UT to Bear Swamp Stream Restoration
2004 Annual Monitoring Report

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Ecosystem Enhancement PROGRAM

NCDENR

NC STATE UNIVERSITY

2004 UT to Bear Swamp Creek Monitoring Abstract

An unnamed tributary of Bear Swamp Creek was restored through the North Carolina Wetlands Restoration Program (NCWRP). The objectives of the project are to:

1.) Establish an stable dimension, pattern and profile on 1400 feet of an UT to Bear Swamp
2.) Improve habitat within the UT to Bear Swamp
3.) Establish an riparian buffer along the UT to Bear Swamp
4.) Incorporate this project into a watershed wide management plan

This is the 2nd year of the 5-year monitoring plan for the unnamed Tributary of Bear Swamp Creek.

Table 1A. Background Information

Project Name	Unnamed Tributary of Bear Swamp Creek
Designer's Name	ARCADIS G&M of North Carolina, Inc 801 Corporate Center Drive Suite 300 Raleigh, NC 27607
Contractor's Name	Unknown
Project County	Franklin County, North Carolina
Directions to Project Site	From Louisburg NC take Route 401 north towards Henderson. Approximately 1 mile north of Louisburg turn left onto West Dykings Road. Continue on Dykings Road 0.9 miles to Murphy's Hay Farm on the left. Turn into Murphy's Hay Farm the UT to Bear Swamp Creek is located in the pasture of the farm. The owner of the Farm is Glenn Murphy.
Drainage Area	0.26 sq. mi.
USGS Hydro Unit	03020101
NCDWQ Subbasin	03-03-02 Upper Tar-Pamlico River Basin
Project Length	1,450 Linear feet
Restoration Approach	1,450 ft of priority 2 Natural Channel Design (dimension, pattern, and profile)
Date of Completion	Summer 2002
Monitoring Dates	January 2004, July, 2004

Results and Discussion

Overall, while the majority of the stream is functioning well and holding grade, the stream has areas of concern and areas of immediate need. Table 2 shows a summary of monitoring measurement results. The stream classifies as a B5c with areas of bedrock outcrops and rock cross vanes that control and hold the grade. Channel dimension and pattern are similar to as-built conditions. There are a few isolated areas of bank erosion. The channel profile is void of many defined bed features and is dominated by runs and pools. There were only five semi-stable riffles located on the restored reach during the 2004 monitoring period. Vegetation is not succeeding to levels required for mitigation credit, replanting trees to obtain mitigation requirements and live stakes only in areas where erosion is problematic. Invasive vegetation is not a major issue on this project site. The fescue should be monitored however, and may need control so more diverse herbaceous vegetation can develop. Placed structures are holding grade and functioning well, with the exception of some localized erosion and four of the structures have piping below the head rock.

Table 2. Summary of Channel Conditions

DIMENSION	UT Bear Swamp Cross-section #1 Riffle		UT Bear Swamp Cross-section #2 Riffle		UT Bear Swamp Cross-section #3 Pool		UT Bear Swamp Cross-section #4 Pool		UT Bear Swamp Cross-section #5 Riffle	
Monitoring Year	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Bankfull Cross-sectional Area	N/A	10.4	N/A	11.2	N/A	18.8	N/A	13.6	N/A	11.2
Bankfull Width	N/A	10.3	N/A	10.2	N/A	13.6	N/A	13.5	N/A	10.6
Bankfull Mean Depth	N/A	1.0	N/A	1.1	N/A	1.4	N/A	1.0	N/A	1.1
Bankfull Max Depth	N/A	1.5	N/A	2.9	N/A	2.2	N/A	2.3	N/A	1.8

PATTERN	UT Bear Swamp Design			UT Bear Swamp As-built 2003			UT Bear Swamp 2004		
	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median
Meander Wave Length	18	77	40	Not Reported			75	240	149
Radius of Curvature	55	342	199	Not Reported			28	261	81
Beltwidth	20	80	37	Not Reported			19	28	21

PROFILE	UT Bear Swamp Design			UT Bear Swamp As-built 2003			UT Bear Swamp 2004		
	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median
Riffle Length	8	23	18	Not Reported			8	23	18
Riffle Slope	0.2%	1.3%	0.7%	Not Reported			0.5%	3.4%	1.2%
Pool Length	6	11	8	Not Reported			9	22	13
Pool to Pool Spacing	19	61	37	Not Reported			23	66	45
Valley (TOB) Slope	1.9%			Not Reported			1.9%		
Bankfull Slope	1.6%	1.6%	1.6%	Not Reported			1.4%	1.8%	1.8%

SUBSTRATE	UT Bear Swamp Cross-section #1 Riffle		UT Bear Swamp Cross-section #2 Riffle		UT Bear Swamp Cross-section #3 Pool		UT Bear Swamp Cross-section #4 Pool		UT Bear Swamp Cross-section #5 Riffle	
Monitoring Year	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
d50	N/A	0.15	N/A	0.23	N/A	0.26	N/A	0.30	N/A	0.35
d84	N/A	0.93	N/A	0.68	N/A	0.99	N/A	1.33	N/A	2.10

VEGETATION 2004 Monitoring	Quad 1 - Bear		Quad 2 - Bear		Quad 3 - Bear		Quad 4 - Bear	
	Observed	Planted*	Observed	Planted*	Observed	Planted*	Observed	Planted*
Tree Stratum (stems/acre)	680	80	280	0	960	200	360	0
Shrub Stratum (% cover)	8	n/a	11	n/a	0	n/a	0	n/a
Herb Stratum (%cover)	100	n/a	112	n/a	107	n/a	28	n/a

* Planted value represents number of stems observed alive that were planted.

The following areas of concern should be monitored closely and considered for repair as suggested:

Unnamed Tributary of Bear Swamp Creek

- Water piping through Rock Cross Vane structures
    - There are three rock cross vanes that are allowing water to pipe under the head rock of the structure at stations 1+60, 3+25 and 6+05
        - At station 1+60 the rock cross vane has water piping under the invert rock with a head loss of 4 inches due to the piping. At this point the structure is not at risk of complete failure due to the boulder size used for the vane construction, the total number of vanes in the project, and the existing vegetation
        - At station 3+25 the rock cross vane has water piping under the invert rock with a head loss of 4 inches due to the piping. At this point the structure is not at risk of complete failure due to the boulder size used for the vane construction, the total number of vanes in the project, and the existing vegetation
        - At station 6+05 the rock cross vane has water piping under the invert rock with a head loss of 8 inches due to the piping. At this point the structure is not at risk of complete failure due to the boulder size used for the vane construction, the total number of vanes in the project, and the existing vegetation
- Areas with bank erosion
    - Bank erosion has been noted at four locations on the stream
        - Bank Erosion due to localized head cuts of 4-8 inches from the piping of water through rock cross vanes occurred at stations
        - Some banks near root wads also have some localized bank erosion
    - There are two areas of major bank erosion due to the overland flow and seepage at station 7+45 on the left bank and station at 8+45 on the left bank Possible repairs would include regarding the gully, preparing this area and seeding with a tackafier and straw mulch
    - The entire length of restored stream has on five existing riffle features
- Vegetation
    - Replanting trees should occur to obtain mitigation requirements
    - The site could benefit from larger containerized trees both for bank stability and aesthetics, although mitigation requirements are currently being met.
    - It is recommended to stake in areas where erosion is problematic, particularly on outside meander bends.
    - Exotic invasive vegetation is a major issue on this project site. Without control the exotic invasive vegetation will likely out-compete native vegetation for resources. A maintenance plan is recommended for control of these species.

Photos

The following are photographs of typical sections and areas of concern throughout the project.

Typical Riffle

Typical Pool

Issue Photo 1. Piping under Structure STA: 3+25

Issue Photo 2. Bank Erosion STA: 9+30

***There are more issue photos in the photo log of this report**

UT TO BEAR SWAMP
LONG PROFILE
ENTIRE REACH
2004 MONITORING

Top of Bank = -0.019 * STA + 101.9
Bankfull = -0.018 * STA + 97.9
Water Surface = -0.018 * STA + 96.5

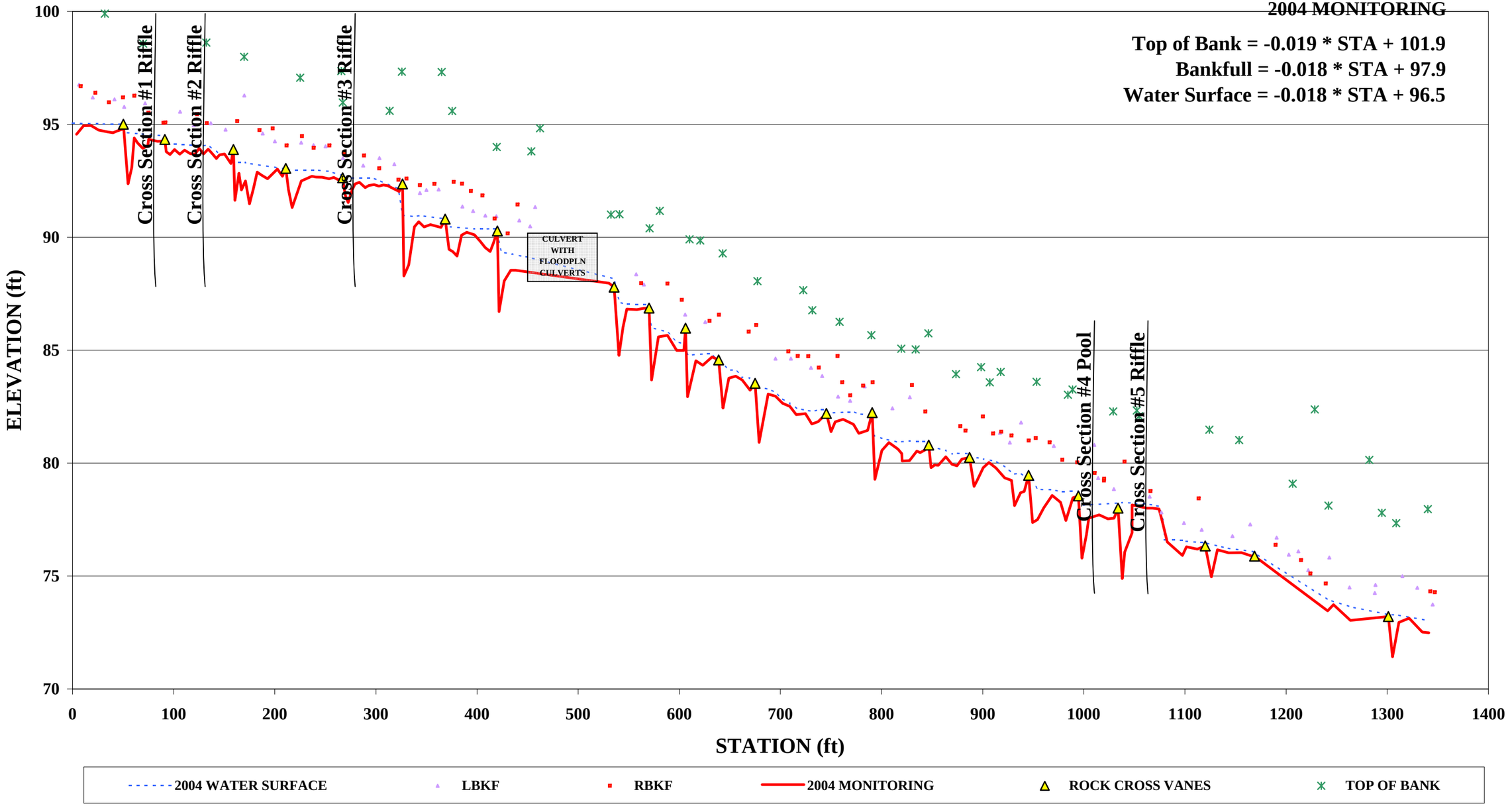

Table of Contents

Tables and Figures

Table 1. Background information

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1.0 BACKGROUND INFORMATION

Project planning was initiated for the Unnamed Tributary of Bear Swamp Creek Stream Restoration in 2001 for the implementation of an rural stream restoration project in Franklin County, North Carolina (Figure 1).

The project consisted of the analysis of the 0.26 square mile portion of the UT to Bear Swamp watershed (located within USGS Hydrologic Unit Code 03020101, NCDWQ Subbasin 03-03-02 of the Upper Tar-Pamlico River Basin) that contributes drainage to the project site. The watershed analysis, including the assessment of stream channel, was conducted for the purpose of developing a clear understanding of existing system characteristics. The resulting Restoration Plan identified opportunities to improve water quality and overall system functions including targeted strategies such as wetland/riparian buffer preservation, stream restoration, and community education.

Following coordination with local leaders, the Wetlands Restoration Program and citizens groups, the project was initiated and focused on the restoration of approximately 1450 linear feet of degraded stream within the property limits of Murphy's Hay Farm. Detailed environmental assessments and engineering studies were conducted and design plans and documents were prepared to facilitate the stream and riparian buffer restoration. Implementation of the project was completed by July 2002.

The restoration of this portion of an UT to Bear Swamp Creek, located north of Louisburg in Franklin County, was conducted to correct identified system deficiencies including severe bank erosion, channel widening, and the loss of aquatic habitat resulting from stream channelization, the loss of riparian vegetation, and watershed development. The channel before restoration was a F5 and G5c stream type with actively eroding banks. Approximately 780 ft of new channel was created, and 680 feet of existing channel was stabilized. The goal of the project was to develop a stable stream channel with reduced bank erosion, efficient sediment transport, enhanced warm water fisheries, and improved overall stream habitat and site aesthetics. Implementation of the project was completed by July 2002.

1.1 Goals and Objective

The goals and objectives of this project are as follows:

1.) Restore 1,450-linear feet of the unnamed Tributary of Bear Swamp through a priority 2 natural channel design approach.
2.) Establish a riparian zone surrounding restored section of the unnamed Tributary of Bear Swamp Improve the habitat within the channel and the riparian zone.
3.) Incorporate this project into a watershed wide management plan.

1.2 Project Location

The UT of Bear Swamp Creek stream restoration is located in Franklin County, NC at Murphy's Hay Farm north of Louisburg. From Louisburg NC take Route 401 north towards Henderson. Approximately 1 mile north of Louisburg turn left onto West Dykings Road. Continue on Dykings Road 0.9 miles to Murphy's Hay Farm on the left. Turn into Murphy's Hay Farm the UT to Bear Swamp Creek is located in the pasture of the farm. The owner of the Farm is Glenn Murphy.

1.3 Project Description

A previously straight and incised channel UT of Bear Swamp Creek located at Murphy's Hay Farm was restored using channel dimension, pattern, and profile modifications and the establishment of riparian zone adjacent to the creek. Channel profile is maintained through the use of rock cross vanes. Channel pattern is maintained through the use of single vanes and vegetation along the channel banks. Due to easement constraints, pattern modifications were limited throughout the project.

2.0 YEAR 2004 RESULTS AND DISCUSSION

Year 2004 monitoring results are shown for the unnamed tributary of Bear Swamp Creek Monitoring.

2.1 Vegetation

Using the Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects, 4 vegetation monitoring plots were randomly located within the riparian buffer of the Bear Swamp Creek tributary. No reference area was studied; therefore no comparisons could be made to reference conditions.

2.1.1 Results and Discussion

Vegetation within the riparian buffer varied in success level. Joe pye weed (Eupatoria fistulosum) and fescue (Festuca spp.) are especially doing well throughout the area. Live stakes are healthy in certain areas. Where living, live stakes thrived, sending up tall stems. Herbaceous vegetation, both planted and naturally regenerating, are doing extremely well and contribute to the bank stability of the project. Planted trees and shrubs are doing poorly throughout the entire buffer. In the fourth plot, no living planted tree stems were found. In the second plot, 3 tree species were noted, 2 of which had been planted. Extrapolation from the plots resulted in an overall average of approximately 40 planted trees per acre for this restoration site, with an average of 1 tree per plot.

Natural regeneration of woody stems dominated the plots, especially nearest the stream. Loblolly pine (Pinus taeda) was present in densities over 6,000 stems per acre. There is a large reproductive sweetgum (Liquidambar styraciflua) in the fourth plot, and a number of young trees surrounding it. Overall, the area appeared to be in an early successional state.

Recommendations include replanting trees to obtain mitigation requirements and live stakes only in areas where erosion is problematic. Invasive vegetation is not a major issue on this project site. The fescue should be monitored however, and may need control so more diverse herbaceous vegetation can develop.

2.2 Morphology

Restored channel dimension, pattern, profile and substrate were examined during the 2004 monitoring.

2.2.1 Results and Discussion

The unnamed Tributary of Bear Swamp Creek is sand bed channel with a percentage of gravel and therefore the dune and anti-dune characteristics of sand-bed sediment transport should be considered. The restoration construction created a B5c channel from an existing G5 / F5 channel. The valley slope is 1.9% at the project location, the tributary was restored with an entrenchment ratio or 1.8 to 2.0 and the ratio of the top of bank height to the bankfull height is approximately 2.5. There is one major bedrock outcrops that hold grade on this reach. The channel profile along UT to Bear Swamp Creek has not shown any significant changes in between the as-build profile and this year's monitoring. The stream is moving toward a step pool and run dominated system pools are filling in and riffles are flattening. Rock cross vanes are holding the grade of the stream. While there are three areas where structures have piping of water occurring below the head rock, there are no major failures with the rock cross vanes. Between the rock size, existing vegetation, and number of structures the piping occurring will not cause any of the structures a major failure. The three structures that are piping have resulted in a localized head cut of 4-8 inches. The stream profile of the as-build shows that riffles were constructed but are transitioning into runs. The design was most likely intended to build a riffle/pool sequence plan form B5c type channel for the majority of the project, but this intent was not maintained over the monitoring period thus far. The location of riffles has not changed significantly from construction to the present, but riffles have transitioned in to other bed features. The average riffle length has also increased and only the steeper riffles remain. The number of riffles has decreased and only the longer and or steeper riffles remain. Unless the substrate become more course the system will stay embedded with sand and will continue to migrate toward a run dominated system. During the 2004 monitoring period there were five semi-stable riffles observed and three un-stable riffles observed related to the piping of the three cross vane structures.

Cross section results were calculated using NCSU techniques for consistency purposes, there were no as-build cross sections available for analysis. Cross-sectional trends were analyzed by looking at the cross-sections, change in planform, BEHI, and the longitudinal profile. Cross-section 1 is a riffle and has a current cross sectional area of 10.4 square feet. Cross section 1 is fairly stable, has low near bank stress and a low bank erosion hazard. This first cross section classifies as a B5c channel with an ER of ~1.8, and is 10 ft upstream of a stable rock cross vane. Cross-section 2 is a riffle and has a current cross sectional area of 11.2 square feet. Cross section 2 is fairly stable, has low near bank stress and a low bank erosion hazard. This second cross section classifies as a B5c channel with an ER of ~1.8, and is 25 ft upstream of a stable rock cross vane. Cross-section 3 is a pool and has a current cross sectional area of 18.8 square feet. Cross section 3 is fairly stable, has a low bank erosion hazard. There is a rock cross vane approximately 5ft upstream from cross section 3, this cross section is a scour pool. Cross-section 4 is a pool and has a current cross sectional area of 13.6 square feet. Cross section 4 is fairly stable, has a moderate bank erosion hazard. There is a rock cross vane

approximately 5ft upstream from cross section 4, this cross section is a scour pool. Cross-section 5 is a riffle and has a current cross sectional area of 11.2 square feet. Cross section 5 is fairly stable, has low near bank stress and a low bank erosion hazard. This second cross section classifies as a B5c channel with an ER of ~1.8, and is 5 ft upstream of a bedrock outcrop and large sycamore roots that are holding grade.

The channel substrate in the riffle sections are sand and have a D50 of 0.24 mm with a D84 of 1.2 mm. The channel substrate in the pool sections are sand and have a D50 of 0.28 mm with a D84 of 1.2 mm. Future monitoring should better evaluate channel substrate and sediment loading patterns.

Channel pattern appears to have been maintained since construction. One of the outside meander bends are experiencing slight migration through bank slumping but no excessive migration is evident and no shoot cut-offs are apparent. The pattern aligns closely with the as-build pattern (Figure 4). Channel banks throughout The unnamed Tributary of Bear Swamp remains fairly stable, with the exception of two spot areas of bank slumping and scour. Slumping and scour is the result of a root wads being placed too high or down cutting due to piping of a structure that have exposed the lower portion of a root wad.

While loosing bedform this project has fairly stable banks and is able to transport the sediment supplied through the reach without forming mid-channel bars. There were no areas of concern noted due to high near bank stress and the bank erosion hazard index was used to rank the stream banks as having a moderate low erodibility rating. Bed scour is primarily limited to meander beds below structures where energy show be dissipated in a stream. Vegetation is growing well and there is a lot of volunteer growth on this project but does not meet the vegetation requirements of the Ecosystem Enhancement Program yet. This reach of the unnamed Tributary of Bear Swamp Creek is a run dominated sand bed stream but the system seems to be relatively stable with an aggrading bedform that is controlled by a major bedrock outcrops and rock vane structure. The owner was also commented that his cattle put on an extra 1 -2 pounds of weight a week since they have been fenced out of the stream and drinking from the supplied alternative watering sources.

2.3 Biological and Ecological

Two post-construction surveys have been conducted at this project. Results of the first post-construction investigation indicated that there were some improvements in the biological condition of the stream above background conditions. For example higher taxa richness and EPT abundance values were found as well as an increase in the Dominant in Common comparison (both to the upstream and to the ecoregional reference locations). These conditions do not improve during the second post-construction investigation. In fact, subtle declines in biological integrity were noted during this investigation.

2.3.1 Results and Discussion

Approximately 1450 linear feet of this UT to Bear Swamp Creek in Franklin County was restored in July 2002. Qual-4 samples were collected from three reaches of this tributary prior to and following construction to assess the recovery of this stream following restoration. Site 1 is above the 1450 linear foot reach on the UT to be restored. The stream at this point is stable with good instream and riparian habitat. The site was selected as an upstream reference reach and receives flow from a series of springs immediately above the site as well as overflow from an instream pond. Two sites were selected within the restoration reach. Site 2 is a midreach location approximately 50 meters below a bridge crossing. The stream prior to construction was severely degraded with very little riparian canopy and direct cattle access. Site 3 is located within a minimally forested reach of the stream at the lower end of the restoration project and appears to be aggrading. Abundance of benthic organisms at this location was much greater than at site 2 during the preconstruction survey and many tolerant organisms were collected at this site (i.e. Chironomus sp.) during this survey. Additional samples were collected from a UT to Crooked Creek, which was selected as the ecoregional reference site and used for the design of the new stream at Murphy Farm. The reference reach at the UT to Crooked Creek appears to be very stable and has a diverse benthic macroinvertebrate population.

Table 11. Summary statistics from the stream restoration project at Murphy Farm,

	UT Crooked Cr., Ecoregional Ref.			**UT Bear Swamp Upstream Ref, Site #1**			**UT Bear Swamp, Site #2**			**UT Bear Swamp, Site #3**		
Date of Survey	12/2001	12/2003	11/2004	12/2001	12/2003	11/2004	12/2001	12/2003	11/2004	12/2001	12/2003	11/2004
Total Taxa Richness	50	51	42	48	43	31	36	39	29	46	40	33
EPT Taxa Richness	21	24	20	16	14	11	4	**8**	9	8	11	7
EPT Abundance	100	107	96	69	67	59	8	**48**	31	23	44	29
Dominant in Common Index (%)	-	-	-	59%	50%	48%	11%[3] (22%)	33%[3] (45%)	32%[3] (24%)	33%[3] (48%)	29%[3] (35%)	24%[3] (24%)
# Keystone taxa	12	14	15	6	7	10	2	1	4	3	2	2

[3]. DIC comparisons were made between the ecoregional reference location and the upstream reference reach (in parentheses) at these two locations

Table 11 summarizes the data from this project to date. A very rapid change in the composition of the benthic fauna occurred between the upstream reference site and

station 2 during the pre-construction survey. The upstream reference was dominated by fairly intolerant taxa including Diplectrona and Chimarra, but their numbers fall off drastically at station 2, these conditions suggest a shift in energy sources from heterotrophic to autotrophic. Many organisms that are abundant or common upstream were not collected at the downstream location during this survey. Abundance and taxa richness increase slightly at station three in 2001, perhaps responding to the slight increase in canopy cover. However tolerant fauna (Chironomus and Physella) dominated the benthic community at this most downstream location.

Conditions improve somewhat the first survey following restoration (2003). Note particularly the increase in EPT taxa richness and abundance values (in bold) during the 2003 survey at station 2 and an increase in the DIC to both of the reference reaches. These data suggest that water quality conditions have improved at this site following construction however; many of the EPT taxa collected at this site are tolerant (i.e. Hydropsyche betteni). Slightly higher EPT values were also found at station 3 and many of the very intolerant taxa collected during the 2001 survey were reduced in abundance. During a March 2004 inspection of this project, enrichment indicators (primarily filamentous algae) were noted from this reach of UT Bear Swamp, suggesting that nutrient laden runoff is entering the stream. Data also were collected from UT Crooked Creek that was selected as the reach for design. Taxa richness and abundance values were higher at this location. Many more mayflies and stoneflies were collected from this location than the upstream reference reach of UT Bear Swamp.

Data from the 2004 investigation suggests that the biological conditions of the restoration reach at Site 2 is similar to, or slightly poorer than, those recorded at this site in 2003. Although EPT increase marginally and we noted an increase in the number of keystone taxa, the dominant in common taxa was lower particularly if the upstream reference was used (45% in 2003 compared to 24% in 2004). All comparisons were somewhat lower at Site 3 during the 2004 investigation that those recorded in 2003. These data indicate that biological conditions at this project have not improved from those recorded in the previous investigation. Much of the difference between the communities at Site 1 and Site 2 are due to the loss of caddisfly taxa at the lower reach, in particular Chimarra and Diplectrona modesta.

Table 1. Summary of Channel Conditions

DIMENSION	UT Bear Swamp Cross-section #1 Riffle		UT Bear Swamp Cross-section #2 Riffle		UT Bear Swamp Cross-section #3 Pool		UT Bear Swamp Cross-section #4 Pool		UT Bear Swamp Cross-section #5 Riffle	
Monitoring Year	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
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Bankfull Width	N/A	10.3	N/A	10.2	N/A	13.6	N/A	13.5	N/A	10.6
Bankfull Mean Depth	N/A	1.0	N/A	1.1	N/A	1.4	N/A	1.0	N/A	1.1
Bankfull Max Depth	N/A	1.5	N/A	2.9	N/A	2.2	N/A	2.3	N/A	1.8

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LONG PROFILE
ENTIRE REACH
2004 MONITORING

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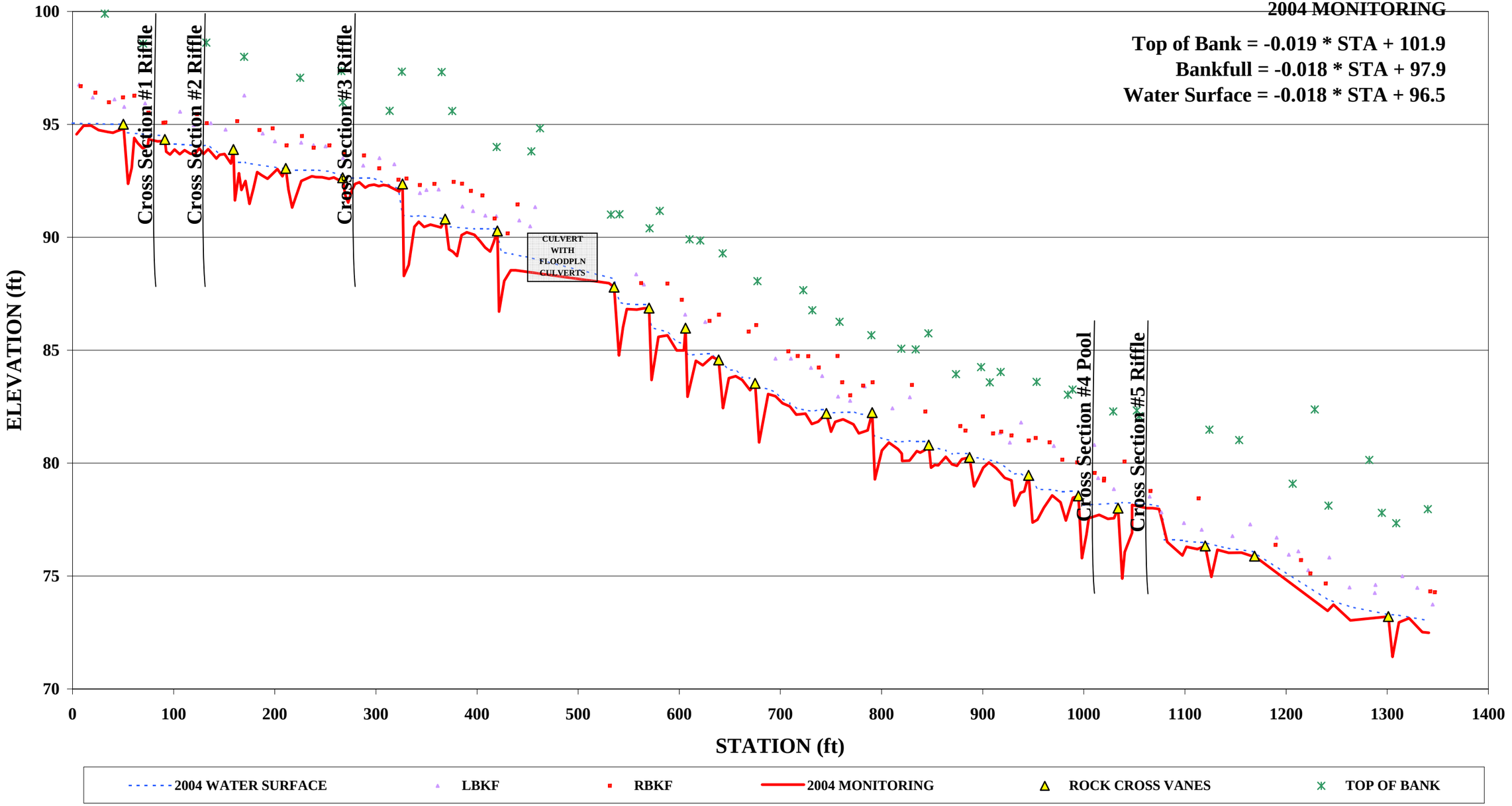
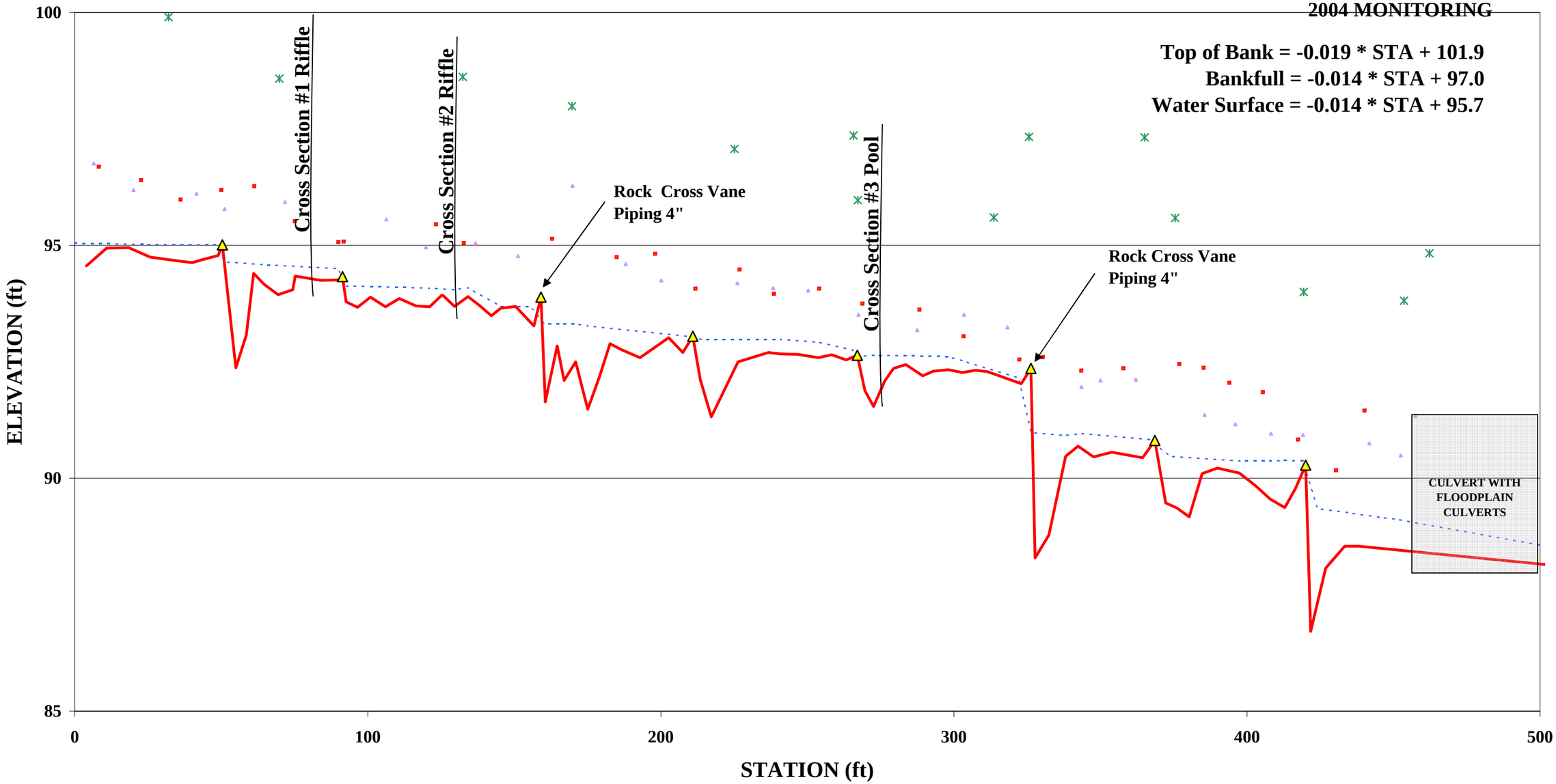


UT TO BEAR SWAMP
LONG PROFILE
UP-STREAM REACH
2004 MONITORING

Top of Bank = -0.019 * STA + 101.9
Bankfull = -0.014 * STA + 97.0
Water Surface = -0.014 * STA + 95.7



UT TO BEAR SWAMP
LONG PROFILE
DOWN-STREAM REACH
2004 MONITORING

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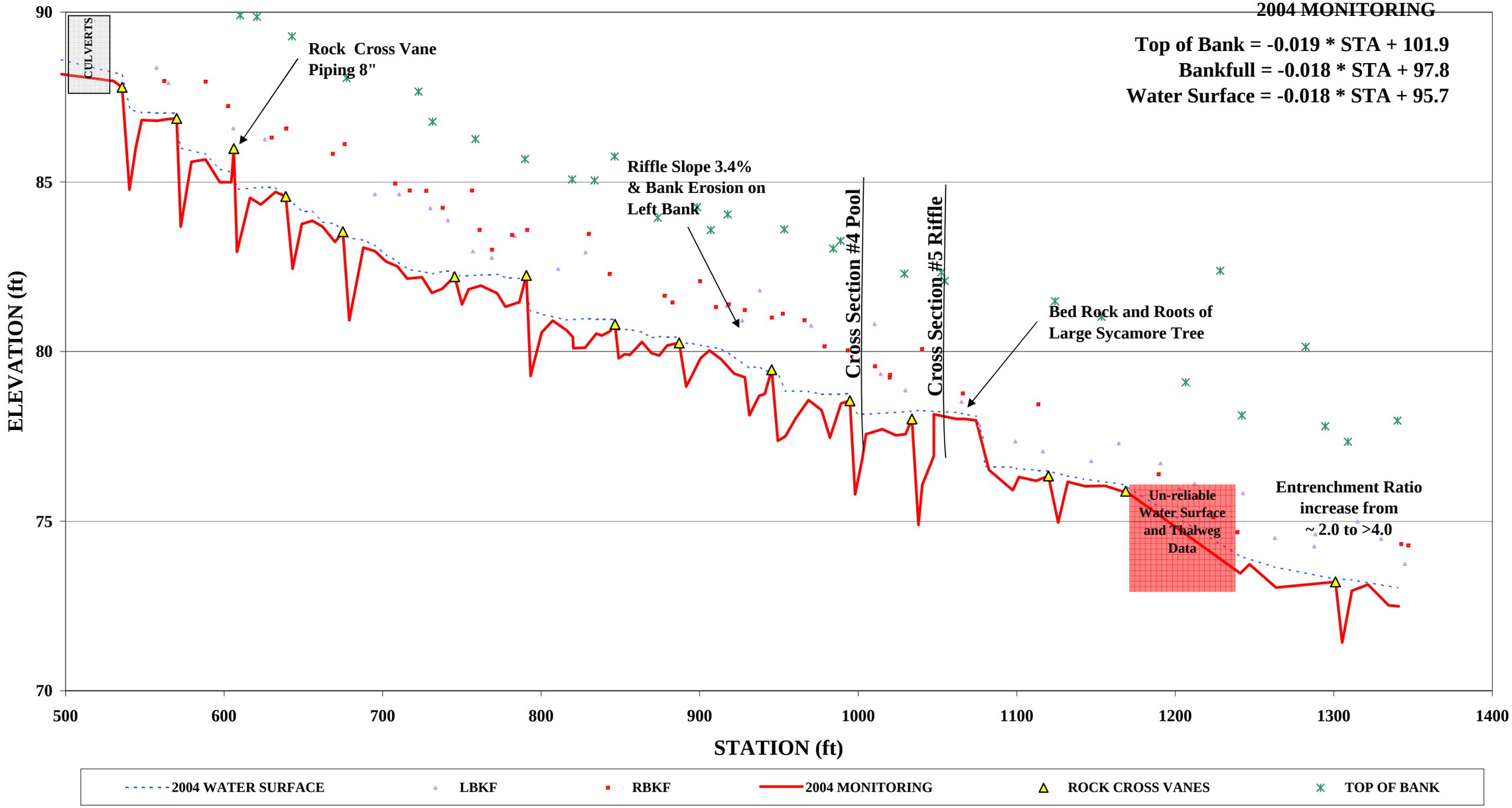
Bankfull = -0.018 * STA + 97.8
Water Surface = -0.018 * STA + 95.7



2.3 Areas of Concern

The following areas of concern should be monitored closely and considered for repair as suggested:

Unnamed Tributary of Bear Swamp Creek

- Water piping through Rock Cross Vane structures
    - There are three rock cross vanes that are allowing water to pipe under the head rock of the structure at stations 1+60, 3+25 and 6+05
        - At station 1+60 the rock cross vane has water piping under the invert rock with a head loss of 4 inches due to the piping. At this point the structure is not at risk of complete failure due to the boulder size used for the vane construction, the total number of vanes in the project, and the existing vegetation
        - At station 3+25 the rock cross vane has water piping under the invert rock with a head loss of 4 inches due to the piping. At this point the structure is not at risk of complete failure due to the boulder size used for the vane construction, the total number of vanes in the project, and the existing vegetation
        - At station 6+05 the rock cross vane has water piping under the invert rock with a head loss of 8 inches due to the piping. At this point the structure is not at risk of complete failure due to the boulder size used for the vane construction, the total number of vanes in the project, and the existing vegetation
- Areas with bank erosion
    - Bank erosion has been noted at four locations on the stream
        - Bank Erosion due to localized head cuts of 4-8 inches from the piping of water through rock cross vanes occurred at stations
        - Some banks near root wads also have some localized bank erosion
    - There are two areas of major bank erosion due to the overland flow and seepage at station 7+45 on the left bank and station at 8+45 on the left bank Possible repairs would include regarding the gully, preparing this area and seeding with a tackafier and straw mulch
    - The entire length of restored stream has on five existing riffle features
- Vegetation
    - Replanting trees should occur to obtain mitigation requirements
    - The site could benefit from larger containerized trees both for bank stability and aesthetics, although mitigation requirements are currently being met.
    - It is recommended to stake in areas where erosion is problematic, particularly on outside meander bends.
    - Exotic invasive vegetation is a major issue on this project site. Without control the exotic invasive vegetation will likely out-compete native vegetation for resources. A maintenance plan is recommended for control of these species.

Photo Point 1 Downstream Station 00+93

Photo Point 2 Upstream Station 04+60

Photo Point 3 Downstream Station 04+80

Photo Point 3 Upstream Station 04+80

Photo Point 4 Downstream Station 07+10

Photo Point 4 Upstream Station 07+10

Photo Point 5 Downstream Station 10+75

Photo Point 5 Upstream Station 10+75

Photo Point 6 Downstream Station 11+75

Photo Point 6 Upstream Station 11+75

Photo Point 7 Downstream Station 12+90

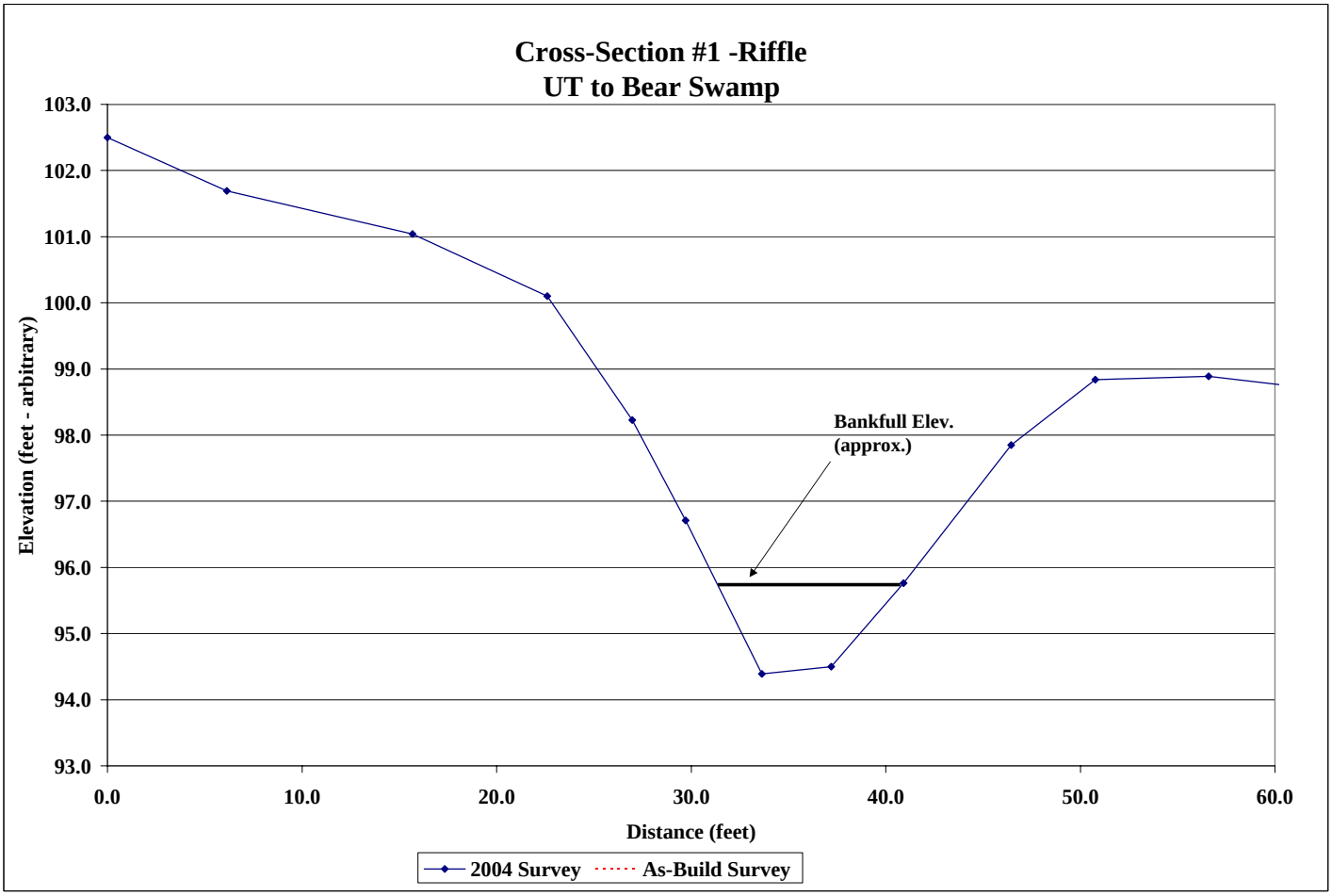
Photo Point 7 Upstream Station 12+90

Project Name	UT to Bear Swamp
Cross Section	#1
Feature	Riffle
Date	7/14/04
Crew	Bidelspach, Clinton

2004 2004 Survey			2002 As-Build Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0.0	102.5	LP			
6.1	101.7				
15.7	101.0				
22.6	100.1				
27.0	98.2				
29.7	96.7				
33.6	94.4				
37.2	94.5				
40.9	95.8				
46.5	97.9				
50.8	98.8	BKF			
56.6	98.9				
70.7	98.4				
85.8	98.1	RP			

Photo of Cross-Section #1 - Looking Downstream @ STA 0+81

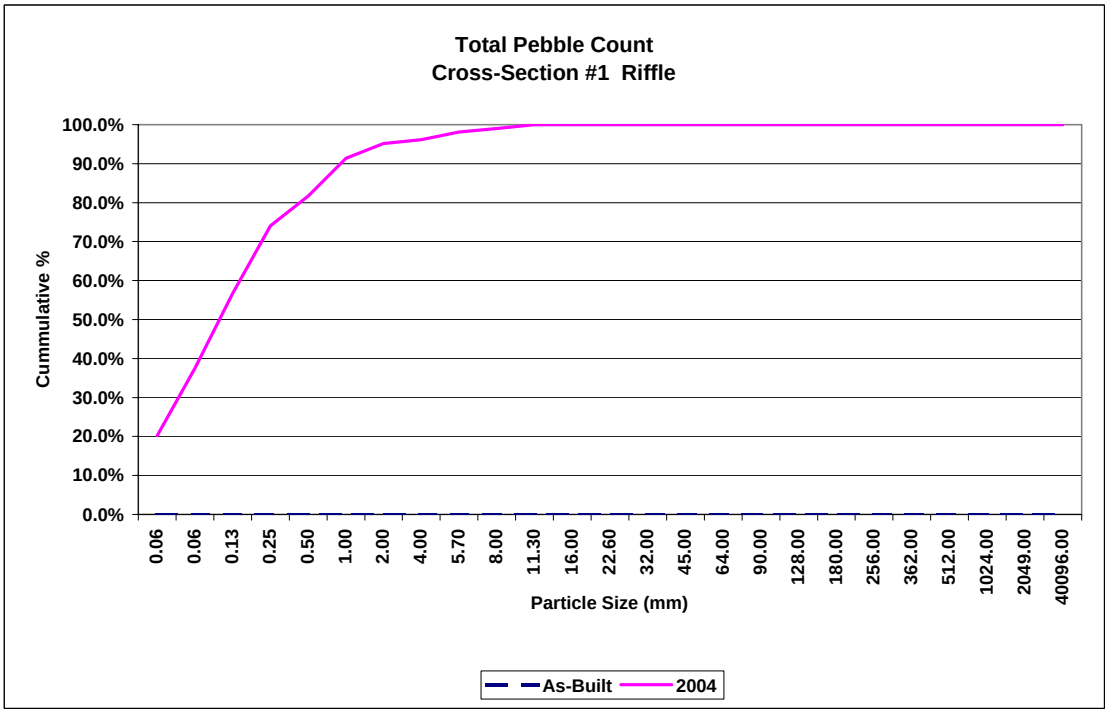
	2004
Area	10.4
Width	10.3
Mean Depth	1.0
Max Depth	1.5
W/D	10.1



Project Name	UT to Bear Swamp
Cross Section	#1
Feature	Riffle
Date	7/14/04
Crew	Bidelspach, Clinton

			As-Built			2004			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	#DIV/0!	#DIV/0!	10	11	20.2%	20.2%
Sand	very fine sand	0.062	0	#DIV/0!	#DIV/0!	10	8	17.3%	37.5%
	fine sand	0.125	0	#DIV/0!	#DIV/0!	10	10	19.2%	56.7%
	medium sand	0.25	0	#DIV/0!	#DIV/0!	10	8	17.3%	74.0%
	course sand	0.50	0	#DIV/0!	#DIV/0!	0	8	7.7%	81.7%
	very course sand	1.0	0	#DIV/0!	#DIV/0!	0	10	9.6%	91.3%
Gravel	very fine gravel	2.0	0	#DIV/0!	#DIV/0!	0	4	3.8%	95.2%
	fine gravel	4.0	0	#DIV/0!	#DIV/0!	0	1	1.0%	96.2%
	fine gravel	5.7	0	#DIV/0!	#DIV/0!	0	2	1.9%	98.1%
	medium gravel	8.0	0	#DIV/0!	#DIV/0!	0	1	1.0%	99.0%
	medium gravel	11.3	0	#DIV/0!	#DIV/0!	0	1	1.0%	100.0%
	course gravel	16.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	course gravel	22.6	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very course gravel	32	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very course gravel	45	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Cobble	small cobble	64	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium cobble	90	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	large cobble	128	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very large cobble	180	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Boulder	small boulder	256	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	small boulder	362	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium boulder	512	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	large boulder	1024	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very large boulder	2049	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
TOTAL / %of whole count			0	#DIV/0!		40	64	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
2004	0.00	0.09	0.15	0.93	2.93

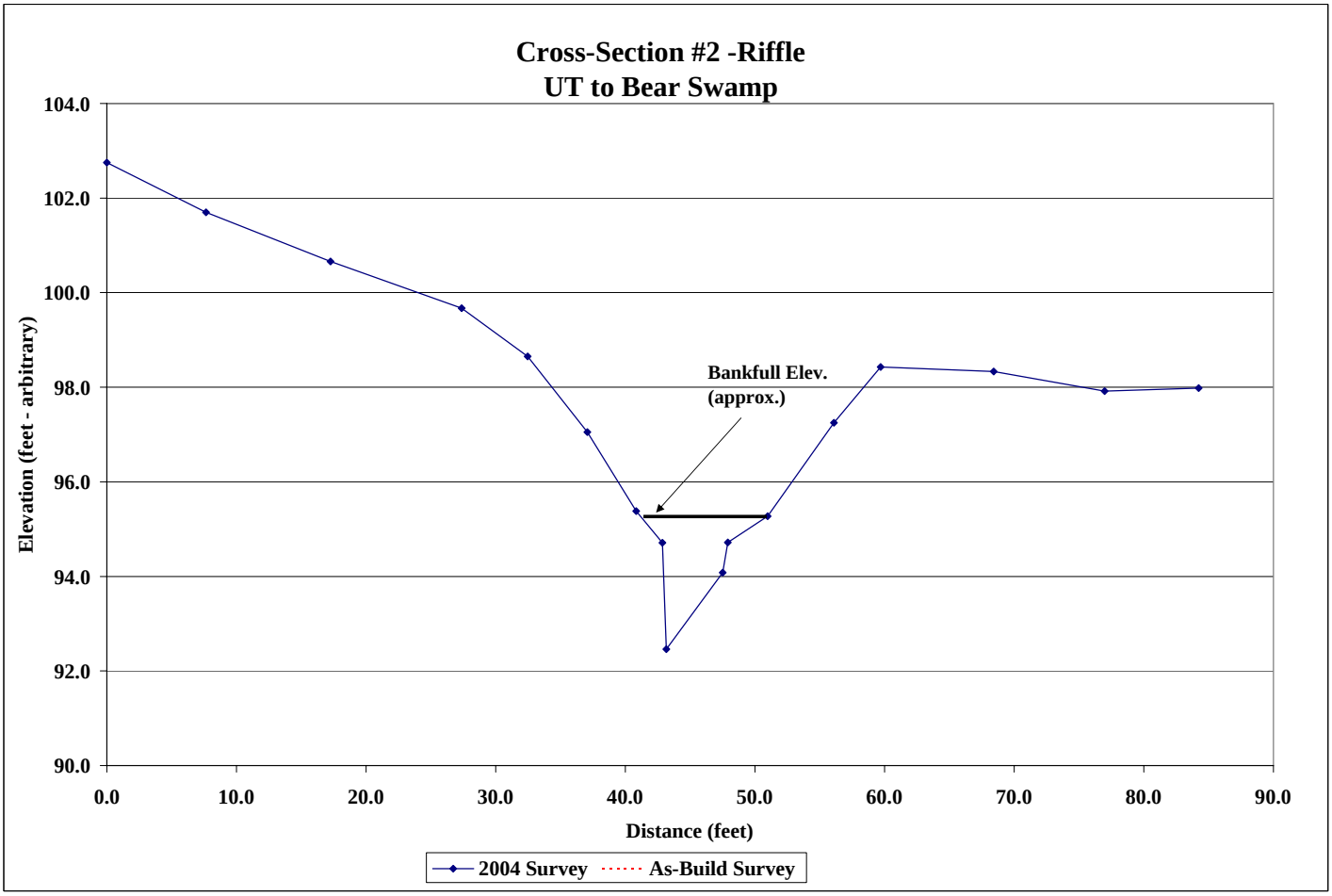


Project Name	UT to Bear Swamp
Cross Section	#2
Feature	Riffle
Date	7/14/04
Crew	Bidelspach, Clinton

2004 2004 Survey			2002 As-Build Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0.0	102.8	LP			
7.6	101.7				
17.3	100.7				
27.4	99.7				
32.5	98.7				
37.1	97.1				
40.8	95.4	BKF			
42.9	94.7				
43.2	92.5				
47.5	94.1				
47.9	94.7				
51.0	95.3				
56.1	97.3				
59.7	98.4				
68.4	98.3				
77.0	97.9				
84.2	98.0	RP			

Photo of Cross-Section #2 - Looking Downstream @ STA 1+30

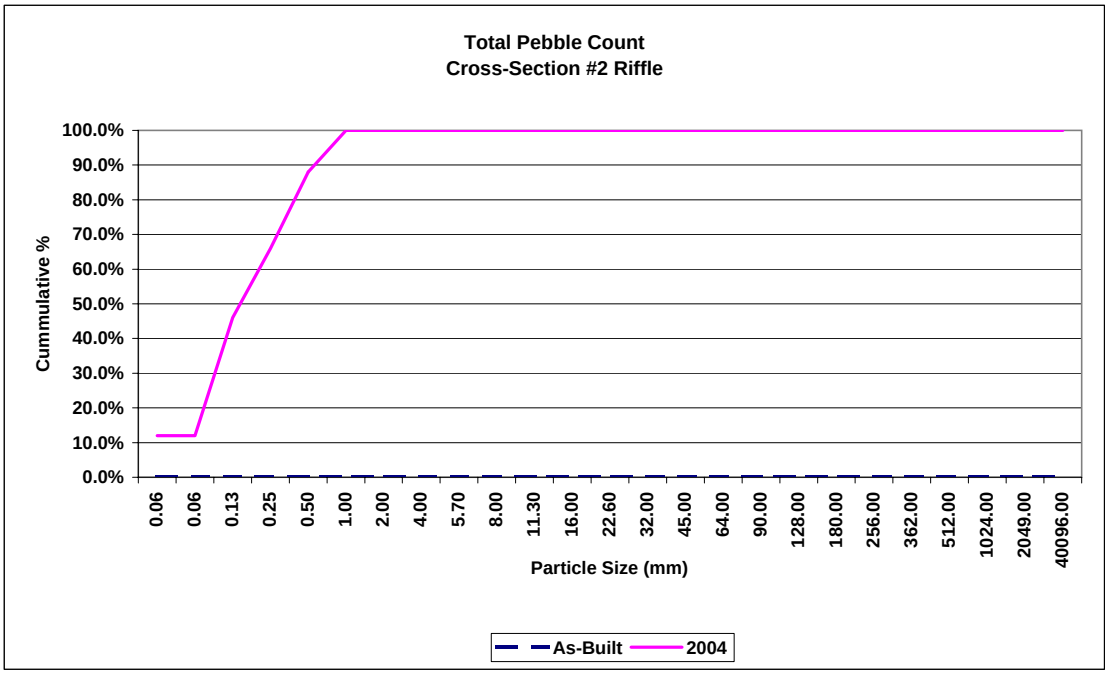
	2004
Area	11.2
Width	10.2
Mean Depth	1.1
Max Depth	2.9
W/D	9.2



Project Name	UT to Bear Swamp
Cross Section	#2
Feature	Riffle
Date	7/14/04
Crew	Bidelspach, Clinton

			As-Built			2004			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	#DIV/0!	#DIV/0!	0	12	12.0%	12.0%
Sand	very fine sand	0.062	0	#DIV/0!	#DIV/0!	0	0	0.0%	12.0%
	fine sand	0.125	0	#DIV/0!	#DIV/0!	20	14	34.0%	46.0%
	medium sand	0.25	0	#DIV/0!	#DIV/0!	20	0	20.0%	66.0%
	course sand	0.50	0	#DIV/0!	#DIV/0!	0	22	22.0%	88.0%
	very course sand	1.0	0	#DIV/0!	#DIV/0!	0	12	12.0%	100.0%
Gravel	very fine gravel	2.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	fine gravel	4.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	fine gravel	5.7	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium gravel	8.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium gravel	11.3	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	course gravel	16.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	course gravel	22.6	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very course gravel	32	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very course gravel	45	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Cobble	small cobble	64	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium cobble	90	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	large cobble	128	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very large cobble	180	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Boulder	small boulder	256	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	small boulder	362	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium boulder	512	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	large boulder	1024	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very large boulder	2049	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
TOTAL / %of whole count			0	#DIV/0!		40	60	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
2004	0.10	0.16	0.23	0.68	1.19

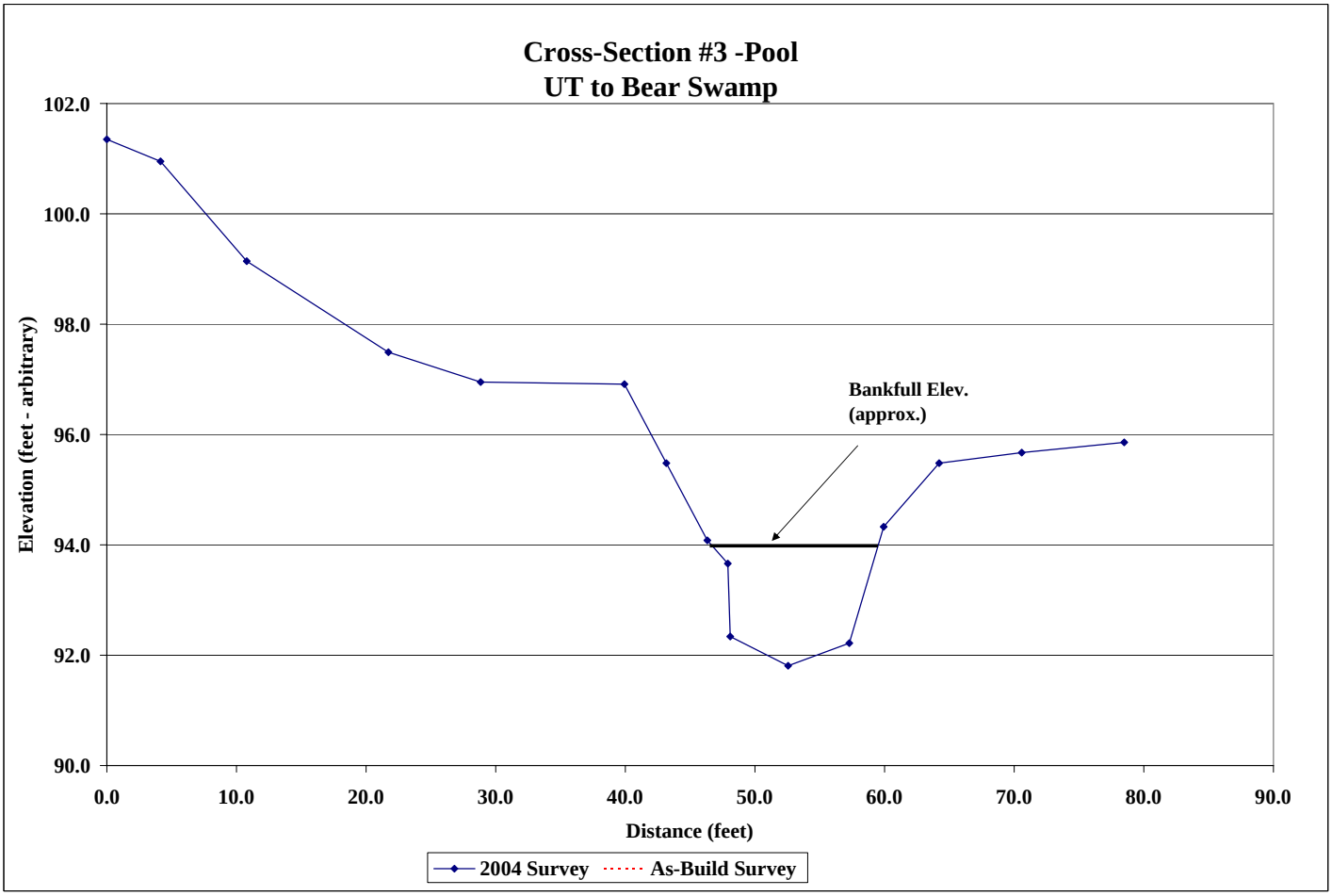


Project Name	UT to Bear Swamp
Cross Section	#3
Feature	Pool
Date	7/14/04
Crew	Bidelspach, Clinton

2004 Survey			2002 As-Build Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0.0	101.4	LP			
4.1	101.0				
10.8	99.1				
21.7	97.5				
28.8	97.0				
39.9	96.9				
43.2	95.5				
46.3	94.1	BKF			
47.9	93.7				
48.1	92.3				
52.6	91.8				
57.3	92.2				
59.9	94.3				
64.2	95.5				
70.6	95.7				
78.5	95.9	RP			

Photo of Cross-Section #3 - Looking Downstream @ STA 2+76

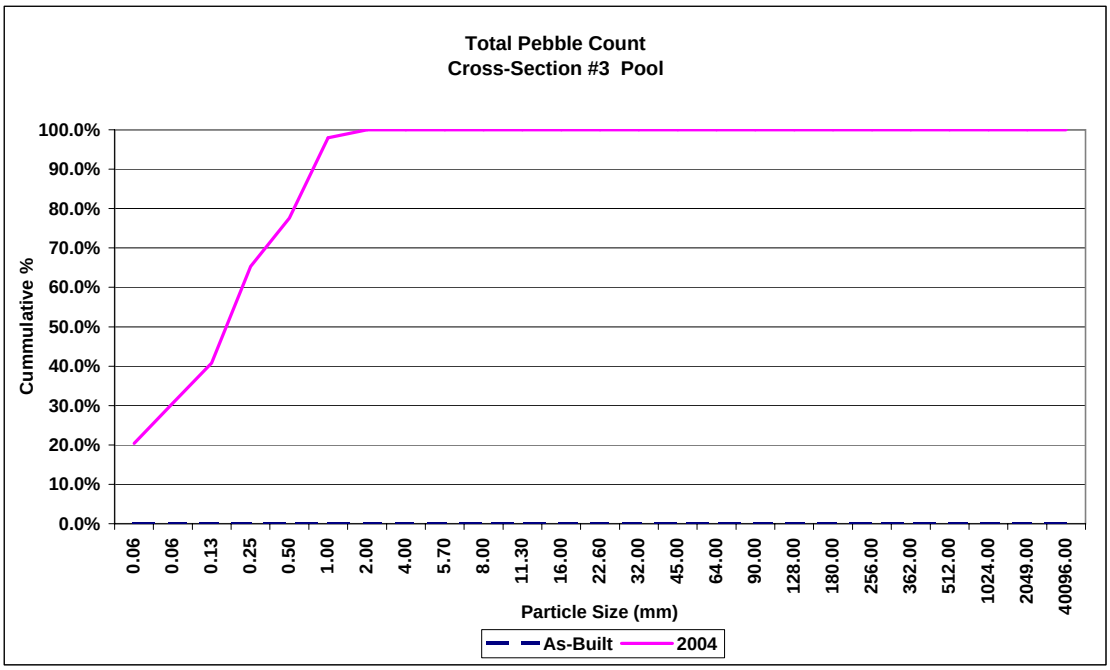
	2004
Area	18.8
Width	13.6
Mean Depth	1.4
Max Depth	2.2
W/D	9.9



Project Name	UT to Bear Swamp
Cross Section	#3
Feature	Pool
Date	7/14/04
Crew	Bidelspach, Clinton

			As-Built			2004			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	#DIV/0!	#DIV/0!	0	20	20.4%	20.4%
Sand	very fine sand	0.062	0	#DIV/0!	#DIV/0!	0	10	10.2%	30.6%
	fine sand	0.125	0	#DIV/0!	#DIV/0!	0	10	10.2%	40.8%
	medium sand	0.25	0	#DIV/0!	#DIV/0!	0	24	24.5%	65.3%
	course sand	0.50	0	#DIV/0!	#DIV/0!	0	12	12.2%	77.6%
	very course sand	1.0	0	#DIV/0!	#DIV/0!	0	20	20.4%	98.0%
Gravel	very fine gravel	2.0	0	#DIV/0!	#DIV/0!	0	2	2.0%	100.0%
	fine gravel	4.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	fine gravel	5.7	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium gravel	8.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium gravel	11.3	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	course gravel	16.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	course gravel	22.6	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very course gravel	32	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very course gravel	45	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Cobble	small cobble	64	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium cobble	90	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	large cobble	128	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very large cobble	180	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Boulder	small boulder	256	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	small boulder	362	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium boulder	512	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	large boulder	1024	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very large boulder	2049	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
TOTAL / %of whole count			0	#DIV/0!		0	98	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
2004	0.00	0.13	0.26	0.99	1.39



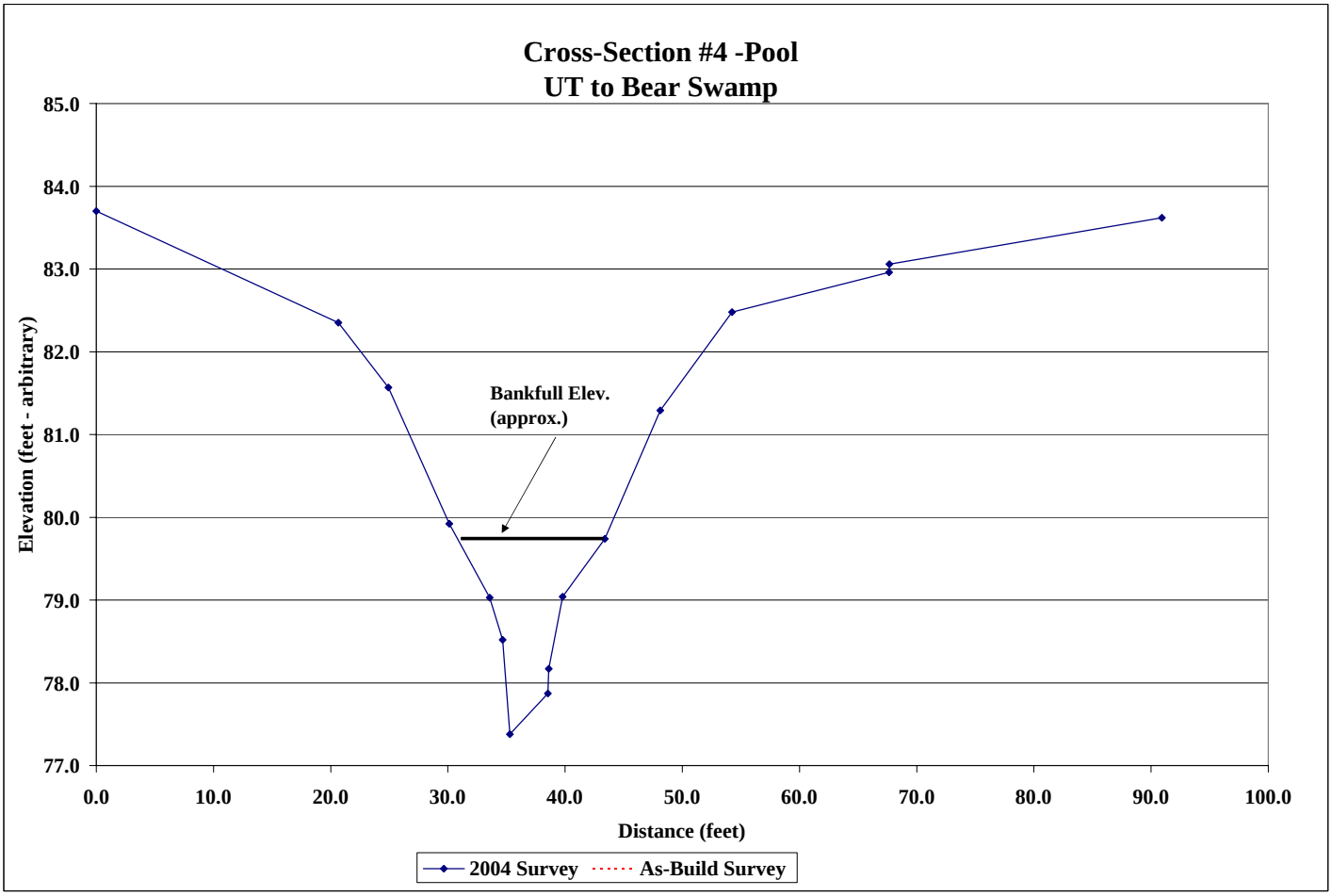
Project Name	UT to Bear Swamp
Cross Section	#4
Feature	Pool
Date	7/14/04
Crew	Bidelspach, Clinton

2004 Survey		
Station	**Elevation**	**Notes**
0.0	83.7	LP
20.7	82.4	
24.9	81.6	
30.1	79.9	
33.6	79.0	
34.7	78.5	
35.3	77.4	
38.5	77.9	
38.6	78.2	
39.8	79.0	BKF
43.4	79.7	
48.1	81.3	
54.3	82.5	
67.7	83.0	
67.7	83.1	RP
90.9	83.6	

2002 As-Build Survey		
Station	**Elevation**	**Notes**

Photo of Cross-Section #4 - Looking Downstream @ STA 10+15

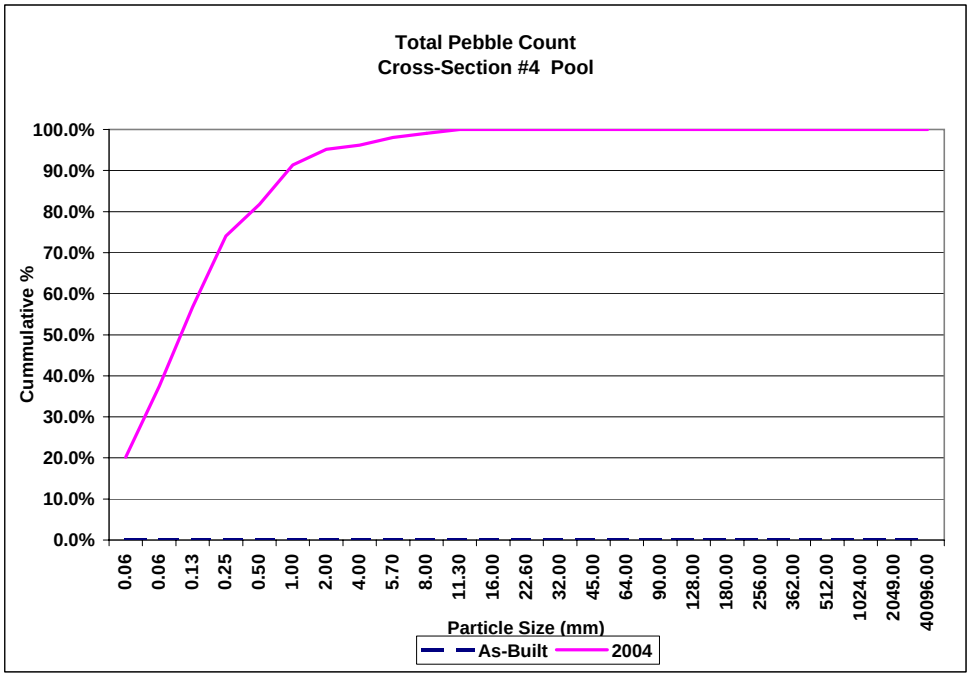
	2004
Area	13.6
Width	13.5
Mean Depth	1.0
Max Depth	2.3
W/D	13.3



Project Name	UT to Bear Swamp
Cross Section	#4
Feature	Pool
Date	7/14/04
Crew	Bidelspach, Clinton

			As-Built			2004			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	#DIV/0!	#DIV/0!	4	3	5.8%	5.8%
Sand	very fine sand	0.062	0	#DIV/0!	#DIV/0!	12	1	10.8%	16.7%
	fine sand	0.125	0	#DIV/0!	#DIV/0!	23	0	19.2%	35.8%
	medium sand	0.25	0	#DIV/0!	#DIV/0!	14	14	23.3%	59.2%
	course sand	0.50	0	#DIV/0!	#DIV/0!	3	13	13.3%	72.5%
	very course sand	1.0	0	#DIV/0!	#DIV/0!	2	16	15.0%	87.5%
G r a v e l	very fine gravel	2.0	0	#DIV/0!	#DIV/0!	2	13	12.5%	100.0%
	fine gravel	4.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	fine gravel	5.7	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium gravel	8.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium gravel	11.3	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	course gravel	16.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	course gravel	22.6	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very course gravel	32	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very course gravel	45	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Cobble	small cobble	64	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium cobble	90	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	large cobble	128	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very large cobble	180	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Boulder	small boulder	256	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	small boulder	362	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	medium boulder	512	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	large boulder	1024	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
	very large boulder	2049	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	#DIV/0!	#DIV/0!	0	0	0.0%	100.0%
TOTAL / %of whole count			0	#DIV/0!		60	60	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
2004	0.09	0.18	0.30	1.33	2.40



UT to Bear Swamp

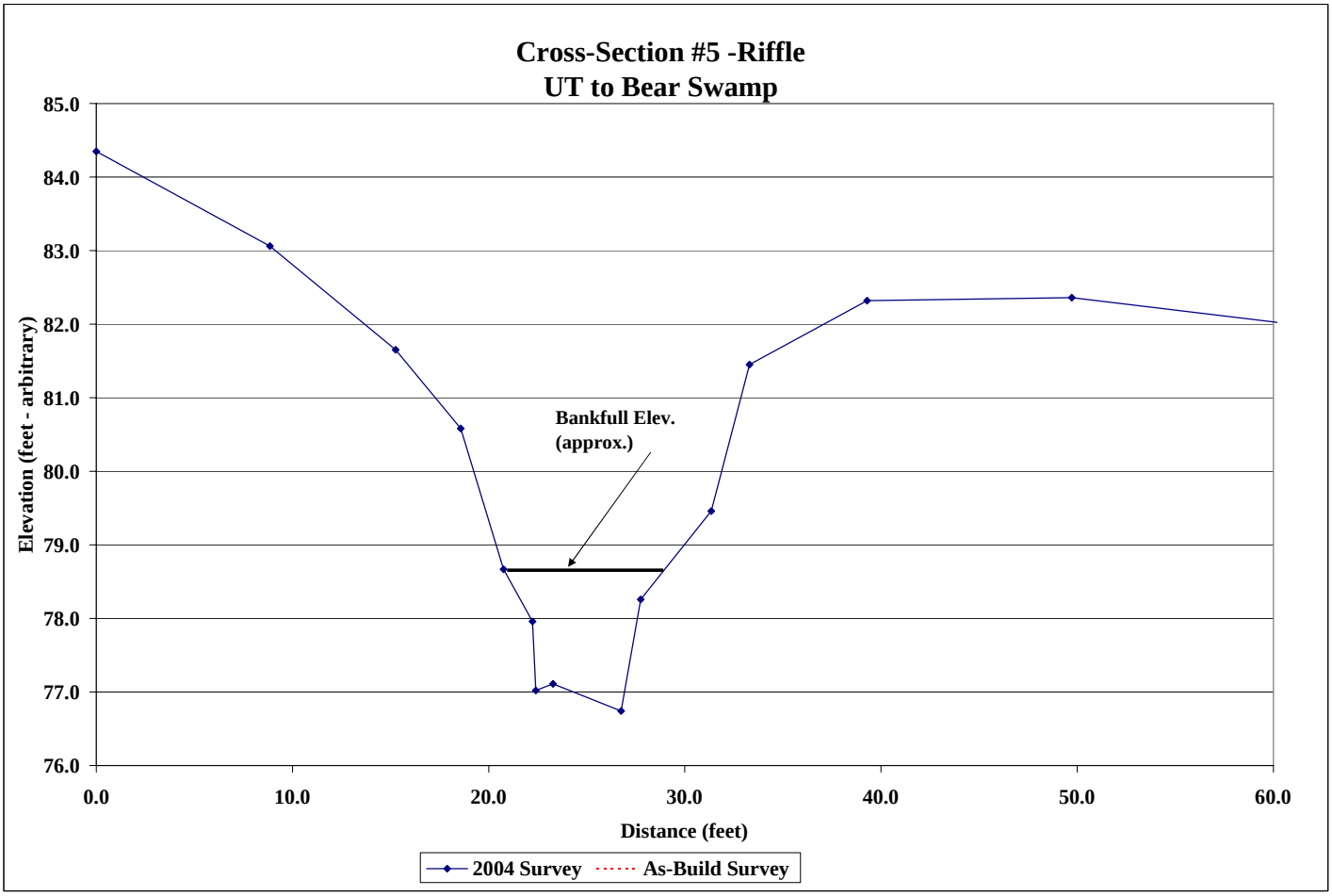
Cross Section #5
Feature Riffle
Date 7/14/04
Crew Bidelspach, Clinton

2004 Survey Station	2004 Survey Elevation	2004 Survey Notes
0.0	84.4	LP
8.9	83.1	
15.3	81.7	
18.6	80.6	
20.8	78.7	BKF
22.2	78.0	
22.4	77.0	
23.3	77.1	
26.8	76.7	
27.8	78.3	
31.4	79.5	
33.3	81.5	
39.3	82.3	
49.7	82.4	
61.2	82.0	
61.3	82.2	RP
70.3	83.2	

2002 As-Build Survey Station	2002 As-Build Survey Elevation	2002 As-Build Survey Notes

Photo of Cross-Section #5 - Looking Downstream @ STA 10+63

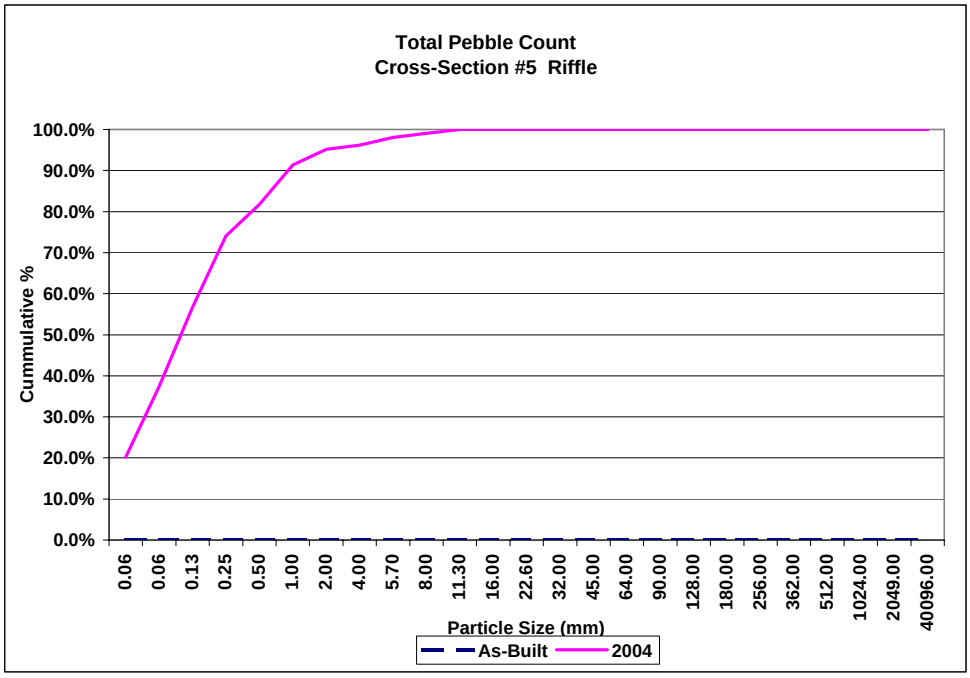
	2004
Area	11.2
Width	10.6
Mean Depth	1.1
Max Depth	1.8
W/D	10.0



Project Name	UT to Bear Swamp
Cross Section	#5
Feature	Riffle
Date	7/14/04
Crew	Bidelspach, Clinton

			As-Built			2004			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	#DIV/0!	#DIV/0!	0	2	1.7%	1.7%
Sand	very fine sand	0.062	0	#DIV/0!	#DIV/0!	8	1	7.5%	9.2%
	fine sand	0.125	0	#DIV/0!	#DIV/0!	19	2	17.5%	26.7%
	medium sand	0.25	0	#DIV/0!	#DIV/0!	18	15	27.5%	54.2%
	course sand	0.50	0	#DIV/0!	#DIV/0!	6	15	17.5%	71.7%
	very course sand	1.0	0	#DIV/0!	#DIV/0!	0	10	8.3%	80.0%
Gravel	very fine gravel	2.0	0	#DIV/0!	#DIV/0!	0	12	10.0%	90.0%
	fine gravel	4.0	0	#DIV/0!	#DIV/0!	0	3	2.5%	92.5%
	fine gravel	5.7	0	#DIV/0!	#DIV/0!	0	2	1.7%	94.2%
	medium gravel	8.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	94.2%
	medium gravel	11.3	0	#DIV/0!	#DIV/0!	0	1	0.8%	95.0%
	course gravel	16.0	0	#DIV/0!	#DIV/0!	0	0	0.0%	95.0%
	course gravel	22.6	0	#DIV/0!	#DIV/0!	0	0	0.0%	95.0%
	very course gravel	32	0	#DIV/0!	#DIV/0!	0	2	1.7%	96.7%
	very course gravel	45	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
Cobble	small cobble	64	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
	medium cobble	90	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
	large cobble	128	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
	very large cobble	180	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
Boulder	small boulder	256	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
	small boulder	362	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
	medium boulder	512	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
	large boulder	1024	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
	very large boulder	2049	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
Bedrock	bedrock	40096	0	#DIV/0!	#DIV/0!	0	0	0.0%	96.7%
TOTAL / %of whole count			0	#DIV/0!		51	65	96.7%	

	d16	**d35**	**d50**	**d85**	**d95**
2004	0.13	0.24	0.35	2.10	60.25



Station 01+60 Root Wad Vane Failure

Station 03+20 Shallow Riffle

Station 03+40 Piping Vane Downstream

Station 03+40 Piping Vane Upstream

Station 04+30 Floodplain Culvert Inlet

Station 05+60 Floodplain Culvert Outlet

Station 06+20 High Root Wad

Station 07+70 Runoff Gulley

Station 07+70 Runoff Gulley from Fence

Station 08+20 Big Drop

Station 08+40 Rock Wall Root Wad

Station 09+40 Bank Slump

Station 11+00 High Root Wads

Station 12+25 Good Riffle

Station 13+50 Unnecessary Vane

Point	Station	Elevation	Description
2008	3.95	94.56	Thalweg
2012	10.86	94.94	Thalweg
2014	18.35	94.95	Thalweg
2016	25.72	94.75	Thalweg
2019	34.82	94.67	Thalweg
2020	40.06	94.63	Thalweg
2022	43.9	94.7	Thalweg
2024	48.86	94.78	Thalweg
2026	50.33	95.01	Rock Vane
2029	54.92	92.37	Max Pool
2031	58.52	93.08	Thalweg
2033	61.01	94.4	Thalweg
2035	64.47	94.17	Thalweg
2037	69.4	93.94	Thalweg
2039	74.37	94.05	Thalweg
2041	75.18	94.34	Thalweg
2043	84.04	94.25	Thalweg
2046	90.1	94.26	Thalweg
2045	91.32	94.33	Rock Vane
2049	92.6	93.79	Thalweg
2051	96.47	93.67	Thalweg
2053	100.91	93.89	Thalweg
2055	106	93.68	Thalweg
2057	110.74	93.86	Thalweg
2059	116.45	93.7	Thalweg
2061	121.11	93.68	Thalweg
2064	125.18	93.93	Thalweg
2063	125.56	93.93	Thalweg
2065	129.58	93.69	Thalweg
2067	134.18	93.9	Thalweg
2069	137.91	93.72	Thalweg
2071	142.17	93.49	Thalweg
2073	145.35	93.65	Thalweg
2075	150.39	93.69	Thalweg
2077	156.66	93.27	Thalweg
2079	159.07	93.89	Rock Vane
2082	160.57	91.64	Head of Pool
2084	164.63	92.84	Thalweg
2086	166.99	92.1	Head of Pool
2088	170.93	92.5	Thalweg
2090	175.05	91.48	Thalweg
2092	178.99	92.17	Thalweg
2094	182.6	92.89	Thalweg
2096	186.59	92.76	Thalweg
2098	192.87	92.59	Thalweg
2102	202.64	93.02	Thalweg
2104	207.5	92.7	Thalweg
2106	210.91	93.05	Rock Vane
2109	213.45	92.12	Head of Pool
2113	217.21	91.32	Thalweg
2111	226.3	92.5	Thalweg
2115	236.69	92.7	Thalweg
2117	240.76	92.67	Thalweg
2119	246.87	92.66	Thalweg
2121	253.72	92.59	Thalweg
2123	258.32	92.65	Thalweg
2125	263.2	92.54	Thalweg
2127	267.03	92.64	Rock Vane
2131	269.61	91.88	Thalweg
2133	272.58	91.54	Thalweg
2137	276.39	92.09	Thalweg
2135	279.36	92.36	Thalweg
2139	283.58	92.44	Thalweg
2141	289.35	92.2	Thalweg
2143	293.02	92.3	Thalweg
2145	298.19	92.33	Thalweg
2147	302.91	92.27	Thalweg
2149	307.37	92.32	Thalweg
2151	311.41	92.29	Thalweg
2153	316.72	92.17	Thalweg
2155	322.94	92.03	Thalweg
2157	326.27	92.36	Rock Vane
2162	327.66	88.29	Thalweg
2160	332.38	88.78	Head of Pool
2164	338.08	90.47	Thalweg
2166	342.33	90.69	Thalweg
2168	347.65	90.46	Thalweg
2170	353.88	90.56	Thalweg
2174	364.37	90.44	Thalweg
2176	368.54	90.81	Rock Vane
2179	372.24	89.47	Thalweg
2181	376.15	89.36	Thalweg
2183	380.29	89.17	Head of Pool
2185	384.67	90.1	Thalweg
2187	389.89	90.22	Thalweg
2189	397.39	90.11	Thalweg
2191	402.88	89.84	Thalweg
2193	408.01	89.55	Thalweg
2195	412.89	89.37	Thalweg
2197	416.52	89.78	Thalweg
2199	420.03	90.28	Rock Vane
2204	421.75	86.71	Head of Pool
2202	426.87	88.07	Thalweg
2206	433.33	88.54	Thalweg
2208	438.31	88.54	Thalweg
2212	452.51	88.45	Thalweg
297	530.37	87.97	BOC
313	535.6	87.79	Rock Vane
310	540.25	84.77	Max Pool
307	544.33	86.01	Head of Glide
304	548.02	86.82	Thalweg
302	557.96	86.8	Thalweg
298	564.5	86.85	Thalweg
296	570.03	86.87	Rock Vane
2005	0	95.05	Water
2017	24.9	95.02	Water
2018	47.9	95.01	Water
2032	52.25	94.64	Water
2036	64.1	94.59	Water
2044	89.62	94.5	Water
2050	92.89	94.13	Water
2062	120.82	94.08	Water
2066	129.27	94.05	Water
2068	134.29	94.09	Water
2074	145.4	93.69	Water
2076	155.25	93.69	Water
2083	160.41	93.31	Water
2087	166.87	93.31	Water
2089	170.91	93.31	Water
2091	175.1	93.27	Water
2114	209.97	93.04	Water
2110	213.77	92.98	Water
2118	240.87	92.98	Water
2122	254.04	92.92	Water
2126	265.58	92.75	Water
2128	268.11	92.62	Water
2134	272.87	92.64	Water
2146	298.01	92.61	Water
2148	303.24	92.52	Water
	322	92.15	Water
2163	326.41	90.98	Water
2165	337.65	90.92	Water
2167	343.82	90.96	Water
2172	366.85	90.83	Water
2186	373.75	90.47	Water
2190	397.6	90.37	Water
2194	407.71	90.37	Water
2196	412.82	90.38	Water
2198	419.01	90.37	Water
2203	424.12	89.35	Water
2207	434.6	89.26	Water
2210	446.21	89.15	Water
2213	451.25	89.12	Water
308	535.6	88.16	Water
311	540.83	87.12	Water
305	547.99	87.04	Water
299	568.24	87.02	Water
294	572.7	86	Water
287	588.07	85.81	Water
284	597.3	85.38	Water
282	604.7	85.28	Water
265	608.78	84.78	Water
273	623.66	84.84	Water
270	632.42	84.84	Water
258	649.25	84.12	Water
254	655.37	84.13	Water
250	662.14	83.81	Water
246	669.7	83.77	Water
235	674.91	83.58	Water
230	678.61	83.35	Water
242	688.12	83.28	Water
239	695.07	83.13	Water
237	702.47	82.84	Water
232	709.34	82.65	Water
227	716.03	82.42	Water
223	725.14	82.35	Water
219	731.73	82.29	Water
214	737.94	82.36	Water
206	742.73	82.36	Water
210	745.14	82.31	Water
202	748.65	82.22	Water
199	762.05	82.25	Water
195	772.81	82.27	Water
191	778.18	82.17	Water
187	789.31	82.15	Water
176	793.22	81.21	Water
179	800.24	81.1	Water
171	815.81	80.93	Water
163	827.31	80.97	Water
155	838.58	80.95	Water
152	845.9	80.95	Water
145	848.26	80.64	Water
139	855.84	80.65	Water
141	863.47	80.57	Water
143	869.85	80.41	Water
137	874.6	80.44	Water
135	884.88	80.42	Water
131	887.37	80.26	Water
125	895.53	80.23	Water
122	900.96	80.18	Water
113	913.55	80.08	Water
98	921.92	79.84	Water
108	930.94	79.52	Water
110	937.74	79.55	Water
106	941.11	79.44	Water
95	948.97	79.38	Water
91	954.17	78.84	Water
83	968.79	78.82	Water
79	976.94	78.74	Water
75	993.84	78.75	Water
56	999.75	78.14	Water
45	1032.93	78.23	Water
38	1037.92	78.26	Water
34	1047.51	78.23	Water
32	1061.9	78.2	Water
30	1067.63	78.15	Water
28	1074.28	78.09	Water
26	1078.57	77.49	Water
2302	6.49	96.76	LBKF
2301	20.03	96.19	LBKF
2297	41.52	96.11	LBKF
2295	51.1	95.78	LBKF
2293	71.73	95.93	LBKF
2285	106.3	95.56	LBKF
2283	119.87	94.96	LBKF
2281	136.76	95.05	LBKF
2279	151.26	94.77	LBKF
2275	169.85	96.28	LBKF
2271	188	94.6	LBKF
2269	200.12	94.25	LBKF
2265	226.09	94.19	LBKF
2263	238.35	94.08	LBKF
2261	250.22	94.03	LBKF
2255	267.46	93.51	LBKF
2253	287.44	93.18	LBKF
2251	303.42	93.51	LBKF
2249	318.26	93.24	LBKF
2245	343.51	91.96	LBKF
2243	349.99	92.1	LBKF
2241	362.1	92.12	LBKF
2237	385.5	91.36	LBKF
2235	396.03	91.16	LBKF
2233	408.17	90.96	LBKF
2231	419.08	90.93	LBKF
2225	441.75	90.75	LBKF
2223	452.5	90.49	LBKF
2221	457.46	91.34	LBKF
309	557.34	88.36	LBKF
312	564.88	87.91	LBKF
318	605.84	86.58	LBKF
256	625.7	86.25	LBKF
220	695.1	84.63	LBKF
216	710.35	84.63	LBKF
208	730.14	84.22	LBKF
203	741.22	83.86	LBKF
197	756.9	82.95	LBKF
188	768.89	82.76	LBKF
181	783.29	83.4	LBKF
164	810.74	82.43	LBKF
160	828	82.92	LBKF
111	917.11	81.34	LBKF
93	926.78	80.91	LBKF
88	937.91	81.8	LBKF
73	970.32	80.76	LBKF
65	1010.27	80.81	LBKF
61	1014.08	79.34	LBKF
53	1029.72	78.85	LBKF
322	1065.14	78.52	LBKF
324	1076.6	77.82	LBKF
327	1099.07	77.35	LBKF
328	1116.51	77.05	LBKF
330	1146.97	76.77	LBKF
333	1164.44	77.29	LBKF
337	1190.68	76.7	LBKF
339	1202.75	75.95	LBKF
344	1212.2	76.1	LBKF
345	1221.83	75.26	LBKF
351	1242.75	75.82	LBKF
361	1262.78	74.5	LBKF
366	1287.63	74.25	LBKF
362	1288.43	74.61	LBKF
374	1315	74.99	LBKF
378	1329.77	74.48	LBKF
381	1344.87	73.74	LBKF
2305	8.16	96.69	RBKF
2303	22.62	96.4	RBKF
2298	36.08	95.98	RBKF
2296	49.99	96.19	RBKF
2294	61.22	96.27	RBKF
2290	75.08	95.52	RBKF
2289	89.93	95.07	RBKF
2288	91.76	95.08	RBKF
2284	123.25	95.45	RBKF
2280	132.76	95.05	RBKF
2276	162.91	95.14	RBKF
2272	184.94	94.75	RBKF
2270	198.05	94.82	RBKF
2268	211.75	94.07	RBKF
2264	226.88	94.48	RBKF
2262	238.57	93.96	RBKF
2260	254.02	94.07	RBKF
2257	268.81	93.75	RBKF
2256	288.23	93.62	RBKF
2254	303.3	93.05	RBKF
2250	322.3	92.55	RBKF
2248	330.35	92.6	RBKF
2246	343.49	92.31	RBKF
2244	357.85	92.36	RBKF
2240	376.93	92.45	RBKF
2238	385.22	92.37	RBKF
2236	393.98	92.05	RBKF
2234	405.41	91.85	RBKF
2232	417.44	90.83	RBKF
2228	430.4	90.17	RBKF
2226	440.1	91.45	RBKF
281	562.29	87.97	RBKF
274	588.34	87.95	RBKF
271	602.48	87.23	RBKF
263	629.98	86.3	RBKF
255	639.25	86.57	RBKF
243	668.63	85.82	RBKF
228	676.13	86.11	RBKF
221	707.9	84.95	RBKF
217	717.15	84.74	RBKF
215	727.54	84.73	RBKF
207	737.97	84.23	RBKF
200	756.4	84.74	RBKF
192	761.16	83.58	RBKF
189	769.04	83	RBKF
182	781.73	83.43	RBKF
180	791.16	83.58	RBKF
157	830.05	83.46	RBKF
150	843.35	82.28	RBKF
133	877.92	81.64	RBKF
129	882.96	81.44	RBKF
119	900.22	82.07	RBKF
115	910.35	81.31	RBKF
99	918.38	81.39	RBKF
96	928.48	81.22	RBKF
92	945.53	81	RBKF
87	952.53	81.11	RBKF
80	966.17	80.92	RBKF
76	978.84	80.15	RBKF
68	993.49	80.03	RBKF
62	1010.63	79.56	RBKF
54	1019.92	79.23	RBKF
58	1020.1	79.31	RBKF
41	1040.3	80.07	RBKF
321	1065.96	78.76	RBKF
323	1113.62	78.44	RBKF
340	1189.55	76.38	RBKF
343	1214.69	75.7	RBKF
346	1224.06	75.11	RBKF
350	1239.24	74.67	RBKF
384	1342.59	74.32	RBKF
388	1347.07	74.28	RBKF

293	572.64	83.68	Max Pool
289	579.34	85.59	Thalweg
286	588.29	85.66	Thalweg
283	597.35	84.99	Thalweg
280	604.57	84.99	Thalweg
278	606.11	85.98	Rock Vane
264	608.14	82.94	Max Pool
275	616.37	84.53	Thalweg
272	623.14	84.33	Thalweg
269	632.48	84.7	Thalweg
267	638.84	84.57	Rock Vane
261	643.19	82.44	Thalweg
257	649.04	83.76	Thalweg
253	655.68	83.85	Thalweg
249	662.16	83.68	Thalweg
245	669.93	83.23	Thalweg
234	674.9	83.53	Rock Vane
229	678.96	80.92	Max Pool
241	687.78	83.06	Thalweg
238	695.13	82.96	Thalweg
236	702.13	82.65	Thalweg
231	709.27	82.51	Thalweg
226	715.55	82.15	Thalweg
222	724.8	82.19	Thalweg
218	731.03	81.73	Thalweg
213	737.36	81.84	Thalweg
209	745.41	82.2	Rock Vane
205	750.05	81.39	Max Pool
201	754.18	81.83	Thalweg
198	762.02	81.94	Thalweg
194	772.21	81.72	Thalweg
190	777.42	81.32	Thalweg
186	786.27	81.45	Thalweg
183	790.65	82.24	Rock Vane
175	793.29	79.28	SP
178	800.26	80.56	Thalweg
173	807.29	80.91	Thalweg
170	816.11	80.62	Thalweg
167	820.02	80.42	Thalweg
166	820.28	80.1	Thalweg
162	827.62	80.11	Thalweg
158	834.82	80.53	Thalweg
154	838.12	80.47	Thalweg
151	843.23	80.59	Thalweg
148	846.59	80.8	Rock Vane
147	848.93	79.8	Thalweg
144	852.57	79.92	Thalweg
138	856	79.9	Thalweg
140	863.55	80.28	Thalweg
142	869.67	79.95	Thalweg
136	874.53	79.88	Thalweg
134	879.44	80.18	Thalweg
130	887.04	80.25	Rock Vane
127	891.49	78.97	Max Pool
124	894.77	79.26	Head of Glide
121	900.51	79.8	Thalweg
116	906.09	80.03	Thalweg
112	913.33	79.78	Thalweg
97	921.75	79.35	Thalweg
102	928.5	79.24	Thalweg
107	931.39	78.12	Head of Pool
109	937.49	78.69	Max Pool
105	941.03	78.75	Thalweg
100	945.38	79.46	Rock Vane
94	949.3	77.37	Head of Pool
90	954.04	77.5	Thalweg
85	960.42	78.02	Thalweg
82	968.62	78.57	Thalweg
78	976.89	78.27	Thalweg
74	982.19	77.46	Thalweg
69	989.17	78.47	Thalweg
66	994.71	78.55	Rock Vane
63	998.07	75.79	Max Pool
59	1002.56	76.84	Thalweg
55	1004.89	77.56	Thalweg
51	1015.16	77.71	Thalweg
48	1023.74	77.53	Thalweg
44	1029.84	77.56	Thalweg
42	1033.82	78.01	Rock Vane
37	1037.95	74.89	Max Pool
35	1040.41	76.07	Max Pool
39	1047.68	76.92	Thalweg
33	1047.68	78.15	Thalweg
31	1062.23	78.01	Thalweg
29	1067.84	78.01	Thalweg
27	1074.32	77.97	BR
25	1077.25	77.46	BR
	1082.48	76.51	Thalweg
21	1097.48	75.91	Max Pool
19	1101.44	76.3	Thalweg
17	1112.23	76.19	Thalweg
15	1120.04	76.33	Rock Vane
13	1126.14	74.96	Max Pool
11	1132.13	76.16	Thalweg
9	1143.08	76.03	Thalweg
7	1155.89	76.04	Thalweg
5	1166.26	75.88	Thalweg
4	1168.76	75.88	Rock Vane
352	1241	73.46	Thalweg
355	1246.84	73.73	Thalweg
358	1263.54	73.04	Thalweg
369	1301.08	73.21	Rock Vane
372	1305.27	71.42	Max Pool
376	1311.46	72.95	Thalweg
379	1321.6	73.13	Thalweg
382	1334.59	72.52	Thalweg
385	1341.04	72.49	Max Pool
24	1079.91	76.61	Water
22	1097.31	76.59	Water
20	1099.79	76.55	Water
18	1112.59	76.5	Water
16	1119.53	76.48	Water
12	1131.89	76.33	Water
10	1142.05	76.24	Water
6	1167.32	76.08	Water
354	1240.59	73.97	Water
359	1262.38	73.65	Water
370	1300.5	73.3	Water
377	1311.45	73.27	Water
386	1340.4	73.03	Water

Point	Station	Elevation	Description
2312	80.75	95.76	X1
2311	80.75	97.85	X1
2310	80.75	98.84	X1
2309	80.75	98.89	X1
2308	80.75	98.4	X1
2307	80.75	98.07	X1RP
2314	80.75	94.39	X1T
2313	80.75	94.5	X1W
2315	80.75	94.6	X1W
2324	129.91	100.66	X2
2327	129.91	97.05	X2
2329	129.91	94.71	X2
2328	129.91	95.38	X2
2325	129.91	99.67	X2
2326	129.91	98.65	X2
2323	129.91	101.7	X2
2338	129.91	98.33	X2
2337	129.91	98.43	X2
2339	129.91	97.92	X2
2336	129.91	97.25	X2
2335	129.91	95.27	X2
2334	129.91	94.72	X2
2322	129.91	102.75	X2LP
2340	129.91	97.98	X2RP
2331	129.91	93.67	X2T
2332	129.91	94.15	X2W
2330	130.54	92.46	X2W
2333	132.48	94.08	X2W
2354	275.76	97.49	X3
2352	275.76	96.91	X3
2351	275.76	94.08	X3
2353	275.76	96.95	X3
2346	275.76	92.69	X3
2355	275.76	99.14	X3
2356	275.76	100.95	X3
2343	275.76	95.48	X3
2342	275.76	95.67	X3
2357	275.76	101.35	X3LP
2341	275.76	95.86	X3RP
2344	275.76	94.33	X3RV
2350	275.76	93.66	X3RV
2347	275.76	91.81	X3T
2348	275.76	91.85	X3W
2345	275.76	92.22	X3W
2349	275.76	92.34	X3W
413	1015.31	82.48	X4
416	1015.31	81.29	X4
418	1015.31	79.74	X4
420	1015.31	79.04	X4
424	1015.31	78.17	X4
417	1015.31	79.03	X4
419	1015.31	78.52	X4
415	1015.31	79.92	X4
410	1015.31	82.35	X4
2361	1015.31	84.65	X4LP
2358	1015.31	84.6	X4RP
408	1015.31	83.62	X4RP
421	1015.31	77.38	X4T
422	1015.31	77.82	X4T
423	1015.31	77.87	X4W
404	1062.58	82.36	X5
407	1062.58	82.32	X5
405	1062.58	79.46	X5
403	1062.58	78.26	X5
406	1062.58	81.45	X5
400	1062.58	77.11	X5
398	1062.58	77.02	X5
395	1062.58	77.96	X5
392	1062.58	80.58	X5
394	1062.58	78.67	X5
391	1062.58	81.65	X5

Point	Station	Elevation	Description
2026	50.33	95.01	Rock Vane
2045	91.32	94.33	Rock Vane
2079	159.07	93.89	Rock Vane
2106	210.91	93.05	Rock Vane
2157	326.27	92.36	Rock Vane
2176	368.54	90.81	Rock Vane
2199	420.03	90.28	Rock Vane
313	535.6	87.79	Rock Vane
296	570.03	86.87	Rock Vane
278	606.11	85.98	Rock Vane
234	674.9	83.53	Rock Vane
209	745.41	82.2	Rock Vane
183	790.65	82.24	Rock Vane
148	846.59	80.8	Rock Vane
130	887.04	80.25	Rock Vane
66	994.71	78.55	Rock Vane
42	1033.82	78.01	Rock Vane
369	1301.08	73.21	Rock Vane
267	638.84	84.57	Rock Vane
100	945.38	79.46	Rock Vane
4	1168.76	75.88	Rock Vane
15	1120.04	76.33	Rock Vane
2127	267.03	92.64	Rock Vane

Point	Station	Elevation	Description
2306	2.16	103.06	Top of Bar
2300	31.99	99.9	Top of Bar
2292	69.77	98.58	Top of Bar
2282	132.37	98.62	Top of Bar
2277	154.9	101.93	Top of Bar
2274	169.69	97.99	Top of Bar
2267	184.08	100.51	Top of Bar
2266	225.11	97.07	Top of Bar
2259	265.72	97.36	Top of Bar
2258	267.19	95.97	Top of Bar
2252	313.59	95.6	Top of Bar
2247	325.6	97.33	Top of Bar
2239	365.05	97.32	Top of Bar
2242	375.49	95.59	Top of Bar
2230	419.35	94	Top of Bar
2222	453.62	93.81	Top of Bar
2220	462.24	94.83	Top of Bar
306	532.39	91.01	Top of Bar
288	540.84	91.02	Top of Bar
279	570.63	90.4	Top of Bar
316	580.6	91.17	Top of Bar
268	610.17	89.91	Top of Bar
252	620.7	89.86	Top of Bar
259	642.81	89.29	Top of Bar
233	677.3	88.06	Top of Bar
212	722.63	87.66	Top of Bar
211	731.43	86.77	Top of Bar
196	758.5	86.26	Top of Bar
185	789.82	85.67	Top of Bar
161	819.5	85.07	Top of Bar
156	833.67	85.04	Top of Bar
153	846.34	85.75	Top of Bar
126	873.57	83.94	Top of Bar
123	898.37	84.25	Top of Bar
114	907.01	83.58	Top of Bar
104	917.67	84.04	Top of Bar
89	953.34	83.6	Top of Bar
67	984.22	83.03	Top of Bar
72	988.85	83.26	Top of Bar
50	1029.09	82.29	Top of Bar
319	1052.39	82.33	Top of Bar
320	1054.62	82.08	Top of Bar
326	1124.12	81.48	Top of Bar
331	1153.53	81.02	Top of Bar
341	1206.58	79.09	Top of Bar
353	1228.34	82.38	Top of Bar
349	1241.97	78.12	Top of Bar
363	1282.22	80.14	Top of Bar
367	1294.65	77.8	Top of Bar
371	1308.84	77.34	Top of Bar
387	1340.21	77.96	Top of Bar

390	1062.58	83.06	X5
396	1062.58	81.99	X5
397	1062.58	82.21	X5
409	1062.58	83.7	X5LP
2359	1062.58	84.35	X5LP
389	1062.58	83.43	X5LP
393	1062.58	82.04	X5RP
2360	1062.58	83.15	X5RP
401	1062.58	76.74	X5T
402	1062.58	77.19	X5W
399	1062.58	77.11	X5W

Cross Section 1 Downstream Station 01+00

Cross Section 1 Upstream Station 01+00

Cross Section 2 Downstream Station 01+50

Cross Section 2 Upstream Station 01+50

Cross Section 3 Downstream Station 02+95

Cross Section 3 Upstream Station 02+95

Cross Section 4 Downstream Station 10+00

Cross Section 4 Upstream Station 10+00

Cross Section 5 Downstream Station 10+75

Cross Section 5 Upstream Station 10+75

Bear Swamp Tributary Restoration									
Louisburg, Franklin County, NC									
		Quad 1							
Tree Stratum									
Species	**Height (cm)**	**Diameter (mm**	**Radius (mm)**	**Σ X-sec. (mm²)**	**Rel. x-sec (%)**	**Density**	**Rel. Density (%)**	**Rank (Importance)**	**Average**
Pinus taeda						161			
Ostrya virginiana	271	32	16	817					
	132	32	16	817					
Total			**32.3**	**1634.5**	**100.0**	2	**1.2**	**1**	**50.6**
Overall Total			**32.3**	**1634.5**	**100**	**163**	**1.2**		
Total Trees per acre						6520			
Planted trees per acre						80			
Natural regen. trees per acre						6360			
Shrub Stratum									
Species	**Cover (%)**	**Rel. cover (%)**	**Density**	**Rel. Density (%)**	**Rank (Importance)**				
Salix nigra	5	100.0	5	100	1				
				0					
Total	**5**	**100.0**	**5**	**100**					
Herb Stratum									
Species	**Cover (%)**	**Rel. cover (%)**	**Rank (Importance)**						
Eupatorium capillifolium	2	5.7							
Aster spp.	3	8.6							
Festuca spp.	30	85.7							
Total	**35**	**100**							

Bear Swamp Tributary Restoration									
Louisburg, Franklin County, NC									
		Quad 2							
Tree Stratum									
Species	**Height (cm)**	**Diameter (mm**	**Radius (mm)**	**Σ X-sec. (mm²)**	**Rel. x-sec (%)**	**Density**	**Rel. Density (%)**	**Rank (Importance)**	**Average**
Juglans nigra	71	6	3.2	31.7	6.1				
	72	8							
Total	**71**	**6**	**3.2**	**31.7**	**6.1**	**2**	**2.8**		
Pinus taeda	45	3	1.6	7.9	1.5				
	44	8	4.0	49.5	9.6				
	32	6	3.2	31.7	6.1				
	29	3	1.6	7.9	1.5				
Total			**10.3**	**97.0**	**18.8**	**69**	**95.8**	**1**	**57.3**
Fraxinus spp.	74	22	11.1	387.9	75.1				
Total			**11.1**	**387.9**	**75.1**	**1**	**1.4**		
Overall Total			**13.5**	**516.6**	**100.0**	**72**	**100**		
Total Trees per acre						2880			
Planted trees per acre						120			
Natural regen. trees per acre						2760			
Shrub Stratum									
Species	**Cover (%)**	**Rel. cover (%)**	**Density**	**Rel. Density (%)**	**Rank (Importance)**				
Salix nigra	5	100.0	7	100	1				
				0					
Total	**5**	**100.0**	**7**	**100**					
Herb Stratum									
Species	**Cover (%)**	**Rel. cover (%)**	**Rank (Importance)**						
Erigeron spp.	20	14.6							
Vicia spp.	3	2.2							
Festuca spp.	70	51.1							
Trifolium spp.	40	29.2							
Aster spp.	2	1.5							
Stellaria spp.	2	1.5							
Total	**137**	**100.0**							

Bear Swamp Tributary Restoration

Louisburg, Franklin County, NC

Quad 3

Tree Stratum

Species	Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)	Average
Betula nigra	119.4	0.5	0.3	**0.2**					
Total			**0.3**	**0.2**	**0.000171912**	**1**	**16.7**		
Pinus taeda	63.5	381.0	190.5	**114009.2**					
	58.4	9.5	4.8	**71.3**					
	43.2	6.4	3.2	**31.7**					
	53.3	6.4	3.2	**31.7**					
	38.1	9.5	4.8	**71.3**					
Total			**15.9**	**114215.0**	**100.0**	**5**	**83.3**	**1**	**91.7**
Overall Total			**16.1**	**114215.2**	**100.0**	**6**	**100**		
Total Trees per acre						240			
Planted trees per acre						40			
Natural regen. trees per acre						200			

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
no shrubs present					
Total					

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Trifolium spp.	60	88.2	
Vicia spp.	2	2.9	
Carex spp.	2	2.9	
Aster spp.	3	4.4	
Festuca spp.	1	1.5	
Total	68	100.0	

Bear Swamp Tributary Restoration

Louisburg, Franklin County, NC

Quad 4

Tree Stratum

Species	Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)	Average
Pinus taeda	56.2	6.4	3.2	**31.7**		40			
	115.6	2.5	1.3	**5.1**					
Total			**4.4**	**36.7**	**1.0**	**40**	**75.5**	**1**	
Liquidambar styracifula	132.1	6.4	3.2	**31.7**					
	217.5	6.4	3.2	**31.7**					
	185.4	12.7	6.4	**126.7**					
	52.4	4.8	2.4	**17.8**					
	103.2	12.7	6.4	**126.7**					
	175.4	15.9	7.9	**197.9**					
	176.5	19.1	9.5	**285.0**					
	189.2	38.1	19.1	**1140.1**					
	174.3	19.1	9.5	**285.0**					
	216.2	27.0	13.5	**572.0**					
	196.9	19.1	9.5	**285.0**					
	175.3	22.2	11.1	**387.9**					
	221.0	15.9	7.9	**197.9**					
Total			**109.5**	**3685.5**	**99.0**	**13**	**24.5**	**2**	**61.8**
Overall Total			**114.0**	**3722.2**	**100.0**	**53**	**100**		
Total Trees per acre						2120			
Planted trees per acre						0			
Natural regen. trees per acre						2120			

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Total					

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Fragaria spp.	4	26.7	
Vicia spp.	2	13.3	
Festuca spp.	2	13.3	
Aster spp.	5	33.3	
Trifolium spp.	2	13.3	
Total	15	100.0	