

XEROX

Administrator

Document Name: AQ-7-003_2008_Mussel_Sampling.pdf
Printing Time: 09/14/11 08:18:22
Copies Requested: 1
Account:
Virtual Printer: docucolor8000/dc8000_slip-sheet
Printed For: Administrator

Administrator



Job Messages

XEROX

Administrator

Document Name: AQ-7-003_2008_Mussel_Sampling.pdf

%%[ProductName: Xerox DocuColor 8000 Digital Press]%%

%%[Page: 1]%%

%%[Page: 2]%%

%%[Page: 3]%%

%%[Page: 4]%%

%%[Page: 5]%%

%%[Page: 6]%%

%%[Page: 7]%%

%%[Page: 8]%%

%%[Page: 9]%%

%%[Page: 10]%%

%%[Page: 11]%%

%%[Page: 12]%%

%%[Page: 13]%%

%%[Page: 14]%%

%%[Page: 15]%%

%%[LastPage]%%

Print Server Release: 61.80.73.86 Wed 14 Sep 2011 08:18:26 AM EDT
Printer Type: Xerox DocuColor 8000 Digital Press
Version Color: 3.0.66
Queue Name: dc8000_slip-sheet
Printer Name: docucolor8000 (SunOS 5.10 i386)
Job Id: 3876
Copies Requested: 1
Total Pages RIP'd: 15

Stock:
Name: Unspecified
Size: US Letter(8.5x11") (216.00 x 279.00)
Color: White
Weight: 90.00
Type: plain
Coating Type: None

Output:
Sides Imaged: 2 Sided
Stapling/Finishing: No Finishing

Image Quality:
Print As Grayscale: Disabled
Image Adjustments:
Lightness: -100 --- 0 --- +100 Cyan: -100 --- 0 --- +100 Red
Contrast: -100 --- 0 --- +100 Magenta: -100 --- 0 --- +100 Green
Saturation: -100 --- 0 --- +100 Yellow: -100 --- 0 --- +100 Blue

Options:
Black Overprint: Disabled
PostScript Overprint: Enabled
Anti-aliasing: Disabled
Trapping: Disabled
Image Vector Trapping: Disabled
User TRC: None
Halftone: System Specified

Input Color Setup
RGB Color Space:
Images Profile: sRGB
Text and Graphics Profile: sRGB
CMYK Color Space:
Images Profile: SWOP Coated CMYK
Text and Graphics Profile: SWOP Coated CMYK
Gray Color Space:
Images Profile: gamma-1.8
Text and Graphics Profile: DC8000 GRAY

Job Messages

Output Color Setup
Destination Profile: XEROX DC8000
Rendering for Specific Data:
 Images: Relative Colorimetric
 Text: Pure
 Graphics: Saturation
Pantone Processing: Enabled
Automatic Image Enhancement: Disabled
Interpolation Method: System Specified
Dynamic LUT Generation: Enabled

PDL Settings:
PostScript Resolution(dpi): 600x600
Process Images at Half Resolution: Disabled

The online help contains information regarding the fields in this report.

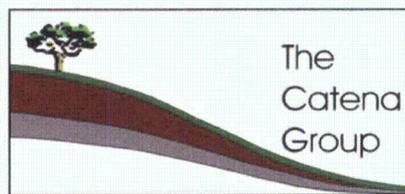
HARRIS ADVANCED REACTOR UNITS 2 AND 3

**NUCLEAR REGULATORY COMMISSION
DOCKET NOS. 52-022 and 52-023**

**MUSSEL SURVEY OF THE CAPE FEAR RIVER, NORTH
CAROLINA, AT BUCKHORN DAM**

Prepared by

The Catena Group, Inc.



Prepared for

**Progress Energy Carolinas, Inc.
Raleigh, North Carolina**



July 8, 2008

Executive Summary

Mussel surveys conducted in the Cape Fear River and Gulf Creek just upstream of the Buckhorn Dam indicate that much of the river contained depositional areas of silt, detritus and woody debris with relatively little flow due to the backwater impoundment effect of the dam. Mussel species richness and abundance was low, which reflected the impoundment conditions. The mussels found in Gulf Creek within the expected proposed dredging and intake operation area were moved upstream to similar habitat. The four mussel species found during the surveys are considered common with wide ranging and fairly "stable" populations. No rare, threatened or endangered mussels were found during this survey. Project construction and operations are not expected to result in substantial impacts to the mussel populations within the study area, as they are present in similar numbers upstream of the impact area, and most being common species and habitat generalists, should re-colonize the study area once any proposed dredging activities are completed.

Table of Contents

1.0	INTRODUCTION	1
1.1	<i>Survey Objectives</i>	1
2.0	SURVEY SITE	2
2.1	<i>Cape Fear River</i>	2
2.2	<i>Gulf Creek</i>	2
3.0	MUSSEL SURVEY METHODS	2
4.0	RESULTS	4
4.1	<i>Survey Results</i>	4
4.1.1	<i>Site 1—Mouth of Gulf Creek</i>	4
4.1.2	<i>Site 2—Cape Fear River Transect 1</i>	4
4.1.3	<i>Site 3— Cape Fear River Transect 5</i>	5
4.1.4	<i>Site 4— Cape Fear River Transect 4</i>	5
4.1.5	<i>Site 5— Cape Fear River Transect 3</i>	5
4.1.6	<i>Site 6— Cape Fear River longitudinal survey along south bank</i>	5
4.1.7	<i>Site 7— Gulf Creek upstream</i>	6
4.2	<i>Water Quality Data</i>	6
5.0	DISCUSSION	7
5.1	<i>Mussel species found during the surveys</i>	7
5.1.1	<i>Elliptio complanata</i> (Eastern elliptio).....	7
5.1.2	<i>Elliptio icterina</i> (variable spike)	8
5.1.3	<i>Unio merus carolinianus</i> (Florida pondhorn).....	8
5.1.4	<i>Utterbackia imbecillis</i> (paper pondshell).....	8
5.2	Factors affecting apparent mussel abundance and diversity.....	9
6.0	CONCLUSIONS	9
7.0	REFERENCES	10

List of Tables

Table 1. Catch-per-unit (CPUE) for freshwater mussels at Site 1	4
Table 2. Catch-per-unit effort (CPUE) for freshwater mussels at Site 2.....	5
Table 3. Catch-per-unit-effort (CPUE) for freshwater mussels at Site 5.....	5
Table 4. Catch-per-unit-effort (CPUE) for freshwater mussels at Site 6.....	6
Table 5. Catch-per-unit (CPUE) for freshwater mussels, Site 7.....	6
Table 6. Water Quality Data Measured at Survey Sites, June 4, 2008.....	6

List of Figures

Figure 1	3
Figure 2	7
Figure 3	8

1.0 INTRODUCTION

Progress Energy Carolinas, Inc. (PEC) has submitted a Combined Operating License Application (COLA) to the Nuclear Regulatory Commission (NRC) for construction and operation of two advanced reactor units (Harris Advanced Reactors Units 2 and 3) at the existing Harris Nuclear Plant (HNP) site (Progress Energy Carolinas 2008a). The HNP site is located in Wake County, North Carolina, approximately 25 miles southwest of the city of Raleigh.

As part of this COLA process, the NRC reviewed the Environmental Report (ER) portion of the COLA and on March 25, 2008, requested PEC to provide additional biological information on fish and benthic invertebrate community composition (including mussels) at the proposed intake makeup water structure. To this end, three surveys were designed to provide the additional requested information: (1) fish spawning and habitat assessment, (2) native mussel survey, and (3) benthic invertebrate community assessment.

To develop the intake makeup structure, PEC is proposing dredging and construction activities on the north bank of the Cape Fear River just above the Buckhorn Dam and in the adjacent main river channel behind the dam. The construction and operation activities of this intake structure could potentially impact freshwater mussels within the river and the confluence with Gulf Creek, a tributary on the north side of the river just above Buckhorn Dam. This mussel survey (Survey No. 2 listed above) was conducted to provide the requested information for COLA ER review and preparation of the Environmental Impact Statement by the NRC.

Freshwater mussels are widely recognized as the most imperiled faunal group in North America (Biggins et al. 1995), with 72% of the species considered extinct, endangered, threatened, or of special concern (Williams et al. 1993). More species of freshwater mussels have been reported from the Cape Fear River Basin (29) than any other river basin in North Carolina (Bogan 2002). Although no federally protected mussel species are known from the basin, there are several species that are classified as Federal Species of Concern (FSC); Atlantic pigtoe (*Fusconaia masoni*), brook floater (*Alasmidonta varicosa*), Carolina creekshell (*Villosa vaghaniana*), Savannah lilliput (*Toxolasma pullus*) and yellow lampmussel (*Lampsilis cariosa*), all of which are all also considered State Endangered in North Carolina.

1.1 Survey Objectives

This survey consisted of two main objectives; (1) determine the species composition, relative abundance, and size distribution of the mussel community (including presence of state and federal listed rare, threatened, and endangered species) just above Buckhorn Dam at five transects within two identified habitat areas (main channel and mouth of Gulf Creek), and (2) provide a qualitative description of the habitat and environmental conditions in these areas for mussel inhabitation.

2.0 SURVEY SITE

2.1 Cape Fear River

The Cape Fear River is the largest river basin occurring entirely within North Carolina and drains approximately 9,322 square miles. The headwaters arise north of Greensboro, in northern Guilford and southern Rockingham Counties. The river is formed by the confluence of the Deep and Haw Rivers approximately 14 miles northeast of the city of Sanford and flows approximately 200 miles to the Atlantic Ocean at the town of Southport. The river at the survey site is located in Chatham and Lee counties. The impounded river channel behind Buckhorn Dam is approximately 1,200 feet wide and flow was not visibly evident within the surveyed area.

2.2 Gulf Creek

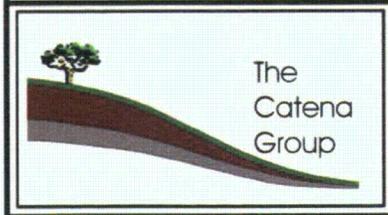
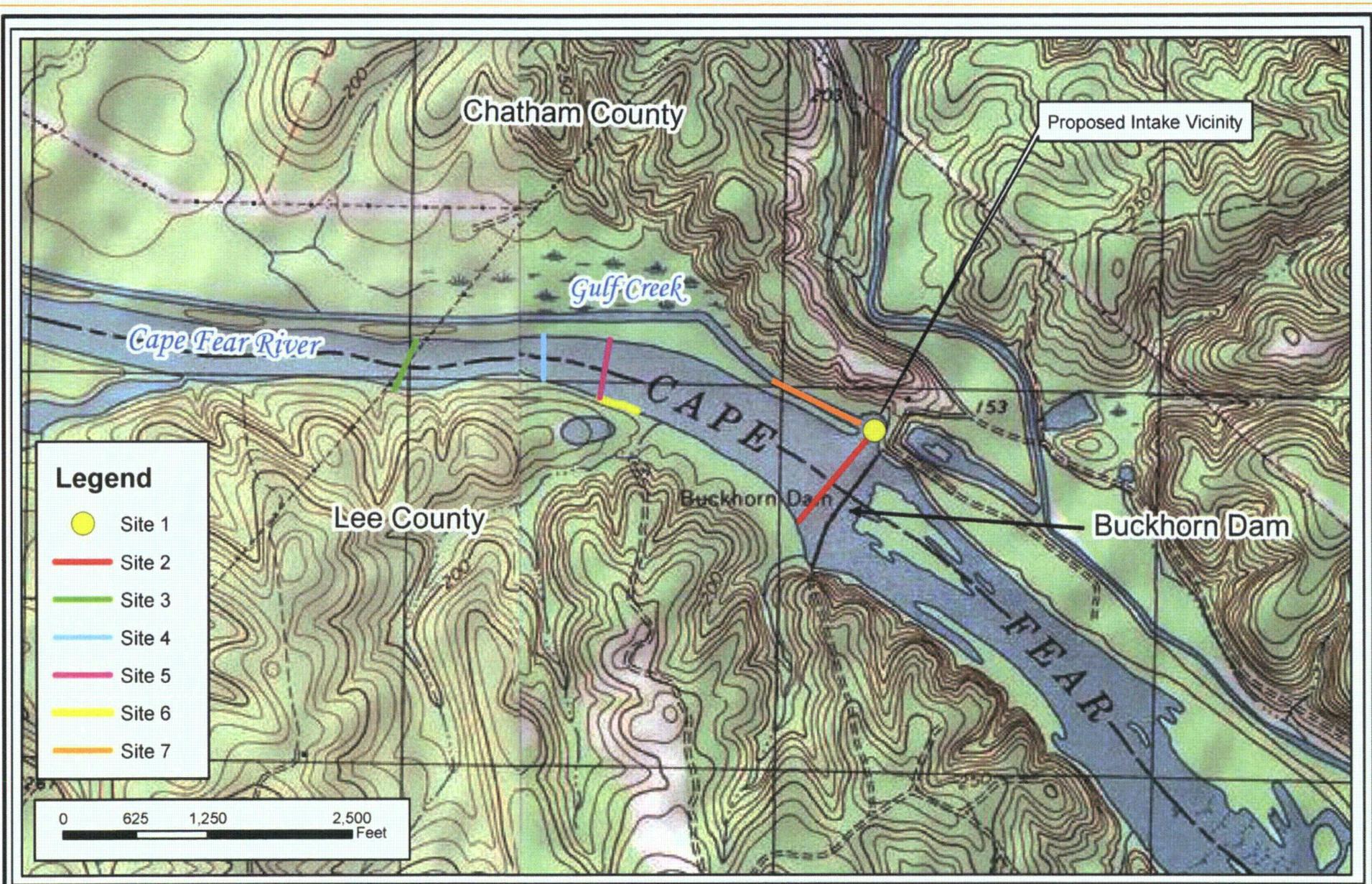
Gulf Creek arises approximately seven miles southeast of the town of Moncure in Chatham County and flows approximately six miles southwest into the Cape Fear River just above Buckhorn Dam. The channel width near the confluence ranges from 20-25 feet, with a channel that cuts through to the river mainstem approximately 300 feet upstream of the confluence at Buckhorn Dam. This creek channel also serves as a discharge canal for PEC's Cape Fear Steam Electric Plant, located upstream. Therefore flow in this channel is partially dependent upon this power plant's operations.

3.0 MUSSEL SURVEY METHODS

Mussel surveys were conducted area on June 4, 2008. Non-game personnel with the North Carolina Wildlife Resources Commission (WRC), who are knowledgeable of mussel taxonomy, assisted with the surveys.

The survey effort consisted of habitat and species reconnaissance of the Cape Fear River and Gulf Creek at five transect sites and two longitudinal sites within the survey area. Survey locations with respect to the Buckhorn Dam are depicted in Figure 1. Site numbers 1-7 were assigned based on sequence of surveys. Sites 1-5 correspond to transect sites defined by PEC for the benthic invertebrate survey (Progress Energy Carolinas 2008b); however, the PEC Transect 2 was not sampled as it was determined surveys would not yield any information not already obtained at other sampled transects. Instead, longitudinal surveys (downstream to upstream orientation) along the Cape Fear River and in Gulf Creek were performed.

Transect surveys were conducted in the mainstem river using two divers equipped with SCUBA and underwater lights. The third person of the survey crew provided surface support by boat. Diver communication with the surface support was maintained with AGA masks equipped with underwater transceivers/receivers. Visual and tactile methodologies were utilized by the divers, as they traversed the river bottom. Mussel surveys within the mouth of Gulf Creek were conducted using mask and snorkel, with four biologists. All mussels collected were brought to the surface, identified, counted, and returned to the substrate in the general vicinity in which they were collected. Catch per unit effort (CPUE) for each mussel species found was calculated at each surveyed site. Visual searches were also conducted for relict shells. The presence of a shell was equated with presence of that species; however the shells found were not factored into the CPUE. Water quality data (temperature, dissolved oxygen, conductivity, pH, and



**Cape Fear River Mussel Surveys
for Proposed Dredging and Intake Establishment**

Client: Progress Energy
Chatham and Lee Counties, North Carolina

Date:
July 2008

Scale:
As Shown

Job No.
3232

Figure
1

turbidity) was measured at each site with a laboratory-calibrated YSI multiparameter instrument. The instrument was field-calibrated for dissolved oxygen measurements.

Photographs were taken of the collected mussel specimens to serve as a voucher specimen reference collection for the survey. All mussels were released alive and in good condition.

4.0 RESULTS

4.1 Survey Results

Four native freshwater mussel species were found during the survey effort; eastern Elliptio (*Elliptio complanata*), variable spike (*Elliptio icterina*), Florida pondhorn (*Unio carolinianus*), and paper pondshell (*Utterbackia imbecillis*). In general, mussel species richness was low and mussels were absent from most of the habitat in the mainstem of the Cape Fear River except along the river banks, where they were rare. In contrast, mussels were relatively common in Gulf Creek. The introduced non-native Asian clam was present at all survey stations, but was comparatively more abundant in Gulf Creek than in the mainstem river channel. Habitat conditions and survey results for each survey site are provided below.

4.1.1 Site 1—Mouth of Gulf Creek

This site combined with Site 2 (Transect across main-stem Cape Fear River) comprises the PEC's Transect 1 (PEC 2008), but were separated into two survey sites due to markedly different habitat conditions. The survey transects extended from the north bank of Gulf Creek across the channel and a flooded point bar with emergent vegetation, primarily water willow (*Justicia americana*), ending at the mouth with the Cape Fear River. Maximum water depth was 8 feet, but averaged 2-3 feet. The substrate consists of compact mud and detritus, overlain with deposition of fine silt of varying thickness. Mussels were found across the entire transect, but were most common along the banks of the creek and at the edge of the water willow beds. A total of 45 eastern elliptio (size range 43-107 mm), ten paper pondshell (43-72 mm) and three Florida pondhorn (85-94 mm) were found in 2.73 person hours of survey time (Table 1).

Table 1. Catch-per-unit (CPUE) for freshwater mussels at Site 1 .

Scientific Name	Common Name	Number	CPUE (No./Person Hr)
<i>Elliptio complanata</i>	Eastern elliptio	45	16.5
<i>Unio carolinianus</i>	Florida pondhorn	3	1.1
<i>Utterbackia imbecillis</i>	Paper pondshell	10	3.7

4.1.2 Site 2—Cape Fear River Transect 1

This transect extends from the mouth of Gulf Creek on the north bank of the river to the south bank. The slope extends gradually from the mouth of the creek to a maximum depth of 14 feet at approximately mid channel. The substrate transitions from mud and detritus near the mouth, to boulder and bedrock overlain with silt to coarse sand near the base of the south bank. The south bank slopes more sharply than the north bank and consists of mud and a large amount of submerged woody debris. Mussels were absent

from the survey transect, with the exception of two paper pondshell and one eastern elliptio found along the north bank (Table 2).

Table 2. Catch-per-unit effort (CPUE) for freshwater mussels at Site 2.

Scientific Name	Common Name	Number	CPUE (No./Person Hr)
<i>Eliptio complanata</i>	Eastern elliptio	1	1.1
<i>Utterbackia imbecillis</i>	Paper pondshell	2	2.2

4.1.3 Site 3— Cape Fear River Transect 5

This site corresponds to PEC's Transect 5 and extended from the south bank to the north bank. The slope extends sharply from the south bank to a depth of 18 feet. The substrate is dominated by mud and detritus, changing to boulder and cobble in mid-channel and back to mud along the north bank. No mussels were found along this transect.

4.1.4 Site 4— Cape Fear River Transect 4

This site corresponds to PEC's Transect 4 and extended from the south bank to the north bank. The slope extends moderately from the south bank to a depth of 18 feet. The substrate along the bank is dominated by mud and detritus, changing to boulder at the base and then to coarse sand in mid channel and sand/boulder near the base of the steep north bank and then to mud and woody debris along the bank. No mussels were found along this transect.

4.1.5 Site 5— Cape Fear River Transect 3

This site corresponds to PEC's Transect 3 and extended from the north bank to the south bank. The slope extends moderately from the north bank to a depth of 16 feet. The substrate along the bank is dominated by mud and woody debris, changing to bedrock and boulder at the base and then to cobble in mid channel and sand/mud/boulder near the base of the south bank and then to mud and woody debris along the bank. No live mussels were found along this transect, but a relict shell of the eastern elliptio was found along the south bank (Table 3).

Table 3. Catch-per-unit-effort (CPUE) for freshwater mussels at Site 5.

Scientific Name	Common Name	Number	CPUE (No./Person Hr)
<i>Eliptio complanata</i>	Eastern elliptio	*	0

* relict shell only

4.1.6 Site 6— Cape Fear River longitudinal survey along south bank

This site consisted of a longitudinal area along the south bank beginning at Site 5 (Transect 3) and extending downriver approximately 345 feet. The width of the surveyed area varied from 2-10 feet depending on the slope in 1-3 feet of water. The substrate along the bank is dominated by mud with large accumulations of woody debris. A total of two eastern elliptio, two paper pondshell, and one Florida pondhorn were found, in small pockets of firm mud, which lacked woody debris (Table 4).

Table 4. Catch-per-unit-effort (CPUE) for freshwater mussels at Site 6.

Scientific Name	Common Name	Number	CPUE (No./Person Hr)
<i>Eliptio complanata</i>	Eastern elliptio	2	5.4
<i>Unio merus carolinianus</i>	Florida pondhorn	1	2.7
<i>Utterbackia imbecillis</i>	Paper pondshell	2	5.4

4.1.7 Site 7— Gulf Creek upstream

This site occurred in Gulf Creek starting from Site 1 and extending upstream approximately 1,000 feet. Maximum water depth was 6 feet, but averaged 1-3 feet. The substrate consists of compact mud and detritus, overlain with deposition of fine silt of varying thickness. Mussels were found across the channel, but were most common along the banks of the creek, often in submerged roots of riparian trees. A total of 76 eastern elliptio, ten paper pondshell, two variable spike, and one Florida pondhorn were found in 2.73 person hours of survey time (Table 5).

Table 5. Catch-per-unit (CPUE) for freshwater mussels, Site 7.

Scientific Name	Common Name	Number	CPUE (No./Person Hr)
<i>Eliptio complanata</i>	Eastern Elliptio	76	25.3
<i>Elliptio icterina</i>	Variable spike	2	0.7
<i>Unio merus carolinianus</i>	Florida pondhorn	1	0.3
<i>Utterbackia imbecillis</i>	Paper pondshell	10	3.3

4.2 Water Quality Data

Water quality parameters measured at each survey site are shown in Table 6. Water temperatures were within expected ranges for Piedmont waters. Dissolved oxygen was supersaturated in some instances, and along with elevated pH values, were indicative of algal photosynthetic activity.

Table 6. Water Quality Data Measured at Survey Sites, June 4, 2008.

Site	Temperature (° C)	Dissolved Oxygen (mg/L)	Conductivity (µs/cm)	pH(Units)
1	30.1	9.2	172	8.8
2	28.4	11.3	171	9.3
3	28.5	11.8	169	9.1
4	27.9	11.5	167	8.8
5-6	28.5	12.7	169	9.2
7	26.8	6.6	174	7.4

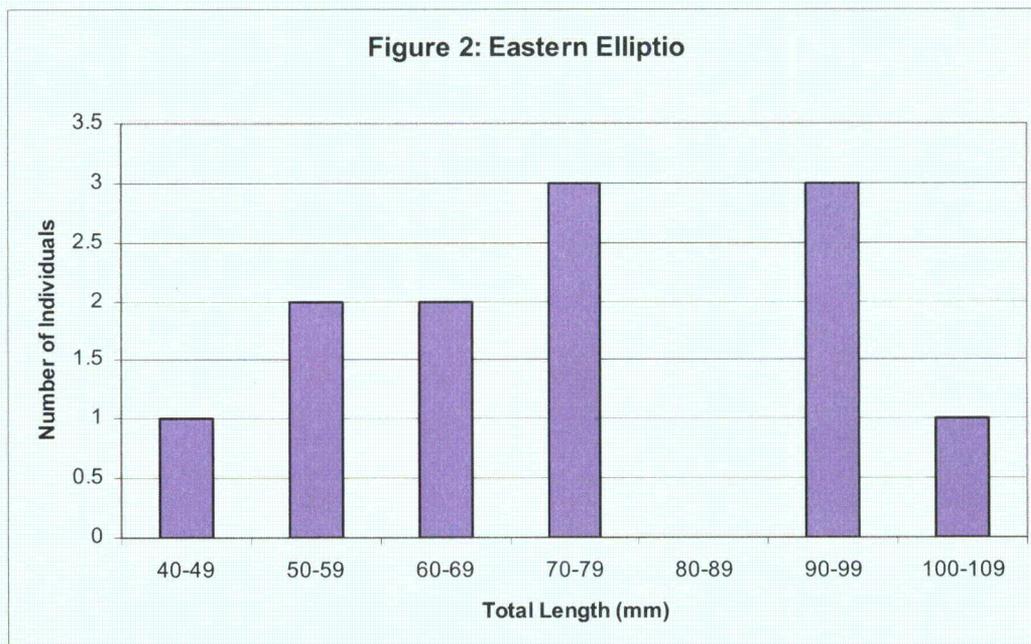
5.0 DISCUSSION

The survey results indicate that a viable and reproducing (based on multiple size classes) populations of eastern elliptio and paper pondshell are present in the surveyed reach of Gulf Creek. Size class frequency distributions were estimated for the populations of these two species (Figures 2 and 3 respectively). The Florida pondhorn and variable spike are also present in the creek in low numbers. The low numbers of the variable spike are likely attributable to a lack of riffle habitats with which this species is usually associated, however, the reasons for low numbers of the Florida pondhorn are unclear as this species typically occupies a variety of habitats and substrates. The eastern elliptio, paper pondshell and Florida pondhorn were also found in the main-stem Cape Fear River in low numbers. The apparent low numbers of mussels in this section of the Cape Fear Rivers is likely attributable to limited amount of suitable sand, gravel, and cobble habitat. Habitat conditions in this area were largely depositional in nature and comprised of silt, detritus, and woody debris.

5.1 Mussel species found during the surveys

5.1.1 *Elliptio complanata* (Eastern elliptio)

This species was originally described as *Mya complanata* from the Potomac River in Maryland (Lightfoot 1786). Shell characteristics are highly variable. Shell shape is typically trapezoidal to rhomboid and compressed to inflated. The usually straight ventral margin is mostly parallel with the dorsal margin and the posterior margin is broadly rounded. Shell thickness varies from thin to solid. This species is widely distributed along the Atlantic Slope from Altamaha River Basin in Georgia north to the St. Lawrence River Basin, and west to Lake Superior and parts of the Hudson Bay Basin. It can be found in a variety of habitats from large rivers and, lakes to small headwater streams. The species is widespread and common throughout its range and considered stable (Williams et al. 1993).



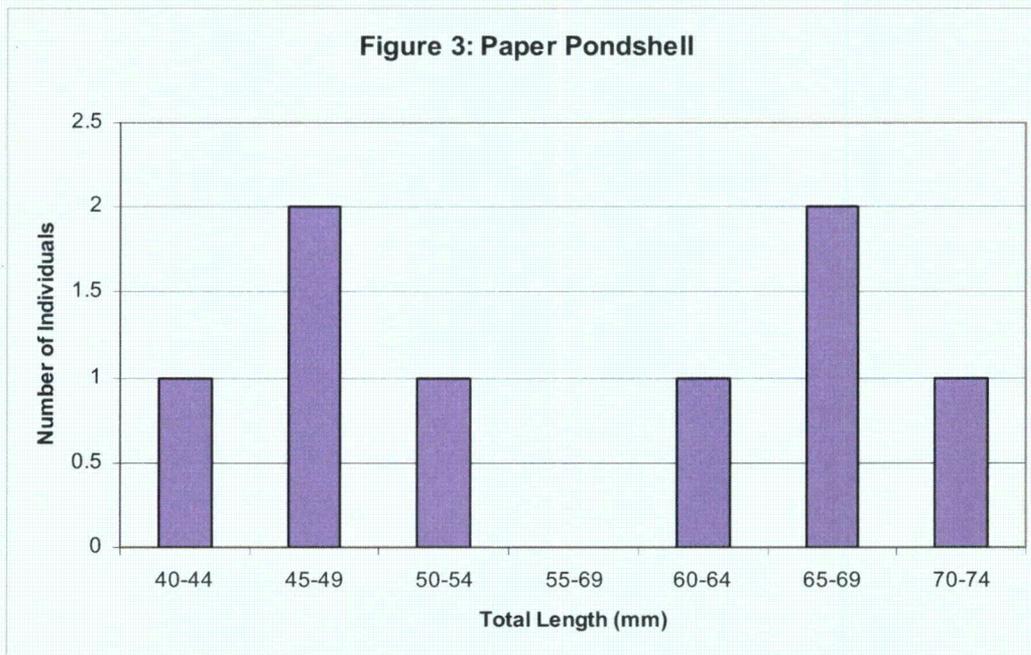
The largest and smallest individuals, along with a randomly selected subset (total 12 individuals) of the 45 eastern elliptio mussels collected at Site 1 were measured to estimate size class frequency distribution within the population (Figure 2).

5.1.2 *Elliptio icterina* (variable spike)

Described from the Savannah River near Augusta Georgia (Conrad 1834), this highly variable species represents a complex of nearly 50 species (Johnson 1970). The shell shape is oblong, subelliptical, or subrhomboid, with a prominent posterior ridge, and moderately elevated beaks. The periostracum is usually smooth and greenish yellow to tawny-brown. This species is considered common and currently stable throughout its range (Williams et al. 1993).

5.1.3 *Unio merus carolinianus* (Florida pondhorn)

Described by Bosc (1801-1804) from “the Carolinas,” this species ranges from Ocmulgee River in Georgia north to the Chowan River in Virginia. Shells are usually inflated rhomboid to long rhomboid and reach lengths to 114 mm. The species generally exhibits a dark brown to black periostracum with a slightly roughened, satiny sheen. Teeth of the left valve contain two subequal pseudocardinals, often with a vestigial tooth above them, and one lateral tooth. This species is considered common and currently stable throughout its range (Williams et al. 1993).



5.1.4 *Utterbackia imbecillis* (paper pondshell)

Described from the Wabash River in Indiana (Say 1829), this mussel occurs throughout the Mississippi River and Great Lakes drainages, as well as sporadically along the Atlantic slope. It has an extremely thin shell that is oblong and inflated. The dorsal and ventral margins are nearly straight and parallel. The periostracum is greenish yellow with fine green rays. This species is considered common throughout its range (Williams et al.

1993). Estimated size class frequency distribution for this population is estimated based on the ten individuals collected at Site 1 (Figure 3).

5.2 Factors affecting apparent mussel abundance and diversity

In general habitat conditions within the surveyed portion of the Cape Fear River were fairly similar at each transect; slackwater conditions with a mud/detritus substrate along the banks, with an array of boulder, bedrock, cobble and sand substrates across the channel. Woody debris was present throughout the channel, with large accumulations dominating the habitat characteristics in several areas, as noted in the habitat descriptions. Two interrelated habitat features are likely limiting factors for mussels in this section of the river, 1) backwater effects of Buckhorn Dam which slows river flow, and 2) large accumulations of silt and woody debris.

A large amount of silt deposition is present on the rocky-dominated substrates in the main channel as a result of the slack water conditions created by the dam. Consequently, mussels were not found in these areas.

The three species of mussel found in the Cape Fear River are adaptable to the shallow areas of reservoir or standing water habitats. The apparent low numbers of these species in the surveyed section is likely attributable to the large accumulations of woody debris along much of the shallow bank habitats. Similar absence of mussels in low-flow habitats with large accumulations of woody debris in other water bodies throughout the southeast United States have been noted by investigators in other surveys. Additionally, the few mussels that were found in the river during this study occurred in small pockets of habitat without woody debris.

Although the section of Gulf Creek near the mouth is a slow flowing channel with large amount of silt deposition, flow is visually detectable. The continual flow likely maintains a degree of consolidation of the fine muddy substrate in the channel. Additionally, there is comparatively much less woody debris in the creek than in the main river, owing to the fact that it is a backwater area.

Based on CPUE (Tables 1 and 5), mussels densities appear to be slightly greater in the channel upstream (Site 7) of the area proposed for dredging activities (Site 1). However, this difference may be attributable to the surveyors focusing more on where "good" mussel habitat was in the channel at Site 7, after becoming familiar with habitat distribution in the creek at Site 1.

The water quality data did not indicate any significant differences between sites that would account for the major differences in mussel abundances, suggesting that habitat differences and flow regimes are likely influencing factors.

6.0 CONCLUSIONS

Much of the surveyed portion of the Cape Fear River contained depositional areas of silt, detritus and woody debris with relatively little river flow due to the backwater impoundment effect of Buckhorn Dam. Correspondingly, mussel species richness and abundance was low which reflected these habitat conditions. The individual mussels found in Gulf Creek within the expected proposed dredging and intake operation area

were moved to similar habitat in the creek upstream. All four of the mussel species found during the survey effort are considered common species with wide ranging and fairly "stable" populations (Williams et al. 1993). No rare, threatened or endangered mussels were found during this survey. Project construction and operations are not expected to result in substantial impacts to the mussel populations, as they are present in similar numbers upstream of the impact area. Most are common species and habitat generalists which should re-colonize the habitat area once any proposed dredging activities are completed.

7.0 REFERENCES

- Biggins, R.G., R.J. Neves and C.K. Dohner. 1995. Draft national strategy for the conservation of native freshwater mussels. U.S. Fish and Wildlife Service, Washington, DC: 26p.
- Bogan, A.E. 2002. Workbook and key to the freshwater bivalves of North Carolina. North Carolina Museum of Natural Sciences, Raleigh, NC. 101 pp + 10 plates.
- Bosc, L. A. G. 1801-1804. *Histoire naturelle des coquilles contenant leur description, les mœurs des animaux qui les habitent et leurs usages. Avec figures dessinees d'apres nature.* Deterville, Paris.
- Conrad, T. A. 1834. New freshwater shells of the United States, with coloured illustrations; and a monograph of the genus *Anculotus* of Say; also a synopsis of the American naiades. 108 Chestnut Street, Philadelphia, Pennsylvania, J. Dobson.
- Johnson, R. I. 1970). The systematics and zoogeography of the Unionidae (Mollusca:Bivalvia) of the southern Atlantic Slope region. *Bulletin of the Museum of Comparative Zoology* 140(6): 263-449.
- Lightfoot, J. 1786. A catalogue of the Portland Museum, lately the property of the duchess Dowager of Portland, deceased, which will be sold at auction by Mr. Skinner and Co. London.
- NCDENR - Division of Water Quality. 2000. Basinwide Assessment Report: Cape Fear River Basin.
- Progress Energy Carolinas, Inc. 2008a. Shearon Harris Nuclear Power Plant Units 2 and 3 COL Application Part 3 Applicant's Environmental Report – Combined License Stage Revision 0. Raleigh, NC.
- Progress Energy Carolinas. 2008b. Harris Advanced Reactor Units 2 and 3. Nuclear Regulatory Commission Docket Nos. 52-022 and 52-023. Assessment of the Benthic Macroinvertebrate Community and Associated Habitat on the Cape Fear River at Buckhorn Dam. Raleigh, NC

Say, T. 1829. Descriptions of some new terrestrial and fluviatile shells of North America. The Disseminator of Useful Knowledge; containing hints to the youth of the United States, from the School of Industry, New Harmony, Indiana 2(19):291-293, 23 September 1829; 2(20):308-310 7 October 1829; 2(21):323-325, 21 October 1829; 2(22):339-341, 4 November 1829; 2(23):355-356, 18 November 1829.

Williams, J. D., and Warren, Jr., M.L., Cummings, K.S., Harris, J.L., Neves, R.J. 1993. Conservation status of the freshwater mussels of the United States and Canada. Fisheries 18(9): 6-22.