

**Candidate Conservation Agreement (CCA) for Mollusks of the
Altamaha River Basin, Georgia**



**Georgia Power Company
U.S. Fish and Wildlife Service
Georgia Wildlife Resources Division**

April 2017

CONTENTS

Definitions	4
Introduction	5
Parties and Cooperators to the Agreement	5
Authority and Purpose	6
Description of the Project Site.....	7
Status of the Species.....	10
Threats to the Species.....	16
Conservation Measures	17
Notices and Reports.....	25
Adaptive Management	25
Funding Conservation Actions.....	26
Duration.....	27
Compliance.....	28
Signatures	30

LIST OF TABLES

Tables	Page
1 Geographic extent of surveys and conservation actions in each Project Area.....	19
2 Designated years of annual conservation actions for each Project Area.....	19

LIST OF APPENDICES

Appendices	Page
Appendix 1 References	31
Appendix 2 GPC Altamaha Basin Project Site Map.....	33
Appendix 3 GPC Detailed Project Area Maps.....	34
Appendix 4 Known distribution of Delicate Spike (<i>Elliptio arctata</i>) within Georgia.....	42
Appendix 5 Known rangewide distribution of Altamaha Arcmussel (<i>Alasmidonta arcula</i>).....	43
Appendix 6 Known rangewide distribution of Inflated Floater (<i>Pyganodon gibbosa</i>)	44
Appendix 7 Known distribution of Savannah Lilliput (<i>Toxolasma pullus</i>) within Georgia.....	45
Appendix 8 Known rangewide distribution of Reverse Pebblesnail (<i>Somatogyrus alcoviensis</i>)	46

DEFINITIONS

1. **Candidate Conservation Agreement (CCA)** – a voluntary conservation agreement between the U.S. Fish and Wildlife Service (Service) and one or more public or private parties. The Service works with its partners to identify threats to candidate species, plan the measures needed to address the threats and conserve these species, identify willing landowners, develop agreements, and design and implement conservation measures and monitor their effectiveness.

2. **Lloyd Shoals Hydro Project (LSHP), Sinclair Hydro Project (SHP), Wallace Hydro Project (WHP), Hatch Nuclear Project (HNP) and Plant Scherer Project (PSP)**. The hydropower facilities and reservoirs are owned by Georgia Power Company (GPC) and are licensed by the U.S. Federal Energy Regulatory Commission (FERC) under the following project numbers:
 - Project No. 2336 (Lloyd Shoals)
 - Project No. 1951 (Sinclair)
 - Project No. 2413 (Wallace)

GPC owns other properties referred to as “bulk properties” in association with HNP and PSP. Although they may be located at or near the developed portions of these facilities, they are considered as non-project lands owned fee-simple by Georgia Power, and are typically managed for forestry, wildlife, or other purposes. HNP and its associated bulk property, located in the Altamaha River basin near Baxley, Georgia is co-owned by GPC, Oglethorpe Power Corporation, Municipal Electrical Authority of Georgia, and Dalton Utilities. HNP is operated by Southern Nuclear Operating Company (a subsidiary of Southern Company) and licensed by the U.S. Nuclear Regulatory Commission (NRC). A large tract of the PSP, a coal-fired power facility, is managed by the Georgia Department of Natural Resources as the Rum Creek Wildlife Management Area. Other lands associated with PSP are defined here as bulk properties.

3. **Property Covered by this Agreement** – The properties described above are partially owned or owned in full by GPC within the Altamaha River basin.

4. **Parties** – Parties specified in section II of this Agreement are GPC and the Service. Georgia Department of Natural Resources (GDNR) is a Cooperator to the Agreement.

I. INTRODUCTION

This Agreement for the Delicate Spike (*Elliptio arctata*), Altamaha Arcmussel (*Alasmidonta arcula*), Inflated Floater (*Pyganodon gibbosa*), Savannah Lilliput (*Toxolasma pullus*), and Reverse Pebblesnail (*Somatogyrus alcoviensis*) has been developed as a collaborative and cooperative effort between GPC, Service, and GDNR, in order to implement conservation measures for the species. This Agreement allows for modifications to formally involve other State and private parties named in the agreement as cooperators. These conservation measures will be implemented in accordance with the Endangered Species Act (ESA) of 1973, as amended, 16 U.S.C. § 1531 *et. seq.*, and applicable Federal and State regulations. Successful implementation of this Agreement should reduce potential threats to the above species and their habitat.

II. PARTIES AND COOPERATORS TO THE AGREEMENT

A. Parties to the Agreement

Georgia Power Company (Property Owner)

GPC is an electric generation and land management subsidiary of Southern Company. GPC owns and operates the projects described in this Agreement, either partially or in full, located within Georgia's Altamaha River watershed. GPC designates the following individual as the contact for this Agreement:

Joe Ernest Slaughter, IV
Environmental Affairs
Georgia Power Company
2480 Maner Road
SE Atlanta,
Georgia 30339

U. S. Department of the Interior (Service)

The Service works to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The Southeast Region is committed to expanded partnerships, which offer innovative opportunities to enhance fish and wildlife resources. The Service will assist with technical matters and permit application development.

The Service designates the following individual as the Agreement Administrator for this Agreement:

Don Imm, PhD
Field Supervisor
U.S. Fish and Wildlife Service
Georgia Ecological Services Field Office
106 Westpark Drive, Suite D
Athens, Georgia 30606
706-613-9493

B. Cooperators to the Agreement

Georgia Department of Natural Resources-Wildlife Resources Division (GDNR)

The mission of GDNR is to sustain, enhance, protect and conserve Georgia's natural, historic and cultural resources for present and future generations, while recognizing the importance of promoting the development of commerce and industry that utilize sound environmental practices.

III. AUTHORITY AND PURPOSE

Sections 2, 7, and 10 of the ESA authorize the Service to enter into this Agreement. Section 2 of the ESA states that encouraging interested parties, through Federal financial assistance and a system of incentives, to develop and maintain conservation programs is essential to safeguarding the Nation's heritage in fish, wildlife, and plants. Section 7 of the ESA requires the Service to review the programs it administers and utilize those programs to further the purposes of the ESA. By entering into the Agreement, the Service is utilizing the CCA Programs to further the conservation of the Nation's fish and wildlife. The purpose of this Agreement is to:

- A. Implement conservation measures for the Delicate Spike, Altamaha Arcmussel, Inflated Floater, Savannah Lilliput, and Reverse Pebblesnail through cooperative work among the Parties and Cooperators to conserve existing populations of these species within GPC's project areas in the Altamaha River Basin.
- B. Increase the understanding of these species' habitat requirements, taxonomy, and life history characteristics so that population expansion and augmentation can be achieved.

The use of a CCA is appropriate because the Delicate Spike is listed as State Endangered, the Altamaha Arcmussel and the Savannah Lilliput are listed as State Threatened, the Inflated Floater is listed as G3 (Vulnerable) across its range, and the Reverse Pebblesnail is listed as G1Q (Critically Imperiled with questionable taxonomy) across its range and S1 (State Imperiled) in Georgia. In 2010, the Service was petitioned by the Center for Biological Diversity (CBD) to federally-list all five of these species and issued a positive 90-day finding stating that a status review was warranted (76 FR 59836). Subsequently, CBD withdrew their petition for several species, including Altamaha Arcmussel, Inflated Floater (Tierra R. Curry's December 17, 2015, letter to the Service) and the Savannah Lilliput (Tierra R. Curry's January 17, 2017 letter to the Service).

In providing for CCAs, the Service did not intend to exclude species that are not officially listed as candidate species, but are nevertheless at risk if populations decline (see the Final Policy, page 32732). Instead, the Service recognizes that taking steps before a species enters into a serious decline is often the most effective way to conserve that species, thereby possibly precluding the need to list the species under the ESA. The conservation measures included in this CCA will help to ensure that these species do not need protection under the ESA in the future.

All Parties to this Agreement recognize that there are specific statutory responsibilities that cannot be delegated by the GDNR or the Service, particularly with respect to the management and conservation of natural resources. Similarly, it is recognized by all Parties that GPC's specific responsibilities with regard to these species are described by and limited to the terms of this Agreement. This Agreement is subject to and is intended to be consistent with all applicable Federal and State laws.

IV. DESCRIPTION OF THE PROJECT SITE

The Project Site is comprised of multiple non-contiguous GPC project areas located across various portions of the upper and middle sections of the Altamaha River Basin, Georgia (Appendix 2). Collectively, those areas include 672 miles of shoreline that offer long-term buffering potential between lands that lay adjacent to lake and riverine habitats. A GPC project area may include:

- a particular GPC-owned FERC hydro facility or other managed facility such as Rum Creek WMA where lacustrine or riverine shorelines exist, or
- a non-project bulk property where shorelines occur.

GPC's Land Department-based Forestry Program manages company-owned bulk properties following four primary objectives. Bulk properties are most often geographically adjacent

to GPC infrastructure such as sub-stations, powerline corridors, or power plant facilities. Specifically, GPC’s land asset management objectives:

- support GPC’s core business, biomass, and sustainability initiatives;
- promote the use of company natural resources for the general public and provide opportunities for outdoor recreation;
- wisely utilize the company’s renewable resources for revenue generation; and
- protect and enhance the scenic, environmental, wildlife, recreational and historical values of forestland assets.

For the purpose of scientific investigations of freshwater mollusks listed in this CCA, the term “project area” also may include free-flowing reaches of rivers in the vicinities of any of those types of GPC-owned parcels. Detailed project area maps (Appendix 3; Pages 1-8) delineate GPC-owned lands in the Project Site. The maps depict riparian areas, currently color-coded in red, as GPC-owned but privately-leased properties that implement a 25-foot buffer (the maintenance of a 25-foot buffer on warm water waterbodies complies with OCGA 12-7-1 Georgia Erosion and Sedimentation Control Act). Areas color-coded in yellow and green depict 100 to 300-foot riparian buffers on GPC non-leased, non-developed lands, respectively.

The Project Site includes:

A. Lloyd Shoals Hydro Project (LSHP) (Appendix 3; Page 1) and free-flowing reaches of the Ocmulgee River downstream:

The Lloyd Shoals Hydropower Project (LSHP) was completed in 1911 and is located on the Ocmulgee River in Butts, Henry, Jasper, and Newton counties, Georgia. The facility has a nameplate generation capacity of 18 megawatts (MW). The impoundment, Jackson Lake, has a full- pool surface area of 4,750 acres currently maintained at 529.55 ft. MSL (mean sea level NAVD 1988), a gross storage capacity of 107,000 acre-feet, and 135 miles of shoreline. During normal inflow periods the reservoir level fluctuates, depending on plant operations.

Regarding drawdown on GPC reservoirs, there are many factors that affect GPC’s decision and need for drawdown, including, but not limited to drought, dam safety, turbine/generator equipment maintenance requirements, and homeowner maintenance needs. GPC’s lake management plan for LSHP changed after 2013 following installation of the Obermeyer gates (reservoir-level control). Currently, LSHP drawdowns are scheduled generally to occur every 3 years with drawdown depth ranging possibly from 5 to 7 feet full pool. Prior to 2013, drawdowns were often conducted annually and as deep as 8 feet

below full pool. The next scheduled drawdown for LSHP is in 2018 and is expected to occur sometime in September through November, when inflows are typically lowest.

B. Plant Scherer Project (PSP) (Appendix 3; Page 2):

Plant Scherer is a coal-fired power plant co-owned by GPC, Oglethorpe Power Corporation, Municipal Electrical Authority of Georgia, Gulf Power Company, Jacksonville Electric Authority, and Dalton Utilities. The facility is located in Juliette, Georgia in Monroe County just north of Macon and approximately 70 miles south of Atlanta. The facility's four coal-fired power units have a combined nameplate generation capacity of 3,272 MW. The facility is located next to Lake Juliette on 3,500 acres and began commercial operation in 1982 with Lake Juliette serving as a cooling water source for the facility. Lake Juliette is an impoundment of Rum Creek and receives make-up water pumped from the Ocmulgee River nearby. A 5,739-acre section of facility property is managed by the GDNR as Rum Creek Wildlife Management Area (WMA). For the purposes of this CCA, this project area includes the Rum Creek WMA lands, Lake Juliette, and other GPC bulk properties adjacent to the Ocmulgee River in the vicinity. Surveys may be additionally conducted on free-flowing reaches of the Ocmulgee River in the vicinity of these bulk properties.

C. Wallace Hydro Project (WHP) (Appendix 3; Pages 3-5):

The WHP was completed in 1980 and is located approximately 10 miles upstream of Sinclair Dam in Hancock, Morgan, Putnam, and Greene counties, Georgia on the Oconee River arm of Lake Sinclair. The impoundment has a full-pool surface area of 19,050 acres (FERC 1995) with a 374 mile shoreline. It is operated as a pumped storage facility with SHP serving as the lower storage pool and has a nameplate generation capacity of 321.3 MW (FERC 1996). Reservoir drawdowns are not conducted in the WHP for homeowner shoreline maintenance; however, the lake is drawn down during extreme drought as it supplements the absolute minimum flows required by the downstream Sinclair Hydro Project (SHP). There may be times when a drawdown is necessary for hydro plant maintenance and repair work, but these are infrequent.

D. Sinclair Hydro Project (SHP) (Appendix 3; Pages 6-7) and free-flowing reaches of the Oconee River downstream:

The Sinclair Hydropower Project (SHP) was completed in 1952 and is located on the Oconee River near the town of Milledgeville in Baldwin County, Georgia.

The facility has a nameplate generation capacity of 45 MW, a hydraulic capacity of 8,000 cfs, and an average annual generation of approximately 124 gigawatts (GW). The impoundment has a full-pool surface area of 15,330 acres, a gross storage capacity of approximately 333,000 acre- feet, and 417 miles of shoreline. The SHP is operated in conjunction with the Wallace Hydropower Project (WHP). Operation of the WHP results in daily lake level fluctuations of about two feet in Lake Sinclair. GPC's past lake management practices for SHP generally included drawdown every 3-5 years to allow shoreline facility owners to perform maintenance to their facilities. These drawdowns usually occurred in December and January for approximately six weeks, and reduced the wetted perimeter along the shoreline in some areas out to a distance of 40 horizontal feet from the full pool (340 ft. PD) bankside. Drawdown frequency for SHP is designed to occur approximately once every five years. SHP drawdown depth is constrained by water elevation needs at the Wallace pumpback facility. Since 1998, maximum reservoir drawdown elevations in SHP averaged about 5.9 feet below full pool. Future drawdowns will most likely occur during the fall during drier months, when inflows are lowest.

E. Hatch Nuclear Project (HNP) (Appendix 3; Page 8)

Hatch Nuclear Project is co-owned by GPC, Oglethorpe Power Corporation, Municipal Electrical Authority of Georgia, and Dalton Utilities. Located near Baxley, Georgia, it is operated by Southern Nuclear Operating Company, a subsidiary of Southern Company. HNP is licensed by the U.S. Nuclear Regulatory Commission (NRC). Commercial operation at Plant Hatch began in 1975. HNP's two generation units have a combined nameplate capacity of 1,848 MW. This HNP site has no bulk properties associated with it. However, all non-developed HNP property adjacent to the Altamaha River currently receives 300-foot buffer protection. The HNP project area includes adjacent free-flowing reaches of the Altamaha River in the vicinity of the plant.

V. STATUS OF THE SPECIES

A. Delicate Spike

Elliptio arctata (Conrad 1834), the Delicate Spike, was described from the Black Warrior and Alabama Rivers in Alabama. The species attains a maximum length of 90 millimeters and is laterally compressed. The outline is elliptical and elongated, with older individuals often being arcuate in shape. It has a rounded anterior margin, straight to slightly concave ventral margin, and a straight to slightly curved dorsal margin. The posterior margin can be truncate, rounded, or bluntly pointed, with a low

and rounded posterior ridge that may be doubled posteroventrally. It has a low posterior slope that is flat to concave. The umbo is low, broad, and does not exhibit sculpturing, except in young individuals. The periostracum can be olive, brown, or black and can occasionally have variable dark green rays. It has small, low, and triangular pseudocardinal teeth and long, thin, and straight to slightly curved lateral teeth. It exhibits a moderately long, narrow interdentum and a shallow, wide umbo cavity. The nacre is often discolored and is typically bluish-white, but is occasionally purplish. Synonyms of the species have included *Unio strigosus*, *Unio tortivus*, *Unio perstriatus*, *Unio gracilentus*, *Unio viridans*, and *Unio perlatus*. Several of these synonyms were described from the Savannah River Basin of South Carolina and Georgia and the Catawba and Cape Fear Basins of North Carolina.

a. Habitat

The Delicate Spike primarily occurs in lotic (flowing) systems with moderate current, often in crevices and beneath large cobble or boulders; it can also be found among roots in beds of macrophytes (Williams et al. 2008).

b. Diet

Native unionids feed on phytoplankton, bacteria and particulate organic matter from the water column but diets may change throughout their lives (Vaughn and Hakenkamp 2001).

c. Life History

Little is known regarding the life history of this species. Most native freshwater mussels have an obligate parasitic larval stage (glochidia) in which the larvae must parasitize suitable host fishes. The adult mussels expel glochidia which must attach to an appropriate host. The Delicate Spike is gravid in spring to early summer, but glochidial hosts are currently unknown (Williams et al. 2008; Wisniewski 2008).

d. Range

The Delicate Spike has been found in most eastern Gulf Coast drainages, from the Apalachicola River Basin in Georgia and Florida to a western boundary of the Pearl River Basin in Mississippi. In Alabama, it is rare in the headwaters of the Chipola, Choctawhatchee, and Conecuh drainages, and possibly a few Chattahoochee River tributaries. In the Mobile River Basin populations are widespread, occurring both above and below the Fall Line, but uncommon and

highly fragmented. The largest known populations in the Mobile River Basin are in the Alabama River below Claiborne Lock & Dam and the Cahaba River (Williams et al. 2008).

Specimens resembling *E. arctata* have also been collected in Atlantic Slope drainages from the Cape Fear River south to the Altamaha River, Georgia (J. Wisniewski, GDNR, 2014, pers. comm.). *E. arctata* may be the *Elliptio* sp. that is present below LSHP on the Ocmulgee River, known to extend downstream to the Altamaha River near Jesup, Georgia (Appendix 4). Molecular taxonomy research is necessary to definitively determine if this species is in fact the Delicate Spike.

B. Altamaha Arcmussel

Alasmidonta arcula (Lea 1838), the Altamaha Arcmussel, was described from the lower Altamaha River in Liberty (now Long) County, Georgia. The species rarely exceeds 80 millimeters in length and has a delicate, inflated shell, often with distinct concentric sculpturing near the umbo. The umbo is elevated above the hinge line and positioned centrally to slightly anterior of the triangulate shell. Adults of this species typically have brown to yellow periostracum with dark rays and a posterior ridge that is sharp and straight. The right valve has one delicate pseudocardinal tooth and a short, delicate lateral tooth; the left valve has one to two delicate, serrated pseudocardinal teeth with absent or reduced lateral teeth. The beak cavity is shallow and the nacre is typically white or iridescent.

a. Habitat

The Altamaha Arcmussel inhabits both riverine and reservoir habitats of the Coastal Plain and Piedmont physiographic provinces. The species is most frequently found in habitats consisting of low shear stress, depositional areas often associated with edge waters and pools in sand and mud substrates. They were most commonly found in fine sandy substrates and along gently sloping banks with low hanging willows and soft mud in the Altamaha River (Meador et al. 2011). Individuals have been infrequently found in pools that were 2-3 meters deep with coarse sand and gravel substrates (Wisniewski 2008).

b. Diet

Native unionids feed on phytoplankton, bacteria and particulate organic matter

from the water column but diets may change throughout their lives (Vaughn and Hakenkamp 2001).

c. Life History

Little is known regarding the life history of this species. Most native freshwater mussels have glochidia in which the larvae must parasitize suitable host fishes. The adult mussels expel glochidia, which must attach to an appropriate host. The Altamaha Arcmussel is gravid beginning in mid-October, and glochidia have successfully transformed on the Robust Redhorse (*Moxostoma robustum*) and Striped Jumprock (*Moxostoma rupiscartes*); hence this species may be specialized in using Catostomids as its hosts (Johnson et al. 2012).

d. Range

The Altamaha Arcmussel was historically considered endemic to the Altamaha River Basin. However, recent collections of conchologically similar animals have been collected from the Ogeechee and Savannah Rivers (J. Wisniewski, GDNR, pers. comm.). The species is currently present in the Altamaha River, Ocmulgee River, the lower Oconee River, and also recently discovered in Lake Jackson, the impoundment of the LSHP (Appendix 5).

C. Inflated Floater

Pyganondon gibbosa (Say 1824), the Inflated Floater, was presumably described from South Carolina but the type specimen was lost. Johnson (1970) restricted the type locality to the Altamaha River, Hopeton, near Darien, McIntosh County, Georgia. The species has a thin, delicate, and greatly inflated shell. The species is elongate and elliptical in outline, with the anterior margin narrowly rounded, the posterior margin bluntly pointed to slightly truncate, and the ventral margin broadly rounded. The posterior ridge is narrowly rounded to angular. Umbos are inflated and elevated well above the hinge line and positioned anterior to the middle of the shell. A dorsal wing is present posterior to the umbo and very prominent on young individuals. The periostracum of this species is typically glossy green to brown, with or without fine rays. Pseudocardinal and lateral teeth are absent from both valves, the umbo cavity is moderately deep, and the nacre is white.

a. Habitat

The Inflated Floater has been most frequently captured in pools and slackwater

areas in rivers and reservoirs with soft substrates of mud, silt, or fine sand, but has been infrequently found in other habitats (Meador et al. 2011).

b. Diet

Native unionids feed on phytoplankton, bacteria and particulate organic matter from the water column but diets may change throughout their lives (Vaughn and Hakenkamp 2001).

c. Life History

Little is known regarding the life history of this species. Most native freshwater mussels have glochidia in which the larvae must parasitize suitable host fishes. The adult mussels expel glochidia, which must attach to an appropriate host. The glochidial hosts for the Inflated Floater are currently unknown.

d. Range

The Inflated Floater is presumably endemic to the Altamaha Basin. However the species was originally described from a lost specimen collected in South Carolina and Johnson (1970) designated a Lectotype (a specimen later selected to serve as the single type specimen) and restricted it to the Altamaha River. This species has been found in the Ocmulgee River (including Lake Jackson in the LSHP), Ochopee River, Oconee River (including Lake Oconee of the WHP), and the Altamaha River (J. Wisniewski, GDNR, 2015, pers. comm.) (Appendix 6).

D. Savannah Lilliput

Toxolasma pullus (Conrad 1838), the Savannah Lilliput, was described from the Wateree River, South Carolina. The shell is small, typically less than 35 millimeters in length, with valves that are somewhat thick and inflated. In females the anterior margin rounded and the ventral margin is straight to convex. In males the posterior margin is typically broadly pointed while more truncated or broadly rounded in mature females. The umbo typically elevates to the hinge line or slightly above and the periostracum is usually satiny and black or brown. The left valve has two triangular pseudocardinal teeth and short straight lateral teeth; the right valve has one triangular pseudocardinal tooth and one

lateral tooth. The umbo pocket is shallow with nacre that is variable in color, ranging from bluish-white to pink, purple, or iridescent.

a. Habitat

The Savannah Lilliput inhabits shallow waters at the edge of streams, rivers and lakes with mud or silty sand substrate near banks; they also may occur in backwaters. This species is rarely found in deep water (Bogan and Alderman 2008).

b. Diet

Native unionids feed on phytoplankton, bacteria and particulate organic matter from the water column but diets may change throughout their lives (Vaughn and Hakenkamp 2001).

c. Life History

Little is known regarding the life history of this species in the Altamaha River Basin. Most native freshwater mussels have glochidia in which the larvae must parasitize suitable host fishes. The adult mussels expel glochidia, which must attach to an appropriate host. The Savannah Lilliput is a long-term brooder, and has been reported gravid from late April to early August (Hanlon and Levine 2004). Glochidia have successfully transformed on hybrid sunfish (*Lepomis* sp.), thus transformation likely occurs on other species of *Lepomis* (Hanlon and Levine 2004).

d. Range

The range for this species is from the Altamaha River Basin in Georgia to the Neuse River Basin in North Carolina (Bogan and Alderman 2008). In Georgia, it is found within the Savannah, Ogeechee, and Altamaha Basins (Wisniewski 2008). It has most recently been collected from a slough in the lower Altamaha River and Alex Creek, a tributary to the lower Altamaha (J. Wisniewski, GDNR, 2012, pers. comm.; Dinkins 2007) (Appendix 7).

E. Reverse Pebblesnail

Somatogyus alcoviensis (Krieger 1972), the Reverse Pebblesnail, is a freshwater snail historically known from two locations in Newton County, Georgia. The species is small

and globose, often with a shell size of less than 3 mm. The species is distinguished from others similar to it by the shape and structure of the verge of their penis (J. Wisniewski, pers. comm. 2016).

a. Habitat

The Reverse Pebblesnail has been found in shoals with rapidly flowing water, on surfaces of gravel, cobble, boulder, and bedrock, as well as vegetation (*Podostemum ceratophyllum*). The species is absent from silty substrates (Watson 2000).

b. Diet

Little is known about the diet of the Reverse Pebblesnail, though members of the Hydrobiidae family often feed on algae, diatoms, and detritus found in their freshwater habitats (Wikipedia, accessed February 9, 2016).

c. Life History

Little is known regarding the life history of the Reverse Pebblesnail. Snails in Hydrobiidae are small in their juvenile state in spring, reaching maturity by early fall (J. Wisniewski, GDNR, 2016, pers. comm.).

d. Range

The Reverse Pebblesnail is known from two locations in Newton County, Georgia: the Alcovy River at Factory Shoals, and the Yellow River at Cedar Shoals. Observed by Watson (2000) in both of these locations, the species was confirmed at the Factory Shoals location most recently in 2012 by J. Wisniewski (GDNR, 2016, pers. comm.) (Appendix 8).

VI. THREATS TO THE SPECIES

Water demands are expected to increase in the future, posing a threat in the form of decreases in river flows, decreases in reservoir water level management flexibility, and/or increases in domestic wastewater effluent and construction of new impoundments. Dam operations can result in incompatible habitat and water quality for these freshwater mollusk species, as well as fragmentation of populations. Non-native, invasive species, such as the introduced Flathead Catfish (*Pylodictus olivaris*) and Blue Catfish (*Ictalurus*

furcatus), may be reducing native mussel populations through direct consumption of mussels or consumption of their host fishes. Hybridization of the Savannah Lilliput with the Lilliput (*Toxolasma parvum*), which is invasive, could also be a possible threat. Impactful activities in riparian zones adjacent to mollusk habitats can negatively affect mollusks and their associated aquatic community. These impacts/threats can result from poorly maintained riparian buffers, direct impacts to riparian vegetation and soil stability such as unregulated use of all-terrain vehicles (ATVs), and erosion from poorly controlled excess point source run-off or soils impacted by cattle use. A variety of land-uses including poorly managed agriculture and silviculture can lead to excess sedimentation as well as introduction of herbicides and pesticides into aquatic systems. Riparian management and protection can help mitigate these threats. In addition, increased bacteria, pathogens, nutrient loads, and other pollutants in water systems can originate from animal waste and domestic wastewater systems. Because of these threats, increasing the understanding of the species' ranges, habitat requirements, taxonomy, and life histories of imperiled mollusk species in the Altamaha Basin is important. Protecting riparian buffer zones on GPC properties, educating landowners regarding the importance of riparian buffer zones, property runoff effects to water quality, and the ecosystem services provided by freshwater mussels, as well as suitably managing GPC reservoir water levels for freshwater mussels, generally, are measures in best management practices (BMP) that can be undertaken to alleviate threats to these imperiled species.

VII. CONSERVATION MEASURES

To accomplish the objectives of this Agreement, the Parties agree to undertake the conservation measures described herein. Actions taken under this Agreement are cooperative and voluntary, and subject to the limitations specified herein, and may help with the understanding of the habitat and life history requirements for these species, as well as alleviating threats to these species within the Altamaha River Basin.

A. Conservation Benefits

This agreement is expected to benefit the Delicate Spike, Altamaha Arcmussel, Inflated Floater, Savannah Lilliput, and Reverse Pebblesnail by implementing the following objectives:

Objective 1 - Increasing the understanding of the species' range, habitat requirements, taxonomy, and/or life histories.

Through this objective, the Parties will ensure that surveys are conducted to determine the

extent of these species' distributions in the Altamaha River Basin, especially in the vicinities of the GPC project areas described in this Agreement. Molecular research will be conducted to resolve taxonomic uncertainties and host fish research will be conducted to determine the fish species used in the development and dispersal for all four focal mussel species. Drawdown rate studies will be conducted for the mussel species in this Agreement that inhabit the GPC impoundments.

Objective 2 - Implementing conservation measures to conserve existing populations of these species within GPC's project areas in the Altamaha River Basin.

Through this objective the Parties will ensure that management actions are achieved, including but not limited to conserving lands that will include effective riparian buffers, implementing best management practices for forestry lands, implementing appropriate impoundment drawdown rates and restricting riparian access for ATVs at GPC projects described in this Agreement.

The Parties believe these objectives, specific to this Agreement, are reasonable and that they will help to reduce threats, contributing to the long-term conservation of the species. They will be accomplished through implementation of specific conservation actions, described below.

B. Conservation Actions

There are three primary categories of conservation actions for freshwater mollusks listed in this CCA. Those categories represent tasks to be distributed among field-, laboratory-, and watershed-based activities. Field-based tasks include conducting intensive searches for species occurrence used ultimately to document geographic distribution and habitat use. Laboratory-based tasks include molecular genetics research and conducting host fish trials and life history studies to result in ecological characterization and taxonomic distinction. Watershed-based tasks include management actions protective of riparian habitat that in turn will be protective of mollusks and associated aquatic organisms as appropriate throughout the Project Site. Those actions are represented by implementation of forestry/riparian zone BMPs including access restriction for ATVs, establishment and protection of expanded riparian buffers, and, potentially, modified GPC reservoir drawdown rates in the long-term depending on results of drawdown studies. In each case, shoreline/riparian zone habitats will be the focus of watershed tasks as guided by adaptive management needs through time.

For each species, and as appropriate through consultation with Service and GDNR, the geographic extent of mollusk surveys and conservation actions is intended as follows:

Table 1. Geographic extent of surveys and conservation actions in each Project Area.

<u>Project Areas</u>	<u>Geographic Extent</u>
LSHP	Shoreline segments within FERC project boundary and free flowing reaches of the Ocmulgee River downstream
WHP	Shoreline segments within FERC project boundary
SHP	Shoreline segments within FERC project boundary and free flowing reaches of the Oconee River downstream
HNP	Free flowing reaches of the Altamaha River in the vicinity of the facility
PSP	Rum Creek WMA, shoreline segments of Lake Juliette, and free flowing reaches of the Ocmulgee River in the vicinity

The Project Site encompasses a broad area with specific research objectives designed to aid conservation for the freshwater mollusks listed herein. The depth of resources and schedule requirements needed to conduct conservation actions are possible through an extended schedule. Unlike some of the research conservation actions that involve a one-time cost that can be achieved during the first few years of implementation, surveys would be conducted on a periodic basis throughout the term of this Agreement. The extended schedule allows for available resources to be distributed annually on a rotating basis among the five projects. When rotated on an extended period of 30 years, multiple repeated 5-year cycles of surveys can feasibly facilitate work in a focused manner to lead to the CCA goal. The following table (Table 2) describes the rotating five-year cycles of annual conservation actions designed for the Project Site:

Table 2. Designated years of annual conservation actions for each Project Area.

<u>Project Areas</u>	<u>Survey Years</u>
LSHP	2018, 2023, 2028, 2033, 2038, 2043
PSP	2019, 2024, 2029, 2034, 2039, 2044
HNP	2020, 2025, 2030, 2035, 2040, 2045
SHP	2021, 2026, 2031, 2036, 2041, 2046
WHP	2022, 2027, 2032, 2037, 2042, 2047

Conservation Need by Species

a. Delicate Spike

Updated surveys should be conducted to determine this species' distribution in the

Altamaha River Basin. Collections should be made during these surveys so that the taxonomy of the Delicate Spike can be investigated to determine if individuals collected from the Altamaha River Basin (Atlantic Slope drainage) are the same species as those from the Apalachicola River Basin and the Mobile Basin (Gulf Slope drainages). Host fish trials should also be conducted. Conducting species occupancy surveys in the upper Altamaha River Basin and a taxonomic review of this species in the Altamaha River Basin were identified as priority inventory and research needs in the 2015 Georgia State Wildlife Action Plan (SWAP). The conservation of this species will benefit from implementation of riparian best management actions, as described below.

1. Updated surveys in the Altamaha River Basin in riverine locations, especially in vicinity of the Project Site, should be conducted on a repeating five-year study area rotation as described above. Once the 5-year rotation is completed, the cycle will be repeated an additional five times during the 30-year duration of this Agreement. The survey design will follow recently applied intensive survey methods for mollusks as currently accepted by GDNR Nongame and Service.
2. Use tissue material from the individuals collected in the surveys mentioned above to genetically determine if the species in the Mobile, Apalachicola, and Altamaha River Basins is the Delicate Spike in the separate drainages.
3. Conduct laboratory host fish trials to determine the fish species used in development and dispersal.
4. Implement management actions on Project Site riverine shorelines in the Altamaha River Basin, including forestry BMPs on GPC upland bulk properties, restricted access of ATVs, and expanded riparian buffers (≥ 100 feet) on GPC-owned non-privately leased, non-developed lands for at least a minimum of the 30-year duration of this Agreement.

b. Altamaha Arcmussel

Updated surveys should be conducted to determine this species' distribution in the Altamaha River Basin. Collections should be made during these surveys so that the taxonomy of the Altamaha Arcmussel can be investigated to determine if individuals collected from the Altamaha River Basin are the same species as those from the Ogeechee and Savannah River Basins. Host fish trials should also be conducted. Drawdown rates should be studied to determine the effects to this species in GPC's lacustrine Project Sites and the rates adjusted, if warranted. Riparian buffers should be protected to avoid unnecessary bank disturbance and nutrient runoff as this species often is found in shallow areas near the water's edge. This species is in need of riparian BMPs as described below. In

developed, lacustrine areas, environmental review for shoreline structure permitting requirements should be further developed.

The 2015 Georgia State Wildlife Action Plan identified several priority actions for the conservation of this species: 1. Conduct an occupancy survey of the Oconee and Ocmulgee Rivers and those reservoirs located on them; 2. Resurvey the Altamaha River using the occupancy design utilized by Meador (2008) to assess population trends in approximately 2016-2018; 3. Work with reservoir managers to control the rate of reservoir drawdown to allow for mussels to track receding water; 4. Basic life-history studies; and 5. Develop propagation and culture techniques (GDNR 2015).

1. Updated surveys in both riverine and lacustrine locations within the Altamaha River Basin, especially in vicinity of the Project Site, should be conducted on the repeating five-year study area rotation described above. Once the 5-year rotation is completed, the cycle will be repeated an additional five times during the 30-year duration of this Agreement. The survey design will follow recently applied intensive survey methods for mollusks as currently accepted by GDNR Nongame and Service.
2. Use tissue material from the individuals collected in the surveys mentioned above to genetically determine if the species in the Altamaha, Ogeechee, and Savannah River Basins is the Altamaha Arcmussel in the separate drainages.
3. Conduct laboratory host fish trials to determine the fish species used in development and dispersal.
4. Study the effects of operational and drought-related, reservoir drawdown rates on Altamaha Arcmussel movement. Results from *in-situ* studies will be evaluated by parties of this agreement. As mutually agreed, additional technical expertise may be invited into the studies to assist in determining how and to what level of significance drawdown rate management can benefit Altamaha Arcmussel under normal operational and drought-caused constraints. Since the construction of lake level management enhancements at LSHP in 2013, the facility conducts reservoir drawdown once every 3 years as compared to annually prior to 2013. Implementation of drawdown studies will be made in concert with normal cycles of reservoir operations (i.e., drawdowns) and consistent with terms of the FERC license.
5. As applicable to GPC-owned or GPC-permitted homeowner lake properties, conditions provided in GPC's homeowner permitting program (construction, dredging, etc.) that address protection of protected species and/or their critical habitats will be followed.

6. Implement management actions on Project Site riverine shorelines in the Altamaha River Basin, including forestry BMPs on GPC upland bulk properties, restricted access of ATVs, and expanded riparian buffers (≥ 100 feet) on GPC-owned non-privately leased, non- developed lands for at least a minimum of the 30-year duration of this Agreement.

c. Inflated Floater

Updated surveys should be conducted to determine this species' distribution in the Altamaha River Basin. Collections should be made during these surveys so that the taxonomy of the Inflated Floater can be investigated. Host fish trials should also be conducted. Drawdown rates should be studied to determine the effects to this species in GPC's lacustrine Project Sites and the rates adjusted, if needed. Riparian buffers should be protected to avoid unnecessary bank disturbance and nutrient runoff as this species often is found in shallow areas near the water's edge. Conservation for this species will benefit from implementation of riparian BMPs as described below. In developed, lacustrine areas, environmental review for shoreline structure permitting requirements should be further developed.

1. Updated surveys in both riverine and lacustrine locations within the Altamaha River Basin, especially in vicinity of the Project Site, should be conducted on the repeating five-year study area rotation described above. Once the 5-year rotation is completed, the cycle will be repeated an additional five times during the 30-year duration of this Agreement. The survey design will follow recently applied intensive survey methods for mollusks as currently accepted by GDNR Nongame and Service.
2. Use tissue material from the individuals collected in the surveys mentioned above to genetically determine if the Inflated Floater is in fact a separate species from the Eastern Floater (*Pyganodon cataracta*).
3. Conduct laboratory host fish trials to determine the fish species used in development and dispersal.
4. Study the effects of drawdown rates on Inflated Floater movement if in GPC lakes subject to drawdown management practices. Results from *in-situ* studies will be evaluated by parties of this agreement. As mutually agreed, additional technical expertise may be invited into the studies to assist in determining how and to what level of significance drawdown rate management can benefit Inflated Floater under normal operational and drought-caused constraints.

5. As applicable to GPC-owned or GPC-permitted homeowner lake properties, conditions provided in GPC's homeowner permitting program (construction, dredging, etc.) that address protection of protected species and/or their critical habitats will be followed.
6. Implement management actions on GPC's Project Sites in the Altamaha River Basin, including the implementation of forestry BMPs on GPC non-developed uplands, restricted access of ATVs, and expanded riparian buffers (≥ 100 feet) on GPC-owned non-privately leased, non-developed lands for at least a minimum of the 30-year duration of this Agreement.

d. Savannah lilliput

Updated surveys should be conducted to determine this species' distribution in the Altamaha River Basin. Host fish trials should also be conducted. Riparian buffers should be protected to avoid unnecessary bank disturbance and nutrient runoff as this species often is found in shallow areas near the water's edge. Conservation of this species will benefit from implementation of riparian BMPs as described below. If the species is located in developed, lacustrine areas, shoreline permitting requirements should be further developed for reservoir structures conditioned for additional environmental review. Drawdown rates should be studied to determine the effects to this species in GPC's lacustrine Project Sites and the rates tweaked, as needed.

Destruction of habitat for the Savannah Lilliput by ATVs during exceptional drought was identified as a contributing reason for the decline of the species in the Ohoopce River (Stringfellow and Gagnon 2001). The 2015 Georgia State Wildlife *Action Plan* identified several priority conservation actions for this species: 1. Sample the lower reaches of the Altamaha and Ocmulgee Rivers with concentrations on backwater slough habitats connected to the rivers; 2. Manage instream flows for the species in the Savannah River and Altamaha River in the vicinity of Plant Hatch; 3. Identify suitable host fishes; and 4. Investigate the status and effects of the invasive Lilliput (*Toxolasma parvum*) on existing populations (i.e. hybridization, competition, etc.; GDNR 2015) along the waterway margins and in floodplain impoundments.

1. Updated surveys in both riverine and lacustrine locations within the Altamaha River Basin, especially in vicinity of the Project Site, should be conducted on the repeating five-year study area rotation described above. Once the 5-year rotation is completed, the cycle will be repeated an additional five times during the 30-year duration of this Agreement. The survey design will follow recently applied intensive survey methods for mollusks as currently accepted by GDNR Nongame and Service.

2. Use tissue material from the individuals collected in the surveys mentioned above to genetically determine if hybridization is occurring between the Savannah Lilliput and the non-native Lilliput.
3. Conduct laboratory host fish trials to determine the fish species used in development and dispersal.
4. If the Savannah Lilliput is located in a GPC lacustrine Project Site, study the effects of GPC lakes subject to drawdown management practices on its movement. Results from *in-situ* studies will be evaluated by parties of this agreement. As mutually agreed, additional technical expertise may be invited into the studies to assist in determining how and to what level of significance drawdown rate management can benefit Savannah Lilliput under normal operational and drought-caused constraints.
5. If the Savannah Lilliput is located in a GPC lacustrine Project Site, conditions provided in GPC's homeowner permitting program (construction, dredging, etc.) that address protection of protected species and/or their critical habitats will be followed.
6. Implement management actions on GPC's Project Sites in the Altamaha River Basin, including the implementation of forestry BMPs on GPC non-developed uplands, restricted access of ATVs, and expanded riparian buffers (≥ 100 feet) on GPC-owned non-privately leased, non-developed lands for at least a minimum of the 30-year duration of this Agreement.

e. Reverse Pebblesnail

Updated surveys should be conducted to determine this species' distribution in the Altamaha River Basin. Collections should be made during these surveys so that the taxonomy of the Reverse Pebblesnail can be confirmed and distinguished from closely related species in the *Somatogyrus* genus.

1. Updated surveys in riverine locations within the Altamaha River Basin, especially in vicinity of the Project Site, should be conducted on the repeating five-year study area rotation described above. Once the 5-year rotation is completed, the cycle will be repeated an additional five times during the 30-year duration of this Agreement. The survey design will follow recently applied intensive survey methods for mollusks as currently accepted by GDNR Nongame and Service.

2. Use tissue material from the individuals collected in the surveys mentioned above to genetically determine if the species is distinct from *Somatogyrus* spp. found in the separate drainages.

VIII. NOTICES AND REPORTS

The following reporting guidelines will be used by the Parties of this Agreement to evaluate the implemented conservation actions outlined in section VII, “Conservation Measures”.

GPC will ensure that the reports for contracted services are provided to the Parties and Cooperators of the Agreement after completion. In addition, GPC will prepare a comprehensive evaluation report after the end of each rotational five-year freshwater mollusk survey cycle and submit the report to the Service and Cooperators to this Agreement before 1 April of the following year; comprehensive evaluation reports will include a summary of field, watershed, and laboratory-based conservation actions. The frequency of submitting evaluation reports can be modified, if conditions warrant and all Parties agree. Any reports will provide the basis for a joint decision by the Parties as to whether the Agreement should be extended for another term.

In the event that any of the Parties to this Agreement determine that there are adverse conditions that may affect the success of the conservation measures of the species defined in this Agreement, such conditions will be reported to all the Parties.

Any notices and reports required by this Agreement shall be delivered to the persons listed in section II, at a minimum and as appropriate.

IX. ADAPTIVE MANAGEMENT

All Parties signed into this agreement recognize that implementation of conservation actions must be consistent with the concepts and principles of adaptive management. The effectiveness of the voluntary conservation actions, monitoring methods/results, and new technologies will be reviewed by the Service and GDNR with GPC on an on-going/as-needed basis. Upon evaluation, appropriate modifications to the conservation actions or removal of actions described in this CCA may be necessary to enhance the goals of the effort as appropriate. Nothing in this agreement will limit GPC’s ability to pursue modification from a CCA to a CCAA as driven by research discovery toward potential future interest in protecting mollusks in the Altamaha Basin.

GPC, its successors and assigns, expressly reserves the right to install, construct, reconstruct, replace, improve, upgrade, enhance, maintain, operate, use, repair, add on to, demolish, and or otherwise develop the property subject to this Agreement. Nothing contained herein shall be construed as limiting or affecting in any way, except as to wildlife conservation, the authority of the GPC in connection with the property subject to this Agreement.

Applying adaptive management generally follows six steps including:

- a. problem assessment
- b. design
- c. implementation
- d. monitoring
- e. evaluation, and
- f. adjustment.

Application of this process can enable a structured and thoughtful approach to adaptively manage in a manner that effectively deals with unforeseen problems and change.

This agreement may be revised as a result of adaptive management, provided all parties agree to the changes, to continue providing conservation benefits for the freshwater mollusk species described herein. A goal of this CCA is to ensure adequate conservation measures and sufficient adaptive management following the effective date of any decision to list mollusk species subject to this agreement.

X. FUNDING CONSERVATION ACTIONS

Funding for the field-based Conservation Actions, both in the form of monetary and in-kind services, will be provided by GPC in a manner that supports the 5-year repeating rotational cycle for the term of this Agreement, as set forth in the Conservation Actions section.

GPC will annually fund approved field-based conservation actions at level not to exceed \$44,500 for the duration of this agreement. Additionally, GPC will fund laboratory-research tasks during the life of the agreement period up to a cumulative total of \$150,000. In terms of labor and monetary expense, field-based tasks will comprise the bulk of total conservation effort actions each year.

Field-based work will be planned in coordination with GDNR and Service. To accomplish the field tasks, GPC will annually hire the services of a qualified mussel survey contractor/firm. GDNR, Service and GPC biologists will always be invited to participate in the surveys or as task oversight. The selected contractor must be recognized as qualified by GDNR and Service. Field-based tasks will be managed by GPC. Principal surveyors must have appropriate State and Federal permits authorizing collection of species listed in this agreement.

Laboratory-based work will include molecular genetics research, host fish trials and drawdown studies. It is anticipated that laboratory-based research needs will evolve at a pace that chronologically tracks along with progress realized from discovery and genetic sample material collections from field-based studies. Scopes of work desired for laboratory research will be collectively planned as far ahead as practical in coordination among GPC, GDNR and Service. GPC will contract the agreed scopes of lab work with a qualified research laboratory(ies). Qualified labs will be chosen as candidates for the work by GPC as guided by recommendations from GDNR and Service.

GPC will directly bear the cost of watershed-based tasks which include conservation management actions protective of riparian habitat as described above in Section VII “Conservation Actions” throughout the life of this agreement.

Additional resources may be applied to this project from other sources, but these are outside the scope of this Agreement. The Service has provided technical assistance in the Agreement and in providing in-kind services described herein.

Nothing in this Agreement will be construed by the Parties to require the obligation, appropriation, or expenditure of any funds from the U.S. Treasury. The Parties acknowledge that the Service will not be required under this Agreement to expend any Federal agency’s appropriated funds unless and until an authorized agency official affirmatively acts to commit such expenditures as evidenced in writing.

XI. DURATION

A. Term

This Agreement will be in effect for the duration of 30 years following its approval and signing by the Parties, subject to the limitations specified herein (see Section XII regarding compliance with existing FERC license obligations). The agreement commencement date will begin the day after receipt of completed authorized signatures.

B. Continuation

After this initial time period, further conservation and management efforts for the species may be addressed through an extension of this Agreement. A continuation of this Agreement must be made in writing and signed by all Parties.

C. Early Termination

If some portion of this Agreement cannot continue to be carried out or if cancellation is desired, GPC will notify the Service within 30 days of the changed circumstances. GPC will remain responsible for any outstanding conservation actions identified in section VI "Conservation Measures" until the early termination date is effective.

The Service may withdraw from this Agreement at any time by submitting a letter with 60 days' notice indicating the desire to terminate the Agreement. The Service will remain responsible for any outstanding conservation actions identified in Section VI, "Conservation Measures" until the early termination date is effective.

XII. COMPLIANCE

A. Federal Energy Regulatory Commission Compliance

Lands owned by GPC contemplated under this Agreement lie within the FERC project boundaries for the LSHP, SHP, and WHP. The current license for the LSHP expires on December 31, 2023, the SHP on April 30, 2036, and the WHP on May 31, 2020 (currently undergoing relicensing at the time of activation of this agreement). GPC operates and manages these hydropower projects in accordance with the terms of its FERC licenses and the applicable rules and regulations of FERC. No terms specified within this Agreement obligates GPC to take actions that may be inconsistent with the terms of their existing FERC licenses. Moreover, the Parties to this Agreement recognize that FERC has authority for the operation of these hydropower projects and may within its authority order GPC to take actions that could at any time affect the existing populations of these five mollusk species and the terms specified in this Agreement. As a Federal agency, FERC actions are subject to consultation requirements under section 7 of the ESA, as well as its own implementing guidance, including designation of a non-federal representative to conduct informal consultation and/or to prepare any biological assessment (50 CFR § 402.02).

B. Nuclear Regulatory Commission Compliance

Lands owned by GPC contemplated under this Agreement lie within the NRC project boundary for Plant Hatch. The current license for Plant Hatch expires in 2022. GPC operates and manages this nuclear project in accordance with the terms of its NRC license and the applicable rules and regulations of NRC. No terms specified within this Agreement obligates GPC to take actions that may be inconsistent with the terms of their existing NRC license. Moreover, the Parties to this Agreement recognize that NRC has authority for the operation of Plant Hatch and may within its authority order GPC to take actions that could at any time affect the existing populations of these mollusk species and the terms specified in this Agreement. As a Federal agency, NRC actions are subject to consultation requirements under section 7 of the ESA, as well as its own implementing guidance, including designation of a non-federal representative to conduct informal consultation and/or to prepare any biological assessment (50 CFR § 402.02).

APPENDIX 1. REFERENCES

- Bogan, A.E., and J. M. Alderman. 2008. Workbook and key to the freshwater bivalves of South Carolina. Revised Second Edition.
- Bogan, A.E., Y. Huang, M. Raley, and J.F. Levine. 2008. Intraspecific relationships in the freshwater bivalve genus *Alasmidonta* (Bivalvia: Unionidae). North Carolina Department of Transportation, North Carolina.
- Dinkins, G. 2007. Survey for the Native Mussels in Selected Tributaries to the Altamaha River, Georgia. Special Report No. 07-07. September 2007. National Council for Air and Stream Improvement. 32 pp.
- Federal Energy Regulatory Commission. 1996. Final Environmental Assessment for hydropower license, Sinclair Hydroelectric Project, FERC Project No. 1951-037, Georgia. March 19, 1996, Washington, D.C.
- Federal Energy Regulatory Commission. 1995. Environmental Assessment, Application for amendment of license, Wallace Project, FERC Project No. 2413, Georgia. December 1995, Washington, D.C.
- Federal Energy Regulatory Commission. 1993. Environmental Assessment, Lloyd Shoals Project, FERC Project No. 2336-009-Georgia. March 1993. Washington, D.C.
- Georgia Department of Natural Resources. 2015. Georgia State Wildlife Action Plan. Social Circle, GA: Georgia Department of Natural Resources.
- Georgia Power Company. 2014. Plant Hatch. Available at: <http://www.southerncompany.com/about-us/our-business/southern-nuclear/hatch.cshtml>. (Accessed on May 21, 2014).
- Georgia Power Company. 2011. Plant Hatch Fact Sheet. Available at: http://www.southerncompany.com/about-us/our-business/southern-nuclear/pdfs/Plant_Hatch_Fact_Sheet.pdf. March 2011. (Accessed on May 21, 2014).
- Hanlon S. D., and J. F. Levine. 2004. Notes on the life history and demographics of the Savannah Lilliput (*Toxolasma pullus*) (Bivalvia: Unionidae) in University Lake, North Carolina. Southeastern Naturalist 3(2): 289-296.
- Johnson, J.A., J.M. Wisniewski, A.K. Fritts, and R.B. Bringolf. 2012. Host identification and glochidia morphology of freshwater mussels from the Altamaha basin. Southeastern Naturalist 11(4): 733-746.
- Johnson, R.I. 1970. The systematics and zoogeography of the Unionidae (Molluska: Bivalvia) of the southern Atlantic slope regions. Bulletin of the Museum of Comparative Zoology 140(6): 263-449.

Meador, J., J.T. Peterson, and J.M. Wisniewski 2011. An evaluation of the factors influencing freshwater mussels capture probability, survival, and temporary emigration in a large lowland river. *Journal of the North American Benthological Society* 30:507-521.

Meador, J.R. 2008. The development and evaluation of a freshwater mussel sampling protocol for a large lowland river. MS Thesis, University of Georgia, Athens, Georgia.

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life. Available at: <http://explorer.natureserve.org>. (Accessed on September 2, 2015).

O'Brien, A.C., and J.D. Williams. 2002. Reproductive biology of four freshwater mussels (Bivalvia: Unionidae) endemic to eastern gulf coastal plain drainages of Alabama, Florida, and Georgia. *American Malacological Bulletin* 17: 147-158.

Stringfellow, R.C., and P. Gagnon. 2001. Final Report of the Altamaha Spiny mussel survey in the lower Oohoopee River. Final Report, U.S. Fish and Wildlife Service, Athens, GA. 10pp.

United States Fish and Wildlife Service. 2011. Endangered and threatened wildlife and plants; partial 90-day finding on a petition to list 404 species in the southeastern United States as endangered or threatened with critical habitat; proposed rule. September 27, 2011. *Federal Register* 76 (187): 59836-59862.

Vaughn, C.C., and C.C. Hakenkamp. 2001. The functional role of burrowing bivalves in freshwater ecosystems. *Freshwater Biology* 46: 1431-1446.

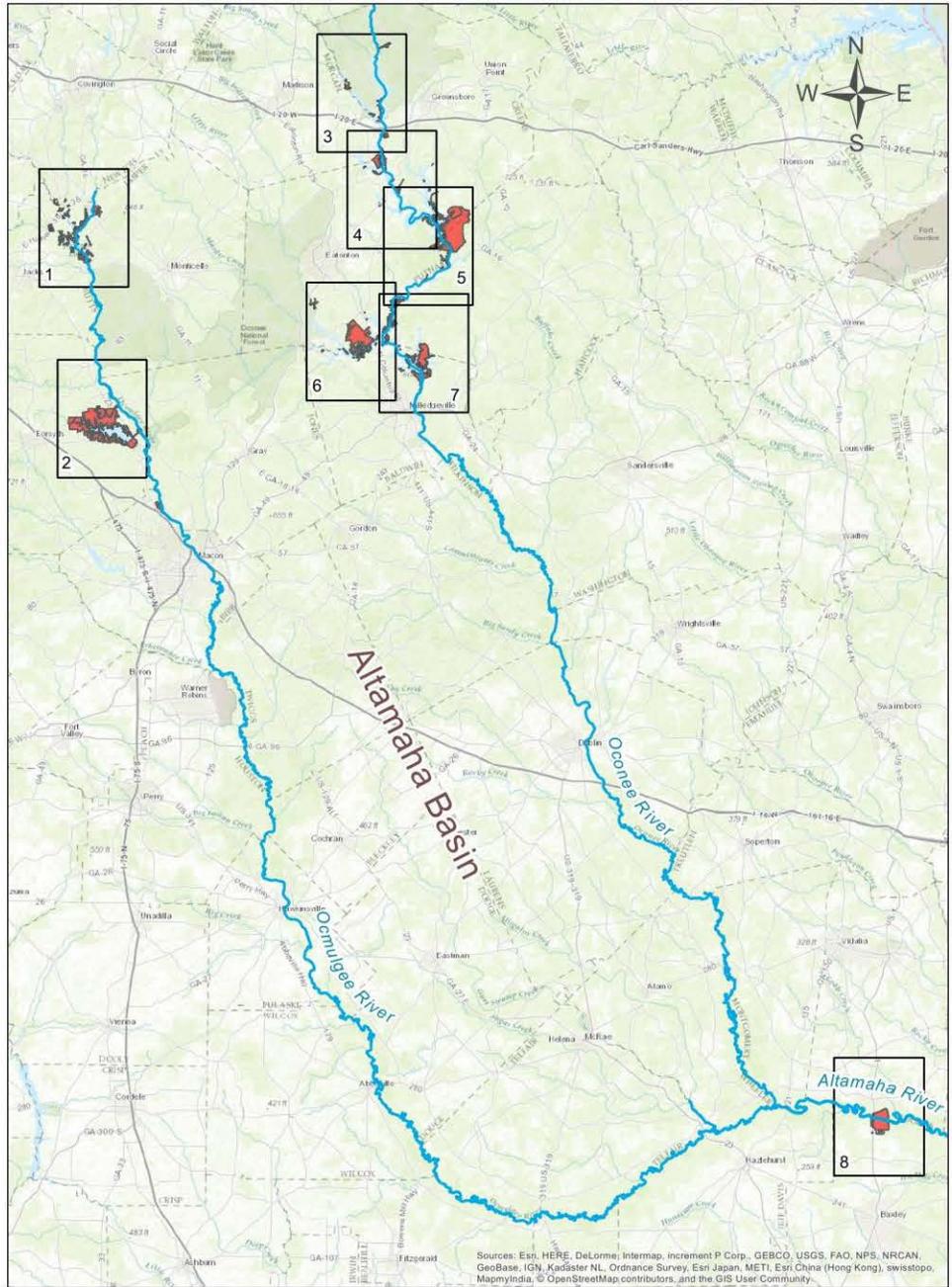
Watson, C. 2000. Results of a survey for selected Hydrobiidae (Gastropods) in Georgia and Florida. *Proceedings of the First Freshwater Mollusk Conservation Society Symposium*. 233-244.

Williams, J.D., A.E. Bogan, and J.T. Garner. 2008. *Freshwater mussels of Alabama and the Mobile Basin in Georgia, Mississippi & Tennessee*. The University of Alabama Press, Tuscaloosa, Alabama. 908 pp.

Wisniewski, J. 2008. Rare mussels and snails of Georgia. Georgia Department of Natural Resources. Available at <http://www.georgiawildlife.com/node/2624>. September 2008. (Accessed on May 28, 2014).

Wisniewski, J.M., B. Albanese, and G. Krakow. 2005. Current status of endemic mussels in the lower Ocmulgee and Altamaha rivers. *In* K.J. Hatcher (ed.), *Proceedings of the 2005 Georgia Water Resources Conference*, Institute of Ecology, The University of Georgia, Athens.

APPENDIX 2. GPC ALTAMAHA BASIN PROJECT SITE MAP

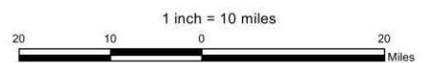


Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

-  Rivers
-  Map Index
-  GPC Property

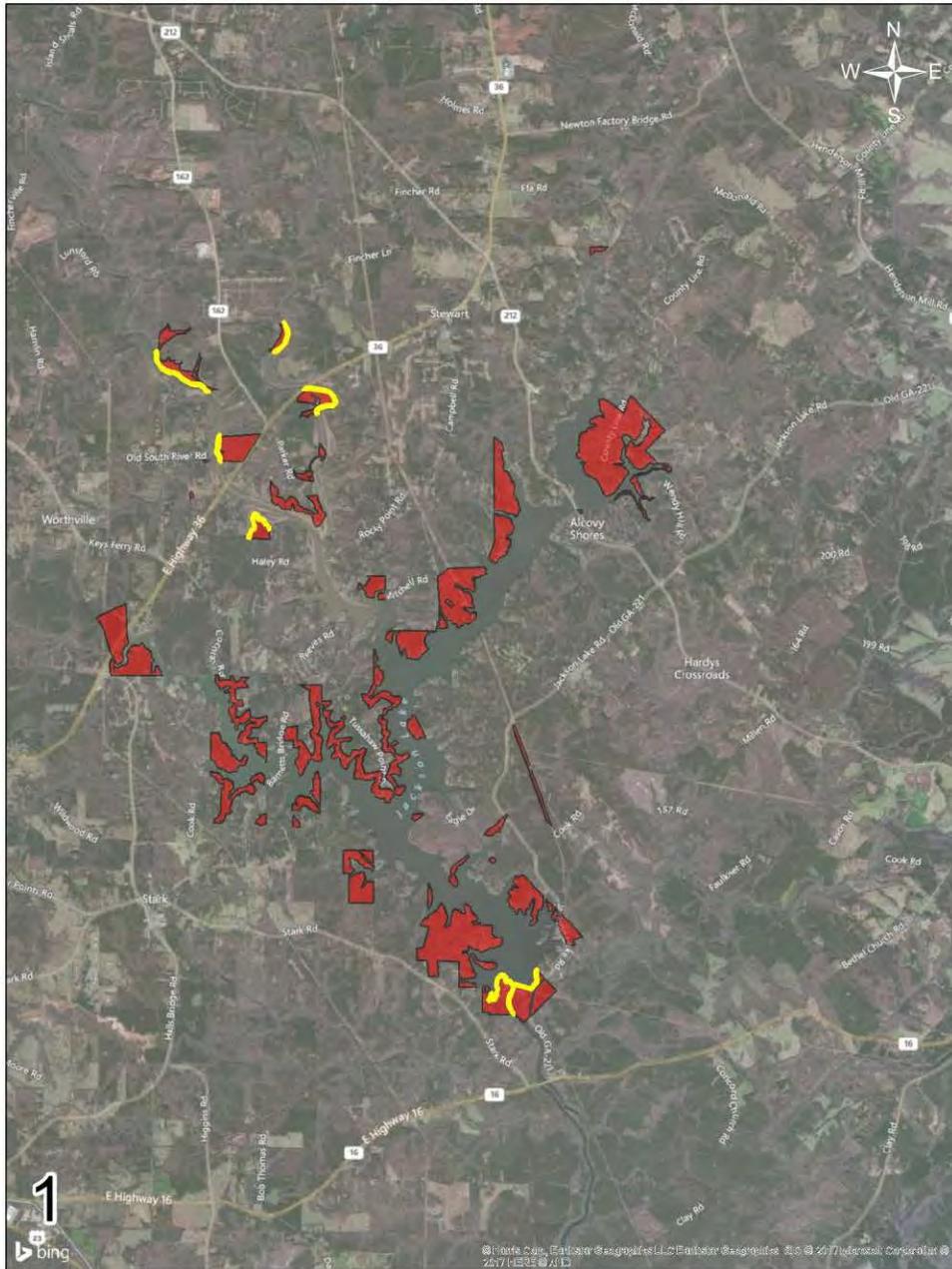
Altamaha Basin

MAP NOT BASED ON FIELD SURVEY DATA



© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.

APPENDIX 3. GPC DETAILED PROJECT AREA MAPS



Altamaha Basin

MAP NOT BASED ON FIELD SURVEY DATA

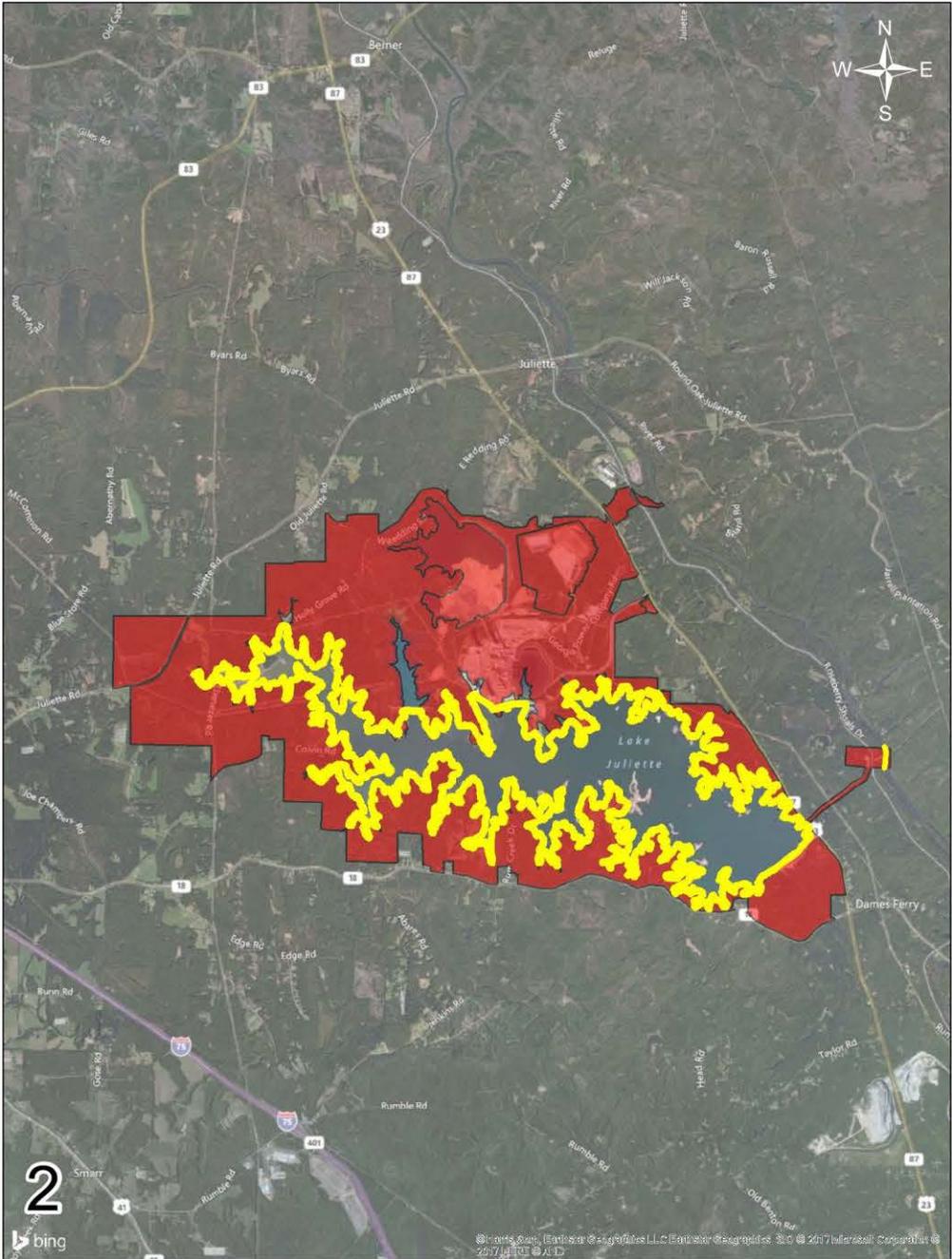
1 inch = 5,000 feet



- GPC Property
- 100 ft Buffer
- 300 ft Buffer

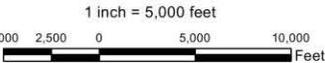


© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.



Altamaha Basin

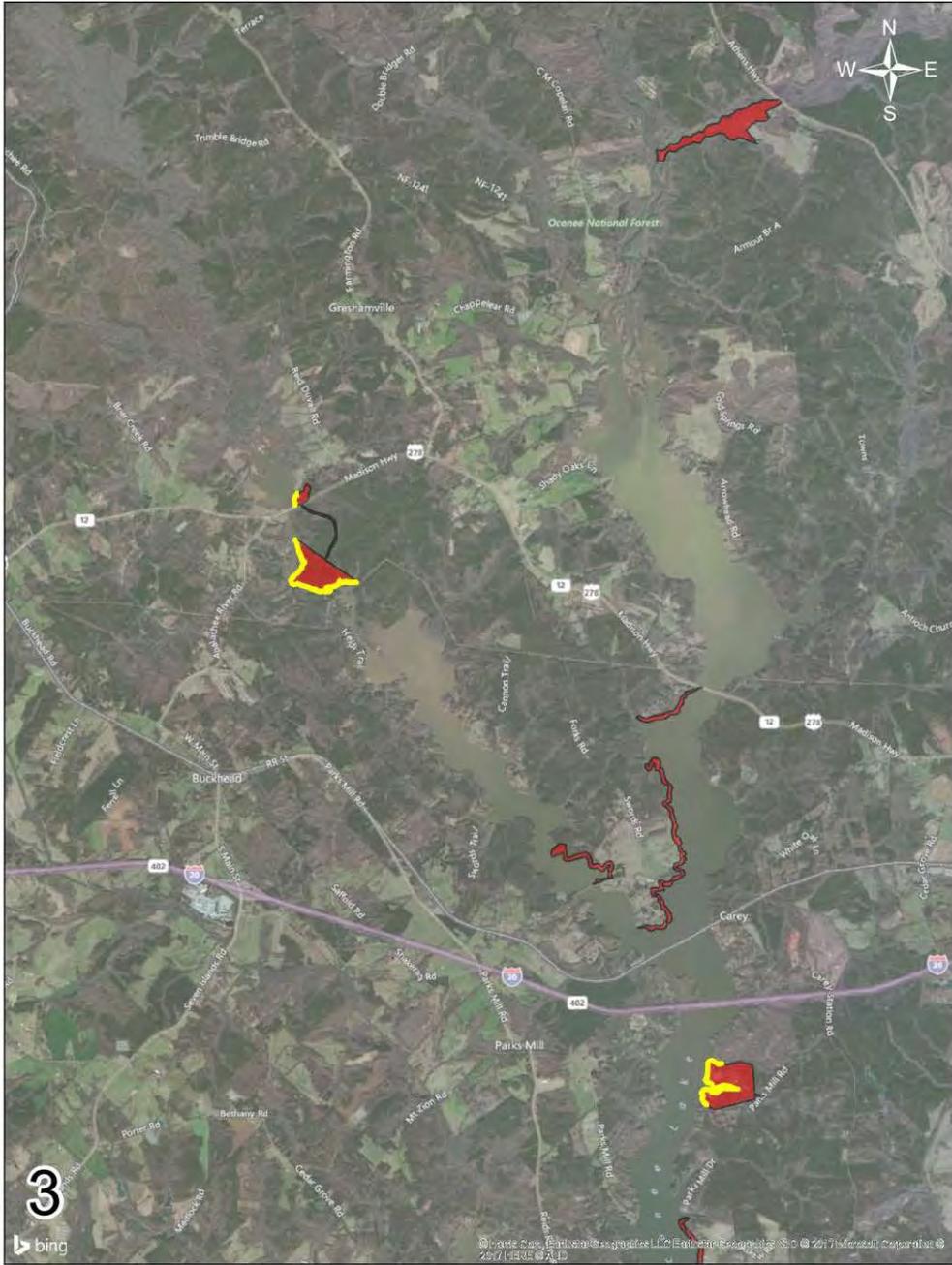
MAP NOT BASED ON FIELD SURVEY DATA



- GPC Property
- 100 ft Buffer
- 300 ft Buffer



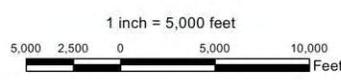
© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.



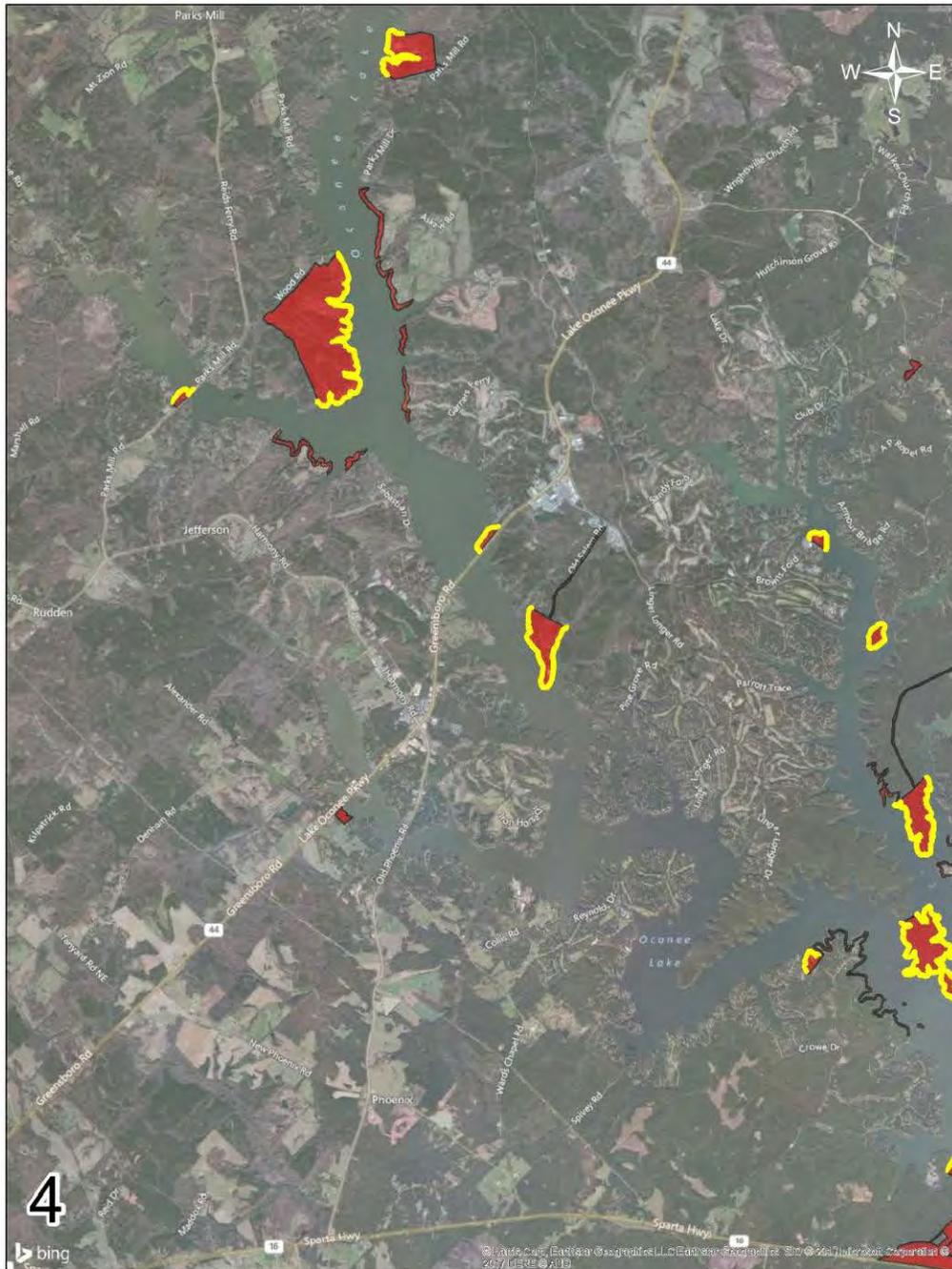
Altamaha Basin

MAP NOT BASED ON FIELD SURVEY DATA

- GPC Property
- 100 ft Buffer
- 300 ft Buffer

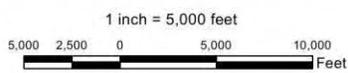


© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.



Altamaha Basin

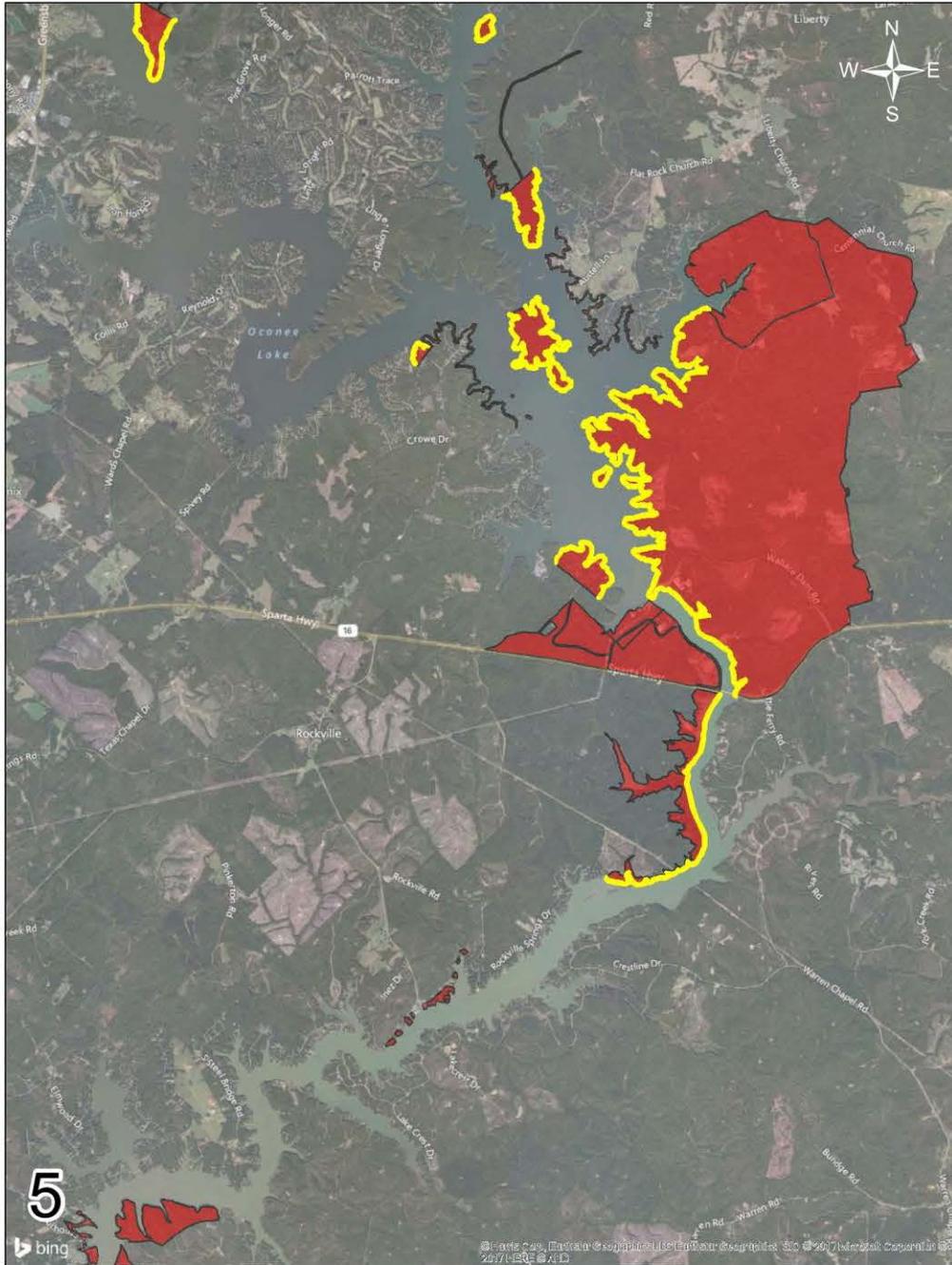
MAP NOT BASED ON FIELD SURVEY DATA



- GPC Property
- 100 ft Buffer
- 300 ft Buffer



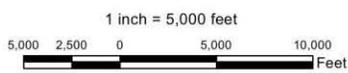
© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.



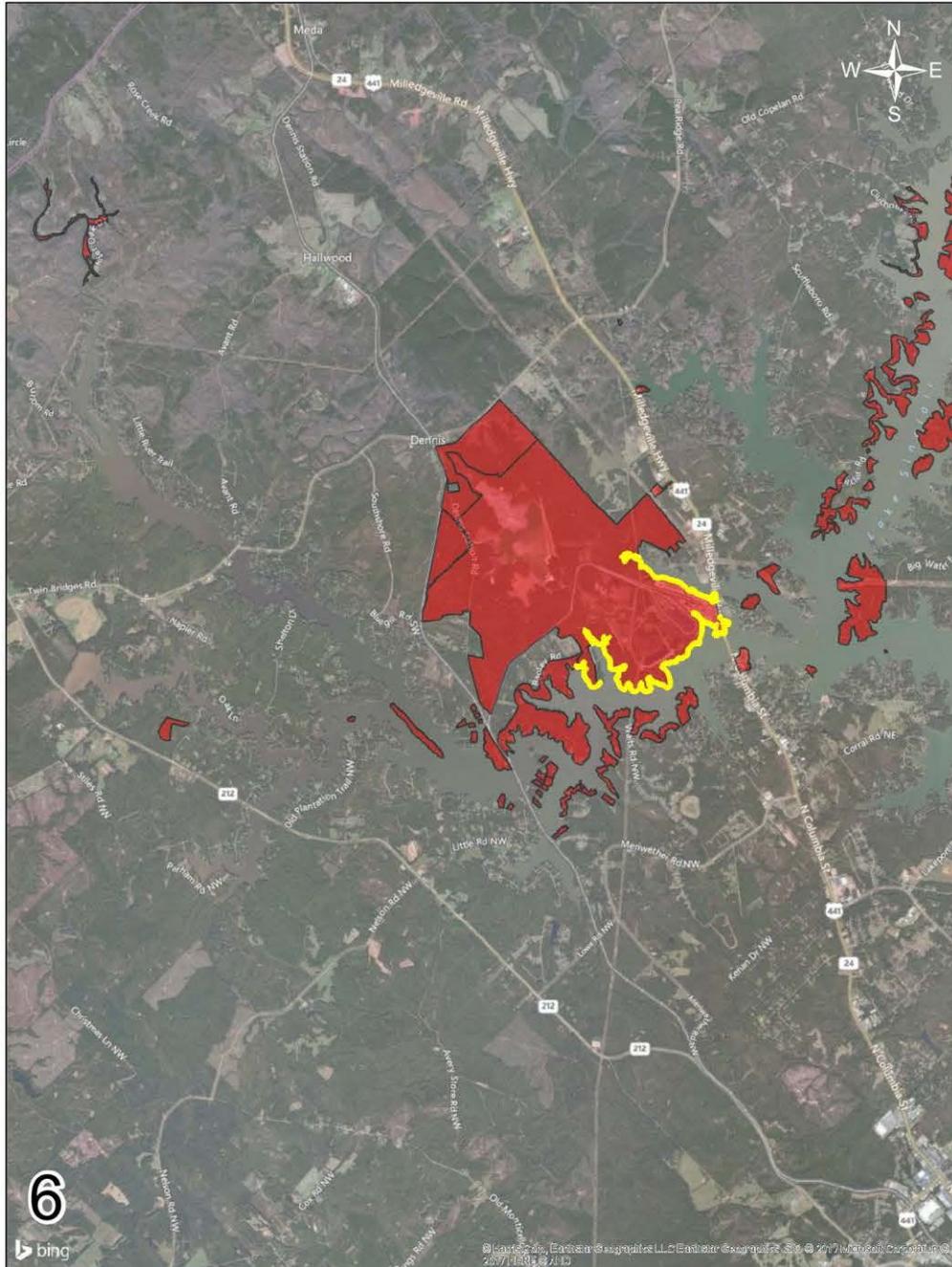
Altamaha Basin

MAP NOT BASED ON FIELD SURVEY DATA

- GPC Property
- 100 ft Buffer
- 300 ft Buffer

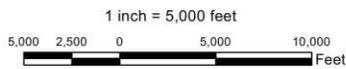


© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.



Altamaha Basin

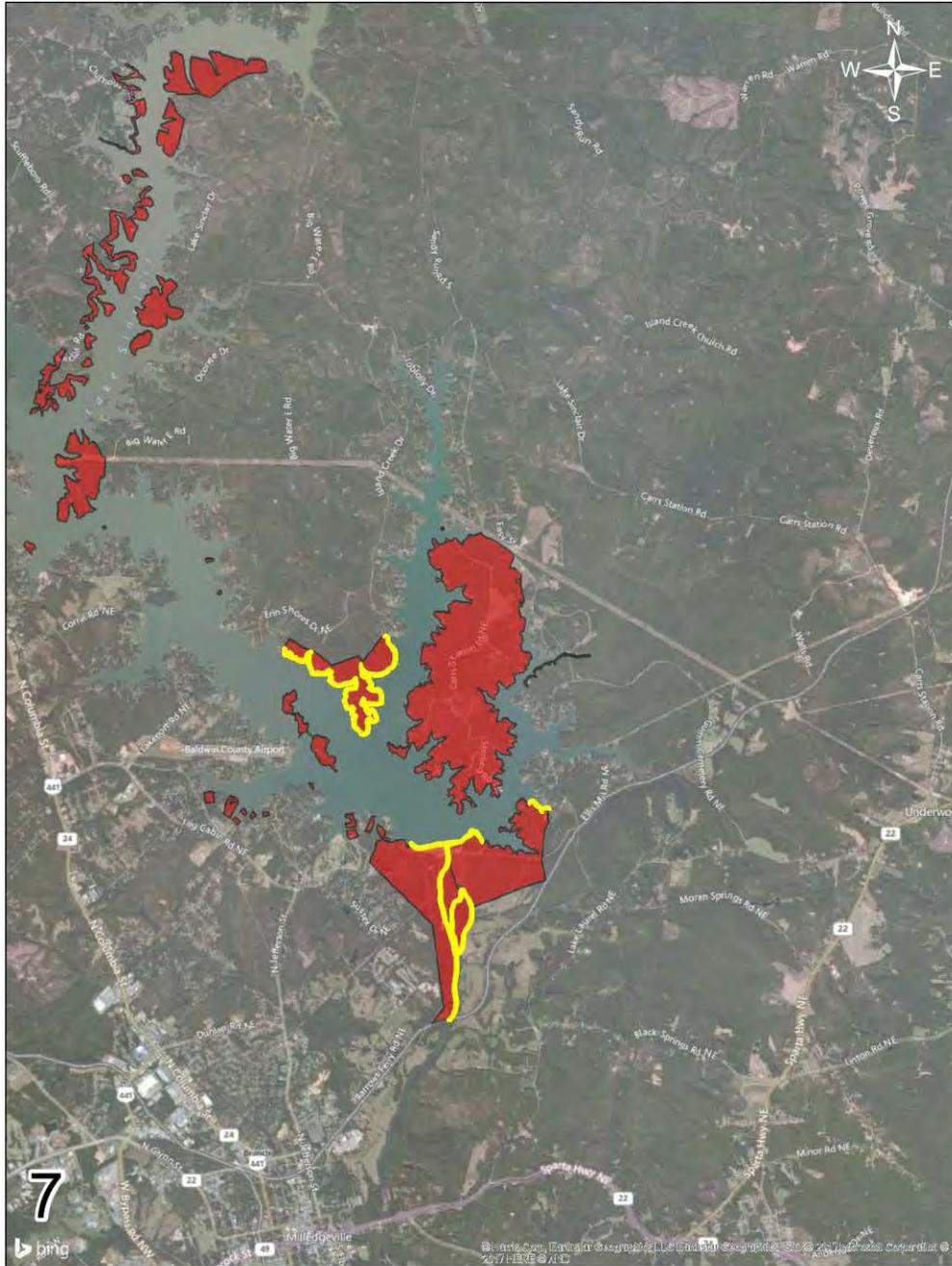
MAP NOT BASED ON FIELD SURVEY DATA



- GPC Property
- 100 ft Buffer
- 300 ft Buffer

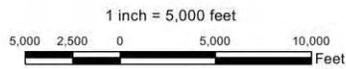


© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.



Altamaha Basin

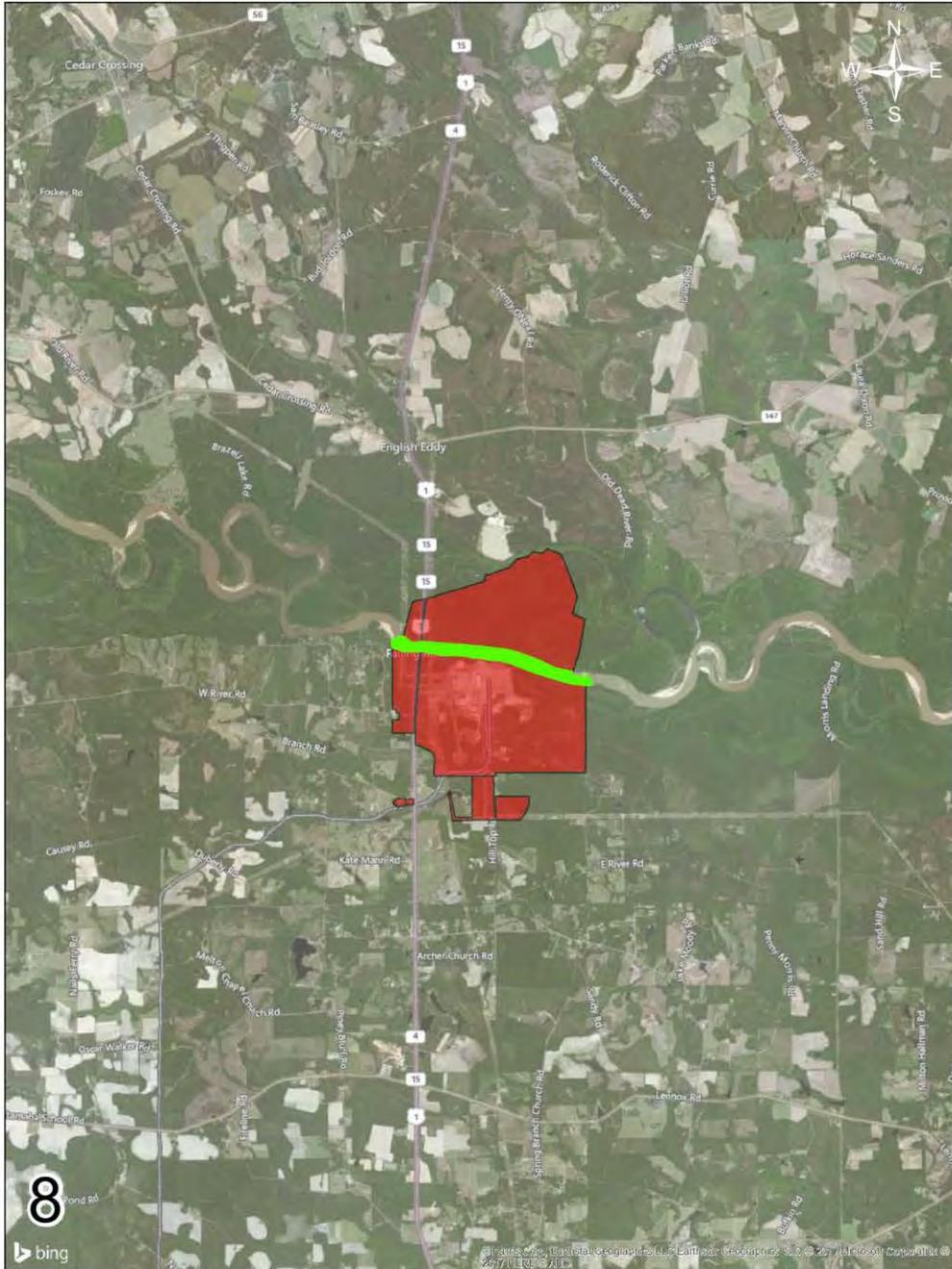
MAP NOT BASED ON FIELD SURVEY DATA



- GPC Property
- 100 ft Buffer
- 300 ft Buffer

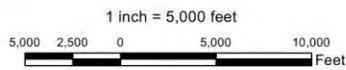


© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.



Altamaha Basin

MAP NOT BASED ON FIELD SURVEY DATA



- GPC Property
- 100 ft Buffer
- 300 ft Buffer



© 2017 Georgia Power Company. All rights reserved. Any unauthorized copying, dissemination or use is strictly prohibited.