"Howard Farm Property"
Buffer Restoration Project

Greene County, NC
Neuse River Basin
(Cataloging Unit #03020203)

2006 Annual Monitoring Report (Year 1 of 5)
(Task 7)

NC EEP Contract #D05020-1

Prepared For:

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Prior to project implementation, the Howard Farm Property was farmed for soybean and cotton production. The site consisted entirely of open agricultural fields with no existing riparian buffer (i.e. trees and shrubs are absent within 200 ft of existing surface waters). Under contract with the North Carolina Ecosystem Enhancement Program (EEP), Land Management Group, Inc. (LMG) implemented the restoration of 26.3 acres of riparian buffer habitat along Mussel Run (a tributary of Contentnea Creek) and contiguous surface-waters (i.e. field ditches) in Greene County, NC.

The entire 26.3-ac project area has been planted with characteristic tree and shrub species on an average density of 900 stems/ac. Planting was completed in February 2006. Thirteen (13) permanent 0.10-ac monitoring plots (equivalent to 5% of the restoration area) were established subsequent to planting. Annual monitoring will be conducted near the end of each growing season for a period of five years beginning in October 2006. Vegetative planting will be deemed successful if survivorship of plantings and volunteers of desirable species meets or exceeds a target stem density of 320 stems/acre.

A total of 1,799 stems (planted and volunteer shrubs/trees) were observed within the thirteen 0.10-acre plots during Year 1 monitoring. Of the total observed, 1,165 stems (total excluding red maple and sweet gum) were counted toward the success criteria (corresponding to an average of 896 stems/acre). Given the average stem density observed, the site seems to be progressing well toward the targeted stem density.

Monitoring reports will be submitted annually to the EEP (by January 1 of each year). These reports will include results of vegetative monitoring and photographic documentation of site conditions. Monitoring reports will also identify any contingency measures that may need to be employed to remedy any site deficiencies.

The following monitoring report summarizes the restoration project and includes more specific information related to project implementation, ‘as-built’ conditions, and site progress through Year 1.

I. PROJECT BACKGROUND

1. Location and Setting

The following report summarizes the riparian buffer site conditions observed during the first year of monitoring subsequent to site planting in February 2006. As approved by the EEP, LMG implemented the restoration of 26.3 acres of farmland located adjacent to Mussel Run (a tributary of the Neuse River) and a series of contiguous surface waters (i.e. field ditches). The project area is part of the "Howard Farm", located approximately 2.5 miles northeast of Hookerton in Greene County, NC (refer to Figure 1). The project includes the establishment of characteristic tree and shrub species adjacent to open field ditches on the east and west side of Churchill Road (SR #1404) as well as Mussel Run (refer to Figure 2). The property is situated within NEU-7 of the lower Neuse River Basin (USGS Cataloging Unit 03020203) and within sub-basin 03-04-07.

2. Mitigation Type and Objectives

The proposed restoration project is intended to provide suitable, high-quality riparian buffer restoration as compensatory mitigation for riparian buffer impacts authorized through the EEP. 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 primary function of the riparian buffer project detailed in this document is to restore the nitrogen (N) removal capacity of those areas situated adjacent to surface waters. In addition, the project will provide ancillary benefits to aquatic and wildlife habitat via enhanced niche habitat, microclimate modification and shade, and increased food-web support.

3. Project History and Background

Table 1 provides information regarding the reporting and milestone history for the Howard Farm Buffer Restoration project.

4. Monitoring Plan View

Locations of vegetation monitoring plots for the Howard Farm Buffer Restoration can be found in Figure 3.

II. PROJECT CONDITIONS

1. Pre-Construction Conditions

The 26.3-acre riparian buffer restoration area represents a portion of a larger 145-acre tract ("Howard Farm") formerly farmed for the production of soybean and cotton. Land use practices (including herbicide, pesticide, and fertilizer application) served as potential contributors to decreased water quality of adjacent surface waters (i.e. ditches and 'blue-line' streams). Application of nitrogen-rich fertilizer represented the most significant non-point source of nitrogen within the immediate project area. Woody vegetation along ditches was either absent or sparse (less than 100 stems per acre that are > 5 inches diameter at breast height). As a result, nutrient-laden runoff was discharged from agricultural fields directly into surface waters with little or no nutrient filtration/transformation.

2. Soils

The site consists predominantly of Johns sandy loam (refer to Figure 4) – a somewhat poorly drained to moderately well drained soil occurring along stream terraces. Infiltration is moderate and surface runoff is slow in these areas. The seasonal high water table occurs between 1.5 ft and 3.0 ft below the soil surface. The remaining portion of the buffer area consists of Lumbee sandy loam – a poorly drained soil characteristic of broader flats of stream terraces. Lumbee soils exhibit moderate infiltration with a seasonal high water table occurring at or near the soil surface.

3. Restoration Activities

The restoration project included the planting of characteristic tree and shrub seedlings adjacent to open ditches and blue-line streams on the 26.3-ac restoration site (refer to Figure 3). No federal or state permits were necessary to conduct the restoration activities. The riparian buffer was planted with various species including river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), water oak (*Quercus nigra*), willow oak (*Quercus phellos*), and red bay (*Persea borbonia*). The outer 50 feet of the buffer area was planted with characteristic shrub species including wax myrtle (*Myrica cerifera*), American beautyberry (*Callicarpa americana*), elderberry (*Sambucus canadensis*), and sweet pepperbush (*Clethra alnifolia*). 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 NCDENR's "Guidelines for Riparian Buffer Restoration" as appropriate species for use in riparian buffer restoration projects. Approximately 20,000 trees and shrubs were planted throughout the project footprint. Bare-root seedlings were planted at a density of 600 trees per acre. Shrubs were planted at densities of 1,000 to 1,200 plants per acre. On-site planting was completed in February 2006. Refer to Table 2 for a list of species planted (with corresponding quantities) within the buffer restoration area.

III. METHODOLOGY & SUCCESS CRITERIA

Annual monitoring will be conducted near the end of each growing season for a period of five years. Vegetative monitoring has included the establishment of thirteen (13) 0.10-acre permanent plots corresponding to a total of 1.3 acres (equivalent to 5% of the restoration area). The locations of the monitoring plots are depicted in Figure 3. Vegetative planting will be deemed successful if survivorship of plantings and volunteers of desirable species[1] meets or exceeds a target stem density of 320 stems/acre.

Monitoring reports will be submitted annually to the EEP (by January 1 of each year). These reports will include results of vegetative monitoring and photographic documentation of site conditions. Monitoring reports will also identify any contingency measures that may need to be employed to remedy any site deficiencies. For instance, deer browse tubes and fencing may need to be used if evidence of significant herbivory or deer browse is observed. In addition, supplemental planting may be necessary in areas of reduced survivorship.

IV. MONITORING

A total of 1,799 stems (planted and volunteer shrubs/trees) were observed within the thirteen 0.10-acre plots. Of the total observed, 1,165 stems (total excluding red maple and sweet gum) were counted toward the success criteria (corresponding to an average of 896 stems/acre). Of the species planted, American sycamore (*Platanus occidentalis*) was the most abundant tree

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

observed within the thirteen monitoring plots. Refer to Table 3 for a summary of results related to species abundance and target stem densities. In addition, individual plot data sheets are provided in Appendix B.

During site inspections of Summer 2006, LMG identified the presence of a large scale infestation of common morning glory (*Ipomoea purpurea*). LMG conducted selective physical removal of vines prior to monitoring the site. Though the morning glory was widespread across the site, survivorship of planted trees and shrubs remained high. Given the presence of this invasive species, LMG will be spot-treating the site with a pre-emergent herbicide application prior to the start of the growing season in 2007. The site will be actively monitored to identify further invasive species problems. If it is deemed that the morning glory is significantly impeding tree and/or shrub growth, additional remedial action may be employed through consultation and approval of the NC EEP.

V. CONCLUSION

LMG has completed the implementation and first year monitoring of 26.3 acres of riparian buffer restoration located in NEU-7 of the lower Neuse Basin. Stem densities within all thirteen plots well exceed the 320 stems/acre target density for restored buffer habitats. The total observed density (896 stems/acre) indicates that the site is progressing well toward the target maturity density. The presence of morning glory will be monitored during the early growing season. Spot treatment with pre-emergent herbicide application should keep this invasive vine sufficiently controlled as to allow for the continued growth and development of planted trees and shrubs.

Reversion of agricultural land to wooded riparian buffer will decrease source nutrient loading and concurrently increase nutrient removal capacity. In addition, the project will provide ancillary benefits to aquatic and wildlife habitat via enhanced niche habitat, microclimate modification and shade, and increased food-web support. By doing so, the proposed project will help to effectively mitigate for authorized loss of riparian buffers within the Neuse Basin.

TABLES

Table 1. Reporting and Milestone History

	Project Milestone	Completion Date	COMMENTS
1	Feasibility Study, CE Document, and Public Meeting	September, 2005	Complete
2	Record a Conservation Easement on the Site	January 2006	Conveyed to SPO
3	Restoration Plan Approved by EEP		
4	Mitigation Site Earthwork Completed	January 2006	
5	Mitigation Site Planting and Installation of Monitoring Devices	February 15, 2006	Complete
6	Submittal of Mitigation Plan (including as-built drawings)	June 2006	Complete
7	Submittal of Monitoring Report #1 to EEP	December 31, 2006	
8	Submittal of Monitoring Report #2 to EEP	December 31, 2007	
9	Submittal of Monitoring Report #3 to EEP	December 31, 2008	
10	Submittal of Monitoring Report #4 to EEP	December 31, 2009	
11	Submittal of Monitoring Report #5 to EEP	December 31, 2010	

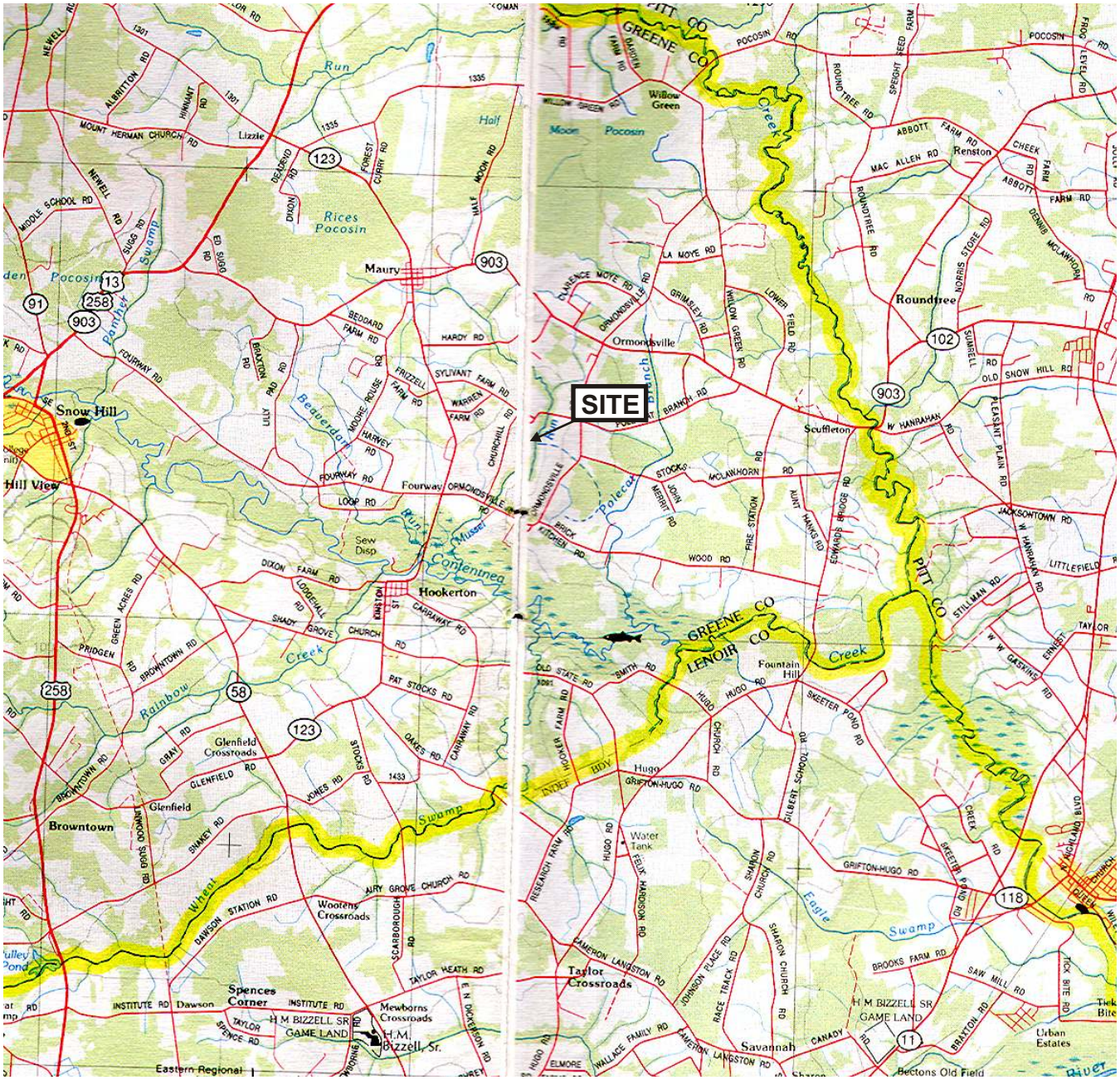
Table 2. Howard Farm Plant List

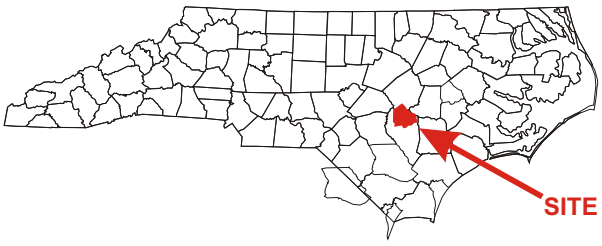
Species (trees)	Quantity
River Birch (*Betula nigra*)	2,000
Sycamore (*Platanus occidentalis*)	2,000
Green Ash (*Fraxinus pennsylvanica*)	1,000
Willow Oak (*Quercus phellos*)	1,000
Overcup Oak (*Quercus lyrata)*	1,000
Water Oak (*Quercus nigra*)	2,000
Black Gum (*Nyssa sylvatica*)	1,000
Red Bay (*Persea borbonia*)	2,000
Species (shrubs)	
Wax Myrtle (*Myrica cerifera*)	2,000
Sweet pepperbush (*Clethra alnifolia*)	2,000
Elderberry (*Sambucus canadensis*)	2,000
American Beautyberry (*Callicarpa americana*)	1,000
Possumhaw (*Viburnum nudum*)	1,000
TOTAL	**20,000**

TABLE 3. ANNUAL MONITORING DATA SHEET (YEAR 1) - VEGETATION PLOTS
HOWARD FARM RIPARIAN BUFFER SITE

SPECIES	PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	PLOT 7	PLOT 8	PLOT 9	PLOT 10	PLOT 11	PLOT 12	PLOT 13	TOTAL
Sycamore	18			3	7			65	94		74	8	39	308
Red Maple		50	10	20	20		110	3	6	1		2		222
Sweet Gum		300	50			13		20	14	10		4	1	412
Green Ash	2				8									10
Wax Myrtle						9	18			5		18		50
River Birch			1	10	14		5	6	12	5	37	1	75	166
Blackgum				6	4			7	31	31	12			91
Amer. Beautyberry	20	41	8			8	16		1	28		9		131
Persimmon	2	2	6										3	13
Elderberry		4	14	1		13	11		10	10	1		3	67
Water Oak			3											3
Overcup Oak	2		1	8	16	7								34
Willow Oak				10	4	4	1							19
Black Willow										2				2
Loblolly Pine		10												10
Possumhaw	3	14	22											39
Sweet Pepperbush	34		33			14						18		99
Red Cedar						10	1	1				3		15
Red Bay	7				9			1				13		30
Eastern False Willow	5	10	8	12				9	11	11	1	8	3	78
TOTAL	93	431	156	70	82	78	162	112	179	103	125	84	124	1799
Total Counted toward Success	93	81	96	50	62	65	52	89	159	92	125	78	123	1165
Stem Density (per ac)	930	810	960	500	620	650	520	890	1590	920	1250	780	1230	896

FIGURES





SCALE 1" = 2.0 miles

Map Source: DeLorme: North Carolina Atlas and Gazetteer., 1997 p. 46.

NC EEP
Howard Farm
Buffer Restoration Project
Greene County

LMG
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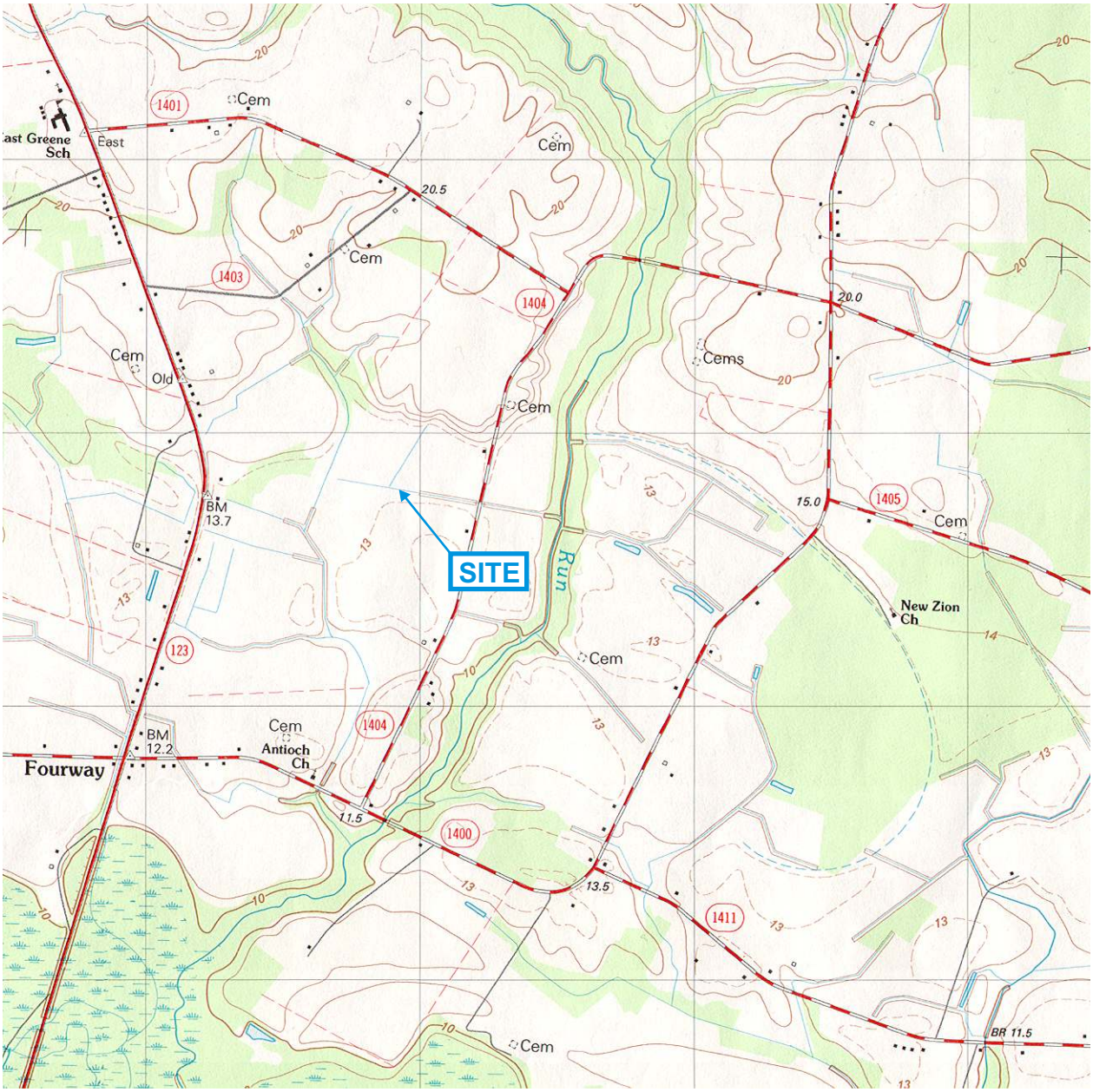
Environmental Consultants

Figure 1.
Site Location Map



Boundaries are approximate and not meant to be absolute.

Map Source: 1982, USGS 7.5' Topographic Quadrangle. Hookerton Quadrangle

N

SCALE 1" = 2000'

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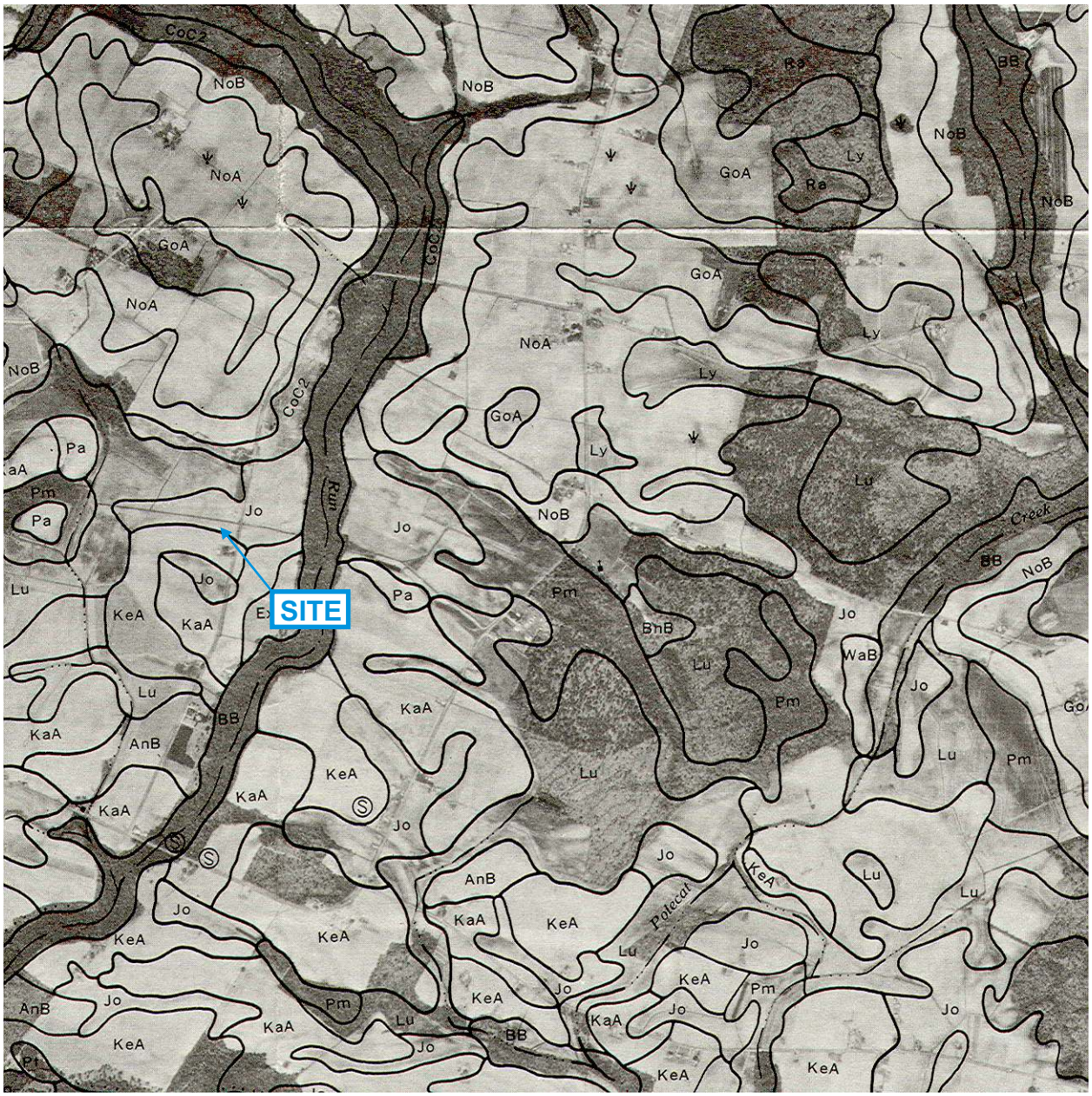
Figure 2.
1982 Topographic Quad



N

SCALE 1" = 2000'

Boundaries are approximate
and not meant to be absolute.

Map Source: Soil Survey of Greene County , 1977.

NC EEP Howard Farm Buffer Restoration Project Greene County	LMG LAND MANAGEMENT GROUP INC. *Environmental Consultants*	**Figure 4.** Generalized Soil Map Greene County, NC

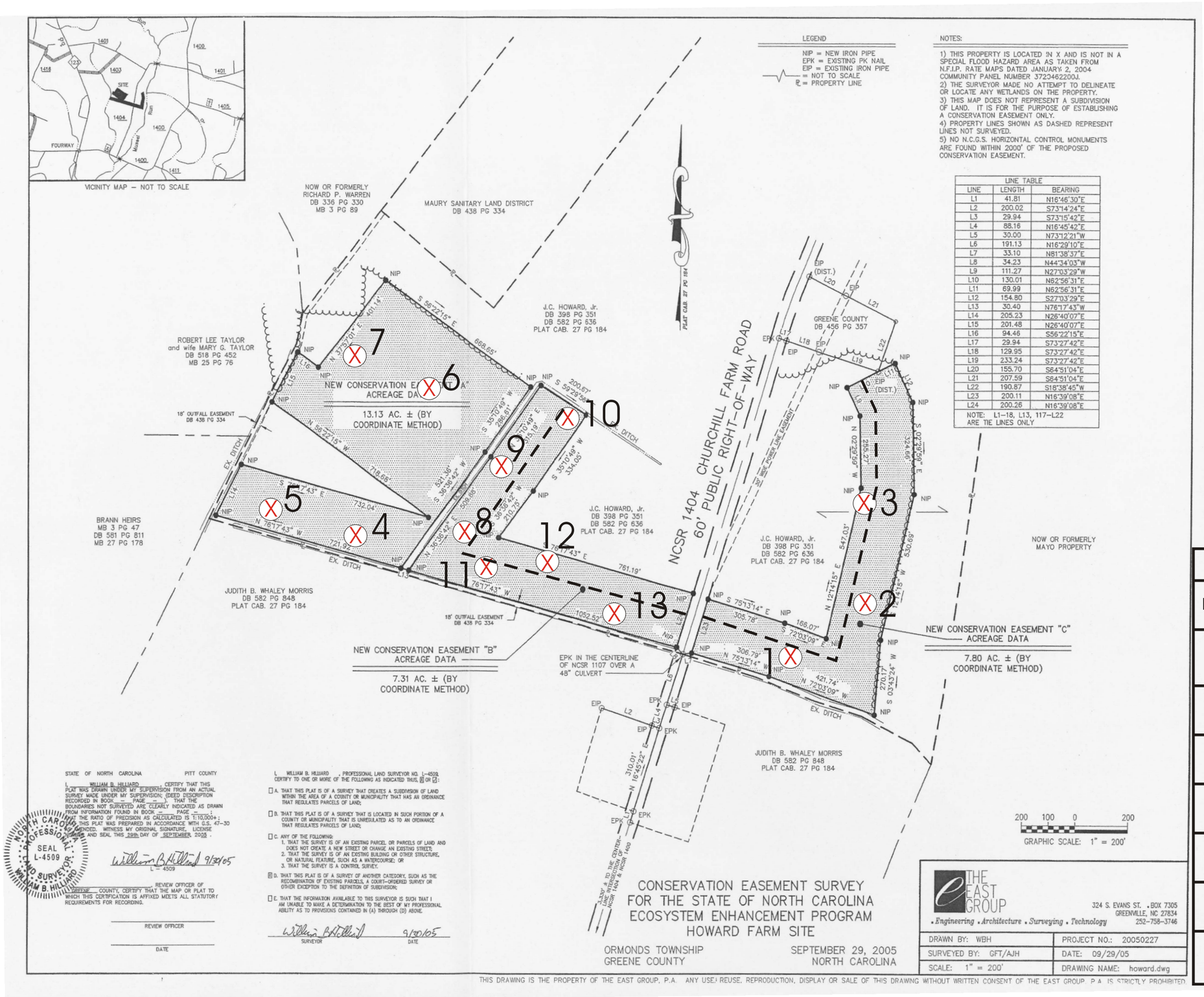


Figure 3. Survey with Monitoring Plot Locations

⊗ Permanent Monitoring Plot			
Plot #	**UTM Coordinates**	**Plot #**	**UTM Coordinates**
1	740025.940563 189523.165945	7	739480.818314 189764.335203
2	740098.689967 189567.014901	8	739637.279362 189603.887887
3	740086.731161 189628.802066	9	739664.309005597 189677.942642213
4	739538.61921 189587.942812	10	739720.991005 189734.438188
5	739586.454435 189726.46565	11	739681.128318 189564.025199
6	739586.454435 189726.46565	12	739645.251899 189634.781469
		13	739820.647723 189570.004602

APPENDIX A:
SITE PHOTOGRAPHS (OCTOBER 2006)

RESTORATION SITE PHOTOGRAPHS

(1) View facing south of flagged trees in Plot 4.

(2) View facing west of Plot 8.

RESTORATION SITE PHOTOGRAPHS

(3) View from outer edge of Plot 2 facing Mussel Run Branch.

(4) View of Plot 1 (facing west) toward SR 1404

RESTORATION SITE PHOTOGRAPHS

(5) Physical removal of vines and herbaceous in Plot 12.

(6) View of tagged saplings in Plot 7 after clearing.

APPENDIX B:
VEGETATION SURVEY DATA BY PLOT

HOWARD FARM 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
American Beautyberry	SH	3	<2ft.	Planted	3
American Beautyberry	SH	4	2ft.	Planted	4
American Beautyberry	SH	10	3ft.	Planted	10
American Beautyberry	SH	3	4ft.	Planted	3
Overcup Oak	SA	1	<2ft.	Planted	1
Overcup Oak	SA	1	2ft	Planted	1
American Sycamore	SA	1	<2ft	Planted	1
American Sycamore	SA	6	2ft	Planted	6
American Sycamore	SA	4	2.5ft	Planted	4
American Sycamore	SA	4	3ft	Planted	4
American Sycamore	SA	3	3.5ft	Planted	3
Green Ash	SA	1	5ft.	Planted	1
Green Ash	SA	1	6ft.	Planted	1
Sweet Pepperbush	SA	34	<2ft	Planted	34
Possumhaw	SA	2	<2ft	Planted	2
Possumhaw	SA	1	2ft	Planted	1
Persimmon	SA	2	2ft	Planted	2
Sweet bay	SA	5	<2ft	Planted	5
Sweet bay	SA	2	2ft	Planted	2
Baccharis	SH	3	<2ft.	Volunteer	3
Baccharis	SH	1	2.5ft.	Volunteer	1
Baccharis	SH	1	3ft.	Volunteer	1
	TOTAL SHRUBS	25		OBSERVED DENSITY (PER PLOT)	93
	TOTAL TREES OF PLANTED SPECIES	68		OBSERVED DENSITY (PER ACRE)	930
	TOTAL TREES OF VOLUNTEER SPECIES	0			
	TOTAL INDIVIDUALS	93			

HOWARD FARM 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
Amer. Beautyberry	SH	2	<2ft.	Planted	2
Amer. Beautyberry	SH	4	2ft.	Planted	4
Amer. Beautyberry	SH	8	2.5ft.	Planted	8
Amer. Beautyberry	SH	6	3ft.	Planted	6
Amer. Beautyberry	SH	8	3.5ft.	Planted	8
Amer. Beautyberry	SH	10	4ft.	Planted	10
Amer. Beautyberry	SH	3	4.5ft.	Planted	3
Elderberry	SH	2	<2ft.	Planted	2
Elderberry	SH	2	2.5ft.	Planted	2
Possumhaw	SA	1	<2ft.	Planted	1
Possumhaw	SA	1	2ft.	Planted	1
Possumhaw	SA	4	2.5ft.	Planted	4
Possumhaw	SA	5	3ft.	Planted	5
Possumhaw	SA	3	3.5ft.	Planted	3
Persimmon	SA	1	2ft.	Planted	1
Persimmon	SA	1	2.5ft	Planted	1
Loblolly Pine	SA	10	<2ft.	Volunteer	10
Baccharis	SH	5	<2ft.	Volunteer	5
Baccharis	SH	5	3ft.	Volunteer	5
Red Maple	SA	50	<2ft.	Volunteer	0
Sweet Gum	SA	≈200	2ft.	Volunteer	0
Sweet Gum	SA	≈100	3ft.	Volunteer	0
	TOTAL SHRUBS	55		OBSERVED DENSITY (PER PLOT)	81
	TOTAL TREES OF PLANTED SPECIES	16		OBSERVED DENSITY (PER ACRE)	810
	TOTAL TREES OF VOLUNTEER SPECIES	360			
	TOTAL INDIVIDUALS	431			

HOWARD FARM 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
Persimmon	SA	5	<2ft	Planted	5
Persimmon	SA	1	2.5ft	Planted	1
River Birch	SA	1	<2ft	Planted	1
Overcup Oak	SA	1	<2ft	Planted	1
Water Oak	SA	3	<2ft	Planted	3
Possumhaw	SA	9	<2ft	Planted	9
Possumhaw	SA	8	2ft	Planted	8
Possumhaw	SA	4	2.5ft	Planted	4
Possumhaw	SA	1	3ft	Planted	1
Elderberry	SH	1	<2ft	Planted	1
Elderberry	SH	2	2ft	Planted	2
Elderberry	SH	2	2.5ft	Planted	2
Elderberry	SH	3	3ft	Planted	3
Elderberry	SH	5	3.5ft	Planted	5
Elderberry	SH	1	4ft	Planted	1
Sweet Pepperbush	SH	14	<2ft	Planted	14
Sweet Pepperbush	SH	2	2ft	Planted	2
Sweet Pepperbush	SH	18	4ft	Planted	18
Amer. Beautyberry	SH	1	2ft	Planted	2
Amer. Beautyberry	SH	4	3ft	Planted	4
Amer. Beautyberry	SH	2	3.5ft	Planted	2
Baccharis	SH	4	2ft	Volunteer	4
Baccharis	SH	1	2.5ft	Volunteer	1
Baccharis	SH	2	3ft	Volunteer	2
Baccharis	SH	1	3.5ft	Volunteer	1
Sweet Gum	SA	50	<2ft	Volunteer	0
Red Maple	SA	10	<2ft	Volunteer	0
	TOTAL SHRUBS	63		OBSERVED DENSITY (PER PLOT)	96
	TOTAL TREES OF PLANTED SPECIES	33		OBSERVED DENSITY (PER ACRE)	960
	TOTAL TREES OF VOLUNTEER SPECIES	60			
	TOTAL INDIVIDUALS	156			

HOWARD FARM 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
Baccharis	SH	1	<2ft	Volunteer	1
Baccharis	SH	3	2ft	Volunteer	3
Baccharis	SH	4	3ft	Volunteer	4
Baccharis	SH	3	4.5ft	Volunteer	3
Baccharis	SH	1	5.5ft	Volunteer	1
Overcup Oak	SA	4	<2ft	Planted	4
Overcup Oak	SA	1	2ft	Planted	1
Overcup Oak	SA	1	2.5ft	Planted	1
Overcup Oak	SA	1	3ft	Planted	1
Overcup Oak	SA	1	4ft	Planted	1
Water Oak	SA	3	<2ft	Planted	3
Water Oak	SA	2	2ft	Planted	2
Water Oak	SA	1	3ft	Planted	1
Water Oak	SA	2	4ft	Planted	2
Water Oak	SA	2	4.5ft	Planted	2
Sycamore	SA	1	2ft	Planted	1
Sycamore	SA	1	3ft	Planted	1
Sycamore	SA	1	4ft	Planted	1
River Birch	SA	4	2ft	Planted	4
River Birch	SA	5	3ft	Planted	5
River Birch	SA	1	4ft	Planted	1
Blackgum	SA	6	<2ft	Planted	6
Elderberry	SH	1	2ft	Planted	1
Red Maple	SA	20	<2ft	Volunteer	0
	TOTAL SHRUBS	13		OBSERVED DENSITY (PER PLOT)	50
	TOTAL TREES OF PLANTED SPECIES	38		OBSERVED DENSITY (PER ACRE)	500
	TOTAL TREES OF VOLUNTEER SPECIES	20			
	TOTAL INDIVIDUALS	71			

HOWARD FARM 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
Overcup Oak	SA	13	<2ft	Planted	13
Overcup Oak	SA	1	2ft	Planted	1
Overcup Oak	SA	2	2.5ft	Planted	2
Willow Oak	SA	4	<2ft	Planted	4
River Birch	SA	9	<2ft	Planted	9
River Birch	SA	3	2ft	Planted	3
River Birch	SA	2	2.5ft	Planted	2
Sycamore	SA	4	<2ft	Planted	4
Sycamore	SA	3	3ft	Planted	3
Green Ash	SA	1	<2ft	Planted	1
Green Ash	SA	1	2ft	Planted	1
Green Ash	SA	3	4ft	Planted	3
Green Ash	SA	1	5ft	Planted	1
Green Ash	SA	1	5.5ft	Planted	1
Green Ash	SA	1	6ft	Planted	1
Red Bay	SA	9	<2ft	Planted	9
Blackgum	SA	3	<2ft	Planted	3
Blackgum	SA	1	2ft	Planted	1
Red Maple	SA	20	<2ft	Volunteer	0
	TOTAL SHRUBS	0		OBSERVED DENSITY (PER PLOT)	62
	TOTAL TREES OF PLANTED SPECIES	62		OBSERVED DENSITY (PER ACRE)	620
	TOTAL TREES OF VOLUNTEER SPECIES	20			
	TOTAL INDIVIDUALS	82			

HOWARD FARM 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	7	2.5ft	Planted	7
Wax Myrtle	SH	1	3.5ft	Planted	1
Elderberry	SH	4	2ft	Planted	4
Elderberry	SH	9	2.5ft	Planted	9
Sweet Pepperbush	SH	13	<2ft	Planted	13
Sweet Pepperbush	SH	1	2.5ft	Planted	1
Amer. Beautyberry	SH	1	2.5ft	Planted	1
Amer. Beautyberry	SH	6	3ft	Planted	6
Amer. Beautyberry	SH	1	3.5ft	Planted	1
Red Cedar	SA	9	<2ft	Planted	9
Red Cedar	SA	1	2ft	Planted	1
Overcup Oak	SA	1	<2ft	Planted	1
Overcup Oak	SA	2	2ft	Planted	2
Overcup Oak	SA	4	3ft	Planted	4
Willow Oak	SA	2	2ft	Planted	2
Willow Oak	SA	1	2.5ft	Planted	1
Willow Oak	SA	1	3.5ft	Planted	1
Sweet Gum	SA	4	<2ft	Volunteer	0
Sweet Gum	SA	6	2ft	Volunteer	0
Sweet Gum	SA	3	3ft	Volunteer	0
	TOTAL SHRUBS	44		OBSERVED DENSITY (PER PLOT)	65
	TOTAL TREES OF PLANTED SPECIES	21		OBSERVED DENSITY (PER ACRE)	650
	TOTAL TREES OF VOLUNTEER SPECIES	13			
	TOTAL INDIVIDUALS	78			

HOWARD FARM 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
Wax Myrtle	SH	3	<2ft	Planted	3
Wax Myrtle	SH	4	2ft	Planted	4
Wax Myrtle	SH	2	2.5ft	Planted	2
Wax Myrtle	SH	8	3ft	Planted	8
Wax Myrtle	SH	1	3.5ft	Planted	1
Amer. Beautyberry	SH	4	<2ft	Planted	4
Amer. Beautyberry	SH	2	2ft	Planted	2
Amer. Beautyberry	SH	2	2.5ft	Planted	2
Amer. Beautyberry	SH	5	3ft	Planted	5
Amer. Beautyberry	SH	2	4ft	Planted	2
Amer. Beautyberry	SH	1	5ft	Planted	1
Elderberry	SH	3	<2ft	Planted	3
Elderberry	SH	1	2ft	Planted	1
Elderberry	SH	3	2.5ft	Planted	3
Elderberry	SH	2	3ft	Planted	2
Elderberry	SH	2	3.5ft	Planted	2
River Birch	SA	3	<2ft	Planted	3
River Birch	SA	1	4.5ft	Planted	1
River Birch	SA	1	5ft	Planted	1
Willow Oak	SA	1	4.5ft	Planted	1
Red Cedar	SA	1	<2ft	Planted	1
Red Maple	SA	60	<2ft	Volunteer	0
Red Maple	SA	40	2ft	Volunteer	0
Red Maple	SA	10	3ft	Volunteer	0
	TOTAL SHRUBS	45		OBSERVED DENSITY(PER PLOT)	52
	TOTAL TREES OF PLANTED SPECIES	7		OBSERVED DENSITY (PER ACRE)	520
	TOTAL TREES OF VOLUNTEER SPECIES	110			
	TOTAL INDIVIDUALS	162			

HOWARD FARM 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
Sycamore	SA	5	<2ft	Planted	5
Sycamore	SA	12	2ft	Planted	12
Sycamore	SA	22	2.5ft	Planted	22
Sycamore	SA	21	3ft	Planted	21
Sycamore	SA	4	3.5ft	Planted	4
Sycamore	SA	1	4ft	Planted	1
River Birch	SA	1	2ft	Planted	1
River Birch	SA	3	2.5ft	Planted	3
River Birch	SA	2	3ft	Planted	2
Blackgum	SA	1	<2ft	Planted	1
Blackgum	SA	5	2ft	Planted	5
Blackgum	SA	1	2.5ft	Planted	1
Red Bay	SA	1	<2ft	Planted	1
Red Cedar	SA	1	<2ft	Planted	1
Baccharis	SH	5	<2ft	Volunteer	5
Baccharis	SH	2	2ft	Volunteer	2
Baccharis	SH	1	2.5ft	Volunteer	1
Baccharis	SH	1	3ft.	Volunteer	1
Sweet Gum	SA	20	<2ft.	Volunteer	0
Red Maple	SA	3	<2ft	Volunteer	0
	TOTAL SHRUBS	9		OBSERVED DENSITY (PER PLOT)	89
	TOTAL TREES OF PLANTED SPECIES	80		OBSERVED DENSITY (PER ACRE)	890
	TOTAL TREES OF VOLUNTEER SPECIES	23			
	TOTAL INDIVIDUALS	112			

HOWARD FARM RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 9

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Baccharis	SH	2	<2ft	Volunteer	2
Baccharis	SH	3	2ft	Volunteer	3
Baccharis	SH	3	2.5ft	Volunteer	3
Baccharis	SH	1	3ft	Volunteer	1
Baccharis	SH	1	3.5ft	Volunteer	1
Baccharis	SH	1	4ft	Volunteer	1
Sycamore	SA	5	<2ft	Planted	5
Sycamore	SA	6	2ft	Planted	6
Sycamore	SA	7	2.5ft	Planted	7
Sycamore	SA	31	3ft	Planted	31
Sycamore	SA	17	3.5ft	Planted	17
Sycamore	SA	10	4ft	Planted	10
Sycamore	SA	10	4.5ft	Planted	10
Sycamore	SA	5	5ft	Planted	5
Sycamore	SA	1	5.5ft	Planted	1
Sycamore	SA	2	6ft	Planted	2
River Birch	SA	1	<2ft	Planted	1
River Birch	SA	1	2ft	Planted	1
River Birch	SA	1	2.5ft	Planted	1
River Birch	SA	1	3ft	Planted	1
River Birch	SA	5	3.5ft	Planted	5
River Birch	SA	2	4ft	Planted	2
River Birch	SA	1	4.5ft	Planted	1
Blackgum	SA	9	<2ft	Planted	9
Blackgum	SA	11	2ft	Planted	11
Blackgum	SA	11	2.5ft	Planted	11
Elderberry	SH	3	<2ft	Planted	3
Elderberry	SH	1	2ft	Planted	1
Elderberry	SH	4	2.5ft	Planted	4
Elderberry	SH	1	3ft	Planted	1
Elderberry	SH	1	3.5ft	Planted	1
Amer. Beautyberry	SH	1	2.5ft	Planted	1
Sweet Gum	SA	14	<2ft	Volunteer	0
Red Maple	SA	6	<2ft	Volunteer	0
	TOTAL SHRUBS	22		OBSERVED DENSITY(PER PLOT)	159

	TOTAL TREES OF PLANTED SPECIES	132		OBSERVED DENSITY (PER ACRE)	1,590
	TOTAL TREES OF VOLUNTEER SPECIES	20			
	TOTAL INDIVIDUALS	174			

HOWARD FARM 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	4	<2ft	Planted	4
Amer. Beautyberry	SH	5	2ft	Planted	5
Amer. Beautyberry	SH	6	2.5ft	Planted	6
Amer. Beautyberry	SH	8	3ft	Planted	8
Amer. Beautyberry	SH	4	3.5ft	Planted	4
Amer. Beautyberry	SH	1	4ft	Planted	1
Wax Myrtle	SH	4	3ft	Planted	4
Wax Myrtle	SH	1	3.5ft	Planted	1
Blackgum	SA	11	<2ft	Planted	11
Blackgum	SA	7	2ft	Planted	7
Blackgum	SA	10	2.5ft	Planted	10
Blackgum	SA	2	3ft	Planted	2
Blackgum	SA	1	3.5ft	Planted	1
River Birch	SA	1	2ft	Planted	1
River Birch	SA	1	3ft	Planted	1
River Birch	SA	2	3.5	Planted	2
River Birch	SA	1	4ft	Planted	1
Elderberry	SH	5	2ft	Planted	5
Elderberry	SH	4	2.5ft	Planted	4
Elderberry	SH	1	3.5ft	Planted	1
Baccharis	SH	3	<2ft	Volunteer	3
Baccharis	SH	5	2ft	Volunteer	5
Baccharis	SH	2	2.5ft	Volunteer	2
Baccharis	SH	1	3ft	Volunteer	1
Black Willow	SA	1	<2ft	Volunteer	1
Black Willow	SA	1	2.5	Volunteer	1
Red Maple	SA	1	<2ft	Volunteer	0
Sweet Gum	SA	10	<2ft	Volunteer	0
	TOTAL SHRUBS	54		OBSERVED DENSITY(PER PLOT)	92
	TOTAL TREES OF PLANTED SPECIES	36		OBSERVED DENSITY (PER ACRE)	920
	TOTAL TREES OF VOLUNTEER SPECIES	11			
	TOTAL INDIVIDUALS	101			

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
Baccharis	SH	1	<2ft	Volunteer	1
River Birch	SA	6	2.5ft	Planted	6
River Birch	SA	16	3.0ft	Planted	16
River Birch	SA	11	3.5ft	Planted	11
River Birch	SA	3	4ft	Planted	3
River Birch	SA	1	5ft	Planted	1
Elderberry	SH	1	2ft	Planted	1
Sycamore	SA	2	<2ft	Planted	2
Sycamore	SA	5	2ft	Planted	5
Sycamore	SA	13	2.5ft	Planted	13
Sycamore	SA	22	3ft	Planted	22
Sycamore	SA	15	3.5ft	Planted	15
Sycamore	SA	8	4ft	Planted	8
Sycamore	SA	9	4.5ft	Planted	9
Blackgum	SA	1	2ft	Planted	1
Blackgum	SA	9	2.5ft	Planted	9
Blackgum	SA	2	3ft	Planted	2
	TOTAL SHRUBS	2		OBSERVED DENSITY(PER PLOT)	125
	TOTAL TREES OF PLANTED SPECIES	124		OBSERVED DENSITY (PER ACRE)	1,250
	TOTAL TREES OF VOLUNTEER SPECIES	0			
	TOTAL INDIVIDUALS	126			

HOWARD FARM 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
American Beautyberry	SH	3	<2ft	Planted	3
American Beautyberry	SH	3	2ft	Planted	3
American Beautyberry	SH	1	2.5ft	Planted	1
American Beautyberry	SH	1	3ft	Planted	1
American Beautyberry	SH	1	3.5ft	Planted	1
Wax Myrtle	SH	11	<2ft	Planted	11
Wax Myrtle	SH	4	2ft	Planted	4
Wax Myrtle	SH	3	2.5ft	Planted	3
Sycamore	SA	4	2ft	Planted	4
Sycamore	SA	1	3ft	Planted	1
Sycamore	SA	3	3.5ft	Planted	3
River Birch	SA	1	<2ft	Planted	1
Red Bay	SA	12	<2ft	Planted	12
Red Bay	SA	1	2ft	Planted	1
Red Cedar	SA	3	<2ft	Planted	3
Sweet Pepperbush	SH	18	<2ft	Planted	18
Baccharis	SH	4	<2ft	Volunteer	4
Baccharis	SH	2	2ft	Volunteer	2
Baccharis	SH	2	2.5ft	Volunteer	2
Sweet Gum	SA	4	<2ft	Volunteer	0
Red Maple	SA	2	<2ft	Volunteer	0
	TOTAL SHRUBS	53		OBSERVED DENSITY(PER PLOT)	78
	TOTAL TREES OF PLANTED SPECIES	25		OBSERVED DENSITY (PER ACRE)	780
	TOTAL TREES OF VOLUNTEER SPECIES	6			
	TOTAL INDIVIDUALS	84			

HOWARD FARM RIPARIAN BUFFER SITE
ANNUAL MONITORING DATA SHEET - VEGETATION PLOTS

PLOT#: 13

SPECIES	STRATUM (T, SA, or SH)	Number of Individuals	HEIGHT	Planted vs. Volunteer Species	Number of Individuals Counted toward Success Criteria
Persimmon	SA	1	2.5ft	Planted	1
Persimmon	SA	2	3ft	Planted	2
Sycamore	SA	7	2ft	Planted	7
Sycamore	SA	12	2.5ft	Planted	12
Sycamore	SA	13	3ft	Planted	13
Sycamore	SA	3	3.5ft	Planted	3
Sycamore	SA	2	4ft	Planted	2
Sycamore	SA	2	5ft	Planted	2
River Birch	SA	7	<2ft	Planted	7
River Birch	SA	13	2ft	Planted	13
River Birch	SA	18	2.5ft	Planted	18
River Birch	SA	30	3ft	Planted	30
River Birch	SA	6	3.5ft	Planted	6
River Birch	SA	1	4ft	Planted	1
Elderberry	SH	1	2ft	Planted	1
Elderberry	SH	2	2.5ft	Planted	2
Baccharis	SH	1	<2ft	Volunteer	1
Baccharis	SH	2	2ft	Volunteer	2
Sweet Gum	SA	1	<2ft	Volunteer	0
	TOTAL SHRUBS	6		OBSERVED DENSITY(PER PLOT)	123
	TOTAL TREES OF PLANTED SPECIES	117		OBSERVED DENSITY (PER ACRE)	1,230
	TOTAL TREES OF VOLUNTEER SPECIES	1			
	TOTAL INDIVIDUALS	124			