

MITIGATION PLAN
and AS-BUILT BASELINE REPORT
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**



Prepared by:

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August 2010

EXECUTIVE SUMMARY

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. 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. 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 60.632-acre Site resulted in 59.45 Riparian Buffer Mitigation Units. The Site will be protected by a permanent conservation easement. Baseline measurements/evaluations indicate that Site vegetation compares favorably to plans as set forth in the detailed restoration plan.

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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 60.632-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 0.632 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 of 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.

3.0 SUCCESS CRITERIA

Characteristic Tree Species include woody tree and shrub species planted at the Site 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.

4.0 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.

5.0 BASELINE SAMPLING RESULTS

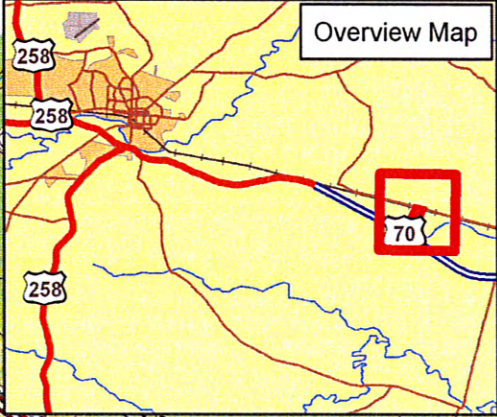
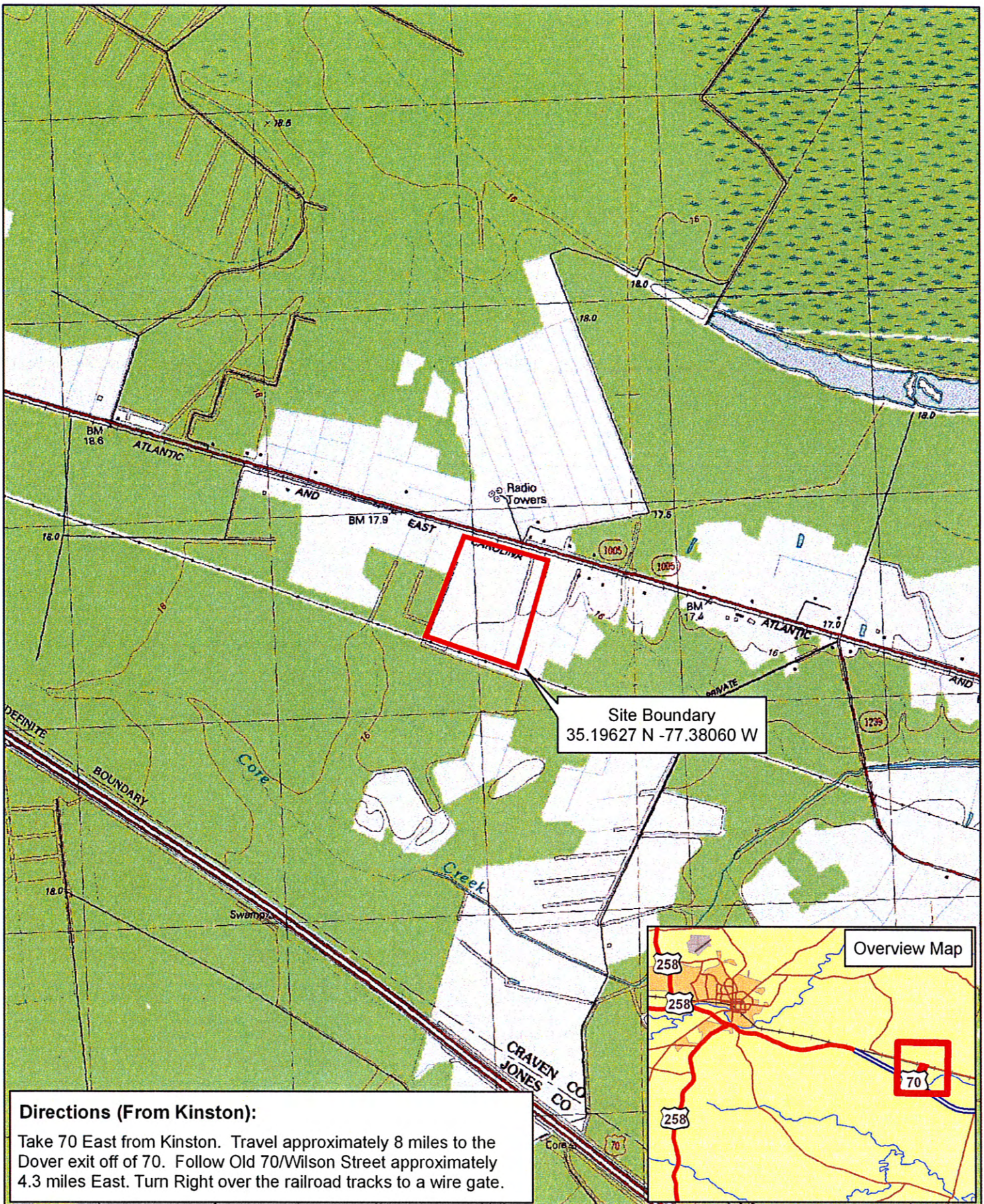
Quantitative sampling of vegetation was conducted following Site planting in April 2010. An average of 868 planted stems per acre was recorded within vegetation plots. In addition, stems counts within each individual plot were well-above the required 320 stems per acre and species diversity was good with 4-10 species per plot. Results are provided in Appendix C.

6.0 REFERENCES

- Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.
- North Carolina Division of Water Quality (NCDWQ). 2007. Redbook, Surface Waters and Wetlands Standards. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, North Carolina.
- North Carolina Division of Water Quality (NCDWQ). 2008a. Draft North Carolina Water Quality Assessment and Impaired Waters List (2008 Integrated 305(b) and 303(d) Report) (online). Available: <http://h2o.enr.state.nc.us/tmdl/documents/B.Draft2008303dList.pdf> [November 10, 2008]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.
- 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**

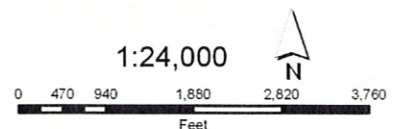
Figure 1. Site Location
Figure 2. Monitoring Plan View



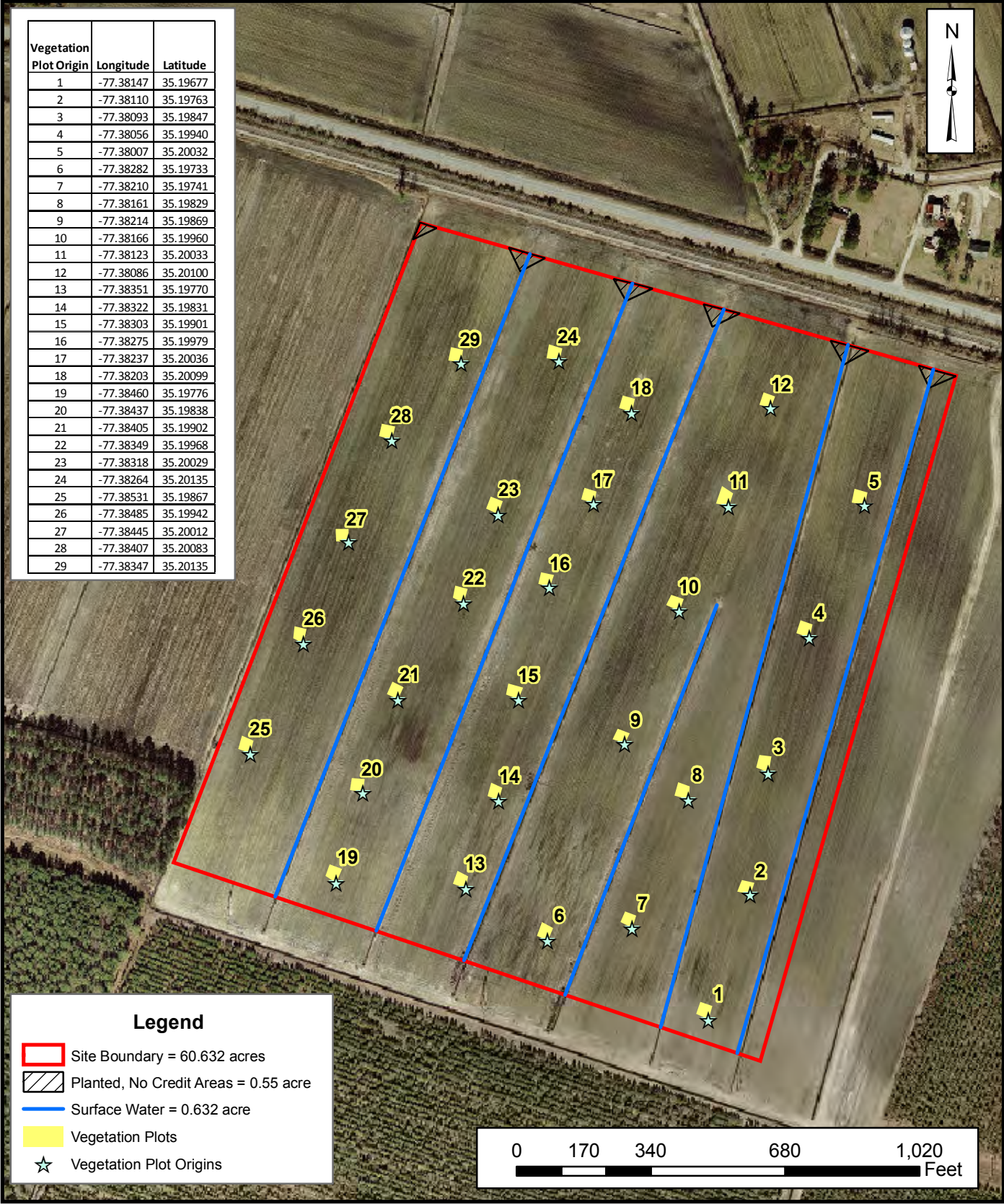
Restoration Systems, LLC
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Figure 1:
Site
Location

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

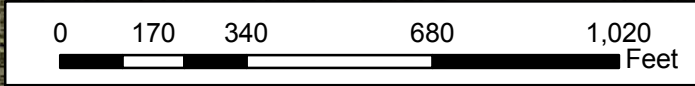


Vegetation Plot Origin	Longitude	Latitude
1	-77.38147	35.19677
2	-77.38110	35.19763
3	-77.38093	35.19847
4	-77.38056	35.19940
5	-77.38007	35.20032
6	-77.38282	35.19733
7	-77.38210	35.19741
8	-77.38161	35.19829
9	-77.38214	35.19869
10	-77.38166	35.19960
11	-77.38123	35.20033
12	-77.38086	35.20100
13	-77.38351	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	
Restoration Level	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	
59.45 Buffer Mitigation Units	

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

Table 3. Project Contacts Table

Designer	Restoration Systems, LLC 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 (919) 755-9490
Planting Contractor	Carolina Silvics 908 Indian Trail Road Edenton, North Carolina 27932 Dwight McKinney (252) 482-8491

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
TOTAL	60,200

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 0 (baseline)
Heath	Heath	Neuse	867.98

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

Project Code	Project Name	River Basin	Year 0 (baseline)
Heath	Heath	Neuse	867.9809309

Vigor

vigor	Count	Percent
1	95	15.3
2	97	15.6
3	374	60.1
4	56	9

Vigor by Species

Species	CommonName	4	3	2	1	0	Missing	Unknown
Carya alba	mockernut hickory		1	1				
Celtis laevigata	sugarberry	1	6	3	1			
Fraxinus pennsylvanica	green ash	25	74	8	1			
Nyssa sylvatica	blackgum	4	44	3	1			
Quercus michauxii	swamp chestnut oak	5	75	15	8			
Quercus nigra	water oak	6	36	8	1			
Quercus phellos	willow oak	3	51	12	6			
Carpinus caroliniana	American hornbeam		5	4	6			
Quercus	oak	1	11	24	29			
Magnolia virginiana	sweetbay		6	10	4			
Ulmus americana	American elm	11	59	7	4			
Unknown			6	2	34			
12	11	56	374	97	95			

Damage

Damage	Count	Percent Of Stems
(no damage)	431	69.3
Unknown	191	30.7

Damage by Species

Species	CommonName	Count of Damage Categories	(no damage)	Unknown
Carpinus caroliniana	American hornbeam	10	5	10
Carya alba	mockernut hickory	1	1	1
Celtis laevigata	sugarberry	4	7	4
Fraxinus pennsylvanica	green ash	9	99	9
Magnolia virginiana	sweetbay	14	6	14
Nyssa sylvatica	blackgum	4	48	4
Quercus	oak	53	12	53
Quercus michauxii	swamp chestnut oak	23	80	23
Quercus nigra	water oak	8	43	8
Quercus phellos	willow oak	18	54	18
Ulmus americana	American elm	11	70	11
Unknown		36	6	36
12	11	191	431	191

Damage by Plot

plot	Count of Damage Categories	(no damage)	Unknown
1	5	21	5
2	3	26	3
3	11	11	11
4	10	17	10
5	8	19	8
6	6	17	6
7	1	22	1
8	6	13	6
9	3	18	3
10	13	14	13
11	12	13	12
12	8	14	8
13	6	14	6
14	11	9	11
15	7	12	7
16	11	9	11
17	7	17	7
18	7	13	7
19	9	11	9
20	4	21	4
21	2	24	2
22	9	16	9

23	6	18	6
Damage by Plot (continued)			
24	10	15	10
25	5	7	5
26	2	9	2
27	1	11	1
28	3	9	3
29	5	11	5
29	191	431	191

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
1	2	0	26	26	0	0	26	26	1052	1052	0	1052	1052	6
2	2	0	27	27	0	0	27	27	1093	1093	0	1093	1093	5
3	2	0	25	25	0	0	25	25	1012	1012	0	1012	1012	5
4	2	0	22	22	0	0	22	22	890	890	0	890	890	10
5	2	0	20	20	0	0	20	20	809	809	0	809	809	8
6	2	0	20	20	0	0	20	20	809	809	0	809	809	5
7	2	0	19	19	0	0	19	19	769	769	0	769	769	7
8	2	0	20	20	0	0	20	20	809	809	0	809	809	7
9	2	0	24	24	0	0	24	24	971	971	0	971	971	8
10	2	0	20	20	0	0	20	20	809	809	0	809	809	6
11	2	0	20	20	0	0	20	20	809	809	0	809	809	8
12	2	0	29	29	0	0	29	29	1174	1174	0	1174	1174	7
13	2	0	25	25	0	0	25	25	1012	1012	0	1012	1012	8
14	2	0	26	26	0	0	26	26	1052	1052	0	1052	1052	6
15	2	0	25	25	0	0	25	25	1012	1012	0	1012	1012	6
16	2	0	24	24	0	0	24	24	971	971	0	971	971	6
17	2	0	25	25	0	0	25	25	1012	1012	0	1012	1012	8
18	2	0	12	12	0	0	12	12	486	486	0	486	486	6
19	2	0	11	11	0	0	11	11	445	445	0	445	445	5
20	2	0	12	12	0	0	12	12	486	486	0	486	486	5
21	2	0	12	12	0	0	12	12	486	486	0	486	486	4
22	2	0	16	16	0	0	16	16	647	647	0	647	647	7
23	2	0	22	22	0	0	22	22	890	890	0	890	890	8

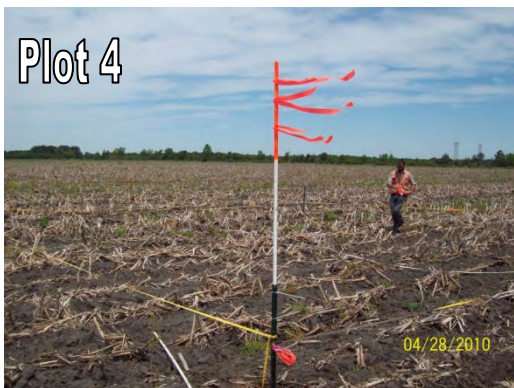
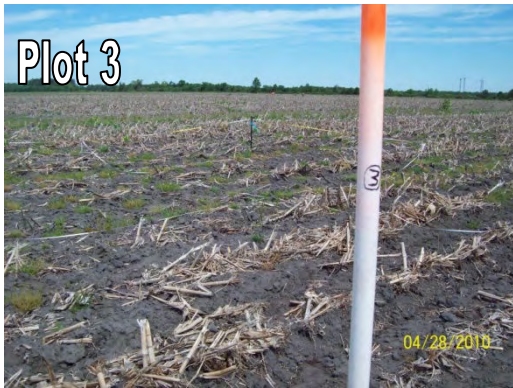
Plot Information (continued)

24	2	0	27	27	0	0	27	27	1093	0	1093	1093	7
25	2	0	27	27	0	0	27	27	1093	0	1093	1093	7
26	2	0	23	23	0	0	23	23	931	0	931	931	8
27	2	0	23	23	0	0	23	23	931	0	931	931	7
28	2	0	19	19	0	0	19	19	769	0	769	769	7
29	2	0	21	21	0	0	21	21	850	0	850	850	7

Planted Stems by Plot (Note: no natural recruits were present during baseline measurements)

Species	Common Name	Stems	# plots																													
				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
Carpinus caroliniana	American hornbeam	15	11	1.36								3					1		1		1	1	1	1		3		1	1			
Carya alba	mockernut hickory	2	2	1																1			1									
Celtis laevigata	sugarberry	11	6	1.83			2		3	1				3	1					1												
Fraxinus pennsylvanica	green ash	108	26	4.15		2	4	5	1	2	5	2	8	5		3	3	1		1	4	4	5	3	11	8	10	2	4	2	5	5
Magnolia virginiana	sweetbay	20	12	1.67	1	3		2	1							1	1			1			1		3		2					1
Nyssa sylvatica	blackgum	52	13	4			2			4	1	7	5	8	5	2			4	1	8	4	1									
Quercus	oak	65	22	2.95	4	2	1	3	5	2	2	4	2			1	1	5	5	4	1	6	4		1		2	7	1		2	
Quercus michauxii	swamp chestnut oak	103	25	4.12	10	4	5	5	12	4	1	1	2	1	1	3	1	4	4	9	2	4	5	2	3	4	6	9	1			
Quercus nigra	water oak	51	17	3	2						6		1			2			1		6		1	6	5	5	3	2	2	3	1	4
Quercus phellos	willow oak	72	23	3.13	2	5	2	3		7	5	1	2	1	9	6	4	8	2	1		1		1	2		1	1		2	1	
Ulmus americana	American elm	81	22	3.68	7	12	2	8	2	2	3		1			1	8	2					2	10	4	2	2	1	3	3	3	2
Unknown		42	15	2.8		1	4	1	3	1		1		12	7	2	1		2	3			1								1	
12	11	622	12		26	29	22	27	27	23	23	19	21	27	25	22	20	20	19	20	24	20	20	25	26	25	24	25	12	11	12	12

**Heath
Baseline
Vegetation Monitoring Plot Photos
Taken April 2010**

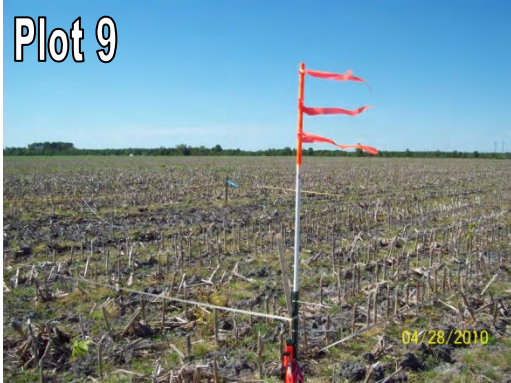


Plot 6

No photo available



**Heath
Baseline
Vegetation Monitoring Plot Photos
Taken April 2010
(continued)**



**Heath
Baseline
Vegetation Monitoring Plot Photos
Taken April 2010
(continued)**



**Heath
Baseline
Vegetation Monitoring Plot Photos
Taken April 2010
(continued)**

