

ADAPTIVE MANAGEMENT PLAN

**ENHANCEMENTS TO THE WEST CHANNEL
DOWNSTREAM OF PARR SHOALS DAM**

SOUTH CAROLINA ELECTRIC & GAS COMPANY

FERC No. 1894

Prepared by:

South Carolina Electric & Gas Company

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DEFINITIONS OF TERMS, ACRONYMS, AND ABBREVIATIONS

Af	acre-foot, the amount of water needed to cover one acre to a depth of one foot
AMP	Adaptive Management Plan
AR	American Rivers
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CRK	Congaree Riverkeeper
CRSA	Comprehensive Relicensing Settlement Agreement
DLA	Draft License Application
DO	dissolved oxygen, generally expressed in units of parts per million or milligrams per liter (mg/L)
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
ft	foot
GPS	Global Positioning System
IFIM	Instream Flow Incremental Methodology
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.
mg/L	Milligrams per liter
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
NGO	non-governmental organization
NMFS	National Marine Fisheries Services, also known as NOAA Fisheries
NOAA	National Oceanic and Atmospheric Administration, including NMFS
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 West Channel AMP. Members of the Review Committee must be signatories to the Comprehensive Relicensing Settlement Agreement.
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
TLP	Traditional Licensing Process
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WQTC	Water Quality Technical Working Committee

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1.0 INTRODUCTION

South Carolina Electric & Gas Company (SCE&G) will file an application for a new license for its Parr and Fairfield developments on the Broad River with the Federal Energy Regulatory Commission (FERC) in June 2018. The relicensing process was 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 hydroelectric project operations. During the relicensing process the issue of water quality in the West Channel of Broad River downstream of the Parr Shoals Dam was identified by the Water Quality Technical Working Committee (WQTWC) as an issue to resolve. Members of the WQTWC included 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), American Rivers and Congaree Riverkeeper. The WQTWC discussed and determined a process for evaluating changes and making decisions based on the best available information. During the WQTWC meetings a framework for a West Channel Adaptive Management Plan (AMP) was developed to address improvement of water quality in the West Channel during the new license term (Appendix A). This AMP describes the water quality issue in the West Channel and SCE&G's proposed actions to improve water quality which will be implemented during the new Parr Hydroelectric Project License (FERC No. 1894).

1.1 PROJECT DESCRIPTION

The Parr Hydroelectric Project, FERC No. 1894 (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 County, South Carolina. Parr Reservoir is a 4,400-acre impoundment formed by the Broad River and the Parr Shoals Dam and serves as the lower reservoir for the Fairfield Pumped Storage 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 the Federal Energy Regulatory Commission (FERC or Commission) 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 WEST CHANNEL AMP REVIEW COMMITTEE

2.1 COMMITTEE MEMBERS

A Review Committee will be formed within 120 days of license issuance 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 West Channel AMP. The Review Committee will not make decisions that supersede state or federal law or USFWS Section 7 Authority. The Review Committee's responsibilities may include, but are not limited to:

- Evaluating baseline information and study plans;
- 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;
- Establishing and documenting the goals and objectives of each action undertaken as part of the AMP and advising when modification to metrics used for evaluation purposes are needed;
- Reviewing and considering long term impacts of operational modifications on the Project and Project economics when evaluating the feasibility of implementing modifications;
- Reviewing the West Channel 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 implementation of this AMP will rest primarily with SCE&G, as licensee for the Parr Project. Annual budgets will be developed by SCE&G relative to the monitoring and study costs as well as administrative costs and expenses. 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 initially scheduled to consult twice per year via a 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 AMP GOAL

The goal of this AMP is to enhance aquatic habitat in the West Channel through increased year-round stream flows to the area. The stakeholders' desired outcomes of this AMP are to improve water quality year-round (specifically to meet state standards for dissolved oxygen and to improve dissolved oxygen levels in the West Channel during summer/fall periods), to provide a more natural water temperature profile, and to improve water depth and velocity. If the increased stream flows produce the outcomes listed above, it is the opinion of the stakeholders that improved aquatic habitat should result. The methods that will be employed under this AMP to achieve this goal are described in Section 5.0, and the scope of this AMP is limited to the implementation of those measures. The stakeholders agree that if the desired improvements to aquatic habitat in the West Channel are not realized to the extent expected or desired by the

Review Committee despite the implementation of the methods described in Section 5.0, no further action on the part of SCE&G will be required under this AMP.

4.0 BASELINE DATA

4.1 WATER QUALITY

Baseline water quality data was collected in the West Channel during 2015 and 2016 (Kleinschmidt 2016 & 2017). Continuous dissolved oxygen (DO) and temperature data were collected from April 1 through October 15 in 2015 at three monitoring sites in the West Channel and one in the east channel (Figure 4-1).

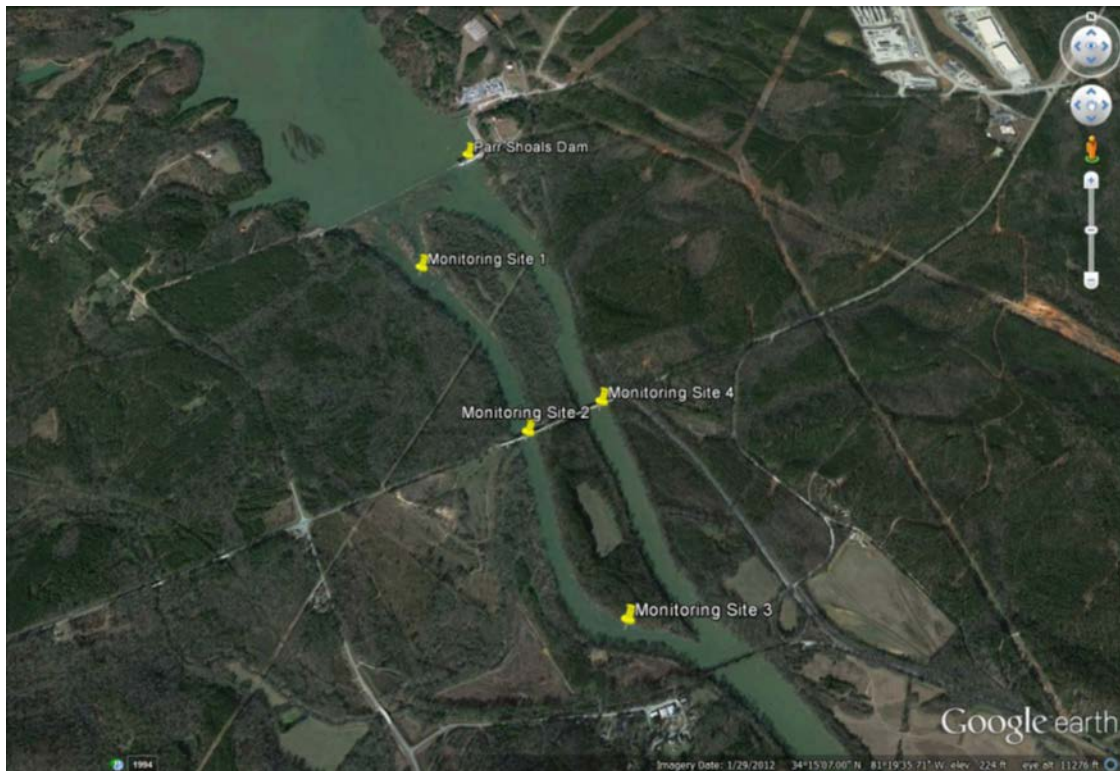


FIGURE 4-1 PARR SHOALS DOWNSTREAM WATER QUALITY MONITORING SITES

Monitoring in 2015 identified DO levels in the West Channel that periodically were below the SCDHEC standard of 4.0 mg/L. Dissolved oxygen levels in the upper West Channel of the Broad River, downstream of Parr Shoals Dam, were consistently lower than those further down the West Channel and in the east channel. This is likely due to the shallow nature of the river in

this area, as well as the presence of dense algal mats. Also, during drier weather conditions, the West Channel does not receive a consistent flow of water.

Based on 2015 monitoring results and WQTWC recommendations, SCE&G performed additional water temperature and DO monitoring during August 2016 to verify baseline conditions and to evaluate how discrete spillway releases or pulses through the spillway gates affect water quality in the West Channel. The pulse flows consisted of distinct releases through spillway gates 1 and 2 for approximately 3 hours. The spills were targeted to release 25 acre-feet of water into the West Channel.

Water temperature and DO were continuously monitored at four sites along the western channel. Water level data were collected at 3 locations in the upper West Channel (Upper Site 1, Upper Site 2, and Upper Site 3), and stream flow measurements were collected at two locations in the upper West Channel (Upper Site 1 and Upper Site 2). Each of the upper West Channel monitoring sites are shown in Figure 4-2.

DO levels generally remained above the SCDHEC standard of 4 mg/L during 2016, with diel fluctuations in both temperature and DO occurring throughout the study. Greater fluctuations in DO were observed later in August as aquatic vegetation increased and spillway flows were curtailed. DO levels in 2016 were generally greater than those observed during 2015. The study also determined that water levels in the West Channel were strongly influenced by flows from the powerhouse and indicate that portions of the tailrace flows from the east channel enter the West Channel. Overall, water quality in the West Channel seems to be most impacted during the later summer months, when stream flows are typically lower, temperatures are warmer, and vegetation growth rates are higher.

4.2 WATER LEVEL AND DISCHARGE

Water level and discharge measurements were collected under several operational scenarios on February 17 and 24, 2017 to investigate the relationship between powerhouse discharge (i.e., east channel discharge) and West Channel discharge. Water levels were recorded at 15-minute intervals at four locations: Upper Sites 1, 2, 4, and 5 (Figure 4-2). Discharge measurements were collected at four powerhouse operation levels, including one, two, three, and five-unit operation. The discharge measurements were collected during stable conditions with no spill at

Upper Sites 1 and 2. Water level logger elevations were determined using a survey-grade GPS and used to calculate water surface elevations. Tailwater elevations and river discharge were obtained from USGS Gage 02160991 (Broad River @ Jenkinsville, SC) and 022161000 (Broad River @ Alston, SC), respectively. Comparisons of water surface elevations during the discharge measurements at the four operational scenarios are depicted graphically in Figure 4-3.

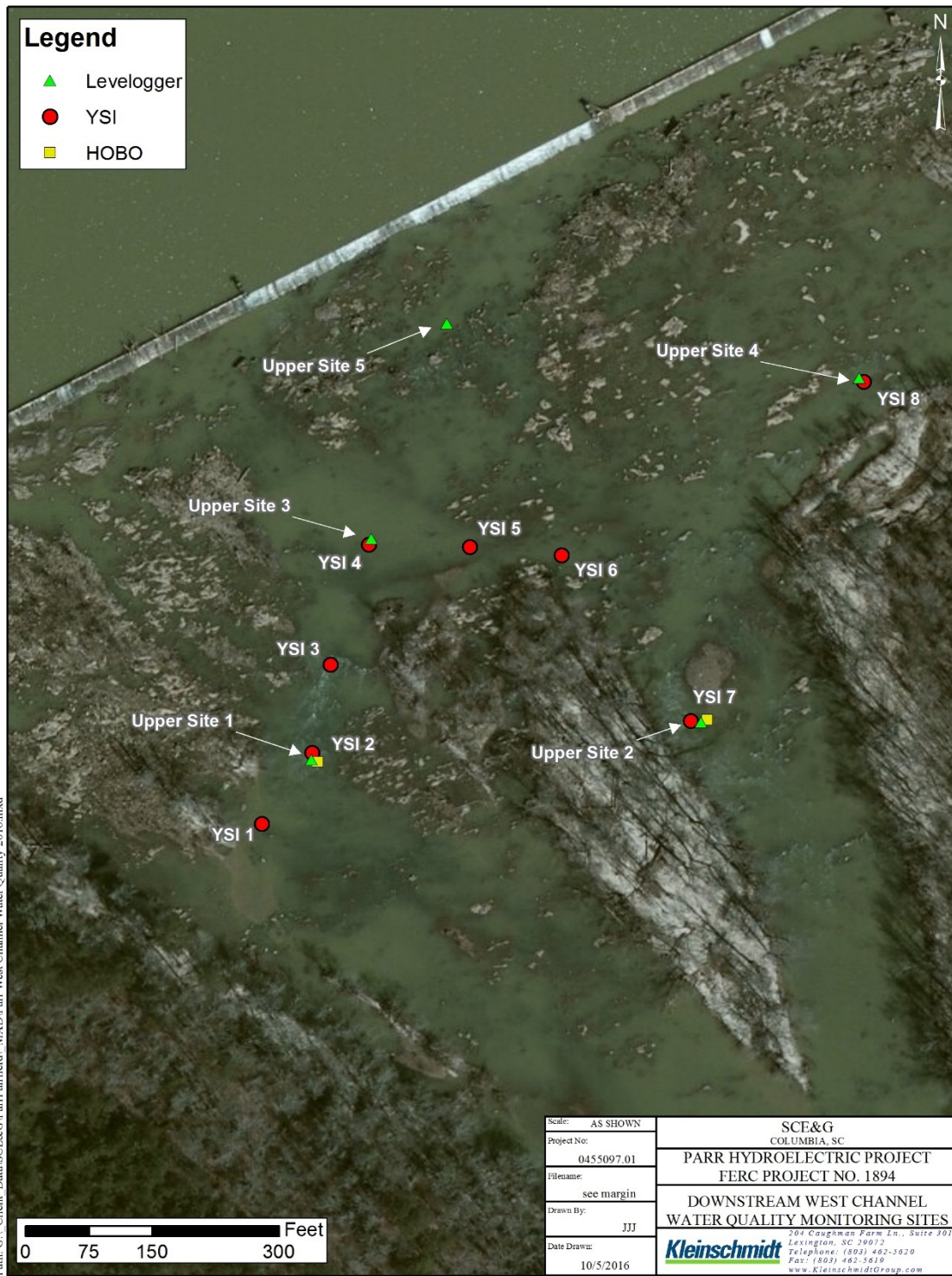


FIGURE 4-2 PARR SHOALS BASELINE MONITORING SITES

TABLE 4-1 RESULTS OF DISCHARGE MEASUREMENTS IN WEST CHANNEL

Operations	Upper Site 1 Discharge	Upper Site 2 Discharge	Total West Channel Discharge	Broad River at Alston
1 Unit	2	0	2	924
2 Unit	23	10	33	1746
3 Unit	47	32	78	2134
5 Unit	100	171	271	3438

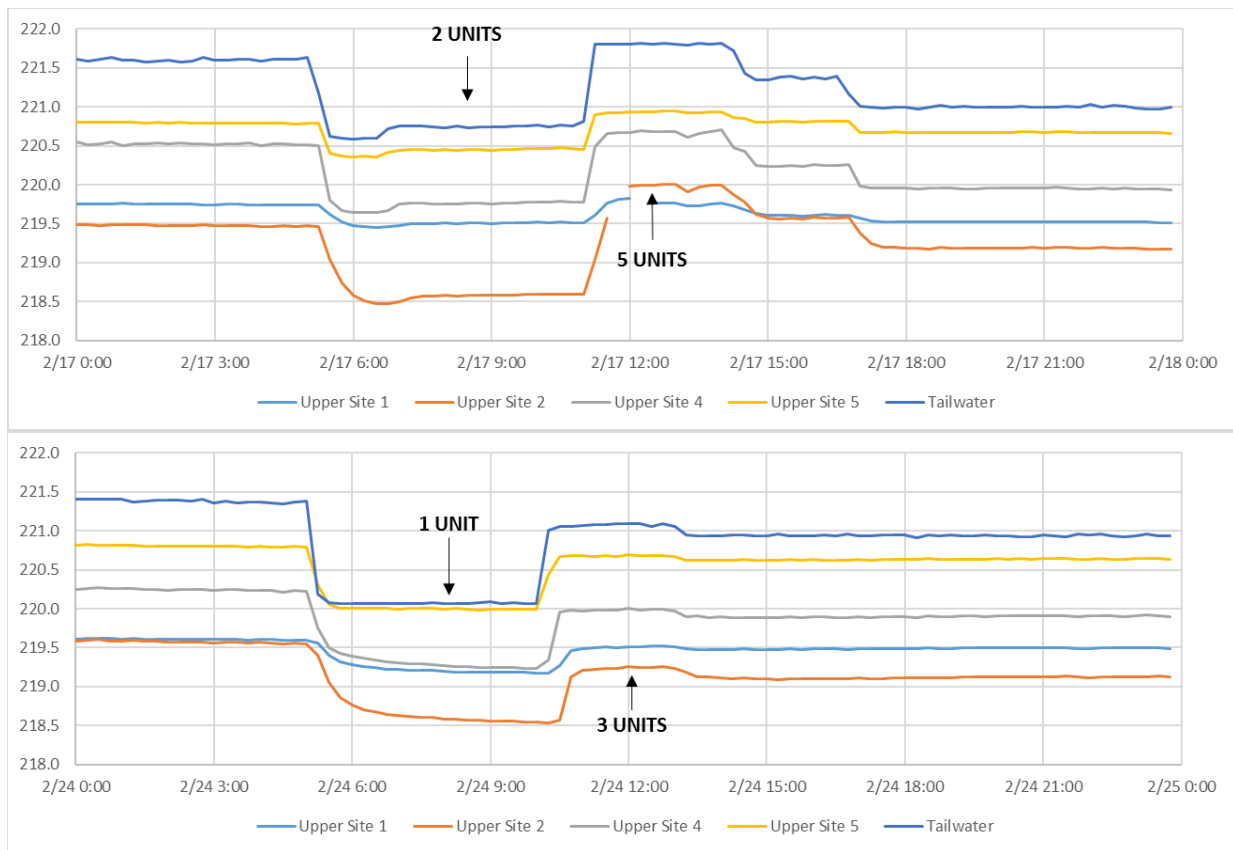


FIGURE 4-3 WATER SURFACE ELEVATIONS AT 1, 2, 3, AND 5 UNIT OPERATIONS

These water surface elevations depicted in Figure 4-3 show the relationship between tailwater elevations and the resulting change at each of the level loggers. This relationship also helps explain why the flows measured in the different channels changed disproportionately as tailwater levels increase with 5-unit flow.

5.0 IMPLEMENTATION

5.1 MANAGEMENT MEASURES

The WQTWC identified several measures to enhance aquatic habitat in the West Channel that will be implemented in the new operating license through the AMP. The WQTWC did not identify the use of an artificial oxygenation system as one of these measures. These measures are described in detail in the sections below.

5.1.1 FLOW TARGET DETERMINATION

The AMP review committee will determine an approximate target flow that it believes will adequately maintain dissolved oxygen levels in the West Channel. The committee will determine this target using data from the 2015 and 2016 monitoring studies and observations made during flow demonstrations for the IFIM study in 2017. Flows between 50 to 200 cfs have been discussed as a target flow in the West Channel during low flow conditions, but no agreement has been reached.

5.1.2 INCREASED FLOWS

The implementation of new instantaneous minimum flows for Parr should result in a more consistent amount of water flowing into the West Channel from the east channel, compared to the previous license requirement of daily average minimum flows. Monitoring, based on a plan agreed to by the Review Committee, will be conducted after implementation of these minimum flows to determine the extent of the benefits to West Channel aquatic habitat.

5.1.3 CHANNEL MODIFICATIONS

If the AMP Review Committee determines that new instantaneous minimum flows will not provide a sufficient flow into the West Channel to maintain DO levels, it will direct efforts to physically modify existing channel(s) leading into the West Channel. Based on current elevation data, modifying existing channels would be the most effective way to increase flows into the West Channel. Contingent upon obtaining permits and approvals from the USACE, SCDHEC, and NMFS the channel(s) will be modified to provide the identified target flow during periods of minimum flow releases. The first channel modification will occur in Year 2 of the AMP (dependent upon permit approval). A second channel modification (if needed) will be

completed in Year 4 of the AMP. Potential channel modifications could include notching or deepening of a small channel at the north tip of Hampton Island, and/or removal of material that currently serves as a hydraulic control closer to the Parr Shoals Dam (Figure 5-1).



FIGURE 5-1 POTENTIAL AREAS FOR CHANNEL MODIFICATION

5.1.4 LOW INFLOW PULSES

If inflows to Parr Reservoir decrease to a point that outflows from the dam do not provide any flows to the West Channel, SCE&G will investigate the use of spillway gates to provide periodic flow pulses to “refresh” the West Channel during periods when dissolved oxygen levels are expected to fall below acceptable levels. During the low inflow period, SCE&G will discuss the use of pulses with the Review Committee to make sure that all downstream resources are considered and releases are distributed in a balanced manner between the main channel and the West Channel.

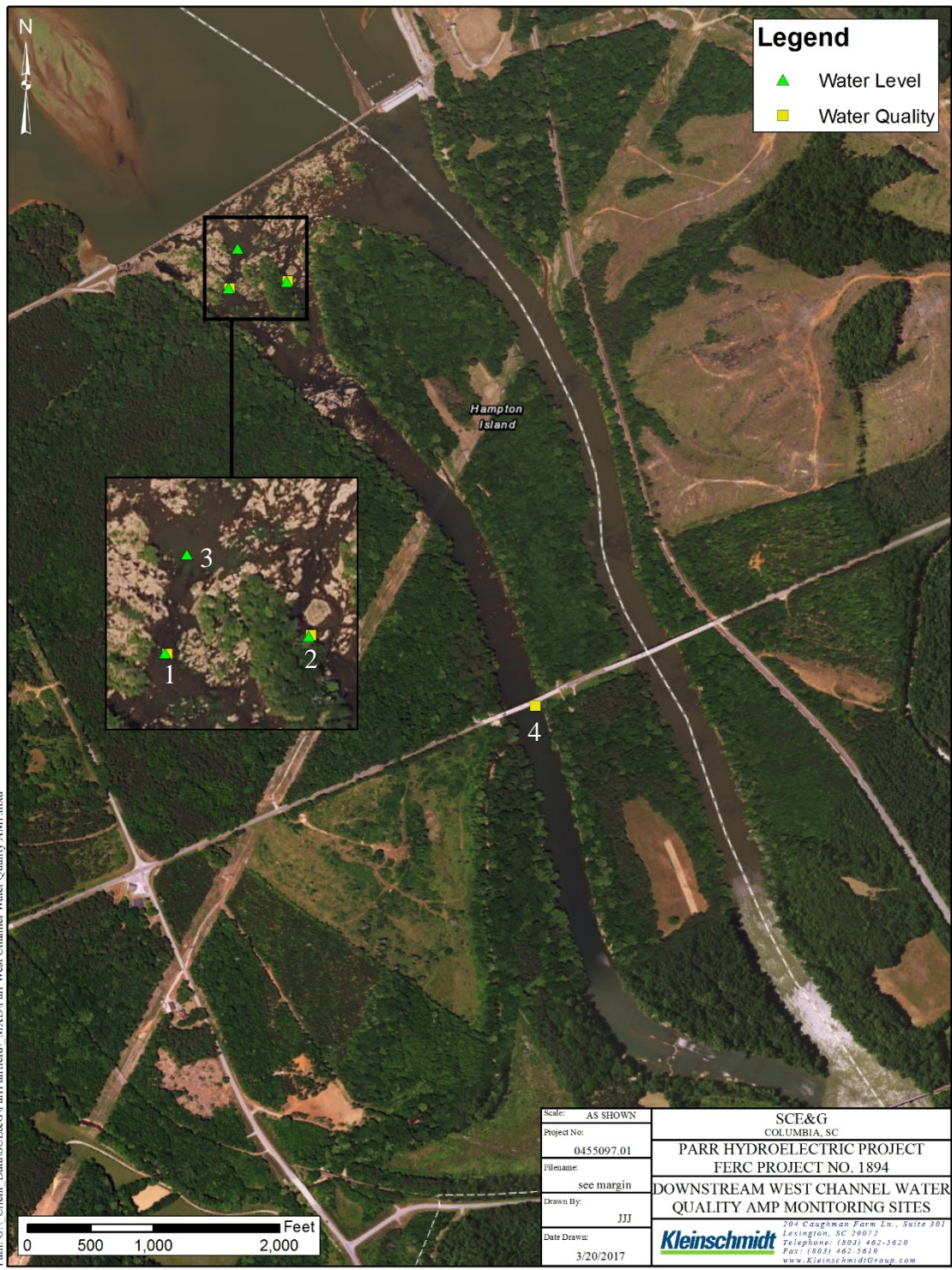
5.2 MONITORING

During each year of the AMP, monitoring will be conducted from May 15 to September 30. Water Quality (temperature and DO) will be continuously monitored (15-minute intervals) at three sites along the western channel: Sites 1 and 2, just downstream of the Parr Dam, and Site 4, midway down Hampton Island near the Highway 213 bridge (Figure 5-2). Water level data will be collected at Sites 1, 2, and 3 in the upper West Channel. Monitors will be checked and cleaned throughout the study. Every two weeks at minimum, random samples of temperature and DO will be collected within the West Channel. A grid illustrating the sampling area is provided in Figure 5-3. Nine cells (or 10% of the total number of cells within the sampling area) will be chosen at random for each biweekly sample. The random sample will be stratified so that six (or approximately 66% of the total number of sampling cells) sampling cells will be chosen from cells 33-89 above the SC-213 bridge. Three (or approximately 33% of the total number of sampling cells) sampling cells will be chosen from cells 1-32 below the SC-213 bridge. Samples will be collected from anywhere within a chosen cell, due to the presence of islands and bedrock high points. If no water is present in a chosen cell, a preselected alternate cell, selected at the same time as the original nine sampling cells, will be used. Concurrent with the biweekly water quality sampling, stream flow will be measured at Sites 1 and 2 in the upper West Channel. While it will not be a biweekly requirement, enough stream flow measurements will be taken in a given monitoring period to develop a stage-discharge relationship for the West Channel during the sampling period.

5.3 ANALYSIS

Monitoring data will be processed using appropriate quality control/quality assurance measures. Dissolved oxygen data will be summarized to determine the percentage of instantaneous readings above 4 mg/L, and the number of daily average values above 5 mg/L observed during the sampling period. Temperature data will also be summarized to determine the range of water temperatures observed in the West Channel during the sampling period.

The analysis will also include a summary of daily average discharge at the Parr powerhouse and the USGS Gage 02161000 (Broad River at Alston, SC). Water level data from depth loggers in the West Channel will be used to estimate flow in the West Channel during the monitoring period. The Review Committee will compare the West Channel flow estimates with the IFIM data collected in the West Channel during relicensing (Kleinschmidt Associates 2016) to evaluate weighted usable area (WUA) for various species identified for the West Channel. The objective of the IFIM comparison is not to reach a specific WUA value (such as 80%), but to determine what WUA value results from the increased flows in the West Channel. For this evaluation, monitoring data will only be collected during the period of May 15 through September 30 of each year this AMP is implemented.



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Source: SCE&G, Kleinschmidt, ESRI

FIGURE 5-2 AMP MONITORING LOCATIONS

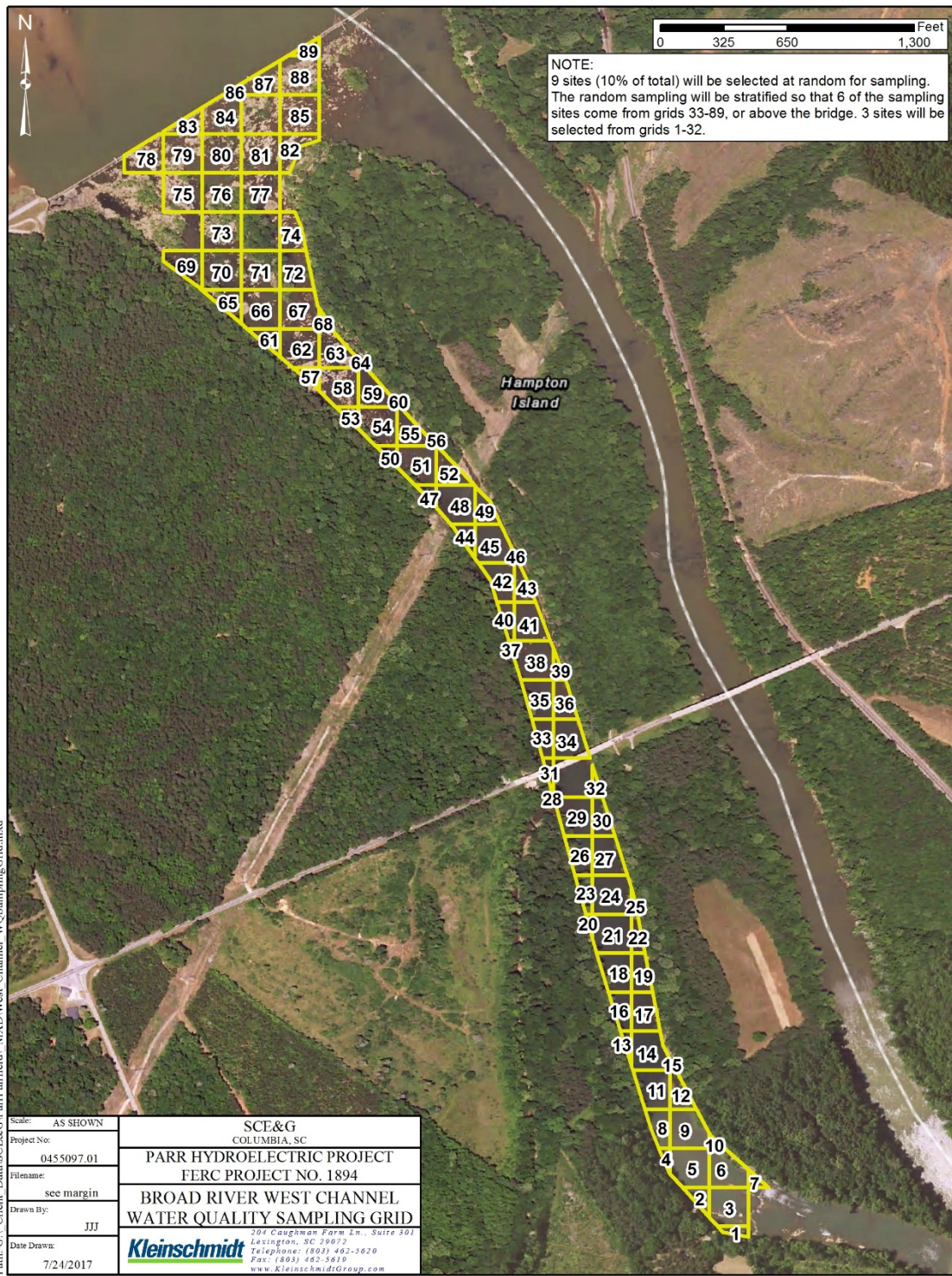


FIGURE 5-3 WEST CHANNEL SAMPLING GRID

6.0 SCHEDULE

The AMP schedule is described in the table below in relation to the issuance of the license by FERC. The dates below are targets and are subject to Review Committee availability.

TABLE 6-1 AMP IMPLEMENTATION SCHEDULE

Period	Item
Within 90 days of license issuance	Submit Final West Channel AMP to FERC
120 days of license issuance	Form Review Committee and review West Channel AMP
Year 1 of new license	<ul style="list-style-type: none"> • Monitoring – May - September • Annual Report – October • Review Committee Meeting – by December 15 • File Annual Report with FERC – April 30 of following year
Year 2 of new license	<ul style="list-style-type: none"> • Review Committee consultation – February • Channel Modifications (if recommended) • Monitoring – May - September • Annual Report – October • Review Committee Meeting – by December 15 • File Annual Report with FERC – April 30 of following year
Year 3 of new license	<ul style="list-style-type: none"> • Review Committee consultation – February • Monitoring – May - September • Annual Report – October • Review Committee Meeting – by December 15 • File Annual Report with FERC – April 30 of following year
Year 4 of new license	<ul style="list-style-type: none"> • Review Committee consultation – by end of March • Second Channel Modification (if needed) • Monitoring – May - September • Annual Report – October • Review Committee Meeting – by December 15 • File Annual Report with FERC – April 30 of following year
Year 5 of new license	<ul style="list-style-type: none"> • Review Committee consultation – by end of March • Monitoring – May - September • Annual Report – October • Review Committee Meeting – by December 15 • Develop recommendation for completion or continuation of AMP • File Annual Report with FERC – April 30 of following year

7.0 COMPLIANCE

Compliance will be based on following the schedule in Section 6.0 and submission of an annual AMP report each year 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. 2016. Water Quality in Downstream West Channel Study Report. April 2016.

Kleinschmidt Associates. 2017. West Channel Water Quality Second Year Study Report. January 2017.

APPENDIX A

SUMMARY OF CONSULTATION

Appendix A

The Water Quality TWC, a sub-section of the Water Quality, Fish and Wildlife RCG, convened often throughout the relicensing process to discuss the development of the West Channel 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.

- Water Quality TWC Meeting – March 23, 2016
- Water Quality TWC Meeting – June 23, 2016
- Water Quality TWC Meeting – December 14, 2016
- Joint¹ RCG Meeting – March 28, 2017
- Joint RCG Meeting – July 18, 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.