Central Electric Power Cooperative, Inc.

McClellanville
115 kV Transmission Project

Supplemental Draft Environmental Impact Statement

Prepared for:

U.S. Department of Agriculture, Rural Utilities Service

Cooperating Agencies:

U.S. Army Corps of Engineers, Charleston District

U.S. Forest Service, Francis Marion National Forest

August 2019

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ACRONYMS AND ABBREVIATIONS

ACSR	aluminum conductor steel reinforced
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
ATV	all-terrain vehicle
Awendaw metering point	Existing point of Berkeley Electric Service from SCE&G
BA	biological assessment
Berkeley Electric	Berkeley Electric Cooperative, Inc.
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practices
Central Electric	Central Electric Power Cooperative Inc.
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel
Dominion	Dominion Energy
draft EIS	draft environmental impact statement
EIS	environmental impact statement
EMF	electric and magnetic fields
ESA	Endangered Species Act
°F	degree Fahrenheit
FEMA	Federal Emergency Management Agency
FMNF	Francis Marion National Forest
FR	Federal Register
GHG	greenhouse gas(es)
GIS	geographic information system

kV	kilovolt
kW	kilowatt
MBTA	Migratory Bird Treaty Act
McClellanville Project	McClellanville Transmission Project
McLCP	McClellanville Load Control Point
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969NFS National Forest System
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Services
NMFS	National Marine Fisheries Service
NO_x	nitrogen oxide
NO_2	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O_3	ozone
OPGW	optical ground wire
PA	Programmatic Agreement
PCB	polychlorinated biphenyls
$PM_{2.5}$	particles with a diameter less than or equal to a nominal 2.5 micrometers
PM_{10}	particles with a diameter less than or equal to a nominal 10 micrometers
Project	McClellanville Transmission Project
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
ROW	right(s)-of-way
RUS	U.S. Department of Agriculture, Rural Utilities Service
Santee Cooper	South Carolina Public Service Authority
SCC	Species of Conservation Concern
SCCN	state priority species
SCDHEC	South Carolina Department of Health and Environmental Control

SCDNR	South Carolina Department of Natural Resources
SCDOT	South Carolina Department of Transportation
SEIS	supplemental environmental impact statement
SGCN	state moderate priority species
SMS	Scenery Management System
SO_2	sulfur dioxide
SUP	special use permit
TCP	Traditional Cultural Properties
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Department of Agriculture, Forest Service
USFWS	U.S. Fish and Wildlife Service
WMA	Wildlife Management Area
WNS	White Nose Syndrome

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1.0 INTRODUCTION

This supplemental environmental impact statement (SEIS) to the April 2014 draft environmental impact statement (draft EIS) evaluates the potential environmental consequences of implementing the proposal by Central Electric Power Cooperative, Inc. (Central Electric), and Berkeley Electric Cooperative, Inc. (Berkeley Electric) to construct, operate, and maintain a new 115 kilovolt (kV) transmission line and accompanying substation (McClellanville Project or Project) near the town of McClellanville, South Carolina. An EIS, prepared in response to comments on the 2014 draft EIS, evaluates alternative transmission line origination points that resulted in two new potential corridors for consideration as part of the Project. The proposed Project would address system capacity, system reliability, and power quality issues resulting from the current use of the aging distribution line supplying electricity to Berkeley Electric. The proposed new transmission line solution could originate at one of three locations, resulting in a new transmission corridor to the McClellanville Substation. The three corridors—Charity, Belle Isle, or Jamestown—are analyzed in this SEIS. The existing distribution line would remain in place and be maintained as a backup supply source.

Central Electric is an electrical transmission cooperative located in Columbia, South Carolina. Central Electric serves 20 member distribution cooperatives throughout South Carolina, including Berkeley Electric, which has service areas located in Berkeley, Charleston, and Dorchester counties. This chapter presents an overview of the Project, including the circumstances that necessitated this SEIS; a description of the McClellanville Transmission Line and Substation, the purpose and need for the McClellanville Project; and the regulatory framework and authorizing actions that are pertinent to the McClellanville Project.

1.1 National Environmental Policy Act Requirements Met by this Supplemental Draft Environmental Impact Statement

The National Environmental Policy Act (NEPA) requires that agencies responsible for preparing environmental review documents provide the public with information about projects and offer the public the opportunity to identify important issues. The Council on Environmental Quality's (CEQ) regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508) stipulate that agencies shall prepare supplements to either draft or final environmental impact statements if: (1) the agency makes substantial changes in the proposed action that are relevant to environmental concerns; or (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts (40 CFR §1502.9[c]). The CFR for the U.S. Department of Agriculture (USDA), Rural Utilities Service (RUS), provides specific guidance for SEISs under 7 CFR §1970.155, *Supplementing EISs*. This guidance states that a supplement to a draft or final EIS will be announced, prepared, and circulated in the same manner (exclusive of meetings held during the scoping process) as a draft and final EIS (see 7 CFR 1970.154). In accordance with 7 CFR §1970.155(a), supplements to a draft or final EIS are to be prepared if:

1. There are substantial changes in the proposed action that are relevant to environmental concerns; or

2. Significant new circumstances or information pertaining to the proposal arise which are relevant to environmental concerns and the proposal or its impacts. RUS has prepared this SEIS to meet its requirements under NEPA and CEQ and RUS regulations.

1.2 Approach to Preparing the Supplemental Draft Environmental Impact Statement

The decision to prepare an SEIS was based on a variety of factors that resulted in substantial changes to the proposed action. These factors included the proposal made by Central Electric and the USDA, Forest Service (USFS), Francis Marion National Forest (FMNF), for new transmission routes; the promulgation of a new environmental regulation applicable to RUS (7 CFR Part 1970 – Environmental Policies and Procedures), which replaced the former 7 CFR Part 1794; issuance and implementation of the One Federal Decision Executive Order; publication of a new FMNF Forest Plan; and a new winter weather operating agreement between South Carolina Electric & Gas, now Dominion Energy (Dominion)[1] and Berkeley Electric to address load concerns during the winter months.

On March 2, 2016, Rural Development, a mission area within the USDA that includes RUS, published a regulation (7 CFR Part 1970) unifying and updating the environmental policies and procedures covering all Rural Development programs by consolidating and replacing two existing Rural Development regulations that implemented NEPA and other applicable environmental requirements. The regulations at 7 CFR Part 1970 supplement the CEQ regulations at 40 CFR Parts 1500-1508 and the Advisory Council on Historic Preservation, On August 15, 2017, the President signed Executive Order 13807, *Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects*. The Executive Order is geared toward obtaining more efficient and effective federal infrastructure decisions and changing the way the federal government processes environmental reviews and authorization decisions.

[1] Dominion Energy completed its purchase of South Carolina Electric & Gas in early 2019.

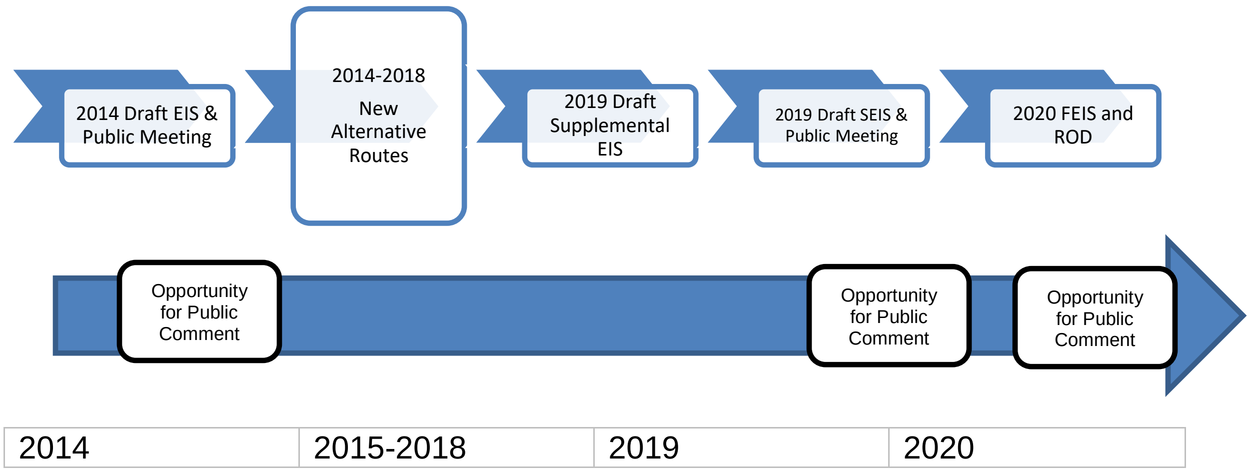
On March 31, 2017, FMNF issued a final Record of Decision approving the Revised Land Management Plan for FMNF, which was developed pursuant to the 2012 Forest Planning Rule that replaced the land management plan approved in 1996. The 2017 land management plan establishes a strong commitment to an all-lands approach and emphasizes restoring the longleaf pine, maintaining habitats for at-risk plants and animals, and providing social opportunities and economic benefits to both forest visitors and local communities in coastal South Carolina.

In January 2017, Dominion and Berkeley Electric entered into a winter weather operating agreement that sets criteria that when met, would restrict Berkeley Electric from taking electric service from the existing Awendaw metering point under cold conditions. Specifically, when temperatures are forecast to drop below 23 degrees F or when the signatories anticipate electrical demand may exceed 120 amps per phase for any reason, the signatories must switch operations on the distribution system to reduce electrical load at the McClellanville delivery point, which increases system exposure to faults and degrades reliability.

1.3 Timeline of Project Development

After the public and agency meetings for the draft EIS in June 2014, Central Electric evaluated the existing Project and coordinated with the FMNF concerning routing options and a need for a more detailed consideration of a Jamestown option. As part of these discussions, Central Electric re-evaluated engineering options, including a third option from the Commonwealth Substation area. Collectively, these alternatives led RUS to assist Central Electric in commissioning an independent engineer to evaluate alternative solutions to the transmission project including alternative transmission line corridors and non-transmission alternatives. RUS received the final Independent Engineering Study in February 2017. After evaluating the study, RUS and the FMNF developed four reasonable alternatives or corridor options, including options originating from the Belle Island Substation (as evaluated in the June 2014 draft EIS), Jamestown Substation, Charity Substation, and the Commonwealth Substation. The Commonwealth Substation option was dismissed as not meeting the purpose and need for the Project. To address the three corridor options, Central Electric commissioned biologists and archaeologists and finalized fieldwork during summer 2018 to develop the SEIS.

The chart below shows the next steps in the SEIS process with specific opportunities for public comment shown below the major milestones.



1.4 Federal Authorizations/Regulatory Framework

This section summarizes federal, state, and local laws, regulations, associated permits, approvals, and coordination applicable to the proposed Project. Table 1-1 summarizes the permits, regulations, or consultations and other required actions that would be necessary for the Project.

Table 1-1: Permits, Regulations, or Consultations Needed for Listed Agencies and Compliance Actions Associated with Project Approval.

Agency	Permit, Regulation, or Consultation	Agency Action
Rural Utilities Service	NEPA	• Review and approve NEPA documentation. • Ensure that all actions associated with the proposed Project are in compliance with applicable federal, state, and local regulations. • Decide whether to approve financing assistance for the Project. • Sign Record of Decision.
	7 CFR Part 1970 (Environmental Policies and Procedures)	• Consult with appropriate agencies to provide decision makers with information to ensure that decisions and actions are based on an understanding of environmental consequences.
	Executive Order 13807, *One Federal Decision*	• Ensure federal environmental review and permitting process for infrastructure projects is coordinated, predictable, and transparent.

Agency	Permit, Regulation, or Consultation	Agency Action
	Executive Order 11988, *Floodplain Management*	• Avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of flood plains.
	Executive Order 11990, *Protection of Wetlands*	• Ensure that short- and long-term impacts on wetlands are avoided where practical alternatives exist.
	Executive Order 13112, *Invasive Species*	• Do not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species in the United States. • Implement all feasible and prudent measures to minimize risk of harm from introduction or spread of invasive species.
U.S. Army Corps of Engineers (USACE)	Clean Water Act (CWA), Section 404	• Regulate and provide permits for the discharge of dredged or fill material in jurisdictional wetlands of waters of the United States.
	Rivers and Harbors Appropriation Act Section 10	• Regulate and provide permits for structures or work in, over, or otherwise affecting navigable waters of the United States.
U.S. Forest Service	Federal Land Policy and Management Act	• Implement operating plans. • Grant easement for the right-of-way (ROW) across lands within FMNF.
	National Forest Management Act	• Grant a special use permit (SUP) for location of transmission line under the Revised Land and Resources Management Plan for the FMNF.
	Executive Order 13007 Indian Sacred Sites on Federal Lands	• Avoid adverse effects to sacred sites. • Provide access to sacred sites to Native Americans for religious practices.
U.S. Fish and Wildlife Service/National Marine Fisheries Service	Endangered Species Act Section 7	• Avoid/minimize impacts to threatened and endangered species and critical habitat. • Participate in Section 7 consultation. • Review the biological assessment. • Provide a biological opinion, if necessary.

Agency	Permit, Regulation, or Consultation	Agency Action
	Migratory Bird Treaty Act	• Avoid/minimize impacts to migratory birds and habitat.
	Bald and Golden Eagle Protection Act	• In accordance with the permitting program established by the Division of Migratory Bird Management, if activities require the removal or relocation of an eagle nest, a permit is required from the Regional Bird Permitting Office.
	Fish and Wildlife Conservation Act	• Ensure that mitigation measures conserve wildlife and wildlife habitat.
	Fish and Wildlife Coordination Act	• In coordination with South Carolina Department of Natural Resources (SCDNR), provide consultation if it is determined that the proposed Project would affect water resources.
	CWA, Section 404	• Work with USACE and the U.S. Environmental Protection Agency (USEPA) to ensure regulation of discharge of dredged or fill material in jurisdictional wetlands of water of the United States.
	National Invasive Species Act	• Prevent the introduction and spread of nonnative invasive species as a result of Project activities.
	Magnuson-Stevens Fishery Conservation and Management Act	• Provide consultation if the Project may adversely affect Essential Fish Habitat.
USDA-Natural Resources Conservation Service	Farmland Protection Policy Act	• Identify and quantify adverse impacts that the Project may have on farmlands. • Minimize contribution to the unnecessary and irreversible conversion of agricultural land to non- agricultural uses.
	Farmland Conversion Impact Rating	• Provide consultation to minimize farmland conversion impacts. • Issue an Impact Rating.
Department of Transportation, Federal Highway Administration	Encroachment Permits	• Issue road crossing permits. • Issue state highway crossing permits; Issue state utility occupancy permits.
U.S. Department of Labor	Occupational Safety and Health Act	• Ensure that Occupational Health and Safety Administration standards are met during the construction,

Agency	Permit, Regulation, or Consultation	Agency Action
		maintenance, and operation of the proposed Project.
Federal Aviation Administration	Determination of No Hazard to Air Navigation	• Issue a determination stating whether the proposed Project would be a hazard to air navigation.
USEPA	NEPA	• Provide NEPA document review and rating.
	Federal Insecticide, Fungicide, and Rodenticide Act	• Ensure that the use of insecticides, fungicides, and rodenticides is done in compliance with federal Insecticide, Fungicide, and Rodenticide Act regulations.
	Pollution Prevention Act	• Ensure that the Project is designed to comply with national policies for waste management and pollution control.
	Resource Conservation and Recovery Act	• Ensure that the treatment, storage, and disposal of hazardous wastes associated with the Project would be handled in accordance with Resource Conservation and Recovery Act regulations.
	Noise Control Act	• Ensure that the Project is designed in a manner that furthers the national policy of promoting an environment free from noise that may jeopardize health and welfare.
	Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	• Identify and address disproportionately high and adverse human health or environmental effects on minority populations and low-income populations.
SCDNR Wildlife and Freshwater Fisheries Biology & Management	Special use permit	• Issue permit for crossing state wildlife management area.
	State-listed species of concern	• Consultation and approval regarding state-listed species of concern.
	Non-native invasive plants	• Consultation regarding non-native invasive plants.
	Fish and Wildlife Coordination Act	• In coordination with the U.S. Fish and Wildlife Service (USFWS), provide consultation if it is determined that the proposed Project would affect water resources.
South Carolina Department of Health and Environmental Control	SCDHEC Rule 19-450: Permits for Construction in Navigable Waters	• Issue permit from construction in navigable waters.

Agency	Permit, Regulation, or Consultation	Agency Action
(SCDHEC) Environmental Quality Control Regions		
South Carolina Department of Archives and History	National Historic Preservation Act (NHPA) Section 106	• Participate in Section 106 consultation with RUS (as lead agency) and other consulting parties.
SCDHEC, Division of Water Quality	Federal Water Pollution Control Act of 1972 (Public Law 92-500), as amended by the CWA of 1977 (Public Law 95-217), as amended by the Water Quality Control Act of 1987 (Public Law 100-4). [United States Code (USC) §§1251 et seq.], the Pollution Control Act (South Carolina Code of Laws, 1976, Title 48, Chapter 1)	• Ensure that the applicant has a Storm Water Pollution Prevention Plan as required under the South Carolina Pollutant Discharge Elimination System.
SCDHEC, Bureau of Water	South Carolina Coastal Management Act of 1977 and Federal Coastal Zone Management Act	• Coastal Zone Consistency certification.
South Carolina Department of Highways and Public Transportation	Encroachment Permits	• Issue road crossing permits. • Issue state highway crossing permits. • Issue state utility occupancy permits.
Berkeley, Charleston, and Georgetown Counties	Local Issuing Authority for National Pollutant Discharge Elimination System and Storm water Pollution Prevention Plan permit	• Issue Storm water Pollution Prevention Plan permits.

1.5 Decision Framework

1.5.1 Federal Actions to Be Made Based on This Analysis

1.5.1.1 U.S. Forest Service

All of the proposed corridors cross a portion of the FMNF. Table 1-2 summarizes the amount of right-of-way (ROW) and length of line that would cross FMNF lands. USFS has primary responsibility to issue special use authorizations for ROWs on National Forest System (NFS) lands under the Federal Land Policy Management Act. USFS will use this analysis to make a decision related to the approval of any special use permit (SUP) application submitted by Central Electric to construct, maintain, and operate a transmission line through lands administered by USFS on the FMNF.

Table 1-2: Project Right-of-Way and Length across U.S. Forest Service lands

Route	ROW on USFS Lands (acres)	Route Length on USFS Lands (miles)	% of Total Route
Belle Isle B	8.0	1.2	7.2%
Belle Isle C	0.3	0.03	0.2%
Jamestown	119.4	17.7	68.6%
Charity	56.3	21.6	69.9%

The FMNF Forest Supervisor will issue a decision on whether or to authorize an SUP to Central Electric if the Project crosses NFS lands. The USFS proposed action is to authorize and subsequently issue an SUP with terms and conditions for the construction, maintenance, and operation of the proposed Project through lands administered by USFS on the FMNF.

1.5.1.2 Rural Utilities Services

RUS is authorized to make loans and loan guarantees to finance the construction of electric distribution, transmission, and generation facilities, including system improvements and replacements required to furnish and improve electric service in rural areas, demand side management, energy conservation programs, and on-grid and off-grid renewable energy systems. Central Electric is preparing to apply for financing assistance from RUS for the proposed Project's 115 kV transmission line. Financing for the purchase of the McClellanville Substation property was requested separately by Berkeley Electric and approved in 2003 prior to the initiation of the proposed transmission line. RUS's proposed federal action is to decide whether to provide financing assistance for the Project. Completing the NEPA process and addressing other technical and financial considerations are requirements for processing Central Electric's forthcoming application.

The Rural Electrification Act of 1936, as amended (7 United States Code [USC] §§901 et seq.), generally authorizes the Secretary of Agriculture to make rural electrification and telecommunication loans, including specifying eligible borrowers, references, purposes, terms and conditions, and security requirements. RUS's agency actions include:

- Providing independent engineering reviews of the purpose and need, engineering feasibility, and cost of the proposed Project;
- Ensuring that the proposed Project meets the borrower's requirements and prudent utility practices;

- Evaluating the financial ability of the borrower to repay its potential financial obligations to RUS;
- Reviewing and studying the alternatives to mitigate and improve transmission reliability issues;
- Ensuring that adequate transmission service and capacity are available to meet the proposed Project needs; and
- Ensuring that NEPA and other environmental requirements and RUS environmental policies and procedures are satisfied prior to taking a federal action.

RUS's decision regarding a request for financing assistance will be informed by the environmental analysis detailed in this SEIS and RUS's technical concurrence or rejection of a project's need and/or applicant's selection of an electrical solution. Based on a project's need and proposed electrical solution that receives technical approval from RUS's engineering staff, the program applicant proposes the corridors(s) or locations, which are then evaluated by RUS. Program applicants typically propose and study multiple corridor options. Because of planning and lead time, utilities may work to obtain easement agreements in advance. Disputes over the wording of an easement agreement are subject to state law, because **RUS does not regulate the siting of utility infrastructure, which includes transmission lines**. After the conclusion of RUS's review processes, Central Electric may acquire easements through eminent domain proceedings with a court determining compensation under state law. This factor is outside the purview of RUS's NEPA process but may be considered by RUS decision-makers when making a financial assistance decision.

This SEIS serves as a detailed written record of the environmental analysis completed for the proposed Project and is intended to provide Agency officials with sufficient information to make a decision regarding the significance of the environmental impacts of its potential federal action. Publication of this SEIS is **not** a decision on a financial assistance application by RUS and therefore not an approval of the expenditure of federal funds. The decision to provide financial assistance is subject to the availability of loan funds for the designated purpose in RUS's budget and may occur after the conclusion of the agency's NEPA process through issuance of a Record of Decision.

1.5.1.3 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) has primary responsibility to issue permits for work in, over, or otherwise affecting navigable waters of the United States as defined at 33 CFR §322.2 and in authorization responsibility for applicants to discharge dredged or fill material into jurisdictional wetlands (defined under 33 CFR §323.3). USACE could use this analysis to make any decisions related to the issuance of a Section 10 permit under the Rivers and Harbors Act of 1899 (33 USC §403) or a Section 404 permit under the Clean Water Act (CWA) (33 USC §1251 et seq. Section 10 or 404 permit applications, if needed, would be submitted to USACE once final design of the Project is completed. USACE, Charleston District Regulatory Division, would process permit applications.

1.6 Public Involvement for the Draft EIS (2014)

This section provides an overview of past public involvement efforts completed for the draft EIS originally issued in 2014. For the reasons detailed in Section 1.2 of this SEIS, RUS and the cooperating agencies will conduct additional public and agency meetings, which will coincide with publication of this SEIS.

1.6.1 Past Agency Coordination

In accordance with §1501.7 and 1508.22 of the CEQ regulations, RUS published a Notice of Intent in the *Federal Register* on September 17, 2010, to hold a public scoping meeting and prepare an EIS. In addition to the *Federal Register* notice, RUS notified federal, state, and local agency representatives about the proposed Project by mail and invited them to attend an agency scoping meeting. A list of federally recognized tribes near the Project area was compiled, and tribal leaders and Tribal Historic Preservation Officers were also notified by mail and invited to attend the agency scoping meeting.

An agency scoping meeting was held on September 29, 2010, at the Sewee Visitor and Environmental Education Center, 5821 Highway 17 North, Awendaw, South Carolina 29429. Fifteen agency participants, representing USFS, South Carolina Department of Natural Resources (SCDNR), U.S. Fish and Wildlife Service (USFWS), South Carolina Forestry Commission, and the Town of McClellanville, attended the meeting. No representatives of federally recognized tribes attended; however, representatives of the Catawba Indian Nation requested to be a consulting party under Section 106 of the National Historic Preservation Act (NHPA), and the Eastern Shawnee Tribe requested to be informed if cultural materials are encountered as the Project progresses

1.6.2 Past Public Scoping Meetings

The purpose of the public participation process was to gain input about any potential concerns and identify issues that need to be addressed in the EIS. During this public participation scoping process, contact was made with federal agencies, tribal representatives, state agencies, local officials, and the general public. More detail about public participation can be found in the McClellanville 115 kV Transmission Project Scoping Report (RUS 2011a) and Scoping Addendum (RUS 2011b).

Scoping was previously conducted for the initial draft EIS from December 2005 to January 2006. A public scoping open house meeting was held on December 14, 2005, and the public was notified of this event by letter and by radio and newspaper announcements. Nearly 200 people, mostly local residents, attended the open house.

After the first scoping meeting in 2005, RUS decided to re-scope the Project because of a change in the need to prepare an EIS, changes in potential transmission line routes/corridors, and changes in updated planning documents (the Alternatives Evaluation Study and Macro-Corridor Study), which incorporated new and updated data.

Letters, public service announcements, and newspaper advertisements announcing the proposed Project and the scoping meeting location and times were distributed prior to the public scoping meetings. One meeting was conducted at the St. James-Santee Elementary School in McClellanville, South Carolina, on September 29, 2010.

1.6.3 Public Review of the 2014 Draft Environmental Impact Statement

1.6.3.1 Public Comment

On May 9, 2014, RUS published the draft EIS for the proposed Project and conducted a public meeting regarding the draft EIS on June 3, 2014, at St. James-Santee Elementary School in McClellanville, South Carolina. RUS held a meeting about cultural resources for the purpose of consultation under Section 106 of the NHPA on the morning of June 4, 2014; in the afternoon of the same day, RUS held a meeting with interested and cooperating agencies to solicit comments on the draft EIS. Comments on the draft EIS were due by June 23, 2014, and RUS received comments from the U.S. Environmental Protection Agency (USEPA), USACE, National Marine Fisheries Service (NMFS), USFWS, SCDNR, South Carolina Fish, Game and Forestry Committee, Coastal Conservation League, Ducks Unlimited, Historic Charleston Foundation, South Carolina Audubon Society, Avian Conservation Center (Center for Birds of Prey), South Carolina Chapter of the Wildlife Society, South Carolina Waterfowl Association, Cape Romain Bird Observatory, Lowcountry Open Land Trust, The Nature Conservancy, St. James-Santee Restoration and Preservation Committee, Evening Post Industries, White Oak Forestry Company, and 197 individuals.

The primary environmental issues associated with the proposed Project are the effects of the proposed Project's construction and operation on surface water; forest stands; rare threatened and endangered species; aesthetics; surface water, specifically crossing the Santee Delta; wetlands; and cultural resources and the potential for invasive species.

An analysis of all comments on the 2014 draft EIS as well as this SEIS will be provided in the Final EIS.

2.0 PROJECT PURPOSE AND NEED

This chapter describes the purpose and need for the McClellanville Project, described with reference to the entities involved in developing the Project. Central Electric, Berkeley Electric, RUS, USFS, and USACE will use this analysis as a factor in making decisions on approving, authorizing, or permitting various Project components. RUS, the lead agency, will determine whether to provide financial assistance for the Project. USFS and USACE are cooperating agencies on the EIS. USFS has primary responsibility to issue special use authorizations for construction, operation, and maintenance of a transmission line on NFS lands. USFS will use this analysis to make decisions related to requirements for SUPs, which may be submitted to construct, maintain, and operate a transmission line through lands administered by USFS on the FMNF. USACE has primary responsibility to issue permits for work in, over, or otherwise affecting navigable waters of the United States and authorization to discharge dredged or fill material into jurisdictional wetlands.

2.1 Central Electric's Purpose and Need

Central Electric must address system capacity, system reliability, and power quality issues resulting from the current use of the aging distribution line supplying electricity to Berkeley Electric. Central Electric, an electric transmission cooperative, provides transmission service from the bulk transmission system to South Carolina's 20 retail electric cooperatives. Central Electric was incorporated and organized in 1948 with offices in Columbia, South Carolina. Central Electric designs and builds transmission lines that connect the state's bulk transmission system (the coordinated and integrated Central Electric/South Carolina Public Service Authority [Santee Cooper] system) and member system substations. Central Electric owns 799 miles of transmission lines, which are maintained by either Santee Cooper or New Horizon Electric Cooperative, Inc.

Berkeley Electric must provide reliable electric service and power quality to its customers. Berkeley Electric is a member distribution electric cooperative of Central Electric and was formed in 1940 to bring electric service to rural areas of coastal South Carolina. Berkeley Electric owns and operates more than 5,700 miles of distribution line serving almost 100,000 member services in Berkeley, Charleston, and Dorchester counties.

Berkeley Electric currently takes electric service from a pole-mounted, metering point (the Awendaw metering point) near the town of McClellanville. The point is on a 22-mile-long, 25 kV Dominion-owned and -operated distribution line. From the Awendaw metering point, Berkeley Electric's own distribution line runs an additional 18 miles. Together, Dominion and Berkeley Electric distribution lines are about 40 circuit miles. This one circuit provides service to 1,100 of Berkeley Electric's cooperative members (Figure 2-1).

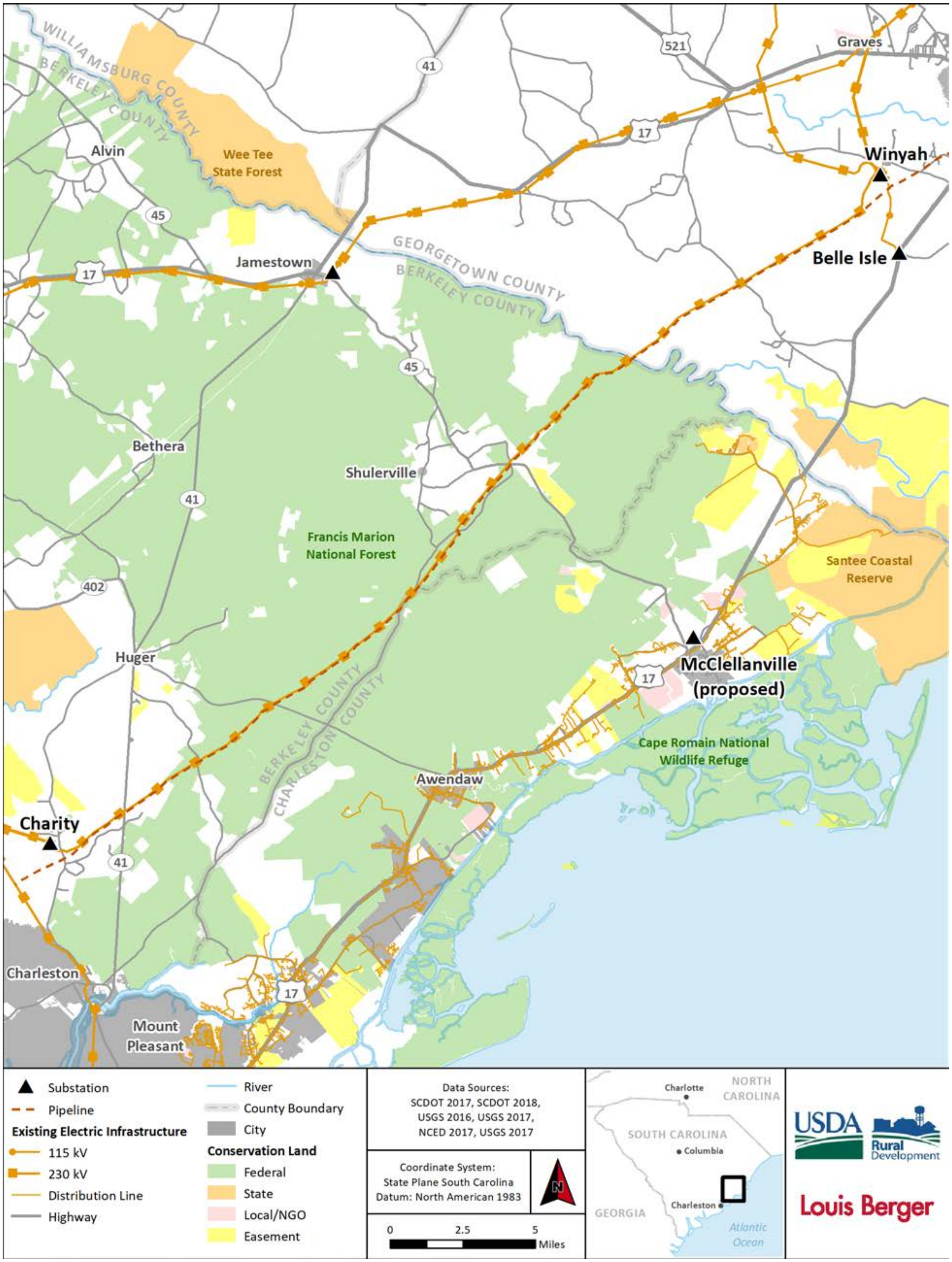


Figure 2-1: Existing Electric Infrastructure in the Study Area

Berkeley Electric relies on an existing 40-mile-long circuit that suffers from issues related to poor reliability and power quality: (1) a winter weather operating agreement that forces Berkeley Electric to switch operations to meet system amperage limits, and (2) an inefficient distribution network rather than higher efficiency transmission line service resulting in substandard electric service for Berkeley Electric's cooperative members in the McClellanville area. Also, the current levels of demand cannot readily accommodate future load growth in this area. Studies of system reliability (RUS 2010a; McGavran 2017) indicate that a new 115 kV transmission line and associated substation is needed to serve the long-term needs of this area of coastal South Carolina by increasing capacity to distribute electricity and enhance the reliability of the delivery system.

It is for these reasons that Central Electric proposes to construct a new 115 kV transmission line to energize the new McClellanville Substation located near the McClellanville service area. The existing 40-mile circuit would remain and provide redundant electrical service to the area. Thus, the purpose of this SEIS is to identify which alternative would be most appropriate for securing system reliability and to minimize potential environmental impacts. The need for the Project is to address system capacity, system reliability, and power quality issues resulting from the current use of the aging distribution line, as detailed below.

2.2 Project Area Reliability Issues

Central Electric has identified a need to improve reliability and reduce power outages to the Berkeley Electric customers. Problems with reliability (i.e., power outages) come from many sources, including: storm damage, environmental factors (corrosion or tree damage), and potential vehicle accidents. The threshold industry standard for acceptable reliability is the N-1 criteria, which as defined by North American Electric Reliability Corporation is preserving service in the event a source is lost. The Dominion line that currently serves the McClellanville area is built on wood poles and follows the route of U.S. Highway 17 north to McClellanville. As such, it parallels the Intracoastal Waterway just inland from coastal barrier islands and the Atlantic Ocean, making it susceptible to reliability issues from storm damage and environmental damage (or corrosion) from a high salt content environment. Other sections of the existing line parallel U.S. Highway 17 and many secondary roadways, thus exposing the line to traffic accidents. The long line exposure is through forested properties, increasing the likelihood of service interruption. All these factors render this source inherently unreliable.

It is also the case that, even if a new transmission line were built to replace this distribution line, Berkeley Electric would still be dependent on a Dominion resource that is, in turn, dependent on reliability in the Mount Pleasant area, as opposed to reliability throughout the Berkeley Electric and Central Electric-Santee Cooper area. Under the current system configuration, all power flows from Mount Pleasant to McClellanville, from Dominion's source. The Dominion 115 kV transmission system is not configured to supply network-level redundant service to the Dominion substation at Hamlin, which is the Dominion source for Berkeley Electric.

McGavran (2017) reports that Berkeley Electric's outage information for each substation/metering point shows that 28 percent of all source outages throughout the system occur at the Awendaw metering point and that from November 2011 to November 2016, 40 separate outages inflicted 525,825 total member minutes that complete service was lost to the delivery point. McGavran (2017) also reports that the most common reasons for the outages include, but are not limited to, complete line outages on the source line, outages that took out part of the line between the source, and the delivery which takes out the delivery point. McGavran (2017) concludes that these incidents and outages relate directly to long line length and location of the line.

Replacing the Awendaw metering point with a new substation served by a new 115 kV transmission line would improve the reliability of electric service provided to cooperative members in this area to a level comparable to that experienced by other Berkeley Electric members.

There are three ways to improve the reliability indices: (1) reduce the duration of the outages; (2) reduce the number of outages that occur; or (3) reduce the number of cooperative members affected. The proposed Project would deliver power via a proposed 115 kV transmission line to the proposed McClellanville Substation. At the proposed McClellanville Substation, Berkeley Electric would be able to separate the existing distribution line into three circuits to serve the customers in the McClellanville area. Serving the same area with three circuits versus one circuit would reduce the number of customers affected by an outage on average and bring the frequency and duration of outages more in line with other circuits on Berkeley Electric's system.

This reduction would be possible for several reasons. First, because electric service to this area would be from a new 115 kV transmission line, it is expected that this alone should bring an increase in reliability. Transmission lines are typically designed to a higher standard than distribution circuits; therefore, they should experience fewer outages than a typical distribution line. Second, because customers would be served by one of three new distribution circuits from the new substation, any outage on a single distribution circuit would not affect the remaining circuits, effectively reducing the impacted number of customers by two-thirds for distribution related outage events. Third, the length of distribution line would be significantly less than the existing 40-mile-long line, enabling a quicker identification of the problem area and, therefore, a significantly quicker response.

Upon the rare case that the proposed 115 kV transmission line loses service, the Berkeley Electric Distribution system would have back-up sources of electricity from the existing Awendaw metering point and from the existing Commonwealth substation, both of which are served from a different transmission source (Dominion). Electric service could be restored from either or both of these backup sources, thus providing an N-1 contingency from the distribution perspective.

2.2.1 Voltage Levels

Berkeley Electric is responsible for providing voltage levels within industry standards to its cooperative members. The most recent standard is American National Standards Institute C84.1-2006, the American National Standard for Electric Power Systems and Equipment—Voltage Ratings (60 Hertz). Berkeley Electric uses voltage regulators, which are electrical devices that automatically step voltages up or down to help keep voltages within the required ranges for members served from one of their distribution lines.

Typically, Berkeley Electric has one set of voltage regulators installed on each circuit at its substations. In the case of the Awendaw metering point and distribution line, two sets of voltage regulators installed by Dominion and Berkeley Electric boost line voltages to acceptable levels. This use of additional voltage regulators will become less effective with even the smallest amount of load growth in the McClellanville area. In this service area, load growth on both Berkeley Electric's and Dominion 's distribution lines directly affects the voltage level delivered to both utilities' customers.

A new transmission line would provide the needed voltage support so that the use of voltage regulators should be significantly reduced, if not eliminated, after construction. This would eliminate concerns regarding potential future reduction of effectiveness of these devices.

2.2.2 Voltage Sags

Voltage sags can occur when an object, such as a tree limb, contacts the distribution line. While every reasonable effort is made to keep distribution line ROWs as clear as possible, the number and magnitude of voltage sags are directly proportional to the length of the distribution line. This is due to the increased amount of "exposure" of the line to the environment and the technical characteristics of the conductor. When voltage sags occur, lights can either dim or go out, motors can stall or overheat, and computers can shut down or fail. As customers continue to add newer, more sensitive electronic equipment, voltage sags and power quality become greater concerns.

As stated above, a new transmission circuit would provide the needed voltage support so voltage sags, although still possible under certain outage scenarios, should be substantially reduced and brought in line with levels of service Berkeley Electric provides across their system.

2.2.3 Meter and Load Forecast

Since 2000, the number of member services served by Berkeley Electric has grown steadily. Table 2-1 shows Berkeley Electric system growth trends. As the table shows, Berkeley Electric increased from 53,491 members in 2000 to 84,684 in 2018, while active member services increased from 63,293 to 99,900 during that period, an increase of 58 percent during this 18-year period. This equates to an average annual growth rate of 2.6 percent.

Table 2-1: Berkeley Electric System Growth—Active Members Services and Membership

Year	Active Members Services	Active Members
2018	99,900	84,684
2017	98,304	80,590
2016	94,158	78,459
2015	90,395	75,826
2014	88,111	72,134
2013	85,307	71,451
2012	83,572	70,066
2011	82,322	68,619
2010	81,284	67,581
2009	75,156	66,257
2008	77,659	65,046
2007	76,526	63,818
2006	74,146	61,736
2005	73,044	60,059
2004	70,484	58,051
2003	67,593	56,479
2002	66,343	55,962
2001	64,891	54,384
2000	63,293	53,491

The Awendaw metering point tends to peak in the winter, driven by growth and weather conditions. The peak demand in 1994 was 3,453 kilowatts (kW). In 2000, that same demand was 4,505 kW. The largest peak demand maximum was 6,300 kW in 2014. The 2015 demand was 6,178 kW, and the 2016 peak was 5,579 kW. 2018 peak demand growth is projected at about 2 percent annually (McGavran 2017).

2.3 Winter Weather Operating Agreement

Since the publication of the draft EIS in 2014, Berkeley Electric and Dominion entered into a Winter Weather Operating Agreement in January 2017 to provide reliable electric service to Berkeley Electric customers. The Winter Weather Operating Agreement indicates that Berkeley Electric load has grown to the point that Berkeley Electric must switch load from a Dominion feed to an alternate Berkeley Electric resource in real time to avoid overload of the Dominion facilities. This agreement states that Santee Cooper, acting in practice as Berkeley Electric, is allowed a maximum of 120 amps at the Awendaw metering point. When temperatures are forecast to fall below 23 degrees F north of the Mount Pleasant and McClellanville areas, or if for any reason anticipated electrical demand is expected to exceed 120 amps per phase, Berkeley Electric will be dispatched to switch load off the Awendaw metering point and over to the Berkeley Electric Commonwealth substation via the circuit that ties with the Awendaw metering point. McGavran 2017 states the following: “Limits on current capacity further illustrate the need for the project. This is most evidenced by the Winter Weather Operating Agreement between Berkeley Electric and Dominion governing the capacity management of the existing resource, a 23.9 kV L-L circuit from Hamlin. This resource cannot deliver more than 120 amps to Awendaw. The operating agreement stipulates that under certain conditions as mentioned above, at least some portion of the load at Awendaw must be switched to the Berkeley Electric Commonwealth substation to assure that the maximum load threshold is not exceeded. This mode of operation is neither reliable nor efficient. As such, the project is justified by bringing in a resource with greater capacity that avoids having to do real-time switching to maintain system integrity.”

2.4 Transmission Line Efficiency

The use of higher voltage lines to serve the customers of McClellanville would reduce line losses (energy lost during transmission) along the length of the line and increase the efficiency of power delivery to existing customers. Other operational advantages and efficiencies would be derived by adding the proposed substation. These advantages include the ability to shift load from other circuits or substations during outages or to handle growth in other areas.

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3.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter describes the alternatives considered for the construction and operation of the McClellanville Transmission Line. Project alternatives were screened at the time of the 2014 draft EIS to determine their ability to meet the purpose and need of the proposed Project and to provide a comparison of Project effects. The following sections describe the general process and key terminology used in the development of the alternatives, as well as the specific formulation of the alternatives and the alternatives evaluated in detail in this document.

3.1 Summary of the Development of Alternatives

RUS has established guidance documents for determining whether a proposed project for which a loan or loan guarantee is sought is both technically and financially feasible. Following RUS's guidance, Central Electric prepared several studies prior to the EIS, including a Macro-Corridor Study and Revised Macro-Corridor Study, and an Alternatives Evaluation Study that was reviewed and approved by RUS (RUS 2010a, 2010b). The studies included engineering and preliminary environmental evaluations and were made available to the public and agencies for review and comment during the scoping period. The information and analyses from the Alternative Evaluation Study and the Macro-Corridor Study were incorporated by reference into the 2014 draft EIS.

From the analysis completed in the Alternative Evaluation Study, it was determined a new transmission line was the preferred alternative to provide the necessary power to the McClellanville area. Once the Alternative Evaluation Study was complete and the transmission alternative was selected as the best method to meet the purpose and need, a Macro-Corridor Study was completed looking at potential areas of opportunities and constraints within the Study Area.

Potential routes were developed along the corridors using geographic information system (GIS) data sets, aerial photography, and a diverse routing team, which included representatives from Central Electric, RUS, USFS, Berkeley Electric, Louis Berger, and DiGioia Gray Associates. The potential corridors were developed to minimize effects on residences, sensitive habitats, conservation lands, and cultural and historical resources, maximize paralleling of existing linear infrastructure, and avoid circuitous paths.

After publication of the 2014 draft EIS, Central Electric commissioned an Independent Engineering Study (McGavran 2017) to evaluate and supplement the previously developed studies and assess the merit of the proposed alternatives based on need, impact, and cost as well as offer additional insight and information that may be relevant to assessing each potential solution. As stated by McGavran (2017), to insure quality of service, an ideal proposed solution to poor reliability in the McClellanville area should meet N-1 criteria by providing multi-source service to the service area so that full service may be quickly restored with one source out of service. Based on N-1 criteria, some corridors evaluated in the 2014 draft EIS could be eliminated as not technically feasible. Similarly, application of the N-1 criteria also resulted in the development of a new Charity corridor, which co-locates the proposed new line adjacent to an existing transmission ROW for a large portion of the overall corridor length. Additionally, Central Electric winnowed the Belle Isle corridor options from six down to two based on public input on the draft EIS.

3.2 Alternatives Considered but Not Evaluated in Detail

Several electrical and system options were considered early in the Project development process to meet the purpose and need, including new energy generation, distribution, and conservation options. While comments received on the 2014 draft EIS recommended that these alternatives receive further consideration in lieu of the lines proposed in the draft EIS to protect environmental, aesthetic, and cultural resources, these options were not carried forward for the reasons discussed below.

From the analysis completed in the Alternative Evaluation Study, the draft EIS, a follow-up agency meeting on April 15, 2015, the Independent Engineering Study (McGavran 2017), and presentation based on the McGavran (2017) study results given on February 28, 2017, it was determined that a new 115 kV transmission line was the preferred alternative to provide the necessary power to the McClellanville area. The McClellanville area suffers from a combination of load growth, poor electrical reliability, and poor power quality, which negatively impact the Berkeley Electric customers. Studies to evaluate solutions to these issues considered distribution system upgrades, transmission and substation capital investment, and onsite generation. Of these, utilization of the McClellanville Substation and a new 115 kV transmission line from a reliable source resolve Project necessity issues totally and permanently. A distribution solution would only be temporary and require a transmission solution at some point (McGavran 2017).

Below is a brief discussion of these options considered in the Alternative Evaluation Study or Independent Engineering Study that were not carried forward for further analysis.

3.2.1 New Generation at McClellanville Substation Site and Energy Storage

Installing onsite generation at the proposed McClellanville Substation was considered in lieu of building a new transmission line to energize the facility. Onsite generation could take two forms and have various functions. First, the nature of onsite generation could be either full load support and operation or confined to peaking and emergency times. A base load solution would mean running the generation system as the primary resource at all times. McGavran (2017) evaluated new generation as part of the Independent Engineering Study.

Three 2-megawatt diesel generators were considered for installation. These generators would be capable of serving up to 6 megawatts. Additional generator units would be installed as needed to serve load growth and so that existing individual units could be taken out of service temporarily for maintenance and repair.

Use of diesel or natural gas generators would introduce a new stationary source of air pollution in the McClellanville area, requiring state permitting under the Clean Air Act and limits on duration and frequency of operations in a new stationary source permit.

Additionally, the largest expense associated with onsite generation is the cost of fuel, which is not only expensive for generation purposes but also, as a commodity, fluctuates in price. McGavern (2017) estimated that the onsite diesel generation option could cost up to $20,000,000. Onsite generation is not an economical alternative for the identified electrical problem and is not part of the decision put before RUS to provide Central Electric funding for a new transmission line. This alternative would not guarantee or eliminate the need for a future transmission line to provide reliable service to the McClellanville area.

An alternative to diesel generators is onsite renewables and batteries (i.e., industrial solar and battery combination) designed to accommodate the forecasted load. Large-scale solar projects do provide carbon-free electricity to the grid and, when used in combination with battery storage solutions, can simulate baseload source; however, this option does not provide full service because the size of the solar farm and the battery storage would need to be very large to provide multiple days of electricity if the current distribution lines were out of service. Onsite renewable generation does not meet N-1 criteria described above in Section 2.2. Furthermore, this option does not address the evaluation criteria based on the purpose and need for the Project. Lastly, this option does not address the decision before RUS to provide Central Electric funding for a new transmission line.

Another alternative to onsite generation is energy storage that would in effect act as a support system to the existing distribution system. McGavran (2017) evaluated three possible alternatives: (1) grid-level battery storage at the McClellanville site; (2) behind the meter technology at an individual member's premise; and (3) a mix of grid-level battery and behind the meter technology. Overall, McGavran (2017) concludes that each of these potential solutions have a number of drawbacks that do not address the need because each requires significant system upgrades; energy storage does not factor in growth; energy storage behind the meter would require major overhauls of Berkeley Electric member rules and regulations and forced compliance; and the estimated back up would cover approximately two-thirds of all outages.

3.2.2 Rebuild Existing Distribution Line

Rebuilding the existing distribution line system serving the McClellanville area was evaluated. For planning purposes, the McClellanville Load Control Point (McLCP) was identified at the intersection of U.S. Highway 17 and Tibwin Road. The McLCP represents the point where rebuilt distribution lines supplying power to the McClellanville area from the Commonwealth and Jamestown substations would converge and from which distribution lines would branch out to serve the electrical load in the McClellanville area.

The distribution line rebuild alternative would require capital cost improvements associated with both rebuilding existing distribution line segments and constructing new distribution line segments serving the McLCP. This alternative would also require capital cost improvements at the existing Commonwealth and Jamestown substations. Improvements at both substations would be required so that the McClellanville area could be served from Jamestown whenever an outage occurs either at Commonwealth Substation or somewhere along the distribution line connecting Commonwealth Substation with the McLCP.

A 30-year load growth projection was used to evaluate the requirements of the distribution line rebuild alternative. Per Central Electric’s current Long Range Engineering Plan, specific design features of this alternative would include:

- Installation of a second power transformer in both the Commonwealth and Jamestown substations to isolate the McLCP load and avoid disruptions to existing customers served from the Jamestown and Commonwealth substations.

- Installation of approximately 2 miles of new underground distribution line (D/C 1000MCM UG) through the FMNF to extend the existing Jamestown circuit to U.S. Highway 17.

- From the Jamestown Substation, installation by Berkeley Electric of 18 miles of additional new D/C 750MCM UG express conductors, with additional voltage regulators, electronic re-closers with Supervisory Control and Data Acquisition operability, and switches needed to address contingencies at the McLCP.

- From the Commonwealth Substation, rebuilding by Berkeley Electric 4 miles of D/C 477 aluminum conductor steel reinforced (ACSR) OH conductor to T/C 477 ACSR OH conductor, convert 14.5 miles of S/C 477 ACSR OH conductor to

D/C 477 ACSR OH conductor, and construct 1.5 miles of new D/C 1000MCM UG conductor needed to complete the circuit along U.S. Highway 17. As with the Jamestown circuit, additional voltage regulators, electronic re-closers with Supervisory Control and Data Acquisition operability, and switches needed to address contingencies at the McLCP would be required.

This alternative would not meet the N-1 criteria defined in Section 2.2 as it would not provide redundant service. RUS estimated the capital costs for rebuilding the distribution to be $8,105,000[2] (RUS 2010a). Because this alternative would cost significantly more to implement over the transmission line alternative and would not guarantee or eliminate the need for a future transmission line to provide reliable service to the McClellanville area, and it is outside the decision before RUS to provide funding to Central Electric for a new transmission line, it was removed from further consideration.

3.2.3 Energy Conservation and Distributed Renewable Generation

Central Electric is working with Berkeley Electric and its other member distribution systems in South Carolina to promote and improve energy efficiency and conservation. Central Electric has in place a statewide load management program, which allows utilities to reduce demand for electricity during peak usage times by temporarily limiting the use of electric power by members who agree to participate in the load management program. Load management is desirable because it can delay the need to construct additional peaking power plants and manage loading on transmission/distribution facilities. Central Electric is implementing a similar program with smart thermostats. Specific measures include the distribution of compact fluorescent light bulbs, on-bill financing to fund LED bulbs and high-efficiency HVAC systems, and purchase of member-generated renewable energy through a net metering program.

Central Electric and Berkeley Electric will continue to pursue and promote energy efficiency improvements, increased conservation, use of renewable resources, and time of day rate adjustments. These efforts will reduce and better manage load growth, which strains the existing distribution system. However, energy conservation and distributed renewables generation alone cannot reliably meet the forecasted load requirements and the continued load growth in the McClellanville area. In addition, reliability remains an issue. The existing 40-mile distribution line will continue to experience outages, require voltage regulators, and still be susceptible to voltage sags.

[2] RUS's estimate in 2010 of $6.9 million was updated to 2019 dollars using https://www.usinflationcalculator.com/, which calculated a cumulative increase of 17.5 percent since then.

3.3 Transmission Alternatives Eliminated from Further Consideration

3.3.1 230/115 kV Switching-Stations and Associated Transmission Infrastructure

The Honey Hill and Britton Neck 230/115 kV options considered in the Macro-Corridor Study (RUS 2010a) would require the construction of a new 230/115 kV transmission substation that would tap the existing Winyah-Charity 230 kV transmission line owned by Santee Cooper. New 115 kV service (the required voltage to energize the McClellanville Substation) cannot be taken directly from a 230 kV source without “stepping down” the voltage, which is the purpose of the transformer and associated equipment installed in a 230/115 kV transmission substation. A new 230/115 kV substation would require land clearing and grading of at least 10 acres of land adjacent to the Winyah-Charity 230 kV transmission line. In addition, tapping a 230 kV line requires outside approvals as it could affect the reliability of the bulk transmission system in the region. Due to this potential impact on reliability, the tapping of a 230 kV line poses a recognizable security risk to the overall transmission system and would need to be considered and approved prior to this decision process considering it a reasonable alternative. As such, a new 230/115 kV transmission substation constructed to energize one new 115 kV transmission line and to serve one new 115/25 kV distribution substation is an expensive and unreasonable alternative that violates normal utility practice. A 230/115 kV transmission substation normally serves several networked 115 kV substations, not just one.

3.3.2 Commonwealth Corridor

The Commonwealth corridor alternative was suggested, during the scoping process and in comments on the draft EIS, by stakeholders who recommended that a new transmission line be collocated with existing distribution corridors and major roads (specifically, U.S. Highway 17) to minimize effects on the natural environment. In addition to sharing similar engineering concerns (relatively long line and contingency concerns) with the Charity corridors, the Commonwealth corridor also originates from the same power source as the Awendaw metering point (the Dominion Hamlin Substation); thus, it is not providing an alternate source in case of voltage loss at Hamlin. The existing distribution line serving the McClellanville area originates from the Hamlin Substation, and a new transmission line originating from the same area would locate both lines into the same corridor and expose both the new transmission line and what would become the back-up distribution line to a common outage scenario (e.g., a hurricane or tornado). This design violates the N-1 criteria for designing transmission infrastructure. Furthermore, this corridor would be constructed in populated rights-of-way that are present in and around the Commonwealth Substation just outside the city of Mt. Pleasant, SC. This area is significantly urbanized with many residences, educational, medical, and commercial centers that make it difficult and costly to place transmission lines. This corridor would also pose cost and time problems during its operational phase relating to accessing and executing operations and maintenance. The total line length from Commonwealth to Awendaw is 24 miles plus an additional 3 miles of added line length back to Hamlin making a total of 27.11 miles of total exposure (second longest line exposure of any proposed corridor). McGavran (2017) estimates that the Commonwealth corridor would cost $10.99 million to construct. McGavran (2017) concluded that further consideration of this corridor is not merited because it does not meet the Project need criteria required by Berkeley and Central Electric. For these reasons, the Commonwealth alternative was eliminated from further consideration.

3.3.3 115 kV Belle Isle Corridors from the 2014 Draft EIS

The 2014 draft EIS contained multiple corridors originating from the Belle Isle Substation, which roughly followed U.S. 17 south, crossing the Santee River, to the proposed McClellanville Substation. In addition to the corridors, members of the public requested that the corridor include an underground option to eliminate the overhead crossing of the Santee River. The elimination of these corridors from consideration as feasible project alternatives is discussed below.

3.3.3.1 Belle Isle Corridors A, D, E, and F

Central Electric’s initial project proposal, as described in the draft EIS, included six corridors; all of which originate at the Belle Isle substation. These corridors were initially selected from a wider range of potential routes because when compared with other options, they reduce impacts to residences, sensitive habitats, conservation lands and cultural and historic resources while trying to address the project need. Comments on the draft EIS were critical of various components within some of the proposed corridors which resulted in Central Electric revisiting the alternatives. In doing so, Central Electric convened its route selection committee and requested the committee evaluate the alternatives and select one or two corridors that should be included in the final EIS. Based on Central Electric’s internal investigation that included engineering, environmental and McGavrans (2017) independent report, Belle Isle Corridors A, D, E and F were eliminated from the proposed project. Alternative corridors E and F are the longest corridors (19.90 and 19.10 miles, respectively) and were eliminated due to greater environmental and line exposure risks. Alternatives A and D are equal in length (16.10 miles); however, these corridors have considerably higher amounts of environmental resource impacts than B and C (e.g., greater forest within the Santee River delta, marine wetlands, prime farmland soil, archeological sites [route A], and residences within 300 feet of the proposed line). Although McGavaran’s (2017) estimates did not directly correspond to the six routes in the draft EIS, the report estimated the cost to engineer and construct a new line within the Belle Isle corridor would cost between $1.9 million to $2.1 million. As such, Central

Electric eliminated four of the six routes associated with the Belle Isle alternative from further consideration.

3.3.3.2 Belle Isle No. 2 Corridor (Underground)

The Belle Isle No. 2 corridor presented in the Macro-Corridor Study involved the option of an underground crossing of the North and South Santee rivers and the Santee Delta adjacent to U.S. Highway 17. Underground transmission lines are often recommended by the public or by resource agencies as a solution to potential visual impacts. During the scoping process, commenters recommended siting the new McClellanville Transmission Line underground because of the widespread damage incurred by the power grid during Hurricane Hugo, a Category 4 hurricane that came ashore in Charleston Harbor in September 1989. The most devastating wind and storm surge came ashore on the storm's northwestern quarter between the towns of Awendaw and McClellanville. The Santee Delta Wildlife Management Area (WMA) also recommended building any transmission line crossing the Santee Delta underground to minimize potential avian interaction (e.g., collision) issues. Note that the siting of lines is the responsibility of the program applicant prior to filing an application for funding the new line; not the responsibility of RUS.

Underground transmission lines are very expensive to construct. Distribution lines, however, are not the same as transmission lines, and more readily lend themselves to underground construction. Underground transmission is almost always found in severely constrained environments, such as the downtown business districts of large cities where insufficient room exists for overhead lines and their ROWs. Depending on the design, system operations requirements, and spatial issues, preliminary design of underground transmission suggests that costs can range from 8 to 15 times the cost of typical overhead construction. In its Macro-Corridor Study, Central Electric (RUS 2010a) estimates that building underground transmission lines at the Santee Delta would involve approximately 10 times the expense of typical overhead construction.

While it is true that a hurricane, tornado, or other contingency could damage an overhead transmission line easier than it can damage an underground line, an overhead line is relatively easy to repair compared to an underground one. Over time, underground conductors deteriorate; and locating underground faults and then mobilizing the right personnel and equipment to the repair site to restore service is time-consuming and labor-intensive. This would also be the case if an underground transmission line were built across the Santee Delta. Furthermore, underground transmission line installation, repair, and replacement require specialized equipment and skills not available within Santee Cooper because of the very minimal use of underground transmission cable on the Central Electric and Santee Cooper system. An outside contractor would have to be hired to complete any of the repairs on the underground transmission line, which would further extend outage times or require a shift in source electricity. Underground transmission for radial line use is not preferred because of the longer restoration time issues referenced previously. Underground transmission should always have an alternative overhead transmission line to help minimize outage time in the event of a failure on the underground section of line. McGavern estimates the underground portion of the transmission line associated with the Belle Isle No. 2 corridor would cost an additional $2.8 million dollars. For cost and maintenance reasons, the underground construction alternative for the Belle Isle No. 2 corridor and other corridors was not carried forward.

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4.0 ALTERNATIVES EVALUATED IN THE SEIS

4.1 No-Action Alternative

Under the no-action alternative, the McClellanville Transmission Line would not be constructed. The existing environment within the Project Area would remain the same, and no land would be used for transmission lines, facilities, or a substation. The customers of Berkeley Electric in the McClellanville area would continue to have reliability issues and outages. In addition, future growth will add additional constraint to an already strained electrical system. The no-action alternative does not meet the identified purpose and need for the Project.

4.2 Proposed Action—115 kV Radial Line

Central Electric proposes construction of a new 115 kV transmission line, which is needed to energize the new McClellanville Substation near the McClellanville service area. This action is based on the good utility practice of adding a new distribution source through transmission service when reliability issues and outages exist and projected future load growth is expected to strain the current electrical system. The proposed action considers three possible corridor locations with one corridor including two different alignments (see Figure 4-1). Corridor locations were selected for further analysis because they reduce effects on residences, sensitive habitats, conservation lands, and cultural and historic resources. Existing ROWs (roads and transmission lines) were used in designing the three corridors as much as practicable. Each corridor location would involve a tap and construction of the McClellanville Substation. Additional details regarding the substation are presented in Section 4.3, *Elements Common to All 115 kV Radial Line Alternatives*.

To begin this process, multiple route segments were identified from each qualified source (Belle Isle, Charity, and Jamestown). Each segment was evaluated for multiple environmental, archeological, geographical, and financial characteristics. Segments were either promulgated forward or eliminated, ultimately creating the corridor for each alternative that is under consideration within this SEIS.

4.2.1 Belle Isle Corridor Alternatives

The Belle Isle corridor alternative originates at the Belle Isle Substation. For the first 3 miles of the alignment, both Belle Isle options B and C parallel U.S. Highway 17 on the north side. The corridor then angles to the southwest for approximately 0.5 mile before turning south. After approximately 1.5 miles, the corridor angles to the southwest to a narrow crossing of the North Santee River. The corridor continues this alignment for approximately 2.5 miles, crossing the South Santee River.

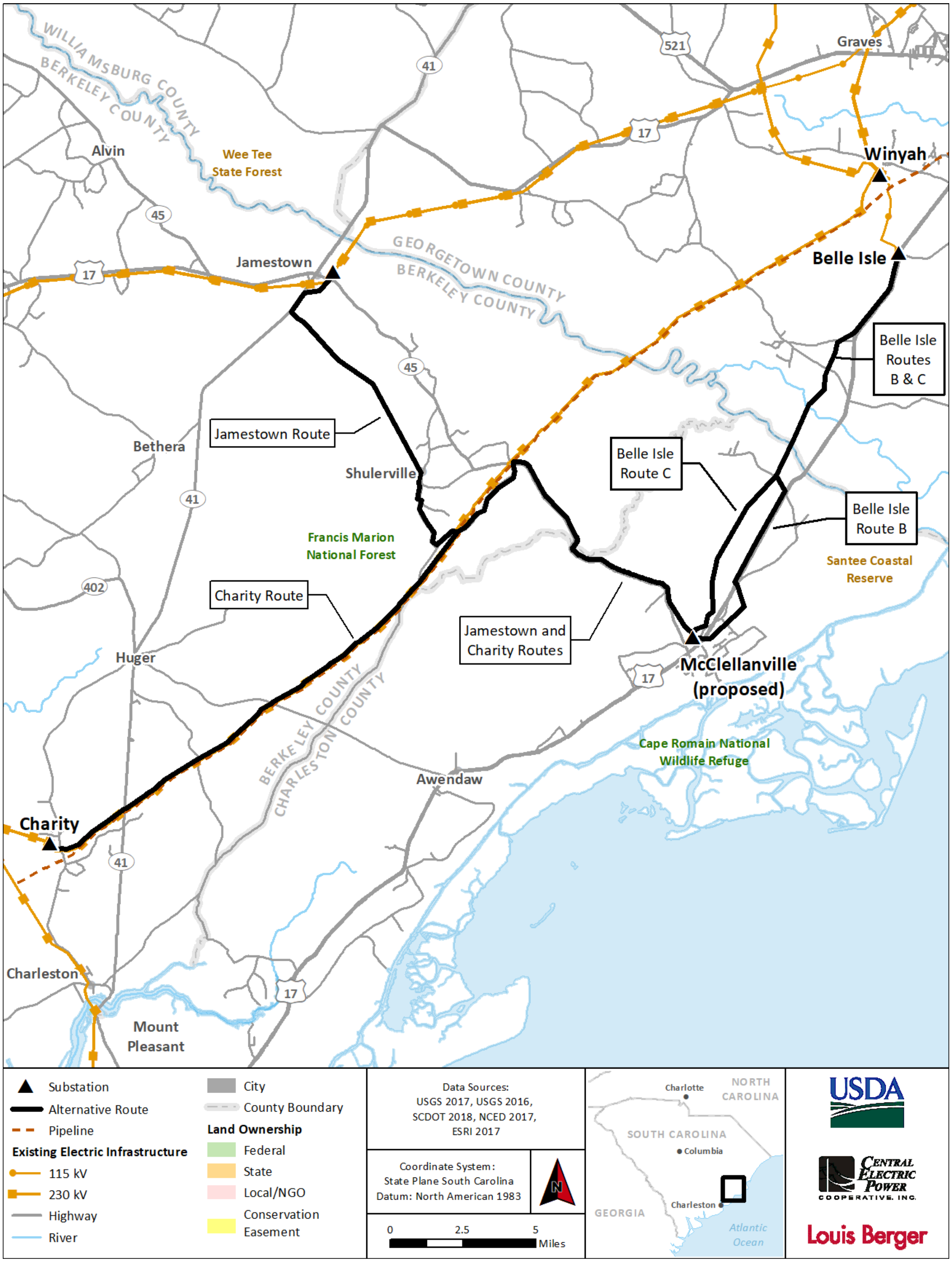

Figure 4-1: Overview of the Transmission Corridor Alternatives

At this point, option B turns southeast until it reaches U.S. Highway 17. Option B continues on the north side of U.S. Highway 17 to avoid an archaeological site located on the south side of the highway. Option B maintains the parallel alignment on the north side of U.S. Highway 17 for another 6 miles and then angles to the southeast for approximately 0.75 mile before angling back to the southwest for 1.5 miles to avoid residences located on the east side of U.S. Highway 17. Option B then turns west, crosses U.S. Highway 17, and terminates in the McClellanville Substation.

Option C continues in a southwest–south direction for approximately 6 miles after crossing the South Santee River. Option C does not parallel any existing infrastructure for these 6 miles and angles between two parcels of land owned by FMNF before reaching the McClellanville Substation (Figure 4-1).

Both Options B and C must cross the Santee River Delta, an approximate 2-mile segment of this alternative. Crossing the delta involves substantial initial construction costs and environmental impacts to wetlands. The delta crossing is unavoidable regardless of the corridors chosen from this alternative.

4.2.2 Jamestown Corridor

The Jamestown corridor (25.8 miles long) begins at the Jamestown Substation and travels southwest as it crosses South Carolina Highway 45, continues briefly along an existing utility corridor before entering the FMNF, and traverses for a short distance before exiting briefly as it angles west to South Carolina Highway 41 to renter the FMNF (Figure 4-1). It then continues along the highway for approximately 0.7 mile until it reaches Tiger Corner Road, at which point it angles southeast, remaining on FMNF lands as it follows the roadway approximately 6.5 miles until exiting the forest at the north end of Shulerville. Once at Shulerville, the corridor turns south on Shulerville Road, re-entering the FMNF approximately 1.4 miles south of Shulerville and continuing to the intersection of Halfway Creek Road. At this point, the Jamestown corridor angles northeast to join Halfway Creek Road and continues to South Carolina Highway 45, where it then angles east toward McClellanville. The westernmost boundary of the Wambaw Creek Wilderness Area lies immediately east of South Carolina Highway 45 as it crosses Wambaw Creek; the corridor, however, does not cross the Wambaw Creek Wilderness area. Overall, the Jamestown corridor crosses 7.28 miles of the FMNF. The Jamestown corridor also crosses Management Area 29, a management area connector for adjacent federally designated wilderness areas within the FMNF.

4.2.3 Charity Corridor

The initial set of potential corridors identified for alternatives documented in the Revised Macro-Corridor Study Report for the McClellanville 115 kV Transmission Project (RUS

2010a, 2011b) identified four separate Charity macro-corridors. These corridors were eliminated from further evaluation in the draft EIS; however, based on the Independent Engineering Study (McGavran 2017) and corresponding agency consultation meeting of the study results, this corridor received renewed interest. McGavran (2017) notes the Charity Substation—the source for the proposed Project transmission line—is a very strong source because it is part of the Santee Cooper 230 kV system, making it the most reliable source in the EIS study area. McGavran (2017) also reports this corridor poses challenges for long-term reliability because of its length and location. After reviewing the results and participating in the study report consultation meeting, the FMNF specifically recommended analyzing the Charity corridor as a potential solution because of preferences to collocate the transmission line with other utility corridors within the FMNF.

The Charity corridor begins at the Charity 230–115 kV Substation located immediately east of the Cooper River outside North Charleston, South Carolina (Figure 4-1). The substation serves a large steel mill that has a very high reliability requirement and is served by the major 230 kV line from the Santee Cooper Winyah steam plant. From the substation, the line would continue east along an existing transmission line and gas pipeline ROW for approximately 18 miles as it crosses South Carolina Highway 41 and various roadways within the FMNF before joining Halfway Creek Road approximately 10 miles northwest of McClellanville. From this point, it continues along the same alignment as the Jamestown corridor, as described above in Section 4.2.2, *Jamestown Corridor*.

4.3 Elements Common to All 115 kV Radial Line Alternatives

Several elements are common to each of the alternative corridors, including various transmission line components, construction techniques, and operation and maintenance procedures. These items are discussed in more detail below.

4.3.1 Transmission Line Characteristics

Transmission lines for all alternative corridors would include the following characteristics:

- A ROW requirement of 75 feet (37.5 feet on either side of centerline);
- Single pole structures, typically 70 to 75 feet above ground and spaced 300 to 400 feet apart;
- H-frame structures, typically 70-80 (except at crossings) feet above ground, which may be used to cross rivers or large wetlands;
- Design features including galvanized steel or COR-TEN "weathering steel" single pole structures carrying three 795 26/7 MCM ACSR electrical conductors (1.107-inch overall diameter) on horizontal polymer brace post insulators with

a single 0.565-inch diameter optical ground wire (OPGW) fiber optic shield wire overhead; and

- A basic overall configuration for the proposed transmission line similar to the structures shown in Photograph 1 with a final design potentially using standard galvanized steel instead of weathering steel.

4.3.2 Right-of-Way and Property Requirements

When a transmission line is placed across private land, a ROW agreement, typically an easement (not a fee title), is required. When a transmission line is placed entirely across private land, an easement for the entire 75-foot ROW would need to be acquired from the landowner(s). Central Electric has indicated a preference for locating poles as close to property division lines as reasonably possible to reduce the amount of ROW on a particular property. When a transmission line parallels roads, railroads, or other transmission lines, a landowner may be able to have a narrower easement. When paralleling existing roadways, for example, the general practice is to place the poles on the adjacent private property, a few feet outside the existing road ROW. So, although the pole is still located on private property, the transmission line can share some of the public ROW, thereby reducing the size of the easement required from the private landowner.

Photograph 1: COR-TEN Single Pole Structure with Horizontal Post Insulators

The South Carolina Department of Transportation Utilities' ROW Accommodation Manual states the preferred location for all longitudinal utility installations within its ROWs is as close to the outside ROWs line as practical. Additionally, except in extreme cases, and then only with specific authorization, longitudinal installations of overhead lines on the highway ROW shall be limited to single pole type construction.

4.3.3 Transmission Line Right-of-Way

In cross-country transmission line segments, Central Electric would acquire a 75-foot-wide (37.5 feet to either side of the centerline) ROW in the form of an easement. In the typical road-side alignment, single pole transmission line structures are usually set about 5 feet outside the road ROW; therefore, roadside alignments would require 5 feet plus an additional 37.5 feet for a total of 42.5 feet of ROW in the form of an easement. In either case, the ROW would be cleared, including the trimming or removal of danger trees that are outside the ROW. (Danger trees are trees or branches that are dead, weak, diseased, leaning toward the line, or otherwise capable of hitting the transmission line were they to fall.) It would be necessary to maintain a cleared ROW and remove danger trees for the duration of the operational life of the proposed transmission line.

4.3.4 Distribution Line Right-of-Way

Three low-side distribution frames would be dedicated to Berkeley Electric with an additional low-side position dedicated to Dominion. Therefore, Berkeley Electric anticipates a total of four 3-phase distribution lines would be brought out to U.S. Highway 17 from the substation low-side along the access strip. The four distribution lines would exit the substation underground, and the conductors would likely be installed within conduit.

At U.S. Highway 17, the MV-04/ Dominion circuit would transition to overhead at a riser pole and tie into the existing Dominion distribution line. The three Berkeley Electric distribution lines would continue underground across U.S. Highway 17 and then follow an interior property line for an additional +/- 400 feet to arrive at an existing 3-phase distribution line. The MV-01, MV-02, and MV-03 circuits would transition from underground conduit via riser poles at this point. Circuit MV-03 would tie into the existing 3-phase distribution line running southeasterly toward Commonwealth Substation. Circuits MV-01 and MV-02 would transition overhead on a second riser pole, forming a double-circuited, 3-phase distribution line running northeasterly toward the intersection of River Road and State Highway S. At that intersection, Circuit MV-02 currently turns southeasterly, paralleling State Highway S, while Circuit MV-01 continues northeasterly along River Road.

4.3.5 Pre-Construction Activities

Central Electric and/or its contractors would perform engineering surveys prior to construction of the transmission line. These surveys would consist of centerline location, profile, and access surveys. Pre-construction surveys would likely coincide with other pre-construction activities.

Geotechnical studies would be conducted along the transmission line ROW to determine engineering requirements for structures and foundations. Truck-mounted augers would be transported to selected locations to drill small-diameter boreholes, and borehole cuttings would be analyzed to determine specific soil characteristics. Minimal land disturbance (approximately 400 square feet) is anticipated for each geotechnical boring site. Additionally, small access trails may be required for some of the boring locations.

4.3.6 Transmission Line Construction

Construction activities are summarized below in the general sequence of occurrence—acquiring ROW access, establishing staging and laydown areas, grading (where needed), installing poles, and installing conductors. The precise timing of construction would take into account factors including permit conditions, system loading issues, and available workforce.

4.3.6.1 Right-of-Way Access

Typically, existing roads or trails that run parallel or perpendicular to the transmission line would be used to access the actual transmission line ROW. Where use of private field roads or trails is necessary, permission from the property owner would be obtained prior to access. In some cases, new access roads may have to be constructed when no current access is available or existing access is inadequate for the heavy equipment used in construction.

4.3.6.2 Establishing Staging and Laydown Areas

The materials would be stored onsite at staging areas until they are needed for construction. Central Electric would prioritize using the ROW for all staging areas to minimize the overall projects footprint. Staging areas would range from few acres to up to 10 acres depending on the location, materials and equipment being stored, and the construction activities in close proximity to the staging area. Larger temporary lay down areas may also be needed in some areas depending on access, security, efficiency, and safety for warehousing supplies (see Section 4.3.9, *Construction Assembly Areas*). Temporary laydown areas outside the transmission line ROW would not be included in a permit. Permission would be obtained from land owners through rental agreements.

4.3.6.3 Grading

Transmission line structures generally would be installed at existing grades. No grading would be required due to the level, flat topography.

4.3.6.4 Power Pole Installation

When sites are prepared for installation, the poles generally would be moved from the staging areas and delivered to the staked location and placed within the ROW. Insulators and other hardware would be attached while the pole is on the ground. The pole would be lifted, placed, and secured using a crane. In nearly all cases, the poles would be installed using vibratory caissons or direct embedment into the soil. Where single pole structures are under higher stress (medium angle, heavy angle or dead-end structures) vibratory caisson foundations are required.

When vibratory caissons are required, the caisson will be vibrated into the earth to the appropriate depth. Then the interior of the caisson is excavated, the pole installed, and crushed rock is backfilled into the caisson. No guy wires would be required for this setup. If the poles are directly embedded, holes approximately 6 feet in diameter would be augured or excavated. The hole would be partially filled with crushed rock, the pole set on top of the rock base, and the hole backfilled with crushed rock and/or soil. In poor soil conditions, a galvanized steel caisson may be installed vertically with the structure set inside as described above.

4.3.6.5 Conductor Installation

After pole placement, conductors would be installed in stringing setup areas located approximately every 2 miles along a Project corridor, either within the ROW or on temporary construction easements. Brief access to each structure would be needed to secure the conductor wire to the insulator hardware and the shield wire. Where the transmission line crosses streets, roads, highways, or other obstructions, temporary guard or clearance poles may be installed to protect conductors and to ensure safety during installation.

Compression dead-end connectors will be used to join conductors and dead-end hardware rather than hydraulic splices.

4.3.7 Right-of-Way Clearing

In upland areas, the ROW would be cleared using heavy equipment to fell trees and understory trees and shrubs. Equipment with a shearing blade attachment designed to sever tree trunks at or near ground level may be used. Alternately, a “feller buncher,” a standard heavy equipment base with attachments consisting of a tree-grabbing device and a circular saw or hydraulic shear that cuts trees off at or near the base may be used. Felled vegetation would be limbed up and removed or chipped. Stumps would be cut or ground down to a maximum height of 3 inches above the soil line. Except in wetland areas, slash (the coarse and fine woody debris generated during logging operations) would typically be chipped and broadcast as mulch or allowed to decompose on the ground.

On USFS lands, merchantable timber would be loaded onto forwarders, which are forestry vehicles that carry felled logs from the stump to a roadside landing where they can be loaded onto log trucks. On private property, timber may be treated similarly, or it may be chipped and broadcast across the ROW to serve as mulch. Except in wetland areas, slash would typically be chipped and broadcast as mulch.

In wetlands, land clearing of the easement would be accomplished by methods that remove trees and tall-growing vegetation above the soil line and do not disturb the native wetland soils. This may be accomplished by using low ground pressure equipment (10 pounds per square inch [psi] or less) or by using similar equipment working from temporary load-dispersing mats to minimize rutting and mucking of wetland soils. Low-growing native plant materials that would not interfere with the installation, maintenance, and operation of the line would not be cleared. The purpose of using such methods is to avoid or minimize disturbance of native wetland soils and encourage the establishment of a scrub/shrub or emergent wetland within the proposed power line ROW.

Felled material would not be pushed or dragged across a wetland. Rather, felled trees would be lifted or carried from the wetland by low ground pressure equipment or equipment working from temporary load-dispersing mats. No material would be placed in stream channels or otherwise placed so as to interfere with stream flows or adjacent wetland hydrology.

A 30-foot upland buffer area would be established adjacent to all streams and at all jurisdictional wetlands. Wetland clearing methods would be used in these buffer areas to minimize the likelihood of upland soils being transported into wetlands. Appropriate soil erosion and sedimentation controls would be established at all wetland/upland and streambank boundaries.

There are currently no gates on existing transmission rights of way. If desired, Central Electric proposes to install fences and gates at road crossings on USFS lands to control public access along the proposed transmission line ROW. This kind of access control is often required to minimize trespassing, especially with off-road vehicles. Central Electric may honor private landowner requests for similar fencing and gates at road crossings.

4.3.8 Access Roads

Off-ROW access roads are existing roads that are not within the proposed transmission line ROW but may be needed for construction and maintenance access. Off-ROW access may be acquired for construction and maintenance on existing roads and/or existing utility easements. No new permanent roads would be constructed as a result of the transmission line construction.

Improvements to existing off-ROW roads may be required if it is determined that heavy transport requires such improvements. Improvements would typically involve re-grading of dirt roads if wear and tear of traffic requires it or adding rock (or additional rock) to unpaved roads. The need for roads improvements or maintenance during construction would depend on the nature of the existing transportation system in the area crossed by the preferred transmission line corridor. Improvements to existing roads would require permitting with the federal, state, or county authorities that own and maintain the roads.

Depending on the preferred transmission line corridor selected, the use of private roads may be required to access the transmission line easement. The right to use private roads for temporary or permanent access would be acquired through negotiation with property owners in the same manner as acquisition of the actual transmission line ROW. Similar improvements to those discussed above may be required before heavy transport can use private roads.

4.3.9 Construction Assembly Areas

A construction assembly area (or lay-down yard) would be identified and secured close to the Project Area. A 5- to 10-acre cleared area probably would be required. In all likelihood, the lay down yard would be leased for the duration of construction, and at least some portion of that area would be fenced and secured. A previously disturbed area is preferred for the construction lay-down yard. If one is not available, a site will be selected that minimizes vegetation clearing requirements, impacts to cultural resources, protected species, and jurisdictional wetlands.

4.3.10 Structures

Central Electric anticipates that single pole structures—typically 70 to 80 feet above ground and spaced 300 to 400 feet apart would be used to build the proposed 115 kV transmission line. Design features being considered include galvanized steel or COR-TEN steel, single pole structures carrying three 795 26/7 MCM ACSR electrical conductors on horizontal polymer post insulators, with a single 0.565 OPGW fiber optic overhead shield wire overhead.

Central Electric may use 2 poles or H-frame structures capable of achieving longer spans between structures in areas such as the Santee Delta or other river crossings. Other types of structures that may be installed include minor angle single pole structures, three-pole major angle structures, self-supporting structures, and “dead end” structures (Figures 4-2 and 4-3). Dead end structures using horizontal strain insulators are required approximately every 2 miles of line length to prevent a cascading event due to a conductor failure. Conductors can be spliced and pulled to eliminate unnecessary dead-end structures. Conductors are connected at dead-end structures by a short conductor cable under tension at both ends. Angle and dead-end structures are typically guyed to counter and resolve vector forces that would otherwise cause angle structures and adjacent tangent structures to fail.

Finally, some angle structures which require guying cannot be guyed directly because the required angle(s) for guying would put the guy wires within roadways or other features (e.g., natural gas pipelines and water mains). In those cases, guyed stub poles (Figure 4-4) are set up on the other side of the road or feature and an overhead wire under tension is connected from the structure to the stub pole. The stub pole itself is then guyed to counter and resolve vector forces. Alternately, a vibratory caisson structure can be used in this type of situation (Figure 4-5), especially where both normal guying and use of stub poles is not practicable due to spatial considerations.

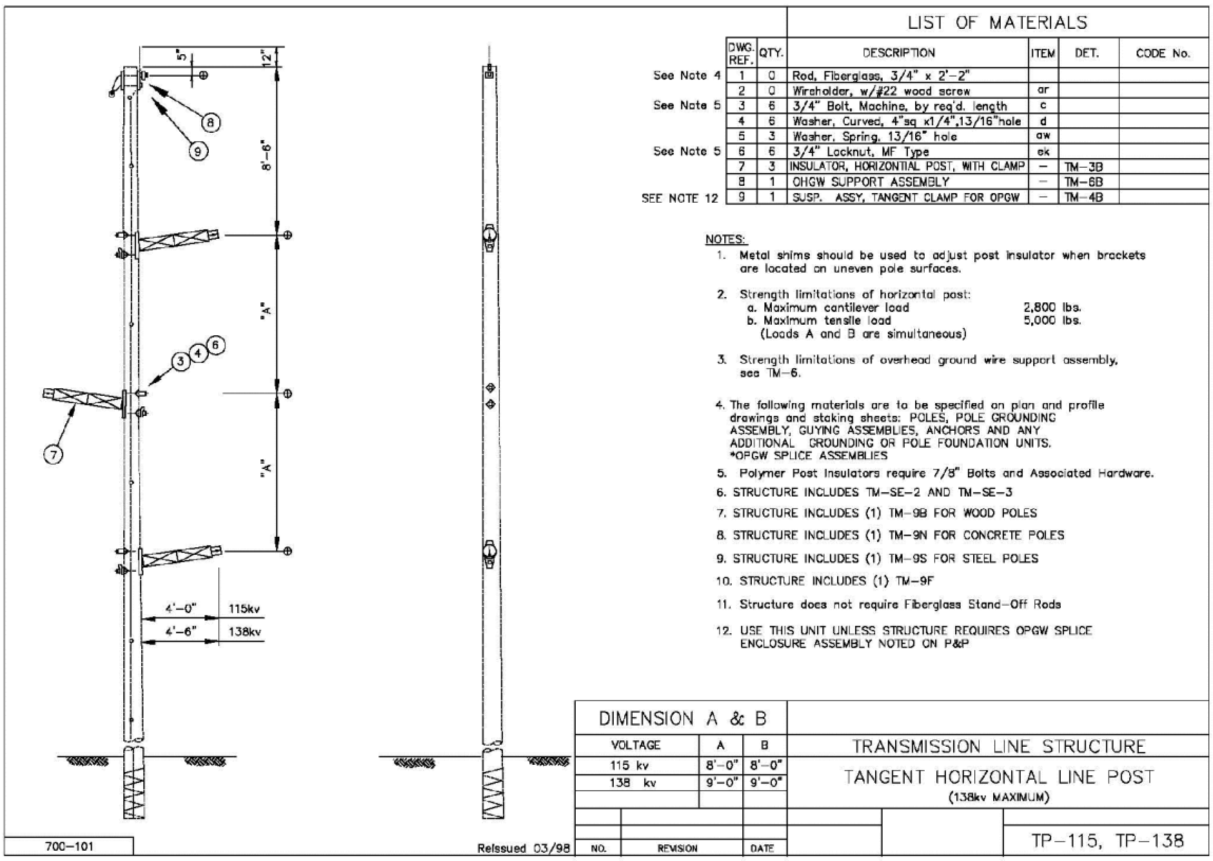

Figure 4-2: Transmission Line Structure—Tangent Horizontal Line Post

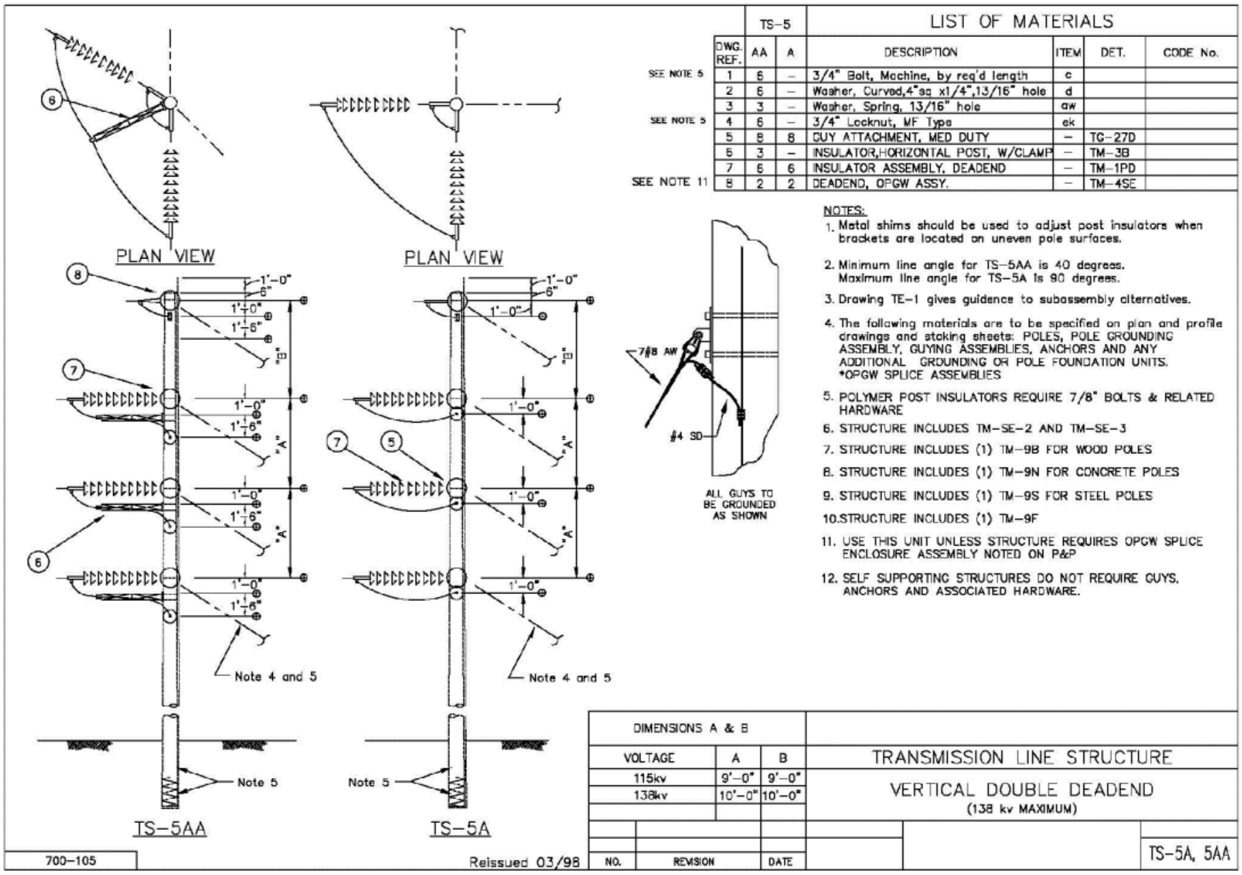

Figure 4-3: Transmission Line Structure—Vertical Double Dead End

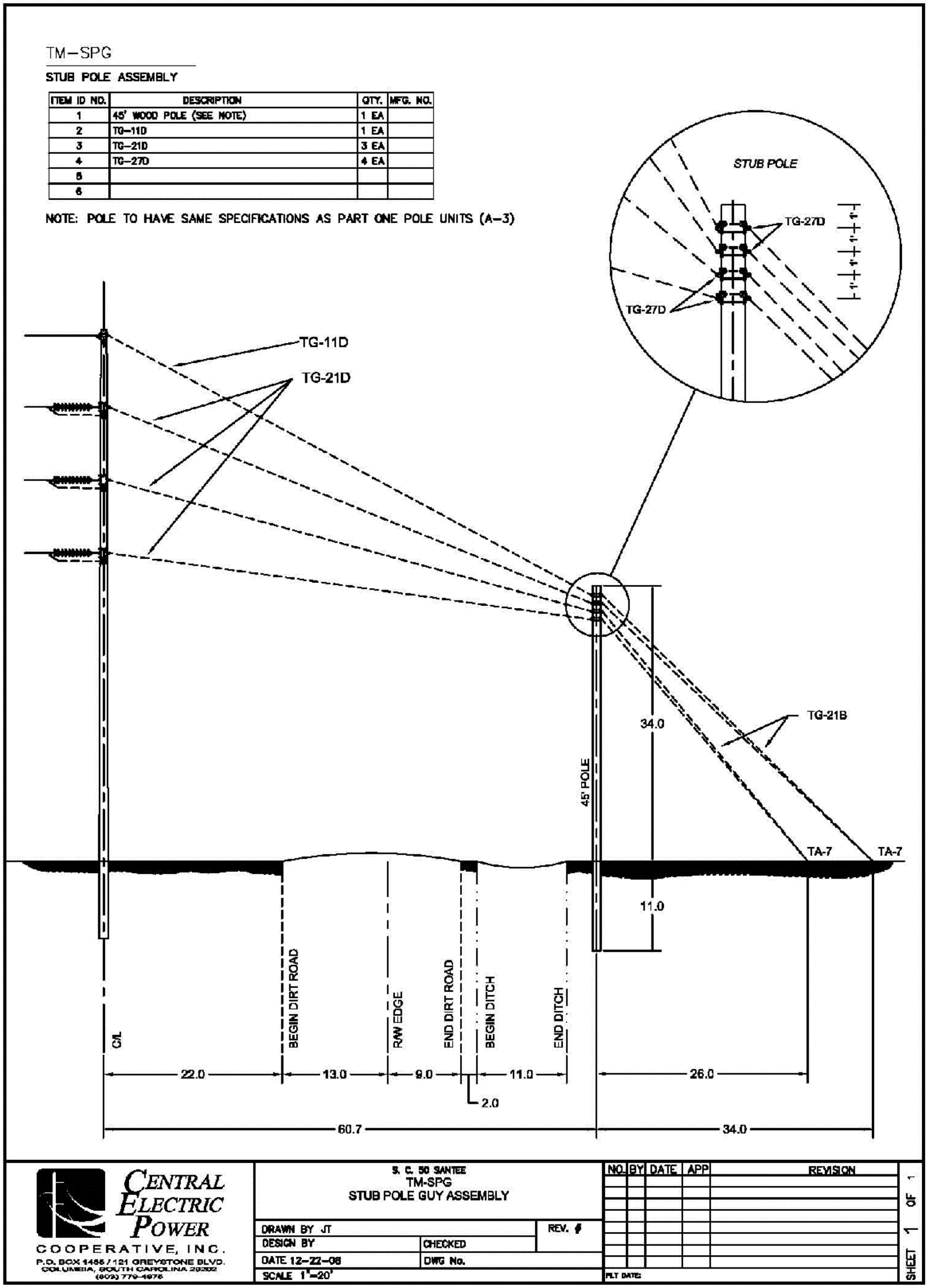

Figure 4-4: TM-SPG—Stub Pole Guy Assembly

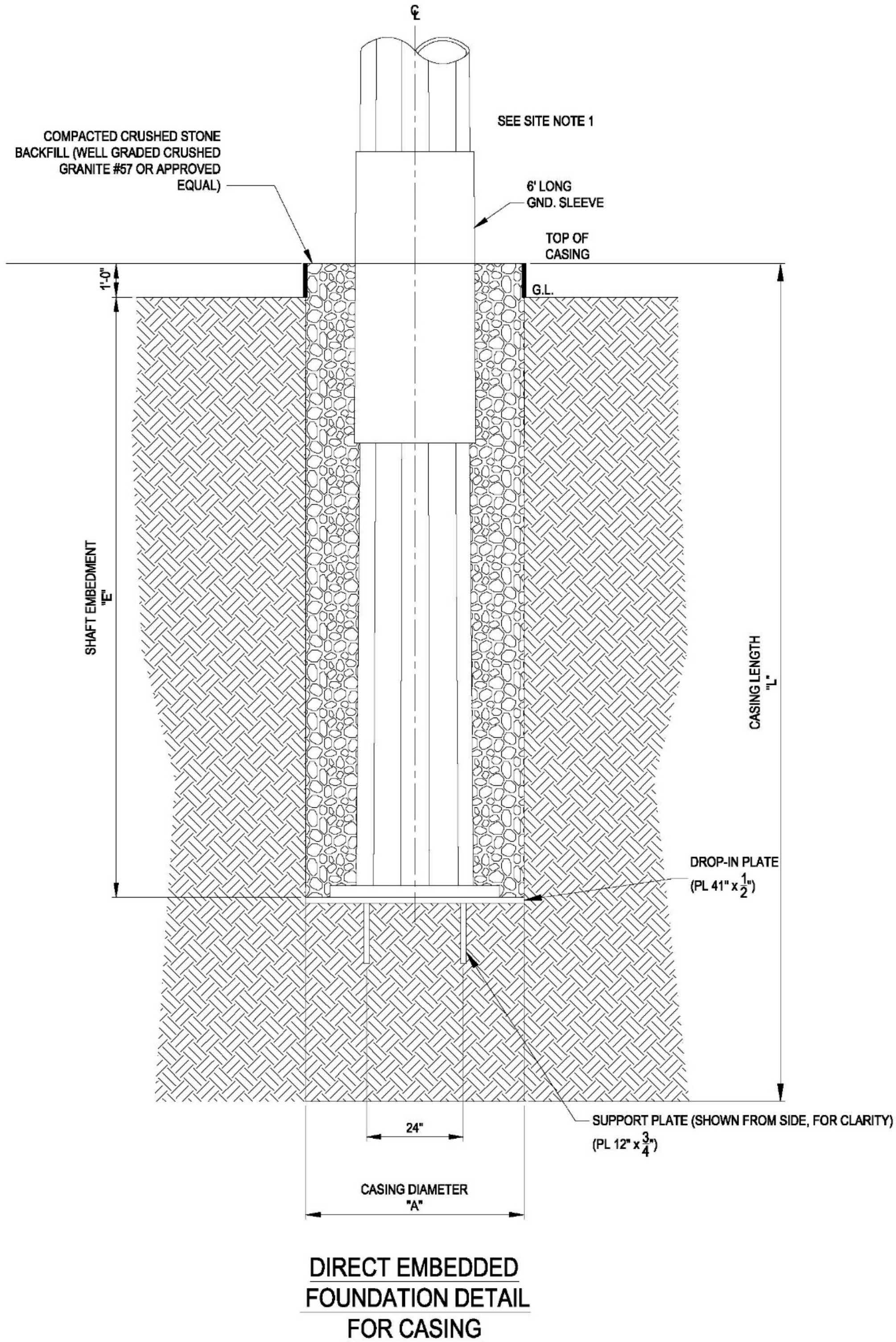

Figure 4-5: Direct Embedded Foundation Detail for Casing

To tap the existing Winyah-Belle Isle 115 kV transmission line, Central Electric's contractors would set new single pole structures within the phases of the existing transmission line and jumper the existing line around the structure in the direction where the tap "pulls off." Pole mounted line switches are normally installed close to the tap in all three resulting directions so that portions of the line can be isolated from faults and sectionalized so that they remain in service while repairs are carried out on damaged structures and/or spans. Sectionalizing is also useful when a utility needs to de-energize portions of the line to facilitate maintenance. Figure 4-6 shows a typical line switch.

Figure 4-6: Typical Line Switch

Because of poor soil conditions in the McClellanville area, Central Electric anticipates that the transmission line would be built using Vibratory Socket or Bolted Flange Caissons. The length and diameter of the Caisson would depend on the soil condition at each pole location. If soil conditions are favorable, direct embedded poles may be used. Direct embedded poles are tare augured to excavate a hole that is 10 percent of overall pole length plus an additional 2 feet. For example, a structure designed to stand 80 feet tall out of the ground would require a single pole structure approximately 91 feet in overall length buried 11.1 feet deep (9.1 feet plus 2 feet). Crusher-run stone backfill may be placed at the bottom of the augured hole. Pole top assemblies would be fitted with attachments and insulators while on the ground, and the poles would be then lifted into position by a crane. The pole would be placed in the hole and set plumb. Additional stone would be placed and tamped to fill the void between the structure and the undisturbed earth.

Typically, wetlands are spanned by transmission lines. However, in coastal South Carolina, wetland crossings may be too wide to span, requiring structures to be installed within wetlands. In such cases, Central Electric anticipates that the transmission line would be constructed in a manner similar to construction on uplands with several notable differences. Equipment used in wetlands would be low-ground pressure equipment, having a 10 psi or less rating, and/or equipment working on load-dispersing mats to minimize rutting and mucking of wetland soils. An environmentally benign, biodegradable drilling mud that is reclaimed at each site and used for the next installation may be used to prevent deep augured holes from collapsing in soft, saturated wetland soils. Native wetland soils removed by augur would be carried from the wetland, relocated to upland areas, spread, and stabilized. Depending on soil conditions in the wetlands, holes may be augured somewhat deeper or somewhat wider depending on the specific soil engineering characteristics at each structure site. Such actions would be consistent with any guidance or permits from USACE and applicable state regulatory agency.

Central Electric anticipates that dead-end structures may be installed atop a vibratory-driven, hollow-steel piling (also known as a caisson piling). The vibratory-driven caisson is a +/- 3/8-inch-thick, hollow-steel piling that, once installed, extends about 3–6 feet above ground elevation and is set to a depth of about 30–40 feet. The top of this vibratory piling is typically fitted with a 2.5-inch-thick steel flange upon which the superstructure sections of the steel pole would be attached using steel bolts. If used in a wetland, equipment used to vibrate the dead-end structure caisson piling into place, attach the upper segment(s), and string conductors would be low ground pressure equipment or equipment working from temporary load-dispersing mats intended to minimize rutting and mucking of wetland soils.

4.3.11 Conductor and Ground Wire Installation

Steel-reinforced aluminum conductors would be strung and attached to the ends of the polymer post insulators using the tension method. Major equipment required for tension stringing includes reel stands, tensioner, puller, reel winder, pilot line winder, splicing cart, and pulling vehicle. Travelers would be attached to the bottom of each insulator, so the conductor can be pulled through multiple structures. At one end, a reel of conductor would be staged in line with the structures. At the other end, a puller would be stationed to pull the conductor from the reel through the travelers located on the structures. Once the proper tension on the conductor is achieved, the conductor would be attached to the insulator and the travelers removed. Similar methods would be used for pulling the overhead shield wire into place along the length of the transmission line.

Guy wires are steel cables under tension designed to stabilize transmission structures. One end of the cable would be attached to the structure, and the other attached to steel helix anchors driven into the ground at some distance from the structure's base. The number of guy wires and their configuration depend on the design of the structure (e.g., single steel or concrete poles versus lattice towers), soil conditions, and whether the structures are tangent structures (several structures in a straight line) or angle structures (structures where the direction of the transmission line is changed). It is common to clear a small additional area, called a guy flare, to install the ground anchors for the guying system. The additional land disturbance area required for guy flares would not likely be significant compared to the overall 75-foot-wide easement. However, based on past experience with building transmission lines in South Carolina's Coastal Plain, Central Electric anticipates that there may be +/- 2.1 dead-end structures per mile and +/- 1.4 swinging angle structures per mile.

Dead-end structures require ahead-and-back guying as shown in Figure 4-3. In that figure, guy flares are labeled as 20 feet wide and 100 feet long. The 100-foot measurement is taken from the center of the pole. With a 75-foot-wide ROW, as proposed for cross-country potions of this Project, a 100-foot-long guy flare would require an additional +/- 65 feet of cleared area (35 feet of the 100-foot cleared area being already within the 75-foot wide easement, an additional +/- 65 feet would make up the 100-foot dimension labeled in the figure). The additional area for each of the two guy flares would therefore be +/- 1,300 square feet, or +/- 2,600 square feet per dead- end structure.

Swinging angle structures require only one set of guy wires to support a small angle structure. These guys are set up along the exterior angle bi-sector, and the flares would also be 100 feet long by 20 feet wide. The additional cleared area would be 65 feet by 20 feet or 1,300 square feet.

As with guying and guy flares, the number of stub poles is unknown at this time. Stub poles are typically required when paralleling roads and may require 20-foot-wide and 100-foot-long guy flares. For road-side alignments, Central Electric estimates that one stub pole and guy flare may be required every 4 miles along U.S. Highway 17. As much as 2,000 square feet of clearing could be required to install stub poles and guys.

4.3.12 Substation Construction

The preferred McClellanville Substation site is a 16.87-acre parcel near the intersection of U.S. Highway 17 and South Carolina Highway 45 near the Town of McClellanville. The substation parcel is in the form of a flag lot and includes a +/- 1,415-foot-long, 20-foot-wide graveled access road within a cleared 60-foot-wide access strip. The substation would require a 225-foot by 400-foot (2.1-acre) graded and fenced area with gravel and ground grid. The substation would also require a 1,415-foot-long, 20-foot-wide graveled access road within a cleared 60-foot-wide access strip. Total land disturbance within the limits of clearing and grading would include about 4.4 acres. Figure 2-1 shows the location of the McClellanville Substation site in relationship to the overall Study Area.

A 115-14.4/24.9 kV, 15/28 megavolt-ampere transformer and associated equipment would be installed within the substation fence. A high-side (transmission) frame would be installed within the substation to terminate the proposed McClellanville 115 kV Transmission Line. Three low-side distribution frames would be dedicated to Berkeley Electric with an additional low-side position dedicated to Dominion. Berkeley Electric anticipates four 3-phase distribution lines would be brought out to U.S. Highway 17 from the substation low-side along the access strip.

The four distribution lines would exit the substation underground, and the conductors would likely be installed within conduit. Once the underground circuits reach the existing distribution lines owned by the respective utilities, the circuits would transition to overhead configuration by means of riser poles set within the existing distribution lines.

Substation construction would take place on a previously graded site. Backhoes would be used to dig holes at certain locations and depths as designed, steel rebar cages would be placed in the holes, and concrete would be poured to create foundations to support the substantial weights of steel structures. These steel structures are needed to terminate the proposed transmission line and support the weights of the 115/25-kV electrical transformer, switches, bus work, and low-side (distribution voltage) frames. Trenching excavators would be used to place the conduit needed to operate switches and other equipment and to bring the four distribution lines out from the low-side structures.

4.3.13 Construction Schedule and Projected Workforce

Survey, ROW acquisition, and construction of the transmission line would occur over a 36 month period after the selection of the preferred corridor. Table 4-1 presents a timeline of the anticipated duration of each task and the projected workforce required to complete the tasks.

Table 4-1: Project Schedule and Projected Workforce

Task	Projected Workforce	Duration	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Survey for permitting	6–8	4–6 months																																				
Engineering survey	6–9	4–6 months																																				
Transmission line design and construction permitting	2–4	4–6 months																																				
Environmental studies	8–10	4–6 months																																				
ROW acquisition	8–10	8–12 months																																				
ROW clearing and preparation	10–15	6–8 months																																				
Transmission construction	20–25	12–16 months																																				

4.3.14 Procedures to Minimize Environmental Impact during Construction

The South Carolina Department of Health and Environmental Control (SCDHEC) manages the National Pollutant Discharge Elimination System (NPDES) General Permit within the state for Storm Water Discharges from Large and Small Construction Activities. The NPDES general permit requires compliance with the provisions of the South Carolina Pollution Control Act (South Carolina Code Sections 48-1-10 et seq., 1976) and with the provisions of the CWA, 33 USC §§1251 et. seq., as amended by the Water Quality Act of 1987, Public Law 100-4. Central Electric would file a Notice of Intent prior to commencing clearing and construction to install and maintain soil erosion and sedimentation control best management practices (BMPs) during clearing and construction and to stabilize the easement areas with permanent cover following completion of work and prior to filing its NPDES Notification of Termination.

Following transmission line construction on privately owned uplands, Central Electric anticipates the ROW would be seeded with a mixture of grasses and forbs suitable to the coastal South Carolina climate. Temporary mulch designed to provide cover and protect soils until the herbaceous vegetation is established may be used.

On USFS land uplands, following transmission line construction, Central Electric would seed the easement areas with a mixture of mutually agreed upon, native, warm season grasses. The seed mixture also may be temporarily mulched to protect soils until the native warm season grasses are established.

4.3.15 Transmission Line Maintenance and Operation

Access to the transmission line ROW would be required to perform periodic inspections, conduct maintenance, and repair damage. Regular maintenance and inspections would be performed during the life of the transmission line to ensure its continued integrity. Inspections would be limited to the ROW and to areas where obstructions or terrain may require off-ROW access. All inspection and maintenance activities would be conducted consistent with local, state, and federal regulations and permits. If problems are found during inspection, repairs would be performed, and the landowner would be compensated for any loss.

The ROW would be managed to control vegetation that interferes with the operation and maintenance of the transmission line. Portions of the Project corridor would be in forested areas, requiring tree maintenance to maintain the integrity of the transmission line. Native shrubs that would not interfere with the safe operation of the transmission line would be allowed to re-establish in the ROW. Central Electric's practice provides for the inspection of major transmission lines every year to determine if clearing is required. Other transmission lines are typically reviewed on a 2-year cycle. ROW clearing practices include a combination of mechanical and hand clearing, along with herbicide application where allowed, to remove or control vegetation growth.

4.3.16 Inspection

Central Electric's transmission lines are inspected on a regular basis by Santee Cooper, under a contractual relationship. Regular periodic inspection is required to ensure that structures, insulators, conductors, shield and guy wires, and all other components previously identified are maintained in good condition.

4.3.17 Vegetation Management

Transmission line ROWs owned by Central Electric or leased to Central Electric are also maintained by Santee Cooper. Santee Cooper's ROW management program is called Transmission Vegetation Management Program, and it includes a broad range of mechanical and chemical vegetation management. Santee Cooper's Vegetation Management Plan is included in Appendix C. The Mechanical Re-clearing Staff is responsible for the mechanical re-clearing and soil stabilization of selected transmission line ROWs. ROW management is responsible for herbicide-related vegetation maintenance, encroachment enforcement, and administering Santee Cooper's Integrated Vegetation Management program. Contract re-clearing is responsible for all tree related maintenance throughout the transmission system.

New Central Electric transmission ROWs would be inspected by Santee Cooper to ensure that ROW conditions can be accepted by Santee Cooper's Operations and Maintenance staff. Danger trees, erosion, correct ROW widths, and stump levels are some of the major items that would be inspected.

Transmission ROWs would be re-cleared on a 2.5- to 3-year cycle, using medium to heavy 4-wheel drive tractors with associated mowing implements, to ensure that vegetation growth does not adversely affect system reliability. Also, re-clearing personnel would use herbicides to control vegetation throughout their respective mow area, where allowed. Herbicide application includes applying granular herbicide at the base of selected transmission structures to reduce the potential for damage from wild fires and/or to facilitate ground rot inspections by line personnel. Also, crews treat wetland areas (i.e., areas where mowing equipment cannot traverse) with a foliar herbicide application, using a Marsh Master or similar equipment, to control woody vegetation.

The goal of Santee Cooper's herbicide program is to control vegetation that could interfere with the normal transmission of electricity, while promoting low-growing native vegetation. The current practice of applying herbicides is to selectively treat undesirable woody vegetation using a low volume methodology. Although the amount of herbicide applied depends on the species composition, density, and height of the vegetation that is present, the selective application approach results in less of the active ingredient being applied per acre, as compared to the broadcast method. Also, only USEPA-approved herbicides would be used within ROWs with each being applied in accordance with manufacturer labeling.

With respect to chemicals used, applications, and application rates, the following information has been submitted by Santee Cooper.

- Backpack application—Mix containing 4 percent Rodeo and 0.5 percent Polaris (average of 10 gallons of mix per acre is applied)
- Large all-terrain vehicle (ATV) application—Mix containing 4 percent Rodeo and 0.5 percent Polaris (average of 26 gallons of mix per acre is applied)
- Cut stump application—Mix containing 20 percent Triclopyr with the amount of mix applied dependent on the diameter of the stump because only the cambium layer is treated)
- Granular Application (applied by hand)—Two pounds or less per pole (dependent on the density of vegetation around the pole and the radius of control that is needed)

Glyphosate, Imazapyr, and Metsulfuron—the primary products Santee Cooper uses in its foliar spray mix—are USFS-approved herbicides. Santee Cooper currently uses the following products that are commonly available on the market.

- Polaris (Imazapyr)—Labeled for upland and wetland/aquatic uses on utility ROWs, Polaris is delivered by backpack or ATV depending on ROW conditions.
- Rodeo (Glyphosate)—Labeled for upland and wetland/aquatic uses on utility ROWs, Rodeo is delivered by backpack or ATV depending on ROW conditions.

- Escort (Metsulfuron)—Used sparingly when vines and waxy vegetation require control. When used, it represents 3 to 5 ounces of a 100-gallon tank mix.

Granular applications would primarily be used around poles to eliminate woody plants and vines. Santee Cooper uses a special granular blend consisting of Topsite and SpraKil S-5 that is applied by hand. Tebuthiuron (SpraKil S-5) represents 5 percent of the active ingredient. Topsite is a blend of herbicides that includes Diuron (which represents 2 percent active ingredient) and Imazapyr (which represents 0.5 percent active ingredient).

Using a selective low volume approach, personnel equipped with backpacks would treat only undesirable vegetation along selected ROWs. Hardwoods, such as sweetgum, red maple, black willow, and various oaks that are tall growing and prolific species like pines, would be targeted. By removing these trees, desirable plants (from an ROW perspective) such as grasses and forbs can better compete for nutrients and, once established, these low-growing species contribute substantially to long-term vegetation control in ROWs.

After initial herbicide application, Santee Cooper would conduct a post application inspection (e.g., aerial and/or ground) to identify any areas that may require follow-up treatment. Maintenance would take place on a 3-year rotation. Because the density of undesirable vegetation would have been reduced, subsequent herbicide applications should require less herbicide to control vegetation.

In wetland areas, Santee Cooper ground crews use backpacks and/or an ATV (e.g., Argo and Marsh Master) equipped with a hydraulic spray system to foliar treat only the undesirable vegetation present. Current procedures dictate a selective, low volume herbicide approach that minimizes the amount of active ingredient applied per acre.

The herbicide products that would be used during wetland area spraying are determined by the species present and, to a great extent, by the location. In areas that have standing water and are connected to a larger aquatic system (e.g., river or swamp), only USEPA-approved herbicides registered for use in wetland or aquatic sites would be used. Wetland areas would be scheduled on a 3- or 4-year rotation depending on the vegetation species present, densities of woody vegetation, and height of conductors. Vegetation densities should decrease with subsequent applications requiring less herbicide to be applied.

Future vegetation management activities on ROWs crossing USFS lands are expected to be similar to vegetation management as described above except for the use of herbicides. Herbicides would not be used during land clearing or maintenance activities of the ROW crossing USFS lands. In the future, Santee Cooper may elect to undertake a risk assessment for the use of chemical management on the FMNF and secure permission from USFS to use chemicals on the ROW, but the use of chemicals on USFS lands is not contemplated at this time. Currently there is no approved use of herbicides on the FMNF.

Transmission lines with tree limbs encroaching into the ROW that pose a problem for maintenance and operations would be scheduled for side trimming. Maintenance options would include removing encroaching limbs from the air or from the ground. Aerial operation would consist of using a set of belt driven saws, suspended from a helicopter, to cut over- hanging limbs back to the edge of the ROW. Ground operation would include using equipment, such as a Jarraff or Skytrim, to perform a similar function. These machines have an extendable boom with an attached circular saw that can reach and trim tree limbs high above the ground.

To manage and maintain danger trees, maintenance personnel would use an instrument called a clinometer that measures angles to determine whether a tree located off ROW is tall enough to hit the transmission line conductors if it were to fall. Depending on the species of tree, height, age, and site index, the tree would either be felled whole or topped. The decision to top or fell would be made by a forester in charge of the operation based on his or her opinion of tree survivability after topping. Felled trees are de-limbed and decked between the spans in which they were cut. The resulting slash (tree tops and limbs) would be left in the ROW to decay.

Reported erosion problems on the ROW typically would be rated from low to extreme based on soil type, topography, and proximity of eroded area to a transmission structure. This information is used to prioritize and schedule erosion control measures that would provide long-term control and ensure system reliability. Corrective action measures would include grading the eroded area and, if necessary, constructing earthen terraces to divert surface waters across the ROW. Crews then would plant the area with an appropriate seed mix for the season and soil characteristics. To enhance stability and ensure that the terraces and repaired ROWs would not be affected by rains before grasses are established, hay bales, or other erosion control structures may be installed where appropriate to protect them.

4.3.18 Structure Replacement

In the event that one or more of the structures fail, they would be replaced as described in Section 4.3.6, *Transmission Line Construction*. Damaged structures and components would be recycled or landfilled.

4.3.19 Substation Maintenance and Operation

Berkeley Electric will follow the latest RUS guidelines in performing operations and maintenance procedures on its substation. Berkeley Electric will inspect its substation monthly to identify anything within the substation that may need attention and to collect operational data from electrical equipment such as transformers, breakers, reclosers, and voltage regulators. The physical condition of equipment, structures, fencing, gates, and signs will be recorded during inspections. The latest version of the National Electrical Safety Code will serve as the minimum requirement on items such as clearance and signage. Relay, infrared, and oil testing will be done per RUS and industry best practices to help ensure safe and reliable operation of the vital substation equipment. Reclosers and voltage regulators will be changed out periodically so that maintenance can be performed in a controlled environment. Berkeley Electric will engage a third-party consulting firm to review its operations and maintenance practices every 3 to 4 years and submit the third-party inspections to Central Electric and RUS.

Routine maintenance would be conducted at substation locations, as required, to remove undesirable vegetation that may interfere with the safe and reliable operation of the substation.

4.3.20 Inspection

Substations are inspected on a regular basis to ensure that transformers, high-side and low-side structures, bus work, and all other components are maintained in good condition.

4.3.21 Spill Prevention, Control, and Countermeasures

Electrical transformers used for the proposed McClellanville Substation would be filled with non-polychlorinated biphenyl (PCB) dielectric fluids needed for cooling and insulating the equipment. No other additional bulk storage of oils would be required onsite. Non-PCB mineral and vegetable-based oils typically used in new transformers display low direct toxicity because they do not contain the water soluble and multi-ringed polynuclear aromatic hydrocarbons typically found in the older PCB/petroleum-based oils. Nevertheless, the transformer at the proposed McClellanville Substation would be installed within a concrete containment area with 2-foot-high walls, forming a containment area with sufficient capacity to hold the transformer cooling/insulating fluids in the unlikely event of a leak or spill.

As required by USEPA, Berkeley Electric has developed and maintains an oil Spill Prevention Control and Countermeasures Plan (SPCC) to identify the quantities of oil at each substation and procedures to follow, in the event of a spill. The plan would give all pertinent information needed to effectively initiate clean up the spill, including all agency contact information required for notification purposes.

Knowledge of a spill would be immediate because the substation transformer would overheat and protective equipment would engage and shut down the power to the substation. Berkeley Electric would respond as quickly as practicable to assess the situation. Installation of a temporary or new transformer and recovery of the spilled fluids would be very high priorities. The site cleanup crew would implement the accidental release measures identified on the Material Safety Data Sheet for Mineral Oil and in the Spill Prevention Control and Countermeasures Plan. The containment area would prevent the spill from leaving the site and entering watercourses. The spilled dielectric fluid would be absorbed with appropriate inert materials or recovered using vacuum pumps, shovels, buckets, or other means and placed in drums or other suitable containers. Recovered material would be delivered to a company that handles the responsible and approved disposal or recycling of used transformer oils.

4.4 Environmental Impact Mitigation

Selecting any of the corridor alternatives would require implementing mitigation measures to prevent or minimize both short- and long-term impacts on resources from construction and operation of the Project. Additional mitigation measures would be evaluated as further information becomes available on the actual route location. Central Electric would implement standard BMPs in the construction and operation of the proposed Project. Table 4-2 presents the proposed mitigation measures for each resource area.

Mitigation measures that would be required by federal agencies as loan or permitting conditions would be included in the Record of Decision issued by each federal agency.

Table 4-2: Summary of Mitigation Measures

BMP No.	Mitigation Measure
Water Resources	
WR-1	Construction equipment, fuels, chemicals, and materials will be stored outside of streams and wetlands.
WR-2	Construction mats will be used for all wetland crossings.
WR-3	Wetland areas will be identified and marked prior to construction along the ROW.
WR-4	Wetland and riparian areas will be spanned, where feasible. Low-water crossings may be used to access the ROW during construction and will be designed so as not to inhibit fish passage or create discharges.
WR-5	BMPs, such as silt fence or other appropriate measures, will be installed at all stream crossings and along the borders of wetlands to prevent sedimentation.
WR-6	Structures will be located outside wetland areas, where feasible.
WR-7	The Project will comply with all requirements of state permits for storm water discharges for construction activities.
WR-8	A Storm water Pollution Prevention Plan will be developed prior to construction.
WR-9	Construction activities will be conducted to prevent the accidental spillage of solid matter contaminants, debris, hazardous liquids, or other pollutants into streams,

BMP No.	Mitigation Measure
	waterways, lakes, land, and underground aquifers. Such pollutants and waste include, but are not restricted to, refuse, garbage, cement, concrete, sanitary waste, industrial waste, oil, and other petroleum products, aggregate processing tailing, mineral salts, and thermal pollution.
WR-10	A hazardous materials management and spill prevention plan will be developed to address storage, use, transportation, and disposal of hazardous materials.
WR-11	An emergency response plan will be developed for accidental spills.
WR-12	Spills or equipment leaks will be promptly cleaned up to prevent materials entering surface water.
WR-13	Construction in river crossing areas will be scheduled during low water periods or during winter, if feasible.
WR-14	Culverts will be installed, where necessary, to accommodate the estimated peak flow of the stream. Disturbance to the stream banks will be minimized during construction and all disturbed areas will be regraded to original contours and revegetated in accordance with the mitigation measures listed for soil/vegetation resources. Annual monitoring will ensure the culverts are functioning as designed.
WR-15	Excavated material and other debris will be removed from flood prone areas to prevent introduction of debris that may lead to clogged culverts or bridges, resulting in changes to water flow and flood patterns.
WR-16	Excavated materials will not be stockpiled near or on stream banks or other waterway perimeters unless the stockpile is protected from high water or storm water runoff.
WR-17	Wastewater discharge from any construction operation will not be allowed to enter streams, waterways, or other surface waters without the appropriate permits.
WR-18	The use of fertilizers, pesticides, or herbicides will be avoided in or near surface waterbodies.
Biological Resources	
BR-1	Temporary access roads created during construction of the transmission line will be restored to the natural condition after construction is completed.
BR-2	Holes drilled or excavated for foundation construction and left unattended overnight will be marked and secured with temporary fencing to reduce the potential for livestock and wildlife to enter the holes, and for public safety.
BR-3	Construction operations will be conducted to prevent, to the extent practical, any unnecessary destruction, scarring, or defacing of the natural surroundings, vegetation, trees, and native shrubbery in the vicinity of the work.
BR-4	A non-native invasive plant management plan will be developed to address the potential spread of non-native invasive plants during construction activities. The plan would include strategies for prevention, detection, and control of non-native invasive plants.
BR-5	Construction equipment will be inspected for seeds and thoroughly cleaned before mobilizing to the Project Area.
BR-6	Raptor and migratory bird surveys will be conducted along and adjacent to the proposed transmission line route prior to construction. In the event a nest is

BMP No.	Mitigation Measure
	located, USFWS will be coordinated with to minimize adverse effects during construction, if avoidance is not possible.
BR-7	The Project will be designed in accordance with the Avian Power Line Interaction Committee's *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006) and protection from line strikes in accordance with recommendations contained in the most recent Avian Power Line Interaction Committee publication, *Reducing Avian Collisions with Power Lines, State of the Art in 2012* (APLIC 2012).
BR-8	The results of the Endangered Species Act (ESA) Section 7 consultation will be included in the final EIS and any mitigation measures that are required for federally listed species will be implemented.
BR-9	Upon completion of all work, all non-agricultural disturbed areas and construction staging areas not needed for maintenance access will be re-graded so that all surfaces drain naturally, blend with the natural terrain, and are reseeded to blend with native vegetation with a seed mixture certified as fee of non-native invasive plants. All destruction, scarring, damage, or defacing of the landscape resulting from construction will be repaired.
BR-10	No tree removal within 300 feet of active swallow-tailed kite nests from April 1 through June 30 or until fledging is completed.
BR-11	If the preferred alternative corridor is near a climbing heath, Carolina fluffgrass, and/or yellow fringeless orchid, a buffer will be placed around the location of the species to minimize impacts.
BR-12	Mitigation measures discussed in the biological assessment for the Project will be implemented before, during, and after construction.
BR-13	In consultation with USFWS, optical ground wire or bird flight diverters will be used to mitigate the potential collision risk in high bird use areas.
BR-14	Implement guidelines for the management of cavity trees and clusters from the most recent red-cockaded woodpecker recovery plan (USFWS 2003), and no removal of trees >10 inches diameter at breast height, whether alive or dead, is allowed within a cluster without concurrence and/or a permit from USFWS.
Soils and Geology	
SG-1	Construction activities will be confined to the ROW and around structure locations for placement of the transmission structures.
SG-2	Topsoil removed during construction will be stockpiled and used for reclamation following construction.
SG-3	All disturbed areas will be re-graded, stabilized, and revegetated to pre-construction conditions.
SG-4	Access roads will be designed to follow the contour of the land to the extent practical rather than in a straight line along the ROW where steep features would result in higher erosion potential.
SG-5	Compacted soils will be sufficiently loosened after construction to minimize impacts on soil productivity and agricultural operations.
SG-6	Water will be applied on roads and disturbed areas to minimize dust, as needed.
Air Quality and Greenhouse Gas Emissions	

BMP No.	Mitigation Measure
AQ-1	Speed limits will be enforced on local gravel roads during construction to reduce dust.
AQ-2	Staging areas and laydown yards will be located as close to the construction site as possible to minimize driving distance.
AQ-3	All waste materials will be disposed of properly at permitted waste disposal areas or landfills.
AQ-4	Waste materials will not be burned or buried on the ROW.
Cultural, Historical, and Paleontological Resources	
CHP-1	A cultural resource survey will be conducted within the ROW for archaeology and the area of potential effects for aboveground resources prior to construction and mitigation measures will be developed, where required as identified in the Programmatic Agreement (PA).
CHP-2	Archaeological sites will be spanned and protected during construction when feasible, as identified in the PA.
CHP-3	All workers will be briefed on the appropriate protocol in the event of a cultural resource discovery during construction. All workers are prohibited from removing artifacts from the Project Area, as identified in the PA.
CHP-4	All construction activities will be suspended within a 50-foot radius if any archaeological resources are discovered, as identified in the PA.
Land Use	
LU-1	A schedule of construction activities will be provided to all landowners who could be affected by construction.
LU-2	Appropriate permits and easements for portions of the ROW traversing public lands will be acquired from the federal or state land management agencies.
LU-3	Construction activities will be planned to minimize temporary disturbance, displacement of crops, and interference with agricultural activities.
LU-4	Access road construction will be kept to the minimum width required for the passage of construction vehicles.
LU-5	Fences, gates, and similar improvements that are removed or damaged during construction will be repaired or replaced.
LU-6	Deep ruts that are hazardous to farming operations and equipment movement will be reclaimed after construction. Such ruts will be leveled, filled, and graded, or otherwise eliminated in an approved manner. Ruts, scars, and compacted soils from construction activities in productive hay or crop lands will be loosened and leveled by scarifying, harrowing, disking, or other appropriate methods. Damage to ditches, tile drains, terraces, roads, and other land features will be corrected. Land contours and facilities will be restored as nearly as practical to their original conditions.
LU-7	Hedges and gates will be used to discourage access to the ROW across non-NFS lands. Gates will be used exclusively to discourage access to the ROW across NFS lands.

BMP No.	Mitigation Measure
Socioeconomics	
SE-1	Landowners will be contacted during construction to minimize short-term impacts on agriculture.
Transportation	
T-1	Conductor stringing across roadways will be coordinated with the State Department of Transportation.
T-2	Coordination with the Federal Aviation Administration may be required if the preferred corridor is near an airfield. Any required coordination will be completed prior to construction.
Health and Safety	
HS-1	A construction plan in accordance with the National Electrical Safety Code and the Occupational Safety and Health Administration's regulations will be prepared, as required by federal law, to ensure the safety of construction workers. The plan will include standards such as requirements for hearing protection, personal protective equipment, site access, chemical exposure limits, safe work practices, training program, and emergency procedures. The plan will also identify procedures should a spill occur or hazardous materials be discovered. The plan will be reviewed with fire department personnel and emergency services personnel to reduce risk of construction and operation activities interfering with emergency response or evacuation plans and procedures.
HS-2	Existing utilities will be identified and coordinated with prior to construction in order to implement appropriate measures to protect both facilities and construction workers during crossings.
HS-3	Fueling of vehicles will be conducted in compliance with established procedures designed to minimize fire risks and fuel spills.
HS-4	All construction areas will be secured at the end of each work day to protect equipment and materials and discourage public access.
Noise	
N-1	Equipment will be equipped with sound-control devices no less effective than those provided on the original equipment.
N-2	All internal combustion engines used in connection with construction activities will be equipped with a muffler and spark arrester to avoid nuisance conditions due to construction noise.
N-3	Construction activities will be conducted between the hours of 7:00 a.m. and 8:00 p.m. in residential areas.

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5.0 AFFECTED ENVIRONMENT, ENVIRONMENTAL IMPACTS, AND MITIGATION MEASURES

5.1 Introduction

This chapter describes the existing environmental resources and potential impacts that the Project corridor alternatives would have on those resources. The affected environment and potential impacts were determined through research and desktop analysis conducted by environmental specialists and from information provided in agency and public comments. Field surveys were conducted on Forest Service lands and those data are provided in this section. However, because Central Electric does not have access rights, private lands were not surveyed. In these areas, publicly available information was used to describe the existing environment and characterize the potential effects. For each resource, potential mitigation measures to reduce or avoid impacts are identified as well as those impacts that are unavoidable even after implementation of mitigation. Finally, this chapter describes irreversible or irretrievable commitment of resources and the relationship between short-term uses of the environment and long-term productivity.

5.2 Affected Environment

NEPA requires that the environment of the area to be affected or created by the alternatives under consideration is sufficiently described (40 CFR §1502.15). The Affected Environment section describes the resources that could be affected by the implementation of the proposed action. The resource descriptions provided in this section serve as the baseline from which to evaluate the potential impacts of the proposed action.

The resources that could be affected by the Project include the following:

- Water Resources
- Biological Resources
- Soils and Geology
- Air Quality and Green House Gas Emissions
- Cultural, Historical, and Paleontological Resources
- Land Use
- Visual Resources

- Socioeconomics
- Environmental Justice
- Transportation
- Health and Safety
- Noise

5.3 Environmental Effects

The Environmental Effects section analyzes both beneficial and adverse impacts that would result from implementing any of the alternatives. NEPA requires agencies to assess the direct, indirect, and cumulative impacts of a proposed action. Direct impacts are those that are caused by the proposed action and happen at the same location and time. Indirect impacts are those impacts that happen later in time and/or farther removed from the proposed action but are still reasonably foreseeable. A cumulative impact is defined as the “impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR §1508.7).

Where specific impacts affecting NFS lands, such as the FMNF, can be addressed separately, they are called out and described in this analysis. In cases where impacts on NFS lands would not be discernable or unique from general effects on all lands (e.g., Project-related effects on regional air quality), such effects on NFS lands are addressed in the general analysis.

To determine whether an action has the potential to result in significant impacts, the context and intensity of the action must be considered. Context refers to area of impacts, timing, and the duration. Intensity refers to the severity of the impact. Intensity definitions have been developed to assess the magnitude of effects for all of the affected resource categories resulting from implementing the proposed action. Context in terms of duration of impact are estimated as either short term or long term. The definitions of intensity and duration are specific to each resource evaluated. Each affected resource impact analysis briefly describes the methodology used for analysis.

For purposes of this draft SEIS, impacts resulting from the Project have been quantified to the extent possible based on proposed corridor alignments and 75-foot-wide ROW associated with the corridor alternatives and a 600-foot buffer (300 feet on either side of the centerline) around the corridor alternatives. As corridor alignments become finalized, minor adjustments would be made based on constructability within this 600-foot buffer. These adjustments would include the locations for the placement of double-pole structures to cross rivers and the location for turn angles to provide a change in direction of the transmission line that would require temporary construction easements outside the 75-foot-wide ROW so that the conductor can be pulled through at an angle. The impacts analysis will be revised during the preparation of the final EIS.

5.4 General Description of the Study Area

5.4.1 Belle Isle

The Study Area for the Project corridor alternatives is bounded on the west by the Winyah-Charity 230 kV Transmission Line, on the north by the Winyah Generation Station, on the east by U.S. Highway 17, and on the south by the McClellanville Substation location (see Figure 5-1). The Study Area encompasses a portion of the Santee River Delta, and Belle Isle corridor alternatives B and C cross both the North and South Santee rivers. The FMNF is located south of the South Santee River and is included in the Study Area.

5.4.2 Jamestown

The Study Area for the Jamestown corridor alternative is bounded on the west by South Carolina Highway 41 on the north by the Jamestown Generation Station, on the east by South Carolina Highway 45, and on the south by U.S. Highway 17 and the McClellanville Substation location (see Figure 5-2). The Study Area encompasses a portion of the Santee River Delta, but the single corridor alternative does not cross the North and South Santee rivers. The corridor alternative is located mostly within the FMNF.

5.4.3 Charity

The Study Area for the Charity corridor alternative is bounded on the west by the Charity Generation Station, on the north by South Carolina Highway 41, on the east by South Carolina Highway 45, and on the south by U.S. Highway 17 and the McClellanville Substation location (see Figure 5-3). The Study area encompasses a portion of the Santee River Delta, but the single corridor alternative does not cross the North and South Santee rivers. The corridor alternative is located mostly within the FMNF.

For each of the resource areas below, a general description of the existing conditions is stated followed by an examination of each alternative and the potential effect on the resource. Eight alternatives (as discussed in Section 2.3) and the no-action alternative were carried forward for the resource analysis.

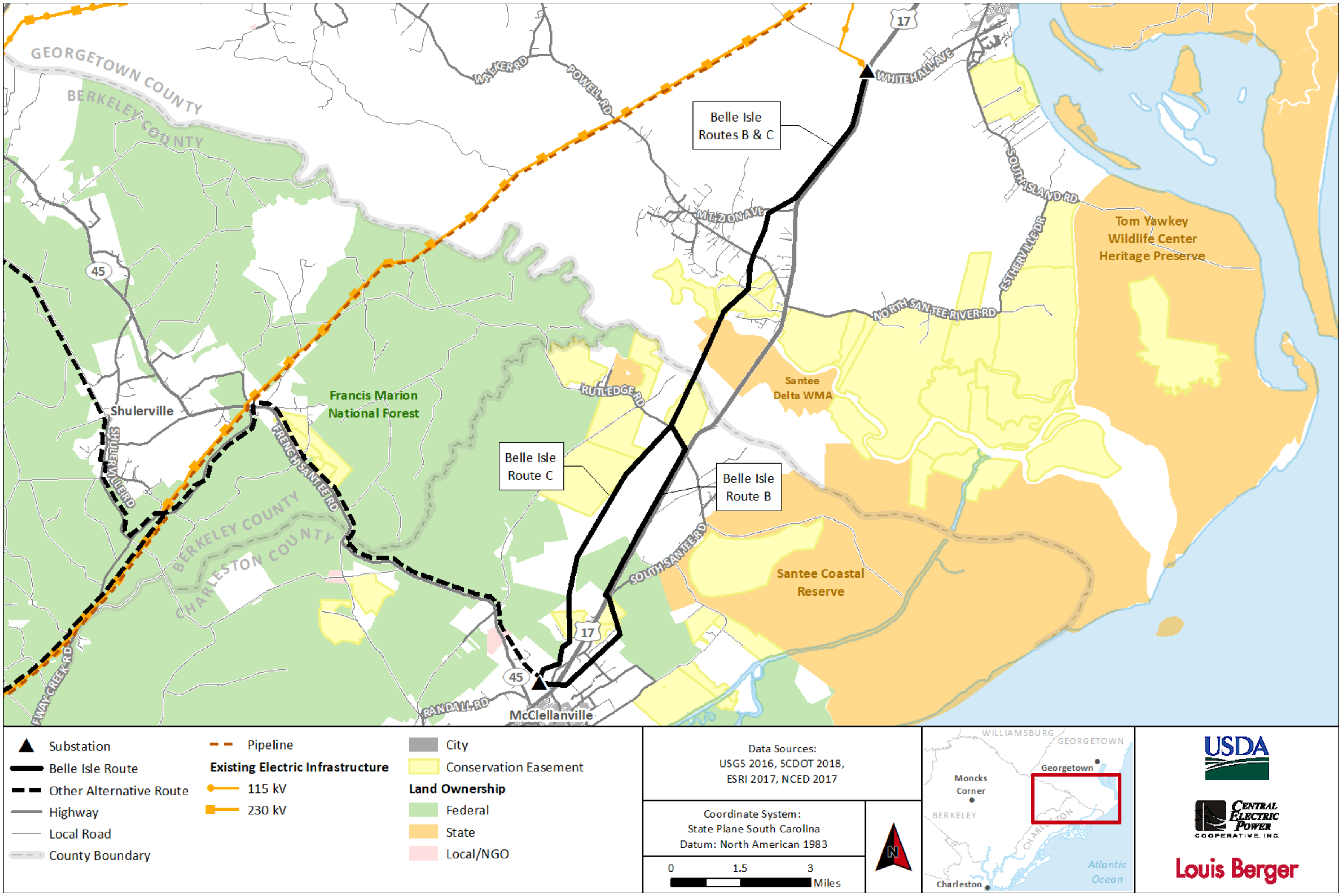


Figure 5-1: Belle Isle Transmission Corridor Alternative

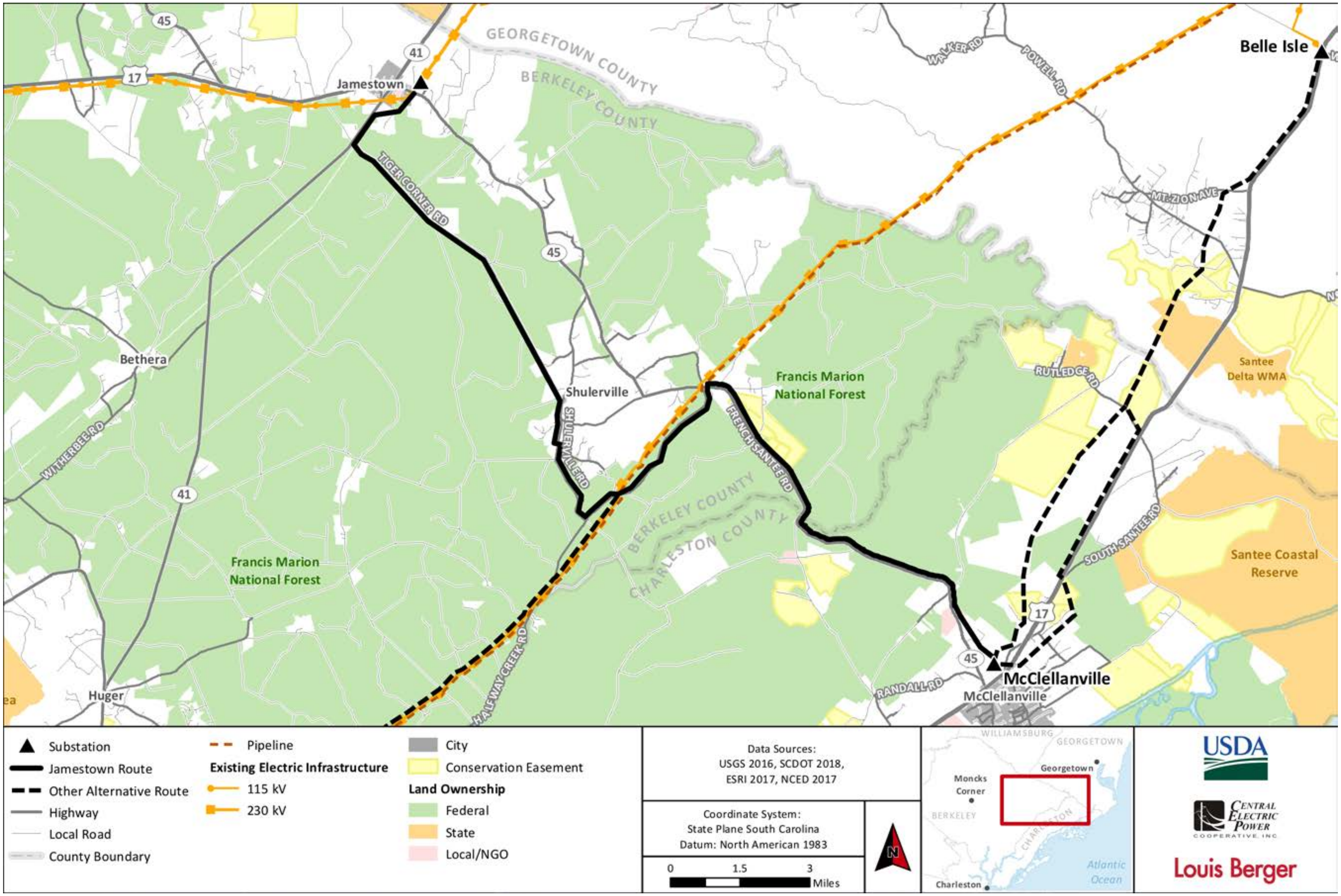


Figure 5-2: Jamestown Transmission Corridor Alternative

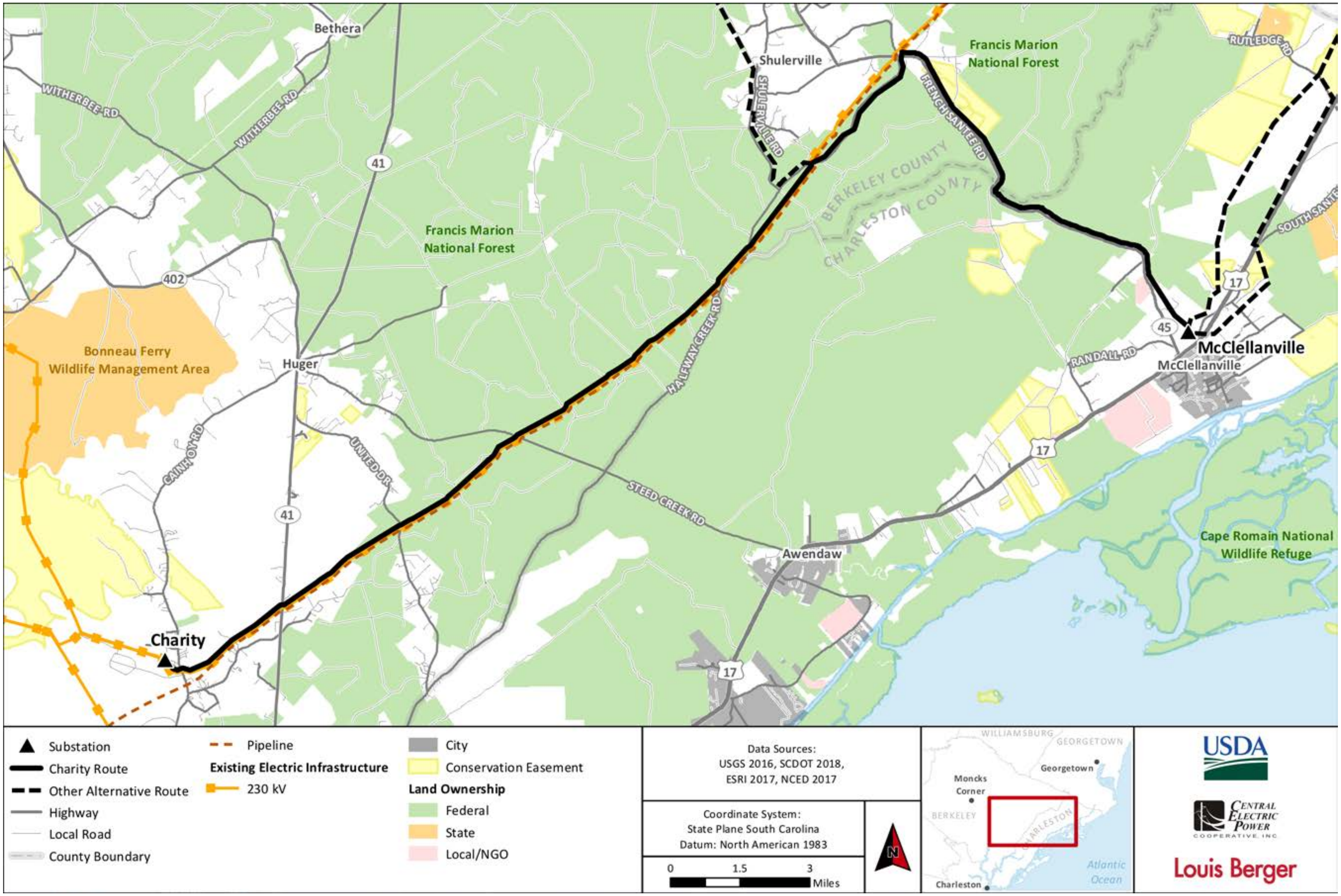


Figure 5-3: Charity Transmission Corridor Alternative

5.5 Water Resources

5.5.1 Affected Environment

The flat, low country region of the South Carolina's Atlantic Coastal Plain has abundant water resources. The Study Area includes extensive areas of swamps, bays, lime sinks, tidal estuaries, freshwater streams, lakes, and reservoirs. Several perennial and intermittent streams are also present.

USACE has regulatory jurisdiction over waters of the United States, including many lakes, rivers, streams, and wetlands, pursuant to Section 404 of the CWA and jurisdiction over navigable waters of the United States pursuant to Section 10 of the 1899 Rivers and Harbors Act. Placing transmission line pole structures, clearing land that involves soil disturbance, or placing construction mats may be considered a discharge of fill material that would require a permit from USACE pursuant to CWA Section 404. Receipt of a Section 404 permit and adherence to the terms and conditions of the permit, including any associated compensatory mitigation and BMPs to reduce sedimentation and erosion control, would demonstrate the Project's compliance with the CWA. Field inspections of the Project would evaluate and verify compliance with permits and the CWA. In addition, placing a transmission line over a navigable waterbody would require a permit pursuant to Section 10 of the 1899 Rivers and Harbors Act.

Transmission lines that cross navigable waters of the United States, as defined by Section 10 of the 1899 Rivers and Harbors Act, must maintain a minimum height requirement above that required for bridges. For a 115 kV transmission line, the minimum height requirement is 20 feet above the required bridge height for a new fixed bridge or existing bridge in the vicinity, as stated in 33 CFR §322.5.

5.5.1.1 Surface Water

Belle Isle

Four named rivers and creeks are present in the Study Area, including the North Santee River, South Santee River, Montgomery Creek, and Bonny Clabber Creek (Figure 5-1). Montgomery and Bonny Clabber creeks are tributaries to the North and South Santee rivers, whereas Pennyroyal Creek flows north from the Study Area into Turkey Creek. The named rivers and creeks are discussed in greater detail below. Remaining stream crossings and waterbodies are unnamed. Most streams crossed by the Study Area are either direct or indirect tributaries to the North and South Santee rivers. Streams that are not tributaries to the North and South Santee rivers are tributaries of the Sampit River, and they are located in the northern portion of the Study Area, near the Belle Isle Substation.

Jamestown

Five named creeks are present within the Study Area—Echaw Creek, Beaman Branch, Wambaw Creek, Mechaw Creek, and Jeremy Creek (Figure 5-2). Echaew Creek and Beaman Branch are tributaries to the Santee River, whereas Wambaw and Mechaw creeks are tributaries to the South Santee River. The named creeks are discussed in greater detail below. The remaining stream crossings and waterbodies are unnamed. Most of the streams crossed by the Study Area are either direct or indirect tributaries to the Santee River system. Streams that are not tributaries to the Santee River system are tributaries of the Atlantic Ocean, and they are located in the southern portion of the Study Area, near U.S. Highway 17 and the McClellanville Substation.

Charity

Five named creeks are present in the Study Area—French Quarter Creek, Quimby Creek, Cropnel Dam Creek, Wambaw Creek, and Mechaw Creek (Figure 5-3). French Quarter and Quimby creeks are tributaries to the East Branch Cooper River, whereas Cropnel Dam Creek is a small tributary to Quimby Creek. Wambaw and Mechaw creeks are tributaries to the South Santee River. The named creeks are discussed in greater detail below. The remaining stream crossings and waterbodies are unnamed. Most of the streams crossed by the Study Area are either direct or indirect tributaries to the Cooper River system. Streams that are not tributaries to the Cooper or Santee River systems are tributaries of the Atlantic Ocean, and they are located in the southern portion of the Study Area, near U.S. Highway 17 and the McClellanville Substation.

The Charity corridor alternative has the greatest number of stream and waterbody crossings, which includes all channels identified from the National Hydrography Dataset, and the Jamestown corridor alternative has the fewest number of stream crossings. Table 5-1 quantifies the streams and waterbodies crossed by each corridor alternative. Figures 5-4 through 5-6 show the location of the streams crossed by each corridor alternative.

Table 5-1: Surface Water Crossed by Each Corridor Alternative

Hydrology	Belle Isle		Jamestown	Charity
	Option B	Option C		
Stream crossings (count)	15	10	10	22
Waterbody crossings (count)	10	15	10	26
Waterbody crossing length (miles)	2	3.5	1.2	2.8

Source: National Hydrography Dataset (USGS 2010)

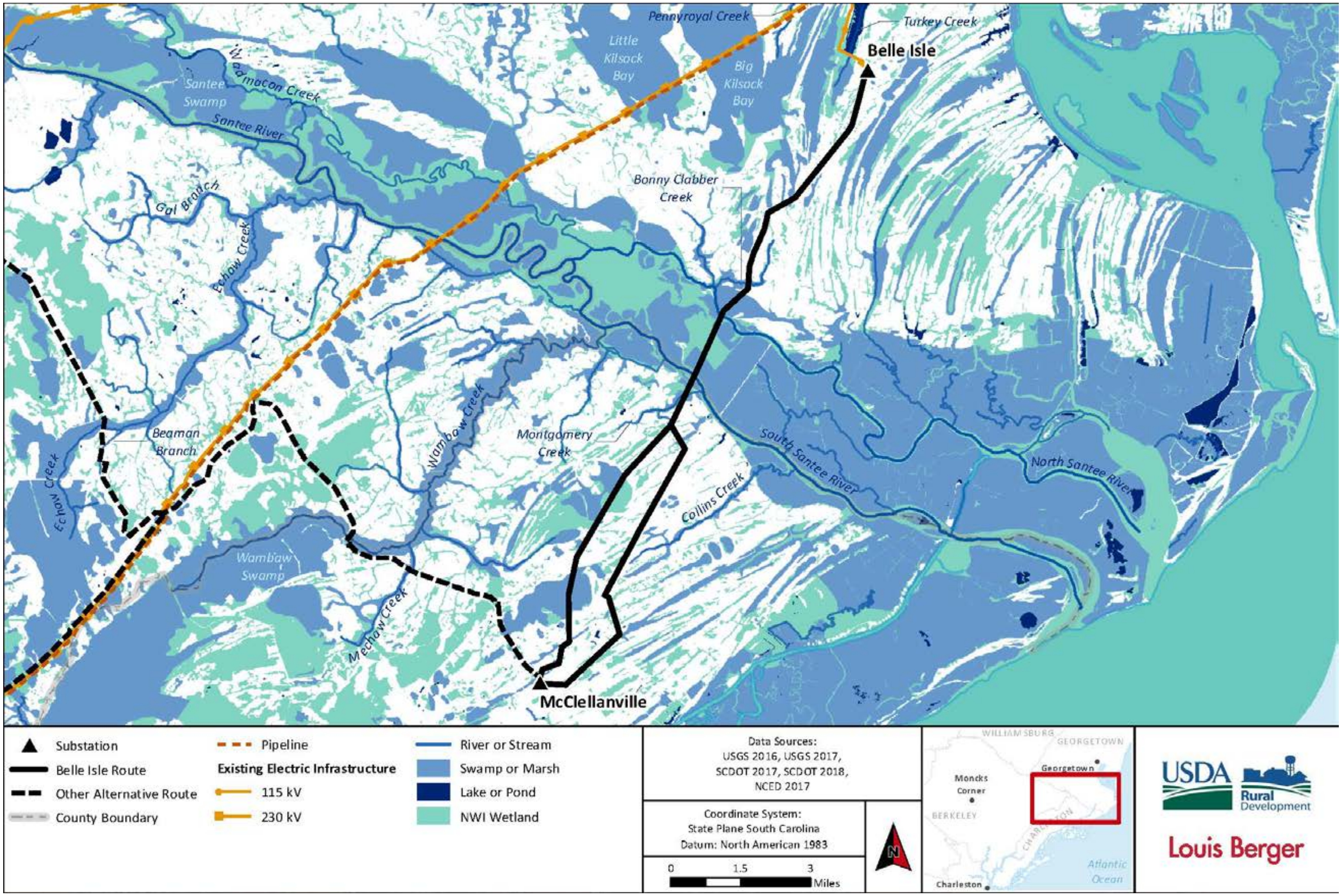


Figure 5-4: Location of Surface Water Crossed by Options B and C of the Belle Isle Corridor Alternative

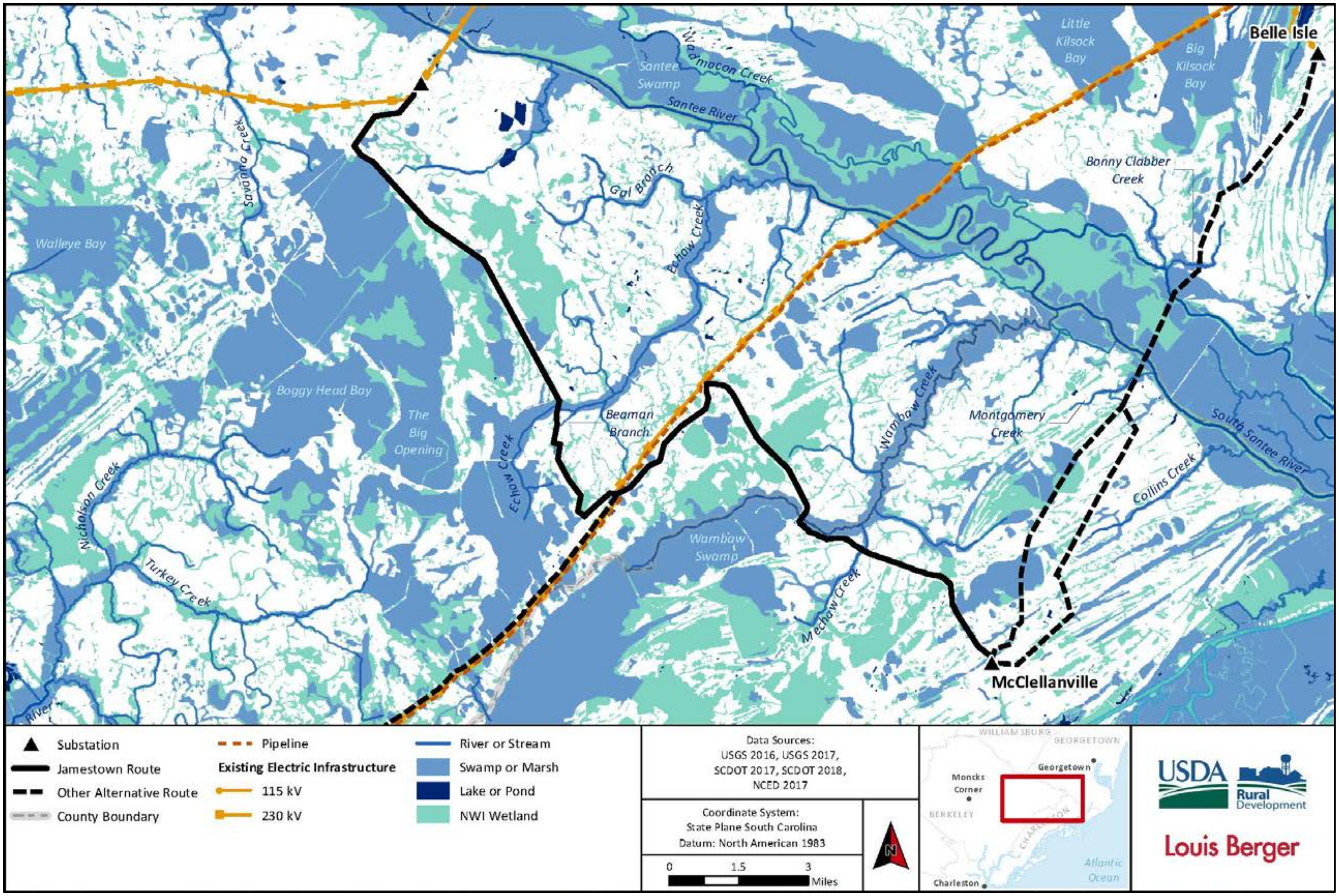


Figure 5-5: Location of Surface Water Crossed by the Jamestown Corridor Alternative

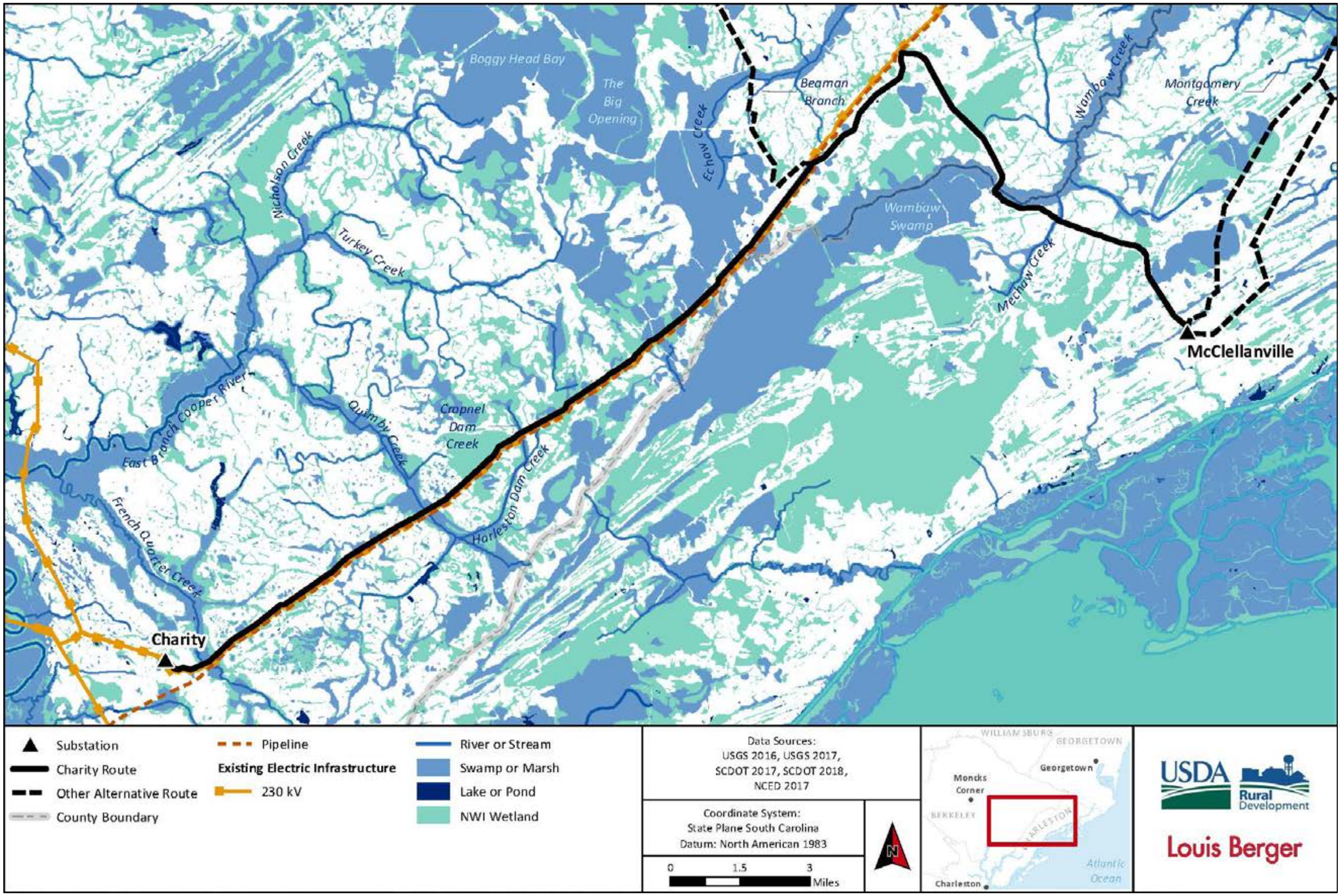


Figure 5-6: Location of Surface Water Crossed by the Charity Corridor Alternative

5.5.1.2 Belle Isle

North and South Santee Rivers

The Santee River Basin, along with associated coastal drainages, is an approximately 24,000-square-mile area in North and South Carolina (Hughes et al. 2000). This area encompasses the Blue Ridge Mountains, the Piedmont, and the Coastal Plain. Most of the Santee River Basin's several million residents live in urban areas.

The Santee River Basin, as defined more narrowly by SCDHEC, includes 11 watersheds and 1,279 square miles. It originates in the Upper Coastal Plain Region of South Carolina and flows southeast to the Lower Coastal Plain and the Coastal Zone regions.

Both the North Santee and South Santee rivers drain the central portion of the Study Area as they flow southeast from their divergence from the Santee River, west of Goat Island. From the divergence, the North Santee River flows southeast through Georgetown County, the South Santee River flows southeast through both Charleston and Georgetown counties, and both rivers drain into the Atlantic Ocean. The North Santee River crosses the Study Area for about 5.3 miles, whereas the South Santee River only crosses the Study Area for about 2.0 miles.

Montgomery Creek

Montgomery Creek flows in a northeast direction across the central portion of the Study Area and is crossed by corridor alternatives B and C in Charleston County.

Montgomery Creek crosses the Study Area for approximately 1.6 miles and then continues to flow until it drains into the South Santee River.

Bonny Clabber Creek

Bonny Clabber Creek flows south and west across the central portion of the Study Area and is crossed by corridor alternatives B and C in Georgetown County. Bonny Clabber Creek crosses the Study Area for approximately 0.1 mile; after which, it flows west and then south to its confluence with the North Santee River.

Unnamed streams and waterbodies cross the remainder of the Study Area. Several of these unnamed streams are classified as ditches and are used to drain wet areas in the eastern portion of the Study Area.

5.5.1.3 Jamestown

Santee River

The Santee River Basin, along with associated coastal drainages, is an approximately 24,000-square-mile area in North and South Carolina (Hughes et al. 2000). This area encompasses the Blue Ridge Mountains, the Piedmont, and the Coastal Plain. Most of the Santee River Basin's several million residents live in urban areas. The Santee River Basin, as defined more narrowly by SCDHEC, includes 11 watersheds and 1,279 square miles. It originates in the Upper Coastal Plain Region of South Carolina and flows southeast to the Lower Coastal Plain and the Coastal Zone regions. The Santee River drains the northeastern portion of the Study Area, forming the northeast boundary of the FMNF. The Santee River is not crossed by the Jamestown corridor alternative.

Echaw Creek

Echaw Creek drains the eastern portion of the Study Area near South Carolina Highway 45 in Berkeley County. Echaw Creek crosses the Jamestown corridor alternative approximately 16.8 miles northwest of the terminus of the Jamestown corridor alternative; this surface water flows across the survey area in a northerly direction before draining into the Santee River, approximately 8.5 northeast of the Study Area.

Beaman Branch

Beaman Branch is a small tributary to Echaw Creek that drains the eastern portion of the Study Area near South Carolina Highway 45 in Berkeley County. Beaman Branch crosses the Jamestown corridor alternative about 16.4 miles northwest of the terminus of that corridor alternative; this surface water flows across the survey area in a northerly direction before draining into Echaw Creek, about 0.1 mile northeast of the Study Area.

Wambaw Creek

Wambaw Creek drains the southeastern portion of the Study Area near South Carolina Highway 45 in Berkeley and Charleston counties. Wambaw Creek crosses the Jamestown corridor alternative about 6.1 miles northwest of the terminus of the Jamestown corridor alternative, this surface water flows across the survey area in a northeasterly direction before draining into the South Santee River, about 9 miles east of the Study Area.

Mechaw Creek

Mechaw Creek is a small tributary to Wambaw Creek that drains the eastern portion of the Study Area near South Carolina Highway 45 in Charleston County. Mechaw Creek crosses the Jamestown corridor alternative approximately 15 miles northwest of the terminus of the Jamestown corridor alternative; this surface water flows across the survey area in a northerly direction before draining into Mechaw Creek, approximately 0.1 mile northeast of the Study Area.

Jeremy Creek

Jeremy Creek is a small tributary to the Atlantic Ocean that drains the southern portion of the Study Area in the U.S. Highway 17 in Charleston County. A small drainage channel of Jeremy Creek crosses the Jamestown corridor alternative approximately 0.1 mile northwest of the terminus of the Jamestown corridor alternative; this surface water flows across the survey area in southeasterly direction before draining into the Atlantic Ocean, approximately 1 mile southeast of the Study Area.

5.5.1.4 Charity

East Branch Cooper River

The East Branch Cooper River and mainstem Cooper River are part of the Santee River Basin. The East Branch Cooper River drains the western portion of the Study Area northwest of the Charity Generation Station.

The Cooper River and associated tributaries are a tidal river system that discharge into Charleston Harbor and form the western boundary of the FMNF. The East Branch Cooper River is not crossed by the Charity corridor alternative.

French Quarter Creek

French Quarter Creek drains the western portion of the Study Area near the Charity Generation Station in Berkeley County. French Quarter Creek crosses the Charity corridor alternative approximately 30.1 miles southwest of the terminus of the Charity corridor alternative; this surface water flows across the survey area in a northwesterly direction before draining into the East Branch Cooper River, approximately 6.1 miles northwest of the Study Area.

Quimby Creek

Quimby Creek drains the south central portion of the Study Area in central portion of the FMNF in Berkeley County. Quimby Creek crosses the Charity corridor alternative approximately 23.8 miles southwest of the terminus of the Charity corridor alternative; this surface water flows across the survey area in a northwesterly direction before draining into the East Branch Cooper River, approximately 5.7 miles northwest of the Study Area.

Cropnel Dam Creek

Cropnel Dam Creek drains a small central portion of the Study Area in the FMNF in Berkeley County. Cropnel Creek crosses the Charity corridor alternative approximately 21 miles southwest of the terminus of the Charity corridor alternative; this surface water flows across the survey area in a southerly direction before draining into Quimby Creek within the Study Area.

Wambaw Creek

Wambaw Creek drains the southeastern portion of the Study Area near South Carolina Highway 45 in Berkeley and Charleston counties. Wambaw Creek crosses the Charity corridor alternative approximately 6.1 miles northwest of the terminus of the Charity corridor alternative, this surface water flows across the survey area in a northeasterly direction before draining into the South Santee River, approximately 9 miles east of the Study Area.

Mechaw Creek

Mechaw Creek is a small tributary to Wambaw Creek that drains the eastern portion of the Study Area near South Carolina Highway 45 in Charleston County. Mechaw Creek crosses the Jamestown corridor alternative approximately 15 miles northwest of the terminus of the Jamestown corridor alternative; this surface water flows across the survey area in a northerly direction before draining into Mechaw Creek, approximately 0.1 mile northeast of the Study Area.

5.5.1.5 Water Quality

As required by Section §303(d) of the CWA and federal regulation 40 CFR §130.7, states must establish water use classifications and water quality criteria to maintain, protect, and enhance public health, water uses, and water quality. SCDHEC, through South Carolina Regulation 61-68, *Water Classifications and Standards*, establishes these water uses and standards. The assessment of water quality is based on a comparison of monitoring data to state and federal standards and criteria for the classified use of the waterbody.

In accordance with federal and state regulations, the state also develops a list of waters that are impaired due to a failure to meet state water quality standards and to support one of the classified uses. In order for listed waterbodies to be removed from the 303(d) list, the water quality standard must be met, a total maximum daily load must be developed and accepted or an error in the list must be discovered. A total maximum daily load is the amount of a specified pollutant that is allowed in a waterbody without exceedance of the water quality criteria.

The state’s most recent 303(d) list of impaired waters, *Integrated Report for 2016 Part I Section 303(d) List of Impaired Waters*, includes several locations close to the corridor alternative study areas. Table 5-2 reports these 303(d) locations (SCDHEC 2016).

Table 5-2: 303(d) Impaired Waters Locations

303(d) Station	Use	Cause of Impairment	Corridor
ST-005	Fish consumption	Mercury	Belle Isle
ST-006	Fish consumption	Mercury	Belle Isle
CSTL-593	Fish consumption	Mercury	Belle Isle
CSTL-112	Fish consumption	Mercury	Jamestown
RS-01056	Recreation	E.coli	Jamestown
RS-02483	Recreation	E.coli	Charity
CSTL-564	Fish consumption	Mercury	Charity
CSTL-123	Aquatic life; fish consumption; recreation	Nutrients	Charity
MD-203	Aquatic life	Dissolved Oxygen	Charity

Source: SCDHEC (2016)

Belle Isle

The first station (ST-005) is located in Georgetown County on the North Santee River immediately downstream of U.S. Highway 17. This location does not support aquatic life uses because of turbidity and fish consumption use due to mercury in fish tissue. Total maximum daily loads for both are not scheduled until 2025.

The second station (ST-006) is located in Charleston County on the South Santee River at U.S. Highway 17. The waters at this location are impaired and do not support aquatic life use and fish consumption use because of turbidity and mercury, respectively. Total maximum daily loads are not scheduled for this location until 2022 for turbidity and 2025 for mercury.

The third station (CSTL-593) is located on a backwater approximately 775 feet from the main stem of the North Santee River. This site does not support fish consumption because of mercury impairment. Fish consumption advisories because of the elevated levels of mercury in fish tissue have been issued for the reaches of the North and South Santee rivers within the Study Area (SCDHEC 2013a). Figure 5-7 shows the locations of the water quality monitoring stations where impairments were observed.

Jamestown

The first station (CSTL-112) is located in Charleston County on Wambaw Creek about 5 miles downstream of South Carolina Highway 45. This location does support aquatic life; however, the increasing trend in turbidity and pH is significant. Wambaw Creek is characterized by naturally low dissolved oxygen conditions, and the substantially decreasing trend in 5-day biochemical oxygen demand suggests improving conditions (SCDHEC 2013b). Recreational uses are partially supported due to fecal coliform bacteria excursions. A fish consumption advisory is active for this location due to mercury in fish tissue (SCDHEC 2016).

The second station (RS-01056) is located in Charleston County on Cedar Creek just above its confluence with Wambaw Creek near the South Santee River. This location does support aquatic life; however, Cedar Creek is characterized by naturally low dissolved oxygen conditions (SCDHEC 2013c). Recreational uses are not supported due to fecal coliform bacteria excursions (SCDHEC 2016).

The Study Area for the Jamestown corridor alternative is within 7 miles of stations CSTL-112 and RS-01056. Figure 5-8 shows the locations of the water quality monitoring stations where impairments were observed.

Charity

The first station (RS-02483) is located in Charleston County on Turkey Creek near the East Branch Cooper River just west of South Carolina Highway 41. This location does not support aquatic life because of dissolved oxygen and pH excursions (SCDHEC 2013d). Recreational uses are partially supported due to fecal coliform bacteria excursions (SCDHEC 2016).

The second station (CSTL-564) is located in Charleston County on the East Branch Cooper River near the mouth of Quimby Creek. Because of mercury in fish tissue, a fish consumption advisory is active for this location (SCDHEC 2016).

The third station (CSTL-123) is located in Charleston County on the East Branch Cooper River near its confluence with the Cooper River main stem. Aquatic life and recreational uses are fully supported at this location. Aquatic macrophytes have proliferated and public access is limited in the Bonneau Ferry area of the river (SCDHEC 2013d).

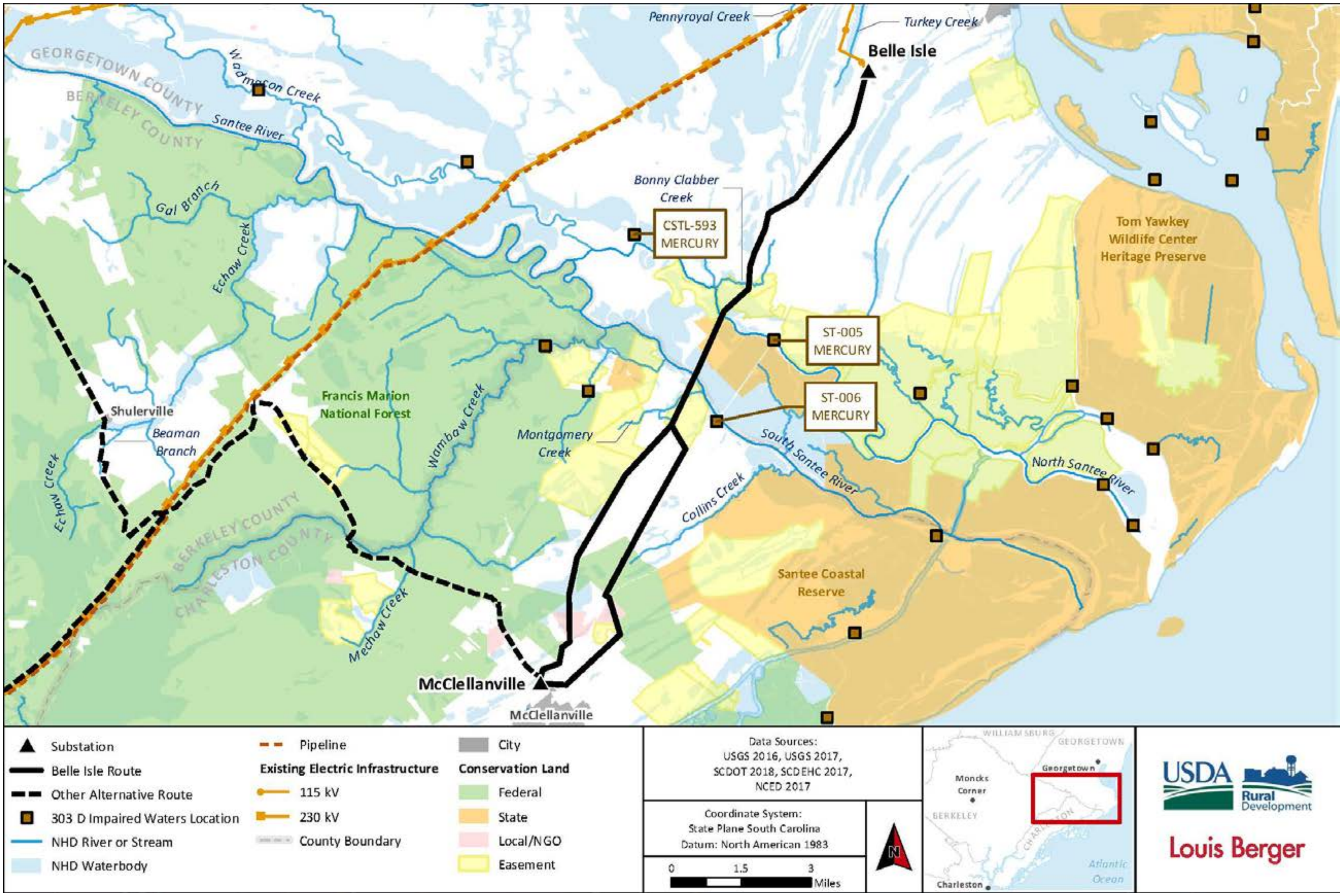


Figure 5-7: Location of Impaired Stream Segments near the Belle Isle Corridor Alternative Options

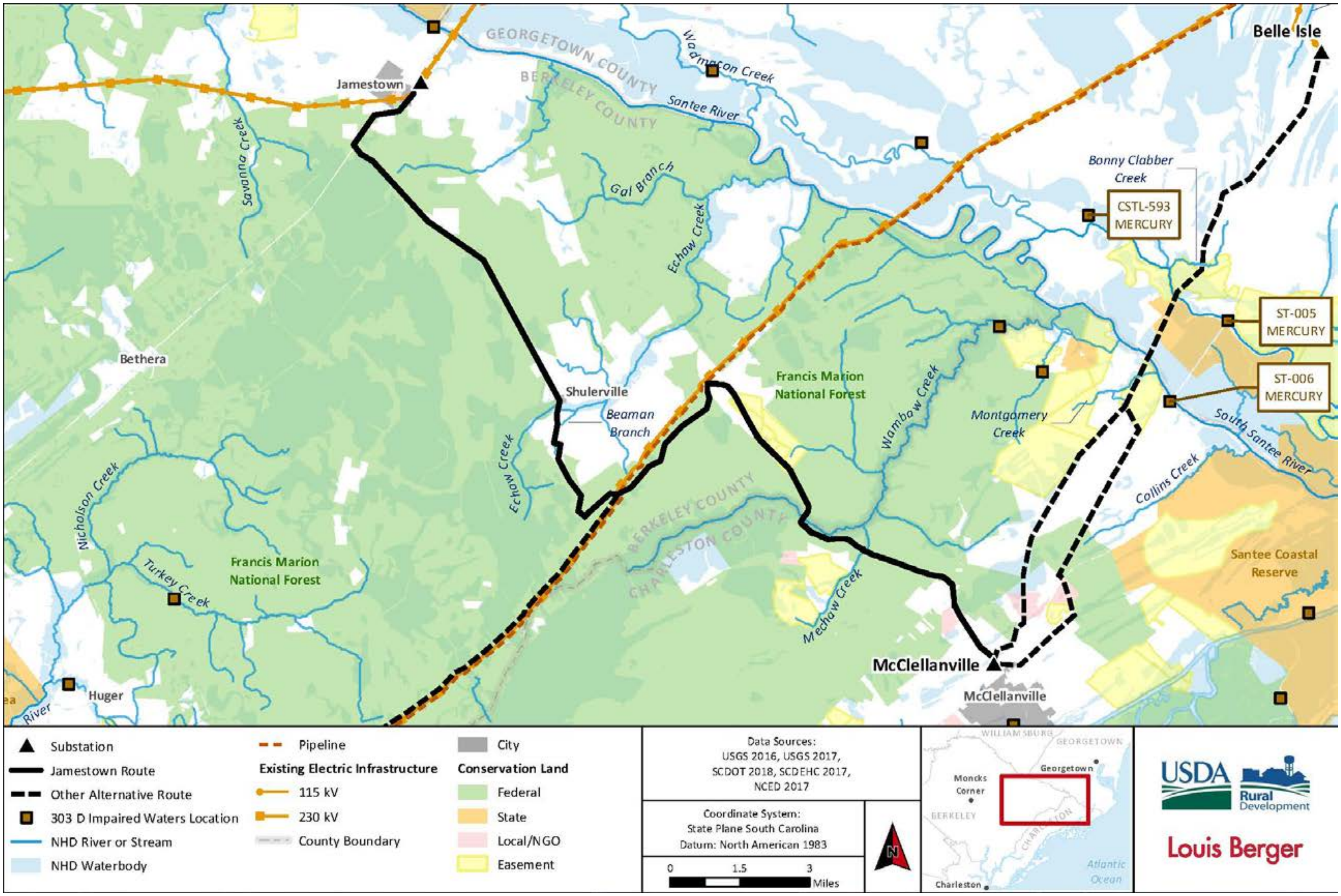


Figure 5-8: Location of Impaired Stream Segments near the Jamestown Corridor Alternative

The fourth station (MD-203) is located in Berkeley County on Jeremy Creek near the McClellanville Substation. Aquatic life uses are not supported due to dissolved oxygen excursions (SCDHEC 2016). Significant decreasing trends in total phosphorus concentration and fecal coliform bacteria suggest improving conditions for these parameters. Recreational uses are fully supported.

The Study Area for the Charity corridor alternative is within 2 miles of stations RS-02483, CSTL-564, CSTL-123, and MD-203. Figure 5-9 shows the locations of the water quality monitoring stations where impairments were observed.

Pesticides are used for agricultural, commercial, and domestic purposes to control harmful or non-native invasive plants, insects, fungi, or other organisms. In past sampling, pesticides have been detected in waterbodies within the Santee River Basin with several exceeding water quality criteria for aquatic life use and/or human health (Maluk and Kelley 1998). Recent data about monitoring to detect pesticide levels in waters within the study areas were not found.

In addition to the turbidity and mercury issues found at locations within the Study Area, the U.S. Geological Survey identified several high priority regional water-quality issues of concern to state and local water-resource managers. Issues included nitrogen and phosphorus enrichment leading to reduced dissolved oxygen concentrations, sediment erosion, urban stormwater runoff polluted with toxic trace elements and synthetic organic compounds, the presence of pesticides in surface water and groundwater, and fecal coliform contamination (Hughes et al. 2000). However, most of these additional issues occur on the lower Santee River upstream of the study areas, or downstream in the case of fecal contamination, and are associated with urban and/or agricultural land use.

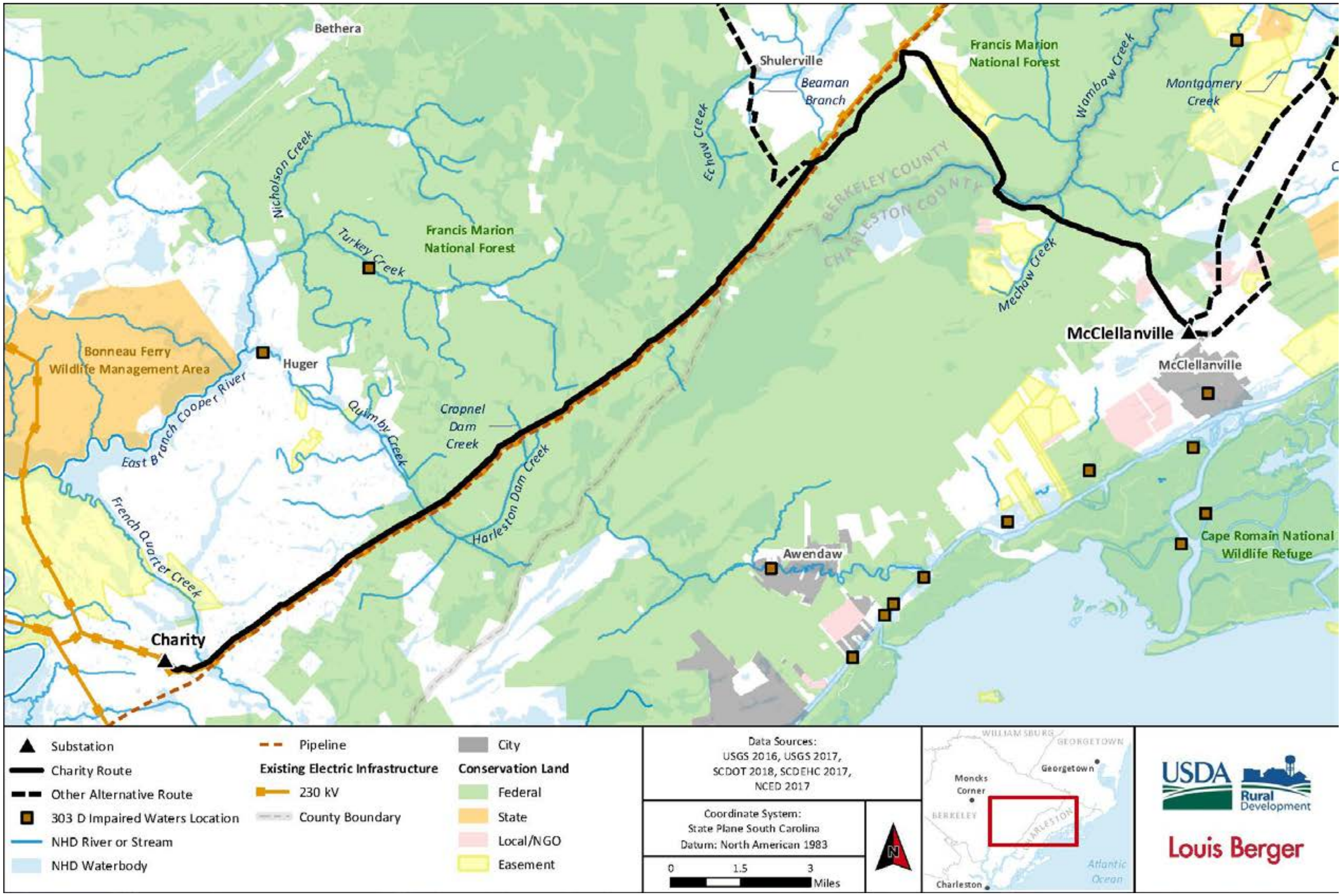


Figure 5-9: Location of Impaired Stream Segments near the Charity Corridor Alternative

5.5.1.6 Wetlands

Wetlands are generally areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation. Many different types of wetlands exist and include fresh and tidal marshes, swamps, fens, bogs, and wet prairie. Agencies, notably USACE and USFWS, define wetlands differently; however, both agencies generally agree that wetlands occur in saturated areas that support hydrophytic vegetation. USFWS, with its National Wetlands Inventory (NWI), has identified the potential location of wetlands throughout the United States.

The location of potential wetlands was determined by reviewing aerial photography, U.S. Geological Survey topological maps, hydrography data, and Natural Resources Conservation Service soil surveys. USFWS does not ground-truth all of the wetlands surveyed; however, some level of effort was made to verify the desktop survey. Classification of wetlands in the NWI database is based on the Cowardin Classification System (Cowardin et al. 1979), which considers both vegetated and non-vegetated areas in its assessment of wetlands. The description of wetlands identified in the Study Area are based on NWI maps and GIS data; because NWI data are largely unverified by field surveys, it is expected that the acreage of wetlands identified is greater than what is present on the ground.

Preliminary field surveys were also conducted to evaluate the extent of wetlands potentially affected by the proposed corridors. Folk (2017) conducted a detailed inventory of the wetlands of the proposed Jamestown ROW, reporting 40 wetlands and 12 stream crossings, for a total of approximately 28,000 linear feet of wetland area and approximately 9,000 linear feet of stream crossing. During a preliminary floristic inventory of the Jamestown and Charity corridors, Gaddy (2017, 2018) identified eight major plant community types, six of which were wetland types within the corridor alternatives. Three of these wetland plant community types—pond cypress lime sinks, pine savannas, and pond cypress savannas—are listed as noteworthy plant communities by SCDNR. In total, Gaddy (2018) found 12 wetlands on NFS lands that would be shared by the Jamestown and Charity corridors between the McClellanville Substation and Honey Hill, totaling 80.15 acres and 23,310 linear feet (within a 150-foot-wide study path centered around the ROW). Along the remainder of the Jamestown 150-foot-wide study corridor, from Honey Hill to Jamestown, the Project would cross an additional 39 wetlands on NFS lands; totalling 64.14 acres and 18,600 linear feet. Along the remainder of the Charity 150-foot-wide study corridor from Honey Hill to Charity, the Project would cross an additional 35 wetlands on NFS lands; including 98.6 acres and 28,600 linear feet. Table 5-3 lists the total number of wetlands on NFS land that would be crossed by the 150-foot-wide Jamestown and Charity field study corridors and the acreage and linear distance of those wetlands. Although the Jamestown corridor survey recorded a greater number of wetlands on NFS lands than the Charity corridor survey, the wetlands in the Jamestown corridor survey were smaller in size. Ultimately, the Charity corridor survey would cross approximately 35 acres and 10,000 linear feet more than the Jamestown corridor survey.

Table 5-3: Wetlands Crossed by a 150-foot Corridor Survey of Each Corridor Alternative

Corridor	Route Length on NFS Lands (miles)	No. of Wetlands	Acreage	Linear Feet
Belle Isle B	X	N/A[a]	N/A[a]	N/A[a]
Belle Isle C	X	N/A[a]	N/A[a]	N/A[a]
Jamestown	X	51	144.43	41,910
Charity	X	47	178.74	51,910

Source: Gaddy (2018)

[a] Gaddy (2018) did not survey all wetlands on NFS lands crossed by options B and C of the Belle Isle corridor alternative due to lack of access/permissions to conduct surveys on private lands.

Wetland types identified within the corridor alternative Study Areas using NWI data include estuarine and marine deepwater, estuarine and marine wetlands, freshwater palustrine emergent wetlands, freshwater palustrine forested/scrub shrub wetlands, freshwater palustrine unconsolidated bottom wetlands (ponds), and riverine wetlands. A brief description of each wetland type is provided below; Table 5-4 quantifies the acreage of each wetland type for each corridor alternative. Figures 5-10 through 5-12 show the distribution of wetlands along the corridor alternatives.

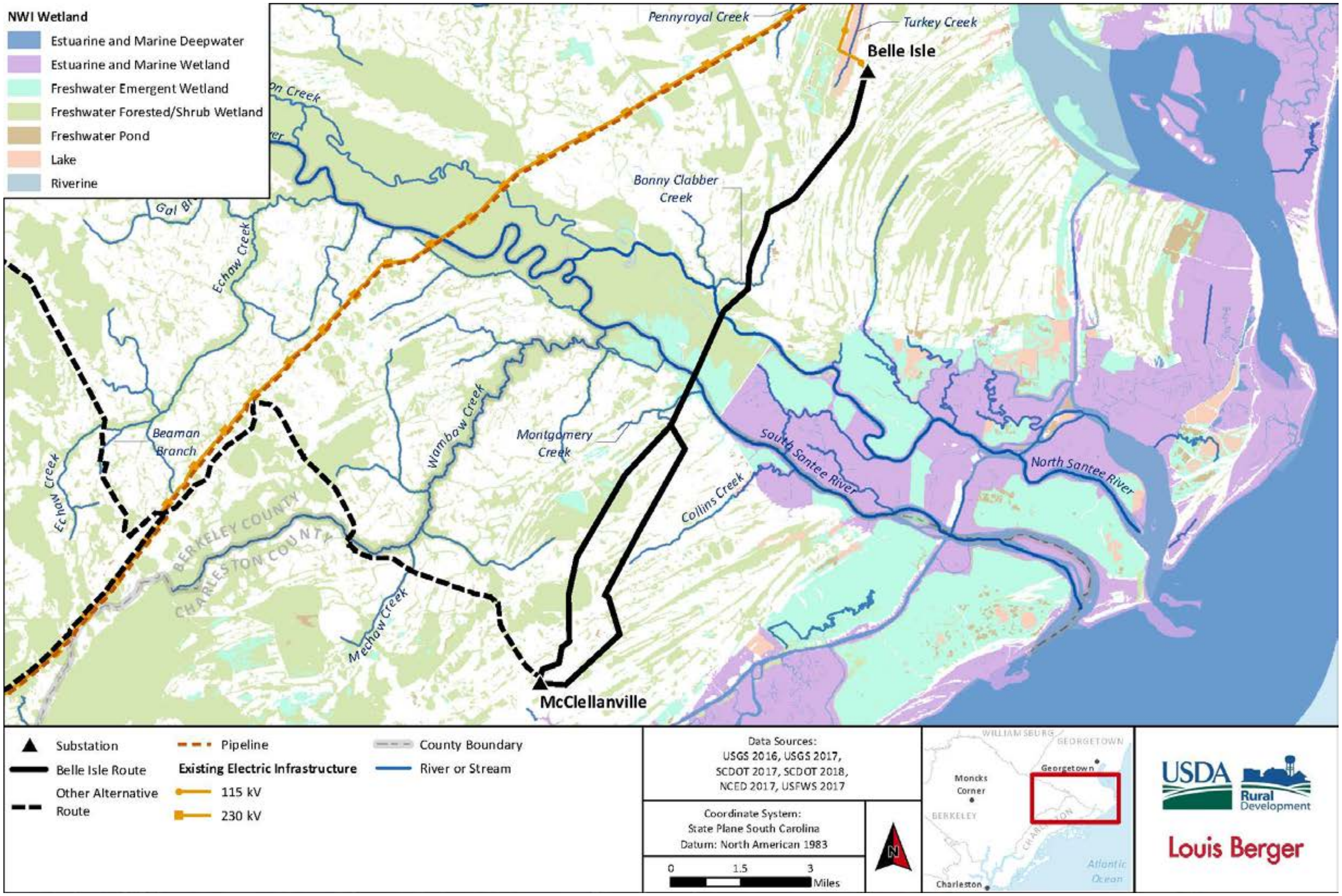


Figure 5-10: Location of Wetlands Crossed by the Belle Isle Corridor Alternative Options

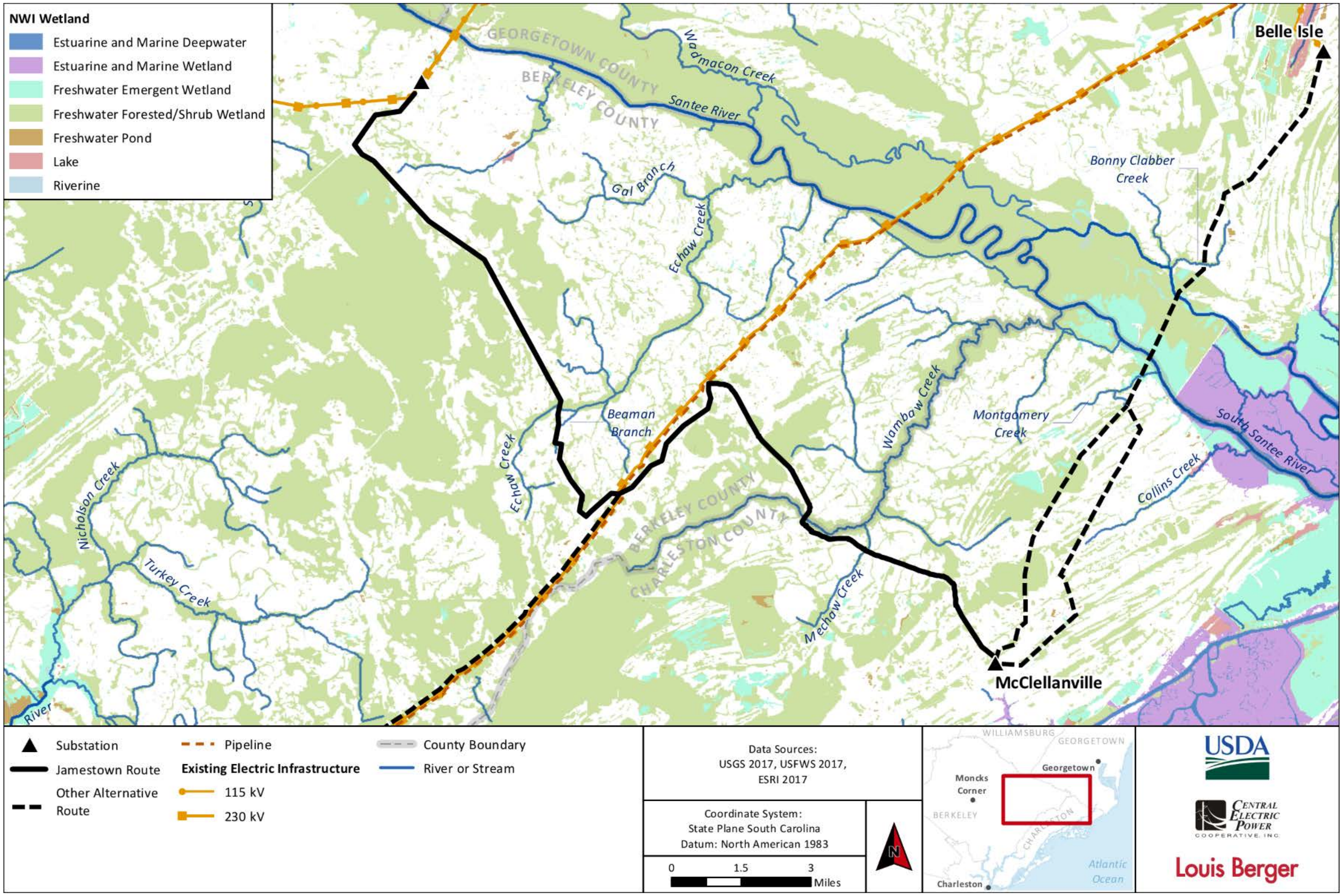


Figure 5-11: Location of Wetlands Crossed by the Jamestown Corridor Alternative

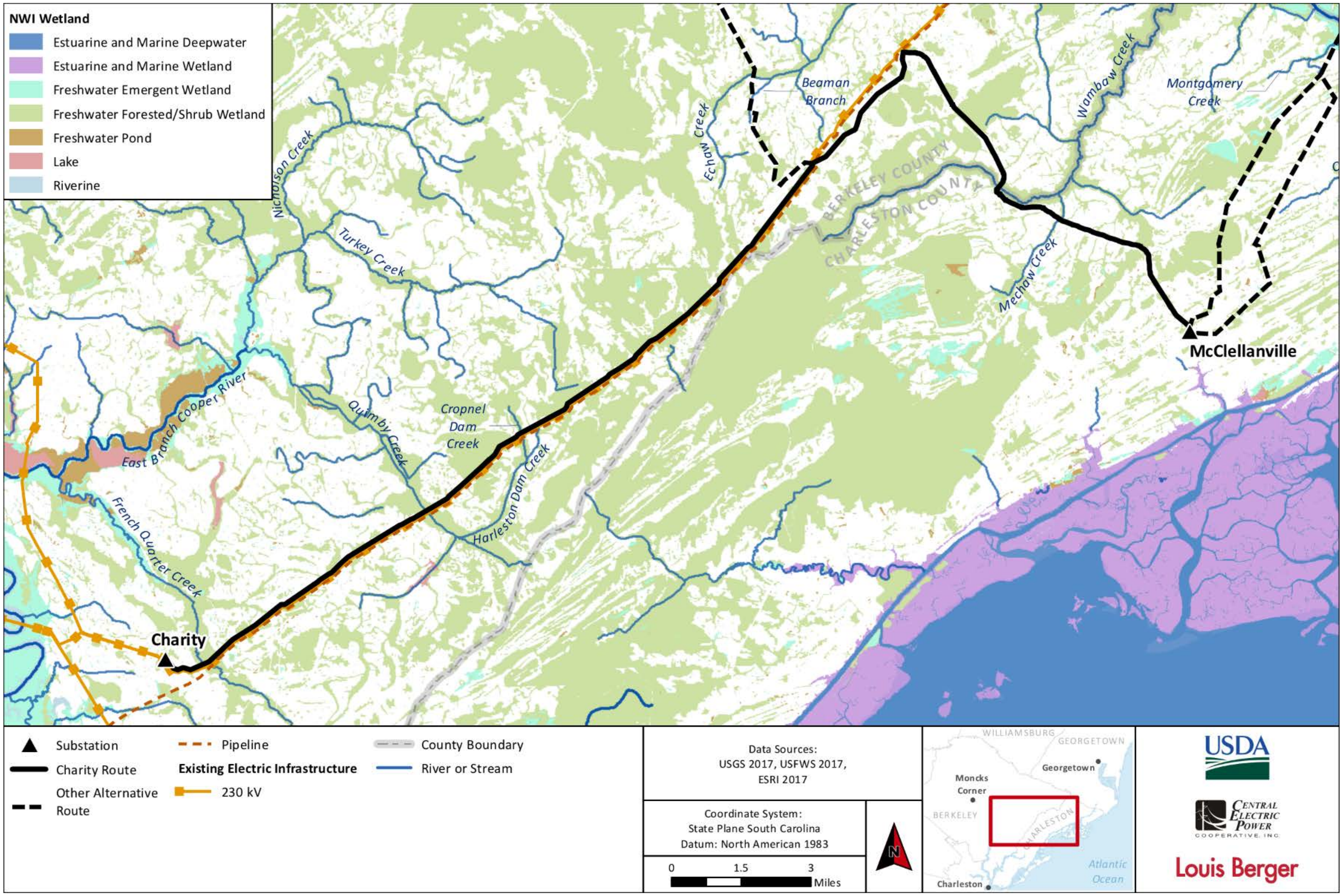


Figure 5-12: Location of Wetlands Crossed by the Charity Corridor Alternative

Table 5-4: Acreage of Wetland Types Crossed by Each Corridor Alternative

Wetland Type	Belle Isle Options		Jamestown	Charity
	B	C		
NWI Wetlands (acres within 75-foot ROW)				
Estuarine and marine deepwater	--	--	--	--
Estuarine and marine wetland	--	--	--	--
Freshwater palustrine emergent	8.5	8.5	--	43.3
Freshwater palustrine forested/shrub wetland	33.5	45.5	24.3	44.2
Freshwater pond	--	--	0.1	0.1
Riverine	1.5	1.5	0.3	0.6
NWI Wetlands (acres within 600-foot corridor)				
Estuarine and marine deepwater	8.5	--	--	--
Estuarine and marine wetland	14.5	--	--	--
Freshwater palustrine emergent	33.0	69	70	0.5
Freshwater palustrine forested/shrub wetland	180.5	258.5	379.5	287.5
Freshwater pond	0.5	--	<0.5	1.3
Freshwater pond	0.5	--	<0.5	1.3

Source: NWI (USFWS 2018a)

Estuarine and Marine Deepwater—Estuarine and marine deepwater areas are dominated by brackish or salt water, which has a salinity of 0.05 percent or higher. Deepwater habitats are permanently inundated or submerged below water that is greater than 6 feet deep (Cowardin et al. 1979). The corridor alternatives do not cross any estuarine and marine deepwater habitat.

Estuarine and Marine Wetlands—Estuarine and marine wetlands are areas that are frequently inundated by brackish or salt water; unlike deepwater habitats, these wetlands are generally submerged by water that is less than 6 feet deep (Cowardin et al. 1979). While deepwater habitats are dominated by submerged aquatic vegetation or unvegetated bottoms, estuarine and marine wetlands are dominated by both submerged aquatic vegetation and emergent plants that have adapted to a brackish or salt water environment. The corridor alternatives do not cross any estuarine and marine habitat.

Freshwater Palustrine Emergent Wetlands—Freshwater palustrine emergent wetlands are characterized by erect, rooted, herbaceous hydrophytes (water-loving plants), excluding mosses and lichens. These plants are present for most of the growing season in most years. Freshwater emergent wetlands are usually dominated by perennial, non-woody plants. In areas with relatively stable climatic conditions, emergent wetlands maintain the same appearance and form for many years (Cowardin et al. 1979). Belle Isle option C and the Charity corridor alternative cross the greatest acreage of freshwater palustrine emergent wetlands within the 75-foot ROW and the 600-foot study corridor. The Jamestown corridor alternative does not cross any freshwater palustrine emergent wetlands within the 75-foot ROW and only crosses 0.5 acre in the 600-foot ROW study corridor.

Freshwater Palustrine Forested/Scrub-Shrub Wetlands—Freshwater palustrine forested/scrub-shrub wetlands are characterized as having a mix of forested and scrub-shrub wetlands. These wetlands are dominated by perennial, woody plants; trees are defined as being greater than 20 feet tall and shrubs are shorter than 20 feet (Cowardin et al. 1979). Forested wetlands are at greatest risk of being affected by overhead transmission projects because the tall trees must be cleared, so they cannot contact the transmission wires. This wetland classification type represents the greatest acreage of wetlands within the entire alternative study areas. The Belle Isle option C and Charity corridor alternative cross the greatest acreage of palustrine forested/scrub-shrub wetlands within both the 75-foot ROW and 600-foot study corridors. The Jamestown corridor alternative crosses the fewest acres of palustrine forested/scrub-shrub wetlands within the 75-foot ROW study corridor.

The portions of options A, B, and E of the Belle Isle corridor alternative that cross the FMNF compose approximately 19 acres of palustrine forested/scrub-shrub wetlands within the 600-foot study corridor.

Freshwater Palustrine Unconsolidated Bottom Wetlands—Freshwater palustrine unconsolidated bottom wetlands, or ponds, are primarily open water systems that have less than 30 percent of their area covered by vegetation. Additionally, their bottom material is composed of material that is smaller than stones (less than 10 inches across). Palustrine unconsolidated bottom wetlands have less than 25 percent stones (Cowardin et al. 1979). Very few palustrine unconsolidated bottom wetlands are located within any of the study areas; only 0.1 acre are located within the 75-foot ROW of the Jamestown and Charity the corridor alternatives. Within the 600-foot study corridor, the Charity corridor alternative crosses the greatest acreage of palustrine unconsolidated bottom wetlands (1.9 acres). All of the Belle Isle corridor alternative options that cross palustrine unconsolidated bottom wetlands do not do so for more than approximately 0.5 acre.

Riverine Wetlands—Riverine wetlands include all wetlands and deepwater habitats contained within a river channel with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water-containing ocean-derived salts in excess of 0.5 part per thousand. A channel is defined as "an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water." Riverine wetlands are bordered on the landward side by upland habitat, by the channel bank (including natural and human-made levees), or by wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens (Cowardin et al. 1979). Within the 75-foot ROW, all of the corridor alternatives are generally similar for the acreage of riverine wetlands. Within the 600-foot study corridor, Belle Isle corridor alternative options B and C cross the greatest acreage of riverine wetlands.

Floodplains

Floodplains are low-lying areas, as identified by the Federal Emergency Management Agency (FEMA), which are subject to inundation from heavy rains or storm surges. These areas are usually located near streams, rivers, coastal zones, and lakes and are a necessary component of water storage during flooding events. Placing structures in floodplains impairs a floodplain’s ability to store water, which could cause flooding to occur beyond the natural extent of the floodplain.

Floodplains are classified by the potential to flood within a certain time frame and assigned a relevant identifying code. FEMA describes the various zones as follows:

- Zone A—Areas with a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones. These areas represent the 100-year floodplain.

- Zone AE—Areas with a 1 percent annual chance of flooding. This is the base floodplain where base flood elevations are provided. These areas represent the 100-year floodplain.

- Zone VE—Coastal areas with a 1 percent or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones. These areas represent the coastal 100-year floodplain.

- Zone X—Area of minimal flood hazard, usually depicted on Flood Insurance Rate Maps as above the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as base floodplain. Unshaded Zone X is defined to be outside the 500-year flood.

The central portion of all the Belle Isle corridor alternative is located within Zone AE of the North and South Santee rivers. The southern portion of option C is in Zone A of Jeremy Creek. The remainder of the Study Area is in Zone X areas; thus, they are outside the 500-year flood area.

The northern and central portions of the Jamestown corridor alternative are located within Zone X; thus, they are outside the 500-year flood area. The south central portion of the Jamestown corridor alternative is located within Zone A of Wambaw Creek. The portion of the corridor near the McClellanville Substation is in Zone AE of the Atlantic Ocean.

The western portion of the Charity corridor alternative, where it crosses French Quarter Creek, is located within Zone AE. The Charity corridor alternative is also located within Zone AE of Quimby Creek. The south central portion of this corridor is located within Zone A of Wambaw Creek. The portion of the corridor near the McClellanville Substation is in Zone AE of the Atlantic Ocean. The remainder of the Study Area is in Zone X (outside of the 500-year flood area).

5.5.2 Environmental Effects

Impacts on water resources include how the proposed Project could potentially affect these resources from the construction and maintenance of the ROW, off-ROW access roads, and lay-down yards. The majority of the impacts would occur during construction and would likely be temporary; however, permanent impacts are anticipated if structures are placed in wetlands or a floodplain.

This section discusses the potential effects of the proposed Project on the various water resources throughout the Study Area. To determine whether the proposed Project could potentially result in significant effects on water resources, it is necessary to consider both the duration and the intensity of the impacts. Table 5-5 presents the definitions for duration and intensity of water resources impacts established for this Project.

Table 5-5: Water Resources Impact Context and Intensity

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Surface Water and Water Quality			
Short term: During construction period Long term: Life of the line (50 years or more)	The effect on surface waters would be measurable or perceptible but small and localized. The effect would not alter the physical or chemical characteristics of the surface water or aquatic influence zone resource.	The effect on surface waters would be measurable or perceptible and could alter the physical or chemical characteristics of the surface water resource to an extent requiring mitigation but not to large areas. The functions typically provided by the surface water or aquatic influence zone would not be substantially altered.	The impact would cause a measurable effect on surface waters and would modify physical or chemical characteristics of the surface water. The impact would be substantial and highly noticeable. The character of the surface water or aquatic influence zone would be changed so that the functions typically provided by the surface water or aquatic influence zone would be substantially altered.
Wetlands			
Short term: Lasting less than two growing seasons Long term: Lasting longer than two growing seasons.	The effect on wetlands would be measurable or perceptible but small in terms of area and the nature of the impact. A small effect on size, integrity, or connectivity would occur; however, wetland function would not be affected and natural restoration would occur if left alone.	The impact would cause a measurable effect on one of the three wetlands indicators (size, integrity, connectivity) or would result in a permanent loss of wetland acreage over small areas. However, wetland functions would not be adversely affected.	The impact would cause a measurable effect on two or more wetlands indicators (size, integrity, connectivity) or a permanent loss of large wetland areas. The impact would be substantial and highly noticeable. The character of the wetland would be changed so that the functions typically provided by the wetland would be substantially altered.
Floodplains			
Short term: During construction period Long term: Life of the line (50 years or more)	Impacts would result in a detectable change to natural and beneficial floodplain values, but the change would be expected to be small, of little consequence, and localized. No appreciable increased risk of flood loss would occur, including impacts on human safety, health, and welfare.	Impacts would result in a change to natural and beneficial floodplain values that would be readily detectable and relatively localized. Location of operations in floodplains could increase risk of flood loss, including impacts on human safety, health, and welfare.	Impacts would result in a change to natural and beneficial floodplain values that would have substantial consequences on a regional scale. Location of operations would increase risk of flood loss including impacts on human safety, health, and welfare.

5.5.2.1 No-action Alternative

Under the no-action alternative, the Project would not be constructed, and no direct effects on surface waters, water quality, wetlands, or floodplains would occur.

5.5.2.2 Proposed Action

Surface Water and Water Quality

Under the proposed action, construction and maintenance of the Project have the potential to affect surface waters and water quality. These potential impacts include increased sedimentation into surface waters from stormwater runoff, increased sedimentation into USEPA-classified impaired waters from stormwater runoff or construction activities, and the possible introduction of contaminants into surface water resources during construction.

All of the corridor alternatives would cross streams and waterbodies; however, neither of the Belle Isle corridor alternative options B or C would cross areas classified by USEPA as impaired waters. It is not anticipated that construction or maintenance of the Project would contribute to further mercury contamination; however, further turbidity contamination could occur if sediments are not prevented from entering these waters. Furthermore, sediment pollution is a potential impact on all surface waters crossed by all of the corridor alternatives.

During construction of the ROW and access roads and placement of the structures, soils would be disturbed, potentially posing a sedimentation risk to surface waters. To minimize these potential impacts, Central Electric would implement several BMPs (see Section 4.4), including storing equipment, fuels, and chemicals outside of surface waters, placing silt fences and other appropriate prevention devices along all stream crossings, developing a stormwater pollution prevention plan prior to construction, developing a hazardous materials management and spill prevention plan and emergency response plan to deal with accidental spills, and promptly cleaning up spilled material to prevent them from entering surface waters.

Additionally, excavated material would not be stockpiled in flood prone areas or near stream banks, unless this material is protected from high water or stormwater runoff. Trees that are removed would have their stumps left in place so that the soil around them remains in place. After construction, temporary access roads and other areas with exposed soil would be revegetated to avoid runoff. Finally, no structures would be allowed to be placed in surface waters, thus there should be no direct construction occurring in surface waters.

Maintenance would mostly include vegetation management within the ROW by Santee Cooper and normal inspection of equipment and hardware, minor repairs activities to transmission structures, and emergency repairs, as needed. Santee-Cooper would maintain a 2.5- to 3-year vegetation management cycle, and it would use selective treatment; therefore, not all the ROW across non-NFS lands would receive an application of herbicides, only those areas where vegetation is posing a threat to the transmission lines. There would be no use of herbicides across NFS lands. Santee Cooper's Vegetation Management Plan is included in Appendix A.

Although Central Electric would implement a thorough plan to minimize impacts, accidents could happen; however, as long as the BMPs and prevention measures are maintained through the life of the Project, accidents should not lead to intense impacts. Thus, impacts to surface waters and water quality from construction and maintenance of the action alternatives would be short term and low intensity.

Wetlands

Impacts on wetland areas within the Project Area are expected to be moderate. Central Electric would avoid affecting wetlands when practicable. When impacts on wetlands cannot be avoided, Central Electric would minimize these impacts as much as possible. Any impacts on jurisdictional wetlands would be mitigated as appropriate in consultation with USACE. Wetland delineations would be conducted to identify wetlands after the final route is chosen. Any unavoidable impacts on wetlands, whether temporary or permanent, would be discussed with USACE, prior to construction, to determine the permitting requirements and conditions necessary for construction involving wetlands within the proposed Project ROW.

Short-term, moderate-intensity impacts on wetland vegetation may occur if construction crews need to access ROW areas through wetlands. Central Electric would implement BMPs similar to those described for surface water (see Section 4.4). All wetlands would be identified and marked prior to construction. During construction, construction equipment, fuels, and chemicals would not be stored in wetlands; construction mats would be used for all wetland crossings; clearing may be accomplished by using low ground pressure equipment (10 psi or less); and structures would be placed outside wetlands when possible.

Forested wetlands would need to be cleared of trees that are tall enough to interfere with the transmission wires. All trees would be cleared within the ROW, but the stumps would be left in place to stabilize the soils. Trees cleared in wetland areas would result in a conversion of forested wetlands to either scrub-shrub or emergent wetlands. As a result, the functions and values attributed to forested wetlands would be lost and altered to reflect the new habitat.

Other permanent impacts to wetlands would occur if it becomes necessary to place a structure in a wetland. However, each pole location in a wetland would likely impact no more than 0.001 acre, thus permanent impacts to wetlands from pole locations would likely be less than 0.05 acre for the entire Project.

Following completion of construction, disturbance to wetlands would cease, and these areas would be restored. During maintenance, impacts to wetlands would mostly derive from vegetation management activities. In wetland areas, ground crews would use backpacks and/or an ATV equipped with a hydraulic spray system to foliar treat only the undesirable vegetation present. ATVs used would be specifically designed with low pressure tires to distribute the mass of the vehicle.

Current procedures dictate a selective, low-volume herbicide approach that minimizes the amount of active ingredient applied per acre when applied to non-NFS ROW. The herbicide products used during wetland-area spraying would be determined based on the species present and, to a great extent, the location. In areas that have standing water and are connected to a larger aquatic system (e.g., river or swamp), only USEPA-approved herbicides registered for use in wetland or aquatic sites would be used. Wetland areas are scheduled on a 3- or 4-year rotation depending on the vegetation species that are present, densities of woody vegetation, and height of conductors. Vegetation densities should decrease with subsequent applications, requiring less herbicide to be applied. There would be no use of herbicides across NFS lands.

Long-term, moderate- to high-intensity impacts on wetlands would be expected to only forested wetlands because trees and other woody vegetation would need to be removed within the ROW. A total of 33.5 to 45.5 acres of forested wetlands would be affected, most notably in the options B and C of the Belle Isle corridor alternative and mostly during the crossing of the North and South Santee rivers (see Figure 5-9). Impacts on non-forested wetlands would be short term and low intensity.

Floodplains

The ROW for all of the corridor alternatives contains areas located in FEMA-designated floodplains. These designated areas mostly consist of wide floodplains associated with the North and South Santee rivers; however, the smaller areas are also located along the southern portions of Belle Isle corridor alternative option C. Most of the designated study area for both the Jamestown and Charity corridor alternatives is located outside the 500-year flood area.

It is not possible avoid placing structures in the floodplain of the North and South Santee rivers; the span across these areas is at least 2 miles for all of the corridor alternatives, thus structures would need to be placed within the 100-year floodplain. Central Electric proposes that each structure would use a temporary 400-square-foot construction area around each pole. The only permanent impacts on the floodplain would result from the presence of structure; however, the pole footprint rarely affects more than 0.001 acre per pole, thus permanent impacts on the floodplain would be less than 0.05 acre for the entire Project. All temporary soil disturbances would be reclaimed by following the BMPs after construction (see Section 4.4).

During construction and maintenance, BMPs would be similar to those used to minimize impacts on surface waters. To the extent practicable, equipment, fuels, and chemicals would not be stored in the floodplain, construction would not occur during periods of high water, and the use of pesticides would be limited to target areas. Although Central Electric would implement a plan to minimize impacts, accidents could happen; however, as long as the BMPs and prevention measures are maintained through the life of the Project, accidents should not lead to intense impacts. Thus, impacts on floodplains from construction and maintenance of the action alternatives would be short term to long term and of low intensity.

5.6 Biological Resources

USFWS regulates construction activities occurring in areas containing potentially suitable habitat for species protected under the Endangered Species Act (ESA) of 1973 (16 USC §§1531 et seq.). The ESA requires that any action that is authorized, funded, or carried out for this Project is not likely to jeopardize the continued existence of a species listed as threatened or endangered or result in the destruction or adverse modification of habitat of such species that is determined to be critical. To offset any potential adverse effects of the Project on federally listed species, RUS could be required to further develop and carry out conservation programs to mitigate those effects.

To avoid potential jeopardy to any species listed under the ESA as threatened and endangered, or candidate species, RUS and the cooperating agencies must consult with USFWS and NMFS in accordance with the implementing regulations for Section 7 of the ESA. Consultation is conducted through the submission of a biological assessment (BA), which is required because the proposed Project is a “major construction activity,” or a major federal action that significantly affects the quality of the human environment (see 50 CFR §402.12(b)(1)).

RUS will prepare a programmatic BA to address the potential impacts of the proposed Project on federally listed threatened and endangered species, and critical habitat. Because a preferred corridor (i.e., alternative) for the Project has not been selected, the BA will lack site-specific studies confirming species’ presence within the Project’s area of potential effect. After RUS identifies a preferred corridor in the final EIS for the Project and Central Electric begins to finalize the preferred corridor’s ROW, additional site surveys will be conducted with the permission of landowners. RUS will subsequently coordinate with USFWS and NMFS to confirm assumptions included in the programmatic BA and incorporate any additional analyses and conservation and mitigation measures needed to avoid or minimize any effects on federally listed and candidate species.

USFS and USACE, Charleston Regulatory District, are cooperating agencies with potential permitting actions. The FMNF must approve any Project activities on NFS lands. Information for this supplemental EIS about federally listed threatened and endangered species on NFS lands was obtained primarily from an evaluation of impacts for the 2013 FMNF *Land and Resource Management Plan* (USFS 2013a) and *Appendix G: Biological Assessment and Biological Evaluations* for the 2017 *Revised Land Management Plan* (USFS 2017). USACE must approve any Project activities that could potentially affect wetlands and other waters, in accordance with guidelines specified in Section 404(b) of the CWA.

USFS develops and implements management practices to ensure that rare plants and animals do not become threatened or endangered and to ensure their continued viability on National Forests. USFS policies dictates that it must analyze impacts on sensitive species to ensure that activities performed on NFS lands do not cause a trend toward federal listing or loss of a species' viability. USFS manages sensitive species under the authority of the National Forest Management Act, requiring that National Forests manage for "viable populations of native and desirable non-native species." The 2012 Planning Rule (36 CFR §219) contains guidance providing for sustainability (CFR §219.8) and diversity of plants and animals.

The 2012 Planning Rule identifies three categories of at-risk species: 1) federally listed threatened and endangered species under the ESA, 2) federally proposed and candidate species under the ESA, and 3) species of conservation concern (SCC). An SCC, a new element required by the 2012 Planning Rule, replaces the Regional Forester's list of sensitive species. These species may require special management emphasis to ensure their persistence and to preclude trends toward endangerment that would result in the need for federal listing. SCC are species, other than federally recognized threatened, endangered, proposed, or candidate species, that are "known to occur in the plan area and for which the regional forester has determined the best available scientific information indicates substantial concern about the species' capability to persist over the long term in the plan area" (36 CFR 219.9(c)). While the goal of both lists is to prevent species from being federally listed as threatened or endangered, the SCC list has more comprehensive and defined criteria for inclusion than the Regional Forester sensitive species list, making it less likely that a species in need of conservation will be overlooked. Another difference between the lists is that the management approach for Regional Forester sensitive species was to manage forest resources to maintain species viability, which was often difficult to measure, but under the 2012 Planning Rule, forest resources are to be managed to provide the type of habitat and other conditions that SCC need to persist (USFS 2015).

As required under the USFS Sensitive Species Program, USFS performs a biological evaluation for activities that could potentially affect Regional Forester sensitive species and SCC. A biological evaluation is similar to a BA for federally listed species. Another requirement of USFS Sensitive Species Program is a biological evaluation process (FSM 2672.4) to ensure species population viability of endangered, threatened, proposed, or sensitive species. The Regional Forester sensitive species list for Region 8, which includes the FMNF, was last updated by the Regional Forester in August 2001. However, as described above, that list for the FMNF was superseded by the list of SCC in the 2017 FMNF *Revised Land Management Plan* (USFS 2017), and the FMNF recently conducted a biological evaluation for this plan (USFS 2017). Table 5-9, in the *FMNF Species of Conservation Concern and State-Listed Species* section, presents a list of the 70 SCC known to occur in the FMNF.

5.6.1 Affected Environment

5.6.1.1 Ecological Conditions

The Project Area is located primarily in the Coastal Plain Ecoregion, although short segments of the Belle Isle corridor alternatives extend into the Coastal Zone and Marine Ecoregion east of U.S. Highway 17 (SCDNR 2005a). Within the Coastal Plain Ecoregion, the Project Area has three main types of habitats: grassland and early successional habitats, pine woodlands, and river bottoms (SCDNR 2005a). All of these habitat types are found in the Study Area and support diverse wildlife species. The FMNF represents the largest and most biodiverse forested landscape in South Carolina.

The majority of the transmission line would be constructed within existing ROWs that are maintained for other transportation infrastructure (highways, primary or secondary roads, railways, and driveways) or utilities (powerlines; telephone lines; and water, sewer, and gas pipelines). The vegetative community within the existing ROWs consists of fescue grass (*Festuca* spp.), Bermudagrass (*Cynodon* spp.), crabgrass (*Digitaria* spp.), and a variety of common herbaceous and woody species, including: wiregrass (*Aristida beyrichiana*); earleaf greenbrier (*Smilax auriculate*); spurge nettle (*Cnidoscolus urens* var. *stimulosus*); sandy-woods chaffhead (*Carphephorus bellidifolius*); small black blueberry (*Vaccinium tenellum*); American ipecac (*Euphorbia ipecacuanhae*); yankeeweed (*Eupatorium compositifolium*); narrowleaf silkgrass (*Pityopsis graminifolia*); and wax myrtle (*Morella cerifera*) (NatureServe 2018a). The desired condition for plant communities within the ROW would be low-growing native species in an early-seral stage of development, whereby undesirable woody vegetation that could interfere with the transmission line would be controlled. ROWs' disturbed areas will be reclaimed with native seed mixes, including but not limited to the aforementioned species, as directed by applicable USFS plans and policies on NFS lands.

Agriculture and timber harvesting have influenced vegetation and wildlife habitat in the Project Area. Settlers and farmers cleared the uplands and better-drained terraces for fields, while extensive longleaf pine and swamp hardwood forests were cleared for timber. Timber harvesting still occurs throughout much of this area of South Carolina.

Belle Isle

Vegetation communities along the Belle Isle corridor alternatives for options B and C were described previously by Central Electric (2014), so no additional field surveys were conducted. If either option were selected as the preferred alternative, additional florisic surveys would be conducted to avoid adverse impacts on threatened, endangered, or special-status plants, or rare plant communities.

Jamestown

Vegetation communities along the Study Area of the Jamestown corridor alternative include mixed age upland pine forests, pine-hardwood stands, and isolated sections with older pine stands of sparse canopy closure. Hardwood swamp forests are frequent along the corridor, and several blackwater stream crossings occur. Isolated seasonal, depressional wetlands are scattered along the corridor and include closed canopy pond cypress and black gum-dominated bays, some remnant grass-dominated, but fire-suppressed wetlands, as well as some apparent sinkhole ponds. Most uplands in the southeastern portion of the Study Area are low beach ridges dissected by mixed hardwood and cypress-dominated swamps and forested floodplains along creeks. Near the mid-portion of the Jamestown corridor alternative, sand hills that are 30 to 45 feet in elevation are present with numerous deep, cypress-filled lime sinks. Along Halfway Creek Road, deep wetlands and large depressional wetlands or Carolina bays and lime sinks are common along the corridor alternative. Finally, from Shulerville northwest to the Jamestown area, flatwoods and low ridges are present with mixed hardwood and cypress-tupelo–dominated depression and forested swamps and floodplain forests. The corridor alternative crosses several small creek floodplains and pine flatwoods (Gaddy 2017). Gaddy (2017) conducted a preliminary floristic inventory of the Jamestown corridor.

Charity

Vegetation communities along the Study Area for the Charity corridor alternative are similar to the Jamestown corridor alternative. The upland natural vegetation is dominated by longleaf pine and loblolly pine in sandy uplands, and clay-based flatwood areas. Transitional areas are dominated by loblolly and pond pine. In wetland areas along the

Charity corridor alternative, the dominant tree species are pond cypress, swamp tupelo, red maple, pond pine, other mixed hardwoods, and occasionally loblolly pine (Gaddy 2018). Gaddy (2018) conducted a floristic survey of the Charity corridor alternative.

Ecosystems

A map of ecosystem groups (hereafter called ecosystems) for the Study Area was obtained from the FMNF, the same map of ecosystems used for the FMNF *Revised Land Management Plan* (USFS 2017). This map of potential natural vegetation types on the FMNF was based on the NatureServe (2012) ecosystem framework and covered the land area crossed by the Jamestown and Charity corridor alternatives, and portions of the Belle Isle corridor alternative options south of the Santee River. To classify ecosystems traversed by the remaining northern portion of the Belle Isle corridor alternative, the GAP/LANDFIRE National Terrestrial Ecosystems dataset (USGS 2011) was used. Table 5-6 presents a crosswalk of the ecosystems mapped, based on ecological groups identified by the FMNF and corresponding U.S. Geological Survey GAP/LANDFIRE map units and a brief description of each ecosystems. These ecosystems represent common and rare community types, both of which are important for sustaining ecological and species diversity. Figures 5-13, 5-14, and 5-15 show the ecosystems that would be traversed by the proposed Project corridors.

Table 5-6: Crosswalk of Mapped Ecosystems in the Study Area and Corresponding GAP/LANDFIRE National Terrestrial Ecosystems, and their Descriptions

Ecosystem	GAP/LANDFIRE National Terrestrial Ecosystems	Brief Description
Upland Longleaf and Loblolly Pine Woodlands	Atlantic Coastal Plain Upland Longleaf Pine Woodland Evergreen Plantation or Managed Pine	Includes all pine-dominated forests throughout the region, including those occupying a variety of soil moisture characteristics, except floodplains. The canopy is dominated by one or several species of pine, generally loblolly, or longleaf pine, depending on elevation, soil type, and silvicultural history. Shrub and mid-story cover are low and groundcover is herbaceous and abundant (>65% cover) with diverse native wildflowers and legumes. Landscape-level; low-intensity fire averaging every 1 to 3 years is common during the dormant season. Fires burn the parts of herbs and shrubs that are above ground but have little effect on fire-tolerant trees.
Wet Pine Savanna and Flatwoods	Central Atlantic Coastal Plain Wet Longleaf Pine Savanna and Flatwoods	Occurs on seasonally wet areas characterized by open-canopy woodland or savanna conditions that is created by periodic fire. Canopy closure is typically less than 60%. Wet pine savanna and flatwoods are dominated by longleaf pine or pond pine and pond cypress on wetter sites. Open loblolly pine-dominated flatwoods and

Ecosystem	GAP/LANDFIRE National Terrestrial Ecosystems	Brief Description
		savannas may occur until conversion to longleaf pine can be complete on mesic sites and pond cypress or pond pine on the wettest sites. Where annual fire is present, grasses may be dominant with pitcher plants and orchids. This type is widely scattered in the study corridor and often harbors noteworthy plant species. Longleaf pine dominates where fire is present, while loblolly pine is found in wetter, less frequently burned stands. Most of the upland forests of the study area are pine flatwoods. Some of these wetter sites are wetlands.
Depressional Wetlands and Carolina Bays	Atlantic Coastal Plain Clay-Based Carolina Bay Forested Wetland Atlantic Coastal Plain Clay-Based Carolina Bay Herbaceous Wetland	Palustrine wetlands that contain a variety of vegetation types depending on fire regime and flooding depth and duration. Vegetation can be pond cypress and swamp tupelo ponds, pond cypress savannas and non-alluvial swamps, Pond cypress sinks and pond cypress savannas are most common. Typically found among wet pine savanna and flatwoods ecosystems. These wetlands range in size from 1 to 50 acres and are characterized by soils that are semi-permanently or permanently saturated from processes such as groundwater seepage, perched water tables, rainfall or beaver activity.
Pocosins	Atlantic Coastal Plain Peatland Pocosin	A type of palustrine wetland with deep, acidic, peat soils that occupy poorly drained higher ground between streams and floodplains. Water is provided by seeps or perched water tables underlying them. Vegetation is predominantly shrubland or very shrubby open woodlands, and they are sometimes called shrub bogs. Herbaceous vegetation is present only as small patches. Prescribed fire and flooding are the most important processes influencing the composition of these ecosystems and in the absence of fire, succession will progress to tall pocosin, or forested sites with pond pine, loblolly pine, longleaf pine, or forested swamp ecosystems.
Oak Forests and Mesic Hardwood Forests	Atlantic Coastal Plain Dry and Dry-Mesic Oak Forest Atlantic Coastal Plain Nonriverine Swamp and Wet Hardwood Forest- Oak East Gulf Coastal Plain Southern Mesic Slope Forest Dominated Modifier; East Gulf Coastal Plain	A forest type that includes both dry and dry to mesic oak forests and mesic slope forests. Occur in areas sheltered from frequent fires, such as slopes adjacent to river terraces, on islands in swamps. Mesic slope forests are influenced by marl or calcareous geology. Oak trees (turkey oak, runner oak, or blackjack oak) are the characteristic component but can be dominated by dominated by other hardwood trees or loblolly pine. A fairly uncommon ecosystem in the Study

Ecosystem	GAP/LANDFIRE National Terrestrial Ecosystems	Brief Description
	Southern Mesic Slope Forest Southern Atlantic Coastal Plain Mesic Hardwood Forest	Area.
Forested Swamps and Floodplain Forests	Atlantic Coastal Plain Blackwater Stream Floodplain Forest - Forest Modifier Atlantic Coastal Plain Small Brownwater River Floodplain Forest Atlantic Coastal Plain Nonriverine Swamp and Wet Hardwood Forest - Taxodium/Nyssa Modifier Atlantic Coastal Plain Southern Tidal Wooded Swamp Introduced Riparian and Wetland Vegetation	Includes forests within small blackwater river and stream floodplains, as well as broad non-riverine swamps and wet hardwood forests within large river floodplain forests, and tidal wooded swamps. Typically composed of a complex of hardwood and hardwood-pine communities, often dominated by swamp tupelo and red maple. On broader sites, bald cypress can become an important canopy species. Tulip poplar, sweet gum, pond pine, loblolly pine, and laurel oak are common associates. Flooding is the most important ecological factor influencing associated ecosystems, though fire can vary from a minor to a significant influence on vegetation composition and structure.
Maritime Forests and Salt Marsh	Atlantic Coastal Plain Central Fresh-Oligohaline Tidal Marsh; Atlantic Coastal Plain Central Salt and Brackish Tidal Marsh; Atlantic Coastal Plain Southern Maritime Forest	Forests in the coastal zone and are found on barrier islands, salt marsh islands including hammock islands) and mainland areas that are influenced by salt spray. Maritime forests are typically dominated by live oaks, southern magnolia, palmetto, coastal red cedar, and one or more species of pine. On the FMNF, nearly one-quarter of maritime forests are dominated by loblolly pine.
Grassland and Early Successional Areas	Cultivated Cropland Disturbed/Successional - Grass/Forb Regeneration Disturbed/Successional - Shrub Regeneration Harvested Forest - Grass/Forb Regeneration Harvested Forest-Shrub Regeneration, Pasture/Hay Undifferentiated Barren Land	Grasslands or early successional fields with cover provided by grasses and/or weeds and with few, if any, trees. Also managed open areas such as meadows, pastures, golf courses, or expansive lawns with or without damp depressions. This habitat type occurs throughout the region due to timber harvest and is most extensive in areas surrounding human development and agriculture.
Rivers and Streams (aquatic lotic systems)	Open Water (Fresh) Open Water (Brackish/Salt) Unconsolidated Shore	Open water habitats that include rivers, streams, and estuaries.

Ecosystem	GAP/LANDFIRE National Terrestrial Ecosystems	Brief Description
Developed Areas	Developed, High Intensity Developed, Medium Intensity Developed, Low Intensity Developed, Open Space Disturbed, Non-specific Quarries, Mines, Gravel Pits and Oil Wells	Areas modified by human activities, including areas developed for residential, commercial, and industrial land uses. Typically include buildings, paved areas, and other impervious surfaces. Most ecosystem processes are regularly affected by humans.

Source: USFS (2017), USGS (2011)

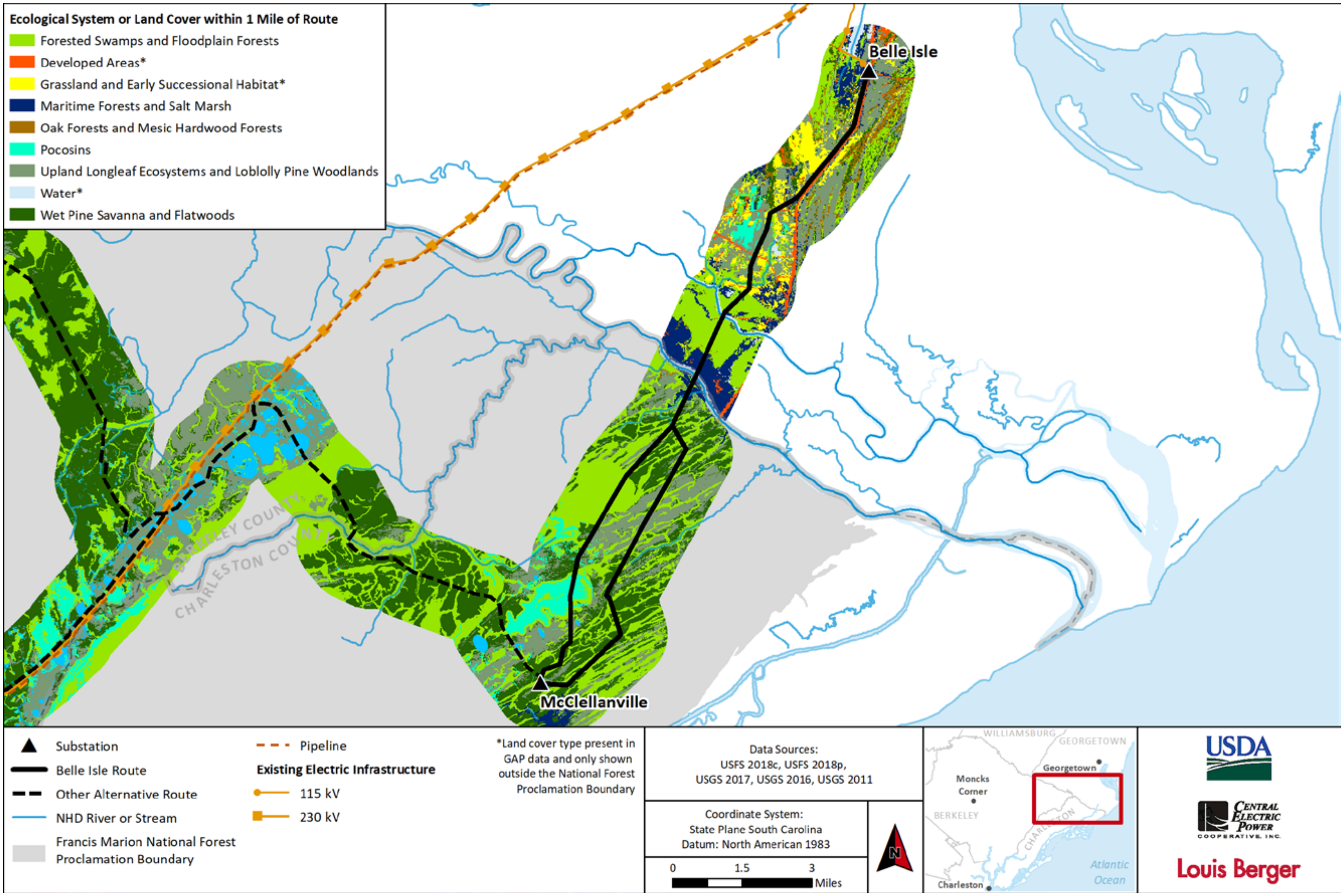


Figure 5-13: Ecosystems in the Belle Isle Corridor Alternative Study Area

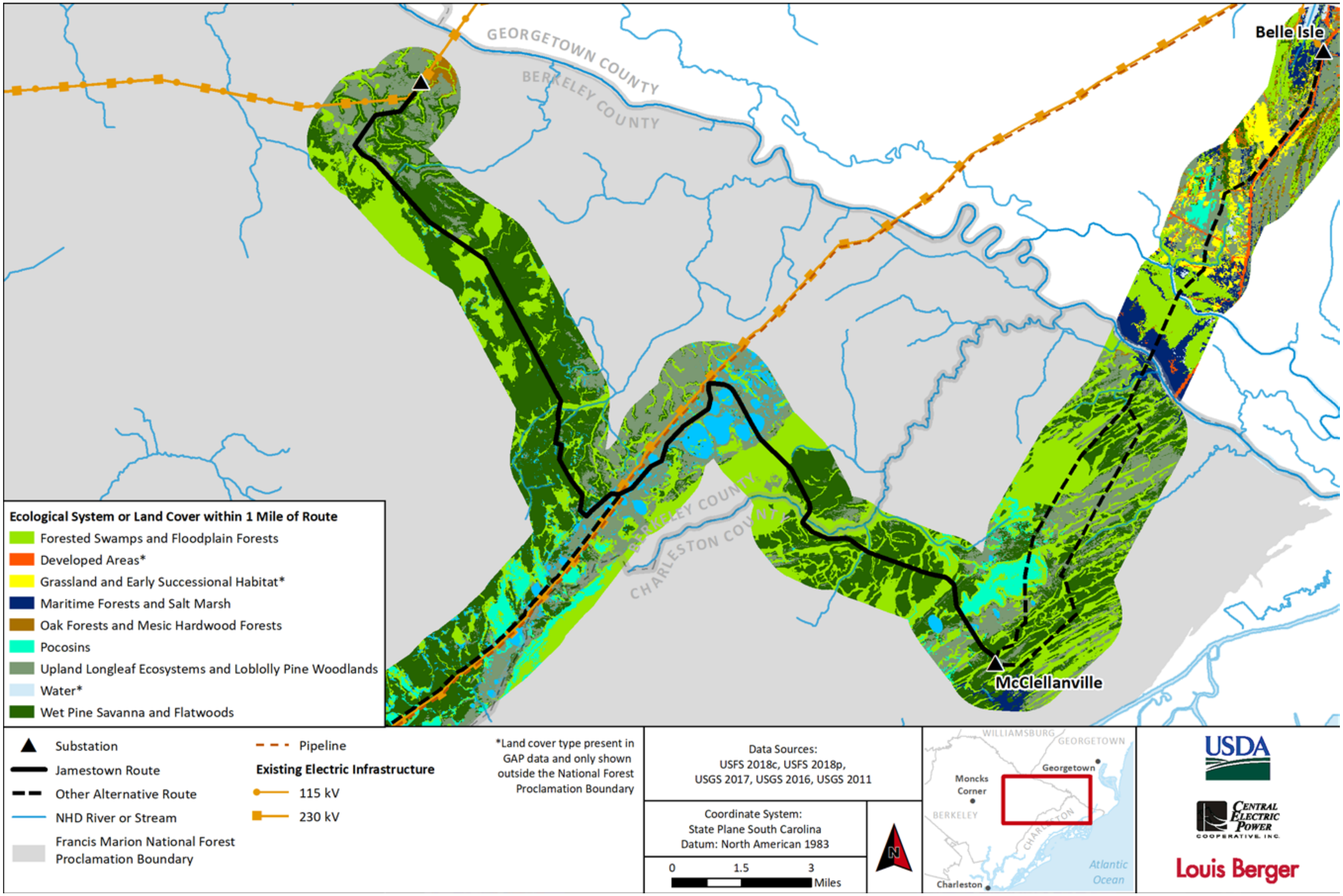


Figure 5-14: Ecosystems in the Jamestown Corridor Alternative Study Area

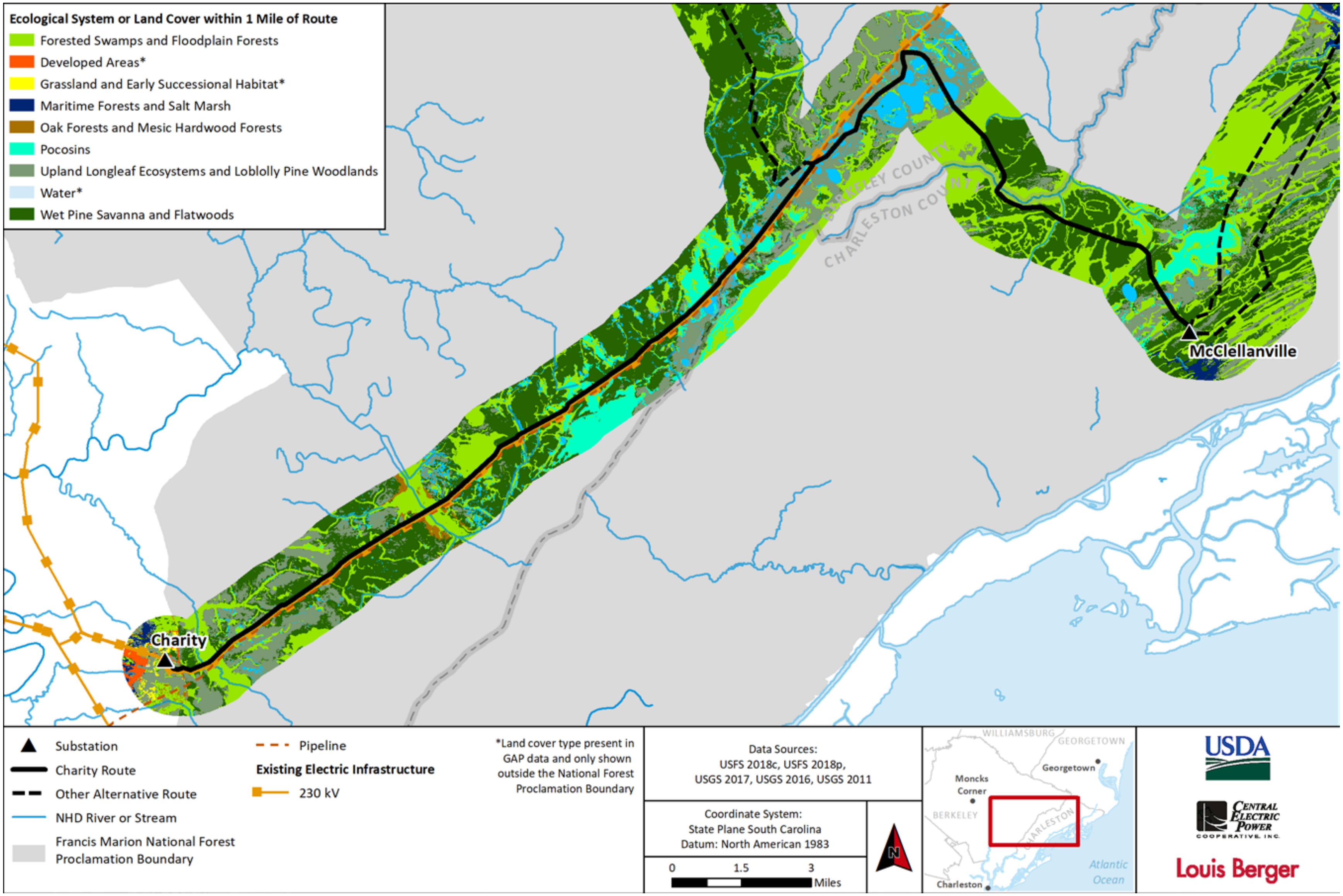


Figure 5-15: Ecosystems in the Charity Corridor Study Area

Table 5-7 presents the percentage of each ecosystem within a 600-foot corridor around each proposed Project corridor. The primary land cover within all of the corridor alternatives is forest. For a description of each ecosystem, see Table 5-6, above.

Table 5-7: Percentage of Ecosystems within a 600-foot Corridor of the Proposed Project Corridor Alternatives

	Belle Isle			
Ecosystem	**Option B**	**Option C**	**Jamestown**	**Charity**
Upland Longleaf and Loblolly Pine Woodlands	24%	22%	27%	25%
Wet Pine Savanna and Flatwoods	18%	14%	48%	40%
Pocosins	1%	5%	0%	4%
Oak Forests and Mesic Hardwood Forests	1%	1%	0%	0%
Forested Swamps and Floodplain Forests	31%	32%	18%	22%
Maritime Forests and Salt Marsh	9%	9%	0%	0%
Grassland and Early Successional Areas	5%	5%	0%	0%
Rivers and Streams (Open Water)	1%	1%	0%	0%
Depressional Wetlands and Carolina Bays	0%	0%	6%	9%
Developed Areas	10%	11%	0%	0%

Source: USGS (2011), USFS (2018a)

Non-native Invasive Plants

Non-native invasive plants are those plants introduced to an area outside their original range and that cause harm because they have no natural enemies to limit their reproduction. Non-native invasive plants usually spread rapidly and are recognized as one of the leading threats to biodiversity. Once established, non-native invasive plants impose enormous costs to agriculture, forestry, fisheries, and other human land uses. Typically, federal agencies, states, and county governments designate the most harmful non-native invasive plants with a status that requires their management or control.

Under the South Carolina Noxious Weed Act, a noxious weed is defined as: "any living stage of any plant including seed or reproductive parts thereof or parasitic plants or parts thereof which is determined by the Commissioner of Agriculture to be directly or indirectly injurious to public health, crops, livestock, or agriculture including but not limited to waterways and irrigation canals" (South Carolina Legislature, Title 46, Chapter 23). This law provides the South Carolina State Crop Pest Commission with the authority to seize, quarantine, treat, destroy, or apply other remedial measures to any noxious weed or any item that it has reason to believe contains or is contaminated with any noxious weed. In addition, the South Carolina Aquatic Plant Management Act created the South Carolina Aquatic Plant Management Program for the purpose of preventing, identifying, investigating, managing, and monitoring aquatic plant problems in public waters of South Carolina (South Carolina Legislature, Title 46, Chapter 9). SCDNR is designated as the state agency to administer this statute. Preventing the spread of non-native invasive species, and eliminating them where possible, is a high-priority conservation action of the South Carolina State Wildlife Action Plan (SCDNR 2015a).

Noxious weed surveys were not conducted in the Study Area. According to EDDMapS (2018), there are 227 non-native invasive species known to occur in Charleston County, 168 in Georgetown County, and 215 in Berkeley County. Across the Southeast, of the 380-plus recognized non-native plants in southern forests and grasslands, 53 are rated high-to-medium risk for natural communities (Wear and Greis 2012).

USFS is required to prevent the introduction and spread of non-native invasive species through Executive Order 13112, released February 2, 1999, and a subsequent amendment released December 5, 2016, *Safeguarding the Nation from the Impacts of Invasive Species*. USFS has a National and Regional Invasive Species Strategies policy regarding invasive species and maintains lists of priority non-native invasive plant species. The University of Georgia–Center for Invasive Species and Ecosystem Health maintains a list of non-native invasive plants of highest priority in the Southern Region at https://www.invasive.org/south/highpriority.html (USFS 2018b). The FMNF displays the affected environment and vision for the prevention and control of invasive species, as well as a list of known non-native invasive species infestations (FEIS, pp.212-221). This information is maintained as an invasive plant species layer in GIS. Also, USFS works in partnership with the South Carolina Exotic Pest Plant Council, and its websites list non-native invasive plant species posing greatest impacts to natural areas in the state. Lists are at: https://www.se-eppc.org/southcarolina/Publications/InvasivePlantsBooklet.pdf (Lund et al. 2015). A list including those recommended for early detection and rapid response efforts can be found at https://www.se-eppc.org/southcarolina/SCEDDR.pdf South Carolina Exotic Pest Plant Council no date).

On the FMNF, approximately 850 acres of non-native invasive plant infestations have been mapped, out of more than 35,000 acres surveyed between 2002 and 2014 (USFS 2017). The most widespread species on the FMNF were Japanese climbing fern (*Lygodium japonicum*) (473 acres), sericea lespedeza (*Lespedeza cuneate*) (110 acres), Japanese honeysuckle (*Lonicera japonica* (60 acres), tall fescue (*Lolium arundinaceum*) (61 acres), and Chinese privet (*Ligustrum sinensis*) (39 acres). Chinese tallow (*Triadica sebifera*), which occupied 19 acres on the FMNF, is a primary threat around the FMNF boundary with Cape Romaine National Wildlife Refuge. Of the terrestrial and riparian non-native invasive plants known or likely to occur on the FMNF, cogongrass, common reed, and alligator weed are regulated as state or federal non-native invasive plant species (USFS 2017).

5.6.1.2 Federally Listed Threatened and Endangered Species

The information below is a summary of the federally listed threatened and endangered species that could occur or have habitat in the Study Area. Table 5-8 lists the status and associated ecosystems of three birds, two mammals, one amphibian, two fish, and three vascular plants that are listed under the ESA and could occur in the Study Area.

Three marine mammals listed under the ESA could occur in the Project vicinity, but do not occur in freshwater and would thus not be affected. Likewise, the four federally listed sea turtles in the Atlantic Ocean could occur on nearby beaches and marine habitats but would not be found in the Santee River or anywhere else in the Study Area. Lastly, two federally listed shorebirds (piping plover [*Charadrius melodus*] and red knot [*Calidris canutus rufa*]) and one plant (seabeach amaranth [*Amaranthus pumilus*]) are found only on coastal beaches. At its nearest point, the proposed transmission line would be approximately 6 miles from any coastal beach habitat where these species could occur. Therefore, the federally listed marine mammals, sea turtles, coastal shorebirds, and one beach plant are dismissed from analysis, and no further discussion is warranted.

Table 5-8: Federally Listed Species in the Study Area with the Potential to Occur or with Suitable Habitat in the Study Area

Common Name (Scientific Name)	Taxonomic Group	ESA Status	Potential to Occur in Study Area	Known Occurrence in the Project Vicinity[a]	Associated Ecosystem(s)
Red-cockaded Woodpecker (*Picoides borealis*)	Bird	Endangered	Yes	Yes	Fire-maintained upland longleaf and loblolly pine-dominated woodlands.
Wood Stork (*Mycteria americana*)	Bird	Threatened	Yes	Yes	Nests in the upper branches of black gum or cypress trees that are in standing water. In South Carolina, colony sites are surrounded by extensive wetlands, in particular palustrine forested wetlands.
Bachman's Warbler (*Vermivora bachmanii*)	Bird	Endangered	No	No	Historically known from central Charleston County in bald cypress swamps and canebrakes, but it has not been seen in the county (or anywhere else) for decades

Common Name (Scientific Name)	Taxonomic Group	ESA Status	Potential to Occur in Study Area	Known Occurrence in the Project Vicinity[a]	Associated Ecosystem(s)
					and is presumed extirpated.
Northern Long-eared Bat (*Myotis septentrionalis*)	Mammal	Threatened	Yes	Yes	Utilize all forest types, roosting alone or in colonies underneath bark, in cavities or in crevices (i.e., of both live and dead trees).
West Indian Manatee (*Trichechus manatus*)	Mammal	Threatened	Yes	Yes	Found in marine and estuarine waters, but there are historical records for the mammal several miles up the Santee River.
Frosted Flatwoods salamander (*Ambystoma cingulatum*)	Amphibian	Threatened	Yes	Yes	Closely associated with the longleaf pine savannas of the lower coast. These communities typically exhibit a sparse canopy of longleaf pine with a rich herbaceous layer. Breeds in isolated temporary ponds.
Shortnose Sturgeon (*Acipenser brevirostrum*)	Fish	Endangered	Yes	Yes	Moves primarily from tidal estuarine or brackish channels into freshwater reaches to spawn. Spawns in freshwater rivers from tidal river reaches to at least as far inland as the fall line.
Atlantic Sturgeon (*Acipenser oxyrhinchus oxyrhinchus*)	Fish	Endangered	Yes	Yes	Adults migrate through nearshore Atlantic shelf waters and enter coastal sounds, bays and inlets to access the river basins in which they spawn. Spawns in freshwater rivers.
Pondberry (*Lindera melissifolia*)	Vascular Plant	Endangered	Yes	Yes	Occurs in seasonally flooded wetlands such as floodplain/bottomland hardwood forests and forested swales, on the bottoms and edges of shallow seasonal ponds in old dune fields, along the margins of ponds and depressions in pinelands, around the edges of sinkholes in coastal areas with karst topography, and along the borders of Sphagnum bogs.

Common Name (Scientific Name)	Taxonomic Group	ESA Status	Potential to Occur in Study Area	Known Occurrence in the Project Vicinity[a]	Associated Ecosystem(s)
American Chaffseed (*Schwalbea americana*)	Vascular Plant	Endangered	Yes	Yes	Occurs in acidic, sandy or peaty soils in open pine flatwoods, pitch pine lowland forests, seepage bogs, palustrine pine savannas, and other grass- and sedge-dominated plant communities.
Canby's Dropwort (*Oxypolis canbyi*)	Vascular Plant	Endangered	No	No	Occurs in Coastal Plain Ecoregion in habitats prone to long periods of inundation, including pond cypress swamps, grass-sedge dominated Carolina bays, wet pine savannas, shallow pineland ponds, and cypress-pine swamps or sloughs.

Sources: USFWS (2018b), SCDNR (2018a), South Carolina Heritage Trust (2018), USFS (2018c)

[a] For animals, due to their mobility, includes all recent observations within potentially affected ecosystems in Charlestown, Berkeley, and Georgetown counties. For plants, due to their relative immobility, includes only those occurrences within one mile of the proposed Project corridors.

Red-cockaded Woodpecker

The red-cockaded woodpecker was federally listed as endangered in 1970 (35 Federal Register [FR] 16047). South Carolina also lists the species as endangered. A recovery plan for red-cockaded woodpecker was originally written in 1979 and has been revised twice (USFWS 2003). The red-cockaded woodpecker is a small, non-migratory woodpecker that resides in mature, fire-maintained pine forests in the southeastern United States, especially longleaf pine forests where it was historically common. Prime nesting habitat includes open, mature pine forests dominated by longleaf, loblolly, pond, slash or other southern pine species with little understory vegetation. They excavate nest cavities in trees that are greater than 60 years of age. Ideal foraging habitat includes upland longleaf pine ecosystems and loblolly pine woodlands, as well as pine-dominated savannas and flatwoods that have been maintained by frequent natural fires and are 30 years of age or older (USFWS 2003). Red-cockaded woodpeckers are cooperative breeders, whereby a group of birds occupy adjacent trees and help to raise nestlings. Groups typically consists of a breeding male and female and one or more helpers, usually male offspring from previous years; their grouping of cavity trees is referred to as a cluster, which may total up 20 or more trees (SCDNR 2005b).

In 2000, an estimated 14,068 red-cockaded woodpeckers were living in 5,627 known active clusters across 11 states; this number represents only 3 percent of the estimated abundance of the bird at the time of European settlement. In South Carolina, 133 groups were found on state-owned lands, and another 524 groups were found on federal land (including military bases) in 2000 (USFWS 2003; SCDNR 2005b). The red-cockaded woodpecker population on the FMNF is expanding in some areas of the forest, especially in locations that are burned on most frequently in Management Area 1. Areas that have been consistently burned on a 2–3 year return interval are lumped together and called the "core burn" area. In areas where forest management does not allow for prescribed fire, such as the wildland/urban interface, undesirable mid-story succession occurs and reduces the forest suitability for red-cockaded woodpecker (USFS 2017).

The FMNF is home to the third largest red-cockaded woodpecker population and is one of 13 designated core recovery populations (USFS 2017). Since 2007, the FMNF's red-cockaded woodpecker population has exceeded the recovery goal of 350 potential breeding groups, as specified in the red-cockaded woodpecker recovery plan (USFS 2017). In the 2013 nesting season, there were 457 active clusters (441 potential breeding groups, 16 single male groups, and 53 inactive clusters) on the FMNF. The South Carolina Heritage Trust (2018) and USFS (2018d) indicate 510 red-cockaded clusters on the FMNF, several of which are bisected by the proposed Project corridor alternatives. Figures 5-16, 5-17, and 5-18 show the locations of known red-cockaded woodpecker clusters within the vicinity of the proposed Project corridor alternatives. In addition, the South Carolina Heritage Trust (2018) reports an additional five red-cockaded occurrences outside and to the north of the FMNF, in the vicinity of the proposed Belle Isle B and C corridor alternatives. However, potential occurrences of red-cockaded woodpecker nesting along the proposed Belle Isle B and C corridor alternatives are not as well documented as for the Jamestown and Charity corridor alternatives because there has not been an extensive survey effort on private lands.

Wildlife Investigations, LLC (2018) conducted surveys of the proposed corridor alternatives to identify the red-cockaded woodpecker clusters potentially impacted along each ROW. Only NFS lands were surveyed. All known clusters were visited during the red-cockaded woodpecker breeding season (April 15 to June 30) to determine breeding status and group composition (number of adults present). To determine group status, the clusters were visited in the early morning before the woodpeckers exited their roost cavities for the day, and a digital playback of the red-cockaded woodpecker calls was used to attract and count individuals. Also, following the breeding season, clusters were visited to determine the total number of cavity trees present and the number of trees that would be removed during ROW construction. To determine the number of trees that could be potentially removed, all trees within 150 feet of both sides of the existing ROW were counted and tallied.

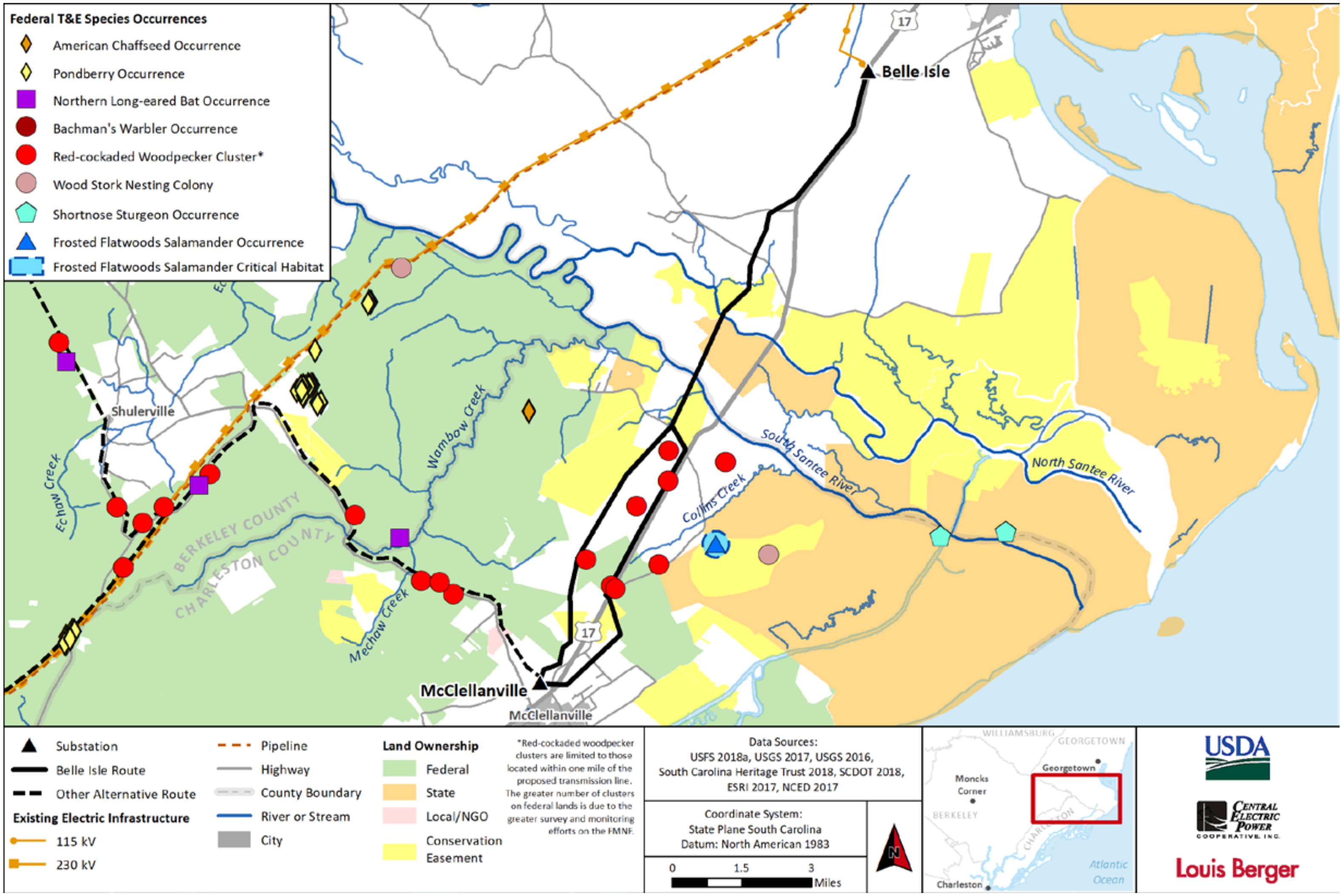


Figure 5-16: Occurrences of Federally Listed Threatened and Endangered Species and Their Designated Critical Habitat in the Belle Isle Corridor Study Area

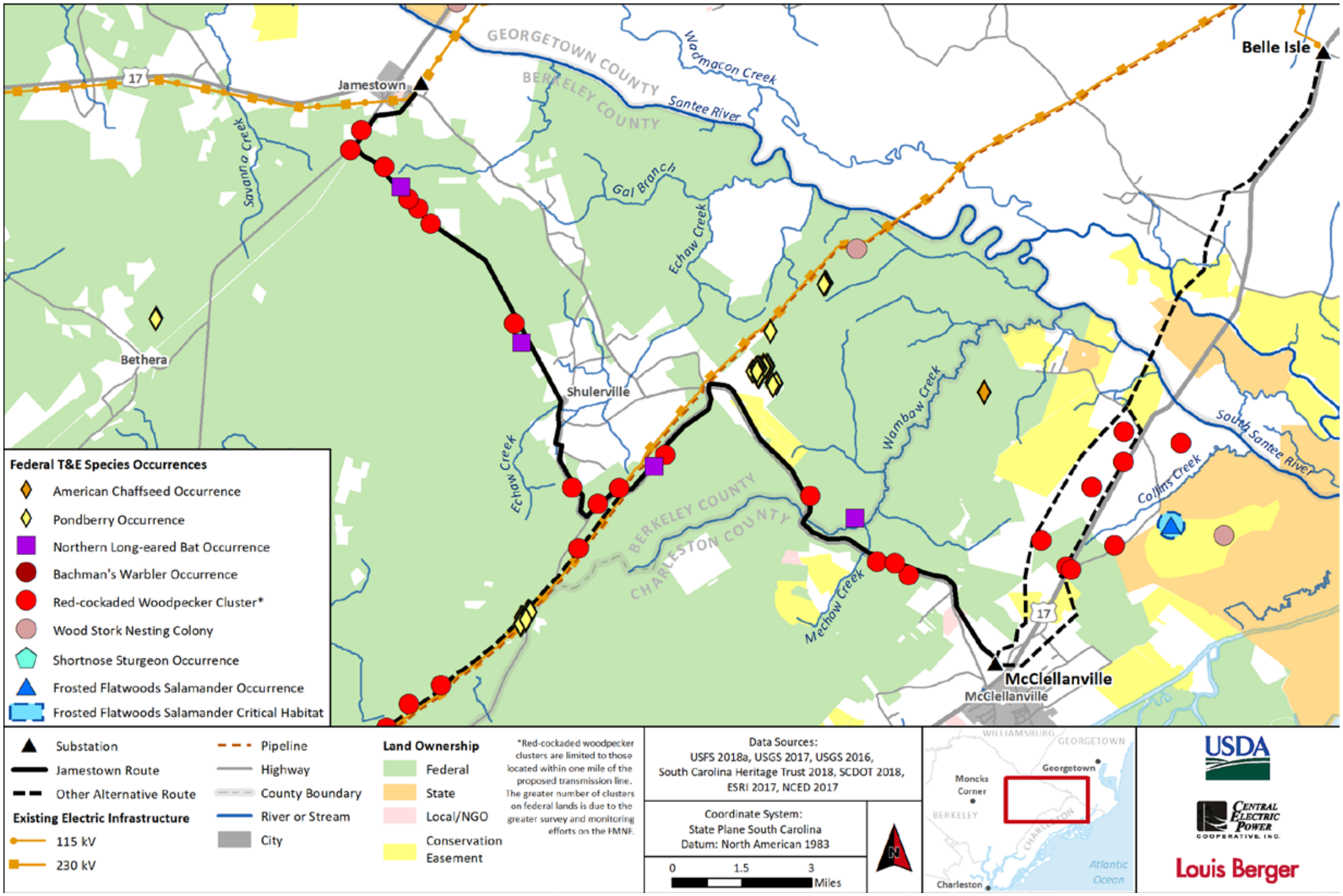


Figure 5-17: Occurrences of Federally Listed Threatened and Endangered Species and Their Designated Critical Habitat in the Jamestown Corridor Study Area

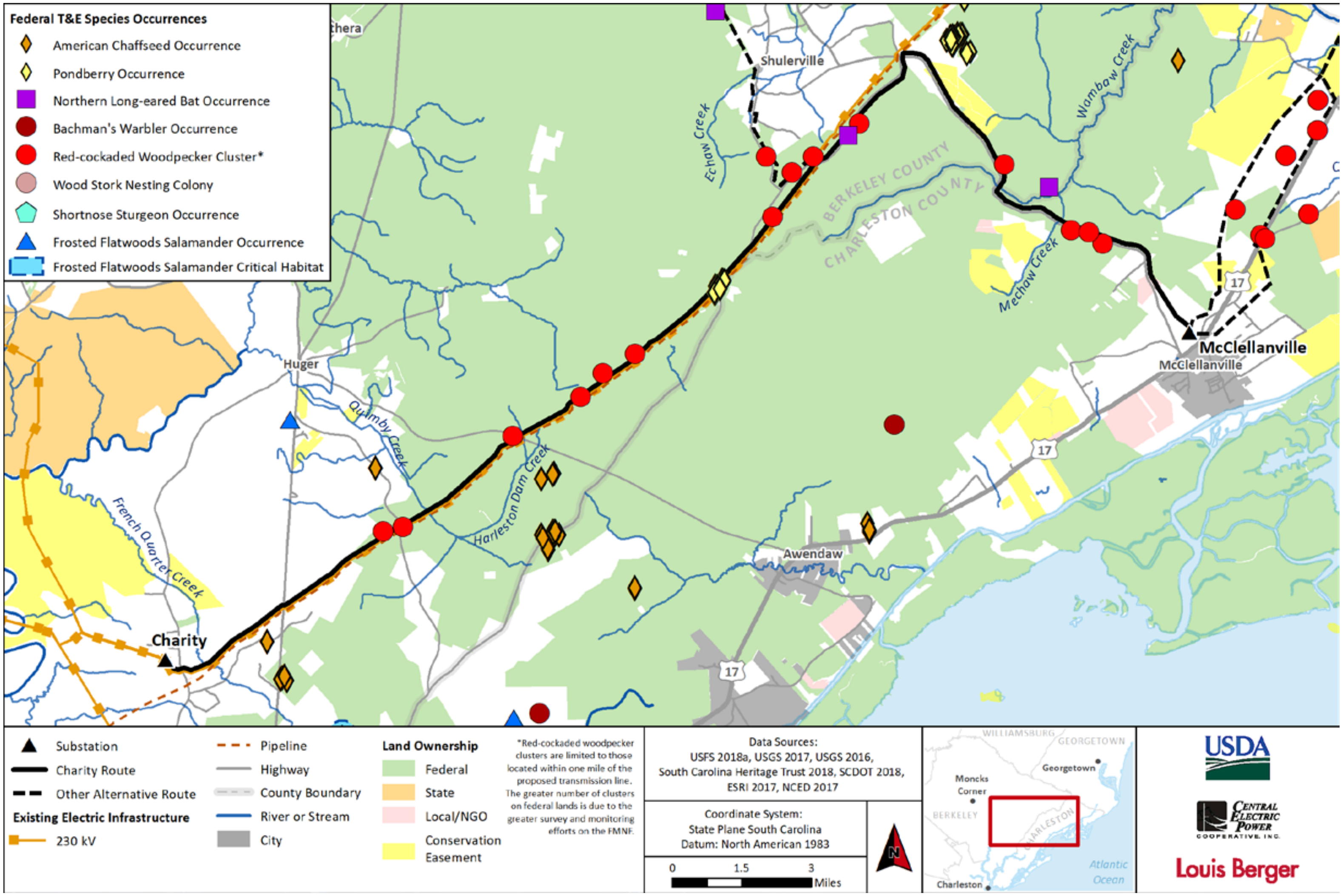


Figure 5-18: Occurrences of Federally Listed Threatened and Endangered Species and Their Designated Critical Habitat in the Charity Corridor Study Area

Wood Stork

The wood stork is a large, long-legged wading bird. The wood stork was listed as endangered under the ESA in 1984 (49 FR 7332). USFWS reviewed its status in 2007, and, due to increasing populations, downlisted the species to threatened in 2014 (79 FR 37077). The species is also listed as endangered by the State of South Carolina (SCDNR 2015a). USFWS has not designated critical habitat for the species. Wood storks inhabit marshes, cypress swamps, and mangrove swamps and breed in colonies with other wading birds.

Wood stork populations declined substantially in South Florida in the 1980s, although populations in the Carolinas and Georgia increased during the same period. In 2012, two known rookeries were located in Georgetown County, four were located in Charleston County, and none were found in Berkeley County. SCDNR monitors the reproductive effort and success of wood storks nesting in South Carolina (SCDNR 2015b). SCDNR (2016) found record high numbers of wood storks nesting in South Carolina from 2013 to 2016, with relatively high nesting success from 2011–2016.

There is a wood stork nesting colony at the Washo Reserve (Audubon 2013a), a bald cypress-dominated wetland managed by the Nature Conservancy, surrounded by the Santee Coastal Reserve. This occurrence is approximately 2.5 miles east of U.S. Highway 17 and about 2 miles south of the South Santee River (see Figure 5-16). The Belle Isle corridor alternatives are proposed parallel the highway in this area. These wood storks, and others in the vicinity, have been documented flying from their night roosts and breeding colonies upriver down to feeding areas in the lower Santee Delta, Santee Coastal Reserve, Cape Romain National Wildlife Refuge, and other nearby areas Cape Romain Bird Observatory (2011). They "often cross [U.S. Highway 17] barely above the treetop level over the Santee Delta, or at even lower altitude[s] as they fly along the North Santee and South Santee river corridors." Both the Belle Isle corridor alternatives B and C would cross the North and South Santee rivers. The wood stork is not known to nest within any of the proposed corridor alternatives and there are no wood stork rookeries documented within 2 miles of the proposed corridors (South Carolina Heritage Trust 2018). In addition to the rookery on the Washo Reserve, USFS (2018c) and Tsai and Frederick (2000) report two additional wood stork colonies along the Santee River, upstream of the proposed river crossing by the Belle Isle corridor alternatives B and C. One wood stork colony is located approximately 2 miles north of the Jamestown Substation, near the U.S. Highway 17 Alternate Bridge over the Santee River; another colony is found in a Carolina Bay off of USFS Road 204F approximately 0.75 mile south of Pleasant Hill Landing on the Santee River (see Figure 5-16). In addition to these colonies along the Santee River, USFS (2018c) reports two additional wood stork occurrences in the Project vicinity: (1) an important roosting site at Buzzards Island

Heritage Preserve, which is on the Copahee Sound more than 10 miles southeast of the Charity Substation; and (2) an important feeding site at Fairlawn Plantation, a conservation property on the Wando River, West of Awendaw, which is approximately 5 miles east of the proposed Charity corridor.

Surveys of the proposed Jamestown corridor detected six observations of wood storks within the proposed ROW Jamestown corridor. Three observations were of a pair, and, three observations were single individuals (ARCI 2018a). Also, three observations of wood storks were foraging or flying within the Jamestown ROW, and the other three were soaring above the tree canopy. Surveys of the proposed Charity corridors detected 15 observations of wood storks within the proposed ROW, divided among 11 ground observations, 2 helicopter observations, and 2 fixed-wing aerial observations. Two observations were single individuals, and 13 were multiple individuals in groups of up to 17 wood storks, totaling 92 individual birds. The three observations of more than 10 wood storks were all soaring high above the proposed ROW. However, the majority (eight) of all other observations were wood storks flying along the ROW, perched on adjacent trees, or foraging within depressional wetlands in the ROW (ARCI 2018b). Surveys for large birds on NFS lands along the southern portion of the proposed Belle Isle corridor alternatives B and C documented one wood stork.

Bachman's Warbler

The Bachman's warbler is a small songbird known to have occurred in central Charleston County in bald cypress swamps and canebrakes. The species was last officially documented in the United States in 1961 and in Cuba in 1984. Bachman's warbler spent its breeding season in the southeastern United States and wintered in Cuba and the Isle of Youth. Based on the literature, Bachman's warbler has not been officially observed in Berkeley or Charleston counties in approximately 50 years. USFS (2018c) reports two separate occurrences of Bachman's warbler in Charleston County, from 1974 and 1977 (see Figure 5-18). Many expert ornithologists believe that the Bachman's warbler is now extinct in South Carolina. Extensive surveys conducted throughout the South Carolina Coastal Plain in 1991 also failed to document the species (USFS 2017).

Northern long-eared Bat

The northern long-eared bat is one of the most common species of forest bats in the southeastern United States and has an extensive range across the eastern half of the country (USFS 2014). Although this species is not considered migratory, many groups or individuals travel considerable distances to seasonal habitat. Northern long-eared bats predominantly overwinter in hibernacula that include caves and abandoned mines (USFS 2014), and these features are not known to exist in the Project vicinity. However, during summer, the species typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags.

USFWS listed the northern long-eared bat as threatened under the ESA in 2013 (78 FR 72058). The most significant range-wide threat to the northern long-eared bat and primary reason for the species' listing is white-nose syndrome (WNS), a lethal fungal disease responsible for drastic declines of some bats in the eastern and Midwestern United States, which is spread while the species inhabits caves and mines during winter hibernation. Thus, USFWS established a rule under Section 4(d) of the ESA to streamline Section 7 consultations when federal actions may affect the northern long-eared bat but would not cause prohibited take. Under the final 4(d) rule (81 FR 1900), incidental take of the species is regulated within its range where WNS has been documented within 150 miles (i.e., the WNS zone), which includes the Project vicinity. Based on the importance of hibernacula to the bat, USFWS prohibits take in and around the hibernacula within the WNS zone. All energy infrastructure development and operation within the WNS zone is conditionally exempt from regulation if it does not occur inside their hibernacula or the activity does not result in the physical or other alteration of the hibernaculum's entrance or environment.

Historically, northern long-eared bats were only documented in Greenville, Oconee, and Pickens counties in upstate South Carolina (NatureServe 2018b). However, in the fall of 2016, two northern long-eared bats, an adult female and sub-adult male, were captured in Beaufort County in the Coastal Plain of South Carolina. USFS (2018c) does not report any documented occurrences of northern long-eared bat on the FMNF, but the South Carolina Heritage Trust (2018) indicates four occurrences documented in the Project vicinity from 2017 (see Figures 5-16, 5-17, and 5-18). These locations are all located in proximity to the proposed Jamestown corridor.

Northern long-eared bats generally like foraging along forested ridges and hillsides, with occasional foraging over water, in open fields, and along forested roads. Size and connectivity of foraging/commuting corridors are important components of suitable foraging habitat for northern long-eared bats. Forest edges, higher elevations, riparian corridors, and narrow, tree-lined roads may be considered important commuting and foraging corridors for this species. Connectivity of forested areas and riparian corridors also allows access to other potential roosting and maternity areas (USFWS 2014).

A preliminary assessment of potential bat habitat and activity for the northern long-eared was conducted along the proposed Jamestown and Charity corridors (Ecological Solutions, Inc. 2017a; Ecological Engineering, LLP 2018a), focused on NFS lands. Within the Jamestown corridor alternative, mist net and telemetry surveys were conducted between June 11 and August 2, 2017 within and in proximity of the proposed Project

ROW. Nine northern long-eared bats, out of 355 total bats of 7 species, were captured in mist nets at 30 survey sites during a total of 60 nights. This included four adult females, three adult males, and two juvenile females. Each was fitted with a transmitter and tracked for approximately 6–7 days each. Thirtyroost trees were documented on the FMNF along the proposed Jamestown corridor ROW, of which 20 were live pine species and eight were pine snags, and two were hardwoods (one live and one snag). One roost tree was located within the proposed Jamestown ROW. The State Highway 45 bridge over Wambaw Creek was surveyed to assess potential bat use, and although no evidence of bat activity was observed on this bridge, it is potential roosting habitat for bats.

Ecological Engineering (2018a) performed mist net surveys at two sites within NFS lands crossed by the Belle Isle B and C corridor alternatives between June 21 and July 26, 2018, within and in proximity to the proposed Project ROW. protocols. One adult male northern long-eared bat was captured within the proposed Belle Isle B and C corridor alternative but was tracked unsuccessfully. Ecological Engineering, LLP (2018a) also conducted mist net surveys at 24 sites from May 30 to August 7, 2018 (total of 48 nights) within the Charity corridor alternative. Ten northern long-eared bats were captured along the Charity corridor, which consisted of two females (one reproductive adult and one juvenile) and eight males (eight adults and one juvenile). During the 2018 surveys, 28 roost trees were identified, 23 of which were live pine species including 18 loblolly, 9 longleaf pines, and 1 red maple. There is thus strong evidence of a reproducing population and potential maternity habitat within the FMNF. Suitable roosting, foraging, and commuting habitat for bats was observed throughout both proposed corridor corridors, as summarized by Ecological Engineering, LLP (2018a). Habitats included large areas of mixed pine-hardwood forest with both live trees and snags, exhibiting suitable roost tree diameter with cavities, broken branches, and sloughing bark.

Frosted Flatwoods Salamander

The frosted flatwoods salamander is a large member of the mole salamander family. The frosted flatwoods salamander was listed as threatened under the ESA in 1999 (64 FR 15691). The species is also currently listed as endangered in South Carolina. Critical habitat (1,176 acres on the FMNF) was designated for the frosted flatwoods salamander in 2008 (73 FR 47258; see Figures 5-16 and 5-17). As a fossorial animal, the frosted flatwoods salamander spends most of its adult life in burrows, inhabiting crayfish holes, root channels, rodent burrows, under logs and decaying vegetation along the margins of ponds and swamps. They are found in wet, grassy flatwoods and is closely associated with the longleaf pine savannas of the lower Coastal Plain Ecoregion. Frosted flatwoods salamanders breed within seasonally flooded isolated wetlands within fire-maintained pine woodlands and savannas (USFS 2013a). Conservation measures for the species included in its listing are intended to address management activities within a 450-meter radius of known flatwoods salamander breeding ponds. Threats to frosted flatwoods salamanders include fire suppression, detrimental forestry practices that destroy the below-ground soil structure, and hydrologic changes from adjacent highways and roads that can alter the ecological functioning of breeding ponds and surrounding terrestrial habitat (USFS 2013a).

Thirty records for the frosted flatwoods salamander are known from five counties in South Carolina, including Berkeley and Charleston counties. In the past decade, this species has only been documented in Jasper and Berkeley counties. In spite of intense survey efforts, very few occurrence records have been documented in the past two decades, consisting of one or two individuals at breeding ponds (SCDNR 2015c). USFS (2013a) reported that, over the preceding 20 years, only 8 adults and 12 larvae had been captured on the FMNF. USFS (2018c) reports 10 frosted flatwoods salamander occurrences in the Project vicinity, the majority of which are more than 2.25 miles away in the Wando River area. The other occurrence closer to the proposed Project was last documented in 1987 and is on the Santee Coastal Reserve. Approximately 162 acres of critical habitat are designated within 1,500 feet surrounding this occurrence (74 FR 6700; see Figure 5-16 and 5-17). The Belle Isle B corridor alternative would be sited alongside U.S. Highway 17, approximately 1.5 miles away, at its nearest point, from this population of frosted flatwood salamander and its critical habitat. Another known population of frosted flatwoods salamander is outside of the Study Area in the FMNF, along State Highway 41 in Berkeley County. This population is located approximately 3 miles south of where the Charity corridor alternative would cross State Highway 41. The Charity corridor alternative would come within approximately 2.25 miles of the nearest known frosted flatwoods occurrence in this area (see Figure 5-18). Frosted flatwoods salamander range can extend up to 1 mile from their breeding sites. Buhlmann and Gross (2018) and Buhlmann (2019) conducted preliminary surveys of the proposed Jamestown and Charity corridor alternatives to identify the occurrences of any rare or threatened amphibians and reptiles; they reported no occurrences of frosted flatwoods salamander but found suitable habitat.

Shortnose Sturgeon

USFWS originally listed the shortnose sturgeon as an endangered species in 1967 under the Endangered Species Preservation Act (32 FR 4001), which preceded the ESA of 1973, and it has since retained that status (39 FR 41370). This species of semi-anadromous fish inhabits rivers and estuaries. The shortnose sturgeon is similar in shape and physical characteristics as the larger Atlantic sturgeon, which is also endangered and discussed below. In general, populations of both species of sturgeon along the entire Atlantic Coast have declined from historical levels in the past half-century. Dams are the primary conservation challenge for both shortnose and Atlantic sturgeon, which block spawning migrations on most major river systems and restrict the availability of spawning and nursery habitat. Dams and other impediments to migration have eliminated sturgeons from many previously occupied habitats in South Carolina, the result being a general reduction in sturgeon populations in even currently accessible river reaches (SCDNR 2015d).

The shortnose sturgeon spawns in the coastal rivers along the east coast of North America from the St. John River in Canada to the St. Johns River in Florida. There presumably are a minimum of five populations of shortnose sturgeon in South Carolina: the Waccamaw-Pee Dee, Santee, Cooper, ACE Basin (Ashepoo, Combahee and Edisto rivers), and Savannah rivers (SCDNR 2015d). Data regarding individual stock status are not available or incomplete, so the status of all shortnose sturgeon populations is poorly understood. Within the Study Area, shortnose sturgeon are known to occupy the North and South Santee rivers. USFS (2018c) reports 7 shortnose occurrences in the Project vicinity, with 2 located in the Santee River approximately 5.5 and 7 miles downstream of the U.S. Highway 17 Bridge. The other occurrences are from the Cooper River, well outside the Study Area.

Atlantic Sturgeon

The Atlantic sturgeon is a long-lived, estuarine-dependent, anadromous fish. The Atlantic sturgeon was listed as endangered under the ESA in 2012 as five distinct population segments, of which the Carolina distinct population segment occurs in the Project vicinity (77 FR 5913). Atlantic sturgeon are among the longest-lived fish, with a life span approaching 50 years or greater; they are also the largest fish inhabiting freshwaters on the Atlantic Coast. Atlantic sturgeon are fully anadromous, with adults migrating upstream into freshwater to spawn in the spring and early summer and spend the remainder of their lives in estuarine and marine waters. They spawn in moderately flowing water (46 to 76 centimeters per second) in deep parts of large rivers. Long-distance migrations away from spawning rivers are common. Atlantic sturgeon are benthic feeders and typically forage on "benthic" invertebrates (e.g., crustaceans, worms, and mollusks). Records of the Atlantic sturgeon—mature and spawning fish—are known from the North and South Santee rivers in the Study Area. However, neither the South Carolina Heritage Trust (2018) nor USFS (2018c) report any known occurrences in their sensitive species databases.

West Indian Manatee

The West Indian manatee was listed as federally endangered under the Endangered Species Preservation Act (32 FR 4001), which preceded the ESA of 1973, and was downlisted to threatened in 2017 (82 FR 16668). Manatees are also state-listed as Species of Concern and are federally protected under the Marine Mammal Protection Act, which prohibits the take (i.e., harass, hunt, capture or kill) of all marine mammals. The species migrates north into South Carolina during summers and returns south towards Florida in the fall, as water temperatures cool. West Indian manatees are primarily found in nearshore marine and estuarine waters, but they occasionally venture into tidal rivers and other freshwater environments. The graze on seagrasses and other submerged aquatic vegetation. One of the greatest threats to manatees, and other marine mammals, is boat strikes (SCDNR 2015e).

There are records of manatees swimming up the North and South Santee rivers, as well as the Cooper and Wando rivers. Several sightings have occurred in the Santee Delta east of the U.S. Highway 17 Bridge, near where the proposed Belle Isle corridor alternatives would cross the Santee River. In 2012, a manatee made it through locks on Santee Cooper Lakes and wound up becoming trapped in Lake Marion (USFS 2017). Neither the South Carolina Heritage Trust (2018) nor USFS (2018c) report any known occurrences in of West Indian manatee within the Project vicinity.

Pondberry

Pondberry is a small deciduous shrub, between 12 and 80 inches tall, that grows along the margins of lime sinks, or shallow seasonal ponds (i.e., depressional wetlands) (USFWS 1993). It was listed as endangered in 1986 (51 FR 27495). The plant also inhabits the margins of ponds within pinelands and recently burned open areas. There are 13 known populations of pondberry on the FMNF, as reported from 2010 monitoring (USFS 2012). No records for pondberry are found in proximity to the proposed Belle Isle B and C corridor alternatives. However, during reconnaissance fieldwork for the Belle Isle corridors, habitat for the species was noted on private land near the intersection of the proposed Belle Isle B and C corridors, southwest of the Santee Delta. The South Carolina Heritage Trust (2018) has documented three occurrences of pondberry that are each approximately 450 to 500 feet from the existing Charity transmission line and proposed adjacent Charity corridor alternative, in the vicinity of the intersection of Halfway Creek Road and Conifer Road (see Figure 5-18). Many pondberry occurrences are also located approximately 0.75 mile north of the proposed shared alignment of the Jamestown and Charity corridor alternatives, in proximity to the community of Honey Hill and north of State Highway 45 (see Figure 5-17). Multiple lime sinks occur in this area and contain the largest concentration of pondberry in the world, and in 1993, comprised 64 of the 73 known colonies and 8,000 of the estimated 12,600 stems of pondberry in South Carolina (USFWS 1993). The FMNF recently completed a land exchange with the Nature Conservancy to acquire 637 acres to the south of these occurrences, which would be crossed by and bordered by proposed corridor alternatives. No pondberry plants were found within these any wetlands crossed by the proposed corridor alternatives during a preliminary survey of the Charity corridor (Gaddy 2018), although depressions near known populations would be resurveyed by a professional botanist prior to Project construction.

American Chaffseed

American chaffseed is a hemiparasitic herb, a plant that obtains some nourishment from but also undergoes photosynthesis. It requires frequent fire or other soil disturbance to persist. It grows in open, moist pine flatwoods, fire-maintained savannas, and along the margins of forests or woodlands. USFWS (2008) reported 12 populations on the FMNF from 2008, but USFS (2012) also reported four populations known to occur on the FMNF in 2010. The South Carolina Heritage Trust (2018) has documented 2 populations within 1 mile of the existing Charity transmission line and proposed adjacent Charity corridor alternative, and several additional occurrences are found within the same area of the FMNF but farther away from the proposed Project (see Figure 5-18; USFS 2018c). Numbers of American chaffseed plants declined by 60 percent on the FMNF between 2001 and 2008 due to a lack of frequent, 1–3 year fire regimes (USFS 2013b).

Canby's Dropwort

Canby’s dropwort is a perennial herbaceous plant in the carrot family, listed as endangered in 1992 (57 FR 44703). According to USFS (2017), its optimal habitat is depressional wetlands or Carolina bays maintained as open and herbaceous by frequent wildfire. Eight sites are managed and protected range wide for Canby’s dropwort, including one pond cypress savanna on the FMNF (Tibwin Savanna). However, only one Canby’s dropwort plant was located there in 2006, and no plants have since been found at this site. The FMNF is working to enhance and reestablish other populations at known or historic sites for the plant on the forest. Threats to these potential sites include succession, lack of prescribed fire, woody competition from red maple and loblolly pine, and feral hogs (USFS 2017). Suitable habitat for the species exists in the Study Area; however, there are no known occurrences of Canby’s dropwort in proximity to any of the proposed corridors.

5.6.1.3 FMNF Species of Conservation Concern and State-Listed Species

The State Code of Laws of South Carolina provides protection for threatened and endangered species under the 1976 South Carolina Nongame and Endangered Species Conservation Act. This law contains provisions for endangered species similar to those of the federal ESA. State-listed species are designated as either threatened or endangered by SCDNR and documented in a list available at www.dnr.sc.gov/species/index.html. All federally listed species in the Project vicinity, as described above in Section 5.6.1.3, are also listed by South Carolina as either threatened or endangered, except for the Atlantic sturgeon and northern long-eared bat. South

Carolina lists two additional animals as endangered in Charlestown, Berkeley, and Georgetown counties: the American swallow-tailed kite (*Elanoides forficatus*), and Carolina gopher frog. South Carolina list six additional animals as threatened, including the bald eagle, common ground dove (*Columbina passerine*), Rafinesque's big-eared bat, broad-striped dwarf siren, spotted turtle, and Carolina pygmy sunfish (*Elassoma boehlkei*). Also, SCDNR (2018a) lists 31 species in Charlestown, Berkeley, and Georgetown counties as Species of Concern. Most animals listed by the South Carolina as threatened, endangered, or Species of Concern are also among those classified as SCC by the FMNF. Table 5-9 provides a list of the state-listed species that could occur in the Project vicinity, within Charlestown, Berkeley, and Georgetown counties. For details about how SCDNR and FMNF have designated state-listed species and SCC, respectively, see Section 5.6.1.

In 1976, South Carolina's Heritage Trust Act gave SCDNR the authority to also conserve plants and to acquire habitat for its natural areas program. Under this statute, SCDNR maintains an additional list of both animals and plants that are thought to be rare, declining, or for which population status is unknown. These are termed *species of concern*, not to be confused with FMNF SCC (discussed above under Section 5.5.1) and correspond to the “Watch List” species in many other states. The species of concern list does not carry the weight of law and is used only as a conservation tool to assist in protection planning and to direct research and survey efforts.

Table 5-9 lists the species designated by South Carolina as threatened, endangered, or species of concern (hereafter state-listed species), as well as 70 FMNF SCC that could potentially occur within the Project vicinity. The table also describes the associated ecosystem occupied by each species and their historical presence in the Project vicinity. For each known occurrence in the Project vicinity or potentially impacted area are 33 FMNF SCC that could be potentially affected by the Project, due to either (1) known occurences in the Project vicinity based on occurrences tracked by South Carolina Heritage Trust (2018) and USFS (2018c), or according to historic records evaluated by Buhlmann and Gross (2018), Buhlmann (2019), or Gaddy (2017, 2018); or (2) documented occurrence within the ROW of the proposed corridors, according to species-specific field surveys by ARCI (2018a,b), Buhlmann and Gross (2018), Buhlmann (2019), Ecological Solutions, Inc. (2017a,b), Gaddy (2017, 2018), Three Oaks Engineering (2017, 2018), or Wildlife Investigations, LLC. (2018) (see Table 5-9).

Figures 5-19, 5-20, and 5-21 show the known occurrences of state-listed species and FMNF SCC found within the Belle Isle B and C, Jamestown, and Charity corridor alternative Study Areas, respectively.

Table 5-9: Species Listed as FMNF SCC, or by the State of South Carolina as Threatened, Endangered, or Species of Concern, with Potential to Occur in the Study Area, Their Associated Ecosystems, and Known or Potential Occurrences Within the Project Vicinity.

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Birds											
American Swallow-tailed Kite (*Elanoides forficatus*)	SE	SCC	----	----	----	X	X	----	----	----	Yes[g,h]
Bachman's Sparrow (*Aimophila aestivalis*)	Species of Concern	SCC	----	----	X	----	----	----	----	----	Yes[h]
Bald Eagle (*Haliaeetus leucocephalus*)	ST	SCC	----	----	----	----	X	----		X	Yes[g,h]
Barn Owl (*Tyto alba*)	Species of Concern	----	----	----	X	----	----	----	X	----	Yes[h]
Black-throated Green Warbler [*Wayne's subspecies*] (*Setophaga virens spp. wayneii*)	Species of Concern	----	X	X	X	----	----	----	----	----	Yes[h]
Common ground dove (*Columbina passerine*)	ST	----	----	----	X	----	----	----	X	----	No
Grasshopper Sparrow (*Ammodramus savannarumi*)	Species of Concern	----	----	----	X	X	----	----	X	----	No

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Little blue heron (*Egretta caerulea*)	Species of Concern	----	----	----	----	X	X	X	----	X	No
Loggerhead Shrike (*Lanius ludovicianus*)	Species of Concern	----	----	----	----	----	----	----	X	----	No
Painted Bunting (*Passerina ciris*)	Species of Concern	----	----	----	X	----	----	X	X	----	No
Red-cockaded Woodpecker (*Picoides borealis*)	SE[e]	----	X	X	X	----	X	X	----	----	Yes[g,h]
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	Species of Concern	----	X	X	X	----	----	----	----	----	Yes[h]
Swainson's Warbler (*Limnothlypis swainsoni*)	Species of Concern	----	X	----	X	----	X	X	----	----	Yes[h]
Wood Stork (*Mycteria americana*)	SE[e]	----	----	----	----	----	X	X	----	X	Yes[g,h]
Mammals											
Black Bear (*Ursus americanus*)	Species of Concern	----	X	X	X	X	X	X	X	----	Yes[h]
Eastern Woodrat (*Neotoma floridana*)	Species of Concern	----	X	X	X	----	X	----	X	----	Yes[h]

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Meadow Vole (*Microtus pennsylvanicus*)	Species of Concern	----	----	----	X	----	----	----	X	----	Yes[h]
Northern Yellow Bat (*Lasiurus intermedius*)	Species of Concern	----	X	X	X	X	X	X	----	----	No
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*)	ST	SCC	X	X	----	X	X	----	X	X	Yes[g,h]
Southeastern Bat (*Myotis austroriparius*)	Species of Concern	SCC	----	----	X	X	X	----	----	----	Yes[g,h]
Star-nosed Mole (*Condylura cristata*)	Species of Concern	----	X	X	X	----	X	----	----	----	Yes[h]
Southern Fox Squirrel (*Sciurus niger niger*)	Species of Concern	----	X	----	X	----	X	----	----	----	Yes[h]
West Indian Manatee (*Trichechus manatus*)	----	SCC[e]	----	----	----	----	----	----	----	X	Yes[h]
Amphibians											
Bird-voiced Tree Frog (*Hyla avivoca*)	Species of Concern	----	----	----	----	----	X	----	----	----	No

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Broad-striped Dwarf Siren (*Pseudobranchus striatus*)	ST	SCC	----	X	----	----	----	----	----	----	Yes[h]
Eastern Tiger Salamander (*Ambystoma tigrinum*)	Species of Concern	----	X	X	X	X	----	----	----	----	Yes[h]
Frosted Flatwoods Salamander (*Ambystoma cingulatum*)	SE[e]	----	----	X	----	----	----	----	----	----	Yes[h]
Carolina Gopher Frog (*Lithobates capito capito*)	SE	SCC	----	X	----	----	----	----	----	----	Yes[h,i]
Northern Cricket Frog (*Acris crepitans*)	Species of Concern	----	----	----	----	X	----	----	----	----	Yes[h]
Pickeral Frog (*Rana palustris*)	Species of Concern	----	----	----	----	X	X	----	----	X	No
Reptiles											
Black Swamp Snake (*Seminatrix pygaea*)	Species of Concern	----	----	----	----	X	X	----	----	X	Yes[i]
Coral Snake *[Harlequin] (Micrurus fulvius*)	Species of Concern	----	X	X	X	----	----	----	----	----	No

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Eastern Diamondback Rattlesnake (*Crotalus adamanteus*)	Species of Concern	SCC	----	X	X	X	X	----	----	----	Yes[h]
Florida Green Watersnake (*Nerodia floridana*)	Species of Concern	----	----	----	----	----	----	----	----	X	Yes[h]
Northern Pine Snake (*Pituophis melanoleucus*)	Species of Concern	----	X	X	X	----	----	----	----	----	Yes[h]
Southern Hognose Snake (*Heterodon simus*)	Species of Concern	SCC	----	X	X	----	----	----	----	----	Yes[h]
Spotted Turtle (*Clemmys guttata*)	ST	SCC	----	X	----	----	X	----	----	X	Yes[g,h,i]
Timber Rattlesnake [canebrake] (*Crotalus horridus*)	Species of Concern	----	X	X	X	X	X	----	----	----	Yes[h,i]
Fish											
American Eel (*Anguilla rostrata*)	----	SCC	----	----	----	----	----	----	----	X	Yes[g,h]
Atlantic Sturgeon (*Acipenser oxyrinchus*)	Species of Concern[e]	----	----	----	----	----	----	----	----	X	Yes[h]
American Shad (*Alosa sapidissima*)	Species of Concern[f]	----	----	----	----	----	----	----	----	X	No

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Blueback Herring (*Alosa aestivalus*)	Species of Concern[f]	----	----	----	----	----	----	----	----	X	No
Carolina Pygmy Sunfish (*Elassoma boehlkei*)	ST	----	----	----	----	----	----	----	----	X	No
Hickory Shad (*Alosa mediocris*)	Species of Concern[f]	----	----	----	----	----	----	----	----	X	Yes[h]
Shortnose Sturgeon (*Acipenser brevirostrum*)	SE[e]	----	----	----	----	----	----	----	----	X	Yes[h]
Insects											
Dusky Roadside Skipper (*Amblyscirtes alternata*)	----	SCC	----	----	X	X	----	----	----	----	No
Monarch Butterfly (*Danaus plexippus*)	----	SCC	----	X	X	X	X	----	----	----	Yes[g]
Berry's Skipper (*Euphyes berryi*)	----	SCC	----	----	----	X	X	----	----	----	Yes[g]
Okefenokee Zale Moth (*Zale perculta*)	----	SCC	----	----	----	----	X	----	----	----	No
Plants											
Coastal Plain False-foxglove (*Agalinis aphylla*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Incised Groovebur (*Agrimonia incisa)*	----	SCC	----	X	----	----	----	----	----	----	No
Elliott's Bluestem (*Andropogon gyrans var. stenophyllus*)	----	SCC	----	X	----	----	----	----	----	----	Yes[g,h,i]
Mohr's Bluestem (*Andropogon mohrii*)	----	SCC	----	----	----	X	X	----	----	----	No
Purple Silkyscale (*Anthaenantia rufa*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h,i]
Savanna Milkweed (*Asclepias pedicillata*)	----	SCC	X	----	----	----	----	----	----	----	No
Black-stem Spleenwort (*Asplenium resiliens*)	----	SCC	X	----	----	----	----	----	----	----	No
Northern Burmannia (*Burmannia biflora*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h,i]
Bearded Grass-pink (*Calopogon barbatus*)	----	SCC	----	X	----	----	----	----	----	----	No
Many-flower Grass-pink (*Calopogon multiflorus*)		SCC	----	X	----	----	----	----	----	----	Yes[i]
Widow Sedge (*Carex basiantha*)	----	SCC	X	----	----	----	----	----	----	----	No
Chapman's Sedge (*Carex chapmanii*)	----	SCC	----	----	----	----	X	----	----	----	No
Ravenfoot Sedge (*Carex crus-corvi*)	----	SCC	----	----	----	----	X	----	----	----	No

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Elliott's Sedge (*Carex elliottii*)	----	SCC	----	----	----	X	X	----	----	----	No
Meadow Sedge (*Carex granularis*)	----	SCC	X	----	----	----	----	----	----	----	No
Tussock Sedge (*Carex stricta*)	----	SCC	----	X	----	----	----	----	----	----	No
Nutmeg Hickory (*Carya myristiciformis*)	----	SCC	X	----	----	----	----	----	----	----	No
Shiny Spikegrass (*Chasmanthium nitidum*)	----	SCC	----	X	----	----	----	----	----	----	No
Twig-Rush (*Cladium mariscoides*)	----	SCC	----	X	----	----	----	----	----	----	No
Ciliate-leaf Tickseed (*Coreopsis integrifolia*)	----	SCC	----	----	X	----	X	----	----	----	No
Ravenel's Eryngo (*Eryngium aquaticum var. ravenelii*)	----	SCC	----	X	----	----	----	----	----	----	No
Florida Thorough-wort (*Eupatorium anomalum*)	----	SCC	----	----	----	X	X	----	----	----	No
Southeastern Sneezeweed (*Helenium pinnatifidum*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h,i]

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Small's Bog Button (*Lachnocaulon minus*)	----	SCC	----	X	----	----	----	----	----	----	No
Southern Twayblade (*Listera australis*)	----	SCC	X	----	----	----	----	----	----	----	No
Boykin's Lobelia (*Lobelia boykinii*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]
Lance-leaf Seedbox (*Ludwigia lanceolata*)	----	SCC	----	X	----	----	----	----	----	----	No
Lance-leaf Loosestrife (*Lysimachia hybrida*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]
Loomis' loosetrife (*Lysimachia loomisii*)	----	SCC	----	----	----	X	X	----	----	----	No
Carolina Bird-in-a nest *(Macbridea caroliniana*)	----	SCC	----	----	----	----	X	----	----	----	No
Yellow Carolina Milkvine (*Matelea flavidula*)	----	SCC	X	----	----	----	----	----	----	----	No
Piedmont Water-mlfoil (*Myriophyllum laxum*)	----	SCC	----	X	----	----	----	----	----	----	No
Yellow Fringeless Orchid (*Platanthera integra*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Pineland Plantain (*Plantago sparsiflora*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]
Shadow-witch Orchid (*Ponthieva racemosa*)	----	SCC	X	----	----	----	----	----	----	----	Yes[h,i]
Crestless Plume Orchid (*Pteroglossapsis ecristata*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h,i]
Bottomland Post Oak (*Quercus similis*)	----	SCC	----	----	----	----	X	----	----	----	No
Short-bristle Baldrush (*Rhynchospora breviseta*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]
Small bunched Beaksedge (*Rhynchospora cephalantha var. attenuata*)	----	SCC	----	X	X	----	----	----	----	----	No
Globe Beakrush (*Rhynchospora globularis var. pinetorum*)	----	SCC	----	X	----	----	----	----	----	----	No
Harper Beakrush (*Rhynchospora harperi*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h,i]

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Few-flowered Beakrush (*Rhynchospora oligantha*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]
Brown Beakrush (*Rhynchospora pleiantha*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h,i]
Long-beaked Beaksedge (*Rhynchospora scirpoides*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h,i]
Chapman Beakrush (*Rhynchospora stenophylla*)	----	SCC	----	----	----	X	X	----	----	----	No
Limestone Petunia (*Ruellia strepens*)	----	SCC	----	----	----	----	X	----	----	----	No
Small-flowered Buckthorn (*Sageretia minutiflora*)	----	SCC	----	----	----	----	----	X	----	----	No
Lace-lip Ladies'-Tresses (*Spiranthes laciniata*)	----	SCC	----	X	----	----	----	----	----	----	No
Pineland Dropseed (*Sporobolus curtisii*)	----	SCC	----	X	----	----	----	----	----	----	No
Carolina Dropseed (*Sporobolus pinetorum*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]

Common Name (Scientific Name)	State Listing Status[a]	USFS Status[b]	Oak Forests and Mesic Hardwood Forests	Wet Pine Savanna and Flatwoods[c]	Upland Longleaf Ecosystems and Loblolly Pine Woodlands	Pocasins	Forested Swamps and Floodplain Forests	Maritime Forests and Salt Marsh	Grassland and Early Succes-sional Habitats	Rivers and Streams	Documented Occurrence in the Project Vicinity[g] or Historic Record and Potential for Occurrence[h,i]
Chapman's Redtop (*Tridens chapmanii)*	----	SCC	X	----	----	----	----	----	----	----	No
Threebirds Orchid (*Triphora trianthophora*)	----	SCC	X	----	----	----	----	----	----	----	No
Greater Bladderwort (*Utricularia macrorhiza*)	----	SCC	----	X	----	----	----	X	----	----	No
Short-leaved Yellow-eyed Grass (*Xyris brevifoli*)	----	SCC	----	X	----	----	----	----	----	----	Yes[h]
Florida Yellow-eyed Grass (*Xyris difformis var. floridana*)	----	SCC	----	X	----	----	X	----	----	----	Yes[h,i]
Savannah Yellow-eyed Grass (*Xyris flabelliformis*)	----	SCC	----	X	----	----	----	----	----	----	No
Pineland Yellow-eyed Grass (*Xyris stricta*)	----	SCC	----	X	----	----	----	----	----	----	No

Sources: SCDNR (2015a, 2018a); South Carolina Heritage Trust (2018); USFS (2017, 2018e); ARCI (2018a,b); Ecological Solutions, Inc. (2017a,b); Gaddy (2017, 2018); Three Oaks Engineering (2017, 2018); Wildlife Investigations, LLC. (2018)

[a] State Listing Status: SE = State Endangered; ST = State Threatened

[b] USFS Status: SCC = FMNF Species of Conservation Concern

[c] Wet Pine Savanna and Flatwoods also include Depressional Wetlands and Carolina Bays, which are exclusively inhabited by the Elliot’s bluestem, northern burmannia, southeastern sneezeweed, Boykin's lobelia, Piedmont water-milfoil, and crestless plume orchid

[e] Also federally listed as threatened or endangered under the ESA (see Table 5-8 above)

[f] American shad, blueback herring, and Hickory shad are not listed by SCDNR (2018a), but indicated to be Species of Concern by the South Carolina Heritage Trust (2018)

[g] Documented occurrence within the ROW of the proposed corridors, according to species-specific field surveys by ARCI (2018a,b); Buhlmann and Gross (2018), Buhlmann (2019), Ecological Solutions, Inc. (2017a,b); Gaddy (2017, 2018); Three Oaks Engineering (2017, 2018); or Wildlife Investigations, LLC. (2018)

[h] Known occurrence within 1 mile (for plants) of the proposed corridors, or within Charlestown, Berkeley, and Georgetown counties (for animals) according to historic records tracked by the South Carolina Heritage Trust (2018) or USFS (2018c)

[i] Known occurrence within the ROW of the proposed corridors, according to historic records evaluated by Buhlmann and Gross (2018), Buhlmann (2019), or Gaddy (2017, 2018)

The FMNF SCC and state-listed species potentially occurring within the vicinity of the proposed Project corridors are discussed in greater detail in the following section. This includes all animals in either special-status category with known occurrences within 5 miles of the proposed Project corridors and plants within 1 mile of the proposed Project corridors, according to records from the South Carolina Heritage Trust (2018) and USFS (2018c). Thus, the discussion of species below is not comprehensive of all FMNF SCC and state-listed species that could occur within the proposed Project corridors but includes only those for which known locations have been documented by state and federal wildlife managers or during targeted surveys of the proposed Project corridor alternatives.

American Swallow-tailed Kite

The American swallow-tailed kite is a migratory bird that is state-listed as endangered and could potentially occur within the proposed corridor alternatives. Today the kite occupies a remnant breeding range of 7 southern states that historically included at least 21 states as far north as Minnesota. It is as a high priority species by Partners in Flight. Primary threats to kites in South Carolina are wetland loss and drainage. The kite prefers large tracts of forested wetlands such as those found on the FMNF and along the Santee and Cooper rivers. An estimated 120 to 170 breeding pairs nest annually in South Carolina (SCWF 2017). The decline of the species in the United States is attributed to habitat disturbance and degradation including native grassland cultivation, wetland drainage, and logging of forests. Egg collecting and indiscriminate shooting have also contributed to the decline of this species.

American swallow-tailed kites are is closely associated with large tracts of forested wetlands of the Coastal Plain Ecoregion, such as those found at the FMNF and along the lower Santee River (SCDNR 2005c). The FMNF supports the northern-most concentration of breeding swallow-tailed kites, numbering around 50 pairs (Audubon 2013b). This raptor species uses rivers, swamps, marshes, and large rivers and are found in the Study Area for nesting and pre-migration staging. They nest in the larger loblolly pines and cypress trees near or the borders of forest openings and forested wetlands (South Carolina Heritage Trust 2018). Important features of the kite's habitat include forested areas with tall trees for nesting and open areas for foraging (NatureServe 2018c).

Suitable habitat for the American swallow-tailed kites exists in the Study Area within all proposed Project corridor alternatives. Although the South Carolina Heritage Trust (2018) does not report any known occurrences of American swallow-tailed kites in the Project vicinity, USFS (2018c) reports three observations nearby. During targeted surveys for large birds within the proposed Jamestown and Charity corridor alternatives, several swallow-tailed kites were observed along the ROWs. ARCI (2018a) observed single or multiple American swallow-tailed kites on 13 occasions during surveys of the proposed

Jamestown corridor alternative, of which 2 were a group of 3 birds and one was a pair. One group of three, in the vicinity of the intersection of Halfway Creek Road and Shulerville Road, was calling as if defending a nest; however, no nest was discovered. Five observations of swallow-tailed kites were reported along the Charity corridor alternative, and all observations were single individuals, except one pair, foraging over the existing ROW or soaring in its vicinity. No observations were reported during surveys of NFS lands along the southern portion of the proposed Belle Isle B and C corridor alternatives (south of the Santee Rivers [ARCI 2018b]).

Bachman's Sparrow

The Bachman's sparrow, not to be confused with the federally listed as endangered Bachman's warbler, is a relatively large songbird associated with open pine woodlands. Because of widespread population declines, SCDNR identifies it as a Species of Concern (SCDNR 2015f; 2018a). Bachman's sparrows benefit from many of the same management practices as the federally listed red-cockaded woodpecker, such as prescribed fire (USFWS 2003). They nest on the ground, preferring areas where understory shrub encroachment is limited due to poor soils, fire, or other disturbance. Populations and trends of forest birds in Southern forests from 1992–2004 show a decreasing trend in habitat usage by Bachman's sparrow from 42 point counts (USFS 2017). The FMNF has recorded one observation of Bachman's sparrow. Central Electric has not performed species-specific surveys for Bachman's sparrow or other songbirds.

Bald Eagle

The bald eagle was delisted from being a threatened species under the ESA in 2007. However, bald eagles remain listed as threatened by South Carolina and are considered an SCC by the FMNF. Bald eagles are still protected under the Bald and Golden Eagle Protection Act (BGEPA; 16 USC §§668-668d), which prohibits the take, sale (or offer of sale), purchase, barter, transport, export, or import at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg.

Bald eagle numbers are increasing in the United States because of the protections from the BGEPA and as the species continues to recover from the impacts of DDT. The bald eagle is found near rivers, lakes, and coastlines, where there is an adequate supply of fish for food. In South Carolina, the bald eagle typically nests from October through May. Courtship and nest construction can begin as early as September and continue through February. Eaglets hatch during the winter and fledge as early as late-January and as late as May. The non-nesting season in the southeastern United States occurs from June through August (USFWS 2007).

SCDNR monitors bald eagle nests annually, and there are approximately 400 bald eagle nests in South Carolina (SCDNR 2018b). The FMNF also has records of numerous bald eagle nests in the Project vicinity and over 100 observations in its SCC database (USFS 2018c). Most bald eagle nesting territories are concentrated along the Santee River. Two bald eagle nests, both active in 2018, are located in the vicinity of the proposed McClellanville Substation: one approximately 1.6 miles north of the proposed substation and the other 2.6 miles west of the substation.

One subadult bald eagle was observed during surveys of the Jamestown corridor alternative, seen from a residential area in Honey Hill (ARCI 2018a). No bald eagles were observed during surveys for large birds along the southern portion of the proposed Belle Isle B and C corridor alternatives (on NFS land south of the Santee rivers) or Charity corridor alternative (ARCI 2018b).

Barn Owl

The barn owl is a permanent resident in South Carolina. The species is identified as a Species of Concern by SCDNR because there is limited information available on the distribution or population size of barn owls in South Carolina. The barn owl is generally thought to be declining over much of its extensive range and is a priority in South Carolina due to concerns over the guild of grassland birds as a whole (SCDNR 2015g).

The barn owl prefers to forage in open grassland area and can be found in such disparate habitats as overgrown weedy urban lots, pastureland, fields, and other open, rural landscapes as well as in both fresh and salt marshes. Barn owls naturally nest in tree cavities, but will also use human structures such as outbuildings, grain silos, duck blinds, and deer stands (SCDNR 2015g). Although not a target of surveys for large birds within the proposed corridor alternatives, no barn owls were observed along the southern portion of the proposed Belle Isle B and C corridor alternatives (south of the Santee rivers) or the Charity or Jamestown corridor alternatives (ARCI 2018a,b).

Wayne’s Black-throated Green Warbler

Two forms of the black-throated green warbler occur in South Carolina, both recognized as Species of Concern by SCDNR. The Wayne’s race (or subspecies) is found in the Coastal Plain Ecoregion. Wayne’s black-throated green warbler are considered a high priority landbird by Partners in Flight. Wayne’s black-throated green warbler prefers stands of deciduous or cypress trees. They remain in areas around the slow-moving headwaters of blackwater creeks and the swamps and swamp borders that feed blackwater rivers and their tributaries. South Carolina colonies sometimes occur in isolated Cypress-Tupelo swamps amid drier pine-hardwoods habitat (SCDNR 2015h). Central Electric has not performed species-specific surveys for black-throated green warblers, or other passerines, within any of the proposed corridor alternatives.

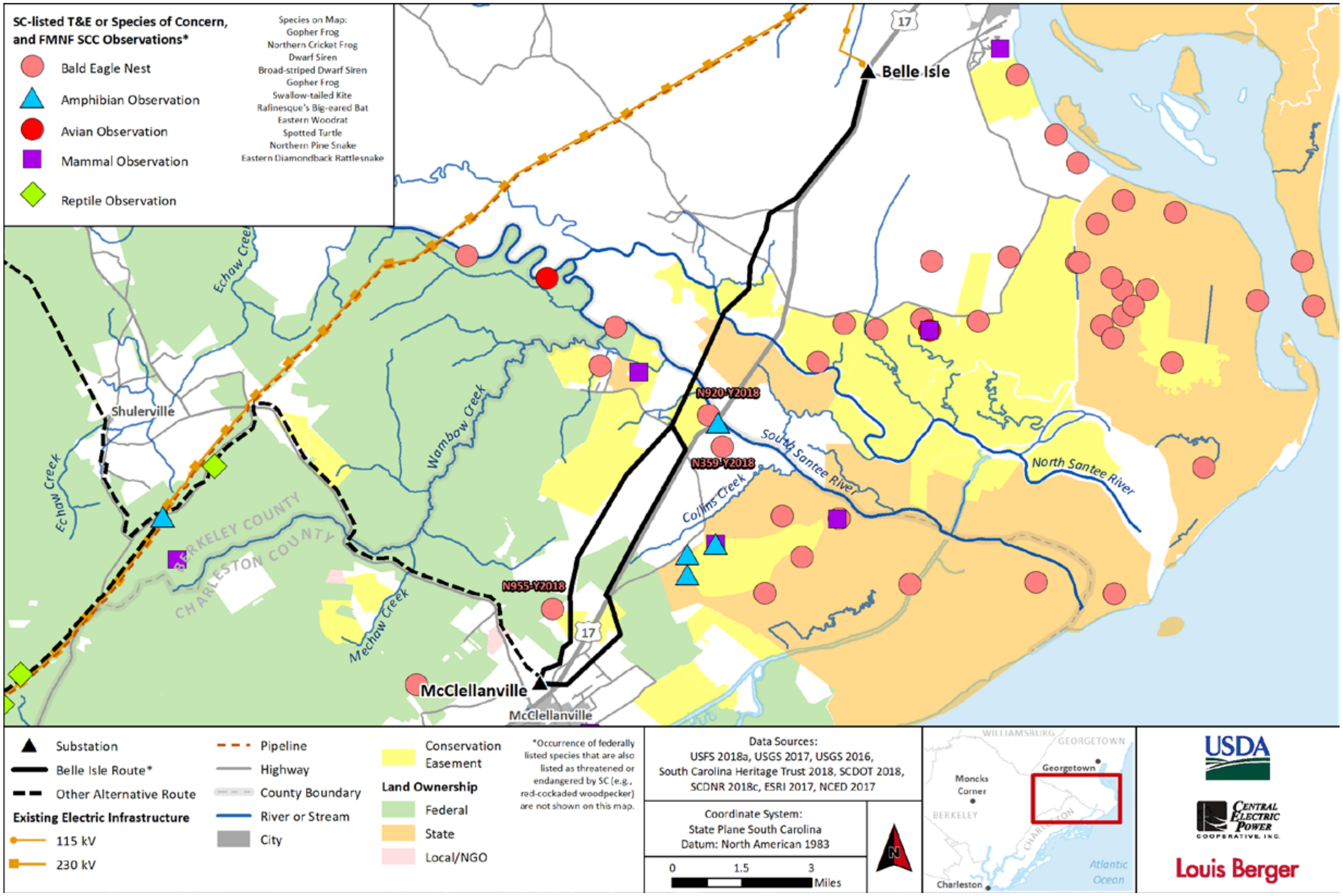


Figure 5-19: Occurrences of Wildlife Listed by the State of South Carolina as Threatened, Endangered, or Species of Concern, or as FMNF SCC, in the Belle Isle Corridor Study Area

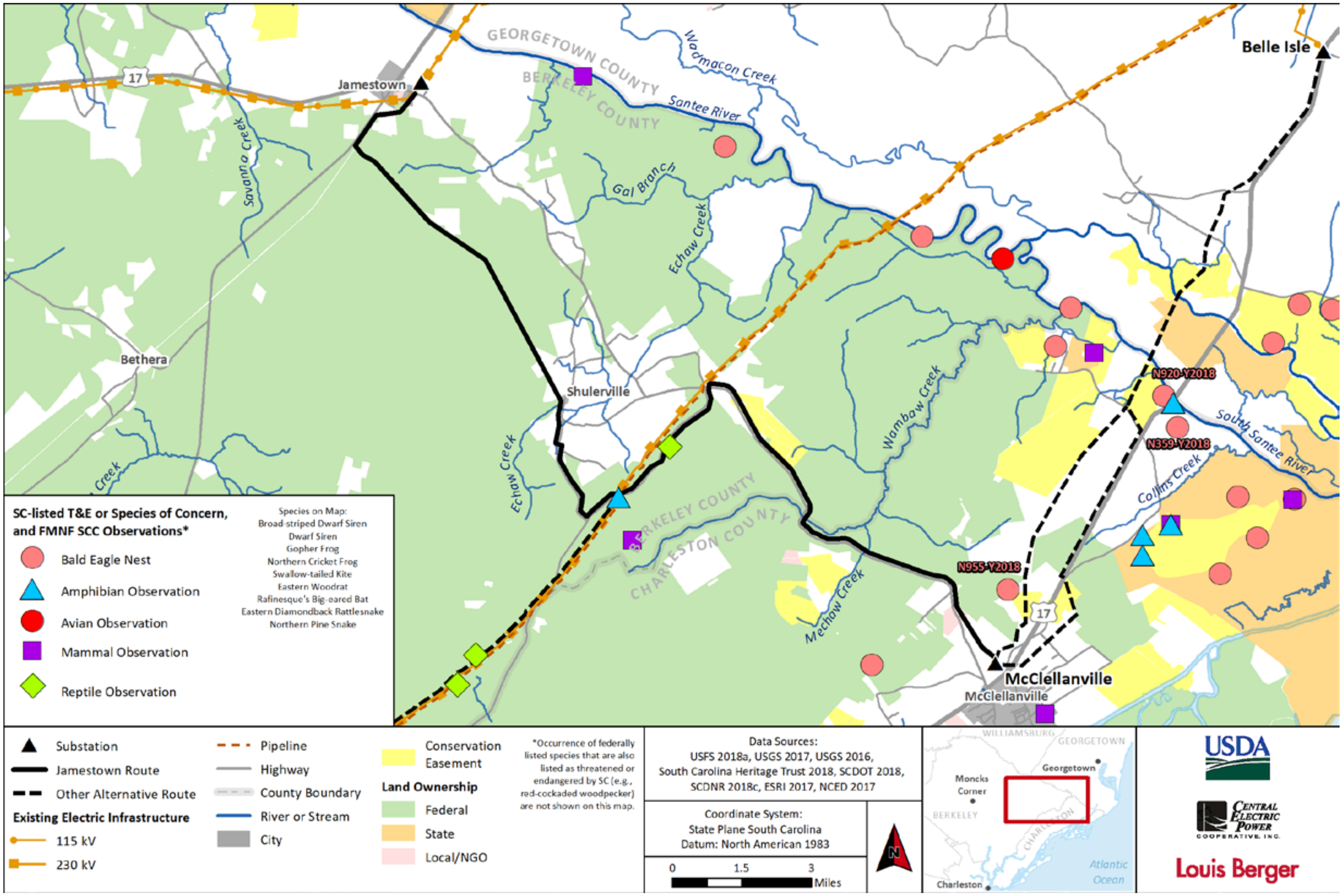


Figure 5-20: Occurrences of Wildlife Listed by the State of South Carolina as Threatened, Endangered, or Species of Concern, or as FMNF SSCC, in the Jamestown Corridor Study Area

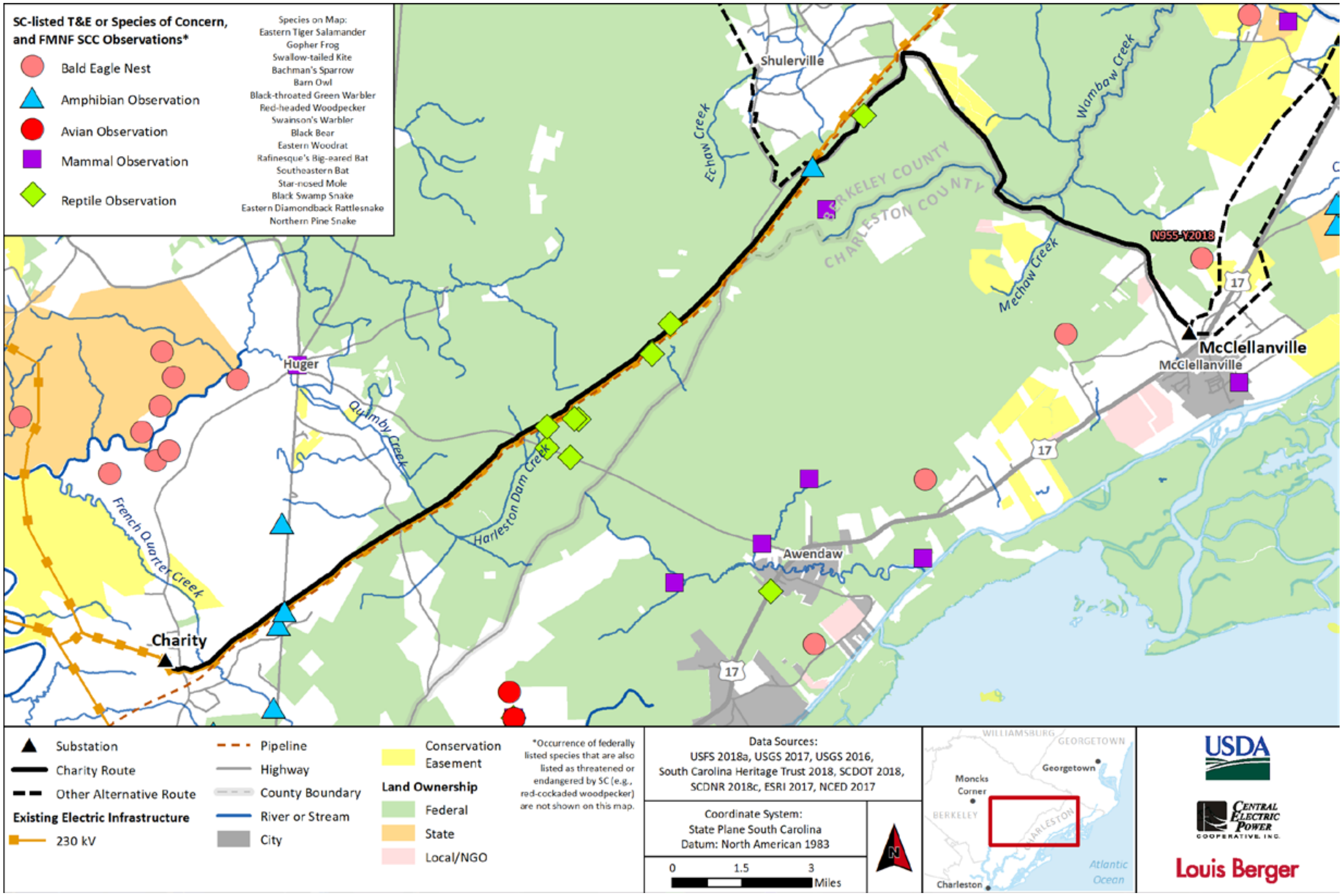


Figure 5-21: Occurrences of Wildlife Listed by the State of South Carolina as Threatened, Endangered, or Species of Concern, or as FMNF SCC, in the Charity Corridor Study Area

Red-headed Woodpecker

Red-headed woodpeckers are present year-round in the region. They prefer open, mature forests and woodlands with an abundance of dead trees in which to nest. Red-headed woodpeckers are adapted to many forest types, so long as there are available cavities for nesting (SCDNR 2015i). The species is listed as a state Species of Concern and is categorized by SCDNR (2015a) as a state moderate priority species (SGCN) (see Section 5.6.2.5). Breeding bird survey data show a significant decline (Sauer et al. 2017). Central Electric has not performed any species-specific surveys for red-headed woodpeckers, and USFS (2018c) reports one known occurrence in the Project vicinity.

Swainson's Warbler

The Swainson's warbler is a small secretive bird that inhabits wet bottomland forests and swamp wetlands in the Coastal Plain region of South Carolina, where they do not typically use inundated areas but forage in wetter areas. They are sensitive to disturbance and are typically not found within narrow or small tracts of intact habitat (SCDNR 2015j). The Swainson's warbler is listed as a state Species of Concern and is categorized by SCDNR (2015a) as a high-priority SGCN (see below, Section 5.6.1.5 *State Priority Species*). A 4-decade trend suggests that Swainson's warbler breeding populations in South Carolina appear to be increasing within the state, with a 6.8 percent population change per year from 1966 to 2010 (Sauer et al. 2017). Central Electric has not performed any species-specific surveys for Swainson's warblers.

Black Bear

Black bears are large omnivores requiring large areas of relatively undeveloped habitat. In coastal South Carolina, bears typically use early successional areas, bottomland hardwoods or mixed pine-hardwoods, as well as Carolina bays. Areas used less often include upland hardwood forests and pine plantations (SCDNR 2005d). Any black bears found in the Project vicinity would be part of South Carolina's one coastal population that resides mostly to the north of the Project, in Georgetown and Horry counties. Based on limited population data, this population is estimated at 300 bears, which likely shares some connection to the black bear population in southeastern North Carolina. Human development along major river systems in the area appears to threaten this connection (SCDNR 2018c). Central Electric has not performed any species-specific surveys for black bears, and USFS (2018c) reports two known occurrences in the Project vicinity from the 1970s.

Eastern Woodrat

The eastern woodrat is a "packrat," which notoriously collects shiny objects to build its large stick nests. The species is categorized by SCDNR as a moderate priority SGCN. In the Coastal Plain, woodrats use floodplain and swamp forests, wet scrub thickets, logged areas, dry and mesic deciduous forests, and hardwood pine forests. Woodrats will use harvested woodlands if piles of woody debris are present but tend not to use timbered areas treated with herbicides within the previous 5 years. They are often found in, but are not limited to, rock outcrops, boulder fields, and cliffs. Coastal populations of eastern woodrats in South Carolina are impacted by habitat loss and isolation due to development (SCDNR 2005e). Central Electric has not performed any species-specific surveys for eastern woodrats. The FMNF (USFS 2018c) has five known occurrences of the eastern woodrat in the Project vicinity.

Meadow Vole

Meadow voles are a wide-ranging species across North America, and the subspecies found in South Carolina is thought to be secure. They are found across the upper Piedmont region of the state, although an isolated population(s) purportedly occurs in Charleston and southern Georgetown counties (SCDNR 2015k). Therefore, the subspecies is listed as a state Species of Concern and is categorized by SCDNR (2015a) as a high-priority SGCN. Meadow voles depend on grassland habitat and prefer areas with dense, tall grass cover. In addition to habitat loss due to agricultural and suburban development, a primary threat to meadow voles is plant community succession as fields and meadows revert to pine or hardwood forest in the absence of wildfire (SCDNR 2015k). Central Electric has not performed any species-specific surveys for meadow voles, and USFS (2018c) reports five known occurrences in the Project vicinity.

Rafinesque’s Big-eared Bats

The Rafinesque’s big-eared bat a colonial cavity roosting bat that has reportedly never been considered abundant. Its status is unknown because the species is extremely difficult to monitor (USFS 2013a). In South Carolina, Rafinesque’s big-eared bat are permanent residents of the Coastal Plain and hibernate rather than move south during winter months (SCDNR 2015l). Rafinesque’s big-eared bat colonies tend to be relatively small, inhabiting caves and mines, but tend to be smaller in the southern portions of the range where caves and mines are less abundant. Manmade structures such as abandoned buildings and bridges can be extremely important for species in this group (SCDNR 2005f). On the FMNF, this species has been observed under USFS bridges (USFS 2017). All four sightings occurred more than 15 years ago with no observations since then. This large bat has primarily been observed roosting and foraging in riparian areas, but it has also been seen foraging in the adjacent pine uplands. Although the South Carolina Heritage Trust (2018) does not report any known occurrences of Rafinesque’s big-eared bats in the Project ROWs, USFS (2018c) reports six observations in the Project vicinity. No Rafinesque’s big-eared bats were captured during mist net surveys of the proposed Jamestown, Charity, or Belle Isle B and C corridor alternatives on NFS lands (Ecological Solutions, Inc. 2017a; Ecological Engineering, LLP 2018a).

Southeastern Bat

The southeastern bat inhabits bottomland hardwood forests where they share similar foraging habitats and structural resources for roosting, sometimes day and night-roosting communally with Rafinesque's big eared bats within the same structures, especially bridges and large-diameter hollow trees (Bat Conservation International and Southeastern Bat Diversity Network 2013). One subspecies occurs in South Carolina, and the southeastern bat is critically imperiled in the state (S1); it is also designated as a state Species of Concern and an SCC by the FMNF, and it is categorized by SCDNR (2015a) as a highest priority SGCN. Southeastern bats prefer to roost over or near water, using forested swamps, Carolina bays, and mesic deciduous and mixed forests. The status of the species in South Carolina is unknown (SCDNR 2005f). One southeastern bat was captured during mist net surveys of the proposed Jamestown corridor (Ecological Solutions, Inc. 2017a), and none were captured on the Charity or Belle Isle B and C corridor alternatives on NFS lands (Ecological Engineering, LLP 2018a).

Star-nosed Mole

The star-nosed mole is found in a variety of habitats with moist soils, where they dig networks of tunnels that sometimes even lead into water. They are found statewide in South Carolina, but in the Coastal Plain their preferred habitats include pocosins, wetlands, saturated bottomland forests, and upland longleaf and loblolly pine forests, rarely more than 400 feet from water. Neither forest age nor successional stage has been reported as a critical factor determining habitat suitability for the star-nosed mole (SCDNR 2015m). The species is listed as a state Species of Concern and is categorized by SCDNR (2015a) as a high-priority SGCN. USFS (2018e) reports one known occurrence of star-nosed mole in the Project vicinity in the upper Wando River watershed in Charleston County.

Southern Fox Squirrel

The southern fox squirrel is the only fox squirrel native to South Carolina, found across most of the state but common in the Coastal Plain. The FMNF did not categorize the fox squirrel as an SCC but it is classified as a Species of Concern by South Carolina due to the lack of information on distribution, abundance, and ecology. Southern fox squirrels select more pine-dominated habitats compared to the deciduous habitats selected by other subspecies of fox squirrel, using fire-maintained upland pine woodlands, oak forests and mesic hardwood forests, and bottomland forested habitats. They utilize tree cavities, as well as leaf nests, and the absence of suitable cavity trees may be a critical factor to their survival. Forest management practices that reduce dense understory vegetation and promote retention of mature mast-producing hardwoods are beneficial to fox squirrels (SCDNR 2015n). USFS (2018a,b) reports two observations of southern fox squirrel in the

Project vicinity: one near the coast on Bull Island in Charleston County and another approximately 40 miles inland in Georgetown County.

Broad-striped Dwarf Siren

The broad-striped dwarf siren is an entirely aquatic, eel-like salamander that retains larval characteristics into adulthood. They are found within stagnant wetlands with mud bottoms and little to no flow that are free of predatory fish such as bass, pickerel, or sunfish (SCDNR 2015c). Broad-striped dwarf sirens are considered secure throughout their range but have begun to decline in South Carolina. The FMNF reported one occurrence from 2016 (USFS 2017). Although not confirmed, the dwarf siren could occur within the proposed corridor alternatives because potential habitat is available. No dwarf sirens were detected from surveys of the proposed Jamestown corridor during winter and spring 2018, which including dipnetting of suitable wetland habitats (Buhlmann and Gross 2018). Buhlmann (2019) found no broad-striped dwarf siren during surveys of the Charity and Belle Isle B and C corridor alternatives on NFS lands.

Eastern Tiger Salamander

The eastern tiger salamander is the largest terrestrial salamander in the eastern United States. Little is known about the population biology of this species in South Carolina; hence, their status as a state Species of Concern and categorized by SCDNR as a highest-priority SGCN. As with the broad-stripped dwarf siren, Carolina gopher frog, and northern cricket frog, tiger salamanders typically breed or live in isolated, temporary freshwater wetlands that are referred to as breeding ponds. Outside of the breeding season, metamorphosed adults inhabit crayfish holes, root channels, rodent burrows, and other subterranean structures and only return to ponds to breed (SCDNR 2015c). USFS (2018e) reports two observations of eastern tiger salamander in the Project vicinity, although no tiger salamanders were detected from surveys of the proposed Jamestown corridor alternative during winter and spring 2018 (Buhlmann and Gross 2018). Buhlmann (2019) found no tiger salamanders during surveys of the Charity and Belle Isle B and C corridor alternatives on NFS lands. However, they documented wetlands that could used as breeding sites for tiger salamanders in the northern section of the Charity corridor alternative, consisting of deep sinkhole ponds. These wetlands could be relatively easily protected during any ROW expansion.

Carolina Gopher Frog

The Carolina gopher frog is a medium-sized frog that closely resembles a toad, and similarly spends most of its life in terrestrial habitats, but underground in holes left by gopher tortoises (state-endangered, but not in Study Area) and other burrowing rodents or crayfish, or stump holes and root tunnels (USFS 2013a). The Carolina gopher frog is listed as endangered by the State of South Carolina, categorized by SCDNR as a highest-priority SGCN, and classified as a SCC by the FMNF. Carolina gopher frogs generally emerge during night to feed. They breed after late winter or early spring rains, between February and April, and travel up to a mile to find an isolated ephemeral pond or other wetlands site. After they mate, females will deposit large egg masses of up to 2,000 eggs underwater, and tadpoles will develop into adults after four to seven months. Newly metamorphosed individuals move away from breeding wetlands into the surrounding uplands and only return to these wetlands.

The Carolina gopher frog was documented from 13 isolated wetlands on the FMNF in 1997. Since 2006, the species has been observed acoustically or visually from 8 isolated wetlands on the FMNF, including a previously undocumented breeding wetland along Halfway Creek Rd that was discovered during 2013 (USFS 2013a). Two known occurrences occur within the Jamestown corridor alternative ROW, off Halfway Creek Road. Surveys by Buhlmann and Gross (2018) attempted to confirm the continued presence at those sites, but the wetlands failed to fill with water during the breeding season, and gopher frogs do not migrate to those ponds if there is insufficient rainfall. Buhlmann (2019) did not observe any Carolina gopher frogs during surveys of NFS lands along the Charity corridor and the southern portion of the proposed Belle Isle B and C corridor alternatives, which were conducted when the frogs are expected to breed during February to early April. None were heard calling during visits to likely and historic sites along the ROW, and none were heard after analysis of the automated recordings. Burlmann (2019) we did observe a potential gopher frog burrow within the proposed Charity corridor alternative, near Steeds Creek Road, but could not confirm its occupancy. Other researchers in the region also detected very few gopher frog breeding occurrences in 2019, and none were detected by other researchers on the FMNF; however, gopher frogs remain the most likely rare species to be found near the ROWs.

Northern Cricket Frog

Northern cricket frogs are relatively common in the Piedmont and Southern Appalachians of the Carolinas where they live on the shores of streams, rivers, and marshes. They are active nearly year-round and call during mating and when temperatures exceed 80 degrees Fahrenheit (°F). Populations of the northern cricket frog in the Coastal Plain Ecoregion are known to exist near Charleston. The species is common to relatively abundant throughout South Carolina (SCDNR 2015c). One occurrence record shows the northern cricket frog is known to exist in along the South Santee River along U.S. Highway 17, approximately 1 mile downstream of where the proposed Belle Isle B and C corridor alternatives would cross the Santee River. It is possible, however, that this record is a misidentification of a southern cricket frog (*Acris gryllus*), which is more common and typically found at higher elevations in the Piedmont Ecoregion in South Carolina. Buhlmann and Gross (2018) reported no known occurrences of northern cricket frog along the proposed Jamestown corridor alternative and did not find the species during field surveys of the corridor. They reported 12 records of southern cricket frogs during surveys of the Jamestown ROW. Buhlmann (2019) reported southern cricket frogs to occur throughout the Charity corridor alternative but did not find any northern cricket frogs.

Eastern Diamondback Rattlesnake

The eastern diamondback rattlesnake is the largest venomous snake in the United States. They are most commonly associated with the mesic longleaf communities, including longleaf pine flatwoods. Eastern diamondback rattlesnakes use underground shelters, such as stump holes, rodent burrows, root channels and gopher tortoise burrows, especially during the colder months. The conservation or restoration of longleaf pine woodlands, which provide open canopies with abundant stump holes, is beneficial to diamondback rattlesnakes (SCDNR 2015o). The species is not listed by the FMNF as a SCC but is a state Species of Concern and categorized as a high-priority SGCN. USFS (2017) reported 12 diamondback rattlesnake observations from 2016. No occurrences were reported from surveys of the proposed Jamestown corridor alternative (Buhlmann and Gross 2018), nor from surveys of the Charity corridor alternative (Buhlmann 2019).

Florida Green Watersnake

The Florida green watersnake is a large to moderately sized snake that was considered a subspecies of the green watersnake (*Nerodia cyclopion*) until recently when it was determined to be a separate species. The species is found within wetlands such as Carolina bays, lakes, and old flooded rice fields. Sites where the Florida green watersnake has been reported typically have open water with little or no canopy of trees and an abundance of "pad plants" such as lily pads (*Nymphaeaceae*) lotus or water shield (*Brasenia schreberi*) (SCDNR 2015p). USFS (2018e, 2018c) reports no known occurrences of Florida green watersnake in the Project vicinity, and no observations of the species were reported from surveys of the proposed Jamestown corridor alternative (Buhlmann and Gross 2018), or along the Charity corridor and the southern portion of the proposed Belle Isle B and C corridor alternatives (Buhlmann 2019).

Northern Pine Snake

The northern pine snake (SCDNR 2015o) is a large non-venomous snake that prefers the relatively open canopy and xeric conditions found in upland longleaf and loblolly pine woodlands upland pine ecosystems. The northern pine snake is listed by South Carolina as a Species of Concern and is considered a highest-priority state priority species (SCCN), but the FMNF does not categorize it as an SCC. USFS (2017) reports one known occurrence of northern pine snake approximately 750 feet from the centerline of the proposed shared alignment proposed for the Jamestown and Charity corridors, in proximity to the intersection of Halfway Creek Road and Shadowmoss Lane. Buhlmann and Gross (2018) reported one known occurrence of northern pine snake along the proposed Jamestown corridor, but did not detect any individuals beneath coverboards targeting the species at one site within suitable upland pine savanna habitat. Buhlmann and Gross (2018) reported one additional recent record of northern pine snakes observed by other researchers, within well-drained upland longleaf pine savanna along Halfway Creek Road but did not detect any individuals via coverboard surveys. Buhlmann (2019) and one recent northern pine snake record (2002) near the proposed Charity corridor detected no individuals during field surveys of suitable habitat. Bulmann (2019) also reported no natural heritage database records or field detections in the vicinity of the southern portion of the proposed Belle Isle B and C corridors, but that may simply be the result of few or no previous surveys.

Southern Hognose Snake

The southern hognose snake is less common and smaller than the related eastern hognose snake. The species is associated with upland pine and pine flatwoods ecosystems, typically drier than those inhabited by eastern diamondback rattlesnake (SCDNR 2015o). Southern hognose snakes are considered a highest priority SCCN by the SCNR and are categorized as a Species of Concern and have been proposed for listing as state-threatened. The FMNF also lists it as a SCC. USFS (2017) reported 7 southern hognose snake observations from 2016. There are no known occurrences of southern hognose snake along the proposed Jamestown corridor and Buhlmann and Gross (2018) did not find any southern hognose snakes beneath coverboards targeting the species at one site within suitable upland pine savanna habitat. Likewise, Buhlmann (2019) detected no southern hognose snakes during coverboard surveys of suitable habitat along the proposed Charity corridor and reported no known records or field detections in the vicinity of the southern portion of the proposed Belle Isle B and C corridors.

Spotted Turtle

The spotted turtle is listed as threatened by South Carolina and is designated a SCC by the FMNF. It was petitioned for listing under the ESA in 2015, indicating that the pet trade, habitat destruction and fragmentation, predation, road mortality and inadequate protections are threats that will be further evaluated as part of a current status review by USFWS (80 FR 37568). Spotted turtle are lay eggs in well-drained soil of marshy pastures, in grass or sedge tussock or mossy hummocks, in open areas (e.g., dirt path or road) at edge of thick vegetation, or similar sites exposed to sun. Sandy, sparsely vegetated strips and washouts along agricultural field edges are favorable for nesting. According to NatureServe (2018d), in South Carolina, gravid females spent a considerable amount of time on or at the edge of a power line ROW, and they nested on the edge of the power line and in relatively recent clearcuts. USFS (2017) reported 4 spotted turtle observations from 2016 in forested swamp wetland habitats, as well as multiple other sightings by USFS personnel. The South Carolina Department of Natural Resources Heritage Trust Program currently ranks this species as a moderate-priority SGCN and as secure in both South Carolina (S5) and globally (G5), but its state-listing as threatened is based on the growing popularity and price of the spotted turtle in the pet trade and the fact that most of South Carolina's neighboring states already protect this species (SCDNR 2015q). Buhlmann and Gross (2018) reported one known occurrence of spotted turtle documented by other researchers along the proposed Jamestown corridor. Buhlmann (2019) identified suitable swamp forest habitat for spotted turtle along the Charity corridor but found no individuals during field surveys.

Fish

The Carolina pygmy sunfish is a small freshwater fish for which only a few populations have been identified in South Carolina. It is listed as threatened by the State of South Carolina and is a federal species of concern. It is reported from the Santee River drainage, but no records are known for the lower Santee River, according to the SCDNR geographic database. The nearest known population to the Study Area is found in remnant rice field ditches near Georgetown. No records for the species are known for the lower Santee River, although it is suspected that additional survey efforts in the Santee River Basin will likely lead to the discovery of additional populations (SCDNR 2015r). No occurrences of the species were detected by electrofishing surveys of waterbodies crossed by the proposed Jamestown and Charity corridors (Three Oaks Engineering 2017; 2018).

American eels are classified as SCC by the FMNF and categorized by SCDNR (2015a) as a highest priority SGCN (SCDNR 2015s). Following two separate petitions to list the American Eel under the ESA, USFWS reviewed the status of the species in 2007 (72 FR 4967) and 2015 (80 FR 60834) and found both times that protection under the ESA was not warranted (USFWS 2015). American eels were detected by electrofishing surveys of several waterbodies crossed by the proposed Jamestown and Charity corridors. Eels were captured in six waterbodies during surveys of the Jamestown corridor alternative: (1) an unnamed tributary to Echaw Creek; (2) Wambaw Creek; (3) Mechaw Creek; (4) an unnamed tributary to Mill Branch; (5) another unnamed tributary to Mill Branch; and (6) an unnamed tributary to Jeremy Creek (Three Oaks Engineering 2017). Two eels were captured at only one of 12 waterbodies sampled within the proposed Charity corridor alternative, in Quinby Creek (Three Oaks Engineering 2018).

Insects

Four insects are listed by the FMNF as SCC: the dusky roadside skipper (*Amblyscirtes alternata*), monarch butterfly (*Danaus plexippus*), Berry's skipper (*Euphyes berryi*), and Okefenokee zale moth (*Zale perculta*). Central Electric conducted a preliminary assessment of the potential presence of host plants for these species on NFS lands within the ROWs for the proposed Jamestown corridor (Ecological Solutions, Inc. 2017b) and

Charity corridor (Ecological Engineering, LLP 2018b). Searches for host plants and associated lepidopteran included broadleaf beardgrass (*Gymnopogon ambiguus*) for dusky roadside-skipper, milkweeds (*Asclepias* spp.) for monarch butterfly, pickerelweed (*Pontederia cordata*) for Berry's skipper, and climbing fetterbush for Okefenokee zale moth.

USFS (2017) reported one documented occurrence of dusky roadside skipper on the FMNF. The dusky roadside-skipper was documented during the annual FMNF butterfly count in 2000, 2003, and 2014 (FMNF, unpub. data in Ecological Solutions, Inc. 2017b). This butterfly is thought to produce two broods from March to August. The larval host plant is the broadleaf beardgrass and possibly other grasses. Broadleaf beardgrass occurs in acidic, sandy soils within dry and open, pine, oak, or pine/oak forest, sandy savannas, sandhill communities within longleaf pine, rocky prairies or barrens, and floodplains (NatureServe 2018e). Ecological Solutions, Inc. (2017b) reported no observations of adults, larvae or instar stages of the dusky roadside-skipper or host plant broadleaf beardgrass within the proposed Jamestown corridor. Likewise, Ecological Engineering, LLP (2018b) reported no occurrences of dusky roadside-skipper along the proposed Charity corridor alternative. However, large populations of broadleaf beardgrass were found primarily in fire-maintained upland pine stands at 9 of 16 survey areas, although no plants showed obvious evidence of insect damage.

The monarch butterfly relies on milkweed as a food plant for its larva, which is commonly found along roadsides, forest edges, and wetlands, and grows in a variety of habitats from dry sandy areas to wet and marshy areas, as well as in sunny open areas to more shaded forested area. The North American Butterfly Association documented 38 monarch butterflies on the FMNF in 2015, and the Carolina Butterfly Society documented 41 monarchs in 2005, 19 in 2007 and 2011, 20 in 2010, and 5 in 2015 (USFS 2017). Ecological Solutions, Inc. (2017b) reported numerous milkweed plants throughout the proposed Jamestown corridor alternative, as well as one adult monarch butterfly. Within the Charity corridor alternative, no adult or larval monarch butterflies were observed during preliminary field surveys by Ecological Engineering, LLP (2018b). Numerous populations of five milkweed species were observed in various habitats at half (8 of 16) the survey areas: *Asclepias perennis*, *A. tuberosa*, *A. lanceolata*, *A. amplexicaulis*, and *A. humistrata.*

The Berry's skipper is typically found in coastal plains habitats that consist of wet areas such as, marshes, wet savannas, depressions, savannahs with pitcher plants, and areas associated with ponds and swamps. A Berry's skipper was documented during the annual FMNF Butterfly Count in 2008 (FMNF, unpub. data in Ecological Solutions, Inc. 2017b). Although the adults are known to take nectar from pickerelweed, an emergent aquatic plant usually found in areas associated with shallow water, the host plant for the larvae is unknown. Pickerelweed is usually found in permanent, shallow, and quiet water. Preliminary surveys by Ecological Solutions, Inc. (2017b) reported two adult Berry's skippers within the proposed Jamestown ROW. They were foraging on pickerelweed within a wet ditch adjacent to a forest of black gum (*Nyssa sylvatica*) and bald cypress (*Taxodium distichum*). Pickerelweed was observed throughout the proposed Project ROW. Within the Charity corridor alternative, no adult or larval Berry's skipper were observed during preliminary field surveys by Ecological Engineering, LLP (2018b). Numerous specimens of pickerelweed were observed in open and forested wet habitats at 5 of 16 survey areas.

The host plant for Okefenokee zale moth, climbing fetterbush, is found in forested wetlands such as pond cypress swamps on the bark of pond cypress trees. Habitat and populations for climbing fetterbush are thought to be stable on the FMNF (USFS 2017). USFS (2017) reported occurrences of the Okefenokee zale moth approximately 0.75 mile apart from two locations in bald cypress swamps. Three populations of climbing fetterbrush are known to occur in proximity to the proposed Belle Isle B corridor, just east of U.S. Highway 17, approximately 500 feet, 750 feet, and 1,000 feet from the centerline of the proposed transmission line. During fieldwork in 2011 for the preliminary Belle Isle corridors, a new population of the plant was found in the same area. USFS (2018c) reports three other known occurrences within 1 mile of the proposed Belle Isle C and the shared alignment proposed for the Jamestown and Charity corridors. These three occurrences are approximately 1.5 and 2 miles northwest of the proposed McClellanville Substation, and the population nearest a proposed corridor is around 950 feet from the centerline of the proposed shared alignment proposed for the Jamestown and Charity corridors. Preliminary floristic surveys of the proposed Jamestown and Charity corridors reported finding no occurrences of climbing fetterbrush or Okefenokee zale moth but found suitable habitat in many places (Ecological Solutions, Inc. 2017b; Gaddy 2017, 2018). On NFS lands within the Belle Isle B and C corridor alternative, no adult or larval Okefenokee zale moths were observed during field surveys. However, approximately 180 specimens of climbing fetterbush were observed within a nonriverine swamp forest, between the maintained highway ROW and the wettest portion of the wetland. Most specimens were observed to be shrubs under 1-foot tall; however, a single specimen was found which had climbed approximately 20 feet up a cypress tree (Ecological Engineering, LLP 2018b).

Plants

There are 56 plants designated as SCC on the FMNF, excluding the three federally listed species discussed above under "Federally Listed Threatened and Endangered Species." Thirteen of these plant SCC have known occurrences within the Project vicinity, determined by locations tracked by South Carolina Heritage Trust (2018) and USFS (2018c) within one mile of the proposed Project corridors (see Table 5-9). This includes:

(1) Coastal Plain false-foxglove (*Agalinis aphylla*), (2) Elliott's bluestem (*Andropogon gyrans* var. *stenophyllus*), (3) yellow fringeless orchid (*Platanthera integra*), (4) pineland plantain (*Plantago sparsiflora*), (5) shadow-witch orchid (*Ponthieva racemose*), (6) crestless plume orchid (*Pteroglossapsis ecristata*), (7) short-bristle baldrush (*Rhynchospora breviseta*), (8) Harper beakrush (*Rhynchospora harperi*), (9) Few-flowered beakrush (*Rhynchospora oligantha*), (10) brown beakrush (*Rhynchospora pleiantha*), (11) long-beaked beaksedge (*Rhynchospora scirpoides*), (12) short-leaved yellow-eyed grass (*Xyris brevifoli*), and (13) Florida yellow-eyed grass (*Xyris difformis* var. *floridana*). In addition, a preliminary floristic inventory of the proposed Jamestown and Charity ROWs was conducted on NFS lands.

According to Gaddy (2017), there are known occurrences of nine FMNF SCC within the 600-foot corridor of the proposed Charity corridor, including purple silkyscale (*Anthenantia rufa*), crestless plume orchid, brown beakrush, Coastal Plain false-foxglove, Elliott's bluestem, northern burmianna (*Burmannia biflora*), southeastern sneezeweed (*Helenium pinnatifidum*), long-beaked beaksedge, and Florida yellow-eyed grass. Gaddy (2017) also reported that the 600-foot corridor of the proposed corridor would include records of 10 state-listed or tracked vascular rare plant species, including: pondspice (*Litsea aestivalis*), climbing fetterbush (*Pieris phyllireifolia*), awned meadowbeauty (*Rhexia aristosa*), sun-facing coneflower (*Rudbeckia heliopsidis*), blue maidencane (*Amphicarpum muhlenbergianum*), slender gayfeather (*Liatris gracilis*), longstem adder's-tongue fern (*Ophioglossum petiolatum*), horned beaksedge (*Rhynchospora careyana*), drowned hornwort (*Rhynchospora inundata*), and Tracy's beaksedge (*Rhynchospora traceyi*). During a preliminary inventory of the proposed Charity corridor ROW, Gaddy (2018) observed one FMNF SCC (Elliott's bluestem) and two tracked species (pondspice and southeastern tickseed [*Coreopsis gladiate*]).

According to Gaddy (2018), there are known occurrences of 10 FMNF SCC within the 600-foot corridor of the proposed Charity corridor, including Elliot's bluestem, northern burmianna (*Burmannia biflora*), many-flowered grass pink (*Calopogon multiflorus*), southeastern sneezeweed, lanceleaf loosestrife (*Lysimachia hybrida*), shadow-witch orchid, crestless plume orchid, Harper's beakrush, and brown beakrush. Gaddy (2018) also reported that the 600-foot corridor of the proposed corridor would include records of 12 state-listed or tracked vascular rare plant species, including Coastal Plain false-foxglove, blue maidencane, southeastern tickseed pine lily (*Lilium catesbaei*), pondspice, spoon flower, (*Peltandra sagittifolia*), climbing fetterbush, awned meadowbeauty, sweet pitcher plant (*Sarracenia rubra*), Carolina fluff grass (*Tridens carolinianus*), and Elliott's yellow-eyed grass (*Xyris elliottii*). During a preliminary inventory of the proposed Charity corridor ROW observed no FMNF SCC and three tracked species (pondspice, southeastern tickseed, and blue maidencane) (Gaddy 2017).

5.6.1.4 Wildlife, Including Neotropical Birds

The major wildlife habitat types in the Study Area, as described above under "Ecological Conditions," include longleaf and loblolly pine interspersed with Carolina bays and pocosins and bottomland hardwoods. Bird species dependent upon pine habitats include the red- cockaded woodpecker (*Picoides borealis*), Bachman's sparrow (*Peucaea aestivalis*), brown-headed nuthatch (*Sitta pusilla*), Henslow's sparrow (*Ammodramus henslowii*), and painted bunting (*Passerina ciris*). Bottomland forests support high densities of numerous breeding neotropical migrants, including the Acadian flycatcher (*Empidonax virescens*), white-eyed vireo (*Vireo griseus*), prothonotary warbler (*Protonotaria citrea*), hooded warbler (*Wilsonia citrina*) and northern parula (*Parula americana*). Species found in grassland habitats include the grasshopper sparrow (*Ammodramus savannarum*), loggerhead shrike (*Lanius ludovicianus*), painted bunting (*Passerina ciris*), and American woodcock (*Scolopax minor*) (SCDNR 2005a). Migratory birds are discussed further below.

Important game species of South Carolina include big game species such as black bear (*Ursus americanus*), white-tailed deer (*Odocoileus virginianus*), and wild turkey (*Meleagris gallopavo silvestris*); furbearers such as bobcat (*Lynx rufus*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), river otter (*Lontra Canadensis*), mink (*Neovison vison*), long-tailed weasel (*Mustela frenata*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale putorius*), muskrat (*Ondatra zibethicus*), and beaver (*Castor canadensis*); small game such as doves (*Zenaida* spp.); and other hunted species including American alligator (*Alligator mississippiensis*), coyote (*Canis* latrans), and feral hog (*Sus scrofa*) (SCDNR 2015a, 2018d).

Mammal species found in the Coastal Plain Ecoregion include: black bear, mink (*Neovison vison*), southern fox squirrel (*Sciurus niger niger*), eastern spotted skunk (*Spilogale putorius*), swamp rabbit (*Sylvilagus aquaticus*), eastern woodrat (*Neotoma floridana*), woodland jumping mouse (*Napaeozapus insignis*), Carolina red-backed vole (*Clethrionomys gapperi*), hairy-tailed mole (*Parascalops breweri*), meadow vole (*Microtus pennsylvanicus*), star-nosed mole (*Condylura cristata*), northern yellow bat (*Lasiurus intermedius*), eastern small-footed myotis (*Myotis leibii*), and Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) (SCDNR 2005a). The proposed Project is located within the range of 9 of 14 species of bats commonly found in South Carolina (Ecological Solutions, Inc. 2017a).

Two mammals, the northern long-eared bat (*Myotis septentrionalis*) and West Indian manatee (*Trichechus manatus*) are listed as federally threatened and are discussed below in Section 5.6.2.2, *Federally Listed Threatened and Endangered Species*. Other special-status species, due to concern for their conservation that could occur in the

Project vicinity are discussed further in Section 5.6.2.2, including Rafinesque's big-eared bat, southeastern bat (*Myotis austroriparius*) black bear, eastern woodrat, southern fox squirrel, star-nosed mole, and meadow vole. Surveys for mammals, in general, have not been completed for the Project. However, surveys for bats were conducted along the Jamestown and Charity corridor alternatives, which specifically targeted the federally threatened northern long-eared bat (see Section 5.6.2.2) and other special-status bats (Ecological Solutions, Inc. 2017a, Ecological Engineering, LLP 2018a).

The Study Area also includes diverse populations of amphibians and reptiles. For example, one area of South Carolina’s Coastal Plain supports more frog species (25) than any other place in North America (SCDNR 2005a). Isolated, temporary wetlands such as Carolina bays and pocosins provide breeding habitat for numerous amphibians, including the federally listed frosted flatwoods salamander (*Ambystoma cingulatum*) and the state-listed Carolina gopher frog (*Lithobates capito capito*), eastern tiger salamander (*Ambystoma tigrinum*), and broad-striped dwarf siren (*Pseudobranchus striatus*). According to SCDNR (2015a), the Coastal Plain Ecoregion of South Carolina contains 112 of the 144 species of amphibians and reptiles that occur in the state, and 49 of these species are endemic to the region, with longleaf pine habitat playing a vital role in the life history of many species. Common snakes in the region include the cottonmouth (*Agkistrodon piscivorus*), copperhead (*Agkistrodon contortrix*), eastern ribbonsnake (*Thamnophis sauritus*), common gartersnake (*Thamnophis sirtalis*), and banded snake (*Nerodia fasciata*). The eastern diamondback rattlesnake is a special-status species that is likely to occur within the Study Area (see above), particularly within pine forest ecosystems. Several common lizards in the Project vicinity include the broadhead skink (*Plestiodon laticeps*), green anole (*Anolis carolinensis*), and little brown skink (*Scincella lateralis*).

Buhlmann and Gross (2018) conducted preliminary surveys of the Jamestown corridor alternative to identify the occurrences of any rare or threatened amphibians and reptiles. Because the entire proposed ROW would follow alongside existing roads, vehicular surveys were conducted to encounter amphibians and reptiles crossing roads during both day and night, especially during the spring and immediately following rain events. For each observation, the adjacent habitat was assessed. To potentially detect fall- and winter-breeding amphibians, such as tiger salamanders or frosted flatwoods salamanders, several isolated wetlands along the corridor were surveyed with dipnets during both day and night in the winter of 2017–18. Also, Buhlmann and Gross (2018) searched for reptiles and amphibians by uncovering logs and rocks and by deploying two arrays of coverboards (sheets of plywood or roofing): one in proximity to a lime sink habitat to detect migrating amphibians and another within upland pine savanna habitat to detect the presence of pine snakes (*Pituophis melanoleucus*) or southern hognose snakes (*Heterodon simus*). Lastly, surveys for calling frogs at suitable wetland sites were performed by ear. To document the continued existence of gopher frog occurrences in proximity to the Project's proposed corridor along Halfway Creek Road, researchers had planned to install sound recorders at two wetlands, but there was insufficient rainfall to fill the wetlands during their February through April 2018 breeding season.

Buhlmann and Gross (2018) detected 35 species of reptiles and amphibians during surveys of the Jamestown corridor alternative, including 16 species of frogs and toads (anurans), 5 species of salamander, 4 lizards, 5 snakes, 4 turtles, and the American alligator. All species detected are thought to be common or are not listed as special-status species in South Carolina. An additional 8 species records were obtained from previous researchers, many of which are rare or at-risk species discussed under Section 5.6.2.2, *FMNF Species of Conservation Concern and State-listed Species*, and Section 5.6.1.5, *State Priority Species*, including Carolina gopher frog, northern pine snake, black swamp snake (*Seminatrix pygaea*), and spotted turtle (*Clemmys guttata*) (Buhlmann and Gross 2018).

Buhlmann (2019) conducted preliminary surveys of the Charity corridor and the southern portion of the proposed Belle Isle B and C corridor alternatives to identify the occurrences of any rare or threatened amphibians and reptiles. Surveys began in July 2018 and continued through April 2019. Known occurrence records for target rare species within the Project vicinity (within 2 miles of the ROW) were obtained from the South Carolina Natural Heritage Program, and summer-fall surveys were conducted in July, August, and November 2018, while winter-spring surveys were conducted in February, March, and April 2019.

Buhlmann (2019) detected 39 species of reptiles and amphibians during surveys of the Charity corridor alternative, including 19 species of frogs and toads (anurans), 3 species of salamander, 4 lizards, 9 snakes, 3 turtles, and the American alligator, totaling 39 species. No occurrences of the highest priority (i.e., rare) species were documented, notably the frosted flatwoods salamander, Carolina gopher frog, pine snake, or southern hognose snake. Natural heritage database records indicated that there are no recent observations within 2 miles of the ROW for frosted flatwoods salamanders (records exist from 1953 to 1997) and gopher frogs (records exist from 1952 to 1999). Southern hognose snake records were not in the immediate vicinity of the ROW, and only one recent pine snake record (2002) was near the ROW. There were no natural heritage database records for target herp species in the Belle Isle section, but that may be the result of few or no previous surveys (Buhlmann 2019).

Neotropical Birds

The primary federal wildlife laws that protect birds that are not federally listed under the ESA are the Migratory Bird Treaty Act (MBTA; 16 USC §§703–712) and the BGEPA. The

MBTA is the cornerstone of migratory bird conservation and protection in the United States, which implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that any action that results in a *take* or possession (permanent or temporary) of a protected species, in the absence of a USFWS permit or regulatory authorization, is a violation of the MBTA. The MBTA (16 USC §§703–712) makes it unlawful to take, kill, or possess migratory birds. In 2017, the U.S. Department of the Interior's Office of the Solicitor issued Memorandum M-370501 interpreting the take prohibition of the MBTA to apply only to actions that have the intent of taking or killing migratory birds, their nests, or their eggs, as opposed to take associated with otherwise lawful activities; however, mortality of migratory birds is still an impact to the human environment that must be considered in the NEPA review of a project. Thus, there are substantial benefits to implementing measures to avoid and minimize impacts on migratory birds. USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13, which includes more than 1,000 species of migratory birds. This list excludes non-native species, such as pigeons (*Columba livia*), house sparrows (*Passer domesticus*), and European starlings (*Sturnus vulgaris*). The BGEPA prohibits the take, sale (or offer of sale), purchase, barter, transport, export, or import at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg. Similar to the MBTA, the BGEPA does not allow the permitting of the incidental take of eagles.

South Carolina's varied environments and habitats support a high diversity of birds during breeding, wintering, and migration. As of 2011, 427 species of birds have been documented in the state, of which more than 181 are classified as breeders (SCDNR 2015a). Because of their significance to migratory birds, the National Audubon Society and BirdLife International have designated 45 Important Bird Areas in South Carolina, of which 3 are in the vicinity of the proposed Project: the FMNF, the Santee Coastal Reserve, and the Washo Reserve (Audubon 2013c). The Important Bird Area program is a global initiative to "identify, monitor, and protect a network of sites of international significance that are critical for the conservation of birds and other biodiversity" (BirdLife International 2018).

The FMNF provides essential stopover habitat for autumn and spring migrating birds, as well as critical breeding habitat. Four species known to occur regularly in the FMNF are state- or federally listed: the red-cockaded woodpecker (*Picoides borealis*), wood stork (*Mycteria americana*), bald eagle (*Haliaeetus leucocephalus*), and American swallow-tailed kite. Several SCC that depend on pine savanna habitat in the Study Area include the Bachman's sparrow, Henslow's sparrow, brown-headed nuthatch, pine warbler (*Dendroica pinus*), and the southeastern race of American kestrel (*Falco sparverius paulus*) (SCDNR 2015f). Approximately 100 pairs of American kestrel also nest on the

FMNF (Audubon 2013b). Numerous other species with high conservation priority such as the black-throated warbler (*Dendroica virens*), Swainson's warbler (*Limnothlypis swainsonii*), prothonotary warbler (*Protonotaria citrea*), worm-eating warbler (*Helmitheros vermivorus*), chuck-will's widow (*Caprimulgus carolinensis*), wood duck (*Aix sponsa*), and northern parula (*Setophaga americana*) have also been documented on the FMNF (USFS 2018e). Because it is managed for old-growth longleaf pine forest habitat, the FMNF is critically important to the federally endangered red-cockaded woodpecker and other SCC that prefer similar pine forest habitat, such as Bachman's sparrow and brown-headed nuthatch. Lastly, the Tibwin Wetland Complex on the FMNF consistently records the highest concentration of migrating hawks along the southeastern coast (Audubon 2013b).

The Santee Coastal Reserve, located east of the Belle Isle B and C corridor alternatives, is a large, state-owned undeveloped coastal ecosystem with diverse avifauna during all seasons. Several endangered and threatened species either breed or forage here, with notable species including the federally endangered red-cockaded woodpecker and wood stork, the federally protected bald eagle, and many other SCC such as the painted bunting, Bachman's sparrow, and brown-headed nuthatch. The Santee Coastal Reserve and Santee River delta provide critical habitat during migration, and overwintering habitat, for large numbers of waterfowl (Audubon 2013d).

The Washo Reserve is another protected ecosystem to the east of the Study Area, on the western edge of the Santee Coastal Reserve. This property, owned by The Nature Conservancy, supports a rookery (i.e., nesting colony) for the federally endangered wood stork, with about 25 percent of the state's breeding population (see *Federally Listed Threatened and Endangered Species* below). Also, more than a dozen osprey (*Pandion haliaetus*) nests are found here, and nesting wood ducks, prothonotary warblers, barred owls, and other cavity nesters find suitable habitat here (Audubon 2013a).

In addition to the three Important Bird Areas, SCDNR manages additional lands upstream of the Santee Coastal Reserve for wildlife habitat and conservation as the Santee Delta WMA. This WMA is just downstream of where the proposed Belle Isle corridor alternative would cross the North and South Santee rivers, near U.S. Highway 17. The Santee River supports numerous migratory birds and provides high-quality habitat for wintering waterfowl such as green-winged and blue-winged teal, ring-necked duck, American widgeon, gadwall, and mallard. The area also host large numbers of colonial waterbirds, including anhinga, great blue heron, and great egret and an abundance of other wetland wildlife. The Santee Delta WMA consists of Santee Delta East, which is predominantly impounded remnant rice fields and Santee Delta West, which is impounded bottomland hardwood forest. The area also provides habitat for upland game and nongame species and provides recreational opportunities for the hunting and non-hunting public (SCDNR Public Lands 2018).

Avian Research and Conservation Institute (ARCI 2018a) performed surveys for all species of "large birds" within the proposed Jamestown corridor alternative between May and July 2017, searching for hawks, eagles, and large wading birds, and their nests with a combination of ground and aerial surveys. Particular attention was given to wood storks, bald eagles, red-cockaded woodpeckers, ospreys, swallow-tailed kites, and the larger species of wading birds. Species observed included: American kestrel, bald eagle, broad-winged hawk (*Buteo platypterus*), Cooper's hawk (*Accipiter cooperii*), Mississippi kite (*Ictinia mississippiensis*), osprey, red-cockaded woodpecker, red-tailed hawk (*Buteo jamaicensis*), swallow-tailed kite (*Elanoides forficatus*), and wood stork. ARCI (2018b) performed similar surveys for large birds along the proposed Charity corridor alternative and the southern portion of the Belle Isle B and C corridor alternatives (south of the Santee River) in May 2018, reporting 9 of the 10 same species as observed for the Jamestown corridor alternative, except for bald eagles.

5.6.1.5 Aquatic Ecosystems

Aquatic species are abundant in South Carolina, with 146 fish species known to inhabit its freshwaters and/or are seasonally dependent on freshwater habitats to complete their life cycle. A diversity of fish, reptile, and amphibians occupy the Coastal Plain Ecoregion, within large fertile blackwater rivers, backwater ponds and seasonally flooded swamps, and estuarine creeks and bays. The Study Area crosses or occurs alongside several ponds, streams, swamps, and rivers. Some of these aquatic habitats are in the FMNF and include the lower Santee and Wando rivers, North and South Santee rivers, along with several tributaries.

Several species of diadromous (i.e., catadromous and anadromous) fish use the Santee River-Cooper system, of which the North and South Santee rivers are a part. These species include blueback herring (*Alosa aestivalus*), American shad (*Alosa sapidissima*), striped bass, hickory shad (*Alosa mediocris*), shortnose sturgeon, and Atlantic sturgeon (SCDNR 2013). Of these, the blueback herring, hickory shad, and American shad are fairly common but are considered Species of Concern by SCDNR (see Section 5.6.2.4) and are ranked with the highest conservation priority in South Carolina (see Section 5.6.2.5), while the shortnose sturgeon and Atlantic sturgeon are federally listed as endangered species (see Section 5.6.2.3).

Stream surveys by SCNDR indicate that American eel, Banded sunfish (*Ennecanthus obesus*), and Ironcolor shiner (*Notropis chalybaeus*) occur within Wambaw and Mechaw creeks, which intersect the Jamestown corridor alternative (South Carolina Heritage Trust 2018). SCDNR lists these species as Species of Conservation Need and classifies American eel as a Species of Concern.

Preliminary surveys of fish were performed at the flowing streams crossed by the proposed Jamestown and Charity corridor alternatives (Three Oaks Engineering 2017; 2018). For the Jamestown corridor alternative, a total of 31 freshwater and three estuarine fish species were found during electrofishing surveys of 12 streams crossed by the proposed corridor, and at specific wetland crossings that were determined in the field to have potential to support a fish community. The largest water body sampled (Wanbaw Creek) had the highest number of species recorded (28), followed by Mechaw Creek (21), the easternmost tributaries to Mill Branch (15 and 13), and Keepers Branch (14). The majority of the species observed are considered fairly common throughout their respective ranges; however, two species are identified in the South Carolina's 2015 State Wildlife Action Plan as priority species (SCDNR 2015a), the American eel (highest priority) and the Flat Bullhead (moderate priority). The Eastern Mosquitofish (*Gambusia holbrooki*) was the most ubiquitous species found in waters crossed by the Jamestown corridor alternative, and at most sites, was the most abundant species encountered. The Flier (*Centrarchus macropterus*) and Redfin Pickerel (*Esox americanus*) were also found at a large number (nine) of sites and were generally common. Other than the Coastal Shiner, Spottail Shiner, and Golden Shiner, the shiners as a group were very underrepresented. Also, darter species were conspicuously absent from the sampling effort, likely attributed to the scarcity of riffle and swift flowing habitats in the sampled segments. However, neither the Swamp Darter (*Etheostoma fusiforme*) nor the Sawcheek Darter (*E. serrifer*), which often occur in slow-moving waters, were detected. Three estuarine species, Fat Sleeper, Freshwater Goby, and Hogchoker were found, and other estuarine species are also likely present in the study area at various times (Three Oaks Engineering 2017).

For streams and wetlands crossed by the proposed Charity corridor alternative, 20 fish species were found during electrofishing surveys of 10 sites. Collectively, the sampled species diversity in these waterbodies was considerably less than what was found within the waterbodies crossed by the Jamestown alignment. As observed during the fish surveys for the Jamestown corridor alternative, the number of species observed at a site was correlated with waterbody size. In the majority of the waterbodies surveyed (seven), four or less species were found. The three other waterbodies (Quinby Creek and 2 channels of Cropnel Dam Creek) produced 15, 8, and 10, species, respectively. Two species, Everglades Pygmy Sunfish (*Elassoma evergladei*) and Blackbanded Sunfish (*Enneacanthus chaetodon*), were found within waters crossed by the Charity corridor alternative and were not detected within the Jamestown corridor alternative (Three Oaks Engineering 2018).

Preliminary surveys of fish were not completed at all streams crossed by the proposed Belle Isle B and C corridor alternatives, and Central Electric (2014) reported a list of aquatic species captured by the FMNF during surveys in the Project vicinity during 2002–

2004, 2006, and 2010 (see Appendix D). Three Oaks Engineering (2018) performed electrofishing surveys at two sites on Collins Creek by U.S. Highway 17 that would be crossed by the Belle Isle B corridor alternative. The eastern mosquitofish, bluespotted sunfish (*Enneacanthus gloriosus*), and flier were most abundant in this creek.

5.6.1.6 State Priority Species

SCDNR (2005a) developed a Comprehensive Wildlife Conservation Strategy Plan in 2005 to identify species in need of conservation, which was updated by the 2015 State Wildlife Action Plan (SCDNR 2015a). The list of priority species (also referenced as SGCN) were identified and categorized into three groups: Highest, High and Moderate Priority. Table 5-10 below provides a list of 173 vertebrate species that are listed as South Carolina's priority species in the Coastal Plain Ecoregion. Each species is categorized into one of three groups based on their conservation need: Highest, High and Moderate Priority. Plants are not categorized due to the large number of species and the limited knowledge for those species. This list of SGCN includes 99 birds; 15 mammals, of which 9 are bats; 9 amphibians, of which 4 are salamanders and 5 are frogs; 21 reptiles, of which 9 are turtles, 8 are snakes, 2 are lizards, and 1 is an alligator; and 28 fish (SCDNR 2015a).

Table 5-10: South Carolina's Priority Animal Species (or SGCN) in the Coastal Plain Ecoregion

Common Name	Scientific Name	Highest Priority	High Priority	Moderate Priority
Birds				
Acadian Flycatcher	*Empidonax virescens*		X	
American Avocet	*Recurvirostra americana*		X	
American Bittern	*Botaurus lentiginosus*	X		
American Black Duck	*Anas rubripes*	X		
American Coot	*Fulica americana*			X
American Golden Plover	*Pluvialis dominica*	X		
American Kestrel	*Falco sparverius*	X		
American Woodcock	*Scolopax minor*			X
Anhinga	*Anhinga*			X
Bachman's Sparrow	*Peucaea aestivalis*	X		
Bald Eagle	*Haliaeetus leucocephalus*		X	

Common Name	Scientific Name	Highest Priority	High Priority	Moderate Priority
Barn Owl	*Tyto alba*			X
Belted Kingfisher	*Ceryle alcyon*			
Black-and-white Warbler	*Mniotilta varia*		X	
Black-crowned Night Heron	*Nycticorax*		X	
Black-throated Green Warbler	*Dendroica virens*	X		
Blue Grosbeak	*Passerina caerulea*			X
Blue-winged Teal	*Anas discors*			X
Broad-winged Hawk	*Buteo platypterus*			X
Brown Thrasher	*Toxostoma rufum*		X	
Brown-headed Nuthatch	*Sitta pusilla*			X
Buff-breasted Sandpiper	*Tryngites subruficollis*	X		
Carolina Chickadee	*Poecile carolinensis*			X
Carolina Wren	*Thryothorus ludovicianus*			X
Chimney Swift	*Chaetura pelagica*		X	
Chuck-will's-widow	*Caprimulgus carolinensis*		X	
Common Gallinule	*Gallinula galeata*			X
Common Ground- Dove	*Columbina passerina*	X		
Dark-eyed Junco	*Junco hyemalis*			X
Dickcissel	*Spiza americana*			X
Downy Woodpecker	*Picoides pubescens*			X
Eastern Kingbird	*Tyrannus*		X	
Eastern Meadowlark	*Sturnella magna*		X	
Eastern Towhee	*Pipilo erythrophthalmus*		X	
Eastern Wood-Pewee	*Contopus virens*		X	
Field Sparrow	*Spizella pusilla*			
Glossy Ibis	*Plegadis falcinellus*			X
Golden-crowned Kinglet	*Regulus satrapa*			X

Common Name	Scientific Name	Highest Priority	High Priority	Moderate Priority
Grasshopper Sparrow	*Ammodramus savannarum*	X		
Great Blue Heron	*Ardea herodias*			X
Great Egret	*Ardea alba*		X	
Green Heron	*Butorides virescens*	X		
Henslow's Sparrow	*Ammodramus henslowii*	X		
Hooded Warbler	*Wilsonia citrina*			X
Horned Grebe	*Podiceps auritus*	X		
Indigo Bunting	*Passerina cyanea*			X
Kentucky Warbler	*Oporornis formosus*	X		
King Rail	*Rallus elegans*	X		
Least Bittern	*Ixobrychus exilis*	X		
Least Sandpiper	*Calidris minutilla*		X	
Little Blue Heron	*Egretta caerulea*	X		
Loggerhead Shrike	*Lanius ludovicianus*	X		
Long-billed Dowitcher	*Limnodromus scolopaceus*			X
Louisiana Waterthrush	*Parkesia motacilla*		X	
Mallard	*Anas platyrhynchos*	X		
Mottled Duck	*Anas fulvigula*			X
Northern Bobwhite	*Colinus virginianus*	X		
Northern Parula	*Parula americana*			X
Northern Pintail	*Anas acuta*	X		
Orchard Oriole	*Icterus spurius*			X
Painted Bunting	*Passerina ciris*	X		
Pectoral Sandpiper	*Calidris melanotos*			X
Pied-billed Grebe	*Podilymbus podiceps*	X		
Pileated Woodpecker	*Dryocopus pileatus*			X
Pine Warbler	*Dendroica pinus*			X

Common Name	Scientific Name	Highest Priority	High Priority	Moderate Priority
Prairie Warbler	*Dendroica discolor*		X	
Prothonotary Warbler	*Protonotaria citrea*			X
Purple Gallinule	*Porphyrio martinica*	X		
Purple Martin	*Progne subis*		X	
Red-bellied Woodpecker	*Melanerpes carolinus*			X
Red-cockaded Woodpecker	*Picoides borealis*	X		
Red-headed Woodpecker	*Melanerpes erythrocephalus*			X
Red-shouldered Hawk	*Buteo lineatus*			X
Ring-necked Duck	*Aythya collaris*			X
Roseate Spoonbill	*Platalea ajaja*			X
Rusty Blackbird	*Euphagus carolinus*	X		
Sedge Wren	*Cistothorus platensis*	X		
Snowy Egret	*Egretta thula*			X
Sora	*Porzana carolina*		X	
Spotted Sandpiper	*Actitis macularia*			X
Stilt Sandpiper	*Calidris himantopus*		X	
Summer Tanager	*Piranga rubra*			X
Swainson’s Warbler	*Limnothlypis swainsonii*		X	
Swallow-tailed Kite	*Elanoides forficatus*	X		
Tricolored Heron	*Egretta tricolor*		X	
Upland Sandpiper	*Bartramia longicauda*	X		
Whip-poor-will	*Caprimulgus vociferus*		X	
White Ibis	*Eudocimus albus*	X		
White-eyed Vireo	*Vireo griseus*			X
White-rumped Sandpiper	*Calidris fuscicollis*			X
Wilson’s Snipe	*Gallinago gallinagodelicata*		X	
Wood Duck	*Aix sponsa*		X	

Common Name	Scientific Name	Highest Priority	High Priority	Moderate Priority
Wood Stork	*Mycteria americana*	X		
Wood Thrush	*Hylocichla mustelina*		X	
Yellow-billed Cuckoo	*Coccyzus americanus*		X	
Yellow-breasted Chat	*Icteria virens*		X	
Yellow-crowned Night Heron	*Nyctanassa violacea*	X		
Yellow-throated Vireo	*Vireo flavifrons*			X
Yellow-throated Warbler	*Setophaga dominica*			X
Mammals				
Big Brown Bat	*Eptesicus fuscus*	X		
Black Bear	*Ursus americanus*			X
Eastern Woodrat	*Neotoma floridana*			X
Hoary Bat	*Lasiurus cinereus*	X		
Meadow Vole	*Microtus pennsylvanicus*		X	
Mink	*Mustela vison*		X	
Northern Yellow Bat	*Lasiurus intermedius*	X		
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*	X		
Red Bat	*Lasiurus borealis*	X		
Seminole Bat	*Lasiurus seminolus*	X		
Silver-haired Bat	*Lasionycteris noctivagans*	X		
Southeastern Bat	*Myotis austroiparius*	X		
Southern Fox Squirrel	*Sciurus niger*			X
Star-nosed Mole	*Condylura cristata*		X	
Tri-colored Bat	*Perimyotis subflavus*	X		
Amphibians				
Bird-voiced Treefrog	*Hyla avivoca*			X
Chamberlain’s Dwarf Salamander	*Eurycea chamberlainii*	X		

Common Name	Scientific Name	Highest Priority	High Priority	Moderate Priority
Flatwoods Salamander (Frosted)	*Ambystoma cingulatum*	X		
Carolina Gopher Frog	*Rana capito*	X		
Mud Salamander (Gulf Coast)	*Pseudotriton montanus flavissimus*		X	
Northern Cricket Frog	*Acris crepitans*			X
Pickerel Frog	*Rana palustris*		X	
Tiger Salamander	*Ambystoma tigrinum*	X		
Upland Chorus Frog	*Pseudacris feriarum*			X
Reptiles				
American Alligator	*Alligator mississippiensis*			X
Black Swamp Snake	*Seminatrix pygaea*		X	
Broad-striped Dwarf Siren	*Pseudobranchus striatus*	X		
Chicken Turtle	*Deirochelys recticularia*			X
Coral Snake (Harlequin)	*Micrurus fulvius*	X		
Eastern Box Turtle	*Terrapene carolina*			X
Eastern Diamondback Rattlesnake	*Crotalus adamanteus*		X	
Florida Cooter	*Pseudemys floridana*			X
Florida Green Watersnake	*Nerodia floridana*	X		
Gopher Tortoise	*Gopherus polyphemus*	X		
Island Glass Lizard	*Ophisaurus compressus*	X		
Northern Pine Snake	*Pituophis melanoleucus*	X		
Pine Woods Snake	*Rhadinaea flavilata*		X	
River Cooter	*Pseudemys concinna*			X
Slender Glass Lizard	*Ophisaurus attenuatus*			X
Snapping Turtle (Common)	*Chelydra serpentina*			X
Southern Hognose Snake	*Heterodon simus*	X		
Spotted Turtle	*Clemmys guttata*		X	

Common Name	Scientific Name	Highest Priority	High Priority	Moderate Priority
Striped Mud Turtle	*Kinosternon baurii*			X
Timber Rattlesnake	*Crotalus horridus*		X	
Yellow-bellied Slider	*Trachemys scripta*		X	
Fish				
Shortnose Sturgeon	*Acipenser brevirostrum*	X		
Atlantic Sturgeon	*Acipenser oxyrinchus*	X		
Blueback Herring	*Alosa aestivalis*	X		
Hickory Shad	*Alosa mediocris*	X		
American Shad	*Alosa sapidissima*	X		
Snail Bullhead	*Ameiurus brunneus*			X
American Eel	*Anguilla rostrata*	X		
White Catfish	*Ameiurus catus*			X
Flat Bullhead	*Ameiurus platycephalus*			X
Swampfish	*Chologaster cornuta*			X
Satinfin Shiner	*Cyprinella analostana*			X
Fieryblack Shiner	*Cyprinella pyrrhomelas*			X
"Thinlip" Chub	*Cyprinella sp. (c.f. zanema)*	X		
Carolina Pygmy Sunfish	*Elassoma boehlkei*	X		
Everglades Pygmy Sunfish	*Elassoma evergladei*			X
Bluebarred Pygmy Sunfish	*Elassoma okatie*	X		
Blackbanded Sunfish	*Enneacanthus chaetodon*		X	
Banded Sunfish	*Ennaecanthus obesus*			X
Savannah Darter	*Etheostoma fricksium*	X		
Sawcheek Darter	*Etheostoma serrifer*			X
Striped Bass	*Morone saxatilis*			X
Notchlip Redhorse	*Moxostoma collapsum*			X
Bridle Shiner	*Notropis bifrenatus*	X		

Common Name	Scientific Name	Highest Priority	High Priority	Moderate Priority
Ironcolor Shiner	*Notropis chalybaeus*			X
Bannerfin Shiner	*Notropis leedsi*		X	
"Broadtail" Madtom	*Noturus spp. (c.f. insignis)*	X		
Piedmont Darter	*Percina crassa*		X	
Lowland Shiner	*Pteronotropis stonei*			X

Source: SCDNR (2005a, 2015a), South Carolina Heritage Trust (2018)

Appendix E provides a complete list of South Carolina's priority vertebrate animal species that occur in the Coastal Plain Ecoregion, providing their federal- or state-listing status, their conservation status according to NatureServe (2018f; 2018g), and their specific habitat requirements. Appendix F lists an additional 136 plants that are also listed as SGCN by the SCDNR (2015a).

Potential habitat could exist within the Study Area for most SGCN that are listed by South Carolina for the Coastal Plain Ecoregion. However, the South Carolina Heritage Trust (2018) and USFS (2018c) do not track occurrences for all SCCN and have only documented known occurrences for those species designated by the SCDNR as Species of Concern. For details about the designation of state Species of Concern, see Section 5.6.1.

5.6.2 Environmental Effects

To complete the analysis of potential effects on vegetation and wildlife, including special-status species, the potentially affected habitats were analyzed. Potential impacts would result from both the construction of the transmission Project, and its operation and maintenance. Table 5-11 provides definitions for duration and intensity developed for this Project, divided among vegetation, wildlife, and special-status species.

Table 5-11: Duration and Intensity Definitions for Biological Resources

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Vegetation and Non-native Invasive Plants			
Short term: Lasting less than two growing seasons	Impacts to native vegetation would be detectable but discountable and would not alter natural conditions measurably. Infrequent	Impacts to native vegetation would be detectable and/or measurable. Occasional disturbance to individual plants could be expected. These disturbances could	Impacts to native vegetation would be measurable and extensive. Frequent disturbances of individual plants would be expected with negative impacts to

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Long term: Lasting longer than two growing seasons	disturbance to individual plants could be expected but without affecting local or range- wide population stability. Infrequent or insignificant one-time disturbance to local populations could occur, but sufficient habitat would remain functional at both the local and regional scales to maintain the viability of the species. Opportunity for increased spread of non-native invasive plants would be detectable but discountable. There would be some minor potential for increased spread of non-native invasive plants.	affect local populations negatively but would not be expected to affect regional population stability. Some impacts might occur in key habitats, but sufficient local habitat would remain functional to maintain the viability of the species both locally and throughout its range. Opportunity for increased spread of non-native invasive plants would be detectable and/or measurable. There would be some moderate potential for increased spread of non-native invasive plants.	both local and regional population levels. These disturbances could negatively affect local populations and could affect range-wide population stability. Some impacts might occur in key habitats, and habitat impacts could negatively affect the viability of the species both locally and throughout its range. Opportunity for increased spread of non-native invasive plants would be measurable and extensive. There would be major potential for increased spread of non-native invasive plants.
Wildlife			
Short term: Lasting one to two breeding seasons, depending on length of breeding season Long term: Lasting beyond two breeding seasons	Impacts to native species, their habitats, or the natural processes sustaining them would be detectable, but discountable, and would not measurably alter natural conditions. Infrequent responses to disturbance by some individuals could be expected but without interference to feeding, reproduction, resting, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors could occur. Sufficient habitat would remain functional at both the local and range-wide scales to maintain the viability of the species.	Impacts to native species, their habitats, or the natural processes sustaining them would be detectable and/or measurable. Occasional responses to disturbance by some individuals could be expected with some negative impacts to feeding, reproduction, resting, migrating, or other factors affecting local population levels. Some impacts might occur in key habitats. However, sufficient population numbers or habitat would retain function to maintain the viability of the species both locally and throughout its range.	Impacts to native species, their habitats, or the natural processes sustaining them would be detectable, and would be extensive. Frequent responses to disturbance by some individuals would be expected with negative impacts to feeding, reproduction, or other factors resulting in a decrease in both local and range-wide population levels and habitat type. Impacts would occur during critical periods of reproduction or in key habitats and would result in direct mortality or loss of habitat that might affect the viability of a species. Local population numbers, population structure, and other demographic factors might experience large changes or declines.

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
FMNF SCC and State-listed Species			
Short term: Lasting one breeding season Long term: Lasting beyond one breeding seasons	Impacts to sensitive species, their habitats, or the natural processes sustaining them would be detectable, but discountable, and would not measurably alter natural conditions. Infrequent responses to disturbance by some individuals could be expected but without interference to feeding, reproduction, resting, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors might occur. However, some impacts might occur during critical reproduction periods or migration for a species but would not result in injury or mortality. Sufficient habitat would remain functional at both the local and range-wide scales to maintain the viability of the species. No take of federally listed species or impacts to designated critical habitat is expected to occur. Impacts would likely result in a *May Affect, Unlikely to Adversely Affect* determination.	Impacts to sensitive species, their habitats, or the natural processes sustaining them would be detectable and/or measurable. Some alteration in the numbers of sensitive or candidate species, or occasional responses to disturbance by some individuals could be expected with some negative impacts to feeding, reproduction, resting, migrating, or other factors affecting local population levels. Some impacts might occur in key habitats. However, sufficient population numbers or habitat would remain functional to maintain the viability of the species both locally and throughout its range. No mortality or injury of federally listed species is expected; however, some disturbance to individuals or impacts to potential or designated critical habitat could occur. Impacts would likely result in a *May Affect, Unlikely to Adversely Affect* determination.	Impacts to sensitive species, their habitats, or the natural processes sustaining them would be detectable and would be permanent. Substantial impacts to the population numbers of sensitive or candidate species, an impact to the population numbers of any federally listed species, or interference with their survival, growth, or reproduction would be expected. There would be direct or indirect impacts on candidate or sensitive species populations or habitat, resulting in substantial reduction to species numbers, take of federally listed species numbers, or the destruction or adverse modification of designated critical habitat. Impacts would like result in an adverse effect determination.

5.6.2.1 No-action Alternative

Under the no-action alternative, the proposed Project would not be constructed, and there would be no new effects on biological resources.

5.6.2.2 Proposed Action

The proposed Project would encompass a variety of terrain, vegetative communities, and habitat types used by a variety of wildlife. Construction, operation, and maintenance of the proposed Project would have effects on vegetation and wildlife. Appropriate mitigation measures would reduce the severity of these adverse effects. Potential effects would include the following:

- Disturbance or change to vegetative communities as a result of clearing and construction within the ROW
- Introduction and spread of non-native invasive plants during construction of the transmission line
- Removal of forested wetland vegetation within the ROW
- Removal of wildlife habitat within the ROW
- Fragmentation of wildlife habitat
- Temporary disturbance to wildlife from human presence and disruption to habitat
- Disturbance to aquatic habitats from construction activities
- Changes in predator-prey relationships due to habitat changes (e.g., increased predation by raptors due to the presence of transmission structures for perching)

The Project's potential effects on vegetation are discussed first, followed by the effects on wildlife in general, and then at-risk species. At risk species include: (1) federally threatened endangered species, (2) FMNF SCC and state-listed species, and (3), and other special-status species.

Ecological Conditions

Impacts from Project Construction—Potential adverse effects on vegetation from Project-construction would include short-term and long-term effects varying in intensity from low to moderate, to high. The ROW would be cleared of trees to a minimum of 75 feet wide, including the trimming or removal of hazard trees that are outside the ROW (hazard trees are trees or branches that are dead, weak, diseased, leaning toward the proposed transmission line, or otherwise capable of hitting the line were they to fall). In addition to ROW clearing, construction effects would include localized disturbance to vegetative communities caused by construction equipment and vehicles during site preparation, such as trampling damage to vegetation from vehicle tires, placement of timber mats in wetlands, and minimal grading. Damage to vegetation in the ROW from construction equipment and vehicles would be considered a short-term, low-intensity effect in areas that are not being permanently developed. Upon completion of all work, all non-agricultural disturbed areas and construction staging areas not needed for maintenance access would be re-graded so that all surfaces drain naturally, blend with the natural terrain, and are reseeded to blend with native vegetation with a seed mixture certified as free of non-native invasive plants. All destruction, scarring, damage, or defacing of the landscape resulting from construction would be repaired.

Within the ROW, permanent long-term vegetation loss would occur at the structure locations. The foundation size of the transmission line structures would not be known until engineering is farther along; however, it is expected they would be relatively small in size with less than an 8-foot diameter per structure. As such, permanent effects from vegetation loss due to structures would be long term yet low intensity. During construction, a 20-foot by 20-foot area of vegetation around each structure would be disturbed for the placement of temporary construction pads. Additional vegetation clearing (5 to 10 acres) could occur if a construction lay-down area is located in an uncleared location; however, Central Electric would prefer to find a site that is already developed or disturbed. Central Electric and/or Berkeley Electric would construct the proposed McClellanville Substation on a developed parcel; therefore, it would have no effect on vegetation.

The amount of forest that would be converted is relatively small, with plentiful comparable habitat available nearby for species to use. However, habitat fragmentation can cause a more severe impact than the actual loss of habitat. Habitat fragmentation occurs when formerly continuous tracks of habitat, particularly forest, are broken up into smaller parcels. Limiting the amount of interior forest fragmented by avoiding large tracks of forest and paralleling existing linear features, such as roads or other utility lines, reduces the effects of habitat fragmentation. Table 5-12 shows the percentage of each corridor alternative that is parallel to another linear feature. Overall, the proposed Jamestown and Charity corridors would be parallel to roads and/or other transmission lines for greater than 90 percent of their length, while the Belle Isle B and C corridor alternatives paralleling existing roads for 45 percent and 20 percent of their length, respectively. However, the Jamestown and Charity corridors are nearly twice as long and would traverse more expansive tracks of forested lands than the Belle Isle corridors. The lands surrounding both Belle Isle corridors are more fragmented due to human development in proximity to U.S. Highway 17. Also, the Jamestown and Charity corridors would parallel an existing power line ROW and 2-lane roads with relatively low levels of rural traffic, as compared to the Belle Isle corridors paralleling a 4-lane highway with much greater traffic volumes. Thus, while the proposed Jamestown and Charity corridors would parallel existing infrastructure for a greater distance, their impacts on wildlife due to habitat fragmentation would be just as great as that of the Belle Isle corridors. All four proposed corridors would have long-term, moderate impacts on wildlife due to habitat fragmentation. This impact would be minimized, however, because the proposed corridors would remove forest at the edge of existing roads and utility corridors, thus not affecting interior (i.e., unfragmented) forest and limiting the amount of new edge habitat created. If the Project ROW is permitted to overlap with the existing county road or highway ROWs, less forest clearing would be required.

Table 5-12: Length (miles) and Percentage of the Proposed Corridors Parallel to Other Linear Features

	Belle Isle Alt. B Corridor	Belle Isle Alt. C Corridor	Jamestown Corridor	Charity Corridor
Parallel to Existing Roads[a]	7.4 (45%)	3.2 (20%)	23.4 (90%)	11.5 (37%)
Parallel to Existing Transmission Lines and/or Pipelines	0 (0%)	0 (0%)	0 (0%)	18.1 (58%)
Total Length and Percentage	7.4 (45%)	3.2 (20%)	23.4 (90%)	29.7 (95%)

[a] See Section 5.14 for further detail about roads in the Project Area

During construction, off-ROW access may be necessary. Off-ROW access may be acquired for construction and maintenance on existing roads and/or existing utility easements. Improvements to existing off-ROW roads may be required and improvements would typically involve re-grading of dirt roads if wear and tear of traffic requires it or adding rock (or additional rock) to unpaved roads. No new permanent roads would be constructed as a result of the transmission line construction and any new temporary access roads would be minimal; therefore, effects on vegetation from access road improvement or construction is expected to be negligible. If any new temporary access roads are required, they would be restored to the natural condition after construction is completed. Therefore, effects on vegetation from the construction of access roads would be short term and low intensity.

Project construction activities could introduce or spread of non-native invasive plants through ground disturbance and the transfer of seeds by construction equipment, which could potentially displace native species and alternative plant community composition and function, threatening wildlife habitat and affecting human uses by altering fire regimes, changing nutrient cycling, and water availability. Additionally, some non-native invasive plants are toxic to both wildlife and humans. Precautions would be needed during construction and reclamation to prevent the introduction and spread of non-native invasive plants, such as re- vegetation of disturbed areas using certified seed and mulch that contains no viable non-native invasive plant seeds, as well as the use of standard BMPs related to construction and re-vegetation practices within disturbed areas (see Section 4.4). Central Electric would develop a non-native invasive plants management plan to address their potential spread during construction activities. The plan would include strategies for prevention, detection, and control of non-native invasive plants. Construction equipment would be inspected for seeds and thoroughly cleaned before mobilizing to the Project Area (see Table 4-2, mitigation measures BR-4 and BR-5).

Impacts from Project Operations and Maintenance—Following construction, vegetation management would continue within the ROW. Transmission ROWs would be managed to remove woody vegetation that could interfere with the transmission line, on a 2.5- to 3-year cycle (4 to 5 years in wetlands), using medium to heavy four-wheel drive tractors with associated mowing implements to ensure that vegetation growth does not adversely affect system safety and reliability. Central Electric would avoid using herbicides to control vegetation on NFS lands, and on non-NFS lands, may apply granular herbicide at the base of selected transmission structures to reduce the potential of damage from wildfires and/or facilitate ground rot inspections by line personnel. Also, crews would treat wetland areas (i.e., areas where mowing equipment cannot traverse) with a foliar herbicide application, using a Marsh Master or similar equipment, to control woody vegetation.

Once constructed, the proposed transmission line would be managed mechanically, and with herbicides on non-NFS lands, and solely by mechanical means on NFS lands, to control vegetation that could interfere with the normal transmission of electricity while promoting low-growing native vegetation. The practice of applying herbicides would selectively reduce undesirable woody vegetation using a low volume methodology. Although the amount of herbicide applied depends on the species composition, density, and height of the vegetation that is present, the selective application approach results in less of the active ingredient being applied per acre, as compared to the broadcast method. Only herbicides approved by USEPA are used within ROWs with each being applied in accordance with manufacturer labeling. Vegetation management activities on ROWs crossing NFS lands are expected to be similar to vegetation management as described above, except for the use of herbicides. Herbicides would not be used during land clearing or maintenance activities of the ROW crossing NFS lands. One exception to the use of chemicals on NFS lands is where FMNF policy permits herbicides for the control of non-native invasive plants, per the FMNF standards and guidelines (see Chapter 4.2, USFS 2017). Furthermore, the construction of a new transmission line would reduce opportunities for conducting prescribed fire to benefit native ecosystems, especially at-risk plants and animals that depend on fire to create suitable habitat. However, Central Electric would use fire where possible to prevent woody vegetation from dominating the understory within upland longleaf and loblolly pine woodlands. Overall, vegetation maintenance would have a long-term, moderate impact on vegetation communities.

Affected Ecosystems—Effects from vegetation clearing of the ROW would vary depending upon the type of vegetation to be cleared. As presented in above in Table 5-7 under *Affected Environment*, all four corridor alternatives would cross predominantly forested ecosystems, including both upland and wetland areas. The proposed Belle Isle B and C corridor alternatives would cross the most developed land area, both directly affecting approximately 18 acres within the 75-foot Project ROW. The Jamestown and Charity corridors would affect little to no developed land, as they cross almost entirely undeveloped and uncultivated vegetation. Construction through forested areas would require the removal of any trees or large shrubs that would interfere with transmission line safety, equipment access, and operation. Clearing forested areas would have a long-term, high-intensity effect on vegetation because it would result in a permanent conversion. Conversion of forested wetland (bottomland hardwoods) to emergent or scrub-shrub wetlands would have greater impacts because of the various functions and values, including wildlife habitat, provided by this habitat type. As shown in Table 5-13, the ROW of the proposed corridors would encompass different proportions of various ecosystems and would thus affect species differently depending on their habitat preferences.

Table 5-13: Acres of Affected Ecosystems Within a 600-foot ROW of the Proposed Project Corridor Alternatives

	Belle Isle			
Ecosystem	**Option B**	**Option C**	**Jamestown**	**Charity**
Upland Longleaf and Loblolly Pine Woodlands	289.5	246.4	516.5	553.6
Wet Pine Savanna and Flatwoods	208.3	154.4	904.8	895.2
Pocosins	6.2	60.0	1.1	94.2
Oak Forests and Mesic Hardwood Forests	14.1	14.1	0	4.7
Forested Swamps and Floodplain Forests	370.3	367.9	346.5	497.9
Maritime Forests and Salt Marsh	103.2	103.2	0	0.3
Grassland and Early Successional Areas	58.7	58.7	0	0.9
Rivers and Streams (Open Water)	14.0	14.0	0	0
Depressional Wetlands and Carolina Bays	0.2	0	113.2	207.7
Developed Areas	124.2	124.2	0	3.5
Total	1,188.7	1,142.8	1,882.1	2,258.1

Approximately 83 percent and 77 percent of the proposed Belle Isle B and C corridors would traverse forested ecosystems as compared to 100 percent and 96 percent of the

Jamestown and Charity corridors, respectively (i.e., upland longleaf and loblolly pine woodlands; wet pine savanna and flatwoods; oak forests and mesic hardwood forests; forested swamps and floodplain forests; and maritime forests and salt marsh). Therefore, the overall permanent impacts on forest-dependent wildlife from ROW clearing would be greatest for the proposed Jamestown and Charity corridors.

Upland pine forest ecosystems comprise approximately 25 percent of that land within the ROWs of all four corridors, so the impacts of the Project on upland forest species would be generally be similar among the alternatives. However, the Charity and Jamestown corridors are about 10 miles longer than the Belle Isle corridors and would affect approximately twice as many acres of upland longleaf and loblolly pine woodlands. Thus, overall effects on wildlife within this ecosystem would be considerably greater within the proposed Jamestown and Charity corridors, as compared to the Belle Isle B and C corridor alternatives.

Wet forest types would also be affected to a greater degree within the Jamestown and Charity corridors, as wet pine savanna and flatwoods, oak forests and mesic hardwood forest, and forested swamps and floodplain forests would comprise approximately 50 percent of both Belle Isle corridor ROWs and approximately 75 percent of the Jamestown and Charity ROWs. For example, less than 20 percent of the Belle Isle corridors would cross wet pine savanna and flatwoods, but approximately half of both the Jamestown and Charity corridors would cross this type of ecosystem. Therefore, the Project's impacts on forest-dependent wildlife that prefer wet forest habitats would generally be much greater for the Charity and Jamestown corridors than for the Belle Isle corridors. Further discussion of the species affected within each ecosystem is provided in the following section, *FMNF Species of Conservation Concern and State-Listed Species*.

Short-term, low-intensity effects on vegetation are anticipated within the ROW in grassland and early successional areas, although they do not comprise a large percentage of the proposed corridors. Approximately 5 percent of the Belle Isle B and C corridor ROWs, where proposed with the same alignment, would impact around 60 acres of grassland and early successional ecosystems. The Jamestown and Charity corridor ROWs would not cross this ecosystem. Impacts to vegetation communities in grasslands and early successional areas, including cropland and pastures, would include clearing shrub vegetation where necessary, depending on height and terrain; however, disturbed areas would be reclaimed with native vegetation within the ROW upon completion of construction. Clearing of shrub vegetation would have a long-term, low-intensity effect on the overall vegetation of the Project area.

In upland areas, the ROW would be cleared using heavy equipment to fell trees and remove understory trees and shrubs, cut at ground level. Felled vegetation would be limbed up and removed or chipped. Stumps would be cut or ground down to a maximum height of 3 inches above the soil line. Slash, the coarse and fine woody debris generated during logging operations, would typically be chipped and broadcast as mulch or allowed to decompose on the ground. The amount of potentially impacted upland forest ecosystems are discussed in more detail in the following section, *FMNF Species of Conservation Concern and State-Listed Species*

Impacts of the proposed Project on wetland plant communities could be lessened by moving the proposed corridor away from wetlands when possible. Where not possible, land clearing within the ROW would be accomplished by methods that remove trees and tall-growing vegetation above the soil line and do not disturb the native wetland soils. This may be accomplished by using low ground pressure equipment (10 psi or less) or similar equipment working from temporary load-dispersing mats to minimize rutting and mucking of wetland soils. Low-growing native plant materials that would not interfere with the installation, maintenance, and operation of the transmission line would not be cleared. Trees that need to be cut within wetlands would be removed from the wetland because rotting wood changes water pH and could make wetlands unsuitable for amphibians and other aquatic life. Also, Central Electric would establish a 30-foot upland buffer area adjacent to all intermittent and perennial streams, and at all jurisdictional wetlands. Wetland clearing methods would be used in these buffer areas to minimize the likelihood of upland soils being transported into wetlands. Appropriate soil erosion and sedimentation controls would be established at streambank boundaries. Wetlands are further discussed in Section 5.5

Federally Listed Threatened and Endangered Species

Of the 21 federally listed or proposed species with the potential to occur in Charlestown, Berkeley, and Georgetown counties, 11 could potentially occur in the vicinity of the proposed Project (see Table 5-8). Nine federally listed species are known to occur or have historically occurred near the proposed Project corridors (red-cockaded woodpecker, wood stork, northern long-eared bat, West Indian manatee, frosted flatwoods salamander, shortnose sturgeon, Atlantic sturgeon, pondberry, and American chaffseed). The two species presently known to occur within the proposed Project corridors are the red-cockaded woodpecker and pondberry. The closest known population of American chaffseed is nearly 2,300 feet of the proposed Charity corridor and no occurrences were documented during preliminary floristic inventories of the Jamestown and Charity corridors. The wood stork flies up and down the Santee River between known breeding colonies, roost sites, and foraging areas, and thus would be affected by the Belle Isle corridors. The frosted flatwoods salamander is known to occur approximately 1.5 miles away from proposed Belle Isle B corridor. Three other marine/aquatic species, including Atlantic sturgeon, shortnose sturgeon, and West Indian manatee, are likely to cross beneath the proposed Belle Isle corridors as they swim in the North and South Santee rivers.

Red-cockaded Woodpecker—Forest clearing for Project construction may cause some red-cockaded woodpecker colonies to relocate and/or may potentially affect the health of other colonies (by reducing the basal area of the foraging trees in the foraging habitat of adjacent colonies). Additionally, noise and ground disturbance from construction activities could disturb woodpeckers during Project construction. If these activities take place during nesting season, it could disrupt nesting activities, decrease feeding and brooding rates, and cause nest abandonment. To minimize these impacts, Central Electric would avoid ROW clearing and construction activities within a 500-foot radius of cluster trees during the species nesting season (April through July).

To the maximum extent practicable, Central Electric would avoid cluster trees when siting the Project ROW. If cluster trees cannot be avoided, Central Electric would coordinate with USFWS, RUS, and USFS to enter into formal consultation and, as appropriate, implement mitigation to minimize adverse effects to the species. Mitigation to reduce effects on red-cockaded woodpecker could include but is not limited to: relocation to nearby suitable habitat outside of the nesting and roosting seasons, enhancing cluster habitat where appropriate, and installing artificial cavities in suitable trees.

The proposed Project corridors may intersect red-cockaded woodpecker cavity-tree clusters. Table 5-14 shows the number of cluster centers within the 600-foot corridor of each proposed corridor and the number of cluster trees within both the 600-foot corridor and the 75-foot ROW. Lastly, Table 5-14 shows the percentage of each proposed corridor intersecting the species' 0.5-mile foraging range from a cluster. The proposed Jamestown and Charity corridors would intersect a greater number of red-cockaded woodpecker nesting and foraging areas than the Belle Isle corridors. However, the greater number of clusters near the Jamestown and Charity corridors is largely due to greater surveying and monitoring of red-cockaded woodpeckers on the FMNF, as compared to non-NFS lands crossed by the proposed Belle Isle B and C corridor alternatives.

Table 5-14: Number of Red-cockaded Woodpecker Cluster Locations within the Corridor Alternative Corridors on the FMNF

Location	Belle Isle Option B Corridor	Belle Isle Option C Corridor	Jamestown Corridor	Charity Corridor
Red-cockaded woodpecker cluster centers within a 0.5-mile foraging range of a 600-foot Project corridor	7	4	32	44
Red-cockaded woodpecker cluster trees within a 600-foot Project ROW	10	0	81	63

Location	Belle Isle Option B Corridor	Belle Isle Option C Corridor	Jamestown Corridor	Charity Corridor
Red-cockaded woodpecker cluster trees within a 75-foot Project ROW	2	0	4	1
Percentage of corridor within the 0.5-mile foraging range of a red-cockaded woodpecker cluster center	25.5%	19.6%	54.9%	55.6%

Note: Red-cockaded woodpecker occurrence data are lacking on private lands due to the lack of surveys on private lands, which comprise approximately 70%of the Belle Isle B corridor alternative, 76% of the Belle Isle C corridor alternative, 23% of the Jamestown corridor alternative; and 24% of the Charity B corridor alternative.

Preliminary surveys by Wildlife Investigations, LLC (2018) found 12 red-cockaded woodpecker clusters near existing ROW for proposed corridor alternatives, 3 of which could be significantly impacted by proposed ROW widening. Of the 12 clusters surveyed, 11 were active in 2017 or 2018 and all 11 exhibited breeding behavior and/or a nest was located. The ROW could potentially remove 22 red-cockaded woodpecker cavity trees on the southern edge of the existing ROW and 18 on the northern edge (Table 5-15).

Table 5-15: Red-cockaded Woodpecker Clusters Potentially Impacted by the Proposed Corridor Alternatives on the FMNF

Cluster ID	No. of Red-cockaded Woodpeckers	Breeding Established?	No. of Cavity Trees	Trees Potentially Cut Within a 300’ ROW (North or South)	Significant Impacts[a]
105D	0	No	9	6 (S)	No
100A	3	Yes	6	1 (N)	No
183A	5	Yes	13	5–2 (S) & 3 (N)	No
183E	3	Yes	11	4 1–2 (S) and 3 (N)	No
184C	3	Yes	10	3 (N)	No
174B	5	Yes	5	3 (S)	Yes
174A	5	Yes	6	6 (S)	Yes
161B	2	Yes	8	4 (N)	No
161F	3	Yes	6	1 (S)	No
136A	3	Yes	9	3 (S)	No
161E	5	Yes	9	4 (N)	Yes
105C	12	Yes	12	0	No

[a] Significant impacts defined as the likelihood that a cluster may be negatively affected in the future due to low forage and few potential cavity trees. Impacts would depend on which side of the existing powerline the proposed ROW is expanded.

The ROW of the proposed corridor alternatives would negatively impact a minimum of three red-cockaded woodpecker clusters within the FMNF by removing occupied cavity trees or potential cavity trees, or reducing habitat surrounding a cluster. Two of the clusters would have most existing cavities removed by clearing for the ROW if the ROW is expanded on the southern side and only one cluster would be impacted if the northern side was expanded. For cluster 174A, the existing cavity trees are the only mature trees in the territory, and all are within the cut area on the southern edge of ROW. However, 174B has potential cavity trees outside of the cut area for artificial or natural cavities in the future. For the least impact on red-cockaded woodpecker clusters, the northern edge of the existing ROW should be used. Although this would cause a significant impact to 161E, potential cavity trees are present so that any removed cavities could be replaced. Because the proposed corridor ROWs would potentially require the removal of active cluster trees or could alter foraging areas potentially being used by the species, Central Electric has determined that all four proposed corridors would be *Likely to Adversely Affect* the red-cockaded woodpecker.

To avoid or minimize effects on red-cockaded woodpeckers, Central Electric would hire a professional biologist to perform a habitat and species presence surveys prior to construction to document red-cockaded woodpecker clusters, cavity trees, and foraging areas within the Project's ROW and assess Project effects to the species. To the maximum extent practicable, Central Electric would avoid cluster trees under active use by the species. When trees cannot be avoided, Central Electric would coordinate with USFWS, and FMNF on NFS lands, to mitigate adverse effects to the species. Mitigation includes, but would not be limited to: relocating colonies to nearby suitable habitat, enhancing colony habitat where appropriate, and installing artificial cavities in suitable trees. Central Electric would restrict construction in areas surrounding red cockaded woodpecker clusters or potential cavity trees to outside of the species' nesting season, which lasts from April 1 through July 31.

On NFS lands, Central Electric would follow three FMNF standards to ensure protection of red-cockaded woodpeckers, including: (1) S32: "Ensure each RCW in an active cluster has a suitable cavity, but maintain a minimum of 4 suitable cavities at all times;" (2) S33: "Retain all potential red-cockaded cavity trees (pines greater than 60 years in age) within RCW clusters, unless pine basal area is above 50 ft^2/acre and all trees are above 60 years within the clusters; protect RCW cavity trees by shielding cavities with restrictors, painting known cavity trees with highly visible paint, or replacing lost cavities with artificial ones;" and (3) S38: "Cutting of active RCW cavity trees is prohibited unless removal is needed for public or employee safety. Written authorization by the USFWS is required after project consultation. Prior to cutting an active RCW tree, it must be replaced with an artificial cavity." Two additional FMNF guidelines would apply to this project, which include: (1) G36: "Mechanical activities within active red-cockaded woodpecker clusters are not allowed during the nesting season (April 1– July 31). Exceptions may be made at the project level with written authorization from the USFWS after project consultation;" and (2) G42: "Ensure forest management activities are consistent with the most up-to-date recovery plan for the red-cockaded woodpecker at the time of the activities. In some instances, there may be a need to deviate from The Red-cockaded Woodpecker Recovery Plan to provide long term benefits for the red-cockaded woodpecker (RCW) and its habitat (e.g., longleaf pine restoration or timber harvest which could reduce foraging below the Managed Stability Standard in the Red-cockaded Woodpecker Recovery Plan). Consult with USFWS."

In accordance with the above standards and guidelines, on NFS lands, Central Electric would adhere to mitigation measure BR-14 (see Table 4-2), which stipulates that Central Electric would implement guidelines for the management of cavity trees and clusters from the most recent red-cockaded woodpecker recovery plan (i.e., USFWS 2003), and no removal of trees >10 inches diameter at breast height, whether alive or dead, is allowed within a cluster without concurrence and/or a permit from USFWS. Furthermore, any mitigation measures from ESA Section 7 consultation with USFWS would be implemented as required by USFWS to avoid potential take of any red-cockaded woodpecker, or any other federally listed species (see Table 4-2, measure BR-8).

Wood Stork—Wood storks are important wetland indicators and particularly vulnerable to habitat degradation because of they require high concentrations of prey in shallow water and because their chicks require care for a long period of time. Loss of feeding habitat from alteration of natural hydroperiods has resulted in abandonment of nesting colonies or widespread nesting failures in south Florida. Development, lowered water tables, and disturbance also degrade nesting sites. As habitat in their historic breeding range has become degraded, South Carolina has become an important breeding area as well as an important feeding area during the nonbreeding season (SCDNR 2015b).

An existing transmission line, which would share its ROW with the majority of the proposed Charity corridor, extends beyond the shared corridor to pass within 0.25 mile of the Pleasant Hill wood stork rookery. The Pleasant Hill rookery has not been surveyed by SCDNR since 2008 (SCDNR 2018e). This existing power line crosses the Santee River about 1 mile east of this rookery, so wood storks that fly up and down the Santee River are presumably successful at avoiding collision with the line since its construction. This suggests that the proposed crossing of the Santee River by the Belle Isle B and C corridor alternatives may not affect wood storks flying up and down the North and South Santee rivers. As noted under the affected environment, wood storks have been observed using the North and South Santee rivers, as well as the existing Jamestown and Charity ROWs, as travel corridors. Because the corridor alternatives contain potential foraging habitat for the species, the Project has the potential to temporarily affect wood storks during forest clearing for Project construction, particularly in the Santee Delta area where the proposed Belle Isle corridor alternatives B and C would cross the North and South Santee rivers, approximately 1 mile upstream of U.S. Highway 17. There would be potential for wood stork collisions with the transmission line, especially over the North and South Santee rivers and during inclement weather and low-light conditions. Given these potential impacts, Central Electric has determined that all four proposed corridor alternatives would be *Likely to Adversely Affect* the wood stork. However, construction activities would be scheduled to avoid morning and evening periods when birds tend to travel in large numbers between feeding, roosting, and nesting areas. After the creation of a new ROW, or expansion of existing ROWs for the Project, wood storks could use the transmission line as a travel corridor to access new foraging areas, which could potentially benefit the species.

To avoid or minimize potential adverse impacts to wood storks, Central Electric would design the Project according to guidelines provided by Avian Power Line Interaction Committee (APLIC) and USFWS (2005) and APLIC's *Reducing Avian Collisions with Power Lines: The State of the Art in 2006* (APLIC 2006) and APLIC (2012) (see Table 4-2, mitigation measure BR-7). If determined necessary during consultation with USFWS, Central Electric would employ a professional biologist to perform a survey, documenting to what degree and magnitude wood storks may use the selected corridor (breeding, foraging, and travel) and how construction and operation of the Project could affect the species. If wood storks are found nesting or roosting in trees within the Project's ROW and the trees require removal, Central Electric would coordinate with USFWS and RUS to enter into formal consultation, and as appropriate, implement mitigation to minimize adverse effects to individuals or disturbance to rookery sites. In coordination with USFWS, areas would be identified that have a high potential for avian collisions (i.e., river crossings). Central Electric would implement mitigation measures in these areas, including using an OPGW instead of a shield wire or marking the shield wire(s) with bird flight diverters to enable birds to see the line at a distance and avoid it.

Northern long-eared Bat—Suitable roosting, foraging, and commuting habitat for bats was observed throughout both proposed corridor corridors, as summarized by Ecological Solutions, Inc. (2017a) and Ecological Engineering, LLP (2018a). Habitats included large areas of mixed pine-hardwood forest with both live trees and snags, exhibiting suitable roost tree diameter with cavities, broken branches, and sloughing bark. In addition, riparian corridors, including perennial streams and creeks, as well as small ponds, swamps and wetlands, crossed by the proposed corridor alternatives provide high-quality flyway and foraging habitat for northern long-eared bats. Direct impacts to foraging, flyway, and roosting habitats within the proposed Project ROW may result in a loss of suitable habitat for the northern long eared bat. Tree removal could likely impact suitable roosting habitat and risks the take of multiple individuals.

The Project ROW would not likely provide suitable roosting sites for northern long-eared bats but could be beneficial as potential flyways for bats that are commuting between suitable roosting and foraging areas. However, the maintained ROW would be considered poor-quality roosting and foraging habitat for northern long-eared bats.

Due to the high-quality flyway, foraging, and roosting habitat found within the proposed Project ROW, seasonal clearing restrictions would be implemented to avoid clearing suitable habitat for this species during time periods that are critical to northern long-eared bat life history, including migration, summer roosting, and raising young (i.e., spring, summer, and early fall). Central Electric would follow FMNF standard S28, which stipulates that surveys would be conducted for at-risk bats before man-made structures are modified or demolished, and if bats are found, then consider installing bat gates and/or erecting bat houses. Also, any additional mitigation measures resulting from ESA Section 7 consultation with USFWS would be implemented as required by USFWS to avoid potential take of any northern long-eared bat, or any other federally listed species (see Table 4-2, mitigation measure BR-8).

West Indian Manatee—The proposed Belle Isle B and C corridor alternatives could affect West Indian manatee in the North and South Santee rivers because of increased sedimentation or reduced water quality from erosion, chemical spills, or herbicide usage. However, the proposed transmission line would span the North and South Santee rivers, and no construction activity would take place below the high-water elevation of the North and South Santee rivers, or in any streams. Central Electric would implement standard erosion-control BMPs for all ground-disturbing activities, especially around Project infrastructure in proximity to the North and South Santee rivers, other streams, or in wetlands. In consultation with USFWS, any additional conservation measures would be implemented to prevent contamination of water from herbicides, fuels, and other spills that could harm aquatic species. The determination for the Belle Isle B and C corridor alternatives would be *May Affect* and *Not Likely to Adversely Affect*, respectively. The proposed Jamestown and Charity corridor alternatives would have No Effect on West Indian Manatee because they would not traverse any waterways used by the species, and BMPs would be implemented to minimize any adverse impacts on downstream water quality.

Frosted Flatwoods Salamander—Construction of the proposed transmission line would involve mechanical ground disturbance that could result in adverse hydrological impacts to breeding sites that are critical to frosted flatwoods salamander, especially within at a 1 mile radius from the edge suitable depressional wetlands and ponds. Project operations and maintenance that precludes future prescribed burning of suitable breeding wetlands to promote grasses and forbs, while limiting shrubs and trees, could also adversely affect the species. The use of herbicides on non-NFS lands to manage vegetation within the Project ROW could also adversely affect frosted flatwoods salamanders.

While there are no known occurrences within the proposed ROWs, frosted flatwoods salamanders can be difficult to detect, and often require multiple surveys, because they are mostly fossorial and do not migrate to their isolated breeding wetlands every year to breed. Previous surveys in the Project's study area do not show the flatwoods salamander using areas within the proposed corridors, but an historic site from 1987 is known in the Santee Coastal Reserve, approximately 1.25 miles south and east of U.S. Highway 17 (closest to the Belle Isle B and C corridors). Although the species is known to usually travel less than 1 mile from breeding sites to forage and burrow (FR 74 6725) and is thus unlikely to affect this known population or its critical habitat, the corridor alternatives may contain potential breeding habitat and foraging areas for the species.

Frosted flatwoods salamander populations are highly susceptible to local extirpation without proper protection and habitat management (USFS 2013a). Because the species could occur in the Project Area, prior to construction, Central Electric would survey the Project's ROW for signs of species presence and to document potential frosted flatwoods salamander breeding habitat and foraging areas that could be affected by the Project. Central Electric would also avoid refueling vehicles within 100-feet of the edge of water features to minimize the potential for hazardous-materials spills reaching a waterway. To minimize potential erosion runoff into waterways, Central Electric would adhere to USACE permits, as necessary pursuant to the Section 10 of the Rivers and Harbors Act and Section 404 of the CWA, including the use of BMPs such as grading areas to approximate preconstruction conditions. To avoid or minimize the adverse effects of herbicides on non-NFS lands, Central Electric would use only USEPA-approved herbicides registered for use in wetland or aquatic sites.

Shortnose Sturgeon and Atlantic Sturgeon—As described above under West Indian manatee, the proposed Belle Isle B and C corridors could affect shortnose sturgeon and Atlantic sturgeon in the North and South Santee rivers. Potential adverse effects include increased sedimentation or reduced water quality from erosion, chemical spills, or herbicide usage. The proposed Jamestown and Charity corridors would not cross any waters providing suitable habitat for either species. Any impacts would be of low intensity and would be avoided or minimized with standard erosion-control BMPs; thus, all proposed corridors would result in a *May Affect, Not Likely to Adversely Affect* determination for both shortnose sturgeon and Atlantic sturgeon.

Pondberry—Pondberry is the only federally listed (endangered) plant species known to occur in the general area of the proposed Project corridors. It is known from several depressions just south of the proposed Charity corridor, near the intersection of Halfway

Creek Road and Conifer Road, but it was not seen in wetlands during an initial May 2018 survey (Gaddy 2018). Pondberry also occurs in sinks in the Honey Hill area, through which the corridor will pass in proximity to. The construction of the proposed Jamestown and Charity corridors would require the disturbance of depressional wetlands that are potential habitat for this species, in proximity to known populations. Therefore, after the centerline for the proposed ROW is selected, a detailed inventory for this species would be conducted within suitable habitat in its vicinity. Central Electric would follow FMNF standard S6, whereby no temporary roads or other project construction area would occur in population sites for at-risk plant species. Based on the potential for the species in the Project thus all proposed corridors would result in a *May Affect, Not Likely to Adversely Affect* determination. To ensure this to be the case, all populations within the ROW of the selected corridor would be resurveyed by a professional botanist prior to Project construction.

American Chaffseed and Canby's Dropwort— South Carolina Heritage Trust (2018) and USFS (2018c) occurrence data, and preliminary floristic surveys of the proposed Project ROWs revealed no records of American Chaffseed or Canby's Dropwort within any of the corridors. Suitable habitat exists within the ROWs, although there is low likelihood for new populations of either plant to be found. Accordingly, Central Electric would hire a professional biologist to resurvey the Project's ROW for habitat and likely presence of the both federally listed plants. The proposed Project would require the clearing of tall, woody vegetation to establish the Project's ROW, which would increase potential habitat for American chaffseed. Direct effects to American chaffseed and Canby's dropwort would be unlikely for all proposed corridors because locations are well-known and there are no known records of American chaffseed or Canby's dropwort within the proposed corridor ROWs. Central Electric would follow FMNF standard S6 and S35 by not constructing temporary or permanent roads in population sites for at-risk plant species. Additional site-specific analysis would be conducted to confirm the lack of any potential adverse effect. Until such time, the Project would result in a *May Affect, Not Likely to Adversely Affect* determination. If either plant were to be found within the Project's ROW, Central Electric would coordinate with USFWS and USFS (as appropriate) to enter formal consultation.

Summary of Effects on Federally Listed Species—Because comprehensive site-specific surveys for federally listed species have not been completed, and the final preferred alternative has not yet been selected, Central Electric has assumed species presence in the study corridors for several species described listed above. From what is known at the present, any effects on the three marine/aquatic species would be minor and these species would not be adversely affected. After the selection of the final corridor, a more accurate determination would be made as to the precise effect of the proposed action on federally listed species. If there is an adverse effect to a species, RUS and Central Electric would continue consultation with USFWS and/or NMFS consistent with Section 7 of the ESA.

FMNF Species of Conservation Concern and State-Listed Species

The potential impacts of the proposed Project on FMNF SCC were analyzed to ensure consistency with the FMNF's *Revised Land Management Plan* (USFS 2017). There are 33 FMNF SCC that could potentially occur within the Project area, due to either: (1) known occurences in the Project vicinity based on occurrences tracked by South Carolina Heritage Trust (2018) and USFS (2018c), or according to records evaluated by Buhlmann and Gross (2018), Buhlmann (2019), or Gaddy (2017, 2018); or (2) documented occurrence within the ROW of the proposed corridors, according to species-specific field surveys by ARCI (2018a,b), Buhlmann and Gross (2018), Buhlmann (2019), Ecological Solutions, Inc. (2017a,b), Gaddy (2017, 2018), Three Oaks Engineering (2017, 2018), or Wildlife Investigations, LLC (2018) (see Table 5-9).

Impacts from Project Construction—Construction of the proposed Project on FMNF SCC, and state-listed species, would be like those discussed below under "Wildlife." However, because of the rarity of these species, their declining trend, or their sensitivity to disturbance, the effects of the Project on these species could be magnified. For the purpose of analysis in this section, these species include animals and plants that are: (1) designated as SCC by FMNF (defined in Section 5.6.1.3); and/or (2) listed by South Carolina as threatened, endangered, or Species of Concern (i.e., state-listed species; see Table 5-9). State-priority species (i.e., SGCN) were not included in this analysis due to the large number of species, although the above criteria includes most at-risk taxa that are categorized by SCDNR (2015a) as high- or highest-priority (see Table 5-10).

Overall, the proposed Belle Isle corridors B and C would have low intensity impacts on FMNF SCC that are found on NFS lands due to the short distances of the corridors in the FMNF. In total, a 75-foot ROW of the Belle Isle B corridor would affect 10.7 acres of NFS lands, and the Belle Isle C corridor would affect 0.3 acre of NFS lands, which is a fraction of the NFS lands affected by a 75-foot ROW for the Jamestown (161.4 acres) and Charity corridors (196.5 acres). The Jamestown and Charity corridors would cross a greater amount of NFS lands. Approximately 70 percent of both corridor ROWs would be on NFS lands, or around 1,320 acres of the Jamestown corridor and 1,600 acres of the Charity corridor.

Impacts from Project Operations and Maintenance—The effects of operation and maintenance of the proposed Project on FMNF SCC, and state-listed species, would be also be similar to those discussed below under "wildlife" species. Likewise, due to their rarity, declining trend, or sensitivity, Project operations and maintenance could have a disproportionate impact on certain special-status species.

Analysis of Project Effects—To evaluate the potential effects of each proposed corridor on FMNF SCC and state-listed species, Central Electric used an ecological suitability framework at a "coarse filter" (i.e., ecosystem-based) scale, similar to that presented in the FMNF's *Revised Land Management Plan* (USFS 2017). Where necessary, based on suitable habitat or known occurrences of FMNF SCC, additional "fine filter" (i.e., species-based) analysis will be performed to evaluate Project impacts on the locations of sensitive resources, which will be incorporated into final line siting/selection of the selected corridor, and to identify which criteria would be considered as constraints (resources to avoid) and opportunities (areas where the transmission line would be most suitable to be sited).

All of the FMNF SCC have been linked to specific ecological conditions that are critical to their survival and long-term persistence on the landscape. Section 2.1.1 of the *Final Revised Land Management Plan* (USFS 2017) specifies the desired future conditions for each ecosystem on the FMNF (i.e., habitats and habitat associates) to protect habitat for SCC. Appendix G provides these desired conditions as they pertain to the FMNF SCC that could potentially be impacted by the Project. Additionally, Section 3.1 of the *Final Revised Land Management Plan* (USFS 2017) describes the objectives that the FMNF strives to meet, and the management strategies it will potentially take to achieve the desired future conditions. Appendix G also provides the objectives and management strategies for each FMNF SCC. Lastly, Section 4.2 of the *Final Revised Land Management Plan* (USFS 2017) describes the standards and guidelines for the FMNF, which are constraints or restrictions placed on projects such as the proposed action.

This analysis of impacts on FMNF SCC tiers to the *Final Revised Land Management Plan* (USFS 2017), which provides further context about species and their habitats across the FMNF. This plan was written under the 2012 Forest Planning Rule and is therefore subject to all applicable requirements. Accordingly, a project-level evaluation requires a review of the proposed Project to ensure that it is consistent with the plan (36 CFR 219.15). A project is consistent with the plan's desired conditions, objectives, or goals if it:

1. Maintains or makes progress toward attaining one or more of the plan's desired conditions, objectives, or goals applicable to the project;

2. Has no effect or only a negligible adverse effect on the maintenance or attainment of applicable desired conditions, objectives, or goals;

3. Does not foreclose the opportunity to maintain or achieve any of the applicable desired conditions, objectives, or goals over the long term, even if the project (or an activity authorized by the project) would have an adverse short-term effect on one or more desired conditions, objectives, or goals; or

4. Maintains or makes progress toward attaining one or more of the plan's desired conditions, objectives, or goals, even if the project or activity would have an adverse but negligible effect on other desired conditions, objectives, or goals.

Central Electric grouped all species listed as FMNF SCC and state-listed species (see Table 5-9) into six ecological associations (i.e., "species groups") based on their known habitat requirements, habitat drivers and threats, and prior grouping by the FMNF (USFS 2017). For each species, Central Electric evaluated the potential project impacts to ensure that the Project is consistent with the *Final Revised Land Management Plan* (USFS 2017), in accordance with 36 CFR 219.15. This includes a review of the FMNF's desired conditions, objectives, and standards and guidelines (see Appendix G) that apply to each SCC species affected (attached), and develops any new mitigation measures, as needed, to conserve known populations and associated ecological conditions. At the "coarse filter" scale, Central Electric consulted USFS (2018c) GIS data for species occurrences; at the "fine filter" scale, field survey data for the applicable SCC species were evaluated.

Table 5-16 summarizes the ecosystems associated with each species group and the potential area affected by a 600-foot corridor for each corridor on both NFS lands vs. non-NFS lands. The acreage presented exceeds the area that would actually be directly affected, but a width of 600 feet assumes that potential effects of the proposed Project would extend 300 feet from either side of the transmission line.

Upland Pine Woodland Associates—Threats to FMNF SCC and state-listed species in this group include habitat destruction and fragmentation from human development and habitat loss due to the lack of disturbance, especially the lack of wildfire. Upland longleaf and loblolly pine woodlands that support the greatest diversity of rare and endemic native species have relatively widely spaced, old trees and diverse herbaceous groundcover. Fires during the growing season maintain the diverse ground cover and keep young pines and shrubs from establishing. Such habitats provide the best potential habitat for red-cockaded woodpecker, discussed previously under *Federally Listed Threatened and Endangered Species*, and are especially important to several rare snakes.

The upland pine woodland associates, classified as FMNF SCC, that were observed during preliminary field surveys of the proposed corridor alternative include:

- Red-cockaded woodpecker
- Monarch butterfly

Table 5-16: FMNF SCC and State-Listed Species Groups, Their Associated Ecosystems, and the Affected Area Within a 600-foot Corridor of the Proposed Corridors

		Belle Isle B Corridor	Belle Isle C Corridor	Charity Corridor	Jamestown Corridor
Species Group	**Ecosystems**	**Acres Within 600-ft Corridor (% of Total Corridor)**	**Acres Within 600-ft Corridor (% of Total Corridor)**	**Acres Within 600-ft Corridor (% of Total Corridor)**	**Acres Within 600-ft Corridor (% of Total Corridor)**
Upland Pine Woodland Associates	Upland Longleaf and Loblolly Pine Woodlands	Non-NFS: 268.2 ac (22.7%)	Non-NFS: 245.8 ac (21.9%)	Non-NFS: 153.2 ac (8.1%)	Non-NFS: 192.2 ac (8.6%)
		NFS: 21.3 ac (1.8%)	NFS: 0.5 ac (0 %)	NFS: 363.2 ac (19.3%)	NFS: 340.4 ac (15.2%)
Forested Wetland Associates	Forested Swamps and Floodplain Forests	Non-NFS: 338.2 ac (28.7%)	Non-NFS: 364.7 ac (32.5%)	Non-NFS: 119.3 ac (6.3%)	Non-NFS: 158.3 ac (7.1%)
		NFS: 32.2 ac (2.7%)	NFS: 3.2 ac (0.3%)	NFS: 227.2 ac (12.1%)	NFS: 339.4 ac (15.2%)
Mesic to Wet Pine Savanna Associates	Wet Pine Savanna and Flatwoods	Non-NFS: 154.3 ac (13.1%)	Non-NFS: 139.1 ac (12.4%)	Non-NFS: 292.6 ac (15.5%)	Non-NFS: 288.3 ac (12.9%)
		NFS: 45.7 ac (3.9%)	NFS: 6.8 ac (0.6%)	NFS: 725.4 ac (38.5%)	NFS: 812.8 ac (36.4%)
Pond Cypress Savanna Associates	Depressional Wetlands and Carolina Bays	Non-NFS: 0.2 ac (0%)	Non-NFS: 0 ac (0%)	Non-NFS: 45.9 ac (2.4%)	Non-NFS: 46.9 ac (2.1%)
		NFS: 0 ac (0%)	NFS: 0 ac (0%)	NFS: 67.3 ac (3.6 %)	NFS: 160.9 ac (7.2%)
Calcareous Mesic Hardwood Associates	Oak Forests and Mesic Hardwood	Non-NFS: 14.1 ac (1.2%)	Non-NFS: 1.4 ac (0.1%)	Non-NFS: 0 ac (0%)	Non-NFS: 0 ac (0%)
		NFS: 0 ac (0%)	NFS: 0 ac (0%)	NFS: 0 ac (0%)	NFS: 4.7 ac (0.2%)
River and Stream Associates	Rivers and Streams	Non-NFS: 14.1 ac (1.2%)	Non-NFS: 14.0 ac (1.3%)	Non-NFS: 0 ac (0%)	Non-NFS: 0 ac (0%)
		NFS: 0 ac (0%)	NFS: 0 ac (0%)	NFS: 0 ac (0%)	NFS: 0 ac (0%)

Sources: SCDNR (2015a), USFS (2017)

Additionally, the Project could affect 12 other FMNF SCC and state-listed species, shown in Table 5-17, based on South Carolina Heritage Trust (2018) and USFS (2018c) records suggesting their likely presence in the vicinity of the proposed corridor alternatives.

Table 5-17: FMNF SCC and State-Listed Species Associated with Upland Pine Woodlands

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
1	Bird	*Picoides borealis*	Red-cockaded Woodpecker	FE	SE	SCC	Highest
2	Bird	*Aimophila aestivalis*	Bachman's Sparrow	----	Species of Concern	SCC	Highest
3	Bird	*Tyto alba*	Barn Owl	----	Species of Concern	----	Moderate
4	Bird	*Columbina passerine*	Common ground Dove	----	ST	----	Highest
5	Bird	*Ammodramus savannarumi*	Grasshopper Sparrow	----	Species of Concern	----	Highest
6	Bird	*Melanerpes erythrocephalus*	Red-headed Woodpecker	----	Species of Concern	----	Moderate
7	Mammal	*Sciurus niger*	Southern Fox Squirrel	----	Species of Concern	----	Moderate
8	Reptile	*Crotalus adamanteus*	Eastern Diamondback Rattlesnake	----	ST	SCC	Highest
9	Reptile	*Heterodon simus*	Southern hognose Snake	----	----	SCC	Highest
10	Reptile	*Pituophis melanoleucus*	Northern Pine Snake	----	Species of Concern	----	Highest
11	Insect	*Amblyscirtes alternata*	Dusky Roadside Skipper	----	----	SCC	No
12	Insect	*Danaus plexippus*	Monarch Butterfly	----	----	SCC	No
13	Vascular Plant	*Pteroglossapsis ecristata*	Crestless Plume Orchid	----	----	SCC	No
14	Vascular Plant	*Schwalbea americana*	American Chaffseed	FE	----	SCC	Highest

Sources: SCDNR (2015a), USFS (2017)

[a] Federal Listing Status: FE = Federally Endangered; FT = Federally Threatened

[b] State Listing Status: SE = State Endangered; ST = State Threatened

[c] USFS Status: SCC = FMNF Species of Conservation Concern

[d] State priority species (SCCN) are assigned one of 3 priorities (Moderate, High, or Highest)

Table 5-7 shows the acreage and percentage of upland longleaf and loblolly pine woodlands within a 600-foot corridor of each proposed corridor, suggesting the general area of affected habitat that could be occupied by upland pine woodland associates. The Belle Isle B and C corridors would affect around 290 and 250 acres of this ecosystem, respectively, occurring almost entirely on non-NFS lands. A 600-foot corridor of the proposed Jamestown and Charity corridors would both encompass just over 500 acres of upland longleaf and loblolly pine woodlands. Within the Jamestown corridor, 70 percent (360 acres) of the upland longleaf and loblolly pine woodlands would occur on NFS land; approximately 65 percent (340 acres) of the upland longleaf and loblolly pine woodlands within the Charity corridor would occur on NFS land.

Habitat loss due to tree removal could occur for individuals of tree-dwelling species, such as red-cockaded woodpecker, red-headed woodpecker, southeastern fox squirrel, and barn owl. At-risk snakes could be killed or temporarily displaced during construction, such as eastern diamondback rattlesnake, southern hognose snake, and northern pine snake. The Bachman's sparrow, grasshopper sparrow, common ground dove, and other ground-nesting birds could be adversely affected by ground-disturbance by heavy equipment and vehicles during Project construction, and to lesser degree during Project operation and maintenance, which could result in the physical destruction of nests. Following construction, the ROW vegetation would not substantially from adjacent upland pine forests and would provide suitable habitat for most upland pine woodland associates. Vegetation management of the ROW to limit shrub and tree encroachment would benefit nesting grasshopper sparrows and Bachman's sparrows because they prefer areas with limited shrubs. The maintenance of early successional/open habitat conditions within the ROW would benefit most other upland pine woodland associates. Central Electric would seek to maximize benefits for these species within the Project corridor by reseeding disturbed areas with preferable native grasses and forbs.

Indirect effects could result from habitat changes due to the Project. For example, utility line structures may affect raptor predator-prey relationships by providing additional locations from which raptors can hunt (perches), which could adversely affect the aforementioned snakes and bobwhite quail (a highest priority SCGN) and benefit American kestrel (a highest-priority SCGN). Project operations and management could also negatively affect upland pine woodland associates by fragmenting fuel sources needed to carry fire and the transmission line would further limit future opportunities for conducting prescribed fires that benefit upland longleaf and loblolly pine woodlands ecosystems and at-risk plants and animals that depend on fire to create suitable habitat.

Two vascular plants listed as FMNF SCC, and closely associated with upland longleaf and loblolly pine woodlands, could be impacted by the proposed Project corridors. The crestless plume orchid has 14 documented occurrences on the FMNF (USFS 2017). Six occurrences are within 1 mile of the proposed Jamestown corridor and another 6 are within 1 mile of the proposed Charity corridor. No observations of crestless plume orchid were recorded during preliminary surveys of the Jamestown and Charity corridors (Gaddy 2017, 2018), but additional surveys would be necessary to confirm its absence from the Project area. Potential Project effects to American chaffseed are discussed above under *Federally Listed Threatened and Endangered Species*. Lastly, there were no observations of the dusky roadside-skipper or its host plant, broadleaf beardgrass, within the proposed corridors on NFS lands, but additional surveys for both would be completed prior to construction. Likewise, monarch butterflies are known to occur within the proposed Jamestown corridor, and its milkweed host plants were observed within all proposed Project ROWs (Ecological Solutions, Inc. 2017b, 2018). Central Electric would seek to maintain or enhance any documented populations of milkweed discovered during Project construction. Given both potential adverse and beneficial effects, the Project would have low-intensity, long-term impacts to upland pine woodland associates.

Of the 33 FMNF SCC species identified as potentially occurring within the proposed ROW of the alternative corridors on NFS lands, five are associated with DC-ECO-2 Upland Longleaf and Loblolly Pine, and include:

- Bachman's sparrow
- eastern diamondback rattlesnake
- southern hognose snake
- monarch butterfly
- crestless plume orchid

For these species, upland longleaf and loblolly pine savanna that contain relatively widely spaced old trees and a diverse herbaceous groundcover are maintained by growing season fires to promote diverse groundcover and keep young pines and scrub oaks from establishing. The FMNF objectives and management strategies to manage habitat for these species include: OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration, and OBJ-ECO-3 Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems.

In addition to the mitigation measures provided above in Table 4-2, Central Electric would adhere to the following forest plan standards and guidelines that are pertinent FMNF SCC species associated with upland pine woodlands:

- S26 – No firelines, temporary roads, or log landings in population sites for at-risk plant species, except as needed to protect facilities, private property, or public safety.
- S34 – Require equipment cleaning practices on equipment, using equipment cleaning clauses in contracts, permits and agreements, when moving equipment from areas infested with non-native invasive plants (FSM 2903).
- S35 – No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species.
- S36 – Use plant materials that contain genetically appropriate native plant species when maintaining and restoring vegetation. Use of non-native plants is allowed only when in compliance with USFS native plant policy (FSM 2070).
- S37 – Maintain stands meeting criteria for old growth during project planning using criteria in the Region 8 Old Growth Guidance. Consider the contribution of old growth communities to the future network of small and medium-sized areas of old growth conditions including the full diversity of ecosystems across the landscape.
- S39 – Use low-psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites.
- S40 – Do not use soil active herbicides (imazapyr, imazapic) in population sites for at-risk plant species.
- S41 – Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species associates and rare communities at desired seasons (growing vs. dormant) and fire return intervals for associated ecosystems.
- G31 – Stumps, standing snags, and den trees should be retained during vegetation management activities. Exceptions may be made where necessary to control insects or disease outbreaks or to provide public and employee safety.
- G32 – Unpaved system roads should be considered for seasonal to permanent closure to conserve at-risk wildlife species sensitive to road use.
- G35 – Guidelines and recovery objectives in the most up-to-date recovery plan should be implemented for all federally listed species, when available and feasible. If site-specific conditions preclude implementing recovery tasks, consult

with the USFWS field office using the appropriate consultation tool. Collaborate with USFWS in the conservation of at-risk species.

- G40 – Encourage use of weed-free materials to limit the introduction and spread of non-native invasive plant species.

- G41 – Commercially purchased seed mixes should be tested by a certified seed laboratory for purity, viability, and non-native invasive plant seed.

Opening the forest canopy of this ecosystem within the Project ROW could be performed in an ecologically beneficial manner, serving to maintain part of that restoration, and perhaps could be achieved in concert with a ROW. Furthermore, the Project would not preclude USFS's ability to conduct prescribed burns. The continued use of prescribed fire would maintain the diverse herbaceous groundcover and relatively open overstory near the electric ROW, which could result in an overall increase in habitat quality and diversity for the five FMNF SCC associated with upland longleaf and loblolly pine ecosystems along the proposed Project corridors. However, minimizing groundcover trampling and preventing invasive plant invasions in disturbed areas would require careful monitoring. Therefore, the proposed action is consistent with the FMNF *Revised Land Management Plan* by maintaining ecological conditions that support viable populations of FMNF SCC associated with upland pine woodlands.

Forested Wetland Associates—This group of species are found within forested swamps and floodplain forests. Forested wetlands are at greatest risk of being affected by the proposed powerline due to their large extent and the need to clear the transmission ROW of their defining structural characteristic of tall trees to avoid contacting the transmission wires. All proposed corridors would affect a large extent of forested swamps and floodplain forests and impacts on associated FMNF SCC species could be lasting due to tree removal. The relative proportion of this ecosystem within the four proposed corridors is similar, at approximately 20 percent to 30 percent of the total area; however, the Jamestown and Charity corridors would have greater impacts on forested wetland associates because they are both nearly 10 miles longer than the Belle Isle B and C corridors. Overall, the Charity corridor would impact the greatest area of habitat used by species associated with forested wetlands.

The species in this group are linked to FMNF desired conditions and management objectives associated with the following ecosystems: large river floodplain forests and tidal swamps; narrow non-riverine swamp and wet hardwood forests; and broad non-riverine swamp and wet hardwood forests. The Project could adversely impact on forested wetland associates by impacting wetland hydrology due to altered drainage patterns, soil compaction, and vegetation removal, which would vary from a minor to a significant influence on hydrologic function.

Six forested wetland associates were observed on NFS lands during preliminary field surveys of the proposed corridors on NFS lands, including:

- American swallow-tailed kite
- Bald eagle
- Wood stork
- Southeastern bat
- Spotted turtle
- Okefenokee zale moth

Table 5-18 shows 16 additional FMNF SCC or state-listed species that the Project could affect, based on South Carolina Heritage Trust (2018) and USFS (2018c) records suggesting their likely presence in the vicinity of the proposed corridor alternatives.

Table 5-18: FMNF SCC and State-Listed Species Associated with Forested Wetlands

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
1	Bird	*Egretta caerulea*	Little Blue Heron	----	Species of Concern	SCC	Highest
2	Bird	*Elanoides forficatus*	American Swallow-tailed Kite	----	SE	SCC	Highest
3	Bird	*Haliaeetus leucocephalus*	Bald Eagle	----	ST	SCC	High
4	Bird	*Limnothlypis swainsonii*	Swainson's Warbler	----	Species of Concern	----	High
5	Bird	*Mycteria americana*	Wood Stork	FT	SE	SCC	Highest
6	Mammal	*Corynorhinus rafinesquii*	Rafinesque's Big-eared Bat	----	ST	SCC	Highest
7	Reptile	*Clemmys guttata*	Spotted Turtle	----	ST	SCC	High
8	Mammal	*Myotis austroriparius*	Southeastern Bat	----	ST	SCC	Highest
9	Insect	*Euphyes berryi*	Berry's Skipper	----	----	SCC	----
10	Insect	*Zale perculata*	Okefenokee Zale Moth	----	----	SCC	----
11	Vascular Plant	*Andropogon mohrii*	Mohr's Bluestem	----	----	SCC	----
12	Vascular Plant	*Carex chapmanii*	Chapman’s Sedge	----	----	SCC	High
13	Vascular Plant	*Carex crus-corvi*	Ravenfoot Sedge	----	----	SCC	----
14	Vascular Plant	*Carex elliottii*	Elliott's Sedge	----	----	SCC	Moderate

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
15	Vascular Plant	*Coreopsis integrifolia*	Ciliate-leaf Tickseed	----	----	SCC	High
16	Vascular Plant	*Eupatorium anomalum*	Florida Thorough-wort	----	----	SCC	Moderate
17	Vascular Plant	*Lysimachia loomisii*	Loomis' Loosestrife	----	----	SCC	----
18	Vascular Plant	*Macbridea caroliniana*	Carolina Bird-in-a Nest	----	----	SCC	High
19	Vascular Plant	*Ponthieva racemosa*	Shadow-witch Orchid	----	----	SCC	----
20	Vascular Plant	*Quercus similis*	Bottomland Post Oak	----	----	SCC	Moderate
21	Vascular Plant	*Rhynchospora stenophylla*	Chapman Beakrush	----	----	SCC	----
22	Vascular Plant	*Ruellia strepens*	Limestone Petunia	----	----	SCC	Moderate

Sources: SCDNR (2015a), USFS (2017)

[a] Federal Listing Status: FE = Federally Endangered; FT = Federally Threatened

[b] State Listing Status: SE = State Endangered; ST = State Threatened

[c] USFS Status: SCC = FMNF Species of Conservation Concern

[d] State priority species (SCCN) are assigned one of 3 priorities (Moderate, High, or Highest)

Table 5-7 shows the acreage and percentage of forested swamps and floodplain forests within a 600-foot corridor of each proposed corridor, suggesting the general area of habitat affected that could be occupied by forested wetland associates. The Belle Isle B and C corridors would affect around 370 and 365 acres of this ecosystem, primarily on private or other non-NFS land. A 600-foot corridor of the Jamestown and Charity corridor alternatives would encompass about 350 and 500 acres of forested swamps and floodplain forests, respectively. Both the Charity and Jamestown corridors would affect approximately twice as many acres of forested swamps and floodplain forests on NFS lands as on non-NFS lands. The Belle Isle corridors would both potentially impact approximately 350 acres of forested swamps and floodplain forest, the vast majority of which are crossed by the Belle Isle B and C corridors would be on non-NFS lands.

The construction of the Project could directly affect individuals of FMNF SCC and state-listed species, listed in Table 5-18, via timber harvest that decrease shading of wetlands by trees and structural diversity. Project operations and management could negatively affect individuals through mechanical removal of vegetation and, on non-NFS lands, herbicide application to control non-native invasive plants. however; BMPs and mitigation measures would be used close to water.

Several observations of American swallow-tailed kites occurred in proximity to the proposed Project corridors, in addition to other known occurrences. While no nests were documented, the Project could have long-term, moderate adverse effects on swallow-tailed kites if their nesting habitat is lost due to the permanent conversion of forested wetlands, herbaceous wetlands, and/or grassland ecosystems. Temporary disturbance during the nesting season could have long-term impacts because the species shows strong site fidelity, returning to previously used sites every year. Indirect impacts could occur due to increased grasslands and shrublands providing increased foraging opportunities for great horned owls (*Bubo virginianus*), which are a major predator of swallow-tailed kites (SCDNR 2015t). However, in some upland areas, vegetation clearing for the Project ROW could provide swallow-tailed kites with additional foraging opportunities of beetles, grasshoppers, and other terrestrial insects. Central Electric would consider the locations of suitable nesting when designing the final footprint and avoid these areas to the extent practicable. Central Electric would follow FMNF standard S31 and mitigation measure BR-10 (see Table 4-2), which stipulates no tree removal within 300 feet of active swallow-tailed kite nests from April 1 through June 30, or until fledging is completed. Given this conservation measure, the proposed Project would have long-term, low-intensity impacts on American swallow-tailed kites. Furthermore, per mitigation measure BR-6 (see Table 4-2), raptor and migratory bird surveys will be conducted along and adjacent to the proposed transmission line corridor prior to construction. In the event a nest is located, USFWS will be coordinated with to minimize adverse effects during construction, if avoidance is not possible.

Bald eagles are particularly sensitive to human disturbance during the first few months of their nesting period. If a bald eagle nest or roosting area is located near the preferred alternative, Project construction noise and the permanent conversion of forested areas could result in a long-term, low to moderate impact to the bald eagle, depending upon the proximity of the nest or roost and the time of year. USFWS (2007) recommends constructing utility lines at least 660 feet from active bald eagle nests. No known bald eagle nests are located within 660 feet of any corridor alternative. Although no eagle nest are found within the proposed segments, its habitat does occur, particularly in the bottomland forest and pocosins near the South and North Santee rivers. No bald eagle nests are located within the vicinity of the proposed Charity or Jamestown corridors. There are 3 nests in proximity to the Belle Isle B and C corridors. Bald eagle nest N472-Y2015, the one located 1.6 miles north of the proposed McClellanville Substation, is approximately 2,050 feet from the nearest point of the proposed Belle Isle C. In proximity to the Santee River, bald eagle nest N920-Y2018 is approximately 3,200 feet from the proposed Belle Isle C corridor, and nest N359-Y2018 is approximately 4,175 feet from the proposed Belle Isle B corridor. Although bald eagle territory sizes vary depending on habitat and prey density, they typically encompass 0.6 to 1.2 square miles (Buehler 2000) and thus extend from around 2,300 to 3,250 feet outward from an active nest. The proposed Project alignments in these locations do not traverse suitable foraging habitat (i.e., open water). Also, on NFS lands, Central Electric would follow FMNF standard S25: “Do not permit the helicopter used for firing to pass within 500 vertical feet and 1,000 horizontal feet of active bald eagle nests October through May." Therefore, it is highly unlikely that these 3 bald eagle nests would be adversely affected by any of the proposed Project corridors. As noted above, pre-construction surveys would be performed to identify any potential bald eagle nests and if avoidance is not possible, consultation with USFWS would occur. Otherwise, the indirect and direct effects on bald eagles from the Project would be similar to effects discussed under general wildlife and migratory birds.

The potential Project effects on wood storks are discussed above under *Federally Listed Threatened and Endangered Species*. Project construction would could have moderate, short-term impacts on the species. However, wood stork numbers appear to be increasing in the Project vicinity and preliminary field surveys recorded numerous observations alongside or within the existing transmission line ROW that would share the majority of the proposed Charity corridor. Therefore, the Project would have low-intensity, long-term impacts on the species.

The Rafinesque's big-eared bat is likely to occur in proximity to the proposed corridors, although they were not detected by preliminary surveys. Surveyors did capture several southeastern bats within the proposed Jamestown corridor. These species roost in in cavity trees, but also roost in bridges, and forage forages around forested wetlands. Project construction could impact both species through the removal of roost trees or other forest features that affect the foraging preferences or insect abundance around forested wetlands. Vegetation management within the Project ROW and selective herbicide use during Project operation and maintenance could further reduce habitat quality for both bat species. It is likely, however, that the bat would use other nearby areas to forage and the local population would not be affected. The proposed Project would thus have long-term, moderate impacts to Rafinesque's big-eared bats. If bats are found during pre-construction surveys, Central Electric would consider installing bat houses, in coordination with USFS.

Although not confirmed, the spotted turtle could occur within the proposed segments and has been found on the FMNF. The spotted turtle is sensitive to harm due to off-road vehicles, heavy equipment, horses, and human traffic (USFS 2017). Short-term effects could occur during the clearing and construction of the ROW due to direct mortality. Long-term effects include the conversion of forested wetland habitat to emergent marsh; however, spotted turtles are found in a wide variety of habitat types identified as potential spotted turtle habitat along the proposed Charity corridor and would benefit from more open canopy conditions that allow more sunlight to penetrate forested wetlands (Buhlmann 2019). Because the proposed Project would span wetlands, adverse effects to the spotted turtle would be short-term and low intensity.

Two adult Berry's skippers were observed within the proposed Jamestown ROW and its host plant, pickerelweed, was observed through the proposed ROW. The observed Berry's skippers were foraging on pickerelweed within a wet ditch adjacent to a black gum and bald cypress dome (Ecological Solutions, Inc. 2017b). Project construction could adversely affect pickerelweed, and other plants listed in Table 5-18, through habitat destruction or ground-disturbance that alters hydrology. As described above under *Ecological Conditions,* Central Electric would seek to avoid or minimize any impacts on wetland plant communities.

Suitable habitat for Okefenokee zale moth and its associated host plant, climbing fetterbrush, was observed within the proposed Project ROWs. This includes older cypress gum swamps, where climbing fetterbush grows on pond and bald cypress (USFS 2013b). Effect to the species would be avoided by performing additional surveys of suitable habitat prior to construction of the proposed corridor. During Project operation and maintenance, vegetation management would not be expected to negatively affect the species as long as all label and forest plan standards are followed. Coordinating Project construction with USFS would provide for additional input about any new records of Okefenokee zale moth prior to Project construction.

Six vascular plants listed as FMNF SCC, and closely associated with forested wetlands, could be impacted by the proposed Project corridors. However, there is only occurrences on the FMNF for four of them (Chapman's sedge, ravenfoot sedge, Carolina bird-in-a nest, and limestone petunia); and five documented occurrences of shadow-witch orchid, and an unreported number of bottomland post oak occurrences (USFS 2017). These plants were not observed during preliminary surveys of the Jamestown and Charity corridors (Gaddy 2017, 2018), but additional surveys would be necessary to confirm their absence from the Project area.

Of the 33 FMNF SCC species identified as potentially occurring within the proposed ROW of the alternative corridors on NFS lands, seven species are associated with DC-ECO-7 Narrow Forested Swamps and Blackwater Stream Forests, and DC-ECO-8 Broad Forested Swamps and Large River Floodplain Forests, and include:

- American swallow-tailed kite
- bald eagle
- Rafinesque's big-eared bat
- southeastern bat
- spotted turtle

- monarch butterfly
- Berry's Skipper

Strategies to restore or maintain many forested wetland habitats are similar to strategies described for mesic to wet pine savanna associates, including fire return intervals from 2 to 10 years (USFS 2017). The open canopy conditions created by fire could be partially provided by the ROW via occasional low-intensity prescribed fire, mechanical vegetation management, and/or herbicide (on non-NFS lands), provided that ground disturbance impacts are minimized, and the ROW is monitored for invasive plants.

The forest plan standards and guidelines pertinent to these FMNF SCC species in this ecosystem include:

- S25 – Do not permit the helicopter used for firing to pass within 500 vertical feet and 1,000 horizontal feet of active bald eagle nests October through May.
- S28 – Survey for at-risk bats before buildings, bridges, wells, cisterns and other man-made structures are structurally modified or demolished. If bats are found, then consider installing bat gates and/or erecting bat houses. Once the bat houses are being use, then demolish or replace structures.
- S31 – Conduct no logging within 300 feet of known active American swallow-tailed kite nests from April 1 through June 30 or until fledging is completed. When nests are found in timber removal areas, logging will be coordinated with timber purchasers to protect the kite nesting site. Inactive nest-site trees may be harvested.
- S35- Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species associates and rare communities at desire.
- S37 – Maintain stands meeting criteria for old growth during project planning using the criteria in the Region 8 Old Growth Guidance. Consider the contribution of old growth communities to the future network of small and medium-sized areas of old growth conditions including the full diversity of ecosystems across the landscape.
- S41 – Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species associates and rare communities at desired seasons (growing vs. dormant) and fire return intervals for associated ecosystems.
- G8 – Low-ground pressure equipment, activity suspension or other soil protection measures, such as mats, bridges, woody fill should be used to minimize the

effects of soil compaction, rutting and puddling during activities when saturated or wet soil conditions cannot be avoided. Indicators that may signal caution include the following:

  - The water table is within 18 inches of the surface;
  - Difficulty in walking across the site without compacting, seeing, or hearing surface or groundwaters under foot;
  - The presence of wetland indicator plant species, hydric soils and/or saturated or flooded hydrologic conditions during activity; and
  - Events which flood or saturate soils.

- G9 – Skid trails, log landings, and log ramps should not be located on wet sites, except where necessary. They should be designated only by a forest officer using the following the criteria:
  - Locate permanent log landings on elevated terrain generally at 0.5-mile intervals;
  - Construct log ramps on the best drained sites to facilitate access to log landings from system roads; and
  - The number of log landings will be the minimum needed to harvest any area.
- G31 – Stumps, standing snags, and den trees should be retained during vegetation management activities. Exceptions may be made where necessary to control insects or disease outbreaks or to provide public and employee safety
- G32 – Unpaved system roads should be considered for seasonal to permanent closure to conserve at-risk wildlife species sensitive to road use.
- G34 – Within Swallowed-tail kite habitat, clumps of canopy trees should be retained during timber harvest treatments to provide for current and/or future nesting/roosting needs. Swallowed-tail kite nest trees should be protected from high intensity prescribed fire by implementing protection measures such as raking leaves and woody debris from around the nest tree.
- G35 – Guidelines and recovery objectives in the most up-to-date recovery plan should be implemented for all federally listed species, when available and feasible. If site-specific conditions preclude implementing recovery tasks, consult with the USFWS field office using the appropriate consultation tool. Collaborate with USFWS in the conservation of at-risk species.

The adherence to these FMNF standards and guidelines, in combination with the mitigation measures provided in Table 4-2, would avoid or minimize impacts to the degree that they would be low- to moderate-intensity and not likely adversely affect populations over the long term. Therefore, the proposed action is consistent with the FMNF *Revised Land Managment Plan* by maintaining ecological conditions that support viable populations of FMNF SCC associated with forested wetlands.

Mesic to Wet Pine Savanna Associates—This group of special-status species occurs within wet pine savanna and flatwoods ecosystems, which provides habitat for 26 FMNF SCC or state-listed species potentially occurring within the proposed Project corridors. This includes the federally threatened frosted flatwoods salamander and endangered red-cockaded woodpecker. One mesic to wet pine savanna associate was observed during preliminary field surveys of the proposed corridors on NFS lands, including:

- Red-cockaded woodpecker

Project effects on red-cockaded woodpeckers are discussed above under *Federally Listed Threatened and Endangered Species.* Table 5-19 shows 29 additional FMNF SCC or state-listed species that the Project could affect, based on South Carolina Heritage Trust (2018) and USFS (2018c) records suggesting their likely presence in the vicinity of the proposed corridors.

Table 5-19: FMNF SCC and State-Listed Species Associated with Mesic to Wet Pine Savannas

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
1	Bird	*Picoides borealis*	Red-cockaded Woodpecker	FE	SE	SCC	Highest
2	Bird	*Aimophila aestivalis*	Bachman's Sparrow	----	Species of Concern	SCC	Highest
3	Amphibian	*Ambystoma cingulatum*	Frosted Flatwoods Salamander	FT	SE	SCC	Highest
4	Amphibian	*Lithobates capito*	Carolina Gopher Frog	----	SE	SCC	Highest
5	Amphibian	*Pseudobranchus striatus*	Broad-striped Dwarf Siren	----	ST	SCC	Highest
6	Reptile	*Crotalus adamanteus*	Eastern Diamondback Rattlesnake	----	ST	SCC	Highest
7	Vascular Plant	*Asclepias pedicillata*	Savanna Milkweed	----	----	SCC	----
8	Vascular Plant	*Agalinis aphylla*	Coastal Plain False-Foxglove	----	----	SCC	Moderate
9	Vascular Plant	*Anthaenantia rufa*	Purple Silkyscale	----	----	SCC	----
10	Vascular Plant	*Calopogon barbatus*	Bearded Grass-pink	----	----	SCC	----
11	Vascular Plant	*Calopogon multiflorus*	Many-flower Grass-	----	----	SCC	Moderate

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
			pink				
12	Vascular Plant	*Carex stricta*	Tussock Sedge	----	----	SCC	Moderate
13	Vascular Plant	*Chasmanthium nitidum*	Shiny Spikegrass	----	----	SCC	High
14	Vascular Plant	*Cladium mariscoides*	Twig-rush	----	----	SCC	Moderate
15	Vascular Plant	*Eryngium aquaticum var. ravenelii*	Ravenel's Eryngium	----	----	SCC	Moderate
16	Vascular Plant	*Lachnocaulon minus*	Small's Bog Button	----	----	SCC	Moderate
17	Vascular Plant	*Ludwigia lanceolate*	Lance-leaf Seedbox	----	----	SCC	High
18	Vascular Plant	*Lysimachia hybrida*	Lance-leaf Loosestrife	----	----	SCC	Moderate
19	Vascular Plant	*Platanthera integra*	Yellow Fringeless Orchid	----	----	SCC	Moderate
20	Vascular Plant	*Rhynchospora breviseta*	Short-bristle Baldrush	----	----	SCC	Moderate
21	Vascular Plant	*Rhynchospora cephalantha var. attenuata*	Small bunched Beaksedge	----	----	SCC	----
22	Vascular Plant	*Rhynchospora oligantha*	Few-flowered Beakrush	----	----	SCC	----
23	Vascular Plant	*Rhynchospora globularis var. pinetorum*	Beakrush	----	----	SCC	Moderate
24	Vascular Plant	*Sporobolus curtisii*	Pineland Dropseed	----	----	SCC	High
25	Vascular Plant	*Sporobolus pinetorum*	Carolina Dropseed	----	----	SCC	High
26	Vascular Plant	*Xyris brevifolia*	Short-leaved Yellow-eyed Grass	----	----	SCC	Moderate
27	Vascular Plant	*Xyris flabelliformis*	Savannah Yellow-eyed Grass	----	----	SCC	Moderate
28	Vascular Plant	*Xyris stricta*	Pineland Yellow-eyed Grass	----	----	SCC	Moderate
29	Vascular Plant	*Agrimonia incisa*	Incised Groovebur	----	----	SCC	High
30	Vascular Plant	*Plapntago sparsiflora*	Pineland Plantain	----	----	SCC	High

Sources: SCDNR (2015a), USFS (2017)

[a] Federal Listing Status: FE = Federally Endangered; FT = Federally Threatened

[b] State Listing Status: SE = State Endangered; ST = State Threatened

[c] USFS Status: SCC = FMNF Species of Conservation Concern

[d] State priority species (SCCN) are assigned one of 3 priorities (Moderate, High, or Highest)

Table 5-7 shows the acreage and percentage of wet pine savanna and flatwoods ecosystems within a 600-foot corridor of each proposed corridor, suggesting the general area of habitat that could be occupied by mesic to wet pine savanna associates. The Belle Isle B and C corridors would affect around 200 and 145 acres of this ecosystem, respectively, of which about 45 and 5 acres would be on NFS lands. A 600-foot corridor of the proposed Jamestown corridor would encompass just over 1,000 acres of wet pine savanna and flatwoods ecosystems; the Charity corridor would encompass just over 1,100 acres. For both corridors, approximately 70 percent, or 725 and 800 acres, of the affected acres occur on NFS lands. As a percentage of the total 600-foot corridor of the Jamestown and Charity corridors, wet pine savanna and flatwoods would comprise about 40 percent and 35 percent, respectively. This is twice the area of any other ecosystem potentially affected by these two corridors.

Rare species of amphibians and reptiles that could be affected within this ecosystem are found using seasonal isolated wetlands that are characterized by relatively open tree canopy, grass-dominated basins, and have a history of being maintained by wildfire during the growing season. Such habitat conditions are rare, largely due to a history of fire suppression, or winter-only fire, logging, agriculture, and draining of wetlands. Short-term effects of the Project could occur during the clearing and construction of the ROW due to direct mortality. Long-term effects include the conversion of forested wetland habitat to emergent marsh.

No special-status amphibians or reptile associated with this ecosystem were encountered during preliminary surveys of the proposed corridors. In general, in order to conserve amphibians and reptiles within wet pine savanna and flatwoods ecosystems, management to maintain open, sparse canopy forests that also support red-cockaded woodpeckers is preferable to closed canopy pine/hardwood forest. However, tree removal and Project construction could also reduce water quality and alter hydrology due to rutting by heavy equipment, or lead to soil compaction, if conducted during wet periods. Thus, Central Electric would seek to avoid construction during wet periods and would minimize ground disturbance as much as possible within wet pine savanna and flatwoods ecosystems.

Twenty-one vascular plants listed as FMNF SCC could be impacted by the proposed Project corridors where they intersect mesic to wet pine savanna ecosystems. However, there are only known occurrences on the FMNF for seven of them (Coastal Plain False-foxglove, Purple Silkyscale, Many-flower Grass-pink, Lance-leaf Loosestrife, Yellow Fringeless Orchid, Short-bristle Baldrush, Carolina Dropseed), five documented occurrences of shadow-witch orchid, and an unreported number of bottomland post oak occurrences (USFS 2017). These plants were not observed during preliminary surveys of the Jamestown and Charity corridors (Gaddy 2017, 2018) and additional surveys would be necessary to confirm their absence from the Project area. Measures to avoid or minimize impacts on these at-risk plants include pre-construction surveys and mitigation measures listed in Table 4-2.

Of the 33 FMNF SCC species identified as potentially occurring within the proposed ROW of the alternative corridors on NFS lands, 14 species are associated with DC-ECO-3 Wet Pine Savanna and Flatwoods, and include:

- broad-striped dwarf siren
- Carolina gopher frog
- eastern diamondback rattlesnake
- coastal plain false-foxglove
- Elliott's bluestem
- purple silkyscale
- many-flower grass-pink
- lance-leaf loosestrife
- pineland plantain
- yellow fringeless orchid
- short-bristle baldrush
- few-flowered beakrush
- Carolina dropseed short-leaved
- yellow-eyed grass

For these species, upland longleaf and loblolly pine savanna that contain relatively wide-spaced, mature trees, and a diverse herbaceous groundcover are maintained by growing season fires to promote diverse groundcover and keep young pines and scrub oaks from establishing. Thus, the FMNF objectives and management strategies to manage habitat for these species include: OBJ-ECO-2 Frequent Prescribed Fire for Ecosystem Maintenance or Restoration, OBJ-ECO-3 Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems, OBJ-ECO-4 Pond Cypress Savannas and Carolina bays, and OBJ-SCC-3 At-Risk Species.

The forest plan standards and guidelines pertinent to these FMN SCC species in this ecosystem include:

- S26 – No firelines, temporary roads, or log landings in population sites for at-risk plant species, except as needed to protect facilities, private property, or public safety.
- S29 – Do not issue forest product permits for collection of carnivorous plants, orchids, or at-risk plant species unless for scientific and educational purposes and approved by a forest or district biologist/botanist.
- S30 – Use only aquatically labeled herbicides and surfactants within designated critical habitat for frosted flatwoods salamander and known habitat for Carolina gopher frog.
- S34 – Require equipment cleaning practices on equipment, using equipment cleaning clauses in contracts, permits, and agreements, when moving equipment from areas infested within non-native invasive species (FSM 2903).
- S35 – No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species.
- S36 – Use plant materials that contain genetically appropriate native plant species when maintaining and restoring vegetation. Use of non-native plants is allowed only when in compliance with USFS native plant policy (FSM 2070).
- S37 – Maintain stands meeting criteria for old growth during project planning using criteria in the Region 8 Old Growth Guidance. Consider the contribution of old growth communities to the future network of small- and medium-sized areas of old growth conditions including the full diversity of ecosystems across the landscape.
- S39 – Use low-psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites.
- S40 – Do not use soil active herbicides (imazapyr, imazapic) in population sites for at-risk plant species.
- S41 – Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species associates and rare communities at desired seasons (growing vs. dormant) and fire return intervals for associated ecosystems.
- G8 – Low ground pressure equipment, activity suspension or other soil protection measures, such as mats, bridges, or woody fill should be used to minimize the

effects of soil compaction, rutting, and puddling during activities when saturated or wet soil conditions cannot be avoided. Indicators that may signal caution include the following:

  - The water table within 18 inches of the surface;
  - Difficulty in walking across the site without compacting, seeing or hearing surface or groundwaters under foot;
  - The presence of wetland indicator plant species, hydric soils, and/or saturated or flooded hydrologic conditions during activity; and
  - Events which flood or saturate soils.

- G9 – Skid trails, log landings, and log ramps should not be located on wet sites, except where necessary. They should be designated only by a forest officer using the following the criteria:
  - Locate permanent log landings on elevated terrain generally at 0.5-mile intervals;
  - Construct log ramps on the best drained sites to facilitate access to log landings from system roads; and
  - The number of log landings will be the minimum needed to harvest any area.
- G31 – Stumps, standing snags, and den trees should be retained during vegetation management activities. Exceptions may be made where necessary to control insects or disease outbreaks or to provide public and employee safety
- G32 – Unpaved system roads should be considered for seasonal to permanent closure to conserve at-risk wildlife species sensitive to road use.
- G35 – Guidelines and recovery objectives in the most up-to-date recovery plan should be implemented for all federally listed species, when available and feasible. If site-specific conditions preclude implementing recovery tasks, consult with the USFWS field office using the appropriate consultation tool. Collaborate with USFWS in the conservation of at-risk species.
- G40 – Encourage use of weed-free materials to limit the introduction and spread of non-native invasive plant species.
- G41 – Commercially purchased seed mixes should be tested by a certified seed laboratory for purity, viability, and non-native invasive plant seed.

The adherence to these FMNF standards and guidelines, in combination with the mitigation measures provided in Table 4-2, would avoid or minimize impacts to the degree that they would be low- to moderate-intensity and would not likely adversely affect populations in mesic to wet pine savannas over the long term. Therefore, the proposed action is consistent with the FMNF *Revised Land Managment Plan* by maintaining ecological conditions that support viable populations of FMNF SCC associated with mesic to wet pine savannas.

Pond Cypress Savanna Associates—Most species associated with depressional wetlands and Carolina bays are maintained where there is open canopy and abundant herbaceous groundcover due to periodic disturbance and are threatened by the lack of frequent prescribed fire, succession by woody species, and in some cases, illegal ATV use (USFS 2013b). SCDNR lists pond cypress savannas as noteworthy plant communities. Although these areas dry out during low rainfall periods, they provide crucial habitat to numerous amphibians and reptiles, and provide high-quality foraging and roosting habitat for bats. In addition, depressional wetlands and Carolina bays provide suitable habitat for populations of the federally listed as endangered pondberry and Canby's dropwort, discussed above under *Federally Listed Threatened and Endangered Species*.

The pond cypress savanna associates found during preliminary field surveys of the proposed corridor alternatives include:

- Spotted turtle
- Elliott's bluestem

Table 5-20 shows 19 additional FMNF SCC or state-listed species that the Project could affect, based on South Carolina Heritage Trust (2018) and USFS (2018c) records suggesting their likely presence in the vicinity of the proposed corridor alternatives.

Table 5-20: FMNF SCC and State-Listed Species Associated With Pond Cypress Savanna

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
1	Amphibian	*Ambystoma cingulatum*	Frosted Flatwoods salamander	FT	SE	SCC	Highest
2	Amphibian	*Lithobates capito*	Carolina Gopher frog	----	SE	SCC	Highest
3	Amphibian	*Pseudobranchus striatus*	Broad-striped Dwarf Siren	----	ST	SCC	Highest
4	Amphibian	*Ambystoma tigrinum*	Eastern Tiger Salamander	----	Species of Concern	----	Highest
5	Reptile	*Nerodia floridana*	Florida Green Watersnake	----	Species of Concern	----	Highest

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
6	Reptile	*Clemmys guttata*	Spotted Turtle	----	ST	SCC	High
7	Bird	*Setophaga virens waynei*	Black-throated Green Warbler (Wayne's)	----	Species of Concern	----t	Highest
8	Vascular Plant	*Andropogon gyrans var. stenophyllus*	Elliott's Bluestem	----	----	SCC	Moderate
9	Vascular Plant	*Anthaenantia rufa*	Purple Silkyscale	----	----	SCC	----
10	Vascular Plant	*Burmannia biflora*	Northern Burmannia	----	----	SCC	----
11	Vascular Plant	*Helenium pinnatifidum*	Southeastern Sneezeweed	----	----	SCC	----
12	Vascular Plant	*Lindera melissifolia*	Pondberry	FE		SCC	Highest
13	Vascular Plant	*Lobelia boykinii*	Boykin's Lobelia	----	----	SCC	Moderate
14	Vascular Plant	*Myriophyllum laxum*	Piedmont Water-Milfoil	----	----	SCC	High
15	Vascular Plant	*Oxypolis canbyi*	Canby's Dropwort	FE		SCC	Highest
16	Vascular Plant	*Rhynchospora harperi*	Harper Beakrush	----	----	SCC	Moderate
17	Vascular Plant	*Rhynchospora pleiantha*	Brown Beakrush	----	----	SCC	High
18	Vascular Plant	*Rhynchospora scirpoides*	Long-beaked Beaksedge	----	----	SCC	Moderate
19	Vascular Plant	*Spiranthes laciniata*	Lace-lip Ladies'-Tresses	----	----	SCC	Moderate
20	Vascular Plant	*Utricularia macrorhiza*	Greater Bladderwort	----	----	SCC	----
21	Vascular Plant	*Xyris difformis var. floridana*	Florida yellow-eyed Grass	----	----	SCC	----

Sources: SCDNR (2015a), USFS (2017)

[a] Federal Listing Status: FE = Federally Endangered; FT = Federally Threatened

[b] State Listing Status: SE = State Endangered; ST = State Threatened

[c] USFS Status: SCC = FMNF Species of Conservation Concern

[d] State priority species (SCCN) are assigned one of 3 priorities (Moderate, High, or Highest)

Table 5-17 shows the acreage and percentage of depressional wetlands and Carolina bay ecosystems within a 600-foot corridor of each proposed corridor alternative, suggesting the general area of habitat affected that could be occupied by pond cypress savanna associates. The Belle Isle B and C corridors would affect less than 1 acre of this ecosystem, so impacts would be minimal. Depression wetlands, including cypress and gum ponds, pocosin and pond pine woodlands, and pond cypress savannas, were observed throughout the proposed Jamestown and Charity corridor alternatives. A 600-foot corridor of the Jamestown and Charity corridors would encompass approximately

110 and 210 acres of depressional wetlands and Carolina bay ecosystems, respectively. Of that, the majority (70 and 160 acres, respectively) would be on NFS lands.

The construction of the Project could directly affect individuals of FMNF SCC and state-listed species, listed in Table 5-20, via timber harvest and the use of heavy equipment. The clearing of a ROW for the Project would open the forest, allowing these habitats to become more productive and potentially benefit amphibian and reptiles. BMPs and mitigation measures would be implemented to avoid or minimize impacts (see Section 4.4). These practices include storing construction equipment, fuels, chemicals, and materials outside of wetlands, and using construction mats over wetland areas to avoid vehicle rutting and minimize soil compaction. Project operations and management could negatively affect individuals through mechanical removal of vegetation and herbicide application (on non-NFS lands) to control non-native invasive plants. However, implementation of BMPs would minimize any adverse effects, and the maintenance of an open ROW would benefit pond cypress savannah associates by maintaining an open canopy and reducing woody shrubs and small trees.

Of the 33 FMNF SCC species identified as potentially occurring within the proposed ROW of the alternative corridors on NFS lands, 7 species are associated with DC-ECO-4 Depressional Wetlands and Carolina Bays, and include:

- broad-striped dwarf siren
- Carolina gopher frog
- spotted turtle
- Elliott’s bluestem
- northern burmannia
- southern sneezeweed
- Boykin’s lobelia
- harper beakrush
- brown beakrush
- Long-beaked beaksedge
- Florida yellow-eyed grass

The forest plan standards and guidelines pertinent to these FMN FSCC species in this ecosystem include:

- S26 – No firelines, temporary roads, or log landings in population sites for at-risk plant species, except as needed to protect facilities, private property, or public safety.
- S30 – Use only aquatically labeled herbicides and surfactants within designated critical habitat for frosted flatwoods salamander and known habitat for Carolina gopher frog.
- S34 – Require equipment cleaning practices on equipment, using equipment cleaning clauses in contracts, permits, and agreements, when moving equipment from areas infested with non-native invasive plants (FSM 2903).
- S35 – No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species.
- S36 – Use plant materials that contain genetically appropriate native plant species when maintaining and restoring vegetation. Use of non-native plants is allowed only when in compliance with USFS native plant policy (FSM 2070).
- S37 – Maintain stands meeting criteria for old growth during project planning using the criteria in the Region 8 Old Growth Guidance. Consider the contribution of old growth communities to the future network of small- and medium-sized areas of old growth conditions including the full diversity of ecosystems across the landscape.
- S39 – Use low-psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites.
- S40 – Do not use soil-active herbicides (imazapyr, imazapic) in population sites for at-risk plant species.
- S41 – Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species associates and rare communities at desired seasons (growing vs. dormant) and fire return intervals for associated ecosystems.
- G8 – Low ground pressure equipment, activity suspension or other soil protection measures, such as mats, bridges, or woody fill should be used to minimize the effects of soil compaction, rutting, and puddling during activities when saturated

or wet soil conditions cannot be avoided. Indicators that may signal caution include the following:

  - o The water table within 18 inches of the surface;
  - o Difficulty in walking across the site without compacting, seeing, or hearing surface or groundwaters under foot;
  - o The presence of wetland indicator plant species, hydric soils and/or saturated or flooded hydrologic conditions during activity; and
  - o Events which flood or saturate soils.

- G9 – Skid trails, log landings, and log ramps should not be located on wet sites, except where necessary. They should be designated only by a forest officer using the following the criteria:
  - o Locate permanent log landings on elevated terrain generally at 0.5-mile intervals;
  - o Construct log ramps on the best drained sites to facilitate access to log landings from system roads; and
  - o The number of log landings will be the minimum needed to harvest any area.
- G32 – Unpaved system roads should be considered for seasonal to permanent closure to conserve at-risk wildlife species sensitive to road use.
- G35 – Guidelines and recovery objectives in the most up-to-date recovery plan should be implemented for all federally listed species, when available and feasible. If site-specific conditions preclude implementing recovery tasks, consult with the USFWS field office using the appropriate consultation tool. Collaborate with USFWS in the conservation of at-risk species.
- G40 – Encourage use of weed-free materials to limit the introduction and spread of non-native invasive plant species.
- G41 – Commercially purchased seed mixes should be tested by a certified seed laboratory for purity, viability, and non-native invasive plant seed.

Adherence to these FMNF standards and guidelines, in combination with the mitigation measures provided in Table 4-2, would avoid or minimize impacts to the degree that they would be low-intensity and would not likely adversely affect populations of pond cypress savanna associates. Therefore, the proposed action is consistent with the FMNF *Revised Land Managment Plan* by maintaining ecological conditions that support viable populations of FMNF SCC associated with pond cypress savanna ecosystems.

Calcareous Mesic Hardwood Associates—Several at-risk plants are associated with high-calcium soils that support mesic slope forests and river floodplain forests. This ecosystem is not crossed by the proposed Jamestown or Charity corridors and is crossed by only 14 and 1 acres of the proposed Belle Isle B and C corridors, respectively. During preliminary field surveys of the proposed corridor alternatives on NFS lands, Central Electric found no occurrences of these calcareous mesic hardwood associates that are listed as FMNF SCC or by the state. However, Table 5-21 lists nine vascular plants that the Project could affect, based on South Carolina Heritage Trust (2018) and USFS (2018c) records suggesting their likely presence in the vicinity of the proposed corridor alternatives.

Table 5-21: FMNF SCC and State-Listed Species Associated With Calcareous Mesic Hardwoods

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
1	Vascular Plant	*Asplenium resiliens*	Black-stem Spleenwort	----	----	SCC	Moderate
2	Vascular Plant	*Carex basiantha*	Widow Sedge	----	----	SCC	No
3	Vascular Plant	*Carex granularis*	Meadow Sedge	----	----	SCC	No
4	Vascular Plant	*Carya myristiciformis*	Nutmeg Hickory	----	----	SCC	No
5	Vascular Plant	*Listera australis*	Southern Twayblade	----	----	SCC	No
6	Vascular Plant	*Matelea flavidula*	Yellow Carolina Spinypod	----	----	SCC	No
7	Vascular Plant	*Tridens chapmanii*	Chapman’s Redtop	----	----	SCC	No
8	Vascular Plant	*Triphora trianthophora*	Threebirds Orchid	----	----	SCC	Moderate
9	Vascular Plant	*Matelea flavidula*	Yellow Carolina Milkvine	----	----	SCC	No

Sources: SCDNR (2015a), USFS (2017)

[a] Federal Listing Status: FE = Federally Endangered; FT = Federally Threatened

[b] State Listing Status: SE = State Endangered; ST = State Threatened

[c] USFS Status: SCC = FMNF Species of Conservation Concern

[d] State priority species (SCCN) are assigned one of 3 priorities (Moderate, High, or Highest)

Of the 33 FMNF SCC species identified as potentially occurring within the proposed ROW of the alternative corridors on NFS lands, 1 species is associated with DC-ECO-6 Oak and Mesic Hardwood Forest:

- shadow-witch orchid

The forest plan standards and guidelines pertinent to these FMN SCC species in this ecosystem include:

- S26 – No firelines, temporary roads, or log landings in population sites for at-risk plant species, except as needed to protect facilities, private property, or public safety.
- S29 – Do not issue forest product permits for collection of carnivorous plants, orchids, or at-risk plant species unless for scientific and educational purposes and approved by a forest or district biologist/botanist.
- S34 – Require equipment cleaning practices on equipment, using equipment cleaning clauses in contracts, permits, and agreements, when moving equipment from areas infested with non-native invasive plants (FSM 2903).
- S35 – No new permanent roads, trails, or recreational sites are allowed in rare plant communities and population sites for at-risk plant species.
- S36 – Use plant materials that contain genetically appropriate native plant species when maintaining and restoring vegetation. Use of non-native plants is allowed only when in compliance with USFS native plant policy (FSM 2070).
- S37 – Maintain stands meeting criteria for old growth during project planning using criteria in the Region 8 Old Growth Guidance. Consider the contribution of old growth communities to the future network of small- and medium-sized areas of old growth conditions including the full diversity of ecosystems across the landscape.
- S39 – Use low-psi ground pressure logging equipment when operating in these ecosystems and special areas: depressional wetlands, Carolina bays, pocosins, and at-risk plants population sites.
- S40 – Do not use soil-active herbicides (imazapyr, imazapic) in population sites for at-risk plant species.
- S41 – Within Management Area 1, prescribe burn habitat for fire-adapted at-risk species associates and rare communities at desired seasons (growing vs. dormant) and fire return intervals for associated ecosystems.
- G40 – Encourage use of weed-free materials to limit the introduction and spread of non-native invasive plant species.
- G41 – Commercially purchased seed mixes should be tested by a certified seed laboratory for purity, viability, and non-native invasive plant seed.

Application of these FMNF standards and guidelines, in combination with the mitigation measures provided in Table 4-2, would avoid or minimize impacts to the degree that they would be low-intensity and would not likely adversely affect populations of calcareous mesic hardwood associates. Furthermore, the potentially impacted habitat only occurs on the proposed Belle Isle corridors. Therefore, the proposed action would be consistent with the FMNF *Revised Land Managment Plan* by maintaining ecological conditions that support viable populations of FMNF SCC associated with calcareous mesic hardwood ecosystems.

River and Stream Associates—The FMNF SCC or state-listed Species of Concern associated with rivers and streams crossed by the proposed corridor alternatives that were found during preliminary field surveys include:

- wood stork
- bald eagle
- wood stork
- spotted turtle
- American eel

Table 5-22 shows an additional eight FMNF SCC or state-listed species that the Project could affect, based on South Carolina Heritage Trust (2018) and USFS (2018c) records suggesting their likely presence in the vicinity of the proposed corridor alternatives. Project effects on wood stork, West Indian manatee, shortnose sturgeon, and Atlantic sturgeon are discussed above under *Federally Listed Threatened and Endangered Species*. Bald eagle and spotted turtle are also discussed previously in this section under *Forested Wetland Associates*.

Table 5-22: FMNF SCC and State-Listed Species Associated with Rivers and Streams

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
1	Bird	*Egretta caerulea*	Little Blue Heron	----	Species of Concern	SCC	Highest
2	Bird	*Mycteria americana*	Wood Stork	FT	SE	SCC	Highest
3	Bird	*Haliaeetus leucocephalus*	Bald Eagle	----	ST	SCC	High
4	Mammal	*Trichechus manatus*	West Indian Manatee	FT	----	SCC	Highest
5	Amphibian	*Acris crepitans*	Northern Cricket Frog	----	Species of Concern	----	Moderate

#	Taxonomic Group	Scientific Name	Common Name	Federal Listing Status[a]	State Listing Status[b]	USFS Status[c]	State Priority[d]
6	Reptile	*Clemmys guttata*	Spotted Turtle	----	ST	SCC	High
7	Fish	*Anguilla rostrata*	American Eel	----	----	SCC	Highest
8	Fish	*Acipenser brevirostrum*	Shortnose Sturgeon	FE	SE	SCC	Highest
9	Fish	*Acipenser oxyrinchus*	Atlantic Sturgeon	FE	SE	SCC	Highest
10	Fish	*Alosa sapidissima*	American Shad	----	Species of Concern	----	Highest
11	Fish	*Alosa aestivalus*	Blueback Herring	----	Species of Concern	----	Highest
12	Fish	*Elassoma boehlkei*	Carolina Pygmy Sunfish	----	Species of Concern	----	Highest
13	Fish	*Alosa mediocris*	Hickory Shad	----	Species of Concern	----	Highest

Sources: SCDNR (2015a), USFS (2017)

[a] Federal Listing Status: FE = Federally Endangered; FT = Federally Threatened

[b] State Listing Status: SE = State Endangered; ST = State Threatened

[c] USFS Status: SCC = FMNF Species of Conservation Concern

[d] State priority species (SCCN) are assigned one of 3 priorities (Moderate, High, or Highest)

The Charity corridor alternative would have the greatest number of river and stream crossings, and the Jamestown corridor alternative would have the fewest, as identified by the National Hydrography Dataset (USGS 2010). The Belle Isle B and C corridor alternatives would both cross the North and South Santee rivers, which are periodically inhabited by the West Indian manatee; northern cricket frog; and all fishes listed in Table 5-22, except the Carolina pygmy sunfish. The wood stork, bald eagle, and little blue heron all use the North and South Santee rivers as flight corridors, and the Santee River Delta is important foraging habitat for them. The spotted turtle likely does not occur in the Santee River, but is found in swamps, bogs and marshes, and small streams, which are crossed by all proposed corridor alternatives.

The American eel is the only FMNF state-listed species found during electrofishing surveys of streams and other waterbodies on NFS lands, along the proposed Jamestown and Charity corridor alternatives. It is assumed, however, that many species were not detected, and the potential exists for other aquatic FMNF SCC or state-listed fish to occur within the proposed corridor alternatives. The proposed Project would span wetlands, rivers, and streams; thus, long-term adverse effects to some species listed in Table 5-22 would be limited to the conversion of forested wetland habitat to emergent marsh within the proposed ROW. Short-term, low-intensity impacts could occur to all species listed in Table 5-22 during construction if new access roads are constructed or culverts are installed at stream crossings. Construction activities could result in the direct mortality of a limited number of individual amphibians or turtles. Most fish would avoid the area and only experience impacts from increased sedimentation.

The proposed Project would not require any instream work, and BMPs would be implemented during construction and maintenance to avoid or minimize potential impacts (see Section 4.4). BMPs would include storing equipment, fuels, and chemicals outside of surface waters; placing silt fences and other appropriate prevention devices along all stream crossings; developing a stormwater pollution prevention plan prior to construction; developing a hazardous materials management and spill prevention plan and emergency response plan to deal with accidental spills; promptly cleaning up spilled material to prevent it from entering surface waters; and avoiding stockpiles of excavated materials near or on stream banks or other waterway perimeters unless protected from high water or stormwater runoff. BMPs would limit soil erosion and runoff; sedimentation; water quality changes; or contamination of water from herbicides, fuels, and other spills that could harm aquatic species. Furthermore, culverts and other drainage structures would be designed and installed so as not to inhibit fish passage or create upstream or downstream habitat changes. Effects related to installation of water crossing structures would be short term and of low intensity. To avoid or minimize adverse impacts, Central Electric would establish a 30-foot upland buffer area adjacent to all intermittent and perennial streams and at all jurisdictional wetlands. Appropriate soil erosion and sedimentation controls would be established at streambank boundaries. Therefore, the proposed action would be consistent with the FMNF *Revised Land Managment Plan* by maintaining ecological conditions that support viable populations of FMNF SCC associated with river and stream ecosystems.

Wildlife, Including Neotropical Birds

Impacts from Project Construction—The proposed Project corridors would cross a variety of different habitat areas used by a diverse assemblage of wildlife species. The proposed Belle Isle B and C corridor alternatives would affect a substantially smaller area than the Jamestown and Charity corridors, as the length of the Belle Isle B corridor (16.3 miles) and Belle Isle C corridor (15.6 miles) corridors would be approximately two-thirds the length of the Jamestown corridor (25.8 miles) and half that of the Charity corridor (31.0 miles).

The primary long-term effect from Project construction would be the permanent conversion of forested upland and wetland habitat to grassland or shrub habitat. Grassland and early successional areas, and the wildlife species that rely on them, may be temporarily disturbed during Project construction, but would likely return following Project construction. Project effects on wildlife that use grassland and early successional areas would be short-term and low in intensity. Central Electric would establish a 30-foot no-disturbance buffer around all streams and wetlands to retain riparian habitat.

Species dependent on forested habitat types would experience a permanent loss of habitat within the ROW, resulting in a long-term, low to moderate impact to wildlife. Wildlife species that rely on forested vegetation could lose cover, and nesting and foraging habitat, and be replaced by early successional wildlife species. Forest conversion could lead to an increased likelihood of starvation and an increased likelihood of predation due to an increase in songbird predators and a reduction in protective covering (DeGregorio et al. 2014). For example, forested swamps and floodplain forests are important habitat for many bird species during the critical over-wintering period. However, the removal of forested habitat for the Project ROWs would provide a potential reservoir of grassland and shrubland habitat for wildlife species, especially birds that breed in this habitat type (King and Byers 2002). Several species of grassland birds in need of conservation, such as the state-threatened common ground-dove and other State Species of Concern, including the barn owl, loggerhead shrike (SCDNR 2015g), and mammals such as the meadow vole would potentially benefit from increased early successional habitats. Some forested areas that are cleared during construction would be quickly revegetated with dense shrubs and young trees, which would benefit species that prefer woodland margins and shrub thickets, such as eastern towhee, field sparrow, northern bobwhite, and state Species of Concern such as the painted bunting. In addition, some raptors would likely have increased foraging habitat in areas where forested habitats are converted to low-growing vegetation, including state Species of Concern such as the barn owl.

Short-term effects from Project construction on wildlife species would include temporary disturbance within and near the transmission ROW during construction and line maintenance due to human intrusion, noise, and construction activity. Project-related effects would be largely short-term, of low to moderate intensity, and typically limited to the construction period and times when workers and equipment are regularly present.

Construction noise and noise from other human activity can result in a variety of effects to wildlife species, including displacement from occupied habitats, interference with hearing ability in songbirds and mating and alarm calls in amphibians and ground squirrels, and disruption of raptor foraging activities (Madsen 1985, Van der Zande et al. 1980, Fyfe and Olendorff 1976). The effects of temporarily elevated noise levels can range from mild disturbance to severe auditory damage or death. Percussive sounds such as those typically involved with installation of piling or with blasting are typically the loudest construction-related sounds. The proposed Project is not expected to require piling or blasting.

Noise levels would be elevated within the Project corridor during the installation of transmission structures, but the sound levels would decrease to ambient conditions within a relatively short distance from the construction area. Some temporary displacement of wildlife from otherwise usable habitat would likely occur in the immediate vicinity of construction sites during the construction period. The degree of displacement would generally be proportional to the change in noise levels and the type of activity. If wildlife species were temporarily displaced at a critical time, such as during the breeding season, it could result in effects to reproductive success. For this reason, temporary construction-related noise effects would be expected to have a short-term, moderate effect on wildlife species.

Operation of heavy equipment and vegetation removal activities could result in direct mortality of less mobile species of wildlife that are present in the Project ROW. Larger, more mobile species that are able to leave the area, such as birds and medium and large mammals, would probably do so. Small mammals, amphibians, and reptiles that typically retreat to shallow burrows or other hiding places to escape danger would be most likely to suffer direct mortality. Additionally, wildlife species could fall into holes that have been drilled for structure placement. Holes are typically not left open with direct imbedded poles; however, when foundations are required, Central Electric would mark holes drilled for foundations that are left unattended overnight and would secure the area with temporary fencing to reduce the potential for livestock and wildlife to enter the holes, and for public safety (see Table 4-2, BR-2).

Potential, temporary effects on raptors and waterfowl species may occur during construction of the proposed Project. Habitat disturbance or alteration, human disturbance, and collisions with transmission lines or equipment during construction could affect some individuals. Foraging areas for these species would be temporarily disturbed during ROW clearing and general construction activities. Effects on foraging areas due to construction activities would be short term and of low to moderate intensity. During ROW clearing and preparation, habitat loss may occur for grassland and forest bird species, causing temporary displacement of local populations. When construction is completed, grassland species would be expected to return to the area as grassland is restored and construction disturbance ceases. Therefore, effects related to temporary habitat loss and displacement for grassland species would be short term and of low to moderate intensity. Forest-dwelling species would likely move into neighboring forested areas adjacent to the ROW during construction and operation of the line. Species dependent on woodland habitat would experience a permanent loss of habitat within the ROW. Effects related to permanent loss of forest habitat would be long term and of moderate intensity. Per mitigation measure BR-6 (see Table 4-2), Central Electric would conduct raptor and migratory bird surveys along and adjacent to the proposed transmission line corridor prior to construction, and in the event a nest is located, Central Electric would coordinate with USFWS to minimize adverse effects during construction, if avoidance is not possible.

Preliminary electrofishing surveys performed for the proposed Jamestown and Charity corridors provide a fairly robust snapshot of the general fish community of the waterbodies that could be impacted by the Project (Three Oaks Engineering 2017, 2018). However, each waterbody crossed by the proposed alignments likely contains a number of other fish species that were not detected during the preliminary one-time field surveys, as time of year and water levels influence species detection; thus, when considering the Project effects on the fish community, the complete list of species (Appendix B) found during the effort should be considered rather than simply focusing on the species list at a particular crossing.

Impacts from Project Operations and Maintenance—Operation of the proposed Project would present the potential for avian collisions with the transmission line, particularly for larger, less maneuverable species and in areas of dense bird congregations, such as the Santee Coastal Reserve and FMNF Important Bird Areas. The proposed Belle Isle B and C corridor alternatives would cross the North and South Santee rivers upstream of the Santee Coastal Reserve Important Bird Area; both the Jamestown and Charity alternatives would cross the FMNF Important Bird Area. The lands surrounding the proposed Project provide foraging, nesting, and wintering habitat to waterfowl, wading birds, and other bird species. Avian collisions with the proposed transmission line could occur under certain conditions, including high wind, fog, or poor light. Such collisions would be expected most often with the overhead shield wire, which is smaller and less visible than the actual conductor. Migratory waterfowl would be especially susceptible to transmission line collisions where the proposed Belle Isle corridors would perpendicularly cross the North and South Santee rivers, as these waterways provide a natural flight corridor for large concentrations of waterfowl. The proposed Project would be designed in accordance with APLIC's recommendations contained in the most recent APLIC publication, *Reducing Avian Collisions with Power Lines, The State of the Art in 2012*. Central Electric would use an OPGW in place of a typical static wire. The diameter of OPGW is larger than that of the static wire and would increase the visibility of the transmission line to avian species. After further consultation with USFWS, Central Electric, as determined appropriate, would use OPGW or mark the shield wire(s) with flight diverters in areas showing high potential for avian collisions. Effects on birds related to line collisions during Project operations would be long term and of moderate intensity.

Electrocutions of large avian species, particularly raptors, have been known to occur from contact with energized lines. Electrocutions are primarily due to the close vertical or horizontal separation of conductors and other equipment often found in distribution lines. APLIC (APLIC 2006) states that transmission lines rarely electrocute birds because of the larger separation distance. The separation of conductors on transmission lines is well beyond the separation found in most distribution lines. APLIC and USFWS (2005) recommends a separation of 60 inches on distribution and transmission lines. Because the proposed Project would be built in accordance with APLIC and USFWS (2005) guidelines and other APLIC (2006, 2012) guidance, the potential for bird to be electrocuted by the proposed transmission line would be minimized.

The presence of the utility line structures may also affect raptor predator-prey relationships by providing additional locations from which raptors can hunt (perches). However, the Study Area already contains plentiful perching opportunities, so the utility line structures are not expected to increase predation. Changes to raptor predator-prey relationships are expected to be long term and of low intensity.

As discussed under vegetation, above, following construction, the ROW would be maintained every 2.5 to 3 years (4 to 5 years in wetlands) through mowing and herbicide application. Wildlife habitat would be maintained in a grassland/shrub state, continuing to provide habitat to wildlife species that use these habitat types. During maintenance, wildlife would temporary leave the area, using adjacent habitat for temporary shelter. Because the duration of vegetation maintenance in any one area is relatively short, wildlife would move back into the ROW after maintenance. Central Electric would apply herbicides following USEPA guidelines and use a low volume, selective treatment approach to application. As such, it is unlikely that herbicides would affect wildlife populations and would have a long-term, low intensity impact. Herbicides would not be used during land clearing or maintenance activities on the ROW crossing NFS lands. In areas that have standing water and are connected to a larger aquatic system (e.g., river or swamp), only USEPA-approved herbicides registered for use in wetland or aquatic sites would be used. As such, there would be negligible direct toxic effects to fish from herbicide applications because of the small size of the treatment sites; the precautions that would be taken to prevent runoff in rainwater; the lack of offsite drift from the backpack, hand, or ground-based boom sprayers that would be used; and the generally rapid degradation of the herbicides after application. Effects from Project operations and maintenance activities on aquatic resources would be long-term, low intensity.

Aquatic Ecosystems

Construction-related effects on fish and other aquatic species would be limited because the Project would span all streams and, where feasible, wetlands and riparian areas. Central Electric also plans to use existing access roads, which would limit the need for temporary culverts in streams. BMPs would be used during construction and maintenance activities to prevent soil erosion and runoff; sedimentation; water quality changes; and contamination of water from herbicides, fuels, and other spills that could harm aquatic species (see Section 4.4). If necessary, temporary low-water crossings or culverts would be installed at ditches, streams, or other watercourses to provide access to the ROW for construction vehicles. Installation of low-water crossings or culverts may require a permit from USACE and/or the state of South Carolina. Central Electric would coordinate with these entities before installing low-water crossings or culverts regarding permitting requirements and construction conditions. Structures would be designed and installed so as not to inhibit fish passage or create upstream or downstream habitat changes. Because improperly installed culverts are a major sources aquatic habitat fragmentation, Central Electric would use open-bottom or arch culverts, where feasible, to maintain hydrologic connectivity over waterways. Effects related to installation of water crossing structures would be short term and of low intensity. To avoid or minimize adverse impacts, wetland areas would be identified and marked prior to construction along the ROW.

Central Electric would establish a 30-foot upland buffer area adjacent to all intermittent and perennial streams and at all jurisdictional wetlands. Wetland clearing methods would be used in these buffer areas to minimize any upland soils transport into wetlands. Appropriate soil erosion and sedimentation controls would be established at streambank boundaries. As described for river and stream associates under *FMNF Species of Conservation Concern and State-listed Species,* the Project would adhere to strict erosion control standards, resulting in short-term, low intensity impact on aquatic ecosystems.

5.7 Soils and Geology

5.7.1 Affected Environment Geology

The proposed Project is located entirely in the Coastal Plain physiographic province of the Atlantic Plain division. The Coastal Plain, which is the flattest of all of the physiographic provinces in the United States, is divided into the Upper and Lower Coastal Plain; however, the entire Project area is located in the Lower Coastal Plain.

5.7.1.1 Coastal Plain

The Lower Coastal Plain is characterized by low, flat topography with much less relief than the Upper Coastal Plain; this characterization of topography is reflected in the nearly level slopes within the Project area (USDA-NRCS 2010a; 2011).

The Coastal Plain is underlain by material from three geologic periods: Cretaceous (65 to 144 million years ago), Tertiary (1.8 to 65 million years ago), and Quaternary (present to 1.8 million years ago) (McReynolds 2008). Although material from the Cretaceous and Tertiary periods has been carried by rivers to the Project area, the dominant geology consists of Quaternary aged material (SCDNR 2018f).

5.7.1.2 Topography

Topography is the physical features of a landscape, such as mountains and valleys, the steepness of slopes, and the shapes of landforms (Chernicoff and Whitney 2002). South Carolina is divided into two major regions: the upcountry, which lies within the Piedmont

Plateau, and the Low Country, which forms part of the Atlantic Coastal Plain. The Piedmont region is characterized by rolling hills and elevations ranging from 400 to 1,200 feet above sea level. The border between these two regions, which is called the “Fall line,” indicates where the upland rivers drain to the Atlantic Coastal Plain (Netstate 2016).

The Atlantic Coastal Plain region accounts for two-thirds of South Carolina. Land in this region rises gradually from the southeast to the northwest. The Lower Coastal Plain extends about 70 miles inland and is considerably flat; the Project area is located entirely within the Lower Coastal Plain. Topography within the Project area is very low and extremely flat. Elevations range from 0 foot to approximately 95 feet above mean sea level. The highest elevations occur in the forested hills near Jamestown in the northwestern portion of the Project area and in the uplands on either side of the Santee River. The lowest elevations occur in the floodplains of the North Santee and South Santee rivers (USGS 2013).

5.7.1.3 Soils

Soil is the top layer of the earth's surface, consisting of rock and mineral particles mixed with organic matter. Soil contains both mineral and organic material (typically decaying vegetation) along with water and air. A soil’s parent material and climate are factors important in determining the nature of the soil. A soil’s parent material is the bedrock or sediment from which the soil develops. An area’s climate—the amount of precipitation it receives and its prevailing temperature—controls the rate of chemical weathering (i.e., erosion) and consequently the rate of soil formation (Chernicoff and Whitney 2002). Topography and vegetation are also factors important to determining the nature of soil.

Composition and texture are soil properties used to determine bearing capacity (a soil’s resistance to penetration from a weighted object), internal drainage, erodibility, and slope stability. Composition refers to materials that make up soil, with four constituents: mineral particles, organic matter, water, and air. Texture is used to describe the composite sizes of particles in a soil sample (Marsh 2005).

Major Soil Types

More than 70 different soil map units are crossed by the alternatives in the Project area. Most of these soil types comprise less than or equal to 5 percent of the total length of all the alternatives. Soils along the corridor alternatives were assessed for their erodibility, hydric status, and whether they are considered prime farmland or farmland of statewide importance. Predominant soil types (those soils that represent more than 5 percent of the total length) are described below and include: Chipley loamy fine sand, Lakeland sand, Levy silty clay loam, Rutlege loamy fine sand, Cainhoy fine sand, and Seewee complex.

Chipley Loamy Fine Sand (Cm)—Soils in the Chipley loamy fine sand map unit formed in thick deposits of sandy marine sediments. This map unit consists of deep, moderately well drained, very rapid or rapidly permeable soils on uplands in the lower Coastal Plain. It occurs in areas where the slope ranges from 0 to 8 percent. These soils are moderately well drained, with very rapid or rapid permeability and slow runoff potentials. Natural vegetation consists of slash pine, longleaf pine, blackjack oak, turkey oak, post oak, several bluestem species, low panicums, and purple lovegrass.

Major uses include cropland, pasture, and hay (USDA-NRCS 2007).

Lakeland Sand (LaB)—Soils in the Lakeland sand map unit formed in thick beds of eolian or marine sands, and its parent material consists of alluvium sediment. The map unit tends to occur in areas with a slope of 0 to 6 percent. It is well drained and has a rapid/very rapid permeability rate. The associated natural vegetation includes blackjack oak, turkey oak, post oak; scattered long leaf pine; and an understory of creeping bluestem, sandy bluestem, lopsided indiangrass, hairy panicum, fringeleaf paspalum, and native annual forbs. Peanuts, watermelons, peaches, corn, and tobacco are grown in this soil type. Areas with Lakeland series are also used for improved pasture (USDA-NRCS 2013a).

Levy Silty Clay Loam (19)—Soils in the Levy silty clay loam map unit formed in marshes and shallow floodplains. Its parent material consists of fluvial sediments. It tends to occur in areas with a slope between 0 and 2 percent. Soils in this map unit are very poorly drained, have slow permeability, and negligible surface runoff rates. The dominant vegetation associated with this soil includes water tupelo, sweetgum, and bald cypress (USDA-NRCS 2003a).

Rutlege Loamy Fine Sand (Rg)—Soils in the Rutlege fine loamy sand map unit formed in upland flats or depressions and floodplains, and its parent material consists of marine or fluvial sediments. These soils tend to occur in areas with a slope between 0 and 2 percent. Soils in this map unit are very poorly drained, have rapid permeability, and negligible surface runoff rate. The natural vegetation associated with this soil includes blackgum, Carolina ash, red maple, sweetbay, tulip poplar, water oak, pin oak, pond pine, slash pine, and loblolly pine. The understory vegetation includes huckleberry, wax myrtle, greenbriar, grasses, and sedges. Some ponded areas consist entirely of grasses and sedges. Corn, soybeans, blueberries, and hay are cultivated in areas where this soil occurs (USDA-NRCS 2003b).

Cainhoy Fine Sand (CaB)—Soils in the Cainhoy fine sand map unit formed in sandy marine sediments. These soils tend to occur on nearly level to sloping landscapes in the Lower Coastal Plain in areas with slopes between 0 and 10 percent. Soils in this map unit are very deep, excessively drained, have rapid permeability, and slow surface runoff. Native vegetation is longleaf pine, live oak, post oak, white oak, bluejack oak, turkey oak, persimmon, and southern red oak. A small acreage is cleared and is used for growing soybeans, corn, small grain, and pasture grasses (USDA-NRCS 1999).

Seewee Complex (Sm)—Soils in the Seewee complex map unit formed in sandy marine sediments. These soils tend to occur on level or nearly level broad ridges and flats at elevations of 5 to 25 feet above sea level along the Atlantic Coast in areas with a slope between 0 and 2 percent. Soils in this map unit are somewhat poorly drained, have moderately rapid permeability, and a slow surface runoff rate. The natural vegetation associated with this soil includes loblolly pine, longleaf pine, sweetgum, and water oak. Tomatoes, snapbeans, cucumbers, soybeans, and pasture are all cultivated in areas where this soil occurs (USDA-NRCS 1999).

Potentially Highly Erodible Soils

The National Resources Conservation Service identifies the erodibility of soils using what it defines as the K factor. The K factor can be expressed as that of the whole soil (Kw) or of the fine soil particles (Kf); in most cases, Kw and Kf are the same value, and Kw is chosen to express erodibility. Erodibility relates the effects of rainfall, soil characteristics, length and steepness of slope, cover practices, and prevention measures to the soil's erosion rate. Soils with clay textures adhere to each other, thus they have a relatively low Kw factor. Soils with sandy textures also have low erosion rates; although they are easily detached, sandy soils have low erosion rates because of low runoff potentials. Medium-textured soils such as loams and silt loams have moderate erosion rates. Soils dominated by silt have the highest erosion rates because they do not adhere to each other and they are highly susceptible to runoff. Kw factors range between 0 and 0.69. For this analysis, the Kw factor for surface soils was reviewed; Kw factors between 0 and 0.2 were assigned a low risk of erosion, between 0.2 and 0.4 were assigned a moderate risk of erosion, and above 0.4 were assigned a high risk of erosion (USDA-NRCS 2002).

The majority of the entire Study Area is underlain by soils with a low risk of erosion.

Figures 5-22 through 5-24 show the distribution of erodible soils units, and Table 5-23 quantifies the distribution of erodible soils along the corridor alternatives.

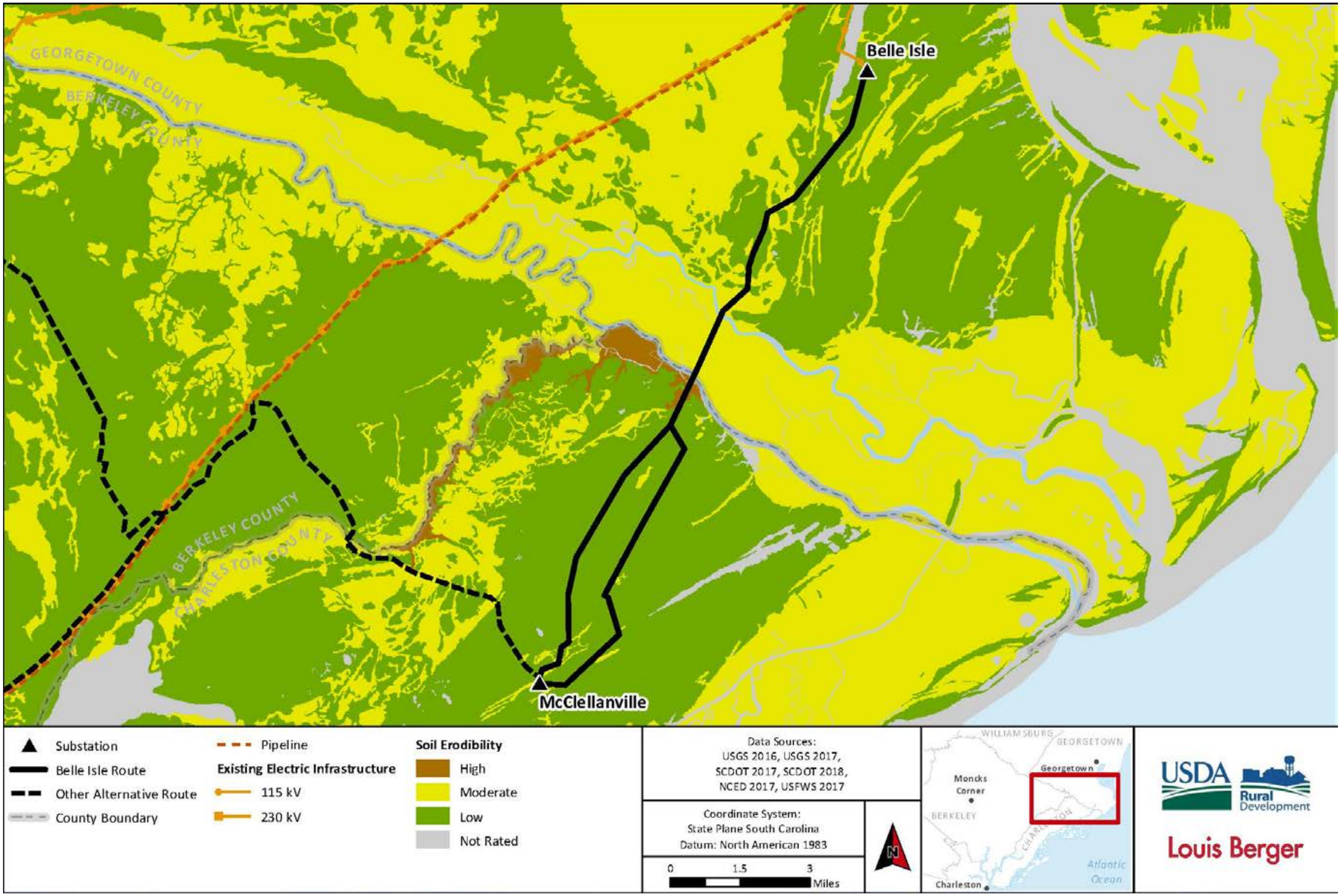


Figure 5-22: Erodible Soils in the Project Area (Belle Isle Corridor)

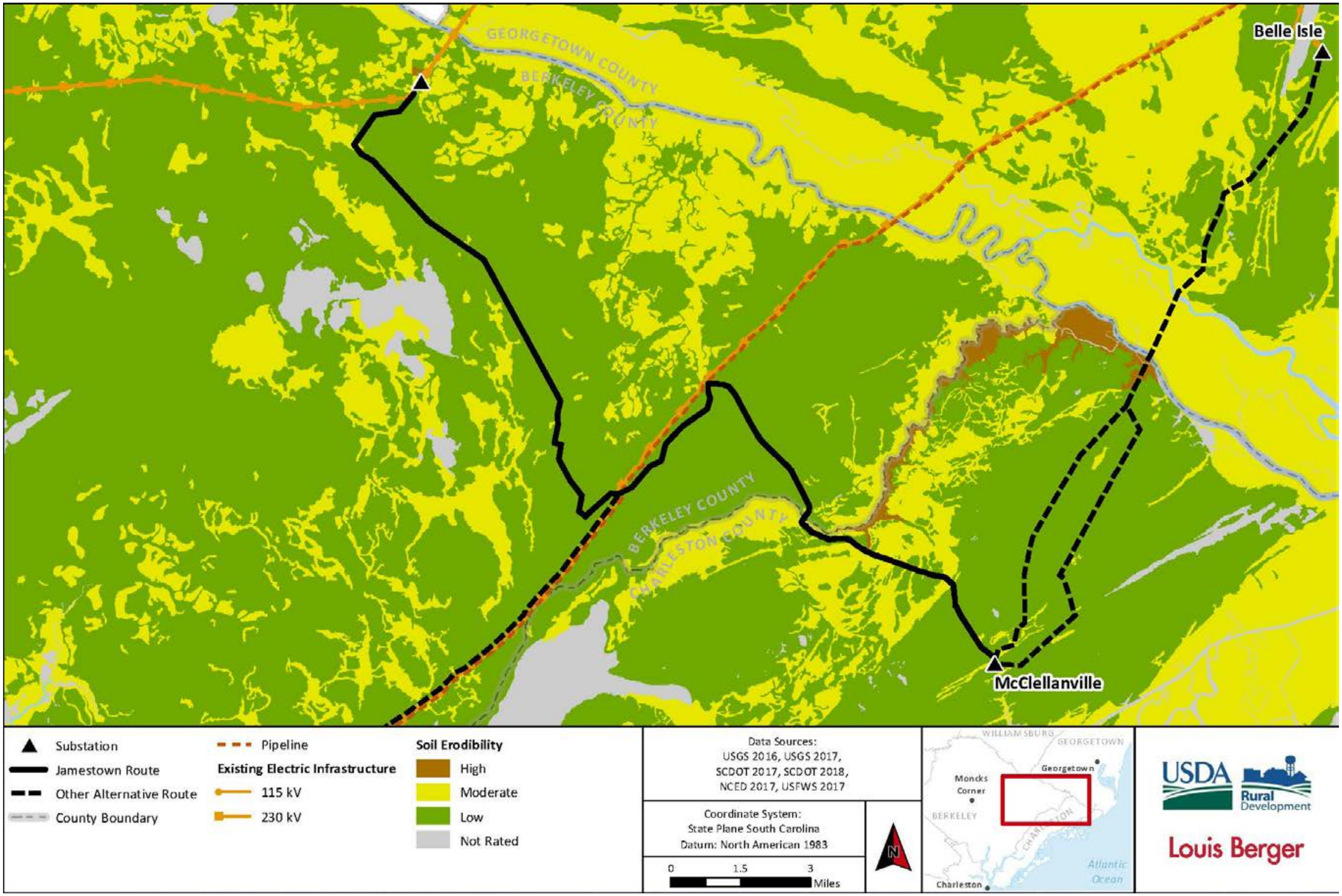


Figure 5-23: Erodible Soils in the Project Area (Jamestown Corridor)

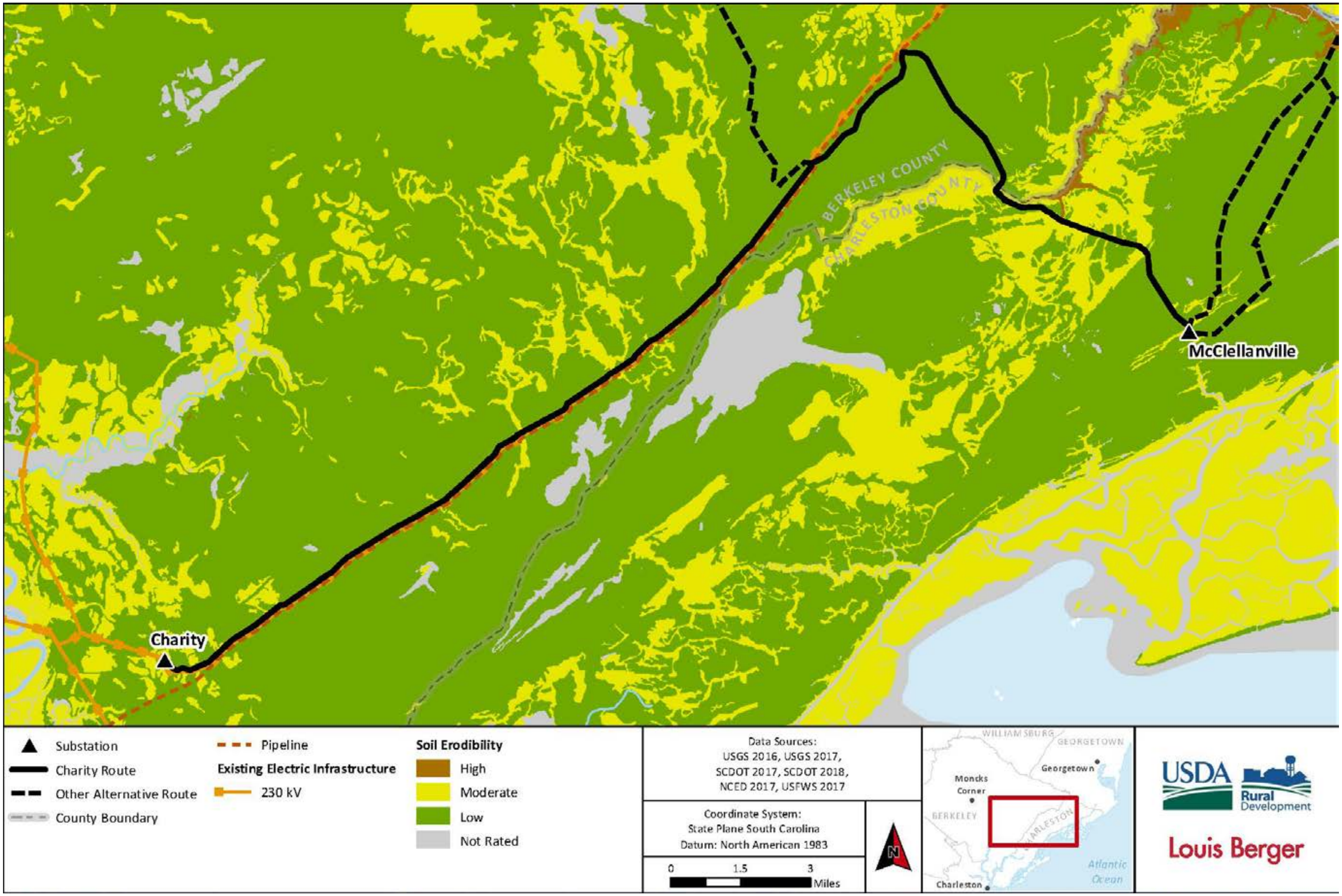


Figure 5-24: Erodible Soils in the Project Area (Charity Corridor)

Table 5-23: Distribution of Prime Farmland, Hydric Soil, and Highly Erodible Soil within the Project Area (600-foot Corridor)

Soil Type	Belle Isle Alt. B	Belle Isle Alt. C	Jamestown	Charity
Farmland (acres)				
Prime Farmland	6.4	4.2	104.0	218.2
Statewide Importance	84.0	103.5	803.9	642.2
Prime if Drained	11.1	11.1	278.9	208.6
Hydric Soils (acres)	101.5	118.8	1,186.8	1,069.0
Erodibility (acres)				
Low risk of erosion	111.6	103.0	209.4	252.3
Moderate risk of erosion	30.6	33.4	25.4	29.5
High risk of erosion	4.2	4.2	-	-

Hydric Soils

Hydric soils form under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil (USDA-NRCS 2010b). Hydric soils develop under conditions sufficiently wet to support growth and regeneration of hydrophytic vegetation; however, presence or absence of hydrophytic vegetation does not determine whether a soil is hydric. Soils that express hydric indicators because of artificial measures are also considered hydric soils; also, soils in which the hydrology has been artificially modified are hydric if the soil, in an unaltered state, was hydric in the upper part (USDA-NRCS 2010b). Some soil series designated as hydric have phases that are not hydric depending on water table, flooding, and ponding characteristics. The overall majority of soils within the entire Study Area are classified as hydric soils. Table 5-23 quantifies the distribution of hydric soils along the corridor alternatives.

Prime Farmland

Prime farmland and farmland of statewide importance are special categories of highly productive cropland recognized by USDA. Prime farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. In some cases, soils may not be considered prime farmland in their natural condition; however, with engineering practices to overcome limitations, these soils could become prime farmland. When this is the case, USDA places a caveat on the classification. Soils that do not meet the USDA prime farmland category may be important to states. Under these circumstances, soils that are agriculturally important to states are classified as farmland of statewide importance (USDA-NRCS 2013b).

Figures 5-25 through 5-27 show the distribution of prime farmland and farmland of statewide importance soils units along the corridor alternatives. Table 5-23 quantifies the distribution of prime farmland and farmland of statewide importance soils along the corridor alternatives.

5.7.2 Environmental Effects

Impacts on soils and geology include how the proposed Project could potentially impact these resources from the construction and maintenance of the ROW, off-ROW access roads, and lay-down yards. Most of the impacts would occur during construction and would likely be temporary; however, permanent impacts would be anticipated if structures are placed in prime farmland or farmland of statewide importance.

This section discusses the potential effects of the proposed Project on the soil and geological resources throughout the Study Area. To determine whether the proposed Project would have the potential to result in significant impacts, it is necessary to consider both the duration and the intensity of the impacts. Table 5-24 describes definitions for duration and intensity of soil and geological resources impacts established for this Project.

Table 5-24: Soils and Geology Impact Context and Intensity Definitions

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Short term: During construction period Long term: Life of the line (50 years)	Disturbance to geology or soils from construction and operation would be detectable but localized and discountable. Erosion and/or compaction would occur from construction and operation in localized areas.	Disturbance would occur over a relatively wide area from construction and operation of the Project. Impacts to geology or soils would be readily apparent and result in short-term changes to the soil character or local geologic characteristics. Erosion and compaction impacts would occur over a wide area.	Disturbance would occur over a large area from construction and operation of the Project. Impacts to geology or soils would be readily apparent and would result in short-term and long-term changes to the character of the geology or soils over a large area both in and out of the Project boundaries. Erosion and compaction would occur over a large area.

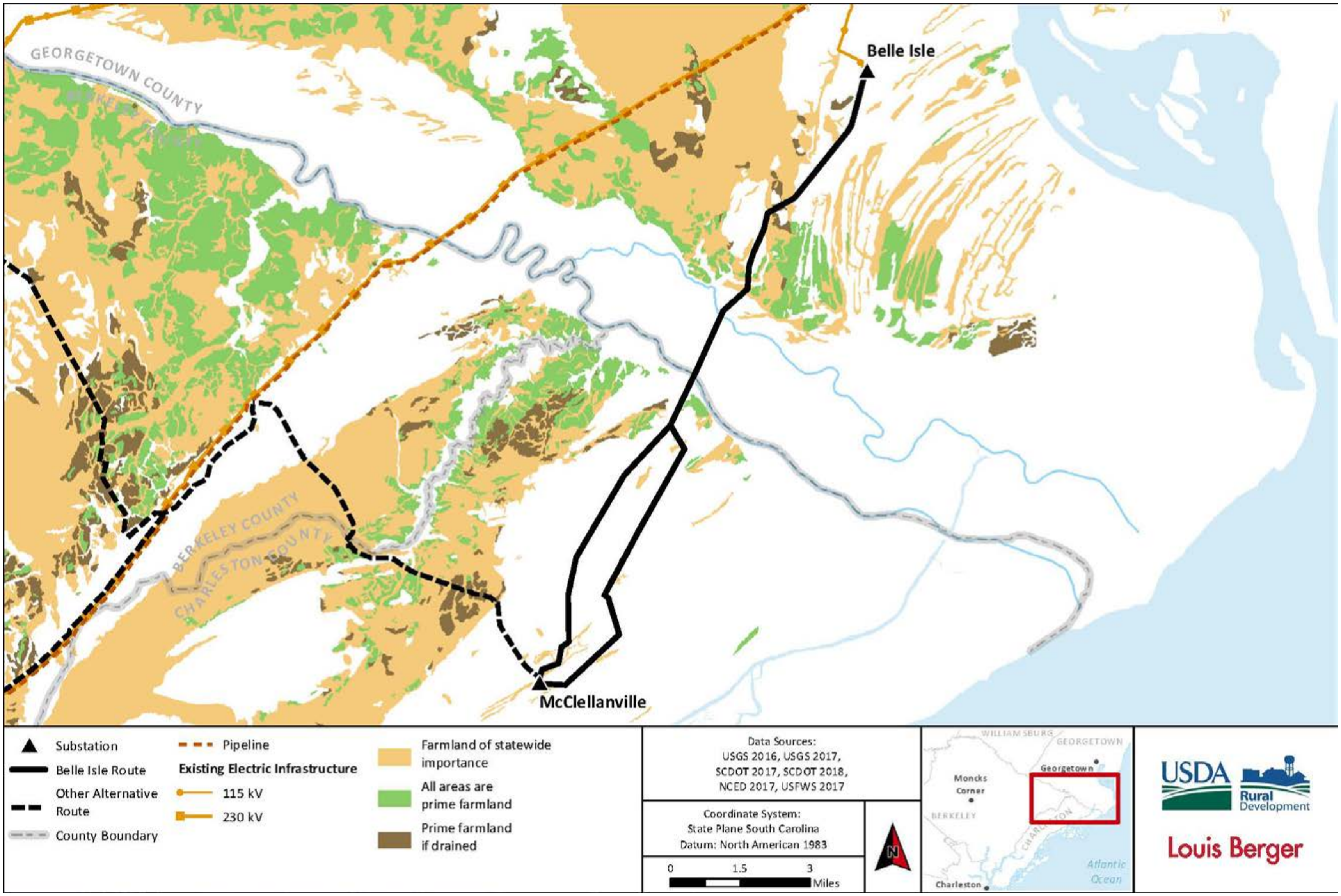


Figure 5-25: Prime Farmland within the Study Area (Belle Isle Corridor)

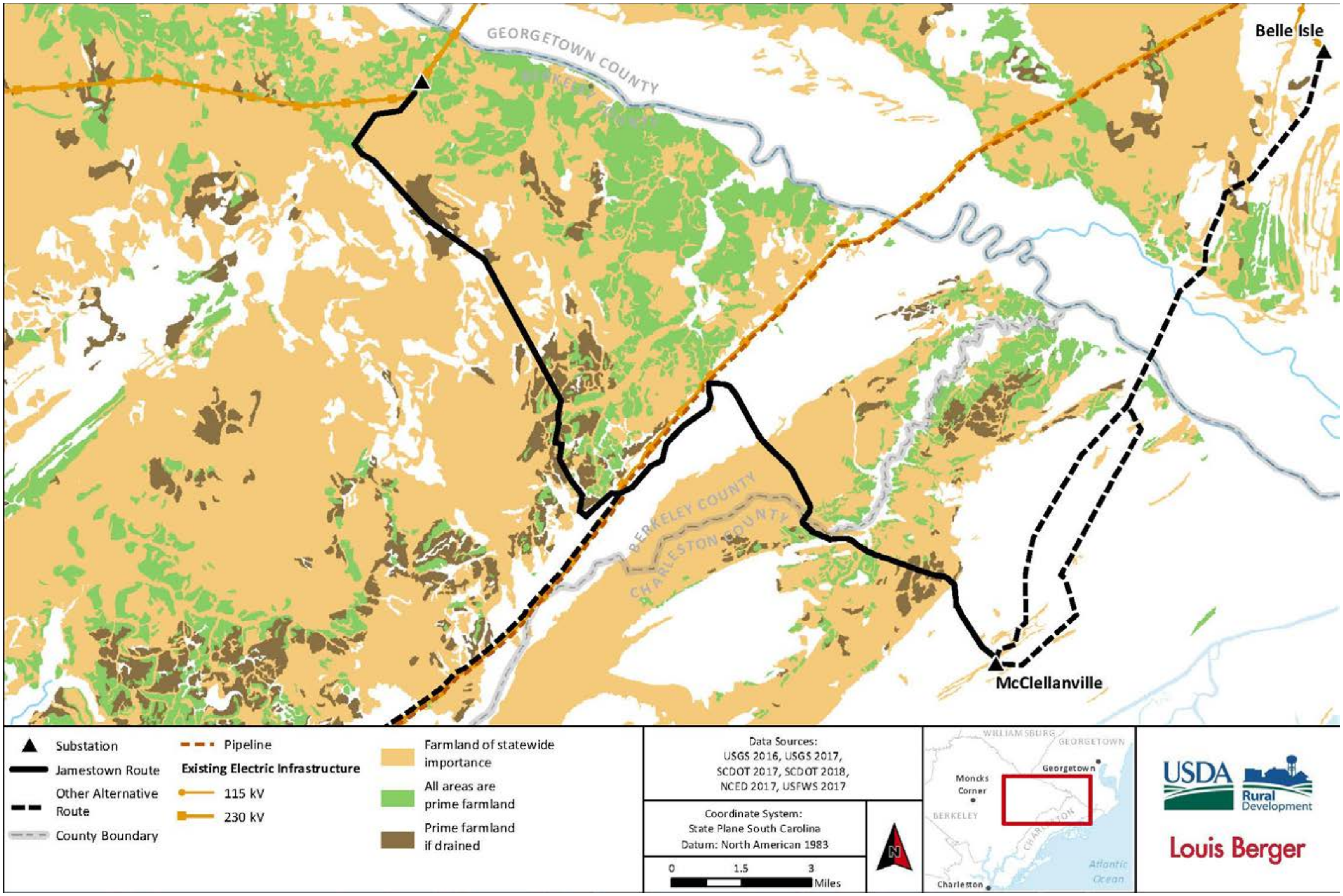


Figure 5-26: Prime Farmland within the Study Area (Jamestown Corridor)

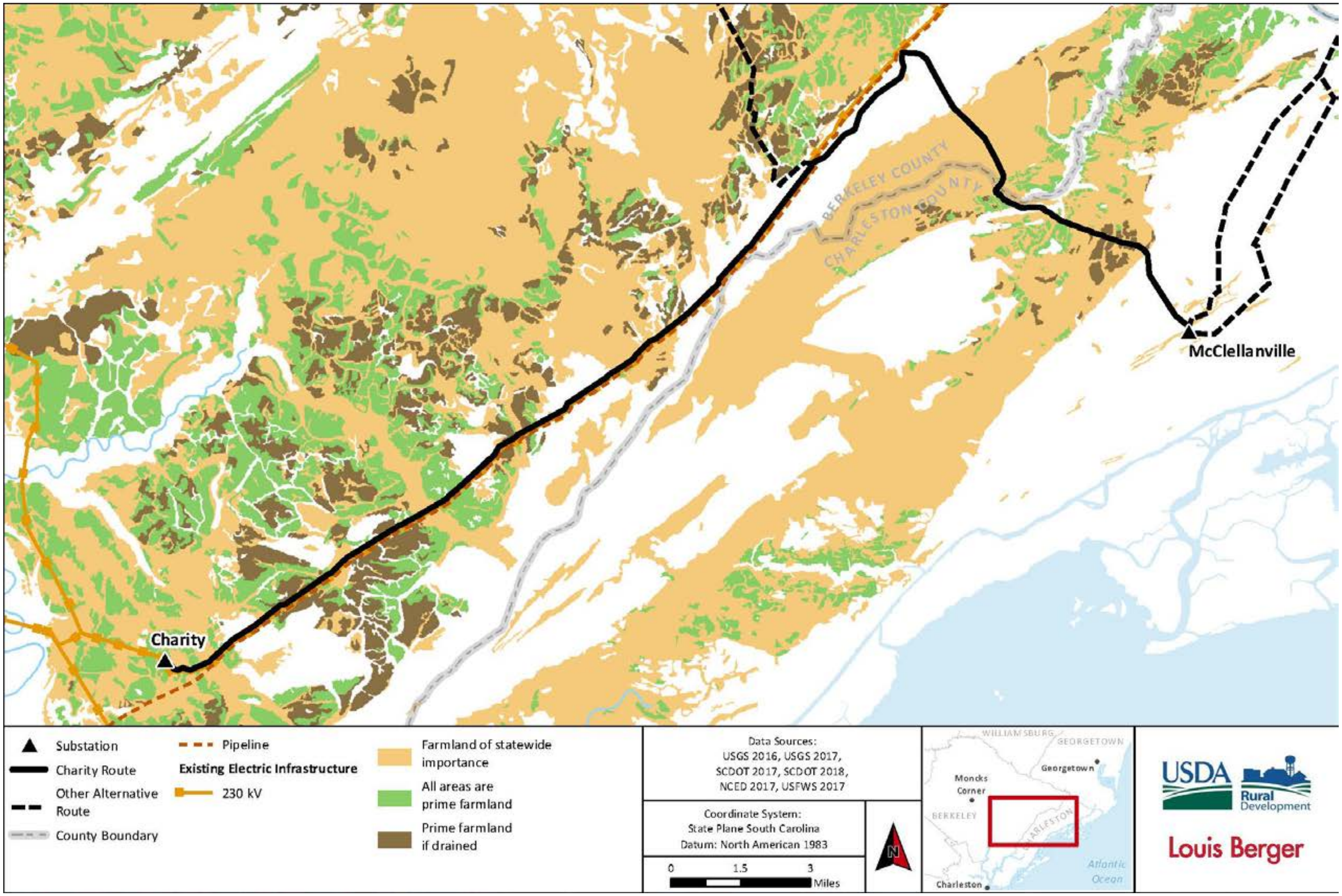


Figure 5-27: Prime Farmland within the Study Area (Charity Corridor)

5.7.2.1 No-action Alternative

Under the no-action alternative, there would be no construction or maintenance of an overhead transmission line. Direct and indirect impacts to geological formations and soils would not be anticipated.

5.7.2.2 Proposed Action

Geology and Topography

Construction of overhead transmission lines generally does not create a great disturbance to soils and geology. Although these types of projects often traverse long distances (16 to 31 miles for the proposed Project), the actual installation of structures only occurs sporadically across the length of the Project and at predetermined locations where the construction or installation of facilities are required (such as for the construction of substations and switchyards). Towers are located approximately 300 to 400 feet apart, and access roads can be designed to cause the least amount of impacts practicable. Generally, Project construction would require little disturbance to surface soil and would neither be large enough or deep enough to have any type of impacts on geologic formations throughout the Study Area.

Consequently, impacts on surface geology would be limited to the sites selected for the erection of structures. At these locations, geologic impacts would be limited to minimal disturbances of subsurface rock during drilling and use of augers to prepare foundation holes. Potential impacts resulting from this activity include: displacement of soil and rock during construction activities, alteration of geologic features due to earth-moving activities during construction, alteration of topographical boundaries during construction, and an increased potential for erosion occurring to adjacent lands from either vehicle disturbances associated with construction activities or accelerated runoff resulting from the creation of impermeable surfaces.

Where possible, Central Electric would use existing access roads to minimize the impacts to geology and topography from building all new access roads. The need for grading and excavation that is associated with constructing access roads would be minimized. Borings may be taken prior to construction to identify geologically sensitive areas; Central Electric would avoid placing structures in those areas to further minimize the effects on geology and topography. Thus, by incorporating these BMPs, impacts to geological resources would be short term and low-intensity.

Erodible Soils

As stated in the affected environment section, very few acres of the overall Study Area cross highly erodible soils; the majority of the soils within the Study Area have a low risk of erosion (see Table 5-23). However, building the transmission line would require vegetation clearing from the proposed ROW and access roads, grading of structure sites for construction, equipment lay-down and vehicle access, and excavation for structure placement and installation of counterpoise. Vegetation removal may increase the erosion potential, even on soils with a low risk of erosion, because roots help to hold soil in place, and low-lying vegetation impedes the velocity of surface flow of water. By minimizing the removal of grasses, forbs, and shrubs, and leaving the stumps of removed saplings and trees in place, erosion potential from vegetation removal would be minimized.

Central Electric would implement a wide array of BMPs to reduce soil erosion (see Section 4.4). The BMPs would be decided based on site conditions but would likely include silt fencing and hay bales, erosion control matting, minimizing the time soils are left bare, minimizing work time on wet soil, reclaiming topsoil, placing vegetation covers on loose piles of soil, revegetating bare areas, and grading the area to its original grade after construction. Additionally, Central Electric would use existing access roads, to the extent practicable, which would reduce the amount of soil moved. Although impacts to soils from erosion are anticipated, implementing these BMPs would likely make them short term and low intensity.

Hydric Soils

Hydric soils are susceptible to compaction and erosion because they are often wet and, thus, more fluid. BMPs similar to those used in wetlands could be employed to reduce the amount of compaction and erosion that would occur during construction and maintenance. These practices could include leaving in place the stumps of cut trees so that soils are not disturbed, not working in saturated soils to avoid compaction and rutting, using load-dispersing mats and/or machinery with load-dispersing tires to reduce compaction and rutting, revegetating bare areas, and aerating compacted areas.

Employing these BMPs would likely result in short-term and low-intensity impacts to hydric soils.

Prime Farmland

It is likely that prime farmland and farmland of statewide importance would be impacted by the proposed Project. Permanent loss of prime farmland at the location of the tower foundations is expected; additionally, temporary compaction impacts from heavy machinery are possible. Central Electric proposes that each structure would use a 400-square-foot construction area, but that this area would be reclaimed and re- seeded. The only permanent impacts to the prime farmland and farmland of statewide importance would come from the actual structure; however, because this type of construction rarely impacts more than 0.001 acre per pole, permanent impacts to prime farmland and farmland of statewide importance would be less than 0.5 acre for the entire Project.

Based on the likelihood that each tower would not be located in prime farmland or farmland of statewide importance, the total area lost to the proposed Project would be less than 1 acre. To minimize impacts to prime farmland and farmland of statewide importance, Central Electric would implement BMPs such as reclaiming topsoil, aerating compacted lands, and using existing access roads. The farming of low-growing vegetation would still be allowed in easements while there may be restrictions in farm operation practices within easements (e.g., no center pivot irrigation). Impacts to prime farmland and farmland of statewide importance would be both long term and short term but would be low intensity.

5.8 Air Quality and Greenhouse Gas Emissions

5.8.1 Affected Environment Air Quality Conditions

5.8.1.1 Regional Setting

The proposed Project is in eastern South Carolina and occupies portions of Georgetown, Charleston, and Berkeley counties. The Project area is primarily rural, and the major existing contributing sources of air emissions/criteria pollutants result from shipping activities along the Cooper River north of Charleston and individual automobiles, trucks, and farm equipment, as well as industrial emissions produced from an industrial gas supplier in the western portion of the Project area. Vehicles are responsible for tailpipe emissions including nitrogen oxides (NO_x), carbon monoxide (CO), and sulfur dioxide (SO_2). The primary pollutant produced by farm equipment is NO_X from the combustion of fuel. In addition to existing contributions to air emissions, farming, timber harvesting, and vehicles using unpaved roads are sources of fugitive dust.

5.8.1.2 National Ambient Air Quality Standards/Attainment

USEPA defines ambient air in 40 CFR §50 as: “that portion of the atmosphere, external to buildings, to which the general public has access.” In compliance with the 1970 Clean Air Act and the 1977 and 1990 Clean Air Act Amendments, USEPA has promulgated National Ambient Air Quality Standards (NAAQS). NAAQS were enacted for the protection of public health and welfare, allowing for an adequate margin of safety. The Clean Air Act established two types of national air quality standards.

Primary standards set limits to protect public health, including the health of “sensitive” populations such as children, the elderly, and those suffering from asthma. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. To date, USEPA has issued NAAQS for seven criteria pollutants: CO, particles with a diameter less than or equal to a nominal 10 micrometers (PM_{10}), particles with a diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$), ozone (O_3), nitrogen dioxide (NO_2), lead and SO_2.

Areas that do not meet NAAQS are called non-attainment areas. While $O_3$is monitored for ambient air quality levels, regulations limit NO_x and volatile organic compound emissions, which are O_3precursors. Table 5-25 displays the primary NAAQS for each criteria pollutant as well as state standards for ambient air quality. All counties in South Carolina are currently in attainment for all criteria pollutants (USEPA 2018a).

Table 5-25: State and Federal Ambient Standards for Criteria Air Pollutants

Pollutant	Period	State Air Quality Standard	Federal Primary Air Quality Standard	Federal Secondary Air Quality Standard
CO	1-hour average (maximum)	Same as Federal	35 ppm	No standard
	8-hour average (maximum)	Same as Federal	9 ppm	No standard
PM_{10}	24-hour average (maximum)	Same as Federal	150 µg/ m3	150 µg/ m3
	Annual average	Same as Federal	No standard	No standard
$PM_{2.5}$	24-hour average (based on 98th percentile)	Same as Federal	35 µg/ m3	35 µg/ m3
	Annual average	Same as Federal	12 µg/ m3	15 µg/m3
O_3	8-hour average (based on 4th highest daily maximum)	Same as Federal	0.070 ppm	0.070 ppm
NO_2	1-hour average (based on 98th percentile)	Same as Federal	100 ppb	No standard
	Annual average	Same as Federal	53 ppb	53 ppb
Lead	Rolling 3-month Average	Same as Federal	0.15 µg/m3	0.15 µg/m3
	Quarterly Average	No standard	1.5 µg/m3	1.5 µg/m3
SO_2	1-hour average (based on 99th percentile)	Same as Federal	75 ppb	No standard
	3-hour average (maximum)	Same as Federal Secondary Standard	No standard	0.5 ppm

Sources: SCDHEC (2018a); USEPA (2018b)

Notes: ppm = parts per million; µg/m^3 = micrograms per cubic meter

Ambient air quality is monitored throughout South Carolina by stations meeting USEPA's design criteria for state and local air monitoring stations and national air monitoring stations. There are three monitoring stations near the Project area: the Cape Romain station located south of Awendaw; the Bushy Park Pump Station located near the Naval Weapons Station in North Charleston; and the Howard High School #3 station located in Georgetown. In 2012, which is the most recent year for which annual air quality data are published by SCDHEC, these monitoring stations reported that levels of air pollutants fell within federal and state standards (SCDHEC 2018b).

To regulate Project emission levels, federal actions located in non-attainment areas are required to demonstrate compliance with the general conformity guidelines established in Determining Conformity of Federal Actions to State or Federal Implementation Plans (40 CFR §93). Section 93.153 of this rule sets the applicability requirements for projects subject to it through the establishment of *de minimis* levels for annual criteria pollutant emissions. These *de minimis* levels are set according to criteria pollutant non-attainment area designations. Projects below the *de minimis* levels are not subject to the rule. Those at or above the levels are required to perform a conformity analysis as established in the rule. The *de minimis* levels apply to direct and indirect sources of emissions that can occur during the construction and operational phases of the action.

The proposed action is not located within a non-attainment area; therefore, a General Conformity Rule applicability analysis is not warranted.

Outside the nonattainment areas, the Clean Air Act includes programs to maintain the air quality in attainment areas and ensure that new sources of criteria pollutants do not detrimentally affect air quality. Programs established include: New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants, Prevention of Significant Deterioration (PSD), and Title V Operating Permits. None of these programs are likely applicable to the Project.

Congress set aside special land classifications where existing good air quality is especially important. These areas include, but are not limited to, national parks, and wilderness areas, all of which are defined as Class I areas. All other areas are designated as Class II areas. There is one Class I area in South Carolina—the Cape Romain Wilderness Area—located about 2 miles to the southeast of the Project.

PSD increments were established for Class I and Class II areas to ensure that air quality is maintained in attainment areas. If it is determined that a project is subject to PSD, the ground-level air concentrations from the project must be below these increment values in attainment areas. In addition, all facilities must meet NAAQS with an appropriate background value added to the source impact concentration.

5.8.1.3 Greenhouse Gases

There is broad scientific consensus that humans are changing the chemical composition of Earth's atmosphere. Human activities such as fossil fuel combustion, deforestation, and other changes in land use are resulting in the increase in greenhouse gas (GHG) emission rates above background levels and the accumulation of additional GHGs, such as carbon dioxide, in our atmosphere above pre-industrial natural levels of those gases. An increase in human GHG emissions is said to result in an increase in the earth's average surface temperature, commonly referred to as global warming or climate change. Climate change is expected in turn to affect weather patterns, average sea level, ocean acidification, chemical reaction rates, and precipitation rates. The Intergovernmental Panel on Climate Change estimates that the average global temperature rise between 2000 and 2100 could range from 1.1°F (with no increase in GHG emissions above year 2000 levels) to 9.2°F (with a substantial increase in GHG emissions). Even small increases in global temperatures could have considerable detrimental impacts on natural and human environments (IPCC 2007).

5.8.1.4 Regional Haze

The Regional Haze Rule (Clean Air Act 169A and 169B, 40 CFR §51, Subpart P) was intended to protect and improve visibility in areas of the country known as federal Class I areas (primarily National Parks and National Wilderness areas). Several facilities in South Carolina were subject to a regional haze analysis per 40 CFR §51.308, known as the Best Available Retrofit Technology analyses. These analyses applied to facilities in 26 source categories (mainly power plants) that were constructed between approximately 1962 and 1977 (years prior to the Clean Air Act Amendments of 1977).

Utilities are the most common facilities that met the requirements under the Best Available Retrofit Technology rules. Facilities constructed before or after 1962 through 1977 may be subject to reasonable progress requirements. South Carolina has developed a State Implementation Plan that includes controls and emission limits required by the Best Available Retrofit Technology and Reasonable Progress analyses to improve visibility in Class I areas. South Carolina has a single Class I area, Cape Romain National Refuge, which is located in the Project vicinity.

5.8.2 Environmental Effects

This section discusses potential impacts on air quality and GHGs, their duration, and intensity resulting from construction and operation of the proposed Project, including the no-action alternative. Definitions for context and intensity are described in Table 5-26.

Table 5-26: Air Quality Impact Context and Intensity Thresholds

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Short term: During construction period Long term: Life of the line (50 years)	The impact on air quality associated with emissions from the operation, maintenance and construction is measureable, but localized and small such that emissions do not exceed USEPA's de minimis criteria for a general conformity analysis, or the USEPA mandatory reporting threshold for GHG emissions.	The impact on air quality would be measurable and primarily localized but have the potential to result in regional impacts. Emissions of criteria pollutants associated with operation, maintenance and construction would be at the USEPA's *de minimis* criteria levels for general conformity analysis and the USEPA mandatory reporting threshold for GHG emissions.	The impact on air quality would be measurable on a local and regional scale. Emissions from operation, maintenance and construction are high, such that they would exceed USEPA's de minimis criteria levels for a general conformity analysis and the USEPA mandatory reporting threshold for GHG emissions.

5.8.2.1 No-action Alternative

Under the no-action alternative, the proposed Project would not be constructed, and current air quality conditions would remain. There would be no impacts on air quality or any contribution to GHGs as a result of the no-action alternative.

5.8.2.2 Proposed Action

Impacts on air quality would occur as a result of construction activities and operations. Potential impacts on air quality as a result of construction include increases in fugitive dust caused by construction activity, vehicles, and equipment and emissions from construction vehicles and equipment. The primary construction impact on air quality comes from fugitive dust. The footprint of the proposed Project occurs primarily on open ranges, undeveloped, or agricultural land, with transportation occurring primarily on dirt or gravel roads. Increases in traffic on these roads from construction-related workers, equipment, earthmoving activities, and wind action on disturbed areas would all lead to increases in the production of fugitive dust. Site preparation for the proposed transmission line and associated projects would require earthmoving and grading activities, exposing soils and increasing the potential for wind erosion. In addition, as a result of grading activities, the transportation of soil and other construction debris in uncovered trucks could also contribute to fugitive dust. The primary concern over fugitive dust would occur during the warmer, drier months when soils are not as compacted and are more prone to dust generation. Impacts from fugitive dust are expected to be short term and only occurring during the construction period. Based on the relatively small size of the affected area and current air quality conditions, it is expected that this alternative will result in low impacts on air quality.

Other impacts on air quality as a result of construction activities come from emissions from construction vehicles and heavy equipment used in the construction process.

Emissions stemming from these vehicles and equipment would emit hydrocarbons, particulate matter, and carbon dioxide. Emissions resulting from the construction activities would be highly localized in the immediate Project area and ROW and would be similar or less than to those created as a result of agricultural activities taking place in most of the Project area. Air emissions as a result of construction are expected to be minimal because these activities are not excessive in nature. Table 5-27 lists estimated emissions. Therefore, emissions stemming from the construction of this alternative would not reduce air quality in the Project area, would not exceed USEPA *de minimis* thresholds, and would not affect the current attainment status of South Carolina resulting in short-term, low impacts.

Table 5-27: Transmission Line and Substation Construction Emissions Estimates and General Conformity *De Minimis* Thresholds

Pollutant	Emissions (tons)	Emissions (tons/year)	General Conformity *De Minimis* Threshold
NOx	6.0	3.0	100
Volatile organic compounds	0.5	0.2	100
$PM_{2.5}$	0.8	0.4	100
SO_2	0.2	0.1	100
CO	2.1	1.1	100

Emissions potentially impacting air quality during operation of the transmission line and substation would only occur as a result of atmospheric interactions with the energized conductors. These minor emissions consist of $O_3$and NOx and occur near the conductor from development of a corona. These emissions relative to NAAQS would be negligible and not approach current *de minimis* standards, resulting in low impacts on air quality.

A potential area of concern regarding proposed air quality impacts associated with the proposed action is the proximity of the proposed transmission line to the Cape Romain Wilderness Area, a federal Class I airshed. The proposed transmission line would be approximately 2 miles from the Cape Romain Wilderness Area. Class I areas are sensitive areas with determined important visual qualities and are protected from air pollutants that can potentially cause visibility impairments. Visibility can be affected by several air pollutants including PM_{10}, $PM_{2.5}$, sulfates, nitrates, and sulfuric acid mist.

Potential pollutants occurring as a result of construction activities resulting from this alternative with the potential to impact visibility are both particulate matters. However, based on the limited amount of emissions resulting from construction activities, its highly localized short-term nature, and the implementation of BMPs to control emissions and fugitive dust, construction emissions would not cause visibility impairments to the Class I area.

The Cape Romain National Refuge is a Class I area which is located in the vicinity of the Project. During construction, the proposed transmission line and substations have the potential to contribute to haze in this area. However, based on a USEPA memo, construction emissions are not a consideration in determining if PSD requirements apply to a source (Reich 1978). Because the construction of the proposed transmission line and associated structures is not a major stationary source, this Project does not come under PSD review. In addition, all emission limits established would be followed, and any contribution to visual haze would not be significant based on the proposed Project (SCDHEC 2007).

GHG emissions resulting from the construction of the transmission line were calculated for two types of activities: construction of the transmission line and ongoing annual operations and maintenance for its estimated 50-year-long operational life. GHG emissions associated with construction activities would occur over a period of approximately 2 years. Based on existing data, it is assumed that an average of 25 people located throughout the Project area would work on the Project daily during peak construction (including road and structure installation) and non-peak construction (including installing and removing BMP measures and staging areas, site preparation and restoration work, and equipment and materials moving). The transportation components of GHG emissions were estimated based on the approximate number of vehicles that would be used during Project construction and the approximate distance those vehicles would travel. The number of round trips was conservatively estimated using the following assumptions.

- All workers would travel in separate vehicles to and within the Project area each day.
- A maximum number of workers (25) would be required to construct the Project.
- The round-trip distance in the Project area is approximately 100 miles, depending on the exact location of workers within the Project area.

- Fuel consumption is based on the average fuel economy for standard pickup trucks of 18 miles per gallon. This is likely an overestimate because more efficient vehicles may be occasionally used. Average helicopter fuel mileage is anticipated to be around 1 mile per gallon.

Fuel consumption and GHG emissions would also result from operation of onsite heavy construction equipment. Heavy construction equipment may include augers, bulldozers, excavators, graders, heavy-duty trucks, and front-end loaders. It is also expected that the majority of heavy construction equipment use would occur during peak construction. Assumptions included a maximum of 20 equipment machines in operation during peak construction and 10 equipment machines during off-peak. It was also assumed that the average size of equipment would not exceed 250 horsepower and would operate at maximum power for 8 hours per day 5 days a week, which is a significant overestimation because equipment commonly operates in idle or reduced power.

Implementation of any of the corridor alternatives would require the permanent removal of trees and other vegetation because of road construction and ROW clearing. Although permanent tree removal would not immediately emit GHGs, it would reduce the level of solid carbon storage in the area. Tree growth and future carbon sequestration rates are highly variable and dependent on several factors, including, the species of the tree, the age of the tree, climate, forest density, and soil conditions. In the South East Region, the average carbon storage associated with forest is 125,000 pounds per carbon acre (USFS 1992). The acres of forest that would be removed vary from 82.7 to 162.8 acres depending on the corridor alternative. Assuming each affected acre contains the average carbon content for the North Central Region, the net carbon footprint associated with the removal of forested area would be an estimated 4,689 and 9,231 metric tons. Given this estimate, the impact of vegetation removal on GHG emissions would be low.

During operation and maintenance of the transmission line, routine patrols, maintenance of roads and structures, and aerial inspections by helicopter would occur once per year. Emergency maintenance and natural resource review would occur on average once every 4 years, with all activities estimated to incur within 100 miles round trip. Operation and maintenance emissions are estimated for the 50-year life span of the transmission line.

Based on the above assumptions, all the corridor alternatives would result in an estimated total of between 4,689 and 9,231 metric tons per year of carbon dioxide equivalent (CO_2e) emissions during construction and a total of an estimated 30 metric tons of CO_2e emissions for ongoing operations and maintenance activities over the 50-year lifespan of the line. To provide context for this level of emissions, the USEPA mandatory reporting threshold for large sources of GHGs is 25,000 metric tons of CO_2e emitted annually (74 Federal Register 56260).

This threshold is approximately the amount of CO_2e generated by 4,400 passenger vehicles per year. Comparatively, the emissions during Project construction would be equivalent to the emissions generated by about 1,146 passenger vehicles per year.

Operation and maintenance activities would translate into CO_2e emissions about equal to that of five passenger vehicles per year. Overall, contributions of construction, operation, and maintenance of the corridor alternatives on GHG concentrations would be low.

5.9 Cultural and Paleontological Resources

This section of the EIS identifies known cultural and paleontological resources crossed by the alternatives in the Study Area. Cultural resources will continue to be identified as consultation under Section 106 of the NHPA proceeds.

There is no legal or generally accepted definition of "cultural resources" within the federal government; however, the term is used to refer to historic, aesthetic, and cultural aspects of the human environment. Under NEPA, the human environment includes the natural and the physical (e.g., buildings) environment, and the relationships of people to that environment. Accordingly, a thorough NEPA analysis should address the human (social and cultural) and natural aspects of the environment and the relationships between them. In meeting its requirements as the lead agency for NEPA, RUS must consider the impact of its actions on all aspects of the human environment, including cultural resources.

Cultural resources include archaeological sites, defined as locations "that contain the physical evidence of past human behavior that allows for its interpretation;" buildings; structures; and traditional resources and use areas (NPS 1997). Those cultural resources that qualify for listing in the National Register of Historic Places (NRHP) must meet at least one of the established criteria for evaluation, defined below.

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association. A resource may be eligible that:

- Criterion A: is associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B: is associated with the lives of persons significant in our past; or
- Criterion C: embodies the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

- Criterion D: yields, or may be likely to yield, information important in prehistory or history (NPS 1997).

In general, these resources must also be greater than 50 years in age. Properties less than 50 years of age must be exceptionally important to be considered eligible for listing, as outlined in NRHP Bulletin Number 22 (Sherfy and Luce 1998).

The NRHP is a commemorative listing of those resources significant to the American past. Those cultural resources listed in, or eligible for listing in, the NRHP are designated “historic properties.” Under NHPA, “historic property” means “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places” including artifacts, records, and material remains related to such a property or resource (16 USC §470w; amended 2006). In accordance with Section 106 of NHPA, 16 USC §470f, RUS is required to take into account the effects of its undertakings on historic properties. The regulation, “Protection of Historic Properties” (36 CFR §800), implementing Section 106 establishes the process through which RUS and other federal agencies consider effects to historic properties in their decision-making.

5.9.1 Affected Environment

Central Electric approached RUS for financial assistance to construct the Project, thereby making the proposed Project an undertaking subject to review under Section 106 of NHPA and its implementing regulation (36 CFR §800). As the lead agency, RUS is coordinating compliance between the Section 106 procedures and the steps taken to meet NEPA requirements as set forth in 36 CFR §800.3(b). As such, studies and analyses conducted to comply with NEPA, including this EIS, would be used and expanded as appropriate by RUS to meet the requirements of Section 106. Pursuant to 36 CFR §800.2(d)(3), RUS has used its NEPA procedures to meet its requirements for public involvement under 36 CFR §800.

Because the corridor alternatives are linear corridors, RUS is identifying properties and assessing effects using a phased approach in accordance with 36 CFR §800.4(b)(2) and §800.5(a)(3). More detailed and extensive studies would be performed after Central Electric selects the final 75-foot ROW within the preferred 600-foot corridor identified in the final EIS. The procedures for completion of the final identification and evaluation; assessment of effects; and, as appropriate, mitigation would be formally documented using a Programmatic Agreement (PA) that would be executed pursuant to 36 CFR §800.14(b). Appendix E contains a draft of the PA.

5.9.1.1 Geographic Scope

Pursuant to 36 CFR §800.16(d), the area of potential effects (APE) is defined as the area within which the proposed Project has the potential to either directly or indirectly affect historic properties that may be present. RUS has identified the APE for direct effects on historic properties (archaeological sites and historic structures) as the 75-foot-wide ROW location that Central Electric would select after the final EIS identifies a preferred corridor.

The APE for indirect or visual effects would initially be a 0.5-mile-wide buffer from the Project's transmission structures located within that final ROW. This standard for the geographic scope of visual effects is consistent with thresholds established by the Federal Communications Commission in its 2004 Nationwide Programmatic Agreement (2004). Given the height of the proposed structures and the requirement to maintain an alignment cleared of vegetation, the proposed Project could alter a historic property's integrity by diminishing its setting or feeling. As more information is gathered, the APE for indirect effects would be further refined to take into account topography, vegetative screening, and other similar factors.

5.9.1.2 Study Area

The Study Area includes the entire geographic area evaluated to develop all of the alternatives proposed in the *Macrocorridor Study* and *Alternatives Evaluation Study* (RUS 2010a; 2011b). As such, it encompasses the APE but is much broader, extending for 300 feet from both sides of the ROW centerline.

5.9.1.3 Consultation

This section describes the consultation process for the proposed Project, which is ongoing. In addition to USFS, which is already a participant, the South Carolina State Historic Preservation Office; Indian Tribes, including the Catawba Indian Nation Tribal Historic Preservation Officer; federal and state permitting agencies; and other yet to be identified agencies and organizations would be invited to participate in Section 106 consultation.

The required NEPA/Section 106 coordination effort provides information to assist in the selection of a corridor alternative to analyze in the EIS. In addition, these efforts help to determine the appropriate level of effort needed to identify and evaluate historic properties and resolve concerns about providing comparable information for analysis across alternatives.

5.9.1.4 History of the Study Area

Belle Isle corridor alternatives B and C are located in Georgetown and Charleston counties. The Charity corridor and the Jamestown corridor cross Charleston and Berkeley counties. Of these Coastal Plain counties, Charleston and Berkeley have probably experienced more cultural resource surveys as a result of the urbanization and the presence of the FMNF. The prehistory of the counties is similar. The data on prehistoric adaptations in the Coastal Plain of South Carolina presented below are derived mainly from USFS archaeological research within the boundaries of the FMNF, with additional information from the research conducted on behalf of the South Carolina Department of Transportation (SCDOT). The historic background section draws on a variety of resources including county-wide historical properties surveys, cultural resources reports, and other publications housed at the South Carolina Institute of Archaeology and Anthropology and the South Carolina Department of Archives and History.

5.9.1.5 Prehistoric Background

This summary of the region's Native American prehistory provides information on cultural chronology, typology, and interpretation of the Coastal Plain's Native American archaeological record.

Archaeologists divide South Carolina's prehistory into the following periods: Paleoindian/Lithic (ca. 12,000–8000 BC), Early Archaic (ca. 8000–6000 BC), Middle Archaic (ca. 6000–3000 BC), Late Archaic (ca. 3000–1000 BC), Early Woodland (ca. 1000–500 BC), Middle Woodland (ca. 500 BC–AD 500), Late Woodland (ca. AD 500–1000), and Mississippian (ca. AD 1000–1540). These cultural divisions signal technological and social adaptations of Native American peoples to southeastern North America's changing natural environment since the end of the last glaciation, approximately 14,000 years ago (Adams and Young 2010; Anderson and Logan 1981; Anderson et al. 1982; Trinkley 1990).

Paleoindians represent the first known human populations to occupy the region that is presently South Carolina. Paleoindian populations have been characterized by archaeologists as small nomadic or seminomadic bands with settlement/subsistence strategies based on hunting and the collection of wild foods. Archaeological markers of the Paleoindian period (12,000 to 8000 BC) consist chiefly of distinctive projectile point types, such as Clovis, Cumberland, Dalton, Hardaway, Simpson, and Suwannee points (Coe 1964; Goodyear 1974, 1982). Goodyear et al. (1979) note that formal variability among Paleoindian point types may reflect chronological or spatial differences. A marked preference for high-quality cryptocrystalline lithic raw materials is also evident in Paleoindian toolkits.

The Archaic period (8000 to 1000 BC) is divided by archaeologists into three sub-periods: Early Archaic (8000 to 7000 BC), Middle Archaic (7000 to 3000 BC), and Late Archaic (3000 to 1000 BC). As the southeastern climate moderated from late glacial conditions into more modern and temperate ranges, Archaic peoples developed a more diversified subsistence economy (Watts 1970, 1980; Whitehead 1965, 1973). They focused on seasonal hunting, fishing, and collecting wild plant foods. The increased efficiency in resource exploitation resulted in the gradual development of more complex societies, regional variability in cultures, trade and exchange networks, and population growth (Caldwell 1958). Paralleling this expansion of adaptive strategies was an enlargement and elaboration of material culture and sites occupied. A wider variety of raw materials was used in the production of both flaked-stone and groundstone tools.

The Early Archaic sub-period (ca. 8000 to 7000 BC) is interpreted as a continuation of the preceding Paleoindian period in terms of settlement and subsistence patterns. The period is marked primarily by adaptations to changing environmental circumstances and an increased use of smaller species of fauna. Diagnostic artifact types of the Early Archaic include Taylor, Big Sandy, Palmer, Kirk, LeCroy, and St. Albans projectile points (Chapman 1975; Coe 1964). The remainder of the Early Archaic toolkit includes a variety of scrapers, wedges, and perforators. Edgefield-type side scrapers are regarded as a hallmark of the period.

Native populations and territoriality gradually increased during the Middle Archaic sub-period (ca. 7000 to 3000 BC). Stemmed projectile points of the Stanly, Morrow Mountain, and Guilford varieties are diagnostic of this period, and locally available quartz was the most common lithic material utilized (Blanton and Sassaman 1989; Tippett 1992). Nonlocal lithic resources were not extensively used.

Relative to the preceding Early Archaic period, when settlement patterns encompassed broad linear territories that crosscut geophysical zones to exploit specific seasonal resources, Middle Archaic settlement patterns reflect limited movement between regions. In contrast to Early Archaic groups, Middle Archaic populations expanded their settlement ranges within geophysical regions and exploited more diverse resources.

Settlement and artifact data from this period suggest “a strategy of small co-resident group size, frequent residential movements, generalized subsistence, low-investment technology, and social flexibility” (Sassaman et al. 1990). Sassaman (1988) and others assert that Middle Archaic populations were mobile and moved residential locations frequently to take advantage of specific resources as they became available. He suggests that tools used in resource procurement and processing were expedient forms manufactured from local materials. In the Piedmont, one such local resource was quartz.

This degree of mobility and expedient technology exhibited by the Middle Archaic populations is reflected by sites that consist principally of quartz debitage scatter.

Trends toward increasing population, group size, organizational complexity, and sedentism characterize the Late Archaic sub-period (3000 to 1000 BC). Diagnostic artifacts of the period include Savannah River and Otarre stemmed projectile points (Coe 1964; Keel 1976). Perforated soapstone slabs, three-quarter–groove groundstone axes, and grinding basins are also common. Another hallmark of the period is the introduction of ceramic technology around 2500 BC. Stallings Island pottery represents the earliest ceramic type in the region. Variety is tempered with fiber and occasionally exhibits surface treatment, such as punctations and incising. Sand-tempered Thom's Creek pottery represents a later variety and displays the same kinds of surface treatments. In general, Stallings pottery is believed to pre-date the Thom's Creek pottery, but some investigators believe that the two pottery wares were produced by contemporaneous Coastal Plain peoples (Trinkley 1980a). Ceramic technology has important implications for social dynamics. Ceramic vessels provide an efficient means of storing food, thereby permitting lengthier occupations at residential camps and offsetting seasonal fluctuations in food availability.

Subsistence data from the Late Archaic period suggest that aquatic resources formed significant proportions of the Late Archaic diet. Sassaman (1993) notes that shellfish constituted a principal food source; also, turtles were important dietary resources during this period. Large shell middens and shell rings developed near tidal marshes in the vicinity of the Project Study Area during this time. Deer and a variety of other terrestrial fauna were also consumed. Sassaman (1993) also cites evidence that marine resources were utilized along the Middle Savannah River. Such resources likely included anadromous fish that were obtained by inland populations, although it is possible that marine resources were acquired through trade with coastal populations.

Wetmore and Goodyear (1986) suggest that the use of grasses, chenopodium, sumpweed, squash, gourds, and sunflowers by 2500 BC is evidence of incipient horticulture.

Beginning in the Woodland period (1000 BC to AD 1000), populations in the Coastal Plain adopted a mixed hunting, gathering, and farming subsistence strategy (Trinkley 1980a, 1990). Semi-permanent to permanent villages were established in riverine settings. The use of ceramics, introduced during the Late Archaic, became widespread for storage and cooking (Anderson et al. 1982; Sassaman 1993; Trinkley 1980b). A number of sequential cultural complexes or phases have been distinguished for the Early Woodland subperiod (1000 BC to AD 1). These cultures, which include the Refuge phase, the Deptford phase, and the Deep Creek phase, are known primarily from the coastal sections of the state and the Savannah River Valley (Trinkley 1990).

Evidence from Marlboro County and Sumter County (Blanton et al. 1986) suggests that northern groups, who produced fabric-impressed and cordmarked pottery, interacted with southern groups of a carved-paddle tradition (Caldwell 1958). In general, the Early Woodland period is characterized by Yadkin series (quartz-tempered) ceramics (Coe 1964). Triangular points also appear during the period.

Subsistence strategies of the Early Woodland were expanded to include locally available floral and faunal resources. Shellfish, although still a part of the diet, were not exploited in such great quantities as during the Late Archaic. In the Coastal Plain, Early Woodland settlement is characterized by residential camps located on the coast. These camps are represented by shell middens located near tidal marshes and ceramic and lithic scatters in a variety of environmental zones. Group organizations appear to be based on semi-permanent occupation of shell midden sites, with short-term use of Inner Coastal Plain sites (Gardner and Roberts 1993).

The Middle Woodland subperiod (AD 1 to 500) includes a continuation of Yadkin pottery, and Deptford pottery becomes more common during this subperiod (Caldwell and McCann 1941; Caldwell and Waring 1939). Specifically, ceramic decorative modes from outside locales were being incorporated into Deptford ceramics and may indicate expansion of groups into other areas (Caldwell 1958). In addition, McClellanville/Santee series pottery has been recovered from sites in the vicinity of the Study Area (Anderson et al. 1982; Trinkley 1981).

Sassaman et al. (1990) have suggested that an increased use of areas around small tributaries occurred during the period as a response to the decreased productivity of maturing river floodplains. Middle Woodland subsistence strategies continued to rely on wild foods; there is no clear evidence of the use of cultivated plants during the period.

Food production intensified, supporting locally concentrated population aggregates. Large-scale storage is also evident (Sassaman et al. 1990). Mobility and settlement patterns resulted in numerous short-term occupations across the Coastal Plain landscape.

The Late Woodland sub-period (AD 500 to 1000) in the Coastal Plain is poorly understood. Few sites of this period have been recorded or excavated, and little information exists about sub-period chronology. Moreover, the relationship between the Late Woodland and later periods is vague. Trinkley (1990) suggests that little change in adaptation occurred between the Middle Woodland period and the development of the

South Appalachian Mississippian complex. Thus, the Late Woodland period may be considered an extension of the preceding era.

Stuart (1975) has developed a chronology for the Wateree Basin that is most applicable to this area. In this chronology, the Deptford/Yadkin pottery tradition gives way to the Camden ceramic series around AD 700. This series, produced until approximately AD 1100, is known by grit-tempered wares with check-stamped, simple-stamped, or incised surface decorations. Anderson and Schuldenrein (1985) suggest that evidence of intensive use of floodplains first appears during the Late Woodland. Such occupations are marked by pits, hearths, posts, and scatters of shell. Trinkley (1990) states that there are few indications of agricultural activity during this period in South Carolina, and if domestic plants were at all available, they constituted an insignificant proportion of the subsistence base. Sassaman et al. (1990) note, however, that maize agriculture was being practiced locally by the Late Woodland.

During the Mississippian period (AD 1000–1540), South Carolina’s native peoples developed into a complex chiefdom-level society. These new sociopolitical structures may have been imposed locally by elites immigrating into the region from the west (Sassaman et al. 1990). The Mississippian period is characterized by large village sites located on floodplains, as well as earthen mounds, settlement hierarchy, evidence of ranked social hierarchy, and an economy based on agriculture. The economic basis of these developments involved intensive maize agriculture. Sassaman et al. (1990) note that maize was being grown locally prior to the emergence of Mississippian polities in South Carolina. Corn, squash, and other cultigens were grown extensively in stream bottoms. Hunting and gathering of wild foods supplemented domesticated foods.

Mississippian populations throughout the Southeast facilitated agricultural production and the exploitation of wild foods by settling in floodplains that combined the advantages of easily tilled soils and access to rich sources of fish and waterfowl in oxbow lakes. Mississippian sites in the region are most often situated along major drainages and appear to reflect these settlement-subsistence trends (Anderson 1989).

Hallmarks of Mississippian sites include ceramic types that are distinguished on the basis of elaborate decorative motifs and rim treatments. These complicated stamped ceramics contrast with the plain, cordmarked, fabric-impressed, and simple stamped ceramics that characterized the preceding Woodland period (Anderson 1989). Distinct Mississippian ceramic phases are recognized for the region (Anderson et al. 1982; Anderson 1989). In coastal South Carolina, the Early Mississippian period is marked by the presence of Jeremy-phase (AD 1100–1400) ceramics, including Savannah Complicated Stamped, Savannah Check Stamped, and Mississippian Burnished Plain types. Poplin et al.’s (1993) excavations at the Buck Hall Site (38CH644) produced radiocarbon dates around

AD 1000 for complicated stamped ceramics similar to the Savannah series, which represents the earliest date for complicated stamped wares in the region and may indicate an earlier appearance of Mississippian types than previously assumed (Poplin et al. 1993).

Sites of the period in the region include shell middens, sites with apparent multiple- and single-house shell middens, and oyster processing sites (e.g., 38CH644 [Poplin et al. 1993]). Adaptation during this period apparently saw a continuation of the generalized Woodland hunting-gathering-fishing economy, with perhaps a growing importance on horticulture and storable foodstuffs. Anderson suggests that environmental unpredictability premised the organization of hierarchical chiefdoms in the Southeast beginning in the Early Mississippian period; the redistribution of stored goods (i.e., tribute) probably played an important role in the Mississippian social system (Anderson 1989). Maize was recovered from a feature suggested to date to the Early Mississippian period from 38BK226, near St. Stephen (Anderson et al. 1982).

During the Late Mississippian Period (AD 1400–1550), the regional chiefdoms apparently realigned, shifting away from the Savannah River centers to those located in the Oconee River Basin and the Wateree-Congaree Basin. As in the Early Mississippian, the Charleston Harbor area apparently lacked any mound centers, although a large Mississippian settlement was present on the Ashley River that may have been a "moundless" ceremonial center (South 2002). Regardless, it appears that the region was well removed from the core of Cofitachequi, the primary chiefdom to the interior (Anderson 1989; DePratter 1989).

5.9.1.6 Historic Background

The early portion of the historic period (from AD 1540 to 1730), also referred to as the Protohistoric period, extends from the end of the Mississippian period through the initial contact between Native Americans and Europeans and into, the Colonial period. The settlement patterns of the Native Americans who were living in the vicinity of the Study Area during the early historic period represents a continuation from the Late Woodland and Mississippian periods. The ethnohistoric record from the South Carolina coast suggests that Native Americans continued to move in a seasonal pattern, involving summer aggregation in villages where domesticated crops were planted and harvested followed by dispersal into small (one to three) family settlements for the rest of the year (Waddell 1980). The social framework and the regional occupation by various tribes remained stable through the 1660s (Waddell 1980).

During the seventeenth century, the British increasingly colonized areas of the New World as the Spanish empire waned. After the Spanish left South Carolina, the British established their first permanent settlement in South Carolina at Charles Town around

1670, which later became Charleston (Edgar 1998). After 1670, the British settlement of South Carolina resulted in changes to Native American settlement patterns. Tribes that occupied areas desired by the British were displaced farther inland. For example, three tribes (the Etiwan, the Wando, and the Sampa) who had lived near the site of Charles Town migrated north to occupy the Wando River; a fourth tribe (the Sewee) occupied the coast south of the Santee River (Waddell 1980).

Additional social migration resulted when the Cherokee consolidated their control of the Piedmont during the late 1600s forcing some tribes to move toward the coast (Waddell 1980). For this reason, when John Lawson traveled up the Santee River from the Atlantic Ocean in 1701 he encountered first the Sewee and then the Santee (Milling 1940). It appears that the Santee originally lived in areas much farther inland (Waddell 1980) but had relocated upstream from the Sewee on the Santee River's south side by the time of Lawson's visit (Milling 1940).

The British were initially content with settling the coastal areas and made treaties with local tribes that yielded control of the back country to the Yemassees and other tribes. However, peace between the local Indians and new settlers did not last long. The need for grazing lands led many British cattlemen to encroach upon the territory legally controlled by the Yemassees. Deceived by the British colonists, the Yemassees led an uprising of Carolina Indians in 1715. After 3 years of bloody war, the British were able to remove the Yamassee and other tribes forcibly and open the entire upcountry to settlement by 1719 (Edgar 1998).

Trade between Native Americans and the British began in the 1670s, but mutual suspicion largely surrounding trade practices soon led to war between the two groups. The Tuscarora tribe and its Native American allies united in war against the English from 1711–1713. The South Carolina Assembly sent troops to aid North Carolina's British residents, bringing an end to the hostilities. Among these troops were approximately 500 Native Americans, including members of the Santee, Sewee, Wateree, and Winyah tribes (Milling 1940). Not long after the end of the Tuscarora War, the settlement of the Port Royal Sound region and years of abuse from traders led to the outbreak of the Yamassee War (1715–1727), which threatened the continuance of the British colony in South Carolina. Although the Yamassee, Apalachicola, and Apalachee were the primary tribes involved in this war, any southeastern Native American tribe that had been mistreated by the British took part to some extent. As a result of the conflict and under continuing military pressure from the English, the Yamassee, Apalachicola, and Apalachee tribes left the region.

The early colonial settlement in the Study Area was guided by the Lord Proprietors (Edgar 1998). The proprietors were given vast power over the colony of Carolina by Charles II following his restoration to the English throne in 1660. Several of the proprietors owned plantations on the island of Barbados, and it is from there that many of the earliest colonists and enslaved Africans originated. The plantation system was quickly introduced to South Carolina, and the labor necessary for the operation of plantations was initially supplied by Native Americans and enslaved Africans.

The slave trade operating through the port of Charleston supplied increasing numbers of Africans to the labor pool resulting in a black majority by the first decades of the eighteenth century (Edgar 1998; Littlefield 1995). Colony-wide black to white ratios are believed to have been two blacks to every white after 1720. The black majority population of some parishes reached as high as 79 percent during the eighteenth century. It is estimated that 40 percent of all African-Americans living in the United States today are decedents of enslaved Africans that entered North America through the port of Charleston (NPS 2005). These statistics form a basis for understanding the later development of the Gullah culture of South Carolina's low-country (Edgar 1998; Littlefield 1995; Pollitzer 2005).

The plantation economy of early South Carolina was based on production of naval stores, indigo, and rice. The development of inland rice fields was labor intensive due to the construction of fresh water rice field impoundments, dikes, canals, and other water control structures. Edgar (1998) notes that the importation of enslaved Africans from the rice-growing regions of the Niger delta increased after 1730 as plantation owners expanded rice production and experimented with the cultivation of indigo. Sea Island cotton began to be cultivated during this period, displacing rice as the favored low-country cash crop after 1790 (Edgar 1998).

Charleston, Berkeley, and Georgetown counties played important roles during the American Revolutionary War. Fort Moultrie, which guarded Charleston Harbor, was attacked by British naval forces on June 28, 1776. This first attempt to subdue the patriot faction in South Carolina failed. While invasion threatened the coast, the back country of South Carolina was ablaze with war between loyalist and patriot militias. War returned to the low-country of coastal South Carolina in 1778 after the fall of Savannah to British forces. The fall of Savannah precipitated the Southern Campaign of 1778–1781. One of the important battles of that campaign was the surrender of the American army garrisoning Charleston to the British in April 1780. During much of this period, British supply lines to interior bases at Camden and Ninety-Six were threatened by Francis Marion operating out of the inland swamps surrounding Charleston and Georgetown.

Rice cultivation experienced a limited renaissance after the Revolutionary War with the introduction of a new method of cultivation, particularly in what is now Georgetown County (Joseph et al. 2006). The change from inland, swamp-based rice cultivation to tidal cultivation changed the plantation settlement pattern in the low-country. Many inland plantations were abandoned during this period in favor of those located closer to the coast (Edgar 1998; Joseph et al. 2006). A formidable system of dikes, ditches, canals, and gates was required to irrigate the fields during the planting season and protect the fields from winter flood events and tropical storms (Agha et al. 2011). These engineered structures were built by enslaved African-Americans using only hand tools and whatever aid could be rendered by mule power. The rice fields located along the banks of the North and South Santee rivers are of the tidal variety.

By 1820, cultivation of rice in the low country was in steep decline as a result of international competition. Planters in search of a replacement cash crop turned to the cultivation of cotton (Edgar 1998). After the invention of the cotton gin by Eli Whitney in 1793, cotton became the chief staple of the South. During the nineteenth century, a mixed planter economy existed in what is today Charleston and Georgetown counties, with wealthy rice plantations that employed slave labor existing along with yeoman farmers. As the demand for cotton increased during the nineteenth century, large plantations operated by slave labor dominated South Carolina's agricultural economy.

Most residents in the low country welcomed South Carolina's secession from the Union in December 1860, but the Civil War proved utterly disastrous for the area. Union forces occupied the Sea Islands within the first year of the war and used Beaufort and Hilton Head as the command base of the South Atlantic Blockading Squadron and headquarters for the U.S. Army, Department of the South (Edgar 1998). Despite this, most of what is now Charleston County remained under control of Confederate forces until late in the war defended by its formidable curtain of earthworks and fortifications.

Eventually, Charleston, Berkeley, and Georgetown counties were abandoned by the Confederates when the area found itself within the path of General William T. Sherman's army marching north from Savannah. Following his March to the Sea in Georgia, Sherman proposed a similar plan for South Carolina and received approval from General Grant and President Lincoln. On February 1, 1865, Sherman left Savannah with 60,000 troops and headed north with two singular strategic purposes: to destroy all resources in his path and to make his way through the Carolinas into Virginia. Once in Virginia, he would converge on Robert E. Lee's Army of Northern Virginia, then besieged at Petersburg by Grant. A third, non-strategic reason for the destructive march through South Carolina was to punish the state for its leading role in secession (McPherson 1988).

After the Civil War, the average size of farms began to decline. In 1860, the average farm in South Carolina encompassed about 570 acres, and by 1880 the average had dropped to 143 acres. By 1900, the average farm was only 90 acres in size. This average continued to decline during the first two decades of the twentieth century (Dodd and Dodd 1973). Smaller farms meant more intensive farming practices with little fertilization or crop rotation, which led to soil depletion and heavy erosion. In 1880, about one half of the state's farms were owner-operated, but by 1900 only 38 percent of the state's farmers owned their own land. This situation resulted in a vast class of tenants who fulfilled annual contracts with landowners.

Under the system of tenancy, landowners received either a share of the crops, with generally one third to one half claimed by the tenant, or cash rent. In most sharecropping cases, landowners provided a house on the parcel of land the tenant was to farm, implements, working livestock, feed, and seed, while the tenant provided all the labor. In 1910, the average tenant holding was 44 acres (Kovacik and Winberry 1987).

Historically, the overwhelming majority (78 percent) of tenants or sharecroppers was African-American (Edgar 1998). In many instances, the system fostered a lifestyle of poverty wherein the tenant became indebted to the landowner or local merchants but was prevented by law from abandoning the farm while indebted. World War I and the healthy business climate of the early 1920s brought agricultural prosperity by encouraging production and high prices for farm products. Many tenant farmers, however, having invested in livestock, machinery, and additional land, found themselves in debt in the late 1920s and 1930s, when agricultural prices plummeted because of a continued wartime production rate operating without the wartime demand (Bloomer 1993).

During the late nineteenth century and well into the twentieth century, the primary commercial enterprises in the low country consisted of phosphate mining and timber harvesting. This economic base was augmented by the presence of the Charleston Naval Base. The rural population declined as agricultural pursuits centered on subsistence and truck farming, and this economic pattern persisted into the post-World War II period after which Charleston and Georgetown counties developed a strong tourism industry.

5.9.1.7 Gullah Community History and Culture

The inland and tidal rice fields of Charleston and Georgetown counties were constructed by enslaved Africans from various ethnic groups from west and central Africa (Littlefield 1995; NPS 2005; Pollitzer 2005). Forced to work on South Carolina's coastal plantations, enslaved Africans met other enslaved Africans from many ethnic groups. The population of early colonial South Carolina included, among others, indentured European servants, enslaved Native Americans, French Huguenot refugees, and planters from the island of Barbados, as well as enslaved Africans. Faced with the challenges of life on the Carolina frontier, these communities borrowed cultural practices from each other to form a creole society.

The mixing of African cultures, languages, and religions on coastal plantations generated a culture that was African in origin but unique to the New World (NPS 2005). This culture and language represented by its decedent modern day low country communities is known as Gullah in South Carolina and Geechee in neighboring Georgia (Barnes and Steen 2012). The development of Gullah culture and language was made possible by the isolation of enslaved and then freed African-Americans in remote coastal areas separated from the mainland by marshes, creeks, and rivers.

The contributions of enslaved Africans and their Gullah decedents to the economy of coastal South Carolina during the ante-bellum period are difficult to estimate. The clearing of inland rice fields and the construction of water control structures during the tidal rice revolution involved extremely difficult and dangerous labor. Once the systems of dams, floodgates, ditches, dikes, and other hydraulic control structures had been built, they had to be maintained. These hydraulic systems were complex and required experience and skill to operate (Pollitzer 2005). Rice planters sought and obtained enslaved Africans from the rice growing regions of West Africa to create and manage the physical infrastructure of large-scale rice cultivation (Littlefield 1995).

Following emancipation and the collapse of the plantation system, the Gullah of coastal South Carolina turned to subsistence farming, timber harvesting, and fishing to sustain their families (NPS 2005). These activities augmented by hunting and gathering wild foods and medicinal plants ensured a strong sense of community inter-dependence and self-sufficiency (Barnes and Steen 2012). Since World War II, coastal South Carolina has experienced an influx of new residents with subsequent development of residential subdivisions, commercial enterprises, and golf course vacation resorts. These changes caused the NPS to undertake *The Low Country Gullah Cultural Special Resource Study*. A document designed to assist the public, state, and federal agencies, and most importantly the Gullah themselves in determining how best to preserve Gullah language and culture in the face of modern development pressures (NPS 2005). In 2006, Congress created the Gullah-Geechee Cultural Heritage Corridor based on its *Special Resource Study*. That corridor extends 30 miles inland along estuarine boundaries from the Cape Fear River in North Carolina to the Saint Johns River in Florida. All of the proposed corridors (Belle Isle corridor alternatives B and C; Charity; Jamestown) are within the boundaries of the Cultural Heritage Corridor.

5.9.1.8 Paleontology

The sedimentary stratigraphy of the South Carolina Coastal Plain was deposited during transgressive and regressive cycles of sea level change (Ward et al. 1991). Sedimentary sequences of Pliocene and Pleistocene (Plio-Pleistocene) age have been documented and mapped in South Carolina by analyzing the lithological characteristics of the deposits coupled with a biostratigraphic framework based primarily on invertebrate marine fauna like mollusks, ostracodes, and foraminifers (Ward et al. 1991).

Cyclic sea level change in response to eustatic loading of continental land masses was a gradual process that allowed development of Coastal Plain landforms like bays, estuaries, and barrier island chains. These landforms provided habitats for marine and terrestrial vertebrates, which left a rich fossil record embedded in Coastal Plain sediments.

Marine fossils found in near-surface sedimentary deposits associated with the Cooper, Pee Dee, and Black Mingo formations in Charleston and Georgetown counties include but are not limited to extinct mollusks, whale skeletal elements, and shark teeth. A variety of Plio-Pleistocene land mammals are included in the fossil record of the Coastal Plain, including but not limited to skeletal elements of extinct horses, camels, mastodons, mammoths, beavers, rodents, and various extinct predators. Near-surface disturbance of fossil-bearing strata by dredging drainage canals, excavating borrow pits, road construction, and other ground-disturbing activities frequently brings fossils to the surface. The South Carolina State Museum houses a large collection of fossils from the low country.

5.9.1.9 Previously Recorded Cultural Resources and Cultural Resource Investigations

Louis Berger entered into a subscriber's agreement with the South Carolina State Historic Preservation Office and South Carolina Institute of Archaeology and Anthropology to access the state's on-line cultural resource information system. This allowed Louis Berger full access to sensitive information about the locations of previously recorded survey areas, archaeological sites, historic buildings, structures, objects, or districts. Information about these resources, including their NRHP eligibility status, is available on the ArchSite server. The Louis Berger GIS-based search was conducted along the length of each of the corridor alternatives for 300 feet on either side of each corridor's centerline. These data were secured on the Louis Berger Project SharePoint site. Data access was restricted to a Louis Berger GIS analyst working under the direct supervision of a Louis Berger senior archaeologist who meets the *Secretary of the Interior's Standards and Guidelines* for conducting archaeological investigations.

The search had two objectives. The first objective was to identify previously recorded cultural resources located within the Study Area including buildings, structures, sites, objects, or districts, as well as properties of religious and cultural significance to Native Americans. The second objective was to identify previous cultural resource studies that have been conducted within the Study Area. Identification of the cultural resources included, to the extent possible, establishing whether the resource has been determined eligible for inclusion in, or was already included in, the NRHP. Both designations are historic properties (36 CFR §800.16[l][1]) and afford the same considerations and protections under NHPA and its implementing regulations, 36 CFR §800. The search results were compiled into tables that list all the recorded cultural resources and previous studies within the Study Area.

5.9.1.10 Cultural Resources and Historic Properties along Belle Isle Corridor Alternatives B and C, the Jamestown Corridor, and the Charity Corridor

The following section summarizes the previously recorded cultural resources identified along the four proposed corridor alternatives. Figures 5-28 through 5-30 illustrate the historic properties found within each of the four Study Areas. The data sets have been organized for use in consultation under Section 106. These consultations will address the need for a Phase I cultural resource inventory of the final ROW that Central Electric selects within the preferred corridor alternative. After the inventory is complete, consultation will continue if there are effects to historic properties or to discuss impacts to lands of religious and cultural significance to the Catawba Indian Nation and other consulting parties such as the Gullah-Geechee Cultural Heritage Corridor Commission and the Lowcountry Rice Culture Project. Consultation will continue until the Section 106 process is complete, which may include fulfilling stipulations of any agreement documents.

The *South Carolina Guidelines and Standards for Archaeological Investigations* (South Carolina State Historic Preservation Office 2009) recognize two classes of archaeological sites that are 50 years or older: sites and isolated finds. Sites are defined as “an area yielding three or more historic or prehistoric artifacts within a 30-meter radius and/or an area with visible or historically recorded cultural features (e.g., shell middens, cemeteries, rockshelters, chimney falls, brick walls, piers, earthworks). Isolated finds are defined as “no more than two artifacts found within a 30-meter radius.” The South Carolina State Historic Preservation Office recognizes buildings, structures, sites, objects, or districts that are 50 years or older as historic resources.

Table 5-28 summarizes the distribution of cultural resources located along the proposed corridor alternatives.

Table 5-28: Distribution of Cultural Resources and Historic Properties in the Study Area

Alternatives	Archaeological Sites	Historic Properties and Potentially Eligible Resources	Old Georgetown Road	Proposed Georgetown County Rice Cultural Historic District	Total
Belle Isle Alternative B	3	3		1	7
Belle Isle Alternative C	1	2		1	4
Jamestown	9		1	1	11

Alternatives	Archaeological Sites	Historic Properties and Potentially Eligible Resources	Old Georgetown Road	Proposed Georgetown County Rice Cultural Historic District	Total
Charity	15		1	1	17
Grand Total	28	5	2	4	39

Note: All of these cultural resources and historic properties fall within the boundaries of the Gullah Geechee Cultural Heritage Corridor. With the exception of the prehistoric archaeological sites, all of these resources could be considered as contributing features of the corridor.

Belle Isle Corridor Alternatives B and C

Three archaeological sites were previously identified within the Belle Isle Study Area. Of those, one site (38CH1132) has been determined not eligible for listing in the NRHP. Site 38CH0512 has not been evaluated for the NRHP. Site 38GE0651 has not been evaluated for the NRHP, and further work was recommended if the site location is compromised by proposed construction activities.

The Oaks Plantation is located within the 0.5-mile APE. Plantation lands are bordered by US 17, SC 24 (Powell Road), and the North Santee River. The South Carolina Department of Archives and History records that the plantation includes more than 1,000 acres of rice fields and is a potentially eligible site that has not been evaluated.

Peachtree Plantation, also located within the 0.5-mile APE, is located in Charleston County, on the south side of the South Santee River. The South Carolina Department of Archives and History has determined that plantation ruins and rice mill are eligible for listing in the NRHP (searchsite, accessed online 9/4/2018).

The proposed addition to the Georgetown County Rice Culture nomination (an addition to the multiple properties NRHP nomination) has been determined eligible for listing in the NRHP. That nomination boundary extends northwest across US 17 and into the north portion of the Study Area. The Georgetown County Rice Cultural district is intersected by both Belle Isle corridor alternatives.

Several properties in the vicinity of the Study Area are listed on the NRHP and are, or potentially are, contributing resources to the district. The properties include the Hopsewee Plantation and associated outbuildings. Hopsewee is a National Historic Landmark and is located approximately 1.5 miles southeast of the Belle Isle alternatives. Extant historic properties associated with the cultivation of rice in South Carolina constitute contributing elements to the multiple property listing. Contributing elements include plantation houses, outbuildings including rice barns, rice mills, and chimneys, cemeteries, slave cabins, and any archaeological sites related to rice cultivation.

The Thames House/Santee Home (455-0713) is also located within the 0.5-mile APE. The property, built in 1929, is potentially eligible for listing in the NRHP. Belle Isle corridor alternative B passes by the house, and it may need to be evaluated if that alignment is chosen.

Charity Corridor

Thirty-nine archaeological sites are present within the 600-foot corridor of the proposed Charity corridor. Of those, nine sites have not been evaluated for inclusion in the NRHP, four sites are recorded as potentially eligible for inclusion, and two sites have been recommended for additional testing. The remainder of the cultural resources have been determined not eligible for listing in the NRHP.

Eight historic structures have also been recorded in the Charity Study Area. All the resources except one have been determined not eligible for listing in the NRHP. Old Georgetown Road is a NRHP-eligible resource. The eastern extent of the Charity/Jamestown corridor crosses Old Georgetown Road about 2 miles north/northwest of the proposed McClellanville Substation location.

Jamestown Corridor

Forty archaeological sites have been previously recorded along the Jamestown corridor Study Area. The count does include those resources located along the merged Charity/Jamestown segment that runs from south of Honey Hill to the proposed McClellanville Substation; those resources are also discussed above with the Charity corridor resources. Of the 40 known resources located along the Jamestown corridor, five sites are considered potentially eligible for listing in the NRHP, and four sites have not yet been evaluated for listing in the NRHP.

Three cultural resources have been previously identified along the Jamestown corridor. The Marvin Bunch House and the John Bunch House have both been determined not eligible for listing in the NRHP. Old Georgetown Road is a NRHP-eligible resource. The eastern extent of the Charity/Jamestown corridor crosses Old Georgetown Road about 2 miles north/northwest of the proposed McClellanville Substation location.

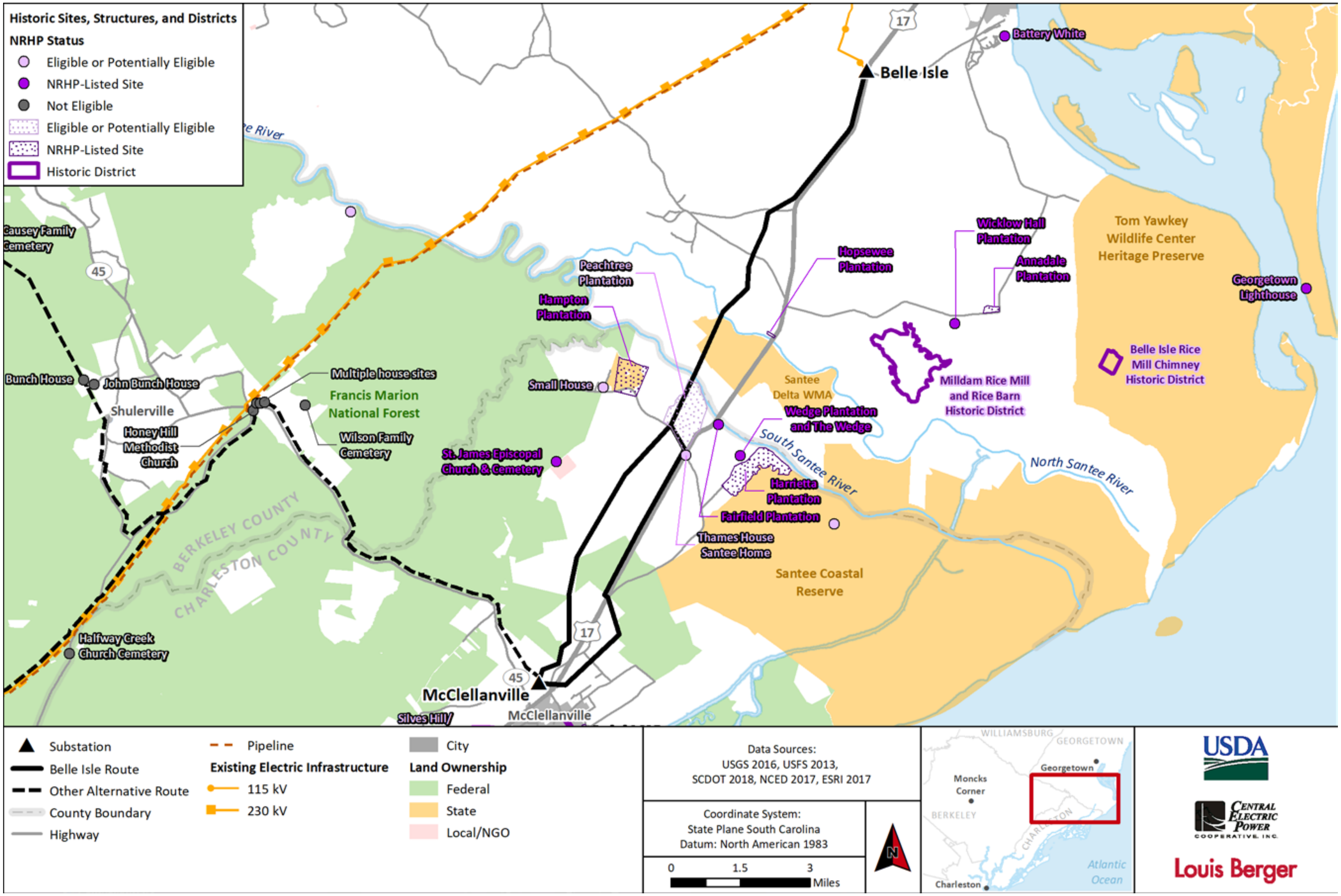


Figure 5-28: Cultural Resources within the Belle Isle Corridor Study Area

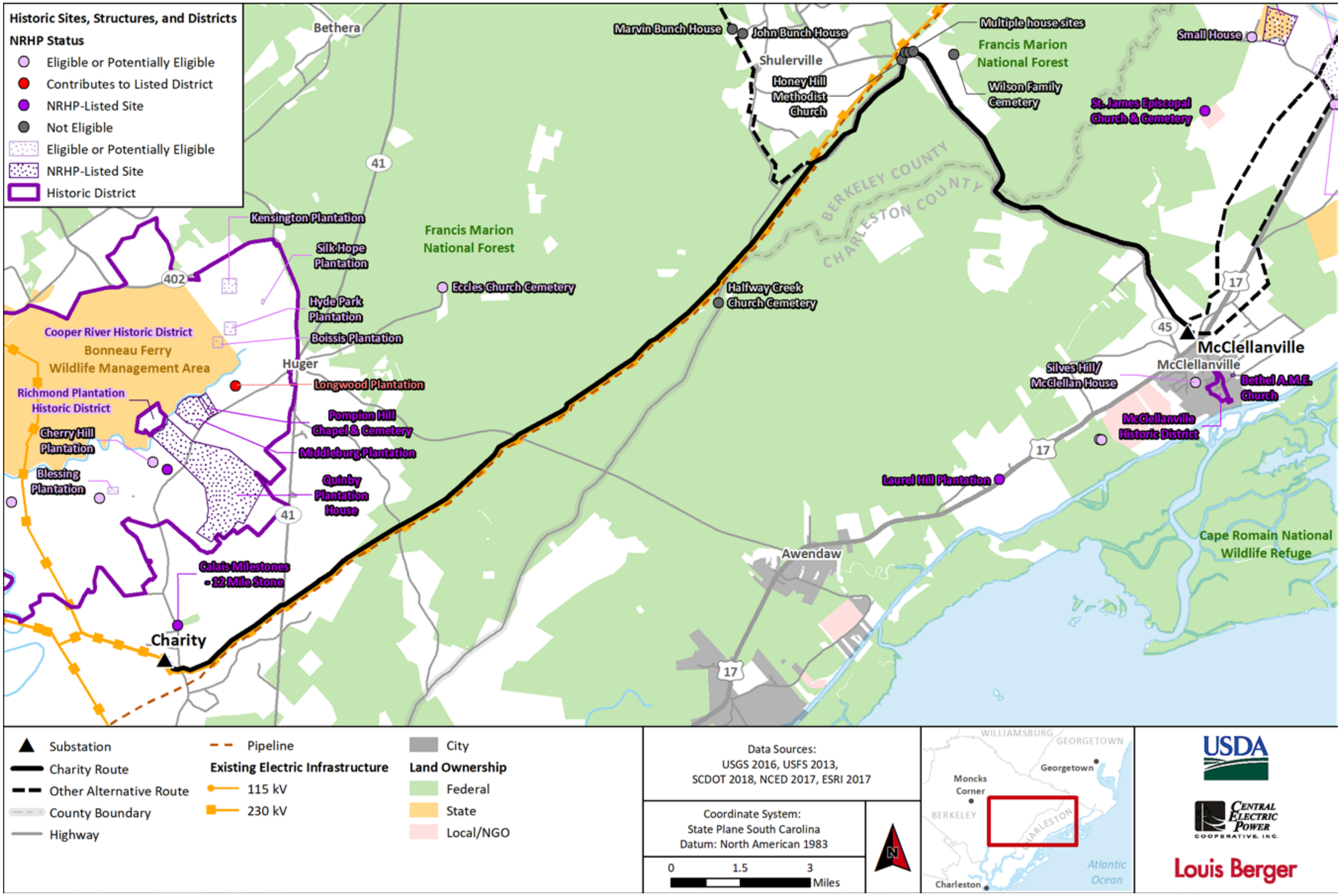


Figure 5-29: Cultural Resources within the Charity Corridor Study Area

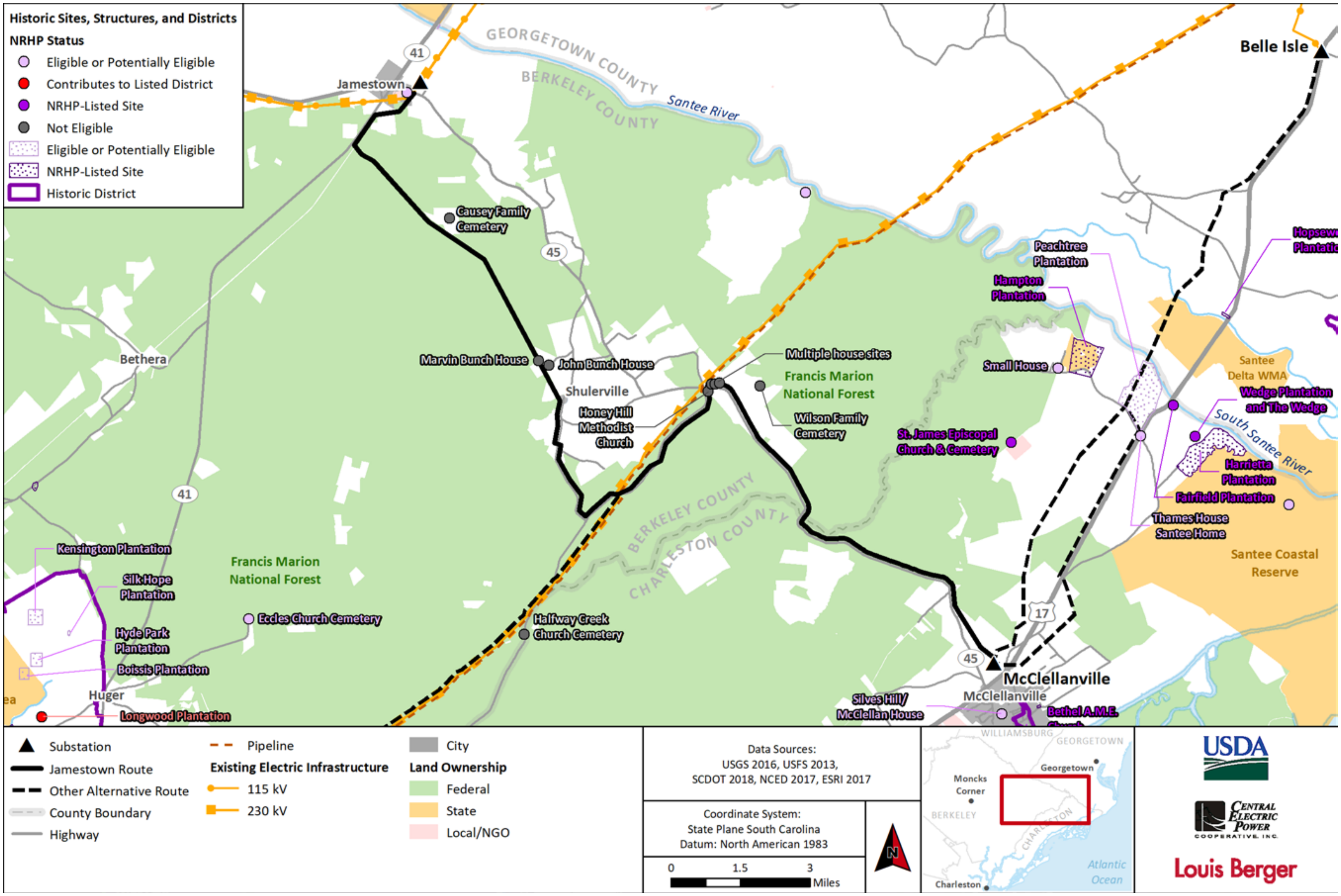


Figure 5-30: Cultural Resources within the Jamestown Corridor Study Area

5.9.1.11 Previous Cultural Resource Investigations

Several cultural resource surveys have included portions of each of the four proposed corridors. This section briefly outlines those surveys.

Belle Isle Corridor Alternatives B and C

Only one previous cultural resources survey has included the Belle Isle Study Area. The archaeological investigation was a reconnaissance survey in Charleston County of a portion of Rutledge Road (SR 857) conducted by SCDOT in 1978 (Trinkley 1978). The survey corridor started at U.S. Highway 17 to the south and crossed Old Georgetown Road.

Several surveys were conducted within 2 miles of the Belle Isle Study Area. Brockington and Associates carried out an archaeological survey ahead of improvements to the Georgetown County Airport in 2005 (Ellerbee and Fowler, 2005). The survey was located less than a mile from the Belle Isle substation. A cultural resources survey was conducted by Brockington and Associates in 2006 for South Carolina Public Service Authority. This work was conducted in Georgetown County for the purposes of identifying archaeological and architectural resources along the path of a proposed water line. The proposed waterline was intended to bring water from Wadmacon Creek to the Santee Cooper power generation station located on Winyah Bay. The north end of that survey corridor was approximately 1.5 miles northwest of the Belle Isle substation. TCR conducted an archaeological survey of the CRIS Tech Park in Georgetown County. In addition to these Project-specific surveys, additional county-wide historical surveys have been conducted for both Charleston and Georgetown counties (Flick 1992; Joseph et al. 2006).

Charity Corridor

At least eight cultural resource surveys have included the proposed Charity Route (USFS Alternative #2) alignment. Most recently, in June 2018 Brockington and Associates conducted a pedestrian survey of the segment up to the Charity/ Jamestown corridor intersection near Honey Hill. The survey included a 150-foot wide study area that generally paralleled the existing Winyah-Charity Transmission Line corridor, along Charity Church Road and Halfway Creek Road into the community of Honey Hill. The surveyors recommended additional investigation at several sites and LIDAR reconnaissance to assess the presence of structures related to rice plantations.

Jamestown Corridor

Between 1970 and 2017, a total of 28 cultural resource surveys have included the Jamestown corridor Study Area. The most recent of those was conducted by Brockington and Associates in 2017 (James and Philips 2017). The study was inclusive of those segments of the proposed Jamestown corridor that had not been previously subjected to archaeological survey or that were not on private land. The 2017 survey utilized a 150-foot APE on either side of the ROW centerline. Included in the survey corridor was the segment of the Charity/ Jamestown corridors where they merged south of Honey Hill and proceeded southeast towards McClellanville.

5.9.1.12 Historic Properties

The Old Georgetown Road and the Georgetown County Rice Fields are both historic properties that have been recommended eligible for the NRHP. The Old Georgetown Road located in Charleston County represents an eighteenth-century transportation-related resource.

The proposed addition to the Georgetown County Rice Culture nomination (an addition to the multiple properties NRHP nomination) has been determined eligible for listing in the NRHP. That nomination boundary extends northwest across U.S. Highway 17 and into the north portion of the Study Area. Extant historic properties associated with the cultivation of rice in South Carolina constitute contributing elements to the multiple property listing. Contributing elements include plantation houses, outbuildings including rice barns, rice mills, and chimneys, cemeteries, slave cabins, and any archaeological sites related to rice cultivation.

Together these historic properties tell the story of the growth and development of tidal rice culture from 1750 until 1910 when rice production ceased. The infrastructure that formed the basis of rice culture in South Carolina was erected by enslaved Africans and African-Americans, and as such, these resources are directly and intimately associated with the Gullah community. All cultural resources and historic properties listed in the Georgetown Rice Fields NRHP nomination should be considered as contributing features of the Gullah-Geechee Cultural Heritage Corridor.

The Belle Isle corridor alternatives cross these tidal rice fields. The corridor alternatives may also intersect potential historic sites not identified on Figure 5-30. This includes the Oaks Plantation, and Commander Island.

Several historic properties like Fairfield Plantation, Hampton Plantation, and Thames House/Santee Home may fall within the preliminary indirect APE of the corridor alternatives. Finally, archaeological site 38CH0512 is recommended potentially eligible for the NRHP. This site is intersected by Belle Isle corridor alternative B.

Traditional Cultural Properties

As mentioned above, consultation with the Catawba Indian Nation will take place to ensure that the Tribe has the opportunity to identify historic properties of religious and cultural importance that may be affected by the undertaking and may include information on Traditional Cultural Properties (TCPs). NRHP Bulletin Number 19 defines a TCP as a historic property where "significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices" and that these resources may be eligible for inclusion in the NRHP because of their "association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1998). In addition to local communities and stakeholders, RUS is consulting with the Gullah-Geechee Cultural Heritage Corridor Commission and the Lowcountry Rice Culture Project regarding possible TCPs within the Study Area.

5.9.2 Environmental Effects

Background research demonstrates that the construction of new transmission line facilities (e.g., pole locations, substation modifications, pull sites, access roads, and lay-down yards) could affect previously recorded historic properties and currently unidentified cultural resources present along all the proposed corridor alternatives, including on state, local, and federal lands. Once historic properties are identified, RUS, in consultation with the consulting parties, would determine if there are effects and if those effects are adverse (36 CFR §§800.4 and .5). Any adverse effects on cultural resources must be resolved in accordance with 36 CFR §800.6.

The transmission line, with its pole installation and substation modification (excluding the substation that has already been surveyed), has the potential to have an effect on archaeological sites through ground-disturbing activities. Once the preferred alternative is selected, Central Electric would work with archaeologists, who meet or exceed the Secretary of the Interior's Guidelines and Standards, to identify and avoid known site boundaries within the archaeological APE. This action represents a good faith effort to minimize construction impacts on archaeological resources.

The proposed Project could also alter the setting and feeling of historic structures, districts, or landscapes as well as properties, including TCPs, important to the Catawba Indian Nation, Gullah-Geechee Cultural Heritage Corridor Commission, and the Low Country Rice Culture Project, as well as other interested parties.

In areas not previously disturbed by construction or by extractive industries, and where archaeological potential is assessed to be high (e.g., near large lakes, river crossings, historic roads, and rice fields), unrecorded archaeological sites, landscapes, historic districts, or TCPs may be affected during construction of transmission line and associated infrastructure. Landscape character associated with historic buildings or other properties may be impacted by the height of the new transmission structures and infrastructure.

Possible impacts on archaeological resources that would apply to all of the corridor alternatives include: (1) subsurface excavations necessary to install structures; (2) disturbance to surface soils throughout the corridor as a result of heavy construction vehicle equipment operation; and (3) disturbance to surface soils through grubbing, stump removal, and grading.

5.9.2.1 No-action Alternative

The no-action alternative would not impact existing cultural resources either directly or indirectly and would allow for existing conditions to remain. Archaeological and historic resources would neither be preserved in another manner nor damaged under the no-action alternative.

5.9.2.2 Proposed Action

Archaeological Sites

Belle Isle Alternatives B and C

A total of three archaeological sites have been identified within the 600-foot preliminary APE of the Belle Isle corridor alternatives. Site 38CH1132 (Thames House/Santee Home) has been recommended as not eligible for the NRHP. This site is intersected by Belle Isle corridor alternative B. Because this site is not eligible for the NRHP, the Project would have no impact on this resource. Site 38CH0512 has been not been evaluated for the NRHP. This site is also intersected by Belle Isle corridor alternative B. If this becomes the preferred alternative, additional archaeological testing would be necessary to evaluate its eligibility for the NRHP. Site 38GE0651 is recommended for further work. This site is intersected by Belle Isle corridor alternatives B and C. Should one of these alternatives become the preferred alternative, additional archaeological testing would be necessary to evaluate its eligibility for listing in the NRHP. In addition, only one previous archeological survey has included a portion of the Belle Isle corridor alternatives. Additional systematic survey will likely be required to identify any unknown resources that may be present within the chosen alternative.

Charity Corridor

A total of 39 archaeological sites have been identified within the 600-foot preliminary APE of the Charity corridor alternative. Since 24 of those have been determined not eligible for listing in the NRHP, the Project would have no impact on those resources. Thirteen sites have not been evaluated for inclusion in the NRHP or have been determined potentially eligible, and two sites have been recommended for further work. Additional archaeological testing would be necessary to evaluate the eligibility of those 15 sites for listing in the NRHP.

Jamestown Corridor

A total of 41 archaeological sites have been identified within the 600-foot preliminary APE of the Jamestown corridor. Because 32 of those sites have been determined not eligible for listing in the NRHP, the Project would have no impact on those resources. Nine archaeological sites have not been evaluated for inclusion in the NRHP or have been determined potentially eligible for listing. Additional archaeological testing would be necessary to evaluate the eligibility of those nine sites for listing in the NRHP.

In the event that unevaluated sites are encountered along the preferred alternatives, Central Electric would flag and avoid impacts to these sites.

Landscape and Transportation Resources

The South Carolina State Historic Preservation Office and other interested parties proposed an Addition to the Georgetown County Rice Culture nomination (a multiple properties NRHP nomination) which has been determined eligible for listing in the NRHP. The expanded nomination would include some of the tidal rice fields lining the banks of the North and South Santee rivers between Wadmacon Creek and the Santee River Delta. This tidal rice field complex would be intersected by the northern portion (the north side of the South Santee River) of the Belle Isle corridor alternatives B and C.

The Peachtree Plantation is situated in Charleston County, on the south bank of the South Santee River. It has been determined eligible for listing in the NRHP. The Belle Isle corridor alternatives B and C as proposed would parallel the west side of the plantation lands. Direct physical and visual impacts to the historic property would need to be minimized. Likewise, the Oaks Plantation, located on the north bank of the North Santee River in Georgetown County, could incur visual impacts if Belle Isle corridor alternative B or C is chosen. The resources has not yet been evaluated for listing in the NRHP and is considered potentially eligible.

Minimization measures for physical impacts may include use of BMPs for installation of transmission line structures in wetlands; avoidance of dikes, embankments, and other associated water control structures when placing towers; and minimization of ground disturbance. Minimization of visual adverse impacts may be through the careful placement of transmission line structures near the edges of woods, topographic depressions, or near the toe of the slope of the rice field dike. After a preferred alternative and the final ROW are selected, RUS and the consulting parties under Section 106 would work together to minimize and mitigate adverse physical and visual impacts. RUS and Central Electric would explore alternative mitigation strategies with the South Carolina State Historic Preservation Office and consulting parties if adverse impacts are unavoidable.

The NRHP-eligible Old Georgetown Road, linking coastal plantations and settlements with Georgetown and Charleston, has been in existence since the eighteenth century. The section of the road located in Charleston County has been determined eligible for listing in the NRHP. The Charity and Jamestown corridor alternatives as presently configured cross but do not parallel this historic property. If adverse impacts occur, they would be visual and would be mitigated by careful placement of transmission line structures outside the roads' existing ROW. This would minimize impacts to existing trees which line portions of the Old Georgetown Road. If necessary, adverse visual impacts could be further mitigated by planting additional trees to serve as visual buffers. Construction of the proposed transmission line could impact the setting of the Old Georgetown Road. The setting of above-ground historic properties is an attribute of their historical significance.

Gullah-Geechee Cultural Heritage Corridor

As noted earlier, all above-ground resources that constitute contributing elements of the Georgetown Rice Fields multiple properties NHRP listing that fall within the APE for the alternatives could be TCPs. These historic properties are significant cultural resources for the interpretation of the Gullah-Geechee Heritage Corridor (Gullah Geechee Heritage Corridor Commission 2012). Some of the Gullah Geechee communities referenced in the Cultural Heritage Corridor Management Plan (e.g., South Santee, Germantown, Tibwin, Buck Hall, and Awendah) are communities that would benefit directly from the operation of the proposed Project.

Cultural landscapes are areas that reflect how people adapt and use natural resources, which is expressed in land organization or use, settlement patterns, circulation, or types of structures, and how the area reflects cultural values and traditions (USFS 2017). The National Park Service categorizes cultural landscapes into four types: historic designed landscapes, historic vernacular landscapes, historic sites, and ethnographic landscapes. Cultural landscapes associated with the Gullah-Geechee corridor may not be previously identified as "cultural landscapes," but can include sites that fulfill the above definition of a cultural landscape. Examples might include plantations, village sites, or other important places with ties to long-established groups identified with Gullah-Geechee cultural history.

Paleontological Resources

Fossilized marine and terrestrial skeletal elements may be encountered along any of the corridor alternatives during the course of transmission line construction. If fossilized animal remains are encountered during construction, Central Electric construction inspectors would be notified immediately. Upon notification, Central Electric project managers may wish to inform the South Carolina State Museum of the discovery so that the staff paleontologist may assess its significance. In addition, the PA has provisions for the treatment of unanticipated discoveries.

5.10 Recreation and Land Use

5.10.1 Affected Environment Regional Setting

The proposed Project area is situated in the low country of South Carolina and includes portions of Georgetown, Charleston, and Berkeley counties. The region surrounding the proposed Project is largely rural, undeveloped lands characterized as low-lying topography covered in forest, with smaller areas of croplands and pockets of residential development (Figure 5-31). The Santee River delta, the confluence of the North and South Santee rivers, is the largest delta on the east coast and flows west to east through the proposed Project area. The delta floodplain was converted to rice fields by early plantation owners, and it now provides quality habitat for wintering birds and other wetland wildlife as well as recreational opportunities. Lands throughout the delta consist of impounded, remnant rice fields and bottomland hardwood forest.

5.10.1.1 Recreation

Public lands and waterways in the South Carolina low country provide plentiful opportunities for outdoor recreation. Popular outdoor recreation activities primarily include fishing, hunting, swimming, picnicking, boating, hiking, camping, and wildlife observation. The FMNF, USFWS, SCDNR, SCDOT, and private conservation groups all provide outdoor recreation areas. Free flowing waterways, like the Santee River, allow for a number of water-based recreation activities. Figures 5-31 through 5-33 show the locations of the major recreation opportunities in proximity to each proposed corridor alternative.

Recreation opportunities are described in four categories based on the ownership and management of each recreation area: federal, state, city/county, and private/non-governmental organization.

Federal

Federal recreation areas within the Project vicinity include the FMNF, managed by USFS, and the Cape Romain National Wildlife Refuge, managed by USFWS. Both areas provide for a number of outdoor recreation opportunities as follows.

FMNF—The FMNF is located in the Coastal Plain of South Carolina and is bounded to the north by the Santee River and the Intracoastal Waterway and the Atlantic Ocean to the east. The 259,625-acre national forest is situated within Berkeley and Charleston counties, west of McClellanville, with a small area crossing U.S. Highway 17 sharing a border with the Santee Coastal Reserve (discussed in detail below) (USFS 2015). Each of the proposed corridor alternatives passes through some amount of the FMNF.

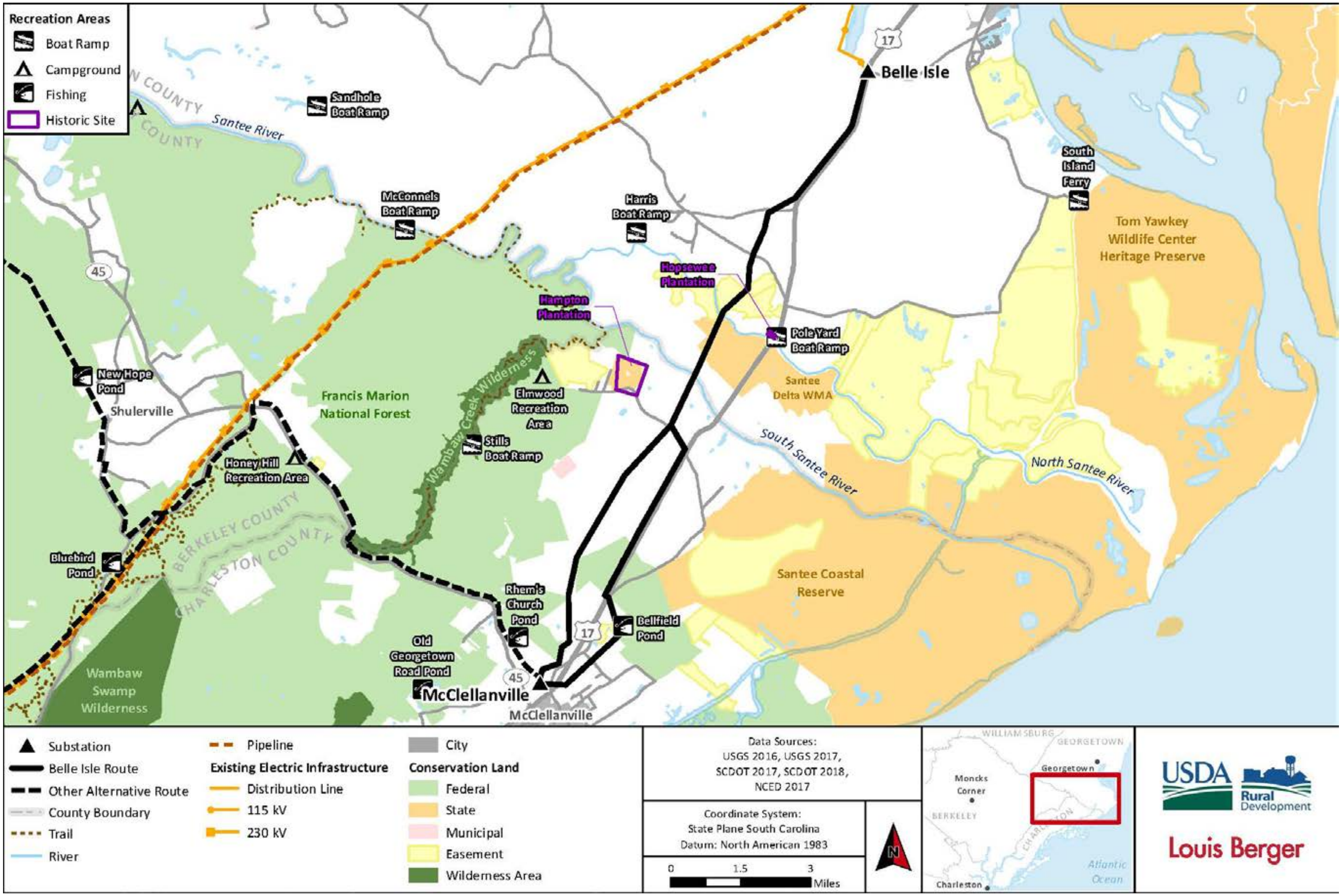


Figure 5-31: Recreation Areas in the Project Area (Belle Isle Alternative)

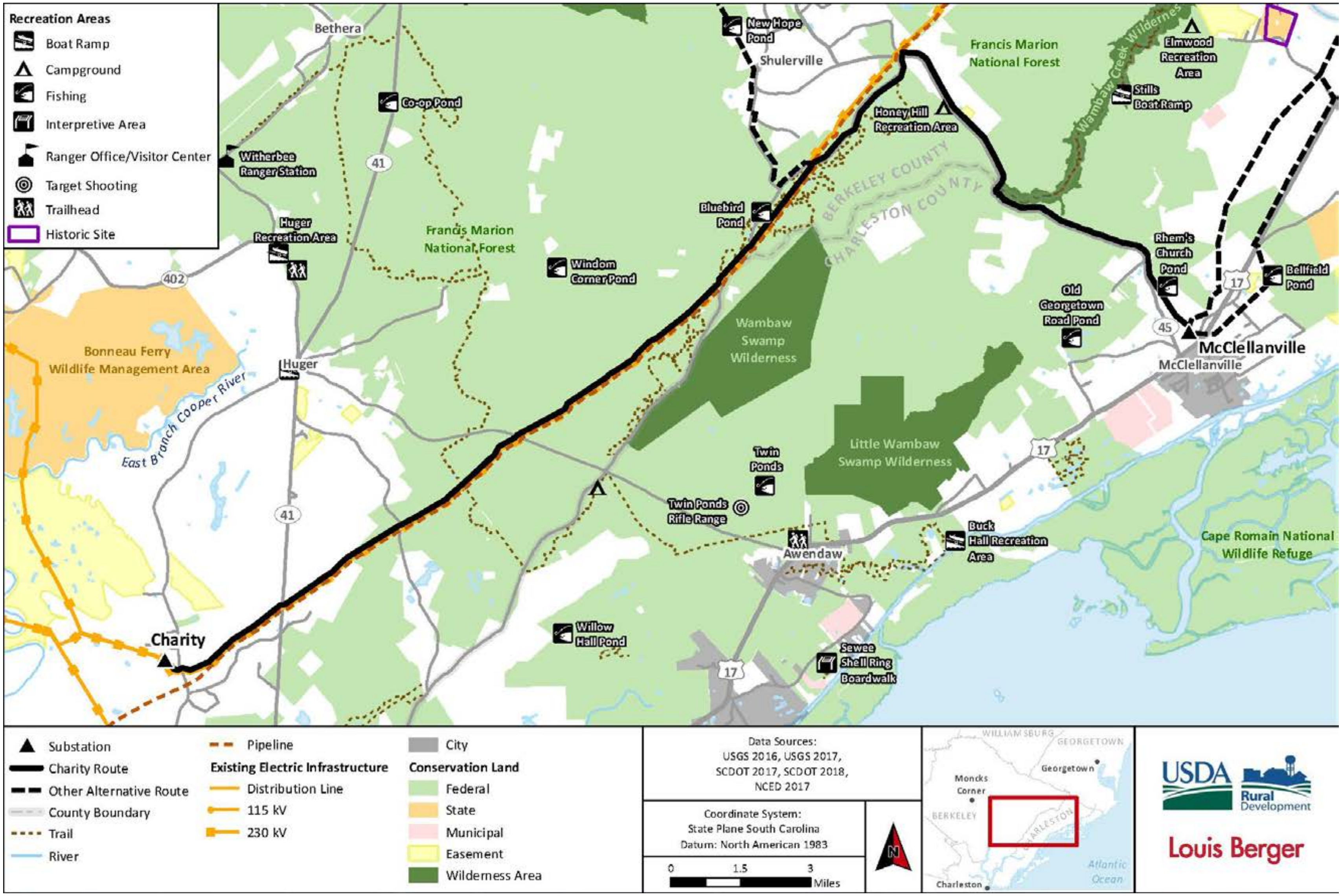


Figure 5-32: Recreation Areas in the Project Area (Charity Alternative)

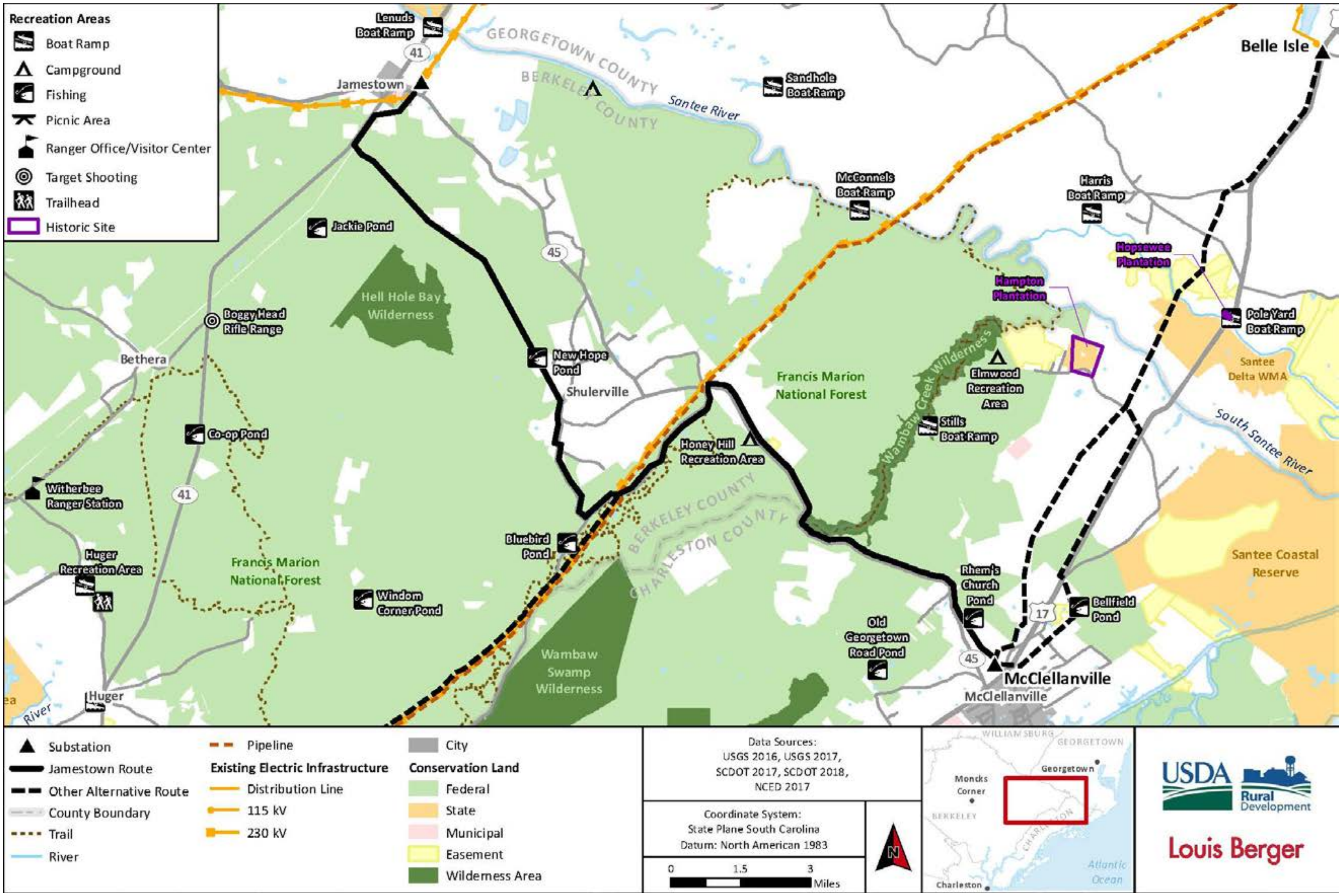


Figure 5-33: Recreation Areas in the Project Area (Jamestown Alternative)

The FMNF provides a number of recreation opportunities. The FMNF maintains approximately 90 miles of trails that offer hiking, horseback riding, motorcycling, off-highway vehicle riding, mountain biking, and canoeing (USFS 2017; USFS 2018f). Additional recreation facilities in the forest include shooting ranges, fishing ponds, boat launches (motorized and non-motorized), campgrounds, educational centers, and interpretive trails. The FMNF has one of the largest publicly available areas for hunting and fishing in the State of South Carolina (USFS 2017). Four wilderness areas in the FMNF total more than 13,000 acres and provide opportunities to hunt turkey, deer, grey squirrels and fish in streams, lakes and ponds. The Wambaw Creek Wilderness Area hosts a 5-mile canoe trail along Wambaw Creek, a blackwater tributary of the South Santee River.

Four designated ‘recreation areas’ lie within the FMNF in the Project vicinity. These areas include Elmwood Recreation Area, Honey Hill Recreation Area, Buck Hall Recreation Area and Huger Recreation Area.

Elmwood Recreation Area—Elmwood Recreation Area is located in the northeastern part of the FMNF just outside of the Wambaw Creek Wilderness. The area is a primitive campsite with a picnic tables, grills, vault toilets and water spigots. The area is popular during deer and turkey hunts and serves as a station for SCDNR to check game during big-game hunting season (USFS 2018g).

Honey Hill Recreation Area—Honey Hill Recreation Area is located in the FMNF between McClellanville and Honey Hill, along French Santee Road and the proposed Jamestown and Charity corridor alternatives. The site includes primitive camping, picnic tables, grills, and vault toilets (USFS 2018h).

Buck Hall Recreation Area—The Buck Hall Recreation Area is located on the south east end of the FMNF near the Cape Romain National Wildlife Refuge and along the Intracoastal Waterway. The recreation area has a boat launch with a floating dock that grants access to the Intracoastal Waterway and the Cape Romain National Wildlife Refuge for motorized and non-motorized boats. Tent and trailer camping are available at this site along with picnic tables, restroom facilities, and water spigots. In addition to boating and camping, this is also a popular spot for shrimp baiting (USFS 2018i).

Huger Recreation Area—The Huger Recreation Area is a day use site located off South Carolina Route 402 along Huger Creek on the west side of the FMNF. Amenities at this site include a boat ramp that grants access to Huger Creek, picnic tables, grills, vault toilets, and water spigots. In addition to boating and picnicking, this is also a popular area for fishing.

Cape Romain National Wildlife Refuge—Cape Romain National Wildlife Refuge is an area located southeast of the FMNF along the Atlantic Ocean. The Refuge is part of the National Wildlife Refuge System and is managed by USFWS. Cape Romain National Wildlife Refuge is about 66,300 acres encompassing a 20-mile segment of the Atlantic coast and includes barrier islands, salt marshes, intricate coastal waterways, sandy beaches, and maritime forests and is managed by USFWS (USFWS 2010). Recreation opportunities at the Refuge include hiking, hunting, freshwater and saltwater fishing, wildlife viewing, photography, and environmental education (USFWS 2010).

State

The State of South Carolina manages two public land areas, two boat ramps, and holds in trust two rivers within the Project vicinity. Both the Santee Delta WMA and Tom Yawkey Wildlife Center Heritage Preserve are managed by the SCDNR. SCDOT manages the two boat ramps.

Santee Delta Wildlife Management Area—The Santee Delta WMA, managed by the SCDNR, provides habitat for wintering waterfowl and other wetland wildlife including wood storks, wading birds, ospreys, and bald eagles. The WMA is divided into two areas: Santee Delta East and Santee Delta West. Santee Delta East is mostly impounded remnant rice fields while Santee Delta West is impounded bottomland hardwood forest. Within the Santee Delta WMA is the Santee Delta Waterfowl Area. This expanse is a Category I waterfowl area, meaning that it is a high quality, intensively managed habitat. The 1,721 acres of wetlands are home to large concentrations of waterfowl. The abundance of waterfowl and migratory birds allows for a number of avian-based recreation activities including birding, photography, and hunting (SCDNR Public Lands 2018).

Santee Coastal Reserve—The Santee Coastal Reserve is a WMA managed by SCDNR. The reserve encompasses 24,000 acres and includes trails and boardwalks for walking, hiking, biking, wildlife viewing and photography (South Carolina Department of Parks, Recreation and Tourism 2018a). The North Santee River runs along portions of the northern border of the reserve and the South Santee River runs through it. These rivers provide opportunities for motorized and non-motorized boating and fishing.

Tom Yawkey Wildlife Center Heritage Preserve—The Tom Yawkey Wildlife Center Heritage Preserve consists of 20,000 acres of coastal land in Georgetown, South Carolina and is bordered on the west by the Esterville Minim Creek Canal and on the east by the Atlantic Ocean. The Preserve includes marshes, wetlands, forests and beaches and provides important habitat for migratory birds, alligators, and sea turtles (South Carolina Department of Parks, Recreation and Tourism 2018b). Recreation at the Preserve is available on a limited basis and must be pre-scheduled (SCDNR Public Lands 2014).

Guided tours provide the opportunity for birding, wildlife viewing, and photography (South Carolina Department of Parks, Recreation and Tourism 2018b). Camping is available in the summer along the ocean-side beaches and is accessible only by boat (SCDNR Public Lands 2014).

Boat Ramps—SCDOT owns two boat Ramps in the Project vicinity that provide access to the Santee River. These ramps include the Pole Yard and Lenuds Boat Ramps.

The Pole Yard boat ramp is on the north bank of the North Santee River in Georgetown County directly across from the Santee Delta WMA (see Photographs 2 and 3). This site has a two-lane ramp, courtesy dock, and paved parking for about 23 vehicles with trailers and can accommodate non-motorized and motorized watercrafts.

The Lenuds boat ramp is in Berkeley County along South Carolina Highway 41 on the Santee River. It is a two-lane concrete ramp with a paved parking area and can accommodate non-motorized and motorized watercrafts.

Photograph 2: Pole Yard Boat Ramp

Photograph 3: North Santee River

County

Boat Ramps—Georgetown County owns two boat launches in the Project vicinity: the Harris Boat Ramp and the Sandhole Boat Ramp. The Harris Boat Ramp is located northeast of the FMNF and provides access to the North Santee River for motorized and non-motorized boats. The ramp has one lane and parking for about 20 vehicles. The Sandhole Boat Ramp is located northwest of the Harris Boat Ramp along Wadamon Creek. The ramp has one lane, limited parking space, and provides access to Wadamon Creek for motorized and non-motorized boats.

Private

Conservation Easements—Ducks Unlimited holds the Oaks (204 acres), Crow Hill (274 acres), and Commander Island (373 acres) plantations in conservation easements. These privately owned and neighboring plantations encompass about 850 acres along the North Santee River in Georgetown County west of U.S. Highway 17. The Oaks Plantation operates as a private hunting club while the other two plantations do not offer any known recreation opportunities.

5.10.1.2 Land Use

Land Cover

The Study Area is located in the southern portion of Georgetown County, the northern portion of Charleston County, and the eastern portion of Berkeley County. U.S. Geological Survey land cover data are publicly available for this area and are useful as a proxy for the types of land uses present. National Land Cover Database (Homer et al. 2015) data were reviewed for the 2,000-foot study corridor with a 75-foot ROW.

Table 5-29 shows the results of the National Land Cover Database analysis in percent land cover for the Belle Isle (B and C), Jamestown, and Charity corridor alternatives. According to Table 5-29, evergreen forest (43 percent) makes up the majority of the land within the ROW for the Belle Isle B and C ROW, followed by woody wetlands (28 percent) and developed open space (15 percent). For the Jamestown corridor alternative, the majority land use is split between evergreen forest (36 percent) and developed open space (36 percent) and is followed by woody wetlands (15 percent). The Charity alternative ROW is primarily made up of woody wetlands (36 percent), followed by evergreen forest (22 percent), shrub/scrub (19 percent), and developed open space (13 percent).

Table 5-29: Land Cover Percentages within 75-foot ROW

Land Cover Categories[a]	Belle Isle B	Belle Isle C	Jamestown	Charity
Open Water	1%	1%	0%	0%
Developed, Open Space	15%	13%	36%	13%
Developed, Low Intensity	1%	0%	0%	0%
Developed, Medium Intensity	0%	0%	0%	0%
Deciduous Forest	0%	0%	0%	0%
Evergreen Forest	43%	39%	36%	22%
Mixed Forest	0%	0%	2%	1%
Shrub/Scrub	4%	2%	7%	19%

Land Cover Categories[a]	Belle Isle B	Belle Isle C	Jamestown	Charity
Grassland/Herbaceous	0%	0%	1%	3%
Pasture/Hay	1%	1%	2%	0%
Cultivated Crops	0%	0%	0%	0%
Woody Wetlands	28%	37%	15%	36%
Emergent Herbaceous Wetlands	6%	6%	1%	5%

[a] Percentages calculated from the National Land Cover Database are not always accurate due to the large cell size.

Figures 5-34 through 5-36 show aggregated land cover data for the area surrounding each alternative. For this analysis, land cover categories were combined, as shown in Table 5-30, based on the similarities among a number of the categories and the application of the dataset as a surrogate for land use. Table 5-30 identifies lands within the 2,000-foot corridor, which are predominantly forested followed by the open water/wetland type habitats, which is expected given the location of the Santee River delta in the middle of the proposed line. Much smaller amounts of the land are developed, shrub/scrub and grassland/herbaceous. There is a negligible amount of pasture/hay and cultivated crops grown in the area.

Table 5-30: Land Cover Percentages within 2,000-foot Corridor

Land Cover Categories[a]	Belle Isle B	Belle Isle C	Jamestown	Charity
Forest	43%	37%	49%	34%
Open water and wetlands	35%	45%	33%	49%
Shrub/scrub and grassland/herbaceous	12%	11%	11%	13%
Developed (open, low, medium and high)	7%	4%	4%	3%
Pasture/hay and cultivated crops	2%	2%	3%	1%

[a] Percentages calculated from the National Land Cover Database are not always accurate due to the large cell size.

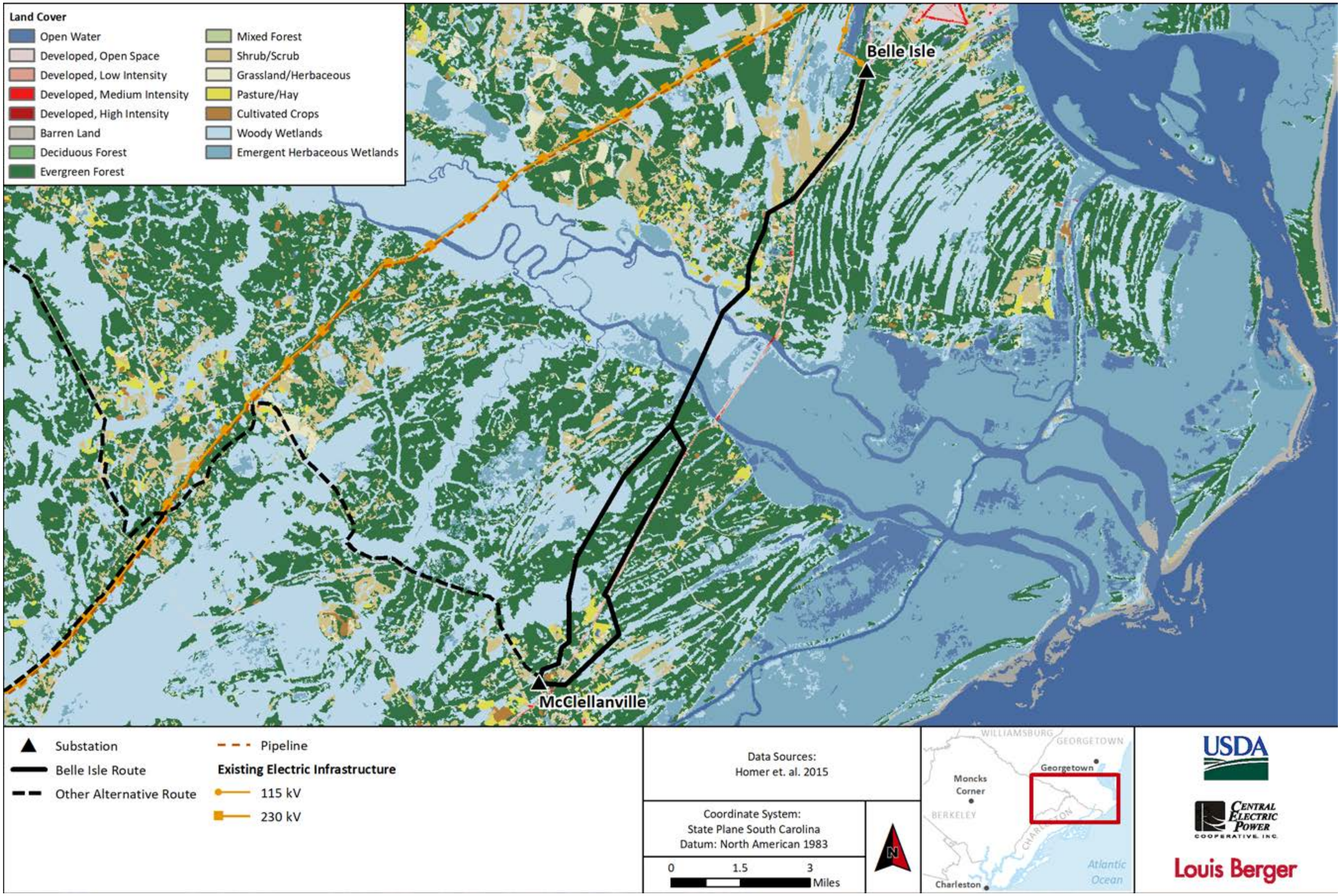


Figure 5-34: Land Use in the Project Area (Belle Isle Alternative)

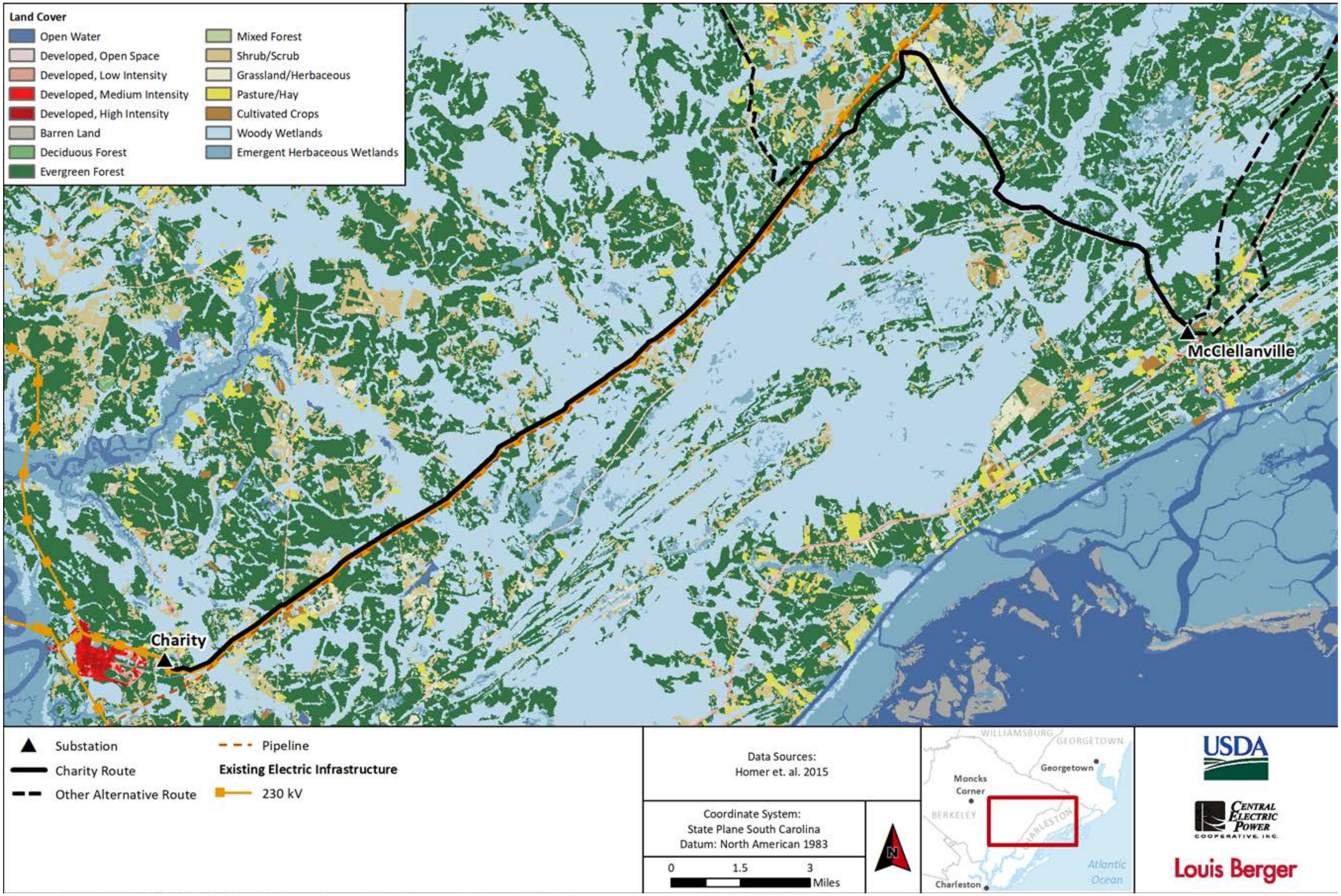


Figure 5-35: Land Use in the Project Area (Charity Alternative)

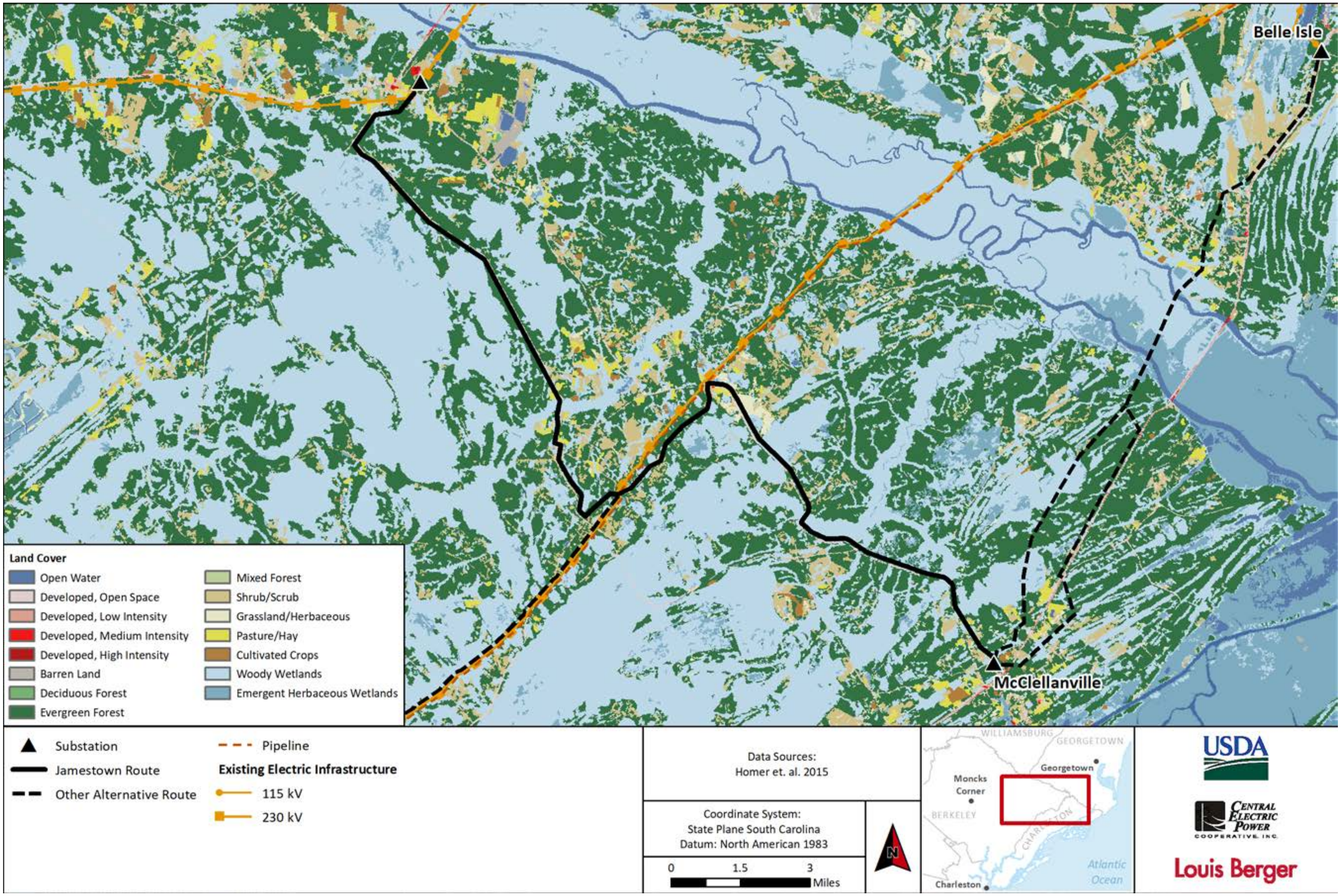


Figure 5-36: Land Use in the Project Area (Jamestown Alternative)

Land Ownership

USFS estimates that 88 percent of the state's 13.1 million acres of forest land are owned by private individuals (USFS 2011). Federal and state lands within proximity to the proposed corridor alternatives include the FMNF, Santee Delta WMA, Santee River, and Santee Coastal Reserve. Private lands set into conservation easements are also identified on Figure 5-34 and include plantations.

Table 5-31 summarizes the amount of forest cover by owner for each alternative. According to this table, the Belle Isle alternatives are predominantly made up of privately owned land while the Jamestown and Charity alternatives are primarily made up of NFS lands because most of these corridors pass through the FMNF.

Table 5-31: Percent of Forest Cover within the 75-Foot Right-of-Way by Land Owner Type

Land Owner Type	Belle Isle B	Belle Isle C	Jamestown	Charity
Forest Cover Total	117.6	114.6	162.8	82.7
NFS Lands	7%	0%	73%	68%
State Lands	7%	7%	0%	0%
NGO	4%	5%	1%	4%
NGO/Private conservation lands (easement)	15%	12%	0%	4%
Privately owned land	67%	76%	23%	24%

Table 5-32 summarizes land ownership within the Study Area by the linear distance the centerline of the transmission line would cross for each corridor alternative.

Table 5-32: Length (miles) and Percentage of Lands Crossed by the Centerline and Respective Owner

Owner	Belle Isle B	Belle Isle C	Jamestown	Charity
NFS Lands	1.2 (7%)	0 (0%)	17.7 (684%)	21.6 (70%)
State Lands	0.9 (6%)	0.9 (6%)	0 (0%)	0 (0%)
NGO/Private conservation lands	3.1 (19%)	2.5 (16%)	1.0 (4%)	1.0 (3%)
Privately owned land	11.0 (68%)	12.2 (78%)	7.2 (28%)	8.4 (27%)

Conservation Easements—Ducks Unlimited holds the Oaks (204 acres), Crow Hill (274 acres), and Commander Island (373 acres) Plantations in conservation easements. These privately owned and neighboring plantations encompass about 850 acres along the North Santee River in Georgetown County west of U.S. Highway 17. The easements restrict the type and amount of development that may take place on the property and are also tailored to the needs and interest of the landowner. Ducks Unlimited states the plantations are managed in cooperation with the goals of the North American Waterfowl Management Plan. Ducks Unlimited's Lowcountry Initiative targets the conservation of the area for its outstanding ecological value. The easements' long-term protection will conserve large, undeveloped upland and wetland ecosystems for the benefit of water birds, other wildlife, and the threatened and endangered species that occur in the low country of South Carolina. The Nature Conservancy protects numerous parcels throughout the low country, including 494 acres of lands owned by White Oaks Forestry Corporation along the South Santee River in Charleston County and about 1,160 acres surrounding the Hampton Plantation. The Low Country Openspace Trust is another non-profit, land preservation focused group that controls conservation easements throughout South Carolina's low country including lands associated with Fairfield Plantation.

Zoning

Counties and towns organize development within their jurisdictions through a number of tools based on land use planning and zoning classifications. Zoning is used to separate uses that are thought to be incompatible with surrounding uses and as a means to prevent new development from interfering with lesser uses, such as an industrial use constructed near existing residential uses. Zoning is also used to preserve the character of a community. Often these regulations dictate the types of uses allowed on a lot, the height of buildings, the amount of space structures may occupy, the location of a structure on a lot, set-backs, and other factors related to land uses. Table 5-33 shows the types of zoning classifications common to the areas near the proposed corridors.

The Georgetown County Comprehensive Plan, adopted August 21, 2007, establishes a vision for future development of the county and includes general goals and objectives for land use, transportation, housing, economic development, community facilities, transportation, natural resources, and population (Georgetown County Department of Planning & Code Enhancement, 2007). The Charleston County Comprehensive Plan Update (Charleston County Planning Commission, 2008), Amended most recently December 15, 2016, also establishes a vision for the county and includes goals and objectives for land use, economic development, natural resources, cultural resources, population, housing, transportation, community facilities, and energy. The Berkeley County Comprehensive Plan of 2010 establishes a vision that values history while furthering economic development and promoting sustainability (Berkeley County Planning Commission 2010). The Plan includes goals and objectives for diverse communities, effective and efficient infrastructure management, historical resources, recreation opportunities, and streamlined processes.

Table 5-33: Zoning Classifications in the Study Area

Georgetown County	Charleston County	Berkeley County
Forest Agriculture	Agricultural Preservation	Manufactured Residential
Heavy Industrial	Agricultural/Residential	Rural Single Family Residential
Conservation Preservation	Resource Management	Exempt Governmental Districts
Rural General Residential		Agricultural District

Sources: Georgetown County Map Server (2018); Charleston County Official Zoning Map (2018); Berkeley County and Municipal Zoning Classifications (2016).

Infrastructure

Infrastructure visible within the corridor alternatives includes water intakes, electrical supply lines, and roadways. Not readily apparent within Table 5-33 is the amount and distribution of various infrastructure (e.g., roadways, gas lines, and overhead transmission and distribution lines) throughout the area. This infrastructure is necessary to support everyday needs of the population such as water delivery and treatment and electrical distribution. Many of these lines and ROWs are visible throughout the proposed Project area. South Carolina coastal policies prefer the siting and placement of new infrastructure within or adjacent to existing ROWs to minimize new corridors that can contribute to sprawl, bisecting property and the diminishment of cohesive planning blocks and cumulative impacts to coastal resources. Roadways are discussed in Section 5.14, *Transportation*.

5.10.2 Environmental Effects

This section discusses potential impacts, their duration, and intensity on recreation and land use from construction and operation of the proposed Project, including the no- action alternative. The effects from the proposed Project on many of these factors are mostly limited to the construction (short-term) period, which includes clearing of the ROW, construction of the towers, and stringing the lines. Impacts over the life of the Project (long term) include the maintenance of the cleared ROW and the impact the new structure has on recreationists and land use. Definitions for duration and intensity developed for this Project are shown in Table 5-34.

Table 5-34: Recreation and Land Use Impact Context and Intensity Definitions

Context—Duration	Low intensity	Moderate Intensity	High Intensity
Recreation			
Short term: During construction period Long term: Life of the line (50 years)	Few recreationists may experience temporary construction-related disturbances including temporary area closures, noise, traffic delays, and visual impacts. Over the life of the Project, few recreationists would be impacted by the aesthetic of new transmission infrastructure. Intermittent, infrequent interruptions to recreation may occur due to operation and maintenance.	Nearly half of the recreationists in the area may experience temporary construction-related disturbances including temporary area closures, noise, and visual impacts from machinery. Over the life of the Project, approximately half of the recreationists would be impacted by the aesthetic of new transmission infrastructure. Minimal interruptions to recreation may occur due to operation and maintenance.	Nearly all recreationists in the area would experience construction-related disturbances including temporary area closures, noise, traffic delays, and visual impacts. Over the life of the Project, most recreationists would be impacted by the aesthetic of new transmission infrastructure. Regular interruptions to recreation may occur due to operation and maintenance.
Land Use			
Short term: During construction period Long term: Life of the line (50 years)	Other than at the footprint of Project features (transmission tower structures, access roads, etc.) previous land uses would continue without interruption. Existing land uses such as agriculture, grazing, timber, or agricultural uses may experience temporary construction-related disturbances and intermittent, infrequent interruptions due to operation and maintenance. There would be no conflicts with local zoning.	Previous land uses (e.g., agriculture, grazing, and timber management) would be diminished or required to change on a portion of the Project Area to be compatible with the Project. Only a few parcels within the Project area would require zoning changes to be consistent with local plans. Some parcels within the Project area (transmission right-of-way, access roads, etc.) may require a change in land ownership through purchase or condemnation.	More than 25% of the Project area (transmission right-of-way, access roads, etc.) would require a change in land ownership through purchase or condemnation. All land use (e.g., agriculture, grazing, and timber management) on these parcels would be discontinued. Most parcels of land within the Project area would require zoning changes to be consistent with local plans.

5.10.2.1 No-action Alternative

Under the no-action alternative, the proposed Project would not be constructed, and there would be no direct impacts on recreation or land use as a result of the Project. The no-action alternative would have indirect impacts for failing to meet the stated Project purpose and would not provide dependable electrical supply to area residences and businesses.

5.10.2.2 Proposed Action

Recreation

NFS Lands—Francis Marion National Forest

USFS administers 259,625 acres of publicly owned lands in the FMNF. With the proper permits obtained, development of utility ROWs is generally consistent with the stated management goals and objectives for the FMNF under the Land Management Plan (USFS 2017). These goals aim to minimize impacts from utility lines by placing new lines along existing road ROWs and existing utility Rows. Belle Isle corridor alternative B would cross NFS lands parallel to where U.S. Highway 17 crosses through the forest about 3 miles north of the McClellanville Substation. The 75-foot ROW would occupy the eastern shoulder of the highway requiring the removal of about 5 acres of forest cover between the edge of highway and the interior edge of the ROW. The ROW would not cross any existing recreation areas, trails, or waterbodies while within FMNF nor would any recreation facilities fall within the 600-foot buffer of the proposed corridor. Additionally, the new transmission line would not impose on natural views experienced by recreationists. Therefore, the implementation of Belle Isle corridor alternative B would not result in adverse impacts to recreation on NFS lands.

Belle Isle corridor alternative C would stray from U.S. Highway 17 to the west of corridor alternative B and would cross NFS land at a corner of two FMNF parcels north of the McClellanville Substation. Clearing of ROW would only alter less than half an acre of NFS lands because the corridor is designed to cross the smallest amount of NFS lands possible at the parcel corners. This development of ROW for corridor alternative C would not cross any existing recreation areas, trails, or waterbodies while within FMNF nor would any federal recreation facilities fall within the 600-foot buffer of the proposed corridor. Additionally, the new transmission line would not impose on natural views experienced by recreationists. Therefore, the implementation of Belle Isle corridor alternative C would not result in adverse impacts to recreation on NFS lands.

The Charity corridor alternative would run along Route 45 through the FMNF and then along the existing 230 kV transmission line owned by Santee Cooper. The entrance to the Honey Hill Recreation Area falls within the 75-foot ROW along Route 45 and the majority of this recreation area falls within the 600-foot buffer. This may result in short-term impacts to the recreation area due to the generation of noise, ground disturbance, short-term road closures, short term closure of the recreation area, reduced parking, impacts to wildlife viewing, and displacement of flora and fauna during the construction period. All of these impacts could affect recreation users' experiences. Short term impacts are expected to be moderate intensity. Because the construction of the transmission line in this area would occur along an existing road, its existence would hinder a recreation users' perception of wilderness or solitude and would not inhibit any natural wilderness views. Operations and maintenance of the alternative over the life of the Project may result in temporary, intermittent disruptions to the Honey Hill recreation area. Therefore, impacts to recreation as a result of this alternative would be low intensity.

The Jamestown corridor alternative would run along Route 45, down Halfway Creek Road and along Shulerville Road to Tiger Corner Road. Most of this corridor is on NFS land. The federal recreation areas that this alternative would pass through include Honey Hill Recreation Area and New Hope Pond. For both of these areas, short-term impacts may occur during the construction period due to the generation of noise, ground disturbance, short-term road closures, short-term closures of the recreation areas, reduced parking, impacts to wildlife viewing, and displacement of flora and fauna. All of these impacts could affect recreation users' experiences. Short-term impacts are expected to be moderate intensity. Because the construction of the transmission line in this area would occur along an existing road, it is not expected that its existence would hinder a recreation users' perception of wilderness or solitude. Over the life of this Project, operations and maintenance may results in temporary, intermittent disruptions to the Honey Hill recreation area and New Hope Pond. Therefore, impacts to recreation as a result of this alternative would be low intensity.

NFS Lands—Cape Romain National Wildlife Refuge

None of the proposed alternatives pass through any part of the Cape Romain National Wildlife Refuge. Therefore, there would be no impacts to recreation at this federally managed site.

State Lands

Belle Isle corridor alternatives C and D would cross 1.3 miles of Santee Delta WMA lands along U.S. Highway 17. The ROW would occupy the eastern side of the highway requiring the removal of about 11.5 acres of forest cover between the edge of highway and the interior edge. The construction of this alternative would result in short-term impacts to recreation on the Santee Delta WMA. Impacts may include the generation of noise, ground disturbance, short-term road closures, short-term closures of parts of the WMA, reduced parking, impacts to wildlife viewing, and displacement of flora and fauna. All of these impacts could adversely affect recreation users' experience in the WMA where wildlife viewing and photography are the primary forms of recreation. Short-term impacts are expected to be moderate intensity. The amount of trees removed is a miniscule (0.1 percent) portion of the total acreage of the WMA and removal would occur along U.S. Highway 17, where habitat fragmentation is already present. Operation and maintenance of the new transmission line may result in minor, infrequent, and intermittent disruptions to recreation in this area. Long term adverse impacts as a result of this alternative would be low intensity.

The same alternatives would also cross adjacent to the Pole Yard boat launch (managed by SCDNR) on the north shore of the North Santee River at the U.S. Highway 17 bridge abutment. This would result in short-term impacts to recreation at the boat launch. Impacts may include the generation of noise, ground disturbance, short-term road closures, short-term closure of the boat ramp and reduced parking. All of these impacts could adversely affect recreation users' experience at the boat ramp. Short term impacts would be moderate-intensity. Over the life of the Project, the presence of a transmission line adjacent to the boat ramp would not impede recreationists' experience. Therefore, there would be no long term

No other corridors would cross state lands.

Private Property

The majority of the lands within the Belle Isle corridor alternative B and C ROWs and 600-foot buffer are privately owned and dominated by forest cover. Impacts on private lands would include temporary loss of use for landowners within the ROW during construction and the permanent loss of uses that are incompatible with the ROW, such as the location and farming of timber. Disturbances from heavy equipment would result in forest cover losses within the ROW during construction and operations. These losses would not impact recreation in the short or long term.

Private Property in Conservation Easement—About 24,000 feet of both Belle Isle corridor alternatives would cross through land in conservation easements by Ducks Unlimited. However, these land areas are not open for public recreation. Therefore, no impacts to recreation would occur as a result of this alternative.

Land Use

Land Cover

The Belle Isle corridor alternative B land cover is dominated by forest. Implementing this alternative would mean converting woodlands to grasslands for the 75-foot ROW. However, nearly a third of this corridor runs parallel to Route 17, which already has a ROW clearing. Conversion of land use already neighboring ROW clearings would have a marginal change in land use type compared to a new ROW clearing through the middle of a parcel or property. For the remainder of the corridor, timber would have to be removed from the ROW to accommodate the transmission line. This would result in short term, moderate intensity impacts to land cover due to heavy machinery, cutting and grading. Over the long term, impacts to land cover would be high intensity as a result of altering the land use type to accommodate the transmission line for the two-thirds of the corridor that do not run parallel to an existing road.

The Belle Isle corridor alternative C is dominated by forest. Short-term, high intensity impacts to land cover would occur during the construction of this alternative due to heavy machinery, cutting and grading. Over the long term, high intensity impacts would occur from altering the land cover type from woodland to grassland to accommodate the transmission line.

The Charity corridor alternative would occur along Route 45 and next to the existing 230 kV transmission line. Therefore, short- and long-term impacts to land cover would be low intensity as the majority of the Project would take place along an existing ROW and changes in land would be minimal.

The Jamestown corridor alternative would occur entirely along existing roads. Therefore, short and long-term impacts to land cover would be low intensity as changes to land cover would be minimal.

Land Ownership

NFS Lands

All of the Project alternative pass through some part of the FMNF. USFS authorizes transmission siting on USFS lands under Title V of the Federal Land Policy and Management Act or 1976 under a special use authorization. This authorization would allow for the Project to be implemented on federal lands without affecting land ownership. Thus, there would be no impact to land ownership on NFS lands as a result of this Project.

None of the alternatives pass through any other type of federal land.

State Lands

The Belle Isle and Jamestown alternatives would run along existing roads for some or all of their length. When constructing utility lines along South Carolina roadways, the developer must obtain a utility agreement from SCDOT. Once authorization is granted, the developer is allowed to construct a utility within the road ROW under the provisions of the agreement. This process does not involve changing land ownership during the construction of the transmission line. Therefore, the proposed Project would have no impact on SCDOT land ownership.

Belle Isle corridors B and C pass through approximately 1.3 miles of the western portion of the Santee Delta WMA. This WMA is managed by SCDNR. For state lands managed by SCDNR, the developer must go through a ROW permitting process with the agency that would not result in land ownership change of any SCDNR-managed lands. Therefore, there would be no impact to the land ownership of state-managed lands as a result of this Project.

County Lands

None of the three counties operate any land areas that would be impacted by the 75-foot ROW or 600-foot buffer for any of the corridor alternatives.

Private Lands

For private lands, the proposed Project would require ROW easements from private property owners, which could encumber the ROW area with land use restrictions. Each transmission line easement would specify the present and future right to clear the ROW and to keep it clear of all trees, whether natural or cultivated, all structure-supported crops, other structures, brush, vegetation, and fire and electrical hazards (non-structure-supported agricultural crops less than 10 feet in height would still be allowed within the ROW). Conversion of land ownership already neighboring ROW clearings would have a marginal change compared to a new ROW clearing through the middle of a parcel or property. Central Electric would coordinate with landowners to obtain easements for the preferred transmission line ROW. A change in landownership through purchase or condemnation would not be necessary. As a result, the anticipated short- or long-term impacts on land ownership for all the alternatives would be low intensity.

Zoning

All the alternatives would cross lands located in zoning districts where transmission line ROW is not prohibited. Under the applicable zoning ordinances and comprehensive plans, transmission lines are either a permitted or conditional use in all jurisdictions crossed by the ROW. All applicable zoning and land use approvals would need to be obtained prior to construction. Therefore, there would be no impacts to zoning as a result of this Project.

Infrastructure

Table 5-35 shows the number of miles and the percent of the total corridor length that each alternative runs parallel to this existing infrastructure.

Table 5-35: Length of Alternative Parallel to Existing Roads, Transmission Lines, and Pipelines

Length of corridor parallel to existing linear infrastructure (miles)	Belle Isle B	Belle Isle C	Jamestown	Charity
Parallel to Road (see Transportation tab for detail)	7.4	3.2	23.4	11.5
Parallel to Existing T-line or Pipeline ROW	0.0	0.0	0.0	18.1
Percent Parallel to Road (see Transportation tab for detail)	45%	20%	90%	37%
Percent Parallel to Existing T-line or Pipeline ROW	0%	0%	0%	58%

Nearly half of Belle Isle corridor alternative B corridor runs along existing roads. This may result in impacts to the road during the construction period due to possible road closures. Road closures would be temporary and intermittent, thus resulting in low intensity impacts to infrastructure as a result of this alternative. Over the life of the Project, road closures may occur due to periodic operation and maintenance of the proposed transmission line. These temporary closures would be infrequent and brief, resulting in low intensity impacts to infrastructure as a result of the implementation of this alternative.

The Belle Isle corridor alternative C corridor has the smallest percentage of its corridor parallel to existing infrastructure. The portion of the corridor that runs along corridor 17 may result in impacts to the road during the construction period due to possible road closures. Road closures would be temporary and intermittent, thus resulting in low intensity impacts to infrastructure as a result of this alternative. Over the life of the Project, road closures may occur due to periodic operation and maintenance of the proposed transmission line. These temporary closures would be infrequent and brief, resulting in low intensity impacts to infrastructure as a result of the implementation of this alternative.

Nearly the entire Jamestown corridor alternative runs parallel to existing roads. This may result in impacts to the roads during the construction period due to possible road closures. Road closures would be temporary and intermittent. Because the nearly the entire length of the Project runs along roads, potential impacts to roads is classified as moderate intensity. Over the life of the Project, road closures may occur due to periodic operation and maintenance of the proposed transmission line. These temporary closures would be infrequent and brief, resulting in low intensity impacts to infrastructure as a result of the implementation of this alternative.

Nearly 60 percent of the Charity corridor alternative runs along an existing transmission line and nearly 40 percent runs along an existing road. During the construction period, there would be no disruption to the existing transmission line and operations would continue as normal. For the roads, there may be possible road closures at periods during the construction period. This may result in low intensity impacts to roads during the construction period. Over the life of the Project, the parallel transmission line would not be impacted by routine operation and maintenance. However, road closures may occur due to periodic operation and maintenance of the proposed transmission line. These temporary closures would be infrequent and brief, resulting in low intensity impacts to infrastructure as a result of the implementation of this alternative.

Potential impacts to roads could also result directly from the construction-related traffic and heavy machinery using the roads to access the Project. The number of construction-related vehicles and truck trips is estimated well within the design of the local transportation network and road surface standards. The areas most at risk of exhibiting impacts to the road surface are at intersections between ROW access roads and the paved public roads because construction-related vehicle trips can track mud and debris onto the asphalt when transitioning from non-paved surfaces to paved surfaces. Additionally, the change in surface is more susceptible to cracking and wear as vehicles use it during the construction period. Overall, impacts from vehicle trips are expected to be greatest during the construction period and negligible during routine maintenance and operations once the line is operational. As such, direct impacts to local roads from vehicle trips are expected to be negligible and unnoticeable relative to the volume of traffic the roads already receive.

5.11 Visual Resources

5.11.1 Affected Environment

USFS' *Landscape Aesthetics: A Handbook for Scenery Management*, defining a Scenery Management System (SMS) (USFS 1995) is the specific manual for evaluating existing landscape character and assessing potential impacts to visual resources. The SMS was developed to provide a standard approach and vocabulary for determining the value, importance, and management of scenery and landscapes within national forests (USFS 1995). The SMS replaced the Visual Management System, which was completed in 1974 by USFS. Given that the FMNF is within the proposed Study Area, this section will reference and follow SMS principles and concepts to analyze visual impacts throughout the Study Area. A *Revised Land Management Plan* for FMNF was published in 2017 (USFS 2017) and contains specific scenic integrity objectives for various management areas within the forest.

As described in the SMS, there are three main components to scenery management, which include: landscape character (including scenic attractiveness), scenic integrity, and visual sensitivity (USFS 1995). Scenic attractiveness is typically mapped and classified as Class A (Distinctive), Class B (Typical), and Class C (Indistinctive). The landscape character of a given area consists of the landforms, vegetation, water features, and cultural modifications (physical changes caused by human activities) that impart an overall visual impression of the area's landscape. Scenic integrity is the degree to which the landscape character deviates from a natural-appearing landscape in line, form, color, and texture of the landscape. In general, natural and natural- appearing landscapes have the greatest scenic integrity. As man-made incongruities are added to the landscape the scenic integrity diminishes. Visual sensitivity incorporates the concept of "viewer groups", including the frequency and distance from which a landscape is viewed and the distance from which elements can be seen. While an area may have a high scenic attractiveness value, if it is not visible to anyone or if the scenic integrity is low, then its visual resource value may not be as high.

5.11.1.1 Francis Marion National Forest

The 2015 Land and Resource Management Plan for the FMNF describes four Resource Integration Zones: Coastal (which contains 5,843 acres designated as having "High" scenic integrity); Wambaw (which contains 46,606 acres designated as having "High" scenic integrity and 46,606 acres designated as having "Very High" scenic integrity); Santee (which contains 22,319 acres designated as having "High" scenic integrity); and Wando (which contains 17,288 acres designated as having "High" scenic integrity). Project activities would not occur in the Santee Resource Integration Zone. Scenic integrity zones for these portions of the FMNF are depicted in Figure 5-37.

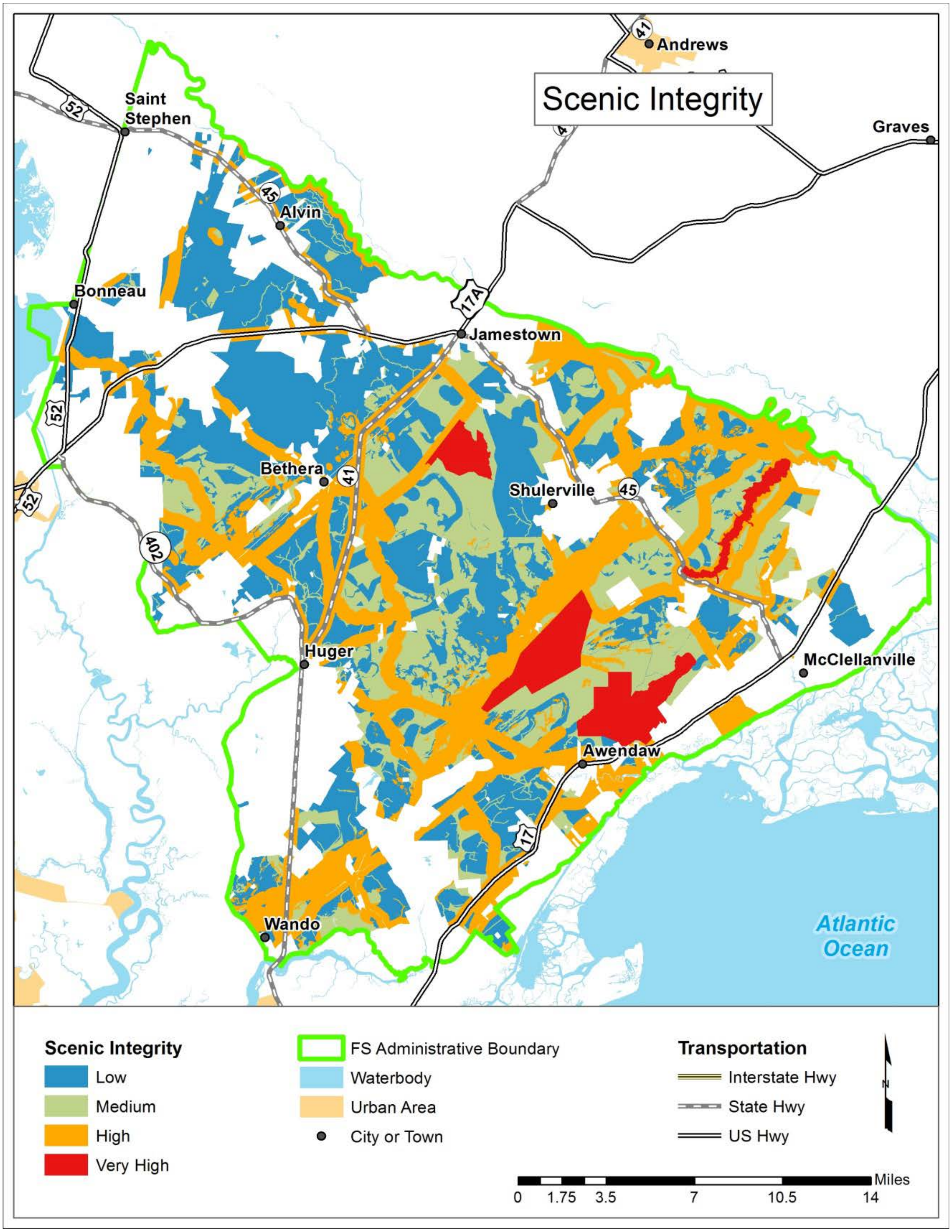


Figure 5-37. Scenic Integrity Zones at FMNF

5.11.1.2 Santee Delta Wildlife Management Area

The Santee Delta WMA is owned by and managed by the SCDNR and is located between the North and South Santee rivers. Primary recreational uses are hunting and bird watching, with 9 miles of hiking or walking trails along the historic rice field dikes.

U.S. Highway 17 is the only major roadway that crosses the WMA; smaller two track roads are located within the WMA to provide accessibility for hunting and other recreational activities.

5.11.1.3 Description of Landscape Character

Visual character encompasses the patterns of landform (topography), vegetation, land use, and aquatic resources (i.e., lakes, streams, and wetlands). The visual character is influenced both by natural systems, human interactions, and use of land. In natural settings, the visual character attributes are natural elements such as forested hillsides, open grasslands, or scenic rivers and lakes, whereas rural or pastoral/agricultural settings may include manmade elements such as fences, walls, barns and outbuildings, and occasional residences. In a more developed setting, the visual character may include commercial or industrial buildings, manicured lawns, pavement, and other infrastructure. The most scenic or visually sensitive areas within the Study Area include the North and South Santee rivers and associated boat ramps, U.S. Highway 17, the Santee Delta WMA, and residential communities.

The Study Area is located in the Coastal Plain Ecoregion with three main natural environments (grasslands, pine woodlands, and river bottom) (SCDNR 2005a). Given the coastal location of the Project, the Study Area has little topographic relief, which allows for wide views of the landscape, however given the dense forest cover (including forested wetlands) throughout the Study Area, long views are typically not offered due to intervening vegetation, which limits views from a viewer standing at ground level.

Places where the viewshed is greatest are areas where there is a natural break in the vegetation (rivers and waterways), areas where forest cover has been cleared (agricultural clearings, residential, or commercial uses), or a human created ROWs (roads, bridges, or utility infrastructure).

Patches of agricultural and residential development exist throughout the Study Area, with areas of higher concentration near Shulerville, North Santee and McClellanville. The remainder of the Study Area is primarily evergreen forests, forested wetlands, and coastal marshes. Land uses transition from forest and agriculture to low density residential and commercial uses toward the Cooper River north of Charleston. Visually sensitive areas typically include areas of high visitor use, such as popular recreation areas, areas of high visibility, such as major roadways or residential areas, and natural undisturbed settings, such as wilderness areas.

U.S. Highway 17 is often referred to as the "Coastal Highway" and provides north south connectivity along the entire coast of South Carolina and beyond, connecting Myrtle Beach and points north and Charleston and points south. U.S. Highway 17 bridges offer scenic views of the North and South Santee rivers (Photograph 4). Additionally, the North and South Santee rivers are popular destinations for boaters with access provided at a number of locations discussed in detail in Section 5.10, *Recreation and Land Use*. Photograph 5 shows the view from the Pole Yard boat ramp located on the north side of the North Santee River, immediately adjacent to U.S. Highway 17.

State Highway 45 also traverses portions of the Study Area from Jamestown to McClellanville. Photograph 6 shows the view of the existing transmission lines crossing Highway 45 from the intersection of Chicken Creek Road and Highway 45.

Photograph 4: View from U.S. Highway 17 over the North Santee River, Facing West

Photograph 5: View from Boat Ramp on North Santee River, Facing Southeast

Photograph 6: View from Intersection of Hwy 45 and Chicken Creek Road, Facing West

5.11.1.4 Scenic Integrity

Some landscapes have a greater ability to absorb alterations with limited reduction in scenic integrity. The character and complexity, as well as environmental factors, influence the ability of a landscape to absorb changes in landscape. A new transmission line next to an existing line provides less contrast, and therefore can be absorbed into that visual landscape better than introducing a transmission line as a new feature in a previously undeveloped area. Scenic integrity refers to the degree of intactness and wholeness of the landscape character. New transmission and substation facilities in areas where existing facilities already exist are more consistent with the scenic integrity. The siting of new transmission lines adjacent to existing lines allows the new lines to "blend-in" with its surroundings.

5.11.1.5 Visual Sensitivity and Viewer/User Groups

The viewer and visual distance zones are two factors that influence the potential visual impact of a new corridor. A viewer is defined as not only the person who is viewing the line, but also as their expectations, activities, and frequency of viewing the line. Three types of viewers were identified within the Study Area.

Local Residents

Local residents are those people who live in the area of the proposed transmission line. Residents may view the line from their yards or homes, while driving on local roads, or during other activities in their daily lives. The sensitivity of local residents to the visual impact of the line may be mitigated by frequent exposure to existing transmission lines and other dissonant features already within the viewshed.

Commuters and Travelers

Commuters and travelers are people who travel by the transmission line on their way to other destinations. Typically, drivers would have limited views of the transmission line where vegetation or buildings provide screening and where the line crosses high above the road surface. Under these conditions, the visual perception of the line for commuters and travelers is anticipated to be relatively low because they are typically moving and have a relatively short duration of visual exposure to the line. When new visual features persist in the immediate vicinity or directly parallel to the road over long distances, longer visual exposure can be expected.

Recreational Users

Recreational users include primarily local residents involved in recreational activities at the North and South Santee rivers, the Santee Delta WMA, and others listed above in Section 5.10, *Recreation and Land Use*. Scenery and visual quality may or may not be an important recreational experience for these viewers. For some recreational users, scenery may be an important part of their experience because their activities may include attentiveness to views of the landscape for long periods. Such viewers also may have a high appreciation for visual quality and high sensitivity to visual change.

To provide an additional level of interpretation to this analysis, impacts to visual resources were also considered with respect to visual distance zones (as described in the USDA *Forest Service Landscape Aesthetics Manual* [USFS 1995]). Distance zones are described below:

- Immediate foreground—This distance zone is 0 to 300 feet from the viewer. At this distance, viewers can discern individual elements of plants (leaves, twigs, and flowers), small mammals and birds, and slight movement. At this level, details are important, and all elements of a transmission line would be visible.

- Foreground—This distance zone is 0 to 0.5 mile from the viewer. At this distance, viewers can discern masses of plant elements (clusters of leaves, tree trunks, large limbs, and masses of flowers), medium-sized mammals, and larger birds. At this level, movement from the wind is discernible at tree boughs and treetops. Individual forms are important, and the conductors, insulators, and structures of the transmission line would be visible.

- Middleground—This distance zone is 0.5 to 4.0 miles from the viewer. At this distance, viewers can discern silhouettes of landscape elements such as tree forms, large boulders, fields of flowers, and small rock outcroppings. Form, texture, color, and pattern are important at this level. In addition, the silhouette of the transmission line structures and ROW clearing would be visible.

- Background—This distance zone is 4.0 miles and beyond to the horizon. At this distance, viewers can discern tree groves, large forest openings, and large rock outcroppings. At this level, vertical distinctions of landforms and horizon lines provide the controlling visual character. The ROW clearing could be visible and possibly the mass of the transmission line structures above the tree canopy in areas where there is no background behind the structure such as along ridge tops. Throughout most of the Study Area, this distance zone would not be visible due to vegetation cover.

- Seldom-seen areas—Seldom-seen areas are an important factor when discussing routing for transmission lines. Topography, vegetation, and lack of access prevent some areas from being seen by most viewers and user groups. People such as hunters, off-trail hikers, utility workers, and oil and gas personnel may occasionally view these areas while traveling off the beaten track.

5.11.2 Environmental Effects

5.11.2.1 No-action Alternative

Under the no-action alternative, the proposed Project would not be constructed, and there would be no direct impacts on visual resources as a result of the Project. The purpose and need for the Project would not be met, and direct and indirect impacts to visual resources would not be anticipated.

5.11.2.2 Proposed Action

The level of visual intrusion created by the Project infrastructure is described with respect to the different distance zones, types of observers, and observation points. Additionally, thresholds are used to assess the level of impacts each alternative would have on visual resources. The context and intensity definitions established for this Project are listed in Table 5-36.

Table 5-36: Visual Resources Impact Context and Intensity Definitions

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Short term: During construction period Long term: Life of the line (50 years)	Proposed changes could attract attention but would not dominate the view or detract from current user activities.	Proposed changes would attract attention, and contribute to the landscape, but would not dominate. User activities would remain unaffected.	Changes to the characteristic landscape would be considered significant when those changes dominate the landscape and detract from current user activities.

General Visual Impacts on Non-NFS Lands

As described in Section 4.3.1, *Transmission Line Characteristics*, the transmission line structures would be single pole and between 70 to 75 feet tall. Construction using COR-TEN "weathering steel" would reduce impacts to visual resources, allowing for the structures to blend into the natural setting because they weather to colors more associated with the surrounding natural environment.

Initially, the color of COR-TEN "weathering steel" structures may be a rust orange color; however, after 2 to 3 years the structures will self-rust to a burnt orange to dark brown color. In the short-term, the towers may be more visually obtrusive due to the unnatural color introduced to the landscape; however, in the long term, the colors of the structures would be more consistent with the natural setting of pine and deciduous forests.

Concrete and galvanized steel structures would have a greater impact on visual resources, since structures would be a tan or gray color and would contrast against the natural darker colored forested vegetation.

Pine forests in South Carolina typically grow between 60 and 120 feet in height. The proposed transmission structures would be on average 70 to 75 feet; largely below the tree line. If the transmission line is sited in a way that provides a tree buffer between highly visible areas such as roadways, and agricultural or residential areas, it is likely that the transmission lines would be blocked to viewers by intervening vegetation.

Visual Impacts within Francis Marion National Forest

Both alignment options of the Belle Isle corridor are located in forested areas of the FMNF south of the Santee River before reaching the McClellanville Substation. The area south of the Santee River is included in the Wambaw Resource Integration Zone, which is classified as an area of high scenic integrity. Option B maintains a parallel alignment with U.S. Highway 17, whereas option C does not parallel any existing infrastructure. The crossing of U.S. Highway 17 in option B would require the construction of an angle structure on either side of the roadway, which would be within the viewshed of users of the road. The transmission line ROW for option B would be cleared up to the edge of the road, with no tree buffer between the edge of the ROW and the roadway, resulting in high visibility of the transmission line to all viewers traveling on U.S. Highway 17.

Given the proximity to U.S. Highway 17 and lack of vegetation buffer between the road and new line ROW, option B would be highly visible to local residents, recreational users, and commuters, resulting in long-term, high intensity impacts to visual resources. Option B would also intersect with the high scenic integrity area of the Costal Resource Integration Zone on its approach to the McClellanville Substation. Option C of the Belle Isle corridor, however, would require clearing but would be in the middleground from all viewers traveling on U.S Highway 17 with low visibility to residents, recreational users, and commuters, resulting in short-term low intensity impacts to visual resources. Residents, recreational users, and commuters on U.S. Highway 17 could have limited views of the transmission line, through breaks in vegetation. Users of U.S. Highway 17 may be able to see either the transmission structures or the wires as they cross the Santee River to the west and in the middleground of the landscape; however, the transmission line features would not dominate the view in either direction and, due to the rate of travel, the viewings would be of very short duration. The view from the bridge offers a break from the confined near ground views typical of the highway through forested areas and provide longer, although brief due to the rate of travel, views up and down the river. Approaching the proposed McClellanville Substation, both Belle Isle alignment options would be located within small residential communities near McClellanville. Road crossings should be minimized to the extent possible in order to reduce impacts to visual resources.

The proposed alignment of the Jamestown corridor is located in largely wooded areas of the FMNF Wambaw Resource Integration Zone, which is designated as an area of high scenic integrity. The Jamestown corridor leaves the residential area and shares the ROW with SC Hwy 41 for less than a mile before heading southeast traversing along NFS lands passing through Shulerville, connecting to Halfway Creek Road corridor heading northeast and then continues along SC Hwy 45 corridor terminating at U.S. Highway 17. The Jamestown corridor would pass at the north end of an area classified as Eligible Wild & Scenic River. For the more than 10 miles of alignment north of Halfway Creek Road, the corridor would require clearing but would be in the middleground from all viewers traveling on SC Hwy 45 with low visibility to residents, recreational users, and commuters, resulting in short-term low intensity impacts to visual resources. Residents, recreational users, and commuters on SC Hwy 45 could have limited views of the transmission line, through breaks in vegetation. Conversely for the remainder of the transmission line ROW for Jamestown corridor, the new ROW would be cleared up to the edge of the road along Halfway Creek Road and then SC Hwy 45, with no tree buffer between the edge of the ROW and the roadway, resulting in high visibility of the transmission line to all viewers traveling on these corridors. Given the proximity to the Halfway Creek Road and SC Hwy 45 and lack of vegetation buffer between the road and new line ROW, the transmission line would be highly visible to local residents, recreational users, and commuters, resulting in long-term, high intensity impacts to visual resources for over half of the corridor.

The Charity corridor is located in largely wooded areas of the FMNF in both the Wando and Wambaw Resource Integration Zones, both of which are designated as having high scenic integrity. The Charity corridor traverses along an existing transmission line ROW for 18 miles, up to the Halfway Creek Road, at which point shares the same alignment as the Jamestown corridor along Halfway Creek Road and southeast along SC Hwy 45 towards the McClellanville Substation terminating north of U.S. Highway 17. Paralleling existing infrastructure is a standard and preferred routing practice and also helps to minimize impacts to visual resources by conserving the scenic integrity of the area. The new transmission line would be placed next to a previously impacted landscape, to the extent practical. Building the new transmission line parallel to an existing transmission line ROW does not create a new ROW scar; it only incrementally expands the existing visual impacts as opposed to creating new visual impacts. The transmission structures would be in the middleground intermittently visible from those traveling on SC Hwy 41, resulting in long-term low to moderate intensity impacts to visual resources. For the new line along Halfway Creek Road and SC Hwy 45, the transmission line ROW would be cleared up to the edge of the road, with no tree buffer between the edge of the ROW and the roadway, resulting in high visibility of the transmission line to all viewers traveling on SC Hwy 45 with long-term high intensity impacts to visual resources. The Charity corridor is located west of the residential development of McClellanville and will not cross U.S. Highway 17. Overall, Charity corridor would minimize long and short-term impacts on visual resources by paralleling existing infrastructure through a forested area and minimizing visual exposure to the largest number of viewers (residential communities, SC Hwy 41, and recreation users).

Temporary impacts to visual resources would result during construction from the presence of large construction equipment in the vicinity and on roadways and brightly colored signage and flagging. Given the proximity to U.S. Highway 17, Belle Isle alternatives would have short-term moderate to high intensity impacts to visual resources. Jamestown corridor would have short-term impacts ranging from low to high based on proximately to existing travel corridors. The Charity corridor would have the lowest intensity, short-term impacts on visual resources since the transmission line would be located away from the major throughways in the Study Area for the largest extent of the proposed alignment.

5.12 Socioeconomics

5.12.1 Affected Environment

The Project is located in a predominantly rural area of Berkeley, Charleston, and Georgetown counties, South Carolina. The population that resides within the area of these corridors is a small fraction of the overall population in these counties. Berkeley Electric services rural populations in Charleston, Berkeley, and Dorchester counties in South Carolina.

Because the proposed Project would be located within Berkeley, Charleston, and Georgetown counties, these three counties, along with the cities of Charleston and Georgetown and towns of McClellanville and Moncks Corner, represent the primary focus for socioeconomic impacts that may be associated with implementation of the proposed action and the Study Area for the socioeconomic analysis. The county seat in Charleston County is the city of Charleston. The city of Charleston, located 40 miles southwest of McClellanville, does not fall in proximity to the corridor alternatives. The county seat in Georgetown County, South Carolina is the city of Georgetown. The city of Georgetown, located about 30 miles northeast of the Project, does not fall inside the boundaries of the proposed transmission line corridors. The county seat in Berkeley County, South Carolina is the town of Moncks Corner. The Town of Moncks Corner is located about 17 miles northwest of the Project and does not fall inside the boundaries of the proposed transmission line corridors.

Population Characteristics

In 2010, the total population for the study area was 572,600 residents. Between 2010 and 2016, the study area’s population increased by 97,207, or 17.0 percent. Statewide populations grew from 4,625,364 in 2010 to 4,959,822 in 2016, an increase of 334,458 residents or 7.2 percent (U.S. Census 2017). As Table 5-37 shows, Charleston County has the highest population of the three counties, followed by Berkeley and then Georgetown counties. Berkeley County’s population grew at a faster rate than the other counties, including the State of South Carolina, did during this period. Charleston County experienced a greater level of population growth compared to the City of Charleston during this period. Charleston County's population grew at nearly double the rate of the state of South Carolina over the same period. Georgetown County experienced a slower, although still positive, growth in comparison to Charleston and the state, while the city of Georgetown experienced a decline in population growth among these areas during this period.

Table 5-37: Population Change, 2010–2016

County/Town	2010 Census	2016 Census	Population Change 2010–2016	Percent Change 2010–2016
Charleston County	350,209	396,570	46,361	13.2%
City of Charleston	120,083	134,385	14,302	11.9%
Town of McClellanville	499	543	44	8.8%
Georgetown County	60,158	61,374	1,216	2.0%
City of Georgetown	9,163	9,024	-193	-1.5%
Berkeley County	162,233	211,863	49,630	30.6 %
Town of Moncks Corner	7,885	10,315	2,430	30.8%
Study Area	572,600	669,807	97,207	17.0%
South Carolina	4,625,364	4,959,822	334,458	7.2%

Source: U.S. Census (2016a, 2017)

Overall, these counties are largely rural: in 2010, Charleston County had an average population density of 382.3 persons per square mile, Georgetown County an average of 73.9 persons per square mile, and Berkeley County an average of 161.8 persons per square mile (U.S. Census 2010).

The population of South Carolina is expected to increase from 4,625,364 in 2010 to 5,730,490 by 2030, as shown in Table 5-38, which would be a 23.9 percent increase in population. Over this same period, the population in the Study Area is anticipated to increase from 588,210 in 2010 to a total of 857,660 in 2030, a 45.8 percent increase in the total population (South Carolina Revenue and Fiscal Affairs Office 2018).

Table 5-38: Projected Population Estimates, 2010–2030

County	Current 2010	Projected Estimates 2020	2025	2030	Numerical Change 2010–2030	Percent Change 2010–2030
Charleston County	350,209	429,490	470,050	509,320	159,111	45.4%
Georgetown County	60,158	62,200	62,580	62,090	1,932	3.2%
Berkeley County	177,843	228,930	256,840	286,250	108,407	61.0%
Study Area	588,210	720,620	789,470	857,660	269,450	45.8%
South Carolina	4,625,364	5,175,800	5,457,700	5,730,490	1,105,126	23.9%

Source: South Carolina Revenue and Fiscal Affairs Office (2018)

Employment and Income

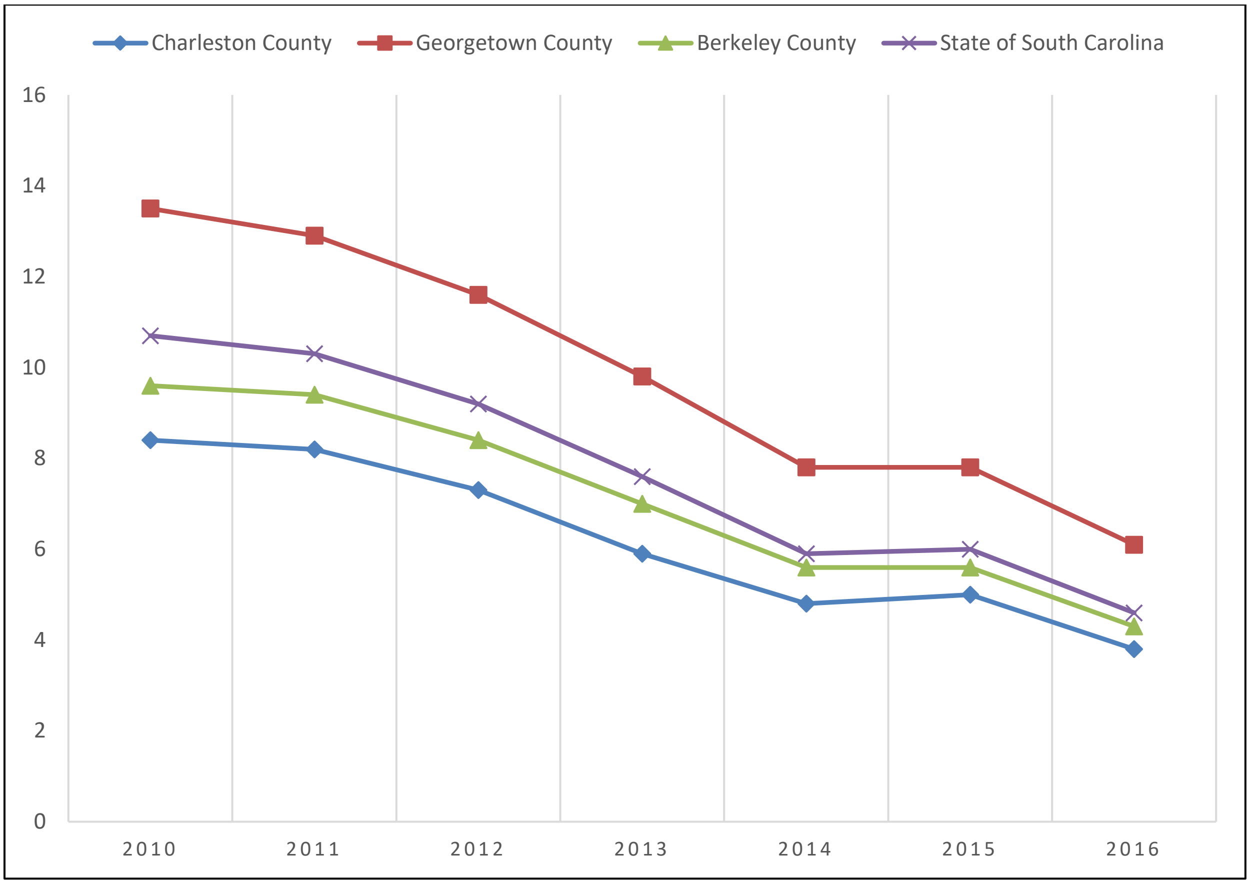
The annual employment levels in the three counties for the years 2010 and 2016 are shown as a comparison with state figures in Table 5-39. Charleston County has a relatively large metropolitan area of Charleston and therefore has a larger number of employed persons compared to Georgetown and Berkley Counties. Total employment in the study area and the state increased between 2010 and 2016. Berkeley County had the largest percent increase in annual employment at 23.9 percent, even higher than that of the state at 13.3 percent over this period.

Table 5-39: Annual Employment

Geography	Total Employment 2010	2016	Numeric Change 2010–2016	Percent Change 2010–2016
Charleston County	164,521	194,636	30,115	18.3%
Georgetown County	22,925	23,959	1,034	4.5%
Berkeley County	75,045	92,928	17,883	23.9%
Study Area	262,491	311,523	49,032	18.7%
South Carolina	1,935,363	2,192,642	257,279	13.3%

Source: U.S. Bureau of Labor Statistics (2018a,b)

Charleston County's annual unemployment rates are consistently below those of the state and Georgetown and Berkeley counties between 2010 and 2016. By contrast, Georgetown County has consistently had annual unemployment rates higher than the state and Charleston and Berkeley counties. Berkeley County has slightly lower unemployment rates to that of the state. All geographic areas have had similar trends during this period, with a peak unemployment rates occurring in 2010 coinciding with the recovery of the national economic downturn that occurred between 2008–2009. Figure 5-38 shows unemployment trends in the Study Area and the state.



Source: U.S. Bureau of Labor Statistics (2018c)

Figure 5-38: Annual Unemployment Rates, 2010–2016

Employment by industry is presented in Table 5-40. Private sector industries in 2016 with the highest employment in the study area include retail trade, accommodation and food services, manufacturing, and health care and social assistance. Between 2010 and 2016, Retail trade increased by 19 percent in the study area and accounted for approximately 11 percent of total employment. Joint Base Charleston, a combination of the United States Air Force, Charleston Air Force Base, and the United States Navy Naval Support Activity Charleston, is the largest public sector employer in the Charleston metropolitan area, with 22,000 employees. The city of Charleston is also home to the Medical University of South Carolina, which employs 13,000 people. Boeing South Carolina is the largest private industry employer in Charleston County (CRDA 2018).

Per-capita personal income is the income received by all persons from all sources, including labor earnings, investment income, and transfer payments, divided by the total midyear population. Table 5-41 summarizes per capita personal income for the Study Area and South Carolina for the years 2005, 2011 and 2016. In 2016, Charleston County had a per capita personal income of $53,272, while that of Georgetown County was $42,195 and that of Berkeley County was $35,667. Statewide, annual per capita personal income was $39,517. Charleston County's annual per capita personal income grew by a rate of 21 percent between 2005 and 2016, while the state and other two counties remained at growth levels below 15 percent.

Table 5-40: Employment by Industry, South Carolina, Charleston, Berkeley and Georgetown Counties, 2010–2016

Type of Employment	South Carolina 2010	South Carolina 2016	South Carolina % Change	Charleston 2010	Charleston 2016	Charleston % Change	Georgetown 2010	Georgetown 2016	Georgetown % Change	Berkeley 2010	Berkeley 2016	Berkeley % Change
Total employment	2,359,117	2,694,346	14%	283,464	336,798	19%	31,016	32,732	6%	56,471	73,140	30%
Farm employment	28,678	28,391	-1%	465	465	0%	311	264	-15%	415	385	-7%
Forestry, fishing, and related activities	10,630	11,641	10%	498	559	12%	561	(D)	NA	(D)	(D)	NA
Mining	3,637	4,753	31%	375	478	27%	66	(D)	NA	(D)	(D)	NA
Utilities	12,442	12,919	4%	645	675	5%	(D)	34	NA	(D)	376	NA
Construction	127,396	144,652	14%	14,160	17,314	22%	2,103	1,782	-15%	4,408	5,872	33%
Manufacturing	214,831	247,849	15%	11,742	17,056	45%	1,959	2,199	12%	6,234	5,660	-9%
Wholesale trade	70,651	85,783	21%	6,829	8,010	17%	539	545	1%	(D)	2,313	NA
Retail trade	267,318	296,939	11%	29,231	33,494	15%	3,617	3,573	-1%	5,575	8,502	53%
Transportation and warehousing	61,697	85,201	38%	9,317	12,266	32%	(D)	550	NA	2,045	3,820	87%
Information	31,789	33,462	5%	4,716	5,071	8%	191	171	-10%	1,110	1,597	44%
Finance and insurance	102,689	108,021	5%	10,490	11,347	8%	1,167	1,483	27%	1,683	2,218	32%
Real estate and rental and leasing	107,170	124,128	16%	17,389	22,160	27%	2,177	2,383	9%	2,495	3,119	25%
Professional, scientific, and technical services	118,875	146,871	24%	20,138	25,287	26%	1,331	1,431	8%	5,996	8,046	34%
Management of companies and enterprises	16,111	20,844	29%	1,448	3,060	111%	157	227	45%	42	163	288%
Administrative and waste management services	172,678	205,447	19%	23,089	25,702	11%	2,176	1,833	-16%	2,762	4,083	48%
Educational services	38,760	47,050	21%	4,733	5,645	19%	233	255	9%	797	1,116	40%
Health care and social assistance	197,431	229,439	16%	26,450	30,627	16%	2,775	3,018	9%	2,820	3,364	19%

Type of Employment	South Carolina			Charleston			Georgetown			Berkeley		
	2010	2016	% Change	2010	2016	% Change	2010	2016	% Change	2010	2016	% Change
Arts, entertainment, and recreation	45,316	52,277	15%	6,022	7,192	19%	1,040	1,334	28%	1,160	1,510	30%
Accommodation and food services	194,659	234,183	20%	27,097	35,703	32%	3,197	3,783	18%	2,913	4,726	62%
Other services, except public administration	138,198	167,043	21%	12,803	16,201	27%	1,755	2,074	18%	4,547	5,761	27%
Federal, civilian	34,360	33,515	-2%	8,525	9,716	14%	169	126	-25%	903	886	-2%
Military	54,480	52,060	-4%	11,518	11,172	-3%	307	270	-12%	789	828	5%
State and local	309,321	321,878	4%	35,784	37,598	5%	4,769	4,697	-2%	7,563	8,420	11%

Source: Bureau of Economic Analysis (2018 D: data not disclosed

Table 5-41: Annual Per Capita Personal Income (in $1,000s, 2016 Dollars)

Geography	Income			
	2005[a]	2011[a]	2016	Percent Change 2005–2016
Charleston County	$44,022	$47,029	$53,272	21%
Georgetown County	$36,954	$38,981	$42,195	14%
Berkeley County	$31,855	$33,520	$35,667	12%
South Carolina	$35,586	$36,068	$39,517	10%

Source: U.S. Department of Commerce, Bureau of Economic Analysis 2017

[a] Adjusted for inflation to 2016 dollars

5.12.1.1 Housing Resources

In 2016, Charleston County had more housing units than Georgetown County or Berkeley County, with a majority of the households residing outside the city of Charleston. Approximately 15 percent of all households in Charleston County were vacant, while Georgetown County and Berkeley County had vacancy rates of approximately 28 percent and 9 percent, respectively. McClellanville had a vacancy rate of 27 percent, and the cities of Charleston, Georgetown, and Moncks Corner had vacancy rates of 12, 19, and 9 percent, respectively (Table 5-42).

Table 5-42: 2011-2016 Household Characteristics

Geography	Total Housing Units	Vacant Housing Units	Percent Vacancy Rate
Charleston County	178,168	27,247	15%
City of Charleston	60,735	7,387	12%
Town of McClellanville	277	75	27%
Georgetown County	34,091	9,712	28%
City of Georgetown	4,156	784	19%
Berkeley County	77,823	7,341	9%
Town of Moncks Corner	3,562	326	9%
South Carolina	2,192,041	353,000	16%

Source: U.S. Census (2018a)

5.12.1.2 Property Taxation

In South Carolina, each class of property is assessed at a ratio unique to that type of property. The assessment ratio is applied to the market value of the property to determine the assessed value of the property. Utility property, such as transmission lines, has an assessment ratio of 10.5 percent. Utility property is assessed by the South Carolina Department of Revenue, which applies a state mill levy to the assessed value to property taxes. For the 2015–2016 year, utility, railroad and pipeline assessments accounted for 7.1 percent of the assessed value for all types of property in the state (South Carolina Department of Revenue 2017). Charleston, Georgetown and Berkeley counties had millage rates of 0.0593, 0.0574 and 0.0505, respectively, in the year 2015 (South Carolina Association of Counties 2018).

5.12.1.3 Timber

In 2013, there were approximately 13,044,001 acres of forestland in the state of South Carolina with a stumpage timber value of $408.5 million. There were approximately 297,220 acres of forestland in Charleston County, 415,602 acres of forestland in Georgetown County, and 569,410 acres of forestland in Berkeley County, representing 2.3, 3.2 and 4.4 percent of the total forestland in the state of South Carolina, respectively. Stumpage timber had a value of $4,591,368 in 2013 in Charleston County, $18,292,399 in Georgetown County and $12,558,209 in Berkeley County, which represented 1.7, and 4.3 percent of the total stumpage timber value in the state of South Carolina in 2013 (South Carolina Forestry Commission 2017). Table 5-43 summarizes these figures.

Table 5-43: Value of Timber Delivered to Forest Product Mills in 2013

Geography	Acres of Forestland Acres (percent of state total)	Stumpage Timber Value Dollars (percent of state total)
Charleston County	297,220 (2.3)	$4,591,368 (1.1)
Georgetown County	415,602 (3.2)	$18,292,399 (4.5)
Berkeley County	569,410 (4.4)	$12,558,209 (3.1)
South Carolina	13,044,001	$408,552,886

Source: South Carolina Forestry Commission (2017)

5.12.2 Environment Effects

Impacts on socioeconomic resources include how the proposed Project could potentially affect elements of the human environment such as population, employment, income, property values, housing, and public services. The effects from the proposed Project on many of these factors are not limited to the ROW, but would result in impacts across the wider geographic area, affecting the three-county Study Area. However, some effects, such as property values, would likely only affect residences within proximity to the proposed Project. The majority of potential Project-induced impacts on social and economic conditions would occur during the construction stage of Project, and therefore, are generally short term and low when compared to all the activities distributed across the larger regional area.

This section discusses the potential effects of the proposed Project on the various social and economic characteristics throughout the Study Area. Economic impacts include impacts that individuals, groups, properties, and businesses would experience from a change in business and economic activity as a result of the proposed Project alternatives. Social impacts are borne by individuals or groups who could experience a change in their social structure and context.

The intensity of impacts on socioeconomic conditions can be described through the thresholds described in Table 5-44.

Table 5-44: Socioeconomic Impact Context and Intensity Definitions

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Short term: During construction period Long term: Life of the line (50 years)	A few individuals, groups, businesses, properties, or institutions would be impacted. Impacts would be minor and limited to a small geographic area. These impacts are not expected to substantively alter social and/or economic conditions.	Many individuals, groups, businesses, properties, or institutions would be impacted. Impacts would be readily apparent and detectable across a wider geographic area and could have a noticeable effect on social and/or economic conditions.	A large number of individuals, groups, businesses, properties, or institutions would be impacted. Impacts would be readily detectable and observed; extend to a wider geographic area, possibly regionally; and would have a substantial influence on social and/or economic conditions.

5.12.2.1 No-action Alternative

Under the no-action alternative, the Project would not be constructed. There would be no change in socioeconomic conditions due to the construction of the Project under the no-action alternative because direct and indirect revenues and tax receipts from construction of the Project would not be realized (construction wages, spending in the communities, and property taxes, among others).

Under the no-action alternative, improved electric reliability and power quality in the Project area would not be achieved. The transmission line would not be built, and the current aging distribution line would result in inadequate and unreliable electric service. The load growth would be capped at the projected 2015 load level, no new load growth could be accommodated, and transmission system reliability would decrease. The no-action alternative would indirectly impact existing socioeconomic conditions because local communities and the region would not benefit from the improved electric reliability and power quality anticipated from the Project. This could lead to increasing frequency and duration of power outages in the region.

5.12.2.2 Proposed Action

Construction and operation of any of the corridor alternatives would result in socioeconomic impacts, including:

- Improved electric reliability and increased capacity for existing and future customers.
- Temporary increase in population as a result of the influx of construction workers.
- Temporary increase in demand for temporary lodging facilities as a result of the influx of construction workers.
- Temporary increase in demand associated with spending on local goods, services, and construction materials.
- Potential changes to property values.
- Minimal reductions in timber production would occur from loss of land for structure placement and ROW clearing to maintain appropriate electrical clearances.

The continued reliability of electric service to the region is necessary to serve the current and future needs of businesses, housing, and infrastructure to allow the economy of the area to continue to operate.

An annual average workforce of approximately 21 workers would occur over the 3-year life of Project implementation, with a peak of 40 workers in the second year of the Project. The types of Project tasks and associated jobs include engineering surveys, permitting, environmental surveys and studies, ROW acquisition and easements, ROW clearing and preparation, and construction of the transmission line and substation. The actual construction activity would occur during the last 12 to 16 months of the 3-year Project implementation period.

Most Project workers are likely to temporarily relocate to the Project area because transmission Project construction requires a specialized expertise and workforce. A small number of local construction workers could be retained for more general activities. Only a few workers would be hired locally, and permanent jobs are not anticipated to be introduced to the area as a result of the operation of the proposed Project.

Because the corridors range from 16 to 31 miles, it is likely that workers would temporarily reside in the cities of Georgetown or Charleston during construction and commute to the various portions of the corridor as construction proceeds. Total earnings of the 21 construction workers would be approximately $1.4 million annually, based on average earnings for construction jobs in Study Area counties (U.S. Department of Commerce, Bureau of Economic Analysis 2018).[3] These earnings represent 0.01 percent of the earnings within Study Area counties, which were $24.1 billion in 2016 (U.S. Department of Commerce, Bureau of Economic Analysis 2018).

Because construction workers spend their money in the local area, revenues would likely increase for some local businesses, such as hotels, restaurants, gas stations, and grocery stores, supporting jobs and incomes for these businesses and their employees. Because construction and other Project workers are not anticipated to be permanent residents of the Study Area, induced spending would be considerably less than locally residing employees because construction workers would send a portion of their earnings to their home area. Overall, the spending would be short term and is likely to have low socioeconomic impacts on the overall region with no detectible changes in socioeconomic conditions in the Study Area.

The Study Area has experienced an increase in population over the past decade with the addition of 97,207 new residents between 2010 and 2016, a 17 percent increase (U.S. Census 2016a, 2017). Over the 3-year construction period, there would be a temporary average population increase of 21 people with a peak of 40 workers in the Study Area as a result of the Project. Larger municipalities in proximity to the Project, including Charleston and Georgetown, are likely to house the temporary residents in housing rentals, hotels or motels, or other housing accommodations in these cities.

Temporary population changes in local communities would be low, particularly compared to the total population in the Study Area.

During construction activities, short-term impacts on nearby residents as a result of the proposed Project would include increased noise, visual presence of construction equipment, and potential traffic resulting from the movement of heavy material haul trucks

[3] Average earnings for construction workers of $52,883.3065,640 in 20116, the latest year for which employment data are available, was based on data available for Berkley, Charleston and Georgetown counties.

that would likely slow vehicular movements and may close lanes during specific types of transmission line work. Long-term impacts on nearby residents as a result of operation of the proposed Project would include minor, infrequent disturbance during ROW maintenance or repair activities. Impacts on property values are discussed below.

New ROWs for the construction and maintenance of the action alternatives would be required to support the proposed Project. Existing access roads would be used where possible. Central Electric would pay market value to nonfederal landowners, as established through the appraisal process, for any new land rights and easements necessary to support the development of the Project. The appraisal process considers all factors affecting land value, including the impact of transmission lines on property value. The appraisals may reference studies conducted on similar properties to support their conclusions. The strength of any appraisal depends on the individual analysis of the property, using neighborhood-specific market data to determine market value.

The impact of introducing a new ROW for transmission structures and lines can vary dramatically depending on the placement of the ROW in relation to the property's size, shape, and location of existing structures. A transmission line may diminish the utility of a portion of property if the line effectively severs this area from the remaining property and subsequently alters existing land use patterns. These factors as well as any other elements unique to the property are taken into consideration to determine any loss in value within the easement area, as well as outside the easement area in cases of severance.

Whenever land use changes, the concern is often raised about the effect the change may have on property values nearby. The question of whether nearby transmission lines can affect residential property values has been studied extensively in the United States and Canada over the last 20 years or so, with mixed results. In general, the impacts are difficult to measure, vary among individual properties, and are influenced by a number of interplaying factors, including:

- Proximity of residential properties to transmission line structures
- Type and size of high-voltage transmission line structures
- Appearance of easement landscaping
- Surrounding topography (Jackson and Pitts 2010)

Pitts and Jackson (2007) summarize the following conclusions on the impacts of high-voltage transmission lines.

- When negative impacts are present, studies report an average decline of prices from 1 to 10 percent.
- Value diminution is attributable to the visual unattractiveness of the lines, potential health hazards, disturbing sounds, and safety concerns.
- Where property value impacts were present, the effect dissipated with time and distance.
- Impacts diminish as the distance between the high-voltage transmission lines and the affected properties increase, and generally disappear at a distance of 200 feet from the lines (when views are obstructed).
- Where views of transmission lines and towers are completely unobstructed, negative impacts can extend up to 0.25 mile.
- If high-voltage transmission-line structures are at least partially screened from view by trees, landscaping, or topography, any negative effects are reduced considerably.
- Value diminution attributed to high-voltage transmission-line proximity is temporary and usually decreases over time, disappearing completely in 4 to 10 years.

A recent study of sales of rural land parcels in central Wisconsin between 2002 and 2008 found small, but not statistically significant negative price effects on the sale of properties encumbered by a transmission line easement (Jackson 2010). Studies of impacts during periods of physical change, such as new transmission line construction or structural rebuilds, generally reveal greater short-term impacts than long-term effects. However, most studies have concluded that other factors (e.g., general location, size of property or structure, improvements, irrigation potential, condition, amenities, and housing supply and demand factors in a specific market area) are far more important criteria than the presence or absence of transmission lines in determining the value of residential real estate.

Some impacts on property values (and salability) might occur on an individual basis as a result of the new transmission line. Depending on the alternative, there are from 9 to 73 residences within 500 feet (approximately 1/10th of a mile), and from 51 to 116 residences within 0.25 mile of the action alternatives. Table 5-45 compares the number of residential structures within various proximities to the corridor alternatives.

Table 5-45: Residences in Proximity to the Corridor Alternatives

Residence Distance	Belle Isle B	Belle Isle C	Jamestown	Charity
Residences within 100 feet	0	0	4	2
Residences within 300 feet	5	2	44	36
Residences within 500 feet	9	9	73	50
Residences within 0.25 mile	68	51	116	87

The Charity and Jamestown corridor alternatives have predominantly more residences in proximity to their corridors, which is due primarily because they are 60 to 100 percent longer than the Belle Isle corridor alternatives, and the Charity and Jamestown corridor alternatives travel through more population areas than do the Belle Isle corridor alternatives. As Figure 5-34 shows (Section 3.9), most of the residences along Belle Isle corridor alternatives B and C that might be in proximity to the lines are in the town of McClellanville within proximity to U.S. Highway 17. Siting of Belle Isle corridor alternatives B and C is likely to occur in more wooded areas around McClellanville lessening impacts to residences located closer to the highway. The transmission line would most likely still be visible from these houses, although it would likely be at least partially obscured from view for most of its corridor it travels through currently forested areas.

The Charity corridor alternative heads northwest from the substation at McClellanville primarily along Highway 45, passing within 500 feet of several residences along this corridor. In some spots as the line travels along the side of the highway it will pass within 100 to 200 feet of some residences. The line turns south at Halfway Creek Road, a rural road with no residences, and within a couple miles enters an existing and currently active transmission line ROW until it reaches its terminus northeast of Charleston, SC. The Jamestown corridor would follow a similar path heading northwest of McClellanville. Approximately 1 mile after the Charity corridor turns south the Jamestown corridor would turn back to the northwest and continue along Shulerville Road, a rural road with a mixture of residences along it. Some of these residences are within 100 to 200 feet of the road, though most are set back at least 300 feet from the roadway. This corridor would continue along roadways until transitioning to a forested area about 1 from its terminus in Jamestown.

Where the transmission lines pass within a few hundred feet of residences, the existing highway and its current developed character would diminish the visual effects associated with the transmission line. Residences located farther from the highway generally have partially obscured views of the highway because of forest cover, further reducing visual impacts on these residences.

As a result, the introduction of the proposed Project likely would result in low adverse effects on property values. These impacts would be highly variable, individualized, and unpredictable. Most of these losses would be temporary in nature because property value effects associated with transmission lines tend to dissipate with time.

The construction, operation, and maintenance of the proposed Project would generate additional property tax revenues to counties where the transmission line would be sited. There are between 16 and 31 miles of transmission lines associated with the proposed alternatives, depending on the final alternative chosen. The state of South Carolina would assess property taxes on the transmission line based on the value of the property, using the unit valuation method. Average construction costs for engineering, materials, equipment, and labor are estimated to be $457,000 per mile plus an additional $675,000 for each alternative for additional requirements for river crossings.

[Note to reviewer: Central Electric to confirm these costs]

The unit valuation method includes a cost- and income-based assessment to determine property taxes. It is likely that the cost-based approach would be used for the first few years at the end of construction and initial operation of the line, and income-based and cost-based approaches (through reconciliation) would be used for the majority of the operation of the line (Ingram 2013). The cost-based approach to valuation would decrease as the constructed cost is depreciated over time. The first year's property taxes would range from $48,000 to $78,000 depending on the corridor alternative. As the line becomes operational, the values would be depreciated, with annual decreases in property tax receipts, and eventually the annual receipts would approach those of the income-based approach. Table 5-46 summarizes these tax receipts to county governments that would be associated with the transmission line of the proposed Project. Additional property taxes would be associated with the substation.

Construction and operation of one of the action alternatives would result in both short- and long-term impacts on agricultural land. During construction, potential short-term impacts within the ROW would include crop damage (depending on the time of year for construction across specific fields), soil disturbance, and potential loss of production for one growing season as a result of construction activities and the transport of construction equipment and vehicles restricting or preventing planting of lands within or adjacent to the ROW.

Table 5-46: Property Tax Revenues to Study Area Counties Associated with the Corridor Alternatives

Geography	Miles	Construction Period and Initial Operation (Annual)	Income-Based Approach (Annual)
Belle Isle Alternative B			
Charleston	8.4	$26,016	$2,862
Georgetown	7.9	$23,739	$2,611
Study Area Counties	16.3	$49,755	$5,473
Belle Isle Alternative C			
Charleston	7.7	$24,128	$2,654
Georgetown	7.7	$23,819	$2,620
Study Area Counties	15.7	$47,947	$5,274
Charity corridor			
Berkeley	25.1	$60,871	$6,696
Charleston	5.9	$16,802	$1,848
Georgetown	0.0	$0	$0
Study Area Counties	31.0	$77,672	$8,544
Jamestown corridor			
Berkeley	19.9	$48,260	$5,309
Charleston	5.9	$16,802	$1,848
Georgetown	0.0	$0	$0
Study Area Counties	25.8	$65,062	$7,157

Source: Ingram (2013)

Note: Assumptions: Charleston, Georgetown and Berkeley counties had millage rates of 0.0593, 0.0574, and 0.0505, respectively, in the year 2015 (South Carolina Association of Counties 2018); Assessment Ratio: 0.105; Capitalization Rate: 0.11.

Very little cultivated cropland exists within the ROW, with all corridor alternatives having 0.5 percent or less within the 2,000-foot corridor (a 2,000-foot corridor was used due to the spatial resolution of the data). Most impacts would be short term and occur during construction. Similarly, there is very little grassland and pasture/hay land in the Study Area. Construction activities are expected to have a short-term impact on cattle grazing because cattle may need to be moved during construction activities in areas where the ROW would cross grassland or pasture.

As Table 5-47 shows, between approximately 119 acres, for Belle Isle corridor alternative C, and 256 acres, for the Charity corridor alternative, of the ROW would cross through forested areas and require tree clearing. The Jamestown and Charity corridor alternatives would result in the largest removal of trees form NFS lands in terms of total trees removed and in terms of the percentage of trees removed of the total line that are on NFS lands. Additional danger trees located outside of the ROW may also require clearing. All tall-growing vegetation would be cut to prevent vegetation from coming close enough to the conductor to cause an electric arc. There would be some positive economic effects associated with the timber harvest associated with the ROW clearing. However, it is likely that this effect would be minimal and short term. Where the ROW crosses private lands, Central Electric would compensate landowners for the reduced timber production at fair market value for the timber and other land values.

Table 5-47: Forest Land Impacts within a 75-foot ROW of the Proposed Project Corridors

Measure Geography	Belle Isle B	Belle Isle C	Jamestown	Charity
All Forest Land (Acres)	124	119	223	256
NMFS Forest Land (Acres)	11	0	155	177
NMFS Forest Land Impacts (Percent of All Trees Removed That Are on NFS lands)	8.6%	0.2%	69.4%	69.2%

Impacts associated with the construction of the alternatives are anticipated to be short term and would cease once the line is in service. Because of the temporary nature of construction activities, few to no families are expected to accompany construction workers to the Study Area. As a result, there would be negligible impacts on schools and enrollment.

The action alternatives would provide an increase in the load-serving capacity to accommodate the long-term electrical needs of the region. Projected load growth would be accommodated, and the reliability of the regional transmission system would be maintained, continuing to serve the electricity needs of the area.

Capital expenditures for improvements to electric-utility infrastructure are investments made to serve customers. Central Electric's customers primarily include 20-member rural electric systems, all located in the state of South Carolina. Capital expenditures can be passed on to customers in the form of increased rates. However, as a regulated utility, Central Electric can increase rates only on approval by state utility commissions or the Federal Energy Regulatory Commission. The Federal Energy Regulatory Commission and state utility commissions must approve rates for sale of wholesale electricity and review rates set by the federal Power Marketing Administrations. Such rate-increase requests are subjected to rigorous analysis by regulators and others as well as a public process. At this time, not all costs for development of the proposed Project are known;

therefore, Central Electric cannot predict what the rate increase may be as a result of this Project. In addition to electrical support for the area, Project construction would itself generate a certain amount of economic activity. While minimal when compared to the current sales throughout the region, the presence of approximately 21 construction workers over a 3-year period would generate additional sales of food, fuel, lodging, and services (primarily vehicle and equipment repairs).

Construction activity would also require concrete, aggregate, lumber, and hardware items. Many of these materials would likely be purchased locally, contributing further to local sales. Most materials for the transmission structures and conductors would be shipped from manufacturers outside the region. However, many of these materials would be subject to sales and taxes payable to local governments.

The action alternatives would not influence long-term employment in the Study Area. Non-residential construction workers would spend a portion of their earnings in the Study Area, contributing to jobs and income across the region. Because these workers will only be in the area temporarily and are likely to be primarily from outside the region, induced employment and income is expected to be short term and low. No long-term employment would be necessary to support the operation of the proposed Project. The local population would increase temporarily, with low and short-term impacts on socioeconomic conditions.

5.13 Environmental Justice

5.13.1 Affected Environment

On February 11, 1994, President Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. Executive Order 12898 directs agencies to address environmental and human health conditions in minority and low-income communities to avoid the disproportionate placement of any adverse effects from federal policies and actions on these populations. The general purposes of this executive order are to:

- Focus the attention of federal agencies on human health and environmental conditions in minority communities and low-income communities with the goal of achieving environmental justice.
- Foster nondiscrimination in federal programs that substantially affect human health or the environment.
- Improve data collection efforts on the impacts of decisions that affect minority communities and low-income communities and encourage more public

participation in federal decision-making by ensuring documents are easily accessible (e.g., available in multiple languages and made readily available).

As defined by the *Environmental Justice Guidance Under NEPA* (CEQ 1997), “minority populations” include persons who identify themselves as Asian or Pacific Islander, Native American or Alaskan Native, Black (not of Hispanic origin), or Hispanic. Race refers to census respondents’ self-identification of racial background. Hispanic origin refers to ethnicity and language, not race, and may include persons whose heritage is Puerto Rican, Cuban, Mexican, and Central or South American.

A potential environmental justice minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. For this analysis, meaningfully greater represents a population that is 10 percent higher than the benchmark or reference region; in this case, the reference or benchmark geographic area is the county within which the census block group resides.

Potential environmental justice low-income populations are identified using the Census Bureau’s statistical poverty threshold, which is based on income and family size. The Census Bureau defines a “poverty area” as having 20 percent or more of its residents below the poverty threshold. A block group is a statistical division within a census tract, which is a small geographic subdivision of a county, and typically contains between 600 and 3,000 persons (U.S. Census 2018b). The Study Area for the environmental justice analysis is defined by Census block groups for the most recent Census data available at the time of this writing, the 2016 American Community Survey 5-year estimates. Any direct and indirect impacts on low-income or minority populations that may be associated with the implementation of the proposed action are assessed at this geographic level. The reference region, or region of comparison, for this analysis is Georgetown, Berkeley, or Charleston counties.

There are 381 Census block groups within Charleston, Berkeley, and Georgetown counties (100 in Berkeley, 235 in Charleston, and 46 in Georgetown). In 2016, 124 of these block groups had at least 20 percent of their population living below the poverty level. These 124 block groups represent approximately 33 percent of all block groups within these counties.

In 2016, all three counties had a combined total of 141 block groups with minority populations where the percentage of respondents identifying themselves as a minority either exceeded 50 percent of the total population of the block group or made up a proportion of the block group population that was at least 10 percent or higher than the minority population at the respective county level. These 141 block groups represented approximately 37 percent of all block groups within the two counties.

5.13.2 Environmental Effects

Table 5-48 provides definitions for duration and intensity of impacts to environmental justice populations established for this Project.

5.13.2.1 No-action Alternative

Under the no-action alternative, the proposed Project would not be constructed. As described in Chapter 1, the McClellanville circuit experiences more reliability issues than does the average Berkeley electric circuit, adversely affecting populations in the Study Area. The no-action alternative would continue this condition and result in continued adverse impacts to the region. Therefore, because the service area of the McClellanville circuit is made up of predominantly minority and low-income communities, as described below, there would be a disproportionate adverse impact on minority and/or low-income populations as a result of the no-action condition resulting in a long-term environmental justice impact.

5.13.2.2 Proposed Action

The corridor alternatives are located in seven block groups in Berkeley, Charleston, and Georgetown counties. One of these block groups contains a potential environmental justice minority population, while five contain both potential impoverished and minority environmental justice populations. One did not contain either a potential impoverished or minority environmental justice population. These block groups are identified in Table 5-48 and Figures 5-39, 5-40, and 5-41.

As Table 5-48 shows, the Jamestown corridor alternative contains the highest number of residences within minority block groups, and corridor alternative C contains the fewest number of residences residing within any block group.

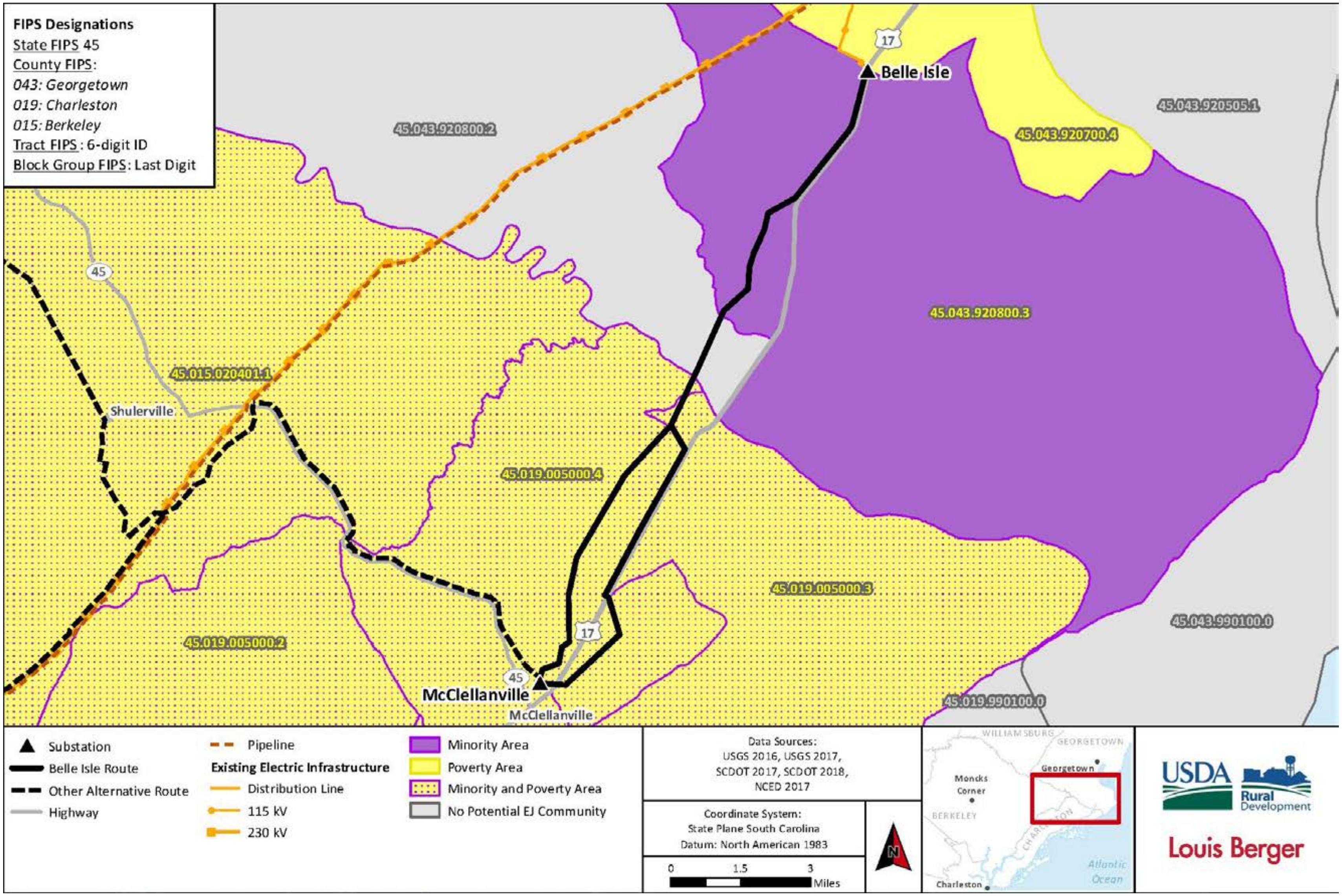


Figure 5-39: Census Block Groups in the Belle Isle Corridor Area, Impoverished and Minority Populations, 2016

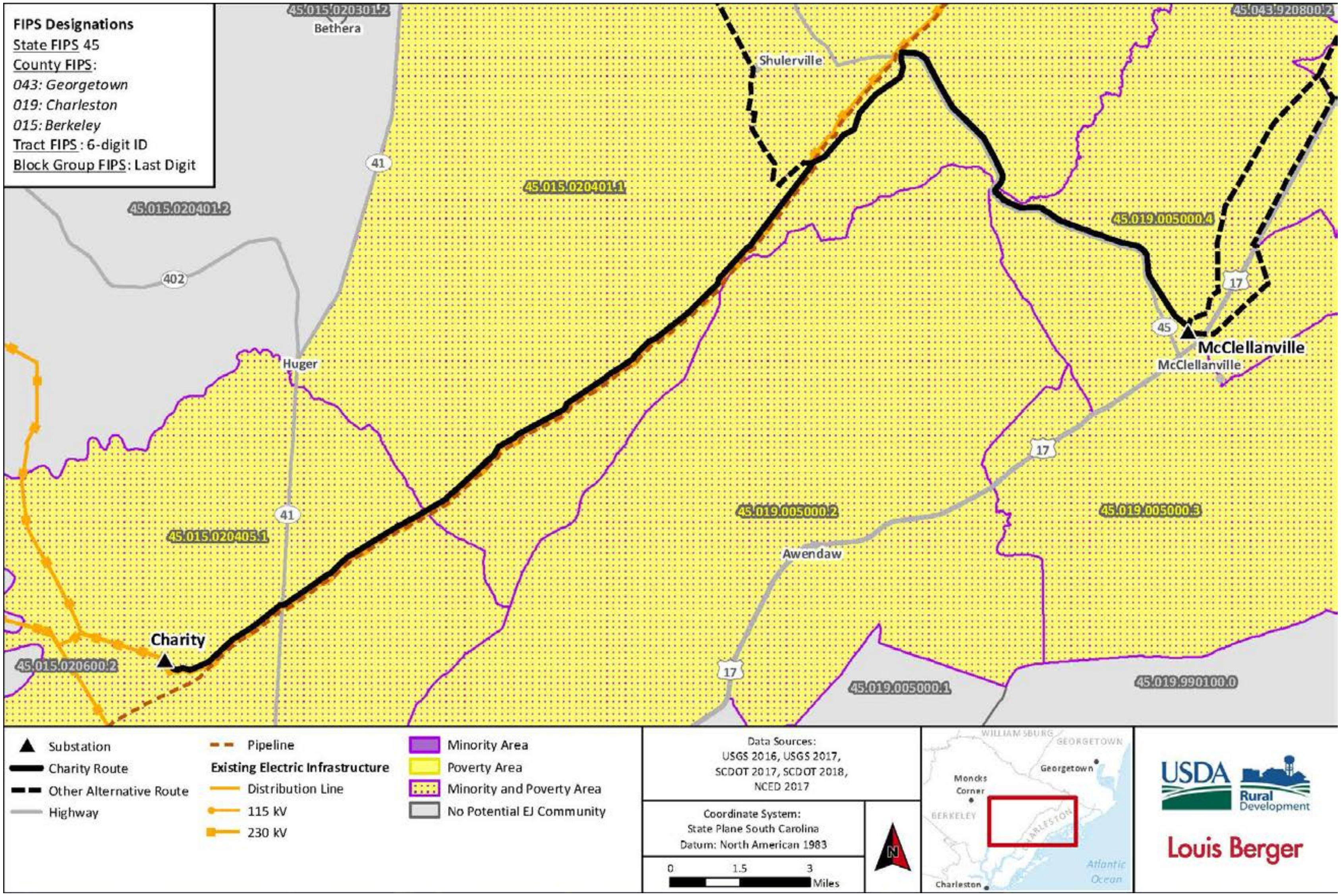


Figure 5-40: Census Block Groups in the Charity Corridor Area, Impoverished and Minority Populations, 2016

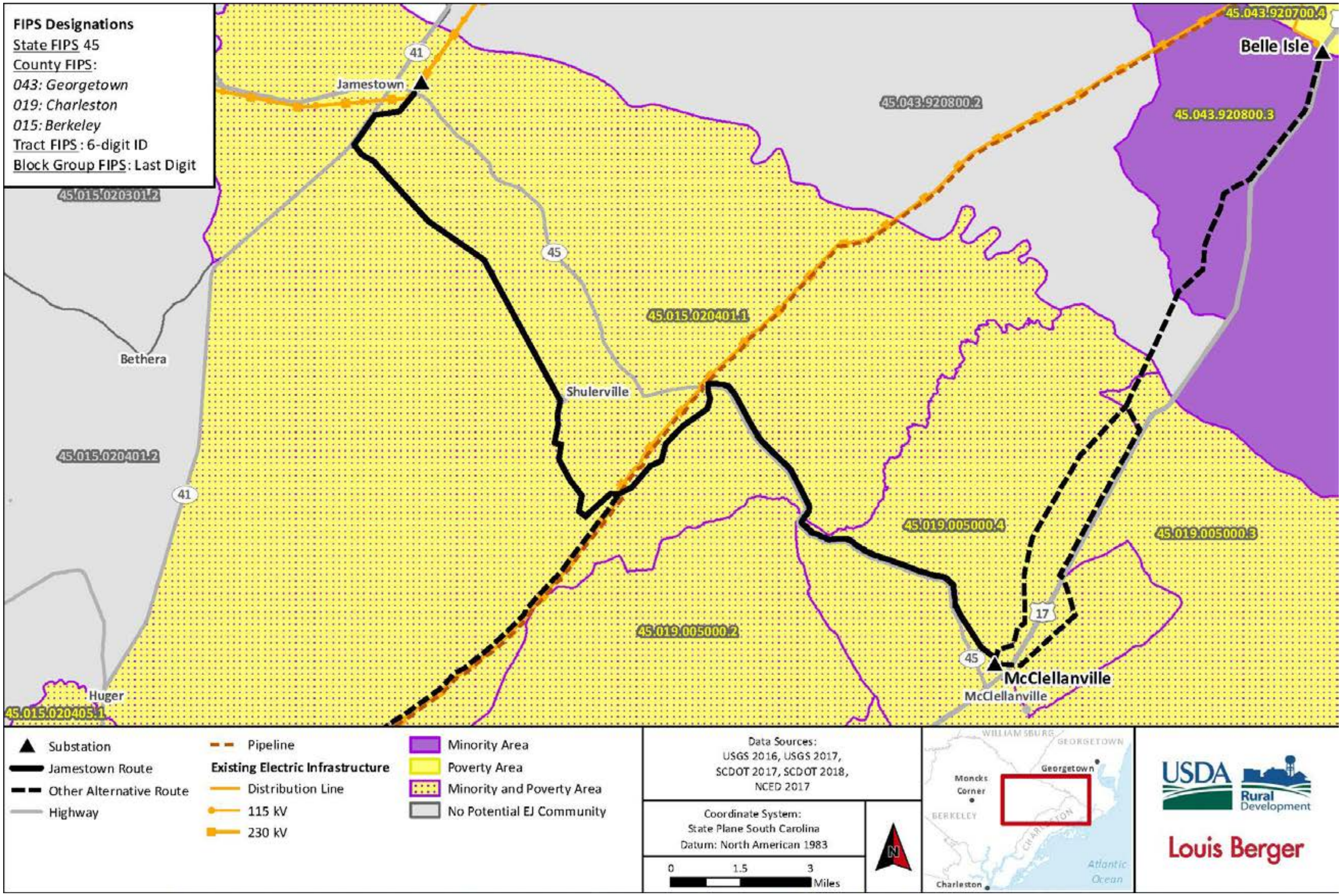


Figure 5-41: Census Block Groups in the Jamestown Corridor Area, Impoverished and Minority Populations, 2016

Table 5-48: Census Block Groups with Residences in the Study Area, Impoverished and Minority Populations, 2016

Block Groups with Counties	Population Status	Alt. B	Alt. C	Jamestown	Charity
Residences within 500 feet/1,000 foot corridor		9	9	73	50
Berkeley County					
45.015.020401.1	Minority and Poverty Area	0	0	61	33
45.015.020405.1	Minority and Poverty Area	0	0	0	5
Charleston County					
45.019.005000.3	Minority and Poverty Area	0	0	0	0
45.019.005000.4	Minority and Poverty Area	8	8	12	12
Georgetown County					
45.043.920800.3	Minority Area	1	1	0	0
Residences within 1,320 feet/2,640 foot corridor		69	51	116	87
Berkeley County					
45.015.020401.1	Minority and Poverty Area	0	0	92	43
45.015.020405.1	Minority and Poverty Area	0	0	0	20
Charleston County					
45.019.005000.3	Minority and Poverty Area	0	0	0	0
45.019.005000.4	Minority and Poverty Area	56	38	24	24
Georgetown County					
45.043.920800.2	No Potential EJ Community	0	0	0	0
45.043.920800.3	Minority Area	13	13	0	0

Source: U.S. Census (2016b)

Each alternative likely would contribute positively to all populations, including minority and low-income communities, through additional fiscal receipts to counties. Additionally, these populations would benefit from improved electricity reliability and power quality. However, these populations also could be adversely affected by potential Project-induced impacts on additional resource areas (e.g., traffic, air quality, and visual resources).

Air quality, noise, and traffic impacts are anticipated to be short-term with air emission dispersion limited to the vicinity of construction activities. The 0.25-mile buffer for the Jamestown corridor alternative contains the highest number of residences among the alternatives while this same buffer for Belle Isle corridor alternative C contains the least number of residences. Therefore, the Jamestown corridor alternative has the highest potential for environmental justice impacts while Belle Isle corridor alternative C has the lowest potential for environmental justice impacts. Not all the residences that reside within the buffer and a block or block group that have statistically impoverished or minority populations would be considered an impoverished or minority household. It is therefore possible that fewer residences than those identified in the tables above would experience potential environmental justice impacts. Impacts resulting from the construction of the line would be temporary and occur only during the construction period. As portions of the transmission line are constructed, the area of impact would transition down the line to the next construction site, resulting in impacts that would be less than if the entire population along the line were impacted during the whole construction period.

However, some short-term disproportionate adverse impacts as result of construction activities would still occur to minority and low income communities resulting in short- term environmental justice impacts.

Following construction, impacts would primarily be limited to land use restrictions within the ROW and the presence of the transmission line and structures on properties. It is possible that some residents would experience adverse visual impacts from construction of the new transmission line. Central Electric could mitigate these impacts with adjustments to alignment to provide a forested buffer between the highway and the transmission line and/or by providing landscaping or vegetation features.

As identified in Section 5.12, *Socioeconomics*, the property value of residences within 0.25 mile of the alternative lines could be impacted as a result of the view of the transmission line from the residence. However, most of the visual impacts from residences would be obscured from forest and other dense vegetation along the corridors. The transmission line will be visible from houses along U.S. Highway 17, although the existing highway and its current developed character would diminish the adverse visual effects associated with the transmission line. Therefore, disproportionate adverse impacts could occur to potential environmental justice populations, although these impacts are expected to be low and highly variable, individualized, and unpredictable. The majority of these losses would be temporary in nature because property value effects associated with transmission lines tend to dissipate with time.

5.14 Transportation

5.14.1 Affected Environment

Much of the traffic in the area is concentrated on primary and secondary roadways; however, area residents use smaller, more rural roadways. No off-highway vehicle corridors occur in the Study Area. As shown in Figures 5-42, 5-43, and 5-44, many roadways are located relatively near the proposed Project.

Primary roadways within the Study Area include U.S. Highway 17, State Highway 41, and State Highway 45. U.S. Highway 17 generally runs north-south paralleling the coast connecting the major cities of Myrtle Beach and Charleston as well as Study Area towns, Georgetown and McClellanville. U.S. Highway 17 is a four-lane, divided highway between McClellanville and Georgetown.

State Highway 41 generally runs north-south and originates in the town of Mt. Pleasant connecting central Charleston County to Jamestown. The highway ends at the South Carolina state line and continues north as North Carolina State Highway 45. State Highway 45 originates in the town of McClellanville and generally runs east-west connecting to the interior of South Carolina serving as the main thoroughfare in northern Berkeley County to the town of Jamestown.

Portions of some of the alternatives were designed to parallel roadways and other linear infrastructure (e.g., gas pipelines) in the Study Area to minimize potential new disturbances. U.S. Highway 17 is the major roadway in the Study Area that runs close to both the Belle Isle and McClellanville substations. State Highway 45/French Santee Road runs parallel to the Jamestown corridor and is also located near the Jamestown substation. The Charity corridor intersects with State Highway 41. The highway is approximately 2.5 miles from the Charity substation. Table 5-49 details the length and percentage of each alternative that would parallel U.S. Highway 17, State Highway 41, and State Highway 45.

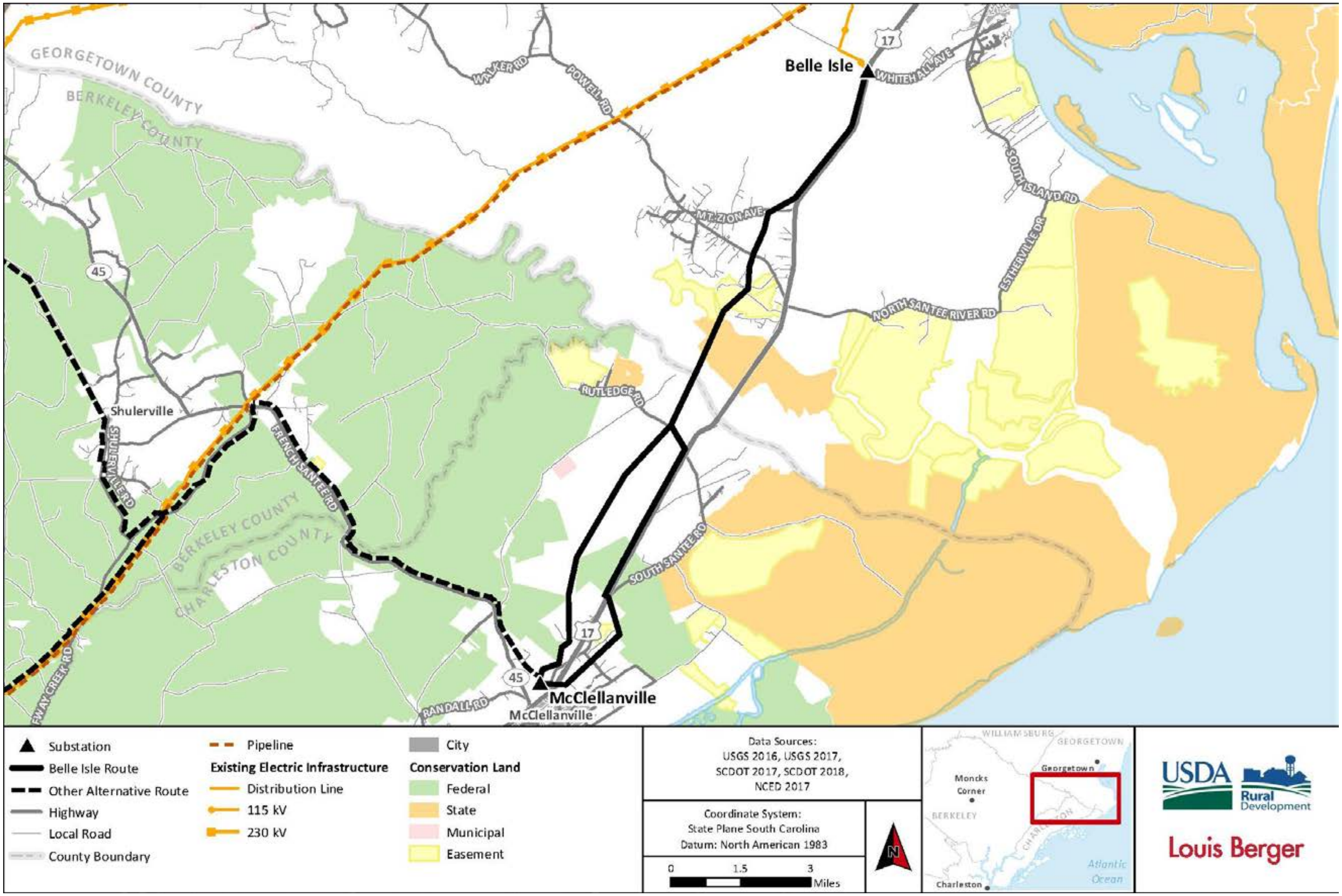


Figure 5-42: Transportation Network in the Belle Isle Corridor Study Area

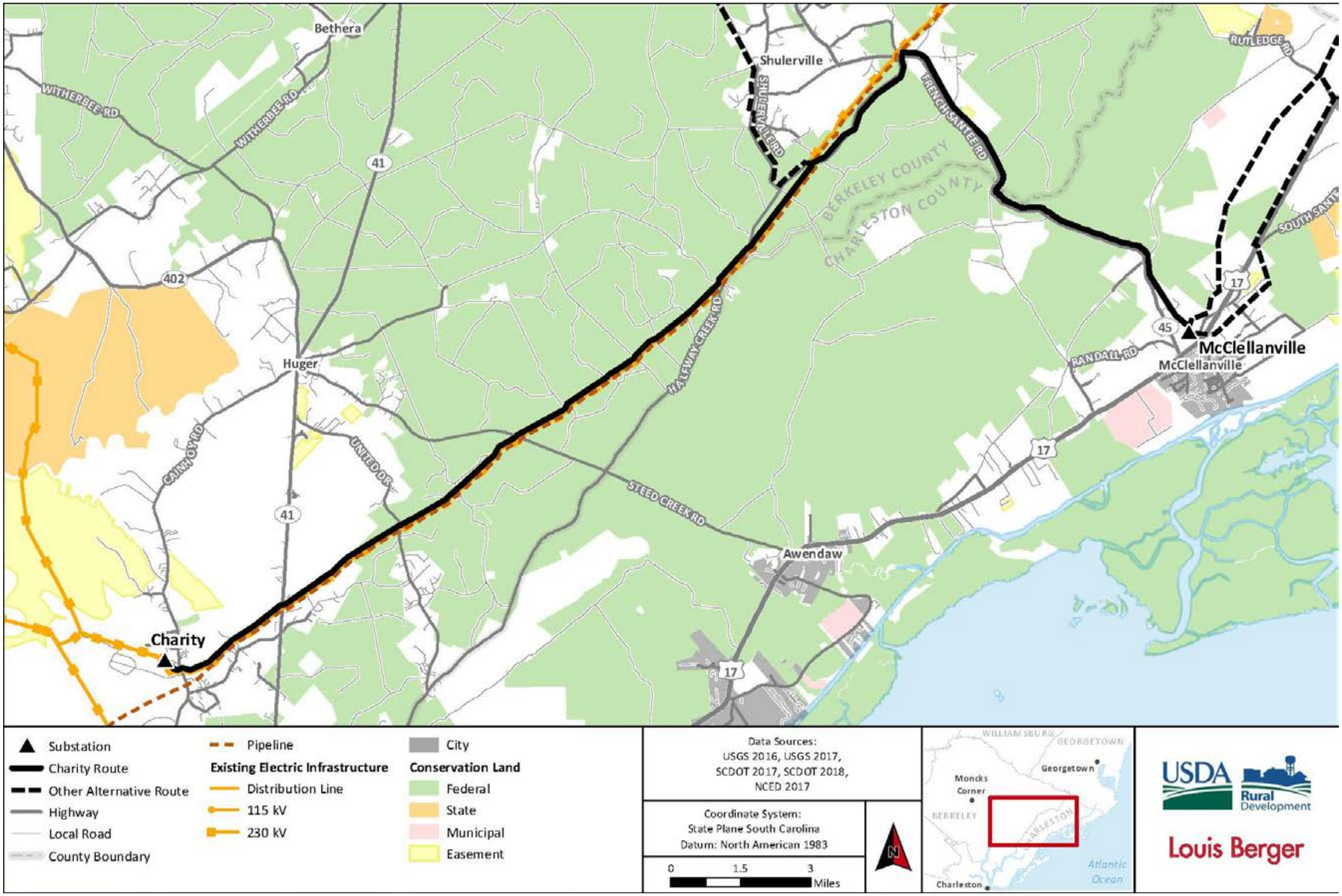


Figure 5-43: Transportation Network in the Charity Corridor Study Area

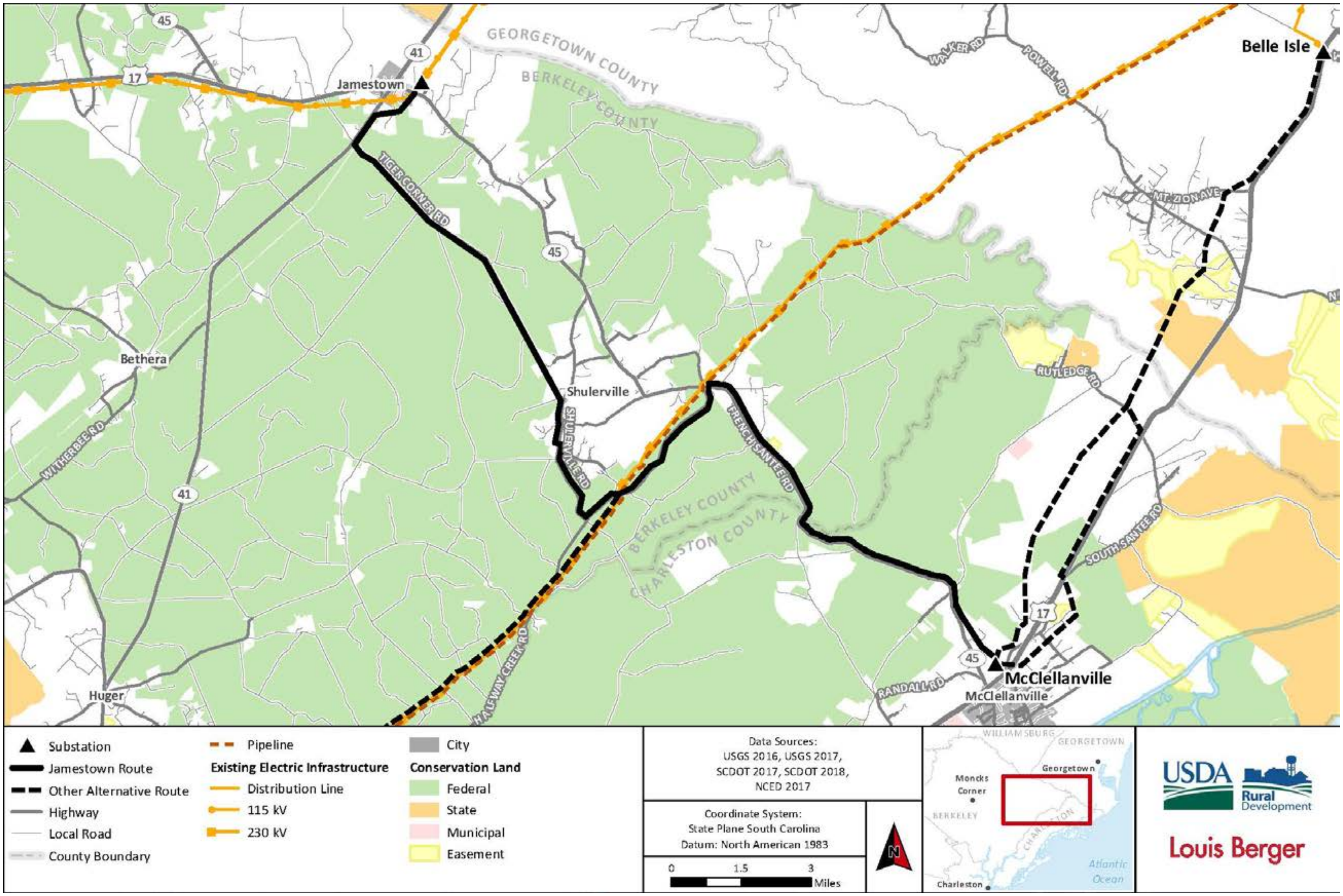


Figure 5-44: Transportation Network in the Jamestown Corridor Study Area

Table 5-49: Miles and Percentage Parallel to U.S. and State Highways

	Belle Isle-B	Belle Isle-C	Jamestown	Charity
U.S. Highway 17	6.7 (41%)	3.2 (20%)	0.0 (0%)	0.0 (0%)
State Highway 41	0.0 (0%)	0.0 (0%)	0.7 (3%)	0.0 (0%)
State Highway 45/French Santee	0.0 (0%)	0.0 (0%)	8.3 (32%)	8.3 (27%)

Most of the roads in the Study Area are rural roads and do not have average annual daily traffic estimates available. Table 5-50 shows the roads in the Study Area with available average annual daily traffic data. For comparison, U.S. Highway 17 north of Georgetown along the coast near the town of Murrells Inlet has average annual daily traffic stations reporting more than 30,000 counts; comparison of these numbers illustrates the rural nature of the overall Project area (SCDOT 2017a).

Table 5-50: Average Annual Daily Traffic Volumes

County	Roadway	Average Annual Daily Traffic	Station ID
Berkeley	S-41 (Clements Ferry Rd to SC 402)	4,100	151
Berkeley	S-41 (Charleston Co. line to Clements Ferry Rd)	15,400	152
Berkeley	S-41 (SC 402 to SC 45/French Santee Rd)	2,900	153
Berkeley	S-45 (S-41 to School Bus Dr)	750	159
Berkeley	S-45 (School Bus Dr to Charleston Co. Line)	600	161
Charleston	U.S. Highway 17 (Fifteen Mile Landing Rd to Tibwin Rd)	111,300	137
Charleston	U.S. Highway 17 (Tibwin Rd to SC 45)	10,900	138
Charleston	S-45 (Berkeley Co. Line to 0.06 miles south of Turner Sullivan Road)	400	197
Charleston	S-45 (Old Georgetown Rd to Randall Rd)	550	199
Charleston	S-45 (Randall Rd to U.S. Highway 17)	900	201
Georgetown	U.S. Highway 17 (Georgetown Co. Line to County Road 23)	10,400	101

Source: SCDOT (2017a, 2017b)

There are no airports in close proximity to be considered potentially affected by the proposed alternatives. The Georgetown airport is the closest airport, and the proposed ROW would be about 8,000-feet away; more than twice the amount from the existing line leaving the Santee Cooper steam plant across Turkey Creek from the airport. The Charity corridor would cross over a railroad that parallels State Highway 41, approximately 5.5 miles south of the town of Huger.

5.14.2 Environmental Effects

This section discusses potential impacts, their duration, and intensity on transportation resulting from construction and operation of the proposed Project, including the no- action alternative. Definitions for duration and intensity developed for this Project are shown in Table 5-51.

Table 5-51: Transportation Impact Context and Intensity Definitions

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Short term: During construction period Long term: Life of the line (50 years)	Negligible increase in daily traffic volumes resulting in perceived inconvenience to drivers but no actual disruptions to traffic. Perceived inconvenience to drivers due to routine inspections by small vehicles or pickup trucks.	Detectable increase in daily traffic volumes (with slightly reduced speed of travel) resulting in slowing down traffic and delays, but no change in level of service. Short service interruptions (temporary closure for a few hours) to roadway traffic.	Extensive increase in daily traffic volumes (with reduced speed of travel) resulting in an adverse change in level of service to worsened conditions. Extensive service disruptions (temporary closure of one day or more) to roadways. Permanent physical change in transportation system. Permanent change in traffic patterns along primary roadways including U.S. Highway 17 with an adverse change in level of service to worsened conditions.

The following section provides an overview of potential impacts associated with the proposed Project alternatives.

5.14.2.1 No-action Alternative

No construction activities would be associated with the no-action alternative, and the proposed Project would not occur. However, traffic volumes are anticipated to continue to increase in areas experiencing growth. Without construction of the proposed Project, businesses and residences in the area would continue to be limited by lack of reliable electrical service.

5.14.2.2 Proposed Action

Construction

During construction of the Project, there could be short-term impacts on the transportation network. Delivery of equipment and material and general construction traffic would increase wear and tear on area roads and highways. There would not be any construction of new roadways to access the transmission line because existing roadways would be used. Potential short-term, direct, and adverse effects to traffic would include increased traffic volume and travel time. Construction of the transmission line could include temporary lane or road closures when the line is being constructed across a roadway. In addition to closures, increased travel time could occur from movement of construction equipment and materials. On roads that currently have very little traffic an increase in traffic during construction could occur if workers use these roads as access roads. Long-term beneficial impacts to roadways and traffic would occur if road improvements are required.

Construction activities associated with corridor alternatives would result in short-term impacts on the roadway network in areas where road and lane closures and traffic detours may be required. The extent of such impacts would depend on location of the road, lane closures, and traffic detours and the duration of the closures or detours.

Because U.S. Highway 17 is the most travelled road in the Study Area, effects to traffic would be the greatest for the Belle Isle corridors B and C alternatives, because they parallel or cross this roadway. State Highway 41 is the second most-traveled corridor within the area's transportation network, which is crossed by the proposed Charity corridor. Effects to traffic from alternatives that intersect or parallel U.S. Highway 17 or State Highway 41 would have greater adverse effects than those that do not given the level of us of these two most travelled roads. Table 5-52 shows the types of roads that would be crossed by the corridor alternatives.

Table 5-52: Roadway Crossings by Various Corridors

Roadway	Belle Isle B	Belle Isle C	Jamestown*	Charity*
Local Roads	4	4	22	16
State Highways	-	-	5	4
U.S. Highways	3	-	-	-
Secondary Highways	5	3	12	11
Total	12	7	39	39

*Note: actual road crossing impacts would likely be reduced through additional micrositing and during the engineering design process

Closures and detours may be necessary to string transmission lines across roads. Short traffic delays may occur to facilitate the movement of material haul trucks. Longer traffic delays would occur on higher volume roadways. Roadway closures would be planned well in advance and timed during off-peak travel times to minimize adverse effects.

Belle Isle corridor alternative B partially parallels U.S. Highway 17. Whereas Central Electric typically acquires a 75-foot ROW, this would need to be expanded an additional 10 feet adjacent to this well-traveled roadway to meet the required total of 85 feet. The proposed corridor for Belle Isle corridor alternative C also partially parallels U.S. Highway 17, but for less than approximately 4 miles. This portion of the proposed corridor would also need the ROW expanded by 10 feet. The proposed corridors for Jamestown and Charity both partially parallel State Highway 45 for varying lengths, and the Jamestown corridor parallels State Highway for less than one mile. These proposed lines are routed through much more rural areas crossing more rural roadways than the Belle Isle alternatives. These corridors have much lower proportions of their overall length parallel to major interstates or other well-travelled roads. Appropriate notification would be posted in and around affected areas to alert motorists of planned closures and detours.

As the proposed Project is further refined, Central Electric would work with the appropriate entities and municipal officials to minimize potential adverse impacts by identifying potential traffic corridors, limitations, and improvements associated with the road network.

Transportation Impacts within Francis Marion National Forest

The Jamestown and Charity corridors are primarily within the FMNF. Within the National Forest, the Jamestown corridor largely runs parallel to State Highway 45, Halfway Creek Road, and State Highway 41. The Jamestown corridor also intersects with several local and rural roads within the National Forest, including Turner Sullivan Road, Honeyhill Road, Old Cemetary Road, Round Pond Road B, State Road S-8-608, Shulerville Road, Yellow Jacket Road, Ackerman Driver, School Bus Drive, Tiger Corner Road, Hell Hole Road, and McKay House Road. While most of the Jamestown corridor is within the ROW for State Highway 45, Halfway Creek Road, and State Highway 41, appropriate notifications would be posted in and around all affected areas to alert motorists of planned closures and detours. Impact on the transportation network within the National Forest for the Jamestown corridor would be short-term and moderately adverse.

Within the FMNF, the proposed Charity corridor runs parallel to State Highway 45 for approximately 8 miles, then runs south at Halfway Creek Road. The proposed Charity corridor intersects with several local and rural roads within the National Forest, including Round Pond Road B, State Road S-8-608, State Road S-8-172, Blue Bird Road, Conifer Road, Buckle Island Road, Halfway Creek Road B, Farewell Corner Road A, Cumbee

Road A, Bob Morris Road, Steed Creek Road, North Hampton Road C, United Driver and Ipco Keystone Road. As with the Jamestown corridor, appropriate notifications would be posted in and around all affected areas to alert motorists of planned closures and detours. The impact on the transportation network within the National Forest for the Charity corridor is expected to be short-term and moderately adverse.

The proposed Belle Isle B and C corridors are not within the FMNF.

Maintenance and Operation

Long-term impacts on roadways in the Project area are not anticipated as a result of the proposed Project. All crossings of roadways would be in compliance with National Electrical Safety Code clearance requirements. Central Electric would coordinate with agencies and obtain all necessary permits for road crossings. Once in operation, there would be periodic maintenance of the transmission line and supporting facilities; however, such activities are not anticipated to adversely affect roadway traffic volumes or patterns. According to the SCDOT accommodations policy, construction of the transmission line should be at least 30 feet from the pavement edge and outside of the clear roadside area (SCDOT 2011). As such, the line’s existence should have no effect on the upkeep of the roadway ROW. Road or land closures are not anticipated during the routine operation and maintenance of the transmission line.

Once in operation, the corridor alternative is not anticipated to result in any long-term, adverse effects. Maintenance activities associated with the transmission line would occur primarily within the proposed Project ROW and avoid disrupting traffic patterns. While maintenance vehicles would need to access locations where repairs or other activities are necessary, these movements would not occur on a regular basis and are not anticipated to adversely affect traffic patterns over the long term.

5.15 Health and Safety

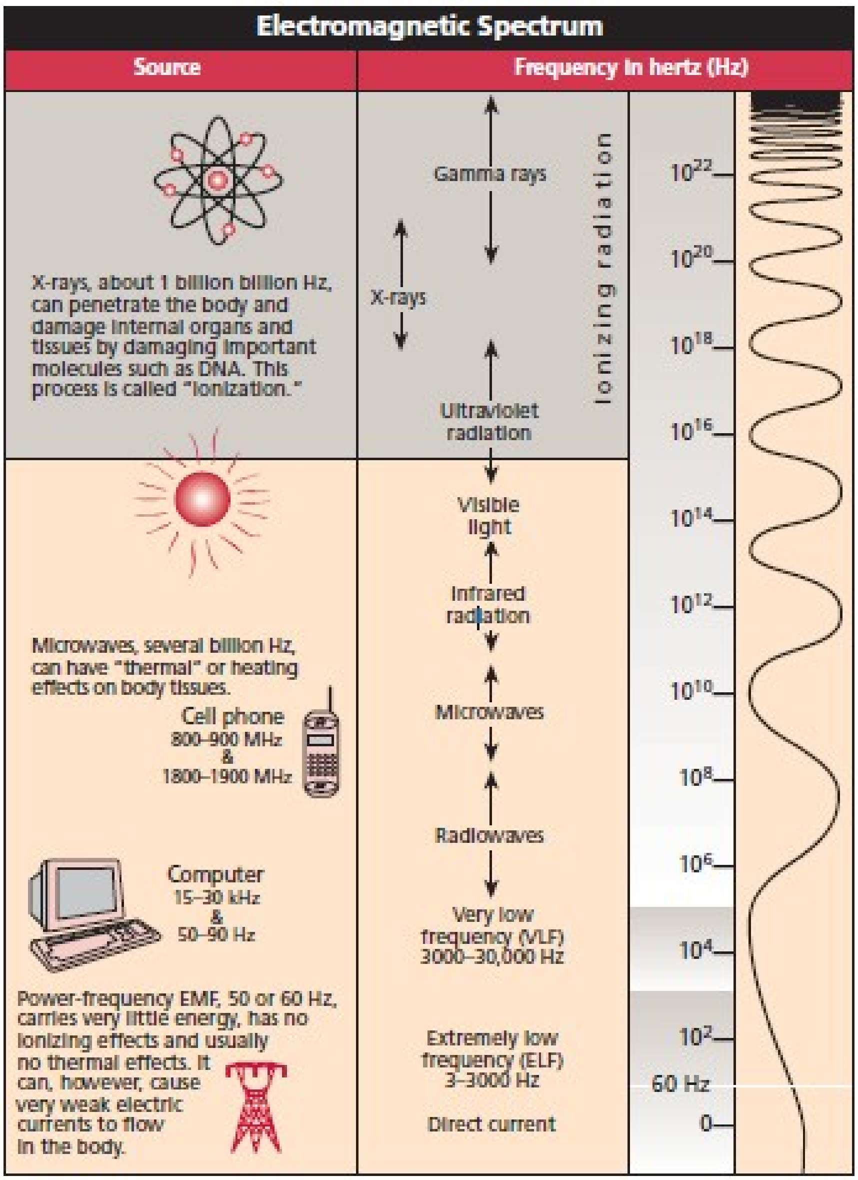
5.15.1 Affected Environment

Potential human health and safety impacts are related to Project construction and operation, and impacts would be confined to within 300 feet of the ROW centerline.

5.15.1.1 Electric and Magnetic Fields

The following overview of electric and magnetic fields (EMF) comes from the National Institute of Environmental Health Sciences (NIEHS) manual *Electric and Magnetic Fields Associated with the Use of Electric Power* (2002).

EMF is a type of energy associated with electric power that includes two fields: the electric field and the magnetic field. The electric field is produced by the voltage of the power source and increases as voltage increases. Magnetic fields are produced from the current flowing through the conductor and increase as the current increases. Both electric and magnetic fields decrease as distance from the source increases (NIEHS 2002). EMF, as it pertains to power lines is considered extremely low frequency electric and magnetic fields. Power frequency is in the range of 50–60 hertz for transmission line facilities. Figure 5-45 illustrates the different types of sources that emit EMF and their associated frequency. Power frequency is at the bottom of the spectrum.



Source: NIEHS (2002)

Figure 5-45: EMF Sources and Frequencies

EMF associated with transmission lines is emitted from a variety of equipment including the transmission lines coming into the substation, transformers, reactors, and capacitor banks. As such, EMF is strongest around substation facilities and decreases rapidly with distance from the source (NIEHS 2002).

The primary concern related to transmission lines and other electrical equipment is the potential negative health effects from exposure to EMF, in particular an increase in cancer, leukemia, and other diseases. Over the last several decades, several epidemiological studies have been conducted to assess potential impacts of EMF as it relates to cancer and other diseases. In 1998, Congress asked NIEHS to complete a study of the possible health effects associated with EMF. The following is an excerpt from that report:

> The NIEHS believes that the probability that EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal, scientific support that exposure to this agent is causing any degree of harm. The scientific evidence suggesting that extremely low frequency EMF exposures pose any health risk is weak. The strongest evidence for health effects comes from associations observed in human populations with two forms of cancer: childhood leukemia and chronic lymphocytic leukemia in occupationally exposed adults. While the support from individual studies is weak, the epidemiological studies demonstrate, for some methods of measuring exposure, a fairly consistent pattern of a small, increased risk with increasing exposure that is somewhat weaker for chronic lymphocytic leukemia than for childhood leukemia. In contrast, the mechanistic studies and the animal toxicology literature fail to demonstrate any consistent pattern across studies, although sporadic findings of biological effects (including increased cancers in animals) have been reported. No indication of increased leukemias in experimental animals has been observed (NIEHS 1999).

Additional organizations have also completed their own analysis. The findings from some of these studies are captured below

USEPA:

> Scientific studies have not clearly shown whether exposure to EMF increases cancer risk. Scientists continue to conduct research on the issue. There is no clear scientific evidence that electromagnetic fields affect health (USEPA 2018c).

National Research Council:

An earlier National Research Council assessment of the available body of information on biologic effects of power-frequency magnetic fields (National Research Council 1997) led to the conclusion:

> …that the current body of evidence does not show that exposure to these fields presents a human health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects. The new, largely unpublished contributions of the EMF-RAPID program are consistent with that conclusion. We conclude that no finding from the EMF-RAPID program alters the conclusions of the previous NRC review on the Possible Effects of Electromagnetic Fields on Biologic Systems.

In 1999, the National Research Council followed up by stating:

> In view of the negative outcomes of EMF-RAPID replication studies, it now appears even less likely that EMFs in the normal domestic or occupational environment produce important health effects, including cancer (National Research Council 1999).

Implantable Medical Devices:

Pacemakers are used to treat arrhythmias, which are problems associated with the rate or rhythm of the heartbeat. The pacemaker can relieve some of the irregular symptoms and sense abnormal heart rhythms and uses electrical pulses to prompt the heart to beat at a normal rate (U.S. Department of Health and Human Services 2012).

Pacemakers and other cardiac electronic devices rely on complex micro-circuitry and use electromagnetic waves for their communication with the programmers. As a result, they are susceptible to interference from surrounding electromagnetic fields.

Electromagnetic interference can be defined as any signal, biological or not, that falls within a frequency spectrum that is being detected by the sensing circuitry of the pacemaker. This can interfere with the device's optimal function and is often a concern for patients (Lakshmanadoss et al. 2004).

At present, there is no standardized guidance regarding acceptable levels of EMF for pacemakers. However, the American Conference of Governmental Industrial Hygienists has prepared recommendations for occupational exposures including EMFs. These guidelines are designed to identify levels that nearly all workers may be exposed to repeatedly without adverse effect. For EMF, the recommendations suggest that persons with pacemakers or similar devices limit their exposure to electric fields to 1 kV/m and magnetic fields to 1,000 milligauss (American Conference of Governmental Industrial Hygienists 2011).

The expected EMF levels on this Project would be significantly below these recommendations.

5.15.2 Environmental Effects

This section discusses potential impacts, their duration, and intensity on health and safety of the public resulting from the construction and operation of the proposed Project. Definitions for duration and intensity associated with safety and public health developed for this Project are described in Table 5-53.

Table 5-53: Health and Safety Impact Context and Definitions

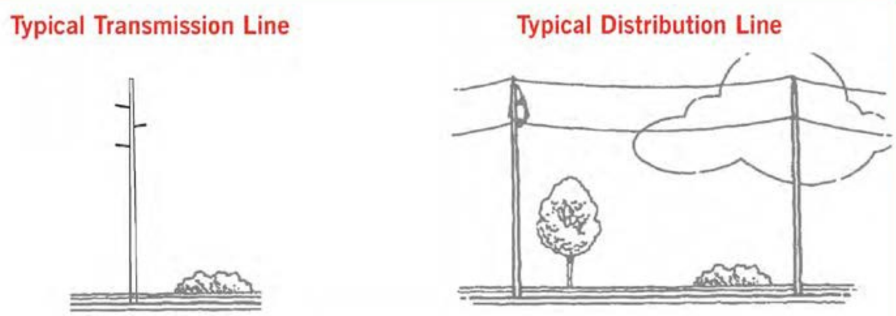
Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Short term: During construction period Long term: Life of the line (50 years)	Construction of the proposed Project would not result in: 1) exposure of contaminated media to construction workers and/or 2) incidents associated with the installation of the transmission line and supporting infrastructure. Operation of the proposed Project would not result in an increase of EMF levels that would rise to a level of concern with regard to public health and safety.	Construction of the proposed Project may result in exposure of contaminated media by construction workers either through the disturbance of hazardous materials and/or chemical spills. The potential for incidents associated with the installation of the transmission line and supporting infrastructure would increase. Operation of the proposed Project would increase EMF levels, but not to a level that would adversely affect public health and safety.	Construction of the proposed Project would result in exposure of contaminated media by construction workers either through the disturbance of hazardous materials and/or chemical spills. Incidents associated with the installation of the transmission line and supporting infrastructure would likely result. Operation of the proposed Project would increase EMF levels to a level high enough to adversely affect public health and safety.

5.15.2.1 No-action Alternative

Under the no-action alternative, the transmission line would not be constructed. Therefore, there would be no increase in the amount of EMF or any related impacts on human health and safety.

5.15.2.2 Proposed Action

All corridor alternatives are anticipated to have similar EMF field values. The proposed ROW for the Project is 75 feet. Figure 5-46 illustrates the levels of EMF associated with various transmission line voltages. For this Project, the EMF range would be between 100 and 230 kV. At the edge of the ROW, the EMF level would be approximately 3.4 to 6.4 milligaus. At a distance of 50 feet from the ROW, the level would decrease to 1.9 to 3.5 milligaus. These levels are significantly below the thresholds set out by the International Commission on Non-Ionizing Radiation Protection, which revised its reference levels in 2010 to 2,000 milligaus. Therefore, the operation of any of the corridor alternatives would not result in an adverse impact on public health and safety as a result of the slight increase in EMF levels.



TYPICAL MAGNETIC FIELD READINGS

Typical 60 hertz magnetic fields measured at various distances.
Magnetic fields are measured in milligauss (mG).

Transmission lines*	Under line	Edge of right of way	50 ft. from edge
44kV	1.0 - 25.0	0.2 - 2.5	0.1 - 1.0
100kV	2.1 - 19.3	0.6 - 3.4	0.3 - 1.9
230kV	4.5 - 29	1.9 - 6.4	1.0 - 3.5
525kV	17 - 40	6 - 15	2.4 - 4.0
Distribution lines*	0.1 - 35		

Substation – Magnetic fields from the equipment in a substation, measured at the fence, are generally negligible. However, readings at the fence can reflect the magnetic fields from the power lines entering and exiting the substation and generally do not exceed readings in this table for distribution lines.

*These are typical readings under normal operating conditions at moderate load.

Source: Central Electric (2014)

Figure 5-46: Typical EMF Levels for Transmission Lines

Electrical Contact Safety

Direct contact with an energized conductor poses the most serious risk of injury or death from a high-voltage transmission line. The transmission structures would be designed to prevent any accidental contact with an energized conductor. Poles would be designed to discourage and prevent climbing, which should also prevent accidental contact even during most acts of vandalism. By designing these structures to the requirements of the National Electrical Safety Code, there would be little danger from contact injuries.

In the event of an extreme event such as a catastrophic storm, which could drop a conductor, safety controls within the substations would immediately open circuit breakers, shutting down the line to prevent accidental exposure.

Induced Voltage Safety

The Charity Route parallels an existing 230 kV transmission line, and extra caution would be required during construction and maintenance if this alternative were selected. Even with the new proposed 115 kV line shut down, induced voltage from a parallel transmission such as the adjacent 230 kV transmission line could induce unsafe conditions for utility workers when servicing the new line. Central Electric would coordinate with the owner of the transmission line (South Carolina Public Service Authority) for outages and safety protocols. With appropriate safety protocols in place, future maintenance could be performed safely on the new line.

Construction Safety

Heavy equipment would be used during the construction of the transmission line and include the use of oil and gas for fueling. At this time, no onsite storage of hazardous materials is planned, and, in the event of a spill, appropriate BMPs outlined in Table 2-2 would be implemented. Adherence to normal safety procedures associated with heavy construction would ensure no danger to utility construction or maintenance workers.

Landowner Concerns

Transmission lines are designed to automatically trip in the event the line comes in contact with trees or other surfaces. Typically, this occurs during storm events or when a tree falls into the transmission line. Santee Cooper would be responsible for maintaining the transmission line ROW once the Project is constructed. A copy of its Vegetation Management Plan is included in Appendix C. In addition, herbicides may be used during the maintenance of the transmission line ROW (with the exception of NFS lands). Santee Cooper would be responsible for complying with all federal and state laws for herbicide application.

All of the corridor alternatives cross some type of agricultural land. The presence of transmission poles in timber plantations or agricultural fields may be difficult to farm around in some locations and may present a hazard to farmers operating large equipment. Central Electric would work with affected landowners as the preferred alternative is identified to mitigate any potential effect on agricultural operations.

5.16 Noise

5.16.1 Affected Environment

Noise is generally defined as unwanted sound. Sound is all around; it becomes noise when it interferes with normal activities such as speech, concentration, or sleep. Noise associated with transmission lines is a factor during construction and operation of both lines and substations. Noise emanates from vehicular traffic and crews associated with construction and maintenance of transmission lines and substations and noise coming from the transmission line itself once operational.

Ambient noise (the existing background noise environment) can be generated by a number of noise sources, including mobile sources, such as automobiles and trucks; and stationary sources such as construction sites, machinery, or industrial operations. In addition, there is an existing and variable level of natural ambient noise from sources such as wind, streams and rivers, wildlife, and other sources.

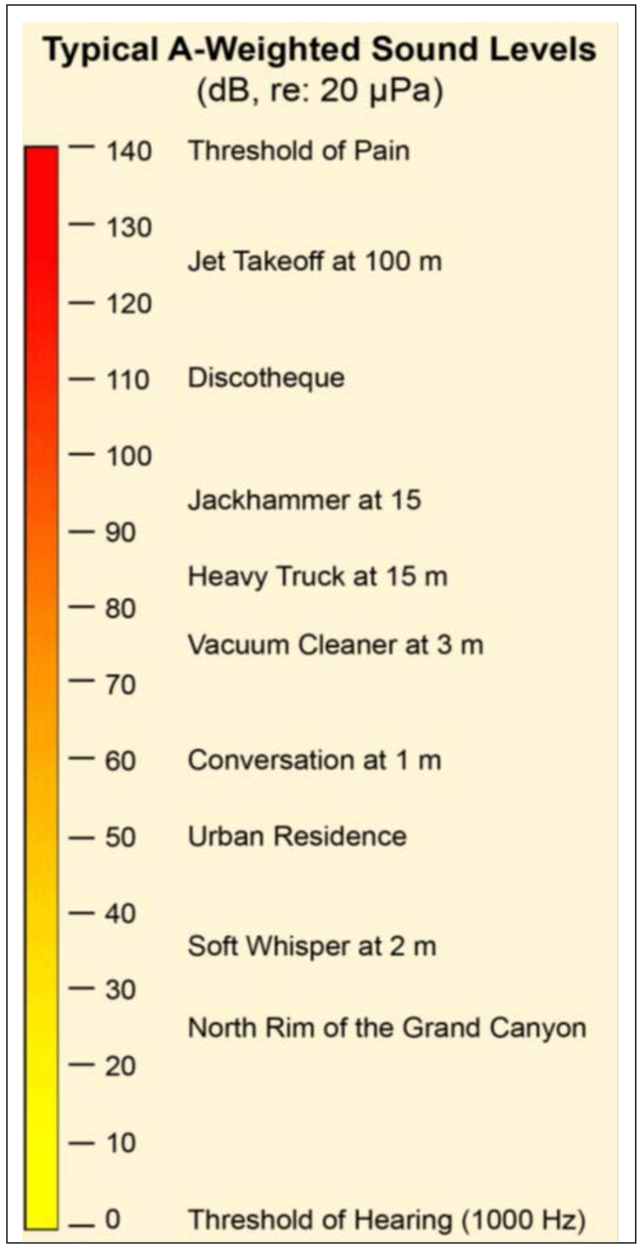


Figure 5-47: Sound Levels of Typical Noise Sources and Noise Environments

The standard measurement unit of noise is the decibel (dB), which represents the acoustical energy present. Noise levels are measured in A-weighted decibels (dBA), a logarithmic scale that approaches the sensitivity of the human ear across the frequency spectrum. The human ear responds to noise in the audible frequencies in a similar way in most individuals. A 3- to 5- dBA increase, which is equivalent to doubling the sound pressure level, is barely perceptible to the human ear. A 6-dBA is a readily perceptible change, and a 10-dBA is doubling of the apparent loudness. Figure 5-47 provides examples of sound levels of typical noise sources and noise environments (U.S. Department of Labor, Occupational and Health Safety Administration 2013).

5.16.1.1 Ambient Noise and Sources in the Project Area

Ambient noise within the Project area can originate from a variety of sources. Most of the Project area is forested and consists of agricultural lands and sparse rural development trending toward more industrial uses at the extreme western extent of the Project area. Within the Study Area, numerous tracts of land are used for timber harvesting. At any given time, timber may be logged and transported, which would include the use of logging equipment and large trucks moving the timber down U.S. Highway 17 and State Highways 41 and 45. Logging equipment can often operate at 80 dBA and above, depending on the specific type of equipment used. In the rural development areas, ambient noise would typically be less than 50 dBA (the level normally associated with urban development). In addition, several highways traverse the Project area, and noise levels increase adjacent to the highways. Roadway noise can vary due to the type of vehicles, speed at which the vehicles are traveling, and the density of surrounding vegetation. In general, an ambient noise level of approximately 70 dBA occurs throughout the Project area.

5.16.2 Environmental Effects

Construction of the transmission line would have the greatest impact on noise levels for the Project. Construction equipment and vehicles would use highways and local roadways to access the Project ROW. Large equipment including, drill rigs, cranes, low boys, large trucks, bucket trucks, and pulling and tensioning equipment would be required to construct the transmission line. Table 5-54 gives the equipment noise levels for some of the equipment that may be used for the Project.

Table 5-54: Typical Construction Equipment Noise Levels

Type of Equipment	Maximum Level (dBA) at 50 feet
Bulldozer	85
Heavy Truck	88
Backhoe	80
Pneumatic Tools	85
Craine	85
Combined Equipment	89

Source: Thalheimer (1996)

Noise related to construction activities would occur along the length of the transmission line for the duration of construction, which is anticipated to take 12 to 16 months. The increase in noise from construction activities would only be an issue in areas with residences, schools, churches, libraries, or where there are sensitive noise receptors. The majority of the Project area is forested, with the majority of the residential development located along U.S. Highway 17. Existing ambient noise levels typically vary between 40 to 50 dB for areas that are not adjacent to U.S. Highway 17. This level is generally considered quiet. For this analysis, dB levels above 50 dBA would be considered moderate and below 50 dBA would be considered low. The Belle Isle corridor alternative parallels U.S. Highway 17 for some portion of its length, while the Jamestown and Charity corridor alternatives each parallel State Highway 45 for some portion of their lengths. The Belle Isle corridor has seven residences within the 600-foot corridor. Noise impacts during construction of the Belle Isle alternative would be of moderate intensity for these receptors but short in duration. The Jamestown and Charity corridor alternatives contain 44 and 36 residences within the 600-foot corridor, respectively. Construction-related noise impacts to these receptors would also be moderate but short in duration.

Noise impacts during the operation and maintenance of the Project are expected to be negligible. Noise from maintenance activities would only occur in the event a maintenance activity must be performed on the transmission line. Typically, maintenance activities are short in duration and can be accomplished with a bucket truck and several pick-up trucks. The impacts from maintenance activities are expected to be low and short in duration (Table 5-55).

Table 5-55: Duration and Intensity Definitions for Project-related Noise

Context (Duration)	Low Intensity	Moderate Intensity	High Intensity
Short term: During the construction period Long term: Life of the line (50 years)	Noise impacts could attract attention but would not dominate the soundscape or detract from current user activities.	Noise impacts would attract attention, and contribute to the soundscape, but would not dominate. User activities would remain unaffected.	Impacts on the characteristic soundscape would be considered significant when those impacts dominate the soundscape and detract from current user activities.

Operation of the transmission line may result in corona-generated noise from the conductors. Changes to local atmospheric pressure may result in a hissing or cracking sound that may be heard directly under or a few feet from the transmission line ROW. The noise generated depends on weather, altitude, and system voltage and dissipates with distance from the transmission line. No receptors are located within 100 feet of the transmission line. For all alternatives, there are several residences located within 300 feet of the transmission line. However, at this distance, impacts on noise from the corona would be low and short term.

The level of corona-generated noise at 115 kV is so low that it generally is not detectable to the human ear at ground level. Therefore, no corona noise impacts are anticipated during operation of this new line.

6.0 CUMULATIVE IMPACTS

6.1 Cumulative Impacts Methodology

Assessment of cumulative impacts in NEPA documents is required by CEQ regulations (CEQ 1987). Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that form the basis of cumulative impacts analysis. The utility sector is characterized by considerable uncertainty because economic and technological factors determining the course of utility infrastructure development are often unpredictable. For this reason, cumulative impacts analysis is a particularly challenging undertaking in the context of such a dynamic and changing utility environment. To provide guidance on how cumulative impacts are assessed in environmental impact analysis, CEQ developed a handbook *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ 1997). CEQ's handbook offers the most comprehensive and useful information to date on practical methods for addressing cumulative effects in NEPA documents. The methodology for cumulative impacts in this section takes its direction from this guidance. The following analysis of cumulative impacts focuses on the specific resources and ecological components that can be affected by the incremental effects of the proposed action and other past, present, and reasonably foreseeable actions and events occurring in the same geographic area.

6.2 Cumulative Impacts

The cumulatively considerable past, present, and reasonably foreseeable actions and events considered in this analysis are the continuing population growth and development in the region, including timber harvesting; actions associated with the FMNF Land and Resource Management Plan; and current ongoing recovery efforts related to hurricane Florence which made landfall in September 2018. These actions and events are described below. The following analysis then characterizes cumulative effects for each topic covered in this SEIS.

6.2.1 Francis Marion National Forest Land and Resource Management Plan

The FMNF completed revising the *Revised Land Management Plan* in 2017 (USFS 2017), as all national forests are periodically required to do. The purpose of the plan is to guide the general management direction of the FMNF during the next 15 years. This document, developed under the 2012 planning regulations outlined in 36 CFR 291, is a second revision of the original forest management plan prepared in 1985 under the National

Forest Management Act. USFS's 2012 Planning Rule directly addresses the ability of a forest to respond to climate change and other stressors.

6.2.2 Hurricane Florence

Hurricane Florence arrived on the Carolina coast in early September 2018. Six counties in South Carolina—Chesterfield, Dillon, Georgetown, Horry, Marion, and Marlboro—were designated by FEMA for disaster assistance on September 21, 2018. This designation allows residents in these counties to apply for uninsured and underinsured damages and losses resulting from the hurricane. Weeks after the tropical storm blew north and dissipated, rivers still swollen by the storm's rains continued to cause flooding along their channels toward the coastal waters of South Carolina. As of this draft SEIS, disaster recovery efforts are continuing.

6.3 Cumulative Impact Analysis

6.3.1 Water Resources

Long-term, moderate- to high-intensity impacts on forested wetlands would be expected to occur as part of the proposed action where trees and other woody vegetation would need to be removed within the ROW. The cumulative contribution of Project-related impacts to water resources would be minor when considered within the context of continuing population growth and development in the region. Within the Project area as a whole, vegetation removal occurs at a regional scale as the human population continues to increase in the counties of Berkeley, Charleston, and Georgetown. Impacts of flooding associated with Hurricane Florence on wetlands and floodplains within the Project area have yet to be determined. Project activities under the proposed action would not result in a significant contribution to these storm-related effects. Development and use of forest resources within areas of the forest is guided by the Francis Marion National Forest Land and Resource Management Plan. Specific use of USFS lands is managed for the protection of resources and planned development is limited in order to reduce impacts to the extent feasible. When taken in the regional context, the incremental contribution to cumulative effects of water resources impacts associated with the Project would be minor.

6.3.2 Biological Resources

The proposed alignments contain a combination of USFS land, residential, agricultural, and undeveloped areas. When combined with the continuing population growth and development in the region, additional vegetation removal and habitat fragmentation associated with the proposed action would contribute to adverse cumulative effects to individual animals, populations, and even ecosystem conditions. Significant adverse effects to biological resources from habitat fragmentation associated with residential development and related infrastructure would be exacerbated by tree clearing associated with the proposed Project. In addition, nonnative invasive plants and animals could be introduced and displace native species, disrupt nutrient and fire cycles, and alter plant succession. Although populations of common wildlife species would not be adversely affected, threatened, endangered, or other at-risk species could be negatively affected by increased human development. The future of most of these sensitive species depends on active restoration and management, in particular via prescribed fire. The potential for increasing human development in the McClellanville area could further limit areas where prescribed fires are possible. The *Southern Forest Resource Assessment* (Wear and Greis 2002) details these threats. However, forested habitat that is managed via natural disturbance (i.e., fire) is abundant in the Project area, and the FMNF would continue to implement forest management activities that would have beneficial long-term effects to fire-dependent ecosystems and associated at-risk wildlife species. Localized effects would occur to red-cockaded woodpecker and other wildlife species dependent on large areas of undisturbed habitat. Any additional land development within or adjacent to known clusters could have substantial adverse effects on this species. Moreover, as the human population continues to increase in the counties of Berkeley, Charleston and Georgetown, wildlife road mortality is expected to continue to increase as more vehicles are on the roads. Some heavily traveled paved roads on the FMNF cause significant amphibian and reptile mortality (USFS 2013a). In summary, impacts to vegetation and wildlife from the proposed action would contribute cumulatively to effects already occurring to biological resources in the McClellanville area. When combined with impacts from land development and population trends, the proposed action would result in minor adverse cumulative impacts on biological resources.

6.3.3 Soils and Geology

Short-term impacts to soils and geology are anticipated to occur as a result of ground disturbances associated with the proposed action. When taken in the regional context, such impacts would not contribute significantly to cumulative effects on soil resources in the Project area.

6.3.4 Air Quality and Greenhouse Gas Emissions

Short-term impacts to air quality would be expected during Project construction. However, the incremental contribution of impacts to air quality associated with the Project to overall cumulative air quality and GHG emissions at the regional level would be negligible.

6.3.5 Cultural and Paleontological Resources

When taken in combination with effects from regional development associated with population growth and development in the region, including timber harvesting, forest service plans or ongoing recovery efforts related to Hurricane Florence, no cumulative contribution to impacts on cultural and paleontological resources is anticipated to occur as a result of the proposed action.

The Gullah Geechee Cultural Heritage Corridor Commission's Cultural Heritage Corridor Management Plan (Gullah Geechee Cultural Heritage Corridor Commission 2012) provides an overview of past, present, and reasonably foreseeable threats to traditional lands and cultural sites used by the Gullah Geechee. This information was extrapolated in a general context to assess potential cumulative effects to cultural resources in the Study Area. In accordance with the stipulations of the PA, which would be developed to conclude Section 106 review and must be executed prior to the issuance of any Record of Decision, an effects assessment to historic properties would occur after Central Electric selects the proposed Project's ROW.

In the late twentieth century, "modern plantations" developed in the coastal southeastern United States in the form of resorts, subdivisions, golf courses, golf communities, and recreational facilities. The Study Area contains a combination of public land, residential communities, agricultural and cropland, and undeveloped areas. According to the U.S. Census Bureau, the population in this region is anticipated to grow by more than one million from 2000 to 2030 (U.S. Census 2005). This is broadly consistent with the patterns of steady growth observed in Charleston and Georgetown counties in the decade just passed (2000 to 2010). The increase in population and its associated development may have resulted in loss of lands and sites of cultural importance. Within and adjacent to the proposed corridor alternatives, however, there is a substantial amount of public and private lands held in conservation easements. These areas were established to conserve natural and cultural resources and have been effective in protecting these resources from development.

Some of the Gullah Geechee communities referenced in the Cultural Heritage Corridor Management Plan (e.g., South Santee, Germantown, Tibwin, Buck Hall, and Awendah) are communities that would benefit directly from the operation of the proposed Project.

By supplying adequate levels of power reliably, the proposed Project has the potential to contribute to the preservation and maintenance of these traditional communities located in the Study Area.

6.3.6 Recreation and Land Use

No cumulative impacts to recreation and land use are anticipated. When taken in combination with effects from regional development associated with population growth and development in the region, including timber harvesting, forest service plans or ongoing recovery efforts related to Hurricane Florence, no cumulative contribution to impacts on recreation and land use is anticipated to occur as a result of the proposed action.

6.3.7 Visual Resources

The cumulative contribution of Project-related impacts to visual resources would be minor when considered within the context of continuing population growth and development in the region. Timber harvesting currently occurs and is expected to occur in the future in the area of the Project. Cumulative impacts associated with visual impacts are anticipated to be short term and minor in the Project area. The contribution of the Project to these cumulative effects would be negligible.

6.3.8 Socioeconomics

No cumulative impacts to socioeconomics are anticipated. The proposed Project would improve electrical reliability and power quality in the McClellanville Area, which would support further economic development within the region.

6.3.9 Environmental Justice

No cumulative impacts to environmental justice communities are anticipated. Adverse cumulative impacts from Project construction and operation, when combined with disaster recovery effects from Hurricane Florence, would not disproportionately affect environmental justice communities.

6.3.10 Transportation

Negligible short-term cumulative impacts to transportation would be expected during Project construction. Timber harvesting currently occurs and is expected to occur during the construction period in the area of the proposed action. Cumulative impacts associated with construction and timber harvesting traffic, and associated road closures, would be temporary in duration, and Project-related contributions to cumulative impacts would be negligible.

6.3.11 Health and Safety

No cumulative impacts to health and safety are anticipated.

6.3.12 Noise

No cumulative impacts to noise are anticipated. Once operational, the Project would not contribute significantly to existing ambient noise in the Project area.

7.0 MITIGATION MEASURES AND OTHER NEPA CONSIDERATIONS

7.1 Summary of Mitigation Measures

As described in Table 4-2, Central Electric proposes to implement mitigation measures to avoid, minimize, or mitigate potential project effects to water resources, biological resources, soils and geology, air quality, cultural resources, land use, socioeconomics, transportation infrastructure, health and safety, and the soundscape. These measures are generally accepted BMPs that Central Electric would implement prior to, during, and post construction to minimize overall project effects. Central Electric can incorporate design elements to avoid areas with sensitive resources, such as suitable habitat for threatened and endangered species, or perform additional site-specific surveys and implement measures to avoid or minimize such areas. Such measures could include: (1) structural measures, such as using construction mats for all wetland crossings and installing bird flight diverters; (2) geographic restrictions, such as confining construction activities to the ROW and around structure locations, and storing construction equipment, fuels, chemicals, and materials outside of streams and wetlands; (3) preventive measures, such as developing a non-native invasive plant management plan and inspecting construction equipment for seeds and thoroughly cleaning equipment before use in the project area; (4) scheduling measures, such as performing river crossings during low water periods or during winter, avoiding construction activities in proximity to nests of sensitive birds, and providing landowners with a schedule of construction activities; (5) procedural measures, such as briefing project workers on the appropriate protocol in the event of a cultural resource discovery during construction, or cleaning up spills or equipment leaks; (6) regulatory measures, such as adhering to any additional mitigation measures identified by USFWS during Section 7 consultation or preparing a Storm Water Pollution Prevention Plan and a construction plan in accordance with federal regulations; and (7) reclamation measures, such as restoring temporary access roads to the natural condition after construction. Furthermore, Central Electric would comply with the FMNF standards and guidelines on NFS lands.

7.2 Irreversible and Irretrievable Commitment of Resources

Irreversible commitment of resources refers to the loss of future options for resource development or management, especially of nonrenewable resources such as cultural resources. Construction and operation of the proposed Project would require the permanent conversion of 142 to 282 acres depending on the alternative selected. This potentially would include federal, state, and private lands. Most of these lands are forested with silviculture production. The introduction of new transmission lines would permanently change the visual landscape in some areas. The construction of the Project would require the irretrievable commitment of non-recycled building materials and fuel consumed by construction equipment.

7.3 Relationship between Short-term Uses of the Environment and the Maintenance and Enhancement of Long-term Productivity

NEPA legislation requires that an EIS describe "the relationship between local short- term uses of man's environment and the maintenance and enhancement of long-term productivity." Construction of the Project would have short-term impacts on environmental resources associated with construction of the transmission line, including installation of poles, conductors, any use of construction laydown areas, and use of the area as a transmission line ROW during the life span of the transmission line and its associated facilities. As indicated in the discussion under the individual resources, the small permanent footprint of the transmission line and the limited resource impacts indicate that operation of the facility would not likely affect regional natural resources to any significant degree. However, the land occupied by transmission towers would be an impact for the life of the transmission line, possibly exceeding 50 years. Additional land would be needed for transmission ROW and any needed access roadways.

Temporary impacts from construction activities are discussed in Chapter 5. The applicants would be required to restore the ROW, temporary work spaces, potential access roads, abandoned ROW, and other lands affected by construction of the Project. During the restoration process, the applicant would work with landowners, SCDNR, USFS, and local wildlife management programs to ensure that the ROW is restored.

Table 7-1: Estimated Long-term Impacts (acres) on Resources within the 75-foot ROW

Resource	Belle Isle – Option B	Belle Isle – Option C	Jamestown	Charity
ROW (acres)	148.0	142.2	234.8	281.8
Forest cover (acres)	117.6	114.6	162.8	82.7
Prime Farmland (acres)	0.6	0.2	13.9	27.9
Wetlands (Freshwater emergent [acres])	9.2	8.2	0	43.3
Wetlands (Forested/Shrub [acres])	34.1	46.8	24.3	44.2

Construction and operation of the Project would result in long-term impacts on vegetation, limited to the permanent conversion of vegetated lands to utility land uses (transmission structures, and any required access roads); conversion of forested or wooded vegetated cover to herbaceous cover; and disturbance related to maintenance activities (mowing, herbicide application, tree trimming, and dangerous tree removal). Long-term (permanent) impacts would also accrue to prime and important farmland soils where transmission line structures are placed within the proposed ROW. However, these losses would constitute a small fraction of total lands within the proposed Project ROW. These resources would not return to productive, pre- disturbance conditions until the transmission line and associated facilities are removed.

In the case of wetland conversion, impacts could be mitigated through reclamation, restoration, or permanently protecting other wetlands for an offset of wetland losses. For all other resource areas identified in the EIS, long-term impacts beyond the Project lifetime of 50 years are either not anticipated or expected to be avoided through mitigation measures.

7.4 Unavoidable Adverse Impacts

7.4.1 Water Resources

Although it is likely that there would be moderate-intensity, short-term impacts to surface waters and water quality, wetlands, and floodplains, these impacts would be minimized and mitigated. Long-term, permanent impacts to wetlands and floodplains are anticipated from the conversion of forested wetlands to scrub-shrub and/or emergent wetlands and from placing structures in wetlands and floodplains. The impacts from converting forested wetlands would be medium to high intensity, but it is anticipated that the impacts from the placement of poles in wetlands and floodplains would only be low intensity because of the minimal area occupied by each structure.

7.4.2 Biological Resources

Depending upon the corridor alternative chosen as the preferred alternative, between 82.7 acres (Charity corridor alternative) and 162.8 (Jamestown corridor alternative) acres of forest cover would be permanently converted to grassland. In addition, a small amount of vegetation would be permanently lost due to the placement of transmission line structures.

7.4.3 Soils and Geology

Potential unavoidable effects on geology and soil resources would include the permanent loss of prime farmland and/or farmland of statewide importance. The permanent loss of these lands would lead to a reduced yield if they are currently being used for agricultural or silvicultural practices. Although landowners would be compensated, a permanent loss in production would still occur.

7.4.4 Air Quality and Greenhouse Gas Emissions

Potential unavoidable impacts on air quality and GHGs stem from emissions associated with construction and construction activities. Although BMPs would be incorporated to reduce the amount of emissions emitted, emissions would still occur.

7.4.5 Cultural and Paleontological Resources

Potential unavoidable adverse effects on cultural and paleontological resources would include diminution of the setting of Peachtree Plantation and the Old Georgetown Road, diminution of the setting and integrity of the Georgetown County tidal rice fields, and loss of integrity to eligible NRHP sites along the preferred alternatives.

7.4.6 Recreation and Land Use

The conversion of forest cover to maintained (cleared) ROW would permanently change the land use along each alternative. Total amounts of forest cover that would be converted are shown above in Table 5-31. Similarly, the ROW would forever alter the land uses for other types of lands, and the amount of adverse effect would be a function of the corridor alternative that is selected.

7.4.7 Visual Resources

While impacts to visual resources can be minimized by locating the transmission line adjacent to existing infrastructure, away from scenic resources and residential areas, they cannot be completely avoided. Despite minimizing overall impacts to visual resources, the transmission line would be constructed and therefore visible to a portion of the population within the Study Area.

7.4.8 Socioeconomics

Potential unavoidable impacts on socioeconomic resources would include the loss of farm production or grazing lands due to structure placement. Any timber resources within the ROW would also be lost. Although landowners would be compensated for the easements, a loss in farming or timber production would still occur.

7.4.9 Environmental Justice

Potential unavoidable impacts on environmental justice communities would include visual impacts from line placement and traffic, noise, and air quality impacts during construction. Although many of these impacts would be short term, adverse and disproportionate impacts to potential environmental justice communities within the Study Area could occur during the short term, although impacts are expected to be low. In the long term, visual impacts to properties and impacts to property values are anticipated to be low, adverse, and highly variable. Therefore, there could be disproportionate adverse effects to environmental justice communities in proximity to the transmission line associated with visual resources, property values, traffic, noise, and air quality.

7.4.10 Transportation

Potential unavoidable impacts on transportation would include low-intensity, short-term disturbances such as detours affecting local roadways and traffic patterns. Once constructed, the new line would not result in new traffic or roadway congestion, closures or any adverse effects to transportation in the Study Area.

7.4.11 Health and Safety

No unavoidable adverse impacts to health and safety are expected to result from the proposed action.

7.4.12 Noise

No unavoidable adverse noise impacts are expected to result from the proposed action.

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8.0 REGULATORY AND PERMIT REQUIREMENTS

The regulatory framework and authorizing actions relevant to the proposed Project are introduced in Section 1.3 of this EIS. Table 1-2 provides a summary of the permits, regulations, consultations, and other actions that would be required for the Project for each agency involved. Table 8-1 describes potential Project requirements that should be considered including permits, approvals, and consultation, etc. required for the Project. Central Electric would obtain necessary permits from counties and/or municipalities along the corridor (such as permits for road, highway, and flood channel encroachment and crossings and temporary use and occupancy permits). Central Electric would also obtain any necessary pipeline and utility crossing permits for crossings of natural gas pipelines and electrical transmission lines.

Table 8-1: Potential Project Requirements

Requirement	Citation	Description
Potential Federal Requirements		
Archaeological Resources Protection Act	16 USC §470	The Act secures, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals having collections of archaeological resources and data which were obtained before October 31, 1979.
Bald and Golden Eagle Protection Act	16 USC §§668-668d	The Act prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” bald eagles, including their parts, nests, or eggs. A permitting program was established by USFWS Division of Migratory Bird Management. If activities require the removal or relocation of an eagle nest, a permit is required from the Regional Bird Permitting office.
Clean Air Act	42 USC §7401	The Act establishes NAAQS for certain pervasive pollutants. The Act establishes limitations on SO_2 and NOx emissions and sets permitting requirements. Authority for implementation of the permitting program is delegated to SCDHEC, Bureau of Air Quality.
CWA	32 USC §1251	The Act contains standards to address the causes of pollution and poor water quality, including municipal and industrial wastewater discharges, polluted runoff from urban and rural areas, and habitat destruction. USEPA has delegated authority to the SCDHEC, Bureau of Water.

Requirement	Citation	Description
		Section 401 – Water Quality Certification for Wetlands. Requires certification for any permit or license issued by a federal agency for any activity that may result in a discharge into waters of the state to ensure that the proposed Project will not violate state water standards. Permits are issued by the SCDHEC, Bureau of Water.
		Section 404 – Permits for Dredged or Fill Material. Regulates the discharge of dredged or fill material in the jurisdictional wetlands and waters of the United States. Permits are issued by USACE.
Determination of No Hazard to Air Navigation	14 CFR §77	Requires that the FAA issue a determination stating whether the proposed construction or alteration would be a hazard to air navigation and will advise all known interested persons.
ESA	16 USC §§1531 et seq.	Section 7 of the Act requires any federal agency authorizing, funding, or carrying out any action to ensure that the action is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species. If the Project is determined to be an activity that might incidentally harm (or “take”) endangered or threatened species, the applicants would be required to obtain an incidental take permit from USFWS or NMFS, which would be a part of the Biological Opinion issued by USFWS or NMFS.
Farmland Protection Policy Act	7 USC §§4201 et seq.	The Act requires federal agencies to identify and quantify adverse impacts of federal programs on farmlands to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to non-agricultural uses. The Act designates farmland as prime, unique, of statewide importance, and of local importance. The Act is overseen by USDA’s National Resources Conservation Service.
Federal Highway Administration Encroachment Permits		The Department of Transportation’s Federal Highway Administration requires encroachment permits for crossing federally funded highways.
Federal Insecticide, Fungicide and Rodenticide Act	7 USC §§136 et seq.	The Act registers and regulates pesticides.

Requirement	Citation	Description
Federal Land Policy Management Act	7 USC §§2801 et seq.	Requires that each federal land-managing agency have a program in place for controlling undesirable plant species and must implement cooperative agreements with the State. Requires that any environmental assessments or impact statements that may be required to implement plant control agreements must be completed within one year of the time the need for the document was established.
Federal Power Act	16 USC Chapter 12	Requires federal agencies to provide transmission service on non-discriminatory basis through compliance with established Tariffs.
Fish and Wildlife Conservation Act	16 USC §§2901 et seq.	The Act encourages federal agencies to conserve and promote conservation of non-game fish and wildlife species and their habitats. Mitigation methods should be designed to conserve wildlife and their habitats.
Fish and Wildlife Conservation Act	16 USC §§661 et seq.	The Act requires federal agencies to consult with USFWS and the state agency responsible for fish and wildlife resources if the Project affects water resources.
Magnuson-Stevens Fishery Conservation and Management Act	16 USC §1802	The act, as amended by the Sustainable Fisheries Act, requires the establishment of Essential Fish Habitat descriptions in federal fishery management plans and requires all federal agencies to consult with National Oceanic and Atmospheric Administration, Fisheries on activities that may adversely affect essential fish habitat.
MBTA	16 USC §§703 et seq.	The Act protects birds that have common migration patterns between the United States and Canada. Under the Act, taking, killing or possessing migratory birds or their eggs or nests is unlawful. The Act requires a Special Purpose Permit when an applicant demonstrates a legitimate purpose to violate the Act.
NEPA	42 USC §§4321-4347	The Act requires agencies of the federal government to study the possible environmental impacts of major federal actions significantly affecting the quality of the human environment.
National Forest Management Act	16 USC §§1600-1614	The Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the NFS. It is the primary statute governing the administration of national forests.

Requirement	Citation	Description
National Historic Preservation Act	16 USC §§470 et seq.	Section 106 of the Act requires federal agencies to take into account the effects of its undertakings on properties listed in or eligible for listing in the NRHP, including prehistoric or historic sites, and districts, buildings, structures, objects, or properties of traditional religious or cultural importance. The Act also requires federal agencies to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. The South Carolina State Historical Preservation Office must also provide consultation.
National Invasive Species Act	P.L. 104-332	The Act aims to prevent the introduction and spread of non-native invasive species. The primary focus of the Act is on ballast water management.
National Trails System Act	16 USC §§1241 et seq.	The Act requires federal agencies to conduct consultations in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the nation.
National Wild and Scenic Rivers Act	16 USC §§1271-1287	The Act requires that "In all planning for the use and development of water and related land resources, consideration shall be given by all federal agencies involved to potential national wild, scenic and recreational river areas." It further requires that "the Secretary of the Interior shall make specific studies and investigations to determine which additional wild, scenic and recreational river areas shall be evaluated in planning reports by all federal agencies as potential alternative uses of water and related land resources involved."
Noise Control Act	42 USC §§4901-4918	The Act directs federal agencies to carry out programs in their jurisdictions “to the fullest extent within their authority” and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare.
Occupational Safety and Health Act	29 USC §§651 et seq.	The Act established regulations for the protection of worker health and safety. The applicants would be subject to Occupational Health and Safety Administration general industry standards and construction standards.
Pollution Prevention Act	42 USC §§13101 et seq.	The Act establishes a national policy for waste management and pollution control.
Resource Conservation & Recovery Act	42 USC §§6901 et seq.	The Act regulates the treatment, storage, and disposal of hazardous wastes. The applicants would be required to manage hazardous wastes generated during construction or operation of the Project in accordance with the Act.

Requirement	Citation	Description
RUS Environmental Policies and Procedures	7 CFR §1970	RUS must make decisions that are based on an understanding of environmental consequences, and take actions that protect, restore, and enhance the environment. In assessing the potential environmental impacts of its actions, RUS will consult early with appropriate federal, state, and local agencies and other organizations to provide decision-makers with information on the issues that are significant to the action in question. Applicants are responsible for ensuring that proposed actions are in compliance with all appropriate RUS requirements. Environmental documents submitted by the applicant shall be prepared under the oversight and guidance of RUS. RUS will evaluate and be responsible for the accuracy of all information contained therein.
Potential Executive Orders (E.O.)		
E.O. 11593, Enhancement, Protection, & Management of the Cultural Environment		The executive order gives the federal government the responsibility for stewardship of our nation's heritage resources and charges federal agencies with the task of inventorying historic and prehistoric sites on their lands.
E.O. 11988, Floodplain Management		The executive order directs federal agencies to establish procedures to ensure that they consider potential effects of flood hazards and floodplain management for any action undertaken. Agencies are to avoid impacts to floodplains to the extent practical.
E.O. 11990, Protection of Wetlands		The executive order directs federal agencies to avoid short- and long-term impacts to wetlands if a practical alternative exists.
E.O. 12898, Environmental Justice		The executive order directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.
E.O. 13007, Indian Sacred Sites		The executive order directs federal agencies, to the extent permitted by law and consistent with agency missions, to avoid adverse effects to sacred sites and to provide access to those sites to Native Americans for religious practices.
E.O. 13112, Invasive Species		The executive order directs federal agencies to prevent the introduction or to monitor and control invasive non- native species and provide for restoration of native species.

Requirement	Citation	Description
E.O. 13175, Consultation and Coordination with Indian Tribal Governments		The executive order directs federal agencies to establish meaningful consultation and collaboration with tribal governments to strengthen United States government- to-government relationships with Indian tribes.
E.O. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds		The executive order directs federal agencies to avoid or minimize the negative impacts of their actions on migratory birds, and to take active steps to protect birds and their habitats.
Potential State Requirements		
NPDES Permit		The applicant must obtain a NPDES permit from SCDHEC impacts greater than 1 acre in size.
State Road Crossing Permits		The applicant must obtain permits from SCDOT
State Highway Crossing Permits		The applicant must obtain permits from SCDOT
State Utility Occupancy Permits		The applicant must obtain permits from SCDOT
Permits to Cross State WMAs		The applicant must obtain permits from SCDNR
Consultation/ Approval regarding State-listed Species of Concern		The applicant must obtain permits from SCDNR
Consultation regarding non-native invasive plants		The applicant must obtain permits from SCDNR
Construction Permits		The applicant must obtain construction permits for crossing navigable waterways from the SCDHEC Water Bureau.

9.0 CONSULTATION, COORDINATION, AND DISTRIBUTION

Organizations and Persons Consulted

Consultation with tribes and federal and state agencies has been ongoing. Various federal and state interagency meetings were conducted to share Project information and determine the scope of the EIS and throughout the development of the SEIS.

Cooperating Agencies

RUS (lead agency) was assisted by USFS and USACE as cooperating agencies and by Central Electric and Berkeley Electric as Project proponents in preparing this SEIS.

Federal Agencies Contacted

- USFS, FMNF
- USACE, Charleston Regulatory District
- FWS
- NFMS
- NPS

South Carolina Agencies Contacted

- SCDNR
- SC State Historic Preservation Office
- South Carolina Forestry Commission

Tribes Contacted

- Catawba Indian Nation
- Eastern Shawnee Tribe

9.1 Preparers and Contributors

Name	Agency/Firm	Title	Education	Years of Experience	Responsibility
Lauren McGee Rayburn	RUS	Environmental Scientist	B.S., Earth and Environ. Science M.S. Environ. Science	6	Project Manager

Name	Agency/Firm	Title	Education	Years of Experience	Responsibility
Jot Splenda	Louis Berger Group	Principal Planner	B.S. Ecology and Evolution, M.E.S.M, Water Resources	19	Project Manager
Joshua Schnabel	Louis Berger Group	Environmental Planner	B.A. Sociology; M.A. Environmental Planning	12	Health and Safety; Visual Resources Soils; Health and Safety; Noise; Air Quality
Phillip Baigas	Louis Berger Group	Biologist	B.S. Geography/GIS M.S. Rangeland Ecology and Wildlife Management	12	Biological Resources
Kara Grosse	Louis Berger Group	Planner	B.A. Environmental Studies M.E.M. Water Resource Management	3	Land Use and Recreation
Jeff Gutierrez	Louis Berger Group	Planner	B.A. Environmental Studies M.U.R.P Environmental Land Use Planning	11	Transportation
Tiffany Raszick	Louis Berger Group	Archaeologist	MPhil, Archaeology MA, Archaeology BA, Anthropology	…	Cultural Resources

Name	Agency/Firm	Title	Education	Years of Experience	Responsibility
Chris Dixon	Louis Berger Group	Environmental Planner	M.U.R.P. Urban and Regional Planning; M.B.A. Business Administration; B.S. Environmental Economics and Management	2	Socioeconomics; Environmental Justice
Nick Funk	Louis Berger Group	Hydrologist	M.S. Water Resources Management and Hydrologic Science B.S. Environmental Policy and Planning	5	Water Resources
Linda Green	Louis Berger Group	GIS Specialist	B.A. Environmental Studies	7	GIS and Mapping

9.2 Distribution

a. Federal Agencies

U.S. Forest Service

U.S. Army Corps of Engineers

b. Tribal Governments and Agencies

Catawba Indian Nation

Eastern Shawnee Tribe

c. South Carolina State Agencies

South Carolina Department of Natural Resources

South Carolina State Historic Preservation Office

d. Local Units of Government

e. Local Libraries

10.0 REFERENCES

Adams, N.P. and S. Young. 2010. A Cultural Resources Survey of the Phase II Pulpwood Harvest in Wando-I'on Analysis Area, Francis Marion National Forest. Report on file at the South Carolina Institute of Archaeology and Anthropology, Columbia, SC.

Agha, A., C.F. Phillips, Jr., and J. Fletcher. 2011. Inland Swamp Rice Context, c. 1690–1783 (Berkeley, Charleston, Dorchester Counties). National Register of Historic Places Multiple Property Documentation Form. Available at: http://nationalregister.sc.gov/SurveyReports/HC08003.pdf. Accessed October 22, 2013.

American Conference of Governmental Industrial Hygienists. 2011. TLVs® and BEIs® Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. Cincinnati, OH.

Anderson, D.G. 1989. The Mississippian in South Carolina. In: Studies in South Carolina Archaeology. A.C. Goodyear III and G.T. Hanson (eds.), pp. 101-132. South Carolina Institute of Archaeology and Anthropology Anthropological Studies 9. Columbia, SC.

Anderson, D.G., C.E. Cantley, and A. L. Novick. 1982. The Mattassee Lake Sites: Archaeological Investigations along the Lower Santee River in the Coastal Plain of South Carolina. U.S. Department of the Interior, National Park Service, Southeast Regional Office, Atlanta, GA.

Anderson, D.G. and P.A. Logan. 1981. Francis Marion National Forest Cultural Resources Overview. U.S. Department of Agriculture, Forest Service, Columbia, SC.

Anderson, D.G., and J. Schuldenrein (editors). 1985. Prehistoric Human Ecology along the Upper Savannah River: Excavations at the Rucker's Bottom, Abbeville, and Bullard Site Groups. Prepared for the National Park Service, Archaeological Services Branch, by Commonwealth Associates, Inc., Jackson, MI.

APLIC (Avian Power Line Interaction Committee). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C. Available at: http://www.aplic.org/uploads/files/11218/Reducing_Avian_Collisions_2012watermarkLR.pdf. Accessed September 3, 2018.

APLIC. 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

APLIC and USFWS (U.S. Fish and Wildlife Service). 2005. Avian Protection Plan (APP) Guidelines. Available at: https://www.aplic.org/uploads/files/2634/APPguidelines_final-draft_Aprl2005.pdf. Accessed September 3, 2018.

ARCI (Avian Research and Conservation Institute). 2018a. "Final Report [for the Jamestown Route]." Prepared by Ken Meyer, Ph.D, Executive Director. Submitted to Ralph Costa. January 11, 2018. 4 pp.

ARCI. 2018b. "Final Report [for the Charity Route]." Prepared by Ken Meyer, Ph.D, Executive Director. Submitted to Ralph Costa. August 21, 2018. 9 pp.

Audubon (National Audubon Society). 2013a. "Washo Reserve Site Profile." In: Important Bird Areas in the U.S. (online). Available at: https://www.audubon.org/important-bird-areas/washo-reserve. Accessed August 9, 2018.

Audubon. 2013b."Francis Marion National Forest." In: Important Bird Areas in the U.S. (online). Available at: https://netapp.audubon.org/iba/Reports/921. Accessed August 9, 2018.

Audubon. 2013c. "Important Bird Areas, South Carolina." Audubon South Carolina." Available at: https://www.audubon.org/important-bird-areas/state/south-carolina. Accessed August 9, 2018.

Audubon. 2013d. "Santee Coastal Reserve." In: Important Bird Areas in the U.S. (online). Available at: http://netapp.audubon.org/iba/site/1120. Accessed August 9, 2018.

Barnes, J.A. and C. Steen. 2012. Archaeology of the Gullah Past: A Community Scale Analysis. South Carolina Antiquities 44:85–95.

Bat Conservation International and Southeastern Bat Diversity Network. 2013. A Conservation Strategy for Rafinesque's Big-Eared Bat (Corynorhinus rafinesquii) and Southeastern Myotis (Myotis austroriparius). Prepared by M.L. Lacki and M.L. Bayless. Bat Conservation International, Austin, TX. Available at: http://www.batcon.org/pdfs/ConservationPlanforCORAandMYAU_2014.pdf.

BEA (U.S. Department of Commerce. Bureau of Economic Analysis). 2018. Table CA25N. Years 2010-2016. Total Full-Time and Part-Time Employment by NAICS Industry. Geographies: State of South Carolina; Counties of Charleston and Georgetown, SC.

BEA. 2017. Table CA1. Personal Income Summary.

Berkley County. 2016. Berkeley County and Municipal Zoning Classifications. Berkeley County GIS Department. Available at: http://gis.berkeleycountysc.gov. Accessed August 21, 2018.

Berkeley County Planning Commission, Comprehensive Plan. *Planning the Future while Preserving the Past.* 2010. Available at: https://www.berkeleycountysc.gov/drupal/dept/planning/plan

BirdLife International. 2018. "Important Bird and Biodiversity Areas (IBAs)." Available at: https://www.birdlife.org/worldwide/programme-additional-info/important-bird-and-biodiversity-areas-ibas. Accessed December 18, 2017.

Blanton, D.B., C.T. Espenshade, and P.E. Brockington, Jr. 1986. An Archaeological Study of 38SU83: A Yadkin Phase Site in the Upper Coastal Plain of South Carolina. Prepared for the South Carolina Department of Transportation, Columbia, SC.

Blanton, D.B. and K.E. Sassaman. 1989. Pattern and Process in the Middle Archaic Period in South Carolina. In: Studies in South Carolina Archaeology. A.C. Goodyear III and G.T. Hanson (eds.). pp. 53-72. South Carolina Institute of Archaeology and Anthropology Anthropological Studies 9. Columbia.

Bloomer, K.A. 1993. Agricultural Tenancy in 1930s America. Hanover Historical Review (Hanover College) 1(spring):n.p. Available at: http://history.hanover.edu/hhr/hhr93_4.html.

Buehler, D.A. 2000. "Bald Eagle (*Haliaeetus leucocephalus*)." The Birds of North America Online. A. Poole (ed.). Ithaca: Cornell Lab of Ornithology. Available at: https://birdsna.org/Species-Account/bna/species/baleag. Accessed August 7, 2018.

Buhlmann, K.A. 2019. Final Report 2019, Charity/Belle Isle Project Central Electric ROW Herpetology Habitat Survey. Buhlmann Ecological Research Consulting, LLC. June 28, 2019. 39 pp.

Buhlmann, K.A. and A. Grosse. 2018. “Final Report: Central Electric Herpetology Survey McClellanville to Jamestown, SC.” May 14, 2018. 26 pp.

Caldwell, J.R. 1958. Trend and Tradition in the Prehistory of the Eastern United States. Memoirs of the American Anthropological Association 88.

Caldwell, J.T. and C. McCann. 1941. The Irene Mound Site (with a section on physical anthropology by Frederick S. Hulse). On file, Department of Anthropology, University of Georgia, Athens.

Caldwell, J.T. and A.J. Waring. 1939. Pottery Type Descriptions. Newsletter of the Southeastern Archaeological Conference 1(6).

Cape Romain Bird Observatory. 2011. Personal Communication.

Census (U.S. Census Bureau). 2010. 2010 Place List. Available at: http://www.census.gov/geo/maps-data/data/docs/gazetteer/2010_place_list_45.txt. Accessed October 29, 2013.

Central Electric (Central Electric Power Cooperative, Inc.). 2014. “McClellanville 115 kV Transmission Project Draft Environmental Impact Statement.” Prepared for the U.S. Department of Agriculture, Rural Utilities Service, in Cooperation with the U.S. Army Corps of Engineers and U.S. Forest Service. April 2014.

CEQ (Council on Environmental Quality). 1997. Environmental Justice: Guidance under the National Environmental Policy Act. Executive Office of the President, Washington, D.C.

CEQ. 1987. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. 40 CFR Parts 1500 - 1508.

Chapman, J. 1975. Rose Island and the Bifurcate Tradition. Report of Investigations 14. Department of Anthropology, University of Tennessee, Knoxville.

Charleston County. 2018. Charleston County Official Zoning Map. Charleston County. Available at: https://ccgisapps.charlestoncounty.org/public_search/. Accessed August 21, 2018.

Charleston County Planning Commission. 2008. Charleston County Comprehensive Plan Update. Available at: http://www.charlestoncounty.org/departments/Planning/Comp_Plan.htm. Accessed October 31, 2013.

Chernicoff, S. and D. Whitney. 2002. Geology. Third Edition. Houghton Mifflin Company, Boston, MA.

Coe, J.L. 1964. Formative Cultures of the Carolina Piedmont. Transactions of the American Philosophical Society 54(5).

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States.

CRDA (Charleston Regional Development Alliance). 2018. County and City Profiles, Leading Employers. Available at: http://www.crda.org/business/market_profile/leading_employers.html. Accessed June 26, 2018.

DeGregorio, B.A., P.J. Weatherhead, and J. Sperry. 2014. "Power lines, roads, and avian nest survival: effects on predator identity and predation intensity." Ecology and Evolution 4(9): 1589–1600.

DePratter, C.B. 1989. Cofitachequi: Ethnohistorical and Archaeological Evidence. In: Studies in South Carolina Archaeology: Essays in Honor of Dr. Robert L. Stephenson. A.C. Goodyear III and G.T. Hanson (eds.). South Carolina Institute of Archaeology and Anthropology Anthropological Studies. Columbia, SC. 133–156 pp.

Dodd, D.B. and W.S. Dodd. 1973. Historical Statistics of the South, 1790–1970. University of Alabama Press, Tuscaloosa.

Ecological Engineering, LLP. 2018a. "Protected Bat Species Survey Report for Northern Long-eared Bat (*Myotis septentrionalis*), Central Electric Transmission Line Berkeley and Charleston Counties, South Carolina." Prepared by D. Brown, Ecological Engineering, LLP. Cary, NC. October 2018. 440 pp.

Ecological Engineering, LLP. 2018b. "Lepidopteran Species of Concern Host Plant Assessment for Monarch Butterfly (*Danaus plexippus*), Okefenokee Zale Moth (*Zale perculta*), Berry's Skipper (*Euphyes berryi*), and the Dusky Roadside-Skipper (*Amblyscirtes alternata*), Central Electric Transmission Line Berkeley and Charleston Counties, South Carolina." Prepared by D. Brown and D.G. Cooper, Ecological Solutions, Inc., Cary, NC. October 2018. 76 pp.

Ecological Solutions, Inc. 2017a. "Protected Bat Species Survey Report for Northern Long-eared Bat (*Myotis septentrionalis*), Central Electric Transmission Line Berkeley and Charleston Counties, South Carolina." Prepared by D. Brown and D. Smith, Ecological Solutions, Inc. Roswell, GA. September 2017. 117 pp.

Ecological Solutions, Inc. 2017b. "Lepidopteran Species of Concern Host Plant Assessment for Monarch Butterfly (*Danaus plexippus*), Okefenokee Zale Moth (*Zale perculta*), Berry's Skipper (*Euphyes berryi*), and the Dusky Roadside-Skipper (*Amblyscirtes alternata*), Central Electric Transmission Line Berkeley and Charleston Counties, South Carolina." Prepared by D. Brown and M. Nugent, Ecological Solutions, Inc., Roswell, GA. October 2017. 89 pp.

EDDMapS. 2018. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available at: http://www.eddmaps.org/. Accessed August 2, 2018.

Edgar, W. 1998. South Carolina: A History. University of South Carolina Press, Columbia, SC.

Federal Communications Commission. 2004. Nationwide Programmatic Agreement for Review of effects on Historic Properties for Certain Undertakings Approved by the Federal Communications Commission. FCC 04-222.

Flick, S. 1992. Charleston County Historical and Architectural Survey: Survey Report. Copy on file at the South Carolina Department of Archives and History, Columbia, SC.

Folk, M. 2017. "Preliminary Wetland Survey Results: Central Electric Transmission Line Project Shulerville & Alternatives Route Berkley & Charleston Counties, South Carolina." Prepared for Central Electric Power Cooperative, Inc., Columbia, SC.

Fyfe, R.W. and R.R. Olendorff. 1976. Minimizing the Dangers of Nesting Studies to Raptors and Other Sensitive Species. Canadian Wildlife Service, Information Canada. Catalogue No. CW69-1/23. Ottawa, Canada.

Gaddy, L.L. 2018. "Preliminary Inventory of Endangered, Threatened, and Otherwise Noteworthy Vascular Plants, Significant Natural Plant Communities, and Wetlands of the Proposed Charity/U.S. Forest Service Survey Corridor, Charleston and Berkeley County, South Carolina." Unpublished report for Central Electric Power Cooperative. Columbia, SC. June 2018.

Gaddy, L.L. 2017. "Preliminary Inventory of Endangered, Threatened, and Otherwise Noteworthy Vascular Plants, Significant Natural Plant Communities, and Wetlands of the Proposed Shulerville Electric Transmission Corridor, Charleston and Berkeley County, South Carolina." Unpublished report for Central Electric Power Cooperative. Columbia, SC. October 2017.

Gardner, J.W. and M. Roberts. 1993. Archaeological Evaluation of 38DN68, 38DN71, and 38ML67, Dillon and Marlboro Counties, South Carolina. Prepared for the South Carolina Department of Transportation, Columbia, by Brockington and Associates, Charleston, SC.

Georgetown County. 2018. Zoning. GIS Map Server. Georgetown County. Available at: http://gis1.georgetowncountysc.org/freeance/Client/PublicAccess1/index.html?appconfig=WebMapServer. Accessed August 21, 2018.

Georgetown County Department of Planning & Code Enhancement. 2007. Comprehensive Plan. Available at: http://www.georgetowncountysc.org/planning/. Accessed October 30, 2013.

Goodyear, A.C. 1982. The Chronological Position of the Dalton Horizon in the Southeastern United States. American Antiquity 47:382–395.

Goodyear, A.C. 1974. The Brand Site: A Techno-functional Study of a Dalton Site in Northeast Arkansas. Arkansas Archaeological Survey, Research Series No. 7. Arkansas Archaeological Survey, Little Rock, AR.

Goodyear, A.C., J.H. House, and N.W. Ackerly. 1979. Laurens-Anderson, An Archaeological Study of the Interriverine Piedmont. Anthropological Studies 4. Occasional Papers of the Institute of Archaeology and Anthropology, University of South Carolina, Columbia, SC.

Gullah Geechee Cultural Heritage Corridor Commission. 2012. Gullah Geechee Cultural Heritage Corridor Management Plan. Prepared and published by the National Park Service, Denver Service Center, Denver, CO.

Homer, C.G., J.A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulston, N.D. Herold, J.D. Wickham, and K. Megown. 2015. Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing 81(5):345-354.

Hughes, W.B., T.A. Abrahamsen, T.L. Maluk, E.J. Reuber, and L.J. Wilhelm. 2000. Water Quality in the Santee River Basin and Coastal Drainages, North and South Carolina, 1995–98: U.S. Geological Survey Circular 1206. 32 pp. Available at: http://pubs.water.usgs.gov/circ1206/.

Ingram, T. 2013. Personal Communication with Taylor Ingram, Specialist in Utilities Property Tax Assessment, State of South Caroline Department of Revenue. October 29, 2013.

IPCC (Intergovernmental Panel on Climate Change). 2007. Climate Change 2007: The Physical Science Basis, Summary for Policymakers. Approved at the 10th Session of Working Group I of the IPCC, Paris. February 2007. IPCC Secretariat, Geneva, Switzerland.

Jackson, T. 2010. Electric Transmission Lines: Is there an Impact on Rural Land Values? Right of Way, (November/December). Available at: http://www.realanalytics.com/Transmission%20Lines%20and%20Rural%20Land.pdf. Accessed May 11, 2012.

Jackson, T.O. and J. Pitts. 2010. The Effects of Electric Transmission Lines on Property Values: A Literature Review. Journal of Real Estate Literature 18(2), 239–259: 258.

James, L. and C. Philips. 2017. An Intensive Archaeological Survey of the Proposed Central Electric Transmission Line, Charleston and Berkeley Counties, South Carolina. Francis Marion and Sumter National Forests Cultural Resource Management Report #2017–13.

Ellerbee, J. and J. Fowler. 2005. *Cultural Resources Survey of Improvements to the Georgetown County Airport Tract, Georgetown County, South Carolina*. Brockington & Associates.

Joseph, J.W., S. Ciomek, B. Botwick, K. Serio, M.B. Reed, and N. Adams. 2006. Historic Resources Survey of Georgetown County, South Carolina. Copy on file at the South Carolina Institute of Archaeology and Anthropology, Columbia, SC.

Keel, B.C. 1976. Cherokee Archaeology. University of Tennessee Press, Knoxville, TN.

King, D.I. and B.E. Byers. 2002. “An Evaluation of Powerline Rights-of-way as Habitat for Early-successional Shrubland Birds.” Wildlife Society Bulletin 30(30):868-874.

Kovacik, C.F. and J.J. Winberry. 1987. South Carolina: A Geography. Westview Press, Boulder, CO.

Lakshmanadoss, U., P. Chinnachamy, and J.P. Daubert. 2004. Electromagnetic Interference of Pacemakers. Available at: http://cdn.intechopen.com/pdfs/13783/InTech-Electromagnetic_interference_of_the_pacemakers.pdf. Accessed November 13, 2013.

Littlefield, D.C. 1995. Rice and the Making of South Carolina. South Carolina Department of Archives and History, Columbia, SC.

Lund, M., D. Soriano, L.S. Pile, S.D. Thomas, and G.G. Wang. 2015. Invasive Plant Species of South Carolina. Clemson Cooperative Extension. Clemson, SC. 76 pp.

Madsen, J. 1985. Impact of Disturbance on Field Utilization of Pink-footed Geese in West Jutland, Denmark. Biological Conservation 33:53–64.

Maluk, T.L. and R.E. Kelley. 1998. Pesticides in Surface Waters of the Santee River Basin and Coastal Drainages, North and South Carolina. USGS Fact Sheet FS007-98. South Carolina Water Science Center Publications: FS007-98. Available at: http://sc.water.usgs.gov/publications/abstracts/fs007-98.html. Accessed October 29, 2013.

Marsh, W.M. 2005. Landscape Planning Environmental Applications, 4th Edition. John Wiley & Sons.

McGavran (McGavran Engineering, P.C.). 2017. McClellanville 115 kV Transmission Line. Independent Engineering Study for Central Electric Power Cooperative, Inc., Columbia, SC. February 2017.

McPherson, J. 1988. Battle Cry of Freedom, The Civil War Era. Ballantine Books, New York, NY.

McReynolds, T. 2008. Geology. In. Woodland Pottery Sourcing in the Carolina Sandhills. J. Herbert, and T. McReynolds (eds.). Research Report 29 Research Laboratories of North Carolina. University of North Carolina, Chapel Hill, NC.

Milling, C.J. 1940. Red Carolinians. University of North Carolina Press, Chapel Hill.

Murphy, T.M. and D.B. Griffin. Undated. Florida manatee. South Carolina Department of Natural Resources Fact Sheet. Charleston, SC. 5 pp. Available at: http://www.dnr.sc.gov/swap/supplemental/mammals/floridamanatee2015.pdf. Accessed August 12, 2019.

National Research Council. 1999. Research on Power-Frequency Fields Completed under the Energy Policy Act of 1992, by Committee on the Possible Effects of Electromagnetic Fields on Biologic Systems, Board on Radiation Effects Research, Commission on Life Sciences, and National Research Council. National Academy Press, Washington, D.C.

National Research Council. 1997. Possible Health Effects of Exposure to Residential Electric and Magnetic Fields. Committee on the Possible Effects of Electromagnetic Fields on Biologic Systems. Board on Radiation Effects

Research. Commission on Life Sciences. National Academy Press, Washington, D.C.

NatureServe. 2018a. "NatureServe Explorer: An Online Encyclopedia of Life [Online]. Ecological Association Comprehensive Report for Pinus palustris / Quercus laevis - Quercus geminata / Aristida stricta Woodland." NatureServe, Arlington, VA. Available at: http://explorer.natureserve.org/servlet/NatureServe?searchCommunityUid=ELEMENT_GLOBAL.2.688575. Accessed July 11, 2019.

NatureServe. 2018b. "NatureServe Explorer: An Online Encyclopedia of Life [Online]. Species report for *Myotis septentrionalis*—Northern Long-eared Bat." NatureServe, Arlington, VA. Available at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Myotis+septentrionalis+. Accessed September 6, 2018.

NatureServe. 2018c. "NatureServe Explorer: An Online Encyclopedia of Life [Online]. Species report for *Elanoides forficatus*—Swallow-tailed Kite." NatureServe, Arlington, Virginia. Available at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Elanoides+forficatus. Accessed June 18, 2018.

NatureServe. 2018d. "NatureServe Explorer: An Online Encyclopedia of Life [Online]. Species report for *Clemmys guttata*—Spotted Turtle." NatureServe, Arlington, Virginia. Available at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Clemmys+guttata. Accessed June 18, 2018.

NatureServe. 2018e. "NatureServe Explorer: An Online Encyclopedia of Life [Online]. Species report for *Amblyscirtes alternata*—Dusky Roadside-Skipper." NatureServe, Arlington, Virginia. Available at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Amblyscirtes+alternata. Accessed September 6, 2018.

NatureServe. 2018f. "Global Conservation Status Definitions." NatureServe Explorer Website. Available at: http://explorer.natureserve.org/granks.htm. Accessed August 6, 2018.

NatureServe. 2018g. "National and Subnational Conservation Status Definitions." NatureServe Explorer Website. Available at: http://explorer.natureserve.org/nsranks.htm. Accessed August 6, 2018.

NatureServe. 2012. “Field Key to Ecological Systems of Francis Marion National Forest, Atlantic Coastal Plain, South Carolina, United States.” NatureServe Terrestrial Ecology Department.

Netstate. 2016. The Geography of South Carolina. Available at: http://www.netstate.com/states/geography/sc_geography.htm. Accessed June 26, 2018.

NIEHS (National Institute of Environmental Health Sciences, National Institutes of Health). 2002. Electric and Magnetic Fields Associated with the Use of Electric Power. Questions. Answers. Available at: http://www.niehs.nih.gov/health/assets/docs_p_z/results_of_emf_research_emf_questions_answers_booklet.pdf. Accessed October 16, 2012.

NIEHS. 1999. Research on Power-Frequency Fields Completed under the Energy Policy Act of 1992, by Committee on the Possible Effects of Electromagnetic Fields on Biologic Systems, Board on Radiation Effects Research, Commission on Life Sciences, and National Research Council. National Academy Press, Washington, D.C.

NPS (National Park Service). 2005. Low Country Gullah Culture: Special Resource Study and Final Environmental Impact Statement. National Park Service, Southeast Regional Office, Planning and Compliance Division, Atlanta. Copy on file at the South Carolina State Historic Preservation Office, Columbia, SC.

NPS. 1997. National Register Bulletin: How to Apply the Criteria for Eligibility. Available at: http://www.nps.gov/nr/publications/bulletins/pdfs/nrb15.pdf. Accessed November 13, 2013.

Parker, P.L. and T.F. King. 1998. Guidelines for Evaluating and Documenting Traditional Cultural Properties. National Register Bulletin 38. U.S. Department of the Interior, National Park Service, Washington, D.C.

Pitts, J.M. and T.O. Jackson. 2007. Power Lines and Property Values Revisited. The Appraisal Journal. Fall 2007. 3 pp.

Pollitzer, W. 2005. The Gullah People and Their African Heritage. The University of Georgia Press, Athens and London, GA.

Poplin, E.C., C.T. Espenshade, and D.C. Jones. 1993. Archaeological Investigations at the Buck Hall Site (38CH644), Francis Marion National Forest, South Carolina. Prepared by Brockington and Associates, Inc. Prepared for the U.S. Department of Agriculture, Forest Service. Columbia, SC.

Reich, E.E. 1978. PSD Applicability—Temporary Emissions. Memo from Edward E. Reich, Director Division of Stationary Source Enforcement, U.S. Environmental Protection Agency, to Anita B. Turpin, Chief Technical Support Section (6AAHAT) Region VI, dated December 11, 1978.

RUS (U.S. Department of Agriculture, Rural Utilities Service). 2011a. Scoping Report. February 2011 (1-18).

RUS. 2011b. Scoping Report Addendum. October 2011.

RUS. 2010a. Alternatives Evaluation Study for the McClellanville 115 kV Transmission Line Project. September 2010.

Sassaman, K.E. 1993. Mims Point 1992, Archaeological Investigations at a Prehistoric Habitation Site in the Sumter National Forest, South Carolina. Francis Marion and Sumter National Forests Cultural Resource Management Report 93-16 and Savannah River Archaeological Research Papers 4, Occasional Papers of the Savannah River Archaeological Research Program, South Carolina. South Carolina Institute of Archaeology and Anthropology, Columbia, SC.

Sassaman, K.E. 1988. The Mid-Holocene Archaeological Record of the Middle Savannah River Valley. Ms. in the possession of the author.

Sassaman, K.E., M.J. Brooks, G.T. Hanson, and D.G. Anderson. 1990. Native American Prehistory of the Middle Savannah River Valley, A Synthesis of Archaeological Investigations on the Savannah River Site, Aiken and Barnwell Counties, South Carolina. Savannah River Archaeological Research Papers 1, Occasional Papers of the Savannah River Archaeological Research Program. South Carolina Institute of Archaeology and Anthropology, Columbia, SC.

Sauer, J.R., D.K. Niven, J.E. Hines, D.J. Ziolkowski, Jr., K.L. Pardieck, J.E. Fallon, and W.A. Link. 2017. The North American Breeding Bird Survey, Results and Analysis 1966–2015. Version 2.07.2017 USGS Patuxent Wildlife Research Center, Laurel, MD. Available at: https://www.mbr-pwrc.usgs.gov/bbs/bbs.html.

Sherfy, M. and W.R. Luce. 1998. National Register Bulletin Number 22: Guidelines for Evaluating and Nominating Properties that Have Achieved Significance within the Past Fifty Years. U.S. Department of the Interior, National Park Service, Washington, D.C.

South, S.A. 2002. Archaeological Pathways to Historic Site Development. Kluwer Academic/Plenum Publishers, New York, NY.

South Carolina Association of Counties. 2018. County Profiles. Available at: http://www.sccounties.org/county-profiles. Accessed June 25, 2018.

SCDHEC (South Carolina Department of Health and Environmental Control). 2018a. Air Pollution Control Regulations and Standards. Updated September 23, 2016. Available at: http://www.scdhec.gov/Agency/docs/air-regs/61-62.5%20Standard%202.pdf. Accessed June 18, 2018.

SCDHEC. 2018b. Ambient Air Quality Monitoring Data Summaries. Available at: http://www.scdhec.gov/HomeAndEnvironment/Air/AmbientAir/. Accessed June 19, 2018.

SCDHEC. 2016. State of South Carolina Integrated Report for 2012 Part I: Section 303(d) List of Impaired Waters. Available at: http://www.scdhec.gov/HomeAndEnvironment/Docs/tmdl_16-303d.pdf.

SCDHEC. 2013a. Watershed Water Quality Assessment Santee River Basin. South Carolina Department of Health and Environmental Control, Bureau of Water. Technical Report No. 0620-13. Columbia, SC. Available at: http://www.scdhec.gov/HomeandEnvironment/docs/San_Whole.pdf.

SCDHEC. 2013b. Watershed Water Quality Evaluation: Watershed 03050112-050. Bureau of Water, Columbia, SC. Available at: https://www.scdhec.gov/HomeAndEnvironment/Docs/50112-050.pdf.

SCDHEC. 2013c. Watershed Water Quality Evaluation: Watershed 03050112-060. Bureau of Water, Columbia, SC. Available at: https://www.scdhec.gov/HomeAndEnvironment/Docs/50112-060.pdf.

SCDHEC. 2013d. Watershed Water Quality Evaluation: Watershed 03050201-040. Bureau of Water, Columbia, SC. Available at: https://www.scdhec.gov/HomeAndEnvironment/Docs/50201-040.pdf.

SCDHEC. 2007. Regional Haze—State Implementation Plan for South Carolina Class I Federal Areas.

SCDNR (South Carolina Department of Natural Resources). 2018a. Rare, Threatened, and Endangered Species of South Carolina—by County. Available at: http://www.dnr.sc.gov/species/county.html. Accessed June 18, 2018.

SCDNR. 2018b. "South Carolina's Bald Eagles—Nest Locations." Google Earth (KML) data (Online). South Carolina Department of Natural Resources. Columbia, SC. Available at: http://www.dnr.sc.gov/wildlife/baldeagle/locations.html.

SCDNR. 2018c. "A Report on Black Bear Harvest and Hunting in South Carolina." June 2018. Report of the Department of Natural Resources. On Act 71 122nd Session of the South Carolina General Assembly (2017). Available at: http://www.dnr.sc.gov/wildlife/bear/2018SCDNRBearReporttoGeneralAssembly.pdf. Accessed September 6, 2018.

SCDNR. 2018d. Hunting – Game Species. Available at: http://www.dnr.sc.gov/hunting/game.html. Accessed June 18, 2018).

SCDNR. 2018e. Personal communication between Christy Hand, Wildlife Biologist SCDNR, and Phillip Baigas, Wildlife Biologist Louis Berger. Regarding SC Rare, Threatened & Endangered Species Data. August 3, 2018.

SCDNR. 2018f. South Carolina General Geology Available at: http://www.dnr.sc.gov/GIS/descggmsl.html. Accessed June 26, 2018.

SCDNR. 2016. "Conservation of Water, Shore and Seabirds in South Carolina. Final Performance Report, South Carolina State Wildlife Grant Project T-41-R." Prepared by F. Sanders, C. Hand, J. Thibault, and M.C. Martin. Available at: http://dnr.sc.gov/swap/grants/T-41.pdf. Accessed August 18, 2018.

SCDNR. 2015a. South Carolina's State Wildlife Action Plan (2015). Columbia, SC. Available at: http://dnr.sc.gov/swap/index.html. Accessed June 18, 2018.

SCDNR. 2015b. "Wood Stork." In: South Carolina's State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. Columbia, SC. Available at: http://dnr.sc.gov/swap/supplemental/birds/woodstork2015.pdf. Accessed June 18, 2018.

SCDNR. 2015c. "Pond Breeding Amphibians Guild." In: South Carolina's State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. Columbia, SC. Available at: http://dnr.sc.gov/swap/supplemental/reptilesandamphibians/pondbreedingamphibiansguild2015.pdf. Accessed June 18, 2018.

SCDNR. 2015d. "Sturgeons Guild." In: South Carolina's State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. Columbia, SC. Available at: http://dnr.sc.gov/swap/supplemental/diadromousfish/sturgeonsguild2015.pdf. Accessed June 18, 2018.

SCDNR. 2015e. "Florida manatee." In: South Carolina's State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. Columbia, SC.

http://www.dnr.sc.gov/swap/supplemental/mammals/floridamanatee2015.pdf. Accessed July 10, 2018.

SCDNR. 2015f. “Pine Savannah Bird Guild.” In: South Carolina’s State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. Columbia, SC. http://www.dnr.sc.gov/swap/supplemental/birds/pinesavannahbirdsguild2015.pdf. Accessed July 10, 2018.

SCDNR. 2015g. “Grassland Birds Guild.” In: South Carolina’s State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. Columbia, SC. http://www.dnr.sc.gov/swap/supplemental/birds/grasslandbirdguild2015.pdf. Accessed July 10, 2018.

SCDNR. 2015h. “Black-throated Green Warbler (nominate and Wayne’s).” In: South Carolina’s State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. Columbia, SC. Available at: http://www.dnr.sc.gov/swap/supplemental/birds/black-throatedgreenwarbler2015.pdf. Accessed July 10, 2018.

SCDNR. 2015i. “Cavity Nesting Birds Guild.” Species Account for South Carolina’s Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/birds/cavitynestingbirdsguild2015.pdf. Accessed June 18, 2018.

SCDNR. 2015j. “Forested Wetland Birds Guild.” Species Account for South Carolina’s Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/birds/forestedwetlandsbirdsguild2015.pdf. Accessed June 18, 2018.

SCDNR. 2015k. “Meadow Vole.” Species Account for South Carolina’s Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/mammals/meadowvole2015.pdf. Accessed June 18, 2018.

SCDNR. 2015l. “ACE Basin Characterization Study: Species Gallery, Rafinesque’s Big-eared Bat.” Online project report. Available at: http://www.dnr.sc.gov/marine/mrri/acechar/speciesgallery/Mammals/RafinesquesBig-earedBat/index.html. Accessed July 10, 2018.

SCDNR. 2015m. “Mole’s Guild.” Species Account for South Carolina’s Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/mammals/molesguild2015.pdf. Accessed June 18, 2018.

SCDNR. 2015n. "Southern Fox Squirrel." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/mammals/southernfoxsquirrel2015.pdf. Accessed June 18, 2018.

SCDNR. 2015o. "Longleaf Pine Reptile Guild." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/reptilesandamphibians/longleafpinereptilesguild2015.pdf. Accessed June 18, 2018.

SCDNR. 2015p. "Florida Green Watersnake." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/reptilesandamphibians/floridagreenwatersnake2015.pdf. Accessed June 18, 2018.

SCDNR. 2015q. "Spotted Turtle." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/reptilesandamphibians/spottedturtle2015.pdf. Accessed June 18, 2018.

SCDNR. 2015r. "Carolina Pygmy Sunfish *Elassoma boehlkei*." In: South Carolina's State Wildlife Action Plan, Supplemental Volume: Species of Conservation Concern. Columbia, SC. Available at: http://dnr.sc.gov/swap/supplemental/freshwaterfish/carolinapygmysunfish2015.pdf. Accessed July 10, 2018.

SCDNR. 2015s. "American Eel." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/diadromousfish/americaneel2015.pdf. Accessed June 18, 2018.

SCDNR. 2015t. "Swallow-tailed Kite." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://dnr.sc.gov/swap/supplemental/birds/swallowtailedkite2015.pdf. Accessed June 18, 2018.

SCDNR. 2013. "Santee Cooper Anadromous Fish Passage & Restoration." Produced in partnership with the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers. Columbia, SC. Available at: http://www.dnr.sc.gov/fish/fishlift/images/fishlift.pdf. Accessed June 20, 2018.

SCDNR. 2005a. Comprehensive Wildlife Conservation Strategy. South Carolina Department of Natural Resources. Columbia, SC. Available at: http://www.dnr.sc.gov/cwcs/index.html. Accessed June 18, 2018.

SCDNR. 2005b. "Red-cockaded Woodpecker." Online Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://www.dnr.sc.gov/cwcs/pdf/Redcockadedwoodpecker.pdf. Accessed June 18, 2018.

SCDNR. 2005c. "Swallow-tailed Kite." Online Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://www.dnr.sc.gov/cwcs/pdf/Swallowtailedkite.pdf. Accessed June 18, 2018.

SCDNR. 2005d. "Black Bear." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://www.dnr.sc.gov/cwcs/pdf/colonialbats.pdf. Accessed June 18, 2018.

SCDNR. 2005e. "Eastern Woodrat." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://www.dnr.sc.gov/cwcs/pdf/easternwoodrat.pdf. Accessed June 18, 2018.

SCDNR. 2005f. "Colonial Cavity Roosting Bats." Species Account for South Carolina's Comprehensive Wildlife Conservation Strategy. Available at: http://www.dnr.sc.gov/cwcs/pdf/colonialbats.pdf. Accessed June 18, 2018.

SCDNR Public Lands. 2018. Santee-Delta Wildlife Management Area (webpage). Available at: https://www2.dnr.sc.gov/ManagedLands/ManagedLand/ManagedLand/62. Accessed July 5, 2018.

SCDNR Public Lands. 2014. DNR Managed Lands Regulations. Tom Yawkey Wildlife Center. Available at: http://www.dnr.sc.gov/mlands/specregshp.html. Accessed on July 5, 2018.

South Carolina Department of Parks, Recreation and Tourism. 2018a. Santee Coastal Reserve. Available at: https://discoversouthcarolina.com/products/81. Accessed August 2, 2018.

South Carolina Department of Parks, Recreation and Tourism. 2018b. Tom Yawkey and the Wildlife Center He Founded. Available at: https://discoversouthcarolina.com/articles/see-coastal-landscape-and-habitat-at-tom-yawkey-wildlife-center.

SCDOT (South Carolina Department of Transportation). 2017a. Traffic Counts Comparison Application. Available at: https://scdot.maps.arcgis.com/apps/MapSeries/index.html?appid=fe2e97641eac493094342c502369814b. Accessed June 18, 2018.

SCDOT. 2017b. Traffic Counts. Available at: https://www.scdot.org/travel/travel-trafficdata.aspx. Accessed June 18, 2018.

SCDOT. 2011. Utilities Accommodation Manual. Available at: http://www.scdot.org/doing/technicalPDFs/publicationsManuals/utilityAccommodations/ua_policy.pdf. Accessed October 2013.

South Carolina Exotic Pest Plant Council. No date. South Carolina Early Detection and Rapid Response Target Species. Available at: https://www.se-eppc.org/southcarolina/SCEDDR.pdf. Accessed July 11, 2019.

SCWF (South Carolina Wildlife Federation). 2017. "Swallow-tailed Kites." By Ray Wade. April 1, 2017. Available at: http://www.scwf.org/swallowtailed-kites/. Accessed June 18, 2018.

South Carolina Department of Revenue. 2017. Annual Report 2015-2016. Available at: https://dor.sc.gov/resources-site/publications/Publications/2015-2016_Annual_Report.pdf. Accessed June 25, 2018.

South Carolina Forestry Commission. 2017. Available at: https://www.state.sc.us/forest/sctpo13.pdf. Accessed June 25, 2018.

South Carolina Heritage Trust. 2018. Personal communication. GIS data provided by Joseph Lemeris, Jr., Geospatial Analyst, South Carolina Department of Natural Resources, to Phillip Baigas, Wildlife Biologist, Louis Berger. Regarding SC Rare, Threatened & Endangered Species Data. August 3, 2018.

South Carolina Revenue and Fiscal Affairs Office. 2018. Population Projections Based on the 2010 Census Data, Population Projections 2000–2030. Available at http://www.sccommunityprofiles.org/census/proj_c2010.html (accessed June 25, 2018).

South Carolina State Historic Preservation Office, South Carolina Institute of Archaeology and Anthropology, and Council of South Carolina Professional Archaeologists. 2009. South Carolina Standards and Guidelines for Archaeological Investigations. Manuscript on file, South Carolina State Historic Preservation Office, Columbia.

Stuart, G. 1975. The Post-Archaic Occupation of Central South Carolina. Unpublished Ph.D. dissertation, Department of Anthropology, University of North Carolina, Chapel Hill.

Thalheimer, E. 1996. Construction noise control program and mitigation strategy at the central artery tunnel project. INCE Noise Control Conference. Seattle, WA.

Three Oaks Engineering. 2018. “Freshwater Fish Surveys for Central Electric Project: Belle Isle and Charity Routes, Francis Marion National Forest, Berkeley and Charleston Counties, South Carolina.” Prepared for Milliken Forestry. August 2018. Durham, NC. 14 pp.

Three Oaks Engineering. 2017. “Freshwater Fish Surveys for Central Electric Project Francis Marion National Forest, Berkeley and Charleston Counties, South Carolina.” Prepared for Milliken Forestry. November 28, 2017. Durham, NC. 34 pp.

Tippett, J.L. 1992. “The Spatial Distribution of Lithic Materials: Implications for the Early and Middle Archaic Hunter-Gatherer Mobility in South Carolina.” Unpublished thesis presented for the Master of Arts Degree, University of Tennessee, Knoxville, TN.

Trinkley, M. 1990. An Archaeological Context for the South Carolina Woodland. Chicora Foundation Research Series No. 22. Prepared for South Carolina Department of Archives and History, Columbia, SC.

Trinkley, M. 1981. The Jeremy-Pee Dee Ceramic Series Along the South Carolina Coast. South Carolina Antiquities 13(1-2):1-12.

Trinkley, M. 1980a. Investigations of the Woodland Period Along the South Carolina Coast. Unpublished PhD dissertation, Department of Anthropology, University of North Carolina, Chapel Hill, NC.

Trinkley, M. 1980b. A typology of Thom’s Creek pottery for the South Carolina coast. South Carolina Antiquities. 12:1-135.

Trinkley, M. 1978. *Archaeological Reconnaissance of the Proposed S-857 Widening*. South Carolina Department of Highways and Public Transportation.

Tsai, J-S. R. and P. Frederick. 2000. Finding Wood Stork Habitat and Conserving the Right Features. Google Earth (KML) data (Online). University of Florida Department of Wildlife Ecology and Conservation. Available at:

http://www.wec.ufl.edu/faculty/frederickp/woodstork/files/Wood%20Stork%20Colonies%20in%20the%20Southeastern%20US.kmz. Accessed August 7, 2018.

U.S. Bureau of Labor Statistics. 2018a. Local Area Unemployment Statistics. Geographies State of South Carolina. Years 2010-2016. Available at: https://data.bls.gov/cgi-bin/dsrv?la. Accessed June 25, 2018.

U.S. Bureau of Labor Statistics. 2018b. Local Area Unemployment Statistics. Geographies: Counties of Charlestown, Georgetown, and Berkeley. Years 2010-2016. Available at: https://data.bls.gov/cgi-bin/dsrv?la. Accessed June 25, 2018.

U.S. Bureau of Labor Statistics. 2018c. Local Area Unemployment Statistics. Geographies: State of South Carolina; Counties of Charleston and Georgetown, SC. Years: 2001-2012.

U.S. Census (U.S. Census Bureau). 2018a. U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates. Table DP04. Selected Housing Characteristics.

U.S. Census. 2018b. Geographic Terms and Concepts - Block Groups Online: Available at: https://www.census.gov/geo/reference/gtc/gtc_bg.html. Accessed: June 26, 2018.

U.S. Census. 2017. Annual Estimates of the Resident Population. Geographies: Counties of Charleston, Georgetown and Berkeley. Table PEPANNRES. Accessed June 25, 2018.

U.S. Census. 2016a. Annual Estimates of the Resident Population: 2016 Population Estimates. Geographies: Cities of Charleston and Georgetown, Towns of McClellanville and Moncks Corner. Table PEPANNRES. Accessed June 25, 2018.

U.S. Census. 2016b. Census ACS 2012-2016 5 Year Estimates. Tables: X03 and X17. Geography: All Census Block Groups in the state of South Carolina. Available at: http://factfinder.census.gov. Accessed August 21, 2018.

U.S. Census. 2005. Population Division, Interim State Population Projections. April 21, 2005. Available at: http://www.census.gov/population/www/projections/statepyramid.html. Accessed January 7, 2012).

USDA-NRCS (U.S. Department of Agriculture, Natural Resources Conservation Service). 2013a. Lakeland Soil Series Official Description. Available at:

https://soilseries.sc.egov.usda.gov/OSD_Docs/C/CHIPLEY.html. Accessed October 2013.

USDA-NRCS. 2013b. National soil survey handbook, title 430-VI. Available at: http://soils.usda.gov/technical/handbook/ (accessed October 2013).

USDA-NRCS. 2011. Soil Survey Geographic (SSURGO) database for Charleston County Area, South Carolina. Available at: <http://SoilDataMart.nrcs.usda.gov/>.

USDA-NRCS. 2010a. Soil Survey Geographic (SSURGO) database for Georgetown County Area, South Carolina. Available at: <http://SoilDataMart.nrcs.usda.gov/>.

USDA-NRCS. 2010b. Field Indicators for Hydric Soils in the United States. A guide for identifying and delineating hydric soils. Version 7.0.

USDA-NRCS. 2007. Chipley Soil Series Official Description. Available at: https://soilseries.sc.egov.usda.gov/OSD_Docs/L/LAKELAND.html. Accessed October 2013.

USDA-NRCS. 2003a. Levy Soil Series Official Description. Available at: https://soilseries.sc.egov.usda.gov/OSD_Docs/L/LEVY.html. Accessed October 2013.

USDA-NRCS. 2003b. Rutlege Soil Series Official Description. Available at: https://soilseries.sc.egov.usda.gov/OSD_Docs/R/RUTLEGE.html. Accessed October 2013.

USDA-NRCS. 2002. Technical Guide to RUSLE in Michigan. Available at: http://35.8.121.139/rusle/kfactor.htm. Accessed October 2013.

USDA-NRCS. 1999. Rutlege Soil Series Official Description. Available at: https://soilseries.sc.egov.usda.gov/OSD_Docs/C/CAINHOY.html. Accessed June 27, 2018.

U.S. Department of Health and Human Services. 2012. What Is a Pacemaker? Available at: http://www.nhlbi.nih.gov/health/health-topics/topics/pace/. Accessed November 13, 2013.

U.S. Department of Labor, Occupational Health and Safety Administration. 2013. Occupational Noise Exposure, NIOSH Noise Meter. Available at: http://www.osha.gov/SLTC/noisehearingconservation/. Accessed November 13, 2013.

USEPA (U.S. Environmental Protection Agency). 2018a. Greenbook. South Carolina Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants. Available at: https://www3.epa.gov/airquality/greenbook/anayo_sc.html. Accessed June 18, 2018.

USEPA. 2018b. U.S. Environmental Protection Agency. National Ambient Air Quality Standards (NAAQS). Available at: https://www.epa.gov/criteria-air-pollutants/naaqs-table.

USEPA. 2018c. Electric and Magnetic Field (EMF) Radiation from Power Lines. Available at: https://www3.epa.gov/radtown/electric-magnetic-fields.html. Accessed June 27, 2018.

USFS (U.S. Department of Agriculture, Forest Service). 2018a. Personal Communication. GIS Data Provided by Andy Maceyka, GIS Specialist, USFS Francis Marion National Forest Supervisor's Office, to Phillip Baigas, Wildlife Biologist, Louis Berger. Regarding Ecosystems Mapping on the Francis Marion National Forest. July 19, 2018.

USFS. 2018b. High Priority Nonnative Invasive Species of Southern Forest and Grassland Ecosystems, June 2008 – DRAFT. Compiled by the USDA Forest Service Regional Task Force for the Assessment of Nonnative Invasive Species of Southern Forests. Available at: https://www.invasive.org/south/highpriority.html. Accessed July 11, 2019.

USFS. 2018c. Personal Communication. GIS Data Provided by Andy Maceyka, GIS Specialist, USFS Francis Marion National Forest Supervisor's Office, to Phillip Baigas, Wildlife Biologist, Louis Berger. Regarding Rare, Threatened & Endangered Species Occurrence Data. August 6, 2018.

USFS. 2018d. Personal Communication. GIS Data Provided by Geoff Holden, GIS Program Manager, USFS Francis Marion National Forest Supervisor's Office, to Phillip Baigas, Wildlife Biologist, Louis Berger. Red-cockaded Woodpecker Occurrence Data. August 13, 2018.

USFS. 2018e. Plants and Wildlife on the Francis Marion National Forest. Available at: https://www.fs.usda.gov/wps/portal/fsinternet/cs/detail/!ut/p/z1/04_Sj9CPykssy0xPLMnMz0vMAfIjo8zijQwgwNHCwN_DI8zPyBcqYKAfjlVBmA9cQRQx-g1wAEci9eNREIXf-HD9KH0CHtDHb4KfR35uqn5BbmhohEGWCQCHVD_f/dz/d5/L2dBISEvZ0FBIS9nQSEh/?position=Not%20Yet%20Determined.Html&pname=Francis%20Marion

%20and%20Sumter%20National%20Forests-%20Resource%20Management&ss=110812&navtype=BROWSEBYSUBJECT&pnavid=130000000000000&navid=130120000000000&ttype=detail&cid=stelprdb5253642. Accessed September 18, 2018.

USFS. 2018f. Francis Marion and Sumter National Forests. Recreation (webpage).Available at: https://www.fs.usda.gov/recmain/scnfs/recreation. Accessed July 5, 2018.

USFS. 2018g. Francis Marion and Sumter National Forests. Elmwood Recreation Area (website). Available at: https://www.fs.usda.gov/recarea/scnfs/recarea/?recid=47297. Accessed July 5, 2018.

USFS. 2018h. Francis Marion and Sumter National Forests. Honey Hill Recreation Area (website). Available at: https://www.fs.usda.gov/recarea/scnfs/recarea/?recid=47299. Accessed July 5, 2018.

USFS. 2018i. Francis Marion and Sumter National Forests. Buck Hall Recreation Area (website). Available at: https://www.fs.usda.gov/recarea/scnfs/recarea/?recid=47291. Accessed July 5, 2018.

USFS. 2017. Francis Marion National Forest Final Environmental Impact Statement for the Revised Land Management Plan. January 2017. Columbia, SC. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd516112.pdf. Accessed June 18, 2018.

USFS. 2015. “Species of Conservation Concern Frequently Asked Questions.” U.S. Forest Service Pacific Southwest Region. July 2015. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3848211.pdf. Accessed July 10, 2018.

USFS. 2014. Biological Assessment for Activities Affecting Northern Long-Eared Bats on Southern Region National Forests. Prepared by R. Whalen and D. Krusac. U.S. Forest Service Southern Region Regional Office. Atlanta, GA. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3837288.pdf.

USFS. 2013a. “Francis Marion National Forest Draft Forest Plan Assessment, Section 5.4: Threatened, endangered, proposed and candidate species.” Francis Marion National Forest, Berkeley and Charleston Counties, South Carolina. Available at:

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5446515.pdf. Accessed July 8, 2018.

USFS. 2013b. Francis Marion National Forest Draft Forest Plan Assessment, Section 5.1-5.3: At Risk Species. Francis Marion National Forest, Berkeley and Charleston Counties, South Carolina. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5446514.pdf. Accessed July 8, 2018.

USFS. 2012. “Fiscal Year 2011 Monitoring and Evaluation Annual Report.” Francis Marion National Forest Revised Land and Resource Management Plan. United States Department of Agriculture, Forest Service, Southern Region August 8, 2012. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5386032.pdf. 73 pp.

USFS. 2011. South Carolina’s Forests. Available at: https://www.srs.fs.usda.gov/pubs/rb/rb_srs208.pdf. Accessed July 6, 2018.

USFS. 1995. Landscape Aesthetics: A Handbook for Scenery Management. Available at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5412126.pdf(. Accessed July 25, 2018.

USFS. 1992. Carbon Storage and Accumulation in the United States Forest Ecosystems.

USFWS (U.S. Fish and Wildlife Service). 2018a. “National Wetland Inventory.” Available at https://www.fws.gov/wetlands/data/Mapper.html. Accessed June 2018.

USFWS. 2018b. “Information for Planning and Conservation (IPaC).” Available at: https://ecos.fws.gov/ipac/. Accessed July 10, 2018.

USFWS 2015. American Eel (*Anguilla rostrata*) 12-Month Petition Finding Form; Docket Number FWS-HQ-ES-2015-0143. https://www.fws.gov/northeast/americaneel/pdf/20150820_AmEel_12M_NotWarranted_BatchFormat_v2_Signed.pdf. Accessed October 10, 2018.

USFWS. 2014. Northern Long-eared Bat Interim Conference and Planning Guidance, USFWS Regions 2, 3, 4, 5, & 6. January 6, 2014. Available at: https://www.fws.gov/northeast/virginiafield/pdf/NLEBinterimGuidance6Jan2014.pdf. Accessed August 10, 2018.

USFWS. 2010. Cape Romain National Wildlife Refuge Comprehensive Conservation Plan. FWS Southeast Region. October 1, 2010. Available at: https://catalog.data.gov/dataset/cape-romain-national-wildlife-refuge-comprehensive-conservation-plan. Accessed September 3, 2018.

USFWS. 2008. American Chaffseed (*Schwalbea americana*) 5–Year Review: Summary and Evaluation. Northeast Region, New Jersey Field Office, Pleasantville, NJ.

USFWS. 2007. National Bald Eagle Management Guidelines. Revision of Bald Eagle Monitoring Guidelines Issued September 2006. September 2007. Available at: https://www.fws.gov/southeast/pdf/bald-eagle-monitoring-guidelines-2007.pdf. Accessed August 1, 2018.

USFWS. 2003. Recovery Plan for the Red-cockaded Woodpecker (Picoides borealis): Second Revision. U.S. Fish and Wildlife Service, Atlanta, GA. 296 pp. Available at: https://www.fws.gov/rcwrecovery/files/RecoveryPlan/finalrecoveryplan.pdf. Accessed June 10, 2018.

USFWS. 1993. Recovery Plan for Pondberry (Lindera melissifolia [Walt.]Blume). Prepared by L. Delay, R. O'Conner, J. Ryan, and R.R. Currie. U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. September 23, 1993. 43 pp. Available at: https://projects.ncsu.edu/cals/plantbiology/ncsc/rare/Recovery_Lindera.pdf. Accessed September 5, 2018.

USGS (U.S. Geological Survey). 2013. National Elevation Dataset. Available at: http://gisdata.usgs.gov/tdds/downloadfile.php?TYPE=ned3i_zip&ORIG=META&FNAME=n33w081.zip. Accessed October 2013.

USGS. 2011. GAP/LANDFIRE National Terrestrial Ecosystems 2011. USGS Gap Analysis Program National Terrestrial Ecosystems Version 3.0. Boise, ID. Available at: https://gapanalysis.usgs.gov/gaplandcover/data/land-cover-metadata/. Accessed July 20, 2018.

USGS. 2010. National Hydrography Dataset. Available at: http://nhd.usgs.gov/data.html. Accessed June 2018.

Van der Zande, A.N., W.J. ter Keurs, and W.J. Van der Weijden. 1980. The Impact of Roads on the Densities of Four Bird Species in an Open Field Habitat—Evidence of a Long Distance Effect. Biological Conservation 18:299–321.

Waddell, E. 1980. Indians of the South Carolina Low Country, 1562-1751. The Reprint Company, Spartanburg, SC.

Ward, L.W., Bailey, R.H., and Carter, J.G. 1991. Chapter 16—Pliocene and Early Pleistocene Stratigraphy, Depositional History, and Mulluscan Paleobiography of the Coastal Plain. In: Horton, J.W.J. and Zullo, V.A., eds., The Geology of The Carolinas—Carolina Geological Society Fiftieth Anniversary Volume. University of Tennessee Press, Knoxville, TN. p. 406.

Watts, W.A. 1980. Late Quaternary Vegetation History at White Pond on the Inner Coastal Plain of South Carolina. Quaternary Research 10.

Watts, W.A. 1970. The Full Glacial Vegetation of Northern Georgia. Ecology 51(1).

Wear, D.N., and J.G. Greis. 2002. Southern Forest Resource Assessment - Technical Report. Gen. Tech. Rep. SRS-53. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 635 pp.

Wear, D.N. and J.G. Greis. 2012. The Southern Forest Futures Project: Summary Report. General Technical Report SRS-168, Southern Research Station, Asheville, NC. 54 pp.

Wetmore, R.Y. and A.C. Goodyear. 1986. Archaeological Investigations at Nipper Creek (38RD18): An Archaic Fall-Line Site. Research Manuscripts Series No. 201. South Carolina Institute of Archaeology and Anthropology, Columbia, SC.

Wildlife Investigations, LLC. 2018. “Red-cockaded Woodpecker (RCW) Cluster Surveys for Central Electric Powerline Right-of-Way.” Prepared by L.A. Wood. Wildlife Investigations, LLC. McClellanville, SC. 3 pp.

Whitehead, D.R. 1973. Late Wisconsin Vegetational Changes in Unglaciated Eastern North America. Quaternary Research 3:621-631.

Whitehead, D.R. 1965. Palynology and Pleistocene Phytogeography of Unglaciated Eastern North America. In: The Quaternary of the United States, H.E. Wright, Jr. and D.G. Frey (eds.). Princeton University Press, Princeton, NJ.

Appendix A—Revised Macro-Corridor Study Report for the McClellanville 115 kV Transmission Project

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CENTRAL ELECTRIC POWER COOPERATIVE (SC50)

Revised Macro-Corridor Study Report

for the

McClellanville 115kV Transmission Line Project

Revised Macro-Corridor Study Report

prepared for the

USDA Rural Utilities Service

by the

Mangi Environmental Group, Inc.

for the

CENTRAL ELECTRIC POWER COOPERATIVE, INC.

proposed

McClellanville 115kV Transmission Line Project

September 2010

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Acronyms and Abbreviations

CEPCI	Central Electric Power Cooperative Inc.
CFR	Code of Federal Regulations
DOE	Determinations of Eligibility
FEMA	Federal Emergency Management Agency
FMNF	Francis Marion National Forest
GIS	Geographic Information System
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
RCW	Red-cockaded Woodpecker
RFSS	Regional Forester Sensitive Species
ROW	Right of Way
RUS	Rural Utilities Service
SCDAH	South Carolina Department of Archives and History
SCDNR	South Carolina Department of Natural Resources
SCDPRT	South Carolina Department of Parks, Recreation, and Tourism
SCDOT	South Carolina Department of Transportation
SCIAA	South Carolina Institute of Archaeology and Anthropology
TES	Threatened and Endangered Species
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WMA	Wildlife Management Area

1.0 Introduction

1.1 Basis for Macro-Corridor Study

The Electric Program of USDA's Rural Utilities Service (RUS) provides leadership and capital to upgrade, expand, maintain, and replace America's vast rural electric infrastructure. Under the authority of the Rural Electrification Act of 1936, RUS makes direct loans and loan guarantees to electric utilities to serve customers in rural areas. The Electric Program makes loans and loan guarantees to finance the construction of electric distribution, transmission and generation facilities, including system improvements and replacement required to furnish and improve electric service in rural areas, and for demand side management, energy conservation programs, and on-grid and off-grid renewable energy systems.

Central Electric Power Cooperative Inc. (Central Electric) has requested financing from RUS to construct a 115 kV transmission line to supply reliable power to the area surrounding the Town of McClellanville, SC. The need for additional reliable power and alternative means to provide that power are discussed in a separate report—the Alternative Evaluation Study, available for review at: http://www.usda.gov/rus/water/ees/eis.htm.

Federal agencies are required under the National Environmental Policy Act (NEPA) and Council on Environmental Quality's (CEQ) NEPA implementing regulations (40 CFR 1500-1508) to evaluate the environmental consequences of their actions. In addition, they are required to consider alternative ways of meeting a proposal's purpose and need before proceeding with a federal action that could significantly affect the human environment. RUS regulations at 7 CFR 1794 are the current agency-specific regulations for implementing NEPA. Agency guidance in RUS Bulletin 1794A-603 requires that two preliminary studies be prepared and approved for linear projects before scoping under NEPA is initiated—an Alternative Evaluation Study and a Macro-Corridor Study. When RUS approves those studies, the formal NEPA process can begin with the initiation of public and agency scoping and the subsequent preparation of an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). RUS has decided to prepare an EIS for this proposal. The USDA Forest Service will serve as a cooperating agency in the preparation of the forthcoming EIS.

As required by RUS, the accompanying Alternative Evaluation Study explains the need for the proposal and discusses alternative methods that have been considered to meet that need. To the extent reasonable and appropriate, the Alternative Evaluation Study examines: the no action alternative; reducing load (or energy demand) in the McClellanville area through load management or energy conservation; rebuilding the existing distribution line infrastructure; constructing new on-site generation; and providing reliable power by constructing a new transmission line. The Alternative Evaluation Study explains each alternative in detail so that interested agencies and the public can gain a general understanding of each alternative. The study explains which alternative is considered the best for fulfilling the purpose and need for the proposal.

As required by RUS, the Macro-Corridor Study defines the proposal study area and shows the end points being considered for the proposed transmission line. Alternative corridor routes, varying in width from a few hundred feet up to a mile, were developed based on environmental, engineering, economic, land use, and permitting constraints. The use of existing rights-of-way or paralleling existing electric transmission lines were addressed as appropriate.

1.2 Basis for Revision of the Macro-Corridor Study

In November 2005, the first Macro-Corridor Study for the proposed McClellanville 115 kV transmission line and the accompanying Alternatives Evaluation Study were completed and made available to the public on the USDA Rural Utilities Service website. Potentially affected property owners were directly contacted by letter. Those individuals as well as federal, state, and local agencies, environmental groups, and the general public in the vicinity of McClellanville were notified about the proposal and invited to participate in scoping. Comments, concerns and opinions about the proposal were solicited through direct mailings as well as by local print and electronic media. Comments were received by RUS via mail, e-mail, phone, and facsimile communications and during an open-house format scoping meeting held in McClellanville in December 2005. The many steps outlined here were taken to widely disseminate information about the proposal to potentially affected property owners and the community as a whole so that all interested parties would have ample opportunity to voice their concerns and share ideas and relevant information they might have with respect to the alternatives and potential impacts of the proposal.

Following the public scoping period, the analysis team reviewed all comments, refined a number of study parameters and the analytical methodology, gathered updated and additional data, and conducted agency telephone meetings in a concerted effort to address all of the substantive issues raised during scoping. The comments and public outreach material compiled during the December 2005 – January 2006 scoping period are available for public review in a scoping report on the RUS website at: http://www.usda.gov/rus/water/ees/eis.htm. For example, one comment voiced by a number of individuals was concern regarding impacts to private lands in areas of concentrated residential development. In response to this concern, an additional mapped data layer was created for the analysis that characterized subdivisions and other residential clusters as higher risk areas. This change and a number of other methodological changes and data updates described in this document required re-running the GIS-based analytical models used to define the original alternative transmission line alignments and corridors. This revised Macro-Corridor Study discusses those analysis changes and data updates and presents a new set of path alignments and corridors that would serve as the basis for consideration of transmission line alternatives in the forthcoming EIS.

2.0 Project Description

McClellanville, South Carolina is located approximately 30 miles north of Charleston, SC along the U.S. Highway 17 corridor linking Charleston with Georgetown, SC (Figure 3-1). This rural area has no existing transmission infrastructure. The presence of the Francis Marion National Forest, Santee River delta and other nearby environmentally sensitive areas has limited the community's growth and allowed it to remain a relatively small electrical distribution load. Berkeley Electric Cooperative, a member of the Central Electric Coop System, has served the community from a long-distance distribution system with the longest circuits reaching almost 40 miles to the Santee River delta. In recent years, the community has begun to experience times of low voltage and frequent outages. The Alternative Evaluation Study determined that Central Electric's best options for addressing these reliability problems would involve construction of a transmission line that delivered power directly to the community with power distribution from a newly-constructed substation in McClellanville.

The proposed line would be a single-circuit 115 kV transmission line from a Santee-Cooper Network transmission line to a substation to be constructed by Berkeley Electric Cooperative that would range from 10 to 33 miles in distance depending on the selection of a source point and routing considerations. The construction will use single 75-foot high poles with three phase conductors and a single 0.565 OPGW fiber optic overhead shield wire. The right-of-way would be cleared to 75 feet in width (37.5 feet on either side of the centerline) and would include the removal of danger trees (hazardous trees that could fall on the line) that may be outside of the right-of-way.

This Macro-Corridor Study was conducted to determine what potential transmission line routing options were available for the McClellanville line, and in general terms, how they might be planned to avoid and minimize potential environmental, social, cultural, and economic effects. The results and findings of this report will serve as the foundation upon which more studies and analyses will be conducted for the EIS. For this study, five originating points for the transmission line—Charity, Jamestown, Honey Hill, Belle Isle, and Britton Neck were considered. The proposed transmission line would be routed from one of these five points to the proposed McClellanville substation (Figure 3-1).

3.0 Study Area Description

3.1 Study Area Location

The McClellanville 115 kV Transmission Line Project study area (Fig. 3-1) is located in the Atlantic coastal plain of South Carolina, within eastern Berkeley, northern Charleston, and southern Georgetown counties (Table 3-1). The study area encompasses approximately 1,008 square miles (645,363 acres) within a perimeter of 200 miles. The Francis Marion National Forest (FMNF) comprises 235,731 acres (37 percent) of the study area. The boundary of the study area follows U.S. Highway 17A from just east of Monck's Corner eastward, then along the Sampit River to Winyah Bay, then south along the west shore of the Bay and the Atlantic coastline at Mount Pleasant, then overland crossing Route 17 to the western boundary at the Cooper River and the West Branch of the Cooper River where it intersects Route 17A.

Table 3-1: Analysis Acres by County

Counties	Total Acres	Acres of Study Area	% Of County in Study Area	FMNF Acres in Study Area
Berkeley	786,236	290,741	37	169,352
Charleston	630,235	200,510	31.8	66,379
Georgetown	541,745	153,821	28.4	0
Williamsburg*	599,375	292	0.1	0
TOTAL	2,557,591	645,363	-	235,731
* A negligible acreage of Williamsburg County is found within the study area boundary. This acreage exists in the northwest corner of the study area, and is found within the 300-foot buffer of Highway 17A.				

3.2 Study Area Characteristics

3.2.1 Physiography

The Atlantic Coastal Plain area – South Carolina's lowcountry – is comprised of extensive lowlands where elevations range from 0 to 80 feet above sea level (USFS, 1996). The terrain is characterized by a series of parallel ridges of sandy beach deposits with large areas of swamps, bays, and upland flats between the ridges. Limestone sinks are also found in the area, and are home for many rare plants, including the endangered pondberry (*Lindera melissaefolium*). Estuaries are common and are affected by tidal action and freshwater drainage from rivers and land. The winters are mild and the summers are hot, with average annual rainfall at about 48 inches (USFS, 1996).

Study Area Depression Swamp
(photo by L.L Gaddy)

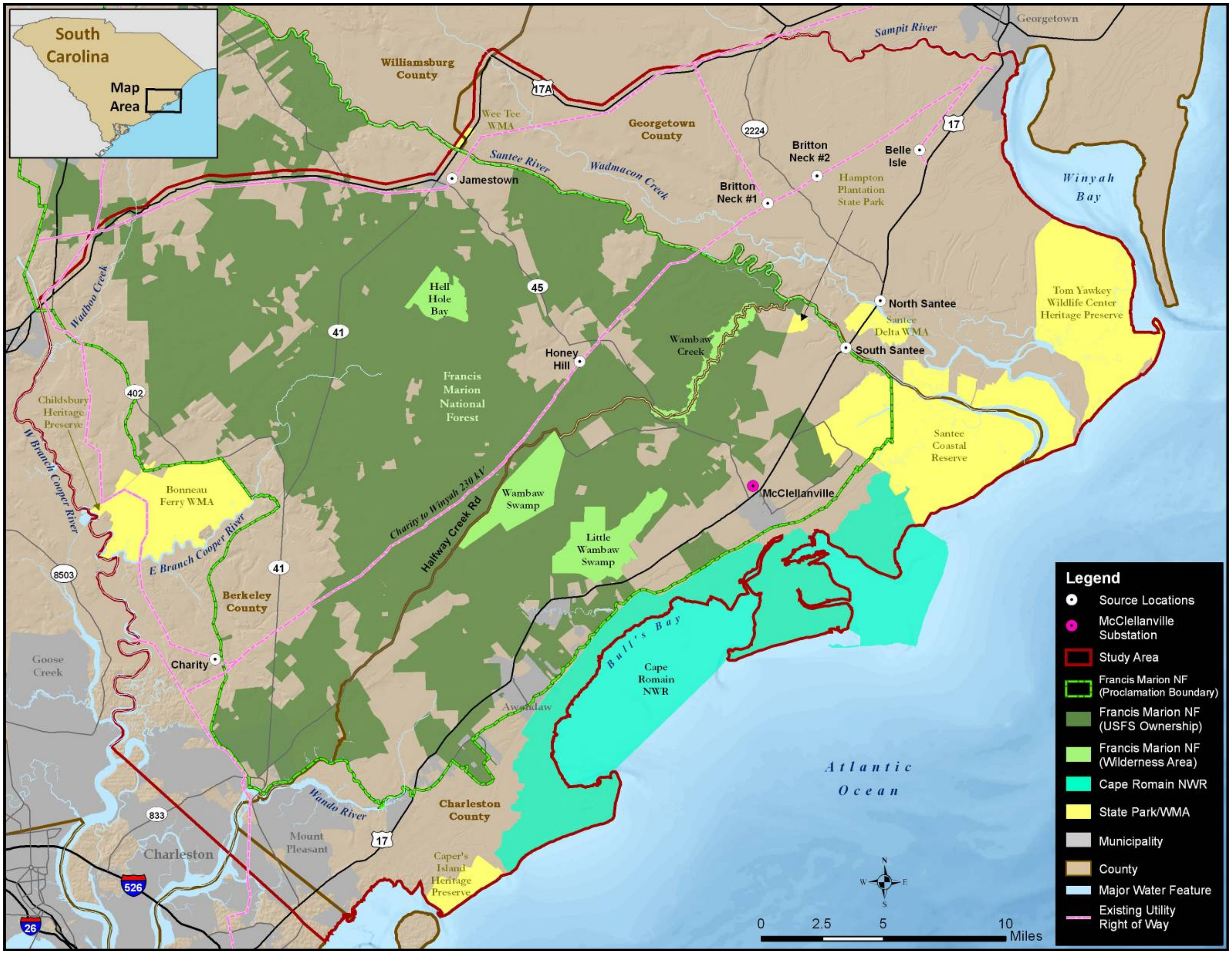


Figure 3-1: Study Area

The Santee River flows through the northern portion of the analysis area. The Santee River Delta is one of the largest deltas on the U.S. East Coast, formed from the deposition of eroded materials transported by the Santee River, and contains meandering creeks, marshes, and islands known for their aesthetic quality and biodiversity. The Delta includes diverse wetlands, ranging from grassy marshes to forested swamps.

3.2.2 Land Use/Land Cover

The study area is dominated by forest, with the majority of upland forested areas dominated by planted loblolly pine and some longleaf pine. On wetter sites, bottomland and swamp hardwoods dominate, with cypress also prominent. Maritime zones contain vegetation that is tolerant to wind and salt spray. Freshwater, brackish, and tidal marshes and their associated plant communities are found along coastal borders and throughout the Santee River Delta.

Managed Upland Forest on the Francis Marion NF (photo by Tim Gaul)

Urban land use is concentrated in the southern portion of the study area associated with Charleston and Mount Pleasant, with some development extending northward along the U.S. Highway 17 corridor to Georgetown.

Table 3-2 lists the land cover types/land uses that are found in the project study area (see USGS, 2001 for land cover type definitions).

Table 3-2: Study Area Land Cover Characteristics

Land Cover Type	USGS Code	Acres	% of Area
Wetland	90,95	302,927	47%
Forest	41,42,43	232,559	36%
Open Water	11	29,339	5%
Grassland/Herbaceous	71	25,062	4%
Shrub/Scrub	52	24,990	4%
Developed	21,22,23,24	15,761	2%
Pasture	81	8,868	1%
Cultivated Crop	82	4,592	1%
Barren Land	31	1,262	<1%
Total		**645,360**	**100%**
Source: USGS, 2001			

3.2.3 Socioeconomic Character

The low country of South Carolina, extending from the Sandhills east of Columbia to the coastline and coastal islands, has experienced a substantial population growth in the last decade. Table 3-3 lists the most recent available estimates of population and population change in the three low country counties of the study area between 2000 and 2006.

Table 3-3: Population of the Study Area

County	Berkeley	Charleston	Georgetown
Population 2000	142,651	309,969	55,797
Estimated Population 2007	163,622	342,973	60,499
Population % Increase	14.7	10.6	8.5
Source: U.S. Census Bureau, 2009			

As the area continues to grow and provide employment opportunities, people living in communities within or adjacent to the study area are becoming less economically dependent on the traditional agricultural and forest-based industries. Though agricultural and forest-based industries remain important in the region, manufacturing has become one the largest expanding employment sectors in Berkeley and Georgetown Counties, while in Charleston County leisure and hospitality has become one of their largest growing employment sectors.

Table 3-4: Percent Employment for Study Area Counties

Industry	Berkeley	Charleston	Georgetown
Educational, health, and social services	17.1	22.7	16.6
Manufacturing	15.4	6.8	17.7
Retail trade	12.4	12.6	12.3
Construction	10.9	8.4	9
Transportation and warehousing, and utilities	7.8	4.9	3.9
Leisure and Hospitality (Arts, recreation, entertainments, accommodation and food services)	7.4	12.3	13.6
Professional, scientific, management, administrative, and waste management services	7	10	6.5
Public administration	6.5	5.6	3.5
Finance, insurance, real estate, and rental and leasing	5	6	6.1
Other services (except public administration)	4.8	5	4.2
Wholesale trade	3.1	2.9	2.8
Information	1.8	2.2	1
Agriculture, forestry, fishing and hunting, mining	0.7	0.6	2.7
Source: U.S. Census Bureau, 2000			

Although portions of the City of Charleston and the Town of Mount Pleasant are within the boundaries of the study area, these urban areas are not indicative of the overall socioeconomic conditions that exist in this predominately rural study area. The following table lists the principal remaining three towns located within the study area (see Table 3-5).

Table 3-5: Rural Towns in the Study Area

Town	County	2000 Population
Town of Awendaw	Charleston	1,195
Town of Jamestown	Berkeley	97
Town of McClellanville	Charleston	459
Source: U.S. Census Bureau, 2000		

3.2.4 Transportation

The major transportation corridors in the area include U.S. Highway 17, which parallels the Atlantic coast from Georgetown to Charleston and U.S. Highway 17A, which forms the northern boundary of the analysis area from Georgetown to the Charleston area. State highways in the area include Highway 41 from Jamestown to the Charleston area and Highway 45 from Jamestown to McClellanville. The Georgetown County Airport is located approximately three miles south of the Town of Georgetown. The Mount Pleasant Regional Airport, formerly known as the East Cooper Airport, is located nine miles northeast of the central business district of Mount Pleasant.

3.2.5 Water Resources

The study area includes large areas of swamps, bays, limestone sinks, tidal estuaries, and freshwater streams, lakes, and reservoirs. Numerous perennial and intermittent streams are found within the analysis area. Table 3-6 lists the major rivers and streams that are located in the analysis area.

North Santee River, View Downriver from the Highway 17 Bridge (photo by T. Gaul)

The Santee River traverses the northern half of the study area, and has one of the largest delta on the Atlantic Coast. The Santee Delta includes many acres of wetlands, from forested swamps, to grassy meadows, and tidal marshes. It harbors numerous species of birds including a variety of waterfowl and migratory species, as well as many sensitive fish, amphibian, and bird species.

Table 3-6: Major Study Area Rivers and Streams

Major Rivers/Streams	Miles in Study Area
Santee River	17.5
North Santee River	11.9
Wadmacon Creek	10
Sampit River	9.6
South Santee River	9.4
East Branch Cooper River	8.2
Wadboo Creek	7.2
Cooper River	7
Nicholson Creek	6.8
Cedar Creek	6.5
West Branch Cooper River	3.6
Huger Creek	3
Tailrace Canal	1.2
Back River	0.4
Total Miles	**102.3**

The U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) maps were used to broadly identify wetlands areas. According to the NWI, the study area has 366,790 acres of wetland, comprising 57 percent of its total area. The apparent discrepancy between the NWI figure for total wetlands (366,790 acres or 57 percent of the study area) and the USGS figure presented in Table 3-2 (302,927 acres or 47 percent of the study area) is primarily because these inventories define the term "wetland" somewhat differently. For example, the NWI definition includes lakes and rivers (lacustrine and riverine wetlands) which are in the separate category of "open water" in the USGS classification. There are also differences in classification methodology and data formats (NWI data is vector-based polygon coverage, while the USGS data is a raster-based grid data format, consisting of cells that measure 30x30 meters). Table 3-7 lists wetland acreage by wetland type.

Table 3-7: Wetland Acreage by Type (National Wetland Inventory)

Wetland Type	Acres
Estuarine	120,013
Lacustrine (lakes, reservoirs)	5,263
Riverine	6,742
Palustrine	
Emergent	30,498
Forested	179,788
Scrub/Shrub	20,482
Other	4,003
Total	**366,790**

Pond Cypress Wetland near Honey Hill (photo by L.L. Gaddy)

3.2.7 Recreation Resources

The Francis Marion National Forest (FMNF) occupies a large portion of the study area and provides a wide range of recreational opportunities, both dispersed and developed. There are approximately 160 miles of trails for hiking, canoeing, horseback riding, bicycling and all-terrain vehicle (ATV) riding. Recreational facilities include boat ramps, horse camps, campgrounds, target shooting ranges, and canoe access areas. The public can also use the Forest for hunting, fishing, bird watching, or simply enjoying nature. The Sewee Environmental Education and Visitor Center is a joint venture between the Cape Romain National Wildlife Refuge (NWR) and the FMNF, and provides interpretive and environmental education programs.

Wildlife Management Areas (WMAs) managed by the South Carolina Department of Natural Resources (SCDNR) are also available for public recreational use, providing opportunities for hunting, camping, and wildlife viewing. WMAs in the study area include Santee Delta, Santee Coastal Reserve, Wee Tee, and Bonneau Ferry. Wildlife heritage preserves managed by SCDNR located in the study area include Tom Yawkey Wildlife Heritage Center Preserve, Childsbury Heritage Preserve, and Caper’s Island Heritage Preserve. Additionally, the Hampton Plantation State Park is located in the western region of the study area, near the U.S. Highway 17 crossing of the Santee River Delta.

The Santee River itself is a popular local recreational recourse, which provides fishing, canoeing, and waterfowl hunting opportunities.

3.2.8 Cultural Resources

The Native American presence in the study area began about 12,000 years ago, as evidenced by prehistoric archaeological sites ranging from approximately 10,000 BC-1550 AD. Additionally, the study area is rich in history with preserved coastal plantation properties dating back to the 18th century and numerous historical sites related to early colonization. Many of these prehistoric and historic sites are listed on the National Register of Historic Places (NRHP) and include prehistoric hunter-gather camps and village complexes, and historic buildings, structures, and archaeological sites. Archaeologists typically encounter these prehistoric and historic archaeological sites in areas of springs, river and stream terraces, environmental transition zones, and ridgetops with moderately well drained to well drained soils within 60 meters of a permanent water source.

3.2.9 Federal and State Lands

Table 3-8 lists Federal and State lands in the analysis area with their acreage and percent of analysis area. The Francis Marion National Forest (FMNF) is managed by the U.S. Forest Service (USFS) and serves many uses, including timber production, watershed protection and improvement, habitat for wildlife and fish species (including threatened and endangered species), wilderness area management, minerals leasing, and outdoor recreation (USFS, 2004). Almost the entire Forest (approximately 90 percent) is located within the boundaries of the analysis area.

Cape Romain National Wildlife Refuge (NWR), managed by the US Fish and Wildlife Service (USFWS), is located within the analysis area, in northeast Charleston County. Part of the Carolinian-South Atlantic Biosphere Reserve, the 64,229-acre Cape Romain NWR extends for 20 miles along the Atlantic Coast. It consists of 34,229 acres of beach and sand dunes, salt marsh, maritime forests, tidal creeks, fresh and brackish water impoundments, and 30,000 acres of open water. Headquarters for the NWR are located on seven acres of permitted lands within the FMNF (USFWS, No date).

Table 3-8: State and Federal Land Ownership in the Study Area

Management Area	Managing Agency	Acreage in Analysis Area	% Of Analysis Area
Francis Marion National Forest	USFS	235,731	36.50%
Cape Romain NWR	USFWS	29,954	4.60%
Santee River Delta WMA	SCDNR	1,524	0.20%
Santee Coastal Reserve WMA	SCDNR	25,564	4%
Wee Tee WMA	SCDNR	200	0.03%
Bonneau Ferry WMA	SCDNR	10,439	1.60%
Tom Yawkey Preserve	SCDNR	15,842	2.50%
Childsbury Preserve	SCDNR	99	0.01%
Caper's Island Preserve	SCDNR	2,178	0.30%
Hampton Plantation State Park	SCDPRT	292	0.04%
Sources: SCDNR, 2008; USFS, 2004; GIS Data			

Additionally, four federally designated wilderness areas, Hell Hole Bay, Little Wambaw Swamp, Wambaw Creek, and Wambaw Swamp, and approximately 11,450 acres of designated wilderness linkages (Management Area 29) that connect the wilderness areas, are located on the Francis Marion National Forest. About 28,000 acres of the Cape Romain NWR are preserved within the National Wilderness Preservation System. Table 3-9 presents their acreage within the analysis area.

Table 3-9: Wilderness Areas in the Study Area

Wilderness	**Acres**
Hellhole Bay	2,125
Little Wambaw Swamp	5,047
Wambaw Creek	1,825
Wambaw Swamp	4,815
Cape Romain NWR Wilderness	28,000
Wilderness Linkages (MA 29)	11,446
Total	**53,258**
Sources: USFS, 1996	

3.2.10 Sensitive Wildlife Resources

The FMNF provides habitat (see text box) for one of the largest populations of the Federal-listed endangered red-cockaded woodpecker (RCW) in the United States. Poorly drained areas, such as swamps, floodplains, upland flats and coastal marshes provide wintering and breeding habitat for many species of waterfowl, osprey, and wading birds. These areas also provide foraging and nesting habitats for the bald eagle *(Haliaeetus leucocephalus)* and support viable populations of many amphibians, such as the federally threatened flatwoods salamander *(Ambystoma cingulatum)*, which has federally designated critical habitat on the Forest. Also found in this area is the northernmost established nesting population of the American swallow-tailed kite *(Elanoides forficatus).*

Since 1971, most of the FMNF has been cooperatively managed as the Francis Marion WMA (USFS, 1996). The Forest offers the largest and most consolidated area available for public hunting in the State. Wild turkeys *(Meleagris gallopavo)* found on the Forest are considered the purest strain of eastern wild turkey found in the United States. The FMNF provides many of the wild turkeys used for restocking other areas.

RCW HABITAT: The red-cockaded woodpecker makes its home in mature pine forests. Longleaf pines (Pinus palustris) are most commonly preferred, but other species of southern pine are also acceptable. While other woodpeckers bore out cavities in dead trees where the wood is rotten and soft, the red-cockaded woodpecker is the only one which excavates cavities exclusively in living pine trees. Cavities are excavated in mature pines, generally over 80 years old. The older pines favored by the red-cockaded woodpecker often suffer from a fungus called red heart disease which attacks the center of the trunk, causing the inner wood, the heartwood, to become soft. Cavity excavation takes one to six years. The aggregate of cavity trees is called a cluster and may include 1 to 20 or more cavity trees on 3 to 60 acres. The average cluster is about 10 acres. Cavity trees that are being actively used have numerous, small resin wells which exude sap. The birds keep the sap flowing apparently as a cavity defense mechanism against rat snakes and possibly other predators. The typical territory for a group ranges from about 125 to 200 acres, but observers have reported territories running from a low of around 60 acres, to an upper extreme of more than 600 acres. The size of a particular territory is related to both habitat suitability and population density. (Source: USFWS Red Cockaded Woodpecker Recovery at

Red-cockaded Woodpecker Nest Tree (Photo T. Gaul)

The Santee River traverses the northern half of the study area, and has one of the largest deltas on the Atlantic Coast. The Santee River Delta includes many acres of wetlands, from forested swamps, to grassy meadows, and tidal marshes. It harbors numerous species of birds, including waterfowl, migratory birds, and some sensitive species (e.g., bald eagles, wood storks, and swallow-tailed kites). Other sensitive species inhabiting the Delta include the federally endangered short nosed sturgeon (*Acipenser brevirostrum*) and federally threatened flatwoods salamander.

Cape Romain NWR habitat is barrier island/salt marsh, which consists of 34,229 acres of beach and sand dunes, salt marsh, maritime forests, tidal creeks, fresh and brackish water impoundments, and 30,000 acres of open water. The refuge provides habitat for over 337 species of birds, including waterfowl, shore birds, wading birds, and raptors. Cape Romain NWR boasts the largest nesting rookery for brown pelicans, terns, and gulls on the coast of South Carolina, as well as the largest nesting population of the federally threatened loggerhead sea turtle (*Caretta caretta*) outside the State of Florida. In addition, the NWR plays an integral role in the recovery of the federally endangered red wolf (*Canis rufus*) (USFWS, No date).

4.0 Suitability Analysis

The GIS modeling analytical methodology described here was initially based on the method used in the Georgia Transmission Corporation alternatives evaluation and power transmission study (GTC, 2001) and refined through application of the methods of Berry's *Map Analysis* (www.innovativegis.com/basis/). The resources to which this methodology were applied in the McClellanville study area and the rankings of sensitive resource risk and opportunity factors were reviewed extensively by RUS and the Forest Service as they were first identified and later refined. The methods, resources, and rankings were then subject to review and revision based on the public and agency scoping conducted by RUS in 2005 and through further agency review and refinements described here. Factors such as the parcel layer used for identifying developed and developable areas were included in the modeling analysis as a direct result of public input.

4.1 Suitability Maps

Planning and routing a transmission line requires consideration of how the line might affect a wide range of environmental, social, and cultural resources, as well as economic factors. These resources are commonly addressed during the planning of a transmission line by correlating the likelihood of impacts on the resources with specific locations on a set of maps. These maps, referred to as 'suitability maps', associate geo-referenced features, land cover types, or land uses with the likelihood of potential impacts from the proposed project – in this case, the construction and operation of a 115 kV transmission line to supply power to McClellanville.

Creating a suitability map begins with identifying study area resources that would likely be affected by transmission line construction, maintenance, and operation. Forested wetlands, for instance, may be affected by vegetation removal, resulting in modification of wetland structure, alteration of species composition, and disturbance to resident species. In many cases, impacts may affect multiple resources at the same location. For example, if an area is occupied by both a wetland and a recreational trail, there may be effects from construction on both the wetland community and the recreational value of the trail throughout the area.

In addition to identifying locations and areas of constraint where there is a greater risk of adverse effects, a suitability map also identifies areas of opportunity – that is, areas where activities of the proposed project would be more consistent with the current land use, the overall impacts of line construction are likely to be minimal, and the operation and management of the line would be more efficient. By identifying areas that are an opportunity for transmission line construction, other factors commonly considered, such as line accessibility, can be brought into the planning process. For example, constructing a transmission line adjacent to an existing road right of way may be anticipated to have reduced additional environmental impacts, and would allow for easy access and the use of existing management and maintenance strategies. In short, the study identified areas of constraint where risks or adverse impacts to valued resources were high and areas of opportunity where risks to resources were relatively low.

4.2 Rating Suitability Constraints and Opportunities

This study relied extensively on the use of Geographic Information Systems (GIS) data, analysis, and modeling techniques to identify possible transmission line corridors for the McClellanville project. GIS technology links information to its location (such as people to addresses, buildings to parcels, or streams to drainage networks) in a computer environment where it can be viewed, combined, and analyzed to identify relationships from a geographic perspective. Using this technology, a wide range of siting criteria were spatially integrated and used to compile a comprehensive suitability map that took into account multiple planning factors.

A wide range of GIS data sources were collected for the purposes of this analysis. Some data sources were used directly to identify areas of potential impact risk, whereas some were used only after modification or additional analysis steps. For the purposes of this report, once compiled and prepared for use in creation of the suitability map, data layers identifying the location and spatial extent of a specific transmission line siting factor (i.e., wetlands, road rights of way, sensitive species locations, etc.) were referred to as 'resource suitability layers'. The resource suitability layers, their sources and preparation are described in Sec. 4.3, 4.4, and 4.5.

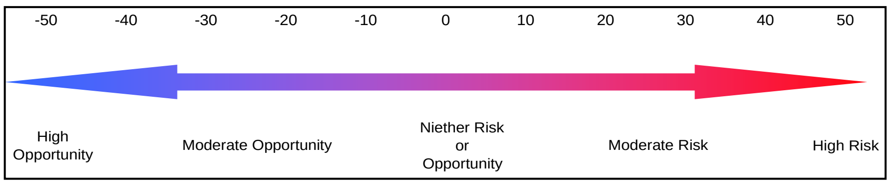
Once a resource suitability layer was compiled, its features were rated with a numeric suitability score that characterized the level of constraint (i.e., those areas that the transmission line should avoid) or opportunity (i.e., those areas that are most appropriate for a transmission line) that it provided for planning the transmission line route. The rating system used was designed to protect the most sensitive parts of the study area by identifying areas of potential impact risk, while highlighting areas best suited for construction of the transmission line, i.e. areas of opportunity.

Areas within each individual resource suitability layer were assigned *positive* numeric values, between +1 and +50, if constructing a transmission line within that area could result in increased risk of potential impacts to that layer's resource. For example, within the threatened and endangered species resource suitability layer (Section 4.4.3), areas within a 200 foot to 1/2 mile management zone buffer zone of a known red cockaded woodpecker colony were assigned a suitability factor of +50. This risk rating reflects the high likelihood of impacts associated with locating a transmission line within the management zone of a red-cockaded woodpecker colony.

In contrast, areas within a resource suitability layer were assigned *negative* numeric values, between -1 and -50, if constructing a transmission line within that area would be considered an appropriate use of that area resource, or more specifically, an opportunity for siting the proposed transmission line. For example, areas immediately adjacent to an existing transmission line corridor were assigned a suitability rating of -50 to identify these areas as a potential opportunity for planning the proposed transmission line corridor.

Areas within a given resource suitability layer that had no sensitive features were assigned a suitability value of zero. A rating of zero indicated that, for that specific resource, no sensitive features were identified in that area. For example, areas of upland in the wetland resource data layer, were attributed a value of zero because no impacts to wetlands would be anticipated in these areas. Although other impacts may occur in upland areas, these areas would be identified, and accounted for in other resource suitability layers, such as in the threatened and endangered species habitat resource layer.

Lastly, certain features within the study area were excluded from consideration for transmission line routing, and were removed from the transmission line path analysis and least-risk corridor delineation. These areas were excluded because of either regulatory restrictions or because adverse impacts associated with locating a transmission line through them would result in likely and potentially significant impacts on area resources. The following graphic summarizes the rating system. A list of the ratings for each layer is summarized in Table 4.1.



4.3 Exclusionary Resource Suitability Layers

The following data layers were used to identify areas that are considered unsuitable for transmission line construction. These areas were excluded from consideration for modeling potential transmission line paths and corridors. Brief descriptions of their origin and any additional modifications are provided below. A simplified graphic displaying the distribution and extent of the resource within the study area is provided for each description.

4.3.1 Historic/Archaeological Districts - *Excluded*

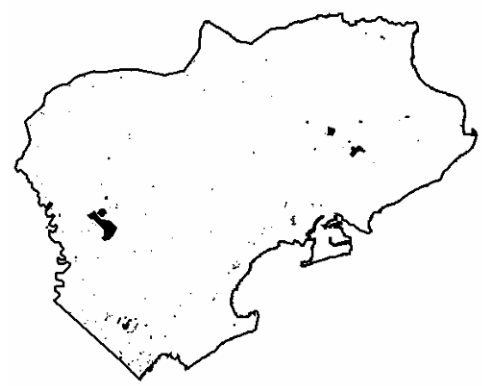
All areas within the boundaries of designated Historic or Archaeological Districts were excluded from consideration for transmission line corridor planning. Transmission line siting in these areas has a high potential to adversely impact cultural resources and/or the historic character being preserved in these areas.

Historic/Archeological District boundaries were obtained from Mr. Chad Long of the South Carolina Department of Archives and History (SCDAH) in Columbia, SC by Brockington and Associates, Inc. in January, 2005

Table 4-1: Summary of Suitability Ratings

Suitability Layers	Rating
Historic /Archeological Districts	Excluded
Known Cultural Sites (Listed or Eligible for Listing on the NRHP)	Excluded
Airports	Excluded
Wilderness Areas	Excluded
Wilderness Linkages (MA 29)	Excluded
Francis Marion National Forest	+25
State Wildlife Management Areas/Preserves	+25
Areas of High Probability of a Cultural Site	+25
Known Cultural Sites (Potentially Eligible for Listing on the NRHP)	+25
Conservation Easements	+25
Threatened, Endangered, and Sensitive Species	
RCW Colony (200 ft Buffer)	Excluded
RCW Management Area (200ft- 1/2 mi)	+50
Flatwoods Salamander (1/4 mile Buffer)	Excluded
Flatwoods Salamander Critical Habitat	Excluded
Potential Flatwoods Salamander Habitat	+25
Bald eagle Primary Management Area (0-660 ft)	Excluded
Other State Listed Species (200 ft Buffer)	+50
Francis Marion National Forest Botanical Habitat	+25
Recreation	
Recreation Areas and Trails (with 300 ft Buffer)	+50
North and South Santee Rivers	+25
Wetlands	
Palustrine Forested, Lacustrine, and Estuarine	+50
Palustrine Emergent and Riverine	+30
Palustrine scrub shrub	+15
Migratory Bird Area	+25
Vistas	
Cultural Site Foreground (0-300ft)	+50
Delta Foreground (0-300ft)	+50
Delta Midground (300ft-1/2 mi)	+30
Delta Background (Beyond 1/2 mile)	+15
Existing Transmission ROWs	-50
Road ROWs	
Major, Minor and Local Road "buildable areas"	-25
Major and Minor Road central "non-buildable areas"	+50
Structures (with 300 ft Buffer)	+50
Parcels	
< .25 Acres	+50
.26 - .75 Acres	+40
.76 -1.5 Acres	+30
1.6 – 3 Acres	+20
3.1 – 6 Acres	+10

4.3.2 Known Cultural Sites (Listed or Eligible for the NRHP) - *Excluded*

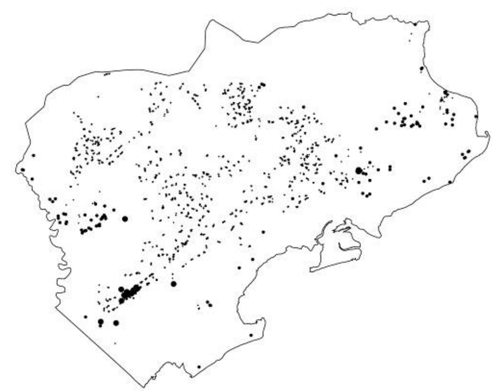


Areas in which transmission line construction could potentially impact known cultural sites were excluded from consideration for transmission line corridor planning. For this analysis, linear architectural features (historic roads or trails) and architectural structure sites (point locations) were buffered by 300 feet. All areas within these buffers were given exclusionary status. Cemeteries, archeological locations, and architectural property boundaries were also excluded.

Cultural sites identified in this data layer included sites listed on the National Register of Historic Places (NRHP) and sites on the Determination of Eligibility (DOE) list that were designated as eligible, potentially eligible, or those that have not yet been assessed for eligibility. Only sites designated as listed or eligible for the NRHP were included in this layer. Sites that were not eligible for the NRHP were not included, and were not excluded from consideration or otherwise considered for planning purposes. Potentially eligible sites are discussed in Section 4.4.1.

Literature was reviewed and data acquired on historic and archeological sites by Brockington and Associates, Inc. in 2005. Known site locations and their eligibility were obtained from the South Carolina Institute of Archaeology and Anthropology (SCIAA) and the SCDAH in Columbia, SC. Information concerning all currently digitized above-ground resources housed at the SCDAH was provided by Mr. Chad Long, SCDAH GIS Coordinator. This information included all above-ground resources including their eligibility recorded after 1989, all cultural resources studies conducted since 1989, and all archaeological sites and structures listed on the NRHP. All other recorded archaeological sites not on the NRHP were digitized from locations hand drawn on USGS topographic maps stored at the SCIAA. Eligibility status for digitized sites was obtained from DOE lists maintained by the SCDAH and the USFS-Witherbee Ranger District, as well as individual site forms and reports at the SCIAA for sites not included in the SCDAH's DOE list. Approximately 640 site forms were reviewed at the SCIAA.

4.3.3 Known Threatened and Endangered Species Locations - *Excluded*

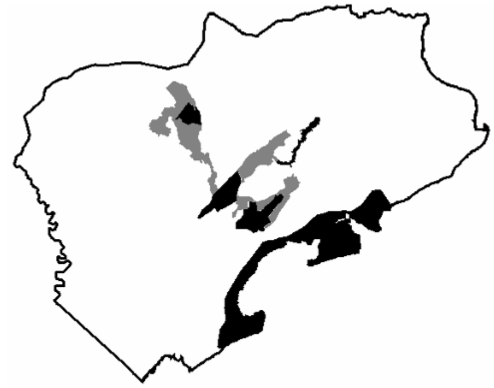


Threatened and endangered species locations for federally listed species were provided by the South Carolina State Natural Heritage Office and the USFS. On National Forest lands, the most recent locations (2008) for red cockaded woodpecker (*Picoides borealis*) colonies were also identified and mapped. All red cockaded woodpecker colonies were buffered by 200 feet and given exclusionary status.

Locations of known bald eagle (*Haliaeetus leucocephalus)* nest trees were buffered by 660 feet to protect the eagle's primary management zone (PMZ). Due to the risk of eagles abandoning nests if tree cutting were to occur with in the PMZ, the PMZ was given exclusionary status (USFWS, 2005). While the bald eagle has been "delisted" under the Endangered Species Act, it is still conferred special status by the Bald Eagle Protection Act of 1940, as amended.

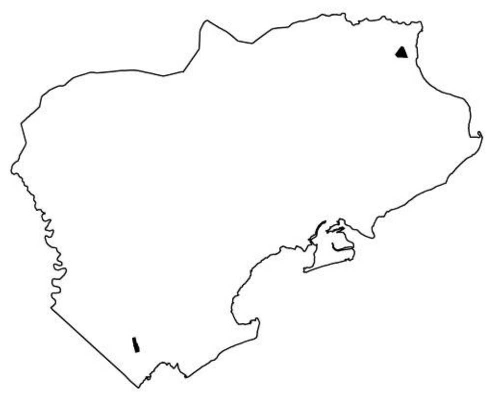
All known flatwoods salamander (*Ambystoma cingulatum)* breeding ponds and a ¼ mile surrounding them were excluded because it is a critically imperiled species in South Carolina. Two areas in the study area designated as critical habitat by the USFWS for flatwoods salamander were also excluded.

4.3.4 Wilderness Areas and Linkages – *Excluded*



Four areas on the FMNF have been designated by federal statute as wilderness areas (i.e., included in the National Wilderness Preservation System): Hellhole Bay, Wambaw Swamp, Wambaw Creek, and Little Wambaw Swamp. In addition, 28,000 acres of the Cape Romain NWR are under wilderness area protection. These areas were removed from consideration for transmission line construction in this analysis. Any proposed transmission line development within a designated wilderness area requires Presidential and Congressional approval.

Forest Service Management Area (MA) 29 provides wilderness linkages between existing Wilderness Areas. The FMNF *Land and Resource Management Plan* emphasizes the minimization of breaks in the forest canopy, road constriction and limits issuance of special use permits. For this reason, MA 29 was excluded except for existing openings, such as existing roads and ROWs.



4.3.5 Airports – *Excluded*

Two regional airports located within the study area, the Georgetown County Airport and the Mount Pleasant Regional Airport, were excluded in the analysis.

4.4 Risk Resource Suitability Layers

The following data layers were used to identify areas where there would be a risk of adverse impacts from transmission line construction and operation, i.e. areas of low suitability for transmission line planning. Brief descriptions of the origin of these data layers and their preparation are provided below.

4.4.1 Known Cultural Sites (Potentially Eligible for the NRHP) - *Risk*

Cultural sites that have been designated as potentially eligible for the NRHP are included as a conservative measure and given a rating of +25. Sites that were not eligible for the NRHP were not included, and were not otherwise considered for planning purposes.

Literature review and data acquisition for historic and archeological site locations was conducted in January, 2005. Known site locations and their eligibility were obtained from the South Carolina State Historic Preservation Officer (SHPO).

4.4.2 Areas of High Probability of a Cultural Site – *Risk*

In addition to excluding areas with known cultural site locations, areas with a high potential for containing as yet unidentified cultural sites were used in the analysis. Construction of a transmission line within these areas would represent a potential risk to as yet unidentified cultural resources. Therefore, these areas were assigned a risk rating of +25.

In 2000 a Memorandum of Understanding (MOU) between the Forest Service, the Advisory Council on Historic Preservation, and the SC Department of Archives and History, regarding the Management of Heritage Resources on the Francis Marion and Sumter National Forests, was developed to comply with the terms of the 1992 Programmatic Agreement (PA) concerning the management of historic properties on national forest lands in the southern region between the Forest Service, the Council, and several State SHPOs from the southern region, including South Carolina.

A section of this document contains criteria for an archaeological probability model which predicts the potential for an area to contain cultural resource sites (prehistoric and historic). This model contains separate criteria for each of the different physiographic regions: mountains and foothills, piedmont, and coastal plain. The coastal plain model, used for this project, defines areas of high probability as ones that consist of springs, river and stream terraces, environmental transition zones and ridgetops with moderately well drained to well drained soils within 60 meters of a permanent water source. Areas of medium probability are ones that generally include locations situated on well-drained soils, but a distance greater than 60 meters from a permanent or intermittent water source and as areas having soils with moderately poor drainage characteristics adjacent to permanent water sources. Areas of low site probability consist of low-lying swampy areas with a soil drainage characteristic of poor to very poorly drained.

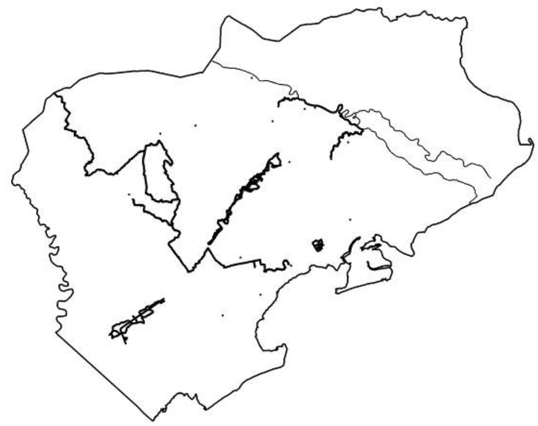
The model that was created for this project was based upon this coastal plain model. Below is a list of the exact criteria used to create the high probability areas:

- Areas at a distance of 0 to 160 meters from the interface of moderate to well drained soils
- Areas of somewhat poorly drained to well drained soils within 160 meters of permanent water sources
- Areas within 70 meters of small ponds or bays

- Areas of moderate to well drained soils within 70 meters of current of abandoned roads
-

Since the results of this model were only one factor in the identifying routing alternatives, only areas of high probability were identified. The model was not created to determine what levels of effort are necessary when survey work begins, but to aid in locating least invasive routes.

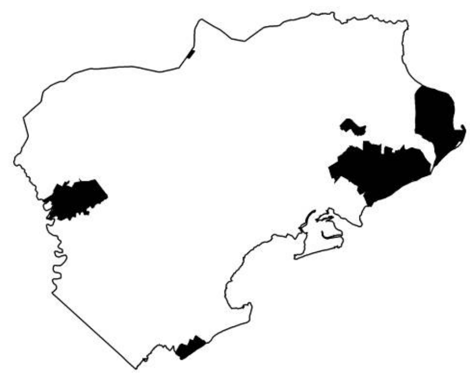
4.4.3 Conservation Easements - *Risk*



Construction of a transmission line through a conservation easement may be contrary to the intent of the conservation easement. Although this is not always the case, depending on the language set forth in the conservation easement agreement, a risk rating of +25 was assigned to all easement locations in this analysis as a conservative measure.

Boundaries for all conservation easements in the study area were obtained from the South Carolina chapters of The Nature Conservancy and the Lowcountry Open Land Trust, as well as tax parcel data provided by Charleston, Berkeley, and Georgetown Counties.

4.4.4 Outdoor Recreation - *Risk*



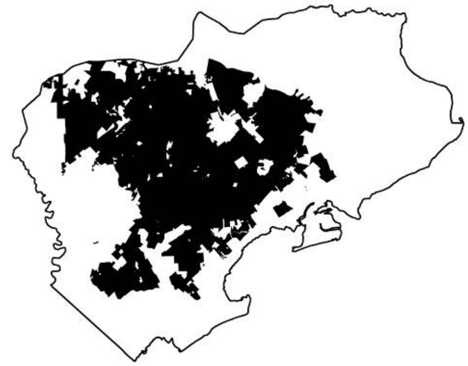
Construction of a transmission line within or adjacent to a developed recreation area on the FMNF may impact the recreational use and value of the site. For this reason, areas within 300 feet of developed recreation sites and trails were assigned a risk rating of +50.

Location information for developed recreation areas was provided by the USFS. A total of 23 developed recreation sites were identified within the study area and approximately 155 miles of designated trails. The North and South Santee rivers are used locally for boating, fishing, and waterfowl hunting therefore, the rivers were included in the recreation layer with a risk rating of +25.

4.4.5 State Wildlife Management Areas/Preserves– *Risk*

The South Carolina Department of Natural Resources (SCDNR) owns and manages several wildlife management areas and natural heritage preserves in the study area, including the Santee Delta WMA and the Santee Coastal Reserve. These areas were rated +25 due to their unique character and state status.

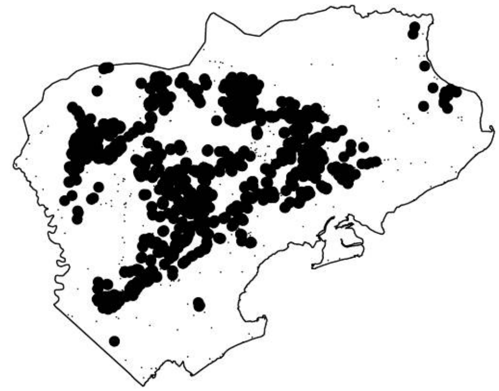
4.4.6 Francis Marion National Forest Ownership - *Risk*



Because of the Francis Marion National Forest's status as an important recreational and ecological resource, the 235,731 acres of land owned by the U.S. Forest Service within the analysis area were included as a resource suitability layer and given a rating of +25.

4.4.7 Threatened, Endangered, and Sensitive Species Habitat Buffers - *Risk*

Threatened and endangered species locations for both state and federally listed species were provided by the South Carolina State Natural Heritage Office and the USFS. All state listed species were buffered by 200 ft and given a rating of +50.



On National Forest lands, locations of Regional Forest Sensitive Species (RFSS) and the most recent locations (2008) for red cockaded woodpecker colonies were also identified and mapped. In addition to the 200 ft exclusion area for each red cockaded woodpecker colony, a buffer of ½ mile was added to locations and the zone between 200 feet and ½ mile of the colony site was assigned a risk rating of +50. This ½ mile zone is an approximation of the normal foraging range of the red cockaded woodpecker, within which, special restrictions are in place for operations requiring tree removals (USFWS, 2003).

Because of the dated nature of the locations used in the flatwoods salamander exclusion (most date to the 1950's), locations identified as potential habitat for the species were given a risk rating of +25. Some of these areas were identified during a survey for the presence of threatened and endangered species on private lands in proximity to the least-risk corridor alignments, while others were identified as habitat with similar characteristics to those found during the survey.

A final layer that was added to the analysis in relation to threatened, endangered, and sensitive species was a botanical habitat layer for the maintained by the Francis Marion National Forest. This layer identifies habitat that may potentially harbor special status plants and vegetation, such as Canby's dropwort *(Oxypolis canbyi)*, and was given a risk rating of +25.

4.4.8 Wetlands - *Risk*

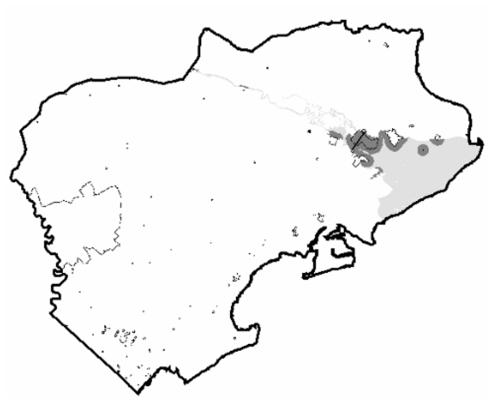
Construction of a transmission line within a wetland area may result in alterations to the structural character and vegetative composition of the wetland, and may disturb resident species and their habitats. For this reason, wetland areas identified in the National Wetlands Inventory, as well as the USFS, were assigned a risk rating.

Since different types of wetlands would likely be affected by transmission line construction in different ways and to different degrees, risk ratings varied by wetland type. Forested, lacustrine, and estuarine wetlands were all given risk ratings of +50. Forested wetlands were given this risk rating because clearing the forest canopy to construct a right of way would result in the conversion of these areas from a forested wetland type to a scrub shrub wetland type. Lacustrine wetlands (consisting of larger open water wetlands, such as lakes or reservoirs) were given a risk rating of +50 because construction of a transmission line through these wetlands may require poles at one or more points in the lake or reservoir, resulting in lake bed disturbance and alterations in the visual character of the site. Estuarine wetlands were rated as +50, due to the importance of these wetlands in the area for nesting waterfowl and migratory birds. Emergent and riverine wetlands in the analysis area were both assigned a risk rating of +30. The lower rating assigned to these wetlands is due to the fact that, for the majority of these wetlands, the transmission line could be constructed to span the wetland without pole construction within the wetland boundary. For larger riverine and emergent wetlands, however, impacts on sediments, vegetation, and aquatic biota may be observed. Lastly, palustrine scrub shrub wetlands were given a risk rating of +15. This rating was assigned due to the anticipation that the majority of these wetlands, typically smaller in size in the study area, would be able to be spanned by transmission line construction with little or no vegetation disturbance required.

4.4.9 Santee River Migratory Bird Area – *Risk*

The Santee River Delta has been identified as a critical area for migratory birds, particularly large concentrations of over wintering waterfowl. Construction of a transmission line within this area may impact migratory species that utilize wetland habitats in this area. For this reason, areas within the southern portion of the Santee River Delta were assigned a risk rating of +25.

The extent of the area of concern for migratory bird habitat was identified for the purposes of this modeling effort as the lower portion of the delta, which is dominated by herbaceous, riverine, and estuarine wetland types. With further progression northwest along the Santee River, forested wetlands become the dominant wetland cover type.



4.4.10 Scenic Vistas and Cultural Landscapes– *Risk*

The Santee River crossing, Santee-Delta WMA, and listed or eligible cultural sites are considered scenic resources. Construction of a transmission line through these areas may obstruct or degrade the quality of the scenic vista or cultural landscape, so risk ratings were assigned to the foreground, midground, and background views for these resources. Areas in the immediate foreground (within 300 feet) were assigned a risk rating of +50. Areas in the midground (from 300 ft to ½ mile) for the Santee-Delta WMA, Santee River crossing, and cultural sites along the delta were assigned a risk rating of +30, and areas in the background, (beyond ½ mile), were assigned a risk rating of +15. The dimensions of the scenic vistas were determined from aerial imagery interpretation of the Santee River and GIS analysis measures (buffers).

4.4.11 Road Travel Lanes and Medians - *Risk*

Transmission lines can be constructed along existing roads allowing for overlap between the two rights of way; however constructing the line within the road bed or between the traffic lanes of a divided highway is considered a risk. To account for the risk, the central "non-buildable" portions of major and minor roads were assigned a risk rating of +50. Local roads were not assigned this risk rating. The "buildable" sections of a road are discussed in Section 4.5.1

4.4.12 Structures and Developable Parcels – *Risk*

To minimize the risk of impact to residents and to other developed land uses, existing structure locations were identified, buffered by 300 feet, and assigned a risk rating of +50. The structure location data was a composite of information provided by Charleston and Georgetown counties and manually digitized locations from aerial imagery (Photo year 2007) for the rest of the study area. Aerial images were used to verify and revise structure locations in data provided by Georgetown County.
In addition, parcel boundaries provided by Charleston, Georgetown, and Berkeley Counties were used as an analysis layer to account for multi-structure developed and developable areas (housing subdivisions, clustered rural homes, concentrated business clusters) where the construction of a transmission line would be less suitable. To achieve this, parcel boundaries were given a descending rating scheme (see Table 4-1) so that the smallest and most closely grouped parcels were given the highest risk rating. Note, that this layer adds to the risk noted above where one or more structures occupy a parcel.

4.5 Opportunity Resource Suitability Layers

The following data layers were used to identify areas within which transmission line construction would have a reduced likelihood of additional impacts. Brief descriptions of the origin of these data layers, their preparation for use in the model, and rationale for inclusion are provided below.

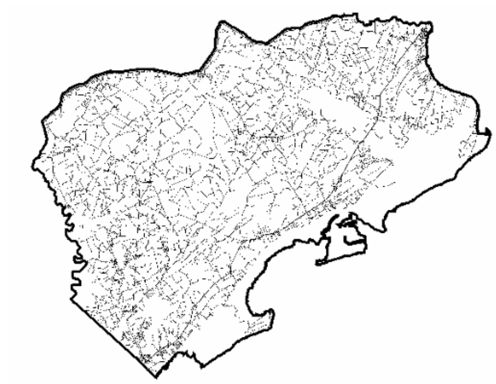
4.5.1 Existing Transmission ROWs - *Opportunity*

Construction of a transmission line immediately adjacent to an existing transmission line right of way avoids or limits: the level of additional forest clearing necessary, new forest fragmentation effects, the creation of edge habitat, and conversion of areas to new land uses (i.e., to a utility corridor). For these reasons, areas immediately adjacent to an existing major transmission line corridor were assigned a suitability rating of -50.

Transmission line ROW information was obtained from the Census Bureau's TIGER database, and improved by correlation with satellite imagery (photo year 2007). Only the ROWs available from the TIGER database or immediately identifiable from satellite imagery sources were included. As a result, many smaller corridors were not included in this data layer.

Transmission line location data were available only as linear feature data, and therefore only identified the centerline of the right of way and not its width. To account for the corridor width, all linear features were buffered by 75 feet to account for an estimated 150 foot width of the right of way[1]. The resultant 150 foot right of way was buffered again by 70 feet on each side (for a total corridor width of 290 feet) to identify areas immediately adjacent to the right of way which could potentially be used to widen the existing right of ways to accommodate the additional proposed transmission line.

4.5.2 Road Rights-of-Way - *Opportunity*



Transmission lines can be constructed along existing roads allowing for overlap between the two rights of way. Construction of a transmission line within or immediately adjacent to an existing road right of way reduces the amount of forest clearing necessary for corridor construction, limits increases in forest fragmentation and in creation of edge habitat, reduces the overall amount of land converted to a new land use (i.e., to a utility corridor), and allows for ease and efficiency when accessing the line for maintenance or repairs. For the above reasons, road rights of way were assigned an opportunity rating of -25.

[1] The 150-foot width is an approximation derived from aerial imagery assessment of the majority of identifiable corridors in the study area.

Road locations were obtained from the Census Bureau's TIGER line database. Census Feature Class Code's (CFCC) for each road in the database provided a means to roughly identify major, minor, and local roads and approximate the width of the road's right of way. Major roads, such as Highway 17, were buffered by 75 feet to account for a an estimated 150 foot right of way, minor roads, such as State Route 46, were buffered by 25 feet to account for an estimated 50 foot right of way, and local roads were buffered by 15 feet to account for an estimated 30 foot right of way. All of the road rights of way were then buffered again by 70 feet to account for the potential for constructing the proposed transmission line adjacent to, and overlapping with, the existing road ROW. Together, these buffers resulted in 290 foot, 190 foot, and 170 foot buffer zones for major, minor, and local roads (respectively) in the study area.

4.6 Data Revisions

Because of the time that has elapsed since the publication of the first macro-corridor report for this project in 2005, all data sources listed in the previous sections were reviewed for currency before the current report was compiled. In some cases, changes had occurred since 2005 and the data used in the modeling process were subsequently updated. In other cases, new data layers were added to the modeling process to account for agency concerns or comments heard at the first scoping meeting held in McClellanville in 2005. The following sections list some of the most pertinent changes.

Structures

The location of structures for the initial Macro-Corridor study report was primarily determined from the use of aerial photography of the study area. However, because the flight dates of these images were 1994 and 1999, the locations of structures needed to be updated utilizing more recent aerial photographs (2007). As with the tax parcel layers, changes between the two structure datasets primarily arose from new residential developments. In the initial macro-corridor study, 18,826 structures were identified. That number has increased 9.6% to 20,645.

Tax Parcels

In 2008, updated tax parcel information was acquired from Charleston, Berkeley, and Georgetown counties. The primary difference between the old and new data is that a number of previously large tax parcels in highly developed areas such as Mount Pleasant and Charleston had been subdivided into smaller lots for residential development, indicating the trend for continued growth. Including parcels owned by the U.S. Forest Service, in 2005 there were 28,720 individual parcels in the analysis area; based on the revised tax parcel data received from the counties, there are now 31,105 (an 8.5% increase).

Further, the addition of tax parcels as a risk resource layer in the modeling process is a new development since the first macro-corridor study report was published. In response to comments received during the 2005 McClellanville project scoping, it was decided that in addition to having a risk resource layer representing structures in the analysis, the boundaries of tax parcels would be included in the analysis in an effort to give greater protection to areas of high residential development. This was done because as parcels become smaller and density increases, there is less distance between the proposed transmission line and structures. To address this issue, all parcels below 6 acres in size were extracted from the parcel dataset and given a descending risk rating value by size, so that the smallest and most densely grouped parcels received the highest risk rating value (see Table 4-1). Parcels larger than 6 acres were not included in this risk resource layer (though any structures on those parcels would appear and be protected in the structures layer). Calculations showed that over 80 percent of identified structures were within parcels less than 6 acres. After the parcel boundaries less than 6 acres were selected, these data were then merged with the 300 foot buffers of identified structures to create a single risk resource layer representing human development.

Conservation Easements

Comments were received in 2005 from The Nature Conservancy and Low Country Open Land Trust concerning protection of conservation easements. Representatives of these organizations were contacted in 2008 and asked to provide updated data on locations of conservation easements. The first macro-corridor study identified 38 square miles of lands in conservation easements; this figure has increased to 80 square miles in the current analysis.

State Wildlife Management Areas and Preserves

In the first macro-corridor study, public lands owned by the state of South Carolina included the Santee Delta Wildlife Management Area and Hampton Plantation State Park. However, there are several other pieces of land managed by South Carolina DNR in the study area. These lands were added to the current analysis phase, and include Wee Tee WMA, Bonneau Ferry WMA, Childsbury Heritage Preserve, Caper’s Island Heritage Preserve, Tom Yawkey Wildlife Heritage Center and Preserve, and Santee Coastal Reserve. The boundary of Bonneau Ferry actually was included in the previous analysis as a conservation easement, but was re-categorized as state-owned land in the current analysis because the state retains the title to the land.

Francis Marion National Forest

Francis Marion National Forest lands were added as a risk resource layer with a risk rating of +25 to account for USFS concerns that the entirety of the National Forest should be treated in the same capacity of other environmental lands such as state wildlife management areas and conservation easements.

Threatened, Endangered, and Sensitive Species

Modeling for the first Macro-corridor study report had used the cluster centers (a central point defined by the surrounding RCW cavity trees) for red-cockaded woodpecker locations rather than the locations of individual cavity trees because the latter information was not available at the time. However, the USFS recently created a layer of known red-cockaded woodpecker cavity tree locations on the FMNF. Therefore, modeling efforts for the current report included both the cluster centers and the cavity tree data, to give maximum protection to known red-cockaded woodpecker locations throughout the forest.

In February of 2007, the U.S. Fish and Wildlife Service designated two areas within the macro-corridor study area as critical habitat for the federally threatened flatwoods salamander. These areas were added to the modeling process as exclusion areas. It must be noted however, the locations of the critical habitat areas are not in proximity to the modeled least-risk corridors and least-risk paths, and thus had no effect on the modeled route alignments.

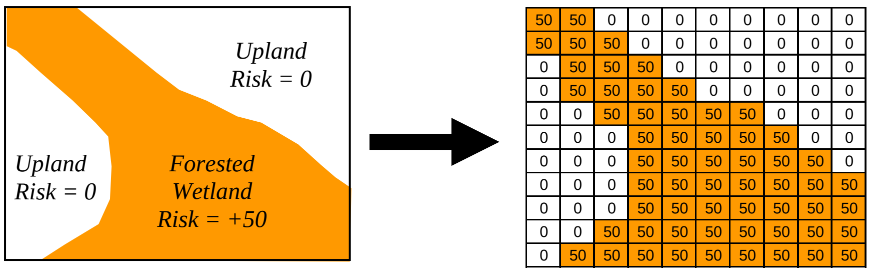
An additional habitat layer that was provided by the Forest Service in 2007 and used in the macro-corridor study was a dataset consisting of several polygons of known habitat for threatened and endangered species. This layer contained several polygons that identified potential habitat for listed plant species on the National Forest, including Canby's dropwort and pondspice. The layer was given a risk rating of +25 and added to the modeling process.

In September of 2008, Central Electric conducted a field survey of accessible portions of the macro-corridor study area on lands outside the FMNF for the occurrence of federally-listed threatened and endangered species (CEPCI, 2008). Results of the Central Electric T&E survey identified locations of three previously unrecorded red-cockaded woodpecker colony sites consisting of several active cavity trees. These sites were added to the macro-corridor study modeling efforts. Additional findings included several areas of potential habitat for red-cockaded woodpecker and multiple wetland locations which represented habitat for the flatwoods salamander.

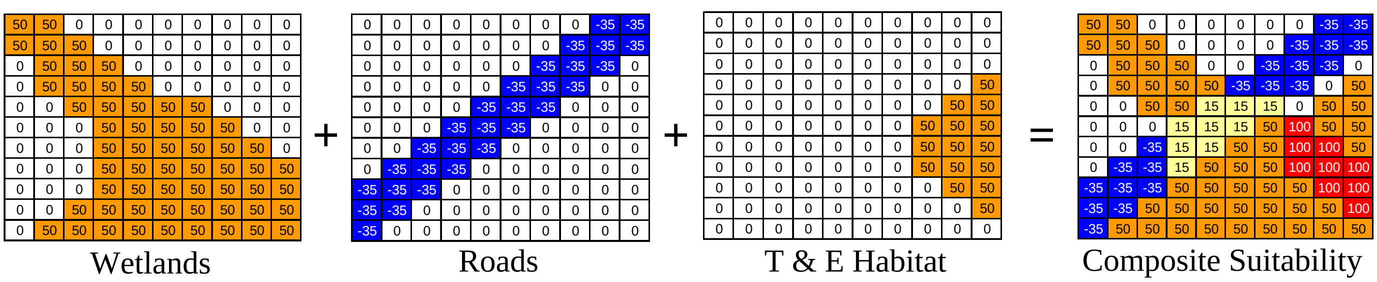
Because of the general lack of data on the locations of flatwoods salamanders in coastal SC, a habitat layer was created and added to the modeling process to characterize potential flatwoods salamander reproduction habitat. Comparison of the Central Electric T&E survey results to the forested wetland layer previously used in the modeling process revealed a strong correlation between small, isolated, generally circular, forested wetlands and the field surveyed areas that were considered by in the Central Electric T&E survey to be good potential habitat for flatwoods salamander. These isolated forested wetlands were delineated on the wetlands layer, given an additional risk rating of +25 and added to the analysis.

4.7 Compiling the Suitability Map

After all of the resource suitability layers were compiled and features within assigned their respective risk/opportunity ratings they were converted from polygon format to a grid-based format (10 x 10 meter cells). Through this conversion, all features in the resource data layers were converted to individual cells, the values of which denoted the risk/opportunity rating assigned to that resource. This conversion is commonly performed for GIS modeling efforts, and allowed for easier manipulation and combination of the suitability layers into one overall lands suitability map. The following graphic illustrates this process.



The resultant raster (grid) based resource layers were then summed in the GIS environment. This process resulted in an overall 'composite suitability map', within which, each grid cell represented the composite score of all risk and opportunity ratings for that particular location. The following graphic depicts a simplified version of this process with examples from three of the suitability criteria data layers.



The composite suitability map compiled for all of the data layers described in Section 4 is presented in Figure 4-1.

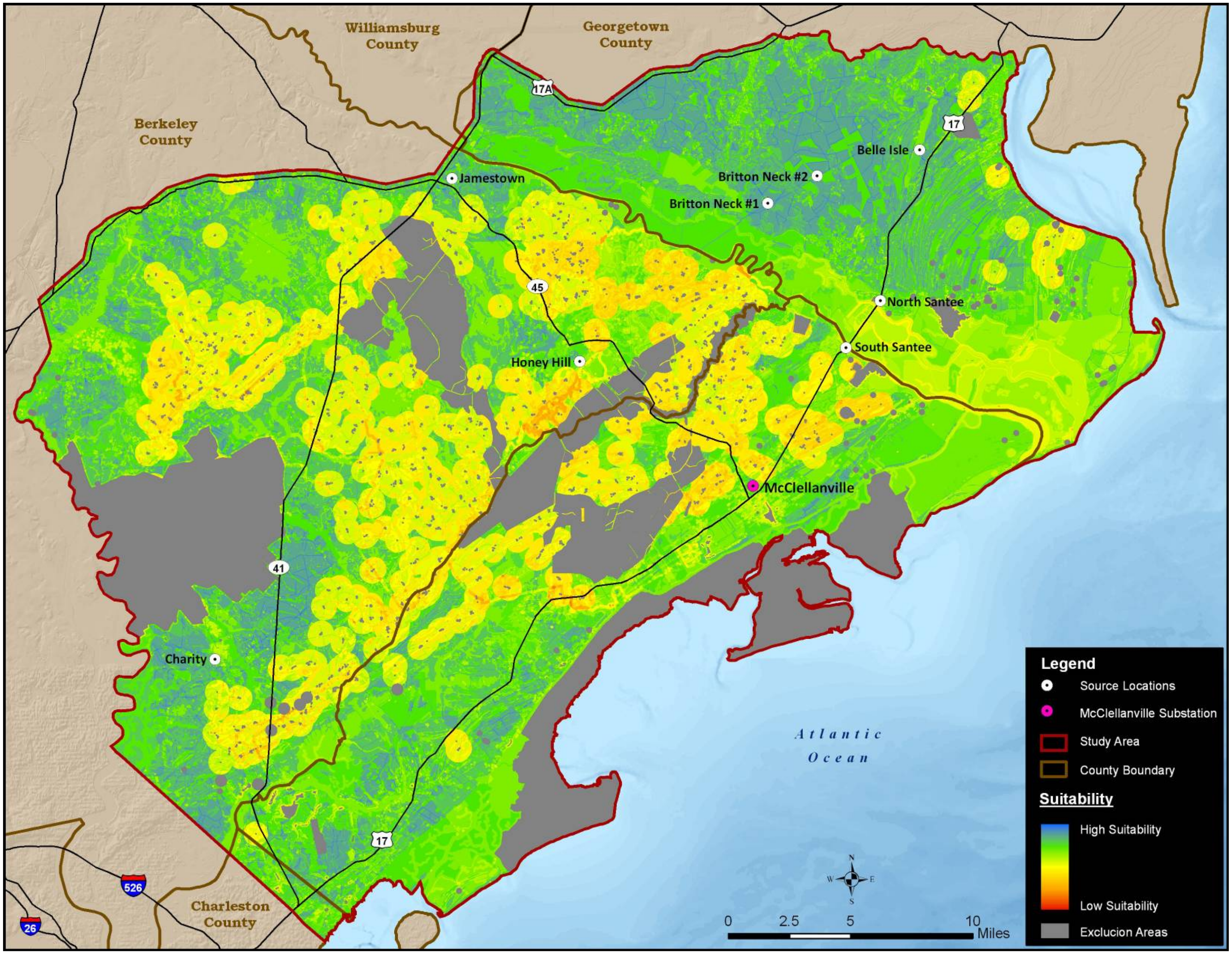


Figure 4-1: Composite Suitability Map

4.8 Modeling Paths and Identifying Least-Risk Corridors

4.8.1 Modeling Least Risk Paths

Once the composite suitability map was compiled, potential paths for the proposed transmission line were identified. This was done by using least risk path analysis algorithms included in ESRI's ArcGIS software (v. 9.2) to model paths between various proposed source points and the proposed McClellanville substation site.

Least risk path analysis methods utilize mathematical algorithms to identify a path of least accumulated risk from one point in the suitability map to the next. In simple terms, the process involves starting from one point in the suitability map (a grid cell representing the transmission line source location) and moving cell by cell toward a destination point (a grid cell representing the location of McClellanville) by following those cells that result in the lowest accumulation of risk scores along the way.

It is with this process in mind, that all risk ratings were assigned *higher numbers* and opportunities were assigned *lower numbers*. Cells with high cumulative risk ratings - the result of multiple resources data layers with positive risk ratings for that cell - would result in a higher accumulated risk if included in the path and would less likely be included in the least risk path. In contrast, cells with lower ratings (the result of either few resource data layers with positive risk ratings or a layer with opportunity value for that cell) would reduce the overall accumulated risk if included in the path, and have a greater likelihood of being included within the least risk path.

In reality, this process is not as mathematically or conceptually simplistic as presented here. For clarity and simplicity, a description of the algorithms used and various intermediate steps of this process (accumulated risk layer creation, back-link directional layer creation, etc.) are not presented here, but are available upon request. For a more thorough review of these concepts, see Berry (2005).

Least risk paths were calculated from the various proposed starting point substations, including Belle Isle, Jamestown, and Charity, as well as routing points in Honey Hill and Britton Neck, to their endpoint at the McClellanville substation (Figure 3-1). A set of least risk paths were also calculated for the Belle Isle to McClellanville route to account for the possibility for using either a directional bore or overhead line along the Highway 17 right of way to cross the Santee River delta. For this route two paths were generated, one from Belle Isle to a point next to the north end of the Highway 17 bridge, while the other was generated from a point on the south end of Highway 17 bridge to the McClellanville substation.

Additionally, optional paths were "directed", or forced to stay in one portion of the study area to examine the impacts of using that particular study area portion. For example, optional paths were created for Charity and Belle Isle by buffering the Highway 17 right of way by one mile. This buffer was then utilized as a mask in the least risk path analysis, so that the modeled path did not travel outside of the one mile buffer. A similar exercise was performed at the origin point of Charity, where the path was directed outside of the Francis Marion National Forest.

4.8.2 Corridor Delineation

Because the suitability map takes into account only a limited number of variables and treats these variables in a generalized manner, it is not expected that the modeled paths would be used directly as the proposed paths for the McClellanville transmission line. They do, however, serve as a useful guide for planning the general right-of-way alignment allowing flexibility to one side or the other of the map-generated path in each alternative corridor within which the proposed transmission line might be constructed.

Typically, a rough estimate of a proposed transmission line path is drawn on a map and buffered by ½ mile on either side to create a 1 mile wide corridor for the analysis. Though simple, this manner of corridor delineation does not take into account the suitability of the areas included within the buffer of the proposed path, and as a result, areas that should be excluded from consideration or large areas of high risk for potential impacts are once again included in the corridor boundary and brought to the next planning level.

To avoid this problem for the McClellanville 115 kV transmission line corridor delineations, the extent of the macro-corridor in the encompassing general study area for each of the modeled pathways was determined from the suitability map. By using the suitability map instead of a simple ½ mile buffer, areas that were considered exclusionary for transmission line construction were also excluded from the macro-corridor boundary, and areas with the highest composite risk ratings were generally avoided.

In some cases, specific paths and corridors were “directed”, or forced, to travel in a specified direction by using an analysis mask. This was done to examine potential alternatives to the paths and corridors produced during the modeling phase of the project. For example, to examine the possibility of using the U.S. Highway 17 right of way corridor from Belle Isle to McClellanville, the highway was buffered by one mile on either side of the road. This buffer was then used as an analysis mask in the modeling process, so that the path and corridor did not travel outside of the ½ mile buffer. This process allowed the project team to look at alternative alignments, and similar processes were constructed for the Charity to McClellanville and Britton Neck to McClellanville alignments. A more detailed description of these alignments is presented in Section 5.

As with the methods used for calculation of the least risk paths, for clarity and simplicity, a description of the algorithms used and various intermediate steps involved in the calculation of the corridor boundaries are not included in this report, but are available upon request (see Berry, 2004 for more information on corridor calculation methods). Some general concepts, however, should be mentioned for interpretation of the results presented in Section 5:

- For each least cost path, a corridor was calculated with an area in square miles roughly equal to the length (in miles) of the path. This was done for two reasons. First, as described above, utility planners typically use a ½ mile buffer on each side of the proposed line to identify the corridor study boundary. This results in a corridor with 1 square mile of area for every linear mile. Second, because each modeled path has a different length, comparisons between corridors concerning land use breakdowns and suitability rankings would not be appropriate without some form of normalization.

- Calculating corridors derived from the suitability map with a unit area equivalent to the unit length of the least risk path is not exact. In most cases, there is a small difference between the length of the least risk path (in miles) and the area of the corridor (in square miles). This variance is due to the distribution of the suitability ratings across the suitability map and is unavoidable.

- Because the delineation of the corridor boundaries was dynamically responsive to the suitability scores in the composite suitability map, the corridor boundaries do not parallel the least risk path. Instead, the corridor boundaries expand and contract in response to the absolute value of the suitability score and the relative distribution of risk ratings within the area of the modeled paths.

5.0 Description of Modeled Alignments and Corridors

In total, ten (10) optional least risk paths (alignments) with associated corridors (Fig. 5-1) were model-generated to connect the various electric power origin points to the power destination point at the proposed McClellanville substation. The ten alignment-corridors are described in the following sections and mapped in Figures 5-2 through 5-6d. Specific characteristics of the corridors, including wetland acreage percentage, risk rating statistics, and land use/land cover are provided in Table 5-1.

5.1 Belle Isle to McClellanville

The Belle Isle to McClellanville corridors begin at the Belle Isle delivery point located approximately two miles southeast of the Winyah generator in Georgetown County. From this point, three separate corridors were created: Belle Isle 1, Belle Isle 2, and Belle Isle 3. Descriptions of each are presented in the following sections.

5.1.1 Belle Isle 1

From the Belle Isle delivery point, the Belle Isle 1 corridor follows along Highway 17 for approximately 4 miles and crosses SR 2224 before the reaching the North Santee River. The corridor crosses over the Santee River approximately 1 to 2 miles northwest of the Highway 17 bridge and continues to the proposed McClellanville substation along a path roughly parallel to Highway 17 (Figure 5-2a). Under this transmission line option, the Santee River Delta would be crossed using an overhead transmission line that follows the Highway 17 right of way. Detailed starting and ending points for this crossing would depend on NEPA and engineering analysis.

5.1.2 Belle Isle 2

As with the Belle Isle 1 corridor, the Belle Isle 2 alignment begins at the Belle Isle delivery point. However, with this option, the 2-mile wide Santee River Delta would be crossed by the utilization of directional boring technology to emplace the transmission line under the surface substrate of the Delta. The bore would start along the northern bank of the North Santee River in the pole yard east of Highway 17, and end on the southern bank of the South Santee River in a small clearing on the west of Highway 17 (Figure 5-2b). The corridor would then travel roughly parallel to and northwest of Highway 17 to the proposed McClellanville substation.

5.1.3 Belle Isle 3

To examine the suitability of utilizing the Highway 17 right of way from the Belle Isle delivery point to the proposed McClellanville substation, Highway 17 was buffered by one mile on either side in the GIS environment. The buffer which was created was then used as a “mask” in the least risk path analysis, so that the resulting path did not stray outside of the one mile buffer of Highway 17. The resulting corridor essentially follows Hwy 17 from the Belle Isle delivery point to the proposed McClellanville substation (Figure 5-2c).

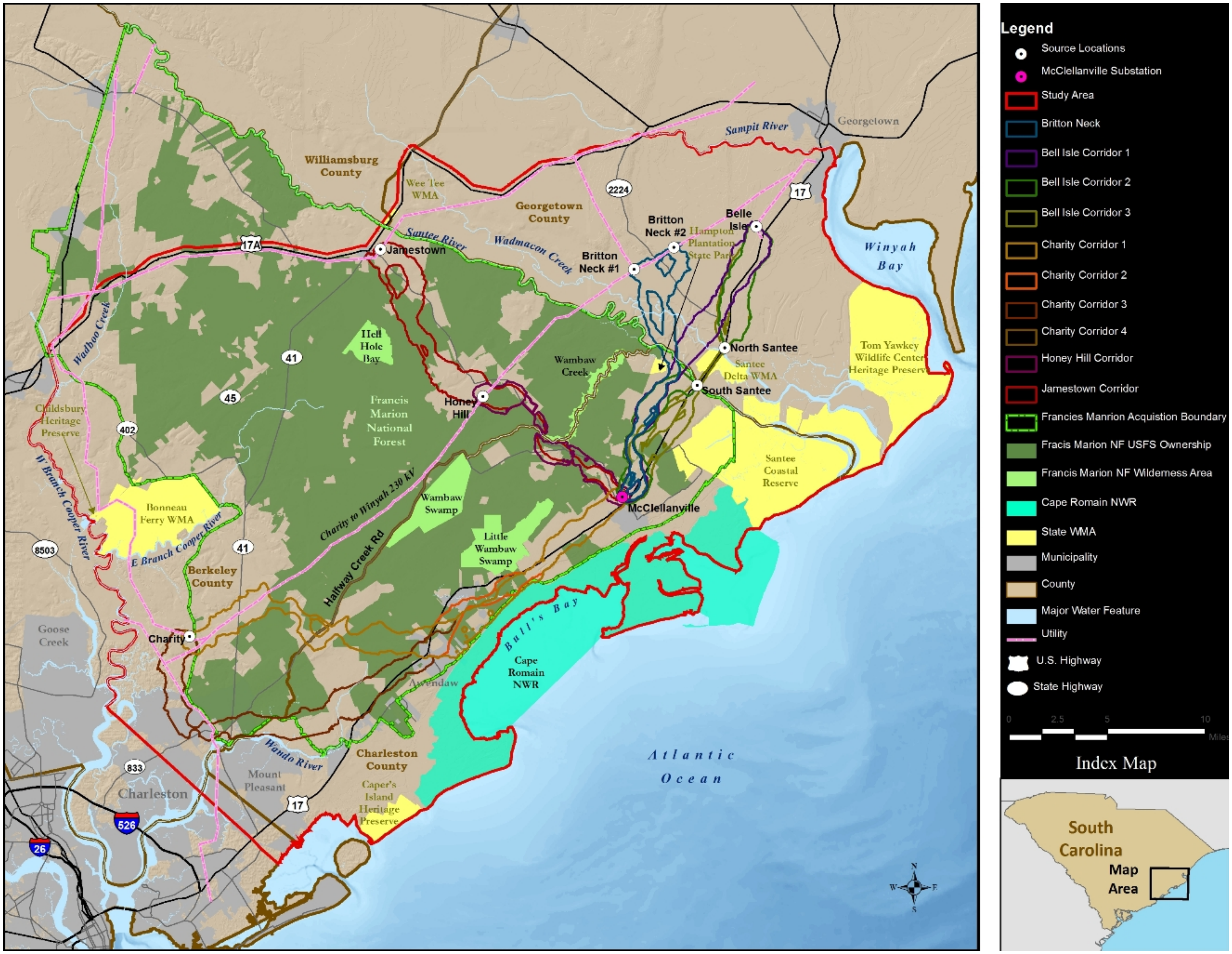


Figure 5-1: Overview of ten optional model-generated least-risk transmission line alignments and associated corridors to supply power to McClellanville, SC

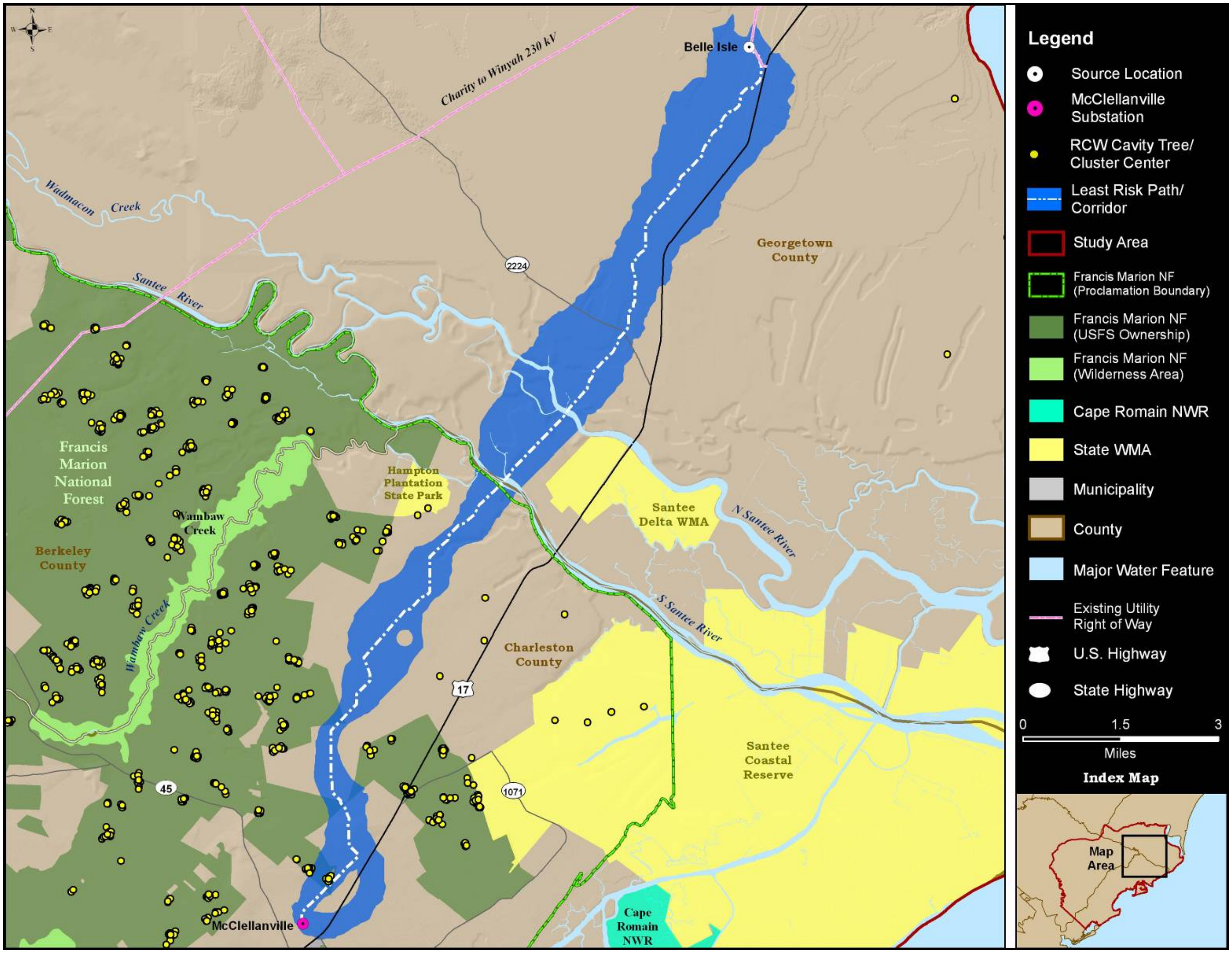


Figure 5-2a: Belle Isle 1 Least Risk Path Alignment and Corridor

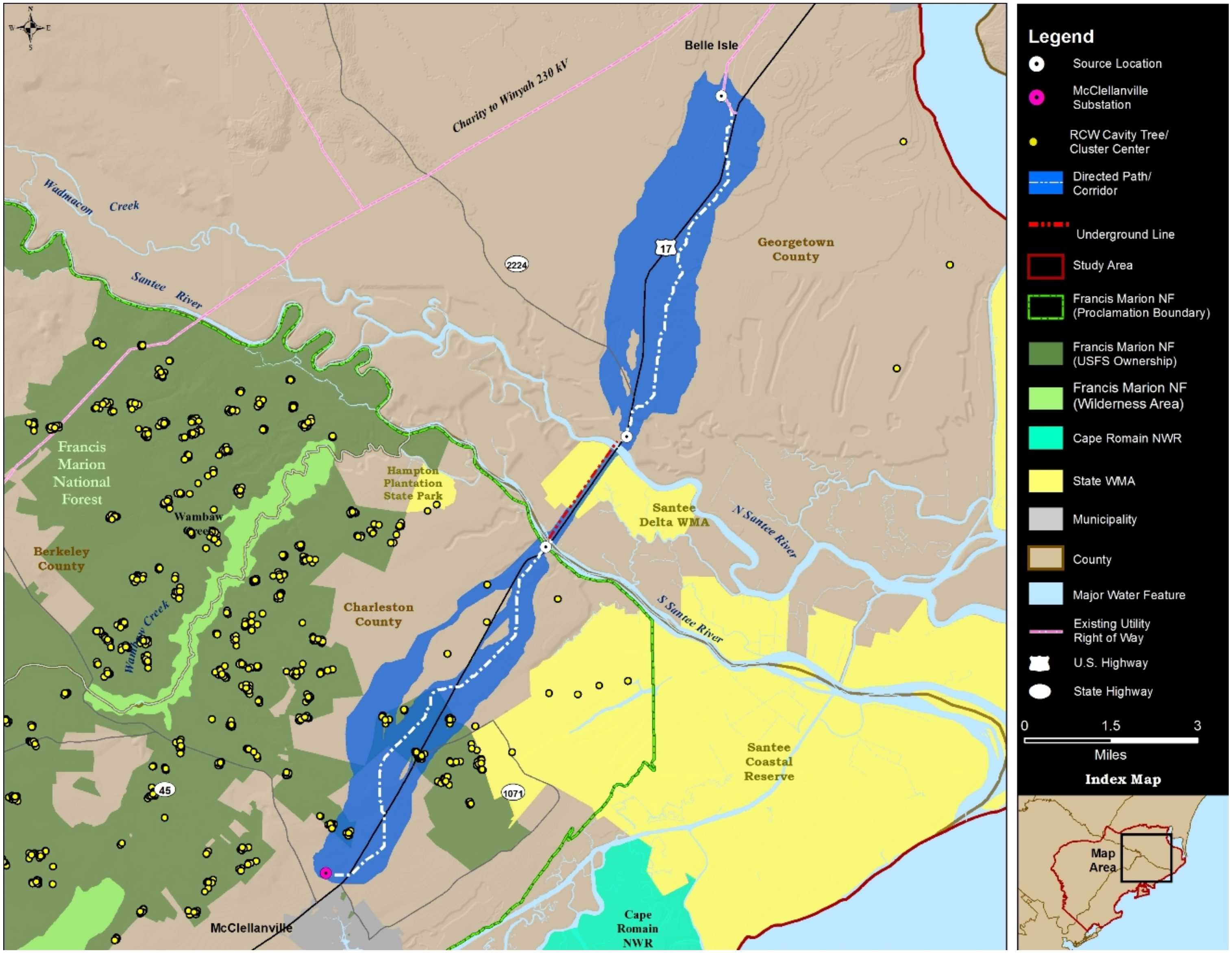


Figure 5-2b: Belle Isle 2 Directed Path Alignment and Corridor

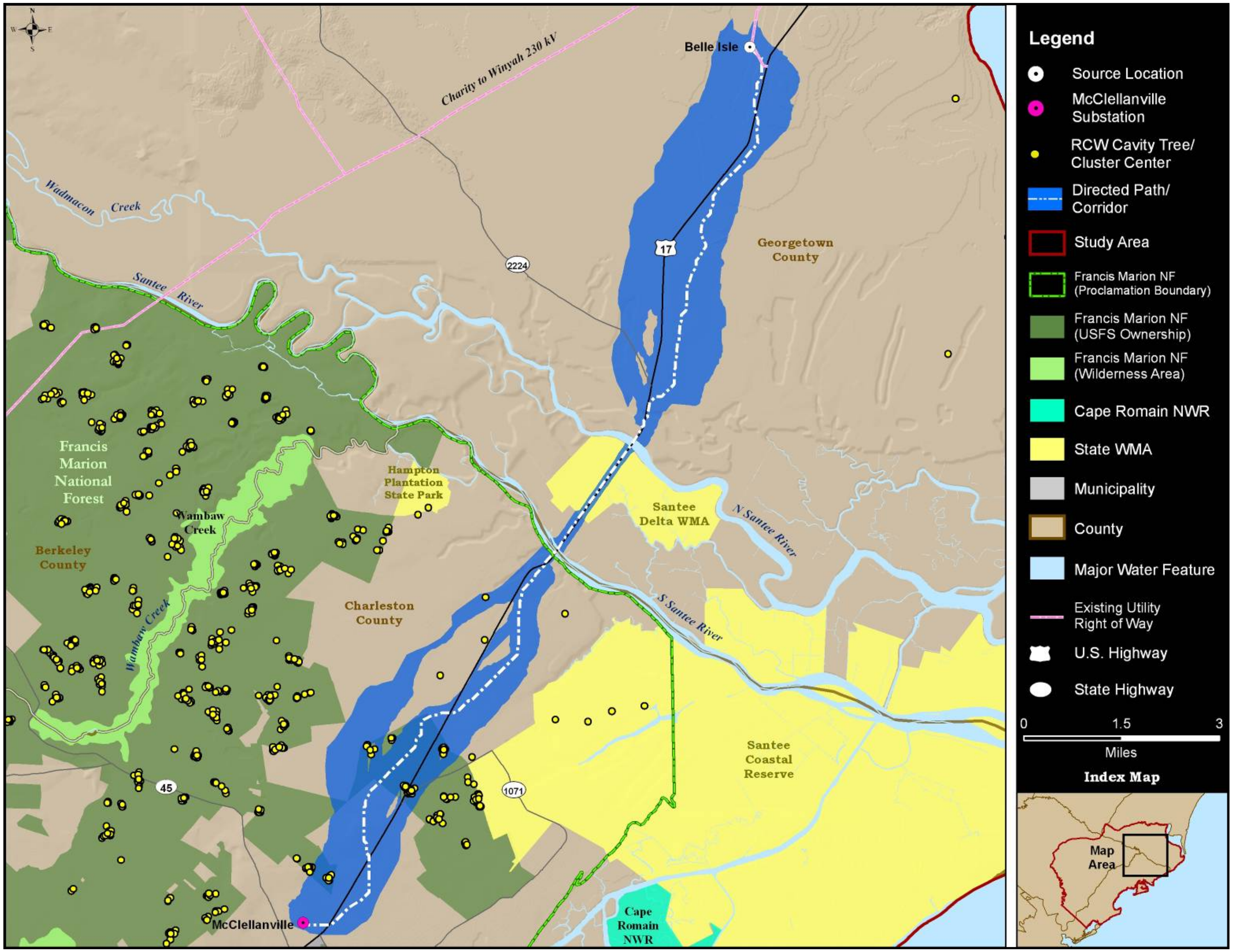


Figure 5-2c: Belle Isle 3 Directed Path Alignment and Corridor

5.2 Britton Neck to McClellanville

The Britton Neck to McClellanville corridor begins at the junction of rights-of-way of existing utility infrastructure and an existing 230kV transmission line that runs from the Winyah Generation Plant through the Francis Marion National Forest (Britton Neck 1). An additional origin point (Britton Neck 2) was placed approximately two miles northeast up the existing transmission line from the Britton Neck 1 point, to look at alternative placements. The final origin point at which a drop-down switching station would need to be constructed if this alternative was selected would depend on the environmental and engineering analyses.

Least risk paths and corridors were modeled from the Britton Neck 1 and 2 origin points. Because the alignments of the paths were identical at the point with which they merge as shown on Figure 5-3 (just west of State Highway 224 and north of the North Santee River), the paths were combined into a single route. A similar action was performed for the corridors. From the origin points on the existing 230kV line, the final corridor travels south across the North and South Santee Rivers, east of Hampton Plantation State Park, and across primarily private forests to the proposed McClellanville substation.

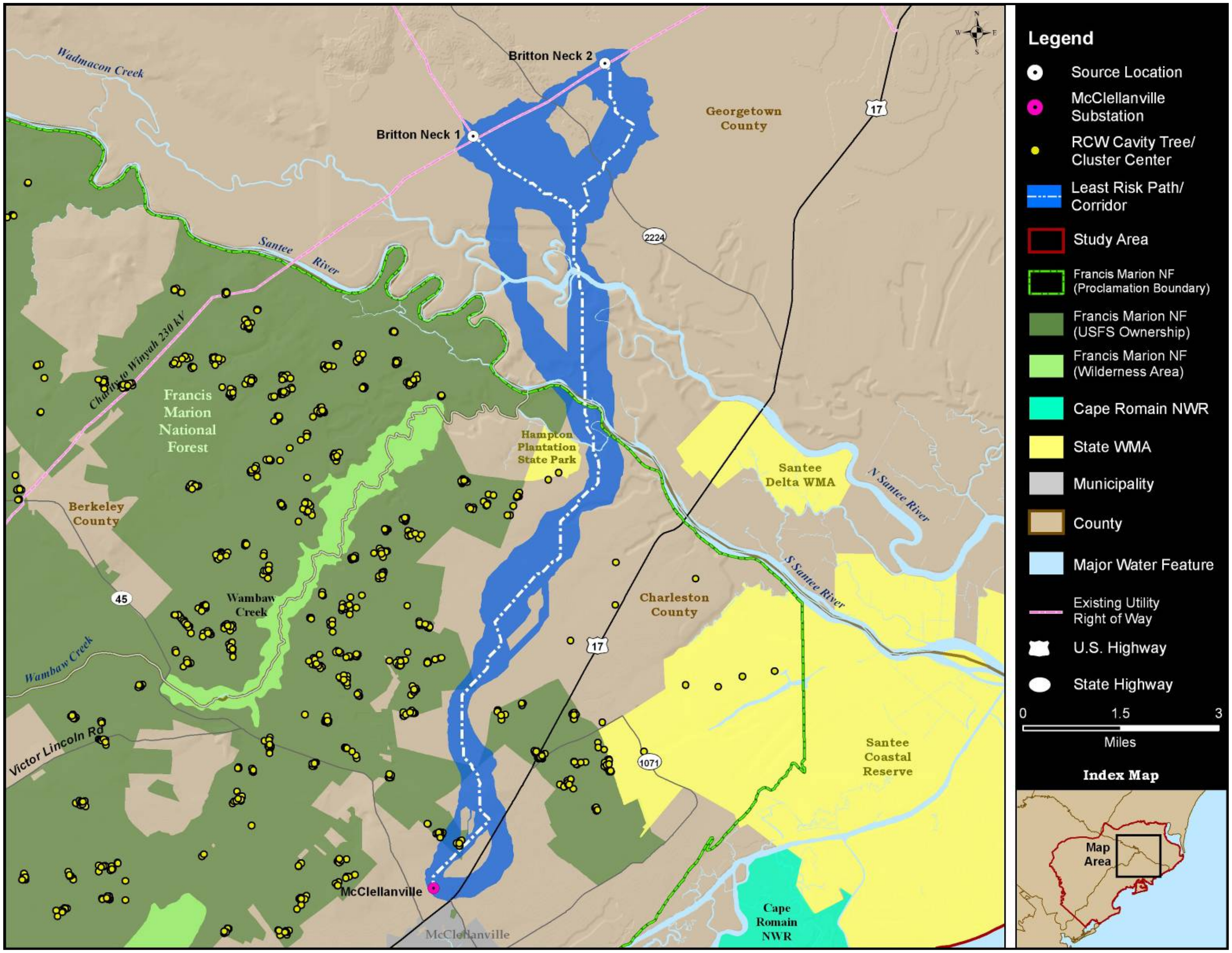


Figure 5-3: Britton Neck Least Risk Path Alignment and Corridor

5.3 Honey Hill to McClellanville

The Honey Hill to McClellanville path begins at a point along the existing Charity to Winyah 230 kV right-of-way approximately 1 mile southwest of the crossing with State Highway 45. From this point, a drop-down switching station would be constructed. Selection of the site would depend on environmental and engineering analyses. From this source, the corridor traverses southeast, joining State Highway 45 to cross the wilderness linkage management area (MA29), then passes just south of the Wambaw Creek Wilderness before continuing on to the proposed McClellanville substation (Figure 5-4).

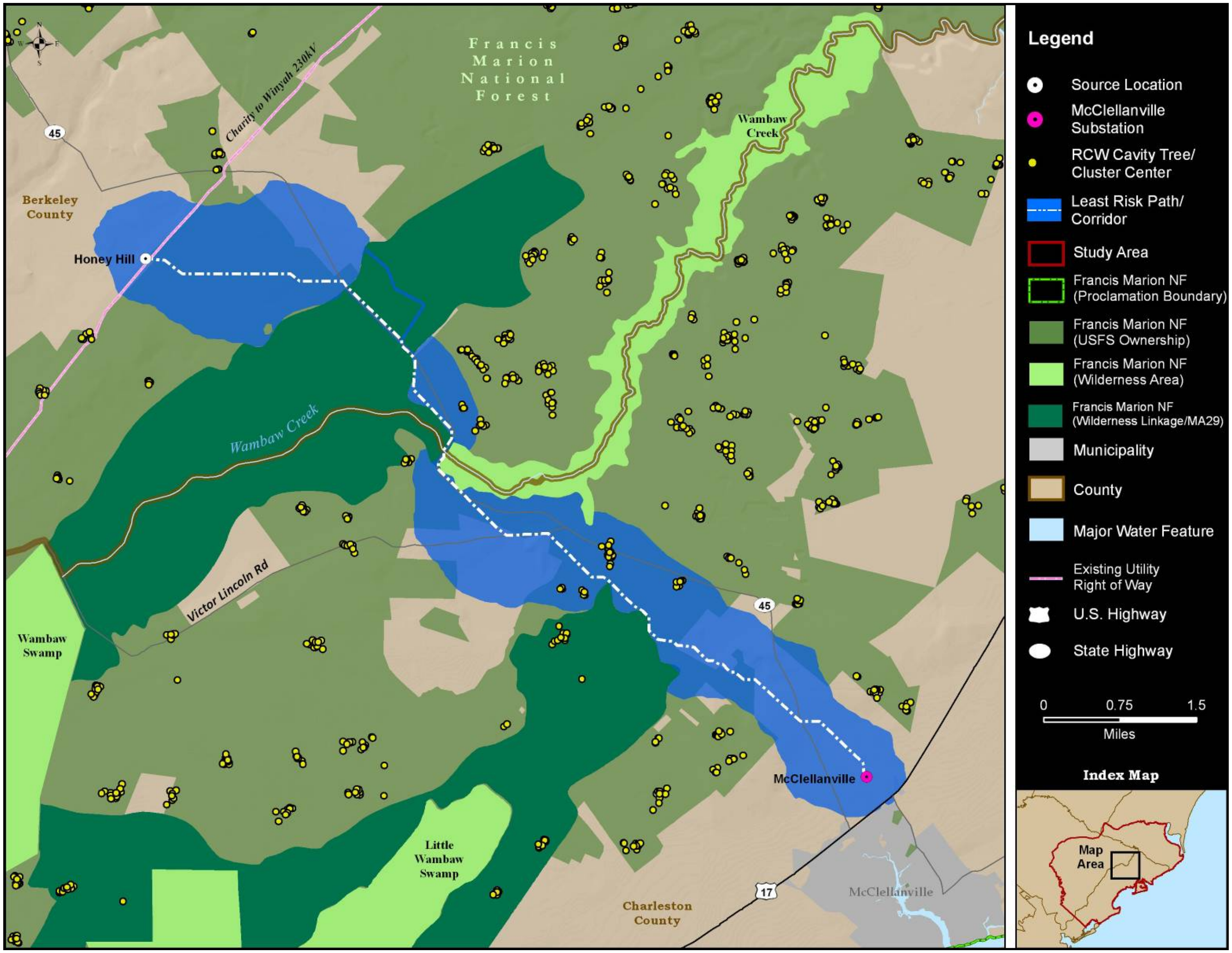


Figure 5-4: Honey Hill Least Risk Path Alignment and Corridor

5.4 Jamestown to McClellanville

The Jamestown to McClellanville path and corridor begins at the Jamestown delivery point and travels southeast through primarily National Forest land, roughly paralleling State Highway 45. It crosses the 230 kV transmission line near Honey Hill. One mile southeast of the transmission line, the corridor then follows State Highway 45 to cross a wilderness linkage management area (MA29), then passes just south of the Wambaw Creek Wilderness before continuing on to the proposed McClellanville substation (Figure 5-5).

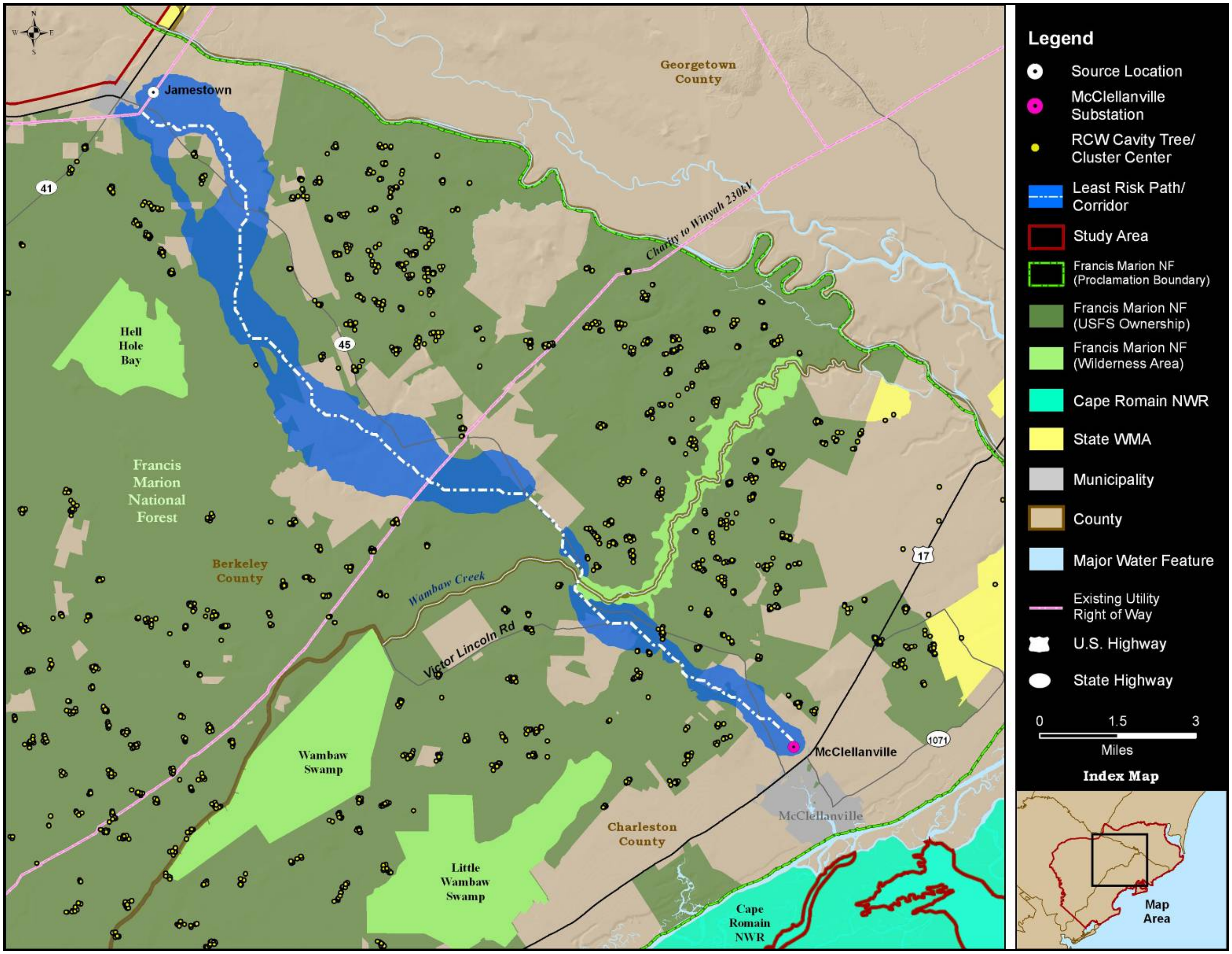


Figure 5-5: Jamestown Least Risk Path Alignment and Corridor

5.5 Charity to McClellanville

Four alternative path and corridor alignments were created from the Charity delivery point. Charity 1 represents the least risk path and corridor alignment created in the macro-corridor analysis, with no modeling masks. To evaluate the possibility of utilizing the Highway 17 right of way as a major portion of an alternative alignment, Highway 17 was buffered by one mile on either side (as was done for the potential alternative Belle Isle alignment). That buffer was utilized as a mask in the analysis, as described previously. A separate alternative directed-corridor alignment was created at the beginning of the Charity route that travels south and then west. This directed path and corridor was created to model an option that does not go directly through the Francis Marion National Forest and to avoid an area with a high density of red cockaded woodpecker cavity trees. Thus, there are two alternative corridor alignments west of Highway 17 and two alternative corridor alignments east of Highway 17. West of Highway 17, the two alternative corridors include the least risk corridor and the directed corridor that avoids the National Forest. East of Highway 17, the two corridor options include the least risk corridor and the directed corridor that is masked by the Highway 17 buffer.

5.5.1 Charity 1

The Charity 1 alignment (Figure 5-6a) starts at the Charity delivery point and parallels the existing Charity to Winyah 230kV transmission line for approximately four miles. The alignment then shifts to the southeast, travelling through the National Forest and into an area with numerous red-cockaded woodpecker cavity trees until it reaches Highway 17. The alignment then travels east to the proposed McClellanville substation, through the towns of Awendaw and McClellanville.

5.5.2 Charity 2

The Charity 2 alignment (Figure 5-6b) is a combination of the Charity 1 alignment west of the Highway 17 crossing point and the Highway 17 buffer alignment east of the highway. The route is exactly the same as described for Charity 1 west of Highway 17; east of Highway 17 it travels a similar path as Charity 1, except that it is generally closer to the highway than the Charity 1 alignment.

5.5.3 Charity 3

The Charity 3 alignment (Figure 5-6c) is a combination of a directed alignment west of the Highway 17 crossing point and the Charity 1 alignment east of the Highway 17 crossing point. This route travels south from the Charity delivery point and then west, generally around the National Forest. This directed route was created to have an alternative alignment that avoids an area on the National Forest with a high density of red-cockaded woodpecker cavity trees.

5.5.4 Charity 4

The Charity 4 alignment (Figure 5-6d) is a combination of the directed alignment west of the Highway 17 crossing point described for Charity 3, as well as the directed alignment east of the Highway 17 crossing point described for Charity 2.

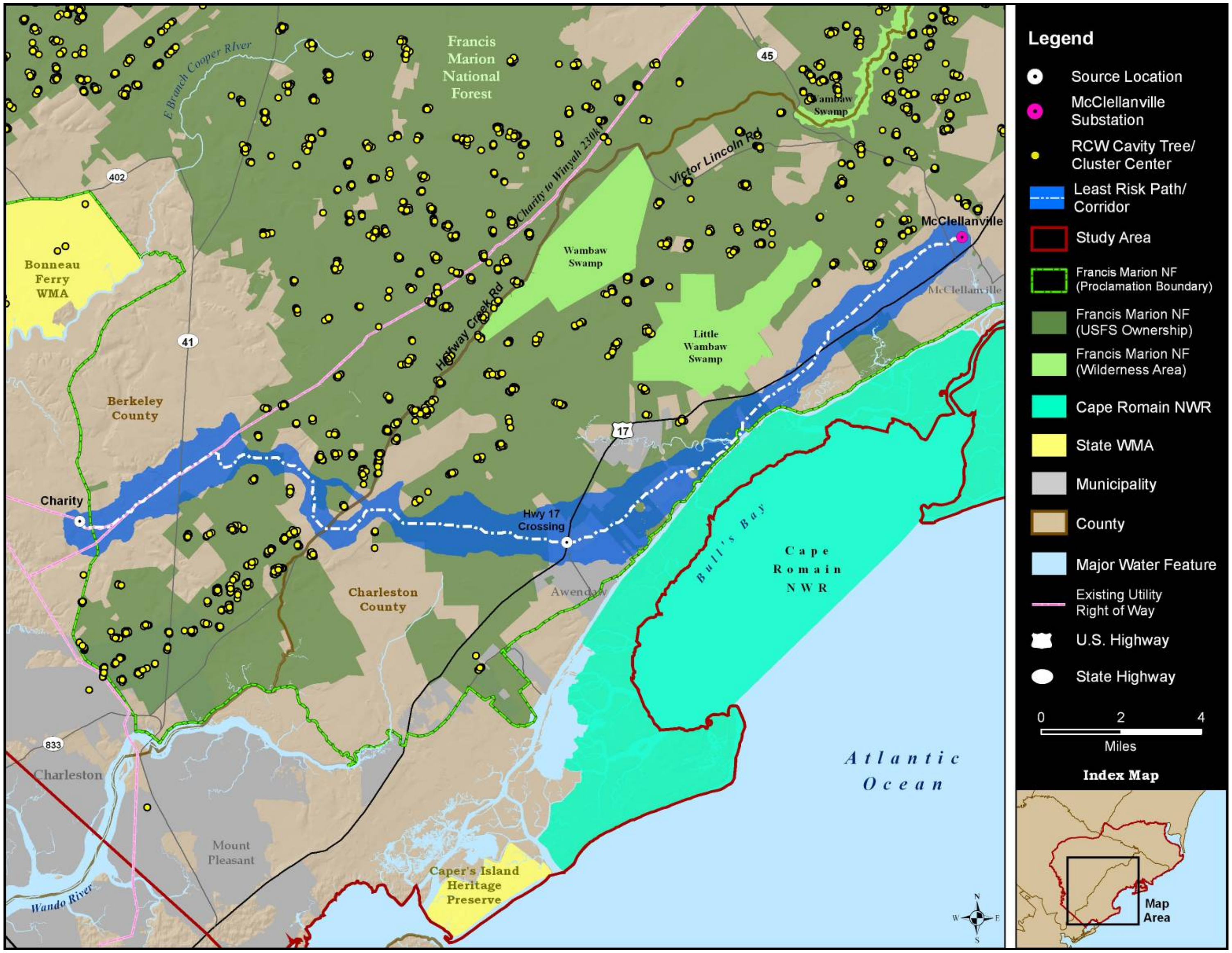


Figure 5-6a: Charity 1 Least Risk Path Alignment and Corridor

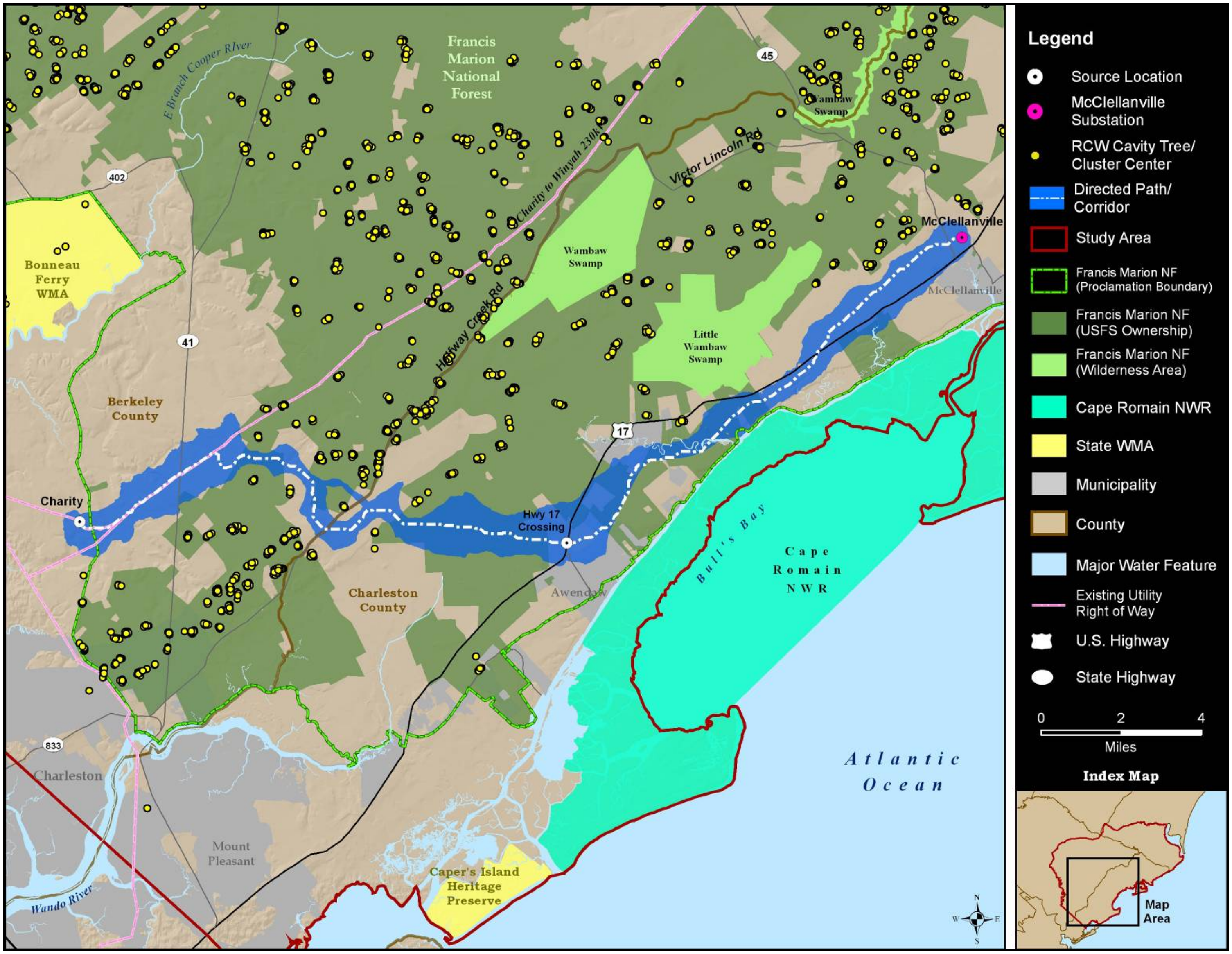


Figure 5-6b: Charity 2 Directed Path Alignment and Corridor

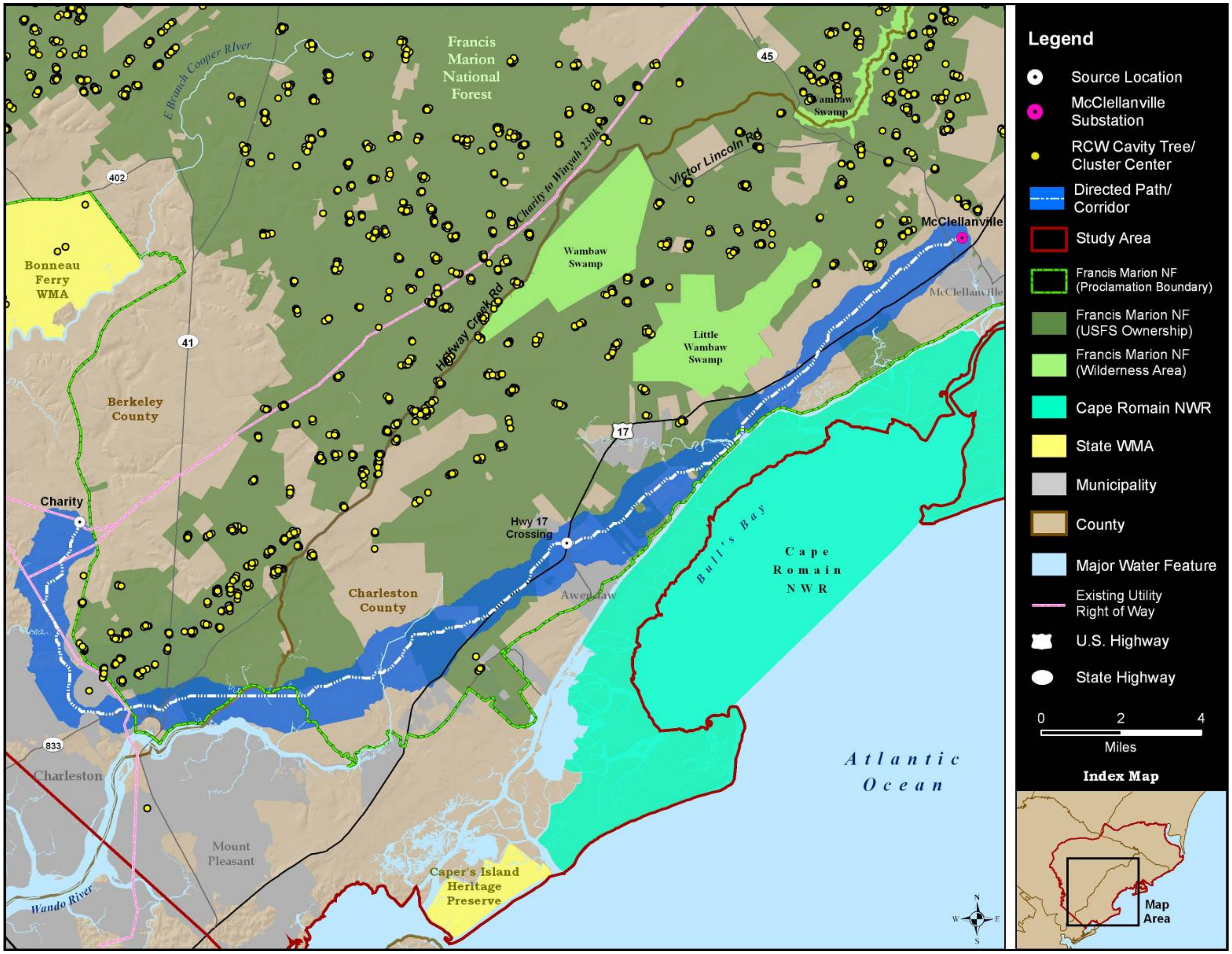


Figure 5-6c: Charity 3 Directed Path Alignment and Corridor

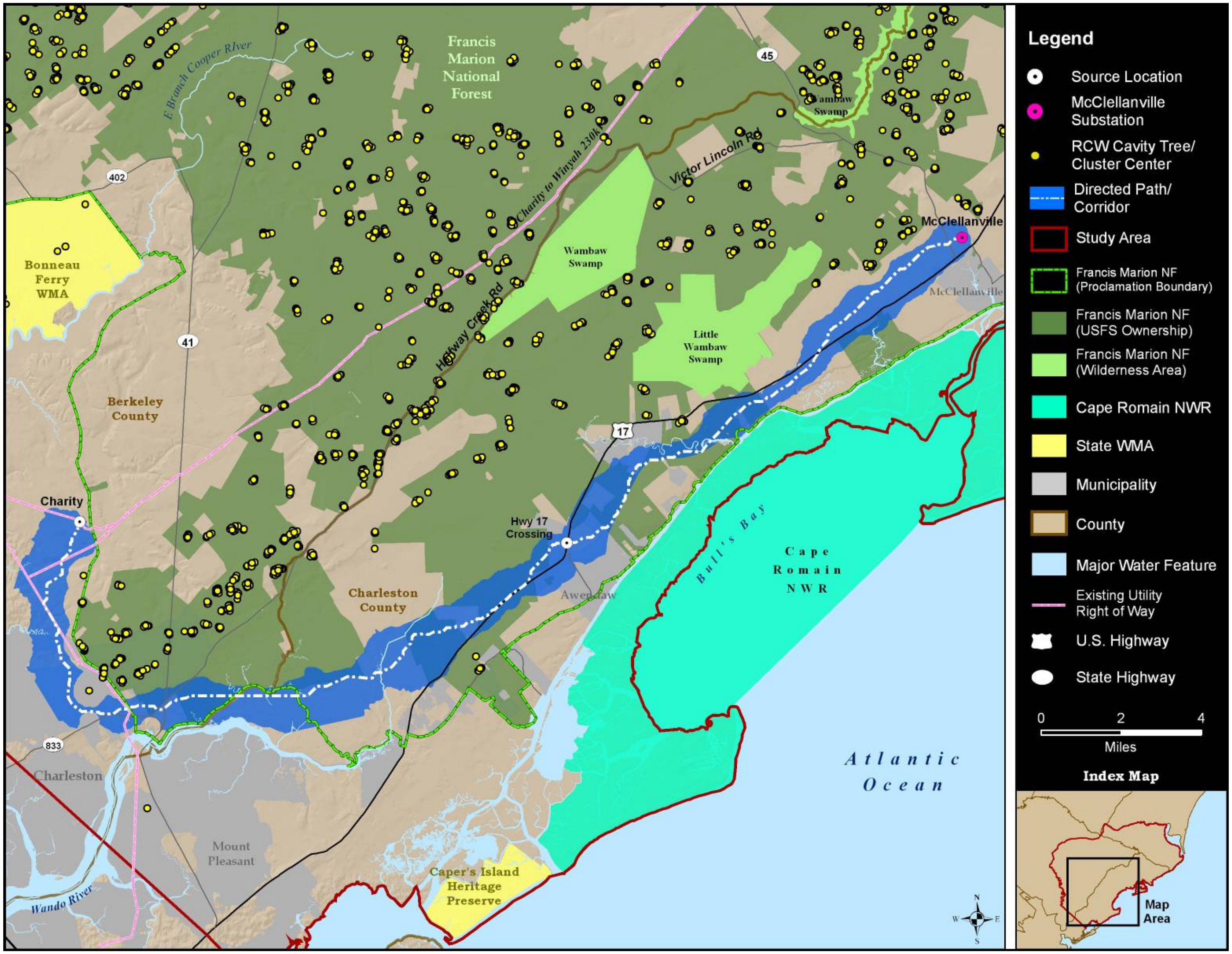


Figure 5-6d: Charity 4 Directed Path Alignment and Corridor

5.6 Alternative Corridor Comparison

A number of comparisons can be made between corridors from the three general origin locations (i.e., the Belle Isle/Britton Neck region vs. the Honey Hill/Jamestown region vs. the Charity region) A number of these comparative metrics can be viewed in Table 5.1. With respect to comparisons between the three general origin locations, the Charity alignments begin the furthest distance from the proposed McClellanville substation, and thus represent the longest alternatives in terms of distance as well as the largest corridors in terms of area. The four Charity alignments range from 28 to 33 miles long, approximately 8 to 13 miles greater than the next longest path (the Jamestown alignment) and approximately 13 to 18 miles longer than the Belle Isle alignments. A similar comparison can be made between the area (square mileage) of the alternative corridors.

With respect to the Francis Marion National Forest, the Charity alternative corridors contain on average approximately 9 square miles of National Forest land within the corridor boundaries, while the Belle Isle and Britton Neck corridors cross very little National Forest land (between .26 and 1.31 square miles). However, as a percentage of its corridor, the Honey Hill corridor crosses the highest percentage of National Forest land (approximately 55 percent, or 4.65 square miles).

Because of their proximity to the Francis Marion National Forest, the Honey Hill and Jamestown corridors contain a higher number of red-cockaded woodpecker cavity trees with the outer corridor perimeter in comparison to the other corridors; however, the Belle Isle 3 corridor contains the most cavity trees, located near the southern end of the corridor where it enters National Forest land. A similar comparison can be made for the amount of red-cockaded foraging area within each corridor.

Because the Charity corridors travel at length in proximity to developed areas along U.S. Highway 17, these corridors contain a great deal more structures and private land parcels in comparison to the other alternative corridors. The corridors originating from Charity contain approximately 800 structures, while the Belle Isle and Jamestown alternative corridors contain between 174 and 280 structures. The Britton Neck and Honey Hill corridors contain the least number of structures, 91 and 72 respectively.

With respect to overall risk scores derived from the suitability map, the alternative corridors originating from Charity are generally higher (i.e. more risk) because of their greater length/area, as well as their proximity to the more developed regions of the study area. The Belle Isle 1, Belle Isle2, and Britton Neck alternative corridors generally have the lowest suitability risk score, due to the fact that they are generally not in highly developed regions of the study area and do not contain a lot of National Forest land. However, these corridors, in addition to the Belle Isle 3 corridor, have the added concern of crossing the Santee Delta. The Honey Hill corridor, although it is the shortest route, is within the boundaries of the National Forest for a great length and contains a high percentage of wetlands, and correspondingly has a generally higher risk (accounting for distance and area).

Table 5.1: Alternative Corridor Comparison

	Belle Isle 1	Belle Isle 2	Belle Isle 3	Britton Neck	Honey Hill	Jamestown	Charity 1	Charity 2	Charity 3	Charity 4
General Characteristics										
Path Length (Miles)	16.9	15.3	17	14 to 14.9	9.9	20.6	28.5	28.7	33	33.2
Corridor Area (Miles^2)	15.23	15.65	16.05	12.04	8.39	17.42	26.92	24.63	32.54	30.74
National Forest Area (Miles^2)	0.26	0.41	1.31	0.28	4.65	7.28	9.34	8.55	9.74	9.24
National Forest Percentage	1.74%	2.62%	8.17%	2.35%	55.39%	41.77%	34.71%	34.72%	29.94%	30.06%
Corridor Risk Score*	19.03	5.54	28.79	13.65	23.69	27.53	36.88	35.26	40.55	39.69
Risk Score Per Miles^2*	1.25	0.35	1.79	1.13	2.82	1.58	1.36	1.43	1.25	1.29
Land Use/Land Cover (Percent of Corridor)*										
Urban/Developed	2.7%	4.2%	5.5%	0.8%	2.8%	2.4%	3.8%	4.1%	4.9%	5.2%
Agricultural	0.4%	0.4%	0.5%	1.1%	0.7%	2.0%	1.1%	1.1%	1.0%	1.0%
Grassland/Pasture	6.8%	5.9%	6.0%	5.5%	5.4%	7.7%	9.1%	8.0%	7.4%	6.3%
Forested	39.5%	53.7%	55.2%	45.1%	53.5%	50.3%	44.6%	45.1%	43.6%	44.3%
Scrub/Shrub	4.8%	4.4%	3.9%	4.6%	5.6%	4.2%	5.1%	4.5%	4.2%	3.6%
Wetland	44.4%	31.1%	28.3%	41.2%	32.0%	32.2%	35.1%	37.0%	36.9%	38.4%
Open Water	1.4%	0.3%	0.6%	1.7%	0.0%	1.2%	1.2%	0.2%	2.0%	1.2%
Wetlands Inventory (Percent of Corridor)**										
All Wetlands	60.7%	58.5%	59.3%	58.5%	96.1%	57.1%	48.7%	54.7%	48.5%	52.7%
Estuarine	13.2%	23.7%	29.1%	14.3%	63.7%	28.4%	21.6%	24.3%	27.7%	29.3%
Lacustrine	0.3%	0.2%	0.3%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
Palustrine Emergent	5.9%	1.5%	1.3%	5.4%	0.0%	0.3%	0.4%	0.5%	1.0%	1.1%
Palustrine Forested	31.7%	26.8%	23.1%	33.0%	30.3%	26.6%	22.1%	23.8%	17.6%	18.5%
Palustrine Scrub/Shrub	7.9%	5.9%	4.9%	5.8%	2.0%	1.3%	2.5%	3.0%	1.7%	1.9%
Palustrine Other	0.2%	0.3%	0.3%	0.0%	0.1%	0.3%	0.2%	0.3%	0.2%	0.2%
Riverine	1.5%	0.1%	0.3%	2.1.%	0.0%	0.0%	1.9%	2.8%	0.3%	1.7%

* 'Corridor Risk Scores' were calculated by summing the suitability scores of each individual 10 x 10 meter cell that fell within the corridor boundary. Due to the large number created by this summation, it was then divided by 1,000,000 for the purposes of display.

** Land Use/Land Cover categories are derived from the USGS National Land Cover Database. Additional data concerning land use categories can be found at http://www.mrlc.gov/nlcd.php.

*** Wetland acreages were calculated based on the most recent and updated National Wetland Inventory analysis, as well as a wetland coverage maintained by the U.S. Forest Service for the Francis Marion National Forest. This is likely an over exaggeration of actual wetland acreage. Note: USGS National Land Cover Database analysis land use information was not used for this calculation.

Table 5.1: Alternative Corridor Comparison (continued)

	Belle Isle 1	Belle Isle 2	Belle Isle 3	Britton Neck	Honey Hill	Jamestown	Charity 1	Charity 2	Charity 3	Charity 4
Red-Cockaded Woodpecker										
Number of National Forest RCW Cavity Trees Within Outer Perimeter of Corridor	10	20	64	10	40	40	11	11	0	0
Percentage of Corridor Within 1/2 Mile RCW Management Area/Foraging Buffer	4.6%	8.6%	22.0%	4.4%	33.3%	12.5%	6.2%	7.1%	1.6%	1.9%
Development										
Number of Structures Within Corridor	174	263	280	91	72	181	862	803	868	803
Number of Private Parcels Within Corridor	429	496	471	239	180	443	1,274	1,185	1,412	1,321
Percentage of Corridor With Parcels Below 6 Acres	4.8%	5.9%	6.2%	2.7%	3.9%	4.0%	8.6%	8.4%	7.1%	6.6%
Miles of Road Within Corridor	37.5	46.2	50.5	28.6	32.4	58.6	93.9	87.7	96.5	91

5.7 Estimated Corridor Costs

Engineering and Construction

Engineering and construction costs estimates were developed for each corridor (Table 5-2). All began with a common base cost per mile derived from Central Electric Engineering Department's tabulation of Construction Cost Projections. The projections were calculated based on historic data from all construction projects since 1980.

Due to developments following the establishment of the cost projections adjustments were made for this project. Considering the unique land values of the area, the right of way acquisition component of the cost projections (historically averaging 25%) was removed and was calculated separately (see below). Recent changes to the National Electric Safety Code dramatically increased the wind speeds used in calculating extreme wind loading, resulting in shorter spans between supporting structures and increased strength requirements for poles. On average, poles are spaced 300-400 feet apart. Pole class and ground clearance would determine the span between poles. The engineering and construction components remaining after removal of right of way acquisition were increased by 20% to reflect this. Construction through wetlands and National Forest land also required additions to the base cost per mile of the estimated cost and both were quantified for each corridor.

Right of Way Acquisition and Wetland Mitigation Costs

Right of way acquisition costs estimated for each corridor (Table 5-2) were based on the following information sources/investigations:

1) Review of county and local economic trends
2) Review of land use patterns, zoning and land use plans
3) Examination of public records for deeds and plans relating to the area
4) Interviews with realtors and appraisers familiar with the area
5) Consideration of Realtor's listings and expertise in specific areas

Land use and assigned cost estimates for the associated use were developed for the following general categories:

- Urban Development: those properties with development potential $25,000/ acre
- Urban Residential: residential development potential or use 7,500/acre
- Wetland Type Properties: limited use due to wetland characteristics 1,500/acre
- Forest/Timber-Recreation: in timber production/recreational assets 4,500/acre
- Agricultural: pasture lands or lands in cultivation 3,500/acre
- River Influenced: properties influenced by the Santee River 60,000/acre

Wetland mitigation estimates are based on Central Electric's previous experience with other projects as to credits per acre and costs of credits.

Table 5.2: Economic Corridor Comparison Table

	Belle Isle to McClellanville #1	Belle Isle to McClellanville #2	Belle Isle to McClellanville #3	Britton Neck #1 230/115 to McClellanville	Britton Neck #2 230/115 to McClellanville	Honey Hill Junc. 230/115 to McClellanville	Jamestown to McClellanville	Charity to McClellanville #1	Charity to McClellanville #2	Charity to McClellanville #3	Charity to McClellanville #4
Line length (miles)	16.9	15.3	17	14	14.9	9.9	20.6	28.5	28.7	33	33.2
Engineering and Construction Cost per Mile[1]	$444,675	$454,575	$444,118	$464,286	$457,383	$511,616	$427,670	$406,140	$405,749	$398,485	$398,193
Base Engineering and Construction Costs	$7,515,000	$6,955,000	$7,550,000	$6,500,000	$6,815,000	$5,065,000	$8,810,000	$11,575,000	$11,645,000	$13,150,000	$13,220,000
Total Length in Wetlands (miles)	9.7	7.6	9.9	9.8	9.8	9	11.8	13	14.6	12.9	14.1
Additional Costs for Construction in Wetlands[2]	$203,922	$160,122	$208,580	$205,963	$205,963	$188,998	$247,541	$273,812	$307,546	$271,736	$297,013
Total Length on National Forest Lands	0.5	1.5	1.5	0.5	0.5	7.7	12.8	15.2	13.9	15.8	15
Additional Costs for Construction on National Forest Lands[3]	$13,527	$40,581	$40,203	$13,527	$13,527	$225,974	$347,380	$405,200	$370,544	$421,193	$399,914
Additional Cost of 230/115 switching / substation[4]	0	0	0	$5,700,000	$5,700,000	$5,700,000	0	0	0	0	0
Additional Cost of 2 .5 Miles Directional Bored Cable[5]	0	$8,000,000	0	0	0	0	0	0	0	0	0
Additional Cost of 2 Miles Overhead Crossing Santee Delta[6]	$675,000	0	$675,000	$675,000	$675,000	0	0	0	0	0	0
Total estimated engineering & construction cost	**$8,407,449**	**$15,155,703**	**$8,473,783**	**$13,094,490**	**$13,409,490**	**$11,179,972**	**$9,404,921**	**$12,254,012**	**$12,323,090**	**$13,842,929**	**$13,916,927**

Table 5.2: Economic Corridor Comparison Table (continued)

	Belle Isle to McClellanville #1	Belle Isle to McClellanville #2	Belle Isle to McClellanville #3	Britton Neck #1 230/115 to McClellanville	Britton Neck #2 230/115 to McClellanville	Honey Hill Junc. 230/115 to McClellanville	Jamestown to McClellanville	Charity to McClellanville #1	Charity to McClellanville #2	Charity to McClellanville #3	Charity to McClellanville #4
Total estimated engineering & construction cost	**$8,407,449**	**$15,155,703**	**$8,473,783**	**$13,094,490**	**$13,409,490**	**$11,179,972**	**$9,404,921**	**$12,254,012**	**$12,323,090**	**$13,842,929**	**$13,916,927**
Estimated Right of Way Acquisition Costs	$1,139,508	$1,004,919	$1,120,835	$937,850	$998,960	$363,000	$900,124	$1,555,289	$1,278,173	$1,847,088	$1,493,300
Estimated Wetland Mitigation Costs	$682,825	$682,825	$682,825	$325,185	$325,185	$323,875	$564,086	$1,100,390	$1,109,562	$1,100,390	$1,109,562
TOTAL COST	**$10,229,782**	**$16,843,447**	**$10,277,443**	**$14,357,525**	**$14,733,635**	**$11,866,847**	**$10,869,131**	**$14,909,691**	**$14,710,825**	**$16,790,407**	**$16,519,789**

[1] Taken from Engineering Department Cost Projections.
[2] Based on most recent unit cost of wetlands clearing.
[3] Estimated increase in base cost due to USFS restrictions on access and timing of activities.
[4] Station cost provided by Santee Cooper for a step down station with high side distance relays and circuit breakers integrated in the station.
[5] Estimate based on recent directional bore installations.
[6] Estimated cost of overhead installation with 35% increase over base cost due to requirement of self supporting angle structures.

6.0 List of Preparers

Mangi Environmental Group, Inc.
Philip Sczerzenie, Senior Technical Leader
Leon Kolankiewicz, Project Manager, Senior Technical Reviewer
Mark Blevins, Suitability Analysis, GIS Leader
George Hoddinott, GIS Analyst
L.L. Gaddy, Biologist, *terra incognita*, biological survey for T&E species and wetlands
Ralph Bailey, Manager, Brockington & Associates Inc., cultural resources
Inna Moore, Analyst, Brockington & Associates Inc., cultural resources

Central Electric Power Cooperative, Inc.
Jimmy Tindal, Manager, Transmission Design and Construction
John Boyt, Vice President of Engineering and Technical Services
Bill Rogers, Supervisor, Right of Way Services

7.0 References

(BCOC, 2004) Berkeley County Chamber of Commerce. 2004. Web page. Demographics and Economy. Accessed at: http://bcoc.com/visitors/about_berkeley_county/demographics.htm

(Berry, 2004) Joseph K. Berry. Map Analysis: Procedures and Applications in GIS Modeling. 2004. Online publication, Spatial Information Systems, Inc. Accessed at: http://www.innovativegis.com/basis/MapAnalysis/Default.htm

(Census, 2000) United States Census Bureau. GCT-PH1. Population, Housing Units, Area, and Density: 2000, Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data, South Carolina –Place.

CEPCI. 2008. Survey for the presence of the red-cockaded woodpecker and other Federally-listed endangered and threatened species on non-National Forest lands in the McClellanville project macro-corridor study area, SC. Unpublished survey report for Central Electric Power Cooperative, Inc., L.L. Gaddy, principal investigator.

(Census, 2009) United States Census Bureau. State and County Quickfacts: Berkeley, Charleston, and Georgetown Counties, 2008. Accessed at http://quickfacts.census.gov/qfd/index.html

GTC (Georgia Transmission Corporation). 2001. Alternatives Evaluation Study and Macro-Corridor Study Report for the Proposed Hickory-Level Yellowdirt 230kV Transmission Line. Report to USDA RUS.

(USFS, 1996) United States Department of Agriculture, Forest Service, Francis Marion National Forest. February 1996. Revised Land and Resource Management Plan.

(USFS, 2004) United States Department of Agriculture, Forest Service, Francis Marion National Forest. 6 October 2004. Web page. Francis Marion and Sumter National Forests: About Us. Accessed at: http://www.fs.fed.us/r8/fms/forest/aboutus/history.html

(USFWS, 2003) United States Department of the Interior, Fish and Wildlife Service. 2003. Recovery plan for the red-cockaded woodpecker (*Picoides borealis*): second revision. U.S. Fish and Wildlife Service, Atlanta, GA. 296 pp.

(USFWS, No date) United States Department of the Interior, Fish and Wildlife Service. No date provided. Web page. Cape Romain National Wildlife Refuge. Accessed at: http://www.fws.gov/caperomain/

(USGS, 2001) United States Department of the Interior, Geological Survey. 2001. National Land Cover Database, 2001. Accessed at: http://www.mrlc.gov/nlcd.php

Appendix B—Alternative Evaluation Study

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McClellanville Power Supply Alternatives Evaluation Study

Central Electric Power Cooperative, Inc.

September 2010

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1.0 Introduction

Central Electric Power Cooperative, Inc. (Central Electric) is proposing to construct a 115 kilovolt (kV) transmission line to Berkeley Electric Cooperative (Berkeley Electric)'s proposed McClellanville substation for the purpose of providing long-term reliable electric service to the McClellanville community and surrounding areas. This proposal would greatly reduce the number and length of extended outages in the area and the number of momentary interruptions (or blinks).

1.1 Description of Central Electric Power Cooperative

Central Electric is a wholesale power supplier owned by the twenty electric member distribution systems that it serves. Central Electric provides electricity to its member distribution systems in the state of South Carolina via a combination of the bulk electric system and its own transmission facilities. Central Electric owns approximately 668 miles of transmission lines.

Central Electric, founded in 1948 by its original member distribution systems, today serves more than 720,000 consumers in South Carolina. Central Electric's mission is to provide its member distribution systems a reliable and affordable supply of electricity while maintaining a sound financial position through effective use of human, capital, and physical resources in accordance with cooperative principles.

1.2 Purpose of the Alternative Evaluation Study

The U.S. Department of Agriculture's (USDA) Rural Utilities Service (RUS) provides capital loans and loan guarantees to electric cooperatives for the upgrade, expansion, maintenance, and replacement of the electric infrastructure in rural areas. Central Electric is pursuing financial support from the RUS for a new 115 kV transmission line to serve Berkeley Electric's proposed McClellanville substation. The transmission line would provide the power delivery infrastructure to increase the reliability and capacity of the existing electrical system serving the area.

RUS is required to evaluate potential environmental impacts of its federal actions in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA implementing regulations (40 Code of Federal Regulations [CFR] 1500–1508), and RUS's NEPA implementing regulations, Environmental Policies and Procedures (7 CFR 1794). RUS guidance regarding NEPA implementation for RUS actions requiring scoping (RUS Bulletin 1794A-603) requires that an Alternative Evaluation Study (AES) and a Macro Corridor Study (MCS) be prepared. RUS normally accepts these studies before starting the official NEPA process (i.e., issuing of a Notice of Intent [NOI] to prepare an Environmental Assessment or an Environmental Impact Statement). Central Electric has prepared this AES to evaluate electric system alternatives that best meet the purpose and need for the proposed project. Potential corridor alternatives are discussed in the associated MCS.

1.3 Purpose/Need for the Proposal

The purpose of the proposal is to provide long-term reliable electric service to the McClellanville community and surrounding areas by constructing a 115-kV transmission line to Berkeley Electric's proposed McClellanville substation. The McClellanville community is located in an area that currently has no existing transmission infrastructure. Transmission lines deliver power to the customer substations long distances away from generating plants at high voltages to ensure that power is transmitted much more efficiently with minimal power losses and voltage drops. These lines are also much more reliable than distribution lines because they: (1) have wider rights-of-way, (2) have more aggressive right-of-way clearing and tree trimming programs, (3) have wider spacing of wires (4) are constructed more solidly, and (5) are more solidly grounded.

1.3.1 Existing System vs. Proposed Project

A diagram, illustrating a complete power system, is included in this document as Figure 1. This diagram functionally represents what the electrical system would look like if the proposal were completed. A substation would be located in a load center (or an area where power is needed). A transmission line from the bulk electric system would then service or energize the load-serving substation. Distribution lines would then exit the substation and provide electric service to residents, commercial buildings, schools, farms, etc. This is a typical and universally desired method of providing electrical service to a substation because it results in a very reliable source for each of the distribution circuits leaving the substation.

Figure 2 is a map of the existing power system serving the McClellanville area. Berkeley Electric, a member Central Electric's system, serves the McClellanville area from a distribution system that is approximately forty (40) miles long from the nearest substation to the end of the distribution line. Geographically, this extends from the Mt. Pleasant area to the Santee River delta. The substation, identified as Hamlin, and approximately twenty-two (22) miles of distribution line, are owned and operated by South Carolina Electric & Gas Company (SCE&G). This SCE&G distribution line serves as the source to Berkeley Electric's McClellanville Metering Point, which serves the McClellanville community. Of all the delivery points provided to Berkeley Electric from Central Electric, this is the only one served by a long distribution line. Unlike transmission lines, the SCE&G distribution line serves other commercial and residential customers along the way and beyond Berkeley Electric's metering point. This 40-mile distribution line is difficult to maintain, creates voltage problems, and results in poor power quality/reliability to all the customers involved. Central Electric is Berkeley Electric's wholesale power provider and is therefore responsible for purchasing the power from SCE&G and reliably delivering it to Berkeley Electric to serve the McClellanville area.

1.3.2 Reliability and Its Measures

The reliability of the electric service provided to consumers is one of Berkeley's primary concerns. Likewise, one of Central's primary concerns is the reliability of electric service provided to Berkeley. Reliability to an electric utility is defined as an effort to keep the lights on as much as possible to as many customers as possible. Reliability of power systems is measured by industry standard indices that are calculated by the utility from actual data captured from electronic meters and/or controls.

Two of the most commonly used indices to measure system performance are the System Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI). SAIDI is the duration in minutes of interruption experienced by the average customer and is equal to the total customer interruption durations divided by the total customers served. . SAIFI is equal to the total number of customer interruptions divided by the total customers served. Please refer to Figure 3, titled SAIDI, 2004-2008 and Figure 4, titled SAIFI, 2004-2008. These charts show the SAIDI and SAIFI as calculated for the source for all of Berkeley's stations for the years 2004-2008. The reliability of the electric service being provided at the McClellanville Source is by far worse than any other station owned and operated by Berkeley, with the second being the Hamlin Metering Point that was replaced by a substation in 2008. As shown in Table 1 below, the SAIDI number for the McClellanville source is over 20 times greater than the typical source at Berkeley Electric. Replacing the McClellanville Metering Point with the McClellanville Substation and a transmission source would improve the reliability to customers in this area to a level equivalent to other customers on Berkeley Electric's system.

Table 1: Reliability Indices – McClellanville Source

Berkeley Electric Reliability Indices	McClellanville Source 2004-2008	Typical Berkeley Electric Source: 2004-2008[1]
SAIDI	623.24	29.95
SAIFI	4.21	0.34

[1] Average SAIDI and SAIFI source values from Berkeley Electric distribution system (as seen in Figures 3 & 4) with the McClellanville and Hamlin Metering Points excluded.

In addition to being measured at the source, reliability is also measured on the distribution system owned and operated by Berkeley Electric. The proposed McClellanville Substation, as shown on Figure 2 is located at a point that is central to the McClellanville area. This area is now being served from one circuit out of the McClellanville Metering Point, whereas the proposed McClellanville Substation would serve this same area with three circuits. The following Table 2 shows SAIDI and SAIFI calculations for the times that the circuit has gone out in addition to when the source was out:

Table 2: Reliability Indices – McClellanville Circuit

Berkeley Electric Reliability Indices	McClellanville Circuit 2004-2008	Typical Berkeley Electric Circuit: 2004-2008[1]
SAIDI	581.71	289.64
SAIFI	4.40	2.76

The SAIDI number is about twice as high as the typical circuit at Berkeley Electric. There are three ways to reduce this number: (1) reduce the duration of the outages, (2) reduce the number of outages that occur, or (3) reduce the number of customers affected. Since McClellanville is a remote area, it would be very difficult to decrease the duration as emergency response times would be above what is typical. However, serving the same area with three circuits versus one circuit would reduce the number of customers affected on many outages and bring the SAIDI more in line with other circuits on Berkeley Electric's system. The SAIFI number is also greater than the typical Berkley Electric circuit, and it is expected that this number would be reduced with the proposed project.

1.3.3 Voltage Levels

Berkeley Electric has a responsibility to provide voltage levels within industry standards to all of its customers. The most recent standard is the ANSI C84.1-2006 titled American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz). It is common for Berkeley Electric to use voltage regulators to help keep voltages within the specified ranges for all the customers served from a distribution line. A voltage regulator is an electrical device that automatically steps voltages up or down to maintain optimum voltage levels. Typically, Berkeley Electric has one set of voltage regulators installed on each circuit at its substations. In the case of the McClellanville Metering Point, two sets of voltage regulators are installed to boost voltages to acceptable levels. This is a "band-aid" solution that will become less effective with even the smallest amount of load growth in the area. Based on the loading on this equipment, another set of voltage regulators may be needed soon. In this case, growth on both Berkeley Electric's and SCE&G's distribution systems directly affects the voltage level delivered to Berkeley Electric's system.

1.3.4 Voltage Sags

Another concern related to voltages is voltage sags. These can occur when an object, such as a tree limb, makes contact with the distribution line. While every reasonable effort is made to keep distribution line rights-of-way as clear as possible, the number and magnitude of voltage sags are directly proportional to the length of the distribution line. This is due to the increased amount of exposure of the line to the environment and the technical characteristics of the wire (or conductor). When voltage sags occur: lights can either go dim or go out, motors can stall out or overheat, and computers can shut down or fail. As customers continue to add newer, more sensitive electrical and electronic equipment, this becomes a much greater concern.

2.0 Project Description

2.1 Proposed Action

The action being proposed by Central Electric is to build a single-circuit 115 kV transmission line from a Santee-Cooper Network transmission line to the proposed McClellanville substation to be constructed by Berkeley Electric. The transmission line macro-corridors from which a route would be selected range from 15 to 33 miles in length and vary in width from a few hundred feet to up a mile.

Current design features being proposed include: single pole structures with three phase conductors and a single 0.565 OPGW fiber optic overhead shield wire. The right-of-way would be cleared to 75 feet in width (37.5 feet on either side of the centerline) and would include the trimming or removal of danger trees (hazardous trees that could fall on the line) that may be outside of the right-of-way.

3.0 Alternative Evaluation

3.1 Alternatives Considered

In the sections below, the “no action” alternative, and other alternatives that address each aspect of the purpose and need for the proposal are discussed. As mentioned above, the most pressing need is to improve the reliability of the electrical service to the McClellanville community and surrounding area. However, each alternative that meets this purpose and need was also explored for its ability to support increased load or energy demand in the McClellanville area.

An economic power supply analysis of each source option was performed, at two different growth rates, by comparing the cost to upgrade the electrical system versus the preferred transmission alternative. Each alternative was evaluated over a 30-year timeframe. The *No Action Alternative* and the *Energy Efficiency/Conservation and Renewable Resources Alternative* are alternatives that require no changes to the existing distribution system, so there are no economic analysis comparisons for new construction.

3.1.1 No Action Alternative

Berkeley Electric has an assigned service territory that includes an area that is generally in the vicinity of the McClellanville community of Berkeley County, South Carolina. This is a unique coastal area that is effectively isolated by virtue of a number of natural boundaries, including the Atlantic Ocean to the east, the Santee River delta to the north and the Francis Marion National Forest to the west. As a result, electrification of the area meant providing service from the south. Long time environmental restrictions along with a relatively low population density in the area had created a situation where the existing power system either could not be expanded or it was not economically feasible.

Approximately twenty years ago, it became clear to the engineering and operations staff at Berkeley Electric that the existing facilities were not providing the community an acceptable level of service. The area is currently served by long distribution lines that extend over forty miles in length. These long lines pass through heavily wooded areas with relatively narrow right-of-way. These lines are difficult to maintain, create voltage problems, and thus result in poor power quality/reliability to all customers involved.

Electrical overload of the conductors causes the distribution lines to sag towards the ground and creates a public safety hazard. Also, the long distances that these circuits (or lines) have to reach presents a voltage problem where the existing equipment will not be capable of sustaining line voltages at acceptable levels, particularly at times when the usage in the area is at its maximum. This could cause appliances and motors to operate unacceptably or be damaged permanently.

While the system capacity and voltage levels are a concern for the near future, the area has already passed the point of unacceptable reliability with outages. Long distribution circuits (such as those that exist to serve the McClellanville area) are normally replaced with shorter circuits by locating a new substation as close to the load center as possible. A new substation requires a transmission line to serve it. Transmission lines are inherently more reliable than distribution lines due to their physical isolation from nearby vegetation and electrical isolation from consumers (i.e., the only loads are other substations).

Over the years, the population of the McClellanville area has minimally grown, resulting in a slightly increased electrical load. While the present system is still able to accommodate the existing load, even a very small growth rate (lower than what has been seen in recent years) would result in a situation where the existing power lines would not have the capacity to serve those growing loads, particularly at those times such as hot summer days or cold winter days when consumers are attempting to cool or heat their homes.

By failing to provide a more reliable source of power to the McClellanville community than presently exists, the community would continue to experience reliability issues. These issues will become even further aggravated by load growth (which would affect voltage and outage concerns). Berkeley Electric can continue to use a “Band-Aid” approach as long as it is necessary to attempt to maintain as high a level of service reliability as possible with the existing distribution lines. However, continuing to use such an approach would not solve the long-term reliability issues that are present in this area.

3.1.2 Energy Efficiency/Conservation and Renewable Resources

Central Electric is working with Berkeley Electric and its other member distribution systems in South Carolina to promote and improve energy efficiency and conservation. Central Electric has in place statewide load control, used at peak load times, and is developing renewable resources. On the energy efficiency side, Central Electric and its member distribution systems will have distributed over 1.9 million compact fluorescent light bulbs (CFLs) by the end of 2010 and has in place a pilot weatherization program for residential consumers. Central Electric and its member distribution systems are also working with the South Carolina Energy Office to provide grants to improve over

1,200 homes with various energy efficiency measures and determine which ones are the most effective. The member distribution systems plan to weatherize 20-30% of residential homes over the next 10 years. This is a huge effort that will reduce annual energy consumption by 180 to 270 million kilowatt-hours (kWh). Central Electric's renewable energy program includes the purchase of qualified green energy through our net metering program. Net metering allows the customer to put additional power generated from solar panels, windmills, or other distributive generation equipment back onto the distribution power lines. Central Electric pays the customer for this localized distributed generation of power.

Central Electric and Berkeley Electric will continue to pursue and promote efficiency improvements, increased conservation, and utilization of renewable resources with vigor, and these efforts should help reduce the load growth that is straining the existing system to some extent. However, these efforts do not provide relief to one of the main factors supporting construction of the transmission line, which is the poor electrical reliability experienced by the cooperative members in the McClellanville area compared to the members on the rest of Berkeley Electric's system.

3.1.3 Rebuild Existing Distribution System

This alternative evaluates rebuilding the existing distribution system to serve the McClellanville area. It requires an upgrade on the SCE&G system, including a new distribution substation at SeeWee, and a new 20 mile 795 SAC feeder from See-Wee to McClellanville. This alternative also requires a new 21 mile double-circuit 477 ACSR line from Jamestown.

With an aggressive growth rate of 4.88%, a capital cost of $6,900,000 would be invested in building an upgraded distribution system from the new SCE&G Seewee substation with the new double circuit distribution circuit from Jamestown for loads over 10 megawatts (MW). The system would be operated over 30 years and the cost of the system losses would be calculated and brought back to a value today of $80,051,850. The total system cost over the lifetime would be $86,951,850. The total system cost is the capital cost plus the value today of system loss cost.

For a more conservative 2.5% growth rate, a capital cost of $6,900,000 would be invested in building an upgraded distribution circuit from a new SCE&G Seewee delivery point with a second distribution circuit from Jamestown for loads over 10 MW. The system would be operated over 30 years and the cost of the system losses would be calculated and brought back to a value today of $62,004,970. The total system cost over the lifetime is $68,904,970.

3.1.4 On–Site Generation

This alternative evaluates the construction of the McClellanville substation with on-site generation initially capable of serving up to 6 MW. Banks of 2-MW diesel generator units were evaluated as an on-site generation alternative. Multiple generator units could be added as needed to serve the community where individual units could be temporarily taken down for repair. The initial capital cost of this project is $12,100,000. In the 4.88% growth case, the fourth generator would be added during the first year of operation due to the projected increase in load. The system is operated over 30 years and the cost of the system losses would be calculated and brought back to a value today of $89,842,364 for a 4.88% growth rate and $52,906,588 for a 2.5% growth rate. The total system cost over the lifetime is $101,942,374 and $65,006,588 respectively.

The analysis concluded that the on-site generation capacity for the McClellanville community is not an economical remedy to the reliability issues. The largest expense to on-site generation is the cost of fuel, which is not only expensive but as a commodity, has a large fluctuation in price.

3.1.5 Preferred Alternative: New Transmission System

The transmission line alternative was considered as the preferred alternative to provide reliable electric service to the McClellanville community. All of the transmission alternatives evaluated in the MCS would provide an alternative source of power into the McClellanville service area. They are evaluated using the same growth rates as the rebuilding existing distribution and on–site generation cases. In each of the cases the system is operated over 30 years and the cost of the system losses is calculated and brought back to today's equivalent value.

There are five basic transmission alternatives that have been considered. Each one of these provides transmission service from a bulk transmission source. The cost of constructing transmission to serve a growth rate of 4.88% in the McClellanville community produces a range from $63,632,903 to $72,329,266. The cost of constructing transmission to serve a growth rate of 2.5% in the McClellanville community produces a range from $48,299,553 to $57,127,599.

The first alternative is installing a switch in the Belle Isle area and constructing approximately 14-17 miles of 115 kV transmission line to the proposed McClellanville substation. The Santee Delta is included within the macro-corridor of this transmission line alternative.

The second transmission alternative is constructing a 230/115 kV switching station/substation in the Britton Neck area (Britton Neck 1 & 2) and constructing approximately 14-15 miles of transmission line to the proposed McClellanville substation.

The third transmission alternative is constructing a 230/115 kV switching station/substation near an existing 230 kV transmission line in the Honey Hill area (Honey Hill) and constructing approximately 10 miles of transmission line to the proposed McClellanville substation. The Frances Marion National Forest is included within the macro-corridor of this transmission line alternative.

The fourth alternative is tapping the existing Jamestown substation and constructing approximately 21 miles of 115 kV transmission line to the proposed McClellanville substation. The Frances Marion National Forest is included within the macro-corridor of this transmission line alternative.

The fifth alternative is tapping near the existing Charity Generation plant's substation at 115 kV and constructing approximately 28-33 miles of 115 kV transmission line to the proposed McClellanville substation. The Frances Marion National Forest is included within the macro-corridor of this transmission line alternative.

Table 3 presents an executive summary analysis of all possible future service alternatives to the McClellanville area. The capital cost of the installed facilities and the present value of the system loss cost were combined in the project total cost. Both a 2.5% load growth and a 4.88% load growth were assumed over the 30 year period. Load refers to the amount of power being used by all of the customers. The 4.88% load growth was forecasted in the area before the economic recession. A 2.5% load growth was used to evaluate the effects caused by the economic recession. Both growth rates band or bracket the 3.5 % growth rate used in the 2005 analysis.

Table 3: McClellanville Future Service Options Executive Summary

Macro Corridor Routes	Load	Transmission Capital Cost	Distribution and Substation Costs	Total Lifetime Cost
Rebuilding existing distribution to serve the McClellanville area	4.88% 2.50%	$0 $0	$6,900,000 $6,900,000	$86,951,850 $68,904,970
Building transmission from a new source to provide service to the McClellanville area	4.88% 2.50%	$10,229,722 to $16,843,447 $10,229,722 to $16,843,447	$2,156,900 $2,156,900	$73,862,510 to $85,276,185 $58,529,160 to $69,942,835
On-site generation	4.88% 2.50%	$12,000,000 $12,000,000	$100,000 $100,000	$101,942,374 $65,006,588

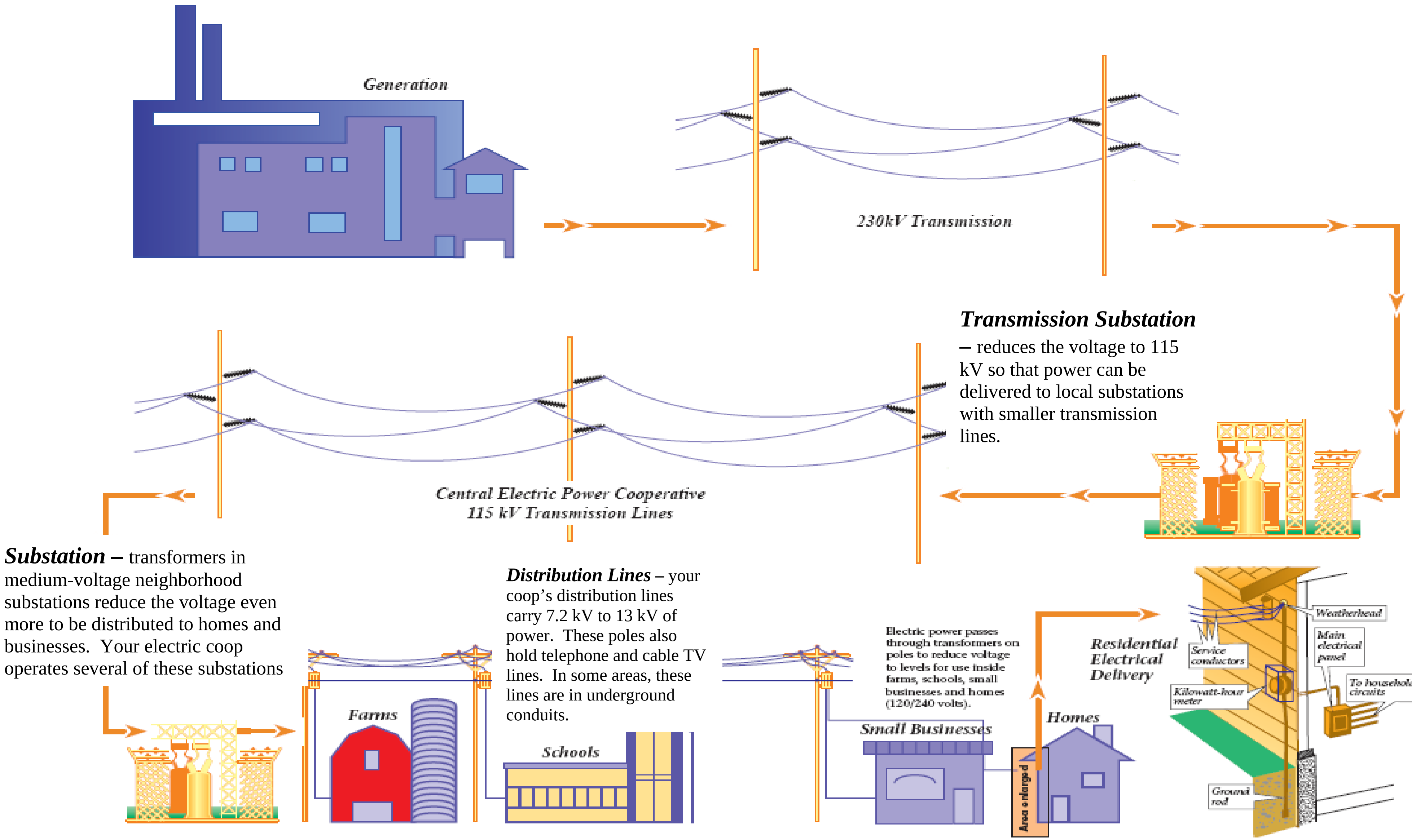

Figure 1: Diagram of a Complete Power System

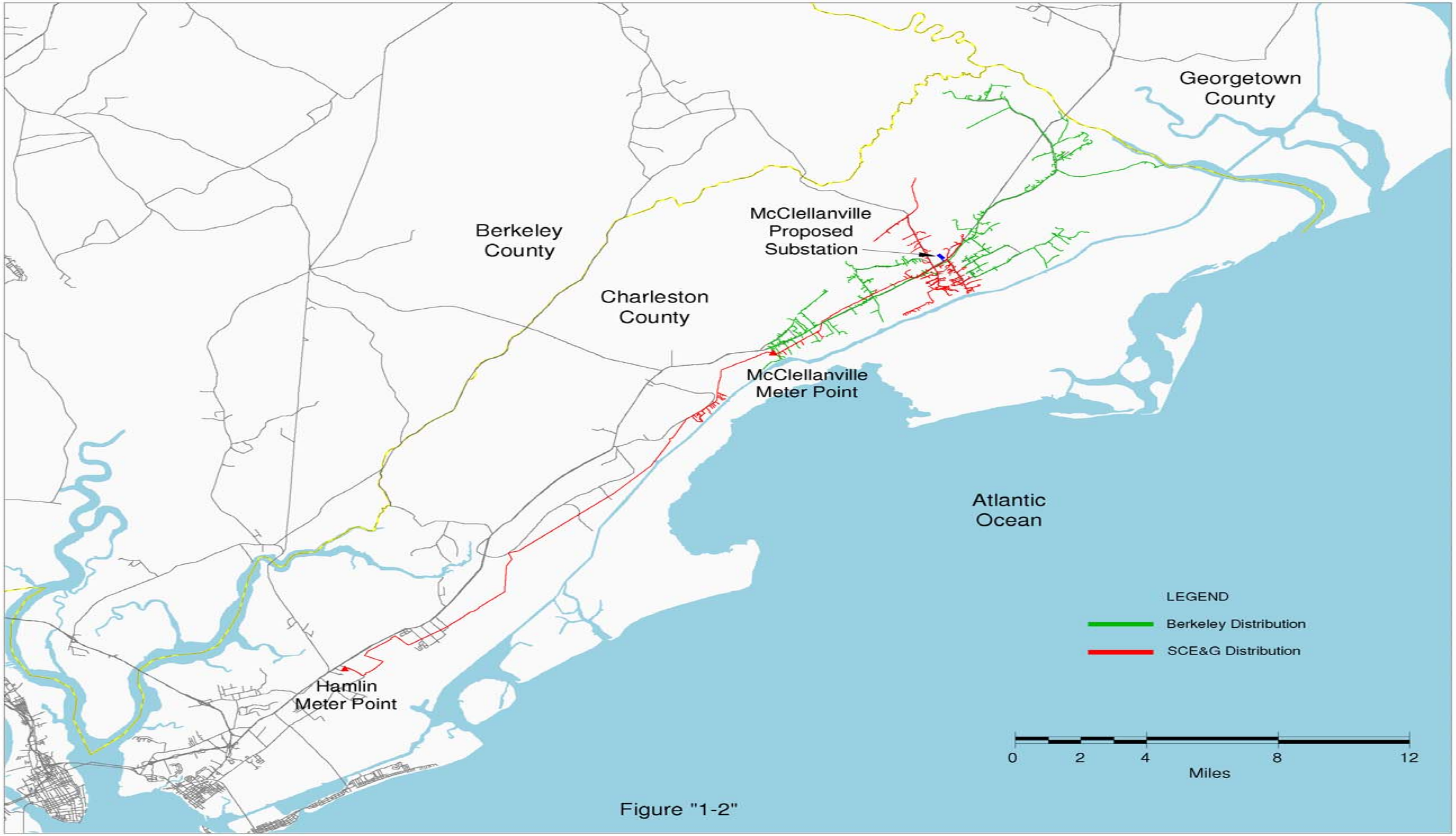

Figure 2: Map of the Power System Serving McClellanville

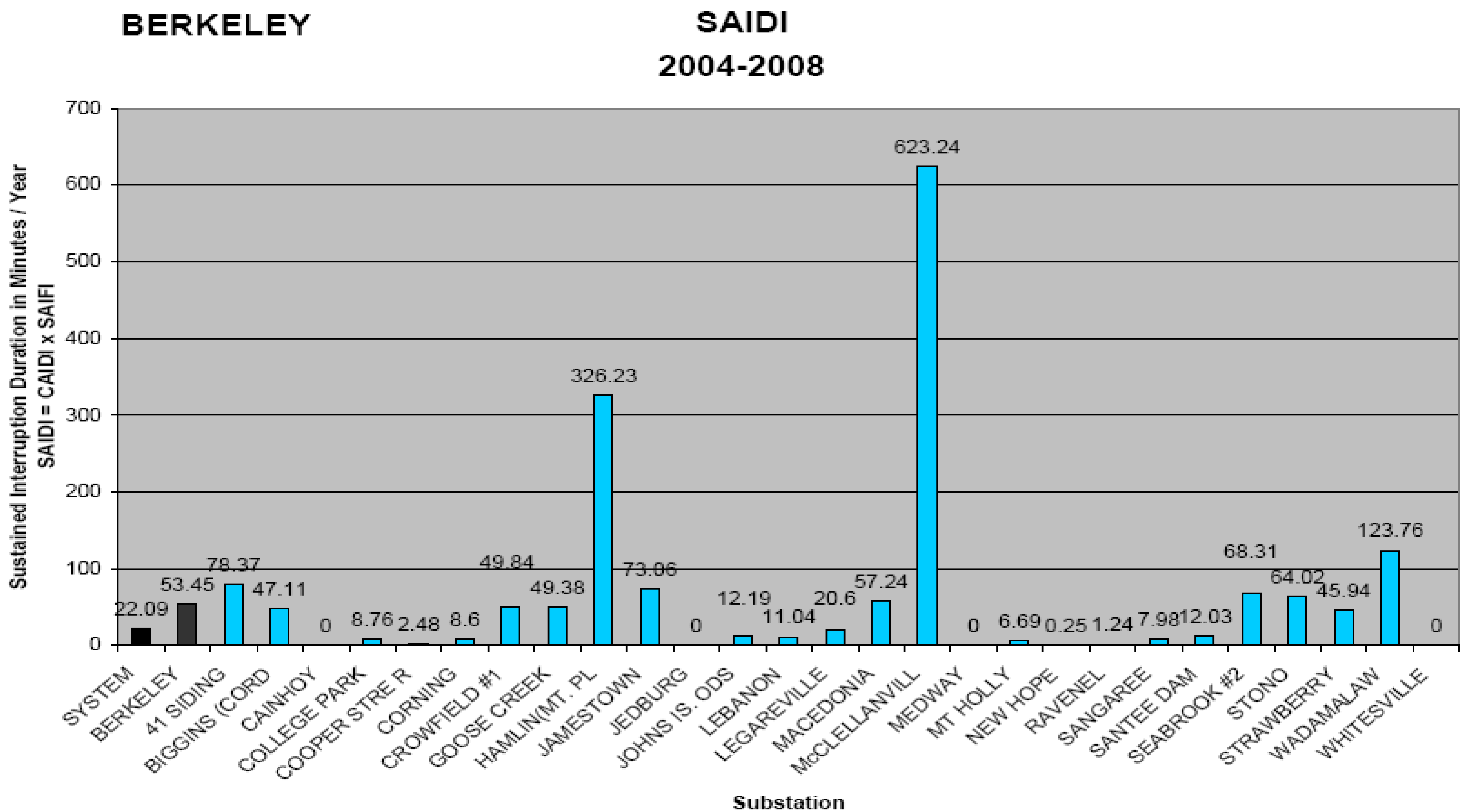

Figure 3: Source SAIDI Index for Berkeley Electric Cooperative from 2004-2008

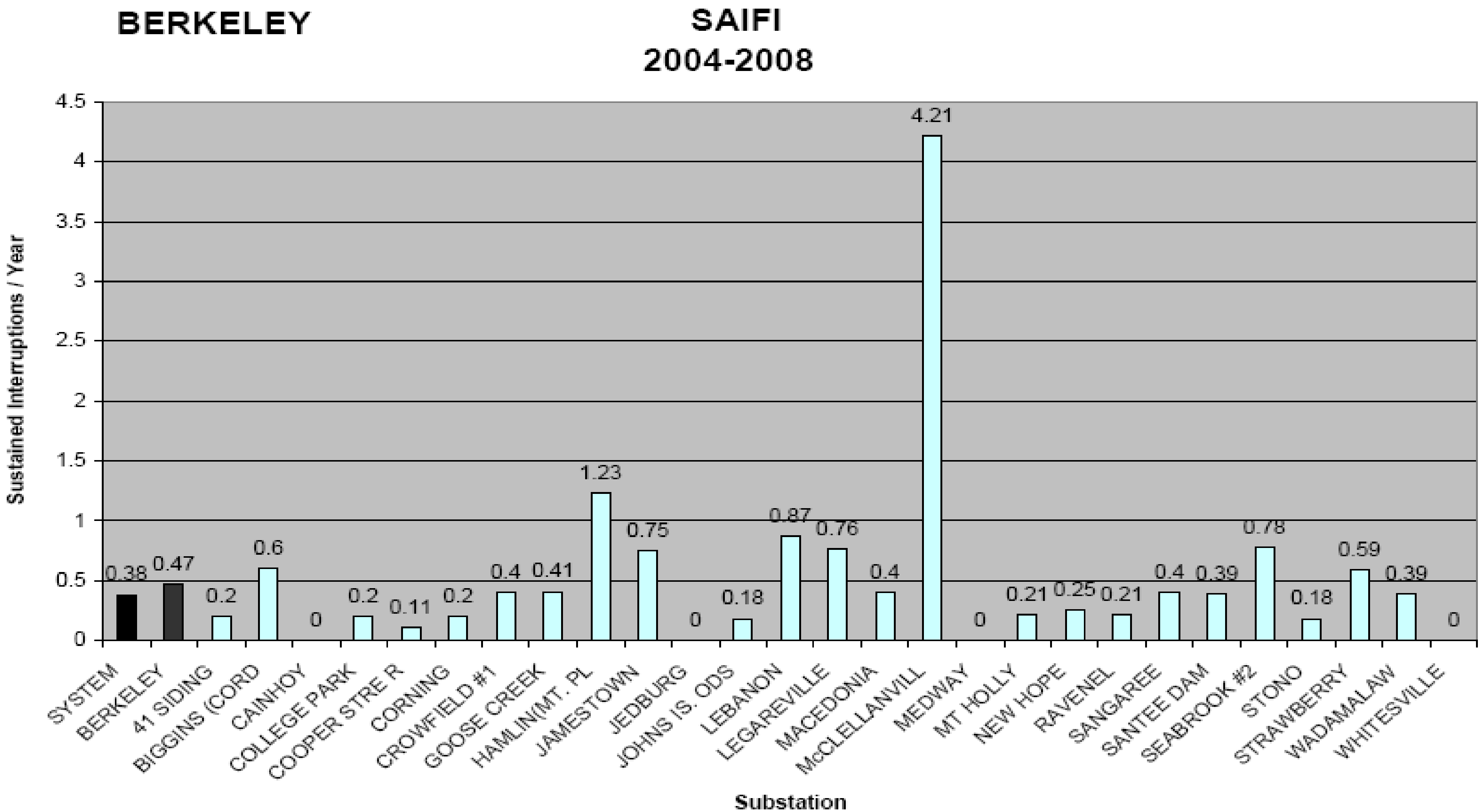

Figure 4: Source SAIFI Index for Berkeley Electric Cooperative from 2004-2008

Appendix C—Santee Cooper Vegetation Management Plan

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RIGHT-OF-WAY MANAGEMENT UNIT PLAN
2011

I. OBJECTIVE

To provide a cost effective and integrated Transmission Vegetation Management Program (TVMP) that protects system availability from undesirable vegetation growth.

II. GOALS

- Comply with NERC Standard FAC-003-1
- Ensure that undesirable woody vegetation growth does not interfere with the inspections and maintenance of transmission facilities by line personnel
- Utilize WMIS (Work Management Information System) to ensure that all appropriate maintenance items are scheduled and completed as designed
- Ensure that annual maintenance production totals are compatible with established maintenance cycles
- Promote a positive public image

III. ORGANIZATION

The Right-of-Way Management section is comprised of three distinct units that are responsible for a variety of right-of-way related maintenance activities. *Mechanical Reclearing* is the largest of the three units with respect to the number of company personnel and is responsible for the mechanical reclearing and soil stabilization of selected transmission rights-of-way. This unit is made up of a Supervisor, two (2) crew leaders, ten (10) equipment operators. A second unit, *Right-of-Way Management*, is responsible for herbicide related vegetation maintenance, encroachment enforcement, and administering the POWER for Wildlife Program. This unit is made up of a Superintendent, Supervisor, Right-of-Way Specialist, Technical Associate, Administrative Associate, and an equipment operator. A third unit, *Contract Reclearing*, is responsible for all tree related maintenance throughout the transmission system and scheduling of right-of-way maintenance work through WMIS. This unit is made up of a Supervisor, Sr. Right-of-Way Specialist and a Right-of-Way Specialist.

The overall supervision and direction of this section is the responsibility of the Superintendent, Right-of-Way Management. Reporting directly to the Superintendent are supervisors from each of the maintenance units, a Right-of-Way Specialist, and an Administrative Associate.

IV. CUSTOMERS

The majority of Right-of-Way Management programs support the daily operations and maintenance of Transmission Operations. However, the diversity of resources within this section, has allowed the customer base to increase over the years. Other customers include Project Management, Survey, Substation Maintenance, Distribution, and landowners along transmission rights-of-way. Services include side trimming, clearing of existing rights-of-way, facility spraying (e.g., substations, material storage sites, etc.), erosion control oversight (capital projects), and planting recommendations for POWER for Wildlife applicants. **Note: Mileage and acreage for the old New Horizons Territory is now included in this unit plan.**

V. RESPONSIBILITIES

Right-of-Way Management is responsible for maintaining approximately 40,060 brush acres as well as problem trees along the periphery of 4,182 miles of the rights-of-way. Because the Santee Cooper transmission system is located throughout the state, a number of vegetation maintenance challenges are encountered due to the differing topography, soil types, and climates found throughout the state. In order to maintain an effective right-of-way maintenance program that can deal with any challenge, it is necessary to utilize an integrated, proactive approach that is cyclic in nature.

Current maintenance programs include mechanical reclearing, low volume herbicide spraying, and tree maintenance which are recognized industry wide as well as by the new NERC vegetation management standards as an effective means of controlling undesirable woody vegetation. Although each program is independent of the other, together they provide the basis of an integrated vegetation management program that can effectively manage vegetation while protecting system availability. Also, Right-of-Way Management administers several other programs that are included with the responsibilities listed below.

A. **Mechanical Reclearing:** Approximately 21,322 acres of transmission rights-of-way are recleared on a 2 ½ - 3 year cycle, using medium to heavy 4WD tractors and associated mowing implements, to ensure that vegetation growth does not adversely effect system reliability. Also, reclearing personnel utilize herbicides to control vegetation throughout their respective mow area. This includes applying granular herbicide at the base of selected transmission structures in order to reduce the potential of damage from wild fires and/or facilitate ground rot inspections by line personnel. Also, crews treat wetland areas (i.e., areas where mowing equipment can not traverse) with a foliar herbicide application, using a Marsh Master, to control woody vegetation.

Typically, the entire right-of-way will be recleared according to the easement specifications less any areas that are planted (i.e., agricultural lands and wildlife food plots will be skipped). An exception to this could include rights-of-way where steep topography creates areas with extreme relief and transmission structures are positioned at the two highest topographical points. As long as clearances are maintained naturally and operations and maintenance are not affected, it may be appropriate to leave this portion of the right-of-way undisturbed during reclearing operations.

1. **Manual Reclearing:** Manual reclearing plays a relatively small role in Santee Cooper's over-all vegetation management plan. Typically, the only two conditions that would initiate a manual reclearing operation is an easement restriction (i.e., any wording in the easement that would preclude the use of mechanical equipment and/or herbicides) or when a potential reliability issue is identified in a problem area (i.e., when a right-of-way inaccessible to mechanical equipment has vegetation growing at or near the conductor).

   Utilizing chain saws, brush saws, and/or bush axes, personnel reclear the right-of-way of any woody vegetation. Typically, low growing shrubs including waxy species are left uncut.

B. Herbicide Spray Programs: The goal of the herbicide program is to control vegetation that could interfere with the normal transmission of electricity while promoting low growing native vegetation. The current practice of applying herbicides is to selectively treat undesirable woody vegetation using a low volume methodology.

Although the amount of herbicide applied is dependent on the species composition, density, and height of the vegetation that is present, the selective application approach results in less active ingredient being applied per acre, as compared to the broadcast method. Also, only herbicides approved by the USEPA (United States Environmental Protection Agency) are used within rights-of-way with each being applied in accordance with manufacturer labeling.

1. **Whole Line Spraying:** Existing transmission rights-of-way that are treated from one substation to the next, without any skips, are considered to be whole line applications and are treated on a 3 year cycle. Currently, 15,875 acres of transmission rights-of-way have been designated for whole line work. New line sections selected for the Whole Line program are treated approximately 1 – 1 ½ years after initial clearing with resulting vegetation heights ranging from 2' to 6' feet at the time of treatment. This vegetation height provides adequate foliage for herbicide uptake and requires less active ingredient per acre to control undesirable vegetation as compared to treating taller vegetation. Also, as the vegetation begins to succumb to the effects of the herbicide, there is a less noticeable brownout.

Utilizing a **selective** low volume approach, personnel equipped with backpacks will treat only undesirable vegetation along selected rights-of-way. Hardwoods such as sweetgum, red maple, black willow, and various oaks that are tall growing and prolific sprouting species along with pines are targeted. By removing these trees, desirable plants such as grasses and forbs can compete for nutrients and, in the long term, provide substantial biological control. Selective spraying will result in a greater bio-diversity of plant life thus enhancing wildlife habitat for most game and non-game species.

After the initial herbicide application, there will be a post inspection (e.g., aerial & ground) to identify any areas that may require a follow-up treatment. Maintenance will then take place on a 3 year rotation. Because the density of undesirable vegetation will have been reduced, subsequent herbicide applications should require less herbicide to control the vegetation present.

2. **Wetland Area Spraying:** Wetland areas are defined as any area on a transmission right-of-way that is inaccessible to mechanized reclearing equipment due to poor soil conditions. Currently, approximately 2,863 acres of significant sized wetland areas have been identified within the transmission system. **Note: ~ 977 acres and ~1,886 acres of wetland areas are managed in the whole line and mow areas, respectively.**

Ground crews (includes both contractors and in-house personnel) utilize backpacks and/or an ATV (Argo, Marshmaster, etc.) equipped with a hydraulic spray system to foliar treat only the undesirable vegetation present. Current procedures dictate a **selective,** low volume (10 - 40 gallons mix/acre) herbicide approach that minimizes the amount of active ingredient applied per acre.

The herbicide products used during Wetland Area Spraying are determined by the species present and to a greater extent by the site location. In areas that have standing water and are connected to a larger aquatic system (e.g., river, swamp, etc.), only EPA approved herbicides registered for use in wetland or aquatic sites are used.

Wetland areas are scheduled on a three or four year rotation depending on the vegetation species that are present, densities of woody vegetation, and height of conductors. As with whole line applications, vegetation densities should decrease with subsequent applications requiring less herbicide to be applied.

C. **Tree Maintenance Programs:** Trees growing outside the right-of-way boundaries provide the greatest potential threat to the transmission system. When these trees reach a sufficient height or have limbs extending into the right-of-way that are in close proximity to a conductor(s) (i.e., no closer than the minimum clearance that is set forth in the Institute of Electrical and Electronics Engineering

(IEEE) Standard 516-2003, section 4.2.2.3), they are considered problem trees. Three distinct operations that include side trimming, patrolling, and danger tree maintenance are used to remove and/or trim reported problem trees along approximately 4,182 miles of rights-of-way.

1. **Side Trimming:** Transmission lines with tree limbs encroaching into the right-of-way that create a problem for maintenance and operations are scheduled for side trimming. Typically, this occurs on narrow rights-of-way or when several lines have been stacked on a single transmission corridor. Maintenance options include removing encroaching limbs from the air and/or the ground. The aerial operation consists of using a set of belt driven saws, suspended from a helicopter, to cut the limbs back to the edge of the right-of-way. Ground operation consists of using a machine called a Jarraff or Skytrim to perform a similar function. This machine has an extendable boom with an attached circular saw that can reach and trim tree limbs high above the ground. Both options provide a cost effective method for ensuring that adequate clearances between transmission conductors and live trees are maintained.

2. **Patrolling:** Patrol crews (e.g., typically 3 men) are used throughout the system to remove trees reported through WMIS as dead, diseased, and/or leaning and pose a threat to system availability. Due to the crew size and required equipment, they are very mobile and able to deal with tree issues in remote locations.

3. **Danger Tree Maintenance:** Danger Tree maintenance is currently being completed on selected capital construction and/or special right-of-way reclamation projects. The establishment of a normal system-wide cycle for O&M operations is being considered. During these O&M operations, easements are researched and landowners are contacted approximately six months prior to this operation. Once this has been accomplished, maintenance personnel utilize an instrument (e.g., clinometer) that measures angles to determine whether a tree located off the right-of-way is tall enough to hit the transmission conductor if it were to fall. Depending on the species of tree, height, age, and site index, the tree will either be felled whole or topped. The decision to top or fell is made by the forester in charge of the operation based on his opinion of tree survivability after topping. However, the landowner may request that any or all trees be felled if a timber sale is planned. Felled trees are de-limbed and decked between the spans in which they were cut. Typically, the easement provides that any felled trees belong to the grantor and/or current landowner. The resulting debris (tree tops and limbs) are left in the right-of-way to decay.

D. **Erosion Control Program:** Reported erosion problems are rated from low to extreme based on soil type, topography, and proximity of eroded area to a transmission structure. This information is used to prioritize and schedule erosion control measures that will provide long-term control and ensure system reliability.

Corrective action measures include grading the eroded area and, if necessary, constructing earthen terraces to divert surface waters across the right-of-way. Crews then will plant the area with an appropriate seed mix for the season and soil characteristics. To enhance stability and ensure that the terraces and repaired rights-of-way are not impacted by rains before grasses are established, hay bales or other erosion control structures are installed to protect them.

E. **Wildlife Habitat Enhancement Program:** In an effort to reduce the overall number of right-of-way acres requiring maintenance and at the same time encourage wildlife habitat enhancement, Santee Cooper entered into a partnership in a state wide program called POWER (Protect Our Wildlife at Every Right-of-Way) for Wildlife. This Program originated in 2000 and provides monetary grants to approved landowners that were willing to maintain and enhance their rights-of-way for wildlife habitat. Individuals interested in the Program are required to submit an application along with a vegetation plan that shows a five-year commitment to right-of-way maintenance and wildlife habitat enhancement on owned or leased property. Applications are rated on several criteria including current soil conditions, benefit to the utility, and the ability of the landowner to maintain the right-of-way for the long term. To date, 904 acres along Santee Cooper's transmission corridors have been maintained to enhance wildlife habitat. Also, maintained areas are marked with POWER for Wildlife signage that is provided by Santee Cooper.

F. **Flood Control Program:** This section inspects problem rights-of-way and schedules flood control activities, when necessary, to remove dam debris resulting from beaver activities. This protects transmission facilities such as switches, poles, and guy anchors from premature corrosion and rotting.

G. **Facility Spraying Program:** This section is responsible for herbicide treatments within transmission and distribution substations, communication sites, crew quarters, and material storage yards to control vegetation growth. This is done primarily for safety reasons and also for aesthetics. Individuals responsible for the grounds within substations and warehousing yards are contacted at the beginning and during the spray season to ensure that their needs are being adequately met. To date, approximately 410 acres are treated annually.

H. **Line Inspections:** New Central Electric transmission rights-of-way are inspected to ensure that right-of-way conditions are favorable for O&M acceptance by Santee Cooper. Danger trees, erosion, correct right-of-way widths, and stump levels are some of the major items that are inspected.

I. **Gate/Lock Program:** Right-of-Way Management is responsible for the budgeting, requisitioning, and supplying of gates and locks to support Transmission Operation requirements. The main goal of this Program is to help facilitate access to and along transmission rights-of-way for maintenance personnel.

J. **Encroachment Program:** All encroachments (structures, pools, utility crossings, etc.), both permissible and non-permissible, that are located within transmission rights-of-way will be processed through this section. The intent of this program is to identify, document, and remove any encroachment that interferes with transmission maintenance and operations or is a public safety issue. All other encroachments will require an agreement with the respective landowner or an assignee.

VI. CONCLUSION

Right-of-Way Management continues to evaluate current maintenance programs to ensure that system reliability and right-of-way integrity are not compromised due to the lack of maintenance. The programs discussed in this plan continue to evolve as added maintenance responsibilities are presented due to the increasing size of the transmission system.

An integrated maintenance program will continue to be an integral part in keeping reclearing costs contained as new acres are added to the system. Also, Right-of-Way Management personnel will have to keep abreast of changing environmental regulations so landowner rights and natural resources are protected.

Appendix D— Fish Species Potentially Present in the Project Area, their Status, and Whether They Were Identified During Surveys of NFS Lands

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Common Name	Scientific Name	Federal Listing Status	State Listing Status[a]	USFS Status[b]	State SGCN Priority[c]	Belle Isle B & C Routes[d]	Jamestown Route[e]	Charity Route[f]
Mud Sunfish	*Acantharchus pomotis*	----	----	----	----	X	X	X
Shortnose Sturgeon	*Acipenser brevirostrum*	FE	SE	----	Highest	----	X	----
Atlantic Sturgeon	*Acipenser oxyrinchus*	FE	Species of Concern		Highest	----	----	----
Blueback Herring	*Alosa aestivalis*	----	Species of Concern	----	Highest	----	----	----
Hickory Shad	*Alosa mediocris*	----	Species of Concern	----	Highest	----	----	----
American Shad	*Alosa sapidissima*	----	Species of Concern		Highest	----	----	----
Snail Bullhead	*Ameiurus brunneus*	----	----	----	Moderate	----	----	----
American Eel	*Anguilla rostrata*	----	----	SCC	Highest	X	X	X
White Catfish	*Ameiurus catus*	----	----	----	Moderate	----	----	----
Yellow Bullhead	*Ameiurus natalis*	----	----	----	----	X	X	X
Flat Bullhead	*Ameiurus nebulosus*	----	----	----	----	X	X	----
Flat Bullhead	*Ameriurus platycephalus*	----	----	----	Moderate	----	X	----
Bowfin	*Amia calva*	----	----	----	----	X	X	X
Pirate Perch	*Aphredoderus sayanus*	----	----	----	----	X	X	X
Flier	*Centrachus macropterus*	----	----	----	----	X	X	X
Swampfish	*Chologaster cornuta*	----	----	----	Moderate	X	X	----
Satinfin Shiner	*Cyprinella analostana*	----	----	----	Moderate	----	----	----
Fieryblack Shiner	*Cyprinella pyrrhomelas*	----	----	----	Moderate	----	----	----
"Thinlip" Chub	*Cyprinella sp.(c.f. zanema)*	----	----	----	Highest	----	----	----
Freshwater Goby	Ctenogobius shufeldti	----	----	----	----	----	X	----
Fat Sleeper	Dormitator maculatus	----	----	----	----	----	X	----
Carolina Pygmy Sunfish	*Elassoma boehlkei*	----	ST	----	Highest	----	----	----
Everglades Pygmy Sunfish	*Elassoma evergladei*	----	----	----	Moderate	X	----	X
Bluebarred Pygmy Sunfish	*Elassoma okatie*	----	----	----	Highest	----	----	----
Banded Pygmy Sunfish	*Elassoma zonatum*	----	----	----	----	X	X	----
Blackbanded Sunfish	*Enneacanthus chaetodon*	----	----	----	High	----	----	X
Bluespotted Sunfish	*Enneacanthus gloriosus*	----	----	----	----	X	X	X
Banded Sunfish	*Ennaecanthus obesus*	----	----	----	Moderate	X	X	X
Creek Chubsucker	*Erimyzon oblongus*	----	----	----	----	X	X	X
Lake Chubsucker	*Erimyzon succetta*	----	----	----	----	----	X	
Redfin Pickerel	*Esox americanus*	----	----	----	----	X	X	X
Chain pickerel	*Esox niger*	----	----	----	----	X	----	----
Savannah Darter	*Etheostoma fricksium*	----	----	----	Highest	----	----	----
Sawcheek Darter	*Etheostoma serrifer*	----	----	----	Moderate	X	----	----
Golden topminnow	*Fundulus chrysotus*	----	----	----	----	X	----	----
Banded killifish	*Fundulus diaphanous*	----	----	----	----	X	----	----
Eastern Mosquitofish	*Gambusia holbrooki*	----	----	----	----	X	X	X
Least killifish	*Heterandria Formosa*	----	----	----	----	X	----	----
Eastern silvery minnow	*Hybognathus regius*	----	----	----	----	X	----	----

Common Name	Scientific Name	Federal Listing Status	State Listing Status[a]	USFS Status[b]	State SGCN Priority[c]	Belle Isle B & C Routes[d]	Jamestown Route[e]	Charity Route[f]
Longnose Gar	*Lepiosteus osseus*	----	----	----	----	----	X	----
Redbreast Sunfish	*Lepomis auratus*	----	----	----	----	X	X	X
Pumpkinseed	*Lepomis gibbosus*	----	----	----	----	X	X	X
Warmouth	*Lepomis gulosus*	----	----	----	----	X	X	X
Bluegill	*Lepomis macrochirus*	----	----	----	----	X	X	X
Dollar Sunfish	*Lepomis marginatus*	----	----	----	----	X	X	----
Redear Sunfish	*Lepomis microlophus*	----	----	----	----	----	X	----
Spotted Sunfish	*Lepomis punctatus*	----	----	----	----	X	X	X
Largemouth Bass	*Micropterus salmoides*	----	----	----	----	X	X	----
Striped Bass	*Morone saxatilis*	----	----	----	Moderate	----	----	----
Notchlip Redhorse	*Moxostoma collapsum*	----	----	----	Moderate	----	----	----
Golden Shiner	*Notemigonus crysoleucas*	----	----	----	----	X	X	X
Bridle Shiner	*Notropis bifrenatus*	----	----	----	Highest	----	----	----
Ironcolor Shiner	*Notropis chalybaeus*	----	----	----	Moderate	----	----	----
Spottail Shiner	*Notropis hudsonius*	----	----	----	----	----	X	----
Bannerfin Shiner	*Notropis leedsi*	----	----	----	High	----	----	----
Coastal Shiner	*Notropis petersoni*	----	----	----	----	X	X	----
Tadpole Madtom	*Noturus gyrinus*	----	----	----	----	X	X	----
"Broadtail" Madtom	*Noturus spp. (c.f. insignis)*	----	----	----	Highest	----	X	----
Piedmont Darter	*Percina crassa*	----	----	----	High	----	----	----
Lowland Shiner	*Pteronotropis stonei*	----	----		Moderate	----	----	----
Hogchoker	*Trinecttes maculatus*	----	----	----	----	X	X	----
Eastern Mudminnow	*Umbra pygmaea*	----	----	----	----	X	X	X

references:	SCDNR (2015a , 2018a); USFS (2017, 2018a); SCDNR 2015a; Central (2014); and Three Oaks Engineering (2017, 2018)
a	*State Listing Status: SE = State Endangered; ST = State Threatened* SCDNR. 2015a. South Carolina's State Wildlife Action Plan (2015). Columbia, SC. Available at: http://dnr.sc.gov/swap/index.html. (accessed June 18, 2018) SCDNR. 2018a. Rare, Threatened, and Endangered Species of South Carolina - by County. Available at: http://www.dnr.sgov/species/county.html (accessed June 18, 2018).
b USFS (2017, 2018a)	USFS Status: SCC = FMNF Species of Conservation Concern USFS. 2018a. Personal communication. GIS data provided by Andy Maceyka, GIS Specialist, USFS Francis Marion National Forest Supervisor's Office, to Phillip Baigas, Wildlife Biologist Louis Berger. Regarding Rare, Threatened & Endangered Species Occurrence Data. July 19, 2018. USFS . 2017. Francis Marion National Forest Final Environmental Impact Statement For the Revised Land Management Plan. January 2017. Columbia, SC. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd516112.pdf (accessed June 18, 2018).

Common Name	Scientific Name	Federal Listing Status	State Listing Status[a]	USFS Status[b]	State SGCN Priority[c]	Belle Isle B & C Routes[d]	Jamestown Route[e]	Charity Route[f]

c SCDNR 2015a	SCDNR. 2015a. South Carolina's State Wildlife Action Plan (2015). Columbia, SC. Available at: http://dnr.sc.gov/swap/index.html. (accessed June 18, 2018)
d	Potentially present in the Project vicinity according to Appendix D of Central (2014), "Fish Species Captured during Surveys in the Francis Marion National Forest 2002–2004, 2006, and 2010" 2002–2004, 2006, and 2010" Central (Central Electric Power Cooperative, Inc.) 2014. "McClellanville 115 kV Transmission Project Draft Environmental Impact Statement." Prepared for the U.S. Department of Agriculture, Rural Utilities Service, in Cooperation with the U.S. Army Corps of Engineers and U.S. Forest Service. April 2014.
e	Captured by Three Oaks Engineering (2017) from a waterbody crossed by the proposed route. Three Oaks Engineering. 2017. "Freshwater Fish Surveys for Central Electric Project Francis Marion National Forest, Berkeley and Charleston Counties, South Carolina." Prepared for Milliken Forestry. November 28, 2017. Durham, NC. 34 pp.
f	Captured by Three Oaks Engineering (2018) from a waterbody crossed by the proposed route. Three Oaks Engineering. 2018. "Freshwater Fish Surveys for Central Electric Project: Belle Isle and Charity Routes, Francis Marion National Forest, Berkeley and Charleston Counties, South Carolina." Prepared for Milliken Forestry. August 2018. Durham, NC. 14 pp.

Appendix E—Priority Animal Species and Habitat Associations in the Coastal Plain Ecoregion of South Carolina

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SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Stream Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Streams/Rivers/Lakes	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
BIRDS																		
Actitis macularia	Spotted Sandpiper	G5	SNA		Moderate											X		tidal to freshwater systems; primarily coastal but occurs inland
Aimophila aestivalis	Bachman's Sparrow	G3	S3	State Species of Concern	Highest	X	X										X	dense grass amongst pines for nesting; saw palemettos in coastal areas
Aix sponsa	Wood Duck	G5	SNRB,SNRN, SNRM		High				X		X	X				X		nest cavities near fresh water; emergent vegetation; ponds, lakes, rivers, swamps, BEAVER PONDS
Ammodramus henslowii	Henslow's Sparrow	G4	SZN		Highest	X	X		X				X				X	moist, grassy areas in open pinewoods
Ammodramus savannarum	Grasshopper Sparrow	G5	SNRB,SNRN	State Species of Concern	Highest	X			X				X				X	broomsedge fields and other openings
Anas acuta	Northern Pintail	G5	SNRN		Highest							X				X		shallow open water with accessible plants and invertebrates
Anas discors	Blue-winged Teal	G5	SNRB,SNRN		Moderate							X				X		shallow open water with accessible plants and invertebrates
Anas fulvigula	Mottled Duck	G4	S?		Moderate							X				X		shallow open water with accessible plants and invertebrates
Anas platyrhynchos	Mallard	G5	SNRB,SNRN		Highest				X		X	X				X		freshwater boides for foraging; shallow water with accessible plants and invertebrates
Anas rubripes	American Black Duck	G5	SNRN		Highest							X				X		shallow open water with accessible plants and invertebrates
Anhinga anhinga	Anhinga	G5	SNRB,SNRN		Moderate						X	X				X		fresh or brackish water for foraging; trees over or surrounded by water for nesting
Ardea alba	Great Egret	G5	SNRB,SNRN		High				X		X	X	X			X		shallow water bodies or shorelines for foraging; trees over or surrounded by water for nesting
Ardea herodias	Great Blue Heron	G5	SNRB,SNRN		Moderate				X		X	X	X			X		shallow water bodies or shorelines for foraging; trees over or surrounded by water for nesting
Aythya collaris	Ring-necked Duck	G5	SNRN		Moderate				X		X	X						submerged aquatic vegetation and invertebrates such as mollusks
Bartramia longicauda	Upland Sandpiper	G5	SNA		Highest												X	extensive grasslands; may use plowed fields; uncommon but can occur throughout state
Botaurus lentiginosus	American Bittern	G4	SNRN	State Species of Concern	Highest						X	X			X	X		extensive freshwater marshes with grasses>3ft. Tall
Buteo lineatus	Red-shouldered Hawk	G5	SNR		Moderate			X	X	X	X	X			X			wet or moist hardwood forests for nesting and foraging
Buteo platypterus	Broad-winged Hawk	G5	S4		Moderate					X	X	X		X				upland hardwood or mixed forests; forage within woodlands; nests in tree crotches in canopy
Butorides virescens	Green Heron	G5	SNRB,SNRN		Highest				X	X	X	X	X		X	X		shallow water bodies and shorelines for foraging; dense shrubs and thickets near water for nesting
Calidris fuscicollis	White-rumped Sandpiper	G5	SNA		Moderate											X		most frequent in managed impoundments
Calidris himantopus	Stilt Sandpiper	G5	SNA		High											X		most frequent in fresh to brackish ponds/impoundments
Calidris melanotos	Pectoral Sandpiper	G5	SNA		Moderate											X		more common away from coast

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Stream Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Streams/Rivers/Lakes	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Calidris minutilla	Least Sandpiper	G5	SNRN		High											X		forages in clumps of marine vegetation; common on coast
Caprimulgus carolinensis	Chuck-will's-widow	G5	S4		High	X	X	X	X	X	X	X		X	X		X	openings for nocturnal feeding; mixed forests with light to moderate understory
Caprimulgus vociferus	Whip-poor-will	G5	S4		High			X						X			X	openings for nocturnal feeding; mixed forests with light to moderate understory
Ceryle alcyon	Belted Kingfisher	G5	SNR		High				X		X	X						sandy vertical banks for nesting burrows; perches near water for foraging
Chaetura pelagica	Chimney Swift	G5	SNRB		High	X	X										X	open areas for foraging; cavity for nesting (often chimneys)
Cistothorus platensis	Sedge Wren	G5	SUB		Highest				X		X		X					favor brackish marshes
Coccyzus americanus	Yellow-billed Cuckoo	G5	S4		High			X		X	X	X			X			closed canopy deciduous forests with thick tangles
Colinus virginianus	Northern Bobwhite	G5	S4		Highest	X	X										X	brushy areas and grasslands, thickets, woodland margins
Columbina passerine	Common Ground-Dove	G5	SNR	State Threatened	Highest	X											X	shrubs near openings for nesting; sandy bare ground or short grass for foraging
Contopus virens	Eastern Wood-Pewee	G5	S5		High	X	X	X	X	X	X			X				open forests with sparse midstory
Dendroica discolor	Prairie Warbler	G5	S4		High	X	X							X			X	open old fields with scattered saplings; open woodlands with shrub-scrub
Dendroica pinus	Pine Warbler	G5	SNR		Moderate	X	X											typically middle to mature pine forests
Dryocopus pileatus	Pileated Woodpecker	G5	SNR		Moderate	X	X	X	X	X	X	X		X	X			extensive mature forests with dead snags for nest cavities; probably prefer riverbottom hardwoods
Egretta caerulea	Little Blue Heron	G5	SNRB,SNRN	State Species of Concern	Highest				X	X	X	X	X			X		shorelines, shallow water, or mudflats for foraging; shrubs or trees over or surrounded by water for colonial nesting
Egretta thula	Snowy Egret	G5	SNRB,SNRN		Moderate				X	X	X	X	X			X		shorelines, shallow water, or mudflats for foraging; shrubs or trees over or surrounded by water for colonial nesting
Egretta tricolor	Tricolored Heron	G5	SNRB,SNRN		High								X			X		shorelines, shallow water, or mudflats for foraging; shrubs or trees over or surrounded by water for colonial nesting
Elanoides forficatus	Swallow-tailed Kite	G5	S2	State Endangered	Highest	X	X			X	X	X		X			X	open savannahs for foraging; mature trees for nesting near swamps and marshes
Empidonax virescens	Acadian Flycatcher	G5	S4B		High					X	X	X		X				Riverbanks, streams, banks, alder zones
Eudocimus albus	White Ibis	G5	SNR		Highest				X	X	X	X	X			X		shallow water or mudflats for foraging on crustaceans; wet meadows or mudflats for probing; thickets or trees over or surrounded by fresh water for colonial nesting
Euphagus carolinus	Rusty Blackbird	G4	SNRN		Highest					X	X	X			X			swamps and margins; wet thickets near hardwoods
Falco sparverius paulus	American Kestrel	G5	SNR		Highest		X										X	nest cavity in large open area; extensive open areas with high perches for foraging
Fulica americana	American Coot	G5	SHB,SNRN		Moderate						X	X						open shallow fresh water such as lakes, ponds, and bays for foraging

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Stream Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Streams/Rivers/Lakes	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Gallinago gallinagodelicata	Wilson's Snipe	G5	SNRN		High				X			X	X				X	boggy areas; wet meadows with short grass; along pond and marsh margins for probe foraging
Gallinula galeata	Common Gallinule	G5	SNR		Moderate						X	X						open freshwater with marsh vegetation for foraging and nesting
Haliaeetus leucocephalus	Bald Eagle	G5	S2	State Endangered	High							X		X				tall living trees, especially pines for nesting; perches near large open water where foraging occurs
Hylocichla mustelina	Wood Thrush	G5	S3?		High			X		X	X	X		X	X			moist understory of shrubs or saplings in deciduous woodlands; leaf litter
Icteria virens	Yellow-breasted Chat	G5	S4B		High	X	X							X			X	old fields, briar thickets, dry woodland margins;
Icterus spurius	Orchard Oriole	G5	S5?B		Moderate	X	X							X			X	orchard-like sttings; woodland margins
Ixobrychus exilis	Least Bittern	G5	SNRB,SNRN		Highest				X		X	X			X			shallow water bodies for foraging; marsh vegetation
Junco hyemalis	Dark-eyed Junco	G5	SNRB,SNRN		Moderate	X	X										X	short grass openings near conifer woodlands
Lanius ludovicianus	Loggerhead Shrike	G4	S3	State Species of Concern	Highest												X	open areas with perches
Limnodromus scolopaceus	Long-billed Dowitcher	G5	SNRN		Moderate											X		most common in fresh coastal wetlands
Limnothlypis swainsonii	Swainson's Warbler	G4T4	S4		High			X		X	X	X		X	X			in mountains: deciduous or mixed forest ravines with thick understory of rhododendron or mountain laurel; at coast: cane stands in hardwoods
Melanerpes carolinus	Red-bellied Woodpecker	G5	SNR		Moderate	X	X	X	X	X	X	X		X	X			open, mature woods with dead snags for nest cavities; man-made poles with cavities
Melanerpes erythrocephalus	Red-headed Woodpecker	G5	SNR		Moderate	X	X	X		X	X	X		X	X			open, mature woods with dead snags for nest cavities; man-made poles with cavities
Mniotilta varia	Black-and-white Warbler	G5	SNRB,SNRN		High			X		X	X	X						mature hardwood forests; coves
Mycteria americana	Wood Stork	G4	S1S2	Federally Threatened and State Endangerd	Highest				X	X	X	X	X			X		shallow water with concentrated prey (6-10 in. deep) for foraging; trees over or surrounded by water for colonial nesting, particularly cypress swamps and trees on small islands
Nyctanassa violacea	Yellow-crowned Night Heron	G5	SNRB,SNRN		Highest				X	X	X	X	X			X		shorelines of water bodies for foraging, especially for crustaceans; trees or thickets near water for colonial nesting, will nest in trees that are on dry lands
Nycticorax nycticorax	Black-crowned Night Heron	G5	SNRB,SNRN		Highest				X	X	X	X			X			shorelines of water bodies for foraging; shrubs or trees over or surrounded by water for colonial nesting
Oporornis formosus	Kentucky Warbler	G5	S4		High			X		X	X	X			X			moist hardwood forests with rich understory
Parula americana	Northern Parula	G5	SNRB		Moderate			X		X	X	X			X			mature, moist forests; hemlock forests in mountains and swamps or bottomlands with Spanish moss near coast
Passerina caerulea	Blue Grosbeak	G5	SNRB		Moderate	X								X			X	hardwood saplings or shrubs for nesting; open areas
Passerina ciris	Painted Bunting	G5	SNRB	State Species of Concern	Highest	X								X	X		X	woodland margins; dense thickets in openings

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Stream Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Streams/Rivers/Lakes	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Passerina cyanea	Indigo Bunting	G5	SNRB		Moderate	X	X							X			X	woodland margins; shrubby thickets in openings
Pelicanus occidentalis	Brown Pelican	G4	S1S2		High											X		ephemeral islands with shrubs and grasses for nesting; shallow marine waters and estuaries for foraging
Picoides borealis	Red-cockaded Woodpecker	G3	S2	Federal and State Endangerd	Highest	X	X											open pine woods with little to no understory; prefers longleaf; heartwood disease for nest cavity excavation
Picoides pubescens	Downy Woodpecker	G5	SNR		Moderate	X	X	X	X	X	X	X		X	X			middle-aged to mature woodlands; prefer hardwoods; dead snags for nest cavities
Pipilo erythrophthalmus	Eastern Towhee	G5	SNR		High	X	X	X	X	X	X	X		X	X		X	brushy areas; woodland margins and understory
Piranga rubra	Summer Tanager	G5	S?		Moderate	X	X	X		X	X	X		X				dry, mixed woodlands
Platalea ajaja	Roseate Spoonbill	G5	SNR		Moderate											X		shallow water for tactile feeding; shrubs or trees over or surrounded by water for colonial nesting, particularly thickets of small trees on coastal islands
Plegadis falcinellus	Glossy Ibis	G5	SHB,SNRN		Moderate											X		shallow water, mudflats, or wet meadows for probing and foraging; shrubs or trees over or surrounded by water for colonial nesting, particularly dense thickets on coastal islands
Pluvialis dominica	American Golden Plover	G5	SNA		Highest											X		rare migrant
Podiceps auritus	Horned Grebe	G5	SNRN,SNRM		Highest											X		small fish as prey
Podilymbus podiceps	Pied-billed Grebe	G5	SNRB,SNRN		Highest				X							X		fresh or slightly brackish water with emergent vegetation within used for nesting; open water in winter for foraging
Poecile carolinensis	Carolina Chickadee	G5	SNR		Moderate	X	X	X		X	X	X		X	X			mature woodlands with dead snags for nest cavities; will use bird boxes
Porphyrio martinica	Purple Gallinule	G5	S4	State Species of Concern	Highest							X				X		freshwater marshes with emergent and floating vegetation for foraging and nesting
Porzana carolina	Sora	G5	SNRN		High				X		X	X						freshwater marshes for foraging and nesting
Progne subis	Purple Martin	G5	SNRB		High								X				X	forage over open areas near or over water; nest in man-made houses or gourds
Protonotaria citrea	Prothonotary Warbler	G5	S3B		Moderate			X		X	X	X			X			near standing water; open swamps with cavities for nesting; willow thickets near lakes and ponds; old stumps and other rotting logs
Rallus elegans	King Rail	G4	SNR		Highest						X	X						mudflats and shallow fresh or brackish water for foraging
Recurvirostra americana	American Avocet	G5	SNRN		High											X		most frequent in managed impoundments
Regulus satrapa	Golden-crowned Kinglet	G5	S4		Moderate	X	X	X		X	X	X		X				winter in coniferous or mixed woodlands
Scolopax minor	American Woodcock	G5	S4		Moderate	X					X	X					X	moist soils and leaf litter for probe foraging; woodlands for nesting; openings for mating displays
Seiurus motacilla	Louisiana Waterthrush	G5	S4		High			X	X	X	X	X						deciduous or mixed forests with rocky streams

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Stream Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Streams/Rivers/Lakes	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Setophaga dominica	Yellow-throated Warbler	G5	S3?		Moderate	X	X					X		X	X			moderately open, mature, moist forests; pines, mixed forests; Spanish moss
Setophaga virens waynei	Black-throated Green Warbler (Wayne's)	G5TU	SNR		Highest					X	X	X			X			coastal moist forests like swamps and bottomlands with cypress and white cedar
Sitta pusilla	Brown-headed Nuthatch	G5	S4		Moderate	X	X											mature, open pines for foraging; nest cavities in snags
Spiza americana	Dickcissel	G5	SNRB		Moderate												X	open, grassy areas
Spizella pusilla	Field Sparrow	G5	S5?		High	X											X	saplings and shrubs in weedy thickets and woodland margins
Sturnella magna	Eastern Meadowlark	G5	SNR		High	X											X	short to medium-height grasses for nesting and foraging
Thryothorus ludovicianus	Carolina Wren	G5	SNR		Moderate	X	X	X	X	X	X	X		X	X			woodland thickets; leaf litter; cavities or ledges for nesting; will use bird boxes and many other human material
Toxostoma rufum	Brown Thrasher	G5	SNR		High	X	X	X		X	X	X		X	X		X	moderate to dense brush and saplings
Tryngites subruficollis	Buff-breasted Sandpiper	G4	SNA		Highest											X		may be seen in pastures and golf courses; rare migrant; most common in interior
Tyrannus tyrannus	Eastern Kingbird	G5	SNRB		High												X	open areas with scattered trees and other perches
Tyto alba	Barn Owl	G5	S4	State Species of Concern	Moderate	X											X	grasslands or marshes for foraging; nest cavities; dense roosting cover
Vireo flavifrons	Yellow-throated Vireo	G5	S3?B		Moderate			X		X	X	X			X			open, moist, mature, deciduous woodlands with tall trees; near water
Vireo griseus	White-eyed Vireo	G5	S4?B		Moderate			X	X	X	X	X		X	X			dense, moist thickets
Wilsonia citrina	Hooded Warbler	G5	S4?B		Moderate			X		X	X	X			X			mature, moist deciduous forests; some mixed forests; rich understory layer
MAMMALS																		
Condylura cristata	Star-nosed Mole	G5	S3?	State Species of Concern	High	X				X		X	X	X				swamps, marshes, bogs, streamsides; dense leaf litter
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	G3/G4	S2?	State Endangered	Highest	X		X		X	X	X	X	X				T-beam and I-beam bridges, abandoned buildings, old bunkers and tunnels, cavity trees, rock outcrops, mines, caves
Eptesicus fuscus	Big Brown Bat	G5	SNR		Highest	X	X	X	X	X	X	X	X	X	X		X	buildings, cavity trees, under bridges and in bat boxes; forage in open fields or forest gaps
Lasionycteris noctivagans	Silver-haired Bat	G5	SNR		Highest	X	X	X							X			roosts include tree cavities, under loose bark, rock crevices, under tree foliage, and occasionally in buildings, stacks of firewood, and bird boxes; forage over water
Lasiurus borealis	Red Bat	G5	SNR		Highest	X	X	X	X	X	X	X		X	X			thinned stands; roost on smaller branches or twigs, often in the hardwood tree canopy; may roost in leaf litter
Lasiurus cinereus	Hoary Bat	G5	S?		Highest	X	X	X	X	X	X	X	X	X	X			tree cavities, trunks, tree foliage, squirrel nests, and Spanish moss
Lasiurus intermedius	Northern Yellow Bat	G4/G5	S?	State Species of Concern	Highest	X	X	X		X		X	X	X	X			forage over open areas such as fields, pastures, golf courses, marshes, and along lake and forest edges; roost in clumps of Spanish moss or under old palm fronds

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Stream Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Streams/Rivers/Lakes	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Lasiurus seminolus	Seminole Bat	G5	SNR		Highest	X	X	X	X	X	X	X	X	X				roost in large pines located near forested corridors; may roost in leaf litter
Microtus pennsylvanicus	Meadow Vole	G5	SNR	State Species of Concern	High	X											X	tall grass prairie habitats
Mustela vison	Mink	G5	SNR		High						X	X	X					near swamps, streams, rivers, ponds, and saltwater marshes
Myotis austroriparius	Southeastern Bat	G3/G4	S1	State Species of Concern	Highest			X	X	X	X	X	X	X	X			caves (including limestone sinks), mines, abandoned buildings, and large hollow trees; prefers to feed and roost over water
Neotoma floridana	Eastern Woodrat	G5	S3/S4	State Species of Concern	Moderate	X	X	X		X		X		X	X		X	wide variety of habitats
Perimyotis subflavus	Tri-colored Bat	G5	SNR		Highest	X	X	X	X	X	X	X	X	X	X			abandoned mines and caves, bridges, buildings
Sciurus niger niger	Southern Fox Squirrel	G5	S4	State Species of Concern	Moderate		X			X		X		X				cavity trees
Ursus americanus	Black Bear	G5	S3?	State Species of Concern	Moderate	X	X	X	X	X	X	X	X	X	X		X	early successional habitat and forest interior; den sites
REPTILES & AMPHIBIANS																		
Alligator mississippiensis	American Alligator	G5	S5	Federal Threatened due to Similarity of Appearance to the American Crocodile	Moderate				X			X				X		large river swamps, lakes, ponds, coastal impoundments, abandoned rice fields, brackish water marshes, and estuarine tidal creeks; juveniles will use Carolina bays and other seasonal wetlands; shallow waters preferred
Acris crepitans	Northern Cricket Frog	G5	S5	State Species of Concern	Moderate								X					isolated, temporary wetlands with no fish; open grassy marshes or shallow water bodies
Ambystoma cingulatum	Flatwoods Salamander (Frosted)	G2/G3	S1	Federal Threatened; State Endangered	Highest	X	X	X					X					isolated, temporary wetlands with no fish that have open canopy above and abundant grasses and sedges
Ambystoma tigrinum	Tiger Salamander	G5	S2/S3	State Species of Concern	Highest	X	X	X	X	X			X					isolated, temporary wetlands with no fish that have open canopy above and abundant grasses and sedges
Chelydra serpentina	Snapping Turtle (Common)	G5	SNR		Moderate				X		X	X	X					soft -bottomed wetlands like rivers, ponds, and lakes that have abundant aquatic vegetation
Clemmys guttata	Spotted Turtle	G5	S5	State Threatened	High				X			X	X					small ponds, streams, swamps, flooded bottomland hardwood forests, and other shallow water bodies with soft substrate for burrowing; aquatic vegetation
Crotalus adamanteus	Eastern Diamondback Rattlesnake	G4	S3	State Species of Concern	High	X	X	X							X			underground refugia such as stump holes and rodent burrows
Crotalus horridus	Timber Rattlesnake	G4	SNR	State Species of Concern	High	X	X	X				X		X			X	dry, south-facing slopes at high elevations; rock outcrops or logs for den sites with south face exposed to sun
Deirochelys recticularia	Chicken Turtle	G5	SNR	State Threatened	Moderate				X			X						freshwater and wetland systems with still water; surrounding upland habitat of live oak/pine
Eurycea chamberlainii	Chamberlain's Dwarf Salamander	G4	SNR		Highest	X		X	X	X	X	X	X	X				wetland types like seepages near small streams; leaf litter and small debris

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Stream Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Streams/Rivers/Lakes	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Gopherus polyphemus	Gopher Tortoise	G3	S1	State Endangered; Federal Candidate	Highest		X											fossorial; deep droughty sands in xeric longleaf pine sandhills; open, early successional
Heterodon simus	Southern Hognose Snake	G2	SNR	State Species of Concern	Highest	X	X								X		X	friable soils; underground refugia such as stump holes and rodent burrows; abundance of toads
Hyla avivoca	Bird-voiced Treefrog	G5	S5	State Species of Concern	Moderate							X						large river bottom swamps
Kinosternon baurii	Striped Mud Turtle	G5	S?	State Species of Concern	Moderate				X		X	X	X					in and around the floodplain swamps of rivers; shallow water; soft substrates
Micrurus fulvius	Coral Snake (Harlequin)	G5	S2	State Species of Concern	Highest	X	X	X							X			underground refugia such as stump holes and rodent burrows; loose soil for burrowing
Nerodia floridana	Florida Green Watersnake	G5	S2	State Species of Concern	Highest								X					quiet open water such as Carolina bays, lakes, old rice fields, and reservoirs with "pad plants"
Ophisaurus attenuatus	Slender Glass Lizard	G5	S4		Moderate	X	X	X						X	X		X	underground refugia such as stump holes and rodent burrows; open canopied forests or fields
Ophisaurus compressus	Island Glass Lizard	G3/G4	S1/S2	State Species of Concern	Highest										X			undisturbed coastal areas that are sandy
Pituophis melanoleucus	Pine Snake (Northern)	G4	S2/S3	State Species of Concern	Highest	X	X	X						X				pine sites with dry soils; underground refugia such as stump holes and rodent burrows
Pseudacris feriarum	Upland Chorus Frog	G5	S3/S4	State Species of Concern	Moderate			X	X			X	X					isolated, temporary wetlands with no fish
Pseudemys concinna	River Cooter	G5	SNR	State Species of Concern	Moderate							X				X		Restricted to reservoirs and associated rivers with aquatic vegetation
Pseudemys floridana	Florida Cooter	G5	SNR	State Species of Concern	Moderate							X	X			X		slow-moving rivers and non-flowing wetlands like ponds and small lakes with soft bottoms, basking sites, and aquatic vegetation
Pseudobranchus striatus striatus	Broad-striped Dwarf Siren	G5	S2	State Threatened	Highest				X				X					isolated, shallow, acidic, temporary wetlands with no fish that have open canopy above and abundant grasses and sedges; small streams with no flow and muck bottoms sometimes
Pseudotriton montanus flavissimus	Mud Salamander (Gulf Coast)	G5	S3/S4	State Species of Concern	High					X	X	X				X		fossorial; wetland areas such as cypress-tupelo ponds, floodplain forests, and seepage slopes
Rana capito capito	Gopher Frog (Carolina)	G3/G4	S1	Federal Threatened; State Endangered	Highest	X	X	X					X					isolated, temporary to semi-permanent wetlands with no fish that have open canopy above and abundant grasses and sedges
Rana palustris	Pickerel Frog	G5	SNR	State Species of Concern	High					X	X	X	X			X		standing water in late winter; moist habitat usually within hardwood forests; sphagnum bogs, meadows, and grassy fields near shaded streams
Rhadinea flavilata	Pine Woods Snake	G4	SNR	State Species of Concern	High	X	X	X						X	X			moist pine flatwoods with many rotten logs; underground refugia such as stump holes and rodent burrows
Seminatrix pygaea	Black Swamp Snake	G5	S?	State Species of Concern	High				X		X	X	X			X		wetlands with abundant aquatic vegetation; leaf litter; *Sphagnum* moss
Terrapene carolina	Eastern Box Turtle	G5	SNR		Moderate	X		X			X	X		X			X	moist woodlands; sandy or loamy soils in open for egg laying; loose soils and leaf litter for burrowing
Trachemys scripta	Yellow-bellied Turtle	G5	SNR	State Species of Concern	High				X		X	X	X			X		non-flowing wetlands like ponds and small lakes with soft bottoms and abundant vegetation

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FISH																		
Acipenser brevirostrum	Shortnose Sturgeon	G3	S3	Federal and State Endangered	Highest											X		Moderate flows; sand or gravel substrates for spawning
Acipenser oxyrinchus	Atlantic Sturgeon	G3	S3	Federal and State Endangered	Highest											X		Moderate flows; sand or gravel substrates for spawning
Alosa aestivalis	Blueback Herring	G3	S3	State Species of Concern	Highest											X		Moderate flows; sand or gravel substrates for spawning
Alosa mediocris	Hickory Shad	G5	S4	State Species of Concern	Highest											X		Moderate flows; sand or gravel substrates for spawning
Alosa sapidissima	American Shad	G5	S5	State Species of Concern	Highest											X		Moderate flows; sand or gravel substrates for spawning
Ameiurus brunneus	Snail Bullhead	G4	SNR		Moderate											X		Rocky riffles, runs, shoals, and pools in streams and rivers
Anguilla rostrata	American Eel	G4	SNR		Highest											X		Warm ponds, reservoirs, and medium to large rivers in freshwater and brackish habitats
Ameiurus catus	White Catfish	G5	SNR		Moderate											X		Streams, rivers, and impoundments; slow-flowing water along banks and in pools; mud, sand, or rock substrates
Ameriurus platycephalus	Flat Bullhead	G4	SNR		Moderate											X		Calm, acidic blackwater streams; organic matter and aquatic vegetation and woody debris
Chologaster cornuta	Swampfish	G5	SNR		Moderate											X		Pools and runs of creeks and small to medium weed-free rivers; sand to gravel/rubble substrates; branches, stumps, rock crevices, roots for spawning sites
Cyprinella analostana	Satinfin Shiner	G5	SNR		Moderate											X		Cool, clear creeks and small to moderately-sized rivers; rocky runs and pools below riffles; coarse substrate; logs and rocks for crevice spawning
Cyprinella pyrrhomelas	Fieryblack Shiner	G4	S4		Moderate											X		Possibly small to medium-sized streams with sand and rocky runs or current-swept pools
Cyprinella sp.(c.f. zanema)	"Thinlip" Chub	G2Q	S1		Highest											X		Shallow, slow-moving, acidic water of ponds, ditches, and streams; abundant aquatic vegetation
Elassoma boehlkei	Carolina Pygmy Sunfish	G2	S1	State Threatened	Highest											X		Swamps and backwaters; dense vegetation
Elassoma evergladei	Everglades Pygmy Sunfish	G5	SNR		Moderate											X		Shallow drainage or stagnant ditches and backwaters of creeks and rivers; abundant vegetation; soft, detritus-rich substrate
Elassoma okatie	Bluebarred Pygmy Sunfish	G2G3	SNR	State Species of Concern	Highest											X		Shallow and densely vegetated margins of lakes, ponds, swamps, roadside ditches, streams; sand or mud substrate; stained, acidic water of 4-5pH; beaver ponds for spawning
Enneacanthus chaetodon	Blackbanded Sunfish	G3G4	SNR		High											X		Sluggish streams and vegetated backwaters of lakes and ponds, often over silt or sand; very low current velocities
Ennaecanthus obesus	Banded Sunfish	G5	SNR		Moderate											X		Clear or tannin-stained creeks and small rivers; strong currents; sand or gravel substrates; aquatic vegetation and woody debris

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Stream Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Streams/Rivers/Lakes	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Etheostoma fricksium	Savannah Darter	G4	SNR		Highest											X		Mud, sand, or organic substrate; aquatic vegetation; moderate current velocity
Etheostoma serrifer	Sawcheek Darter	G5	SNR		Moderate											X		Fresh water to estuaries over a wide range of salinities up to 20ppt; lakes, ponds, slow velocity streams; sand, gravel, or detritus-covered bottom with submerged aquatic plants
Morone saxatilis	Striped Bass	G5	SNR		Moderate											X		Medium to large rivers; clean, sandy substrate with fine gravel and rock; shallow rocky and gravely areas with strong current for spawning sites; 17-18 C optimal for egg development
Moxostoma collapsum	Notchlip Redhorse	G5	SNR		Moderate											X		Medium to large rivers of moderate gradient; pool-dweller in streams; also in natural and artificial lakes
Notropis bifrenatus	Bridle Shiner	G3	SNR		Highest											X		Warm water streams, swamps, lakes; clear or slightly stained water; abundant aquatic vegetation for feeding and breeding; sand, mud, or gravel substrates
Notropis chalybaeus	Ironcolor Shiner	G4	SNR		Moderate											X		Low-velocity blackwater streams and swamps; woody debris
Notropis leedsi	Bannerfin Shiner	G4	S2		High											X		Channels of medium to large rivers; sand substrate; eddies with woody debris; logs and rocks for crevice spawning
Noturus spp. (c.f. insignis)	"Broadtail" Madtom	G2	S1		Highest											X		Middle of narrow and deep rivers; sand and gravel substrates with woody debris
Percina crassa	Piedmont Darter	G4	SNR		High											X		Clean, moderate to large stream riffles; sand to cobble substrate; moderate currents
Pteronotropis stonei	Lowland Shiner	G5	SNR		Moderate											X		Small to medium-clear and blackwater streams; moderate flow-like slow riffles, runs, and flowing pools; clean sand substrate; aquatic vegetation
INSECTS																		
Acanthametropus pecatonica	"A Mayfly"	GNR	SNR					X	X	X	X	X	X			X		mesic forests near water
Atrytone arogos	Arogos Skipper	G3	SNR	State Species of Concern		X	X										X	specialist in seasonally wet to dry grassland and pine savannah habitats; regenerating burn sites; host plants: Little Bluestem, Pine Barrens Reed Grass, and Lopsided Indian Grass; nectar plants
Dolania americana	American Sand Burrowing Mayfly	G4	S3	State Species of Concern				X	X	X	X	X	X			X		mesic forests near water
Dorymyrmex bureni	"A Pyramid Ant"	GNR	SNR				X										X	prefer sandy soils in highly disturbed areas like pastures, open fileds, open scrub, sandhills, dunes, lawns, and roadsides
Dorymyrmex medeis	"A Pyramid Ant"	GNR	SNR				X										X	prefer sandy soils in highly disturbed areas like pastures, open fields, open scrub, sandhills, dunes, lawns, and roadsides
Euphyes bimacula	Two-Spotted Skipper	G4	S1?						X				X					isolated wetlands: open bogs, fens, and marshes with *Carex* sp.; nectar plants like iris
Heterocloeon berneri	"A Mayfly"	G2G3	SNR															mesic forests near water

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Homoeoneuria dolani	"A Mayfly"	G3G4	SNR					X	X	X	X	X	X			X		mesic forests near water
Mycotrupes retusus	Sandhills Earth Boring Scarab Beetle	GNR	SNR				X											restricted to deep, well-drained xeric sands of Fall-line Sandhills; mostly fossorial
Rhadinoceraea zigadenusae	Zigadenus Sawfly	G4	SNR				X		X	X	X	X	X		X			dependent upon host plant: Death Camas (*Zigadenus densus*)
Siphlonurus decorus	"A Mayfly"	GNR	SNR					X	X	X	X	X	X			X		mesic forests near water
Somatochlora calverti	Calvert's Emerald	G3	SNR					X	X	X	X	X	X	X		X		boggy forest seepages for breeding; forest openings for foraging
Taeniopteryx robinae	Savannah Willowfly	G1	SNR					X	X	X	X	X	X			X		mesic forests near water
Toxorhynchites rutilus rutilus	"An Elephant (Tree Hole Mosquito)"	GNR	SNR					X	X	X	X	X	X	X	X	X		tree holes and artificial basins for breeding; nectar producing plants for foraging
Toxorhynchites rutilus septentionalis	"An Elephant (Tree Hole Mosquito)"	GNR	SNR					X	X	X	X	X	X	X	X	X		tree holes and artificial basins for breeding; nectar producing plants for foraging
TERRESTRIAL LEECHES																		
Haemopis septagon	"A terrestrial leech"	GNR	SNR		High				X	X	X	X	X			X		moist areas near water sources; feeds on earthworms; only known from Georgetown County but probably more widespread in Pee Dee region of Coastal Plain
SNAILS																		

Appendix F—Priority Plant Species in the Coastal Plain Ecoregion of Coastal South Carolina

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SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Streams Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
PLANTS																	
Aesculus parviflora	Small-flowered Buckeye	G3	S1		High			X		X							
Agalinis aphylla	Coastal Plain False-foxglove	G3/G4	S1		Moderate								X			X	
Agarista populifolia	Carolina Dog-hobble	G4/G5	S1		Moderate						X	X					
Agrimonia incisa	Incised Groovebur	G3	S2		High	X											
Aletris obovata	White Colicroot	G4/G5	S1		Moderate	X										X	Longleaf Pine savannas
Amorpha georgiana var. georgiana	Georgia Leadplant	G3T2	S1		Moderate		X										
Andropogon brachystachyus	Short-spike Bluestem	G4	S1		Moderate	X							X			X	
Andropogon gyrans var. stenophyllus	Elliott's Bluestem	G4Q	S1		Moderate				X				X			X	
Arabis missouriensis	Missouri Rock-cress	G5	S1		Moderate									X			granitic outcrops or over metamudstone
Aristolochia tomentosa	Woolly Dutchman's-pipe	G5	S1		Moderate			X			X	X					
Asclepias connivens	Large-flower Milkweed	G4?	S1		Moderate	X										X	
Asplenium heteroresiliens	Wagner's Spleenwort	GNA	S1		Moderate						X	X					
Asplenium resiliens	Black-stem Spleenwort	G5	S1		Moderate						X	X					
Bacopa cyclophylla	Coastal-plain Water-hyssop	G3/G5	S1		Moderate						X		X				brackish and freshwater marshes
Balduina atropurpurea	Purple Balduina	G2	S1		High						X	X					
Calamovilfa brevipilis	Pine-barrens Reed-grass	G4	S1		Moderate					X							
Calopogon multiflorus	Many-flower Grass-pink	G2/G3	S1		High	X		X								X	
Campanulastrum americanum	Tall Bellflower	G5	S1		Moderate			X									rich forests - marl forests in the Coastal Plain
Campylopus carolinae	Carolina Campylopus Moss	G2	SNR		High		X										quartz sands in Longleaf Pine/Turkey Oak Sandhills that are fire maintained - Not Documented for SC, but likely to occur here
Carex chapmanii	Chapman's Sedge	G3	S1		High						X	X					
Carex decomposita	Cypress-knee Sedge	G3	S2		High						X	X	X				
Carex elliottii	Elliott's Sedge	G4?	S1		Moderate	X		X			X						

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Carex socialis	Social Sedge	G4	S1		Moderate							X					
Carex stricta	Tussock Sedge	G5	S1		Moderate						X						
Cayaponia quinqueloba	Cayaponia	G4	S1?		Moderate							X					
Ceratiola ericoides	Sandhills Rosemary	GNR	S1		Moderate		X										
Chasmanthium nitidum	Shiny Spikegrass	G3	S1		High											X	
Chrysoma pauciflosculosa	Woody Goldenrod	G4/G5	S1/S2		Moderate	X	X										
Cladium mariscoides	Twig Rush	G5	S1		Moderate								X			X	bay forest depression meadows
Cladrastis kentukea	Yellowwood	G4	S1		Moderate			X		X							
Collinsonia serotina	Southern Horse-balm	G3/G4	S1		Moderate					X							white oak / beech bluff; validity of species is questionable
Coreopsis integrifolia	Ciliate-leaf Tickseed	G1/G2	S1		High	X					X						
Coreopsis rosea	Rose Coreopsis	G3	S2		High				X				X				bay forest depression meadows
Croton elliottii	Elliott's Croton	G2/G3	S2/S3		High				X								pond cypress savannahs
Cyperus lecontei	Leconte Flatsedge	G4?	S1		Moderate								X			X	
Dicerandra odoratissima	Rose Balm	G4/G5	S1		Moderate		X										
Dionaea muscipula	Venus' Fly-trap	G3	S3		High				X								damp to wet peaty sands near pocosin margins
Draba reptans	Carolina Whitlow-grass	G5	S1		Moderate											X	presence makes 'little ecological or phytogeographic sense'
Dryopteris carthusiana	Spinulose Shield Fern	G5	S1		Moderate						X	X					
Eleocharis vivipara	Viviparous Spike-rush	G5	S1		Moderate								X			X	depression meadows
Eryngium aquaticum var. ravenelii	Ravenel's Eryngo	G4,T2/T4 Q	S1		Moderate								X			X	damp, calcareous soils
Eupatorium anomalum	Florida Thorough-wort	G2/G3	S1?		High	X										X	
Eupatorium recurvans	Coastal-plain Thorough-wort	G3/G4Q	S1?		Moderate								X			X	depression meadows

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Streams Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Eupatorium resinosum	Pine Barrens Boneset	G3	S1		High								X			X	pocosins
Fimbristylis perpusilla	Harper's Fimbry	G2	S2		High						X	X					exposed banks and drawdown zones along blackwater systems
Fimbristylis vahlii	Vahl Fimbry	G5	S1		Moderate						X	X					exposed banks and drawdown zones along blackwater systems
Forestiera segregata	Southern Privet	G4	S1		Moderate										X		marl forests, shell middens, and other calcareous soils
Gaura biennis	Biennial Gaura	G5	S1		Moderate											X	
Gentiana autumnalis	Pine Barren Gentian	G3	S2		High		X										
Habenaria quinqueseta	Long-horn Orchid	G4/G5	S1		Moderate	X		X									
Halesia diptera	Two-wing Silverbell	G5	S1		Moderate					X							
Helenium brevifolium	Shortleaf Sneezeweed	G4	S1		Moderate				X	X			X				
Hottonia inflata	Featherfoil	G4	S1		Moderate								X				
Hydrolea corymbosa	Corymb Fiddleleaf	G5	S1		Moderate				X				X				
Hypericum adpressum	Creeping St. John's-wort	G3	S2		High				X				X				
Hypericum harperi	Harper's St. John's-wort	G3/G4	S2		Moderate				X				X				
Iris hexagona	Walter's Iris	G4/G5	S1		Moderate					X	X						
Isoetes hyemalis	Winter Quillwort	G2/G3	S1		High					X	X	X	X				
Lachnocaulon minus	Small's Bog Button	G3/G4	S1		Moderate				X				X				
Liatris gracilis	Slender Gayfeather	G5	S1		Moderate		X										
Licania michauxii	Gopher-apple	G4/G5	S1		Moderate		X										
Lilaeopsis carolinensis	Carolina Lilaeopsis	G3/G5	S2		Moderate								X				
Lindera melissifolia	Pondberry	G2/G3	S2	LE: Endangered	Highest				X				X				
Lindera subcoriacea	Bog Spicebush	G2/G3	S3		High				X		X						
Litsea aestivalis	Pondspice	G3	S3		High				X				X				
Lobelia boykinii	Boykin's Lobelia	G2/G3	S3		High				X				X				
Ludwigia brevipes	Long Beach Seedbox	G2/G3	S1		High								X				
Ludwigia lanceolata	Lance-leaf Seedbox	G3	S1		High								X				
Ludwigia spathulata	Spatulate Seedbox	G2	S2		High				X				X				
Lysimachia hybrida	Lance-leaf Loosestrife	G5	S1		Moderate				X	X	X		X				
Macbridea caroliniana	Carolina Bird-in-a-nest	G2/G3	S3		High	X					X	X					
Magnolia pyramidata	Pyramid Magnolia	G4	S1		Moderate			X									

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Streams Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Malaxis spicata	Florida Adder's-mouth	G4?	S1/S2		Moderate					X							
Minuartia godfreyi	Godfrey's Stitchwort	G1	SX		High			X									
Myriophyllum laxum	Piedmont Water-milfoil	G3	S2		High								X				
Narthecium americanum	Bog Asphodel	G2	SH	C: Candidate	Highest				X				X				
Nyssa ogeche	Ogeechee Tupelo	G4/G5	S1		Moderate				X				X				
Ophioglossum petiolatum	Longstem Adder's-tongue Fern	G5	S1		Moderate											X	
Orbexilum lupinellum	Sampson Snakeroot	G3/G4	S1		Moderate	X											
Oxypolis canbyi	Canby's Dropwort	G2	S2	LE: Endangered	Highest				X								
Oxypolis ternata	Piedmont Cowbane	G3	S1		High				X				X				
Parnassia caroliniana	Carolina Grass-of-parnassus	G3	S2		High	X											
Peltandra sagittifolia	Spoon-flower	G3/G4	S2		Moderate				X				X				
Pieris phillyreifolia	Climbing Fetter-bush	G3	S1		High				X				X				climbing on cypress trunks
Plantago sparsiflora	Pineland Plantain	G3	S2		High	X			X				X				
Platanthera integra	Yellow Fringeless Orchid	G3/G4	S1		Moderate				X				X				
Polygala hookeri	Hooker's Milkwort	G3	S1		High	X											
Polygala nana	Dwarf Milkwort	G5	S1		Moderate	X											
Prunus alabamensis	Alabama Black Cherry	G4	S1		Moderate		X										sandhill scrub forests
Ptilimnium nodosum	Harperella	G2	S1	LE: Endangered	Highest											X	bay forest depression meadows
Pycnanthemum nudum	Pinelands Mountain Mint	G5?	S1		Moderate			X								X	flatwoods and savannas
Quercus austrina	Bluff Oak	G4?	S1		Moderate					X					X		
Quercus similis	Bottom-land Post Oak	G4	S1		Moderate							X					
Rhexia aristosa	Awned Meadowbeauty	G3	S3		High				X								bay forest depression meadows; pond cypress savannas; swamp tupelo ponds
Rhododendron eastmanii	May White	G2	S2		High			X									rich loamy soils often on river bluffs
Rhododendron flammeum	Piedmont Azalea	G3	S3		High			X									rich loamy soils often on river bluffs
Rhynchospora alba	White Beakrush	G5	S1		Moderate								X				pocosins, limesink ponds

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Streams Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Rhynchospora harperi	Harper Beakrush	G4?	S1		Moderate				X				X			X	pond cypress savannas
Rhynchospora leptocarpa	Narrow-fruited Beaksedge	G3	S1		High						X						steepheads and shallows along blackwater streams
Rhynchospora pleiantha	Brown Beaked-rush	G2/G3	S1		High								X				limesink ponds
Rhynchospora scirpoides	Long-beaked Baldrush	G4	S1		Moderate				X				X				
Rudbeckia mollis	Soft-hair Coneflower	G3/G5	S1		Moderate	X										X	sandy woods
Ruellia strepens	Limestone Petunia	G4/G5	S1		Moderate			X									low woods over marl
Sabatia bartramii	Bartram's Rose-gentian	G4/G5	S1		Moderate											X	pine savannnas
Sabatia kennedyana	Plymouth Gentian	G3	S2		High						X						drawdown banks
Sagittaria graminea var. weatherbiana	Grassleaf Arrowhead	G5,T3/T4	S1		Moderate											X	depression meadows and ponds
Schisandra glabra	Bay Starvine	G3	S1		High								X				bottomlands
Schwalbea americana	Chaffseed	G2/G3	S3	LE: Endangered	Highest	X											longleaf pine-oak savannas
Scleria reticularis	Reticulated Nutrush	G4	S1		Moderate				X				X			X	savannas
Sideroxylon lanuginosum	Gum Bumelia	G4/G5	S1		Moderate		X					X					sandy uplands near bottomlands
Sideroxylon reclinatum	Gum Bully	G4/G5	S1		Moderate		X					X					sandy uplands near bottomlands
Solidago pulchra	Carolina Goldenrod	G3	S1		High											X	pine savannas
Spiranthes laciniata	Lace-lip Ladies'-tresses	G4/G5	S1/S2		Moderate								X			X	swamps and pond cypress savannas
Spiranthes longilabris	Giant Spiral Ladies'-tresses	G3	S1		High								X			X	swamps, marshes, cypress savannas
Sporobolus curtissii	Pineland Dropseed	G3	S1		High				X							X	savannas
Sporobolus floridanus	Florida Dropseed	G3	S1		High											X	savannas
Sporobolus pinetorum	Carolina Dropseed	G3	S2		High											X	savannas
Sporobolus teretifolius	Wire-leaved Dropseed	G2	S1		High											X	hardwood forests
Stachys tenuifolia	Smooth Hedge-nettle	G5	S1		Moderate							X					swamp forests

SCIENTIFIC NAME	COMMON NAME	G-RANK	S-RANK	LEGAL STATUS	PRIORITY	Pine Woodland	Sandhill Pine Woodland	Mesic Forest	Carolina Bays	Hardwood Slopes & Streams Bottoms	Blackwater Stream Systems	River Bottoms	Depressions	Upland Mixed Forest	Maritime Forest	Grasslands/Early-Successional	SPECIFIC HABITAT REQUIREMENTS
Thelypteris ovata var. ovata	Ovate Marsh Fern	G3/G5, T3/T4	S1		Moderate			X									calcareous substrates
Tofieldia glabra	White False-asphodel	G4	S1/S2		Moderate		X										savannas, pocosins
Torreyochloa pallida	Pale Manna Grass	G5	S1		Moderate							X					streams and bottomlands
Tradescantia virginiana	Virginia Spiderwort	G5	S1		Moderate		X										rich coves, calcareous substrates
Trepocarpus aethusae	Aethusa-like Trepocarpus	G4/G5	S1		Moderate								X				floodplain forests
Tridens carolinianus	Carolina Fluff Grass	G3/G4	S1		Moderate		X										savannas
Tridens chapmanii	Chapman's Redtop	G3	S1		High		X										rocky and sandy barrens
Trillium oostingii	Wateree Trillium	G1	S1		High							X					
Trillium pusillum var. pusillum	Least Trillium	G3T2	S1		Moderate					X							wet hardwood forests over marl
Triphora trianthophora	Nodding Pogonia	G3/G4	S2		Moderate			X									moist rich woods
Utricularia floridana	Florida Bladderwort	G3/G5	S2		Moderate				X				X				depression meadows, cypress-gum ponds
Xyris brevifolia	Short-leaved Yellow-eyed Grass	G4/G5	S1		Moderate						X					X	savannas and seepages
Xyris flabelliformis	Savannah Yellow-eyed Grass	G4	S1		Moderate	X			X				X				sandy seepages and Longleaf Pine savannas
Xyris serotina	Acid-swamp Yellow-eyed Grass	G3/G4	S1		Moderate	X							X				
Xyris stricta	Pineland Yellow-eyed Grass	G4	S1		Moderate								X				shallow acidic ponds
Xyris torta	Twisted Yellow-eyed-grass	G5	S1		Moderate				X				X				wet sandy swales and seeps with peat moss
Zephyranthes simpsonii	Rain Lily	G2/G3	S1?		High										X		calcareous substrates

Appendix G—Forest Plan Strategies for FMNF SCC Species

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Table G-1. Forest Plan Strategies for FMNF SCC Species.

	Coarse-filter Components		Fine-filter Components		
Scientific Name	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Birds					
American Swallow-tailed Kite (Elanoides forficatus)	DC-ECO-5. Pocosins DC-ECO-7. Narrow Forested Swamps and Blackwater Stream Floodplain Forests DC-ECO-8. Broad Forested Swamps and Large River Floodplain Forests	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-5. Pocosins		OBJ-SCC-2. Swallow-tailed Kite OBJ-SCC-3. At-Risk Species	S31, S41; G8, G9, G34
Bachman's Sparrow (Aimophila aestivalis)	DC-ECO-2. Upland Longleaf and Loblolly Pine Woodlands	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems		OBJ-SCC-3. At-Risk Species	S36, S41; G40, G41
Bald Eagle (*Haliaeetus leucocephalus*)	DC-ECO-7. Narrow Forested Swamps and Blackwater Stream Floodplain Forests DC-ECO-8. Broad Forested Swamps and Large River Floodplain Forests		DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-3. At-Risk Species	S25, S41
Mammals					
Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*)	DC-ECO-5. Pocosins DC-ECO-7. Narrow Forested Swamps and	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-8. Forested Wetlands Associates DC-SCC-9. Wildlife Snag and Large	OBJ-SCC-3. At-Risk Species	S28; G31

	Coarse-filter Components		Fine-filter Components		
Scientific Name	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
	Blackwater Stream Forests DC-ECO-8. Broad Forested Swamps and Large River Floodplain Forests		Diameter Hollow Tree Associates SCC-11. Forest Opening Associates		
Southeastern Bat (*Myotis austroriparius*)	DC-ECO-5. Pocosins DC-ECO-7. Narrow Forested Swamps and Blackwater Stream Forests DC-ECO-8. Broad Forested Swamps and Large River Floodplain Forests	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-SCC-3. At-Risk Species	DC-SCC-8. Forested Wetlands Associates DC-SCC-9. Wildlife Snag and Large Diameter Hollow Tree Associates SCC-11. Forest Opening Associates	OBJ-SCC-3. At-Risk Species	S28, S37; G31
Amphibians					
Broad-striped Dwarf Siren (*Pseudobranchus striatus*)	DC-ECO-3. Wet Pine Savanna and Flatwoods DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems OBJ-ECO-4. Pond Cypress Savannas and Carolina bays		OBJ-SCC-3. At-Risk Species	S41; G8, G9.

	Coarse-filter Components		Fine-filter Components		
Scientific Name	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Carolina Gopher Frog (*Lithobates capito capito*)	DC-ECO-3. Wet Pine Savanna and Flatwoods DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems OBJ-ECO-4. Pond Cypress Savannas and Carolina bays	DC-SCC-2. Wildlife Species Sensitive to Road Use Associates DC-SCC-1. Wildlife Stump and Root Mound Associates	OBJ-SCC-1. Carolina Gopher Frog OBJ-SCC-3. At-Risk Species	S30, S41; G8, G9, G32
Reptiles					
Eastern Diamondback Rattlesnake (*Crotalus adamanteus*)	DC-ECO-2. Upland Longleaf and Loblolly Pine Woodlands DC-ECO-3. Wet Pine Savanna and Flatwoods DC-ECO-5. Pocosins	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-SCC-3. At-Risk Species	DC-SCC-1. Wildlife Stump and Root Mound Associates DC-SCC-2. Wildlife Species Sensitive to Road Use Associates DC-SCC-3. Pine Upland/Wetland Ecotones Associates	OBJ-SCC-3. At-Risk Species	S37; G31, G32, G35
Southern Hognose Snake (*Heterodon simus*)	DC-ECO-2. Upland Longleaf and Loblolly Pine Woodlands	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-2. Wildlife Species Sensitive to Road Use Associates	OBJ-SCC-3. At-Risk Species	G32
Spotted Turtle (*Clemmys guttata*)	DC-ECO-4. Depressional Wetlands and Carolina Bays DC-ECO-7. Narrow Forested Swamps and Blackwater Stream Forests	OBJ-SCC-3. At-Risk Species	DC-SCC-2. Wildlife Species Sensitive to Road Use Associates DC-SCC-6. Pond Cypress Savannas Associates DC-SCC-8. Forested Wetlands Associates	OBJ-SCC-3. At-Risk Species	S35; G32, G35

	Coarse-filter Components		Fine-filter Components		
Scientific Name	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
	DC-ECO-8. Broad Forested Swamps and Large River Floodplain Forests				
Fish					
American Eel (*Anguilla rostrata*)	DC-ECO-10. Rivers and Streams		DC-SCC-10. River and Stream Associates		
Insects					
Monarch Butterfly (*Danaus plexippus*)	DC-ECO-2. Upland Longleaf and Loblolly Pine Woodlands DC-ECO-5. Pocosins DC-ECO-7. Narrow Forested Swamps and Blackwater Stream Floodplain Forests	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems		OBJ-SCC-3. At-Risk Species	S35, S36, S41; G40, G41
Berry's Skipper (*Euphyes berryi*)	DC-ECO-5. Pocosins DC-ECO-7. Narrow Forested Swamps and Blackwater Stream Floodplain Forests	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration		OBJ-SCC-3. At-Risk Species	S35, S36; G40, G41
Plants					
Coastal Plain False-foxglove (*Agalinis aphylla*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-SCC-3. At-Risk Species	DC-RIZ-S Santee Rare Plants	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

	Coarse-filter Components		Fine-filter Components		
Scientific Name	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Elliott's Bluestem (*Andropogon gyrans var. stenophyllus*)	DC-ECO-3. Wet Pine Savanna and Flatwoods DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC 6. Pond Cypress Savannas Associates DC-RiZ-Wambaw-S-9. rare plant communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Purple Silkyscale (*Anthaenantia rufa*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration		OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Northern Burmannia (*Burmannia biflora*)	DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays		OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Many-flower Grass-pink (*Calopogon multiflorus*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems		OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41
Southeastern Sneezeweed (*Helenium pinnatifidum*)	DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays		OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Boykin's Lobelia (*Lobelia boykinii*)	DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays		OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

	Coarse-filter Components		Fine-filter Components		
Scientific Name	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Lance-leaf Loosestrife (*Lysimachia hybrida*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Pineland Plantain (*Plantago sparsiflora*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates		S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Yellow Fringeless Orchid (*Platanthera integra*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41
Shadow-witch Orchid (*Ponthieva racemosa*)	DC-ECO-6. Oak and Mesic Hardwood Forest	OBJ-ECO-6. Oak Forests and Mesic Hardwoods	DC-SCC-4. Calcareous Mesic Forests Associates DC-Z-Santee-S-3. Rare Plant Community	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41
Crestless Plume Orchid (*Pteroglossapsis ecristata*)	DC-ECO-2. Upland Longleaf and Loblolly Pine Woodlands	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-7. Upland Pine Woodland Associates	OBJ-SCC-3. At-Risk Species	S26, S29, S34, S35, S36, S37, S39, S40, S41; G40, G41
Short-bristle Baldrush (*Rhynchospora breviseta*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

	Coarse-filter Components		Fine-filter Components		
Scientific Name	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Harper Beakrush (*Rhynchospora harperi*)	DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Few-flowered Beakrush (*Rhynchospora oligantha*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Brown Beakrush (*Rhynchospora pleiantha*)	DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Depressional Wetlands and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Long-beaked Beaksedge (*Rhynchospora scirpoides*)	DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Depressional Wetlands and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Carolina Dropseed (*Sporobolus pinetorum*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-3. Upland Longleaf and Wet Pine Savanna and Flatwoods Ecosystems	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates DC-RIZ-Wambaw-S-9. Rare Plant Communities	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41
Short-leaved Yellow-eyed Grass (*Xyris brevifoli*)	DC-ECO-3. Wet Pine Savanna and Flatwoods	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration	DC-SCC-5. Mesic to Wet Pine Savanna and Flatwoods Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41

	Coarse-filter Components		Fine-filter Components		
Scientific Name	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Desired Conditions**	**Objectives & Mgmt. Strategies**	**Standards & Guidelines**
Florida Yellow-eyed Grass (*Xyris difformis var. floridana*)	DC-ECO-4. Depressional Wetlands and Carolina Bays	OBJ-ECO-2. Frequent Prescribed Fire for Ecosystem Maintenance or Restoration OBJ-ECO-4. Pond Cypress Savannas and Carolina Bays	DC-SCC-6. Pond Cypress Savannas Associates	OBJ-SCC-3. At-Risk Species	S26, S34, S35, S36, S37, S39, S40, S41; G40, G41