

UT to Cane Creek Restoration Project Year 2 Final Monitoring Report

**Alamance County, North Carolina
NC DEQ-DMS Project ID Number – 95729**

Report Prepared and Submitted by Michael Baker Engineering, Inc.
NC Professional Engineering License # F-1084



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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 (AC) of native riparian species vegetation within the 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) formerly Department of Environment and Natural Resources) - Division of Mitigation Services ((DMS) formerly Ecosystem Enhancement Program) Targeted Local Watershed (TLW) 03030002-050050 of the Cape Fear River Basin. The Project involved the restoration and enhancement of Rural Piedmont Streams (NC WAM 2010, Schafale and Weakley 1990) 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.

During Year 2 monitoring, the planted acreage performance categories were functioning at 100 percent with no bare areas to report (Appendix B). The average density of total planted stems, based on data collected from the six monitoring plots following Year 2 monitoring in October 2015, was 688 stems per acre. The Year 2 vegetation data demonstrate that the Site is on track for meeting the minimum success interim criteria of 320 trees per acre by the end of Year 3.

One area of invasive species vegetation was observed during Year 2 monitoring. It is noted that re-sprouts of *Ligustrum sinense* (Chinese privet) was noted along Reach 5 near the confluence with Reach 3. The Chinese privet plants observed consist of an area less than 1000 square feet and is shown on the Current Condition Plan View (CCPV) map in the Appendix B.

Additionally, an easement issue regarding buffer encroachment was documented along the downstream portion of Reach 1 following Year 1 monitoring. This problem area was approximately 0.06 acre in size and encompassed 3.8% of the planted riparian buffer area of Reach R1. Encroachment occurred due to confusion relating to the prior use of this area as an active agricultural field. Following construction, buffer signage was in place at the concerned easement corner; however, signage was removed by an equipment operator. This encroachment was noted by Baker monitoring staff and the signage was re-established. To further demarcate the easement boundary, 1-inch wire-mesh horse tape was installed and has prevented further encroachment. Following Year 2 monitoring, this encroachment area is now thick with herbaceous vegetation as well as tree stems. This area will continue to be periodically checked future site visits.

The Year 2 monitoring survey data of twelve cross-sections indicates that the Site is geomorphically stable and performing at 100 percent for the all parameters evaluated. The data collected are within the lateral/vertical stability and in-stream structure performance categories.

During Year 2 monitoring, the Reach R3 crest gauge (crest gauge 2) documented at least two post-construction bankfull events. Additionally, the Reach R5 crest gauge (crest gauge 1) recorded one bankfull event during Year 2 monitoring.

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 2 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 CCPV map found in Appendix B.

The Year 2 cross-section data and vegetation plot data were collected in October 2015. All visual site assessment data contained in Appendix B were also collected in October 2015.

2.2 Stream Assessment

The Project involved the restoration and enhancement of a Rural Piedmont Stream System (NC WAM 2010, Schafale and Weakley 1990) 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.

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal accuracy using Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the As-built survey.

2.2.1 Morphological Parameters and Channel Stability

Cross-sections were classified using the Rosgen Stream Classification System, and all monitored cross-sections fall within the quantitative parameters defined for channels of the design stream type. Morphological survey data is presented in Appendix D.

A longitudinal profile was surveyed for the entire length of channel immediately after construction to document as-built baseline conditions for the first year of monitoring 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.

2.2.2 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 2 monitoring, two above bankfull stage events were documented by Crest gauge 1. Additionally, one above bankfull stage event was recorded by Crest Gauge 2. The crest gauge readings are presented in Appendix E.

2.2.3 Photographic Documentation

Reference photograph transects were taken at each permanent cross-section. The survey tape was centered in the photographs of the bank. The water line was located in the lower edge of the frame, and as much of the bank as possible is included in each photograph.

Representative photographs also were taken of grade control structures and buffer areas along the restored stream. Selected stream photographs from Year 2 monitoring are shown in Appendix B.

2.2.4 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 2 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. Locations of potential Stream Problem Areas (SPAs) are documented in the field for subsequent mapping on the CCPV figures. A detailed summary of the methodology and results for the visual stream stability assessment can be found in Appendix B, which includes supporting data tables, and SPA photos if applicable.

2.3 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.

During Year 2 monitoring, the planted acreage performance categories were functioning at 100 percent with no bare areas to report (Appendix B). The average density of total planted stems, based on data collected from the six monitoring plots following Year 2 monitoring in October 2015, was 688 stems per acre.

One area of Chinese privet less than 1,000 square feet was noted at Station 28+50 on the downstream portion of Reach 5. This area will be closely monitored during Year 3 and appropriate actions will be taken if deemed necessary.

As stated in Baker's letter dated November 7, 2014 to Mr. Jeff Schaffer of DMS, buffer areas with low stem densities were to be "replanted during the 2014 dormant season". In March 2015, the supplemental replanting of Reaches R3, R4 and R5 was completed with bare-root stems in accordance with this letter. These areas, as well as vegetation monitoring plots 2 through 6, were replanted during this effort. The planting areas were mostly unforested within the respective reach buffers.

Based on recent data collected from the vegetation monitoring plots the planted stem density is 688 stems per acre. Therefore, the replanting data demonstrate that the Site is on back on track for meeting the minimum interim success criteria of 320 trees per acre by the end of Year 3.

Following the replanting effort completed in March 2015 and the monitoring effort in October 2015, it is reported that Chinese privet area shown on the Year 2 CCPV is the only invasive area of concern noted during Year 2 monitoring.

Year 2 vegetation assessment information is provided in Appendix B and C.

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.

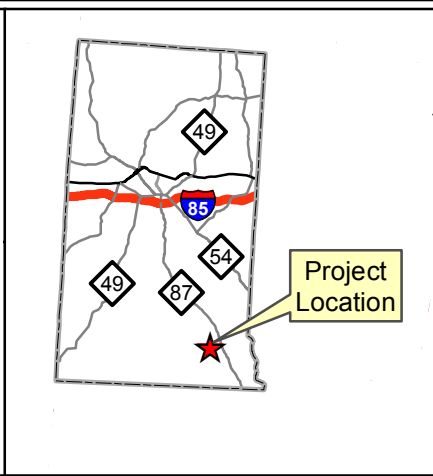
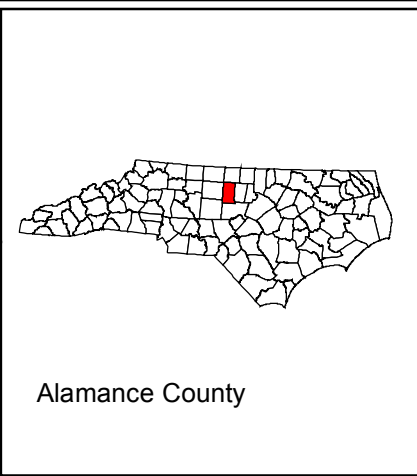
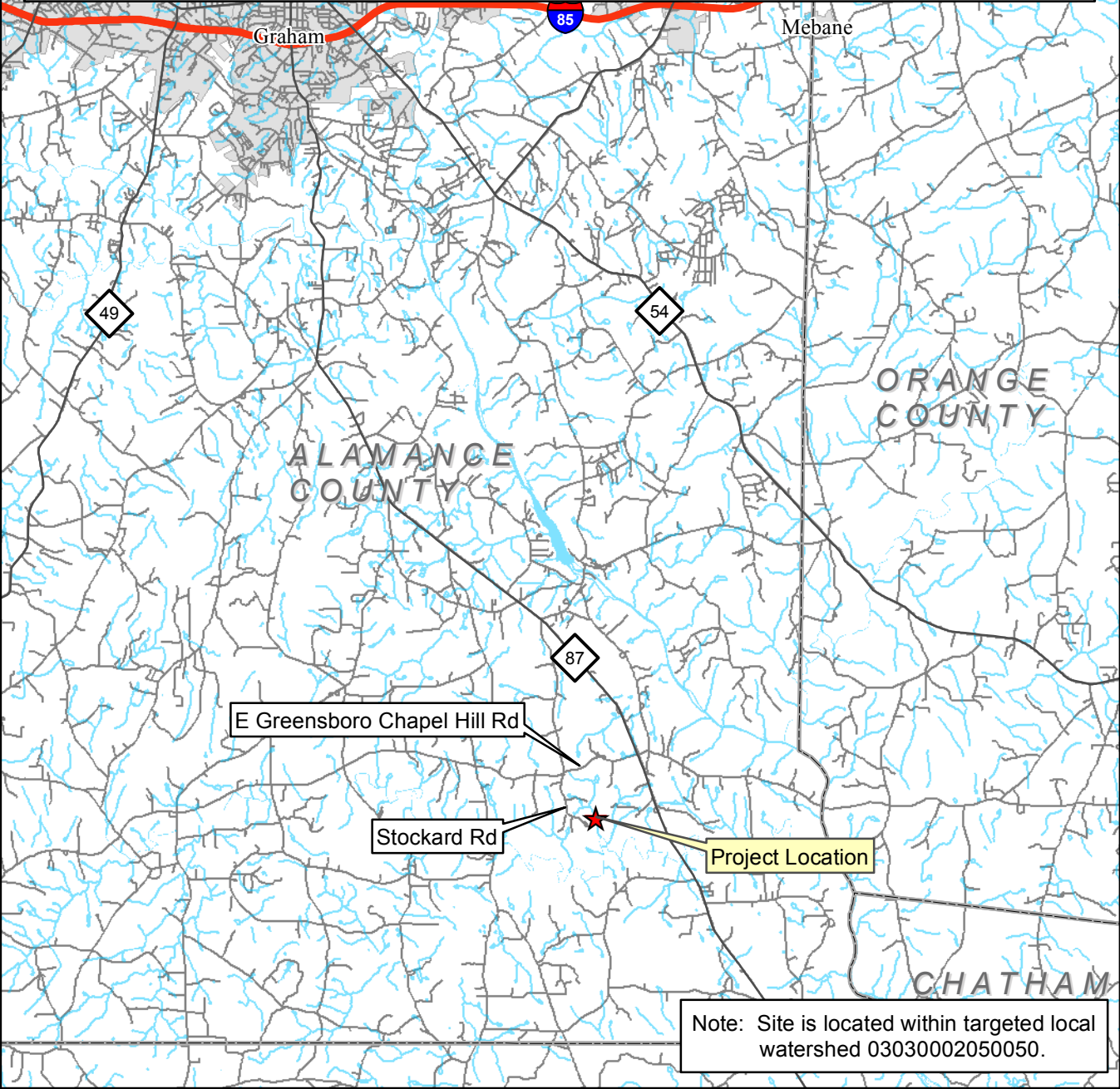
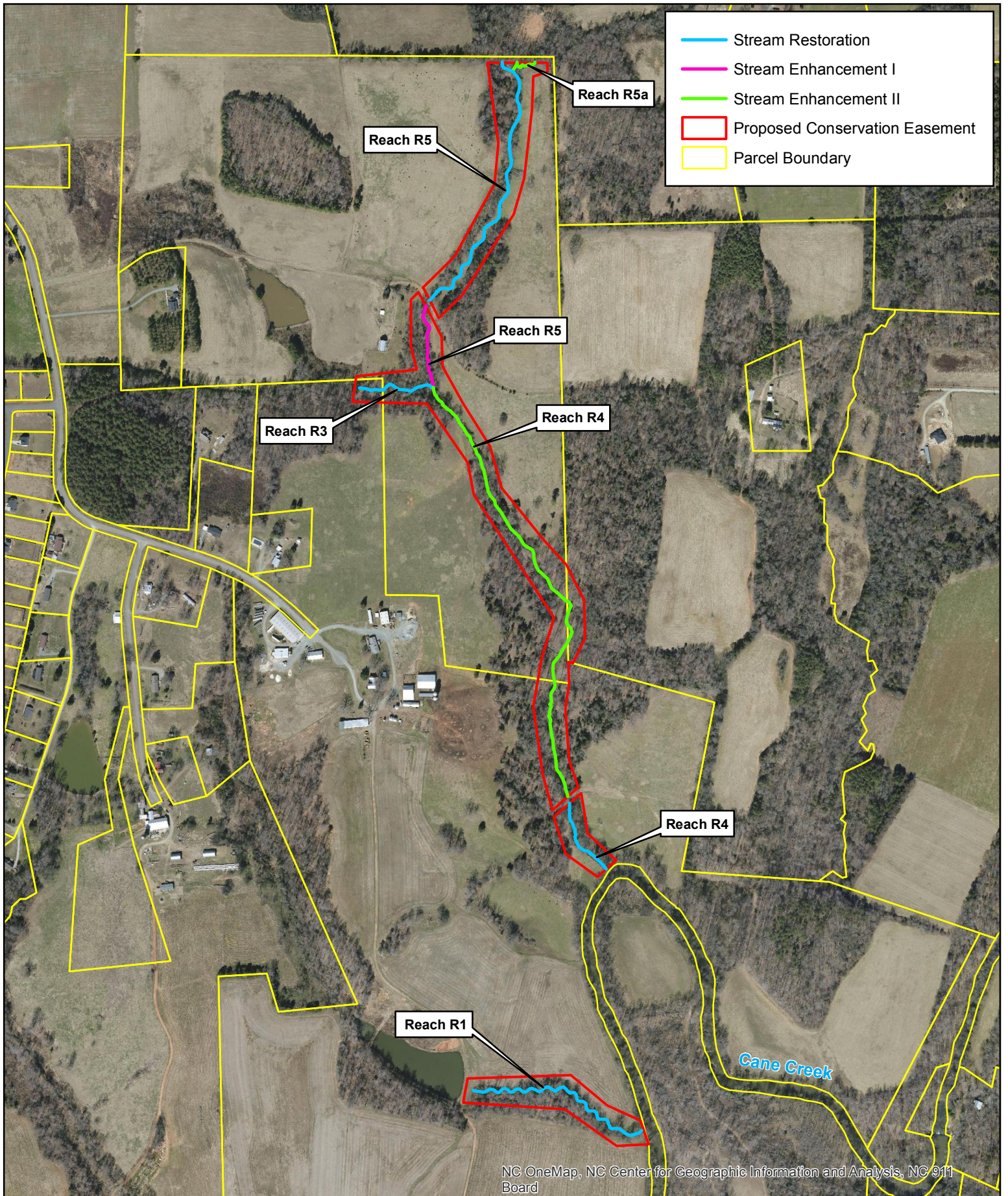


Figure 1
Project Vicinity Map
UT to Cane Creek Site

DEQ - Division of Mitigation Services

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0 0.5 1 2 3 Miles



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0 500 1,000 Feet
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Project # 95729



Figure 2
Mitigation Work Plan
UT to Cane Creek Site

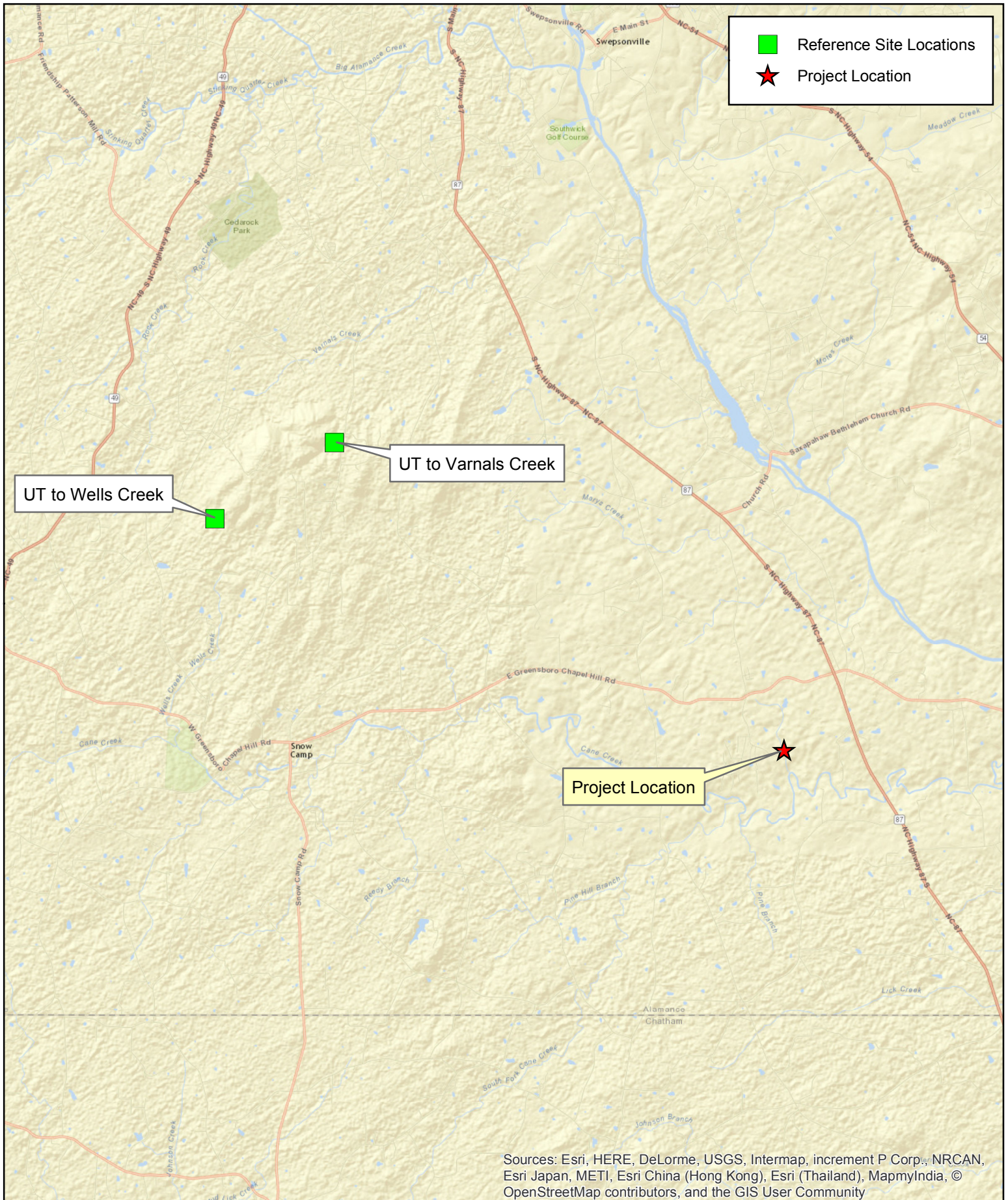


Table 1. Project Components and Mitigation Credits								
UT to Cane Creek Restoration Project: DMS Project ID No. 95729								
Mitigation Credits								
	Stream	Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R, E1, EII	R	E					
Totals	4,594 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	N/A	N/A
Year 4 Monitoring	Dec-17	N/A	N/A
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 <u>Contact:</u> Scott King, Telephone: 919-481-5731
Construction Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 <u>Contact:</u> Phillip Todd, Telephone: 919-582-3575
Planting Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 <u>Contact:</u> Phillip Todd, Telephone: 919-582-3575
Seeding Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 <u>Contact:</u> Phillip Todd, Telephone: 919-582-3575
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 <u>Contact:</u>
Stream Monitoring Point of Contact	Dwayne Huneycutt, Tel. 919-481-5745
Vegetation Monitoring Point of Contact	Dwayne Huneycutt, Tel. 919-481-5745

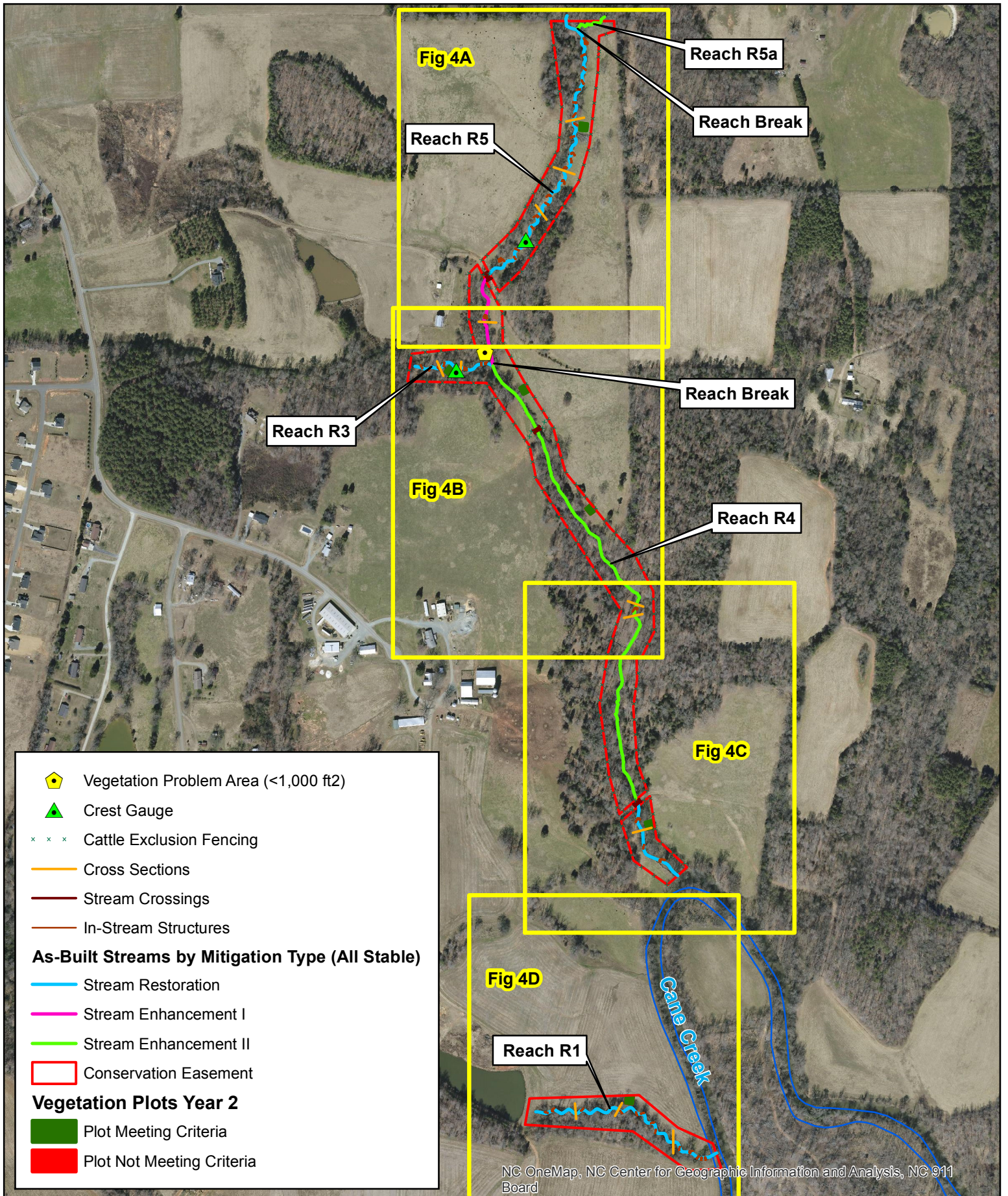
Table 4. Project Attributes

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	3-06-04				
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



- Vegetation Problem Area (<1,000 ft²)
- Crest Gauge
- Cattle Exclusion Fencing
- Cross Sections
- Stream Crossings
- In-Stream Structures

As-Built Streams by Mitigation Type (All Stable)

- Stream Restoration
- Stream Enhancement I
- Stream Enhancement II

Conservation Easement

- Conservation Easement

Vegetation Plots Year 2

- Plot Meeting Criteria
- Plot Not Meeting Criteria

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0 250 500 Feet

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Project # 95729



Current Condition
Plan View - Figure Index
Monitoring Year 2
UT to Cane Creek Site

As-Built Streams by MitigationType (All Stable)

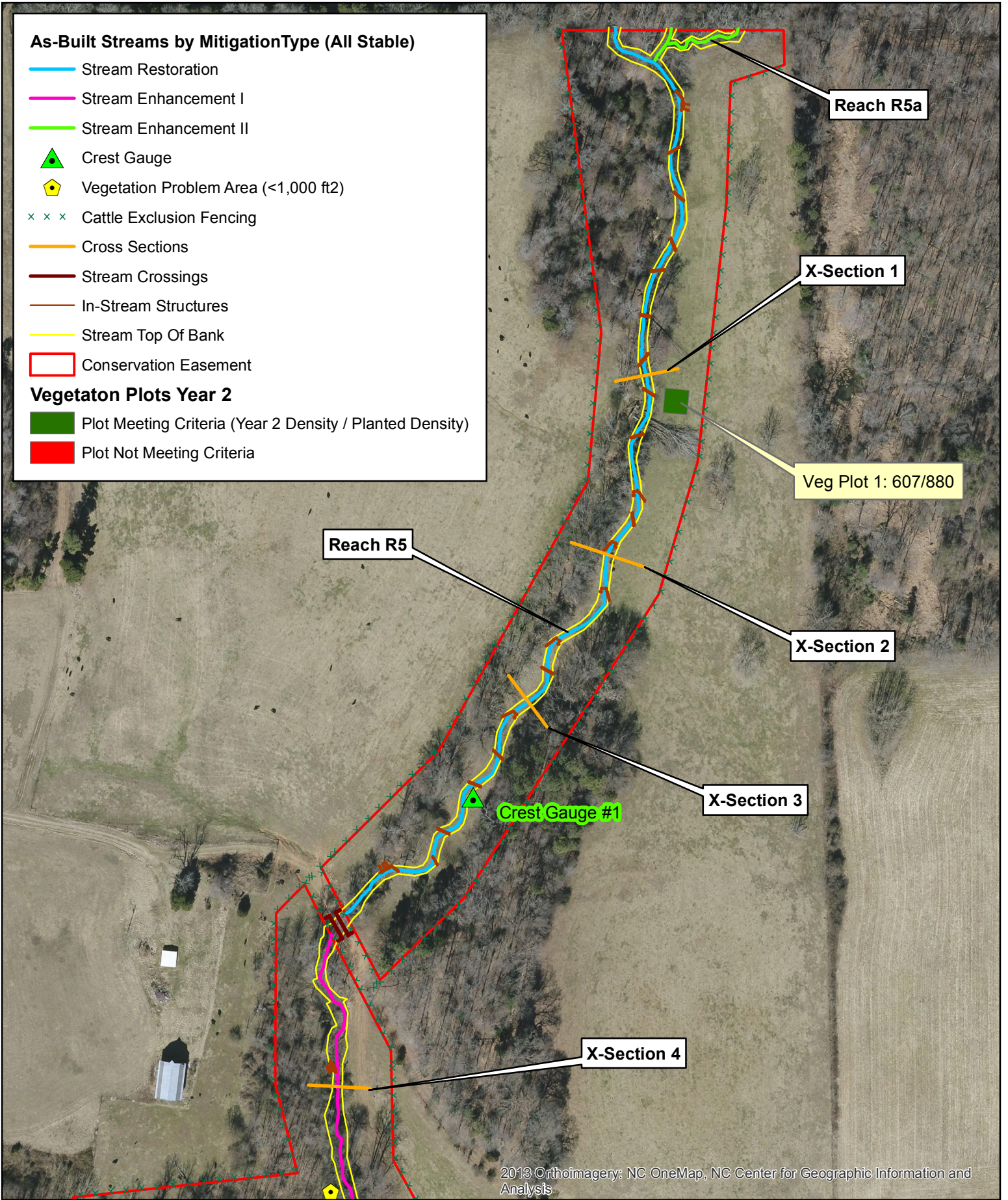
- Stream Restoration
- Stream Enhancement I
- Stream Enhancement II

- ▲ Crest Gauge
- ⬠ Vegetation Problem Area (<1,000 ft²)
- x x x Cattle Exclusion Fencing

- Cross Sections
- Stream Crossings
- In-Stream Structures
- Stream Top Of Bank
- ⬠ Conservation Easement

Vegetation Plots Year 2

- Plot Meeting Criteria (Year 2 Density / Planted Density)
- Plot Not Meeting Criteria



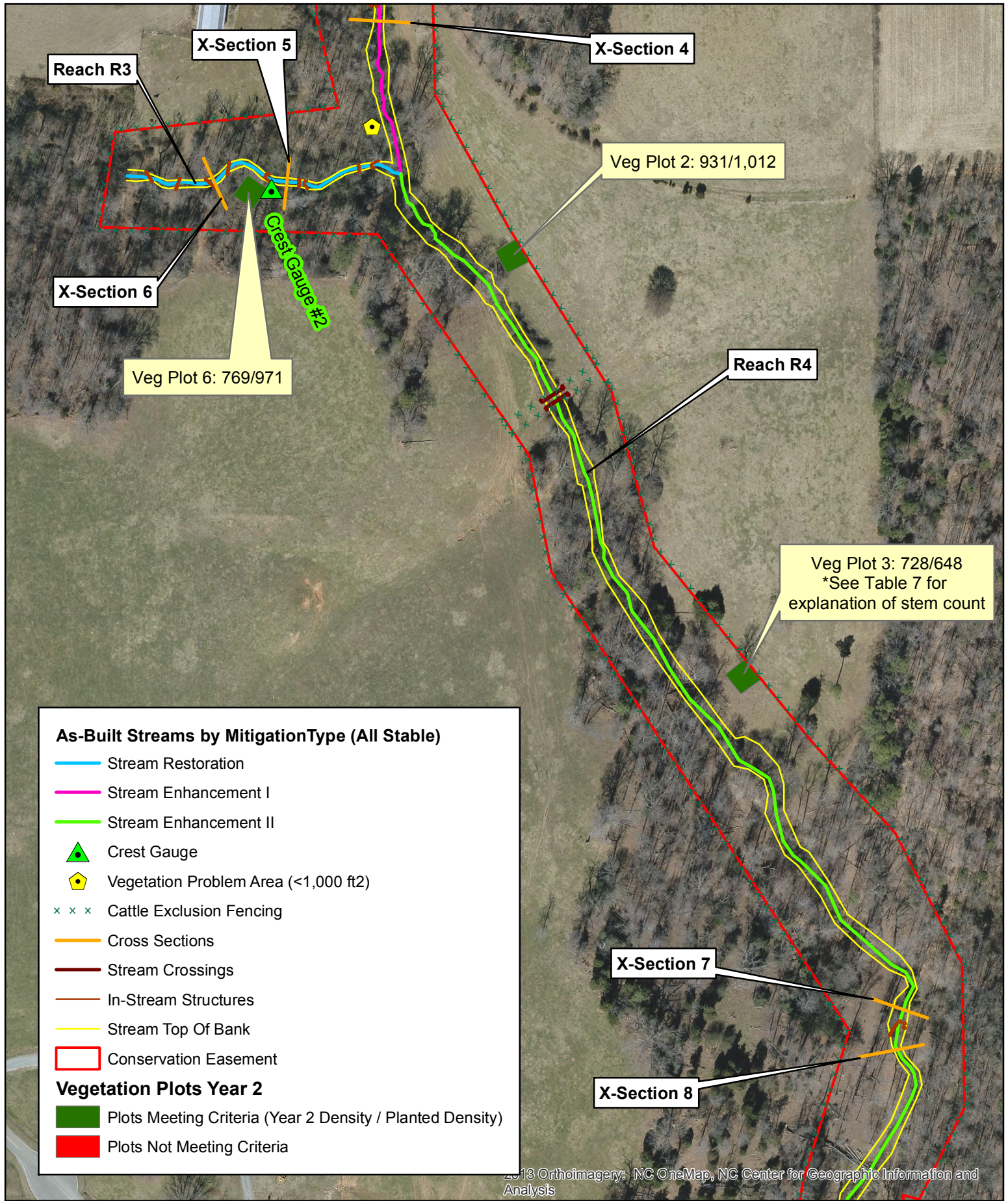
2013 Orthoimagery: NC OneMap, NC Center for Geographic Information and Analysis

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0 100 200 Feet
DEQ - Division of Mitigation Services
Project # 95729



Current Condition
Plan View - Figure 4A
Monitoring Year 2
UT to Cane Creek Site



As-Built Streams by MitigationType (All Stable)

- Stream Restoration
- Stream Enhancement I
- Stream Enhancement II
- ▲ Crest Gauge
- ⬠ Vegetation Problem Area (<1,000 ft²)
- x x x Cattle Exclusion Fencing
- Cross Sections
- Stream Crossings
- In-Stream Structures
- Stream Top Of Bank
- Conservation Easement

Vegetation Plots Year 2

- Plots Meeting Criteria (Year 2 Density / Planted Density)
- Plots Not Meeting Criteria

Veg Plot 3: 728/648
 *See Table 7 for explanation of stem count

2013 Orthoimagery: NC OneMap, NC Center for Geographic Information and Analysis

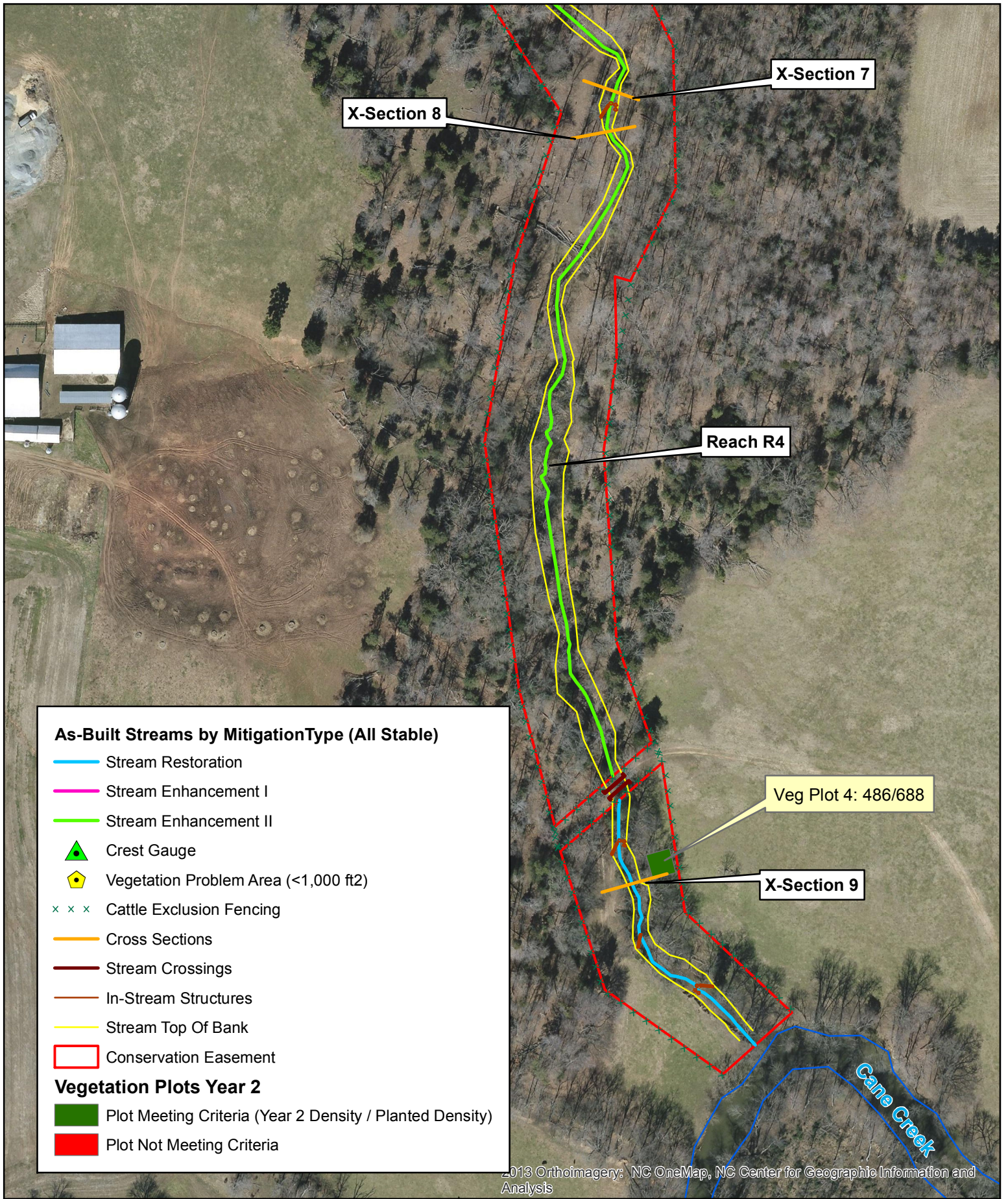


0 100 200 Feet

DEQ - Division of Mitigation Services
 Project # 95729



**Current Condition
 Plan View - Figure 4B
 Monitoring Year 2
 UT to Cane Creek Site**



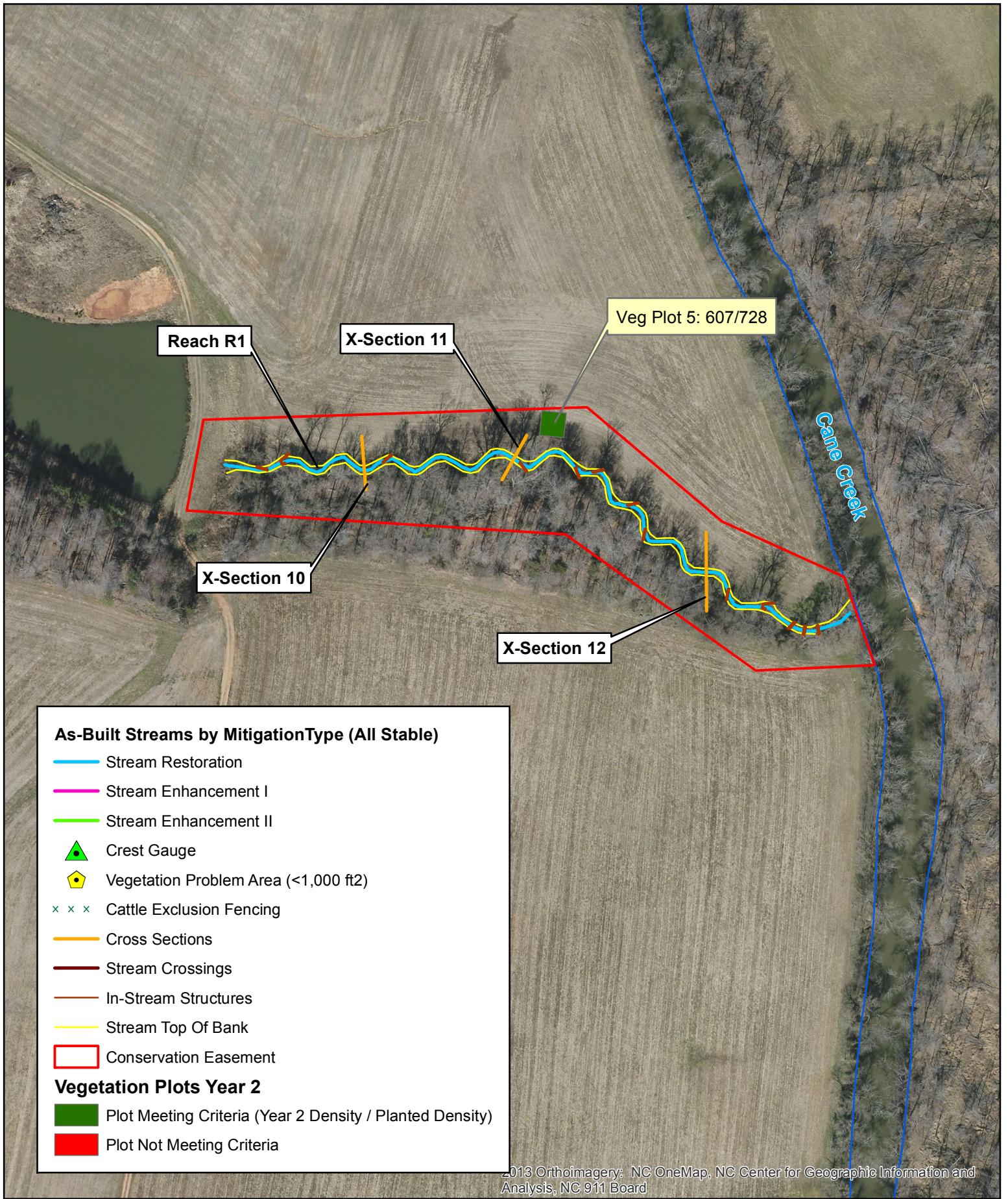


Table 5a. Visual Stream Morphology Stability Assessment										
UT to Cane Creek Restoration Project: DMS Project ID No. 95729										
Reach ID: Reach 1										
Assessed Length (LF): 1,045										
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number 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
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 Stream 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
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 Stream 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
	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 Stream 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
	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						
Reach ID: Reach 1						
Planted Acreage: 3.1						
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: 3.1						
Vegetation Category	Defintions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
5. Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale)	1000 ft ²	NA	0	0.00	0.0%
6. Easement Encroachment Areas	Easement area shown was encroached into by use of farm equipment and will need to be replanted.	none	NA	0	0.00	0.0%
Reach ID: Reach 3 and 4						
Planted Acreage: 8.4						
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: 8.4						
Vegetation Category	Defintions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
5. Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale)	1000 ft ²	NA	0	0.00	0.0%
6. Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale)	none	NA	0	0.00	0.0%
Reach ID: Reach 5						
Planted Acreage: 5.0						
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: 5.0						
Vegetation Category	Defintions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
5. Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale)	1000 ft ²	Points Only	Area <1000 ft ²	0.00	0.0%
6. Easement Encroachment Areas	Areas of 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	Photo Number
Chinese privet (<i>Ligustrum sinense</i>)	*Reach 5, Station ~28+50	Re-sprout	VPA 1, 2, 3

* See Figure 4B for location of invasive species



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



Reach R5 – View upstream towards 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



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 stream crossing, Station 33+00



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 48+00



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



Reach R4 – View upstream, Station 55+50



Reach R4 – View upstream, Station 56+50



Reach R1 – View upstream, Station 10+50



Reach R1 – View downstream, Station 14+75



Reach R1 – Vernal Pool, Station 15+00



Reach R1 – View downstream, Station 17+00



Reach R1 – View upstream, Station 19+25



Reach R1 – View upstream, Station 20+00



Reach R5 – Crest Gauge 1, 0.62 feet. October 13, 2015



Reach R5 – Crest gauge 1 area. October 26, 2015



Reach R5– Crest Gauge 2, 0.33 feet. March 26, 2015



Reach R3 – Crest Gauge 2, 0.79 feet. October 13, 2015



Reach R5 lower – Bankfull evidence, October 26, 2015



Reach R5 upper – Bankfull evidence, October 26, 2015



Vegetation Plot 1 – October 2015



Vegetation Plot 2 – October 2015



Vegetation Plot 3 – October 2015



Vegetation Plot 4 – October 2015



Vegetation Plot 5 – October 2015



Vegetation Plot 6 – October 2015



1) Vegetation Problem Area #1 – Vicinity of Reach 5 Station 28+50, October 2015



2) Vegetation Problem Area #1 – Vicinity of Reach 5 Station 28+50, October 2015



3) Vegetation Problem Area #1 – Vicinity of Reach 5 Station 28+50, October 2015

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Plot ID	Vegetation Survival Threshold Met?	October 2015 Total/Planted Stem Count*	Tract Mean
1	Y	607/880	688
2	Y	931/1,012	
3	Y	**728/648	
4	Y	486/688	
5	Y	607/728	
6	Y	769/971	

Notes:
 * Total/Planted Stem Count reflects the change in stem density based on the density of stems at the time of the As-Built Survey (Planted) and the current total density of planted stems (Total)
 ** Includes stems planted during the March 2015 re-planting effort

Table 8. CVS Vegetation Plot Metadata
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Report Prepared By	Dwayne Huneycutt
Date Prepared	10/28/2015 8:00
database name	MichaelBaker_2015_UTCaneCrk_95729.mdb
database location	L:\Monitoring\Veg Plot Info\CVS Data Tool\UT to Cane Creek
computer name	CARYLDHUNEYCUTT
file size	48234496
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	95729
project Name	UT to Cane Creek
Description	
River Basin	Cape Fear
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	6

Table 9a. CVS Stem Count of Planted Stems by Plot and Species
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

	Comment	Species	Species Type	Common Name	Total Planted Stems	# plots	Avg# stems	Plot 95729-01-0001	Plot 95729-01-0002	Plot 95729-01-0003	Plot 95729-01-0004	Plot 95729-01-0005	Plot 95729-01-0006
		<i>Betula nigra</i>	Tree	river birch	10	3	3.33	6				1	3
		<i>Carpinus caroliniana</i>	Shrub Tree	American hornbeam	7	5	1.4		1	1	1	1	3
		<i>Diospyros virginiana</i>	Tree	common persimmon	5	4	1.25	2	1	1	1		
		<i>Fraxinus pennsylvanica</i>	Tree	green ash	27	6	4.5	1	10	5	3	4	4
		<i>Liriodendron tulipifera</i>	Tree	tuliptree	1	1	1				1		
		<i>Nyssa sylvatica</i>	Tree	blackgum	3	1	3				3		
		<i>Platanus occidentalis</i>	Tree	American sycamore	11	5	2.2	4	2	2		1	2
		<i>Quercus spp.</i>	Shrub Tree	oak	1	1	1		1				
		<i>Quercus alba</i>	Tree	white oak	5	3	1.67		2	2	1		
		<i>Quercus laurifolia</i>	Tree	laurel oak	3	2	1.5	1				2	
		<i>Quercus lyrata</i>	Tree	overcup oak	11	4	2.75		5	2		2	2
		<i>Quercus michauxii</i>	Tree	swamp chestnut oak	13	6	2.17	1	1	3	2	1	5
		<i>Quercus nigra</i>	Tree	water oak	3	2	1.5			1		2	
		<i>Unknown</i>	unknown	NA	2	2	1			1		1	
TOT:	0	14	14	13	102	14		15	23	18	12	15	19

Table 9b. Stem Count for Each Species Arranged by Plot							
UT to Cane Creek Restoration Project: DMS Project ID No. 95729							
Botanical Name	Common Name	Plots					
		1	2	3	4	5	6
Tree Species							
<i>Betula nigra</i>	river birch	6				1	3
<i>Fraxinus pennsylvanica</i>	green ash	1	10	5	3	4	4
<i>Liriodendron tulipifera</i>	tulip poplar				1		
<i>Nyssa sylvatica</i>	black gum				3		
<i>Platanus occidentalis</i>	American sycamore	4	2	2		1	2
<i>Quercus alba</i>	white oak		2	2	1		
<i>Quercus laurifolia</i>	laurel oak	1				2	
<i>Quercus lyrata</i>	overcup oak		5	2		2	2
<i>Quercus michauxii</i>	swamp chestnut oak	1	1	3	2	1	5
<i>Quercus nigra</i>	water oak			1		2	
<i>Quercus spp.</i>	unknown oak		1			1	
Shrub Species							
<i>Asimina triloba</i>	paw paw						
<i>Carpinus caroliniana</i>	ironwood		1	1	1	1	3
<i>Diospyros virginiana</i>	persimmon	2	1	1	1		
<i>Hamamelis virginiana</i>	witch hazel						
<i>Itea virginica</i>	Virginia sweetspire						
<i>Lindera benzoin</i>	spicebush						
<i>Viburnum dentatum</i>	arrowwood Viburnum						
<i>Unknown</i>	unknown			1			
Total Stems Per Plot for Year 2 (October 2015)		15	23	18	12	15	19
Density Per Plot for Year 2 (October 2015)		607	931	728	486	607	769
Density Per Plot for Year 1 (After re-planting Mar. 2015)		728	1012	648	688	728	971
Total Stems/ Acre for Year 1 (Before re-planting Dec. 2014)		728	405	121	364	202	567
Total Stems/ Acre for Year 0 As-Built (Baseline Data)		880	680	640	680	760	520
							Average Stems Per Acre
							688
							796
							398
							693

Table 9c. CVS Density Per Plot

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

			Current Plot Data (MY2 2015)																		Annual Means					
Scientific Name	Common Name	Species Type	95729-01-0001			95729-01-0002			95729-01-0003			95729-01-0004			95729-01-0005			95729-01-0006			MY2 (2015)			MY1 (2015)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Betula nigra</i>	river birch	Tree	6	6	6										1	1	1	3	3	3	10	10	10	13	13	13
<i>Carpinus caroliniana</i>	American hornbeam	Tree				1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	7	7	7	5	5	5
<i>Diospyros virginiana</i>	common persimmon	Tree	2	2	2	1	1	1	1	1	1	1	1	1							5	5	5	1	1	1
<i>Fraxinus pennsylvanica</i>	green ash	Tree	1	1	1	10	10	10	5	5	5	3	3	3	4	4	4	4	4	4	27	27	27	15	15	15
<i>Liriodendron tulipifera</i>	tuliptree	Tree										1	1	1							1	1	1			
<i>Nyssa sylvatica</i>	blackgum	Tree										3	3	3							3	3	3	4	4	4
<i>Platanus occidentalis</i>	American sycamore	Tree	4	4	4	2	2	2	2	2	2				1	1	1	2	2	2	11	11	11	7	7	7
<i>Quercus spp.</i>	oak	Tree				1	1	1													1	1	1			
<i>Quercus alba</i>	white oak	Tree				2	2	2	2	2	2	1	1	1							5	5	5			
<i>Quercus laurifolia</i>	laurel oak	Tree	1	1	1										2	2	2				3	3	3	3	3	3
<i>Quercus lyrata</i>	overcup oak	Tree				5	5	5	2	2	2				2	2	2	2	2	2	11	11	11			
<i>Quercus michauxii</i>	swamp chestnut oak	Tree	1	1	1	1	1	1	3	3	3	2	2	2	1	1	1	5	5	5	13	13	13	9	9	9
<i>Quercus nigra</i>	water oak	Tree							1	1	1				2	2	2				3	3	3	1	1	1
Unknown	unk	unk							1	1	1				1	1	1				2	2	2	1	1	1
Stem count			15	15	15	23	23	23	18	18	18	12	12	12	15	15	15	19	19	19	102	102	102	59	59	59
size (ares)			1			1			1			1			1			1			6			6		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.15			0.15		
Species count			6	6	6	8	8	8	9	9	9	7	7	7	9	9	9	6	6	6	14	14	14	10	10	10
Stems per ACRE			607.03	607.03	607.03	930.78	930.78	930.78	728.43	728.43	728.43	485.62	485.62	485.62	607.03	607.03	607.03	768.90	768.90	768.90	687.97	687.97	687.97	397.94	397.94	397.94

■ Fails to meet requirements, by less than 10%

Table 9d. CVS Vegetation Summary and Totals
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Year 2 (October 2015)

Vegetation Plot Summary Information

Plot #	Riparian Buffer Stems ¹	Stream/ Wetland Stems ²	Live Stakes	Invasives	Volunteers ³	Total ⁴	Unknown Growth Form
1	n/a	15	0	0	0	15	0
2	n/a	23	0	0	0	23	0
3	n/a	n/a	0	0	0	18	0
4	n/a	n/a	0	0	0	12	0
5	n/a	n/a	0	0	0	15	0
6	n/a	19	0	0	0	19	0

Wetland/Stream Vegetation Totals
(per acre)

Plot #	Stream/ Wetland Stems ²	Volunteers ³	Total ⁴	Success Criteria Met?
1	607	0	607	Yes
2	931	0	931	Yes
3	728	0	728	Yes
4	486	0	486	Yes
5	607	0	607	Yes
6	769	0	769	Yes
Project Average	769	0	688	Yes

Riparian Buffer Vegetation Totals
(per acre)

Plot #	Riparian Buffer Stems ¹	Success Criteria Met?
1	n/a	
2	n/a	
3	n/a	
4	n/a	
5	n/a	
6	n/a	
Project Average	n/a	

Stem Class	Characteristics
¹ Buffer Stems	Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.
² Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
³ Volunteers	Native woody stems. Not planted. No vines.
⁴ Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Appendix D

Stream Survey Data

Permanent Cross-section 1, Reach 5

(Year 2 Data - Collected October 2015)

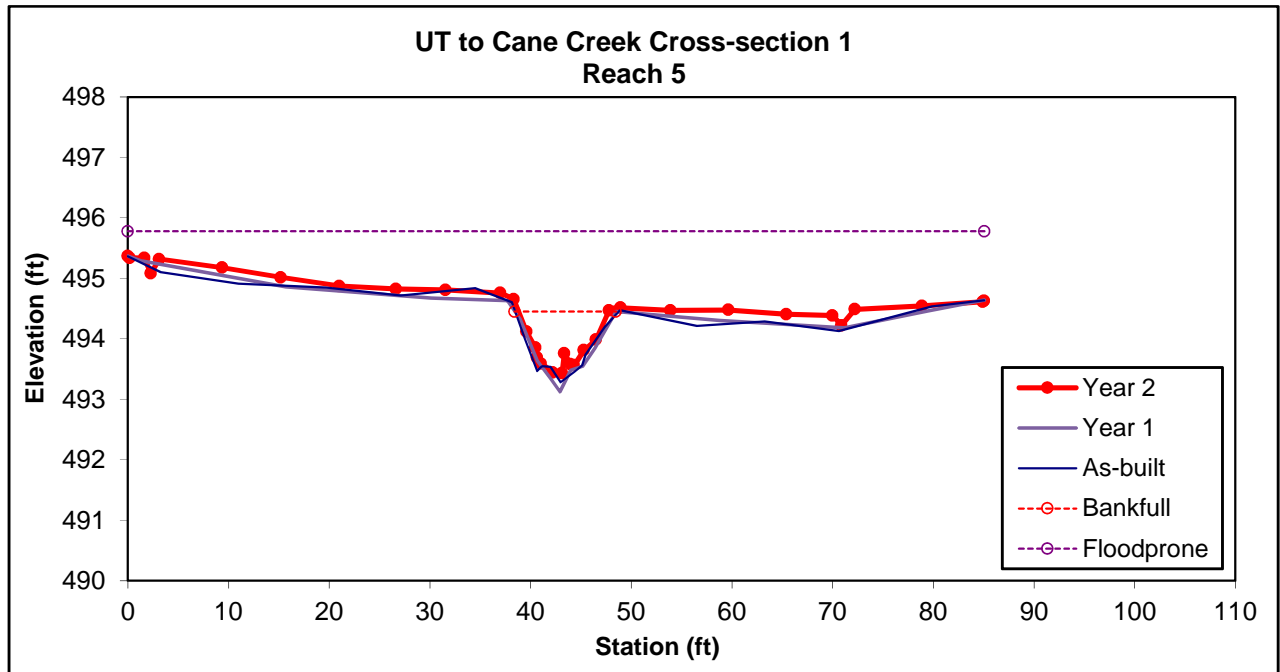


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Cc	2.6	6.24	0.41	0.87	15.06	1.2	10.1	437.9	438.05



Permanent Cross-section 2, Reach 5

(Year 2 Data - Collected October 2015)

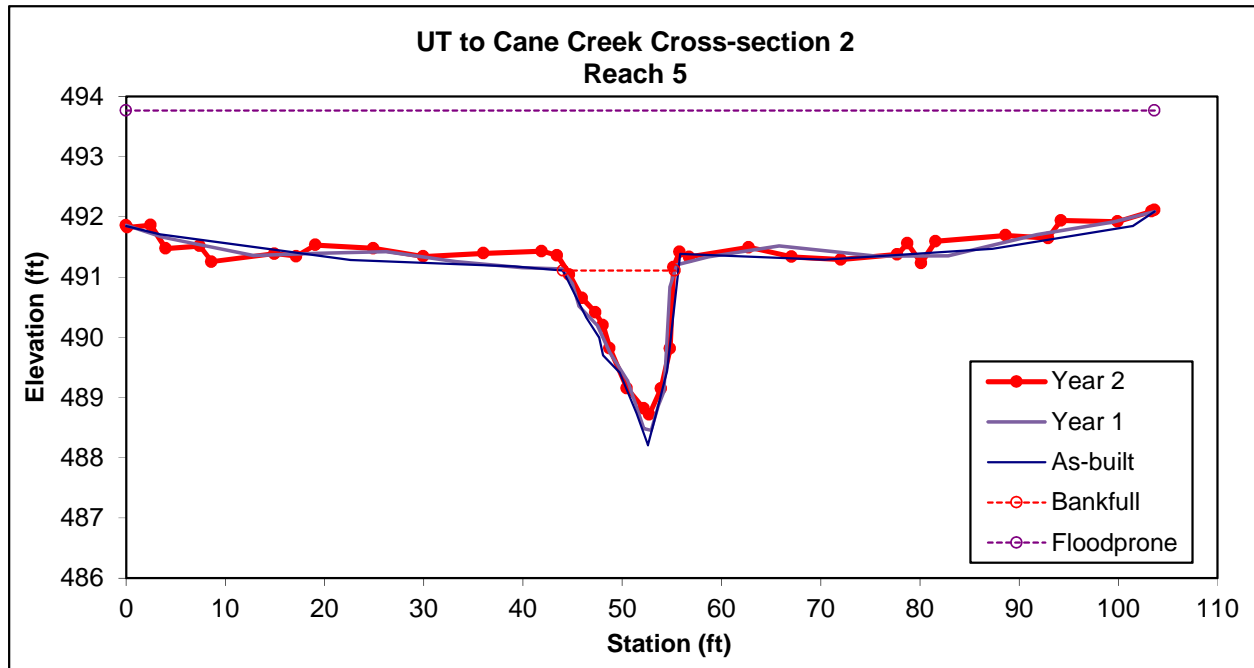


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		14.5	10.75	1.35	2.39	7.98	1.1	9.6	491.11	491.36



Permanent Cross-section 3, Reach 5

(Year 2 Data - Collected October 2015)

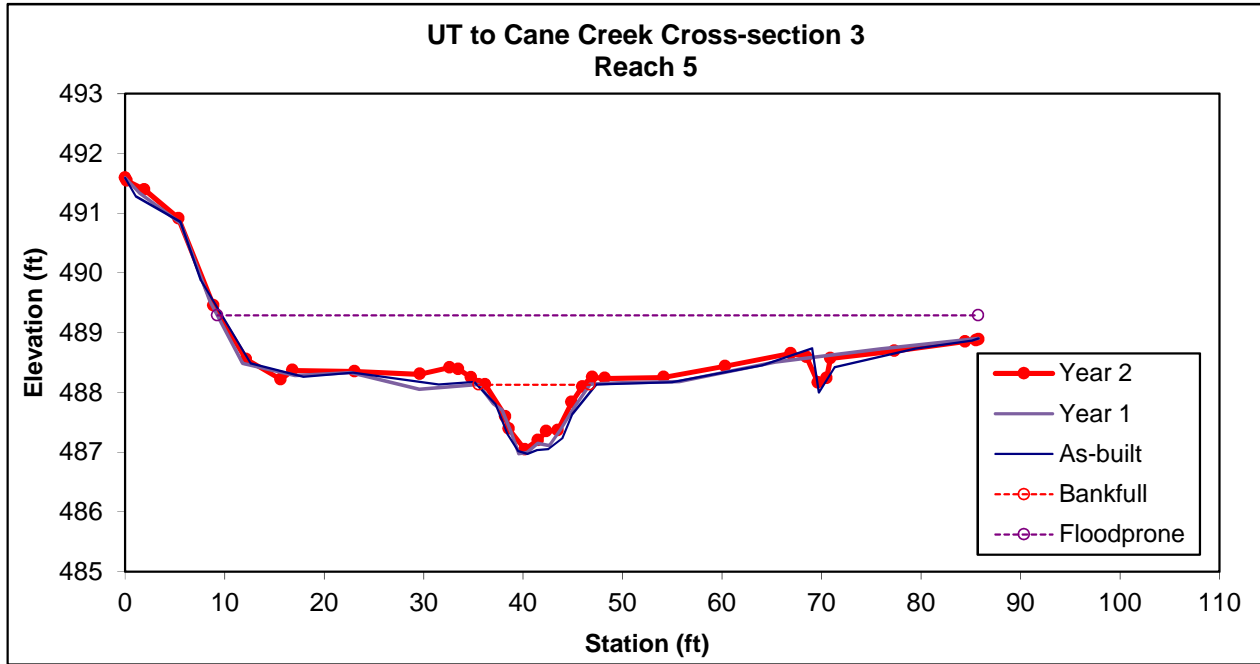


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Cc	6.1	10.04	0.61	1.08	16.56	1	7.6	488.13	488.13



Permanent Cross-section 4, Reach 5

(Year 2 Data - Collected October 2015)

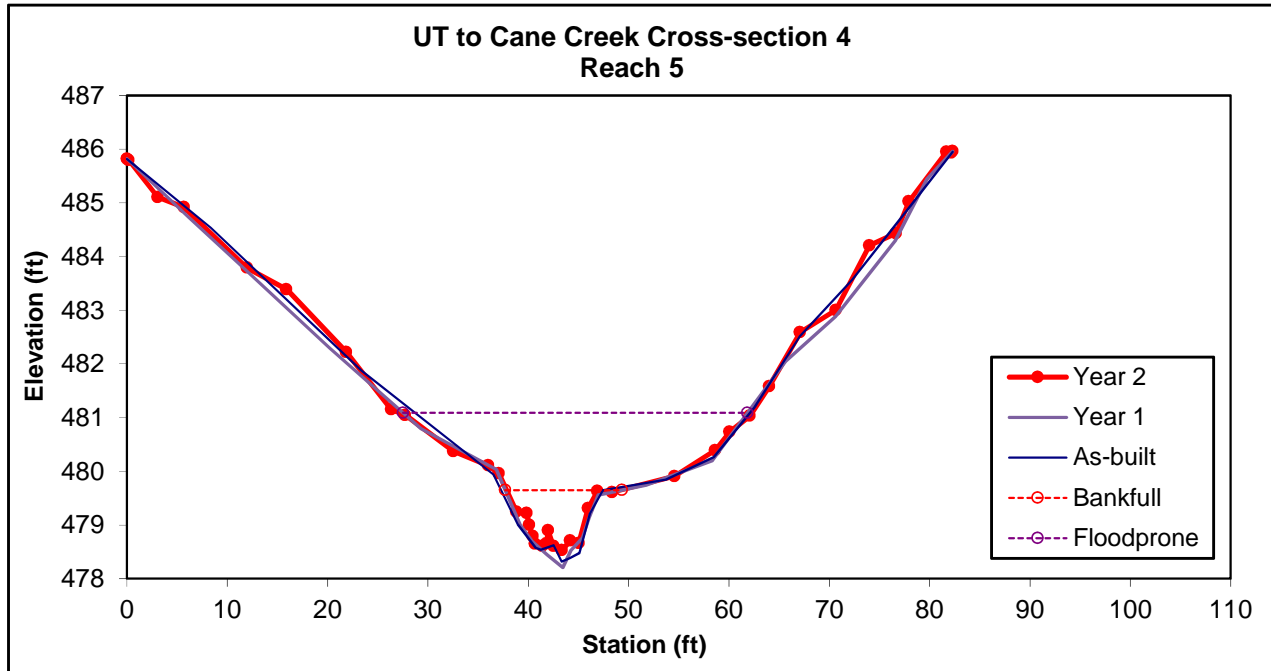


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Cc	6.2	9	0.69	1.1	13.08	1	3.3	479.63	479.63



Permanent Cross-section 5, Reach 3

(Year 2 Data - Collected October 2015)

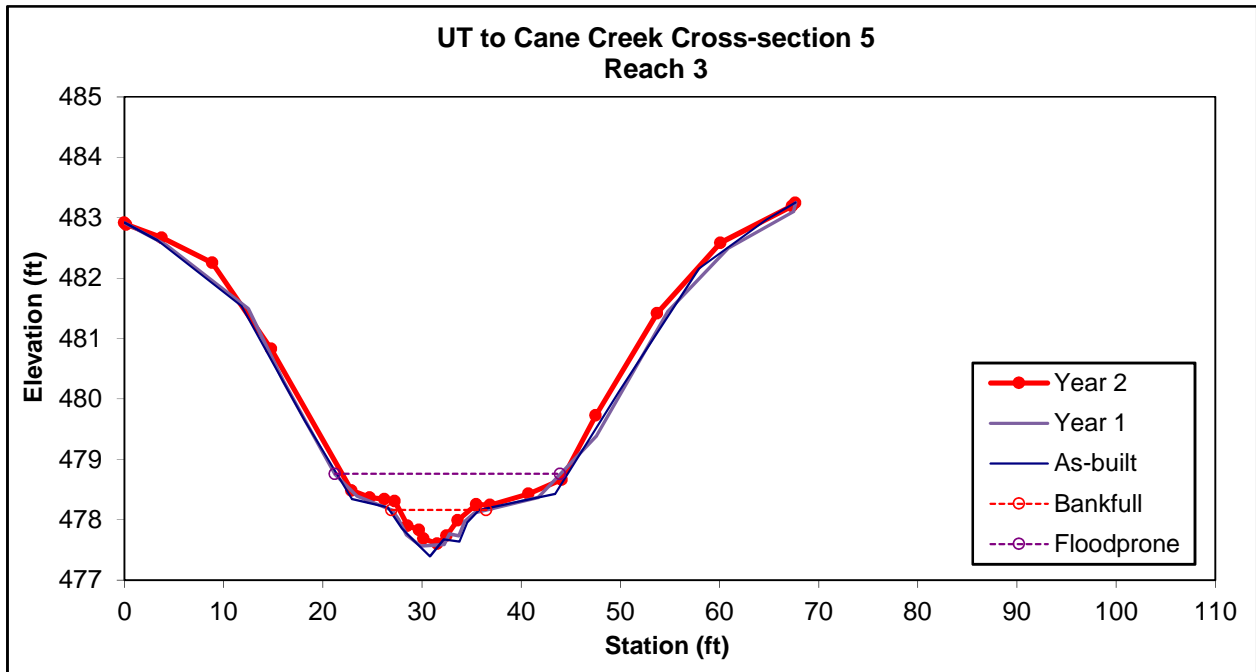


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Cc	2.2	7.08	0.32	0.56	22.39	1.2	3.1	478.16	478.26



Permanent Cross-section 6, Reach 3

(Year 2 Data - Collected October 2015)

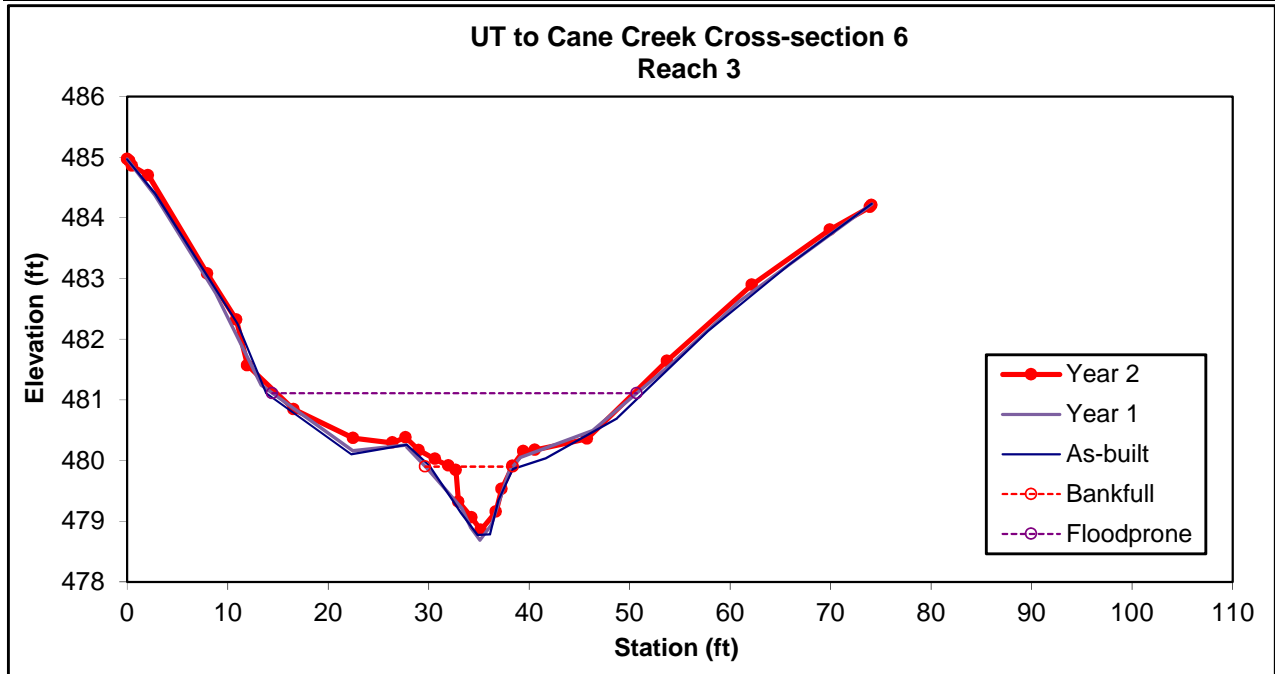


Looking at the Left Bank



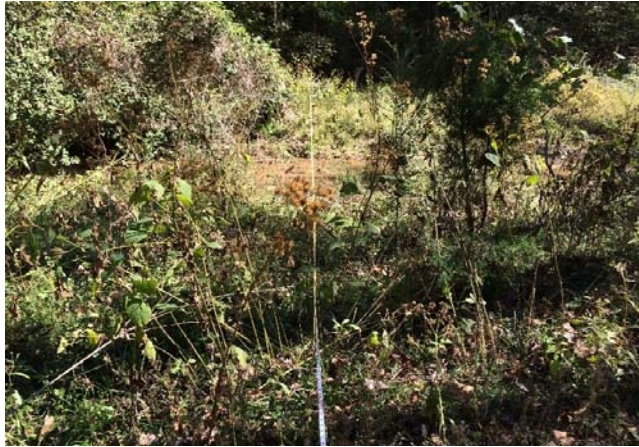
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		3.7	6.17	0.61	1.04	10.19	1.1	5.4	479.9	480.02



Permanent Cross-section 7, Reach 4

(Year 2 Data - Collected October 2015)

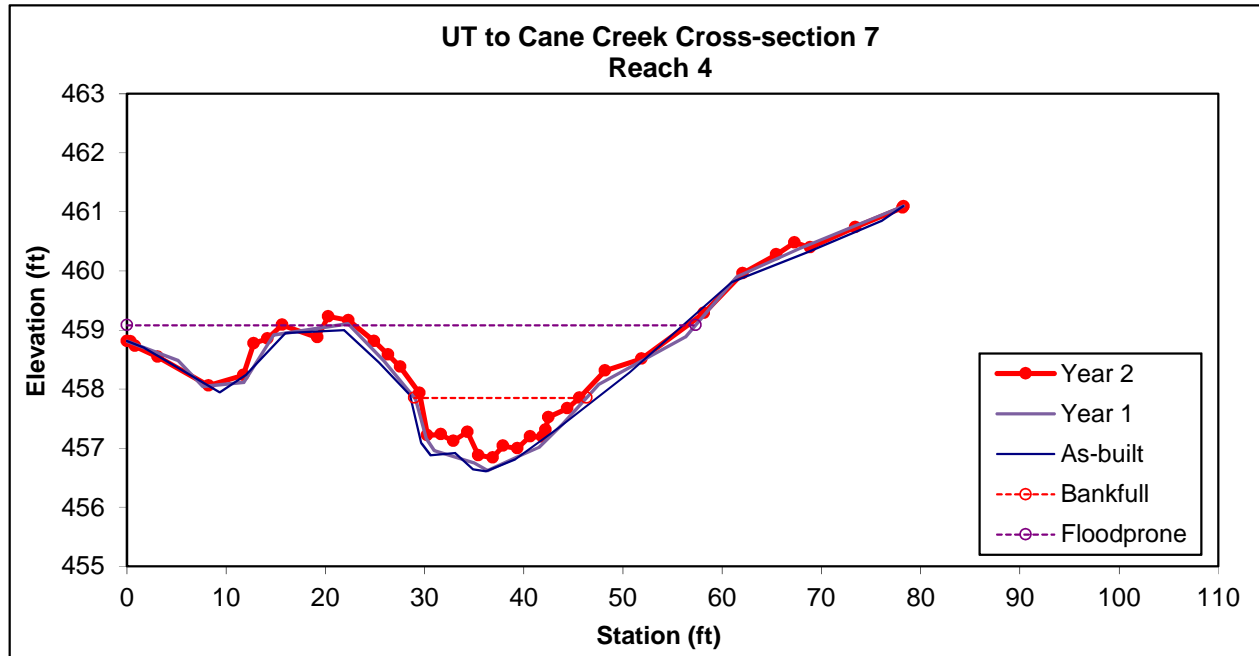


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Bc	10.0	16.00	0.62	1.01	25.7	1.0	1.9	457.85	457.85



Permanent Cross-section 8, Reach 4

(Year 2 Data - Collected October 2015)

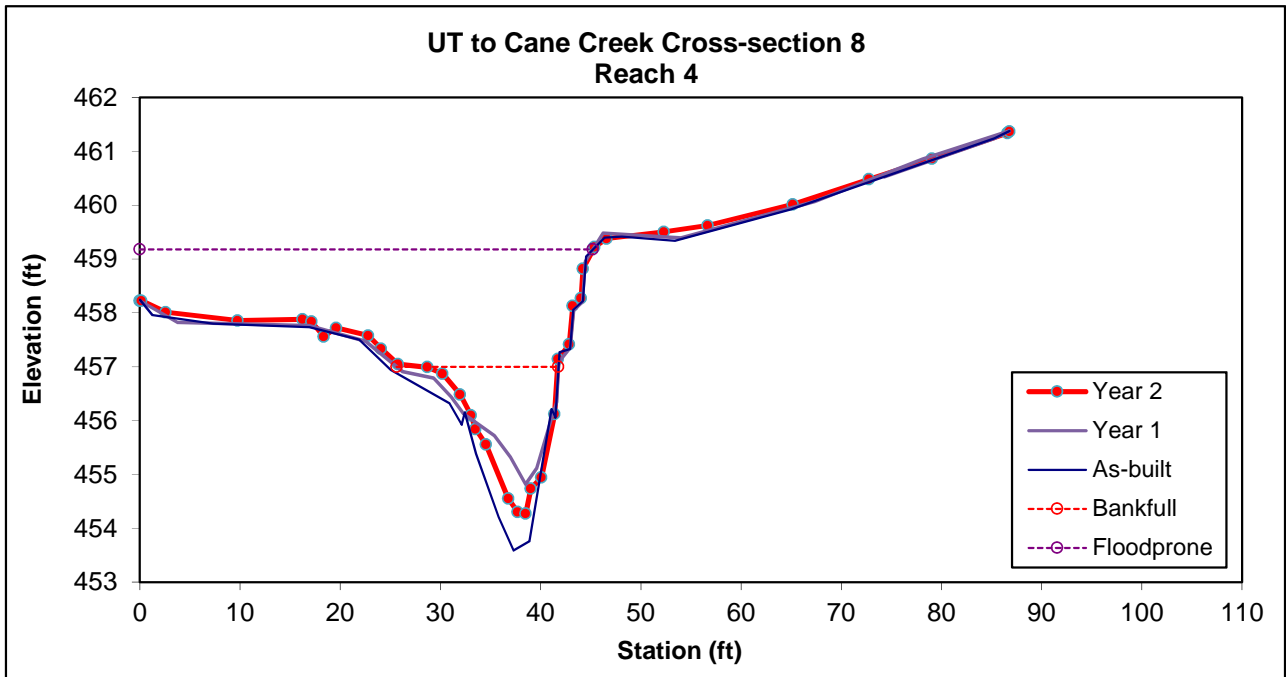


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		17.8	13.37	1.33	2.73	10.06	1.0	4.4	457	456.99



Permanent Cross-section 9, Reach 4

(Year 2 Data - Collected October 2015)

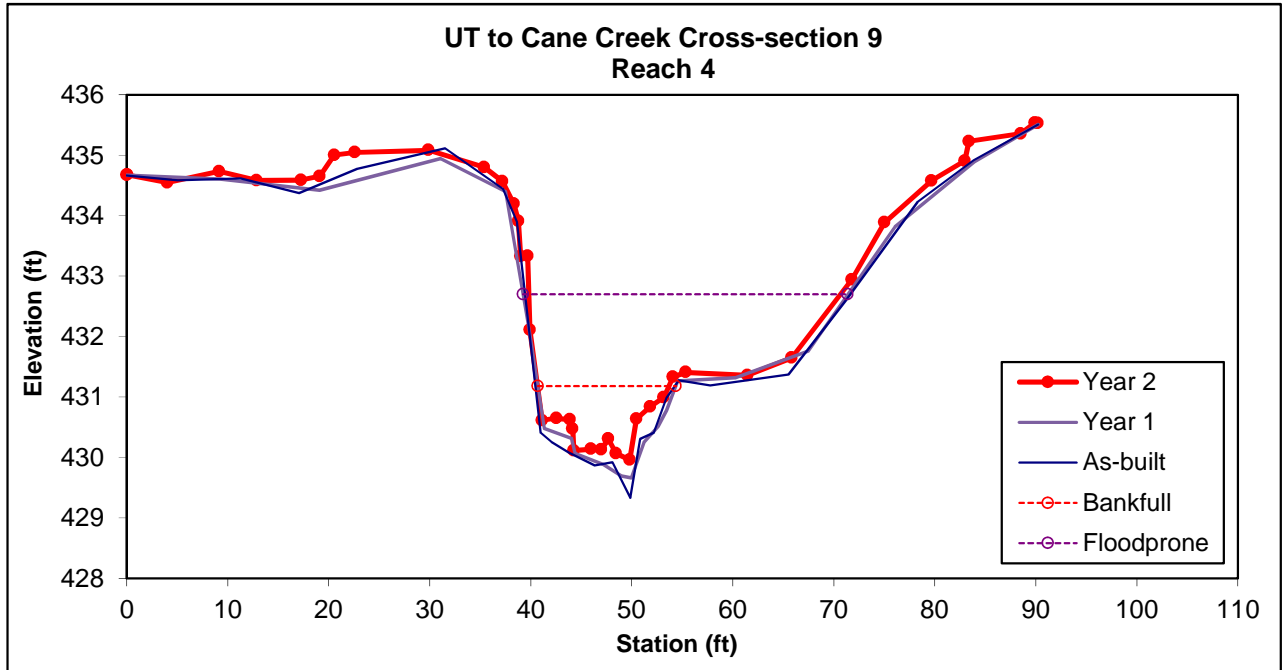


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Cc	9.3	13.01	0.72	1.22	18.12	1.1	2.3	431.18	431.33



Permanent Cross-section 10, Reach 1

(Year 2 Data - Collected October 2015)

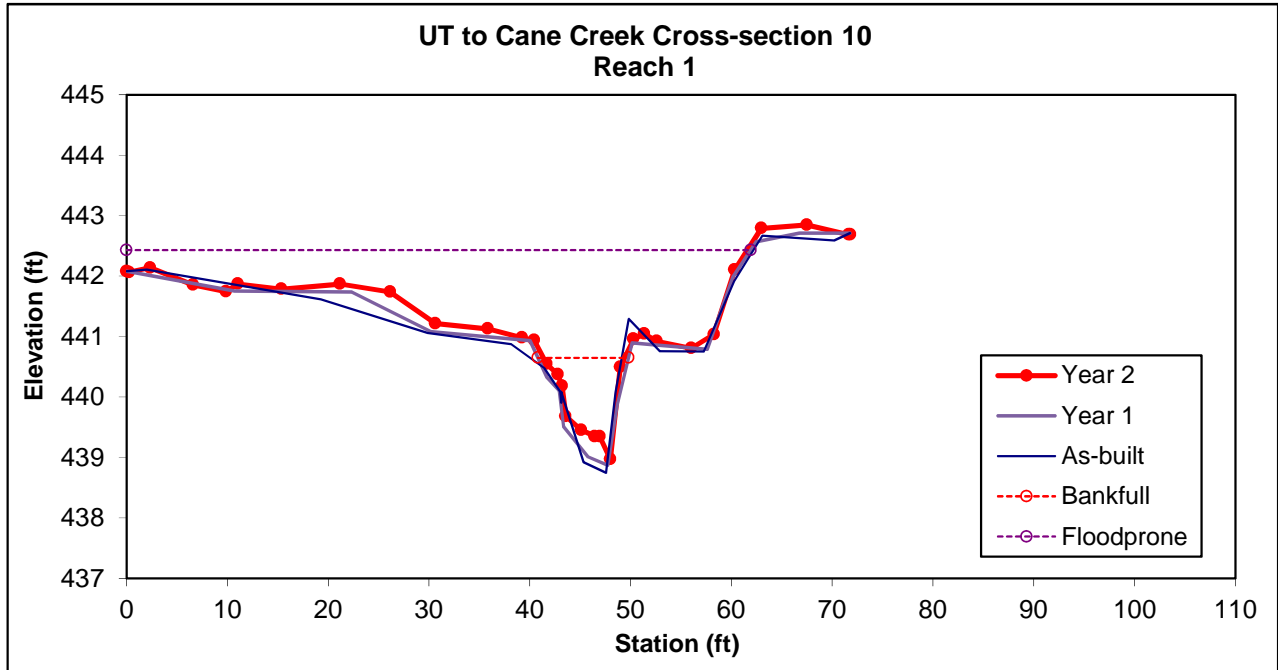


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		7.1	8.05	0.88	1.68	9.1	1.2	7.6	440.65	440.94



Permanent Cross-section 11, Reach 1

(Year 2 Data - Collected October 2015)

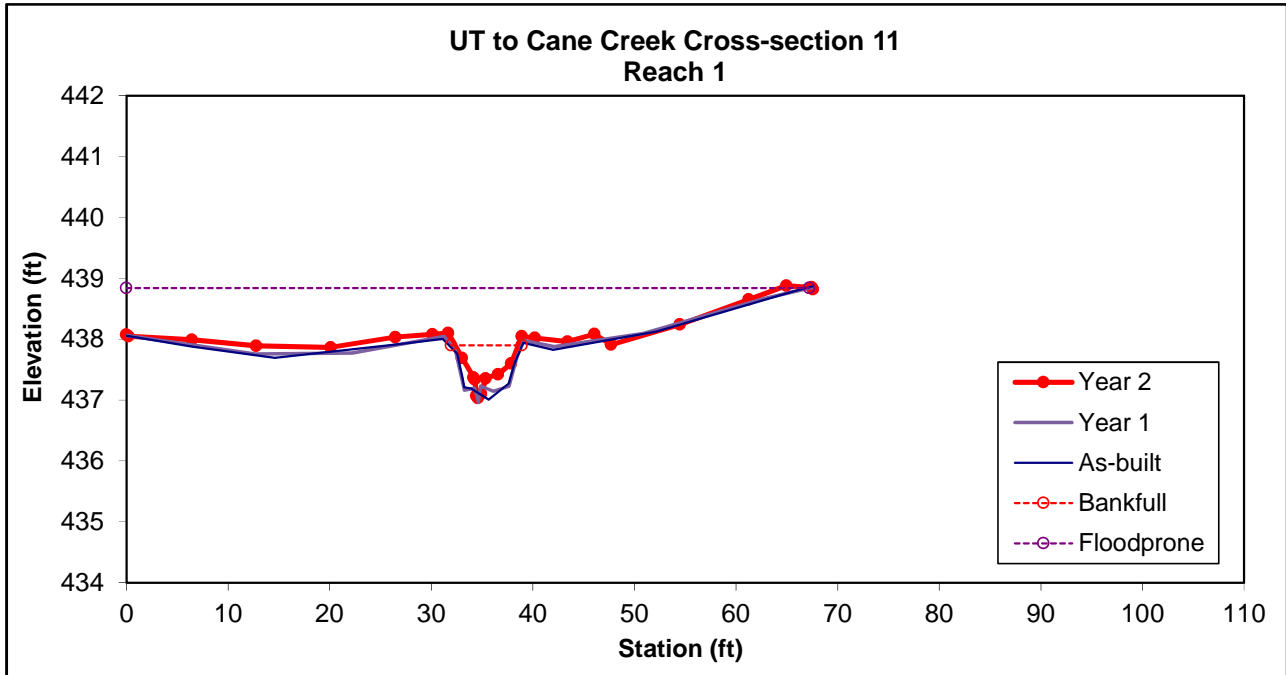


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Cc	2.6	6.24	0.41	0.87	15.06	1.2	10.1	437.9	438.05



Permanent Cross-section 12, Reach 1

(Year 2 Data - Collected October 2015)



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	Cc	3.95	7.23	0.55	0.85	13.2	1	12	434.7	434.7

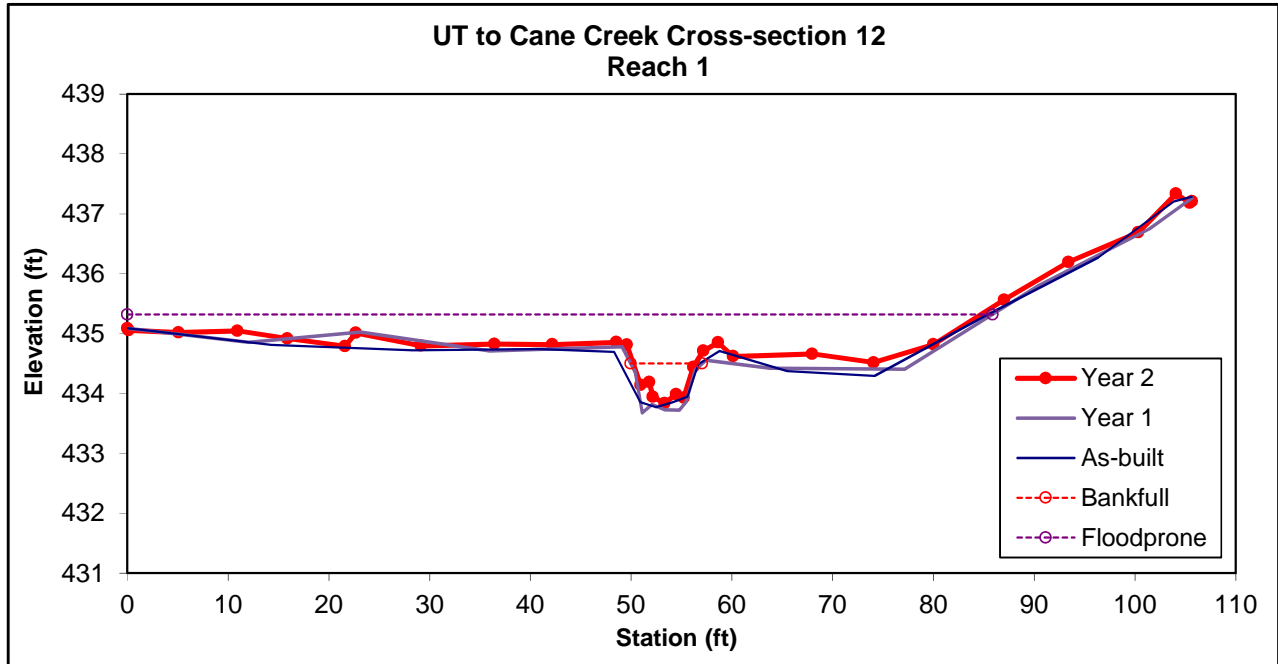


Table 10. Baseline Stream Summary																																						
UT to Cane Creek Restoration Project: DMS Project ID No. 95729																																						
Reach 1 (1,045 LF)																																						
Parameter	USGS Gauge	Regional Curve Interval (Harman et al. 1999) ^a			Pre-Existing Condition ¹							Reference Reach(es) Data												Design						As-built								
												UT to Wells Creek						UT to Varnals Creek																				
												Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n													Min	Mean	Med
Dimension and Substrate - Riffle																																						
BF Width (ft)	----	23.0	80.0	4.9	5.6	----	----	7.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Floodprone Width (ft)	----	----	----	----	6.8	----	----	>30	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
BF Mean Depth (ft)	----	2.3	5.8	0.8	0.7	----	----	0.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
BF Max Depth (ft)	----	----	----	----	1.1	----	----	1.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
BF Cross-sectional Area (ft ²)	----	80.0	300.0	5.2	5.1	----	----	5.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----									
Width/Depth Ratio	----	----	----	----	6.1	----	----	10.5	----	----	7	----	----	26	----	----	----	8	----	----	18	----	----	----	13.0	----	----	9.6	----									
Entrenchment Ratio	----	----	----	----	1.2	----	----	9.5	----	----	2.0	----	----	3.4	----	----	----	1.9	----	----	3.9	----	----	----	>2.2	----	----	6.9	----									
Bank Height Ratio	----	----	----	----	1.6	----	----	4.3	----	----	1.4	----	----	2.5	----	----	----	1.1	----	----	1.5	----	----	----	1.0	----	----	1.0	----									
d50 (mm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----								
Pattern																																						
Channel Beltwidth (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	25.0	----	----	45.0	----	----								
Radius of Curvature (ft)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	14.0	----	----	21.0	----	----	----								
Re: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 (ft ³)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----					
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/ft ²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----				
Max part size (mm) mobilized at bankfull (Rosgen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----				
Stream Power (transport capacity) W/m ²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
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	----	----	----	----	----	----	46.6	----	----	----	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	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

^aHarman, 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. *Wetland 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) ^a			Pre-Existing Condition ¹						Reference Reach(es) Data												Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	UT to Wells Creek						UT to Varnals Creek																	
		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	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	----	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)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Re: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)	----	----	----	----	----	----	----	----	----	----	----	----	----	7.9	----	2.9	----	----	5.0	----	36	----	----	----	----	----	----	----	----	----			
	Pool Max Depth (ft)	----	----	----	----	----	----	----	----	----	----	2.1	----	----	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/ft²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	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	----	----	0.1	----	----	----	----	----				
	Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Rosgen Classification	----	----	----	----	----	B4c	----	----	----	C4/1	----	----	----	B4/1a	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	BF Velocity (fps)	----	----	----	----	----	----	----	----	----	5.3	----	----	----	46.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	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	----	----	1.20	----	1.18	----	----	1.1	----	----	----	----	----				
	Water Surface Slope (Channel) (ft/ft)	----	----	----	----	----	0.0195	----	----	----	0.0197	----	----	----	0.0405	----	0.016	----	----	0.0405	----	0.016	----	----	0.0172	----	----	----	----	----				
	BF slope (ft/ft)	----	----	----	----	----	0.0168	----	----	----	0.028	----	----	----	0.0458	----	0.018	----	----	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	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			

^aHarman, 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. *Wetland 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) ^a			Pre-Existing Condition ¹							Reference Reach(es) Data										Design					As-built								
												UT to Wells Creek					UT to Varnals Creek																		
												Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max											SD	n	Min	Mean
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						
	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 (ft ²)	----	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 (ft ³)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Substrate and Transport Parameters																																			
	R1% / R10% / 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/ft ²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Max part size (mm) mobilized at bankfull (Rosen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Stream Power (transport capacity) W/m ²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Additional Reach Parameters																																			
	Drainage Area (SM)	----	----	----	----	----	----	----	0.7	----	----	----	----	----	0.13	----	----	----	----	----	0.24	----	----	----	----	----	0.7	----	----	----	----	----	0.7	----	----
	Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Rosen Classification	----	----	----	----	B3c	----	----	F5	----	----	----	----	----	C4/1	----	----	----	----	----	B4/1a	----	----	----	B3c	----	----	----	----	----	B3c	----	----	----	----
	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	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

^aHarman, 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. *Wetland 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) ^a			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									
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 (ft ²)	----	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)	----	----	----	----	----	----	----	----	----	----	0.3	----	----	4.0	----	0.8	----	----	2.3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Re:Bankfull width (ft/ft)	----	----	----	----	----	----	----	----	----	----	4.4	----	----	8.8	----	4.9	----	----	6.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Meander Wavelength (ft)	----	----	----	----	----	----	----	----	----	----	1.3	----	----	4.4	----	1.2	----	----	1.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
Meander Width Ratio	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
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 (ft ³)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Substrate and Transport Parameters																																					
R ₁ % / R ₂ % / 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/ft ²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Max part size (mm) mobilized at bankfull (Rosen Curve)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Stream Power (transport capacity) W/m ²	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	
Additional Reach Parameters																																					
Drainage Area (SM)	----	----	----	----	----	----	0.5	----	----	----	----	----	0.13	----	----	----	----	0.24	----	----	0.5	----	----	----	----	0.5	----	----	----	----	----	----	----	----			
Impervious cover estimate (%)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Rosen Classification	----	----	----	----	----	----	G4	----	----	----	----	----	C4/1	----	----	----	----	B4/1a	----	----	----	----	----	----	----	----	B4c	----	----	----	----	----	----	----	----	----	
BF Velocity (fps)	----	----	----	----	----	----	4.5	----	----	----	----	----	5.3	----	----	----	----	46.6	----	----	----	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	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

^a 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. *Wetland 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) ^a			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 (ft ²)	----	80.0	300.0	1.7	----	----	----	4.2	----	----	5.3	----	----	----	----	7.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----			
	Width/Depth Ratio	----				----	----	----	45.0	----	----	7	----	----	----	----	8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	Entrenchment Ratio	----				----	----	----	1.3	----	----	2.0	----	----	----	----	1.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	Bank Height Ratio	----				----	----	----	2.3	----	----	1.4	----	----	----	----	1.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	d50 (mm)	----				----	----	----		----	----																										
Pattern																																					
	Channel Beltwidth (ft)	----				----	----	----		----	----																										
	Radius of Curvature (ft)	----				----	----	----		----	----																										
	Re:Bankfull width (ft/ft)	----				----	----	----		----	----	0.3	----	----	----	----	0.8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	Meander Wavelength (ft)	----				----	----	----		----	----	4.4	----	----	----	----	4.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	Meander Width Ratio	----				----	----	----		----	----	1.3	----	----	----	----	1.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Profile																																					
	Riffle Length (ft)	----				----	----	----		----	----																										
	Riffle Slope (ft/ft)	----				----	----	----		----	----																										
	Pool Length (ft)	----				----	----	----		----	----																										
	Pool Spacing (ft)	----				----	----	----		----	----																										
	Pool Max Depth (ft)	----				----	----	----		----	----	2.1	----	----	----	----	2.9	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
	Pool Volume (ft ³)	----				----	----	----		----	----	2.3	----	----	----	----	1.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----		
Substrate and Transport Parameters																																					
	Ri% / Ru% / P% / G% / S%	----				----	----	----		----	----																										
	SC% / Sa% / G% / B% / Be%	----				----	----	----		----	----																										
	d16 / d35 / d50 / d84 / d95	----				----	----	----		----	----																										
	Reach Shear Stress (competency) lb/ft ²	----				----	----	----		----	----																										
	Max part size (mm) mobilized at bankfull (Rosen Curve)	----				----	----	----		----	----																										
	Stream Power (transport capacity) W/m ²	----				----	----	----		----	----																										
Additional Reach Parameters																																					
	Drainage Area (SM)	----				----	----	0.025	----	----	----																										
	Impervious cover estimate (%)	----				----	----			----	----																										
	Rosen Classification	----				----	----			----	----																										
	BF Velocity (fps)	----				----	----	1.7	----	----	----																										
	BF Discharge (cfs)	----	290.0	2000.0	6.2	----	----	7.1	----	----	----																										
	Valley Length	----				----	----			----	----																										
	Channel length (ft)	----				----	----	144	----	----	----																										
	Sinuosity	----				----	----	1.19	----	----	----																										
	Water Surface Slope (Channel) (ft/ft)	----				----	----	0.0236	----	----	----																										
	BF slope (ft/ft)	----				----	----	0.0224	----	----	----																										
	Bankfull Floodplain Area (acres)	----				----	----			----	----																										
	BEHI VL% / L% / M% / H% / VH% / E%	----				----	----			----	----																										
	Channel Stability or Habitat Metric	----				----	----			----	----																										
	Biological or Other	----				----	----			----	----																										

^a 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. Wetland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

**Table 11. Morphology and Hydraulic Monitoring Summary
UT to Cane Creek Restoration Project: DMS Project ID No. 95729**

Reach 1 (1,045 LF)																													
Dimension and substrate	Cross-section X-10 (Pool)							Cross-section X-11 (Riffle)							Cross-section X-12 (Riffle)														
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	
Based on fixed baseline bankfull elevation																													
BF Width (ft)	9.11	8.98	8.05					7.21	6.98	6.24					7.83	7.08	7.23												
BF Mean Depth (ft)	0.95	1.05	0.88					0.57	0.57	0.41					0.51	0.56	0.55												
Width/Depth Ratio	9.6	8.6	9.1					12.8	12.3	15.1					15.2	12.6	13.2												
BF Cross-sectional Area (ft²)	8.7	9.4	7.1					4.1	4.0	2.6					4.0	4.0	4.0												
BF Max Depth (ft)	1.9	1.8	1.7					0.9	0.9	0.9					0.7	0.8	0.9												
Width of Floodprone Area (ft)	65.62	61.92	61.19					65.90	67.22	63.14					84.37	85.88	87.20												
Entrenchment Ratio	6.9	6.9	7.6					9.1	9.6	10.1					10.8	12.1	12.0												
Bank Height Ratio	1.1	1.1	1.2					1.0	1.1	1.2					1.3	1.1	1.0												
Wetted Perimeter (ft)	11.0	11.1	9.8					8.4	8.1	7.1					8.9	8.2	8.3												
Hydraulic Radius (ft)	0.8	0.8	0.7					0.5	0.5	0.4					0.5	0.5	0.5												
Based on current/developing bankfull feature																													
BF Width (ft)																													
BF Mean Depth (ft)																													
Width/Depth Ratio																													
BF Cross-sectional Area (ft²)																													
BF Max Depth (ft)																													
Width of Floodprone Area (ft)																													
Entrenchment Ratio																													
Bank Height Ratio																													
Wetted Perimeter (ft)																													
Hydraulic Radius (ft)																													
Cross Sectional Area between end pins (ft²)																													
d50 (mm)																													

Reach 3 (398 LF)																													
Dimension and substrate	Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)							Cross-section X-7 (Riffle)														
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	
Based on fixed baseline bankfull elevation																													
BF Width (ft)	8.94	9.55	7.08					8.98	8.70	6.17					8.98	8.70	6.17												
BF Mean Depth (ft)	0.41	0.35	0.32					0.59	0.59	0.61					0.59	0.59	0.61												
Width/Depth Ratio	21.7	27.3	22.4					15.3	14.7	10.2					15.3	14.7	10.2												
BF Cross-sectional Area (ft²)	3.7	3.3	2.2					5.3	5.2	3.7					5.3	5.2	3.7												
BF Max Depth (ft)	0.8	0.6	0.6					1.1	1.2	1.0					1.1	1.2	1.0												
Width of Floodprone Area (ft)	24.39	22.72	22.20					36.29	36.27	33.48					36.29	36.27	33.48												
Entrenchment Ratio	2.7	2.4	3.1					4.0	4.2	5.4					4.0	4.2	5.4												
Bank Height Ratio	1.0	0.9	1.2					1.0	1.1	1.1					1.0	1.1	1.1												
Wetted Perimeter (ft)	9.8	10.3	7.7					10.2	9.9	7.4					10.2	9.9	7.4												
Hydraulic Radius (ft)	0.4	0.3	0.3					0.5	0.5	0.5					0.5	0.5	0.5												
Based on current/developing bankfull feature																													
BF Width (ft)																													
BF Mean Depth (ft)																													
Width/Depth Ratio																													
BF Cross-sectional Area (ft²)																													
BF Max Depth (ft)																													
Width of Floodprone Area (ft)																													
Entrenchment Ratio																													
Bank Height Ratio																													
Wetted Perimeter (ft)																													
Hydraulic Radius (ft)																													
Cross Sectional Area between end pins (ft²)																													
d50 (mm)																													

Reach 4 (2,333 LF)																											
Dimension and substrate	Cross-section X-7 (Riffle)							Cross-section X-8 (Pool)							Cross-section X-9 (Riffle)												
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5
Based on fixed baseline bankfull elevation																											
BF Width (ft)	18.74	17.33	16.00					17.08	16.13	13.37											13.77	13.66	13.01				
BF Mean Depth (ft)	0.79	0.81	0.62					1.45	0.96	1.33											1.02	0.97	0.72				
Width/Depth Ratio	23.7	21.5	25.7					11.8	16.8	10.1											13.5	14.1	18.1				
BF Cross-sectional Area (ft²)	14.8	14.0	10.0					24.7	15.5	17.8											14.1	13.3	9.3				
BF Max Depth (ft)	1.24	1.23	1.01					3.41	2.18	2.73											1.85	1.52	1.22				
Width of Floodprone Area (ft)	56.09	57.30	30.16					72.51	45.24	59.00											33.85	32.12	29.41				
Entrenchment Ratio	3.0	2.0	1.9					4.2	2.8	4.4											2.5	2.4	2.3				
Bank Height Ratio	1.9	1.0	1.0					1.1	1.2	1.0											1.1	1.1	1.1				
Wetted Perimeter (ft)	20.3	19.0	17.2					20.0	18.1	16.0											15.8	15.6	14.5				
Hydraulic Radius (ft)	0.7	0.7	0.6					1.2	0.9	1.1											0.9	0.9	0.6				
Based on current/developing bankfull feature																											
BF Width (ft)																											
BF Mean Depth (ft)																											
Width/Depth Ratio																											
BF Cross-sectional Area (ft²)																											
BF Max Depth (ft)																											
Width of Floodprone Area (ft)																											
Entrenchment Ratio																											
Bank Height Ratio																											
Wetted Perimeter (ft)																											
Hydraulic Radius (ft)																											
Cross Sectional Area between end pins (ft²)																											
d50 (mm)																											

Reach 5 (1,461 LF)																											
Dimension and substrate	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (Riffle)							Cross-section X-4 (Riffle)					
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5
Based on fixed baseline bankfull elevation																											
BF Width (ft)	10.41	10.06	6.24					11.24	11.28	10.75											12.00	11.16	10.04				
BF Mean Depth (ft)	0.68	0.71	0.41					1.41	1.37	1.35											0.68	0.65	0.61				
Width/Depth Ratio	15.2	14.2	15.1					8.0	8.3	8.0											17.8	17.3	16.6				
BF Cross-sectional Area (ft²)	7.1	7.2	2.6					15.8	15.4	14.5											8.1	7.2	6.1				
BF Max Depth (ft)	1.19	1.33	0.87					2.79	2.66	2.39											1.16	1.16	1.08				
Width of Floodprone Area (ft)	85.05	85.00	85.05					103.66	103.67	103.65											76.03	76.48	76.04				
Entrenchment Ratio	8.2	8.5	10.1					9.2	9.2	9.6											6.3	6.9	7.6				
Bank Height Ratio	1.0	1.0	1.2					1.0	1.0	1.1											1.0	1.0	1.0				
Wetted Perimeter (ft)	11.8	11.5	7.1					14.1	14.0	13.5											13.4	12.5	11.3				
Hydraulic Radius (ft)	0.6	0.6	0.4					1.1	1.1	1.1											0.6	0.6	0.5				
Based on current/developing bankfull feature																											
BF Width (ft)																											
BF Mean Depth (ft)																											
Width/Depth Ratio																											
BF Cross-sectional Area (ft²)																											
BF Max Depth (ft)																											
Width of Floodprone Area (ft)																											
Entrenchment Ratio																											
Bank Height Ratio																											
Wetted Perimeter (ft)																											
Hydraulic Radius (ft)																											
Cross Sectional Area between end pins (ft²)																											
d50 (mm)																											

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
3/25/2015	0.33	0.00	3/6/2015	Crest Gauge
10/13/2015	0.62	0.79	10/3/2015	Crest Gauge

