

MITIGATION PLAN
(including AS-BUILT DRAWINGS)
BIG BULL BUFFER RESTORATION SITE
JOHNSTON COUNTY, NORTH CAROLINA

(Contract #16-D05015-2)
FULL DELIVERY PROJECT
TO PROVIDE BUFFER MITIGATION IN THE NEUSE RIVER BASIN
CATALOGING UNIT 03020201

Prepared for:
NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
ECOSYSTEM ENHANCEMENT PROGRAM
RALEIGH, NORTH CAROLINA



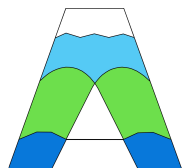
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April 2006

EXECUTIVE SUMMARY

Restoration Systems, L.L.C. (Restoration Systems) has completed riparian buffer restoration at the Big Bull Buffer Restoration Site (hereafter referred to as the “Site”) to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling restoration goals in the region. The Site is located approximately 4 miles southwest of Clayton, in Johnston County. This portion of Johnston County is located centrally within Neuse River Basin 14-digit Cataloging Unit 03020201110040, which is not a Targeted Local Watershed.

This document details riparian buffer restoration procedures implemented on the Site. The Site conservation easement encompasses approximately 36.76 acres of floodplain immediately adjacent to White Oak Creek and unnamed tributaries to White Oak Creek. Within the Site, a total of approximately 35.84 Buffer Mitigation Units were completed in January 2006.

Site drainage features provide water quality function to an approximately 14.3-square mile watershed and drain into Swift Creek. The Site is not located in a North Carolina Wetlands Restoration Program (NCWRP) Targeted Local Watershed and the receiving stream (Swift Creek) has not been placed on the state’s 303(d) list by the North Carolina Division of Water Quality (NCDWQ). Swift Creek has a Best Usage Classification of **C, NSW** and supports its designated uses.

Prior to restoration, Site land use consisted of livestock pasture and hay fields. A few isolated stands of hardwood forest were scattered throughout the Site; however, these areas were highly disturbed and of low density. Site streams and tributaries are characterized by extensively eroding stream banks. Residential development adjacent to the southern Site boundary exacerbated stream-bank erosion problems caused by on-site land use.

Site reforestation, consisting of a Piedmont Bottomland Forest community, was implemented within the entire 36.76-acre Site. The primary goals of the buffer restoration project focused on reforestation of the floodplain with native species to 1) improve water quality; 2) enhance flood attenuation; 3) reduce sedimentation/siltation; 4) increase channel bank stability; 5) filter and reduce pollutants prior to entering Swift Creek; 6) serve as a wildlife corridor by providing connectivity to forested areas adjacent to the Site; 7) provide increased habitat for aquatic and terrestrial wildlife; 8) increase organic matter, carbon export, and woody debris in the stream corridor; 9) restore shade to Site open waters; 10) increase potential for appropriate mussel habitat; and 11) enhance characteristic macroinvertebrate species populations in the channel.

Vegetation monitoring procedures and success criteria are outlined in this document.

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MITIGATION PLAN
(including AS-BUILT DRAWINGS)
BIG BULL BUFFER RESTORATION SITE
JOHNSTON COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

Restoration Systems, L.L.C. (Restoration Systems) has completed riparian buffer restoration at the Big Bull Buffer Restoration Site (hereafter referred to as the “Site”) to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling restoration goals in the region. The Site is located approximately 4 miles southwest of Clayton, in Johnston County (Figure 1, Appendix A). This portion of Johnston County is located centrally within Neuse River Basin Cataloging Unit 03020201 (Figure 2, Appendix A).

The Site conservation easement encompasses 36.76 acres of floodplain immediately adjacent to White Oak Creek and unnamed tributaries to White Oak Creek within subbasin 03-04-02 of the Neuse River Basin. The Site is part of United States Geological Survey Hydrologic Unit 03020201110040 of the South Atlantic/Gulf Region and is not encompassed within a watershed that has been targeted for restoration needs (NCWRP 2002) (Figure 2, Appendix A).

A Detailed Buffer Restoration Plan was completed for the Site in July 2005. That plan outlined methods designed to reforest the entire 36.76-acre Site with native riparian vegetation. Prior to implementation, the entire Site was composed of livestock pasture and hay fields. The following implemented activities provide approximately 35.84 Buffer Mitigation Units requested under the EEP Request for Proposal (RFP) 16-D05015 dated October 22, 2004. Approximately 0.92 acre of the conservation easement is located greater than 200 feet away from a stream or drainageway and therefore, is not included within the buffer restoration acreage.

- Restoration of 35.84 acres of riparian buffer through planting with native forest vegetation.
- Protection of the Site in perpetuity with a conservation easement which is held by the State of North Carolina.

The primary goals of this buffer restoration project focused on reforestation of the entire 36.76-acre Site with native species to 1) improve water quality; 2) enhance flood attenuation; 3) reduce sedimentation/siltation; 4) increase channel bank stability; 5) filter and reduce pollutants prior to entering Swift Creek; 6) serve as a wildlife corridor by providing connectivity to forested areas adjacent to the Site; 7) provide increased habitat for aquatic and terrestrial wildlife; 8) increase organic matter, carbon export, and woody debris in the stream corridor; 9) restore shade to Site open waters; 10) increase potential for appropriate mussel habitat; and 11) enhance characteristic macroinvertebrate species populations in the channel.

The primary goals were accomplished by:

1. Removing non-point sources of pollution associated with agricultural production including a) cessation of broadcasting fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams and b) providing a vegetative buffer adjacent to streams to treat surface runoff.
2. Reducing sedimentation within on-site and downstream receiving waters through a) reduction of bank erosion associated with agricultural practices, b) filter surface runoff from adjacent land and

reduce particulate matter deposited into area waterways, and c) planting a forested vegetative buffer adjacent to Site streams.

3. Promoting floodwater attenuation by revegetating Site floodplains thereby promoting increased frictional resistance on floodwaters crossing Site floodplains.
4. Providing wildlife habitat including a riparian forested corridor.

As constructed, the Site provides 35.84 acres of riparian buffer restoration (35.84 Buffer Mitigation Units).

2.0 SUMMARY

2.1 PRECONSTRUCTION CONDITIONS

The Site encompasses approximately 36.76 acres of land located 4 miles southwest of the Town of Clayton. Due to easy access to Interstate 40 and the close proximity to the City of Raleigh, the area is expanding rapidly. Development pressure is primarily due to residential expansion. Developments are dissected by forested riparian corridors which are protected under Riparian Area Protection Rules. The Site is situated adjacent to White Oak Creek, a fourth-order tributary to Swift Creek and a first- and second-order unnamed tributary to White Oak Creek. Area features drain to Swift Creek, and ultimately to the Neuse River.

Prior to restoration, Site land use consisted primarily of livestock pasture and hay fields (Figure 3, Appendix A). A few isolated stands of hardwood forest were scattered throughout the Site; however, these areas were highly disturbed and of low density. Site streams and tributaries were characterized by extensively eroding stream banks. Residential development adjacent to the southern Site boundary exacerbated stream-bank erosion problems caused by on-site land use.

2.2 PROJECT HISTORY

On June 27, 2005, EEP contracted with Restoration Systems to complete restoration of the Site. A Detailed Buffer Restoration Plan was completed for the project in July 2005. Upon completion of the detailed plan, Carolina Silvics completed planting of the Site during the last week of January 2006.

Information on project managers, owners, and contractors follows:

Owner Information

Restoration Systems, L.L.C.
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Designer Information

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Planting Contractor Information

Carolina Silvics
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3.0 BUFFER RESTORATION ACTIVITIES

Restoration of native forest species will contribute to development and expansion of characteristic species across the landscape, species diversity, and provide secondary benefits such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife.

During the last week of January 2006, the Site was revegetated with native tree species (Figure 4, Appendix A). Observations of forest stands near the Site and community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) were used to develop the primary plant community association to be promoted during restoration efforts. The entire 36.76-acre Site was planted with species characteristic of a Piedmont Bottomland Forest community. Eight tree species were planted at the Site; planting elements and quantities are listed below.

Vegetation Association (Planting Area)	Piedmont Bottomland Forest	
Area (acres)	36.76	
SPECIES	Total Number Planted	Percentage of Total
River Birch (<i>Betula nigra</i>)	5300	15.1
Sugarberry (<i>Celtis laevigata</i>)	1800	5.1
Green Ash (<i>Fraxinus pennsylvanica</i>)	5200	14.8
Blackgum (<i>Nyssa sylvatica</i>)	1700	4.8
Sycamore (<i>Platanus occidentalis</i>)	5200	14.8
Cherrybark Oak (<i>Quercus pagodaefolia</i>)	5300	15.1
Willow Oak (<i>Quercus phellos</i>)	5300	15.1
Northern Red Oak (<i>Quercus rubra</i>)	5300	15.1
TOTAL	35,100	100

Bare-root tree seedlings were planted within the Site at a density of approximately 955 stems per acre (6.8-foot centers). Planting was carried out during the last week of January 2006 to allow plants to stabilize during the dormant period and set root during the spring season. A total of 35,100 diagnostic tree seedlings were planted in support of Site buffer restoration. The entire 36.76-acre restoration area was revegetated during implementation of this plan.

4.0 VEGETATION MONITORING PLAN

Monitoring procedures for vegetation were designed in accordance with *Stream Mitigation Guidelines* (USACE et al. 2003) and the *Draft Internal Guidance for Vegetation Monitoring Plans for NCWRP Riparian Buffer and Wetland Restoration Projects* (undated). A general discussion of the plant community restoration monitoring program is provided. Monitoring of restoration efforts will be performed for a minimum of 5 years or until success criteria are fulfilled. The locations of monitoring plots are depicted in Figure 4 (Appendix A).

During the first year, vegetation will receive visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species. Subsequently, quantitative sampling of vegetation will be performed between September 1 and October 30, after each growing season, until the vegetation success criteria are achieved. Permanent sampling plots (8 plots) were established at randomly placed locations within the Site. Sampling plots are 8 feet

wide and 300 feet long; each plot provides a 0.055-acre sampling area. The sampling plots equally represent the Site and cover a total of 0.44 acres. In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be recorded but not used for vegetative success criteria.

4.1 VEGETATION SUCCESS CRITERIA

Vegetation success criteria dictate that an average density of 320 stems per acre of Character Tree Species must be surviving on the Site at the end of the third growing season. Subsequently, 290 Character Tree Species per acre must be surviving in year 4 and 260 Character Tree Species per acre in year 5. A minimum of five Character Tree Species should be present in the sample. Planted species must represent a minimum of 30 percent of the required stem per acre total (96 stems/acre). Each naturally recruited character species may represent up to 10 percent of the required stem per acre total. In essence, seven naturally recruited character species may represent a maximum of 70 percent of the required stem/acre total. Additional stems of naturally recruited species above the 70 percent threshold are discarded from the statistical analysis. The remaining 30 percent are not removed from the Site, but will be left as a reserve and future seed source for species maintenance during mid-succession phases of forest development.

4.2 CONTINGENCY

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting will be performed with tree species originally planted. Supplemental planting may be performed as needed until achievement of vegetation success criteria. No quantitative sampling requirements are proposed for herb assemblages as part of the vegetation success criteria. Development of floodplain forests over several decades shall dictate the success in migration and establishment of desired understory and groundcover populations. Visual estimates of the percent cover of herbaceous species and photographic evidence will be reported for information purposes only.

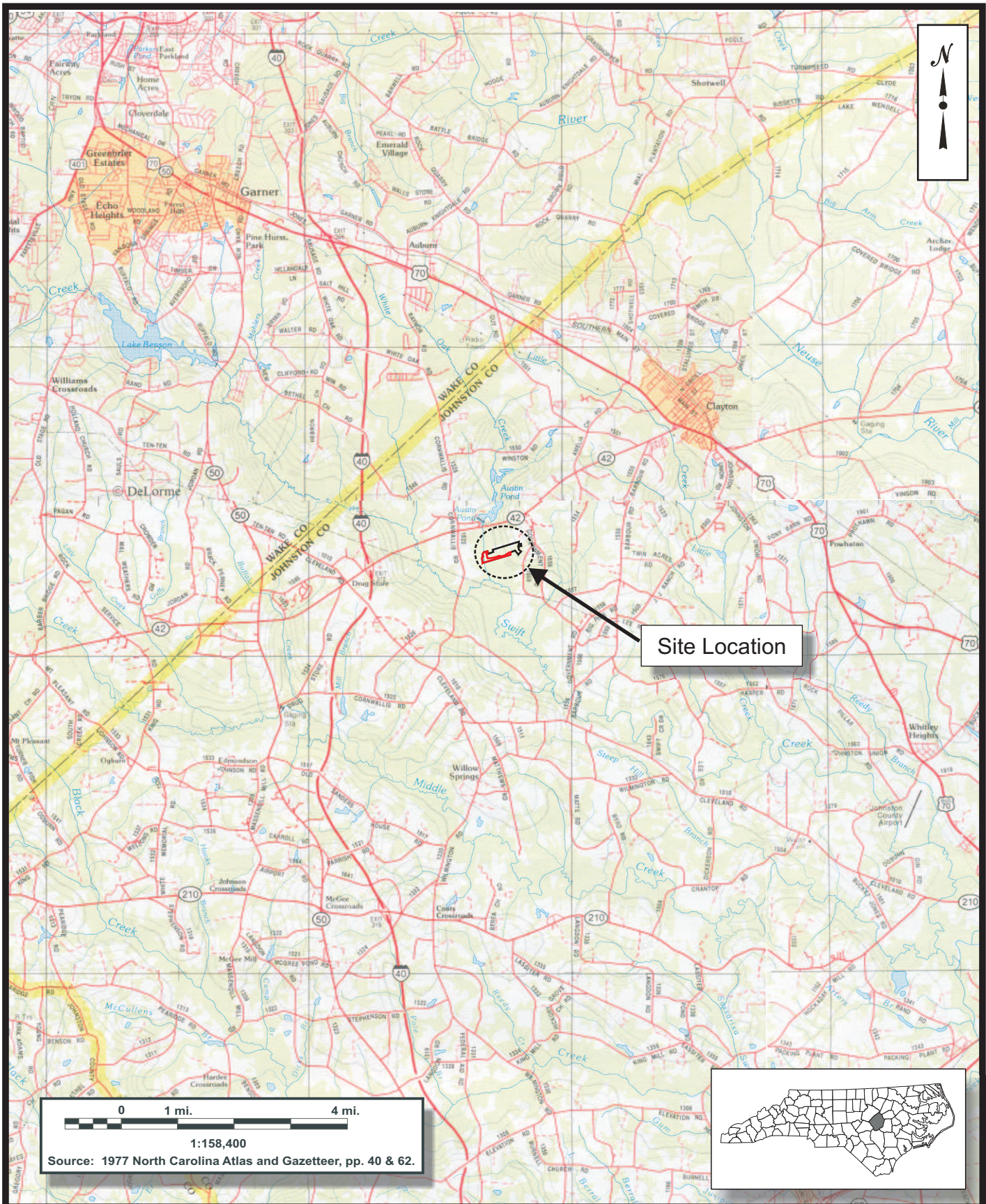
5.0 MONITORING REPORT SUBMITTAL

An Annual Buffer Monitoring Report will be prepared at the end of each monitoring year (growing season) for a minimum of 5 years or until success criteria are fulfilled. The monitoring report will depict the sample plot locations and include photographs which illustrate Site conditions. Data compilation and analyses will be presented including graphic and tabular format, where practicable. Raw data in paper or computer (EXCEL) file format will be prepared and submitted as an appendix or attachment to the monitoring report.

6.0 REFERENCES

- North Carolina Wetlands Restoration Program (NCWRP). 2002. North Carolina Wetlands Restoration Program Neuse River Basin Watershed Restoration Plan. North Carolina Department of Environment and Natural Resources, Raleigh.
- North Carolina Wetlands Restoration Program (NCWRP). Undated. Draft Internal Guidance for Vegetation Monitoring Plans for NCWRP Riparian Buffer and Wetland Restoration Projects. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.
- Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.
- United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA), North Carolina Wildlife Resources Commission (NCWRC), Natural Resources Conservation Service (NRCS), and North Carolina Division of Water Quality (NCDWQ). 2003. Stream Mitigation Guidelines. State of North Carolina.

Appendix A. Figures and As-Built Drawings



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 Source: 1977 North Carolina Atlas and Gazetteer, pp. 40 & 62.



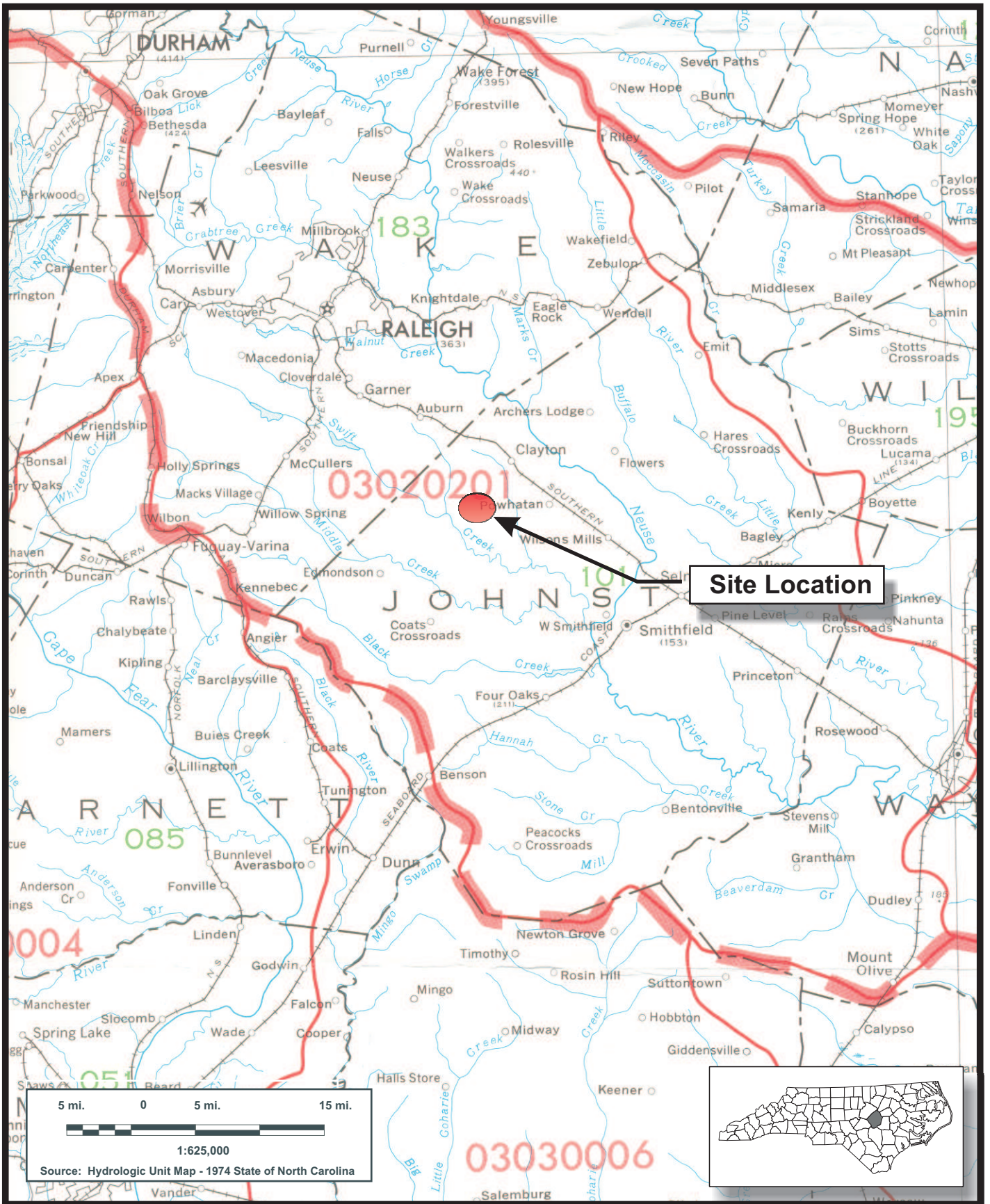
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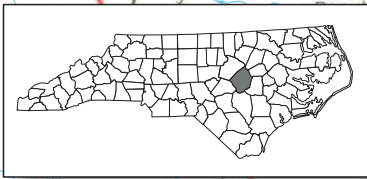
SITE LOCATION
BIG BULL BUFFER RESTORATION SITE
 Johnston County, North Carolina

Dwn. by:	CLF
Ckd by:	WGL
Date:	April 2006
Project:	06-008

FIGURE
1



Site Location



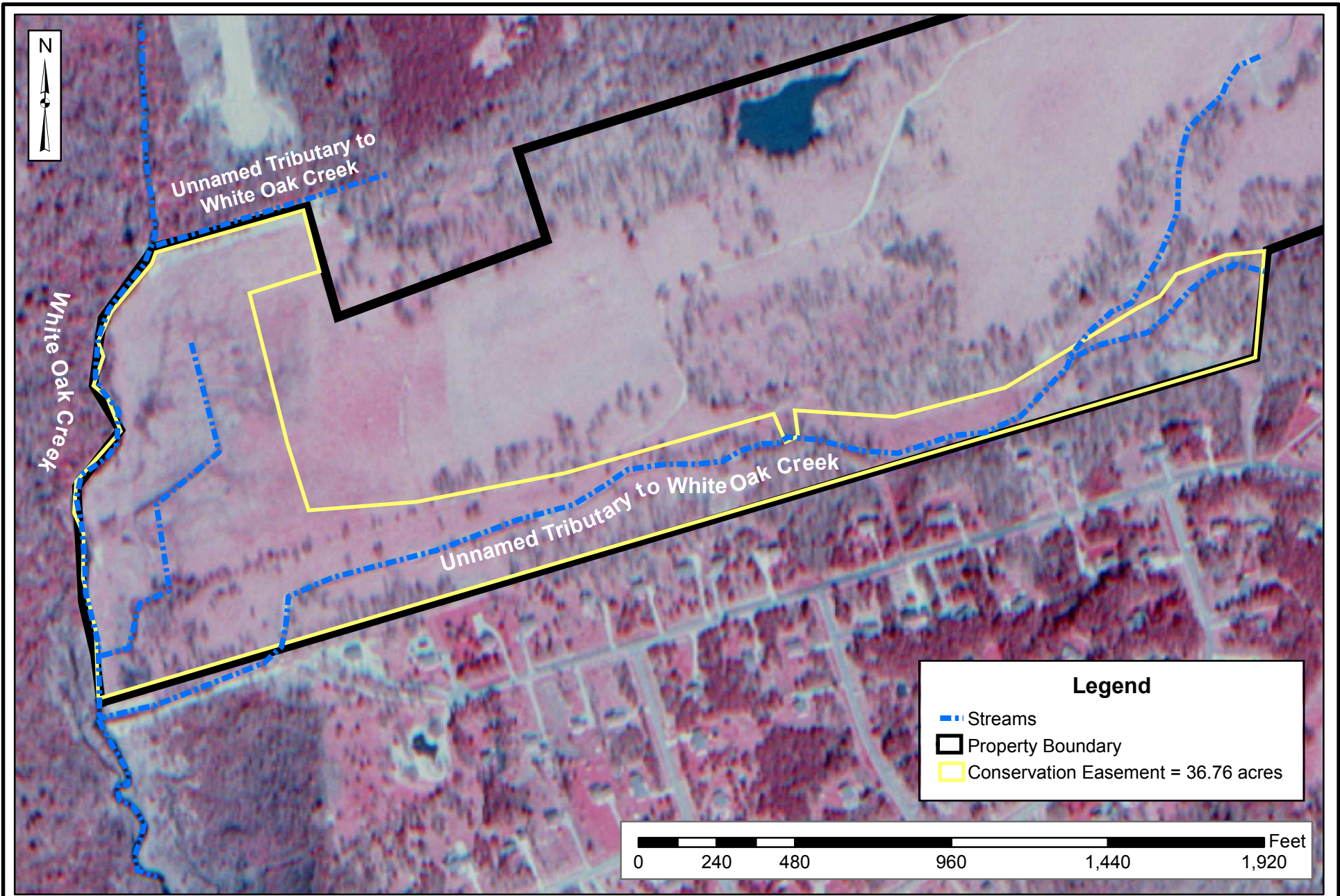
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USGS HYDROLOGIC UNIT MAP
BIG BULL BUFFER RESTORATION SITE
Johnston County, North Carolina

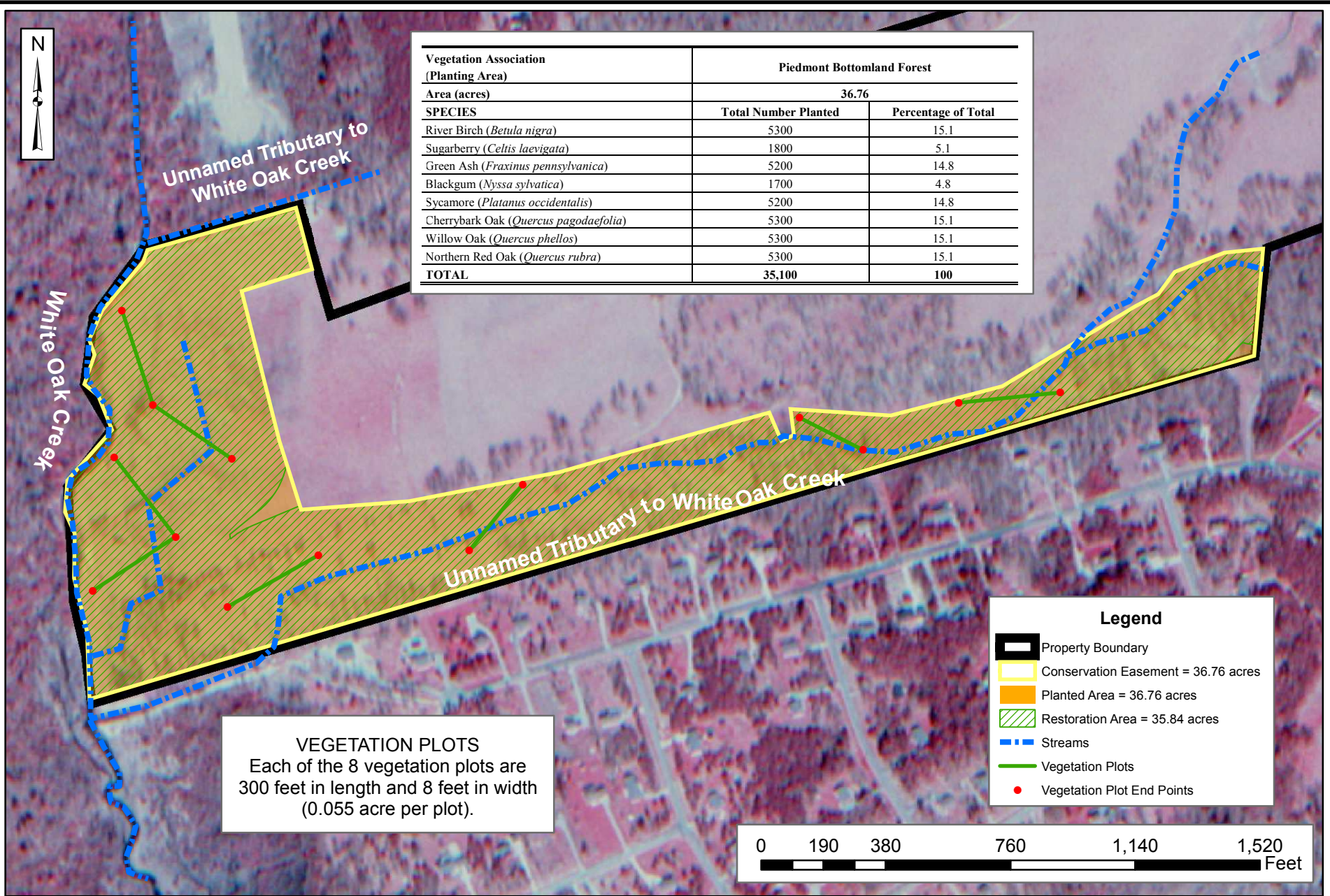
Dwn. by:	CLF
Ckd by:	WGL
Date:	April 2006
Project:	06-008

FIGURE
2





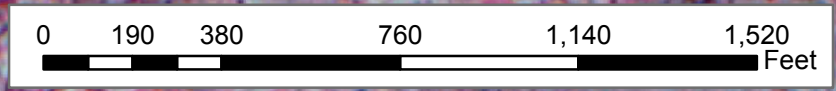
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TOTAL	35,100	100



VEGETATION PLOTS
 Each of the 8 vegetation plots are 300 feet in length and 8 feet in width (0.055 acre per plot).

Legend

- Property Boundary
- Conservation Easement = 36.76 acres
- Planted Area = 36.76 acres
- Restoration Area = 35.84 acres
- Streams
- Vegetation Plots
- Vegetation Plot End Points



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PLANTING AND MONITORING PLAN
BIG BULL BUFFER RESTORATION SITE
 Johnston County, North Carolina

Dwn. by:	CLF	FIGURE 4
Date:	April 2006	
Project:	06-007	