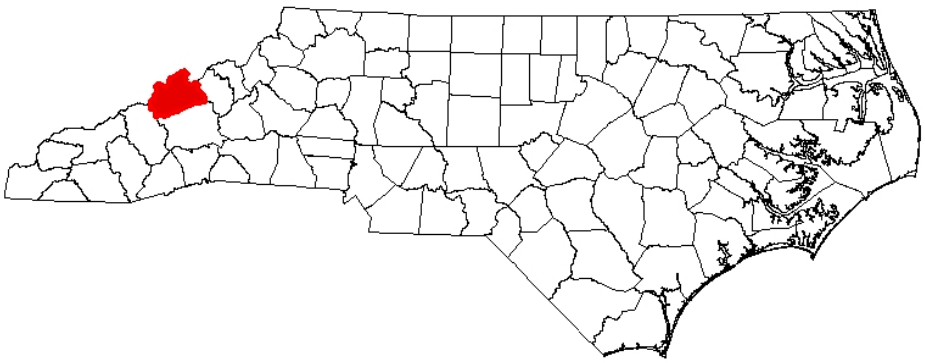
ANNUAL REPORT FOR 2004



Paint Fork Creek Stream Mitigation Site (Brigmon Site)
Madison County
WBS Element 32573.4.1
TIP No. A-10WM

Prepared By:
Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
March 2005

Summary

The following report summarizes the stream monitoring activities that have occurred during the Year 2004 at the Brigmon Site in Madison County. This site was designed and constructed during 1999 and 2000 by the North Carolina Wildlife Resources Commission (NCWRC). This report provides the monitoring results for the second formal year of monitoring; however, it is actually the fifth year since construction. Based on existing conditions, NCDOT does not anticipate any additional monitoring efforts at this time. The actual timeline for formal monitoring will be decided by the Mitigation Review Team.

Based on the overall conclusions of monitoring along Paint Fork Creek and its associated tributaries, the Brigmon Site has met the required monitoring protocols for the second formal year of monitoring. Localized areas of active bank scour and erosion exist; however, immediate stabilization is not warranted at this time and is not anticipated in the near future.

Based on stream gage information obtained from the USGS, the Brigmon Site has met the required hydrologic monitoring protocols and vegetative success criteria. No biological sampling was conducted as part of this monitoring project. It is unknown whether or not this sampling will be conducted as part of overall monitoring activities.

NCDOT anticipates that the year 2004 formal monitoring efforts will close out all monitoring requirements on this site. The site has met all required monitoring protocols and supplemental corrective actions are not warranted at this time.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2004 at the Brigmon Site. The site is situated immediately south and adjacent to Paint Fork Road (SR 1530) in the southeastern portion of Madison County (Figure 1). It is approximately 3.0 miles (4.5 kilometers) east-southeast of Mars Hill and nearly 14 miles (22.4 kilometers) north of Asheville. The Brigmon Site was constructed as one of four projects to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number A-10 in Madison County.

The mitigation project covers approximately 5,175 linear feet of Paint Fork Creek and two of its unnamed tributaries. Design and construction was implemented during 1999 and 2000 by the North Carolina Wildlife Resources Commission (NCWRC). Stream mitigation involved the installation of cross and j-hook vanes and sloping the adjacent streambanks to reduce overall erosion. It also included the installation of livestock management practices and native vegetation.

1.2 Purpose

According to the as-built report (NCWRC, 2000), the following objectives were proposed:

- Protection of the streams and riparian zones via conservation easements;
- Protection of the riparian zone vegetation from grazing by fencing livestock out of the easement area and installing watering tanks, stream crossings, etc.;
- Enhancement of overall stability by establishing the correct width/depth ratio, reducing entrenchment, sloping banks, and planting woody vegetation along Paint Fork Creek and its tributaries;
- Installation of j-hook vanes along eroding sections of the creek to reduce erosion and provide fish habitat;
- Stabilization of the "big meander bend" by removing existing automobile parts and constructing a bankfull bench with boulders and a rootwad revetment;
- Enhancement of instream habitat by constructing a series of cross vanes, primarily along the lower half of the reach;
- Establishment of the proper width/depth ratio below the "big meander bend" by narrowing the channel and establishing a floodplain. This narrowing will also be completed along portions of the tributaries; and
- Planting of native trees, shrubs, and ground cover that will help to stabilize the stream banks, establish shade, and provide wildlife cover and food.

Successful stream mitigation is demonstrated by a stable channel that does not aggrade or degrade over time. It is also demonstrated by reduced erosion rates, the permanent establishment of native vegetation, and bed features consistent with the design stream type. Vegetation survival is based on federal guidelines denoting success criteria for wetland mitigation. Results of stream monitoring conducted during the 2003 and 2004 growing season at the Brigmon Site are included in this report.

Activities in 2004 reflect the second formal year of monitoring following the restoration efforts; however, this is the fifth year following construction at the site. Included in this report are analyses on stability (primarily the longitudinal profile and cross sections), vegetative monitoring results, and site photographs.

1.3 Project History

The effort to provide stream mitigation for TIP No. A-10 began in 1996 with a Memorandum of Agreement (MOA) between the North Carolina Department of Transportation (NCDOT) with the NCWRC. The MOA was to provide 25,000 feet of mitigation for 9,990 feet of jurisdictional stream impacts. Subsequent amendments to the MOA were made to provide mitigation for additional stream impacts from TIP No. A-10. These amendments resulted in a total mitigation of over 26,000 feet.

The NCDOT worked with representatives from the NCWRC, U.S. Army Corps of Engineers, North Carolina Division of Water Quality, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, Natural Resources Conservation Service and Madison County Soil and Water Conservation District on a Mitigation Review Team. The purpose of the team was to develop criteria and policies for selecting stream reaches for mitigation.

The Brigmon Site was one of the sites selected by the Mitigation Review Team to provide compensatory mitigation for TIP No. A-10. The mitigation plan for this mitigation site was developed during 1998 and approved by the team. The NCWRC implemented the project in 1999.

June 2000	Construction Completed.
June 2000	Site Planted with Live Stakes and Bare Rooted Trees
December 2001	NCWRC Planted Additional Live Stakes and Bare Rooted Trees
June – July 2003	Stream Channel Monitoring (1 yr.)
June – July 2003	Vegetation Monitoring (1 yr.)
May 2004	Stream Channel Monitoring (2 yr.)
May 2004	Vegetation Monitoring (2 yr.)

1.4 Debit Ledger

The entire Brigmon Site was used for TIP No. A-10 to compensate for unavoidable stream impacts related with roadway construction. This project generated 5,175 linear feet of stream credits.

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The success criterion, as defined by the Mitigation Site Monitoring Protocol for the NCWRC/NCDOT Mitigation Program (2003), evaluates channel stability and improvements to fish habitat. Specifically, this evaluation includes all or a combination of the following parameters: channel stability, erosion control, seeding, woody vegetation, and overall response of fish and invertebrate populations for stream mitigation projects. This is to be accomplished using photo reference sites, stream dimension and profile, survival of planted vegetation, and direct sampling of

important populations. The chart provided below further details the criteria used to evaluate success or failure at these mitigation sites.

NCWRC/ NCDOT Mitigation Monitoring Criteria

Measurement	Success (requires no action)	Failure	Action
Photo Reference Sites			
Longitudinal Photos	No significant* aggradation, degradation, or erosion	Significant* aggradation, degradation, or erosion	When significant* aggradation, degradation or erosion occurs, remedial actions will be undertaken.
Lateral Photos			
Channel Stability			
Cross-Sections	Minimal evidence of instability (down-cutting, deposition, erosion, decrease in particle size)	Significant* evidence of instability	When significant* evidence of instability occurs, remedial actions will be undertaken.
Longitudinal Profiles			
Pebble Counts			
Plant Survival			
Survival Plots	≥75% coverage in Photo Plots	<75% coverage in Photo Plots	Areas of less than 75% coverage will be re-seeded and/or fertilized, live stakes and bare-rooted trees will be replanted to achieve >80% survival.
Stake Counts	≥80% survival of stakes, 4/m2	<80% survival of stakes, 4/m2	
Tree Counts	≥80% survival of bare-rooted trees	<80% survival of bare-rooted trees	
Biological Indicators (only used for projects with potential to make watershed level changes)			
Invertebrate Pop.	Population measures remain to same or improve	Population measures indicate a negative trend	Reasons for failure will be evaluted and remedial action plans developed and implemented.
Fish Populations			
Overall success or failure will be based on success of 3 of the 5 criteria or 3 of the 4 criteria when biological indicators are not used.			

*Significance or subjective determinations of success will be determined by a majority decision of the Mitigation Review Team

Federal guidelines for stream mitigation are relatively consistent with those protocols established by the NCWRC and NCDOT. These guidelines include the following main parameters: no less than two bankfull events for the five-year monitoring period, reference photos, plant survivability analyses, channel stability analyses, and biological data if specifically required by permit conditions (USACE, 2003). This report addresses all of the above mentioned parameters for both the NCWRC/NCDOT protocols and federal guidelines aside from shading and biological data, which were not required at this site.

Natural streams are dynamic systems that are in a constant state of change. Longitudinal profile and cross section surveys will differ from year to year based on changes in the watershed. Natural channel stability is achieved by allowing the stream to develop a proper dimension, pattern, and profile such that, over time, channel features are maintained and the stream system neither aggrades nor degrades. A stable stream consistently transports its sediment load, both in size and type, associated with local deposition and scour. Channel instability occurs when the scouring process leads to degradation, or excessive sediment deposition results in aggradation (Rosgen, 1996). The following surveys were conducted in support of the monitoring assessment:

- Longitudinal Profile Survey. This survey addressed the overall slope of the reach, as well as slopes between bed features. The bed features are secondary delineative criteria describing channel configuration in terms of riffle/pools, rapids, step/pools, cascades and convergence/divergence features which are inferred from channel plan form and gradient. The surveys are compared on a yearly basis to note and/or compare aggradation, degradation, head cuts, and areas of mass wasting. The longitudinal profile is expected to change from year to year. Significant changes may require additional monitoring.
- Cross Section Surveys. These surveys addressed the following characteristics at various locations along the reach: entrenchment ratio, width/depth ratio, and dominant channel materials. The entrenchment ratio is a computed index value used to describe the degree of vertical containment. The width/depth ratio is an index value which indicates the shape of the channel cross section. The dominant channel materials refer to a selected size index value, the D_{50}, representing the most prevalent of one of six channel material types or size categories, as determined from a channel material size distribution index.

2.2 Stream Description

2.2.1 Pre-Construction Conditions

The Paint Fork Creek channel at the Brigmon Site is confined by a narrow valley, which descends approximately 21.3 feet over a 2,925 linear-foot reach. Its water surface slope was calculated to be 0.0073 and the overall drainage area is approximately 13.6 square miles. The two unnamed tributaries (UTs) exhibit small watersheds of 0.15 (easternmost) and 0.16 (westernmost) square miles, with steeper water surface slopes of 0.07 and 0.05, respectively. The tributaries were severely degraded by livestock practices. Paint Fork Creek, upstream of Mr. Brigmon's driveway bridge, exhibits a low width/depth ratio with well-defined pools. Downstream of the driveway, the creek experiences a low-radius meander bend that was stabilized using junked automobiles. Below this bend, the width/depth ratio increases and the overall slope decreases. The entrenchment ratio was calculated at 2.4 and the width/depth ratio was approximately 12.8. The D_{50} was medium to coarse gravel (16 mm). According to the As-Built Report (NCWRC, 2000), this channel was classified as a B4c stream type.

Pool habitat along the lower reach of Paint Fork Creek was limited, with only one large pool present. Riparian conditions were poor on the two UTs, and fair on the main stem of Paint Fork Creek. It consisted mainly of herbaceous vegetation with little to no woody vegetation. Erosion was evident along the bankfull elevation of Paint Fork Creek, especially along the left bank facing downstream. A small berm was present in several areas. The existing riparian vegetation varied between 10 and 30 feet in width and provided minimal shade to the overall channel (NCWRC, 2000).

2.2.2 Post-Construction Conditions

Mitigation of Paint Fork Creek and its two UTs involved the construction of cross and j-hook vanes, rootwad revetments, and additional bank sloping. Coir logs were used to define and stabilize the bank at the bankfull elevation along both the UTs and the main channel. A conservation easement was established and the livestock management practices were enacted. These practices included stream crossings, a watering system, and fencing of the riparian areas (NCWRC, 2000).

2.2.3 Monitoring Conditions

Paint Fork Creek was initially classified as a B4c stream type according to the Rosgen Classification of Natural Rivers. Prior to construction, the channel was moderately entrenched with a high width/depth ratio. Sinuosity was low as compared with other B stream types (NCWRC, 2000). Construction reduced the overall width/depth ratio, however, property constraints did not allow for an increase in sinuosity. A total of 12 cross sections (six along Paint Fork Creek and three along both of its tributaries) were surveyed. A comparison of channel morphology is presented in Table 1. Channel stationing is provided on Figure 2.

Table 1. Abbreviated Morphological Summary (Brigmon Site)

Variable		Paint Fork Creek - Main Channel (Combined Cross Sections #7 Thru #12)						
		Pre-Const.*	As-Built*	2000**	2001**	2002**	2003	2004
Drainage Area (mi^2)		13.6	13.6	13.6	13.6	13.6	13.6	13.6
Bankfull Width (ft)	Mean	-	-				21.0	22.6
Bankfull Mean Depth (ft)	Mean	-	-				1.7	1.9
Width/Depth Ratio	Mean	12.8	-				13.1	12.9
Bankfull Cross Sectional Area (ft^2)	Mean	-	-				34.9	40.8
Maximum Bankfull Depth (ft)	Mean	-	-				2.3	2.7
Width of Floodprone Area (ft)	Mean	-	-				200	200
Entrenchment Ratio	Mean	2.4	-				6.9	6.9
Slope		0.0073	-				0.0064	0.0064
Particle Sizes (Riffle Section)								
D_{16} (mm)		-	-				1.9	0.737
D_{35} (mm)		-	-				37.6	1.87
D_{50} (mm)		16.0	-				60.9	14.3
D_{84} (mm)		-	-				195	176
D_{95} (mm)		-	-				421	442

Variable		Paint Fork Creek - Easternmost Unnamed Tributary #1 (Combined Cross Sections #4 Thru #6)						
		Pre-Const.*	As-Built*	2000**	2001**	2002**	2003	2004
Drainage Area (mi^2)		0.15	0.15	0.15	0.15	0.15	0.15	0.15
Bankfull Width (ft)	Mean	-	-				7.8	5.0
Bankfull Mean Depth (ft)	Mean	-	-				0.8	0.4
Width/Depth Ratio	Mean	-	-				10.5	12.6
Bankfull Cross Sectional Area (ft^2)	Mean	-	-				6.0	2.0
Maximum Bankfull Depth (ft)	Mean	-	-				1.3	0.8
Width of Floodprone Area (ft)	Mean	-	-				17.7	17.7
Entrenchment Ratio	Mean	-	-				2.2	2.2
Slope		0.07	-				0.056	0.056
Particle Sizes (Riffle Sections)								
D16		-	-				0.064	<0.062
D35		-	-				0.21	0.08
D50		-	-				0.9	0.1
D84		-	-				27	4
D95		-	-				84	49

Variable		Paint Fork Creek - Westernmost Unnamed Tributary #2 (Combined Cross Sections #1 Thru #3)						
		Pre-Const.*	As-Built*	2000**	2001**	2002**	2003	2004
Drainage Area (mi^2)		0.16	0.16	0.16	0.16	0.16	0.16	0.16
Bankfull Width (ft)	Mean	-	-				4.2	3.5
Bankfull Mean Depth (ft)	Mean	-	-				1.1	0.9
Width/Depth Ratio	Mean	-	-				4.0	4.6
Bankfull Cross Sectional Area (ft^2)	Mean	-	-				4.7	3.0
Maximum Bankfull Depth (ft)	Mean	-	-				1.6	1.0
Width of Floodprone Area (ft)	Mean	-	-				23.3	23.3
Entrenchment Ratio	Mean	-	-				3.0	3.0
Slope		0.05	-				0.044	0.044
Particle Sizes (Riffle Sections)								
D16		-	-				0.439	0.104
D35		-	-				1.78	1.30
D50		-	-				10.2	4.3
D84		-	-				54.0	45
D95		-	-				100.0	71

* According to the NCWRC, comparisons of pre-construction, as-built, and monitoring data are not valid due to intangible factors. Monitoring data for subsequent years should be used as the basis of comparison.
** No data available.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the re-survey of 12 cross sections of the three streams and the longitudinal profile of Paint Fork Creek established by the NCWRC after construction. The length of the profile along Paint Fork Creek was approximately 1,554 linear feet. Longitudinal profile surveys were also completed along UT #1 and UT #2. They were approximately 1,188 and 747 linear feet, respectively. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The locations of the cross sections and longitudinal profiles are shown in Appendix A.

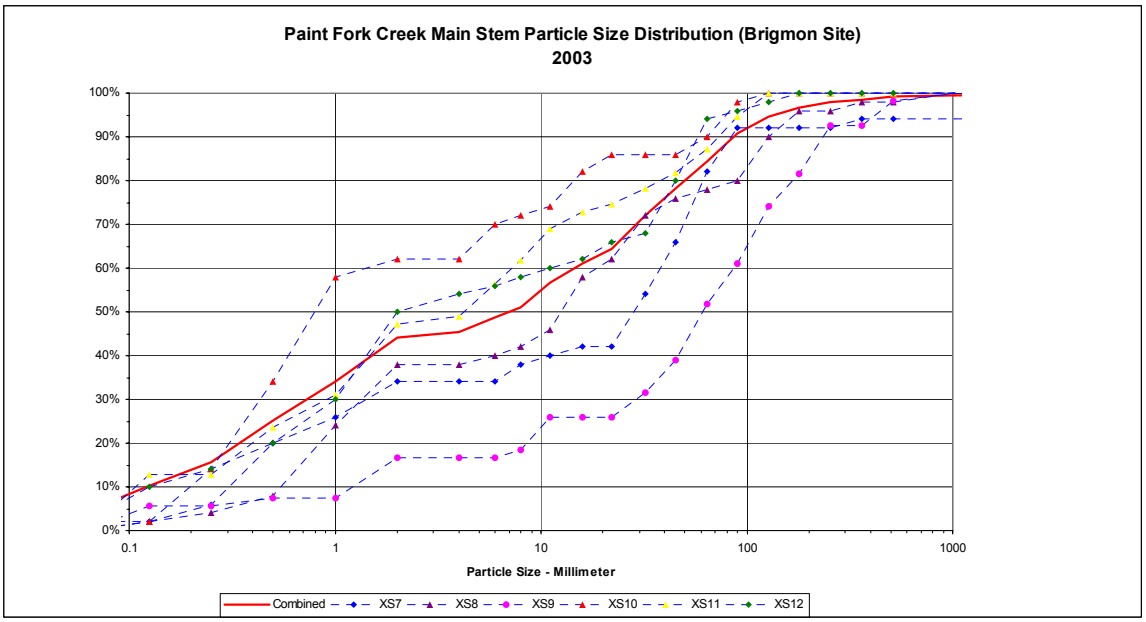
- Cross Section #1. UT #2, Station 0+07, midpoint of riffle
- Cross Section #2. UT #2, Station 5+95, midpoint of riffle
- Cross Section #3. UT #2, Station 6+42, midpoint of riffle
- Cross Section #4. UT #1, Station 4+97, midpoint of riffle
- Cross Section #5. UT #1, Station 5+34, midpoint of riffle
- Cross Section #6. UT #1, Station 11+26, midpoint of riffle
- Cross Section #7. Paint Fork Creek, Upstream of Station 0+00, midpoint of run
- Cross Section #8. Paint Fork Creek, Station 0+00, midpoint of pool
- Cross Section #9. Paint Fork Creek, Station 1+24, midpoint of riffle
- Cross Section #10. Paint Fork Creek, Station 4+70, midpoint of run
- Cross Section #11. Paint Fork Creek, Station 7+24, midpoint of glide
- Cross Section #12. Paint Fork Creek, Station 14+75, midpoint of run

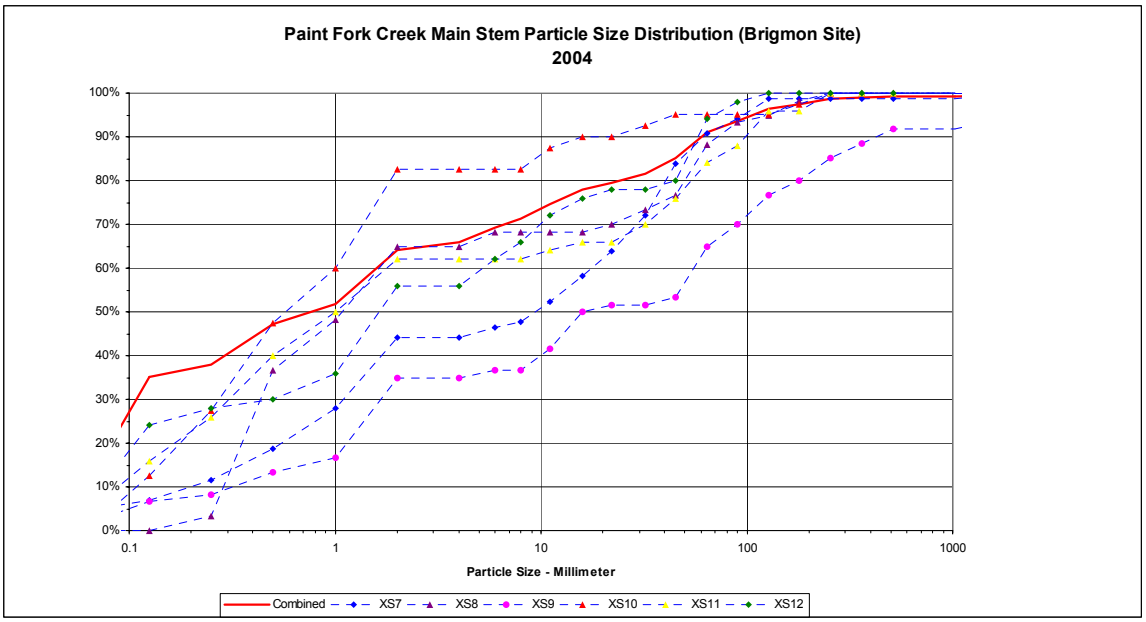
The majority of the cross sections have remained intact based on comparisons with as-built data and visual observations. Several benchmarks associated with the as-built surveys were not found; therefore exact data comparisons were not feasible. These areas included Cross Sections #7 through #12 along the main stem of Paint Fork Creek, Cross Section #6 along UT #1, and Cross Section #2 along UT #2. The Year 2003 data is used for comparison to Year 2004 data. Based on the comparison of Year 2004 cross section survey results with the Year 2003 cross section results, Cross Sections #2, #10, and #12 appears to be slightly aggrading while Cross Section #11 appears to be slightly degrading. Cross Section #4 was nearly identical with the as-built data. All of the cross sections appeared stable with little or no active bank erosion. Survey data will also vary depending on actual location of rod placement and alignment; however, this information should remain similar in overall appearance. The cross section comparison is presented in Appendix B.

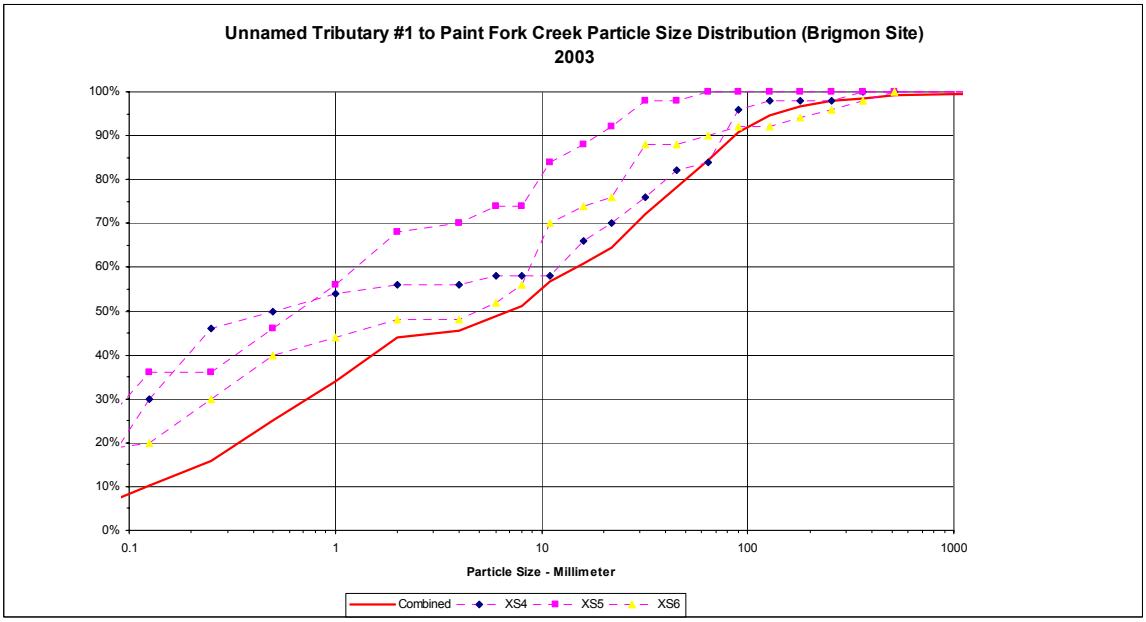
Pebble counts were taken at each cross section as a means to determine the extent of change in bed material during the monitoring period. However, only pebble counts taken at riffle sections will be utilized to classify the streams. Existing data was available for Paint Fork Creek; though, the exact locations of the sampling were not consistent with the locations used during the monitoring assessment. No prior information existed for its two tributaries. The pebble counts taken during the Year 2003 monitoring period noted that the D_{50} (50 percent of the sampled population is equal to or finer than the representative particle diameter) for the riffle sections of Paint Fork Creek was approximately 60.9 mm, which is indicative of a gravel-bed stream. The D_{50} for UT#1 was 0.9 mm,

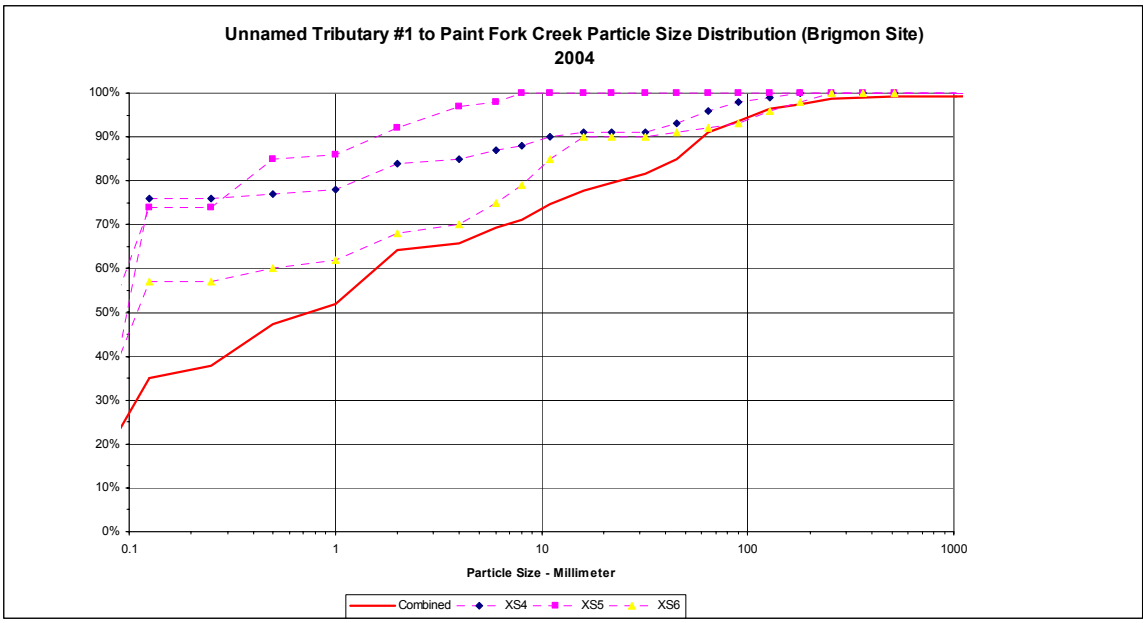
which is characteristic of a sand-bed stream and the D_{50} for UT#2 was 10.2 mm, which is characteristic of a gravel-bed stream.

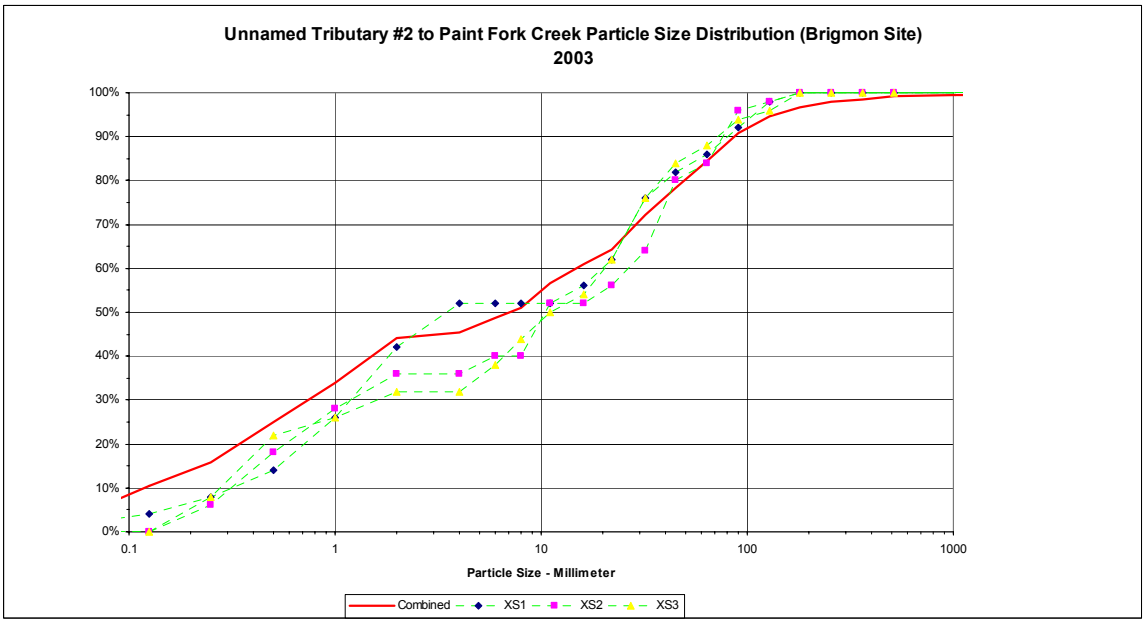
The Year 2004 pebble counts for the riffle sections noted a D_{50} of 14.3 mm for Paint Fork Creek, a D_{50} of 0.1 mm for UT#1, and a D_{50} of 4.3 mm for UT#2. The results of these pebble counts indicate a decrease in the size of bed material. Since no significant amount of erosion was observed on site, the accumulation of finer material from 2003 to 2004 may be attributed to watershed problems outside and upstream of the Brigmon Site. It could also be a result of increased streamflow associated with 2003. Approximately 10 bankfull events were documented in 2003, while in 2004 only two bankfull events have been documented (USGS, 2004). The increased streamflow in 2003 could have distributed the finer material either on the floodplain or farther downstream, thus resulting in a higher D_{50} in 2003 than in 2004.

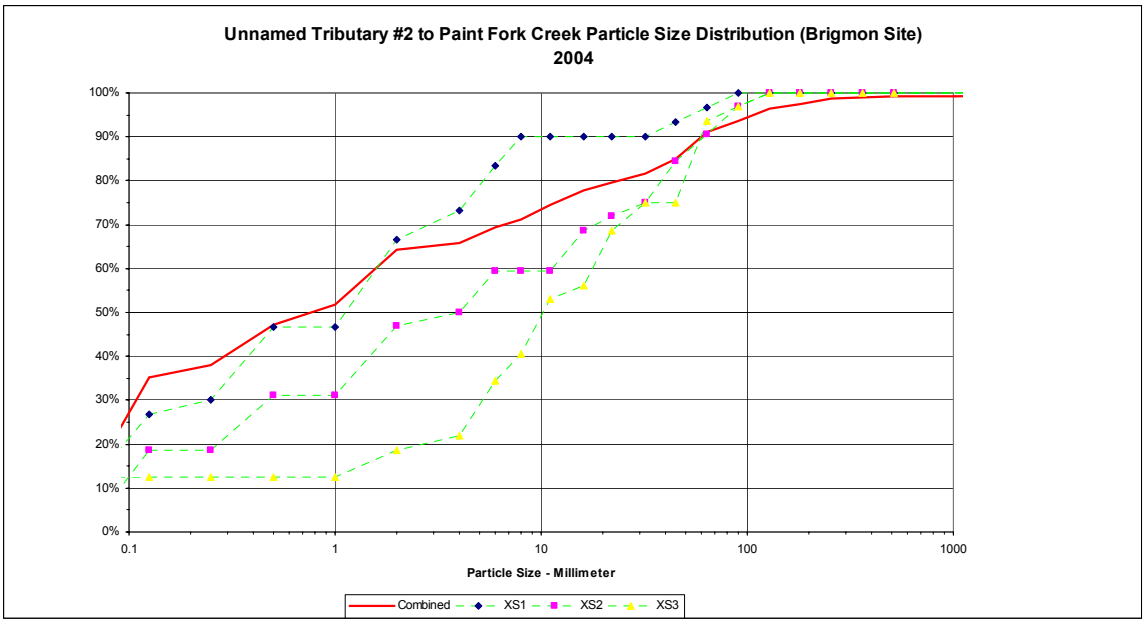



Paint Fork Creek Main Stem Particle Size Distribution (Brigmon Site)
2004
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.1
1
10
100
1000
Particle Size - Millimeter
Combined
XS7
XS8
XS9
XS10
XS11
XS12


Unnamed Tributary #1 to Paint Fork Creek Particle Size Distribution (Brigmon Site)
2003
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.1
1
10
100
1000
Particle Size - Millimeter
Combined
XS4
XS5
XS6


Unnamed Tributary #1 to Paint Fork Creek Particle Size Distribution (Brigmon Site)
2004
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.1
1
10
100
1000
Particle Size - Millimeter
Combined
XS4
XS5
XS6


Unnamed Tributary #2 to Paint Fork Creek Particle Size Distribution (Brigmon Site)
2003
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.1
1
10
100
1000
Particle Size - Millimeter
Combined
XS1
XS2
XS3



Longitudinal profile surveys were conducted on predetermined segments of all three streams. Bank stability was assessed during the longitudinal profile survey. Several areas of active scouring and/or sloughing were observed in 2003. These areas were re-assessed in 2004. Descriptions and evaluations of these areas are as follows:

Paint Fork Creek (Main Stem)

- Approximately 500 feet upstream of Station 0+00. Scour was observed around rootwad on left bank in 2003. This area remained stable in 2004, and no remedial actions are warranted at the current time.
- Stations 2+81 to 3+60. The formation of a transverse bar was observed in the middle of channel through the riffle section in 2003 and again in 2004. Two potential cutoff areas were observed. This bar may develop into center bar under low flow conditions. Based on current conditions, this area does not pose any threats to the overall stabilization of the channel.
- Cross Section #10 at Station 4+70. Active erosion was noted along left side of cross vane arm in 2003. This area remained stable in 2004.
- Cross Section #11 at Station 6+16. Active erosion was noted along cross vane arms on both sides of channel in 2003. This erosion has led to undercutting of the vane arms; however, the cross vane continues to maintain the thalweg in the middle of the channel through this section. This area remained stable in 2004.
- Stations 9+25 through 10+00. Active erosion was noted along left bank across from large boulders associated with roadfill in a large curve in 2003. This area remained stable in 2004.
- Station 14+67. The existing elevation of the header rock at a cross vane immediately downstream of Cross Section #12 is higher than the adjacent vane arms, which has resulted in the formation of a center bar immediately upstream of the vane. Active erosion was noted along both arms of the vane in 2003. Vegetation has stabilized this area in 2004. It was observed in 2004 that one of the boulders along the left arm has failed, though it does

not appear to be jeopardizing the overall structure. No remedial actions are necessary at this time.

UT #1 to Paint Fork Creek

- Stations 0+26 to 0+36. The banks along the left side (facing downstream) appeared to be undercut approximately one foot in 2003. This area appeared stable in 2004, and no remedial action is necessary.
- Stations 0+32 to 0+54. The banks along the left side were sloughing, and subsequently failing in 2003 and 2004. This area has stabilized somewhat in 2004 due to the increased establishment of vegetation.
- Stations 1+09 to 1+35. The existing coir log along the left bank appeared to be undermined in 2003 and 2004. This area is currently stable and no remedial actions are warranted at this time.
- Stations 2+65 to 3+30. Undercut banks were observed along the left side of the channel in 2003 and 2004; however, the adjacent bedrock is providing control and stability. These overhangs appear to be providing excellent amphibian habitat. No remediation is required at this time.
- Stations 3+65 to 4+00. Bank erosion was observed along left bank in 2003 and 2004. This area appears to be stabilizing with the increased establishment of vegetation.
- Stations 4+43 to 4+50. Erosion was present at header log and left banks were undercut approximately one foot in 2003 and 2004. The rootwad is stable; however, scour is evident both upstream and downstream of the structure. The structure remains intact and no remedial action is needed at this time.
- Stations 5+10 to 5+20. The existing coir log appeared to have failed prior to 2003, had increased localized scour. Based on observations in 2004, a mid-channel bar has formed. This area remains stable due to increased establishment of vegetation.
- Stations 5+60 to 5+70. It was noted in 2003 that the left bank was eroding and the existing vegetation was being compromised. The erosion was observed again in 2004. It was also noted that a tree is about to fall into the stream in this area.
- Station 8+00. The existing coir log was observed to be unstable in 2003 and 2004; however, erosion was minimal. No remedial action is warranted at this time.
- Stations 9+13 to 9+23. The existing coir log failed in 2003 and bank erosion was present. The establishment of vegetation has stabilized this area in 2004.
- Stations 10+06 to 10+17. The existing coir log was unstable in 2003 and 2004; however erosion was minimal. No remedial action is needed at this time.
- Stations 11+17 to 11+30. A center bar was noted at low flow conditions in 2003 and 2004. This bar may be the result of a failed coir log. This area is stable, and no remedial action is necessary.
- Stations 11+38 to 11+58. Bank erosion was noted along right side of channel in 2003. The establishment of vegetation has stabilized this area in 2004. A cast- iron pipe enters the channel from the right at Station 11+48. This pipe has subsequently broken into two pieces and should be removed as per the landowner's requests.
- Station 11+73. A one-inch pipe was noted extending from the right bank which may create hazardous conditions for future surveys. This pipe was flagged with surveyor's ribbon.

UT #2 to Paint Fork Creek

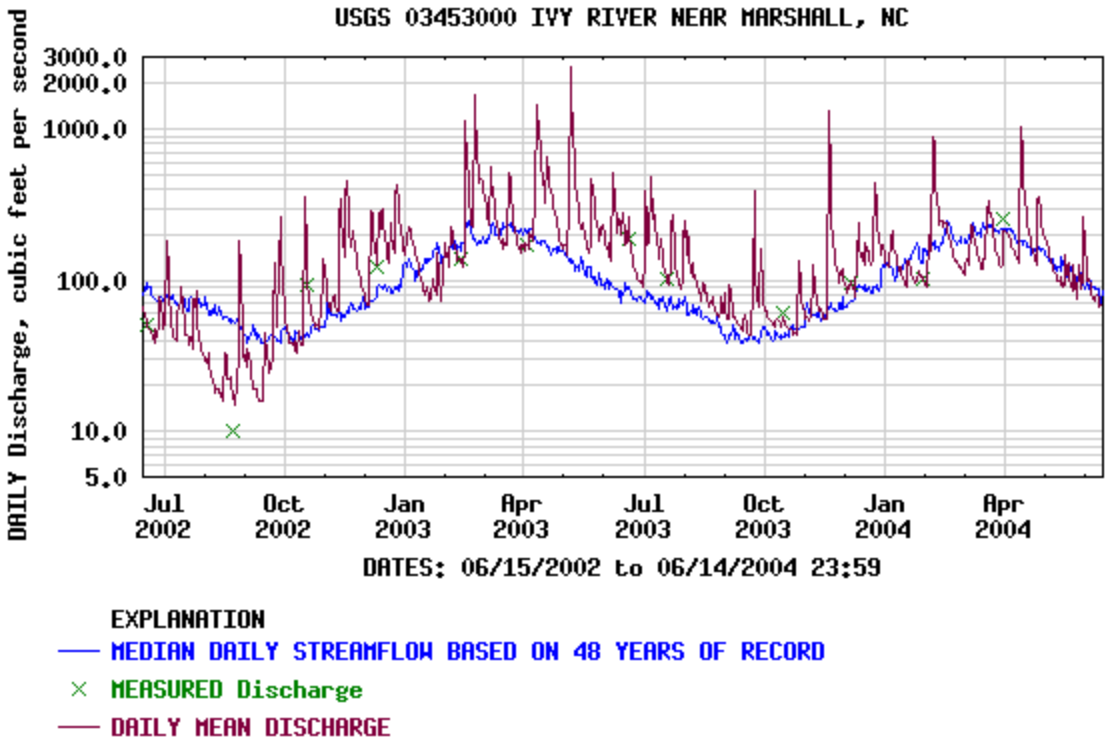
- Stations 0+07 to 0+15. In 2003 the existing coir log along left bank was observed to be undermined. This appears to have been caused by large debris jam at the property line fence situated immediately upstream of the cross section. The coir log was still undermined in 2004, but this area has remained stable. The coir logs along the right bank were also experiencing active scour and erosion in 2003. This area appeared stable in 2004. No remedial action is warranted at this time.
- Station 1+16. Several large tree limbs had fallen across the fence denoting the Conservation Easement area in 2003. The large tree limbs were removed from the fence before the 2004 monitoring period and the fence remains intact.
- Stations 1+90 to 2+07. A center bar was observed in the channel in 2003. No observed impacts had occurred to either bank. In 2004, water in the channel was noted to be following the left side of the channel while the right side of the channel was dry. The banks remained stable.
- Station 2+85. Localized scour was observed on left bank immediately upstream of culvert in 2003. This area has stabilized in 2004.
- Stations 3+01 to 3+10. Undercut banks along the right side of the channel were observed in 2003. No active erosion or scour was noted 2003 or 2004.
- Stations 4+79 to 5+10. The existing coir log appeared to be undermined along the left side of the channel in 2003 and again in 2004. The log remains stable and no remedial action is needed at this time.
- Station 5+11. Active scour and erosion was observed immediately upstream of rootwad in 2003. The establishment of vegetation has stabilized this area in 2004.
- Stations 5+50 to 5+75. Active scour and erosion was present with the rootwads on the left side of the channel in 2003. A drainage pipe from one of the watering troughs enters the stream through this area. The establishment of vegetation has stabilized this area in 2004.
- Station 5+90. The existing coir log appeared to be undermined and near collapse in 2003. Both banks along the channel were also degrading. This area appeared stable in 2004 due to the establishment of vegetation.
- Stations 6+00 to 7+06. Localized scour was observed along both banks in 2003. The left bank was also failing at Station 6+94 in 2003. The establishment of vegetation has stabilized the entire area in 2004.

2.3.2 Climatic Data

Monitoring requirements state that at least two bankfull events must be documented through the five-year monitoring period. No surface water gages exist on Paint Fork Creek or its tributaries. A review of known U.S. Geological Survey (USGS) surface water gages identified two gages within 10 miles of the mitigation site: one along the French Broad River approximately one mile downstream of Marshall and one along the Ivy River at the US 25/70 crossing between Marshall and Weaverville, immediately northwest of the Madison and Buncombe County boundary.

The Ivy River gage was utilized for this report since it is downstream and part of the overall watershed of Paint Fork Creek. It was also the smaller of the two gages (158 square-mile drainage area as compared to the 1,332 square-mile drainage area associated with the French Broad). The Ivy

River gage more accurately reflects hydrology and precipitation in the project area. It is situated in USGS Hydrologic Unit 06010105. Datum of the gage is 1,700.41 feet above sea level NGVD29. Based on the drainage area associated with the gage, the correlated bankfull discharge according to the NC Rural Mountain Regional Curves (USACE, 2003) is between 450 and 500 cubic feet per second (cfs). A review of peak flows was conducted for the period between June 2002 and June 2004. According to the graph, there were 13 bankfull events occurring during this period, with 10 of the events happening in 2003. Approximately six of these events over the two year period exceeded 1,000 cfs, well above the bankfull discharge. The USGS graph depicting these peak flows is presented below.



2.4 Conclusions

Overall, Paint Fork Creek and its two tributaries remain stable. Areas of degradation exist along all three reaches; however, most of these areas have been stabilized with the establishment of vegetation. Common areas of failure were associated with the coir logs, which have been the main contributors of scour and erosion.

The majority of the cross sections along all three reaches remain intact. Cross Sections #2, #10, and #12 appeared to be slightly aggrading based on the comparison of 2004 data to 2003 data. Cross Section #11 appears to be slightly degrading. It is anticipated that the channel will continue to aggrade and degrade over the course of time due to overall changes in the watershed.

Based on stream gage information obtained from the USGS, the Brigmon Site has met the required monitoring protocols for hydrology. No supplemental work is warranted at this time.

3.0 VEGETATION

3.1 Success Criteria

The NCDOT will monitor the Paint Fork Creek Site for five years or until success criteria is met. A 320 stems per acre survival criterion for planted seedlings was used to determine success for the first three years. The required survival criterion decreases by 10 percent per year after the third year of vegetation monitoring (i.e., for an expected 290 stems per acre for year 4, and 260 stems per acre for year 5). The number of plants of one species will not exceed 20 percent of the total number of plants of all species planted.

3.2 Description of Species

According to the As-Built Report for the Brigmon Mitigation Site, Paint Fork Creek, Madison County (2000), the following species were planted along the streambanks:

Live Stakes

Black willow (*Salix nigra*)
Silky willow (*Salix sericea*)
Silky dogwood (*Cornus amomum*)

Bare Rooted Trees

Black willow (*Salix nigra*)
Red-osier dogwood (*Cornus stonoifera*)
Willow oak (*Quercus phellos*)
River birch (*Betula nigra*)
Black walnut (*Juglans nigra*)
Persimmon (*Diospyros virginiana*)
Green ash (*Fraxinus pennsylvanica*)

Permanent Seeding Mix

Sensitive fern (*Onoclea sensibilis*)
Joe pye weed (*Eupatorium fistulosa*)
Swamp milkweed (*Asclepias incarnata*)
Eastern gamagrass (*Tripascum dactyloides*)
Creeping spikerush (*Eleocharis palustris*)
Green bulrush (*Scirpus atrovirens*)
Hop sedge (*Carex lupilina*)
Rice cut grass (*Leersia oryzoides*)
Soft rush (*Juncus effusus*)
Softstem bulrush (*Scirpus validus*)
Three square spikerush (*Scirpus americanus*)
Virginia wild rye (*Elymus virginicus*)
Woolgrass (*Scirpus cyperinus*)
Deertongue (*Panicum clandestinum*)
Button bush (*Cephalanthus occidentalis*)
Elderberry (*Sambucus canadensis*)
Red chokeberry (*Aronia arbutifolia*)
Silky dogwood (*Cornus amomum*)
Winterberry (*Ilex verticillata*)
Blackgum (*Nyssa sylvatica*)
Green ash (*Fraxinus pennsylvanica*)
Red maple (*Acer rubrum*)
Pin oak (*Quercus palustris*)
Black cherry (*Prunus serotina*)
Silver maple (*Acer saccharium*)

3.3 Plot Descriptions

Several vegetation plots were installed during and immediately after construction. Since these plots were not staked and information regarding species was not available, eight new plots were randomly established along the left streambank and floodplain within the project area. No plots were established on the right streambank due to the narrow buffer and on-going right-of-way

maintenance associated with Paint Fork Road. These eight plots included two large 1,000 square-foot areas along the left bank of Paint Fork Creek (Tree Plot A and Tree Plot B) and six one-meter square (12.1 square-foot) plots randomly placed within the easement area. Stakes were placed at all four edges of the 1,000 square-foot plots and at the two opposing edges of the 12.1 square-foot plots. These stakes were flagged and labeled for future identification. Vegetation (trees) within the two 1,000 square-foot plots were flagged, tagged, and numbered for future assessments. The vegetation associated with the 12.1 square-foot plots were only flagged. Due to the narrow riparian area and ease of access, the locations of these plots were not surveyed.

Tree Plot A is situated approximately 200 linear feet upstream of the Brigmon driveway bridge. It is oriented in a north-south direction along the right streambank between Cross Sections #7 and #8. Black willow, silky willow, silky dogwood, and green ash were observed in the plot. Section 3.4 provides numerical counts for species found within Tree Plots A and B, as well as the six small plots.

Tree Plot B is located on the right streambank near Station 5+00. It is oriented in a west-east direction. Black willow, silky dogwood, and green ash were the only species observed in the plot.

3.4 Results of Vegetation Monitoring

Plot No. (Type)	Black Willow	Silky Willow	Silky Dogwood	Red-osier Dogwood	Willow Oak	River Birch	Black Walnut	Persimmon	Green Ash	Total 2003 (Year 1)	Total 2004 (Year 2)	Total 2005 (Year 3)	Total 2006 (Year 4)	Total 2007 (Year 5)	Total (at planting)	Density (Trees/Acre)
Plot A (100'x10')	3	2	1						1	8	7				8	305
Plot B (100'x10')	2		7						8	20	17				20	741
										AVERAGE DENSITY (2004)						**523**

Plot No. (Type)	Black Willow	Silky Willow	Silky Dogwood	Red-osier Dogwood	Willow Oak	River Birch	Black Walnut	Persimmon	Green Ash	Total 2003 (Year 1)	Total 2004 (Year 2)	Total 2005 (Year 3)	Total 2006 (Year 4)	Total 2007 (Year 5)	Total (at planting)	Density (Trees/Acre)
Plot 1 (1 meter grid)									1	1	1				1	3,600
Plot 2 (1 meter grid)			1							1	1				1	3,600
Plot 3 (1 meter grid)									1	1	1				1	3,600
Plot 4 (1 meter grid)			1							1	1				1	3,600
Plot 5 (1 meter grid)										0	0				0	0
Plot 6 (1 meter grid)									1	1	1				1	3,600
										AVERAGE DENSITY (2004)						**2,880**

Site Notes:
Vegetation plots were established during the first year of monitoring. Several plots were installed during construction; however, these plots could not be located. Canary grass (*Phalaris* sp.) dominates the herbaceous stratum at the site, especially along Paint Fork Creek. This species can be invasive; however, it provides excellent ground cover and rooting stability during the growing season. Specific notes regarding each plot are presented below.

Tree Plot A. Two volunteer spice bushes (*Lindera benzoin*) were observed in the plot. Herbaceous species included canary grass, Japanese honeysuckle (*Lonicera japonica*), blackberry (*Rubus* sp.), vetch (*Vicia* sp.), goldenrod (*Solidago* sp.), fescue (*Festuca* sp.), rush (*Juncus* sp.), meadowrue (*Thalictrum* sp.), plantain (*Plantago* sp.), onion (*Allium* sp.), and henbit (*Lamium* sp.). No silky dogwood, red-osier dogwood, willow oak, black walnut, or persimmon species were observed in this plot in 2004.

Tree Plot B. No woody volunteers were observed. Herbaceous species included canary grass, blackberry, fescue, Japanese honeysuckle, plantain, henbit, and chickweed (*Stellaria* sp.). No silky willow, red-osier dogwood, willow oak, river birch, black walnut, or persimmon species were observed in this plot in 2004.

Plot 1. Fescue (*Festuca* sp.), goldenrod (*Solidago* sp.), rose (*Rosa* sp.), and blackberry (*Rubus* sp.) were observed in and immediately adjacent to the vegetation plot. No other woody stems were noted within five feet of the vegetation plot.

Plot 2. Fescue, jewelweed (*Impatiens capensis*), blackberry, clover (*Trifolium* sp.), and goldenrod were observed in and immediately adjacent to the vegetation plot. No other woody stems were noted within five feet of the vegetation plot.

Plot 3. Fescue and jewelweed were observed in and immediately adjacent to the vegetation plot. In addition, four green ash and three hackberry (*Celtis laevigata*) were noted within five feet of the vegetation plot.

Plot 4. Fescue, goldenrod, jewelweed, plantain (*Plantago* sp.), and Japanese honeysuckle (*Lonicera japonica*) were observed in and immediately adjacent to the plot. Three black willow, two river birch, one silky dogwood, and one tulip poplar (*Liriodendron tulipifera*) stems were noted within five feet of the vegetation plot.

Plot 5. Canary grass, fescue, Japanese honeysuckle, plantain, and rush (*Juncus* sp.) were observed in and immediately adjacent to the plot. No other woody stems were noted within five feet of the vegetation plot.

Plot 6. Canary grass, fescue, and blackberry were observed in and immediately adjacent to the plot. In addition, one silky dogwoods and one green ash were noted within five feet of the vegetation plot.

3.5 Conclusions

The 2004 vegetation monitoring of the site resulted in an average density above the minimum required by the success criteria of 260 trees per acre.

4.0 BIOLOGICAL INDICATORS

Personnel with the Tennessee Valley Authority (TVA) were to conduct biological sampling along Paint Fork Creek and its two tributaries. It is unknown at this time whether or not the sampling has been conducted at the mitigation site. If this information becomes available, it will be inserted into the report at a later time.

5.0 OVERALL CONCLUSIONS

The Brigmon Site has met the required monitoring protocols for the second formal year of monitoring. Localized areas of active bank scour and erosion exist; however, these areas appear to be stabilizing with the increased establishment of vegetation. No remedial actions are warranted at this time.

Based on stream gage information obtained from the USGS, the Brigmon Site has met the required hydrologic monitoring protocols. The vegetative success criteria have also been met for the second formal year of monitoring. No biological sampling has been conducted to-date. It is unknown whether or not this sampling will be conducted as part of overall monitoring activities.

6.0 REFERENCES

North Carolina Wildlife Resources Commission (NCWRC), 2000. As-built Report for the Brigmon Mitigation Site, Paint Fork Creek, Madison County.

North Carolina Wildlife Resources Commission (NCWRC) and North Carolina Department of Transportation (NCDOT), 2003. Mitigation Site Monitoring Protocol for the NCWRC/NCDOT Mitigation Program.

Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

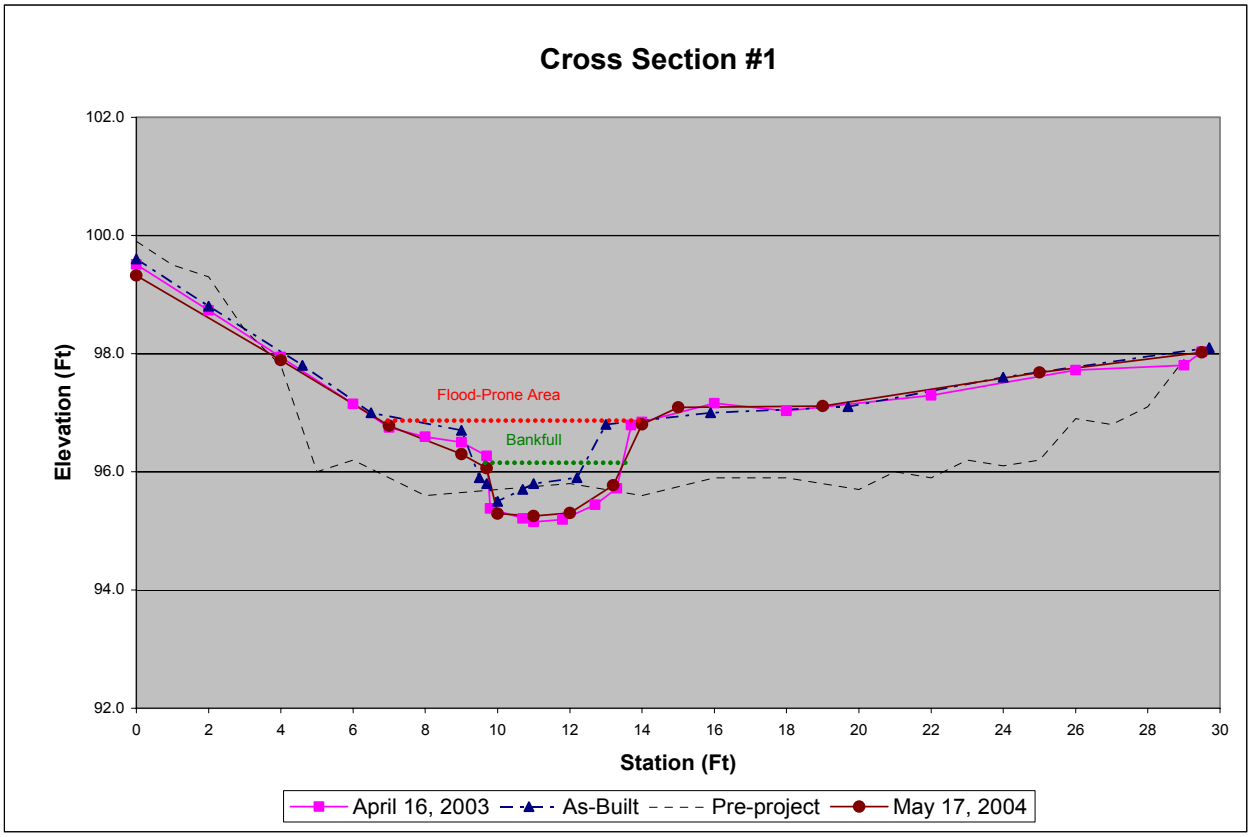
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

US Geological Survey (USGS), 2004. Real-time Data for USGS 03453000 Ivy River near Marshall, NC. http://waterdata.usgs.gov/nc/nwis.

APPENDIX A
AS-BUILT DATA

APPENDIX B

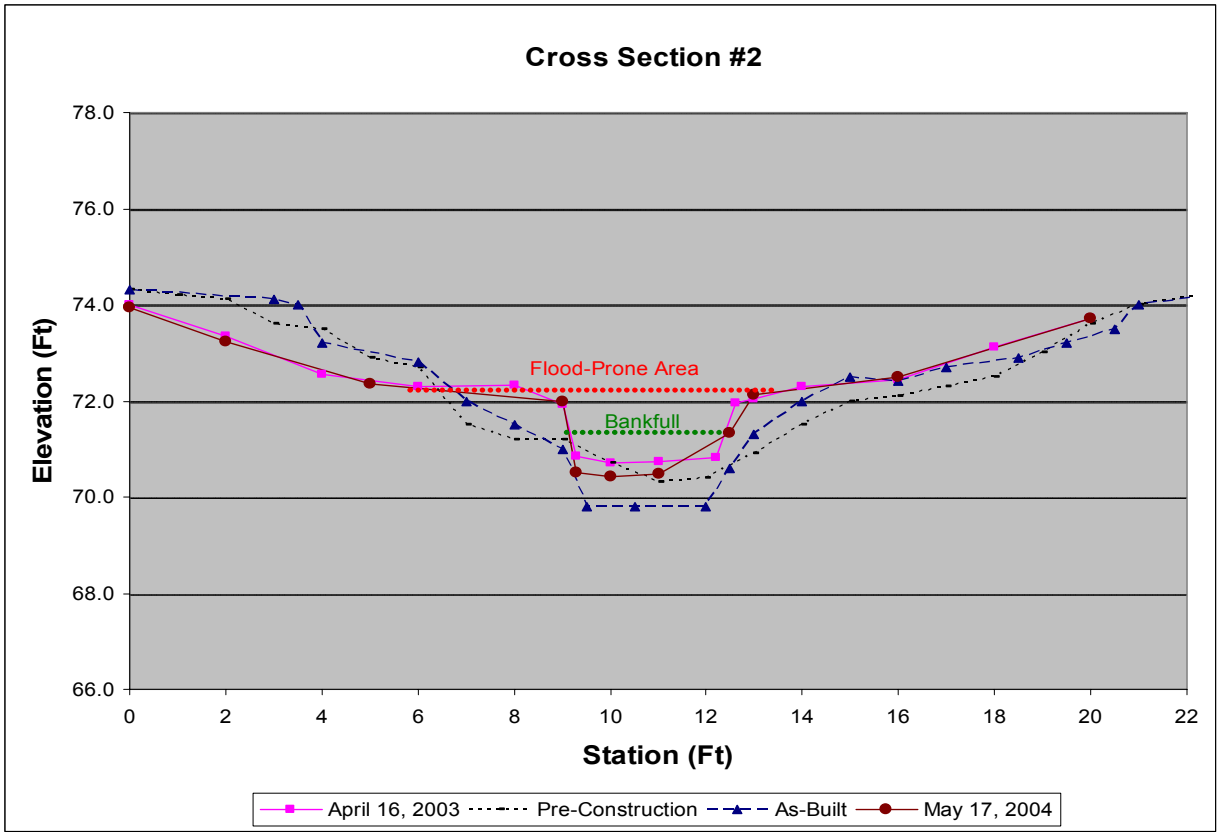
CROSS SECTIONS AND THE LONGITUDINAL PROFILE COMPARISON



Cross-Section #1 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	4.4	2.4
Maximum Bankfull Depth (ft)	1.4	0.8
Bankfull Mean Depth (ft)	1	0.6
Width/Depth Ratio	4.8	5.9
Entrenchment Ratio	5.9	2.4
Bankfull Width (ft)	4.6	3.7

Cross Section #1 at Station 0+07 along Unnamed Tributary #2. Tributary flows from left to right. 2004

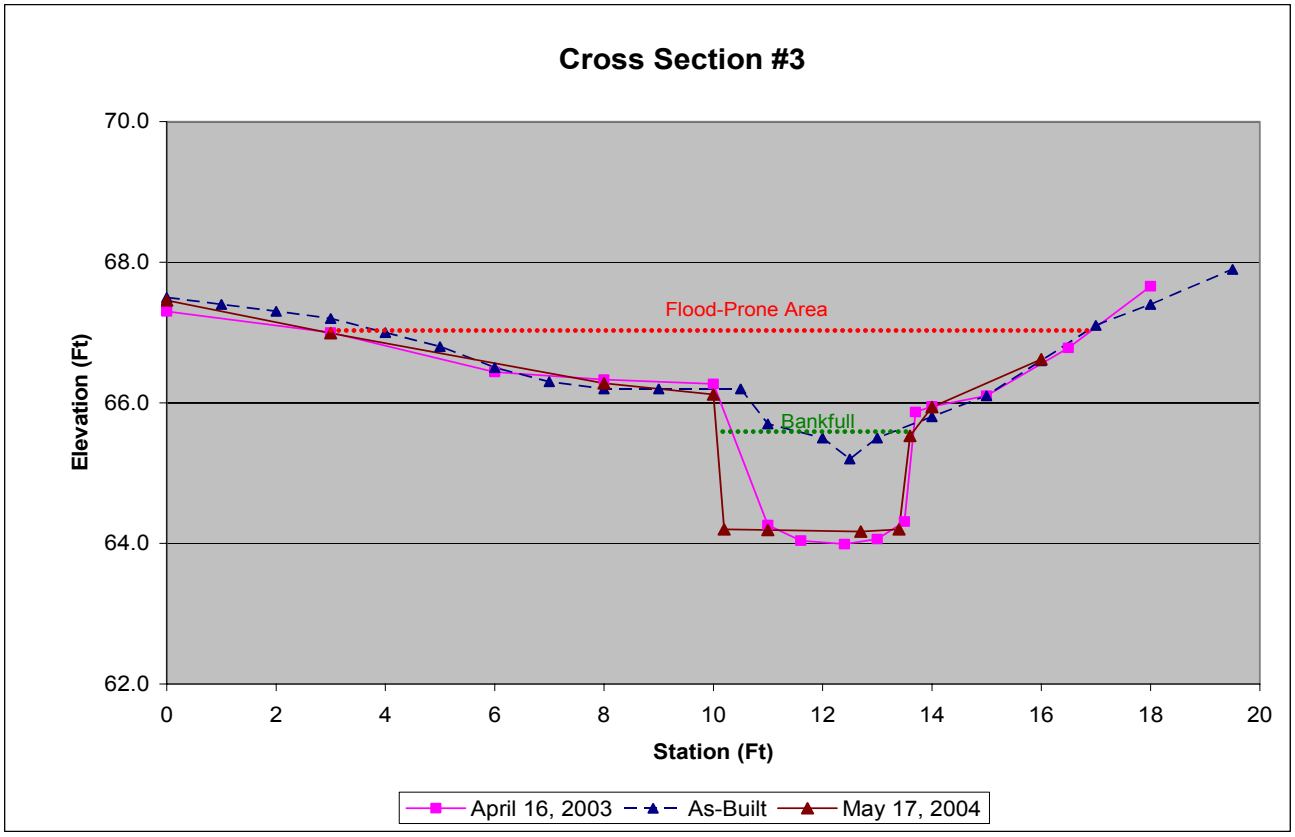
Cross Section #1 at Station 0+07 along Unnamed Tributary #2. Tributary flows from left to right. 2003



Cross-Section #2 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	4.1	2.2
Maximum Bankfull Depth (ft)	1.3	0.9
Bankfull Mean Depth (ft)	1	0.7
Width/Depth Ratio	4.4	5.1
Entrenchment Ratio	4	3
Bankfull Width (ft)	4.2	3.4

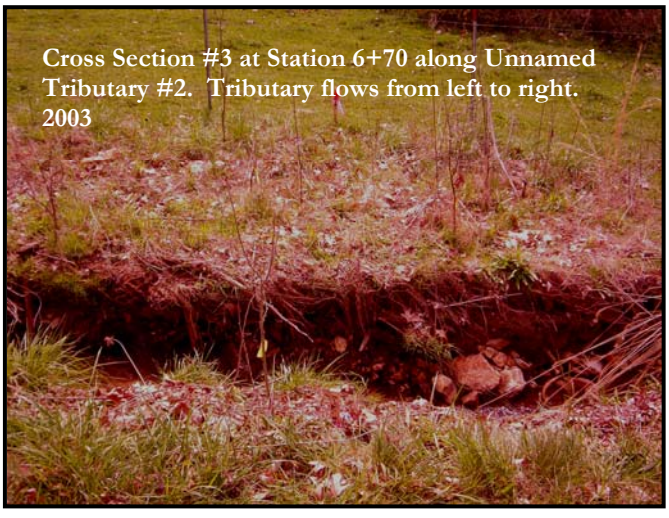
Cross Section #2 at Station 5+95 along Unnamed Tributary #2. Tributary flows from right to left. 2004

Cross Section #2 at Station 6+23 along Unnamed Tributary #2. Tributary flows from left to right. 2003

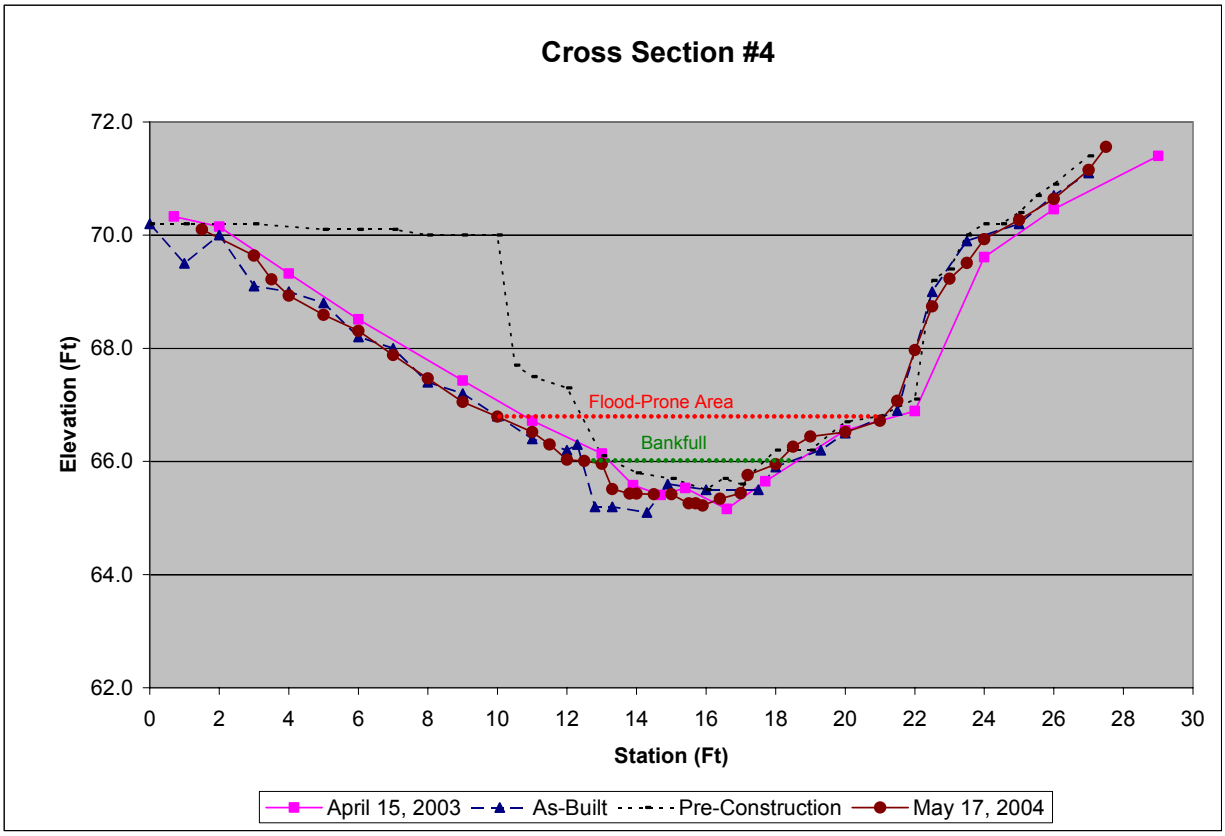


Cross-Section #3 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	5.6	4.5
Maximum Bankfull Depth (ft)	2	1.4
Bankfull Mean Depth (ft)	1.4	1.3
Width/Depth Ratio	2.7	2.8
Entrenchment Ratio	6.5	4.8
Bankfull Width (ft)	3.8	3.5

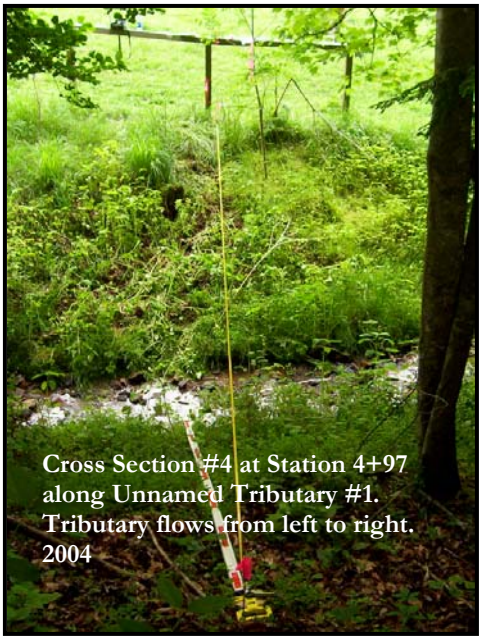
Cross Section #3 at Station 6+42 along Unnamed Tributary #2. Tributary flows from right to left. 2004



Cross Section #3 at Station 6+70 along Unnamed Tributary #2. Tributary flows from left to right. 2003

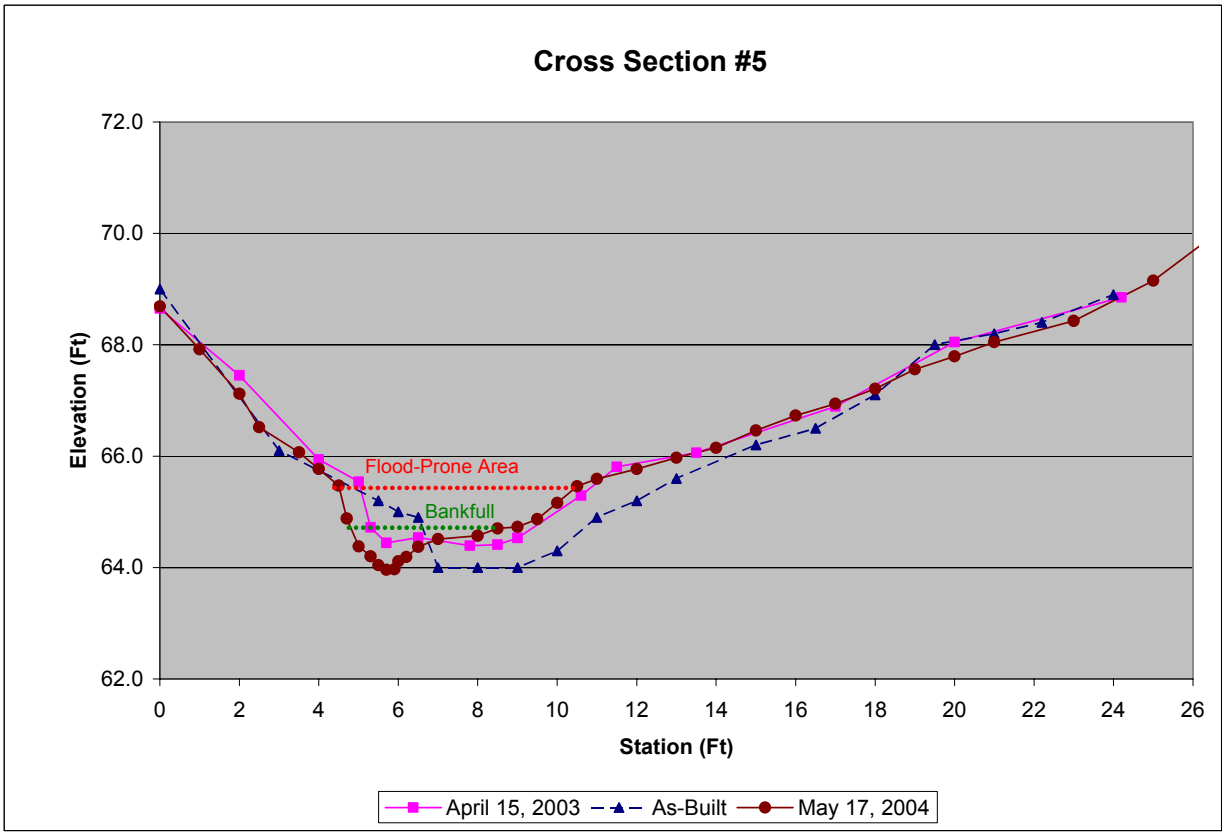


Cross-Section #4 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	6.3	2.8
Maximum Bankfull Depth (ft)	1.4	0.8
Bankfull Mean Depth (ft)	0.7	0.5
Width/Depth Ratio	11.3	13.6
Entrenchment Ratio	2	2.1
Bankfull Width (ft)	8.4	6.1

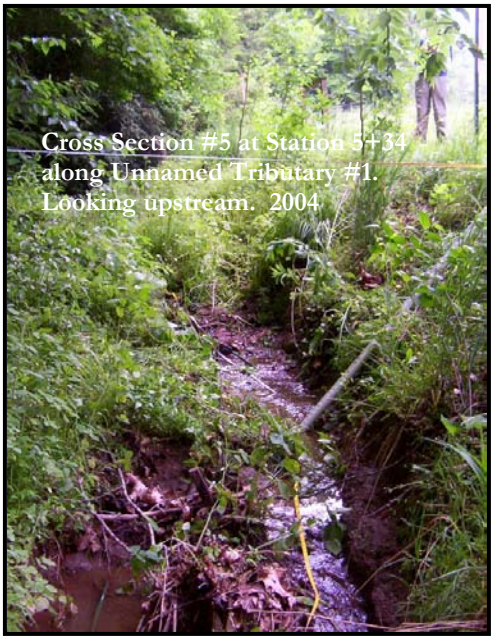


Cross Section #4 at Station 4+97 along Unnamed Tributary #1. Tributary flows from left to right. 2004

Cross Section #4 at Station 4+84 along Unnamed Tributary #1. Tributary flows from right to left. 2003

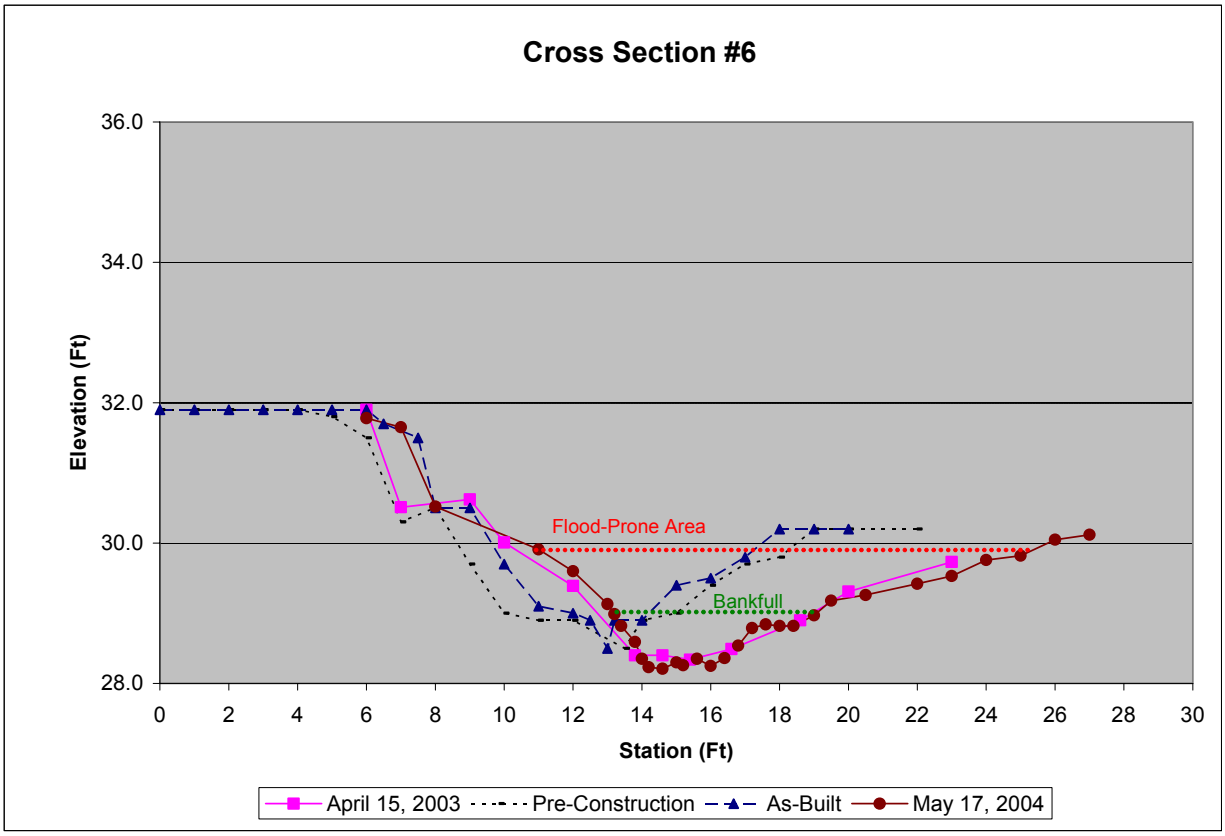


Cross-Section #5 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	6.9	1.3
Maximum Bankfull Depth (ft)	1.4	0.8
Bankfull Mean Depth (ft)	1	0.3
Width/Depth Ratio	7.4	13.6
Entrenchment Ratio	2.1	1.7
Bankfull Width (ft)	7.2	4.2

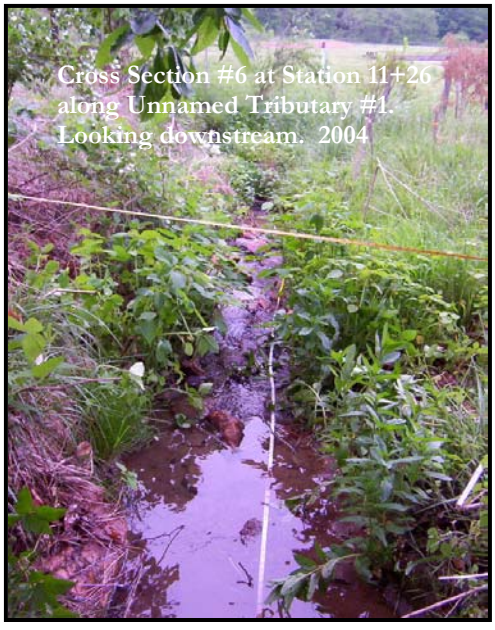


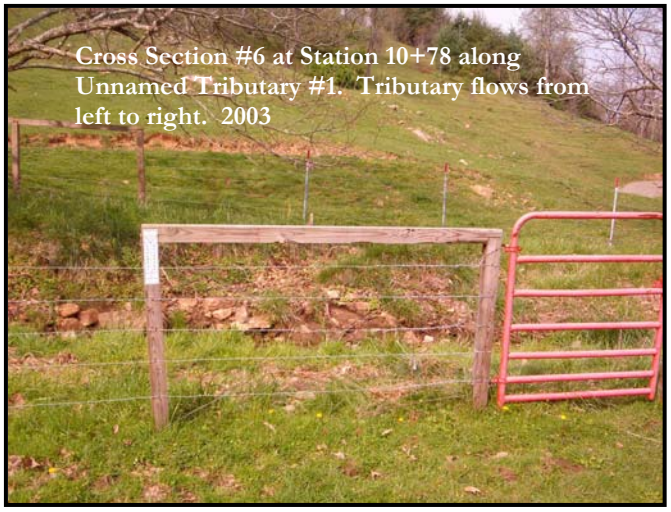
Cross Section #5 at Station 5+34 along Unnamed Tributary #1. Looking upstream. 2004

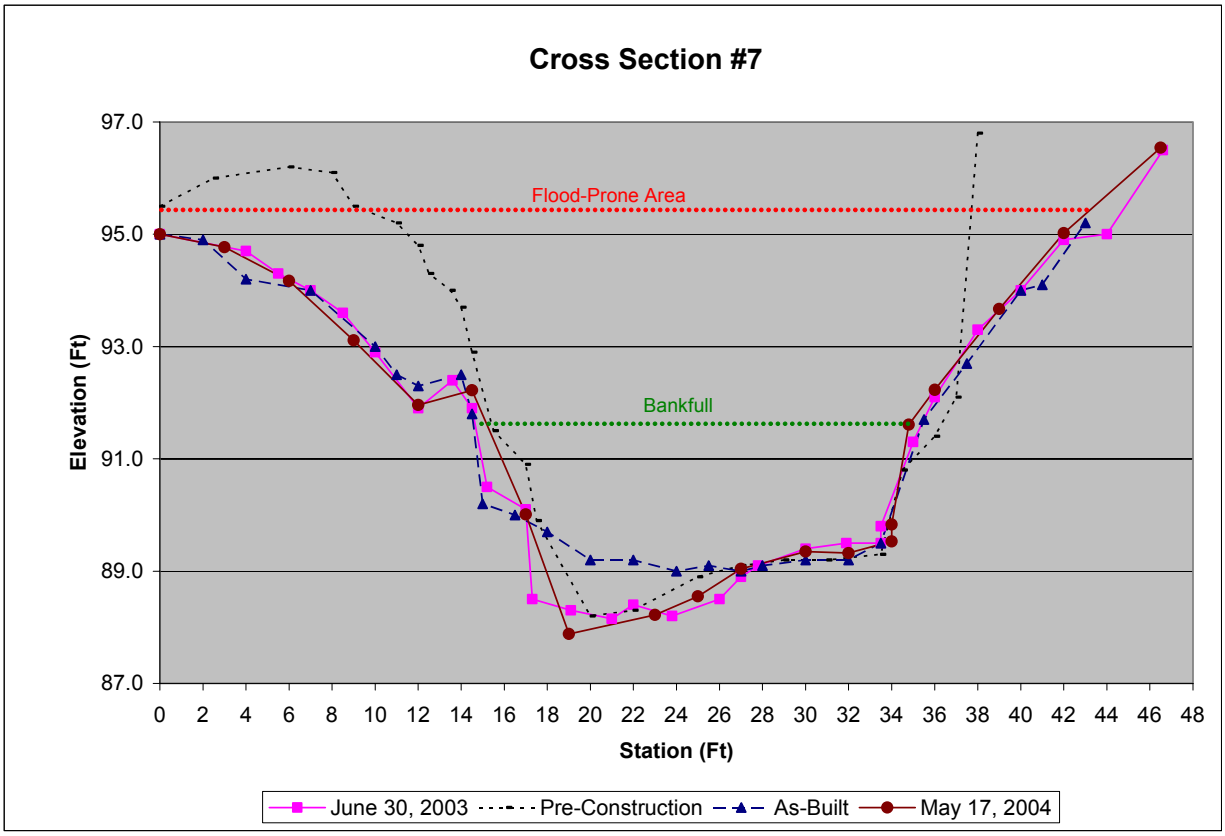
Cross Section #5 at Station 5+20 along Unnamed Tributary #1. Tributary flows from right to left. 2003



Cross-Section #6 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	4.8	2.5
Maximum Bankfull Depth (ft)	1	0.8
Bankfull Mean Depth (ft)	0.6	0.4
Width/Depth Ratio	12.8	13.4
Entrenchment Ratio	2.3	2.4
Bankfull Width (ft)	7.9	5.8


Cross Section #6 at Station 11+26 along Unnamed Tributary #1. Looking downstream. 2004

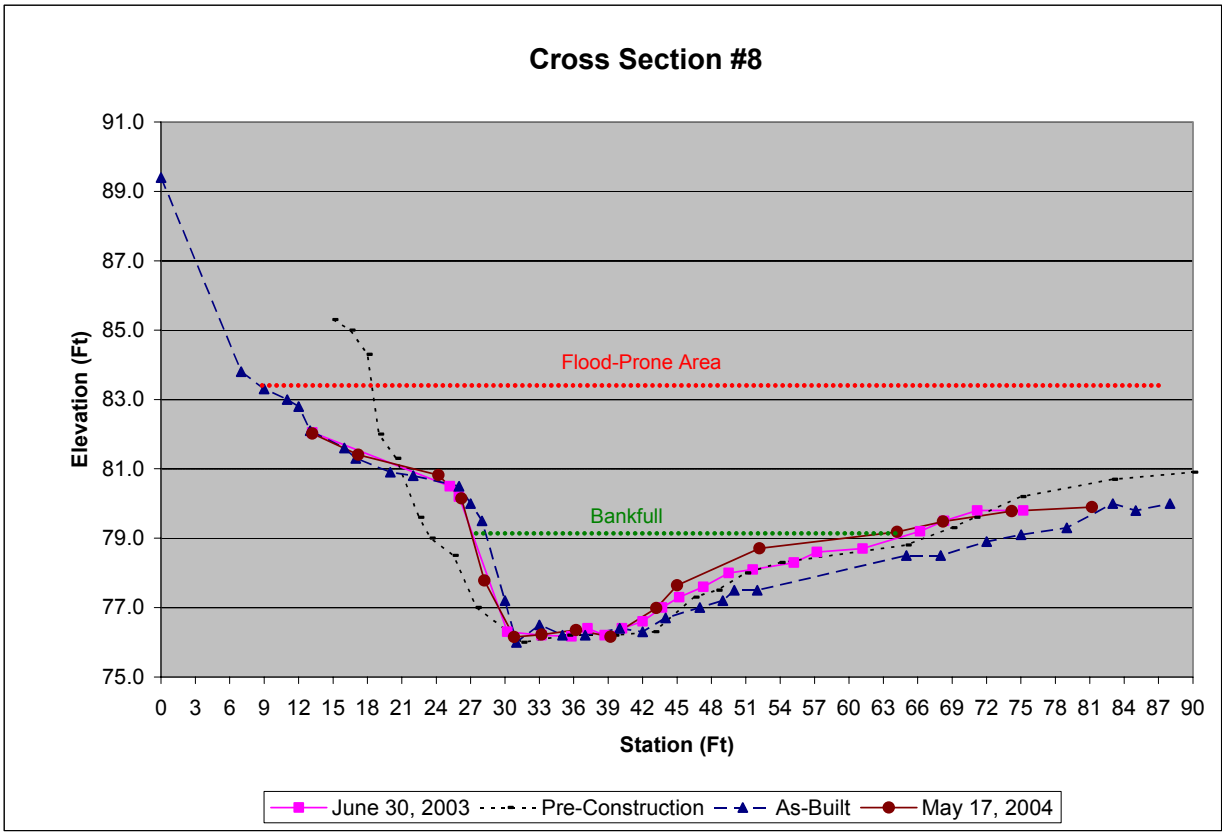

Cross Section #6 at Station 10+78 along Unnamed Tributary #1. Tributary flows from left to right. 2003



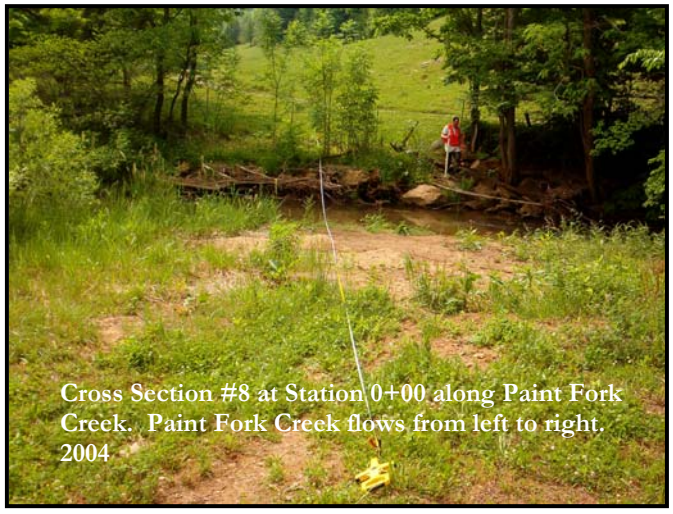
Cross-Section #7 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	22.2	50
Maximum Bankfull Depth (ft)	2	3.7
Bankfull Mean Depth (ft)	1.3	2.5
Width/Depth Ratio	12.7	7.7
Entrenchment Ratio	1.4	2.2
Bankfull Width (ft)	16.8	19.6

Cross Section #7 upstream from Station 0+00 along Paint Fork Creek. Paint Fork Creek flows from right to left. 2004

Cross Section #7 upstream from Station 0+00 along Paint Fork Creek. Paint Fork Creek flows from right to left. 2003

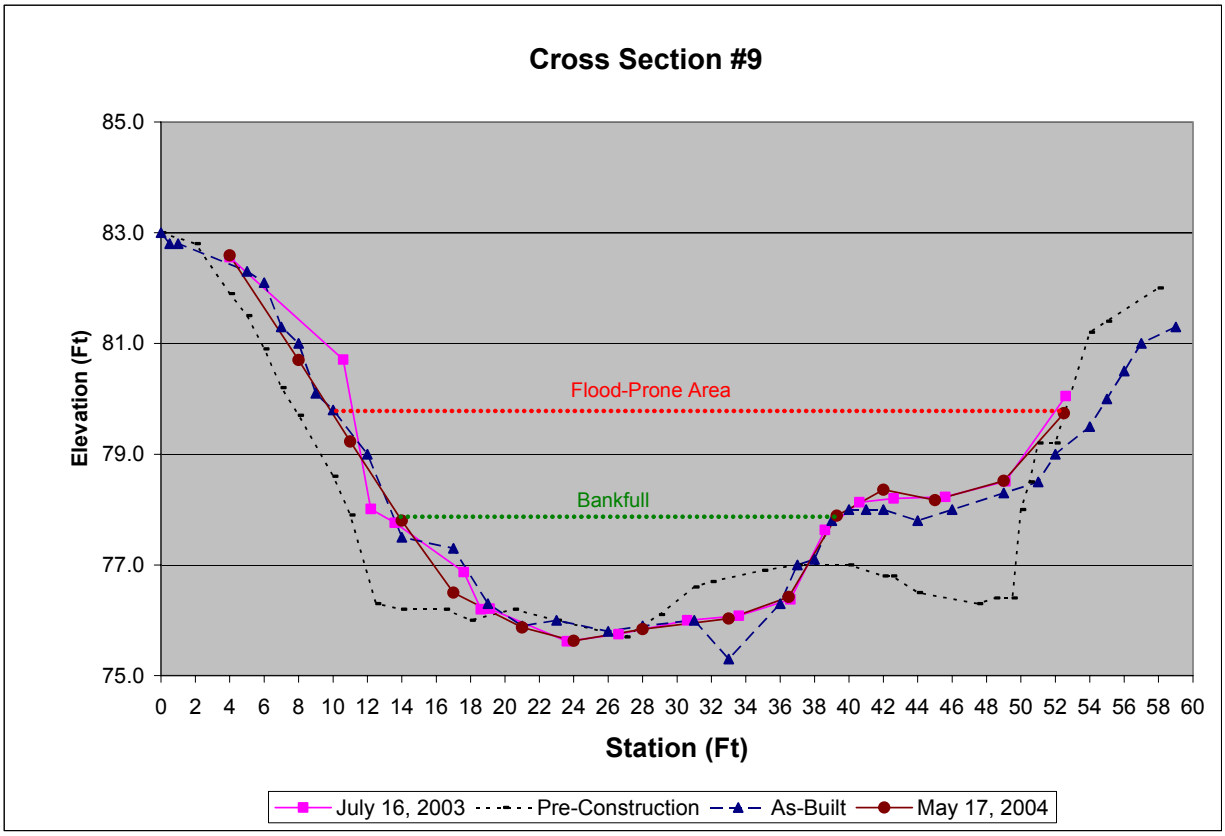


Cross-Section #8 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	26.6	55.1
Maximum Bankfull Depth (ft)	1.8	3
Bankfull Mean Depth (ft)	1.3	1.5
Bankfull Width (ft)	21.1	37.2



Cross Section #8 at Station 0+00 along Paint Fork Creek. Paint Fork Creek flows from left to right. 2004

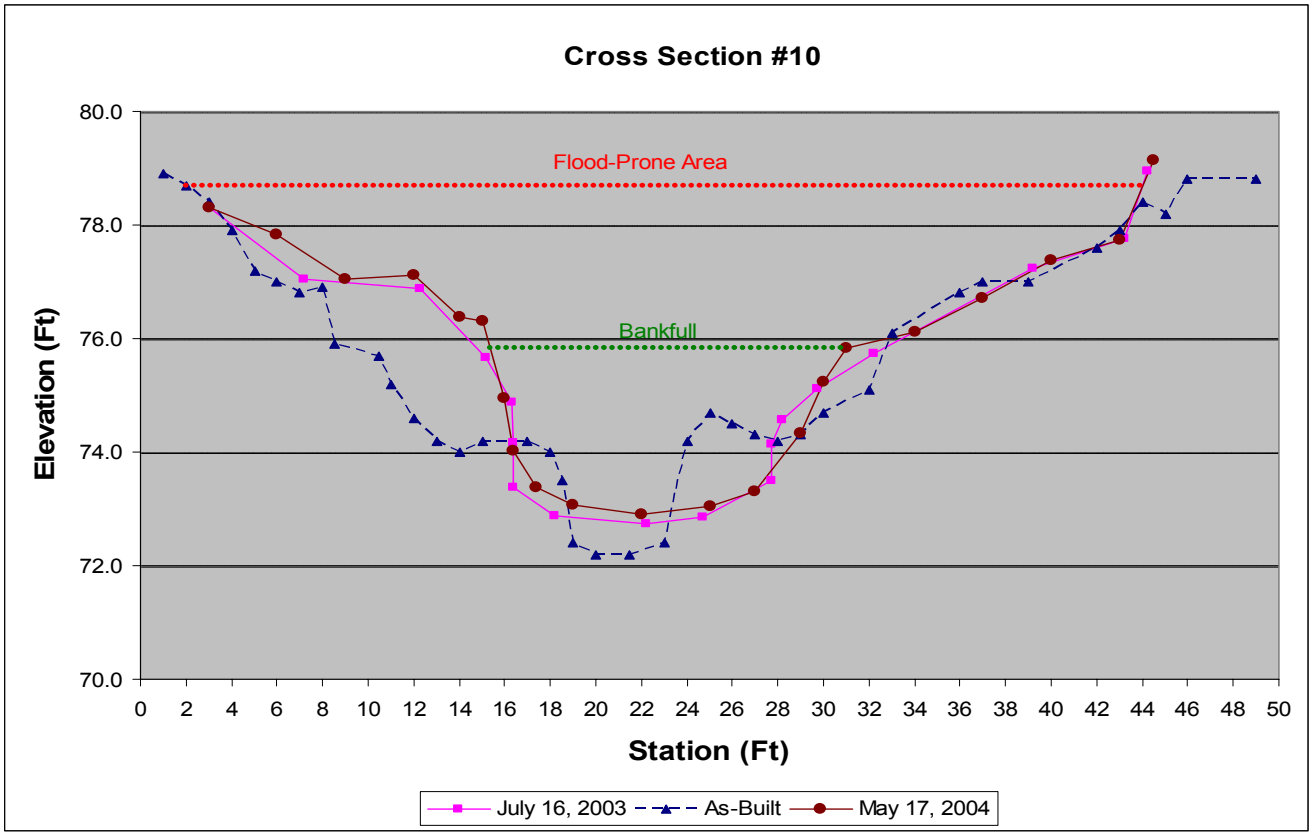
Cross Section #8 at Station 0+00 along Paint Fork Creek. Paint Fork Creek flows from left to right. 2003



Cross-Section #8 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	49.3	41.7
Maximum Bankfull Depth (ft)	2.6	2.3
Bankfull Mean Depth (ft)	1.6	1.6
Width/Depth Ratio	19.2	15.6
Entrenchment Ratio	1.5	1.8
Bankfull Width (ft)	30.7	25.5

Cross Section #9 at Station 1+24 along Paint Fork Creek. Creek is flowing left to right. 2004

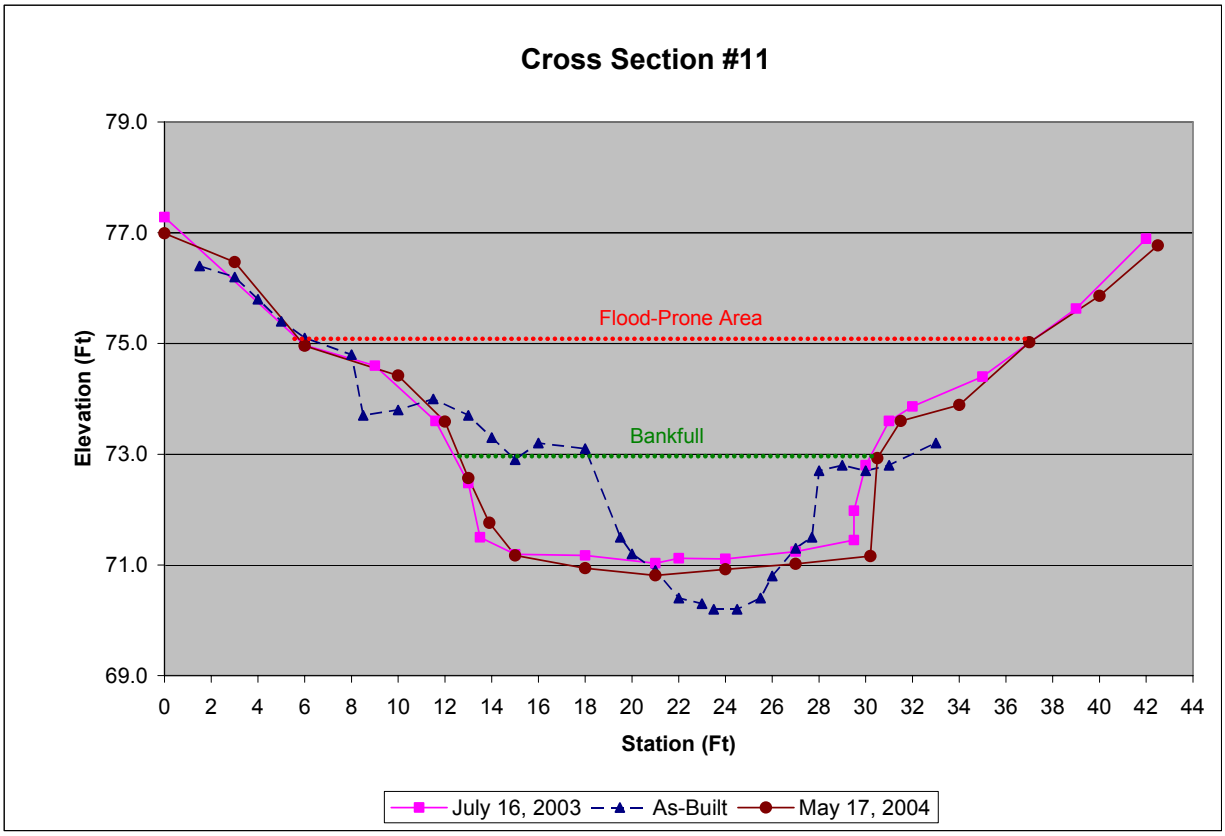
Cross Section #9 at Station 0+60 along Paint Fork Creek. Facing upstream. 2003



Cross-Section #10 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	33.8	35
Maximum Bankfull Depth (ft)	2.9	2.9
Bankfull Mean Depth (ft)	2	2.2
Width/Depth Ratio	8.3	7
Entrenchment Ratio	3	3.2
Bankfull Width (ft)	16.7	15.6

Cross Section #10 at Station 4+07 along Paint Fork Creek. Paint Fork Creek flows from right to left. 2004

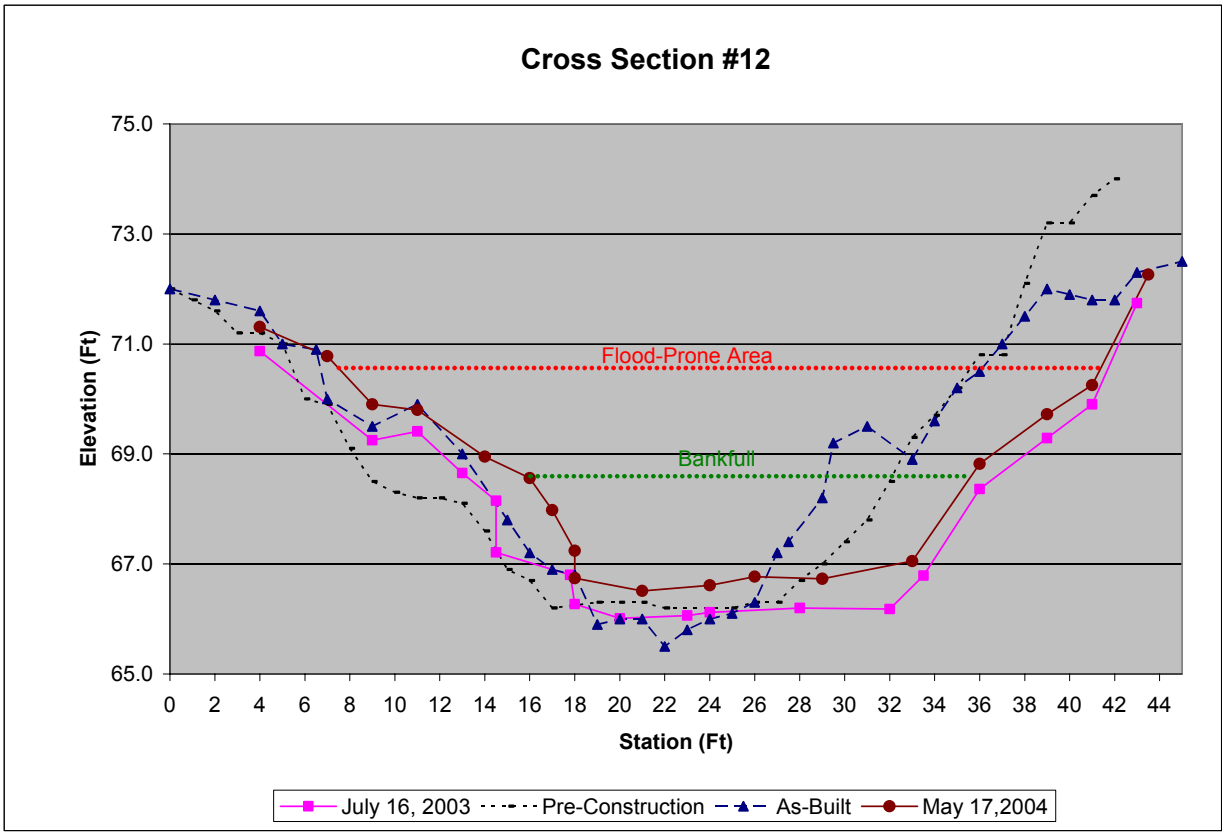
Cross Section #10 at Station 4+00 along Paint Fork Creek. Paint Fork Creek flows from left to right. 2003



Cross-Section #11 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	41.1	32.4
Maximum Bankfull Depth (ft)	2.6	2.1
Bankfull Mean Depth (ft)	2.1	1.8
Bankfull Width (ft)	19.4	17.9

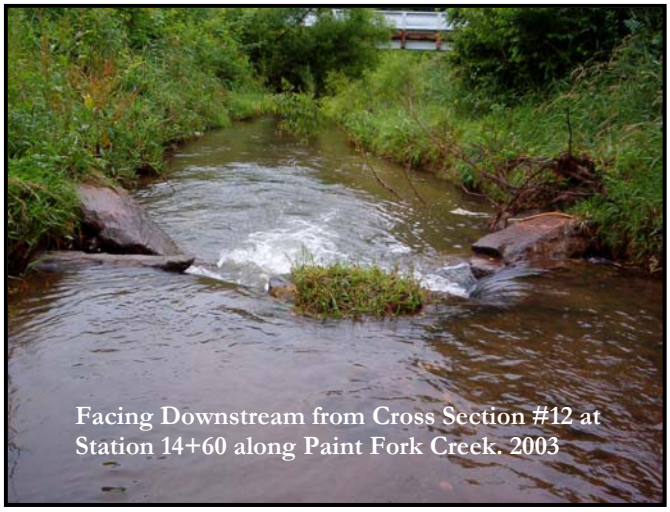
Cross Section #11 at Station 6+16 along Paint Fork Creek. Paint Fork Creek flows from left to right. 2004

Cross Section #11 at Station 6+16 along Paint Fork Creek. Paint Fork Creek flows from left to right. 2003

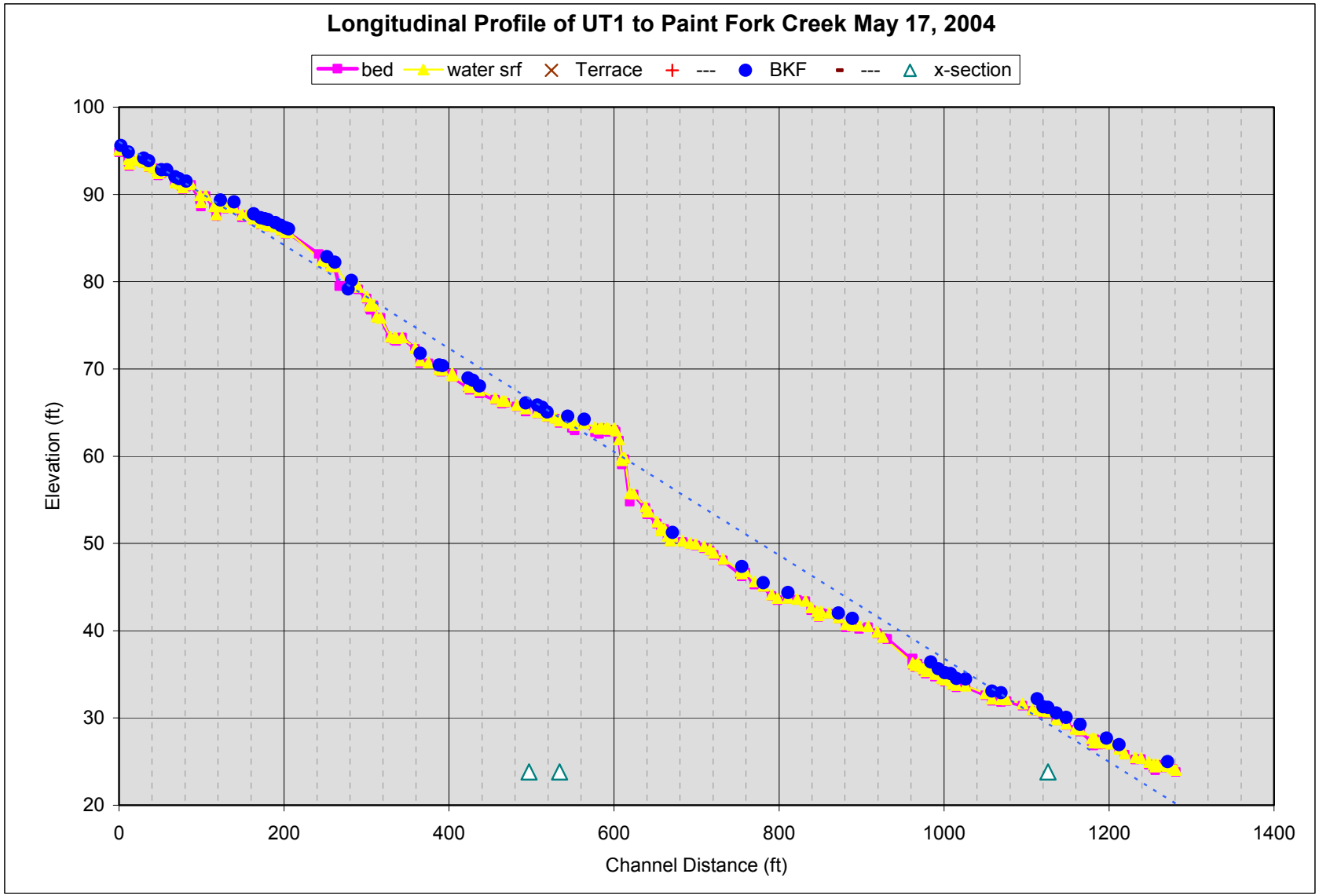


Cross-Section #12 Abbreviated Morphological Summary		
	2003	2004
Bankfull Cross Sectional Area (ft2)	36.4	30.8
Maximum Bankfull Depth (ft)	2.1	2.1
Bankfull Mean Depth (ft)	1.7	1.6
Width/Depth Ratio	12.3	12.4
Entrenchment Ratio	1.7	1.8
Bankfull Width (ft)	21.2	19.6

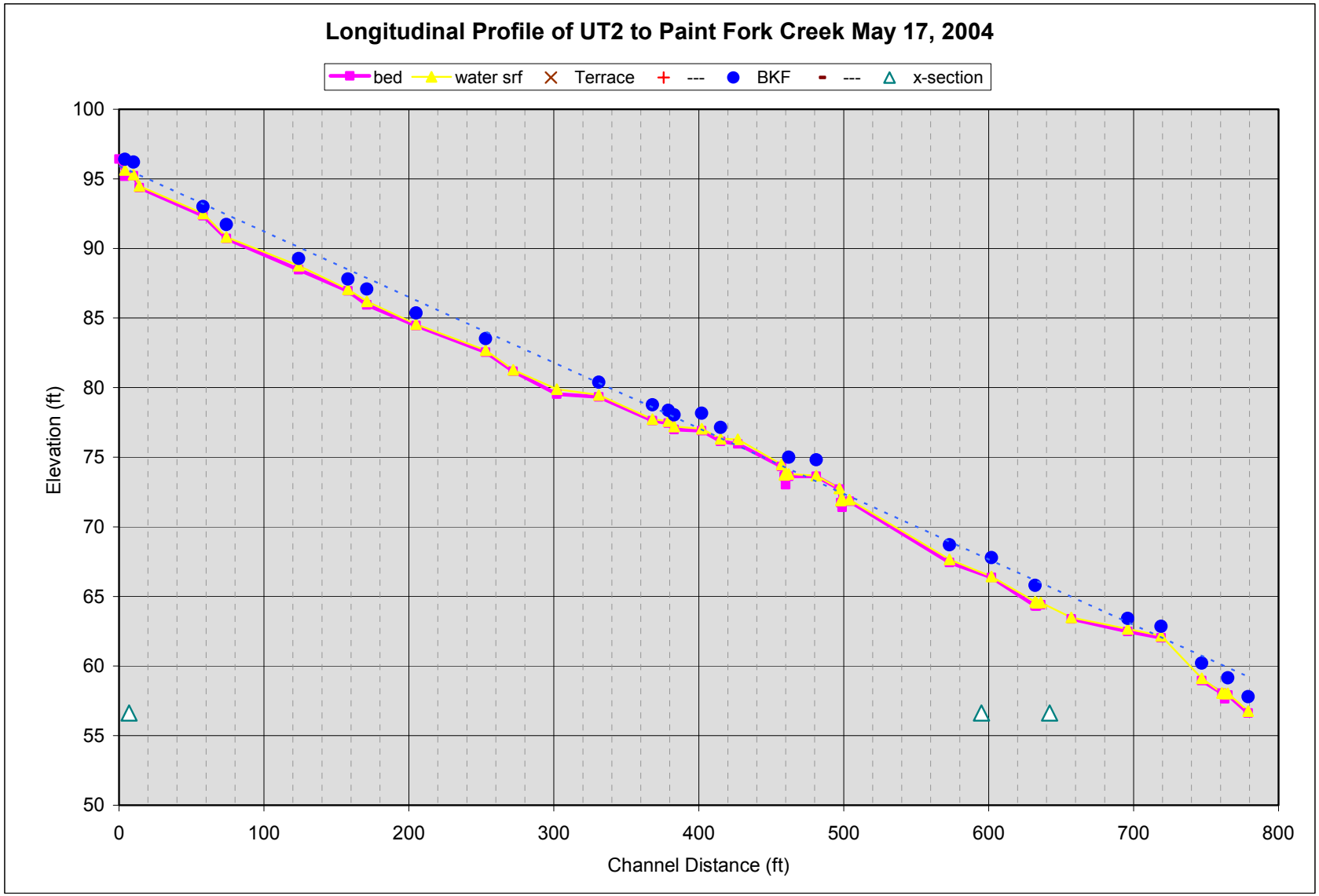
Facing Downstream from Cross Section #12 at Station 14+75 along Paint Fork Creek. 2004



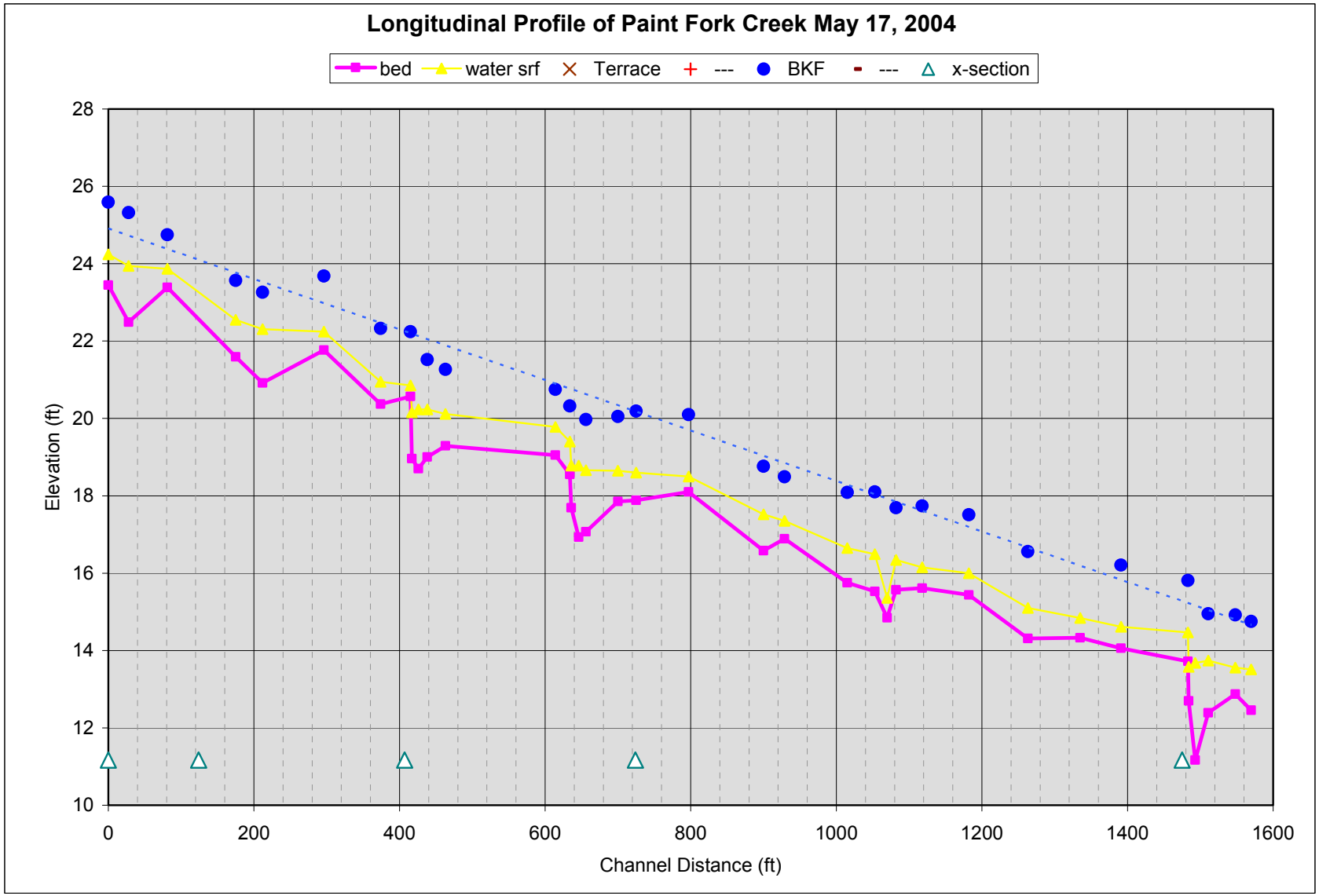
Facing Downstream from Cross Section #12 at Station 14+60 along Paint Fork Creek. 2003


Longitudinal Profile of UT1 to Paint Fork Creek May 17, 2004
bed
water srf
Terrace

BKF
---
x-section
Elevation (ft)
100
90
80
70
60
50
40
30
20
0
200
400
600
800
1000
1200
1400
Channel Distance (ft)


Longitudinal Profile of UT2 to Paint Fork Creek May 17, 2004
bed
water srf
Terrace

BKF
---
x-section
Elevation (ft)
100
95
90
85
80
75
70
65
60
55
50
0
100
200
300
400
500
600
700
800
Channel Distance (ft)


Longitudinal Profile of Paint Fork Creek May 17, 2004
bed
water srf
Terrace

BKF
---
x-section
Elevation (ft)
28
26
24
22
20
18
16
14
12
10
0
200
400
600
800
1000
1200
1400
1600
Channel Distance (ft)

APPENDIX C

SITE PHOTOGRAPHS

Tree Plot A upstream of Station 0+00
along Paint Fork Creek - 2004

Tree Plot A upstream of Station 0+00
along Paint Fork Creek - 2003

Tree Plot B near Station 5+00
along Paint Fork Creek - 2004

Tree Plot B near Station 5+00
along Paint Fork Creek - 2003

Vegetation Plot #1 along UT #1 - 2004

Vegetation Plot #1 along UT #1 - 2003

Vegetation Plot #2 along UT #1 - 2004

Vegetation Plot #2 along UT #1 - 2003

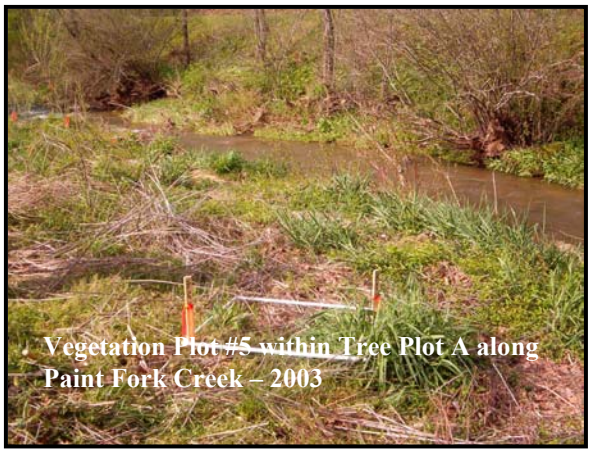
Vegetation Plot #3 along UT #2 - 2004

Vegetation Plot #3 along UT #2 - 2003

Vegetation Plot #4 along UT #2 - 2004

Vegetation Plot #4 along UT #2 - 2003

Vegetation Plot #5 within Tree Plot A along Paint Fork Creek – 2004

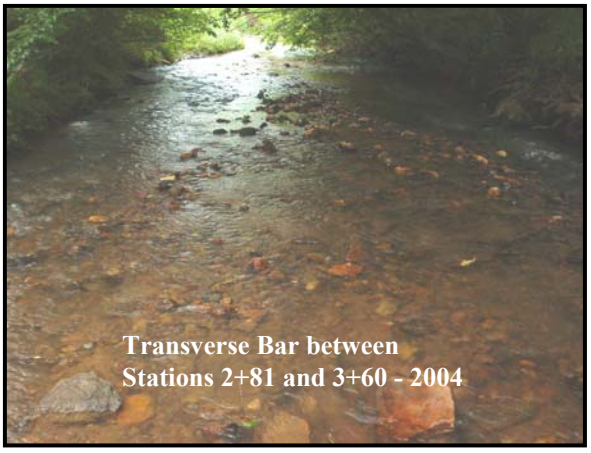


Vegetation Plot #5 within Tree Plot A along Paint Fork Creek – 2003

Vegetation Plot #6 within Tree Plot B along Paint Fork Creek - 2004

Vegetation Plot #6 within Tree Plot B along Paint Fork Creek - 2003

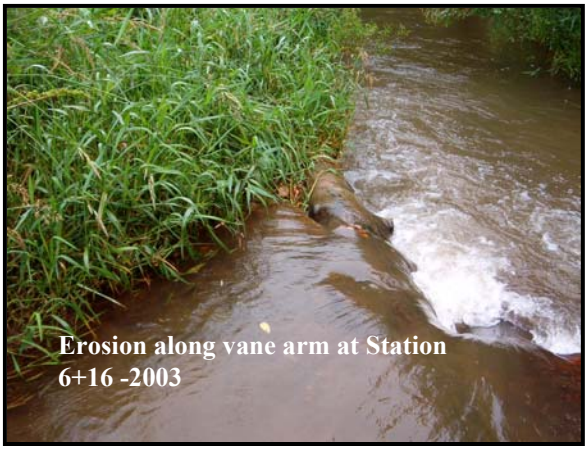
Paint Fork Creek



Transverse Bar between Stations 2+81 and 3+60 - 2004

Transverse Bar between Stations 2+81 and 3+60 - 2003

Vane arm at Station 6+16 -2003



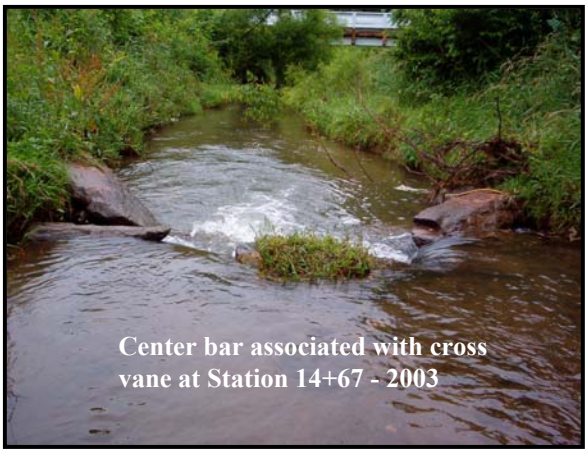
Erosion along vane arm at Station 6+16 -2003

Left bank at Station 9+75 - 2004

Erosion on left bank at Station 9+75 - 2003

Paint Fork Creek Continued

Center bar associated with cross vane at Station 14+67 - 2004



Center bar associated with cross vane at Station 14+67 - 2003

Unnamed Tributary #1

Undercut banks at Station 0+32 - 2003

Undercut banks at Station 0+32 - 2003

Undermined coir log at Station 1+30 - 2004

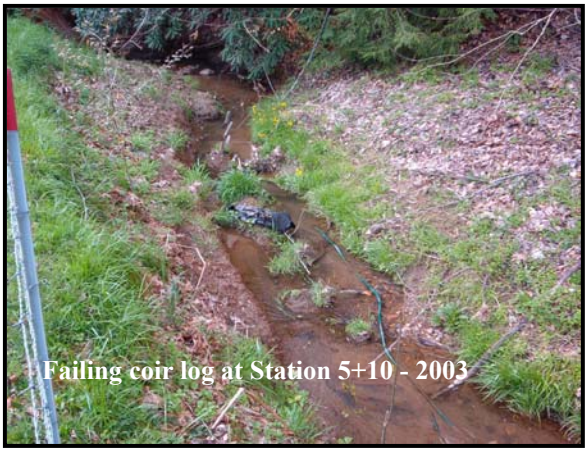
Undermined coir log at Station 1+30 - 2003

Unnamed Tributary #1 Continued

Erosion along left bank at Station 3+65 - 2004

Erosion along left bank at Station 3+65 - 2003

Failing coir log at Station 5+10 has caused mid stream bar to form - 2004



Failing coir log at Station 5+10 - 2003

Unstable coir log at Station 8+00 - 2004

Unstable coir log at Station 8+00 - 2003

Unnamed Tributary #1 Continued

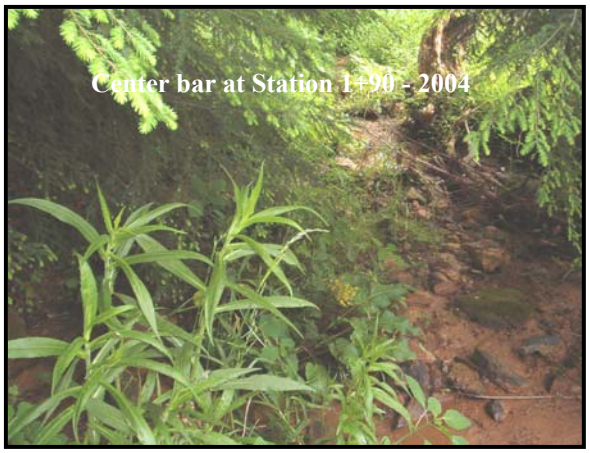

Station 11+48 - 2004


Bank erosion at Station 11+48 - 2003

Unnamed Tributary #2


Coir logs at Station 0+07 - 2004


Unstable coir logs at Station 0+07 - 2003


Center bar at Station 1+90 - 2004


Center bar at Station 1+90 - 2003

Unnamed Tributary #2 Continued


Coir log at Station 4+79 - 2004


Undermined coir log at Station 4+79 - 2003


Coir log at Station 5+90 - 2004

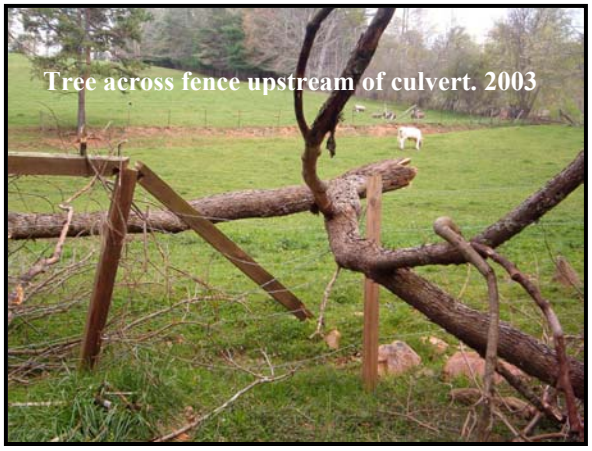

Undermined coir log at Station 5+90 - 2003


Coir log at Station 6+00 - 2004


Undermined coir log at Station 6+00 - 2003

Unnamed Tributary #2 Continued


Fence upstream of culvert. 2004


Tree across fence upstream of culvert. 2003