Little Pine & Brush Creek

2004 Annual Monitoring Report

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North Carolina State University
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Raleigh, NC 27695

February, 2004

Ecosystem Enhancement PROGRAM

NCDENR

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2004 Little Pine & Brush Creek Monitoring Abstract

Brush Creek and one of its tributaries, Little Pine Creek, were enhanced/restored through the North Carolina Ecosystem Enhancement Program (NCEEP). The objectives of the project are to:

1.) Establish a stable dimension, pattern and profile on 950 feet of Little Pine Creek
2.) Improve habitat within Little Pine Creek
3.) Establish a forested riparian zone surrounding restored and enhanced sections of Little Pine and Brush Creeks
4.) Restore through dimension, pattern and profile modifications 340 linear feet of Brush Creek
5.) Enhance channel stability along 2,300 linear feet of Brush Creek through the use of bank stabilization and reforestation

This is the 3rd year of the 5-year monitoring plan for both Little Pine and Brush Creeks.

Table 1A. Background Information

Project Name	Little Pine and Brush Creek
Designer's Name	HDR Engineering, Inc. of the Carolinas 128 South Tryon St, Suite 1400 Charlotte, NC, 28202
Contractor's Name	A&D Environmental & Industrial Services
Directions to Project Site	From Interstate I-77 follow NC-21 north. Follow NC-21 turn right (north) on Shuffeltown Road (SR1464). Follow Shuffeltown road for 5 miles. Turn left on Glad Valley Road. Follow Glade Valley Road for 1 mile and turn right on Big Oak Road. The project is located downstream of the Big Oak Road Bridge.
Drainage Area	4.3 sq. mi. (Little Pine) 26.3 sq. mi. (Brush Creek)
USGS Hydro Unit	05050001
NCDWQ Subbasin	05-07-04
Project Length	950 linear feet (Little Pine) 2,640 linear feet (Brush Creek)
Restoration Approach	950 feet of dimension, pattern, and profile on Little Pine Creek 340 feet of bank stabilization on Brush Creek 2,300 feet of bank and riparian enhancement on Brush Creek
Date of Completion	2001
Monitoring Dates	2001 (baseline); May, 2002; September, 2003; June, 2004

Results and Discussion

Overall, while the majorities of both streams are functioning well and are stable, each stream has areas of concern and areas of immediate need. Table 2A shows a summary of monitoring measurement results. Overall the project is performing well. Channel dimension, pattern, and profile are similar to as-built conditions with the exceptions of some limited areas of bank slumping. Vegetation is not succeeding to levels required for mitigation credit.

Table 2. Summary of Channel Conditions

DIMENSION	Little Pine Cross-section #1 Riffle			Little Pine Cross-section #2 Riffle			Little Pine Cross-section #3 Pool			Brush Creek Cross-section #4 Riffle			Brush Creek Cross-section #5 Pool			Brush Creek Cross-section #6 Pool		
	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004	As-built*	2003	2004	As-built*	2003	2004
Bankfull Cross-sectional Area	86.7	101.7	97.1	88.7	87.8	94.5	86.6	100.4	86.4	266.9	305.7	300.1	387.1	384.6	398.9	285.3	297.6	288.9
Bankfull Width	31.5	31.5	31.5	33.7	32.6	32.2	35.4	40.4	36.8	55.3	53.2	58.2	106.0	105.4	107.7	67.0	68.0	61.0
Bankfull Mean Depth	2.8	3.2	3.1	2.6	2.7	2.9	2.4	2.5	2.3	4.8	5.7	5.2	3.7	3.6	3.7	4.3	4.4	4.7
Bankfull Max Depth	5.0	5.0	4.9	4.8	5.5	6.0	4.5	6.4	4.9	8.0	8.4	7.7	6.1	6.6	6.3	6.9	7.2	7.4

PATTERN	Little Pine As-built			Little Pine 2003			Little Pine 2004			Brush Creek As-built			Brush Creek 2003			Brush Creek 2004		
	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
Meander Wave Length	-	-	n/a	86	139	113	91	164	113	-	-	n/a	228	570	380	268	566	547
Radius of Curvature	-	-	50.5	18	65	42	26	147	56	-	-	n/a	25	192	72	66	284	108
Beltwidth	-	-	25	37	62	46	23	65	34	-	-	n/a	122	304	217	71	325	149

PROFILE	Little Pine As-built			Little Pine 2003			Little Pine 2004			Brush Creek As-built			Brush Creek 2003			Brush Creek 2004		
	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
Riffle Length	6	47	18	18	96	37	14	50	25	20	417	33	53	346	103	58	489	104
Riffle Slope	1.17%	2.79%	1.61%	0.64%	2.67%	1.75%	1.36%	3.43%	2.18%	0.24%	1.65%	1.35%	0.13%	0.98%	0.53%	0.12%	0.74%	0.32%
Pool Length	34	112	45	44	121	78	45	90	54	51	348	187	179	311	226	51	218	88
Pool to Pool Spacing	51	150	64	116	192	162	71	183	121	53	966	359	274	789	370	170	589	218

SUBSTRATE	Little Pine Cross-section #1 Riffle			Little Pine Cross-section #2 Riffle			Little Pine Cross-section #3 Pool			Brush Creek Cross-section #4 Riffle			Brush Creek Cross-section #5 Riffle			Brush Creek Cross-section #6 Pool		
	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004
d50	36.4	10.2	3.00	59.4	0.47	0.94	1.2	0.36	0.13	34.7	3.6	6.2	18.8	6.2	2.4	36.9	4.9	10.05
d84	116.1	50.9	41.2	119.7	15.5	79.7	7.8	6.4	8.7	71.8	29.5	28.0	68.2	44.9	33.12	263.5	36.9	46.5

VEGETATION	Trees Planted		Quad 1 - Little Pine Creek		Quad 2 - Little Pine Creek		Quad 3 - Brush Creek		Quad 1 - Little Pine Creek		Quad 2 - Little Pine Creek		Quad 3 - Brush Creek	
	2001		2003		2003		2003		2004		2004		2004	
	L. Pine	Brush	% Cover	Density	% Cover	Density	% Cover	Density	% Cover	Density	% Cover	Density	% Cover	Density
	#/acre	#/acre		(trees/ac)		(trees/ac)		(trees/ac)		(trees/ac)		(trees/ac)		(trees/ac)
Tree Stratum	n/a	n/a	-	40	-	0	-	0		0		0		2520
Trees Naturally Regenerated	-	-	-	0	-	0	-	0	-	0	-	0	-	2520
Shrub Stratum	n/a	n/a	0.05%	2509	0.0%	0	1.0%	809	0.5%	0	0.0%	0	4.0%	25
Herb Stratum	n/a	n/a	146%	-	203%	-	25%	-	111.0%		144.0%		42.5%	-

The following areas of concern should be monitored closely and considered for repair as suggested. A plan sheet follows which shows locations of areas of concern and plan view of existing conditions overlain as-built conditions.

Little Pine Creek

1.) Areas with bank slumping

- These areas (Table 3 below) have continued to degrade. Additional stabilization is needed in most areas. Root Wads are recommended. The area around station 0+50 has developed a substantial central bar causing scour to both banks and downstream. Additional measures should be taken to stabilize this area.

Table 3A. Locations of Degraded Areas along Little Pine Creek

Stations	Problem
0+50 to 0+80	Large amount of erosion on the right bank and a mid channel bar forming.
1+60 to 2+00	Right bank eroding
7+20 to 7+50	Right Bank slump and eroding
7+75 to 8+45	Left bank migrating
Throughout (both streams)	Poor hardwood tree and live stake establishment

Brush Creek

1.) Brush creek has several areas upstream of the confluence with Little Pine creek with bank slumping and indications of meander migration.

- These areas should be addressed to limit further degradation. See recommendations below.

2.) The left bank along the relocated section (station 9+00 to 10+00) is showing signs of scouring.

- This area should be monitored during upcoming site visits.

LP VEG PLOT 1

LP XS-2

LP XS-1

MID-CHANNEL BAR

LITTLE PINE CREEK

LP VEG PLOT 2

BANK SLUMPING/EROSION

BANK SLUMPING/EROSION

DEBRIS JAM

LP XS-3

BC XS-4

BC VEG PLOT 1

BC XS-5

BRUSH CREEK

TOE SCOUR

BC XS-6

SCALE 1" = 100'

50 0 50 100

LEGEND

ROOT WAD
EASEMENT
FENCE
LOG
ROCK BED
TREE
VEGETATION PLOT
PHOTO STATION
RIFFLE
ROCK VANE
AREA OF CONCERN
VEGETATION PLOTS
BANKFULL
BENCH VANE
OLD CHANNEL PLUG

BRUSH CREEK MONITORING
ALLEGHANY COUNTY, N.C.
WETLANDS RESTORATION PROGRAM

FIGURE 1A
2004 MONITORING PLAN VIEW

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North Carolina State University
Raleigh, NC 27695

NO	REVISIONS	DRN	CHK	DATE
1	ISSUED TO WRP FOR REVIEW	DAB	DRC	12/22/04

DRAWING NO. C – 2
SHEET NO.
FILENAME BRUSHCREEK.DWG
PROJECT NO.
DATE 12/19/2003

Photos

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

Little Pine Creek

Typical Photo 1.
Typical Riffle along Little Pine Creek.

Typical Photo 2.
Typical Pool along Little Pine Creek.

Issue Photo 1.
Little Pine near Station 0+60.
Central Bar and Right Bank Scour

Issue Photo 2.
Little Pine near Station 1+80.
Bank slump on left bank.

Issue Photo 3. Little Pine near station 7+80.
Bank Scour on Right Bank

Issue Photo 4. Little Pine near station 6+00.
Toe Scour along Right Bank

Brush Creek

Typical Photo 1.
Typical Riffle along Brush Creek.

Typical Photo 2.
Typical Pool along Brush Creek.

Issue Photo 1.
Brush Creek near Station1+50.
Left Bank slump and scour.

Issue Photo 2.
Brush Creek near Station 0+50.
Transverse bar at start of project.

Issue Photo 3.
Brush Creek near Station 9+50.
Left bank scour.

Issue Photo 4.
Brush Creek near Station 5+00.
Large Woody Debris in channel.

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Tables and Figures

1.0 BACKGROUND INFORMATION

The background information for this report is referenced from previous monitoring reports conducted by HDR, Inc. The following was excerpted from 2003 HDR monitoring report section 2.1:

> The project site is located in Alleghany County, in the Blue Ridge Province of the Appalachian Mountains. At this site, Little Pine Creek, a third-order perennial stream draining a watershed of 4.3 square miles, enters Brush Creek, a fourth-order perennial stream draining a watershed area of 26.3 square miles (Figure 1). Brush Creek is a tributary to the Little River. These streams are part of the New River watershed, United States Geologic Survey (USGS) Hydrologic Unit 05050001, and North Carolina Division of Water Quality (NCDWQ) Subbasin 05-07-03. Streams have been assigned a best usage classification by NCDWQ that reflects water quality conditions and potential resource usage. The classification for Brush Creek is C TR. Waters classified as C TR are used for secondary recreation and protected for the intent of trout propagation and survival (NCDENR, 2000).
>
> In 1969, Little Pine Creek was channelized upstream of its confluence with Brush Creek. In the recent past, approximately 340 feet of Brush Creek stream bank, downstream of the Little Pine Creek confluence, experienced significant bank collapse. This collapse may be linked to a variety of factors, including the steep angle of the Little Pine Creek confluence, deflection of Brush Creek streamflow by point bar formation downstream of the confluence, the unconsolidated alluvial composition of the collapsing Brush Creek streambank, and limited riparian vegetation.
>
> In response to landowner desires to restore Little Pine Creek and Brush Creek to a condition of natural stability, restoration of these streams occurred from April to July 2001, ~~as shown in Figures 2 and 3~~. Riparian planting was completed in January 2002. Approximately 600 linear feet of altered Little Pine Creek channel were replaced with a new, 950-linear foot meandering channel reconnected to the flood plain and designed to maintain stable dimension, pattern, and profile while effectively transporting anticipated streamflow and sediment load. A vegetated riparian corridor was established along Little Pine Creek in order to improve water quality and increase aquatic and terrestrial habitat resources. In addition, 340 linear feet of Brush Creek were stabilized to eliminate existing severe bank collapse problems. Another 2,300 feet of degraded Brush Creek riparian corridor were enhanced in an effort to stabilize unstable banks, increase instream aquatic habitat, and improve the riparian buffer.
>
> The lower 700 feet of Brush Creek, which is included in the conservation easement, does not include cross-section or permanent photograph station establishment. No grading work or planting was performed in this stable reach. Two boulder clusters were placed in the stream in this section to augment existing riffle sections.

1.1 Goals and Objective

The goals and objectives of this project are as follows.

1.) Establish an stable dimension, pattern and profile on 950 feet of Little Pine Creek
2.) Improve habitat within Little Pine Creek
3.) Establish a forested riparian zone surrounding restored and enhanced sections of Little Pine and Brush Creeks
4.) Restore through dimension, pattern and profile modifications 340 linear feet of Brush Creek
5.) Enhance channel stability along 2,300 linear feet of Brush Creek through the use of bank stabilization and reforestation

1.2 Project Location

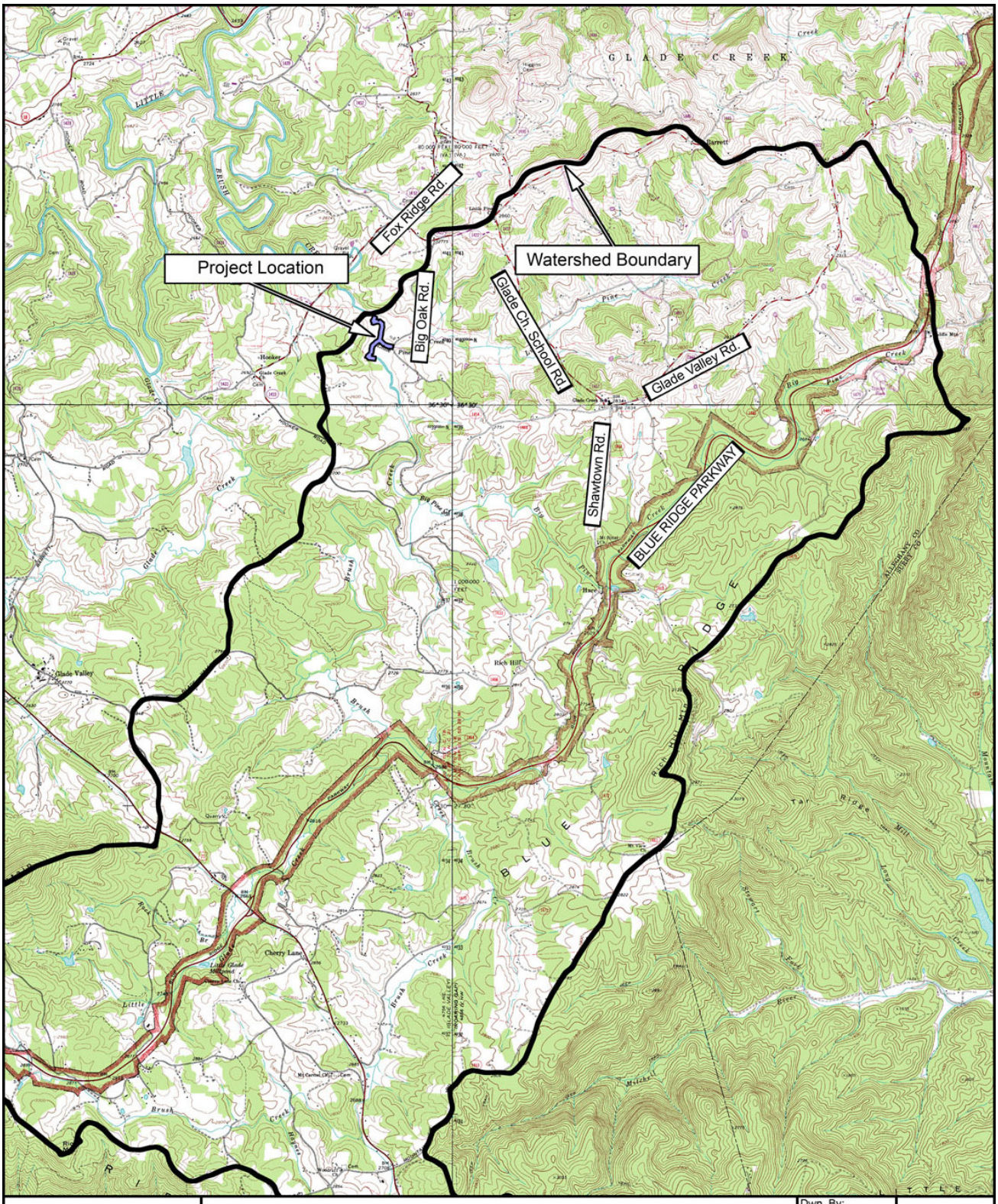
From Interstate I-77 follow NC-21 north. Follow NC-21 turn right (north) on Shuffeltown Road (SR1464). Follow Shuffeltown road for 5 miles. Turn left on Glad Valley Road. Follow Glade Valley Road for 1 mile and turn right on Big Oak Road. The project is located downstream of the Big Oak Road Bridge. See Figure 1 for map showing project location.

1.3 Project Description

The restoration of 950 linear feet of Little Pine Creek consists of relocating the existing channel away from a previously straightened ditch. Riffle-pool bedform was constructed as well as a stable meander pattern developed from stable reference streams. Bed features were stabilized utilizing constructed riffles consisting of graded stone. Biologs were used to stabilize outside meander bends. Vegetation was planted to establish a dense root mass along the stream banks and in the riparian zone.

The restoration of 340 linear feet of Brush Creek consisted of relocating a section of the channel that was rapidly eroding due to lack of vegetation and poor channel pattern. Rock sills were utilized to ensure the channel does not reopen previous channel. A low sloped point bar was graded into the area were the previous channel was located. This area was re-vegetated with native seedlings, shrubs, and herbs.

An additional 2,300 linear feet of Brush Creek was enhanced with vegetation and bank stabilization structures. Structures include single rock vanes, boulder bank toe, and log toe. The entire length of Brush Creek was also fenced to exclude cattle from the riparian area.



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Raleigh, NC 27606

Project Location: Little Pine and Brush Creek

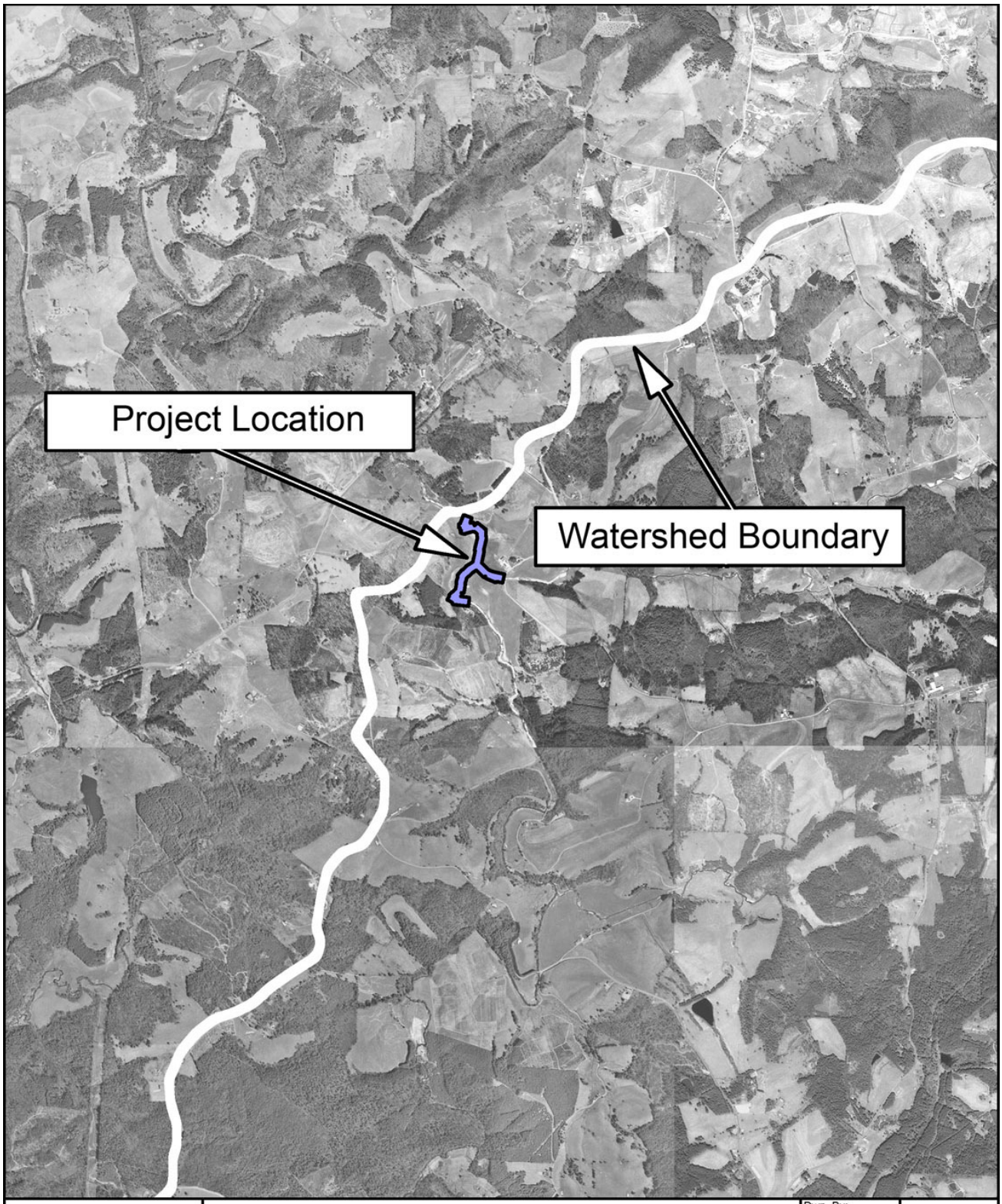
Alleghany County, North Carolina

EEP Monitoring Report

SCALE 1:60,000

Dwn. By:	MVH
Ckd By:	DAB
Date:	March 2004

FIGURE 1



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Aerial Watershed Photo: Little Pine & Brush Creek
Alleghany County, North Carolina

EEP Monitoring Report

SCALE 1:30,000
0 1 MILE
0 1000 2000 3000 4000 5000 FEET

N

Dwn. By: MVH
Ckd By: DAB
Date: March 2004

FIGURE 2

LP VEG PLOT 1

LP XS-2

LP XS-1

LITTLE PINE CREEK

LP VEG PLOT 2

LP XS-3

BC XS-4

BC VEG PLOT 1

BC XS-5

BRUSH CREEK

BC XS-6

SCALE 1" = 100'

50 0 50 100

LEGEND

- ROOT WAD
- EASEMENT
- FENCE
- LOG
- ROCK BED
- TREE
- VEGETATION PLOT
- P1 PHOTO STATION
- BANKFULL
- VEGETATION PLOTS
- AREA OF CONCERN
- ROCK VANE
- RIFFLE
- BENCH VANE
- OLD CHANNEL PLUG

BRUSH CREEK MONITORING
ALLEGHANY COUNTY, N.C.
WETLANDS RESTORATION PROGRAM

FIGURE 3
AS-BUILT PLAN VIEW

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NO	REVISIONS	DRN	CHK	DATE
1	ISSUED TO WRP FOR REVIEW	DAB	DRC	12/22/03

DRAWING NO.
SHEET NO. C – 2
FILENAME BRUSHCREEK.DWG
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LP VEG PLOT 1

LP XS-2

LP XS-1

MID-CHANNEL BAR

LITTLE PINE CREEK

LP VEG PLOT 2

BANK SLUMPING/EROSION

BANK SLUMPING/EROSION

DEBRIS JAM

LP XS-3

BC XS-4

BC VEG PLOT 1

BC XS-5

BRUSH CREEK

TOE SCOUR

BC XS-6

SCALE 1" = 100'

50 0 50 100

LEGEND

ROOT WAD
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PHOTO STATION
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FIGURE 1A
2004 MONITORING PLAN VIEW

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DRAWING NO. C – 2
SHEET NO.
FILENAME BRUSHCREEK.DWG
PROJECT NO.
DATE 12/19/2003

2.0 YEAR 2004 RESULTS AND DISCUSSION

Year 2004 monitoring results are shown for Little Pine and Brush Creek Monitoring.

2.1 Vegetation

2.1.1 Results and Discussion

Using the Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects, the previous three vegetation monitoring plots randomly selected from monitoring year 2003 were surveyed for the 2004 monitoring season. No reference area was studied; therefore no comparisons could be made to reference conditions.

Little Pine Creek

Vegetation within the riparian buffer of Little Pine Creek varied in success; however showed no real improvement from the previous year's monitoring. Although the planted native herbaceous vegetation was dense in areas, fescue is becoming an invasive problem throughout much of the buffer. *Impatiens* spp., *Solidago* spp., and *Ranunculus* spp. are especially thriving throughout the area. Live stakes are marginally healthy in certain areas, although many have washed out during high flows and bank sloughing. Planted trees and shrubs are doing poorly throughout the entire buffer. In both plots, no tree stems were counted. Although some stakes were found to be thriving, by and large, dead stakes were prevalent throughout. Further, of the shrub and tree stems found alive throughout the site, most have been browsed. Overall, planted trees were found to be not successful.

Little to no natural regeneration was noted this year. It was noted that a few large planted sycamores and walnuts were thriving and appeared not be have been browsed. Overall, the area appeared to be in an early successional state.

Buffer width is inconsistent along the creek. Although there were no pumpkins encroaching into the riparian buffer, fescue was making strong inroads. Despite lack of woody vegetation, buffer was 100% covered with herbaceous vegetation.

Brush Creek

The Brush Creek vegetation quad contained no planted bare root trees, but had numerous sprouts of naturally regenerated *Prunus serotina* and *Acer rubrum*. Live stake sprouts from *Cornus amomum,* and *Salix nigra* were prevalent. . Also, natural regeneration of *Alnus serrulata* was common. Herbaceous vegetation was thick and lush throughout the plot and adjoining area. *Juncus* spp. and *Polygonum* spp. were dominant in the entire area. Next to the plot, several planted trees were doing well, although browse was noted. Much deposition, overwash, and erosion has taken place within the plot since the last monitoring season, however, the vegetation has either held its ground or naturally regenerated from local seed sources.

Vegetation overall within this project has mixed success. Herbaceous vegetation, both planted and naturally regenerating, are doing extremely well and contribute to the bank stability of the project. Live stakes are marginal in most areas. No planted tree species were encountered in any of the plots.

Recommendations include replanting larger containerized trees to meet mitigation requirements and stake only in areas where erosion is problematic. Although invasive vegetation is not a major issue on this project site, the fescue in the adjacent field should be monitored. The riparian buffer should be extended to its rightful width in that area. Lastly, deer are an issue on this site. Measures should be taken to prevent deer browse of planted vegetation.

2.2 Morphology

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

2.2.1 Results and Discussion

Little Pine Creek

Channel profile along Little Pine Creek has shown some down-cutting near the confluence with Brush Creek. The number of defined riffles in the bedform has decreased from 13 in 2001, to 10 in 2002, to 6 in 2003, and remained constant with 6 in 2004. This is consistent with pebble count results which show a significant increase in fine particles since construction but remained relatively consistent from 2003 to 2004. Little Pine Creek has not shown any further down-cutting since 2003 and in fact aggraded near the confluence with Brush Creek. Hardened riffle areas are maintaining elevation throughout the relocated reach.

All channel cross-sections remained similar to 2003 conditions. Cross sections 1 and 3 decreased slightly in cross sectional area. Section 2 increased slightly.

Channel substrate in the all sections continues to decrease in median size. The d50 decreased from as-built of 36.4mm to 10.2mm in 2003 to 3.0mm in 2004 at riffle 1 and from 59.4mm to 0.47mm to 0.94mm in riffle 2. The upstream bank slumping and erosion below the beginning of the project is likely the source of most of these fine particles. The d84 has not decreased in the riffle sections. Many courser sediments consisting of gravels and cobbles exist in the channel bed. The riffles are maintaining a mostly gravel substrate. The pool cross-section d50 has decreased as well, from 1.2mm to 0.36mm to 0.13mm. The d84 in the pool has increased from 6.4mm in 2003 to 8.7mm in 2004.

Channel pattern appears to have remained stable since construction with the exception of the area with a central bar and a few meander bends that are showing signs of lateral migration. These stations are noted in Section 2.4 Areas of Concern.

Channel banks throughout Little Pine Creek remain mostly stable with the exception of five spot areas of bank slumping. Slumping is likely the result of the lack of deep rooting vegetation, steep stream banks, and high stream velocities near the channel toe. The largest area of slumping is due to a beaver dam that was located near station 0+50. A central bar has formed in this area accelerating the bank erosion. The Beaver Dam is no longer in the channel.

Brush Creek

Channel profile along the relocated section of Brush Creek appears to have downcut between 2001 and 2002, although the cross-sections do not show this. The channel has maintained the adjusted elevation over the past two years of monitoring. Most other areas have maintained grade throughout the project. Pools throughout the project have deepened since construction and have maintained the consistent depth from 2002 through 2004. The number and location of defined riffles has remained constant. Brush Creek has not shown any potential for down-cutting over the past year. The section of channel above the confluence appears to be in a state of transition with bedform changing slightly from previous years surveys. There is bank erosion and meander migration occurring in this section. Hardened riffle areas are maintaining elevation throughout the relocated reach.

The left bank at cross-section 4 along Brush Creek has slumped over the past year. There is some evidence of toe scour along the left bank along the relocated section between stations 7+50 and 10+00. Toe scour is also common throughout the channel above the confluence with Little Pine Creek. Cross-section 6 is very similar to previous measurements.

Channel substrate appears to have stabilized in all sections. Minor fluctuations exist but the differences are well within measurement error limits. The d50 decreased from as-built of 34.6mm to 3.6mm in 2003 but increased to 6.2mm at riffle 4 in 2004. Riffle 5 d50 decreased from 18.8mm at as-built to 6.2mm in 2003 and to 2.4mm in 2004. There are areas of course sediments consisting of cobbles and the channel bed in the riffles are maintaining a mostly gravel substrate with d84 only slightly decreasing over the past year in cross section 4 and 5 with an increase in cross section 6.

Table 1. Summary of Channel Conditions

DIMENSION	Little Pine Cross-section #1 Riffle			Little Pine Cross-section #2 Riffle			Little Pine Cross-section #3 Pool			Brush Creek Cross-section #4 Riffle			Brush Creek Cross-section #5 Pool			Brush Creek Cross-section #6 Pool		
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Bankfull Cross-sectional Area	86.7	101.7	97.1	88.7	87.8	94.5	86.6	100.4	86.4	266.9	305.7	300.1	387.1	384.6	398.9	285.3	297.6	288.9
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Bankfull Mean Depth	2.8	3.2	3.1	2.6	2.7	2.9	2.4	2.5	2.3	4.8	5.7	5.2	3.7	3.6	3.7	4.3	4.4	4.7
Bankfull Max Depth	5.0	5.0	4.9	4.8	5.5	6.0	4.5	6.4	4.9	8.0	8.4	7.7	6.1	6.6	6.3	6.9	7.2	7.4

PATTERN	Little Pine As-built			Little Pine 2003			Little Pine 2004			Brush Creek As-built			Brush Creek 2003			Brush Creek 2004		
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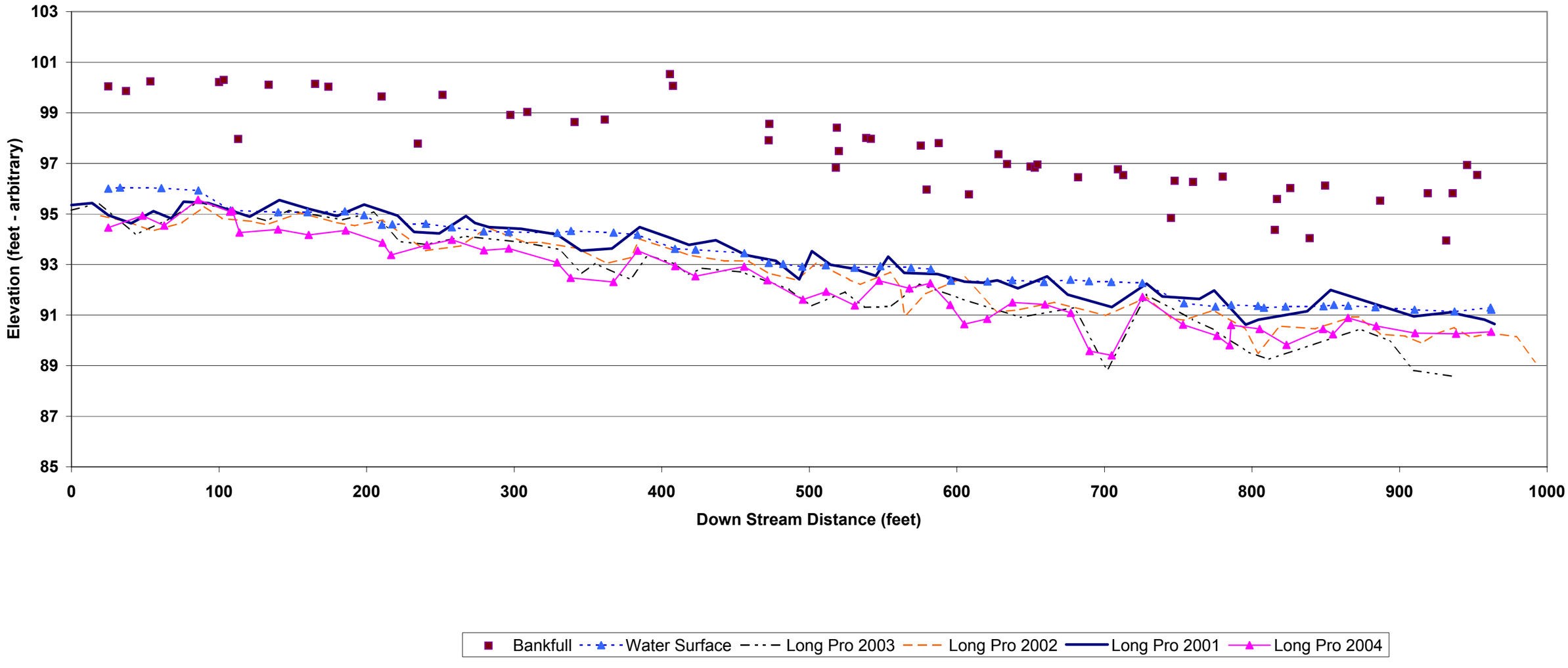
	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
Riffle Length	6	47	18	18	96	37	14	50	25	20	417	33	53	346	103	58	489	104
Riffle Slope	1.17%	2.79%	1.61%	0.64%	2.67%	1.75%	1.36%	3.43%	2.18%	0.24%	1.65%	1.35%	0.13%	0.98%	0.53%	0.12%	0.74%	0.32%
Pool Length	34	112	45	44	121	78	45	90	54	51	348	187	179	311	226	51	218	88
Pool to Pool Spacing	51	150	64	116	192	162	71	183	121	53	966	359	274	789	370	170	589	218

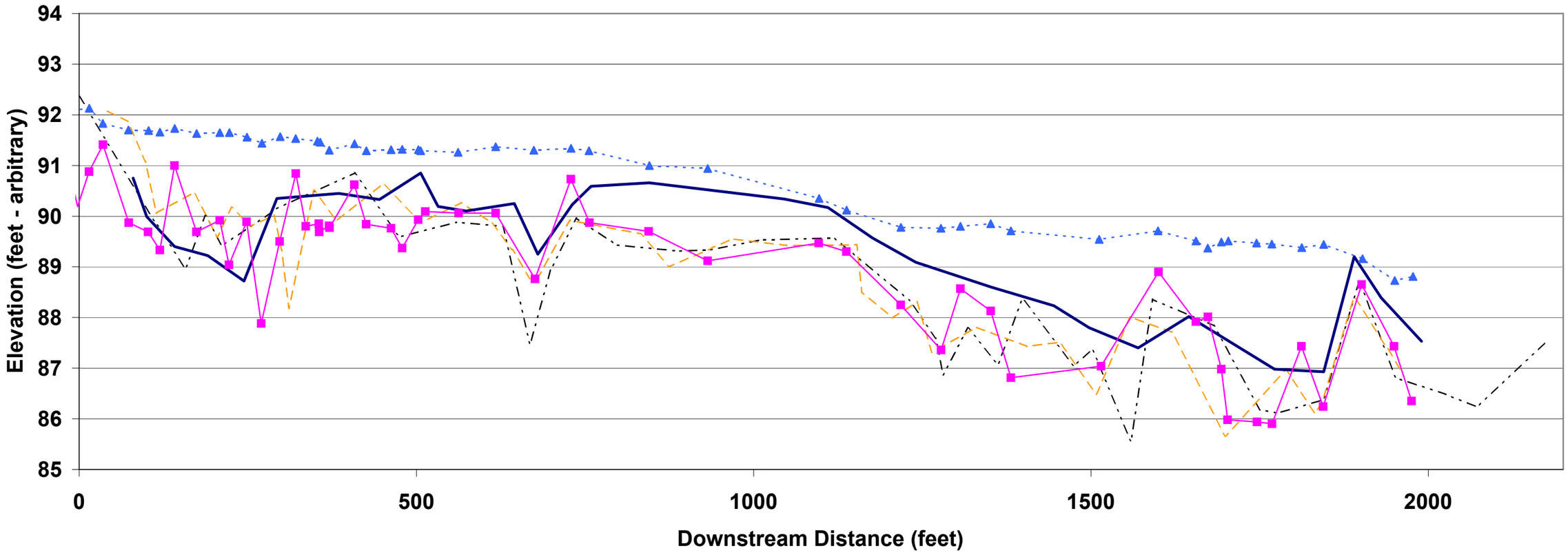
SUBSTRATE	Little Pine Cross-section #1 Riffle			Little Pine Cross-section #2 Riffle			Little Pine Cross-section #3 Pool			Brush Creek Cross-section #1 Riffle			Brush Creek Cross-section #2 Pool			Brush Creek Cross-section #3 Pool		
	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004	As-built	2003	2004
d50	36.4	10.2	3.00	59.4	0.47	0.94	1.2	0.36	0.13	34.7	3.6	6.2	18.8	6.2	2.4	36.9	4.9	10.05
d84	116.1	50.9	41.2	119.7	15.5	79.7	7.8	6.4	8.7	71.8	29.5	28.0	68.2	44.9	33.12	263.5	36.9	46.5

VEGETATION	Trees Planted		Quad 1 - Little Pine Creek		Quad 2 - Little Pine Creek		Quad 3 - Brush Creek		Quad 1 - Little Pine Creek		Quad 2 - Little Pine Creek		Quad 3 - Brush Creek	
	2001		2003		2003		2003		2004		2004		2004	
	L. Pine	Brush	% Cover	Density	% Cover	Density	% Cover	Density	% Cover	Density	% Cover	Density	% Cover	Density
	#/acre	#/acre		(trees/ac)		(trees/ac)		(trees/ac)		(trees/ac)		(trees/ac)		(trees/ac)
Tree Stratum	n/a	n/a	-	40	-	0	-	0		0		0		2520
Trees Naturally Regenerated	-	-	-	0	-	0	-	0	-	0	-	0	-	2520
Shrub Stratum	n/a	n/a	0.05%	2509	0.0%	0	1.0%	809	0.5%	0	0.0%	0	4.0%	25
Herb Stratum	n/a	n/a	146%	-	203%	-	25%	-	111.0%		144.0%		42.5%	-

Little Pine Creek
Longitudinal Profile
2004 Monitoring
N.C. State University



Brush Creek
Longitudinal Profile
2004 Monitoring
N.C. State University



2.3 Macroinvertebrates

Little Pine Creek is a third order tributary of Brush Creek with a catchment size of 4.3 square miles at the confluence. The project/construction site is the lower reach of Little Pine Creek before it flows into Brush Creek. This reach was artificially straightened in 1969 and 950 linear feet of the channel was restored to original pattern, dimension and profile in July 2001. However, this reach appeared to be relatively stable at the time of restoration (although some bank instability was noted) and cattle had been previously excluded from this lower reach. It appeared that Little Pine Creek above the restoration reach (station 1) has also been straightened in the past and, unlike station 2, cattle have access to the stream in this reach. The aquatic insect data from Little Pine Creek reflects the water quality conditions of the entire catchment. Other investigations conducted in small stressed streams in the New River Basin by the Environmental Sciences Branch of the Division of Water Quality have indicated that the biological integrity is unusually high. These data are for surveys conducted in 2001 (pre-construction) and 2003 (post-construction), no data were collected in 2004.

Brush Creek near the confluence of Little Pine Creek has a substrate dominated by sand and various reaches of Brush Creek above and below the confluence with Little Pine Creek have experienced significant streambank collapse. A large eroding streambank was found below the confluence with Little Pine Creek and may have been partially related to the channelization of Little Pine. Part of this project included an enhancement of the 2,640 linear feet of this streambank. Biological samples were collected from sites above and within the restoration reach of Little Pine (Stations 1 and 2) and above, within and below the enhancement reach of Brush Creek (Stations 1, 2 and 3). Data from these surveys are summarized in Table 3.

Table 2. Summary statistics from the stream mitigation project at Little Pine and Brush Creeks.

	Restoration				Enhancement					
	Little Pine 1		**Little Pine 2**		**Brush Crk. 1**		**Brush Crk. 2**		**Brush Crk. 3**	
Metric/survey	4/ 2001	4/2003	4/ 2001	4/2003	4/ 2001	4/2003	4/ 2001	4/2003	4/ 2001	4/2003
Total Taxa Richness	47	66	64	52	75	56	63	60	79	74
EPT taxa Richness	**22**	**29**	**29**	**27**	38	36	38	34	39	40
EPT abundance	110	184	135	138	**166**	**150**	**129**	**162**	**199**	**221**
Biotic Index	4.28	n/a	3.66	n/a	2.50	n/a	3.39	n/a	3.58	n/a
EPT Biotic Index	2.88	n/a	2.52	n/a	2.50	n/a	2.66	n/a	2.41	n/a
Dominant in Common Index (%)	-	-	78%	60%	-	-	50%	68%	75%	87%
# Keystone Species	14	18	8[1]	11	23	22	21	19	22	20

Benthic macroinvertebrates have been collected at five locations prior to construction and once following construction from this project. Interestingly, taxa richness and EPT abundance values were greater at station 2 (downstream) than station 1 on Little Pine Creek before restoration and these numbers declined only slightly following construction of the new channel. The Dominant Taxa Index was 78% at station 2 compared to station 1 prior to construction and declined to 60% following construction. The number of keystone taxa, primarily EPT taxa or other taxa commonly collected from stable habitat, was slightly higher following channel restoration. These observations suggest that there are watershed wide conditions affecting the

[1] Keystone species at this project represent intolerant EPT taxa (having a biotic index value of less than 2.00) and other taxa that are typically found on stable substrate (i.e. elmid beetles).

water quality of this reach of Little Pine Creek and that the restoration has had a minor effect on the benthic fauna. It is apparent that fencing cattle from the stream helped to stabilize the channel and allowed the restored reach prior to construction to provide riparian habitat for the aquatic insects. The habitat was removed following construction and the number of EPT taxa and DIC numbers declined following restoration.

Data from the Brush Creek enhancement effort illustrate a slight improvement in the biological condition at station 2 (which is the reach of Brush Creek that had a major sediment source/bank failure stabilized). The benthos in the immediate area of this part of the project may be responding to the elimination of the sediment source. Whereas prior to construction the EPT abundance values were lowest at station 2 (129), these numbers were slightly higher than station 1 (162 vs. 150) following enhancement of this eroding bank. Station 3 remains the most stable/diverse reach of Brush Creek. Dominant Common Taxa were higher following construction at stations 2 and 3 and the number of keystone taxa was very high at these two locations as well. Seasonally appropriate information will be collected from this project in 2005.

2.4 Areas of Concern

Current Project Status

Little Pine Creek

1.) Areas with bank slumping

- These areas (Table 3 below) have continued to degrade. Additional stabilization is needed in most areas. Root Wads are recommended. The area around station 0+50 has developed a substantial central bar causing scour to both banks and downstream. Additional measures should be taken to stabilize this area.

Table 3A. Locations of Degraded Areas along Little Pine Creek

Stations	Problem
0+50 to 0+80	Large amount of erosion on the right bank and a mid channel bar forming.
1+60 to 2+00	Right bank eroding
7+20 to 7+50	Right Bank slump and eroding
7+75 to 8+45	Left bank migrating
Throughout (both streams)	Poor hardwood tree and live stake establishment

Brush Creek

1.) Brush creek has several areas upstream of the confluence with Little Pine creek with bank slumping and indications of meander migration.

- These areas should be addressed to limit further degradation. See recommendations below.

2.) The left bank along the relocated section (station 9+00 to 10+00) is showing signs of scouring.

- This area should be monitored during upcoming site visits.

Previous concerns and results are described below.

Little Pine Creek

1.) Easement Limits

2003 Concern: NCWRP should work with landowners to ensure easement limits are maintained.

2004 Status: All mowing and outside activities have ceased within the easement limits

2.) The lack of successful vegetation in the riparian buffer

2003 Concern: Supplemental plantings are needed to meet minimum density. Soil should be tested for fertility and amended as directed.

2004 Status: Supplemental plantings remain necessary to meet mitigation requirements.

3.) Down-cutting near channel confluence

2003 Concern:

- This area should be monitored to ensure the down-cutting does not continue up Little Pine Creek.

2004 Status:

- This area has aggraded over the past year and does not appear to be an issue at this time. Future monitoring should watch this more closely.

4.) Areas with bank slumping

2003 Concern:

- These areas should be planted heavily with live stakes to help establish root mass along the channel bank. These areas should be monitored closely during upcoming site visits to determine if the problem is localized to more regional in scale.

2004 Status:

- These areas have continued to degrade. Additional stabilization is needed in most areas. Root Wads are recommended. The area around station 0+60 has developed a substantial central bar causing scour to both banks and downstream. Additional measures should be taken to stabilize this area.

5.) Decrease in defined channel bedform

2003 Concern:

- This should be closely monitored during upcoming site visits. If the bedform continues to decrease actions may become necessary.

2004 Status:

- Bedform has not changed over the past year.

Brush Creek

1.) Bank Scour upstream of the confluence with Little Pine Creek

2003 Concern:

- These areas should be planted heavily with live stakes to help establish root mass along the channel bank.
- These areas should be monitored closely during upcoming site visits to determine if the problem is localized to more regional in scale.

2004 Status:

- Banks continue to scour in this area. Additional measures beyond revegetation are likely required to restabilize this area.

2.) The lack of successful vegetation in the riparian buffer

2003 Concern:

- Supplemental plantings are needed to meet minimum density.
- Soil should be tested for fertility and amended as directed.

2004 Status:

- Supplemental plantings remain necessary to meet mitigation requirements although volunteer species are beginning to establish along Brush Creek.

Vegetation Overall

2003 Concern:

- Replanting trees to obtain mitigation requirements
- Stake only in areas where erosion is problematic
- Monitor invasive vegetation
    - The fescue in the adjacent field should be monitored.
- The pumpkin patch should be pushed back and the riparian buffer should be extended to its rightful width in that area.
- Deer are an issue on this site. Measures should be taken to prevent deer browse of planted vegetation.

2004 Status:

- As mentioned above replanting is necessary to meet mitigation requirements.
- Live staking along will no longer address some of the areas with bank slumping.
- Fescue invasion should continue to be monitored.
- The pumpkin patch has been removed and is no longer an issue.
- Future planting plan should address deer browse.

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2.5 Photo Log

Little Pine and Brush Creek Photo Log

Appendices

A. Methods
    1. Vegetation
    2. Morphology
B. Vegetation data
    1. Listed by plot
    2. Species, number and age
    3. Analysis of planted vs. natural recruitment
C. Morphology Data
    1. Cross-section data and plotted
    2. Longitudinal data and plotted
    3. Pebble count data and plotted
    4. Pattern

2.5 Photo Log

Little Pine Creek Photo Log

2002 **2004**

Little Pine Creek Photograph Station 1
260º from North

Little Pine Creek Photograph Station 20617BC
North

Little Pine Creek Photograph Station 20617AB
320º from North


Little Pine Creek Photograph Station 2
320º from North


Little Pine Creek Photograph Station 2
280º from North


Little Pine Creek Photograph Station 3
100º from North


Little Pine Creek Photograph Station 3
60º from North


Little Pine Creek Photograph Station 3
60º from North


Little Pine Creek Photograph Station 3
20º from North


Little Pine Creek Photograph Station 4
120º from North


Little Pine Creek Photograph Station 4
80º from North


Little Pine Creek Photograph Station 4
80º from North


Little Pine Creek Photograph Station 4
40º from North


Little Pine Creek Photograph Station 5
180º from North


Little Pine Creek Photograph Station 5
105º from North

2003 **2004**

Little Pine Vegetation Plot Quad 1 on Little Pine Creek

2003 **2004**

Little Pine Vegetation Plot Quad 2 on Little Pine Creek

Brush Creek Photo Log

2002 **2004**

Brush Creek Photograph Station 1
235º from North

Brush Creek Photograph Station 1
275º from North

Brush Creek Photograph Station 2
310º from North

Brush Creek Photograph Station 2
330º from North


Brush Creek Photograph Station 2
330º from North


Brush Creek Photograph Station 2
10º from North


Brush Creek Photograph Station 3
160º from North


Brush Creek Photograph Station 3
120º from North


Brush Creek Photograph Station 3
80º from North


Brush Creek Photograph Station 3
North


Brush Creek Photograph Station 4
145º from North


Brush Creek Photograph Station 4
95º from North


Brush Creek Photograph Station 4
55º from North


Brush Creek Photograph Station 5
40º from North


Brush Creek Photograph Station 6
150º from North


Brush Creek Photograph Station 6
115º from North


Brush Creek Photograph Station 6
55º from North


Brush Creek Photograph Station 6
5º from North


Brush Creek Photograph Station 7
90º from North


Brush Creek Photograph Station 7
335º from North


Brush Creek Photograph Station 8
140º from North


Brush Creek Photograph Station 8
180º from North


Brush Creek Photograph Station 8
220º from North


Brush Creek Photograph Station 9
130º from North


Brush Creek Photograph Station 9
170º from North


Brush Creek Photograph Station 9
230º from North


Brush Creek Photograph Station 9
270º from North


Brush Creek Photograph Station 9
310º from North


Brush Creek Photograph Station 9
340º from North


Brush Creek Photograph Station 10
120º from North


Brush Creek Photograph Station 10
85º from North


Brush Creek Photograph Station 10
50º from North


Brush Creek Photograph Station 10
30º from North

Vegetation Plot Brush Creek - 2004

Appendices

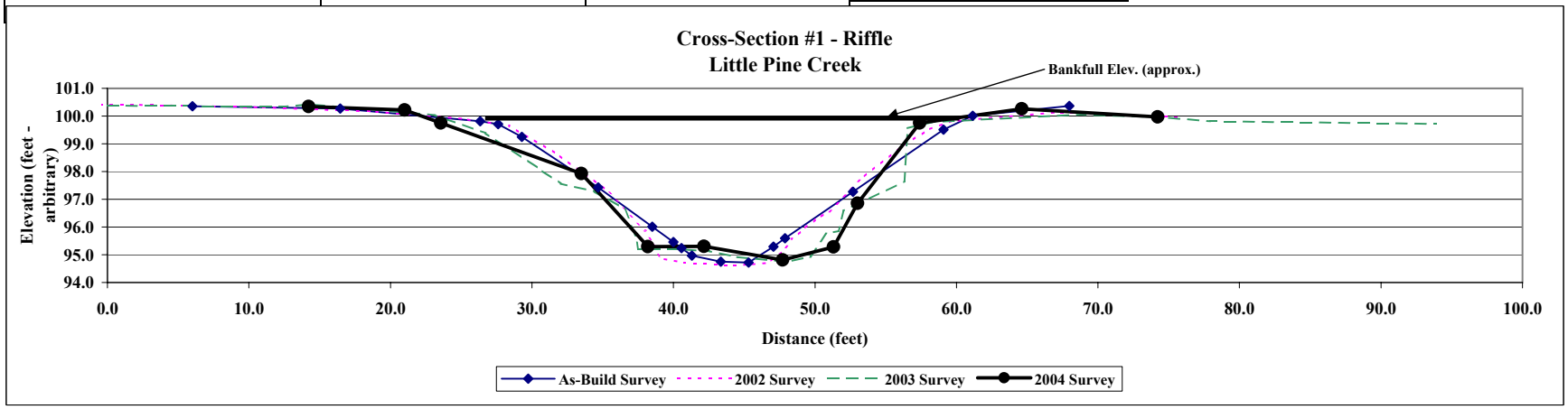
- Methods
- Vegetation
- Morphology
- Vegetation data
  - Listed by plot
  - Species, number and age
  - Analysis of planted vs. natural recruitment
- Morphology Data
  - Cross-section and Pebble Count data
  - Longitudinal data
  - Pattern

Project Name	Little Pine Creek
Cross Section	#1
Feature	Riffle
Date	6/2/04
Crew	Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey			2004 2004 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
6.0	100.4		-6.4	100.41		0	100.37		14.22	100.34	Left Pin
16.5	100.3		2	100.41		12.62	100.34		21.01	100.22	
26.4	99.8		11	100.31		14.22	100.43	Left Pin	23.57	99.75	BKF(interp)
27.6	99.7	BKF	19	100.16		23.15	100.03	BKF	33.5	97.93	
29.3	99.3		25	99.91	BKF	26.74	99.39		38.2	95.29	X1W
34.7	97.4		28.4	99.66		30.41	98.14		42.16	95.3	
38.5	96.0		32	98.56		32.04	97.56		47.73	94.81	X1T
40.0	95.5		35.2	97.36		34.44	97.28		51.31	95.28	X1W
40.6	95.2		38	95.86		36.56	96.66		53.02	96.85	
41.3	95.0		38.5	95.46		37.35	95.64		57.4	99.75	
43.3	94.8		39.1	94.86		37.5	95.2		64.62	100.26	
45.3	94.7		40.8	94.71		40.54	95.2		74.23	99.97	Right Pin
47.1	95.3		44	94.61		42.36	95.13				
47.9	95.6		45.5	94.66		42.56	95.13				
52.7	97.3		46.7	94.71		44.52	94.92				
59.1	99.5		47.7	95.11		48.04	94.74				
61.2	100.0	BKF	48.4	95.56		49.65	94.93				
68.0	100.4		49.3	95.96		50.81	95.75				
			50	96.26		51.67	95.85				
			51	96.56		52.04	96.58				
			53.34	97.76		56.33	97.65				
			56	98.86		56.55	99.56				
			58	99.51		58.26	99.78	BKF			
			59.6	99.81	BKF	68.78	100.05				
			67	100.13		74.46	99.96	Right Pin			
			76	99.96		77.93	99.81				
			89	99.81		93.86	99.72				
			95.5	99.76							

Photo of Cross-Section #1 - Looking Upstream

	As-Built	2002	2003	2004
Area	86.7	90.55	101.74	97.08
Width	31.5	31.2	31.5	31.5
Mean Dept	2.8	2.9	3.2	3.1
Max Depth	5.0	5.2	5.0	4.9

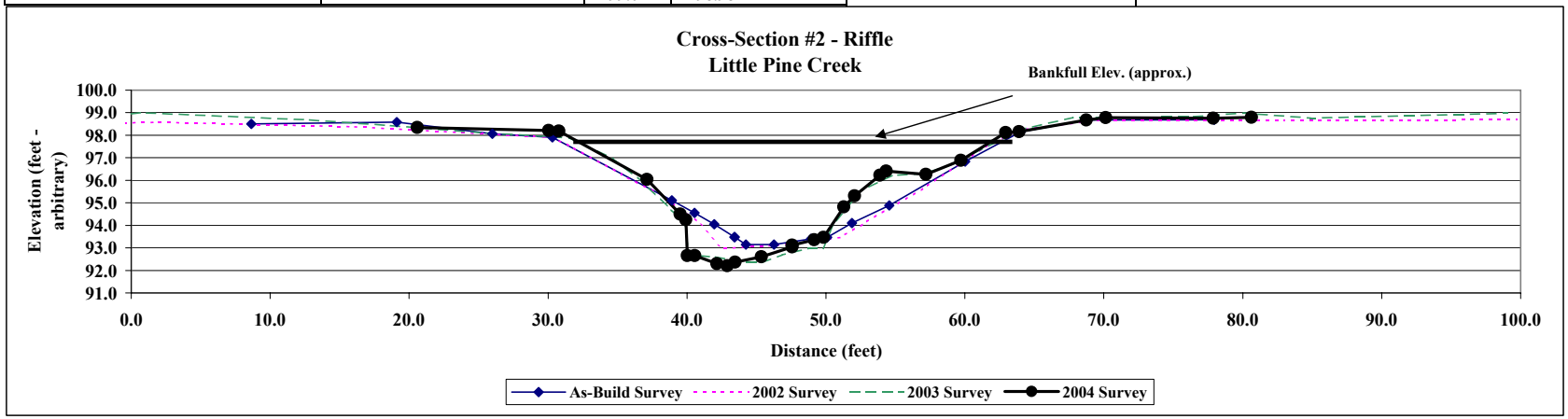


Project Name	Little Pine Creek
Cross Section	#2
Feature	Riffle
Date	6/2/04
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey			2004 2004 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
8.7	98.5		-5	98.5		0.0	98.95		20.6	98.34	Left Pin
19.1	98.6		2	98.58		0.7	99.01		30.06	98.21	
26.0	98.1		16	98.38		12.7	98.69		30.78	98.19	(bkf)
30.3	97.9	BKF	30.3	97.91	BKF	18.6	98.43		37.13	96.04	
38.9	95.1		31.8	97.45		20.6	98.34	Left Pin	39.5	94.5	
40.5	94.6		35.3	96.26		25.5	98.11		39.91	94.25	
42.0	94.1		38.3	95.29		31.5	97.89	BKF	40.03	92.66	X1W
43.4	93.5		40.9	94.09		34.7	96.95		40.57	92.66	
43.4	93.5		42.5	92.97		37.0	95.82		42.15	92.3	X1T
44.2	93.2		46.1	93.11		38.7	94.77		42.9	92.21	X2T
46.3	93.2		48.7	93.25		39.8	94.18		43.46	92.37	
48.9	93.4		51	93.46		40.1	92.69		45.35	92.6	
50.1	93.5		52.7	94.08		42.0	92.61		47.57	93.04	X2W
51.9	94.1		57.3	95.75		44.3	92.35		47.57	93.12	X2W
54.6	94.9		61.2	97.39		45.4	92.35		49.17	93.36	
60.0	96.8		64	98.25	BKF	46.9	92.69		49.83	93.47	
64.0	98.1	BKF	69.7	98.68		48.7	92.97		51.29	94.82	
68.7	98.7		83	98.66		49.8	92.97		52.06	95.31	
77.9	98.7		99.7	98.69		50.6	94.12		53.89	96.22	
						52.6	95.55		54.34	96.41	
						54.76	96.22		57.2	96.26	
						57.18	96.32		59.71	96.89	
						59.06	96.71		62.93	98.12	
						64.08	98.27	BKF	63.91	98.16	
						67.79	98.79		68.74	98.68	
						76.14	98.82		70.15	98.78	
						80.09	98.99	Right Pin	77.87	98.75	
						84.88	98.77		80.64	98.8	Right Pin
						99.04	98.98				

Photo of Cross-Section #2 - Looking Upstream

	As-Built	2002	2003	2004
Area	88.7	92.42	87.80	94.46
Width	33.7	33.7	32.6	32.2
Mean Dept	2.6	2.7	2.7	2.9
Max Depth	4.8	4.9	5.5	6.0

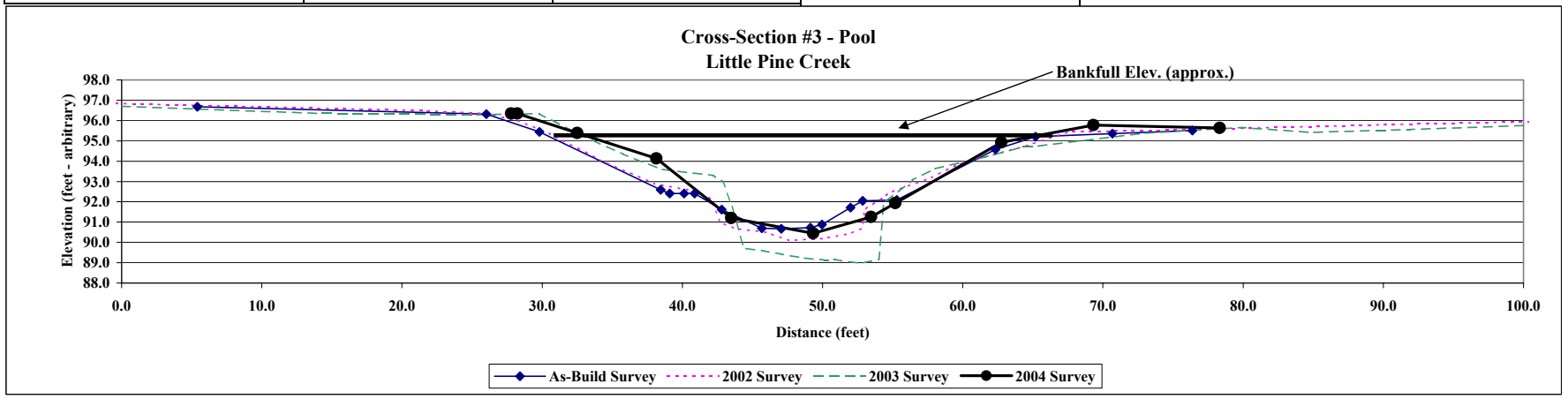


Project Name	Little Pine Creek
Cross Section	#3
Feature	Pool
Date	6/2/04
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey			2004 2004 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
5.4	96.7		-1	96.86		0	96.71		27.8	96.35	Left Pin
26.0	96.3		9.7	96.68		14.14	96.36		28.24	96.34	
29.8	95.4	BKF	21.5	96.5		25.29	96.29		32.5	95.39	BKF(interp)
38.5	92.6		26.1	96.35		29.8	96.35	Left Pin	38.14	94.13	
39.1	92.4		28.3	96		32.46	95.39	BKF	43.5	91.2	X3W
40.1	92.4		30.6	95.35	BKF	35.82	94.34		49.33	90.45	X3T
40.9	92.4		34	94.1		38.5	93.6		53.46	91.26	X3W
42.8	91.6		38	92.9		42.24	93.3		55.19	91.94	
45.7	90.7		41.1	92.5		42.88	92.98		62.75	94.92	
47.1	90.7		42	92.15		43.51	91.8		69.33	95.78	
49.1	90.7		42.7	91		44.37	89.73		78.34	95.63	Right Pin
50.0	90.9		43.7	90.7		45.83	89.58				
52.0	91.7		46	90.5		47.04	89.43				
52.9	92.0		47.6	90.1		48.61	89.24				
55.3	92.1		50	90.2		50.12	89.14				
62.3	94.6		52	90.45		50.95	89.15				
65.2	95.2	BKF	52.8	90.7		52.73	88.97				
70.7	95.4		53	91.6		54.01	89.17				
76.4	95.5		54.5	92.3		54.36	91.92				
			55	92.5		56.43	93.08				
			57.8	93.2		57.98	93.63				
			59.5	93.8		61.55	94.21				
			64.7	94.8		64.3	94.72	BKF Field			
			67.6	95.45	BKF	65	94.72				
			76	95.55		72.89	95.38	BKF			
			90	95.8		79.93	95.67	Right Pin			
			103.2	96		84.79	95.43				
						91.92	95.56				
						100.54	95.78				

Photo of Cross-Section #3 - Looking Downstream

	As-Built	2002	2003	2004
Area	86.6	96.63	100.41	86.42
Width	35.4	37.0	40.4	36.8
Mean Dept	2.4	2.6	2.5	2.3
Max Depth	4.5	5.3	6.4	4.9

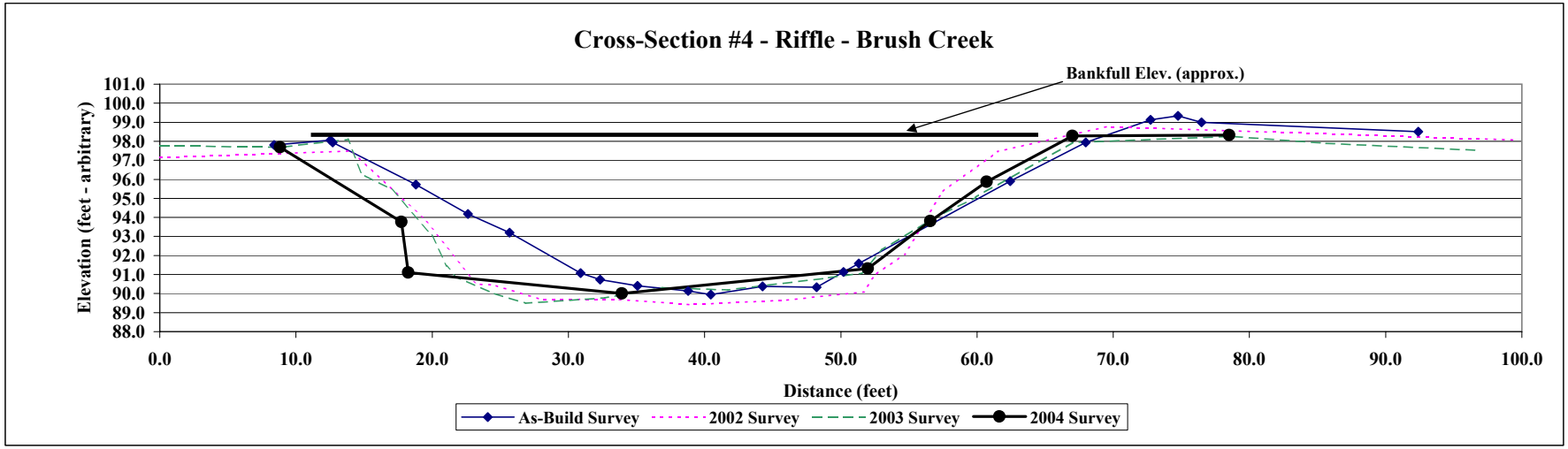


Project Name	Brush Creek
Cross Section	#4
Feature	Riffle
Date	6/2/04
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey			2004 2004 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
8.4	97.8		-2.5	97.1		0	97.78		8.82	97.69	Left Pin
12.5	98.1	BKF	14.1	97.49	BKF	8.82	97.69	Left Pin	17.75	93.77	
12.7	97.9		19.5	93.82		13.82	98.1	BKF	18.25	91.11	X4W
18.8	95.7		23.27	90.5		14.8	96.31		33.92	90	X4T
22.6	94.2		24.5	90.46		17.02	95.48		51.99	91.31	X4W
25.7	93.2		28	89.7		19.95	93.1		56.58	93.81	
30.9	91.1		33.5	89.71		21.04	91.44		60.72	95.88	
32.3	90.7		39	89.42		21.76	90.9		67	98.28	
35.1	90.4		46	89.66		24.3	90.06		78.51	98.33	Right Pin
38.8	90.1		51.7	90.1		26.86	89.5				
40.4	89.9		52.5	90.95		32.69	89.79				
44.3	90.4		54.7	92.09		36.89	90.32				
48.2	90.3		57.5	95.35		41.72	90.2				
50.2	91.1		61.5	97.46	BKF	48.79	90.81				
51.3	91.6		69.5	98.77		51.52	91.08				
62.4	95.9		99.5	98.08		53.05	92.29				
68.0	97.9	BKF				56.76	93.94				
72.7	99.1					59.92	95.05				
74.8	99.3					67.03	97.94	BKF			
76.5	99.0					78.7	98.27	Right Pin			
92.4	98.5					85.38	97.91				
						96.95	97.52				

Photo of Cross-Section #4 - Looking Left Bank

	As-Built	2002	2003	2004
Area	266.9	283.59	305.71	300.06
Width	55.3	47.4	53.2	58.2
Mean Dept	4.8	6.0	5.7	5.2
Max Depth	8.0	8.1	8.4	7.7

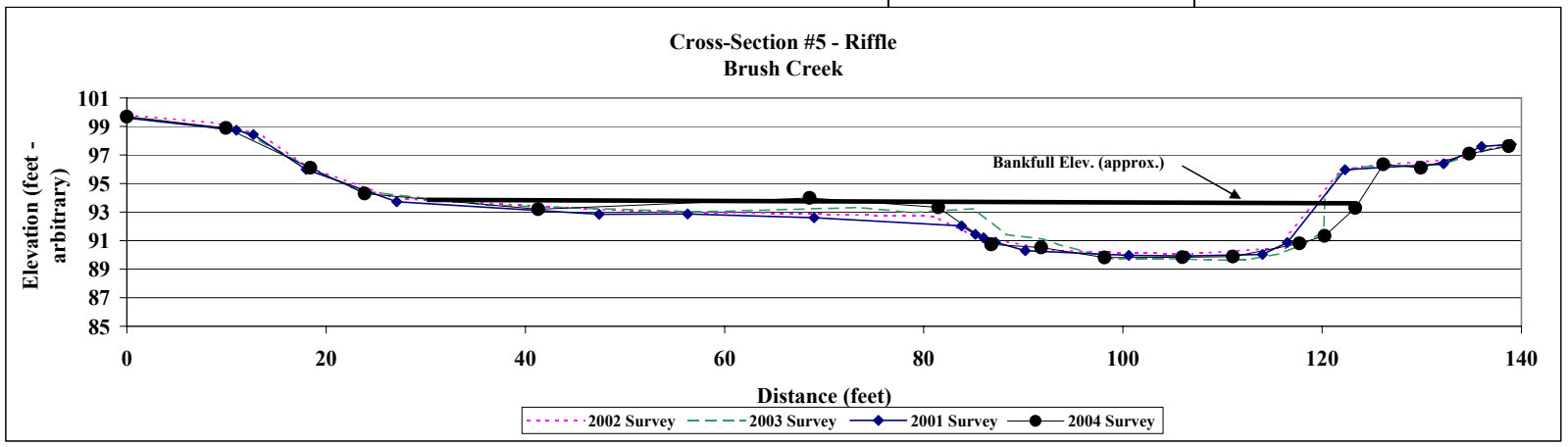


Project Name	Brush Creek
Cross Section	#5
Feature	Riffle
Date	6/2/04
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey			2004 2004 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0.0	99.6		0	99.81		0	99.69	Left Pin	0	99.69	Left Pin
11.0	98.7		9	99.25		3	99.43		9.96	98.89	
12.7	98.4		13.5	98.42		11.75	98.62		18.42	96.1	bkf(interp)
18.0	96.0	BKF	18	96.2		18	96.2		23.88	94.3	
27.1	93.7		27	93.96		23.27	94.51		41.31	93.19	
47.4	92.9		50	93.12		36.06	93.5		68.56	93.99	
56.3	92.9		81	92.71		57.41	93.02		81.47	93.32	
69.0	92.6		86	90.99		73.48	93.34		86.79	90.74	X5W
83.8	92.0		86.9	91.11		78.72	92.97		86.79	90.74	X5W
85.2	91.4		93	90.34		84.99	93.24		91.79	90.52	X5W
86.0	91.2		101	90.13		88.24	91.44		98.17	89.81	X5W
87.2	90.9		107	90.1		92.02	91.12		105.97	89.83	X5T
90.2	90.3		116.3	90.51		93.45	90.75		111.06	89.87	X5W
100.6	90.0		116.6	91.48		98.99	89.72		117.74	90.81	X5W
106.4	89.9		122	95.96	BKF	104.22	89.77		120.26	91.32	
114.0	90.0		124	96.2		108.6	89.66		123.32	93.28	
116.5	90.9		134	96.75		108.65	89.66		126.13	96.34	
122.3	96.0	BKF	139	97.97		112.24	89.63		129.92	96.1	(bkf)
132.2	96.4					115.73	90.1		134.76	97.09	
136.0	97.6					118.42	90.83		138.74	97.62	Right Pin
139	97.75					120.16	91.66				
						120.26	94.14				
						121.75	95.65				
						123.67	96.19	BKF			
						132.08	96.35				
						136.53	97.38				
						138.87	97.69	Right Pin			

Photo of Cross-Section #5 - Looking Downstream

	As-Built	2002	2003	2004
Area	392.0	387.12	384.62	398.92
Width	104.3	106.0	105.4	107.7
Mean Dept	3.8	3.7	3.6	3.7
Max Depth	6.1	6.1	6.6	6.3

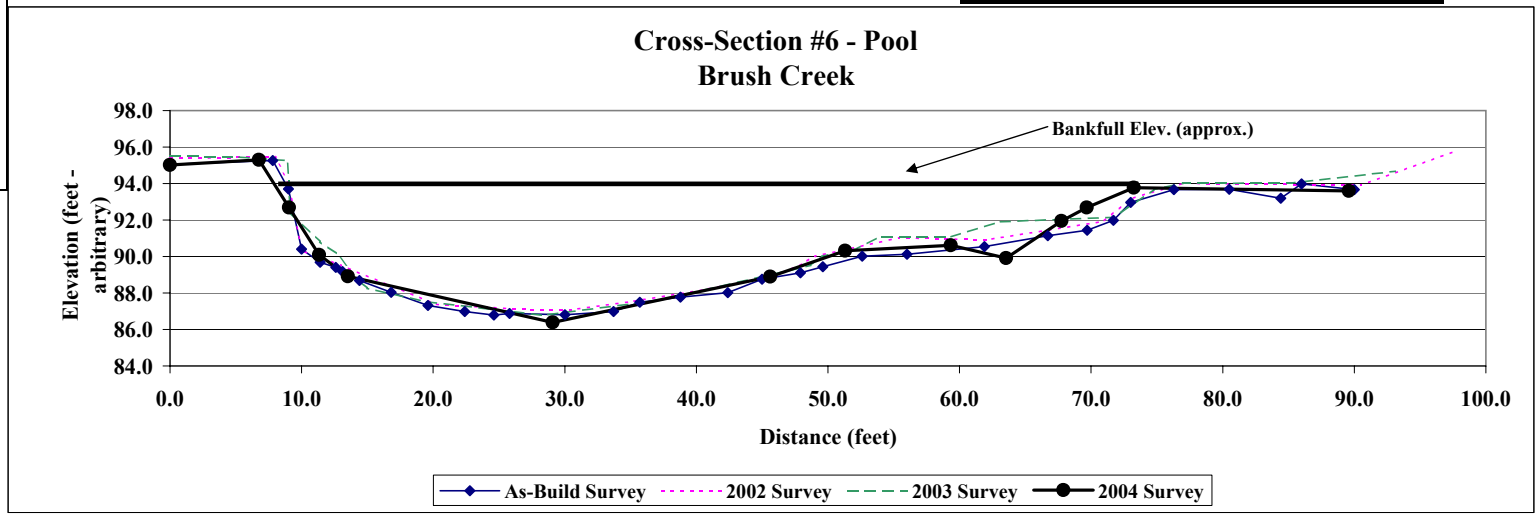


Project Name	Brush Creek
Cross Section	#6
Feature	Pool
Date	6/2/04
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey			2004 2004 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation***	**Notes**
0.0	95.1		0	95.38		0	95.51	Left Pin	0	95.01	Left Pin
7.8	95.3		8	95.46		4.69	95.49		6.75	95.29	
9.0	93.7	BKF	9	94.01		8.92	95.27		9.05	92.68	bkf(interp)
10.0	90.4		10	90.34		9	94.01		11.34	90.09	
11.4	89.7		13	89.52		9.12	92.42		13.52	88.91	X6W
12.6	89.4		20.2	87.38		11.41	90.8		29.09	86.39	X6T
13.1	89.2		27.3	87.09		12.75	90.12		45.62	88.89	X6W
14.4	88.7		30.5	87.08		14.08	88.82		51.32	90.32	
16.8	88.0		35	87.52		14.99	88.27		59.34	90.61	
19.6	87.3		40.6	88.19		19.35	87.54		63.55	89.91	
22.4	87.0		45.8	88.89		28.33	86.79		67.75	91.94	
24.6	86.8		48	89.6		37.25	87.61		69.67	92.68	bkf(interp)
25.8	86.9		49	90.02		48.7	89.52		73.26	93.78	
30.0	86.8		55.4	91.03		49.53	90.01		89.58	93.59	Right Pin
33.7	87.0		62	90.91		52.23	90.43				
35.7	87.5		71	91.95		53.88	91.09				
38.8	87.8		73	93.18		59.19	91.05		*adjusted numbers down by 1 foot		
42.4	88.0		77	94.01	BKF	63.08	91.91				
45.0	88.8		90.5	93.92		71.79	92.16				
47.9	89.1		97.5	95.74		74.79	93.68	BKF			
49.6	89.4					77	94.01				
52.6	90.0					85.24	94.03				
56.0	90.1					93.15	94.68				
61.9	90.6										
66.7	91.1										
69.7	91.4										
71.7	92.0										
73.0	93.0										
76.3	93.7	BKF									
80.5	93.7										
84.4	93.2										
86.0	94.0										
90.0	93.7										

Photo of Cross-Section #6 - Looking Upstream

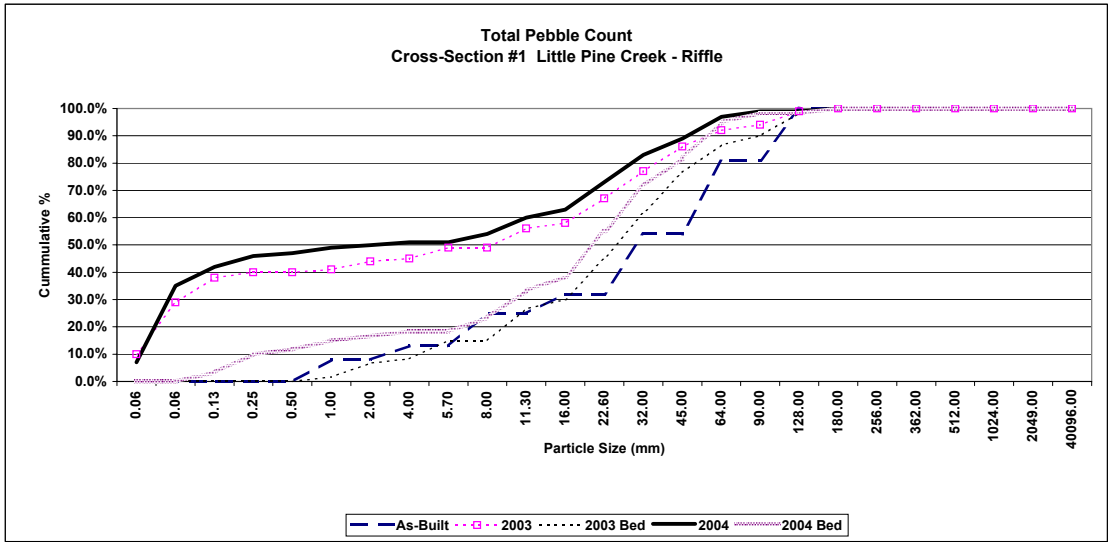
	As-Built	2002	2003	2004
Area	305.0	285.27	297.58	288.95
Width	67.3	67.0	68.0	61.0
Mean Depth	4.5	4.3	4.4	4.7
Max Depth	6.9	6.9	7.2	7.4



Project Name	Little Pine Creek
Cross Section	#1
Feature	Riffle
Date	6/1/04
Crew	Shaffer, Bidelspach, Clinton

		As-Built				2003		TOTAL		BED		2004		TOTAL		BED	
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	10	10.0%	10.0%	0.0%	0.0%	0	7	7.0%	7.0%	0.0%	0.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	0	19	19.0%	29.0%	0.0%	0.0%	0	28	28.0%	35.0%	0.0%	0.0%
	fine sand	0.125	0	0.0%	0.0%	0	9	9.0%	38.0%	0.0%	0.0%	2	5	7.0%	42.0%	3.3%	3.3%
	medium sand	0.25	0	0.0%	0.0%	0	2	2.0%	40.0%	0.0%	0.0%	4	0	4.0%	46.0%	6.7%	10.0%
	course sand	0.50	0	0.0%	0.0%	0	0	0.0%	40.0%	0.0%	0.0%	1	0	1.0%	47.0%	1.7%	11.7%
	very course sand	1.0	8	8.0%	8.0%	1	0	1.0%	41.0%	1.7%	1.7%	2	0	2.0%	49.0%	3.3%	15.0%
G r a v e l	very fine gravel	2.0	0	0.0%	8.0%	3	0	3.0%	44.0%	5.0%	6.7%	1	0	1.0%	50.0%	1.7%	16.7%
	fine gravel	4.0	5	5.0%	13.0%	1	0	1.0%	45.0%	1.7%	8.3%	1	0	1.0%	51.0%	1.7%	18.3%
	fine gravel	5.7	0	0.0%	13.0%	4	0	4.0%	49.0%	6.7%	15.0%	0	0	0.0%	51.0%	0.0%	18.3%
	medium gravel	8.0	12	12.0%	25.0%	0	0	0.0%	49.0%	0.0%	15.0%	3	0	3.0%	54.0%	5.0%	23.3%
	medium gravel	11.3	0	0.0%	25.0%	7	0	7.0%	56.0%	11.7%	26.7%	6	0	6.0%	60.0%	10.0%	33.3%
	course gravel	16.0	7	7.0%	32.0%	2	0	2.0%	58.0%	3.3%	30.0%	3	0	3.0%	63.0%	5.0%	38.3%
	course gravel	22.6	0	0.0%	32.0%	9	0	9.0%	67.0%	15.0%	45.0%	10	0	10.0%	73.0%	16.7%	55.0%
	very course gravel	32	22	22.0%	54.0%	10	0	10.0%	77.0%	16.7%	61.7%	10	0	10.0%	83.0%	16.7%	71.7%
	very course gravel	45	0	0.0%	54.0%	9	0	9.0%	86.0%	15.0%	76.7%	6	0	6.0%	89.0%	10.0%	81.7%
Cobble	small cobble	64	27	27.0%	81.0%	6	0	6.0%	92.0%	10.0%	86.7%	8	0	8.0%	97.0%	13.3%	95.0%
	medium cobble	90	0	0.0%	81.0%	2	0	2.0%	94.0%	3.3%	90.0%	2	0	2.0%	99.0%	3.3%	98.3%
	large cobble	128	19	19.0%	100.0%	5	0	5.0%	99.0%	8.3%	98.3%	0	0	0.0%	99.0%	0.0%	98.3%
	very large cobble	180	0	0.0%	100.0%	1	0	1.0%	100.0%	1.7%	100.0%	1	0	1.0%	100.0%	1.7%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		60	40	100.0%		100.0%		60	40	100.0%		100.0%	

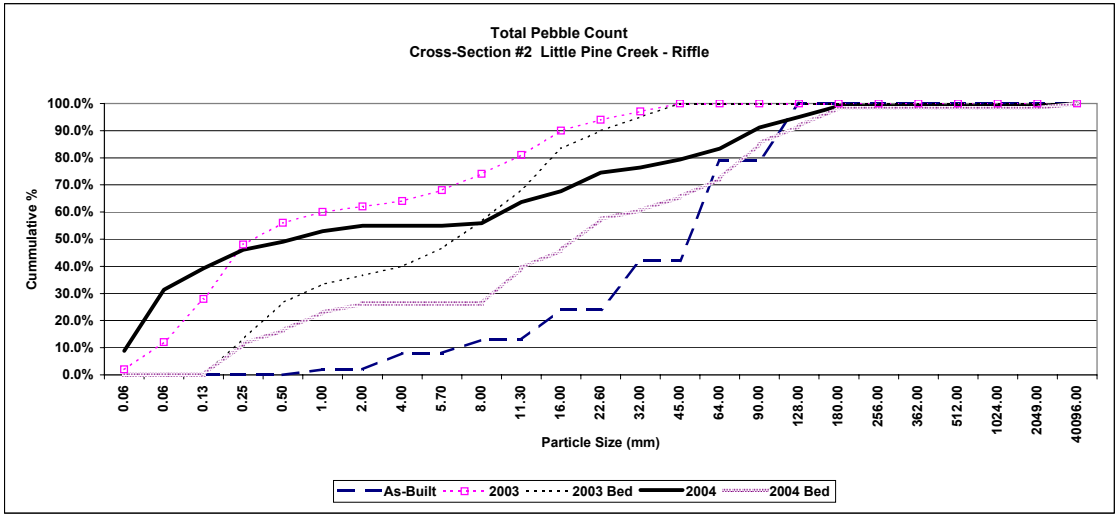
	d16	d35	d50	d84	d95
As-Built	7.55	28.83	36.46	116.11	142.16
2003	0.07	0.16	10.22	50.94	118.00
2004	0.07	0.09	3.00	41.17	71.37



Project Name	Little Pine Creek
Cross Section	#2
Feature	Riffle
Date	6/1/04
Crew	Shaffer, Bidelspach, Clinton

		As-Built				2003		TOTAL		BED		2004		TOTAL		BED	
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	2	2.0%	2.0%	0.0%	0.0%	0	9	8.8%	8.8%	0.0%	0.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	0	10	10.0%	12.0%	0.0%	0.0%	0	23	22.5%	31.4%	0.0%	0.0%
	fine sand	0.125	0	0.0%	0.0%	0	16	16.0%	28.0%	0.0%	0.0%	0	8	7.8%	39.2%	0.0%	0.0%
	medium sand	0.25	0	0.0%	0.0%	8	12	20.0%	48.0%	13.3%	13.3%	7	0	6.9%	46.1%	11.5%	11.5%
	course sand	0.50	0	0.0%	0.0%	8	0	8.0%	56.0%	13.3%	26.7%	3	0	2.9%	49.0%	4.9%	16.4%
	very course sand	1.0	2	2.0%	2.0%	4	0	4.0%	60.0%	6.7%	33.3%	4	0	3.9%	52.9%	6.6%	23.0%
G r a v e l	very fine gravel	2.0	0	0.0%	2.0%	2	0	2.0%	62.0%	3.3%	36.7%	2	0	2.0%	54.9%	3.3%	26.2%
	fine gravel	4.0	6	6.0%	8.0%	2	0	2.0%	64.0%	3.3%	40.0%	0	0	0.0%	54.9%	0.0%	26.2%
	fine gravel	5.7	0	0.0%	8.0%	4	0	4.0%	68.0%	6.7%	46.7%	0	0	0.0%	54.9%	0.0%	26.2%
	medium gravel	8.0	5	5.0%	13.0%	6	0	6.0%	74.0%	10.0%	56.7%	0	1	1.0%	55.9%	0.0%	26.2%
	medium gravel	11.3	0	0.0%	13.0%	7	0	7.0%	81.0%	11.7%	68.3%	8	0	7.8%	63.7%	13.1%	39.3%
	course gravel	16.0	11	11.0%	24.0%	9	0	9.0%	90.0%	15.0%	83.3%	4	0	3.9%	67.6%	6.6%	45.9%
	course gravel	22.6	0	0.0%	24.0%	4	0	4.0%	94.0%	6.7%	90.0%	7	0	6.9%	74.5%	11.5%	57.4%
	very course gravel	32	18	18.0%	42.0%	3	0	3.0%	97.0%	5.0%	95.0%	2	0	2.0%	76.5%	3.3%	60.7%
	very course gravel	45	0	0.0%	42.0%	3	0	3.0%	100.0%	5.0%	100.0%	3	0	2.9%	79.4%	4.9%	65.6%
Cobble	small cobble	64	37	37.0%	79.0%	0	0	0.0%	100.0%	0.0%	100.0%	4	0	3.9%	83.3%	6.6%	72.1%
	medium cobble	90	0	0.0%	79.0%	0	0	0.0%	100.0%	0.0%	100.0%	8	0	7.8%	91.2%	13.1%	85.2%
	large cobble	128	21	21.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	4	0	3.9%	95.1%	6.6%	91.8%
	very large cobble	180	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	4	0	3.9%	99.0%	6.6%	98.4%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	99.0%	0.0%	98.4%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	99.0%	0.0%	98.4%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	99.0%	0.0%	98.4%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	99.0%	0.0%	98.4%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	99.0%	0.0%	98.4%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	1	0	1.0%	100.0%	1.6%	100.0%
TOTAL / %of whole count			100	100.0%		60	40	100.0%		100.0%		61	41	100.0%		100.0%	

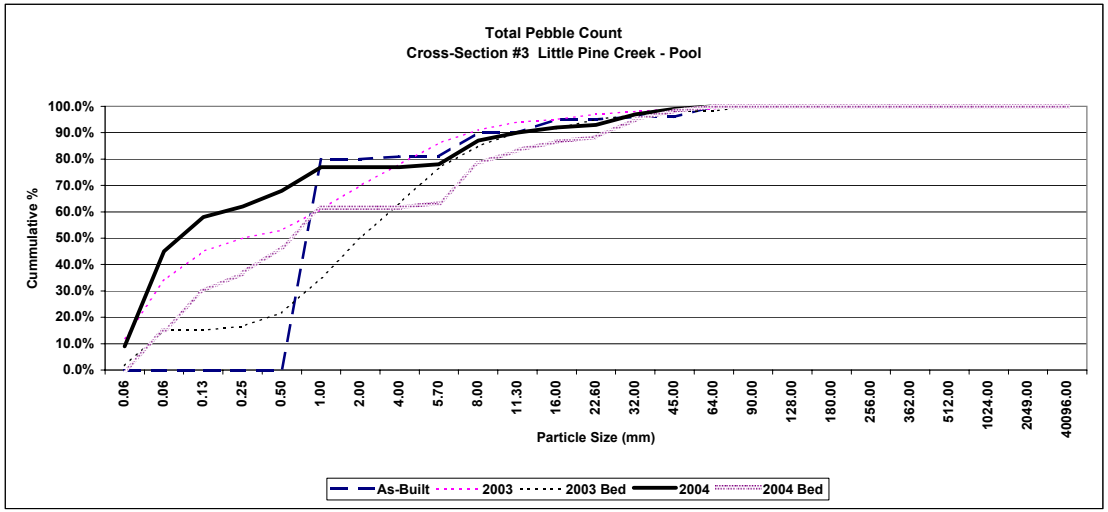
	d16	d35	d50	d84	d95
As-Built	15.19	34.14	59.36	119.71	143.29
2003	0.12	0.25	0.47	15.53	31.03
2004	0.07	0.14	0.94	79.72	152.88



Project Name	Little Pine Creek
Cross Section	#3
Feature	Pool
Date	6/1/04
Crew	Shaffer, Bidelspach, Clinton

		As-Built				2003						2004					
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	1	11	12.0%	12.0%	1.7%	1.7%	0	9	9.0%	9.0%	0.0%	0.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	8	14	22.0%	34.0%	13.3%	15.0%	9	27	36.0%	45.0%	15.0%	15.0%
	fine sand	0.125	0	0.0%	0.0%	0	11	11.0%	45.0%	0.0%	15.0%	9	4	13.0%	58.0%	15.0%	30.0%
	medium sand	0.25	0	0.0%	0.0%	1	4	5.0%	50.0%	1.7%	16.7%	4	0	4.0%	62.0%	6.7%	36.7%
	course sand	0.50	0	0.0%	0.0%	3	0	3.0%	53.0%	5.0%	21.7%	6	0	6.0%	68.0%	10.0%	46.7%
	very course sand	1.0	80	80.0%	80.0%	8	0	8.0%	61.0%	13.3%	35.0%	9	0	9.0%	77.0%	15.0%	61.7%
G r a v e l	very fine gravel	2.0	0	0.0%	80.0%	9	0	9.0%	70.0%	15.0%	50.0%	0	0	0.0%	77.0%	0.0%	61.7%
	fine gravel	4.0	1	1.0%	81.0%	8	0	8.0%	78.0%	13.3%	63.3%	0	0	0.0%	77.0%	0.0%	61.7%
	fine gravel	5.7	0	0.0%	81.0%	8	0	8.0%	86.0%	13.3%	76.7%	1	0	1.0%	78.0%	1.7%	63.3%
	medium gravel	8.0	9	9.0%	90.0%	5	0	5.0%	91.0%	8.3%	85.0%	9	0	9.0%	87.0%	15.0%	78.3%
	medium gravel	11.3	0	0.0%	90.0%	3	0	3.0%	94.0%	5.0%	90.0%	3	0	3.0%	90.0%	5.0%	83.3%
	course gravel	16.0	5	5.0%	95.0%	1	0	1.0%	95.0%	1.7%	91.7%	2	0	2.0%	92.0%	3.3%	86.7%
	course gravel	22.6	0	0.0%	95.0%	2	0	2.0%	97.0%	3.3%	95.0%	1	0	1.0%	93.0%	1.7%	88.3%
	very course gravel	32	1	1.0%	96.0%	1	0	1.0%	98.0%	1.7%	96.7%	4	0	4.0%	97.0%	6.7%	95.0%
	very course gravel	45	0	0.0%	96.0%	1	0	1.0%	99.0%	1.7%	98.3%	2	0	2.0%	99.0%	3.3%	98.3%
Cobble	small cobble	64	4	4.0%	100.0%	0	0	0.0%	99.0%	0.0%	98.3%	1	0	1.0%	100.0%	1.7%	100.0%
	medium cobble	90	0	0.0%	100.0%	1	0	1.0%	100.0%	1.7%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	large cobble	128	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		60	40	100.0%		100.0%		60	40	100.0%		100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As-Built	0.90	1.08	1.22	7.78	46.60
2003	0.07	0.10	0.38	6.35	19.30
2004	0.07	0.08	0.13	8.72	32.90

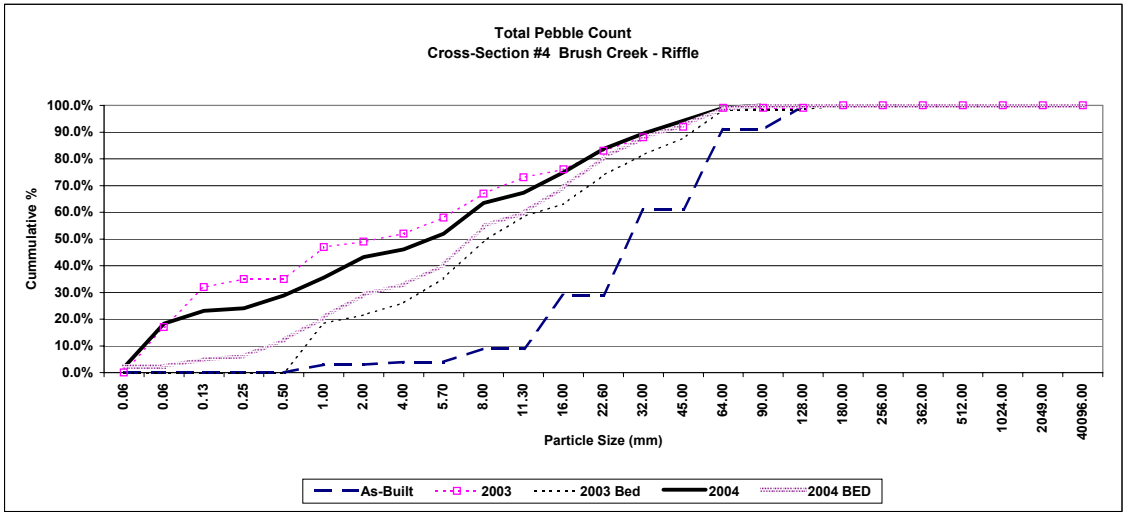


Project Name	Brush
Cross Section	#4
Feature	Riffle
Date	6/1/04
Crew	Shaffer, Bidelspach, Clinton

Cross Section #1
Brush Creek

			As-Built			2003		TOTAL		BED		2004		TOTAL		BED	
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	0	0.0%	0.0%	0.0%	0.0%	2	0	1.9%	1.9%	2.4%	2.4%
Sand	very fine sand	0.062	0	0.0%	0.0%	0	17	17.0%	17.0%	0.0%	0.0%	0	17	16.3%	18.3%	0.0%	2.4%
	fine sand	0.125	0	0.0%	0.0%	0	15	15.0%	32.0%	0.0%	0.0%	2	3	4.8%	23.1%	2.4%	4.9%
	medium sand	0.25	0	0.0%	0.0%	0	3	3.0%	35.0%	0.0%	0.0%	1	0	1.0%	24.0%	1.2%	6.1%
	course sand	0.50	0	0.0%	0.0%	0	0	0.0%	35.0%	0.0%	0.0%	5	0	4.8%	28.8%	6.1%	12.2%
	very course sand	1.0	3	3.0%	3.0%	12	0	12.0%	47.0%	18.5%	18.5%	7	0	6.7%	35.6%	8.5%	20.7%
G r a v e l	very fine gravel	2.0	0	0.0%	3.0%	2	0	2.0%	49.0%	3.1%	21.5%	7	1	7.7%	43.3%	8.5%	29.3%
	fine gravel	4.0	1	1.0%	4.0%	3	0	3.0%	52.0%	4.6%	26.2%	3	0	2.9%	46.2%	3.7%	32.9%
	fine gravel	5.7	0	0.0%	4.0%	6	0	6.0%	58.0%	9.2%	35.4%	6	0	5.8%	51.9%	7.3%	40.2%
	medium gravel	8.0	5	5.0%	9.0%	9	0	9.0%	67.0%	13.8%	49.2%	12	0	11.5%	63.5%	14.6%	54.9%
	medium gravel	11.3	0	0.0%	9.0%	6	0	6.0%	73.0%	9.2%	58.5%	4	0	3.8%	67.3%	4.9%	59.8%
	course gravel	16.0	20	20.0%	29.0%	3	0	3.0%	76.0%	4.6%	63.1%	8	0	7.7%	75.0%	9.8%	69.5%
	course gravel	22.6	0	0.0%	29.0%	7	0	7.0%	83.0%	10.8%	73.8%	9	0	8.7%	83.7%	11.0%	80.5%
	very course gravel	32	32	32.0%	61.0%	5	0	5.0%	88.0%	7.7%	81.5%	6	0	5.8%	89.4%	7.3%	87.8%
	very course gravel	45	0	0.0%	61.0%	4	0	4.0%	92.0%	6.2%	87.7%	4	1	4.8%	94.2%	4.9%	92.7%
Cobble	small cobble	64	30	30.0%	91.0%	7	0	7.0%	99.0%	10.8%	98.5%	5	0	4.8%	99.0%	6.1%	98.8%
	medium cobble	90	0	0.0%	91.0%	0	0	0.0%	99.0%	0.0%	98.5%	1	0	1.0%	100.0%	1.2%	100.0%
	large cobble	128	9	9.0%	100.0%	0	0	0.0%	99.0%	0.0%	98.5%	0	0	0.0%	100.0%	0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	1	0	1.0%	100.0%	1.5%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		65	35	100.0%		100.0%		82	22	100.0%		100.0%	

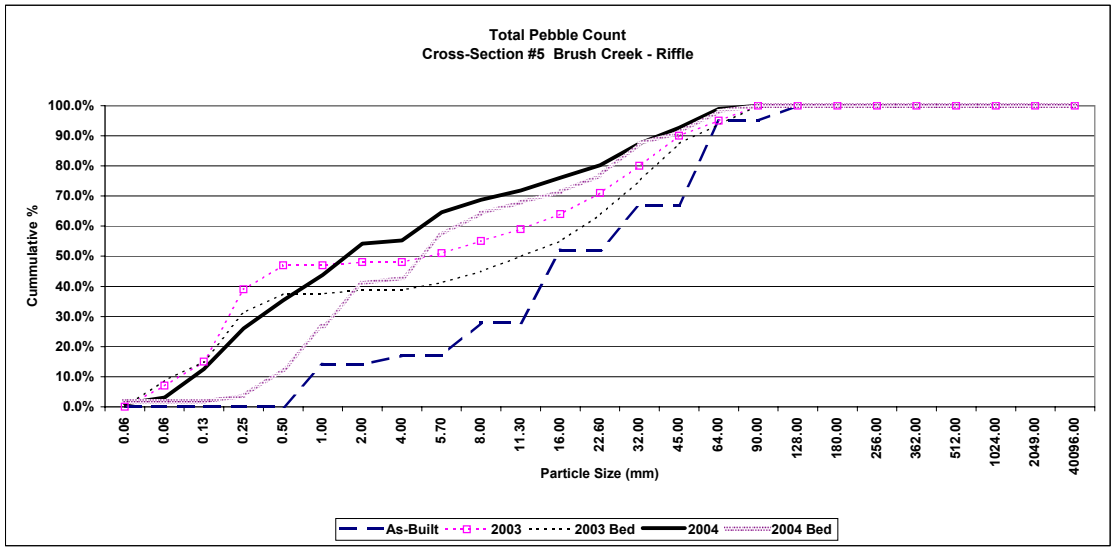
	d16	d35	d50	d84	d95
As-Built	15.63	29.40	34.65	71.75	129.00
2003	0.09	0.56	3.62	29.54	64.14
2004	0.09	1.44	6.18	27.97	58.10



Project Name	Brush Creek
Cross Section	#5
Feature	Riffle
Date	6/1/04
Crew	Shaffer, Bidelspach, Clinton

Brush Creek			As-Built			2003			TOTAL		BED	2004			TOTAL		BED
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	0	0.0%	0.0%	0.0%	0.0%	1	0	1.0%	1.0%	1.8%	1.8%
Sand	very fine sand	0.062	0	0.0%	0.0%	7	0	7.0%	7.0%	8.8%	8.8%	0	2	2.1%	3.1%	0.0%	1.8%
	fine sand	0.125	0	0.0%	0.0%	5	3	8.0%	15.0%	6.3%	15.0%	0	9	9.4%	12.5%	0.0%	1.8%
	medium sand	0.25	0	0.0%	0.0%	13	11	24.0%	39.0%	16.3%	31.3%	1	12	13.5%	26.0%	1.8%	3.6%
	course sand	0.50	0	0.0%	0.0%	5	3	8.0%	47.0%	6.3%	37.5%	5	4	9.4%	35.4%	8.9%	12.5%
	very course sand	1.0	14	14.0%	14.0%	0	0	0.0%	47.0%	0.0%	37.5%	8	0	8.3%	43.8%	14.3%	26.8%
G r a v e l	very fine gravel	2.0	0	0.0%	14.0%	1	0	1.0%	48.0%	1.3%	38.8%	8	2	10.4%	54.2%	14.3%	41.1%
	fine gravel	4.0	3	3.0%	17.0%	0	0	0.0%	48.0%	0.0%	38.8%	1	0	1.0%	55.2%	1.8%	42.9%
	fine gravel	5.7	0	0.0%	17.0%	2	1	3.0%	51.0%	2.5%	41.3%	8	1	9.4%	64.6%	14.3%	57.1%
	medium gravel	8.0	11	11.0%	28.0%	3	1	4.0%	55.0%	3.8%	45.0%	4	0	4.2%	68.8%	7.1%	64.3%
	medium gravel	11.3	0	0.0%	28.0%	4	0	4.0%	59.0%	5.0%	50.0%	2	1	3.1%	71.9%	3.6%	67.9%
	course gravel	16.0	24	24.0%	52.0%	4	1	5.0%	64.0%	5.0%	55.0%	2	2	4.2%	76.0%	3.6%	71.4%
	course gravel	22.6	0	0.0%	52.0%	7	0	7.0%	71.0%	8.8%	63.8%	3	1	4.2%	80.2%	5.4%	76.8%
	very course gravel	32	15	15.0%	67.0%	9	0	9.0%	80.0%	11.3%	75.0%	6	1	7.3%	87.5%	10.7%	87.5%
	very course gravel	45	0	0.0%	67.0%	10	0	10.0%	90.0%	12.5%	87.5%	2	3	5.2%	92.7%	3.6%	91.1%
Cobble	small cobble	64	28	28.0%	95.0%	5	0	5.0%	95.0%	6.3%	93.8%	4	2	6.3%	99.0%	7.1%	98.2%
	medium cobble	90	0	0.0%	95.0%	5	0	5.0%	100.0%	6.3%	100.0%	1	0	1.0%	100.0%	1.8%	100.0%
	large cobble	128	5	5.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		80	20	100.0%		100.0%		56	40	100.0%		100.0%	

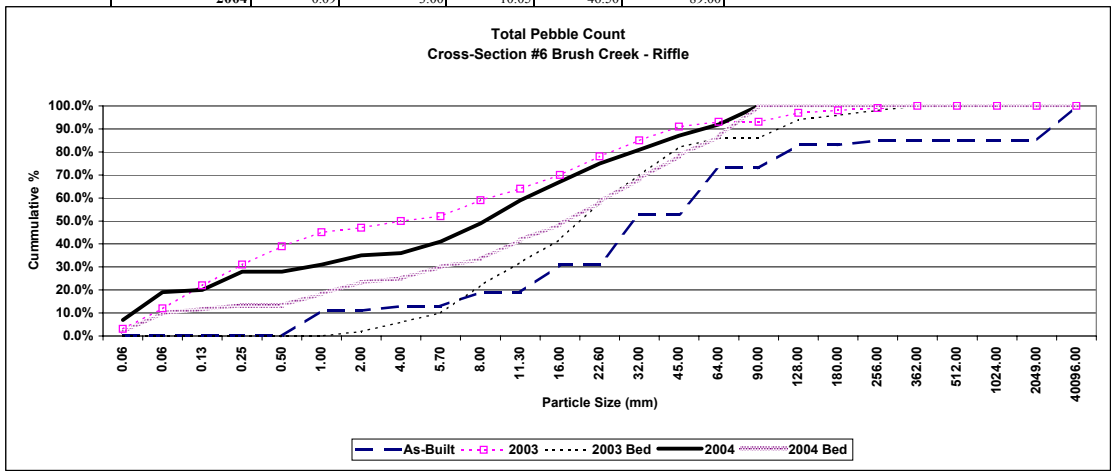
	d16	d35	d50	d84	d95
As-Built	4.23	15.30	18.83	68.16	186.00
2003	0.20	0.34	6.18	44.90	77.00
2004	0.24	0.73	2.40	33.12	62.75



Project Name	Brush Creek
Cross Section	#6
Feature	Pool
Date	6/1/04
Crew	Shaffer, Bidelspach, Clinton

Brush Creek			As-Built			2003			TOTAL		BED	2004			TOTAL		BED
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	3	3.0%	3.0%	0.0%	0.0%	1	6	7.0%	7.0%	1.7%	1.7%
Sand	very fine sand	0.062	0	0.0%	0.0%	0	9	9.0%	12.0%	0.0%	0.0%	5	7	12.0%	19.0%	8.3%	10.0%
	fine sand	0.125	0	0.0%	0.0%	0	10	10.0%	22.0%	0.0%	0.0%	1	0	1.0%	20.0%	1.7%	11.7%
	medium sand	0.25	0	0.0%	0.0%	0	9	9.0%	31.0%	0.0%	0.0%	1	7	8.0%	28.0%	1.7%	13.3%
	course sand	0.50	0	0.0%	0.0%	0	8	8.0%	39.0%	0.0%	0.0%	0	0	0.0%	28.0%	0.0%	13.3%
	very course sand	1.0	11	11.0%	11.0%	0	6	6.0%	45.0%	0.0%	0.0%	3	0	3.0%	31.0%	5.0%	18.3%
G r a v e l	very fine gravel	2.0	0	0.0%	11.0%	1	1	2.0%	47.0%	2.0%	2.0%	3	1	4.0%	35.0%	5.0%	23.3%
	fine gravel	4.0	2	2.0%	13.0%	2	1	3.0%	50.0%	4.0%	6.0%	1	0	1.0%	36.0%	1.7%	25.0%
	fine gravel	5.7	0	0.0%	13.0%	2	0	2.0%	52.0%	4.0%	10.0%	3	2	5.0%	41.0%	5.0%	30.0%
	medium gravel	8.0	6	6.0%	19.0%	6	1	7.0%	59.0%	12.0%	22.0%	2	6	8.0%	49.0%	3.3%	33.3%
	medium gravel	11.3	0	0.0%	19.0%	5	0	5.0%	64.0%	10.0%	32.0%	5	5	10.0%	59.0%	8.3%	41.7%
	course gravel	16.0	12	12.0%	31.0%	5	1	6.0%	70.0%	10.0%	42.0%	4	4	8.0%	67.0%	6.7%	48.3%
	course gravel	22.6	0	0.0%	31.0%	8	0	8.0%	78.0%	16.0%	58.0%	6	2	8.0%	75.0%	10.0%	58.3%
	very course gravel	32	22	22.0%	53.0%	6	1	7.0%	85.0%	12.0%	70.0%	6	0	6.0%	81.0%	10.0%	68.3%
	very course gravel	45	0	0.0%	53.0%	6	0	6.0%	91.0%	12.0%	82.0%	6	0	6.0%	87.0%	10.0%	78.3%
Cobble	small cobble	64	20	20.0%	73.0%	2	0	2.0%	93.0%	4.0%	86.0%	5	0	5.0%	92.0%	8.3%	86.7%
	medium cobble	90	0	0.0%	73.0%	0	0	0.0%	93.0%	0.0%	86.0%	8	0	8.0%	100.0%	13.3%	100.0%
	large cobble	128	10	10.0%	83.0%	4	0	4.0%	97.0%	8.0%	94.0%	0	0	0.0%	100.0%	0.0%	100.0%
	very large cobble	180	0	0.0%	83.0%	1	0	1.0%	98.0%	2.0%	96.0%	0	0	0.0%	100.0%	0.0%	100.0%
Boulder	small boulder	256	2	2.0%	85.0%	1	0	1.0%	99.0%	2.0%	98.0%	0	0	0.0%	100.0%	0.0%	100.0%
	small boulder	362	0	0.0%	85.0%	1	0	1.0%	100.0%	2.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	medium boulder	512	0	0.0%	85.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	large boulder	1024	0	0.0%	85.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
	very large boulder	2049	0	0.0%	85.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
Bedrock	bedrock	40096	15	15.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%	0	0	0.0%	100.0%	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		50	50	100.0%		100.0%		60	40	100.0%		100.0%	

	d16	d35	d50	d84	d95
As-Built	8.25	29.34	36.97	263.50	33754.83
2003	0.13	0.56	4.85	36.90	131.50
2004	0.09	3.00	10.05	46.50	89.00



Project Name Little Pine Creek
Task Longitudinal Profile

Date 9/30/03
Crew Shaffer, Bidelspach, Clinton

Symbol Key	
T	Thalweg
TR	Head of Riffle
TP	Head of Pool
TU	Head of Run
TM	Max Pool

2004 Survey

TW Station	TW Elevation	WS Station	WS Elevation	BKF Station	BKF Elevation	Feature
25.00	94.46	25.00	96	25	100.04	TP
48.09	94.93	32.94	96.04	37.01	99.86	
62.82	94.54	60.96	96.02	53.47	100.24	
85.76	95.56	86.04	95.93	100.02	100.21	TR
107.53	95.09	107.78	95.14	103.17	100.3	
109.16	95.13	140.06	95.07	113.04	97.96	Trun
113.84	94.26	159.99	95.07	133.68	100.11	
139.96	94.39	185.29	95.1	165.11	100.14	
160.81	94.17	198.29	94.95	174.18	100.03	TP
185.81	94.35	210.32	94.57	210.25	99.64	TR
210.78	93.86	217.40	94.59	234.70	97.78	TP
216.65	93.38	240.19	94.61	251.46	99.71	
240.82	93.77	257.84	94.47	297.49	98.91	
257.74	93.98	279.42	94.31	308.99	99.03	Trun
279.51	93.56	296.38	94.29	341.01	98.63	
296.31	93.63	329.33	94.25	361.4	98.73	
329.01	93.08	338.48	94.33	405.58	100.53	TP
338.33	92.47	367.36	94.26	407.67	100.06	
367.34	92.31	383.57	94.18	472.55	97.91	
383.72	93.55	408.98	93.62	472.99	98.56	TR
409.13	92.94	422.97	93.59	518.00	96.83	Trun
422.87	92.54	455.99	93.45	518.73	98.41	
455.86	92.92	472.55	93.06	520.09	97.48	TR
471.65	92.38	482.32	93.02	538.58	98	
495.70	91.61	495.18	92.92	541.80	97.97	TP
511.39	91.93	511.18	92.97	575.63	97.7	
530.90	91.38	530.61	92.87	579.55	95.96	
547.26	92.36	548.14	92.94	587.79	97.8	
567.80	92.06	568.96	92.88	608.22	95.77	
582.01	92.26	582.35	92.82	628.2	97.36	TR
595.52	91.4	595.99	92.36	634.04	96.97	Trun
605.03	90.64	620.85	92.33	649.87	96.87	
620.59	90.85	637.53	92.38	652.82	96.83	
637.67	91.5	658.98	92.31	654.65	96.95	
659.67	91.42	677.00	92.4	682.23	96.45	
677.19	91.09	689.64	92.34	709.11	96.76	TP
689.89	89.58	704.66	92.31	712.76	96.53	
704.85	89.41	725.68	92.27	745.11	94.84	
725.85	91.72	753.90	91.47	747.63	96.31	TR
753.27	90.62	775.23	91.34	760.07	96.26	
776.25	90.18	785.97	91.4	780.21	96.47	TP
784.77	89.81	804.07	91.36	815.55	94.37	
785.85	90.61	808.07	91.29	816.99	95.59	
805.15	90.45	822.68	91.34	826.02	96.02	
823.43	89.82	848.44	91.35	839.1	94.04	
848.14	90.45	855.58	91.4	849.63	96.12	
854.82	90.24	865.21	91.37	886.91	95.52	
865.08	90.89	883.64	91.31	919.19	95.82	TRun
884.21	90.57	910.15	91.21	931.6	93.95	
910.53	90.29	937.26	91.14	935.99	95.82	
938.27	90.26	961.66	91.3	945.82	96.93	
962.13	90.34	962.18	91.21	952.71	96.54	

2003 Survey

TW Shot number		TW Station	TW Elevation	WS Station	WS Elevation	LBKF Station	LBKF Elevation	RBKF Station	RBKF Elevation	Feature
2902	0+00.00	0.00	95.15	0.00	96.22			0.00	100.4	T
2904	0+18.75	18.75	95.43	18.23	96.25					TP
2906	0+43.59	43.59	94.18	43.51	96.14	35.50	101.03	49.08	101.03	TP
2908	0+67.97	67.97	94.85	67.56	96.16					T
2910	0+85.85	85.85	95.48	85.78	96.1	95.72	100.83	89.09	101.02	TR
2912	1+32.30	132.30	94.73	132.09	95.8	116.27	100.61	120.87	100.61	TU
2914	1+47.22	147.22	95.14	147.28	95.76	159.79	100.14			TR
2916	1+83.79	183.79	94.77	184.05	95.56			175.11	100.32	T
2918	2+04.49	204.49	95.07	204.41	95.55	199.81	99.57	204.38	100.14	TR
2920	2+22.73	222.73	93.91	222.79	95.07	227.75	99.9	216.89	99.98	TU
2922	2+40.63	240.63	93.79	241.28	95.05	261.06	99.47			TM
2924	2+66.73	266.73	94.12	266.30	95.01	280.29	99.1	261.36	99.39	TR
2926	3+08.00	308.00	93.86	307.13	94.74	302.50	98.64	296.78	99.19	TU
2929	3+30.33	330.33	93.6			318.81	99.03	320.39	98.94	TP
2654	3+45.96	345.96	92.65	345.40	94.5	333.34	98.4			T
2928	3+54.67	354.67	93.05			349.52	98.25	363.64	98.44	TM
2652	3+78.75	378.75	92.41	377.84	94.42	369.49	97.6			TM
2650	3+90.64	390.64	93.37	390.46	94.33			399.00	98.37	TR
2648	4+09.59	409.59	93.01	409.35	93.86	405.55	96.9			TU
2646	4+18.03	418.03	92.6	417.71	93.75			413.95	98.01	T
2644	4+27.27	427.27	92.85	426.99	93.75			431.37	98.18	T
2642	4+54.52	454.52	92.7	454.17	93.41			454.00	97.43	TR
2640	4+86.35	486.35	92.02	485.75	93.06	479.40	97.38	462.78	98.35	TU
2638	5+01.38	501.38	91.36	501.56	93.2	507.44	97.43	499.67	98.26	T
2636	5+24.29	524.29	91.92	524.00	93.23			515.92	97.92	TP
2634	5+37.33	537.33	91.31	536.86	93.26	541.60	97.2	524.00	97.88	TM
2632	5+55.25	555.25	91.34	554.66	93.24	573.00	97.17	542.26	97.52	T
2630	5+74.55	574.55	92.23	573.47	93.14	600.25	96.81	566.55	97.54	TR
2628	6+01.23	601.23	91.68	601.08	92.55	623.05	97.07	604.72	97.07	TU
2626	6+43.13	643.13	90.91	642.57	92.59	647.23	96.46	630.95	96.64	T
2624	6+79.46	679.46	91.3	678.94	92.58	681.72	95.59	658.15	95.98	TU
2671	7+01.86	701.86	88.83	700.67	92.52	701.00	96.03	684.52	95.52	TM
2621	7+28.55	728.55	91.8	728.53	92.48	720.27	95.76	719.38	95.7	TR
2619	7+59.67	759.67	90.83	759.45	91.7	753.71	95.7	749.21	95.85	TU
2617	7+73.76	773.76	90.43	772.95	91.62			778.39	95.37	TU
2615	7+97.68	797.68	89.53	797.40	91.62	789.16	95.84		94.72	TP
2613	8+11.45	811.45	89.25	811.08	91.67	811.45	95.84	817.12	95.19	TM
2602	8+73.24	873.24	90.45	873.37	91.71	854.33	95.57	855.92	95.14	TU
2601	8+92.90	892.90	89.99	895.34	91.63	900.22	95.17	892.00	95.39	TP
2774	9+09.74	909.74	88.81	909.71	91.7	929.22	96.24	909.13	96.01	T
2776	9+38.53	938.53	88.56			944.23	96.86	942.56		T
						983.99	95.02			

Project Name Little Pine Creek
Task Longitudinal Profile

Date 9/30/03
Crew Shaffer, Bidelspach, Clinton

Symbol Key	
T	Thalweg
TR	Head of Riffle
TP	Head of Pool
TU	Head of Run
TM	Max Pool

2002 Survey
Conducted by HDR, Inc

Original Station	Original TW Elevation	Adjusted Station	Adjusted TW Elevation
0	86.93	20	94.93
18.5	86.68	38.5	94.68
35	86.33	55	94.33
55	86.65	75	94.65
70	87.29	90	95.29
82	86.82	102	94.82
102	86.71	122	94.71
112.4	86.57	132.4	94.57
135	87.05	155	95.05
159	86.66	179	94.66
172	86.54	192	94.54
191	86.76	211	94.76
220	85.55	240	93.55
244	85.74	264	93.74
262	86.47	282	94.47
287.7	85.86	307.7	93.86
298	85.88	318	93.88
323	85.63	343	93.63
343	85.04	363	93.04
359	85.28	379	93.28
365	86.01	385	94.01
398.2	85.38	418.2	93.38
422	85.15	442	93.15
439	85.14	459	93.14
452	84.66	472	92.66
472	84.38	492	92.38
484.8	85.09	504.8	93.09
507.2	84.4	527.2	92.4
514.6	84.21	534.6	92.21
534.6	84.69	554.6	92.69
541.4	84.15	561.4	92.15
544.6	82.97	564.6	90.97
559	83.84	579	91.84
585.3	84.5	605.3	92.5
607.5	83.12	627.5	91.12
622	83.21	642	91.21
646	83.51	666	91.51
681	82.98	701	90.98
709	83.71	729	91.71
725	82.88	745	90.88
734	82.8	754	90.8
754	83.2	774	91.2
775	82.47	795	90.47
784	81.5	804	89.5
799	82.56	819	90.56
823	82.46	843	90.46
847.8	82.93	867.8	90.93
852.5	82.93	872.5	90.93
867	82.24	887	90.24
884	82.17	904	90.17
895	81.89	915	89.89
904.2	82.25	924.2	90.25
917	82.51	937	90.51
928	82.13	948	90.13
933.2	82.18	953.2	90.18
943.3	82.28	963.3	90.28
959	82.14	979	90.14
972	81.15	992	89.15

2001 As-built
Conducted by HDR, Inc

Longitudinal Profile - Little Pine Creek									Station Adjusted	TW Elevation Adjusted
Alleghany County, NC										
	Station	BS (+)	HI	FS (-)	Notes	Elevation	Distance	H2O depth		
	BM1	4.86	93.76		RR spike	88.90				
	CONF			11.75	Confluence	82.01	-12.0	1.10		
	0			11.59		82.17	0.0	1.00	964.40	90.7
R14	R1B			11.42		82.34	6.8	0.90	957.60	90.8
	R1T			11.13		82.63	30.3	0.55	934.10	91.1
P13	P1			11.29	iddle of poo	82.47	54.8	0.85	909.60	91.0
R13	R2B			11.11		82.65	64.4	0.58	900.00	91.1
	R2T			10.25		83.51	111.2	0.48	853.25	92.0
P12	P2			11.09	end, cobble	82.67	127.0	1.06	837.40	91.2
	P2a			11.42		82.34	160.0	1.54	804.40	90.8
R12	R3B			11.62		82.14	168.7	1.54	795.70	90.6
	R3T			10.27		83.49	190.0	0.62	774.40	92.0
P11	P3			10.60	iddle of poo	83.16	200.0	0.90	764.40	91.6
R11	R4B			10.50		83.26	225.2	0.88	739.20	91.7
	R4T			10.00		83.76	235.8	0.57	728.60	92.2
P10	P4			10.92		82.84	259.4	1.56	705.00	91.3
R10	R5B			10.43		83.33	289.3	1.00	675.10	91.8
	R5T			9.71		84.05	303.2	0.50	661.20	92.5
P9	P5			10.18		83.58	323.0	1.05	641.40	92.1
	P5a			9.87		83.89	337.0	0.80	627.40	92.4
R9	R6B			9.96		83.80	346.5	0.84	617.90	92.3
	R6T			9.92		83.84	359.0	0.50	605.40	92.3
	TP1	6.07	95.65	4.18		89.58	377.4	1.00	587.00	92.6
P8	P6			11.51		84.14	400.0	0.92	564.40	92.7
R8	R7B			11.46		84.19	410.9	0.50	553.50	93.3
	R7T			10.82		84.83	419.3	1.25	545.10	92.6
P7	P7			11.58		84.07	434.2	0.95	530.20	92.8
	P7a			11.30		84.35	450.0	0.80	514.40	93.0
R7	R8B			11.14		84.51	462.7	0.60	501.70	93.5
	R8T			10.60		85.05	471.2	1.72	493.20	92.4
P6	P8			11.72		83.93	487.0	0.98	477.40	93.2
	P8a			10.98		84.67	507.2	0.75	457.20	93.4
R6	R9B			10.76		84.89	527.7	0.40	436.70	94.0
	R9T			10.17		85.48	546.0	0.70	418.40	93.8
Run 3	P9/RUN1			10.35	run, not poo	85.30	558.6	0.50	405.80	94.1
R5	R10B			10.08		85.57	579.4	0.32	385.00	94.5
	R10T			9.65		86.00	598.1	1.26	366.30	93.6
P5	P10			10.50		85.15	606.1	1.34	345.40	93.6
	P10a			10.58		85.07	622.5	0.65	329.00	94.2
Run 2	P10b/RUN2			9.94	run	85.71	646.9	0.56	304.60	94.4
	P10c			9.72	stream boul	85.93	668.7	0.60	282.80	94.5
	P10d			9.65	run	86.00	678.1	0.45	273.40	94.6
R4	R11B			9.49	sig. velocity difference	86.16	684.2	0.34	267.30	94.9
	R11T			9.21		86.44	702.3	1.10	249.20	94.2
P4	P11			9.90		85.75	719.4	1.08	232.10	94.3
	TP2	5.94	97.57	4.02		91.63	730.5	0.48	221.00	94.9
P4	P11a			11.76		85.81	753.2	0.40	198.30	95.4
R3	R12B			11.12		86.45	771.5	0.86	180.00	94.9
	R12T			10.68		86.89	790.7	0.65	160.80	95.2
P3	P12			11.13		86.44	810.6	0.54	140.90	95.6
R2	R13B			10.85		86.72	830.8	1.22	120.70	94.9
	R13T			10.50		87.07	858.7	0.68	92.80	95.4
P2	P13			11.16		86.41	875.5	0.86	76.00	95.5
R1	R14B			10.62		86.95	883.8	1.55	67.70	94.8
	R14T			10.57		87.00	896.0	1.25	55.50	95.1
P1	P14			11.23		86.34	911.0	1.72	40.50	94.6
	P14a			10.94		86.63	926.5	1.30	25.00	95.0
	P14b			11.42		86.15	937.4	0.96	14.10	95.4
	P14c			11.10		86.47	951.5	1.00	0.00	95.4
Run 1	P14d			10.62		86.95				
	P15			10.70	ake, near br	86.87				
	TP3	4.14	96.35	5.36		92.21				
	TP4	5.25	93.91	7.69		88.66				
	BM1			5.01		88.90				

Project Name Brush Creek
Task Longitudinal Profile

Date 6/1/04
Crew Shaffer, Bidelspach, Clinton

Symbol Key	
T	Thalweg
TR	Head of Riffle
TP	Head of Pool
TU	Head of Run
TM	Max Pool

2004 Survey

TW Station	TW Elevation	WS Station	WS Elevation	Feature
-156	91.89	-155.4	92.8	
-146.4	92.17	-147.04	92.78	
-101.09	92.09	-101.44	92.73	
-77.75	90.81	-77.57	92.7	
-62.36	91.1	-62.7	92.81	
-43.46	91.83	-43.09	92.46	
-22.2	91.36	-23.04	92.13	
-2.39	90.19	-2.05	92.1	
14.68	90.88	14.95	92.13	TR
35.24	91.41	35.18	91.83	
73.46	89.87	72.93	91.7	TP
102.24	89.69	103.04	91.69	
119.66	89.33	119.79	91.66	
141.34	91	141.68	91.73	TR
173.94	89.69	174.28	91.63	
208.44	89.92	208.39	91.65	
222.27	89.04	222.81	91.65	
248.17	89.89	248.77	91.56	
269.9	87.88	270.85	91.44	TP
297.35	89.5	297.92	91.57	
321.15	90.84	321.08	91.53	TR
335.91	89.8	353.33	91.48	
355.39	89.85	357.3	91.46	
355.78	89.69	370.72	91.3	
370.54	89.81	408.19	91.43	
371.26	89.77	425.88	91.29	TP
408.08	90.62	462.46	91.31	
425.6	89.84	478.88	91.32	
462.45	89.76	502.93	91.31	
478.82	89.37	506.21	91.29	Trun
502.65	89.93	561.62	91.26	
513.23	90.09	617.43	91.37	
562.55	90.06	674.04	91.3	TP
617.47	90.06	729.24	91.34	
675.85	88.76	755.75	91.29	
728.94	90.73	845.41	91	TR Begin Relocation
756.5	89.87	931.87	90.94	
844.16	89.7	1096.87	90.35	
931.71	89.12	1137.67	90.12	
1096.26	89.47	1218.07	89.78	
1137.36	89.3	1277.4	89.76	End Relocation
1217.83	88.25	1306.42	89.8	TP
1277.66	87.36	1351.44	89.85	
1306.43	88.57	1381.26	89.71	TR
1351.39	88.13	1512.13	89.54	
1381.22	86.81	1599.29	89.71	TP
1514.9	87.04	1655.52	89.51	
1600.07	88.9	1673.21	89.37	TR
1655.63	87.92	1693.29	89.49	
1673.23	88.01	1703.6	89.51	TP
1693.18	86.98	1745.37	89.47	
1702.6	85.98	1768.15	89.45	
1746.2	85.94	1812.51	89.38	
1768.29	85.9	1844.95	89.44	
1811.96	87.43	1902.48	89.16	
1844.11	86.24	1950.34	88.73	TR
1901.14	88.65	1977.33	88.81	
1949.09	87.43			
1975.33	86.35			

2003 Survey
Conducted by NCSU

TW Shot number	TW Station	TW levatio	WS Station	WS Elevation	LBKF Station	LBKF Elevation	RBKF Station	RBKF Elevation	Feature
2756	0	92.36	0.5	92.68			70.36	100.14	TR
2758	115.07	89.83	114.16	91.81	93.84	99.23	117.2	100.26	TU
2760	157.77	88.96	158.41	91.89			186.9	99.54	T
2762	187.44	90.02	187.31	91.8	181.26	97.94	256.3	99.43	T
2764	211.68	89.41	212.53	91.74	217.4	100.25	333.8	99.49	TM
2766	291.59	90.14	290.6	91.79	281.63	98.99	398.9	99.74	T
2768	408.24	90.85	408.75	91.78	290	99.68	461	99.37	TR
2770	474.9	89.59	475	91.69	347.43	99.43	510.4	98.99	TU
2772	559.4	89.88	559.37	91.59	434.71	96.98	591	98.83	T
2997	628.33	89.8	633.22	91.69	470.91	96.81	614.6	96.86	TP
2998	668.28	87.47	668.83	91.65	517.68	97.64	670.2	95.02	TM
2999	699.22	88.95	699.04	91.69	563.23	98.32	705.4	94.54	T
3003	737.34	89.96	736.9	91.47	647.17	99.05	760.4	96.9	TR-Begin Re
3005	796.55	89.43	796.66	90.88			777.4	94.86	T
3007	887.59	89.31	887.09	90.88	901.88	98.66	811.4	96.25	T
3009	934.51	89.33	935.06	90.77	1063	99.05	858.1	95.61	T
3011	1010.1	89.53	1010.76	90.61	1091.39	94.46	921.5	94.8	T
3013	1120.45	89.57	1121.54	90.27	1152.82	93.94	1004	97.85	TR -End Rel
3015	1230.92	88.33	1230.87	90.02	1202.25	92.85	1065	97.87	TU
3017	1270.02	87.59	1271.24	89.92	1270	95	1108	96.65	TP
3033	1280.59	86.87	1280.21	89.71	1289	94.16	1137	97.06	TM
3035	1317.49	87.79	1316.96	89.83			1174	97.38	T
3037	1362.23	87.07	1361.24	89.8	1346.26	93.54	1175	97.36	T
3039	1398.33	88.37	1399.77	89.83			1222	93.69	T
3041	1474.87	87.04	1476.36	89.72	1420.63	92.95	1225	97.7	T
3045	1501.87	87.38	1502.2	89.83	1493.09	90.66	1273	98.73	TP
3043	1559.27	85.55	1557.95	89.6	1543.84	91.13	1455	100.58	TM
3047	1591.31	88.36	1591.01	89.76	1623.18	91.58	1502	101.7	TR
3049	1681.79	87.84	1682.65	89.52	1685.19	91.84	1650	92.97	TU
3052	1750.51	86.18	1752.02	89.44	1719.23	90.88	1705	90.41	TP
3054	1777.08	86.11	1778.03	89.38	1795.23	95.47			TM
3051	1844.77	86.38	1850.14	89.42			1831	92.55	TG
3082	1897.76	88.72	1898.17	89.3	1898.54	97.22	1886	90.04	TR
3084	1951.61	86.81	1951.94	88.84	1978.4	95.86	1950	90.86	TU
3090	2026.11	86.48	2027.43	88.69			2017	91.4	TP
3088	2072.91	86.23	2070.59	88.75			2033	90.93	TM
3086	2178.09	87.57	2177.73	89.03					TR

Project Name Brush Creek
Task Longitudinal Profile

Date
Crew Shaffer, Bidelspach, Clinton

2002 Survey
Conducted by HDR, Inc

Original Station	Original TW Elevation	Adjusted Station	Adjusted TW Elevation
0	84.08	42	92.08
30	83.87	72	91.87
56	83.08	98	91.08
72.5	82.06	114.5	90.06
128	82.47	170	90.47
163	81.59	205	89.59
184	82.17	226	90.17
212	81.8	254	89.8
247	82.02	289	90.02
258	81.34	300	89.34
269	80.18	311	88.18
306	82.51	348	90.51
340	81.91	382	89.91
408	82.64	450	90.64
465	81.87	507	89.87
525	82.27	567	90.27
569	81.87	611	89.87
600	81.34	642	89.34
626	80.77	668	88.77
638	80.8	680	88.8
686	81.92	728	89.92
790	81.65	832	89.65
833	81	875	89
896	81.37	938	89.37
926	81.55	968	89.55
1007	81.42	1049	89.42
1111	81.43	1153	89.43
1118	80.51	1160	88.51
1164	79.99	1206	87.99
1200	80.31	1242	88.31
1222	79.31	1264	87.31
1288	79.81	1330	87.81
1363	79.43	1405	87.43
1411	79.51	1453	87.51
1466	78.49	1508	86.49
1516	80.01	1558	88.01
1578	79.71	1620	87.71
1657	77.66	1699	85.66
1747	78.96	1789	86.96
1790	78.11	1832	86.11
1800	78.32	1842	86.32
1848	80.4	1890	88.4
1894	79.46	1936	87.46
1922	78.85	1964	86.85

2001
Conducted by HDR, Inc

FS (-)	Notes	Elevation	Distance	H2O depth	Station Adjusted	TW levation djusted
		88.90				
4.03		92.42				
14.20		83.78	0.0	0.50	80.00	90.8
14.96		83.02	20.0	0.96	100.00	90.0
15.55		82.43	61.5	1.35	141.50	89.4
15.73		82.25	110.6	1.42	190.60	89.2
16.23		81.75	164.3	1.80	244.30	88.7
5.79		92.19				
14.60		82.23	213.0	1.30	293.00	90.4
14.50		82.33	305.0	1.25	385.00	90.5
14.62		82.21	365.0	1.25	445.00	90.3
14.10		82.73	426.2	0.70	506.20	90.9
14.76		82.07	452.0	1.05	532.00	90.2
14.85		81.98	493.6	1.10	573.60	90.1
14.70		82.13	565.0	0.90	645.00	90.3
7.91		88.92				
		96.83				
15.04		80.75	600.0	2.30	680.00	89.3
14.06		81.73	651.0	1.30	731.00	90.2
13.70		82.09	679.0	0.85	759.00	90.6
13.63		82.16	765.0	0.60	845.00	90.7
13.95		81.84	965.0	0.50	1045.00	90.3
5.71		90.08				
13.15		81.67	1030.0	0.60	1110.00	90.2
13.75		81.07	1096.0	0.85	1176.00	89.6
14.23		80.59	1160.0	0.95	1240.00	89.1
4.47		90.35				
15.58		80.10	1272.0	1.25	1352.00	88.6
15.95	nd of ru	79.73	1365.0	1.50	1445.00	88.2
16.38		79.30	1417.0	1.90	1497.00	87.8
16.78		78.90	1490.0	2.30	1570.00	87.4
16.16		79.52	1565.0	1.70	1645.00	88.0
8.43		87.25				
15.98		78.48	1692.0	2.80	1772.00	87.0
16.03		78.43	1765.0	2.90	1845.00	86.9
13.76		80.70	1810.0	0.60	1890.00	89.2
14.57		79.89	1850.0	0.75	1930.00	88.4
15.43		79.03	1910.0	1.60	1990.00	87.5
6.78		87.68				
3.90		92.67				
6.82		88.94				

Project Name	Little Pine and Brush Creeks
Task	Feature Slope and Length Calculations
Date	6/1/04
Crew	Shaffer, Bidelspach, Clinton

2003 Data
Little Pine

Riffle Station	Length	Bed elevation	Water elevation	change	slope
85		95.48	96.1		
132	47	94.73	95.8	0.3	0.64%
204		95.07	95.55		
222	18	93.91	95.07	0.48	2.67%
266		94.12	95.01		
308	42	93.86	94.74	0.27	0.64%
390		93.37	94.33		
486	96	92.02	93.06	1.27	1.32%
574		92.23	93.14		
601	27	91.68	92.55	0.59	2.19%
728		91.8	92.48		
759	31	90.83	91.7	0.78	2.52%

Pool	length	p-p spacing
18.75		
85.85	67.1	
222		
266	44	191.7
330		
390	60	116
486		
574	88	170
601		
722	121	131.5
773		
873	100	161.5

2004 Data
Little Pine

Riffle Station	Length	Water elevation	change	slope
86		95.93		
109	23	95.14	0.79	3.43%
185		95.1		
210	25	94.57	0.53	2.12%
383		94.18		
408	25	93.62	0.56	2.24%
456		93.45		
495	39	92.92	0.53	1.36%
582		92.82		
596	14	92.36	0.46	3.29%
725		92.27		
775	50	91.34	0.93	1.86%

Run Station	Length	Water elevation	change	slope
109		95.14		
140	31	95.07	0.07	0.23%
257		94.47		
329	72	94.25	0.22	0.31%
408		93.62		
456	48	93.45	0.17	0.35%
596		92.36		
677	81	92.4	-0.04	-0.05%
865		91.37		
962	97	91.21	0.16	0.16%

Pool	length	p-p spacing
25		
86	61	
140		
185	45	107
210		
257	47	71
329		
383	54	122.5
495		
582	87	182.5
677		
725	48	162.5
775		
865	90	119

2003
Brush Creek

Riffle Station	Length	Water elevation	change	slope
0		92.68		
114	114	91.81	0.87	0.76%
408		91.78		
559	151	91.59	0.19	0.13%
736		91.47		
796	60	90.88	0.59	0.98%
935		90.77		
1281	346	89.71	1.06	0.31%
1591		89.76		
1682	91	89.52	0.24	0.26%
1898		89.3		
1951	53	88.84	0.46	0.87%

Pool	length	p-p spacing
114		
408	294	
557		
736	179	385.5
1280		
1591	311	789
1682		
1898	216	354.5
1951		
2177	226	274

2004
Brush Creek

Riffle Station	Length	Water elevation	change	slope
14		91.63		
72	58	91.2	0.43	0.74%
141		91.23		
270	129	90.94	0.29	0.22%
321		91.03		
425	104	90.79	0.24	0.23%
729		90.84		
1218	489	89.29	1.55	0.32%
1306		89.3		
1381	75	89.21	0.09	0.12%
1599		89.21		
1673	74	88.87	0.34	0.46%
1844		88.94		
1950	106	88.23	0.71	0.67%

Run Station	Length	Water elevation	change	slope
506		90.79		
617	111	90.87	0.08	0.07%

Pool	length	p-p spacing
72		
141	69	
270		
321	51	189
425		
506	81	170
617		
729	112	207.5
1218		
1306	88	589
1381		
1599	218	228
1673		
1844	171	268.5

PROFILE	Little Pine As-built - 2001			Brush Creek As-built - 2001			Little Pine 2003			Brush Creek 2003			Little Pine 2004			Brush Creek 2004		
	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
Riffle Length	6.1	46.8	18.4	20	417	32.9	18	96	36.5	53	346	102.5	14	50	25	58	489	104
Riffle Slope	1.17%	2.79%	1.61%	0.24%	1.65%	1.35%	0.64%	2.67%	1.75%	0.13%	0.98%	0.53%	1.36%	3.43%	2.18%	0.12%	0.74%	0.32%
Pool Length	34.1	111.6	44.5	51	348	187	44	121	77.55	179	311	226	45	90	54	51	218	88
Pool to Pool Spacing	51	150.3	63.7	53	966	359	116	191.7	161.5	274	789	370	71	182.5	120.75	170	589	217.75

Project Name	Little Pine and Brush Creeks
Task	Channel Pattern Measurements
Date	
Crew	Shaffer, Bidelspach, Clinton

Little Pine Creek 2003				**Little Pine Creek** 2004		
Radius of Curvature	**Meander Wavelength**	**Channel Beltwidth**		**Radius of Curvature**	**Meander Wavelength**	**Channel Beltwidth**
43	139	39		54	113	34
62	113	37		46	140	35
39	116	43		147	164	65
65	117	62		41	102	24
35	86	50		55	125	26
18	108	46		71	113	23
38	94	50		26	91	43
50	97	37		63	103	30
52	116	54		76	109	37
42		46		56	98	
33		50		33	123	
65				77	114	
33				48		
				82		
18	86	37	***min***	26	91	23
65	139	62	***max***	147	164	65
42	113	46	***median***	55.5	113	34

Brush Creek 2003				**Brush Creek** 2004		
Radius of Curvature	**Meander Wavelength**	**Channel Beltwidth**		**Radius of Curvature**	**Meander Wavelength**	**Channel Beltwidth**
75	248	122		101	547	71
25	512	167		95	566	149
52	570	304		68	481	75
72	228	267		115	268	325
90				159	565	164
192				284		
119				164		
62				66		
60						
25	228	122	***min***	66	268	71
192	570	304	***max***	284	566	325
72	380	217	***median***	108	547	149

Brush Creek Stream Restoration
Alleghany County, NC

Brush Creek Quad 1

Tree Stratum

Species	Height (cm)	Diameter (mm)	Σ X-sec. (cm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
Prunus serotina	5	1			62	98.4	1
Acer rubrum	5	1			1	1.6	2
Total					63	100.0	
Total Trees per acre					2520		
Planted trees per acre					0		
Natural regen trees per acre					2520		

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Cornus amomum	3	75	12	48	1
Salix nigra	0.5	12.5	4	16	3
Alnus serrulata	0.5	12.5	9	36	2
Total	4	100	25	100	

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Eupatorium sp.	1	2.4	3
Ranunculus sp.	5	11.8	2
Polygonum sp.	0.5	1.2	4
Festuca sp.	15	35.3	1
Ambrosia sp.	0.5	1.2	4
Verbesina sp.	0.5	1.2	4
Panicum clandestinu	15	35.3	1
Solidago sp.	5	11.8	2
Total	**42.5**	**100.0**	

Brush Creek Stream Restoration
Alleghany County, NC

Little Pine Creek Quad 1

Tree Stratum

Species	Height (cm)	Diameter (mm)	Σ X-sec. (cm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
(none)							

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Cornus amomum	0.5	50	6	100	1
Total	**0.5**	**100**	**6**	**100**	

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Aster sp.	10	9.0	3
Ambrosia spp.	0.5	0.5	4
Chenopodium album	0.5	0.5	4
Stellaria sp.	30	27.0	2
Elymus virginicus	70	63.1	1
Total	**111**	100.0	

Brush Creek Stream Restoration							
Alleghany County, NC							
		Little Pine Creek Quad 2					
Tree Stratum							
Species	**Height (cm)**	**Diameter (mm)**	**Σ X-sec. (cm²)**	**Rel. x-sec (%)**	**Density**	**Rel. Density (%)**	**Rank (Importance)**
(none)							
Shrub Stratum							
Species	**Cover (%)**	**Rel. cover (%)**	**Density**	**Rel. Density (%)**	**k (Importance)**		
(none)							
Herb Stratum							
Species	**Cover (%)**	**Rel. cover (%)**	**Rank (Importance)**				
Elymus virginicus	0.5	0.3	4				
Impatiens capensis	90	62.5	1				
Rununculus sp.	50	34.7	2				
Aster sp.	0.5	0.3	4				
Stellaria sp.	2	1.4	3				
Festuca sp.	0.5	0.3	4				
Unkwn grass	0.5	0.3	4				
Total	**144**	**100.0**					