

**ANNUAL MONITORING REPORT**  
**YEAR 4 (2013)**  
**HEATH RIPARIAN BUFFER MITIGATION SITE**  
**CRAVEN COUNTY, NORTH CAROLINA**  
**(EEP Contract No. 002280)**



**Prepared for:**

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



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**November 2013**

## EXECUTIVE SUMMARY

Restoration Systems, LLC completed riparian buffer restoration at the Heath Riparian Buffer Mitigation Site (hereafter referred to as the “Site”) through the North Carolina Ecosystem Enhancement Program (NCEEP) Full Delivery Process (RFP 16-001383) to provide 59.45 Riparian Buffer Mitigation Units. The Site is located approximately 3.4 miles southeast of Dover in Craven County within United States Geological Survey Hydrologic Unit and Targeted Local Watershed 03020202080010 (North Carolina Division of Water Quality Subbasin 03-04-08) of the Neuse River Basin. Site streams drain to Core Creek (Stream Index 27-90), which is included on the draft 2008 303(d) list for impaired biological integrity and low dissolved oxygen resulting from agricultural crop production.

Prior to construction, the Site was characterized by ditched agricultural land used for row crop production. Land use practices including the maintenance and removal of vegetation, regular plowing, and use of agricultural chemicals had resulted in degraded water quality.

The goals and objectives of this project focused on improving local water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat. These goals were accomplished by the following.

1. Removing nonpoint sources of pollution associated with agriculture production by a) ceasing the application of agricultural herbicides, pesticides, fertilizers, and other agricultural materials into and adjacent to Site ditches and open waterways and b) providing a vegetative buffer adjacent to ditches and waterways to treat surface runoff that may be laden with sediment and/or agricultural pollutants.
2. Reducing sedimentation/siltation within on-Site and downstream receiving waters by a) increasing retention time for surface waters entering and leaving the Site, b) reducing erosion associated with vegetation maintenance and agricultural plowing to Site ditches, and c) planting a forested vegetative buffer adjacent to Site ditches and waterways.
3. Promoting floodwater attenuation by ripping compacted soils and revegetating the Site to increase frictional resistance on floodwaters crossing the Site.
4. Providing terrestrial wildlife habitat including a forested riparian corridor within an area that was previously cleared and highly dissected by agricultural land use.

This project was constructed in late winter/early spring 2010. Planting of the entire 60.63-acre Site resulted in 59.45 Riparian Buffer Mitigation Units. The Site will be protected by a permanent conservation easement. As a whole, the densities of vegetation plots across the Site were above the required 320 stems per acre with an average of 839 planted stems per acre counting towards riparian buffer success in the Fourth Monitoring Year (2013). In addition, each individual plot met success criteria based on planted stems alone.

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## 1.0 INTRODUCTION

### 1.1 Location and Setting

Restoration Systems, LLC has completed riparian buffer restoration at the Heath Riparian Buffer Mitigation Site (hereafter referred to as the “Site”) through the North Carolina Ecosystem Enhancement Program (NCEEP) Full Delivery Process (RFP 16-001383) to provide 59.45 Riparian Buffer Mitigation Units. The Site is located approximately 3.4 miles southeast of Dover in Craven County (Figure 1, Appendix A). The Site is located in United States Geological Survey Hydrologic Unit and Targeted Local Watershed 03020202080010 (North Carolina Division of Water Quality Subbasin 03-04-08) of the Neuse River Basin (USGS 1974).

Directions to the Site from Kinston, North Carolina:

- Take 70 East for approximately 8 miles
- Take the Dover exit and follow Old 70/Wilson Street for approximately 4.3 miles east
- Turn right over the railroad tracks to wire gate.
- Site coordinates:
  - Latitude 35.19627°N, Longitude 77.38060°W (NAD83/WGS84)

### 1.2 Project Goals and Objectives

The goals and objectives of this project focused on improving local water quality, enhancing flood attenuation, and restoring aquatic and riparian habitat. These goals were accomplished by the following.

1. Removing nonpoint sources of pollution associated with agriculture production by a) ceasing the application of agricultural herbicides, pesticides, fertilizers, and other agricultural materials into and adjacent to Site ditches and open waterways and b) providing a vegetative buffer adjacent to ditches and waterways to treat surface runoff that may be laden with sediment and/or agricultural pollutants.
2. Reducing sedimentation/siltation within on-Site and downstream receiving waters by a) increasing retention time for surface waters entering and leaving the Site, b) reducing erosion associated with vegetation maintenance and agricultural plowing to Site ditches, and c) planting a forested vegetative buffer adjacent to Site ditches and waterways.
3. Promoting floodwater attenuation by ripping compacted soils and revegetating the Site to increase frictional resistance on floodwaters crossing the Site.
4. Providing terrestrial wildlife habitat including a forested riparian corridor within an area that was previously cleared and highly dissected by agricultural land use.

### 1.3 Project Structure, Restoration Type, and Approach

Prior to construction, the Site was characterized by ditched agricultural land used for row crop production. Land use practices including the maintenance and removal of vegetation, regular plowing, and use of agricultural chemicals had resulted in degraded water quality.

As constructed, Site activities restored historic riparian buffer functions by planting the entire 60.63-acre Site with native riparian vegetation. This resulted in 59.45 Riparian Buffer Mitigation Units (Table 1, Appendix B and Figure 2, Appendix A). Approximately 0.63 acres of the Site is surface water associated with Site ditches and 0.55 acres of the Site received no credit due to diffuse flow requirements. These areas were planted; however, the area is not eligible to provide credit. The target natural community consisted of Coastal Plain Bottomland Hardwood Forest (Schafale and Weakley 1990). Table 5 (Appendix C) outlines

woody species planted within the Site. Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4 (Appendix B).

## **2.0 MONITORING PLAN**

Monitoring of Site restoration efforts will be performed for vegetation components at the Site for five years or until success criteria are fulfilled. After planting was completed, an initial evaluation was performed to verify planting methods were successful and to determine initial species composition and density. Twenty-nine sample vegetation plots (10-meter by 10-meter) were installed within the Site as per guidelines established in CVS-EEP Protocol for Recording Vegetation, Version 4.0 (Lee et al. 2006). 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 documented by photograph.

### **2.1 Vegetation Success Criteria**

Characteristic Tree Species include woody tree and shrub species planted at the Site (Table 5, Appendix C) or outlined for the appropriate plant community in Schafale and Weakley (1990). An average density of 320 stems per acre of Characteristic Tree Species must be surviving after year 5 monitoring.

### **2.2 Maintenance and Contingency**

In the event that success criteria are not fulfilled, a mechanism for contingency will be implemented. If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

### **2.3 Vegetation Sampling Results and Comparison to Success Criteria**

Quantitative sampling of vegetation was conducted in October 2013. Results are provided in Appendix C. Vegetation success criteria for year 4 (320 stems per acre) were exceeded for the 2013 annual monitoring year with an average density of 839 planted stems per acre counting towards riparian buffer success across the Site. In addition, each individual plot met success criteria based on planted stems alone. Average densities of planted stems went up in year 2 in several plots including Plots 1, 3-5, 8, and 10-11. During year 1, browse by deer and rodents on young planted stems was abundant throughout the Site. Several stems within these plots were not counted, or counted as missing in year 1; however, many survived and were doing well in years 2-4. In addition, several stems that were thought to be dead during year 1 monitoring resprouted from the base and were counted during years 2-4 monitoring.

There are several small natural recruits of mimosa (*Albizia julibrissin*) noted in the vicinity of Plot 10 during year 3 (2012) monitoring, these stems were treated with herbicide in late summer 2012 and no stems were observed during year 4 (2013) monitoring.

## **3.0 CONCLUSIONS**

As a whole, the densities of vegetation plots across the Site were above the required 320 stems per acre in years 1-4 (2010-2013). In addition, each individual plot met success criteria based on planted stems alone.

**Summary of Planted Stem Vegetation Plot Results**

Plot	Planted Stems/Acre (Hardwood Trees Counting Toward Riparian Buffer Success Only)				
	Year 1 (2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
1	890	1053	1053	1093	
2	971	972	972	891	
3	850	1012	1012	1012	
4	1012	1053	1053	1053	
5	931	1012	1012	1134	
6	850	850	850	769	
7	1012	972	972	972	
8	688	769	810	769	
9	850	850	891	891	
10	1012	1053	1012	1012	
11	931	1093	1134	1134	
12	850	810	810	810	
13	728	729	729	688	
14	890	891	931	891	
15	850	850	891	891	
16	728	729	607	607	
17	931	850	850	850	
18	728	729	810	769	
19	728	648	729	729	
20	1052	1012	1053	1053	
21	1052	1053	1053	1012	
22	931	931	931	931	
23	1012	972	972	972	
24	971	972	972	972	
25	486	445	445	445	
26	486	486	486	486	
27	486	486	486	486	
28	445	445	445	445	
29	607	567	567	567	
<b>Average Plots 1-29</b>	<b>826</b>	<b>837</b>	<b>846</b>	<b>839</b>	

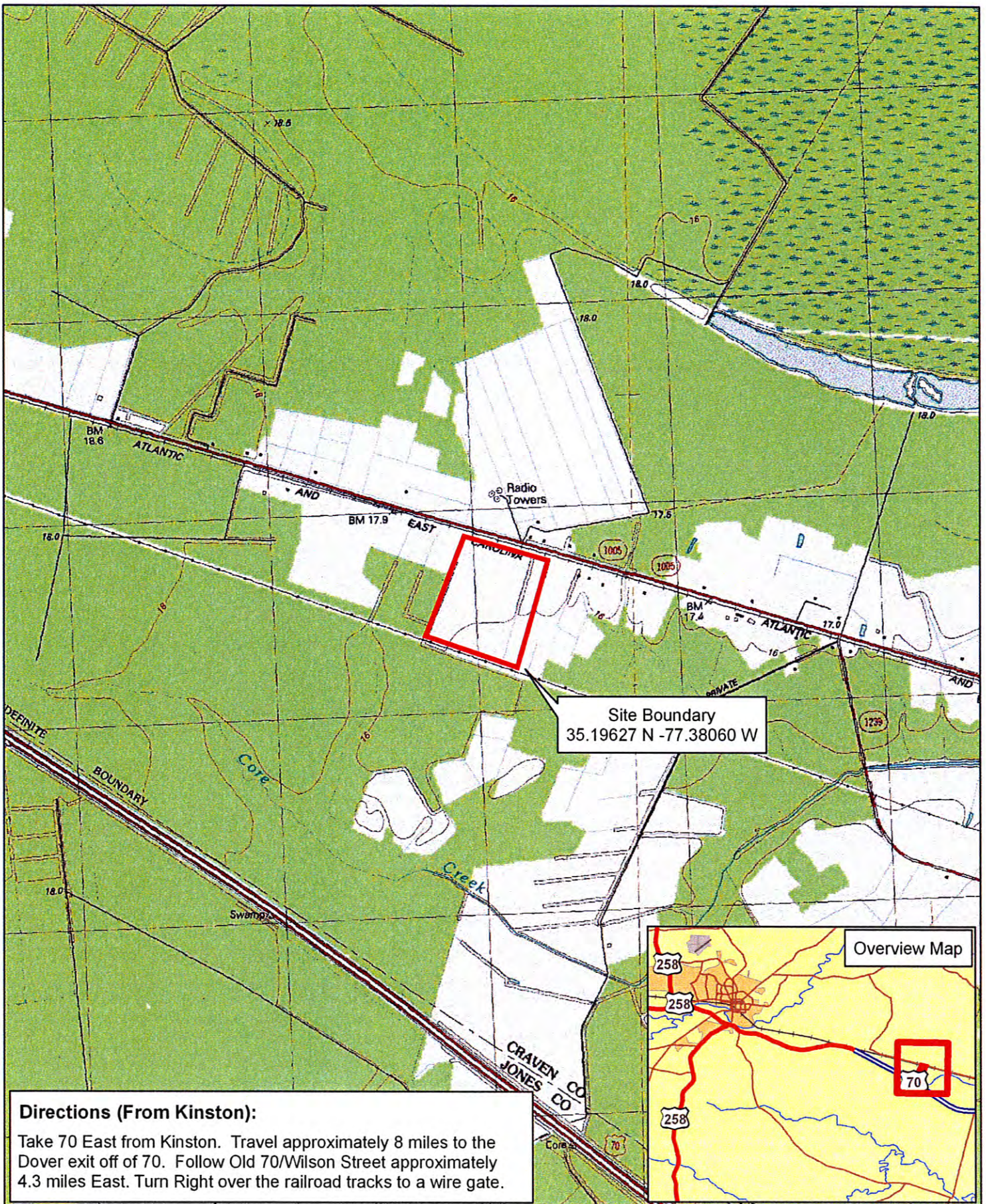
#### 4.0 REFERENCES

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- North Carolina Division of Water Quality (NCDWQ). 2008b. Draft Basinwide Planning Program: Neuse River Basinwide Water Quality Plan-June 2008. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, North Carolina.
- Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.
- United States Geological Survey (USGS). 1974. Hydrologic Unit Map - 1974. State of North Carolina.

**Appendix A.  
Figures**

**Figure 1. Site Location**  
**Figure 2. Monitoring Plan View**

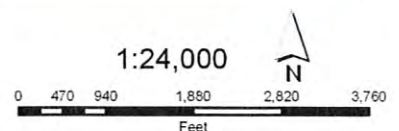




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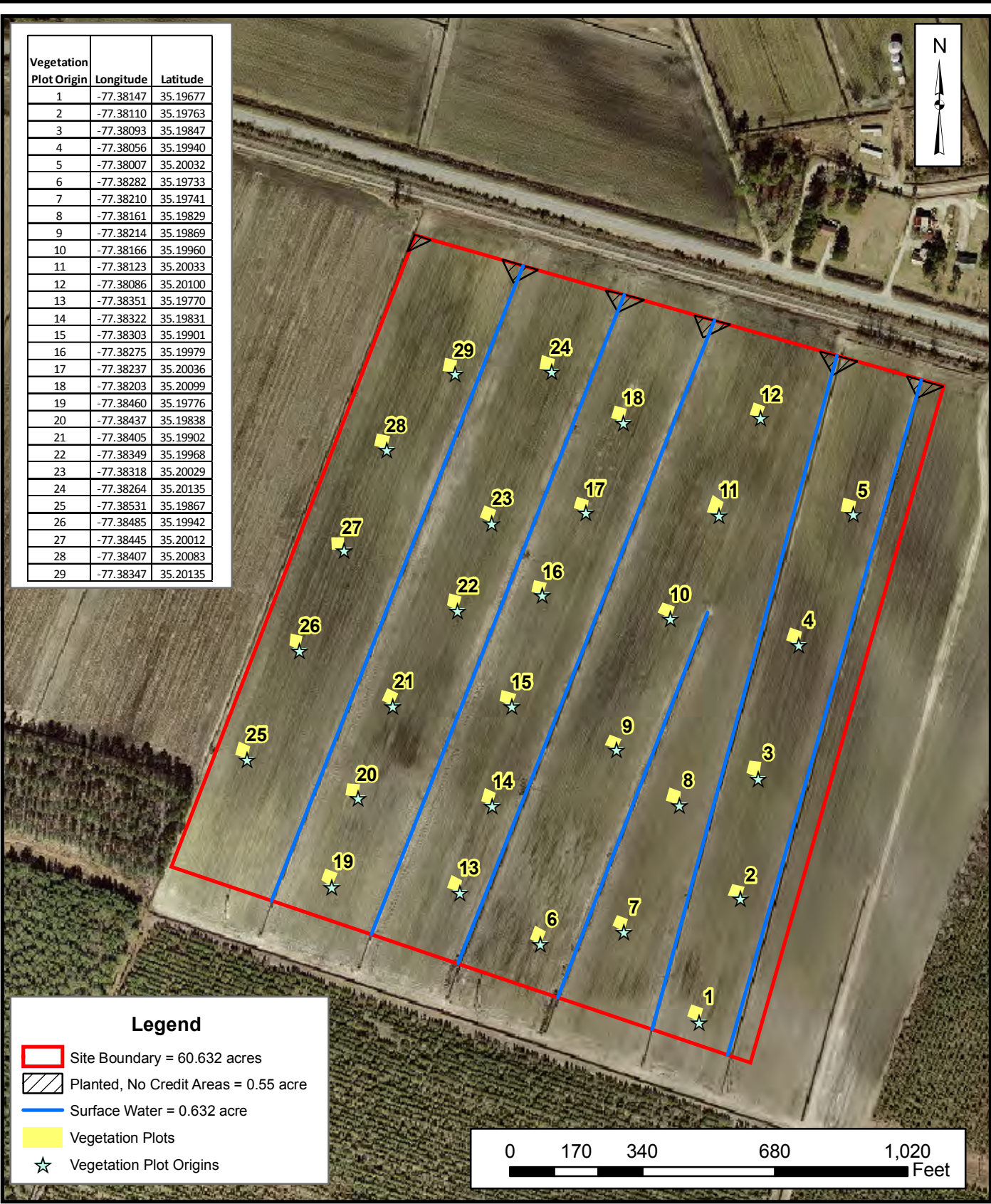
**Figure 1:**  
Site  
Location

**Heath Riparian Buffer  
Mitigation Site  
Craven County, NC**



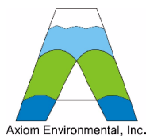
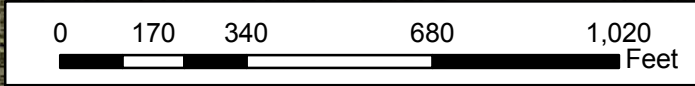


Vegetation Plot Origin	Longitude	Latitude
1	-77.38147	35.19677
2	-77.38110	35.19763
3	-77.38093	35.19847
4	-77.38056	35.19940
5	-77.38007	35.20032
6	-77.38282	35.19733
7	-77.38210	35.19741
8	-77.38161	35.19829
9	-77.38214	35.19869
10	-77.38166	35.19960
11	-77.38123	35.20033
12	-77.38086	35.20100
13	-77.38351	35.19770
14	-77.38322	35.19831
15	-77.38303	35.19901
16	-77.38275	35.19979
17	-77.38237	35.20036
18	-77.38203	35.20099
19	-77.38460	35.19776
20	-77.38437	35.19838
21	-77.38405	35.19902
22	-77.38349	35.19968
23	-77.38318	35.20029
24	-77.38264	35.20135
25	-77.38531	35.19867
26	-77.38485	35.19942
27	-77.38445	35.20012
28	-77.38407	35.20083
29	-77.38347	35.20135



**Legend**

- Site Boundary = 60.632 acres
- Planted, No Credit Areas = 0.55 acre
- Surface Water = 0.632 acre
- Vegetation Plots
- ☆ Vegetation Plot Origins



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**MONITORING PLAN VIEW  
HEATH  
RIPARIAN BUFFER MITIGATION SITE  
Craven County, North Carolina**

Dwn. by: CLF  
Date: Aug 2010  
Project: 10-001

FIGURE  
**2**

**Appendix B.  
General Tables**

**Table 1. Site Restoration Structures and Objectives**

**Table 2. Project Activity and Reporting History**

**Table 3. Project Contacts Table**

**Table 4. Project Attributes Table**

**Table 1. Site Restoration Structures and Objectives**

Component Summation	
<b>Restoration Level</b>	Riparian buffer mitigation was completed by planting the entire 60-acre Site with native forest vegetation; credit was received for 59.45 acres of the Site.
Riparian Buffer Restoration	
<b>59.45 Buffer Mitigation Units</b>	

**Table 2. Project Activity and Reporting History**

Activity or Report	Data Collection Complete	Completion or Delivery
Final Restoration Plan	--	April 2010
Site Planting	--	Late winter/early spring 2010
Mitigation Plan	April 2010	August 2010
Year 1 Monitoring	September 2010	October 2010
Year 2 Monitoring	August 2011	August 2011
Year 3 Monitoring	June 2012	June 2012
Invasive Species Treatment		Late summer 2012
Year 4 Monitoring	October 2013	November 2013

**Table 3. Project Contacts Table**

<b>Designer</b>	Restoration Systems, LLC 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 (919) 755-9490
<b>Planting Contractor</b>	Carolina Silvics 908 Indian Trail Road Edenton, North Carolina 27932 Dwight McKinney (252) 482-8491
<b>Monitoring Performer</b>	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, North Carolina 27603 Grant Lewis (919) 215-1693

**Table 4. Project Attribute Table**

Project County	Craven County, North Carolina
Physiographic Region	Coastal Plain
Ecoregion	Carolina Flatwoods and Mid-Atlantic Floodplains/Low Terrace
Project River Basin	Neuse
USGS 14-digit HUC	03020202080010
NCDWQ Subbasin	03-04-08
Within EEP Watershed Plan Extent?	Yes-Targeted Local Watershed
WRC Class	Warm
% of project easement fenced	0 %
Beaver activity observed during design phase	No

**Appendix C.  
Vegetation Data**

**Table 5. Planted Woody Species  
Vegetation Survey Data Tables  
Vegetation Monitoring Plot Photographs**

**Table 5. Planted Woody Vegetation**

Species	Quantity
American elm ( <i>Ulmus americana</i> )	6300
Black gum ( <i>Nyssa sylvatica</i> )	3200
Green ash ( <i>Fraxinus pennsylvanica</i> )	9500
Ironwood ( <i>Carpinus caroliniana</i> )	3200
Mockernut hickory ( <i>Carya tomentosa</i> )	6300
Sugarberry ( <i>Celtis laevigata</i> )	3200
Swamp chestnut oak ( <i>Quercus michauxii</i> )	9500
Sweetbay magnolia ( <i>Magnolia virginiana</i> )	3200
Water oak ( <i>Quercus nigra</i> )	6300
Willow oak ( <i>Quercus phellos</i> )	9500
<b>TOTAL</b>	<b>60,200</b>

**CVS Database Output**

**Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.**

Project Code	Project Name	River Basin	Year 1	Year 2	Year 3	Year 4
Heath	Heath	Neuse	826.12	838.68	847.05	<b>838.68</b>

**Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:**

Project Code	Project Name	River Basin	Year 1	Year 2	Year 3	Year 4
Heath	Heath	Neuse	909.84	1024.27	1327.09	<b>1500.13</b>

**Vigor**

Vigor	Count	Percent
	1	0.2
0	2	0.3
1	4	0.6
2	51	8.3
3	141	22.8
4	405	65.5
Missing	15	2.4

**Damage**

Damage	Count	Percent Of Stems
(no damage)	530	85.6
Unknown	37	6
Deer	37	6
Other/Unknown Animal	7	1.1
Insects	6	1
Vine Strangulation	1	0.2
Human Trampled	1	0.2

### Vigor by Species

Species	CommonName	4	3	2	1	0	Missing	Unknown
<i>Carya ovata</i>	shagbark hickory			1				
<i>Celtis laevigata</i>	sugarberry	2	5	2	1			
<i>Fraxinus pennsylvanica</i>	green ash	49	39	14	2		1	
<i>Nyssa sylvatica</i>	blackgum	12	21	10			5	
<i>Persea palustris</i>	swamp bay	1						
<i>Quercus michauxii</i>	swamp chestnut oak	124	20	1	1		2	
<i>Quercus nigra</i>	water oak	66	2					
<i>Quercus phellos</i>	willow oak	95	11				2	
<i>Carpinus caroliniana</i>	American hornbeam	28	3					
<i>Quercus</i>	oak	9	1				1	
<i>Quercus rubra</i>	northern red oak		1					
<i>Carya</i>	hickory		3	3		1	1	
<i>Magnolia virginiana</i>	sweetbay	10						
<i>Nyssa</i>	tupelo	1	2	2				
<i>Platanus occidentalis</i>	American sycamore		1					
<i>Ulmus</i>	elm		4	2				
<i>Ulmus americana</i>	American elm	8	28	16		1	3	
<b>17</b>	<b>17</b>	<b>405</b>	<b>141</b>	<b>51</b>	<b>4</b>	<b>2</b>	<b>15</b>	

### Damage by Species

Species	CommonName	Count of Damage Categories	(no damage)	Deer	Diseased	Human Trampled	Insects	Unknown	(other damage)
<i>Carpinus caroliniana</i>	American hornbeam	2	29	1			1		
<i>Carya</i>	hickory	3	5					3	
<i>Carya ovata</i>	shagbark hickory	1						1	
<i>Celtis laevigata</i>	sugarberry	5	5			1	2	2	
<i>Fraxinus pennsylvanica</i>	green ash	35	70	19		3	1	12	
<i>Magnolia virginiana</i>	sweetbay	0	10						
<i>Nyssa</i>	tupelo	1	4					1	
<i>Nyssa sylvatica</i>	blackgum	7	41				2	5	
<i>Persea palustris</i>	swamp bay	0	1						
<i>Platanus occidentalis</i>	American sycamore	0	1						
<i>Quercus</i>	oak	0	11						
<i>Quercus michauxii</i>	swamp chestnut oak	2	147					2	
<i>Quercus nigra</i>	water oak	1	67		1				
<i>Quercus phellos</i>	willow oak	1	107			1			
<i>Quercus rubra</i>	northern red oak	0	1						
<i>Ulmus</i>	elm	3	3				1	2	
<i>Ulmus americana</i>	American elm	28	28	17		1		9	1
<b>17</b>	<b>17</b>	<b>89</b>	<b>530</b>	<b>37</b>	<b>1</b>	<b>6</b>	<b>7</b>	<b>37</b>	<b>1</b>

**Damage by Plot**

<b>plot</b>	<b>Count of Damage Categories</b>	<b>(no damage)</b>	<b>Deer</b>	<b>Diseased</b>	<b>Human Trampled</b>	<b>Insects</b>	<b>Unknown</b>	<b>(other damage)</b>
Heath-AXE-0001-year:4	1	26					1	
Heath-AXE-0002-year:4	0	24						
Heath-AXE-0003-year:4	7	18			2	1	4	
Heath-AXE-0004-year:4	6	20				1	5	
Heath-AXE-0005-year:4	1	29	1					
Heath-AXE-0006-year:4	2	20				1	1	
Heath-AXE-0007-year:4	2	22					2	
Heath-AXE-0008-year:4	5	15				2	3	
Heath-AXE-0009-year:4	2	20			1		1	
Heath-AXE-0010-year:4	3	24					3	
Heath-AXE-0011-year:4	0	28						
Heath-AXE-0012-year:4	3	17			2		1	
Heath-AXE-0013-year:4	5	13			1		4	
Heath-AXE-0014-year:4	2	21				1	1	
Heath-AXE-0015-year:4	5	17				1	4	
Heath-AXE-0016-year:4	0	18						
Heath-AXE-0017-year:4	2	20					2	
Heath-AXE-0018-year:4	0	20						
Heath-AXE-0019-year:4	5	13					5	
Heath-AXE-0020-year:4	10	16	9	1				
Heath-AXE-0021-year:4	5	21	5					
Heath-AXE-0022-year:4	6	17	6					
Heath-AXE-0023-year:4	1	23	1					
Heath-AXE-0024-year:4	0	24						
Heath-AXE-0025-year:4	6	5	5					1
Heath-AXE-0026-year:4	3	9	3					
Heath-AXE-0027-year:4	2	10	2					
Heath-AXE-0028-year:4	5	6	5					
Heath-AXE-0029-year:4	0	14						
<b>29</b>	<b>89</b>	<b>530</b>	<b>37</b>	<b>1</b>	<b>6</b>	<b>7</b>	<b>37</b>	<b>1</b>



## Plot Information

Plot	Plot Level	Year	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
0001	2	4	27	27	0	15	42	42	1093	1093	607	1700	1700	6
0002	2	4	22	22	1	32	54	54	890	890	1295	2185	2185	7
0003	2	4	25	25	0	14	39	39	1012	1012	567	1578	1578	6
0004	2	4	26	26	0	6	32	32	1052	1052	243	1295	1295	7
0005	2	4	28	28	2	4	32	32	1133	1133	162	1295	1295	5
0006	2	4	19	19	3	13	32	32	769	769	526	1295	1295	6
0007	2	4	24	24	0	16	40	40	971	971	647	1619	1619	10
0008	2	4	19	19	1	10	29	29	769	769	405	1174	1174	6
0009	2	4	22	22	0	9	31	31	890	890	364	1255	1255	7
0010	2	4	25	25	2	5	30	30	1012	1012	202	1214	1214	4
0011	2	4	28	28	0	2	30	30	1133	1133	81	1214	1214	4
0012	2	4	20	20	0	19	39	39	809	809	769	1578	1578	7
0013	2	4	17	17	1	16	33	33	688	688	647	1335	1335	6
0014	2	4	22	22	1	11	33	33	890	890	445	1335	1335	6
0015	2	4	22	22	0	10	32	32	890	890	405	1295	1295	7
0016	2	4	15	15	3	7	22	22	607	607	283	890	890	5
0017	2	4	21	21	1	13	34	34	850	850	526	1376	1376	6
0018	2	4	19	19	1	3	22	22	769	769	121	890	890	6
0019	2	4	18	18	0	18	36	36	728	728	728	1457	1457	5
0020	2	4	26	26	0	40	66	66	1052	1052	1619	2671	2671	7
0021	2	4	25	25	1	30	55	55	1012	1012	1214	2226	2226	5
0023	2	4	23	23	0	6	29	29	931	931	243	1174	1174	7
0023	2	4	24	24	0	3	27	27	971	971	121	1093	1093	6

**Plot Information (continued)**

<b>Plot</b>	<b>Plot Level</b>	<b>Year</b>	<b>Planted Living Stems</b>	<b>Planted Living Stems EXCLUDING Live Stakes</b>	<b>Dead/Missing Stems</b>	<b>Natural (Volunteer) Stems</b>	<b>Total Living Stems</b>	<b>Total Living Stems EXCLUDING Live Stakes</b>	<b>Planted Living Stems per ACRE</b>	<b>Planted Living Stems EXCLUDING Live Stakes PER ACRE</b>	<b>Natural (Volunteer) Stems PER ACRE</b>	<b>Total Living Stems PER ACRE</b>	<b>Total Living Stems EXCLUDING Live Stakes PER ACRE</b>	<b># species</b>
0024	2	4	24	24	0	21	45	45	971	971	850	1821	1821	5
0025	2	4	11	11	0	49	60	60	445	445	1983	2428	2428	5
0026	2	4	12	12	0	28	40	40	486	486	1133	1619	1619	4
0027	2	4	12	12	0	17	29	29	486	486	688	1174	1174	5
0028	2	4	11	11	0	57	68	68	445	445	2307	2752	2752	3
0029	2	4	14	14	0	0	14	14	567	567	0	567	567	6

Heath 2013 (Year 4) Total Planted Stems (No Livestakes) by Plot and Species

Type	Species	CommonName	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
tree	<i>Carpinus caroliniana</i>	American hornbeam	4	8		1	6	3	2		1		2	2																	2	
tree	<i>Carya</i>	hickory							1		2						2					1										
tree	<i>Carya ovata</i>	shagbark hickory							1																							
tree	<i>Celtis laevigata</i>	sugarberry					1			4			1	1		3																
tree	<i>Fraxinus pennsylvanica</i>	green ash		2	3	5	1	2	4	2	7	5		2	3	1		1	4	4	5	3	11	8	10	2	4	2	5	5	3	
tree	<i>Magnolia virginiana</i>	sweetbay	1	2		2	1										1						1			1				1		
tree	<i>Nyssa</i>	tupelo							1										4													
tree	<i>Nyssa sylvatica</i>	blackgum			2			2	1	6	5	9	6	3		3			3	3												
tree	<i>Persea palustris</i>	swamp bay																				1										
tree	<i>Platanus occidentalis</i>	American sycamore						1																								
tree	<i>Quercus</i>	oak				1			1						2		1	1	1				1	1						1		
tree	<i>Quercus michauxii</i>	swamp chestnut oak	13	5	8	8	19	4	1	2	2	2	3	3	2	4	9	10	3	6	9	3	3	4	7	14	1		1			
tree	<i>Quercus nigra</i>	water oak	4	3					10	3	1			2			1		6	1	1	6	5	5	3	5	2	3	2	4	1	
tree	<i>Quercus phellos</i>	willow oak	2	1	7	3		7	2	2	4	9	17	7	4	11	3	2		4	1	2	3	2	1	2		3	1		6	
tree	<i>Quercus rubra</i>	northern red oak															1															
tree	<i>Ulmus</i>	elm			2										1	3																
tree	<i>Ulmus americana</i>	American elm	3	1	3	6									6	1					2	10	3	2	2	1	3	4	3	2		
<b>Totals</b>			<b>Stem count</b>	27	22	25	26	28	19	24	19	22	25	28	20	17	22	22	15	21	19	18	26	25	23	24	24	11	12	12	11	14
			<b>Species count</b>	6	7	6	7	5	6	10	6	7	4	4	7	6	6	7	5	6	6	5	7	5	7	6	5	5	4	5	3	6
			<b>Stems per ACRE</b>	1093	891	1012	1053	1134	769	972	769	891	1012	1134	810	688	891	891	607	850	769	729	1053	1012	931	972	972	445	486	486	445	567
<b>Riparian Buffer Success Criteria</b>			<b>Stem count</b>	27	22	25	26	28	19	24	19	22	25	28	20	17	22	22	15	21	19	18	26	25	23	24	24	11	12	12	11	14
			<b>Species count</b>	6	7	6	7	5	6	10	6	7	4	4	7	6	6	7	5	6	6	5	7	5	7	6	5	5	4	5	3	6
			<b>Stems per ACRE</b>	1093	891	1012	1053	1134	769	972	769	891	1012	1134	810	688	891	891	607	850	769	729	1053	1012	931	972	972	445	486	486	445	567

\***Bolded** hardwood tree species are counted toward riparian buffer success criteria.

Heath 2013 (Year 4) Total Stems Planted and Natural Recruit by Plot and Species

Type	Species	CommonName	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
tree	<b>Acer rubrum</b>	red maple																							2		12	8	3				
shrub	Baccharis halimifolia	eastern baccharis	7	4	9	5	3	11	13	10	6	3	2	12	8	4	6	5	10	3	2	24	28	4		8	2	5	3	12			
shrub	Callicarpa americana	American beautyberry																										1					
tree	<b>Carpinus caroliniana</b>	<b>American hornbeam</b>	4	8		1	6	3	2		1		2	2																	2		
tree	<b>Carya</b>	<b>hickory</b>						1	1		2						2						1										
tree	<b>Carya ovata</b>	<b>shagbark hickory</b>							1																								
tree	<b>Celtis laevigata</b>	<b>sugarberry</b>					1			4			1	1		3																	
tree	<b>Fraxinus pennsylvanica</b>	<b>green ash</b>		2	3	5	1	2	4	2	7	5		2	3	1		1	4	4	5	3	11	8	10	2	4	2	5	5	3		
shrub	Ilex opaca	American holly																									1	1					
tree	<b>Liquidambar styraciflua</b>	<b>sweetgum</b>											1	2	1	2					2												
tree	<b>Magnolia virginiana</b>	<b>sweetbay</b>	1	2		2	1											1						1			1				1		
tree	<b>Nyssa</b>	<b>tupelo</b>							1											4													
tree	<b>Nyssa sylvatica</b>	<b>blackgum</b>			2			2	1	6	5	9	6	3		3																	
tree	<b>Persea palustris</b>	<b>swamp bay</b>																				1											
tree	Pinus taeda	loblolly pine	8	1	3			2	2		3	2		6	6	6	2	2	3		10	16	2	2	1	2	18	5	3	2			
tree	<b>Platanus occidentalis</b>	<b>American sycamore</b>						1																									
tree	<b>Prunus serotina</b>	<b>black cherry</b>		1	2																					10							
tree	<b>Quercus</b>	<b>oak</b>				1			1							2		1	1	1				1	1							1	
tree	<b>Quercus michauxii</b>	<b>swamp chestnut oak</b>	13	5	8	8	19	4	1	2	2	2	3	3	2	4	9	10	3	6	9	3	3	4	7	14	1		1				
tree	<b>Quercus nigra</b>	<b>water oak</b>	4	3					10	3	1			2			1		6	1	1	6	5	5	3	5	2	3	2	4	1		
tree	<b>Quercus phellos</b>	<b>willow oak</b>	2	1	7	3		7	2	2	4	9	17	7	4	11	3	2		4	1	2	3	2	1	2		3	1		6		
tree	<b>Quercus rubra</b>	<b>northern red oak</b>															1																
shrub	Rhus copallinum	flameleaf sumac		26		1	1		1													4					16	8	8	43			
tree	<b>Ulmus</b>	<b>elm</b>			2									1	3																		
tree	<b>Ulmus americana</b>	<b>American elm</b>	3	1	3	6								6	2						2	10	3	2	2	2	3	4	3	2			
<b>Totals</b>			<b>Stem count</b>	42	54	39	32	32	33	40	29	31	30	30	39	33	34	32	22	34	22	36	66	55	29	27	45	60	40	29	68	14	
			<b>Species count</b>	8	11	9	9	7	9	13	7	9	6	5	10	9	9	10	7	8	7	9	9	7	9	8	8	10	10	9	6	6	
			<b>Stems per ACRE</b>	1700	2186	1579	1296	1296	1336	1619	1174	1255	1215	1215	1579	1336	1377	1296	891	1377	891	1457	2672	2227	1174	1093	1822	2429	1619	1174	2753	567	
<b>Riparian Buffer Success Criteria</b>			<b>Stem count</b>	27	23	27	26	28	20	24	19	22	25	28	21	19	24	24	15	21	19	20	26	25	23	26	35	23	20	15	11	14	
			<b>Species count</b>	6	8	7	7	5	7	10	6	7	4	4	8	7	7	8	5	6	6	6	7	5	7	7	6	6	5	6	3	6	
			<b>Stems per ACRE</b>	1093	931	1093	1053	1134	810	972	769	891	1012	1134	850	769	972	972	607	850	769	810	1053	1012	931	1053	1417	931	810	607	445	567	

\***Bolded** hardwood tree species are counted toward riparian buffer success criteria.

**Heath  
Year 4 (2013)  
Vegetation Monitoring Plot Photos  
Taken October 2013**

Plot 1



Plot 2



Plot 3



Plot 4



Plot 5



Plot 6



Plot 7



Plot 8





**Heath  
Year 4 (2013)  
Vegetation Monitoring Plot Photos  
Taken October 2013  
(continued)**





**Heath  
Year 4 (2013)  
Vegetation Monitoring Plot Photos  
Taken October 2013  
(continued)**



Plot 19

No photo





**Heath  
Year 4 (2013)  
Vegetation Monitoring Plot Photos  
Taken October 2013  
(continued)**

