

**UT to Crooked Creek
Stream Restoration Monitoring Report
EEP Project # 434
Monitoring Year 05**



Submitted to:



NCEEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

**Data Collection: 2011
Construction Completed: July 2006
Submitted: December 2011**

Monitoring Firm



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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Unnamed Tributary to Crooked Creek (UTCC) in Franklin County, NC was identified as a restoration design project in 2004. The 0.52-mi² project watershed is located within the USGS 8-digit HUC 03020101 and the NCDWQ Sub-basin 03-03-01 of the Tar-Pamlico Basin. The project restored and preserved streams, restored riparian buffer, and created and preserved wetlands. The project goals and objectives are listed below.

- Restore the degraded channel to a stable, functioning channel by using Natural Channel Design principles.
- Enhance the ability of aquatic fauna and flora to survive and flourish by replacing the existing degraded stream habitat with a stable stream channel and riparian buffer that is more conducive to propagation.
- Restore a healthy, vegetated riparian community to the currently denuded, fallow floodplain and adjacent hill slopes.
- Enhance existing wetlands by planting supplementary vegetation.
- Preserve in perpetuity, through a conservation easement, lands surrounding the UTCC that will soon be impacted by residential development.

The previously unvegetated portion of the conservation easement, including the buffer restoration and wetland creation areas, was planted with an appropriate mix of bare root and live stake species. Three vegetative plots were established during the baseline monitoring to determine the vegetative success of the site. Four additional plots were established in the fourth year of monitoring so that the site met the recommended number of plots based on the EEP-CVS monitoring protocol. The fifth-year monitoring of these plots revealed an average density of 353 total planted stems/acre (excluding live stakes) and minimal coverage by invasive vegetation. Due to the age of this site, this site has been grandfathered in and is allowed to count buffer restoration credit up to 200 feet away from the stream, which means that all of the plots must meet a success criterion of 320 stems/acre. Vegetation Plots 1, 2, and 3 are not meeting this criterion. However, these three plots have extensive volunteer populations and densities over 680 total stems/acre, when including volunteers. Across the site there is good vegetative coverage. There are plentiful volunteers, with some dense stands of young loblolly pine (*Pinus taeda*). Many parts of the stream have vegetation growing in the channel, including some pools with cattails (*Typha latifolia*). The vegetation growing in the channel obscures the thalweg location in places, but overall is not adversely affecting the project. Some areas with low planted stem densities have been noted in this report. These areas are most frequently found on the excavated floodplain, where the soil quality is generally low. This site will receive supplemental planting in the winter of 2011/2012 and areas of fescue in the upland portions of the buffer will be controlled with herbicide.

The stream monitoring at the site involves surveying eight permanent cross-sections and a longitudinal profile along the entire length of UTCC. The stream assessment completed during the fifth year of monitoring found the stream to be functioning and holding grade. The site does not have any bank erosion problems or widespread bed incision or aggradation. Throughout the monitoring history of this project there have been a series of beaver dams on the project channel. These dams have been removed or breached, but continue to be rebuilt. During the site evaluation there was an active beaver dam at the site that was creating backwater conditions. Most of the dams that have been breached or removed in the past, collected fine sediment behind them, which caused small areas of bed aggradation. These remnant beaver dams still create small areas of backwater in the channel, which have been mapped on the Current Condition Plan View (CCPV). Another beaver dam is located below the restored channel, and it is causing backwater conditions in the downstream portion of the lower reach. The EEP is planning to conduct maintenance to remove active and relic beaver dams at the site.

Another finding from the stream monitoring is some inconsistency in bed morphology. This is typical for the stream type and setting of UT Crooked Creek, and is not an indicator of instability. The lack of a well-defined riffle-pool system can be attributed to a couple of different factors at the site. The vegetation in the channel, which is typical for low gradient systems, can trap sediment and organic matter that can alter the bed morphology. Even though the riffle-pool sequence is not being maintained at the intended rate, the in-stream cross vanes have maintained deep water habitat and large rain events move the sediment through the stream, helping create heterogeneity in the channel bed. All of these factors create a well-functioning channel that is stable and provides significant habitat.

Summary information and data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on the EEPs website. All raw data supporting the tables and figures in the appendices are available upon request.

2.0 METHODOLOGY

The Level 2 CVS-EEP protocol (<http://cvs.bio.unc.edu/methods.htm>) was used to collect vegetation data from UT to Crooked Creek this year, the fifth year of monitoring.

The profile was stationed by thalweg length and then adjusted to match grade control structures between monitoring years.

3.0 REFERENCES

Lee, M. T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (<http://cvs.bio.unc.edu/methods.htm>)

Weakley, A. S. 2006. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas. (http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2006-Jan.pdf)

Appendix A

Project Vicinity Map and Background Tables

DIRECTIONS TO UT CROOKED SITE:
From Raleigh, take US 64 East. Take the exit for NC 98 and travel west. After driving through the Town of Bunn make a right onto Pearces Road. Then take the first driveway on the left to get to the project site.

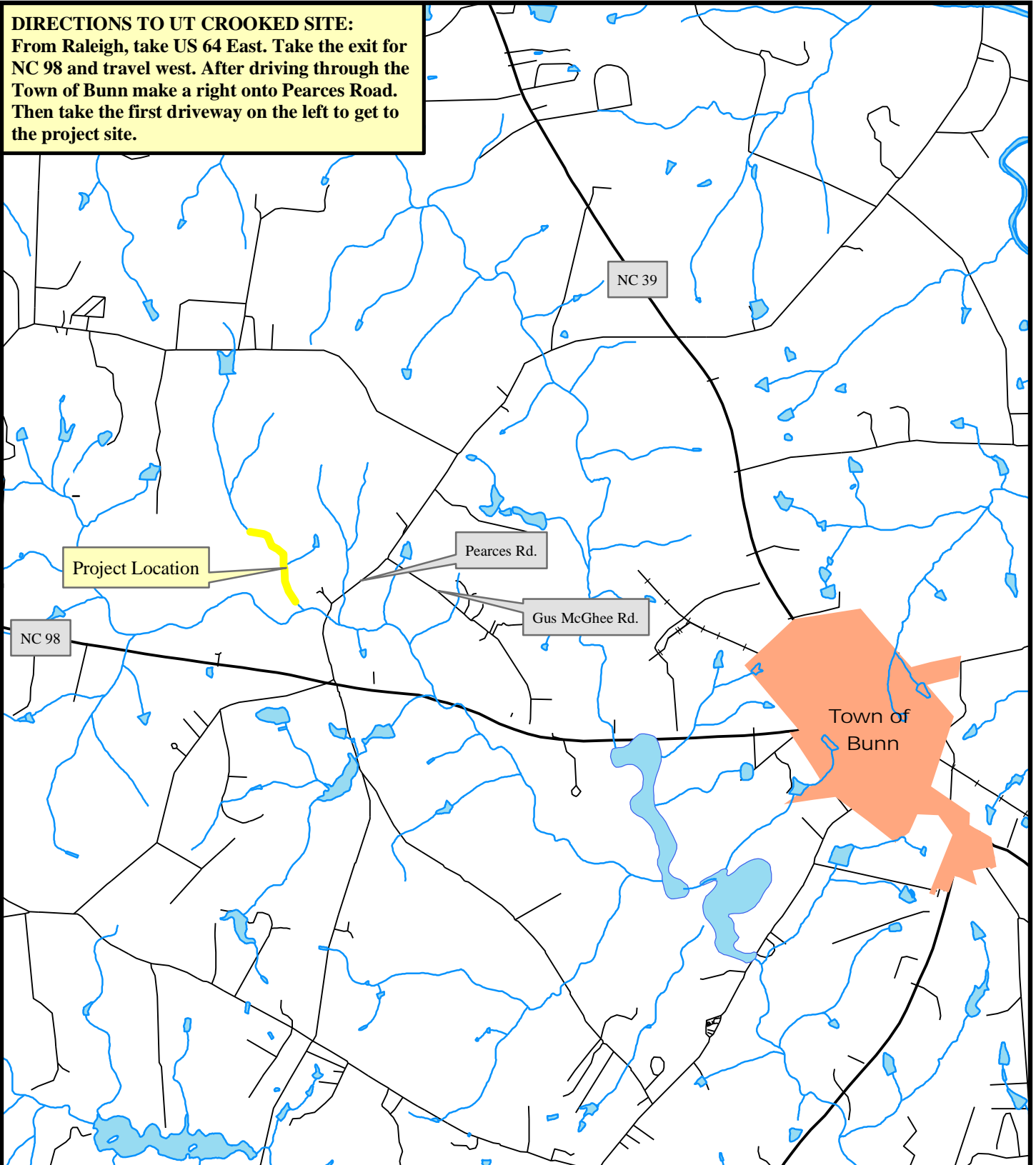
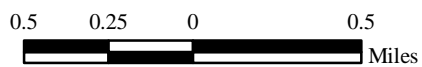
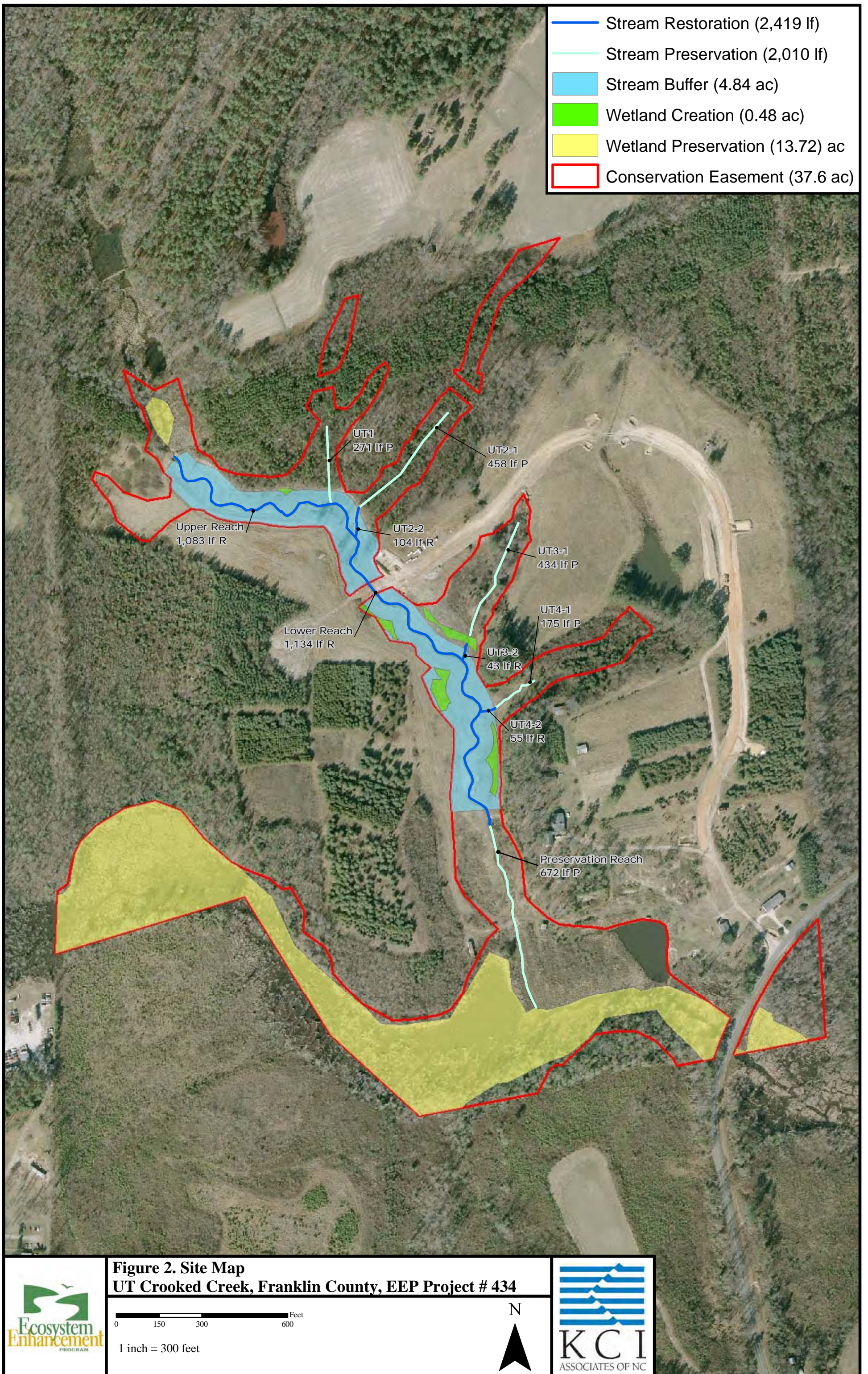


Figure 1. Site Vicinity Map
UT Crooked Creek, Franklin County, EEP Project # 434





- Stream Restoration (2,419 lf)
- Stream Preservation (2,010 lf)
- Stream Buffer (4.84 ac)
- Wetland Creation (0.48 ac)
- Wetland Preservation (13.72) ac
- Conservation Easement (37.6 ac)

Figure 2. Site Map
UT Crooked Creek, Franklin County, EEP Project # 434



0 150 300 600 Feet
 1 inch = 300 feet



Table 1a. Project Restoration Components

Project Number and Name: 434 - UT to Crooked Creek

Project Component	Existing Linear Feet / Acreage	Restoration Level	Approach	Linear Feet / Acreage*	Stationing	Mitigation Ratio	Mitigation Units	BMP Elements	Comment
Upper Reach	1,920 lf	R	P1/2	1,083 lf	10+00 - 21+34	1:1	1,083		Restored pattern, profile, and dimension
Lower Reach		R	P1/2	1,134 lf	21+34 - 32+67	1:1	1,134		Restored pattern, profile, and dimension
Preservation Reach	672 lf	P	-	672 lf	-	5:1	134		In conservation easement
UT1	271 lf	P	-	271 lf	-	5:1	54		In conservation easement
UT2-1	458 lf	P	-	458 lf	-	5:1	92		In conservation easement
UT2-2	U	R	P2	104 lf	-	1:1	104		Restored pattern, profile, and dimension
UT3-1	434 lf	P	-	434 lf	-	5:1	87		In conservation easement
UT3-2	U	R	P2	43 lf	-	1:1	43		Restored pattern, profile, and dimension
UT4-1	175 lf	P	-	175 lf	-	5:1	35		In conservation easement
UT4-2	U	R	P2	55 lf	-	1:1	55		Restored pattern, profile, and dimension
Buffer	4.84 ac	R	-	4.84 ac	-	1:1	4.84		Planted
Riparian Wetland	0.48 ac	C	-	0.48 ac	-	3:1	0.16		Graded to new floodplain elevation and planted
Riparian Wetland	13.72 ac	P	-	13.72 ac	-	5:1	2.74		In conservation easement

U - Unknown R - Restoration P - Preservation C - Creation P1 - Priority 1 P2 - Priority 2

* A 50' easement exception is not included in these values.

Table 1b. Project Component Summations

Project Number and Name: 434 - UT to Crooked Creek

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	2,419					4.84	
Enhancement							
Enhancement I							
Enhancement II							
Creation		0.48					
Preservation	2,010	13.72					
HQ Preservation							
		14.2	0				
Totals (Feet/Acres)	4,429	14.2		0	0	4.84	
MU Totals	2,821	2.9		0	0	4.84	

Table 2. Project Activity and Reporting History		
Project Number and Name: 434 - UT to Crooked Creek		
Elapsed Time Since Grading Complete: 5 years 5 months		
Elapsed Time Since Planting Complete: 5 years		
Number of Reporting Years: 5		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan		Apr 05
Final Design - 90%		Jun 05
Construction		Jul 06
Planting		Winter 06/07
Mitigation Plan		Feb 07
Year 1 Monitoring	Dec 07	Dec 07
Year 2 Monitoring	Oct 08	Jan 09
Year 3 Monitoring	Nov 09	Dec 09
Year 4 Monitoring	Sep 10	Dec 10
Year 5 Monitoring	Aug 11	Dec 11

Table 3. Project Contacts Table		
Project Number and Name: 434 - UT to Crooked Creek		
Design Firm	Ko & Associates, P. C. 5121 Kingdom Way, Suite 100 Raleigh, NC 27607 Contact: R. Kevin Williams, PE Phone: (919) 851-6066 Fax: (919) 851-6846	
Construction Contractor	Land Mechanics Designs 126 Circle G Lane Willow Springs, NC 27592 Contact: Mr. Lloyd Glover Phone: (919) 639-6132	
Vegetation Design Firm (2004 Vegetation and Stream Maintenance Plan)	HARP 9305-D Monroe Rd. Charlotte, NC 28270 Contact: Mr. Alan Peoples Phone: (704) 841-2841 Fax: (704) 841-2447	
Nursery Stock Suppliers	Goldsboro Forestry Service 762 Claridge Nursery Rd Goldsboro, NC 27530 Phone: (919) 731-7988	
MY-01	Stream	Ko & Associates, P. C. 5121 Kingdom Way, Suite 100 Raleigh, NC 27607 Contact: R. Kevin Williams, PE Phone: (919) 851-6066 Fax: (919) 851-6846
	Vegetation	Environmental Services, Inc. 524 S. New Hope Road Raleigh, North Carolina 27610 Todd Milam Phone: (919) 212-1760
MY-02 - MY-05		KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute Table			
Project Number and Name: 434 - UT to Crooked Creek			
Project County	Franklin County		
Physiographic Region	Piedmont		
Ecoregion	Northern Outer Piedmont		
Project River Basin	Tar-Pamlico		
USGS HUC for Project (8 digit)	03020101		
NCDWQ Sub-basin for Project	03-03-01		
Within extent of EEP Watershed Plan?	U		
WRC Class (Warm, Cool, Cold)	Warm		
% of project easement demarcated	U		
Beaver activity observed during design phase?	Yes		
Restoration Component Attribute Table			
Drainage Area	0.52 sq.mi.		
Stream Order	Second		
Restored length (feet)	2,219		
Perennial or Intermittent	Perennial		
Watershed Type (Rural, Urban, Developing, etc.)	Rural		
Watershed LULC Distribution			
Urban	-		
Ag-Row Crop	-		
Ag-Livestock	-		
Forested	-		
Water/Wetlands	-		
Watershed impervious cover (%)	-		
NCDWQ AU/Index Number	-		
NCDWQ Classification	C, NSW		
303d listed?	No		
Upstream of a 303d listed segment?	No		
Reasons for 303d Listing or Stressor	N/A		
Total acreage of easement	37.6 Acres		
Total vegetated acreage within the easement	37.6 Acres		
Total planted acreage as part of the restoration	7.5 Acres		
Rosgen Classification of pre-existing	F5		
Rosgen Classification of As-built	C5		
Valley Type	U		
Valley Slope	U		
Valley side slope range (e.g. 2-3%)	U		
Valley toe slope range (e.g. 2-3%)	U		
Trout waters designation	No		
Species of concern, endangered etc.? (Y/N)	No		
Dominant soil series and characteristics			
Series	Chewacla and Wehadkee		
Depth Clay%	-	-	-
K	-	-	-
T	-	-	-

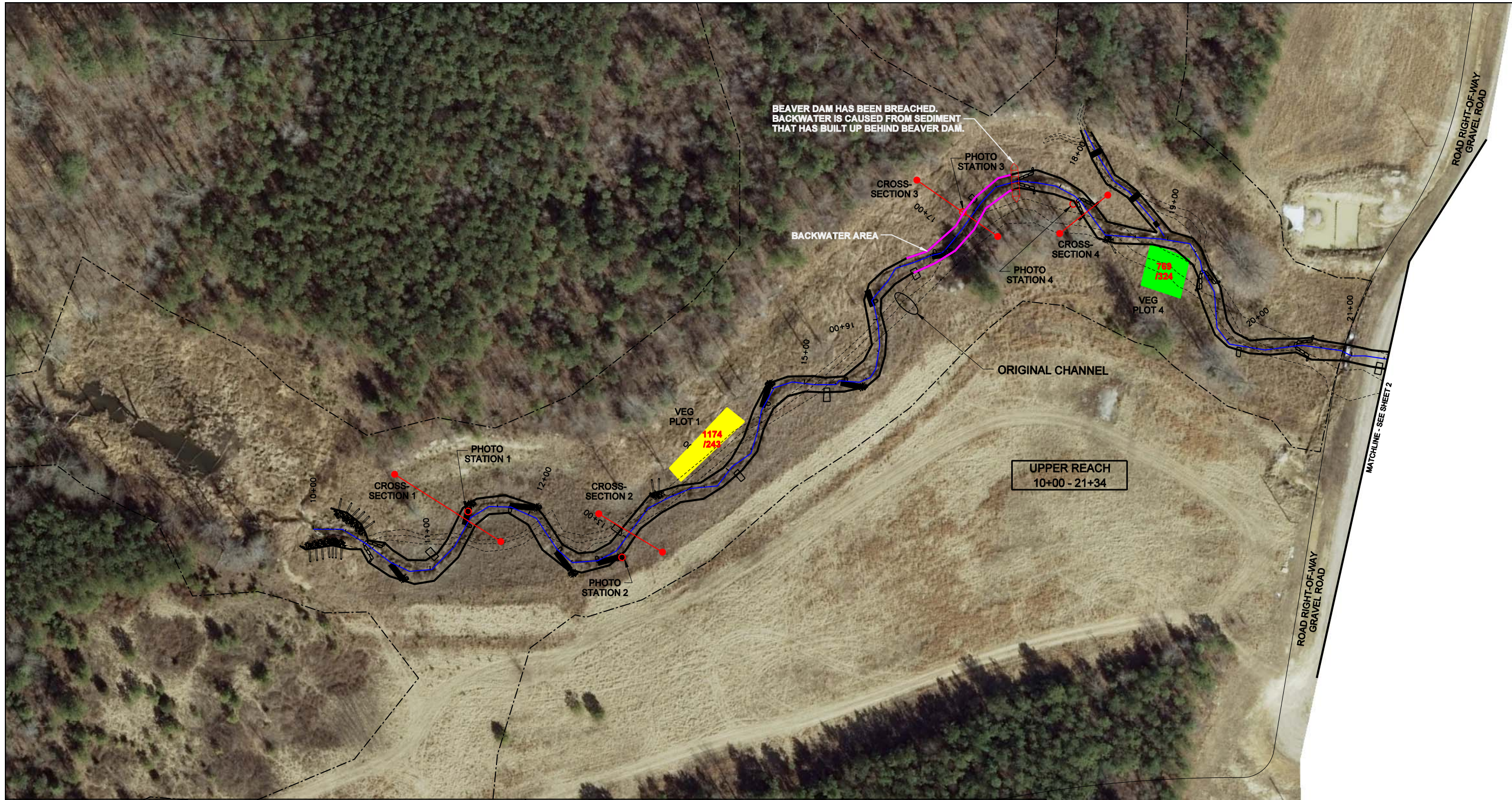
"N/A" is for items that do not apply.

"-" is for items that are unavailable.

"U" is for items that are unknown.

Appendix B

Visual Assessment Data



REV	DATE	DESCRIPTION	APPROVED



KCI
 ASSOC. OF NC
 ENGINEERS • PLANNERS • SCIENTISTS
 4801 SIX FORKS ROAD
 RALEIGH, NORTH CAROLINA 27609

UT CROOKED CREEK
 FRANKLIN COUNTY, NORTH CAROLINA
 EEP PROJECT NUMBER 434 - MY05
 STATION 10+00 TO STATION 21+28

DATE: NOV 2011
 SCALE: 1"=80'
 CURRENT
 CONDITION
 PLAN VIEW
 SHEET 1 OF 2

LEGEND

- EASEMENT BOUNDARY
- AS-BUILT STATIONED CENTERLINE AND TOP OF BANK
- PHOTO POINT
- CROSS-SECTION
- BEAVER DAM
- ROCK CROSS VANE
- LOG VANE
- ROOTWAD
- ROOTBALL
- RIP-RAP

PROJECT CONDITION

- STREAM BED DEGRADATION
- BANK EROSION
- UNDERCUT BANK
- MASS WASTING OF BANK
- BACKWATER AREA FROM BEAVER DAM
- VEG PLOT ABOVE 288 TOTAL PLANTED STEMS/ACRE
- VEG PLOT BELOW 288 TOTAL PLANTED STEMS/ACRE
- LOW PLANTED STEM DENSITY
- VEG PLOT TOTAL / PLANTED STEM DENSITY



890/423

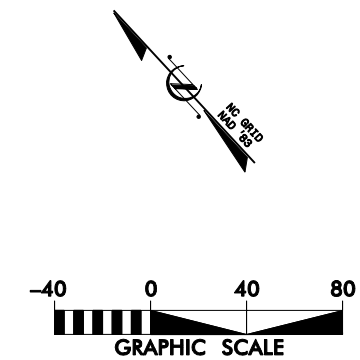


IMAGE SOURCE: NC 2010 ORTHOIMAGERY

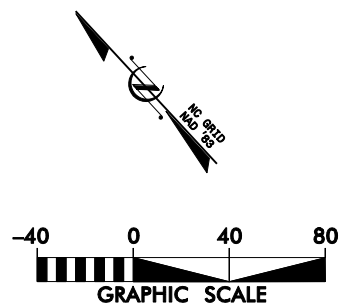
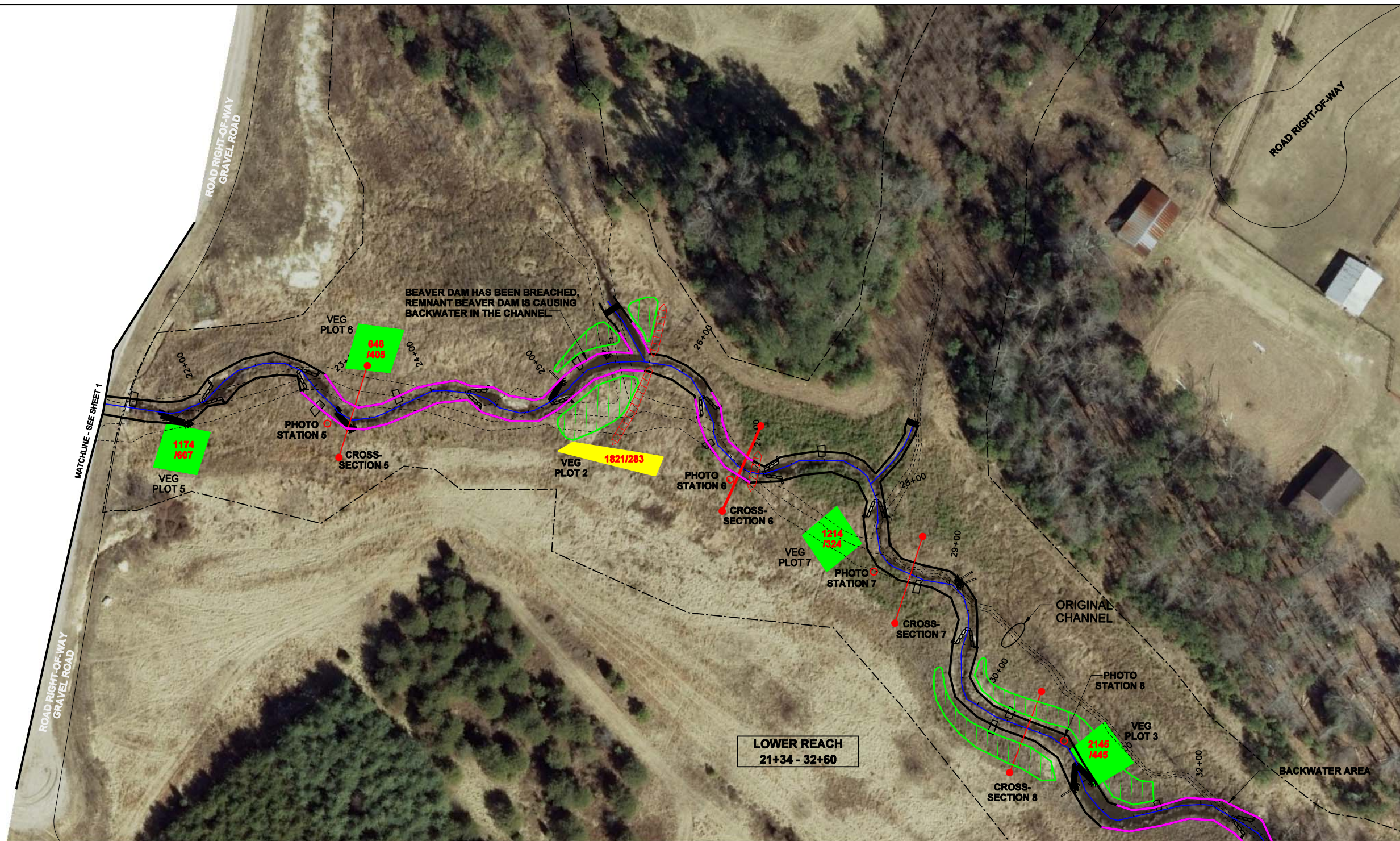


IMAGE SOURCE: NC 2010 ORTHOIMAGERY



LEGEND

- EASEMENT BOUNDARY
- AS-BUILT STATIONED CENTERLINE AND TOP OF BANK
- PHOTO POINT
- CROSS-SECTION
- BEAVER DAM
- ROCK CROSS VANE
- LOG VANE
- ROOTWAD
- ROOTBALL
- RIP-RAP

PROJECT CONDITION

- STREAM BED DEGRADATION
- BANK EROSION
- UNDERCUT BANK
- MASS WASTING OF BANK
- BACKWATER AREA FROM BEAVER DAM
- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT ABOVE 288 TOTAL PLANTED STEMS/ACRE
- VEG PLOT BELOW 288 TOTAL PLANTED STEMS/ACRE
- VEG PLOT TOTAL / PLANTED STEM DENSITY

890/423

REV	DATE	DESCRIPTION	APPROVED



KCI
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4801 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

UT CROOKED CREEK
FRANKLIN COUNTY, NORTH CAROLINA
EEP PROJECT NUMBER 434 - MY05
STATION 21+28 TO STATION 32+64

DATE: NOV 2011
SCALE: 1"=80'
CURRENT CONDITION PLAN VIEW
SHEET 2 OF 2

Table 5. Visual Stream Morphology Stability Assessment												
Project Number and Name: 434 - UT to Crooked Creek												
Project linear footage ** 2,219												
Major Channel Category	Channel Sub-Category	Metric	Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Stabilizing Woody Vegetation	Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation		
1. Bed [#]	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%					
		2. <u>Degradation</u> - Evidence of downcutting					100%					
	2. Riffle Condition*	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	18	30		60%						
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	22	32		69%						
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	22	32		69%						
	4. Thalweg Position ⁺	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A		N/A						
2. Thalweg centering at downstream of meander (Glide)		N/A	N/A	N/A								
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. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.					0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse					0	0	100%	0	0	100%
Totals					0	0	100%	0	0	100%		
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	26	26			100%					
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	26	26			100%					
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	26	26			100%					
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	26	26			100%					
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	26	26			100%					

*Since all of the riffles are sand riffles and mostly covered with vegetation, this metric identifies all of the stable riffles that were identified during the longitudinal profile survey. Due to the channel being dry during the survey, most of these riffles were indistinct. The total number of as-built riffles has been estimated from the as-built profile and planview sheets.

⁺The exact position of the thalweg in relation to the pattern is not a factor in channel stability for this stream. All of the banks are well vegetated and stable. This is a low flow, sand bed stream with a variable thalweg.

**This evaluation only includes the length of the mainstem and not the portions of restoration on the small tributaries.

[#]These metrics are variable in this stream. Because this is a sand bed channel, the pools and riffles have shifted and moved throughout the monitoring period. The vegetation in the channel further obscures these bed features. The changing number of stable bed features throughout the monitoring period is typical for a stable low flow, sand bed channel such as this.

Table 6. Vegetation Condition Assessment						
Project Number and Name: 434 - UT to Crooked Creek						
Planted Acreage - 7.5						
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	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 acres	Pattern and Color	5	0.15	2.0%
Total				5	0.15	2.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
Cumulative Total				5	0.15	2.0%
Easement Acreage - 37.6						
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Stream Station Photos



PS-1 Looking Downstream – 12/3/07 - MY 01



PS-1 Looking Downstream – 11/16/11 - MY 05



PS2 Looking Upstream– 12/3/07 - MY 01



PS-2 Looking Upstream– 11/16/11 - MY 05



PS-3 Looking Downstream – 12/3/07 - MY 01



PS-3 Looking Downstream – 11/16/11 - MY 05



PS-4 Looking Downstream – 12/3/07 - MY 01



PS-4 Looking Downstream – 11/16/11 - MY 05



PS-5 Looking Downstream – 12/3/07 - MY 01



PS-5 Looking Downstream – 11/16/11 - MY 05



PS-6 Looking Downstream – 12/3/07 - MY 01



PS-6 Looking Downstream – 11/16/11 - MY 05



PS-7 Looking Downstream – 12/3/07 - MY 01



PS-7 Looking Downstream – 11/16/11 - MY 05



PS-8 Looking Downstream – 12/3/07 - MY 01

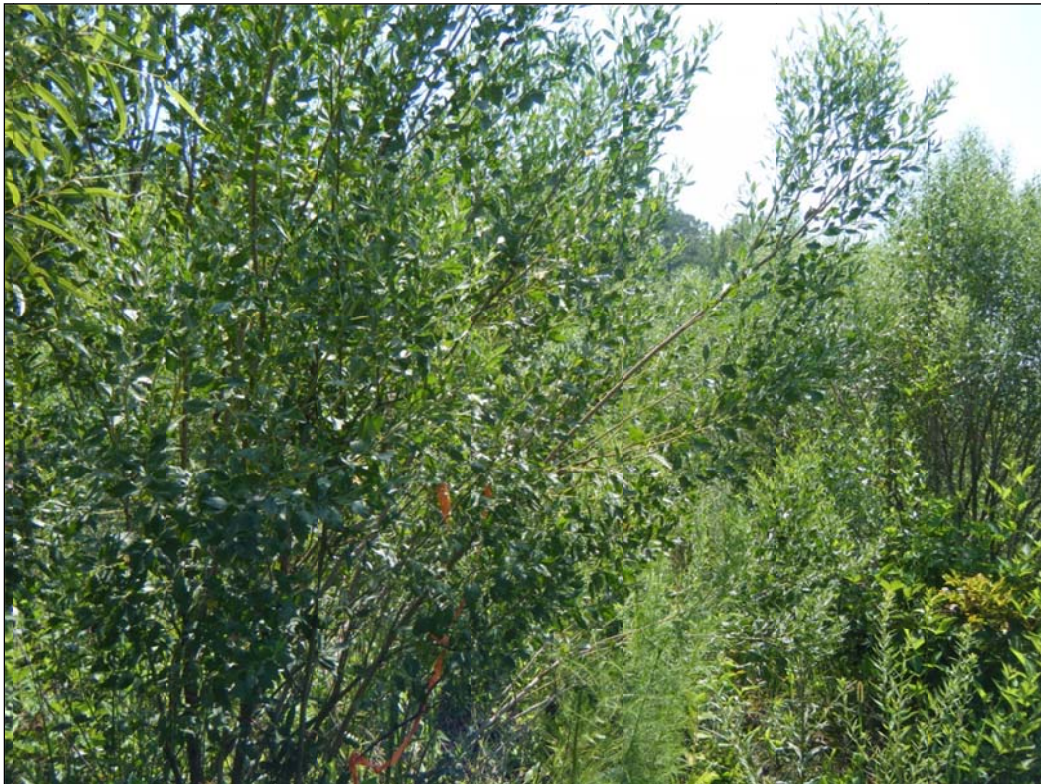


PS-8 Looking Downstream – 11/16/11 - MY 05

Vegetation Monitoring Plot Photos



Plot 1 Photo – 8/17/11 - MY 05



Plot 2 Photo – 8/17/11 - MY 05



Plot 3 Photo – 8/17/11 - MY 05



Plot 4 Photo – 8/17/11 - MY 05



Plot 5 Photo – 8/17/11 - MY 05



Plot 6 Photo – 8/17/11 - MY 05



Plot 7 Photo – 8/17/11 - MY 05

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment	
Project Number and Name: 434 - UT to Crooked Creek	
Vegetation Plot ID	Vegetation Survival Threshold Met? (320 Planted Stems/Acre)
1	No
2	No
3	No
4	Yes
5	Yes
6	Yes
7	Yes

Table 8. CVS Vegetation Plot Metadata	
Project Number and Name: 434 - UT to Crooked Creek	
Report Prepared By	April Helms
Date Prepared	12/5/2011 9:16
database name	KCI-2011-A.mdb
database location	M:\2007\12071067_2007 EEP OPEN END\Veg_database
computer name	12-CV76KF1
file size	59768832
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	434
Project Name	UT to Crooked Creek/Speas Property (G)
Description	stream mitigation site
River Basin	Tar-Pamlico
length(ft)	2267
stream-to-edge width (ft)	50
area (sq m)	10534.39
Required Plots (calculated)	7
Sampled Plots	7

Table 9. CVS Stem Count Total and Planted Stems by Plot and Species																																					
Project Number and Name: 434 - UT to Crooked Creek																																					
Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2011)																					Annual Means													
			E434-GT-0001			E434-GT-0002			E434-GT-0003			E434-AH-0004			E434-AH-0005			E434-AH-0006			E434-AH-0007			MY5 (2011)			MY4 (2010)			MY3 (2009)							
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T					
<i>Acer rubrum</i>	red maple	Tree			2																										2						
<i>Alnus serrulata</i>	hazel alder	Shrub Tree			2				1	1	2				4	4	4								5	5	8	6	6	6	2	2	2				
<i>Baccharis sp.</i>	baccharis	Shrub Tree			14						33						3			12			5			13			118			92					
<i>Betula nigra</i>	river birch	Tree	1	1	5								2	2	2							2	2	2	5	5	9	5	5	5	1	1	1				
<i>Cephalanthus occidentalis</i>	common buttonbush	Shrub Tree							2	5	5				1	1	1							3	6	6	3	6	6		3	3					
<i>Cornus amomum</i>	silky dogwood	Shrub							3	4	4					1								3	4	5	3	4	4	4	5	5					
<i>Fraxinus pennsylvanica</i>	green ash	Tree			1				1	1	1													1	1	2	1	1	1	1	1	1	1	1	1	1	1
<i>Liquidambar styraciflua</i>	sweetgum	Tree						1			3			3			1										11			5							
<i>Nyssa sylvatica</i>	blackgum	Tree	2	2	2																			2	2	2	2	2	2	3	3	3					
<i>Quercus sp.</i>	oak	Shrub Tree																			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
<i>Quercus alba</i>	white oak	Tree				1	1	1																1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Quercus michauxii</i>	swamp chestnut oak	Tree	3	3	3							2	2	3	4	4	4	6	6	6	2	2	2	17	17	18	16	16	16	3	3	3					
<i>Quercus nigra</i>	water oak	Tree										1	1	1	4	4	4	4	4	4	3	3	3	12	12	12	13	13	13								
<i>Quercus phellos</i>	willow oak	Tree				6	6	6				3	3	4	2	2	2							11	11	12	11	11	11	6	6	6					
<i>Quercus rubra</i>	northern red oak	Tree												3												3											
<i>Rhus copallinum</i>	flameleaf sumac	Shrub Tree																	1								7			4							
<i>Ulmus alata</i>	winged elm	Tree						4																		4											
Stem count			6	6	29	7	7	45	7	11	53	8	8	19	15	15	29	10	10	16	8	8	30	61	65	221	62	66	167	21	25	25					
size (ares)			1			1			1			1			1			1			1			7			7			3							
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.17			0.17			0.07							
Species count			3	3	7	2	2	5	4	4	6	4	4	7	5	5	8	2	2	4	4	4	7	11	11	17	11	11	14	8	9	9					
Stems per ACRE			243	243	1174	283	283	1821	283	445	2145	324	324	769	607	607	1174	405	405	647	324	324	1214	353	376	1278	358	382	965	283	337	337					

Appendix D

Stream Survey Data

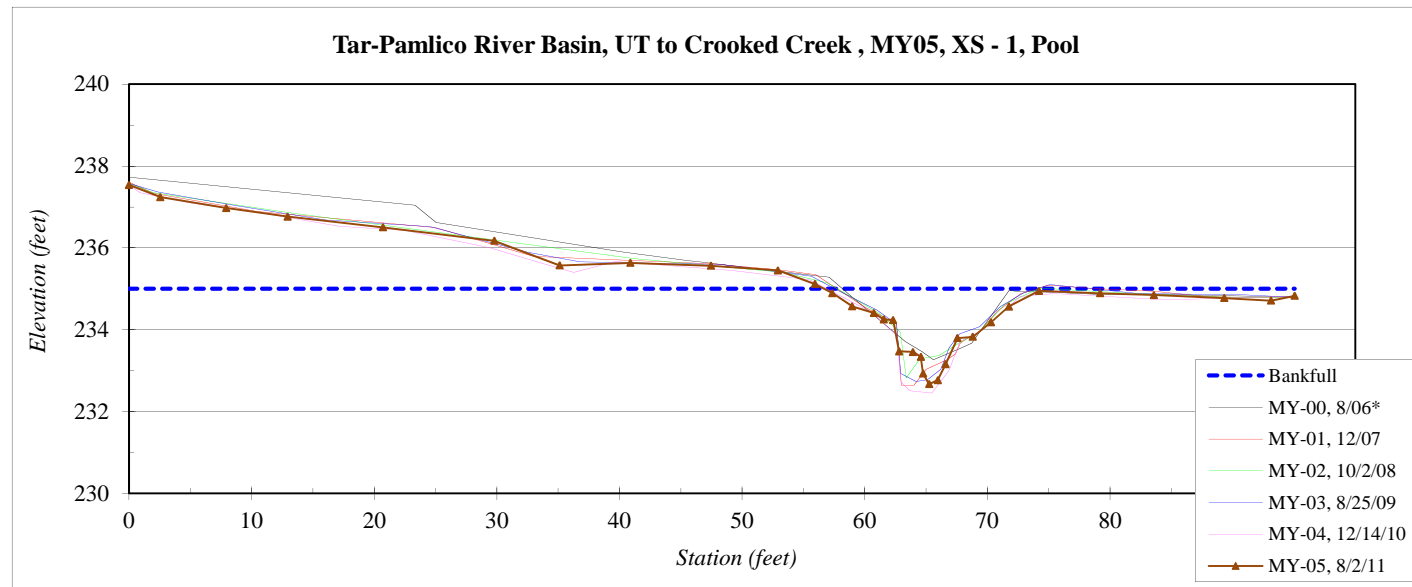
Cross-Section Plots

River Basin:	Tar-Pamlico
Watershed:	UT to Crooked Creek , MY05
XS ID	XS - 1, Pool
Drainage Area (sq mi):	0.52
Date:	8/2/2011
Field Crew:	A. French, J. Anders



Station	Elevation
0.0	237.54
2.5	237.24
7.9	236.98
12.9	236.77
20.7	236.50
29.8	236.17
35.1	235.57
40.9	235.64
47.5	235.56
52.9	235.45
55.9	235.12
57.4	234.90
59.0	234.57
60.7	234.41
61.5	234.25
62.3	234.24
62.8	233.47
63.9	233.46
64.6	233.33
64.8	232.93
65.3	232.67
66.0	232.77
66.6	233.16
67.6	233.80
68.8	233.83
70.3	234.18
71.7	234.57
74.2	234.95
79.2	234.89
83.6	234.85
89.3	234.77
93.1	234.71
95.1	234.83

SUMMARY DATA	
Bankfull Elevation:	235.0
Bankfull Cross-Sectional Area:	16.1
Bankfull Width:	17.5
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	0.9
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



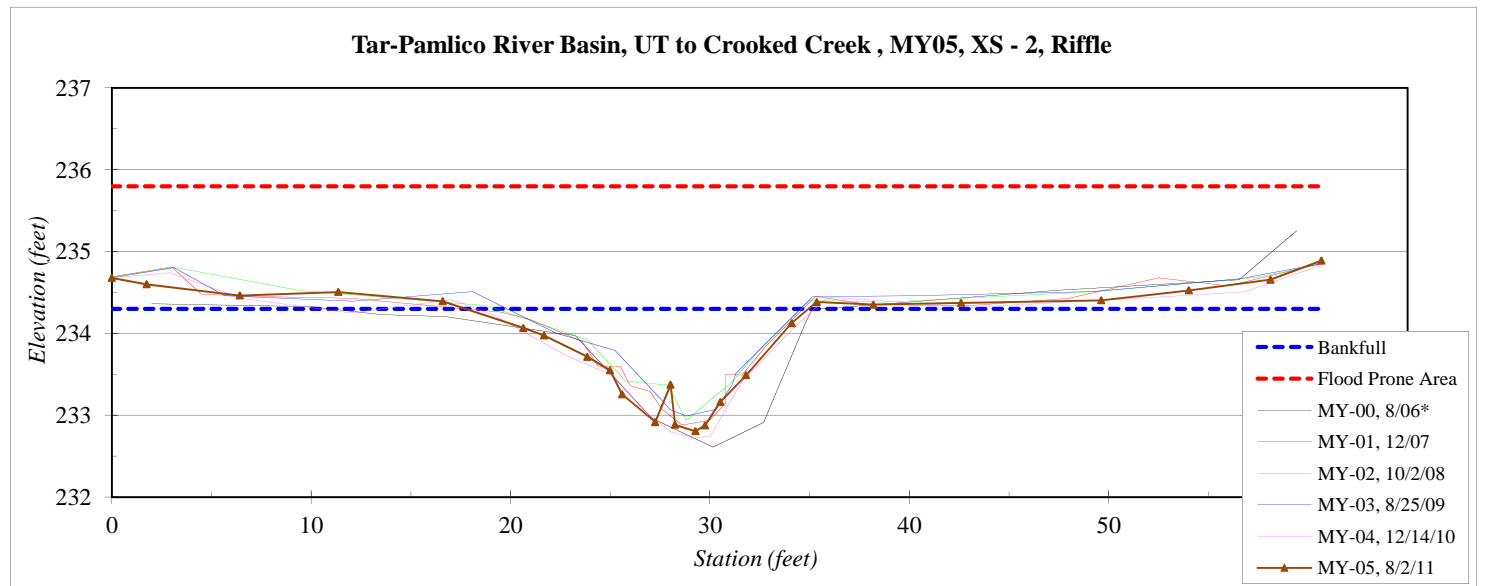
*MY-00 cross-section plots shifted as needed due to likely stationing issue during baseline monitoring.

River Basin:	Tar-Pamlico
Watershed:	UT to Crooked Creek , MY05
XS ID	XS - 2, Riffle
Drainage Area (sq mi):	0.52
Date:	8/2/2011
Field Crew:	A. French, J. Anders



Station	Elevation
0.0	234.68
1.8	234.60
6.4	234.46
11.4	234.51
16.6	234.39
20.6	234.07
21.7	233.97
23.9	233.71
25.0	233.55
25.6	233.26
27.3	232.92
28.0	233.37
28.3	232.88
29.3	232.80
29.8	232.88
30.5	233.16
31.8	233.49
34.1	234.12
35.4	234.38
38.2	234.35
42.6	234.37
49.6	234.40
54.0	234.52
58.1	234.66
60.7	234.89

SUMMARY DATA	
Bankfull Elevation:	234.3
Bankfull Cross-Sectional Area:	11.7
Bankfull Width:	17.2
Flood Prone Area Elevation:	235.8
Flood Prone Width:	>60
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.7
W / D Ratio:	25.3
Entrenchment Ratio:	3.5
Bank Height Ratio:	1.0



*MY-00 cross-section plots shifted as needed due to likely stationing issue during baseline monitoring.

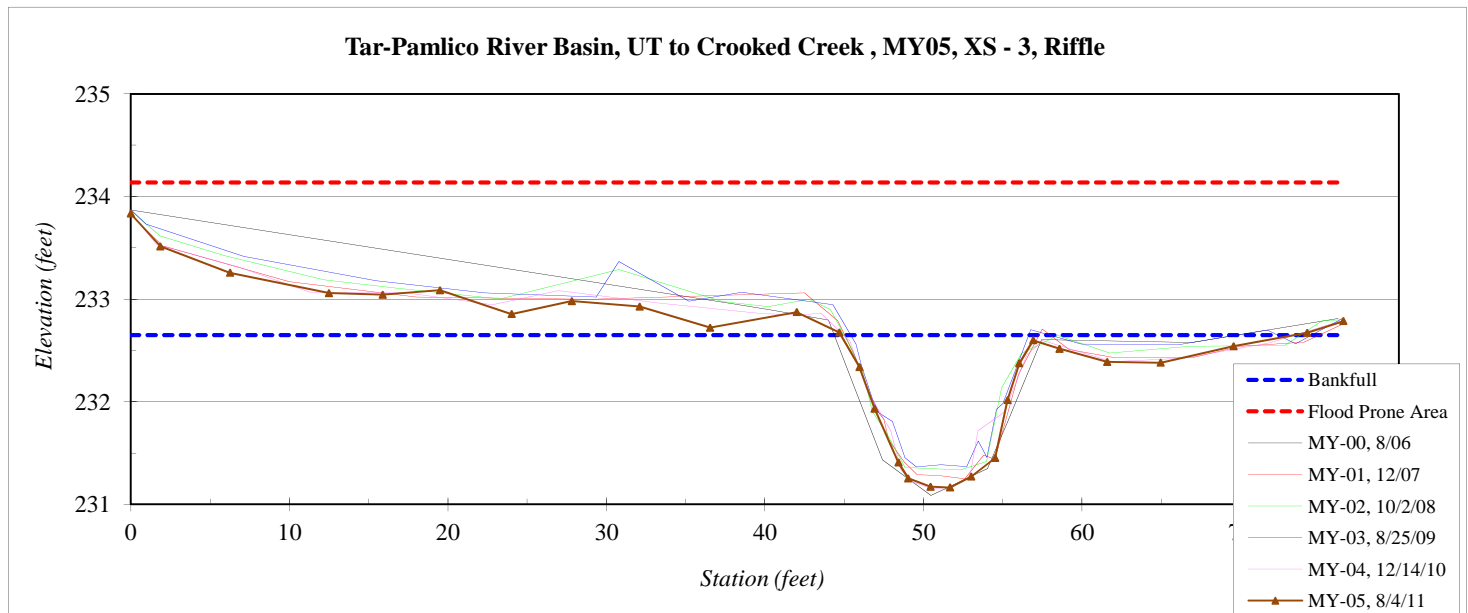
River Basin:	Tar-Pamlico
Watershed:	UT to Crooked Creek , MY05
XS ID	XS - 3, Riffle
Drainage Area (sq mi):	0.52
Date:	8/4/2011
Field Crew:	A. French, J. Anders



Station	Elevation
0.0	233.83
1.9	233.51
6.3	233.26
12.5	233.06
15.9	233.04
19.5	233.09
24.0	232.85
27.8	232.98
32.1	232.93
36.5	232.72
42.0	232.87
44.7	232.68
46.0	232.34
46.9	231.93
48.4	231.41
49.0	231.25
50.4	231.17
51.7	231.16
53.0	231.27
54.5	231.45
55.3	232.02
56.0	232.37
56.9	232.60
58.6	232.52
61.6	232.39
65.0	232.38
69.6	232.54
74.2	232.67
76.5	232.79

SUMMARY DATA	
Bankfull Elevation:	232.7
Bankfull Cross-Sectional Area:	11.9
Bankfull Width:	12.1
Flood Prone Area Elevation:	234.1
Flood Prone Width:	>75
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.0
W / D Ratio:	12.3
Entrenchment Ratio:	6.2
Bank Height Ratio:	1.0

Tar-Pamlico River Basin, UT to Crooked Creek , MY05, XS - 3, Riffle

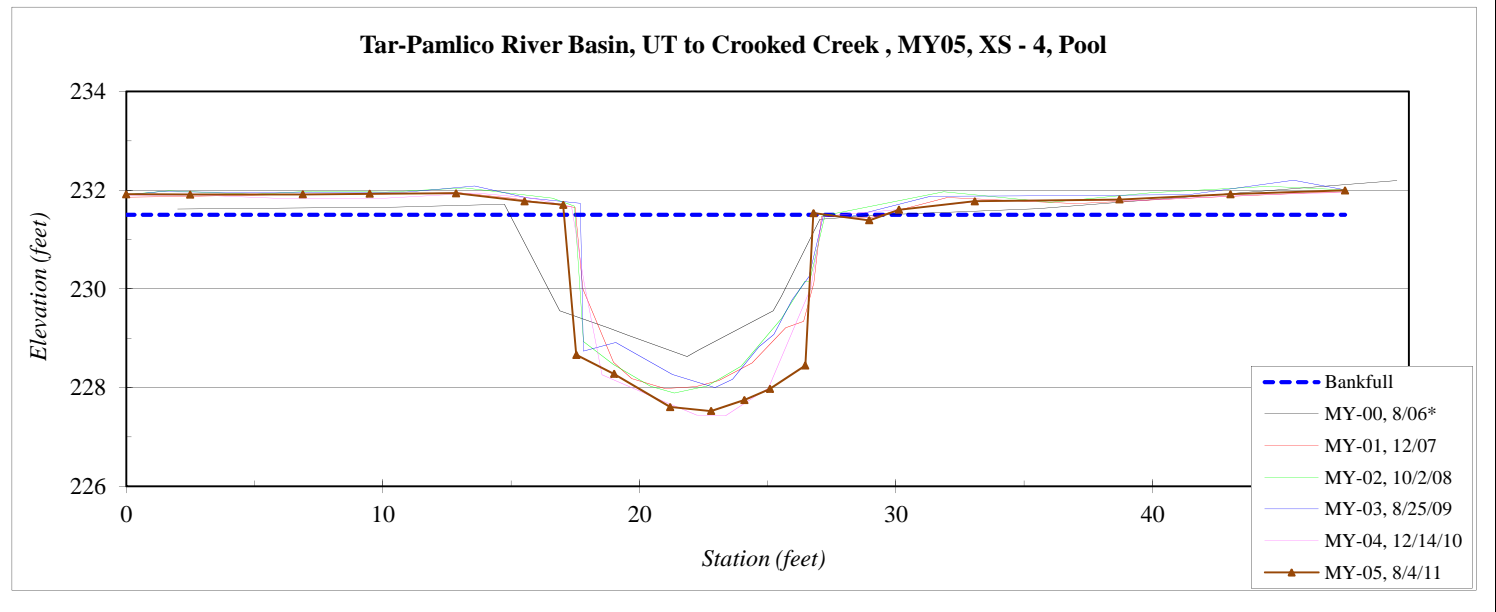


River Basin:	Tar-Pamlico
Watershed:	UT to Crooked Creek , MY05
XS ID	XS - 4, Pool
Drainage Area (sq mi):	0.52
Date:	8/4/2011
Field Crew:	A. French, J. Anders



Station	Elevation
0.0	231.92
2.5	231.91
6.9	231.92
9.5	231.93
12.9	231.94
15.5	231.77
17.0	231.70
17.5	228.66
19.0	228.27
21.2	227.60
22.8	227.52
24.1	227.75
25.1	227.97
26.5	228.44
26.8	231.53
29.0	231.39
30.1	231.60
33.1	231.78
38.7	231.81
43.0	231.92
47.5	231.99

SUMMARY DATA	
Bankfull Elevation:	231.5
Bankfull Cross-Sectional Area:	32.9
Bankfull Width:	9.7
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	4.0
Mean Depth at Bankfull:	3.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



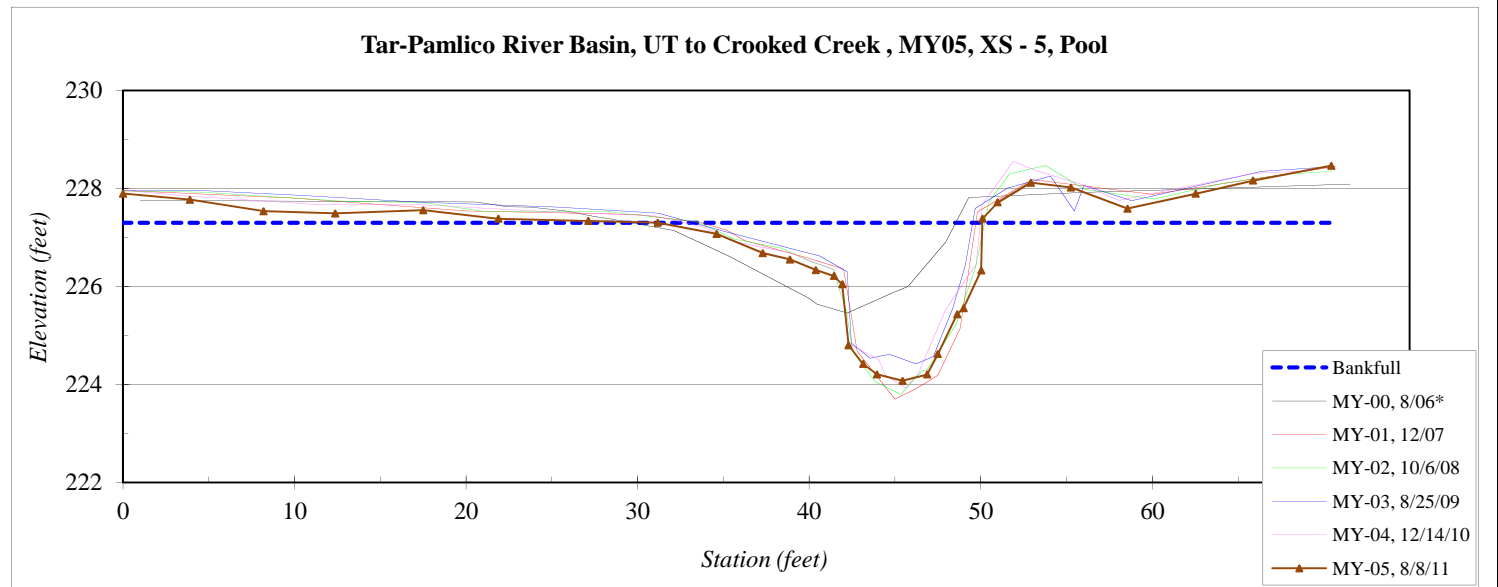
*MY-00 cross-section plots shifted as needed due to likely stationing issue during baseline monitoring.

River Basin:	Tar-Pamlico
Watershed:	UT to Crooked Creek , MY05
XS ID	XS - 5, Pool
Drainage Area (sq mi):	0.52
Date:	8/8/2011
Field Crew:	A. French, J. Anders



Station	Elevation
0.0	227.89
3.9	227.77
8.2	227.54
12.4	227.49
17.5	227.56
21.9	227.38
27.1	227.34
31.2	227.30
34.6	227.07
37.3	226.68
38.9	226.55
40.4	226.33
41.4	226.21
41.9	226.04
42.3	224.80
43.1	224.41
44.0	224.20
45.4	224.07
46.9	224.20
47.5	224.62
48.6	225.43
49.0	225.56
50.0	226.32
50.1	227.38
51.0	227.71
52.9	228.12
55.3	228.02
58.5	227.59
62.5	227.89
65.9	228.16
70.4	228.46

SUMMARY DATA	
Bankfull Elevation:	227.3
Bankfull Cross-Sectional Area:	26.7
Bankfull Width:	18.9
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	3.2
Mean Depth at Bankfull:	1.4
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



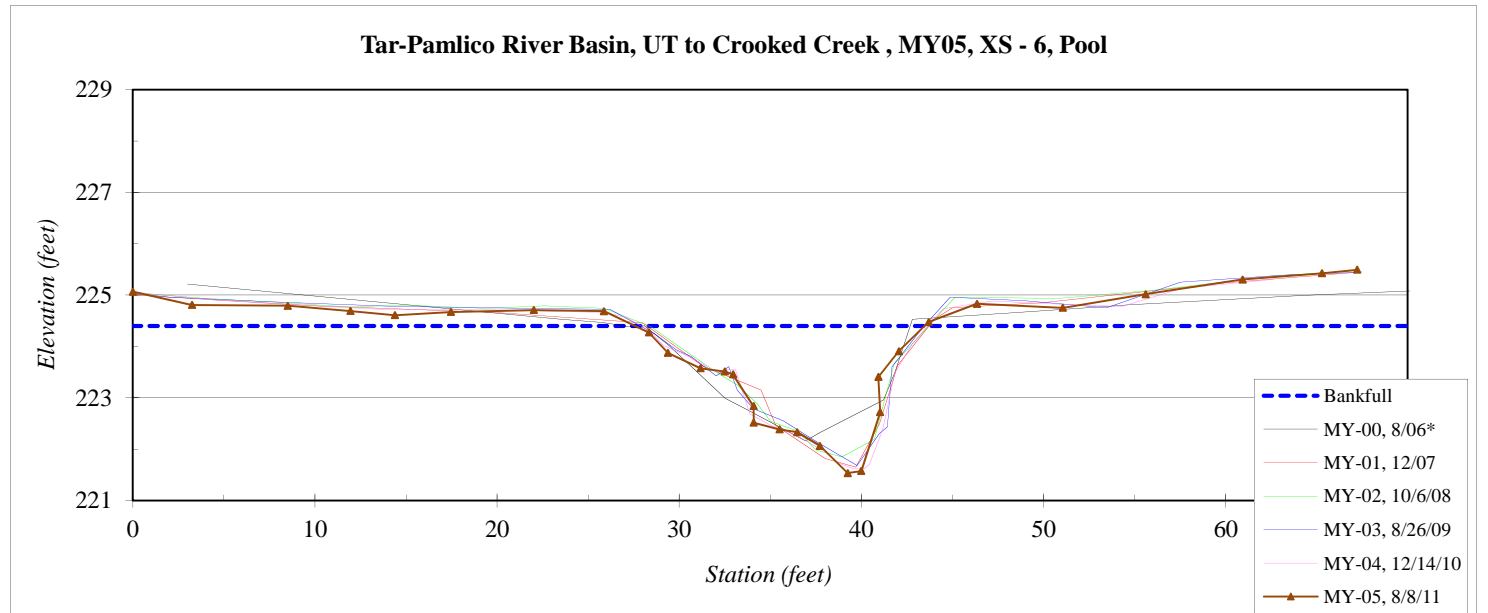
*MY-00 cross-section plots shifted as needed due to likely stationing issue during baseline monitoring.

River Basin:	Tar-Pamlico
Watershed:	UT to Crooked Creek , MY05
XS ID	XS - 6, Pool
Drainage Area (sq mi):	0.52
Date:	8/8/2011
Field Crew:	A. French, J. Anders



Station	Elevation
0.0	225.07
3.3	224.81
8.5	224.79
12.0	224.69
14.4	224.61
17.5	224.67
22.0	224.71
25.9	224.69
28.3	224.27
29.4	223.87
31.2	223.57
32.5	223.51
33.0	223.46
34.1	222.84
34.1	222.51
35.5	222.38
36.5	222.33
37.7	222.06
39.3	221.53
40.0	221.57
41.0	222.72
40.9	223.41
42.1	223.91
43.7	224.47
46.4	224.83
51.1	224.75
55.6	225.02
60.9	225.30
65.3	225.43
67.2	225.49

SUMMARY DATA	
Bankfull Elevation:	224.4
Bankfull Cross-Sectional Area:	20.8
Bankfull Width:	15.5
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.9
Mean Depth at Bankfull:	1.3
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-



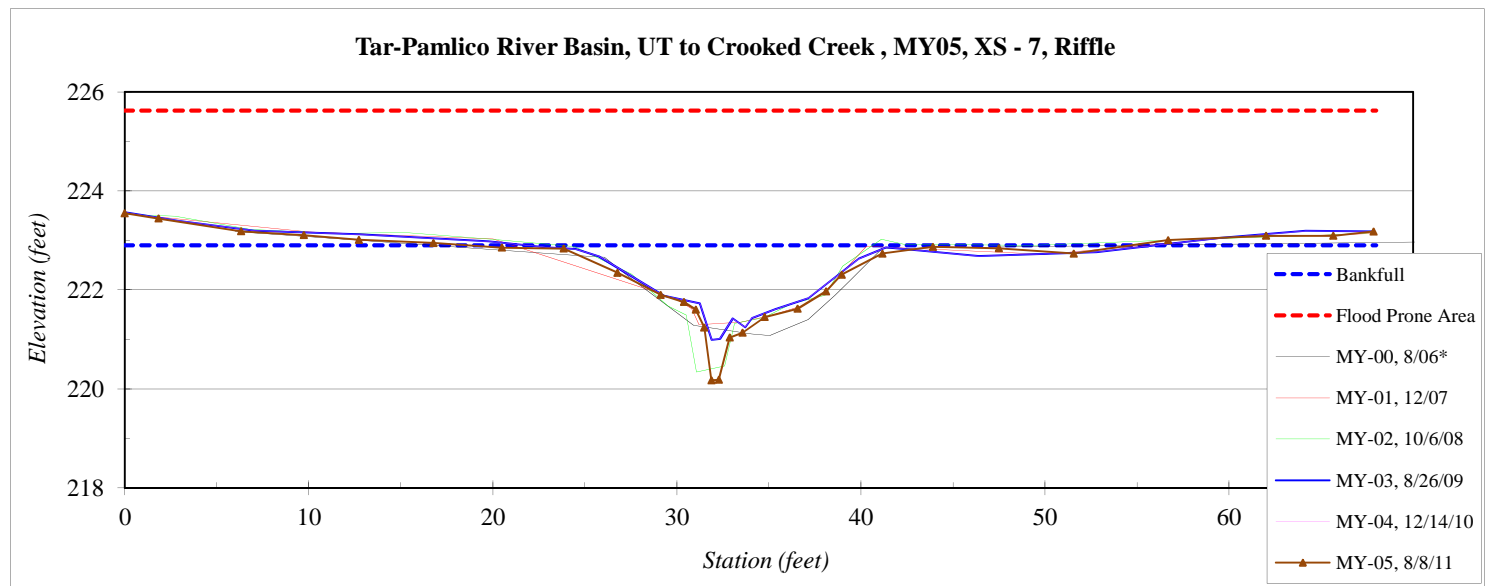
*MY-00 cross-section plots shifted as needed due to likely stationing issue during baseline monitoring.

River Basin:	Tar-Pamlico
Watershed:	UT to Crooked Creek , MY05
XS ID	XS - 7, Riffle
Drainage Area (sq mi):	0.52
Date:	8/8/2011
Field Crew:	A. French, J. Anders



Station	Elevation
0.0	223.55
1.8	223.44
6.3	223.18
9.7	223.11
12.7	223.01
16.8	222.95
20.5	222.85
23.9	222.84
26.8	222.35
29.1	221.90
30.4	221.75
31.0	221.60
31.5	221.24
31.9	220.17
32.3	220.18
32.9	221.04
33.6	221.14
34.8	221.45
36.6	221.62
38.1	221.97
39.0	222.31
41.2	222.73
43.9	222.87
47.5	222.84
51.6	222.73
56.7	223.01
62.0	223.09
65.7	223.10
67.9	223.18

SUMMARY DATA	
Bankfull Elevation:	222.9
Bankfull Cross-Sectional Area:	20.8
Bankfull Width:	15.5
Flood Prone Area Elevation:	225.6
Flood Prone Width:	>70
Max Depth at Bankfull:	2.7
Mean Depth at Bankfull:	0.8
W / D Ratio:	19.4
Entrenchment Ratio:	4.5
Bank Height Ratio:	1.0



Note: A clump of in-stream vegetation, immediately upstream of this cross-section, has caused a small area of scour in the bed that is evident in the above cross-section plot. This is not causing any bank erosion or adjacent stream instability.

*MY-00 cross-section plots shifted as needed due to likely stationing issue during baseline monitoring.

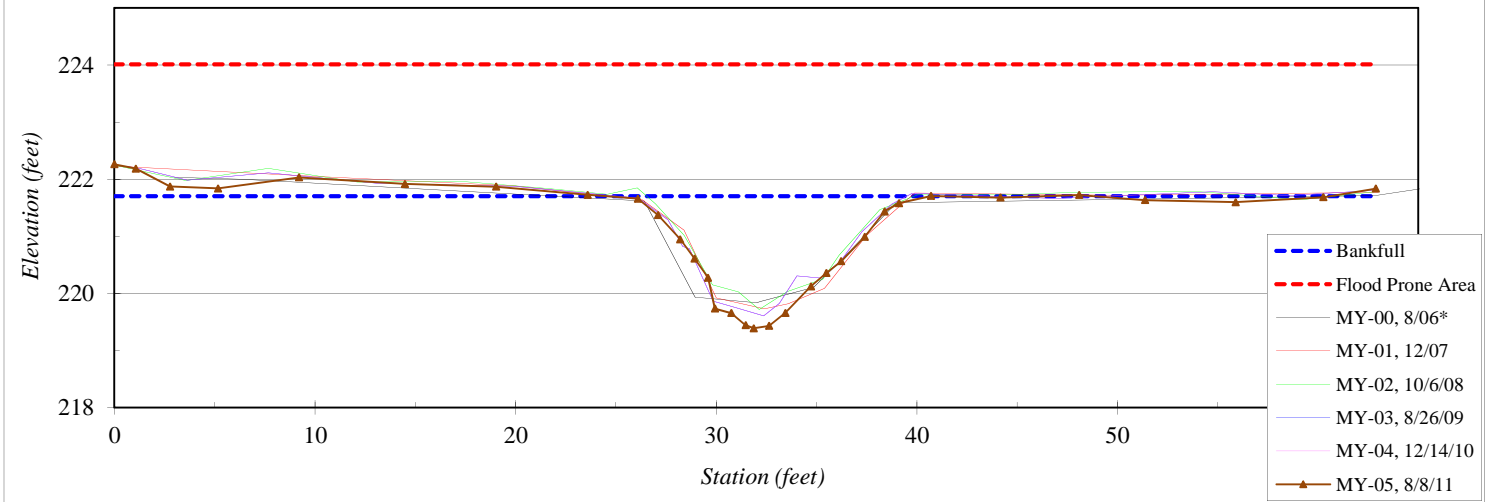
River Basin:	Tar-Pamlico
Watershed:	UT to Crooked Creek , MY05
XS ID	XS - 8, Riffle
Drainage Area (sq mi):	0.52
Date:	8/8/2011
Field Crew:	A. French, J. Anders



Station	Elevation
0.0	222.26
1.1	222.19
2.8	221.87
5.2	221.84
9.2	222.03
14.5	221.92
19.0	221.87
23.6	221.73
26.1	221.66
27.1	221.37
28.2	220.95
28.9	220.61
29.6	220.27
29.9	219.73
30.8	219.65
31.5	219.44
31.9	219.39
32.6	219.43
33.4	219.66
34.7	220.12
35.5	220.36
36.2	220.56
37.4	220.99
38.4	221.44
39.1	221.58
40.7	221.71
44.2	221.68
48.1	221.72
51.4	221.63
55.9	221.60
60.3	221.68
62.9	221.84

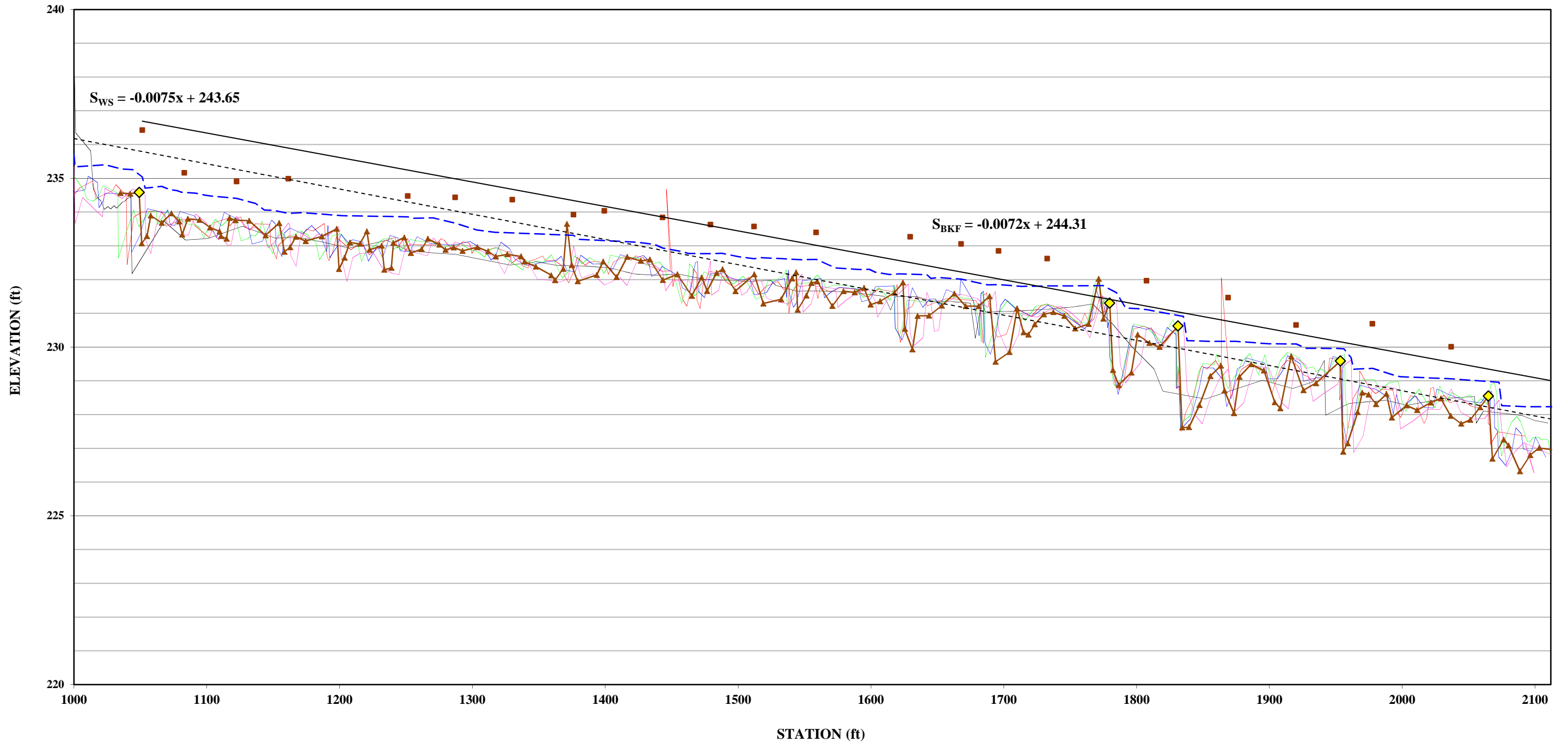
SUMMARY DATA	
Bankfull Elevation:	221.7
Bankfull Cross-Sectional Area:	16.6
Bankfull Width:	14.5
Flood Prone Area Elevation:	224.0
Flood Prone Width:	>65
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.1
W / D Ratio:	12.7
Entrenchment Ratio:	4.5
Bank Height Ratio:	1.0

Tar-Pamlico River Basin, UT to Crooked Creek , MY05, XS - 8, Riffle



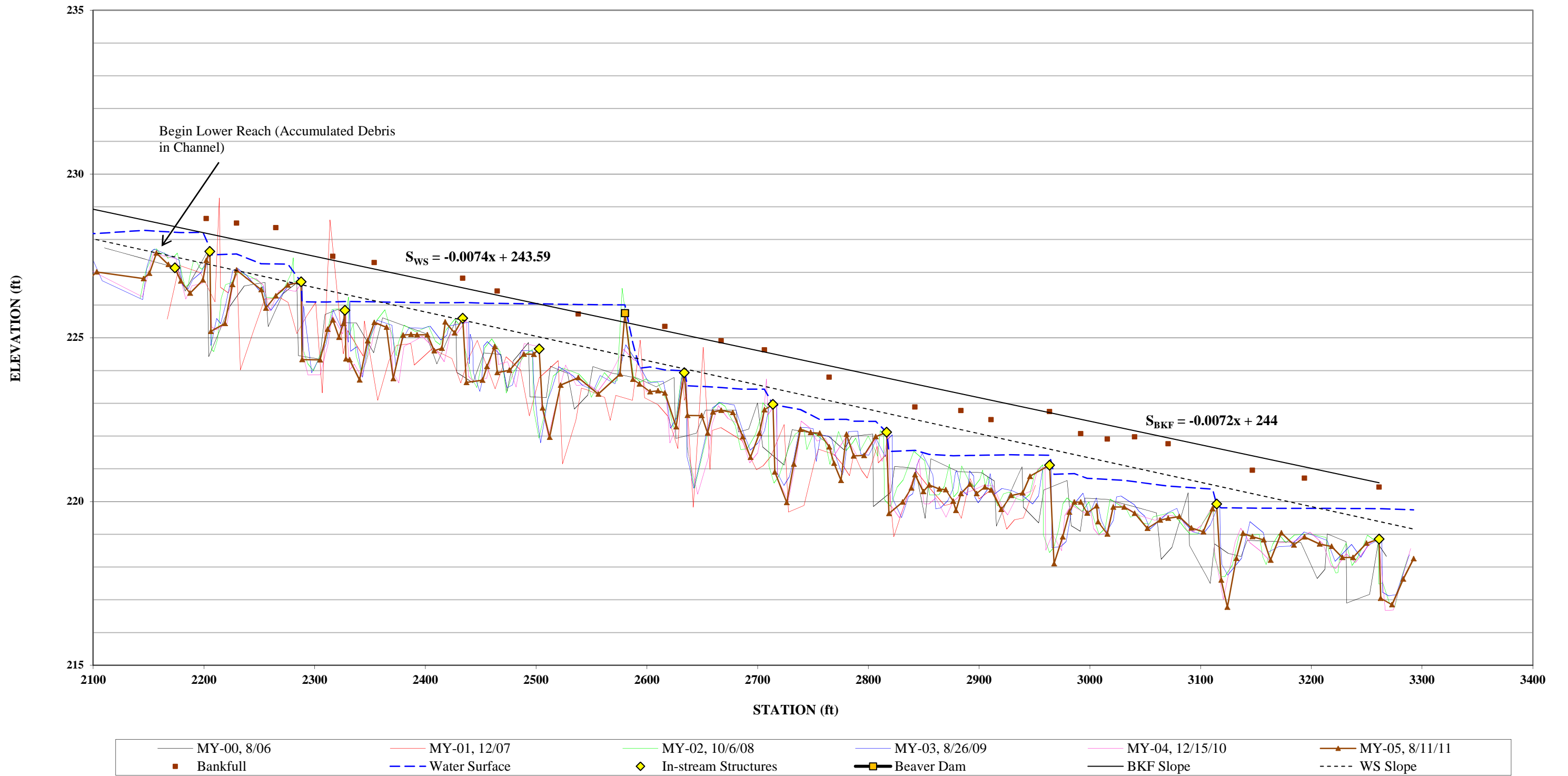
*MY-00 cross-section plots shifted as needed due to likely stationing issue during baseline monitoring.

Longitudinal Profile
UT to Crooked Creek (Upper Reach), Franklin County
EEP Project Number 434 - MY05



— MY-00, 8/06	— MY-01, 12/07	— MY-02, 10/6/08	— MY-03, 8/26/09	— MY-04, 12/15/10	— MY-05, 8/11/11
■ Bankfull	- - - Water Surface	◆ In-stream Structures	— BKF Slope	- - - - WS Slope	

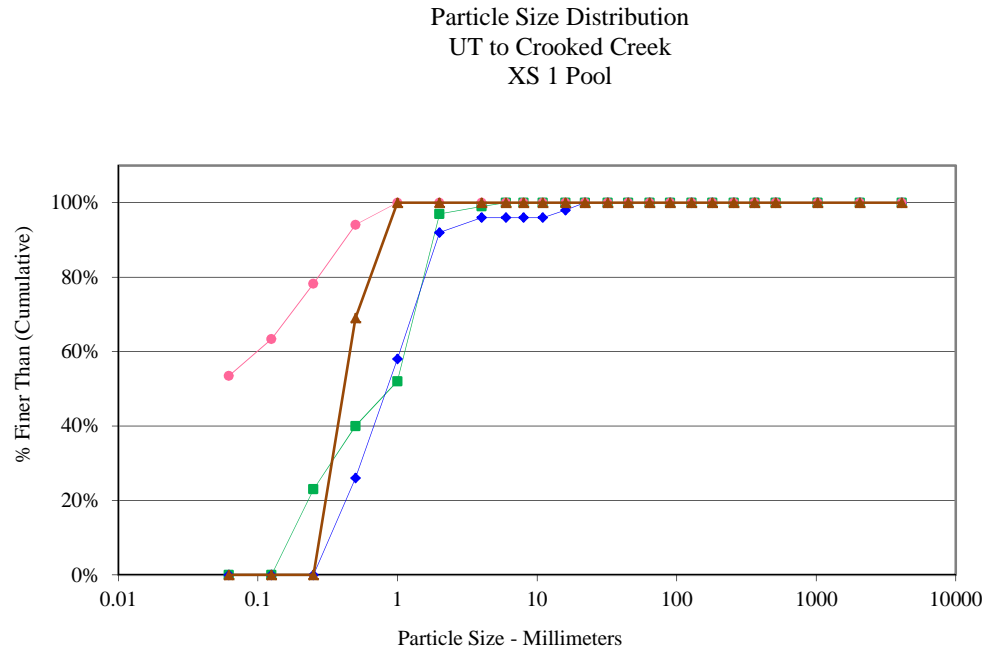
Longitudinal Profile
UT to Crooked Creek (Lower Reach), Franklin County
EEP Project Number 434 - MY05



Note: MY-01 profile data ends at Station 29+50. A survey error affected the elevations from Station 29+50 to the end of the profile.

Pebble Count Plots

Cross-Section 1 Pool - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	69
Coarse	.50 - 1	D	31
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100
Note:			

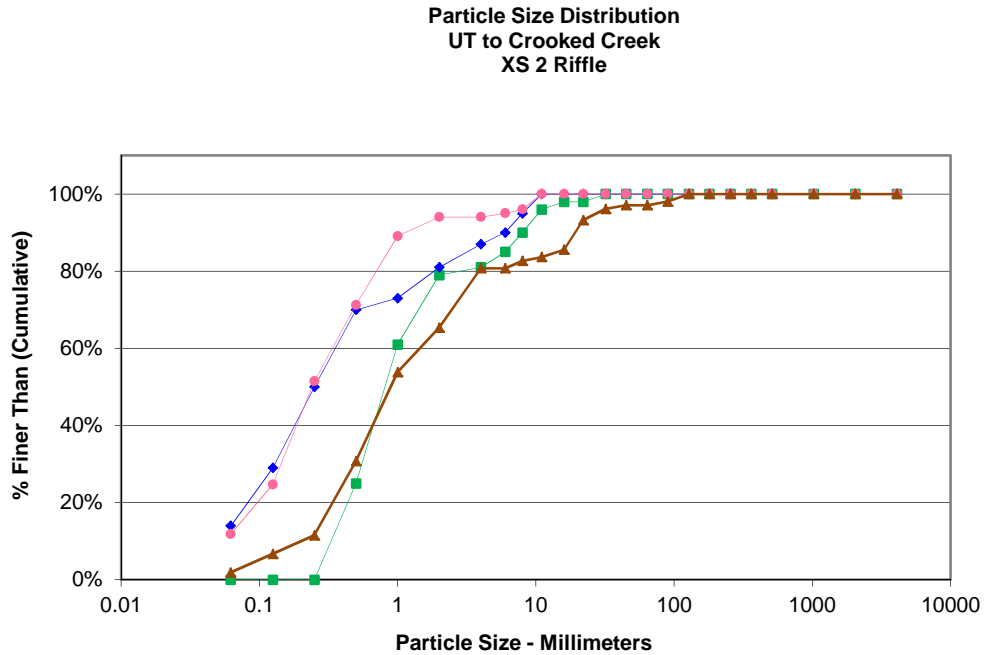


Size (mm)	
D16	0.29
D35	0.36
D50	0.41
D65	0.48
D84	0.7
D95	0.89

Size Distribution	
mean	0.5
dispersion	1.6
skewness	0.07

Type	
silt/clay	0%
sand	100%
gravel	0%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 2 Riffle - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	2
Very Fine	.062 - .125	S	5
Fine	.125 - .25	A	5
Medium	.25 - .50	N	20
Coarse	.50 - 1	D	24
Very Coarse	1 - 2	S	12
Very Fine	2 - 4		16
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	8
Coarse	22.6 - 32	L	3
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		
Small	64 - 90	C	1
Small	90 - 128	O	2
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	104
Note:			

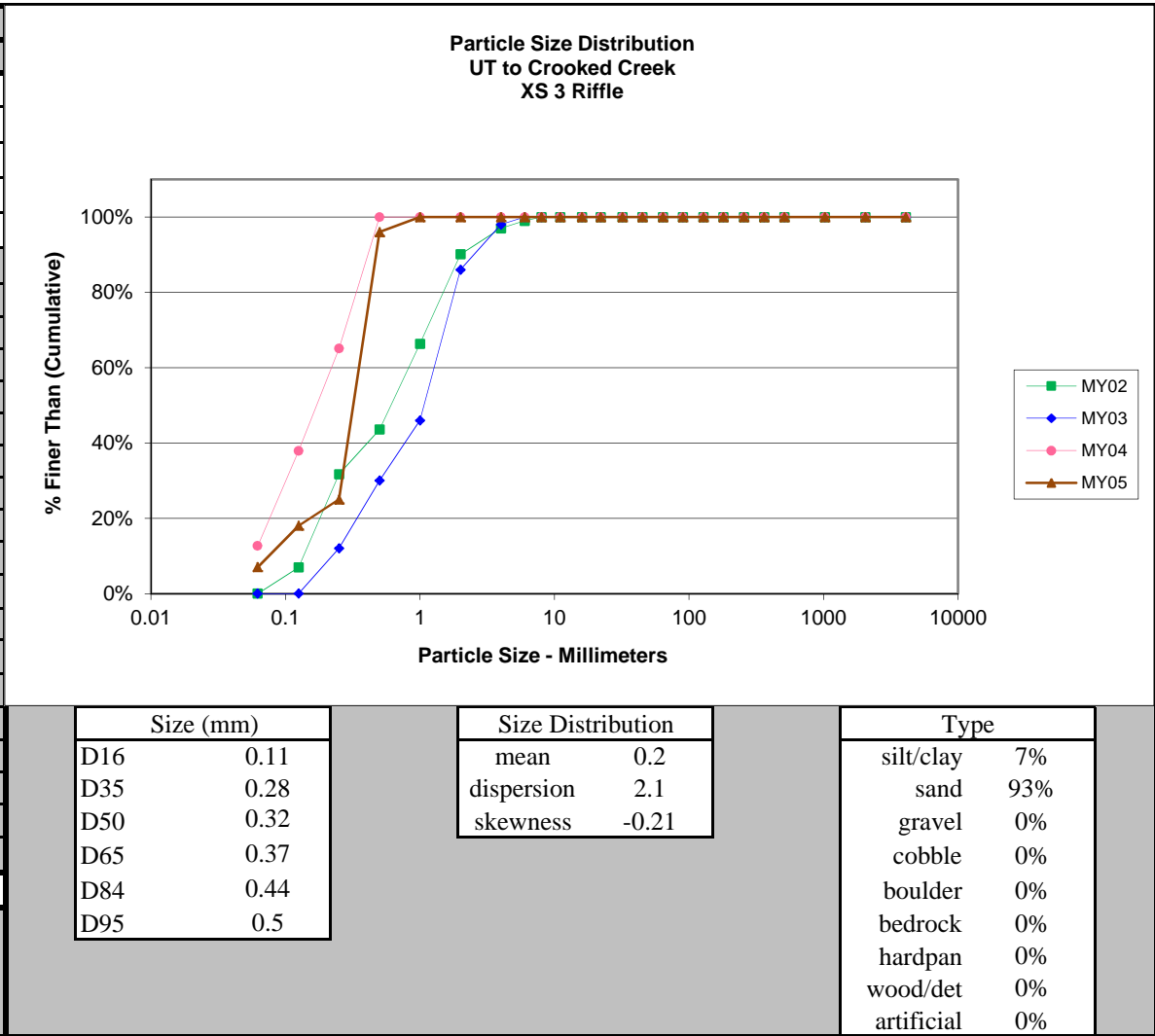


Size (mm)	
D16	0.29
D35	0.57
D50	0.89
D65	2
D84	12
D95	28

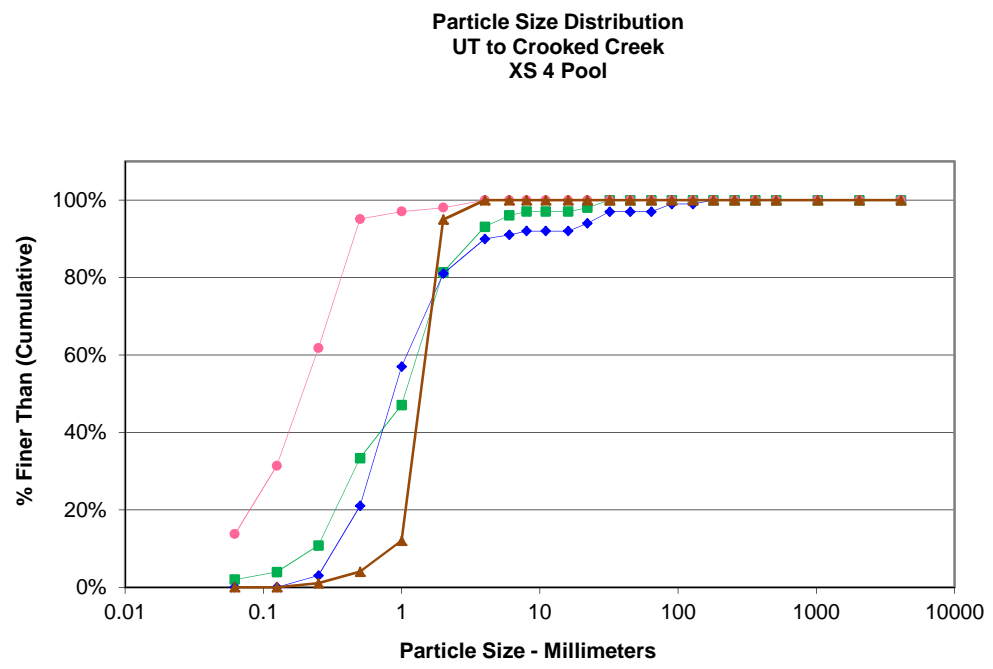
Size Distribution	
mean	1.9
dispersion	8.3
skewness	0.25

Type	
silt/clay	2%
sand	63%
gravel	32%
cobble	3%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 3 Riffle - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	7
Very Fine	.062 - .125	S	11
Fine	.125 - .25	A	7
Medium	.25 - .50	N	71
Coarse	.50 - 1	D	4
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100
Note:			



Cross-Section 4 Pool - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	1
Medium	.25 - .50	N	3
Coarse	.50 - 1	D	8
Very Coarse	1 - 2	S	83
Very Fine	2 - 4		5
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		100
Note:			

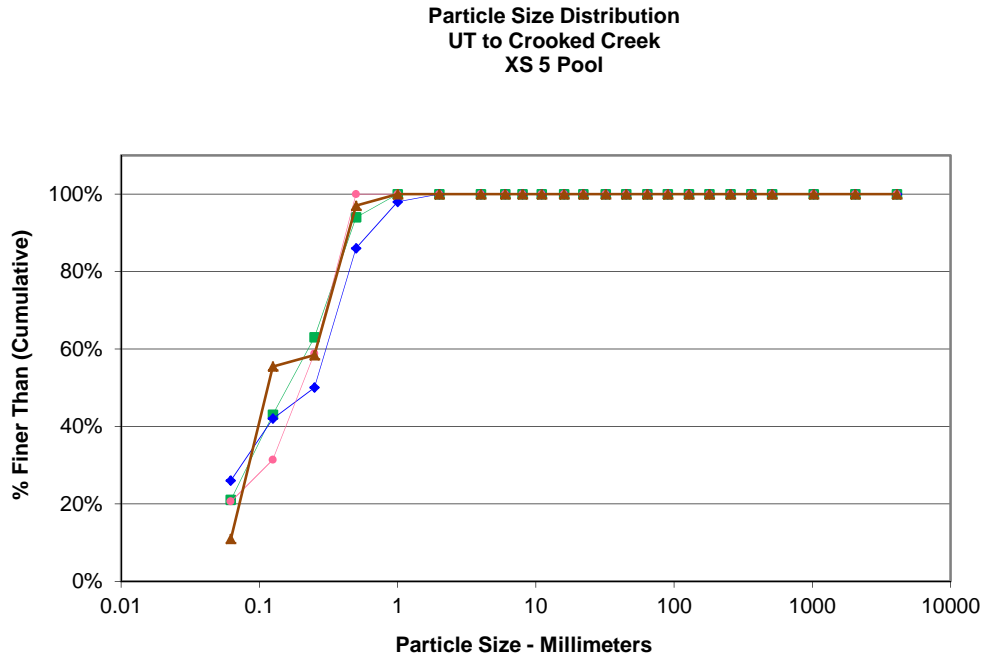


Size (mm)	
D16	1
D35	1.2
D50	1.4
D65	1.6
D84	1.8
D95	2

Size Distribution	
mean	1.3
dispersion	1.3
skewness	-0.04

Type	
silt/clay	0%
sand	95%
gravel	5%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 5 Pool - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	11
Very Fine	.062 - .125	S	45
Fine	.125 - .25	A	3
Medium	.25 - .50	N	39
Coarse	.50 - 1	D	3
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		101
Note:			

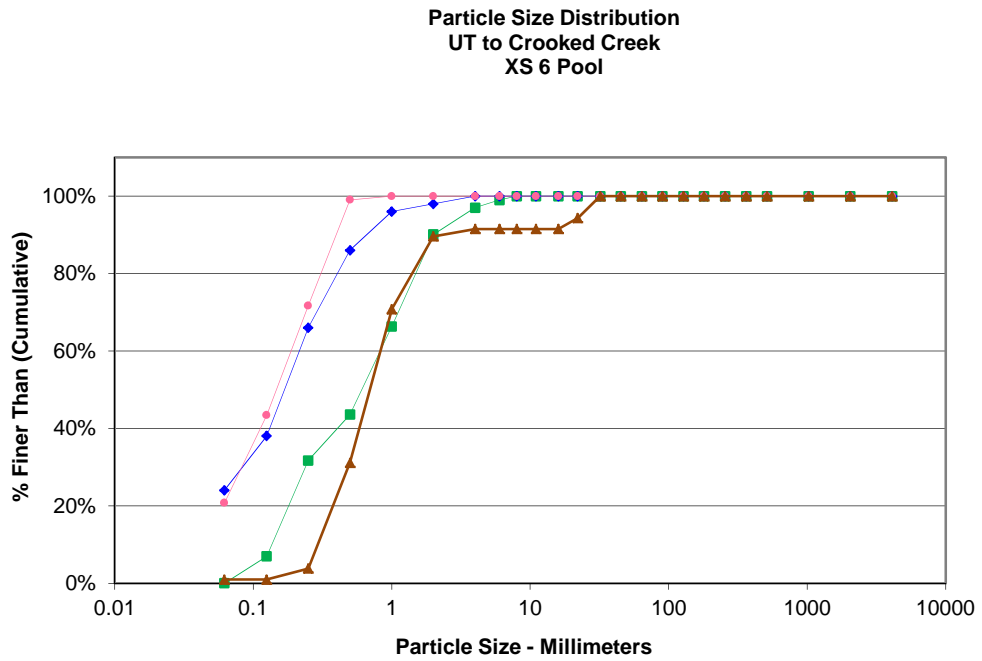


Size (mm)	
D16	0.067
D35	0.091
D50	0.11
D65	0.28
D84	0.4
D95	0.48

Size Distribution	
mean	0.2
dispersion	2.6
skewness	0.20

Type	
silt/clay	11%
sand	89%
gravel	0%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 6 Pool - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	1
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	3
Medium	.25 - .50	N	29
Coarse	.50 - 1	D	42
Very Coarse	1 - 2	S	20
Very Fine	2 - 4		2
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	3
Coarse	22.6 - 32	L	6
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	106
Note:			

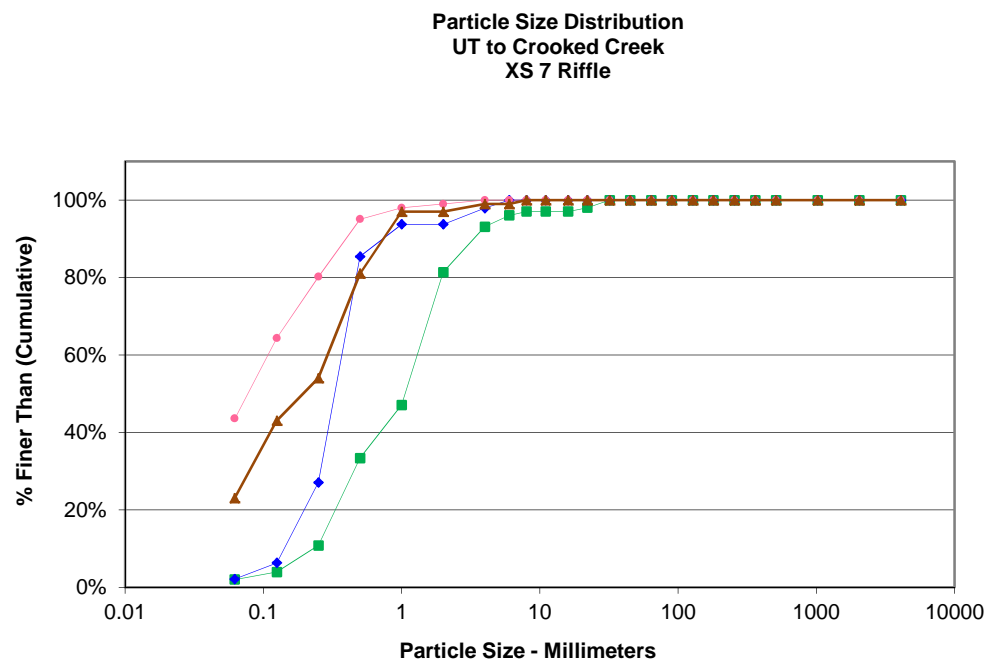


Size (mm)	
D16	0.34
D35	0.54
D50	0.7
D65	0.9
D84	1.6
D95	23

Size Distribution	
mean	0.7
dispersion	2.2
skewness	0.03

Type	
silt/clay	1%
sand	89%
gravel	10%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 7 Riffle - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	23
Very Fine	.062 - .125	S	20
Fine	.125 - .25	A	11
Medium	.25 - .50	N	27
Coarse	.50 - 1	D	16
Very Coarse	1 - 2	S	
Very Fine	2 - 4		2
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100
Note:			

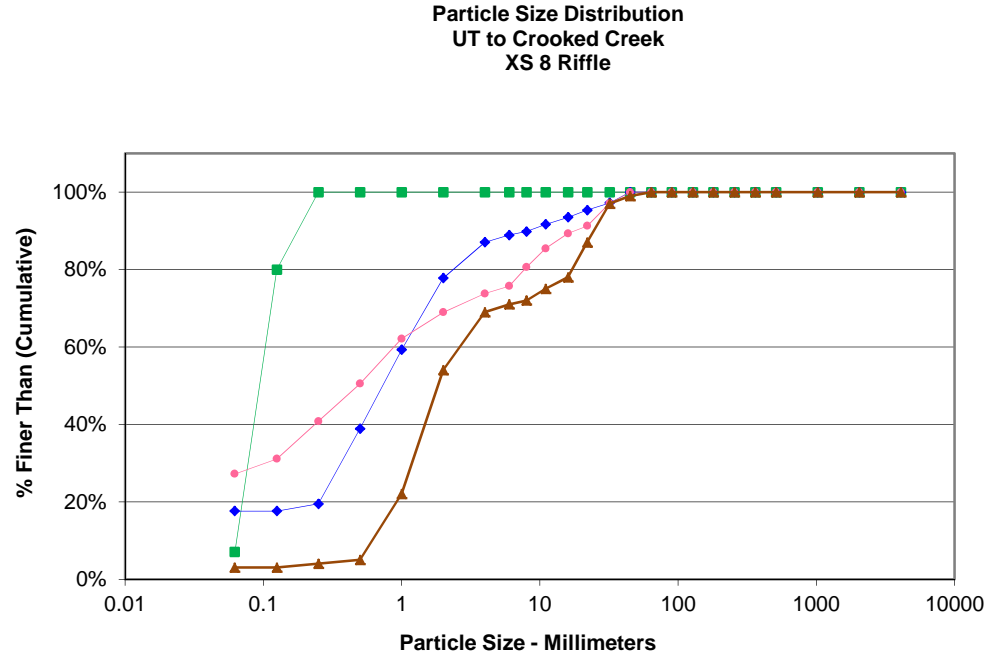


Size (mm)	
D16	0.062
D35	0.094
D50	0.19
D65	0.33
D84	0.57
D95	0.92

Size Distribution	
mean	0.2
dispersion	3.0
skewness	0.00

Type	
silt/clay	23%
sand	74%
gravel	3%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 8 Riffle - MY05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	3
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	1
Medium	.25 - .50	N	1
Coarse	.50 - 1	D	17
Very Coarse	1 - 2	S	32
Very Fine	2 - 4		15
Fine	4 - 5.7	G	2
Fine	5.7 - 8	R	1
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	9
Coarse	22.6 - 32	L	10
Very Coarse	32 - 45	S	2
Very Coarse	45 - 64		1
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
	Total		100
Note:			



Size (mm)	
D16	0.78
D35	1.3
D50	1.8
D65	3.3
D84	20
D95	30

Size Distribution	
mean	3.9
dispersion	6.7
skewness	0.29

Type	
silt/clay	3%
sand	51%
gravel	46%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Table 10. Baseline - Stream Data Summary Table

Project Number and Name: 434 - UT to Crooked Creek

Segment Reach: UT to Crooked Creek (2,219 ft)

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
	Min	Max	Mean	Min	Max	Med	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Bankfull Width (ft)									16.4			11.4			15.0			
Floodprone Width (ft)									24.8	67.5	69	68.3			59			
Bankfull Cross Sectional Area (ft ²)									13.3			8.8			17.3			
Bankfull Mean Depth (ft)									0.8			0.7			1.2			
Bankfull Maximum Depth (ft)									1.9			1.8			1.5			
Width/Depth Ratio									20.2			15.4			13.0			
Bank Height Ratio																		
Entrenchment Ratio									1.5	4.6	4.6	4.6			5.3			
Wetted Perimeter (ft)									18.0			12.5			17.3			
Hydraulic Radius (ft)									0.74			0.64			1.02			
Pattern																		
Channel Beltwidth (ft)									7.9			37.7	31.5	63	94.5	25	63	45
Radius of Curvature (ft)							4	7	5.5	6.6	15.8	11.2	30	45	38	25	40	32
Meander Wavelength (ft)							6	29	17.5	19.7	42	31	45	135	90	101	150	125
Meander Width Ratio									0.6	1.8	3.8	5.6	3	9	6	6.7	10	8
Profile																		
Riffle Length (ft)							6	20	13	5	13	9	20	40	25	21	61	48
Riffle Slope (ft/ft)									0.043			0.031			0.004			
Pool Length (ft)							6	8	7	14	20	17	15	60	20	7	81	29
Pool Spacing (ft)							6	31	18.5	4.9	47.3	26.1	36	82.5	59.3	23.6	129.5	49.3
Substrate																		
d50 (mm)									0.2						0.2			0.2
d84 (mm)									0.2						0.2			0.2
Additional Reach Parameters																		
Valley Length (ft)							1,900			86			1,866			1,866		
Channel Length (ft)							1,920			106			2,277			2,267		
Sinuosity							1.01			1.23			1.22			1.21		
Water Surface Slope (ft/ft)							0.0071			0.0164			0.0039			N/A		
BF Slope (ft/ft)							0.0071			0.0164			0.0039			0.004		
Rosgen Classification							F5			C5			C5			C5		

Table 11a. Monitoring - Cross-Section Morphology Data Table

Project Number and Name: 434 - UT to Crooked Creek

Segment / Reach: UT to Crooked Creek (2,219 ft.)

Parameter	Cross-Section 1						Cross-Section 2						Cross-Section 3					
	Pool						Riffle						Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Elevation (datum) used		235.0	235.0	235.0	235.0			234.3	234.3	234.3	234.3			232.7	232.7	232.7	232.7	
Bankfull Width (ft)	17.7	16.4	16.4	18.6	17.5		15.0	15.3	14.7	14.1	17.2		12.6	12.7	11.2	12.6	12.1	
Floodprone Width (ft)	95						61	>60	>60	>60	>60		77	>70	>70	>70	>70	
Bankfull Cross-Sectional Area (ft ²)	17.5	14.4	15.2	18.6	16.1		9.6	9.1	9.2	12.1	11.7		12.2	10.1	10.0	11.2	11.9	
Bankfull Mean Depth (ft)	1.0	0.9	0.9	1.0	0.9		0.6	0.6	0.6	0.9	0.7		1.0	0.8	0.9	0.9	1.0	
Bankfull Maximum Depth (ft)	2.5	2.2	2.3	2.5	2.3		1.4	1.4	1.3	1.6	1.5		1.5	1.3	1.3	1.5	1.5	
Width/Depth Ratio							23.5	25.6	23.6	16.4	25.3		13.0	16.1	12.7	14.2	12.4	
Entrenchment Ratio	5.4						4.0	>4.0	>4.0	>4.0	3.5		6.1	>5.0	>6.0	>6.0	>6.0	
Bank Height Ratio							1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Cross-Sectional Area between end pins (ft ²)				16.2	13.7					30.0	27.2					18.2	18.9	
d50 (mm)	0.2	0.9	0.8	0.1	0.4		0.2	0.8	0.3	0.2	0.9		0.2	0.6	1.1	0.2	0.3	

Parameter	Cross-Section 4						Cross-Section 5						Cross-Section 6					
	Pool						Pool						Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Elevation (datum) used		231.5	231.5	231.5	231.5			227.3	227.3	227.3	227.3			224.4	224.4	224.4	224.4	
Bankfull Width (ft)	9.6	9.9	10.8	10.5	9.7		16.5	16.7	16.3	17.2	18.9		15.9	15.0	15.2	15.4	15.5	
Floodprone Width (ft)	48						71						68					
Bankfull Cross-Sectional Area (ft ²)	26.6	26.8	25.3	30.8	32.9		25.6	25.7	21.1	23.7	26.7		22.3	20.0	20.5	21.7	20.8	
Bankfull Mean Depth (ft)	2.8	2.7	2.3	2.9	3.4		1.6	1.5	1.3	1.4	1.4		1.4	1.3	1.4	1.4	1.3	
Bankfull Maximum Depth (ft)	3.5	3.6	3.5	4.1	4.0		3.6	3.5	2.9	3.4	3.2		2.8	2.5	2.7	2.7	2.8	
Width/Depth Ratio																		
Entrenchment Ratio	5.0						4.3						4.3					
Bank Height Ratio																		
Cross-Sectional Area between end pins (ft ²)				37.4	40.5					45.8	51.0					43.5	44.9	
d50 (mm)	0.2	1.1	0.9	0.2	1.4		0.2	0.4	0.5	0.2	0.1		0.2	0.4	0.5	0.2	0.7	

Table 11a. Monitoring - Cross-Section Morphology Data Table, Cont.												
Project Number and Name: 434 - UT to Crooked Creek												
Segment / Reach: UT to Crooked Creek (2,219 ft.)												
Parameter	Cross-Section 7						Cross-Section 8					
	Riffle						Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Elevation (datum) used		222.9	222.9	222.9	222.9			221.7	221.7	221.7	221.7	
Bankfull Width (ft)	19.1	17.0	19.5	20.8	23.4		15.0	13.3	12.1	13.5	14.5	
Floodprone Width (ft)	68	>60	>60	>60	>60		200	>60	>60	>60	>60	
Bankfull Cross-Sectional Area (ft ²)	16.7	17.5	15.2	16.8	18.1		15.7	14.0	14.6	15.9	16.6	
Bankfull Mean Depth (ft)	0.9	1.0	0.8	0.8	0.8		1.1	1.1	1.2	1.2	1.1	
Bankfull Maximum Depth (ft)	1.6	2.6	1.9	2.5	2.7		1.2	2.0	2.1	2.2	2.3	
Width/Depth Ratio	21.9	16.6	22.4	25.7	19.4		14.3	12.6	10.1	11.4	12.7	
Entrenchment Ratio	3.6	>3.0	>3.0	>3.0	>3.0		4.0	>4.0	>4.0	>4.0	>4.0	
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Cross-Sectional Area between end pins (ft ²)				25.4	32.4					20.7	22.8	
d50 (mm)	0.2	0.2	0.5	0.1	0.2		0.2	0.1	3.2	0.5	1.8	

Table 11b. Monitoring - Stream Reach Morphology Data Table																								
Project Number and Name: 434 - UT to Crooked Creek																								
Segment Reach: UT to Crooked Creek (2,219 ft.)																								
Parameter	MY - 01 (2007)			MY - 02 (2008)			MY - 03 (2009)						MY - 04 (2010)						MY - 05 (2011)					
Dimension	Min	Max	Med	Min	Max	Med	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	12.6	19.0	15.0	12.7	17.0	14.3	11.2	14.4	13.4	19.5	3.7	4	12.6	15.6	13.4	22.9	4.9	4	12.1	16.8	15.9	23.4	4.9	4
Floodprone Width (ft)	60	200	75	60	70	60	60.0	62.5	60.0	70.0	5.0	4	60.0	67.5	67.5	75.0	6.5	4	60.0	62.5	60.0	70.0	5.0	4
Bankfull Cross Sectional Area (ft ²)	10.0	17.0	16.0	9.1	17.5	12.1	9.2	12.3	12.3	15.2	3.1	4	11.2	13.7	13.4	16.8	2.5	4	11.7	14.6	14.3	18.1	3.3	4
Bankfull Mean Depth (ft)	0.6	1.1	0.9	0.6	1.1	0.9	0.6	0.9	0.9	1.2	0.3	4	0.8	0.9	0.9	1.1	0.1	4	0.7	0.9	0.9	1.1	0.2	4
Bankfull Maximum Depth (ft)	1.4	2.0	1.5	1.3	2.6	1.7	1.3	1.7	1.6	2.1	0.4	4	1.5	1.8	1.8	2.0	0.2	4	1.5	2	1.9	2.7	0.6	4
Width/Depth Ratio	13.0	23.5	14.3	12.6	25.6	16.4	10.1	17.2	17.6	23.6	6.8	4	11.0	16.9	15.3	25.8	6.4	4	12.4	17.5	16.1	25.3	6.2	4
Entrenchment Ratio	4.0	13.0	6.0	-	-	-	3.0	4.3	4.0	6.0	1.3	4	3.4	4.7	4.7	6.0	1.1	4	3.5	4.7	4.5	6.2	1.1	4
Bank Height Ratio	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	4	1.0	1.0	1.0	1.0	0.0	4	1.0	1.0	1.0	1.0	0.0	4
Pattern																								
Channel Beltwidth (ft)																								
Radius of Curvature (ft)																								
Meander Wavelength (ft)																								
Meander Width Ratio*																								
Profile																								
Riffle Length (ft)	11	66	30	10	44	22	4	14		52			3	15	13	47	12.3	18	*	*	*	*	*	*
Riffle Slope (ft/ft)	0.000	0.025	0.006	0.003	0.037	0.009	0.001	0.010		0.051			0.009	0.015	0.012	0.049	0.013	18	*	*	*	*	*	*
Pool Length (ft)	5	48	27	3	29	10	3	9		40			3	15	15	44	7.9	40	4	14	14	30	7.1	22
Pool Spacing (ft)	10	86	48	12	160	44	12	34		138			17	59	48	182	37.4	39	27	105	89	392	81.7	21
Additional Reach Parameters																								
Valley Length (ft)	1,866			1,866			1,866						1,866						1,866					
Channel Thalweg Length (ft)	2,376**			2,287			2,287						2,287						2,287					
Sinuosity	1.21			1.23			1.23						1.23						1.23					
Water Surface Slope (ft/ft)	0.00384-0.00484			0.0073			0.0067						0.0074						0.0067					
Bankfull Slope (ft/ft)	0.00384-0.00484			0.0073			0.0068						0.0072						0.0064					
SC% / Sa% / G% / C% / B% / Be%													25% / 70% / 5% / - / - / -						6% / 82% / 12% / - / - / -					
d16 / d35 / d50 / d84 / d95													0.062 / 0.096 / 0.17 / 0.44 / 2						0.367 / 0.55 / 0.73 / 4.7 / 10.7					
% of Reach with Eroding Banks													0%						0%					
Rosgen Classification	C5			C5			C5						C5						C5					

** Thalweg longer due to tape skew

* No riffle measurements or water surface slope due to no stream flow.

Appendix E

Hydrologic Data

Table 12. Verification of Bankfull Events			
Project Number and Name: 434 - UT to Crooked Creek			
Date of Data Collection	Date of Occurrence	Method	Photo Number
11/11/2009	06/18/09	Evaluation of rainfall data	N/A
11/25/2009	11/13/09	Evaluation of rainfall data	N/A
10/15/2010	9/30/2010	Site visit to evaluate indicators after rainfall event	N/A
11/16/2011	unknown	Crest gauge	N/A