BROAD RIVER SPINY CRAYFISH *CAMBARUS SPICATUS* STUDY REPORT

PARR HYDROELECTRIC PROJECT

(FERC NO. 1894)

Prepared for:

South Carolina Electric & Gas Company
Cayce, South Carolina

Prepared by:

Kleinschmidt

Lexington, South Carolina
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1.0 INTRODUCTION

South Carolina Electric & Gas Company (SCE&G) is the Licensee for the Parr Hydroelectric Project (FERC No. 1894) (Project). The Project consists of the Parr Shoals 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 (NGO), and interested individuals. SCE&G has established several Technical Working Committees (TWC's) comprised of members from the interested stakeholders. The TWC's objectives include the evaluation of relicensing issues and achieving consensus for addressing these issues in the new license.

The TWC identified the potential need for a crayfish survey based upon recommendations from the U.S. Fish and Wildlife Service ("USFWS"). On June 6, 2013, the USFWS noted that the Broad River Spiny Crayfish (*Cambarus spicatus*) may be located within the Project area and recommended that crayfish surveys for this species be performed in the Parr Shoals Reservoir and in the Broad River downstream of the Parr Shoals Dam. The South Carolina Department of Natural Resources currently designates this species with "special concern" status and is considering upgrading its priority rank from S3 to S2 (SC SWAP 2015). Additionally, the USFWS has been petitioned to list the Broad River Spiny Crayfish (BRSC) under the Endangered Species Act (USFWS 2011).

2.0 RELEVANT LIFE HISTORY INFORMATION

As noted, the BRSC (*Cambarus spicatus*) is a species of concern in South Carolina. Eversole (1990) identified BRSC as having a distribution limited to lotic environments in the Broad River Basin. BRSC collections in the vicinity of the Project are known from the upper portion of the Little River, a tributary to the Broad River, in Fairfield County (Figure 2-1; Eversole 2014). Although BRSC collections are limited, individuals are primarily associated with leaf litter and other organic debris located along the banks of streams. Preferred substrates are comprised primarily of sand and tend to be unstable in nature with a lack of rooted aquatic vegetation. Current information indicates that BRSC reproduce during the summer months (Eversole, 1990). BRSC was described by Hobbs (1956) as gray-green with cream, pink, purple and brown highlights. The chelae (the "claw" or "pincer") are green with orange tips and a double row of tubercles on the mesial margin of the palm. Individuals range from about 60 mm (2.4 inches) to 78 mm (3.1 inches) in length.

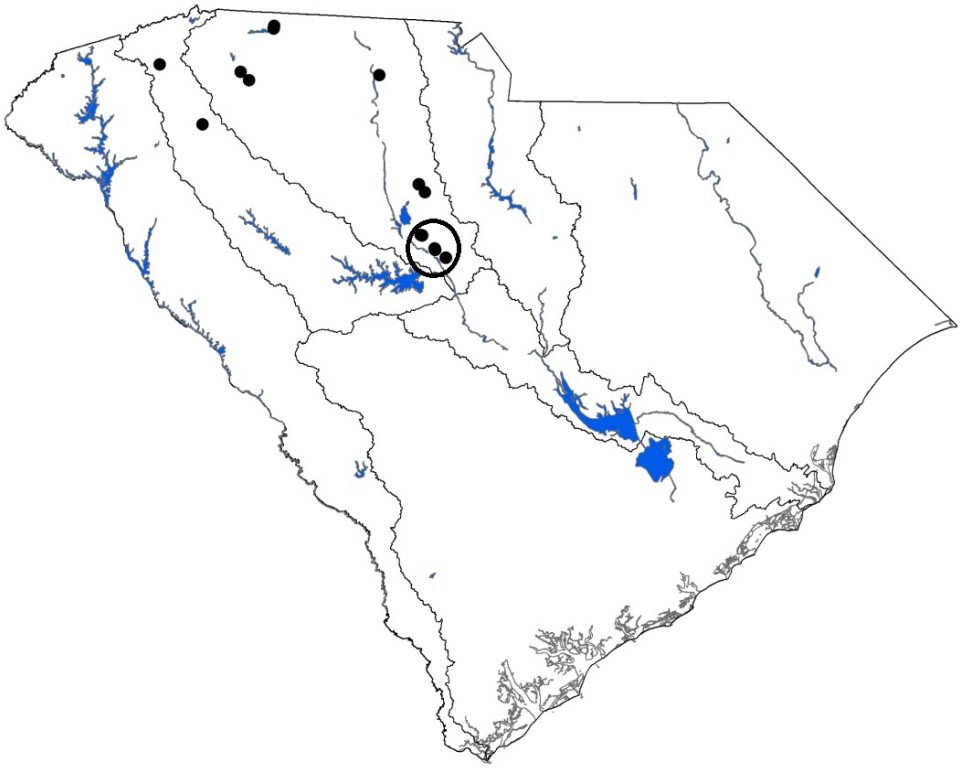


FIGURE 2-1 SPATIAL DISTRIBUTION OF *CAMBARUS SPICATUS* (EVERSOLE 2014): CIRCLE DELINEATES OCCURRENCES OF C. SPICATUS THAT OCCURRED IN THE LITTLE RIVER

3.0 STUDY OBJECTIVES

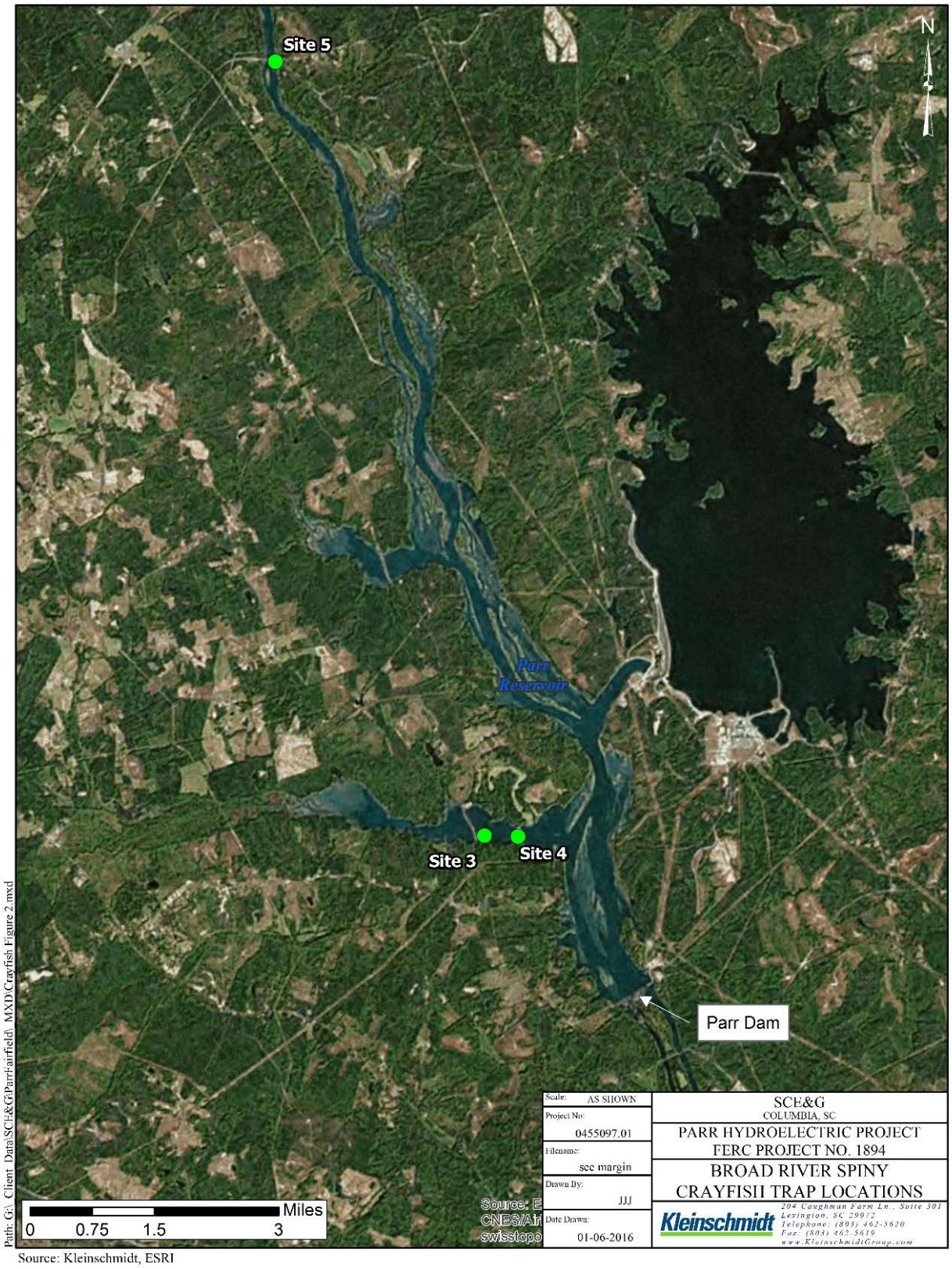
The objective of this survey was to assess the presence of BRSC in the Parr Shoals Reservoir and in the Broad River downstream of the Parr Shoals Dam.

Based upon the life history information for BRSC and input from the USFWS (Appendix A) sampling sites were selected along the margins of the Broad River and associated tributaries, in areas of leaf litter/detritus. Collection areas included the Broad River at the Highway 34 Bridge (Figure 3-1) (Photo 3-1, and Photo 3-2), the Cannon's Creek arm of Parr Reservoir (Figure 3-1) (Photo 3-3), and downstream of Parr Shoals Dam at the confluence of the Broad River and Little River (Figure 3-2).

PHOTO 3-1 TRAP LOCATION ON THE BROAD RIVER NEAR THE HIGHWAY 34 BRIDGE

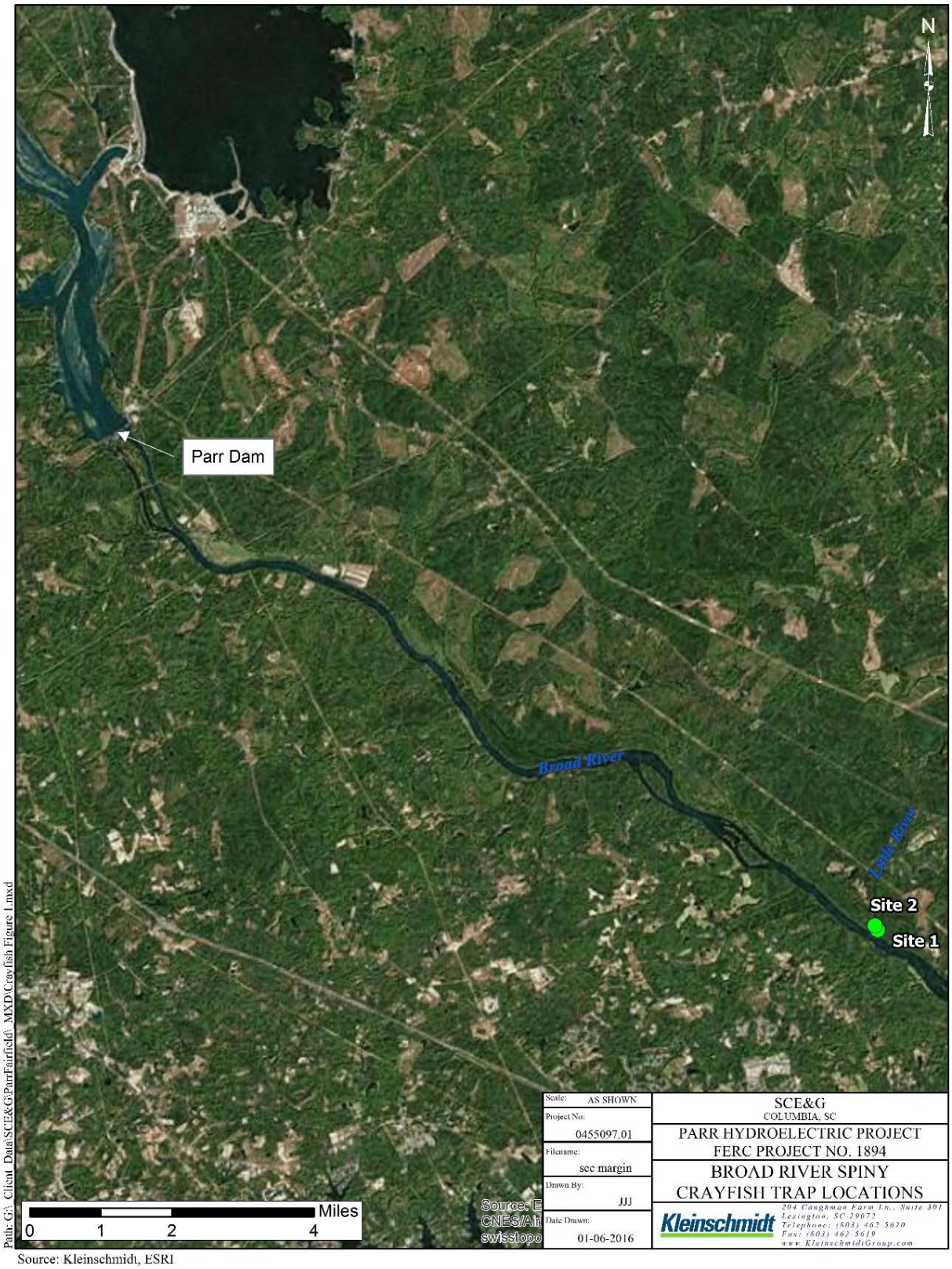
PHOTO 3-2 TRAP LOCATION ON THE BROAD RIVER NEAR THE HIGHWAY 34 BRIDGE

PHOTO 3-3 TRAP LOCATION ON THE CANNON'S CREEK ARM OF PARR RESERVOIR



Source: Kleinschmidt, ESRI

FIGURE 3-1 CRAYFISH SAMPLING AREAS AT HIGHWAY 34 AND CANNON'S CREEK



Source: Kleinschmidt, ESRI

FIGURE 3-2 CRAYFISH SAMPLING AREAS DOWNSTREAM OF PARR DAM

4.0 COLLECTION METHODS

Sampling at all locations occurred from early September to late October, 2015 (Table 1). Passive trap methods were utilized for this study. Traps consisted of double-entry, galvanized wire mesh crayfish traps with 1.5 inch opercula (Photo 4-1). Traps were baited with canned fish and canned cat food, and were re-baited during biweekly (every 3 to 4 days) trap checks. A one-pound weight was originally placed in the traps to ensure that they remained submerged. However, after loss of gear due to flooding, traps were anchored to structures along the shoreline. Traps were deployed along shoreline habitats, in areas of detritus and/or leaf litter at all sampling sites. Traps were also placed in locations where water depth was sufficient to ensure that they remained inundated. Water quality parameters (temperature, DO, and conductivity) were periodically collected when traps were checked for crayfish.

PHOTO 4-1 EXAMPLE OF CRAYFISH TRAP USED IN THE STUDY

5.0 RESULTS

Traps at sites 1 and 2 fished for a total of 5,136 hours during this study (Table 1). Over the study period, water temperatures at the confluence of the Broad River and Little River ranged from 12-26°C, dissolved oxygen ranged from 8.5-10.6 mg/L, and conductivity ranged from 80-151 µS. No crayfish were collected, although traps at this site did collect several small sunfish throughout the study.

Traps at sites 3 and 4 were fished for a total of 4,860 hours during this study (Table 5-1). Over the study period, water temperatures at Cannon's Creek ranged from 19-28°C, dissolved oxygen ranged from 6.6-7.9 mg/L, and conductivity ranged from 60-117 µS. No crayfish were collected.

Traps at site 5 were fished for a total of 2,760 hours during this study (Table 1). Over the study period, water temperatures at the Highway 34 Bridge ranged from 16-25°C, dissolved oxygen ranged from 7.1-8.9 mg/L, and conductivity ranged from 65-159 µS. No crayfish were collected, although traps at this site did collect numerous small sunfish throughout the study.

TABLE 5-1 LOCATIONS AND DATES OF SAMPLING EFFORTS

LOCATION		NUMBER OF TRAPS AND DATES SAMPLED			NOTES
Confluence of Little River and Broad River	Site 1 (34°10'32.73"N, 81°10'41.80"W)	3 – traps 9/3/2015-10/4/2015	2 – traps 10/20/2015-10/27/2015		Traps were replaced due to 10/4/2015 flood event
	Site 2 (34°10'35.45"N, 81°10'43.74"W)	3 – traps 9/3/2015-10/4/2015	2 – traps 10/20/2015-10/27/2015		
Cannon's Creek Arm of Parr Reservoir	Site 3 (34°16'56.08"N, 81°21'35.26"W)	3 – traps 9/3/2015-10/4/2015	2 – traps 10/13/2015-11/2/2015		Traps were replaced due to 10/4/2015 flood event
	Site 4 (34°16'54.56"N, 81°21'12.86"W)	2 – traps 9/3/2015-10/4/2015	1 – trap 10/13/2015-11/2/2015		
Highway 34 Bridge	Site 5 (34°23'37.39"N, 81°23'46.53"W)	3 – traps 9/3/2015-9/28/2015	2 – traps 9/29/2015-10/4/2015	2 – traps 10/13/2015-10/28/2015	Traps were replaced during study due to flooding and theft

6.0 DISCUSSION

No crayfish were collected during the BRSC study. During the American eel study performed in the Parr Shoals Dam tailrace area, approximately thirteen crayfish were collected in a large fyke net that sampled the west channel area during springtime collections. Through consultation with USFWS (Byron Hamstead), we identified these crayfish as either acuminate crayfish *Cambarus acuminatus* or Carolina needlenose crayfish *Cambarus aldermanorum* and a reference sample was kept in 70% ethanol. No BRSC were collected in the fyke net.

7.0 REFERENCES

Eversole, A. G. 1990. Status Report on *Cambarus (Puncticambarus) spicatus* Hobbs, *Distocambarus (Fitzcambarus) youngineri* Hobbs, and *Procambarus (Pennides) echinatus* Hobbs. Completion Report. 21 pp.

Eversole, A.G. 2014. Identification and distribution of crayfishes in South Carolina. Final Report. 69 pp.

Hobbs, H. H., Jr. 1956a. A new crayfish of the genus Procambarus from South Carolina (Decapoda:Astacidae). J. Wash. Acad. Sci. 46(1):117-121.

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APPENDIX A
STUDY SITE COLLECTION NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
Parr Hydroelectric Project (FERC No.1894)

MEETING NOTES

Rare, Threatened and Endangered Species TWC
Broad River Spiny Crayfish Study – Study Site Selection Notes

July 23, 2014

Final CSB 092214

ATTENDEES:

Shane Boring – Kleinschmidt
Byron Hamstead – USFWS
Milton Quattlebaum – SCANA Environmental Services

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

The group met with the purpose of selecting collection spots for the Broad River spiny crayfish (BRSC) as part of one of the proposed relicensing studies for the Parr Hydroelectric Project. The group launched from the Cannon's Creek ramp on Parr Reservoir and examined habitats from Cannon's Creek upstream to approximately 1 mile above the Highway 34 Bridge by boat. The group also examined habitat along Haltiwanger Island downstream of Parr Dam on foot. Prime collection areas included backwater areas with the presence of coarse woody debris and reasonable access for sampling.

Byron indicated that he was less impressed with habitats observed in Parr Reservoir, although some level of sampling was warranted in that area. The group determined that habitat in the vicinity of Haltiwanger Island in general lack the course woody debris and had higher velocities than are likely suitable for BRSC. Byron expressed an interest in exploring the area in the vicinity of the mouth of Little River for potential access since that is the area closest to where BRSC has been documented. The group made several attempts to examine Little River in that area, but were unable to find an access point. Shane and Milton noted that they would contact local landowners and attempt to facilitate an access point. Byron reiterated his desire to focus on the Little River mouth area.

Based on the field examinations and identifying a local landowner that would allow access to the Little River area, five sampling sites were identified, which are shown below in Figure 1 and Table 1. Two of the selected sites will be established at the Bookman Station Property to accommodate the USFWS request for additional sampling in the Vicinity of the Little River site located downstream of Parr Dam. A minimum of 3 traps will be deployed at each collection site.

Kleinschmidt

Figure 1. Broad River Spiny Crayfish Sampling Sites

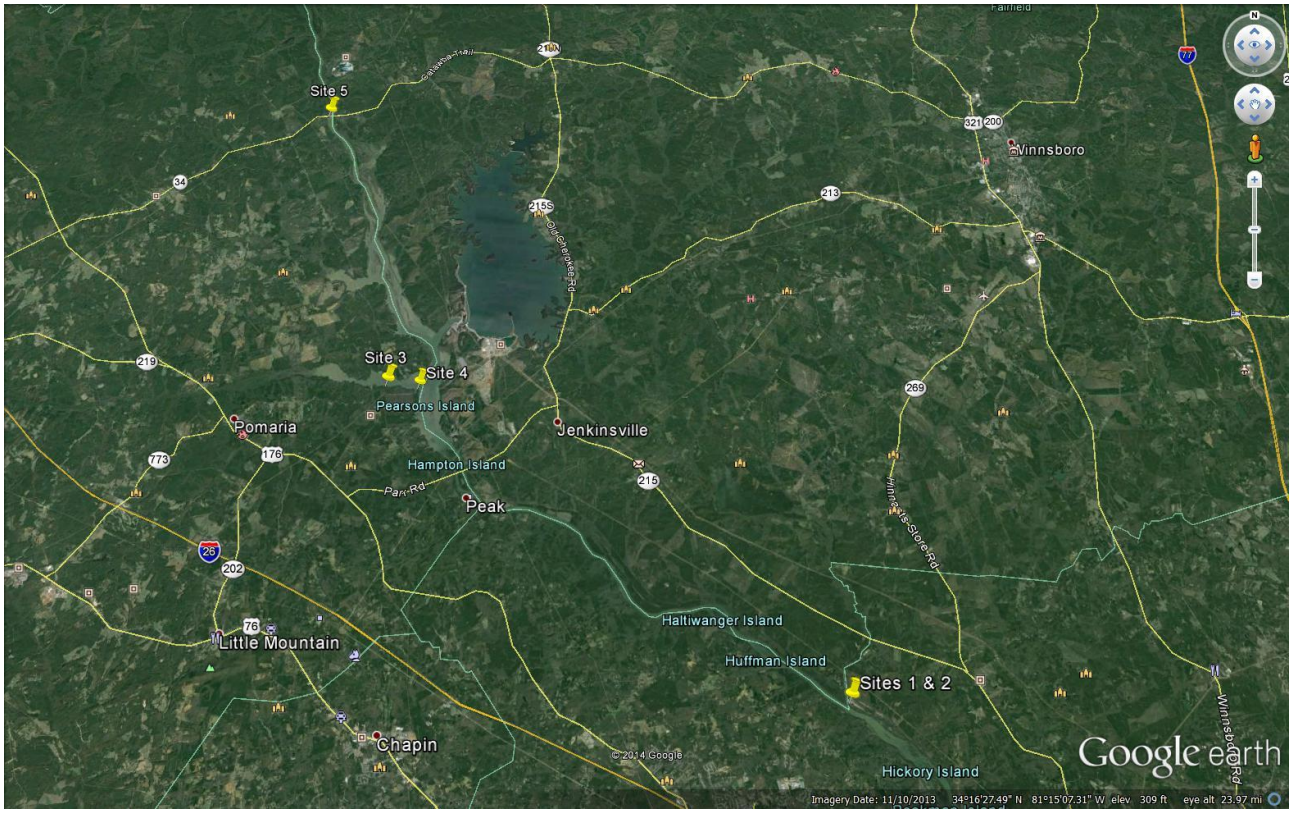

Table 1. Broad River Spiny Crayfish Sites

Site No.	Latitude/Longitude	Description/Notes
1	34°10'33.79"N, 81°10'41.48"W	Sites downstream of Parr Dam at mouth of Little River. Will be accessed from Bookman Station, LLC property. Two set of 3 traps will be positioned sufficiently apart in appropriate habitat to represent 2 sites.
2		
3	34°16'53.04"N, 81°21'35.93"W	Cove directly across from Cannon's Creek launch.
4	34°16'49.39"N, 81°20'48.05"W	Noted by USFWS as a shallow area with more overhead forest cover than other habitat in reservoir.
5	34°23'37.73"N, 81°23'55.93"W	Vicinity of Highway 34 Bridge.

ACTION ITEMS:

- Include these notes in the Final BRSC sampling plan and revise the Plan to note the listed sampling locations and number of sampling traps to be used.

Kleinschmidt