UT to Cane Creek Restoration Project
Year 4 Final Monitoring Report

Alamance County, North Carolina

DMS Project ID Number – 95729, DEQ Contract No. 4951

Permits: SAW-2012-01907, DWR# 13-1177

Project Info:	Monitoring Year: 4 of 7 Year of Data Collection: 2017 Year of Completed Construction: 2014 Submission Date: November 2017
Submitted To:	NCDEQ - Division of Mitigation Services 1652 Mail Service Center Raleigh, NC 27699 NC DEQ Contract ID No. 004951

Mitigation Services
ENVIRONMENTAL QUALITY

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

November 29, 2017

Scott King, LSS – Project Manager
Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600
Cary, NC 27518

Ref: Task 10–Draft Year 4 Monitoring Report Comments
UT to Cane Creek Restoration Project (#95729)
Cape Fear Basin 03030002
Alamance County, North Carolina
Contract No. 004951, RFP No. 16-004357

Dear Mr. King:

On November 9, 2017, DMS received one (1) hardcopy of the Draft Monitoring Year 4 Report and on November 7, 2017 DMS received one (1) electronic transfer of the pdf copy and digital files for UT to Cane Creek from Michael Baker Engineering, Inc. (Baker). DMS and Baker staff also conducted a site visit on November 29, 2017. DMS has completed our review of the DRAFT Year 3 Monitoring Report and digital submittals and have no additional comments.

Please provide the required three (3) hardcopies, one (1) pdf copy of the FINAL report. If you have any questions, or wish to discuss these comments further, please contact me at any time. I can be reached at (919) 707-8308, or via email at jeff.schaffer@ncdenr.gov.

Sincerely,

Jeff Schaffer
Eastern Supervisor/Project Manager
NCDEQ Division of Mitigation Services

cc: file
Jake Byers

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Report Prepared and Submitted by Michael Baker Engineering, Inc.

NC Professional Engineering License # F-1084

Michael Baker
INTERNATIONAL

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APPENDICES

* Note: The figures and tables marked above with an asterisk are not included as part of this Year 4 Monitoring Report, but were left listed in the Table of Contents to explain the otherwise out-of-sequence figure/table numbering and appendix designations. For clarity, Michael Baker wishes to preserve the continuity of the labeling for these features between monitoring years to avoid confusion (e.g. to allow Appendix C to always contain vegetation data, and Table 12 to always be the bankfull event table, etc. in each monitoring report). These figures and tables had been included in past reports and will be included again as part of the Year 5 monitoring report for 2018.

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 3,314 linear feet (LF) of perennial and intermittent streams and enhanced 2,911 LF of channel for the Unnamed Tributary (UT) to Cane Creek Restoration Project (Site). Baker also planted approximately 14.0 acres of native riparian species vegetation within the 19.9 acre recorded conservation easement areas along the restored and enhanced reaches (Reaches R1, R3, R4, R5 and R5a) for the Site. Table 1 summarizes project components and mitigation credits (Appendix A). The Site is located in Alamance County, approximately three miles south of the Town of Saxapahaw (Figure 1). The Site is located in the NC Division of Water Resources (NCDWR) Sub-basin 03-06-04 and the North Carolina Department of Environmental Quality (NCDEQ) - Division of Mitigation Services' (DMS) Targeted Local Watershed (TLW) 03030002-050050 of the Cape Fear River Basin. The Project involved the restoration and enhancement of rural Piedmont streams, which had been impaired due to past agricultural conversion and cattle grazing.

Based on the DMS 2009 Cape Fear River Basin Restoration Priority (RBRP) Plan, the UT to Cane Creek Restoration Project area is located in an existing TLW within the Cape Fear River Basin, although it is not located in a Local Watershed Planning (LWP) area. The restoration strategy for the Cape Fear River Basin targets specific projects, which focus on developing creative strategies for improving water quality flowing to the Haw River in order to reduce non-point source (NPS) pollution to Jordan Lake.

The primary goals of the Project were to improve ecologic functions and to manage NPS inputs to the impaired areas as described in the DMS 2009 Cape Fear RBRP and as identified below:

- Create geomorphically stable conditions along the UTs across the Site,
- Implement agricultural best management practices (BMPs) to reduce NPS inputs to receiving waters,
- Protect and improve water quality by reducing stream bank erosion, and nutrient and sediment inputs,
- Restore stream and floodplain interaction by connecting historic flow paths and promoting natural flood processes, and
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.

To accomplish these goals, the following objectives were identified:

- Restore existing incised, eroding, and channelized streams by providing flood water access to the relic floodplains,
- Prevent cattle from accessing the conservation easement by installing permanent fencing thus reducing excessive stream bank erosion and nutrient inputs,
- Increase aquatic habitat value by providing more bedform diversity, creating natural scour pools and reducing sediment inputs from accelerated stream bank erosion,
- Plant native species riparian buffer vegetation along stream bank and floodplain areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve stream bank stability and riparian habitat connectivity, and shade the stream to decrease water temperature,
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, and reduction of water temperature, and
- Treat invasive species vegetation within the Site area and, if necessary, continue treatments during the monitoring period.

In accordance with the Mitigation Plan and the project-applicable DMS guidance document "Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation" dated 11/7/2011, no formal vegetation plot monitoring was performed, nor were any stream cross-sectional surveys conducted as part of this Year 4 monitoring effort. A visual assessment of the site is emphasized this year, with the full vegetation and cross-section survey work to resume for the Year 5 monitoring in 2018.

From the Year 4 visual inspection monitoring, all stream reaches appear stable and functioning. All stream riffle beds are vertically stable, the pools are maintaining depth, stream banks are stable and vegetating, and in-stream structures are physically intact and performing as designed (Appendix B). No Stream Problem Areas (SPAs) were identified.

The Year 4 visual inspection monitoring also observed that the planted acreage performance categories were functioning at 100 percent with no eroding or bare areas to report, nor any areas of poor growth (Appendix B). In January of 2017, Baker conducted a vegetation assessment of several areas located outside of the vegetation plots to estimate planted stem densities, and subsequently identified four locations totaling ~0.66 acres with somewhat thin densities (Figure 4). These areas were planted with additional bareroot stems in February of 2017 to ensure they met success criteria on future site evaluations. Subsequent inspection of these areas during monitoring activities in October 2017 revealed they appeared to be doing well.

There were a few areas of scattered Chinese privet (*Ligustrum sinense*) previously identified as Vegetation Problem Areas (VPAs) in Year 3 that were treated in February of 2017 through spraying and/or cutting depending on plant size. A total of ~0.25 acres of scattered privet were treated at the confluence of Reach R5 and Reach R3, and a total of ~0.54 acres of scattered privet were treated along the right bank of lower Reach R4, as shown in Figure 4 (Appendix B). These areas will be observed closely in the future for any sign of re-sprouting. One new area of Chinese privet totaling ~0.14 acres was discovered in the Year 4 monitoring effort in the middle section of Reach R4, and will be treated in the winter of 2017-2018. This was the only identified VPA for Year 4.

During Year 4 monitoring, both the Reach R5 crest gauge (crest gauge #1) and the Reach R3 crest gauge (crest gauge #2) documented at least one post-construction bankfull event (Appendix E).

Summary information/data related to the Site 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 and in the Mitigation Plan available on the DMS website. All raw data supporting the tables and figures in the Appendices is available from DMS upon request.

This report documents the successful completion of the Year 4 monitoring activities for the post-construction monitoring period.

2.0 METHODOLOGY

The seven-year monitoring plan for the Site includes criteria to evaluate the success of the stream and vegetation components of the Site. The methodology and report template used to evaluate these components adheres to the DMS monitoring report template document Version 1.4 (November 7, 2011), which will continue to serve as the template for subsequent monitoring years. The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photograph stations, and crest gauges, are shown on the Current Condition Plan View (CCPV) map (Figure 4) found in Appendix B.

In accordance with the Mitigation Plan and the project-applicable DMS guidance document "Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation" dated 11/7/2011, no formal vegetation plot monitoring was performed, nor were any stream cross-sectional surveys conducted as part of this Year 4 monitoring effort. A visual assessment of the site is emphasized this year, with the full vegetation and cross-section survey work to resume for the Year 5 monitoring in 2018.

The Year 4 site visual site assessment data contained in Appendix B was collected in October 2017, unless otherwise noted.

2.1 Stream Assessment

The Project involved the restoration and enhancement of a rural Piedmont stream system that had been impaired due to past agricultural conversion and cattle grazing. Restoration practices involved raising the existing streambed and reconnecting the stream to the relic floodplain, and restoring natural flows to areas previously drained by ditching activities. The existing channels abandoned within the restoration areas were partially to completely filled to decrease surface and subsurface drainage and raise the local water table. Permanent cattle exclusion fencing was provided around all proposed reaches and riparian buffers, with the exception of Reach R1, where cattle lack access.

2.1.1 Morphological Parameters and Channel Stability

A longitudinal profile was surveyed for the entire length of channel immediately after construction to document as-built baseline monitoring conditions (Year 0) only. Annual longitudinal profiles will not be conducted during subsequent monitoring years unless channel instability has been documented or remedial actions/repairs are required by the U.S. Army Corps of Engineers (USACE) or DMS.

As per the Mitigation Plan and DMS monitoring guidance for this project, no cross-section survey data were collected for this Monitoring Year 4 assessment. Consequently, none of the cross-sectional survey graphs (Figure 5) or morphology data (Table 11) are presented in Appendix D as in previous monitoring reports.

2.1.2 Hydrology

To monitor on-site bankfull events, crest gauges were installed along two of the restored reaches. One crest gauge was installed on the floodplain at the bankfull elevation along the left top of bank on Reach R5 (Crest gauge 1), approximately at Station 22+00. The second crest gauge was installed on the floodplain along the right top of bank along Reach R3 (Crest gauge 2), approximately at Station 13+50.

During Year 4 monitoring, one above-bankfull stage event was documented by both Crest gauge 1 and Crest gauge 2. The crest gauge readings are presented in Appendix E, with photographic documentation presented in Appendix B.

2.1.3 Photographic Documentation

Representative project photographs were taken of grade control structures and buffer areas along the restored streams. Selected stream photographs from Year 4 monitoring are provided in Appendix B.

2.1.4 Visual Stream Morphological Stability Assessment

The visual stream morphological stability assessment involves the qualitative evaluation of lateral and vertical channel stability, and the integrity and overall performance of in-stream structures throughout the Project reaches as a whole. Habitat parameters and pool depth maintenance are also measured and scored. During Year 4 monitoring, Baker staff walked the entire length of each of the Project reaches, noting geomorphic conditions of the stream bed profile (riffle/pool facets), both stream banks, and engineered in-stream structures. Representative photos were taken per the Site's Mitigation Plan. All stream reaches appear stable and functioning. All stream riffle beds are vertically stable, the pools are maintaining depth, stream banks are stable and vegetating, and in-stream structures are physically intact and performing as designed. No Stream Problem Areas (SPAs) were documented during Year 4 monitoring. A more detailed summary of the results for the visual stream stability assessment can be found in Tables 5a and 5b in Appendix B.

2.2 Vegetation Assessment

In order to determine if the success criteria are achieved, vegetation-monitoring quadrants were installed and are monitored across the restoration site in accordance with the Carolina Vegetation Survey (CVS)-DMS Protocol for Recording Vegetation, Version 4.1 (2007). The vegetation monitoring plots are a minimum of 2 percent of the planted portion of the Site with six plots established randomly within the planted riparian buffer areas per Monitoring Levels 1 and 2. No monitoring quadrants were established within the undisturbed wooded areas of Reach R4. The sizes of individual quadrants are 100 square meters for woody tree species.

As per the Mitigation Plan and DMS monitoring guidance for this project, there was no vegetation plot monitoring conducted for the Year 4 monitoring effort, and thus no vegetation data summary tables are included in Appendix C as in previous monitoring reports. However, as reported in Tables 6a (Appendix B), the planted acreage performance categories were functioning at 100 percent with no bare areas to report, no current low stem density areas, no areas of poor growth rates.

In January of 2017, Baker conducted a vegetation assessment of a few areas located outside of the vegetation plots that were suspected of potentially having thin stem densities. Although the areas investigated certainly appeared to be meeting somewhere between the Year 3 and Year 5 success criteria of 320 and 260 stems/acre, they nevertheless appeared thinner than the total vegetation plot average. As such, four areas totaling ~0.66 acres located along the left banks of upper Reach R5 and R4 (see Figure 4) were planted with additional bareroot stems in February 2017, to help ensure they met success criteria on future site evaluations. These areas were inspected again in October 2017 and appeared to be doing well.

There were a few areas of scattered Chinese privet (*Ligustrum sinense*) previously noted in the Year 3 monitoring report. In February of 2017, these areas were treated through spraying and/or cutting depending on plant size. A total of ~0.25 acres of scattered privet were treated at the confluence of Reach R5 and Reach R3, and a total of ~0.54 acres of scattered privet were treated along the right bank of lower Reach R4, as shown in Figure 4. Photographs of the treated privet can be found in Appendix B. These areas will be observed closely in the future for any sign of re-sprouting. One new area of Chinese privet totaling ~0.14 acres was discovered in the Year 4 monitoring effort in the middle section of Reach R4, and will be treated in the winter of 2017-2018. This area was designated a Vegetation Problem Area (VPA) as reported in Table 6b and shown in the Photolog found in Appendix B.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.

North Carolina Division of Mitigation Services (DMS). 2011. Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation. Version 1.4, November 7, 2011.

North Carolina Division of Mitigation Services (DMS). 2010. Baseline Monitoring Template and Guidance. Version 2.0, October 14, 2010.

Rosgen, D. L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

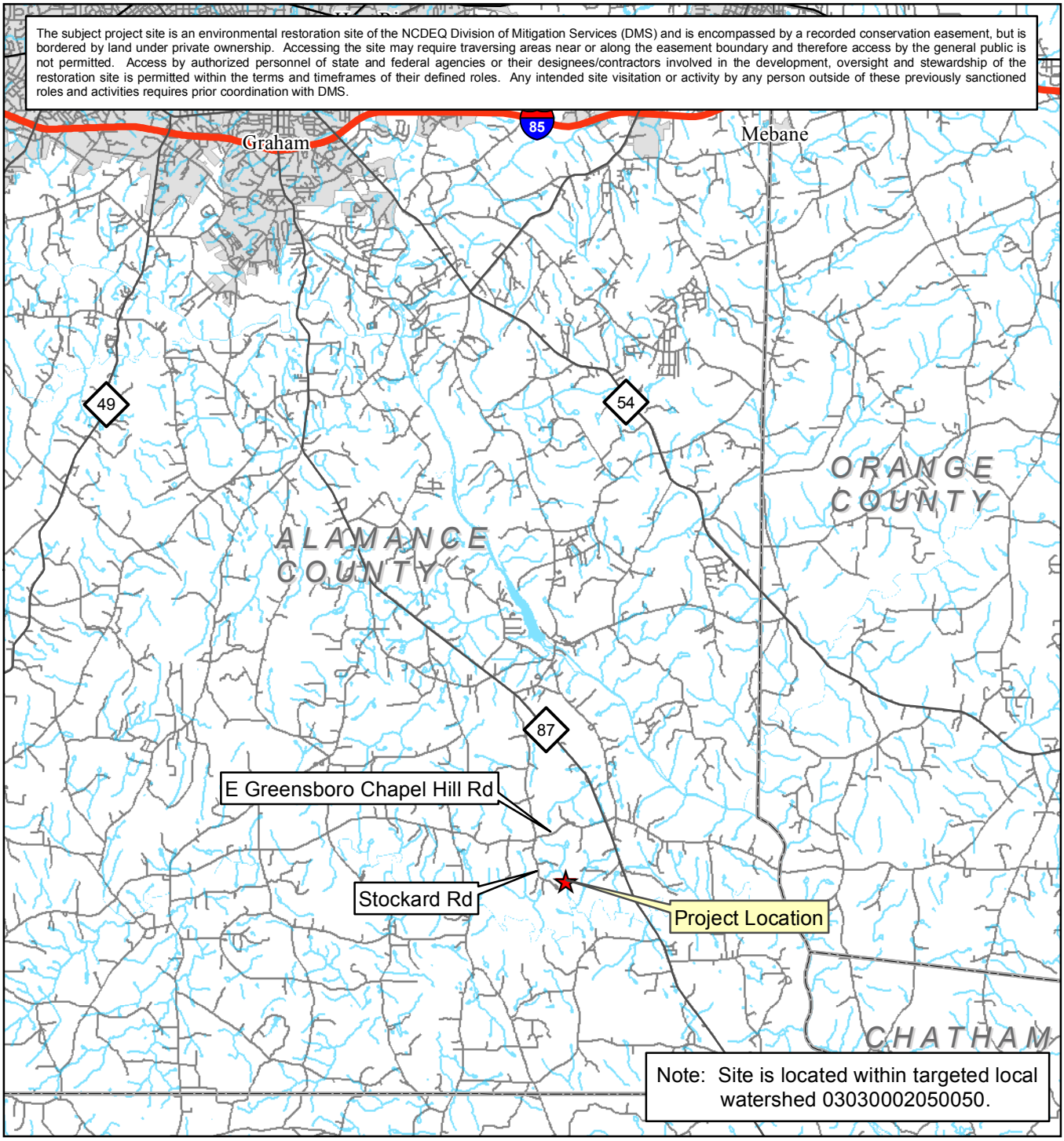
Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third Approximation. North Carolina Natural Heritage Program. Division of Parks and Recreation, NCDEQ. Raleigh, NC.

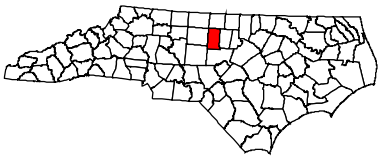
U.S. Army Corps of Engineers. 2003. Stream Mitigation Guidelines, April 2003, U.S. Army Corps of Engineers (USACE). Wilmington District.

Appendix A

Project Vicinity Map and Background Tables

The subject project site is an environmental restoration site of the NCDEQ Division of Mitigation Services (DMS) 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 DMS.





Alamance County

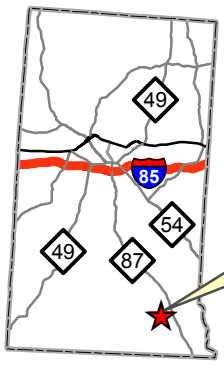


Figure 1
Project Vicinity Map
UT to Cane Creek Site

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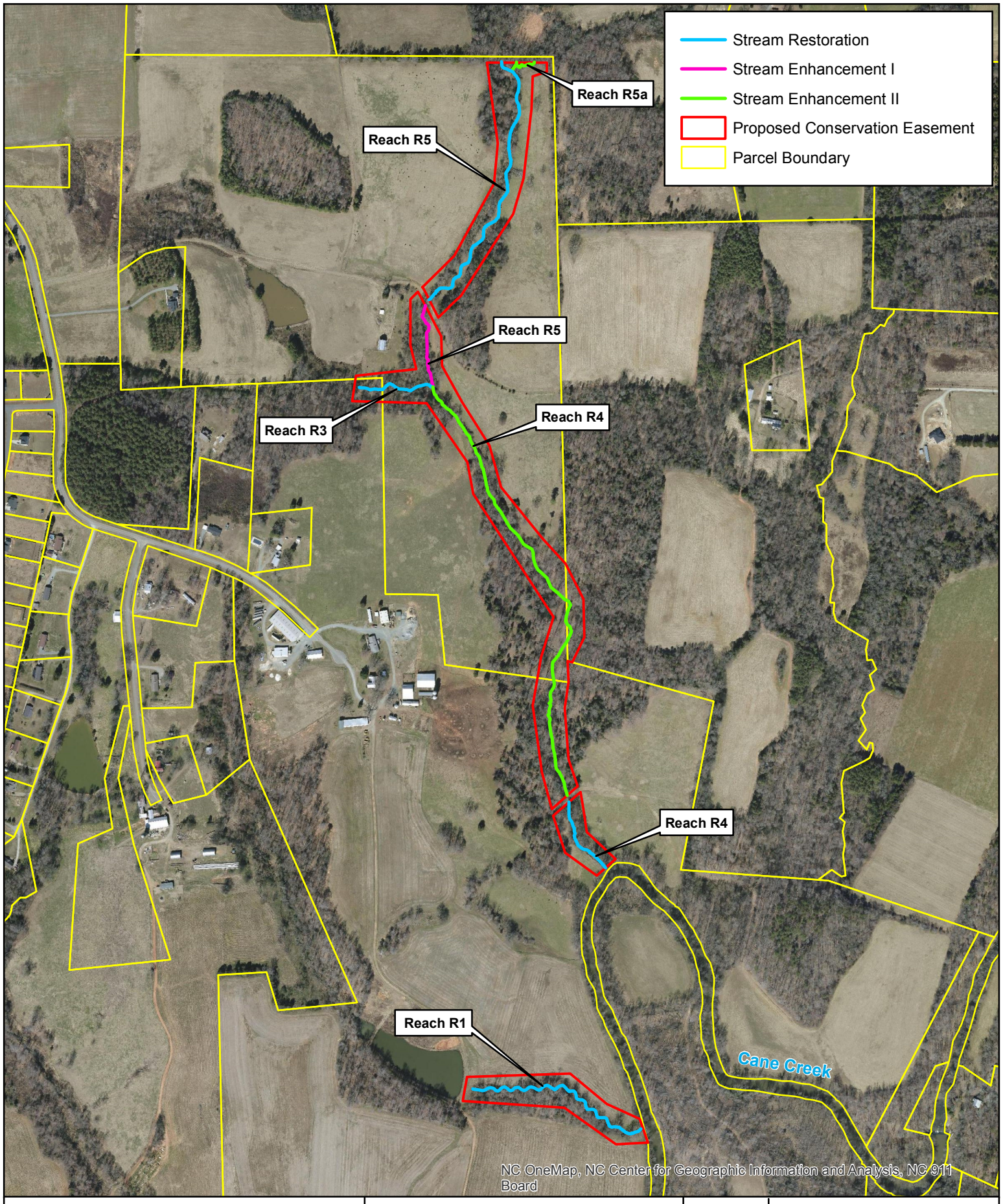
0 0.5 1 2 3 Miles



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0 500 1,000 Feet

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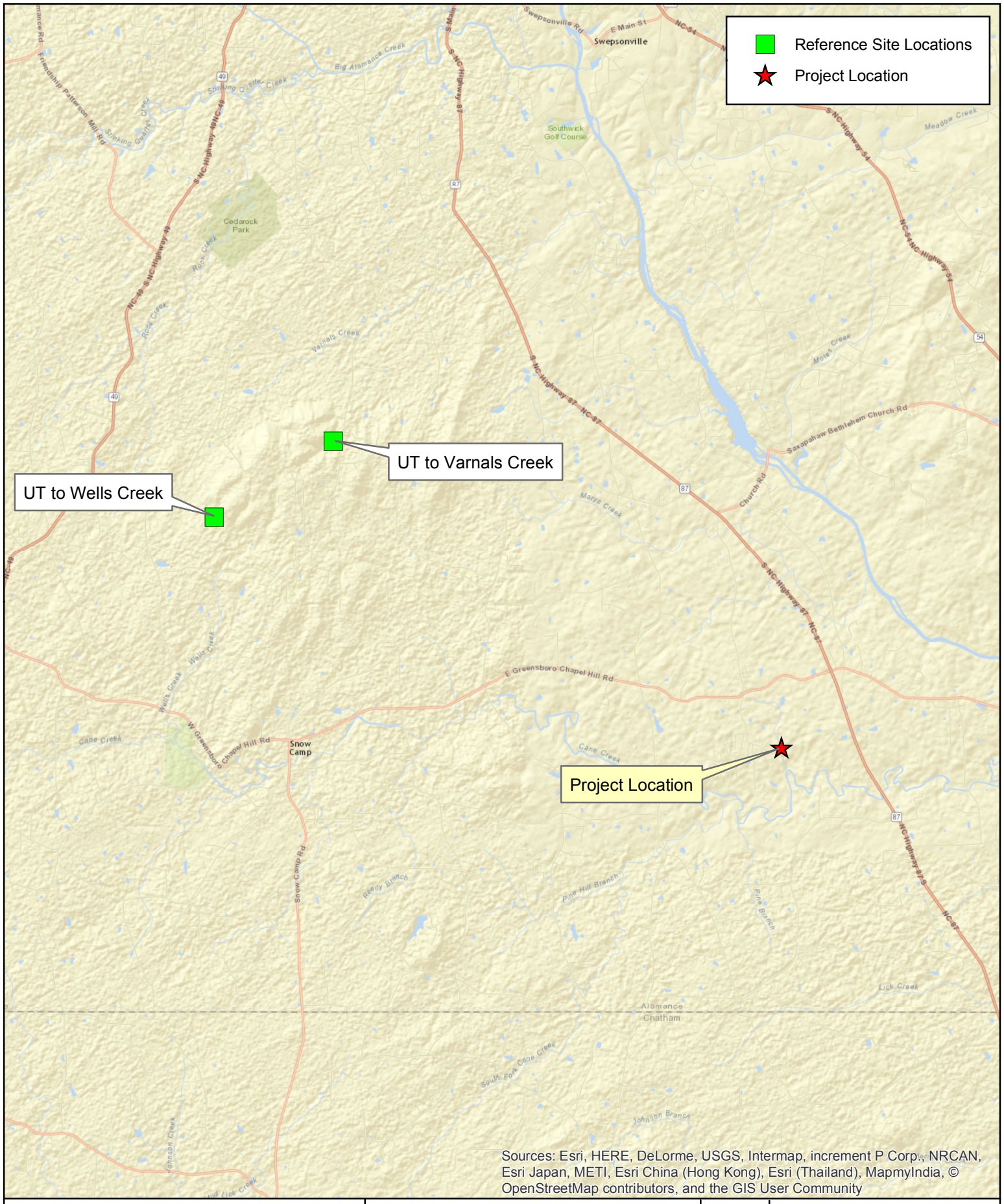
DEQ -Division of Mitigation Services
Project # 95729

Figure 2
Mitigation Work Plan
UT to Cane Creek Site



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0 1 2 Miles

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Project #95729

Figure 3
Reference Reach Location Map
UT to Cane Creek Site

Table 1. Project Components and Mitigation Credits

UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Mitigation Credits

	Stream	Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R, E1, EII	R	E					
Totals	4,594 SMU	0	0					

Project Components

Project Component or Reach ID	Stationing/ Location	Existing Footage/ Acreage (LF)	Approach	Restoration/ Restoration Equivalent (SMU)	Restoration Footage or Acreage (LF)	Mitigation Ratio
Reach 1	10+00 – 20+45	944	Restoration	1,045	1,045	1:1
Reach 3	10+00 – 13+98	425	Restoration	398	398	1:1
Reach 4 (Upstream section)	29+32 – 52+86	2,346	Enhancement Level II	933	2,333	2.5:1
Reach 4 (Downstream section)	53+20 – 57+30	411	Restoration	410	410	1:1
Reach 5 (Upstream section)	10+03 – 24+64	1,386	Restoration	1,461	1,461	1:1
Reach 5 (Downstream section)	25+00 – 29+32	426	Enhancement Level I	289	433	1.5:1
Reach 5a	10+02 – 11+47	144	Enhancement Level II	58	145	2.5:1

Component Summation

Restoration Level	Stream (LF)	Riparian Wetland (AC)		Non-riparian Wetland (AC)	Buffer (SF)	Upland (AC)
		Riverine	Non-Riverine			
Restoration	3,314					
Enhancement I	433					
Enhancement II	2,478					
Creation	0					
Preservation	0					
High Quality Preservation	0					

BMP Elements

Element	Location	Purpose/Function	Notes

BMP Elements: BR= Bioretention Cell; SF= Sand Filter; SW= Stormwater Wetland; WDP= Wet Detention Pond; DDP= Dry Detention Pond; FS= Filter Strip; S= Grassed Swale; LS= Level Spreader; NI=Natural Infiltration Area

Table 2. Project Activity and Reporting History
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan Prepared	N/A	N/A	Aug-13
Mitigation Plan Amended	N/A	N/A	Oct-13
MItigation Plan Approved	May-13	N/A	Dec-13
Final Design – (at least 90% complete)	N/A	N/A	Feb-14
Construction Begins	Nov-13	N/A	Mar-14
Temporary S&E mix applied to entire project area	Feb-14	N/A	Jun-14
Permanent seed mix applied to entire project area	Feb-14	N/A	Jun-14
Planting of live stakes	Feb-14	N/A	Jun-14
Planting of bare root trees	Feb-14	N/A	Jun-14
End of Construction	Feb-14	N/A	Jun-14
Survey of As-built conditions (Year 0 Monitoring-baseline)	Apr-14	Jul-14	Aug-14
Year 1 Monitoring	Dec-14	Jan-15	Apr-15
Year 2 Monitoring	Dec-15	Oct-15	Nov-15
Year 3 Monitoring	Dec-16	Oct-16	Nov-16
Year 4 Monitoring	Dec-17	Oct-17	Nov-17
Year 5 Monitoring	Dec-18	N/A	N/A
Year 6 Monitoring	Dec-19	N/A	N/A
Year 7 Monitoring	Dec-20	N/A	N/A

Table 3. Project Contacts **UT to Cane Creek Restoration Project: DMS Project ID No. 95729**	
Designer	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Scott King, Telephone: 919-481-5731
Construction Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Telephone: 919-582-3574
Planting Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Telephone: 919-582-3574
Seeding Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Bill Wright, Telephone: 919-582-3574
Seed Mix Sources	Green Resources, Telephone: 336-855-6363
Nursery Stock Suppliers	Mellow Marsh Farm, Telephone: 919-742-1200 ArborGen, Telephone: 843-528-3204
Monitoring Performers	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518
	Contact:
Stream Monitoring Point of Contact	Scott King, Tel. 919-481-5731
Vegetation Monitoring Point of Contact	Scott King, Tel. 919-481-5731

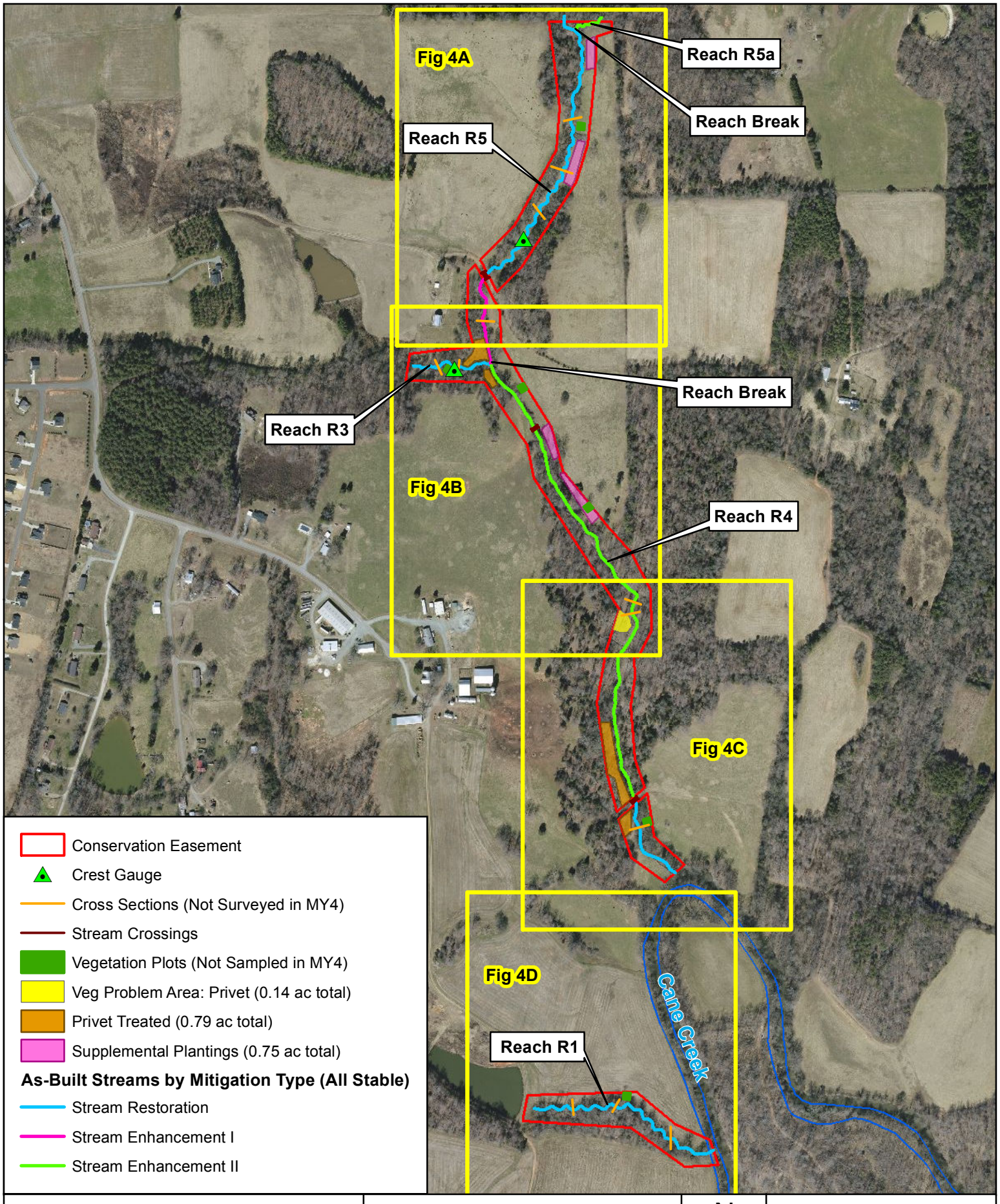
Table 4. Project Attributes
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Project Information					
Project Name	UT to Cane Creek Restoration Project				
County	Alamance				
Project Area (acres)	19.9				
Project Coordinates (latitude and longitude)	35.8934 N, -79.3187 W				
Project Watershed Summary Information					
Physiographic Province	Piedmont				
River Basin	Cape Fear				
USGS Hydrologic Unit 8-digit and 14-digit	03030002 / 03030002050050				
NCDWR Sub-basin	03-06-04				
Project Drainage Area (acres)	452 (Reach R4 main stem at downstream confluence w/ Cane Creek)				
Project Drainage Area Percent Impervious	<1%				
CGIA Use Classification	2.01.01.01, 2.03.01, 2.99.01, 3.02 / Forest (49%) Agriculture (46%) Impervious Cover (1%)				
Reach Summary Information					
Parameters	**Reach R1**	**Reach R3**	**Reach R4**	**Reach R5**	**Reach R5a**
Length of Reach (linear feet)	1,052	400	2,731	1,925	145
Valley Classification (Rosgen)	VII	VII	VII	VII	VII
Drainage Area (acres)	80	91	452	290	14
NCDWR Stream Identification Score	30.5	36	42.5	38.5	33.5
NCDWR Water Quality Classification	WS V; NSW				
Morphological Description (Rosgen stream type)	Incised E	G	Bc (upstream)/ F (downstream)	G	B
Evolutionary Trend	Incised E→Gc→F	Bc→G→Fb	Bc→G→Fb	Bc→G→Fb	B→G
Underlying Mapped Soils	We, GaE, Cg, DbB	We	We, GbD3, Mc, Cg, TaD	We	We
Drainage Class	Poorly drained	Poorly drained	Poorly	Poorly drained	Poorly
Soil Hydric Status	Hydric	Hydric	Hydric	Hydric	Hydric
Average Channel Slope (ft/ft)	0.0127	0.0168	0.0169	0.0126	0.0223
FEMA Classification	N/A	Zone AE	Zone AE	N/A	N/A
Native Vegetation Community	Piedmont Small Stream				
Percent Composition of Exotic/Invasive Vegetation	<5%	<5%	<5%	<5%	<5%

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion
Endangered Species Act	No	N/A	Categorical Exclusion
Historic Preservation Act	No	N/A	Categorical Exclusion
Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion
FEMA Floodplain Compliance	Yes	Yes	Categorical Exclusion
Essential Fisheries Habitat	No	N/A	Categorical Exclusion

Appendix B

Visual Assessment Data



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0 250 500 Feet

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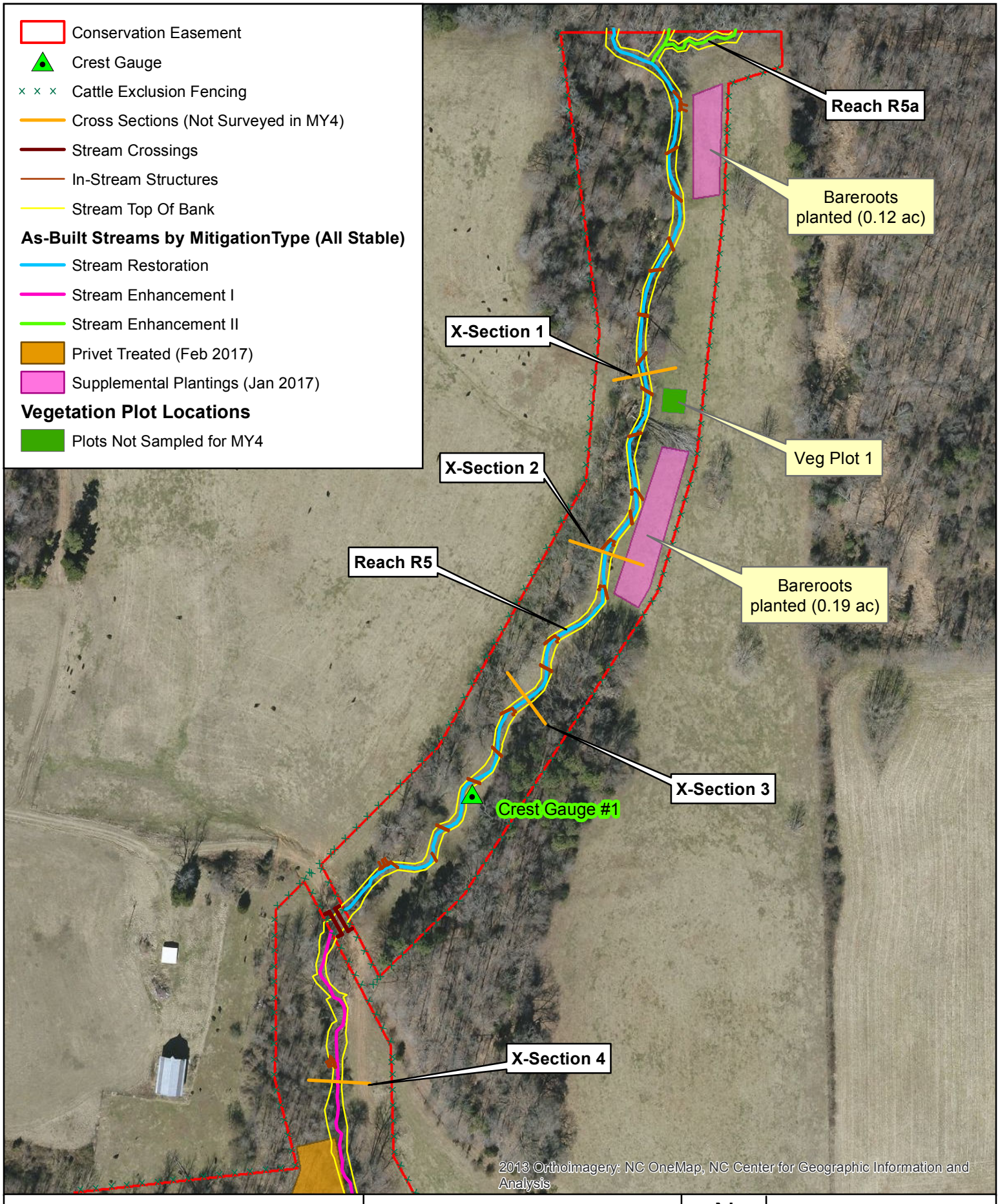
DEQ - Division of Mitigation Services
Project # 95729

Current Condition Plan View - Figure Index
Monitoring Year 4
UT to Cane Creek Site



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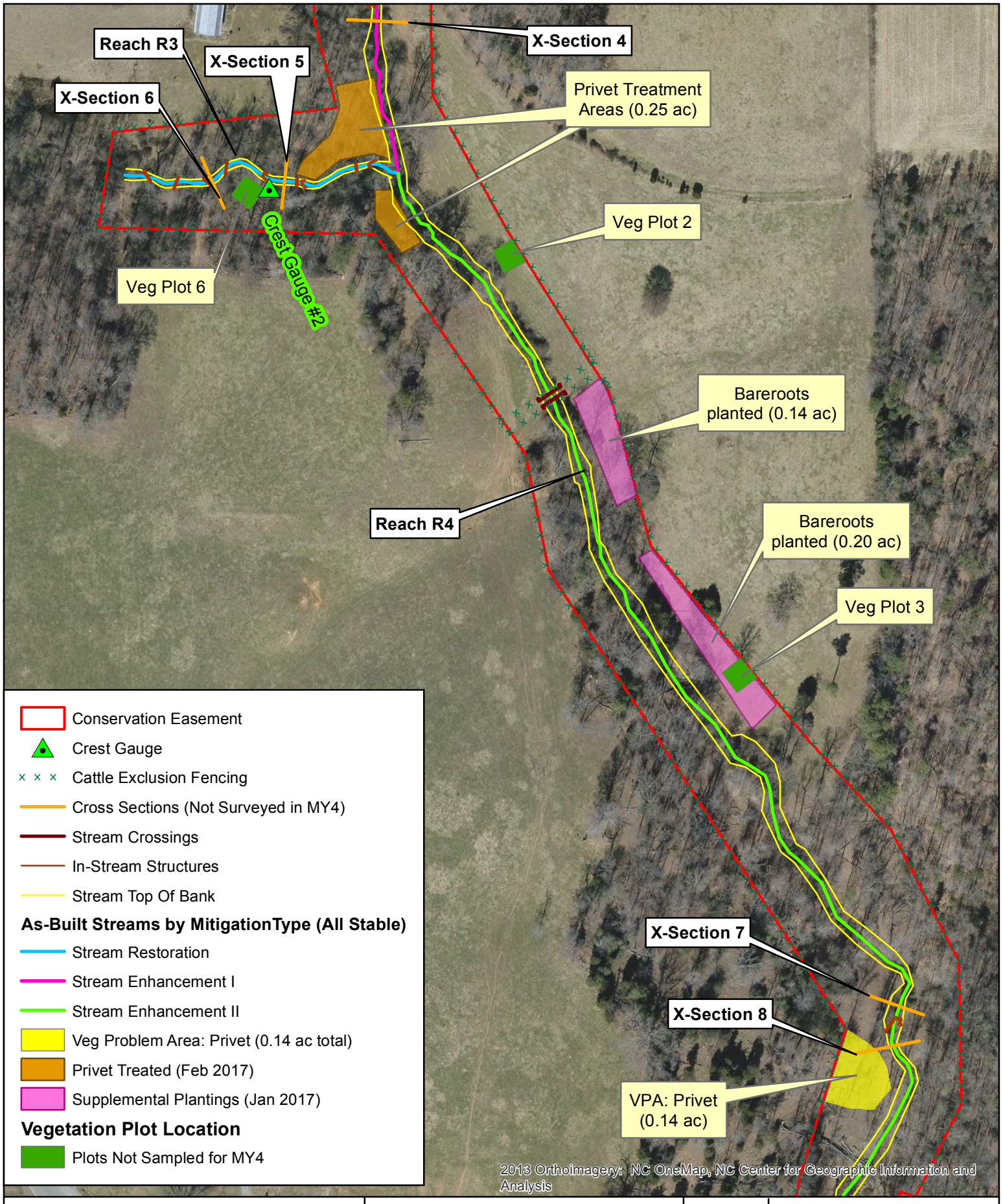
Project # 95729

Current Condition Plan View - Figure 4A
Monitoring Year 4
UT to Cane Creek Site



Conservation Easement
Crest Gauge
Cattle Exclusion Fencing
Cross Sections (Not Surveyed in MY4)
Stream Crossings
In-Stream Structures
Stream Top Of Bank

As-Built Streams by MitigationType (All Stable)

Stream Restoration
Stream Enhancement I
Stream Enhancement II
Veg Problem Area: Privet (0.14 ac total)
Privet Treated (Feb 2017)
Supplemental Plantings (Jan 2017)

Vegetation Plot Location

Plots Not Sampled for MY4

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0 100 200 Feet

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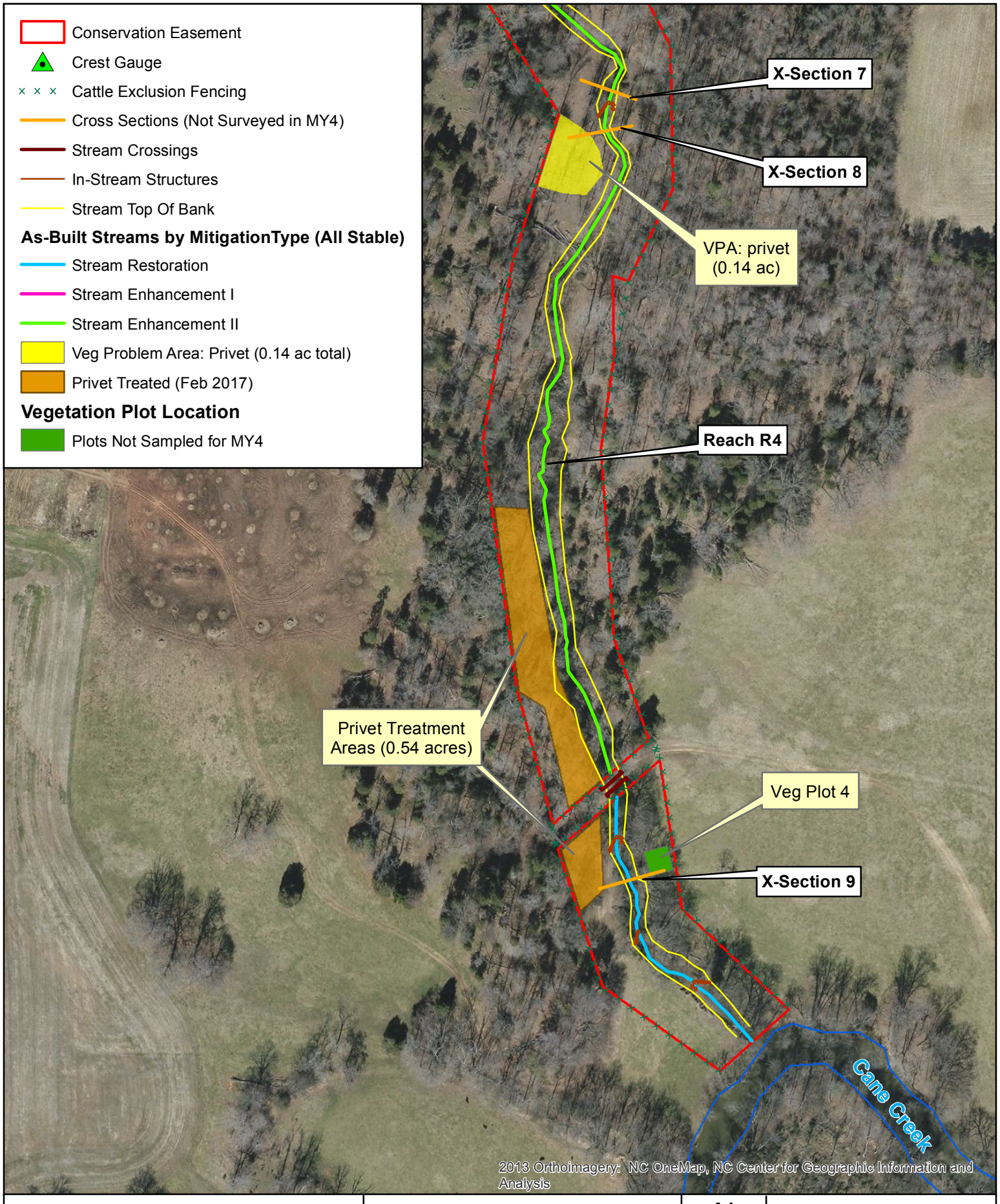
Project # 95729

Current Condition Plan View - Figure 4B Monitoring Year 4 UT to Cane Creek Site



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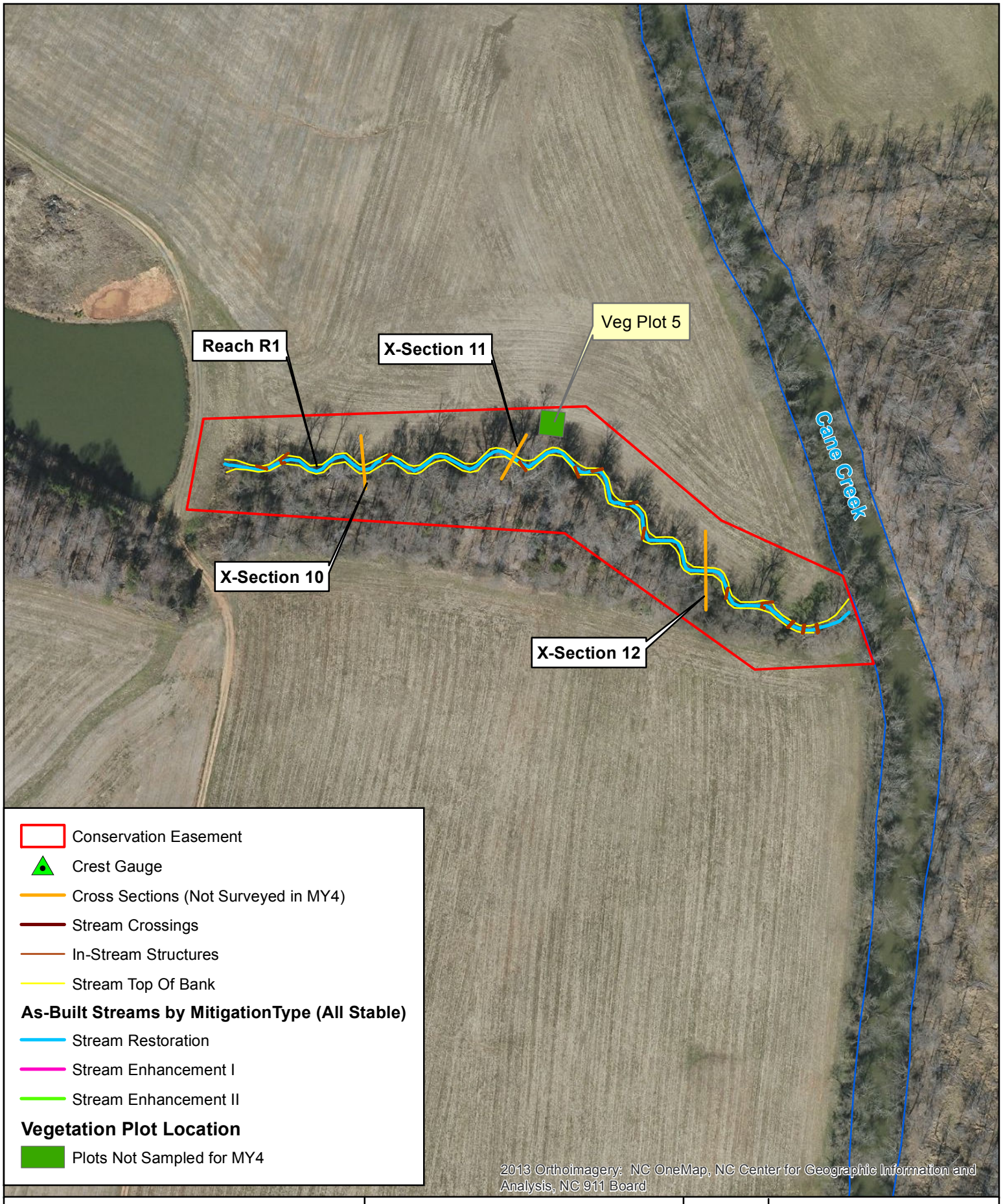
Project # 95729

Current Condition Plan View - Figure 4C
Monitoring Year 4
UT to Cane Creek Site



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0 100 200 Feet

N

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Project # 95729

Current Condition Plan View - Figure 4D Monitoring Year 4 UT to Cane Creek Site

Table 5a. Visual Steam Morphology Stability Assessment
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach ID: Reach 1
Assessed Length (LF): 1,045

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0%	100%			
	2. Riffle Condition	1. Texture Substrate	9	9			100%			
	3. Meander Pool Condition	1. Depth	21	21			100%			
		2. Length	21	21			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	21	21			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	20	20			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
		Totals			0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	4	4			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	4	4			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	4	4			100%			

Table 5a. Visual Steam Morphology Stability Assessment
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach ID: Reach 3
Assessed Length (LF): 398

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0%	100%			
	2. Riffle Condition	1. Texture Substrate	6	6			100%			
	3. Meander Pool Condition	1. Depth	3	3			100%			
		2. Length	3	3			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	3	3			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	3	3			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
		Totals			0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	4	4			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	4	4			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	4	4			100%			

Table 5a. Visual Steam Morphology Stability Assessment
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach ID: Reach 4
Assessed Length (LF): 2,743

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0%	100%			
	2. Riffle Condition	1. Texture Substrate	7	7			100%			
	3. Meander Pool Condition	1. Depth	2	2			100%			
		2. Length	2	2			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	2	2			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
		Totals			0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	3	3			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	3	3			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	3	3			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	3	3			100%			

Table 5a. Visual Steam Morphology Stability Assessment
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach ID: Reach 5
Assessed Length (LF): 2,039

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0%	100%			
	2. Riffle Condition	1. Texture Substrate	15	15			100%			
	3. Meander Pool Condition	1. Depth	19	19			100%			
		2. Length	19	19			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	19	19			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	18	18			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	0	100%
		Totals			0	0	100%	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	17	17			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	17	17			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	17	17			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	17	17			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	17	17			100%			

Table 5b. Stream Problem Areas (SPAs)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Feature Issue	Station Number	Suspected Cause	Photo Number
None Observed	N/A	N/A	N/A

Table 6a. Vegetation Conditions Assessment
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Planted Acreage: 14.0

Vegetation Category	Defintions	Mapping Threshold (acres)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1	NA	0	0.00	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	NA	0	0.00	0.0%
			Total	**0**	**0.00**	**0.0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25	NA	0	0.00	0.0%
			Cumulative Total	**0**	**0.00**	**0.0%**

Easement Acreage: 19.9

Vegetation Category	Defintions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
5. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	Yes	1	0.14	0.7%
6. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	NA	0	0.00	0.0%

Table 6b. Vegetation Problem Areas (VPAs)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Feature Issue	Station Number	Suspected Cause	Photos
Chinese privet (*Ligustrum sinense*)	Reach R4, Station 44+00	re-sprouts	Appendix B

UT to Cane Creek: Stream and Project Photographs

Reach R5 – View upstream of culvert, Station 24+75

Reach R5 – View upstream from crest gauge, Station 22+00

Reach R5 – View upstream, Station 20+00

Reach R5 – View upstream, Station 17+25

Reach R5 – View upstream, Station 16+50

Reach R5 – View upstream, Station 13+75

UT to Cane Creek: Stream and Project Photographs

Reach R5 – View upstream, Station 12+00

Reach R5 – View upstream, Station 11+50

Reach R5 – View upstream, Station 28+50

Reach R3 – View upstream, at cross-section 6

Reach R4 – View upstream, Station 31+50

Reach R4 – View of upstream, Station 35+00

UT to Cane Creek: Stream and Project Photographs

Reach R4 – View upstream, enhancement area, Station 38+50

Reach R4 – View upstream, enhancement area (Log J-Hook), Station 43+50

Reach R4 – View upstream, enhancement area, Station 49+00

Reach R4 – View upstream, stream crossing, Station 53+00

Reach R4 – View upstream, Station 54+75

Reach R4 – View upstream, Station 56+50

UT to Cane Creek: Stream and Project Photographs

Reach R1 – View upstream, Station 10+50

Reach R1 – View upstream, Station 14+75

Reach R1 View upstream, Station 15+00

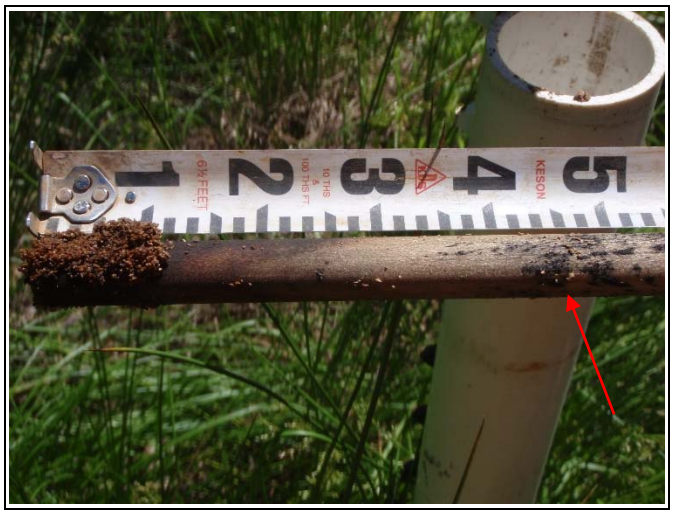
Reach R1 – View upstream, Station 17+00

Reach R1 – View upstream, Station 19+25

Reach R1 – View upstream, Station 20+00

UT to Cane Creek: Stream and Project Photographs

Reach R5: Crest Gauge #1, 0.76 feet on May 3, 2017



Reach R3: Crest Gauge #2, 0.46 feet on May 3, 2017

Reach R3: Bankfull evidence on May 3, 2017

Reach R3: Bankfull evidence, May 3, 2017

Reach R5/R3: Dead privet sprayed in Feb. 2017

Reach R4: Dead privet sprayed in Feb. 2017

UT to Cane Creek: Stream and Project Photographs

Reach R4: Privet re-sprouts, Station 44+00

Reach R4: Privet re-sprouts, Station 44+00

Appendix C

Vegetation Plot Data*

***No vegetation plot monitoring was required for Year 4.**

Appendix D

Stream Survey Data*

***No cross-section stream survey monitoring was required for Year 4.**

Table 10. Baseline Stream Summary
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach 1 (1,045 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																		
BF Width (ft)	-----	23.0	80.0	4.9	5.6	-----	-----	7.3	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	6.9	-----	-----	-----	-----	7.2	-----	-----	9.1	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	6.8	-----	-----	>30	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>20	-----	-----	-----	-----	65.6	-----	-----	84.4	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.8	0.7	-----	-----	0.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	0.5	-----	-----	1.0	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.1	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.7	-----	-----	-----	-----	0.7	-----	-----	1.9	-----	-----
BF Cross-sectional Area (ft²)	-----	80.0	300.0	5.2	5.1	-----	-----	5.2	-----	-----	-----	5.3	-----	-----	-----	-----	-----	7.9	-----	-----	-----	-----	-----	3.7	-----	-----	-----	-----	4.0	-----	-----	8.7	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	6.1	-----	-----	10.5	-----	-----	7	-----	-----	26	-----	-----	8	-----	-----	18	-----	-----	-----	13.0	-----	-----	-----	-----	9.6	-----	-----	15.2	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	1.2	-----	-----	9.5	-----	-----	2.0	-----	-----	3.4	-----	-----	1.9	-----	-----	3.9	-----	-----	-----	>2.2	-----	-----	-----	-----	6.9	-----	-----	10.8	-----	-----
Bank Height Ratio	-----	-----	-----	-----	1.6	-----	-----	4.3	-----	-----	1.4	-----	-----	2.5	-----	-----	1.1	-----	-----	1.5	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.3	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25.0	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.0	-----	-----	21.0	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	2.0	-----	-----	3.0	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	50.0	-----	-----	80.0	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	3.6	-----	-----	6.5	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	28.0	-----	-----	42.0	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	-----	1.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																		
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----										0.1 / 0.6/ 4.5 / 53 / 96										0.2 / 2.5/ 8 / 92 / 1,536			-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																		
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.125	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	-----	-----	0.125	-----	-----	-----	-----	-----	0.125	-----	-----
Impervious cover estimate (%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	G5c		-----	E5	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	E4/C4	-----	-----	-----	-----	-----	E4/C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	0.8	-----	-----	1.2	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	-----	-----	-----	3.5	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	19.8	-----	-----	-----	19.8	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	13	-----	-----	-----	-----	-----	13	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	859.4	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	943	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1044.9	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.09	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.20	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0127	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	0.012	-----	-----	-----	-----	-----	0.0123	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0135	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	0.015	-----	-----	-----	-----	-----	0.0150	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 10. Baseline Stream Summary (continued)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach 3 (398 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
Dimension and Substrate - Riffle		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	-----	23.0	80.0	5.1	-----	-----	-----	7.6	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	7.2	-----	-----	-----	-----	8.9	-----	-----	9.0	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	>16.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12	-----	-----	20.0	-----	-----	24.4	-----	-----	36.3	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.8	-----	-----	-----	0.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.6	-----	-----	-----	-----	0.4	-----	-----	0.6	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.7	-----	-----	-----	-----	0.8	-----	-----	1.1	-----	-----
BF Cross-sectional Area (ft²)	-----	80.0	300.0	5.7	-----	-----	-----	5.6	-----	-----	-----	5.3	-----	-----	-----	-----	-----	7.9	-----	-----	-----	-----	-----	4.0	-----	-----	-----	-----	3.7	-----	-----	5.3	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	9.9	-----	-----	7	-----	-----	26	-----	-----	8	-----	-----	18	-----	-----	-----	13.0	-----	-----	-----	-----	15.3	-----	-----	21.7	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	2.2	-----	-----	2.0	-----	-----	3.4	-----	-----	1.9	-----	-----	3.9	-----	-----	1.8	-----	-----	2.2	-----	-----	2.7	-----	-----	4.0	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	1.4	-----	-----	2.5	-----	-----	1.1	-----	-----	1.5	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	11	-----	-----	36	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	1.5	-----	-----	1.5	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																		
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----										0.1 / 0.6/ 4.5 / 53 / 96										0.2 / 2.5/ 8 / 92 / 1,536			-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																		
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.1	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	0.1	-----	-----	-----	-----	-----	0.1	-----	-----	-----	-----
Impervious cover estimate (%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	B4c	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	-----	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	21.7	-----	-----	-----	21.7	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	356.8	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	425	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	389.1	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.16	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.18	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0195	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	0.016	-----	-----	-----	-----	-----	0.0172	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0168	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	0.018	-----	-----	-----	-----	-----	0.0187	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 10. Baseline Stream Summary (continued)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach 4 (2,333 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																		
BF Width (ft)	-----	23.0	80.0	10.2	15.4	-----	-----	16.7	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	14.0	-----	-----	-----	-----	10.1	-----	-----	13.8	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	18.4	-----	-----	26.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>30	-----	-----	-----	-----	80.1	-----	-----	105.0	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	1.3	0.9	-----	-----	1.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	0.6	-----	-----	1.2	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.3	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	1.1	-----	-----	2.0	-----	-----
BF Cross-sectional Area (ft²)	-----	80.0	300.0	16.9	14.8	-----	-----	15.5	-----	-----	-----	5.3	-----	-----	-----	-----	-----	7.9	-----	-----	-----	-----	-----	14.0	-----	-----	-----	-----	7.5	-----	-----	12.3	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	15.4	-----	-----	19.0	-----	-----	7	-----	-----	26	-----	-----	8	-----	-----	18	-----	-----	-----	14.0	-----	-----	-----	-----	8.3	-----	-----	19.4	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	1.2	-----	-----	1.6	-----	-----	2.0	-----	-----	3.4	-----	-----	1.9	-----	-----	3.9	-----	-----	-----	>2.2	-----	-----	-----	-----	7.9	-----	-----	9.4	-----	-----
Bank Height Ratio	-----	-----	-----	-----	1.3	-----	-----	2.8	-----	-----	1.4	-----	-----	2.5	-----	-----	1.1	-----	-----	1.5	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.1	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	38.0	79.0	-----	120.0	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	21.0	26.0	-----	31.0	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	38.0	79.0	-----	120.0	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	-----	-----	-----	-----	-----	-----	72.0	104.0	-----	124.0	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	-----	-----	-----	-----	-----	-----	3.5	6.0	-----	8.0	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0046	0.0043	-----	0.0039	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	42	-----	-----	84	-----	-----	41	-----	72	57	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	-----	2.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																		
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			24.2 / 50.6 / 69.4 / 50.6 / 24.2							0.1 / 0.6 / 4.5 / 53 / 96								0.2 / 2.5 / 8 / 92 / 1,536						-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																		
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.7	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	-----	-----	0.7	-----	-----	-----	-----	-----	0.7	-----	-----
Impervious cover estimate (%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	B3c	-----	-----	F5	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	4.4	-----	-----	4.6	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.0	-----	-----	-----	-----	-----	3.0	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	69.2	-----	-----	-----	69.2	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	56.0	-----	-----	-----	-----	-----	56.0	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	349	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	2,783	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	386	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.04	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0169	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	0.015	-----	-----	-----	-----	-----	0.0074	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0148	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	0.017	-----	-----	-----	-----	-----	0.0082	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 10. Baseline Stream Summary (continued)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach 5 (1,461 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																		
BF Width (ft)	-----	23.0	80.0	8.4	-----	-----	-----	8.9	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	10.8	-----	-----	-----	-----	10.2	-----	-----	12.0	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	11.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>25	-----	-----	-----	-----	76.0	-----	-----	103.7	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	1.2	-----	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----	0.7	-----	-----	1.4	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----	1.2	-----	-----	2.8	-----	-----
BF Cross-sectional Area (ft²)	-----	80.0	300.0	12.5	-----	-----	-----	10.9	-----	-----	-----	5.3	-----	-----	-----	-----	-----	7.9	-----	-----	-----	-----	-----	9.0	-----	-----	-----	-----	7.1	-----	-----	15.8	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	7.2	-----	-----	7	-----	-----	26	-----	-----	8	-----	-----	18	-----	-----	-----	13.0	-----	-----	-----	-----	8.0	-----	-----	17.8	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	2.0	-----	-----	3.4	-----	-----	1.9	-----	-----	3.9	-----	-----	-----	>2.2	-----	-----	-----	-----	3.2	-----	-----	9.2	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	2.6	-----	-----	1.4	-----	-----	2.5	-----	-----	1.1	-----	-----	1.5	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	32.0	-----	65.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	-----	2.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																		
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			16.6/31.2/47.0/85.3/116.1						0.1 / 0.6/ 4.5 / 53 / 96						0.2 / 2.5/ 8 / 92 / 1,536						-----	-----	-----	-----	-----	-----			6.74 / 20.49 / 29.79 / 63.73 / 118.25			
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																		
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	-----	0.5	-----	-----
Impervious cover estimate (%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	G4	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	4.5	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	-----	-----	-----	4.4	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	50.0	-----	-----	-----	50	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	40	-----	-----	-----	-----	-----	40	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	1848	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.07	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0144	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	0.014	-----	-----	-----	-----	-----	0.014	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0128	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	0.017	-----	-----	-----	-----	-----	0.017	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 10. Baseline Stream Summary (continued)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach 5a (145 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																		
BF Width (ft)	-----	23.0	80.0	2.4	-----	-----	-----	13.6	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	16.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.5	-----	-----	-----	0.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft²)	-----	80.0	300.0	1.7	-----	-----	-----	4.2	-----	-----	-----	5.3	-----	-----	-----	-----	-----	7.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	45.0	-----	-----	7	-----	-----	26	-----	-----	8	-----	-----	18	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	2.0	-----	-----	3.4	-----	-----	1.9	-----	-----	3.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	1.4	-----	-----	2.5	-----	-----	1.1	-----	-----	1.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft³)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																		
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----										0.1 / 0.6/ 4.5 / 53 / 96										0.2 / 2.5/ 8 / 92 / 1,536												
Reach Shear Stress (competency) lb/f²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m²	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																		
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.025	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Impervious cover estimate (%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	1.7	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	6.2	-----	-----	-----	7.1	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft)	-----	-----	-----	-----	-----	-----	-----	144	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.19	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0236	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0224	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Appendix E

Hydrologic Data

Table 12. Verification of Bankfull Events

UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Date of Data Collection	Crest Gauge 1 (Reach 5)	Crest Gauge 2 (Reach 3)	Estimated Occurrence of Bankfull Event	Method of Data Collection
Year 1 Monitoring				
10/1/2014	NA	0.18	7/16/2014	Crest Gauge
Year 2 Monitoring				
3/25/2015	0.33	NA	3/6/2015	Crest Gauge
10/13/2015	0.62	0.79	10/3/2015	Crest Gauge
Year 3 Monitoring				
7/27/2016	1.21	NA	2/17/2016	Crest Gauge
9/30/2016	1.31	1.12	9/19/2016	Crest Gauge
11/9/2016	0.75	0.66	10/9/2016	Crest Gauge
Year 4 Monitoring				
5/3/2017	0.76	0.46*	4/24/2017	Crest Gauge

* Although the reading from Crest Gauge 2 on 5/3/2017 wasn't as clear as on previously recorded events, the evidence of overbank flow was obvious and was documented through photographs as presented in Appendix B.

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