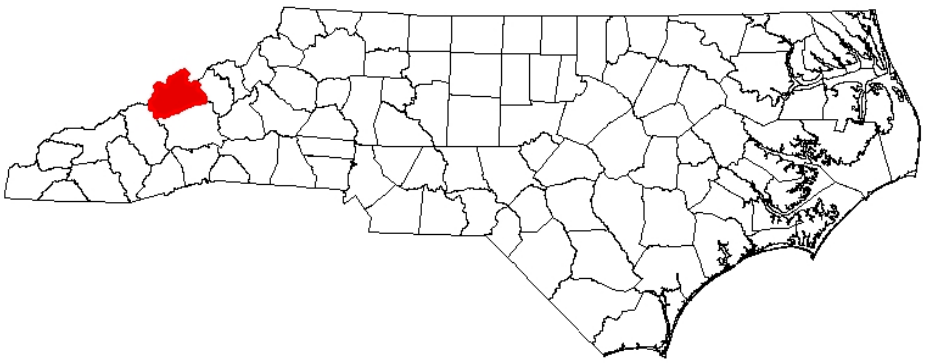
ANNUAL REPORT FOR 2004



South Fork Big Pine Creek Stream Mitigation Site
(Charles/McGinnis Site)
Madison County
WBS Element 32573.4.1
TIP No. A-10WM

Prepared By:
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North Carolina Department of Transportation
January 2005

Summary

The following report summarizes the stream monitoring activities that have occurred during the Year 2004 at the Charles/McGinnis Site in Madison County. This site was constructed in 1999 by the North Carolina Wildlife Resources Commission (NCWRC). This report provides the monitoring results for the second formal year of monitoring (Year 2004); however, it is actually the fifth year since construction.

Based on the overall conclusions of monitoring along South Fork Big Pine Creek, the Charles/McGinnis Site has not met the required monitoring protocols for the second year of monitoring. Areas of severe bank scour and erosion exist as a result of several large storm events. These areas should be assessed by the Mitigation Review Team to determine if remedial actions are warranted.

Based on information obtained from the U.S. Geological Survey (USGS), the Charles/ McGinnis Site has experienced more than ten bankfull events between 1999 and 2004, well beyond the protocols required for hydrologic monitoring. However, the stream has experienced de-stabilization throughout several sections of the reach. Vegetative success criteria, however, have been met for the second 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.

The extent of yearly monitoring activities at the Charles/McGinnis Site will be dependent on the decisions made by Mitigation Review Team during the fall/winter 2004 meeting.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2004 at the Charles/McGinnis Site. The site is situated along South Fork Big Pine Creek, immediately west of Big Pine Road (SR 1158) in the southwestern portion of Madison County (Figure 1). It is approximately 16 miles (25.6 kilometers) west-southwest of Mars Hill and nearly 18 miles (28.8 kilometers) northwest of Asheville. The Charles/ McGinnis Site was constructed as one of four projects to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) Project No. A-10 in Madison County.

This mitigation project covers approximately 1,100 linear feet of South Fork Big Pine Creek. It was designed and constructed in 1999 by the North Carolina Wildlife Resources Commission (NCWRC). Stream restoration involved construction of rock vanes for stabilization purposes, installing livestock management practices, and re-vegetation of the streambanks with native species. During the winter of 2000, the site was extensively planted with live stakes and bare rooted trees.

1.2 Purpose

According to the as-built report (NCWRC, 2000), the objectives at this mitigation site were to improve water quality, riparian quality and stability, and fisheries habitat associated with South Fork Big Pine Creek. The following objectives were proposed:

- Increasing the floodplain area and stabilizing the bankfull elevations along the reach;
- Installing boulder vanes, log vanes, or rootwads along the stream to reduce overall erosion and enhance/improve fish habitat;
- Installing small vortex weirs to create pool habitat in sections of long riffles;
- Sloping and vegetating the streambanks to provide more resistance to flooding; and
- Planting of native trees, shrubs, and ground cover to stabilize the banks, shade the stream, and improve wildlife cover and food.

The majority of these objectives were completed by reshaping the stream banks to a more stable cross-sectional profile. Areas of high bank stress were protected using rootwads, coir logs, and vanes. The riparian zone was planted with native vegetation. No vortex weirs or cross vanes however, were installed to create pool habitat.

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 2004 growing season at the Charles/McGinnis Site are included in this report.

Activities in 2004 reflect the second formal year of monitoring following the restoration efforts; however, it is the fifth year since construction. Included in this report are analyses on stability (primarily the longitudinal profile and cross sections), vegetative monitoring results, and site photographs. Monitoring activities were conducted twice during 2004 due to heavy rain events and subsequent flooding encountered during July. The data for the May and August monitoring is presented for comparison purposes.

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 Charles/McGinnis 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.

August 1999	Site grading commenced
August 1999	Site Planted with Native Perennial Seed Mix
January 2000	Site Planted with Live Stakes and Bare Rooted Trees
July 2000	NCWRC Site Review to Evaluate Vegetation
June – July 2003	Stream Channel Monitoring (1 yr.)
June – July 2003	Vegetation Monitoring (1 yr.)
May/June 2004	Stream Channel Monitoring (2 yr.)
May 2004	Vegetation Monitoring (2 yr.)
August 2004	Additional Stream Channel Monitoring (2 yr.) following "above-bankfull" events.

During July of 2004, the Charles/McGinnis Site experienced heavy rains that caused South Fork Big Pine Creek to reach stages above bankfull. The overall event worsened the existing scour and erosion taking place along the stream. As a result, several sections of the stream remain undercut and unstable. Based on conversations with the NCWRC, remedial actions have been proposed during the fall/winter of 2004; however, the Mitigation Review Team will ultimately decide on the degree of effort, timing, and extent of future monitoring required at this site.

1.4 Debit Ledger

The entire Charles/McGinnis Site was used for TIP No. A-10 to compensate for unavoidable stream impacts related with roadway construction. This project generated 1,100 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 4 criteria.

*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 was 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 D50, 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

South Fork Big Pine Creek classified as a B stream type in 1998 according to the Rosgen Classification of Natural Rivers. The channel was moderately entrenched with an unusually low width/depth ratio and sinuosity. According to the Natural Resources Conservation Service (NRCS), flood damage along the creek was addressed by channelization in the early 1980's. Vegetation consisted primarily of reed canary grass planted by the NRCS. Few pools existed (NCWRC, 1998).

2.2.2 Post Construction Conditions

Two rock vanes and one rootwad revetment were installed at the project site to control erosion of the streambanks on the outside of the meander bends. A rock/soil berm was removed and the banks were sloped accordingly. Coir logs were used to define the bankfull elevation. Three watering tanks were installed at the site for livestock management and a barbed-wire fence was erected along the left riparian zone (facing downstream).

2.2.3 Monitoring Conditions

South Fork Big Pine Creek was initially classified as a B stream type according to the Rosgen Classification of Natural Rivers. A total of five cross sections were surveyed as part of monitoring activities. A comparison of channel morphology is presented in Table 1. Channel stationing is provided on Figure 2.

Table 1. Abbreviated Morphological Summary (Charles/McGinnis Site)

Variable		South Fork Big Pine Creek (Combined Cross Sections #1 Thru #5)						
		Pre-Const.*	As-Built*	Year 1	Year 2 (June)	Year 2 (August)	Year 3**	Year 4**
Drainage Area (mi^2)		2.7	2.7	2.7	2.7	2.7	2.7	2.7
Bankfull Width (ft)	Mean	-	-	11.1	9.1	13.3		
Bankfull Mean Depth (ft)	Mean	-	-	1.6	1.2	1.8		
Width/Depth Ratio	Mean	-	-	7.9	8.1	8.3		
Bankfull Cross Sectional Area (ft^2)	Mean	-	-	17.8	10.7	23.8		
Maximum Bankfull Depth (ft)	Mean	-	-	2.6	1.9	2.8		
Width of Floodprone Area (ft)	Mean	-	-	>200	>200	>200		
Entrenchment Ratio	Mean	-	-	>18	>22	>15		
Slope		-	-	0.029	0.033	0.031		
Particle Sizes (Riffle Sections)								
D_{16} (mm)		-	-	0.6	0.9	11.9		
D_{35} (mm)		-	-	17.7	8.5	49.4		
D_{50} (mm)		-	-	49.5	23.1	70.2		
D_{84} (mm)		-	-	140.0	97.0	126.0		
D_{95} (mm)		-	-	257.0	128.0	175.0		

* 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.
** Year 3 through Year 4 Formal Monitoring has not been defined and may change based on MBRT opinions. Monitoring was conducted twice during Year 2 (2004) due to the above-bankfull event in July after the initial monitoring for the year was completed.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the re-survey of five cross sections and the longitudinal profile established by the NCWRC after construction. This data is presented in the Appendix. The

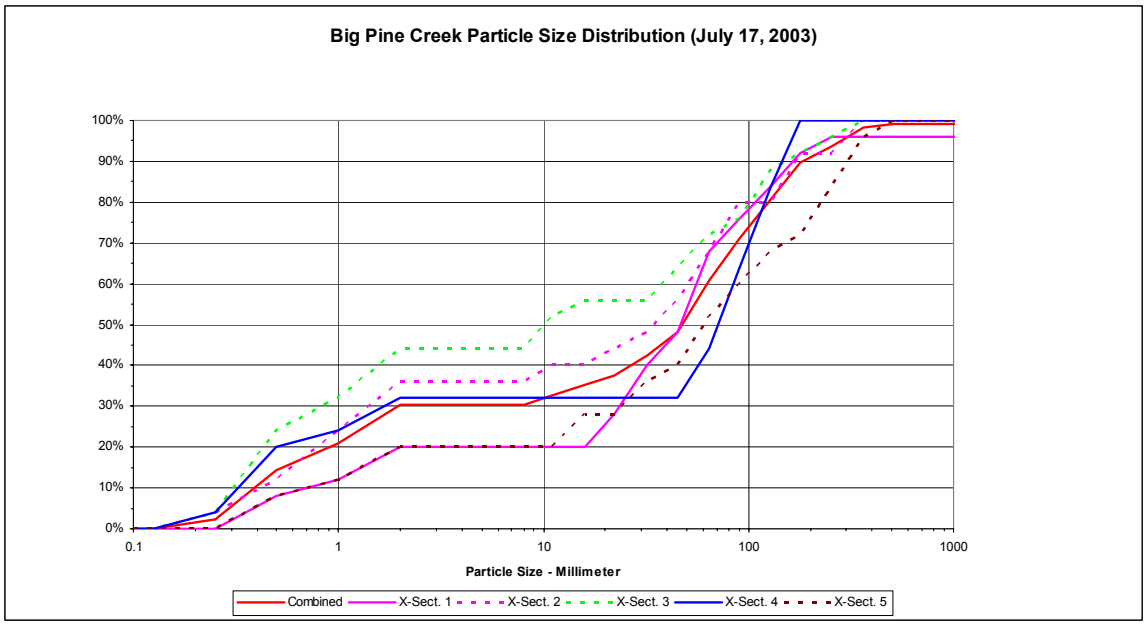
longitudinal profile originated along the southern boundary of the site and proceeded northward throughout the 1,100 linear-foot section of the reach. Stationing began at 0+00 and ended at 12+00. Both points were in the middle of riffle sections. Cross section locations were subsequently based on the stationing of the longitudinal profile and are listed below.

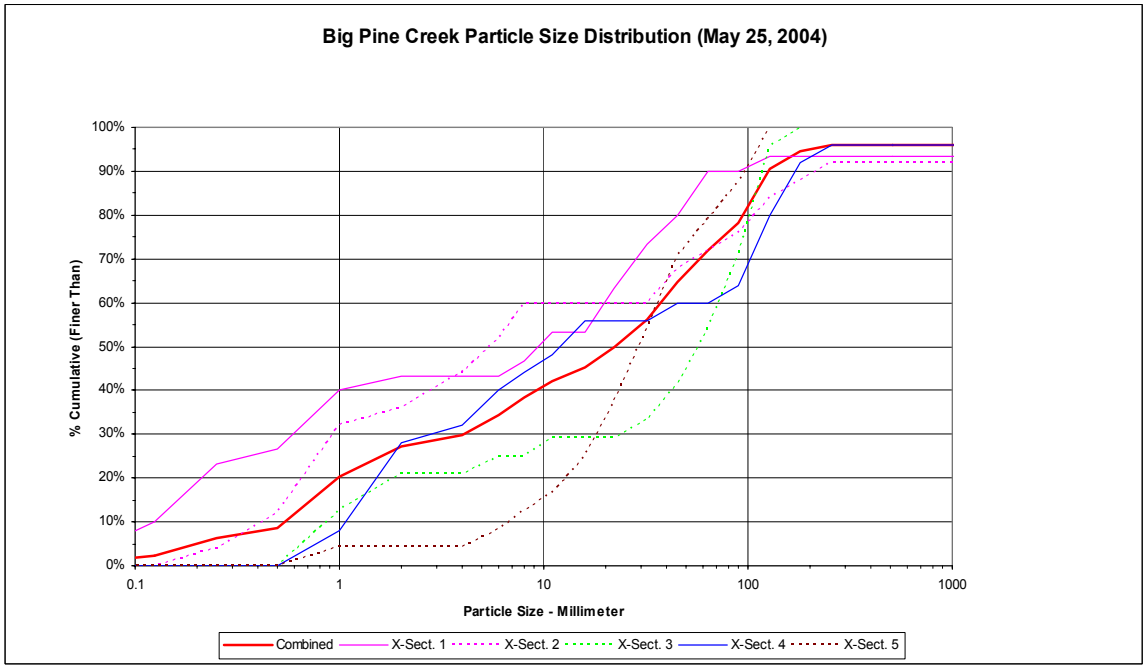
- Cross Section #1. Station 0+96, midpoint of riffle at rock vane
- Cross Section #2. Station 1+97, midpoint of run
- Cross Section #3. Station 3+31, midpoint of riffle
- Cross Section #4. Station 5+99, midpoint of riffle
- Cross Section #5. Station 7+70, midpoint of riffle

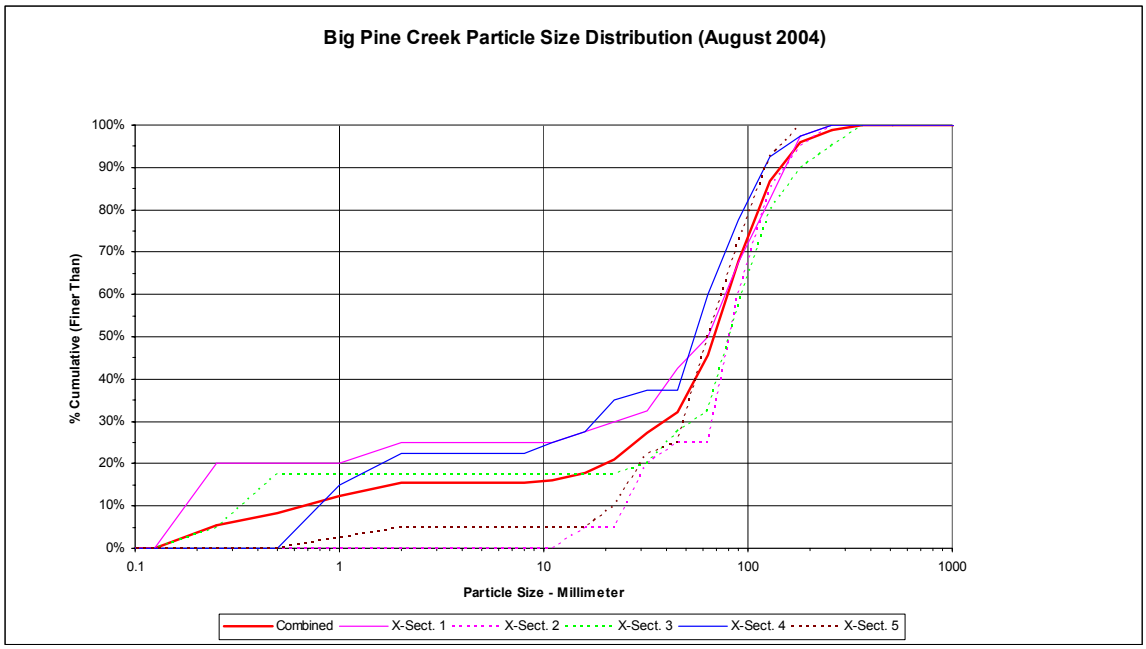
Due to heavy rains and associated flooding in July 2004, nearly all of the cross sections have experienced changes. Based on the comparison of May and August 2004 cross section survey results with the 2003 cross section results and as-built sections, Cross Sections #1, #2, and #4 have degraded, while Cross Section #3 and #5 have aggraded. Even though Cross Sections #3 and #5 have aggraded, the channels through these locations have widened. Survey data varies dependent 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. However, only pebble counts taken at riffle sections were utilized to classify the stream. No existing data was available for South Fork Big Pine Creek. Based on the Year 2003 surveys, the cumulative D_{50} (50 percent of the sampled population is equal to or finer than the representative particle diameter) of the reach was approximately 49.5 mm, indicative of a gravel-bed stream.

The June 2004 and August 2004 pebble counts for the riffle sections noted a D_{50} of 23.1 and 70.2 mm, respectively. These results confirm changes in particle size distribution associated with heavy rainfall and bankfull events. The channel has maintained its overall classification as a gravel-bed, B stream type. As anticipated, the overall percentage of fines has decreased throughout the size distribution charts, thus noting that the channel is becoming more stable and efficient at transporting these materials. Charts depicting the particle size distributions for South Fork Big Pine Creek for the Years 2003 and 2004, respectively, are presented below.


Big Pine Creek Particle Size Distribution (July 17, 2003)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.1
1
10
100
1000
Particle Size - Millimeter
Combined
X-Sect. 1
X-Sect. 2
X-Sect. 3
X-Sect. 4
X-Sect. 5


Big Pine Creek Particle Size Distribution (May 25, 2004)
% Cumulative (Finer Than)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.1
1
10
100
1000
Particle Size - Millimeter
Combined
X-Sect. 1
X-Sect. 2
X-Sect. 3
X-Sect. 4
X-Sect. 5



Several potential head cuts or niche points were noted during the survey of the longitudinal profile in 2003. The first was noted at Station 0+40. This cut was causing debris to accumulate in the center of the channel and exacerbating bank erosion along both sides of the channel. The cut was due to an old fence crossing the channel at this location which had accumulated debris along the upstream side and thus raised the overall elevation of the channel. The estimated drop of the thalweg was approximately two feet. This cut had adjusted by the 2004 survey resulting in less accumulation of debris and an improvement in bank stabilization. The other two cuts were observed at Stations 4+70 and 7+63. The second cut exhibited a vertical drop of nearly 1.5 feet while the third dropped approximately one foot. Both the second and third cuts had resulted in minor bank scouring. These cuts had also adjusted by the 2004 survey causing bank scouring to cease.

Qualitative investigations were conducted in 2003 on the adjacent property downstream of the project area to assess the applicability of a source for the head cutting. One area was identified approximately 100 feet (30.5 meters) downstream of the project area. The adjoining property owner had straightened a meander bend during the spring/summer of 2003. A log crib wall was placed on the outside of the reach for bank protection. This straightening has resulted in the conversion of a pre-existing pool to a riffle thus, increasing the overall slope of the channel through this area. Observations in 2004 indicated the project has not yet been affected by the straightened channel.

Bank stability was also assessed during the longitudinal profile survey. Several areas of active scouring and/or sloughing were observed in 2003. These areas were re-assessed during both surveys in 2004. Descriptions relating to these areas are as follows:

- Station 0+96 at Cross Section #1. The existing coir log along the left streambank (facing downstream) has been undermined by 2003. The structure remained in its

same state during both 2004 surveys. NCDOT will continue to monitor this area through the next monitoring period.

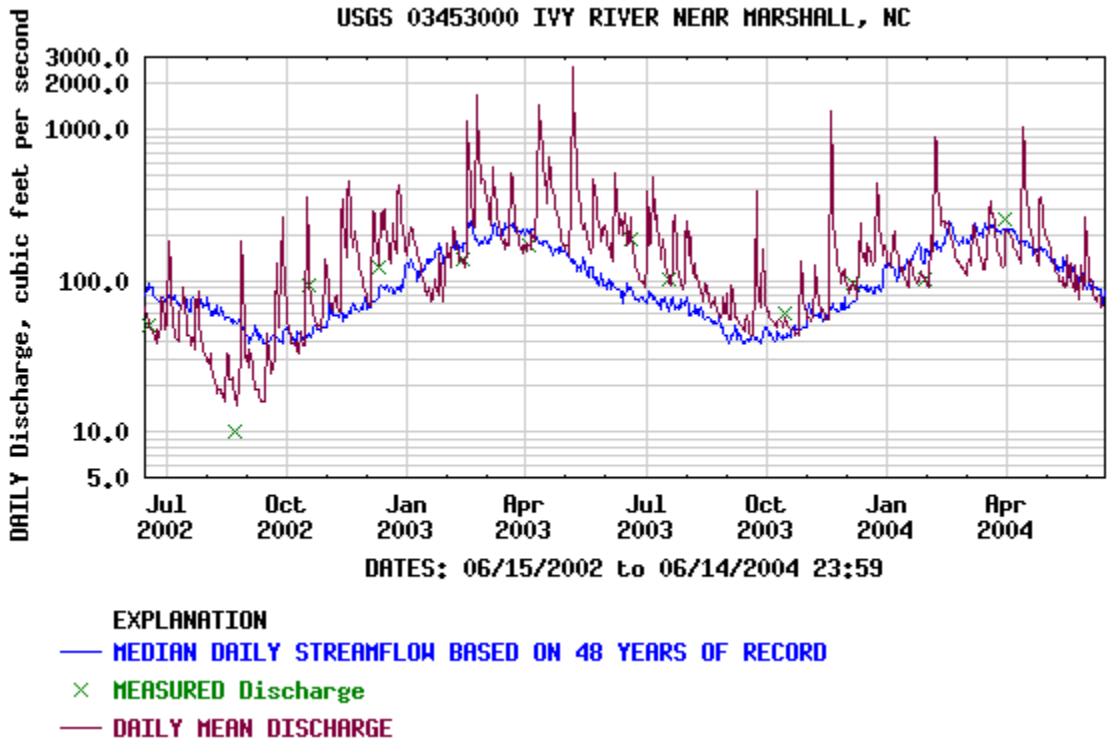
- Station 1+89 through 2+00. In August of 2004 it was noted that severe erosion was undercutting the left bank due to formation of a pool immediately downstream of cross section #1. This area should be monitored closely during the next monitoring period.
- Stations 2+21 through 2+54. A center bar was observed through this section of the reach in 2003. The thalweg is currently following the left channel; however, the right channel also funnels water during normal and high flows as noted during the August 2004 surveys. This area should be re-assessed during the next monitoring period.
- Stations 4+12 through 4+24. The 2004 survey noted bank erosion occurring through this area along both sides of the channel resulting in approximately 1.5 feet of bank undercutting. This area should continue to be monitored.
- Stations 5+33 through 5+63. The right streambank was undermined and actively sloughing by the 2003 survey. During the first 2004 survey, the majority of the undercut material had been washed downstream. The August 2004 survey revealed a vertical streambank through this area.
- Stations 5+33 through 6+50. The left streambank was severely undercut by 2003. This streambank remained unstable in 2004. This area should continue to be monitored.
- Station 5+99 at Cross Section #4. Active erosion is present along outside of meander bend. This meander bend experienced erosional problems during the summer of 2003. NCDOT maintenance crews were forced to repair the outside of this bend due to severe erosion along the roadway embankment. As a result, one rootwad was removed and not replaced. Due to the bankfull event in July of 2004 the right bank has continued to undercut to a point where was under the roadway pavement. NCDOT maintenance crews will likely stabilize this area; however, remedial actions should be considered due to its close proximity to the existing roadway and ease of access. These actions should include the placement of a vane structure to divert the thalweg away from the roadway.
- Station 7+66 at Cross Section #5. In August 2004 it was noted that streambank was undercut on the left side approximately 1.2 feet. This was the result of the high flows experienced through this area. This area should be re-evaluated during the next monitoring period.
- Stations 7+67 through 8+00. Active erosion was noted at and around the pipe outlet entering from the right side. This area should continue to be monitored during the next monitoring period.
- Stations 9+00 through 10+00. The right streambank is actively eroding. Existing vegetation and access issues will likely prohibit remedial actions from being completed. This area should continue to be monitored during the next monitoring period.

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 Big Pine Creek or

its tributaries. A review of known U.S. Geological Survey (USGS) surface water gages identified two gages within 12 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 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) and more accurately reflects hydrology and precipitation in the area. The Ivy River gage 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

Remedial actions may be necessary throughout several areas of this project dependent upon decisions made by the Mitigation Review Team, NCDOT and the NCWRC. Based on recent conversations with the NCWRC, additional maintenance related to bank stabilization will likely be conducted during the fall and winter of 2004. Due to the stream's close

proximity to Big Pine Road and non-restricted channel access, channel work can be done from this side of the stream. Recommendations from the consultant monitoring group are presented below regarding remedial action(s):

1. Re-assess the South Fork Big Pine Creek channel from Station 0+00 to Station 10+00. Compare the existing data to reference reach data of similar type stream. Determine the amount of instability present and formulate a plan of action to correct problem areas.
2. Consider the installation of a grade control structure (cross vane) in the vicinity of Station 0+40. This structure would provide grade control, bank stability and additional fisheries habitat.
3. Assess the center bar at Station 2+21. Consider re-aligning the channel via placement of a rock vane structure.
4. Consider re-grading the eroding banks between Stations 5+33 and 6+50. Several cross vane structures would likely help to stabilize the streambanks through this area.
5. Rock vanes should be the structures considered in the vicinity of Cross Section #4 to help stabilize the outside of the meander bend.
6. Cross Section #5 appears to be degrading. Placement of cross vanes through this section (from Stations 7+67 to 8+00) would assist with grade control issues. It will also assist with stabilizing the adjacent stream banks.

The remaining areas of concern should be monitored for the next several years to determine the actual extent of change.

Additional substrate destabilization occurring from the noted downstream source will be monitored to determine the overall effect on the project. Pending the outcome of this assessment, the NCDOT may request the downstream landowner to remedy the problem.

Based on information obtained from the USGS, the Charles/McGinnis Site has not met the required monitoring protocols. If the Mitigation Review Team determines that supplemental work is needed, this work should be conducted during the winter of 2003/2004 to insure that the overall goals of this project are maintained.

3.0 VEGETATION

3.1 Success Criteria

The NCDOT will monitor the South Fork Big Pine Creek Site for five years or until success criteria is met. A 320 stems per acre survival criterion for planted seedlings will be used to determine success for the first three years. The required survival criterion will decrease 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 Charles/McGinnis Mitigation Site, South Fork Pine Creek, Madison County (2000), the following species were planted along the streambanks:

Live Stakes (*installed during winter of 1999/2000*)

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

Bare Rooted Trees (*installed during early winter 2000*)

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*)
Red maple (*Acer rubrum*)

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, six 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 Big Pine Road. These six plots included two large 1,000 square-foot areas near Stations 3+00 and 4+00. The remaining four plots were one-meter square plots (12.1 square feet). 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. 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 along the section upstream from the existing culvert. It is on the left streambank (facing downstream) and is oriented in a north-south direction. Black willow,

silky willow, silky dogwood, green ash, and river birch account for the woody species in the plot. Section 3.4 provide numerical counts for species found within Tree Plots A and B, as well as the four small plots.

Tree Plot B is located on the left streambank immediately downstream of the culvert. It is also oriented in a north-south direction. Dominant woody vegetation includes black willow, silky willow, silky dogwood, and green ash.

3.4 Results of Vegetation Monitoring

Vegetation Monitoring Statistics, by Tree Plot

Plot No. (Type)	Black Willow	Silky Willow	Silky Dogwood	Red-osier Dogwood	Willow Oak	River Birch	Black Walnut	Persimmon	Green Ash	Red Maple	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')	5	1	90			1			1		104	98				104	4,269
Plot B (100'x10')	25	16	49						1		94	90				94	3,920
											AVERAGE DENSITY						**4,094**

Vegetation Monitoring Statistics, by Vegetation Plot

Plot No. (Type)	Black Willow	Silky Willow	Silky Dogwood	Red-osier Dogwood	Willow Oak	River Birch	Black Walnut	Persimmon	Green Ash	Red Maple	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)			2								2	2				2	7,200
Plot 3 (1 meter grid)			2								2	2				2	7,200
Plot 4 (1 meter grid)		1									1	1				1	3,600
											AVERAGE DENSITY						**5,400**

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. This species is considered invasive; however, it provides excellent ground cover and rooting stability during the growing season. Specific notes regarding each plot is presented below.

Tree Plot A. One volunteer American elm (*Ulmus americana*) was observed in the plot. Herbaceous species included canary grass, blackberry (*Rubus* sp.), clover (*Trifolium* sp.), goldenrod (*Solidago* sp.), and ragweed (*Ambrosia* sp.).

Tree Plot B. Two volunteers were noted; cherrybark oak (*Quercus pagoda*) and forsythia (*Forsythia* sp.). Herbaceous species included canary grass, blackberry, clover, goldenrod, and ragweed.

Plot 1. Canary grass and goldenrod were observed in and immediately adjacent to the vegetation plot. In addition, two silky dogwoods, two elderberries (*Sambucus canadensis*), and one silky willow were noted within five feet of the vegetation plot.

Plot 2. Canary grass and blackberry were observed in and immediately adjacent to the vegetation plot. In addition, seven silky dogwoods and one green ash were noted within five feet of the vegetation plot.

Plot 3. Canary grass, clover (*Trifolium* sp.) and Japanese honeysuckle (*Lonicera japonica*) were observed in and immediately adjacent to the vegetation plot. In addition, one silky willow and six silky dogwoods were noted within five feet of the vegetation plot.

Plot 4. Canary grass, clover, vetch (*Vicia* sp.), and goldenrod (*Solidago* sp.) were observed in and immediately adjacent to the plot. In addition, six silky dogwoods and three silky willows were noted within five feet of the vegetation plot.

3.5 Conclusions

The 2004 vegetation monitoring of the site represents 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 South Fork Big Pine Creek. 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

Based on the overall conclusions of monitoring along South Fork Big Pine Creek, the Charles/McGinnis Site has not met the required monitoring protocols for the second year of monitoring. Areas of severe bank scour and erosion exist. These areas should be assessed by the Mitigation Review Team to determine if remedial actions are warranted.

Based on information obtained from the U.S. Geological Survey (USGS), the Charles/ McGinnis Site has experienced more than ten bankfull events between 1999 and 2004, well beyond the protocols required for hydrologic monitoring. However, the stream has experienced de-stabilization throughout several sections of the reach. Vegetative success criteria have been met for the second 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 Charles/McGinnis Mitigation Site, South Fork Big Pine Creek, Madison County.

North Carolina Wildlife Resources Commission (NCWRC), 1998. Conceptual Restoration Plan, Charles-McGinnis Site, South Fork Big Pine Creek, Madison County.

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

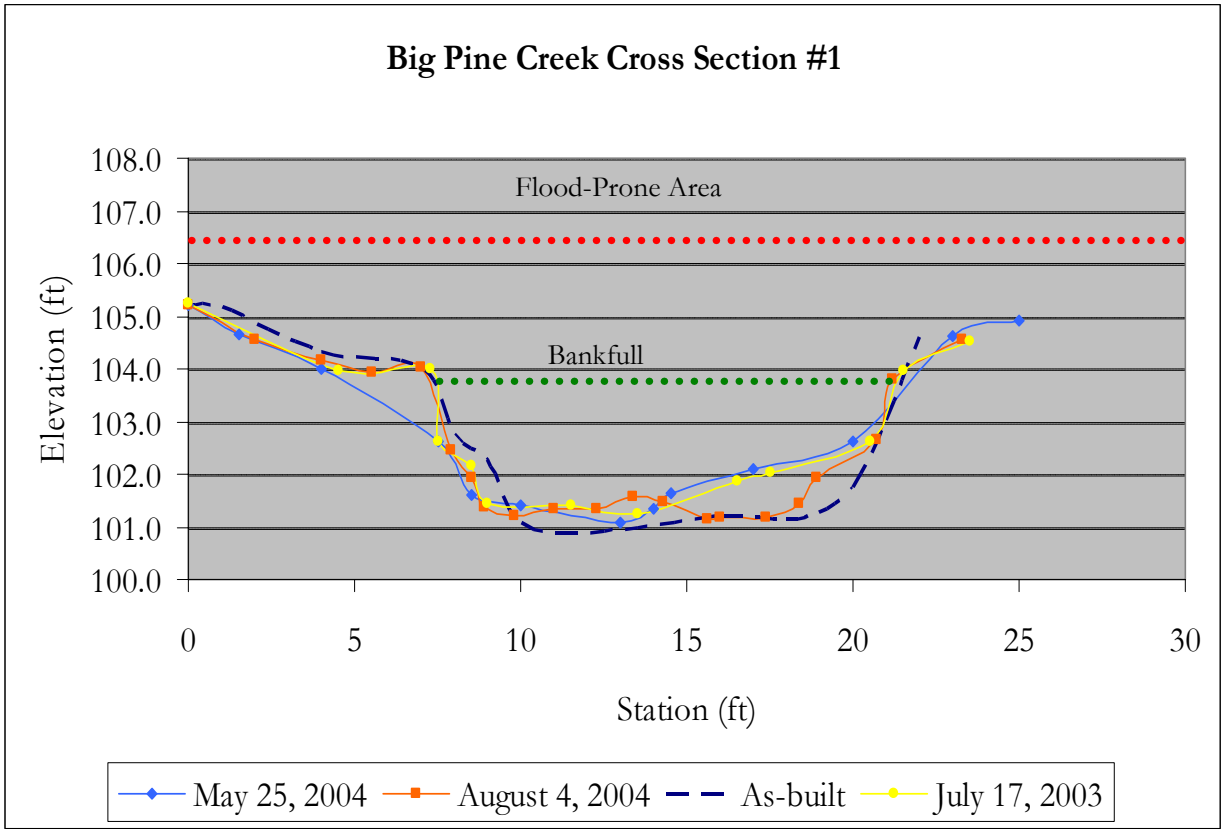
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

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



Stream Classification

Location: Station 0+96

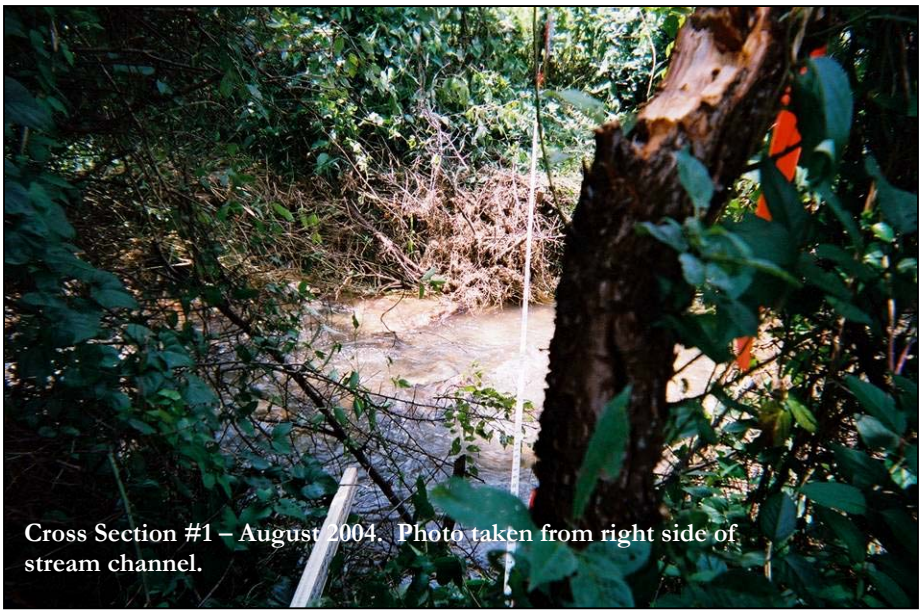
Year 2003	E4b stream type (mid point of riffle)
Year 2004 (June)	C4b stream type (mid-point of riffle)
Year 2004 (August)	E4b stream type (mid-point of riffle)

Cross-Section #1 Abbreviated Morphological Summary			
	2003	**2004**	**2004b***
Bankfull Cross Sectional Area (ft^2)	29.5	10.8	29.9
Maximum Bankfull Depth (ft)	2.8	1.5	2.7
Bankfull Mean Depth (ft)	2.1	0.9	2.1
Width/Depth Ratio	6.8	14.4	6.6
Entrenchment Ratio	>14	>16	>14
Bankfull Width (ft)	14.2	12.5	14.1

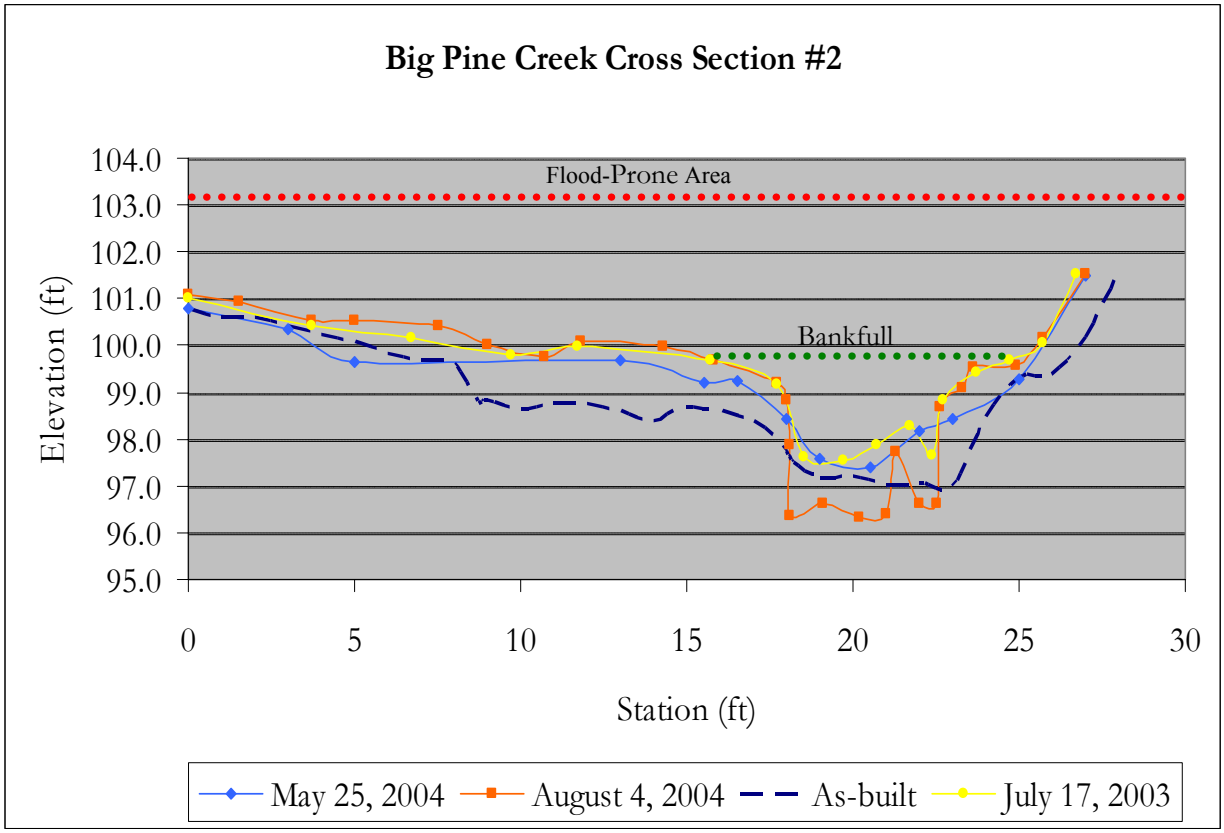
*Measurements were taken after "above bankfull" event.

Cross Section #1 at Station 0+96 – 2003. Photo taken from left side of stream channel.

Cross Section #1 – June 2004. Photo taken from right side of stream channel.



Cross Section #1 – August 2004. Photo taken from right side of stream channel.



Stream Classification

Location: Station 1+97

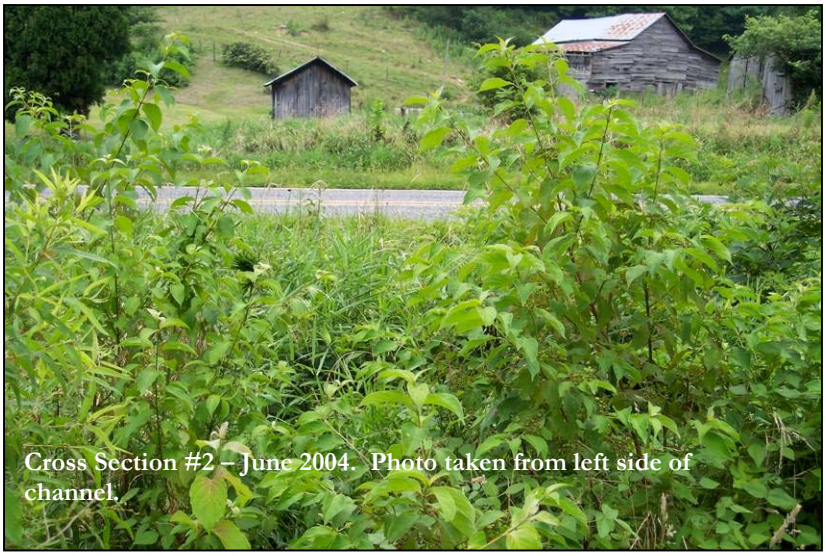
Year 2003	E4b* stream type (mid point of run)
Year 2004 (June)	E4b* stream type (mid-point of run)
Year 2004 (August)	E4b* stream type (head of pool))

* Stream classifications are given for comparison purposes only. Normally, classifications are taken only along riffle sections.

Cross-Section #2 Abbreviated Morphological Summary			
	2003	**2004**	**2004b***
Bankfull Cross Sectional Area (ft^2)	9.8	8.1	15.4
Maximum Bankfull Depth (ft)	2.1	1.8	3.4
Bankfull Mean Depth (ft)	1.1	1	1.7
Width/Depth Ratio	8.1	8.4	5.5
Entrenchment Ratio	>4.0	>4.0	>4.0
Bankfull Width (ft)	8.9	8.3	9.3

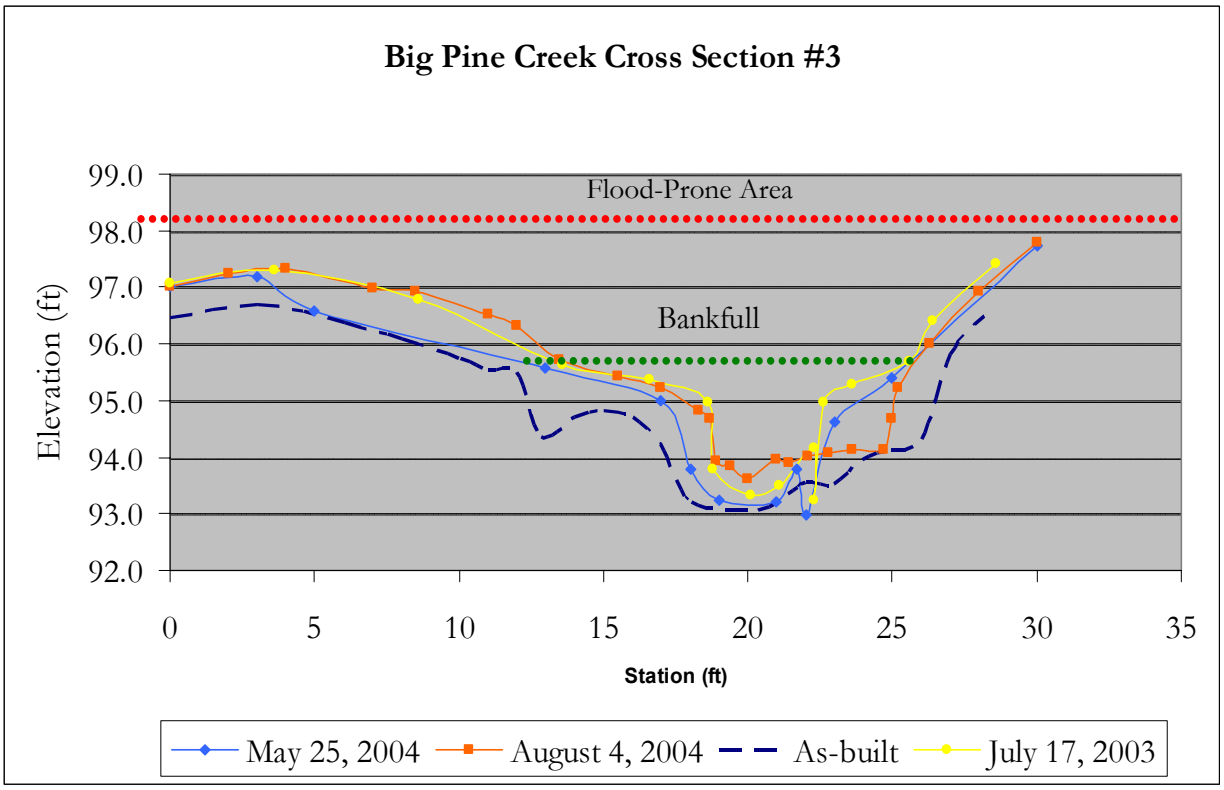
*Measurements were taken after above bankfull event.

Cross Section #2 at Station 1+97 - 2003. Photo taken from right side of channel.



Cross Section #2 – June 2004. Photo taken from left side of channel.

Cross Section #2 – August 2004. Photo taken from right side of channel.



Stream Classification

Location: Station 3+31

Year 2003	C4b* stream type (mid point of riffle)
Year 2004 (June)	E4b* stream type (mid-point of riffle)
Year 2004 (August)	E4b* stream type (mid-point of riffle))

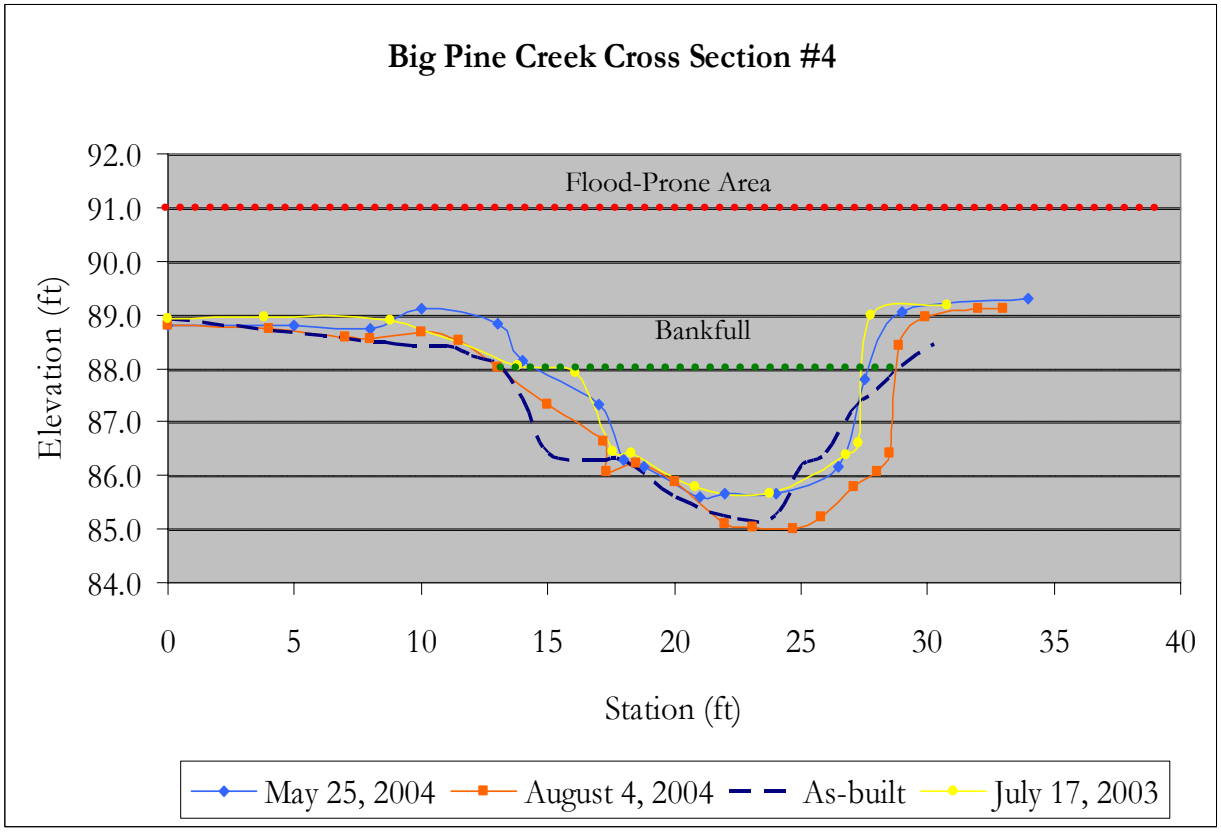
Cross-Section #3 Abbreviated Morphological Summary			
	2003	**2004**	**2004b***
Bankfull Cross Sectional Area (ft^2)	10.7	8.6	17
Maximum Bankfull Depth (ft)	2.5	2	2.4
Bankfull Mean Depth (ft)	0.9	1.2	1.3
Width/Depth Ratio	14.2	5.7	10.8
Entrenchment Ratio	>3.0	>3.5	>3.0
Bankfull Width (ft)	12.3	7	13.5

*Measurements were taken after above bankfull event.

Cross Section #3 at Station 3+31 – 2003. Photo taken from right side of channel.

Cross Section #3 – June 2004. Photo taken from right side of channel.

Cross Section #3 – August 2004. Photo taken from right side of channel.



Stream Classification

Location: Station 5+99

Year 2003	E4b* stream type (mid point of riffle)
Year 2004 (June)	E4b* stream type (mid-point of riffle)
Year 2004 (August)	E4b* stream type (mid-point of riffle))

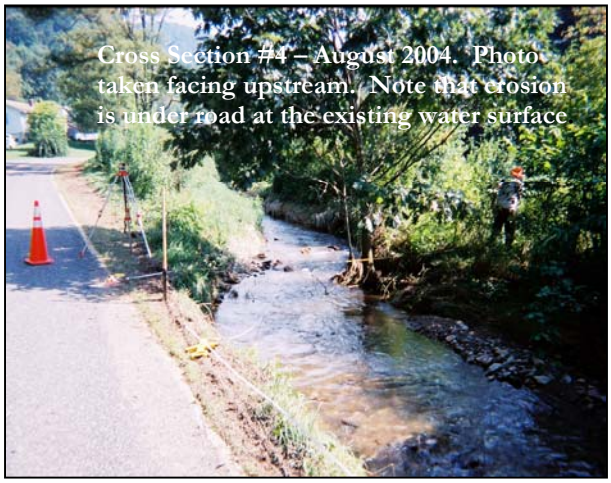
Cross-Section #4 Abbreviated Morphological Summary			
	2003	**2004**	**2004b***
Bankfull Cross Sectional Area (ft^2)	20	13.4	31.1
Maximum Bankfull Depth (ft)	2.3	1.7	3.0
Bankfull Mean Depth (ft)	1.7	1.3	2.0
Width/Depth Ratio	6.6	7.8	7.9
Entrenchment Ratio	>3.0	>3.0	>3.0
Bankfull Width (ft)	11.5	10.2	15.8

*Measurements were taken after above bankfull event.

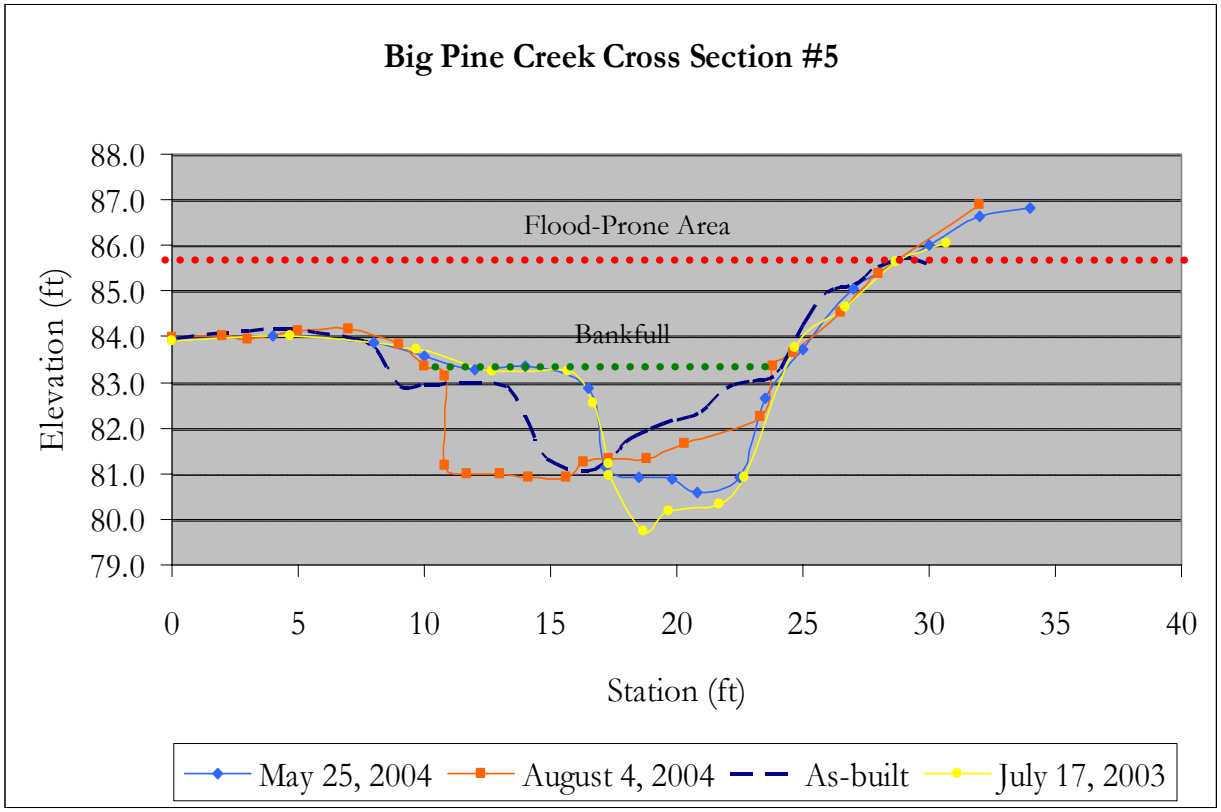
Cross Section #4 – 2003. Photo taken facing upstream.

e 2004. Photo taken from right side of channel.

Cross Section #4 – August 2004. Photo taken from right side of channel.



Cross Section #4 – August 2004. Photo taken facing upstream. Note that erosion is under road at the existing water surface



Stream Classification

Location: Station 7+70

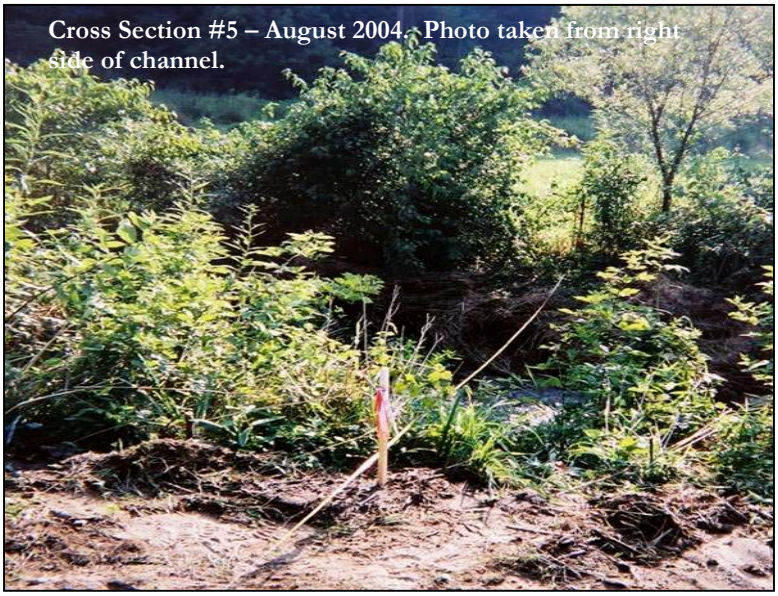
Year 2003	E4b* stream type (mid point of riffle)
Year 2004 (June)	E4b* stream type (mid-point of riffle)
Year 2004 (August)	E4b* stream type (mid-point of riffle))

Cross-Section #5 Abbreviated Morphological Summary			
	2003	**2004**	**2004b**
Bankfull Cross Sectional Area (ft^2)	19	12.5	25.4
Maximum Bankfull Depth (ft)	3.5	2.3	2.5
Bankfull Mean Depth (ft)	2.2	1.7	1.8
Width/Depth Ratio	3.9	4.3	7.5
Entrenchment Ratio	>4.0	>4.0	>4.0
Bankfull Width (ft)	8.6	7.3	13.8

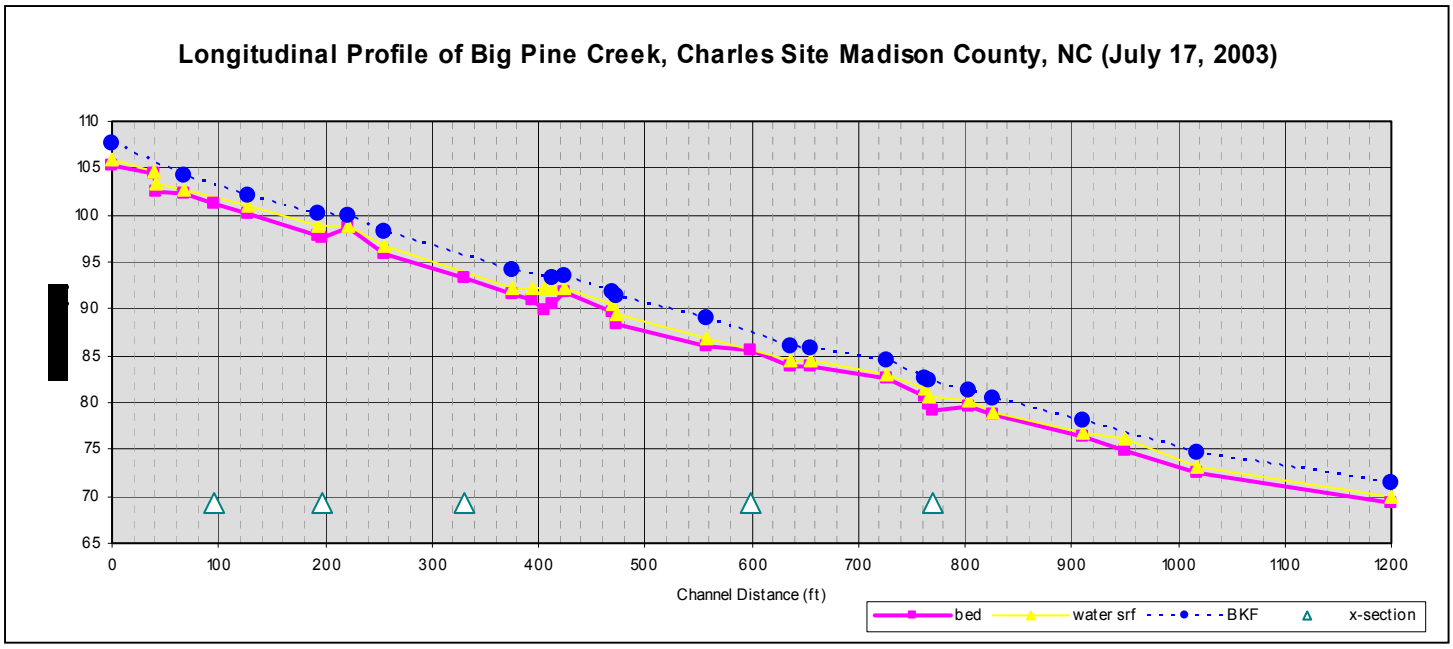
*Measurements were taken after above bankfull event.

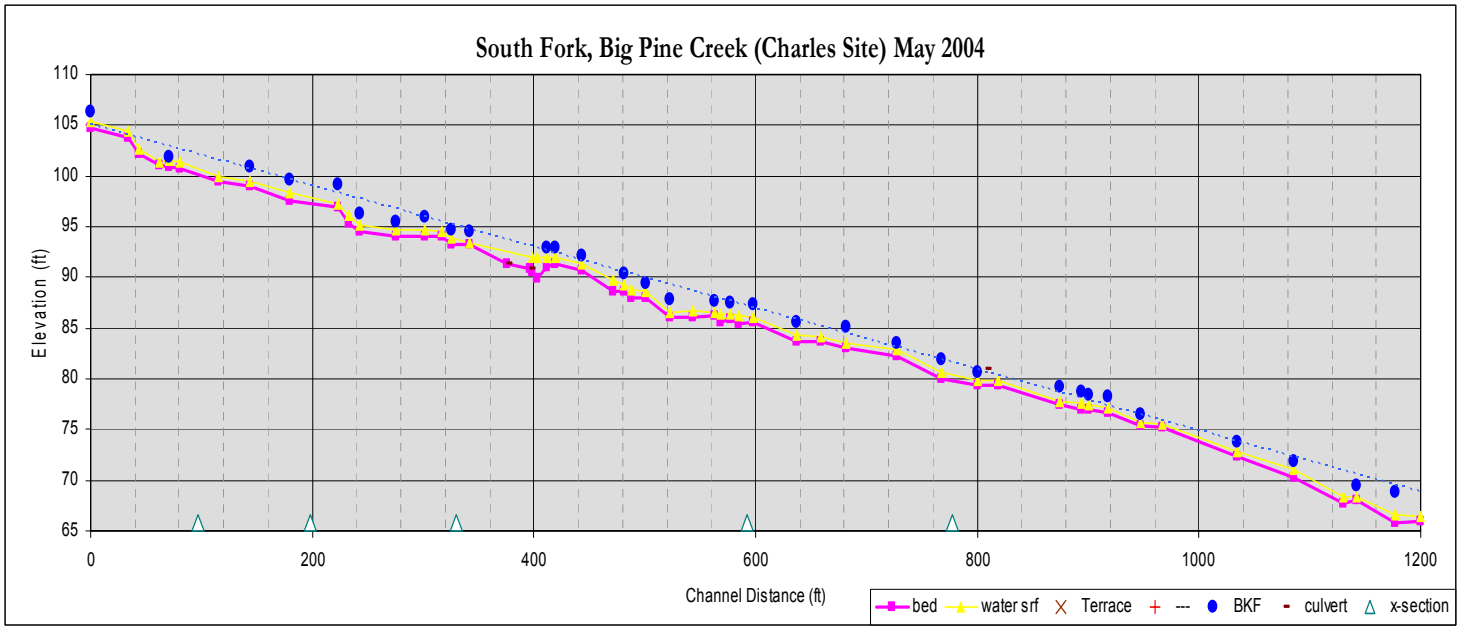
Cross Section #5 at Station 7+70 – 2003. Photo taken from right side of channel.

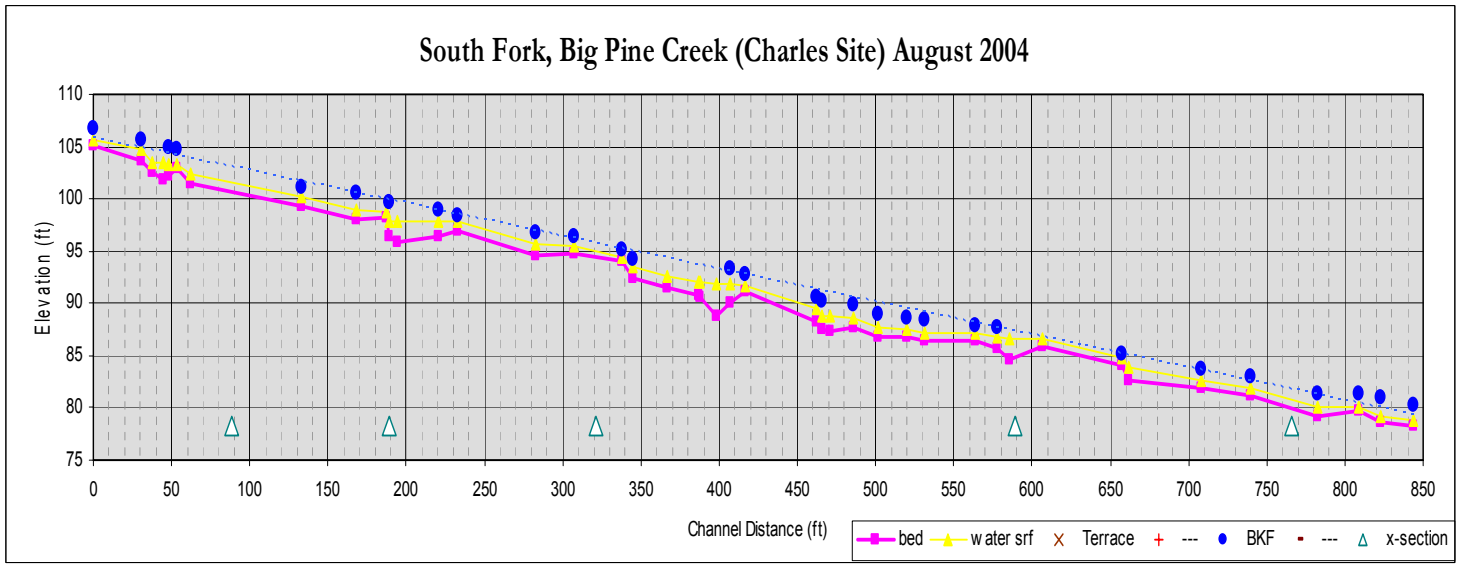
Cross Section #5 – June 2004. Photo taken from right side of channel.



Cross Section #5 – August 2004. Photo taken from right side of channel.


Longitudinal Profile of Big Pine Creek, Charles Site Madison County, NC (July 17, 2003)
110
105
100
95
90
85
80
75
70
65
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Channel Distance (ft)
bed
water srf
BKF
x-section


South Fork, Big Pine Creek (Charles Site) May 2004
Elevation (ft)
110
105
100
95
90
85
80
75
70
65
0
200
400
600
800
1000
1200
Channel Distance (ft)
bed
water srf
Terrace
BKF
culvert
x-section

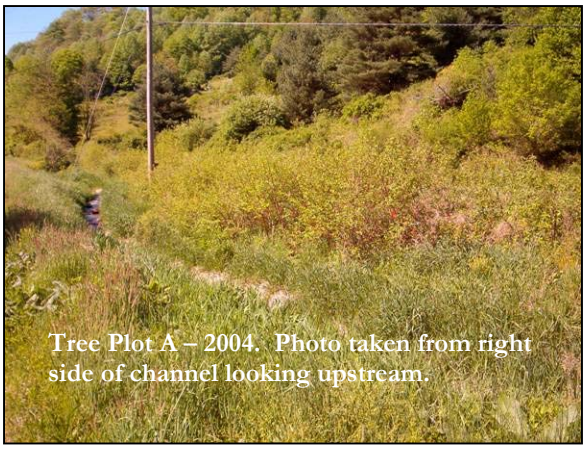

South Fork, Big Pine Creek (Charles Site) August 2004
Elevation (ft)
110
105
100
95
90
85
80
75
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
Channel Distance (ft)
bed
water srf
Terrace
BKF
x-section

APPENDIX C

SITE PHOTOGRAPHS

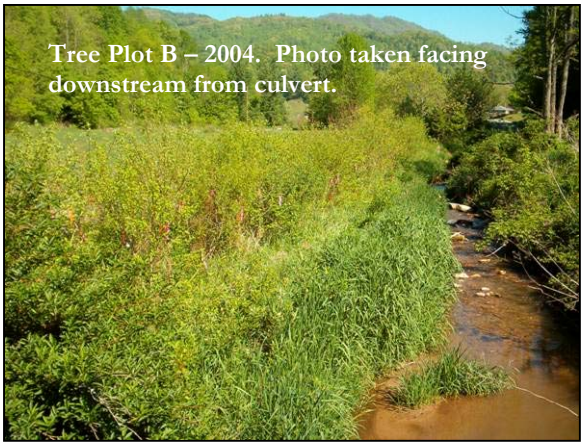
Vegetation Plot Photographs

Tree Plot A – 2003. Photo taken from right side of channel looking downstream.



Tree Plot A – 2004. Photo taken from right side of channel looking upstream.

Tree Plot B – 2003. Photo taken facing downstream from culvert.



Tree Plot B – 2004. Photo taken facing downstream from culvert.

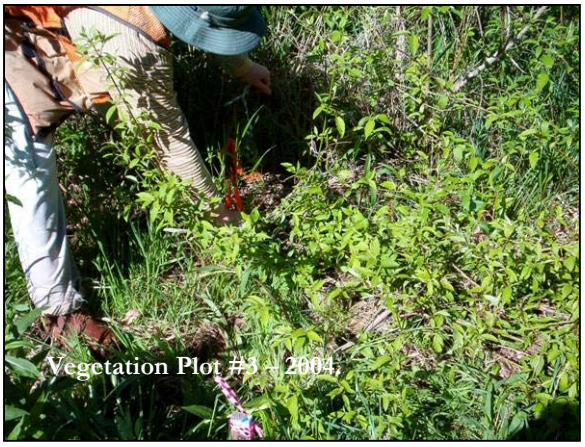
Vegetation Plot #1 near Station 0+96 along left side of channel – 2003.

Vegetation Plot #1 – 2004.

Vegetation Plot #2 within Tree Plot A – 2003.

Vegetation Plot #2 – 2004.

Vegetation Plot #3 within Tree Plot B – 2003.



Vegetation Plot #3 – 2004.

Vegetation Plot #4 near Station 7+00 along left side of channel – 2003.

Vegetation Plot #4 – 2004.

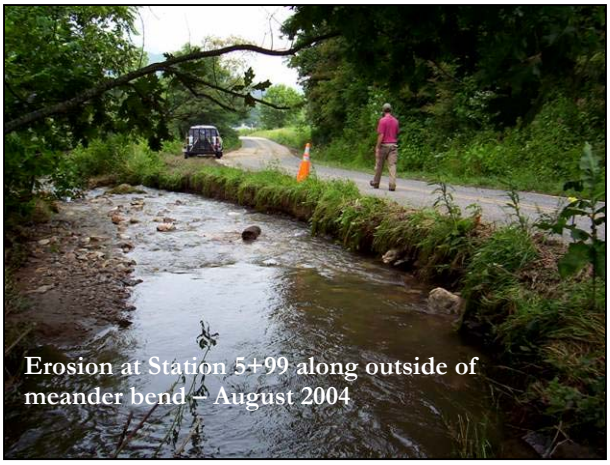
South Fork Big Pine Creek

Facing downstream at debris jam at Station 0+40 - 2003

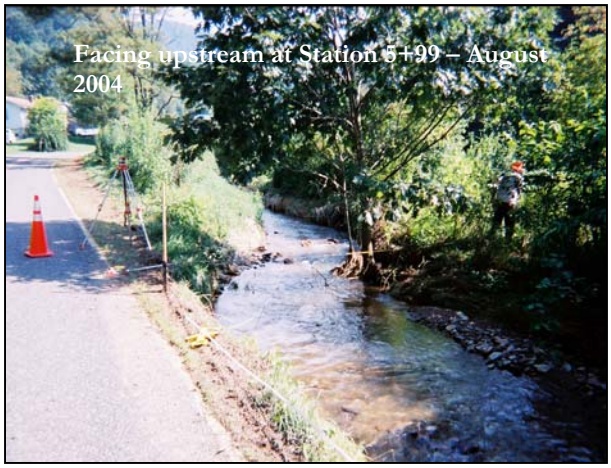
Debris jam at Station 0+40 - 2004

Existing center bar at Station 2+21 - 2004

Facing upstream at undercut banks at Station 5+65 – June 2004



Erosion at Station 5+99 along outside of meander bend – August 2004

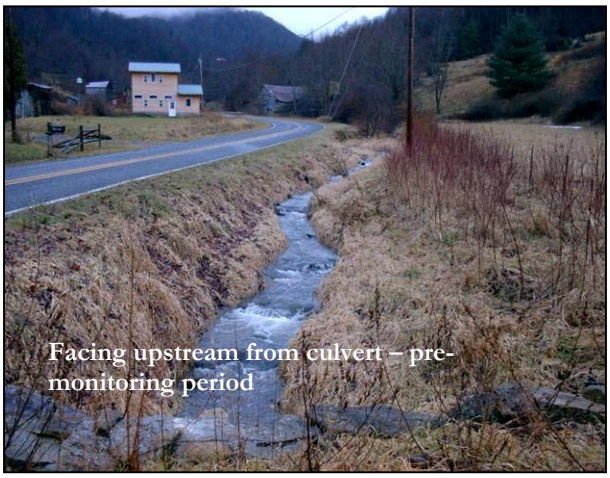


Facing upstream at Station 5+99 – August 2004

Facing downstream at pipe outlet at Station 7+70 - 2003

Pipe outlet at Station 7+70 – June 2004

As-Built Comparisons



Facing upstream from culvert – pre-monitoring period

Facing upstream from culvert - 2003

Facing upstream from culvert – June 2004

Facing upstream from culvert – August 2004