

4.0 DEVELOPMENTAL ANALYSIS

In this section, we analyze the project's use of the Santee and Cooper rivers' available water resources to generate hydropower, and estimate the cost of various environmental protection and enhancement measures and the effects of these measures on project economics.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECT

Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corporation, Publishing Paper Division*,³⁵ the Commission employs an analysis that uses current costs to compare the costs of the project and likely alternative power with no forecasts concerning potential future inflation, escalation, or deflation beyond the license issuance date. The basic purpose of the Commission's economic analysis is to provide a general estimate of the potential power benefits and the costs of a project, and reasonable alternatives to project power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license.

The economic analyses used in this section include various parameters listed in table 18. Using these parameters, we assessed the value of generation output from the facility.

SCPSA reports that the average annual generation for the 10-year period ending in 1999 was 210,204 MWh at the Jefferies Hydroelectric Station and 13,823 MWh at the Santee Spillway Hydroelectric Station, for a total average annual generation of 224,027 MWh. The annual average generation for the Corps' St. Stephen Project for this period was 301,007 MWh. SCPSA states that the terms of operating Jefferies station and St. Stephen are governed by a contract with the Corps, which includes provisions for payments to SCPSA from the Corps if energy loss exceeds capacity gain, or payments to the Corps from SCPSA if capacity gain exceeds energy lost, based on the combined operation of the two facilities. SCPSA did not provide information relative to historical payments under this contract that could be used to determine a typical or average net gain or loss in revenue to SCPSA, therefore, we were unable to include the value of this contract as it relates to overall value of the Santee Cooper Project.

SCPSA indicates that the cost of replacement power using gas-fired simple-cycle combustion turbines would be \$20.8 million per year in \$2006. Staff calculates the resulting power value to be \$92.85/MWh based on an annual generation of 224,027 MWh. Though this power value is based on a 2004 estimate of fuel costs of alternative energy (i.e., natural gas) for 2006, we believe this value is a reasonable estimate of total energy and capacity for measuring the economic benefits of project operation, and for the cost of replacing power for any alternative that would reduce project generation.

³⁵72 FERC ¶61,027 (1995).

Table 18. Staff parameters for economic analysis of the Santee Cooper Project.
(Source: Exhibit D of SCPSA, 2004a; staff)

Parameter	Value	Sources
Power value (2006) ^a	\$53.00/MWh	SCPSA (license application)
Peak vs. off peak ratio	All hours average price	
Period of analysis	30 years	Staff
Cost of capital	7.5 percent	SCPSA (license application)
Discount rate	7.5 percent	SCPSA (license application)
Escalation rate	0 percent	Staff
Federal income tax rate	0 percent	SCPSA (license application)
Local income tax rate ^b	0 percent	SCPSA (license application)
Term of financing	30 years	Staff
Insurance	\$180,000	SCPSA (response to AIR)
O&M costs (\$2005)	\$4,900,000	SCPSA (license application)
Net investment ^c	Not provided	
Cost of preparing license application and conducting studies ^d	\$3,000,000 for license application and \$3,000,000 for studies (Total \$6,000,000)	SCPSA (letter filed June 19, 2007)

^a For our analysis we use an average of peak (\$70 per MWh) and off peak (\$36 per MWh) rates for the Virginia/Carolinas power region as reported by Platt's Megawatt Daily for 2005. Because the average annual energy production for the project did not identify a ratio between peak and off peak, we use an unweighted average of \$53 per MWh for the purposes of evaluating project economics.

^b SCPSA is a public entity and therefore not subject to income tax and certain other state and local taxes. However, SCPSA indicates that other payments to state and local entities are made in lieu of taxes (i.e., \$13,000,000 in 2002). SCPSA did not indicate what, if any, component of this payment was directly attributable to the day-to-day operation of the project. Therefore, we assumed that any components of this amount that relate to the Santee Cooper Project are included in the O&M costs (averaging \$4.9 million per year) provided in the license application.

^c SCPSA did not provide information regarding net investment for the project, but rather provided an amortization of costs based on an assumed principal balance of \$28.8 million for "projected 2006-2025 hydro plant additions" and costs based on an alternative power source. This information does not appear to reflect historical actual project costs or production values, therefore was not used in our analysis.

^d The cost for relicensing the Santee Cooper Project, including studies, is included in our analysis of costs for all four alternatives identified below.

4.1.1 No-action Alternative

Under the no-action alternative, SCPSA would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

The estimated average annual generation of the Santee Cooper Project is 224,027 MWh, valued at about \$11,873,000 (53 mills/kWh). The annual cost would be about \$5,423,000 (24.21 mills/kWh) resulting in costs of \$6,450,000 (28.79 mills/kWh) less than the cost of the most likely alternative source of power.

4.1.2 Proposed Action

For the proposed action, we present the annual cost that includes operating the Santee Cooper Project with the environmental measures SCPSA's proposed in its license application and those identified in supplemental additional information request responses (e.g., improved bank fishing access and parking and deepwater access upgrades at several existing boat landings).

Based on the parameters in table 18 and the cost of measures identified in table 19 we estimate that the annual power value under SCPSA's proposed action would be about \$11,844,000 (53.00 mills/kWh) for the estimated annual generation of 223,477 MWh. The annual cost would be \$5,623,000 (25.16 mills/kWh) which is about \$6,221,000 (27.84 mills/kWh) less than the cost of the most likely alternative source of power.

4.1.3 Final Settlement Alternative

For the final settlement alternative we present the annual cost that includes operating the Santee Cooper Project with the environmental measures identified in the FSA.

Based on the parameters in table 18 and the cost of measures identified in table 19 we estimate that the annual power value would be about \$11,705,000 (53.00 mills/kWh) for the estimated annual generation of 220,847 MWh. The annual cost would be \$10,175,000 (46.07 mills/kWh) which is about \$1,530,000 (6.93 mills/kWh) less than the cost of the most likely alternative source of power.

4.1.4 Staff-recommended Alternative

The staff-recommended alternative includes certain measures proposed by SCPSA, recommended or required by the agencies, included in the FSA, and recommended by other stakeholders. While we recommend adopting fish passage measures, we also recommend development of a formalized fish passage implementation plan (see section 3.3.3.2) prior to construction of fish passage facilities. For our analysis, we have incorporated costs for addressing fish passage needs at the project similar to

those prescribed by NMFS and Interior and proposed by SCPSA and SCDNR as part of the FSA.³⁶

In comments received on the draft EIS, Interior and SCPSA identify higher costs associated with installation of fish passage facilities than were included in our analysis. Interior states fish passage facilities at Santee dam would range from \$4,000,000 for a trap and sort facility to \$9,000,000 for a complete fish lift facility, compared to our initial estimate of about \$2,000,000 for similar facilities. SCPSA identifies several different costs for fish passage measures and associated studies in various filings. In its filing of alternatives to Interior's preliminary section 18 prescription, SCPSA states that costs for the prescribed measures would be \$54,800,000. However, SCPSA states in response to non-signatory comments on the FSA that "its costs to implement the fish passage provisions of appendix A of the FSA would be approximately \$33,850,000."

We reassessed the estimated costs for fish passage facilities, to be more consistent with costs identified by Interior and SCPSA. While NMFS did not provide the costs for the facilities required by its prescription, we expect that the costs for NMFS's prescribed measures may be higher than Interior's measures. The most notable difference between the Interior and NMFS's prescriptions is that NMFS requires installation of downstream passage/protection measures without advance downstream passage studies, and NMFS provides specific design criteria for its facilities. Interior and the FSA approach downstream passage in a step-wise manner, rather than assuming the best solution and constructing it, as NMFS prescribes. The lack of downstream passage studies prior to construction could result in a need for significant post-construction modifications to achieve effectiveness goals. The NMFS's prescription also requires installation of a fish lift with trap and sort facilities at Santee dam 1 to 3 years sooner than the Interior/FSA timeframe, and requires more extensive upstream passage studies at Pinopolis lock and dam, targeting sturgeon.

We also recommend additional measures including a recreation management plan and more shoreline management provisions together with the CLMP (see section 3.3.5.2).

Based on the parameters in table 18 and cost of measures identified in table 19, we estimate that the annual value of power for the Santee Cooper Project with environmental measures under the staff alternative would be about \$11,705,000 (53.00 mills/kWh) for the estimated annual generation of about 220,847 MWh. The annual cost would be

³⁶In its June 7, 2006, alternative fish passage prescriptions, SCPSA identifies a range of costs for fish passage and protection measures (including mortality and effectiveness studies). SCPSA identifies a high range of \$54.8 million to implement NMFS's section 18 prescription for fish passage, and a low range of \$3.75 million, representing their alternative with reduced or eliminated costs for effectiveness and mortality studies, no upstream fish passage at the Santee spillway or Pinopolis dam, and a lower cost for attraction flows at Pinopolis dam. Staff's estimate to provide all the prescribed measures for passage facilities and studies is about \$47,575,000.

\$10,262,000 (46.47 mills/kWh) which is \$1,443,000 (6.54 mills/kWh) less than the cost of the most likely alternative source of power.

Table 19. Summary of annual costs of the proposed and recommended measures for the Santee Cooper Project.
(Source: SCPSA and staff)

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
1	Continue peaking and load regulation operations	SCPSA	\$0	\$0	\$0	Yes
2	Formalize the existing rule curve for reservoir operations	SCPSA	\$0	\$0	\$0	Yes
3	Modified rule curve to maintain full pool at Lake Marion in winter months	Interior, FWS	\$0	\$347,521	\$347,521	No
4	Post licensing study of effects of winter draw down on migratory waterfowl and recreational access	SCDNR	\$30,000	\$0	\$2,615	No
5	Conduct water quality monitoring and remediation, as necessary, in Lake Marion and the Santee River ^a	EPA, SCDNR	\$250,000	\$0	\$21,800	Yes, in part, for the Santee River downstream of the dam, as part of the adaptive management program
6	Develop water quality enhancement plan with action measures, implementation schedule, and monitoring program ^b	Interior	\$250,000	\$0	\$21,800	No

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
7	Improvements to project equipment and operations to meet narrative and numeric state water quality standards	Forest Service	N/A	N/A	N/A	No
8	Consider ways to release a portion of incoming sediments during storm events	Forest Service	N/A	N/A	N/A	No
9	Conduct study to evaluate effects of instream flows on DO and temperature ^b	American Rivers/CCL	\$250,000	\$0	\$21,800	Yes as part of the adaptive management program
10	Continue providing weekly average flow of 4,500 cfs from Jefferies to minimize shoaling in Charleston Harbor and prevent saline waters from reaching Bushy Park industrial complex	SCPSA, SCDNR, FWS, NMFS, Forest Service, American Rivers/CCL	\$0	\$0	\$0	Yes
11	Continuous flows at St. Stephen - 5,600 cfs during fish passage season contingent on water availability ^c	SCPSA, SCDNR, American Rivers/CCL, Staff, NMFS ^d	\$0	\$0	\$0	Yes

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
12	Increase continuous minimum flows from Santee dam to 30% of remaining inflow or 1,600, whichever is greater (Feb-Apr), and 25% of remaining inflow or 1,600 cfs, whichever is greater (May-Jan)	American Rivers/CCL, Forest Service	\$0	\$3,121,700	\$3,121,700 ^e	No
13	Increase instantaneous minimum flows from Santee dam to 5,000 cfs or 2,300 cfs (Feb-Apr) and 2,300 cfs for the remainder of the year.	NMFS	\$0	\$3,344,300	\$3,344,300 ^f	No
14	Consider increase to minimum release of 2,600 cfs from Santee dam to maintain above the record low flow in the Santee River	Forest Service	\$0	\$3,286,000	\$3,286,000 ^g	No
15	Increase continuous minimum flows at Santee dam to 2,400 (February – April) and 1,200 (May – January)	SCPSA, FWS, SCDNR	\$0	\$1,579,400	\$1,579,400 ^h	Yes
16	Provide one annual flushing release of 40,000 cfs from Santee dam to accommodate sediment transport ⁱ	Forest Service	\$0	\$0	\$0	No
17	Develop a drought contingency plan for the operation of the project during low inflows and/or drought ^j	SCPSA, SCDNR, American Rivers/CCL, FWS, NMFS	\$100,000	\$10,000	\$18,700	Yes

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
18	Develop an adaptive management program to assess the effectiveness of flow alternatives in providing aquatic habitat and navigation ^k	American Rivers/CCL, NMFS	\$500,000	\$0	\$43,600	Yes
18(a)	Develop a Jefferies station instream flow operations plan	NMFS	Included in Item 17	Included in Item 17	Included in Item 17	Yes, assumed to be part of overall project operations plan under the adaptive management program
18(b)	Develop a St. Stephen operations and fish passage plan	NMFS	N/A	N/A	N/A	No
18(c)	Form a Technical Advisory Committee for Instream Flows	SCPSA, FWS, SCDNR, NMFS	\$0	\$0	\$0 ^l	Yes
19	Increased locking operations for fish passage at Pinopolis lock - a minimum of 6 per day, when water conditions permit ^m	SCPSA	\$0	\$29,150	\$29,150	Yes

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
20	Construct fish passage and protection measures, including pre-design studies, facility design, operations plans and post- construction effectiveness testing and evaluation modification plans. ⁿ The following provides estimated costs for the major fish facilities that are included within the total capital cost shown.	SCPSA, SCDNR, FWS, NMFS, American Rivers/CCL	\$47,575,000	\$370,000	\$4,532,210	Yes
20(a)	Install new fish counting technology at Pinopolis lock and conduct effectiveness testing	SCPSA, SCDNR, FWS, NMFS	\$300,000	\$0	\$26,150	Yes
20(b)	Construct upstream fish lift/elevator at Jefferies powerhouse for alosids and sturgeon, if passage at Pinopolis lock is determined inadequate	SCPSA, SCDNR, FWS, NMFS	\$10,000,000	\$60,000	\$931,710	Yes, pending Pinopolis lock effectiveness study
20(c)	Construct upstream eel ladders at Jefferies	SCPSA, SCDNR, FWS, NMFS	\$375,000	Included in Item 20b	\$32,700	Yes
20(d)	Conduct alosid and sturgeon population study in lower Santee River, and provide capture and transport above Santee dam (capture and transport prescribed by FWS only)	SCPSA, SCDNR, FWS, NMFS	\$560,000	\$50,000	\$98,820	Yes

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
20(e)	Construct upstream fish lift/elevator at Santee dam for alosids and sturgeon (cost includes both fish lift facility and trap and sort facility)	SCPSA, SCDNR, FWS, NMFS	\$15,000,000	\$100,000	\$1,407,570	Yes
20(f)	Construct upstream eel ladders at Santee dam	SCPSA, SCDNR, FWS, NMFS	\$375,000	Included in Item 20e	\$32,700	Yes
20(g)	Conduct monitoring studies for downstream passage at Santee dam and Pinopolis lock and dam	SCPSA, SCDNR, FWS	\$1,550,000	\$0	\$135,120	Yes
20(h)	Install downstream passage and protection measures, as determined site specifically appropriate from monitoring studies, at Santee and Jefferies stations and Pinopolis lock	SCPSA, SCDNR, FWS, NMFS (no studies)	\$16,125,000	Included in Items 20b & 20e	\$1,405,640	Yes, pending monitoring studies
20(i)	Conduct effectiveness testing of upstream and downstream fish passage measures at Santee and Jefferies stations	SCPSA, SCDNR, FWS, NMFS	\$1,150,000	\$0	\$100,250	Yes
20(j)	Develop fish passage implementation plan (including design, construction, operation and maintenance plan)	SCPSA, FWS, SCDNR, NMFS	\$225,000	\$0	\$34,610	Yes

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
20(k)	Develop and implement a shortnose sturgeon enhancement plan	SCPSA, FWS, SCDNR, NMFS	\$15,000	Included in Item 20e	\$1,310	Yes, in consultation with NMFS to address goals of restoration plan
20(l)	Provide attraction flow at Pinopolis lock (NMFS prescribed 600-cfs flow) and develop assessment of timing and number of locking events, and sequence of turbine operations needed for passage	SCPSA, FWS, SCDNR, NMFS	\$1,900,000	\$160,000	\$325,630	Yes
21	Formalize the use of manatee exclusion devices at Pinopolis lock modify lock operations, and develop a protection plan	SCPSA	\$25,000	\$0	\$2,200	Yes
22	Manage aquatic nuisance and invasive plants adjacent to or encroaching the Santee NWR ^{o, p}	SCPSA, SCDNR, FWS	-	-	-	Yes
22(a)	Maintain Santee NWR pumping stations	SCPSA, SCDNR, FWS	-	-	-	Yes
22(b)	Remove vegetation from canals and dikes on the Cuddo Unit	SCPSA, SCDNR, FWS	-	-	-	Yes

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
22(c)	Implement erosion control measures at the Santee NWR	SCPSA, SCDNR, FWS	-	-	-	Yes
22(d)	Place large woody debris in deep water portions of the Santee NWR	SCPSA, SCDNR, FWS	-	-	-	Yes
22(e)	Support irrigation options on the Bluff and Cuddo units	SCPSA, SCDNR, FWS	-	-	-	No
22(f)	Reduce the stand density on the Pine Island Unit	SCPSA, SCDNR, FWS	-	-	-	Yes
22(g)	Assist in the expansion of an elevated observation structure on Wrights Bluff	SCPSA, SCDNR, FWS	-	-	-	No
23	Develop and implement an RTE species management plans for those wildlife species on project lands or affected by project operations, including a red-cockaded woodpecker management plan for Persanti Island ^p	SCDNR, FWS	\$25,000	\$10,000	\$12,600	Yes
24	Develop a recreation plan and update every 6 years for the life of the license ^q	SCDNR	\$25,000	\$5,000	\$7,180	Yes

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
25	Provide recreational enhancements of an additional classroom at Old Santee Park and picnic shelters and paved parking at Overton Park	SCPSA	\$100,000	\$5,000	\$13,717	Yes
26	Install mooring piers at several locations, upgrade several existing boat landings for deep water access, and construct a two-lane boat launch at Richard Landing at White Point	SCPSA	\$375,000	\$8,000	\$40,700	Yes
27	Provide improved bank fishing access and parking an additional boat navigation channel across Lake Marion, and enhanced channel markers. ^r	SCPSA, SCDNR	\$125,000	\$5,000	\$15,900	Yes, with the exception of unspecified navigation channel
28	Mark and snag a new navigation channel in Jack's Creek	SCPSA, SCDNR, FWS	Included in Item 27	Included in Item 27	-	Yes
29	Revise the existing SMP incorporating existing CLMP programs and update the plan every 10 years for the life of the license	SCDNR, SCPSA	\$30,000	\$110,000	\$112,600	Yes (we recommend updating the existing CLMP to incorporate elements of our SMP, including a provision for updates every 10 years)

	Measures	Entity	Capital Cost (\$)	Annual Cost (\$)	Total Annualized Cost (\$)	Adopted by Staff
30	Implement a PA that would be incorporated by reference into the project license and prepare an HPMP to guide SCPSA's management of the project's historic properties during the term of the license.	SCPSA	\$20,000	Included in Item 29	\$1,700	Yes

- ^a Assumes 5 years of data collection and reporting at \$50,000 per year at 15 locations, as were analyzed by SCPSA during relicensing to characterize water quality conditions at the project.
- ^b Assumes an effort equivalent to that identified for the SCDNR recommended water quality enhancement and monitoring plan.
- ^c Assumes no cost to SCPSA because flows could not be otherwise used for generation at Santee or Jefferies stations.
- ^d Recommendations for the timing of releases were variable between recommending entities. The timeframe included represents that proposed by SCPSA and recommended by staff.
- ^e This value represents a loss of 58,900 MWh at a power value of \$53/MWh at St. Stephen for this minimum flow alternative.
- ^f This value represents a loss of 400 MWh at Jefferies and 62,700 MWh at St. Stephen at a power value of \$53/MWh.
- ^g This value represents a loss of 2,500 MWh at Jefferies and 59,500 MWh at St. Stephen at a power value of \$53/MWh.
- ^h This value represents a loss of 2,600 MWh at Jefferies and 27,200 MWh at St. Stephen at a power value of \$53/MWh.
- ⁱ Flushing flows at the level suggested by the Forest Service occur naturally during flood conditions and are passed by the project, therefore, we do not consider this measure to result in additional costs, if implemented.
- ^j Capital cost assumes \$125,000 to develop a formal water use model and plan and \$25,000 of agency consultation through a series of meetings and negotiations. Annual cost assumes annual coordination efforts to forecast water availability, corresponding use of allocation information, and distribution/consultation with agencies and the public.

- ^k Assumes \$50,000 year for 10 years to monitor aquatic habitat conditions in the Santee bypass including periodic DO measurement and quantification of fish and wildlife habitat and population observations. Assumes only monitoring portion of the adaptive management program would be implemented. Study of effects of alternative flow regime on DO and temperature proposed by adaptive management program is addressed under measure 9.
- ^l Assumes costs associated with this measure would fall under other related activities including the adaptive management program and drought contingency plan.
- ^m Cost assumes lost generation potential of 550 MWh associated with use of approximately 8,900 acre-feet of water from February through April, and a power value of \$53/MWh.
- ⁿ Our estimated costs include measures prescribed by FWS and proposed in the FSA. For the purposes of evaluating project net benefits, we used costs comparable to those identified in appendix E of SCPSA's June 7, 2006, filing for trial type hearing, and considered costs for Santee dam fish passage identified by FWS at the Section 10(j) meeting, and costs provided by SCPSA in its comments on the draft EIS.
- ^o Assumes limited effort to formalize a plan around existing nuisance plant control efforts, and an annual cost to conduct an annual survey of existing information.
- ^p The FSA identifies a number of provisions for enhancements associated with the Santee NWR. The FSA states that SCPSA has already performed many of these enhancements without an indication of which have been completed. Because neither this information, nor any indication of cost has been provided, costs for these measures have not been included in our analysis.
- ^q Assumes limited effort to develop the plan due to availability of existing information. Primary effort needed would be to identify triggers for the timing and potential locations of future facilities.
- ^r Capital cost includes construction of five fishing access and parking area locations at \$15,000 each, and \$50,000 to install 40 solar powered marker buoys.

4.2 COST OF ENVIRONMENTAL MEASURES AND ECONOMIC COMPARISON OF ALTERNATIVES

Table 20 presents a summary of the current annual net benefits for no action, the proposed action, the final settlement, and staff's recommended alternative.

Table 20. Summary of annual net benefits of the alternatives for the Santee Cooper Project. (Source: Staff)

Parameter	No-Action Alternative	Proposed Action	FSA Alternative	Staff Alternative
Annual generation (MWh)	224,027	223,477	220,847	220,847
Installed capacity (MW)	134.5	134.5	134.5	134.5
Annual power value (\$)	\$11,873,000	\$11,844,000	\$11,705,000	\$11,705,000
Mills/kWh	53.00	53.00	53.00	53.00
Annual cost (\$)	\$5,423,000	\$5,623,000	\$10,175,000	\$10,262,000
Mills/kWh	24.21	25.16	46.07	46.47
Annual net benefit (\$)	\$6,450,000	\$6,221,000	\$1,530,000	\$1,443,000
Mills/kWh	28.79	27.84	6.93	6.54

This page intentionally left blank.