

MONTICELLO RESERVOIR HABITAT ENHANCEMENT REPORT AND PME MEASURES

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

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SOUTH CAROLINA ELECTRIC & GAS COMPANY

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HABITAT ENHANCEMENT REPORT**

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FERC No. 1894**

SOUTH CAROLINA ELECTRIC & GAS COMPANY

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 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 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. SCE&G established several Technical Working Committees (TWCs) comprised of interested stakeholders with the objective of identifying Project-related resource issues and impacts.

During issue scoping meetings, the Fisheries TWC identified the 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. Monticello Reservoir is currently permitted to fluctuate up to 4.5 feet. However, the amount that the Project reservoirs fluctuate will vary dependent on load demands and system needs. The magnitude of daily fluctuations also varies seasonally in both impoundments, with the largest average daily fluctuations generally occurring in June, July, and August in both reservoirs (Table 1-1).

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
June	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

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 (TWC Meeting presentation 12-19-13). Resource agencies and stakeholders expressed concerns that these daily and seasonal fluctuations may be affecting aquatic habitat along the shorelines of the reservoirs and fish spawning and recruitment.

2.0 METHODS

This study report was developed as a result of the Monticello Reservoir Fluctuation Study to assess the effects of fluctuations on reservoir habitat. The bases for this study can be found in the following documents: Fisheries TWC Meeting notes from April 2014, September 2015, March 2016, and May 2016, the Revised Reservoir Fluctuation Study Plan, and the Parr and Monticello Reservoir Fluctuation Study. The April 2014 TWC meeting identified the study objectives relative to each reservoir. It was decided that Monticello would be assessed qualitatively to identify areas that could be candidates for habitat enhancement. The September 2015 meeting identified potential habitat enhancement areas and the types of enhancements that would be explored: spawning, nursery, and deep-water. The subsequent March 2016 meeting involved discussions of the findings of the Reservoir Fluctuation Study and refining of the habitat enhancements for Monticello Reservoir. The group further refined the types of structures that

could be used for each enhancement and the amount of enhancement that could be provided to an identified area. The final TWC meeting in May 2016 involved a site visit to Monticello Reservoir to confirm the potential enhancement sites and the exact location and amount of enhancements that could be installed at a given site.

3.0 RESULTS

The TWC proposed potential fish habitat enhancements to be placed throughout Monticello Reservoir to mitigate for reservoir fluctuation impacts on current shoreline areas. Habitat enhancement structures would be installed to enhance spawning, nursery, and deep-water habitats available within Monticello Reservoir. The habitat enhancement structures would serve two purposes within the reservoir. First, the structures could provide enhanced fish production within the reservoir. Second, they would concentrate fish as an enhancement for recreational fishermen (Wagner 2016). Maps of the proposed locations within Monticello Reservoir for habitat enhancement are included in Appendix A. Descriptions for each proposed enhancement and total PM&E installation costs are presented in the following sections.

3.1 SPAWNING HABITAT ENHANCEMENTS

The proposed spawning habitat enhancements could be made by the installation of “spawning bed” structures. These structures would consist of commercially available three-foot diameter plastic pools (of varying color based upon vendor) (Figure 3-1) filled with 3-4 inches (in.) of pea gravel/sand. While the commercially available plastic pools were used for purposes of estimating costs and materials, the TWC suggested that other more permanent spawning structure materials may be considered. There were eight spawning areas identified by the TWC and spawning beds could be installed in each area identified for spawning habitat enhancement. The structures would be constructed on a pontoon style work boat and lowered into place via a three-point attachment rope system and winch. The enhancement locations would be located in areas that are approximately 5 to 6 feet deep when the reservoir is at full pool, leaving the spawning beds 0.5 to 1.5 feet underwater at the lowest reservoir elevation.



FIGURE 3-1 COMMERCIALY AVAILABLE 3-FOOT DIAMETER PLASTIC POOL
(Color may vary based upon vendor selected.)

Timing of Installation

Due to TWC concerns over the resilience of the proposed spawning structures, these habitat enhancements will be installed and evaluated in a stepwise approach. The proposed number of spawning structures to be installed during the new license is 360. Based on TWC recommendations, SCE&G will install 15 spawning beds in each of the 8 coves identified for spawning habitat enhancement (Appendix A) within the first three years of the new license. The SCDNR may request to vary the spawning structure material, substrate material, and/or substrate depth to evaluate fish preferences. SCE&G and SCDNR will develop a matrix to test the effects of these variables. The installed spawning beds will be inspected by SCE&G (underwater camera observation) after two spawning seasons for condition and evidence of use by fish. SCE&G will report observations to SCDNR and consult on the installation of up to 240 (30 structures per 8 locations) additional spawning beds to be installed over the following two years.

3.2 NURSERY HABITAT ENHANCEMENTS

Nursery habitat enhancements could be made by the installation of Mossback Safe-Haven structures. The safe-haven structures are made up of three 50 inches tall PVC posts, 72 50 inches long composite limbs, a three-post base, and a three-hole shade top (Mossback 2016) (Figure 3-2). The nursery structures would be constructed on a pontoon style work boat, weighted with a concrete cinder block, and lowered into position via rope. The structures would be installed at a depth sufficient to leave approximately four feet of water above the top of the structure at the lowest reservoir elevation. Three safe-haven structures would be installed at each point marked

by the TWC for nursery habitat enhancement (Appendix A). A total 111 nursery structures would be installed based on TWC recommendations.



FIGURE 3-2 MOSSBACK SAFE-HAVEN KIT

During the Fishery TWC meeting on September 1, 2016, the SCDNR stated that they would like to investigate periodic “shoreline tree felling” in various areas around the reservoir as an aquatic habitat enhancement. Shoreline trees (including hardwood, pine or cedar trees) would be felled into the lake and cabled to the shoreline to insure they do not become a navigation hazard. SCE&G agreed to coordinate with the SCDNR on their efforts to introduce this aquatic habitat during the new license.

Timing of Installation

Within the first five years of the new license, SCE&G will install three Mossback Safe-Haven (or equivalent) structures for nursery habitat enhancements at each location identified in the Appendix A for a total of 111 structures. These nursery habitat enhancements will require no additional monitoring after installation.

3.3 DEEP-WATER HABITAT ENHANCEMENT

Deep-water habitat enhancements would be made by the installation of Mossback Trophy Tree and Trophy Tree XL structures. As an alternative, structures constructed by SCE&G could be used in place of the Mossback structures (TWC meeting March 2016). The Mossback Trophy Tree structure is made up of three 50 in. tall PVC posts, 36 50 in. long composite limbs, a three-post base, and a three-hole shade top (Mossback 2016) (Figure 3-3). The Mossback Trophy Tree XL structure is approximately eight feet tall and made up of six 50 in. tall PVC posts, with 72 50 in. long composite limbs, a three-post base, and a three-hole shade top (Mossback 2016) (Figure 3-4). The deep-water structures would be constructed on a pontoon style work boat, weighted with a concrete cinder block, and lowered into position via rope. The structures would be installed at a depth sufficient to leave 10-15 feet of water above the top of the structure at the lowest reservoir elevation. The TWC recommended that 15 deep-water enhancement structures would be installed at each location marked for enhancement (Appendix A). The structures would be positioned in a five by three grid around the enhancement area. If Mossback structures are used, the four corners of the grid would be Trophy Tree XL units with the regular Trophy Trees making up the final 11 units within the enhancement area. Each of these areas would be marked with a floating buoy for reference.

Timing of Installation

Within the first five years of the new license, SCE&G will install deep-water habitat enhancements and buoy markers at 13 sites identified by the TWC and presented in Appendix A. Each of these enhancements will consist of 11 Mossback Trophy Tree (or equivalent) structures (143 total) and 4 Mossback Trophy Tree XL (or equivalent) structures (52 total) for a total of 195 structures. These deep-water habitat enhancements will require no additional monitoring after installation.



FIGURE 3-3 MOSSBACK TROPHY TREE KIT



FIGURE 3-4 MOSSBACK TROPHY TREE XL KIT

3.4 INSTALLATION COSTS

Habitat enhancement implementation costs were evaluated to include the costs to purchase the enhancement structure materials and estimated installation costs. Cost evaluations were made using several assumptions. Those assumptions include:

- One work day is 20 man-hours (two people working 10 hours);
- the labor rate used is \$50/hour;
- installation of spawning beds would be 15 units/day;
- nursery habitat structures would be installed at a rate of 10 units/day; and
- deep-water habitat structures would be installed at a rate of 10 units/day.

Costs were evaluated for each individual enhancement structure and then grouped by enhancement type. Total costs for each habitat enhancement type are presented in the sections below. All estimates are based on 2016 prices for materials and labor. More detailed tables and information is presented in Appendix B.

3.4.1 SPAWNING BED MATERIAL COSTS

The cost of the materials for an individual spawning bed are approximately \$16 for the plastic pool, \$10.50 for the pea gravel/sand, and \$2 for the rope. Using these assumptions, we used a value of \$28.50 for the materials for each spawning bed. Installation costs were based on the previous stated assumptions. Total estimated cost including materials and installation for 360 spawning structures is \$34,260 (Table 3-1). This estimate does not include the cost of alternate spawning bed materials or the spawning structure evaluation and consultation with the SCDNR during the license.

TABLE 3-1 SPAWNING HABITAT ENHANCEMENT COSTS

SPAWNING HABITAT ENHANCEMENT	
Structure Costs	\$10,260.00
Labor Costs	\$24,000.00
TOTAL COSTS	\$34,260.00

3.4.2 NURSERY HABITAT ENHANCEMENTS

The cost for materials for an individual Mossback Safe-Haven unit is \$209.99. This includes a discount for bulk orders. Installation costs were based on the previous stated assumptions. Total estimated cost for installation of 111 Safe-Haven structures is \$34,409.89 (Table 3-2).

TABLE 3-2 NURSERY HABITAT ENHANCEMENT COSTS

NURSERY HABITAT ENHANCEMENT	
Structure Costs	\$23,308.89
Labor Costs	\$11,100.00
TOTAL COSTS	\$34,408.89

3.4.3 DEEP-WATER HABITAT ENHANCEMENTS

The cost for materials for an individual Mossback Trophy Tree is \$179 and for an individual Trophy Tree XL is \$359. This includes a discount for bulk orders. Installation costs were based on the previous stated assumptions. Total estimated cost for materials and installation is \$66,365.00. We did not include the price option for SCE&G to construct deep-water structures from recycled materials, but installation costs should be similar. This includes installation of one buoy (\$200) per site. We did not include a cost for periodic replacement of the buoys during the new license.

TABLE 3-3 DEEP-WATER HABITAT ENHANCEMENT COSTS

NURSERY HABITAT ENHANCEMENT	
Structure Costs	\$46,865.00
Labor Costs	\$19,500.00
TOTAL COSTS	\$66,365.00

4.0 DISCUSSION

The TWC recommended aquatic habitat enhancements for Monticello Reservoir that should enhance fish production and recreational fishing on the reservoir. The total costs of implementing these habitat enhancements (based on 2016 costs) is approximately \$135,000 (Appendix B). These enhancements were proposed to offset the impacts of daily reservoir fluctuations and should create spawning and nursery habitat for juvenile fish that is not impacted by the maximum fluctuations. The placement of deep-water enhancements should also improve recreational fishing on the reservoir. Finally, implementation of this enhancement program should help to offset potential entrainment issues related to the operation of the Fairfield Development. Habitat structures have been located further up the lake away from the turbine intakes. Therefore, fish production and survival should be increased in the upper portions of the lake and these fish would be much less susceptible to entrainment by project operations.

5.0 PROTECTION MITIGATION AND ENHANCEMENT MEASURES

SCE&G proposes to provide these habitat enhancements on Monticello Reservoir as a Protection, Mitigation, and Enhancement measure (PME) for the renewal of the Parr Hydroelectric Project License.

Installation of both Nursery and Deepwater habitat enhancements are fairly straightforward.

- Within the first five years of the new license, SCE&G will install three Mossback Safe-Haven (or equivalent) structures for nursery habitat enhancements at each location identified in Appendix A of this report - for a total of 111 structures. These nursery habitat enhancements will require no long-term monitoring.
- Within the first five years of the new license, SCE&G will install deep-water habitat enhancements and buoy markers at 13 sites identified in Appendix A of this report. Each of these enhancements will consist of 11 Mossback Trophy Tree (or equivalent) structures (143 total) and 4 Mossback Trophy Tree XL (or equivalent) structures (52 total) for a total of 195 structures. These deep-water habitat enhancements will require no long-term monitoring.

Installation of the spawning structures will be performed more in an adaptive management approach. TWC members expressed concern that the plastic pools might not be resilient or be used by target fish species. Therefore, SCE&G will install these habitat enhancements in a

stepwise approach. Within the first three years of the new license, SCE&G will install 15 spawning beds as described in this report in each of the 8 coves (120 structures total) identified for spawning habitat enhancement as depicted in Appendix A of this report. The SCDNR noted during TWC discussions that they may request an alternate spawning bed material and that a variety of spawning substrate materials (pea gravel/sand) of various sizes and/or depth of substrates within the spawning structure may be evaluated on these initial installations. SCE&G and SCDNR will consult to develop a test matrix to evaluate the effects of these and other variables on the preference of fish to use the structure for spawning. The installed spawning beds will be inspected by SCE&G (possibly by underwater camera) after two spawning seasons for the condition of the structure and evidence of use for fish spawning. SCE&G will report observations to SCDNR and consult on the installation of up to 240 (30 structures per 8 locations) additional spawning beds to be installed over the following two years after completion of consultation.

6.0 REFERENCES

Kleinschmidt. 2013. *Baseline Fisheries Resources Report: Parr Hydroelectric Project*. Prepared for SCE&G by Kleinschmidt Associates, Lexington, SC. November 2013.

Kleinschmidt. 2016. *Parr and Monticello Reservoir Fluctuation Study*. Prepared for SCE&G by Kleinschmidt Associates, Lexington, SC. February 2016.

Mossback Fish Habitat. www.mossbackrack.com. Web. January 2016.

Wagner, Eric. "Review of Fish Habitat Improvement Methods for Freshwater Reservoirs." *Utah Division of Wildlife Resources*. N.p., n.d. Web. Apr. 2016.

APPENDIX A

MONTICELLO RESERVOIR HABITAT ENHANCEMENT AREAS

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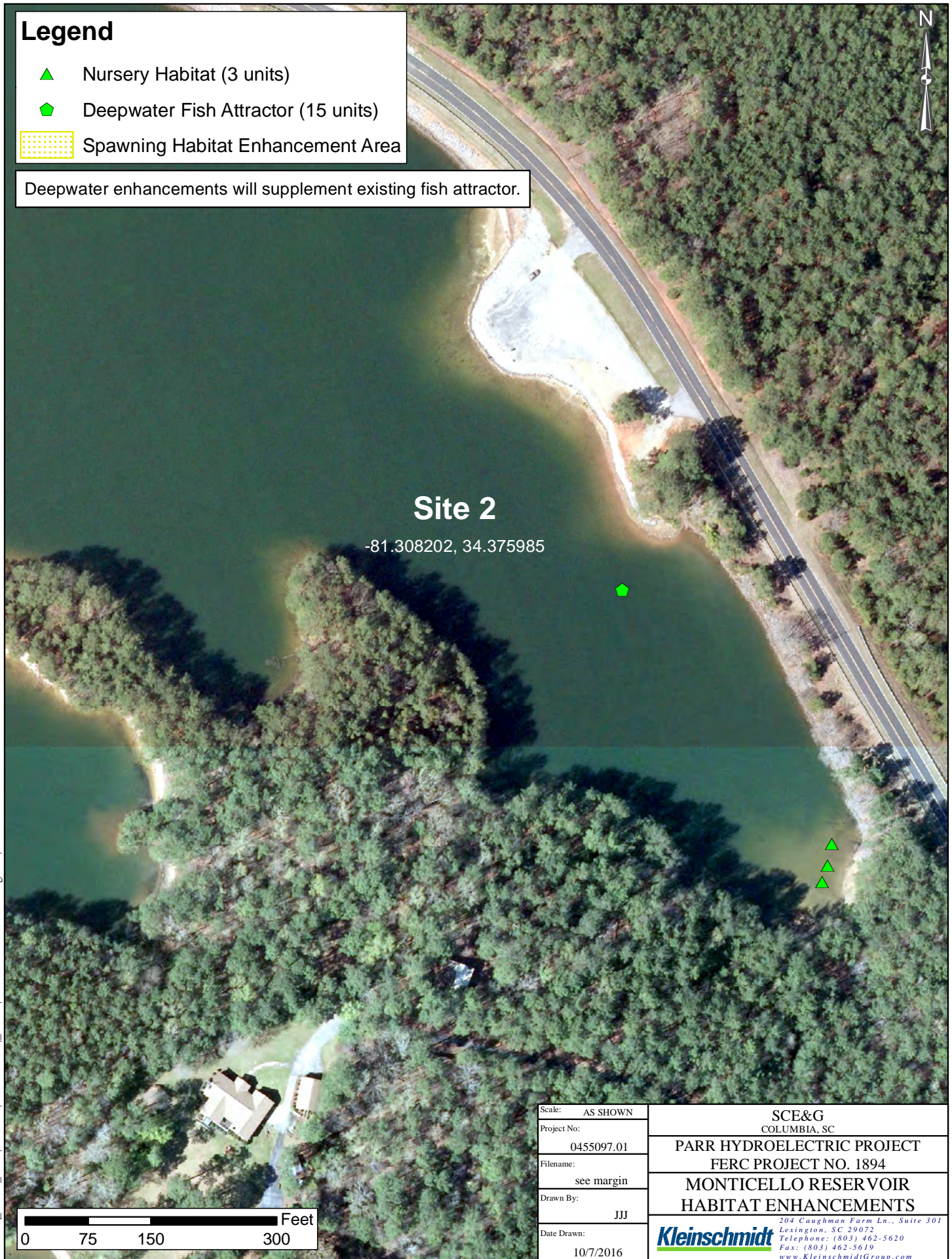


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Filename:	see margin	MONTICELLO RESERVOIR HABITAT ENHANCEMENTS	
Drawn By:	JJJ	Kleinschmidt 204 Coughman Farm Ln., Suite 301 Lexington, SC 29072 Telephone: (803) 462-5620 Fax: (803) 462-5619 www.KleinschmidtGroup.com	
Date Drawn:	10/7/2016		

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Legend

- ▲ Nursery Habitat (3 units)
- ◆ Deepwater Fish Attractor (15 units)
- ▨ Spawning Habitat Enhancement Area



Site 5

-81.327358, 34.36236



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Date Drawn:	10/7/2016	Kleinschmidt

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Legend

-  Nursery Habitat (3 units)
-  Deepwater Fish Attractor (15 units)
-  Spawning Habitat Enhancement Area

Deepwater enhancements will supplement existing fish attractor.

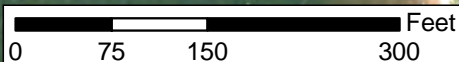


Site 8

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Date Drawn:	10/7/2016

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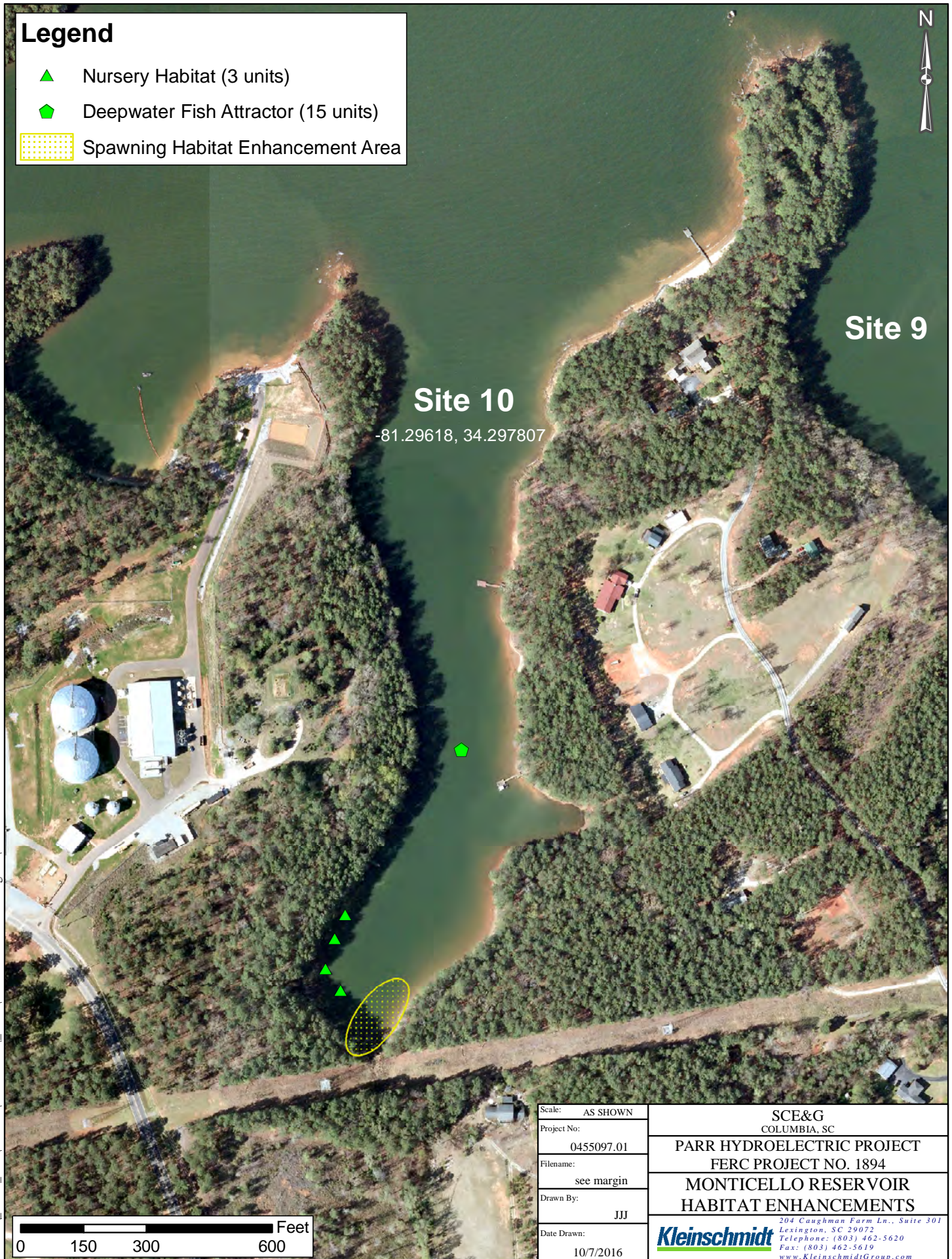
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Date Drawn:	10/7/2016	Kleinschmidt




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Source: Kleinschmidt, Orbis, SCE&G

Legend

-  Nursery Habitat (3 units)
-  Deepwater Fish Attractor (15 units)
-  Spawning Habitat Enhancement Area

Deepwater enhancements will supplement existing fish attractor.

Site 12

-81.333339, 34.344586



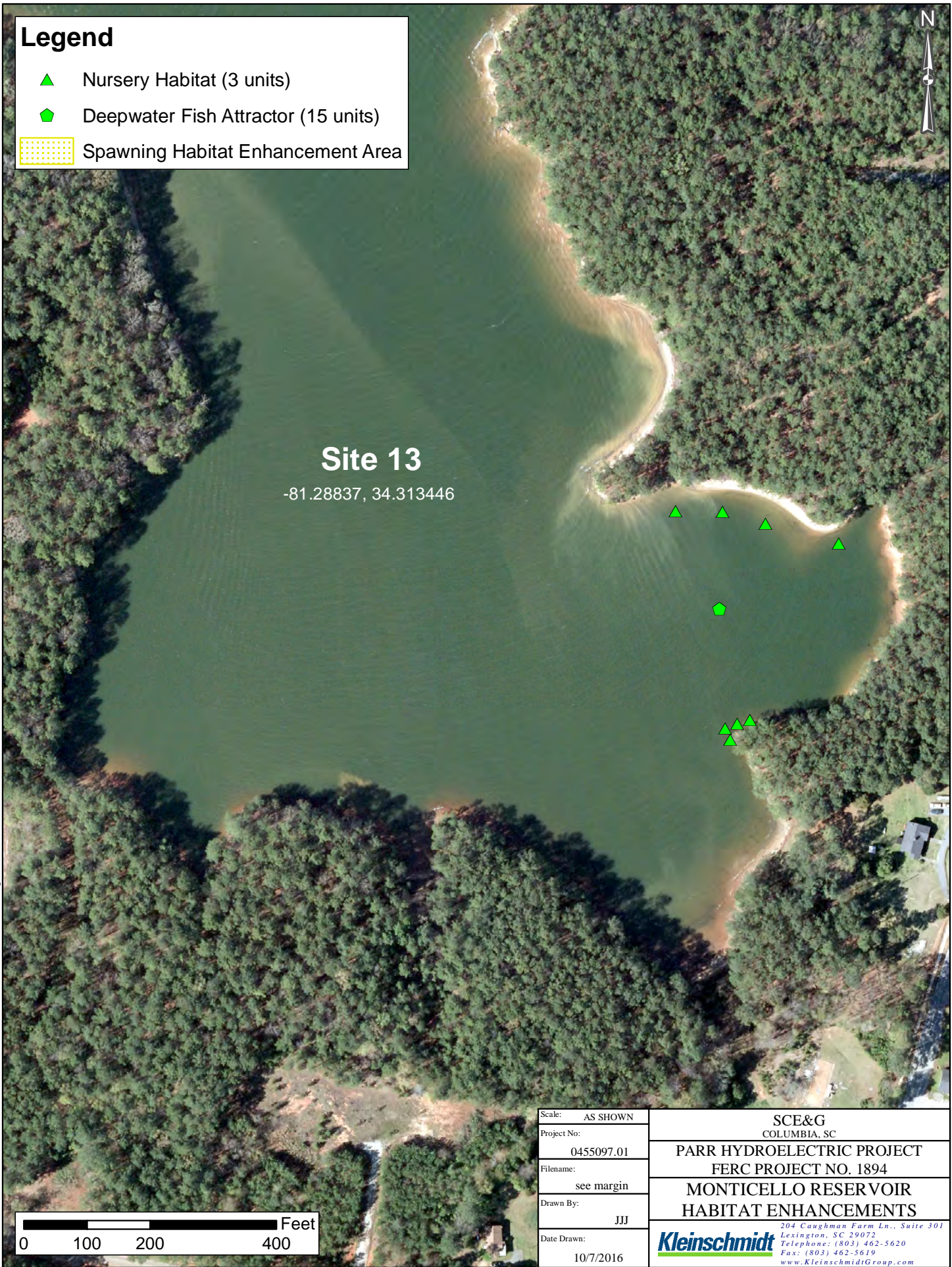
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APPENDIX B

MONTICELLO RESERVOIR HABITAT ESTIMATED ENHANCEMENT COSTS

Monticello Reservoir Habitat Enhancements Costs for Materials and for Installation						June 30, 2016
Enhancement Structure	Enhancement Locations	Structures per Enhancement Area	Total Structures	Costs per Structure	Total Structure Costs	Note that these prices are valid for 2016 only and do not include a CPI for future costs.
Spawning Bed	8	15	360	\$28.50	\$10,260.00	
Safe Haven	37	3	111	\$209.99	\$23,308.89	
Trophy Tree	13	11	143	\$179.00	\$25,597.00	
Trophy Tree XL	13	4	52	\$359.00	\$18,668.00	
Buoy Markers	13	1	13	\$200.00	\$2,600.00	
Total					\$80,433.89	

Labor Costs	Hours/day	\$/hr	\$/day	Installation Assumptions
Person 1	10	\$50	\$500	Day = 20 man-hours
Person 2	10	\$50	\$500	10 nursery structures/day
Total	20	\$50	\$1,000	10 deep-water structures/day
				15 spawning structures per day

Enhancement Type	Total Structure Costs	Install Speed (structure/day)	Install Days	Labor Costs (\$/day)	Total Labor Costs	Total PM&E Costs
Spawning Enhancement	\$10,260.00	15	24.0	\$1,000	\$24,000.00	\$34,260.00
Nursery Enhancement	\$23,308.89	10	11.1	\$1,000	\$11,100.00	\$34,408.89
Deep-water Enhancement	\$46,865.00	10	19.5	\$1,000	\$19,500.00	\$66,365.00
Total	\$80,433.89				\$54,600.00	\$135,033.89