlife from construction or recreational activities. Planning prior to the onset of construction and consideration of seasonal wildlife use, especially RTE or special status species, in the area proposed for construction is vital.

Shoreline Management Plan

The SMP provides classifications and lake use restrictions intended to protect specific natural communities and the wildlife species that may use or inhabit those areas. Vegetation removal, construction, and shoreline stabilization or excavation activities would be restricted within emergent wetlands, especially water willow beds, stream confluences and heads of coves, bottomland hardwood forests, and areas designated as “natural”. Shoreline stabilization criteria recommend the use of species native to North or South Carolina and encourage the avoidance of activities in water willow beds. The SMP provides vegetation management requirements to

protect and enhance shoreline vegetation and applies to all 13 developments within the Catawba-Wateree Project. A complete discussion of the SMP is found in section 3.3.8, *Land Use and Aesthetics*. The SMP presents a number of protection measures including restrictions on clearing, thinning, spraying, planting, and sowing of vegetation except for hazard trees that are unsafe; restrictions on mechanical removal and clearing of footpaths; viewshed clearing; and herbicide use. Wildlife enhancements may be authorized through application to Duke Energy with approval of adjacent property owners and appropriate state wildlife agencies. Planting of native Piedmont vegetation is recommended. EPA stated that their primary interest related to shoreline management for the Catawba-Wateree Project is to ensure the protection of sensitive wetlands, riparian, and terrestrial habitat along the reservoirs and riverine sections from impacts related to development and recreation. Interior recommends that the Catawba-Wateree Project boundary in South Carolina include the 50-ft-wide vegetated riparian buffer area required by the North Carolina Environmental Management Commission and contained within their Catawba Riparian Buffer Protection Rules as the minimum necessary to protect riparian resources.

Our Analysis

The SMP would provide for the protection and enhancement of sensitive wetland and bottomland habitats including water willow beds and forested areas. Restrictions, use classifications, and identification of important habitat areas were developed and updated by Duke Energy with the assistance and consultation of agencies. These revisions to the SMP would increase the amount of land protected through the designations of "natural" to greater than 0.7 percent and "environmental" to greater than 0.3 percent, and offer protection to bottomlands (0.6 percent) as a new designation (section 3.3.8, *Land Use*). By protecting the wetlands, cove heads, riparian, and forested habitats surrounding the Catawba-Wateree Project development reservoirs, rivers, coves, and islands, the SMP provides for the protection and enhancement of wildlife habitat including the heron rookeries found at Lake Norman and the Mountain Island bypassed reach habitat for RTE species such as Schweinitz's sunflower. Special status bat species will benefit from SMP recommendations for keeping dead trees (snags) that could provide roosting sites. Red-headed woodpecker and other cavity nesting species will benefit from the maintenance of dead trees and snags, especially within the Wateree River regulated reach adjacent to the Congaree Swamp National Park.

Removal of invasive aquatic and terrestrial plant species and the planting of species native to the North Carolina and South Carolina Piedmont physiogeographic region would enhance existing terrestrial and shoreline habitat for wildlife as nesting, foraging, and nursery areas. However, we think that invasive species management that would provide for active removal and management policies and procedures for lands within the Catawba-Wateree project boundary and zone of influence would have more success if a terrestrial invasive species management plan were developed and implemented as previously discussed.

Continued development of the shoreline surrounding reservoirs of the Catawba-Wateree Project would increase erosion of the shoreline and sedimentation input into reservoirs, particularly Rhodhiss and Mountain Island Lakes. In those reservoirs, sediment has buried emergent wetlands in some areas and created emergent wetlands in others. The SMP and its guidelines would provide protection and enhancement measures to prevent shoreline erosion and sedimentation within the Catawba-Wateree Project area. New development outside of the Catawba-Wateree development boundaries would continue to affect project reservoirs; however the current SMP would be adequate in its protection of shoreline within the Catawba-Wateree

Project boundaries and guidelines for maintaining vegetated buffers. The SMP would provide protection of "environmental" and "natural" designated lands as well as areas of bottomland hardwood natural communities that would in turn benefit plants and wildlife adapted to bottomland habitat. As recreation and development continues to increase around project reservoirs, disturbance and fragmentation of riparian and terrestrial plant communities would result in an increase in opportunities for terrestrial invasive plant species to colonize or expand. The development and implementation of a terrestrial invasive species management plan for lands within the Catawba-Wateree project boundary and zone of influence would provide additional policies and procedures to maintain the vigor of natural plant communities along reservoir shorelines.

Land Conservation

The impacts of reduced flows in Paddy Creek bypassed reach, Oxford regulated river reach, Lookout Shoals regulated river reach, and Mountain Island bypassed reach within the Catawba-Wateree Project in North Carolina, and Wylie regulated river reach, Great Falls long and short bypassed reaches, and Wateree regulated river reach in South Caroline are discussed in section 3.3.2, *Water Resources*. The North Carolina and South Carolina flow mitigation packages provide for protection and permanent conservation of riparian corridors and upland habitat to mitigate for unavoidable impacts in exchange for the reduced flows in the bypassed reaches. The North Carolina flow mitigation package provides for permanent conservation easements on 22 miles of streambank; the South Carolina flow mitigation package provides for permanent conservation easements on 6.6 miles of streambank. The conservation easements are 100-ft wide, perpetual easements to be located on the Johns, Catawba, and Linville Rivers and transferred to the state of North Carolina or state-chosen land trust within 18 months of the issuance of the license. In South Carolina, the 100-ft-wide perpetual easements are to be located on tributaries to the Catawba River. In addition, within 1 year following the issuance of a new license, Duke Energy will provide a one-time contribution of $1 million to South Carolina DNR to create a fish and wildlife mitigation and enhancement fund for support of survey and inventory, research, and population enhancement of fish and wildlife in the Catawba-Wateree River Basin including RTE, biodiversity protection and enhancement, and environmental outreach programs.

Duke Energy will make one-time contributions of $1 million to the HEP funds in North and South Carolina, respectively, in addition to the $80,000 annual contribution per state contributed by Duke Energy through 2009. HEP funds may be used by the states to support long-term management of conservation easements established through the Revised CRA or add land as conservation easements.

North Carolina WF is pleased with the new gamelands, riparian buffers, and island habitat acreage proposed for protection, which would benefit terrestrial non-game and game wildlife species, reduce fragmentation of habitat, and protect wildlife corridors. North Carolina WF is also pleased with the HEP fund, which would allow long-term enhancement for fish and wildlife. South Carolina DPRT supports the additional opportunities for land acquisition for conservation including more than 10 miles of conservation easements. American Rivers requests that mitigation be located within the Catawba-Wateree Project area. Interior recommends that Duke Energy develop a comprehensive plan to work with federal and state resource agencies, CIN, communities, and non-profit organizations to conserve and protect its lands including fish

and wildlife habitat based at Bridgewater, Johns River in the vicinity of Rhodhiss, Dearborn Island, Wateree canal, and the lands and waters within Congaree National Park.

Our Analysis

The primary benefit of placing riparian stream habitat along the tributaries and rivers that drain into the Catawba River in both North and South Carolina in new conservation easements would be the protection of water quality and aquatic habitats, riparian corridors, natural plant communities, wildlife habitat and migration corridors. Riparian stream habitat attenuates periodic high inflows during flooding, reducing damage from erosion of stream banks. In turn, sediment entering the water during flooding is reduced and water quality is not compromised. We think that funding and conservation mechanisms proposed by Duke Energy in consultation with applicable agencies would allow Duke Energy to be proactive in protecting the natural communities adjacent to the Catawba-Wateree Project area. Benefits from resulting flow attenuation outside of the project area would reduce impacts from flooding to the existing plant communities in downstream project developments. Proposed conservation easements would establish unfragmented corridors of habitat for wildlife movement and migrations. However, under the existing license, not all of the riparian habitat proposed for permanent conservation ease is included in the project boundaries. Because conservation of these lands is being proposed as mitigation to offset the environmental effects of reduced flows in some river reaches, we conclude that these lands are necessary for project purposes, and recommend that they be included in the project boundary. Lastly, we agree that conservation measures proposed in concert with guidelines and restrictions for riparian habitat use in the SMP would conserve and enhance riparian habitat in the Catawba-Wateree Project area and basin consistent with the Catawba River Basin natural resources plan (North Carolina DENR and North Carolina WRC, 2001).

3.3.4.3 Unavoidable Adverse Effects

Terrestrial natural communities, wetlands, and wildlife habitat have developed in association with current operations and are generally considered to be stable and in good condition, but would be subjected to potential effects of fluctuating reservoir levels. As proposed in the license application, stabilization of reservoir levels and flow regimes would protect and enhance Catawba-Wateree Project terrestrial resources. Until the species protection plans are implemented with the issuance of the new license, special status plant and animal species are at risk of adverse effects from fluctuating water levels, inconsistent flows, and human activity.

3.3.5 Threatened and Endangered Species

3.3.5.1 Affected Environment

Schweinitz's Sunflower

Endemic to the Piedmont region of North and South Carolina, Schweinitz's sunflower is a federally listed endangered species as of 1991 and is listed as endangered by the states of North Carolina and South Carolina. Conditions that led to the listing of Schweinitz's sunflower include habitat destruction, alteration, or both; curtailment of range; loss of known populations; and fire suppression. Historically, Schweinitz's sunflower probably inhabited open, prairie-like habitats or post oak-blackjack oak savannas that were maintained by fires set by lightning and Native Americans or by grazing (FWS, 1994). The species has lost much of its original habitat to forest

succession and is now most frequently found in transmission line corridors, old pastures, and other areas that receive partial sun. It is commonly found along roadsides where it is difficult to protect and can be affected by mowing and herbicide spraying. Plants are often associated with other species from the aster family was well as grasses and legumes (FWS, 1994). Within the Catawba-Wateree Project, Schweinitz's sunflower is located in the spillway channel of the Mountain Island bypassed reach, which is the site one of the largest known populations of Schweinitz's sunflower.

Schweinitz's sunflower is a long-lived perennial sunflower that has a small yellow flower head approximately 0.25 to 0.6 in. in diameter, and has alternate leaves; it is usually less than 3 ft in height and bushy (FWS, 1994). It blooms from August to frost (FWS, 1994). Geologically, Schweinitz's sunflower is found within the Charlotte Belt and the Carolina Slate Belt, primarily on mafic rocks. Schweinitz's sunflower prefers poor soils that are clayey, thin, and derived from mafic rocks such as Cecil, Enon, and Iredell soils. Cecil soils are found throughout the Catawba-Wateree Project from Rhodhiss south and including Wylie. Enon and Iredell soils are found in the Mountain Island Development. Soil types are described in section 3.3.1.1, *Affected Environment*, *Soils*. Plants are generally located on upland flats and gentle slopes (FWS, 1994). Limiting factors for survival and growth of Schweinitz's sunflower are partial shade for protection from sunlight and excessive competition from other vegetation (FWS, 1994). Because of these criteria, Schweinitz's sunflower requires active management of its habitat by controlled burns or removal of encroaching shrubs and trees to maintain the semi-open habitat and reduced competition from surrounding vegetation (FWS, 1994).

Consultation with FWS under section 7 of the ESA was initiated by Duke Energy in 1999 for proposed tree removal at Mountain Island Development. The resulting biological opinion was issued by FWS in 2000 and resulted in the development of a species protection plan and the request for designation of the bypassed reach as "natural" in the next filing of the SMP (letter from FWS, March 23, 2000).

Dwarf-Flowered Heartleaf

Dwarf-flowered heartleaf is a federally listed threatened species and a state listed threatened species in both North and South Carolina. Dwarf-flowered heartleaf is a low growing evergreen perennial herbaceous species that is endemic to a nine-county area in the western upper Piedmont of North and South Carolina (North Carolina Natural Heritage Program [NHP], 2008). When listed in 1989, reasons cited for the decline of the species included habitat loss from development, conversion to agriculture, timber cutting, and cattle grazing. Since listing, the number of documented populations have risen from 24 to more than 130, and the number of individual plants has increased from 5,900 to more than 248,000 (FWS, 2004). Three populations of dwarf-flowered heartleaf are located in the Paddy Creek and Linville dam areas of the Bridgewater Development, but outside of the Catawba-Wateree Project boundaries. Several populations of the dwarf-flowered heartleaf are located along the shores of Lake Hickory upslope from the project area. Dwarf-flowered heartleaf occurs along Ball Creek, a tributary of Lake Norman, and is within the Catawba-Wateree Project boundary.

Dwarf-flowered heartleaf grows in acidic, sandy loam soils along bluffs and slopes of hillside ravines and in boggy areas adjacent to creeks and streams. It is often associated with laurel. The most important habitat requisite for the dwarf-flowered heartleaf is soil type: the species requires Pacolet, Madison, or Mustella sandy loam to grow (North Carolina NHP, 2008).

In the correct soils, dwarf-flowered heartleaf can tolerate dry conditions or moderate moisture. Dwarf-flowered heartleaf flowers from mid-March through early June, and the jug-shaped flowers are inconspicuous under the leathery, evergreen leaves. Maximum flowering requires sunlight in the early spring. Seed distribution relies on ants and existing plants spread via rhizomes below the soil surface (FWS, 2004).

Duke Energy has consulted with FWS under section 7 of the ESA for the Paddy Creek Dam Seismic Stability Improvement Project (FERC Project No. 222-540). Consultation resulted in the development of a biological assessment and the issuance of a biological opinion by FWS. As a result, Duke Energy prepared a species protection plan and developed and implemented a monitoring plan for the three populations of dwarf-flowered heartleaf in the Bridgewater Development. Dwarf-flowered heartleaf has been monitored and protected as part of a species protection plan at Paddy Creek dam in accordance with requirements of the Paddy Creek Dam Embankment Seismic Stability Improvement Project Biological Opinion through 2007. Baseline and annual monitoring through post-construction has been reported. Monitoring included the determination of condition of populations, survival, and any population trends. Buffers 200 ft wide were placed around the population sites and included in the monitoring. Buffers surrounding the sites are affected by the growth of kudzu, which is being controlled by selective herbicide application (Duke Energy, 2007).

Carolina Heelsplitter

The Carolina heelsplitter, a freshwater mussel, inhabits cool, slow-moving, and small- to medium-sized streams and rivers. The Carolina heelsplitter was once widespread. Its historic distribution included several locations within the Catawba and Pee Dee River systems in North Carolina and the PeeDee and Savannah River systems, and possibly the Saluda River system, in South Carolina. The Carolina heelsplitter currently has a very fragmented distribution and appears to persist in only six streams and one small river, including Waxhaw Creek, a tributary of the Catawba River (FWS, 1997a). Two individuals were found near the Wylie Development in Waxhaw Creek 1.5 miles upstream of the Catawba-Wateree Project zone of influence during surveys conducted in 2004.

The decline of the species has been attributed to several factors related to human activities, including siltation, development, runoff containing pollutants, and habitat alteration and fragmentation due to impoundments on rivers and streams (FWS, 1997a).

Because of its rarity, little is known about its life cycle or specific habitat requirements of the Carolina heelsplitter. It is thought that the species prefers silt-free substrate comprised primarily of a mixture of sand, gravel, and cobble. Like other freshwater mussels, the Carolina heelsplitter feeds by filtering food particles from the water column, but the specific food habits are unknown. The reproductive cycle is thought to be similar to other freshwater mussels and includes a glochidia (larva) lifestage. The Carolina heelsplitter's life span, fish host species, and a number of other aspects of its life history are unknown (FWS, 1997a).

Wood Stork

Wood stork is a federally listed endangered species, and also is listed as endangered by the states of North Carolina and South Carolina. Loss of habitat, water manipulations affecting inundation, human disturbance, and lack of regeneration of cypress trees are factors that have influenced the decline in wood stork populations.

Wood storks are a colonial species that use freshwater and estuarine wetlands for nesting, roosting, and feeding in the southeastern United States. Wood storks select nest sites that have patches of medium to tall trees, often with species such as bald cypress, black gum, and coastal plain willow. Inundation followed by a period of drying that concentrates food resources is a habitat requisite to protect the nests from predation by raccoons and prevent adults from abandoning nests. Wood storks are faithful to a colony site as long as habitat and food availability are adequate (FWS, 1997b).

The nesting season occurs from March through August. After nesting, wood storks disperse northward as far as North Carolina and as far west as Mississippi and Alabama (FWS, 1997b). They are occasionally observed in summer flying over the Congaree Swamp National Park (Carter, 2005). Although not within the Catawba-Wateree Project boundaries, wood storks were observed foraging adjacent to the Wateree River Regulated Reach, in a backwater area of the Congaree River during relicensing surveys (DTA, 2005b).

Wood storks forage in open, shallow water areas where small fish are concentrated and feeding is easier. Seasonal differences of inundation depth and duration and rainfall amounts cause wood storks to change where and what wetlands are used for nesting, foraging, or roosting; however, in general, nesting wood storks generally feed within approximately 30 miles of the colony. The most successful colonies are those found in regions where there are a variety of wetland types and varying hydrologic schemes readily available. Proximity to foraging areas appears to play a major role in chick and fledgling survival (FWS, 1997b). Roosting sites are usually similar to nesting colony sites, but may use more variable habitat, especially by non-breeding individuals who choose roost sites based on access to feeding sites and may change sites as feeding locations change (FWS, 1997b).

Wood storks require roosting, foraging, and nesting areas that may change geographically over their range based on available hydrologic regimes, rainfall, food availability, and nest sites. Because of this variability, FWS thinks that the long-term recovery of the species will require the identification and protection of a mosaic of nesting, roosting, and foraging habitats (FWS, 1997b).

Shortnose Sturgeon

Shortnose sturgeon are benthic omnivores feeding on crustaceans, insect larvae, worms, and mollusks and may shift food preferences at various life stages. They are found in rivers, estuaries, and oceans, but are confined primarily to natal rivers and estuaries and are therefore, not considered a truly anadromous species (FWS, 1998). Instead, shortnose sturgeon migrate within their natal systems to spawn in late winter through early spring. Spawning habitat requires large rivers with deep channels, moderate river discharge and coarse substrates. Shortnose sturgeon have undergone population declines due to a number of threats including non-point and point-source pollution, commercial overharvesting, hydroelectric dams, and channelization, as well as incidental mortality in dredges or through impingement.

In 1998, NOAA Fisheries recognized 19 distinct population segments including the Santee River Basin, which includes Lake Marion and Lake Moultrie formed by impounding the Santee and Cooper Rivers, and the Wateree and Congaree Rivers. Shortnose sturgeon spawning has been documented in the Cooper and Congaree Rivers, but has not been reported from the Wateree River for more than 100 years. Shortnose sturgeon can access the lower regulated reach of the Wateree River below the Wateree Development, and numerous researchers conclude that

there are isolated populations of shortnose sturgeon in the lakes of the Santee-Cooper System, including some migration up the Congaree River during spawning season (Duke Energy, 2006e). One shortnose sturgeon was collected during sampling in the Congaree River near Columbia, South Carolina, in 2004. No shortnose sturgeon, a federally listed endangered species, were observed in the Wateree River during 2004 or 2005; similarly, other recent sampling studies have failed to collect sturgeon in the Wateree River. A supplemental gillnetting study (developed in consultation with FWS, NOAA Fisheries, and South Carolina DNR), which targeted shortnose sturgeon potentially inhabiting the Wateree River, was conducted in the spring of 2006. No shortnose sturgeon were collected in this effort, although a concurrent study by South Carolina DNR indicated that a single shortnose sturgeon entered the lower section of the Wateree River for a few days before returning downstream and then moving upstream into the Congaree River.

Atlantic and shortnose sturgeon were selected as target species for the instream flow assessment performed by DTA (2005a). The habitat suitability curves used for calculation of WUA for evaluation of the relationship between flow and available habitat indicate that sturgeon prefer water depths greater than 6 ft and water velocities between 0.5 and 3 ft per second. Preferred substrate for sturgeon spawning includes sand, gravel, cobble, and boulder.

Duke Energy has prepared a species protection plan for the shortnose sturgeon with a provision for Duke Energy to share any occurrences of the species within the Wateree River downstream of the Wateree dam with the appropriate agencies. The species protection plan further provides for management and habitat protection, restoration, and enhancement for the shortnose sturgeon through the *Santee-Cooper Basin Diadromous Fish Passage Restoration Plan* (FWS, et al., 2001) and the *Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement*.

American Alligator

Since 1987, FWS has considered the American alligator to be fully recovered, although it remains federally listed as a threatened species due to similarity of appearance with other endangered or threatened crocodilians (NatureServe, 2008). It is listed as threatened by North Carolina and is a delisted species in South Carolina. The American alligator is not found within the Catawba-Wateree Project area; however, it is found in the lower Wateree River and adjacent Congaree Swamp National Park.

The American alligator primarily inhabits freshwater swamps and marshes, but can use estuarine wetlands, shallow rivers and lakes, and other small open water areas. During dry periods, American alligators modify their habitat by creating water-retaining depressions in the mud that also provide a refuge for other aquatic species. Alligators can move from one wetland to another over land up to 5 miles a day (Nature Serve, 2008).

American alligators are opportunistic predators feeding on a wide range of small mammals, fish, reptiles, amphibians, and birds. Feeding activity is dependent on water temperature with foraging activity ceasing below 68-73°F. Alligators reach reproductive age between 8 and 13 years. Courtship rituals that signal the initiation of the breeding season are temperature dependent beginning when temperatures rise in the spring. Vegetation and mud mounds form nests typically constructed on banks or mats of vegetation in early summer. Flooding will kill most eggs within 12 hours of submergence, so nests are constructed such that the eggs are elevated above the water level. Females are faithful to a nest site as long as

conditions remain conducive to nesting. Juvenile alligators are protected by remaining in close proximity to the mother for up to a year, but occasionally for a longer period of 2 to 3 years (Duke Energy, 2006f). American alligators provide some measure of protection to wood stork nesting colonies as predators of raccoons, which are known to be highly effective predators of eggs and nestlings of wood storks.

Bog Turtle

The bog turtle has two distinct populations in the United States: a northern population listed as threatened by FWS, and a southern population listed as threatened due to their similarity in appearance to other endangered or threatened turtles. Bog turtles are listed as threatened by the state of North Carolina. Populations of bog turtles have declined due to loss, fragmentation, and degradation of habitat (FWS, 2001). Three individual bog turtles were observed from Bristol Creek, a tributary of Lake Rhodhiss in Burke County located northeast of Lake Rhodhiss. This location is outside of the Catawba-Wateree Project area and the zone of operational influence.

Bog turtles are one of the smallest North American turtles with a carapace length of approximately 4 to 4½ in. They usually occur in small, discrete populations in wetlands that have micro-habitats, including flooded areas, dry areas, and saturated areas that provide foraging, breeding, hibernating, basking, and shelter areas. Wetlands are variable by type, but are often small, open-canopy, herbaceous sedge meadows or fens with thickly vegetated or wooded borders. Denser vegetation provides shelter and hibernation habitat (FWS, 2001). Cattle pastures in North Carolina currently provide some of the best habitat for bog turtles because grazing cattle can keep vegetation from successional encroachment in the wetlands (Dorcas, 2005b).

Bog turtles feed primarily on insects, slugs, and earthworms, and, on occasion, crayfish, frogs, and vegetation. They lay eggs in the spring on raised mounds of grass devoid of woody shrubs and generally sparsely vegetated. Tussocks used for nesting are clustered in nursery areas (FWS, 2001).

3.3.5.2 Environmental Effects

Catawba-Wateree Project operations affect federally listed plant and wildlife species. Reductions in the number of viable stems of Schweinitz's sunflower are a result of spills and inundation, and reductions of dwarf-flowered heartleaf are a result of activities outside of the focus of the relicensing application. Flood plain habitat in the Wateree regulated river reach downstream to the confluence of the Congaree River is occasionally used by foraging wood storks and has potential for use by the American alligator. The lack of regular, seasonal flood plain inundation currently makes habitat inconsistently available for wood storks and American alligators. Continuous dialogue between Duke Energy and the agencies would provide opportunity for changes to management and protection of the species; the capability to discern any adverse or beneficial impacts occurring to the species from Catawba-Wateree project operations; and the ability to ameliorate or mitigate those impacts.

American Rivers and the Coastal Conservation League think that the provisions in the Revised CRA do not provide adequate basis for compliance with the ESA because it does not identify needs critical to endangered species habitat or final species protection plans, or describe a connection between direct and indirect impacts of project operations on endangered species.

Interior recommends Duke Energy initiate consultation with FWS regarding ESA listed species and assess the effects of the Catawba-Wateree Project.

Our Analysis

Species protection plans have been written or updated and would be implemented within 60 days of the issuance of the license for the Catawba-Wateree Project. The species protection plans have specific methods for monitoring each species, and determination of the effectiveness of management and conservation measures proposed for each species, including annual communication and consultation with the appropriate state and federal agencies. Monitoring results and agency consultation will provide opportunity for amending or otherwise altering management and conservation measures for specific species. In addition, annual consultation with agencies will provide Duke Energy with current information on changes in status of existing protected species, and the addition or removal of species to the ESA or applicable state lists that are found within the Catawba-Wateree Project area. We conclude that the species protection plans would provide adequate opportunity for the collection of information on the status of federally listed species within the Catawba-Wateree project area; however, the plans should be considered a work in progress, subject to review and amendment as necessary for the benefit of the applicable species based on consultation with the agencies and timely review of the data gathered during monitoring.

Schweinitz's Sunflower

Periodic flooding events cause uncontrolled spills from the dam and adversely affect Schweinitz's sunflower habitat by causing scouring and inundation of the existing plants. Natural succession could close openings in the vegetation that the Schweinitz's sunflower requires for survival. The presence of uncontrolled exotic invasive plant species could compete with the species for sunlight and limit the availability of sunlight to the Schweinitz's sunflower. FWS recommends that section 7 consultation on Schweinitz's sunflower be re-initiated after the loss of some stems of the species as the result of a spill event. FWS further states that the species protection plan should include relocation strategies so that some stems could be moved to a protected upland site where better management could be implemented and spill hazards could be avoided.

As part of the species protection plan, monitoring on an annual basis will be conducted during the flowering period to determine the health and status of Schweinitz's sunflower populations in Mountain Island bypassed reach. Results will be documented in a report, and evidence of any decline in the population will initiate consultation with FWS and North Carolina NHP (Duke Energy, 2006g).

Project maintenance within Schweinitz's sunflower habitat in the Mountain Island bypassed reach will occur only with prior notification to FWS and North Carolina NHP personnel. Tree removal can be accomplished using hand tools between November and February when the Schweinitz's sunflowers are dormant. Stump removal herbicides are acceptable for use, but broadcast herbicides may not be used without prior consultation with FWS and North Carolina NHP. Duke Energy proposes to remove or reduce invasive species directly competing with the sunflower during the plant's period of dormancy through possible use of controlled burns, hand clearing, or herbicides, or a combination of these methods. Activities will require consultation with FWS and North Carolina NHP.

To avoid adverse impacts to Schweinitz's sunflower habitat after habitat management activities have occurred, Duke Energy will manage Mountain Island Lake to avoid spills to prevent damage to the improved habitat from erosion (Duke Energy, 2006g). The population of Schweinitz's sunflower, however, will continue to be at risk from unavoidable spills when periodic meteorological events result in high levels of precipitation.

Our Analysis

These actions, as proposed, will ensure that growing conditions for the Schweinitz's sunflower within the Mountain Island bypassed reach will be maintained and potentially enhanced, increasing the potential for expansion of the existing population. Updates and amendments to the species management plan will occur as additional information on the life history, current management practices, and condition of the Mountain Island bypassed reach population are integrated through consultation dialogue with FWS and North Carolina NHP.

The Schweinitz's sunflower population found within the Mountain Island bypassed reach has persisted under current project operations and periodic flooding events including, most recently, the effects of hurricanes in the fall of 2004. Additional protection measures outlined in the species protection plan in concert with monitoring, management of spills from Mountain Island Lake and continued partnership with FWS and North Carolina NHP would provide necessary protection for Schweinitz's sunflower. In addition, these actions would allow for potential opportunistic expansion of the Schweinitz's sunflower population within the Mountain Island bypassed reach, despite the continued threat of impacts from uncontrollable meteorological events. Re-initiation of section 7 consultation with FWS may become necessary if monitoring determines that the population is declining; however, consultation with FWS and state agencies would occur on an informal basis as part of the species protection plan and provide opportunity for dialogue and advisement that may offset the need for formal section 7 consultation. We caution that the relocation of viable stems of the Schweinitz's sunflower may not be effective in protecting the existing population. However, the collection and planting of seeds in appropriate habitat may indirectly provide enhancement of the Mountain Island bypassed reach population and appropriately mitigate the loss of plants from unavoidable spills and inundation. Planting of seeds and transplanting of mature Schweinitz's sunflower plants should occur after consultation and assistance from applicable agency personnel.

We conclude that proposed project operations would be likely to adversely affect Schweinitz's sunflower during unavoidable spills resulting from uncontrollable meteorological events. The implementation of a species protection plan along with protection measures would provide adequate safeguards. Consultation with applicable agencies would allow Duke Energy to be proactive in developing mitigation and enhancement of the Mountain Island populations through propagation and transplanting of additional plants.

Dwarf-flowered Heartleaf

To protect dwarf-flowered heartleaf from the potential effects of any future human activities related to the project such as construction activities, maintenance of access roads, or control of invasive species, Duke Energy would consult with FWS and North Carolina Natural Heritage Program and appropriately protect populations of dwarf-flowered heartleaf found within the project boundaries or on Duke Energy-owned property. Once documented, Duke Energy will place, if applicable, the identified populations within protective buffers or place the property inside the buffer into conservation easements. After protective measures are completed,

Duke Energy would develop a site-specific species protection plan for dwarf-flowered heartleaf. Management guidelines will be developed and include monitoring of populations location(s), size, and overall condition every 4 years. A significant component of the management guidelines will involve the possible removal and future control of invasive exotic terrestrial plant species from the dwarf-flowered heartleaf protection buffers and easements (Duke Energy, 2006h).

Our Analysis

The establishment of buffers and/or conservation easements for protection of the dwarf-flowered heartleaf would provide beneficial protection of existing populations within the project boundary and on Duke Energy-owned lands. Further protection and potential enhancement of the existing populations would be provided by the development of a species protection plan.

Data gathered from monitoring and protection of dwarf-flowered heartleaf during the seismic rehabilitation work at the Bridgewater Development provides an excellent basis for the development of a species protection plan. These activities together with continued consultation with FWS and North Carolina NHP staff would enable Duke Energy to produce a species protection plan and best management practices to protect and potentially enhance all dwarf-flowered heartleaf populations within the Catawba-Wateree Project.

Monitoring to be provided for in the species protection plan for dwarf-flowered heartleaf would provide a comparison of current populations with existing baseline data and document any project-related impacts. Initiation of agency consultation would follow any determination of project-related effects. Monitoring would provide information on the success of invasive species management. Control measures for invasive species would be implemented through the species protection plan and in conjunction with a proposed terrestrial invasive species management plan if accepted as a license article. The implementation of the proposed species protection plan with periodic consultation and updates would provide protection and potential enhancement of the dwarf-flowered heartleaf populations located within the Catawba-Wateree Project area. Implementation of an active management of invasive species is necessary to protect this species.

In conclusion, project operations as proposed, are not likely to adversely affect this species with acceptance of an appropriate species protection plan, monitoring and invasive species management.

Carolina Heelsplitter

Like the other freshwater mussel species found during surveys within the Catawba-Wateree Project area, it appears that the Carolina heelsplitter generally requires habitat in clean free-flowing streams and rivers with coarse-grained substrate. The Catawba-Wateree Project may contain suitable habitat for the Carolina heelsplitter; however, specimens were found only outside of the Catawba-Wateree Project zone of influence in Waxhaw Creek. The Catawba-Wateree Project is not likely to affect the Carolina heelsplitter population in Waxhaw Creek.

Our Analysis

Improved conditions in regulated reaches as a result of proposed continuous minimum flows and equipment modifications to improve DO below the dams and powerhouses will provide improved habitat conditions for survival of existing mussel populations and potentially could increase habitat available for the Carolina heelsplitter. Fish passage required by the FWS preliminary prescriptions and the Santee River Basin Accord for Diadromous Fish Protection,

Restoration, and Enhancement would eventually provide opportunity for movement of resident glochidia-host fish species upstream, further expanding the potential for range expansion of extant mussel populations.

The distribution, diversity, and abundance of freshwater mussels upstream of the project boundaries are not directly affected by the individual project developments. Furthermore, increased flows to the bypass and regulated reaches would increase and enhance aquatic habitat for both mussels and glochidial host fish. Project operations as proposed are not likely to adversely affect the Carolina heelsplitter.

Shortnose Sturgeon

The Wateree Development is the upstream limit of diadromous fish passage, including the shortnose sturgeon, in the Catawba-Wateree River Basin, and prevents possible upstream spawning opportunities in the Wateree River for the shortnose sturgeon. Shortnose sturgeon utilize portions of the Santee-Cooper system, but are not established in the Catawba-Wateree River above the confluence with the Congaree River. Historic records (Newcomb and Fuller, 2001; DTA and LEI, 2005) document the use of portions of the Catawba-Wateree River at least upstream to the Great Falls by these species.

Our Analysis

The Santee-Cooper Basin Diadromous Fish Passage Restoration Plan and the Final Recovery Plan for the Shortnose Sturgeon provide goals and actions for restoration of the shortnose sturgeon and other anadromous species in the Catawba-Wateree River Basin. These actions are not likely to result in the use of the Wateree regulated river reach by significant numbers of spawning sturgeon. The section18 preliminary fish passage prescriptions submitted by FWS acknowledge that for the life of this license, the passage of sturgeon is not a goal. Rather, FWS's prescriptions call for a sturgeon handling plan for fish captured at passage facilities for American shad and American eels and the release of sturgeon to areas downstream of the Wateree dam.

Our analysis of the Revised CRA and alternative flow recommendations for the Wateree Development (table 39) indicate that the recommended alternatives may have the potential to provide more spawning habitat than the proposed Revised CRA flows. At such time as significant numbers of sturgeon begin to utilize the Wateree regulated reach for spawning and FWS makes prescriptions for sturgeon passage, additional assessment of the relationship of flows and spawning habitat could be performed to determine the appropriate flows to support sturgeon spawning.

Table 39. Summary of weighted useable area analysis for sturgeon spawning based on Revised CRA and alternative flow scenarios recommended by FWS, NOAA Fisheries, and American Rivers/ Coastal Conservation League for the Wateree regulated river reach.

Time period	Flow (cfs)	WUA (ft^2/ 1,000 ft)	CRA			FWS			NMFS, AR/CCL		
			% of Max.	Flow (cfs)	WUA (ft^2/ 1,000 ft)	% of Max.	% change from Revised CRA	Flow (cfs)	WUA (ft^2/ 1,000 ft)	% of Max.	% change from Revised CRA
January	930	7,090	15.7	2,700	27,176	60.1	44.4	2,400	23,363	51.7	36
February 1-14	930	7,090	15.7	3,700	35,155	77.8	62.1	3,700	35,155	77.8	62.1
February 15-29	2,400	23,363	51.7	3,700	35,155	77.8	26.1	3,700	35,155	77.8	26.1
March	2,700	27,176	60.1	3,700	35,155	77.8	17.7	3,700	35,155	77.8	17.7
April	2,700	27,176	60.1	2,700	27,176	60.1	0	2,700	27,176	60.1	0
May 1-15	2,400	23,363	51.7	930	7,090	15.7	-36	2,400	23,363	51.7	0
May 16-31	1,250	9,782	21.6	930	7,090	15.7	-5.9	2,400	23,363	51.7	30.1
Maximum		45,203			45,203				45,203		

The Santee River Basin Accord for Diadromous Fish Protection, Restoration, and Enhancement (effective April 15, 2008) is a cooperative partnership among Duke Energy, South Carolina Electric and Gas, FWS, South Carolina DNR, and North Carolina WRC; NOAA Fisheries and South Carolina DHEC were involved in the development of the accord, but are not signatories. The accord moves to implement a 10-year action plan for diadromous fish in the basin drafted January 24, 2007. Agreements specific to fish passage at the Catawba-Wateree Project are reinforced in the preliminary section 18 prescriptions for fishways pursuant to the FPA issued by FWS (May 23, 2008). In comments on the Ready for Environmental Analysis, NOAA Fisheries concurred with the FWS prescriptions, but reserved its own authority to issue additional prescriptions in the future relative to species within its jurisdiction.

FWS indicates that the prescriptions were developed in concert with Duke Energy and considered alternative designs and approaches to fish passage presented in Duke Energy's *Fish Passage Assessment* (DTA and LEI 2005). We consider the preliminary prescriptions and associated elements of the accord to be part of the license application for the Catawba-Wateree Project. FWS prescribed that any sturgeon collected in the TS&T facility at Wateree dam would not be passed upstream at this time, but would be released at an appropriate downstream location in consultation with the agency. NOAA Fisheries has concluded that progress of restoration for sturgeon is not likely to achieve a stage that would warrant upstream passage prescriptions during the life of the next license; NOAA Fisheries has reserved its authority to prescribe fish passage, which could be invoked should restoration actions be more successful than anticipated. As proposed, project operations would therefore not be likely to adversely affect the shortnose sturgeon.

Wood Stork

As a proactive measure to protect and potentially increase foraging habitat for any wood storks that may use habitat within the Catawba-Wateree Project area, Duke Energy has developed and would implement a species protection plan for wood storks with the issuance of a new licensee (Duke Energy, 2006i). As part of that plan, Duke Energy would maintain communication with FWS and state agencies regarding the presence or potential for nesting and foraging sites within and adjacent to the Catawba-Wateree Project boundaries and zone of operational influence. Duke Energy would enhance wood stork foraging habitat by providing increased flow (duration and magnitude) for inundation of the sloughs and emergent wetlands of the Wateree River flood plain and bottomlands.

To enhance foraging and potential nesting habitat for wood stork, the Wateree Development would be operated such that minimum continuous flows of 2,400 cfs (February 15-29; May 1-15), 2,700 cfs (March 1 to April 30), and 1,250 cfs (May 16-31) are maintained. Operating under this regime would allow two 10-day periods of stable flow releases each spring unless operating in the Low Inflow Protocol or Maintenance and Emergency Protocol modes, or as long as weather and inflow conditions allow. Following periods of high natural inflow between February 1 and May 31 that create spill flow conditions at Wateree dam, Duke Energy proposes to operate the Wateree Development powerhouse to gradually reduce flood plain inundation in the Wateree River regulated reach to approximate natural inflow conditions.

Our Analysis

The proposed flow regime for the Wateree River regulated reach would provide a beneficial extension of the natural seasonal inundation of the Wateree River flood plain providing weather conditions are conducive and flows (natural and regulated) are available. Although the primary reason for implementing the Wateree flood plain inundation is to create and enhance spawning habitat for diadromous fish, inundation of the flood plain will secondarily provide foraging habitat for dispersed post-nesting wood storks and other wading birds. As the inundated area diminishes over time, small fish would be concentrated in remaining shallow areas and pools providing the preferred foraging habitat for wood storks dispersed from coastal nesting areas. Proposed project operations are not likely to adversely affect wood storks that may visit the Wateree River flood plain; instead, some beneficial enhancement of foraging habitat may result from implementation of proposed flow regimes.

American Alligator

Duke Energy has developed a species protection plan for the American alligator that is based upon enhanced flood flow duration and intensity on the Wateree River (Duke Energy, 2006f). As outlined in section 3.3.2.2.1, *Water Quantity*, these flows would result in the inundation of back sloughs and emergent wetlands within the Wateree River flood plain and bottomlands adjacent to the Congaree Swamp National Park, potentially expanding existing habitat for the American alligator into the Wateree River. No other protection measures or monitoring of the American alligator is proposed.

Our Analysis

The flow regime proposed by Duke Energy to increase diadromous fish spawning habitat by way of seasonal inundation of the Wateree flood plain would provide a secondary potential benefit by increasing habitat for the American alligator. Additional food resources would be available from the increase in aquatic habitat for fish, amphibian, and invertebrate populations for foraging alligators, and nesting habitat may become available. In summary, the proposed project operations are not likely to adversely affect American alligators that may use the Wateree River flood plain. Proposed changes in flow regimes may result in enhancement of habitat and forage resources for American alligator in the Wateree River flood plain.

Bog Turtle

Although several bog turtles were documented approximately 12 miles from the Paddy Creek Seismic Remediation Project area during surveys prior to project initiation, literature searches and field surveys have not determined the presence of any preferred habitat, individuals, or populations of bog turtles within the Catawba-Wateree Project area (Dorcas, 2005b).

Our Analysis

Because bog turtles are not known from within the Catawba-Wateree Project boundaries, the proposed operations of the Catawba-Wateree Project outlined in the license application would not affect the species.

3.3.5.3 Unavoidable Adverse Effects

Until RTE species protection plans with associated management guidelines are completely developed and implemented, species would continue to be at risk of adverse effects associated with human activities and disturbance including recreational activities, invasive plant

species encroachment, fluctuating water levels, and flow releases. Schweinitz's sunflower would still be at risk from uncontrollable meteorological events that trigger spillage into the Mountain Island bypassed reach regardless of protection and enhancement measures provided by Duke Energy.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Area of Potential Effects

Section 106 of the NHPA, as amended, requires that the Commission evaluate the potential effects on properties listed or eligible for listing on the National Register. Such properties listed or eligible for listing on the National Register are called historic properties. In this case, the Commission must take into account whether any historic property could be affected within the project's APE. The Catawba-Wateree Project's APE encompasses areas directly affected by project operations, including lands within the project boundaries (areas at or below full pond contour, licensee-owned islands in the reservoirs, access areas owned by Duke Energy, and land around the powerhouses and dams) and lands along the regulated river reaches downstream from the project. No federal or tribal lands are located within the APE. The CIN reservation adjoins the APE downstream of the Wylie Development along the Wylie regulated river reach.

The APE for the Catawba-Wateree Project was defined in consultation with the Cultural Resources Resource Committee (Cultural Committee). The Cultural Committee was formed to work closely with Duke Energy in both the preparation of the study plans and the selection of consultants to conduct the studies, and provide technical review of study reports. The Cultural Committee included representatives from the North Carolina SHPO, South Carolina SHPO, CIN THPO, EBCI, South Carolina DPRT, South Carolina DNR, FWS, and the University of South Carolina.

Cultural Resource Investigations

As part of Duke Energy's licensing efforts, the following cultural resource surveys and studies have been conducted within and adjacent to the project's APE:

- Brockington and Associates, Inc. 2006. *Historic properties management plan for the Catawba-Wateree Hydroelectric Project (FERC #2232) North and South Carolina*. Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina by Brockington and Associates, Inc., Raleigh, North Carolina.
- Cleveland, M. Todd, and Jeffrey L. Holland. 2004. *National Register of Historic Places Assessment for the Catawba-Wateree Hydroelectric Project, Bridgewater, Rhodhiss, Oxford, Lookout Shoals, Cowans Ford, and Mountain Island Developments, North Carolina.* Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina by TRC, Columbia, South Carolina.
- Cleveland, M. Todd, Jeffrey L. Holland, and Ruth D. Nichols. 2004. *National Register of Historic Places Assessment for the Catawba-Wateree Hydroelectric Project, Wylie, Fishing Creek, Great Falls–Dearborn, Rocky Creek–Cedar Creek, and Wateree Developments, South Carolina.* Submitted to Duke Power, Division of

Duke Energy Corporation, Charlotte, North Carolina by TRC, Columbia, South Carolina.

- Green, William. 2004. *Phase II archaeological testing at Site 38CS321, Fishing Creek Lake, Chester County, South Carolina.* Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina by TRC, Columbia, South Carolina.
- Hargrove, Thomas. 1997a. An archaeological survey of the proposed Lake Pointe South Project, Sherrill's Ford Vicinity, Lake Norman, Catawba County, North Carolina. Archaeological Research Consultants, Inc., Raleigh. Crescent Resources, Charlotte.
- Hargrove, Thomas. 1997b. An archaeological survey of the Pointe Development, Brawley School Road, Lake Norman, Iredell County, North Carolina. Archaeological Research Consultants, Inc., Raleigh. Crescent Resources, Charlotte.
- Hargrove, Thomas. 1999. An archaeological survey of the proposed Northview Harbor Development, Lake Norman, Catawba County, North Carolina. Archaeological Research Associates, Inc., Raleigh. Submitted to Crescent Resources, Charlotte.
- Joy, Deborah. 2004. Cultural resource context for the Catawba-Wateree Hydroelectric Project. Submitted to Duke Power, a Division of Duke Energy Corporation, Charlotte, North Carolina by Legacy Research Associates, Inc., Durham, North Carolina.
- Louis Berger Group (LBG). 2000a. GIS database and maps for the Catawba-Wateree Hydroelectric Project, Alexander, Burke, Cabarrus, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, McDowell, Mecklenberg, Rowan, Rutherford, and Watauga Counties, North Carolina and Chester, Fairfield, Kershaw, Lancaster, and York Counties, South Carolina. Appendix C, Parts 3 and 4 (Restricted Access) of Duke Power shoreline management plan update for the Catawba-Wateree Hydro Project (FERC No. 2232). Submitted to the Federal Energy Regulatory Commission, Washington, DC by Duke Power, A Division of Duke Energy Corporation, Group Environment Health & Safety Department, Lake Management, Charlotte, North Carolina.
- LBG. 2000b. Cultural resources context for the Catawba-Wateree Hydroelectric Project, Alexander, Burke, Cabarrus, Caldwell, Catawba, Cleveland, Gaston, Iredell, Lincoln, McDowell, Mecklenberg, Rowan, Rutherford, and Watauga Counties, North Carolina and Chester, Fairfield, Kershaw, Lancaster, and York Counties, South Carolina. Appendix C, Part 2 of Duke Power shoreline management plan update for the Catawba-Wateree Hydro Project (FERC No. 2232). Submitted to the Federal Energy Regulatory Commission, Washington, DC by Duke Power, A Division of Duke Energy Corporation, Group Environment Health & Safety Department, Lake Management, Charlotte, North Carolina.
- LBG. 2001. *Duke Power shoreline management plan update for the Catawba-Wateree Hydro Project (FERC No. 2232).* Submitted to the Federal Energy

- LBG. 2002. *Predictive model for historic and archaeological site location*. Developed for Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina by the Louis Berger Group, Inc., Cary, North Carolina.
- Millis, Heather. 2004. *Cultural resources survey for the Catawba-Wateree Hydroelectric Relicensing Project, Alexander, Burke, Catawba, Gaston, Iredell, Lincoln, McDowell, and Mecklenberg Counties, North Carolina*. Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina by TRC, Columbia, South Carolina.
- Norris, Sean. 2004. *Cultural resources survey for the Catawba-Wateree Hydroelectric Project, Chester, Fairfield, Kershaw, Lancaster and York Counties, South Carolina*. Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina, by TRC, Columbia, South Carolina.
- Tibbetts, Rachel, and Bobby Southerlin. 2003a. Archaeological shoreline survey at Lake James, Burke and McDowell Counties, North Carolina. Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina, by Brockington and Associates, Inc., Raleigh, North Carolina.
- Tibbetts, Rachel, and Bobby Southerlin. 2003b. Archaeological shoreline survey at Lake Norman, Catawba, Iredell, Lincoln, and Mecklenberg Counties, North Carolina. Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina by Brockington and Associates, Inc., Raleigh, North Carolina.
- Tibbetts, Rachel, and Bobby Southerlin. 2003c. *Archaeological shoreline survey at Fishing Creek Lake, Chester and Lancaster Counties, South Carolina*. Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina by Brockington and Associates, Inc., Raleigh, North Carolina.
- Whitley, Thomas G. and David S. Leigh. 2005. *Evaluation of the natural and cultural impacts at the Mulberry Site (38KE12), Kershaw County, South Carolina*. Submitted to Duke Power, Division of Duke Energy Corporation, Charlotte, North Carolina by Brockington and Associates, Inc., Atlanta, Georgia.

Archaeological Resources

The APE of the Catawba-Wateree Project contains six archaeological sites that are considered eligible for inclusion in the National Register. Four of the eligible archaeological sites are located in Chester County while the remaining sites are located in York and Lancaster Counties, South Carolina. These resources were discovered and assessed through a series of investigations conducted within the project's APE.

A total of 20 sites are considered potentially eligible within the Catawba-Wateree developments. Nine sites are located within the Cowans Ford Development. None of the sites within the Lake Norman Development are actively eroding, but monitoring was recommended, as each will be preserved in place. Two sites are located within the Great Falls and Dearborn Developments. Both sites are stable and would be preserved in place and monitored. The

Fishing Creek Development features two potentially eligible sites. One is threatened by looting, while the second site is eroding. Four potentially eligible sites are found in the Cedar Creek Development. Of the sites located in the Cedar Creek Development, three sites would be preserved in place, while the remaining site is eroding. One site in the Wylie Development is actively eroding, necessitating mitigation. The remaining two potential eligible sites are located in the Wateree Development and would require monitoring, as there is potential for erosion.

Site 38CS235, located on Courtney Island in the Fishing Creek Development, consists of a Native American mound (Tibbetts and Southerlin, 2003c). CIN considers the site sacred. It is assumed to contain human remains. The site has been extensively looted in the past and was, in fact, being actively looted at the time of survey. Duke Energy and CIN began cooperative management efforts of the site in 2000 when both parties entered into a memorandum of agreement regarding the site. CIN THPO undertook an intensive effort to stabilize the mound site, assess the extent of the resource, and implement site-monitoring activities. Duke Energy supplemented these efforts by hiring security patrols for the site. These patrols have been in place since 2003. Both CIN THPO and Duke Energy deem that, as the site is well known to artifact collectors, it will continue to be at risk of looting for the term of the new license.

The Dearborn Armory Site (38CS307) is located on Dearborn Island, also known as Big Island, in the Cedar Creek and Rocky Creek Developments. The site was originally constructed in the early nineteenth century as one of three national armories. It was in service for less than 30 years before being abandoned (Tibbetts and Southerlin, 2003c). In 2002, Duke Energy granted access to the South Carolina Institute of Archaeology and Anthropology to evaluate the armory site. The results of this evaluation indicate that the site is eligible for the National Register. The incorporation of this site in a new state park is a goal for a number of groups including the South Carolina DPRT and the town of Great Falls.

Sites 38CS321 and 38CS339 were located during the 2002 and 2004 shoreline and island surveys conducted in support of the Catawba-Wateree Project (Green, 2004; Tibbetts and Southerlin, 2003c). Site 38CS321, located in the Fishing Creek Development, is an actively eroding Woodland/Mississippian Period occupation site, while site 38CS339, located in the Rocky Creek and Cedar Creek Developments, is a prehistoric occupation dating to the Early and Middle Archaic Periods and also features Nineteenth Century components. These sites are considered eligible for the National Register.

Site 38KE12 consists of a significant Native American mound complex and the Mulberry Plantation National Historic Landmark. The site is located within the APE, but outside of the project boundary along the Catawba River. The Native American component of the site consists of a village and an associated complex of mounds. The mounds are thought to represent the location of Cofitachequi (or possibly Talimeco), a significant Native American occupation in the region. Mulberry Plantation possesses significance as a National Historic Landmark as the most important site associated with the writing of Mary Boykin Chesnut's remarkable first-hand account of southern society during the Civil War. Historians have long recognized the journal's value as a source of information concerning the people and events of the war and life during the period. The diary contributes toward understanding one of the most important events in America's history.

Sites 38YK427 and 38LA475 were identified in 2004 during the Phase I survey of islands within the project (Norris, 2004). Site 38YK427, located in the Wylie Development, is a very

dense scatter of Archaic through Woodland Period artifacts that potentially could represent a lithic tool workshop, while 38LA475, located in the Wateree Development is a deeply buried site containing artifacts dating to the Late Woodland Period. Both sites were either actively eroding or susceptible to erosion.

Historical Resources

The Catawba-Wateree Project features a total of 13 developments. A majority of the dam and powerhouse facilities associated with each of the developments are eligible for listing on the National Register.

Based on prior research conducted in accordance with 36 C.F.R. § 60.4, the Bridgewater,[14] Rhodhiss, Oxford, Lookout Shoals, and Mountain Island Developments were recommended eligible for the National Register under criteria A and C. The significance of the pre-1930 Duke Catawba-Wateree developments in North Carolina lies in the fact that they retain the distinctive characteristics of their types and uses, illustrating and representing their historic time period and cultural associations. The developments have undergone minimal alteration and retain historic integrity. Alterations to the facilities have included installation of modern controls, changes made for safety reasons, Commission-mandated upgrades for flood control, and upgrades of generating and transmission equipment. Their continued operations illustrate the historical associations for which they are significant. Operational maintenance of the developments has preserved their integrity, and they remain good examples of their types (Cleveland and Holland, 2004).

Cowans Ford Development was recommended but found to be ineligible for the National Register due to its more recent age. Criterion Consideration G of the National Register assessment process states that resources less than 50 years old that possess exceptional significance are eligible for listing. However, the Cowans Ford Development does not meet the standards set forth in Criterion Consideration G. It was recommended, however, that Duke Power reassess the eligibility of Cowans Ford after it becomes 50 years old (Cleveland and Holland, 2004).

Additional National Register assessment of developments Wylie, Fishing Creek, Great Falls, Dearborn, Rocky Creek, Cedar Creek, and Wateree, in South Carolina, was undertaken in 2006. Similar to the North Carolina developments, those in South Carolina were recommended eligible for the National Register under criteria A and C. The Duke Catawba-Wateree developments in South Carolina were typical of the level of engineering and technology available between 1907 and 1926, and these developments were not the first of their kind. Although Great Falls and Rocky Creek were early examples of hydroelectric facilities, they did

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[14] On September 11, 2007, Duke Energy proposed to remove and replace the existing Bridgewater powerhouse in conjunction with the Bridgewater Seismic Stability Project. It was determined that in order to strengthen the Linville dam, the Bridgewater powerhouse, adjacent to the dam, must be demolished and reconstructed 200 meters downstream. Because the modifications would adversely affect the Bridgewater powerhouse, a facility determined eligible for listing in the National Register, a Memorandum of Agreement (MOA) was executed between the Commission and the North Carolina SHPO on June 10, 2008. The stipulations of the MOA appropriately mitigated for any adverse effects that resulted from the removal of the powerhouse.

not employ groundbreaking methods of construction or utilize unique types of equipment. However, their significance lies in the fact that they retain the distinctive characteristics of their types and uses, illustrating and representing their historic time period and cultural association. The developments in South Carolina featured many of the qualities of integrity and significance possessed by the developments in North Carolina. All seven developments were recommended eligible for the National Register (Cleveland et al., 2004).

Traditional Cultural Properties

Although traditional cultural properties have not been formally recorded in either project's APE, both Duke Energy and the Commission have invited interested tribes to participate in the relicensing process.

CIN and EBCI have been integral parts of the Cultural Committee. As members of the Cultural Committee, CIN and EBCI have collaborated in the development of the HPMP and expressed interest in archaeological site management, management of inadvertent discoveries of human remains or Native American burials, and curation.

Additionally, Duke Energy and CIN began cooperative management efforts of the site in 2000 when both parties entered into a memorandum of agreement regarding site 38CS235, a Native American mound located on Courtney Island in the Fishing Creek Development. CIN THPO has undertaken intensive stabilization, assessment, and monitoring efforts to protect a property important to them.

3.3.6.2 Environmental Effects

Historic Properties Management Plan

Duke proposes to protect historic properties within the APE by implementing the HPMP and any PA developed for the project. In consultation with the Cultural Committee, the *Historic Properties Management Plan for the Catawba-Wateree Hydroelectric Project (FERC #2232) North and South Carolina* was developed in 2006 to provide a framework to manage cultural resources within the project's APE (Brockington and Associates, Inc., 2006). The goals specified in the HPMP for the Catawba-Wateree Project are consistent with the goals of the NHPA and its implementing regulations (36 C.F.R. Part 800). These goals include:

- identifying historic properties located within the APE and the FERC project boundaries;
- ensuring that planning for all proposed activities within the FERC project boundaries considers the effects of the activities on historic properties from the earliest stage of the planning process;
- preserving, protecting, and interpreting historic properties within the APE and the FERC project boundaries; and
- ensuring that conflicts among project operations, land management needs, and historic properties are resolved within the context of the Advisory Council on Historic Preservation's regulations (36 C.F.R. Part 800: Protection of Historic Properties; as revised August 5, 2004) for compliance with the NHPA.

In letters filed April 9, 2007, and April 23, 2008, the South Carolina and North Carolina SHPOs, respectively, concurred with the HPMP's findings and recommendations. On June 5, 2008, the CIN concurred with the HPMP's findings and recommendations.

In the letter filed June 4, 2008, BIA recommended that Duke Energy be required to consult with CIN and BIA in the development and execution of the HPMP.

Our Analysis

Continued operation of the Catawba-Wateree Project would maintain the historic facilities at this project in productive use for the purpose for which they were originally designed and built, and would, therefore, be beneficial. However, operating the project under the protections afforded by section 106 does not ensure that there would be no adverse effects. Adverse effects may occur to licensed historic project features due to repairs and modifications that, while necessary for the continued safe and efficient operation of these projects, are not in keeping with the projects' historic character. While adverse effects on historic properties may be acceptable because of the need to continue operating the projects safely and efficiently, they should nevertheless be taken into account. Also, there may be undiscovered historic properties in the APE that could be adversely affected by future changes in project operation or by project-related activities.

As a provision of the HPMP, site-specific management plans have been developed to avoid, lessen, or mitigate any adverse effects on eligible or potentially eligible archaeological sites listed in section 3.3.6.1, *Affected Environment, Archaeological Resources* . When future site evaluations are conducted, the HPMP would be revised to reflect changes in site location and determination of National Register eligibility. Also, the HPMP includes principles and procedures to respond to accidental discovery of cultural resources during project operations. Such principles and procedures would ensure that cultural resources are accorded proper treatment, and, as appropriate, protection, over the term of the license.

The HPMP was developed as a cooperative effort between Duke Energy and the Cultural Committee. Because the Cultural Committee included representatives from state agencies as well as regional Native American tribes, including the CIN, which has concurred with the mitigation plans outlined in the HPMP, BIA is not needed to represent the tribe's interests.

In addition to the management of archaeological sites, all but one of the hydroelectric developments of the Catawba-Wateree Project have been determined eligible for the National Register. Duke Energy intends to manage all of the historic hydroelectric structures found to be eligible for the National Register with the goal of ensuring that the facilities retain their historically significant features. The HPMP would provide principals and procedures to address any major changes to the properties, such as partial or total removal of buildings or structures. Additionally, the HPMP delineates actions listed as a Categorical Exclusion, which are necessary for the operation of the development, but do not require consultation with the SHPOs.

As part of its obligation under section 106, the Commission plans to execute a PA that incorporates the HPMP with the North Carolina and South Carolina SHPOs, and affords the Advisory Council on Historic Preservation a reasonable opportunity to comment. Duke Energy, CIN THPO, and the EBCI, would be invited to participate in the PA as concurring parties. If a license is ultimately issued, the PA would be incorporated into the license by reference.

Cowans Ford

Only 45 years has passed since the completion of Cowans Ford, making it ineligible for the National Register. Criterion Consideration G of the National Register assessment process states that resources less than 50 years old that possess exceptional significance are eligible for listing. However, the *National Register of Historic Places Assessment for the Catawba-Wateree Hydroelectric Project Bridgewater, Rhodhiss, Oxford, Lookout Shoals, Cowans Ford, and Mountain Island Developments, North Carolina*, report recommended that Duke Energy reassess the eligibility of Cowans Ford after it becomes 50 years old (Cleveland and Holland, 2004). On May 17, 2005, North Carolina SHPO stated that they concur that the Cowans Ford Development should be reassessed after it is 50 years old.

Our Analysis

Even though the Cowans Ford Development is ineligible for the National Register due to its more recent age, it was the largest of the developments and the last to be constructed, thereby completing the build-out of the river begun in 1900. It followed a different design, had a much larger capacity than the other developments, and was built in the post-World War II, modern era, which places it in a different context than the neighboring developments. However, the cultural impact of the development is congruent with the surrounding facilities. Therefore, at 50 years of age Cowans Ford would likely meet the standards set under Criteria A and C, and we agree that reassessment occur at that point.

Sites 38CS321, 38CS339, and the Mulberry Site

Phase I and II archaeological investigations at Site 38CS321 revealed that it contains components from the Late Woodland Period, Uwharrie phase occupation and a Mississippian Period, Pee Dee phase component. There also may be a Middle Woodland, Yadkin phase component as well, but this has not been firmly established. The site retains only a moderate degree of integrity, but because so little is known about the Late Woodland and Mississippian periods of the area, the site offers a rare opportunity to enhance knowledge of these poorly understood time periods. Based on this, Site 38CS321 is recommended eligible for inclusion in the National Register. Similarly, Site 38CS339 is an Early to Late Archaic and nineteenth century site located on a flood plain on the east side of Big Island. Artifacts were recovered from deeply buried deposits. Therefore, Phase II testing was recommended to determine the National Register eligibility of this potentially significant site.

Both sites are either actively eroding or susceptible to erosion associated with lake level fluctuation and wave action. Impact avoidance is not feasible for these sites, as site protection/stabilization efforts pose a significant challenge. Therefore, to offset the adverse effects to these sites, a plan has been developed to maximize mitigation resources.

Duke Energy, in consultation with the South Carolina SHPO and CIN THPO, proposes that the project-related effects of Sites 38CS321 and 38CS339 can be mitigated at a more significant site, the Mulberry Site (38KE12). The Mulberry Site is located adjacent to the Wateree River approximately 9 miles downstream of the project outside the FERC project boundaries, but within the APE of the project. The site has been eroding since its abandonment by Indian occupants in the 1500s. This site has the potential to answer questions about the complex pre-contact societies in South Carolina. Therefore, Duke Energy would provide funding for 3 years to support data recovery efforts at Mound A of the Mulberry Site in

accordance with the Revised CRA.[15] The Cultural Committee agrees with Duke Energy's proposal to mitigate project effects at Sites 38CS321 and 38CS339 through additional archaeology at the Mulberry Site.

Our Analysis

The Mulberry Site was a significant political center for Native Americans in the region as late as the 17th century. Historical documents support the site's significance, indicating the village was visited on several occasions by European explorers Hernando de Soto and Juan Pardo. Section 106 does not require that all adverse effects be lessened, avoided, or mitigated. However, all parties must agree that the resources could be better used to mitigate a more significant site in lieu of other resources. Therefore, because of the weight of its prehistoric and early historic significance, mitigation efforts would be better utilized at the Mulberry Site rather than Sites 38CS321 and 38CS339. Because this mitigation plan extends over a limited time period (3 years) and does not represent ongoing maintenance of Site 38KE12, it is unnecessary to change the project boundaries to include the Mulberry Site.

Land Leases

Duke Energy offered to lease an island containing an historic gravesite to the North Carolina DPR for management as part of Lake James State Park. Duke Energy also offered to lease sites 38LA467, 38LA468, 38LA469, 38LA470, 38LA471, 38LA473, 38LA474 to South Carolina DPRT for the term of the any new license and require a management plan for these sites in consultation with CIN THPO and South Carolina DAH. The sites and the historic gravesite are not eligible for the National Register.

Our Analysis

Duke Energy's proposal to offer a lease to various agencies would force a contract between two parties. This would be outside the Commission's authority; however, Duke Energy could pursue these measures as a non-license article measure since these measures would provide protection to these sites.

3.3.6.3 Unavoidable Adverse Effects

None.

3.3.7 Recreational Resources

3.3.7.1 Affected Environment

Regional Recreational Resources

The recreation use and needs study conducted during relicensing considered regional recreational opportunities within the regional impact zone, or the area within 40 to 50 miles of the Catawba-Wateree Project that is within about an hour's drive from the project. Recreational resources within this zone provide a full range of activities, including boating, canoeing,

[15] In the event that the funding support for work at the Mulberry site does not occur for any reason, Duke would revise the management plan for Sites 38CS321 and 38CS339 in consultation with South Carolina SHPO and CIN THPO and incorporate the revised plan in the HPMP.

swimming, fishing, hiking, camping, hunting, mountain biking, horseback riding, and wildlife viewing. The lakes and reservoirs in the region, which include the project reservoirs, provide a variety of recreational opportunities and varying levels of developed facilities for camping and day-use activities. Boat launches in the area provide opportunities for motorized boat use.

Three federal agencies operate recreational facilities within the region, the Forest Service, FWS, and Park Service. The Forest Service operates the Pisgah, Uwharrie, and Nantahala National Forests in North Carolina and the Sumter National Forest in South Carolina. These forests offer opportunities for hiking, camping, horseback riding, hunting, boating, off-highway vehicle use, fishing, picnicking, and mountain biking. Additionally, the Uwharrie National Forest has opportunities for gold panning and rock hounding. Two notable features pass through the Pisgah National Forest, the Appalachian Trail and the Pisgah Loop Scenic Byway, managed by the North Carolina Department of Transportation (North Carolina DOT).

The FWS operates the Pee Dee National Wildlife Refuge in Anson and Richmond Counties, North Carolina and the Carolina Sand Hill National Wildlife Refuge in Chesterfield and Darling Counties, South Carolina. These wildlife refuges provide opportunities for hiking, hunting, fishing, picnicking, wildlife viewing, and interpretive and educational programs.

The Park Service operates the Congaree Swamp National Park, Cowpens National Battlefield, and Kings Mountain National Military Park in South Carolina. These Park Service areas provide opportunities for camping, hiking, boating, horseback riding, auto touring, fishing, picnicking, wildlife viewing, environmental education, museum visitation, and historic interpretation. Also, the Park Service operates the Blue Ridge Parkway, which travels through Virginia and North Carolina and is located about 20 miles from the project's Bridgewater Development (Lake James), and the Overmountain Victory National Historic Trail, which travels through North Carolina, South Carolina, Tennessee, and Virginia. Portions of the Overmountain Victory National Historic Trail are located in the project area.

North Carolina state agencies provide recreational opportunities in the region surrounding the project. In addition to managing gamelands, North Carolina WRC operates 11 boat access areas in the region outside of the Catawba-Wateree system on the South Yadkin River, Yadkin River, High Rock reservoir, Tuckertown reservoir, Narrows reservoir, Lake Tillery, and the Pee Dee River. North Carolina DPR manages seven state parks in the region that are outside of the Catawba-Wateree system, including Mount Mitchell, Mount Jefferson, New River, Stone Mountain, Morrow Mountain, South Mountains, and Crowder's Mountain. These state parks offer opportunities for hiking, mountain biking, picnicking, horseback riding, camping, boating, fishing, swimming, and environmental education. A portion of the more than 800-mile Mountains to Sea Trail and the French Broad River Trail are notable trails in the project region.

South Carolina DPRT manages 11 state parks within the project region, including Kings Mountain, Chester, Dreher Island, Sesquicentennial, Poinsett, Woods Bay, Lee, Goodale, Cheraw, Landsford Canal, and Andrew Jackson. Recreational opportunities within these state parks generally include swimming, boating, fishing, hiking, picnicking, horseback riding, camping, lodging, golf, tennis, and interpretive programs. There also are three South Carolina state forests within the region, Harbison, Manchester, and Sand Hills, that offer opportunities for fishing, hiking, canoeing, picnicking, hunting, mountain biking, and off-highway vehicle use.

Additionally, counties, local governments, and the private sector in both North Carolina and South Carolina provide additional recreational opportunities in the region surrounding the

project that are generally tailored to the local population. Facilities typically include parks with walking trails, athletic fields, playgrounds, and picnic areas; commercial marinas; campgrounds; golf courses; and amusement parks.

A number of other major lakes and reservoirs in the region provide a variety of recreational opportunities. Major lakes and reservoirs within 40 to 50 miles of the project include Watauga Lake, Wilkesboro reservoir, High Rock reservoir, Tuckertown reservoir, Narrows reservoir, Falls reservoir, Lake Tillery, Blewett Falls reservoir, Lake Lure, Lake Adger, and Moss Lake in North Carolina; and Monticello reservoir, Parr reservoir, Lake Murray, and Lake Marion in South Carolina.

Project Recreational Facilities

Project Boundary

The existing project boundary generally includes the area within full pond elevation of the project reservoirs and the land immediately surrounding the dams and powerhouses. Existing public recreation access areas that provide access to the project and are owned by Duke Energy are included in the project boundary, but portions of the existing Duke Energy-owned project recreation access areas may lie partially outside the boundary. For non-Duke Energy-owned recreation access areas, portions of the recreation access areas that extend beyond the normal full pond elevation of the reservoir lie within the project boundary. For example, Lake Norman State Park includes boat ramps and a courtesy dock on Lake Norman that extend below the normal full pool elevation of the reservoir and are therefore within the project boundary (i.e., extend below the full pond elevation) while the parking area and other facilities likely lie outside the project boundary (i.e., located above the full pond elevation).

Overview of Project Recreational Facilities

There are 86 public recreation access areas located adjacent to the reservoirs, tailraces, bypassed reaches, and regulated river reaches of the Catawba-Wateree Project that provide access to the project, including 59 Duke Energy-owned public access areas and 27 access areas owned and managed by state, county, or local government or non-profit organizations (see tables 40 through 49). These public recreation access areas provide 140 boat ramps, 65 courtesy docks, 31 fishing piers, 3 swimming areas, 21 picnic areas, and 4 camping areas. Duke Energy has an Access Area Maintenance Agreement that expires in 2008 with North Carolina WRC whereby Duke Energy pays North Carolina WRC to maintain boating access facilities (boat ramps, courtesy docks, parking areas, and lighting) at most Duke Energy-owned public recreation access areas located in North Carolina.

In addition to the public recreation sites described above, as part of its relicensing studies, Duke Energy identified 39 commercial public marinas and campgrounds that also provide visual or recreational access to the project. As commercial recreation areas, these sites are generally available to the public for a fee. The Upper Catawba River Trail is a state designated river trail that is an 82-mile water route for non-motorized boats that extends from the Black Bear Access Area on Lake James to the Lookout Shoals Access Area on Lookout Shoals Lake.

Bridgewater Development

The Bridgewater Development includes Lake James. At a full pond elevation of 1,200 ft msl, Lake James has a surface area of 6,754 acres and 149 miles of shoreline. There is also a regulated river reach downstream of Lake James. Five public recreation areas provide direct

access to Lake James (figure 19 and table 40). There are major recreational facilities at all of these public recreation areas, including 13 boat ramps, 6 courtesy docks, a fishing pier, a swim area, 18 campsites, a picnic area, and 4.5 miles of trails. Lake James State Park is a 3,067-acre state park owned and operated by the State of North Carolina located in the central portion of Lake James. The park provides a number of the recreational opportunities described above including the fishing pier, swim area, campsites, picnic area, and hiking trails. There are also three commercial marinas and campgrounds that provide direct access to Lake James.

Five public recreation access areas are located along the regulated river reach downstream of Lake James (figure 20 and table 40). There are major recreational facilities at four of these public recreation areas, including three canoe launches, a canoe portage around Linville dam, four fishing piers, two picnic areas, bank fishing, and almost 13 miles of trails. Four of these public recreation areas are municipal-owned and managed. These include the Watermill Road canoe access that is owned by the town of Glen Alpine, North Carolina, and three multi-use public recreation areas (Greenlee Ford, River Village, and Catawba Meadows Parks) that are part of the Morganton Greenway owned and managed by the city of Morganton, North Carolina.

Duke Energy owns slightly more than one-half of the project-related recreational facilities at the Bridgewater Development; however, these are managed by North Carolina DENR (North Carolina DPR) or by North Carolina WRC.

Table 40. Recreational facilities at the Bridgewater Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Lake James		
Black Bear	Duke Energy/North Carolina WRC	six concrete boat ramps, three courtesy docks, large paved parking area, six ADA-compliant parking spaces
Lake James State Park	State of North Carolina/North Carolina DENR (North Carolina DPR)	1 ADA-fishing pier, large paved parking area, 1 swim beach, 18 campsites, picnic tables, 4.5 miles of trails, 1 restroom/shower
Hidden Cove	Duke Energy/North Carolina DENR (North Carolina DPR)	two concrete boat ramps, one courtesy dock, small parking area, one vault toilet, one ADA-compliant toilet, and one ADA-compliant parking space
Canal Bridge	Duke Energy/North Carolina DENR (North Carolina DPR)	three concrete boat ramps, one courtesy dock, large parking area, flush toilets, five ADA-compliant parking spaces, two ADA-compliant toilets
Linville	Duke Energy/North Carolina WRC	two concrete boat ramps, one courtesy dock, large paved parking area, bank fishing, two ADA-compliant parking spaces

Site name	Owner/manager	Facilities
Bridgewater Regulated River Reach		
Bridgewater Access Area	Duke Energy /North Carolina WRC	includes canoe portage take-out on Lake James and canoe put-in below the tailrace of the dam and a public fishing area, bank fishing, small parking area, one ADA-compliant fishing pier, one ADA-compliant parking space
Watermill Road Canoe Access	Town of Glen Alpine, North Carolina	canoe launch, small parking area, picnic table
Morganton Greenway - Greenlee Ford Park	City of Morganton, North Carolina	canoe launch, one fishing pier, bank fishing, moderate-sized paved parking area, playground, flush toilets, picnic tables and shelters, 4.25 miles of trail
Morganton Greenway - River Village Park	City of Morganton, North Carolina	canoe launch, 2 fishing piers, large paved parking area, 2 flush toilets, 14 ADA-compliant parking spaces, 4.25 miles of trails (paved/wooden)
Morganton Greenway - Catawba Meadows Park	City of Morganton, North Carolina	baseball field, moderate-sized parking area, 4.25 miles of trail

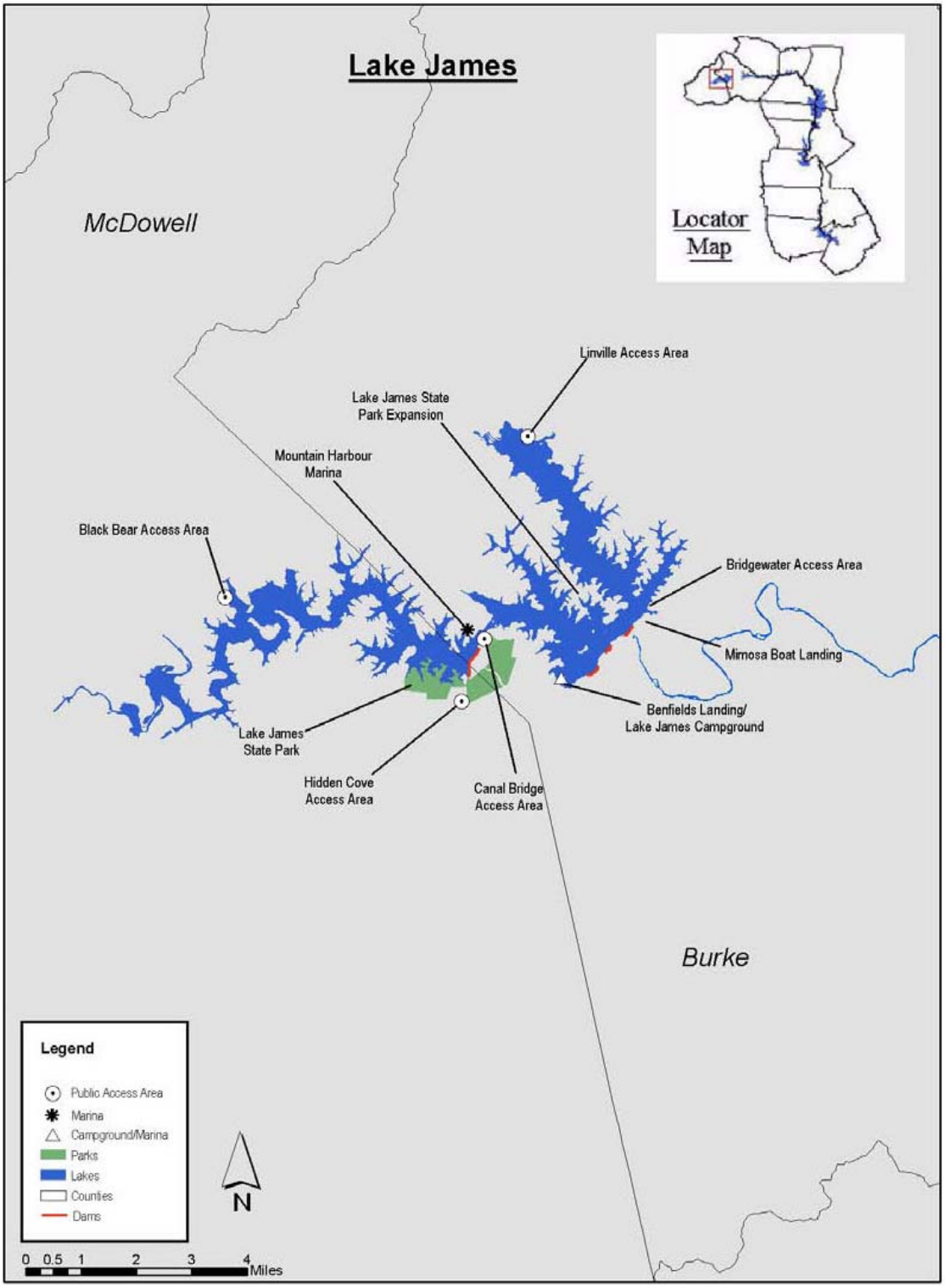

Figure 19. Catawba-Wateree Project (P-2232) Bridgewater Development recreational facilities (Source: Duke Energy, 2007).

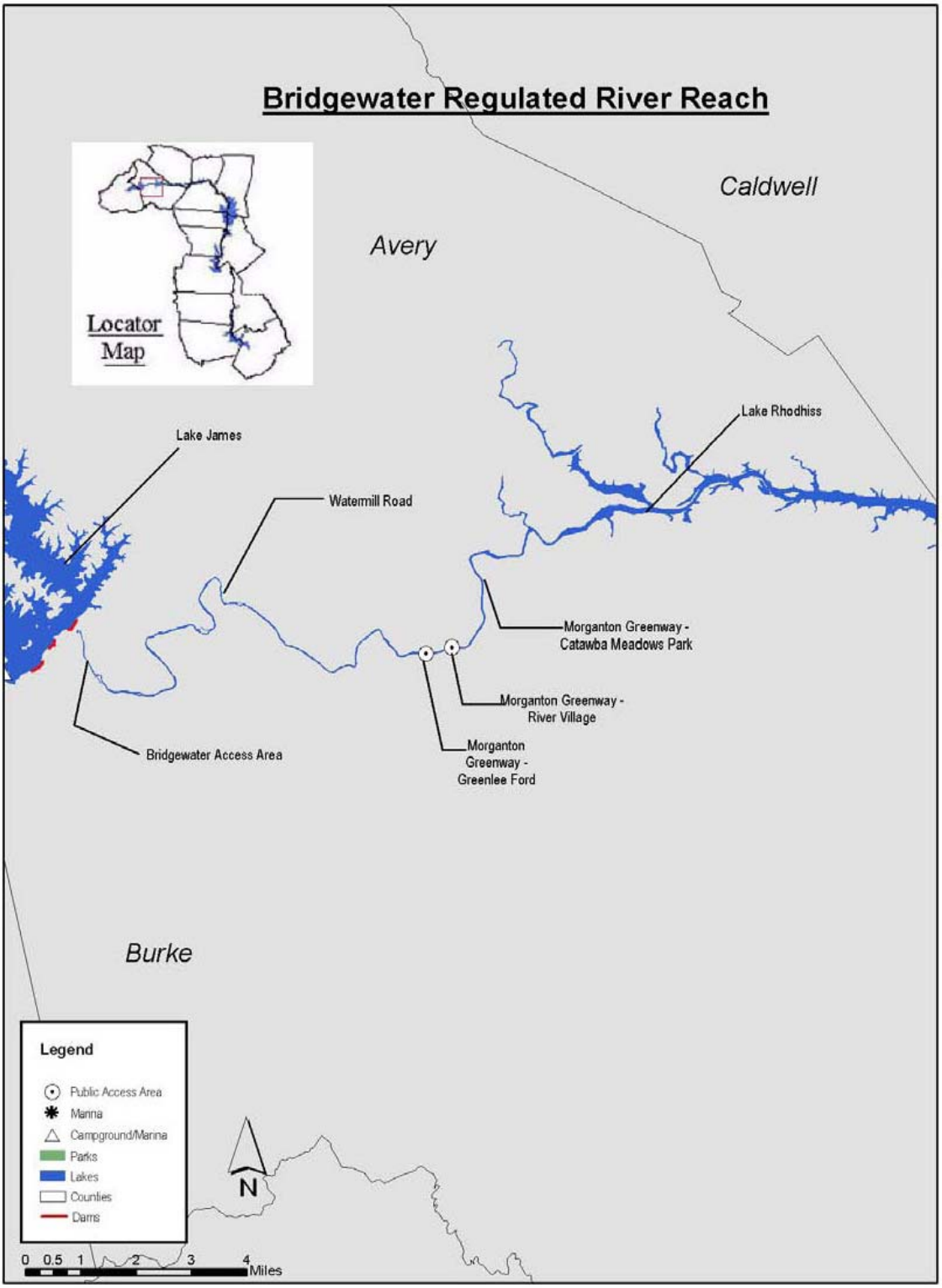

Figure 20. Catawba-Wateree Project (P-2232) Bridgewater regulated river reach recreational facilities (Source: Duke Energy, 2007).

Rhodhiss Development

The Rhodhiss Development includes Lake Rhodhiss and the Rhodhiss tailrace. At a full pond elevation of 995.1 ft msl, Lake Rhodhiss has a surface area of 2,724 acres and 95.5 miles of shoreline. There are six public recreation areas on Lake Rhodhiss (figure 21 and table 41). Five of these public recreation areas have major recreational facilities including 11 boat ramps, 6 courtesy docks, a canoe portage around the dam, and a fishing pier. There is also one commercial marina on Lake Rhodhiss. There are no additional public recreation areas at the Rhodhiss Development.

Duke Energy owns all of the project-related recreational facilities at the Rhodhiss Development; however, four of these are managed by North Carolina WRC and another, the Sawmills Veterans Memorial Park, is managed by the town of Sawmills, North Carolina, with North Carolina WRC managing its boating access facilities.

Table 41. Recreational facilities at the Rhodhiss Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Lake Rhodhiss		
Johns River	Duke Energy/North Carolina WRC	one boat ramp, one courtesy dock, small parking area
Huffman Bridge	Duke Energy/North Carolina WRC	bank fishing, small parking area
Castle Bridge	Duke Energy/North Carolina WRC	six boat ramps, three ADA-compliant courtesy docks, large paved parking area, six ADA-compliant parking spaces
Conley Creek/Sawmills Veterans Memorial Park	Duke Energy/North Carolina WRC and Town of Sawmills	two boat ramps, one ADA-compliant courtesy dock, one fishing pier, large paved parking area, two ADA-compliant parking spaces
Rhodhiss	Duke Energy/North Carolina WRC	two boat ramps, one ADA-compliant courtesy dock, large paved parking area, four ADA-compliant parking spaces
Rhodhiss Canoe Portage	Duke Energy	canoe portage around the dam

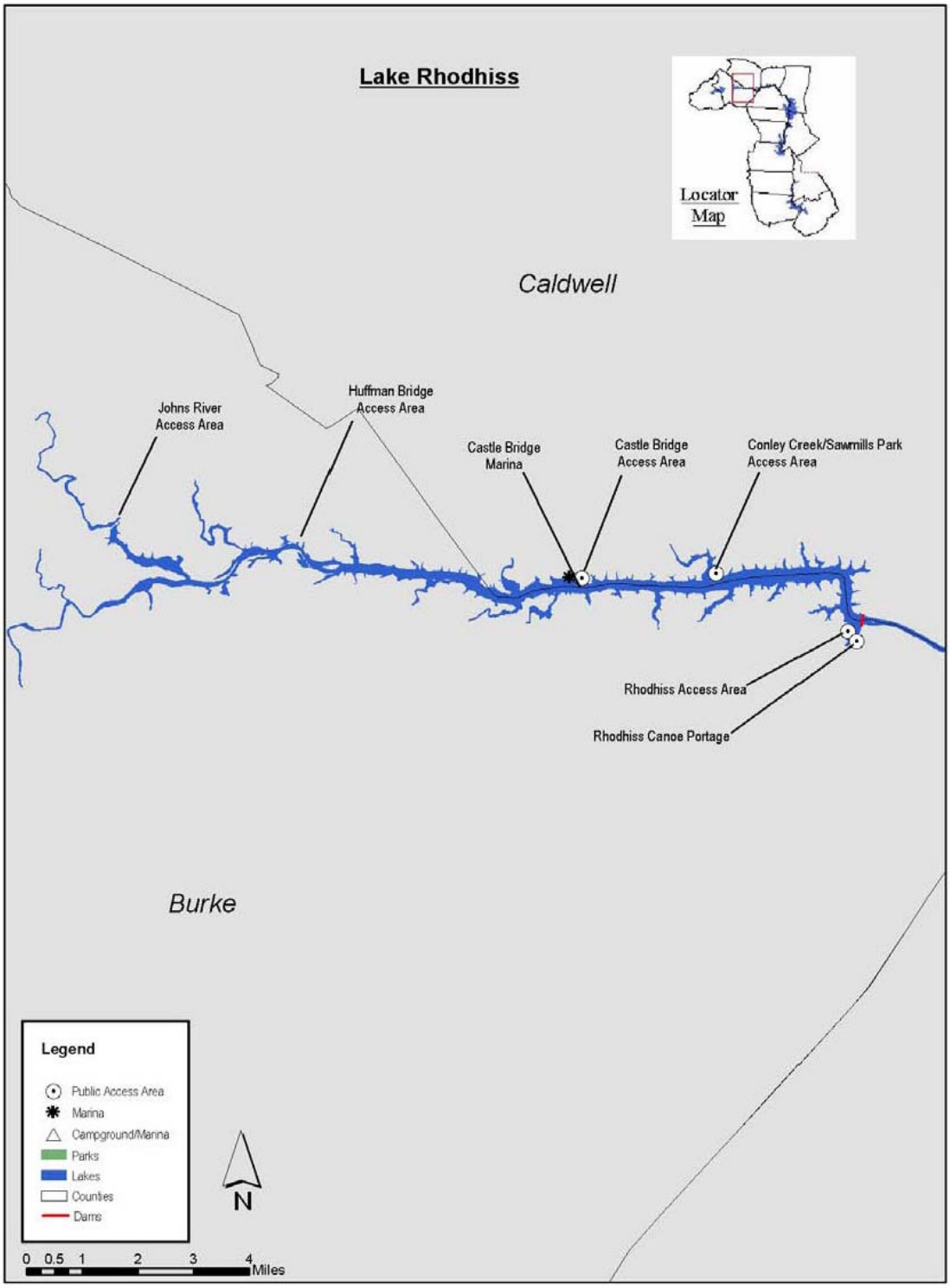

Figure 21. Catawba-Wateree Project (P-2232) Rhodhiss Development recreational facilities (Source: Duke Energy, 2007).

Oxford Development

The Oxford Development includes Lake Hickory. At a full pond elevation of 935.0 ft msl, Lake Hickory has a surface area of about 4,072 acres and 109.8 miles of shoreline. There is also a regulated river reach between Oxford dam and Lookout Shoals Lake. There are 10 public recreation areas located on Lake Hickory, including one undeveloped area (figure 22 and table 42). Eight of these public recreation areas have major recreational facilities including 17 boat ramps, 9 courtesy docks, 4 fishing piers, a canoe portage around the dam, and 3 picnic areas. The city of Hickory, North Carolina, owns and operates three of these public recreation areas: Bud Geitner Park, Hickory Greenway, and Glenn C. Hilton Park. There are also five commercial marinas or campgrounds that provide additional public access to Lake Hickory.

There is one public recreation area located along the regulated river reach downstream of Lake Hickory (figure 22 and table 42). Major recreational facilities at this public recreation area include a canoe launch, a fishing platform, a picnic area, and 12.1 miles of trails (4.3 miles horse and 7.8 miles foot/bike). This public recreation area, Riverbend Park, is owned and operated by Catawba County, North Carolina.

Duke Energy owns more than one-half of the project-related recreational facilities at the Oxford Development; however, most of these are managed by North Carolina WRC.

Table 42. Recreational facilities at the Oxford Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Lake Hickory		
Bud Geitner Park	City of Hickory, North Carolina	one concrete boat ramp, one courtesy dock, one fishing pier, bank fishing, flush toilets, medium-sized paved parking area, 2 ADA-compliant flush toilets, picnic area and shelters, grills
Hickory Greenway	City of Hickory, North Carolina	large parking area, 3 ADA-compliant parking spaces, 3.9 miles of trail
Glenn C. Hilton Park	City of Hickory, North Carolina	one canoe launch, one fishing pier, bank fishing, flush toilets, large parking area, one ADA-compliant parking space, picnic area and shelters, grills, athletic fields, observation deck
Gunpowder	Duke Energy/North Carolina WRC	two boat ramps, one ADA-compliant courtesy dock, medium-sized parking area
Lovelady	Duke Energy/North Carolina WRC	two boat ramps, one courtesy dock, medium-sized paved parking area, one ADA-compliant parking space
Wittenburg	Duke Energy/North Carolina WRC	six boat ramps, three ADA-compliant courtesy docks, two ADA-compliant fishing piers, large paved parking area, 10 ADA-compliant parking spaces

Site name	Owner/manager	Facilities
Long Shoals	Duke Energy/ Undeveloped	20.1-acre undeveloped area
Dusty Ridge	Duke Energy/North Carolina WRC, Alexander County, North Carolina	two boat ramps, one courtesy dock, bank fishing, large parking area, 8 ADA-compliant parking spaces, restrooms, baseball fields, picnic area
Oxford	Duke Energy	four boat ramps, two ADA-compliant courtesy docks, large paved parking area, 5 ADA-compliant parking spaces
Oxford Canoe Portage	Duke Energy	canoe portage around the dam, small gravel parking area
Oxford Regulated River Reach		
Riverbend Park	Catawba County, North Carolina	one canoe launch, one ADA-compliant fishing platform, tailrace fishing, one fishing pond, ADA-compliant flush toilets, medium-sized paved parking area, nine ADA-compliant parking spaces, picnic area and shelter, 12.1 miles of trail (4.3 miles horse and 7.8 miles foot/bike), wildlife area

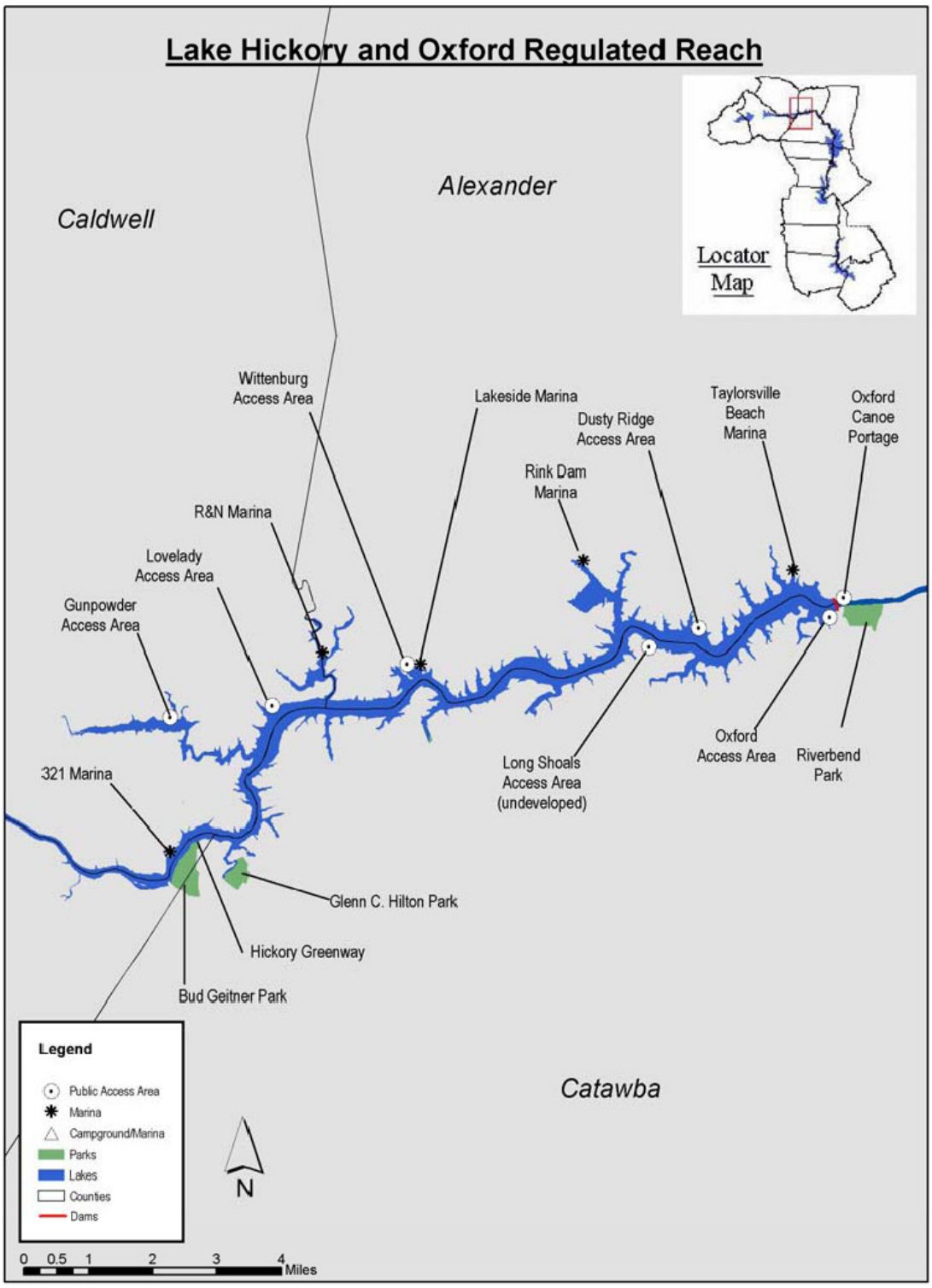

Figure 22. Catawba-Wateree Project (P-2232) Oxford Development recreational facilities (Source: Duke Energy, 2007)

Lookout Shoals Development

The Lookout Shoals Development includes Lookout Shoals Lake. At full pond elevation of 838.1 ft msl, Lookout Shoals Lake has a surface area of about 1,155 acres and 33.1 miles of shoreline. Two public recreation access areas are located on Lookout Shoals Lake (figure 23 and table 43). There are major recreational facilities at both of these public recreation areas, including three boat ramps and two courtesy docks. There are no state or county park facilities and no commercial marinas along Lookout Shoals Lake.

Duke Energy owns both of the project-related recreational facilities at the Lookout Shoals Development; however, both are managed by North Carolina WRC.

Table 43. Recreational facilities at the Lookout Shoals Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Lookout Shoals Lake		
Lookout Shoals	Duke Energy/North Carolina WRC	two boat ramps, one courtesy dock, medium-sized paved parking area, two ADA-compliant parking spaces
Sharon	Duke Energy/North Carolina WRC	one boat ramp, one courtesy dock, small paved parking area, one ADA-compliant parking space

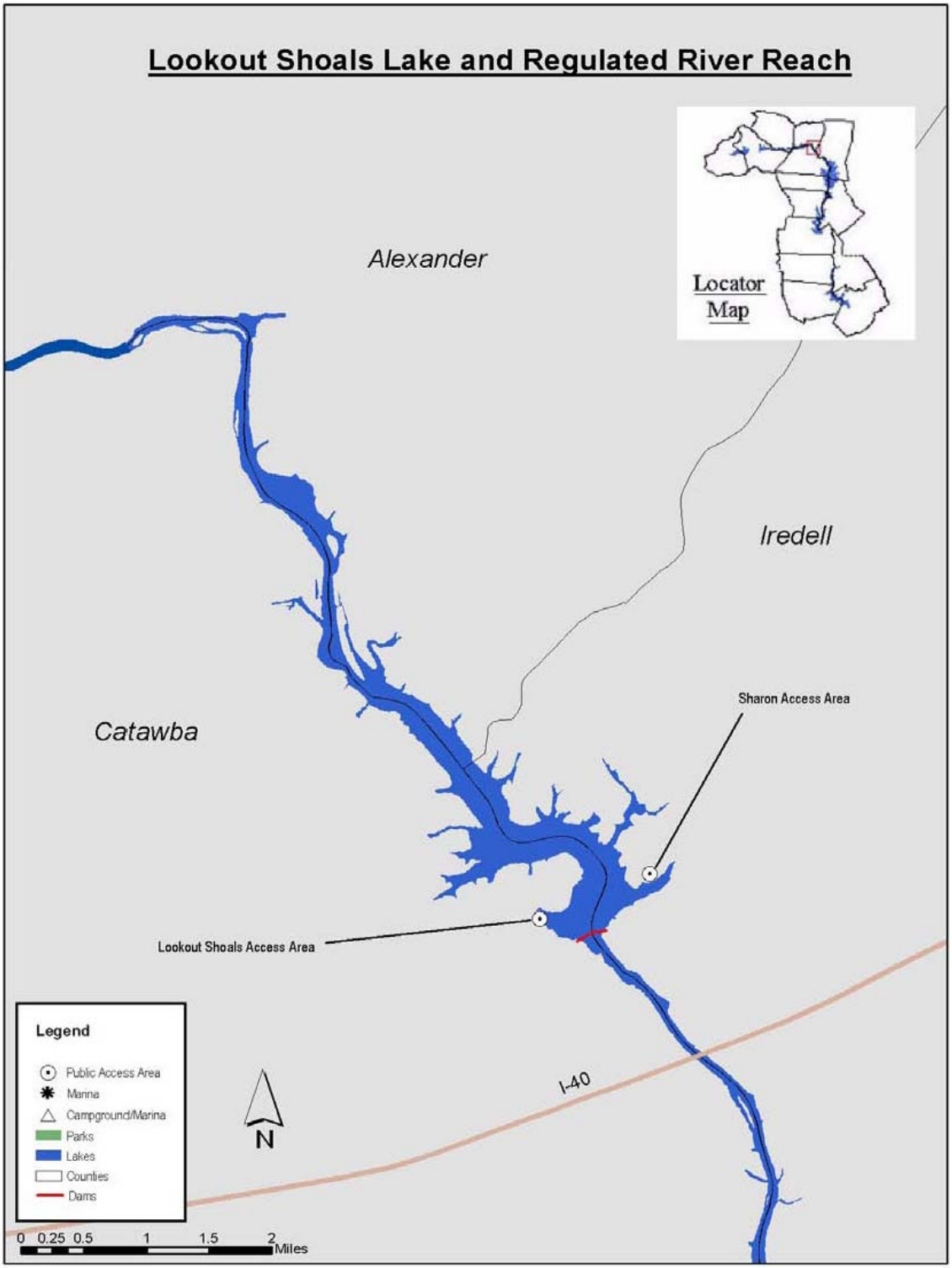

Figure 23. Catawba-Wateree Project (P-2232) Lookout Shoals Development recreational facilities (Source: Duke Energy, 2007).

Cowans Ford Development

The Cowans Ford Development includes Lake Norman and the Cowans Ford tailrace. At a full pond elevation of 760.0 ft msl, Lake Norman has a surface area of about 32,339 acres and 562.3 miles of shoreline. Eighteen public recreation access areas are located at Lake Norman, including three undeveloped areas (figure 24 and table 44). There are major recreational facilities at 14 of these public recreation areas, including 36 boat ramps, 17 courtesy docks, 3 fishing piers, a swimming area, a sunbathing beach posted for "no swimming," 5 picnic areas, camping, and 16.5 miles of trails. Lake Norman State Park is a 1,328-acre state park owned and operated by the State of North Carolina located in the northeast portion of Lake Norman. The park provides several recreational opportunities described above, such as a fishing pier, the swim area, camping, a picnic area, and hiking trails. Two of the public recreation areas on Lake Norman are county parks (Mecklenburg County, North Carolina), Jetton Road County Park and Blythe Landing Park, and two are municipal parks, Roosevelt Wilson Park (town of Davidson, North Carolina) and Hunsucker Park (town of Catawba, North Carolina). There are also 17 commercial marinas or campgrounds that provide additional public access to Lake Norman.

Duke Energy owns most of the project-related recreational facilities at the Cowans Ford Development; however, most of the developed areas are managed by North Carolina WRC.

Table 44. Recreational facilities at the Cowans Ford Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Lake Norman		
Hunsucker Park	Town of Catawba, North Carolina	one gravel/dirt boat ramp, bank fishing, small parking area
Buffalo Shoals	Duke Energy	10.8-acre undeveloped area
Long Island	Duke Energy/North Carolina WRC	two boat ramps, one ADA-compliant courtesy dock, medium-sized paved parking area, two ADA-compliant parking spaces
Lake Norman State Park	State of North Carolina/North Carolina DENR (North Carolina DPR)	1 concrete boat ramp, 1 courtesy dock, 1 swimming area, fishing pier, bank fishing, camping, large paved parking area, flush toilets, 17 ADA-compliant parking spaces, 1 ADA-compliant flush toilet, picnic area with shelters, 11.4 miles of trail, showers, grills
Island Point	Duke Energy/North Carolina WRC	141.3-acre undeveloped area
Stumpy Creek	Duke Energy	two boat ramps, one ADA-compliant courtesy dock, large parking area, six ADA-compliant parking spaces, athletic fields

Site name	Owner/manager	Facilities
Pinnacle	Duke Energy/North Carolina WRC	five boat ramps, two ADA-compliant courtesy docks, large paved parking area, six ADA-compliant parking spaces
McCrary Creek	Duke Energy/North Carolina WRC	four boat ramps, two ADA-compliant courtesy docks, bank fishing, large paved parking area, five ADA-compliant parking spaces
Marshall Fishing Area	Duke Energy/North Carolina WRC	bank fishing, small gravel parking area, port-a-john
Slanting Bridge	Duke Energy	12.6-acre undeveloped area
Hager Creek	Duke Energy/North Carolina WRC	four boat ramps, two ADA-compliant courtesy docks, bank fishing, large paved parking area, five ADA-compliant parking spaces
Little Creek	Duke Energy/North Carolina WRC	two boat ramps, one courtesy dock, bank fishing, medium-sized paved parking area, two ADA-compliant parking spaces
Roosevelt Wilson Park	Town of Davidson, North Carolina	bank fishing, small paved parking area, playground, one port-a-john, picnic area and shelter, grills, 0.5 miles of trail and two boardwalks, one ADA-compliant parking space
Beatty's Ford	Duke Energy/North Carolina WRC, Lincoln County, North Carolina	four boat ramps, two ADA-compliant courtesy docks, large paved parking area, six ADA-compliant parking spaces
Jetton Road County Park	Mecklenburg County, North Carolina	bank fishing, 1 sunbathing beach posted for "no swimming," large paved parking area, flush toilets, 15 ADA-compliant parking spaces, 8 ADA-compliant flush toilets, picnic area with shelters, 3.8 miles of trail, playground, formal garden
Ramsey Creek	Duke Energy/ Mecklenburg County, North Carolina	four boat ramps, two ADA-compliant courtesy docks, one ADA-compliant fishing pier, picnic area with shelters, large paved parking area, 10 ADA-compliant parking spaces, restrooms, volleyball court, playground, 0.5 m of trail
McGuire Fishing Area	Duke Energy	one ADA-compliant fishing pier, bank fishing, medium-sized parking area, three ADA-compliant parking spaces, port-a-johns
Blythe Landing County Park	Mecklenburg County, North Carolina	six concrete boat ramps, three courtesy docks, picnic area with shelters, large parking area, four ADA-compliant parking spaces, flush toilets, volleyball courts, playground, grills, 0.3 miles of paved trail

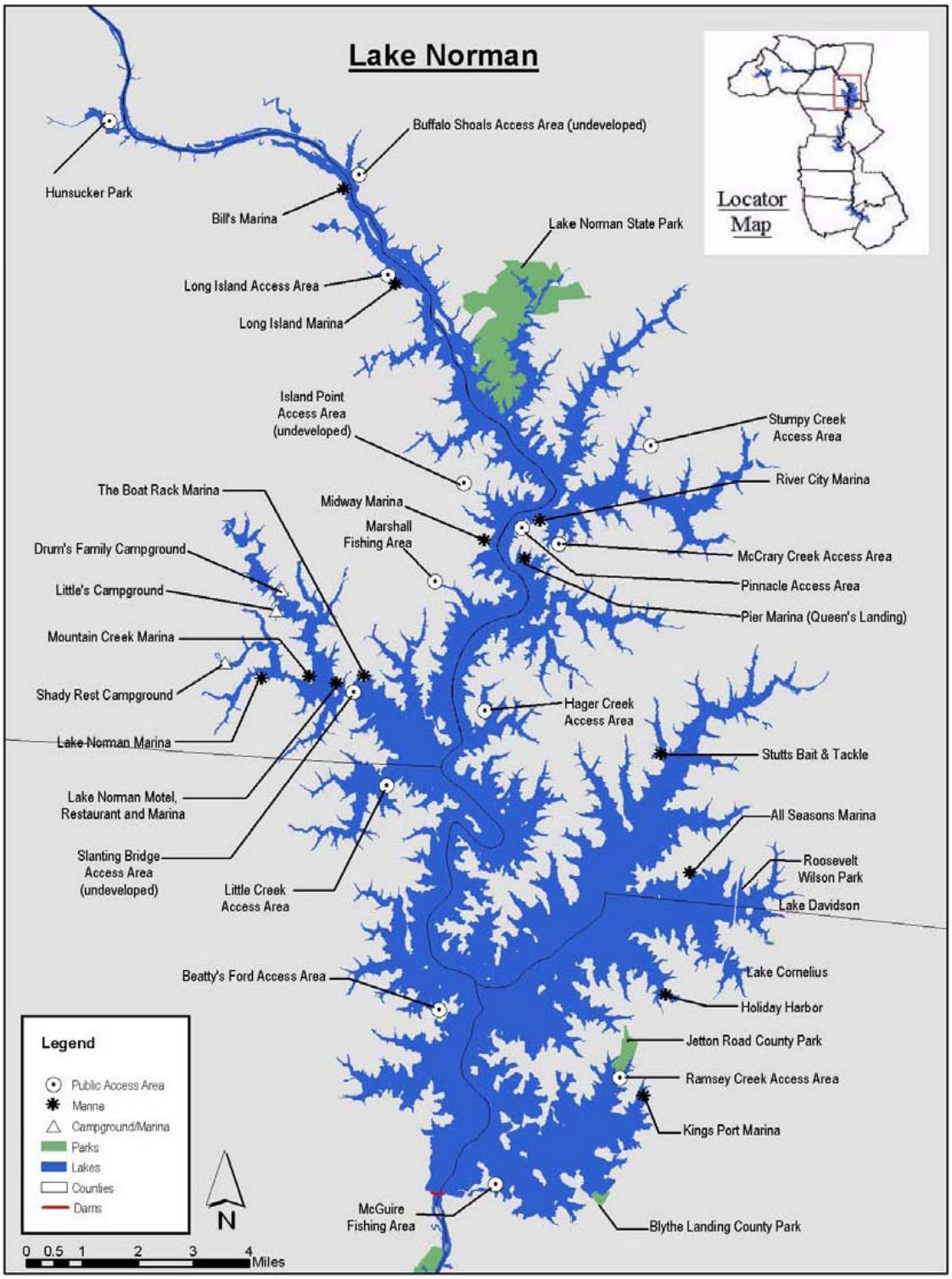

Figure 24. Catawba-Wateree Project (P-2232) Cowans Ford Development recreational facilities (Source: Duke Energy, 2007).

Mountain Island Development

The Mountain Island Development includes Mountain Island Lake and the Mountain Island bypassed reach. At a full pond elevation of 647.5 msl, Mountain Island Lake has a surface area of 3,117 acres and 94.3 miles of shoreline. Five public recreation areas are located at Mountain Island Lake (figure 25 and table 45). There are major recreational facilities at all of these public recreation areas, including 6 boat ramps, 3 courtesy docks, a fishing pier, a sunbathing beach posted as "no swimming," just over 16 miles of trails (horseback riding is allowed on 13 miles of these trails), and 3 picnic areas. Mecklenburg County, North Carolina, owns and operates three of these public recreation areas: Cowans Ford Wildlife Refuge, Rural Hill Park, and Latta Plantation County Park. There are no commercial marinas or campgrounds on Mountain Island Lake. In addition to the current recreational facilities, the North Carolina Division of Forestry is currently developing the Mountain Island State Educational Forest on Mountain Island Lake.

Duke Energy owns two of the project-related recreational facilities at the Mountain Island Development; however, both of these are managed by North Carolina WRC.

Table 45. Recreational facilities at the Mountain Island Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Mountain Island Lake		
Cowans Ford Wildlife Refuge	Mecklenburg County, North Carolina	picnic area, interpretive display, observation deck, waterfowl pond, 0.05 mile of trail, small gravel parking area, 2 ADA-compliant parking spaces
Rural Hill Park	Mecklenburg County, North Carolina	one picnic shelter, small parking area, one ADA-compliant parking space, flush toilets
Neck Road	Duke Energy/North Carolina WRC	two boat ramps, one ADA-compliant courtesy dock, bank fishing, medium-sized paved parking area, four ADA-compliant parking spaces
Latta Plantation County Park	Mecklenburg County, North Carolina	picnic area with shelters, large parking area, six ADA-compliant parking spaces, sunbathing beach posted as "no swimming," one fishing pier, bank fishing, scenic overlook, volleyball court, grills, 16 miles of trail (horseback riding is allowed on 13 miles of these trails), flush toilets, four ADA-compliant flush toilets
Riverbend	Duke Energy/North Carolina WRC	four boat ramps, two ADA-compliant courtesy docks, large paved parking area, four ADA-compliant parking spaces

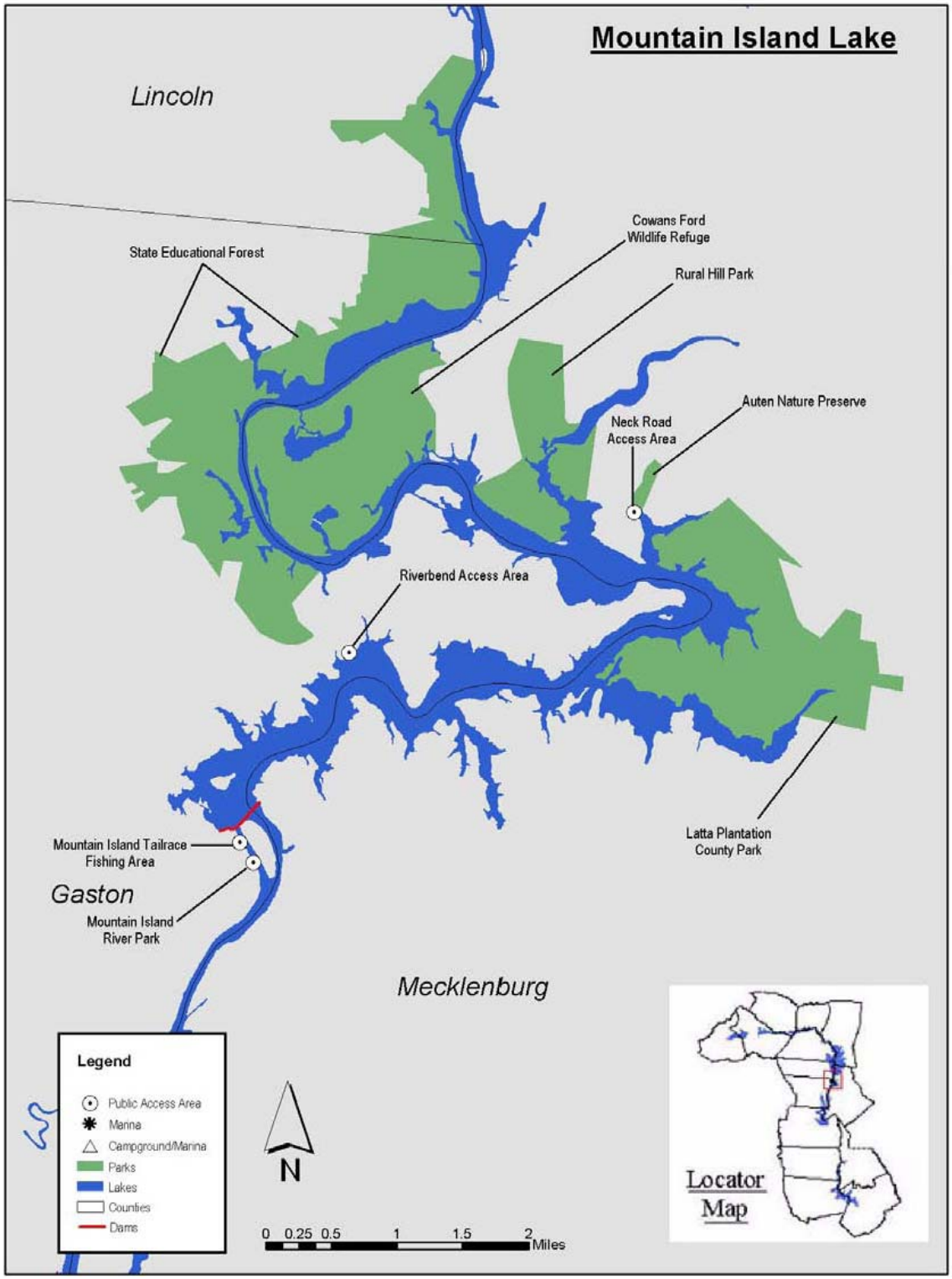

Figure 25. Catawba-Wateree Project (P-2232) Mountain Island Development recreational facilities (Source: Duke Energy, 2007).

Wylie Development

The Wylie Development includes Lake Wylie. At a full pond elevation of 569.4 ft msl, Lake Wylie has a surface area of 12,177 acres and 340.3 miles of shoreline. There is also a regulated river reach downstream of the Wylie dam. Eleven public recreation access areas (Indian Ground is currently closed according to Duke Energy's license application) are located on Lake Wylie, and two public recreational facilities (Mountain Island River Park and Mountain Island Tailrace Fishing Area) are located just downstream of Mountain Island Lake (figure 26 and table 46). There are major recreational facilities at 10 of these public recreation areas, including 23 boat ramps, 15 courtesy docks, 13 fishing piers, a swim area, 121 individual campsites and 4 group campsites, 4 picnic areas, 2 canoe/kayak put-ins, and 9 miles of trails. Three of the 13 public recreation areas are city, county, or privately owned parks, including Mount Holly River Street Park (city of Mount Holly, North Carolina), McDowell Park (Mecklenburg County, North Carolina), and the Stowe Botanical Garden (Daniel Stowe Family). In addition to these public recreation areas, there are eight commercial marinas or campgrounds that provide additional direct access to Lake Wylie.

Three public recreation areas are located along the regulated river reach downstream of Lake Wylie (figure 27 and table 46). All of these public recreation areas have major recreational facilities, including a boat ramp, two picnic areas, two canoe/kayak put-ins, and 4.5 miles of trails. Landsford Canal State Park is a 448-acre state park owned and operated by the State of South Carolina located in the regulated river reach downstream of Lake Wylie. The park provides several recreational opportunities described above such as a canoe/kayak put-in, picnic area, and 2 miles of trails. The city of Rock Hill, South Carolina, owns and manages one of the three public recreation areas, Rock Hill River Park.

Duke Energy owns a majority of the project-related recreational facilities at the Wylie Development; however, one-half of these are managed by other parties including North Carolina WRC; city of Mount Holly, North Carolina; and Mecklenburg County, North Carolina.

Table 46. Recreational facilities at the Wylie Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Lake Wylie		
Mountain Island River Park	Duke Energy/City of Mount Holly, North Carolina	bank fishing, walking trail, small gravel parking area, four ADA-compliant parking spaces
Mountain Island Tailrace Fishing Area	Duke Energy/North Carolina WRC, City of Mount Holly, North Carolina	two fishing piers, small gravel parking area, two ADA-compliant parking spaces

Site name	Owner/manager	Facilities
Mount Holly River Street Park	City of Mount Holly, North Carolina	two wooden put-ins for canoes/kayaks, bank fishing, one fishing pier, medium-sized gravel parking area, one ADA-compliant parking space, picnic area with shelters, 0.5 mile of trails, playground, athletic fields, flush toilets, grills
South Point	Duke Energy/North Carolina WRC	six boat ramps, four courtesy docks, large paved parking area, seven ADA-compliant parking spaces
Allen Fishing Area	Duke Energy/North Carolina WRC	two fishing piers, bank fishing, small paved parking area, two ADA-compliant parking spaces, ADA-compliant walkway from restrooms to fishing piers
Stowe Botanical Garden	Daniel Stowe Family	100-acre wildlife area, 0.5 mile of trail, large paved parking area, flush toilets, two ADA-compliant flush toilets
Copperhead	Duke Energy/Mecklenburg County, North Carolina	four boat ramps (two ADA-compliant), three courtesy docks, six ADA-compliant fishing piers, six tent campsites, two observation decks, scenic overlook, 1 mile of trails, large paved parking area, three ADA-compliant parking spaces, picnic area with shelters, playground, athletic fields, restrooms (two are ADA-compliant), volleyball courts
McDowell Park	Mecklenburg County, North Carolina	1 courtesy dock, 1 fishing pier, bank fishing, 56 individual campsites and 4 group campsites, large paved parking area, 10 ADA-compliant parking spaces, picnic area with shelters, 7 miles of trail, 1 wildlife area, playground, flush toilets, 4 ADA-compliant toilets, volleyball court, grills
Buster Boyd	Duke Energy	four boat ramps, two ADA-compliant courtesy docks, large paved parking area, six ADA-compliant parking spaces
Indian Ground	Duke Energy/closed	currently closed, fishing platform
Allison Creek	Duke Energy	four boat ramps, two ADA-compliant courtesy docks, one ADA-compliant fishing pier, large paved parking area, one ADA-compliant parking space
Ebenezer Park	Duke Energy/York County, North Carolina	three boat ramps, two ADA-compliant courtesy docks, 69 campsites, picnic area with shelters, one swim area, large paved parking area, six ADA-compliant parking spaces, playground, showers, four ADA-compliant restrooms
Nivens Creek	Duke Energy	two boat ramps, one courtesy dock, medium-sized paved parking area, two ADA-compliant parking spaces

Site name	Owner/manager	Facilities
Wylie Regulated River Reach		
Fort Mill	Duke Energy	one boat ramp, bank fishing, small gravel parking area
Rock Hill River Park	City of Rock Hill, South Carolina	one concrete canoe/kayak put-in, bank fishing, picnic area with shelter, 2.5 miles of trail, small gravel parking area, two ADA-compliant parking spaces, port-a-johns
Landsford Canal State Park	South Carolina DPRT	one canoe/kayak put-in, bank fishing, picnic area with shelters, one rental cabin, 2 miles of trail, medium-sized gravel parking area, one ADA-compliant parking space, flush toilets, two ADA-compliant flush toilets, grills, playground

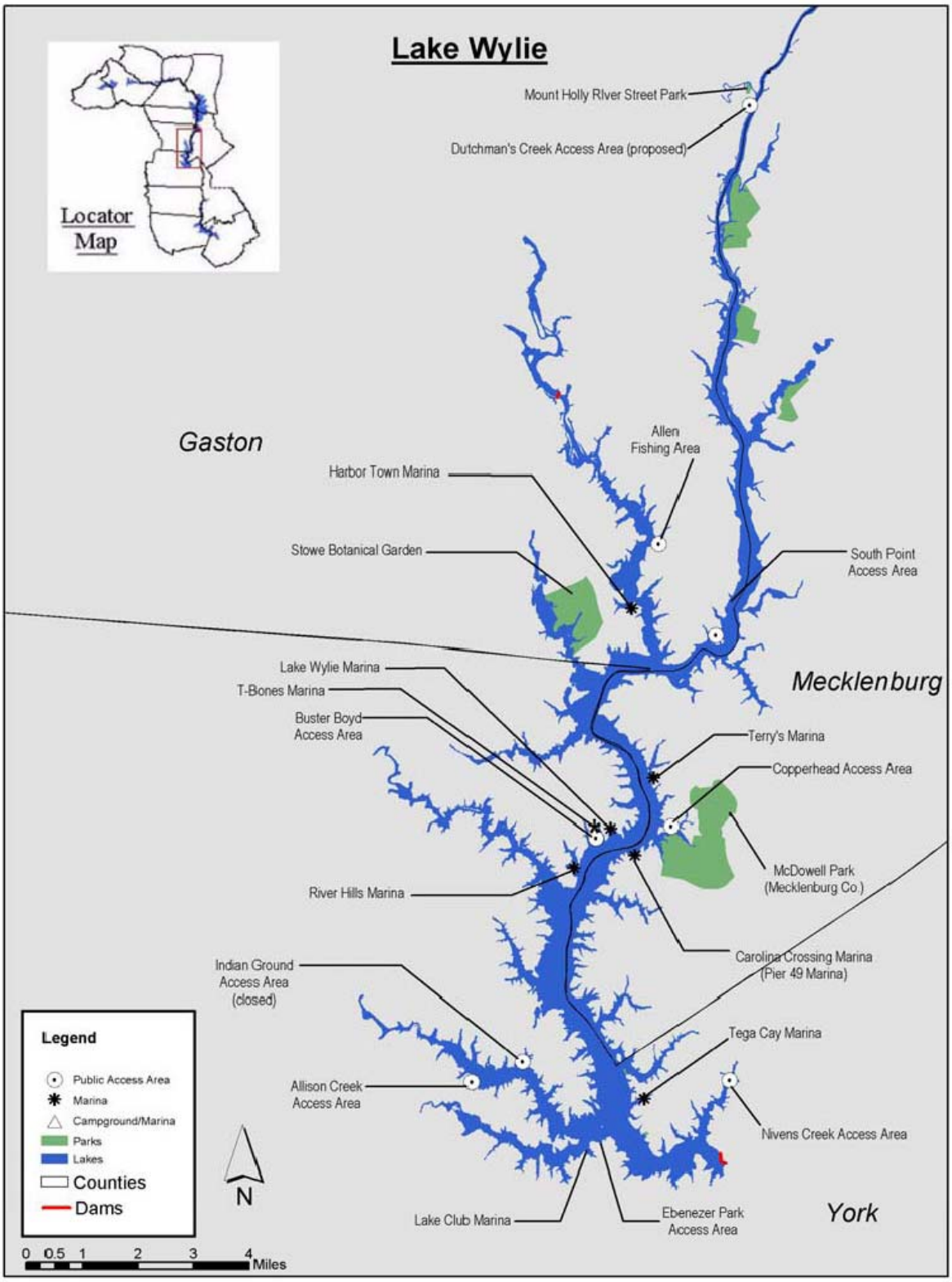

Figure 26. Catawba-Wateree Project (P-2232) Wylie Development recreational facilities (Source: Duke Energy, 2007).

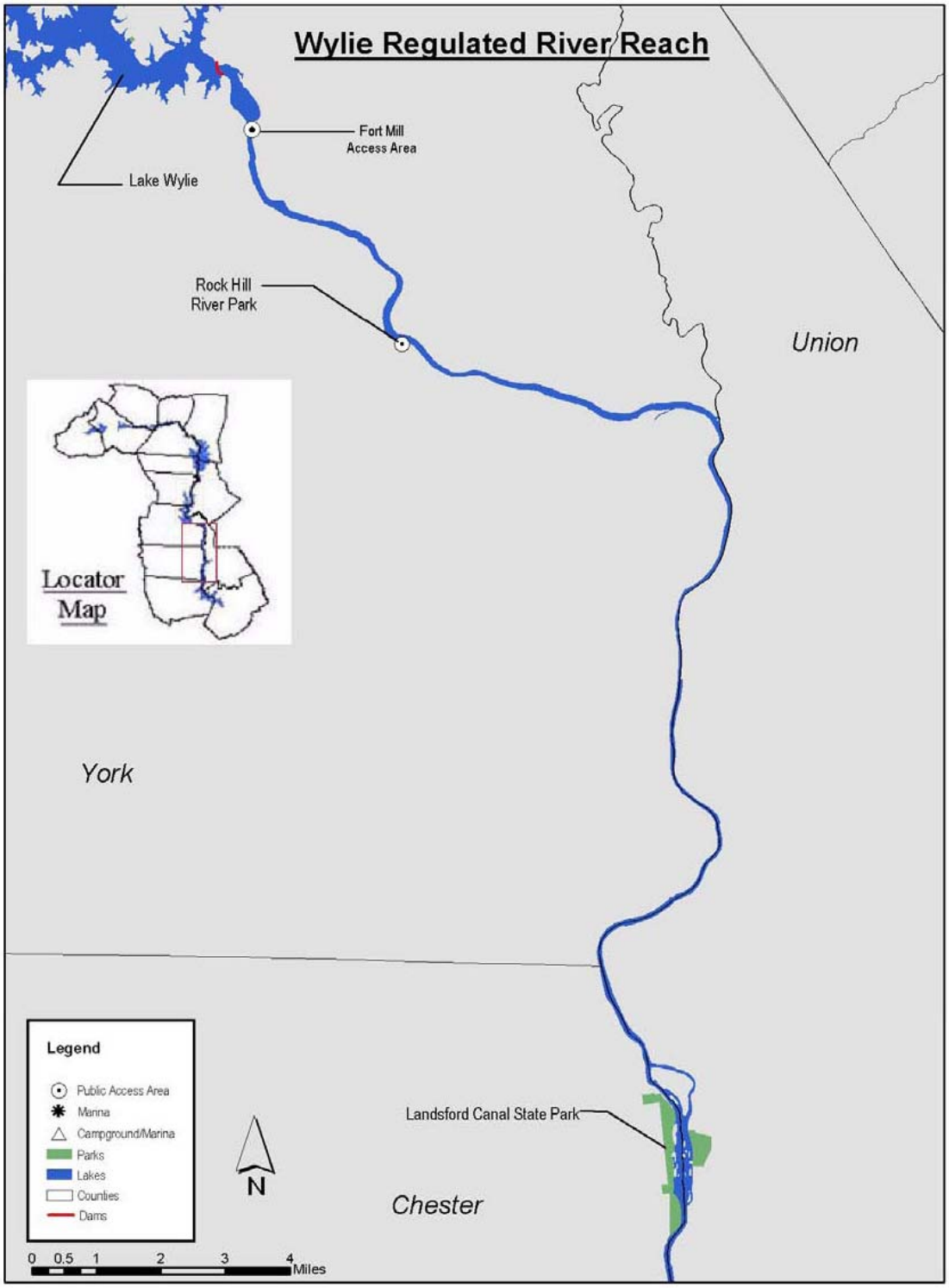

Figure 27. Catawba-Wateree Project (P-2232) Wylie regulated river reach recreational facilities (Source: Duke Energy, 2007).

Fishing Creek Development

The Fishing Creek Development includes Fishing Creek reservoir. At a full pond elevation of 417.2 ft msl, Fishing Creek reservoir has a surface area of 3,431 acres and 90.4 miles of shoreline. Three public recreation areas are located on Fishing Creek reservoir (figure 28 and table 47). There are major recreational facilities at all of these public recreation areas, including four boat ramps and one courtesy dock. There are no commercial marinas at Fishing Creek reservoir.

Duke Energy owns and manages two of the project-related recreational facilities at the Fishing Creek Development.

Table 47. Recreational facilities at the Fishing Creek Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Fishing Creek Reservoir		
Highway 9 Landing	South Carolina DNR	one concrete boat ramp, informal bank fishing, small parking area
Cane Creek	Duke Energy	one boat ramp, small gravel parking area
Fishing Creek	Duke Energy	two boat ramps, one courtesy dock, bank fishing, medium-sized paved parking area, two ADA-parking spaces

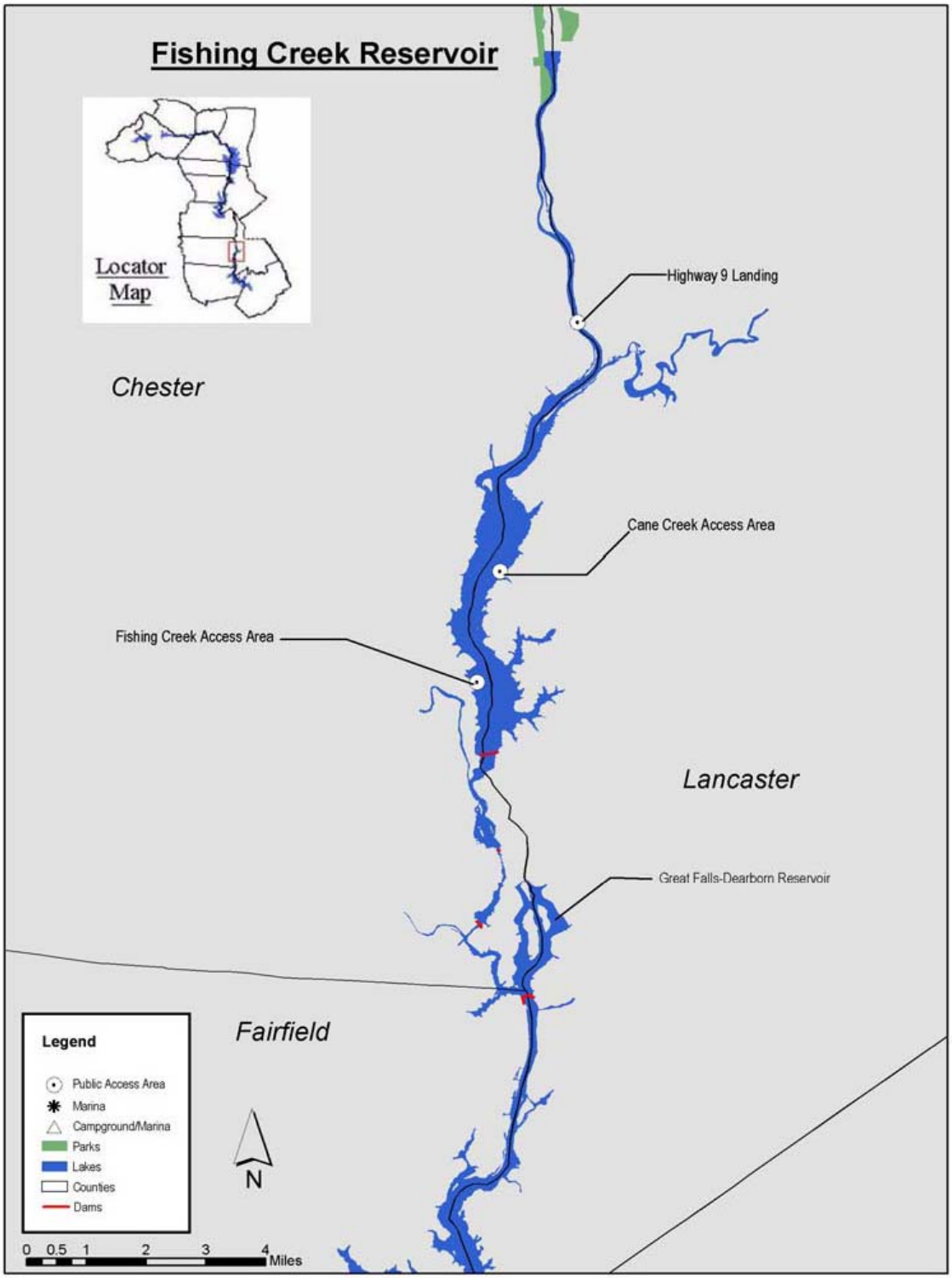

Figure 28. Catawba-Wateree Project (P-2232) Fishing Creek Development recreational facilities (Source: Duke Energy, 2007).

Great Falls and Dearborn Developments

The Great Falls and Dearborn Developments include Great Falls reservoir. At a full pond elevation of 355.8 ft msl, Great Falls reservoir has a surface area of 353 acres and 13.2 miles of shoreline. There are two bypassed reaches at the developments, the Great Falls Long bypassed reach along the east side of Mountain Island and the Great Falls Short bypassed reach on the west side of Mountain Island. The Great Falls and Dearborn Developments currently have no developed public recreational facilities.

Rocky Creek and Cedar Creek Developments

The Rocky Creek and Cedar Creek Developments include Cedar Creek reservoir. At a full pond elevation of 284.4 ft msl, Cedar Creek reservoir has a surface area of 748 acres and 22.3 miles of shoreline. Two public recreation areas are located on Cedar Creek reservoir (figure 29 and table 48). Each of these public recreation areas has a boat ramp. There are no commercial marinas, or state or county recreational facilities on Cedar Creek reservoir.

Duke Energy owns and manages these two project-related recreational facilities at the Rocky Creek and Cedar Creek Developments.

Table 48. Recreational facilities at the Rocky Creek and Cedar Creek Developments of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Cedar Creek Reservoir		
Stumpy Pond	Duke Energy	one boat ramp, small gravel parking area
Debutary Creek	Duke Energy	one boat ramp, small gravel parking area

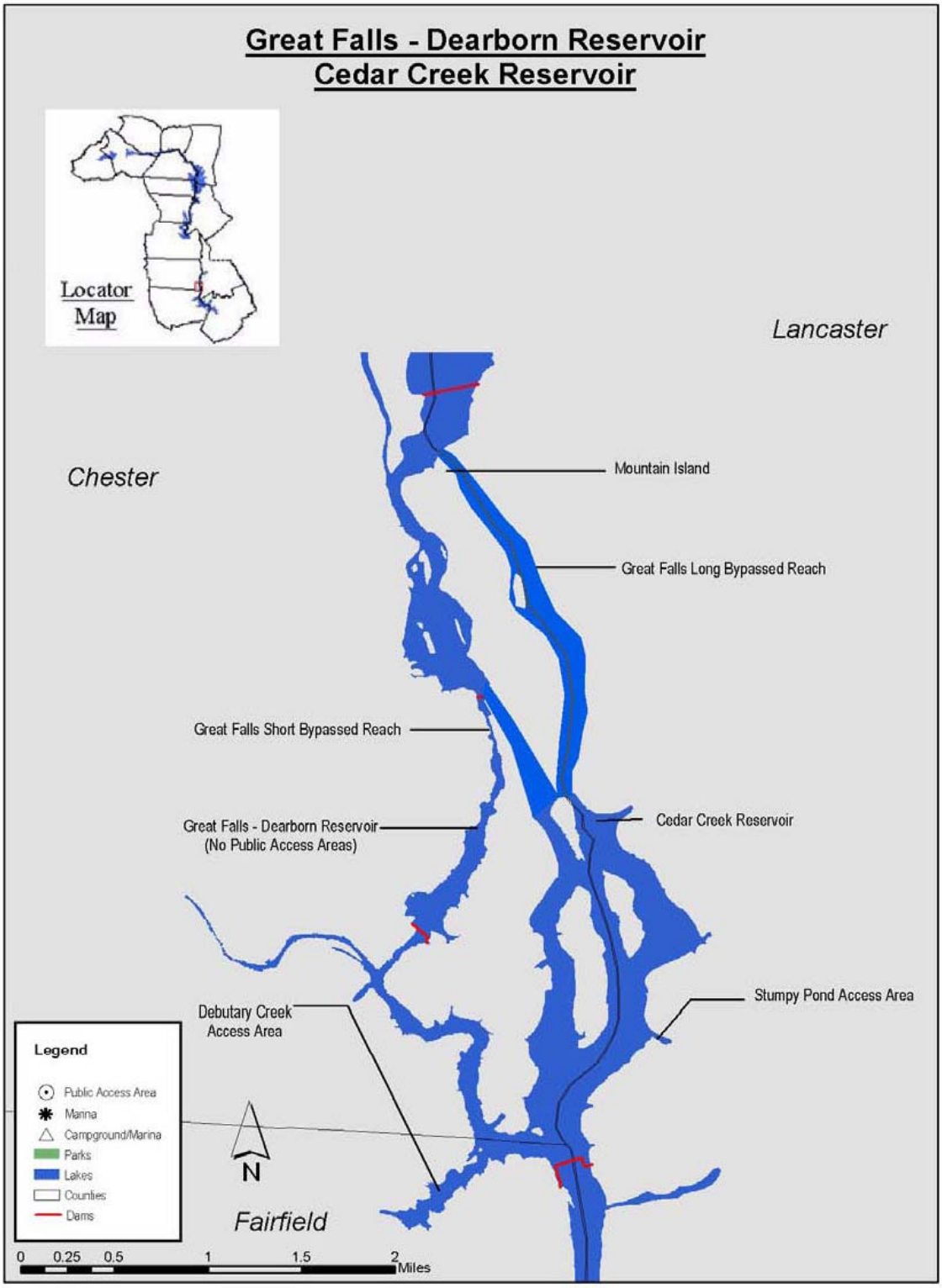

Figure 29. Catawba-Wateree Project (P-2232) Rocky Creek and Cedar Creek Developments recreational facilities (Source: Duke Energy, 2007).

Wateree Development

The Wateree Development includes Lake Wateree. At a full pond elevation of 225.5 ft msl, Lake Wateree has a surface area of about 13,025 acres and 189.4 miles of shoreline. There is also a regulated river reach downstream of the dam. Nine public recreation access areas are located on Lake Wateree (figure 30 and table 49). There are major recreational facilities at all of these public recreation areas, including 20 boat ramps, 6 courtesy docks, 2 fishing piers, 70 individual campsites and 2 group campsites, 0.7 mile of trails, and 2 bird sanctuaries. One of these public recreation areas is Lake Wateree State Park, owned and managed by South Carolina DPRT. A significant amount of public fishing also occurs at the Wateree Creek, Taylor's Creek, Dutchman's Creek, and Colonel's Creek bridges at informal areas on the west side of the reservoir, two of which are owned by Fairfield County, South Carolina, and two of which are managed by South Carolina DNR. The county does not allow formal parking or bridge fishing at these areas. In addition to these public recreation areas, six commercial marinas or campgrounds provide additional access to Lake Wateree.

Three public recreation areas are located along the regulated river reach downstream of Lake Wateree (figure 31 and table 49). All of these public recreation areas have major recreational facilities, including four boat ramps and one fishing pier.

Duke Energy owns and manages a majority of the project-related recreational facilities at the Wateree Development.

Table 49. Recreational facilities at the Wateree Development of the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Site name	Owner/manager	Facilities
Lake Wateree		
Cedar Creek	Duke Energy	two boat ramps, medium-sized gravel parking area
Wateree Creek Access Area	Duke Energy	two boat ramps, one courtesy dock, small paved parking area, two ADA-compliant parking spaces
Taylors Creek Access Area	Duke Energy	two boat ramps, one ADA-compliant courtesy dock, small paved parking area, two ADA-compliant parking spaces
Lake Wateree State Park	South Carolina DPRT	2 concrete boat ramps, 1 courtesy dock, 1 fishing pier, bank fishing, 70 individual campsites and 2 group campsites, 13 flush toilets (6 ADA-compliant), showers, 0.7 mile of trail, large parking area, 1 ADA-compliant parking space, grills
June Creek	Duke Energy	two boat ramps, one courtesy dock, bank fishing, medium-sized paved parking area, one ADA-compliant parking space
Beaver Creek Landing	South Carolina DNR	one concrete boat ramp, bird sanctuary, medium-sized parking area

Site name	Owner/manager	Facilities
Colonel's Creek Access Area	Duke Energy	three boat ramps, large paved parking area
White Oak Creek	Duke Energy	four boat ramps, two ADA-compliant courtesy docks, one boat dock, one event/fishing pier, bird sanctuary, large paved parking area, two ADA-compliant parking spaces
Buck Hill	Duke Energy	two boat ramps, medium-sized gravel parking area
Wateree Regulated River Reach		
Lugoff	Duke Energy	one boat ramp, one ADA-compliant fishing pier, ADA-compliant walkway, medium-sized gravel parking area, one ADA-compliant parking space
Highway 1 Landing	South Carolina DNR	one concrete boat ramp, small gravel parking area
Billy Tolar Landing	South Carolina DNR	two concrete boat ramps, informal bank fishing, medium-sized paved parking area, one ADA-compliant parking space

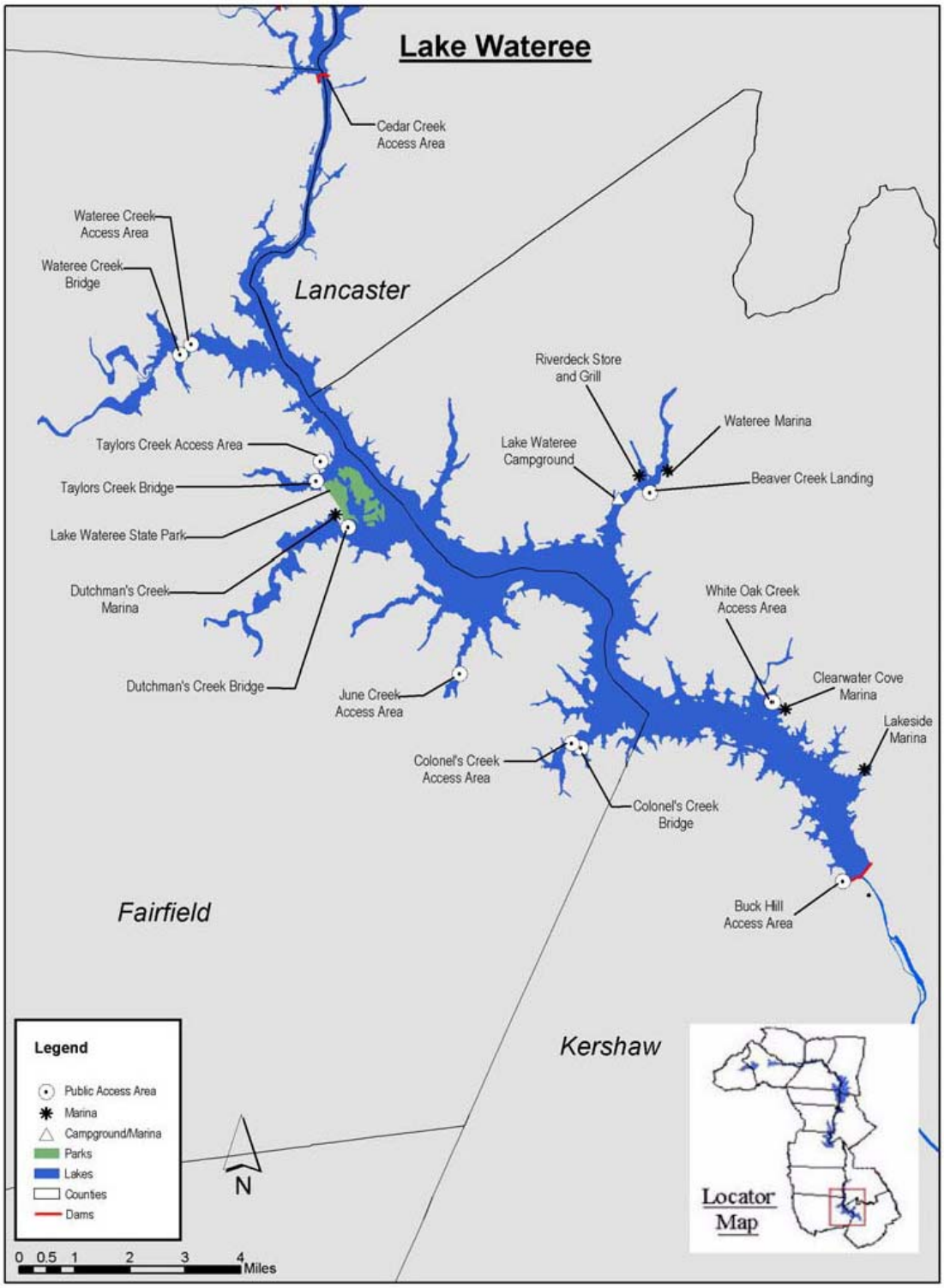

Figure 30. Catawba-Wateree Project (P-2232) Wateree Development recreational facilities (Source: Duke Energy, 2007).

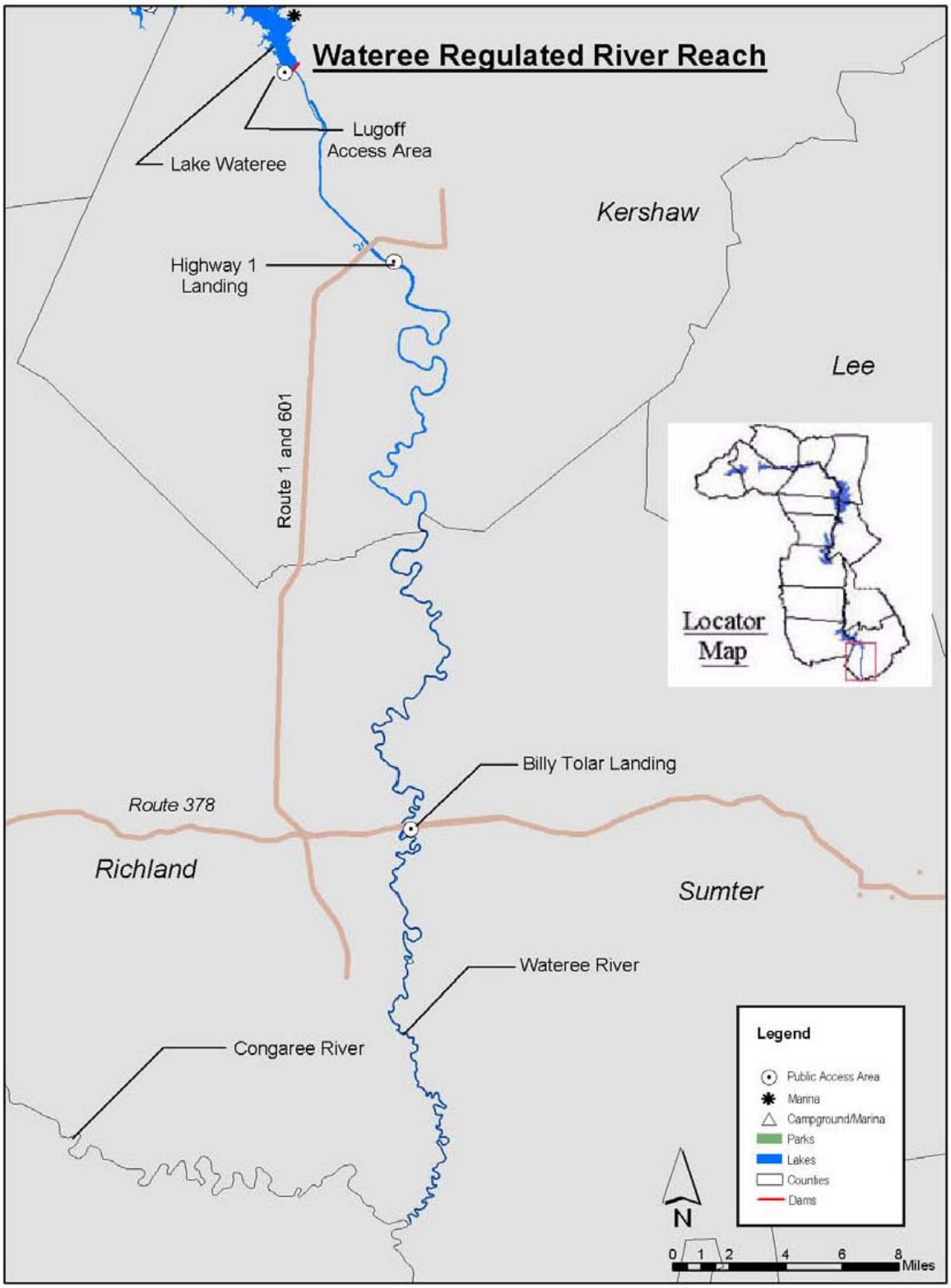

Figure 31. Catawba-Wateree Project (P-2232) Wateree regulated river reach recreational facilities (Source: Duke Energy, 2007).

Recreational Use

Duke Energy estimates that the entire Catawba-Wateree Project had more than 10.1 million recreation days[16] from March 2004 through February 2005, including non-public access use from shoreline residents, back lot residents, and commercial marina use (table 50). The total visitation at public recreation areas at the project for the same period is estimated at more than 8.3 million recreation days. The greatest use occurs at Lake Norman (31 percent) and Lake Wylie (21 percent), followed by Lake Hickory (11 percent), Lake Wateree (9 percent), Lake James (8 percent), and Mountain Island Lake (5 percent). The Oxford regulated river reach receives the lowest use with about 0 percent of the project's total recreation use.

Table 50. Recreational Use at the Catawba-Wateree Project (P-2232). (Source: Duke Energy, 2007)

Development (reservoir and regulated river reach)	Visitation at public recreation areas (recreation days)	Non-public access use[1] (recreation days)	Total visitation (recreation days)	Percent of total project
Bridgewater	1,076,484	79,642	1,156,126	11%
Lake James	734,754	79,642	814,396	8%
Bridgewater Regulated River Reach	341,730	0	341,730	3%
Rhodhiss	406,091	2,723	408,814	4%
Oxford	950,537	143,447	1,093,984	11%
Lake Hickory	926,757	143,447	1,070,204	11%
Oxford Regulated River Reach	23,780	0	23,780	0%
Lookout Shoals	221,291	22,516	243,807	3%
Lookout Shoals Lake	142,127	22,516	164,643	2%
Lookout Shoals Regulated River Reach	79,164	0	79,164	1%
Cowans Ford	2,227,923	912,624	3,140,547	31%
Mountain Island	416,364	62,884	479,248	5%
Wylie	1,919,425	423,349	2,342,774	22%
Lake Wylie	1,688,646	423,349	2,111,995	21%
Wylie Regulated River Reach	230,779	0	230,779	2%

[16] A recreation day is defined as "any part of a day a person visited an area for recreation purposes." Therefore, any and all recreation during a 24-hour period by one person would equal one recreation day.

Development (reservoir and regulated river reach)	Visitation at public recreation areas (recreation days)	Non-public access use[1] (recreation days)	Total visitation (recreation days)	Percent of total project
Fishing Creek	229,195	3,865	233,060	2%
Rocky Creek and Cedar Creek	50,315	750	51,065	1%
Wateree	830,313	203,692	1,034,005	10%
Lake Wateree	678,926	203,692	882,618	9%
Wateree Regulated River Reach	151,387	0	151,387	1%
Total Visitor Use	**8,327,938**	**1,855,492**	**10,183,430**	**100%**

[1] Includes shoreline residents, back lot residents, and commercial marina use.

Table 51 summarizes the monthly distribution of visitation at the public recreation areas based on traffic counter data for the 2004-2005 study period. Most use occurs during May (15 percent), followed by July (12 percent), June (11 percent), April (10.4 percent), and September (10.1 percent) (Study Team/Resource Committee, 2006). About 67 percent of recreational use occurs during the peak recreation season (April through September).

Boating (motor boating and boat fishing) is the primary recreational activity, representing about 20 percent of recreation days (about 10.2 percent for boat fishing and about 9.6 percent for motor boating). Swimming represents about 9.6 percent of recreation days, and bank/pier fishing represents 8 percent (Study Team/Resource Committee, 2006).

As part of the recreation use and needs study, Duke Energy estimated boating use and boat carrying capacity for the six developments that experience the greatest recreational use and provide the most public access to the project (Bridgewater, Oxford, Cowans Ford, Mountain Island, Wylie, and Wateree). Duke Energy estimates that none of the six reservoirs have reached its boat carrying capacity. Lake Hickory has the highest estimated peak-day weekday, weekend, and holiday period boat carrying capacity at 10, 71, and 70 percent, respectively (Study Team/Resource Committee, 2006).

Table 51. Estimate of recreational visitation at public recreation areas based on traffic counter data by month at the Catawba-Wateree Project (P-2232). (Source: Study Team/Resource Committee, 2006; staff)

Development(s)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Bridgewater													
Visitation	66,165	41,015	57,527	97,498	156,113	131,344	132,648	88,215	115,984	68,114	71,567	50,296	1,076,486
% Total use	6%	4%	5%	9%	15%	12%	12%	8%	11%	6%	7%	5%	100%
Rhodhiss													
Visitation	20,018	14,433	26,967	44,925	64,848	44,257	46,482	35,179	45,748	23,718	22,446	17,071	406,091
% Total use	5%	4%	7%	11%	16%	11%	11%	9%	11%	6%	6%	4%	100%
Oxford													
Visitation	49,766	35,640	61,844	105,052	152,875	103,108	107,045	84,577	103,094	56,369	51,845	39,321	950,537
% Total use	5%	4%	7%	11%	16%	11%	11%	9%	11%	6%	5%	4%	100%
Lookout Shoals													
Visitation	13,537	9,110	12,889	20,018	29,932	22,592	23,340	18,881	35,120	12,980	13,154	9,737	221,292
% Total use	6%	4%	6%	9%	14%	10%	11%	9%	16%	6%	6%	4%	100%
Cowans Ford													
Visitation	140,057	115,395	156,391	218,571	302,129	226,499	253,058	198,801	224,105	146,405	143,080	103,432	2,227,923
% Total use	6%	5%	7%	10%	14%	10%	11%	9%	10%	7%	6%	5%	100%
Mountain Island													
Visitation	23,370	17,497	24,437	41,218	63,799	46,293	51,008	37,173	39,651	28,064	26,290	17,566	416,364
% Total use	6%	4%	6%	10%	15%	11%	12%	9%	10%	7%	6%	4%	100%

Development(s)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Wylie													
Visitation	103,228	81,563	119,750	195,256	275,884	195,867	251,411	193,706	191,334	125,111	103,188	83,167	1,919,426
% Total use	5%	4%	6%	10%	14%	10%	13%	10%	10%	7%	5%	4%	100%
Fishing Creek													
Visitation	14,254	9,290	16,263	27,687	34,459	23,037	27,775	18,932	18,763	13,827	14,371	10,538	229,195
% Total use	6%	4%	7%	12%	15%	10%	12%	8%	8%	6%	6%	5%	100%
Rocky Creek and Cedar Creek													
Visitation	3,248	3,033	4,066	6,499	6,507	3,893	3,877	3,200	4,053	4,844	4,242	2,854	50,315
% Total use	6%	6%	8%	13%	13%	8%	8%	6%	8%	10%	8%	6%	100%
Wateree													
Visitation	40,700	42,934	53,169	109,632	141,081	100,035	87,073	63,294	60,841	40,126	48,087	31,022	830,313
% Total use	5%	5%	6%	13%	17%	12%	10%	8%	7%	5%	6%	4%	100%
Total Project													
Visitation	474,343	369,910	533,303	866,356	1,227,627	896,925	983,717	741,958	838,693	519,558	498,270	365,004	8,327,942
% Total use	6%	4%	6%	10%	15%	11%	12%	9%	10%	6%	6%	4%	100%

Duke Energy estimated recreational use projections by incorporating indexed values for future recreational use for various activities, modified to account for differences in population estimates. The populations of counties immediately surrounding the project experienced about an 18.6 percent increase in population from 1999 to 2000 (Duke Energy, 2007). Duke Energy estimated population projections through 2030 using data from the Office of State Planning for the counties located in North Carolina and from the Office of Research and Statistics for the counties in South Carolina. Population estimates through 2050 were calculated by applying an average percentage increase for each 10-year period. Duke Energy estimates a 57 percent increase in recreational visitation at the Catawba-Wateree Project from 2004 to 2050.

Bridgewater Development

The Bridgewater Development public recreation areas received more than 1 million recreational visits (including both recreational area visitors and shoreline resident visitors) for the 2004-2005 study period. Sixty-seven percent of the visitation at the Bridgewater Development occurred during the peak recreation season (April through September). Boat fishing (14 percent), motor boating (11 percent), and swimming are the primary recreational activities at Lake James recreation areas. At the Bridgewater regulated river reach recreation areas, recreational visitors were primarily walking (29 percent), sightseeing (21 percent), fishing (16 percent), and picnicking (11 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Bridgewater Development, the Linville Access Area had a mean percent capacity of 58 percent on non-holiday weekends and is the only recreation access area where the capacity exceeded 50 percent (table 52). During the study period, the Linville Access Area was recorded over capacity 13 percent of the time on non-holiday weekends.

For Lake James, the peak numbers of boats (highest day) during the days when counts were conducted were 60 boats (weekday), 344 boats (weekend), and 253 boats (holiday). The average number of boats (per type of day) was 43 boats (weekday), 211 boats (weekend), and 119 boats (holiday). In terms of overall lake-wide boating capacity, the estimated percent of capacity for the peak day was 8 percent (weekday), 45 percent (weekend), and 33 percent (holiday). Based on the average boat counts per category, the estimated percent of capacity was 6 percent (weekday), 27 percent (weekend), and 18 percent (holiday) (Study Team/Resource Committee, 2006).

Table 52. Summary of non-holiday weekend capacity of the recreation access areas at the Bridgewater Development. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Lake James					
Black Bear Access Area	171	60	90	35%	
Lake James State Park		44	77	NA	
Hidden Cove Access Area	47	7	13	15%	
Canal Bridge Access Area	95	38	70	40%	
Linville Access Area	62	36	70	58%	13%
Bridgewater Regulated River Reach					
Bridgewater Access Area	24	2	8	10%	8%
Watermill Road Canoe Access	14	4	10	28%	
Morganton Greenway - Greenlee Ford Park	0	21	37	NA	
Morganton Greenway - River Village Park	0	0	4	NA	

Recreational use is estimated to increase by 42 percent between 2004 and 2050 for Lake James and by 51 percent for the Bridgewater regulated river reach. Boating (motor boating and boat fishing), sightseeing, and swimming are anticipated to receive the greatest amounts of future use at Lake James. Walking, sightseeing, bank/pier fishing, and picnicking are anticipated to receive the greatest amounts of future use at the Bridgewater regulated river reach. For Lake James, Duke Energy estimated 164 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006). This includes about 5 acres of beaches, 8 acres of picnic areas, 58 acres of campsites, 74 acres of boat ramps, 14 acres of hiking trails, and 5 acres of fishing access areas. For the Bridgewater regulated river reach, an estimated 160 acres would be required to accommodate future recreational facilities demand through the year 2050, including about 7 acres of picnicking, 38 acres of campsites, 6 acres of boat ramps, 102 acres of hiking trails, and 7 acres of fishing access areas.

Rhodhiss Development

More than 400,000 people visited the Rhodhiss Development (Lake Rhodhiss and Rhodhiss tailrace) recreation areas (including both recreational area visitors and shoreline resident visitors) for the 2004-1005 study period. Sixty-nine percent of the visitation at the Rhodhiss Development occurred during the peak recreation season (April through September). Visitors to the Rhodhiss Development recreation areas were primarily boat fishing (46 percent) and bank/pier fishing (15 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Rhodhiss Development, none of the recreation access areas had a mean percent capacity greater than 50 percent on non-holiday weekends (table 53). During the study period, none of the access areas were recorded over capacity on non-holiday weekends.

Table 53. Summary of non-holiday weekend capacity of the recreation access areas at the Rhodhiss Development. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	**Number of parking spaces**	**Mean number of cars counted**	**Maximum number of cars counted**	**Mean % of capacity**	**Percentage of time the site was recorded over capacity**
Lake Rhodhiss					
Johns River	30	4	13	14%	
Huffman Bridge	20	1	4	7%	
Castle Bridge	155	35	72	22%	
Conley Creek/Sawmills Veterans Memorial Park	72	11	24	16%	
Rhodhiss Access Area	104	11	24	11%	
Rhodhiss Canoe Portage	0	0	0	NA	

Recreational use is estimated to increase by about 38 percent between 2004 and 2050 at the Rhodhiss Development. Boat fishing, bank/pier fishing, and motor boating are anticipated to receive the greatest amounts of future use. For Lake Rhodhiss, Duke Energy estimated that 84 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006). This acreage would include approximately 12 acres of beaches, 22 acres of picnic areas, 14 acres of campsites, 59 acres of boat ramps, 1 acre of hiking trails, and 7 acres of fishing access areas.

Oxford Development

The Oxford Development public recreation areas received more than one million recreational visits (taking into account both recreational area visitors and shoreline resident visitors) for the 2004-2005 study period. Sixty-nine percent of the total visitation at the Oxford Development occurred during the peak recreation season (April through September). Boat fishing (15 percent), motor boating (11 percent), bank/pier fishing (9 percent), and swimming (9 percent) are the primary recreational activities at the Lake Hickory recreation areas. At the Oxford regulated river reach recreation areas, recreational visitors were primarily sightseeing (31 percent), picnicking (22 percent), and walking (14 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Oxford Development, none of the recreation access areas had a mean percent capacity greater than 50 percent on non-holiday weekends (table 54). During the study period, none of the access areas were recorded over capacity on non-holiday weekends.

For Lake Hickory, the peak number of boats during the days when counts were conducted were 41 boats (weekday), 281 boats (weekend), and 278 boats (holiday). The average number of boats were: 28 boats (weekday), 171 boats (weekend), and 143 boats (holiday). In terms of overall lake-wide capacity, for the peak day the estimated percent of capacity was 10 percent (weekday), 71 percent (weekend), and 70 percent (holiday). Based on the average boat counts per category, the estimated percent of capacity was 7 percent (weekday), 43 percent (weekend), and 36 percent (holiday) (Study Team/Resource Committee, 2006).

Recreational use is estimated to increase by 47 percent between 2004 and 2050 for Lake Hickory and by 58 percent for the Oxford regulated river reach. For Lake Hickory, boating (motor boating and boat fishing), and bank/pier fishing are anticipated to receive the greatest amounts of future use. Sightseeing, picnicking, and walking are anticipated to receive the greatest amounts of future use at the Oxford regulated river reach. For Lake Hickory, Duke Energy estimated 167 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006). This includes 6 acres of beaches, 9 acres of picnic areas, 20 acres of campsites, 116 acres of boat ramps, 4 acres of hiking trails, and 12 acres of fishing access areas. For the Oxford regulated river reach, an estimated 1 acre would be required to accommodate future recreational facilities demand through 2050 for picnic areas, campsites, and hiking trails.

Table 54. Summary of non-holiday weekend capacity of the recreation access areas at the Oxford Development. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Lake Hickory					
Bud Geitner Park	0	15	32	NA	
Glenn C. Hilton Park	0	39	81	NA	
Gunpowder	60	16	24	26%	
Lovelady	49	22	58	46%	
Wittenburg	206	44	84	21%	
Dusty Ridge	117	10	24	9%	
Oxford Access Area	125	18	28	14%	
Oxford Canoe Portage	20	4	12	21%	
Oxford Regulated Reach					
Riverbend Park	0	6	16	NA	

Lookout Shoals Development

The Lookout Shoals Development public recreation areas received more than 243,000 recreational visits (including both recreational area visitors and shoreline resident visitors) for the 2004-2005 study period. Sixty-nine percent of the total visitation at the Lookout Shoals Development occurred during the peak recreation season (April through September). Boat fishing (18 percent), motor boating (10 percent), and swimming (8 percent) are the primary recreational activities at the Lookout Shoals Lake recreation areas. At the tailrace and Lookout Shoals regulated river reach recreation areas, recreational visitors were primarily tailrace fishing, (75 percent), boat fishing (12 percent), and hunting (12 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Lookout Shoals Development, none of the recreation access areas had a mean percent capacity greater than 50 percent on non-holiday weekends (table 55). During the study period, none of the access areas were recorded over capacity on non-holiday weekends.

Table 55. Summary of non-holiday weekend capacity of the recreation access areas at the Lookout Shoals Development. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Lookout Shoals Lake					
Sharon Access Area	29	7	12	24%	
Lookout Shoals Access Area	56	23	33	41%	

Recreational use is estimated to increase by 48 percent between 2004 and 2050 for Lookout Shoals Lake and by 49 percent for the Lookout Shoals regulated river reach. For Lookout Shoals Lake, boating (motor boating and boat fishing) and sightseeing are anticipated to receive the greatest amounts of future use. Boat fishing and sunbathing are anticipated to receive the greatest amounts of future use at the Lookout Shoals regulated river reach. For Lookout Shoals Lake, Duke Energy estimated 36 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006) that includes approximately 1 acre of beaches, 1 acre of picnic areas, 13 acres of campsites, 19 acres of boat ramps, 1 acre of hiking trails, and 2 acres of fishing access areas. For Lookout Shoals regulated river reach, an estimated 3 acres of fishing access area would be required to accommodate future recreational facilities demand through the year 2050.

Cowans Ford Development

More than 3.1 million people visited the Cowans Ford Development (Lake Norman and Cowans Ford tailrace) public recreation areas (including both recreational area visitors and shoreline resident visitors) for the 2004-1005 study period. Sixty-four percent of the visitation at the Cowans Ford Development occurred during the peak recreation season (April through September). Visitors to the Cowans Ford Development recreation areas were primarily swimming (10 percent), motor boating (10 percent), sunbathing (8 percent), and boat fishing (7 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Cowans Ford Development on non-holiday weekends, the Marshall fishing area had a mean percent capacity of 87 percent, Roosevelt Wilson Park had a mean percent capacity of 243 percent, and the McGuire fishing area was close to 50 percent capacity (table 56).

Table 56. Summary of non-holiday weekend capacity of the recreation access areas at the Cowans Ford Development. (Source: Study Team/Resource Committee, 2006; and staff)

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Lake Norman					
Hunsucker Park	20	1	2	4%	
Long Island	50	2	5	5%	
Lake Norman State Park		16	31	NA	
Stumpy Creek	157	58	106	37%	
Pinnacle	146	20	63	14%	
McCrary Creek	103	37	49	36%	
Marshall Fishing Area	38	33	57	87%	
Hager Creek	125	3	6	3%	
Little Creek	63	8	18	13%	
Roosevelt Wilson Park	6	15	29	243%	
Beatty's Ford	126	2	6	2%	
Jetton Road County Park		28	74	NA	
Ramsey Creek	295	31	52	11%	
Blythe Landing County Park	261	24	48	9%	
McGuire Fishing Area	55	27	43	49%	

For Lake Norman, the peak numbers of boats during the days when counts were conducted were 262 boats (weekday), 982 boats (weekend), and 1,814 boats (holiday). The average number of boats were 210 boats (weekday), 830 boats (weekend), and 1,104 boats (holiday). For the peak day, the estimated percent of capacity in terms of overall lake-wide capacity was 6 percent (weekday), 23 percent (weekend), and 43 percent (holiday). Based on the average boat counts, the estimated percent of capacity was 5 percent (weekday), 20 percent (weekend), and 26 percent (holiday) (Study Team/Resource Committee, 2006).

Recreational use is estimated to increase by 62 percent between 2004 and 2050 at the Cowans Ford Development. Motor boating, swimming, and sightseeing are anticipated to

receive the greatest amounts of future use. For Lake Norman, Duke Energy estimated that approximately 489 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006). This includes approximately 20 acres of beaches, 31 acres of picnic areas, 104 acres of campsites, 289 acres of boat ramps, 23 acres of hiking trails, and 23 acres of fishing access areas.

Mountain Island Development

The Mountain Island Development public recreation areas received more than 479,000 recreational visits (taking into account both recreational area visitors and shoreline resident visitors) for the 2004-2005 study period. Sixty-seven percent of the visitation at the Mountain Island Development occurred during the peak recreation season (April through September). Visitors to the development recreation areas were primarily swimming (9 percent), motor boating (9 percent), boat fishing (7 percent), picnicking (7 percent), sightseeing (7 percent), and sunbathing (6 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Mountain Island Development, none of the recreation access areas had a mean percent capacity greater than 50 percent on non-holiday weekends (table 57).

Table 57. Summary of non-holiday weekend capacity of the recreation access areas at the Mountain Island Development. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Mountain Island Lake					
Cowans Ford Wildlife Refuge	14	4	16	29%	
Rural Hill Park	7	0	1	4%	
Neck Road	65	0	0	0%	
Latta Plantation County Park	179	19	33	11%	
Riverbend	104	34	69	33%	

For Mountain Island Lake, the peak number of boats during the days when counts were conducted were 19 boats (weekday), 67 boats (weekend), and 165 boats (holiday). The average number of boats were 13 boats (weekday), 51 boats (weekend), and 108 boats (holiday). In terms of overall lake-wide capacity, for the peak day the estimated percent of capacity was 7 percent (weekday), 26 percent (weekend), and 64 percent (holiday). Based on the average boat counts per category, the estimated percent of capacity was 5 percent (weekday), 20 percent (weekend), and 42 percent (holiday) (Study Team/Resource Committee, 2006).

Recreational use is estimated to increase by 63 percent between 2004 and 2050 at the Mountain Island Development. Motor boating, sightseeing, and swimming are anticipated to receive the greatest amounts of future use. For Mountain Island Lake, Duke Energy estimated that approximately 87 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006). This includes approximately 3 acres of beaches, 6 acres of picnic areas, 19 acres of campsites, 50 acres of boat ramps, 4 acres of hiking trails, and 4 acres of fishing access areas.

Wylie Development

The Wylie Development public recreation areas received more than 2.3 million recreational visits (including both recreational area visitors and shoreline resident visitors) for the 2004-2005 study period. Sixty-seven percent of the total visitation at the Wylie Development occurred during the peak recreation season (April through September). Bank/pier fishing (20 percent), sightseeing (17 percent), walking (14 percent), and picnicking (10 percent) are the primary recreational activities at the Lake Wylie recreation areas. At the Wylie regulated river reach recreation areas, recreational visitors were primarily bank/pier fishing (20 percent), sightseeing (17 percent), walking (14 percent), and picnicking (10 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Wylie Development on non-holiday weekends, the Mountain Island River Park had a mean percent capacity of 146 percent, and the Nivens Creek Access Area had a mean percent capacity of 111 percent (table 58). The Buster Boyd Access Area was close to 50 percent capacity on non-holiday weekends. During the study period, the Nivens Creek Access Area was recorded over capacity 50 percent of the time on non-holiday weekends.

Table 58. Summary of non-holiday weekend capacity of the recreation access areas at the Wylie Development. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	**Number of parking spaces**	**Mean number of cars counted**	**Maximum number of cars counted**	**Mean % of capacity**	**Percentage of time the site was recorded over capacity**
Lake Wylie					
Mountain Island River Park	24	35	92	146%	
Mountain Island Tailrace Fishing Area	22	4	7	18%	
Mount Holly River Street Park	30	1	8	5%	
Allen Fishing Area	29	4	10	13%	
South Point	172	41	86	24%	
Copperhead	100	33	76	33%	

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Buster Boyd	176	83	216	47%	
McDowell Park		28	105	NA	
Allison Creek	106	39	81	37%	
Ebenezer Park	236	75	156	32%	
Nivens Creek	34	38	93	111%	50%
Wylie Regulated River Reach					
Fort Mill	20	5	7	26%	
Rock Hill River Park		6	11	NA	
Landsford Canal State Park		25	55	NA	

For Lake Wylie, the peak number of boats during the days when counts were conducted were 117 boats (weekday), 238 boats (weekend), and 506 boats (holiday). The average number of boats was 75 boats (weekday), 222 boats (weekend), and 397 boats (holiday). For the peak day, in terms of overall lake-wide capacity, the estimated percent of capacity was 8 percent (weekday), 17 percent (weekend), and 37 percent (holiday). Based on the average boat counts per category, the estimated percent of capacity was 5 percent (weekday), 16 percent (weekend), and 29 percent (holiday) (Study Team/Resource Committee, 2006).

Recreational use is estimated to increase by 65 percent between 2004 and 2050 for Lake Wylie and by 64 percent for the Wylie regulated river reach. For Lake Wylie, motor boating, bank/pier fishing, boat fishing, and swimming are anticipated to receive the greatest amounts of future use. Bank/pier fishing, sightseeing, walking, and picnicking are anticipated to receive the greatest amounts of future use at the Wylie regulated river reach. For Lake Wylie, Duke Energy estimated that approximately 410 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006), including about 15 acres of beaches, 26 acres of picnic areas, 93 acres of campsites, 227 acres of boat ramps, 18 acres of hiking trails, and 32 acres of fishing access areas. For the Wylie regulated river reach, Duke Energy estimated that approximately 5 acres would be required to accommodate future recreational facilities demand through the year 2050. This includes about 1 acre of picnic areas, less than 1 acre of campsites, 1 acre of boat ramps, 3 acres of hiking trails, and 1 acre of fishing access areas.

Fishing Creek Development

The Fishing Creek Development public recreation areas received more than 233,000 recreational visits (including both recreational area visitors and shoreline resident visitors) for the 2004-2005 study period. Sixty-six percent of the visitation at the Fishing Creek Development occurred during the peak recreation season (April through September). Visitors to the Fishing

Creek Development recreation areas were primarily bank/pier fishing (24 percent), boat fishing (22 percent), and motor boating (10 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Fishing Creek Development, none of the recreation access areas had a mean percent capacity greater than 50 percent on non-holiday weekends (table 59). During the study period, none of the access areas were recorded over capacity on non-holiday weekends.

Table 59. Summary of non-holiday weekend capacity of the recreation access areas at the Fishing Creek Development. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Fishing Creek Reservoir					
Highway 9 Landing	20	6	16	29%	
Cane Creek	35	5	10	13%	
Fishing Creek	60	13	19	22%	

Recreational use is estimated to increase by 39 percent between 2004 and 2050 at the Fishing Creek Development. Bank/pier fishing, boat fishing, and motor boating are anticipated to receive the greatest amounts of future use. For Fishing Creek Lake, Duke Energy estimated that approximately 358 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006) including about 1 acre of beaches, 2 acres of picnic areas, 2 acres of campsites, 24 acres of boat ramps, less than 1 acre of hiking trails, and 7 acres of fishing access areas.

Great Falls and Dearborn Developments

There are currently no public recreation areas associated with the Great Falls reservoir, tailraces, and bypassed reaches. Therefore, future use estimates were not projected.

Rocky Creek and Cedar Creek Developments

About 51,000 people visited the Rocky Creek and Cedar Creek Developments' (Cedar Creek reservoir and tailraces) recreation areas (including both recreational area visitors and shoreline resident visitors) for the 2004-1005 study period. Fifty-six percent of the visitation at the Rocky Creek and Cedar Creek Developments occurred during the peak recreation season (April through September). Visitors to the Rocky Creek and Cedar Creek Developments' recreation areas were primarily boat fishing (30 percent), bank/pier fishing (22 percent), sightseeing (7 percent), and picnicking (7 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the

Rocky Creek and Cedar Creek Developments, none of the recreation access areas had a mean percent capacity greater than 50 percent on non-holiday weekends (table 60). During the study period, none of the access areas were recorded over capacity on non-holiday weekends.

Table 60. Summary of non-holiday weekend capacity of the recreation access areas at the Rocky Creek and Cedar Creek Developments. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Cedar Creek Reservoir					
Stumpy Pond	23	4	10	16%	
Debutary Creek	20	5	17	23%	

Recreational use is estimated to increase by 41 percent between 2004 and 2050 at the Rocky Creek-Cedar Creek Developments. Boat fishing, bank/pier fishing, and sightseeing are the recreational activities anticipated to receive the greatest amounts of future use. For Cedar Creek reservoir, Duke Energy estimated that 9 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006). This includes less than 1 acre of beaches, 1 acre of picnic areas, 1 acre of campsites, 6 acres of boat ramps, less than 1 acre of hiking trails, and 1 acre of fishing access areas.

Wateree Development

The Wateree Development public recreation areas received more than 680,000 recreational visits (taking into account both recreational area visitors and shoreline resident visitors) for the 2004-2005 study period. Sixty-seven percent of the total visitation at the Wateree Development occurred during the peak recreation season (April through September). Boat fishing (13 percent), swimming (11 percent), motor boating (10 percent), and bank/pier fishing (9 percent) are the primary recreational activities at the Lake Wateree recreation areas. At the Wateree regulated river reach recreation areas, recreational visitors were primarily tailrace fishing (45 percent), bank/pier fishing (21 percent), and boat fishing (16 percent).

During the recreation use and needs study conducted during the relicensing of the project, spot counts were conducted to analyze parking capacity at the recreation access areas. At the Wateree Development on non-holiday weekends, the Wateree Creek Access Area had a mean percent capacity of 50 percent, White Oak Creek Access Area had a mean percent capacity of 63 percent, and the Highway 1 landing had a mean percent capacity of 58 percent (table 61). The Beaver Creek Landing was close to 50 percent capacity on non-holiday weekends. During the study period, the White Oak Creek Access Area was recorded over capacity 11 percent of the time on non-holiday weekends.

Table 61. Summary of non-holiday weekend capacity of the recreation access areas at the Wateree Development. (Source: Study Team/Resource Committee, 2006; staff)

Public recreation area	Number of parking spaces	Mean number of cars counted	Maximum number of cars counted	Mean % of capacity	Percentage of time the site was recorded over capacity
Lake Wateree					
Cedar Creek	55	13	26	23%	
Wateree Creek Bridge	0	0	2	NA	
Wateree Creek Access Area	37	19	36	50%	
Taylors Creek Access Area	70	14	35	20%	
Taylors Creek Bridge	2	0	0	0%	
Lake Wateree State Park		30	78	NA	
Dutchman's Creek Bridge	4	1	2	13%	
June Creek	35	12	23	34%	
Beaver Creek Landing	45	19	78	43%	
Colonel's Creek Bridge	4	1	2	13%	
Colonel's Creek Access Area	72	21	38	30%	
White Oak Creek	88	55	91	63%	11%
Buck Hill	50	11	21	22%	
Wateree Regulated River Reach					
Lugoff	48	12	25	26%	
Highway 1 Landing	26	15	27	58%	
Billy Tolar Landing	49	15	15	31%	

For Lake Wateree, the peak number of boats during the days when counts were conducted were 62 boats (weekday), 158 boats (weekend), and 260 boats (holiday). The average number of boats was 38 boats (weekday), 117 boats (weekend), and 168 boats (holiday). In terms of overall lake-wide capacity, for the peak day the estimated percent of capacity was 3 percent (weekday), 9 percent (weekend), and 14 percent (holiday). Based on the average boat

counts per category, the estimated percent of capacity was 2 percent (weekday), 6 percent (weekend), and 9 percent (holiday) (Study Team/Resource Committee, 2006).

Recreational use is estimated to increase by 30 percent between 2004 and 2050 for Lake Wateree and by 24 percent for the Wateree regulated river reach. For Lake Wateree, motor boating, boat fishing, and swimming are anticipated to receive the greatest amounts of future use. Tent/vehicle camping, swimming, bank/pier fishing, and motor boating are anticipated to receive the greatest amounts of future use at the Wateree regulated river reach. For Lake Wateree, Duke Energy estimates 124 acres would be required to accommodate future recreational facilities demand through the year 2050 (Study Team/Resource Committee, 2006). This includes approximately 4 acres of beaches, 6 acres of picnic areas, 40 acres of campsites, 65 acres of boat ramps, 3 acres of hiking trails, and 8 acres of fishing access areas. For the Wateree regulated river reach, an estimated 31 acres would be required to accommodate future recreational facilities demand through the year 2050. This includes less than 1 acre of beaches, 1 acre of picnic areas, 11 acres of campsites, 6 acres of boat ramps, 3 acres of hiking trails, and 10 acres of fishing.

3.3.7.2 Environmental Effects

Reservoir Elevations

Duke Energy proposes to continue to maintain the normal target reservoir elevation high enough to ensure that all boat ramps at Duke Energy-owned public access areas would be usable during the peak recreation season and to ensure that the majority of the reservoirs' surface area is boatable during the peak recreation season, which runs from April through September. The proposed reservoir level ranges are generally not as broad as existing ranges, and proposed overall reservoir target levels are slightly higher or similar to those under the existing license. Duke Energy proposes, within 60 days of license issuance, to operate the project to maintain reservoir elevations within specific normal minimum and normal maximum elevations around normal target elevations. The proposed normal minimum elevation ranges from 1.5 to 4 ft (generally about 2-3 ft) below the normal target elevation, depending on the reservoir and season, taking into consideration the following: (1) the ability to draw down the reservoir when substantial precipitation is expected; (2) the ability to use a portion of the reservoir storage during relatively dry periods; (3) the ability to ensure that all public water supply, large industrial, and regional power station water intakes on the reservoirs are fully usable; and (4) the ability to ensure that most of the boat ramps at the Duke Energy-owned public access areas on the reservoirs are operational. Duke Energy's proposed reservoir elevations are discussed further in section 3.3.2.2.1 *Water Resources, Environmental Effects, Water Quantity*.

Ms. Donna Lisenby, the Catawba Riverkeeper, commented that target elevations are not enforceable and that the minimum elevations for some reservoirs are lower than the previous guide curves.

Mr. Chris Goudreau with North Carolina WRC comments that the new reservoir level regimes will expand the time of year that the project reservoirs can be used for recreational purposes, particularly for Lake James where the reservoir will be filled earlier in the spring and held high longer in the fall.

Our Analysis

As part of a Comprehensive Relicensing Settlement Agreement (CRA) (Proposed Article A-1.0 Reservoir Elevations), Duke Energy's proposal would expand the time of year that the project reservoirs can be used for recreational purposes, particularly for Lake James where the reservoir will be filled earlier in the spring and held high longer in the fall. The proposed reservoir elevations would generally reduce the reservoir elevation fluctuations with the normal minimum elevation ranging from 1.5 to 4 ft (generally 2 to 3 ft) below the normal target elevation. Proposed reservoir target levels are generally slightly higher than existing, but there would be no associated effects on recreational use and access at the project which currently supports more than 10.1 million recreation days annually.

A normal minimum elevation of 4 ft below the normal target elevation is proposed at Lake James during the month of April only and at Lake Wateree during the month of November only. The November period is outside of the project's peak recreation season while the April period is still inside the project peak recreation season. Lake Wateree receives about 9 percent of the total recreational use at the project while Lake James receives about 8 percent. The recreational use and needs study conducted for the relicensing, which included surveys of recreation access area visitors and shoreline residents, did not identify reservoir levels as an issue related to recreational use or boating.

The reservoir level study conducted during relicensing showed that historic reservoir levels were influenced over the life of the Catawba-Wateree hydroelectric facilities by hydrologic conditions, maintenance needs, and power generation needs. The magnitude of reservoir level variation and the number of days when boating access was restricted due to reservoir levels have generally decreased in recent years (Duke Energy, 2005a). The study report summarized the critical reservoir elevations[17] for boating access as feet msl relative to 100 ft equal to full pond. The critical reservoir elevation is 92.0 ft for Lake James, 95.5 ft for Lake Wylie, 95.0 ft for Fishing Creek reservoir, 96.0 ft for Cedar Creek reservoir, 93.0 ft for Lake Wateree, not applicable for Great Falls reservoir, and 91.0 ft for the remaining project reservoirs. Duke Energy's proposed normal target elevations are well above these critical reservoir elevations. Generally, Duke Energy's proposed normal minimum elevations are at or above these critical reservoir elevations, except for Lake Wylie where the proposed year-round normal minimum elevation is 94 ft, which is below the critical reservoir elevation for boating access but above the critical elevation for power production and municipal/industrial intakes.

We conclude that that the proposed reservoir elevations would not have an adverse effect on recreation at the project.

Under the proposed license article, Duke Energy proposes in good faith to endeavor to achieve the normal target elevations and maintain reservoir levels within the newly established minimum and normal maximum elevations unless operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol. Duke Energy also proposes (Proposed License Article A-6.0 Flow and Reservoir Elevation Monitoring) to file a report by June 30 of each year with the Commission that verifies compliance for the previous year with the normal minimum

[17] Critical reservoir elevations for boating access are the reservoir elevations below which public boating access to the reservoir is restricted based on keeping at least two Duke Energy-owned recreation access areas open per reservoir.

reservoir elevations and normal maximum reservoir elevations, spring reservoir level stabilization program, recreational flow releases, minimum continuous flows, minimum average daily flows, and the Wylie High Inflow Protocol. Thus, compliance with reservoir elevations would be reviewed by the Commission.

In the Catawba-Wateree Revised CRA, to address the flooding issue at Lake Wateree, Duke Energy and the signatories agree that Duke Energy would install a bladder dam along the Wateree dam's spillway to provide approximately 10,000 cfs flow release capacity with Lake Wateree at full pond elevation to improve Duke Energy's flood management capabilities at Lake Wateree. The Revised CRA states that the signatories agree this measure would not prevent flooding on Lake Wateree above any specific elevation. Interior, American Rivers, and the Coastal Conservation League recommend the inclusion of the proposed bladder dam in the new license regardless of the license term.

Although the flooding issues and proposed bladder dam at the Wateree Development were not raised as an issue for recreational use and access, flooding has the potential to affect recreational use and access. Lake Wateree currently has 9 public recreation access areas with 20 boat ramps and 2 fishing piers. Flooding has the potential to limit access to recreation access areas if roads are flooded, and also to inundate boat ramps, making them inaccessible to the public. While flooding is expected to continue even with the proposed bladder dam, it would occur less frequently and less severely than under current conditions. Therefore, potential flooding impacts to recreational use and facilities would be lessened, though not eliminated, under Duke Energy's proposal. As discussed in section 3.3.2.2.1, *Water Resources, Environmental Effects, Water Quantity,* high intensity rainfall events have been shown to cause Lake Wateree to rise above the normal full reservoir elevation (225.5 ft msl). The potential for such occurrences is exacerbated if the rainfall events occur within the portion of the Catawba watershed downstream of Lake Wylie because the three reservoirs between Wylie and Wateree have limited storage capacity. Lake Norman and Lake James are the only upstream reservoirs with significant storage capacity in the Catawba-Wateree River Basin.

Under the existing license, Duke Energy attempts to maintain the water surface level in Lake Wateree at a year-round target elevation of 97 ft; however, the proposed water surface under the new license would be 95 ft in December, 94.5 ft in January, and 97 ft the remainder of the year. Since most high rainfall events would probably occur in the late winter or early spring, potential flooding impacts to recreational use and facilities are less than they would be if high rainfall events typically occurred during the peak recreation season (April through September).

Minimum Flows, Recreational Flows, and Streamflow Monitoring

Under existing conditions at the Bridgewater Development, Duke Energy releases a continuous minimum flow of at least 25 cfs from the Linville dam into the Bridgewater tailrace and 0 cfs from the Catawba dam into the Catawba River bypassed reach. Duke Energy currently releases a continuous minimum flow of at least 40 cfs from the Oxford Development, 60 cfs from the Lookout Shoals Development, 0 cfs from the Wylie Development, 0 cfs from the Great Falls and Dearborn Developments into the Long and Short bypassed reaches, and 0 cfs from the Wateree Development.

Duke Energy proposes to provide increased minimum flows from the Bridgewater, Oxford, Lookout Shoals, Wylie, Great Fall-Dearborn, and Wateree Developments to protect and enhance aquatic habitat and water quality in the downstream riverine sections, in addition to

minimum average daily flows from the remaining project developments, as described in section 3.3.3.2 *Aquatic Resources, Environmental Effects*.

South Carolina DNR comments that the minimum flows proposed by Duke Energy for aquatic habitat would comply with the state water plan, enhance fish and wildlife habitat in the Catawba River Basin, meet all requirements for recreational navigation, and protect and enhance water quality. South Carolina DNR also comments that the proposed Wylie High Inflow Protocol would provide some additional benefit to the aquatic community in the Catawba River below Lake Wylie and enhance recreational navigation.

Mr. Tim Mead, representing recreational anglers, comments that recreational anglers are pleased with the minimum flows in the river reaches below Lake James and Lake Wylie.

Duke Energy proposes to provide dedicated recreational flow releases at rates and on schedules to support paddling, wade fishing, boat fishing, and other activities. These new scheduled flows would be provided in the Bridgewater, Oxford, Wylie, and Wateree regulated river reaches as well as scheduled flow releases for canoeing and whitewater boating into the Great Falls bypassed reaches. These recreational flows would be provided within 60 days of license issuance at the Bridgewater, Oxford, Wylie, and Wateree Developments and could be temporarily modified if Duke Energy is operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol. Duke Energy proposes to convene an annual recreational flow schedule planning meeting in March of each year with North Carolina DENR, North Carolina WRC, South Carolina DNR, South Carolina DPRT, and other entities with recreational experience or expertise to identify potential improvements to the recreational flow release schedule, to establish the schedule for the added recreational flow releases (10 additional hours of recreational flows at each location per year), and to identify potential dates for replacement flows at the Bridgewater Development.

Duke Energy proposes to provide recreational flow releases at the Bridgewater Development to support float angling and paddling, in accordance with the schedule shown in table 62. The flows for float angling would be as close as feasible to 900 cfs, but would not exceed 1,200 cfs, and the flows for paddling would be at least 900 cfs with scheduled recreational flow release days divided approximately equally.

Table 62. Bridgewater Development recreational flow schedule. (Source: Duke Energy, 2006a)

Dates (inclusive)	Days/description	Flow (at or above cfs)	Hour start	Hour end
Apr 1–Apr 30	Last full weekend–Saturday and Sunday	900	10:00 AM	3:00 PM
May 1–Jul 15	Each Friday, Saturday, and Sunday plus Memorial Day and Independence Day	900	10:00 AM	3:00 PM
Jul 16–Aug 31	Each Saturday and Sunday	900	10:00 AM	3:00 PM
Jun 1–July 31	Wednesdays and Thursdays	900	4:30 PM	6:30 PM

Dates (inclusive)	Days/description	Flow (at or above cfs)	Hour start	Hour end
Sep 1–Sep 30	Each Friday, Saturday, and Sunday plus Labor Day	900	10:00 AM	3:00 PM
Oct 1–Oct 31	Each Saturday and Sunday	900	10:00 AM	3:00 PM

Duke Energy proposes to provide recreational flow releases at the Oxford Development of at least 2,600 cfs in accordance with the schedule shown in table 63.

Table 63. Oxford Development recreational flow schedule. (Source: Duke Energy, 2006a)

Dates (inclusive)	Days/Description	Flow (at or above cfs)	Hour Start	Hour End
May 1–Sept 30	Each Saturday and Sunday plus Memorial, Independence, and Labor Days	2,600	10:00 AM	3:00 PM
Oct 1–Oct 31	First four Saturdays	2,600	10:00 AM	3:00 PM

Duke Energy proposes to provide recreational flow releases at the Wylie Development in accordance with the schedule below. In addition, Duke Energy proposes, from May 1 to July 15 inclusive, to release at least 1,300 cfs for 6 hours prior to the recreational flow release scheduled start times shown in table 64 to ensure suitable water levels at the Landsford Canal State Park.

Table 64. Wylie Development recreational flow schedule. (Source: Duke Energy, 2006a)

Dates (inclusive)	Days/description	Flow (at or above cfs)	Hour start	Hour end
Apr 1–Apr 30	Last full weekend–Saturday and Sunday	3,000	10:00 AM	4:00 PM
May 1–Jun 15	Each Friday, Saturday, and Sunday plus Memorial Day	3,000	10:00 AM	4:00 PM
Jun 16–Jul 15	Each Friday, Saturday, and Sunday plus Independence Day	6,000	10:00 AM	4:00 PM
Jul 16–Aug 31	Each Saturday and Sunday	6,000	10:00 AM	4:00 PM
Sep 1–Sep 30	Each Friday, Saturday, and Sunday plus Labor Day	6,000	10:00 AM	4:00 PM
Oct 1–Oct 31	Each Saturday and Sunday	3,000	10:00 AM	4:00 PM

Duke Energy proposes to evaluate safety concerns associated with boating near the Great Falls Diversion dam, the Great Falls headworks, and the Great Falls-Dearborn dam, and determine the need for constructing boating safety devices upstream of the structures. This evaluation would be completed, and the necessary structures would be completed prior to beginning the recreational flows. Duke Energy proposes, within 60 days following completion of the structural modifications at both the Great Falls diversion dam and the Great Falls headworks and the completion of the Highway 200 Bridge Access Area, the Great Falls diversion dam portage, the Great Falls headworks portage, and the Great Falls headworks-to-Cedar Creek reservoir portage, to provide recreational flow releases as summarized in table 65 of at least 2,940 cfs into Great Falls Long bypassed reach and at least 2,860 cfs into Great Falls Short bypassed reach.

Table 65. Great Falls and Dearborn Developments recreational flow schedule. (Source: Duke Energy, 2006a)

Channel	Dates (inclusive)	Days/description	Flow (at or above cfs)	Hour start	Hour end
Long Bypassed Reach	Mar 1–Oct 31	Two Saturdays per month	2,940	10:00 AM	3:00 PM
		A total of four Saturdays	2,940		
Short Bypassed Reach	Mar 1–Apr 30	One Saturday per month to correspond with Long bypass releases	2,860	10:00 AM	3:00 PM
	May 1–Oct 31	Two weekends (Saturday and Sunday) per month	2,860		

Duke Energy proposes to provide recreational flow releases at the Wateree Development of at least 2,760 cfs in accordance with the schedule shown in table 66.

Table 66. Wateree Development recreational flow schedule. (Source: Duke Energy, 2006a)

Dates (inclusive)	Days/description	Flow (at or above cfs)	Hour start	Hour end
Apr 1–Apr 30	Last full weekend–Saturday and Sunday	2,760	10:00 AM	3:00 PM
May 1–Jul 31	Each Saturday and Sunday plus Memorial and Independence Days	2,760	10:00 AM	3:00 PM
Sep 1–Sep 30	Each Saturday and Sunday plus Labor Day	2,760	10:00 AM	3:00 PM
Oct 1–Oct 31	Each Saturday and Sunday	2,760	10:00 AM	3:00 PM

Many comments were received supporting the scheduled recreational flows. Mr. Irvin Pitts with South Carolina DPRT and Mr. Maurice Blackburn with the Carolina Canoe Club support the recreational flows and conclude they will enhance tourism in the area. Mr. Blackburn comments that the negotiated recreational flows, particularly at Bridgewater, took into account downstream angling. Mr. Ben Van Camp and Mr. Andrew Lazenby with American Whitewater support the recreational flows, particularly in the Bridgewater Reach, which has good beginner Class II and intermediate whitewater, and at Great Falls. Mr. Chris Goudreau, North Carolina WRC, comments that the scheduled recreational flows will be a good improvement from existing conditions. Ms. Barbara Baddy with Catawba County, North Carolina, supports the recreational flows at the Oxford development. Mr. Nick Stegall, City of Rock Hill, South Carolina, comments that the proposed recreational flows are adequate for improved boating access below Lake Wylie. Ms. Glenda Coleman, Great Falls Hometown Association, comments that the recreational flows will attract paddlers from other states and help restore the town of Great Falls to a nature-based economy. The North Carolina Wildlife Federation comments that the increased flows will benefit paddlers, float hunters, and wade anglers. South Carolina DNR supports the recreational flows and comments that the recreational flows will enhance paddling and boating opportunities, but recommends the Commission evaluate the effect of these flows on operations and natural resources, particularly at Great Falls.

Duke Energy proposes, within 1 year following the implementation of the minimum continuous flow from the Linville dam at the Bridgewater Development, to fund the installation of a new USGS streamflow gage to be located on the Linville River between the Linville dam and the confluence with the Catawba River to monitor compliance with the minimum flow and recreational flow release requirements and to provide a readily available source of public information. Additionally, Duke Energy proposes to fund the annual maintenance cost for the term of the new license for the new gage and for six existing USGS streamflow gages (#02137727 Catawba River near Pleasant Gardens, North Carolina; #02140991 Johns River at Arney's Store, North Carolina; #02145000 South Fork Catawba River at Lowell, North Carolina; #02146000 Catawba River near Rock Hill, South Carolina; #02147500 Rocky Creek at Great Falls, South Carolina; and #02148000 Wateree River near Camden, South Carolina) to monitor compliance with the minimum flow and recreational flow release requirements and to provide a readily available source of information.

Duke Energy also proposes to file a report by June 30 of each year with the Commission that verifies compliance for the previous year with reservoir level and flow requirements, including normal minimum reservoir elevations and normal maximum reservoir elevations, recreational flow releases, minimum continuous flows, and minimum average daily flows.

South Carolina DNR comments that it concurs with Duke Energy's proposal to fund the installation and annual maintenance cost for the term of the new license of a new USGS streamflow gage to be located on the Linville River between the Linville dam and the confluence with the Catawba River to monitor compliance with the minimum flow and recreational flow release requirements. It also concurs with Duke Energy's proposal to file a report by June 30 of each year with the Commission that verifies compliance for the previous year with reservoir level and flow requirements.

Our Analysis

Duke Energy's proposed minimum flows (Proposed Article A-2.0 Minimum Flows) and additional recreational flows (Proposed Article A-2.0 Recreational Flows) would enhance recreational opportunities by providing non-motorized boating and fishing opportunities. The proposed minimum flows at most of the developments represent a modest to moderate increase in minimum flows over what is currently provided. For the recreation use and needs study conducted for the relicensing, recreation access area visitors and shoreline residents provided considerable input on the need for additional flows in the bypassed reaches at the Great Fall-Dearborn Developments and an interest in additional recreational opportunities in the tailraces, regulated river reaches, and bypassed reaches.

FWS, American Rivers, and the Coastal Conservation League commented that the Wateree River (below Wateree Lake) and portions of the Catawba River (from above Fishing Creek reservoir to Lake Wylie and from the backwaters of Lake James to the Catawba River headwaters) are included in the Nationwide Rivers Inventory as potentially eligible for wild and scenic river designation. They state that pursuant to a 1979 Presidential Directive and Council on Environmental Quality procedures, the Commission must seek to avoid or mitigate actions that would have an adverse effect on one or more National Rivers Inventory segments. Duke Energy's proposed minimum flows for the Wylie and Wateree Developments would enhance these sections by providing minimum flows to protect and enhance aquatic habitat and water quality in the downstream riverine sections, while the proposed recreation flows at the Wylie and Wateree Developments would enhance the recreational values.

Duke Energy's proposed recreational flows would provide reliable flows for recreation that would greatly enhance recreational opportunities in the regulated river reaches and provide whitewater boating opportunities in the bypassed reaches at Great Falls, where there are currently none. Duke Energy proposes to provide weekend and holiday recreational flows during most of the project's peak recreation season (April through September) at the Bridgewater, Oxford, Wylie, and Wateree Developments. Duke Energy proposes to provide recreational flows late April through September at the Bridgewater and Wylie Developments, late April through July and September at the Wateree Development, and May through September at the Oxford Development. Recreational flows are also proposed for most weekend days in October at these developments. A more limited schedule for recreational flow releases is proposed at the Great Falls and Dearborn Developments with a total of 26 recreational flow days between the two bypassed reaches.

Duke Energy conducted a recreation flow study during the relicensing to determine the flow, range, and timing of flows that would enhance recreational opportunities for anglers and boaters of various skill levels (Duke Energy, 2006j). The recreation flow study was designed to address public needs for riverine recreation flows, specifically those of recreational boaters (canoe, kayak, drift boat) and recreational anglers, not provide flows for aquatic habitat. Results from the boating evaluation were used to develop Duke Energy's proposed recreational flows. The proposed recreational flows for the Bridgewater Development are within the range for acceptable flows for paddling (400 cfs minimum and 1,000 cfs optimum) and for boat fishing (350 to 900 cfs). Duke Energy's proposed recreational flows for the Oxford Development are the optimum flow (2,600 cfs) for paddling and the minimum flow (2,600 cfs) for motorized boating. The proposed recreational flows at the Wylie Development reflect the minimum (3,000 cfs) and optimum (6,000 cfs) flows for paddling. The optimum paddling flow of

3,000 cfs for the Great Falls Long bypassed reach is reflected in the proposed recreational flow of 2,940 cfs, and the proposed flow for the Great Falls Short bypassed reach is 2,860 cfs (slightly higher than the optimum paddling flow of 2,800 cfs). Duke Energy's proposed recreational flows at the Wateree Development are slightly lower than the minimum suggested flow of 3,500 cfs.

Duke Energy's proposed recreational flows coupled with the proposed recreational enhancements at the Great Falls and Dearborn Developments would provide good to excellent whitewater boating opportunities at the project in both the Great Falls Long and the Great Falls Short bypassed reaches. Under existing conditions, there are no whitewater boating opportunities at the project. In comparing whitewater opportunities at the project to other rivers within a 1-hour drive, the recreation flow study participants noted that the overall experience at both Great Falls bypassed reaches was excellent, while the experience at Bridgewater, Wateree, and Wylie (Fort Mill to Sugar Creek) were rated as better than average. The Wylie section (Sugar Creek to Landsford Canal State Park) was rated as average during this comparison.

Section 3.3.3.3, *Aquatic Resources, Cumulative Effects,* and section 3.3.1.4, *Geology and Soils, Environmental Effects, River Geomorphology,* discuss the effects of the proposed recreational flows on aquatic resources and stream bank erosion below the Wylie and Wateree Developments, and recommend that "ramping" (the gradual increase and decrease of flow) recreational flows over a period of several hours before and after each scheduled recreational release be evaluated and potentially implemented to reduce the risk to aquatic resources. If ramping of flows is considered for achieving the target recreational flow releases, we recommend that the ramping occur outside of Duke Energy's proposed window for target recreational flow releases so that the overall time for recreational boating and angling would not be reduced.

Duke Energy's proposal to convene an annual meeting with North Carolina DENR, North Carolina WRC, South Carolina DNR, South Carolina DPRT, and other entities with recreational experience or expertise to identify potential improvements to the recreational flow release schedule and to establish the schedule for the added recreational flow releases (10 additional hours of recreational flows at each location per year) would provide an opportunity to re-evaluate and modify as necessary, the recreational flow schedule.

During periods of drought or emergency maintenance, the capacity to provide the recreational flows may be compromised, but Duke Energy has proposed a mechanism for temporary variance from recreational flow releases when conditions trigger implementation of the Low Inflow Protocol or Maintenance and Emergency Protocol.

Accurate and timely streamflow data provides important information for recreational visitors planning water-related activities at the project reservoirs, tailraces, and regulated river reaches. While Duke Energy's proposal for funding the installation of a new USGS gage and for funding the maintenance costs of the new gage and six existing gages (Proposed Article A-6.0 Funding for USGS Streamflow Gages) would allow Duke Energy to monitor compliance with the minimum flow and recreational flow release requirements, this proposal also would ensure that recreational users have a readily available source of public information. The streamflow information available through the USGS website would be useful to recreational users in planning and staging water-related visits to the project for fishing, flat water boating, and

whitewater boating, and also would enhance public safety at the project by providing up-to-date information to recreational users about flows.

This streamflow data would be used in the report proposed under the Proposed License Article A-6.0 Flow and Reservoir Elevation Monitoring. Duke Energy proposes to file a report by June 30 of each year with the Commission that verifies compliance for the previous year with the recreational flow releases, minimum continuous flows, minimum average daily flows, normal minimum reservoir elevations and normal maximum reservoir elevations, spring reservoir level stabilization program, and the Wylie High Inflow Protocol. This report would verify compliance with the Commission license requirements for streamflow.

We conclude that Duke Energy's proposed minimum flows, recreational flows, and provision of streamflow data would likely enhance recreational boating use of the project waters, as well as recreation-related spending, which would benefit local communities.

Shoreline Management Plan

The SMP and its guidelines provide classifications and lake use restrictions intended to regulate activities within the project to protect and enhance the scenic, cultural, environmental, public safety, and public recreational values of the reservoirs. Duke Energy is proposing changes to the existing project SMP in two areas: (1) revised shoreline classification maps, and (2) revised SMG. The proposed changes to the SMP and its guidelines were developed by Duke Energy, in consultation with resource agencies, and other interested stakeholders

The SMP is fully discussed in section 3.3.8 *Land Use and Aesthetics.* The proposed SMP and its guidelines include a number of restrictions that could impact recreational resources. Water willow beds would have additional restrictions under the proposed SMP for construction. Excavations would be more limited in nature. Private and common use facilities would be restricted with a reduction in boat slips and limitation on watercraft moorings. The shoreline lot width would be increased for waterfront lots to be eligible for private piers or common use facilities. The number of watercraft per boat slip would be limited. Private swim areas that exclude the public from a portion of the project and large inflatable recreation equipment within the project boundary would not be allowed. The facilities allowed at true public marinas would be modified to allow a maximum of 200 ft in length and an exemption from requirements limiting the expansion of commercial marinas. The location of new boat ramps at residential marinas would be restricted from the backs of coves and smaller coves.

Duke Energy's SMP guidelines include Lake Use Policy Statements (Lake Policy). The Lake Policy delineates the types of access and activities that may be allowed on all reservoirs owned or managed by Duke Energy. With respect to the Catawba-Wateree Project, Lake Policy allows for review of four basic types of lake access: (1) private access; (2) public recreational access; (3) public infrastructure access; and (4) business/industrial access on the lakes with existing private and business development (James, Rhodhiss, Hickory, Lookout Shoals, Norman, Mountain Island, Wylie, Fishing Creek, Cedar Creek, and Wateree). Public infrastructure and business/industrial access will be allowed in accordance with the Commission's standard land use articles. The Lake Policy does not allow any additional private access on Great Falls reservoir, but public recreational access will be allowed as required to meet the terms of the new FERC license.

Catawba County, North Carolina, states that the revised SMP will improve shoreline preservation by providing incentives for buffers and reduced the number of multi-slip boat facilities.

Our Analysis

Restrictions, shoreline use classifications, and identification of important habitat areas were developed and updated by Duke Energy with the assistance and consultation of agencies. Under the proposed shoreline use classification maps, Public Recreation areas, both existing and future, would account for approximately 7.0 percent of the project shoreline. Future Public Recreation classification remains nearly unchanged from the 2003 approved shoreline use classification maps. Future Commercial Marina classification has been reduced from 11.5 to 5.5 percent, and Future Residential Marina classification has been reduced from 7.4 to 2.0 percent. Conversely, Future Residential classification has increased from 4.8 to 10.8 percent.

With these proposed changes in the shoreline use classification maps, minor decreases in the Future Commercial Marina and Future Residential Marina classifications could result in fewer marinas being developed project-wide. Increases in the Future Residential classification indicates that more of the project shoreline would be developed with residential dwellings, many of which would construct docks and other related private recreation facilities as allowed under the SMP. The shoreline use classifications for natural, environmental, and impact minimization zones may have a negative impact on recreational resources since no development would be allowed to occur in areas classified as Natural, Environmental, or Bottomland Hardwood.

The construction restrictions for water willow beds under the proposed SMP would restrict recreational facilities over water willow beds. These new provisions and restrictions could negatively impact recreational access.

Under the proposed SMP, excavations would be more limited since excavation could only be undertaken to provide access to an existing permitted facility. Proposed recreational access would be negatively impacted by this new restriction since excavation would not be allowed to create new recreational access.

Private and common use facilities would be restricted under the proposed SMP. Although private boat ramps would not be allowed, there would be little impact on recreational access to the project waters due to the large number of existing and proposed boat ramps on each project reservoir. The proposed SMP would require that decks, gazebos, covered boat slips, and boat shelters constructed within the project boundary be single-story structures, which would enhance recreational safety on the project reservoirs by reducing the impacts of potential sight impairment of boaters and other recreationists to oncoming boat traffic. The proposed SMP also includes several changes regarding common use facilities: (1) common use facilities with more than three boat slips would not be eligible for mooring additional watercraft including personal watercrafts, and (2) no more than one common use boat slip per waterfront lot would be allowed, and ownership or interest in a common use facility would eliminate the eligibility of that person also to have a separate slip at another common-use facility. The proposed common use facility restrictions would significantly benefit project resources by reducing the total number of watercraft that can be moored on each reservoir and by reducing the overall total number of boat slips ultimately developed on the project reservoirs. This reduction in total boat slips along with limitations on watercraft moorings would help reduce recreational crowding in certain areas of some of the project reservoirs, particularly Lake Norman, and improve boating safety and the

quality of the boating experience. The proposed SMP also would increase the shoreline lot width for pier or common use facility eligibility, which would help to limit the total number of new piers and other private recreation facilities that would be developed. This would ultimately help prevent overcrowding of the reservoirs and help preserve the recreational experience.

Under the proposed SMP, only one watercraft at a time could be moored within a boat slip or docking/mooring location. This would help limit the total number of watercraft on the reservoirs and prevent overcrowding which would help to preserve the quality of the recreational experience. Boating safety also would benefit by a reduction in the total number of watercraft being moored on a particular reservoir.

Large inflatable recreation equipment would not be allowed under the proposed SMP, and private individuals would not be allowed to rope-off or exclude the public from a portion of the project area for the purpose of creating a private swim area. These new provisions would benefit boaters on the reservoirs by ensuring that ropes and buoys deployed by private individuals do not become navigational hazards. Recreational users of the project reservoirs also would benefit as the entire reservoir would remain available for public use. Through its current and proposed recreational facilities, Duke Energy has ensured that safe public swimming areas area available for use on nearly all the project reservoirs.

The proposed SMP defines "true public marinas" and would allow these facilities to be a maximum length of 200 ft, and would allow the expansion of existing true public marinas to be exempted from adhering to certain requirements limiting expansion of other commercial facilities. Extending the maximum facility length could, depending on the location of the facility, disrupt or impair recreational use of some small portion of the reservoir. These new provisions would allow existing true public marinas to expand, rather than to have new marinas developed, in order to accommodate increased recreational use and demand. In essence, this provision would encourage a clustering of additional boat slips and other marina facilities at a fewer number of larger facilities. Additionally, the proposed SMP would not allow new boat ramps at residential marinas to be located in the backs of coves or in smaller coves. Recreational resources would benefit from this provision. Restrictions on boat ramps in small coves would help to prevent boating congestion in the cove and reduce the potential for unsafe boating conditions.

We conclude that Duke Energy's proposed SMP and its guidelines would generally have positive effects on recreational resources. The proposed modifications would help reduce recreational crowding in certain areas of some of the project reservoirs, improve boating safety and the quality of the boating experience, and generally enhance the recreational experience. Negative impacts would generally be related to limitations on facilities and uses.

Public Information and Public Safety

Public safety measures undertaken by Duke Energy are contained in the Public Safety Plans for each development that are filed with the Commission. Recreational maps for 11 of the 13 developments (Great Falls and Dearborn Developments have no recreational areas), which is part of a map booklet including most of the Duke Energy's lakes, contains the following warning to boaters:

> *"Keep clear of power lines. Contact with or arcing from these lines can be very dangerous. Stay 300 feet away from the upstream and downstream sides of the*

dam and powerhouse. Do not enter the tailrace section directly below hydro stations. A flashing red beacon and/or sounding of a horn mean sudden rising swift and turbulent waters below the dam."

Duke Energy proposes to implement several measures within 60 days of license issuance to facilitate the public's enjoyment of the project and support the safe and effective public use of the project's resources. Duke Energy proposes to post the following reservoir level information for each project reservoir via its website: normal minimum elevation, normal target elevation, normal maximum elevation, actual reservoir level, recent reservoir level history, 13-month reservoir level history, projections, points of contact for additional information, and special messages. Special messages and actual levels for each project reservoir are proposed to be available via Duke Energy's toll-free telephone system. Duke Energy also proposes to post an annual calendar on its website showing all scheduled flow releases from the Bridgewater (Lake James), Oxford (Lake Hickory), Wylie, and Wateree Developments and into the Great Falls bypassed reaches, including the dates, times of day, and expected minimum release rates of the scheduled releases. Additionally, Duke Energy proposes to post 2-day flow release forecasts on its website and toll-free telephone system for the Oxford (Lake Hickory), Wylie, and Wateree Developments and the Great Falls bypassed reaches; and 3-day flow release forecasts for the Bridgewater Development.

Interior, more specifically BIA, recommends that Duke Energy, in consultation with CIN, develop a proactive notification system to alert CIN of all releases of water above minimum flow levels in the stretch of river below Wylie dam. Interior comments that pulsing operations at Wylie dam cause significant, rapid variations in the river volume, level , and flow strength resulting in potential safety hazards to tribal members using the river as it passes by their lands.

Although the Catawba Riverkeeper, Ms. Donna Lisenby, comments that the proposed public information systems are good, she recommends a longer near-term forecast period over Duke Energy's proposed 2-day flow release forecasts.

The town of Cornelius recommends funding for public safety (such as the navigation aids, marine commissions) and environmental protection and enhancement on Lake Norman, including, but not limited to, an independent $10 million endowment fund. The town recommends the provision of resources for increased public safety on and around the lake, including, but not limited to, additional fire/rescue capacity and a lighted buoy navigation aid system. Mr. Gary Knox with the town comments that it is a challenge for the town to respond to the growing number of public safety calls on Lake Norman.

Several comments were received supporting the proposed public information system, including comments from Mr. Maurice Blackburn with the Carolina Canoe Club, Mr. Michael McLaurin with the Lake Wylie and Mountain Island Lake Marine Commissions, American Whitewater, and Catawba County, North Carolina.

Our Analysis

Accurate and timely information provides important information to enhance public safety and to assist recreational visitors planning water-related activities at the project reservoirs, tailraces, and regulated river reaches. Duke Energy's proposal (Proposed Article A-8.0 Public Information) would ensure that recreational users have a readily available source of public information.

The availability of reservoir levels and projected reservoir levels would allow the public to know when water levels are expected to rise or fall while the availability of special messages via Duke Energy's toll-free telephone system would alert the public of special circumstances that could affect public safety. The availability of this information would not only enhance public safety, but it also would be useful to recreational users in planning and staging water-related visits to the project.

Although the Catawba Riverkeeper, Ms. Donna Lisenby, recommends a longer near-term forecast period over Duke Energy's proposed 2-day flow release forecasts, 2 days is enough for a peaking facility because generating electricity is dependent on demand. Demand would be difficult for Duke Energy to forecast more than 2 days in advance.

Additionally, the availability of flow release forecasts on Duke Energy's website and toll-free telephone system and the annual calendar of scheduled flow releases would be useful to recreational users in planning and staging water-related visits to the project for fishing, flat water boating, and whitewater boating. The availability of this information would also enhance public safety at the project by providing up-to-date information about flows to alert the public about forecasted increases in flows so that the public is not caught in unexpected conditions.
As part of the Catawba-Wateree Revised CRA, Duke Energy committed to providing, as non-license article measures, additional public information related to river flow, including frequent flow arrival and recession times, hotlinks on its website to USGS streamflow gages and groundwater monitoring wells, and special messages consistent with the Low Inflow Protocol or Maintenance and Emergency Protocol. Up-to-date river flow information would be useful to recreational users in planning and staging water-related visits to the project for fishing, flat water boating, and whitewater boating. The availability of this information would also enhance public safety at the project by providing up-to-date information about flows so that the public is not caught in unexpected conditions. We find that providing appropriate public information related to river flow in a manner that provides the most up-to-date information possible would enhance public safety at the project.

As part of the Catawba-Wateree Revised CRA, Duke Energy committed to providing, as non-license article measures, public safety measures, including updates to its public safety plans, warning devices, Spanish language tailrace signage, horns at the Bridgewater and Oxford Developments, Riverbend Park warning system, English and universal signage, and facility exclusion zones. The revision and implementation of the public safety plans would enhance public safety at the project by taking into consideration the need for providing warnings of rising or falling water levels at recreation access areas affected by project operations, and signage for Spanish-speaking people, which is a demonstrated need in the project area. We conclude that revising the project's public safety plans while considering these specific measures would enhance public safety at the project. For all recreation access areas located within the project boundary, the Commission's part 8 regulations for signage will apply.

BIA recommends that Duke Energy, in consultation with the tribe, develop a proactive notification system to alert the tribe of all releases of water above minimum flow levels in the stretch of river below Wylie dam. The CIN reservation is located approximately 7 miles downstream of the Wylie Development, and Duke Energy comments that, during relicensing, it was learned that flow release patterns substantially attenuate in this distance and this location is not subject to the rapid variations that could be observed in the Wylie tailrace. Duke Energy has proposed to implement phone-based and internet-based public information systems, which are

being recommend by staff for adoption, so the public can access information about planned operations.

The town of Cornelius recommends funding for public safety (such as the navigation aids, marine commissions, and additional fire/rescue capacity). The town comments that it is a challenge for it to respond to the growing number of public safety calls on Lake Norman. The Lake Norman Marine Commission consists of members appointed by the counties bordering Lake Norman: Catawba, Iredell, Lincoln, and Mecklenburg. As defined by the North Carolina 1969 State Statute, the Lake Norman Marine Commission is responsible for taking appropriate responsibility for Lake Norman and its shoreline area for all matters relating to or affecting public recreation and water safety. It maintains a Navigational Marker System as part of its duties. Fire and rescue response funding is available through localities through other sources and is not a relicensing issue.

Recreational Facility Enhancements

Duke Energy proposes within 1 year of license issuance to develop and file with the Commission, in consultation with the North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, local governments, and other entities, a recreation management plan (RMP) for the Catawba-Wateree Project that describes the implementation of the recreational enhancements proposed to be undertaken, described below by development. Duke Energy proposes that the RMP would include: (1) a schedule in 5-year increments for implementing the recreational enhancements within 20 years following Commission approval of the RMP; (2) maps that clearly identify all existing and proposed recreational areas in relation to the project boundary; (3) maps that identify where the project boundary would be modified such that all land areas associated with the recreational enhancements described in the RMP are incorporated into the project boundary; (4) conceptual facility site plans; (5) descriptions of how new facilities would be constructed and how new and existing facilities would be operated and maintained; (6) procedures for temporary closures of project recreation sites; (7) discussion of how the needs of the disabled were considered in planning and design of recreational facilities; (8) discussion of how Low Impact Development practices were considered in planning and design of recreational facilities; and (9) a description of the standardized recreational signage program for recreation sites.

Duke Energy also proposes to file with the Commission a biennial report for the first 20 years of the new license of the progress made under the RMP. Additionally, Duke Energy proposes to file with the Commission as-built drawings following the completion of construction for each recreation area within the project boundary.

To address future recreational needs, Duke Energy proposes to complete a review of the project's recreational needs at 20 years following the issuance of a new license and repeated at every subsequent 10 years during the term of the new license. This review would include a recreation use and needs assessment and identification of any additional public recreational facility needs at the project. Subsequent to the reviews, Duke Energy proposes to file supplements to the RMP. Duke Energy proposes to consult with the North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, local governments, and other entities to provide recommendations on the assessment and the RMP.

Duke Energy proposes to upgrade and improve existing recreational facilities and construct new recreational facilities within 20 years of the Commission's approval of the RMP.

The RMP would include these proposed enhancements and a schedule in 5-year increments for development. The Catawba-Wateree Revised CRA includes a proposed schedule for implementation of these measures and the proposed measures are summarized by development in the sections below.

Interior generally supports the Revised CRA's provisions for the recreational enhancements and recommends that Duke Energy continue to allow and enhance free reasonable public access to the project waters and adjacent project lands owned by Duke Energy for the purpose of full utilization of such lands and waters for navigation and outdoor recreational purposes.

Interior, American Rivers, Coastal Conservation League, and Ms. Donna Lisenby (the Catawba Riverkeeper) express concerns about some of the Revised CRA measures being dependent on third parties. Ms. Lisenby comments that local and state governments are expected to cost share at a time when they are struggling to provide other services to meet growth. She expresses concern that in some cases Duke Energy agreed to backstop some of the recreational enhancements if the cost share partner could not afford them.

Ms. Michelle Mann, a Lake Wateree homeowner, comments that she does not think that the numbers the recreation enhancements are based on are good numbers and recommends that those numbers be reviewed. She does not think that some of the recreational facilities will meet the needs of the public. Ms. Donna Lisenby and Ms. Sarah Williams also comment that the population projections used in the studies were underestimated and those projections were used to estimate recreational needs.

American Rivers and the Coastal Conservation League express concern about the conceptual conservation easement outline appended to the Revised CRA. They conclude that the document is not adequate to ensure public access to the Catawba and Wateree Rivers.

Numerous comments were received supporting the proposed increased recreational access and recreational facility improvements at the project, including comments from Mr. Irvin Pitts with South Carolina DPRT, Mr. Chris Goudreau with North Carolina WRC, Ms. Barbara Baddy with Catawba County, North Carolina, Mr. Warren Selquist with Iredell County, North Carolina, Mr. Maurice Blackburn with the Carolina Canoe Club, Mr. Bo Cash with the Foothills Advisory Group and a fly fishing guide, Mr. Richard Moat with North Carolina Wildlife Federation, Mr. Ben Van Camp and Mr. Andrew Lazenby with American Whitewater, and Ms. Shirley Greene representing about 1,000 non-boating anglers on Lake Wateree.

South Carolina DPRT comments that the expansion of smaller recreation access areas and development of new access areas would accommodate population growth including the proposed new park on the east side of Lake Wateree. Additionally, South Carolina DPRT supports the recreational planning review process and particular support for canoe access areas below Lake Wylie. Mr. Steve Reed with North Carolina DWR comments that the proposed Revised CRA significantly increases access to project waters, particularly for non-motorized boats, and provides increased trails and swimming, bank fishing, and camping areas. Mr. Reed recommends the Revised CRA as the preferred alternative in the Commission's analysis and comments that the conservation lands are also extremely important. Duke Energy provided the funds early for the conservation lands, such the Johns River Confluence gamelands, which will provide hunting access and other recreational opportunities to the public. Mr. Michael McLaurin with the Lake Wylie and Mountain Island Lake Marine Commissions supports the increased

recreation access areas, particularly the canoe and kayak trails, increased swimming areas, and the York County EMS measure on Lake Wylie that will allow law enforcement officers to better serve the public. Mr. Marc Collins with Burke County, North Carolina, supports the proposed increased recreational access at the project, in particular the public accessible trails provided for in the Revised CRA. Mr. Steve Gilbert with Lincoln County, North Carolina, supports the proposed recreational enhancements, and expresses appreciation particularly for those proposed in Lincoln County. Ms. Glenda Coleman, Great Falls Hometown Association, comments that the recreational enhancements at Great Falls will attract paddlers from other states and help restore the town of Great Falls to a nature-based economy. Mr. Richard Moat, North Carolina Wildlife Federation, also strongly urged the Commission to accept the proposed license articles in their entirety.

Our Analysis

Duke Energy's proposed RMP (Proposed License Article A-9.0) would provide the measures to define the specific design for Duke Energy's proposed recreational facilities and facilitate Duke Energy in developing its proposed recreational facilities in a coordinated manner. The RMP would be helpful as a planning tool and the Catawba-Wateree Revised CRA has clearly outlined the proposed recreational facilities and enhancements that have been agreed to by the signatories of the Revised CRA. As proposed, the RMP would include a discussion of how the needs of the disabled were considered in the design and construction of recreation facilities, while Duke Energy committed in the Revised CRA to ensuring that all facilities constructed at the Duke Energy-owned access areas comply with ADA requirements. Improving access for the disabled at the project would be consistent with the Commission's policy on recreational facilities at licensed projects**.**

Duke Energy's proposal to file a biennial report for the first 20 years following the issuance of a new license with the Commission of the progress it has made on completing the recreation enhancements under any new license would assist the Commission and the other Revised CRA signatories with tracking the status of the required recreation enhancements. Since supplements to the RMP are proposed to be filed at 20 years following the issuance of a new license and repeated at every subsequent 10 years during the term of the new license, we find that biennial reports for the term of any new license would be appropriate as there would be recreational enhancements under future RMP supplements that would also need tracking.

Generally, the project offers numerous opportunities for public recreation, most of which are free to the public, with the exception of some of the local county parks and state parks. Duke Energy proposes to provide a number of recreational enhancements at the project including 26 additional recreation access areas in the project boundary and numerous enhancements at existing areas (Proposed License Article A-9.0). The existing recreation access areas and the proposed recreational enhancements would accommodate the projected increase in recreational users at the project. Respondents for the recreation and use needs study did not feel crowded at the public recreation access areas on weekdays and felt only slightly to moderately crowded on typical weekends during the peak recreation season.

Several individuals, Ms. Michelle Mann, Ms. Lisenby, and Ms. Williams, expressed concerns about whether the proposed recreational enhancements would meet the increasing population and felt the future recreation needs and population numbers should be reviewed. No other alternative methodology or population projections have been brought forward since the

recreation use and needs study was begun in 2004. The methods and models used to project recreation needs within the project area are documented, standard approaches that are accepted in the recreation planning profession. The facility needs projections were developed by computing current use numbers based on a full year of data collection, and by incorporating indexed values for future recreation use for the various activities. The index values for each activity were obtained from Cordell et al. (1999), a recognized future projection data source. Duke Energy consulted with Cordell and Bowker, authors of the model, to review the study methods and to incorporate regional population growth into the model. Duke Energy compared Cordell's population projections to current state and U.S. Census Bureau projections to determine an adjustment factor. An average percentage increase for each 10-year period was calculated. Population growth estimates also were obtained from population data from the Office of State Planning for the counties in North Carolina and from the Office of Research and Statistics for the counties in South Carolina, and population projections from the U.S. Census Bureau for 2010, 2020, and 2030. The model was adjusted to account for the difference in population estimates between sources.

However, to address future recreational needs, Duke Energy proposes to complete a review of the project's recreational needs at 20 years following the issuance of a new license and repeated at every subsequent 10 years during the term of the new license. This review would be conducted in consultation with North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, local governments, and other interested parties, and would include a recreation use and needs assessment and identification of any additional public recreational facility needs at the project. This review would provide Duke Energy and the stakeholders with an opportunity to re-evaluate recreation use and needs at the project and to identify additional recreational needs at the project. Subsequent to the reviews, Duke Energy proposes to file supplements to the RMP. We conclude that consulting with, at a minimum, North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, Burke County, York County, American Whitewater, Carolina Canoe Club, Catawba-Wateree Relicensing Coalition, Lake Wylie Covekeeper, and South Carolina Coastal Conservation League on the assessment and the RMP (the entire relicensing Recreation Resources Committee) would be beneficial to maintain continuity in the recreation planning process.

More than 90 percent of those interviewed at the public recreation access areas during the recreation and use needs study were satisfied with the recreation opportunities available and the condition of the facilities. Visitors using the public recreation access areas indicated a need for increased restrooms, trails, and picnic facilities. Shoreline residents indicated a need for more swimming areas, multiple day-use facilities, commercial opportunities, and trails. Duke Energy's proposed recreational enhancements would provide additional opportunities to address these identified needs and emphasis has been placed on land-based recreational enhancements and non-motorized boating access to the regulated river reaches. Most reservoirs, except for several of those receiving the least amount of recreational use, offer a range of water-based and land-based recreational opportunities, and recreational opportunities are generally available within a short drive somewhere within the project.

American Rivers and the Coastal Conservation League express concern about the conceptual conservation easement outline appended to the Revised CRA and conclude that the document is not adequate to ensure public access to the Catawba and Wateree Rivers. The

proposed conservation easements are for lands that are currently outside and proposed to be outside the project boundary.

In addition to those measures for which Duke Energy would be responsible for under any new license, Duke Energy has partnered with others to enhance existing recreation access areas or to develop additional areas in addition to those that Duke Energy would be responsible for. These measures as described later in this section are included in the Revised CRA and are not proposed to be included as license articles. Although Interior, American Rivers, Coastal Conservation League, and Ms. Donna Lisenby (the Catawba Riverkeeper) express concern about some of the Revised CRA measures being dependent on third parties, we have evaluated each of these additional enhancements to determine if any of them might be appropriate to include in any license for the project. All of these non-license article measures were agreed to by the Revised CRA signatories.

Proposed Enhancements Inside the Project Boundary

Duke Energy is proposing to include a number of recreational enhancements discussed below as a license article that would be included in the project boundary and RMP.

FWS recommends that the importance of fish and wildlife-based recreation, especially bird-watching, should be considered, as well as water-based recreation.

Bridgewater Development

At the Bridgewater Development, Duke Energy proposes a number of recreational enhancements to be included as a license article and in the RMP (table 67). These enhancements include three new public recreation access areas and significant improvements at three existing recreation access areas. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 67. Proposed recreation measures at the Bridgewater Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Lake James		
Black Bear Access Area	Provide restrooms, additional shade trees, a shoreline buffer, trails, primitive camping sites, picnic facilities, and a fishing pier (or bank fishing trail) if suitable resource conditions are located at existing recreation area.	5 years of the Commission's approval of RMP
Lake James State Park Islands Management Zone	Offer North Carolina DENR a nominal-cost lease for the term of the new license for the Lake James State Park management zone (300 horizontal feet lakeward from full pond elevation) along the shoreline adjoining the state park, including three islands.	5 years of the Commission's approval of RMP

Recreation access area	Proposed measure	CRA proposed schedule
New Linville Access Area	Acquire approximately 10 acres of land near the existing Linville Access Area and develop two boat ramps for trailered motor boats, lighted and paved parking, one courtesy dock, an access road, and a vault toilet.	10 years of the Commission's approval of RMP
Linville Canoe/Kayak Access Area	After the ramps at the New Linville Access Area are in-service, convert the existing Linville Access Area to canoe/kayak use, provide picnic facilities and restrooms, and plant shade trees.	10 years of the Commission's approval of RMP
Pocket Park for Lake James Loop Trail	Develop an approximately 10-acre park near the Linville dam at the existing canoe portage take-out with parking facilities, picnic facilities, photographic overlooks, and a bank fishing trail.	10 years of the Commission's approval of RMP
Bridgewater Regulated River Reach		
Bridgewater Access Area	Develop restrooms, a ramp for trailered boats, additional parking, and picnic facilities at existing recreation area. Evaluate the existing portage trail and signage and incorporate needed improvements.	10 years of the Commission's approval of RMP
Muddy Creek Access Area	Acquire 1-3 acres of property adjoining Muddy Creek between I-40 and the confluence of Muddy Creek with the Catawba River bypassed reach and develop a canoe/kayak access area with approximately 10 gravel parking spaces.	10 years of the Commission's approval of RMP

Rhodhiss Development

Duke Energy proposes a number of recreational enhancements at the Rhodhiss Development to be included as a license article and in the RMP (table 68), including one new public recreation access area and significant improvements at four existing recreation access areas. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 68. Proposed recreation measures at the Rhodhiss Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Corpening Bridge Access Area	Acquire approximately 10 acres and construct a trailered boat ramp and approximately 10 gravel parking spaces on the Johns River at the Corpening Bridge.	5 years of the Commission's approval of RMP
Conley Creek Access Area (Sawmills Veterans Park)	Construct approximately two additional miles of trail at existing recreation area.	5 years of the Commission's approval of RMP
Rhodhiss Access Area	Provide restrooms at existing recreation area.	5 years of the Commission's approval of RMP
Rhodhiss Dam Canoe Portage	Evaluate the condition of the existing portage trail and its signage and develop any needed improvements.	5 years of the Commission's approval of RMP
Castle Bridge Access Area	Provide restrooms at existing recreation area.	15 years of the Commission's approval of RMP

Oxford Development

At the Oxford Development, Duke Energy proposes a number of recreational enhancements to be included as a license article and in the RMP (table 69). These enhancements include three new public recreation access areas and significant improvements at six existing recreation access areas, including one undeveloped area. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 69. Proposed recreation measures at the Oxford Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Lake Hickory		
Lake Hickory first swimming area	Develop swimming area at Lake Hickory.	5 years of the Commission's approval of RMP
Wittenburg Access Area	Acquire approximately 15 additional acres to include in the access area and provide restrooms, picnic facilities, and additional paved parking.	10 years of the Commission's approval of RMP
Dusty Ridge Access Area	Develop approximately 1 mile of trail and restrooms at the site.	10 years of the Commission's approval of RMP
Lovelady Access Area	Provide a fishing pier if suitable resource conditions are located. If a suitable location cannot be found, then construct a fishing pier at another site on Lake Hickory in Caldwell County.	15 years of the Commission's approval of RMP
Long Shoals Access Area	Develop a canoe/kayak access with gravel parking.	15 years of the Commission's approval of RMP
Oxford Access Area	Develop a primitive campground, paved parking, picnic facilities, bank fishing, trails, and restrooms.	20 years of the Commission's approval of RMP
Lake Hickory second swimming area	Develop second swimming area at Lake Hickory.	20 years of the Commission's approval of RMP
Oxford Regulated River Reach		
Oxford Tailrace Fishing Area	Develop public fishing area facilities.	15 years of the Commission's approval of RMP
Oxford Dam Canoe Portage	Improve existing parking and extend the existing canoe portage trail to Catawba County's Riverbend Park.	15 years of the Commission's approval of RMP

Lookout Shoals Development

Duke Energy proposes several recreational enhancements at the Lookout Shoals Development to be included as a license article and in the RMP (table 70), including three new public recreation access areas and improvements at one existing recreation access area. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 70. Proposed recreation measures at the Lookout Shoals Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Lookout Shoals Lake		
Upper Lookout Shoals Access Area	Acquire approximately 1-5 acres of property in Catawba County and develop a trailered boat access area with parking, restrooms, and primitive camping downstream of the "bend" of the lake (RM 227).	5 years of the Commission's approval of RMP
Lookout Shoals Access Area	Provide restrooms.	5 years of the Commission's approval of RMP
Lookout Shoals Regulated River Reach		
Lookout Shoals Tailrace Fishing Area	Develop a public fishing area.	15 years of the Commission's approval of RMP
Lookout Shoals Dam Canoe Portage	Develop a portage trail with canoe/kayak access (take-out, put-in) and signage around Lookout Shoals dam.	20 years of the Commission's approval of RMP

Cowans Ford Development

At the Cowans Ford Development, Duke Energy proposes a number of recreational enhancements to be included as a license article and in the RMP (table 71). These enhancements include one new public recreation access area and significant improvements at five existing recreation access areas, including one undeveloped area. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

The town of Cornelius recommends additional public recreational opportunities on Lake Norman, specifically additional public lakefront property in and around the Cornelius shoreline, to provide sufficient public recreation opportunities, including, but not limited to, swimming areas, fishing piers, and non-motorized boating access. Mr. Gary Knox with the town comments that there is less public access on Lake Norman than 20 years ago and that there is no public access to Lake Cornelius except through a YWCA, which is limited to members only.

Ms. Jean McKinley, a resident near the proposed Island Point Access Area, expressed numerous concerns about the proposed access area and its impact on local residents, including lack of police and fire protection, a decrease in property values, traffic, and whether the lessee would be a "good citizen." She expressed particular concern over the Revised CRA proposal (proposed as a non-license article measure) to offer a lease to a commercial operator for the development of a recreational vehicle (RV) campground, marine pump-out, dump station, and

bathhouse. She requested that if the access area is forced on local residents, the access road to the Island Point Access Area should be Steam Plant Road.

Table 71. Proposed recreation measures at the Cowans Ford Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Lake Norman State Park Management Zone	Offer North Carolina DENR a nominal-cost lease for the term of the new license for the Lake Norman State Park management zone (300 horizontal feet lakeward from full pond elevation) along the shoreline adjoining Lake Norman State Park) including one island.	5 years of the Commission's approval of RMP
Beatty's Ford Access Area	Develop picnic facilities, a fishing pier, swimming area, restrooms, and shade trees.	5 years of the Commission's approval of RMP
Hagers Creek Access Area	Develop additional paved parking, trails, bank fishing, picnic facilities, restrooms, and, if suitable conditions are located, a fishing pier.	5 years of the Commission's approval of RMP
Stumpy Creek Access Area	Develop a fishing pier, picnic facilities, walking trail, restrooms, and additional paved parking.	10 years of the Commission's approval of RMP
Little Creek Access Area	Develop restrooms, a fishing pier, paved parking spaces, and a picnic shelter.	10 years of the Commission's approval of RMP
Island Point Access Area	Develop trails, bank or pier fishing, picnic facilities, a swimming area, boating access facilities, and restrooms. Conceptual plan development would be coordinated with Catawba County.	15 years of the Commission's approval of RMP
Cowan's Ford Dam Portage and Overlook	Develop a portage trail to the new Highway 73 Access Area, a reservoir overlook with park benches, and approximately 10 gravel parking spaces.	20 years of the Commission's approval of RMP

Mountain Island Development

At the Mountain Island Development, Duke Energy proposes several recreational enhancements to be included as a license article and in the RMP (table 72). These enhancements include three new public recreation access areas and significant enhancements at an existing recreation access area. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 72. Proposed recreation measures at the Mountain Island Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Highway 73 Access Area	Develop approximately 2 acres of Duke Energy-owned property as a canoe/kayak access with approximately 10 gravel parking spaces.	5 years of the Commission's approval of RMP
Lucia Access Area	Develop a canoe/kayak access and approximately 10 gravel parking spaces.	5 years of the Commission's approval of RMP
Riverbend Access Area	Develop restrooms, bank fishing, a swimming area, and a fishing pier.	10 years of the Commission's approval of RMP
Mountain Island Dam Canoe Portage	Develop a portage trail with canoe access (take-out, put-in) and signage.	10 years of the Commission's approval of RMP

Wylie Development

Duke Energy proposes a number of recreational enhancements at the Wylie Development to be included as a license article and in the RMP (table 73). These enhancements include two new public recreation access areas and significant improvements at four existing recreation access areas. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 73. Proposed recreation measures at the Wylie Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation Access Area	Proposed Measure	CRA Proposed Schedule
Lake Wylie		
Dutchmans Creek Access Area	Develop a canoe/kayak access and approximately 10 gravel parking spaces	5 years of the Commission's approval of RMP
Saddler Island	Offer an AAII lease of the approximately 37-acre island to the U.S. National Whitewater Center for individual and group environmental education and outdoor recreation programming.	5 years of the Commission's approval of RMP
South Point Access Area	Develop trails, a fishing pier, a bank fishing area, picnic facilities, a swimming area, restrooms, and additional paved parking.	5 years of the Commission's approval of RMP
Buster Boyd Access Area	Provide restrooms.	5 years of the Commission's approval of RMP
Allison Creek Access Area	Expand existing access area by approximately 48 acres and develop restrooms, picnic facilities, additional paved parking, and approximately 1 mile of trail.	5 years of the Commission's approval of RMP
Rock Hill Park	Develop a bank fishing trail with fishing stations, picnic facilities, a swimming area, restrooms, and parking on approximately 17 acres of land.	5 years of the Commission's approval of RMP
Wylie Regulated River Reach		
Fort Mill Access Area	Provide restrooms and picnic facilities.	10 years of the Commission's approval of RMP

Fishing Creek Development

At the Fishing Creek Development, Duke Energy proposes several recreational enhancements to be included as a license article and in the RMP (table 74). These enhancements include one new public recreation access area, a replacement access area, and significant improvements at one existing recreation access area. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 74. Proposed recreation measures at the Fishing Creek Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Springs Park	Relocate the existing Cane Creek Access Area to an approximately 18-acre portion of the old Springs Park Property and develop two trailered boat ramps, courtesy dock, paved and lighted parking, fishing pier, and bank fishing trail. Once the boating facilities and parking areas are developed and in service at this site, the existing Cane Creek Access Area would be closed, and Duke Energy would file revised exhibit G drawings for Commission approval to remove the existing Cane Creek Access Area from the FERC project boundary.	5 years of the Commission's approval of RMP
Fishing Creek Access Area	Develop a fishing pier, additional paved parking, picnic facilities, restrooms, and a swimming area if a suitable swimming area is feasible at the site.	10 years of the Commission's approval of RMP
Fishing Creek Tailrace Fishing Area	Develop a public fishing area, including a platform, pier or bank fishing trail, and paved parking.	10 years of the Commission's approval of RMP

Great Falls and Dearborn Developments

Duke Energy proposes to evaluate safety concerns associated with boating at the Great Falls and Dearborn Developments near the Great Falls diversion dam, the Great Falls headworks, and the Great Falls-Dearborn dam, and determine the need for constructing boating safety devices upstream of the structures. Duke Energy proposes to report conclusions to the Commission and submit a revised public safety plan for Commission acceptance, if necessary. This evaluation is proposed to be completed and the necessary structures completed prior to beginning the recreational flows and prior to construction of any public boat launching area providing boat access to the Great Falls reservoir. Duke Energy proposes five new public recreation access areas to be included as a license article and in the RMP (table 75). Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 75. Proposed recreation measures at the Great Falls and Dearborn Developments to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Highway 200 Bridge Access Area	Acquire and develop a 1- to 5-acre site with a canoe/kayak launch, restrooms, and gravel parking area in the vicinity of the Highway 200, Highway 21, and Fishing Creek intersection.	5 years of the Commission's approval of RMP
Great Falls Diversion Dam Portage	Develop a portage trail on the north end of Mountain Island to provide boater access the Great Falls Long bypassed reach.	5 years of the Commission's approval of RMP
Great Falls Headworks Portage	Develop a portage trail on Mountain Island around the Great Falls headworks to provide boater access to the Great Falls Short bypassed reach.	5 years of the Commission's approval of RMP
Great Falls Headworks to Cedar Creek Reservoir Portage	Provide a portage trail along the Great Falls Short bypassed reach to Cedar Creek reservoir.	5 years of the Commission's approval of RMP
Lower Great Falls Reservoir Canoe/Kayak Launch	Acquire approximately 1 to 7 acres and construct a canoe/kayak launch on Great Falls reservoir downstream of the Great Falls headworks.	10 years of the Commission's approval of RMP

Rocky Creek and Cedar Creek Developments

Duke Energy proposes one new recreation access area at the Rocky Creek and Cedar Creek Developments and to offer a lease to South Carolina DPRT for improvements at the islands in Cedar Creek reservoir to be included as a license article and in the RMP (table 76). Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Table 76. Proposed recreation measures at the Rocky Creek and Cedar Creek Developments to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Cedar Creek Reservoir Island Improvements	Offer a lease of the islands associated with Great Falls, Dearborn, Rocky Creek, and Cedar Creek Developments to the South Carolina DPRT to establish and maintain a new state park centered on the Dearborn Armory site.	5 years of the Commission's approval of RMP
Mudcat Inn Access Area	Acquire approximately 1 acre of property and develop a canoe/kayak access facility with approximately 10 gravel parking spaces.	10 years of the Commission's approval of RMP

Wateree Development

At the Wateree Development, Duke Energy proposes a number of recreational enhancements to be included as a license article and in the RMP (table 77). These enhancements include one new public recreation access area and significant improvements at four existing recreation access areas. Duke Energy proposes to modify the project boundary so that all land areas associated with these proposed measures are included in the project boundary.

Interior recommends that the new license include provisions for the establishment and long-term sustainability of a water trail from Wateree Dam to Congaree National Park. Interior suggests the provisions could include the development of a map and brochure for the trail, acquisition of additional access locations, and development and management of several primitive campsites along the trail.

Table 77. Proposed recreation measures at the Wateree Development to be included in the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Wateree Creek Access Area	Provide a fishing pier, a 5 to 10 table picnic facility, restrooms, and approximately 10 gravel parking spaces.	5 years of the Commission's approval of RMP
Molly Creek Park	Acquire approximately 100 acres and provide a swimming area, paved parking, restrooms, trails, bank and pier fishing, picnic facilities, and trailered boat access.	5 years of the Commission's approval of RMP
Lake Wateree State Park Management Zone	Offer the South Carolina DPRT a nominal-cost lease for the Lake Wateree State Park management zone (up to 300 horizontal feet lakeward from full pond elevation along all the shoreline adjoining the state park) along the shoreline adjoining the state park.	5 years of the Commission's approval of RMP
Colonels Creek Access Area	Provide a courtesy dock, a swimming area, restrooms, and additional paved parking.	5 years of the Commission's approval of RMP
Taylors Creek Access Area	Expand the existing access area by approximately 3 acres and develop approximately 10 gravel parking spaces.	10 years of the Commission's approval of RMP
Lugoff Access Area	Provide restrooms and improved gravel parking.	15 years of the Commission's approval of RMP

Our Analysis

Generally, the project offers numerous opportunities for public recreation, and Duke Energy proposes to provide a number of recreational enhancements at the project including 26 additional recreation access areas in the project boundary and numerous enhancements at existing areas (Proposed License Article A-9.0). The existing recreation access areas and the

proposed recreational enhancements would accommodate the projected increase in recreational users at the project. Duke Energy is proposing to include a number of recreational enhancements as a license article, that would be included in the project boundary and RMP, and, as the licensee, Duke Energy would be responsible for these measures and enhancements and for all operation and maintenance of those facilities.

The existing and proposed public recreation access areas would be spaced geographically throughout the project reservoirs and regulated river reaches to provide recreational opportunities no matter where the potential user is traveling from. Generally, the developments receiving the greatest recreation use are proposed for the most recreational enhancements.

The existing project boundary generally includes the area within full pond elevation of the project reservoirs and the land immediately surrounding the dams and powerhouses. Existing Duke Energy-owned public recreation access areas that provide access to the project are included in the project boundary, but portions of the existing Duke Energy-owned project recreation access areas may lie partially outside the boundary. All lands needed for the operation of the project, including lands needed to ensure the protection of non-power values, must be included in the project boundary. This would allow the Commission to ensure that maintenance and operation of those recreation access areas would be continued over the life of the issued license.

FWS recommends that the importance of fish and wildlife-based recreation, especially bird-watching should be considered. The project provides many opportunities for fishing, and Duke Energy's proposed enhancements provide numerous additional opportunities for pier and bank fishing and fishing in the regulated river reaches. With only four formal areas available for wildlife viewing at the project (none of which are in the project boundary), additional wildlife viewing opportunities would enhance the recreational opportunities available at the project. In the Revised CRA, Duke Energy has committed to evaluating the need for and feasibility of including wildlife viewing facilities at appropriate Duke Energy-owned public access areas located within the project boundary; however, we conclude that this measure is needed at the project.

In the Revised CRA, Duke Energy has committed to ensuring that the shoreline of all Duke Energy-owned access areas remains open for bank fishing for the term of the new license, except those minimal shoreline areas where bank fishing is restricted for safety reasons, for management problems, or to avoid conflicts with other access area users. Duke Energy has not proposed this measure as a license article; however, ensuring that all bank fishing areas provided by Duke Energy be available to recreationists for the term of the new license would enhance bank fishing opportunities at the project.

Duke Energy has committed in the Revised CRA to a non-license article measure whereby Duke Energy would ensure that all of its islands located on the project reservoirs or in the regulated river reaches would remain open for the term the new license for any permissible day-use public recreation activity. Islands may be designated as off-limits by Duke Energy due to issues related to cultural resource protection, wildlife protection or safety, security, or management concerns or restrictions by state or local public health, safety or law enforcement authorities. Camping on islands located in project reservoirs and regulated river reaches would be authorized only on specific Duke Energy-owned islands. All lands that serve a project purpose or are affected by the project must be included within the project boundary. This

measure would enhance recreational use by boaters and non-motorized boaters using the project waters.

Bridgewater Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Bridgewater Development that would help meet future recreational need at the development. Specifically, the proposed enhancements would provide additional facilities in the project boundary at Lake James for boating, non-motorized boating, picnicking, pier/bank fishing, camping, overlooks, and restrooms. The Bridgewater regulated river reach would include additional facilities for boating, non-motorized boating, picnicking, and restrooms. The proposed new Linville Access Area would alleviate some of the recreational pressure at the existing Linville Access Area, which has a mean capacity of 58 percent on non-holiday weekends.

Duke Energy's proposal to offer a lease to North Carolina DENR for the Lake James State Park Islands Management Zone would force a contract between two parties. This would be outside the Commission's authority; however, Duke Energy could pursue this measure as a non-license article measure since this measure would allow the state park to enforce its regulations below the full pond elevation adjacent to the state park.

Rhodhiss Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Rhodhiss Development that would help meet future recreational need at the development. Specifically, the proposed enhancements would provide additional facilities in the project boundary at Lake Rhodhiss for boating, trails, and restrooms. The proposed Corpening Bridge Access Area would provide boating access well above the existing Johns River Access Area to provide a more "riverine" recreational experience. Lake Rhodhiss is a relatively small reservoir and no swimming areas are provided or proposed on the reservoir; however, there is a swimming area at the nearby Lake James State Park on Lake James and two proposed swimming areas on Lake Hickory.

Oxford Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Oxford Development that would help meet future recreational need at the development. Specifically, the proposed enhancements would provide additional facilities in the project boundary at Lake Hickory for non-motorized boating, swimming areas, picnicking, pier/bank fishing, primitive camping, trails, and restrooms. The Oxford regulated river reach would include facilities for public fishing and a trail. The proposed expansion of the Wittenburg Access Area would alleviate some of the recreational pressure at the existing Lovelady Access Area, which has a mean capacity of close to 50 percent on non-holiday weekends.

Lookout Shoals Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Lookout Shoals Development that would help meet future recreational need at the development. Specifically, the proposed enhancements would provide additional facilities in the project boundary at Lookout Shoals Lake for boating, non-motorized boating, primitive camping, and restrooms. The Lookout Shoals regulated river reach would include facilities for public fishing and a portage trail around the Lookout Shoals dam. The proposed Upper Lookout Shoals Access Area would provide boating access and camping in the upper portion of Lookout Shoals Lake. Lookout Shoals Lake is a relatively small reservoir and no swimming areas are provided or proposed on the reservoir;

however, there is a swimming area at the nearby Lake Norman State Park on Lake Norman and two proposed swimming areas for Lake Hickory.

Cowans Ford Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Cowans Ford Development that would help meet future recreational need at the development. Specifically, the proposed enhancements would provide additional facilities in the project boundary at Lake Norman for boating, non-motorized boating, trails, swimming, pier/bank fishing, a portage trail, and restrooms. The proposed Island Point Access Area and the proposed enhancements at the existing Little Creek Access Area, especially the fishing pier, would alleviate some of the recreational pressure at the existing Marshall fishing area which has a mean capacity of 87 percent on non-holiday weekends. The proposed enhancements at the existing Hagers Creek Access Area would alleviate some of the recreational pressure at the existing Roosevelt Wilson Park, which has a mean capacity of 243 percent on non-holiday weekends, by providing bank fishing and picnic facilities. The proposed enhancements at the Beatty's Ford Access Area would alleviate the recreational pressure at the existing McGuire fishing area, which has a mean capacity of 49 percent on non-holiday weekends, by providing a fishing pier in addition to other day use facilities.

Duke Energy's proposal to offer a lease to North Carolina DENR for the Lake Norman State Park Management Zone would force a contract between two parties. This would be outside the Commission's authority; however, Duke Energy could pursue this measure as a non-license article measure since this measure would allow the state park to enforce its regulations below the full pond elevation adjacent to the state park.

The town of Cornelius recommends additional public recreational opportunities on Lake Norman, specifically additional public lakefront property in and around the Cornelius shoreline, to provide sufficient public recreation opportunities, including, but not limited to, swimming areas, fishing piers, and non-motorized boating access. Lake Cornelius and Lake Davidson were cut off from the remainder of Lake Norman by the construction of Interstate 77 and, therefore, there is no public access from Lake Norman proper. Lake Davidson does have one existing public boat access, but Lake Cornelius does not have any public access. The Lake Norman YMCA does provide some access to Lake Cornelius, but only to its members. In Duke Energy's April 30, 2007, response to scoping meeting comments, it acknowledged that there is no public access to Lake Cornelius, but stated that none was recommended by the Recreation Ad Hoc Committee during relicensing. We find that operation of the project affects Lake Cornelius and conclude that that public access appropriate for the size of Lake Cornelius would serve a project purpose.

Ms. Jean McKinley expressed numerous concerns about the proposed Island Point Access Area, particularly related to the Revised CRA proposal (proposed as a non-license article measure) to offer a lease to a commercial operator for the development of an RV campground. The proposed recreation access area would be developed in a manner consistent with the SMP and all local zoning ordinances and would alleviate some of the recreational pressure at the existing Marshall fishing area which has a mean capacity of 87 percent on non-holiday weekends. Duke Energy has proposed as a license article to provide trails, bank or pier fishing, picnic facilities, a swimming area, boating access facilities, and restrooms at the Island Point Access Area. The Revised CRA contains an additional non-license article provision that states that within 15 years of the effective date of the new FERC license, Duke Energy may market to commercial operators a lease for development and management of a multi-use recreation area at

this site. If an acceptable proposal is received, the additional amenities could include, but would not necessarily be limited to RV camping with bathhouse and dump station, and a marine pump-out in addition to the previous facilities. The Revised CRA also includes a commitment for Duke Energy and Catawba County, North Carolina, to form a workgroup of parties that represents the public interest to participate in developing the site plan for this access area.

Mountain Island Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Mountain Island Development that would help meet future recreational need at the development**.** Specifically, the proposed enhancements would provide additional facilities in the project boundary for non-motorized boating, pier/bank fishing, a portage trail, swimming, and restrooms. The proposed enhancements at the Riverbend Access Area would provide bank and pier fishing and the only swimming area on Mountain Island Lake (Latta Plantation County Park, owned and operated by Mecklenburg County, North Carolina, has a beach for sunbathing only). Mountain Island Lake is a relatively small reservoir and there are no public camping areas currently provided; however, there are camping areas nearby at Lake Norman State Park on Lake Norman, and the Copperhead Access Area and McDowell Park on Lake Wylie.

Wylie Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Wylie Development that would help meet future recreational need at the development. Specifically, the proposed enhancements would provide additional facilities in the project boundary at Lake Wylie for non-motorized boating, picnicking, pier/bank fishing, swimming areas, trails, and restrooms. The Wylie regulated river reach would include additional facilities for picnicking and restrooms. The proposed Rock Hill Park and the proposed enhancements at the existing Fort Mill Access Area would alleviate some of the recreational pressure at the existing Nivens Creek Access Area, which has a mean capacity of 111 percent on non-holiday weekends, by providing other types of recreational opportunities including a swimming area and bank fishing. The proposed enhancements at the Allison Creek Access Area include a trail, parking, and picnic facilities, which would help alleviate some of the recreational pressure at the Nivens Creek Access Area and the Buster Boyd Access Area, which has a mean capacity of 47 percent on non-holiday weekends. Although located at the Mountain Island Development, the Riverbend Access Area is very close to the Mountain Island River Park, which has a mean capacity of 146 percent on non-holiday weekends, and would help alleviate some of the recreational pressure at the existing Mountain Island River Park**.**

Duke Energy's proposal to offer a lease for Saddler Island to the U.S National Whitewater Center for environmental education programming would force a contract between two parties. This would be outside the Commission's authority; however, Duke Energy could pursue this measure as a non-license article measure.

Fishing Creek Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Fishing Creek Development that would help meet future recreational need at the development. Specifically, the proposed enhancements would provide additional facilities in the project boundary at the Fishing Creek Development for boating, non-motorized boating, picnicking, pier/bank fishing, a swimming area (if a suitable swimming area is feasible at the access area), and restrooms. The reservoir does not have an existing swimming area, but there is one proposed swimming area on Fishing Creek reservoir.

Great Falls and Dearborn Developments—Duke Energy's proposed recreational enhancements would provide recreational opportunities at the Great Falls and Dearborn Developments where none previously existed. After evaluating safety concerns associated with boating near the Great Falls diversion dam, the Great Falls headworks, and the Great Falls-Dearborn dam, Duke Energy would provide the proposed recreational enhancements that would provide canoeing/kayaking facilities, portage trails, and restrooms where none previously existed. We find that the safety evaluation is necessary to ensure public safety.

Rocky Creek and Cedar Creek Developments—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Rocky Creek and Cedar Creek Developments that would help meet future recreational need at the developments and provide a facility for non-motorized boating. Since the Cedar Creek reservoir is small, recreational opportunities are limited but can be found at other nearby public recreation access areas within the project.

Duke Energy's proposal to offer a lease to South Carolina DPRT for Cedar Creek reservoir island improvements would force a contract between two parties. This would be outside the Commission's authority; however, Duke Energy could pursue this measure as a non-license article measure since this measure would provide a new state park centered around the Dearborn Armory Site.

Wateree Development—Duke Energy's proposed recreational enhancements would provide increased recreational opportunities at the Wateree Development that would help meet future recreational need at the development. Specifically, the proposed enhancements would provide additional facilities in the project boundary at Lake Wateree for boating, non-motorized boating, picnicking, pier/bank fishing, swimming areas, trails, and restrooms. The Wateree regulated river reach would include additional facilities for parking and restrooms. The proposed expansion of the parking area at the Taylors Creek Access Area would alleviate some of the recreational pressure at the existing Wateree Creek Access Area, which has a mean capacity of 50 percent on non-holiday weekends.

Duke Energy's proposal to offer a lease to South Carolina DPRT for the Lake Wateree State Park Management Zone would force a contract between two parties. This would be outside the Commission's authority; however, Duke Energy could pursue this measure as a non-license article measure since this measure would allow the state park to enforce its regulations below the full pond elevation adjacent to the state park.

Interior recommends that the license include provisions for the establishment and long-term sustainability of a water trail from Wateree dam to Congaree National Park. The requested measure would not serve project purposes and does not have a clear nexus to project operation. Duke Energy proposes to provide minimum flows and recreational flow releases from the Wateree Development which would enhance recreational use below Wateree dam.

Proposed Enhancements Outside the Project Boundary

In addition to those measures for which Duke Energy would be responsible for under any new license (i.e., those located in the project boundary and proposed for inclusion in the RMP), Duke Energy has partnered with others to enhance existing recreation access areas or to develop additional recreation areas. The measures as described below are commitments in the Revised CRA that are not proposed as license articles or to be included inside the project boundary.

Bridgewater Development—In addition to Duke Energy's recreational enhancements proposed to be included in the project boundary and the RMP, the Revised CRA includes recreational enhancements for the Bridgewater Development that are proposed to be outside the project boundary and not included in the proposed license article (table 78). Additionally, the Revised CRA includes a non-license article enhancement to offer a lease to a third party to provide cabins at the Black Bear Access Area which is proposed for inclusion in the project boundary.

Interior recommends that the measure described below for the Overmountain Victory National Historic Trail Corridor be included as a license article and the easements provided by Duke Energy for the trail should be in perpetuity rather than for the term of the FERC license.

Table 78. CRA recreation measures at the Bridgewater Development to be excluded from the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	**Proposed measure**	**CRA proposed schedule**
Black Bear Connector Trail	Facilitate discussions about trail easement agreements among McDowell County, North Carolina, and the owners of Bear Cliff Development, Sunset Development Homeowner's Association, and Crescent Resources, LLC to connect the Black Bear Access Area to the Lake James Loop Trail.	5 years of the Commission's approval of RMP
Lake James Loop Trail	Provide up to $500,000 to either Burke County or North Carolina DENR to construct up to 5 miles of the Lake James Loop Trail, including the portion across the project dams (length to be determined by engineering feasibility).	10 years of the Commission's approval of RMP
North Bend Recreation Land	Transfer approximately 550 acres of property adjoining the Bridgewater regulated river reach downstream of the Bridgewater Development to North Carolina DENR for public recreation and permanent conservation.	5 years of the Commission's approval of RMP
Catawba-Linville River Confluence Recreation Land	Transfer approximately 420 acres of property adjoining the Catawba River downstream of the Bridgewater Development in the vicinity of the confluence of the Catawba River bypassed reach and the Bridgewater regulated river reach to North Carolina DENR for public recreation and permanent conservation.	5 years of the Commission's approval of RMP

Recreation access area	Proposed measure	CRA proposed schedule
Paddy Creek Recreation Land	Transfer or cause to be transferred 275 acres of property downstream of Paddy Creek and Linville dams to North Carolina DENR for public recreation and permanent conservation.	5 years of the Commission's approval of RMP
North Bend Recreation Land Access Area	Transfer approximately 10 acres of property at the second Powerhouse Road bridge to North Carolina WRC and provide up to $225,000 for North Carolina WRC to develop and maintain a trailered boat access, bank fishing area, and parking area.	5 years of the Commission's approval of RMP
Morganton Weir Take-out Area	Provide up to $125,000 to the City of Morganton, North Carolina, or North Carolina DENR to develop a trailered boat ramp and approximately 10 gravel parking spaces upstream in the immediate vicinity of the Morganton weir.	5 years of the Commission's approval of RMP
Lake James-to-Morganton Overmountain Victory National Historic Trail Corridor	Provide up to $600,000 to Burke County, North Carolina DENR, or others to develop approximately 6 miles of the Overmountain Victory National Historic Trail. Acquire easements (up to 300 ft in width) for approximately 6 miles of the Overmountain Victory National Historic Trail Corridor on the North Bend Recreation Land tract, the Paddy Creek tract, or the Catawba-Linville River Confluence tract and provide $600,000 to support land conservation in North Carolina if other entities develop the Overmountain Victory National Historic Trail in Burke County such that Duke Energy's funding support is unnecessary.	10 years of the Commission's approval of RMP
Watermill Road Access Area	The Licensee would provide up to $65,000 to the town of Glen Alpine, North Carolina, to modify the existing canoe/kayak facility to better accommodate trailered boats in addition to canoes and kayaks	10 years of the Commission's approval of RMP

Rhodhiss Development—In addition to Duke Energy's recreational enhancements proposed to be included in the project boundary and the RMP, the Revised CRA includes recreational enhancements for the Rhodhiss Development that are proposed to be outside the project boundary and not included in the proposed license article (table 79).

Table 79. Proposed recreation measures at the Rhodhiss Development to be excluded from the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Wilson Creek Access Area	Acquire 50 to 100 acres of land along Wilson Creek between Adako Road and the confluence of Wilson Creek with the Johns River and offer it to Caldwell County, North Carolina, through the AAII. Duke Energy to develop bank fishing and picnic facilities if Caldwell County leases the site. Duke Energy funds the installation of a USGS streamflow gage on Wilson Creek near Adako Road if Caldwell County agrees to pay for annual USGS gage maintenance.	5 years of the Commission's approval of RMP
Upper Johns River Access Area	Provide up to $125,000 to Caldwell County to develop a canoe/kayak access with parking at a location to be acquired by Caldwell County located on the Johns River, upstream of its confluence with Wilson Creek.	5 years of the Commission's approval of RMP
Johns River Gameland	Support the acquisition of up to 2,882 acres of property by the Foothills Conservancy or North Carolina WRC in the vicinity of the confluence of Johns River and Lake Rhodhiss for public recreation and permanent conservation by effecting a reduction in price of $915 per acre purchased up to $2,640,000 if the total tract is purchased.	Between the effective date of the Revised CRA and August 1, 2009

Oxford Development—In addition to Duke Energy's recreation enhancements proposed to be included in the project boundary and the RMP, the Revised CRA includes several non-license article enhancements to offer leases to third parties to provide enhancements at the Wittenburg Access Area (additional day use facilities), Lovelady Access Area (additional day use facilities including, but not limited to picnic areas, trails, restrooms), and Oxford Access Area (RV campground, dump station, marine pump-out, and bathhouse) which are proposed for inclusion in the project boundary.

Lookout Shoals Development—In addition to Duke Energy's recreational enhancements proposed to be included in the project boundary and the RMP, the Revised CRA includes a recreational enhancement for the Lookout Shoals Development that is proposed to be outside the project boundary and not included in the proposed license article (table 80).

Table 80. Proposed recreation measures at the Lookout Shoals Development to be excluded from the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Riverbend Park/Upper Lookout Shoals Trail	Provide up to $220,000 to Catawba County, North Carolina, or North Carolina DENR to support easement, acquisition and the development of a 50-ft-wide, 1.5-mile-long trail between Catawba County's Riverbend Park and the new Upper Lookout Shoals Access Area.	5 years of the Commission's approval of RMP

Cowans Ford Development—In addition to Duke Energy's recreational enhancements proposed to be included in the project boundary and the RMP, the Revised CRA includes recreational enhancements for the Cowan's Ford Development that are proposed to be outside the project boundary and not included in the proposed license article (table 81). The Revised CRA includes several additional non-license article enhancements to offer leases to third parties to provide additional enhancements at the Hagers Creek Access Area (RV campground, dump station, marine pump-out, and bathhouse), Little Creek Access Area (additional day use facilities such as picnic areas), and Island Point Access Area (RV campground, dump station, marine pump-out, and bathhouse), which are proposed for inclusion in the project boundary.

Table 81. Proposed Recreation measures at the Cowans Ford Development to be excluded from the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Mountain Creek Park	Support the acquisition by Catawba County of up to 600 acres of property at the mouth of Mountain Creek by effecting a reduction in price of $1,900 per acre purchased up to $1,140,000 if the total tract is purchased. If Catawba County does not acquire the property, the applicant would acquire 20-30 acres at this location and develop a canoe/kayak launch, restrooms, fishing pier, swimming beach, and paved parking.	Between the effective date of the Revised CRA and August 1, 2009

Recreation access area	Proposed measure	CRA proposed schedule
Hunsucker Park	Offer an AAII lease to the town of Catawba, North Carolina, or another public entity for the applicant's property on the south side of Lyle Creek near Hunsucker Park. If a lessee is located, the applicant would develop picnic facilities, 0.5 mile of trail, a trailered boat access, and parking on the applicant's property. The applicant also would incorporate its property on the north side of Lyle Creek in the lease provided that the town's or public entity's operations and management plan for the park is acceptable.	5 years of the Commission's approval of RMP
Lake Norman Trail Planning Assistance	Provide technical assistance to facilitate any needed bicycle route crossings of the FERC project boundary and use of Duke Energy's access areas along the North Carolina DOT's proposed Lake Norman Bike Route.	5 years of the Commission's approval of RMP
Lake Davidson Park	Provide up to $130,000 to the town of Davidson, North Carolina, to acquire adjoining property or develop a canoe/kayak launch and fishing pier at Lake Davidson Park.	5 years of the Commission's approval of RMP

Mountain Island Development—In addition to Duke Energy's recreational enhancements proposed to be included in the project boundary and the RMP, the Revised CRA commits Duke Energy to providing trail planning and technical assistance to state and local governments on an as-requested basis to connect existing multi-use trail systems in the vicinity of Mountain Island Lake. The Revised CRA includes an additional non-license article enhancement to offer a lease to a third party to provide a campground and bathhouse at the Riverbend Access Area, which is proposed for inclusion in the project boundary.

Wylie Development—In addition to Duke Energy's recreational enhancements proposed to be included in the project boundary and the RMP, the Revised CRA includes recreational enhancements for the Wylie Development that are proposed to be outside the project boundary and not included in the proposed license article (table 82) The Revised CRA also includes non-license article enhancements to offer leases to a third party to provide RV campgrounds, marine pump-outs, dump stations, and bathhouses at the South Point and Allison Creek Access Areas, and additional recreational facilities at the Fort Mill Access Area. The Revised CRA also includes one non-license article measure that involves lands that lie within the FERC project boundary and extend under the reservoirs 300 horizontal feet lakeward from the normal full pond elevation of the reservoir within which they lie: to offer the South Carolina DPRT a nominal-cost lease for the Landsford Canal State Park management zone. These are lands that are necessary for project purposes, in that they lie within the normal full pool elevation of the reservoir, and, as such cannot be removed from the project boundary.

BIA expressed concerned about a measure in the Revised CRA whereby CIN would maintain a proposed canoe access not in the project boundary at the reservation. As a non-license article Revised CRA commitment, Duke Energy proposes to provide funding to CIN THPO to develop a canoe/kayak access and parking area at the CIN reservation.

Table 82. Proposed recreation measures at the Wylie Development to be excluded from the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Lake Wylie		
Upper Wylie Access Area	Provide up to $435,000 to Mecklenburg, North Carolina, or any other governmental entity to develop a double-lane concrete boat ramp with a metal courtesy dock and paved and lighted parking for 100 vehicles and trailers north of the Allen Steam Station.	5 years of the Commission's approval of RMP
York County EMS	Provide approximately 1 acre of property in York County, South Carolina, for the development of a dedicated marine law enforcement and emergency access facility for Lake Wylie. The property would be offered through the AAII lease to a state or local governmental entity for the term of the new license, provided the leasing entity agrees to develop and manage all approved facilities.	5 years of the Commission's approval of RMP
Wylie Regulated River Reach		
Upper Wylie Regulated River Reach Trail	Develop approximately 1 mile of trail up to 4 ft in width downstream of the Wylie Development along the eastern shore of the river, if such a trail can be constructed consistent with the water quality mitigation conservation easement on the same property. The applicant would offer to lease the trail to York County, South Carolina, or another governmental entity. If the trail is not leased, the applicant would not develop the trail.	5 years of the Commission's approval of RMP
Catawba Indian Reservation or Highway 5 Canoe/Kayak Access	Provide up to $165,000 to CIN THPO to develop a canoe/kayak access and parking area at the Catawba Indian Reservation or the applicant would develop the canoe/kayak launch with gravel parking at the Catawba Indian Reservation to be maintained by CIN THPO. If this site is not developed as planned, Duke Energy would acquire the necessary lands and develop a canoe/kayak launch with associated parking in the vicinity of the Highway 5 bridge within 10 years of the effective date of the new license.	5 years of the Commission's approval of RMP

Recreation access area	Proposed measure	CRA proposed schedule
Landsford Canal State Park Access Area	Provide up to $265,000 to South Carolina DPRT to develop a canoe/kayak access, gravel parking area to accommodate up to 50 cars, and a vault toilet at Landsford Canal State Park if South Carolina DPRT would provide any needed road enhancements and long-term facility maintenance.	5 years of the Commission's approval of RMP
Culp Island	Offer an AAII lease to South Carolina DPRT to manage Culp Island as part of Landsford Canal State Park.	5 years of the Commission's approval of RMP
Simpson Island	Retain ownership of Simpson Island for the term of the new license. If York County, South Carolina, acquires and develops a park on land adjoining Simpson Island, the applicant would offer an AAII lease with York County, South Carolina, to manage any facilities on the island and would provide funding of up to $265,000 to York County for the development of a canoe/kayak access and picnic shelter on the county-owned land adjoining the island.	10 years of the Commission's approval of RMP

Fishing Creek Development—In addition to Duke Energy's recreational enhancements proposed to be included in the project boundary and the RMP, the Revised CRA includes a recreational enhancement for the Fishing Creek Development that is proposed to be outside the project boundary and not included in the proposed license article (table 83). The Revised CRA also includes a non-license article enhancement to offer a lease to a third party to provide additional recreational facilities at the Fishing Creek Access Area, which is proposed for inclusion in the project boundary.

Table 83. Proposed recreation measures at the Fishing Creek Development to be excluded from the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
Highway 9 Access Area	Provide up to $215,000 to an entity that would provide 1 to 5 acres of suitable property and develop and maintain a new 1- to 5-acre trailered boat access area with parking in the vicinity of the existing Highway 9 Access Area.	20 years of the Commission's approval of RMP

Rocky Creek and Cedar Creek Developments—In addition to the recreational enhancements proposed to be included in the proposed license article and the RMP, the Revised CRA includes recreational enhancements at the Cedar Creek reservoir islands, which are

dependent upon the South Carolina DPRT leasing the islands, that are proposed to not be included in the proposed license article. More specifically, Duke Energy would provide up to $1 million to support the development and management of the new state park on Dearborn Island and construct a pedestrian bridge from the Lower Great Falls reservoir canoe/kayak launch to Dearborn Island.

Wateree Development—In addition to Duke Energy's recreational enhancements proposed to be included in the project boundary and the RMP, the Revised CRA includes recreational enhancements for the Wateree Development that are proposed to be outside the project boundary and not included in the proposed license article (table 84). The Revised CRA also includes non-license article enhancements to offer leases to third parties to provide additional enhancements at Molly Creek Park (RV campground, bathhouse, marine pump-out, and dump station) and the Colonels Creek Access Area (additional recreation development) which are proposed for inclusion in the project boundary.

Table 84. Proposed recreation measures at the Wateree Development to be excluded from the Catawba-Wateree Project (P-2232) boundary. (Source: Duke Energy, 2006a; staff)

Recreation access area	Proposed measure	CRA proposed schedule
East Wateree Access Improvements	Provide up to $900,000 to Kershaw County, South Carolina, or other governmental entities to construct two motorized boat ramps with a courtesy dock, paved and lighted parking, and a swimming area with bath house on the east side of Lake Wateree.	5 years of the Commission's approval of RMP
Lake Wateree Recreation lands (Wateree Development)	Transfer or cause to be transferred approximately 800 acres of land adjoining the Heritage Tract to the South Carolina DNR for public recreation and permanent conservation.	5 years of the Commission's approval of RMP

Our Analysis

In addition to those measures for which Duke Energy would be responsible for under any new license (i.e., those located in the project boundary), Duke Energy has partnered with others to enhance existing recreation access areas or to develop additional recreation areas as discussed above. These measures are included in the Revised CRA and are not proposed to be included as license articles or in the RMP. We have evaluated each of these additional enhancements to determine if any of them might be appropriate to include in any license for the project. All of these non-license article measures were agreed to by the Revised CRA signatories.

Bridgewater Development—As described previously, the Revised CRA includes recreational enhancements for the Bridgewater Development that are proposed to be outside the project boundary and not included in the proposed license article. The Revised CRA also includes a non-license article enhancement to offer a lease to a third party to provide cabins at the Black Bear Access Area. There has not been a demonstrated need at the project for cabins at the Black Bear Access Area. Camping is already proposed at the Black Bear Access Area and is currently provided at the Lake James State Park.

We have evaluated each of the non-license article enhancements described in table 78 to determine if any are appropriate to be included in any license for the project and conclude that there is not a demonstrated need that would require these enhancements. Since none of the trails would connect two project facilities, we do not find that they are needed for project purposes and, therefore, do not need to be brought into the project boundary. The Watermill Road Access Area is owned by a town and, like the Morganton Weir Take-out Area, is not needed for project purposes.

The land conveyances described in table 78 and in section 3.3.8.2, *Land Use and Aesthetics, Environmental Effects*, would transfer several areas of Duke Energy-owned lands, that are not associated with project operations, to federal, state, or local entities. The potential for land transfers is included in the Revised CRA, but is not considered under the proposed action for relicensing, and would be decided by Duke Energy at a later time.

Interior recommends that the measure described for the Overmountain Victory National Historic Trail Corridor be included as a license article. Since this trail would not connect two project facilities, we do not find that it is needed for project purposes and, therefore, does not need to be brought into the project boundary.

Rhodhiss Development—As described previously, the Revised CRA includes recreational enhancements for the Rhodhiss Development that are proposed to be outside the project boundary and not included in the proposed license article.

We have evaluated each of the non-license article enhancements in table 79 to determine if any are appropriate to be included in any license for the project and conclude that there is not a demonstrated need that would require these additional enhancements. The Wilson Creek and Upper Johns River Access Areas are both some distance from the project and are not needed for project purposes.

The land conveyance described in table 79 and in section 3.3.8.2, *Land Use and Aesthetics, Environmental Effects*, would transfer an area of Duke Energy-owned land, that is not associated with project operations, to state, or local entities. The potential for land transfer is included in the Revised CRA, but is not considered under the proposed action for relicensing, and would be decided by Duke Energy at a later time.

Oxford Development—As described previously, the Revised CRA includes several non-license article enhancements to offer leases to third parties to provide enhancements at the Wittenburg Access Area, Lovelady Access Area, and Oxford Access Area which are proposed for inclusion in the project boundary. These day uses are available at other nearby recreation access areas and there has not been a demonstrated need at the project for RV camping. We have evaluated each of these non-license article enhancements to determine if any are appropriate to be included in any license for the project and conclude that there is not a demonstrated need that would require these additional enhancements.

Lookout Shoals Development—As described previously, the Revised CRA includes a recreational enhancement for the Lookout Shoals Development that is proposed to be outside the project boundary and not included in the proposed license article. We have evaluated the non-license article enhancement described in table 80 to provide funding to Catawba County, North Carolina, for the development of a trail from a county park to a project recreation access area.

Since the trail would not connect two project facilities, we do not find that it is needed for project purposes and, therefore, does not need to be brought into the project boundary.

Cowans Ford Development—As described previously, the Revised CRA includes recreational enhancements for the Cowans Ford Development that are proposed to be outside the project boundary and not included in the proposed license article. The Revised CRA also includes several non-license article enhancements to offer leases to third parties to provide additional enhancements at the Hagers Creek Access Area (RV campground, dump station, marine pump-out, and bathhouse), Little Creek Access Area (additional day use facilities such as picnic areas), and Island Point Access Area (RV campground, dump station, marine pump-out, and bathhouse), which are proposed for inclusion in the project boundary. There has not been a demonstrated need at the project for RV camping, but camping is provided at Lake Norman State Park. A number of day use facilities are proposed by Duke Energy for the Beatty's Ford Access Area, which is located near the Little Creek Access Area, including, but not limited to, swimming areas, fishing piers, and non-motorized boating access.

We have evaluated each of the non-license article enhancements described in table 81 to determine if any are appropriate to be included in any license for the project and conclude that there is not a demonstrated need that would require these additional enhancements. Since there is already a boat ramp at Hunsucker Park and the existing area is only at 4 percent capacity on non-holiday weekends (Study Team/Resource Committee, 2006), we conclude that there is not a demonstrated need for the additional enhancements near Hunsucker Park. We also conclude that there is not a demonstrated need for the Mountain Creek Park because the nearby proposed Island Point Access Area would provide the same recreational facilities as those that would be provided at Mountain Creek Park. There is no public access from Lake Norman proper to Lake Davidson, but Lake Davidson does have one existing public boat access.

Mountain Island Development—As described previously, the Revised CRA commits Duke Energy to providing trail planning and technical assistance to state and local governments on an as-requested basis and to offer a lease to a third party to provide a campground and bathhouse at the Riverbend Access Area, which is proposed for inclusion in the project boundary.

We have evaluated these non-license article enhancements to determine if they are appropriate to be included in any license for the project and conclude that there is not a demonstrated need that would require these additional enhancements. There has not been a demonstrated need specifically for camping at Mountain Island Lake. There are nearby camping areas at Lake Norman State Park on Lake Norman, and Ebenezer Park, McDowell Park, and the Copperhead Access Area on Lake Wylie.

Wylie Development—As described previously, the Revised CRA includes additional recreational enhancements for the Wylie Development that are proposed to be outside the project boundary and not included in the proposed license article. The Revised CRA also includes non-license article enhancements to offer leases to third parties to provide RV campgrounds, marine pump-outs, dump stations, and bathhouses at the South Point and Allison Creek Access Areas, and additional recreational facilities at the Fort Mill Access Area. There has not been a demonstrated need at the project for RV camping, but camping is provided nearby at Ebenezer Park, McDowell Park, and the Copperhead Access Area on Lake Wylie, and at Lake Norman State Park on Lake Norman. A number of day use recreation facilities are proposed by Duke

Energy for Rock Hill Park and are currently provided by McDowell Park, both of which are located near the Fort Mill Access Area.

We have evaluated each of the non-license article enhancements described in table 82 to determine if any are appropriate to be included in any license for the project and conclude that there is not a demonstrated need that would require these additional enhancements. There is already a boating access area (Highway 9 Landing) near the proposed Landsford Canal State Park Access Area and a boating access area near the proposed Upper Wylie Access Area. Since the Upper Wylie regulated river reach trail would not connect two project facilities, we do not find that it is needed for project purposes and, therefore, does not need to be brought into the project boundary. We cannot adopt any measure that would force a contract between two parties.

BIA expressed concerned about a measure in the Revised CRA whereby CIN would maintain a proposed canoe access not in the project boundary at the reservation. As a non-license article Revised CRA commitment, Duke Energy proposes to provide funding to CIN THPO to develop a canoe/kayak access and parking area at the CIN reservation. The proposed facility would be located approximately 7 miles downstream of the Wylie Development and would not serve a project purpose or have a project nexus.

Fishing Creek Development—As described previously, the Revised CRA includes a recreational enhancement for the Fishing Creek Development that is proposed to be outside the project boundary and not included in the proposed license article. The Revised CRA also includes a non-license article enhancement to offer a lease to a third party to provide additional recreational facilities at the Fishing Creek Access Area, which is proposed for inclusion in the project boundary.

We have evaluated each of these non-license article enhancements to determine if either is appropriate to be included in any license for the project and conclude that there is not a demonstrated need that would require these additional enhancements. There is already a boating access area (Highway 9 Landing) that is at 29 percent capacity on non-holiday weekends (Study Team/Resource Committee, 2006).

Rocky Creek and Cedar Creek Developments—As described previously, the Revised CRA includes recreational enhancements at the Cedar Creek reservoir islands, which are dependent upon the South Carolina DPRT leasing the islands, that are proposed to not be included in the proposed license article. Duke Energy would provide up to $1 million to support the development and management of the new state park on Dearborn Island and construct a pedestrian bridge from the Lower Great Falls reservoir canoe/kayak launch to Dearborn Island. Since these enhancements would be specific to the leasing of the islands and the creation of a new state park, we conclude that there is not a demonstrated need that would require these additional enhancements to be included in any license issued for the project. We cannot adopt a measure that would force a contract between two parties.

Wateree Development—As described previously, the Revised CRA includes additional recreational enhancements at the Wateree Development that are proposed to be outside the project boundary and not included in the proposed license article. Additionally, the Revised CRA includes additional non-license article enhancements to offer leases to third parties to provide additional enhancements at Molly Creek Park (RV campground, bathhouse, marine pump-out, and dump station) and the Colonels Creek Access Area (additional recreation

development) which are proposed for inclusion in the project boundary. There has not been a demonstrated need at the project for RV camping and additional development at the Colonels Creek Access Area. RV camping is provided at Lake Wateree State Park.

We have evaluated each of the non-license article enhancements described in table 84 to determine if any are appropriate to be included in any license for the project and conclude that there is a demonstrated need for the East Wateree Access Area. This access area is proposed for the east side of Lake Wateree to provide two motorized boat ramps with courtesy dock, paved and lighted parking, and a swimming area with bathhouse. This access area would enhance recreation opportunities on the east side of Lake Wateree since there are only two access areas on the east side of Lake Wateree that provide four ramps and one fishing pier, but no other recreational opportunities. The west side of Lake Wateree currently has one swimming area and two proposed swimming areas. We conclude that the East Wateree Access Area would serve a project purpose by providing additional boating opportunities and being the only access area providing non-boating or fishing activities on the east side of Lake Wateree.

The land conveyance described in table 84 and in section 3.3.8.2, *Land Use and Aesthetics, Environmental Effects*, would transfer several areas of Duke Energy-owned lands, that are not associated with project operations, to a state entity. The potential for land transfers is included in the Revised CRA, but is not considered under the proposed action for relicensing, and would be decided by Duke Energy at a later time.

3.3.7.3 Cumulative Effects

The proposed and staff recommended recreational measures would improve recreational opportunities throughout the project. Enhancements to recreation facilities and increases in public access areas would distribute recreational visitors more evenly throughout the project's recreation access areas as well as improve the quality of the recreational facilities and public access. The measures would improve recreational opportunities in the region, allowing the project to adapt to changing recreational use over time and develop new resources that address foreseeable recreational activities.

The proposed recreational flows and minimum flows throughout the project would provide additional recreational opportunities and enhance angling and boating in the regulated river reaches. The scheduled recreational flows also would provide varying levels of whitewater opportunities at the project. Public safety at the project would be enhanced by the proposed and staff recommended public information and public safety measures. The proposed and staff recommended public information measures would improve the availability of reservoir elevations and flow information to the public.

There are a number of measures in the Revised CRA that Duke Energy has committed to that are not recommended by staff; however, these measures also would improve recreational opportunities at the project. A number of new recreation access areas would be developed or enhanced under the Revised CRA that would be outside the project boundary but close to or adjacent to the project, that also will enhance recreation at the project. Duke Energy's commitment to providing trails planning and technical assistance to state and local governments on an as-requested basis to connect existing multi-use trail systems in the vicinity of Mountain Island Lake also would enhance trails in the vicinity of the project. In the Revised CRA, Duke Energy committed to providing $4 million to North Carolina WRC, North Carolina DENR, or both, and $5.32 million to South Carolina DNR, South Carolina DPRT, or both, to support the

purchase of agency-selected land in Catawba-Wateree River Basin for public recreation, game management, and compatible permanent conservation. Duke Energy's commitment to conveying lands for public recreation and permanent conservation would enhance recreational resources at the project, provide land conservation, and provide gamelands near the project. These land conveyances include 550 acres adjoining the Bridgewater regulated river reach downstream of the Bridgewater Development to North Carolina DENR, 420 acres adjoining the Catawba River downstream of the Bridgewater Development in the vicinity of the confluence of the Catawba River bypassed reach and the Bridgewater regulated river reach to North Carolina DENR, 275 acres downstream of Paddy Creek and Linville Dams to North Carolina DENR, and 800 acres adjoining the Heritage Tract to South Carolina DNR. Duke Energy, North Carolina DENR, North Carolina WRC, and North Carolina WF have developed a plan to address waterfowl hunting in the Catawba River in the vicinity of the North Bend Recreation Land, North Bend Access Area, Catawba-Linville River Confluence Recreation Land, and Paddy Creek Recreation Land.

Additionally, Duke Energy, in cooperation with North Carolina WRC, South Carolina DNR, and North Carolina DENR, currently uses public education and stakeholder outreach as the primary mechanism to prevent aquatic nuisance plant species from establishing and spreading in Catawba-Wateree Project waters. These aquatic nuisance plant species can potentially reduce boating and recreation access and reduce the aesthetic value of the recreational experience. Continued education of the residents and users of lands and waters within the project area will increase public awareness of potential new invasive weed species, methods of prevention for new and existing species, and accepted control methods for existing populations.

These measures would have a significant positive cumulative effect on recreational opportunities at the project, public safety, and the quality of the recreational experience.

3.3.7.4 Unavoidable Adverse Effects

None.

3.3.8 Land Use and Aesthetics

3.3.8.1 Affected Environment

The Catawba-Wateree Project is located on the Catawba and Wateree Rivers in North and South Carolina. The majority of the project area is located within the Piedmont Province, with the exception of the headwaters of Lake James, which are located within the Blue Ridge Province, and the portion the Wateree River downstream of the Wateree dam, which is located in the Coastal Plain Province.

In the mountain region of the watershed, the majority of the project area is characterized by oak-hickory forests dominated by white oak with an understory of dogwood, sourwood, and black locust. Although development in this region of the watershed is increasing, the area is predominately still rural, with large areas of forests, valleys, and some agricultural land, interspersed with scattered homes and small farms.

The Piedmont portion of the watershed is more extensively developed than the mountain region. The Piedmont consists of a wide plateau of gently rolling hills, and is characterized by oak-hickory forests with primarily dogwood and sourwood in the understory. The Piedmont was intensively farmed in the past, and former agricultural fields are in various stages of succession

or have been converted to managed pine plantations. Considerable development also has occurred in the Piedmont region.

The Fall Line marks the transition from the Piedmont to the Sandhills region. The Catawba River passes through a relatively short stretch of the Sandhills region before it continues into the lower elevations of the Coastal Plain. The Sandhills region is characterized by long leaf pines and open Savannahs (Kovacik, 1987). The lower portion of the watershed supports some development, but is generally more rural in character than the Piedmont region.

Most of the development in the watershed is found within the Piedmont region. Considerable development is centered around the city of Charlotte, with additional development clustered in and around the cities of Morganton, Hickory, Mooresville, and Gastonia in North Carolina, and Rock Hill and Lancaster in South Carolina.

There are several major travel routes in the project vicinity, most of which are found in the Piedmont region, including Interstate Routes 77, 85, and 40. There are also numerous U.S. and state highways in the project vicinity. These roads provide transportation connections between many of the communities, and support both residential and commercial/industrial development.

Land Use

Land use within the Catawba River Basin varies greatly, but is generally a mix of forest, agricultural, and developed lands. Within the watershed, approximately 5 percent of the land is developed. Most of the population in the watershed is located in the major metropolitan areas including the area around Charlotte, North Carolina. Table 85, provides a breakdown of the major land use categories within the basin.

Table 85. Percent land use in the North Carolina and South Carolina portions of the Catawba Wateree River Watershed. (Sources: North Carolina DWQ, 2004; South Carolina DHEC, 2006)

Land Use	North Carolina	South Carolina
Forest	67%	81%
Agriculture	24%	12%
Urban/Developed	6%	4%
Water	3%	3%

Human uses of lands within the Catawba-Wateree River Basin include timber harvesting, agriculture, industry/commercial, residences, recreation, and other miscellaneous uses. Current land use within the immediate vicinity of the project is characterized as agriculture, forest (public and private), riparian buffer, residential (low and high density), recreational and public access, industrial/commercial, and utility use (including project works and transmission line corridors). Most of the forest lands in the vicinity of the project are privately owned forests. However, a portion of the Pisgah National Forest borders the Bridgewater Development along Lake James.

There are no wilderness areas within or adjacent to the project, nor are there any wild and scenic rivers or eligible river segments within the project. One designated wild and scenic river, Wilson Creek, is located in the Catawba River watershed but is not within the project boundary or within the influence of the project. Similarly, the Linville Gorge Wilderness Area is located along the Linville River, which is a tributary to the Bridgewater Development. However, none of the designated wilderness area is located within the project boundary or within the influence of the project.

Bridgewater Development

The Bridgewater Development is the most upstream of the project developments and consists of the Catawba dam, the Paddy Creek dam, the Linville dam, the Bridgewater powerhouse, and the resulting impoundment, Lake James. At a full pond elevation of 1,200 ft msl, Lake James has a surface area of 6,754 acres and 149 miles of shoreline. Project lands at this development include the land within the full pond elevation and land surrounding the dams and powerhouse. Most of the land adjoining Lake James is privately owned. The State of North Carolina owns and operates the 605-acre Lake James State Park, which is located adjacent to the Catawba dam. In 2004, the State of North Carolina announced the acquisition of 2,900 acres of property on the north side of Lake James for the expansion of Lake James State Park.

The Bridgewater Development is the only one of the project developments located partially in the mountain region, and the lands immediately adjacent to Lake James are generally steep, forested slopes. Shoreline development around Lake James is limited, and excluding lands designated for public recreation, approximately 17 percent of the shoreline of the lake has a permitted shoreline use. Approximately 21 percent is classified as existing or future public recreation.

Lake James provides scenic mountain views of the surrounding region from many locations, including views of Pisgah National Forest to the north and west, and the Blue Ridge Mountains to the west. Even where foreground views include residential housing developments, the background views are dominated by mountains.

Rhodhiss Development

The Rhodhiss Development consists of a concrete spillway, an earthen embankment, and a powerhouse. At a full pond elevation of 995.1 ft msl, Lake Rhodhiss has a surface area of 2,724 acres and 95.5 miles of shoreline. Project lands include land within the full pond elevation of the reservoir and land surrounding the dam complex.

The headwaters of Lake Rhodhiss begin approximately 19 miles downstream of the Bridgewater powerhouse near the confluence of the Johns River and the Catawba River. Lake Rhodhiss is a riverine reservoir with very limited development. Much of the land adjacent to the reservoir is forested, including areas of bottomland hardwoods and planted loblolly pine stands. The upper reaches of Lake Rhodhiss support large areas of submerged vegetation. Excluding lands designated for public recreation, approximately 6 percent of the shoreline of Lake Rhodhiss has a permitted shoreline use, and approximately 3 percent is classified as existing or future public recreation.

Oxford Development

The Oxford Development consists of a dam, a powerhouse, and an impoundment known as Lake Hickory. At a full pond elevation of 935.0 ft msl, Lake Hickory has a surface area of

approximately 4,072 acres and 109.8 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land surrounding the dam and powerhouse.

The lands adjacent to Lake Hickory are heavily developed. Development consists primarily of residential housing interspersed with other types of development. An invasive aquatic weed, parrot feather, has become established in the upper end of Lake Hickory. Excluding lands designated for public recreation, approximately 61 percent of the shoreline of Lake Hickory has a permitted shoreline use and approximately 3 percent is classified as existing or future public recreation.

Lookout Shoals Development

The Lookout Shoals Development consists of an earthen dam, a concrete spillway, a powerhouse, and an impoundment (Lookout Shoals Lake). At full pond elevation of 838.1 ft msl, Lookout Shoals Lake has a surface area of approximately 1,155 acres and 33.1 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land immediately surrounding the dam and powerhouse.

Lookout Shoals Lake is a riverine impoundment with development located primarily along the lower half of the reservoir. Undeveloped areas upland of the shoreline retain predominantly rural characteristics and include both agricultural areas and planted loblolly pine stands. Two invasive aquatic plants, parrot feather and hydrilla, are present in Lookout Shoals Lake. Excluding lands designated for public recreation, approximately 31 percent of the shoreline of Lookout Shoals Lake has a permitted shoreline use and approximately 4 percent is classified as existing or future public recreation. In addition to the public recreation areas provided by Duke Energy, Catawba County operates River Park located along the upper end of Lookout Shoals Lake.

Cowans Ford Development

The Cowans Ford Development consists of an earthen dam, a concrete spillway, a powerhouse, an earthen dike located east of the powerhouse complex, and an impoundment (Lake Norman). Lake Norman is the largest reservoir in the Catawba-Wateree Project, and the largest lake wholly within North Carolina. At a full pond elevation of 760.0 ft msl, Lake Norman has a surface area of approximately 32,339 acres and 562.3 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land immediately surrounding the dams and powerhouse.

Lake Norman begins immediately downstream of the Lookout Shoals dam. This upper part of Lake Norman is riverine in nature and supports many wetland areas. Moving downstream, the lake becomes wider and shoreline development increases. Development adjacent to the reservoir is most dense along the southern portions of the lake, closest to the city of Charlotte, North Carolina. The shoreline of Lake Norman is heavily developed and the lake receives a considerable amount of recreational use. Much of the land adjacent to the reservoir is developed in single family and multi-family housing, commercial marinas, and to a limited extent, industrial facilities. Marshall Steam Station, a coal-fired power generating facility, and McGuire Nuclear Station are located on the shores of Lake Norman and utilize reservoir waters for cooling.

Two areas of Lake Norman were cut off by the construction of Interstate 77. Although both of these “lakes” are now hydraulically connected to Lake Norman by culverts, these two

cut-off lakes are known locally as Lake Cornelius and Lake Davidson. The culverts connect the two cut-off lakes to Lake Norman, but do not provide boating access between the smaller lakes and Lake Norman. Because there is no boat access between the lakes, boating use of both Lake Cornelius and Lake Davidson is less than the boating use on Lake Norman. As a result both Lake Davidson and Lake Cornelius have a more secluded feel than the heavily utilized Lake Norman.

The towns of Mooresville, Davidson, Cornelius, and Huntersville, North Carolina, adjoin Lake Norman. There are a number of parks located along the reservoir shoreline including the 1,459-acre Lake Norman State Park, located on the northern half of Lake Norman. Excluding lands designated for public recreation, approximately 68 percent of the shoreline of Lake Norman currently has a permitted shoreline use and approximately 5 percent is classified as existing or future public recreation.

Mountain Island

The Mountain Island Development consists of an earthen dam, a concrete spillway, a powerhouse, and an impoundment (Mountain Island Lake). At a full pond elevation of 647.5 ft msl, Mountain Island Lake has a surface area of 3,117 acres and 94.3 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land immediately surrounding the dam and powerhouse.

Mountain Island Lake is a long, narrow reservoir, the upper half of which is riverine in nature. Much of the land adjoining this portion of Mountain Island Lake has been acquired by state agencies and local entities for conservation purposes. Approximately halfway down the reservoir, the lake doubles back on itself, creating a peninsula, which is known locally as "Riverbend." The reservoir supports extensive areas of emergent aquatic vegetation and is very shallow in the vicinity of the bend. Mountain Island Lake supports drinking water intakes for Charlotte, Mount Holly, and Gastonia, North Carolina. Riverbend Steam Station, a coal-fired generating facility, also is located on the reservoir.

Excluding lands designated for public recreation, approximately 26 percent of the shoreline of Mountain Island Lake has a permitted shoreline use, and approximately 16 percent is classified as existing or future public recreation. The remaining waterfront shoreline has been developed or is being developed with residential housing.

Wylie Development

The Wylie Development consists of an earthen dam, a concrete gated spillway, a powerhouse, and an impoundment (Lake Wylie). At a full pond elevation of 569.4 ft msl, Lake Wylie has a surface area of 12,177 acres and 340.3 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land immediately surrounding the dam and powerhouse.

Lake Wylie is the second largest reservoir in the Catawba-Wateree Project. Like Lake Norman, due to its proximity to the city of Charlotte, North Carolina, lands adjacent to the reservoir are generally developed as residential housing. In addition to the residential development, a number of industrial facilities, including a chemical plant, several textile mills, and two electrical generating facilities, are located adjacent to Lake Wylie. The upper reaches of the reservoir are more riverine in nature and, until recently, less developed than the downstream portions of the reservoir. In addition, at the confluences of large tributaries such as Allison

Creek and Crowder Creek, the reservoir supports areas of emergent aquatic vegetation and undeveloped hardwood bottomlands, and thus gives these areas a different feel from the main part of the reservoir. In addition to the public recreation areas operated by Duke Energy, there are several parks located on the shores of Lake Wylie that are accessible to the public including Mecklenburg County's McDowell Nature Preserve and the privately owned Daniel Stowe Botanical Gardens.

Excluding lands designated for public recreation, approximately 51 percent of the shoreline of Mountain Island Lake has a permitted shoreline use, and approximately 4 percent is classified as existing or future public recreation. The remaining waterfront shoreline has been developed or is being developed with residential housing.

Fishing Creek Development

The Fishing Creek Development consists of an earthen embankment, a concrete gated spillway, a powerhouse, and an impoundment (Fishing Creek reservoir). Locally the facility is known as the "Nitrolee Plant." At a full pond elevation of 417.2 ft msl, Fishing Creek reservoir has a surface area of 3,431 acres and 90.4 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land immediately surrounding the powerhouse.

The upper end of Fishing Creek reservoir is largely undeveloped. Landsford Canal State Park adjoins the upper end of the reservoir, and this area is very shallow with numerous shoals. A large colony of the Rocky Shoals spider lily is located in this portion of the reservoir. Downstream of Highway 9, the reservoir widens, and moving downstream the western shoreline is largely developed as residential housing. Eastern shoreline of the reservoir is largely undeveloped, but a large new residential subdivision is currently being developed on the eastern shore of the reservoir.

Excluding lands designated for public recreation, approximately 7 percent of the shoreline of Mountain Island Lake has a permitted shoreline use, and approximately 4 percent is classified as existing or future public recreation. The remaining waterfront shoreline has been developed or is being developed with residential housing.

Great Falls and Dearborn Developments

The Great Falls and Dearborn Developments consist of an ungated concreted diversion weir, an intake canal, the concrete Great Falls headworks, a concrete dam with two powerhouses, and an impoundment (Great Falls reservoir). At a full pond elevation of 355.8 ft msl, Great Falls reservoir has a surface area of 353 acres and 13.2 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land immediately surrounding the dams and powerhouses.

There is no public access to the Great Falls reservoir due to safety concerns associated with the ungated spillways. Shoreline development along the Great Falls reservoir is limited, and due to safety concerns Duke Energy does not permit the construction of any private recreation facilities on Great Falls reservoir.

Approximately 71 percent of the shoreline of Great Falls reservoir has a permitted shoreline use and approximately 19 percent is classified as existing or future public recreation.

The Great Falls and Dearborn Developments include two bypassed river reaches. The bypassed river reaches contain boulder fields, large potholes, and exposed rock cliffs. The shorelines of the bypassed reaches are undeveloped.

Rocky Creek and Cedar Creek Developments

The Rocky Creek and Cedar Creek Developments consist of a dam, two powerhouses, and an impoundment (Cedar Creek reservoir). At a full pond elevation of 284.4 ft msl, Cedar Creek reservoir has a surface area of 748 acres and 22.3 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land immediately surrounding the dam and powerhouses.

Cedar Creek reservoir is a relatively shallow reservoir and is locally known as "Stumpy Pond." Within the reservoir is a an island, known as Big Island or Dearborn Island, that rises almost 200 ft above the full pond elevation of the reservoir. The reservoir shoreline is characterized by steep hardwood forested slopes, and the uplands are primarily loblolly pine stands. The steep-sloped islands and lands surrounding Cedar Creek reservoir provide a mountain-like setting for the lake. Shoreline development is limited and is confined to one cove on the reservoir. The remaining shoreline is currently under option to a local land conservancy for purchase for permanent conservation.

Excluding lands designated for public recreation, approximately 11 percent of the shoreline of Cedar Creek reservoir has a permitted shoreline use, and approximately 35 percent is classified as existing or future public recreation.

Wateree Development

The Wateree Development consists of an earthen dam, a concrete spillway, a powerhouse, and an impoundment (Lake Wateree). At a full pond elevation of 225.5 ft msl, Lake Wateree has a surface area of approximately 13,025 acres and 189.4 miles of shoreline. Project lands include lands within the full pond elevation of the reservoir and land immediately surrounding the dam and powerhouse.

Lake Wateree is the lowermost development in the project. Downstream of the Wateree dam, the Wateree River takes on the characteristics of a Coastal Plain river, with meanders and adjacent swamps. The landscape around Lake Wateree marks the transition between the Piedmont and Coastal Plain regions of the watershed. Most of the area consists of former agricultural fields that have been converted to loblolly pine plantations. Much of the property adjacent to the reservoir on the western side and southern half of Lake Wateree is developed in residential housing. The upland areas remain relatively rural in nature. The upper half of the east side of Lake Wateree remains undeveloped, but a residential development is being planned for a 3,500-acre tract in this area. In addition to Duke Energy's public access areas, Lake Wateree State Park, located on the west side of the reservoir, provides public access to the reservoir.

Excluding lands designated for public recreation, approximately 48 percent of the shoreline of Lake Wateree has a permitted shoreline use and approximately 5 percent is classified as existing or future public recreation.

Land Ownership and Management

Lands within the project boundary are generally limited to lands within the full-pond elevation contour of the project reservoirs and lands immediately surrounding project dams, powerhouses, and related facilities. Project lands are generally owned by Duke Energy. There are no federal lands within the Catawba-Wateree Project boundary. The Pisgah National Forest comprises federal lands adjacent to Lake James. State-owned or managed lands adjacent to the project include Lake James State Park, Lake Norman State Park, and Lake Wateree State Park. There also are several major county- or municipal-owned local parks adjacent to the project reservoirs. Most of the lands immediately adjacent to the project are privately owned. Private lands include agricultural lands, forest lands (managed or unmanaged), permanent or seasonal homes, and commercial use lands. Significant federal or state lands located adjacent to the project that are available for public use include the following.

Pisgah National Forest

The Forest Service manages the Pisgah National Forest adjacent to the project. The Pisgah National Forest covers 510,113 acres, a portion of which borders Lake James (Bridgewater Development), and includes diverse communities, habitats, and recreational opportunities. Management of the Pisgah National Forest is guided by the Nantahala and Pisgah National Forests land and resource management plan that establishes management standards and guidelines for the national forest lands. The goal of the plan is to provide a management program that has a mixture of management activities that allow use and protection of the forest resources; fulfill legislative requirements; and address local, regional, and national issues and concerns.

Lake James State Park

Lake James State Park is a state park located adjacent to Lake James that is owned and operated by the State of North Carolina (North Carolina DPR). The park provides a number of the recreational opportunities at Lake James including a swim area, picnic area, a fishing pier, trails, and campsites. Lake James State Park was established in 1987 by the North Carolina General Assembly and is one of the most recent additions to the North Carolina state park system. For the initial phase of development, 565 acres of land were purchased. An expansion in 2005 added almost 3,000 acres of land and almost 30 miles of shoreline.

Lake Norman State Park

Lake Norman State Park is a 1,328-acre state park located adjacent to Lake Norman (Cowans Ford Development) that is owned and operated by the State of North Carolina (North Carolina DPR). The park was established in 1962 when Duke Energy donated 1,328 acres of land for a state park. The park provides a number of the recreational opportunities at Lake Norman including boat ramps, a swim area, picnic area, bank fishing, trails, and campsites.

Lake Wateree State Park

Lake Wateree State Park is a 238-acre state park located adjacent to Lake Wateree (Wateree Development) that is owned and operated by the State of South Carolina (South Carolina DPRT). The park provides a number of the recreational opportunities at Lake Wateree including boat ramps, pier/bank fishing, trails, and campsites. Land for the state park was purchased in 1982. State parks in South Carolina conserve and protect the diverse natural and cultural resources found in the state parks.

State parks in North Carolina are managed by the North Carolina DPR under the Systemwide Plan for the North Carolina State Parks System. The plan outlines goals for interpretation and education, natural and cultural resource protection, park operations, capital improvements, planning, community outreach, and system expansion. The overall mission of North Carolina state parks is to conserve and protect representative examples of the natural beauty, ecological features, and recreational resources of statewide significance; to provide outdoor recreational opportunities; and to provide environmental education opportunities.

Mountain Island Educational State Forest

The Mountain Island Educational State Forest is a state educational forest operated by the North Carolina Division of Forest Resources (North Carolina DFR), a division within North Carolina DENR. The forest is still under development adjacent to Mountain Island Lake (Mountain Island Development) and is not yet open to the public. Once open, the forest will feature classes and exhibits designed to educate schoolchildren, forestry professionals, and the general public about the importance of North Carolina's forest health. North Carolina DFR's primary purpose is to ensure adequate and quality forest resources for the state to meet present and future needs.

City of Hickory, North Carolina, Local Parks

The City of Hickory owns and manages two city parks adjacent to Lake Hickory (Oxford Development) that total about 224 acres, Bud Geitner Park and Glenn C. Hilton Park. These parks provide a variety of public recreational opportunities including a boat ramp, a canoe launch, bank/pier fishing and picnic areas. The city manages its parks under its Parks and Recreation Master Plan.

Mecklenburg County, North Carolina, Local Parks

Mecklenburg County, North Carolina, owns and manages two county parks adjacent to Lake Norman (Cowans Ford Development), Jetton Road County Park and Blythe Landing County Park, that total about 131 acres. Mecklenburg County, North Carolina, also owns and manages a wildlife refuge (Cowans Ford Wildlife Refuge) and two county parks adjacent to Mountain Island Lake (Mountain Island Development), Rural Hill Park and Latta Plantation County Park, that total about 2,356 acres. The county also owns and manages a 956-acre park located adjacent to Lake Wylie (Wylie Development), McDowell Park. These areas provide a variety of public recreational opportunities including boat ramps, pier/bank fishing, sunbathing beaches, picnic areas, trails, volleyball courts, playgrounds, an observation deck, a wildlife area, and a formal garden. The county manages its parks in accordance with its Parks and Recreation Master Plan.

Stowe Botanical Garden

The Stowe Botanical Garden is a 100-acre botanical garden and wildlife area located adjacent to Lake Wylie (Wylie Development) that is owned and managed by the Daniel Stowe Family.

Shoreline Management Plan

An SMP for the Catawba-Wateree Project has been in effect since June 1, 1996, and was last updated and approved by the Commission in October 2003. Since its inception, the project

SMP has consisted of two primary components: (1) the SMG, and (2) the shoreline classification maps and associated lake use restrictions.

Working with interested agencies and other stakeholders, Duke Energy has revised and updated both the shoreline classification maps and its SMG as part of its relicensing study efforts and is proposing the adoption of these revised maps and guidelines as part of a newly approved SMP for the project. The updated guidelines consist of revised criteria within each of the six lake use permitting programs, including: (1) shoreline stabilization, (2) private facilities, (3) commercial facilities, (4) conveyance, (5) excavation, and (6) miscellaneous reservoir uses.

As the SMP for the Catawba-Wateree Project was last updated and approved in October 2003 (Order Approving and Modifying the Shoreline Management Plan issued on October 15, 2003) this EIS focuses on the incremental changes between the 2003 approved SMP and the proposed SMP, and we assess the effects of these proposed changes on environmental resources of the project.

Shoreline Classifications

The existing SMP for the Catawba-Wateree Project includes maps that classify the shoreline into various use categories. Each category carries with it a description of the area characteristics and established lake use restrictions. The classification maps are an integral part of the project SMP and are a critical component of the proposed action. The Catawba-Wateree Project shoreline classifications are summarized in table 86.

Table 86. Summary of Shoreline Classifications Proposed for the Revised SMP for the Catawba-Wateree Project (P-2232). (Source: Duke Energy, 2007)

Classification	Summary description	Lake use restrictions
Environmental	Vegetated areas or cove heads with stream confluences with either (1) stable, wetland-type habitat and emergent vegetation, or (2) intermittent or permanent streams entering the upper ends of shallow coves.	No removal of vegetation, construction, excavation, or shoreline stabilization inside the project boundaries.
Bottomland Hardwood Area	Areas with diverse, well-developed tree canopies consisting of some combination of hydrophytic tree species. The soils are typically sandy, organically rich, alluvial soils that exhibit hydric soil conditions. These areas have gentle slopes and are often associated with a drainage area or stream confluence.	No removal of vegetation, construction, excavation, or shoreline stabilization inside the project boundaries.

Classification	Summary description	Lake use restrictions
Natural	These areas have characteristics that make most types of development inside the project boundaries undesirable from an overall lake management standpoint. Natural areas exist where any of four criteria, summarized as follows, are met: (1) large areas of shallow water, (2) important terrestrial habitat areas, (3) significant cultural resource areas, or (4) narrow isolated berms within the project boundary.	No removal of vegetation, construction, or excavation inside the project boundaries
Impact Minimization Zones	Areas that have specifically identified importance on a given lake from a scenic, environmental, or cultural standpoint. Applicants must first try to avoid impact minimization zones, but if complete avoidance is not a practicable alternative, then the lake use restrictions apply.	No boat ramps except those required for public recreation, and no excavation.[1] Construction in these areas may have specific mitigation requirements imposed by the federal, state, or local resource agencies. Shoreline stabilization within the project boundaries must adhere to the Shoreline Stabilization Technique Selection Process.
Commercial Marina	Project lands and waters where boats can be launched, retrieved, or moored, and where provisions for food services, convenience retailing such as petroleum sales, wet and dry storage of watercraft, and other related activities take place.	Per the SMG, new commercial marina facilities will not be authorized in areas within a half-mile radius of an existing commercial marina facility nor areas where more than 50 percent of the shoreline within a half-mile radius is residentially developed.
Residential Marina	Project lands and waters where boats can be launched, retrieved, or moored for the purpose of providing private access to the lake for specific residential properties including: (1) multi-family dwellings, (2) long-term campgrounds, and (3) subdivision access lots that provide boating access for owners of any residential lots that do not have project frontage.	No commercial marina facilities.
Residential	Project lands and waters occupied by private facilities for project-front landowners, none of which can have multi-family dwellings.	No commercial marina or new residential marina facilities.

Classification	Summary description	Lake use restrictions
Business/Industrial	Project lands and waters that are typically used by private businesses but which have little to no effect on boating.	No facilities that have an appreciable effect on boating.
Project Operations	Project lands and waters associated with hydropower production including, but not limited to, dams, dikes, powerhouses, and other hydro plant properties. Downstream Clear Zones also are part of this classification and include project lands and waters immediately downstream of all operating hydro stations that are potentially subject to rapid and significant variations in flow rates based on plant operations.	No new or expanded residential marina, commercial marina or residential facilities.
Public Recreation	Project lands and waters occupied by facilities supporting various public recreational amenities.	No non-project uses except public infrastructure.
Public Infrastructure	Project lands and waters occupied by public, non-recreational facilities supporting regional needs.	No new or expanded residential marina, commercial marina, or residential facilities.

[1] Different lake use restrictions apply for Lake James in the Impact Minimization Zone classification.

The classification of Bottomland Hardwood is a new classification under the proposed 2006 modifications. Shoreline in this new classification is afforded the same level of protection as shoreline classified as Environmental.

The proposed 2006 classification maps designate classifications for the entire shoreline of the Catawba-Wateree Project. However, as the project boundary for this project generally follows the normal full pond elevation of the reservoirs, the classifications apply only to the immediate shoreline uses. The exceptions to this are project lands surrounding the dams and powerhouses, but these are all classified as project operations, within which no new residential marina, commercial marina, or residential facilities are permitted.

Shoreline Management Guidelines

The SMG are a set of detailed procedures and criteria that Duke Energy uses to regulate activities within reservoirs owned and managed by Duke Energy, including lands and waters within the Catawba-Wateree Project boundary. The revised SMG developed by Duke Energy in consultation with agencies and other stakeholders are designed to be consistent with the Commission's Standard Land Use article.

The SMG provide detailed guidance for allowable uses of project lands and waters in several program categories including the: (1) Marina Facilities Program, (2) Conveyance Program, (3) Excavation Program, (4) Private Facilities Program, (5) Shoreline Stabilization Program, (6) Miscellaneous Reservoir Uses Program, (7) General Policies that are not Lake Specific, and (8) Vegetation Management Requirements. The SMG also include sections that

outline True Public Marina Requirements and the Shoreline Stabilization Technique Selection Process. In addition to providing specific criteria and procedures in each of the these program areas, the SMG also outline the step-wise review processes that Duke Energy utilizes in considering all lake use permit activity requests and in evaluating non-project uses. Overall, the review steps outlined in the SMG are intended to ensure consistency in reviewing all permit applications and considering all requests for non-project use of project lands and waters, consistent with its FERC license.

A cornerstone of Duke Energy's SMG for the Catawba-Wateree Project is its Lake Use Policy Statements (Lake Policy). The Lake Policy delineates the types of access and activities that may be allowed on all reservoirs owned or managed by Duke Energy. With respect to the Catawba-Wateree Project, Lake Policy allow for review of four basic types of lake access: (1) private access, (2) public recreational access, (3) public infrastructure access, and (4) business/industrial access on the lakes with existing private and business development (James, Rhodhiss, Hickory, Lookout Shoals, Norman, Mountain Island, Wylie, Fishing Creek, Cedar Creek, and Wateree). Public infrastructure and business/industrial access will be allowed in accordance with the Commission's standard land use articles. However, the Lake Policy will not allow any additional private access on Great Falls reservoir, but public recreational access will be allowed as required to meet the terms of any new FERC licenses.

Duke Energy is proposing changes to the SMG. Table 87 summarizes the SMG changes being proposed for inclusion in the revised SMG.

Table 87. Summary of proposed modifications to the Shoreline Management Guidelines. (Source: Duke Energy, 2007)

SMG section	Description of new or modified policy or criteria
Fees	Applicant proposes fees for permitting of private and commercial docks, marinas, and other recreational use facilities allowed under the SMP. Some fees are earmarked for inclusion in the Habitat Enhancement Program Funds, and are to be used to help purchase or otherwise protect lands outside the project boundary for conservation or other public use purposes. The revised SMP establishes no caps on fees.
Enforcement	The SMP and SMG both include provisions and restrictions for activities that can be authorized within the project boundary. Specific restrictions and consequences for violations are included within each SMG permitting program.
Seawalls	Areas with an average eroded bank height less than or equal to 3 ft can only be stabilized utilizing bioengineering techniques, or riprap, or both: seawalls are not allowed. This is a change over the previously approved SMP, which allowed seawalls regardless of bank height.
	A layer of riprap must be placed along the entire base of all bulkheads extending 6 ft lakeward from full pond. This is a change over the previously approved SMP, which did not require 6ft extension of riprap, resulting in undermining of bulkheads.
Plantings	The type of plantings utilized in bioengineering and landscape planting projects should be native to North Carolina, South Carolina, or both, and must be reviewed and approved by Duke Energy prior to introduction. The previously approved SMP did not limit plant introduction to native species.
Excavation	Excavation is not allowed within water willow beds except as necessary to maintain access to previously approved facilities. The previously approved SMP did not limit excavations in areas of water willow.
	Excavation activities must not occur during the months of March, April, May, and June because of potential impacts to fish spawning areas. The previously approved SMP allowed excavations during these months in the North Carolina portion of the project.
	Excavation permits will not be issued for the following activities: (a) channeling to create additional shoreline or channeling that would alter the project boundary or the full pond contour elevation; (b) excavation that would impact threatened or endangered species, historic properties, or environmentally important areas; and (c) excavation activities not associated with maintaining access to an existing permitted facility or a proposed facility for which the owner had made application and received written approval from Duke Energy for its construction. These measures expand restrictions on excavation over what was allowed in the previously approved SMP.
Sand Mining	Sand mining operations for the removal of sand from within the project boundary, usually on headwater portions of the reservoir, may be authorized in accordance with the Excavation and Conveyance Program guidelines to the maximum practical extent. The previously approved SMP did not address sand mining in project waters.

SMG section	Description of new or modified policy or criteria
Placement of Excavated Materials	All excavated material must be handled following best management practices unless special consideration is given in writing by South Carolina DHEC or North Carolina DENR. The previously approved SMP did not specify how excavated materials were to be handled.
Commission Review of Excavation Application	Commission review is required for: (a) all excavations, except for maintenance excavations, that will exceed 2,000 cubic yards of material removed; and (b)any excavation activity that is required to support another proposed lake use request that requires Commission review. The previously approved SMP did not specify the need for Commission review of these excavation projects.
Protection of Water Willow Beds	Applicants are encouraged to avoid activities that could have an adverse impact upon existing water willow beds. Unavoidable impacts should be confined to the sides of water willow beds to minimize disruption of their function as shallow water fish habitat. No floating structures or other extraneous facilities may be constructed over water willow beds. The width of walkways over water willow beds will be limited to less than 3 ft. Removal of water willow for continued lake access may be allowed provided only that necessary for limited access in specifically identified areas is approved in writing. The previously approved SMP did not limit or encourage limitations on facilities and uses in areas of water willow beds.
Private Boat Ramps	The SMP will no longer allow boat ramps for private use. The previously approved SMP allowed private boat ramps, but placed some restrictions on when such boat ramps could be constructed.
Material Requirements	Floatation for all facilities and boat mooring buoys must be constructed of materials manufactured for marine use. Materials will resist puncture and penetration and will not be subject to damage by animals. The uncoated, beaded polystyrene will not be permitted for any new construction or as replacement for existing facilities. Reuse of plastic, metal, or other previously used drums or containers for encasement or flotation purposes is prohibited. Existing approved flotation is authorized until it has severely deteriorated and is no longer serviceable, at which time it must be replaced with approved flotation.
No Permanently Moored Houseboats	Watercraft used for habitation shall not be permanently moored at private docks. Permanent mooring must be at marinas with sewer facilities. The previously approved SMP did not limit mooring of houseboats.
Limitations on Watercraft Moored at Common Use Facilities	Common use facilities with three or more slips are not eligible for mooring additional watercraft including personal watercrafts. The previously approved SMP did not specifically limit the number of watercraft at common use facilities.

SMG section	Description of new or modified policy or criteria
Common Use Boat Slips per Waterfront Lot	Unless grandfathered, no more than one common use boat slip per waterfront lot will be considered for approval. Ownership or interest in a common use facility eliminates the option of having a separate facility at the lot attributed a slip in a common use facility. The previously approved SMP did not specifically limit common use slips to one per lot.
Shoreline Structures	Decks, gazebos, covered boat slips, and boat shelters must be single-story structures. They may be roofed and designed to allow second story use; however, the second story must not be roofed creating a two-story roofed structure. The previously approved SMP did not restrict two-story structures.
Lot Width	Unless grandfathered, a lot having less than 100 ft of shoreline that is suitable for residential use will *not* be considered for a pier or common use slip. The previously approved SMP required 75 ft of shoreline to qualify for a pier.
Inflatable Recreation Equipment	The use and placement of large water-based recreational equipment will not be allowed within the project boundary. The previously approved SMP did not restrict the use of water-based recreational equipment.
Water Withdrawals	The applicant may authorize a single water withdrawal pump for private home use provided the pump has a rated horsepower of less than or equal to 2 horsepower and is used exclusively for the adjoining waterfront lot. The previously approved SMP allowed withdrawal pumps that did not exceed 1 mgd for home and agricultural use.
Private Swim Areas	Private individuals will not be authorized to rope off or exclude the public from a portion of the project area for the purpose of creating a private swim area. The previously approved SMP did not include this provision.
Wildlife Enhancement Activities	The applicant may authorize wildlife enhancement activities such as wood duck boxes and other similar structures, regardless of the shoreline classification, provided the activity does not pose a hazard to public safety or navigation, the state wildlife agency approves of the activity, and there are no objections from adjacent property owners.
Shoreline Vegetation	Any new developer that desires to provide off-water access for interior lots within a development is required to set aside a minimum of 20 percent of the entire development's shoreline, in addition to any shoreline in a protected habitat classification. The SMG also encourage owners and developers of shoreline property to set aside additional property upland of the project boundary either associated with these preserved shoreline areas or associated with a protected shoreline classification.
True Public Marinas	Facilities operated as true public marinas may be considered for a maximum length of 200 ft provided the facility meets all other requirements and continues to be operated as a true public marina. The previously approved SMP did not allow commercial facility piers (including those that would meet the definition of true public marina) to be longer than 120 ft.

SMG section	Description of new or modified policy or criteria
Expansion of True Public Marinas	Expansion of existing true public marinas may be exempted from adhering to certain requirements limiting expansion of other existing commercial facilities even if: (a) The facility is behind a constriction point of 200 ft or less, (b) the facility expansion would exceed the maximum of 200 boat slips, or (c) the facility expansion is within the 200-ft setback from the outermost project front property corners or from any privately owned in-holdings.
Petroleum at Commercial Facilities	New, expanding, or rebuilding commercial marina facilities that dispense gasoline within the project boundary must provide petroleum absorbent materials or similar best available technology at all the slips dedicated or available for gasoline dispensing. The previously approved SMP had no spill or clean-up requirements for marinas that dispense petroleum products.
Commercial Boat Ramp Construction	New boat ramps for residential marina facility use shall not be located in the backs of coves if any portion of the cove between the proposed boat ramp location and the main channel is less than 200 ft in width. The previously approved SMP had no restrictions on the location of commercial boat ramps.
Pump-out Installation	Any proposed new or rebuilding residential marina facility must provide onsite sanitation facilities for pump-out and disposal of waste if any of the following criteria are met: (a) the facility will have more than 65 docking/mooring spaces, (b) The facility will moor more than 25 watercraft with marine sanitation devices, or (c) the facility will moor watercraft that will be used for human habitation. The previously approved SMP did not require pump-out facilities for any size residential marina facilities.
Extraneous Facilities	New extraneous facilities that are not required to provide lake access (e.g., gazebos, that are not incorporated into the boating facilities) are prohibited. The previously approved SMP did not have this restriction.
Watercraft per Boat Slip	Unless a boat slip or docking/mooring location is specifically designed to accommodate additional watercraft and the capacity is specified, only one watercraft at a time shall be moored within a boat slip or docking/mooring location. The previously approved SMP did not specify any limitations on boats per slip.
Water Withdrawals/ Intakes	New, expanding, or rebuilding large (greater than 1 mgd) permanent water intakes should be fully operational at or below the critical lake elevation. The previously approved SMP did not specify this requirement for large intakes.
Waste Water Discharges	New, expanding, or rebuilding waste water effluent outfalls should be completely submerged and fully operational at or below the critical lake elevation.
Private Bridges/Causeways	New construction of non-public bridges that will cross the full pond contour of the project, except that are intended to provide access to privately owned islands, will not be authorized. The previously approved SMP was silent on whether private bridges across the project were allowed.
Non-Project Use of Project Lands/Waters	Conveyance proposals for non-project use activities should generally avoid crossing an applicant-owned public access area. The previously approved SMP was silent on this issue.

SMP Review and Update

Duke Energy proposes to review and update the SMP at 10 years following the issuance of a new project license and every 10 years thereafter for the term of the new license. In developing the revised SMP, Duke Energy proposes to convene and consult with a working group consisting of North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, FWS, local governments, and other interested parties to review the implementation of the SMP and recommended potential modifications. Coincident with filing the revised SMP, Duke Energy proposes to update and file revised shoreline classifications maps that have been updated to reflect changes in the project's shoreline development.

Visual Aesthetics

The visual quality of the Catawba-Wateree Project developments is highly variable. Starting at the top of the watershed, the Bridgewater Development is set partially within the Blue Ridge Province, and the lands immediately adjoining Lake James are generally steep and forested slopes. The lake affords scenic views of Pisgah National Forest and the Blue Ridge Mountains. With only 17 percent of the shoreline in permitted uses, much of the Lake James shoreline remains in a natural state, adding to the overall aesthetic quality of the reservoir. Just downstream from Lake James, Lake Rhodhiss offers a riverine type reservoir with very limited shoreline development. In contrast, the lands adjacent to Lake Hickory (Oxford Development) are heavily developed, and most views of the reservoir shoreline include homes and other types of development. At the next downstream development, Lookout Shoals Lake, the shoreline development is clustered primarily along the lower half of the reservoir, while the upper part of this reservoir retains a natural, riverine character.

Lake Norman (Cowans Ford Development) is the largest of the project reservoirs, and one of the most heavily developed. Visually, much of the reservoir shoreline supports residential development, and boating use of the reservoir is very heavy. The two areas of the reservoir that were cut off from the main reservoir by the construction of Interstate 77, Lake Davidson and Lake Cornelius, get less use and provide a more secluded setting than does the main part of the reservoir. Despite the preponderance of development along much of the Lake Norman shoreline, portions of the reservoir shoreline, particularly at the upper end of the reservoir, remain undeveloped and provide a more natural visual setting. The most frequently observed view of Lake Norman is undoubtedly the view of the reservoir from the Interstate 77 causeway. From this perspective, passing motorists get a good view of the lake, with a moderately developed shoreline in the background. Excellent views of the Cowans Ford dam and powerhouse also are available to the public at the visitor's overlook.

Mountain Island Lake (Mountain Island Development) is a long narrow lake, the upper half of which is riverine in nature. Much of the land adjacent to this part of the reservoir has been purchased for conservation. Key viewpoints of Mountain Island Lake for the public include the Highway 73 Bridge that crosses the reservoir downstream of Cowans Ford Hydro and the Highway 16 Bridge that crosses the reservoir near Riverbend Steam Station.

The second largest of the project reservoirs, Lake Wylie (Wylie Development), has a shoreline that also is heavily developed. In addition to considerable residential development, several industrial facilities dot the shoreline. Views of Lake Wylie are accessible from

Highway 273, Highway 27, and Interstate 85, on the northern end of the reservoir, and from Highway 49 which crosses the southern half of the reservoir.

Fishing Creek reservoir is a moderate sized reservoir which is largely undeveloped. Only 7 percent of this reservoir's shoreline has a permitted shoreline use. However, a large new development is planned for the eastern side of the reservoir, and may alter the aesthetic quality of the reservoir in the future. Views of Fishing Creek reservoir are accessible primarily from the Highway 9 Bridge crossing on the upper end of the reservoir and limited views on the western side from Highway 21. The public is afforded an excellent view of the Fishing Creek dam and powerhouse from the Highway 200 Bridge, which crosses the river just downstream of the dam.

Due to safety concerns, there is no public access provided to the Great Falls reservoir, so views of the reservoir are generally limited to private individuals with residences located along the reservoir shoreline. Moreover, while there is considerable development along the Great Falls reservoir shoreline (71 percent of the shoreline has a permitted use), Duke Energy does not permit the construction of private piers on this reservoir, so the shoreline remains uncluttered. The primary view of the reservoir afforded to the public is from the Highway 200 bridge as it crosses the reservoir just downstream from the Fishing Creek dam.

Cedar Creek reservoir is one of the least developed of the project reservoirs. Only 11 percent of the shoreline of this small reservoir has permitted shoreline use. The reservoir's unique features are two large islands, Big Island which rises almost 200 ft above the full pond elevation, and Mountain Island which rises 506 ft above msl. The reservoir shoreline is characterized by steep hardwood forested slopes, interspersed with stands of loblolly pine in upland areas. Much of the Cedar Creek reservoir shoreline is under option to a local land conservancy and is likely to be conserved in a natural state in the future.

Lake Wateree has a moderately developed shoreline with nearly half of the shoreline (48 percent) in permitted use. As this development is located in the transition region between the Piedmont and the Coastal Plain, much of the land surrounding the reservoir is flat, and views from the reservoir are generally limited to the immediate shoreline. Lake Wateree State Park provides the public with outstanding views of the lake. Views from public roads are limited to bridge crossings on the west side of the reservoir and the Highway 97 bridge crossing at Beaver Creek on the east side of the reservoir.

3.3.8.2 Environmental Effects

Minimum Flows, Recreational Flows, and Reservoir Levels

Duke Energy is proposing to provide new or increased minimum flows at several of the project developments including the Bridgewater, Oxford, Lookout Shoals, Wylie, Great Falls, Dearborn, and Wateree Developments.

Additionally, Duke Energy proposes to provide minimum average daily flows at the remaining project developments, including Rhodhiss Cowans Ford, Mountain Island, Fishing Creek, and Rocky Creek and Cedar Creek. Minimum flows are discussed in detail in section 3.3.7.2, *Recreational Resources, Environmental Effects*.

In addition to its proposed minimum flows Duke Energy proposes to provide dedicated recreational flow releases at rates and on schedules to support paddling, wade fishing, boat fishing, and other activities. These new scheduled flows would be provided in the Bridgewater, Oxford, Wylie, and Wateree regulated river reaches in addition to scheduled flow releases for

canoeing and whitewater boating into the Great Falls bypassed reaches. Recreational flows are discussed in detail in Section 3.3.7, *Recreational Resources*.

There were no comments regarding the potential effect of the proposed recreational flows on land use, ownership, or development. There were comments from the public in support of the proposed flow releases into the Great Falls bypassed reaches. South Carolina DNR commented that Great Falls will be greatly enhanced with the flows proposed in the Revised CRA. The Great Falls Hometown Association expressed its support of the proposed flow releases noting that the flows will help to restore the sound of the Great Falls, which historically were described as "a great wonder, that could be heard for miles." Similarly, the Honorable H.C. Sterns, Mayor of Great Falls, commented that with the planned release of water through the old river bed, the historic sounds of the Great Falls of the Catawba will be heard again.

Duke Energy also is proposing some changes to reservoir water level regimes. These proposed modifications are discussed in detail in section 3.3.2, *Water Resources*. There were no comments regarding the potential for the proposed reservoir water level regimes to adversely impact land use, shoreline management, or project aesthetics.

Our Analysis

The changes in minimum flows proposed for the Catawba-Wateree Project developments would have minimal to no effect on land use, ownership, or management. Proposed minimum flows at most of the developments represent a modest to moderate increase in minimum flows over what is currently provided. At nearly every development where Duke Energy has proposed an increase in continuous minimum flows, it would be anticipated that the increased minimum flows would enhance the scenic quality of the river or bypassed reach. This is particularly true of the bypassed reaches at the Great Falls Development, where Duke Energy's proposal to provide a continuous minimum flow 100 cfs in the Short bypassed reach and 450-850 cfs (depending on the season) in the Long bypassed reach will significantly enhance the aesthetic quality of the falls that historically distinguished this river reach.

Recreational flows proposed for a number of the developments also are anticipated to enhance the visual quality of these river reaches during periods of higher recreational flow releases, and greater recreational use. As part of the studies used to evaluate and consider appropriate recreational flow release levels for each of the developments, the aesthetic quality of the range of recreational flows being considered for each of the river reaches was assessed. The aesthetic quality of the recreational boating flows proposed for the Bridgewater, Oxford, Wylie, Great Falls, Dearborn (Long and Short bypassed reaches), and Wateree Developments were all rated as "Acceptable" to "Totally Acceptable."

Provisions of recreational flows in the various development reaches, as proposed, will result in an increase in recreational use of these reaches. In turn, unless appropriate facilities and accommodations are provided to handle the increased recreational use, having more users along the shorelines could result in an increase in shoreline disturbance and eventually lead to additional shoreline erosion. Littering, and other unsightly forms of human disturbance could result. Duke Energy's proposal for adding and modifying planned recreation sites to accommodate the expected increase in recreational use along these river reaches, should be adequate to more than offset any adverse impacts to the shoreline or the aesthetics of the bypassed reaches that might result from increased use. We conclude that the proposed

recreational flows will have no significant adverse effect on the project shorelines or land use, and will further enhance the aesthetic quality of these reaches.

Reservoir water level regimes proposed for each of the project developments will have minimal or no effect on project land use, shoreline management, or aesthetics. None of the proposed water level regimes will result in significant increases in reservoir draw-down or fluctuation levels. Modified guide curves for Lake James and Lake Norman will reduce the maximum winter draw-down of the reservoir. At Lake James and Lake Norman, the proposed guide curves will reduce the winter draw-down from a current maximum of 8 ft to a new maximum of 6 ft. Modifications proposed for the operating levels of the other reservoirs are all within 1 ft of the current operating levels and would have no effect land use or the visual quality of the reservoirs.

Lake Wateree Flooding

As discussed in detail in section 3.3.2, *Water Resources,* high intensity rainfall events cause Lake Wateree to rise above the normal full pool elevation of the reservoir, causing flooding in low-lying shoreline areas around the reservoir. Lake Wateree property owners have indicated that flooding increases shoreline erosion and causes impacts to roads, structures, land, septic systems, docks, and other recreation facilities.

Our Analysis

To help reduce the magnitude, frequency, and duration of flooding at Lake Wateree, Duke Energy is proposing to install a bladder dam in the Wateree spillway. As discussed in section 3.3.2, Water Resources, the proposed spillway and bladder dam would increase the discharge capacity at the 103-ft flood stage by approximately 33 percent, and is anticipated to reduce the peak flood elevation at the Wateree dam from 104.9 ft to approximately 104 ft, and reduce the duration the reservoir elevation is above 103 ft from 20.5 to 15 hours. Much of the shoreline in the lower portion of Lake Wateree has minimal topographic relief and is therefore prone to flooding. Historically, these same areas have been developed with little consideration of the location of structures and facilities within the flood zone. Even with the proposed bladder dam, flooding of portions of the Lake Wateree shoreline would be expected to continue, albeit at a reduced frequency and magnitude. Unless steps are taken to modify existing development within low-lying shoreline areas, flooding of roads and structures, including private and public recreation facilities, will continue to occur. To reduce the impact of flooding on property and structures, the SMP should be modified in such a way as to strictly limit all new shoreline development within the flood zone. To do this, we recommend that the shoreline classification map for the Wateree Development be revised to create a new "flood zone" shoreline classification, and that no new development be allowed within this classification zone.

Shoreline Management Plan

Duke Energy is proposing changes to the existing project SMP in two areas: (1) revised shoreline classification maps, and (2) revised SMG. The proposed changes to the shoreline classification maps are important in that they reflect a comprehensive review of the existing shoreline classifications for all the project reservoirs, by Duke Energy, in consultation with resource management agencies and other interested stakeholders. Table 88 provides a summary of the proposed shoreline classifications project-wide and compares these classifications to the currently approved classifications. In the project settlement agreement Duke Energy reserves the

right to make changes to the classification maps to protect newly discovered resources such as archeological or historic sites, threatened or endangered species, special concern species, or to correct errors.

Under the proposed classification maps, project-wide, the Residential classification makes up the single greatest shoreline classification accounting for 37.7 percent of the total project shoreline. Combined with the other development categories, both current and future, development classifications account for 65.3 percent of the project shoreline.[18] Public Recreation areas, both existing and future, account for approximately 7.0 percent of the project shoreline. Project-wide, approximately 79.6 miles of shoreline would be classified as Natural areas (4.7 percent), 322.3 miles would be classified as Environmental (19.0 percent), 9.9 miles would be classified as Bottomland Hardwood areas (0.6 percent), and 54.5 miles would be classified as Impact Minimization Zones (3.2 percent). In all, 470 miles (27.7 percent) of the total project shoreline would be afforded some sort of protection from development with the proposed modifications to the classifications. This is nearly the same as the 27.3 percent of the project shoreline classified in protective classifications in the 2003 approved maps.

Table 88. Comparison between the 2003 classifications and the proposed classifications. (Source: Duke Energy, 2007)

2003 Approved SMP classification type and percent of total shoreline in each classification		**2006 Proposed SMP classification type and percent of total shoreline in each classification**	
Commercial/Non-Residential	1.2%	Commercial Marina	1.1%
Commercial/Residential	1.9%	Residential Marina	1.9%
Residential	34.4%	Residential	37.7%
Public Recreational	0.5%	Public Recreation	0.6%
Project Operations	1.5%	Project Operations	1.4%
Environmental	18.3%	Environmental	19.0%
Natural Areas	5.7%	Natural	5.4%
Business/Industrial	0.3%	Business/Industrial	0.6%
Public Infrastructure	3.2%	Public Infrastructure	3.9%
Impact Minimization Zone	3.3%	Impact Minimization Zone	3.2%
Future Commercial/Non-Residential	11.5%	Future Commercial Marina	5.5%
Future Commercial/Residential	7.4%	Future Residential Marina	2.0%
Future Residential	4.8%	Future Residential	10.8%
Future Public Recreation	6.0%	Future Public Recreation	6.5%
		Bottomland Hardwood	0.6%
Total	100.0%		100.0%

[18] Development categories include Commercial Marina, Residential Marina, Residential, Business/Industrial, Public Infrastructure, Project Operations, Future Commercial Marina, Future Residential Marina, Future Residential, Impact Minimization Zone Developed.

At the development level, Table 89 summarizes the proposed percent classification of shoreline for each of the 13 project developments. As proposed, the two developments with the greatest amount of shoreline in development classifications remain the Oxford and Cowans Ford Developments, which have 79.9 and 82.3 percent of their shorelines classified in development categories, respectively. In total, 7 of the 13 project developments have greater than 50 percent of their shorelines classified for development (not including public recreation areas). In addition to Oxford and Cowans Ford, these developments include Bridgewater, Wylie, Great Falls, and Wateree. The greatest percentage of shoreline classified in protected natural or environmental areas occur at the Rhodhiss (56.6 percent), Fishing Creek (52.9 percent), and Mountain Island (50.65 percent) Developments. Public Recreation classification (both existing and future) is greatest at the Bridgewater (21.5 percent), Mountain Island (15.5 percent), and Great Falls and Dearborn Developments (18.9 percent).

Table 89. Proposed shoreline classifications by development (percentage). (Source: Duke Energy, 2007)

Classification	Bridge-water	Rhodhiss	Oxford	Look-out Shoals	Cowans Ford	Mountain Island	Wylie	Fish-ing Creek	Great Falls	Cedar Creek	Wateree
Commercial Marina	1.0%	0.4%	1.4%	0.0%	1.2%	0.0%	2.0%	0.1%	0.0%	0.0%	0.9%
Residential Marina	2.7%	0.3%	2.0%	0.9%	3.8%	0.7%	1.0%	0.0%	0.0%	0.0%	0.4%
Residential	11.3%	1.6%	51.9%	25.1%	56.8%	10.8%	40.7%	4.2%	0.0%	0.5%	44.6%
Business/ Industrial	0.0%	0.4%	0.9%	0.0%	0.8%	0.2%	1.0%	0.3%	0.8%	0.0%	0.0%
Public Recreation	0.5%	0.4%	0.7%	0.3%	0.4%	0.2%	0.9%	0.2%	0.0%	0.5%	0.3%
Project Operations	0.4%	2.6%	2.6%	1.2%	4.9%	9.5%	5.6%	1.4%	1.5%	4.5%	1.0%
Natural	1.7%	0.3%	1.5%	4.2%	0.7%	3.0%	0.5%	0.8%	50.0%	5.4%	0.6%
Natural Isolated Berm	5.0%	27.7%	0.1%	10.6%	1.1%	4.7%	6.8%	2.8%	1.5%	7.1%	2.1%
Bottomland Hardwood	0.0%	0.1%	0.0%	0.6%	0.4%	4.7%	0.2%	3.2%	0.0%	0.0%	0.8%
Future Commercial Marina	0.0%	0.0%	0.0%	2.1%	0.2%	0.3%	0.1%	6.8%	1.5%	0.0%	0.6%
Future Residential Marina	14.7%	19.1%	1.2%	6.6%	1.3%	0.0%	1.5%	18.8%	0.0%	14.8%	8.8%
Future Residential	1.3%	0.9%	2.6%	0.9%	1.9%	3.3%	2.7%	0.4%	0.0%	0.0%	2.6%

Classification	Bridge-water	Rhodhiss	Oxford	Look-out Shoals	Cowans Ford	Mountain Island	Wylie	Fish-ing Creek	Great Falls	Cedar Creek	Wateree
Future Public Recreation	19.5%	15.0%	15.2%	7.9%	10.3%	5.1%	8.4%	16.9%	0.0%	12.1%	6.1%
Impact Minimization Zone	21.1%	2.3%	2.6%	3.9%	4.6%	15.3%	3.0%	3.9%	18.9%	34.5%	4.5%
Impact Minimization Zone Developed	6.0%	1.7%	1.5%	10.6%	1.8%	3.3%	2.6%	0.6%	0.0%	3.6%	4.1%
Environmental	0.2%	0.1%	0.6%	1.2%	0.5%	1.3%	0.3%	0.0%	0.0%	0.0%	0.3%

Several agencies commented on the proposed revisions to the Catawba-Wateree Project SMP. South Carolina DPRT comments that improvements to the SMP will help protect scenic integrity and improve water quality and natural habitat. South Carolina DNR concurs with proposed revisions to the SMP and supports the inclusion of the revised SMP in the new license. Catawba County states that the revised SMP will improve shoreline preservation by providing incentives for buffers and reduced the number of multi-slip boat facilities. EPA recommends that the EIS discuss the extent to which the revised SMP will help to protect sensitive wetlands and riparian and terrestrial habitat. Interior comments that the EIS should include a review of various SMP modeling scenarios to determine the impact of existing and future watershed land development, both within and beyond the project boundary, on current and future water quality in the Catawba-Wateree system.

North Carolina WRC expressed its support of the proposed revisions to the SMP noting that the revised SMP would be a considerable improvement over the existing SMP. North Carolina WRC also noted its strong support for the provisions of the Revised CRA to continue stakeholder involvement in the periodic review and revision of the SMP throughout the term of the new license.

Specific to the proposed revisions to the SMG, a number of comments were received. Ms. Suzanne Johnson raised concerns that the revised SMG do not cap fees, and in particular noted that there was a lack of restrictions on dock fees. A number of commentors, including Ms. Michelle Mann, Ms. Donna Lisenby, Ms. Sarah Williams, Mr. Robert Anderson, and Ms. Rebecca McSwain, raise concerns that the enforcement provisions of the SMG are inadequate and that Duke Energy does not adequately enforce the current SMG. Regarding seawalls, North Carolina WRC comments that the EIS should consider the effects of the SMP on shoreline erosion and sedimentation.

Our Analysis

The proposed changes in shoreline classifications for the project will have a modest effect on land use, ownership, or management of the project shoreline. Overall, there is very little change in project-wide classifications between the 2003 approved classification maps and the 2006 proposed classification maps. The greatest changes in classification proposed project-wide are the future use classifications. Future Commercial Marina classification has been reduced from 11.5 to 5.5 percent. Future Residential Marina classification has been reduced from 7.4 to 2.0 percent. Conversely, Future Residential classification has increased from 4.8 to 10.8 percent. Future Public Recreation classification remains nearly unchanged, as does the project-wide amount of shoreline in natural and environmental classifications which accounted for 27.3 percent in the 2003 classification maps and 27.7 percent in the 2006 classification maps.

With these proposed changes in the classification maps, there would be little to no impact on project resources, compared to the 2003 approved classifications. Minor decreases in the Future Commercial Marina and Future Residential Marina classifications could result in fewer marinas being developed project-wide, with a corresponding benefit to project resources. However, any such benefits would likely be offset by the proposed increase in the Future Residential classification. Increases in the Future Residential classification indicate that more of the project shoreline will be developed with private homes and residential dwellings, and that many of these residences will construct docks and other related private recreation facilities as allowed under the SMG. Construction activities would lead to short-term and localized impacts

on aquatic habitats due to increased shoreline erosion, disturbance of bottom substrates, elevated turbidity, and sedimentation.

Many of the development activities would involve permanent shoreline modifications, such as alteration of shoreline vegetation (as allowed under the SMG), and the installation of seawalls and shoreline riprap. Removal of forested shoreline vegetation and elimination of the natural shoreline slope would reduce the availability of cover, eliminate sources of submerged woody debris, and increase the potential for shoreline erosion and sedimentation. Loss of shoreline cover, especially woody debris, and increased sedimentation of benthic habitats may locally alter shallow water spawning and rearing habitats for fishes.

Natural shoreline cover would be replaced in part by constructed docks, piers, and other structures. These features would seasonally harbor largemouth bass, crappie, sunfish, and other species seeking overhead cover. However, the increased boating activities, and associated increases in wave action and bottom disturbance, could disrupt the spawning behavior of shallow-water fish species. Development of the shoreline would result in incremental losses of some shoreline fish habitat (including spawning and nursery areas) and invertebrate food sources; however, many of the most productive shallow water areas have been classified in the natural or environmental categories and therefore are afforded protection from development under the proposed SMP.

Given the potential impacts associated with the development that would be allowed under the revised SMP, the classifications and associated lake use restrictions for natural, environmental, and impact minimization zones are critical for the protection of project resources. As with the previously approved classification maps, the proposed classification maps designate reservoir shoreline areas as either "Environmental" or "Natural." Environmental areas include vegetated areas or cove heads with stream confluences. Natural areas are areas of isolated berms or those areas that have important resource characteristics such as shallow water, significant cultural resources, or significant terrestrial habitats. No development is allowed to occur in areas classified as Natural or Environmental. Similarly, areas classified as Bottomland Hardwood are afforded this same level of protection.

The proposed revisions to the SMG will have a variety of affects on project resources. The most significant of these are discussed in more detail below.

Vegetation Management

Under the proposed SMG, Duke Energy has proposed several modifications to SMG provisions designed to strengthen beneficial vegetation management practices at the project reservoirs. These include provisions to better protect existing aquatic vegetation including water willow, and shoreline vegetation, as well as provisions for vegetative plantings along the shoreline.

Plantings—Under the proposed SMG, the type of plantings used in bioengineering and landscape projects should be native species and must be reviewed and approved by Duke Energy prior to introduction. This is a change from the 2003 approved SMP which did not limit plant introduction to native species. The requirement to use native species in shoreline plantings is an improvement over the previously approved SMP in that it reduces the potential for the accidental introduction of invasive non-native plant species along the project shorelines, which have the potential to spread and crowd out other native species. The use of native species in plantings

also will be of greater use and benefit to wildlife species that might utilize such plantings for food or cover. Native plantings also have the potential to be more aesthetically pleasing as they blend more naturally into the surrounding landscape.

Water Willow—Under the proposed SMG, applicants for use permits are encouraged to avoid activities that could impact water willow beds. Unavoidable impacts should be confined to the sides of beds to minimize disruption of their function as shallow water fish habitat. No floating structures or other extraneous facilities may be constructed over water willow beds. The width of walkways over water willow beds will be limited to less than3 ft. Removal of water willow for continued lake access may be allowed provided only that necessary for limited access in specifically identified areas is approved in writing. The previous SMP did not limit or encourage limitations on facilities and uses in areas of water willow beds. These new provisions and restrictions will help to minimize the impacts of shoreline development on water willow beds which provide important habitat for fish and other aquatic organisms. The water willow beds also are beneficial for maintaining reservoir water quality.

Shoreline Stabilization

Seawalls—Under the proposed SMG areas with an average eroded bank height of 3 ft or less can only be stabilized utilizing bioengineering techniques, riprap, or both. Seawalls are not allowed in these situations. This represents a change from the 2003 approved SMP which allowed seawalls to be installed along the shoreline regardless of bank height. In addition, under the revised SMG a layer of riprap must be placed along the entire base of all bulkheads extending 6 ft lakeward from full pond. The previously approved SMP did not require this riprap installation, resulting in undermining of bulkheads. The additional restrictions on the installation of seawalls along the project shoreline will benefit both terrestrial and aquatic resources by limiting the installation of seawalls, which significantly limit the use of the shoreline edge by many species. Installation of riprap in these situations is preferable in that it provides some useable habitat for both terrestrial and aquatic species, and provides some useable interface between the water and the land. Similarly, the requirement to install riprap at the base of bulkheads will provide some additional habitat for aquatic species and will help to maintain installed bulkheads and reduce undermining and resulting shoreline erosion.

Excavation and Mining

Excavation—Under the proposed SMG, excavation is not allowed within water willow beds except as necessary to maintain access to previously approved facilities. In addition, excavation is prohibited during the months of March, April, and June because of potential impacts to fish spawning. The proposed SMG do not allow excavation for several specified activities, including: (a) channeling to create additional shoreline or to alter the project boundary; (b) excavation that would impact threatened or endangered species, historic properties, or environmentally important areas; or (c) excavation not associated with maintaining access to an existing permitted facility. Under the proposed SMG, all excavated material must be handled following best management practices unless given special consideration by South Carolina DHEC or North Carolina DENR. Finally, the proposed SMG require that the Commission review: (1) all excavations, other than maintenance excavations, that exceed 2,000 cubic yards, and (2) any excavation that is required to support another proposed lake use that requires Commission review. None of these restrictions on excavation were included in the previously approved SMG. Taken as a whole, these additional restrictions on excavation in the

project reservoirs will significantly benefit project resources. Water willow beds will be protected from excavation, as will other important aquatic habitat or environmental areas. Excavations will be more limited in nature, since under the proposed SMP, excavation can be undertaken only to provide access to a permitted facility. These restrictions will help to protect habitat and reduce the potential for impacts to water quality and aquatic habitat that would results from more extensive excavations.

Sand Mining—Under the proposed SMG, sand mining operations for the removal of sand from within the project boundary may be authorized in accordance with the Excavation and Conveyance Program guidelines. The previously approved SMG did not address sand mining. This new provision will benefit project resources by allowing a consistent review of proposed sand mining operations before such operations are approved.

Private and Common Use Facilities

Private Boat Ramps—Under the proposed SMG, private boat ramps will no longer be allowed. The previously approved SMG allowed private boat ramps under certain restrictions. This proposed change in the SMG will greatly benefit project resources by reducing the impact to the shoreline from future residential development.

Shoreline Structures—Under the proposed SMG, decks, gazebos, covered boat slips, and boat shelters constructed within the project boundary must be single-story structures. The previously approved SMP did not restrict two-story structures. This proposed change in the SMG will enhance recreational safety on the project reservoirs by reducing the impacts of potential sight impairment of boaters and other recreationists to oncoming boat traffic. These restrictions also will help significantly to reduce the aesthetic impact of new structures installed along the reservoir shorelines by limiting the vertical intrusion of shoreline structures to a single story.

Common Use Facilities—Duke Energy is proposing two changes to the SMG regarding common use facilities. First, under the proposed SMG, common use facilities with more than three boat slips will not be eligible for mooring additional watercraft including personal watercrafts. The previously approved SMG did not limit the number of watercraft moored at common use facilities. Also under the proposed SMG, unless grandfathered, no more than one common use boat slip per waterfront lot will be allowed, and ownership or interest in a common use facility will eliminate the eligibility of that person to have a separate slip at another common use facility. The previously approved SMG did not limit common use slips to one per lot. These proposed changes in the SMG will significantly benefit project resources by reducing total number of watercraft that can be moored on each reservoir and by reducing the overall total number of boat slips ultimately developed on the project reservoirs. If each lot owner is restricted to a single common use boat slip, then the total number of boat slips, and therefore the total area of the project impacted by the construction of additional common use boat docks, will be reduced. This reduction in total boat slips along with limitations on watercraft moorings will help reduce recreational crowding in certain areas of some of the project reservoirs, particularly Lake Norman, and will generally benefit the aesthetic quality of all the project reservoirs. Fewer boat slips and fewer moored boats will help to preserve more of the reservoir area in a natural undeveloped condition, which in turn will benefit reservoir water quality and aquatic habitat.

Lot Width—Under the proposed SMG, unless grandfathered, a lot having less than 100 ft of shoreline that is suitable for residential use will not be considered for a pier or common use

facility. The previously approved SMG required only 75 ft of shoreline to qualify for a pier. This proposed modification to the SMG will significantly benefit all the natural and environmental resources of the project by reducing the total number of new piers that ultimately will be developed along the reservoir shorelines. The additional lot width requirement will force adjacent private property developers to plat larger lots, thereby reducing the total portion of the adjacent shoreline that is disturbed and developed with homes and other related structures. The resulting reduction in the total number of homes developed along the shoreline will help to better preserve the aesthetic quality of the reservoir shorelines. It also will help to limit the total number of new piers and other private recreation facilities that will be developed, which will help prevent over-crowding of the reservoirs and preserve the recreational experience. Reduced development along the shorelines also will help to better protect reservoir water quality by reducing the impacts to water quality due to construction activities, and the resulting increase in stormwater runoff and non-point source pollution that results from the conversion of natural shoreline to developed.

New Extraneous Facilities—Under the proposed SMG, new extraneous facilities that are not required to provide lake access will be prohibited. These include gazebos and other facilities and structures not incorporated into the access facilities. The previously approved SMG did not include this provision. The proposed restriction on the development of extraneous shoreline facilities will benefit project resources by reducing the total amount of development along the reservoir shorelines. Fewer structures will result in less disturbance of shoreline vegetation and soils and will benefit reservoir water quality and habitats. Limitations on shoreline structures also will help to better preserve the aesthetic quality of the shoreline.

Watercraft

Houseboats—Under the proposed SMG, watercraft used for habitation shall not be permanently moored at private docks. Permanent mooring must be at marinas with sewer facilities. The previously approved SMP did not limit mooring of houseboats. This proposed change in the SMG will benefit the project reservoirs by helping to eliminate the potential for overboard discharges from live-aboard boats, which will benefit reservoir water quality.

Watercraft per Boat Slip—Under the proposed SMG, only one watercraft at a time shall be moored within a boat slip or docking/mooring location, unless the boat slip or mooring is specifically designed to accommodate a specified number of additional watercraft. The previously approved SMG did not specify any limitations on boats per slip. This proposed change in the SMG will benefit project resources by serving to help limit the total number of watercraft on the reservoirs. In turn, a reduction in the total number of watercraft will help to prevent overcrowding on the reservoirs and preserve the quality of the recreational experience. Boating safety also will benefit by a reduction in the total number of watercraft being moored on a particular reservoir.

Swim Areas and Swimming

Private Swim Areas—Under the proposed SMG, private individuals will not be allowed to rope-off or exclude the public from a portion of the project area for the purpose of creating a private swim area. The previously approved SMG did not include this provision. The inclusion of this new provision will benefit recreational users of the project reservoirs by ensuring that all of the reservoir remains available for public use. It will benefit boaters on the reservoirs by ensuring that ropes and buoys deployed by private individuals do not become navigational

hazards. Through its current and proposed recreational facilities, Duke Energy has ensured that safe public swimming areas are available for use on nearly all the project reservoirs.

Inflatable Recreational Equipment—Under the proposed SMG, the use and placement of large water-based recreational equipment will not be allowed within the project boundary. The previously approved SMG did not include this provision. Eliminating the placement and use of large inflatable recreational equipment will enhance recreational user safety on the project reservoirs. The removal of large inflatables also will improve the overall aesthetic quality of the reservoirs, particularly in areas of dense shoreline development.

Marinas

True Public Marinas—The current and proposed SMG establish a definition for a true public marina. For establishments that meet the definition of a true public marina, Duke Energy is proposing several modifications to provisions in its SMG regarding facilities allowed at true public marinas. First, under the proposed SMG, facilities operated as true public marinas may be considered for a maximum length of 200 ft, provided the facility meets all the other requirements of a true public marina. The previously approved SMP did not allow commercial facilities to be longer than 120 ft. Second, the proposed SMG allows for the expansion of existing true public marinas, which when they expand may be exempted from adhering to certain requirements that would apply to other types of commercial facilities. Taken together, these two modified provisions would be expected to benefit project resources. Extending the maximum facility length from 120 to 200 ft will result in some additional impacts to reservoir water quality and aquatic habitat. The longer facilities also will have an adverse affect on project aesthetics and, depending on the location of the facility, the potential to disrupt or impair recreational use of some small portion of the reservoir. However, these impacts would be offset by other benefits. Of particular note would be the benefit of allowing existing marinas to expand, rather than developing new marinas, in order to accommodate increased recreational use and demand. In essence these provisions will encourage a clustering of additional boat slips and other marina facilities at a fewer number of larger facilities.

Commercial Boat Ramp Construction—Under the proposed SMG, new boat ramps at residential marinas will not be allowed to be located in the backs of coves if any portion of the cove between the proposed boat ramp and the main channel is less than 200 ft in width. The previously approved SMG had no restrictions on the location of boat ramps in coves. This provision will benefit project resources by not allowing the development of commercial boat ramps in smaller coves. The backs of coves and the smaller coves are generally areas of shallower water habitats that are likely to support aquatic vegetation, and which would be more significantly impacted by the development of a commercial boat ramp. Recreational resources also will benefit from this provision, as restrictions on boat ramps in small coves will help to prevent boating congestion in the cove, and will reduce the potential for unsafe boating conditions.

Petroleum at Marinas—Under the proposed SMG, new or expanding Commercial Marina facilities that dispense gasoline within the project boundary must provide petroleum absorbent materials or similar best available technology at all the slips dedicated for gasoline dispensing. The previously approved SMG did not have spill or clean-up requirements for marinas dispensing petroleum products. The addition of this new provision will significantly benefit project resources by helping to ensure that the impacts to water quality, fish, aquatic life,

water willow, and recreational users is minimized in the event that a spill of petroleum products occurs at a marina.

Pump-out Installation—Under the proposed SMG, any proposed new or rebuilding residential marina facility must provide onsite sanitation facilities for pump-out and waste disposal if the facility has more than 65 mooring/docking spaces, or will have more than 25 watercraft with marine sanitation devices, or the facility will moor watercraft used for human habitation. The previously approved SMG did not require pump-out facilities for any size residential marina. The addition of this provision to the SMG will benefit project resources by helping to reduce the impact of overboard discharges on reservoir water quality.

Fees and Enforcement

Under the previously approved SMP, Duke Energy established fees for permitting of private and commercial docks, marinas, and other recreational use facilities. Consistent with Commission policy, fees collected by a licensee can be used to help defray the cost of administering the shoreline management program for the project, but cannot exceed the total cost of program administration. As it has in the past, under the proposed revisions to the SMP, some of the fees collected by Duke Energy are earmarked for inclusion in the HEP and will be used to help purchase or otherwise protect lands outside the project boundary for conservation or other public use purposes. So long as the total amount of the fees collected does not exceed the total cost to Duke Energy of administering its SMP, the use of fees to help protect lands adjacent to the project, but outside the project boundary will generally be of great benefit to project resources, and will help to protect the natural resources and aesthetic quality of the project reservoirs.

The previously approved SMP and SMG both include provisions for Duke Energy's enforcement of the provisions of the SMP. Specific provisions and consequences for violation of SMP and SMG requirements will continue to be provided in each of Duke Energy's SMG permitting programs. Generally, the enforcement provisions will remain unchanged under the proposed SMP

Recreation Improvements

Duke Energy proposes within 1 year of license issuance to develop and file with the Commission an RMP for the Catawba-Wateree Project that describes certain proposed recreation enhancements for the project. The proposed recreation measures are described in detail in section 3.3.7.2, *Recreational Resources, Environmental Effects* and are summarized in tables 67 through 77.

Our Analysis

The proposed recreational enhancement to be included in the project RMP would have positive environmental effects by guiding recreational land use and management for the license term, and may help avoid conflicts by coordinating interagency management of recreation and land use. The proposed recreational enhancements would be expected to have little or no impact on project visual resources. Improvements to existing facilities would not affect land use, management, or visual aesthetics, provided that such improvements are made consistent with the guidelines set forth in the SMG.

Bridgewater Development—Duke Energy proposes a number of recreational enhancements at the Bridgewater Development, including three new public recreation access

areas and significant improvements at three existing recreation access areas. Modifications and additions to the existing recreation areas as proposed would have no impact on shoreline management, land use, or project aesthetics. These areas have already been designated as public recreation areas, and the addition of facilities at these areas as proposed will result in no additional impacts. The new facilities proposed for the new Linville Access Area will result in the development of a portion of 10 acres with boat ramps and related facilities. Addition of these facilities will have a minor impact on the shoreline, but such impacts will be offset by the provision of an additional boat launch area available for public use on the popular Lake James. Similarly, the development of additional facilities for the proposed pocket park at the existing canoe portage take-out will have a minor impact on the shoreline in this area that will be offset by the improvement in public access to this portion of the project. In addition, a proposed photographic overlook at this location will provide the public with additional access to the high visual quality of the Bridgewater Development. Downstream of the dam, in the regulated river reach, Duke Energy's proposal to acquire 1-3 acres to develop a canoe/kayak access area with gravel parking will have a minor impact on natural aesthetics of the river shoreline. However, these impacts would be small and would be more than offset by the benefits to the recreating public of having a new canoe/kayak access in this location.

Rhodhiss Development—Duke Energy proposes a new public recreation access area and improvements to four existing recreation sites at the Rhodhiss Development. Modifications and additions to the existing recreation areas as proposed would have no impact on shoreline management, land use, or project aesthetics. These areas have already been designated as public recreation areas, and the addition of facilities at these areas, as proposed, will result in no additional impacts. The new facilities proposed for the new Corpening Bridge Access Area will result in the development of a portion of 10 acres for a trailered boat ramp and approximately 10 gravel parking spaces at the Corpening bridge. Addition of these facilities will have a minor impact on the shoreline, but such impacts will be offset by the provision of a new boat launch which will provide additional public access to Lake Rhodhiss.

Oxford Development—Duke Energy proposes a number of recreational enhancements at the Oxford Development, including three new public recreation access areas and significant improvements at six existing recreation access areas. Modifications and additions to the existing recreation areas as proposed would have no impact on shoreline management, land use, or project aesthetics. These areas have already been designated as public recreation areas, and the addition of facilities at these areas as proposed will result in no additional impacts. The new facilities proposed for the Wittenburg Access Area will result in the development of a portion of 15 additional acres with restrooms, picnic facilities, and additional paved parking. Addition of these facilities could have a minor impact on the shoreline, but such impacts will be offset by the provision of additional public recreation areas on Lake Hickory. Similarly, the new facilities proposed for the Oxford Access Area, including a primitive campground, paved parking, picnic facilities, restrooms, and trails, will have a minor impact on the reservoir shoreline, but the impacts will be more than offset by the benefits to the public of additional recreational access on Lake Hickory. Downstream of the dam, Duke Energy proposes to develop a tailrace fishing area. This new access area would have little or no impact on the shoreline or the aesthetic quality of the tailwater area. Any impacts that may occur would be offset by the benefit of providing anglers access to the Oxford Development tailwaters.

Lookout Shoals Development—Duke Energy proposes a number of recreational enhancements at the Lookout Shoals Development, including three new public recreation access areas and improvements at one existing recreation access area. The proposed improvements to the Lookout Shoals Access Area would have no impact on shoreline management, land use, or project aesthetics. This area has already been designated as a public recreation area, and the addition of restrooms at this site, as proposed, will result in no additional impacts. The new facilities proposed for the new Upper Lookout Shoals Access Area will result in the development of 1-5 acres with a boat ramp, parking, and restroom facilities. Addition of these facilities will have a minor impact on the shoreline, but such impacts will be offset by the provision of an additional boat launch area available for public use on Lake Lookout Shoals. Downstream of the dam, on the regulated river reach, Duke Energy is proposing two new public recreation sites, a canoe portage trail and a public tailrace fishing area. Development of these facilities will have little or no impact on land use or visual aesthetics in this area.

Cowans Ford Development—Duke Energy proposes a number of recreational enhancements at the Cowans Ford Development, including one new public recreation access area and significant improvements at five existing recreation access areas. The proposed improvements to the five existing access areas would have no impact on shoreline management, land use, or project aesthetics. These areas have already been designated as public recreational areas, and the addition of new facilities at these sites, as proposed, will result in no additional impacts. Downstream of the dam, the new facilities proposed for the Cowans Ford dam portage and overlook area will have minimal to no effect on the shoreline or the visual quality of the project. Moreover, the addition of the overlook area will provide the public with improved visual access to the project.

Mountain Island Development—Duke Energy proposes several recreational enhancements at the Mountain Island Development, including three new public recreation access areas and significant enhancements at one existing recreation access area. The proposed improvements to the Riverbend Access Area will have no impact on shoreline management, land use, or project aesthetics. This area has already been designated as a public recreation area, and the addition of new restrooms, bank fishing, and swimming facilities at this site, as proposed, will result in no additional impacts. The new facilities proposed for the Highway 73 Access Area will result in the development of approximately 2 acres of Duke Energy-owned property as a canoe/kayak access with gravel parking. A similar canoe/kayak access area is proposed for development at the Lucia Access Area. The addition of these canoe access facilities will have little to no impact on the project shoreline, and any impacts that do occur will be offset by providing the public with two convenient put-in locations for canoes and kayaks. In addition, Duke Energy proposes to develop a canoe portage trail to give paddlers a route around the Mountain Island dam. As with the two canoe put-in areas, the proposed canoe portage trail will have a negligible effect on the project shoreline, and will have no effect on land use and project aesthetics.

Wylie Development—Duke Energy proposes several recreational enhancements at the Wylie Development, including three new public recreation access areas and significant improvements at four existing recreation access areas. The proposed improvements to the existing recreation access areas will have no impact on shoreline management, land use, or project aesthetics. These areas have been designated as public recreation areas, and the addition of new facilities proposed for these areas will result in no additional impacts. Duke Energy

proposes a significant new recreational area, Rock Hill Park, on Lake Wylie in the vicinity of the city of Rock Hill's water intake. Creation of this recreation area will result in the development of a portion of 17 acres of land and the installation of a swim area, restrooms, bank fishing sites, and parking. The development of this site will result in minor impacts to the shoreline in this area, but these impacts will be more than offset by the benefits to the public of having a new recreational area that provides access to this portion of Lake Wylie. The canoe/kayak access and associated gravel parking proposed for the Dutchmans Creek Access Area will have little to no impact on the project shoreline, and any impacts that do occur will be offset by providing the public with an additional put-in for paddlers on the western side of Lake Wylie. Downstream of the dam, the proposed Fort Mill Access Area will provide restrooms and picnic facilities. These facilities will have little or no impact on the shoreline of the Wylie regulated river reach.

Fishing Creek Development—Duke Energy proposes a number of recreational enhancements at the Fishing Creek Development, including one new public recreation access area, the replacement of an existing access area, and significant improvements at one existing recreation area. Modifications to the existing Fishing Creek Access Area, as proposed, will have no impact on shoreline management, land use, or project aesthetics. This area has already been designated as public recreational area, and the addition of new facilities at this area, as proposed, will result in no additional impacts. The relocation of the Cane Creek Access Area will result in the development of a portion of about 18 acres with two trailered boat ramps, a fishing pier, parking, and other related facilities. Addition of these facilities will have a minor impact on the shoreline, but such impacts will be offset by the improved recreational access provided at the new access area. Downstream of the dam, Duke Energy proposes to develop a public fishing pier and paved parking. The development of these facilities will have a minor impact on the shoreline, but no impacts on project aesthetics and land use. Impacts to the project shoreline would be small, however, and would be more than offset by the benefits to the recreating public of having a new tailwater fishing pier in this location.

Great Falls and Dearborn Developments—Duke Energy proposes a number of recreational enhancements at the Great Falls and Dearborn Developments, including five new public recreation access areas. Duke Energy proposes several canoe portage trails for these developments including a portage trail on the north end of Mountain Island, a portage trail on Mountain Island around the Great Falls headworks, and a portage trail along the Great Falls Short bypassed reach. The addition of these portage trails will have minor impacts to the project shoreline that will be more than offset by the improved public access to the bypassed reaches for paddlers. Similarly, Duke Energy's proposal to acquire a 1- to 7-acre site and develop a canoe/kayak launch on Great Falls reservoir downstream of the Great Falls headworks will result in minor impacts to the reservoir shoreline that will be offset by providing improved public access to the reservoir. Duke Energy proposes to acquire and develop a 1- to 5-acre site to create the Highway 200 Bridge Access Area. This site would include a canoe/kayak launch, restrooms, and a gravel parking lot. Impacts to the shoreline from the development of this site would be minimal and would be offset by improved public access to the reservoir for paddlers.

Rocky Creek and Cedar Creek Developments—Duke Energy proposes a new recreation access area at the Rocky Creek and Cedar Creek Developments. The proposed Mudcat Inn Access Area would result in the development of approximately 1 acre into a canoe/kayak access site with associated gravel parking. The addition of this canoe/kayak access facility will have

little or no impact on the project shoreline, and any impacts that do occur will be offset by providing the public with a new put-in location for canoes and kayaks.

Wateree Development—Duke Energy proposes a number of recreational enhancements at the Wateree Development, including one new public recreation access area and significant improvements at four existing recreation access areas. Modifications and additions to the existing recreation areas as proposed would have no impact on shoreline management, land use, or project aesthetics. These areas have already been designated as public recreational areas, and the addition of facilities at these areas as proposed will result in no additional impacts. For the proposed new Molly Creek Park, Duke Energy would acquire approximately 100 acres and would develop a small portion of this acreage with a swimming area, restrooms, fishing pier, picnic facilities, trailered boat access, and parking. The development of Molly Creek Park represents a significant addition to public recreational access on Lake Wateree. While the construction of some of the planned facilities would have some minor impact on the reservoir shoreline, and would result in a visual modification to the shoreline in this vicinity, the majority of the park land would remain undeveloped and would be protected for the future. This benefit, combined with the benefit of additional public access to the project, would more than offset any small impacts to the shoreline and project aesthetics resulting from the installation of the recreation facilities.

Cultural Resources

As part of its relicensing efforts, Duke Energy conducted cultural resource surveys that identified 20 sites that are considered potentially eligible within the Catawba-Water Project. To address potential ongoing project effects on these sites, Duke Energy prepared and is proposing to implement an historic properties management plan for the project that includes site-specific management plans for maintaining and protecting the eligible sites. In general, Duke Energy's proposal to implement the HPMP and site-specific management plans will have no direct affect on land use or aesthetics, but indirect or synergistic affects, particularly those that could occur as a result of the proposed SMP could occur.

Our Analysis

Duke Energy's proposed implementation of the HPMP includes site-specific management plans for seven significant cultural sites. Implementation of these management plans will have no adverse effect on project land use. Mitigation plans for each of these sites varies, but in no case will the management actions proposed for protection of the sites have an adverse effect on project land use or aesthetics. To the contrary, several of the eligible sites are actively experiencing erosion, and implementation of the proposed management plans will ensure that appropriate measures are taken to prevent additional site erosion, which also should benefit the project shoreline and would help to improve the general aesthetic character of the reservoir.

As discussed in more detail in Section 3.3.6, *Cultural Resources,* the Dearborn Armory Site (38CS307) is located on Dearborn Island, also known as Big Island, in the Rocky Creek and Cedar Creek Developments. The site was originally constructed in the early nineteenth century as one of three national armories. The HPMP proposed by Duke Energy for implementation includes a site specific management plan for the Dearborn Armory Site. This site is located on an island that is proposed for inclusion in a conveyance of project land to the state of South Carolina for the development of a new state park. Specifically, Duke Energy proposes to offer a

lease of the islands associated with the Great Falls, Dearborn, Rocky Creek, and Cedar Creek Developments (including Big Island) to South Carolina DPRT for purposes of establishing and maintaining a new state park centered on the Dearborn Armory site. Implementation of the Dearborn Armory site management plan, in conjunction with Duke Energy's proposal to lease the land on which this site is located to South Carolina to create a new state park, will benefit the public and protect a cultural resource, and would be an appropriate non-project use of project lands.

Land Conveyances

As part of its relicensing settlement agreement, Duke Energy has agreed to transfer several areas of Duke Energy-owned lands, that are not associated with project operations, to federal, state, or local entities through sale or deed. Table 90 summarizes the lands included in the settlement agreement that are proposed for transfer. The potential for land transfers is included in the settlement agreement, but is not considered under the proposed action for relicensing, and would be decided by Duke Energy at a later time.

Table 90. Conveyances of non-project land included in the Revised CRA.

Development(s)/area	Conveyance agreement
Bridgewater	
North Bend Recreation Land	Approximately 500 acres of non-project property adjacent to the Catawba River at the second Powerhouse Road Bridge downstream of the Bridgewater powerhouse to be conveyed to North Carolina DENR for development and management of public recreation access and permanent conservation.
North Bend Access Area	Approximately 10 acres of non-project property adjacent to the Catawba River at the second Powerhouse Road Bridge downstream of the Bridgewater powerhouse to North Carolina WRC for development and maintenance of a public recreation access area.
Catawba-Linville River Confluence Recreation Land	Approximately 420 acres of non-project property adjacent to the Catawba River in the vicinity of the confluence of the Catawba River bypassed reach and the Bridgewater regulated river reach to North Carolina DENR for public recreation and permanent conservation.
Paddy Creek Recreation Land	Approximately 275 acres of non-project property downstream of the Paddy Creek and Linville dams to North Carolina DENR for public recreation and permanent conservation.
Rhodhiss	
Johns River Gameland	Duke Energy shall support the acquisition by the Foothills Land Conservancy, North Carolina WRC, or both of up to 2882 acres of non-project land in the vicinity of the confluence of the Johns River and Lake Rhodhiss for public recreation and permanent conservation.

Development(s)/area	Conveyance agreement
Cowans Ford	
Mountain Creek Park	Duke Energy shall support the acquisition by Catawba County of up to 600 acres of non-project land at the mouth of Mountain Creek for the development of a public park.
Wateree	
Lake Wateree Recreation Lands	Approximately 800 acres of non-project land adjoining the Heritage Project, Cedar Creek Access Area, and Lake Wateree to South Carolina DNR for public recreation and conservation.

There are some project-related land conveyances, however, mostly in association with existing recreation access areas, that are being proposed by Duke Energy, and that are included in the proposed action for relicensing, and therefore are considered herein. The proposed land conveyances are summarized in Table 91.

Table 91. Proposed conveyances of project lands.

Development/area	Proposed conveyance
Bridgewater	
Lake James State Park Islands Management Zone	Offer North Carolina DENR a nominal-cost lease for the term of the new license for the Lake James State Park management zone (300 horizontal feet lakeward from full pond elevation) along the shoreline adjoining the state park, including three islands.
Cowans Ford	
Lake Norman State Park Management Zone	Offer North Carolina DENR a nominal-cost lease for the term of the new license for the Lake Norman State Park management zone (300 horizontal feet lakeward from full pond elevation) along the shoreline adjoining Lake Norman State Park) including one island.
Wylie	
Saddler Island	Offer an AAII lease of the approximately 37-acre island to the U.S. National Whitewater Center for individual and group environmental education and outdoor recreation programming.
Rocky Creek and Cedar Creek	
Cedar Creek Reservoir Island Improvements	Offer a lease of the islands associated with Great Falls, Dearborn, Rocky Creek, and Cedar Creek Developments to South Carolina DPRT to establish and maintain a new state park centered on the Dearborn Armory site.

Development/area	Proposed conveyance
Wateree	
Lake Wateree State Park Management Zone	Offer South Carolina DPRT a nominal-cost lease for the Lake Wateree State Park management zone (up to 300 horizontal feet lakeward from full pond elevation along all the shoreline adjoining the state park) along the shoreline adjoining the state park.

Several comments were received regarding the land protection measures and land conveyances proposed by Duke Energy both as part of the Revised CRA and/ or as proposed license articles. The Great Falls Hometown Association expressed its support for the Cedar Creek reservoir island improvements, noting that, as proposed, the Dearborn Armory Site and several other islands totaling more than 900 acres that would be protected as a new state park would be consistent with local efforts to establish nature-based tourism in the region, and would all create several thousand acres of contiguous public lands in the vicinity of Great Falls.

North Carolina DENR commented in support of the land conveyance proposals included in the Revised CRA, noting that the proposed conveyance of the Paddy Creek, Catawba-Linville Confluence, and North Bend lands will provide diverse recreational opportunities in the upper river basin. North Carolina DENR also indicated its support for the provision of the Revised CRA under which Duke Energy would support North Carolina WRC's efforts to acquire certain lands for conservation and future public access. The Lake Wateree Homeowners Association expressed its support for the land conveyance proposals embodied in the Revised CRA noting that the agreement preserves a significant track of shoreline in the upper section of Lake Wateree. Several other agencies and NGOs made comment in general support of the land conveyance measures included in the Revised CRA (including both those that were and were not proposed as license articles) including North Carolina WRC and the Foothills Conservancy.

Our Analysis

We have reviewed the lands proposed by Duke Energy for conveyance to different entities for the purpose of providing additional recreational access and public use. All of the land conveyances agreed to in the Revised CRA that are not proposed as license articles involve lands that are outside of the project boundary. Upon review of these lands we conclude that the non-project lands being proposed for conveyance are not needed for project purposes, and therefore require no further consideration in this review of environmental effects.

All of the lands proposed for transfer under new license articles are currently within the FERC project boundary. Two of the proposed project land conveyances involve islands that are currently within the project boundary. At the Wylie Development, Duke Energy proposes to lease the approximately 37-acre Saddler Island to the U.S. National Whitewater Center. In the event that the U.S. National Whitewater Center does not go forward with its plans for the use of Saddler Island, it is necessary that property rights for the island revert back to Duke Energy, so that the island can be managed consistent with the purposes of the project. Therefore, we find that the land that makes up Saddler Island, above the normal full pool elevation of Lake Wylie, is necessary for project purposes and should remain within the project boundary. In order to allow the U.S. National Whitewater Center to develop and operate whitewater facilities on the island, consistent with the standard land use article, Duke Energy could lease the island to the U.S. National Whitewater Center as proposed. At the Great Falls, Dearborn, Rocky Creek, and Cedar

Creek Developments, Duke Energy proposed to lease the islands associated with the four developments to the State of South Carolina DPRT for the purpose of establishing a new state park centered on the Dearborn Armory site. We find that the islands proposed for lease are necessary for project purposes and should remain within the project boundary. Consistent with the standard land use article, Duke Energy could lease the islands to the State of South Carolina as proposed, to allow the development of a new state park.

The remaining land conveyances proposed by Duke Energy at the Bridgewater, Cowans Ford, and Wateree Developments involve lands that lie within the FERC project boundary and extend under the reservoirs 300 horizontal feet lakeward from the normal full pond elevation of the reservoir within which they lie. We find that these are lands that are necessary for project purposes, in that they lie within the normal full pool elevation of the reservoir, and are subject to changes in water levels that may occur as a result of project operations. As such, these lands cannot be removed from the project boundary. In as much as the proposed use of these project lands is for public recreational use, and presumably to consolidate the administration and enforcement authority for the state parks which lie adjacent to these lands under a single entity, we find that it would be appropriate for Duke Energy to apply to the Commission for approval for non-project use of project lands, and to enter into a lease agreement with the states, as proposed in the relicensing settlement agreement. Such an arrangement would benefit the recreating public, and would allow the states to better manage these existing and popular state parks.

Land Conservation

As mitigation for reduced flows at several of the project developments (discussed in detail in Section 3.3.2, *Water Resources*), Duke Energy is proposing to establish permanent conservation easements in the riparian corridor along certain sections of the river. As proposed, the North Carolina flow mitigation package provides for permanent conservation easements on 22 bank miles of stream; the South Carolina flow mitigation package provides for permanent conservation easements on 6.6 bank miles of stream. The conservation easements are 100-ft wide perpetual easements to be located on the Johns, Catawba, and Linville Rivers and transferred to the state of North Carolina or state-chosen land trust within 18 months of the issuance of the license. In South Carolina, the 100-ft-wide perpetual easements are to be located on tributaries to the Catawba River.

In addition, under the terms of the Revised CRA, Duke Energy proposes to make one-time contributions of $1 million to the HEP funds in North and South Carolina, respectively, in addition to the $80,000 annual contribution per state contributed by Duke Energy through 2009. HEP funds may be used by the states to support long-term management of conservation easements established through the Revised CRA or add land as conservation easements.

The Catawba River Keeper Foundation commented that it did not think that the "land for water mitigation scheme" negotiated as part of the Revised CRA was a good thing. They did note that, in general, the proposed land conservation would help to ensure open space for generations to come, and more specifically that the agreement would result in the protection of 28.6 miles of riparian corridor in Burt and Caldwell Counties, and about 6 miles of riparian corridor in Chester and Lancaster Counties in South Carolina. However, they expressed concern regarding the inequity in riparian land protection between the two states, with South Carolina receiving only 6 miles of riparian corridor protection, compared to 28 miles in North Carolina.

Interior commented that one of the highest priorities in the region is the protection and conservation of Piedmont rocky shoals, as such reaches are increasingly scarce and often support unique assemblages of plant and animal species. At the Catawba-Wateree Project, Interior notes that the protection, restoration, and recovery of these areas, including the Mountain Island bypassed reach, the Great Falls of the Catawba, and the Wateree bypassed reach, are extremely important.

Our Analysis

Some of the lands proposed for the establishment of conservation easements are considered necessary for project purposes, in that they are consistent with the need to preserve the natural aesthetic character of the project shorelines and to protect important riparian habitat. Some of the lands proposed for permanent conservation easement are with the existing project boundary, and the establishment of permanent conservation easements on these lands will ensure their protection from development and other uses that may be inconsistent with the need to preserve their values as riparian corridor. Protection of these lands, combined with Duke Energy's other proposals for conveying both project and non-project lands to various entities for future preservation or the establishment of parks or other public access areas, will greatly benefit the project but further limit the potential for new development along the shorelines of the reservoirs and tailwater areas, and will help to maintain aesthetic quality of the reservoirs and riparian corridors.

3.3.8.3 Cumulative Effects

Duke Energy's proposed revisions to the SMP, including both the classification maps and the SMG, would have positive cumulative benefits to water quality, fisheries, wildlife habitat, and the Catawba-Wateree Project's long-term scenic qualities. The proposed revisions to the SMP have the potential to negatively affect shoreline property owners or commercial developers if construction is restricted or not permitted under the classification maps or the regulations and policies that make up the SMG. These effects would be experienced on an individual, case-by-case basis, as shoreline classifications vary among the reservoirs.

Revisions to the SMG that target stormwater runoff, waste water effluent, and shoreline erosion are expected to result in less nutrients, turbidity, and other non-point-source pollution entering project waters. The maintenance of natural vegetation and the requirement to use native vegetation in shoreline plants would attenuate surface water runoff, capture and filter nutrients, and reduce shoreline erosion by anchoring soils.

Duke Energy proposes several revisions to the SMG that over time would reduce the total amount of shoreline development that occurs along the project reservoirs. The most significant of these revisions is the proposal to increase the minimum lot width necessary in order to be eligible for a private pier from 75 to 100 ft. This revision alone will significantly reduce the number of new shoreline homes that are constructed along the reservoir shoreline, which in turn will have significant positive effects on reservoir water quality, fisheries, wildlife habitat, and aesthetics.

Duke Energy also proposes several revisions to the SMG that over time would reduce the total number of piers and docks constructed on the reservoirs. The development of fewer docks and piers on the reservoirs will have a cumulative benefit to recreational users of the reservoirs

by helping to alleviate over-use and crowding. The aesthetic quality of the project reservoirs also will benefit from having fewer docks and piers developed along the shoreline.

There are several proposed revisions to the SMG that are aimed at reducing the total number of watercraft that can be moored or docked on a reservoir. The most significant of these proposals is the SMG revision that would restrict pier owners to mooring only a single boat or personal watercraft at each dock, pier, or slip, unless that facility was specifically designed and approved to moor additional watercraft. As shoreline development continues and recreational use of the reservoirs increases, these SMG revisions will have a significant positive cumulative effect in helping to reduce overcrowding on the reservoirs, and to improve boating safety and the quality of the boating experience.

The proposed conveyance and conservation of Duke Energy-owned project and non-project lands would add positively to efforts of land managing agencies. These measures are designed to protect the shorelines from development that could affect the aesthetics, water quality, recreational opportunities, and wildlife throughout this project.

3.3.8.4 Unavoidable Adverse Effects

The proposed revisions to the project SMP including the classification maps and SMG will allow shoreline development to continue. In turn, continued development of the project shoreline will have an unavoidable adverse effect on project resources including, most particularly, water quality, fisheries, and wildlife habitat. Shoreline development by its very nature results in disturbance to the vegetation and soils and conversion of natural pervious surfaces to impervious surfaces. These effects combined result in an increase in runoff, non-point source pollutant loads, and soil erosion, resulting in a decline in water quality and adverse impacts to fish and wildlife habitat.

However, the revisions to the SMP proposed by Duke Energy will strengthen the SMP, and will generally result in less shoreline development, with fewer structures constructed on the reservoir, than would have occurred under the existing approved SMP.

3.3.9 Socioeconomic Resources

3.3.9.1 Affected Environment

The Catawba River begins in western North Carolina and flows easterly and southerly into South Carolina, where it joins Big Wateree Creek to form the Wateree River. The project spans over 225 RM within nine counties in North Carolina and five counties in South Carolina. The counties bordering the project area are diverse in nature, ranging from urban to rural. These counties include Alexander, Burke, Caldwell, Catawba, Gaston, Iredell, McDowell, and Mecklenberg, North Carolina; and Chester, Fairfield, Kershaw, Lancaster, and York, South Carolina (table 92).

Table 92. Counties associated with the Catawba-Wateree Development.

Development	County/state
Bridgewater Development	Burke/McDowell, North Carolina
Rhodhiss Development	Burke/Caldwell, North Carolina
Oxford Development	Alexander/Burke/Caldwell/Catawba, North Carolina
Lookout Shoals Development	Alexander/Catawba/Iredell, North Carolina
Cowans Ford Development	Mecklenburg/Iredell/Catawba/Lincoln, North Carolina
Mountain Island Development	Mecklenburg/Lincoln/Gaston, North Carolina
Wylie Development	Gaston/Mecklenburg, North Carolina; York, South Carolina
Fishing Creek Development	Lancaster/Chester, South Carolina
Great Falls and Dearborn Developments	Chester/Lancaster/Fairfield, South Carolina
Rocky Creek and Cedar Creek Developments	Chester/Lancaster/Fairfield, South Carolina
Wateree Development	Lancaster/Kershaw/Fairfield, South Carolina

Population and Demographics

North Carolina's population grew from 8.05 million in 2000 to 8.9 million in 2006 (10 percent) and is projected to grow to 10.3 million by 2015 (16 percent) (Duke Energy, 2007; North Carolina State Data Center, 2008). South Carolina's population grew from 4.0 million in 2000 to 4.3 million in 2006 (8 percent) and is projected to grow to 4.7 million by 2015 (9 percent) (Duke Energy, 2007; South Carolina Budget and Control Board, 2006). The population changes between 2000 and 2006 and the population estimate for 2015 for each county within the Catawba-Wateree Project are displayed in table 93.

Table 93. 2000 and 2006 population size by county within the Catawba-Wateree Project.

County	State	2000[2]	2006[3]	Percent change	Population estimate 2015[4,5]
Burke	North Carolina	89,148	90,054	1.0 %	88,074
McDowell	North Carolina	42,151	NA[1]	--	46,217
Caldwell	North Carolina	77,415	79,841	3.1%	81,210
Alexander	North Carolina	33,603	NA	--	39,208
Iredell	North Carolina	122,660	146,206	19.2%	183,685
Mecklenburg	North Carolina	695,454	827,445	19.0%	1,067,396
Catawba	North Carolina	141,685	153,784	8.5%	167,119
Lincoln	North Carolina	63,780	71,894	12.7%	83,445
Gaston	North Carolina	190,365	199,397	4.5%	215,548
York	South Carolina	164,614	199,035	20.9%	221,910
Lancaster	South Carolina	61,351	NA	--	67,300
Chester	South Carolina	34,068	NA	--	34,910
Fairfield	South Carolina	23,454	NA	--	25,540
Kershaw	South Carolina	52,647	NA	--	63,800

1 NA – 2006 data unavailable for those counties with a population less than 65,000.
2 Source: U.S. Census Bureau [USCB], 2000.
3 Source: USCB, 2006.
4 Source: North Carolina State Data Center, 2008.
5 Source: South Carolina Budget and Control Board, 2006.

The fastest growing counties between 2000 and 2006 were York, South Carolina (20.9 percent); Iredell, North Carolina (19.2 percent); and Mecklenburg, North Carolina (19.0 percent). The slowest growing counties include Burke (1 percent), Caldwell (3.1 percent), and Gaston (4.5 percent) Counties. Population data for 2006 is not available for those counties with a population less than 65,000. The population increase from 1990 to 2000 for these counties are as follows: McDowell (18.1 percent), Alexander (22.0 percent), Lancaster (12.5 percent), Chester (5.9 percent), Fairfield (5.2 percent), and Kershaw (21 percent) (USCB, 1990).

Mecklenburg County, North Carolina, has the largest population of all counties within the project area. This county includes the city of Charlotte. Mecklenburg County was one of the fastest growing counties from the year 2000 to 2006. The population is expected to grow by 29 percent to more than one million by 2015 (table 93). Iredell County is expected to grow 25.6 percent to more than 183,000 by 2015. Caldwell and Chester Counties are projected to experience slow growth increasing 2 and 2.5 percent, respectively, by 2015. Burke is the only county within the project expected to lose population by 1.2 percent. Moderate growing counties

include Mc Dowell (9.6 percent), Alexander (16.7 percent), Lincoln (16.0 percent), York (11.5 percent), and Lancaster (9.7 percent).

In 2005, the population of North Carolina was 67.7 percent White, 21.2 percent African American, 6.7 percent Hispanic or Latino, 1.8 percent Asian, 1.2 percent persons of two or more races, 1.1 percent American Indian or Alaska Native, 0.2 percent persons of some other race, and 0.1 percent Native Hawaiian (USCB, 2006). The minority population, defined as the non-white and multi-racial population of a given area which includes African American, Asian, American Indian, Native Alaskan, Native Hawaiian, Pacific Islander, persons reporting some other race, and persons reporting two or more races, comprised 29 percent of North Carolina. The population of South Carolina in 2005 was 65.3 percent White, 28.6 percent African American, 3.4 percent Hispanic or Latino, 1.2 percent persons of two or more races, 1.1 percent Asian, 0.25 percent American Indian or Alaska Native, 0.1 percent persons of some other race, and 0.05 percent Native Hawaiian (USCB, 2006). Minorities in South Carolina comprised 35 percent of the total population. Table 94 displays the demographic breakdown of each of the counties associated with the Catawba-Wateree Project.

Mecklenburg was the only county in North Carolina with a high minority population (44.7 percent). The minority population was comprised of 66 percent African Americans, 22 percent Hispanic or Latino, 9 percent Asian, and 3 percent of other race. Approximately 10 to 20 percent of the total population of Burke, Caldwell, Alexander, Iredell, Catawba, and Lincoln Counties was comprised of minorities. The lowest minority population in North Carolina was McDowell County (9.7 percent). The counties within South Carolina have a higher minority population than those counties within North Carolina. In 2000, the total population in Fairfield County was 23,454, which comprised of 60.8 percent minorities, the highest minority population within the Catawba-Wateree Project. Approximately, 96 percent of the minority population was African American. The remaining counties in South Carolina had minority populations ranging from 25 to 40 percent, comprised of predominantly African Americans.

Table 94. Demographic breakdown (percent of total population in 2006) of Catawba-Wateree Project area. (Source: USCB, 2000 and 2006)

County	White	African American	Hispanic	American Indian/ Alaska Native	Asian	Native Hawaiian	Two or More Races	Some Other Race	Minority Population
Burke	84.0	6.5	4.9	0.2	3.2	0.0	1.2	0.0	16.0
McDowell[1]	89.6	4.0	2.8	0.3	0.9	0.0	0.8	1.6	9.7
Caldwell	89.1	4.1	3.6	0.1	1.5	0.0	1.2	0.4	10.9
Alexander[1]	89.8	4.6	2.4	0.1	1.0	0.0	0.8	1.3	10.2
Iredell	79.8	11.8	5.2	0.1	0.9	0.3	1.8	0.1	20.2
Mecklenburg	55.3	29.5	9.8	0.4	3.9	0.0	0.9	0.2	44.7
Catawba	79.3	7.7	8.4	0.3	3.0	0.0	1.3	0.0	20.7
Lincoln[1]	85.4	6.1	5.4	0.3	0.3	0.0	0.9	1.6	14.6
Gaston	78.2	13.7	5.2	0.3	1.1	0.1	1.4	0.0	21.7
York	74.9	18.9	3.2	0.5	1.1	0.1	1.3	0.0	25.1
Lancaster[1]	69.9	26.4	1.6	0.2	0.3	0.0	0.7	0.9	30.1
Chester[1]	59.5	38.4	0.7	0.3	0.3	0.0	0.5	0.3	40.5
Fairfield[1]	39.1	58.5	1.1	0.2	0.2	0.0	0.5	0.4	60.8
Kershaw[1]	70.4	25.9	1.7	0.3	0.3	0.0	0.8	0.6	29.6

[1] Based on 2000 data; 2006 data unavailable.

Economic Base

Table 95 displays the economic and employment data for the counties within the Catawba-Wateree Project area. The 2006 median household income in Burke ($37,677), Caldwell ($34,052), Lincoln (38,433), and Gaston ($42,410) Counties in North Carolina were below the state median of $42,265. Iredell, Mecklenburg, and Catawba Counties had higher median household incomes of $43,307, $51,945, and $42,349, respectively (USCB, 2006). The 2000 median household income in the counties of McDowell ($32,396) and Alexander ($38,684) were lower than the state median of $39,184 (2006 data unavailable) (USCB, 2000). The percentage of people living below the poverty level in North Carolina grew from 12.3 percent in 2000 to 14.7 percent in 2006. Counties in the project area with higher poverty rates include Burke (17.6 percent), Gaston (15 percent), and Caldwell (14.9 percent). All other counties within the project area in North Carolina had poverty rates lower than the state rate (USCB, 2000 and 2006).

The median household income in South Carolina in 2006 was $41,100. The only county within the project area in South Carolina that had a higher median household income than the state was York County ($45,739) (USC 2006). The 2006 economic data for Lancaster, Chester, Fairfield, and Kershaw Counties is unavailable. The 2000 median household incomes in the counties of Lancaster ($34,688), Chester ($32,425), and Fairfield ($30,376) were lower than the state median of $37,082. Kershaw County ($38,804) was slightly higher than the state median (USCB, 2000). The percentage of people living below poverty level in South Carolina was 14.1 percent in 2000 and 15.7 percent in 2006, which was slightly higher than the rates in North Carolina. Chester and Fairfield Counties had higher poverty rates in 2000 (15.3 and 19.6 percent, respectively) when compared to the state.

Employment in the project area is quite diverse and includes jobs ranging from white collar or professional, to blue collar or labor-intensive. Some of the industries include farming and forestry; government employment; education and health services; leisure and hospitality; trade; retail; and manufacturing. The two largest industries of employment in both North Carolina and South Carolina are education services, health care, and social assistance; and manufacturing. These industries represented more than 50 percent of the workforce in the majority of the counties within the project area.

The unemployment rate in North Carolina grew from 5.3 percent in 2000 to 6.6 percent in 2006. The following counties in North Carolina had unemployment rates equal to or higher than the state in 2000 or 2006: Caldwell (10.1 percent), Burke (8.4 percent), Catawba (7.4 percent), Mecklenburg (7.0 percent), and Lincoln (6.6 percent) (USCB, 2000 and 2006). Gaston, McDowell, and Alexander Counties had unemployment rates of 6.4, 4.5, and 2.5 percent, respectively, which were lower than the state rate. The unemployment rate in South Carolina also grew from 5.9 percent in 2000 to 7.4 percent in 2006. Fairfield (6.9 percent), Chester (6.8 percent), and Lancaster (6.4 percent) Counties had higher unemployment rates than the state in 2000. York and Kershaw Counties had unemployment rates of 5.6 and 5.3, respectively, which were lower than the state rate.

Table 95. 2006 economic and employment data of the Catawba-Wateree Project area. (Source: USCB, 2000 and 2006).

County	Median Household Income	Average Household Size	Median Value of Home	% Unemployed	% Living Below Poverty Level	Largest Industry of Employment	% High School Graduates or Higher[1]	% Bachelors Degree or Higher[1]
Burke	$37,677	2.58	$99,700	8.4	17.6	Education, Health Care, Social Assistance	76.3	15.4
McDowell	$32,396	2.45	$72,000	4.5	11.6	Manufacturing	70.2	9.0
Caldwell	$34,052	2.55	$105,600	10.1	14.9	Manufacturing	70.2	11.7
Alexander	$38,684	2.54	$95,600	2.5	8.5	Manufacturing	68.7	9.3
Iredell	$43,307	2.61	$156,600	6.5	12.0	Manufacturing	84.9	22.1
Mecklenburg	$51,945	2.41	$172,000	7.0	11.3	Education, Health Care, Social Assistance	87.8	38.1
Catawba	$42,349	2.62	$127,700	7.4	10.7	Manufacturing	79.9	18.9
Lincoln	$38,433	2.58	$129,900	6.6	13.9	Manufacturing	71.5	14.9
Gaston	$42,410	2.65	$114,000	6.4	15.0	Education, Health Care, Social Assistance	77.1	18.7
York	$45,739	2.61	$143,400	5.6	11.8	Education, Health Care, Social Assistance	85.9	24.1
Lancaster	$34,688	2.56	$77,100	6.4	12.8	Manufacturing	69.8	10.2
Chester	$32,425	2.62	$62,800	6.8	15.3	Manufacturing	67.1	9.6
Fairfield	$30,376	2.63	$69,900	6.9	19.6	Manufacturing	67.0	11.7
Kershaw	$38,804	2.58	$88,000	5.3	12.8	Manufacturing	75.4	16.3

[1] Based on the population 25 years and over.

3.3.9.2 Environmental Effects

Employment in the project area is quite diverse and includes farming and forestry; government employment; education and health services; leisure and hospitality; trade; retail; and manufacturing. The two largest industries of employment in both North Carolina and South Carolina are education services, health care, and social assistance; and manufacturing. These industries represented more than 50 percent of the workforce in the majority of the counties within the project area. The primary contribution that the project currently makes to the local economy is related to recreational use.

Changes to reservoir water surface elevations and instream flows could affect the water uses in varying ways. Higher reservoir water levels year-round are more desirable to both visitors and residents resulting in more recreational use, visitor spending, income to local recreation-related businesses, recreation-related employment, and higher property values and tax revenues. On the other hand, lower reservoir levels would be associated with less recreation use, spending, income, employment, property value, and tax revenue. Recreational flow releases and recreation facility enhancements are proposed for the project. Details on the proposed recreation enhancements are discussed in section 3.3.7, *Recreational Resources*.

General Recreation User Characteristics

During the 2004-2005 recreation use and needs study period, total visitation to the project site was more than 10.1 million visits. Lake Norman and Lake Wylie received the highest level of visitation, followed by Lake Hickory, Lake Wateree, and Lake James.

Of the people who were interviewed at the public recreation areas, 28 percent were female and 72 percent were male, and the average age was 44 for females and 45 for males. For shoreline residents, 5 percent were less than 35 years old, 47 percent were between the ages of 35 and 54, 27 percent were between the ages of 55 and 64, and the remaining 21 percent were over the age of 64. For potential visitors, about 13 percent were less than 35 years old, 42 percent were between the ages of 35 and 54, 21 percent were between the ages of 55 and 64, and the remaining 24 percent were over the age of 64.

In terms of race, for public recreation area visitors, 79 percent indicated they were Caucasian, 15 percent African American, 4 percent Hispanic or Latino, and 2 percent Asian. For shoreline and backlot residents, 98 percent indicated they were Caucasian, and less than 1 percent each indicated they were African American, Hispanic or Latino, Asian, or American Indian and Alaska Native. For potential visitors, 91 percent indicated they were Caucasian, 6 percent African American, and less than 1 percent each indicated they were Hispanic or Latino, Asian, or American Indian and Alaska Native.

For shoreline residents, 13 percent indicated they had an annual income of less than $50,000, 32 percent were between $50,000 and $99,999, and the remaining 55 percent indicated an annual income of more than $100,000. For potential visitors, 42 percent indicated they had an annual income of less than $50,000, 40 percent were between $50,000 and $99,999, and the remaining 18 percent indicated an annual income of more than $100,000.

Economic Value of Recreation Assessment

The socioeconomic effects of Catawba-Wateree Project recreation on the local economies of North and South Carolina was assessed utilizing recreation use estimates combined with

expenditure information. The IMPLAN model (MIG, 1999) was used to estimate the economic effects of recreation expenditures in the study area based on the value of income, jobs, and taxes attracted to the region due to project-related recreation. IMPLAN is a widely used regional economic impact model. Visitor use data collected during the recreation study was used to populate the model.

Key Findings

- More than 11 million people visited public recreation areas in the Catawba-Wateree Project study area from March 1, 2004, to February 28, 2005.
- Visitation is projected to increase by about 11 percent per decade through 2050.
- Fifty percent of the visitors went to Lake Norman or Lake Wylie.
- The primary recreation activities were motor boating, boat fishing, bank/pier fishing, and swimming.
- The peak recreation season for the Catawba-Wateree system is April through September, and the peak visitation months are May and July.
- More than 3,000 boats used the 11 reservoirs during July 4th weekend (the peak holiday weekend in 2004), but only Lake Hickory was at more than 50 percent capacity.
- On a typical weekend during the peak recreation season, 2,000 boats use the 11 reservoirs.
- People using the public recreation areas typically spent money on food and beverages, lodging, entrance fees, boat rental and supplies, bait and tackle, gasoline, and other related services. These expenditures directly support almost 1,700 jobs and provide more than $24 million dollars in total economic benefits.
- Ninety percent of the visitors to the public recreation areas were satisfied with both the condition of the areas, and the types of recreation opportunities available at the areas.
- During the peak recreation season, visitors did not feel crowded at the public recreation areas on weekdays, and felt slightly to moderately crowded on weekends.
- People rated the reservoirs as not crowded or only slightly crowded during the weekdays, and between slightly crowded and moderately crowded during the weekends.
- Visitors using the public recreation areas generally felt safe but were concerned about uncontrolled operation of personal watercraft, excessive boat speeds on the reservoirs, and deadheads and floating logs.

Recreation spending at the Catawba-Wateree Project areas accounts for a small fraction of the regional economies of North and South Carolina. Individuals using the project for recreational purposes typically make expenditures (approximately $50 per group per visit) on food and beverages, lodging, entrance fees, boat rental and supplies, bait and tackle, gasoline, and other related services. These expenditures directly support almost 1,700 jobs and provide more than $24 million dollars in direct labor income to the region. The total labor income

(direct, indirect, and induced) associated with recreation expenditures is almost exclusively in the service sector; however, this is less than 1 percent of the total labor income for the 14 counties surrounding the project. The sectors most significantly influenced by recreation visits to the project include: restaurants, gas stations, convenience stores, sporting goods, hotels/motels, and general merchandise stores.

The surrounding counties and states benefit from this spending through recreation-related sales tax revenues that bring in approximately $10 million and gasoline tax revenues that bring in approximately $7 million to counties and states. Counties with the largest tax benefits from recreational use of project area waters are Mecklenburg (North Carolina) and York (South Carolina).

Management directives and policy that support and potentially enhance recreation resources and opportunities along the Catawba-Wateree Project, as discussed in section 3.3.7, *Recreational Resources*, would ultimately increase visitation to project waters. Higher visitation numbers would increase the amount of expenditures related to recreational activities within the region, which in turn would have a positive effect on the regional economy.

Our Analysis

Lake and river users contribute substantially to local economies (e.g., boat and equipment purchases, gas, food, and lodging), and their purchases of hunting and fishing licenses and boat registrations help the state wildlife agencies fund management programs. Additionally, the growth of the area due to the presence of the project has allowed the tax base and economy of the counties and areas surrounding the project reservoirs to increase substantially since construction of the project reservoirs.

Recreational flow releases and recreation facility enhancements proposed for the project, as well as continued operation of the project, are unlikely to change the social and economic conditions of the project vicinity. However, not relicensing the project could have a negative impact on the area by increasing future electricity rates, thereby increasing living and business costs and causing fewer businesses to be attracted to the area, as well as lowering the tax base for the local economies.

Population

There is no reason to expect that implementing the proposed recreational enhancements will cause any appreciable or permanent migration to or from the area.

Employment

No local impacts to employment are expected due to the proposed recreational enhancements of the project. The economic future of the area will remain tied to its traditional employment sources.

Housing

Housing in the project area should not be affected by the proposed recreational enhancements of the project. No additional housing will be required. No residences or businesses will be displaced, and local government expenditures are not expected to increase.

Recreation

Recreational opportunities in the project area will be increased by implementing the proposed action due to the recreation enhancement PM&E measures. A full description of recreational resources is discussed in section 3.3.7, *Recreational Resources*.

Existing Socioeconomic Resource Protection, Mitigation, and Enhancement Measures

There are no existing socioeconomic PM&E measures associated with the project.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing license, and there would be no change to the existing environment. Under this scenario, there would be continued energy production and no enhancement of existing natural resources. We use the no-action alternative to establish baseline environmental conditions for comparison with other alternatives.

Specifically, under the no-action alternative, water supply throughout the project area would not be appropriately managed, especially in periods of drought; water quality, especially DO, would be affected during periods of low flow and would in turn continue to affect aquatic resources; reservoir levels and flow releases would not provide protection or enhancement of aquatic resources and bypassed reaches would not receive water flow below Lake James or at Great Falls. Low flows, high inflows/flooding would continue to occur and affect fish populations in downstream reaches. Reservoir levels and the elevation of existing public boat ramps in development reservoirs could continue to limit access to the reservoir during periods of low water levels. Special status aquatic and terrestrial species, including federally listed species within the project area, while still potentially affected by some project operations would not be provided with monitoring or habitat enhancements provided through the implementation of specie-specific protection plans. Bald eagles and heron rookeries would continue to be threatened by inadvertent disturbance from recreation use along the shorelines. Historic properties and archaeological resources would not receive protective management including monitoring of erosional processes, monetary support for a number of initiatives. Interpretive displays and opportunities for education on the historical and archaeological importance of the area would not be made available to the residents, visitors and children of the Catawba-Wateree area. Recreational flows for the support of whitewater, paddling, and boat fishing activities would not be made available to enhance recreational use of the project area. Without the new license, enhancements to existing public facilities or the construction of new facilities at 88 locations would not occur. The revised SMP provides modifications to shoreline classifications, lake use restrictions, the SMG, and land conservation that would otherwise not be implemented or receive periodic review and updates to continue to improve water quality and shoreline and riparian habitat within the project area. Implementation of proposed flows would not be made available to improve habitat for diadromous fish species.

3.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Continued operation of the existing project would continue to commit lands and waters previously developed for energy production. This commitment would not necessarily be irreversible or irretrievable because removal of the project dams and restoration of disturbed

areas could return the project areas to near pre-project conditions. However, given the substantial costs and loss of energy, recreational, and socioeconomic benefits, removal of the dams is unlikely in the foreseeable future.

3.6 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM USES

Under all alternatives considered, the project would continue to generate power for customers of Duke Energy, as well as provide recreation and socioeconomic benefits for the duration of any new licenses. The proposed action with staff-recommended modifications would provide significant long-term protection and enhancement of biological, cultural, and recreational resources in the Catawba-Wateree River Basin, although energy generation at the existing project would be somewhat reduced.

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4. DEVELOPMENTAL ANALYSIS

In this section, we look at the Catawba-Wateree Project's use of the Catawba and Wateree Rivers for hydropower purposes to see what effect various environmental measures would have on the project's costs and power benefits. Consistent with the Commission's approach to economic analysis, the power benefit of the project is determined by estimating the cost of obtaining the same amount of energy and capacity using the likely alternative generating resources available in the region. In keeping with Commission policy as described in *Mead*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.[19]

Our analysis includes: (1) an estimate of the net power benefit of the project for each of the licensing alternatives; and (2) an estimate of the cost of individual measures considered in the EIS for the protection, mitigation, and enhancement of environmental resources affected by the project. To determine the net power benefit for each of the licensing alternatives, we compare project costs to the value of the power output as represented by the cost of a likely alternative source of power in the region. For any alternative, a positive net annual power benefit indicates that the project power costs less than the current cost of alternative generation resources, and a negative net annual benefit indicates that project power costs more than the current cost of alternative generation resources. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND ECONOMIC BENEFITS OF THE BRIDGEWATER DEVELOPMENT

Table 96 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); estimated future capital investment required to maintain and extend the life of plant equipment and facilities; relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

[19] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

Table 96 Staff assumptions for the economic analysis of the Bridgewater Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	72,447,768
Future major capital cost[5]	22,670,930
Relicensing cost (2008$)[6]	1,763,780
Operation and maintenance (2008$)[7]	638,083
Energy value (2008$/MWh)[8]	43.30
Capacity value (2008$/kW-year)[9]	30.12
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $2,344,786 (2008$) net plant investment for the existing facilities and $65,100,000 (2006$) for the new powerhouse as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Bridgewater Development in 2006$ is $1,637,906.

[7] Annual plant operation and maintenance costs reported by Duke are $554,941 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.21/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $27.97/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls)

As currently operated, the 27.7-MW Bridgewater Development generates an average of 74,250 MWh annually and has a dependable capacity of 25.8 MW.

4.1.1 Comparison of Alternatives

Table 97 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative. The power benefit in Table 97 is the combined annual value of the energy generation and capacity value for the Bridgewater Development.

Table 97 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Bridgewater Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	27.7	27.7	27.7
Annual generation (thousand MWh)	74.25	66.08	66.08
Annual power value, 2008$: (mills/kWh):	3,992,121 (53.77)	3,638,360 (55.06)	3,638,360 (55.06)
Annual cost, 2008$: (mills/kWh):	7,833,257 (105.50)	9,849,563 (149.06)	9,780,844 (148.02)
Annual net benefit, 2008$ (mills/kWh):	-3,841,136 (-51.73)	-6,211,203 (-94.00)	-6,142,484 (-92.96)

4.1.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 74,250 MWh, the existing project has an annual power value of $3,992,121 and costs $7,833,257 annually to operate and maintain. This results in a net annual benefit of negative $3,841,136 (or -$51.73/MWh). In other words, the project produces energy at a cost that is greater than that of currently available alternative generation by $3,841,136 annually.

4.1.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Bridgewater Development would generate an average of 66,080 MWh of electricity annually, have an annual power value of $3,638,360 (55.06 mills/kWh), and total annual costs of $9,849,563 (149.06 mills/kWh). This results in a net annual benefit of negative $6,211,203 (-94.00 mills/kWh). In other words, the project

produces energy at a cost that is greater than that of currently available alternative generation by $6,211,203 annually.

4.1.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 98 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 66,080 MWh of electricity annually, have an annual power value of $3,638,360 (55.06 mills/kWh) and have total annual costs of $9,780,844 (148.02 mills/kWh). This results in an annual net benefit of negative $6,142,484 (-92.96 mills/kWh). In other words, the project produces energy at a cost that is greater than that of currently available alternative generation by $6,142,484 annually. The staff alternative would increase the net annual project benefit by about $68,719 ($1.04/MWh) compared to the project as proposed by Duke Energy.

4.1.2 Cost of Environmental Measures

Table 98 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 98 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by staff for the Bridgewater Development for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Operations						
Reservoir Level Control – Install flow compliance gage and provide maintenance	Duke Energy	108,000	9,974	11,000	20,974	Yes
Reservoir Level Stabilization (Spring Lake Stabilization)	Duke Energy	0	0	1,000	1,000	Yes
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Flow and Reservoir Elevation Monitoring – USGS gage installation and maintenance	Duke Energy	21,000	1,939	30,000	31,939	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Water Quality Enhancements-Minimum flow units and aeration on 3 units	Duke Energy	5,400,000	498,699	12,000	510,699	Yes

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Aquatic Habitat Flows-Bypass Flow Valve	Duke Energy	1,134,000	104,727	25,000	129,727	Yes
Flow Mitigation – Conservation Easements	Duke Energy	643,000	59,383	0	59,383	Yes
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	10,000	924	6,000	6,924	Yes
Habitat Enhancement Fund	Duke Energy	167,000	15,422	0	15,422	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	9,000	831	1,000	1,831	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	2,779,000	256,646	65,000	321,646	Yes
Recreation Enhancements	Duke Energy	9,360,000	864,412	125,000	989,412	Yes
Recreation Enhancements	Duke Energy	113,000	10,435	9,000	19,435	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Recreation Flow Communication – Develop and Maintain Systems	Duke Energy	20,000	1,847	5,000	6,847	Yes

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Safety and Security – Signage and Warning Device	Duke Energy	80,000	7,388	1,000	8,388	No
Safety and Security – Revise and implement safety plans	Staff	98,500	9,097	1,000	10,097	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	667,000	61,599	0	61,599	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	250,000	23,088	0	23,088	No

4.2 POWER AND ECONOMIC BENEFITS OF THE RHODHISS DEVELOPMENT

Table 99 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 99 Staff assumptions for the economic analysis of the Rhodhiss Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	14,515,721
Future major capital cost[5]	11,215,390
Relicensing cost (2008$)[6]	1,517,376
Operation and maintenance (2008$/yr)[7]	427,664
Energy value (2008$/MWh)[8]	43.35
Capacity value (2008$/kW-year)[9]	28.46
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $15,897,941 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Rhodhiss Development in 2006$ is $1,409,087.

[7] Annual plant operation and maintenance costs reported by Duke are $397,143 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.26/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $26.43/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group.

As currently operated, the 31.6-MW Rhodhiss Development generates an average of 63,880 MWh annually and has a dependable capacity of 31.6 MW.

4.2.1 Comparison of Alternatives

Table 100 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 100 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Rhodhiss Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	31.6	31.6	31.6
Annual generation (thousand MWh)	63.88	56.85	56.85
Annual power value, 2008$: (mills/kWh):	3,668,534 (57.43)	3,363,784 (59.17)	3,363,784 (59.17)
Annual cost, 2008$: (mills/kWh):	2,793,298 (43.73)	3,743,443 (65.85)	3,588,482 (62.59)
Annual net benefit, 2008$: (mills/kWh):	875,236 (13.70)	-379,660 (-6.68)	-194,698 (-3.42)

4.2.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 63,880 MWh, the existing project has an annual power value of $3,668,534 and costs $2,793,298 annually to operate and maintain. This results in a net annual benefit of $875,236 (or $13.70/MWh). In

other words, the project produces energy at a cost that is less than that of currently available alternative generation by $875,236 annually.

4.2.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Rhodhiss Development would generate an average of 56,850 MWh of electricity annually, have an annual power value of $3,363,748 (59.17 mills/kWh), and total annual costs of $3,743,443 (65.85 mills/kWh), resulting in a negative net annual benefit of $379,660 (-6.68 mills/kWh). In other words, the project produces energy at a cost that is more than that of currently available alternative generation by $379,660 annually.

4.2.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 101 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 56,850 MWh of electricity annually, have an annual power value of $3,363,784 (59.17 mills/kWh), and have total annual costs of $3,588,482 (62.59 mills/kWh). This results in a annual net benefit of negative $194,698 (-3.42 mills/kWh). In other words, the project produces energy at a cost that is greater than that of currently available alternative generation by $194,698 annually. The staff alternative would reduce the net annual project benefit by about $184,962 ($3.26/MWh) compared to the project as proposed by Duke Energy.

4.2.2 Cost of Environmental Measures

Table 101 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levilized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 101 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Rhodhiss Development for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Operations						
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Water Quality Enhancement – new aerating runner	Duke Energy	2,876,000	265,603	12,000	277,603	Yes
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	7,000	647	5,000	5,647	Yes
Habitat Enhancement Fund	Duke Energy	167,000	15,422	0	15,422	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	9,000	831	1,000	1,831	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	2,041,000	188,490	77,000	265,490	Yes
Recreation Enhancements	Duke Energy	2,971,000	274,377	0	274,377	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Safety and Security – Signage	Duke Energy	10,000	924	1,000	1,924	No
Safety and Security – Revise and implement safety plans	Staff	28,500	2,632	1,000	3,632	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	667,000	61,599	0	61,599	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Funding for Conservation Easements	Duke Energy	250,000	23,088	0	23,088	No
Conservation Easements	Duke Energy	1,125,000	103,896	0	103,896	Yes

4.3 POWER AND ECONOMIC BENEFITS OF THE OXFORD DEVELOPMENT

Table 102 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 102 Staff assumptions for the economic analysis of the Oxford Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	28,323,220
Future major capital cost[5]	8,201,300
Relicensing cost (2008$)[6]	2,471,040
Operation and maintenance[7]	439,605
Energy value (2008$/MWh)[8]	43.25
Capacity value (2008$/kW-year)[9]	36.95
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $30,696,742 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Oxford Development in 2006$ is $2,294,691.

[7] Annual plant operation and maintenance costs reported by Duke are $408,232 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.16/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $34.31/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group.

As currently operated, the 41.6-MW Oxford Development generates an average of 104,030 MWh annually and has a dependable capacity of 41.6 MW.

4.3.1 Comparison of Alternatives

Table 103 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 103 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Oxford Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	41.6	41.6	41.6
Annual generation (thousand MWh)	104.03	92.58	92.58
Annual power value, 2008$: (mills/kWh):	6,036,418 (58.03)	5,541,205 (59.85)	5,541,2050 (59.85)
Annual cost, 2008$: (mills/kWh):	4,782,301 (45.97)	5,571,041 (60.18)	5,512,412 (59.54)
Annual net benefit, 2008$: (mills/kWh):	1,254,117 (12.06)	-29,836 (-0.32)	28,793 (0.31)

4.3.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 104,030 MWh, the existing project has an annual power value of $6,036,418 and costs $4,782,301 annually to operate and maintain. This results in a net annual benefit of $1,254,117 (or $12.06 /MWh). In

other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,254,117 annually.

4.3.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Oxford Development would generate an average of 92,580 MWh of electricity annually, have an annual power value of $5,541,205 (59.85 mills/kWh), and total annual costs of $5,571,041 (60.18 mills/kWh). This results in a net annual benefit of negative $29,836 (-0.32 mills/kWh). In other words, the project produces energy at a cost that is greater than that of currently available alternative generation by $29,836 annually.

4.3.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 104 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 92,580 MWh of electricity annually, have an annual power value of $5,541,205 (59.85 mills/kWh), and have total annual costs of $5,512,412 (59.54 mills/kWh), resulting in an annual net benefit of $28,793 (0.31 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $28,793 annually. The staff alternative would increase the net annual project benefit by about $56,629 ($0.63/MWh) compared to the project as proposed by Duke Energy.

4.3.2 Cost of Environmental Measures

Table 104 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 104 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Oxford Development for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Operations						
Reservoir Level Control – Install flow compliance gage and provide maintenance	Duke Energy	108,000	9,974	11,000	20,974	Yes
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Water Quality Enhancement – new aerating runner	Duke Energy	2,633,000	243,162	12,000	255,162	Yes
Aquatic Habitat Flows – Bypass flow valve installation and maintenance	Duke Energy	570,000	52,640	30,000	82,640	Yes
Flow Mitigation - Conservation Easements	Duke Energy	643,000	59,383	0	59,383	Yes

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	9,000	831	5,000	5,831	Yes
Habitat Enhancement Fund	Duke Energy	167,000	15,422	0	15,422	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	9,000	831	1,000	1,831	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	3,072,000	283,705	119,000	402,705	Yes
Recreation Enhancements	Duke Energy	0	0	9,000	9,000	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Recreation Flow Communication – Develop and Maintain Systems	Duke Energy	20,000	1,847	5,000	6,847	Yes
Safety and Security – Warning Device	Duke Energy	100,000	9,236	0	9,236	No
Safety and Security – Signage	Duke Energy	10,000	924	1,000	1,924	No
Safety and Security – Revise and implement safety plans	Staff	28,500	2,632	1,000	3,632	Yes

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	667,000	61,599	0	61,599	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	250,000	23,088	0	23,088	No

4.4 POWER AND ECONOMIC BENEFITS OF THE LOOKOUT SHOALS DEVELOPMENT

Table 105 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 105 Staff assumptions for the economic analysis of the Lookout Shoals Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	12,664,705
Future major capital cost[5]	4,496,930
Relicensing cost (2008$)[6]	2,164,135
Operation and maintenance[7]	435,517
Energy value (2008$/MWh)[8]	43.00
Capacity value (2008$/kW-year)[9]	43.68
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $13,960,963 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Lookout Shoals Development in 2006$ is $2,009,689.

[7] Annual plant operation and maintenance costs reported by Duke are $404,436 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $39.93/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $40.56/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group.

As currently operated, the 27.8-MW Lookout Shoals Development generates an average of 91,110 MWh annually and has a dependable capacity of 27.8 MW.

4.4.1 Comparison of Alternatives

Table 106 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 106 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Lookout Shoals Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	27.8	27.8	27.8
Annual generation (thousand MWh)	91.11	81.08	81.08
Annual power value, 2008$: (mills/kWh):	5,132,034 (56.33)	4,700,744 (57.98)	4,700,744 (57.98)
Annual cost, 2008$: (mills/kWh):	3,167,170 (34.76)	3,550,028 (43.78)	3,501,085 (43.18)
Annual net benefit, 2008$: (mills/kWh):	1,964,864 (21.57)	1,150,716 (14.19)	1,199,659 (14.80)

4.4.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 91,110 MWh, the existing project has an annual power value of $5,132,034 and costs $3,167,170 annually to operate and maintain. This results in a net annual benefit of $1,964,864 ($21.57/MWh). In other

words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,964,864 annually.

4.4.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Lookout Shoals Development would generate an average of 81,080 MWh of electricity annually, have an annual power value of $4,700,744 (57.98 mills/kWh), and total annual costs of $3,550,028 (43.78 mills/kWh). This results in a net annual benefit of $1,150,716 (14.19 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,150,716 annually.

4.4.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 107 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 81,080 MWh of electricity annually, have an annual power value of $4,700,744 (57.98 mills/kWh), and have total annual costs of $3,501,085 (43.18 mills/kWh). This results in an annual net benefit of $1,199,659 (14.80 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,199,659 annually. The staff alternative would reduce the net annual project benefit by about $48,943 ($0.61/MWh) compared to the project as proposed by Duke Energy.

4.4.2 Cost of Environmental Measures

Table 107 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 107 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Lookout Shoals Development for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Operations						
Reservoir Level Control – Install flow compliance gage and provide maintenance	Duke Energy	108,000	9,974	11,000	20,974	Yes
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Flow Mitigation - Conservation Easements	Duke Energy	643,000	59,383	0	59,383	Yes
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	9,000	831	5,000	5,831	Yes
Habitat Enhancement Fund	Duke Energy	167,000	15,422	0	15,422	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	9,000	831	1,000	1,831	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	1,595,000	147,301	40,000	187,301	Yes
Recreation Enhancements	Duke Energy	426,000	39,342	73,000	112,342	Yes
Recreation Enhancements	Duke Energy	0	0	9,000	9,000	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Safety and Security – Signage	Duke Energy	10,000	924	1,000	1,924	No
Safety and Security – Revise and implement safety plans	Staff	128,500	11,868	1,000	12,868	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes

Other Enhancements						
Land Conservation Support	Duke Energy	667,000	61,599	0	61,599	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	250,000	23,088	0	23,088	No

4.5 POWER AND ECONOMIC BENEFITS OF THE COWANS FORD DEVELOPMENT

Table 108 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 108 Staff assumptions for the economic analysis of the Cowans Ford Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	34,294,153
Future major capital cost[5]	2,979,650
Relicensing cost (2008$)[6]	4,267,600
Operation and maintenance[7]	2,240,110
Energy value (2008$/MWh)[8]	43.42
Capacity value (2008$/kW-year)[9]	5.94
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $38,982,106 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Cowans Ford Development in 2006$ is $3,963,038.

[7] Annual plant operation and maintenance costs reported by Duke are $2,080,242 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.32/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $5.52/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

As currently operated, the 400-MW Cowans Ford Development generates an average of 179,660 MWh annually and has a dependable capacity of 400 MW.

4.5.1 Comparison of Alternatives

Table 109 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 109 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Cowans Ford Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	400	400	400
Annual generation (thousand MWh)	179.66	159.89	159.89
Annual power value, 2008$: (mills/kWh):	10,176,837 (56.64)	9,318,424 (58.28)	9,318,424 (58.28)
Annual cost, 2008$: (mills/kWh):	7,975,219 (44.39)	8,281,668 (51.80)	8,258,585 (51.65)
Annual net benefit, 2008$: (mills/kWh):	2,201,618 (12.25)	1,036,756 (6.48)	1,059,839 (6.63)

4.5.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 179,660 MWh, the existing project has an annual power value of $10,176,837 and costs $7,975,219 annually to operate and maintain. This results in a net annual benefit of $2,201,618 (or $12.25/MWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $2,201,618 annually.

4.5.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Cowans Ford Development would generate an average of 159,890 MWh of electricity annually, have an annual power value of $9,318,424 (58.28 mills/kWh), and total annual costs of $8,281,668 (51.80 mills/kWh). This results in a net annual benefit of $1,036,756 (6.48 mills/kWh). In other words, the project produces energy at a cost that is greater than that of currently available alternative generation by $1,036,756 annually.

4.5.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 110 list these proposed measures and identifies the ones that were adopted by staff. The cost for the staff recommendation to reassess the eligibility of the Cowans Ford Development for the National Register is negligible since the reassessment would occur as part of the process of review for the HPMP.

The staff alternative would generate an average of 159,890 MWh of electricity annually, have an annual power value of $9,318,424 (58.28 mills/kWh), and have total annual costs of $8,258,585 (51.65 mills/kWh). This results in an annual net benefit of $1,059,839 (6.63 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,059,839 annually. The staff alternative would increase the net annual project benefit by about $23,083 ($0.15/MWh) compared to the project as proposed by Duke Energy.

4.5.2 Cost of Environmental Measures

Table 110 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 110 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Cowans Ford Development for a 30-year license. (Source: Staff)

Mitigation Measure	Recommending Entities	Capital Costs (2006$)[1]	Annualized Capital Costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by Staff
Operations						
Reservoir Level Stabilization (Spring Lake Stabilization)	Duke Energy	0	0	1,000	1,000	Yes
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Flow and Reservoir-Gage Maintenance	Duke Energy	0	0	30,000	30,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	7,000	647	5,000	5,647	Yes
Habitat Enhancement Fund	Duke Energy	167,000	15,422	0	15,422	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation Measure	Recommending Entities	Capital Costs (2006$)[1]	Annualized Capital Costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by Staff
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	9,000	831	1,000	1,831	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	2,145,000	198,094	47,000	245,094	Yes
Recreation Enhancements	Duke Energy	1,655,000	152,842	0	152,842	Yes
Recreation Enhancements	Duke Energy	0	0	9,000	9,000	No
Recreation Enhancements	Staff	304,500	28,121	4,600	32,721	Yes
Public Information						
Safety and Security – Signage	Duke Energy	10,000	924	1,000	1,924	No
Safety and Security – Revise and implement safety plans	Staff	98,500	9,097	1,000	10,097	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes

Mitigation Measure	Recommending Entities	Capital Costs (2006$)[1]	Annualized Capital Costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by Staff
Other Enhancements						
Land Conservation Support	Duke Energy	667,000	61,599	0	61,599	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	250,000	23,088	0	23,088	No

4.6 POWER AND ECONOMIC BENEFITS OF THE MOUNTAIN ISLAND DEVELOPMENT

Table 111 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 111 Staff assumptions for the economic analysis of the Mountain Island Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	16,705,673
Future major capital cost[5]	3,144,400
Relicensing cost (2008$)[6]	2,696,777
Operation and maintenance[7]	867,750
Energy value (2008$/MWh)[8]	43.40
Capacity value (2008$/kW-year)[9]	25.32
Interest rate (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $19,371,329 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Mountain Island Development in 2006$ is $2,504,318.

[7] Annual plant operation and maintenance costs reported by Duke are $805,822 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.30/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $23.51/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

As currently operated, the 60.6-MW Mountain Island Development generates an average of 113,530 MWh annually and has a dependable capacity of 60.6 MW.

4.6.1 Comparison of Alternatives

Table 112 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 112 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Mountain Island Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	60.6	60.6	60.6
Annual generation (thousand MWh)	113.53	101.04	101.04
Annual power value, 2008$: (mills/kWh):	6,461,594 (56.92)	5,919,528 (58.59)	5,919,528 (58.59)
Annual cost, 2008$: (mills/kWh):	4,265,532 (37.57)	4,443,747 (43.98)	4,386,092 (43.41)
Annual net benefit, 2008$: (mills/kWh):	2,196,062 (19.34)	1,475,781 (14.61)	1,533,436 (15.18)

4.6.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 113,530 MWh, the existing project has an annual power value of $6,461,594 and costs $4,265,532 annually to operate and maintain. This results in a net annual benefit of $2,196,062 (or $19.34/MWh). In other words, the project produces energy at a cost that is greater than that of currently available alternative generation by $2,196,062 annually.

4.6.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Mountain Island Development would generate an average of 101,040 MWh of electricity annually, have an annual power value of $5,919,528 (58.59 mills/kWh), and total annual costs of $4,443,747 (43.98 mills/kWh). This results in a net annual benefit of $1,475,781 (14.61 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,475,781 annually.

4.6.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 113 list these proposed measures and identify the ones that were adopted by staff.

The staff alternative would generate an average of 101,040 MWh of electricity annually, have an annual power value of $5,919,528 (58.59 mills/kWh), and have total annual costs of $4,386,092 (43.41 mills/kWh). This results in an annual net benefit of $1,553,436 (16.97 mills/kWh). In other words, the project produces energy at a cost that is greater than that of currently available alternative generation by $1,533,436 annually. The staff alternative would increase the net annual project benefit by about $57,655 ($0.57/MWh) compared to the project as proposed by Duke Energy.

4.6.2 Cost of Environmental Measures

Table 113 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 113 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Mountain Island Development for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Operations						
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Flow Mitigation – Conservation Easements	Duke Energy	643,000	59,383	0	59,383	Yes
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	9,000	831	5,000	5,831	Yes
Habitat Enhancement Fund	Duke Energy	167,000	15,422	0	15,422	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes
Cultural Resources						

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Historic Properties Management Plan – Annual HPMP review, signs, website, & materials	Duke Energy	9,000	831	1,000	1,831	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	667,000	61,599	20,000	81,599	Yes
Recreation Enhancements	Duke Energy	206,000	19,024	20,000	39,024	Yes
Recreation Enhancements	Duke Energy	0	0	9,000	9,000	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Safety and Security – Signage	Duke Energy	10,000	924	1,000	1,924	No
Safety and Security – Revise and implement safety plans	Staff	28,500	2,632	1,000	3,632	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	667,000	61,599	0	61,599	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	250,000	23,088	0	23,088	No

4.7 POWER AND ECONOMIC BENEFITS OF THE WYLIE DEVELOPMENT

Table 114 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 114 Staff assumptions for the economic analysis of the Wylie Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	31,856,667
Future major capital cost[5]	13,602,790
Relicensing cost (2008$)[6]	3,364,083
Operation and maintenance[7]	810,852
Energy value (2008$/MWh)[8]	42.44
Capacity value (2008$/kW-year)[9]	25.88
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $34,522,323 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Wylie Development in 2006$ is $3,124,001.

[7] Annual plant operation and maintenance costs reported by Duke are $752,985 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $39.41/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $24.03/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

As currently operated, the 74-MW Wylie Development generates an average of 141,620 MWh annually and has a dependable capacity of 74 MW.

4.7.1 Comparison of Alternatives

Table 115 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 115 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Wylie Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	74	74	74
Annual generation (thousand MWh)	141.62	126.04	126.04
Annual power value, 2008$: (mills/kWh):	7,925,473 (55.96)	7,264,258 (57.63)	7,264,258 (57.63)
Annual cost, 2008$ (mills/kWh):	6,006,040 (42.41)	7,039,944 (55.85)	7,144,612 (56.69)
Annual net benefit, 2008$ (mills/kWh):	1,919,432 (13.55)	224,313 (1.78)	119,645 (0.95)

4.7.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 141,620 MWh, the existing project has an annual power value of $7,925,473 and costs $6,006,040 annually to operate and maintain. This results in a net annual benefit of $1,919,432 (or $13.55/MWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,919,432 annually.

4.7.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Wylie Development would generate an average of 126,040 MWh of electricity annually, have an annual power value of $7,264,258 (57.63 mills/kWh), and total annual costs of $7,039,944 (55.85 mills/kWh). This results in a net annual benefit of $224,313 (1.78 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $224,313 annually.

4.7.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 116 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 126,040 MWh of electricity annually, have an annual power value of $7,264,258 (57.63 mills/kWh), and have total annual costs of $7,144,612 (56.69 mills/kWh). This results in a annual net benefit of $119,645 (0.95 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $119,645 annually. The staff alternative would reduce the net annual project benefit by about $104,668 ($0.83/MWh) compared to the project as proposed by Duke Energy.

4.7.2 Cost of Environmental Measures

Table 116 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period analysis to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 116 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Wylie Development for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Operations						
Reservoir Level Stabilization (Spring Lake Stabilization)	Duke Energy	0	0	1,000	1,000	Yes
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Flow and Reservoir Elevation Monitoring – USGS gage installation and maintenance	Duke Energy	0	0	30,000	30,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Water Quality Enhancement – minimum flow unit with aerating runner	Duke Energy	3,989,000	368,391	12,000	380,391	Yes
Flow Mitigation – Conservation Easements	Duke Energy	168,000	15,515	0	15,515	Yes
Flow Mitigation – Mitigation Fund	Duke Energy	200,000	18,470	0	18,470	No

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	12,000	1,108	8,000	9,108	Yes
Habitat Enhancement Fund	Duke Energy	167,000	15,422	0	15,422	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	9,000	831	1,000	1,831	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	1,816,000	167,711	20,000	187,711	Yes
Recreation Enhancements	Duke Energy	4,292,000	396,373	18,000	414,373	No
Recreation Enhancements	Duke Energy	260,000	24,011	0	24,011	No
Recreation Enhancements	Staff	2,178,500	201,188	18,000	219,188	Yes
Public Information						
Recreation Flow Communication – Develop and Maintain Systems	Duke Energy	20,000	1,847	5,000	6,847	Yes
Safety and Security – Signage	Duke Energy	10,000	924	1,000	1,924	No
Safety and Security – Revise and implement safety plans	Staff	28,500	2,632	1,000	3,632	Yes

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	1,064,000	98,262	0	98,262	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	300,000	27,706	0	27,706	No

4.8 POWER AND ECONOMIC BENEFITS OF THE FISHING CREEK DEVELOPMENT

Table 117 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 117 Staff assumptions for the economic analysis of the Fishing Creek Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	30,145,439
Future major capital cost[5]	6,378,190
Relicensing cost (2008$)[6]	3,540,554
Operation and maintenance[7]	828,301
Energy value (2008$/MWh)[8]	43.24
Capacity value (2008$/kW-year)[9]	43.29
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $32,866,883 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value..

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Fishing Creek Development in 2006$ is $3,287,878.

[7] Annual plant operation and maintenance costs reported by Duke are $769,188 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.15/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $40.20/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls)

As currently operated, the 52.1-MW Fishing Creek Development generates an average of 149,050 MWh annually and has a dependable capacity of 52.1 MW.

4.8.1 Comparison of Alternatives

Table 118 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 118 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Fishing Creek Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	52.1	52.1	52.1
Annual generation (thousand MWh)	149.05	132.65	132.65
Annual power value, 2008$: (mills/kWh):	8,700,331 (58.37)	7,991,195 (60.24)	7,991,195 (60.24)
Annual cost, 2008$: (mills/kWh):	6,138,685 (41.19)	6,551,119 (49.39)	6,446,639 (48.75)
Annual net benefit, 2008$: (mills/kWh):	2,561,646 (17.19)	1,440,076 (10.86)	1,524,556 (11.49)

4.8.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 149,050 MWh, the existing project has an annual power value of $8,700,331 and costs $6,138,685 annually to operate and maintain. This results in a net annual benefit of $2,561,646 (or $17.19/MWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $2,561,646 annually.

4.8.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Fishing Creek Development would generate an average of 132,650 MWh of electricity annually, have an annual power value of $7,991,195 (60.24 mills/kWh), and total annual costs of $6,551,119 (49.39 mills/kWh). This results in a net annual benefit of $1,440,076 (10.86 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,440,076 annually.

4.8.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, Comprehensive Development and Recommended Alternative, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 119 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 132,650 MWh of electricity annually, have an annual power value of $7,991,195 (60.24 mills/kWh), and have total annual costs of $6,446,639 (48.75 mills/kWh. This results in an annual net benefit of $1,524,556 (11.49 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,524,556 annually. The staff alternative would increase the net annual project benefit by about $84,480 ($11.49/MWh) compared to the project as proposed by Duke Energy.

4.8.2 Cost of Environmental Measures

Table 119 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 119 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Fishing Creek Development for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levilized) Cost (2008$)	Adopted by staff
Operations						
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Flow Mitigation – Mitigation Fund	Duke Energy	200,000	18,470	0	18,470	No
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	9,000	831	5,000	5,831	Yes
Habitat Enhancement Fund	Duke Energy	200,000	18,470	0	18,470	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes
Cultural Resources						

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levilized) Cost (2008$)	Adopted by staff
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	9,000	831	1,000	1,831	Yes
Historic Properties Management Plan – Site Monitoring	Duke Energy	0	0	25,000	25,000	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	2,111,000	194,954	39,000	233,954	Yes
Recreation Enhancements	Duke Energy	508,000	46,915	0	46,915	Yes
Recreation Enhancements	Duke Energy	0	0	9,000	9,000	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Recreation Flow Communication – Develop and Maintain Systems	Duke Energy	20,000	1,847	5,000	6,847	Yes
Safety and Security – Signage	Duke Energy	10,000	924	1,000	1,924	No
Safety and Security – Revise and implement safety plans	Staff	28,500	2,632	1,000	3,632	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levilized) Cost (2008$)	Adopted by staff
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	1,064,000	98,262	0	98,262	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Trash Rake	Duke Energy	1,200,000	110,822	0	110,822	Yes
Funding for Conservation Easements	Duke Energy	300,000	27,706	0	27,706	No

4.9 POWER AND ECONOMIC BENEFITS OF THE GREAT FALLS AND DEARBORN DEVELOPMENTS

Table 120 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 120 Staff assumptions for the economic analysis of the Great Falls and Dearborn Developments.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	18,711,557
Future major capital cost[5]	7,726,400
Relicensing cost (2008$)[6]	3,237,448
Operation and maintenance[7]	1,036,632
Energy value (2008$/MWh)[8]	43.32
Capacity value (2008$/kW-year)[9]	40.68
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $20,718,638 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Great Falls and Dearborn Developments in 2006$ is $3,006,404.

[7] Annual plant operation and maintenance costs reported by Duke are $962,652 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.23/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $37.78/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls)

As currently operated, the 63.3-MW Great Falls and Dearborn Developments generates an average of 136,290 MWh annually and has an installed capacity of 63.3 MW.

4.9.1 Comparison of Alternatives

Table 121 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 121 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Great Falls and Dearborn Developments (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	63.3	63.3	63.3
Annual generation (thousand MWh)	136.29	121.30	121.30
Annual power value, 2008$: (mills/kWh):	8,479,127 (62.21)	7,829,760 (64.55)	7,829,760 (64.55)
Annual cost, 2008$: (mills/kWh):	5,236,999 (38.43)	5,846,237 (48.20)	5,779,604 (47.65)
Annual net benefit, 2008$: (mills/kWh):	3,242,128 (23.79)	1,983,523 (16.35)	2,050,156 (16.90)

4.9.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 136,290 MWh, the existing project has an annual power value of $8,479,127 and costs $5,236,999 annually to operate and maintain. This results in a net annual benefit of $3,242,128 (or $23.79/MWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $3,242,128 annually.

4.9.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Great Falls and Dearborn Developments would generate an average of 121,300 MWh of electricity annually, have an annual power value of $7,829,760 (64.55 mills/kWh), and total annual costs of $5,846,237 (48.20 mills/kWh). This results in a net annual benefit of $1,983,523 (16.35 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $1,933,523 annually.

4.9.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Tables 122 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 121,300 MWh of electricity annually, have an annual power value of $7,829,760 (64.55 mills/kWh), and have total annual costs of $5,779,604 (47.65 mills/kWh). This results in an annual net benefit of $2,050,156 (16.90 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $2,050,156 annually. The staff alternative would increase the net annual project benefit by about $66,633 ($0.55/MWh) compared to the project as proposed by Duke Energy.

4.9.2 Cost of Environmental Measures

Table 122 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 122 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Great Falls and Dearborn Developments for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Operations						
Reservoir Level Control – Install flow compliance gage and provide maintenance	Duke Energy	215,000	19,855	22,000	41,855	Yes
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Aquatic Habitat Flows – Diversion Dam and Headworks Structural Modifications	Duke Energy	3,376,000	311,780	20,000	331,780	Yes
Flow Mitigation – Mitigation Fund	Duke Energy	200,000	18,470	0	18,470	No
Flow Mitigation – Conservation Easements	Duke Energy	168,000	15,515	0	15,515	Yes
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	12,000	1,108	8,000	9,108	Yes

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Habitat Enhancement Fund	Duke Energy	200,000	18,470	0	18,470	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	159,000	14,684	1,000	15,684	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	957,000	88,381	121,000	209,381	Yes
Recreation Enhancements	Duke Energy	212,000	19,578	0	19,578	Yes
Recreation Enhancements	Duke Energy	0	0	9,000	9,000	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Safety and Security – Signage	Duke Energy	20,000	1,847	1,000	2,847	No
Safety and Security – Revise and implement safety plans	Staff	38,500	3,556	1,000	4,556	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	1,064,000	98,262	0	98,262	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	300,000	27,706	0	27,706	No

4.10 POWER AND ECONOMIC BENEFITS OF THE ROCKY CREEK AND CEDAR CREEK DEVELOPMENTS

We base our analysis of this project's net benefits on the economic information and parameters shown in Table 123. These values are common to all the licensing alternatives for the Rocky Creek and Cedar Creek Developments. All dollars are year 2008 unless specified otherwise.

Table 123 Staff assumptions for the economic analysis of the Rocky Creek and Cedar Creek Developments.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	21,795,730
Future major capital cost[5]	5,187,190
Relicensing cost (2008$)[6]	3,679,753
Operation and maintenance[7]	704,608
Energy value (2008$/MWh)[8]	43.29
Capacity value (2008$/kW-year)[9]	41.38
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $24,076,918 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Rocky Creek and Cedar Creek Developments in 2006$ is $3,417,143.

[7] Annual plant operation and maintenance costs reported by Duke are $654,323 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.20/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $38.43/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls)

As currently operated, the 56.6-MW Rocky Creek and Cedar Creek Developments generate an average of 154,910 MWh annually and have a dependable capacity of 56.6 MW.

4.10.1 Comparison of Alternatives

Table 124 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 124 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Rocky Creek and Cedar Creek Developments (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	56.6	56.6	56.6
Annual generation (thousand MWh)	154.91	137.87	137.87
Annual power value, 2008$: (mills/kWh):	9,048,162 (58.41)	8,310,500 (60.28)	8,310,500 (60.28)
Annual cost, 2008$: (mills/kWh):	5,485,529 (35.41)	5,756,826 (41.76)	5,690,192 (41.27)
Annual net benefit, 2008$: (mills/kWh):	3,562,633 (23.00)	2,553,675 (18.52)	2,620,308 (19.01)

4.10.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 154,910 MWh, the existing project has an annual power value of $9,048,162 and costs $5,485,529 annually to operate and maintain. This results in a net annual benefit of $3,562,633 (or $23.00/MWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $3,562,633 annually.

4.10.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Rocky Creek and Cedar Creek Developments would generate an average of 137,870 MWh of electricity annually, have an annual power value of $8,310,500 (60.28 mills/kWh), and total annual costs of $5,756,826 (41.76 mills/kWh). This results in a net annual benefit of $2,553,675 (18.52 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $2,553,675 annually.

4.10.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 125 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 137,870 MWh of electricity annually, have an annual power value of $8,310,500 (60.28 mills/kWh), and have total annual costs of $5,690,192 (41.27 mills/kWh). This results in an annual net benefit of $2,620,308 (19.01 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $2,620,308 annually. The staff alternative would increase the net annual project benefit by about $66,633 ($0.49/MWh) compared to the project as proposed by Duke Energy.

4.10.2 Cost of Environmental Measures

Table 125 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 125 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Rocky Creek and Cedar Creek Developments for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Operations						
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Flow Mitigation – Mitigation Fund	Duke Energy	200,000	18,470	0	18,470	Yes
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	5,000	461	5,000	5,461	Yes
Habitat Enhancement Fund	Duke Energy	200,000	18,470	0	18,470	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes
Cultural Resources						
Historic Properties Management Plan –	Duke Energy	9,000	831	1,000	1,831	Yes

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Annual HPMP review, signs, website, and materials						
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	1,473,000	136,034	20,000	156,034	Yes
Recreation Enhancements	Duke Energy	1,254,000	115,809	0	115,809	Yes
Recreation Enhancements	Duke Energy	0	0	9,000	9,000	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Safety and Security – Signage	Duke Energy	20,000	1,847	1,000	2,847	No
Safety and Security – Revise and implement safety plans	Staff	38,500	3,556	1,000	4,556	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	1,064,000	98,262	0	98,262	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	300,000	27,706	0	27,706	No

4.11 POWER AND ECONOMIC BENEFITS OF THE WATEREE DEVELOPMENT

Table 126 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 126 Staff assumptions for the economic analysis of the Wateree Development.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	33,106,816
Future major capital cost[5]	26,208,390
Relicensing cost (2008$)[6]	5,541,307
Operation and maintenance[7]	962,347
Energy value (2008$/MWh)[8]	43.29
Capacity value (2008$/kW-year)[9]	38.83
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $36,410,989 (2006$) net plant investment for the existing facilities as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. Staff has assumed total project relicensing cost $31,800,000 (2006$) is prorated by the average annual energy generation per project to determine the relicensing cost for each project. The Staff assumed relicensing cost for the Wateree Development in 2006$ is $5,145,845.

[7] Annual plant operation and maintenance costs reported by Duke are $893,668 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.20/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $36.06/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls)

As currently operated, the 88.5-MW Wateree Development generates an average of 233,280 MWh annually and has a dependable capacity of 88.5 MW.

4.11.1 Comparison of Alternatives

Table 127 summarizes the annual cost, power benefit, and annual net benefit for the three alternatives considered in this DEIS: no-action alternative, Duke Energy's proposal, and the staff-recommended alternative.

Table 127 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Wateree Development (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	88.5	88.5	88.5
Annual generation (thousand MWh)	233.28	207.62	207.62
Annual power value 2008$: (mills/kWh):	13,514,151 (57.93)	12,405,639 (59.75)	12,405,639 (59.75)
Annual cost2008$: (mills/kWh):	8,181,437 (35.07)	10,139,869 (48.84)	9,905,480 (47.71)
Annual net benefit2008$: (mills/kWh):	5,332,714 (22.86)	2,265,770 (10.91)	2,500,159 (12.04)

4.11.1.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Based on the above information and an average annual generation of 233,280 MWh, the existing project has an annual power value of $13,514,151 and costs $8,181,437 annually to operate and maintain. This results in a net annual benefit of $5,332,714 (or $22.86/MWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $5,332,714 annually.

4.11.1.2 Applicant's Proposal

In its license application and CRA, filed on December 22, 2007, Duke Energy proposes numerous operational and non-operational measures.

As proposed by Duke Energy, the Wateree Development would generate an average of 207,620 MWh of electricity annually, have an annual power value of $12,405,639 (59.75 mills/kWh), and total annual costs of $10,139,869 (48.84 mills/kWh). This results in a net annual benefit of $2,265,770 (10.91 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $2,265,770 annually.

4.11.1.3 Staff Alternative

Resource agencies and nongovernmental organizations recommended the implementation of a variety of measures at the project. Staff reviewed each recommendation and determined which measures were the most appropriate for implementation. In section 5.0, *Comprehensive Development and Recommended Alternative*, we discuss our reasons for recommending the staff alternative and why we conclude that the environmental benefits are worth these costs. Table 128 list these proposed measures and identifies the ones that were adopted by staff.

The staff alternative would generate an average of 207,620 MWh of electricity annually, have an annual power value of $12,405,639 (59.75 mills/kWh), and have total annual costs of $9,905,480 (47.71 mills/kWh). This results in an annual net benefit of $2,500,159 (12.04 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $2,500,159 annually. The staff alternative would increase the net annual project benefit by about $234,389 ($1.13/MWh) compared to the project as proposed by Duke Energy.

4.11.2 Cost of Environmental Measures

Table 128 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 128 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Wateree Development for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Operations						
Reservoir Level Stabilization (Spring Lake Stabilization)	Duke Energy	0	0	1,000	1,000	Yes
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	2,000	2,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	14,000	14,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	1,000	1,000	Yes
Flow and Reservoir Elevation Monitoring – USGS gage installation and maintenance	Duke Energy	0	0	30,000	30,000	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	108,000	9,974	55,000	64,974	Yes
Water Quality Enhancement – minimum flow unit with aerating runner	Duke Energy	4,045,000	373,563	12,000	385,563	Yes
Flow Mitigation – Conservation Easements	Duke Energy	168,000	15,515	0	15,515	Yes
Flow Mitigation – Mitigation Fund	Duke Energy	200,000	18,470	0	18,470	No

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	15,000	1,385	8,000	9,385	Yes
Habitat Enhancement Fund	Duke Energy	200,000	18,470	0	18,470	No
Terrestrial Invasive Plant Species Management Plan	Staff	3,000	277	150	427	Yes
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	9,000	831	1,000	1,831	Yes
Historic Properties Management Plan – Archaeological Site Data Recovery, Site Monitoring, and Plan	Duke Energy	540,000	49,870	0	49,870	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	91,000	8,404	1,000	9,404	No
Recreation Use and Needs Update	Duke Energy	45,000	4,156	0	4,156	Yes
Recreation Enhancements	Duke Energy	2,580,000	238,267	63,000	301,267	Yes
Recreation Enhancements	Duke Energy	6,712,000	619,864	0	619,864	Yes
Recreation Enhancements	Duke Energy	0	0	9,000	9,000	No
Recreation Enhancements	Staff	4,500	416	0	416	Yes
Public Information						
Recreation Flow Communication – Develop and Maintain Systems	Duke Energy	20,000	1,847	5,000	6,847	Yes
Safety and Security – Signage	Duke Energy	10,000	924	1,000	1,924	No

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) Cost (2008$)	Adopted by staff
Safety and Security – Revise and implement safety plans	Staff	28,500	2,632	1,000	3,632	Yes
Shoreline Management						
Shoreline Management Plan Updates (every 10 years)	Duke Energy	26,000	2,401	0	2,401	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	8,000	738	0	738	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	1,064,000	98,262	0	98,262	Yes
Trash Management/Safety	Duke Energy	14,000	1,293	4,000	5,293	Yes
Funding for Conservation Easements	Duke Energy	300,000	27,706	0	27,706	No
Conservation Easements -67	Duke Energy	503,000	46,453	0	46,453	Yes
Flood Management at Wateree	Duke Energy	7,680,000	709,261	0	709,261	No
Flood Management at Wateree	Staff	6,000,000	554,110	0	554,110	Yes

4.12 POWER AND ECONOMIC BENEFITS OF THE CATAWBA-WATEREE PROJECT

Table 129 summarizes the assumptions and economic information we use in our analysis. This information was provided by Duke Energy in its license application. We find that the values provided by Duke Energy are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); estimated future capital investment required to maintain and extend the life of plant equipment and facilities; relicensing costs; normal operation and maintenance cost; and Commission fees. All dollars are year 2008 unless specified otherwise.

Table 129 Staff assumptions for the economic analysis of the Catawba-Wateree Project.

Parameter	Value
Period of analysis (years)	30
Local Tax Rate (%)[1]	3.0
Federal tax rate (%)[2]	32
Insurance Rate (%)[3]	0.25
Net investment (2008$)[4]	244,464,467
Future major capital cost (2008$)[5]	115,435,160
Relicensing cost (2008$)[6]	34,243,853
Operation and maintenance (2008$)[7]	10,966,206
Energy value (2008$/MWh)[8]	43.20
Capacity value (2008$/kW-year)[9]	22.64
Cost of Capital (%)[10]	8.5
Discount rate (%)[11]	8.5

[1] Staff assumed a local tax rate of 3.0 percent.

[2] Staff assumed federal tax rate at 32 percent revenues.

[3] Staff assumed insurance rate equal to 0.25 percent of net investment.

[4] Net investment is the depreciated project investment allocated to power purposes and includes $270,553,226 (2006$) net plant investment for the existing facilities, as reported by Duke Energy in exhibit D.

[5] Future major capital costs include implementation of measures to maintain present-day capability scheduled between 2008 and 2039 and are expressed as a present value.

[6] Relicensing costs include the administrative, legal/study, and other expenses to date. As reported by Duke the cost for relicensing Catawba-Wateree is $31,800,000 (2006$).

[7] Annual plant operation and maintenance costs reported by Duke are $10,183,590 (2006$).

[8] Source: application for new license, exhibit D, page D-27, $40.12/MWh in 2006$.

[9] Source: application for new license, exhibit D, page D-27, $21.02/kW-year in 2006$.

[10] Based on Duke Energy's weighted average cost of capital. Source: application for new license, exhibit D.

[11] Assumed by staff to be same as interest rate.

Note: Staff escalated all 2006 values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls)

As currently operated, the 923.8-MW Bridgewater Development generates an average of 1,441,590 MWh annually and has a dependable capacity of 921.90 MW.

4.12.1 Comparison of Alternatives

Table 130 summarizes the combined annual cost, power benefit, and annual net benefit of the alternatives considered in this DEIS for all eleven of the hydroelectric developments in the Catawba-Wateree Project. The power benefit in Table 130 is the combined annual value of the energy generation and capacity value for the Bridgewater Development.

Table 130 Summary of the annual cost, power benefits, and annual net benefits for the three alternatives for the Catawba-Wateree Project (Source: Staff).

	No action	**Duke Energy's Proposal**	**Staff-recommended alternative**
Installed capacity (MW)	923.80	923.80	923.80
Annual generation (thousand MWh)	1,441.59	1,283.01	1,283.01
Annual power value, 2008$: (mills/kWh):	83,148,504 (57.68)	76,297,848 (59.47)	76,297,848 (59.47)
Annual cost, 2008$: (mills/kWh):	57,159,248 (39.65)	66,068,715 (51.50)	63,089,564 (49.17)
Annual net benefit, 2008$: (mills/kWh):	25,989,256 (18.03)	10,229,133 (7.97)	13,208,284 (10.29)

4.12.1 No-Action Alternative

Under the no-action alternative, Duke Energy would continue to operate as it does now. The project generates an average of 1,441,590 MWh of electricity annually. The average annual power value would be $83,148,504 (57.68/MWh). The average annual cost of producing this power would be $57,159,248 (39.65/MWh), resulting in a net annual benefit of $25,989,256

(18.03/MWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $25,989,256 annually.

4.12.2 Applicant's Proposal

As discussed in the previous sections for each of the hydroelectric development in the Catawba-Wateree Project, Duke Energy proposes numerous operational and non-operational measures. As proposed by Duke Energy, all of the developments in the Catawba-Wateree Project would generate a combined average of 1,283,010 MWh of electricity annually, have an annual power value of $76,297,848, and total annual costs of $66,068,715, resulting in a net annual benefit of negative $10,229,133 (7.97 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $10,229,133 annually.

4.12.3 Staff Alternative

The staff alternative would generate an average of 1,283,010 MWh of electricity annually, have an annual power value of $76,297,848 (59.47 mills/kWh) and have total annual costs of $63,089,564 (49.17 mills/kWh). This results in an annual net benefit of $13,208,284 (10.29 mills/kWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $13,208,284 annually.

4.12.4 Cost of Environmental Measures

Table 131 summarizes the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period to give a uniform basis for comparing the benefits of a measure to its cost. All costs were adjusted from 2006$ to 2008$.

Table 131 Summary of capital, annual O&M, and annualized costs for environmental measures proposed by Duke Energy and recommended by Staff for the Catawba-Wateree Project for a 30-year license. (Source: Staff)

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Operations						
Reservoir Level Control – Install flow compliance gage and provide maintenance	Duke Energy	539,000	49,777	55,000	104,777	Yes
Reservoir Level Stabilization (Spring Lake Stabilization)	Duke Energy	0	0	4,000	4,000	Yes
Drought Mitigation – Low inflow protocol administration	Duke Energy	0	0	22,000	22,000	Yes
Drought Mitigation – Water Management Group Dues	Duke Energy	0	0	154,000	154,000	No
Maintenance and Emergency Protocol	Duke Energy	0	0	11,000	11,000	Yes
Flow and Reservoir Elevation Monitoring - USGS gage maintenance	Duke Energy	21,000	1,939	120,000	121,939	Yes
Water Quality and Quantity						
Monitoring and Compliance – Installation and maintenance of DO and groundwater monitors	Duke Energy	1,188,000	109,714	605,000	714,714	Yes
Water Quality Enhancement – Aerating Runners, bypass Flow Valve, Diversion Dam	Duke Energy	18,943,000	1,749,418	60,000	1,809,418	Yes

[1] Staff escalated those values to 2008 by 2.0 percent (12/31/05 to 12/31/06), 3.2 percent (12/31/06 to 12/31/07), and 2.3 percent (12/31/07 to 12/31/08) per year, respectively. The escalation rates were reported by the Department of Energy's Cost Engineering Group (http://www.oecm.energy.gov/Portals/2/Inflators%20to%20Constant%20Dollars%20for%20Various%20Years.xls).

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
and Headworks Modification						
Flow Mitigation - Conservation Easements	Duke Energy	3,076,000	284,074	0	284,074	Yes
Flow Mitigation - Mitigation Fund	Duke Energy	1,000,000	92,352	0	92,352	No
Fish, Wildlife, and Botanical Resources						
Species Protection Plans	Duke Energy	104,000	9,604	65,000	74,604	Yes
Terrestrial Invasive Plant Species Management Plan	Staff	33,000	3,048	1,650	4,698	Yes
Cultural Resources						
Historic Properties Management Plan – Annual HPMP review, signs, website, and materials	Duke Energy	798,000	73,697	37,000	110,697	Yes
Recreational Resources						
Recreation Management Plan Development	Duke Energy	1,000,000	92,352	11,000	103,352	No
Recreation Use and Needs Update	Duke Energy	495,000	45,714	0	45,714	Yes
Recreation Enhancements	Duke Energy	24,182,000	2,233,248	948,000	3,181,248	Yes
Recreation Enhancements	Duke Energy	25,023,000	2,310,917	0	2,310,917	Yes
Recreation Enhancements	Staff	2,523,500	233,049	22,600	255,649	Yes
Public Information						
Recreation Flow Communication – Develop and Maintain Systems	Duke Energy	100,000	9,236	25,000	34,236	Yes
Safety and Security – Signage and Warning	Duke Energy	150,000	13,853	11,000	24,853	No
Safety and Security – Device Modification	Duke Energy	30,000	2,771	0	2,771	No

Mitigation measure	Recommending entities	Capital costs (2006$)[1]	Annualized capital costs (2008$)	Annualized O&M (2008$)	Total Annual (Levelized) cost (2008$)	Adopted by staff
Safety and Security – Warning Device Installation	Duke Energy	150,000	13,853	11,000	24,853	No
Safety and Security – Revise and implement safety plans	Staff	573,500	52,963	11,000	63,963	Yes
Shoreline Management						
Shoreline Management Plan Review	Duke Energy	0	0	11,000	11,000	Yes
Shoreline Management Plan Updates (every 10 years)	Duke Energy	286,000	26,413	0	26,413	Yes
Shoreline Management Guidelines Updates (every 10 years)	Duke Energy	88,000	8,127	0	8,127	Yes
Other Enhancements						
Land Conservation Support	Duke Energy	9,322,000	860,902	0	860,902	Yes
Trash Management/Safety	Duke Energy	154,000	1,293	4,000	5,293	Yes
Trash Rake	Duke Energy	1,200,000	110,822	0	110,822	Yes
Funding for Conservation Easements	Duke Energy	4,125,000	380,951	0	380,951	No
Funding for Conservation Easements – 67	Duke Energy	503,000	46,453	0	46,453	Yes
Flood Management at Wateree	Duke Energy	7,680,000	709,261	0	709,261	No
Flood Management at Wateree – Bladder Dam	Staff	6,000,000	554,110	0	554,110	Yes

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5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a) of the FPA require the Commission to give equal consideration to all uses of the waterway on which a project is located. The review of a hydropower project gives equal consideration to recreation, fish, wildlife, and other non-development values of the waterway with the project's electric energy and other developmental values. In deciding whether, and under what circumstances, a hydroelectric power license should be issued, the Commission must weigh the various economic and environmental tradeoffs involved in that decision. In this section we weigh the costs and benefits of our recommended alternative against other proposed measures and provide the basis for, and the summary of, our recommendations for relicensing the Catawba-Wateree Project.

Based on our independent review and evaluation of the environmental and economic effects of the proposed action, the proposed action with staff-identified measures, and no action, we recommend the proposed action with staff-identified measures as the preferred alternative for the Catawba-Wateree Project. We recommend this alternative because (1) issuing the new license would allow the applicant to continue operating the Catawba-Wateree Project as a beneficial, dependable source of electric energy; (2) the Catawba-Wateree Project, with a total installed capacity of 831 MW, may offset an equivalent amount of fossil fuel-produced energy, thereby conserving a non-renewable resource and limiting atmospheric pollution; (3) our recommended environmental measures would protect water quality and quantity, enhance fish and wildlife resources, protect cultural resources, and improve public use of the Catawba-Wateree recreational facilities and resources; and (4) the public benefit of these measures would exceed those of the other alternatives.

We recommend including the following environmental measures proposed by Duke Energy and described in the Revised CRA for inclusion in any license issued for the Catawba-Wateree Project.

Project Operations

- Implement a Spring Reservoir Level Stabilization Program after consultation with North Carolina WRC and South Carolina DNR to enhance fish spawning at Lake James, Lake Norman, Lake Wylie, and Lake Wateree. The program should consist of: (1) trigger points, (2) suitable surface water temperature monitoring locations, (3) reservoir level variability limits, and (4) adequate stabilization period, and would be implemented unless operating in the Low Inflow Protocol or Maintenance and Emergency Protocol modes, or if maintaining the stable reservoir level on Lake Wateree would prevent or alter flow releases from the Wateree Development necessary to support downstream fish habitat.
- Implement the Low Inflow Protocol within 60 days of the issuance of the new license to conserve a limited water supply during periods of drought.
- Implement the Maintenance and Emergency Protocol within 60 days of the issuance of the new license to define procedures in the event of an emergency, maintenance, or abnormal situations.

- Prepare an annual report for verification of compliance with normal minimum elevation and normal maximum elevation for reservoir levels, Spring Reservoir Level Stabilization Program, recreational flow releases, minimum continuous flows, minimum average daily flows, and the Wylie High Inflow Protocol.
- Install a new streamflow gage on the Linville River between the Linville dam and the confluence of the Linville and Catawba Rivers, and perform annual maintenance of this gage and six existing gages to support implementation of the Low Inflow Protocol and Wylie High Inflow Protocol, to monitor compliance with the minimum flow and recreational flow release requirements, and to provide a ready source of public information on flows.
- Provide flows to protect and enhance aquatic habitat including minimum average daily flows as follows: 225 cfs from the Rhodhiss Development, 311 cfs from the Cowans Ford Development, 314 cfs from the Mountain Island Development, 440 cfs from the Fishing Creek Development, and 445 cfs from the Rocky Creek and Cedar Creek Developments, and minimum continuous flows according to a seasonal schedule provided in Chapter 2 of this EIS, for the Bridgewater, Oxford, Wylie, Great Falls, Dearborn, and Wateree Developments and the Catawba River and Great Falls-Dearborn Long and Short bypassed reaches.
- Implement the Wylie High Inflow Protocol to provide additional protection and enhancement of aquatic habitat downstream of the Wylie Development when above-average flow is available. Minimum continuous flow would be increased from 1,100 to 1,300 cfs from February 15 through May 15 unless the February median flow is below the February median flow for the period of record for any gage; then, the minimum flow requirement would be reduced on April 1 to 1,100 cfs.

Water Quality

- Implement the WQMP to monitor compliance with water quality requirements.
- Provide an annual report verifying compliance with the 401 WQC for the previous calendar year by June 30 of the following calendar year for the term of the new license.
- Implement the Flow and Water Quality Implementation Plan for completing modifications necessary to implement minimum continuous flow, recreation flow, and water quality requirements at project developments.

Aquatic Resources

- Following completion of the new Bridgewater powerhouse, under the WQMP (see water quality recommendations), implement the supplemental trout habitat monitoring for flow and water temperature to assess the effect of flows from the Catawba River bypassed reach on trout habitat.
- Conduct surveys for freshwater mussels at selected sites after consultation with state resource agencies at 5-year intervals throughout the life of the license as described in the species management and protection plan for freshwater mussels.

- Implement upstream and downstream fish passage study, design, installation, and operations for alosine species and American eel in accordance with section 18 prescriptions and the Santee-Cooper Accord.
- Continue to partner with the Robust Redhorse Conservation Committee concerning management and protection of this species in the project area, particularly at the Wylie and Wateree Developments.

Terrestrial Resources

- File species protection plans with North Carolina WRC and South Carolina DNR, and implement species protection plans within 60 days following the issuance of a new license for::
  - rocky shoals spider lily;
  - Rafinesque's big-eared bat;
  - the mussels: creeper, eastern floater, paper pondshell, eastern creekshell, notched rainbow, brook floater, and rayed-pink fatmucket;
  - flat and snail bullheads;
  - robust redhorse; and
  - heron rookeries.

Threatened and Endangered Species

- In addition to the Species Protection Plans for state listed threatened and endangered species, provide a coordinated and consultative approach to the protection of federally-listed species through the implementation of the Federal Threatened and Endangered Species Protection Plans for:
  - Schweinitz's sunflower;
  - dwarf-flowered heartleaf;
  - bald eagle;
  - wood stork;
  - American alligator; and
  - shortnose sturgeon.

  These species protection plans should be implemented within 60 days of the issuance of the new license. Annual review and update of the plans would occur after consultation with FWS, North Carolina DENR and WRC, and South Carolina DNR.

Cultural Resources

- Develop and implement the HPMP and monitoring plan of known historic properties within the FERC project boundaries to ensure that adverse effects on known and potential historic properties, and to any as-yet unidentified archaeological resources, are satisfactorily resolved over the term of a new license.

Recreational Resources

- File an RMP within 1 year of license issuance developed after consultation with, at a minimum, North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, local governments, and other entities. The RMP would include construction schedules, specific recreation measures, operation and maintenance guidelines, construction plans or conceptual facility site plans, procedures for temporary closures of project recreational sites, a description of the recreational signage program for the recreational sites, and discussions of how the needs of the disabled and Low Impact Development practices were considered in the planning of the recreational facilities.
- File a biennial report with the Commission on the progress made on the RMP recreation enhancements.
- Complete a review of the project's recreation needs 20 years following the issuance of a new license and repeat every subsequent 10 years during the term of the new license and file with the Commission a supplement to the RMP after consultation with, at a minimum, North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, local governments, and other entities.
- Implement the recreational flow releases from the Bridgewater, Oxford, Wylie, Great Falls, Dearborn, and Wateree Developments, as outlined in section 2.2.2.1, *Required Minimum Flows*, within 60 days of license issuance to support recreational activities, which could be modified if operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol.
- Hold an annual meeting with, at a minimum, North Carolina DENR, North Carolina WRC, South Carolina DNR, and South Carolina DPRT to re-evaluate and modify, as necessary, the recreational flow schedule, taking into account information related to pattern of usage of the recreational flows and the effectiveness of the communication related to the resource.
- Within 60 days of license issuance, provide reservoir-related and flow release information to the public via telephone, internet, annual scheduled flow release calendar, and flow release forecasts.
- Expand the existing project boundary, where necessary, to include all of the new recreation access areas and enhancements recommended for inclusion in the project boundary and the entire Duke Energy-owned recreation access areas.

Land Use

- Implement the revised SMP.
- Expand the project boundary, where necessary, to incorporate all the 100-ft-wide riparian corridor lands proposed for permanent conservation easement along 22 miles of the Johns, Catawba, and Linville Rivers in North Carolina and along 6.6 miles of the Catawba River in South Carolina.

Additional Measures Recommended by Staff

Water Quantity

- Install a bladder dam modification at the Wateree dam to improve management of flood events, designed as recommended in the Revised CRA.
- Achieve normal target elevations and maintain reservoir levels within newly established normal minimum and normal maximum elevations unless operating in the Low Inflow Protocol or the Maintenance and Emergency Protocol. New levels would be implemented within 60 days following the issuance of the new license as proposed in Chapter 2 of this EIS.
- Add NOAA Fisheries and FWS to the Drought Management Advisory Group.
- Consult with NOAA Fisheries on Maintenance and Emergency Protocol implementation.

Aquatic Resources

- Implement ramping during the increase and decrease in recreational flow releases to achieve the target flow over a period of several hours to minimize the risk to aquatic resources.
- Establish an advisory group with representatives of Duke Energy, federal and state resource managers, and other stakeholders to evaluate and recommend appropriate mitigation for fish losses resulting from abnormal conditions when the applicant cannot avoid falling below any of the critical flows, in accordance with the Maintenance and Emergency Protocol. When an event occurs, monitor impacts to aquatic species in affected stream segments. Mitigate impacts based on recommendations from the advisory group.

Terrestrial Resources

- Develop and implement a terrestrial invasive plant species management plan.

Cultural Resources

- Re-assess the eligibility of the Cowans Ford Development for the National Register when the development reaches 50 years of age. The reassessment would occur as part of the process of review for the HPMP.

Recreation

- Provide two additional recreational enhancements that would be included in the project boundary and in the RMP:
    - East Wateree Access Improvements – Construct two motorized boat ramps with a courtesy dock, paved and lighted parking, and a swimming area with bathhouse on the east side of Lake Wateree within 5 years of approval of the RMP.
    - Lake Cornelius Access – Consult with the town of Cornelius and develop a small boat access and parking area that would be appropriate for the size of Lake Cornelius within 10 years of approval of the RMP.

- Evaluate and consult with, at a minimum, FWS, North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, Burke County, York County, American Whitewater, Carolina Canoe Club, Catawba-Wateree Relicensing Coalition, Lake Wylie Covekeeper, and South Carolina Coastal Conservation League to determine the recreation access areas where wildlife viewing areas would be most appropriate; and file a plan with the Commission within 1 year of license issuance for implementing additional wildlife viewing areas at the project.
- Provide public information related to river flow in a manner that provides the most up-to-date information possible.
- Revise public safety plans, including consideration of the need for warning devices, Spanish language tailrace signage, horns at the Bridgewater and Oxford Developments, Riverbend Park warning system, English and universal signage, and facility exclusion zones, and file for Commission approval within 1 year of license issuance.
- Include within the project boundary all Duke Energy-owned islands that serve a project purpose or are affected by the project to ensure that these islands remain open for the term of the new license for any permissible day-use public recreation activity. Where there are issues related to cultural resource protection, wildlife protection or safety, security, or management concerns or restrictions by state or local public health, safety, or law enforcement authorities, islands may be designated as off-limits by Duke Energy.
- Expand project boundary at all Duke Energy-owned recreation access areas to include any adjacent bank fishing areas provided by Duke Energy, except those minimal shoreline areas where bank fishing is restricted for safety reasons, management problems, or to avoid conflicts with other access area users.

The following discussion describes the basis for staff-recommended measures as well as for not recommending measures recommended by other entities. Under each major issue, we discuss our recommendations for the Catawba-Wateree Project.

Water Quantity

In the analysis of costs and effectiveness of reducing frequency and duration of flooding that can be attained with the proposed bladder dam compared to the alternatively proposed public infrastructure upgrades within the existing flood easement, we concluded that the proposal for management of periodic episodes of high water conditions by providing an increased discharge capacity through the installation of a bladder dam would provide an adequate and reasonable effort toward mitigation of effects of the occasional flood events. The beneficial attenuation of high volume flows provided from the installation of the bladder dam would be significant enough that we recommend the installation of the bladder dam be implemented without regard to the duration of the license that is issued.

The original proposed license article stated that Duke Energy "would endeavor in good faith to achieve the Normal Target Elevations and would keep reservoir levels within newly established Normal Minimum and Normal Maximum elevations unless operating in the LIP or the MEP modes." This measure would not ensure that reservoir elevations are maintained on average at the normal target elevations, but would be merely goals and not required conditions of

the new license. Staff proposes that the normal target elevations proposed by Duke Energy be made conditions of the license to be enforceable as an annual average, and the proposed minimum elevations (maximum draw-downs) be made conditions of the license to be enforceable at all times except when operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol. We further recommend that the proposed monitoring and reporting requirements for lake levels include the daily average reservoir level, in addition to the daily minimum and maximum elevations proposed by Duke Energy.

We recommend that NOAA Fisheries and FWS be represented on the Drought Management Advisory Group to ensure that the federal interest in aquatic resources is adequately protected to the extent possible during extended low inflow periods. The applicant should consult with NOAA Fisheries during implementation of the Maintenance and Emergency Protocol to ensure adequate representation of the federal interest in aquatic resources.

Aquatic Resources

When recreational flows are implemented, rapid increases and decreases in flow could affect aquatic resources. As previously stated, proposed recreational releases are within, and generally similar to, the mean and median flow conditions, and well within the frequency distribution of flows for each development. Existing aquatic resources in these reaches are adapted to the range of flows; however, the rate at which the flows increase and decrease for these recreational releases may be more rapid than typically experienced by aquatic organisms in these reaches. In particular, rapid decreases in the flow from peak recreational flows to minimum continuous flows designated for a reach have the potential to strand fish in small isolated pools as water levels recede. Water temperatures and DO can become inhospitable for fish and other aquatic organisms in these isolated pools. We recommend that "ramping" (the gradual increase and decrease of flow) recreational flows over a period of several hours before and after each recreational release be evaluated and implemented to reduce the risk to aquatic resources, especially fish.

The Maintenance and Emergency Protocol appropriately provides for replacement of resources lost during a maintenance and emergency event such as recreational flows and aquatic resources. It is recognized that during certain maintenance events and particularly in an emergency, unavoidable fish mortality may occur. The protocol indicates that if critical flows cannot be maintained during the Maintenance and Emergency Protocol, Duke Energy would monitor any potential aquatic species impacts in the affected stream segment and replace any aquatic species mortalities that are identified.

We conclude that the second requirement, as included, may be vague, unnecessary, and for given situations may be impractical or impossible to comply with. For example, replacement of a threatened and endangered species may not be possible if breeding programs are not available. Where an adequate forage base is present and the resource is otherwise healthy, replacement of forage species or the diversity in "minnows" also may not be necessary.

We recommend that the responses for fish losses that result from a Maintenance and Emergency Protocol event be evaluated on a case-by-case basis considering the species affected, the number of organisms affected, and the habitat, population, and community characteristics at the affected location. Where the populations and community are robust and healthy, monitoring or other habitat and resource management activities may be more beneficial than direct mitigation of the fish losses. We recommend that an advisory group be established, with

representatives of Duke Energy, federal and state resource managers, and other stakeholders to evaluate and recommend appropriate mitigation for fish losses.

Duke Energy has formed a task force with North Carolina WRC, South Carolina DNR, and North Carolina State University to work on aquatic invasive species issues. Duke Energy also is consulting with the municipalities of Hickory and Longview, North Carolina, North Carolina DENR, and North Carolina WRC on the implementation of an aquatic invasive species management program for parrotfeather. We recommend that Duke Energy continue to implement invasive aquatic species management measures in affected reservoirs. We further recommend that Duke Energy continue to provide public education opportunities and materials promoting awareness of aquatic invasive species and the means for preventing their expansion throughout the Catawba-Wateree Project area. We support the FWS recommendation for using the "Stop Aquatic Hitchhikers Program" for educational materials and signage to assist with their public education initiative.

Terrestrial Resources

Duke Energy does not currently have a specific management policy or plan for invasive exotic terrestrial plants and has no ongoing cooperative agreements with any state resource agencies to manage invasive vegetation with the project boundary. Management of vegetation on private land within the project boundary is regulated by Duke Energy's Shoreline Management Guidelines. Adjacent property owners may selectively control non-native invasive plants using hand tools and approved herbicides after receiving written concurrence from Duke Energy's Lake Services. In addition, regular management of both native and exotic invasive vegetation at all project facilities involves mowing and spraying herbicides approved by EPA or North Carolina and South Carolina Departments of Agriculture.

To provide a consistent source for guidance and protocol for identifying and controlling terrestrial invasive plant species such as kudzu, Japanese honeysuckle, and Chinese privet within the project area, we recommend that Duke Energy implement a terrestrial invasive plant species management plan. This management plan would include the following measures: (1) baseline identification of the range and extent of terrestrial invasive plant species within the Catawba-Wateree Project boundary; (2) methods for management to be used (e.g., herbicide treatment, mechanical removal, mowing); (3) requirement that applicant's staff involved in herbicide use be trained as a certified herbicide applicator; (4) a schedule for treatments, follow-up surveys, and additional treatments based on species-specific seasonal growth cycles to provide a basis for effective implementation of control measures; and (5) estimated costs for management. Procedures for management of invasive species in locations where RTE plant species occur would provide the guidance necessary to remove invasive species without harming RTE species. Implementation of the terrestrial invasive plant management plan would occur with consultation and guidance from applicable state and federal agencies as well as organizations such as the North Carolina and/or South Carolina Natural Heritage Program, and The Nature Conservancy.

We recommend that Duke Energy implement a terrestrial invasive plant species management plan as a mechanism to improve/restore native plant communities within the project area and protect special status species habitat. In addition, we recommend that Duke Energy develop an educational brochure that would be made available to adjacent landowners for management of invasive terrestrial plant species on their property. Costs for implementation of the terrestrial invasive species management plan are presented in table 131 at the end of this

section and detailed further in section 4, *Developmental Analysis*. Lastly, we recommend that the terrestrial invasive species management plan which would be implemented as a "stand alone" plan, be considered for integration into the next revision of the SMP.

Threatened and Endangered Species

As part of the Revised CRA, Duke Energy has developed and proposed to implement, species protection plans for state and/or federally-listed plant species that are endangered, threatened, and species of concern including: Schweinitz's sunflower and dwarf-flowered heartleaf. Species protection plans have also been developed and would be implemented for animal species with state and/or federal status including: American alligator, wood stork, and freshwater mussels (including Carolina heelsplitter). Guidelines for the species protection and management plans would require annual review of federal and state lists of special status species. Consultation with the applicable agencies would occur not just to update the lists on an annual basis, but also to provide Duke Energy opportunities to discuss management actions and alternatives with the agencies and determine necessary modifications of shoreline classifications if new species are located. Specific content for individual protection plans has been discussed previously in section 3.3.3, *Aquatic Resources*; section 3.3.4, *Terrestrial Resources*; and section 3.5, *Threatened and Endangered Species*.

In addition to providing species management and protection plans for federally-listed species, Duke Energy has developed, and proposed to implement, additional species protection plans for the rocky shoals spider lily, Rafinesque's big-eared bat, American eel, robust redhorse, flat bullhead, snail bullhead, and bald eagle, as well as a plan to protect and manage heron rookeries located within the project area. Species protection and management plans for these species would be developed and implemented with the same guidelines outlined for the federal species mentioned above. We provide the costs for the applicant-proposed species protection plans in table 131 at the end of this section, which are detailed further in section 4, *Developmental Analysis*. We find that the benefits of the species protection plans would be worth the costs.

We recommend that the species plans, as proposed by the applicant, be implemented after consultation with the appropriate agencies and approval by the Commission. We further recommend that these plans be reviewed and revised as necessary when new information applicable to the species and Catawba-Wateree habitats supporting those species becomes available.

Cultural Resources

Historic Property Management Plan

To ensure that adverse effects on known and potential historic properties, and to any as-yet unidentified archaeological resources are satisfactorily resolved over the term of a new license, the Commission staff plans to execute a PA with the South Carolina and North Carolina SHPOs for the Catawba-Wateree developments. Duke Energy, CIN, and EBCI would be invited to participate as concurring parties. The PA would incorporate the final HPMP filed on December 12, 2006. The HPMP for the project contains the principles and procedures to address the proposed continued use, and protection of, historic properties; mitigation of unavoidable adverse effects; compliance with laws and regulations governing human remains; and discovery of previously unidentified resources over the term of any license issued. We recommend that

Duke Energy implement the HPMP. The protection afforded to historic properties justifies the annual estimated cost of $ 2,403 for the HPMP.

Cowans Ford

Even though the Cowans Ford development is currently ineligible for the National Register due to its more recent age, it is the largest of the developments and the last to be constructed, thereby completing the build-out of the river begun in 1900. It followed a different design, had a much larger capacity than the other developments, and was built in the post-World War II, modern era, which places it in a different context than the neighboring developments. At 50 years of age, Cowans Ford likely would meet the standards set under criteria A and C, and should be reassessed for its eligibility at that time. Therefore, we recommend that the PA incorporate a stipulation that requires Duke Energy to reassess the eligibility of Cowans Ford after it is 50 years old. The cost for the staff recommendation to reassess the eligibility of the Cowans Ford Development for the National Register is negligible since the reassessment would occur as part of the review process for the HPMP.

Land Leases

Duke Energy offered to lease lands that contained cultural resource sites not eligible for the National Register to North Carolina DPR and South Carolina DPRT for the term of any license issued[20]. Duke Energy's proposal to offer a lease to various agencies would force a contract between two parties and would be outside the Commission's authority. Therefore, we do not recommend this measure. However, we encourage Duke Energy to enter into these leases because they would provide protection for the sites, which are not eligible for protection under National Historic Preservation Act.

Recreational Resources

Recreational Facility Enhancements and Recreation Management Plan

After consultation with North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, local governments, and other entities and within 1 year of license issuance, Duke Energy proposes to develop and file an RMP with the Commission. The RMP would include (1) a schedule for implementing the recreational enhancements; (2) maps that identify all existing and proposed recreational areas in relation to the project boundary; (3) maps that identify where the project boundary would be modified such that all land areas associated with the recreational enhancements described in the RMP are incorporated into the project boundary; (4) conceptual facility site plans; (5) descriptions of new facility construction and operation and maintenance of existing and new facilities; (6) procedures for temporary closures of project recreation sites; (7) discussion of how the needs of the disabled were considered in planning and design of recreational facilities; (8) discussion of how the low impact development practices were considered in the planning and design of recreational facilities; and (9) a description of the standardized recreational signage program for recreation sites. We recommend that Duke Energy develop the RMP after consultation with, at a minimum, North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, Burke County, York County, American Whitewater, Carolina Canoe Club, Catawba-Wateree Relicensing Coalition, Lake Wylie Covekeeper, and South Carolina Coastal Conservation

[20] These cultural resources sites are not affected by project operations.

League (the entire relicensing Recreation Resources Committee) and file the plan with the Commission for approval. Consulting with the relicensing Recreation Resources Committee, at a minimum, would be beneficial by providing continuity to the recreation planning process.

Generally, the project offers numerous opportunities for public recreation and Duke Energy proposes to provide a number of recreational enhancements at the project, including 26 additional recreation access areas in the project boundary and numerous enhancements at existing areas. As the licensee, Duke Energy would be responsible for all recreational enhancements and facilities, including operation and maintenance of those facilities. We recommend that the following recreational enhancements proposed by Duke Energy be included in the RMP and the project boundary (see tables 67-77 in section 3.3.7.2, *Recreational Resources, Environmental Effects*):

Bridgewater Development

- Black Bear Access Area
- New Linville Access Area
- Linville Canoe/Kayak Access Area
- Pocket Park for Lake James Loop Trail
- Bridgewater Access Area
- Muddy Creek Access Area

Rhodhiss Development

- Corpening Bridge Access Area
- Conley Creek Access Area (Sawmills Veterans Park)
- Rhodhiss Access Area
- Rhodhiss Dam Canoe Portage
- Castle Bridge Access Area

Oxford Development

- Two Lake Hickory swimming areas
- Wittenburg Access Area
- Dusty Ridge Access Area
- Lovelady Access Area
- Long Shoals Access Area
- Oxford Access Area
- Oxford Tailrace Fishing Area
- Oxford Dam Canoe Portage

Lookout Shoals Development

- Upper Lookout Shoals Access Area

- Lookout Shoals Access Area
- Lookout Shoals Tailrace Fishing Area
- Lookout Shoals Dam Canoe Portage

Cowans Ford Development

- Beatty's Ford Access Area
- Hagers Creek Access Area
- Stumpy Creek Access Area
- Little Creek Access Area
- Island Point Access Area
- Cowan's Ford Dam Portage and Overlook

Mountain Island Development

- Highway 73 Access Area
- Lucia Access Area
- Riverbend Access Area
- Mountain Island Dam Canoe Portage

Wylie Development

- Dutchmans Creek Access Area
- South Point Access Area
- Buster Boyd Access Area
- Allison Creek Access Area
- Rock Hill Park
- Fort Mill Access Area

Fishing Creek Development

- Springs Park
- Fishing Creek Access Area
- Fishing Creek Tailrace Fishing Area

Great Falls and Dearborn Developments

- Evaluate safety concerns associated with boating at the Great Falls and Dearborn Developments; determine the need for constructing boating safety devices upstream of the structure; and report conclusions to the Commission. Submit a revised public safety plan for the Great Falls and Dearborn Developments for Commission acceptance, if necessary.
- Highway 200 Bridge Access Area
- Great Falls Diversion Dam Portage

- Great Falls Headworks Portage
- Great Falls Headworks to Cedar Creek Reservoir Portage
- Lower Great Falls Reservoir Canoe/Kayak Launch

Rocky Creek and Cedar Creek Developments

- Mudcat Inn Access Area

Wateree Development

- Wateree Creek Access Area
- Molly Creek Park
- Colonels Creek Access Area
- Taylors Creek Access Area
- Lugoff Access Area

The existing and proposed public recreation access areas would be spaced geographically throughout the project reservoirs and regulated river reaches to provide recreational opportunities no matter where the potential user originates. Generally, the developments receiving the greatest recreational use would receive the most recreational enhancements. The proposed recreational enhancements would provide increased recreational opportunities at the project and alleviate some of the pressure at the existing recreation access areas that are approaching or over capacity.

As license articles, Duke Energy proposed offering five areas of land currently within the project boundaries to federal or state entities through nominal-cost leases. These are project-related land conveyances, mostly in association with existing recreation access areas.

- Lake James State Park Islands Management Zone (Bridgewater Development)—Offer a lease to North Carolina DENR for the Lake James State Park Islands Management Zone.
- Lake Norman State Park Management Zone (Cowans Ford Development)—Offer a lease to North Carolina DENR for the Lake Norman State Park Management Zone.
- Saddler Island (Wylie Development)—Offer a lease for Saddler Island to the U.S. National Whitewater Center for environmental education programming.
- Cedar Creek Reservoir island improvements (Rocky Creek and Cedar Creek Developments)—Offer a lease to South Carolina DPRT for Cedar Creek reservoir island improvements.
- Lake Wateree State Park Management Zone (Wateree Development)—Offer a lease to South Carolina DPRT for the Lake Wateree State Park Management Zone.

In addition to providing diverse recreational opportunities in the upper river basin, protecting these lands would be consistent with local efforts to establish nature-based tourism in the region and would create several thousand acres of contiguous public lands in the vicinity of Great Falls. However, we find that the lands proposed for lease are necessary for project purposes and should remain within the project boundary. It would be appropriate for Duke Energy to apply to the Commission for approval for non-project use of project lands, and to enter

into a lease agreement with the federal or state entities, as proposed in the relicensing settlement agreement. Such an arrangement would benefit the recreating public, and would allow the state or federal entities to better manage the land, which includes existing, popular state parks.

In addition to those measures proposed by Duke Energy for inclusion in the RMP that would be located within the project boundary, Duke Energy has partnered with others to enhance existing recreation access areas or to develop areas in addition to those for which Duke Energy would be responsible. These off-site measures, as described in section 3.3.7.2, *Recreational Resources, Environmental Effects*, and tables 78-84, included in the Revised CRA are not proposed to be included as license articles or in the RMP.

We have evaluated each of these off-site enhancements to determine if any are appropriate to be included in any license for the project and conclude that there is not a demonstrated need that would require these enhancements except for the East Wateree access improvements. The east side of Lake Wateree currently has four ramps and one fishing pier, while the west side has one swimming area and two proposed swimming areas. We conclude that the East Wateree Access Area would serve a project purpose by providing additional boating opportunities and the only access area providing non-boating or fishing activities on the east side of Lake Wateree. Therefore, we recommend that Duke Energy provide East Wateree access improvements, including the construction of two motorized boat ramps with a courtesy dock, paved and lighted parking, and a swimming area with bathhouse on the east side of Lake Wateree within 5 years of approval of the RMP.

One stakeholder, the Town of Cornelius, recommended additional public recreational opportunities on Lake Norman, specifically additional public lakefront property in and around the Cornelius shoreline, to provide sufficient public recreation opportunities. Lake Cornelius and Lake Davidson were cut off from the remainder of Lake Norman by the construction of Interstate 77 and, therefore, there is no public access from Lake Norman proper. Lake Cornelius does not have any public access. We find that operation of the project affects Lake Cornelius and conclude that public access appropriate for the size of Lake Cornelius would serve a project purpose. Therefore, we recommend that Duke Energy consult with the Town of Cornelius and develop a small boat access and parking area that would be appropriate for the size of Lake Cornelius within 10 years of approval of the RMP.

FWS recommended that the importance of fish and wildlife-based recreation, especially bird-watching should be considered. We find that the project provides many opportunities for fishing, and Duke Energy's proposed enhancements provide numerous additional opportunities for pier and bank fishing and fishing in the regulated river reaches. With only four formal areas available for wildlife viewing at the project (none of which are in the project boundary), we conclude that the measure to evaluate the feasibility of including wildlife viewing facilities at appropriate Duke Energy-owned public access areas located within the project boundary is needed at the project. Therefore, we recommend that Duke Energy evaluate and consult with, at a minimum, FWS, North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, Burke County, York County, American Whitewater, Carolina Canoe Club, Catawba-Wateree Relicensing Coalition, Lake Wylie Covekeeper, and South Carolina Coastal Conservation League to determine the recreation access areas where wildlife viewing areas would be most appropriate, and file a plan with the Commission, within one year of license issuance, to implement additional wildlife viewing areas at the project.

Comments from stakeholders on the recreational enhancements also included the following: (1) a recommendation that the non-license article measure to provide $600,000 to Burke County, North Carolina DENR, or others to develop approximately 6 miles of the Overmountain Victory National Historic Trail Corridor be included as a license article; (2) concern about the non-license article measure where CIN would maintain a canoe access outside the project boundary; and (3) a recommendation that the license include provisions for the establishment of a water trail from Wateree dam to Congaree National Park. We do not recommend including any of these suggested enhancements in the RMP or license article. We conclude that the Overmountain Victory National Historic Trail is not needed for project purposes since it would not connect any project facilities and, therefore, does not need to be brought into the project boundary. Since the canoe/kayak access at the CIN reservation would be located approximately 7 miles downstream of the Wylie Development, we conclude that it would not serve a project purpose or have a project nexus. Finally, we conclude that the requested water trail from Wateree dam to Congaree National Park would not serve project purposes and does not have a clear nexus to project operation.

One stakeholder, Ms. Jean McKinley, expressed concern about the proposed Island Point Access Area at Lake Norman that would be located within the project boundary, especially the non-license article measure to offer a lease to a commercial operator for the development of an RV campground. Day-use facilities are currently proposed by Duke Energy for this access area, and the Revised CRA contains a non-license article provision whereby Duke Energy could market to commercial operators a lease for the development and management of a multi-use recreation area at this site. However, the Revised CRA also includes a commitment for Duke Energy and Catawba County, North Carolina, to form a workgroup of stakeholders representing the public interest, to participate in developing the site plan for this access area. We conclude that the proposed recreation access area would be developed in a manner consistent with the SMP and all local zoning ordinances, and would alleviate some of the recreational pressure at the existing Marshall fishing area.

Stakeholders also commented that some of the Revised CRA measures for recreational enhancements were dependent on third parties and cost-shares with other entities, and questioned if the proposed recreational enhancements would meet the demands of an increasing population. We have evaluated each of the proposed recreational enhancements and those enhancements proposed as non-license article measures in the Revised CRA to determine if any of them might be appropriate to include in any license for the project. Recreational enhancements determined to be necessary for project purposes that were not proposed for inclusion in the project boundary have been recommended by staff for inclusion in the project boundary. We conclude that the methods and models used to project recreation needs within the project area are documented, standard approaches that are accepted in the recreation planning profession.

Duke Energy proposed to file a biennial report for the first 20 years following the issuance of a new license with the Commission to document the progress made on completing the recreation enhancements under any new license. This report would assist the Commission and the other Revised CRA signatories with tracking the status of the required recreation enhancements. Supplements to the RMP are proposed to be filed at 20 years following the issuance of a new license and repeated every subsequent 10 years. The supplements to the RMP would include recreational enhancements that would also need tracking. Therefore, we

recommend that Duke Energy file biennial reports for the term of any new license instead of only for the first 20 years.

To address future recreational needs, Duke Energy proposes to complete a review of the project's recreational needs at 20 years following the issuance of a new license and repeated at every subsequent 10 years during the term of the new license. This review would be conducted after consultation with North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, local governments, and other interested parties. Subsequent to the reviews, Duke Energy proposes to file supplements to the RMP. The reviews and RMP supplements would provide Duke Energy and the stakeholders with an opportunity to re-evaluate recreation use and needs at the project and to identify additional recreational needs at the project. We conclude that consulting with, at a minimum, North Carolina DENR, North Carolina WRC, South Carolina DPRT, South Carolina DNR, Burke County, York County, American Whitewater, Carolina Canoe Club, Catawba-Wateree Relicensing Coalition, Lake Wylie Covekeeper, and South Carolina Coastal Conservation League, regarding the RMP and the recreational needs assessment would be beneficial since it would provide continuity to the recreation planning process.

Recreational Flows

Under the existing license, Duke Energy does not provide recreational flows at the project. As discussed in further detail in section 3.3.7.2, *Recreational Resources, Environmental Effects*, Duke Energy proposes to provide dedicated recreational flow releases at rates, and on schedules, to support paddling, wade fishing, boat fishing, and other activities, which could be temporarily modified if Duke Energy is operating under the Low Inflow Protocol or the Maintenance and Emergency Protocol. These new scheduled flows would be provided in the Bridgewater, Oxford, Wylie, and Wateree regulated river reaches. In addition, scheduled flow releases for canoeing and whitewater boating would be provided in the Great Falls bypassed reaches. Duke Energy proposes to provide weekend and holiday recreational flows during most of the project's peak recreation season (April through September) at the Bridgewater, Oxford, Wylie, and Wateree Developments. Recreational flows are also proposed for most weekend days in October at these developments. A more limited schedule for recreational flow releases is proposed at the Great Falls and Dearborn Developments with a total of 26 recreational flow days between the two bypassed reaches.

As discussed in further detail in section 3.3.7.2, *Recreational Resources, Environmental Effects*, Duke Energy's proposed recreational flows would provide reliable flows for recreation that would greatly enhance recreational opportunities in the regulated river reaches, and provide whitewater boating opportunities in the bypassed reaches at Great Falls, where there are currently none. Therefore, we recommend that Duke Energy's proposed recreational flows be adopted.

Section 3.3.3.3, *Aquatic Resources, Cumulative Effects*, and section 3.3.1.4.3, *Geology and Soils, Environmental Effects, River Geomorphology*, discuss the effects of the proposed recreational flows on aquatic resources and stream bank erosion below the Wylie and Wateree Developments. Those sections suggest that the ramping of the recreational flows over a period of several hours before and after each scheduled recreational release should be evaluated and potentially implemented, to reduce the risk to aquatic resources. If ramping of flows is considered for achieving the target recreational flow releases, it may be necessary for the

ramping to occur outside of Duke Energy's proposed window for target recreational flow releases so that the overall time for recreational boating and angling would not be reduced.

During periods of drought or emergency maintenance, the capacity to provide the recreational flows may be compromised. However, our evaluation of the mechanism to implement a temporary variance from recreational flow releases when conditions trigger implementation of the Low Inflow Protocol or Maintenance and Emergency Protocol as Duke Energy has proposed concludes that this mechanism would be a proper response to such conditions. The mechanism would allow Duke Energy to act to protect the aquatic resources of the Catawba-Wateree river system during extreme climatic conditions, such as a drought.

Therefore, we recommend the adoption of this mechanism to protect the uses of the project. Duke Energy also proposes to convene an annual meeting with, at a minimum, North Carolina DENR, North Carolina WRC, South Carolina DNR, and South Carolina DPRT to re-evaluate and modify, as necessary, the recreational flow schedule. This meeting would be held to ensure that quality recreational opportunities would continue to exist at the project. We recommend that Duke Energy convene an annual meeting with the proposed stakeholders to re-evaluate the recreational flow schedule so that any modifications that are necessary can be implemented.

Public Information and Public Safety

Duke Energy proposes to implement several measures to facilitate the public's enjoyment of the project and support the safe and effective public use of the project's resources. Duke Energy proposes to post reservoir level information and special messages for each project reservoir on its website, with special messages and actual levels for each project reservoir also available via Duke Energy's toll-free telephone system. Duke Energy proposes to post an annual calendar on its website showing all scheduled flow releases from the Bridgewater, Oxford, Wylie, and Wateree Developments and into the Great Falls bypassed reaches. Additionally, Duke Energy proposes to post 2-day flow release forecasts on its website and toll-free telephone system for the Oxford, Wylie, and Wateree Developments and the Great Falls bypassed reaches, and 3-day flow release forecasts for the Bridgewater Development.

Providing accurate and timely information is important to enhance public safety and to assist recreational visitors planning water-related activities at the project. The availability of reservoir levels and projected reservoir levels would allow the public to know when water levels are expected to rise or fall, while the availability of special messages via Duke Energy's toll-free telephone system would alert the public of special circumstances that could affect public safety. The availability of flow release forecasts on Duke Energy's website and toll-free telephone system, and the annual calendar of scheduled flow releases would be useful to recreational users in planning and staging water-related visits to the project and provide up-to-date information about flows to alert the public about forecasted increases in flows so that the public is not caught in unexpected conditions. Therefore, we recommend adopting Duke Energy's proposed public information and safety measures to ensure that recreational users have a readily available source of public information.

As discussed in detail in section 3.3.7.2, *Recreational Resources, Environmental Effects*, Duke Energy, as part of the Revised CRA, committed to providing, as non-license article measures, additional public information related to river flow. Up-to-date river flow information would be useful to recreational users in planning and staging water-related visits to the project.

The availability of this information would also enhance public safety at the project by providing up-to-date information about flows to alert the public so they are not caught in unexpected conditions. Although we do not recommend that Duke Energy provide the specific measures included in the Revised CRA, we recommend that Duke Energy provide public information related to river flow in a manner that provides the most up-to-date information possible to enhance public safety at the project.

As discussed in detail in section 3.3.7.2, *Recreational Resources, Environmental Effects,* Duke Energy committed in the Revised CRA to providing non-license article public safety measures, including updates to its public safety plans, warning devices, Spanish language tailrace signage, horns at the Bridgewater and Oxford Developments, a Riverbend Park warning system, English and universal signage, and facility exclusion zones. We recommend that Duke Energy implement the proposed public safety plans within one year of issuance of the new license, to enhance public safety at the project.

Comments from stakeholders regarding public information and safety included a recommendation to provide a longer near-term forecast period, a proactive notification system to alert CIN of all releases of water above minimum flow levels in the river below Wylie dam, and funding for public safety (such as the navigation aids, marine commissions, and additional fire/rescue capacity) at Lake Norman. We conclude that 2 days for near-term forecasts is sufficient for a peaking facility because generating electricity is dependent on demand and demand would be difficult for Duke Energy to forecast more than 2 days in advance. Duke Energy's proposed phone-based and internet-based public information systems would be sufficient for the public, including the CIN, to access information about planned operations. The CIN reservation is located approximately 7 miles downstream of the Wylie Development, and this location is not subject to the rapid variations that could be observed in the Wylie tailrace.

We conclude that Duke Energy should not be required to provide funding for public safety at Lake Norman, since the Lake Norman Marine Commission is responsible for all matters relating to or affecting public recreation and water safety at Lake Norman. Fire and rescue response funding is available through localities from other sources.

Shoreline Management Plan

The proposed changes to the SMP are anticipated to benefit the project reservoir shorelines, as well as environmental resources at the project. In general, the changes proposed by Duke Energy to the classification maps and the SMP represent modifications and adjustments to the existing, approved SMP. The proposed modifications would reduce the environmental impacts resulting from continuing shoreline development, and would also help to address changing conditions at the project or questions and issues that have arisen since the Commission's most recent approval of the SMP in 2003.

As discussed in detail in section 3.3.8, *Land Use and Aesthetics,* proposed modifications to the SMP would provide a variety of environmental, recreational, and aesthetic benefits. Proposed modification to the vegetation management, planting, and water willow provisions of the SMP would better protect existing shoreline and aquatic vegetation, including water willow. Proposed modifications to the seawall provisions of the SMP would further restrict the installation of seawalls along the project shoreline which would benefit both terrestrial and aquatic resources by maintaining a more natural shoreline edge. Modifications to the excavation provisions of the SMP would further restrict excavations in areas of water willow or other

sensitive areas. Proposed modifications to the SMP provisions for private use facilities (e.g., prohibition of new private boat ramps, prohibition of two-story boat dock structures) would help to reduce the environmental and aesthetic impacts of private individual shoreline recreation facilities. Modification of the minimum lot width requirement would significantly reduce the environmental impacts of residential shoreline development, by requiring larger lots, resulting in fewer piers and structures along the shoreline. This same provision should also help to reduce overcrowding of reservoirs by boats, as would the proposed new limitations on watercraft per slip.

Comments from stakeholders regarding the SMP included a recommendation to cap fees, particularly for private piers. Duke Energy's current and proposed fee system is consistent with the Commission's policy on fees, in that a licensee may charge reasonable fees for permitting/licensing of shoreline recreational and access facilities, to help defray the cost of administering the shoreline management program. So long as the fees charged by Duke Energy do not exceed the cost of the program, we see no need to cap the fees proposed. Moreover, under the terms of the Revised CRA, Duke Energy has earmarked certain portions of the fees they charge to be used to help conserve lands around the project, which combined with the specific changes proposed to the SMP, would be environmentally beneficial to the project.

Land Conveyances and Conservation

Duke Energy proposes to establish permanent conservation easements in the riparian corridor along certain sections of the river, as mitigation for reduced stream flows. As proposed, the North Carolina flow mitigation package provides for permanent conservation easements on 22 bank miles of stream; and the South Carolina flow mitigation package provides for permanent conservation easements on 6.6 bank miles of stream. The conservation easements are 100-ft-wide perpetual easements to be located on the Johns, Catawba, and Linville Rivers and transferred to the state of North Carolina or state-chosen land trust. In South Carolina, the 100-ft-wide perpetual easements are to be located on tributaries to the Catawba River.

Under the existing license, not all of the riparian habitat proposed for permanent conservation easement is provided protection, as some of these lands lie outside the existing project boundary. As conservation of these lands is being proposed as mitigation to offset the environmental effects of reduced flows in some river reaches, we conclude that these lands are necessary for project purposes, and accordingly we recommend that the project boundary be expanded to encompass all of these riparian corridor lands. Establishment of conservation easements along these river corridors would have a wide variety of environmental benefits. The establishment of permanent conservation easements on these lands would ensure their protection from development and other uses that may be inconsistent with the need to preserve their values as riparian corridor. Conservation easements would ensure that natural vegetation remains in place, which in turn would preserve the aesthetic quality of these corridors, ensure protection of these areas for use by both aquatic and terrestrial flora and fauna, and benefit both river and reservoir water quality.

As part of its relicensing agreement, Duke Energy has also proposed various types of conveyances of both project and non-project lands for purposes of conservation and/or public recreation. We have reviewed the lands proposed by Duke Energy for conveyance to different entities for the purpose of providing additional recreational access and public use. As discussed in section 3.3.8, *Land Use and Aesthetics*, we have concluded that these land conveyances can

appropriately be placed into two distinct categories: (1) proposed land conveyances involving project or project-related lands (section 3.3.8, table 91); and (2) proposed land conveyances involving non-project lands (section 3.3.8, table 90).

All of the non-project land conveyances agreed to in the Revised CRA, but that are not proposed as license articles, involve lands that are outside of the existing project boundary. Upon review of these lands we conclude that none of the non-project lands being proposed for conveyance are needed for project purposes, and therefore are not recommended for inclusion in the project or the project license. Allowing these lands to remain outside the project boundary would have no adverse effect on the environment or natural resources of the project. Moreover, conveyance of these non-project lands, for purposes of land conservation and/or public recreation, as proposed through the terms of the Revised CRA, would benefit the environment in many ways: by limiting shoreline development in these areas; by preserving natural vegetation and the corresponding benefits to watershed conservation and tributary and reservoir water quality; by providing contiguous parcels of undeveloped land which would serve as greenways and wildlife corridors; and by making additional lands in the vicinity of the project available for public use.

The project-related land conveyances (leases) proposed by Duke Energy (section 3.3.8, table 91) include the following.

- Offer North Carolina DENR a lease for the term of the new license for the Lake James State Park management zone (300 horizontal feet lakeward from full pond elevation) along the shoreline adjoining the state park, including three islands.
- Offer North Carolina DENR a lease for the term of the new license for the Lake Norman State Park management zone (300 horizontal feet lakeward from full pond elevation) along the shoreline adjoining Lake Norman State Park) including one island.
- Offer a lease of the approximately 37-acre island to the U.S. National Whitewater Center for individual and group environmental education and outdoor recreation programming.
- Offer a lease of the islands associated with the Great Falls, Dearborn, Rocky Creek, and Cedar Creek Developments to South Carolina DPRT to establish and maintain a new state park centered on the Dearborn Armory site.
- Offer South Carolina DPRT a lease for the Lake Wateree State Park management zone (up to 300 horizontal feet lakeward from full pond elevation along all the shoreline adjoining the state park) along the shoreline adjoining the state park.

Leases of these project-related lands, as proposed, would significantly benefit the environmental and recreational resources of the project. At the Wylie Development, the proposed lease of Saddler Island to the U.S. National Whitewater Center would promote the development of additional recreational benefits in the project area. At the Great Falls, Dearborn and Cedar Creek Developments, the proposed lease of several islands associated with the two developments, totaling more than 900 acres, to the State of South Carolina, would result in the establishment of a new state park centered on the Dearborn Armory Site. Such a park would be consistent with local efforts to establish nature-based tourism in the region, and would create several thousand acres of contiguous public lands in the vicinity of Great Falls. The proposed

lease of the Paddy Creek, Catawba-Lindell Confluence, and North Bend lands would provide diverse recreational opportunities in the upper river basin, and would serve as a natural buffer against additional development in this area.

The remaining leases of project land proposed by Duke Energy at the Bridgewater, Cowans Ford, and Wateree Developments involve lands that lie within the FERC project boundary and extend under the reservoirs 300 horizontal feet lakeward from the normal full pond elevation of the reservoir within which they lie. These are lands that are necessary for project purposes, in that they lie within the normal full pool elevation of the reservoir, and, as such cannot be removed from the project boundary. Inasmuch as the proposed use of these project lands is for public recreational use, however, and presumably to consolidate the administration and enforcement authority for the state parks which lie adjacent to these lands under a single entity, lease of these lands, as proposed, would benefit the recreating public, and would allow the states to better manage these existing and popular state parks. Accordingly, we recommend that in order to achieve the desired purpose of the property conveyance, that Duke Energy request Commission approval for the proposed non-project use of project lands in accordance with the SMP and standard land use license article.

Project Boundaries

The existing project boundary generally includes the area within full pond elevation of the project reservoirs and the land immediately surrounding the dams and powerhouses. Existing Duke Energy-owned public recreation access areas that provide access to the project are generally included in the project boundary, but portions of the existing Duke Energy-owned project recreation access areas lie partially outside the boundary. All lands needed for the operation of the project, including lands needed to ensure the protection of non-power values, must be included in the project boundary. This would allow the Commission to ensure that maintenance and operation of those recreation access areas continue over the life of the issued license. If licensed, the Catawba-Wateree Project boundaries would need to include all of Duke Energy's existing and new recreation facilities.

Table 130 summarizes the existing recreation access areas at the project, whether they are currently in the project boundary, and whether there are proposed enhancements at these areas that would need to be brought into the project boundary. This table also summarizes the new recreation access areas that are proposed by Duke Energy or recommended by staff which would need to be included in the project boundary.

Table 132. Summary of existing recreation access areas and Duke Energy or staff proposed new recreation access areas to be included in the Catawba-Wateree project boundary. (Source: Staff)

	Currently inside the project boundary	**Proposed by Duke Energy to be brought into the project boundary**	**Recommended by staff to be brought into the project boundary**	**New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary**
Bridgewater Development				
Existing Recreation Access Areas				
Black Bear	X			X
Lake James State Park				
Hidden Cove	X			
Canal Bridge	X			
Linville	X			X
Bridgewater Access Area	X			X
Watermill Road Canoe Access				
Morganton Greenway - Greenlee Ford Park				
Morganton Greenway - River Village Park				
Morganton Greenway - Catawba Meadows Park				
New Access Areas or Management Zones				
New Linville Access Area		X	X	
Pocket Park for Lake James Loop Trail		X	X	

	Currently inside the project boundary	Proposed by Duke Energy to be brought into the project boundary	Recommended by staff to be brought into the project boundary	New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary
Muddy Creek Access Area		X	X	
Lake James State Park Management Zone		X	X	
Rhodhiss Development				
Existing Recreation Access Areas				
Johns River	X			
Huffman Bridge	X			
Castle Bridge	X			X
Conley Creek/Sawmills Veterans Memorial Park	X			X
Rhodhiss	X			X
Rhodhiss Canoe Portage	X			X
New Access Areas or Management Zones				
Corpening Bridge Access Area		X	X	
Oxford Development				
Existing Recreation Access Areas				
Bud Geitner Park				
Hickory Greenway				
Glenn C. Hilton Park				
Gunpowder	X			

	Currently inside the project boundary	Proposed by Duke Energy to be brought into the project boundary	Recommended by staff to be brought into the project boundary	New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary
Lovelady	X			X
Wittenburg	X			X
Long Shoals (undeveloped)	X			X
Dusty Ridge	X			X
Oxford	X			X
Oxford Canoe Portage	X			X
Riverbend Park				
New Access Areas or Management Zones				
Lake Hickory swimming areas		X	X	
Oxford Tailrace Fishing Area		X	X	
Lookout Shoals Development				
Existing Recreation Access Areas				
Lookout Shoals	X			X
Sharon	X			
New Access Areas or Management Zones				
Upper Lookout Shoals Access Area		X	X	
Lookout Shoals Tailrace Fishing Area		X	X	
Lookout Shoals Dam Canoe Portage		X	X	

	Currently inside the project boundary	Proposed by Duke Energy to be brought into the project boundary	Recommended by staff to be brought into the project boundary	New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary
Cowans Ford Development				
Existing Recreation Access Areas				
Hunsucker Park				
Buffalo Shoals (undeveloped)	X			
Long Island	X			
Lake Norman State Park				
Island Point (undeveloped)	X			X
Stumpy Creek	X			X
Pinnacle	X			
McCrary Creek	X			
Marshall Fishing Area	X			
Slanting Bridge (undeveloped)	X			
Hager Creek	X			X
Little Creek	X			X
Roosevelt Wilson Park				
Beatty's Ford	X			X
Jetton Road County Park				
Ramsey Creek	X			
McGuire Fishing Area	X			
Blythe Landing County Park				

	Currently inside the project boundary	Proposed by Duke Energy to be brought into the project boundary	Recommended by staff to be brought into the project boundary	New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary
New Access Areas or Management Zones				
Cowans Ford Dam Portage and Overlook		X	X	
Lake Cornelius Access			X	
Lake Norman State Park Management Zone		X	X	
Mountain Island Development				
Existing Recreation Access Areas				
Cowans Ford Wildlife Refuge				
Rural Hill Park				
Neck Road	X			
Latta Plantation County Park				
Riverbend	X			X
New Access Areas or Management Zones				
Highway 73 Access Area		X	X	
Lucia Access Area		X	X	
Mountain Island Dam Canoe Portage		X	X	

	Currently inside the project boundary	Proposed by Duke Energy to be brought into the project boundary	Recommended by staff to be brought into the project boundary	New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary
Wylie Development				
Existing Recreation Access Areas				
Mountain Island River Park	X			
Mountain Island Tailrace Fishing Area	X			
Mount Holly River Street Park				
South Point	X			X
Allen Fishing Area	X			
Stowe Botanical Garden				
Copperhead	X			
McDowell Park				
Buster Boyd	X			X
Indian Ground (currently closes)	X			
Allison Creek	X			X
Ebenezer Park	X			
Nivens Creek	X			
Fort Mill	X			X
Rock Hill River Park (regulated river reach)				
Landsford Canal State Park				

	Currently inside the project boundary	Proposed by Duke Energy to be brought into the project boundary	Recommended by staff to be brought into the project boundary	New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary
New Access Areas or Management Zones				
Dutchmans Creek Access Area		X	X	
Rock Hill Park (lake)		X	X	
Saddler Island		X	X	
Landsford Canal State Park Management Zone		X	X	
Fishing Creek Development				
Existing Recreation Access Areas				
Highway 9 Landing				
Cane Creek	X (proposed for removal when Springs Park is constructed)			
Fishing Creek	X			X
New Access Areas or Management Zones				
Springs Park		X	X	
Fishing Creek Tailrace Fishing Area		X	X	

	Currently inside the project boundary	Proposed by Duke Energy to be brought into the project boundary	Recommended by staff to be brought into the project boundary	New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary
Great Falls and Dearborn Developments				
New Access Areas or Management Zones				
Highway 200 Bridge Access Area		X	X	
Great Falls Diversion Dam Portage		X	X	
Great Falls Headworks Portage		X	X	
Great Falls Headworks to Cedar Creek Reservoir Portage		X	X	
Lower Great Falls Reservoir Canoe/Kayak Launch		X	X	
Rocky Creek and Cedar Creek Developments				
Existing Recreation Access Areas				
Stumpy Pond	X			
Debutary Creek	X			
New Access Areas or Management Zones				
Cedar Creek Reservoir island improvements		X	X	
Mudcat Inn Access Area		X	X	

	Currently inside the project boundary	Proposed by Duke Energy to be brought into the project boundary	Recommended by staff to be brought into the project boundary	New facilities are proposed at existing area by Duke Energy that must be brought into the project boundary
Wateree Development				
Existing Recreation Access Areas				
Cedar Creek	X			
Wateree Creek Access Area	X			X
Taylors Creek Access Area	X			X
Lake Wateree State Park				
June Creek	X			
Beaver Creek Landing				
Colonel's Creek Access Area	X			X
White Oak Creek	X			
Buck Hill	X			
Lugoff	X			X
Highway 1 Landing				
Billy Tolar Landing				
New Access Areas or Management Zones				
Molly Creek Park		X	X	
East Wateree access improvements			X	
Lake Wateree State Park Management Zone		X	X	

Duke Energy has committed in the Revised CRA to a non-license article measure whereby it would ensure that all of its islands located on the project reservoirs or in the regulated river reaches would remain open for the term of the new license for any permissible day-use public recreation activity. Islands could be designated as off-limits by Duke Energy due to issues related to cultural resource protection, wildlife protection or safety, security, or management concerns or restrictions by state or local public health, safety, or law enforcement authorities. We conclude that all Duke Energy-owned islands that serve a project purpose or are affected by the project, including islands designated as off-limits, should be included in the project boundary to ensure that the open access islands remain available for the term the new license for permissible day-use public recreation activity, and recommend including this measure in any license issued for the project. This measure would enhance recreational use by boaters and non-motorized boaters using the project waters.

In the Revised CRA, Duke Energy also committed to ensuring that the shoreline of all Duke Energy-owned access areas remains open for bank fishing for the term of the new license, except those minimal shoreline areas where bank fishing is restricted for safety reasons, for management problems, or to avoid conflicts with other access area users. Ensuring that all bank fishing areas provided by Duke Energy are available to recreationists for the term of the new license would enhance bank fishing opportunities at the project. Therefore, we recommend that Duke Energy expand the project boundary at all Duke Energy-owned recreation access areas to include any adjacent bank fishing areas provided by Duke Energy.

Conclusion

Based on our review of the agency and public comments filed on the project and our independent analysis pursuant to sections 4(e), 10(a)(1), and 10(a)(2) of the FPA, we conclude that licensing the Catawba-Wateree Project as proposed by Duke Energy with additional staff-recommended measures would be best adapted to a plan for improving or developing the Catawba and Wateree rivers waterway.

5.2 CONSISTENCY WITH THE RECOMMENDATIONS OF THE FISH AND WILDLIFE AGENCIES

Section 10(j) of the FPA requires the Commission to include license conditions, based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project. Section 10(j) of the FPA states that, whenever the Commission concludes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency should attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency. If the Commission still does not adopt a recommendation, it must explain how the recommendation is inconsistent with Part I of the FPA, or other applicable law, and how the conditions imposed by the Commission adequately and equitable protect, mitigate damages to, and enhance fish and wildlife resources.

In response to the Commission's ready for environmental analysis notice, issued April 7, 2008, Interior, NMFS, North Carolina WRC, and South Carolina DNR filed letters providing comments and terms and conditions for the Catawba-Wateree Project, pursuant to section

10(j).[21] Of the six recommendations that we consider to be within the scope of section 10(j) we wholly include three, include one in part, and do not include two. We discuss the reasons for not including those recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*. Table 131 summarizes the agency recommendations made under section 10(j) for the Catawba-Wateree Project, as well as our analysis of those recommendations and whether to adopt the measures as part of the staff alternative.

Recommendations Under Section 10(a) of the FPA

We have analyzed recommendations filed by FWS and NOAA Fisheries that we consider outside the scope of section 10(j) under section 10(a) of the FPA. These measures are addressed in specific resource sections of this document. Measures considered under section 10(a) were recommended for implementation by staff.

Table 133. Analysis of fish and wildlife agency section 10(j) recommendations for the Catawba-Wateree Project. (Source: Staff)

Recommendation	Agency[1]	Within Scope of 10(j)?	Total Annual Cost (2008$)	Staff Recommending?
1. Request the establishment of a Low Inflow Protocol and a Drought Management Advisory Group, and request NOAA Fisheries as well as other interested federal and state agencies be included in the Drought Management Advisory Group.	NOAA Fisheries; FWS	LIP yes DMAG no	$176,000	Yes
2. Require applicant consultation with NOAA Fisheries during development and implementation of Maintenance and Emergency Protocol: • as it applies to Lake Wylie – Consult with CIN and BIA.	NOAA Fisheries; FWS	No	$11,000	Yes

[21] The North Carolina DENR, North Carolina WRC, and South Carolina DNR letters were filed on June 3, 5, and 6, 2008, respectively. The NOAA Fisheries letter was filed on June 6, 2008, and the Interior letter was filed on June 4, 2008, amended with errata on July 17, 2008.

Recommendation	Agency[1]	Within Scope of 10(j)?	Total Annual Cost (2008$)	Staff Recommending?
3. Prepare an Flow and Water Quality Implementation Plan within 180 days following the issuance of the new license after consultation with NOAA Fisheries, FWS, North Carolina DENR, North Carolina WRC, South Carolina DNR, and South Carolina DHEC.	NOAA Fisheries	Yes		Yes
4. Provide minimum flows for aquatic habitat, specifically as follows:				
• Initial instream flows developed in Revised CRA have been accepted; however, recommend a provision for re-evaluating and implementing revised instream flow requirements if future prescriptions for fish passage are issued.	NOAA Fisheries; FWS	Yes	$1,820,800	Yes
• Implement the Wateree Spring Stable Flows and Protocol each calendar year from February 15 through May 15.	NOAA Fisheries; FWS	Yes		No
5. Establish a Catawba-Wateree Project Fisheries Technical Committee with NOAA Fisheries, FWS, North Carolina DENR, North Carolina WRC, South Carolina DNR, South Carolina DHEC, and non-governmental conservation organizations to review monitoring and evaluation	NOAA Fisheries	No		Yes

Recommendation	Agency[1]	Within Scope of 10(j)?	Total Annual Cost (2008$)	Staff Recommending?
studies, operating plans, and maintenance issues.				
6. Install and operate the bladder dam as recommended in the Revised CRA.	FWS	No, not a specific measure to protect fish and wildlife [10(a)]	$554,110	Yes
7. Develop an implementation and operation plan that includes ramping or pulsing of hydro units for the Wateree Flood Plain Inundation.	FWS	Yes		No
8. Implement High Inflow Protocol as described in the Revised CRA.	FWS	Yes		Yes
9. For invasive non-native species:				
• Provide and maintain a program to reduce the spread of invasive exotic aquatic species.	FWS	No		Yes
• Develop an invasive terrestrial and riparian vegetation management program to manage invasive exotic terrestrial plant species that occur on project lands.	FWS	No	$4,700	Yes
10. For bald eagle monitoring:				
• Provide an annual bald eagle monitoring report to the Commission, FWS, and state agencies.	FWS	No, monitoring is not an enhancement or protection measure	$8,600	Yes

Recommendation	Agency[1]	Within Scope of 10(j)?	Total Annual Cost (2008$)	Staff Recommending?
• Develop and implement management guidelines for bald eagles to be included in a species management plan.	FWS	Yes		Yes
11. For land conservation: • Develop a comprehensive plan to conserve and protect lands and special places in and around the Catawba-Wateree Project in concert with federal and state resource agencies, CIN, communities, and non-profit organizations.	FWS	No, not a specific measure to protect fish and wildlife [10(a)]	$1,329,323	Yes
12. For the SMP: • Recommend re-acquisition and restoration of contiguous shoreline segments or, where not practicable, a program for protection of key tracts along the regulated reaches of the Catawba and Wateree Rivers. • Recommend the avoidance of impacts to shoreline vegetation or near-shore habitats. • Require planting of native species and installation of fish-friendly pier features under docks. • Require the project boundary to include a	FWS	No, not a specific measure to protect fish and wildlife [10(a)]	$26,411	Yes

Recommendation	Agency[1]	Within Scope of 10(j)?	Total Annual Cost (2008$)	Staff Recommending?
50-ft vegetated riparian buffer area required by North Carolina as the minimum necessary to protect riparian resources.				

[1] In lieu of specific 10(j) measures, North Carolina WRC and South Carolina DNR are signatories of the Revised CRA, which they state in their letters is protective of their fish and wildlife interests.

Wateree Flood Plain Inundation

We do not recommend measures as currently proposed to provide inundation to the Wateree flood plain. The ability to meet the goals of flood plain inundation is highly dependent upon weather conditions in the Catawba-Wateree River Basin, natural inflows, and regulated flows into the Wateree Development. The various Revised CRA conditions affecting inflow and discharge of water at Lake Wateree create a complex set of goals that encompass minimum continuous releases, flood plain inundation, lake level stabilization, and flood-management. We conclude that the flexibility of an adaptive management approach is needed to implement these programs and optimize the success of each. This can be accomplished through the reporting and consultation process described in the Revised CRA. We agree that a 10-year period is appropriate to test and refine these protocols within the operating constraints and uncertainties of weather prediction before determining whether enforceable articles should be incorporated into the license.

High Inflow Protocol and Wateree Spring Stable Flow Protocol

In order to spawn in the Wylie regulated river reach, anadromous fish first would need to pass the six downstream developments, which, based on the preliminary section 18 fish passage prescriptions, is not likely to occur until at least 10 years following issuance of the new license. Therefore, we do not recommend the proposed measures for implementation of the High Inflow Protocol or the Wateree Spring Stable Flow Protocol. FWS and NOAA Fisheries have agreed with the minimum continuous flows recommended in the Revised CRA for Wylie and Wateree, including implementation of the Wylie High Inflow Protocol and the Wateree Spring Stable Flow Protocol. We agree that Duke Energy, FWS, NOAA Fisheries, and South Carolina DNR should consult during the first 10 years following implementation of the FWQIP on a license article to be included as an amendment for the Wateree Spring Stable Flow Protocol.

Recommendations Under Section 10(a) of the FPA

We have analyzed recommendations filed by FWS and NOAA Fisheries that we consider outside the scope of section 10(j) under section 10(a) of the FPA. Table 131 identifies three measures for the Catawba-Wateree Project that we consider under 10(a). These measures are addressed in the specific resource sections of this document. All three measures considered under section 10(a) were recommended by staff.

5.3 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal and state comprehensive plans for improving, developing, and conserving waterways affected by a project. Under this section, federal and state agencies filed a total of 72 qualifying North Carolina, South Carolina, and federal comprehensive plans, of which we identified 11 North Carolina, 6 South Carolina, and 3 federal that are applicable to the Catawba-Wateree Project. The continued operation of the Catawba-Wateree Project, as recommended in this EIS is consistent with the 20 state and federal plans listed below that are applicable to the Catawba-Wateree Project.

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APPENDIX A

PROJECT FIGURES

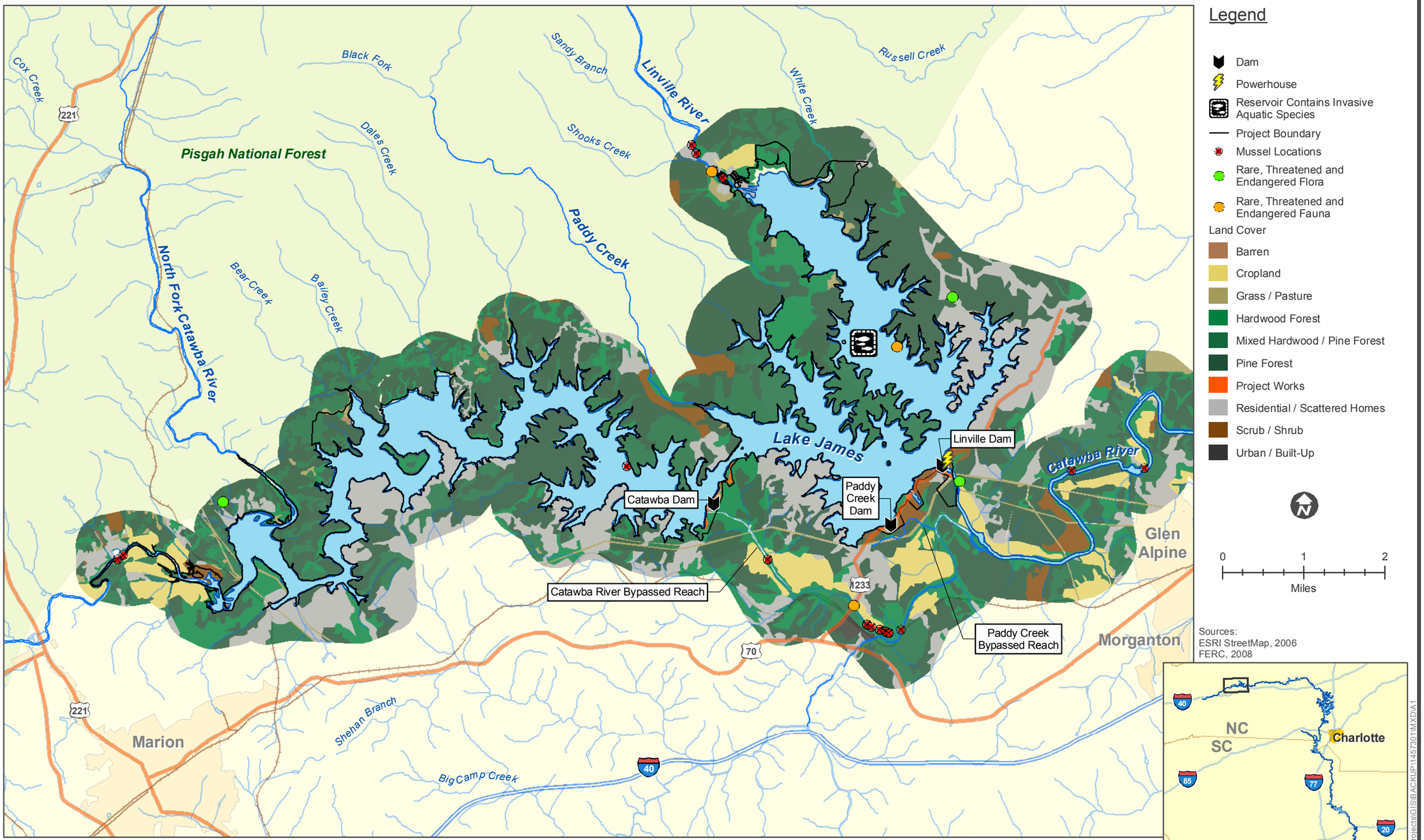

Figure A-1 - Bridgewater Development Project Area, Catawba River, Burke and McDowell Counties, North Carolina

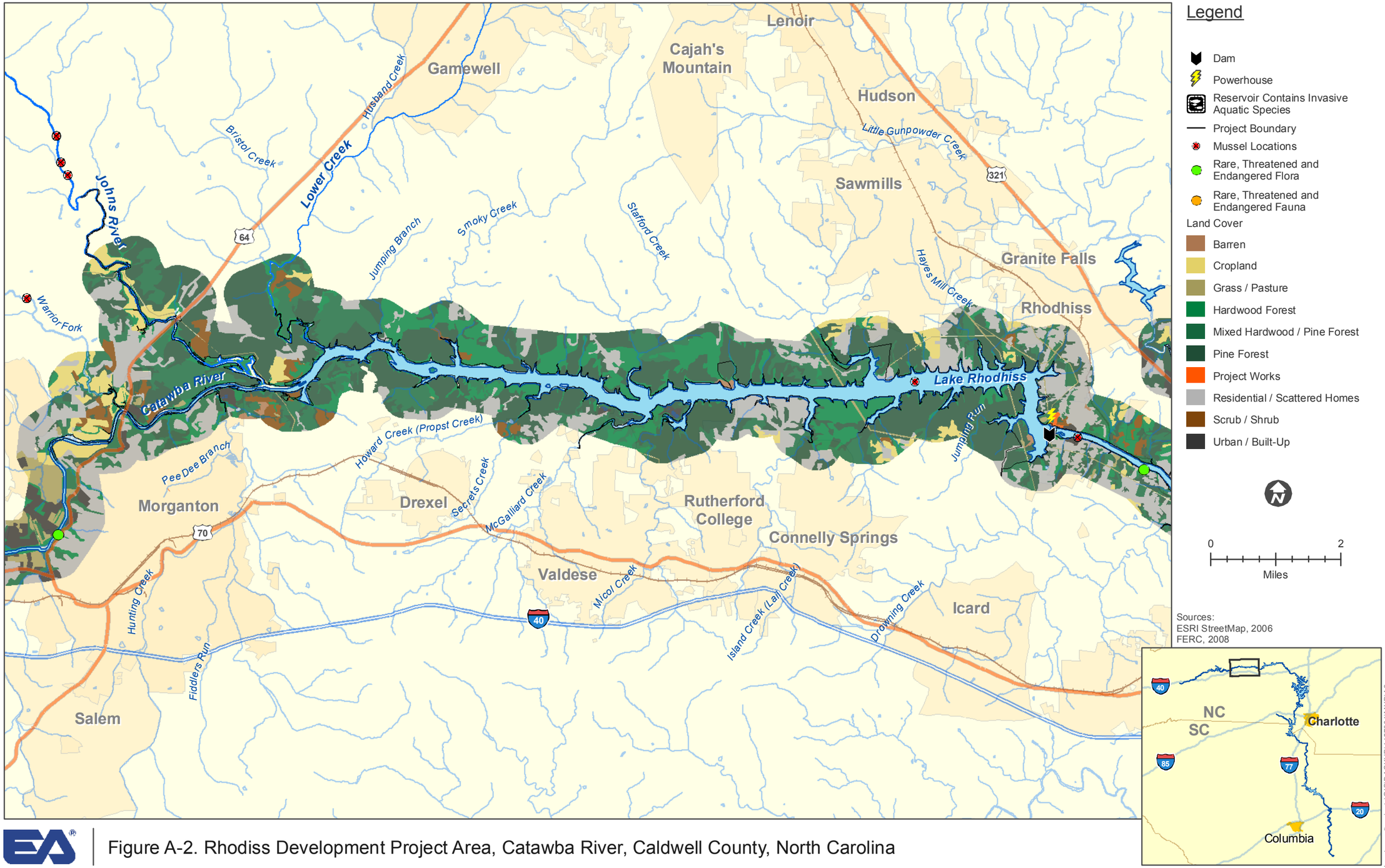

Figure A-2. Rhodiss Development Project Area, Catawba River, Caldwell County, North Carolina

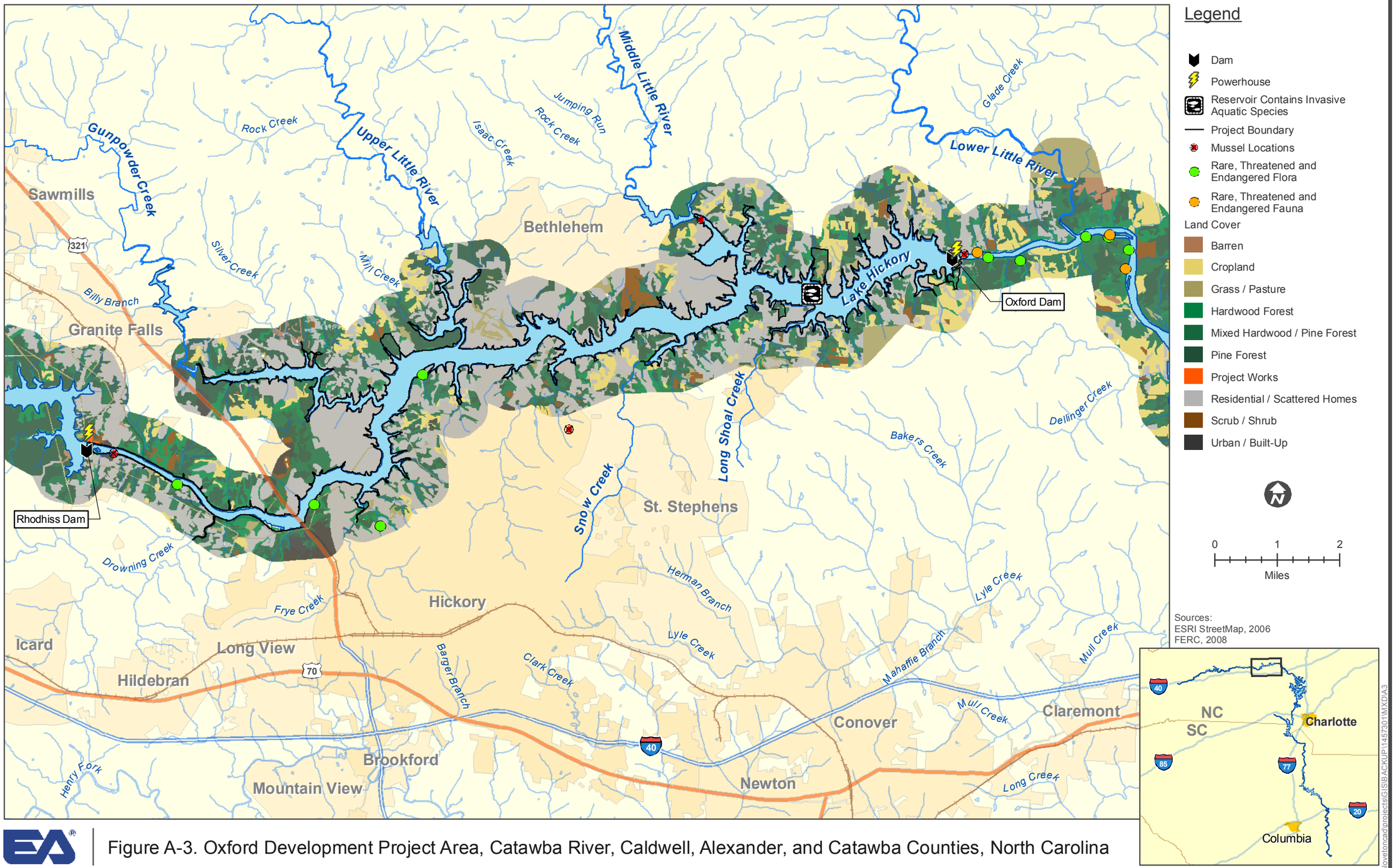

Figure A-3. Oxford Development Project Area, Catawba River, Caldwell, Alexander, and Catawba Counties, North Carolina

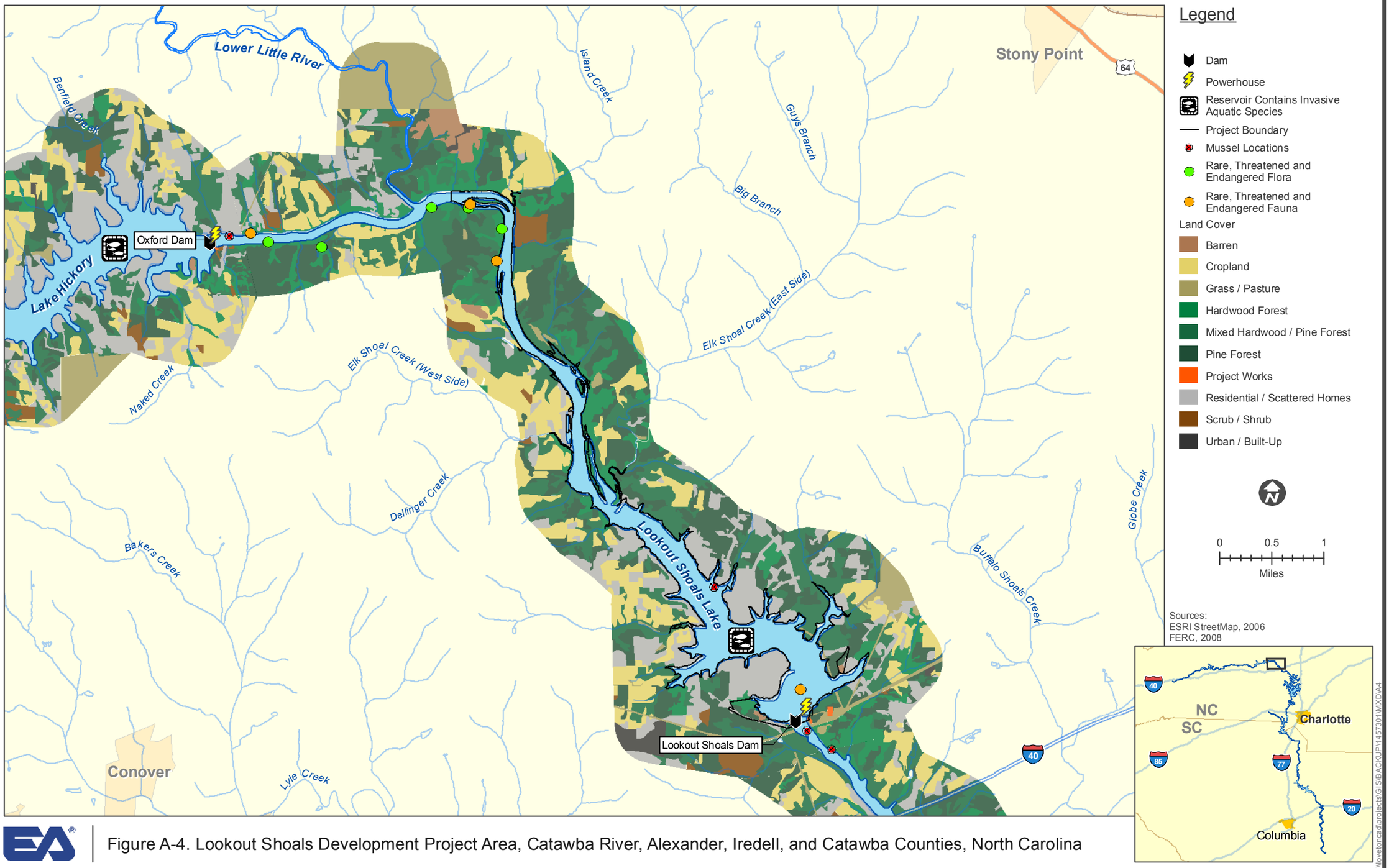

Figure A-4. Lookout Shoals Development Project Area, Catawba River, Alexander, Iredell, and Catawba Counties, North Carolina

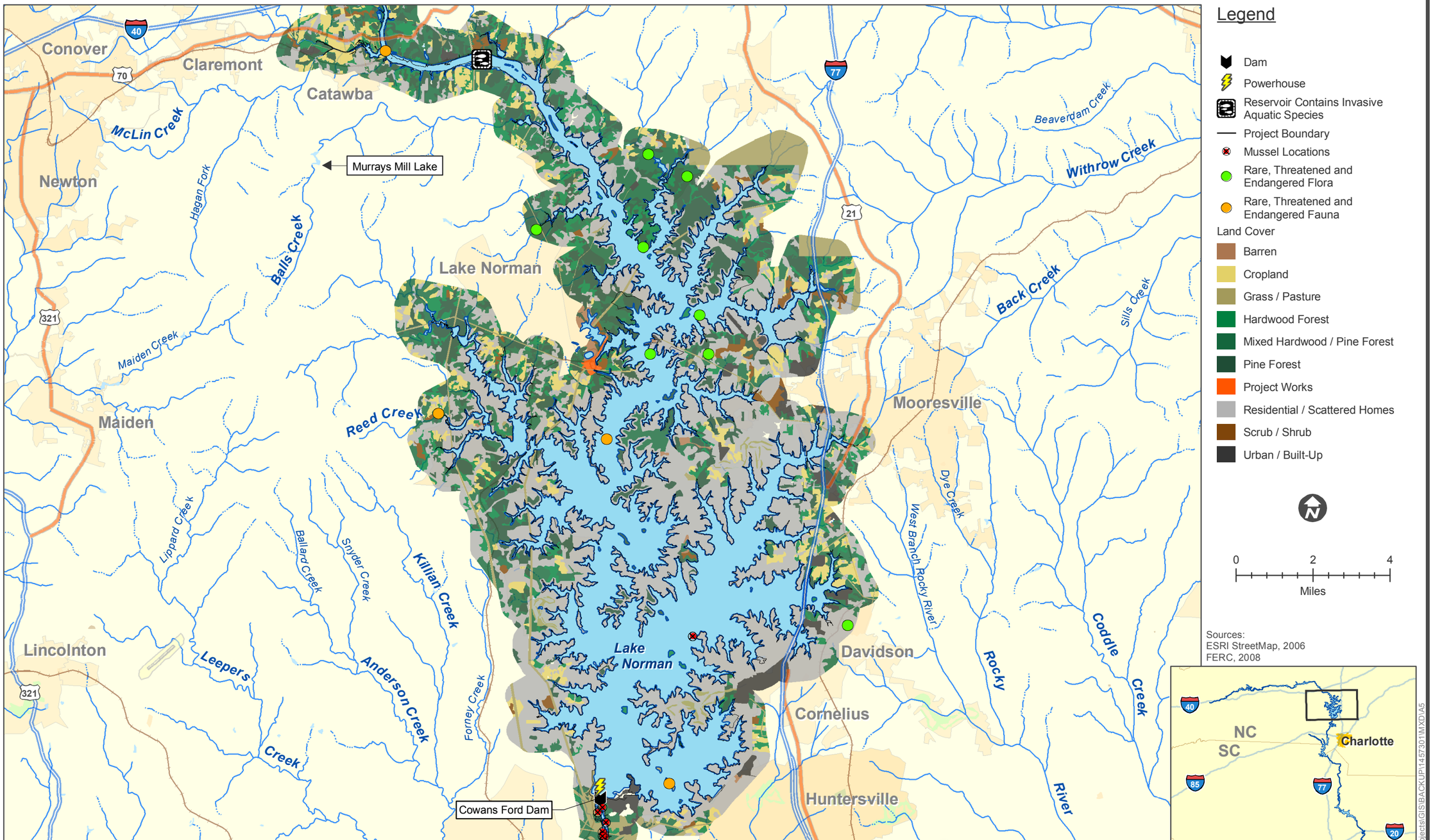

Figure A-5. Cowans Ford Development Project Area, Catawba River, Iredell and Catawba Counties, North Carolina

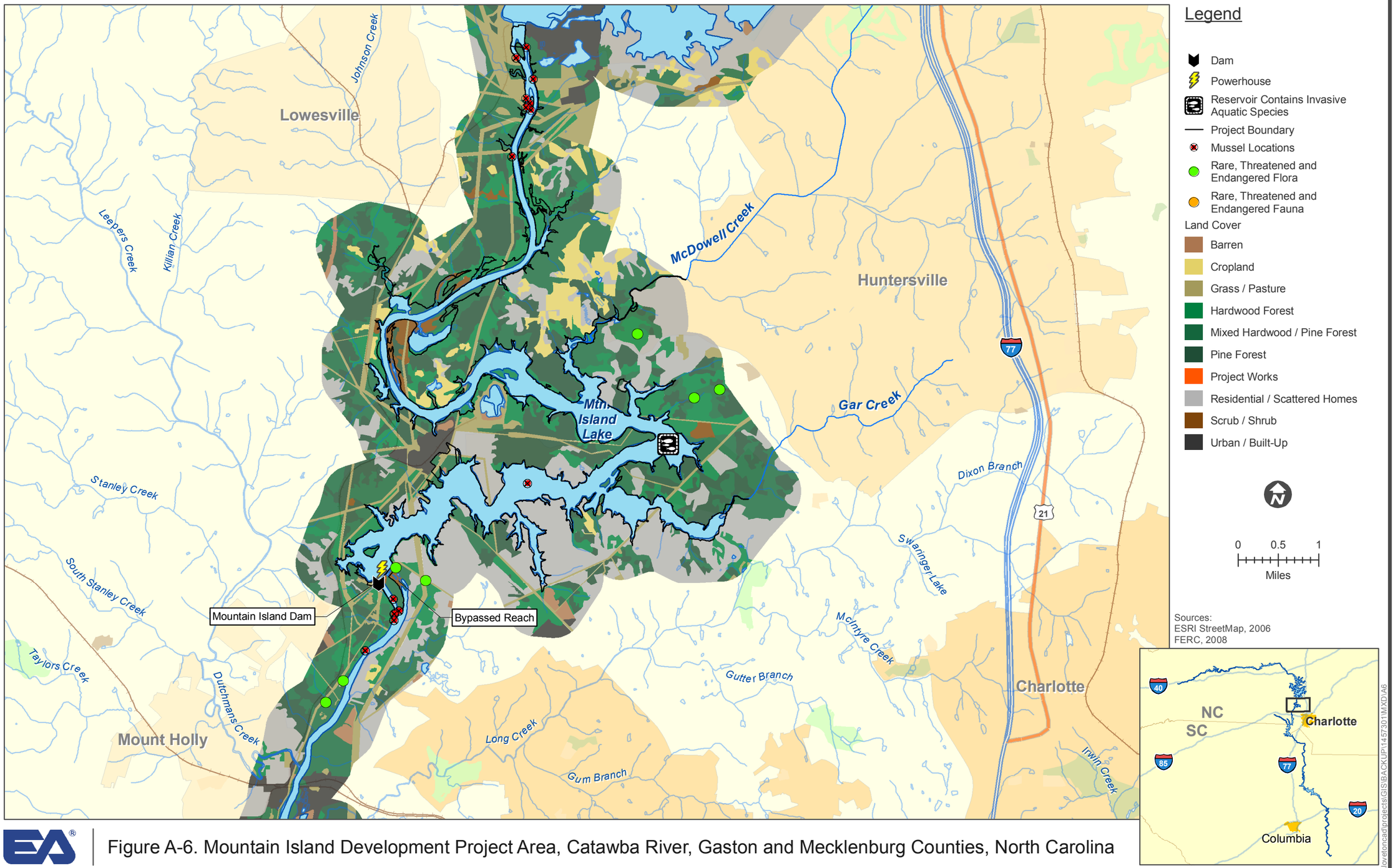

Figure A-6. Mountain Island Development Project Area, Catawba River, Gaston and Mecklenburg Counties, North Carolina

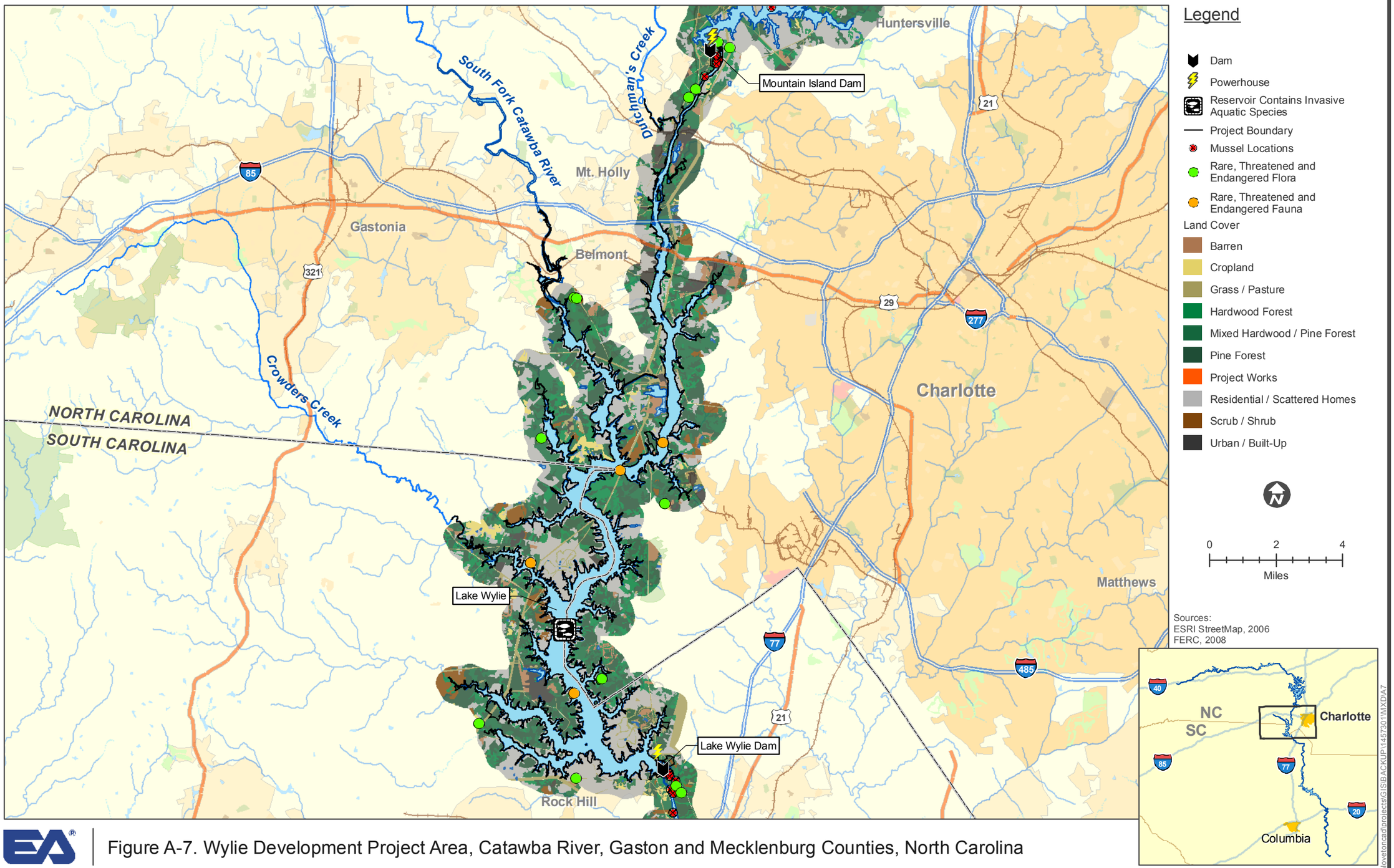

Figure A-7. Wylie Development Project Area, Catawba River, Gaston and Mecklenburg Counties, North Carolina

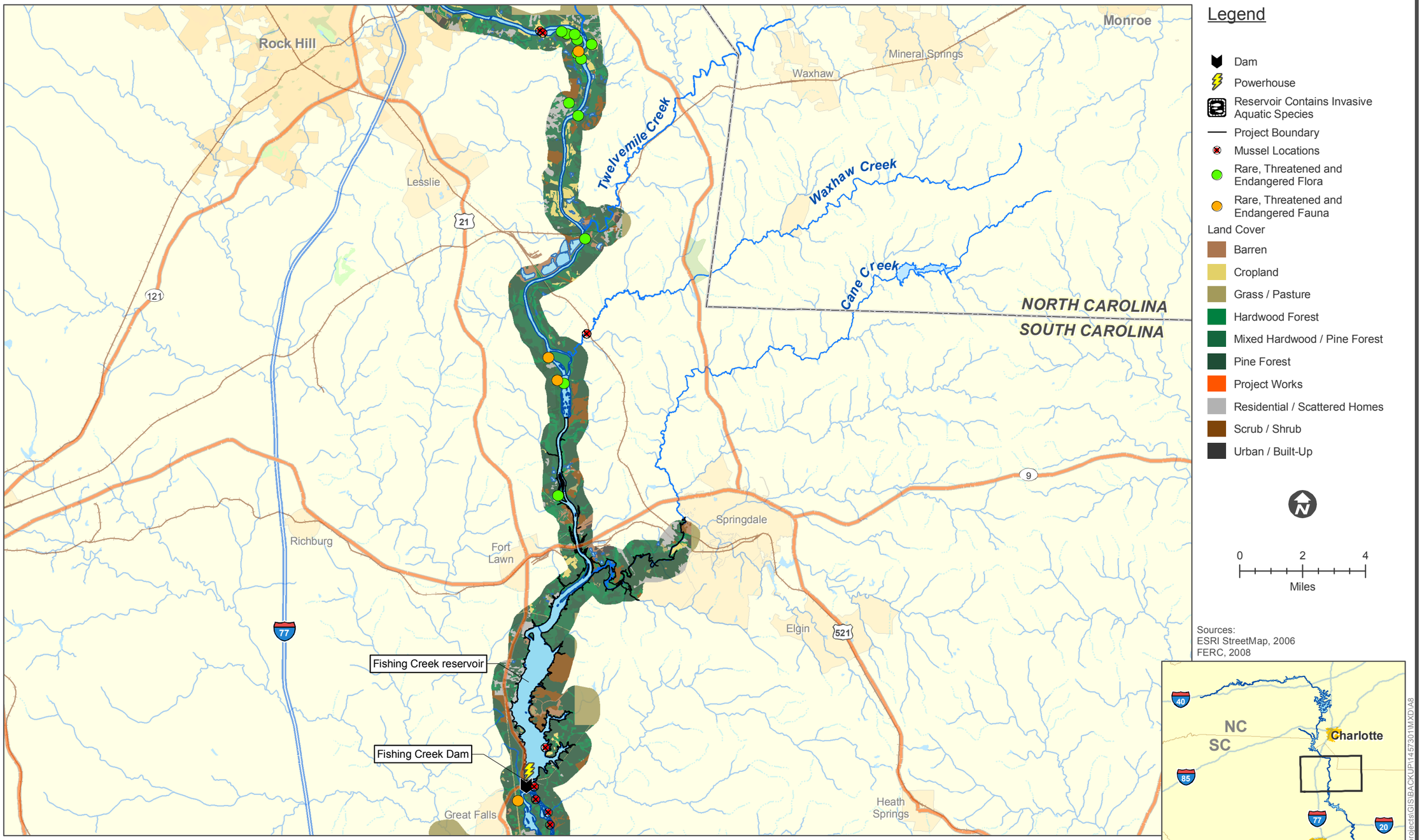

Figure A-8. Fishing Creek Development Project Area, Catawba River, York, Chester, and Lancaster Counties, South Carolina

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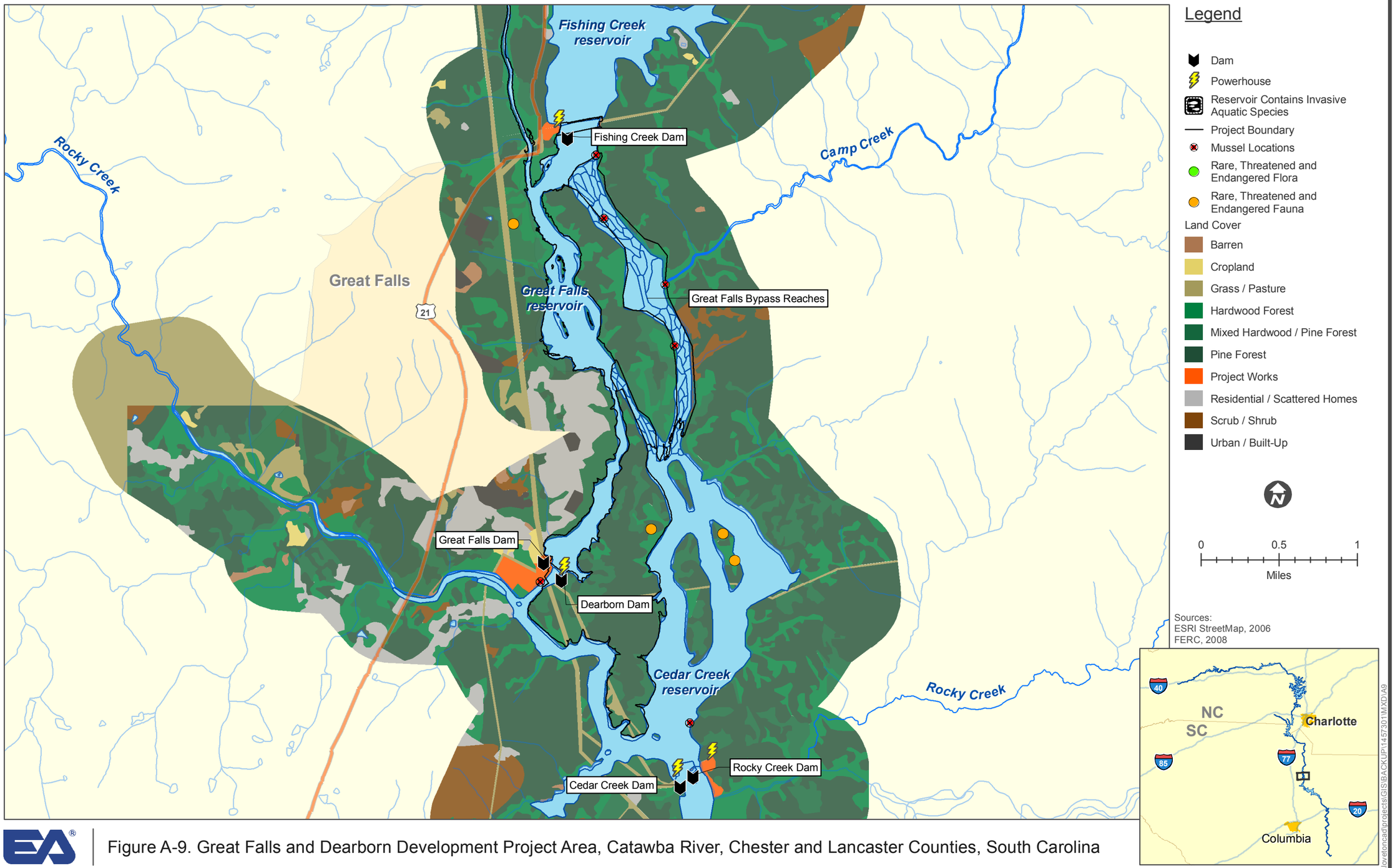

Figure A-9. Great Falls and Dearborn Development Project Area, Catawba River, Chester and Lancaster Counties, South Carolina

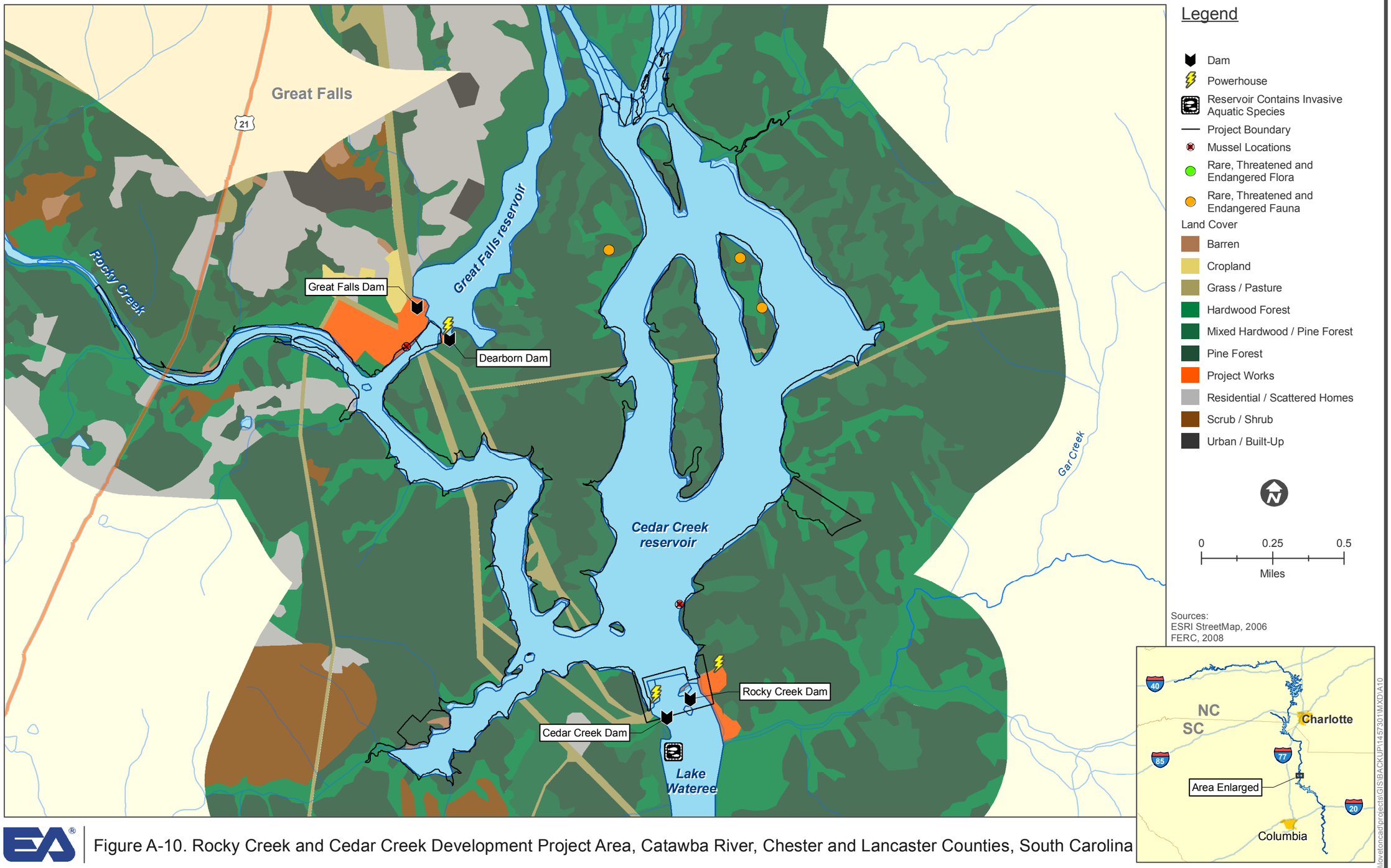

Figure A-10. Rocky Creek and Cedar Creek Development Project Area, Catawba River, Chester and Lancaster Counties, South Carolina

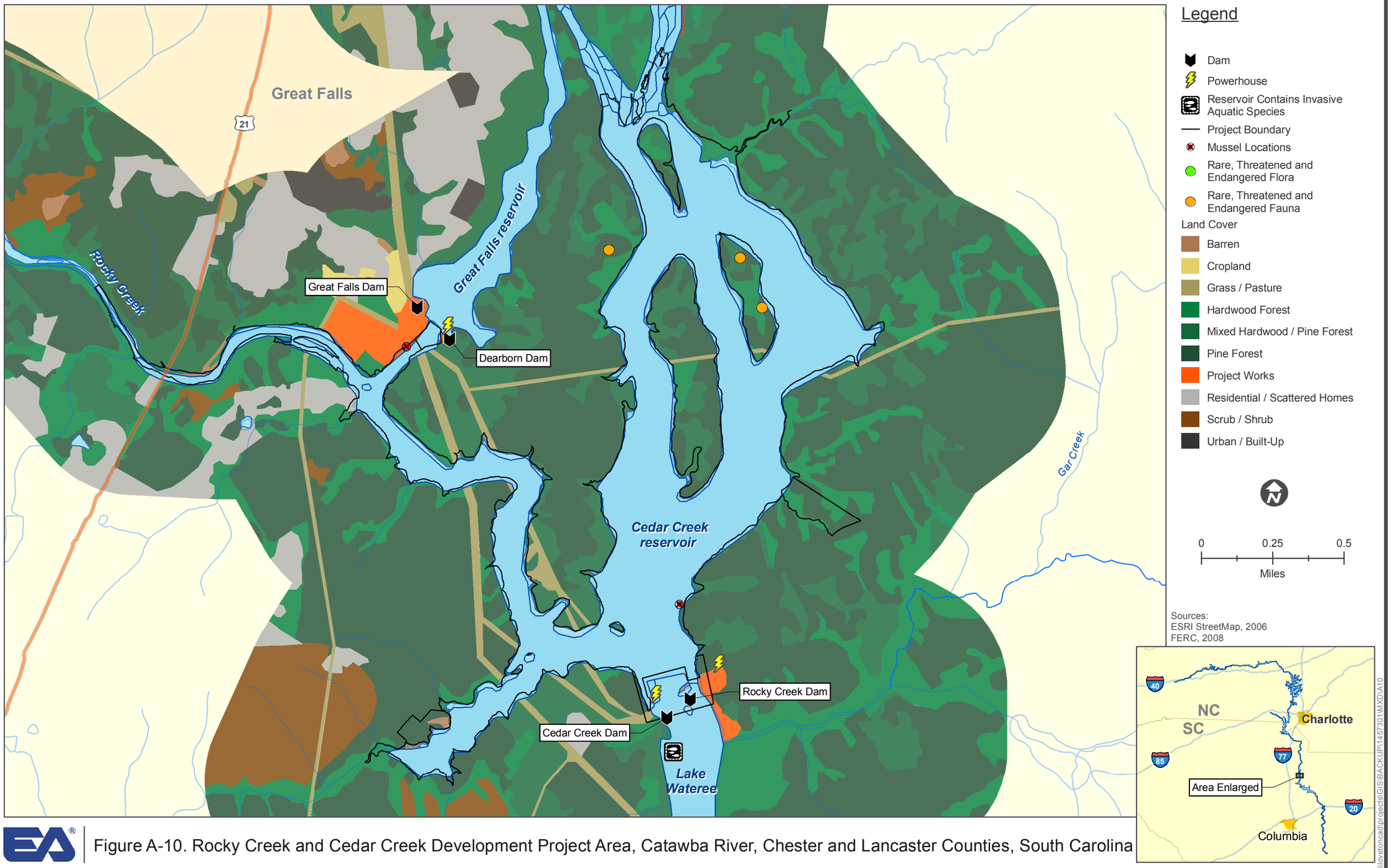

Figure A-10. Rocky Creek and Cedar Creek Development Project Area, Catawba River, Chester and Lancaster Counties, South Carolina

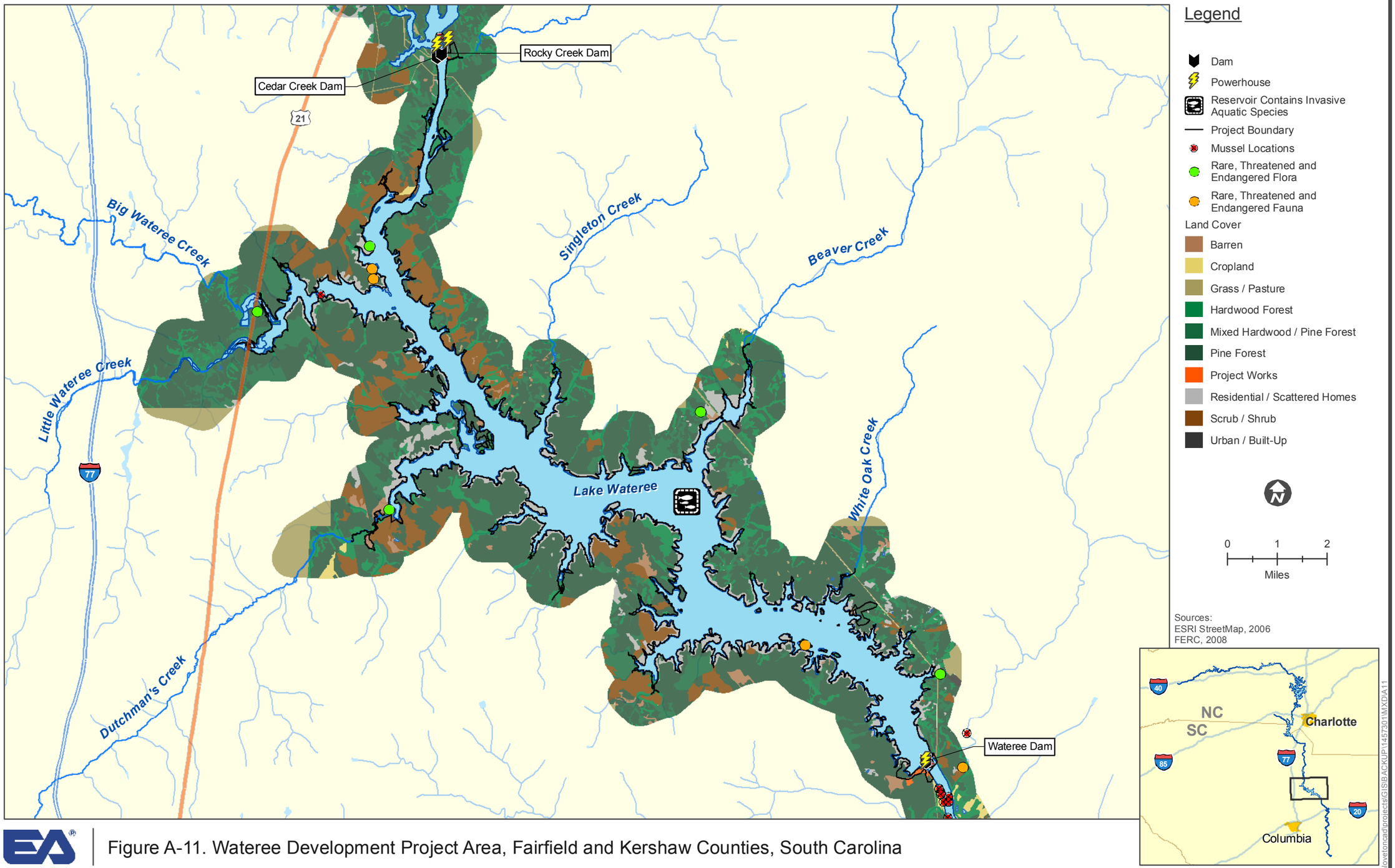

Figure A-11. Wateree Development Project Area, Fairfield and Kershaw Counties, South Carolina

APPENDIX B

HIGH-VALUE WETLANDS

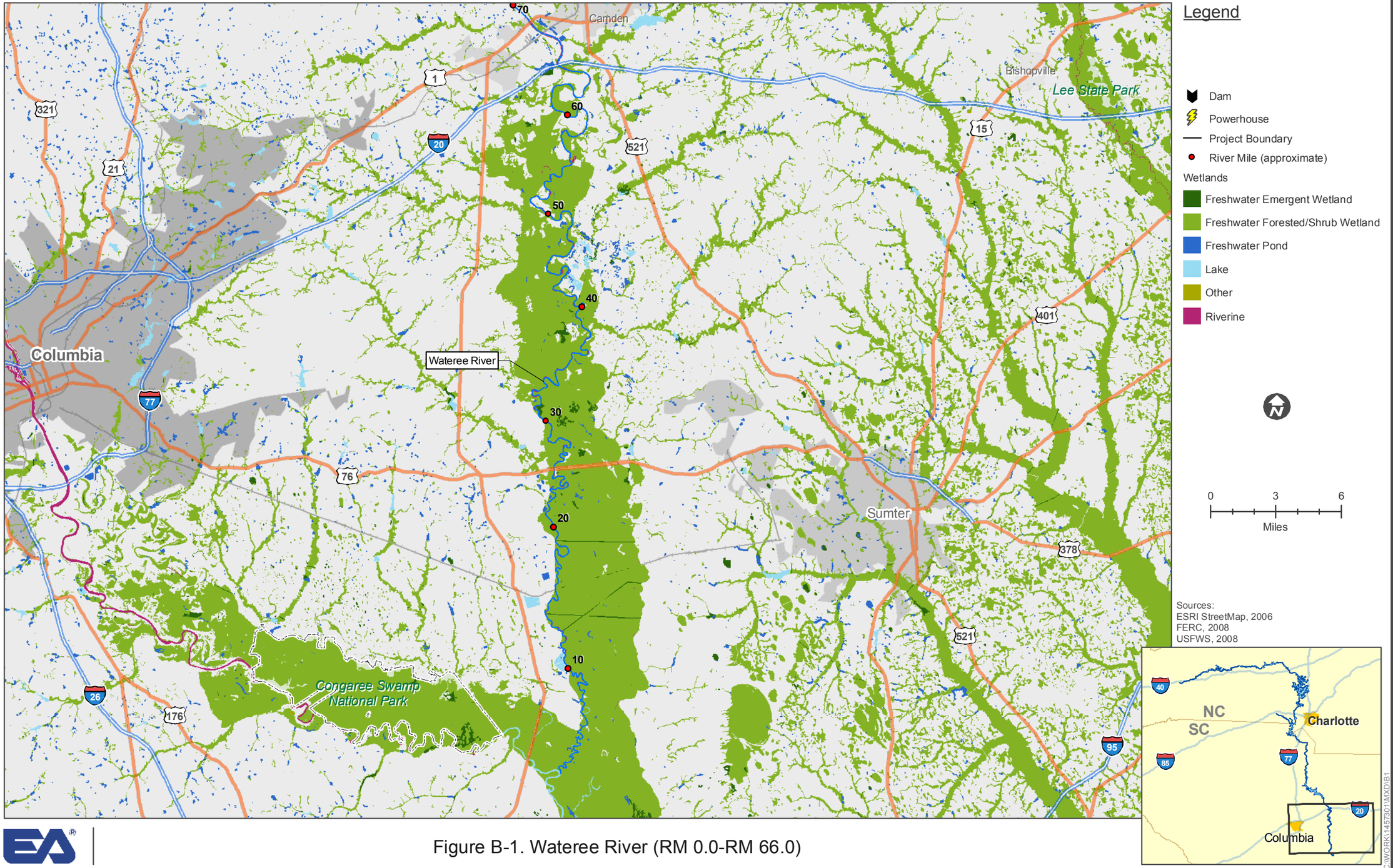

Figure B-1. Wateree River (RM 0.0-RM 66.0)

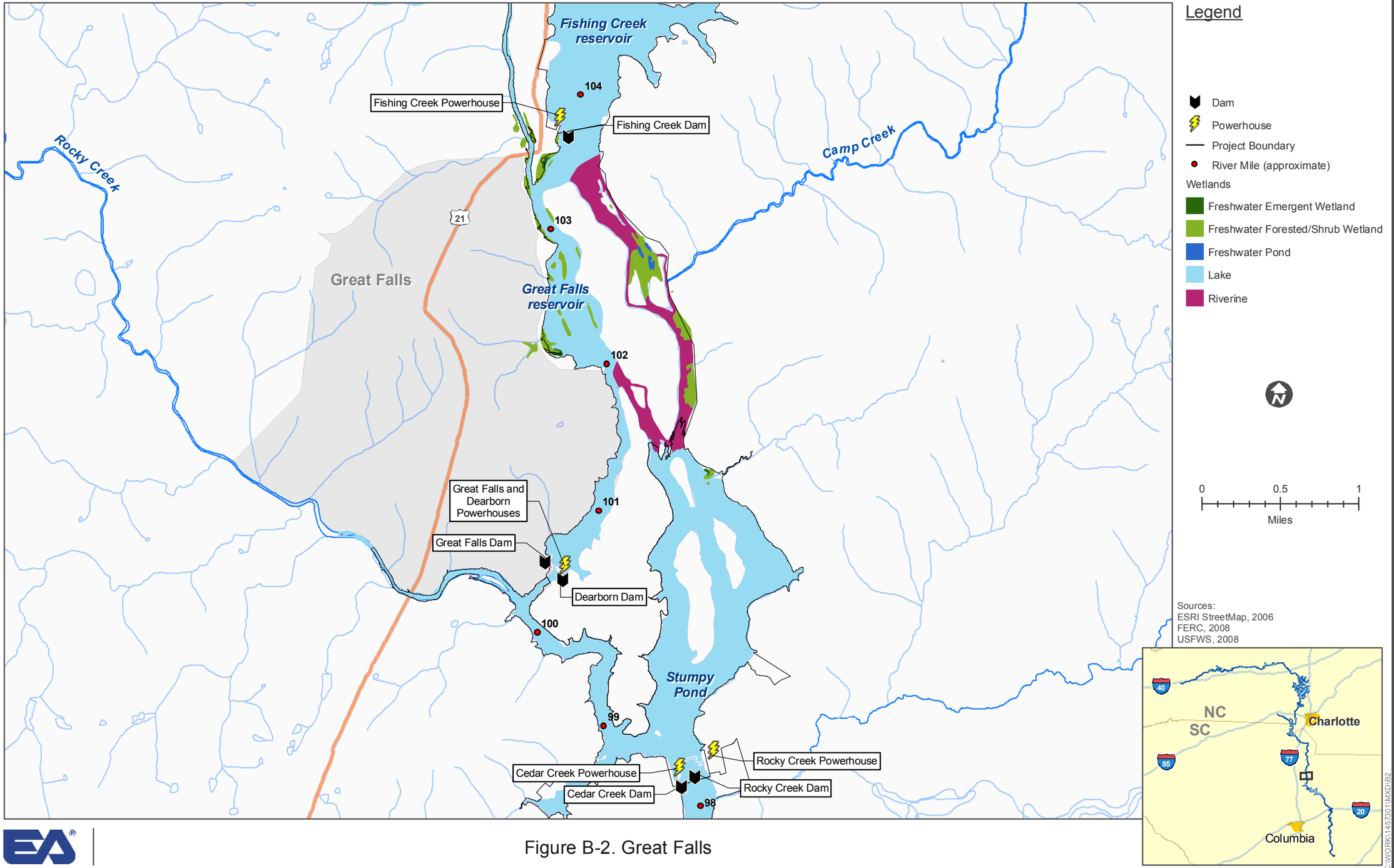

Figure B-2. Great Falls

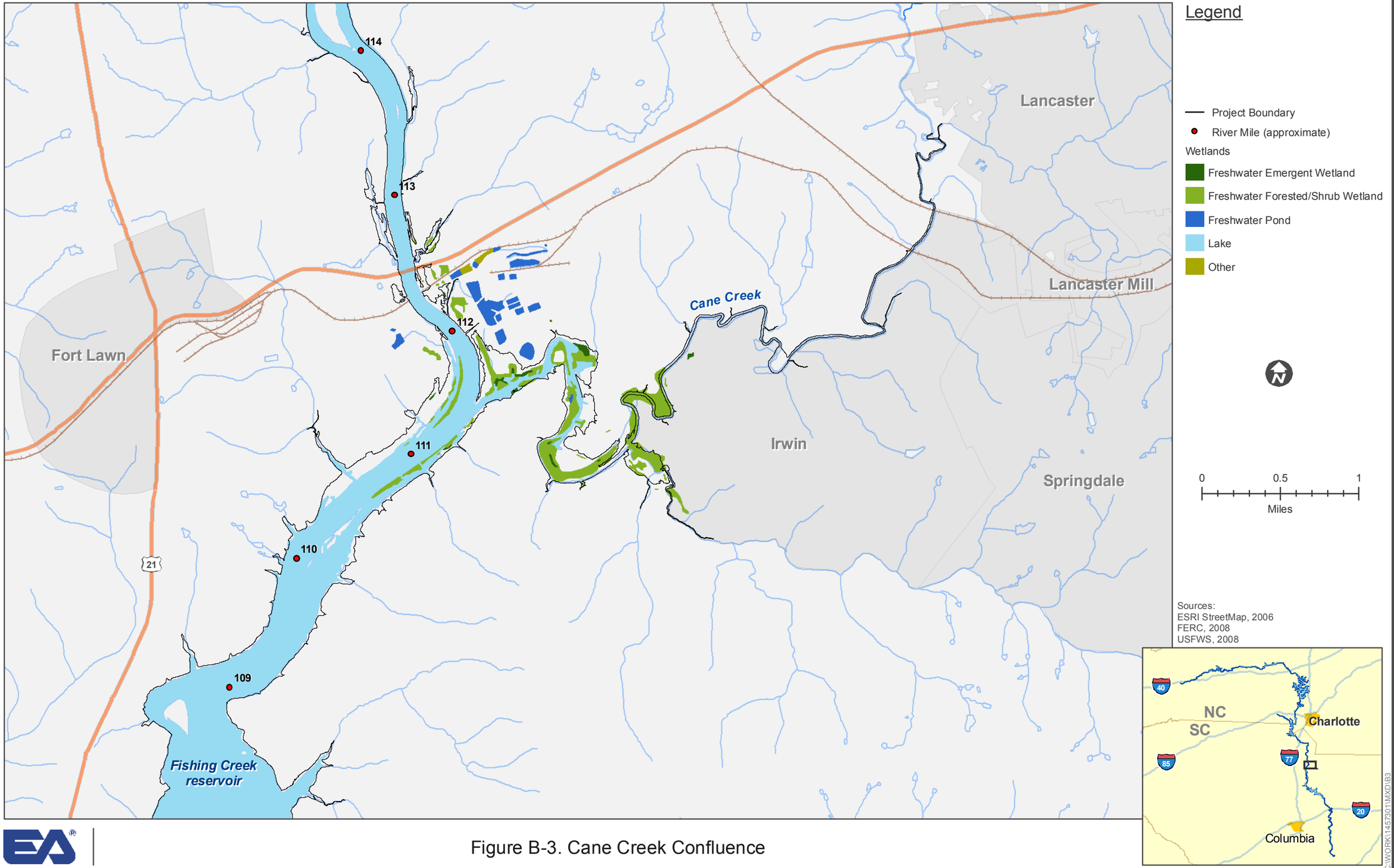

Figure B-3. Cane Creek Confluence

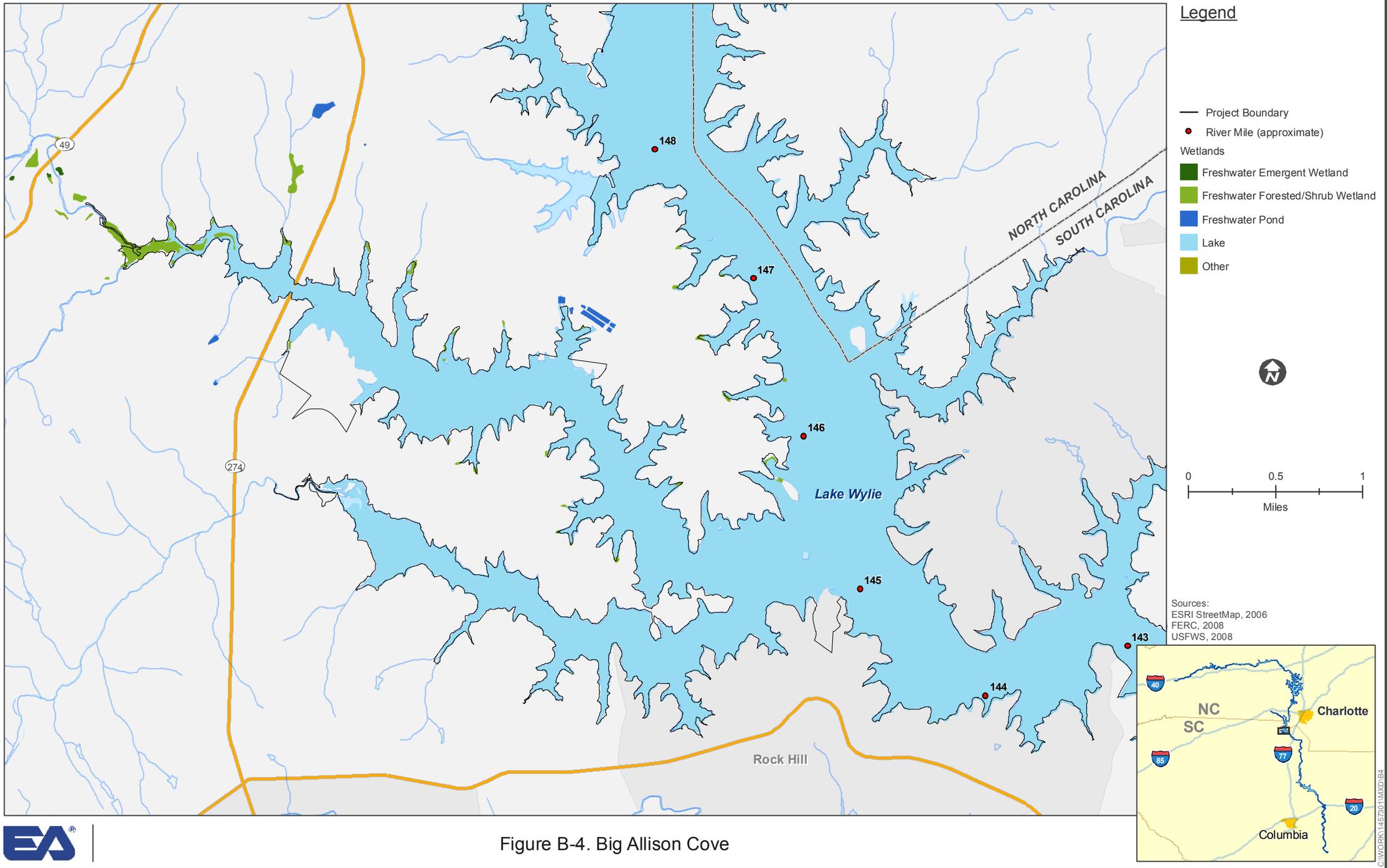

Figure B-4. Big Allison Cove

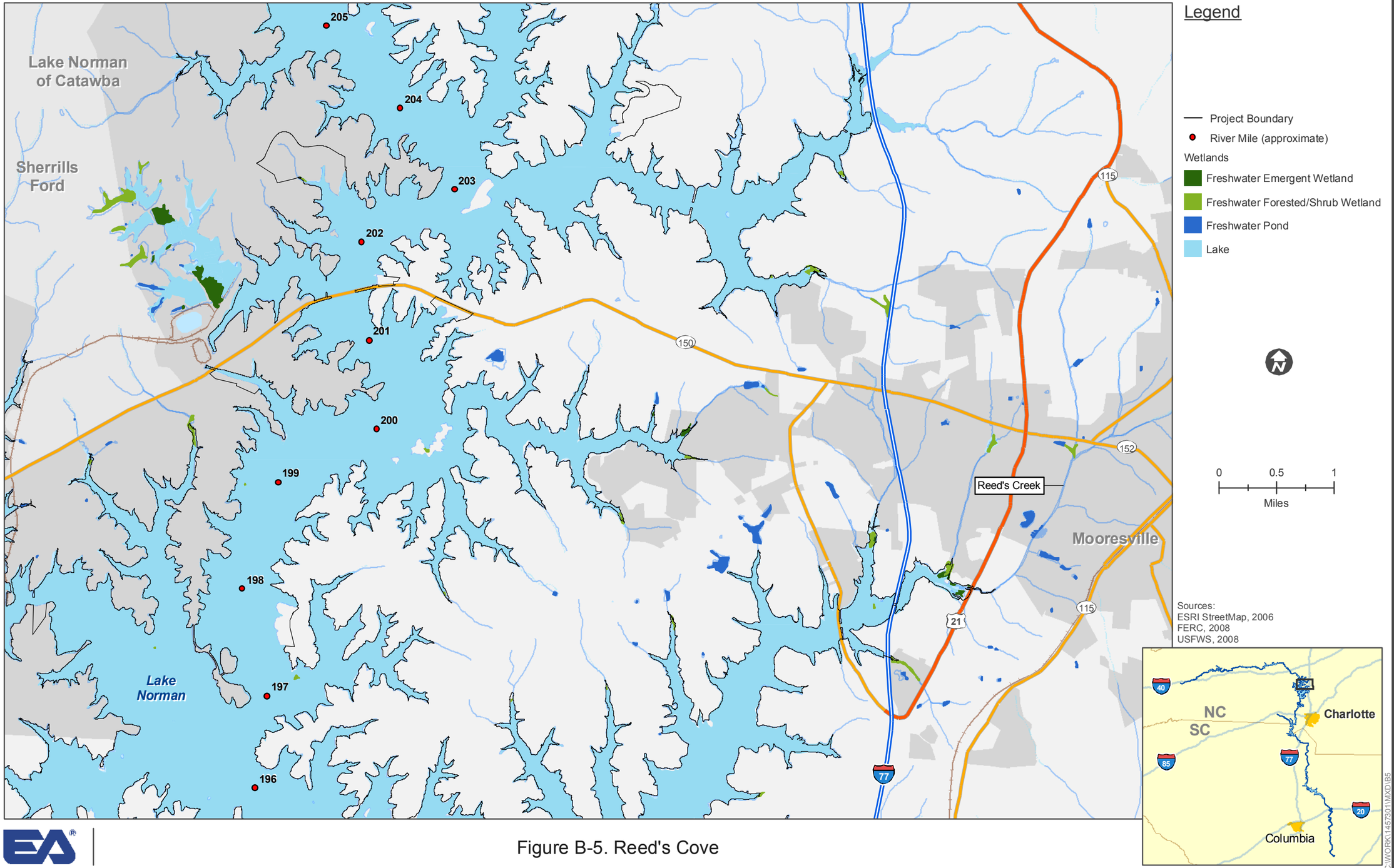

Figure B-5. Reed's Cove

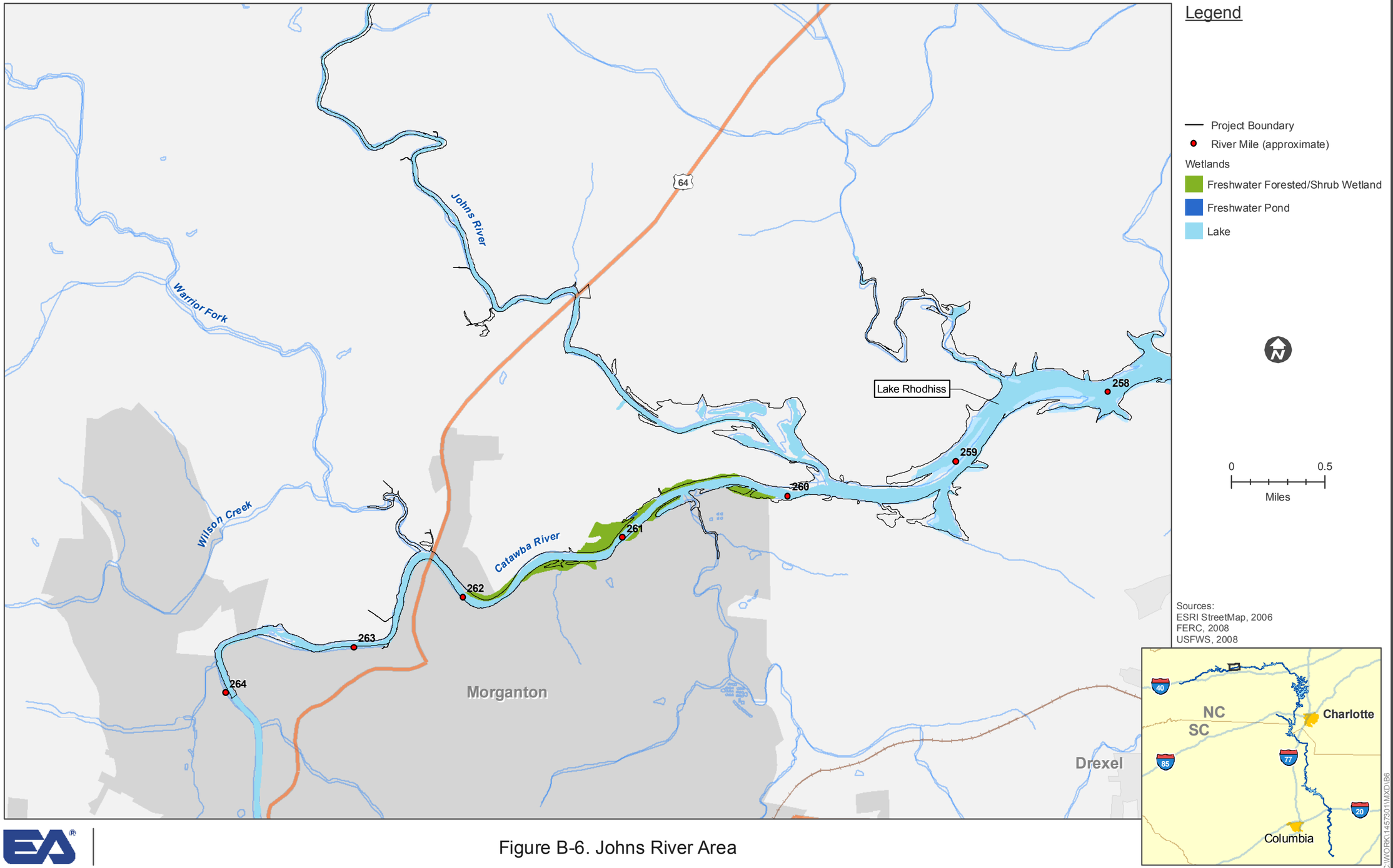

Figure B-6. Johns River Area

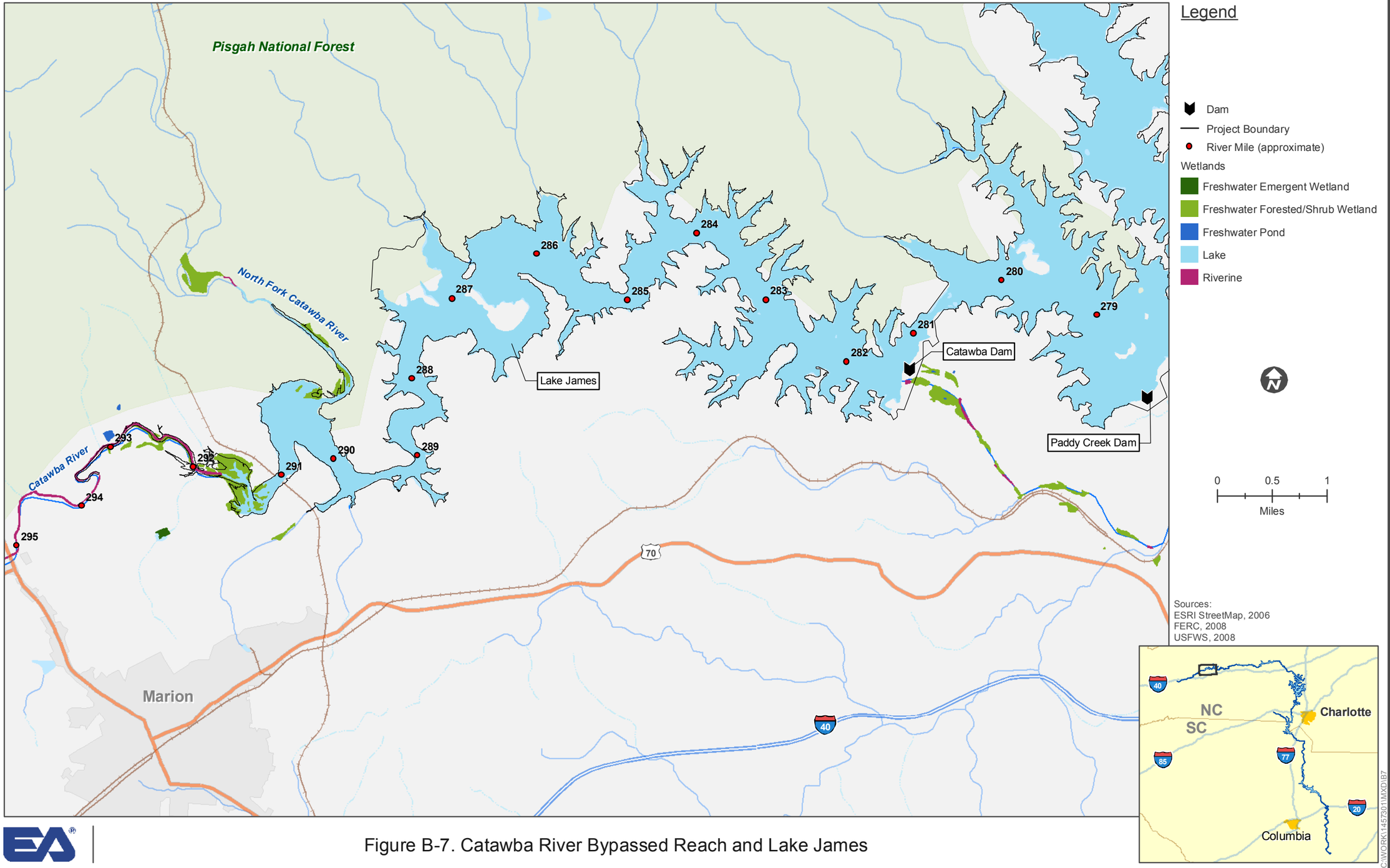

Figure B-7. Catawba River Bypassed Reach and Lake James

APPENDIX C

SOIL MAP UNIT DESCRIPTIONS

Types, composition, and erosion factors associated with the soils of the Catawba-Wateree developments.

Development	Soil map unit	Composition	Erosion factor (K_f)[1]
Bridgewater	Hayesville-Evard	41% Hayesville	0.28
		39% Evard	0.28
		20% soils of minor extent	NA
	Iotla-Braddock-Rosman-Potomac	31% Iotla	0.20
		16% Braddock	0.32
		13% Rosman	0.15
		11% Potomac	0.10
		29% soils of minor extent	NA
	Northcove-Lonon	50% Northcove	0.2
		33% Lonon	0.37
		17% soils of minor extent	NA
Rhodhiss	Cecil-Pacolet-Rion	40% Cecil	0.17
		40% Pacolet	0.20
		6% Rion	0.17
		14% soils of minor extent	NA
Oxford	Pacolet-Cecil	45% Pacolet	0.20
		35% Cecil	0.17
		20% soils of minor extent	NA
	Pacolet-Rion	72% Pacolet	0.20
		10 % Rion	0.17
		18% soils of minor extent	NA
	Hibriten-Bethlehem-Pacolet	44% Hibriten	0.17
		26% Bethlehem	0.20
		23% Pacolet	0.20
		7% soils of minor extent	NA
	Hiwassee-Cecil	30% Hiwassee	0.28
		30% Cecil	0.17
		40% soils of minor extent	NA
	Cecil	65% Cecil	0.17
		35% soils of minor extent	NA
Lookout Shoals	Pacolet-Cecil	45% Pacolet	0.20
		35% Cecil	0.17
		20% soils of minor extent	NA
	Hiwassee-Cecil	30% Hiwassee	0.28
		30% Cecil	0.17
		40% soils of minor extent	NA
	Lloyd-Cecil	43% Lloyd	0.28
		35% Cecil	0.17
		22% soils of minor extent	NA

Development	Soil map unit	Composition	Erosion factor (K_f)[1]
Cowans Ford	Pacolet-Cecil	45% Pacolet	0.20
		35% Cecil	0.17
		20% soils of minor extent	NA
	Lloyd-Cecil	43% Lloyd	0.28
		35% Cecil	0.17
		22% soils of minor extent	NA
	Cecil	65% Cecil	0.17
		35% soils of minor extent	NA
Mountain Island	Cecil	65% Cecil	0.17
		35% soils of minor extent	NA
	Wilkes-Enon	40% Wilkes	0.32
		30% Enon	0.32
		30% soils of minor extent	NA
	Iredell-Mecklenburg	40% Iredell	0.28
		35% Mecklenburg	0.24
		25% soils of minor extent	NA
	Gaston-Winnsboro-Cecil	70% Gaston	0.10
		9% Winnsboro	0.28
		8% Cecil	0.17
		13% soils of minor extent	NA
	Appling-Wedowee-Pacolet	47% Appling	0.20
		21% Wedowee	0.20
		20% Pacolet	0.20
		12% soils of minor extent	NA
	Monacan	80% Monacan	0.37
		20% soils of minor extent	NA
Wylie	Cecil	65% Cecil	0.17
		35% soils of minor extent	NA
	Cecil-Urban Land	38% Cecil	0.17
		30% Urban land	NA
		32% soils of minor extent	NA
	Cecil-Pacolet	30-50% Cecil	0.17
		25-30% Pacolet	0.20
		20-25% soils of minor extent	NA
	Cecil-Lloyd-Appling	50% Cecil	0.17
		50% Appling	0.20
	Gaston-Winnsboro-Cecil	70% Gaston	0.10
		9% Winnsboro	0.28
		8% Cecil	0.17
		13% soils of minor extent	NA
	Enon-Mecklenburg	75% Enon-Mecklenburg	0.32/ 0.24
		25% soils of minor extent	NA

Development	Soil map unit	Composition	Erosion factor (K_f)[1]
Wylie Regulated River Reach	Cecil-Davidson	64% Cecil	0.17
		7% Davidson	0.28
		29% soils of minor extent	NA
	Wedowee-Wilkes-Gullied Land	45% Wedowee	0.20
		24% Wilkes	0.32
		9% Gullied Land	NA
		22% soils of minor extent	NA
	Pacolet-Lockhart-Gullied Land	35% Pacolet	0.20
		30% Lockhart	0.20
		20% Gullied Land	NA
		5% soils of minor extent	NA
	Chewacla-Toccoa	55-60% Chewacla	0.28
		30-35% Toccoa	0.24
		10% soils of minor extent	NA
	Chewacla-Congaree-Wickham	Information not available	NA
Fishing Creek	Cecil-Pacolet-Appling	37-46% Cecil	0.17
		23-32% Pacolet	0.20
		6-8% Appling	0.20
		16-32% soils of minor extent	NA
	Cecil-Davidson	64% Cecil	0.17
		7% Davidson	0.28
		29% soils of minor extent	NA
	Chewacla-Toccoa	55-60% Chewacla	0.28
		30-35% Toccoa	0.24
		10% soils of minor extent	NA

Development	Soil map unit	Composition	Erosion factor (K_f)[1]
Great Falls-Dearborn	Cecil-Pacolet-Appling	37-46% Cecil	0.17
		23-32% Pacolet	0.20
		6-8% Appling	0.20
		16-32% soils of minor extent	NA
	Wedowee-Wilkes-Gullied Land	45% Wedowee	0.20
		24% Wilkes	0.32
		9% Gullied Land	NA
		22% soils of minor extent	NA
Rocky Creek-Cedar Creek	Cecil-Pacolet-Appling;	37-46% Cecil	0.17
		23-32% Pacolet	0.20
		6-8% Appling	0.20
		16-32% soils of minor extent	NA
	Cecil-Davidson	64% Cecil	0.17
		7% Davidson	0.28
		29% soils of minor extent	NA
	Wateree-Rion-Helena	39% Wateree	0.24
		28% Rion	0.17
		5% Helena	0.24
		28% soils of minor extent	NA
	Wedowee-Wilkes-Gullied Land	45% Wedowee	0.20
		24% Wilkes	0.32
		9% Gullied Land	NA
		22% soils of minor extent	NA
	Pacolet-Lockhart-Gullied Land	35% Pacolet	0.20
		30% Lockhart	0.20
		20% Gullied Land	NA
		15% soils of minor extent	NA

Development	Soil Map Unit	Composition	Erosion Factor (K_f)[1]
Wateree	Wateree-Rion-Helena	39% Wateree	0.24
		28% Rion	0.17
		5% Helena	0.24
		28% soils of minor extent	NA
	Wilkes-Winnsboro-Mecklenburg	51% Wilkes	0.32
		23% Winnsboro	0.28
		8% Mecklenburg	0.24
		18% soils of minor extent	NA
	Georgeville-Herndon	53% Georgeville	0.43
		21% Herndon	0.43
		26% soils of minor extent	NA
	Madison-Cecil-Pacolet	70% Madison	0.24
		19% Cecil	0.17
		5% Pacolet	0.20
		6% soils of minor extent	NA
	Pacolet-Lockhart-Gullied Land	35% Pacolet	0.2
		30% Lockhart	0.2
		20% Gullied Land	NA
		15% soils of minor extent	NA

Development	Soil Map Unit	Composition	Erosion Factor (K_f)[1]
Wateree Regulated River Reach	Nason-Georgeville-Herndon	15% Nason	0.49
		15% Georgeville	0.43
		13% Herndon	0.43
		57% soils of minor extent	NA
	Chewacla-Congaree	60% Chewacla	0.28
		25% Congaree	0.32
		15% soils of minor extent	NA
	Congaree-Tawcaw-Chastain	37% Congaree	0.32
		31% Tawcaw	0.28
		14% Chastain	0.32
		18% soils of minor extent	NA
	Chastain-Chewacla	75% Chastain-Chewacla	0.32/0.28
		25% soils of minor extent	NA

[1] Soil Erodibility K factors provided by Natural Resource Conservation Service (NRCS) Soils Data Mart (NRCS, 2008), and reflect the tendency for soils to both produce runoff and detach. Values greater than 0.4 are highly erodible.