As-built report for the Carp Mitigation Site, Unnamed Tributary to Laxon Creek, Watauga County

North Carolina Wildlife Resources Commission

Joe Mickey and Staci Scott

May 2001

CONTENTS

Introduction

This as-built plan is submitted as part of the fulfillment of the off-site stream mitigation agreement between the North Carolina Department of Transportation (DOT) and North Carolina Wildlife Resources Commission (WRC) for the R-529 US 421 road improvement project in Watuaga County. Under this agreement, a total of 14,814 linear feet of stream mitigation is required by the United States Army Corps of Engineers (COE) and 7,407 linear feet of mitigation for the North Carolina Division of Water Quality (DWQ). The purpose of this report is to summarize 538 linear feet of stream restoration at the Carp site on an unnamed tributary to Laxon Creek, Watauga County.

Preconstruction Site conditions

The Carp site (Figure 1) is located in the South Fork New River Watershed on an unnamed tributary to Laxon Creek. Drainage area of the site is 448 acres (0.7 sq mi.). The lower end of the project begins with the tributary's confluence with Laxon Creek. The watershed is developed with a low density of homes with the primary land disturbing activity in the watershed being agriculture. Most of the hillsides and valleys are used for cattle grazing, hay production, and Christmas tree farming. A significant portion of the watershed remains in secondary growth forest. At the present time, there is some conversion of agricultural land to single family home sites. Sedimentation of the stream comes from livestock pastures and gravel roads.

Determining stream type at this site was complicated by past stream channelization activities. Channel sinuosity was 1.1. The stream should have had a meandering pattern through the pasture. Based on entrenchment ratio (1.57), width/depth ratio (6.92), slope (0.02) and streambed materials (D-50 = 11.5 mm), the stream was classified as a B4c stream type (Table 1). Soils at the site were Class 4A - Nikwasi loam, found on 0 to 3% slopes. These soils are very deep, poorly drained soils on floodplains in the Southern Appalachian Mountains.

Some bank erosion was occurring at several locations, with the most severe bank erosion occurring between the lower fence line and Laxon Creek. The entire reach is void of shrub/tree riparian vegetation except for the upper fourth of the channel along the left bank (looking downstream) on the steep hillside. This area contains a small stand of alders and white pines. Fish habitat is considered fair to poor due to the lack of overhead cover (shrubs/trees), undercut banks, and a lack of pools which make up only 27% of the reach.

Project Objectives

The objectives at this mitigation site were to improve water quality, fish habitat, riparian quality and stream stability of the unnamed tributary on the Carp property. The primary activity used to achieve these goals was a Priority I restoration (new channel on new location) at the site.

Specific objectives at the Carp site were:

1. Construct a meandering E/C channel through the middle of the pasture on a new alignment. This will reestablish proper stream dimension, pattern and profile in the pasture. The new channel construction will be based on a reference E/C stream channel reach (unnamed tributary to Peak Creek, Ashe County).

2. On the lower fourth of the stream channel not to be reconstructed, slope stream banks where appropriate so that they are more resistant to flooding and bank erosion.

3. During construction of the new channel, salvage sod mats for later placement along the new stream banks.

4. Install rootwads and/or rock vanes or rock weirs where appropriate in the new channel to reduce future bank erosion and to provide long term bank stability and fish habitat.

5. Plant native trees, shrubs and ground cover on all disturbed banks and along the new channel to provide long term bank stability, stream shading, and cover and food for wildlife. This effort will be coordinated with the NC Forest Service, which has already developed a reforestation plan for the site.

6. Earth removed for construction of the new channel will be stockpiled for later filling of the old channel. Once filled, the old channel will be seeded based on Objective No. 5.

Conservation Easement

In order to ensure long term protection of the site, a conservation easement was signed by the landowner, DOT and WRC on September 25, 2000. The conservation easement puts limitations and restrictions on 0.67 acres of land that includes the restoration site and riparian zone. The conservation easement is perpetual and will be held by the WRC. The conservation easement is described in Book 527, page 728, of the Watauga County Registry and plat titled "Conservation Easement" recorded in Plat Book 15, page 132 of the Watauga County Registry. A copy of the conservation easement was submitted to DWQ and COE.

Channel Modifications

Construction at the site was carried out through an informal contract with Rick's Excavating. Work began on November 3, 2000 and was completed on November 7, 2000 for a total of 3 days at the site (Photos). The contractor provided one trackhoe, one backhoe with loader, and one dump truck. Access to the site was from SR 1353 and across land owned by Mr. and Mrs. Fred Racey. Work began by hauling approximately three dump truck loads of rock and two dump truck loads of root wads from the nearby US 421 construction site. These materials were stockpiled at the site and moved as needed by the backhoe.

The project's main goal was to construct a new channel, Priority I restoration, approximately 344 feet in length from station 1+41 to station 4+97 (Figure 2). This would increase stream length from 395 feet to approximately 592 feet. We began construction of the new channel at the lower end at Station 4+32 and worked upstream to Station 1+28. Total length of the new channel was 304 feet. Total length of the project was 538 feet (new and existing channel). During excavation, soil was stockpiled between the old and new channels. New banks were sloped and sod mats salvaged from the site were used to stabilize the new banks. In some areas a blanket of erosion control fabric was installed to provide temporary bank protection until vegetation could be established. Rock weirs, rock vanes, and log vanes were installed in the new channel as work progressed. These structures were to assist with bank protection and with creation of fish habitat. At the outside of five meanders, root wads were installed for bank

protection and fish habitat. Below rock weirs and at the outside of meanders, holes were dug at the convergence points of the water velocities so that pools could be maintained.

We constructed a rock weir on the downstream side of the existing ford (Station 4+73) in order to prevent head cutting at this site and elimination of the ford. From below the ford to the confluence with Laxon Creek we sloped the left bank to eliminate a vertical eroding bank.

The pre-construction and post-construction longitudinal profiles (Figures 3 & 4) show how the priority I construction has increased stream length and deep-water habitat. The scour action of root wad meanders, rock weirs, and rock and log vanes can be observed from the as-built profile (Figure 4). Pool habitat has increased from 26% to 44%. The weirs and vanes are creating the desired deep-water habitat and sorting bed material in a way that will provide needed fish spawning gravel.

Figure 5 summarizes post and pre-construction pebble count data. Post-construction pebble count data for the reach shows a decline in particle size when compared to pre-construction data. This can be explained due to an increase in pool habitat which contains smaller particle sizes and a decease in slope following construction (B to C channel type). As the stream bottom becomes more stable over time, it is expected that particle size through the reach should increase slightly.

Figure 6 shows post construction cross-sections of the new channel. These cross-sections will be used to monitor long-term channel stability. Based on data from the riffle cross-section at station 2+24 (Figure 6c), the new channel is classified as a C4e (Table 1).

Riparian Improvements

During construction, sod mats salvaged from the site were used to provide instant bank stability and long term erosion control. Sod mats had the advantage of containing an established seed mix. On sites where sod mats were not used, the area was seeded with a native riparian mix and cover crop of winter wheat and rye. After seeding, an eight-foot wide straw erosion control blanket was used to cover the soil. These blankets were used to stabilize the soil surface until a vegetative cover could be achieved and to contribute to soil stability after vegetation is established. As the straw blankets decompose over a 2-year period, permanent vegetation should be well established. Since the site was seeded in early November, only the winter wheat and rye spouted over-winter as the native vegetation lay dormant. By this spring, both the existing native vegetation and seeded areas were experiencing good growth. It is expected that native vegetation will be well established the end to the summer.

Four hundred forty (440) live stakes and bare root nursery trees were planted on the 0.67 acre site during March 2001. Live stakes, collected form nearby stream corridors, were silky dogwood (*Cornus amomum*), silky willow (*Salix sericea*), and black willow (*Salix nigra*). Bare root trees from the NC Forest Service were northern red oak (*Quercus rubra)*, black cherry (*Prunus serotina*), persimmon (*Diospyros virginiana*), sugarberry (*Celtis laevigata*), white ash (*Fraxinus americana*), and white pine (*Pinus strobus*). We had hoped to plant tag alder (*Alnus serrulata*) at the site but a source could not be located. The site will be monitored to ensure that a good stand of trees is established.

Livestock Management

Livestock is not grazed at this site so livestock management practices were not installed for this project. However, if livestock are allowed to graze the area in the future, language in the conservation easement requires that the landowner install fencing at his expense to protect the restoration project.

Conclusion

Through natural stream design, a new C channel containing proper pattern, dimension and profile was constructed at the Carp site (Table 1, Photos). Water quality should be improved through reduced sedimentation from eroding banks. As the riparian zone matures, water temperatures should decrease, improving the likelihood that trout could once again inhabit the stream. In-stream habitat has been increased for fish and aquatic invertebrates. Both aquatic and wildlife species will benefit with the return of a functioning riparian corridor and stream aesthetics have been improved.

Figure 1. Site Map

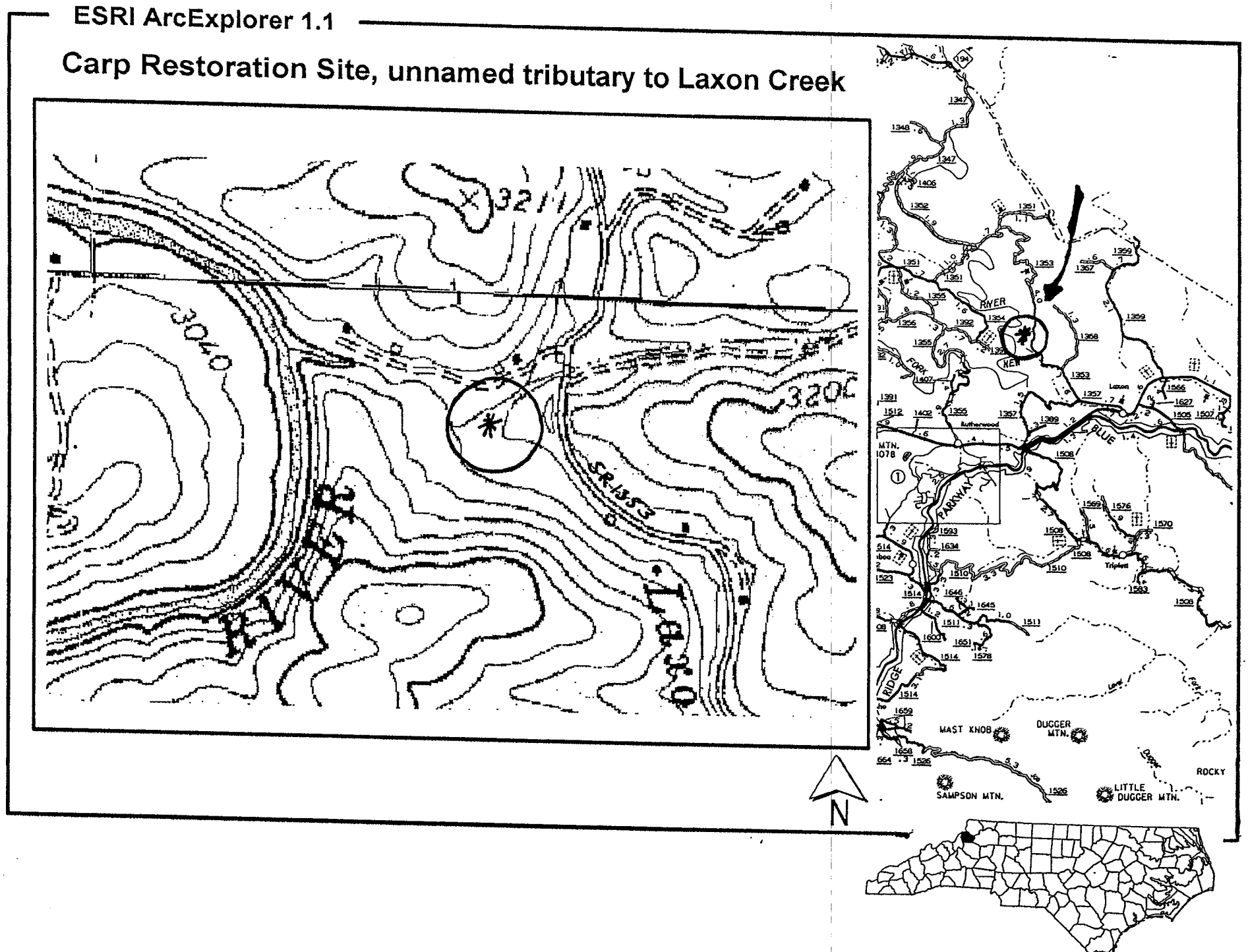


Figure 2. Plan View of New Channel

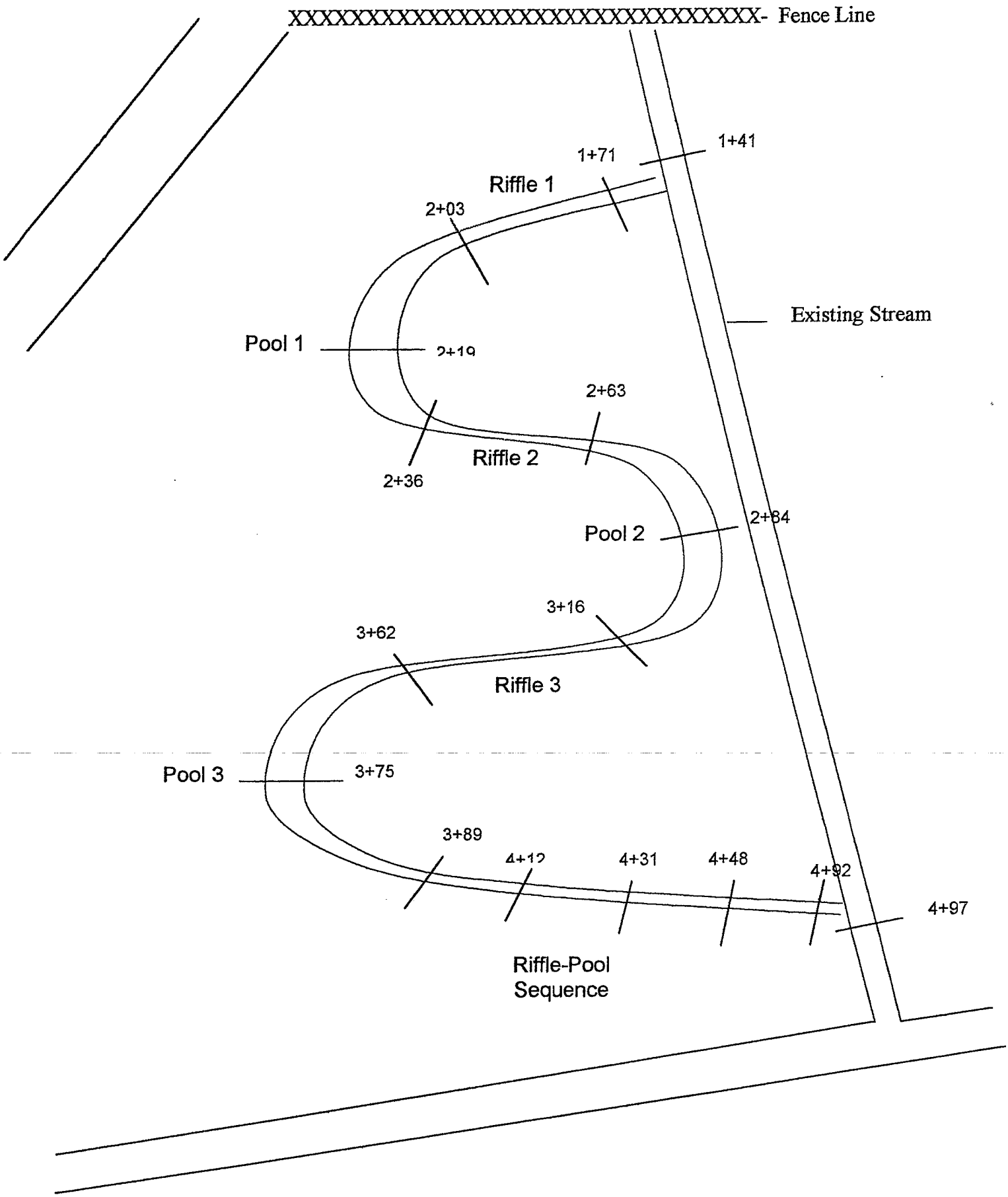


Figure 3. Pre-Construction Longitudinal Profile - Carp Site, UT Laxon Creek

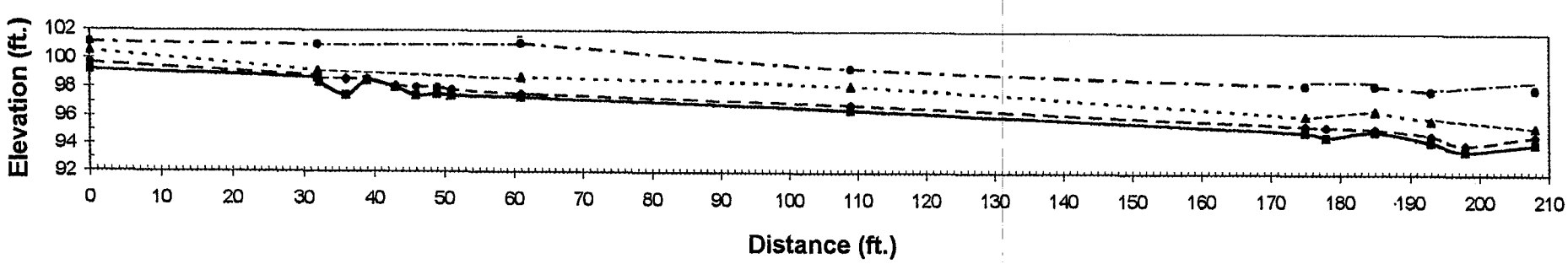
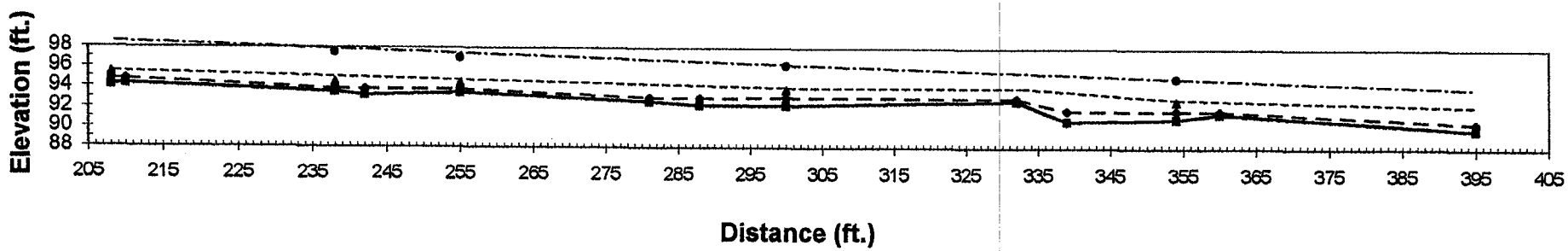


Figure 3. (cont.) Pre-Construction Longitudinal Profile - Carp Site, UT Laxon Creek



Thalwag elevation
Bankfull
Water Surface
Top of Bank elevation

Figure 4. Longitudinal Profile Carp - UT Laxon Creek
Post-Construction

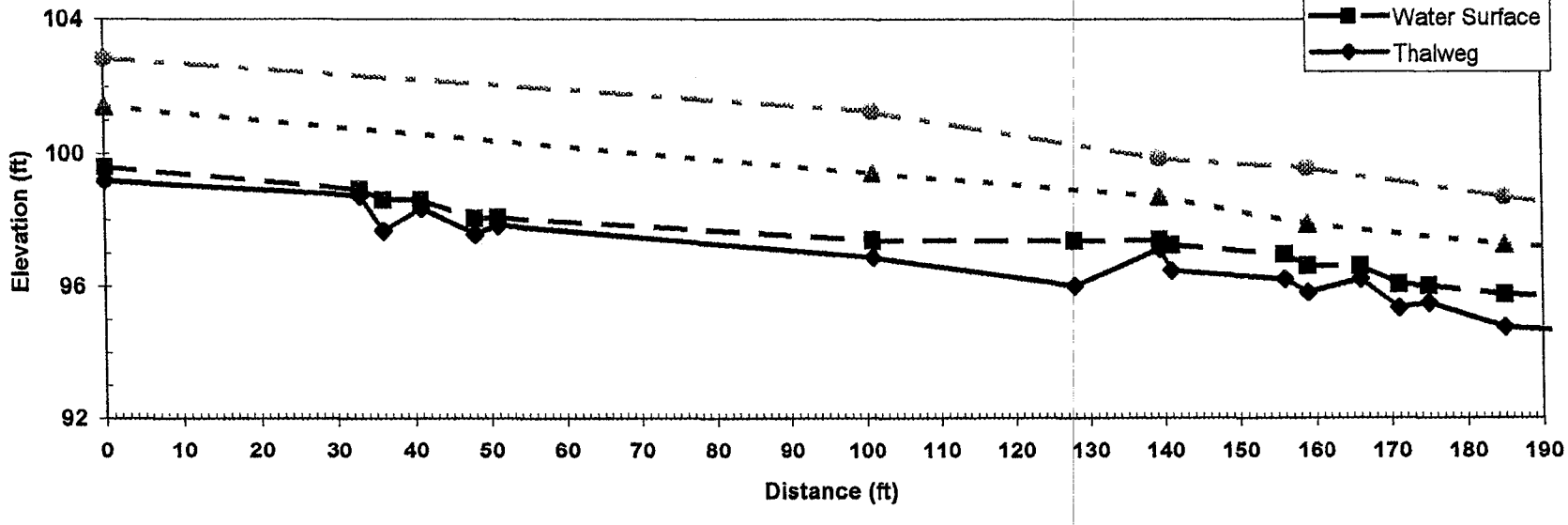


Figure 4. (cont) Longitudinal Profile Carp - UT Laxon Creek
Post-Construction

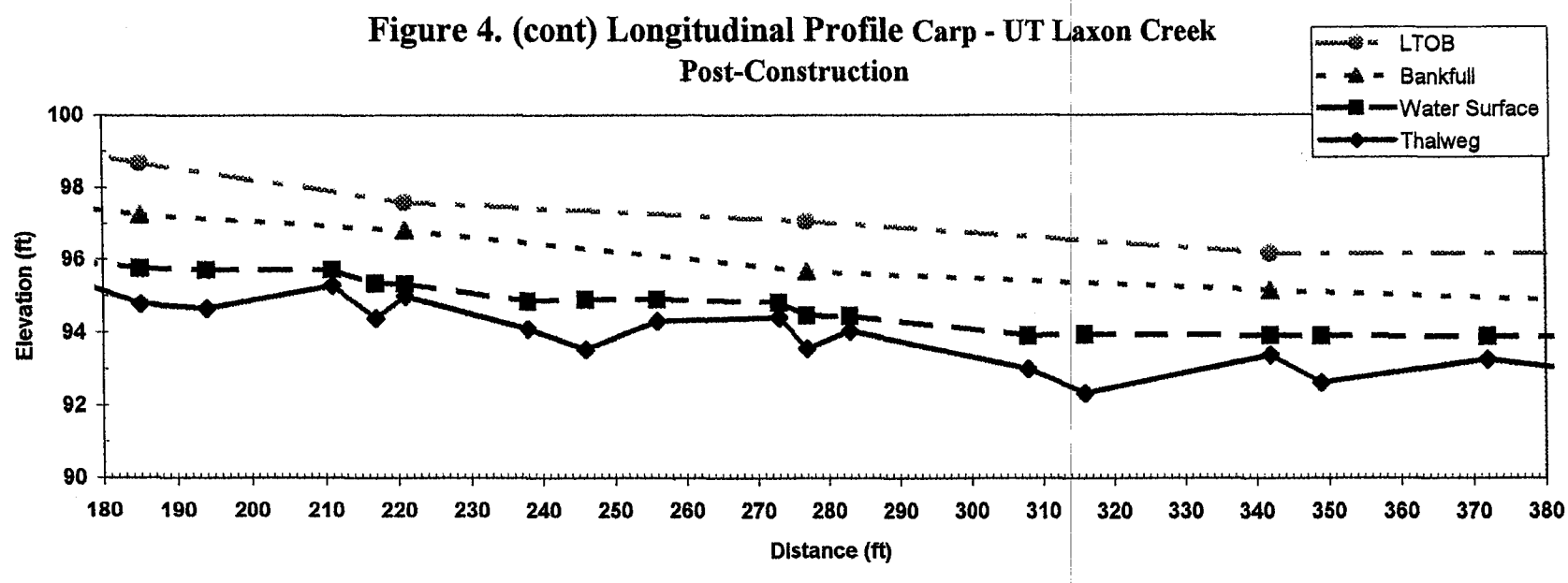


Figure 4. (cont) Longitudinal Profile Carp - UT Laxon Creek
Post-Construction

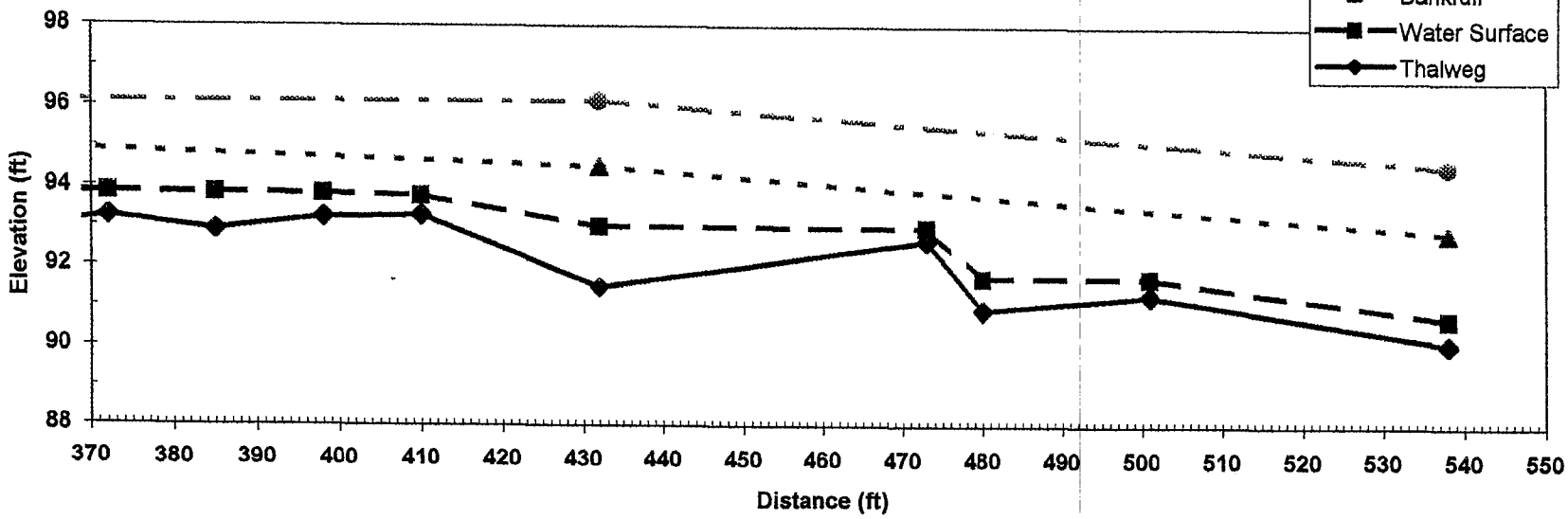
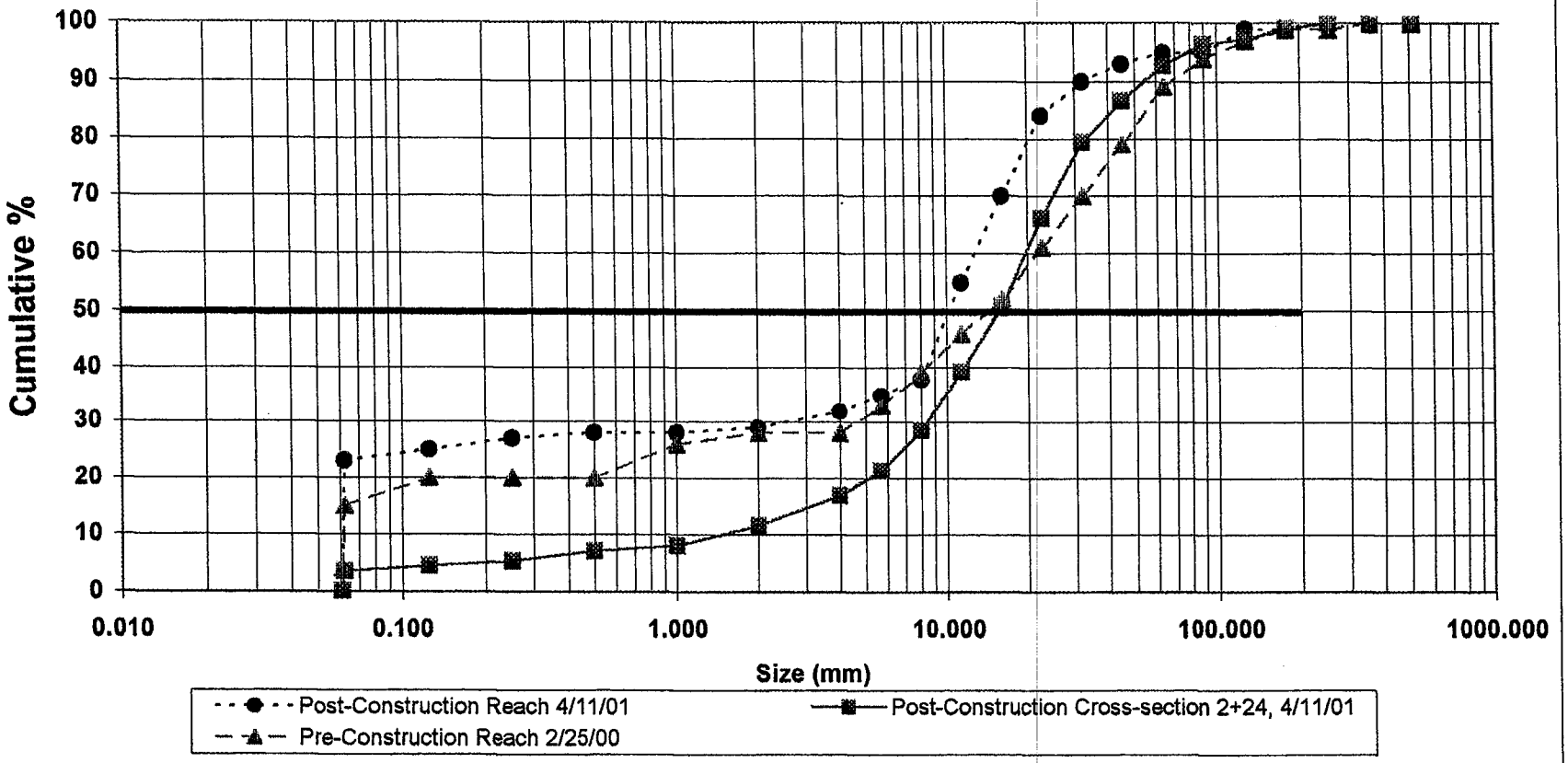


Figure 5. Pebble Count Carp - UT Laxon Creek



Post-Construction Reach Particle Sizes (mm):		Post-Construcion X-Section Particle Sizes (mm):		Pre-Construction Reach Particle Sizes (mm):	
D16	0.02	D16	4	D16	0.065
D35	5.7	D35	10	D35	6
D50	10	D50	16	D50	15
D84	22.6	D84	40	D84	60
D95	64	D95	90	D95	91

Figure 6a. Carp - UT Laxon Creek
Cross Section STN #1+69 Stair step pool

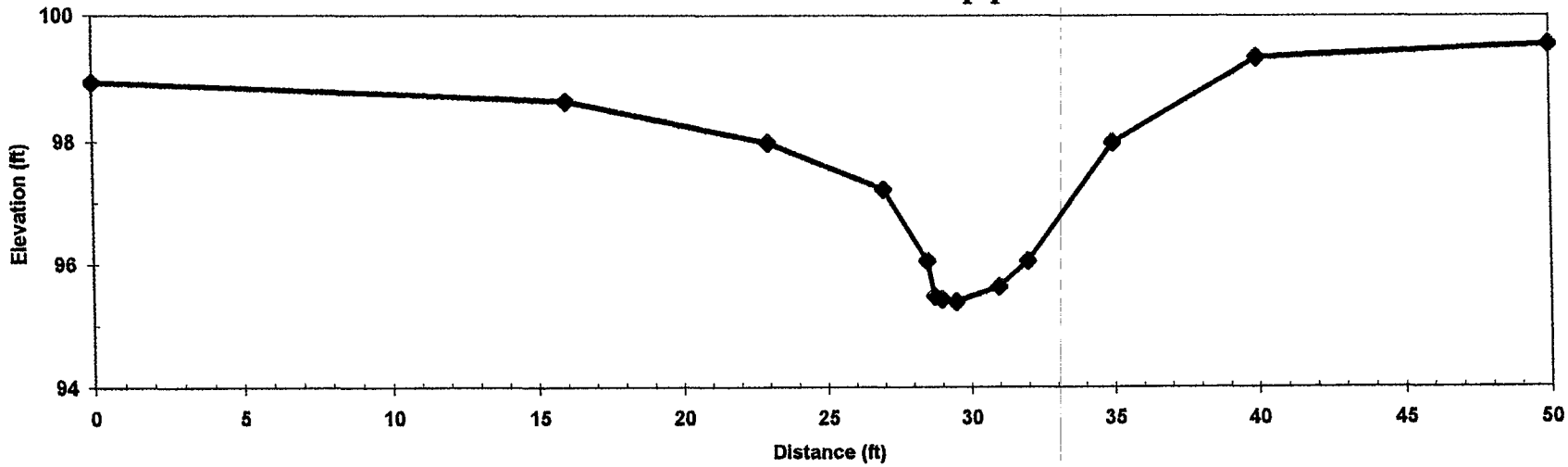


Figure 6b. Carp - UT Laxon Creek
Cross Section STN #1+94 Pool

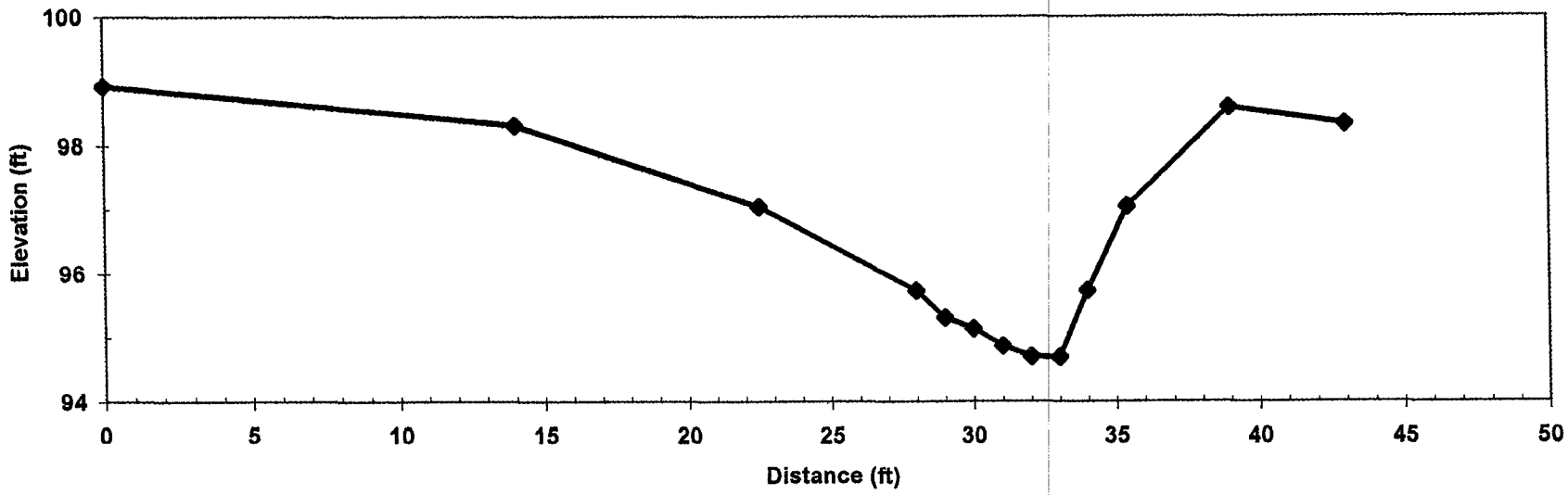
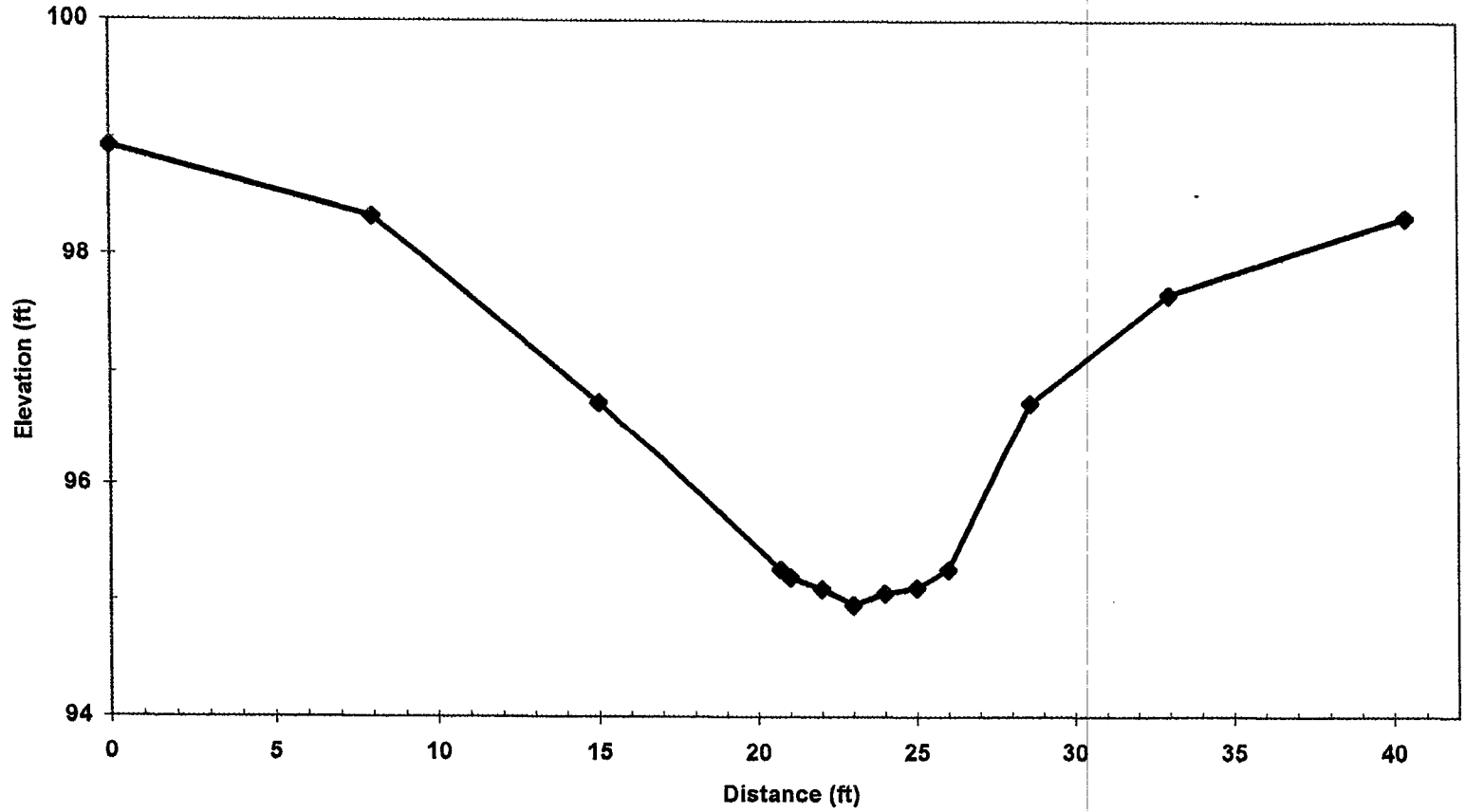


Figure 6c. Carp - UT Laxon Creek
Cross Section STN #2+24 Riffle between rock weirs



2+24	Feature	Type	Wfpa	LBKF	RBKF	ELEVbkf	Wbkf	Dbkf	W/D	Abkf	Dmax	ER
Existing	Riffle	C4e	40	15.0	28.6	96.74	13.6	0.9	14.4	12.9	1.8	2.9

Figure 6d. Carp - UT Laxon Creek
Cross Section STN #2+45 Pool

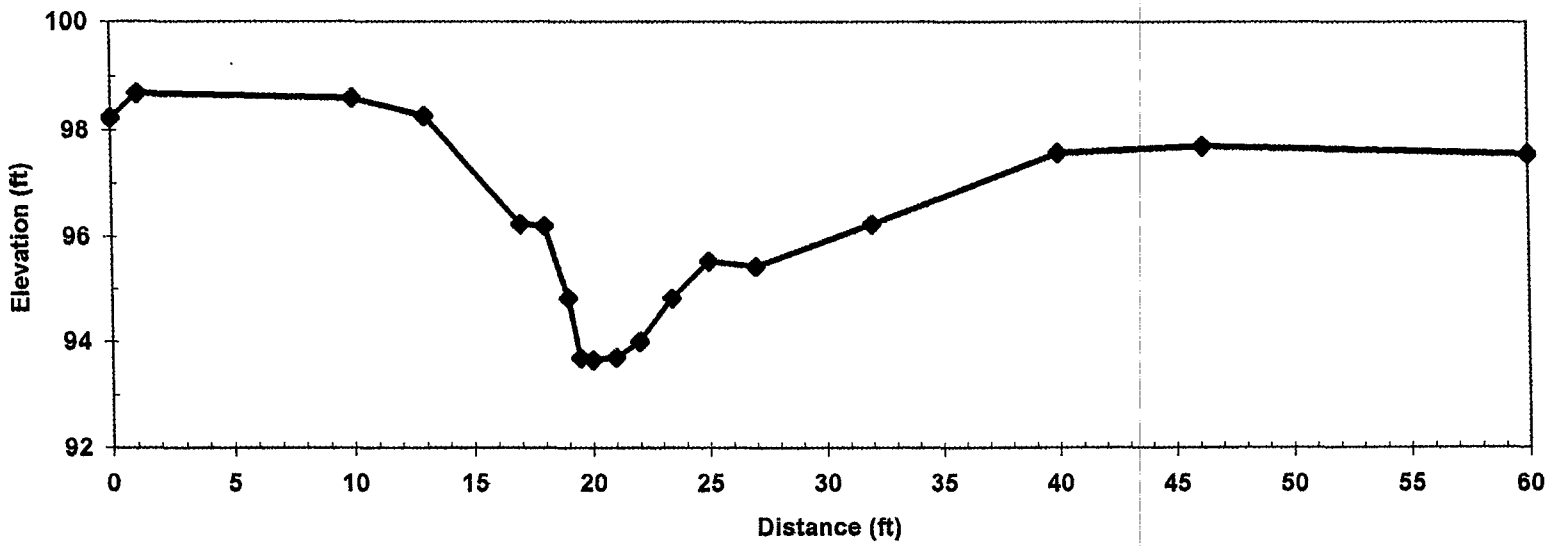


Figure 6e. Carp - UT Laxon Creek
Cross Section STN #2+79 Step pool

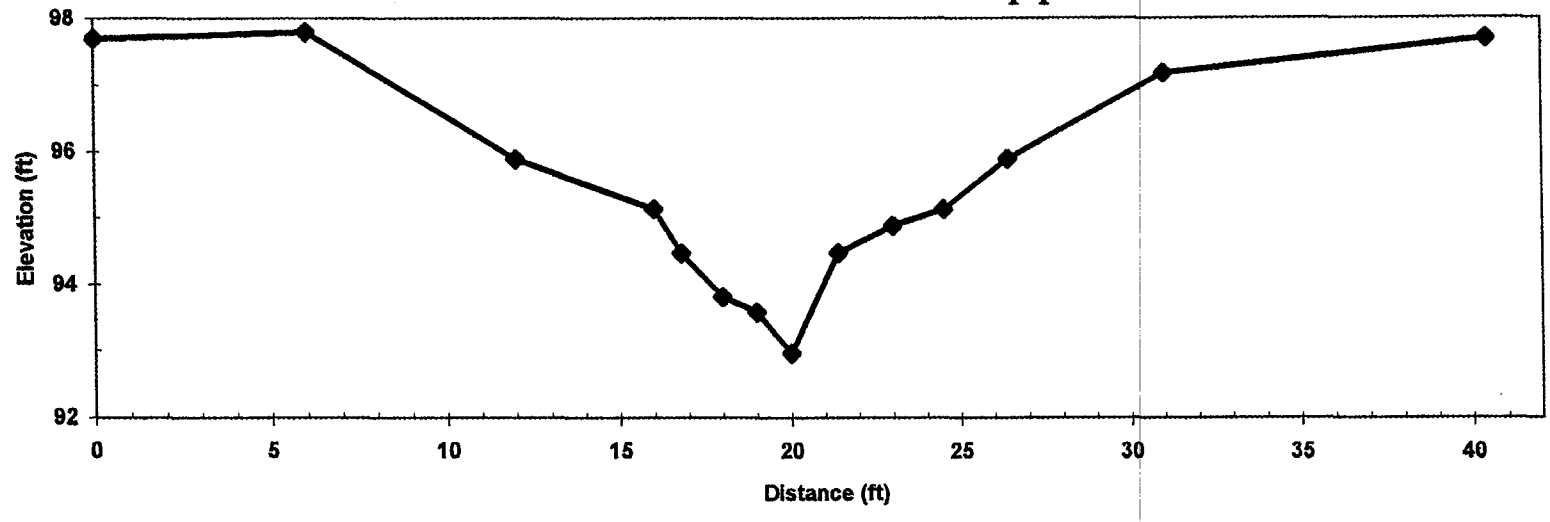


Table 1. Stream Reach Data

Stream Name: **Unnamed tributary to Laxon Creek** Date **10/04/2000 & 5/25/2001**

Basin Name: **NEW** Drainage Area: **448 Acres, 0.7 MI^2**

Location: **Carp property at confluence with Laxon Creek. 421 Stream Mitigation Site**

Observers: J. Mickey, M. Martinez, S. Scott

	Stable X-Section Stn.	Design	Post-Construction XS 2+24	Regional Curve Data
Bankfull WIDTH (W_{bkf}):	7	14	13.6	12-14
Mean DEPTH (D_{bkf}):	1.01	1.1	0.9	1.5
Bankfull X-sectional AREA (A_{bkf}):	7.08	15-17	12.9	14.3
Width / Depth RATIO (W_{bkf}/d_{bkf}):	6.92	13	14.4	
Maximum DEPTH (d_{mbkf}):	1.53	1.5	1.8	
WIDTH of Flood-Prone Area (W_{fpa}):	11	30	40	
Entrenchment Ratio (ER):	1.57	2.5	2.9	
Channel Materials D50:	16	16	16	
Water Surface SLOPE (S):	0.02	0.02	0.017	
Channel SINUOSITY (K):	1	1.6	1.35	
STREAM TYPE:	B4	C4	C4e	

Photos

Priority 1 Restoration

Carp site, unnamed tributary to Laxon Creek, Watauga County. Nov. 3, 6-7, 2000

New channel location before construction.

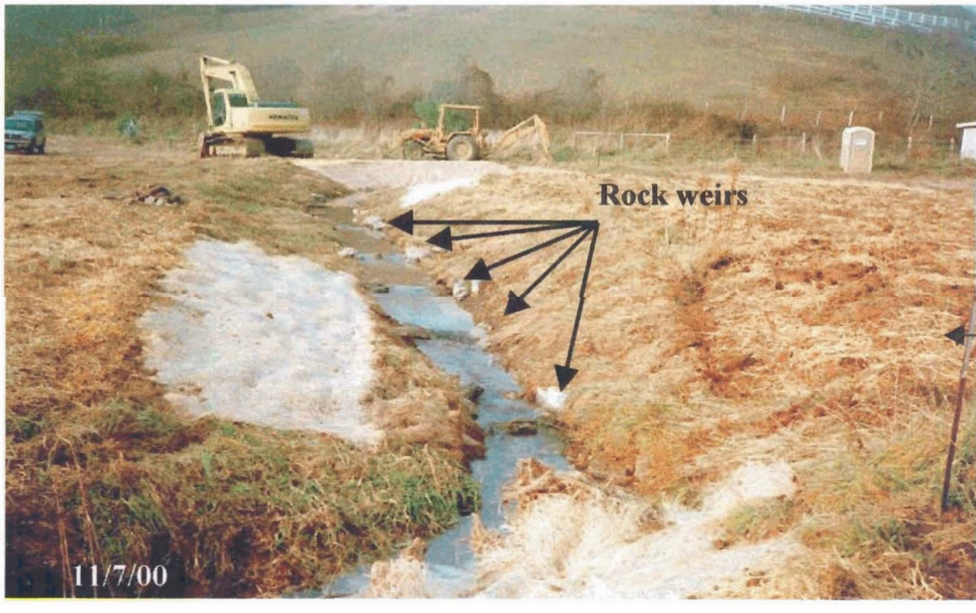
Construction of new channel pools and riffles. The outside of meanders are stabilized with root wads.

New Channel completed, station 1+28 - 4+32.

Photos continued

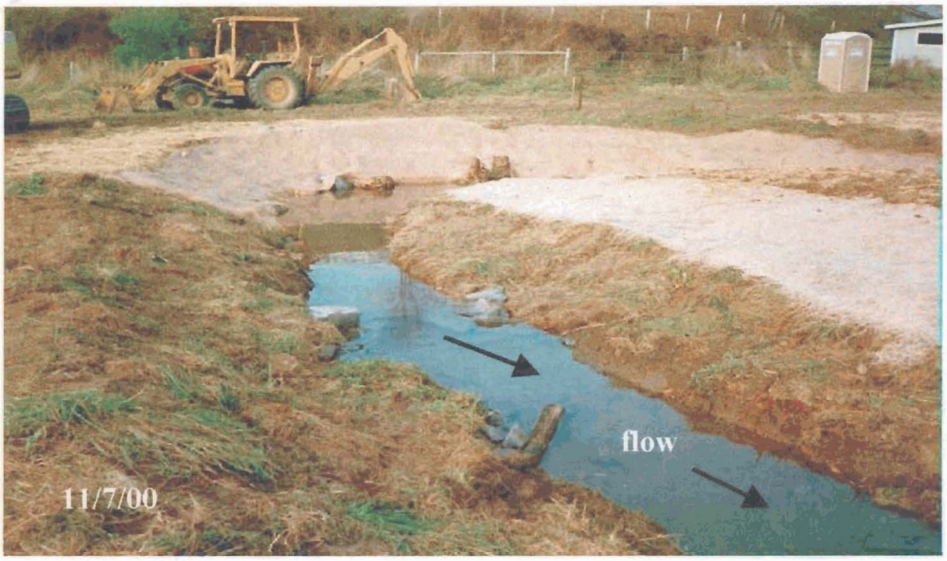
Location of new channel at lower tie-in with existing stream, station 4+32.

Completed new channel before water is diverted into it. Looking upstream from station 4+32 to 3+16.



New channel, lower section, looking upstream from station 4+32 to 3+16.

Photos continued

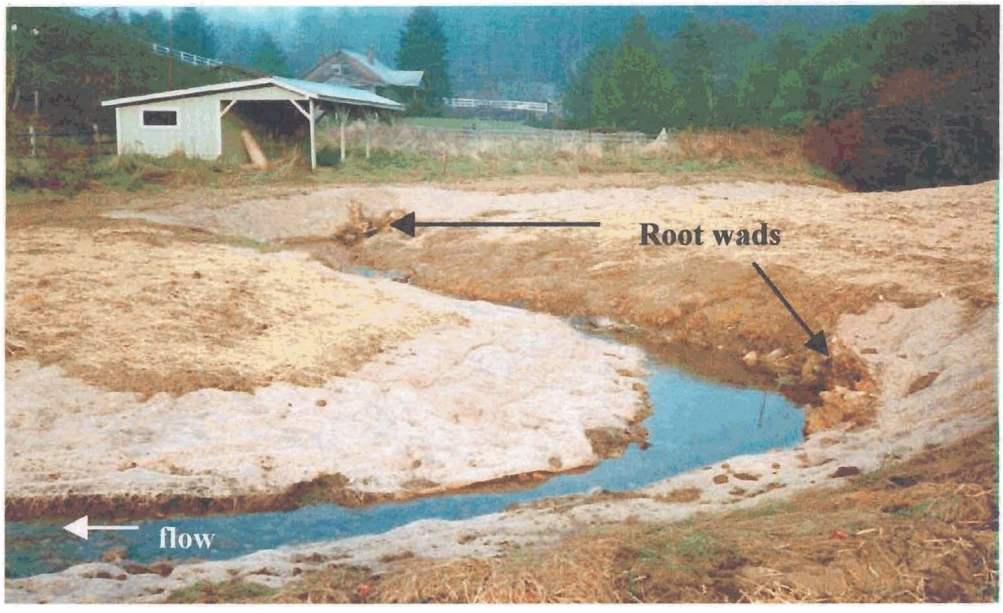


New channel showing first meander and deep run, station 3+46 to 3+16.

First meander showing root wads and constructed point bar, station 3+16.

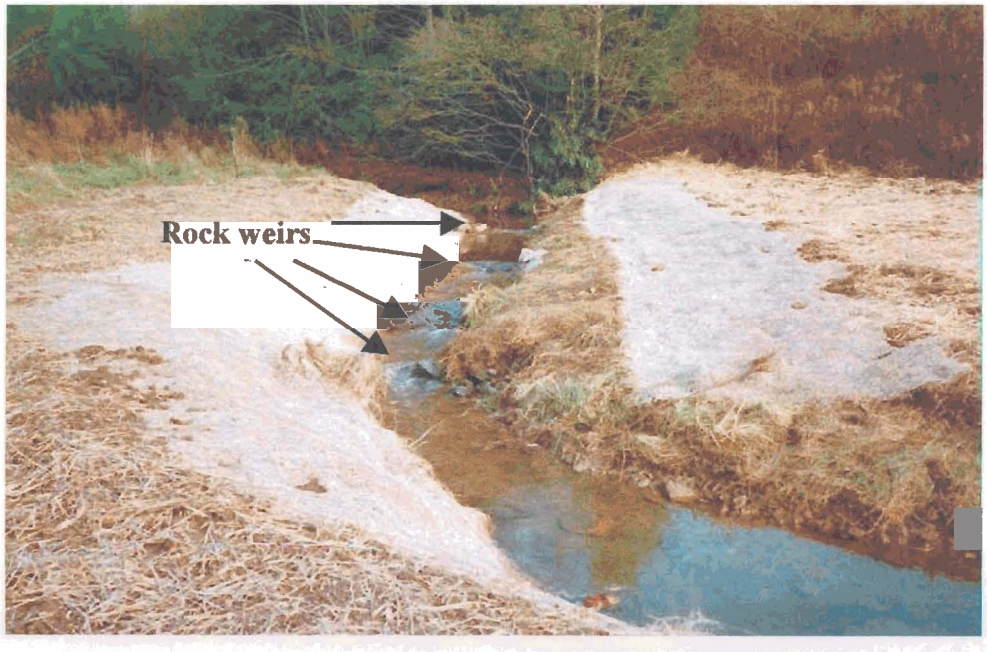
Looking upstream from first meander to second meander , station 3+16 to 2+46.

Photos continued



Looking upstream from second meander to third meander, station 2+46 to 1+59

Riffle section between second and third meander, station 2+46 to 1+59.



Looking upstream from third meander pool to tie-in with existing channel. Note the step/pool riffle complex, station 1+59 to 1+28.