UT to Barnes Stream and Wetland Restoration
Project No. 397
2008 Monitoring Report (Final): Year 3 of 5

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EXECUTIVE SUMMARY

Executive Summary

The unnamed tributary (UT) to Barnes Creek Stream and Wetland Restoration Project (Site) is located north of Town of Troy in Montgomery County, North Carolina. Prior to restoration, wetland, stream, and buffer functions on the site were impaired as a result of agricultural conversion. Streams flowing through the site were channelized many years ago to reduce flooding and provide drainage for adjacent farm fields. According to the mitigation plan, the Site was restored by relocating 3,916 linear feet (lf) of stream (Priority 1 and 2) and 1.38 acres (ac) of wetlands, and enhancing 3.14 ac of wetlands. UT to Barnes Creek's riparian areas were planted to improve habitat and stabilize streambanks. The following specific goals were established for the Site (The lf and ac listed in the project goals below are not the same as the final as-built lf and acreage for stream and wetland restoration/enhancement work completed).

1. Restore 4,063 lf of channel dimension, pattern and profile.
2. Enhance 3.12 ac of existing wetlands by planting vegetation in previous grazed wetland areas.
3. Restore wetland hydrology to 1.38 ac of wetland by raising the water table, restoring over bank flooding, and increasing surface storage.
4. Create 0.39 acres of wetland as ephemeral pools in the existing stream bed after construction for the proposed meandering channel.
5. Improve floodplain functionality by matching floodplain elevations with the bankfull stage.
6. Establish native streambank and floodplain vegetation in the buffer.
7. Improve the water quality in the Barnes Creek watershed by fencing cattle out of the stream and reducing bank erosion.
8. Improve in-stream and riparian habitat by creating deeper pools, areas of re-aeration, planting a riparian buffer, and reducing bank erosion.

This report serves as the 3rd year of the 5 year monitoring plan for the Site.

The 2008 vegetation monitoring indicated an average survivability of 360 stems per acre, which is greater than the required vegetation survival criteria of 320 stems per acre surviving after the third growing season. The survival rate for the planted woody vegetation monitored for 2008 is 64%, which is up 9% from previous data recorded in 2007. A survivability increase is most likely due to the resprouting of suspected dead stems recorded by Rummel, Klepper & Kahl, LLP (RK&K) in 2007. The monitoring data indicates an average of 9 stems per plot.

Results from the 2008 stream monitoring effort indicate that stream pattern, profile, and dimension of UT Barnes and its tributary are maintaining vertical and lateral stability with minimal problem areas. A few problem areas were observed, such as moderate bank erosion, in-stream vegetation, beaver dams, and inundation/back water areas. Areas with in-stream vegetation growth could potentially result in localized areas of aggradation, and lead to lateral and/or vertical shifts in the stream. These areas will continue to be monitored closely for significant adjustments in the bed features and the channel thalweg. It is recommended that the beaver activity and the associated dams should be removed to prevent inundation areas from evolving and to restore the natural hydrologic flow regime.

There were no problem areas observed within the wetland restoration zones for the Site. With the exception of groundwater gauge MW3, all gauges on site achieved the wetland success criterion of soil saturation within the upper 12 inches for 29 consecutive days, which is 12.5 percent of the March 19 to November 16 (243 days) growing season. However, for this monitoring report hydrologic data is shown through September 30 due to report submittal due dates. The general success of hydrology within the wetland restoration zones is adequate to meet success requirements. Surface inundation to ground saturation was observed throughout the site; therefore, appropriate hydrological condition for the wetland zones appears to be present.

Overall, the Site appears to be stable and has met stream, vegetation, and wetland mitigation goals for monitoring year 3.

SECTION 1
PROJECT BACKGROUND

SECTION 1
PROJECT BACKGROUND

The background information provided in this report is referenced from the mitigation plan and previous monitoring reports prepared by Baker Engineering (2007) and RK&K (2008).

1.1 Location and Setting

The Site is located north of the Town of Troy in Montgomery County, North Carolina (Figure 1.1). The restoration site is located within the Carolina Slate Belt Eco-Region of the Piedmont physiographic region in the Yadkin River Basin (USGS HUC 03040103).

To access the site from Charlotte, take US-74 east to NC-27/NC-24 east. Continue on NC-24 east until you reach the Town of Troy. In the Town of Troy, turn north on route 109. Follow 109 north for approximately 9.2 miles, then turn left onto Abner Road (NC-1311). Take Abner Road for 1.5 miles and then turn left onto Flint Hill Road. After approximately 2 miles, the restoration project will be located on the right before Love Joy Road.

1.2 Mitigation Structure and Objectives

Prior to restoration, wetland, stream, and buffer functions on the site were impaired as a result of agricultural conversion. Streams flowing through the site were channelized many years ago to reduce flooding and provide drainage for adjacent farm fields. According to the mitigation plan, the Site was restored by relocating 3,916 lf of stream (Priority 1 and 2) and 1.38 ac of wetlands, and enhancing 3.14 acres of wetlands (Table 1.1). UT to Barnes Creek's riparian areas were planted to improve habitat and stabilize streambanks.

The following specific goals were established for the Site (The lf and ac listed in the project goals below are not the same as the final as-built lf and acreage for stream and wetland restoration/enhancement work completed).

1. Restore 4,063 lf of channel dimension, pattern and profile.
2. Enhance 3.12 ac of existing wetlands by planting vegetation in previous grazed wetland areas.
3. Restore wetland hydrology to 1.38 ac of wetland by raising the water table, restoring over bank flooding, and increasing surface storage.
4. Create 0.39 acres of wetland as ephemeral pools in the existing stream bed after construction for the proposed meandering channel.
5. Improve floodplain functionality by matching floodplain elevations with the bankfull stage.
6. Establish native streambank and floodplain vegetation in the buffer.
7. Improve the water quality in the Barnes Creek watershed by fencing cattle out of the stream and reducing bank erosion.

8. Improve in-stream and riparian habitat by creating deeper pools, areas of re-aeration, planting a riparian buffer, and reducing bank erosion.

UT to Barnes stream channels were designed and constructed as C-type channels. In-stream structures, such as rootwads, log vanes, cross vanes, rock vanes, rock weirs, and log weirs were used to control streambed grade, reduce stresses on stream banks, and promote bed form sequences and habitat diversity. Where grade control was a consideration, constructed riffles or rock weirs were installed to provide long-term stability. Stream banks were stabilized using a combination of erosion control matting, bare-root plantings, brush mattresses, and transplants. The Site was planted with native riparian vegetation and fenced around the permanent conservation easement. Wetland restoration on the Site consisted of raising the local water table and restoring a natural flooding regime. Drainage ditches within the restoration areas were filled to decrease surface and subsurface drainage and raise the local water table.

Table 1.1
Project Mitigation Structure and Objectives
UT to Barnes Creek/Project No. 397

Segment/Reach	Mitigation Type	Approach	Linear Footage or Acres	Stationing (ft)	Comments
Main Channel	R	P1/ P2	3,305 lf	0+00-33+05	Channel restoration, relocation with use of grade control and bank protection structures.
Tributary	R	P2	611 lf	0+00-6+11	Channel restoration, relocation with use of grade control and bank protection structures.
Wetland Enhancement	E	---	3.14 ac	---	Enhancement of jurisdictional wetland.
Wetland Restoration	R	---	1.38 ac	---	Restoration of wetlands.

Component Summations						
Restoration Level	Stream (lf)	Wetland (ac)		Upland (ac)	Buffer (ac)	BMP
		Riparian	Non-Riparian			
Restoration (R)	3,916	1.38	N/A	N/A	N/A	N/A
Enhancement (E)	N/A	3.14	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)	N/A	N/A	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	**3,916**	**4.52**	**N/A**	**N/A**	**N/A**	**N/A**

*The final linear footage and acreage listed above is based on the as-built values constructed on-site.

1.3 Project History and Background

The stream enhancement/restoration plan was designed by Baker Engineering and constructed by North State Environmental, Inc. Construction activities were completed in December 2005. The

first annual monitoring activities were conducted in October 2006. This report serves as year 3 of the 5 year monitoring plan for the Site. Tables 1.2 and 1.3 provide detailed project activity, history, and contact information for this project. Table 1.4 provides more in-depth watershed/site background for the project.

Table 1.2
Project Activity and Reporting History
UT to Barnes Creek/Project No. 397

Activity or Report	Scheduled Completion	Data Collection Completed	Actual Completion or Delivery
Restoration Plan	March 2004	NA	N/A
Final Design-90%	March 2005	NA	July 2005
Construction	July 2005	NA	March 2006
Temporary S&E mix applied to entire project area*	NA	NA	March 2006
Permanent seed mix applied to entire project area	NA	NA	March 2006
Planting of live stakes and bare root trees	Unknown	NA	March 2006
Mitigation Plan/ As-Built (Year 0 Monitoring)	September 2005	June 2006	July 2006
Year 1 Monitoring	November 2006	October 2006	March 2007
Year 2 Monitoring	November 2007	November 2007	March 2008
Year 3 Monitoring	2008	TBD	TBD
Year 4 Monitoring	2009	TBD	TBD
Year 5 Monitoring	2010	TBD	TBD

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

Table 1.3
Project Contacts
UT to Barnes Creek/Project No. 397

Designer	Baker Engineering 1447 South Tryon, Suite 200 Charlotte, NC 28203
Construction	North State Environmental, Inc. 2889 Lowery Street Winston-Salem, NC 27101
Planting Contractor	North State Environmental, Inc.
Seeding Contractor	North State Environmental, Inc.
Monitoring Performers	
Year 1	Baker Engineering 1447 South Tryon, Suite 200 Charlotte, NC 28203
Year 2	Rummel, Klepper & Kahl, LLP 900 Ridgefield Drive Suite 350 Raleigh, NC 27609
Year 3	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	
Wetland Monitoring, POC	

Table 1.4
Project Background
UT to Barnes Creek/Project No. 397

Project County	Montgomery County, North Carolina
Drainage Area: UT to Barnes (Main Channel) Tributary	 2.0 sq.mi. 0.18 sq.mi.
Drainage impervious cover estimate: UT to Barnes (Main Channel) Tributary	 <5% <5%
Stream Order: UT to Barnes (Main Channel) Tributary	 2nd 1st
Physiographic Region	Piedmont
Ecoregion	Carolina Slate Belt
Rosgen Classification of As-built: UT to Barnes (Main Channel) Tributary	 C C
Cowardin Classification	Riverine, Lower Perennial, Unconsolidated Bottom, Cobble-Gravel
Dominant Soil Types: UT to Barnes (Main Channel) Tributary	 Chenneby Silt Loam and Herndon Silt Loam Chenneby Silt Loam
Reference site ID	Spencer Creek and UT to Spencer Creek
USGS HUC for Project	0304010305
NCDWQ Sub-basin for Project and Reference	03-07-09
NCDWQ classification for Project and Reference	C
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%

1.4 Monitoring Plan View

The monitoring plan view map (Figure 1.2) illustrates the location of the longitudinal profile stations, cross-section stations, vegetation plots, hydrologic gauges, and photo points. The UT to Barnes Creek project was divided into three reaches by the previous designer/monitoring consultant. For JJG's monitoring and analysis purposes, the on-site streams are referenced as the UT Barnes main reach, two reaches along the main stem of the UT to Barnes Creek (Hurley and Harris Reaches), and the UT Barnes tributary, previously referred to as the Harris tributary.

SECTION 2

PROJECT CONDITION AND MONITORING RESULTS

SECTION 2

PROJECT CONDITION AND MONITORING RESULTS

The following monitoring results are from the 2008 (year 3 of 5) survey.

2.1 Vegetation Assessment

2.1.1 Soil Data

UT to Barnes Creek is situated within an agricultural valley in the Carolina Slate Belt of the North Carolina Piedmont Physiographic Province.

Review of the *Soil Survey of Montgomery County, North Carolina* (*USDA-NRCS-1968*, in Baker Engineering, 2007) indicates that two soil series are found within the project limits (Table 2.1). These soil series consist of Chenneby Silt Loam and Herndon Silt Loam in the main reach and Chenneby Silt Loam in the tributary. Chenneby silt loams are typically on slopes from 1 to 2 percent in frequently flooded areas and generally have a very deep soil profile, somewhat poor-drainage, moderate permeability, and a very shallow depth to the seasonal high water table. Herndon silt loams are typically well-drained and well suited for pastureland and occur on slopes between 15 to 25 percent.

Table 2.1
Preliminary Soil Data
UT to Barnes Creek/Project No. 397

Series	Max Depth (in)	% Clay on Surface	K Factor	T Factor	OM %
Chenneby Silt Loam	72	12-27	0.37	5	0.5-3
Herndon Silt Loam	68	5-27	0.43	5	0.5-1

2.1.2 Vegetative Current Condition

Please refer to Appendix 1.1 and 1.2 for more details on vegetative current condition areas and photos.

2.1.3 Vegetative Current Condition Plan View

Please refer to Appendix 4 for location of vegetative current conditions on-site and Appendix 1.2 for representative vegetation current condition photos.

2.1.4 Stem Counts

JJG conducted the 2008 (year 3 of 5) vegetative assessment and vegetative plot analysis in June 2008. Four vegetation monitoring plots 100 m^2 (10m x 10m) in size were previously established

on site by Baker Engineering. Vegetation assessments were conducted following the DOT Stem Counting Protocol which consists of counting woody stems within the established vegetation plots.

The seed mix of herbaceous species applied to the project's riparian area included bushy seedbox (*Ludwigia alternifolia*), little bluestem (*Schizachyrium scoparium*), wool grass (*Scirpus cyperinus*), river oats (*Uniola latifolia*), white clover (*Trifolium repens*), fringed sedge (*Carex crinata*), soft rush (*Juncus effusus*), Virginia wild rye (*Elymus virginica*), and switchgrass (*Panicum virgatum*). This seed mixture was broadcast on the site at a rate of 21 pounds per acre. All planting was completed in the spring of 2006. The taxonomic standard used was "Flora of the Carolinas, Virginia, Georgia, and surrounding areas" by: Alan S. Weakley.

The 2008 vegetation monitoring indicated an average survivability of 360 stems per acre, which is greater than the required vegetation survival criteria of 320 stems per acre surviving after the third growing season. The survival rate for the planted woody vegetation monitored for 2008 is 64%, which is up 9% from previous data recorded in 2007. A survivability increase could most likely be due to the resprouting of suspected dead stems recorded by RK&K Engineers in 2007. The monitoring data indicates an average of 9 stems per plot.

Although all plots met the vegetation success threshold with the exception of plot 3, the results from plot 3 did not affect the Site's average survivability to be considered unsuccessful. The Site has exceeded the predicted number of stems per acre. In conclusion, the riparian restoration project meets the requirements per the success criterion for the 2008 monitoring year. Refer to Appendix 1.1 for vegetation raw data and Table 2.2 for a summary of stem counts for planted species recorded by plot for the 2008 monitoring year.

Table 2.2
Stem Counts for Planted Species Arranged by Plot
UT to Barnes Creek/Project No. 397

Stem Counts for Planted Species Arranged by Plot – MY-2008							
	Vegetation Plots Monitored (MY-2008)				MY1 - 2006	MY2 - 2007	MY3 - 2008
Species	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Totals**	**Totals**	**Totals**
Acer rubrum		2	1		**3**	**4**	**3**
Betula nigra	1	2	2	4	**14**	**6**	**9**
Cornus amomum	1				**6**	**5**	**1**
Carpinus caroliniana				1			**1**
Lindera benzoin				1	**6**	**4**	**1**
Nyssa sylvatica			1		**3**	**3**	**1**
Platanus occidentali	3		2	4	**3**	**1**	**9**
Quercus falcata		3			**9**	**8**	**3**
Quercus lyrata			1		**2**	**3**	**1**
Quercus spp	1	1		1	**2**	**2**	**3**
Unknown	2	1			**7**	**5**	**3**
Total Planted Live Stems (2008)	**8**	**9**	**7**	**11**	**N/A**	**N/A**	**24**
Average # of Stems (2008)	**9**						
Stem Density (2008)	**360**						
Percent Survival (2008)	**50%**	**56%**	**64%**	**85%**	**Avg=64%**		
Volunteer Stems							
Species	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Totals**	**Totals**	**Totals**
Betula nigra				1			**1**
Carya cordiformis		2					**2**
Cornus amomum				1			**1**
Liquidambar styraciflua		7			*		**7**
Sambueus canadensis		1					**1**
Salix nigra	1						**1**
Total Volunteer Stems (2008)	1	10	0	2			**13**

*Data was not provided in previous monitoring reports

2.1.5 Vegetation Plot Photos

Please refer to Appendix 1.3 for photographs of the monitoring plots.

2.2 Stream Assessment

Stream dimension, pattern, profile, and substrate were evaluated within 3,916 linear feet of the Site. Please refer to Table 2.3 for a summary of the visual stability assessment, Table 2.4 for the as-built morphology and hydraulic summary, Table 2.5 for morphology and hydraulic summary, Table 2.6 for hydrologic criteria, and Appendix 2 for more detailed stream data tables and plots.

2.2.1 Stream Current Condition Plan View

Please refer to Appendix 4 for the location of stream current conditions on-site.

2.2.2 Stream Current Condition Table

Please refer to Appendix 2.1 for the stream current condition table.

2.2.3 Numbered Issues Photo Section

Please refer to Appendix 2.2 for representative stream current condition photos.

2.2.4 Fixed Photo Station Photos

Please refer to Appendix 2.3 for stream photo station photos and Appendix 2.4 for stream cross-section photos.

2.2.5 Stability Assessment

The majority of the project conditions reflected the as-built drawings. The following general observations were noted.

- The pattern, profile, and dimension of the restored main channel and its tributary appear stable.
- There were several areas of emergent wetland vegetation such as various grasses, broad-leaved cattail *(Typha latifolia,)* and soft rush *Juncus effusus).* Primarily, this in-stream vegetation growth is occurring along constructed riffles.
- Moderate bank erosion is occurring along a few areas of the main channel. Most erosion is minor, but below the cross vane at stationing 1+50, the erosion appears to be the greatest. This is most likely due to the fact that two culverts discharge into a plunge pool directly upstream of this bank erosion condition.
- One log vane has bank scour occurring behind the root ball of the log (approximate stationing 6+31).
- Two beaver dams were located along the main channel (approximate stationing 2+39 and 15+50). The most upstream dam (station 2+39) has resulted in channel inundation above the top of bank upstream of the dam; however, the water levels above the downstream dams are still within the channel, but near the bankfull elevation (top of bank).
- Heavy sediment deposition is occurring within the tributary.

Main Channel

Overall, the present stream dimensions in the main channel appear to be stable. The average bankfull width (19.50 ft) of the surveyed cross-sections is higher than the proposed 18.8 ft, and the average surveyed mean bankfull depth is 1.6 ft compared to the proposed 1.4 ft. The surveyed bankfull widths and depths lead to an average Width/Depth ratio of 13 which typifies a

Rosgen C-type stream; however, the average Width/Depth ratio has decreased in cross-section 6 since the 2006/2007 monitoring year indicating the channel is becoming more narrow and deep. Cross-Section 3 was inundated with back water from the beaver dam located downstream at station 15+50. The channel appears to be functioning in the areas where beaver activity has not impacted the channel hydrology. It is recommended that the beaver activity and the associated dams should be removed to prevent inundation areas from evolving and to restore the natural hydrologic flow regime.

The reach appears to be maintaining vertical and lateral stability with minimal bank erosion. Areas with in-stream vegetation growth could potentially result in localized areas of aggradation; therefore leading to lateral and/or vertical shifts in the stream. These areas will continue to be monitored closely for significant adjustments in the bed features and channel thalweg. The thalweg profile appears to be stable, and was characterized by well-defined riffle and pool features. The average water surface slope and the average bankfull slope were very similar for the surveyed reach, 0.0053 ft/ft and 0.0054 ft/ft, respectively. Shifts in pool to pool spacing could be due to the increase in compound pools forming throughout the restoration site. For the 2007 monitoring year, the pool furthest downstream within the compound pool was counted for pool to pool spacing measurements. From the 2008 monitoring year, the substrate analysis illustrates a significant shift in bed materials; however, this change is most likely due to the back water conditions occurring from existing beaver activity within the restoration site.

Tributary

Based on current monitoring data and the visual inspection, the channel seems to be functioning properly and maintaining stability. The average bankfull width (16.30 ft) of the surveyed cross-sections is higher than the proposed 14.40 ft, and the average surveyed mean bankfull depth is 0.8 ft compared to the proposed 0.7 ft. The surveyed bankfull widths and depths lead to an average Width/Depth ratio of 20.2 which typifies a Rosgen C-type stream. The thalweg profile appears to be stable, and was characterized by well-defined riffle and pool features. The average water surface slope and the average bankfull slope were very similar for the surveyed reach, 0.0096 ft/ft and 0.0093 ft/ft, respectively.

From the 2008 monitoring year, the substrate analysis illustrates a significant shift in bed materials, which indicates a high sedimentation rate is occurring throughout the tributary. Conditions such as in-stream vegetation growth and drought conditions in previous years could have attributed to the high silt deposition within the reach.

Overall, the main channel and its tributary appear to be maintaining grade with stable structures and minimal bank erosion.

Table 2.3
Categorical Stream Feature Visual Stability Assessment
UT to Barnes Creek/Project No. 397

Feature	Initial-2006	MY1-2007	MY2-2008	MY3-2009	MY4-2010	MY5-2011
A. Riffles	100%	100%	100%	90%		
B. Pools	100%	100%	100%	100%		
C. Thalweg	100%	100%	100%	100%		
D. Meanders	100%	100%	100%	100%		
E. Bed General	100%	100%	100%	100%		
F. Bank	*	*	*	100%		
G. Vanes	100%	100%	100%	0%		
H. Wads/ Boulders	100%	100%	100%	95%		

*Data was not provided

2.2.6 Quantitative Measures Tables

Tables 2.4 and 2.5 display morphological summary data for baseline as-built conditions and for the 2006, 2007, and 2008 monitoring year. Please refer to Appendix 2 for morphological plots and raw data tables.

Table 2.4
Baseline Morphology and Hydraulic As-Built Summary
UT to Barnes Creek/Project No. 397
(Noted as Hurley Reach in previous monitoring reports)

Parameter	Pre-Existing Condition			Reference Reach Data			Reference Reach Data			Design			As-built		
DIMENSION	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
Bankfull Width (ft)	10.8		23.1	10.7		11.2		7.0			15.0		17.0		18.8
Floodprone Width (ft)	52		92+	60		114+		81+			100+		45		151
Bankfull Mean Depth (ft)	0.9		1.7	1.6		1.8		1.1			1.4		1.0		1.4
Bankfull Max Depth (ft)	1.5		3.1	2.1		2.6		2.0			2.3		2.0		2.4
Bankfull Cross Sectional Area (ft2)	17.2		21.0	17.8		19.7		7.7			20.6		19.0		23.5
Width/Depth Ratio	6.8		25.9	5.8		7.1		6.4			10.9		12.5		18.7
Entrenchment Ratio	2.3		9.7+	5.5		10.2		11.6		5.0		10+	2.6		8.0
Bank Height Ratio	1.0		1.4	1.0		1.0		1.0			1.0		1.0		1.0
Bankfull Velocity (fps)	4.6		5.6	4.9		5.4		3.2			4.7		5.1		4.1
PATTERN															
Channel Beltwidth (ft)	28.2		38.2	38.3		40.8	11.4		26.7	53.0		120.0			
Radius of Curvature (ft)	7.7		19.9	10.9		14.6	5.8		15.8	30.0		45.0			
Meander Wavelength (ft)	41.9		82.5	46.0		48.0	37.7		42.5	170.0		188.0			
Meander Width Ratio	2.0		2.9	3.4		3.6	1.6		3.8						
PROFILE															
Riffle Length (ft)															
Riffle Slope (ft/ft)	0.014		0.017	0.013			0.014			0.008		0.016			
Pool Length (ft)															
Pool Spacing (ft)	65		206	71			19		42	45		109			
SUBSTRATE															
d16 / d35 / d50 / d84 / d95	<0.062/0.125/2.0/22/64			<0.062/3.0/8.8/42/90			<0.062/0.062/1.0/16.0/22.3								
ADDITIONAL REACH PARAMETERS															
Channel length (ft)															
Drainage Area (sq.mi.)		1.70			0.96			0.01			2.00			2.00	
Rosgen Classification		E5			E4			E5							
Bankfull Discharge (cfs)		97			97			25			97			97	
SinuosityBF	---	1.24			2.32			2.45			1.43				
slope (ft/ft)	0.006		0.006		0.005			0.003			0.005				

Table 2.4 Cont.
Baseline Morphology and Hydraulic As-Built Summary
UT to Barnes Creek/Project No. 397
(Noted as Harris Reach in previous monitoring reports)

Parameter	Pre-Existing Condition			Reference Reach Data			Reference Reach Data			Design			As-built		
DIMENSION	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
Bankfull Width (ft)		8.6		10.7		11.2		7.0			15.0		17.0		18.8
Floodprone Width (ft)		70+		60		114+		81+			100+		45		151
Bankfull Mean Depth (ft)		2.0		1.6		1.8		1.1			1.4		1.0		1.4
Bankfull Max Depth (ft)		2.4		2.1		2.6		2.0			2.3		2.0		2.4
Bankfull Cross Sectional Area (ft2)		16.8		17.8		19.7		7.7			20.6		19.0		23.5
Width/Depth Ratio		4.4		5.8		7.1		6.4			10.9		12.5		18.7
Entrenchment Ratio		8.1+		5.5		10.2		11.6		5.0		10.0+	2.6		8.0
Bank Height Ratio	1.0		1.5	1.0		1.0		1.0			1.0		1.0		1.0
Bankfull Velocity (fps)		5.8		4.9		5.4		3.2			4.7		5.1		4.1
PATTERN															
Channel Beltwidth (ft)	18.9		27.9	38.3		40.8	11.4		26.7	53.0		120.0			
Radius of Curvature (ft)	7.3		19.1	10.9		14.6	5.8		15.8	30.0		45.0			
Meander Wavelength (ft)	40.5		52.6	46.0		48.0	37.7		42.5	170.0		188.0			
Meander Width Ratio	2.0		2.9	3.4		3.6	1.6		3.8						
PROFILE															
Riffle Length (ft)															
Riffle Slope (ft/ft)	0.014		0.020	0.013			0.014			0.008		0.016			
Pool Length (ft)															
Pool Spacing (ft)	65.0		206.0	71.0			19.0		41.7	45.0		109.0			
SUBSTRATE															
d16 / d35 / d50 / d84 / d95	<0.062/0.125/2.0/22/64			<0.062/3.0/8.8/42/90			<0.062/0.062/1.0/16.0/22.3								
ADDITIONAL REACH PARAMETERS															
Channel length (ft)															
Drainage Area (sq.mi.)		1.70			0.96			0.01			2.00			2.00	
Rosgen Classification		E5			E4			E5							
Bankfull Discharge (cfs)		97			97			25			97			97	
Sinuosity	---	1.24			2.32			2.45			1.43				
slope (ft/ft)	0.006		0.010		0.005			0.003			0.005				

Table 2.4 Cont.
Baseline Morphology and Hydraulic As-Built Summary
UT to Barnes Creek/Project No. 397
(Noted as Harris Tributary Reach in previous monitoring reports)

Parameter	Pre-Existing Condition			Reference Reach Data			Reference Reach Data			Design			As-built		
DIMENSION	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Max**
Bankfull Width (ft)		8.5		10.7		11.2		7.0			10.0			14.4	
Floodprone Width (ft)		92+		60		114+		81+		30		60		45	
Bankfull Mean Depth (ft)		0.8		1.6		1.8		1.1			0.8			0.7	
Bankfull Max Depth (ft)		1.6		2.1		2.6		2.0			1.3			1.4	
Bankfull Cross Sectional Area (ft2)		6.8		17.8		19.7		7.7			7.5			9.9	
Width/Depth Ratio		10.6		5.8		7.1		6.4			13.3			20.7	
Entrenchment Ratio		10.9		5.5		10.2		11.6		2.5		10.0+		3.1	
Bank Height Ratio		1.0		1.0		1.0		1.0			1.0			1.0	
Bankfull Velocity (fps)		4.0		4.9		5.4		3.2			3.6			2.7	
PATTERN															
Channel Beltwidth (ft)				38.3		40.8	11.4		26.7	35.0		80.0			
Radius of Curvature (ft)				10.9		14.6	5.8		15.8	20.0		30.0			
Meander Wavelength (ft)				46.0		48.0	37.7		42.5	113.0		125.0			
Meander Width Ratio				3.4		3.6	1.6		3.8	3.5		80.0			
PROFILE															
Riffle Length (ft)															
Riffle Slope (ft/ft)	0.020		0.026	0.013			0.014			0.011		0.021			
Pool Length (ft)															
Pool Spacing (ft)	29.4		129.7	71.0			19.0		41.7	22.2		57.5			
SUBSTRATE															
d16 / d35 / d50 / d84 / d95	<0.062/0.062/1.0/16/21			<0.062/3.0/8.8/42/90			<..062/0.062/1.0/16.0/22.3								
ADDITIONAL REACH PARAMETERS															
Channel length (ft)															
Drainage Area (sq.mi.)	0.20			0.96			0.01			0.20			0.20		
Rosgen Classification	E5			E4			E5			E5					
Bankfull Discharge (cfs)	27			97			25			27			27		
Sinuosity	1.02			2.32			2.45			1.28					
slope (ft/ft)	0.0090			0.0050			0.0030			0.0067					

Table 2.5
Morphology and Hydraulic Monitoring Summary
UT to Barnes Creek/Project No. 397

PARAMETER	Cross-Section 1-Riffle					Cross-Section 2-Pool					Cross-Section 3-Pool					Cross-Section 4-Riffle				
DIMENSION	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010
Bankfull Width (ft)	17.1	17.5	17.1			27.9	31.0	28.8			21.1	21.0	24.8			17.71	19.0	16.1		
Floodprone Width (ft)	>151	>45	>151			>132	>45	>132			> 45	>45	>45			>45	>45	>45		
Bankfull Cross-sectional Area	18.6	18.5	15.9			62.2	82.4	62.2			43.3	43.0	47.3			21.7	16.7	19.8		
Bankfull Mean Depth	1.1	1.1	0.9			2.2	2.7	2.2			2.1	2.0	1.9			1.22	1.1	1.2		
Bankfull Max Depth	2.0	2.1	1.8			4.4	4.7	4.6			4.0	3.8	3.8			2.16	2.1	2.3		
Width/Depth Ratio	15.8	16.5	18.4			12.5	11.7	13.3			10.3	10.5	13.0			14.5	12.8	13.1		
Entrenchment Ratio	>8	>2.2	>8			>4.0	>2.2	>4.0			> 2.1	>2.2	>2.1			>2.6	>2.2	>2.6		
Wetted Perimeter (ft)	*	*	17.6			*	*	31.7			*	*	22.9			*	*	16.9		
Hydraulic Radius (ft)	*	*	0.9			*	*	2.0			*	*	1.8			*	*	1.2		
Bank Height Ratio	*	*	1.0			*	*	1.0			*	*	1.0			*	*	1.0		
	Cross-Section 5-Riffle					Cross-Section 6-Pool					Cross-Section 7-Riffle					Cross-Section 8-Pool				
DIMENSION	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010
Bankfull Width (ft)	15.6	14.6	15.0			19.2	18.0	15.6			14.3	>45	14.0			20.3	>45	18.5		
Floodprone Width (ft)	>45	>45	>45			>45	>45	>45			>45	16.5	>44.8			>39.4	14.2	>39.1		
Bankfull Cross-sectional Area	16.9	16.7	17.1			35.0	42.6	35.2			10.1	9.9	8.7			23.7	20.8	19.3		
Bankfull Mean Depth	1.1	1.1	1.1			1.8	2.4	2.3			0.7	0.6	0.6			1.2	1.5	1.0		
Bankfull Max Depth	2.0	2.1	2.0			3.7	3.8	3.3			1.5	1.4	1.3			2.7	2.6	2.4		
Width/Depth Ratio	14.4	12.8	13.1			10.5	7.6	6.9			20.2	27.5	22.6			17.4	9.7	17.8		
Entrenchment Ratio	>2.9	>2.2	>3			>2.4	>2.2	>2.4			>3.1	>2.2	>3.2			>1.9	>2.2	>2.1		
Wetted Perimeter (ft)	*	*	15.9			*	*	17.8			*	*	14.3			*	*	19.6		
Hydraulic Radius (ft)	*	*	1.1			*	*	2.0			*	*	0.6			*	*	1.0		
Bank Height Ratio	*	*	1.0			*	*	1.0			*	*	1.0			*	*	1.0		
	Main Channel					Tributary														
SUBSTRATE (Reachwide)	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010	MY1-2006	MY2-2007	MY3-2008	MY4-2009	MY5-2010										
D50 (mm)	0.180	0.170	0.110			<0.063	<0.080	0.130												
D84 (mm)	64.00	60.50	13.65			24.80	25.00	12.24												

*Data was not provided

Table 2.5 Cont.
Morphology and Hydraulic Monitoring Summary
UT to Barnes Creek/Project No. 397

PROFILE	MY1-2006			MY2-2007**			MY3-2008			MY4-2009			MY5-2010		
Main Channel	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Riffle Length (ft)	*	*	*	25.8/5.0	110.5/21.0	124.0/24.0	23.7	84.1	50.8						
Riffle Slope (ft/ft)	*	*	*	0.008/0.021	0.043/0.048	0.027/0.034	0.0000	0.0234	0.0104						
Pool Length (ft)	*	*	*	20.1/8.0	174.3/17.0	100.0/11.0	48.0	100.3	72.4						
Pool to Pool Spacing (ft)	*	*	*	48.0/20.0	210.0/45.0	129.0/32.5	69.5	159.9	113.5						
Tributary	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Riffle Length (ft)	*	*	*	*	*	*	12.72	45.49	25.93						
Riffle Slope (ft/ft)	*	*	*	*	*	*	0.0061	0.0383	0.0224						
Pool Length (ft)	*	*	*	*	*	*	23.97	61.64	45.98						
Pool to Pool Spacing (ft)	*	*	*	*	*	*	42.56	74.36	68.00						
ADDITIONAL REACH PARAMETERS	**Main Channel/Tributary**			**Main Channel/Tributary**			**Main Channel/Tributary**			**Main Channel/Tributary**			**Main Channel/Tributary**		
Valley Length (ft)	*			*			2,355.60/483.17								
Channel Length (ft)	*			*			3,302.00/612.42								
Sinuosity	*			*			1.40/1.27								
Water Surface Slope (ft/ft)	*			*			0.0053/0.0096								
Bankfull Slope (ft/ft)	*			*			0.0054/0.0093								
Rosgen Classification	*			*			C5								

*Data was not provided
**Data reported only for main channel (former Hurley and Harris Reaches)

2.2.7 Hydrologic Criteria

Two crest gauges are located within the project site. Table 2.6 below, verifies that one bankfull event or greater occurred within the restoration project during the 2008 monitoring year. The on-site crest gauge documented the occurrence of two bankfull events during the first year (2006) of the post-construction monitoring period. No bankfull events were recorded or observed during the 2007 monitoring, which was conducted from August through November 2007. Other indicators such as old wrack lines and staining were observed at the bankfull and greater elevations within the restoration site as well.

Table 2.6
Verification of Bankfull Events
UT to Barnes Creek/Project No. 397

Date of Collection	Date of Occurrence	Method	Photo # (if available)
7/13/2006	6/24/2006	CG 1	N/A
7/13/2006	6/24/2006	CG 2	N/A
9/29/2006	8/31/2006	CG 1	N/A
9/29/2006	8/31/2006	CG2	N/A
8/2008	Unknown	CG1/CG2	N/A

2.3 Wetland Assessment

The restoration plan for the Site specifies that eight monitoring wells (four automated and four manual) would be established across the restored site. These eight monitoring wells were installed during March 2006 to document water table hydrology in all required monitoring locations. The monitoring gauges are programmed to download groundwater levels daily and were downloaded monthly from March to November in order to capture hydrological data during the 2008 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 30 consecutive days, which is 12.5 percent of the March 19 to November 16 (243 days) growing season. However, for this monitoring report hydrologic data is shown through September 30 due to report submittal due dates.

Please refer to Appendix 3 for wetland raw data tables and plots.

2.3.1 Wetland Current Condition Plan View

There were no problem areas observed within the wetland restoration zones for the Site. With the exception of one gauge, the general success of hydrology within the wetland restoration zones is adequate to meet success requirements. Surface inundation to ground saturation was observed throughout the site; therefore, appropriate hydrological condition for the wetland zones appears to be present. Hydrophytic vegetation consists of a thick herbaceous layer of sedge species (*Carex* sp.), rush species (*Juncus* sp.), and smartweed species (*Polygonum* sp.). The planted woody stem species throughout the wetland areas are meeting the required success

criteria; however, mortality of woody stems was observed. It is suspected that the mortality of planted stems may be subject to the planting technique or the soil conditions prior to planting. The general success of hydrology within the wetland restoration zones is adequate to meet success requirements. Surface inundation to ground saturation was observed throughout the site; therefore, appropriate hydrological condition for the wetland zones appears to be present.

2.3.2 Wetland Criteria Attainment

With the exception of groundwater gauge MW3, all gauges on the Site achieved the wetland success criterion of soil saturation within the upper 12 inches for 30 consecutive days during the growing season (Table 2.7).

Table 2.7
Wetland Criteria Attainment
UT to Barnes Creek/Project No. 397

Gauge ID	Hydrology Threshold Met (Y/N)*	Hydrology Met During Growing Season (%)		Vegetation Plot ID	Vegetation Survival Threshold Met (Y/N)	Vegetation Survival per site (%)
MW1	Y	83		Plot 1	Y	75
MW2	Y	67		Plot 2	Y	
MW3	N	48		Plot 3	N	
MW4	Y	93		Plot 4	Y	
AW1	Y	71				
AW2	Y	71				
AW3	Y	97				
AW4	Y	90				

SECTION 3
METHODOLOGY

SECTION 3
METHODOLOGY

3.1 Methodology

Methods employed for the UT Barnes Stream Restoration Project were a combination of those established by standard regulatory guidance and procedures documents and as well as previous monitoring reports completed by Baker Engineering and RK&K, LLP. 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 conducted following the NCDOT protocol which consists of counting woody stems within the established vegetation plots. 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 both on-site and off-site resources. Off-site daily precipitation was obtained from Weather Underground for the Albemarle, NC weather station (the nearest offering daily precipitation data) through the following URL.

http://waterdata.usgs.gov/nwis/dv?cb_00060=on&cb_00065=on&cb_00045=on&format=html&begin_date=2008-01-01&end_date=2009-12-31&site_no=02118500&referred_module=sw.

SECTION 4
REFERENCES

SECTION 4
REFERENCES

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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.

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.

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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 5
FIGURES

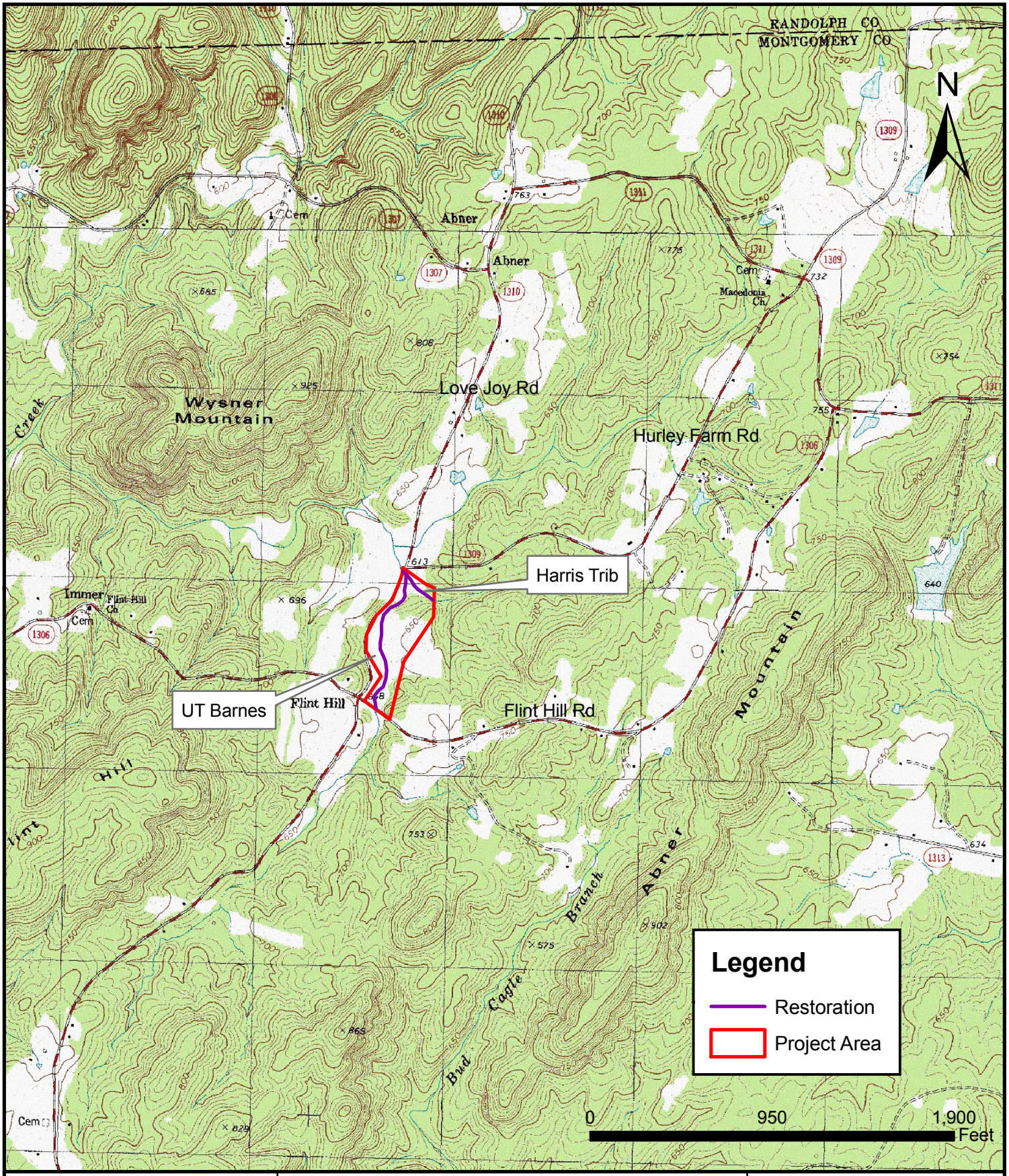


Figure 1.1 Project Location Map
UT Barnes Stream and Wetland Restoration
Montgomery County, NC
Year 3 of 5

Project No. 397
February 2009

Ecosystem Enhancement PROGRAM

NOTES:
1. GENERAL SITE DATA PROVIDED BY NCEEP.
2. ALL LOCATIONS ARE APPROXIMATE.
3. AERIAL IMAGE FROM NCDOT 1995

PROJECT NO. 397
MONTGOMERY COUNTY
NORTH CAROLINA
MONITORING
YEAR 3 of 5

JJG

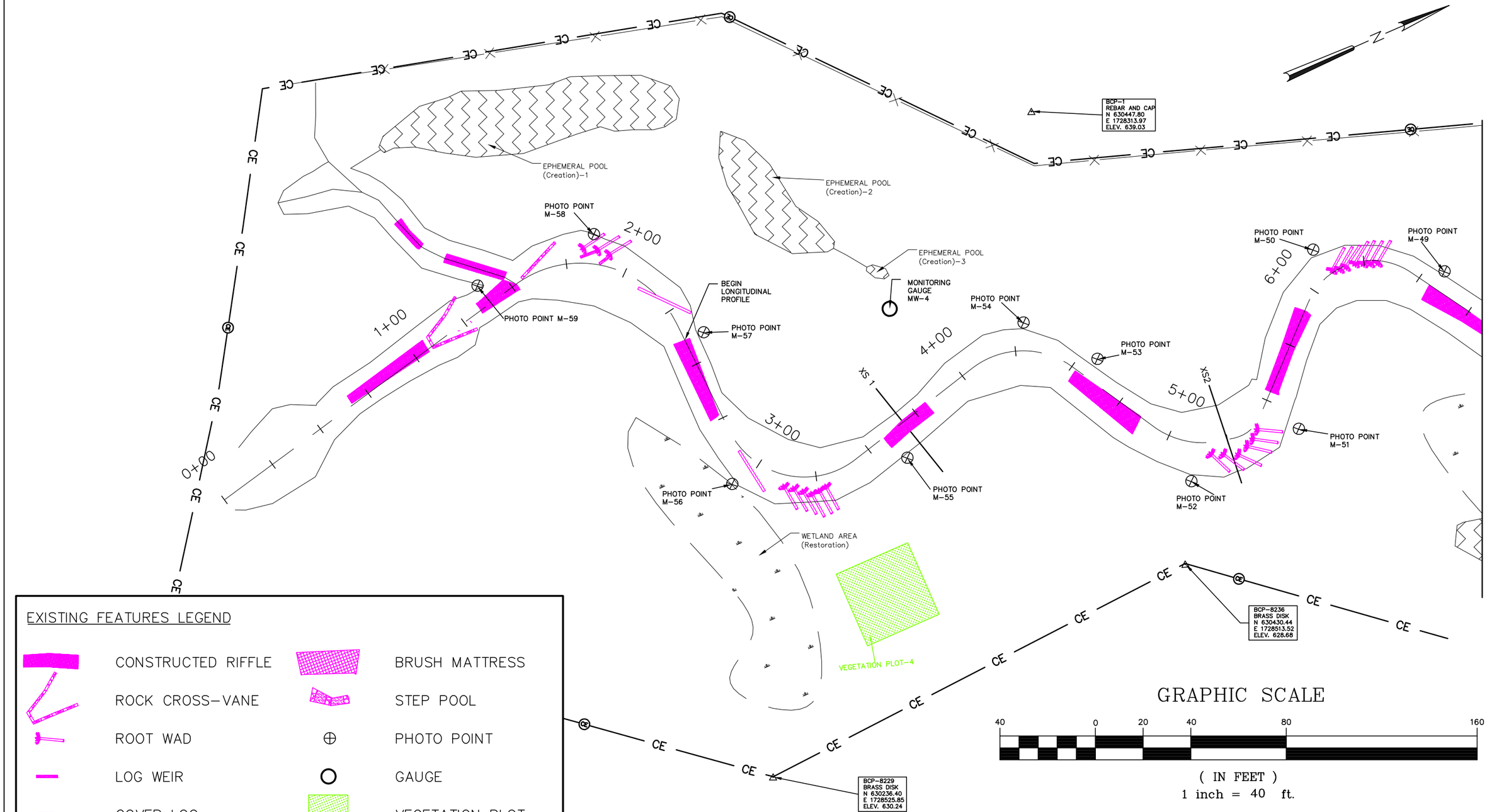
NC ECOSYSTEM ENHANCEMENT PROGRAM
UT BARNES STREAM AND WETLAND RESTORATION

FIGURE 1.2
MONITORING PLAN VIEW

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

FIGURE KEY

THETA MILLER



EXISTING FEATURES LEGEND

	CONSTRUCTED RIFFLE		BRUSH MATTRESS
	ROCK CROSS-VANE		STEP POOL
	ROOT WAD	⊕	PHOTO POINT
	LOG WEIR	○	GAUGE
	COVER LOG		VEGETATION PLOT

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40 ft.

Ecosystem Enhancement PROGRAM

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

PROJECT NO. 397
MONTGOMERY COUNTY
NORTH CAROLINA
MONITORING
YEAR 3 of 5

JJG

NC ECOSYSTEM ENHANCEMENT PROGRAM
UT BARNES STREAM AND WETLAND RESTORATION

FIGURE 1.2
MONITORING PLAN VIEW

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

FIGURE 1 OF 6

THETA MILLER

EXISTING FEATURES LEGEND

- CONSTRUCTED RIFFLE
- ROCK CROSS-VANE
- ROOT WAD
- LOG WEIR
- COVER LOG
- BRUSH MATTRESS
- STEP POOL
- PHOTO POINT
- GAUGE
- VEGETATION PLOT

MATCHLINE SHEET 1

MATCHLINE SHEET 3

7+00 8+00 9+00 10+00 11+00 12+00 13+00

MONITORING GAUGE MW-2

RAIN GAUGE

MONITORING GAUGE MW-3

PHOTO POINT M-39

PHOTO POINT M-38

PHOTO POINT M-37

PHOTO POINT M-42

PHOTO POINT M-40

PHOTO POINT M-41

PHOTO POINT M-46

PHOTO POINT M-48

PHOTO POINT M-47

PHOTO POINT M-45

PHOTO POINT M-43

PHOTO POINT M-44

VEGETATION PLOT-3

WETLAND AREA (Restoration)

EPHEMERAL POOL (Creation)-4

EPHEMERAL POOL (Creation)-5

BCP-633
REBAR AND CAP
N 631058.60
E 1728464.87
ELEV. 619.89

CE

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40 ft.

Ecosystem Enhancement PROGRAM

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

PROJECT NO. 397
MONTGOMERY COUNTY
NORTH CAROLINA
MONITORING
YEAR 3 of 5

JJG

NC ECOSYSTEM ENHANCEMENT PROGRAM
UT BARNES STREAM AND WETLAND RESTORATION

FIGURE 1.2
MONITORING PLAN VIEW

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

FIGURE 2 OF 6

THETA MILLER

EXISTING FEATURES LEGEND

- CONSTRUCTED RIFFLE
- ROCK CROSS-VANE
- ROOT WAD
- LOG WEIR
- COVER LOG
- BRUSH MATTRESS
- STEP POOL
- PHOTO POINT
- GAUGE
- VEGETATION PLOT

CE

AUTOMATIC GAUGE AW-4

WETLAND AREA (Restoration)

PHOTO POINT M-34

MONITORING GAUGE MW-1

PHOTO POINT M-33

PHOTO POINT M-29

AUTOMATIC WELL AW-3

PHOTO POINT M-28

PHOTO POINT M-25

PHOTO POINT M-24

PHOTO POINT M-26

PHOTO POINT M-27

PHOTO POINT M-23

PHOTO POINT M-21

PHOTO POINT M-22

PHOTO POINT M-35

PHOTO POINT M-36

PHOTO POINT M-32

PHOTO POINT M-30

PHOTO POINT M-31

EPHEMERAL POOL (Creation)-6

EPHEMERAL POOL (Creation)-7

14+00

15+00

16+00

17+00

18+00

19+00

20+00

21+00

XS 3

XS 4

MATCHLINE SHEET 2

MATCHLINE SHEET 4

N

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40 ft.

MATCHLINE SHEET 4

THETA MILLER

Ecosystem Enhancement PROGRAM

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

PROJECT NO. 397
MONTGOMERY COUNTY
NORTH CAROLINA
MONITORING
YEAR 3 of 5

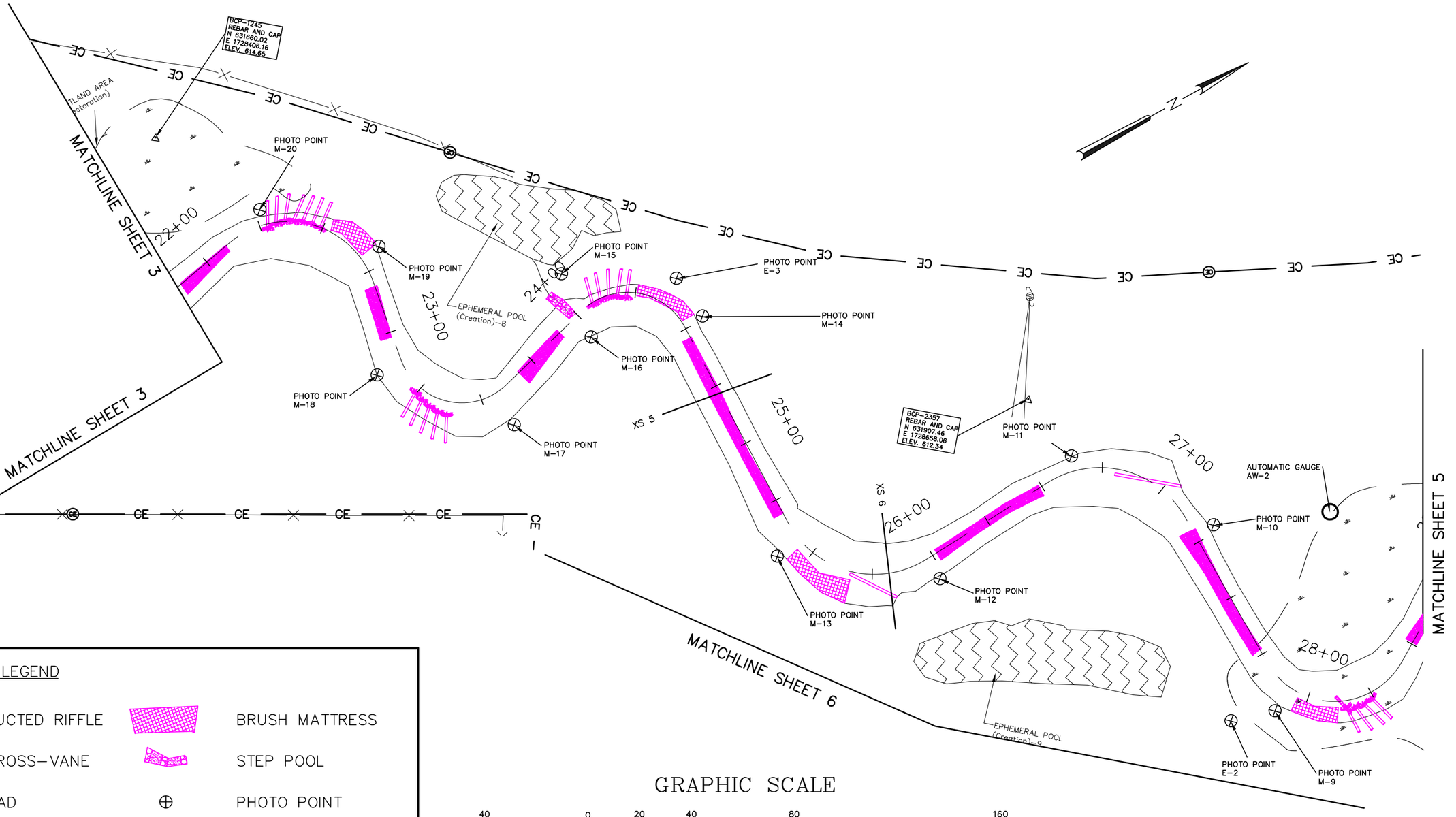
JJG

NC ECOSYSTEM ENHANCEMENT PROGRAM
UT BARNES STREAM AND WETLAND RESTORATION

FIGURE 1.2
MONITORING PLAN VIEW

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

FIGURE 3 OF 6



EXISTING FEATURES LEGEND

CONSTRUCTED RIFFLE		BRUSH MATTRESS	
ROCK CROSS-VANE		STEP POOL	
ROOT WAD		PHOTO POINT	
LOG WEIR		GAUGE	
COVER LOG		VEGETATION PLOT	

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

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

PROJECT NO. 397
MONTGOMERY COUNTY
NORTH CAROLINA
MONITORING
YEAR 3 of 5

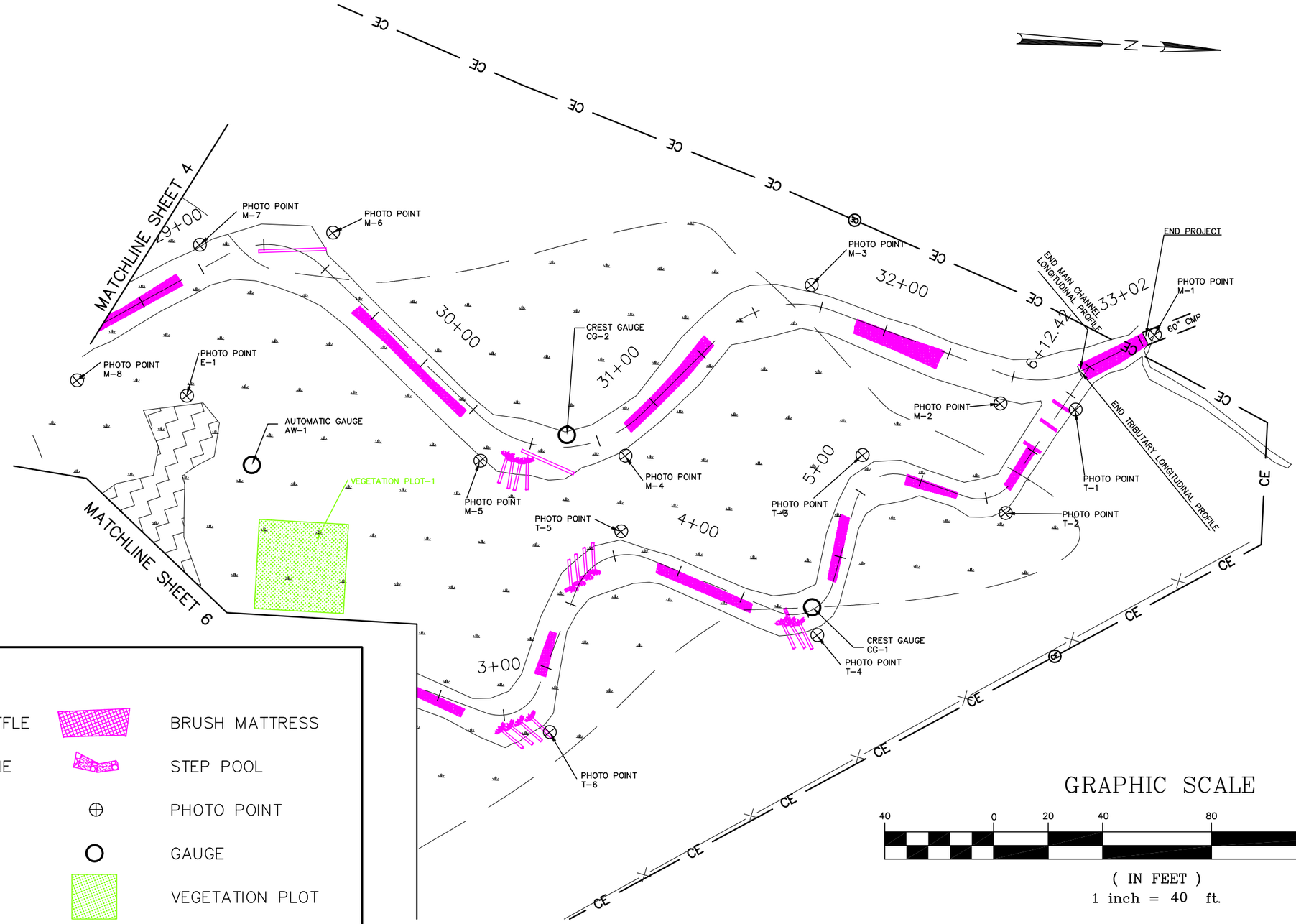
NC ECOSYSTEM ENHANCEMENT PROGRAM
UT BARNES STREAM AND WETLAND RESTORATION

FIGURE 1.2
MONITORING PLAN VIEW

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

FIGURE 4 OF 6

THETA MILLER



EXISTING FEATURES LEGEND

CONSTRUCTED RIFFLE		BRUSH MATTRESS	
ROCK CROSS VANE		STEP POOL	
ROOT WAD	⊕	PHOTO POINT	
LOG WEIR	○	GAUGE	
COVER LOG		VEGETATION PLOT	

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40 ft.

Ecosystem Enhancement PROGRAM

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

PROJECT NO. 397
MONTGOMERY COUNTY
NORTH CAROLINA
MONITORING
YEAR 3 of 5

JJG

NC ECOSYSTEM ENHANCEMENT PROGRAM
UT BARNES STREAM AND WETLAND RESTORATION

FIGURE 1.2
MONITORING PLAN VIEW

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

FIGURE 5 OF 6

THETA MILLER

MATCHLINE SHEET 4

MATCHLINE SHEET 5

N

EPHEMERAL POOL (Creation)–10

WETLAND AREA (Restoration)

PHOTO POINT T–7

PHOTO POINT T–8

PHOTO POINT T–9

PHOTO POINT T–10

PHOTO POINT T–11

XS 8

XS 7

2+00

1+00

0+00

BEGIN TRIBUTARY LONGITUDINAL PROFILE

BCP–16ST
REBAR AND CAP
N: 632072.39
E: 1729074.96
ELEV: 616.18

VEGETATION PLOT–2

CE

EXISTING FEATURES LEGEND

	CONSTRUCTED RIFFLE		BRUSH MATTRESS
	ROCK CROSS–VANE		STEP POOL
	ROOT WAD	⊕	PHOTO POINT
	LOG WEIR	○	GAUGE
	COVER LOG		VEGETATION PLOT

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

NOTES:
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PROJECT NO. 397
MONTGOMERY COUNTY
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NC ECOSYSTEM ENHANCEMENT PROGRAM
UT BARNES STREAM AND WETLAND RESTORATION

FIGURE 1.2
MONITORING PLAN VIEW

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

FIGURE 6 OF 6

THETA MILLER

Click on the Desired Link Below

Appendices