Mitigation Project Name	UT to Cane Creek Restoration Project	County	Alamance	USACE Action ID	2012-01907
DMS ID	95729	Date Project Instituted	10/29/2012	NCDWR Permit No	2013-1177
River Basin	Cape Fear	Date Prepared	5/22/2018		
Cataloging Unit	03030002				

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Year (Wetland)
Potential Credits (Mitigation Plan)		4,603.000												
Potential Credits (As-Built Survey)		4,593.867												
1 (Site Establishment)	N/A				N/A	N/A	N/A				N/A		N/A	N/A
2 (Year 0 / As-Built)	30%	1,378.160			2014	12/1/2014	30%				30%		N/A	N/A
3 (Year 1 Monitoring)	10%	459.387			2015	4/23/2015	10%				10%		N/A	N/A
4 (Year 2 Monitoring)	10%	459.387			2016	4/25/2016	10%				15%		N/A	N/A
5 (Year 3 Monitoring)	10%	459.387			2017	4/3/2017	15%				20%		N/A	N/A
6 (Year 4 Monitoring)	5%	229.693			2018	4/25/2018	5%				10%		N/A	N/A
7 (Year 5 Monitoring)	10%				2019		15%				15%		N/A	N/A
8 (Year 6 Monitoring)	5%				2020		5%				N/A		N/A	N/A
9 (Year 7 Monitoring)	10%				2021		10%				N/A		N/A	N/A
Stream Bankfull Standard	10%	459.387			2017	4/3/2017	N/A				N/A		N/A	N/A
Total Credits Released to Date		3,445.400												

DEBITS (released credits only)

Ratios			1	1.5	2.5	5	1	3	2	5	1	3	2	5	1	3	2	5
			Stream Restoration	Stream Enhancement I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
As-Built Amounts (feet and acres)			3,314.000	433.000	2,478.000													
As-Built Amounts (mitigation credits)			3,314.000	288.667	991.200													
Percentage Released			75%	75%	75%													
Released Amounts (feet / acres)			2,485.500	324.750	1,858.500													
Released Amounts (credits)			2,485.500	216.500	743.400													
NCDWR Permit	USACE Action ID	Project Name																
2013-0517	2013-00557	NCDOT TIP R-2413A / B - NC 68 Connector	1,325.600	173.200	991.200													
2013-0517	2013-00557	NCDOT TIP R-2413A / B - NC 68 Connector	331.400	43.300	247.800													
2013-0912	2013-01990	NCDOT TIP R-2612B - US 421 Improvements	662.800	86.600	495.600													
2013-0918	2005-21386	NCDOT TIP U-2525B / C - Greensboro Eastern Loop	165.700	21.650	123.900													
Remaining Amounts (feet / acres)			0.000	0.000	0.000													
Remaining Amounts (credits)			0.000	0.000	0.000													

Contingencies (if any): None

Signature of Wilmington District Official Approving Credit Release

9/6/18
Date

1 - For DMS, no credits are released during the first milestone
2 - For DMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCEEP Portal, provided the following criteria have been met:
1) Approval of the final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
4) Reciept of necessary DA permit authorization or written DA approval for porjects where DA permit issuance is not required

3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met

UT to Cane Creek Restoration Project
Year 5 FINAL Monitoring Report

Alamance County, North Carolina

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

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

Project Info:	Monitoring Year: 5 of 7 Year of Data Collection: 2018 Year of Completed Construction: 2014 Submission Date: December 2018
Submitted To:	NCDEQ - Division of Mitigation Services 1625 Mail Service Center Raleigh, NC 27699 NC DEQ Contract ID No. 004951

UT to Cane Creek Restoration Project
Year 5 FINAL Monitoring Report

Alamance County, North Carolina

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

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

Report Prepared and Submitted by Michael Baker Engineering, Inc.

NC Professional Engineering License # F-1084

Michael Baker
INTERNATIONAL

Michael Baker
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Innovation Done Right...We Make a Difference

December 27, 2018

Jeff Schaffer
NCDEQ, Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Subject: Task 11: Response Letter to DMS review comments regarding the Draft Year 5 Monitoring Report for the UT to Cane Creek Restoration Project (#95729)
Cape Fear Basin – CU#03030002, Alamance County, North Carolina
Service Contract No. 004951, DMS No. 95729, RFP No. 16-004357, Baker No. 132700

Mr. Schaffer,

Please find enclosed three hardcopies of the Final Year 5 Monitoring Report and our responses to your review comments received on December 13, 2018 regarding the UT to Cane Creek Restoration Project located in Alamance County, NC.

1. The review of the digital data and drawings have been reviewed and determined to meet DMS requirements.

Response: Very good. No final digital data/drawings need be provided then.

2. Appendix B, CCPV: Recommend using a different color for Privet Treated(Feb 2018). Chosen color is difficult to see.

Response: A new color was selected for that layer so that it stands out better.

3. Appendix D, Table 11: During our review of the Bank Height Ratios (BHR) in Table 11, DMS staff performs a visual comparison of the MY5 data to As-Built/Baseline cross-sections. DMS noted/realized that by displaying the As-built Bankfull Cross-Sectional Area alone, the calculation for the BHR can be difficult to reconcile. We noted possible discrepancies in the BHR calculations for cross-sections 5, 9, 11 and 12 given this disconnect. Using the new BHR calculation methodology where the As-Built Bankfull Area is held constant, please display the Year 5 bankfull elevation as another data series just for the sake of clarity between the BHR calculation and the overlay. It appears that the BHR calculations were done correctly, but just please add the MY5 bankfull data series with its elevation for the sake of clarity to the reader.

Response: An additional data series was added to each cross-section figure showing the MY5 bankfull line (generated using the as-built bankfull area as per the recent DMS memo) as requested. The BHR calculations for the three listed cross-sections were re-checked again and were all confirmed as correct. With the new bankfull line shown, a visual comparison between it and the MY5 cross-section data certainly makes the BHR values appear to make intuitive sense.

As requested, Baker has provided three (3) hardcopies, and one pdf copy of the FINAL report. No additional digital data/drawings or other e-submittal files will be provided as the draft submission was

found acceptable. Please do not hesitate to contact me at 919-481-5731 or via email at scott.king@mbakerintl.com should you have any questions regarding our response submittal.

Sincerely,

Scott King, LSS, PWS
Project Manager

Enclosures

TABLE OF CONTENTS

APPENDICES

1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 3,314 linear feet of perennial and intermittent streams and enhanced 2,911 linear feet of channel for the Unnamed Tributary (UT) to Cane Creek Restoration Project (Site). Baker also planted approximately 14.0 acres of native riparian species vegetation within the 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 (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.

The Year 5 monitoring survey data of twelve cross-sections indicates that the Site is geomorphically stable and performing at virtually 100 percent for all the parameters evaluated. Certain cross-sections (located in Appendix D) have shown very minor fluctuations in their geometry over Monitoring Year 3, when the previous cross-section survey was conducted. These fluctuations do not represent a trend towards instability based off visual field evaluations. All reaches are stable and performing as designed. The data collected are within the lateral/vertical stability and in-stream structure performance categories.

One Stream Problem Area (SPA) was observed during the Year 5 monitoring. During the post-Hurricane Florence site inspection, an approximately 30 ft section of bank scour was discovered along the outer right bank of a pool bend located in the middle of Reach R4. The bank scour was a direct result of the high flows associated with Florence, which dropped approximately six inches of rain on the site over a 24-hour period between September 16 and 17. The bank scour resulted in the loss of a significant portion of the livestake vegetation that had been growing in the bank. Cross-section 8 is located within this section and reveals the resulting scour in its graph. The visual inspection of the bank revealed that there is still a substantial amount of living, established livestake vegetation growing in the bank and during the winter of 2018-2019, Baker will supplement with additional livestakes and transplants, likely consisting of black willow (*Salix nigra*) and silky dogwood (*Cornus amomum*) species. The SPA is reported in Tables 5a and 5b, representative photographs can be found in the photolog, and its exact location is shown on the CCPV, all of which are found in Appendix B.

During Year 5 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 5 monitoring in September 2018, was 627 stems per acre. Thus, the Year 5 vegetation data demonstrate that the Site has met the minimum success interim criteria of 260 trees per acre by the end of Year 5.

Throughout the monitoring year, Baker also conducted numerous temporary vegetation transects in areas outside the permanent vegetation plots to help assess project performance. The transects were measured out in the field as 100 ft long by 12 ft wide (for an area roughly similar to that of the veg plots). Any living stem of an acceptable species that was at least 2 ft in height was counted. These stem counts were then converted into stems/acre values for comparison to the vegetation success criteria values. There were five transects taken during the Year 5 monitoring season; each one meeting the MY5 success criteria, and with an overall average of 776 stems/acre. The location of the transects and their stems/acre values are shown on the CCPV found in Appendix B.

There was one Vegetation Problem Area (VPA) observed during the Year 5 monitoring. A few small areas of scattered resprouts of the invasive species Chinese privet (*Ligustrum sinense*) were discovered along the middle and lowers sections of Reach R4 as detailed in Table 6a and 6b. The total combined area of the scattered privet is 0.71 acres in size. Their locations are shown on the Current Condition Plan View (CCPV) maps in the Appendix B along with representative photographs.

During Year 5 monitoring, both the Reach R5 crest gauge (crest gauge #1) and Reach R3 crest gauge (crest gauge #2) documented one bankfull event from the flooding resulting from Hurricane Florence.

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 5 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, and crest gauges are shown on the CCPV map found in Appendix B.

The Year 5 cross-section data was collected in October 2018, while the vegetation plot data was collected in September 2018. All visual site assessment data contained in Appendix B was collected in September and October 2018.

2.1 Stream Assessment

The Project involved the restoration and enhancement of a Rural Piedmont Stream System (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.

2.1.1 Morphological Parameters and Channel Stability

Survey data from the twelve permanent project cross-sections were collected and classified using the Rosgen Stream Classification System (Rosgen 1994), and all monitored cross-sections fall within the quantitative parameters defined for channels of the design stream type. The Year 5 monitoring survey data for the cross-sections indicates that the Site is geomorphically stable and performing at virtually 100 percent for all the parameters evaluated. The data collected are within the lateral/vertical stability and in-stream structure performance categories. All 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.

2.1.2 Hydrology

To monitor on-site bankfull events, crest gauges were installed along two of the restored reaches. One crest gauge was installed on the floodplain at the bankfull elevation along the left top of bank on Reach

R5 (Crest gauge 1), approximately at Station 22+00. The second crest gauge was installed on the floodplain along the right top of bank along Reach R3 (Crest gauge 2), approximately at Station 13+50.

During Year 5 monitoring, one above-bankfull stage event was documented each by Crest gauge 1 and Crest gauge 2, both associated with Hurricane Florence in September of 2018. The crest gauge readings are presented in Appendix E.

2.1.3 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. Stream photographs from Year 5 monitoring are shown in Appendix B.

2.1.4 Visual Stream Morphological Stability Assessment

The visual stream morphological stability assessment involves the qualitative evaluation of lateral and vertical channel stability, and the integrity and overall performance of in-stream structures throughout the Project reaches as a whole. Habitat parameters and pool depth maintenance are also evaluated. During Year 5 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 (one SPA was identified in Year 5, as described above). A detailed summary of the results for the visual stream stability assessment can be found in Appendix B, which includes all supporting figures, data tables, and SPA photos if applicable.

2.2 Vegetation Assessment

In order to determine if the success criteria are achieved, vegetation-monitoring quadrants were installed and are monitored across the restoration site in accordance with the Carolina Vegetation Survey (CVS)-DMS Protocol for Recording Vegetation, Version 4.1 (Lee 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 5 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 5 monitoring in September 2018, was 627 stems per acre. Thus, the Year 5 vegetation data demonstrate that the Site has met the minimum success interim criteria of 260 trees per acre by the end of Year 5.

Additionally, five temporary vegetation transects of 100 ft by 12 ft were taken during the Year 5 monitoring season. Each one met the MY5 success criteria, and overall had an average of 776 stems/acre. The location of the transects and their stems/acre values are shown on the CCPV found in Appendix B.

Three areas of scattered Chinese privet (*Ligustrum sinense*) resprouts were discovered along the middle and downstream portions of Reach 4, totaling a combined 0.71 acres, as shown on the CCPV in Appendix B. The privet found in these areas will be treated in 2019.

Year 5 vegetation assessment information is provided in Appendices 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. 2012.

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). 2009. Cape Fear River Basin Restoration Priorities.

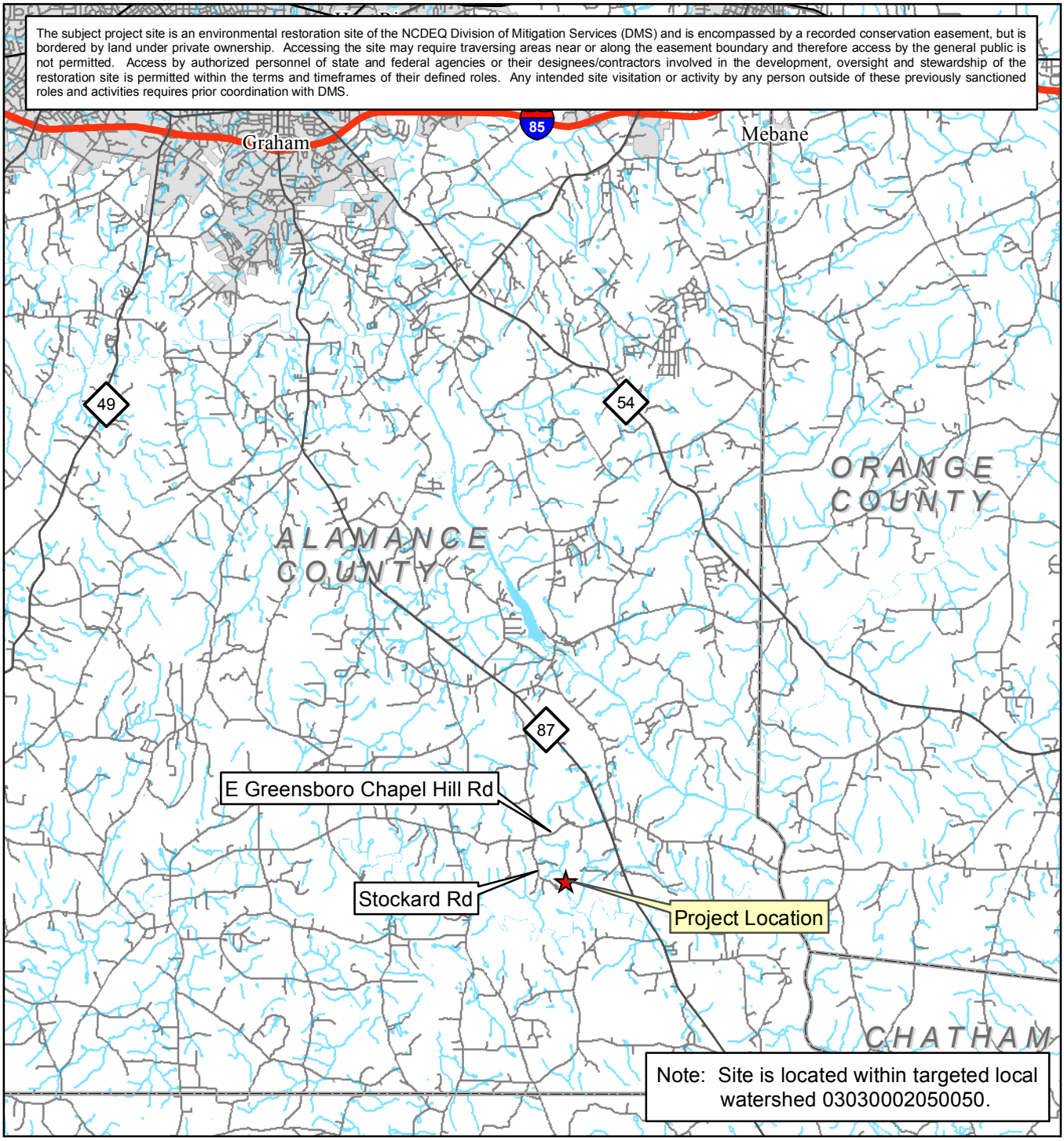
Rosgen, D. L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

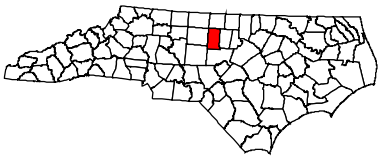
Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, third Approximation. North Carolina Natural Heritage Program. Division of Parks and Recreation, NCDEQ. Raleigh, NC.

Appendix A

Project Maps and Background Tables

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





Alamance County

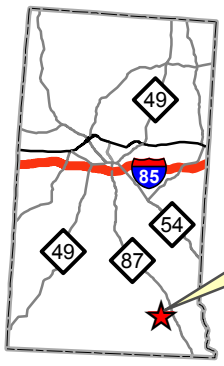


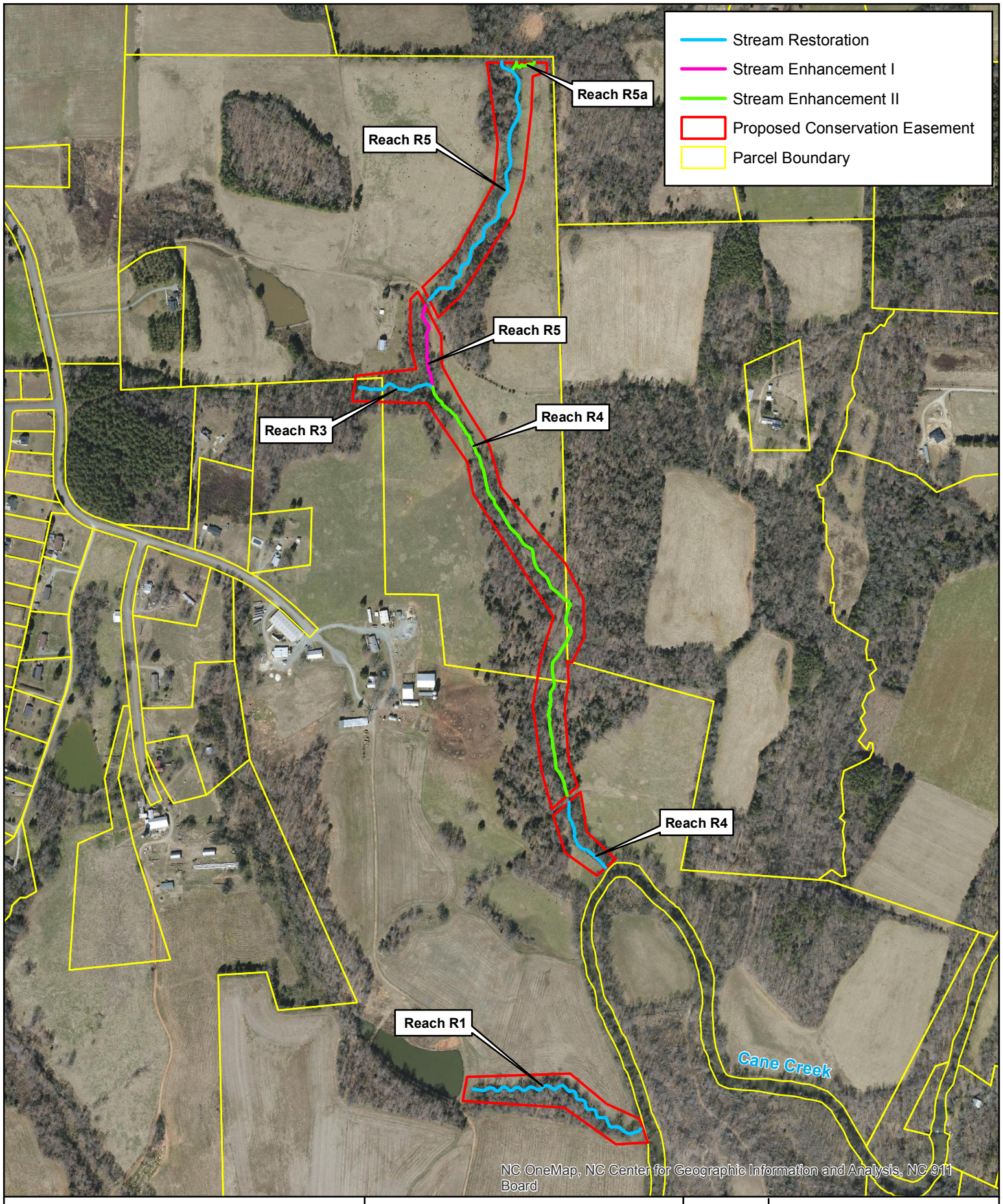
Figure 1
Project Vicinity Map
UT to Cane Creek Site

DEQ - Division of Mitigation Services

N

Michael Baker INTERNATIONAL

0 0.5 1 2 3 Miles



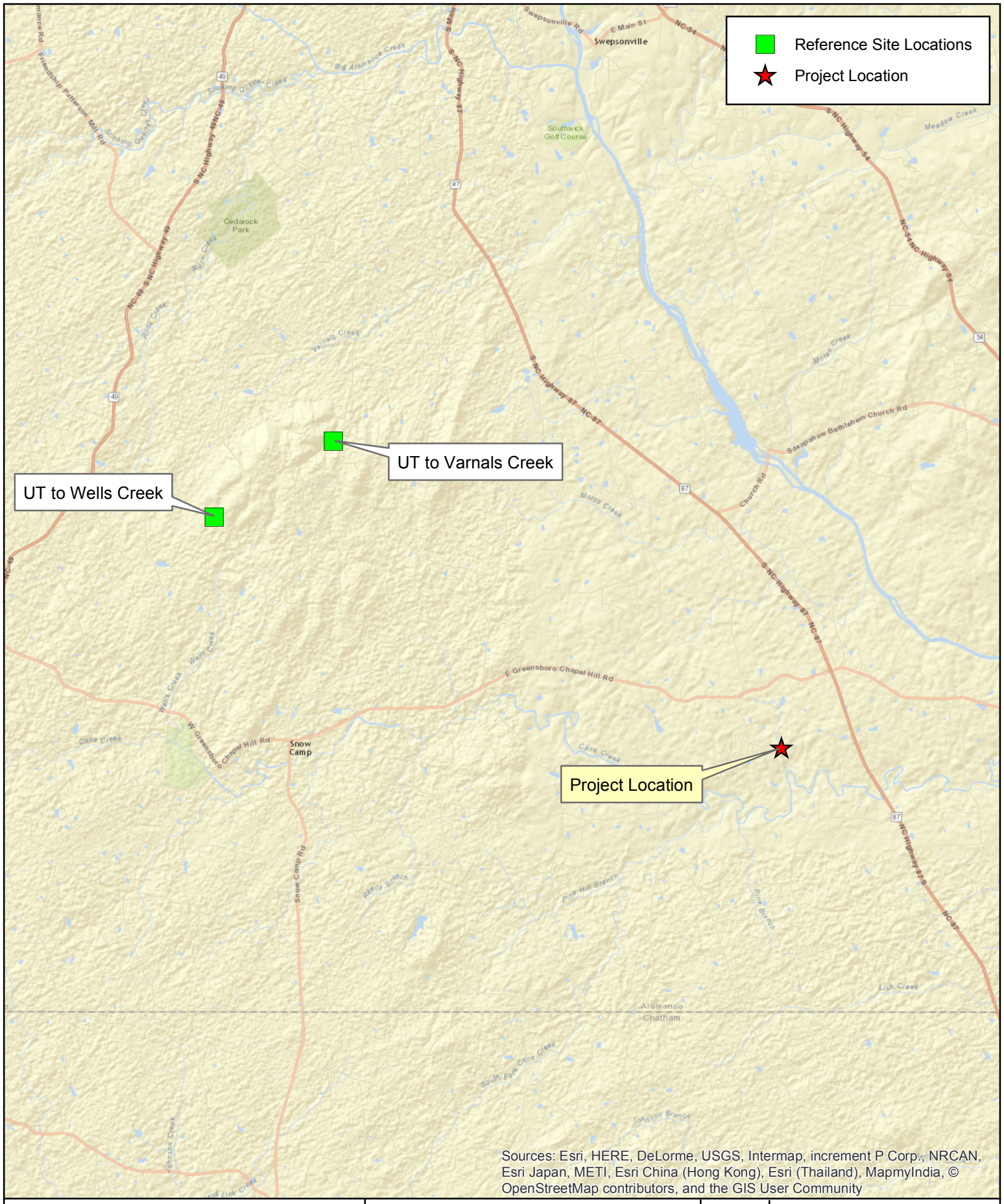
Michael Baker INTERNATIONAL

0 500 1,000 Feet

N

DEQ -Division of Mitigation Services
Project # 95729

Figure 2
Mitigation Work Plan
UT to Cane Creek Site



Michael Baker INTERNATIONAL

0 1 2 Miles

N

DEQ - Division of Mitigation Services
Project #95729

Figure 3
Reference Reach Location Map
UT to Cane Creek Site

Table 1. Project Components and Mitigation Credits

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

Mitigation Credits

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

Project Components

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

Component Summation

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

BMP Elements

Element	Location	Purpose/Function	Notes

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

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

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

Table 3. Project Contacts UT to Cane Creek Restoration Project: DMS Project ID No. 95729	
Designer	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Scott King, Telephone: 919-481-5731
Construction Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: Bill Wright, Telephone: 919-582-3574
Planting Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: George Morris, Telephone: 919-582-3574
Seeding Contractor	
River Works, Inc.	114 W. Main St. Clayton, NC 27520 Contact: George Morris, Telephone: 919-582-3574
Seed Mix Sources Nursery Stock Suppliers	Green Resources, Telephone: 336-855-6363 Mellow Marsh Farm, Telephone: 919-742-1200 ArborGen, Telephone: 843-528-3204
Monitoring Performers	
Michael Baker Engineering, Inc. Stream Monitoring Point of Contact Vegetation Monitoring Point of Contact	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Scott King, Tel. 919-481-5731 Scott King, Tel. 919-481-5731

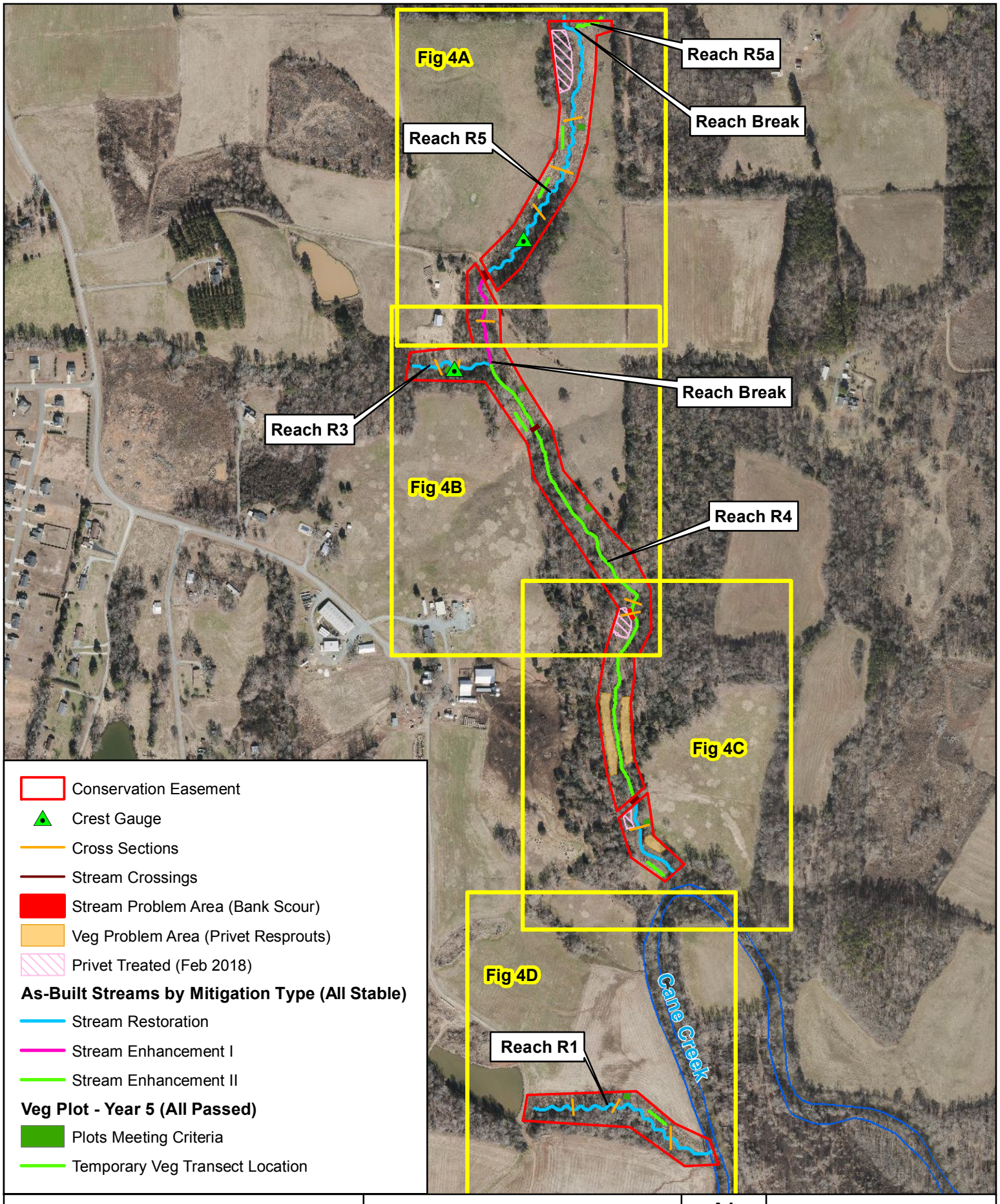
Table 4. Project Attributes (Pre-Construction Conditions)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

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

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

Appendix B

Visual Assessment Data



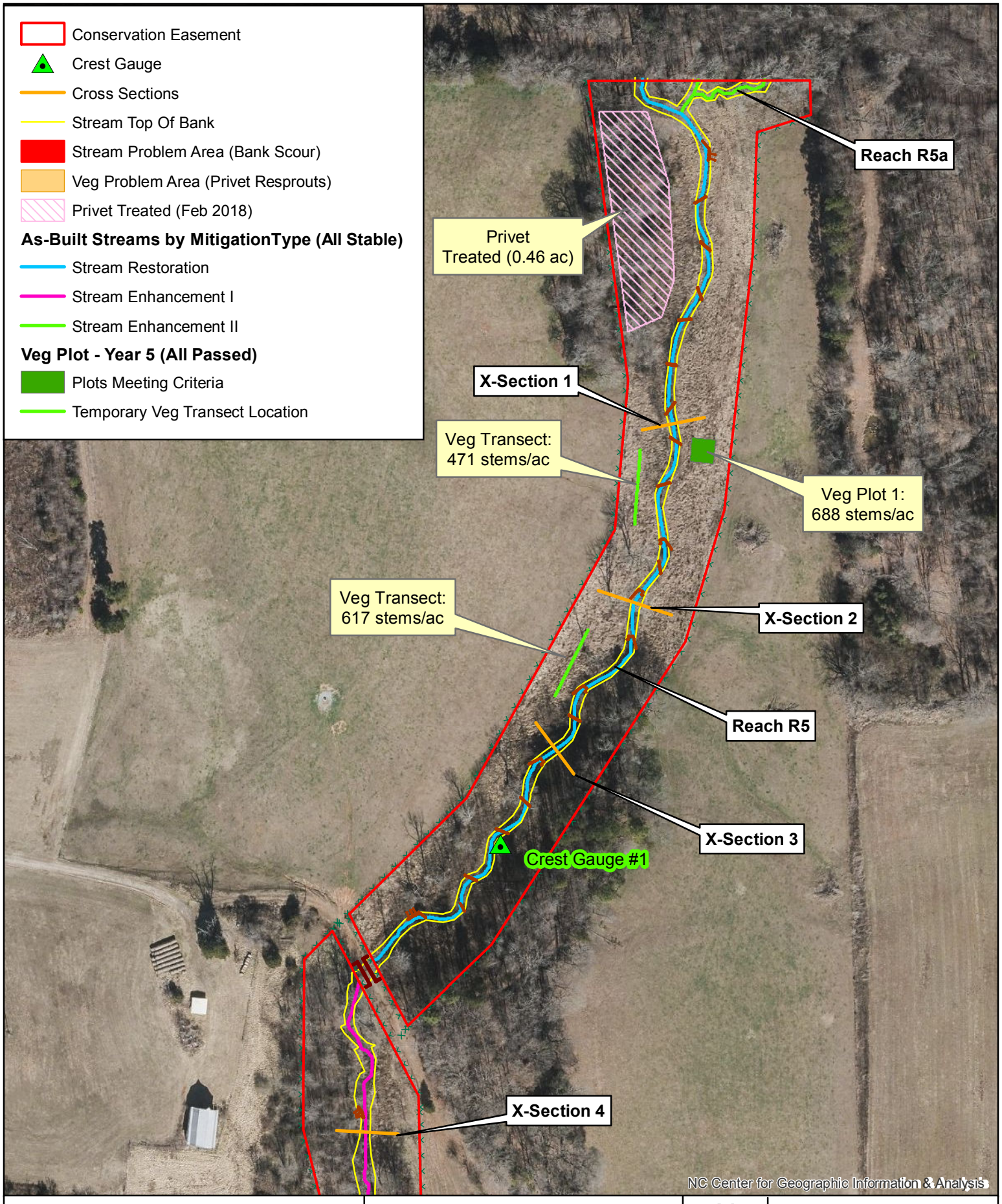
Michael Baker INTERNATIONAL

0 250 500 Feet

N

DEQ - Division of Mitigation Services
Project # 95729

Current Condition Plan View - Figure Index Monitoring Year 5 UT to Cane Creek Site



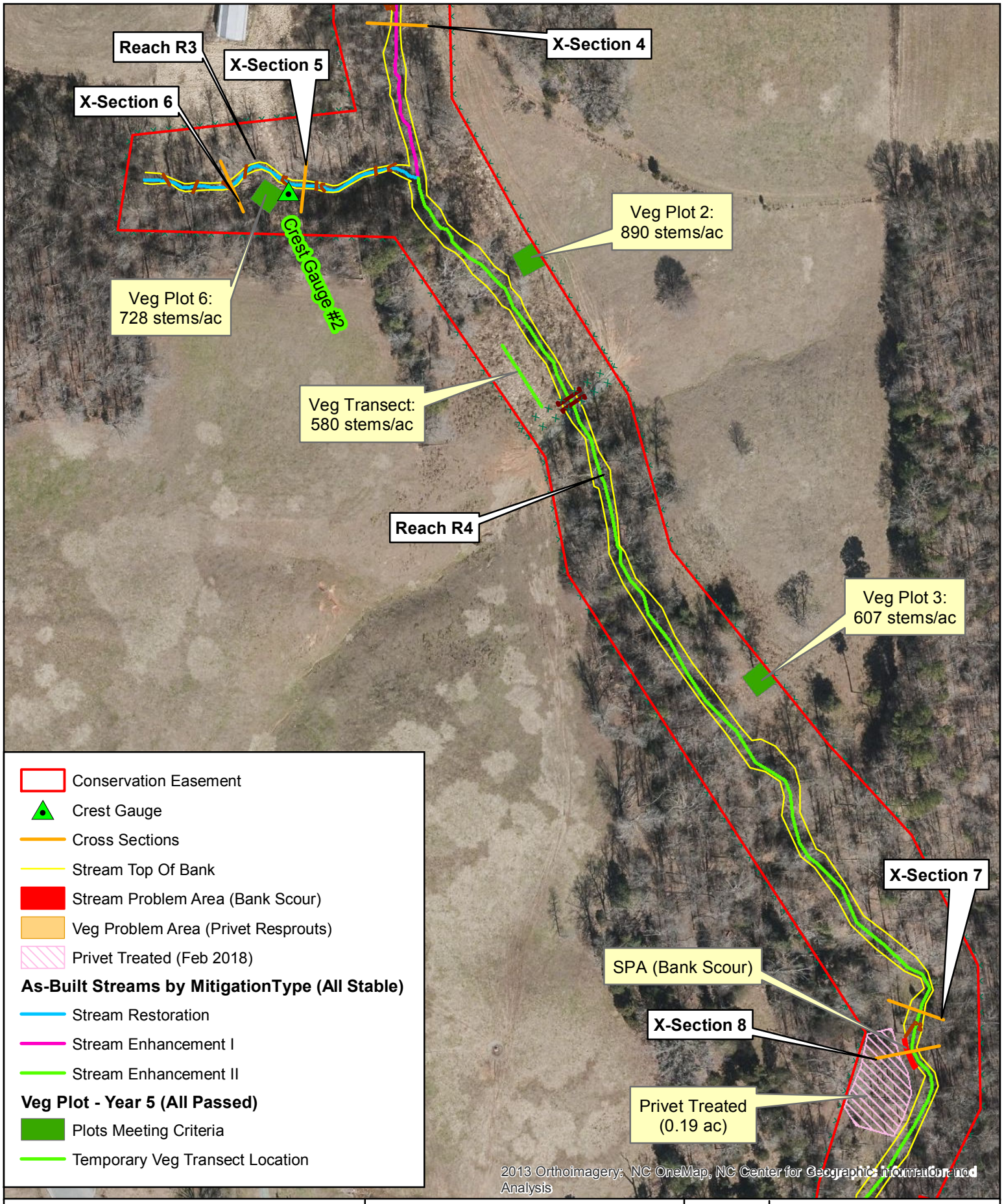
Michael Baker INTERNATIONAL

0 100 200 Feet

N

DEQ - Division of Mitigation Services
Project # 95729

Current Condition Plan View - Figure 4A
Monitoring Year 5
UT to Cane Creek Site



Michael Baker INTERNATIONAL

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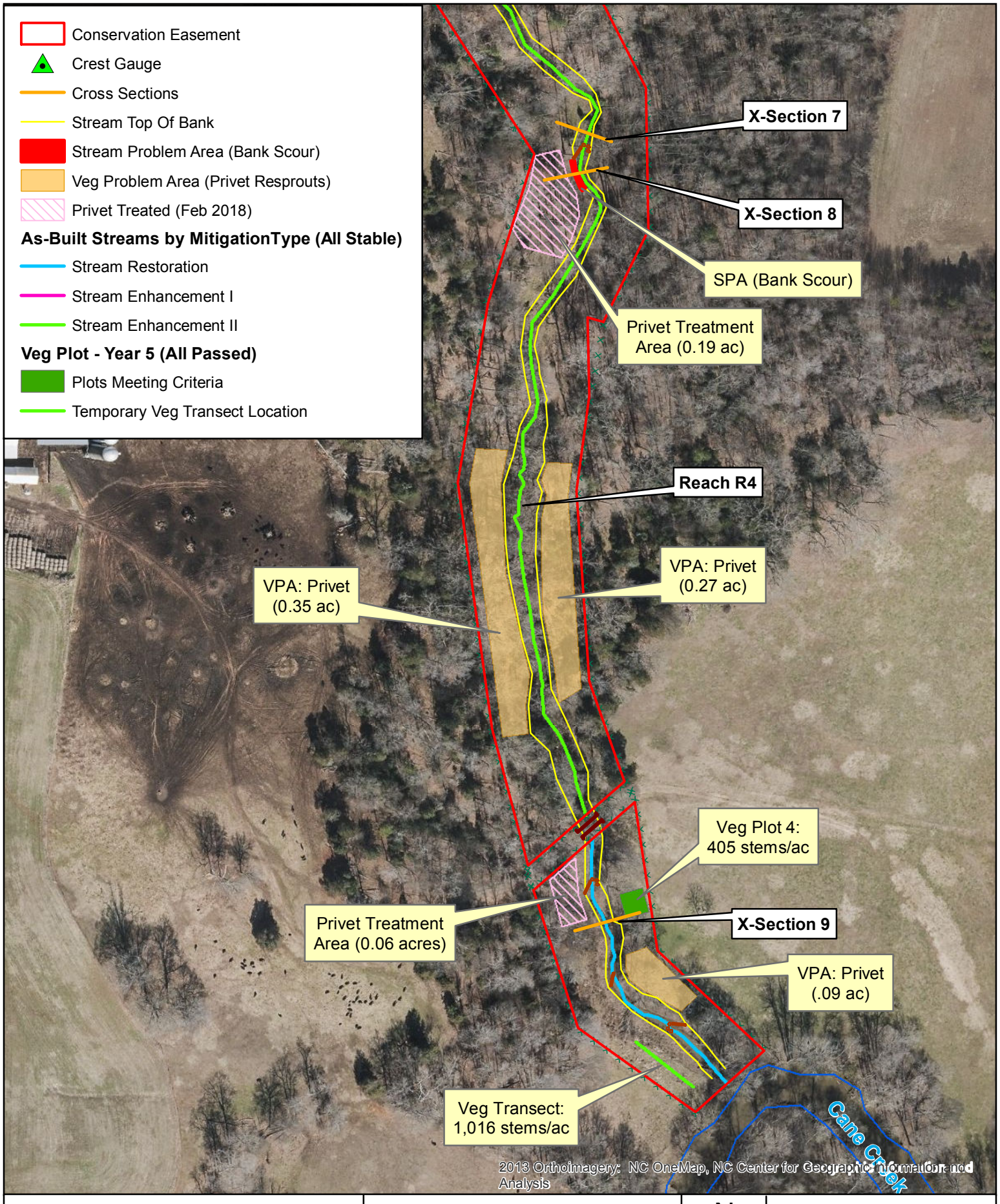
DEQ - Division of Mitigation Services
Project # 95729

Current Condition Plan View - Figure 4B Monitoring Year 5 UT to Cane Creek Site



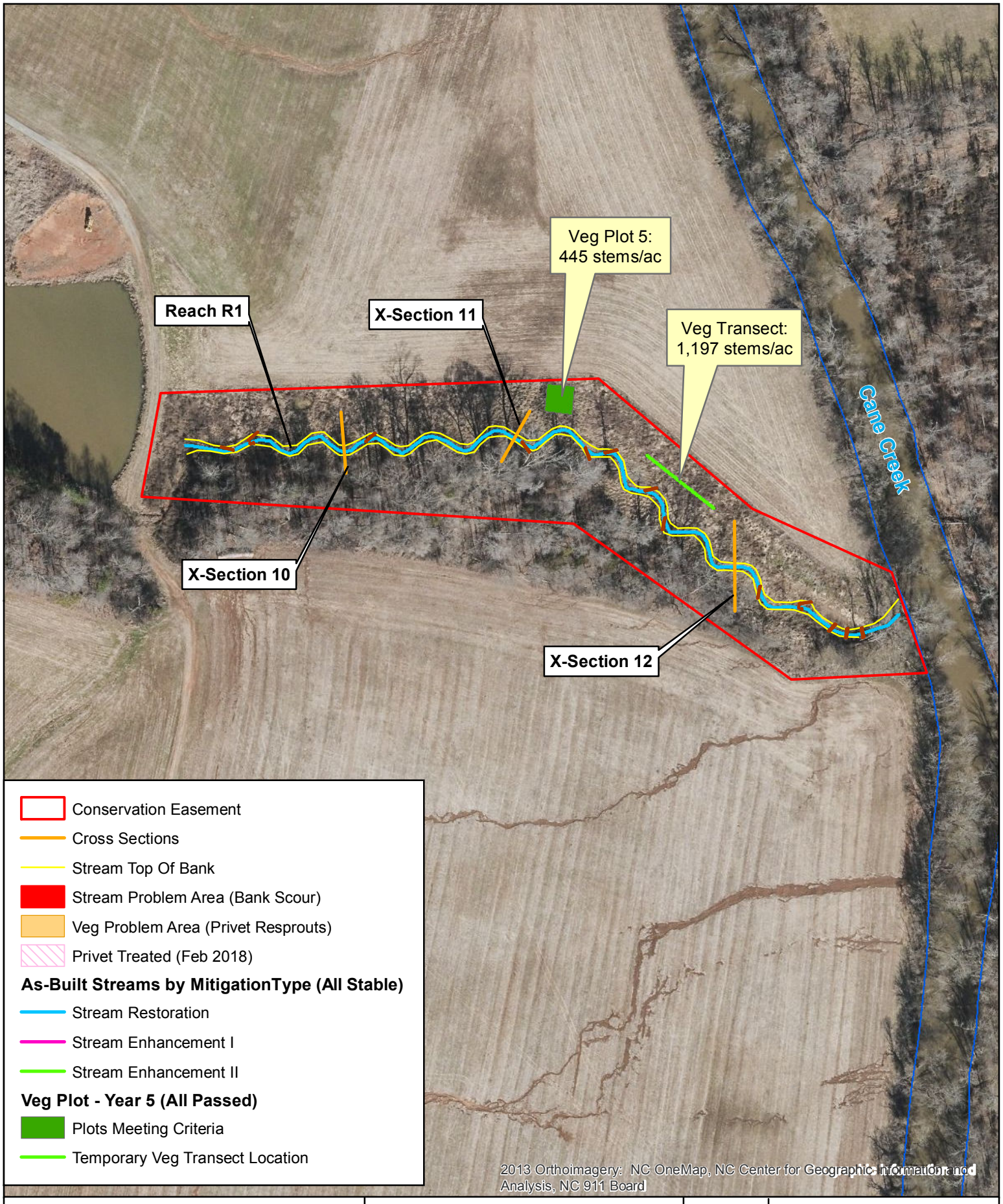
Michael Baker INTERNATIONAL

0 100 200 Feet

N

DEQ - Division of Mitigation Services
Project # 95729

Current Condition Plan View - Figure 4C Monitoring Year 5 UT to Cane Creek Site



Michael Baker INTERNATIONAL

0 100 200 Feet

N

DEQ - Division of Mitigation Services
Project # 95729

Current Condition Plan View - Figure 4D Monitoring Year 5 UT to Cane Creek Site

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

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

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

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

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

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	7	7			100%			
	3. Meander Pool Condition	1. Depth	2	2			100%			
		2. Length	2	2			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		2. Thalweg centering at downstream of meander bend (Glide)	2	2			100%			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	30	99%	0	0	99%
	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			1	30	99%	0	0	99%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	3	3			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	3	3			100%			
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	3	3			100%			
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	3	3			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	3	3			100%			

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

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

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

Feature Issue	Station Numbers	Suspected Cause	Photos
Bank Scour	43+40 to 43+70 (30' in length)	High flow from Hurricane Florence	Appendix B

Table 6a. Vegetation Conditions Assessment UT to Cane Creek Restoration Project: DMS Project ID No. 95729						
Planted Acreage: 14.0						
Vegetation Category	**Defintions**	**Mapping Threshold (acres)**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1	NA	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4 or 5 stem count criteria.	0.1	NA	0	0.00	0.0%
			Total	**0**	**0.00**	**0.0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25	NA	0	0.00	0.0%
			Cumulative Total	**0**	**0.00**	**0.0%**
Easement Acreage: 19.9						
Vegetation Category	**Defintions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
5. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	Orange polygons	3	0.71	3.6%
6. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	NA	0	0.00	0.0%

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

Feature Issue	Station Numbers	Suspected Cause	Photos
Chinese privet (*Ligustrum sinense*)	Reach R4: Stations 47+00 to 51+00 (both banks), and 55+00 to 56+00 (left bank)	Re-sprouts	Appendix B

UT to Cane Creek: MY5 Stream and Project Photographs

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

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

Reach R5 – View upstream, Station 20+00

Reach R5 – View upstream, Station 17+25

Reach R5 – View upstream, Station 16+50

Reach R5 – View upstream, Station 13+75

UT to Cane Creek: MY5 Stream and Project Photographs

Reach R5 – View upstream, Station 12+00

Reach R5 – View upstream, Station 11+50

Reach R5 – View upstream, Station 28+50

Reach R3 – View upstream, at cross-section 6

Reach R4 – View upstream, Station 31+50

Reach R4 – View of upstream, Station 35+00

UT to Cane Creek: MY5 Stream and Project Photographs

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

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

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

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

Reach R4 – View upstream, Station 54+75

Reach R4 – View upstream, Station 56+50

UT to Cane Creek: MY5 Stream and Project Photographs

Reach R1 – View upstream, Station 10+50

Reach R1 – View upstream, Station 14+75

Reach R1 – View upstream, Station 15+00

Reach R1 – View upstream, Station 17+00

Reach R1 – View upstream, Station 19+25

Reach R1 – View upstream, Station 20+00

UT to Cane Creek: MY5 Stream and Project Photographs

Reach R5: Crest Gauge #1, 1.22 feet on 9/24/18

Reach R3: Crest Gauge #2, 1.08 feet on 9/24/18

Reach R5: Closeup of Crest Gauge #1 on 9/24/18

Reach R5: Debris caught in fence in the crossing at Station 53+00

Reach R4: Leaf staining in the trees at Station ~54+00

Reach R5: Debris/wrack lines on floodplain at Station ~14+00.

UT to Cane Creek: MY5 Stream and Project Photographs

Reach R1: Debris caught in trees, Station ~18+00

Reach R1: That same debris as observed from the stream at Station ~18+00

Reach R5 upper: Privet treated (Feb 2018)

Reach R4 middle: Privet treated (Feb 2018)

Reach R4 lower: Privet treated (Feb 2018)

VPA: Privet scattered along both banks of middle Reach R4 (~47+00 to 51+00)

UT to Cane Creek: MY5 Stream and Project Photographs

VPA: Privet scattered along left bank of lower Reach R4 (~55+00 to 56+00)

SPA: Bank scour along Reach R4 (~43+50)

SPA: Bank scour along Reach R4 (~43+50), looking downstream

UT to Cane Creek: MY5 Vegetation Plot Photographs

Vegetation Plot 1 – September 2018

Vegetation Plot 2 – September 2018

Vegetation Plot 3 – September 2018

Vegetation Plot 4 – September 2018

Vegetation Plot 5 – October 2018

Vegetation Plot 6 – September 2018

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?	MY5 Total / Planted Stem Count	Tract Mean
1	Y	688/880	627
2	Y	890/1,012	
3	Y	607/648	
4	Y	405/688	
5	Y	445/728	
6	Y	728/971	

Notes:

* Total/Planted Stem Count reflects the change in stem density based on the current total density of planted stems (Total), over the density of stems at the time of the As-Built Survey (Planted).

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

Report Prepared By	Drew Powers
Date Prepared	9/27/2018 12:04
database name	MichaelBaker_2018_UTCaneCrk_95729.mdb
database location	\\CARYFS1.bkr.mbakercorp.com\PROJECTS\132700\Monitoring\Post_Restoration\Veg Plots\Year 5
computer name	CARYLAPOWERS1
file size	50827264
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	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	SpType	CommonName	Total Planted Stems	# plots	avg# stems	plot 95729-01-0001-year:5	plot 95729-01-0002-year:5	plot 95729-01-0003-year:5	plot 95729-01-0004-year:5	plot 95729-01-0005-year:5	plot 95729-01-0006-year:5
		Betula nigra	Tree	river birch	10	3	3.33	6				1	3
		Carpinus caroliniana	Shrub Tree	American hornbeam	7	5	1.4		1	1	1	1	3
		Diospyros virginiana	Tree	common persimmon	5	4	1.25	2	1	1	1		
		Fraxinus pennsylvanica	Tree	green ash	23	6	3.83	1	9	5	2	3	3
		Liriodendron tulipifera	Tree	tuliptree	2	2	1	1			1		
		Nyssa sylvatica	Tree	blackgum	2	1	2				2		
		Platanus occidentalis	Tree	American sycamore	12	5	2.4	5	2	2		1	2
		Quercus alba	Tree	white oak	5	3	1.67		2	2	1		
		Quercus laurifolia	Tree	laurel oak	2	2	1	1				1	
		Quercus lyrata	Tree	overcup oak	11	4	2.75		6	1		2	2
		Quercus michauxii	Tree	swamp chestnut oak	11	5	2.2		1	2	2	1	5
		Quercus nigra	Tree	water oak	3	3	1	1		1		1	
TOT:	**0**	**12**	**12**	**12**	**93**	**12**		**17**	**22**	**15**	**10**	**11**	**18**

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								
Betula nigra	river birch	6				1	3	
Fraxinus pennsylvanica	green ash	1	9	5	2	3	3	
Liriodendron tulipfera	tulip poplar	1			1			
Nyssa sylvatica	black gum				2			
Platanus occidentalis	American sycamore	5	2	2		1	2	
Quercus alba	white oak		2	2	1			
Quercus laurifolia	laurel oak	1				1		
Quercus lyrata	overcup oak		6	1		2	2	
Quercus michauxii	swamp chestnut oak		1	2	2	1	5	
Quercus nigra	water oak	1		1		1		
Shrub Species								
Asimina triloba	paw paw							
Carpinus caroliniana	ironwood		1	1	1	1	3	
Diospyros virginiana	persimmon	2	1	1	1			
Hamamelis virginiana	witch hazel							
Itea virginica	Virginia sweetspire							
Lindera benzoin	spicebush							
Viburnum dentatum	arrowwood viburnum							
Total Stems Per Plot for Year 5 (September 2018)		17	22	15	10	11	18	**Average Stems Per Acre**
Density Per Plot for Year 5 (September 2018)		688	890	607	405	445	728	627
Density Per Plot for Year 3 (September 2016)		607	890	607	405	526	769	634
Density Per Plot for Year 2 (October 2015)		607	890	728	486	607	769	681
Density Per Plot for Year 1 (After Supplemental Planting Mar. 2015)		728	1012	648	688	728	971	796
Total Stems/ Acre for Year 1 (Before Supplemental Dec. 2014)		728	405	121	364	202	567	398
Total Stems/ Acre for Year 0 As-Built (Baseline Data)		880	680	640	680	760	520	693

Table 9c. CVS Density Per Plot

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

			Current Plot Data (MY5 2018)																		Annual Means								
			95729-01-0001			95729-01-0002			95729-01-0003			95729-01-0004			95729-01-0005			95729-01-0006			MY5 (2018)			MY3 (2016)			MY2 (2015)			MY1 (2015)		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Betula nigra	river birch	Tree	6		6										1		1	3	1	4	10	1	11	10		10	10		10	13		13
Carpinus caroliniana	American hornbeam	Tree				1		1	1		1	1		1	1		1	3		3	7		7	7		7	7		7	5		5
Celtis laevigata	sugarberry	Tree											4	4								4	4								
Diospyros virginiana	common persimmon	Tree	2		2	1	3	4	1		1	1		1		1	1				5	4	9	6		6	5		5	1		1
Fraxinus pennsylvanica	green ash	Tree	1	1	2	9		9	5	3	8	2	14	16	3	2	5	3		3	23	20	43	24		24	27		27	15		15
Liriodendron tulipifera	tuliptree	Tree	1		1					2	2	1		1		1	1				2	3	5	1		1	1		1			
Nyssa sylvatica	blackgum	Tree										2		2							2		2	2		2	3		3	4		4
Platanus occidentalis	American sycamore	Tree	5		5	2		2	2	3	5				1		1	2	1	3	12	4	16	11		11	11		11	7		7
Quercus	oak	Tree																									1		1			
Quercus alba	white oak	Tree				2		2	2		2	1		1							5		5	5		5	5		5			
Quercus laurifolia	laurel oak	Tree	1		1										1		1				2		2	3		3	3		3	3		3
Quercus lyrata	overcup oak	Tree				6		6	1		1				2		2	2		2	11		11	11		11	11		11			
Quercus michauxii	swamp chestnut oak	Tree		1	1	1		1	2		2	2		2	1		1	5		5	11	1	12	11		11	13		13	9		9
Quercus nigra	water oak	Tree	1		1				1		1				1	1	1				3		3	3		3	3		3	1		1
Salix nigra	black willow	Tree					1	1														1	1									
Ulmus alata	winged elm	Tree											2	2								2	2									
Unknown		Shrub or Tree																									2		2	1		1
		Stem count	17	2	19	22	4	26	15	8	23	10	20	30	11	5	15	18	2	20	93	40	133	94	0	94	102	0	102	59	0	59
		size (ares)	1			1			1			1			1			1			6			6			6			6		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.15			0.15			0.15			0.15		
		Species count	7	2	8	7	2	8	8	3	9	7	3	9	8	4	10	6	2	6	12	9	15	12	0	12	14	0	14	10	0	10
		Stems per ACRE	687.97	80.937	768.9	890.31	161.87	1052.2	607.03	323.75	930.78	404.69	809.37	1214.1	445.15	202.34	607.03	728.43	80.937	809.37	627.26	269.79	897.05	634.01	0	634.01	687.97	0	687.97	397.9409	0	397.9409

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

UT to Cane Creek (#95729)
Year 5 (September 2018)

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	17	0	0	2	19	0
2	n/a	22	0	0	4	26	0
3	n/a	15	0	0	8	23	0
4	n/a	10	0	0	20	30	0
5	n/a	11	0	0	4	15	0
6	n/a	18	0	0	2	20	0

Wetland/Stream Vegetation Totals

(per acre)

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	688	81	769	Yes
2	890	162	1052	Yes
3	607	324	931	Yes
4	405	809	1214	Yes
5	445	162	607	Yes
6	728	81	809	Yes
Project Avg	**627**	**270**	**897**	**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 Avg	**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

Figure 5. Year 5 Cross-sections with Annual Overlays

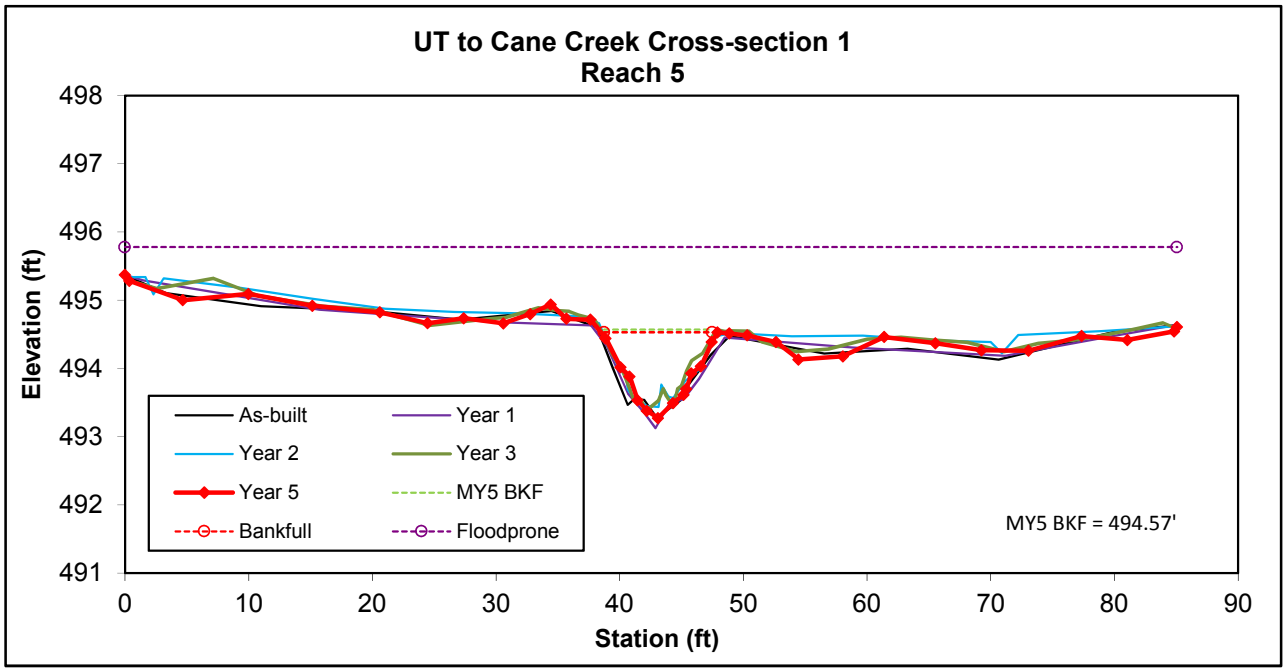
Permanent Cross-section 1, Reach 5

(Year 5 Data - Collected October 2018)

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	C	6.7	9.4	0.7	1.3	13.4	1.0	9.0	494.53	494.53



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

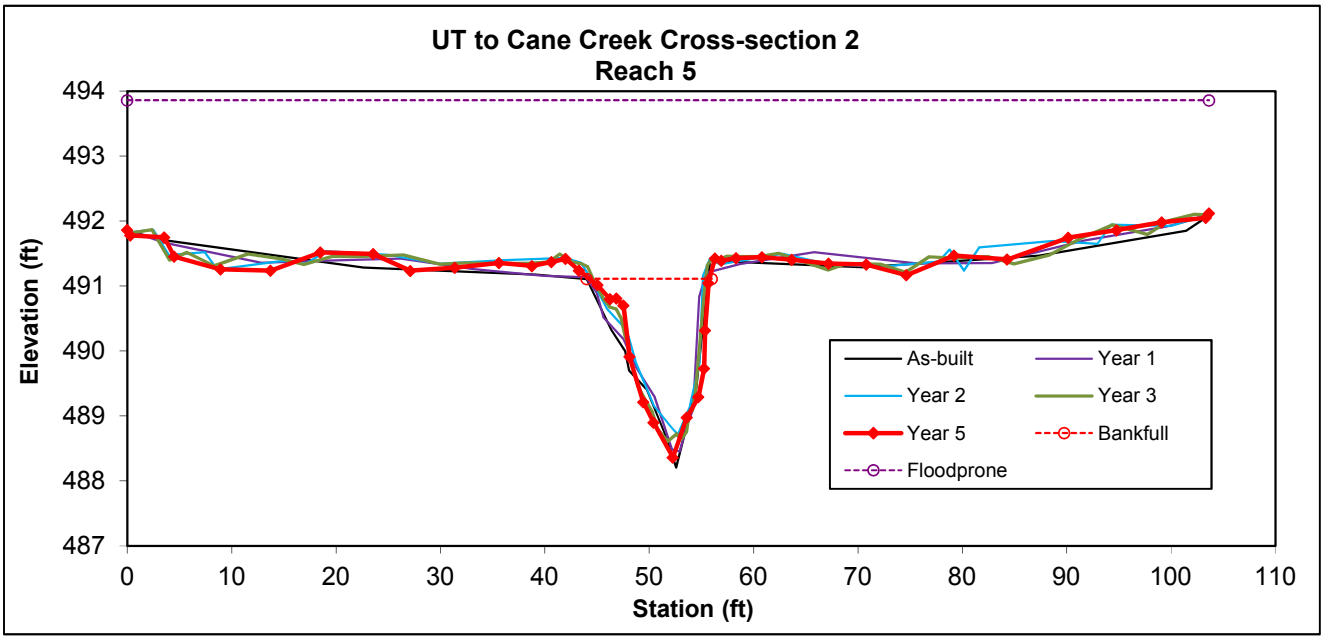
Permanent Cross-section 2, Reach 5

(Year 5 Data - Collected October 2018)

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	-	16.4	11.5	1.4	2.7	8.0	-	-	491.11	491.42



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

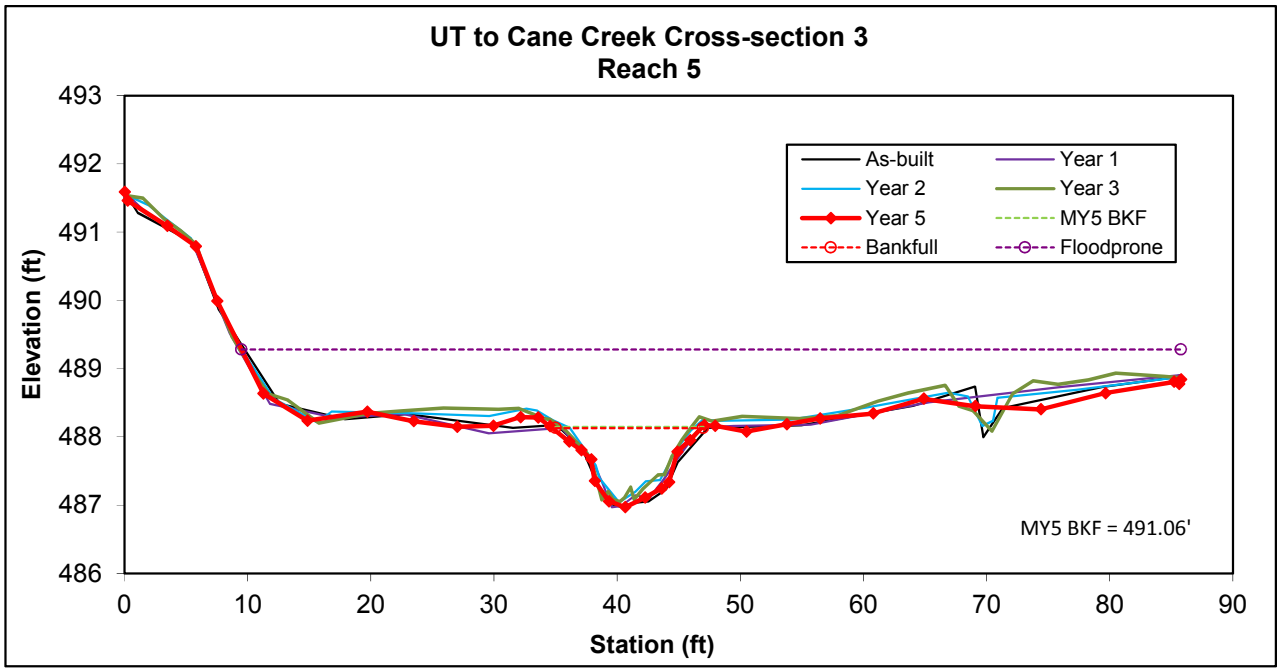
Permanent Cross-section 3, Reach 5

(Year 5 Data - Collected October 2018)

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	C	7.8	15	0.5	1.2	29.2	1.0	5.1	488.13	488.18



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

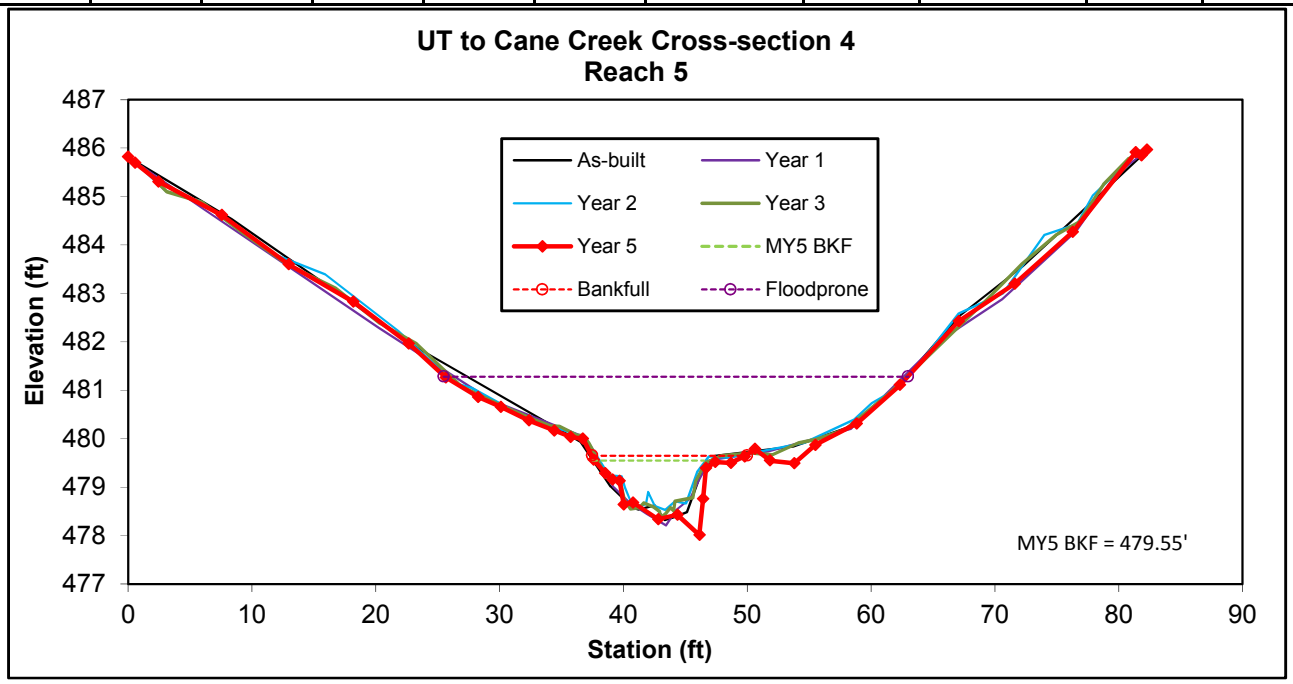
Permanent Cross-section 4, Reach 5

(Year 5 Data - Collected October 2018)

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	C	9.5	12.5	0.8	1.6	16.3	1.1	3.0	479.65	479.78

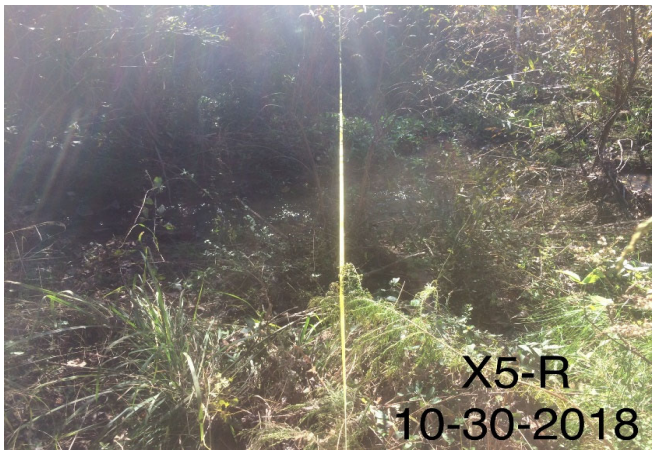


Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

Permanent Cross-section 5, Reach 3

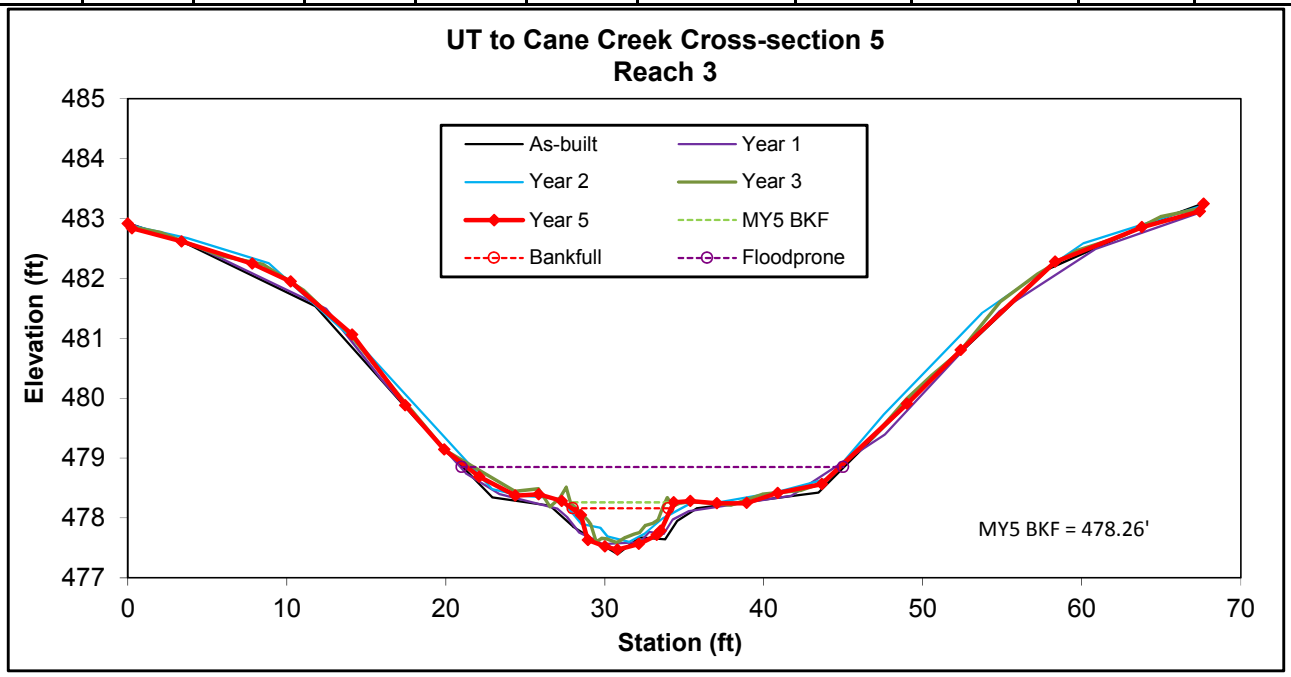
(Year 5 Data - Collected October 2018)

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	C	3.0	6.2	0.5	0.7	13.0	1.0	3.8	478.16	478.26



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

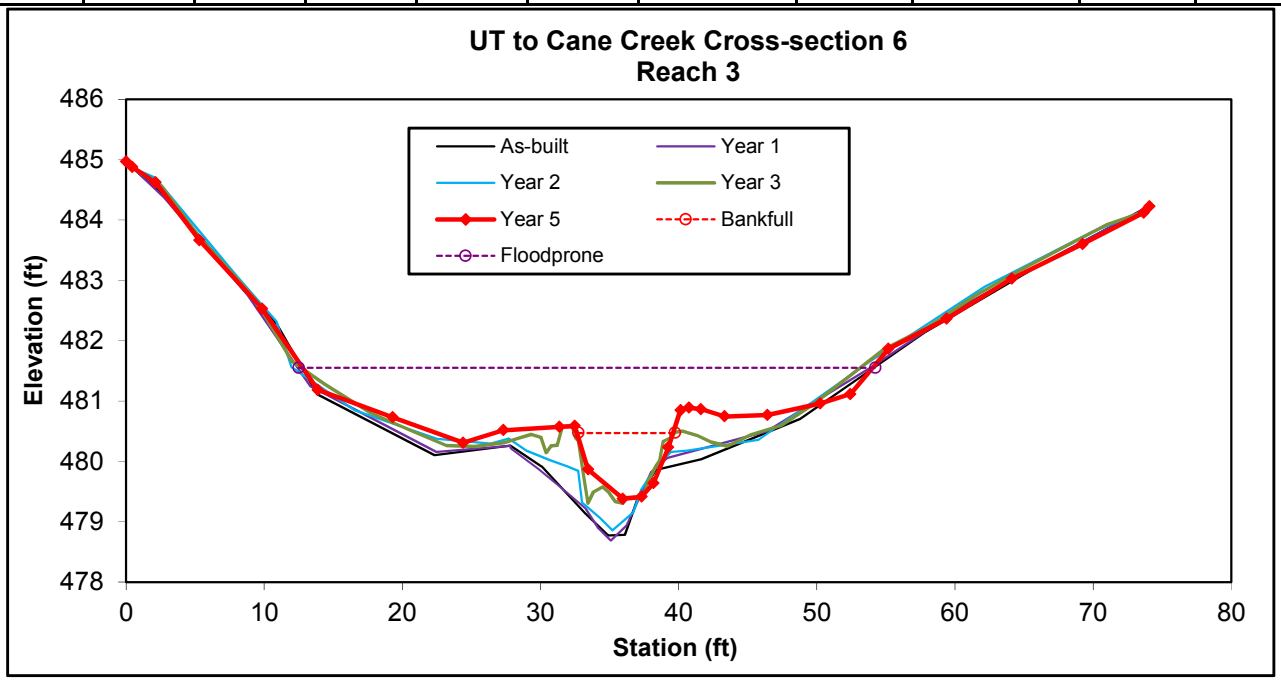
Permanent Cross-section 6, Reach 3

(Year 5 Data - Collected October 2018)

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	-	5.2	6.9	0.8	1.1	9.2	-	-	480.47	480.59



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

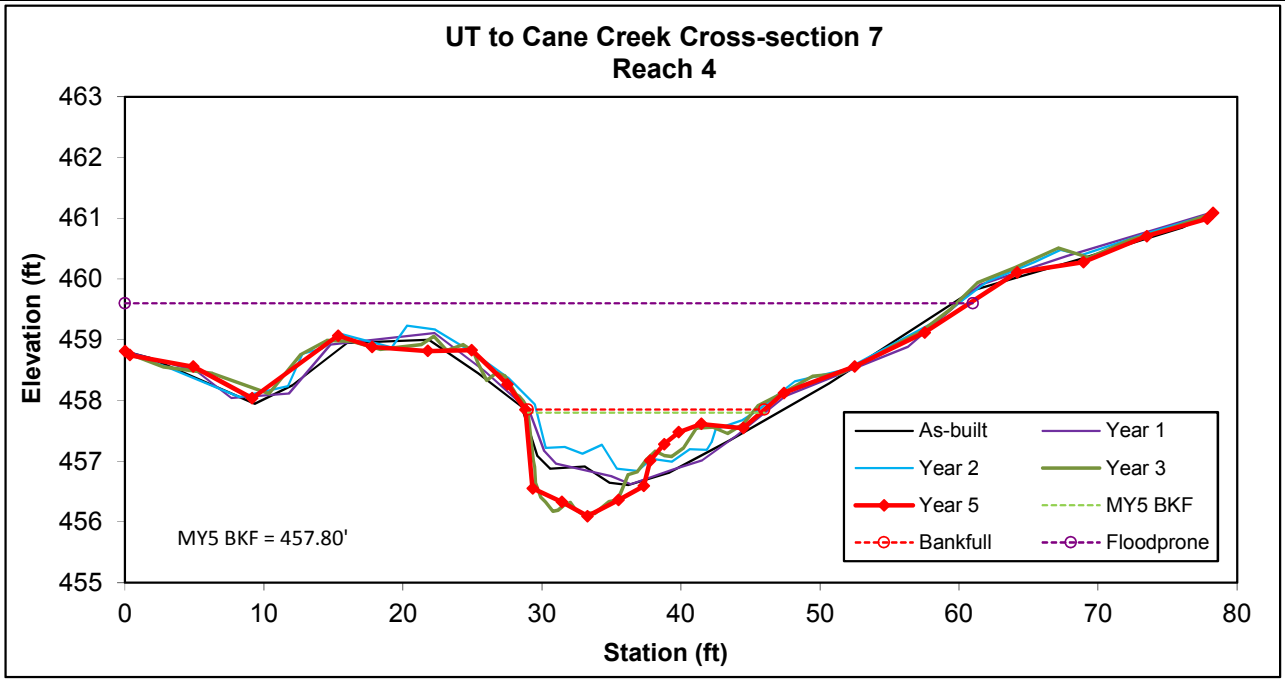
Permanent Cross-section 7, Reach 4

(Year 5 Data - Collected October 2018)

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	C	15.6	17.2	0.9	1.8	18.9	0.9	3.5	457.85	457.48



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

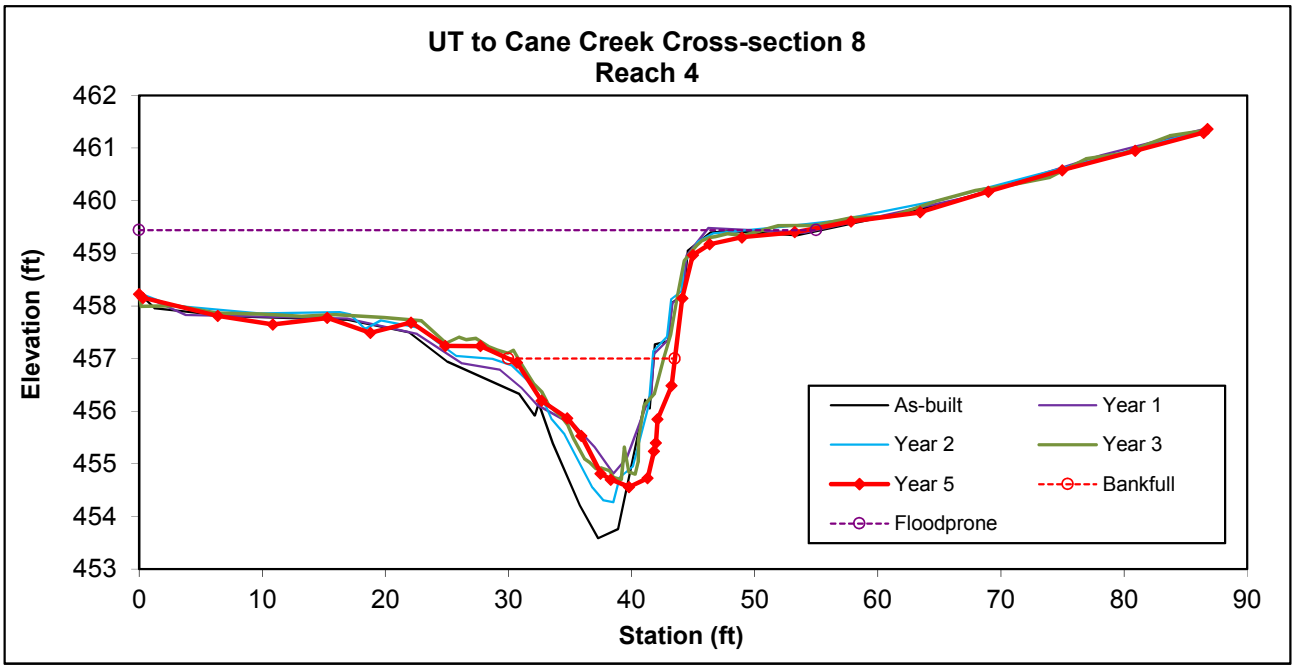
Permanent Cross-section 8, Reach 4

(Year 5 Data - Collected October 2018)

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	-	18.7	13.5	1.4	2.4	9.8	-	-	457	457.24



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

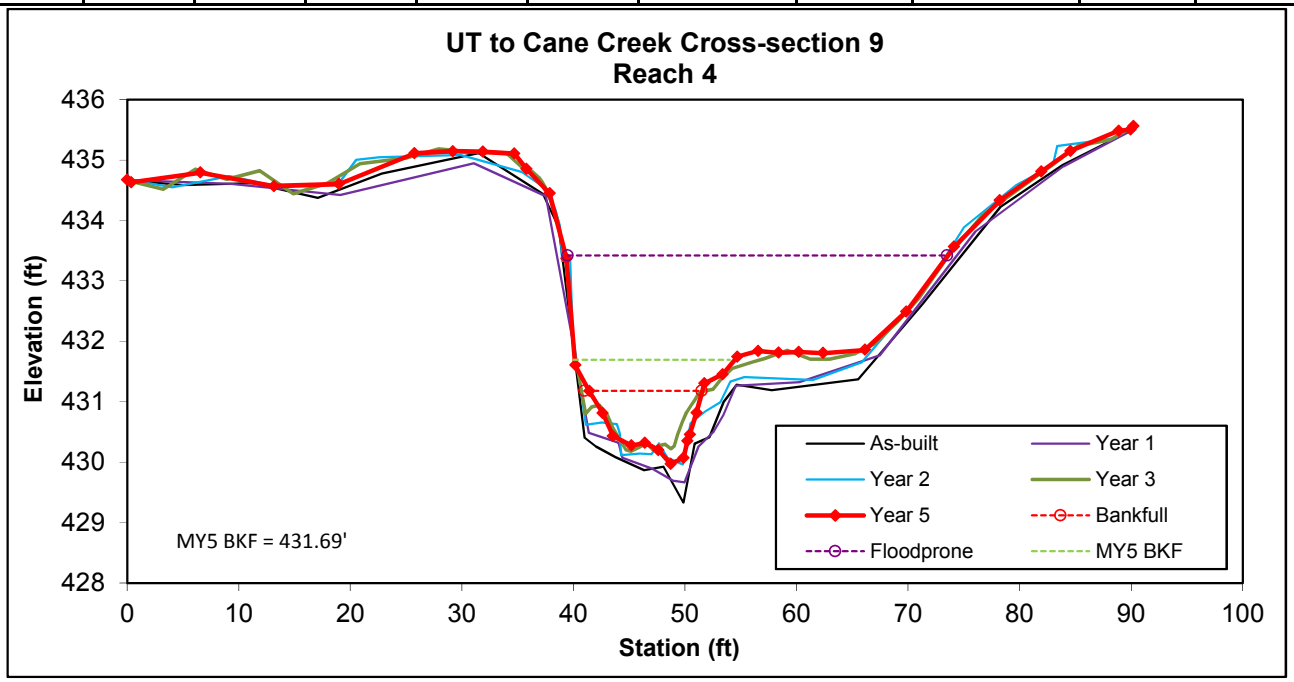
Permanent Cross-section 9, Reach 4

(Year 5 Data - Collected October 2018)

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	C	7.8	10.1	0.8	1.2	13.3	1.1	2.9	431.18	431.84



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

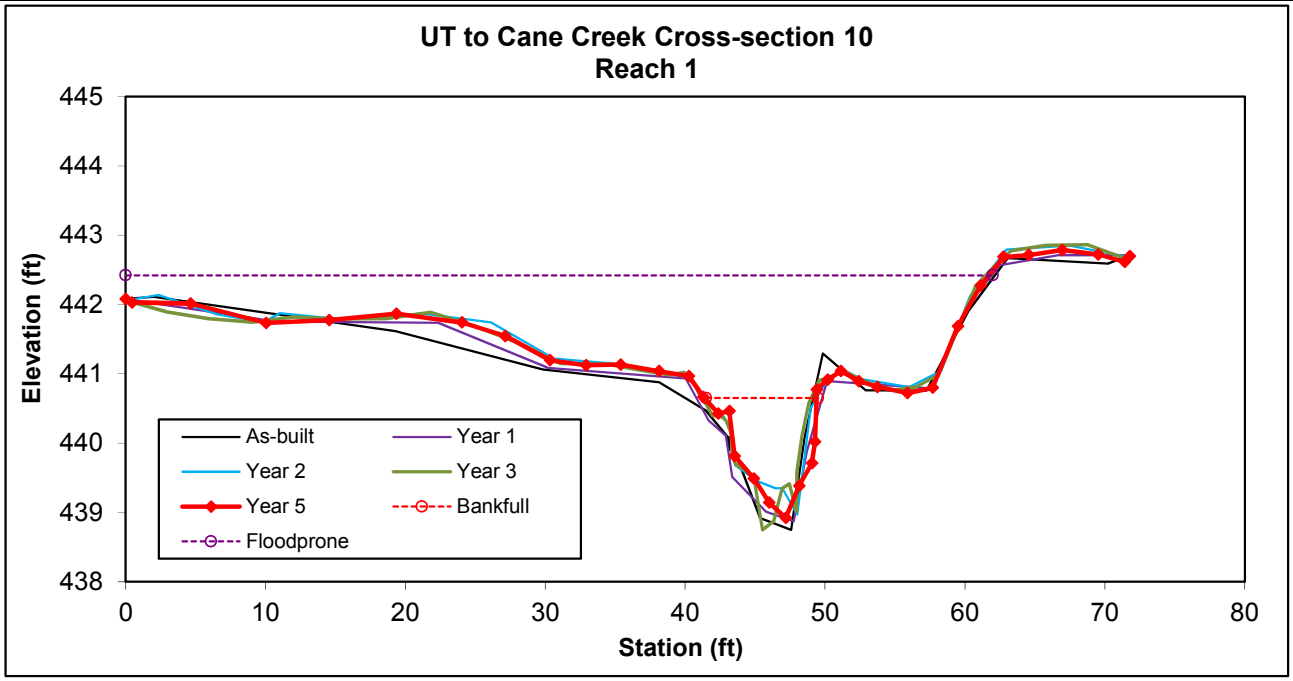
Permanent Cross-section 10, Reach 1

(Year 5 Data - Collected October 2018)

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	-	7.9	8.0	1.0	1.7	8.2	-	-	440.65	440.96



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

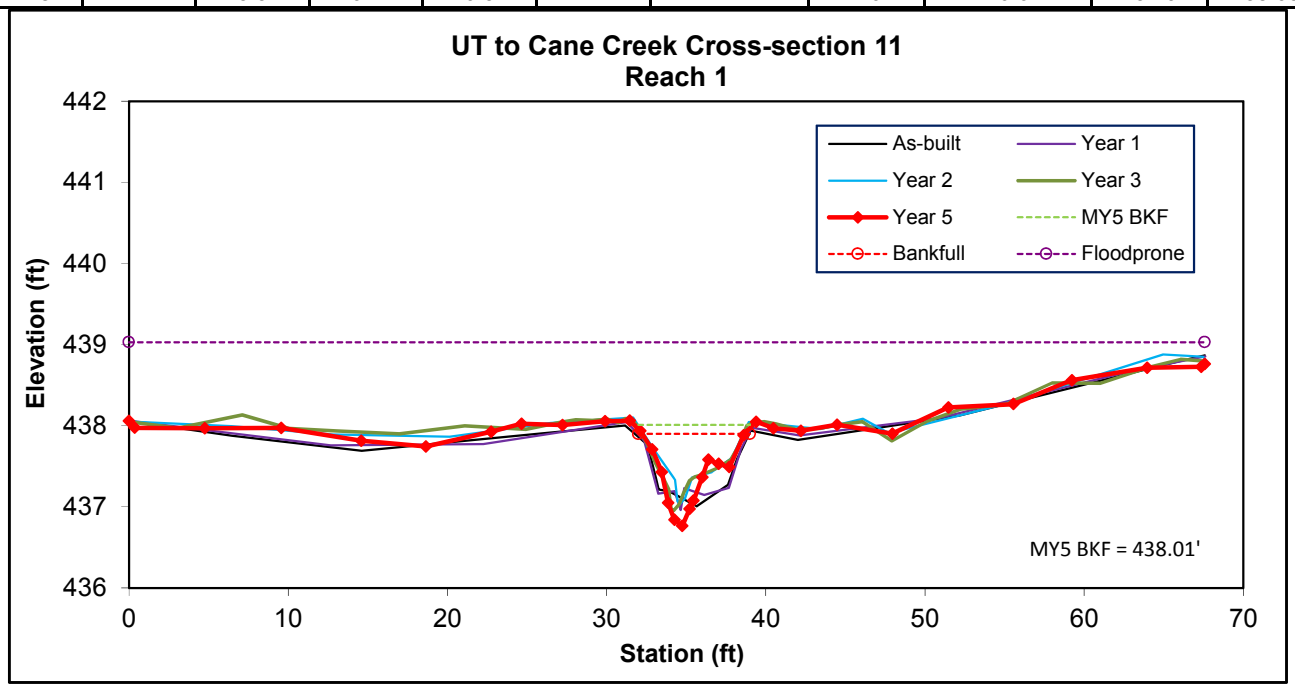
Permanent Cross-section 11, Reach 1

(Year 5 Data - Collected October 2018)

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	E	3.3	6.4	0.5	1.1	12.2	1.0	10.6	437.9	438.05



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

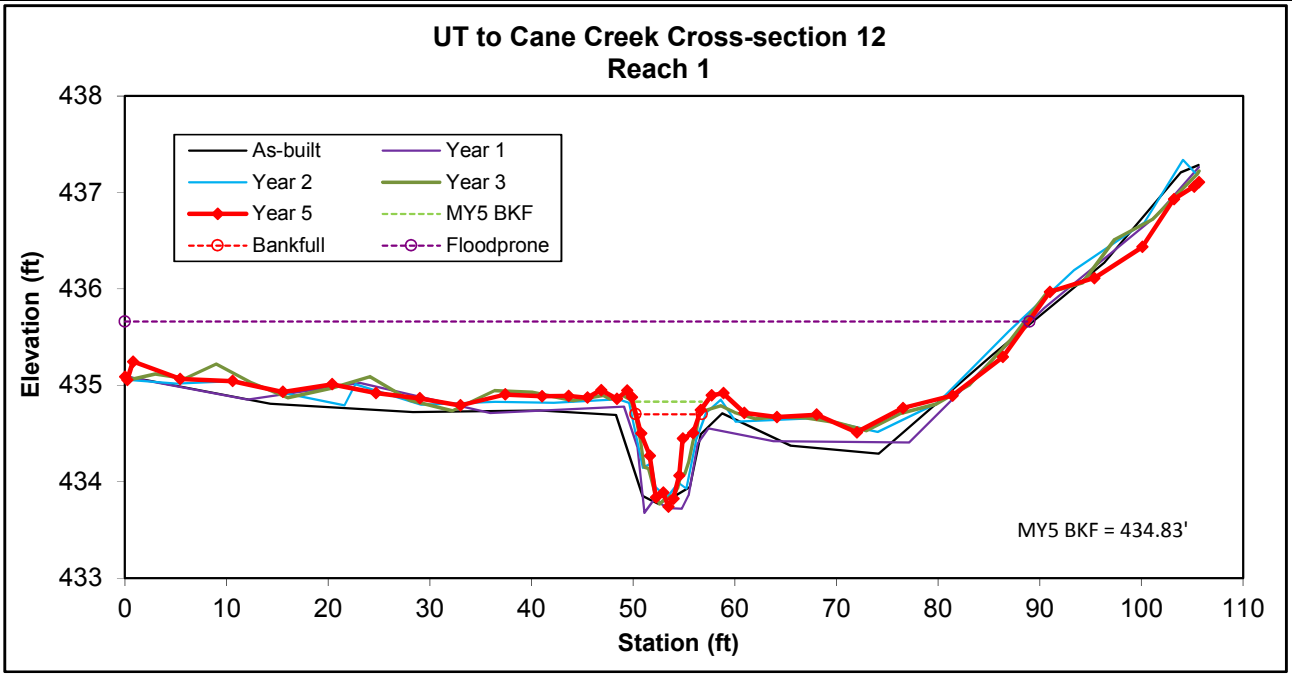
Permanent Cross-section 12, Reach 1

(Year 5 Data - Collected October 2018)

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	E	3.1	6.2	0.5	1.0	12.6	1.1	14.3	434.70	434.89



Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

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

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																		
BF Width (ft)	-----	23.0	80.0	4.9	5.6	-----	-----	7.3	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	6.9	-----	-----	-----	-----	7.2	-----	-----	9.1	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	6.8	-----	-----	>30	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>20	-----	-----	-----	-----	65.6	-----	-----	84.4	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.8	0.7	-----	-----	0.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	0.5	-----	-----	1.0	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.1	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.7	-----	-----	-----	-----	0.7	-----	-----	1.9	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	5.2	5.1	-----	-----	5.2	-----	-----	-----	5.3	-----	-----	-----	-----	-----	7.9	-----	-----	-----	-----	-----	3.7	-----	-----	-----	-----	4.0	-----	-----	8.7	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	6.1	-----	-----	10.5	-----	-----	7	-----	-----	26	-----	-----	8	-----	-----	18	-----	-----	-----	13.0	-----	-----	-----	-----	9.6	-----	-----	15.2	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	1.2	-----	-----	9.5	-----	-----	2.0	-----	-----	3.4	-----	-----	1.9	-----	-----	3.9	-----	-----	-----	>2.2	-----	-----	-----	-----	6.9	-----	-----	10.8	-----	-----
Bank Height Ratio	-----	-----	-----	-----	1.6	-----	-----	4.3	-----	-----	1.4	-----	-----	2.5	-----	-----	1.1	-----	-----	1.5	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.3	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25.0	-----	-----	45.0	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.0	-----	-----	21.0	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	2.0	-----	-----	3.0	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	50.0	-----	-----	80.0	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	3.6	-----	-----	6.5	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	28.0	-----	-----	42.0	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	-----	1.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (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/f^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	-----	-----	-----	-----	-----	-----	-----	-----	-----	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)[2]	-----	-----	-----	-----	-----	-----	-----	943	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1044.9	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.09	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.20	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0127	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	0.012	-----	-----	-----	-----	-----	0.0123	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0135	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	0.015	-----	-----	-----	-----	-----	0.0150	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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

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

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		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	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 (ft^2)	-----	80.0	300.0	5.7	-----	-----	-----	5.6	-----	-----	-----	5.3	-----	-----	-----	-----	-----	7.9	-----	-----	-----	-----	-----	4.0	-----	-----	-----	-----	3.7	-----	-----	5.3	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	9.9	-----	-----	7	-----	-----	26	-----	-----	8	-----	-----	18	-----	-----	-----	13.0	-----	-----	-----	-----	15.3	-----	-----	21.7	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	2.2	-----	-----	2.0	-----	-----	3.4	-----	-----	1.9	-----	-----	3.9	-----	-----	1.8	-----	-----	2.2	-----	-----	2.7	-----	-----	4.0	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	1.4	-----	-----	2.5	-----	-----	1.1	-----	-----	1.5	-----	-----	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	11	-----	-----	36	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	1.5	-----	-----	1.5	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (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)	-----	-----	-----	-----	-----	-----	-----	0.1	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	0.1	-----	-----	-----	-----	-----	0.1	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	B4c	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	-----	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	21.7	-----	-----	-----	21.7	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	356.8	-----	-----	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	425	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	389.1	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.16	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	1.18	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0195	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	0.016	-----	-----	-----	-----	-----	0.0172	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0168	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	0.018	-----	-----	-----	-----	-----	0.0187	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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

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

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																		
BF Width (ft)	-----	23.0	80.0	10.2	15.4	-----	-----	16.7	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	14.0	-----	-----	-----	-----	10.1	-----	-----	13.8	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	18.4	-----	-----	26.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>30	-----	-----	-----	-----	80.1	-----	-----	105.0	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	1.3	0.9	-----	-----	1.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	0.6	-----	-----	1.2	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.3	-----	-----	1.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	1.1	-----	-----	2.0	-----	-----
BF Cross-sectional Area (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																																		
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			24.2 / 50.6 / 69.4 / 50.6 / 24.2							0.1 / 0.6 / 4.5 / 53 / 96						0.2 / 2.5 / 8 / 92 / 1,536						-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																		
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.7	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	-----	-----	0.7	-----	-----	-----	-----	-----	0.7	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	B3c	-----	-----	F5	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	4.4	-----	-----	4.6	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.0	-----	-----	-----	-----	-----	3.0	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	69.2	-----	-----	-----	69.2	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	56.0	-----	-----	-----	-----	-----	56.0	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	349	-----	-----	-----	-----
Channel length (ft)[2]	-----	-----	-----	-----	-----	-----	-----	2,783	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	386	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.04	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0169	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	0.015	-----	-----	-----	-----	-----	0.0074	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0148	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	0.017	-----	-----	-----	-----	-----	0.0082	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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

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

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																		
BF Width (ft)	-----	23.0	80.0	8.4	-----	-----	-----	8.9	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	10.8	-----	-----	-----	-----	10.2	-----	-----	12.0	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	11.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>25	-----	-----	-----	-----	76.0	-----	-----	103.7	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	1.2	-----	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----	0.7	-----	-----	1.4	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	1.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----	1.2	-----	-----	2.8	-----	-----
BF Cross-sectional Area (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)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	32.0	-----	65.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	-----	2.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																																		
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			16.6/31.2/47.0/85.3/116.1							0.1 / 0.6/ 4.5 / 53 / 96						0.2 / 2.5/ 8 / 92 / 1,536					-----	-----	-----	-----	-----	-----			6.74 / 20.49 / 29.79 / 63.73 / 118.25			
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																																		
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	-----	0.5	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	G4	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	4.5	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	-----	-----	-----	4.4	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	50.0	-----	-----	-----	50	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	40	-----	-----	-----	-----	-----	40	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft^2)	-----	-----	-----	-----	-----	-----	-----	1848	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.07	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0144	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	0.014	-----	-----	-----	-----	-----	0.014	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0128	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	0.017	-----	-----	-----	-----	-----	0.017	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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

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

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Reference Reach(es) Data												Design						As-built					
											UT to Wells Creek						UT to Varnals Creek																	
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																																		
BF Width (ft)	-----	23.0	80.0	2.4	-----	-----	-----	13.6	-----	-----	-----	8	-----	-----	-----	-----	-----	9.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	16.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.5	-----	-----	-----	0.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	0.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	1.7	-----	-----	-----	4.2	-----	-----	-----	5.3	-----	-----	-----	-----	-----	7.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	45.0	-----	-----	7	-----	-----	26	-----	-----	8	-----	-----	18	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	2.0	-----	-----	3.4	-----	-----	1.9	-----	-----	3.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	1.4	-----	-----	2.5	-----	-----	1.1	-----	-----	1.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																																		
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.3	-----	-----	4.0	-----	-----	0.8	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.4	-----	-----	8.8	-----	-----	4.9	-----	-----	6.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	4.4	-----	-----	1.2	-----	-----	1.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																																		
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.1	-----	-----	7.9	-----	-----	2.9	-----	-----	5.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.3	-----	-----	2.7	-----	-----	1.6	-----	-----	2.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (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)	-----	-----	-----	-----	-----	-----	-----	0.025	-----	-----	-----	-----	-----	0.13	-----	-----	-----	-----	-----	0.24	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	C4/1	-----	-----	-----	-----	-----	B4/1a	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	1.7	-----	-----	-----	-----	-----	5.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	6.2	-----	-----	-----	7.1	-----	-----	-----	-----	-----	25.2	-----	-----	-----	-----	-----	46.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel length (ft^2)	-----	-----	-----	-----	-----	-----	-----	144	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.19	-----	-----	-----	-----	-----	1.40	-----	-----	-----	-----	-----	1.20	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0236	-----	-----	-----	-----	-----	0.0197	-----	-----	-----	-----	-----	0.0405	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0224	-----	-----	-----	-----	-----	0.028	-----	-----	-----	-----	-----	0.0458	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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

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

Reach 1 (1,045 LF)

	Cross-section X-10 (Pool)							Cross-section X-11 (Riffle)							Cross-section X-12 (Riffle)													
Dimension and substrate	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)	9.1	9.0	8.1	7.8	-	8.0		7.2	7.0	6.2	6.4	-	6.4		7.8	7.1	7.2	6.3	-	6.2									
BF Mean Depth (ft)	0.95	1.05	0.88	0.94	-	1.00		0.57	0.57	0.41	0.46	-	0.50		0.51	0.56	0.55	0.59	-	0.50									
Width/Depth Ratio	9.6	8.6	9.1	8.3	-	8.2		12.8	12.3	15.1	13.9	-	12.2		15.2	12.6	13.2	10.7	-	12.6									
BF Cross-sectional Area (ft^2)	8.7	9.4	7.1	7.3	-	7.9		4.1	4.0	2.6	2.9	-	3.3		4.0	4.0	4.0	3.8	-	3.1									
BF Max Depth (ft)	1.9	1.8	1.7	1.9	-	1.7		0.9	0.9	0.9	0.9	-	1.0		0.7	0.8	0.9	0.9	-	1.0									
Width of Floodprone Area (ft)	65.6	61.9	61.2	62.1	-	61.5		65.9	67.2	63.1	67.6	-	67.6		84.4	85.9	87.2	88.3	-	88.9									
Entrenchment Ratio	-	-	-	-	-	-		9.1	9.6	10.1	10.6	-	10.6		10.8	12.1	12.0	13.9	-	14.3									
Bank Height Ratio	-	-	-	-	-	-		1.0	1.1	1.2	1.1	-	1.0		1.3	1.1	1.0	1.1	-	1.1									
Wetted Perimeter (ft)	11.0	11.1	9.8	9.7	-	9.4		8.4	8.1	7.1	7.3	-	7.0		8.9	8.2	8.3	7.5	-	6.7									
Hydraulic Radius (ft)	0.8	0.8	0.7	0.8	-	0.8		0.5	0.5	0.4	0.4	-	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 (ft^2)																												
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 (ft^2)																												
d50 (mm)																												

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

Reach 3 (398 LF)

	Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)																				
Dimension and substrate	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)	8.9	9.6	7.1	5.4	-	6.2		9.0	8.7	6.2	7.3	-	6.9															
BF Mean Depth (ft)	0.41	0.35	0.32	0.36	-	0.50		0.59	0.59	0.61	0.78	-	0.80															
Width/Depth Ratio	21.7	27.3	22.4	15.0	-	13.0		15.3	14.7	10.2	9.3	-	9.2															
BF Cross-sectional Area (ft^2)	3.7	3.3	2.2	2.0	-	3.0		5.3	5.2	3.7	5.7	-	5.2															
BF Max Depth (ft)	0.8	0.6	0.6	0.6	-	0.7		1.1	1.2	1.0	1.2	-	1.1															
Width of Floodprone Area (ft)	24.4	22.7	22.2	21.8	-	23.5		36.3	36.3	33.5	41.5	-	41.7															
Entrenchment Ratio	2.7	2.4	3.1	4.0	-	3.8		-	-	-	-	-	-															
Bank Height Ratio	1.0	0.9	1.2	1.0	-	1.0		-	-	-	-	-	-															
Wetted Perimeter (ft)	9.8	10.3	7.7	6.2	-	6.6		10.2	9.9	7.4	8.8	-	7.4															
Hydraulic Radius (ft)	0.4	0.3	0.3	0.3	-	0.5		0.5	0.5	0.5	0.6	-	0.7															
Based on current/developing bankfull feature																												
BF Width (ft)																												
BF Mean Depth (ft)																												
Width/Depth Ratio																												
BF Cross-sectional Area (ft^2)																												
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 (ft^2)																												
d50 (mm)																												

Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

Table 11. Morphology and Hydraulic Monitoring Summary (continued)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach 4 (2,333 LF)

	Cross-section X-7 (Riffle)							Cross-section X-8 (Pool)							Cross-section X-9 (Riffle)													
Dimension and substrate	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)	18.7	17.3	16.0	16.3	-	17.2		17.1	16.1	13.4	11.8	-	13.5		13.8	13.7	13.0	11.1	-	10.1									
BF Mean Depth (ft)	0.79	0.81	0.62	0.95	-	0.90		1.45	0.96	1.33	1.31	-	1.40		1.02	0.97	0.72	0.61	-	0.80									
Width/Depth Ratio	23.7	21.5	25.7	17.2	-	18.9		11.8	16.8	10.1	9.0	-	9.8		13.5	14.1	18.1	18.1	-	13.3									
BF Cross-sectional Area (ft^2)	14.8	14.0	10.0	15.5	-	15.6		24.7	15.5	17.8	15.5	-	18.7		14.1	13.3	9.3	6.8	-	7.8									
BF Max Depth (ft)	1.24	1.23	1.01	1.72	-	1.80		3.41	2.18	2.73	2.30	-	2.40		1.85	1.52	1.22	1.00	-	1.20									
Width of Floodprone Area (ft)	56.1	57.3	30.2	59.7	-	60.8		72.5	45.2	59.0	46.3	-	54.1		33.9	32.1	29.4	28.4	-	29.4									
Entrenchment Ratio	3.0	2.0	1.9	3.7	-	3.5		-	-	-	-	-	-		2.5	2.4	2.3	2.6	-	2.9									
Bank Height Ratio	1.9	1.0	1.0	1.0	-	0.9		-	-	-	-	-	-		1.1	1.1	1.1	1.0	-	1.1									
Wetted Perimeter (ft)	20.3	19.0	17.2	18.2	-	18.4		20.0	18.1	16.0	14.4	-	15.0		15.8	15.6	14.5	12.3	-	10.7									
Hydraulic Radius (ft)	0.7	0.7	0.6	0.8	-	0.9		1.2	0.9	1.1	1.1	-	1.2		0.9	0.9	0.6	0.6	-	0.7									
Based on current/developing bankfull feature																												
BF Width (ft)																												
BF Mean Depth (ft)																												
Width/Depth Ratio																												
BF Cross-sectional Area (ft^2)																												
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 (ft^2)								-																				
d50 (mm)								-																				

Table 11. Morphology and Hydraulic Monitoring Summary (continued)
UT to Cane Creek Restoration Project: DMS Project ID No. 95729
Reach 5 (1,461 LF)

	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (Riffle)							Cross-section X-4 (Riffle)						
Dimension and substrate	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)	10.4	10.1	9.0	8.8	-	9.4		11.2	11.3	10.8	10.8	-	11.5		12.0	11.2	10.0	10.4	-	15.0		10.2	11.7	9.0	10.3	-	12.5	
BF Mean Depth (ft)	0.68	0.71	0.65	0.62	-	0.7		1.41	1.37	1.35	1.45	-	1.4		0.68	0.65	0.61	0.61	-	0.5		0.81	0.70	0.69	0.70	-	0.80	
Width/Depth Ratio	15.2	14.2	14.0	14.1	-	13.4		8.0	8.3	8.0	7.4	-	8.0		17.8	17.3	16.6	17.0	-	29.2		12.5	16.7	13.1	14.7	-	16.3	
BF Cross-sectional Area (ft^2)	7.1	7.2	5.8	5.4	-	6.7		15.8	15.4	14.5	15.7	-	16.4		8.1	7.2	6.1	6.4	-	7.8		8.3	8.1	6.2	7.2	-	9.5	
BF Max Depth (ft)	1.19	1.33	1.04	1.07	-	1.30		2.79	2.66	2.39	2.50	-	2.70		1.16	1.16	1.08	1.08	-	1.20		1.33	1.44	1.10	1.28	-	1.60	
Width of Floodprone Area (ft)	85.1	85.0	85.1	85.1	-	85.1		103.7	103.7	103.7	103.6	-	103.6		76.0	76.5	76.0	76.2	-	76.3		32.2	34.3	30.1	33.2	-	37.5	
Entrenchment Ratio	8.2	8.5	9.4	9.7	-	9.0		-	-	-	-	-	-		6.3	6.9	7.6	7.3	-	5.1		3.2	2.9	3.3	7.3	-	3.0	
Bank Height Ratio	1.0	1.0	1.0	1.1	-	1.0		-	-	-	-	-	-		1.0	1.0	1.0	1.1	-	1.0		1.0	0.9	1.0	1.1	-	1.1	
Wetted Perimeter (ft)	11.8	11.5	10.3	10.0	-	9.8		14.1	14.0	13.5	13.7	-	13.5		13.4	12.5	11.3	11.7	-	15.4		11.8	13.1	10.4	11.7	-	13.9	
Hydraulic Radius (ft)	0.6	0.6	0.6	0.5	-	0.7		1.1	1.1	1.1	1.1	-	1.2		0.6	0.6	0.5	0.5	-	0.5		0.7	0.6	0.6	0.6	-	0.7	
Based on current/developing bankfull feature																												
BF Width (ft)																												
BF Mean Depth (ft)																												
Width/Depth Ratio																												
BF Cross-sectional Area (ft^2)																												
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 (ft^2)																												
d50 (mm)																												

Note: Per DMS/IRT request, the bank height ratio for MY5 has been calculated using the as-built bankfull area. All other values were calculated using the as-built bankfull elevation, as was done for previous monitoring reports.

Appendix E

Hydrologic Data

Table 12. Verification of Bankfull Events
UT to Cane Creek Restoration Project: DMS Project ID No. 95729

Date of Data Collection	Crest Gauge 1 (Reach 5)	Crest Gauge 2 (Reach 3)	Estimated Occurrence of Bankfull Event	Method of Data Collection
Year 1 Monitoring				
10/1/2014	NA	0.18	7/16/2014	Crest Gauge
Year 2 Monitoring				
3/25/2015	0.33	NA	3/6/2015	Crest Gauge
10/13/2015	0.62	0.79	10/3/2015	Crest Gauge
Year 3 Monitoring				
7/27/2016	1.21	NA	2/17/2016	Crest Gauge
9/30/2016	1.31	1.12	9/19/2016	Crest Gauge
11/9/2016	0.75	0.66	10/9/2016	Crest Gauge
Year 4 Monitoring				
5/3/2017	0.76	0.46	4/24/2017	Crest Gauge
Year 5 Monitoring				
9/24/2018	1.22	1.08	9/17/2018*	Crest Gauge

* The overbank events recorded here were the result from the heavy rainfall associated with Hurricane Florence.

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