CARP MITIGATION SITE, UNNAMED TRIBUTARY TO LAXON CREEK, WATAUGA COUNTY

Year 5 Monitoring Report
Period Covered: September 27, 2005 – June 27, 2006

Prepared for the
North Carolina Ecosystem Enhancement Program

North Carolina Wildlife Resources Commission
Division of Inland Fisheries
Watershed Enhancement Group
Raleigh

2007

The purpose of this report is to summarize 2006 monitoring data collected from 542 ft of restored stream channel on an unnamed tributary (UT) to Laxon Creek at the Carp stream mitigation site in Watauga County (Figure 1), to summarize the five years of monitoring data, and to make recommendations for future monitoring. Site conditions, project objectives, pre-construction conditions, as-built conditions, and monitoring methods are described in previous reports (Mickey and Martinez 2000; Mickey and Scott 2001; Mickey and Hining 2003; Mickey and Wasseen 2006). The purpose of the project was to replace the incised and straightened channel with a new, stable channel at a higher elevation and with appropriate dimension, pattern, and profile (based on reference reach data). This project is considered a Priority I restoration (Rosgen 1996) and includes reestablishment of riparian vegetation. Meeting this goal will result in improved aquatic and terrestrial habitats and ecological and hydrologic function. This mitigation site was obtained as partial fulfillment of the off-site stream mitigation permit requirements of the North Carolina Department of Transportation's (NCDOT) R-0529 (US 421) road improvement project in Watauga County. For that project a total of 14,814 linear feet of stream mitigation were required by the United States Army Corps of Engineers, Section 404 permit and 7,407 linear feet of mitigation were required by the North Carolina Division of Water Quality (NCDWQ) Section 401 water quality certification.

From 2000 to 2005 all reports associated with this mitigation site were prepared for the NCDOT stream mitigation program. In 2005, responsibility for this site was transferred from NCDOT to the North Carolina Ecosystem Enhancement Program (EEP). This document was prepared using format guidelines previously developed by the North Carolina Wildlife Resources Commission. This was done to maintain consistency with earlier reports and to allow the 2006 data to be compared with previous years' data without having to change report format.

Monitoring

Monitoring survey data were collected on May 17, 2006. The 2006 monitoring data are compared with the as-built and previous years' monitoring data (Mickey and Scott 2001; Mickey and Hining 2003; Mickey and Wasseen 2006). The 2006 monitoring efforts included a longitudinal profile survey, channel cross-section dimensional measurements, pebble counts, and stem counts of planted trees and live stakes. A photographic log of the site was maintained at several locations along the project length (Appendices 1-6).

Bankfull Events

Bankfull stream flow events were documented through review of the United States Geological Survey's South Fork New River flow gage (station number 03161000) near Jefferson, North Carolina, by photographic records, and by personal observations of bankfull stage pins placed on site. Bankfull at the Carp site has been corresponding to approximately 1,800 cubic feet per second (cfs) at the gage station. However, due to the localization of many rain events, some bankfull events could only be noted by direct observation. Since completion of the project there have been 14 bankfull or greater flow events at the site (Table 1). The largest, localized storm occurred on November 19, 2003. This storm measured only 1,880 cfs at the gage station; however, observations at the project site revealed the heaviest flooding ever

observed by the landowners (Appendix 1 and personal communication). The UT to Laxon Creek (drainage area 0.7 mi^2) suffered no damage (Appendix 1). This localized storm event created more flooding at the site than the September 2, 2004 remnant hurricane rains that measured 14,700 cfs at the gage station (Table 1). The November 19, 2003 localized storm and the September 2, 13, and 28, 2004 remnant hurricane storms caused major adjustments to the longitudinal profile and cross-sections.

Longitudinal Profile

The 2001, 2002, 2003, 2004, and 2006 longitudinal surveys (Figure 2) show a relatively stable channel, but one that is making minor natural adjustments from its original construction characteristics (Mickey and Scott 2001). Channel bed elevations show aggradation occurred throughout the stream reach; however the channel is stable. During the five years of monitoring profile adjustments, both aggradation and degradation were observed as the new channel settled into its new position and adjusted to a range of stream flows.

The 2006 longitudinal survey documented channel profile aggradation occurring at stations 0+49 to 1+04, 1+61 to 3+98, and 4+11 to 4+31. While aggradation has occurred at these locations, it has not been detrimental to the success of the project. Based on annual observations, there has been no apparent shift in the meander pattern and no bank scour or erosion is evident. These aggradations appear to be a result of substrate transported from upstream sources (unstable streambanks, pastures, construction activities, and unpaved roads). Furthermore, during the 2003 flood, the stream was unable to transport this material through the project reach. Flood waters from the South Fork New River backed up into this area and reduced stream sediment transport power. The stream channel is stable, there is no bank erosion, and its pattern has not changed since construction.

Cross-sections

Seven cross-sections were surveyed during 2006 and compared with previous cross-section measurements (Figure 3; Mickey and Scott 2001; Mickey and Hining 2003; Mickey and Wasseen 2006). Cross-section profiles indicate some major adjustments occurred following the 2003 and 2004 hurricanes. Moderate to major adjustments in thalweg depths (aggradation) occurred at all cross-sections following these storms. All of the cross-sections exhibited a build up of the streambanks due to deposition of soil materials (silt, sand, and small gravel) during bankfull or greater than bankfull flow events. The thalweg at five of the seven cross-sections has shifted slightly as a result of the streambanks' build up of soil materials. There has been no lateral movement of the channel as a result of the large storm events. From 2001 thru 2006 all cross-sections exhibited some channel aggradation. Since 2005 the seven cross-sections have remained stable and exhibited little aggradation or degradation, indicating that the channel is stable (Figure 3; Appendices 1–6).

CROSS-SECTION 1+69 – riffle (Figure 3.1): Following construction this cross-section was a step-pool. Over the years some of the crossvane rocks and substrate materials have moved causing this cross-section to evolve from a step-pool to a riffle with a few deep pockets of water.

The cross-section indicates the stream channel is stable with no bank erosion or lateral movement occurring.

CROSS-SECTION 1+94 – riffle (Figure 3.2): Following construction this cross-section was a pool. The movement of substrate into this location has caused the pool to migrate downstream to station 2+01. As a result, the cross-section now represents a riffle. The cross-section data indicate the stream channel is stable with no bank erosion or lateral movement occurring.

CROSS-SECTION 2+24 – riffle (Figure 3.3): Following construction this cross-section represented a pool. Because substrate materials have been transported into the area, the pool has filled in and the cross-section now contains a riffle. The cross-section data reveals the stream channel is stable with no bank erosion or lateral movement occurring.

CROSS-SECTION 2+45 – pool (Figure 3.4): The pool represented in this cross-section has remained since construction was completed. The pool is maintained by root wads placed along the high left bank. The cross-section data shows the stream channel is stable with no bank erosion and little lateral movement occurring.

CROSS-SECTION 2+79 – run (Figure 3.5): Following construction, this cross-section included a step-pool. Due to the movement of substrate material into the area following major storm events, it has evolved into a run and the pool has been eliminated. The cross-section data reveal the stream channel is stable with no bank erosion or lateral movement occurring.

CROSS-SECTION 3+16 – riffle (Figure 3.6): Following construction this cross-section included a pool below root wads. The pool has shifted downstream to station 3+19. The cross-section now contains a riffle. The cross-section data suggests the stream channel is stable with no bank erosion or lateral movement occurring.

CROSS-SECTION 3+76 – run (Figure 3.7): The run complex represented in this cross-section has remained unchanged since construction was completed. The cross-section data indicates the stream channel is stable with no bank erosion or lateral movement occurring.

Substrate

Bed material analyses (pebble counts) were conducted in the area of the cross-section located at station 2+24 (Figure 4). From 2001 to 2006 the D_{50} cumulative distribution particle size ranged from 11 mm to 26 mm with a mean of 19 mm. Substrate composition has been consistent over all monitoring years, except for 2002 (Figure 4). The unusually small <0.06 mm D_{16} particle size of 2002 reveals that 25 percent of the particles in the substrate sample were in the silt/clay size category. This was likely attributable to sampling bias or the presence of an unusually heavy silt/sand load in the stream at the time of the sample.

Riparian Improvements

Since construction was completed on November 7, 2000, all disturbed banks have become well vegetated (Appendices 1, 2, and 3). A total of 533 stems (livestakes and bare-rooted plants)

were planted in the 0.67 acre conservation easement over a three-year period (2001, 2002) (Table 2). In 2006, a total of 236 stems (44%) of the original plantings remained alive. The density of stems counted (352 stems/acre) in 2006 is well above the 260 stems/acre required for woody species planted at mitigation sites through year five (USACE 2003). Vegetation has been the key factor in maintaining bank integrity and sinuosity.

Summary

Since construction was completed on November 7, 2000 there have been 14 bankfull or greater events that caused no damage to the site other than changes in the cross-section composition. The cross-vane rocks at station 1+69 have been redistributed, but this has not negatively impacted stream channel stability or habitat conditions. The streambanks have remained stable and no failures have occurred. The riparian vegetation is thriving and continues to build and stabilize the streambanks.

Recommendation

It has been six years since construction was completed on November 7, 2000. During this period an as-built survey and five monitoring surveys have been conducted and the site has remained stable. The longitudinal profile and the cross-sections have revealed some aggradation of the stream channel during the five year monitoring period. This is most likely due to substrate transported from upstream sources (unstable streambanks, pastures, construction activities, and unpaved roads). Substrate composition has remained constant. The riparian vegetation is flourishing, preserving bank integrity and channel sinuosity. Given these results, we recommend that this site be considered stabilized and released from further monitoring. We also recommend the 542 mitigation credits (1:1 ratio) established for this site be released (NCDWQ letter to the NCWRC dated November 6, 2000).

Acknowledgements

The Elkin Watershed Enhancement Team of J. Mickey, Jr. and J. Wasseen, II collected and analyzed the field data and prepared the report. J. Borawa improved the report with his thorough review and thoughtful suggestions.

References

Mickey, J. and M. Martinez. 2000. Conceptual restoration plan (revised), Carp site, unnamed tributary to Laxon Creek. North Carolina Wildlife Resources Commission, Raleigh.

Mickey, J. and S. Scott. 2001. As-built report for the Carp mitigation site, unnamed tributary to Laxon Creek, Watauga County. North Carolina Wildlife Resources Commission, Raleigh.

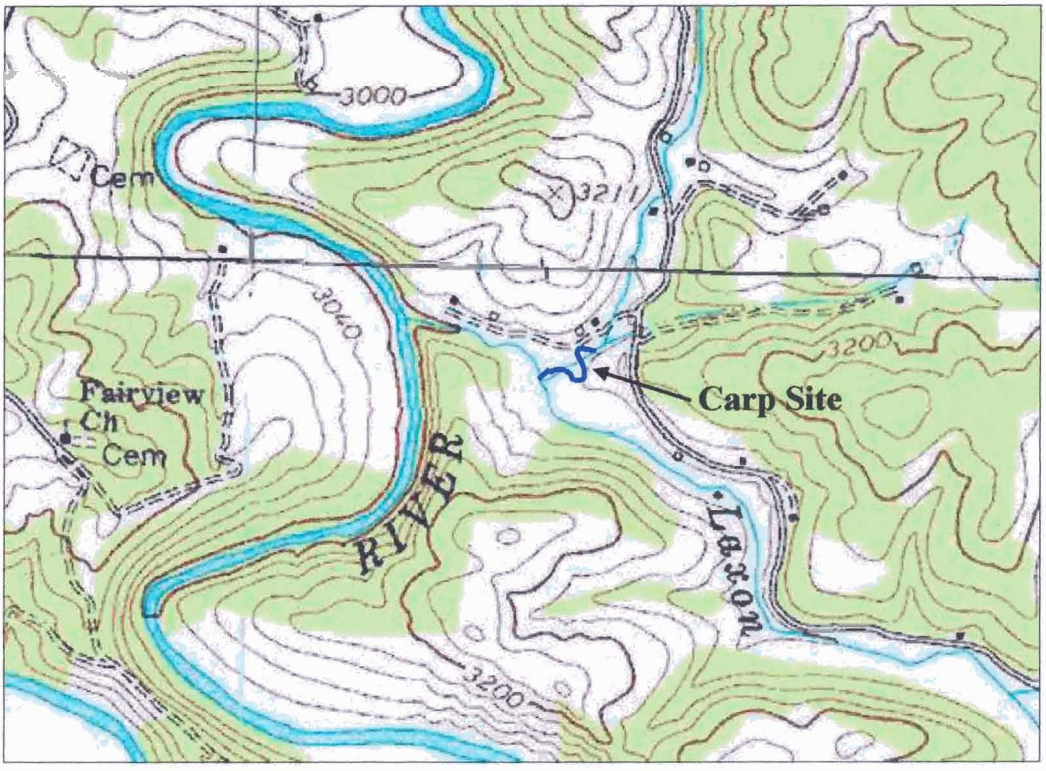
Mickey, J. H. and S. Hining. 2003. Carp mitigation site, unnamed tributary to Laxon Creek, Watauga County. Period covered: April 2, 2002 – April 15, 2003. North Carolina Wildlife Resources Commission, Raleigh.

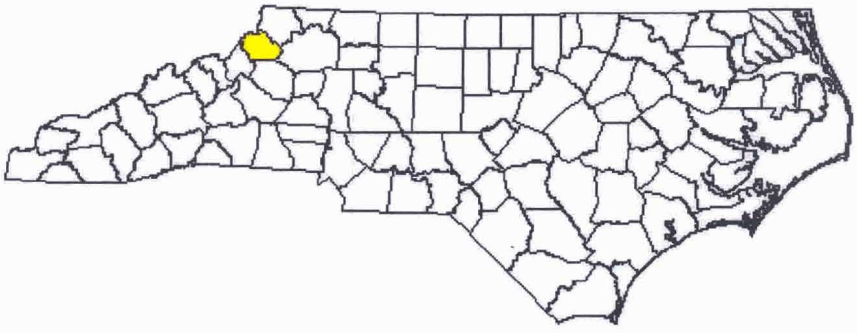
Mickey, J. H. and J. Wasseen II. 2006. Carp mitigation site, unnamed tributary to Laxon Creek, Watauga County. Period covered: June 3, 2004 – September 27, 2005. North Carolina Wildlife Resources Commission, Raleigh.

Rosgen, D.L. 1996. Applied river morphology. Wildland Hydrology Books, Pagosa Springs, Colorado.

USACE (U.S. Army Corps of Engineers), Wilmington District, U. S. Environmental Protection Agency, North Carolina Wildlife Resources Commission, and the North Carolina Division of Water Quality. 2003. Stream Mitigation guidelines. Wilmington, North Carolina.

FIGURE 1.—Carp mitigation site, unnamed tributary to Laxon Creek, New River drainage, Watauga County.





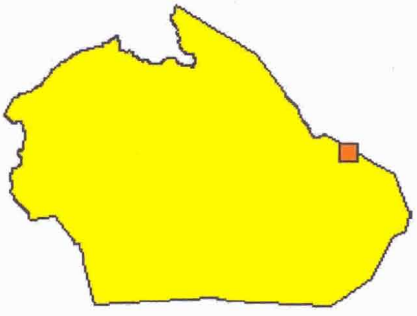


FIGURE 2.—Five annual longitudinal profile comparisons, Carp mitigation site, unnamed tributary to Laxon Creek, Watauga County, 2001-2006.

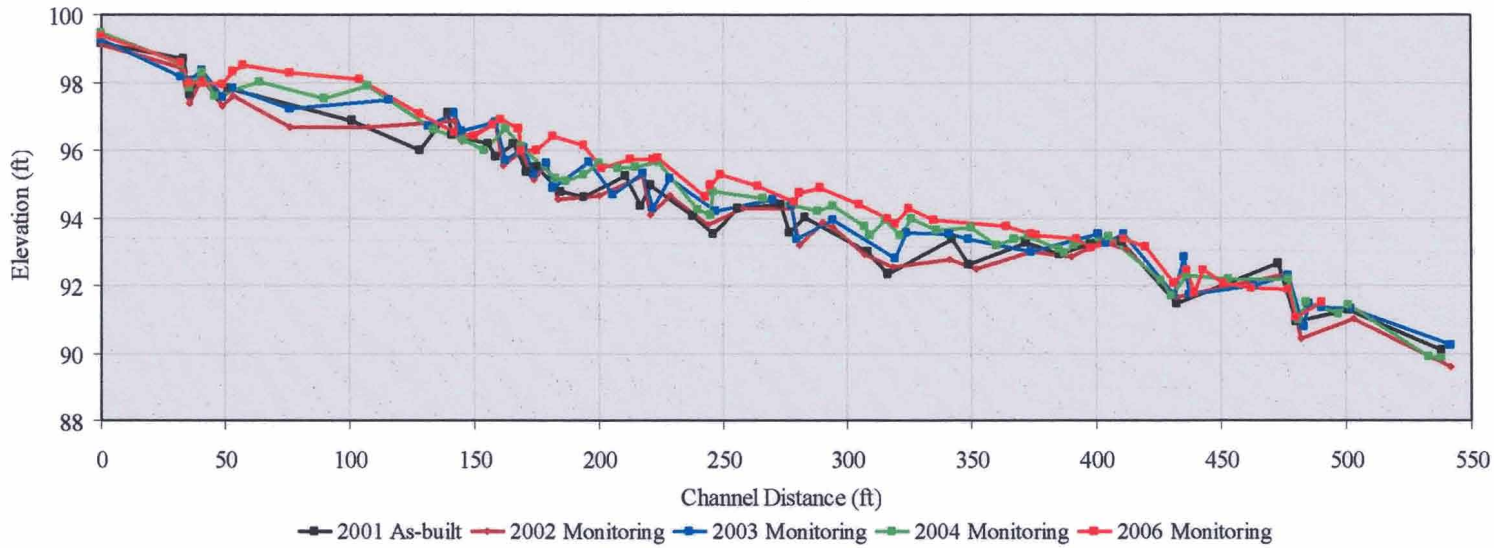


FIGURE 3.—Seven annual cross-section comparisons, Carp mitigation site, unnamed tributary to Laxon Creek, Watauga County, 2001-2006.

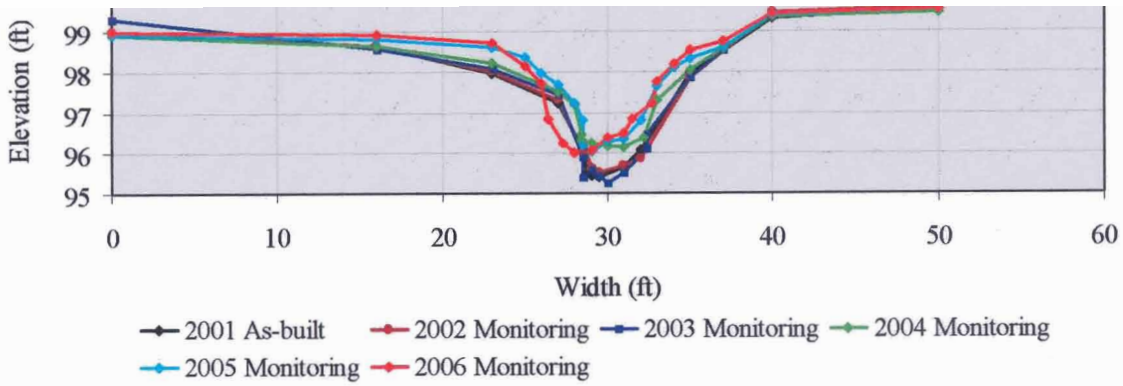


FIGURE 3.1.—Cross-section 1+69, riffle.

FIGURE 3.—Continued.

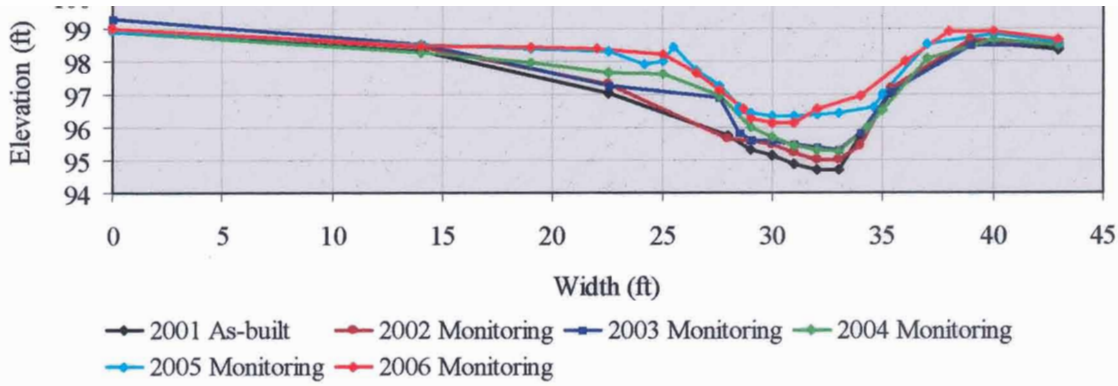


FIGURE 3.2.—Cross-section 1+94, riffle.

FIGURE 3.—Continued.

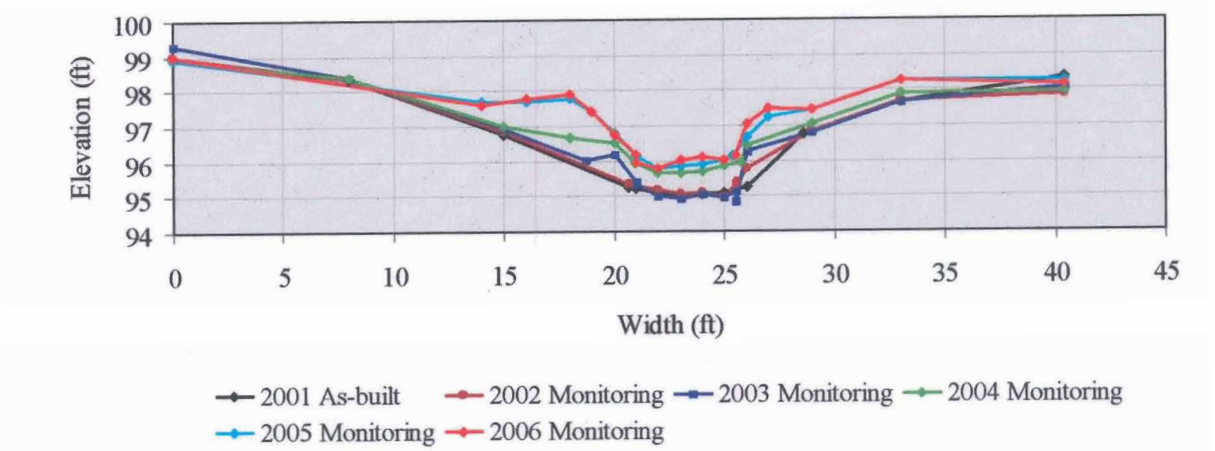


FIGURE 3.3.—Cross-section 2+24, riffle.

FIGURE 3.—Continued.

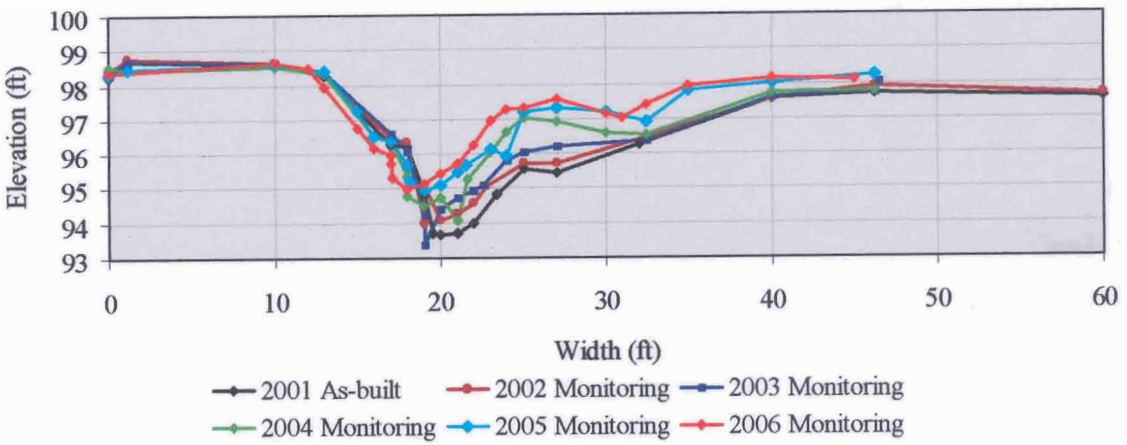


FIGURE 3.4.—Cross-section 2+45, pool.

FIGURE 3.—Continued.

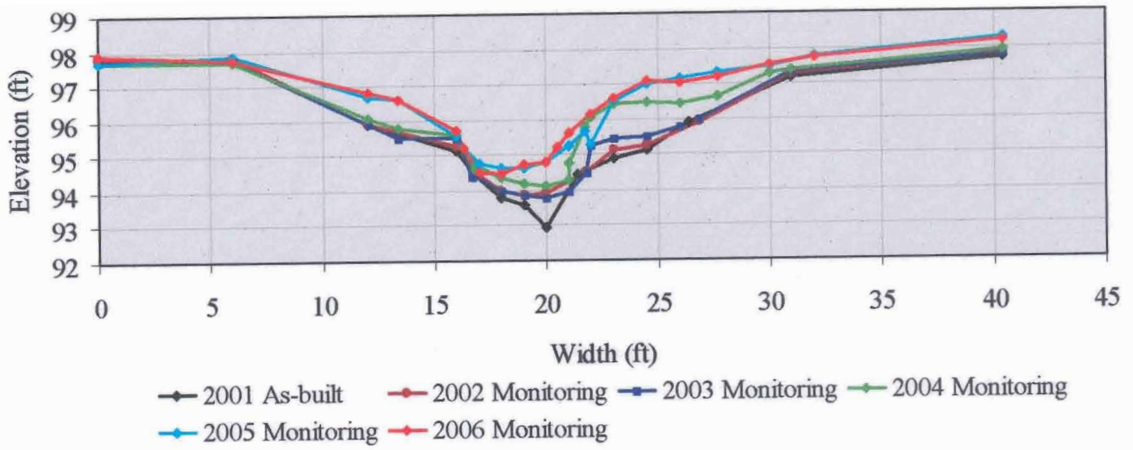


FIGURE 3.5.—Cross-section 2+79, run.

FIGURE 3.—Continued.

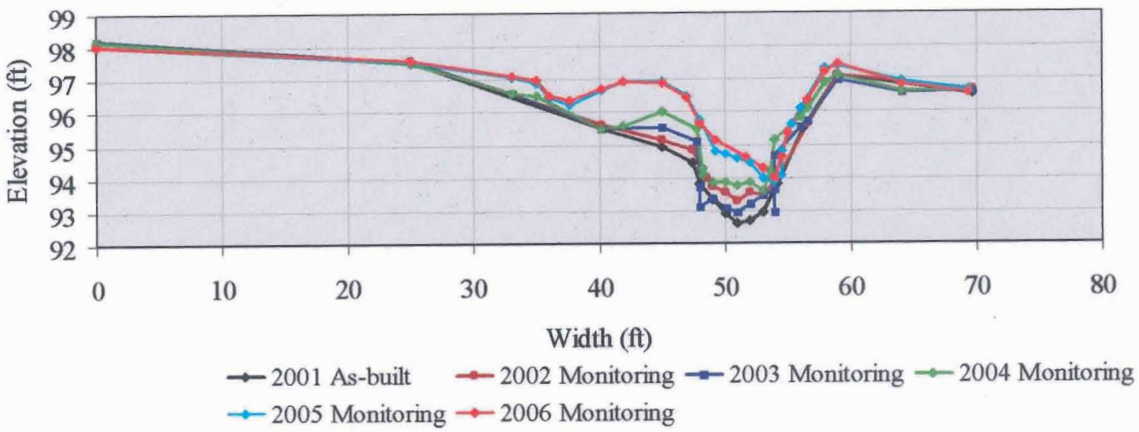


FIGURE 3.6.—Cross-section 3+16, riffle.

FIGURE 3.—Continued.

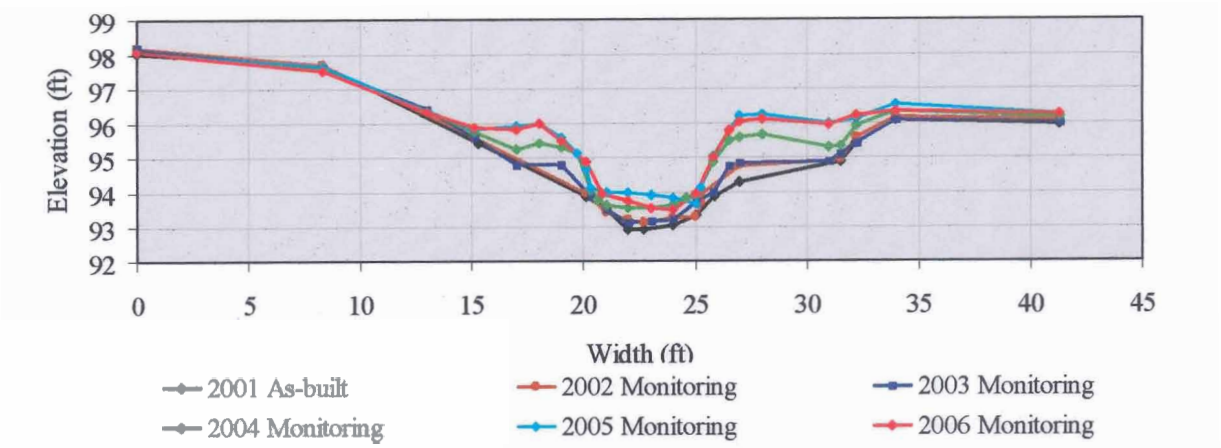
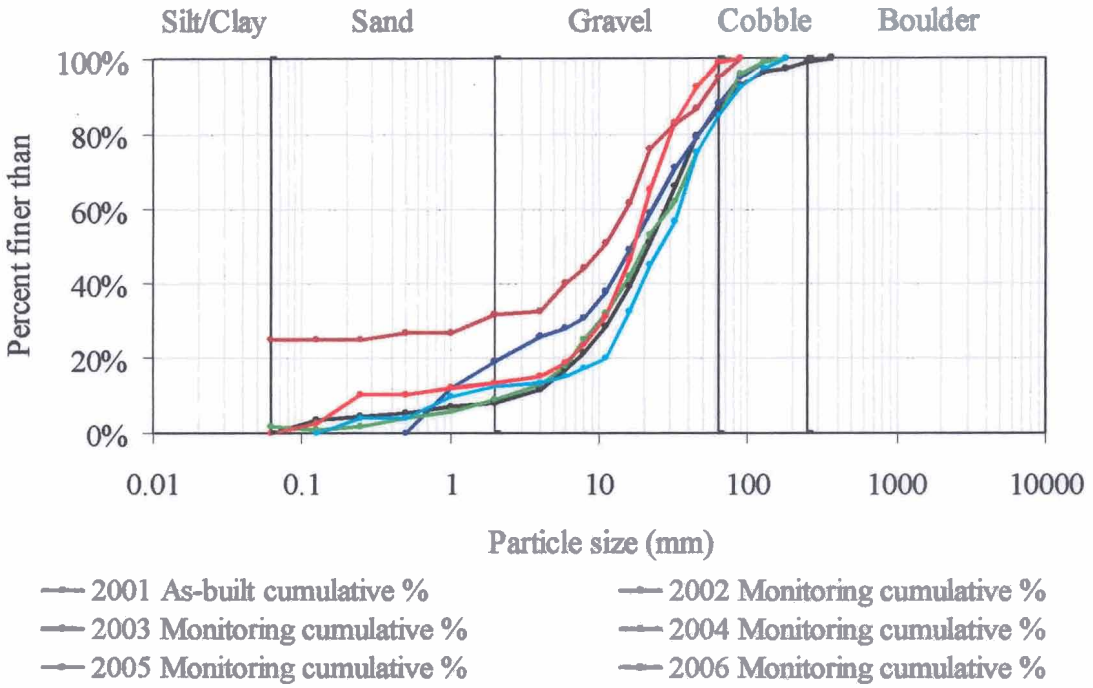


FIGURE 3.7.—Cross-section 3+76, run.

FIGURE 4.—Pebble count comparisons, Carp mitigation site, unnamed tributary to Laxon Creek, Watauga County, 2001-2006.



Size class	Particle size (mm) in year sampled					
index	2001	2002	2003	2004	2005	2006
D_{16}	5.6	0.06	1.5	5.1	6.6	4.4
D_{35}	14.0	4.5	9.6	12.0	17.0	12.0
D_{50}	21.0	11.0	17.0	20.0	26.0	17.0
D_{84}	56.0	36.0	55.0	62.0	63.0	33.0
D_{95}	110.0	64.0	90.0	87.0	110.0	52.0

TABLE 1.—Monitoring of inner berm and bankfull events at the Carp mitigation site based on data from the United States Geological Survey's South Fork New river gage (Number 03161000) near Jefferson, Ashe County, North Carolina and from visual observations.

Date	Gage height (ft)	Flows (cfs)	Comments
2/22-23/03	5.0	2,250	Bankfull event (gage quit working)
3/16/03	4.4	1,725	Inner berm event
4/10/03	5.4	2,819	Bankfull event
4/18/03	5.6	3,200	Bankfull event
6/7/03	4.1	1,820	Inner berm event
6/17/03	4.7	2,000	Bankfull event
8/9/03	4.2	1,450	Inner berm event
8/10/03	4.1	1,400	Inner berm event
11/19/03	5.4	1,880	Bankfull event
2/7/04	4.8	2,080	Bankfull event
9/2/04	11.7	14,700	Bankfull event (hurricane)
9/13/04	8.6	7,550	Bankfull event (hurricane)
9/28/04	6.3	3,820	Bankfull event (hurricane)
6/2-3/05	[a]	[a]	Observed bankfull event
6/14/05	[a]	[a]	Observed bankfull event
7/8/05	4.6	2,000	Bankfull event (tropical storm)
10/7/05	4.0	1,410	Inner berm event (tropical storm)
11/29/05	6.5	4,130	Bankfull event
1/18/06	5.2	2,460	Bankfull event
2/5/06	4.4	1,690	Inner berm event
4/22/06	4.3	1,610	Inner berm event
6/25/06	6.8	4,470	Bankfull event (tropical storm)
6/27/06	5.7	3,130	Bankfull event (tropical storm)

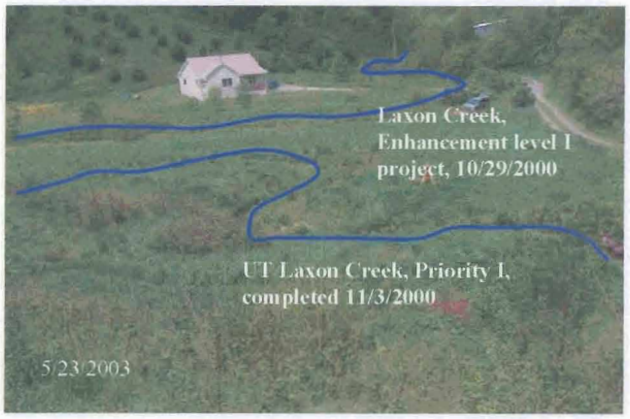
[a]Observations not correlated to gage data.

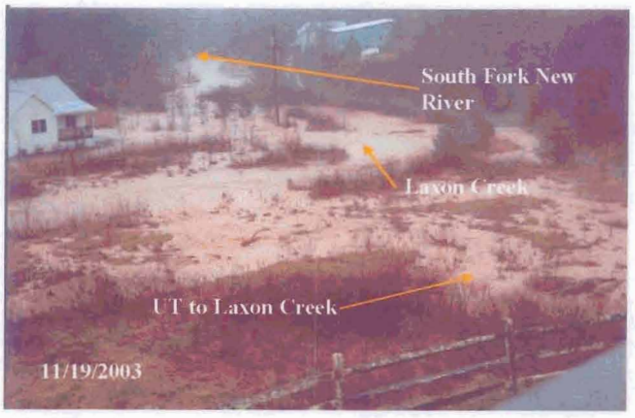
TABLE 2.—Vegetation monitoring results at the Carp mitigation site on an UT to Laxon Creek, Watauga County, 2001-2006.

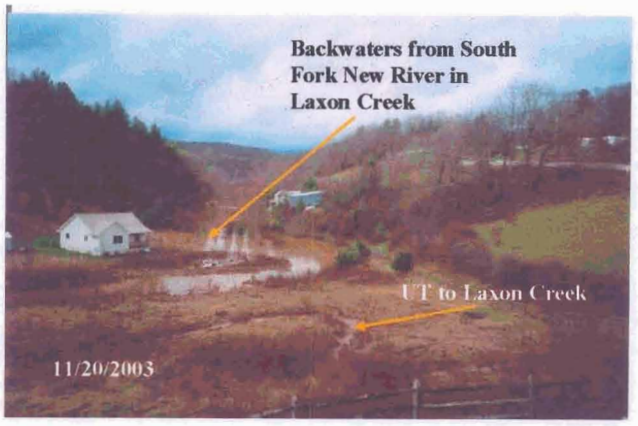
Type of plants Scientific name	Common name	Number planted	2003 stem count	2004 stem count	2005 stem count	2006 stem count
Livestakes						
Cornus amomum	Silky dogwood	94	56	81	83	58
Salix sericea	Silky Willow	77	85	121	98	114
Bare root nursery stock						
Alnus serrulata	Tag alder	35	20	8	5	2
Celtis laevigata	Sugarberry	5	5	3		
Cornus florida	Dogwood	15	8	3	3	3
Diospyros virginiana	Persimmon	72		6	2	
Fraxinus americana	White ashe	65	1	4		5
Juglans nigra	Black walnut	12	9	6	3	
Pinus strobes	White pine	40	10	19	16	10
Prunus serotina	Black Cherry	50	28	27	27	25
Quercus rubra	Northern red oak	57	20	20	19	15
Robinia pseudoacacia	Black locust	8	7	4	2	3
Tsuga canadensis	Hemlock	3	3	1	1	1
Total (trees and livestakes)		533	252[a]	303	259	236[a]
Percent Survival			47%	57%	49%	44%

[a] Stem survival required by DWQ at this 0.67 acre site after 3 years is 214 and after 5 years is 174 stems.

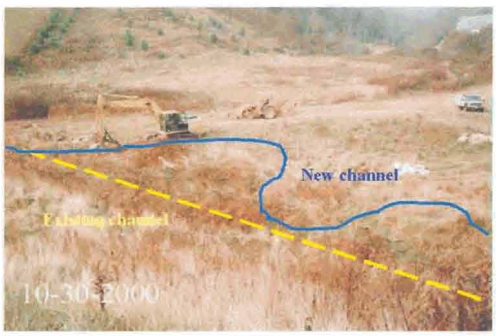
Appendix 1: Carp and Racey sites before, during, and after the November 19, 2003 flood, Watauga County.

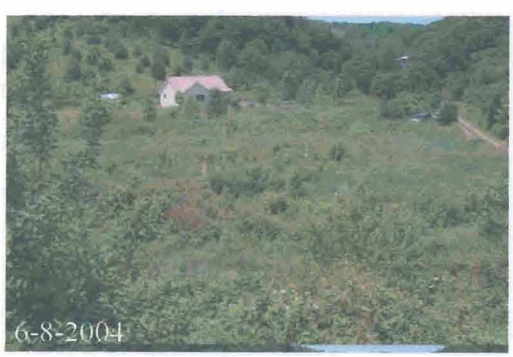






Appendix 2: Overview of Carp restored stream mitigation site, unnamed tributary to Laxon Creek, Ashe County, October 30, 2000 – May 17, 2006.



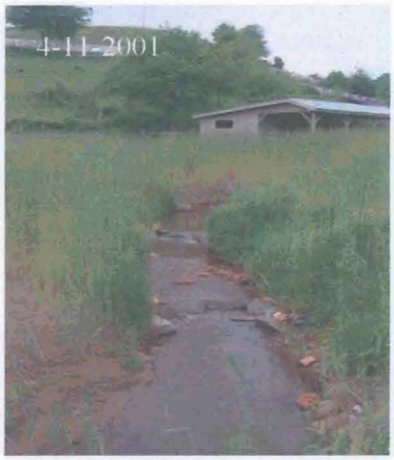


Appendix 2: Continued.

Appendix 3: Photographic log of Carp Priority I stream mitigation site, unnamed tributary to Laxon Creek, Ashe County, looking upstream from station 1+82 to 1+32, November 3, 2000 – May 17, 2006.

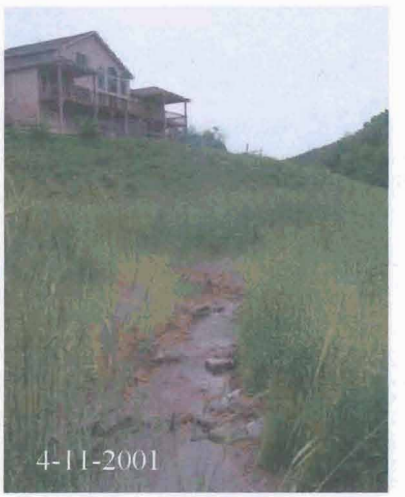
Appendix 3: Continued.

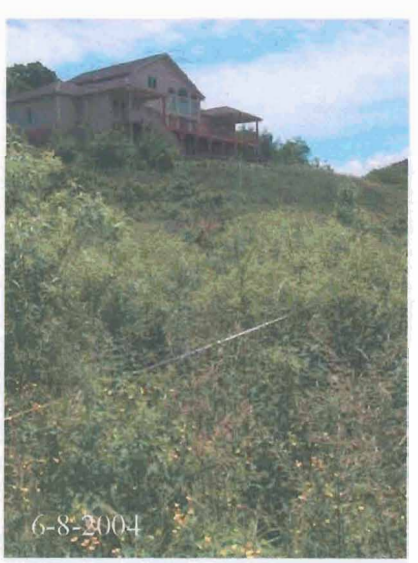
Appendix 4: Photographic log of Carp restored stream mitigation site, unnamed tributary to Laxon Creek, Ashe County, looking upstream from station 2+45 to 1+94, November 3, 2000 – April 24, 2006.



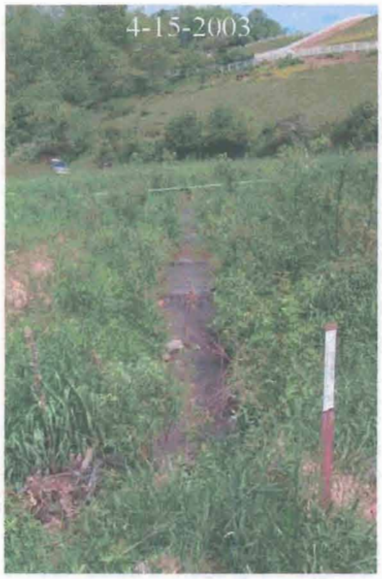
Appendix 4: Continued.

Appendix 5: Photographic log of Carp restored stream mitigation site, unnamed tributary to Laxon Creek, Ashe County, looking upstream from station 3+16 to 2+45, November 3, 2000 – July 21, 2005.





Appendix 6: Photographic log of Carp restored stream mitigation site, unnamed tributary to Laxon Creek, Ashe County, looking upstream from station 4+30 to 3+16, October 30, 2000 – May 17, 2006.



Appendix 6: Continued.

James C. Borawa

From: Jim Wasseen [jimwasseen@earthlink.net]
Sent: Friday, February 23, 2007 7:53 AM
To: Jim Borawa
Subject: FW: p-card receipt

Jim;

Have you sent these into Raleigh?

Jim Wasseen II
NC Wildlife Resources Commission
Watershed Enhancement Technician
<°/,}}}}}}}=<{

-----Original Message-----
From: Burttram, Delila G. [mailto:delila.burttram@ncwildlife.org]
Sent: Thursday, February 22, 2007 12:10 PM
To: Wasseen , Jim
Subject: p-card receipt

Outstanding P-Card Receipts

Jim Wasseen

{Date}	{Amount}	{Vendor}
01/24/07	38.90	USPS
01/26/07	128.00	Duncan Parnell GPS
02/05/07	118.46	Rickly Hydrological

If you have already sent your receipt in, please call me at (919) 707-0089. Otherwise, please email a scanned copy or fax the receipt to (919) 707-0094.

Thank you in advance for your attention to this matter.

Delila Burttram

NCWRC

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