RESERVOIR FLUCTUATION STUDY PLAN

PARR HYDROELECTRIC PROJECT

FERC NO. 1894

Prepared for:

South Carolina Electric & Gas Company
Cayce, South Carolina

Prepared by:

Kleinschmidt

Lexington, South Carolina
www.KleinschmidtGroup.com

June 2014

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1.0 INTRODUCTION

South Carolina Electric & Gas Company (SCE&G) is the Licensee of the Parr Hydroelectric Project (FERC No. 1894) (Project). The Project consists of the Parr Hydro Development and the Fairfield Pumped Storage Development. Both developments are located along the Broad River in Fairfield and Newberry Counties, South Carolina.

The Project is currently involved in a relicensing process which involves cooperation and collaboration between SCE&G, as licensee, and a variety of stakeholders including state and federal resource agencies, state and local government, non-governmental organizations (NGOs), and interested individuals. Their collaboration and cooperation is essential to the identification and treatment of operational, economic, and environmental issues associated with a new operating license for the Project. SCE&G has established several Technical Working Committees (TWCs) with members from among the interested stakeholders with the objective of achieving consensus regarding the identification and proper treatment of these issues in the context of a new license.

During issues scoping, the Fisheries TWC identified the potential need for a Reservoir Fluctuation Study on the Parr and Monticello Reservoirs. The operating regime for the Project consists of a lowering and a refilling of the Project's two reservoirs on a daily basis. Although the amount that the Project reservoirs fluctuate varies (based on load demands and system needs), Monticello Reservoir is currently permitted by the FERC license to fluctuate up to 4.5 feet, while Parr Reservoir is permitted to fluctuate up to 10 feet. The magnitude of daily fluctuations varies seasonally in both impoundments. The largest daily fluctuations generally occur in June, July, and August in both reservoirs (see Table 1-1 and Table 1-2).

TABLE 1-1 MONTICELLO RESERVOIR MONTHLY AVERAGE ELEVATIONS: 2005-2013

Monthly Average Res. Elev.			
	Max	Min	Range
Jan	423.92	422.32	1.60
Feb	423.93	422.45	1.49
Mar	423.82	422.18	1.66
Apr	424.08	421.88	2.22
May	424.42	421.64	2.80
Jun	424.74	421.42	3.33
Jul	424.69	421.38	3.29
Aug	424.71	421.31	3.40
Sep	424.53	421.45	3.06
Oct	424.02	421.83	2.18
Nov	423.61	422.00	1.61
Dec	423.86	422.28	1.58
Average	**424.19**	**421.84**	**2.35**

TABLE 1-2 PARR RESERVOIR MONTHLY AVERAGE ELEVATIONS: 2005-2013

Monthly Average Res. Elev.			
	Max	Min	Range
Jan	263.04	259.96	3.08
Feb	262.88	260.01	2.87
Mar	263.44	260.32	3.13
Apr	263.81	259.61	4.20
May	264.22	258.79	5.43
Jun	264.59	258.09	6.49
Jul	264.72	257.96	6.75
Aug	264.74	257.71	7.03
Sep	264.17	258.27	5.90
Oct	263.60	259.14	4.46
Nov	263.53	259.97	3.56
Dec	263.38	260.11	3.28
Average	**263.84**	**259.16**	**4.68**

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During February through April, when many fish species are spawning in shallow water habitat, average daily fluctuations range from 1.6-2.4 feet in Monticello Reservoir and from 2.9-4.2 feet in Parr Reservoir (Argentieri presentation 12-19-13; Tables 1 and 2). Resource agencies and stakeholders have expressed concerns of how these daily and seasonal fluctuations are affecting aquatic habitat along the shorelines of the reservoirs.

Fisheries

The Project area supports warmwater fish communities typical of impounded river reaches in the Piedmont of South Carolina. Recent survey work within the Project area documented 30 species of fish occurring in Parr Reservoir and 24 species in Monticello Reservoir (see Table 2-1).

TABLE 2-1 FISH SPECIES DOCUMENTED AT PARR AND MONTICELLO RESERVOIRS

COMMON NAME	SCIENTIFIC NAME	PARR	MONTICELLO
black crappie	*Pomoxis nigromaculatus*	x	x
blue catfish	*Ictalurus furcatus*	x	x
bluegill	*Lepomis macrochirus*	x	x
channel catfish	*Ictalurus punctatus*	x	x
flat bullhead	*Ameiurus platycephalus*	x	x
flathead catfish	*Pylodictis olivaris*	x	
gizzard shad	*Dorosoma cepedianum*	x	x
golden shiner	*Notemigonus chrysoleucas*	x	x
highfin carpsucker	*Carpiodes velifer*	x	
largemouth bass	*Micropterus salmoides*	x	x
longnose gar	*Lepisosteus osseus*	x	
northern hogsucker	*Hypentelium nigricans*	x	x
notchlip redhorse	*Moxostoma collapsum*	x	x
pumpkinseed	*Lepomis gibbosus*	x	x
quillback	*Carpiodes cyprinus*	x	x
redbreast sunfish	*Lepomis auritus*	x	x
redear sunfish	*Lepomis microlophus*	x	x
robust redhorse	*Moxostoma robustum*	x	x
sandbar shiner	*Notropis scepticus*	x	
shorthead redhorse	*Moxostoma macrolepidotum*	x	x
smallmouth bass	*Micropterus dolomieu*	x	x
snail bullhead	*Ameiurus brunneus*		x
spottail shiner	*Notropis hudsonius*	x	x
threadfin shad	*Dorosoma petenense*	x	x
warmouth	*Lepomis gulosus*	x	
white bass	*Morone chrysops*	x	
white catfish	*Ameiurus catus*	x	x
white perch	*Morone americana*	x	x
whitefin shiner	*Cyprinella nivea*	x	x
yellow bullhead	*Amierus natalis*	x	x
yellow perch	*Perca flavescens*	x	x

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Although some seasonal variations in community structure have been documented, the fish communities are generally similar between the two reservoirs, with gizzard shad, blue catfish, bluegill, channel catfish and white perch often being the dominant species (Normandeau 2007, 2008, 2009; SCANA 2013). Important game fish species such as largemouth bass, black crappie, and smallmouth bass (to a lesser extent) are also abundant in the two reservoirs. Life history and spawning preferences can influence the extent to which fish species are affected by reservoir fluctuations. Habitat and spawning preferences of the dominant fish species are briefly considered below.

Gizzard shad are a pelagic species that generally occupy the limnetic zone as well as feed along the littoral zone. Spawning typically occurs in the spring, associated with rapidly rising water levels. Gizzard shad typically spawn in shallow waters, 5 feet deep or less, and prefer recently inundated habitats, when available (Williams and Nelson, 1985). Blue and channel catfish typically occupy deep, protected areas, spawning at sites 6.5 to 13 ft deep (McMahon and Terrell, 1982). Bluegill typically inhabit and spawn within shallow, back-water habitats, at depths of 3 to 6 ft (Stuber et. al., 1982a). White perch also spawn in relatively shallow habitat within reservoirs (0-5 feet). Adult white perch exhibit seasonal movements, utilizing both shallow and deep water habitat (Stanley and Danie, 1983). Largemouth bass typically spawn in gravel, or other substrates such as vegetation, roots, sand, or mud, at depths of 1-3 feet, with a full range 0.5-15 feet (Stuber et. al., 1982b). Smallmouth bass spawning typically occurs over course gravel substrate in close proximity to a boulder, overhead limb, log, or stump, in shallow areas of reservoirs or in protected areas of streams where current is minimal (Edwards, et. al., 1983). Black crappie spawn in backwater habitats or littoral areas in lakes in beds of vegetation on a soft mud, sand, or gravel substrate (Edwards, et. al., 1982a). White crappie tend to spawn at depths from 0.5 to 13.5 ft in river pools or coves and littoral areas of lakes and reservoirs (Edwards, et. al., 1982b). Redear sunfish utilize a wide variety of spawning habitats, with nesting substrates ranging from sand, sand-clay, mud, limestone, shells, and gravel with no vegetation in water depths ranging from several inches to 24 ft deep (Twomey, et. al., 1984). Redbreast sunfish typically spawn in shallow waters (1 to 1.5 ft) near logs, stumps, or boulders in quiet backwater locations or open areas of lakes and reservoirs (Aho, et. al, 1986).

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Small fishes, such as shiners, juvenile sunfish, and small suckers serve as the food base for larger, piscivorous species. In general, these species typically have high fecundity rates and will utilize a variety of habitat types for spawning, cover, and resting. These species are typically found within or in the vicinity of aquatic vegetation or other cover. When inundated, the shallow areas may be frequented by these species for forage and cover.

Pool Elevations

During the construction of Monticello Reservoir and the Fairfield Development in 1974, crest gates were added to Parr Shoals Dam, allowing for a full operating range of 256 ft to 266 ft at Parr Reservoir. Monticello Reservoir was constructed to allow for a full operating range of 420.5 ft to 425 ft.

SCE&G submitted surface area and capacity curves as part of the Final Environmental Impact Statement for Parr Hydroelectric Project, conducted in March 1974, after the crest gates were added to Parr Shoals Dam. In Monticello Reservoir, a change in elevation from 425 feet to 420.5 feet will reduce the surface area of the reservoir from 6,800 acres to 6,467 acres (95% of full pool surface area), resulting in a difference of 333 acres of shoreline exposed. The exposed shoreline is generally included in a narrow band that extends around the reservoir. A change in elevation on Parr Reservoir from 266 ft to 256 ft will reduce the surface area of the reservoir from 4,369 acres to 1,375 acres (31.5% of the full pool surface area), resulting in a difference of 2,994 acres of exposed lake bottom. Prior to the construction of the crest gates and reservoir expansion, the approximately 3,000 acres was not inundated or available as aquatic habitat in Parr Reservoir.

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3.0 STUDY OBJECTIVES

Monticello Reservoir Study Objectives

The objective of this study with regards to Monticello Reservoir is two-fold. First, SCE&G will provide a qualitative assessment of the potential effects of operational reservoir fluctuations on aquatic habitat within the reservoir. As noted in Section 2.0, areas of shoreline are exposed during impoundment fluctuations, but the type and quality of those areas are not currently documented. This study will provide information to characterize habitats within areas exposed during lake-level fluctuations, including the collection of reservoir elevations at all study sites. Second, this study will identify potential fish habitat enhancements which could be considered as part of the Protection, Mitigation and Enhancements (PM&E) measures.

Parr Reservoir Study Objectives

Study objectives with regards to Parr Reservoir include providing a qualitative and quantitative assessment of the potential effects of operational reservoir fluctuations on aquatic habitat and navigation within the reservoir. This study will provide information to characterize habitats within areas exposed during lake-level fluctuations as well as identify areas with potential navigation issues caused by fluctuations. Data collected will characterize the degree to which reservoir fluctuations affect navigation in the reservoir and identify portions of the reservoir which are potentially influenced in relation to dewatering of aquatic habitat and constricted channel.

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4.0 GEOGRAPHIC AND TEMPORAL SCOPE

The study will focus on the littoral zones of Parr and Monticello Reservoirs between maximum normal pool and minimum normal pool that are dewatered by reservoir fluctuations. Several transects will be established at representative locations along Parr and Monticello Reservoirs, where information such as slope and elevation will be gathered. Members of the Fisheries TWC will select these transect locations prior to the study being performed, which will be no later than the summer of 2015. The study will commence after transect locations are selected.

After fluctuation data is collected and analyzed, the TWC will meet to discuss potential PM&E measures that could be considered for each reservoir.

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5.0 METHODOLOGY

The study area will include both Parr and Monticello reservoirs. A maximum of four Priority Areas will be identified in Parr Reservoir by the Fisheries TWC members. Potential Priority Areas in Parr Reservoir have been identified and are depicted in Figure 5-1 and Figure 5-2. These Priority Areas will be locations within the reservoir that best depict a variety of existing aquatic habitat types. Within each Priority Area, 3 to 5 transects will be identified across the wetted area. At each transect, elevations will be collected at full pool via GPS (GeoExplorer 6000 paired with an external Zephyr antenna or equivalent model) or survey methods, as well as at 1 foot increments as the reservoir level is lowered during a fluctuation cycle. Surveys will be performed during a low inflow and high energy demand period (possibly August/September) so that as much of the full operating range of 10 ft as possible, from 266 ft to 256 ft can be observed. From this information an estimate of how much reservoir area is dewatered at each 1 foot contour will be documented and compared to the existing Reservoir Area Curve for the Project. At or near the minimum normal pool elevation (256 ft), slope and habitat type will also be photographed. Prior to the field study, locations that may present potential navigation issues during low fluctuations in Parr Reservoir will be identified (or included as a Priority Area). While aquatic habitat information is being collected in Parr Reservoir, field workers will also examine these areas during a fluctuation cycle. Any areas that appear to have navigation concerns will be documented and photographed.

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FIGURE 5-1 POTENTIAL PRIORITY AREAS IN UPPER PORTION OF PARR RESERVOIR

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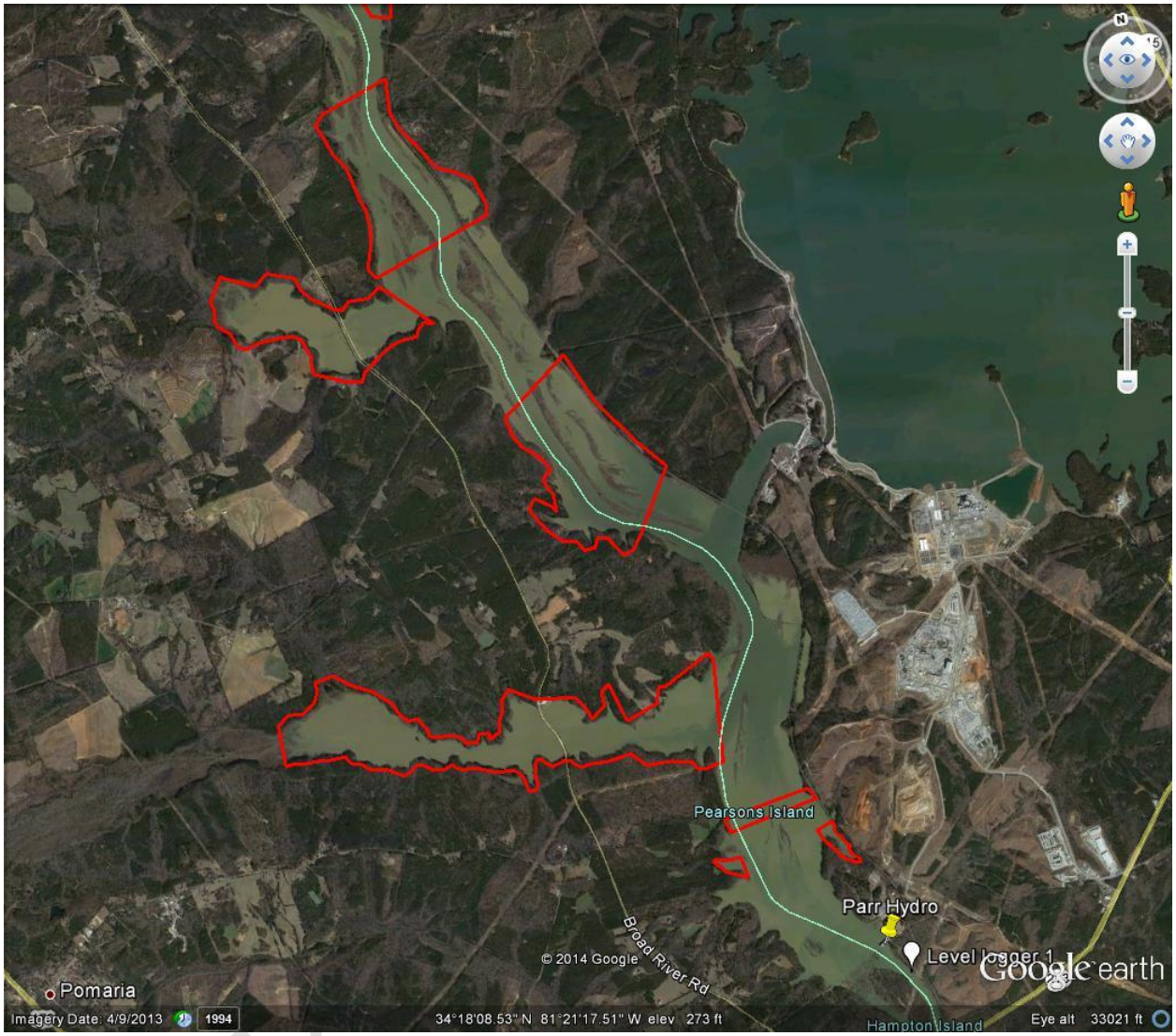
FIGURE 5-2 POTENTIAL PRIORITY AREAS IN LOWER PORTION OF PARR RESERVOIR



In Monticello Reservoir, from two to six Priority Areas will be identified that represent potential critical aquatic habitat areas (see Figure 5-3). At each of these locations, data will be collected to characterize the general slope (measured at 1 ft increments) and habitat type (photographed at each 1 ft increment) of the Priority Area for the 425 ft to 420.5 ft fluctuation band. Data will be collected to characterize the general slope and habitat of the Priority Area.

The collected data will be consolidated into a report for the Fisheries TWC review and comment. This report will be used as a basis for the Fisheries TWC to identify potential PM&E measures that could be implemented at each reservoir.

FIGURE 5-3 POTENTIAL PRIORITY AREAS IN MONTICELLO RESERVOIR

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6.0 SCHEDULE

Selection of Priority Areas will be completed no later than July of 2015. Field collections will be completed no later than the fall of 2015. After field data collection have been summarized in a report and distributed for review, the Fisheries TWC will meet to discuss PM&E measures that are appropriate for each reservoir. A final report summarizing the study findings and potential PM&E measures that could be considered as part of the Final License Application will be issued in or around July 2016. Study methodology, timing and duration may be adjusted based on weather and consultation with resource agencies and interested stakeholders.

7.0 USE OF STUDY RESULTS

Study results will be used as an information resource during discussion of relicensing issues and developing potential Protection, Mitigation and Enhancement measures with the South Carolina Department of Natural Resources, U.S. Fish and Wildlife Service (USFWS), Fisheries TWC, and other relicensing stakeholders.

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