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

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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)

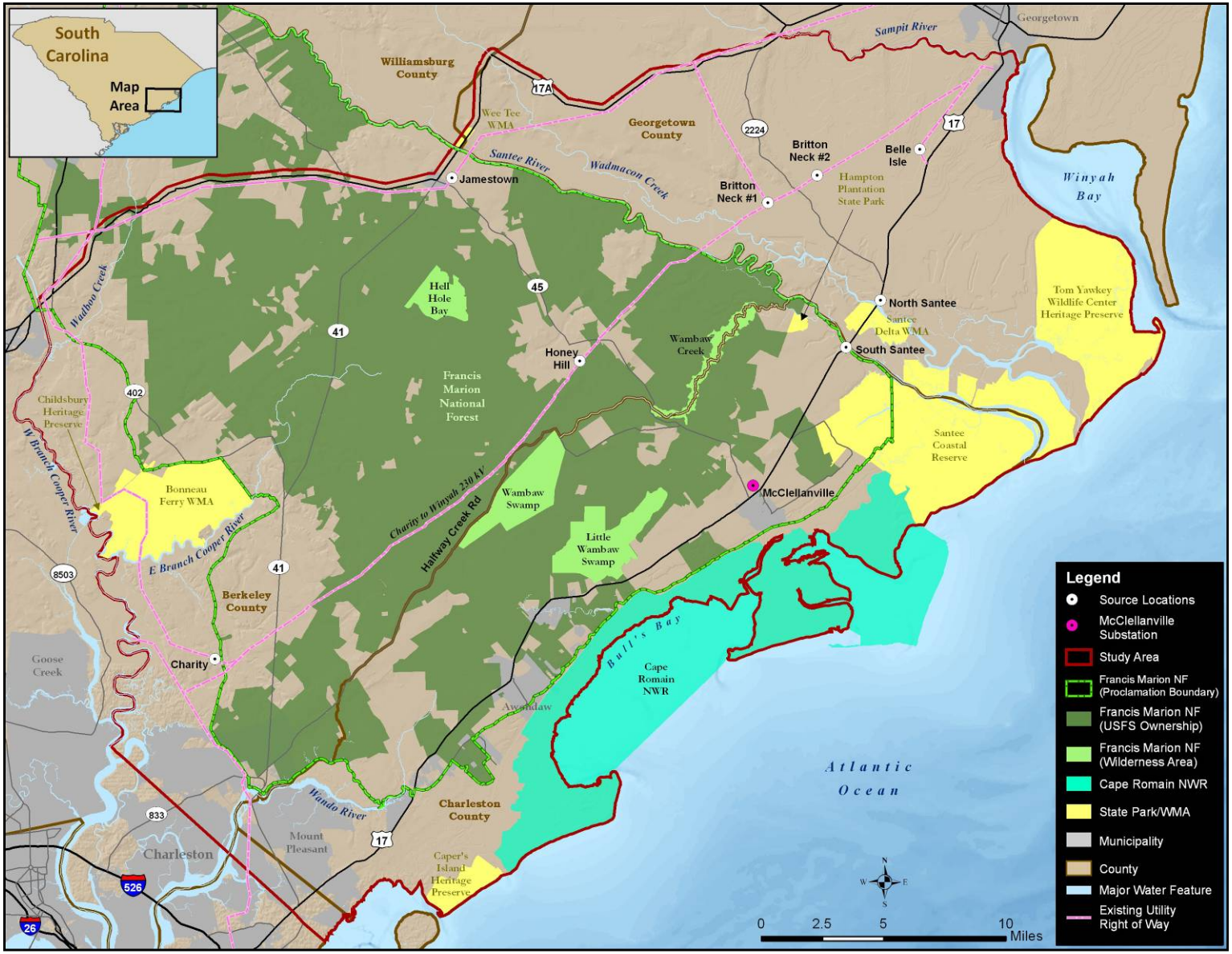


Figure 3-1: Study Area

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

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.

Red-cockaded Woodpecker Nest Tree (Photo T. Gaul)

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.

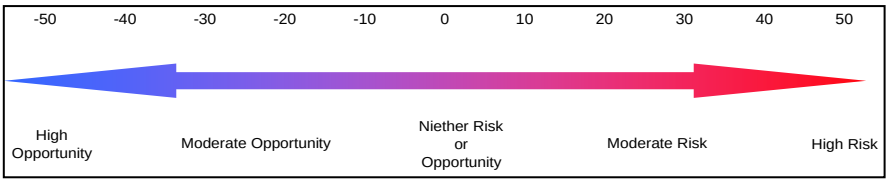
Areas within each individual resource suitability layer were assigned *positive* numeric values, between +1 and +50, if constructing a transmission line within that area could result in increased risk of potential impacts to that layer's resource. For example, within the threatened and endangered species 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*

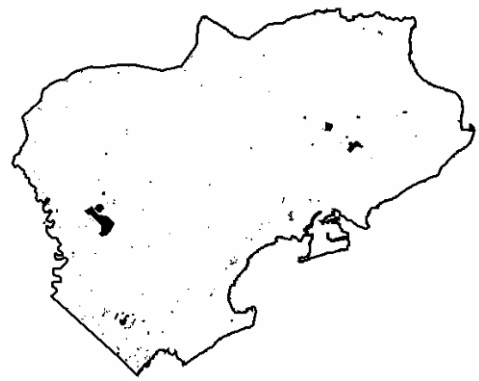
All areas within the boundaries of designated Historic or Archaeological Districts were excluded from consideration for transmission line corridor planning. Transmission line siting in these areas has a high potential to adversely impact cultural resources and/or the historic character being preserved 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*

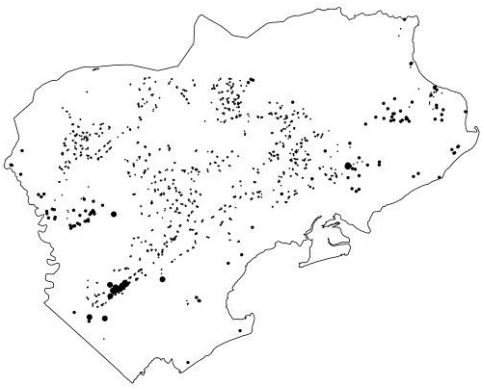


Areas in which transmission line construction could potentially impact known cultural sites were excluded from consideration for transmission line corridor planning. For this analysis, linear architectural features (historic roads or trails) and architectural structure sites (point locations) were buffered 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*



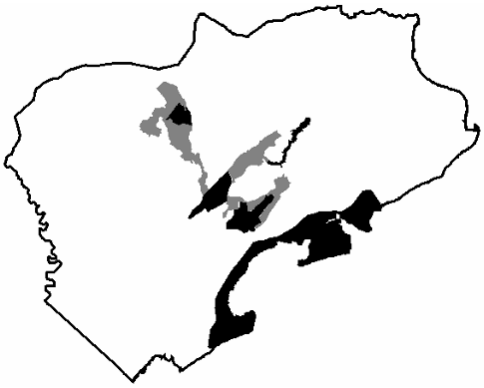
Threatened and endangered species locations for federally listed species were provided by the South Carolina State Natural Heritage Office and the USFS. On National Forest lands, the most recent locations (2008) for red cockaded woodpecker (*Picoides borealis*) colonies were also identified and mapped. 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.

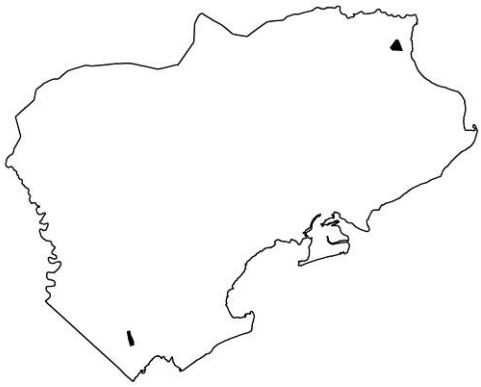
4.3.4 Wilderness Areas and Linkages – *Excluded*



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:

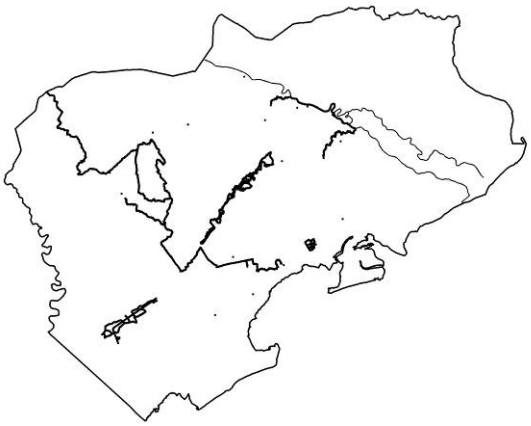
- Areas at a distance of 0 to 160 meters from the interface of moderate to well drained soils
- Areas of somewhat poorly drained to well drained soils within 160 meters of permanent water sources
- Areas within 70 meters of small ponds or bays

- 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*

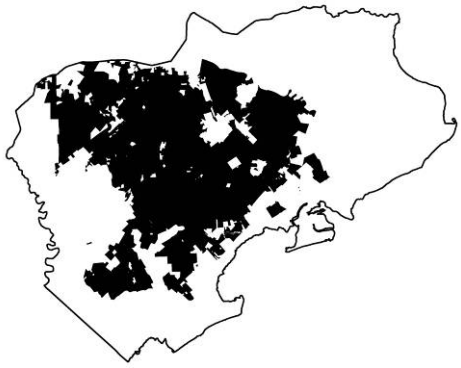
Construction of a transmission line within or adjacent to a developed recreation area on the FMNF may impact the recreational use and value of the site. For this reason, areas within 300 feet of developed recreation sites and trails were assigned a risk rating of +50.

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.

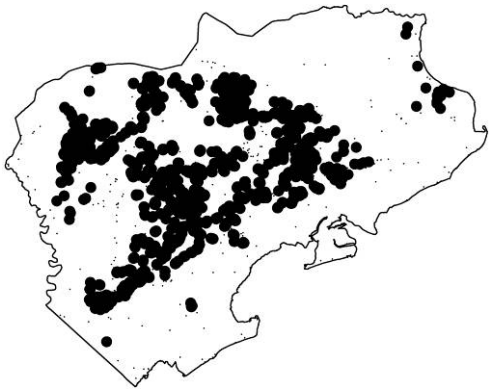
4.4.6 Francis Marion National Forest Ownership - *Risk*



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*

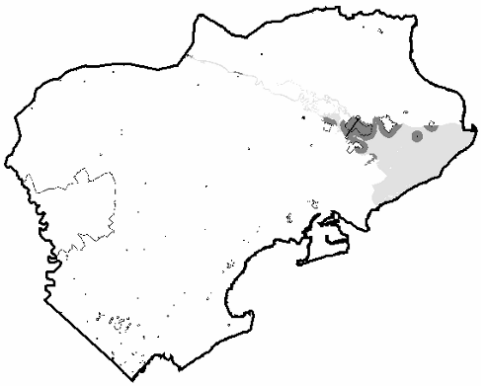
Construction of a transmission line within a wetland area may result in alterations to the structural character and vegetative composition of the wetland, and may disturb resident species and their habitats. For this reason, wetland areas identified in the National Wetlands Inventory, as well as the 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.

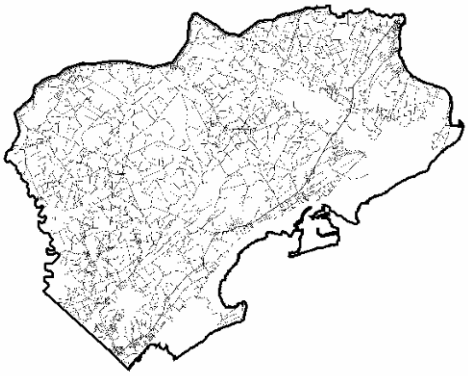
4.5.1 Existing Transmission ROWs - *Opportunity*

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.

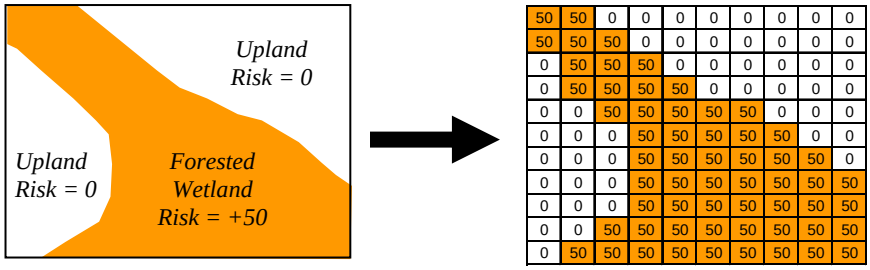
An additional habitat layer that was provided by the Forest Service in 2007 and used in the macro-corridor study was a dataset consisting of several polygons of known habitat for threatened and endangered species. This layer contained several polygons that identified potential habitat for listed plant 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.

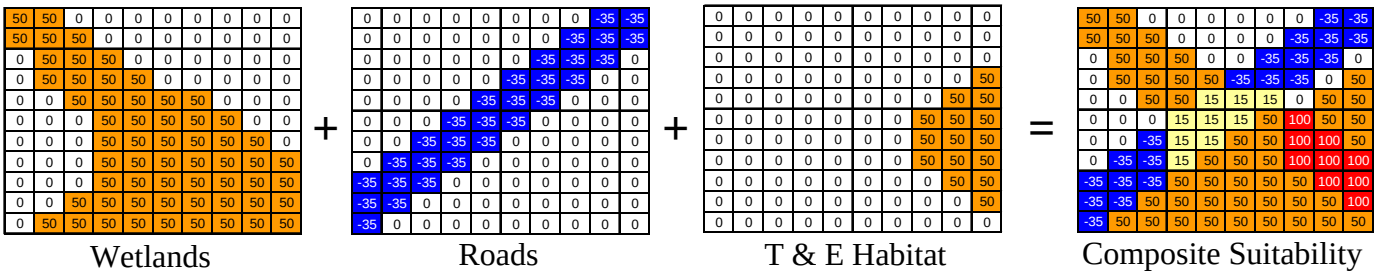
Because of the general lack of data on the locations of flatwoods salamanders in coastal SC, a habitat layer was created and added to the modeling process to characterize potential flatwoods salamander reproduction habitat. Comparison of the Central Electric T&E survey results to the forested wetland 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.

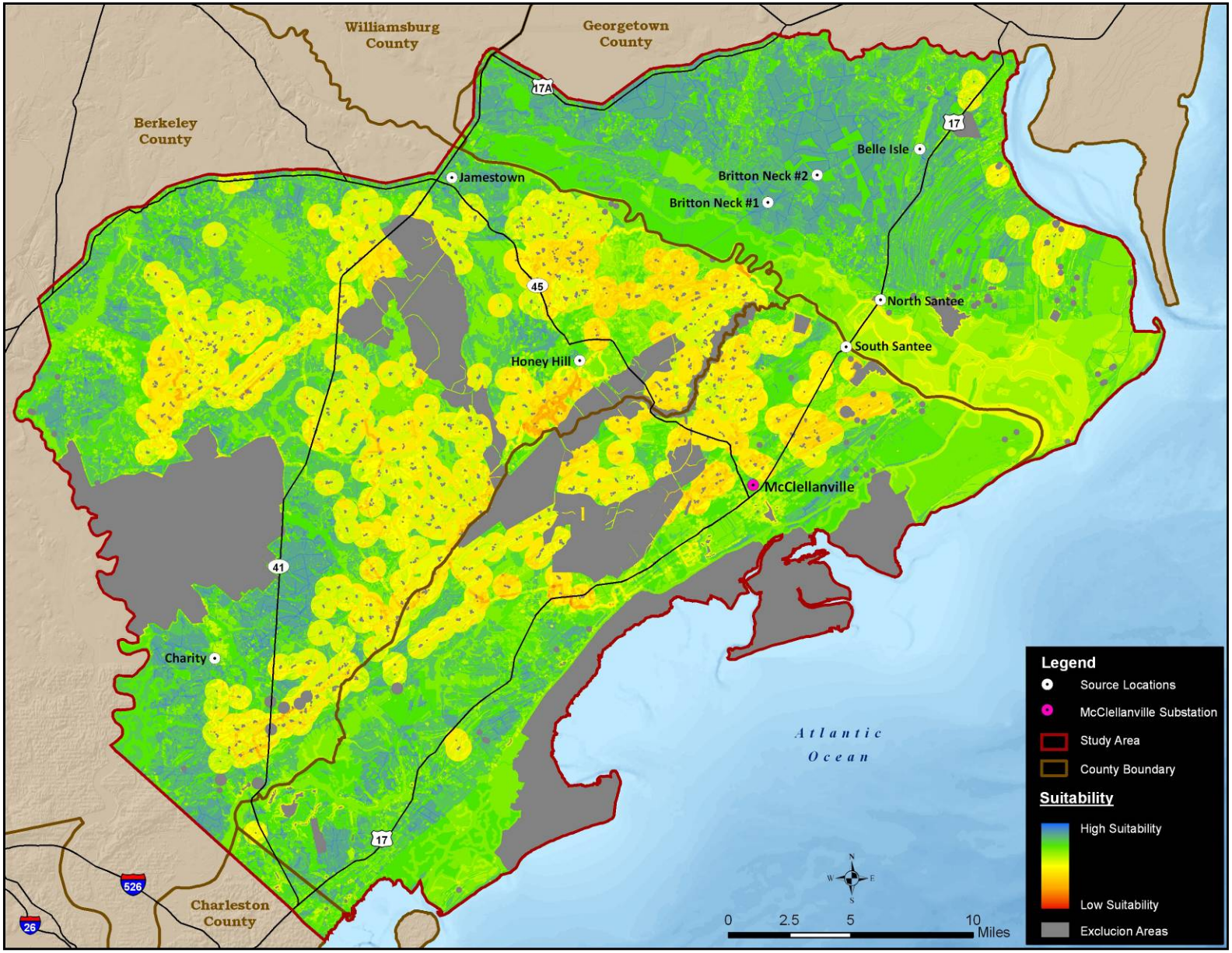


Figure 4-1: Composite Suitability Map

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).

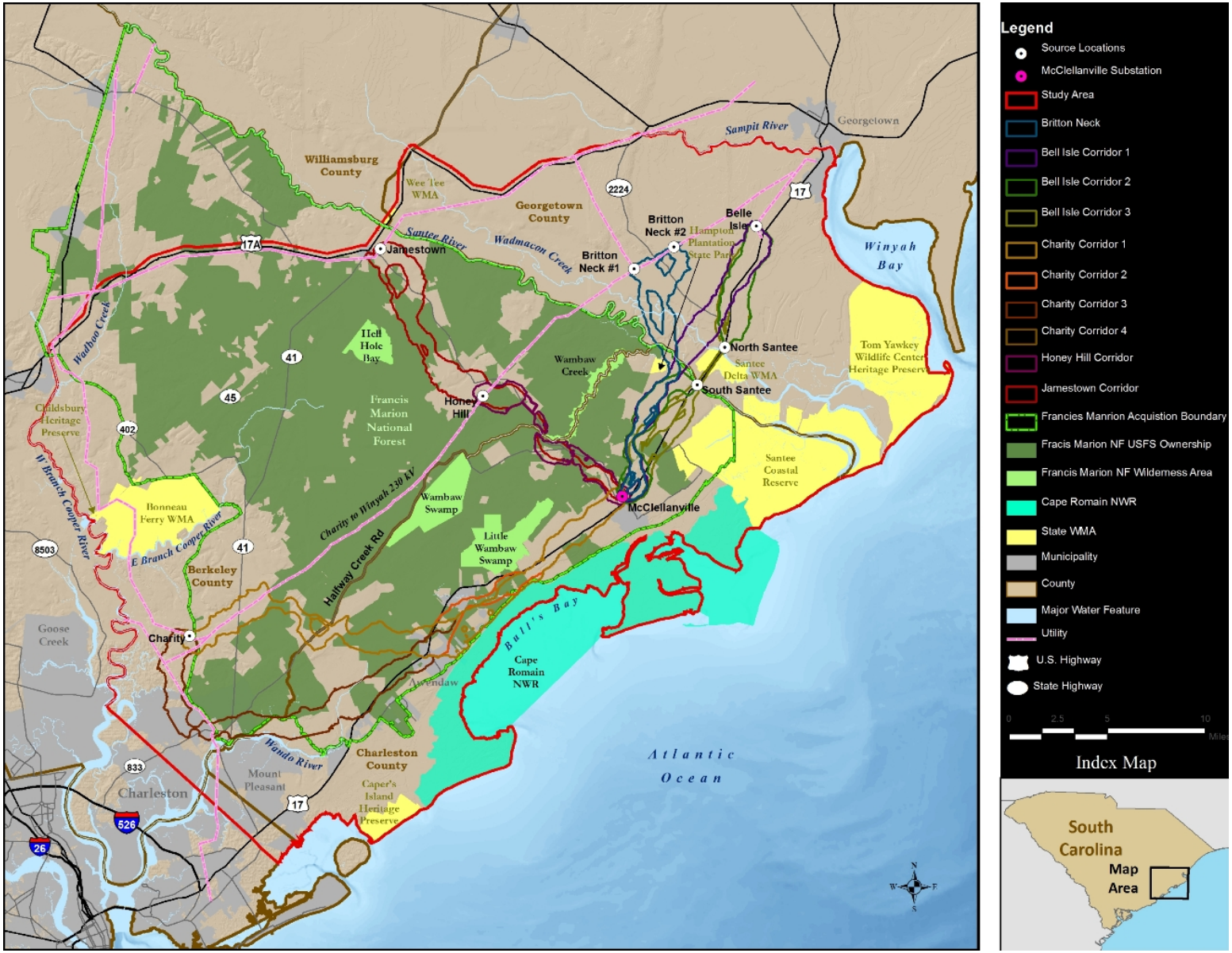


Figure 5-1: Overview of ten optional model-generated least-risk transmission line alignments and associated corridors to supply power to McClellanville, SC

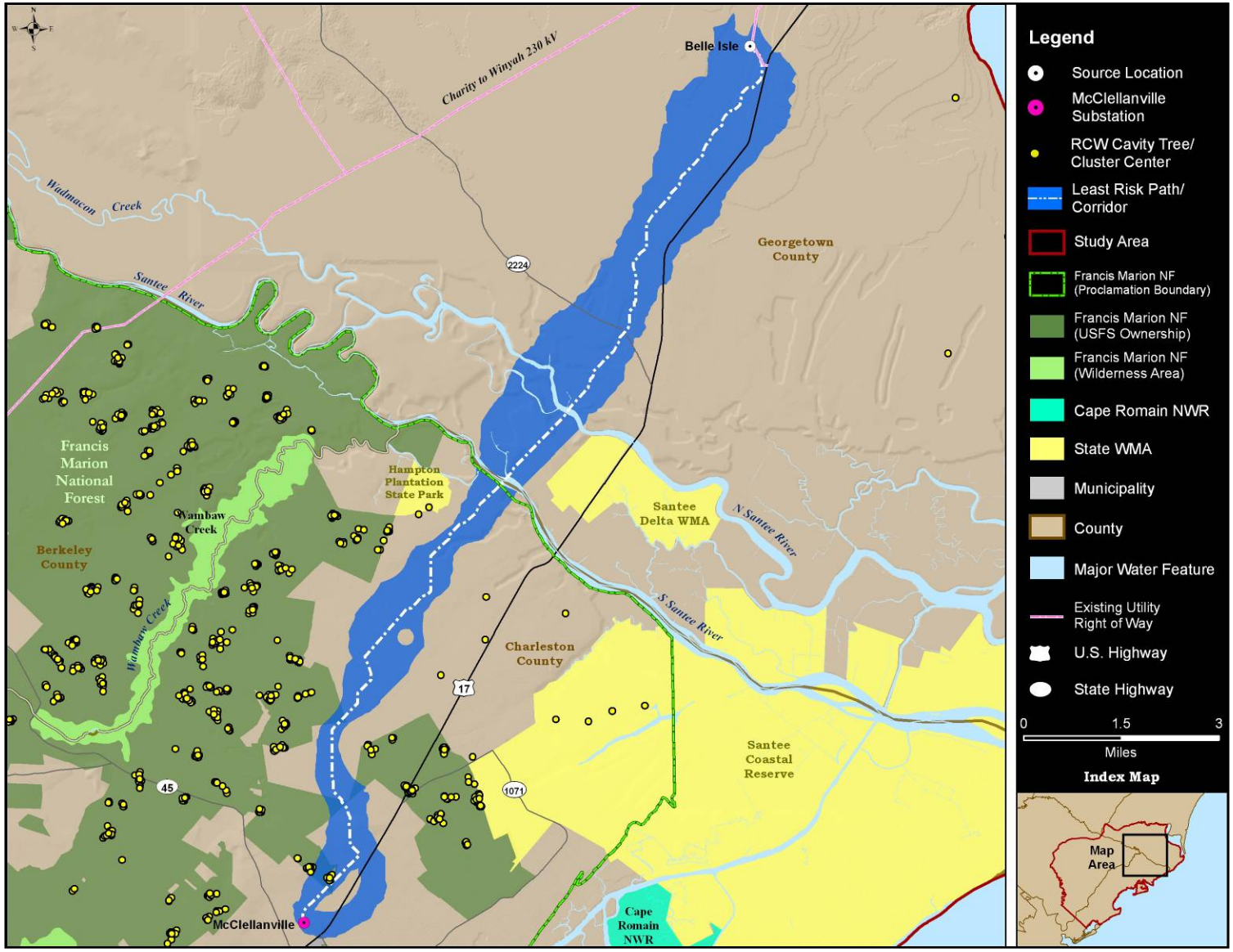


Figure 5-2a: Belle Isle 1 Least Risk Path Alignment and Corridor

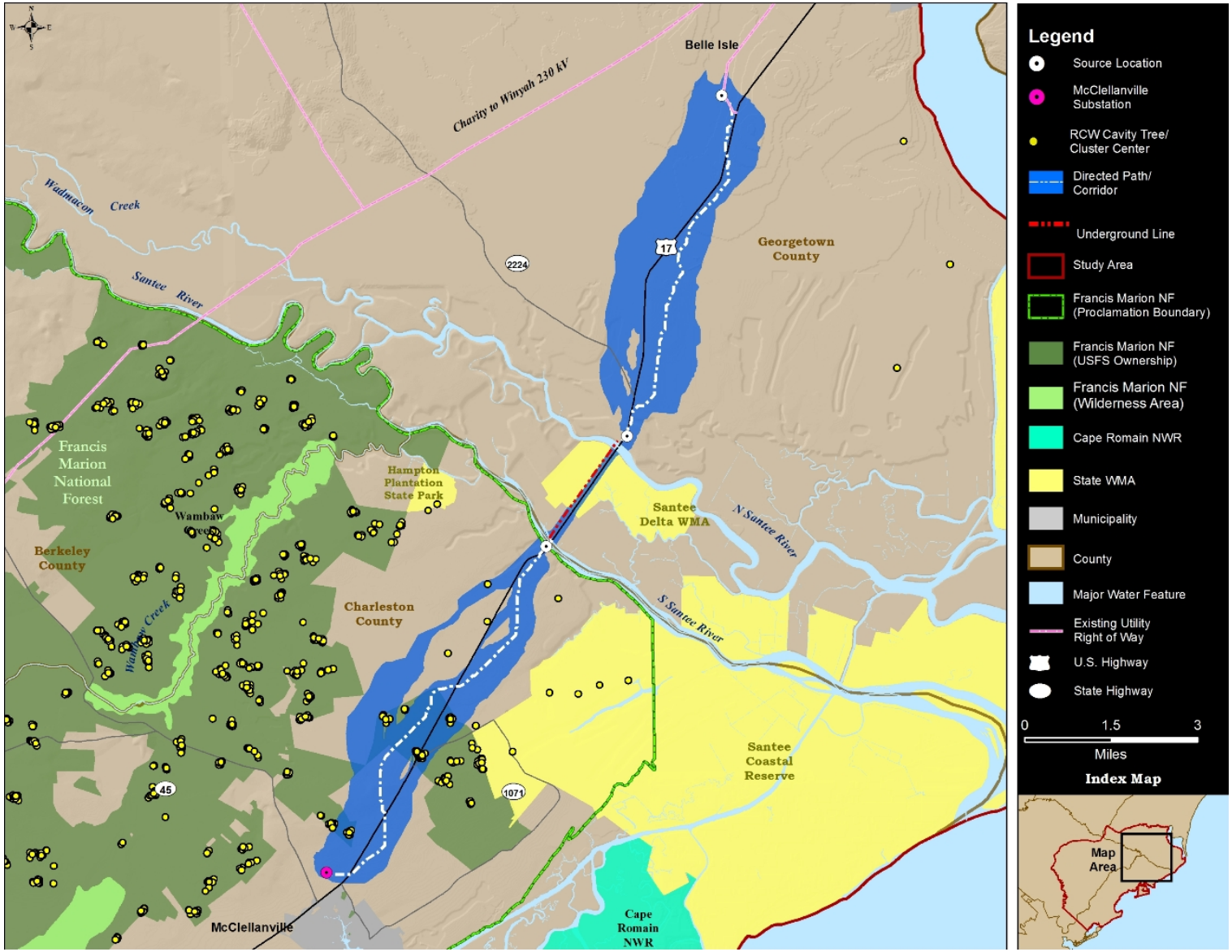


Figure 5-2b: Belle Isle 2 Directed Path Alignment and Corridor

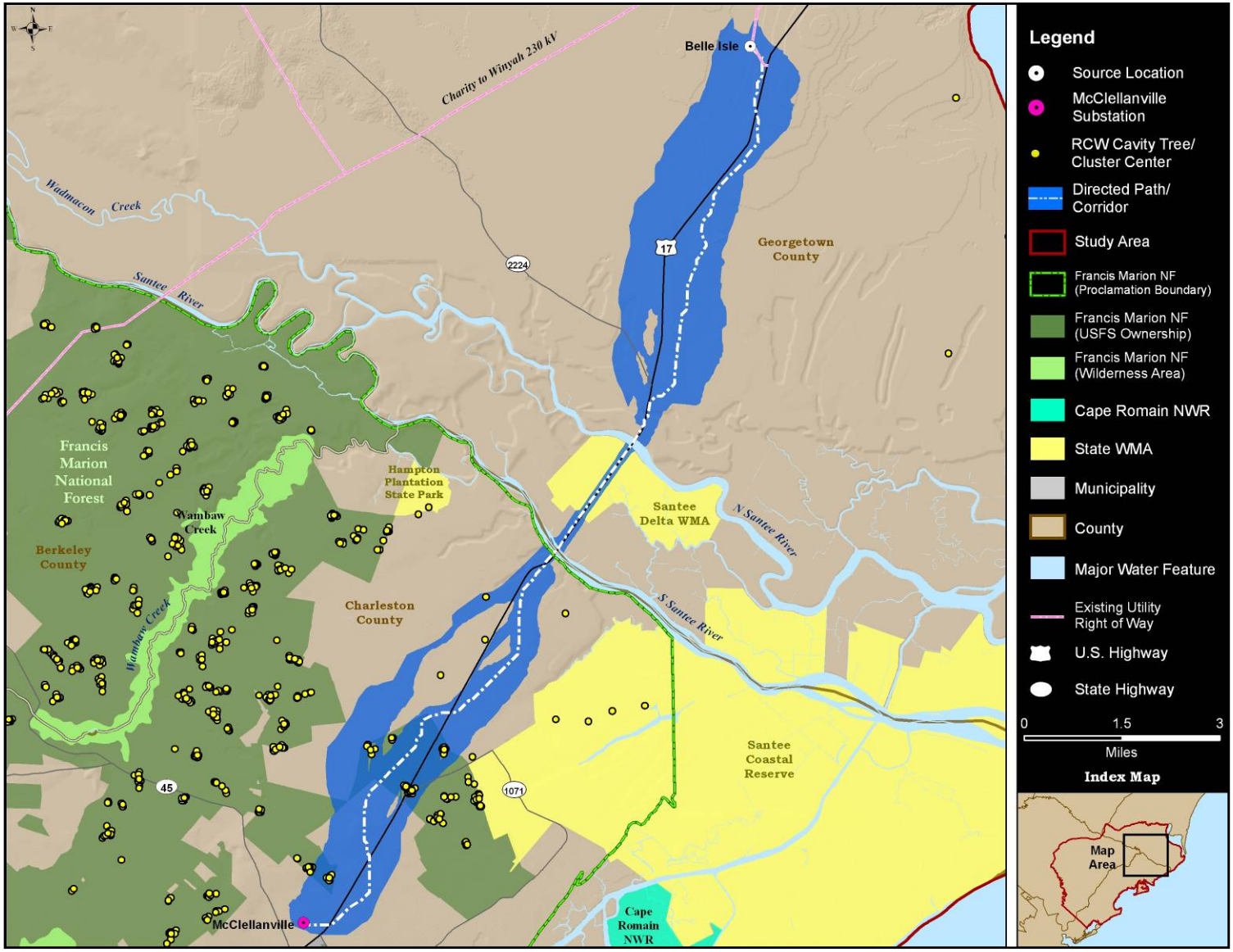


Figure 5-2c: Belle Isle 3 Directed Path Alignment and Corridor

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.

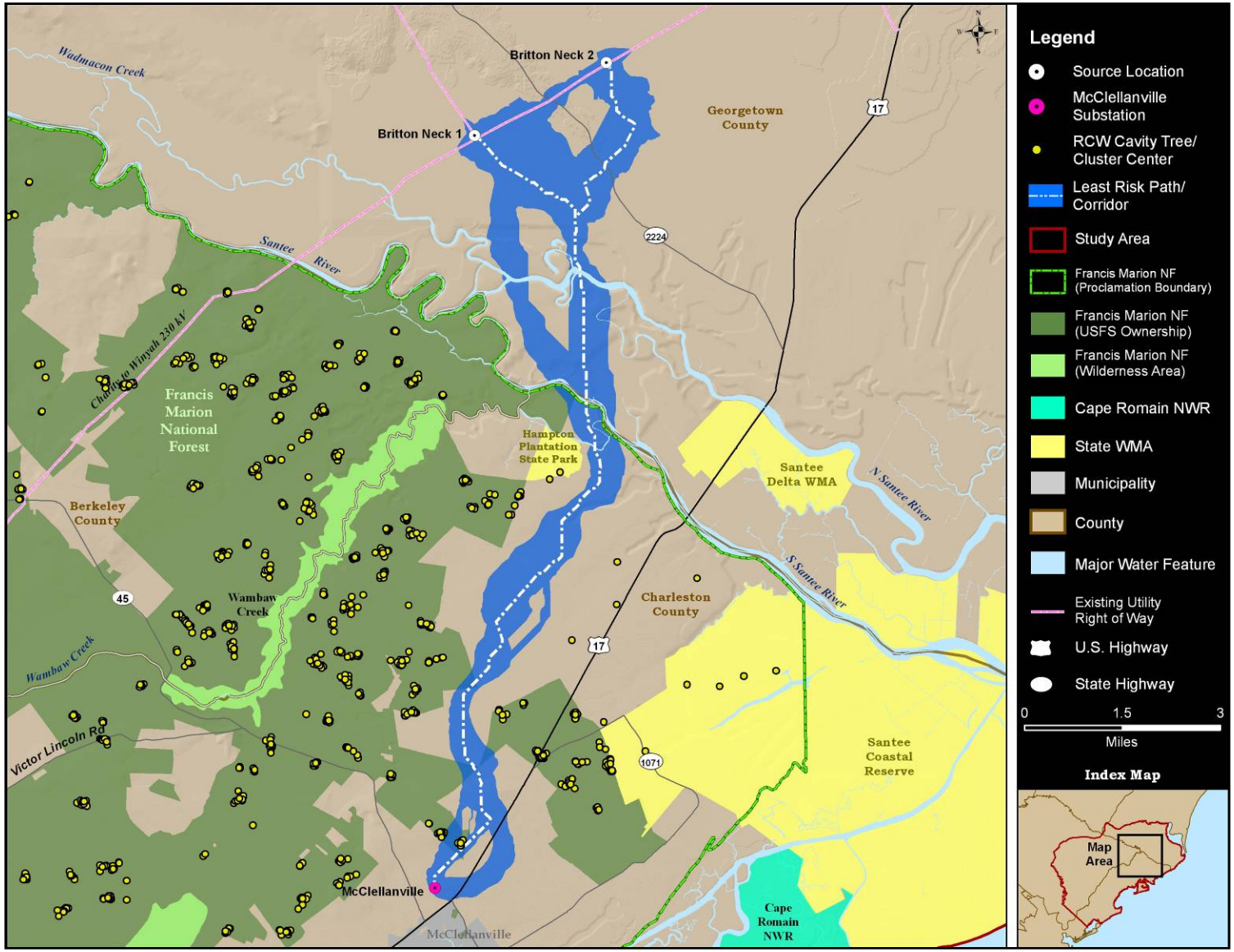


Figure 5-3: Britton Neck Least Risk Path Alignment and Corridor

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).

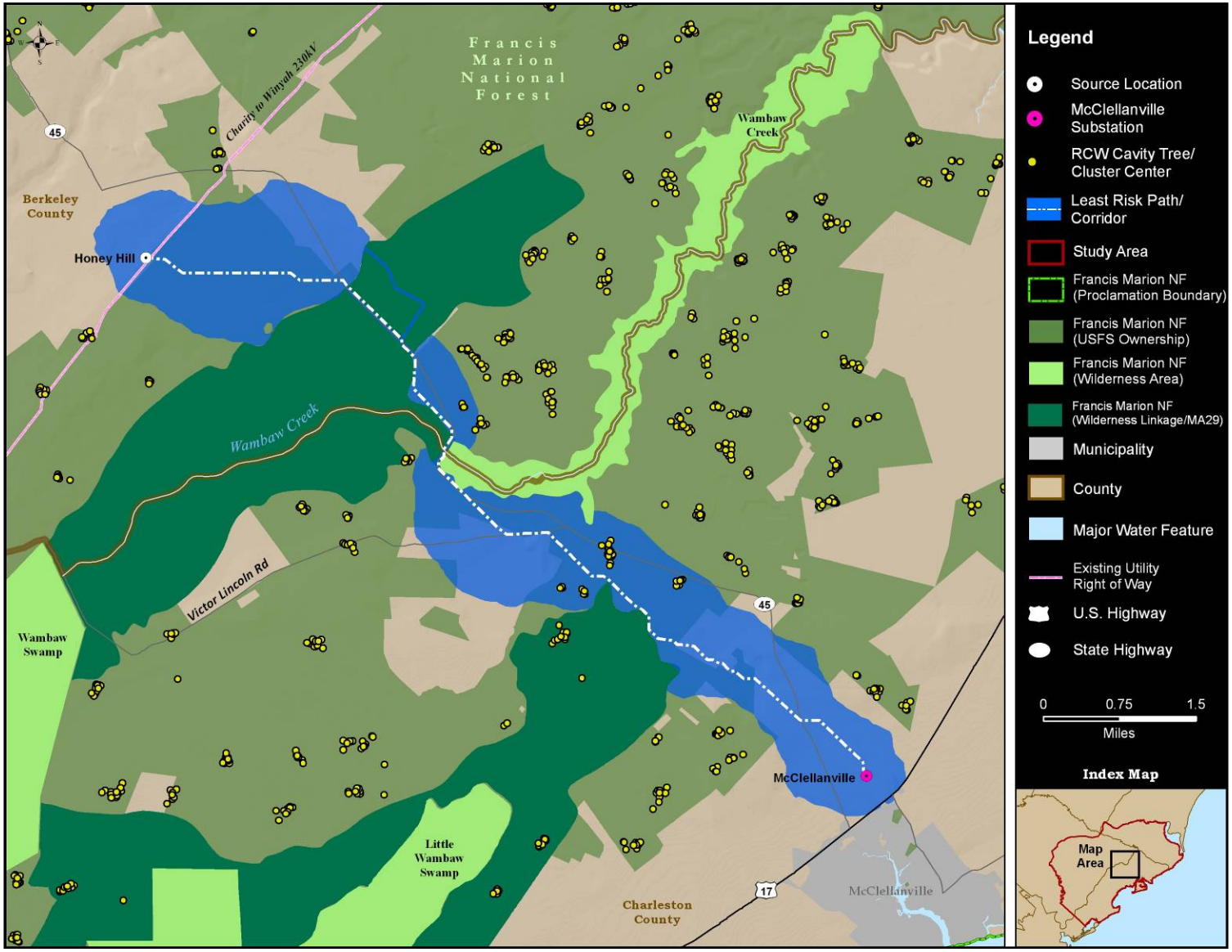


Figure 5-4: Honey Hill Least Risk Path Alignment and Corridor

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).

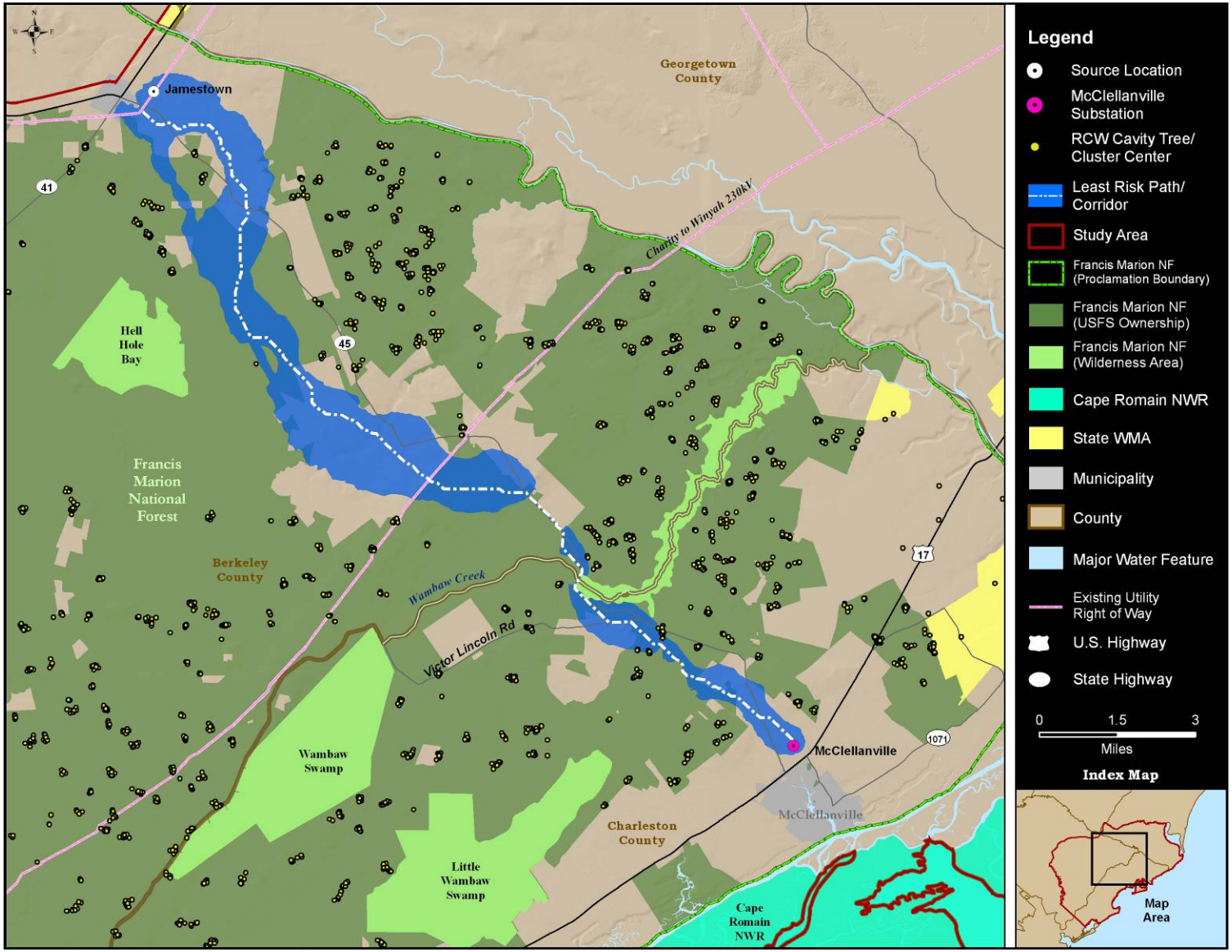


Figure 5-5: Jamestown Least Risk Path Alignment and Corridor

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.

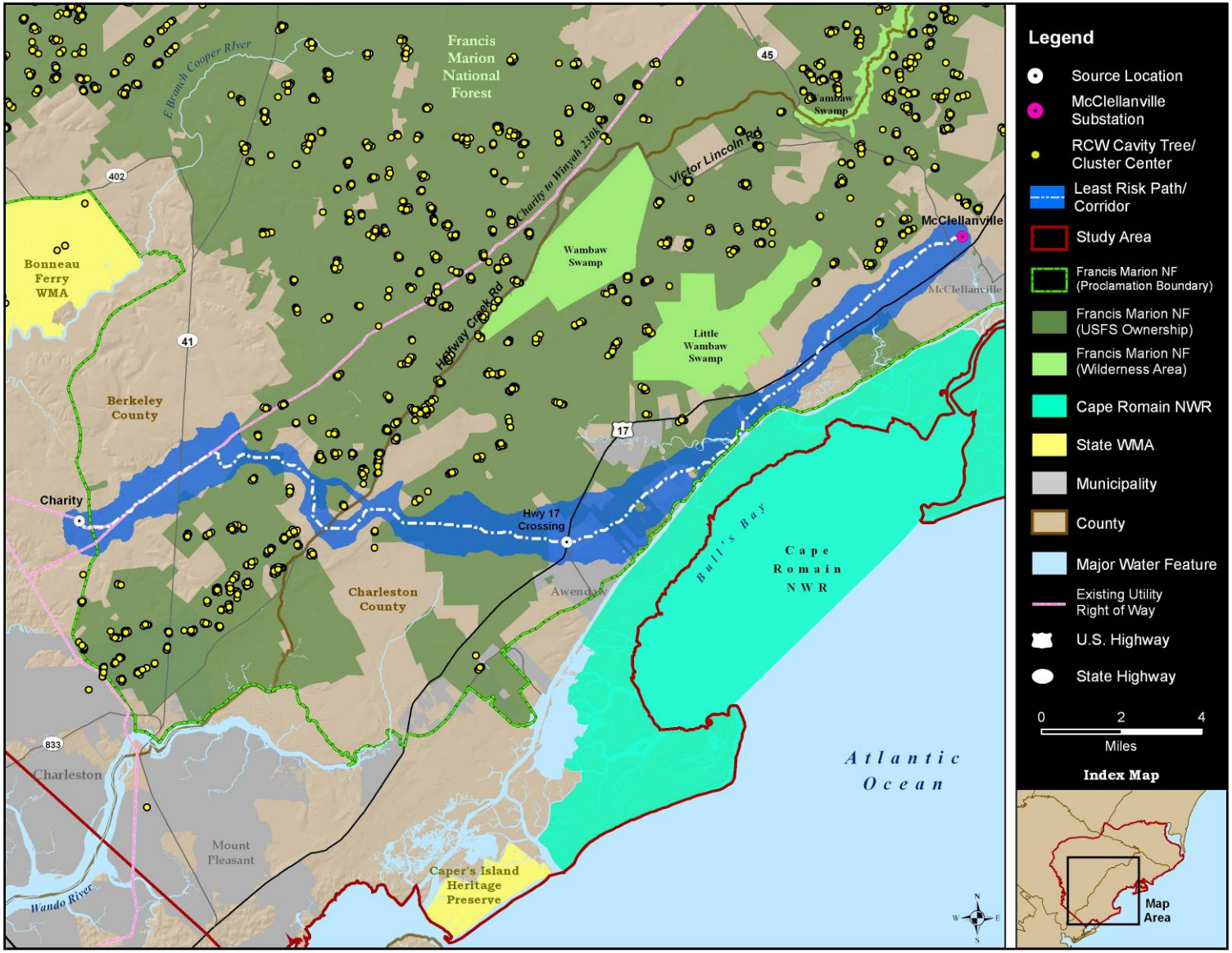


Figure 5-6a: Charity 1 Least Risk Path Alignment and Corridor

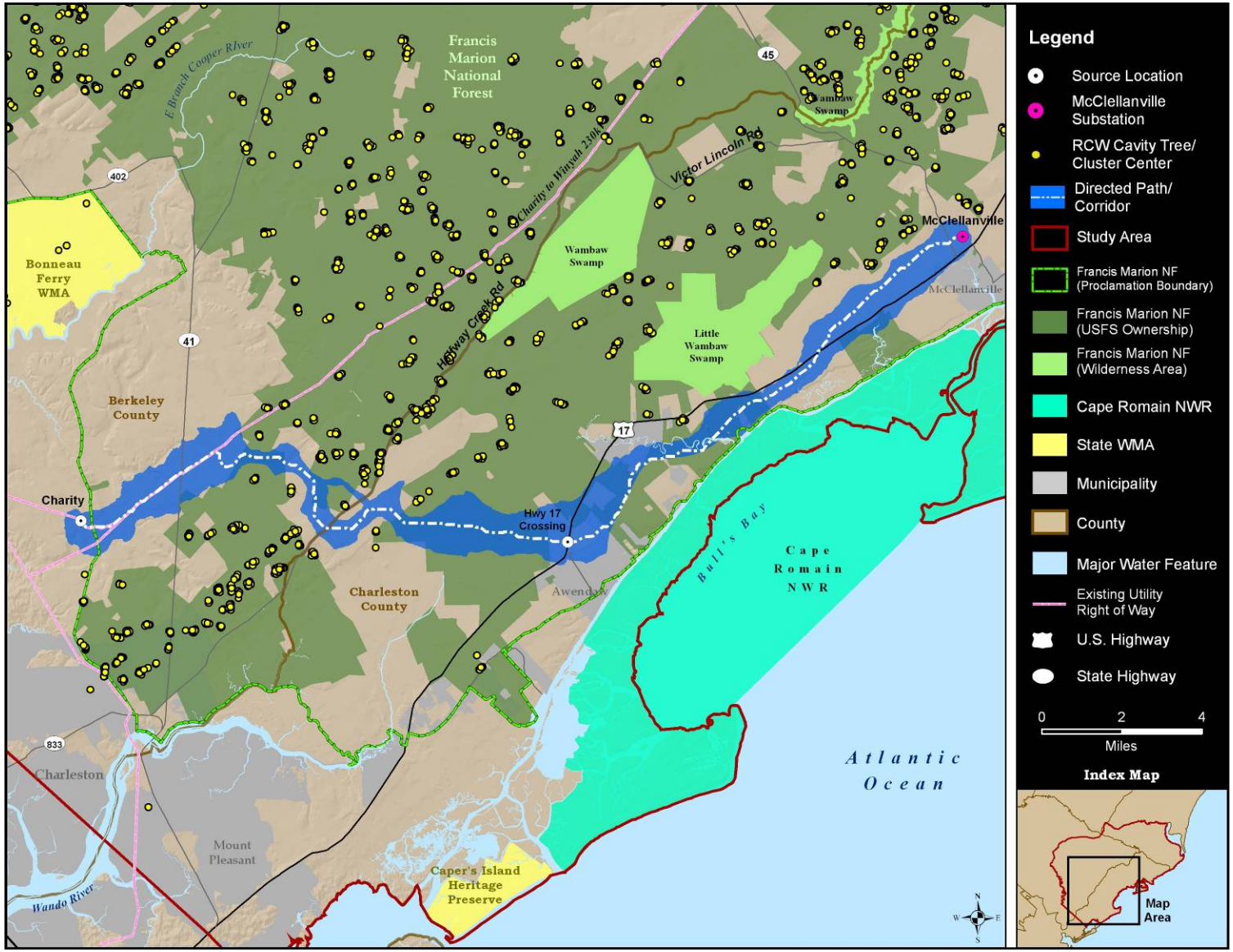


Figure 5-6b: Charity 2 Directed Path Alignment and Corridor

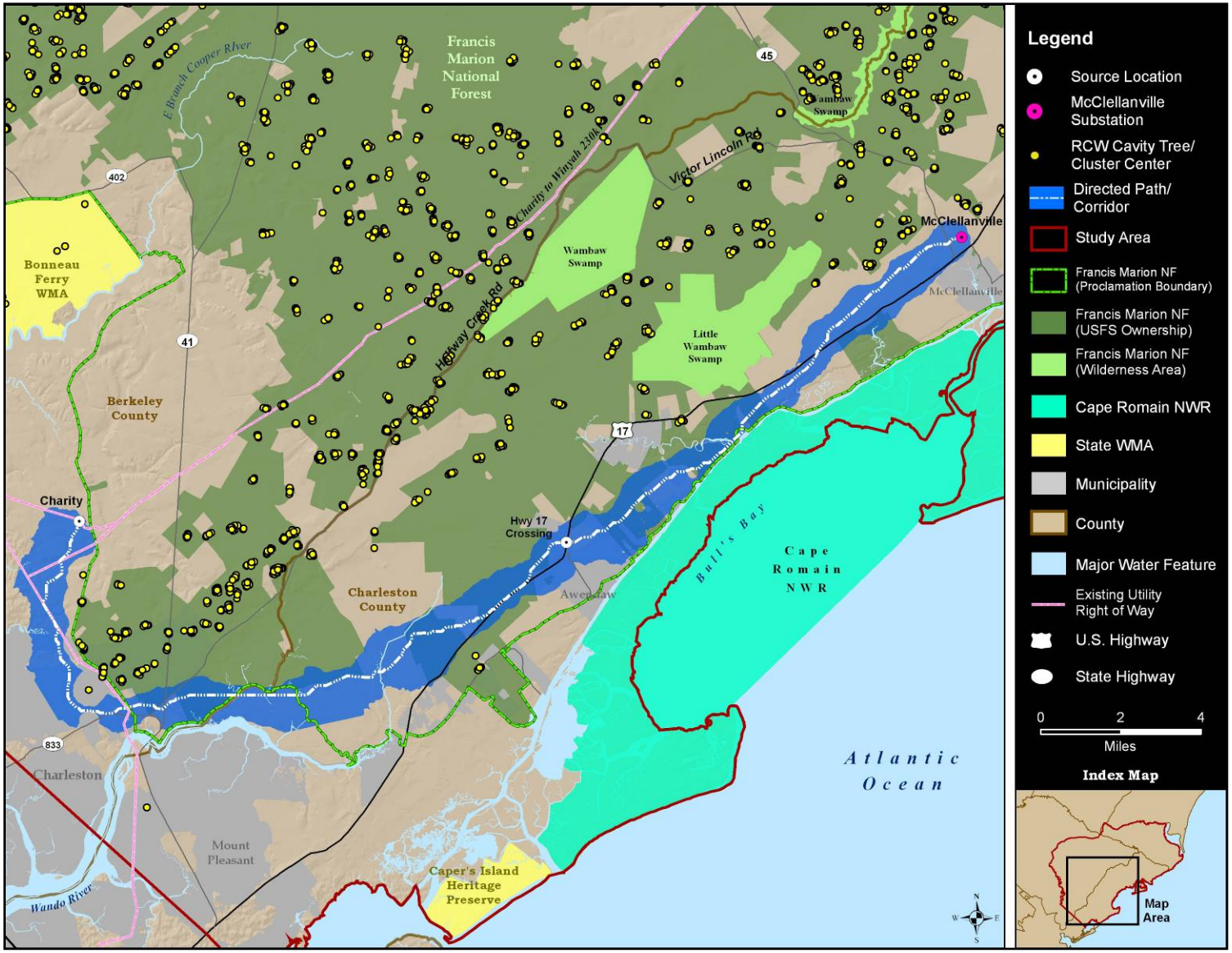


Figure 5-6c: Charity 3 Directed Path Alignment and Corridor

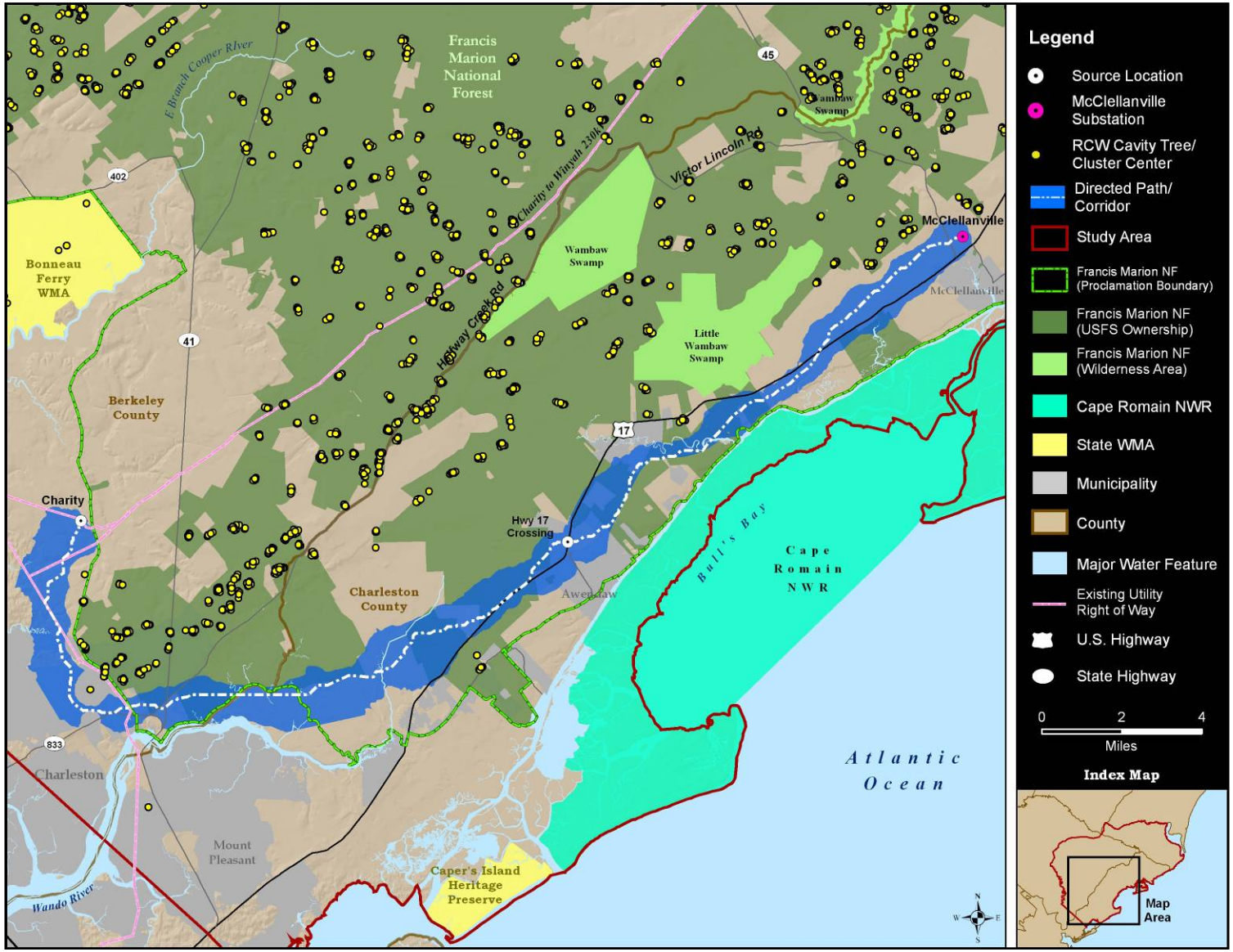


Figure 5-6d: Charity 4 Directed Path Alignment and Corridor

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

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