Neuse River Riparian Restoration Project
Annual Monitoring
Year 3

24.4-acre "McCotter/Raines Farm"

Contract No. AW03011-3

Prepared For:

North Carolina Ecosystem Enhancement Program
Raleigh, NC

Prepared By:

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I. INTRODUCTION

The following report summarizes riparian buffer site conditions through Year 3 of the "McCotter/Raines Farm" buffer restoration project. Under contract with the NC Ecosystem Enhancement Program (EEP), Land Management Group, Inc. (LMG) initiated the restoration of 24.4 acres of riparian buffer habitat in February 2003.

The project site is located approximately 5.5 miles northwest of Trenton (refer to Figure 1) in Jones County, NC. The site is bordered to the north by State Route (SR) 1317 and to the south by Beaver Creek (refer to Figure 2). Beaver Creek is a second-order tributary of the Trent River located within subasin NEU-11 of the lower Neuse River Basin (USGS Cataloging Unit 03020204).

The restoration project is intended to provide suitable, high-quality riparian buffer restoration as compensatory mitigation for riparian buffer impacts authorized through the North Carolina Division of Water Quality (NC DWQ). The objective of the project is to restore riparian buffer vegetation and diffuse flow conditions to help reduce non-point source discharge of contaminants into adjacent water bodies. The restoration project has resulted in the removal of agricultural fields adjacent to Beaver Creek and surface-water ditches contiguous with the creek. In doing so, the restoration project helps to reduce non-point source loading of nitrogen (N) into surface waters while increasing the nutrient removal capacity of the adjacent land. The following monitoring report summarizes conditions related to restoration site development through Year 3.

II. PROJECT DEVELOPMENT

A. Pre-Project Conditions

The 24.4-acre riparian buffer restoration area represents a portion of a larger 211-acre tract ("McCotter/Raines Farm") actively farmed for the production of soybean and cotton. Prior to

restoration activities, land use practices (including herbicide, pesticide, and fertilizer application) served as potential contributors to decreased water quality of adjacent surface waters within the project area. Application of nitrogen-rich fertilizer represented the most significant non-point source of nitrogen. Woody vegetation adjacent to ditches was either absent or sparse (less than 100 stems per acre that are > 5 inches diameter at breast height). As a result, surface waters were subject to direct run-off from adjacent agricultural fields with little or no nutrient filtration/transformation.

B. Land Acquisition and Protection

LMG arranged for the execution of the conservation easement deed to ensure the protection of the riparian buffer restoration area in perpetuity. The easement prohibits any activities (e.g. timbering, farming, building, etc.) that would alter the environmental state of the restoration project. Post-restoration management will be consistent with allowable activities as identified in the Neuse Buffer Rule (15A NCAC 02B.0233). The conservation easement deed was conveyed to the North Carolina Cooperative Extension Service Foundation (NCCESF).

In addition to the 24.4-acre project area, 10.6 acres of wooded land adjacent to Beaver Creek (located immediately adjacent to the project area) was donated to NCCESF. This additional land was incorporated into the conservation easement and will be protected under the terms and conditions conveyed with the deed. Two 20-ft access easements have also been granted by the property owner to allow for suitable access to the project site.

C. Restoration Activities

Restoration activities included minor grading and planting within the 24.4-acre project area (refer to Figure 3 for a plan view of restoration activities completed at the site). Areas of higher topographic relief and incised ditch banks were graded to 3:1 slopes to provide more stable areas for planting. Much of the field area was plowed and disked prior to planting to reduce compaction and to enhance microtopography. Removal of drain tiles and installation of check dams help to promote diffuse flow conditions. Restoration activities have reduced peak discharge rates to promote enhanced nutrient uptake and exchange.

The riparian buffer was planted with characteristic tree species including river birch (*Betula nigra*), American sycamore (*Platanus occidentalis*), southern red oak (*Quercus falcata*), and

green ash (*Fraxinus pennsylvanica*). Bare-root seedlings were planted at a density of 600 trees per acre. The outer 50 feet of the proposed buffer areas were planted with characteristic shrub species including wax myrtle (*Myrica cerifera*), American beautyberry (*Callicarpa americana*), elderberry (*Sambucus canadensis*), and winged sumac (*Rhus copallina*). Shrubs were planted at a density of 1200 plants per acre. The planted species list for the riparian buffer restoration area is detailed in Table 1.

Species were selectively planted in areas corresponding to changes in micro-elevation and soil texture. For instance, white oak (adapted for relatively low moisture requirements) was planted in slightly higher topographic areas. Conversely, river birch and green ash were planted in lower landscape positions and finer soils – conditions suitable for these species' relatively high moisture requirements. These same considerations were used to plant shrub species in appropriate locations within the shrub planting zone. All species selected for the restoration project naturally occur on the site within undisturbed riparian buffer areas. These species are considered to be well-suited for site-specific conditions (including soil characteristics and moisture regimes). In addition, each of these species is listed within WRP's "Guidelines for Riparian Buffer Restoration" as appropriate species for use in riparian buffer restoration projects.

D. Conditions through Year 2 Monitoring

Year 1 and Year 2 monitoring (conducted in the Fall of 2003 and 2004, respectively) indicated that much of the site was developing toward successful restoration. At the end of the first growing season, stem density targets were achieved in all but one plot monitored. Supplement planting was conducted within a six-acre area in the southeastern quadrat of the restoration site (inclusive of Plot 11 and Plot 12) in February 2004. A total of 2,397 tree and shrub seedlings (including wax myrtle (*Myrica cerifera*), water oak (*Quercus nigra*), white oak (*Quercus alba*), sycamore (*Platanus occidentalis*), persimmon (*Diospyros virginiana*), and willow oak (*Quercus phellos*) were planted as part of this effort. As documented during the Fall 2004 annual monitoring, stem density targets were achieved in all twelve of the plots for Year 2.

III. MONITORING PLAN & SUCCESS CRITERIA

Based upon standard mitigation site monitoring requirements, annual monitoring is conducted at the end of each growing season over a period of five years. Twelve (12) 0.10-acre permanent plots corresponding to a total of 1.2 acres (equivalent to 5% of the restoration area) were

established subsequent to site planting. The locations of the monitoring plots are depicted in Figure 3. Monitoring includes the identification and enumeration of individuals (including shrubs and trees, planted or volunteer) occurring within each plot. All tree and shrub species within the plots are identified, flagged, and recorded on field data sheets during each monitoring event. Site planting is to be deemed successful if survivorship of plantings and volunteers of desirable species[1] meets or exceeds a target stem density of 320 trees/shrub per acre at the end of five years. For the purpose of calculating stem density, red maple (*Acer rubrum*) and sweet gum (*Liquidambar styraciflua*) are excluded from the recorded plot density.

Monitoring reports are submitted annually to the NC EEP by December 1 of each year (immediately following the fall monitoring event). These reports include results of vegetative monitoring and photographic documentation of site conditions.

IV. RESULTS

A total of 2,217 stems (planted and volunteer shrubs/trees) were observed within the twelve 0.10-acre plots. This represents a 61% increase from total stems counted in Year 1 monitoring (likely resulting from supplemental planting and increased recruitment of volunteer individuals). Of the total observed, 1226 stems (total excluding red maple and sweet gum) were counted toward the success criteria (corresponding to 1,022 stems/acre). In Year 2, a total of 1297 stems (excluding red maple and sweet gum) were identified. Of the species planted, American sycamore (*Platanus occidentalis*) was the most abundant tree observed within the twelve monitoring plots. Refer to Table 2 for a summary of results related to species abundance and target stem densities. In addition, individual plot data sheets are provided in Appendix B.

V. CONCLUSION

Restoration activities have demonstrated to be successful at the 24.4-acre project site through the third year of annual monitoring. Stem densities within all twelve monitoring plots well exceed

[1] Desirable species are considered as noninvasive species characteristic of riparian habitats.

the 320 stem/acre target density for restored buffer habitats. The total observed density (1,022 stems/acre) indicates that the site is progressing well toward the target maturity density.

It should be noted that red maple and sweet gum demonstrate relatively high abundances in many of the plots monitored. However, nearly all of the stems of these individuals are under 3-feet in height and likely do not represent a competitive advantage over planted trees. Stem densities of planted species and desirable volunteer species remain high and are not compromised by the presence of these more opportunistic red maple and sweet gum species. Stem heights and numbers will continue to be monitored over time. If red maple and/or sweet gum saplings appear to have a competitive advantage over planted species, then mechanical removal may be warranted.

Based upon documented densities of planted and acceptable volunteer species, the buffer restoration area appears to be developing well. Reversion of agricultural land to wooded riparian buffer will continue to decrease non-point source nutrient loading and concurrently increase nutrient filtration/uptake. Establishment of tree and shrub vegetative cover also promotes diffuse flow and increases the N removal capacity of the restored buffer area. By doing so, the proposed project effectively mitigates for authorized loss of riparian buffers within the Neuse River Basin.

TABLE 1: PLANTED SPECIES[1] – NEUSE RIVER RIPARIAN BUFFER PROJECT, McCOTTER/RAINES FARM

Buffer Zone	Zone 1 –Trees	Zone 2 - Shrubs	TOTAL
Stem Density: Area (acres):	600/acre (18.3)	1200/acre (6.1)	 (24.4)
SPECIES	# planted (% of total)	# planted (% of total)	#planted
River Birch (*Betula nigra*)	2800 (25)		2,800
Sycamore (*Platanus occidentalis*)	1,100 (10)		1,100
Southern Red Oak (*Quercus falcata*)	1,500 (13)		3,500
White Oak (*Quercus alba*)	2,500 (23)		2,500
Cherrybark Oak (*Quercus falcata*)	1,500 (13)		1,100
Persimmon (*Diospyros virginiana)*	500 (4)		500
Tulip Poplar (*Liriodendron tulipifera*)	200 (2)		200
Green Ash (*Fraxinus pennsylvanica*)	1,100 (10)		1,100
Wax Myrtle (*Myrica cerifera*)		3,000 (41)	3,000
American Beautyberry (*Callicarpa Americana*)		2,424 (33)	2,424
Elderberry (*Sambucus canadensis*)		1,062 (14)	1,062
Winged Sumac (*Rhus copallina*)		850 (12)	850
Possumhaw (*Viburnum nudum*)		14 (0.2)	14
TOTAL TREES/SHRUBS	11,200	7,350	18,550

[1]Seedlings planted February 2003.

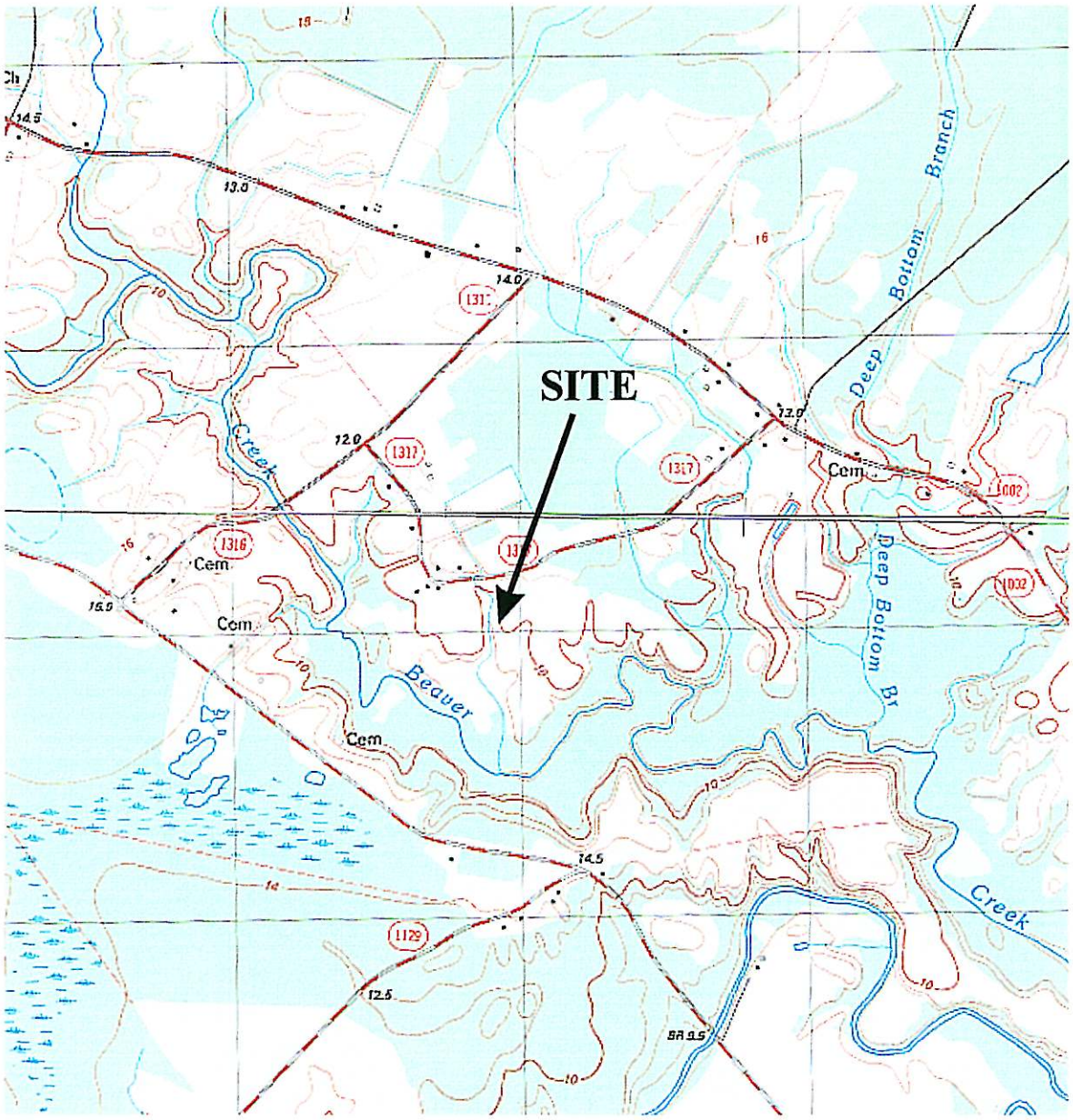
NEUSE RIVER RIPARIAN BUFFER RESTORATION PROJECT
'MCCOTTER-RAINES FARM'

PLANTED SPECIES LIST

TREES:	**QUANTITY:**
River Birch	2800
Sycamore	1100
~~Water Oak~~	~~3500~~
Southern Red Oak	2000
Cherrybark Oak	1500
Persimmon	500
White Oak	2500
Tulip Poplar	200
Green Ash	1100
TOTAL:	11,700

SHRUBS:	**QUANTITY:**
Wax Myrtle	3000
American Beautyberry	2424
Elderberry	1062
Winged Sumac	850
Possumhaw	14
TOTAL:	7,350

FIGURES

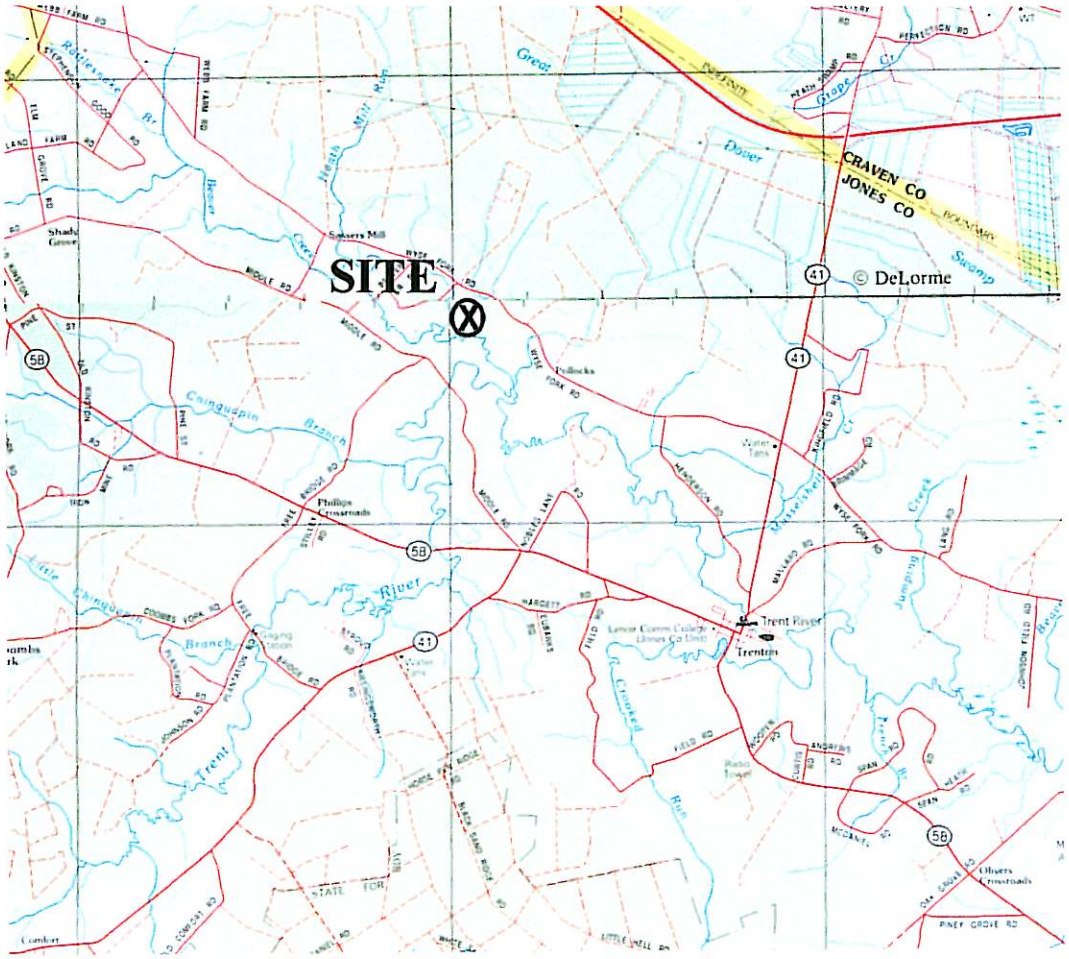


Phillips Crossroads Quadrangle

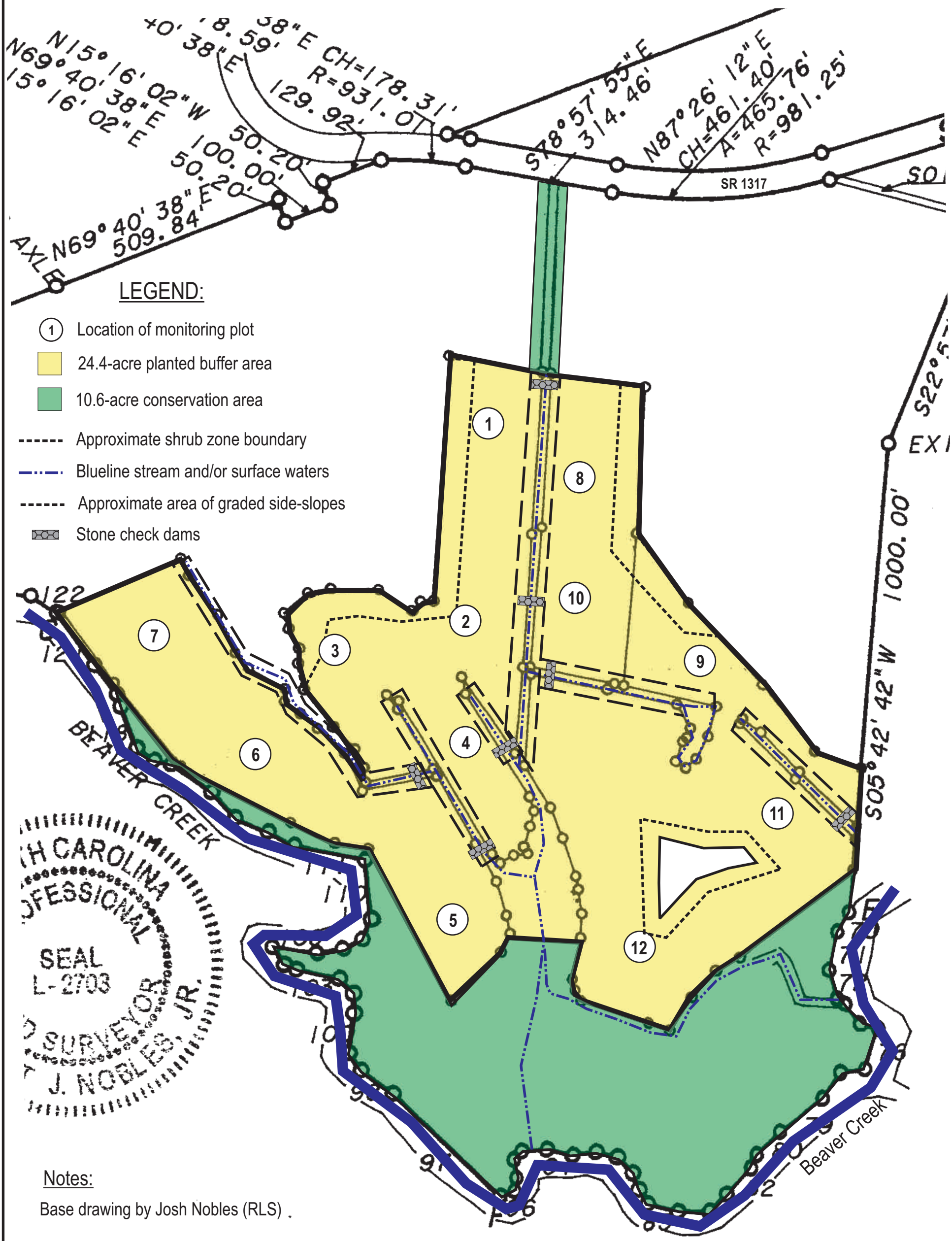
N

SCALE 1" = 2000'

Neuse River Riparian Buffer Restoration Project Jones County, NC (Contract Number AW03011-3)	***Land Management Group, Inc.*** **Environmental Consultants** Wilmington, N.C.	**Figure 2.** USGS Topographic Quadrangle McCotter/Raines Farm



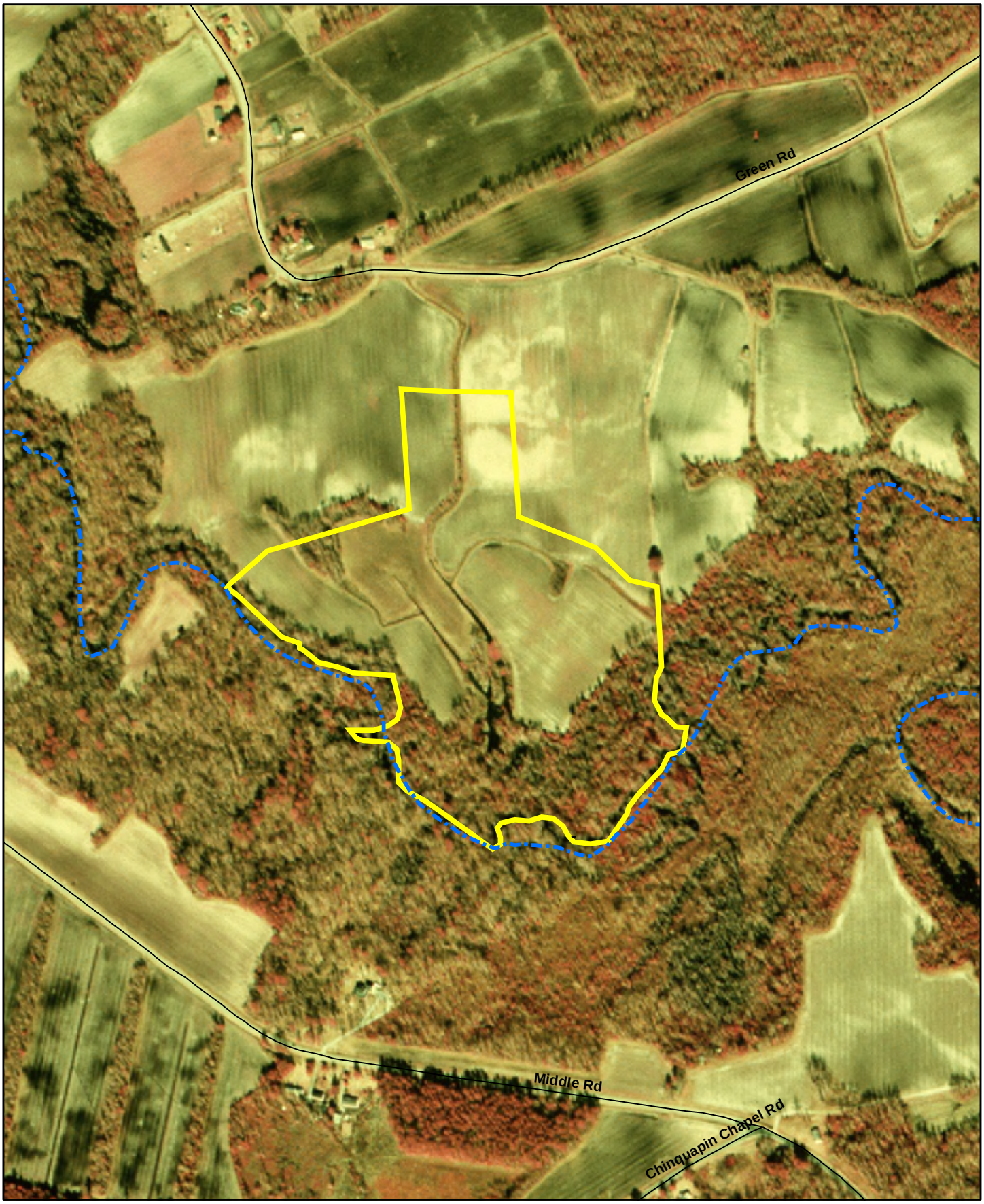
Neuse River Riparian Buffer Restoration Project Jones County, NC (Contract Number AW03011-3)	***Land Management Group, Inc.*** **Environmental Consultants** Wilmington, N.C.	**Figure 1.** Site Vicinity Map McCotter/Raines Farm



Notes:

Base drawing by Josh Nobles (RLS)

Neuse River Riparian Buffer Restoration Project Jones County, NC (Contract Number AW03011-3)	***Land Management Group, Inc.*** **Environmental Consultants** Wilmington, N.C.	**Figure 3.** Site Plan View & Plot Locations McCotter/Raines Farm



McCotter-Raines Farm
Neuse River Buffer Site

Jones County

0 500 1,000 Feet

Figure 4.
1998 Aerial Photography

APPENDIX A.

SITE PHOTOGRAPHS

RESTORATION SITE PHOTOGRAPHS

(1) View facing southwest prior to planting (January 2003)

(2) View of volunteer sycamore seedling

RESTORATION SITE PHOTOGRAPHS

(3) View of sample green ash saplings in Plot 4

(4) View of monitoring plot and identified green ash sapling

RESTORATION SITE PHOTOGRAPHS

(5) View of volunteer sweet gum in Plot 3 (not counted toward target stem density)

(6) View of river birch and wax myrtle plantings in Plot 7

APPENDIX B.

PLOT DATA SHEETS

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 1

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Winged Sumac	SH	1	2ft.	Planted	1
Winged Sumac	SH	2	4ft.	Planted	2
American Beautyberry	SH	12	<2ft.	Planted	12
American Beautyberry	SH	3	2ft	Planted	3
White Oak	SA	5	<2ft.	Planted	5
Southern Red Oak	SA	11	<2ft.	Planted	11
Southern Red Oak	SA	3	3ft	Planted	3
River Birch	SA	7	<2ft.	Planted	7
Persimmon	SA	3	3ft.	Planted	3
Willow Oak	SA	1	<2ft.	Planted	1
Willow Oak	SA	1	2ft.	Planted	1
Loblolly Pine	SA	19	<2ft	Volunteer	19
Black Willow	SA	11	3ft.	Volunteer	11
Black Willow	SA	7	4ft	Volunteer	7
Black Willow	SA	1	5ft	Volunteer	1
Red Maple	SA	40	<2ft.	Volunteer	0
Red Maple	SA	2	2ft.	Volunteer	0
Sweet Gum	SA	6	<2ft.	Volunteer	0
Sweet Gum	SA	9	3ft.	Volunteer	0
Sweet Gum	SA	1	4ft	Volunteer	0
	TOTAL SHRUBS	18		OBSERVED DENSITY (PER PLOT)	87
	TOTAL TREES OF PLANTED SPECIES	31		OBSERVED DENSITY (PER ACRE)	870
	TOTAL TREES OF VOLUNTEER SPECIES	96			
	TOTAL INDIVIDUALS	145			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 2

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Winged Sumac	SH	1	<2ft.	Planted	1
Amer. Beautyberry	SH	1	<2ft.	Planted	1
Amer. Beautyberry	SH	2	2ft.	Planted	2
Amer. Beautyberry	SH	2	3ft.	Planted	2
Wax Myrtle	SH	1	3ft.	Planted	1
Southern Red Oak	SA	6	<2ft.	Planted	6
Southern Red Oak	SA	2	2ft	Planted	2
Water Oak	SA	2	<2ft.	Planted	2
Cherry Bark Oak	SA	3	<2ft.	Planted	3
Cherry Bark Oak	SA	1	2ft.	Planted	1
Willow Oak	SA	1	<2ft.	Planted	1
White Oak	SA	13	<2ft.	Planted	13
White Oak	SA	8	2ft.	Planted	8
White Oak	SA	1	3ft.	Planted	1
River Birch	SA	1	2ft.	Planted	1
River Birch	SA	1	3ft.	Planted	1
Sycamore	SA	7	<2ft.	Planted	7
Sycamore	SA	10	2ft.	Planted	10
Sycamore	SA	7	3ft.	Planted	7
Sycamore	SA	2	4ft.	Planted	2
Tulip poplar	SA	7	<2ft.	Planted	7
Tulip poplar	SA	1	2ft	Planted	1
Tulip poplar	SA	1	3ft	Planted	1
Black Willow	SA	1	<2ft.	Volunteer	1
Black Willow	SA	5	2ft.	Volunteer	5
Black Willow	SA	5	3ft.	Volunteer	5
Red Maple	SA	11	<2ft.	Volunteer	0
Sweet Gum	SA	35	<2ft.	Volunteer	0
Sweet Gum	SA	5	2ft.	Volunteer	0
Sweet Gum	SA	2	3ft.	Volunteer	0
	TOTAL SHRUBS	7		OBSERVED DENSITY (PER PLOT)	92
	TOTAL TREES OF PLANTED SPECIES	74		OBSERVED DENSITY (PER ACRE)	920
	TOTAL TREES OF VOLUNTEER SPECIES	64			
	TOTAL INDIVIDUALS	145			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 3

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Wax Myrtle	SH	1	4ft	Planted	1
Wax Myrtle	SH	1	8ft	Planted	1
Baccharis	SH	1	5ft	Volunteer	1
Cherry Bark Oak	SA	4	3ft	Planted	4
Cherry Bark Oak	SA	2	4ft	Planted	2
Cherry Bark Oak	SA	4	5ft	Planted	4
Cherry Bark Oak	SA	1	7ft	Planted	1
Green Ash	SA	1	<2ft	Planted	1
Green Ash	SA	1	3ft	Planted	1
Green Ash	SA	2	4ft	Planted	2
Green Ash	SA	2	5ft	Planted	2
Green Ash	SA	5	6ft	Planted	5
Green Ash	SA	9	7ft	Planted	9
Green Ash	SA	4	8ft	Planted	4
Green Ash	SA	4	9ft	Planted	4
Tulip Poplar	SA	1	3ft	Planted	1
Sycamore	SA	1	2ft	Planted	1
Sycamore	SA	1	3ft	Planted	1
Persimmon	SA	2	2ft	Planted	2
Persimmon	SA	6	3ft	Planted	6
Persimmon	SA	5	4ft	Planted	5
Persimmon	SA	1	5ft	Planted	1
River Birch	SA	1	2ft	Planted	1
River Birch	SA	1	4ft	Planted	1
River Birch	SA	3	7ft	Planted	3
White Oak	SA	1	3ft	Planted	1
White Oak	SA	3	4ft	Planted	3
White Oak	SA	1	6ft	Planted	1
Sweet Gum	SA	15	<2ft	Volunteer	0
Sweet Gum	SA	100	3ft	Volunteer	0
Sweet Gum	SA	4	4ft	Volunteer	0
Sweet Gum	SA	10	5ft	Volunteer	0
Red Maple	SA	>300	3ft	Volunteer	0

	TOTAL SHRUBS	3		OBSERVED DENSITY (PER PLOT)	69
	TOTAL TREES OF PLANTED SPECIES	66		OBSERVED DENSITY (PER ACRE)	690
	TOTAL TREES OF VOLUNTEER SPECIES	~429			
	TOTAL INDIVIDUALS	498			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 4

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Wax Myrtle	SH	1	<2ft	Planted	1
Wax Myrtle	SH	1	3ft	Planted	1
Wax Myrtle	SH	1	5ft	Planted	1
Baccharis	SH	1	2ft	Volunteer	1
Baccharis	SH	5	5ft	Volunteer	5
Southern Red Oak	SA	1	2ft	Planted	1
Green Ash	SA	2	2ft	Planted	2
Green Ash	SA	7	3ft	Planted	7
Green Ash	SA	8	4ft	Planted	8
Green Ash	SA	11	5ft	Planted	11
Green Ash	SA	9	6ft	Planted	9
Green Ash	SA	6	7ft	Planted	6
Green Ash	SA	7	8ft	Planted	7
Green Ash	SA	1	9ft	Planted	1
Green Ash	SA	1	10ft	Planted	1
Sycamore	SA	9	<2ft	Planted	9
Sycamore	SA	6	3ft	Planted	6
Cherrybark Oak	SA	1	4ft	Planted	1
Loblolly Pine	SA	5	3ft	Volunteer	5
Red Maple	SA	15	<2ft	Volunteer	0
Sweet Gum	SA	2	<2ft	Volunteer	0
Sweet Gum	SA	2	3ft	Volunteer	0
Sweet Gum	SA	3	4ft	Volunteer	0
	TOTAL SHRUBS	9		OBSERVED DENSITY (PER PLOT)	83
	TOTAL TREES OF PLANTED SPECIES	69		OBSERVED DENSITY (PER ACRE)	830
	TOTAL TREES OF VOLUNTEER SPECIES	27			
	TOTAL INDIVIDUALS	105			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 5

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
White Oak	SA	2	2ft	Planted	2
White Oak	SA	5	3ft	Planted	5
White Oak	SA	8	4ft	Planted	8
So. Red Oak	SA	1	<2ft	Planted	1
So. Red Oak	SA	1	3ft	Planted	1
So. Red Oak	SA	3	5ft	Planted	3
River Birch	SA	1	<2ft	Planted	1
River Birch	SA	3	3ft	Planted	3
Sycamore	SA	1	<2ft	Planted	1
Sycamore	SA	7	2ft	Planted	7
Sycamore	SA	48	3ft	Planted	48
Sycamore	SA	6	4ft	Planted	6
Sycamore	SA	1	5ft	Planted	1
Sycamore	SA	1	6ft	Planted	1
Tulip Poplar	SA	2	2ft	Planted	2
Green Ash	SA	6	2ft	Planted	6
Green Ash	SA	7	3ft	Planted	7
Green Ash	SA	3	4ft	Planted	3
Green Ash	SA	5	5ft	Planted	5
Green Ash	SA	11	6ft	Planted	11
Green Ash	SA	5	7ft	Planted	5
Green Ash	SA	3	12ft	Planted	3
Persimmon	SA	1	<2ft	Planted	1
Sweet Gum	SA	14	2ft	Volunteer	0
Sweet Gum	SA	8	3ft	Volunteer	0
Sweet Gum	SA	3	4ft	Volunteer	0
Red Maple	SA	10	<2ft	Volunteer	0
Loblolly Pine	SA	8	<2ft	Volunteer	8
Loblolly Pine	SA	5	3ft	Volunteer	5
Loblolly Pine	SA	15	4ft	Volunteer	15
Loblolly Pine	SA	10	5ft	Volunteer	10
	TOTAL SHRUBS	0		OBSERVED DENSITY (PER PLOT)	169
	TOTAL TREES OF PLANTED SPECIES	131		OBSERVED DENSITY (PER ACRE)	1,690
	TOTAL TREES OF VOLUNTEER SPECIES	73			
	TOTAL INDIVIDUALS	204			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 6

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Wax Myrtle	SH	1	2ft	Planted	1
Wax Myrtle	SH	1	5ft	Planted	1
Wax Myrtle	SH	3	6ft	Planted	3
Wax Myrtle	SH	5	7ft	Planted	5
Sycamore	SA	2	2ft	Planted	2
Sycamore	SA	1	3ft	Planted	1
Sycamore	SA	12	4ft	Planted	12
Sycamore	SA	1	6ft	Planted	1
Sycamore	SA	3	7ft	Planted	3
Sycamore	SA	2	8ft	Planted	2
Sycamore	SA	1	9ft	Planted	1
Sycamore	SA	1	12ft	Planted	1
Persimmon	SA	2	2ft	Planted	2
Persimmon	SA	3	3ft	Planted	3
So. Red Oak	SA	1	<2ft	Planted	1
So. Red Oak	SA	3	2ft	Planted	3
So. Red Oak	SA	1	3ft	Planted	1
So. Red Oak	SA	1	4ft	Planted	1
River Birch	SA	7	5ft	Planted	7
River Birch	SA	4	6ft	Planted	4
River Birch	SA	5	7ft	Planted	5
Water Oak	SA	1	3ft	Planted	1
Green Ash	SA	1	2ft	Planted	1
Tulip Poplar	SA	4	<2ft	Planted	4
Tulip Poplar	SA	5	3ft	Planted	5
Tulip Poplar	SA	1	4ft	Planted	1
Cherry Bark Oak	SA	6	<2ft	Planted	6
Cherry Bark Oak	SA	5	2ft	Planted	5
Cherry Bark Oak	SA	17	3ft	Planted	17
Cherry Bark Oak	SA	2	5ft	Planted	2
Cherry Bark Oak	SA	1	6ft	Planted	1
Loblolly Pine	SA	7	3ft	Volunteer	7
Loblolly Pine	SA	41	4ft	Volunteer	41
Loblolly Pine	SA	2	5ft	Volunteer	2
Loblolly Pine	SA	4	6ft	Volunteer	4

Sweet Gum	SA	1	2ft	Volunteer	0
Sweet Gum	SA	75	3ft	Volunteer	0
Sweet Gum	SA	46	4ft	Volunteer	0
Sweet Gum	SA	1	5ft	Volunteer	0
Sweet Gum	SA	15	6ft	Volunteer	0
	TOTAL SHRUBS	10		OBSERVED DENSITY (PER PLOT)	157
	TOTAL TREES OF PLANTED SPECIES	93		OBSERVED DENSITY (PER ACRE)	1,570
	TOTAL TREES OF VOLUNTEER SPECIES	192			
	TOTAL INDIVIDUALS	295			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 7

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Baccharis	SH	1	6ft	Volunteer	1
Wax Myrtle	SH	2	5ft	Planted	2
Wax Myrtle	SH	17	6ft	Planted	17
Wax Myrtle	SH	1	7ft	Planted	1
Wax Myrtle	SH	25	8ft	Planted	25
River Birch	SA	1	4ft	Planted	1
River Birch	SA	1	7ft	Planted	1
River Birch	SA	3	8ft	Planted	3
River Birch	SA	6	9ft	Planted	6
River Birch	SA	6	10ft	Planted	6
Persimmon	SA	2	3ft	Planted	2
Persimmon	SA	7	4ft	Planted	7
Tulip Poplar	SA	4	<2ft	Planted	4
Tulip Poplar	SA	1	2ft	Planted	1
Tulip Poplar	SA	20	3ft	Planted	20
Tulip Poplar	SA	3	5ft	Planted	3
Tulip Poplar	SA	3	6ft	Planted	3
Tulip Poplar	SA	1	8ft	Planted	1
Sycamore	SA	13	2ft	Planted	13
Sycamore	SA	5	3ft	Planted	5
Sycamore	SA	1	4ft	Planted	1
Sycamore	SA	2	6ft	Planted	2
Sycamore	SA	2	8ft	Planted	2
Sycamore	SA	1	9ft	Planted	1
Sycamore	SA	1	11ft	Planted	1
Green Ash	SA	1	3ft	Planted	1
Green Ash	SA	1	4ft	Planted	1
Sweet Gum	SA	6	3ft	Volunteer	0
Sweet Gum	SA	8	5ft	Volunteer	0
Sweet Gum	SA	2	6ft	Volunteer	0
Sweet Gum	SA	1	8ft	Volunteer	0
Loblolly Pine	SA	6	3ft	Volunteer	6
Loblolly Pine	SA	5	5ft	Volunteer	5
Red Maple	SA	30	2ft	Volunteer	0
Red Maple	SA	1	3ft	Volunteer	0

	TOTAL SHRUBS	46		OBSERVED DENSITY(PER PLOT)	142
	TOTAL TREES OF PLANTED SPECIES	85		OBSERVED DENSITY (PER ACRE)	1,420
	TOTAL TREES OF VOLUNTEER SPECIES	59			
	TOTAL INDIVIDUALS	190			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 8

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Am. Beautyberry	SH	1	5ft	Planted	1
Elderberry	SH	2	2ft	Planted	2
Wax Myrtle	SH	2	2ft	Planted	2
Wax Myrtle	SH	1	4ft	Planted	1
Wax Myrtle	SH	2	6ft	Planted	2
Wax Myrtle	SH	1	7ft	Planted	1
Sycamore	SA	3	2ft	Planted	3
Sycamore	SA	7	4ft	Planted	7
Sycamore	SA	4	5ft	Planted	4
Sycamore	SA	5	6ft	Planted	5
Sycamore	SA	5	7ft	Planted	5
Sycamore	SA	3	8ft	Planted	3
Tulip Poplar	SA	1	2ft	Planted	1
Tulip Poplar	SA	4	3ft	Planted	4
Tulip Poplar	SA	6	4ft	Planted	6
Tulip Poplar	SA	1	5ft	Planted	1
Persimmon	SA	5	<2ft	Planted	5
Persimmon	SA	1	2ft	Planted	1
River Birch	SA	1	<2ft	Planted	1
Red Maple	SA	12	<2ft	Volunteer	0
Sweet Gum	SA	2	<2ft.	Volunteer	0
	TOTAL SHRUBS	9		OBSERVED DENSITY (PER PLOT)	55
	TOTAL TREES OF PLANTED SPECIES	46		OBSERVED DENSITY (PER ACRE)	550
	TOTAL TREES OF VOLUNTEER SPECIES	14			
	TOTAL INDIVIDUALS	69			

NEUSE RIVER RIPARIAN BUFFER SITE
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PLOT#: 9

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Wax Myrtle	SH	4	3ft	Planted	4
Wax Myrtle	SH	7	4ft	Planted	7
Wax Myrtle	SH	10	5ft	Planted	10
Wax Myrtle	SH	1	6ft	Planted	1
Baccharis	SH	1	3ft	Volunteer	1
Baccharis	SH	1	4ft	Volunteer	1
Baccharis	SH	1	5ft	Volunteer	1
Winged Sumac	SH	1	2ft	Planted	1
Sycamore	SA	6	<2ft	Planted	6
Sycamore	SA	2	2ft	Planted	2
Sycamore	SA	6	3ft	Planted	6
Sycamore	SA	1	4ft	Planted	1
Sycamore	SA	2	7ft	Planted	2
Sycamore	SA	1	8ft	Planted	1
Persimmon	SA	1	<2ft	Planted	1
Persimmon	SA	1	3ft	Planted	1
River Birch	SA	2	<2ft	Planted	2
River Birch	SA	3	2ft	Planted	3
River Birch	SA	10	3ft	Planted	10
River Birch	SA	8	4ft	Planted	8
River Birch	SA	6	5ft	Planted	6
River Birch	SA	4	6ft	Planted	4
River Birch	SA	5	7ft	Planted	5
River Birch	SA	2	8ft	Planted	2
Willow Oak	SA	3	<2ft	Planted	3
Willow Oak	SA	2	2ft	Planted	2
Willow Oak	SA	2	3ft	Planted	2
White Oak	SA	1	<2ft	Planted	1
White Oak	SA	1	2ft	Planted	1
Southern Red Oak	SA	2	<2ft	Planted	2
Southern Red Oak	SA	1	4ft	Planted	1
Sweet Gum	SA	1	<2ft	Volunteer	0
Sweet Gum	SA	1	2ft	Volunteer	0
Sweet Gum	SA	2	3ft	Volunteer	0
Black Willow	SA	1	2ft	Volunteer	1
Red Maple	SA	25	<2ft	Volunteer	0

Loblolly Pine	SA	1	<2ft	Volunteer	1
Loblolly Pine	SA	2	2ft	Volunteer	2
Loblolly Pine	SA	2	3ft	Volunteer	2
	TOTAL SHRUBS	26		OBSERVED DENSITY(PER PLOT)	104
	TOTAL TREES OF PLANTED SPECIES	72		OBSERVED DENSITY (PER ACRE)	1,040
	TOTAL TREES OF VOLUNTEER SPECIES	35			
	TOTAL INDIVIDUALS	133			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 10

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Amer. Beautyberry	SH	5	<2ft	Planted	5
Amer. Beautyberry	SH	5	3ft	Planted	5
Amer. Beautyberry	SH	1	5ft	Planted	1
Elderberry	SH	5	<2ft	Planted	5
Wax Myrtle	SH	1	4ft	Planted	1
Wax Myrtle	SH	1	5ft	Planted	1
Wax Myrtle	SH	1	6ft	Planted	1
Sycamore	SA	2	<2ft	Planted	2
Sycamore	SA	8	3ft	Planted	8
Sycamore	SA	1	4ft	Planted	1
Sycamore	SA	6	5ft	Planted	6
Sycamore	SA	5	6ft	Planted	5
Sycamore	SA	3	7ft	Planted	3
Tulip Poplar	SA	6	<2ft	Planted	6
Tulip Poplar	SA	3	3ft	Planted	3
Southern Red Oak	SA	1	<2ft	Planted	1
River Birch	SA	1	5ft	Planted	1
River Birch	SA	1	6ft	Planted	1
Red Maple	SA	26	<2ft	Volunteer	0
Red Maple	SA	3	3ft	Volunteer	0
Black Willow	SA	3	7ft	Volunteer	3
Black Willow	SA	1	8ft	Volunteer	1
	TOTAL SHRUBS	19		OBSERVED DENSITY(PER PLOT)	60
	TOTAL TREES OF PLANTED SPECIES	37		OBSERVED DENSITY (PER ACRE)	600
	TOTAL TREES OF VOLUNTEER SPECIES	33			
	TOTAL INDIVIDUALS	89			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 11

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Am. Beauty Berry	SH	5	<2ft	Planted	5
Am. Beauty Berry	SH	1	3ft	Planted	1
Am. Beauty Berry	SH	4	4ft	Planted	4
Baccharis	SH	2	5ft	Volunteer	2
Wax Myrtle	SH	8	3ft	Planted	8
Wax Myrtle	SH	9	4ft	Planted	9
Wax Myrtle	SH	1	5ft	Planted	1
White Oak	SA	3	<2ft	Planted	3
White Oak	SA	2	2ft	Planted	2
White Oak	SA	12	3ft	Planted	12
White Oak	SA	3	4ft	Planted	3
White Oak	SA	2	5ft	Planted	2
Cherrybark Oak	SA	3	3ft	Planted	3
River Birch	SA	1	3ft	Planted	1
Sycamore	SA	1	<2ft	Planted	1
Sycamore	SA	1	2ft	Planted	1
Sycamore	SA	3	3ft	Planted	3
Sycamore	SA	2	5ft	Planted	2
Sycamore	SA	1	6ft	Planted	1
Sycamore	SA	1	7ft	Planted	1
Willow Oak	SA	3	2ft.	Planted	3
Willow Oak	SA	1	3ft.	Planted	1
Persimmon	SA	5	<2ft	Planted	5
Persimmon	SA	1	2ft	Planted	1
Persimmon	SA	1	3ft	Planted	1
Persimmon	SA	1	4ft	Planted	1
Tulip Poplar	SA	1	3ft	Planted	1
Southern Red Oak	SA	2	<2ft	Planted	2
Southern Red Oak	SA	1	2ft	Planted	1
Southern Red Oak	SA	5	3ft	Planted	5
Sweet Gum	SA	1	<2ft	Volunteer	0
Sweet Gum	SA	6	3ft	Volunteer	0
Sweet Gum	SA	8	4ft	Volunteer	0
Red Maple	SA	20	<2ft	Volunteer	0
Red Maple	SA	1	2ft	Volunteer	0
Loblolly Pine	SA	2	<2ft	Volunteer	2

Loblolly Pine	SA	4	2ft	Volunteer	4
Loblolly Pine	SA	5	3ft	Volunteer	5
Loblolly Pine	SA	3	4ft	Volunteer	3
	TOTAL SHRUBS	30		OBSERVED DENSITY(PER PLOT)	100
	TOTAL TREES OF PLANTED SPECIES	56		OBSERVED DENSITY (PER ACRE)	1,000
	TOTAL TREES OF VOLUNTEER SPECIES	50			
	TOTAL INDIVIDUALS	136			

NEUSE RIVER RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 12

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Winged Sumac	SH	12	2ft	Planted	12
American Beautyberry	SH	3	2ft	Planted	3
American Beautyberry	SH	1	3ft	Planted	1
Wax Myrtle	SH	1	<2ft	Planted	1
Wax Myrtle	SH	1	2ft	Planted	1
Wax Myrtle	SH	2	3ft	Planted	2
Wax Myrtle	SH	2	4ft	Planted	2
Wax Myrtle	SH	5	5ft	Planted	5
Wax Myrtle	SH	8	6ft	Planted	8
Wax Myrtle	SH	25	7ft	Planted	25
Wax Myrtle	SH	5	8ft	Planted	5
Wax Myrtle	SH	1	9ft	Planted	1
Water Oak	SA	17	<2ft	Planted	17
White Oak	SA	1	2ft	Planted	1
Persimmon	SA	1	3ft	Planted	1
Sycamore	SA	10	<2ft	Planted	10
Sycamore	SA	8	3ft	Planted	8
Sycamore	SA	1	6ft	Planted	1
Sycamore	SA	1	7ft	Planted	1
Sweet Gum	SA	10	<2ft	Volunteer	0
Sweet Gum	SA	18	3ft	Volunteer	0
Sweet Gum	SA	33	4ft	Volunteer	0
Sweet Gum	SA	12	5ft	Volunteer	0
Sweet Gum	SA	6	6ft	Volunteer	0
Sweet Gum	SA	1	7ft	Volunteer	0
Loblolly Pine	SA	1	2ft	Volunteer	1
Loblolly Pine	SA	2	4ft	Volunteer	2
Red Maple	SA	20	<2ft	Volunteer	0
	TOTAL SHRUBS	66		OBSERVED DENSITY(PER PLOT)	108
	TOTAL TREES OF PLANTED SPECIES	39		OBSERVED DENSITY (PER ACRE)	1,080
	TOTAL TREES OF VOLUNTEER SPECIES	103			
	TOTAL INDIVIDUALS	208			

APPENDIX C.

LIST OF SUPPLEMENTAL PLANTINGS

Riparian Buffer Restoration – Neuse River Basin ("McCotter/Raines Farm")
Contract No. AW03011-3/Task #5 – Annual Monitoring

SUPPLEMENTAL PLANTING

Supplemental planting was conducted in an approximate six-acre area of the buffer site during February 2004:

- 200 wax myrtle installed on east side of primary ditch/water of the US and in select areas of southeast portion of site
- 1067 water oak planted in six-acre area
- 300 white oak planted in higher elevations of six-acre area
- 300 persimmon planted in six-acre area
- 387 willow oak planted in six-acre area
- 143 sycamore planted in six-acre area

  2,397 total trees and shrubs planted