UT to Dutch Buffalo Creek
Stream and Wetland Enhancement Project
Project No. 172
2009 Baseline/Monitoring Report: Year 0/1 of 5

November 2009 (Revised April 2010)

Prepared for: NCDENR-EEP
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EXECUTIVE SUMMARY

SECTION 1

EXECUTIVE SUMMARY

The unnamed tributary (UT) to Dutch Buffalo Creek, hereafter referred to as the Site, is located approximately 1.5 miles southwest of the Town of Bostian Heights in Rowan County, North Carolina (Figure A1). The Site is a second order stream located within the Southern Outer Piedmont Ecoregion of the Piedmont physiographic region in the Yadkin River Basin (USGS HUC 03040105). The stream restoration plan was designed by EcoScience. Construction and seeding activities were completed in April 2009.

This report serves as the Year 0 (baseline/as-built report) and the Year one (2009 annual monitoring report) of the five year monitoring plan for the Site. The goals and mitigation success requirements and contingency plans will be followed as stated in this report.

1.1 Goals and Objectives

Prior to construction activities, wetland, stream, and buffer functions on the Site were impaired as a result of being dredged and straightened. Natural vegetation within the floodplain, including stream buffer zones was maintained through regular mowing and active grazing. According to the as-built plan sheets, the activities completed on the Site consist of enhancing 1,400 linear feet (lf) of stream (Level 2) and 0.4 acres (ac) of wetlands. The Site's riparian areas were planted to stabilize streambanks, improve habitat, and protect water quality.

The following restoration goals were established for the Site.

1. Enhance (Level 2) 1,400 lf of UT to Dutch Buffalo Creek by establishing native vegetation along streambanks and floodplain areas.
2. Enhance 0.4 ac of wetlands by planting native wetland vegetation in areas with existing hydric soils.
3. Installation of livestock exclusion fencing.

Streambanks, riparian areas, and wetland areas were stabilized using bare-root plantings as well as temporary and permanent seeding mixes. The Site was planted with native riparian vegetation and fenced around the permanent conservation easement. Enhancement of the stream and wetland areas will help to improve water quality via nutrient removal, increase local vegetative biodiversity, provide wildlife habitat, and serve as a forested corridor linking the Site with adjacent forested areas. Appendix B provides more detailed project activity, history, contact information, and watershed/site background information for this project.

1.1.1 Monitoring Plan

In order to ensure the Site meets regulatory stream and wetland enhancement success criteria, each feature on-site will be monitored annually for five years. The entire stream reach will be visually monitored for stability and vegetation establishment. Permanent photographic reference points established along the channel will be used to support the visual assessments for the annual

monitoring and subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation and effectiveness of erosion control measures. Photos will indicate the absence of developing mid-channel bars within the channel, excessive bank erosion, changes in channel depth over time, and maturation of riparian vegetation. A stream crest gauge has been installed adjacent to the stream enhancement reach to monitor overbank occurrences greater than or equal to bankfull. In order for the above conditions to meet success criteria for the stream enhancement area the channel's streambank stability must be indicative of a stable stream system at the end of the five year monitoring period with two or more bankfull events occurring over the five year monitoring period. The two bankfull events must occur in separate years.

In order to monitor and assess the planted woody vegetation, 10X10 meter (m) vegetation monitoring plots have been randomly established within planted portions of the Site. Planted vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2006). To achieve vegetative success criteria the average number of planted stems per acre must exceed or meet 320 stems/acre after the third year of monitoring, 288 stems/acre after four years, and 260 stems/acre after the fifth year of project monitoring.

One groundwater monitoring gauge was installed by EcoScience to document water table hydrology in the required wetland enhancement location. The monitoring gauge is programmed to download groundwater levels daily and will be downloaded monthly from March to November in order to capture hydrological data during the growing season. The target wetland hydrological success criterion is saturation or inundation for at least 12.5 percent of the growing season in the lower landscape (floodplain) positions. To achieve the above hydrologic success criterion, groundwater levels must be within 12-inches of the ground surface for 29 consecutive days, which is 12.5 percent of the March 23 to November 7 (229 days) growing season.

1.1.2 Maintenance and Contingency Plans

Potential problem areas, such as streambank instability, aggradation/degradation, or unsuccessful vegetation establishment will be evaluated during the annual monitoring. If, during the annual review of the stream reach, a failure is noted, the areas will be evaluated and discussed with EEP staff to determine if remedial maintenance measures are required to resolve the problem. If remediation of an area is required, a proposal will be submitted for the needed work. If vegetative success criteria is not achieved, supplemental plantings will be performed with native species.

1.2 Vegetative Assessment

JJG conducted the 2009 (MY-0/1 of 5) vegetative survey in October 2009. Four vegetation monitoring plots 100 m^2 (10m x 10m) in size were randomly established on site within the enhancement areas. The CVS protocol (Level 2) was conducted to establish baseline and year 1 monitoring data. Vegetative monitoring success criteria for the Site requires that the planted woody vegetation must meet a minimum survival success rate of 320 stems/acre after three years, 288 stems/acre after four years, and 260 stems/acre after five years.

The 2009 vegetation monitoring indicated an average survivability of 405 stems per acre, which is greater than the required vegetation survival criteria of 320 stems per acre after the first growing season. The survival rate for the planted woody vegetation monitored for 2009 is 100%. The monitoring data indicates an average of 10 stems per plot. In conclusion, the riparian restoration project meets the requirements per the success criterion for the 2009 monitoring year. Please refer to Appendix C for vegetation photos and raw data tables.

1.3 Stream Assessment

Stream dimension, pattern, profile, and substrate were evaluated within 1,400 linear feet of the Site. Results from the 2009 stream monitoring effort indicate that stream pattern, profile, and dimension of UT to Dutch Buffalo is maintaining vertical and lateral stability with minimal problem areas. A few areas were noted with in-stream vegetation growth, but it does not appear to have affected channel flow at this time. Please refer to Figure A2 for the CCPV and Appendix D for stream photos and data tables.

One crest gauge was installed by JJG in November 2009 to verify bankfull or greater events occurring within the Site. For the Site to meet mitigation success criteria, at least two bankfull or greater event should occur over the five year monitoring period. No bankfull events were recorded with the crest gauge for the 2009 monitoring due to the timing of installation. However, during the 2009 assessment, other indicators such as old wrack lines and staining were observed at the bankfull and greater elevations within the Site.

1.4 Wetland Assessment

There were no problem areas observed within the wetland areas for the Site. The groundwater gauge located onsite was damaged and the data was unable to be downloaded. Due to the malfunctioning gauge, it is unknown whether the general success of hydrology within the wetland restoration zones is adequate to meet success requirements at this time. JJG replaced the gauge and will report results from the wetland assessment in the 2010 monitoring year.

1.5 Annual Monitoring Summary

Overall, the Site appears to be stable and has met stream and vegetation mitigation goals for monitoring year 0/1. Wetland success could not be provided in this report due to malfunction of the groundwater gauge.

The background information provided in this report is referenced from previous reports prepared by EcoScience (2003). Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

SECTION 2
METHODOLOGY

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METHODOLOGY

2.1 Methodology

Methods employed for the Site were a combination of those established by standard regulatory guidance and procedure documents as well as previous reports completed by EcoScience. Geomorphic and stream assessments were performed following guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in the Stream Restoration a Natural Channel Design Handbook (Doll et al, 2003). Vegetation assessments were performed following the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2006). JJG used the *Flora of the Carolinas, Virginia, Georgia, and surrounding areas* by Alan S. Weakley as the taxonomic standard for vegetation nomenclature for this report. Precipitation data for the hydrographs was obtained from off-site resources.

SECTION 3
REFERENCES

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REFERENCES

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E., 2003. Stream Restoration A Natural Channel Design Handbook.

EcoScience. 2003. Unnamed Tributary to Dutch Buffalo Creek Detailed Stream Mitigation Plan. Raleigh, NC.

Harrelson, Cheryl C; Rawlins, C.L.; Potyondy, John P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique.* Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. (2006). CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved from http://www.nceep.net/business/monitoring/veg/datasheets.htm.

Rosgen, D L. 1996. Applied River Morphology. Wildland Hydrology Books, Pagosa Springs, CO.

Weakley, A.S. 2008. *Flora of the Carolinas, Virginia, Georgia, Northern Florida, and Surrounding Areas* (Draft April 2008). University of North Carolina at Chapel Hill: Chapel Hill, NC.

SECTION 4
APPENDICES

Appendix 1 - General Figures and Plan Views

Appendix 2 - General Project Tables

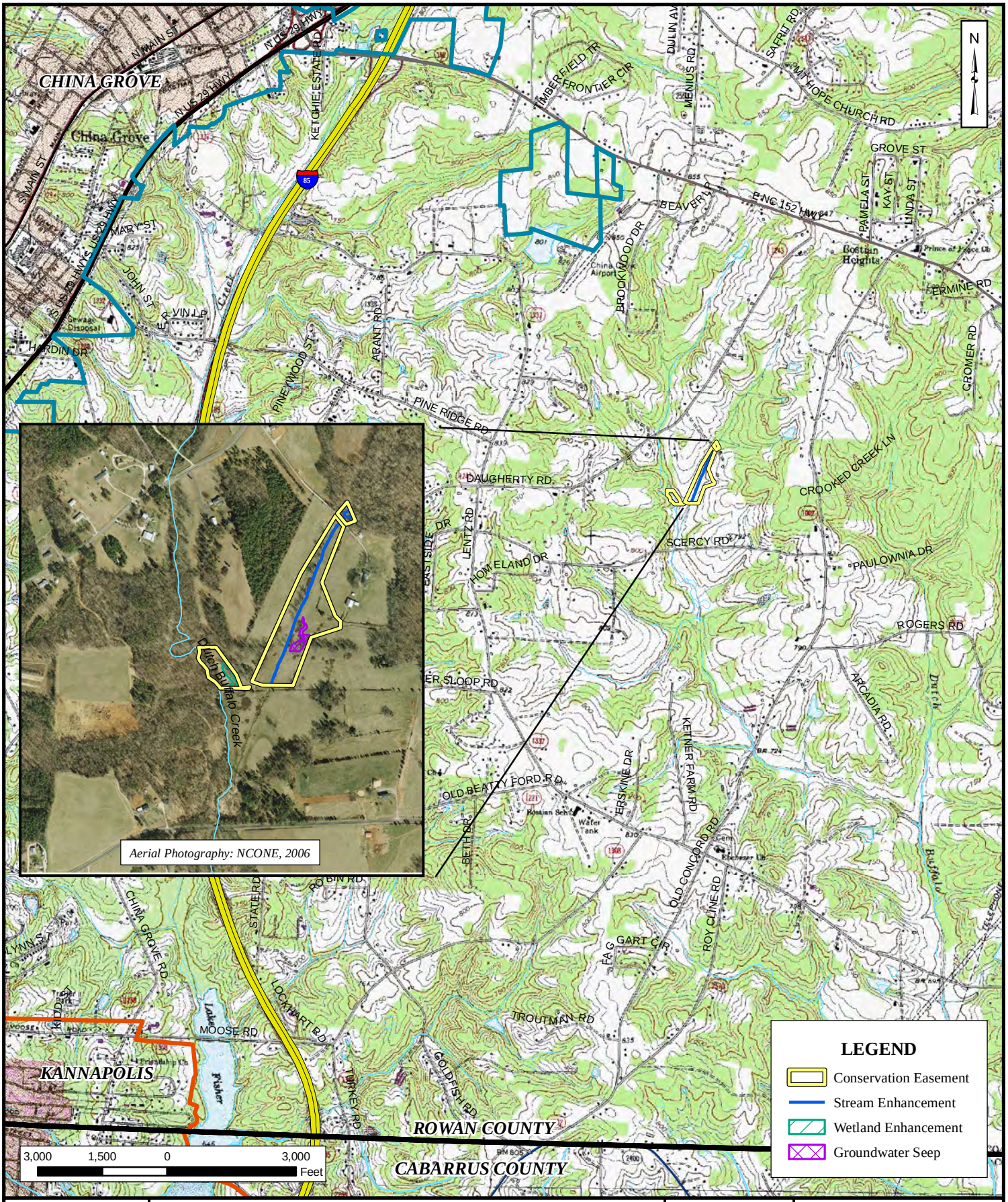
Appendix 3 - Vegetation Assessment Data

Appendix 4 – Stream Assessment Data

APPENDIX 1
GENERAL FIGURES AND PLAN VIEWS

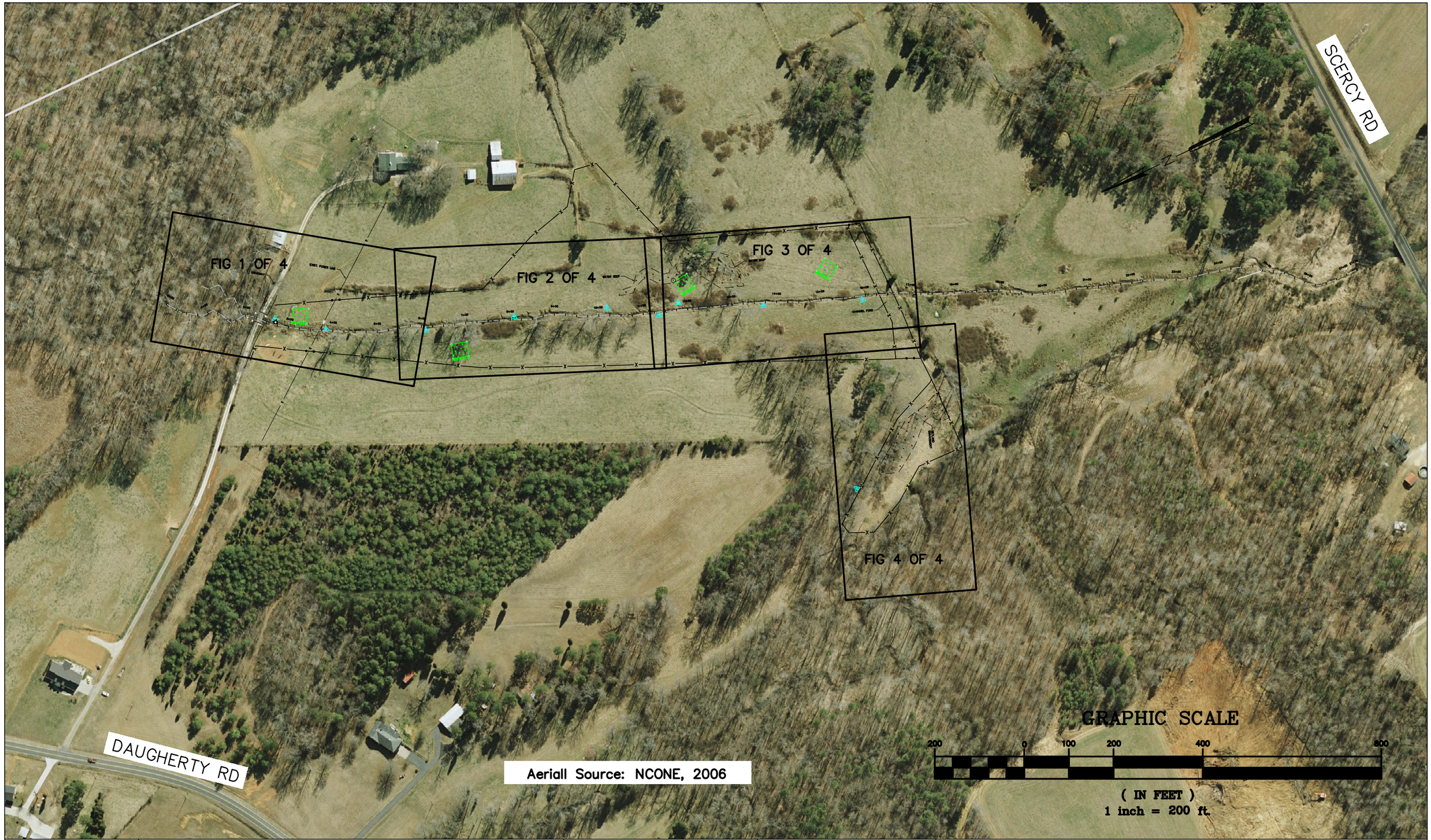
Figure 1.1 - Vicinity Map

Figure 1.2 - Current Condition Plan View



APPENDIX 1. GENERAL FIGURES AND PLAN VIEWS
FIGURE 1.1 VICINITY MAP
UT TO DUTCH BUFFALO CREEK
ROWAN COUNTY, NORTH CAROLINA
YEAR 1 OF 5

Date: November 2009
Scale: 1" = 3,000'



NOTES:
1. GENERAL SITE DATA PROVIDED BY NCEEP.
2. ALL LOCATIONS ARE APPROXIMATE.

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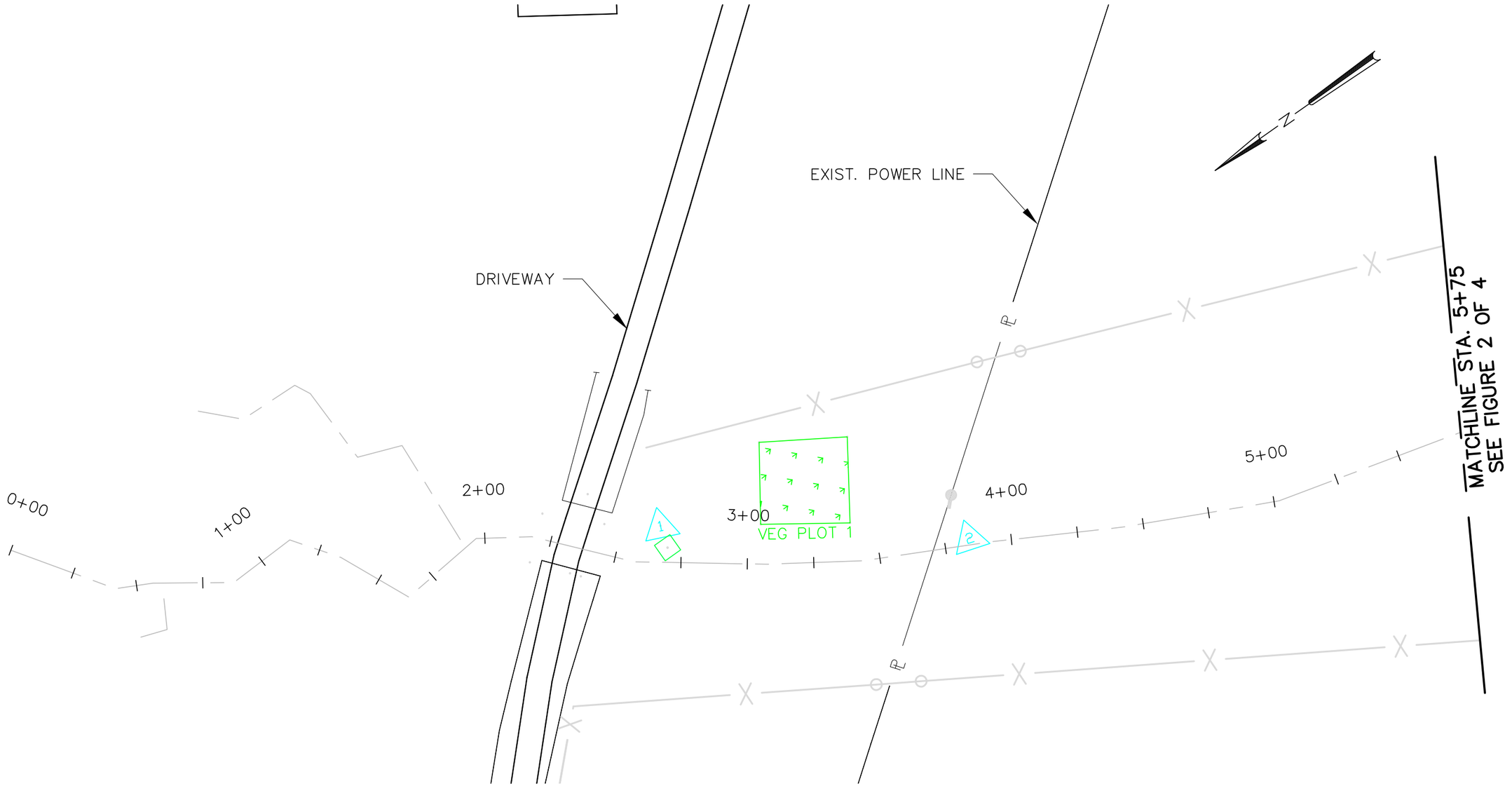
NC ECOSYSTEM ENHANCEMENT PROGRAM
UT TO DUTCH BUFFALO CREEK

FIGURE 1.2
CURRENT CONDITION PLAN VIEW

DATE : NOVEMBER 2009
SCALE : 1"=200'
JOB NO.: 03060005

FIGURE KEY



LEGEND

PHOTO POINT	GROUNDWATER GAUGE	STREAM CENTERLINE
CREST GAUGE	VEGETATION PLOT	CONSERVATION EASEMENT

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

Ecosystem Enhancement PROGRAM

NOTES:
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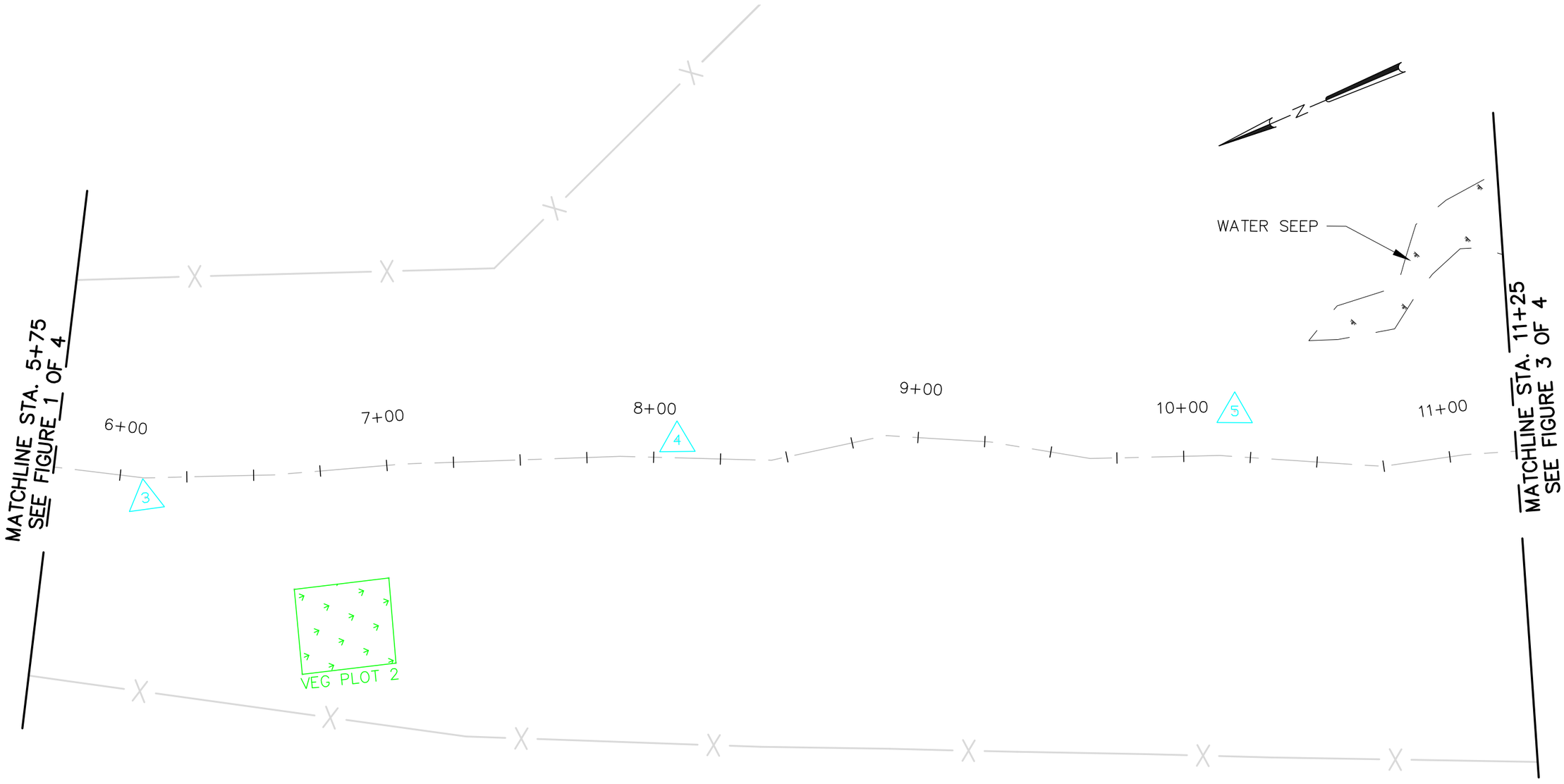
NC ECOSYSTEM ENHANCEMENT PROGRAM
UT TO DUTCH BUFFALO CREEK

FIGURE 1.2
CURRENT CONDITION PLAN VIEW

DATE : NOVEMBER 2009
SCALE : 1"=40'
JOB NO.: 03060005

FIGURE 1 OF 4



LEGEND

PHOTO POINT	GROUNDWATER GAUGE	STREAM CENTERLINE
CREST GAUGE	VEGETATION PLOT	CONSERVATION EASEMENT

GRAPHIC SCALE

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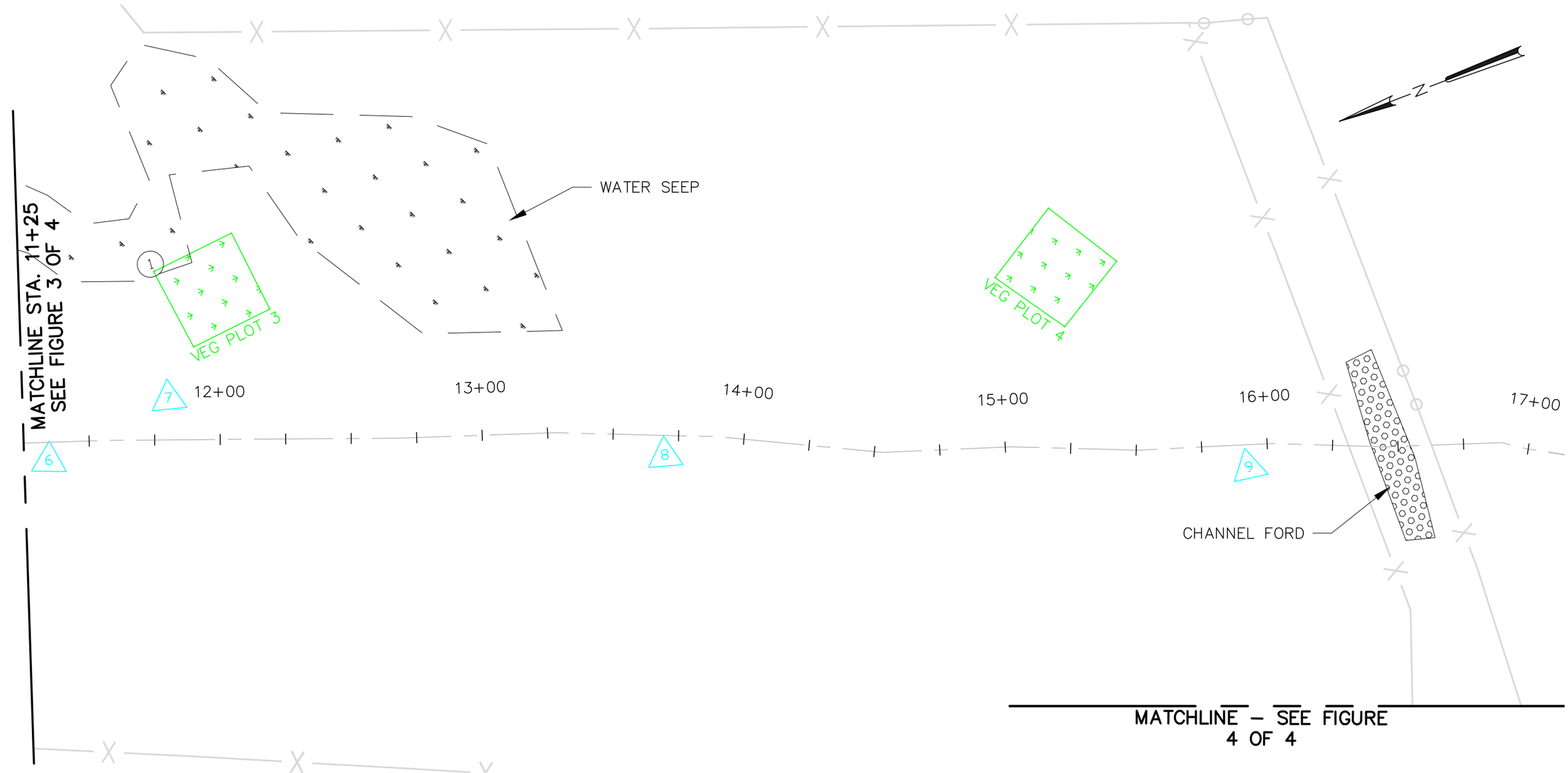
UT TO DUTCH BUFFALO CREEK

FIGURE 1.2
CURRENT CONDITION PLAN VIEW

DATE : NOVEMBER 2009
SCALE : 1"=40'
JOB NO.: 03060005

FIGURE 2 OF 4



LEGEND

PHOTO POINT	GROUNDWATER GAUGE	STREAM CENTERLINE
CREST GAUGE	VEGETATION PLOT	CONSERVATION EASEMENT

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(IN FEET)
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FIGURE 1.2
CURRENT CONDITION PLAN VIEW

DATE : NOVEMBER 2009
SCALE : 1"=40'
JOB NO.: 03060005

FIGURE 3 OF 4

MATCHLINE – SEE FIGURE 3 OF 4

LEGEND

PHOTO POINT	GROUNDWATER GAUGE	STREAM CENTERLINE
CREST GAUGE	VEGETATION PLOT	CONSERVATION EASEMENT

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

Ecosystem Enhancement PROGRAM

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2. ALL LOCATIONS ARE APPROXIMATE.

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JJG

NC ECOSYSTEM ENHANCEMENT PROGRAM
UT TO DUTCH BUFFALO CREEK

FIGURE 1.2
CURRENT CONDITION PLAN VIEW

DATE : NOVEMBER 2009
SCALE : 1"=40'
JOB NO.: 03060005

FIGURE 4 OF 4

APPENDIX 2
GENERAL PROJECT TABLES

Table 2.1 - Project Restoration Components

Table 2.2 - Project Activity and Reporting History

Table 2.3 - Project Contacts Table

Table 2.4 - Project Attribute Table

Table 2.1 Project Restoration Components

Segment/Reach	Mitigation Type	Approach	Linear Footage or Acres	Stationing (ft)	Comments
Main Channel	Enhancement	Level 2	1,400	0+00-14-00	Stream Enhancement using native vegetative plants.
Wetland Area	Enhancement	N/A	0.4		Wetland Enhancement using native plants in areas with existing hydric soils.

Component Summations						
		Wetland (ac)				
Restoration Level	Stream (lf)	Riparian	Non-Riparian	Upland (ac)	Buffer (ac)	BMP
Restoration (R)	N/A	N/A	N/A	N/A	N/A	N/A
Enhancement (E)	N/A	N/A	N/A	N/A	N/A	N/A
Enahncement I (E)	N/A	N/A	N/A	N/A	N/A	N/A
Enhancement II (E)	1400	0.4	N/A	N/A	N/A	N/A
Creation (C)	N/A	N/A	N/A	N/A	N/A	N/A
Preservation (P)	N/A	N/A	N/A	N/A	N/A	N/A
HQ Preservation (P)	N/A	N/A	N/A	N/A	N/A	N/A
Totals	**1,400**	**0.4**	**N/A**	**N/A**	**N/A**	**N/A**

Table 2.2 Project Activity and Reporting History

Activity or Report	Data Collection Completed	Actual Completion or Delivery
Restoration Plan	Jul-03	Jul-03
Final Design-90%	N/A	N/A
Construction	N/A	Apr-09
Temporary S&E mix applied to entire project area*	N/A	Apr-09
Permanent seed mix applied to reach	N/A	Apr-09
Containerized and B&B plantings for reach	N/A	Apr-09
Mitigation Plan/ As-Built (Year 0 Monitoring)	Oct-09	Nov-09
Year 1 Monitoring	Nov-09	Nov-09
Year 2 Monitoring	2010	2010
Year 3 Monitoring	2011	2011
Year 4 Monitoring	2012	2012
Year 5 Monitoring	2013	2013

*Seed and mulch is added as each section of construction is completed.

Table 2.3 Project Contacts Table

Designer	EcoScience Corporation 1101 Haynes Street, Suite 101 Raleigh, NC 27604 919- 828-3433
Construction	Husky Construction 617 Westbury Road Charlotte, NC 28211
Planting Contractor	
Seeding Contractor	
Monitoring Performers	Jordan, Jones & Goulding 9101 Southern Pine Blvd., Suite 160 Charlotte, NC 28273
Stream Monitoring, POC	Kirsten Young, 704-527-4106 ext.246
Vegetation Monitoring, POC	

Table 2.4 Project Attribute Table

Project County	Rowan County, North Carolina
Drainage Area	0.6 sq. mi
Drainage impervious cover estimate	<10%
Stream Order	2nd
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Rosgen Classification of As-built	G5/4 and E5/4
Dominant soil types	Chewalca, Cecil, and Enon/Mecklenburg
Reference site ID	Dutch Buffalo Creek
USGS HUC	3040105
NCDWQ Sub-basin for Project and Reference	03-07-12
NCDWQ classification for Project and Reference	WS-II;HSW
Any portion of any project segment 303d list?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reason for 303d listing or stressor?	N/A
% of project easement fenced?	100%

APPENDIX 3
VEGETATION ASSESSMENT DATA

Table 3.1 - Vegetation Plot Mitigation Success Summary Table

Photos - Vegetation Monitoring Plot Photos

Table 3.2 - Vegetation Metadata Table

Table 3.3 – Stem Counts Total and Planted by Plot and Species

Table 3.1 Vegetation Plot Mitigation Success Summay Table

Vegetation Plot ID	Vegetation Survival Threshold Met (Y/N)
Plot 1	Y
Plot 2	Y
Plot 3	Y
Plot 4	N
Total Mean Density (stems/acre)	445
Total Planted Density (stems/acre)	425

Monitoring Plot 1 (10/2009)

Monitoring Plot 2 (10/2009)

Monitoring Plot 3 (10/2009)

Monitoring Plot 4 (10/2009)

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	Appendix 3. Vegetation Assessment Data **Photos - Vegetation Monitoring Plot Photos**	

Table 3.2 Vegetation Metadata Table

Report Prepared By	Kirsten Young
Date Prepared	
database name	
database location	
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Stem Count by Plot and Spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	172
project Name	Helms Property (UT Dutch Buffalo)
Description	Stream and Wetland Enhancement Rowan County, North Carolina
length(ft)	1400
stream-to-edge width (ft)	
area (sq m)	20436.6
Required Plots (calculated)	4
Sampled Plots	4

Table 3.3 Stem Counts Total and Planted by Plot and Species

			Current Data (MY2-2009)								Annual Means	
					Plot 2		Plot 3		Plot 4		Current Mean	
Species	**Common Name**	**Type**	P	T	P	T	P	T	P	T	P	T
Betula nigra	river birch	T			2	2					**2**	**2**
Carya sp.	hickory	T				1					**N/A**	**1**
Diospyros virginiana	common persimmon	T	3	3							**3**	**3**
Fraxinus pennsylvanica	green ash	T	4	4	1	1	3	3			**3**	**3**
Liquidambar stryaciflua	sweet gum	T				1					**N/A**	**1**
Nyssa sylvatica	blackgum	T	1	1							**1**	**1**
Platanus occidentalis	American sycamore	T	3	3	2	2	2	2	5	5	**3**	**3**
Quercus lyrata	overcup oak	T	1	1							**1**	**1**
Quercus michauxii	swamp chestnut oak	T	1	1	1	1	5	5			**2**	**2**
Quercus nigra	water oak	T			1	1			1	1	**1**	**1**
Quercus pagoda	cherrybark oak	T	1	1					1	1	**1**	**1**
Quercus phellos	willow oak	T	1	1							**1**	**1**
Viburnum dentatum	southern arrowwood	T/S			2	2					**2**	**2**
Unknown sp.	unknown species	T	1	1							**1**	**1**
		Plot Area (acres)	**0.0247**									
		Species Count	**9**	**9**	**6**	**8**	**3**	**3**	**3**	**3**	**12**	**14**
		Stem Count	**16**	**16**	**9**	**11**	**10**	**10**	**7**	**7**	**21**	**23**
		Stems per Acre	**648**	**648**	**364**	**445**	**405**	**405**	**283**	**283**	**425**	**445**

Type=**S**hrub or **T**ree
P = Planted
T = Total

APPENDIX 4
STREAM ASSESSMENT DATA

Photos - Stream Station Photos

Table 4.1 - Visual Morphological Stability Assessment

Table 4.2 - Verification of Bankfull Events

Table 1.1 Visual Morphological Stability Assessment

Main Channel-1,400 linear feet

Feature Category		(# Stable) Number Performing as Intended	Total Number assessed per as-built survey	Total Number/ feet in unstable state	% Perform in Stable Condition	Feature Perform Mean or Total
A. Riffles	1. Present?	N/A				
	2. Armor Stable?					
	3. Facet grade appears stable?					
	4. Minimal evidence of embedding/fining?					
	5. Length appropriate?					
B. Pools	1. Present?	N/A				
	2. Sufficiently deep?					
	3. Length Appropriate?					
C. Thalweg	1. Upstream of meander bend centering?	N/A			100%	**100%**
	2. Downstream of meander centering?				100%	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	N/A			100%	**100%**
	2. Of those eroding, # w/concomitant point bar formation?				100%	
	3. Apparent Rc within spec?				N/A	
	4. Sufficient floodplain access and relief?				100%	
E. Bed General	1. General channel bed aggradation areas (bar formation)?	N/A		0	97%	**99%**
	2. Channel bed degradation - areas of increasing down-cutting or head cutting?			0	100%	
F. Bank	1. Actively eroding, wasting, or slumping bank	N/A		0	98%	**98%**
G. Vanes	1. Free of back or arm scour?	N/A				
	2. Height appropriate?					
	3. Angle and geometry appear appropriate?					
	4. Free of piping or other structural failures?					
H. Wads/ Boulders	1. Free of scour?	N/A				
	2. Footing stable?					

*Minor in-stream vegetation and minor bank erosion was observed in small sections along the channel

Table 1.2 Verification of Bankfull Events

Date of Collection	Date of Occurrence	Method	Photo # (if available)
11/18/09	11/11/2009-11/12/2009	Visual	N/A