

ADAPTIVE MANAGEMENT PLAN

MINIMUM FLOWS DOWNSTREAM OF PARR SHOALS DAM

SOUTH CAROLINA ELECTRIC & GAS COMPANY

FERC No. 1894

Prepared by:

South Carolina Electric & Gas Company

September 2017

**ADAPTIVE MANAGEMENT PLAN
FOR THE
MINIMUM FLOWS DOWNSTREAM OF PARR SHOALS DAM**

TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	PROJECT DESCRIPTION.....	2
2.0	MINIMUM FLOW AMP REVIEW COMMITTEE	2
2.1	COMMITTEE MEMBERS	2
2.2	BUDGET/RESOURCES	3
2.3	COMMITTEE MEETINGS.....	3
3.0	GOALS AND OBJECTIVES.....	3
4.0	INSTREAM FLOW STUDIES	4
4.1	IFIM STUDY AND IFTWC DISCUSSIONS.....	4
4.2	DOWNSTREAM NAVIGATIONAL FLOW ASSESSMENT.....	6
5.0	MINIMUM FLOW RECOMMENDATION.....	9
5.1	TARGET FLOW	9
5.2	COMPLIANCE LIMIT	9
5.3	CALCULATION OF NET INFLOW AND TARGET FLOWS	10
5.4	MINIMUM FLOW RECOMMENDATION.....	10
6.0	SCHEDULE.....	11
7.0	COMPLIANCE.....	12
8.0	REFERENCES	13

LIST OF FIGURES

FIGURE 4-1	IFIM STUDY AREA	5
FIGURE 4-2	POINTS OF NAVIGATIONAL CONSTRICTION	7
FIGURE 4-3	LEDGE 1	7
FIGURE 4-4	LEDGE 2.....	8

LIST OF TABLES

TABLE 5-1	PARR MINIMUM FLOW RECOMMENDATION	11
TABLE 6-1	AMP IMPLEMENTATION SCHEDULE.....	11

LIST OF APPENDICES

APPENDIX A	SUMMARY OF CONSULTATION
APPENDIX B	EVAPORATION METHODOLOGY

DEFINITIONS OF TERMS, ACRONYMS, AND ABBREVIATIONS

AMP	Adaptive Management Plan
AR	American Rivers
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
Compliance Limit	The instantaneous minimum flow required by FERC to be released from the Project.
CRK	Congaree Riverkeeper
CRSA	Comprehensive Relicensing Settlement Agreement
DLA	Draft License Application
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
ft	foot
IFIM	Instream Flow Incremental Methodology
IFTWC	Instream Flow Technical Working Committee
installed capacity	the nameplate megawatt rating of a generator or group of generators
interested parties	individuals and entities that have an interest in a proceeding
kW	Kilowatt
kWh	kilowatt-hour
Licensee	South Carolina Electric & Gas Company
Licensing/Relicensing	the process of acquiring an original FERC license for a new proposed hydropower project; or, the process of acquiring a new FERC license for an existing hydropower project after the previous license has expired.
Low inflow protocol	An agreement between a licensee and stakeholders that provides instructions to the licensee on how to manage flows during low inflow periods.
Minimum Flow	A continuous flow, measured in CFS that is required to be released from the Project dam during specified periods of time.
Msl	mean sea level
MW	megawatt
MWh	megawatt-hour
Net inflow	The previous day's daily average inflow as calculated using the sum of the three upstream USGS gages (USGS 02156500, Broad River near Carlisle, SC; USGS 02160105, Tyger River near Delta, SC; and USGS 02160700, Enoree River at Whitmire, SC) minus evaporation from the reservoirs.
NGO	non-governmental organization

NMFS	National Marine Fisheries Services, also known as NOAA Fisheries
NOAA	National Oceanic and Atmospheric Administration, including NMFS
normal operating capacity	The maximum MW output of a generator or group of generators under normal maximum head and flow conditions
PM&E	protection, mitigation and enhancement measures
Project	Parr Hydroelectric Project (FERC No. 1894)
Project Area	Zone of potential, reasonably direct project effects within the FERC Project Boundary.
Project Boundary	The boundary line defined in the license issued by FERC that surrounds areas needed for Project purposes.
Review Committee	A group, including SCE&G and stakeholders, formed to direct the implementation of the Minimum Flow AMP. Members of the Review Committee must be signatories to the Comprehensive Relicensing Settlement Agreement.
RTWC	Recreation Technical Working Committee
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company
SHPO	State Historic Preservation Officer
Tailrace	Channel through which water is discharged from the turbines
Target Flow	The instantaneous minimum flow recommended by the IFTWC to be released from the Project.
TLP	Traditional Licensing Process
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service, an agency of the DOI
USGS	U.S. Geological Survey
WQC	Water Quality Certification, issued under Section 401 of the Federal Clean Water Act
WUA	Weighted Usable Area

**ADAPTIVE MANAGEMENT PLAN
FOR THE
MINIMUM FLOWS DOWNSTREAM OF PARR SHOALS DAM**

1.0 INTRODUCTION

South Carolina Electric & Gas Company (SCE&G) must file an application for a new license for its Parr Hydroelectric Project (Project) (FERC No. 1894) (Project) with the Federal Energy Regulatory Commission (FERC) by June 2018. The relicensing process is a multi-year cooperative effort between SCE&G and stakeholders, including state and federal resource agencies, non-governmental organizations and concerned citizens, to address operational, recreational and ecological concerns associated with Project operations. During the relicensing process, the potential impact of Project operation minimum flows on fishery resources, aquatic habitat, and fish/navigation passage was identified as an issue to address.

SCE&G formed the Instream Flow Technical Working Committee (IFTWC) and the Recreation Technical Working Committee (RTWC) to develop an Instream Flow Incremental Methodology (IFIM) Study and a Downstream Navigational Flow Assessment, respectively, to address the minimum flow issue. The IFTWC includes representatives from SCE&G, South Carolina Department of Natural Resources (SCDNR), South Carolina Department of Health and Environmental Control (SCDHEC), U.S. Fish and Wildlife Service (USFWS), National Ocean and Atmospheric Administration (NOAA), American Rivers, and Congaree Riverkeeper. The RTWC includes representatives from SCE&G, SCDNR, SCDHEC, NOAA, American Rivers, Congaree Riverkeeper, and other interested individuals.

During the TWC meetings, a framework for a Minimum Flow Adaptive Management Plan (AMP) was developed to address minimum flows to be released downstream of the Project during the new license term. This AMP describes the minimum flow issue and SCE&G's proposed actions to maintain minimum flows that will support fishery resources, aquatic habitat, and navigation passage downstream of the Project. These actions will be implemented during the new Project license.

1.1 PROJECT DESCRIPTION

The Project includes the 14.88-megawatt (MW) Parr Shoals Development (Parr Development) and the 511.2-MW Fairfield Pumped Storage Development (Fairfield Development) located in Fairfield and Newberry counties, South Carolina. Parr Reservoir is a 4,400-acre impoundment formed by the Parr Shoals Dam on the Broad River and serves as the lower reservoir for the Fairfield Development. Monticello Reservoir is a 6,800-acre impoundment formed by a series of four earthen dams and serves as the upper reservoir for the Fairfield Development. The existing Project license was issued by FERC on August 28, 1974 for a period of 46 years, terminating on June 30, 2020. SCE&G intends to file for a new license with FERC on or before May 31, 2018.

2.0 MINIMUM FLOW AMP REVIEW COMMITTEE

2.1 COMMITTEE MEMBERS

A Review Committee will be formed to direct the implementation of the AMP. Members of the Review Committee must be signatories to the Comprehensive Relicensing Settlement Agreement (CRSA) with the exception of NOAA Fisheries, USFWS, US Forest Service, South Carolina State Historic Preservation Office, SCDHEC and SCDNR.

SCE&G will serve as chairperson of the Review Committee, and be responsible for organizing meetings and distributing documents to committee members. Each entity will have the opportunity to select a representative to the Review Committee from within their organization.

The Review Committee will ultimately work to guide the decision making processes specified in the Minimum Flow AMP. The Review Committee will not make decisions that supersede state or federal law. The Review Committee's responsibilities may include, but are not limited to:

- Providing overall guidance for the AMP process;
- Evaluating other study (i.e., existing) information or information which becomes available during the time period of evaluations and would be applicable to the AMP;
- Reviewing and considering long term impacts of operational modifications on the Project and Project economics when evaluating the feasibility of implementing modifications;

- Reviewing the Minimum Flow Annual Report which documents the prior year's AMP activities which SCE&G will file with FERC, making it publicly available; and
- Advising on modifications to the AMP to be presented to FERC and advising if any amendment action is necessary during the license.

2.2 BUDGET/RESOURCES

The responsibility for implementing this AMP will rest primarily with SCE&G, as licensee for the Project. SCE&G will also rely on other resources outside of its establishment including, but not limited to, the following:

- federal, state and local grants
- donated services (federal and state agency involvement)
- equipment (purchases and loaners)
- expertise (governmental, non-governmental, private)

2.3 COMMITTEE MEETINGS

The Review Committee is tentatively scheduled to consult once per year via an in-person meeting or conference call. The frequency of meetings may be adjusted based on need. The tentative schedule is provided in Section 6.0 of this plan. Minutes from each meeting, as well as any pertinent materials discussed in the meetings will be filed with FERC as an appendix to the annual report of AMP activities, as described in Section 7.0.

3.0 GOALS AND OBJECTIVES

The overall goal of this AMP is to provide a minimum flow from the Project that considers fishery resources, aquatic habitat, and fish/navigation passage needs. This AMP provides the guidance for releasing minimum flows from the Project that consider these downstream resources. The methods that will be employed under this AMP to achieve this goal and objective are described in Section 5.0.

4.0 INSTREAM FLOW STUDIES

4.1 IFIM STUDY AND IFTWC DISCUSSIONS

SCE&G conducted an IFIM study during 2014-2016 in the Broad River from the Parr Shoals Dam to the downstream end of the Bookman Island complex (Figure 4-1) (Kleinschmidt 2016b). The IFIM study results provided quantitative estimates of habitat area at selected discharges, based on site-specific measurements of stream morphology, cover, substrate, depth, velocity and discharge gathered at transects within predetermined river reaches. These physical measurements were rated for habitat suitability based on habitat use data developed for eleven key aquatic species (and various life stages) and quantified as Weighted Usable Areas (WUA) over a range of flow releases from Parr Shoals Dam (Kleinschmidt 2016b and Meeting Notes Appendix A).

The IFTWC had multiple meetings from September 2016 through July 2017 to discuss the results of the IFIM study and to develop a recommendation for a minimum flow at the Project (Meeting Notes - Appendix A). The IFTWC conducted a float trip in October 2017 to observe target minimum flow(s) at select study sites. During the field observations, the IFTWC concurred with the minimum flow recommendations for the Project.

The IFTWC established three minimum flow periods and a series of minimum flow targets for each period (Section 5.0). The recommendation includes a “Target Flow” and a “Compliance Limit”. Because the Project is not a storage project and outflows should be related to inflow to the Project, the Target Flow is a minimum flow based on habitat data from the IFIM study results and the Compliance Limit is based on inflow exceedance values and the need for an operation margin. Target Flow and Compliance Limit will be evaluated as part of this AMP, which is anticipated to last for the first 5 years of the new license. The Review Committee will evaluate annually how well SCE&G met the Target Flow and the Compliance Limit in relation to inflows to the Project. It is SCE&G’s goal to improve the instream habitat downstream of Parr Shoals Dam and minimize the number of non-compliance events during the license. The IFTWC also agreed to an “operation margin” that would allow operations during low flow periods to be conducted without the need for a complicated low inflow protocol.

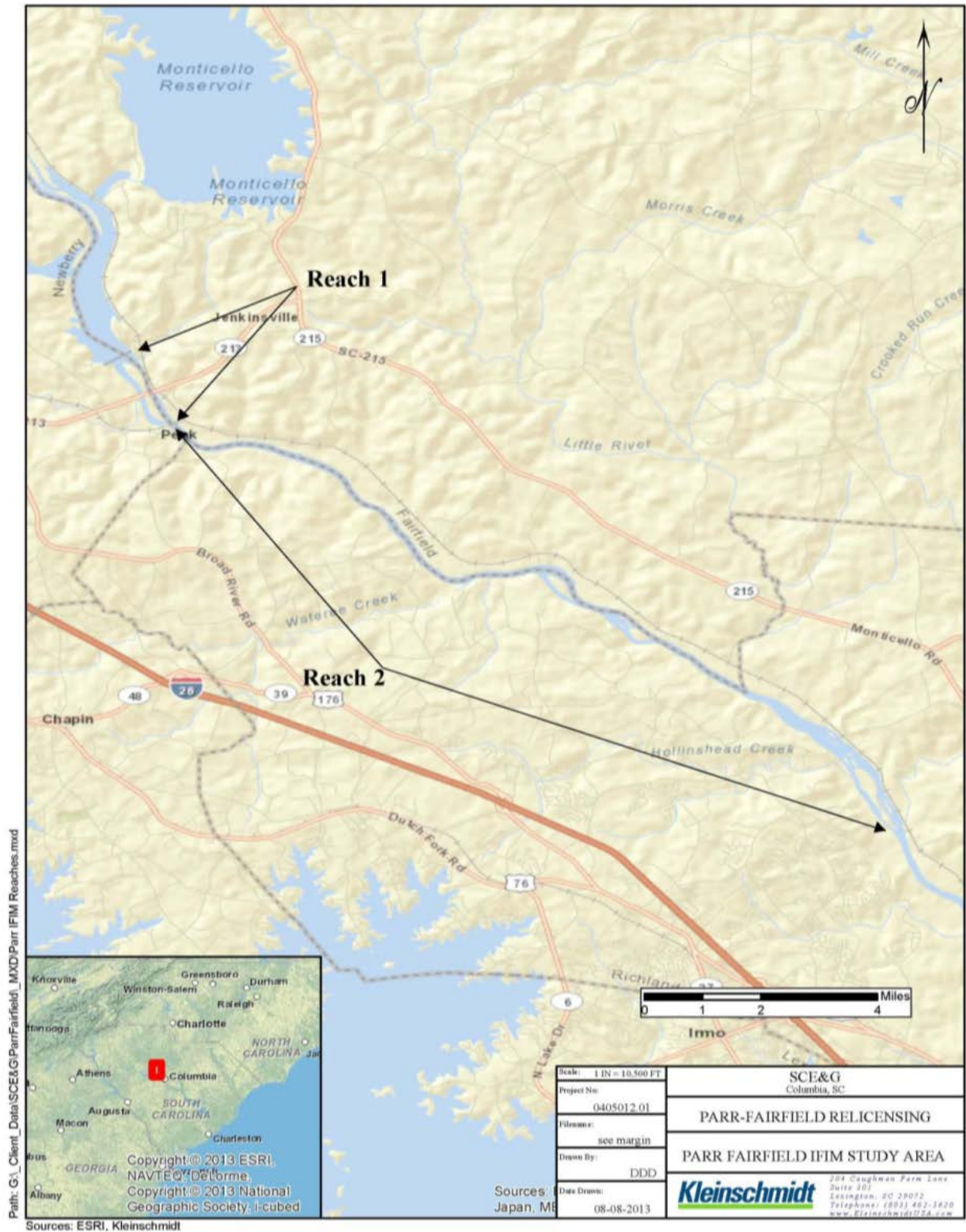


FIGURE 4-1 IFIM STUDY AREA

4.2 DOWNSTREAM NAVIGATIONAL FLOW ASSESSMENT

The Downstream Navigational Flow Assessment was conducted to ensure that the minimum flow recommendation developed during relicensing would consider the flow needed for one-way navigation in the Broad River. The recommendation for one-way navigation is defined as a "minimum depth of one foot across a channel 10 feet wide or across 10 percent of the total stream width, whichever is greater. Minimum depth does not need to occur across a continuous 10 percent of the stream width, but each point of passage must be at least 10 feet wide." One-way navigation recommendations are based on the passage of a 14 foot Jon-boat without a motor in the downstream direction only (SCWRC, 1988).

The navigational analyses evaluated constrictions on the Broad River downstream of the Parr Dam at two areas identified by the Recreation TWC. These areas were identified as "Ledge 1" and "Ledge 2" (Figure 4-2). Ledge 1 (Figure 4-3) consists of a bedrock ledge located approximately 2.4 miles upstream of Haltiwanger Island. Ledge 2 (Figure 4-4) consists of a bedrock ledge located 1.3 miles upstream of Hickory Island and approximately 0.5 miles downstream of the mouth of Little River.

Results of the assessment indicated that a flow of 500 cfs meets the passage recommendation at Ledge 1 with approximately 205 ft of cross-sectional passage provided collectively by two notches. A flow of 1,000 cfs meets the passage recommendation at Ledge 2. The navigation report noted that flows of 700 cfs provide the '1-foot' passage criteria through a notch at Ledge 2 that is 66 ft wide. Although this flow does not meet the exact navigation recommendation of providing navigation across 10 percent of the total stream width, it does provide a passage point that should be sufficient for one-way passage of a 14 ft Jon-boat, canoes, and kayaks. These results were considered along with the results of the IFIM Study in developing a minimum flow recommendation for the new license.

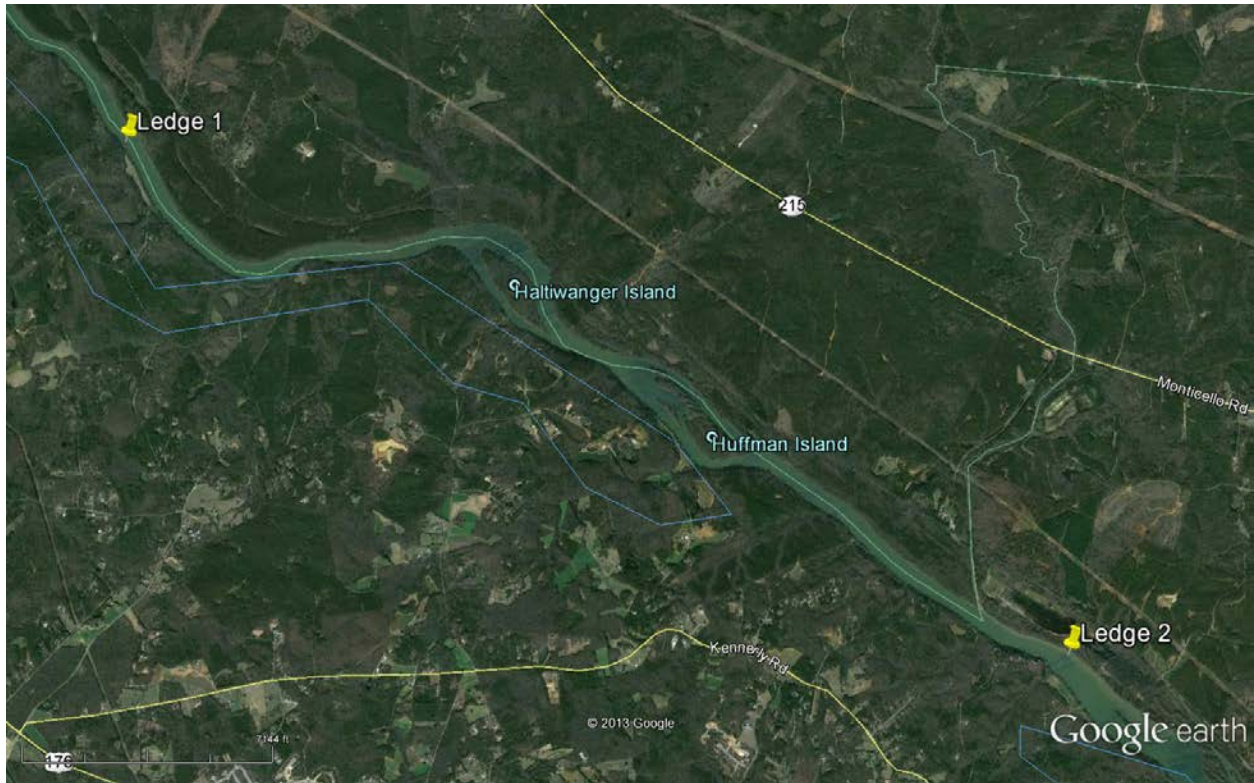


FIGURE 4-2 POINTS OF NAVIGATIONAL CONSTRICTION



FIGURE 4-3 LEDGE 1



FIGURE 4-4 LEDGE 2

5.0 MINIMUM FLOW RECOMMENDATION

The IFTWC identified several measures to implement and monitor the recommended minimum flow regime in the new operating license through the AMP. These measures are described in detail in the sections below. The timing and magnitude of the IFTWC's recommended "continuous" flows are as follows.

5.1 TARGET FLOW

A Target Flow is defined as the instantaneous minimum flow recommended by the IFTWC to be released from the Project. The Target Flow value will vary seasonally and will have "operation margin" based on inflow. During this AMP, the Review Committee will evaluate the annual flow record at the Alston gage for meeting the Target Flow.

5.2 COMPLIANCE LIMIT

A Compliance Limit is defined as the instantaneous minimum flow required by FERC to be released from the Project. The Compliance Limit value will vary based on net inflow, but will generally be 100 to 200 cfs lower than the Target Flow. For compliance purposes, "operation margin" will allow SCE&G to discharge less than the Target Flow for up to six hours per day (with a maximum of three consecutive hours) so that flows are between the target and compliance flow without triggering a non-compliance event. This variance will be used to adjust the balance of storage between the reservoirs, and to allow for variation in flow due to equipment or human factors. When net inflow falls to 600 cfs or less, the Compliance Limit flow would be computed as net inflow minus a 50 cfs buffer. If flow releases drop below the Compliance Limit, or if flows drop below the Target Flow for longer than 6 hours a day and/or longer than 3 consecutive hours, SCE&G will notify the Review Committee within ten days and will include the deviation and reason for that deviation in the annual report to FERC.

A goal of the AMP is to reduce the number of hours per day and the number of consecutive hours of flows between the target and compliance flow values, to the extent that a reduction is shown to be possible based on operational experience during the term of the AMP.

5.3 CALCULATION OF NET INFLOW AND TARGET FLOWS

Net inflow is defined as the previous day's daily average inflow as calculated using the sum of the three upstream USGS gages¹ minus evaporation from the reservoirs. Evaporation for the Parr and Monticello reservoirs is based on standard accepted evaporation methodology. Monthly evaporation values for each reservoir, calculation of those values, and citations for the methodology used are provided in Appendix B.

The previous day's daily average inflow would be based on midnight to midnight of the previous day, and the new Target Flow would be implemented from noon of the current day to noon of the next day. When the previous day's net inflow is below the prescribed Target Flow but above the Compliance Limit, the new target flow would be computed as the net inflow. The Compliance Limit would fluctuate based on how low the net inflow is below the prescribed Target Flow as shown in Section 5.4 below.

When net inflow falls to 600 cfs or less, the new Compliance Limit flow would be computed as net inflow minus a 50 cfs buffer. This step will allow an operation margin for SCE&G to recover up to 50 cfs for up to six hours during each day (with a maximum of three consecutive hours) during low flow periods. This provision will take the place of a low inflow protocol for the project.

5.4 MINIMUM FLOW RECOMMENDATION

Table 5-1 describes the specifics of a Minimum Flow Recommendation for the Project. This recommendation identifies Target Flows and Compliance Limits in relation to net inflows into the Project.

¹ (USGS 02156500, Broad River near Carlisle, SC; USGS 02160105, Tyger River near Delta, SC; and USGS 02160700, Enoree River at Whitmire, SC)

TABLE 5-1 PARR MINIMUM FLOW RECOMMENDATION

	Net Inflow (cfs)	Minimum Target Outflow (cfs)	Compliance Outflow (cfs)
High Flow Period Feb 1 – April 30	> 2300	2300	2100
	≤ 2300 and > 2200	net inflow	2100
	≤ 2200 and ≥ 600	net inflow	(net inflow minus 100 cfs) or 550 cfs whichever is greater
	< 600	net inflow	net inflow minus 50 cfs
Transitional Flow Periods Dec 1 – Jan 31; May 1 – May 31	>1500	1500	1300
	≤ 1500 and > 1400	net inflow	1300
	≤ 1400 and ≥ 600	net inflow	(net inflow minus 100 cfs) or 550 cfs whichever is greater
	< 600	net inflow	net inflow minus 50 cfs
Low Flow Period June 1 – Nov 30	> 1000	1000	900
	≤ 1000 and ≥ 600	net inflow	(net inflow minus 100 cfs) or 550 cfs whichever is greater
	< 600	net inflow	net inflow minus 50 cfs

6.0 SCHEDULE

The AMP schedule is described in the table below in relation to the issuance of the license by FERC.

TABLE 6-1 AMP IMPLEMENTATION SCHEDULE

Period	Item
Within 90 days of license issuance	Submit Final Minimum Flow AMP to FERC
120 days of license issuance	Form Review Committee and review Minimum Flow AMP
Year 1 of new license	<ul style="list-style-type: none"> • Implementation of Minimum Flow • Review Committee annual meeting February of following year • File Annual Report with FERC – April 30th after Review Committee meeting
Year 2 of new license	<ul style="list-style-type: none"> • Implementation of any AMP-Minimum Flow changes • Review Committee annual meeting February of following year • File Annual Report with FERC – April 30th after Review Committee meeting

Year 3 of new license	<ul style="list-style-type: none"> • Implementation of any AMP-Minimum Flow changes • Review Committee annual meeting February of following year • File Annual Report with FERC – April 30th after Review Committee meeting
Year 4 of new license	<ul style="list-style-type: none"> • Implementation of any AMP-Minimum Flow changes • Review Committee annual meeting February of following year • File Annual Report with FERC – April 30th after Review Committee meeting
Year 5 of new license	<ul style="list-style-type: none"> • Implementation of any AMP-Minimum Flow changes • Review Committee annual meeting February of following year • Develop recommendation for completion or continuation of AMP • File Annual Report and Final AMP Recommendations with FERC – April 30th after Review Committee meeting

7.0 COMPLIANCE

Compliance will be based on following the schedule in Section 6.0 and the submission of an annual AMP report to FERC. The annual report will contain a summary of all AMP activities and data, including an assessment of the extent to which goals and objectives were achieved. The report will be made available to appropriate entities for review and comment at least 30 days prior to being submitted to FERC. All comments on the report, pertinent correspondence, and Review Committee meeting minutes will be appended to the annual report.

At the end of the 5-year AMP period, the Review Committee will provide final recommendations to FERC on extension or completion of the AMP.

8.0 REFERENCES

Kleinschmidt Associates. 2016a. Downstream Navigational Flow Assessment. September 2016.

Kleinschmidt Associates. 2016b. Instream Flow Study Report. October 2016.

South Carolina Water Resources Commission (SCWRC). 1988. Instream Flow Study Phase II: Determination of Minimum Flow Standards to Protect Instream Uses in Priority Stream Segments: A Report to the South Carolina General Assembly. Available Online [URL]: <http://scwaterlaw.sc.gov/Instream%20Flow%20Study%20ph2.pdf>. Accessed August 2013.

APPENDIX A

SUMMARY OF CONSULTATION

Appendix A

The Instream Flow TWC, a sub-section of the Water Quality, Fish and Wildlife RCG, convened often throughout the relicensing process to discuss the development of the Minimum Flows AMP. A list of meeting dates pertinent to the development of this AMP is included below. The complete consultation record for the development of this AMP, including notes from the meetings listed below, can be found in Appendix A of the Final License Application's Exhibit E.

- Instream Flow TWC Meeting – March 5, 2014
- Instream Flow TWC Meeting – September 27, 2016
- Instream Flow TWC Meeting – January 24, 2017
- Joint¹ RCG Meeting – March 28, 2017
- Joint RCG Meeting – July 13, 2017

¹ A Joint RCG Meeting refers to a meeting where all RCGs are present, including the Water Quality, Fish and Wildlife RCG, the Lake and Land Management and Recreation RCG, and the Operations RCG.

APPENDIX B

EVAPORATION METHODOLOGY

Estimated Evaporation from Parr and Monticello Reservoirs

Evaporation, Central SC			Reservoir Evaporation Loss Estimates in CFS					
	Avg. Monthly FWS Evap. (in).	Evap. Rate (CFS/1000 ac.)	Monticello Evap. Rate (CFS)	VCS Increased Evap. Rate (CFS)	Parr Evap. Rate, (CFS)	Total Evap. Rate Incl. VCS (CFS)	Total Evap. Rate Not Incl. VCS (CFS)	Total Evaporation (ac-ft)
January	1.29	1.75	12	20	8	40	20	2,462
February	1.82	2.74	19	21	12	51	31	2,845
March	3.19	4.33	29	21	19	70	48	4,282
April	4.50	6.31	43	23	28	93	71	5,553
May	5.24	7.10	48	24	31	103	79	6,356
June	5.53	7.75	53	25	34	112	87	6,656
July	5.77	7.82	53	26	34	113	88	6,953
August	5.00	6.78	46	25	30	101	76	6,231
September	4.03	5.64	38	24	25	88	63	5,207
October	3.08	4.18	28	23	18	70	47	4,276
November	2.00	2.80	19	21	12	53	31	3,127
December	1.37	1.85	13	20	8	41	21	2,523
Whole Year	42.8	4.92	33	23	22	78	55	56,473
May-October	28.7	6.54	45	24	29	98	73	35,680
	(Sum)	(Average)	(Average)	(Average)	(Average)	(Average)	(Average)	(Sum)

Source: Pan Evaporation Records for the South Carolina Area, John C. Purvis, South Carolina State Climatology Office

FWS values were computed as 75 percent of pan evaporation values.

This factor was estimated from a discussion in NOAA Technical Report NWS 33, Evaporation Atlas for the 48 Contiguous States.

Reservoir evaporation loss estimates are based on surface areas of 6,800 acres for Monticello and 4,400 acres for Parr.

The conversion from evaporation in inches to evaporation rate in CFS per thousand acres is:

(inches) x (1 ft/12 in) x (1 month/31 [or 30 or 28] days) x (43,560 SF/acre) x (1 day/86,400 sec) x (1,000 acres/thousand acres)

Increased evaporation from V.C. Summer Station is estimated using information provided by VCS, and is based on average ambient temperature for each month.