ANNUAL MONITORING REPORT
YEAR 3 (2008)
CONETOE BUFFER RESTORATION SITE
PITT COUNTY, NORTH CAROLINA
(Contract Number D05026-1)

Prepared for:

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

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June 2008

EXECUTIVE SUMMARY

Restoration Systems, LLC (Restoration Systems) has completed riparian buffer restoration at the Conetoe 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 10 miles northwest of Greenville, in Pitt County. This portion of Pitt County is located centrally within Tar-Pamlico River Basin 14-digit Targeted Local Watershed 03020103050050**.**

The Site encompasses approximately 10.19 acres immediately adjacent to unnamed tributaries to Conetoe Creek. A total of 10.19 Buffer Mitigation Units, resulting from 10.19 acres of buffer restoration, were completed in February 2006.

Prior to restoration, Site land use was characterized by spray fields utilized for sewage sludge application. The Site was cleared of native forest vegetation, ditched to reduce the impacts of groundwater on land use, and planted with herbaceous ground cover. Site streams were ditched and received periodic vegetative maintenance, resulting in eroding banks.

Site reforestation, consisting of a Mesic Pine Flatwoods community, was implemented within the entire 10.19-acre Site. The primary goals of this buffer restoration project focused on reforestation of the 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 Conetoe 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 open waters of the Site; 10) increase potential for appropriate mussel habitat; and 11) enhance macroinvertebrate species populations in the channel.

As a whole, the densities of four vegetation plots across the Site were above the required 320 stems per acre with an average of 1432 tree stems per acre in the Third Monitoring Year (Year 2008). In addition, each individual plot met success criteria and had increasing species diversity with 8 to 10 species present within each plot.

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ANNUAL MONITORING REPORT
YEAR 3 (2008)
PITT COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

Restoration Systems, LLC (Restoration Systems) has completed the restoration of riparian buffer at the Conetoe 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 10 miles northwest of Greenville, in Pitt County (Figure 1).

The Site conservation easement encompasses 10.19 acres immediately adjacent to unnamed tributaries to Conetoe Creek within subbasin 03-03-03 of the Tar-Pamlico River Basin. The Site is part of United States Geological Survey Catalogue Unit 03020203 of the South Atlantic/Gulf Region and is encompassed within a Hydrologic Unit that has been targeted for restoration needs (Targeted Local Watershed 03020103050050) (EEP 2004).

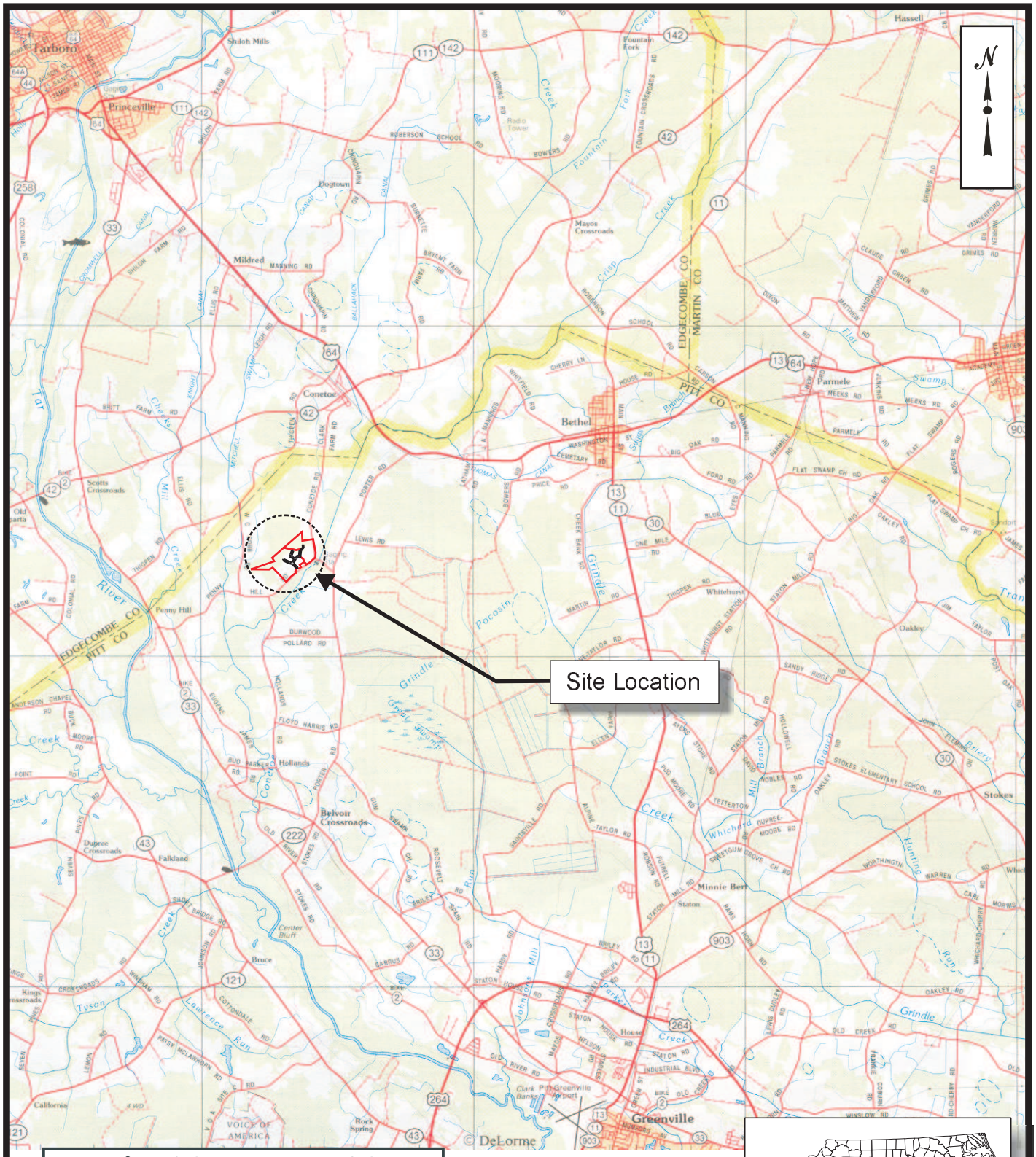
A Detailed Buffer Restoration Plan was completed for the Site in July 2005. The plan outlined methods designed to reforest the entire 10.19-acre Site with native species. Prior to implementation, the entire Site was composed of sewage sludge spray fields. The following objectives provide 10.19 Buffer Mitigation Units as requested under the EEP Request for Proposal (RFP) 16-D05026 dated October 22, 2004:

- Restoration of approximately 10.19 acres of riparian buffer through planting with native forest species.
- 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 10.19-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 Conetoe 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 open waters of the Site; 10) increase potential for appropriate mussel habitat; and 11) enhance macroinvertebrate species populations in the channel.

The primary goals were accomplished by:

1. Removing nonpoint sources of pollution associated with land use practices including a) removal of spray field application of sewage sludge into and adjacent to Site streams and b) cessation of broadcasting fertilizer, pesticides, and other agricultural materials into and adjacent to Site streams.
2. Reducing sedimentation within onsite and downstream receiving waters through a) a reduction of bank erosion associated with ditch vegetation maintenance, b) filtering and reducing surface runoff from adjacent spray fields, and c) planting a forest buffer adjacent to Site streams.



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SITE LOCATION
CONETOE BUFFER RESTORATION SITE
Pitt County, North Carolina

Dwn. by:	CLF
Ckd by:	WGL
Date:	June 2008
Project:	08-007

FIGURE
1

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

As constructed, the Site provides 10.19 acres of riparian buffer restoration (10.19 Buffer Mitigation Units).

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 planted the Site during the first week of February 2006. An As-built Mitigation Plan was completed by Axiom Environmental, Inc. in May 2006.

Information on project managers, owners, and contractors follows:

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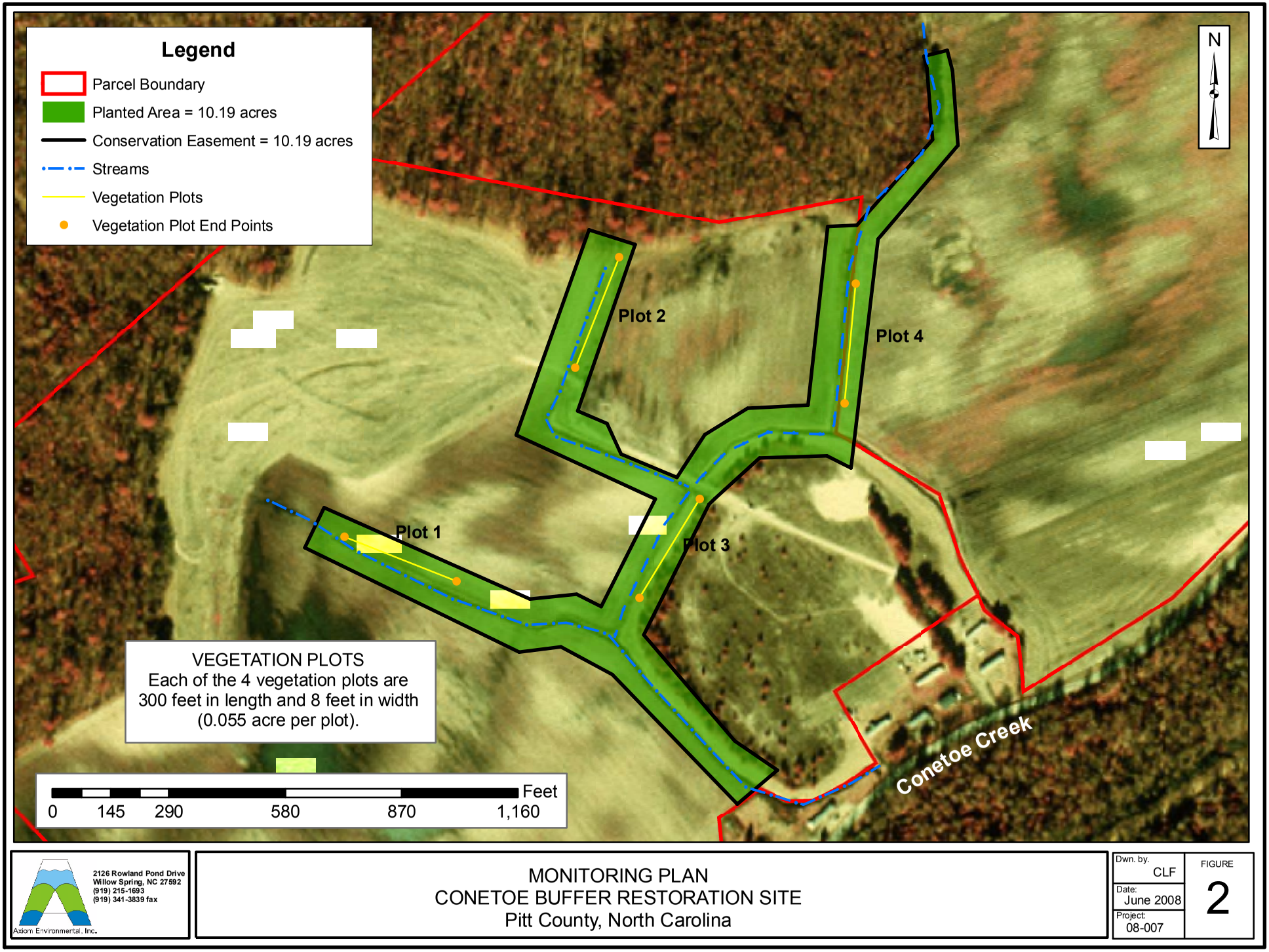
2.0 VEGETATION MONITORING PROGRAM

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 2.

During the first year, vegetation received visual evaluation on a periodic basis to ascertain the degree of overtopping of planted species by nuisance species. Subsequently, quantitative sampling of vegetation will be performed between June 1 and September 30 of each monitoring year for five years or until the vegetation success criteria are achieved.



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MONITORING PLAN
CONETOE BUFFER RESTORATION SITE
Pitt County, North Carolina

Dwn. by: CLF
Date: June 2008
Project: 08-007

FIGURE 2

Four sample transects were installed within planted areas of the Site shortly after replanting to equally represent the Site (Figure 2). Each transect is 300 feet in length and 8 feet in width (0.055 acre). 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 were also noted. Photographs of the four vegetation plots are included in Appendix A.

2.2.1 Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component is dependent upon density and growth of "Character Tree Species." Character Tree Species include planted species, those observed in forest stands near the Site, and those listed in the Mesic Pine Flatwood community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990). All planted canopy tree species and those identified in Schafale and Weakley (1990) will be utilized to define "Characteristic Tree Species" as termed in the success criteria.

Table 1. Character Tree Species

Planted Species	Examples of Mesic Pine Flatwood Species*
River Birch (*Betula nigra*)	Mockernut Hickory (*Carya alba*)
Loblolly Pine (*Pinus taeda*)	Sand Hickory (*Carya pallida*)
White Oak (*Quercus alba*)	Sweetgum (*Liquidambar styraciflua*)
Southern Red Oak (*Quercus falcata*)	Longleaf Pine (*Pinus palustris*)
Swamp Chestnut Oak (*Quercus*	Bluejack Oak (*Quercus incana*)
Water Oak (*Quercus nigra*)	Post Oak (*Quercus stellata*)
Cherrybark Oak (*Quercus pagoda*)	Blackjack Oak (*Quercus marilandica*)
Willow Oak (*Quercus phellos*)	Black Cherry (*Prunus serotina*)
Northern Red Oak (*Quercus rubra*)	

* Species described in Schafale and Weakley (1990) and observed within adjacent sites; this is not a comprehensive list.

Vegetation success criteria for the Site will be the existence of an overall density of at least 320 stems per acre five years after the initial planting. Additional seedlings are expected to be recruited to the Site from adjacent forested communities. These individuals may also be counted in the overall success rate for the Site provided they are native hardwood tree species.

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with Character Tree Species. Supplemental planting will 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 will dictate the success in recruitment and establishment of desired understory and groundcover populations. Visual

estimates of the percent cover of herbaceous species will be noted and documented through periodic photographs. Photographs of the vegetation plots are included in Appendix A.

2.2.2 Vegetation Sampling Results and Comparison to Success Criteria

Quantitative sampling of vegetation was conducted in June 2008. Results are provided in Table 2. Vegetation success criteria for year 3 (320 stems per acre) were exceeded for the 2008 annual monitoring year with 1432 tree stems per acre across the Site. In addition, each individual plot met success criteria and had increasing species diversity with 8 to 10 species present within each plot.

3.0 CONCLUSIONS

As a whole, vegetation plots across the Site were above the required 320 stems per acre with an average of 1432 tree stems per acre in the Third Monitoring Year (Year 2008). In addition, each individual plot met success criteria and had decent species diversity with 8 to 10 species present within each plot. Average stems per acre and species diversity has increased since the first year of monitoring.

Table 3. Summary of Vegetation Plot Results

Plot	Stems/Acre Counting Towards Success Criteria				
	Year 1 (2006)	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**
1	764	945	1091		
2	1473	2327	1345		
3	655	1309	1236		
4	1673	1655	2055		
Average Plots 1-4	**1141**	**1547**	**1432**		

Documented animal species that utilize the developing wetland ecosystem are listed in Appendix B.

TABLE 2
2008 VEGETATION MONITORING DATA AND RESULTS

Note: Each plot totals 0.055 acre in size.

Community	Mesic Pine Flatwoods						
Species*	Plot 1	Plot 2	Plot 3	Plot 4	Total Stems for Plots 1-4	Total Stems/ Acre	Total Stems/Acre Counting Towards Success Criteria
Character Tree Species (count toward success)							
Acer rubrum (red maple)				1	1	5	5
***Betula nigra* (river birch)**	19	2	13	11	45	205	205
Carya illinoinensis (pecan)	1				1	5	5
Ilex opaca (American holly)	1	1			2	9	9
Liquidambar styraciflua (sweetgum)		28			28	127	127
***Pinus taeda* (loblolly pine)**	13	5		7	25	114	114
Prunus serotina (black cherry)		3			3	14	14
***Quercus alba* (white oak)**			29	32	61	277	277
***Quercus falcata* (southern red oak)**		3	1	1	5	23	23
***Quercus michauxii* (swamp chestnut oak)**	7	6	6	18	37	168	168
***Quercus nigra* (water oak)**	5	9	1	6	21	95	95
***Quercus pagoda* (cherrybark oak)**	2		11		13	59	59
***Quercus phellos* (willow oak)**	1				1	5	5
***Quercus rubra* (northern red oak)**	11	8	5	36	60	273	273
Quercus sp. (oak)		9	2	1	12	55	55
Species that Don't Count Toward Success							
Baccharis halimifolia (eastern baccharis)	3	1		3		0	0
TOTAL STEMS/PLOT	**63**	**75**	**68**	**116**	**315**	**1432**	**1432**
TOTAL STEMS/PLOT COUNTING TOWARDS SUCCESS CRITERIA	**60**	**74**	**68**	**113**			
TOTAL STEMS/ACRE COUNTING TOWARDS SUCCESS CRITERIA	**1091**	**1345**	**1236**	**2055**			

* Planted species are in bold.

4.0 REFERENCES

Ecosystem Enhancement Program (EEP). 2004. Tar-Pamlico 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., A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation, NC Natural Heritage Program, Division of Parks and Recreation, NC DEM, Raleigh NC.

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.

APPPENDIX A
VEGETATION PLOT PHOTOGRAPHS

Conetoe Buffer Restoration Site
Year 3 (2008) Annual Monitoring
Vegetation Plot Photos Taken June 2008

APPPENDIX B
WILDLIFE OBSERVATIONS

WILDLIFE OBSERVED AT SITE CONETOE RESTORATION SITE

BIRDS*:		August	June
		2006	2008
Red-tailed Hawk	*Buteo jamaicensis*	x	
Turkey Vulture	*Cathartes aura*	x	x
Northern Bobwhite	*Colinus virginianus*	x	
Killdeer	*Charadrius vociferus*	x	
Mourning Dove	*Zenaida macroura*	x	x
Barn Swallow	*Hirundo rustica*	x	
Common Crow	*Corvus brachyrhynchos*	x	
Eastern Bluebird	*Sialia sialis*	x	x
Starling	*Sturnus vulgaris*	x	
Northern Cardinal	*Cardinalis cardinalis*	x	
Indigo Bunting	*Passerina cyanea*	x	
American Goldfinch	*Cardeulis tristis*	x	
Field Sparrow	*Spizella pussila*	x	
Red-winged Blackbird	*Agelaius phoeniceus*		x
REPTILES and AMPHIBIANS:			
Green Frog	*Rana clamitans*	x	
Black Snake	--	x	
Bullfrog	*Rana catesbeiana*		x

*Bird list: The Sibley Guide to Birds by David Allen Sibley. National Audubon Society. 2000. Chanticleer Press, Inc.

August 2006/June 2008 - incidental to other fieldwork.