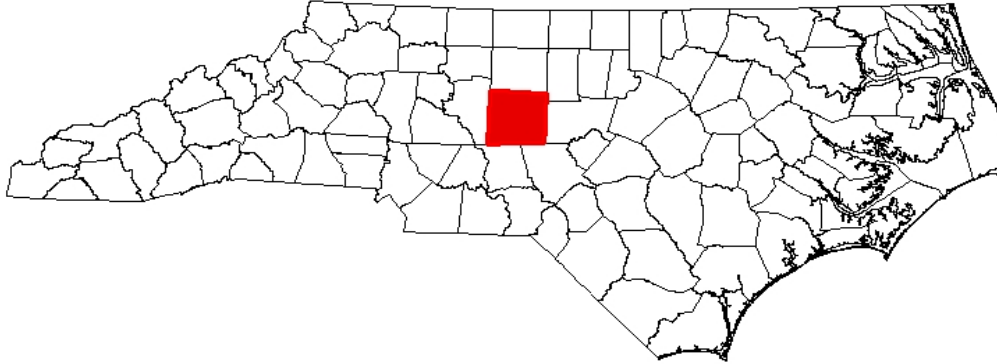


ANNUAL REPORT FOR 2003



Fork Creek Tributaries Stream Mitigation Site (Deaton Site)
Randolph County
WBS Element 34820.4.1
TIP No. R-2417WM



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Summary

The following report summarizes the stream monitoring activities that have occurred during the Year 2003 at the two unnamed tributaries to Fork Creek at the Deaton Site. The site is located in southeastern Randolph County, North Carolina. This site was designed during 2001 and constructed in 2003 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the first documented year of monitoring (Year 2003). The Deaton Site will be monitored through the Year 2007 or until success criteria are met.

The Deaton Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2417 for 4,545 linear feet. This site provided 5,050 linear feet of stream mitigation credit. Overall, the two unnamed tributaries to Fork Creek remain stable. Based on information obtained from the USGS, the Deaton Site has met the required monitoring protocols for hydrology. No supplemental work is proposed at this time.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2003 at the Deaton Site. The site is situated along two unnamed tributaries (UTs) to Fork Creek, immediately adjacent to Erect Road (SR 1003) in the southeastern portion of Randolph County, North Carolina (Figure 1). It is approximately six miles (9.7 kilometers) southeast of Coleridge and nearly one mile (1.6 kilometers) north of Erect. The Deaton Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2417 in Lee County, North Carolina.

The mitigation project covers approximately 5,050 linear feet of UTs to Fork Creek, identified as the northern UT and the southern UT in this report. Approximately 4,100 linear feet were surveyed along the two main tributaries. Several smaller tributaries entering both the main tributaries were not surveyed as part of this assessment. Design and construction of the project was implemented between 2001 and 2003 by the North Carolina Department of Transportation (NCDOT). Priority Level I and II restorations were completed along both tributaries at the site. Construction involved establishing a new channel along each reach. Cross vanes were installed for grade control and bank stability. The adjacent streambanks were re-sloped to reduce overall erosion. It also included the installation of native vegetation and livestock management practices, including a 50-foot riparian buffer and at-grade stream crossings in several locations.

1.2 Purpose

According to the stream mitigation plan (NCDOT, 2001), the following objectives were proposed:

- ◆ Protection of the streams, including the smaller tributaries, and riparian zones via 50-foot conservation easements;
- ◆ Protection of the riparian zones 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 the northern UT and southern UT tributaries to Fork Creek;
- ◆ Installation of rock cross vanes along eroding sections of the creek to reduce erosion and provide habitat diversity;
- ◆ Enhancement of instream habitat by constructing a series of cross vanes;
- ◆ Establishment of the proper width/depth by narrowing the channel and establishing a floodplain; 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.

Based on the stream surveys completed as part of the Year 2003 monitoring, all of these objectives had been met.

Successful stream mitigation is demonstrated by a stable channel that neither aggrades nor degrades 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-growing season at the Deaton Site are included in this report.

Activities in 2003 reflect the first formal year of monitoring following the restoration efforts. Included in this report are analyses on stability (primarily the longitudinal profile and cross-sections) and site photographs. Vegetation monitoring was conducted by NCDOT.

1.3 Project History

January 2003	Construction Completed.
February 2003	Site Planted with Native Perennial Seed Mix
February 2003	Site Planted with Live Stakes and Bare Rooted Trees
June 2003	Vegetation Monitoring (1 yr.)
September 2003	Stream Channel Monitoring (1 yr.)

1.4 Debit Ledger

The entire Deaton Site will be used for TIP No. R-2417 for 4,545 linear feet to compensate for unavoidable stream impacts related with roadway construction. This project generated 5,050 linear feet of stream credits.

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The success criteria, as defined by federal guidelines for stream mitigation, includes the following main parameters: no less than two bankfull events for the five-year monitoring period, reference photos, plant survivability analyses, and channel stability analyses (USACE, 2003). Biological data was not required; however, benthic monitoring was conducted as part of pre-construction sampling in April 2002 and will be conducted again in April 2004.

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

The proposed design for the northern UT to Fork Creek was an E4 stream type according to the Rosgen Classification of Natural Rivers. Prior to construction, the channel was incised below the historic stream grade by as much as two feet. A total of three cross sections (one pool and two riffles) were established and surveyed along the tributary. Based on survey measurements, the stream is characteristic of a C4 stream type as it crosses the property with a high width/depth ratio. The proposed design width/depth ratio was 10; however, a ratio of 14.8 was found at Cross Section #7 and 13.2 at Cross Section #8. Sinuosity for this channel is comparable with other C stream types. A significant amount of herbaceous vegetation was found growing in and across the active channel during the survey, which may have contributed to the higher width/depth ratios. Overall, the channel is maintaining stability and is expected to narrow over time.

The proposed design for the southern UT to Fork Creek was an E4 stream type. A total of five cross sections (two pools and three riffles) were established and surveyed along the tributary. Survey data indicates that the existing channel transitions through stream types as it crosses the property. At Cross Sections #1 and #2, the upper portions of this reach are characteristic of a B4 and B6/4 type, respectively, where the surrounding topography confines the channel to the base of the slope. It should be noted that the B6/4 classification at Cross Section #2 is based on a pebble count that was dominated by silt/clay along the bankfull width but the bed material in the active channel was

predominantly gravel. Width/depth ratios were higher in the upper reach possibly due to the greater than expected bankfull channel width. A significant amount of herbaceous vegetation was found growing in and across the active channel during the survey, which may have contributed to the higher width/depth ratios. The lower portions of the reach exhibit C4 stream type characteristics. The existing width/depth ratio of 13.4 more closely matches the proposed design and is related to the narrow bankfull channel width in the lower reach. Overall, the channel is maintaining stability and is expected to further narrow over time.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of eight total cross sections associated with both tributaries, as well as the longitudinal profiles. Cross section locations established by the NCDOT after construction were not available prior to the field survey. Approximately 1,374 linear feet of channel was surveyed along the northern UT. The southern UT was considerably longer, requiring the survey of approximately 2,697 linear feet. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. Benchmark stakes were installed on both the left and right stream banks for each cross section location.

- ◆ Cross-Section #1. Southern UT, Station 0+69, midpoint of pool
- ◆ Cross-Section #2. Southern UT, Station 8+63, midpoint of riffle
- ◆ Cross-Section #3. Southern UT, Station 19+00, midpoint of riffle
- ◆ Cross-Section #4. Southern UT, Station 23+36, midpoint of riffle
- ◆ Cross-Section #5. Southern UT, Station 24+17, midpoint of pool
- ◆ Cross-Section #6. Northern UT, Station 4+51, midpoint of pool
- ◆ Cross-Section #7. Northern UT, Station 5+76, midpoint of riffle
- ◆ Cross-Section #8. Northern UT, Station 10+91, midpoint of riffle

The cross sections established during the 2003 monitoring survey will be monitored during the next several years to determine the actual extent of aggradation or degradation. All of the cross section locations appeared stable with little or no active bank erosion. Survey data collected during future monitoring periods may 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 A.

Pebble counts were taken at each cross section as a means to determine the composition of bed material during the monitoring period. Existing data for the Deaton Site was available from the mitigation plan. The comparison of pre-construction data with first year monitoring noted cumulative D50s (50 percent of the sampled population is equal to or finer than the representative particle diameter) of 9 mm and 8 mm,

respectively. The similarity in bed material size indicates overall stability after construction. Charts noting the particle size distributions are presented for the northern and southern UTs at the end of this section. Comparisons will be made between 2003 data and future monitoring efforts.

Longitudinal profile surveys were conducted on predetermined segments of both streams. Bank stability was assessed during the longitudinal profile survey. A few areas of active scouring, aggradation, headcutting, and/or sloughing were observed. Descriptions relating to these areas are as follows:

Northern UT

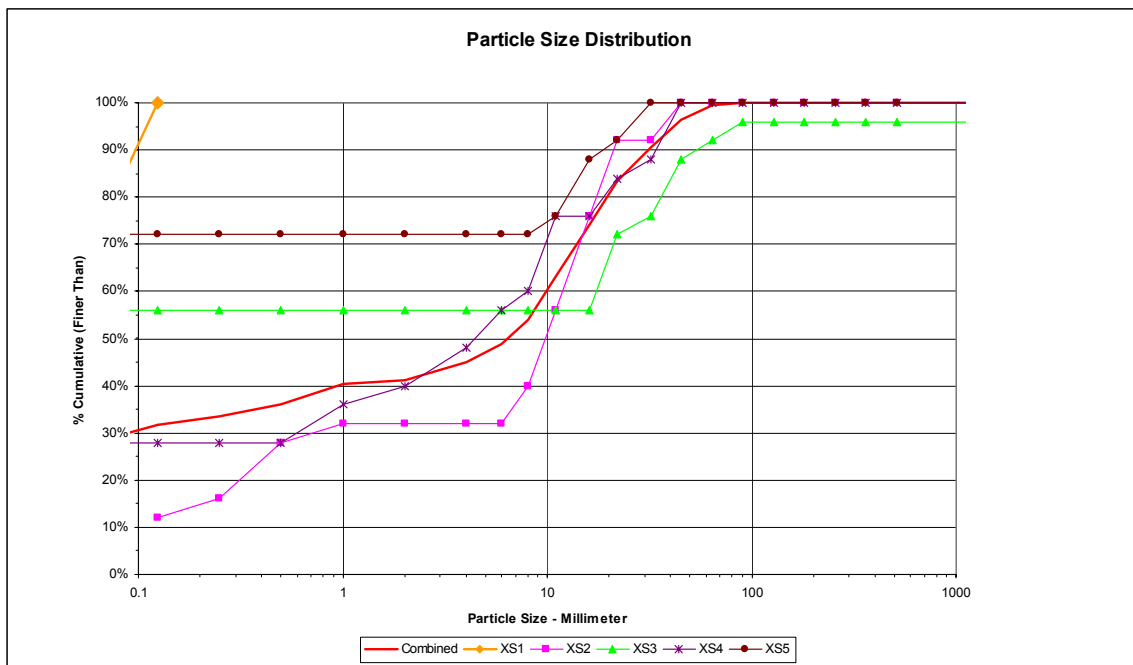
- ◆ Station 1+90 DN. A small transverse bar was observed in the middle of the channel through the riffle section. As a result, the right bank is exhibiting minor toe scour. This reach is within the wooded area at the beginning of the restoration where minimal channel work was performed to save established vegetation. This location should be assessed during the next monitoring period to determine remedial actions, if necessary.
- ◆ Station 4+40 DN. Active erosion was noted on the left bank just upstream from the maximum pool depth. Most of the erosion is due to overland flow spilling over banks with minimal vegetation. This area should be assessed during the next monitoring period to determine remedial actions, if necessary.
- ◆ Station 10+60 DN. Active erosion was noted along right side of cross vane arm. This area should be assessed during the next monitoring period to determine remedial actions, if necessary.
- ◆ Throughout the restored reach, herbaceous vegetation continues to dominate the stream banks and channel areas. This should be assessed during the next monitoring period to determine remedial actions, if necessary.

Southern UT

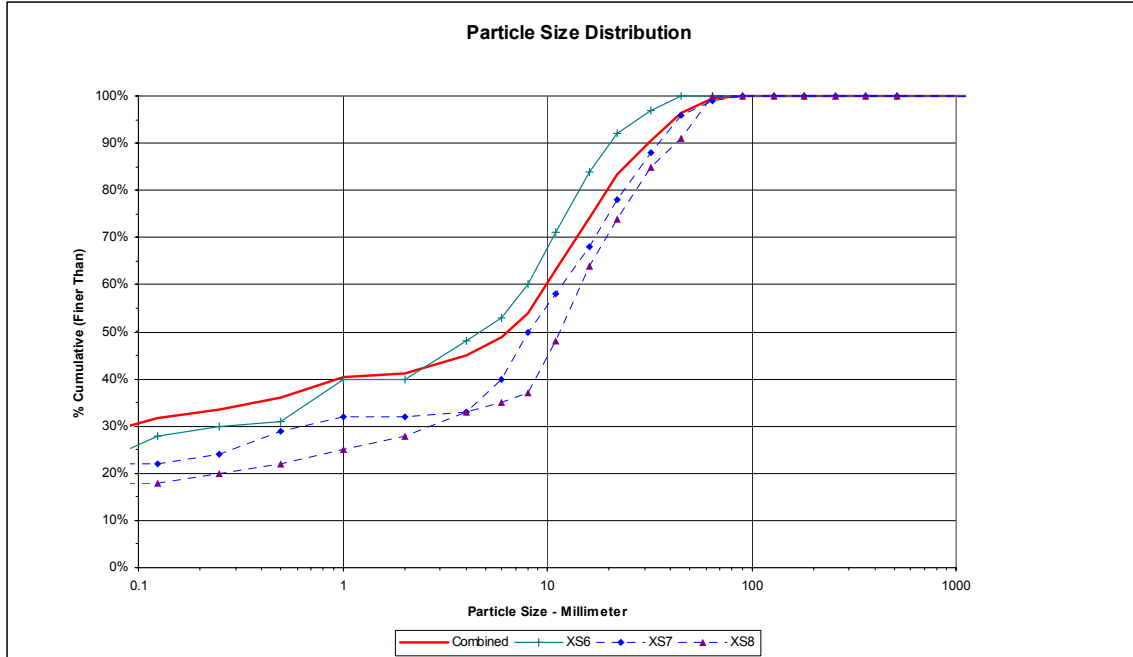
- ◆ Station 2+85 DS. The cross vane and header rock were covered by fine sediment. The sediment may be originating from an area outside the mitigation buffer and immediately upstream of the headwaters. Flushing of the sediment is expected to occur once the vegetation dies back during the winter. This should be assessed during the next monitoring period to determine remedial actions, if necessary.
- ◆ Station 5+77 DS. Gravel has accumulated and filled the pool below the cross vane. This location should be assessed during the next monitoring period to determine remedial actions, if necessary.
- ◆ Station 6+06 DS. Active scour is undercutting the outside of the meander bend. Minimal channel work was performed in this wooded area in order to save established vegetation. This location should be assessed during the next monitoring period to determine remedial actions, if necessary.
- ◆ Station 13+47 DS. Several rocks from the cross vane structure have fallen into the middle of the channel. No erosion was noted, possibly due to the thick herbaceous vegetation growing along the banks and across the channel. This location should be

assessed during the next monitoring period to determine remedial actions, if necessary.

- ◆ Station 19+12 DS. A possible headcut was observed between Stations 19+12 and 19+15. The thalweg differed approximately 1.3 feet in elevation. The surrounding area is sparsely wooded with several mature willow oak and black walnut trees. Minimal channel work was completed in order to reduce potential impacts to the vegetation. This location should be assessed during the next monitoring period to determine remedial actions, if necessary.
- ◆ Station 23+67 DS. Scour associated with the outside of the meander bend has undercut the bank behind the erosion control matting. This location should be assessed during the next monitoring period to determine remedial actions, if necessary.
- ◆ Station 24+67 DS. Several rocks from the cross vane structure have fallen into the middle of the channel. No erosion was noted, possibly due to the thick herbaceous vegetation growing along the banks and across the channel. This location should be assessed during the next monitoring period to determine remedial actions, if necessary.



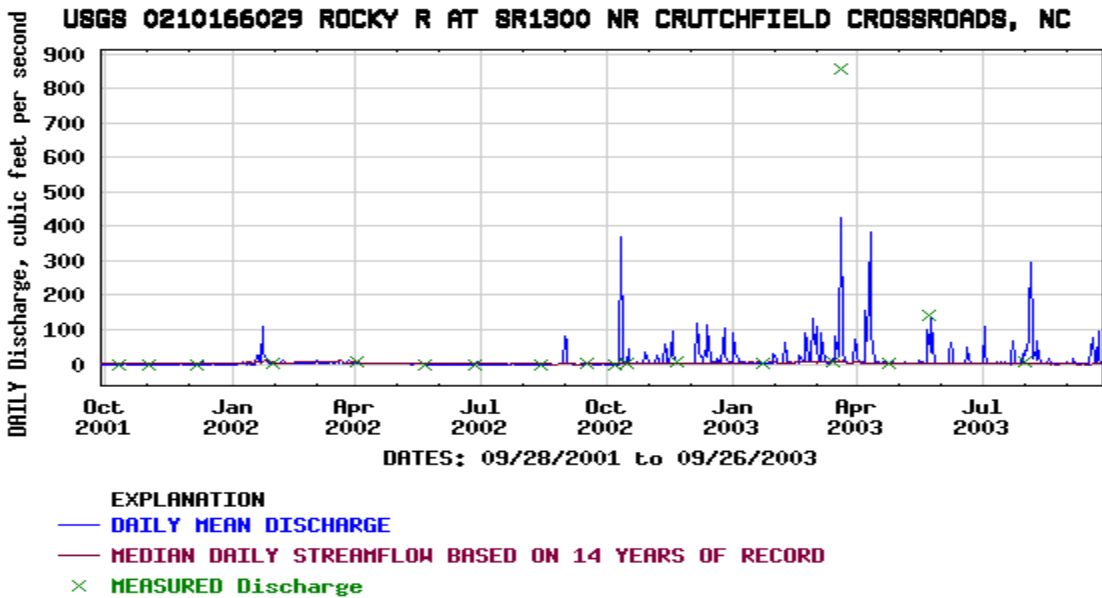
Note: Particle size distribution at Cross Sections #1, #2, and #3 reflect the high level of silt/clay and fine sand in the bed material that is associated with herbaceous vegetation in the active channel.



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 Fork Creek or its tributaries. A review of known U.S. Geological Survey (USGS) surface water gages identified two gages within 21 miles (32 kilometers) of the mitigation site: one along the Rocky River near Crutchfield Crossroads and one along Tick Creek approximately 5 miles southeast of Siler City. Both gage stations are located in Chatham County. The gage station on the Deep River near Ramseur is located closer to the project site; however, its large drainage area of 349 square miles does not accurately reflect the hydrology and precipitation of the Deaton Site.

The Rocky River gage was utilized for this report since it is the smaller of the two gages (7.42 square-miles drainage area as compared to the 15.5 square-miles drainage area associated with Tick Creek). The Rocky River gage is situated in USGS Hydrologic Unit 03030003 and has a datum of 620 feet above sea level NGVD29. Based on the drainage area associated with the gage, the correlated bankfull discharge according to the NC Rural Piedmont Regional Curves (USACE, 2003) is between 300 and 350 cubic feet per second (cfs). A review of peak flows was conducted for the period between August 2001 and August 2003. According to the graph, two bankfull events occurred during 2003. The USGS graph depicting these peak flows is presented below.



Provisional Data Subject to Revision

2.4 Conclusions

Overall, the two UTs to Fork Creek remain stable. Areas of degradation exist along both stream reaches; however, the extensive growth of herbaceous vegetation in and across the active channel may be contributing to this degradation. Work associated with corrective actions would likely cause more sedimentation than actual benefit.

The majority of the cross vane structures along both stream reaches remain intact. Failure of two structures and development of a possible headcut was noted on the southern UT. Localized areas of active bank scour and erosion exist; however, immediate stabilization is not required at this time. These areas and all other areas will continue to be monitored during 2004. If significant problems are noted during the next monitoring period, NCDOT may conduct supplemental corrective-action work. This work would primarily include structure rehabilitation and bank stabilization.

Based on information obtained from the USGS, the Deaton Site has met the required monitoring protocols for hydrology. No supplemental work is proposed at this time. Due to the density of vegetation within the riparian buffer and along the stream channel, permanent photo reference points were not established for several months after the monitoring survey. The photo reference points are presented in Appendix B.

3.0 VEGETATION: DEATON FARM MITIGATION SITE (YEAR 1 MONITORING)

3.1 Success Criteria

Success Criteria states that there must be a minimum of 320 trees per acre living after three years and 260 trees per acre after five years.

3.2 Description of Species

The following species were planted in the Wetland Restoration Area:

Fraxinus pennsylvanica, Green Ash

Quercus phellos, Willow Oak

Quercus nigra, Water Oak

Quercus laurifolia, Laurel Oak

Quercus falcata var. *falcata*, Southern Red Oak

3.3 Results of Vegetation Monitoring

Plot #	Green Ash	Willow Oak	Water Oak	Laurel Oak	Southern Red Oak	Total (1 year)	Total (at planting)	Density (Trees/Acre)
1	5	11	4	3		23	44	355
2	6	11	2	5	1	25	50	340
AVERAGE DENSITY								348

Site Notes: Other species noted: Heavy fescue competition noted on site. There are a large number of trees living outside the plots where there is less competition.

3.4 Conclusions

There were 2 vegetation-monitoring plots established throughout the 13 acre planting area. The 2003 vegetation monitoring of the site revealed an average tree density of 348 trees per acre. This average is above the minimum success criteria of 320 trees per acre.

NCDOT will continue vegetation monitoring at the Deaton Farm Mitigation Site.

4.0 OVERALL CONCLUSIONS / RECOMMENDATIONS

For the 2003 – year, the Deaton Site has met the required monitoring protocols for hydrology. Overall, the two UTs to Fork Creek remain stable. No supplemental work is proposed at this time.

The 2003 vegetation monitoring of the site revealed an average tree density of 348 trees per acre. This average is above the minimum success criteria of 320 trees per acre.

NCDOT will continue stream assessment and vegetation monitoring at the Deaton Site.

5.0 REFERENCES

North Carolina Department of Transportation (NCDOT), 2001. Stream Mitigation Plan, Deaton Site, Randolph County, NC. State Project Number 8.U492107, TIP Number U-2524WM.

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

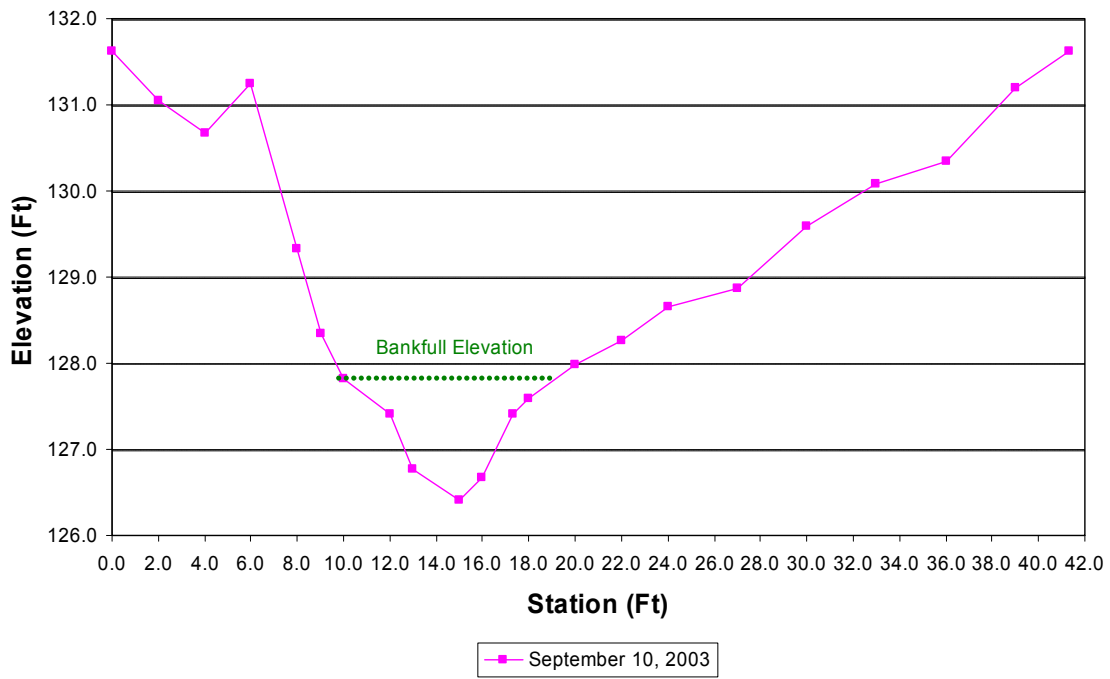
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

US Geological Survey (USGS), 2003. Real-time Data for USGS 0210166029 Rocky River at SR1300 near Crutchfield Crossroads, NC. World Wide Web: <http://waterdata.usgs.gov/nc/nwis>. Accessed on September 28, 2003.

APPENDIX A

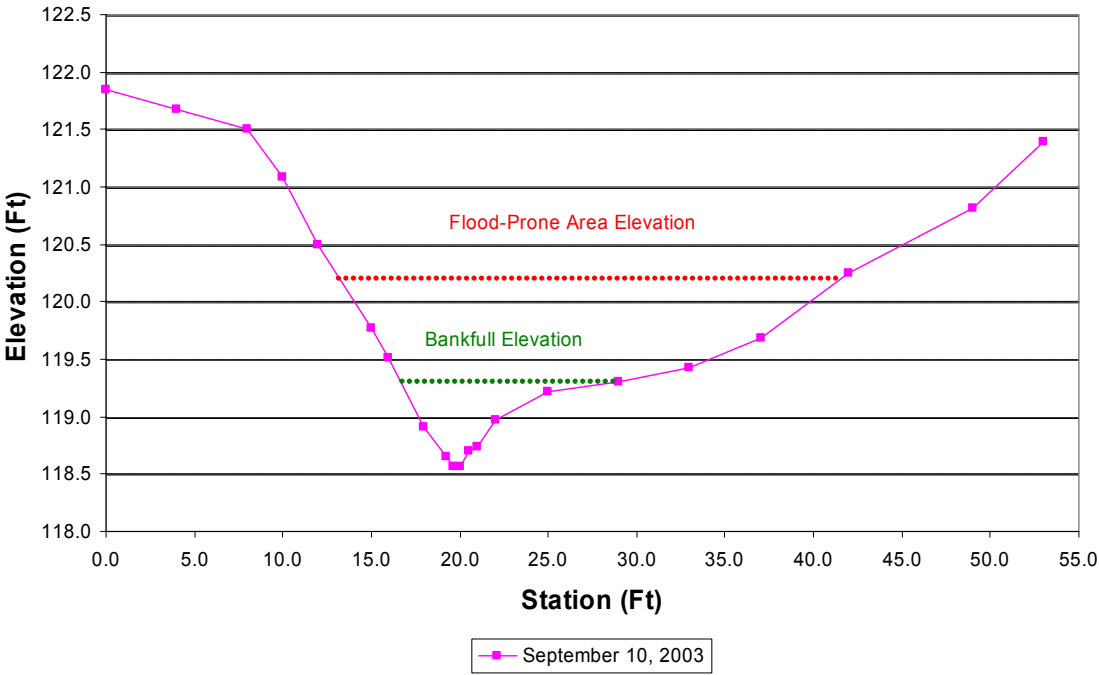
CROSS SECTIONS AND THE LONGITUDINAL PROFILE COMPARISON

**Cross Section-1, Station 0+69
(UT to Fork Creek, South Branch - Pool Section)**



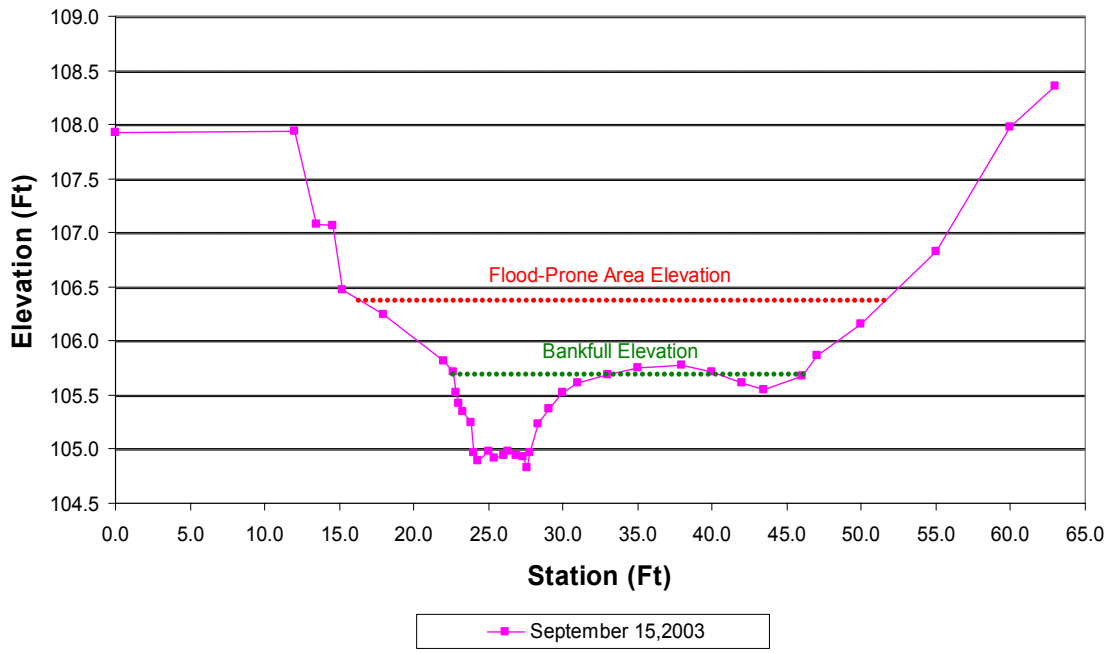


**Cross Section-2, Station 8+63
(UT to Fork Creek, South Branch - Riffle Section)**



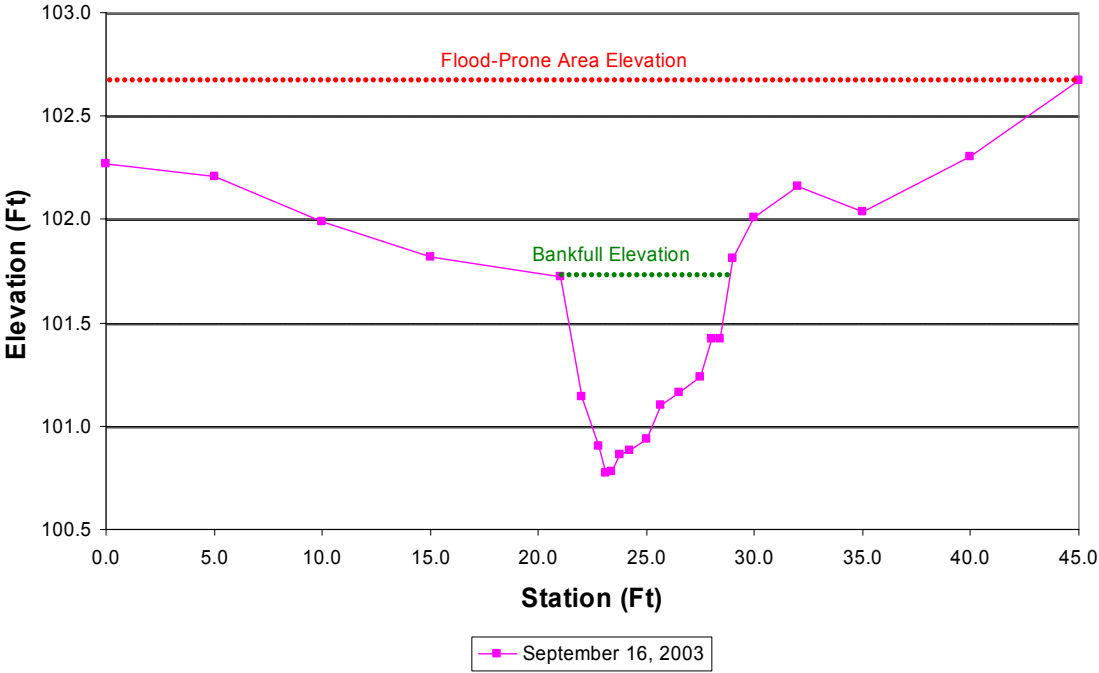


**Cross Section-3, Station 19+00
(UT to Fork Creek, South Branch - Riffle Section)**



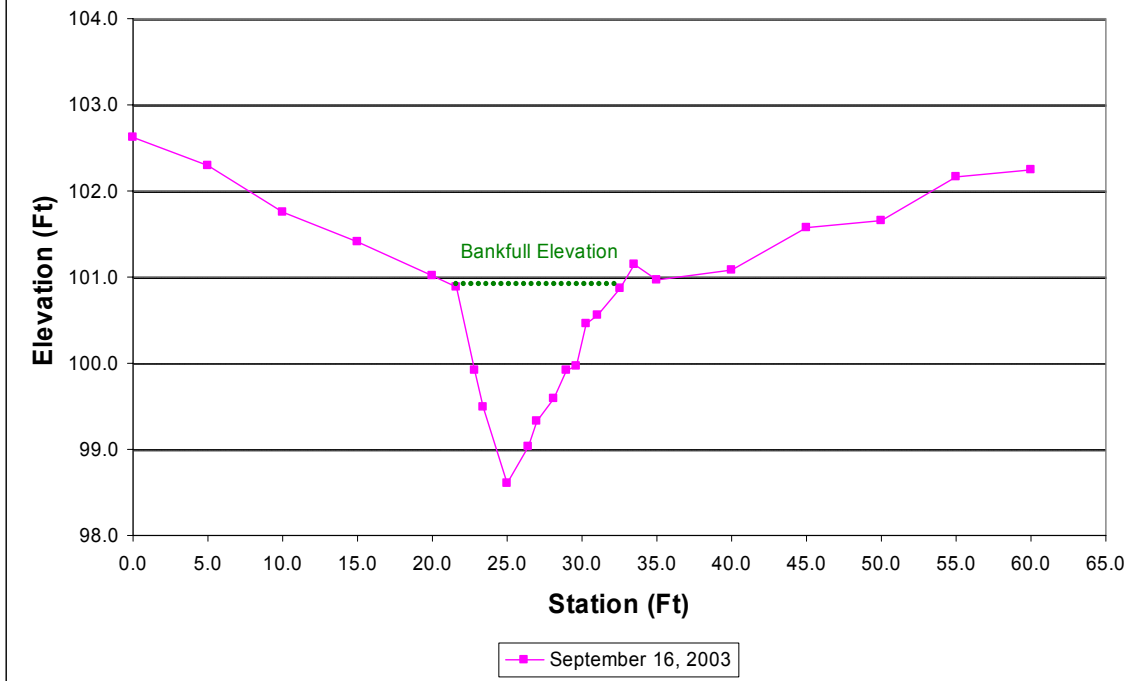


**Cross Section-4, Station 23+36
(UT to Fork Creek, South Branch - Riffle Section)**

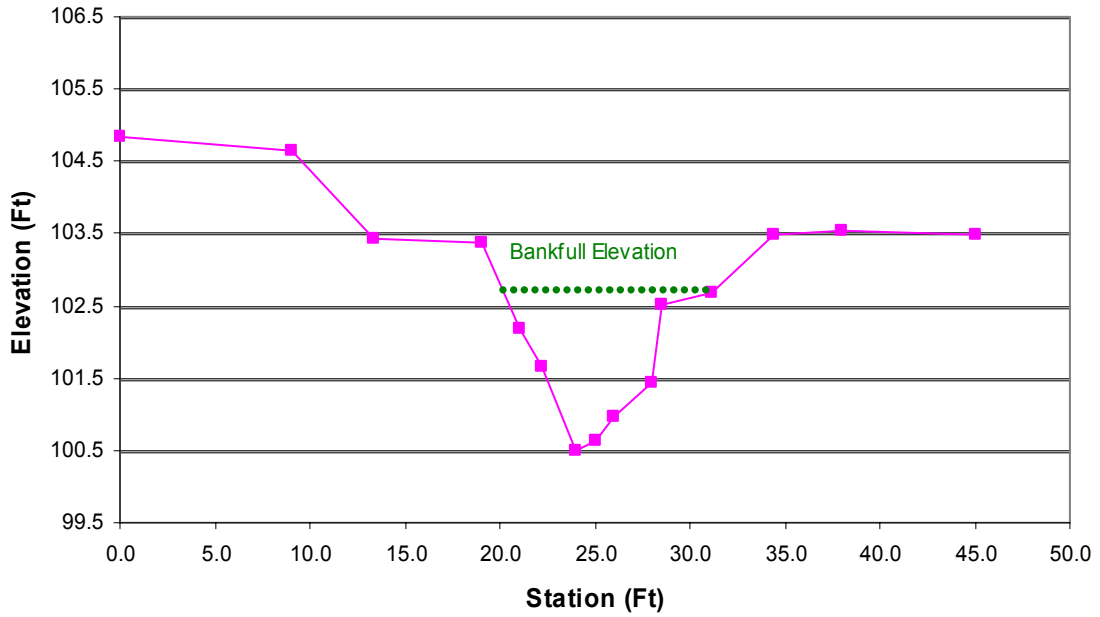




**Cross Section-5, Station 24+17
(UT to Fork Creek, South Branch - Pool Section)**



**Cross Section-6, Station 4+51
(UT to Fork Creek, Northern UT - Pool Section)**

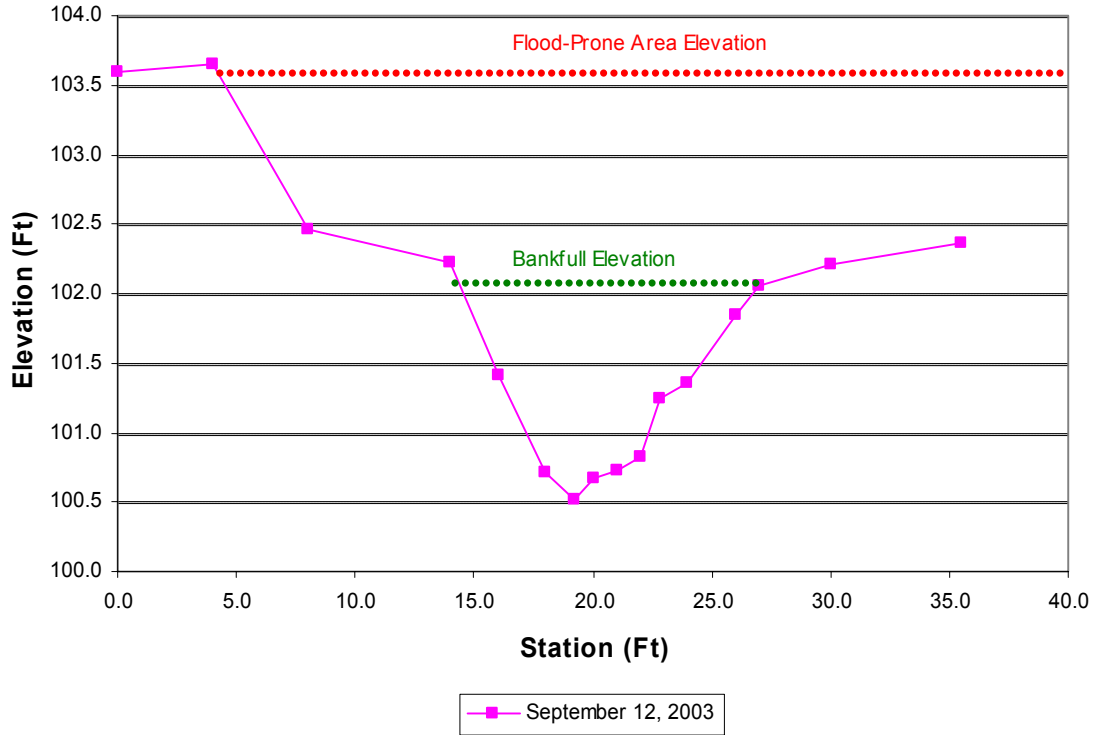


—■— September 12, 2003



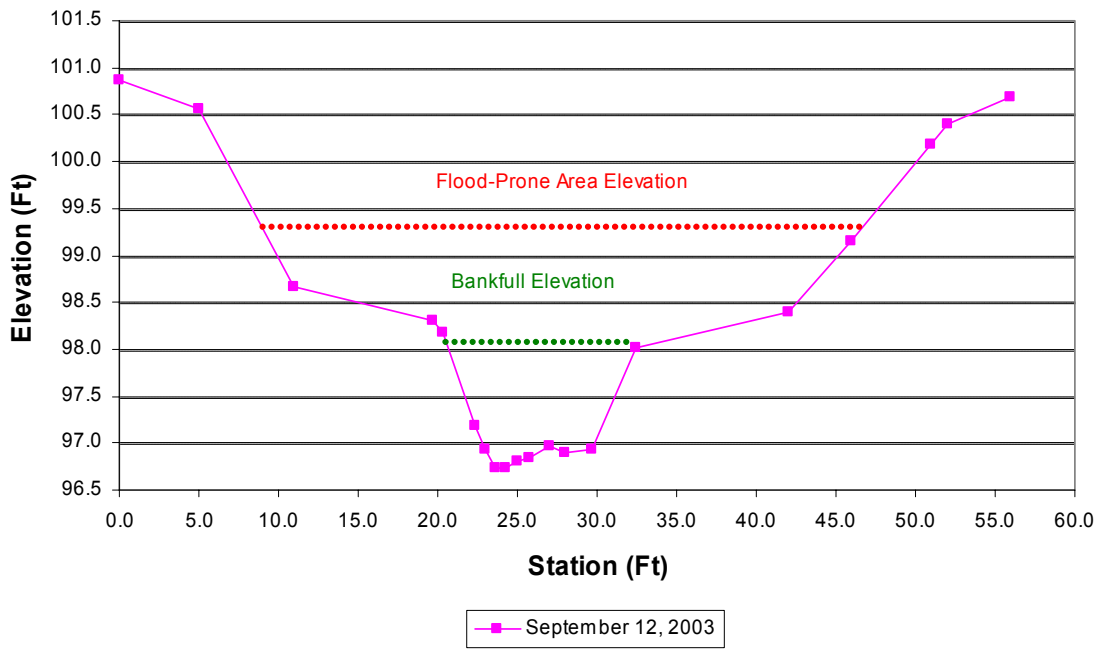
Cross Section #7 upstream from Station
0+00 along Paint Fork Creek

**Cross Section-7, Station 5+76
(UT to Fork Creek, Northern UT - Riffle Section)**



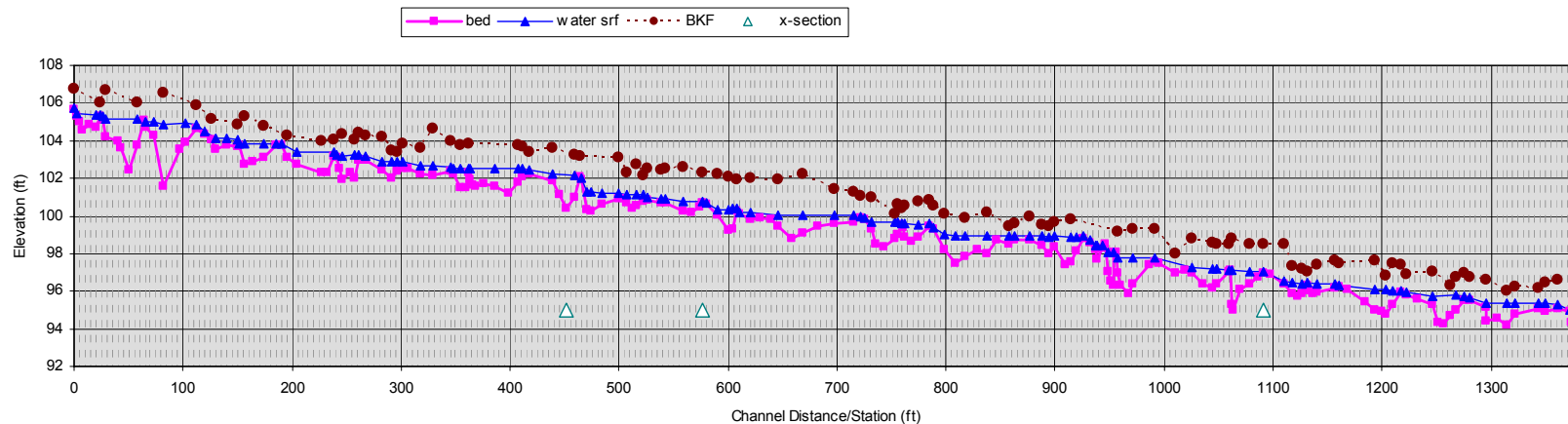


**Cross Section-8, Station 10+91
(UT to Fork Creek, Northern UT - Riffle Section)**

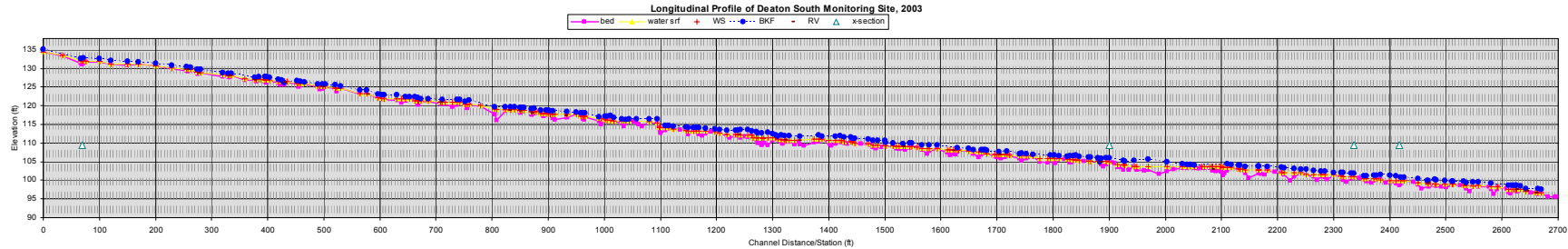




Longitudinal Profile of Deaton North Branch Monitoring Site , 2003



Longitudinal Profile of Deaton South Monitoring Site, 2003



APPENDIX B
STREAM PHOTOGRAPHS

Permanent Photo Points





Photo Point #4 – Facing Upstream
Southern Tributary



Photo Point #4 – Facing Downstream
Southern Tributary



Photo Point #5 – Facing Upstream
Southern Tributary



Photo Point #5 – Facing Downstream
Southern Tributary



Photo Point #6 – Facing Upstream
Southern Tributary



Photo Point #6 – Facing Downstream
Southern Tributary

Northern UT







Southern UT







Southern UT







Southern UT

View Downstream in
Lower Reach







APPENDIX C

VEGETATION PHOTOGRAPHS AND SITE MAP

Deaton Farm



Photo 1



Photo 2

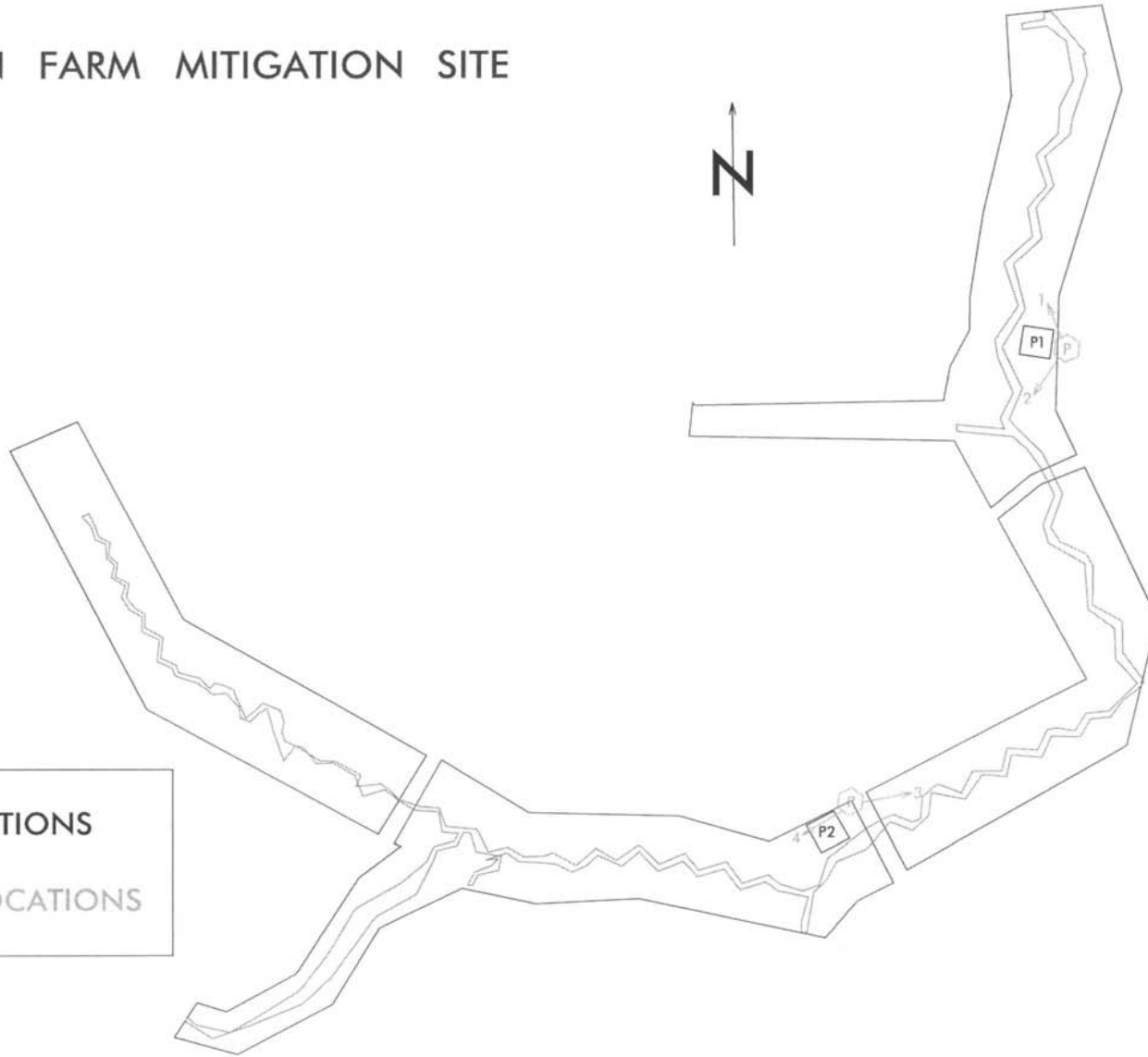




Photo 3



Photo 4

DEATON FARM MITIGATION SITE



	PLOT LOCATIONS
	PHOTO LOCATIONS