MITIGATION PLAN

SLEEPY CREEK
WETLAND AND RIPARIAN BUFFER MITIGATION SITE
LENOIR COUNTY, NORTH CAROLINA

Prepared for:

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

Prepared by:

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Photo 1: Preconstruction Conditions

Photo 2: Post construction Conditions

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MITIGATION PLAN

SLEEPY CREEK
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LENOIR COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

Restoration Systems, LLC, established the Sleepy Creek Wetland and Riparian Buffer Mitigation Site (Project) in the Coastal Plain region of the Neuse River Basin (United States Geological Survey Cataloging Unit 03020202. The Project consists of four properties including a Core Restoration Site located northwest of the Town of LaGrange in Lenoir County (Figure 1, Appendix A) in Hydrologic Unit 03020203030030 and three preservation Sites located near the City of Kinston (Figure 2, Appendix A). The Project provides compensatory mitigation for in-kind, unavoidable wetland and riparian buffer impacts associated with development in the middle Neuse River Basin. Mitigation generated by this project will be used by the North Carolina Ecosystem Enhancement Program (NCEEP) and North Carolina Department of Transportation (NCDOT) to ensure no net loss of wetland functions associated with transportation improvement projects (TIPs) in the region.

The Project comprises 534 acres distributed within the floodplains of Bear Creek and the Neuse River. The Project includes a 153.58-acre Core Restoration Site and approximately 380 acres of preservation areas within the Bear Creek/Neuse River regional wetland corridor. Survey plats depicting the wetland management and preservation areas are included in Appendix B.


Photo 3: Post-Construction Conditions

A Detailed Wetland Restoration Plan was completed for the Core Restoration Site in July 2002. The plan outlined methods designed to restore agricultural fields that had been ditched, drained, and cleared for row crop production to pristine riverine wetlands. The plan outlined wetland restoration procedures including 1) ditch/canal backfilling, 2) ditch outlet plugs, 3) slough/drainageway construction, 4) embankment construction, 5) depressional wetland excavation, and 6) drainage control outlets (Figure 3, Appendix A).

The objectives of the Detailed Wetland Restoration Plan included the following.

1) Establish a backwater cypress-tupelo swamp,
2) Provide a perennial source for groundwater recharge through restored bottomland hardwood forest, and
3) Facilitate nutrient reduction goals in the Neuse River Basin.

As constructed, the Core Restoration Site provides 96.4 acres of riverine wetland restoration, 39.2 acres of riverine wetland enhancement, and 18.0 acres of upland riparian buffer restoration (Figure 4, Appendix A) totaling 153.58 acres. In addition, the three wetland preservation areas contain 380 acres.

2.0 SUMMARY

2.1 Preconstruction Condition

The Core Restoration Site provides floodplain wetland functions to a 51-square mile watershed extending from Northern Goldsboro to Greene County, south of Greenville. This agricultural watershed contributes nitrogen loads and flood waters to the lower Neuse River Basin including municipalities such as Kinston, Grifton, and New Bern. Prior to Site implementation, the river floodplain had been ditched, leveled, and drained to support agricultural and silvicultural activities. Bear Creek has been dredged, straightened, and levees were constructed to further impede flood storage and surface water impacts to alternative land uses.

The Core Restoration Site encompasses 153.58 acres of river floodplain along a 2925-foot reach of Bear Creek, a fifth-order blackwater river (Strahler 1964). Prior to Site implementation land uses included approximately 93 acres of crop land and 61 acres of clear-cut, forested tracts. The Site is bound by the CSX Railway to the north, Washington Street to the south, and a former hog farm to the east. Another completed wetland restoration project (Bear Creek-Mill Branch Mitigation Bank) is located immediately south of Washington Street.

Photo 4. Pre-Construction Conditions

Upstream watershed land use including agricultural production and development have resulted in elevated nutrient loading rates discharged into the Neuse River. River dredging and levee construction throughout the Bear Creek watershed has most likely exacerbated water quality problems. Therefore, wetland restoration plans were designed specifically to maximize nutrient reduction functions at the Core Restoration Site.

2.2 Project History

A Detailed Wetland and Riparian Buffer Restoration Plan was completed for the Core Restoration Site in July 2002 with final issuance of permits occurring in September 30, 2002, conditioned upon approval of the Detailed Wetland and Riparian Buffer Restoration Plan - Revised (approved June 29, 2004). Upon completion of the detailed plan and issuance of permits, construction plans were developed and construction was initiated in October 15, 2004. Backwater Environmental, Inc., a subsidiary of Osborne Co. Inc., completed earthwork and grading at the Core Restoration Site on April 27, 2005. Carolina Silvics completed planting of the Site from April 1 through 15, 2005.

Information on project managers, owners, and contractors follows:

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3.0 RESTORATION ACTIVITIES

Alterations designed to restore groundwater, surface flow dynamics, and wetland hydrology at the Core Restoration Site include 1) ditch/canal backfilling, 2) ditch outlet plugs, 3) slough/drainageway construction, 4) embankment construction, 5) depressional wetland excavation, 6) drainage control outlets, and 7) wetland soil restoration. Site construction is detailed in Figure 3 (Appendix A).

3.1 Ditch/Canal Backfilling

Ditches were backfilled using earthen material excavated from depressional wetland construction, slough/drainageway construction, borrow areas, and/or from spoil ridges adjacent to canals. Vegetative material including trees and rooting debris was removed from earthen fill to the maximum extent feasible before reinsertion into the canal. The ditches/canals were filled, compacted, and graded to the elevations depicted in Figure 3 (Appendix A).


Photo 5: Ditch Backfilling

3.2 Ditch Outlet Plugs

Ditch outlets into Bear Creek and at canal infalls were effectively plugged to prevent migration of flows back into the former ditch. The plugs were constructed of high-density material designed to withstand erosive forces associated with river floods. Each plug was backfilled in 2-foot lifts of vegetation free material and compacted into the bottom of the ditch. The earthen material was obtained from adjacent levee sections and/or through construction of shallow wetland pools within the primary floodplain. The top of the plugs extend to a minimum of 1 foot above the adjacent surfaces to reduce overtopping by periodic flood flows.

Terminal plugs at the ditch outfalls to Bear Creek are relatively large, near permanent structures spanning the excavated canal and tying into the existing levee. Erosive flows will be experienced on the Bear Creek side of plugs. In addition, hydraulic head may be experienced against the interior face of the plug. Therefore, structural support was placed on the face, such as crushed rock. The stabilized outfall plugs reduce potential for head-cuts to migrate from the dredged river into the former canal.

3.3 Slough/Drainageway Construction

Intermittent sloughs were constructed to provide relatively long-term surface water storage. In addition, the sloughs function to divert water into interior portions of the floodplain and away from the railroad easement and low-lying depressions immediately adjacent to Bear Creek. The excavated material was used for ditch backfilling (Section 3.1). The sloughs range from 10 to 20 feet in width and 0.5 to 2 feet in depth. The depth of the slough was designed to elevations that direct water into interior floodplain flats, as depicted in Figure 3 (Appendix A).

Photo 6 Slough Construction

In the forested area, sloughs and intermittent drainageways have been allowed to redevelop primarily through passive processes. Braiding, ponding, and anastomosed conditions occur, similar to reference wetlands in the region. As crop land portions of the Core Restoration Site become forested, the potential for surface water runoff will be reduced and natural backwater slough development processes will intercede.

3.4 Embankment Construction

Low-lying embankments were constructed within ditch backfill sections and at the locations depicted in Figure 3 (Appendix A). These embankments, averaging 1 foot or less in height, were placed within sloughs near the approach to the Bear Creek channel. The embankments serve to impede surface water runoff towards the lower landscape.

3.5 Depressional Wetland Construction

Depressional wetlands were constructed at the locations depicted in Figure 3 (Appendix A). These excavation areas provided material for ditch backfilling. The depressions generally range from 0 to 2 feet in depth and 0.1 to 0.7 acres in size. The depressions were placed to promote surface water migration in the down-valley direction, to increase habitat diversity, and to provide localized storage in wetland areas prior to discharge into Bear Creek.

3.6 Drainage Control Outlets

Drainage control outlets were installed at locations depicted in Figure 3 (Appendix A). These outlets were positioned where culverts existed prior to Site implementation. The outlets serve to allow for drainage during large storm events. Potential for head-cuts diminishes as the reforestation process ensues. Ultimately, vegetation will serve to stabilize soil material along the banks of Bear Creek and will reduce runoff rates that induce head-cut formation. Consequently, these drainage control outlets provide a temporary function during the interim, early successional period until reforestation is completed.

Photo 7: Drainage Control Outlet

3.7 Wetland Soil Restoration

Restoration activities were designed to reintroduce wetland hydroperiods in support of organic soil maintenance. However, dredging in Bear Creek has reduced the total amount of water potentially available for this effort. Consequently, water inputs from the auxiliary watershed must be held on soil surfaces for the maximum time period possible. In addition, local microtopography has been maximized to further promote long-term water storage. Soil restoration activities conducted at the Site include soil ripping and woody debris deposition.

3.7.1 Wetland Surface Ripping

Before wetland community restoration was implemented, compacted agricultural areas and graded backfill material were ripped by bulldozer with a rock rake. The ripping was performed as linear bands directed perpendicular to the land slope (perpendicular to potential surface water flows). After scarification, the soil surface exhibited complex microtopography ranging to 1 foot in

vertical asymmetry across the landscape. Restored microtopographic relief is considered critical to short-term hydrology restoration efforts. Therefore, multiple passes were conducted along each band to ensure adequate surface roughing and surface water storage potential across the Site. Subsequently, community restoration was initiated on scarified wetland surfaces.

Photo 8: Wetland Surface Ripping

3.7.2 Woody Debris Deposition

Woody debris cleared during restoration activities or located in adjacent areas was placed on restored wetland surfaces to the maximum extent practicable. The absence of large woody debris represented a limiting factor in the establishment of habitat diversity, nutrient cycling (soil microbial) functions, and energy dissipation on abandoned farmland (Brinson et al. 1995). Woody debris jams were also used to impede flow within drainageways through the Site.

4.0 WETLAND COMMUNITY RESTORATION

In the spring of 2005, the Site was planted with 91,149 native, wetland-adapted tree species. During the planting effort, tree seedlings were purchased from the International Paper, South Carolina Supertree Nursery, located in Blenheim, South Carolina. The seedlings were grouped into three primary associations based on the landscape position for planting: 1) Riverine Swamp Forest (Floodplain Depressions), 2) Riverine Swamp Forest (Strip Planting), 3) Bottomland Hardwood Forest, and 4) Riparian Buffer Forest. The location of each planting association is depicted in Figure 5 (Appendix A).

Photo 9: Site Planting

Before wetland plant community restoration was implemented, agricultural fields and graded backfill material on the primary floodplain were scarified. Scarification was performed as linear bands directed perpendicular to the land slope (surface water flows). Subsequently, community restoration was initiated on scarified wetland surfaces.

Fifteen tree species were planted at the Site; they are as follows (with planted quantity):

Common Name	Scientific Name	Number Planted
American Elm	*Ulmus americana*	2,468
Atlantic White Cedar	*Chamaecyparis thyodes*	2,949
Bald Cypress	*Taxodium distichum*	16,111
Cherrybark Oak	*Quercus pagodaefolia*	4,158
Laurel Oak	*Quercus laurifolia*	5,848
Overcup Oak	*Quercus lyrata*	3,380
River Birch	*Betula nigra*	4,124
Swamp Black Gum	*Nyssa sylvatica var. biflora*	12,778
Swamp Chestnut Oak	*Quercus michauxii*	2,468
Sycamore	*Platanus occidentalis*	4,124
Water Oak	*Quercus nigra*	4,124
Water Tupelo	*Nyssa aquatica*	14,521
Willow Oak	*Quercus phellos*	5,848
Yellow Poplar	*Liriodendron tulipifera*	4,124
	Total	91,149

Bare-root seedlings of tree species were planted within specified areas at a density of 680 stems per acre (8-foot centers).

5.0 MONITORING PLAN

The Site monitoring protocol consists of a comparison between reference and restoration areas along with evaluation of jurisdictional wetland criteria (Environmental Laboratory 1987). Monitoring will entail analysis of two primary parameters: hydrology and vegetation. Monitoring of restoration efforts will be performed for a minimum of 5 years or until success criteria are fulfilled. The monitoring program is described below.

The restoration portion of the Core Restoration Site has been divided into two community types, swamp forest and bottomland hardwood forest as depicted in Figure 6 (Appendix A). Bottomland hardwood forest areas are floodplain flats adjacent to Bear Creek that are characterized by elevated groundwater tables and a rich diversity of vegetative species. Swamp forest areas are characterized by backwater sloughs that are semipermanently impounded and composed primarily of cypress-tupelo vegetation. The margins between bottomland hardwood forest and swamp forest areas were delineated and located utilizing Global Positions System equipment with reported submeter accuracy.

Swamp forest areas are expected to aggrade due to organic matter accumulation, sediment deposition, and vegetation mat formation and may fluctuate in location and extent throughout the monitoring period. Similarly, bottomland hardwood forest areas may be affected by beaver activity, changes in upstream watershed land use, storm flows, and/or climactic variations. Therefore, provisions for reclassification of bottomland hardwood and swamp forest areas represents an important component to be observed throughout the monitoring period.

5.1 Hydrology Monitoring Procedure

After hydrological modifications were completed at the Site, continuous recording, surficial monitoring gauges were installed in accordance with specifications outlined in *Installing Monitoring Wells/Piezometers in Wetlands* (NCWRP 1993). Monitoring gauges were set to a depth of approximately 24 inches below the soil surface. Screened portions of each gauge were surrounded by filter fabric, buried in a sand screen, and sealed with a bentonite cap to prevent siltation and surface flow infiltration during floods.

Sixteen monitoring gauges were installed in wetland restoration areas to provide representative coverage within each physiographic landscape area (Figure 6, Appendix A). In addition, three monitoring gauges were installed in reference areas in similar landscape positions (Figure 1, Appendix A). The growing season dictated by the *Soil Survey of Lenoir County, North Carolina* (USDA 1977) indicates that the beginning and ending dates of the period between the last date in spring and the first date in the fall, on which the probability is 5 years in 10 that the air temperature at 5 feet above the ground surface will fall to 28 degrees Fahrenheit is March 12 through November 15. The Sleepy Creek Wetland and Riparian Restoration Plan dictated a growing season from February 25 to November 29; however, this was incorrectly based on a probability of 5 years in 10 that the air temperature will fall to 24 degrees Fahrenheit. Therefore, hydrologic sampling will be carried out in restoration areas during the growing season (March 12 to November 15 or 248 days) at daily intervals necessary to satisfy hydrology success criteria.

5.2 Vegetative Monitoring Procedure

Restoration monitoring procedures for vegetation are designed in accordance with guidelines presented in *Mitigation Site Classification (MiST)* documentation (USEPA 1990) and

Compensatory Hardwood Mitigation Guidelines (USDOA 1993). The following presents a general discussion of the monitoring protocol.

Vegetation will receive visual evaluations during the periodic reading of monitoring gauges to ascertain the general conditions and degree of overtopping of planted elements by weeds. Subsequently, quantitative sampling of vegetation will be performed once annually during late summer or fall for a minimum of 5 years or until vegetation success criteria are achieved. Sampling dates may be modified to accommodate river flood events and plot inundation, if needed.

During the first sample event, a visual survey will be performed in the reference wetlands to identify all canopy tree species represented within target communities. These reference tree species will be utilized to define "Character Tree Species" as termed in the success criteria.

Sixteen sample plots were installed within planted areas of the Core Restoration Site to equally represent the various hydrologic regimes and plant communities (Figure 6, Appendix A). Each transect is 600 feet in length and 8 feet in width (0.11 acre) centered on each of the 16 groundwater monitoring gauges. 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.

In each plot, presence/absence of shrub and herbaceous species will be recorded.

6.0 SUCCESS CRITERIA

6.1 Hydrologic Success Criteria

Target hydrological goals have been developed using regulatory wetland hydrology criteria and reference wetland sites.

Regulatory Wetland Hydrology Criteria

The regulatory wetland hydrology criteria require saturation (free water) within 1 foot of the soil surface for 5 percent of the growing season under normal climatic conditions. In some instances, the regulatory wetland hydroperiod may extend between 5 and 12.5 percent of the growing season.

Reference Wetland Sites

Three monitoring gauges were placed in reference wetland areas located in the vicinity of the Site. These groundwater gauges will provide reference hydroperiods for the bottomland hardwood forest and swamp forest physiographic areas.

Based on the Sleepy Creek Wetland and Riparian Buffer Restoration Plan – Revised (2004), under normal climatic conditions, the hydrologic success criteria require saturation (free water) within 1 foot of the soil surface for a minimum of 7.5 percent of the growing season for bottomland forest areas depicted in Figure 6 (Bottomland Hardwood Forest). The swamp forest areas as depicted in Figure 6 must support saturation (free water) within 1 foot of the soil surface for a minimum of 15 percent of the growing season (Swamp Forest). This hydroperiod translates to saturation for a minimum, 19-day (7.5 percent) to 37-day (15 percent) consecutive period during the growing season, which extends from March 12 to November 15 (USDA 1977).

Individual groundwater gauges will be compared to a reference gauge if the gauge does not meet or exceed the hydroperiod outlined for success criteria. In such cases, its hydroperiod must exceed 75 percent of the hydroperiod exhibited by the reference gauge located within the same physiographic landscape area. If the reference gauge does not meet or exceed success criteria, a wetland data form (Environmental Laboratory 1987) will be completed to document the classification and description of vegetation, soil, and hydrology.

6.2 Vegetation Success Criteria

Success criteria have been established to verify that the vegetation component supports community elements necessary for floodplain forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon density and growth of “Character Tree Species," which include planted species, species listed by Schafale and Weakley (1990) as occurring in bottomland and swamp forests, and species identified in the reference forest ecosystems (RFE’s). All canopy tree species planted and identified in the reference forest ecosystem will be utilized to define “Character Tree Species” as termed in the success criteria (Table 1) except for loblolly pine, red maple, and sweet gum.

The vegetation success criteria have been designed to evaluate bottomland hardwood forest and riverine swamp forest separately. This division in success criteria by community type has been applied because bottomland hardwood forests typically contain relatively high tree species

diversity while backwater swamp forests are characterized by relatively low tree species diversity, sometimes dominated by one or two tree species.

TABLE 1

INVENTORY OF REFERENCE WETLAND TREE SPECIES
NEUSE RIVER CORRIDOR, LENOIR COUNTY

Species Name	Common Name	Species Name	Common Name
Acer rubrum[1]	Red Maple[1]	*Platanus occidentalis*	American Sycamore
Acer negundo	Box Elder	*Populus heterophylla*	Swamp Cottonwood
Betula nigra	River Birch	*Prunus serotina*	Black Cherry
Carpinus caroliniana	Ironwood	*Quercus alba*	White Oak
Carya aquatica	Water Hickory	*Quercus laurifolia*	Laurel Oak
Carya tomentosa	Mockernut Hickory	*Quercus lyrata*	Overcup Oak
Celtis laevigata	Hackberry	*Quercus michauxii*	Swamp Chestnut Oak
Chamaecyparis thyoides	Atlantic White Cedar	*Quercus nigra*	Water Oak
Cornus spp.	Dogwood	*Quercus pagoda*	Cherrybark Oak
Fagus grandifolia	American Beech	*Quercus phellos*	Willow Oak
Fraxinus caroliniana	Carolina Ash	*Quercus rubra*	Northern Red Oak
Fraxinus pennsylvanica	Green Ash	*Salix caroliniana*[1]	Carolina Willow[1]
Fraxinus profunda	Pumpkin Ash	*Salix nigra*[1]	Black Willow[1]
Gordonia lasianthus	Loblolly Bay	*Symplocus tinctoria*	Horse Sugar
Ilex opaca	American Holly	*Taxodium distichum*	Bald Cypress
Juglans nigra	Black Walnut	*Ulmus alata*	Winged Elm
Juniperus virginiana	Eastern Red Cedar	*Ulmus americana*	American Elm
Liquidambar styraciflua[1]	Sweet Gum[1]	*Ulmus rubra*	Slippery Elm
Liriodendron tulipifera	Tulip Poplar		
Magnolia virginiana	Sweet Bay		
Morus rubra	Red Mulberry		
Nyssa aquatica	Water Tupelo		
Nyssa biflora	Swamp Tupelo		
Nyssa sylvatica	Black Gum		
Oxydendrum arboreum	Sourwood		
Persea palustris	Red Bay		
Pinus serotina	Pond Pine		
Pinus taeda[1]	Loblolly Pine[1]		

1: Loblolly pine, red maple, sweet gum, and willow species have been excluded as character elements by the Mitigation Banking Review Team.

Bottomland Hardwood Forest

The bottomland hardwood forest areas are depicted in Figure 6 (Appendix A). For these quadrants, a minimum mean density of 320 character trees per acre must be surviving for 3 years after initial planting. Subsequently, 290 character trees per acre must be surviving in year 4 and 260 character trees per acre in year 5. In addition, at least five character tree species must be present, and no species can comprise more than 20 percent of the 320 stem per acre total. For species with stem counts above the 20 percent threshold, the excess stems will be discarded from the statistical analysis.

Riverine Swamp Forest

The riverine swamp forest areas are depicted in Figure 6 (Appendix A). For these quadrants, an average density of 320 character tree species per acre must be surviving in the first three monitoring years. Subsequently, 290 character tree species per acre must be surviving in year 4 and 260 character tree species per acre in year 5. One planted species may represent up to 100 percent of the required stem per acre total (most likely bald cypress, water tupelo, and/or swamp tupelo).

If vegetation success criteria are not achieved based on average density calculations by community type, the individual plots that do not meet the stem per acre requirement will be identified. Supplemental planting may be performed in those quadrants, as needed, until achievement of vegetation success criteria. Alternatively, that plot, or area adjacent to the plot, may be mapped and reclassified as riverine bottomland hardwood forest or riverine swamp forest habitat.

6.3 Monitoring Report Submittal

An Annual Wetland Monitoring Report (AWMR) will be prepared at the end of each monitoring year (growing season). The AWMR will depict the sample plot and quadrant locations and include photographs which illustrate Site conditions. Data compilations 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 AWMR.

7.0 REFERENCES

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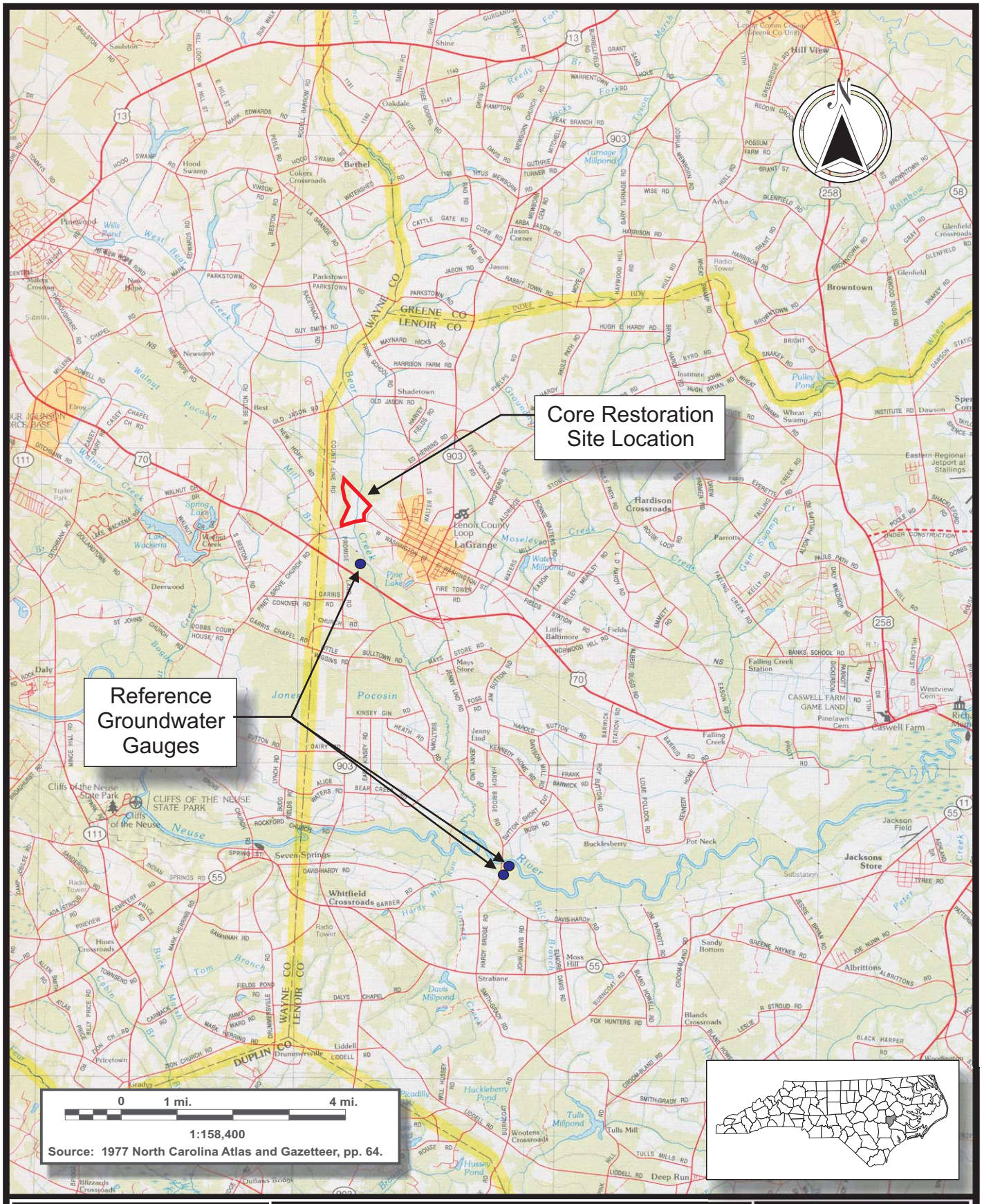
APPPENDIX A
FIGURES



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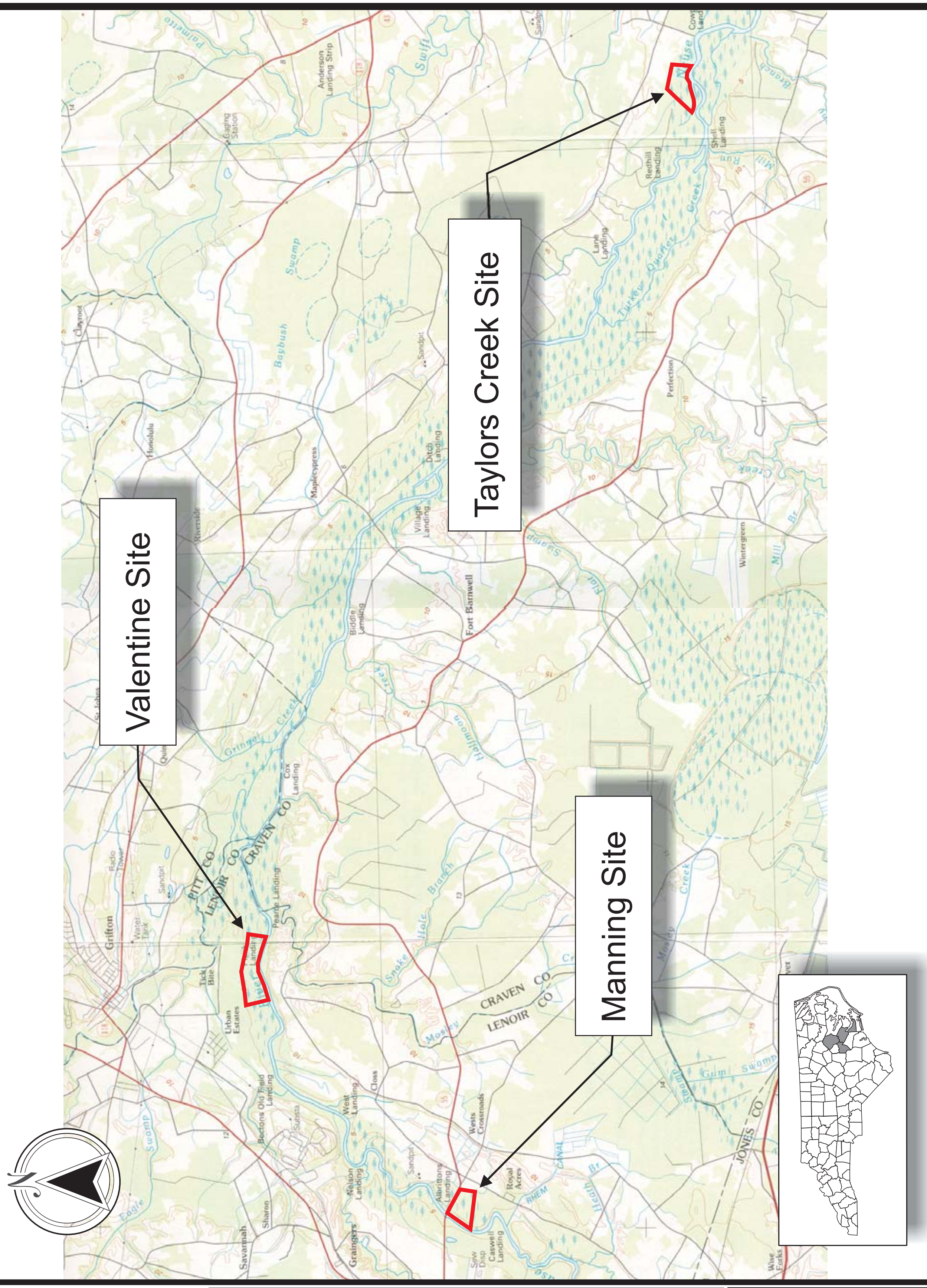
CORE RESTORATION SITE LOCATION
SLEEPY CREEK AS-BUILT MITIGATION PLAN
Lenoir County, North Carolina

Dwn. by:	WGL
Ckd by:	WGL
Date:	May 2006
Project:	06-001

FIGURE
1



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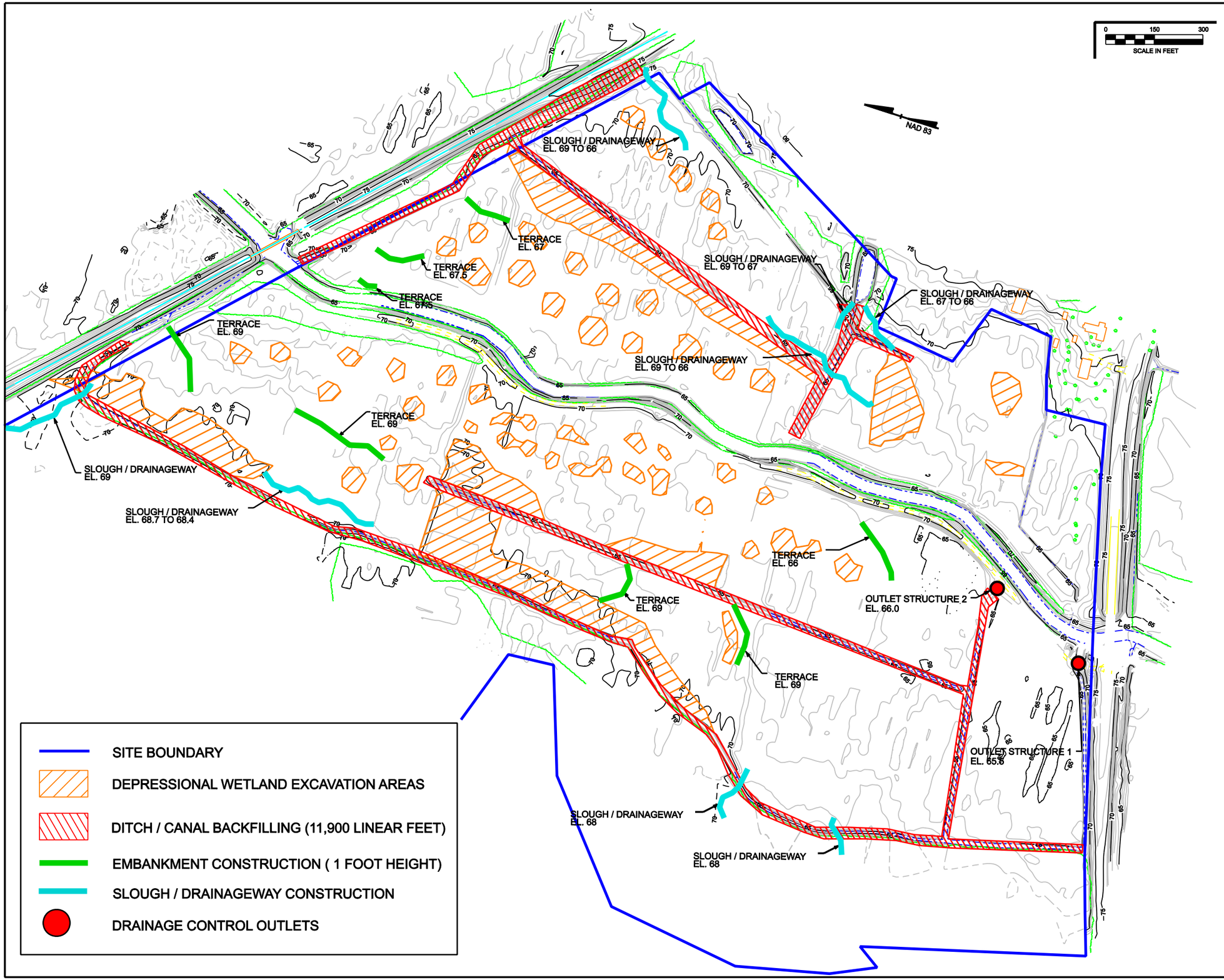
WETLAND PRESERVATION SITE LOCATION
SLEEPY CREEK AS-BUILT MITIGATION PLAN
Lenoir County, North Carolina

Dwn. by:	WGL
Ckd by:	WGL
Date:	May 2006
Project:	06-001

FIGURE

2



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NOTES/REVISIONS

Project:

Sleepy Creek Wetland Restoration Site

Lenoir County
North Carolina

Title:

SITE RESTORATION PLAN

Scale:	SHEET NO.
1" = 300'	3
Date: May 2006	
Project No.: 06-001	

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SCALE IN FEET

NAD 83

Legend

- Site Boundary = 153.58 acres
- Wetland Restoration (Swamp Forest) = 15.29 acres
- Wetland Restoration (Bottomland Hardwood Forest) = 81.12 acres
- Wetland Enhancement = 39.20 acres
- Riparian Buffer Restoration = 17.97 acres

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NOTES/REVISIONS

Project:

Sleepy Creek Wetland Restoration Site

Lenoir County
North Carolina

Title:

MITIGATION UNITS

Scale:	SHEET NO.
1" = 370'	4
Date: May 2006	
Project No.: 06-001	

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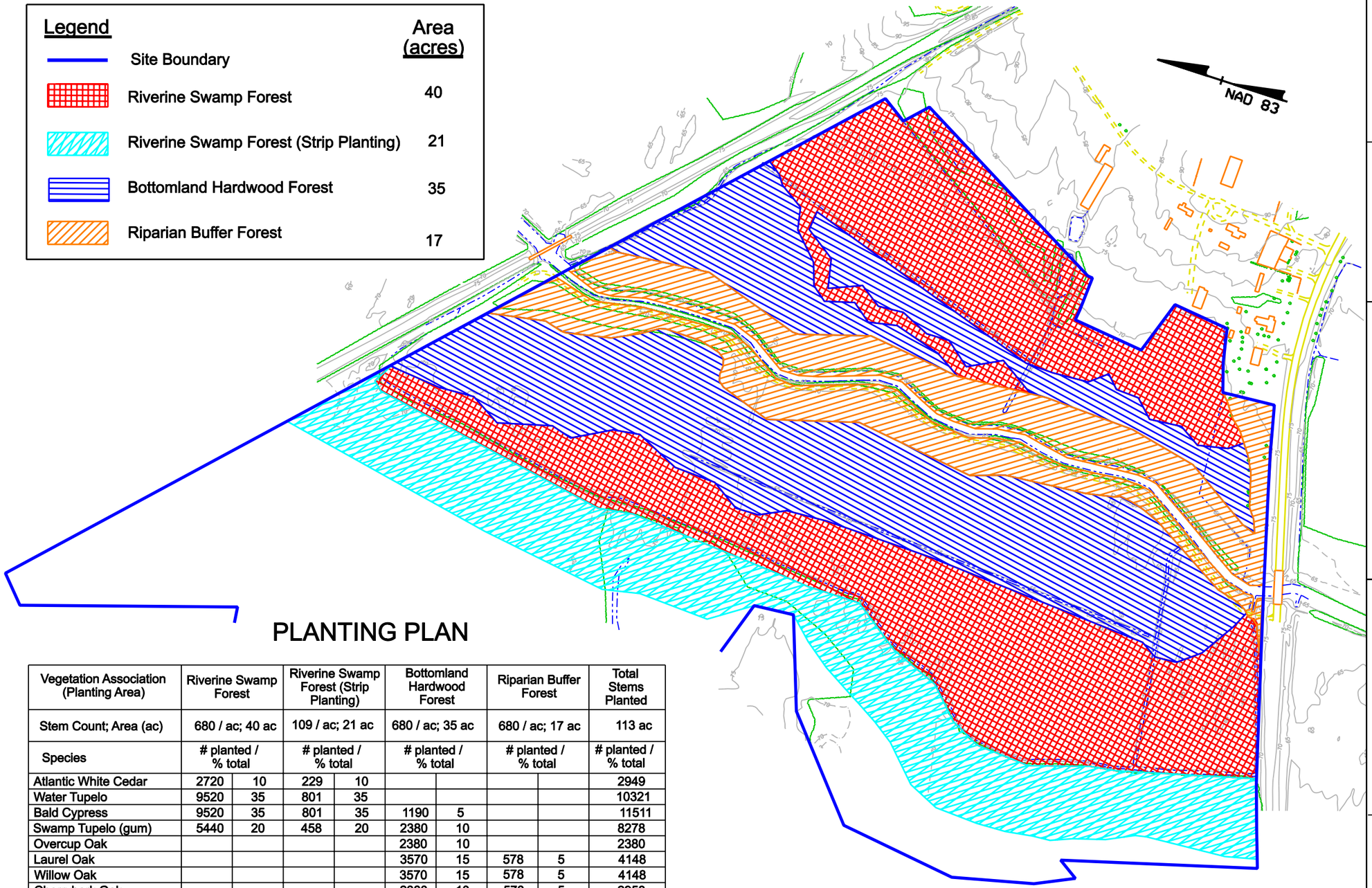
Legend		Area (acres)
	Site Boundary	
	Riverine Swamp Forest	40
	Riverine Swamp Forest (Strip Planting)	21
	Bottomland Hardwood Forest	35
	Riparian Buffer Forest	17



PLANTING PLAN

Vegetation Association (Planting Area)	Riverine Swamp Forest		Riverine Swamp Forest (Strip Planting)		Bottomland Hardwood Forest		Riparian Buffer Forest		Total Stems Planted
Stem Count; Area (ac)	680 / ac; 40 ac		109 / ac; 21 ac		680 / ac; 35 ac		680 / ac; 17 ac		113 ac
Species	# planted / % total		# planted / % total		# planted / % total		# planted / % total		# planted / % total
Atlantic White Cedar	2720	10	229	10					2949
Water Tupelo	9520	35	801	35					10321
Bald Cypress	9520	35	801	35	1190	5			11511
Swamp Tupelo (gum)	5440	20	458	20	2380	10			8278
Overcup Oak					2380	10			2380
Laurel Oak					3570	15	578	5	4148
Willow Oak					3570	15	578	5	4148
Cherrybark Oak					2380	10	578	5	2958
Green Ash					1190	5	1734	15	2924
Swamp Chestnut Oak					1190	5	578	5	1768
American Elm					1190	5	578	5	1768
Yellow Poplar					1190	5	1734	15	2924
Water Oak					1190	5	1734	15	2924
River Birch					1190	5	1734	15	2924
American Sycamore					1190	5	1734	15	2924
TOTAL	27200		2289		23800		11560		64849

Axiom Environmental, Inc.

RESTORATION SYSTEMS
1101 HAYNES STREET, STE 107
RALEIGH, N.C. 27604

NOTES/REVISIONS

Project:

Sleepy Creek Wetland Restoration Site

Lenoir County
North Carolina

Title:

PLANTING PLAN

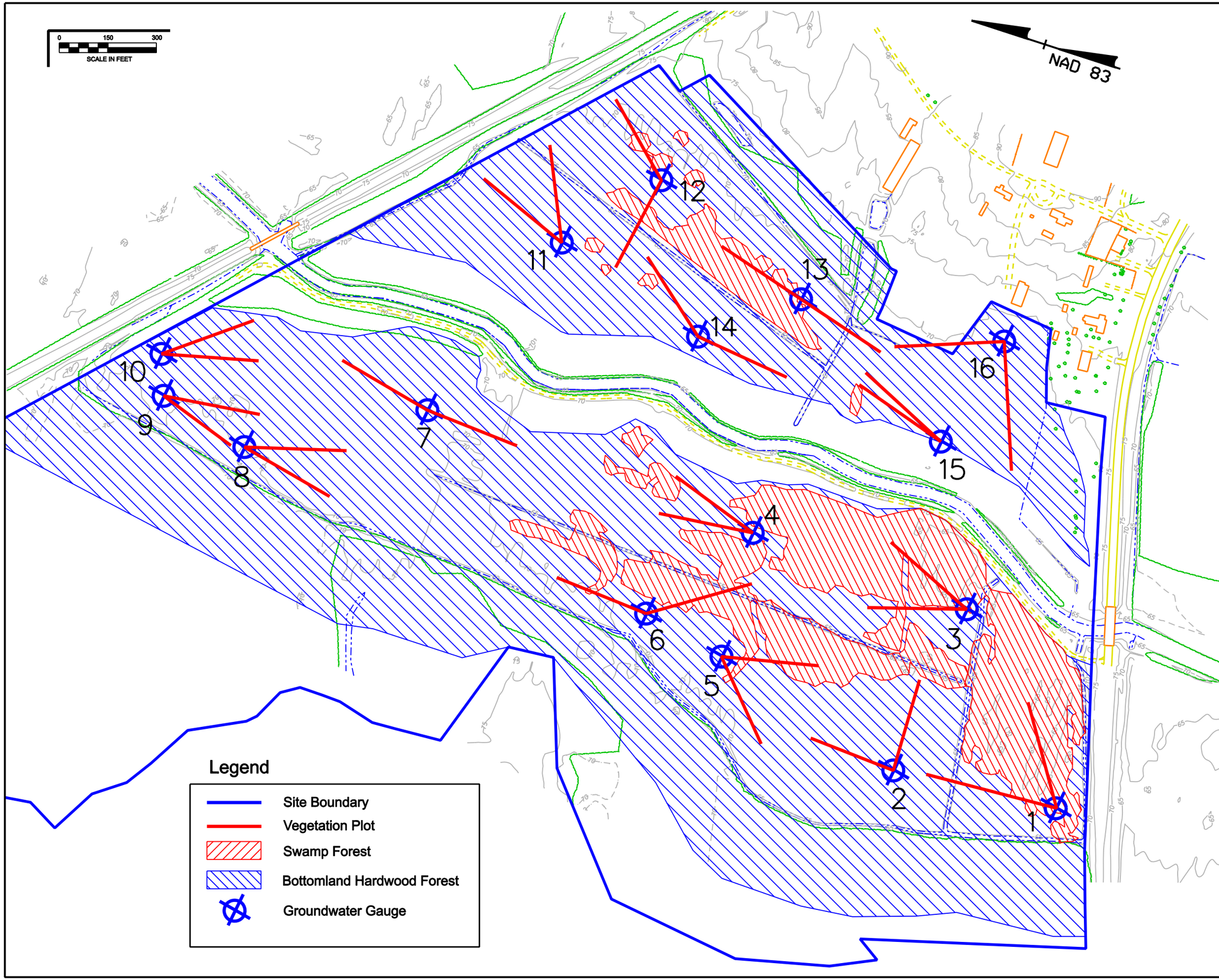
Scale: 1" = 370'

Date: May 2006

Project No.: 06-001

SHEET NO. 5

...\Mit_Plan_Fig5_Planting.dgn 6/12/2006 2:19:25 PM



Axiom Environmental, Inc.

RESTORATION SYSTEMS
1101 HAYNES STREET, STE 107
RALEIGH, N.C. 27604

NOTES/REVISIONS

Project:

Sleepy Creek Wetland Restoration Site

Lenoir County
North Carolina

Title:

MONITORING PLAN

Scale:	SHEET NO.
1" = 300'	6
Date: May 2006	
Project No.: 06-001	

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