FINAL

Year 5 Annual Monitoring Document

UT to Haw River (#747)

Alamance County

Data Collection Period: September 2016
Submission Date: January 2017

North Carolina Department of
Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Owner

NC Division of Environmental Quality
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Monitoring Firm

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Phone: (919) 858-1797

TABLE OF CONTENTS

APPENDICES

1.0 Executive Summary

The following report summarizes the vegetation establishment and stream stability for Year 5 monitoring for the Unnamed Tributary (UT) to Haw River Stream Enhancement Project (Site) in Alamance County, North Carolina. This project will result in 1,812 feet of stream preservation and 10,091 feet of stream Enhancement II for credit, and an additional uncredited 516' of enhancement. The total footage will yield 4,399 mitigation units and is accomplished through livestock removal, invasive species treatment, native species panting, and stream stabilization measures.

1.1 Goals and Objectives

Goals

- Improve the overall water quality by reducing the input of sediment and nutrients into the aquatic system.
- Restore the richness and diversity of the plant species within the riparian zone and upland buffers.
- Improve the overall wildlife habitat across the entire conservation easement.

Objectives

- Stabilize excessively eroded stream banks through bioengineering techniques and appropriate vegetation planting.
- Eliminate livestock access to project reaches and associated riparian buffers through the installation of cattle exclusion fencing.
- Effectively treat and eliminate approximately 4.2 acres of invasive plant species and replace with appropriate native plant material.
- Implement a specific planting plan that addresses immediate planting needs for 0.45 acres of stream bank, 1.06 acres of riparian buffer, 3.14 acres of upland buffer, and provides for supplemental planting of all vegetative zones based on site specific needs identified during project construction.
- Protect the completed enhancement activities at the Site through 39.4 acres of perpetual conservation easement.
- Implement a site specific farm management plan that compliments enhancement activities by providing alternative water sources, additional fencing, and at-grade permanent stream crossings.

1.2 Project Background

The Site consists of 13 unnamed tributaries to the Haw River located approximately 2.8 miles southeast of the Town of Ossipee and 3.1 miles northwest of the City of Burlington (Figure 1). The site is within the area bounded by Gerringer Mill Road (SR 1530) to the north, Burch Bridge Road (SR 1530) to the east, and the Haw River to the south and west (Figure 1). The enhancement project is located entirely on two private parcels owned by Ms. Jane Iseley (Parcel ID Nos. 118481 and 118526). The Division of Mitigation Services (DMS) purchased 39.4 acres and established four perpetual conservation easement areas to protect stream enhancement activities.

The Site is located within the Cape Fear River Basin Cataloging Unit 03030002 and local watershed unit 03030002030010 (14-digit HUC). DMS identified this HUC as a Targeted Local Watershed in the 2009 Cape Fear River Basin Restoration Priority report. The Haw River is the closest named stream to the Site.

1.3 Vegetation

Stream Vegetation Success Criteria

Vegetation monitoring will be considered successful for stream mitigation credit if at least 260 planted stems/acre (trees and shrubs), are surviving at the end of five years. The interim measure of vegetative success for the site will be the survival of at least 320 3-year old stems per acre at the end of year three of the monitoring period and 2 4-year old stems per acre at the end of year four of the monitoring period (USACE et al. 2003).

Monitoring Results

Overall stem counts were based on an average of the evaluated vegetation plots. Based on the number of stems counted toward stream mitigation credit, average densities were measured at 273 planted stems per acre (excluding livestakes) surviving in Year 5 (2016). The dominant species identified at the Site were planted stems of white oak (*Quercus alba*) and American witchazel (*Hamamelis virginiana*).

Three (Plots 1, 2, and 3) of the four individual vegetation plots met success criteria when counting planted stems alone. Plot 4 did not meet success criteria based on planted stems alone; however, all plots met the success criteria when considering both planted stems and appropriate naturally recruited stems. In January 2016 a supplemental planting of 300 (75 stems of each species: tulip popular, green ash, mockernut hickory, and white oak) stems were planted throughout the project site.

Although there are isolated and sporadic re-sprouting of Chinese privet (*Ligustrum sinense*) and multiflora rose (*Rosa multiflora*), invasive treatments that occurred November 2 11, ove er 2 15, June 2016, and August 2016 were effective at controlling populations of invasive on-site.

1.4 Stream Stability

The UT to Haw River project includes preservation and enhancement level II restoration. Since there were no changes made to dimension, pattern, or profile for any project reaches, morphological characteristics will not be measured. Instead, thorough visual assessments and established photo points will focus on documenting evidence of aggradation, degradation, and bank erosion.

Year 5 monitoring surveys along UT to Haw River project occurred in September 2016. Thirty photo point locations were reviewed and subsequent photographs taken during data collection at the Site. These photographs serve as documentation of the Year 5 stream condition as well as reference photos for future monitoring years. Based on available data and visual comparison between Year 5 and Year 1, no new areas of channel instability were identified during the September 2016 site visit.

Six at-grade stream crossings and one rock structure to stabilize an existing crossing were installed on project reaches at the Site during construction. The conditions of these features were observed during the site visit in September 2016. All of these features are stable and functioning properly as depicted on the CCPV.

No crest gauges are installed at the Site as hydrology is not being evaluated for this project.

1.5 Note

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 Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on DMS's website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

2.0 Methodology

The UT to Haw River project includes preservation and enhancement level II restoration. Since there were no changes made to dimension, pattern, or profile for any project reaches, no morphological characteristics were measured. Instead, project-wide stream monitoring was accomplished using visual assessment as well as photo documentation. Any areas showing evidence of aggradation, degradation, and/or bank erosion are identified and mapped on the CCPV.

Vegetation monitoring was conducted according to the CVS-EEP Protocol for Recording Vegetation, Version 4.0 (Lee, M.T. et al., 2008). Four 100 square meter vegetation monitoring plots were established along the project reaches in August 2012. Two plots measure ten meters by ten meters, and two plots measure five meters by twenty meters. The four corners of each plot are marked with one-half inch steel rebar. Level 2 (planted and volunteer woody stems) data collection was performed in all plots. Each planted woody stem location (x and y), height (cm), and live stem diameter (dbh) were recorded. All planted stems were identified with pink flagging and silver tree tags indicating tree species. Vegetation was identified using Weakley (Weakley 2011). Photos were taken of each vegetation plot. Plots lacking cover, or with low planted-stem density or vigor, are identified and mapped on the CCPV.

3.0 References

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (http://cvs.bio.unc.edu/methods.htm).

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NCDENR-Ecosystem Enhancement Program. 2012. Baseline and Year 1 Annual Monitoring Document, UT to Uwharrie River (#747), Randolph County, North Carolina.

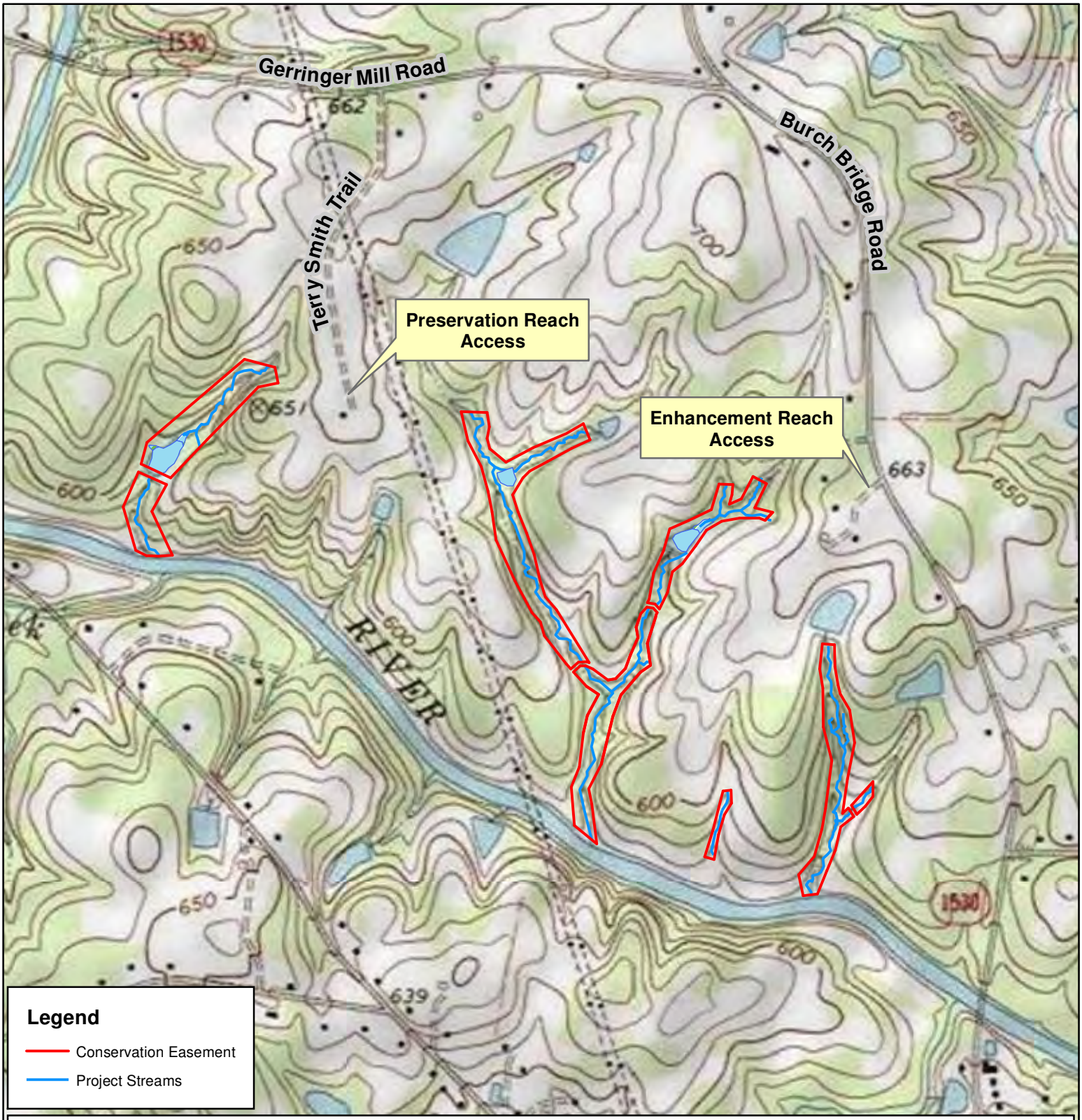
NRCS (Natural Resources Conservation Service). 2012. Web Soil Survey—Randolph County. Available at: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

Schafale, M.P., and A.S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. N.C. Natural Heritage Program, Raleigh, NC.

USACE. 2003. *Stream Mitigation Guidelines*. USACOE, USEPA, NCWRC, NCDENR-DWQ.

Weakley, Alan S. 2011. Flora of the Southern and Mid-Atlantic States. University of North Carolina Herbarium, North Carolina Botanical Garden, UNC Chapel Hill. http://herbarium/unc/edu/FloraArchives/WeakleyFlora_2011-May-nav.pdf

APPENDIX A
Project Vicinity Map and Background Tables



Directions to the Project:
The project site is located directly adjacent to the Haw River approximately 2.8 miles southeast of the Town of Ossipee and 3.1 miles northwest of the City of Burlington in Alamance County. The approximate center of the project site is located at 36.14158º N Latitude and 79.47554º W Longitude. The site is bounded by Gerringer Mill Road (SR 1530) to the north, Burch Bridge Road (SR 1593) to the east, and the Haw River to the west and south.

Access to the conservation easement during all phases of the project will be maintained through the landowner's gated entrances to the Site. These entrances are located at the end of Terry Smith Trail and on Burch Bridge Road approximately 0.75 mile south of Gerringer Mill Road.

The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP.

1 inch = 1,000 feet

GRAPHIC SCALE
0 500 1,000 Feet

Environmental Quality

PROJECT VICINITY MAP
UT TO HAW RIVER
STREAM ENHANCEMENT PROJECT
EEP PROJECT #747
ALAMANCE COUNTY, NC

FIGURE
1

Table 1. Project Components and Mitigation Credits
UT to Haw River Stream Restoration Project (#747)

Mitigation Credits

	Stream	
Type	R	RE
Totals		4,399

Project Components

Project Component	Stationing/Location	Existing Footage	Restoration -or- Restoration Equivalent	Restoration Footage	Mitigation Ratio	Stream Credits (SMU)
Main West	0+00 - 17+68	1768	P	1684	5:1	337
Trib W1	0+00 - 1+49	149	P	128	5:1	26
Main Center	0+00 - 41+02	4102	E2	3879	2.5:1	1552
Trib C1	0+00 - 8+25	825	E2	776	2.5:1	310
Trib C2	0+00 - 20+50	2050	E2	1944	2.5:1	778
Trib C2-a	0+00 - 2+71	271	E2	221	2.5:1	88
Trib C2-b	0+00 - 2+39	239	E2	239	2.5:1	96
Trib C2-c	0+00 - 0+98	98	E2	98	2.5:1	39
Southeast Trib	0+00 - 5+16	516	E2	0	2.5:1	0
Main East	0+00 - 21+64	2164	E2	2122	2.5:1	849
Trib E1	0+00 - 1+21	121	E2	121	2.5:1	48
Trib E2	0+00 - 2+91	291	E2	291	2.5:1	116
Trib E3	0+00 - 4+47	447	E2	400	2.5:1	160

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-			
Restoration						
Enhancement						
Enhancement I						
Enhancement II	10,091					
Creation						
Preservation	1,812					
High Quality Preservation						

Table 2. Project Activity and Reporting History UT to Haw River Stream Enhancement Project (#747)		
Activity or Deliverable	**Data Collection Complete**	**Completion or Delivery**
Environmental Resources Technical Report	Oct-07	Nov-07
Permanent Conservation Easement Executed & Recorded	N/A	Mar-08
Restoration Plan	N/A	Aug-08
Final Design – Construction Plans	N/A	Mar-11
Invasive Treatment	N/A	Nov-11
Livestock Exclusion Fencing	Nov-11	Nov-11
Construction	N/A	Dec-11
Planting	N/A	Dec-11
Baseline/Year 1 Monitoring	Aug-12	Dec-12
Year 3 Monitoring	Aug-14	Nov-14
Year 4 Monitoring	Aug-15	Nov-15
Supplemental Planting	N/A	Jan-16
Invasive Treatment	N/A	Spring 2016
Invasive Treatment	N/A	Aug-16
Year 5 Monitoring	Sept-16	Dec-16

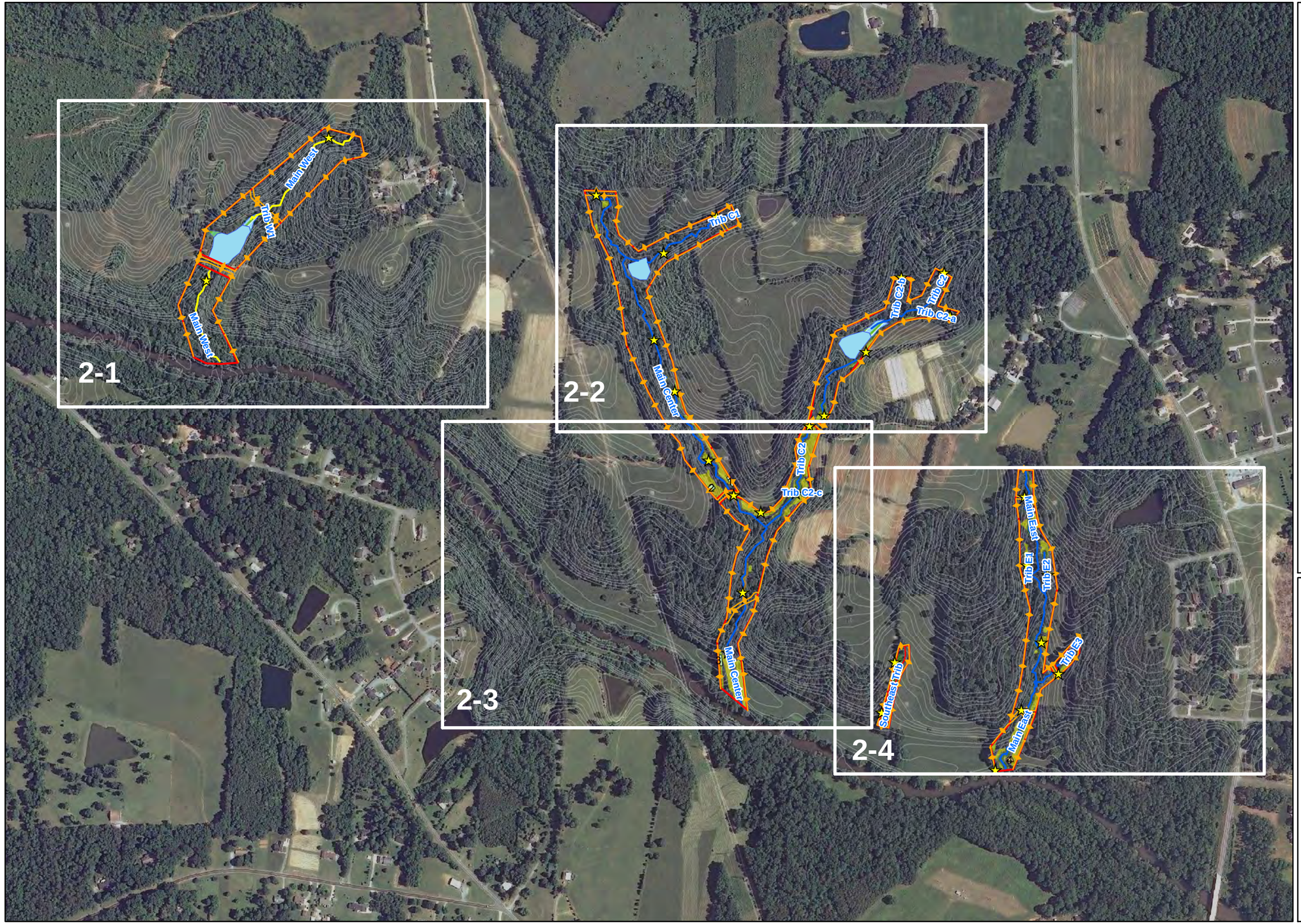
Table 3. Project Contacts Table UT to Haw River Stream Enhancement Project (#747)	
Designer	CALYX Engineers and Consultants, Inc. (Formerly Mulkey)
	6750 Tryon Road
	Cary, NC 27518
Primary project design POC	Mark Mickley, (919) 858-1797
Construction Contractor	River Works, Inc.
	8000 Regency Parkway, Suite 200
	Cary, NC 27518
Construction contractor POC	William Pederson, (919) 459-9001
Survey Contractor	Level Cross Surveying, PLLC
	668 March County Lane
	Randleman, NC 27317
Survey contractor POC	Jena Bundy, (336) 495-1713
Planting/Seeding Contractor	River Works, Inc.
	8000 Regency Parkway, Suite 200
	Cary, NC 27518
Planting/Seeding contractor POC	William Pederson, (919) 459-9001
Seed Mix Sources	Green Resources, (336) 855-6363
Nursery Stock Suppliers	Mellow Marsh Farms, Inc., (919) 742-1200
	Cure Nursery, (919) 542-6186
	Foggy Mountain Nursery, LLC, (336) 384-5323
Monitoring Performers	CALYX Engineers + Consultants, Inc.
	6750 Tryon Road
	Cary, NC 27518
Stream/Vegetation Monitoring POC	Mark Mickley, (919) 858-1797

Table 4. Project Attribute Table - UT to Haw River Stream Enhancement Project (#747)													
Project County	Alamance												
Physiographic Region	Piedmont												
Ecoregion	Carolina Slate Belt												
Project River Basin	Cape Fear												
USGS HUC for Project (14 digit)	3030002030010												
NCDWQ Sub-basin for Project	03-06-02												
Within extent of EEP Watershed Plan?	2009 Cape Fear River Basin Restoration Priority Report												
WRC Hab Class (Warm, Cool, Cold)	Warm												
% of project easement fenced or demarcated	100%												
Beaver activity observed during design phase?	No												
Restoration Component Attribute Table													
Reach	Main West	Trib W1	Main Center	Trib C1	Trib C2	Trib C2-a	Trib C2-b	Trib C2-c	Southeast Trib	Main East	Trib E1	Trib E2	Trib E3
Drainage area (ac)	67.0	9.5	356.4	41.3	111.1	8.8	16.0	6.6	18.2	74.5	U	U	25.3
Stream order	1st/2nd	1st	2nd/3rd	1st	1st/2nd	1st	1st	1st	1st	1st/2nd	1st	1st	1st
Restored length (feet)	1720.0	128.0	3952.5	792.0	1971.5	221.0	239.0	97.5	349.0	2163.5	121.0	290.0	400.0
Perennial or Intermittent	Per	Int	Per	Per/Int	Per	Int	Int	Per	Int	Int/Per	Per	Per	Per
Watershed type (Rural, Urban, Developing etc.)	Rural		Rural						Rural	Rural			
Watershed LULC Distribution (e.g.)													
Residential	5%		8%						1%	2%			
Ag-Row Crop	0%		11%						6%	8%			
Ag-Livestock	37%		15%						46%	7%			
Forested	55%		61%						43%	80%			
Etc.	3%		5%						3%	3%			
Watershed impervious cover (%)	1%		4%						3%	1%			
NCDWQ AU/Index number	16-(1)d2		16-(1)d2						16-(1)d2	16-(1)d2			
NCDWQ classification	WS-V;NSW		WS-V;NSW						WS-V;NSW	WS-V;NSW			
303d listed?	No		No						No	No			
Upstream of a 303d listed segment?	No		No						No	No			
Reasons for 303d listing or stressor	N/A		N/A						N/A	N/A			
Total acreage of easement	10.02		21.78						0.73	6.84			
Total vegetated acreage within the easement	9.19		21.01						0.73	6.84			
Total planted acreage as part of the restoration	0.04		3.21						0.25	1.25			
Rosgen classification of pre-existing	N/A		N/A						N/A	N/A			
Rosgen classification of As-built	N/A		N/A						N/A	N/A			
Valley type	N/A		N/A						N/A	N/A			
Valley slope	N/A		N/A						N/A	N/A			
Valley side slope range (e.g. 2-3.%)	N/A		N/A						N/A	N/A			
Valley toe slope range (e.g. 2-3.%)	N/A		N/A						N/A	N/A			
Cowardin classification	N/A		N/A						N/A	N/A			
Trout waters designation	N/A		N/A						N/A	N/A			
Species of concern, endangered etc.? (Y/N)	No		No						No	No			
Dominant soil series and characteristics													
Series	Worsham	Worsham	Worsham	Worsham	Wilkes	Vance	Helena	Wilkes	Local Alluvial	Local Alluvial	Cecil	Local Alluvial	Local Alluvial
Depth (in)	80	80	80	80	20-80	80	80	20-80	80	80	80	80	80
Clay%	33.7	33.7	33.7	33.7	26.3	32.5	28.8	26.3	24.1	24.1	33.9	24.1	24.1
K	0.37	0.37	0.37	0.37	0.24	0.24	0.24	0.24	0.32	0.32	0.24	0.32	0.32
T	5	5	5	5	2	5	3	2	5	5	5	5	5

N/A = Not Applicable, "-" = Unavailable, "U" = Unknown

APPENDIX B
Visual Assesment Data

Figure 2.	Current Condition Plan View (CCPV)
Table 5.	Vegetation Condition Assessment
Photographic Log	Photo Point Photographs



LEGEND

- Conservation Easement
- Cattle Exclusion Fencing
- Photopoints
- Enhancement II
- No Credit
- Preservation
- Existing Ponds
- Existing Wetlands
- 2' Contour

Planting Zones

- Zone 1 - Stream Banks
- Zone 2 - Riparian
- Zone 3 - Upland
- Zone 4 - Wetland Seep

YEAR 5 CONDITIONS

Vegetation Plot Condition

- Criteria Met
- Criteria Unmet

In-Stream Structure Condition

- At-grade Crossing (Stable)
- Step Pool (Stable)

NOTES:

Aerial Imagery: Terrain Navigator Pro

PREPARED FOR:

NC Environmental Quality

1 inch = 600 feet

GRAPHIC SCALE

0 300 600 1,200 Feet

CURRENT CONDITION PLAN VIEW

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT
EEP PROJECT #747

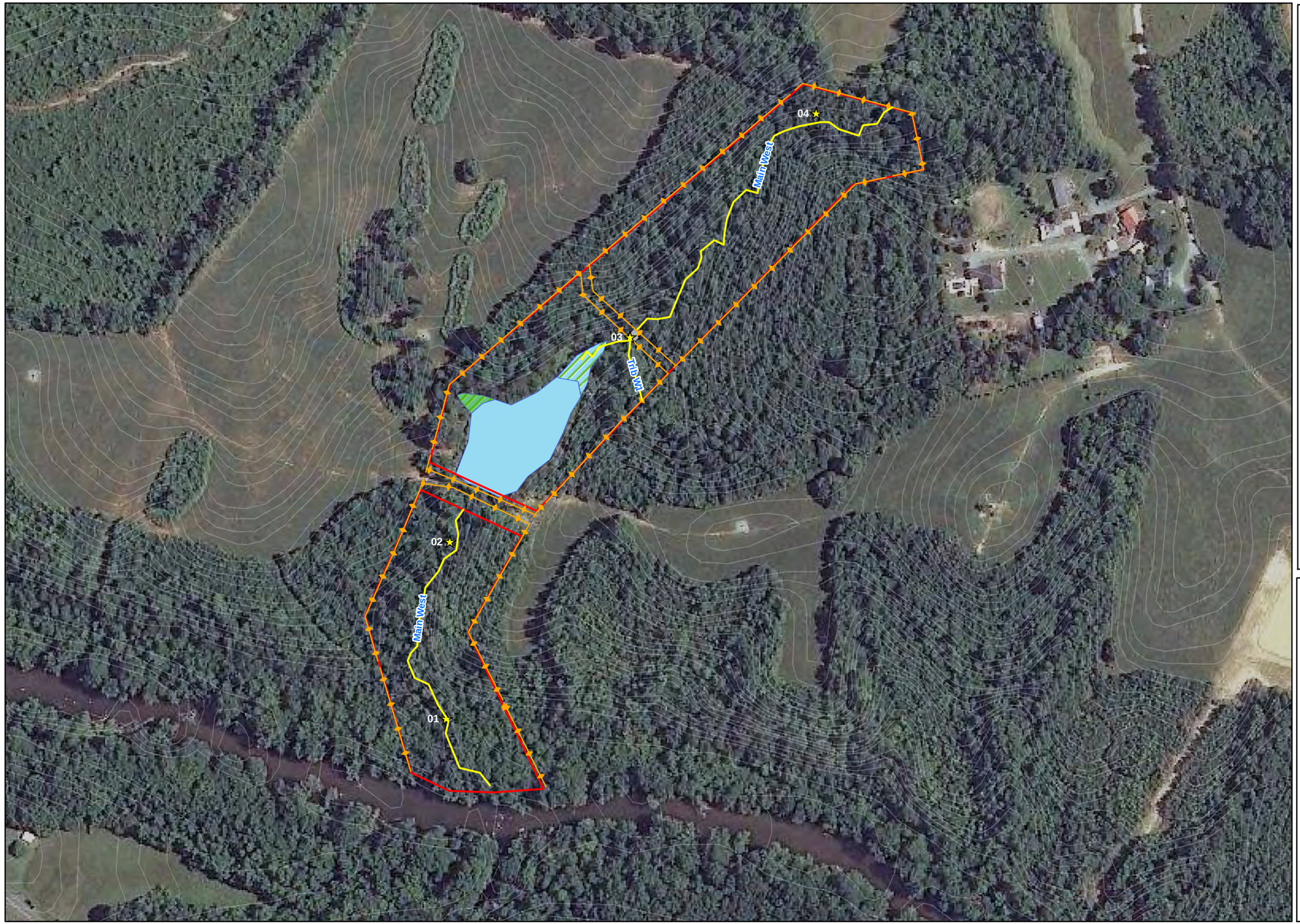
ALAMANCE COUNTY, NC

FIGURE

2

MONITORED BY:

CALYX ENGINEERS + CONSULTANTS



LEGEND

- Conservation Easement
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YEAR 5 CONDITIONS

Vegetation Plot Condition

- Criteria Met
- Criteria Unmet

In-Stream Structure Condition

- At-grade Crossing (Stable)
- Step Pool (Stable)

NOTES:

Aerial Imagery: Terrain Navigator Pro
© 2010 MyTopo

Veg Plot 4 placement was chosen as a representative location of planted woody stems observed during Baseline/MY1 data collection. Planting Zone 3 boundary was enlarged during construction and the boundaries shown are approximations only.

PREPARED FOR:

NC Environmental Quality

1 inch = 200 feet

GRAPHIC SCALE

0 100 200 400 Feet

CURRENT CONDITION PLAN VIEW

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT
EEP PROJECT #747

ALAMANCE COUNTY, NC

FIGURE

2-1

MONITORED BY:

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LEGEND

- Conservation Easement
- Cattle Exclusion Fencing
- Photopoints
- Enhancement II
- No Credit
- Preservation
- Existing Ponds
- Existing Wetlands
- 2' Contour

Planting Zones

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YEAR 5 CONDITIONS

Vegetation Plot Condition

- Criteria Met
- Criteria Unmet

In-Stream Structure Condition

- At-grade Crossing (Stable)
- Step Pool (Stable)

NOTES:

Aerial Imagery: Terrain Navigator Pro
© 2010 MyTopo

Veg Plot 4 placement was chosen as a representative location of planted woody stems observed during Baseline/MY1 data collection. Planting Zone 3 boundary was enlarged during construction and the boundaries shown are approximations only.

PREPARED FOR:

NC Environmental Quality

1 inch = 200 feet

GRAPHIC SCALE

0 100 200 400 Feet

CURRENT CONDITION PLAN VIEW

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT
EEP PROJECT #747

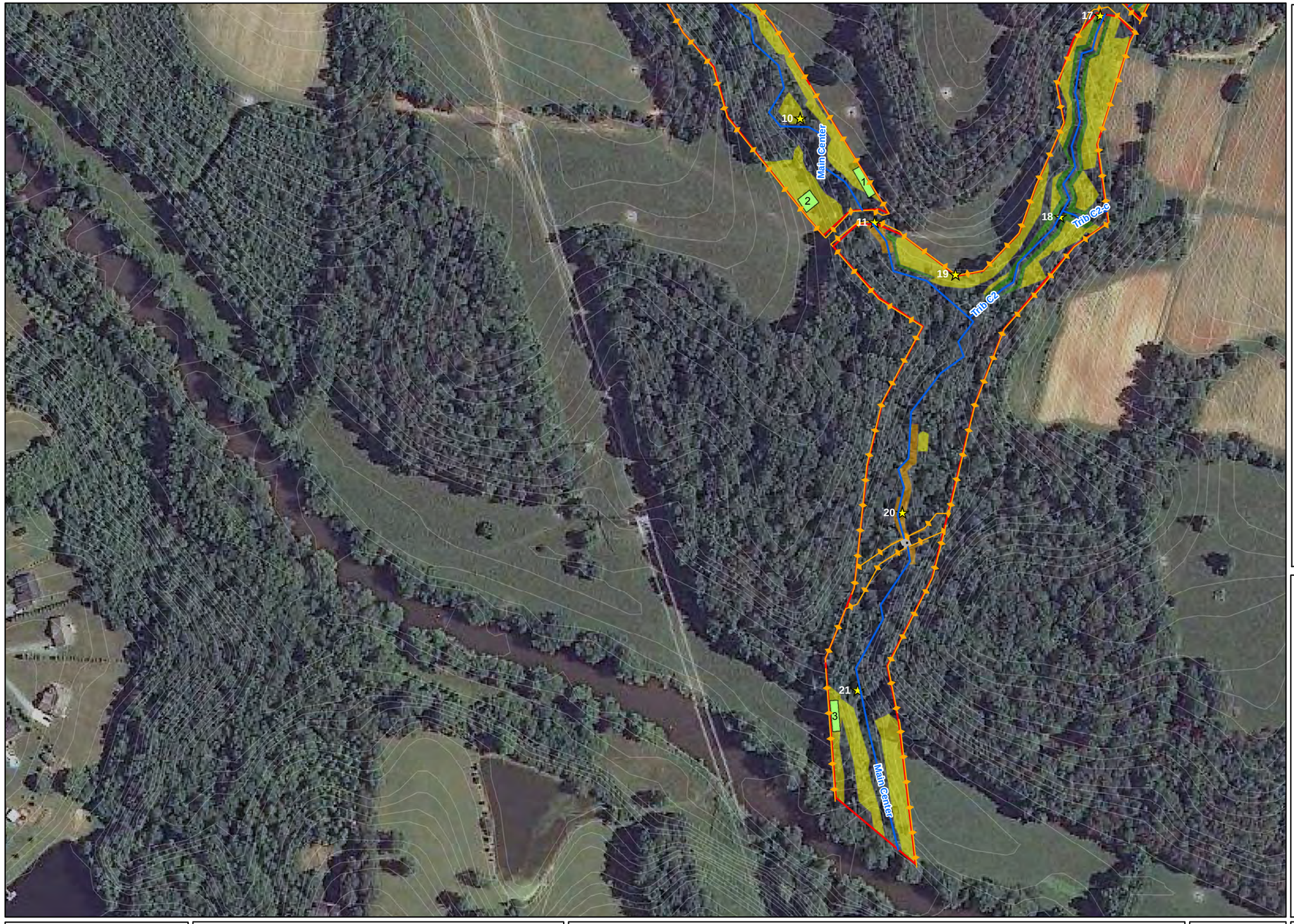
ALAMANCE COUNTY, NC

FIGURE

2-2

MONITORED BY:

CALYX ENGINEERS + CONSULTANTS



LEGEND

- Conservation Easement
- Cattle Exclusion Fencing
- Photopoints
- Enhancement II
- No Credit
- Preservation
- Existing Ponds
- Existing Wetlands
- 2' Contour

Planting Zones

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- Zone 2 - Riparian
- Zone 3 - Upland
- Zone 4 - Wetland Seep

YEAR 5 CONDITIONS

Vegetation Plot Condition

- Criteria Met
- Criteria Unmet

In-Stream Structure Condition

- At-grade Crossing (Stable)
- Step Pool (Stable)

NOTES:

Aerial Imagery: Terrain Navigator Pro
© 2010 MyTopo

Veg Plot 4 placement was chosen as a representative location of planted woody stems observed during Baseline/MY1 data collection. Planting Zone 3 boundary was enlarged during construction and the boundaries shown are approximations only.

PREPARED FOR:

NC Environmental Quality

1 inch = 200 feet

GRAPHIC SCALE

0 100 200 400 Feet

CURRENT CONDITION PLAN VIEW

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT
EEP PROJECT #747

ALAMANCE COUNTY, NC

FIGURE

2-3

MONITORED BY:

CALYX ENGINEERS + CONSULTANTS

LEGEND

- Conservation Easement
- Cattle Exclusion Fencing
- Photopoints
- Enhancement II
- No Credit
- Preservation
- Existing Ponds
- Existing Wetlands
- 2' Contour

Planting Zones

- Zone 1 - Stream Banks
- Zone 2 - Riparian
- Zone 3 - Upland
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YEAR 5 CONDITIONS

Vegetation Plot Condition

- Criteria Met
- Criteria Unmet

In-Stream Structure Condition

- At-grade Crossing (Stable)
- Step Pool (Stable)

NOTES:

Aerial Imagery: Terrain Navigator Pro
© 2010 MyTopo

Veg Plot 4 placement was chosen as a representative location of planted woody stems observed during Baseline/MY1 data collection. Planting Zone 3 boundary was enlarged during construction and the boundaries shown are approximations only.

PREPARED FOR:

NC Environmental Quality

1 inch = 200 feet

GRAPHIC SCALE

0 100 200 400 Feet

CURRENT CONDITION PLAN VIEW

UT TO HAW RIVER STREAM ENHANCEMENT PROJECT
EEP PROJECT #747

ALAMANCE COUNTY, NC

FIGURE

2-4

MONITORED BY:

CALYX ENGINEERS + CONSULTANTS

Table 5. Vegetation Assessment - UT to Haw River Stream Enhancement Project (#747) - MY5 (2016)

Planted Acreage[1]	5.03

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0	0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0%
			Total	**0**	**0**	**0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0	0%
			Cumulative Total	**0**	**0**	**0%**

Easement Acreage[2]	39.4

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[3]	Areas or points (if too small to render as polygons at map scale).	1000 sf	Pattern and Color	0	0	0%
5. Easement Encroachment Areas[4]	Areas or points (if too small to render as polygons at map scale).	None	Pattern and Color	0	0	0%

1 = Total planted acreage within the easement.

2 = Total acreage within the easement boundaries.

3 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage.

4 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage.

Photo Point 1: Looking Upstream on Main West

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 1: Looking Downstream on Main West

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 2: Looking Upstream on Main West

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 2: Looking Downstream on Main West

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 3: Looking Upstream Main West

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 3: Looking Downstream Along Main West

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 4: Looking Upstream Along Main West

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 4: Looking Downstream Along Main West

As-Built/Year 1 Survey: August 2012

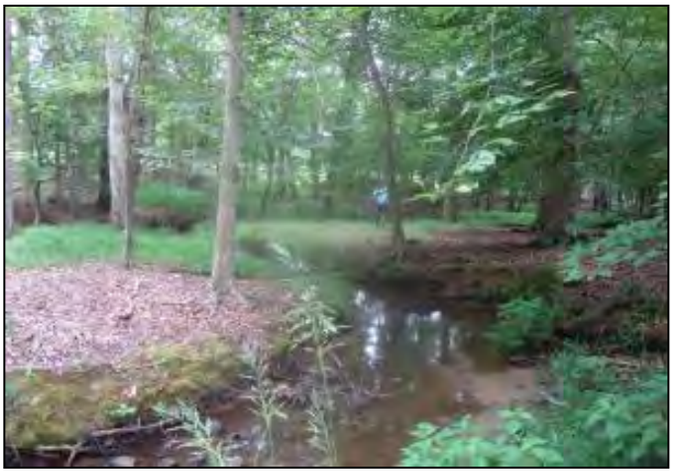
Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 5: Looking Downstream Along Main Center



As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 6: Looking Across Trib C1 Crossing

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 6: Looking Downstream Along Trib C1

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 7: Looking Upstream Along Trib C1

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: November 2009

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 7: Looking Downstream Along Trib C1

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 8: Looking Upstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 8: Looking Downstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 9: Looking Upstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 9: Looking Downstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 10: Looking Upstream Along Main Center (across planted area)

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 10: Looking Downstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 11: Looking Upstream Along Main Center at Crossing

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 11: Looking Downstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 12: Looking Downstream Along C2-b

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 13: Looking Downstream Along C2

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 14: Looking Downstream Along C2-a

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 15: Looking Upstream Along Fence on Trib C2 at Pond

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 16: Looking Upstream Along Trib C2

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 16: Looking Downstream Along Trib C2

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 17: Looking Upstream Along Trib C2 at Step Pool

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 17: Looking Downstream Along Trib C2

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 18: Looking Upstream Along Trib C2

As-Built/Year 1 Survey: August 2012

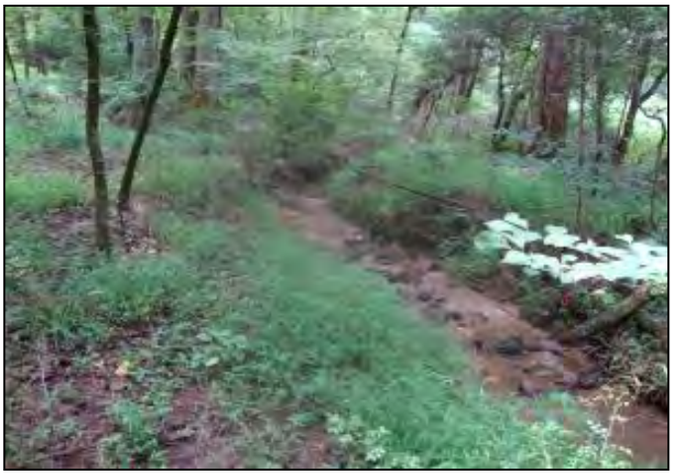
Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 18: Looking Downstream Along Trib C2



As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 18: Looking Upstream Along Trib C2-c

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

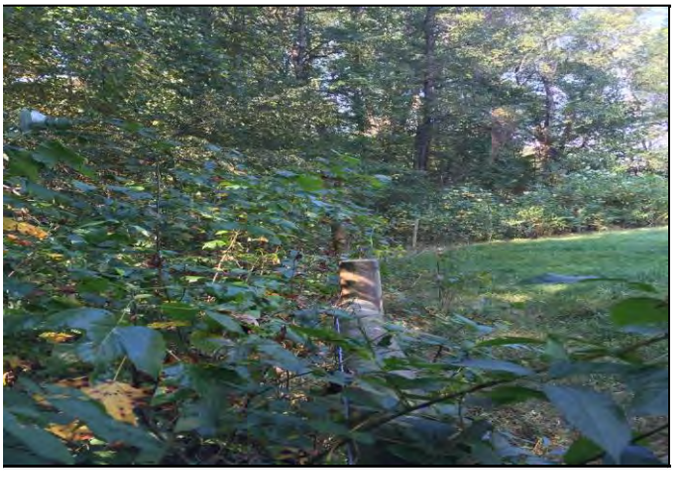
Photo Point 19: Looking Downstream Along Main Center - Invasive Management

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015



Year 5 Monitoring: September 2016

Photo Point 19: Looking Upstream Along Trib C2 - Invasive Management

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 20: Looking Upstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 20: Looking Downstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 21: Looking Upstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 21: Looking Downstream Along Main Center

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 22: Looking Upstream Along Southeast Tributary

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 22: Looking Downstream Along Southeast Tributary

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 23: Looking Upstream Along Southeast Tributary

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 23: Looking Downstream Along Southeast Tributary

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 24: Looking Upstream Along Main East

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

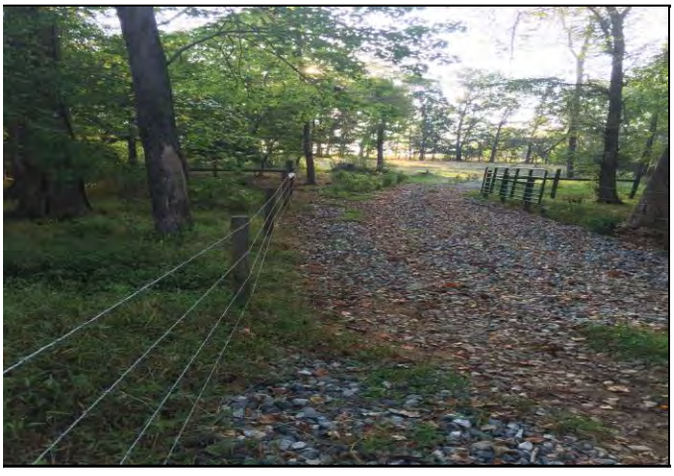
Photo Point 24: Looking Across Main East at Upper Crossing

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015



Year 5 Monitoring: September 2016

Photo Point 24: Looking Downstream Along Main East

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 25: Looking Upstream Along Trib E1

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

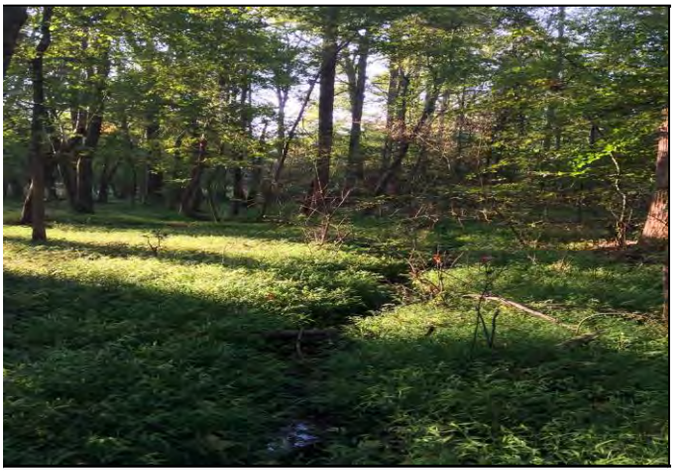
Photo Point 25: Looking Downstream Along Trib E1

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015



Year 5 Monitoring: September 2016

Photo Point 26: Looking Upstream Along Trib E2

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 26: Looking Downstream Along East 2

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 27: Looking Upstream Along Main East

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 27: Looking Downstream Along Main East

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

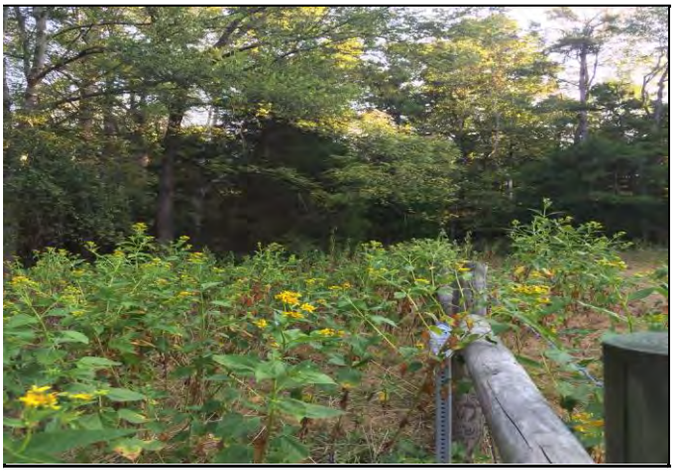
Photo Point 28: Looking Upstream Along Trib E3

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015



Year 5 Monitoring: September 2016

Photo Point 28: Looking Across Trib E3 Crossing

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 28: Looking Downstream Along Trib E3

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 29: Looking Upstream Along Main East

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 29: Looking Across Main East at Lower Crossing

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 29: Looking Downstream Along Main East

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Photo Point 30: Looking Upstream Along Main East

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

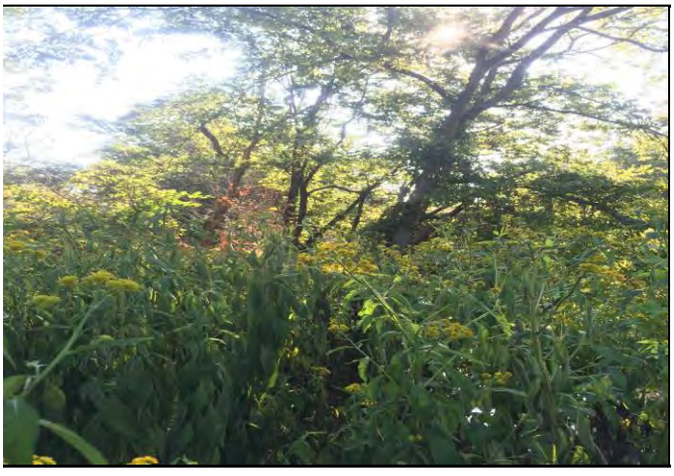
Photo Point 30: Looking Across Main East

As-Built/Year 1 Survey: August 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015



Year 5 Monitoring: September 2016

APPENDIX C
Vegetation Plot Data

Table 6. Vegetation Plot Attributes and Criteria Attainment - MY5 (2016)
UT to Haw River Stream Enhancement Project (#747)

Plot ID	Community Type	Planting Zone ID	Reach ID	Associated Gauges(s)	Method	CVS Level	Survival Threshold Met?	Tract Mean
1	Mesic Mixed Hardwood	3	Main Center	NA	CVS	I&II	Yes	100%
2	Mesic Mixed Hardwood	3	Main Center	NA	CVS	I&II	Yes	
3	Mesic Mixed Hardwood	3	Main Center	NA	CVS	I&II	Yes	
4	Mesic Mixed Hardwood	3	Main East	NA	CVS	I&II	No	0%

Table 7. CVS Vegetation Metadata Table - UT to Haw River Stream Enhancement Project (#747)
MY5 (2016)

Report Prepared By	Brian Dustin
Date Prepared	9/16/2016 13:04
database name	2016 cvs-eep-entrytool-v2.3.1.mdb
database location	G:\Project\2012\2012058.00\ENV\MONITORING\Monitoring Year 5\CVS
computer name	BDUSTIN-7
file size	64225280

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
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 by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems 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	747
Project Name	UT to Haw River
Description	The Unnamed Tributary (UT) to Haw River Stream Enhancement Site (Site) is situated in the northwest corner of Alamance County, North Carolina. Specifically, the Site is located on multiple UTs to the Haw River approximately 2.8 miles southeast of the Tow
River Basin	Cape Fear
Length(ft)	
Stream-to-edge width (ft)	
Area (sq m)	15742
Required Plots (calculated)	6
Sampled Plots	4

Table 8. Planted and Total Stem Counts (Species by Plot with Annual Means) - UT to Haw River Stream Enhancement Project (#747) - MY5 (2016)																					
			Current Data (MY5 2016)								Annual Means										
			Plot 1		Plot 2		Plot 3		Plot 4		Baseline/MY1		MY2		MY3		MY4		MY5		
Species	**Common Name**	**Type**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	**P**	**T**	
Acer negundo	Boxelder	T												1							
Carpinus caroliniana	Ironwood	T					1	1			2	2	2	2	1	1	1	1	1	1	
Celtis laevigata	Sugarberry	T									1	1	1	1							
Cercis canadensis	Redbud	T									2	2	2	2	0	0	1	1			
Diospyros virginiana	Persimmon	T	1	1	1	3					4	4	3	5	3	5	1	4	2	4	
Fraxinus pennsylvanica	Green ash	T							2	2	1	1	1	2	2	7	1	2	2	2	
Hamamelis virginiana	Witch hazel	T	3	3							4	4	4	4	3	3	4	4	3	3	
Ilex decidua	Deciduous holly	S							1	1	1	1	1	1	1	1	1	1	1	1	
Ilex opaca	American holly	T									1	1	1	1	0	0	1	1	0	0	
Juniperus virginiana	Eastern redcedar	T						5		1										6	
Juglans nigra	Black walnut	T												1							
Liquidambar styraciflua	Sweetgum	T		10		4		6		5				33		42		18		25	
Liriodendron tulipifera	Tulip poplar	T		9	3	3					1	1	2	34	3	24	2	16	3	12	
Quercus alba	White oak	T	3	3	3	3	5	5	1	1	10	10	10	10	10	10	8	8	12	12	
Quercus nigra	Water oak	T							1	1	1	1	1	1	1	1	1	1	1	1	
Quercus rubra	Northern Red oak	T									1	1	1	1	0	0	1	1			
Rhus typhina	Staghorn Sumac	S														2	0	1			
Viburnum dentatum	Arrow wood	S			1	1	1	1			2	2	3	3	3	3	0	1	2	2	
Viburnum prunifolium	Black haw	S									1	1									
	Unknown										1	1									
	Stem count		7	26	8	14	7	18	5	11	33	33	32	102	27	99	22	60	27	69	
	Size (acres)		1		1		1		1		4		4		4		4		4		
	Size (acres)		0.02		0.02		0.02		0.02		0.10		0.10		0.10		0.10		0.1		
	Species Count		3	5	4	5	3	5	4	6	15	15	13	16	12	14	13	14	10	12	
	Stems per acre		283.4	1052.6	323.89	566.8	283.4	728.74	202.43	445.34	334.01	334.01	323.89	1032.4	273.28	1002	220.00	1032.40	270.00	690	

Type = T - Tree, S- Shrub, H - Herb, L - Livestake

P = Planted

T = Total

VEGETATION PLOT PHOTOGRAPHS

Vegetation Plot 1

As-Built Survey/Year 1 Monitoring: September 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Vegetation Plot 2

As-Built Survey/Year 1 Monitoring: September 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

VEGETATION PLOT PHOTOGRAPHS

Vegetation Plot 3

As-Built Survey/Year 1 Monitoring: September 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016

Vegetation Plot 4

As-Built Survey/Year 1 Monitoring: September 2012

Year 2 Monitoring: October 2013

Year 3 Monitoring: August 2014

Year 4 Monitoring: August 2015

Year 5 Monitoring: September 2016