YEAR ONE MONITORING REPORT

Jefferson Pilot Stream Restoration
Guilford County, North Carolina

N.C. Wetlands Restoration Program
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1.0 INTRODUCTION

The North Carolina Wetlands Restoration Program (WRP) requested that Earth Tech conduct the year one monitoring study on the Jefferson Pilot Stream Restoration in Guilford County, North Carolina.

The objective of this study was to measure and document site conditions and compile a photographic log of the current stream for the Year One monitoring period. Monitoring includes the measurement of the restored channel dimension, pattern, profile, channel substrate, and riparian vegetation. Monitoring was established to fit within the US Army Corps of Engineers guidelines for monitoring of stream restoration projects.

This report is broken into five main components:

1) Assessment of the stream channel geomorphology
2) Assessment of the vegetation in the riparian buffer
3) Photographic reference points comparing As-built to Year One conditions
4) Maintenance recommendations based on findings

1.1 Methodology

Year-1 monitoring of geomorphic and vegetative conditions was performed on the Jefferson Pilot Stream Restoration project. Refer to the Stream Mitigation Monitoring Report for the methodologies used in the Year One monitoring.

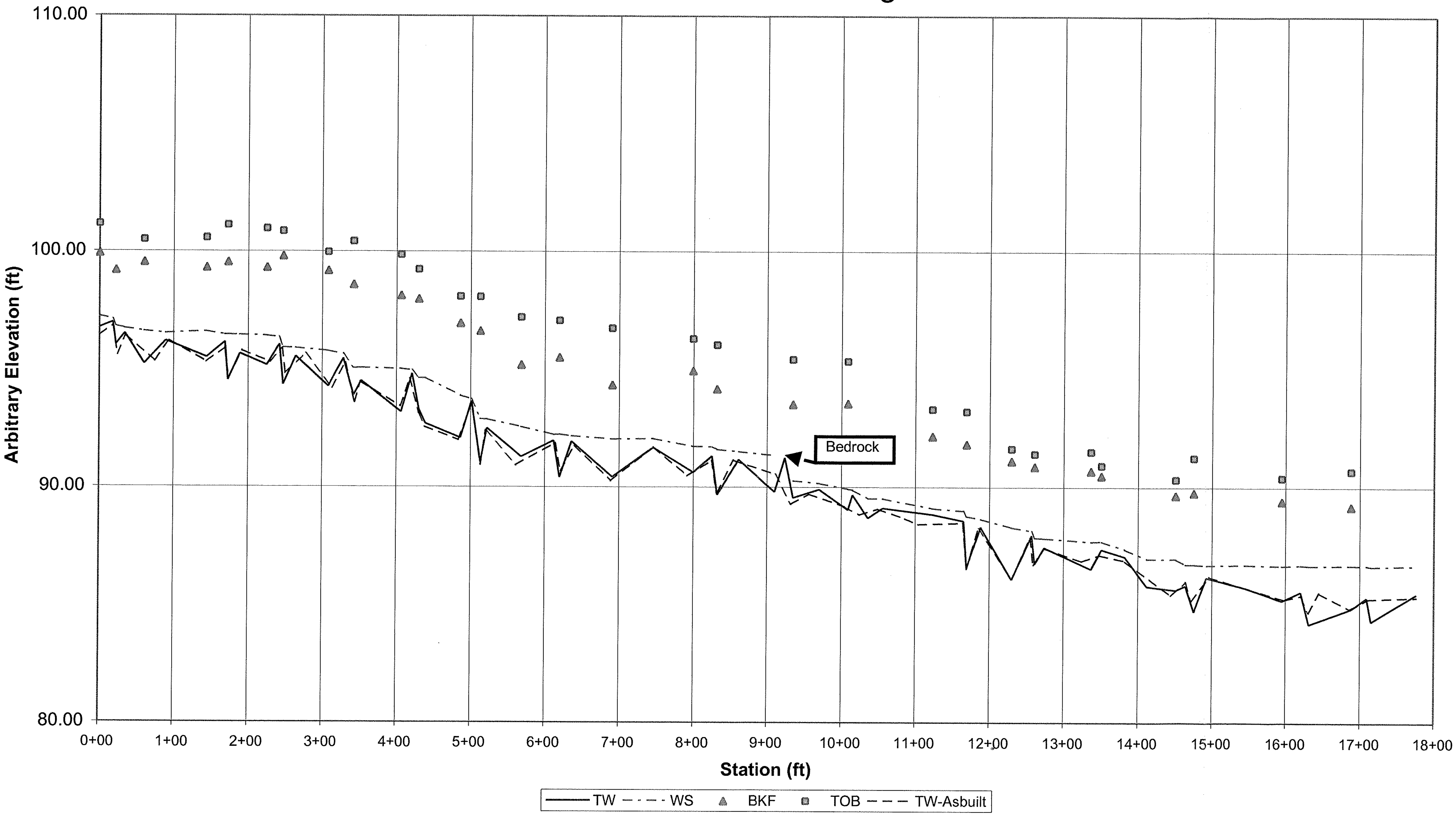
1.2 Geomorphology

The dimension, pattern, and profile of the channel were evaluated on the stream for approximately 1776 feet along the thalweg. The dimension was assessed through four (4) cross-sections, profile through a longitudinal profile, and the pattern was visually assessed. In addition, pebble counts were taken at each of the cross-sections to determine if the bed is coarsening in the riffles and if the pools, in general, have a finer material than the riffles. In the following sections, the results of the Year One geomorphological monitoring are discussed.

1.2.1 Longitudinal Profile

A longitudinal profile of the stream was conducted on December 17, 2002. The survey began at the fence that crosses the stream near the property boundary and ended at the culvert beneath Hobbs Road. The elevations of the thalweg, water surface, bankfull, and build-out bench were measured at the head of each riffle, max pool, and at each cross-vane. In addition, max pool depth and water surface were taken below each cross-vane to monitor the change in the scour pool depth. Figure 1 depicts the Year One survey with the thalweg of the As-Built conditions overlaid for comparison.

Figure 1: Longitudinal Profile
Jefferson Pilot Stream Restoration
Year 1 Monitoring



In general, the bed features have remained in about the same location since the as-built survey conducted on April 11, 2002. In a few places, the pool below the cross-vane appears to have moved slightly upstream or downstream. However, the stations on the head of cross-vane were typically different from the As-Built conditions survey to the Year One conditions. In order to determine if the pool below the cross-vane had moved, the difference between the cross-vane station and the station of the maximum pool below each cross-vane was summed and divided by the total number of cross-vanes for both the as-builts and the Year One surveys. On the As-built survey, the average distance from the top of the cross-vane to the max pool was 7.5’ while it was 7.6’ on the Year One survey, which is essentially the same.

The depth of pools were measured from the thalweg shot on the top of the cross-vane and the max pool below the vane. The difference between these values were used to determine the change in the depth of the scour pools. The depths of the pools, on average, tended to increase in depth by about 1.7 inches or 0.14 ft. The range of values can be found in Table 1.

Table 1. Maximum Cross-Vane Pool Depth

	Minimum Depth (ft)	Average Depth (ft)	Maximum Depth (ft)
As-built	0.70	1.38	2.62
Year 1	0.95	1.52	2.59

A fraction of these differences between the As-Built and Year One survey may be explained through man-induced error. Some of these errors include, the differences in the pulling of the tape along the thalweg or in the rounding (up or down) to the nearest station when reading the tape. In addition, the thalweg on the cross portion of the cross-vane sometimes is not actually on the cross rock. Therefore, the location where the rod-man is holding the rod can affect the reported values.

The overall bed slope of the channel has remained the same from the As-Built to the Year One monitoring period at 0.0059 ft/ft. The water surface slope was 0.0062 ft/ft during the As-Built survey and 0.0064 ft/ft in the Year One survey, a minor difference.

1.2.2 Cross-Sections

The four cross-sections were surveyed to establish the dimensions of the channel using standard differential leveling techniques and equipment. The cross-sections that were measured in the Year One survey were overlaid on top of the As-Built cross-sections to give a visual representation of any changes that might have occurred. Appendix A contains these graphs and the data for each cross-section including pictures of each cross-section. The riffle cross-section at Station 4+54 has remained basically the same except for the bed material (discussed in Section 1.2.4). A small bar is forming on the inside of the meander on the pool Cross Section at Station 6+86. This bar can be located in the photograph by the vegetation that is growing on the bar. The third cross-section, a riffle at Station 7+52, has undergone changes since the As-Built survey due to overland flow from the left bank. The coir matting has been undercut by the overland flow and poses a problem in the long term. This problem is discussed in more detail in Section 2.1. The riffle at Station 15+11 has remained the same with regards to cross-sectional area and shape.

1.2.3 Pattern

The pattern of the channel was not measured in the field due to lack of time and since it has not changed since construction. The majority of the meanders contain rootwads that prohibits the direct measurement of radius of curvature. Therefore, the radii were taken from the drawings. The radius of curvature ranges from 47.5 to 84.5 with an average of 63.5. The meander wavelength ranges from 118.0 to 197 with an average of 154.1. The Belt width ranges from 49-80 above the culvert and 52-95 below the culvert.

1.2.4 Pebble Count

A pebble count was taken at each cross-section to determine the particle size distribution of the channel materials. The data was entered into a spreadsheet to calculate the cumulative percent by particle size class. These values were plotted on log-normal scale. The D50 and the D84 particle sizes are listed in Table 2 and on the graphs contained in Appendix A. From the graphs, it can be seen that the bed material of Riffle #1 (4+54) appears to have become finer since the as-built. This is heavily influenced by the riprap that was placed in the bed during construction. Some of this material has been transported downstream, which makes this riffle appear to have increased in fineness. The pool (6+86) has become finer below the D70 and has increased in coarseness beyond the D70. The riffle at Station 7+52 has become coarser below the D80 and varies beyond this point. There is an overall coarsening trend depicted by the Particle Size Distribution Graph for the riffle at Station 15+11.

Table 2. Particle Size Comparison

Cross-Section	D50		D84	
Station (Facet)	As-Built	Year 1	As-Built	Year 1
4+54 (Riffle)	Med. Sand	Med. Sand	Small Cobble*	Coarse Gravel
6+86 (Pool)	Med. Sand	Fine Sand	V. Coarse Sand	Fine Gravel
7+52 (Riffle)	Fine Sand	Med. Sand	Fine Gravel	Med. Sand
15+11 (Riffle)	Med. Sand	V. Coarse Sand	Fine Gravel	Med. Gravel

* Influenced by riprap placed in the bed

It must be noted that the soil was extremely dry during the As-Built survey and wet in the Year One pebble counts. In addition, the temperature during the Year One surveys was at or near freezing, making the accurate gradation of the sands difficult at best.

1.3 Vegetation

Ten vegetative belt transects (BT-1 through BT-10) established for the post-construction monitoring were re-evaluated, six at runs and four at pools. The general locations of these transects are shown in Figure 2 of the As-Built Report submitted June 2002. The belt transects were pulled perpendicular to the channel. Within each transect there are two zones: bankfull to build-out (called build-out bench) and build-out to the edge of the buffer (called buffer) (Figure 3). These two zones are present on each side of the stream channel resulting in two sample plots on each side of the channel. The build-out bench vegetation zone was measured beginning at the intersection of the belt transect with the top of bank feature and extends downstream for 30 feet. The width of this vegetation zone is variable due to structures, root wads, and the sinuosity of the channel, varying from 8 to 13 feet. The buffer zone vegetation was measured beginning at the top of the build-out bench for a distance of 35.5 feet, ending approximately to the buffer extents. This buffer plot extends for 10 feet on either side of the belt transect creating a 20 feet wide by 35.5 feet long buffer plot on either side of the stream.

Within the two planting zones bare-root seedlings were evaluated for density and height. Estimates of the target planting density within the build-out zone are based upon a linear 7-foot spacing of seedlings. Estimates of the target planting density for the buffer zone are based upon 10 x 10-foot spacing. See Appendix B for a summary of the Year-1 findings with regard to the vegetation.

All seedlings planted within plots were counted and their height measured. Identification to species was made when possible. Because of the small seedling size, mechanical damage, and low density of leaves, identification to species of many seedlings was uncertain. Accurate determination of diversity was therefore not possible during this monitoring event. Mechanical damage was due to past planting techniques, insect damage and the high use of the park area by local citizens.

The following is a summary of findings of the Year One Monitoring as well as recommendations for future monitoring.

1.3.1 Seedlings

Following the first year growing season the original 10 belt-transects were reestablished and sampled using benchmarks established for the as-built survey. Only live seedlings were recorded. Two species not specified in the design and planting plans were planted at the site. Sycamore (*Plantanus occidentalis*) and black gum (*Nyssa sylvatica*) seedlings were found in Transects 8, 9 and 10. In transects 1 and 6 black gum seedlings are volunteers. These tree species are considered appropriate for riparian buffers of Piedmont Levee Forest (Schafale, M.P. and A.S. Weakley. 1990).

1.3.2 Buffer

Based on the mitigation planting plan the expected number of stems in the buffer was 14 stems per transect with 11 the minimal acceptable. Within the buffer zone all 10 transects contained less than 11 stems and averaged 4.4 stems (135 stems per acre). Seedling mortality was 190 stems per acre or 58 percent (Table 3). Based on the percent of total area sampled 31% of the expected stems were present. Average stem height was 1.4 and ranged from 0.7 to 2.9 feet.

Table 3. Average Buffer Density and Mortality

Sampling Event	Number Sampled (Stems)	Density (Stems/Acre)
As-Built	106	325
Year 1	44	135
Mortality	**62**	**190**

1.3.3 Build-out Bench

Based on the mitigation planting plant the expected number of stems in the build-out bench was 8 stems per transect with 7 the minimal acceptable. All 10 transects contained less than 7 stems. Two transects did not contain any live seedlings. Within the bench zone averaged 261 stems per acre or 3.6 stems per transect (Table 4). Seedling mortality was 56 percent (341 stems per acre). Based on the percent of total area sampled 60% of the expected stems were counted. Average stem height was 1.4 and ranged from 1.0 to 3.2 feet.

Table 4. Average Build-Out Bench Density and Mortality

Sampling Event	Number Sampled (Stems)	Density (Stems/Acre)
As-Built	83	603
Year 1	36	261
Mortality	**47**	**342**

Recorded density of stems was lower than expected. Local drought conditions are likely the largest cause of low seedling establishment and high losses. Also contributing to seedling mortality is damage from installation of additional structures after planting, damage from past planting techniques, insect damage, and high use of the park area by local citizens.

1.3.4 Herbaceous Vegetation

Herbaceous vegetation was qualitatively assessed using general observations of coverage. No quantification of individual plants was recorded. Coverage within the buffer area ranged from 55 to 98 percent with an average of 85 percent. Coverage within the build-out bench ranged from 5 to 75 percent with an average of 30 percent. Individual plants in the bench zone are smaller in comparison to the buffer area. Herbaceous species were observed to be similar in both the buffer and build-out bench zones. Coverage within the channel banks ranged from 2 to 33 percent with an average of 16 percent. Most of the vegetation was observed along the bottom of the channel. Species included rushes (*Juncus effusus*, *J. coriaceus*) and sedges (*Carex* sp.). For a complete summary of the vegetation data collected, see Appendix B.

Throughout most of the buffer zone herbaceous vegetation appeared adequate. A species trend toward weedier species was observed. Small, basal rosettes, most likely tickseed (*Coreopsis* sp.), were common throughout the site. Small grass seedlings, likely Italian ryegrass (*Lolium multiflorum*), were also visible across much of the site.

The bench zone and channel banks lack adequate vegetative cover. Only one transect has a bench average above 70 percent and none of the bank transects average above 40 percent. The greatest estimated average bank cover is 33 percent for transect 8. The average cover was higher for the left bank for all three area estimated.

1.3.5 Species Identification

Accurate identification of small seedlings was difficult. Separation of ironwood and hop hornbeam and the separation of species as oaks are difficult in the seedling stages. Identification at the site is further compounded by stress and the small size of the seedlings. The diversity of the seedlings planted could not be accurately determined at the time of this monitoring due to lack of confidence in correctly identifying all species.

1.3.6 Summary of Year One Monitoring Findings

The density of bare root seedlings planted at the site is less than the targeted density for all areas measured. The structures added in February 2002 affected some of the counts in the buffer zone (transects 2 and 4). Replanting should bring the number of stems to an acceptable density.

Local weather conditions have greatly influenced vegetative growth. The Greensboro area experienced a drought in the summer of 2002. This follows a drier than normal winter and a number of consecutively dry years. These dry conditions create an environment that is difficult for the establishment of vegetation.

A number of areas contain exotic and invasive vegetation. Areas where trees were left during construction have a higher occurrence. Species include multiflora rose (*Rosa multiflora*), privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), Elaeagnus (*Elaeagnus* sp.) and bittersweet (*Celastrus orbiculata*). In the buffer area below the bridge and near the sewer easement Johnson grass (*Sorghum halepense*) was observed.

1.4 Photo Reference Points

The photo reference points were used for a visual assessment of how the channel and vegetation have changed since the as-builts were conducted. Photographs were taken to depict existing conditions for the stream channel, cross-sections, structures, and vegetation. To document channel conditions, a photograph was taken looking upstream and downstream from the back of each meander bend. Since the cross-vanes are located immediately downstream of the meanders, this serves not only as a representative view of the stream, but also each cross-vane. The stream channel photo log is included in Appendix C comparing the As-Built photos to the Year One photos. Additional photos are included with the cross-section data in Appendix A to depict the existing conditions of the cross-sections.

In general, the photographs depict an increase in vegetative cover especially at the streambank and water surface interface and on point bars. The photographs also show an increase in the point bar formation. Photographs M7-US and M9-DS are examples of this. Photographs M1-US and M12-US depict a narrowing of the channel at the beginning of the project and immediately downstream from the culvert at Station 11+04. These cross-sections were left wider during construction in an effort to match the existing cross-sections and the width of the box culvert, knowing that they would narrow over time.

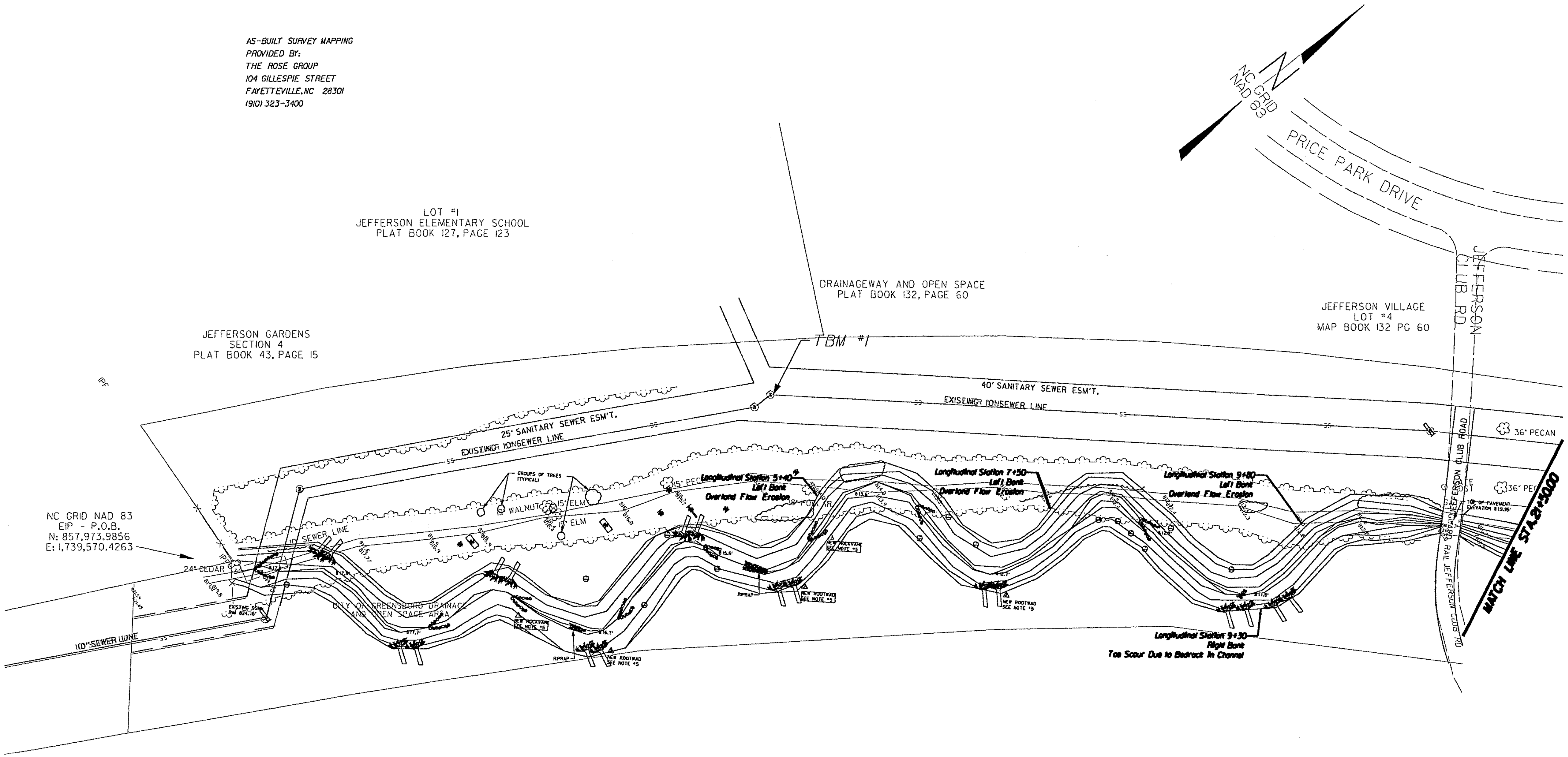
To document existing vegetative conditions, a photograph was taken looking upstream and downstream to show the bench zone and looking toward the right bank and toward the left bank, to show the buffer zone. The vegetation photo log included in Appendix D contains a sample of these photos comparing the As-Built Survey and the Year One Monitoring event.

2.0 Maintenance

The following maintenance plan is recommended to correct some problem areas noted during the Year One Monitoring. This section is broken into two categories: Specific recommendations by station and General vegetation recommendations.

2.1 Maintenance by Station

The following is a listing of the problems noted during the Year One Monitoring, a solution and a photograph indicating the problem. Figure 2 contains the as-built site map that is labeled with location of the maintenance areas discussed below.



SCALE

40 0 40 80

LEGEND

CROSS VANE* See Detail

ROOT WAD* See Detail

NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.

NOTE:
NO WATERCOURSE OR 100 - YEAR FLOOD PLAIN AS MAPPED BY F.E.M.A. OR AS DEFINED BY ANY FEDERAL, STATE OR LOCAL AUTHORITY IS LOCATED ON THIS PROPERTY.

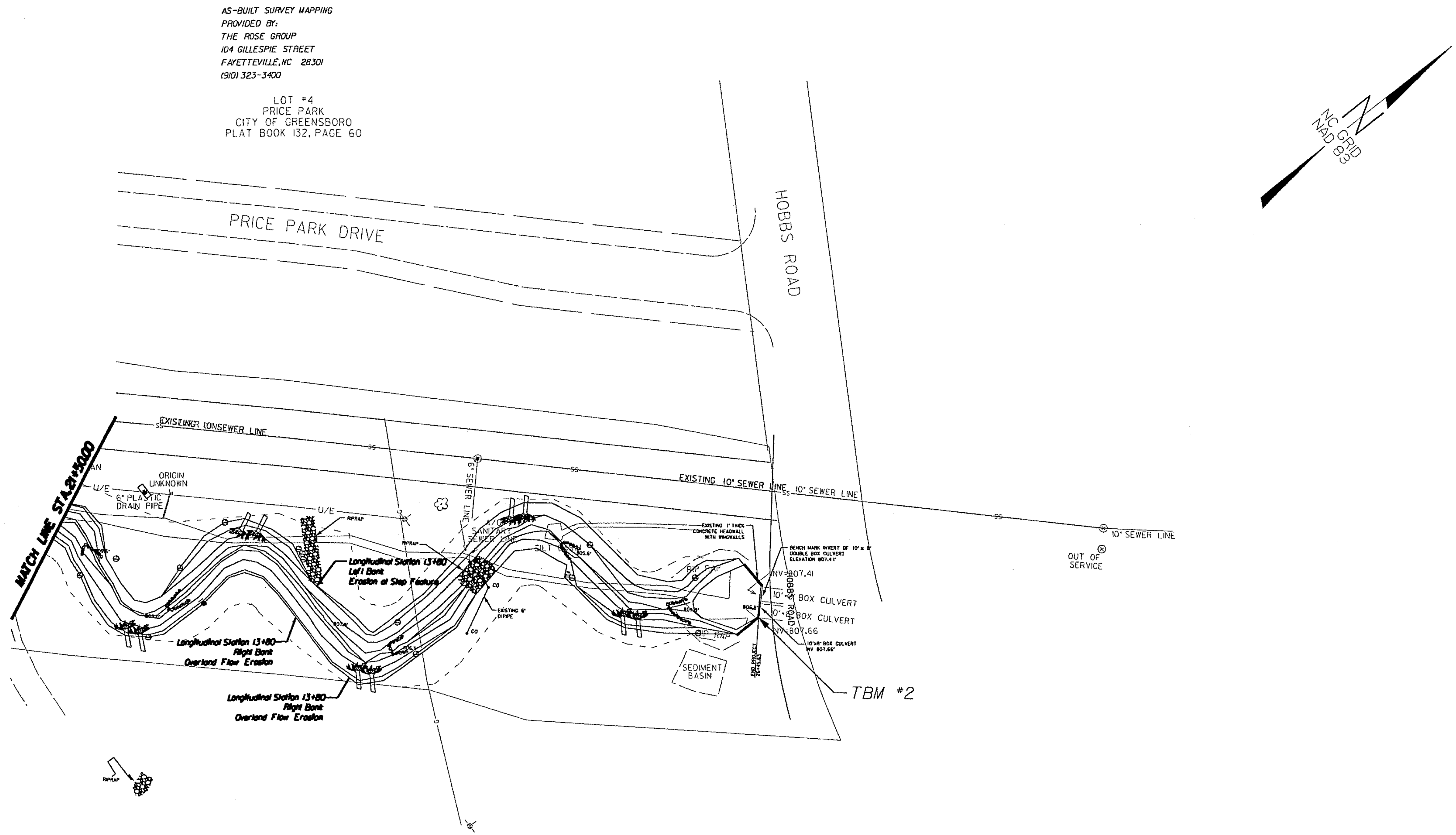
NO	REVISIONS	DRN	CHK	DATE

EARTH TECH

JEFFERSON PILOT STREAM RESTORATION
NORTH CAROLINA WETLANDS RESTORATION PROGRAM
GREENSBORO, GUILFORD COUNTY, NORTH CAROLINA

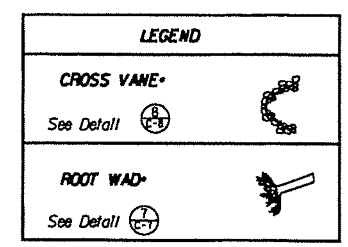
STREAM MAINTENANCE AREAS
YEAR 1 MONITORING

DATE	JANUARY, 2003
PROJECT NO	40361
FILENAME	FIGURE 2
SHEET NO	
DRAWING NO	



NOTE:
NO WATERCOURSE OR 100 - YEAR FLOOD PLAIN AS MAPPED BY F.E.M.A.OR AS DEFINED BY ANY FEDERAL,STATE OR LOCAL AUTHORITY IS LOCATED ON THIS PROPERTY.

SCALE
40 0 40 80



NOTE: Structure placement on Plan Sheets are for location only. Actual placement shall be directed by Resident Engineer.

NO	REVISIONS	DRN	CHK	DATE

EARTH TECH

JEFFERSON PILOT STREAM RESTORATION
NORTH CAROLINA WETLANDS RESTORATION PROGRAM
GREENSBORO, GUILFORD COUNTY, NORTH CAROLINA

STREAM MAINTENANCE AREAS
YEAR 1 MONITORING

DATE	JANUARY, 2003
PROJECT NO	40361
FILENAME	FIGURE 2
SHEET NO	
DRAWING NO	

Problem: (Station 5+40-Left Bank) Erosion from overland flow
Solution:
a. Remove the existing blanket.
b. Re-grade the area.
c. Hydro seed with seed, fertilizer and mulch.
d. Place Erosion Control Blanket rated for steeper slopes and medium to high flow.
e. Increase the woody and herbaceous vegetation both upslope and on the banks to promote stability through vegetation.

Photo:

Problem: (Station 7+50-Left Bank) Erosion from overland flow and deer crossing
Solution:
a. Remove the existing blanket.
b. Re-grade the area.
c. Hydro seed with seed, fertilizer and mulch.
d. Place Erosion Control Blanket rated for steeper slopes and medium to high flow.
e. Increase the woody and herbaceous vegetation both upslope and on the banks to promote stability through vegetation.

Photo:

Problem: (Station 9+30-Right Bank) Eroding bank due to bedrock in channel
Solution:

a. Remove boulders that have fallen in.
b. Add two to three large rootwads, footer logs and header logs.
c. Incorporate boulders.
d. Grade the top of bank so that overland flow does not enter the stream in this area.
e. Revegetate on top with container stock and live stakes at the interface between the water and toe of slope.

Photo:

Problem: (Station 9+80-Left Bank) Erosion from overland flow in trenches where fabric was keyed in and under coir matting
Solution:

a. Remove the existing blanket.
b. Re-grade the area.
c. Hydro seed with seed, fertilizer and mulch.
d. Place Erosion Control Blanket rated for steeper slopes and medium to high flow.
e. Increase the woody and herbaceous vegetation both upslope and on the banks to promote stability through vegetation.

Photos:


Problem: (Station 13+80-Right Bank) Erosion from overland flow
Solution:

a. Remove the existing blanket.
b. Re-grade the area.
c. Hydro seed with seed, fertilizer and mulch.
d. Place Erosion Control Blanket rated for steeper slopes and medium to high flow.
e. Increase the woody and herbaceous vegetation both upslope and on the banks to promote stability through vegetation.

Photo:

Problem: (Station 13+80-Left Bank) Erosion at step feature.
Solution:

a. Transplant vegetation from tributary channel at edges of boulders.
b. Hydro seed the adjacent banks with seed, fertilizer and mulch.
c. Install Erosion Control Blanket adjacent to the boulders.

Photo:

Problem: (Station 14+40-Right Bank) Overland flow has eroded behind rootwad rock and coir.
Solution:

a. Remove the boulder and existing blanket.
b. Re-grade the area.
c. Hydro seed with seed, fertilizer and mulch.
d. Place Erosion Control Blanket rated for steeper slopes and medium to high flow.
e. Increase the woody and herbaceous vegetation both upslope and on the banks to promote stability through vegetation.
f. Replace the boulder on top of the Erosion Control Blanket.

Photo:

2.2 Vegetation Maintenance Recommendations

The following recommendations are provided as a guide for potential efforts to correct deficiencies observed at the site and help ensure the success of this project. Some of these recommendations may be labor intensive or considered costly. All recommendations are compared to the repair cost and environmental damage should this project fail in the future due to these deficiencies. No guarantee of success is implied.

Problem: *Low Seedling Density*
The survival of adequate seedlings density will need to be addressed. The planting of seedlings to re-establish density will be addressed by the initial contractors obligations. The following additional work will not be covered under the original contract.
Solution:

a. Determine and correct any deficiencies in site conditions relative to pH and nutrient levels. Access these deficiencies for at least 6 separate areas of the buffer and build-out bench zones.
b. Replanting of bare-root seedlings in the buffer zone to at least 70 percent of the original density is recommended.

c. Replanting of bare root seedlings in the build-out bench zone to at least 60 percent of the original density is recommended.
d. Oversight of planting should be considered to ensure seedlings are planted properly.
e. Larger and older seedlings should be used to increase survival and seedling ability to compete with the established vegetation.
f. Use of a commercial polymer root-gel on bare root seedlings at the time of planting may increase seedling survival.
g. If drought conditions are present in the summer of 2003, consideration of irrigation from the downstream pond or regular watering should be considered (for bare root seedlings a 24 day period with less than 0.5 inches of rainfall should be considered critically dry). Watering with 0.5 to 1.0 inches weekly till appreciable precipitation is measured will prevent additional seedling mortality.

<u>Problem:</u> *Lack of Vegetation on Channel Banks*
The lack of adequate vegetation along the channel banks needs to be corrected. Establishment of vegetative cover in this area is critical. The continued lack of vegetation increases the chance of a physical failure at structures and along the banks. The coir is aging and cannot be expected to meet the initial performance requirements needed for banks absent of stabilizing vegetation.
<u>Solution:</u>
a. Add annual rye seed and straw to the channel banks and build-out bench, either by hand or hydro seed. Areas with bare soil should be hand raked after seeding to increase seed to soil contact before addition of straw.
b. Either throughout the reach or in areas identified as critical to stability, an additional layer of lightweight coir matting should be added to increase the performance reliability of the existing coir. This will also stabilize and protect the seed/straw mix.
c. Install live stakes along the lower portion of the channel banks, especially along outside meander bends.
d. Add limited potted plants to the top of bank. Larger plants with greater root systems will establish quicker, providing roots to stabilize the bank. These larger plants will also provide protection as herbaceous plants to establish along the bank and top of bank.

<u>Problem:</u> *Exotic and Invasive Species*
Numerous exotic and invasive species are becoming re-established at the site. These species grow and reproduce rapidly, competing for resources with seedlings and other desired vegetation. Initial control of these species is recommended to allow adequate establishment time for other species and to reduce their presence in this community in the future.
<u>Solution:</u>
a. At least a one-time mechanical removal and treatment of stumps with an herbicide will kill roots of established individuals. These species include multiflora rose (*Rosa multiflora*), privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), elaeagnus (e*laeagnus* sp.), Johnson grass

(*Sorghum halepense*) and bittersweet (*Celastrus orbiculata*). This will prevent immediate reseeding and root sprouts.

b. Involve park personnel in removal and control of exotics. This may extend to other areas adjacent to the site that are seed sources.

c. Review the possibility of a long-term control plan of three to five years.

d. The herbaceous species such as fescue (*Festuca arundinacea*), white clover (*Trifolium repens*) and Bermuda grass (*Cynodon dactylon*) are localized and are less of an invasive threat. Control of these species is not necessary at this time.

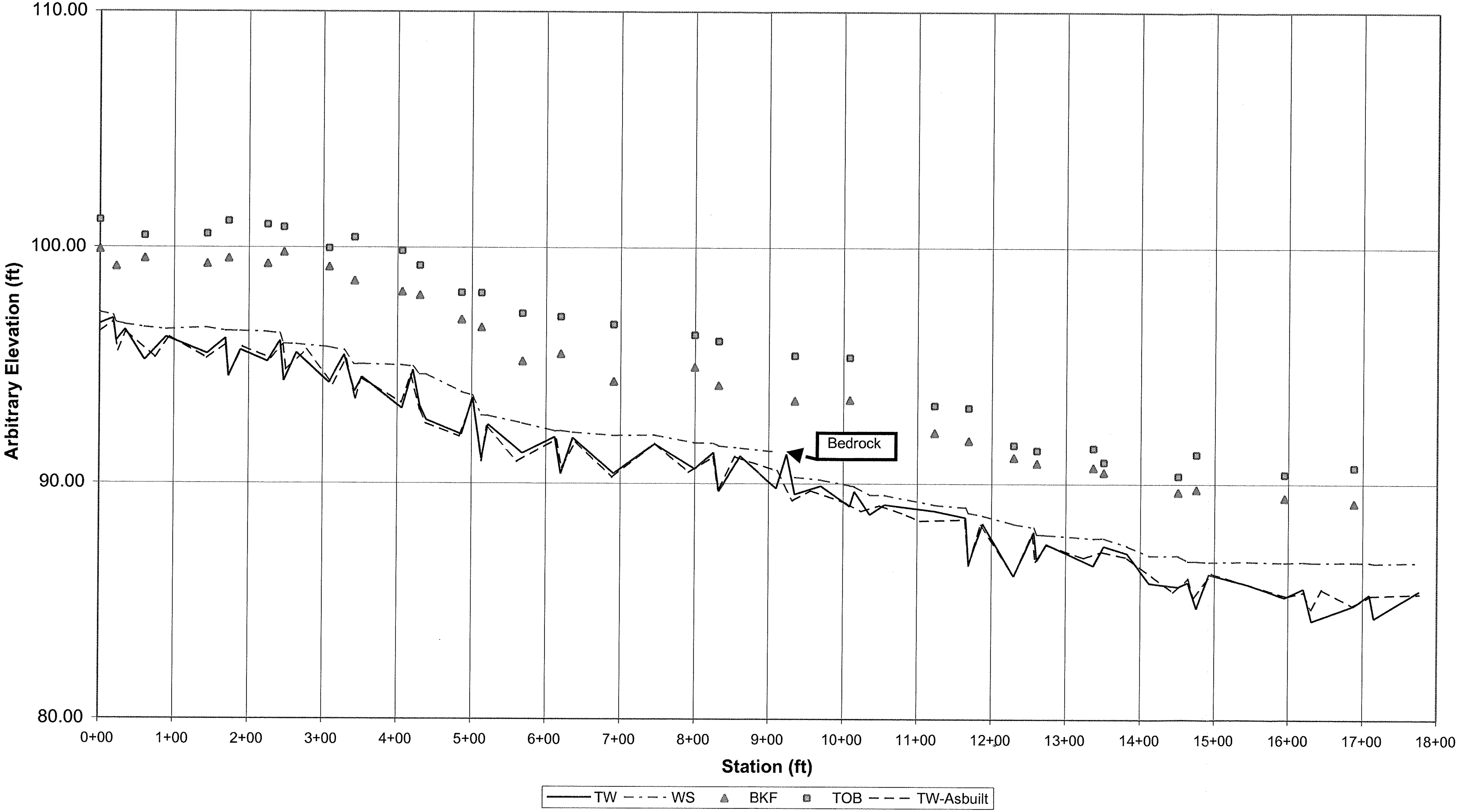
APPENDIX A
STREAM CONDITIONS

Field Crew:	Rhett Pace, Jan Patterson
River Basin:	Cape Fear
Watershed:	**Guilford College**
Stream Reach:	Jefferson Pilot
Draiange Area:	1.00
Date:	12/17/2002
Description:	LONGITUDINAL PROFILE

Station	TW (FS)	TW	WS (FS)	WS	BKF (FS)	BKF	BOB (FS)	BOB	Notes	HI
00+00.0	8.95	96.74	8.46	97.23					Fenceline	105.69
00+18.0	8.73	96.96	8.60	97.09	5.78	99.91	4.54	101.15	XVANE	105.69
00+22.0	9.68	96.01	8.89	96.80					XVANE-Max Pool	105.69
00+34.0	9.21	96.48	8.98	96.71	6.51	99.18			Head of Riffle	105.69
00+60.0	10.50	95.19	9.10	96.59					Max Pool	105.69
00+89.0	9.52	96.17	9.19	96.50	6.17	99.52	5.21	100.48	Head of Riffle	105.69
01+44.0	10.22	95.47	9.12	96.57					Max Pool	105.69
01+69.0	9.57	96.12	9.25	96.44	6.40	99.29	5.14	100.55	XVANE	105.69
01+73.0	11.19	94.50	9.25	96.44					XVANE-Max Pool	105.69
01+89.0	10.07	95.62	9.26	96.43	6.17	99.52	4.59	101.10	Head of Riffle	105.69
02+25.0	10.55	95.14	9.30	96.39					Max Pool	105.69
02+42.0	9.67	96.02	9.36	96.33	6.40	99.29	4.74	100.95	XVANE	105.69
02+47.0	11.37	94.32	9.80	95.89					XVANE-Max Pool	105.69
02+64.0	10.18	95.51	9.81	95.88	5.91	99.78	4.85	100.84	Head of Riffle	105.69
03+08.0	11.45	94.24	9.94	95.75					Max Pool	105.69
03+28.0	10.26	95.43	10.06	95.63	6.53	99.16	5.74	99.95	XVANE	105.69
03+42.0	11.82	93.87	10.66	95.03					XVANE-Max Pool	105.69
03+52.0	11.21	94.48	10.65	95.04	7.12	98.57	5.28	100.41	Head of Riffle	105.69
04+06.0	12.53	93.16	10.69	95.00					Max Pool	105.69
04+21.0	10.90	94.79	10.75	94.94	7.58	98.11	5.85	99.84	XVANE	105.69
04+30.0	12.41	93.28	11.08	94.61					XVANE-Max Pool	105.69
04+39.0	11.45	92.67	11.08	94.61	7.72	97.97	6.47	99.22	Head of Riffle	105.69
04+86.0	12.16	92.06	10.36	93.86					Max Pool	104.22
05+01.0	10.60	93.62	10.50	93.72	7.28	96.94	6.15	98.07	XVANE	104.22
05+13.0	13.19	91.03	11.35	92.87					XVANE-Max Pool	104.22
05+22.0	11.74	92.48	11.36	92.86	7.61	96.61	6.16	98.06	Head of Riffle	104.22
05+68.0	12.96	91.26	11.68	92.54					Max Pool	104.22
06+12.0	12.27	91.95	12.02	92.2	9.05	95.17	7.03	97.19	XVANE	104.22
06+20.0	13.83	90.39	12.00	92.22					XVANE-Max Pool	104.22
06+36.0	12.31	91.91	12.07	92.15	8.74	95.48	7.17	97.05	Head of Riffle	104.22
06+91.0	13.82	90.40	12.20	92.02					Max Pool	104.22
07+46.0	12.56	91.66	12.18	92.04	9.91	94.31	7.50	96.72	Head of Riffle	104.22
08+00.0	13.61	90.61	12.51	91.71					Max Pool	104.22
08+25.0	12.92	91.30	12.52	91.7	9.30	94.92	7.94	96.28	XVANE	104.22
08+32.0	14.56	89.66	12.64	91.58					XVANE-Max Pool	104.22
08+61.0	13.06	91.16	12.72	91.5	10.07	94.15	8.20	96.02	Head of Riffle	104.22
09+10.0	14.44	89.78	12.88	91.34					Max Pool	104.22
09+24.0	12.99	91.23							Top Bedrock	104.22
09+35.0	14.68	89.54	13.96	90.26					Max Pool	104.22
09+70.0	14.12	89.89	13.86	90.15	10.51	93.5	8.60	95.41	Head of Riffle	104.01
10+09.0	14.99	89.02	14.10	89.91					Top Bedrock	104.01
10+15.0	14.35	89.66	14.14	89.87	10.47	93.54	8.68	95.33	Max Pool	104.01
10+36.0	15.33	88.68	14.50	89.51					Head of Riffle	104.01
10+56.0	14.91	89.1	14.5	89.51					US Box Culvert	104.01
11+23.0	13.23	88.83	12.97	89.09					DS Box Culvert	102.06
11+65.0	13.51	88.55	13.08	88.98	9.91	92.15	8.77	93.29	XVANE	102.06
11+69.0	15.50	86.56	13.31	88.75					XVANE-Max Pool	102.06
11+88.0	13.76	88.3	13.42	88.64	10.25	91.81	8.86	93.20	Head of Riffle	102.06
12+30.0	15.99	86.07	13.78	88.28					Max Pool	102.06
12+57.0	14.12	87.94	13.93	88.13	10.96	91.1	10.45	91.61	XVANE	102.06
12+61.0	15.33	86.73	14.22	87.84					XVANE-Max Pool	102.06
12+74.0	14.64	87.42	14.24	87.82	11.2	90.86	10.66	91.40	Head of Riffle	102.06
13+37.0	15.54	86.52	14.38	87.68					Max Pool	102.06
13+51.0	14.71	87.35	14.37	87.69	11.38	90.68	10.57	91.49	Head of Riffle	102.06
13+82.0	15.02	87.04	14.70	87.36	11.58	90.48	11.16	90.90	Intermediate Point	102.06
14+12.0	16.27	85.79	15.11	86.95					Lateral Scour Pool	102.06
14+51.0	16.43	85.63	15.11	86.95					Max Pool	102.06
14+64.0	16.24	85.82	15.34	86.72	12.41	89.65	11.74	90.32	XVANE	102.06
14+75.0	17.34	84.72	15.34	86.72					XVANE-Max Pool	102.06
14+92.0	15.89	86.17	15.37	86.69	12.30	89.76	10.82	91.24	Head of Riffle	102.06
15+47.0	16.34	85.72	15.35	86.71					Aerial Sewer Line	102.06
15+95.0	16.88	85.18	15.40	86.66					Max Pool	102.06
16+20.0	16.5	85.56	15.37	86.69	12.66	89.4	11.67	90.39	XVANE	102.06
16+31.0	17.88	84.18	15.40	86.66					XVANE-Max Pool	102.06
16+88.0	17.22	84.84	15.38	86.68					Max Pool	102.06
17+09.0	16.75	85.31	15.39	86.67	12.89	89.17	11.39	90.67	XVANE	102.06
17+15.0	17.76	84.30	15.43	86.63					XVANE-Max Pool	102.06
17+76.0	16.6	85.46	15.39	86.67					DBL 10' x 8' Box Cul	102.06

ws slope 0.0064 tw slope 0.0059

Figure 1: Longitudinal Profile
Jefferson Pilot Stream Restoration
Year 1 Monitoring



Field Crew:	Rhett Pace, Jan Patterson
River Basin:	Cape Fear
Watershed:	**Guilford College**
Stream Reach:	Jefferson Pilot
Draiange Area:	1.00
Date:	12/17/2002
Description:	Longitudinal Station ~ 4+54
Feature:	CS#1, Riffle

STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	104.22	5.67	98.55	LPIN GRD
0+12.0	104.22	5.50	98.72	
0+24.0	104.22	5.23	98.99	LT BOB
0+26.0	104.22	6.46	97.76	Toe BOB
0+34.3	104.22	6.87	97.35	LBKF
0+37.5	104.22	8.19	96.03	
0+38.7	104.22	9.64	94.58	
0+38.9	104.22	9.90	94.32	LEW
0+42.2	104.22	10.51	93.71	TW
0+44.0	104.22	10.42	93.80	REW
0+44.1	104.22	8.44	95.78	
0+44.8	104.22	8.21	96.01	
0+47.4	104.22	6.87	97.35	
0+49.1	104.22	5.97	98.25	RBKF
0+55.3	104.22	5.51	98.71	Toe BOB
0+56.0	104.22	5.23	98.99	
0+59.0	104.22	4.05	100.17	RT BOB
0+73.0	104.22	3.55	100.67	
0+86.0	104.22	3.55	100.67	
0+91.5	104.22	3.73	100.49	
1+00.0	104.22	3.55	100.67	RPIN GRD
1+24.0	104.22	2.82	101.40	edge g-way

BUILDOUT BENCH
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	2.0	1.2	1.2
	8.3	1.6	11.9
	3.2	3.0	7.4
	1.2	4.4	4.4
	0.2	4.7	0.9
	3.3	5.3	16.4
	1.8	5.2	9.4
	0.1	3.2	0.4
	0.7	3.0	2.2
	2.6	1.6	6.0
	1.7	0.7	2.0
	6.2	0.3	3.2
	3.7	0.0	0.5
TOTALS	35.0		66.0

SUMMARY DATA (TOB)

A(BKF)	66.0
W(BKF)	35.0
Max d	5.3
Mean d	1.9

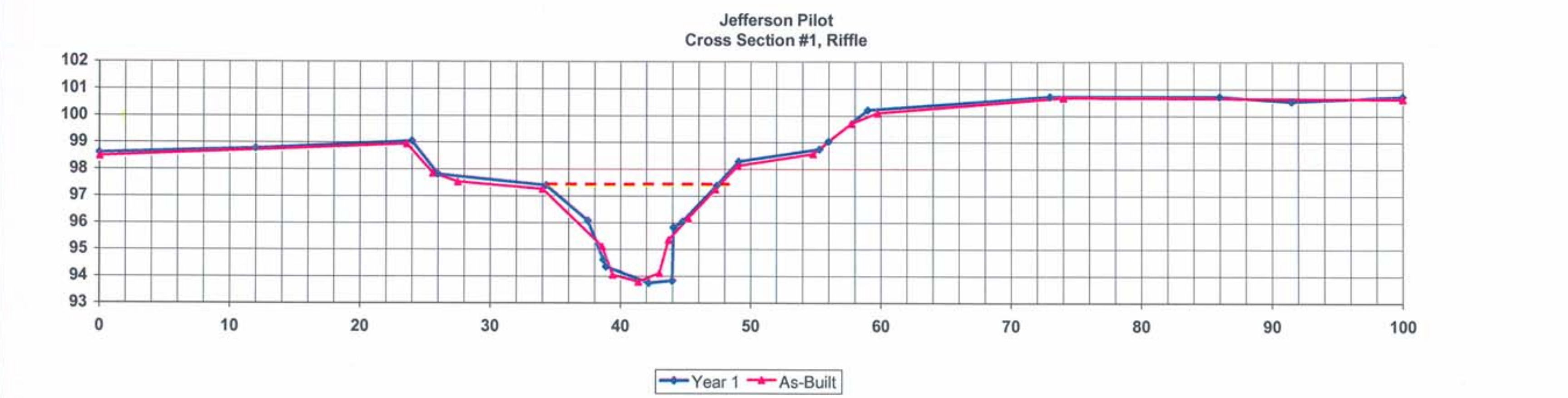
BANKFULL
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	3.2	1.3	2.1
	1.2	2.8	2.5
	0.2	3.0	0.6
	3.3	3.6	11.0
	1.8	3.6	6.5
	0.1	1.6	0.3
	0.7	1.3	1.0
	2.6	0.0	1.7
TOTALS	13.1		25.6

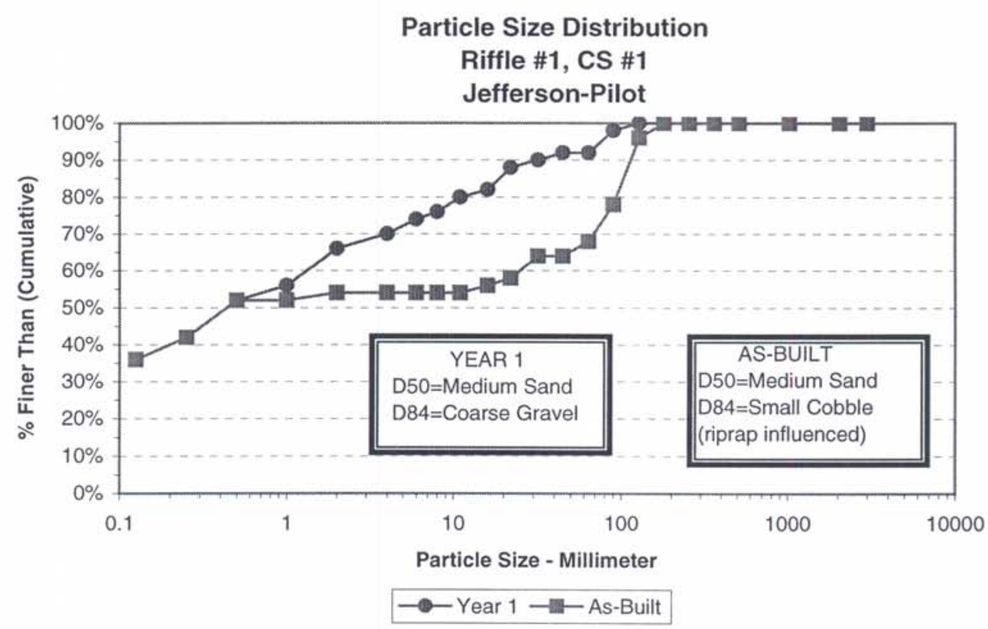
SUMMARY DATA (BANKFULL)

A(BKF)	25.6	W(FPA)	>74
W(BKF)	13.1		
Max d	3.6		
Mean d	2.0	Area= A	
W/D	6.7	Width= W	
Entrenchment	>4.9	Depth= D	
Stream Type	E	Bankfull= BKF	

Riffle (CS#1) looking in the upstream direction.



PEBBLE COUNT								
Site: Jefferson-Pilot, Greensboro, NC								Date: 12/17/02
Party: J. Patterson and R. Pace					Reach: Riffle #1 (CS #1)			
Notes:	Year 1 Monitoring; Ground Wet			Particle Count				
Inches	Particle	Millimeter		Riffle		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	15		15	30%	30%
	Very Fine	.062 - .125	S	3		3	6%	36%
	Fine	.125 - .25	A	3		3	6%	42%
	Medium	.25 - .50	N	5		5	10%	52%
	Coarse	.50 - 1.0	D	2		2	4%	56%
.04 -.08	Very Coarse	1.0 - 2.0		5		5	10%	66%
.08 - .16	Very Fine	2.0 - 4.0		2		2	4%	70%
.16 - .22	Fine	4.0 - 5.7	G	2		2	4%	74%
.22 - .31	Fine	5.7 - 8.0	R	1		1	2%	76%
.31 - .44	Medium	8.0 - 11.3	A	2		2	4%	80%
.44 - .63	Medium	11.3 - 16.0	V	1		1	2%	82%
.63 - .89	Coarse	16.0 - 22.6	E	3		3	6%	88%
.89 - 1.26	Coarse	22.6 - 32.0	L	1		1	2%	90%
1.26 - 1.77	Very Coarse	32.0 - 45.0		1		1	2%	92%
1.77 - 2.5	Very Coarse	45.0 - 64.0		0		0	0%	92%
2.5 - 3.5	Small	64 - 90	C	3		3	6%	98%
3.5 - 5.0	Small	90 - 128	O	1		1	2%	100%
5.0 - 7.1	Large	128 - 180	B	0		0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0		0	0%	100%
14.3 - 20	Small	362 - 512	L	0		0	0%	100%
20 - 40	Medium	512 - 1024	D	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0		0	0%	100%
	Bedrock		BDRK	0		0	0%	100%
			Totals	**50**		**50**	**100%**	**100%**



Field Crew:	Rhett Pace, Jan Pattersor
River Basin:	Cape Fear
Watershed:	**Guilford College**
Stream Reach:	Jefferson Pilot
Drainange Area	1.00
Date:	12/17/2002
Description:	Longitudinal Station ~ 6+86
Feature:	CS#2, Pool

STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	104.22	7.22	97.00	LPIN GRD
0+15.0	104.22	7.19	97.03	
0+35.3	104.22	7.15	97.07	LT BOB
0+38.6	104.22	8.39	95.83	Toe BOB
0+45.0	104.22	8.85	95.37	LBKF
0+51.8	104.22	11.28	92.94	bench
0+54.2	104.22	11.11	93.11	
0+56.0	104.22	11.80	92.42	
0+56.8	104.22	13.05	91.17	LEW
0+61.0	104.22	13.62	90.60	TW
0+61.8	104.22	13.18	91.04	
0+62.6	104.22	10.58	93.64	
0+66.0	104.22	8.54	95.68	RBKF
0+71.3	104.22	8.06	96.16	Toe BOB
0+74.0	104.22	6.68	97.54	RT BOB
0+84.0	104.22	6.72	97.50	
0+92.7	104.22	6.89	97.33	
1+00.0	104.22	6.73	97.49	RPIN GRD

BUILDOUT BENCH
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	3.3	1.2	2.0
	6.4	1.7	9.4
	6.8	4.1	19.8
	2.4	4.0	9.7
	1.8	4.6	7.7
	5.0	5.9	26.4
	0.8	6.5	4.9
	0.8	6.0	5.0
	3.4	3.4	16.1
	5.3	1.4	12.8
	2.7	0.9	3.1
TOTALS	38.7		117.0

SUMMARY DATA (TOB)

A(BKF)	117.0
W(BKF)	38.7
Max d	6.5
Mean d	3.0

BANKFULL
Hydraulic Geometry

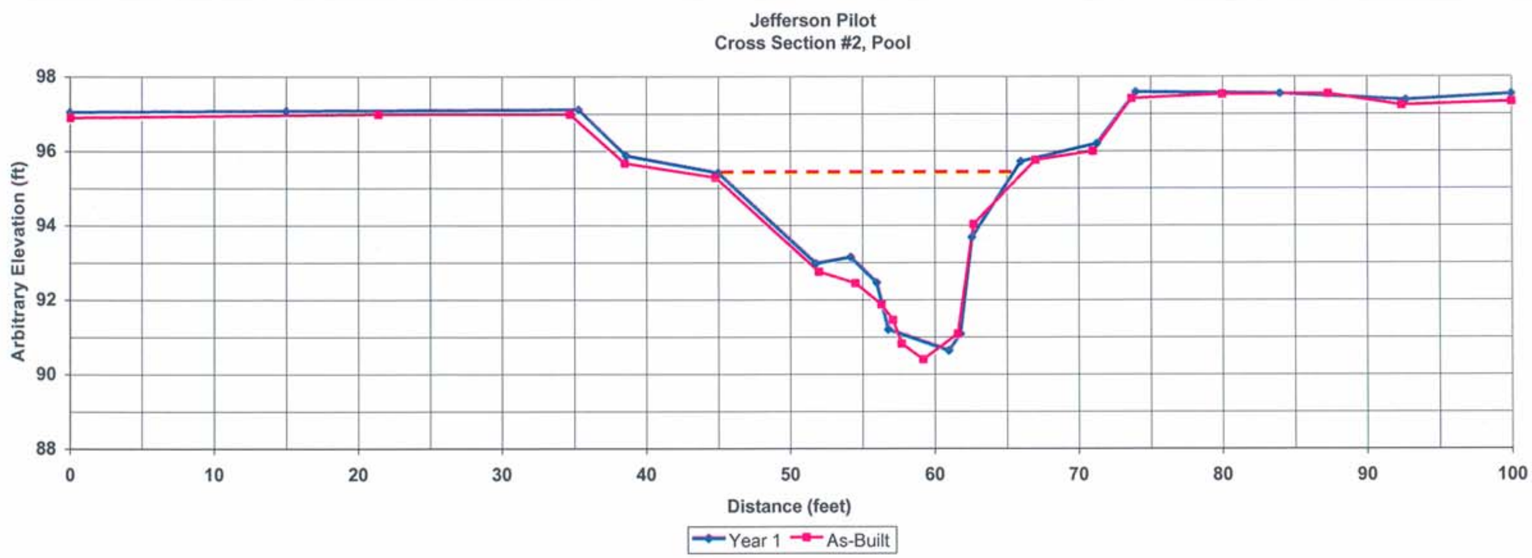
	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	6.8	2.4	8.3
	2.4	2.3	5.6
	1.8	3.0	4.7
	0.8	4.2	2.9
	4.2	4.8	18.8
	0.8	4.3	3.6
	0.8	1.7	2.4
	3.4	-0.3	2.4
TOTALS	21.0		48.8

SUMMARY DATA (BANKFULL)

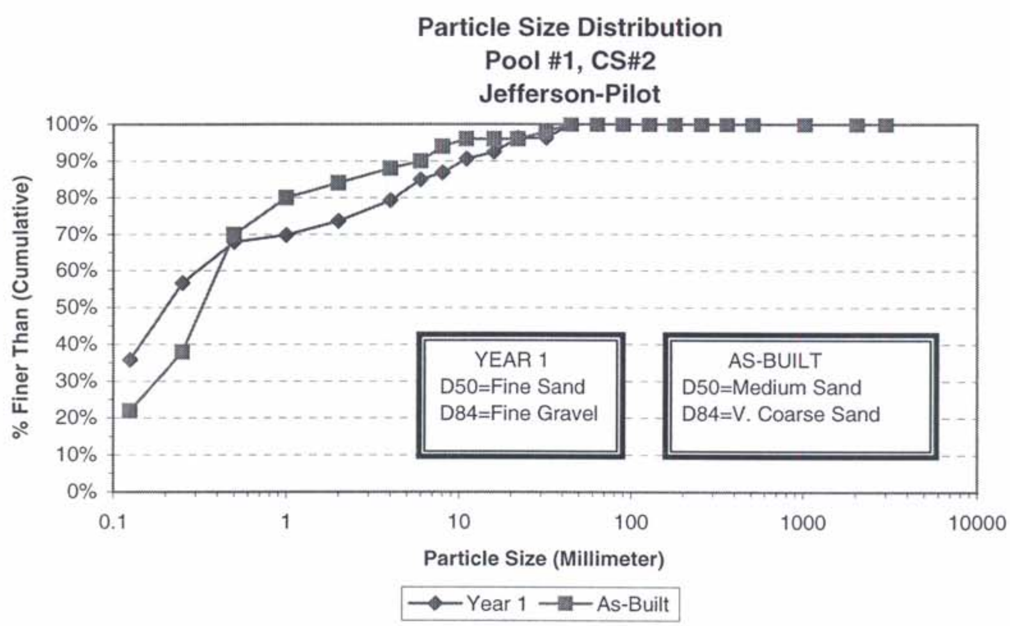
A(BKF)	48.8
W(BKF)	21.0
Max d	4.8
Mean d	2.3

Area= A
Width= W
Depth= D
Bankfull= BKF

Pool (CS#2) looking in the upstream directior



PEBBLE COUNT								
Site: Jefferson-Pilot, Greensboro, NC							Date: 12/17/02	
Party: J. Patterson and R. Pace				Reach: Pool #1 (CS #2)				
Notes: Year 1 Monitoring; Grond Wet				Particle Count				
Inches	Particle	Millimeter			Pool	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C		11	11	21%	21%
	Very Fine	.062 - .125	S		8	8	15%	36%
	Fine	.125 - .25	A		11	11	21%	57%
	Medium	.25 - .50	N		6	6	11%	68%
	Coarse	.50 - 1.0	D		1	1	2%	70%
.04 -.08	Very Coarse	1.0 - 2.0			2	2	4%	74%
.08 - .16	Very Fine	2.0 - 4.0			3	3	6%	79%
.16 - .22	Fine	4.0 - 5.7	G		3	3	6%	85%
.22 - .31	Fine	5.7 - 8.0	R		1	1	2%	87%
.31 - .44	Medium	8.0 - 11.3	A		2	2	4%	91%
.44 - .63	Medium	11.3 - 16.0	V		1	1	2%	92%
.63 - .89	Coarse	16.0 - 22.6	E		2	2	4%	96%
.89 - 1.26	Coarse	22.6 - 32.0	L			0	0%	96%
1.26 - 1.77	Very Coarse	32.0 - 45.0			2	2	4%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0				0	0%	100%
2.5 - 3.5	Small	64 - 90	C			0	0%	100%
3.5 - 5.0	Small	90 - 128	O			0	0%	100%
5.0 - 7.1	Large	128 - 180	B			0	0%	100%
7.1 - 10.1	Large	180 - 256	L			0	0%	100%
10.1 - 14.3	Small	256 - 362	B			0	0%	100%
14.3 - 20	Small	362 - 512	L			0	0%	100%
20 - 40	Medium	512 - 1024	D			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R			0	0%	100%
	Bedrock		BDRK			0	0%	100%
			Totals		**53**	**53**	**100%**	**100%**



Field Crew:	Rhett Pace, Jan Patterson
River Basin:	Cape Fear
Watershed:	Guilford College
Stream Reach:	Jefferson Pilot
Draiange Area:	1.00
Date:	12/17/2002
Description:	Longitudinal Station ~ 7+52
Feature:	CS#3, Riffle

STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	104.22	7.6	96.62	LPIN GRD
0+06.0	104.22	7.74	96.48	
0+12.5	104.22	7.29	96.93	
0+23.8	104.22	7.76	96.46	LT BOB
0+24.8	104.22	8.64	95.58	Toe BOB
0+29.8	104.22	9.12	95.10	LBKF (overland wash)
0+30.3	104.22	9.31	94.91	overland wash
0+30.7	104.22	9.82	94.40	overland wash
0+31.0	104.22	10.04	94.18	overland wash
0+31.3	104.22	9.17	95.05	
0+32.0	104.22	9.15	95.07	
0+36.5	104.22	11.34	92.88	
0+37.0	104.22	12.24	91.98	LEW
0+40.1	104.22	12.57	91.65	TW
0+42.2	104.22	12.41	91.81	REW
0+42.8	104.22	11.27	92.95	
0+46.0	104.22	9.18	95.04	RBKF
0+52.0	104.22	8.78	95.44	Toe BOB
0+55.4	104.22	7.55	96.67	RT BOB
0+72.0	104.22	7.66	96.56	
1+00.0	104.22	7.49	96.73	RPIN GRD

BUILDOUT BENCH
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	1.0	0.9	0.4
	5.0	1.4	5.6
	0.5	1.6	0.7
	0.4	2.1	0.7
	0.3	2.3	0.7
	0.3	1.4	0.6
	0.7	1.4	1.0
	4.5	3.6	11.2
	0.5	4.5	2.0
	3.1	4.8	14.4
	2.1	4.6	9.9
	0.6	3.5	2.4
	3.2	1.4	7.9
	6.0	1.0	7.3
	3.4	-0.2	1.4
TOTALS	31.6		66.2

SUMMARY DATA (TOB)

A(BKF)	66.2
W(BKF)	31.6
Max d	4.8
Mean d	2.1

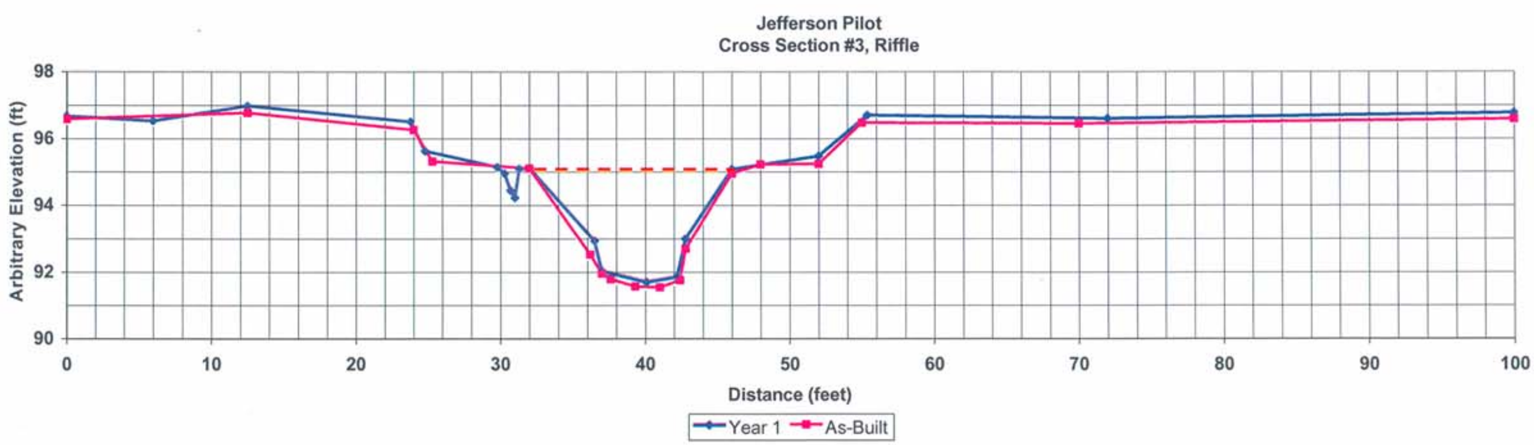
BANKFULL
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	0.5	0.2	0.0
	0.4	0.7	0.2
	0.3	0.9	0.2
	0.3	0.0	0.1
	0.7	0.0	0.0
	4.5	2.2	5.1
	0.5	3.1	1.3
	3.1	3.4	10.2
	2.1	3.3	7.1
	0.6	2.1	1.6
	3.2	0.1	3.5
TOTALS	16.2		29.5

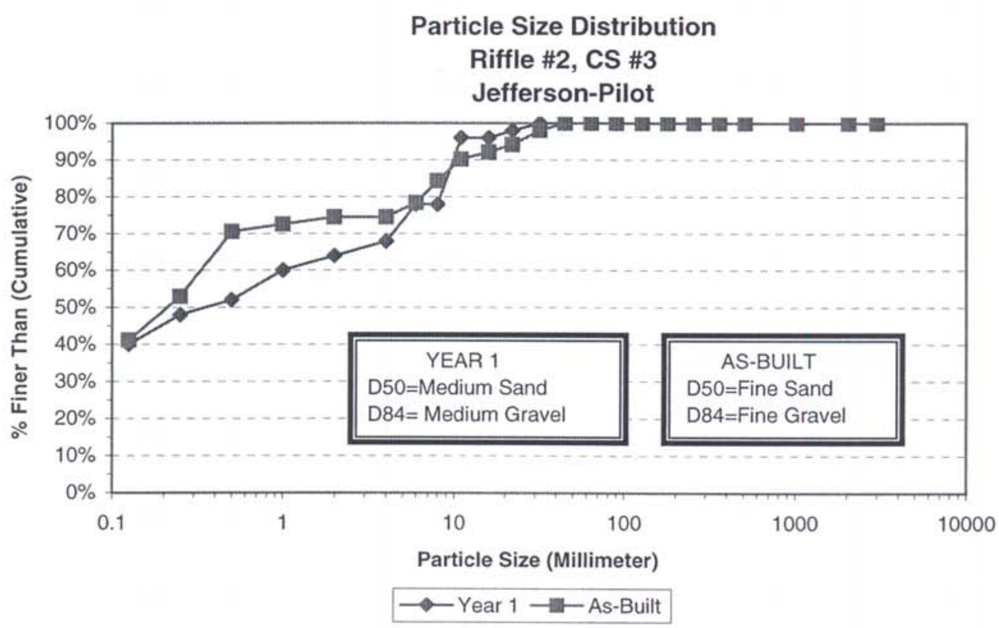
SUMMARY DATA (BANKFULL)

A(BKF)	29.5	W(FPA)	>100
W(BKF)	16.2		
Max d	3.4		
Mean d	1.8	Area= A	
W/D	8.9	Width= W	
Entrenchment	>7.1	Depth= D	
Stream Type	E	Bankfull= BKF	

Riffle (CS#3) looking in the downstream direction.



PEBBLE COUNT								
Site: Jefferson-Pilot, Greensboro, NC								Date: 12/17/02
Party: J. Patterson and R. Pace					Reach: Riffle #2 (CS #3)			
Notes: Year 1 Monitoring; Ground Wet				Particle Count				
Inches	Particle	Millimeter		Riffle		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	16		16	32%	32%
	Very Fine	.062 - .125	S	4		4	8%	40%
	Fine	.125 - .25	A	4		4	8%	48%
	Medium	.25 - .50	N	2		2	4%	52%
	Coarse	.50 - 1.0	D	4		4	8%	60%
.04 -.08	Very Coarse	1.0 - 2.0		2		2	4%	64%
.08 - .16	Very Fine	2.0 - 4.0		2		2	4%	68%
.16 - .22	Fine	4.0 - 5.7	G	5		5	10%	78%
.22 - .31	Fine	5.7 - 8.0	R			0	0%	78%
.31 - .44	Medium	8.0 - 11.3	A	9		9	18%	96%
.44 - .63	Medium	11.3 - 16.0	V			0	0%	96%
.63 - .89	Coarse	16.0 - 22.6	E	1		1	2%	98%
.89 - 1.26	Coarse	22.6 - 32.0	L	1		1	2%	100%
1.26 - 1.77	Very Coarse	32.0 - 45.0				0	0%	100%
1.77 - 2.5	Very Coarse	45.0 - 64.0				0	0%	100%
2.5 - 3.5	Small	64 - 90	C			0	0%	100%
3.5 - 5.0	Small	90 - 128	O			0	0%	100%
5.0 - 7.1	Large	128 - 180	B			0	0%	100%
7.1 - 10.1	Large	180 - 256	L			0	0%	100%
10.1 - 14.3	Small	256 - 362	B			0	0%	100%
14.3 - 20	Small	362 - 512	L			0	0%	100%
20 - 40	Medium	512 - 1024	D			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R			0	0%	100%
	Bedrock		BDRK			0	0%	100%
			Totals	**50**		**50**	**100%**	**100%**



Field Crew:	Rhett Pace, Jan Patterson
River Basin:	Cape Fear
Watershed:	**Guilford College**
Stream Reach:	Jefferson Pilot
Draiange Area:	1.00
Date:	12/17/2002
Description:	Longitudinal Station ~ 15+11
Feature:	CS#4, Riffle

STATION (Feet)	HI (Feet)	FS (Feet)	ELEVATION (Feet)	NOTES
0+00.0	102.06	10.23	91.83	LPIN GRD
0+14.0	102.06	10.17	91.89	
0+25.0	102.06	10.31	91.75	
0+45.8	102.06	10.73	91.33	LT BOB
0+48.4	102.06	11.86	90.20	Toe BOB
0+54.2	102.06	12.56	89.50	LBKF
0+59.3	102.06	14.86	87.20	
0+60.4	102.06	15.39	86.67	LEW/WS
0+61.8	102.06	15.61	86.45	
0+63.0	102.06	16.16	85.90	TW
0+65.2	102.06	16.15	85.91	
0+66.4	102.06	15.42	86.64	REW
0+67.5	102.06	14.82	87.24	
0+71.5	102.06	12.56	89.50	RBKF
0+76.3	102.06	12.25	89.81	Toe BOB
0+78.3	102.06	11.46	90.60	RT BOB
0+84.0	102.06	10.98	91.08	
0+89.0	102.06	10.88	91.18	
1+00.0	102.06	10.95	91.11	RPIN GRD

BUILDOUT BENCH
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.0
	2.6	1.1	1.5
	5.8	1.8	8.6
	5.1	4.1	15.2
	1.1	4.7	4.8
	1.4	4.9	6.7
	1.2	5.4	6.2
	2.2	5.4	11.9
	1.2	4.7	6.1
	1.1	4.1	4.8
	4.0	1.8	11.8
	4.8	1.5	8.0
	2.0	0.7	2.3
TOTALS	32.5		87.9

SUMMARY DATA (TOB)

A(BKF)	87.9
W(BKF)	32.5
Max d	5.4
Mean d	2.7

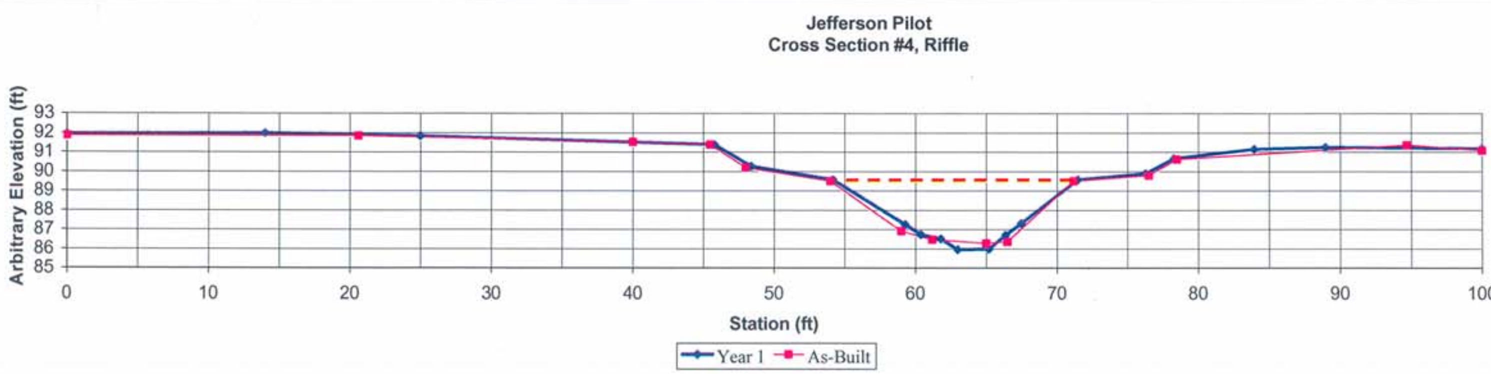
BANKFULL
Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Area (Sq. Ft.)
	0	0	0
	5.1	2.3	5.9
	1.1	2.8	2.8
	1.4	3.1	4.1
	1.2	3.6	4.0
	2.2	3.6	7.9
	1.2	2.9	3.9
	1.1	2.3	2.8
	4.0	0.0	4.5
TOTALS	17.3		35.9

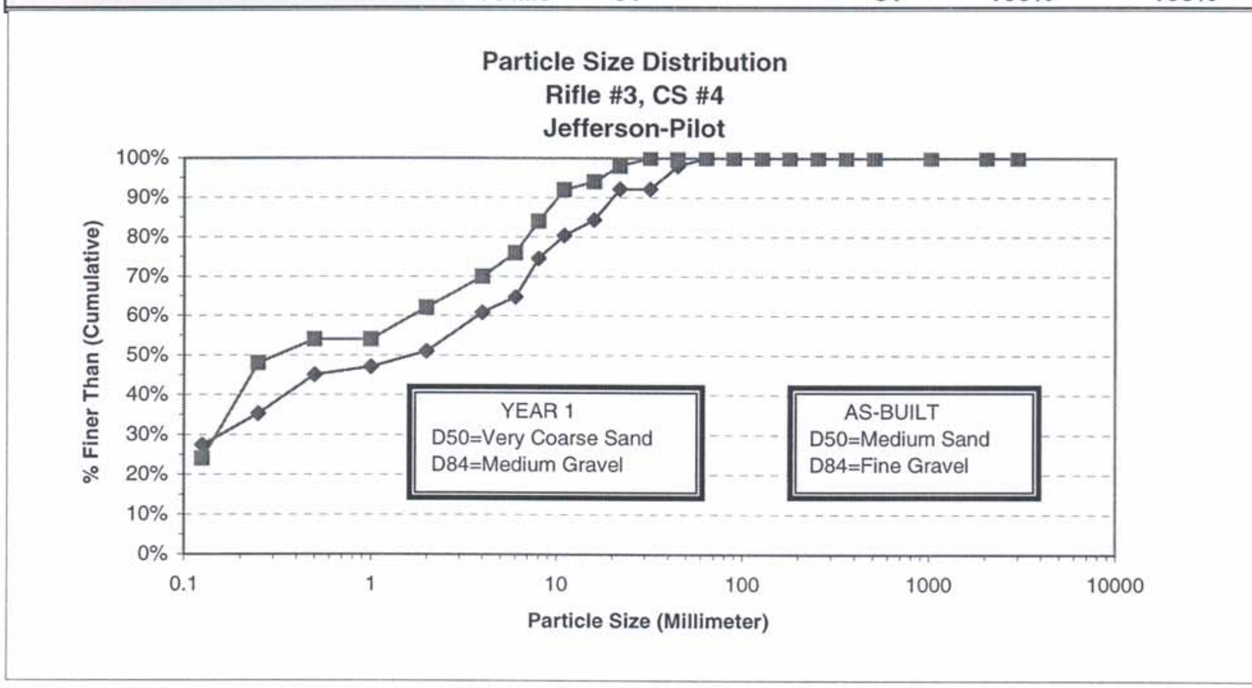
SUMMARY DATA (BANKFULL)

A(BKF)	35.9	W(FPA)	>100
W(BKF)	17.3		
Max d	3.6		
Mean d	2.1	Area= A	
W/D	8.3	Width= W	
Entrenchment	>5.8	Depth= D	
Stream Type	E	Bankfull= BKF	

Riffle (CS#4) looking in the upstream direction.
CS is on opposite side of sewer crossing.



PEBBLE COUNT								
Site: Jefferson-Pilot, Greensboro, NC								Date: 12/17/02
Party: J. Patterson and R. Pace					Reach: Riffle #3 (CS #4)			
Notes: Year 1 Monitoring; Ground Wet				Particle Count				
Inches	Particle	Millimeter		Riffle		Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	7		7	14%	14%
	Very Fine	.062 - .125	S	7		7	14%	27%
	Fine	.125 - .25	A	4		4	8%	35%
	Medium	.25 - .50	N	5		5	10%	45%
	Coarse	.50 - 1.0	D	1		1	2%	47%
.04 -.08	Very Coarse	1.0 - 2.0		2		2	4%	51%
.08 - .16	Very Fine	2.0 - 4.0		5		5	10%	61%
.16 - .22	Fine	4.0 - 5.7	G	2		2	4%	65%
.22 - .31	Fine	5.7 - 8.0	R	5		5	10%	75%
.31 - .44	Medium	8.0 - 11.3	A	3		3	6%	80%
.44 - .63	Medium	11.3 - 16.0	V	2		2	4%	84%
.63 - .89	Coarse	16.0 - 22.6	E	4		4	8%	92%
.89 - 1.26	Coarse	22.6 - 32.0	L			0	0%	92%
1.26 - 1.77	Very Coarse	32.0 - 45.0		3		3	6%	98%
1.77 - 2.5	Very Coarse	45.0 - 64.0		1		1	2%	100%
2.5 - 3.5	Small	64 - 90	C			0	0%	100%
3.5 - 5.0	Small	90 - 128	O			0	0%	100%
5.0 - 7.1	Large	128 - 180	B			0	0%	100%
7.1 - 10.1	Large	180 - 256	L			0	0%	100%
10.1 - 14.3	Small	256 - 362	B			0	0%	100%
14.3 - 20	Small	362 - 512	L			0	0%	100%
20 - 40	Medium	512 - 1024	D			0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R			0	0%	100%
	Bedrock		BDRK			0	0%	100%
			Totals	**51**		**51**	**100%**	**100%**



APPENDIX B
VEGETATION CONDITIONS

JEFFERSON PILOT: YEAR-1 MONITORING REPORT--VEGETATION PLOTS

BELT TRANSECT FIELD DATA

	BELT TRANSECT											
	BT-1	BT-2 *	BT-3	BT-4 *	BT-5	BT-6	BT-7	BT-8	BT-9	BT-10	Average	Average - Without Disturbed Transects *
Buffer Stem Count	5	7	5	2	8	5	1	6	3	2	4.4	4.4
Build-out Bench Stem Count	3	5	5	6	4	4	4	0	0	5	3.6	3.1
Buffer Average Stem Height (ft)	1.1	1.2	1.2	0.8	0.9	1.3	0.7	2.4	2.9	1.2	1.4	
Build-out Bench Average Stem Height (ft)	0.7	3.2	3.0	1.1	1.0	1.4	1.0	0.0	0.0	2.7	1.4	

SUMMARY STEM COUNT (FOR SAMPLING EFFORT)

Buffer (10' x 10' Spacing)

Estimated density =
35.5 ft x 20 ft x 2 = 1420 sq ft
1420/100 = **14.2 Stems**

Total Area Sampled
14200 sq ft

Total Area in Buffer Area
116840 sq ft

Percent Buffer Sampled
12 %

Minimum Acceptable for each Transect (80%) 11

Total Stems Estimated for Project	Total Stems Expected Within Plots	Total Stems Counted Within Plots	**% of Expected**
1168.4	142	44	**31**

Build-out Bench (7' Spacing)

Estimated density =
(30 ft x 2) 7 ft = **8.6 Stems**

Total Length Sampled
600 feet

Total Build-out Bench Length
3292 feet

% Build-out Bench Sampled
18 %

Minimum Acceptable for each Transect (80%) 7

Total Stems Estimated for Project	Total Stems Expected Within Plots	Total Stems Counted Within Plots	**% of Expected**
470	86	36	**42**

*Note: mechanical disturbance due to additon of new structures
= stem count/average below the acceptable 80% limit

JEFFERSON PILOT: YEAR-1 MONITORING REPORT--VEGETATION PLOTS

Herbaceous Vegetation

Estimated Percent Cover (%)

Belt Transect	Buffer Left	Buffer Right	Transect Average	Build-out Bench Left	Build-out Bench Right	Transect Average	Channel Bank Left	Channel Bank Right	Average	
BT-1	90	90	90	10	10	10	2	2	2	Run
BT-2*	93	90	92	25	10	18	5	10	8	Pool
BT-3	75	80	78	25	5	15	10	25	18	Pool
BT-4*	85	85	85	10	40	25	15	3	9	Pool
BT-5	80	60	70	10	5	8	3	3	3	Run
BT-6	95	95	95	45	10	28	20	3	12	Run
BT-7	80	85	83	30	15	23	30	7	19	Run
BT-8	98	97	98	75	75	75	60	6	33	Run
BT-9	95	90	93	65	45	55	30	30	30	Run
BT-10	75	55	65	70	20	45	10	40	25	Pool
Average Cover (%)	87	82.7	85	36.5	23.5	30	18.5	12.9	16	
Range	75-98	55-97		10-75	5-75		2-60	2-40		

stems per acre	
expected	440
80%	352

Build-out Bench Width (ft)

Belt Transect	Build-out Bench Left	Build-out Bench Right	Transect Average
BT-1	9	9.5	9
BT-2*	12	11	12
BT-3	8	9.4	9
BT-4*	11	13	12
BT-5	8	10.5	9
BT-6	12	9.5	11
BT-7	11	9	10
BT-8	9.5	8	9
BT-9	8	8	8
BT-10	13	10	12
Average Width (ft)	10.2	9.8	10
Range	8-13	8-13	

DENSITY AND MORTALITY

Buffer

sq ft/acre	sq ft sampled	% acre sampled
43560	14200	0.33
	# sampled	**density/acre**
	106	**325** as built
	44	**135** 1-yr
	Mortality	**190**

Buffer * transects 2 & 4 removed

sq ft/acre	sq ft sampled	% acre sampled
43560	11360	0.26
	# sampled	**density/acre**
	89	**341** as built
	35	**134** 1-yr
	Mortality	**207**

Bench

acre	sq ft sampled	% acre sampled
43560	6000	0.14
	number sampled	**density/acre**
	83	**603** as built
	36	**261** 1-yr
	Mortality	**341**

Bench * transects 2 & 4 removed

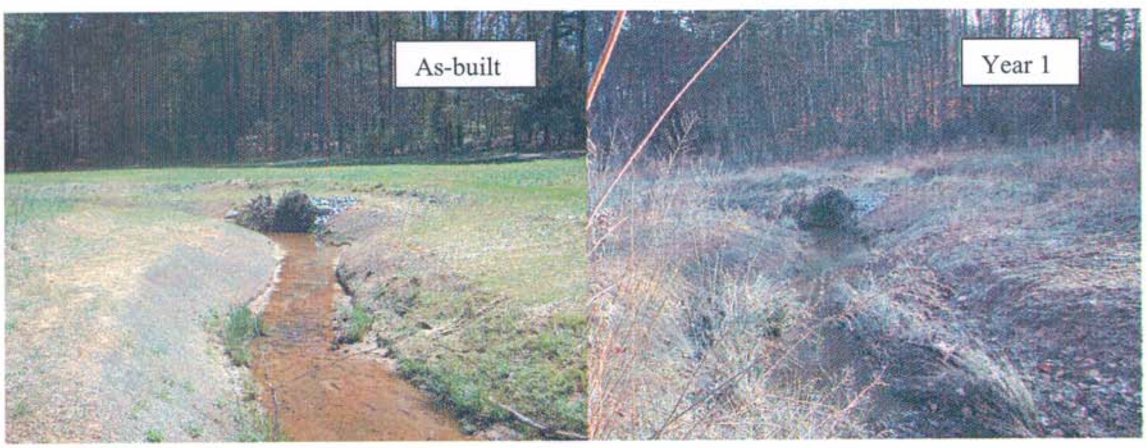
acre	sq ft sampled	% acre sampled
43560	4800	0.11
	number sampled	**density/acre**
	71	**644** as built
	25	**227** 1-yr
	Mortality	**417**

APPENDIX C
PHOTO REFERENCE POINTS

Photo Reference Points

Jefferson Pilot Stream Restoration
Guilford County, North Carolina

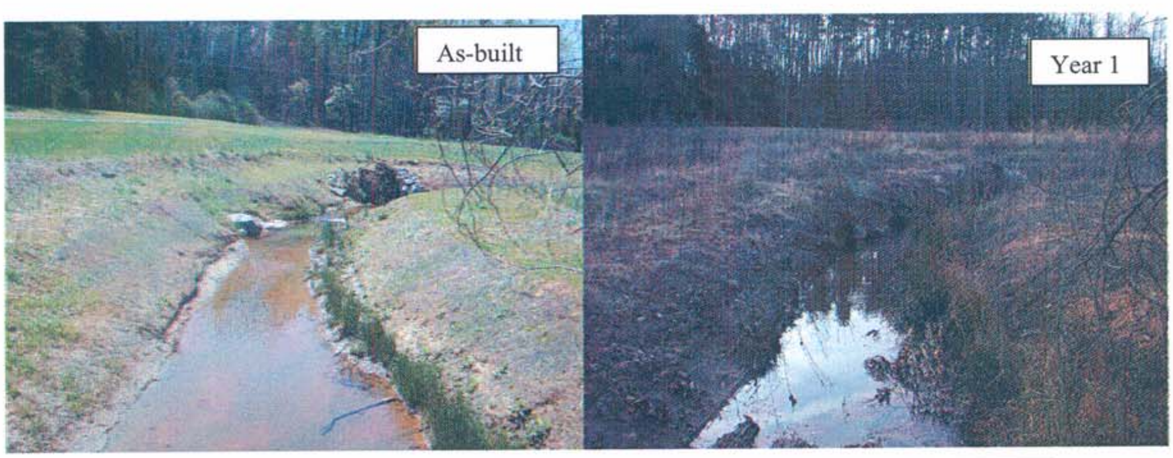
M1-US: Meander 1, looking in the upstream direction. Fenceline represents the beginning of the project and longitudinal profile. Note bar formation and vegetation establishment in this region.



M1-DS: View from Meander 1, looking downstream towards M2.

M2-US: View from Meander 2 looking in the upstream direction towards M1.

M2-DS: View from Meander 2, looking downstream at M3.

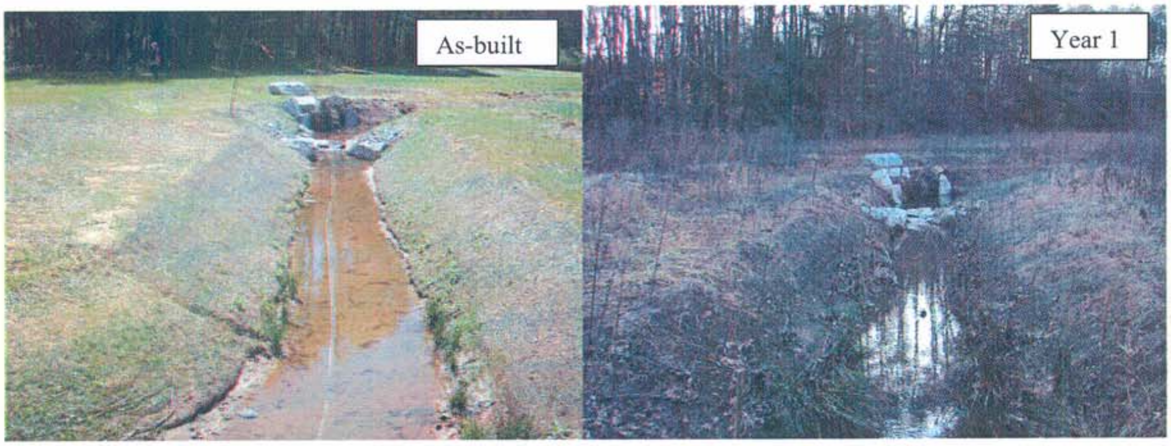


M3-US: View from Meander 3 looking upstream.

M3-DS: View from Meander 3 looking downstream towards a cross vane that was installed after the main construction period due to concerns with the grade downstream.

M4-US: View from Meander 4 looking upstream at Meander 3.

M4-DS: View from Meander 4 looking downstream towards Meander 5.



M5-US: View from Meander 5 looking upstream towards Meander 4.

M5-DS: View from Meander 5 looking downstream towards Meander 6.

M6-US: View from Meander 6 looking upstream towards Meander 5. Note rip-rap was installed at the end of construction due to bed downcutting.

M6-DS: View from Meander 6 looking downstream.

M7-US: View from Meander 7 looking upstream.

M7-DS: View from Meander 7 looking downstream.

M8-US: View from Meander 8 looking upstream.

M8-DS: View from Meander 8 looking downstream towards Meander 9.

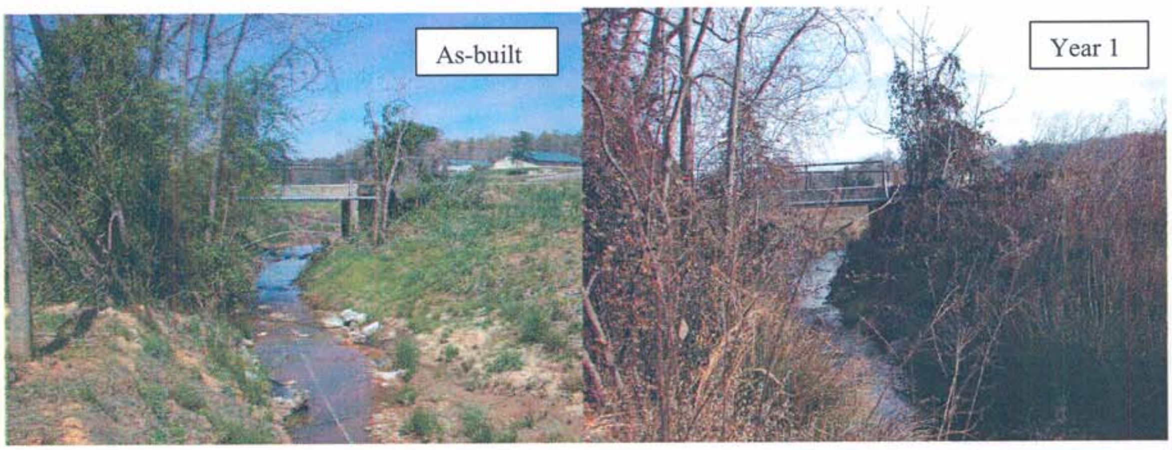
M9-US: View from Meander 9 looking upstream.

M9-DS: View from Meander 9 looking downstream. Note the point bar formation in the lower right corner of picture.

M10-US: View from Meander 10 looking upstream.

M10-DS: View from Meander 10 looking downstream. Note the bedrock in the bed of the channel exposed during construction.

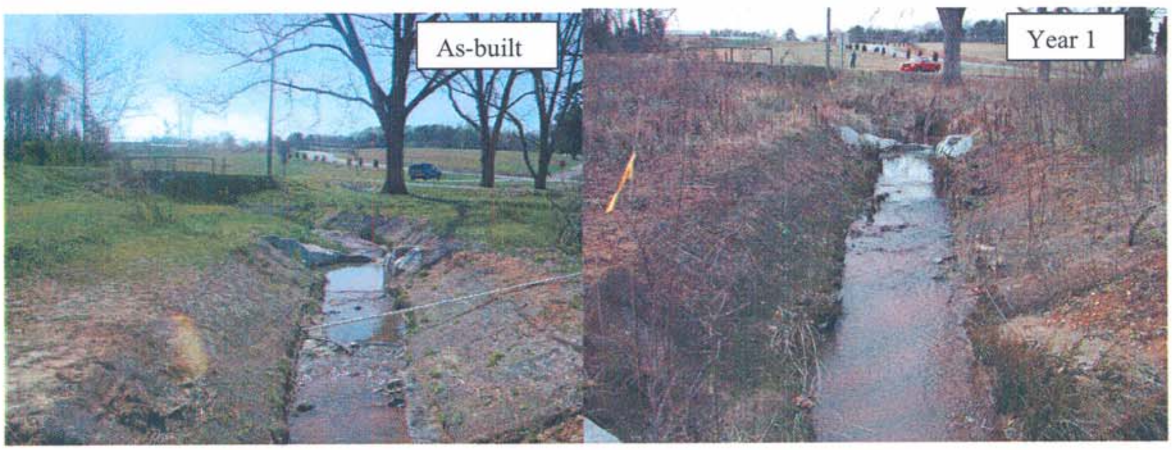
M11-US: View from Meander 11 looking upstream.



M11-DS: View from Meander 11 looking downstream. Jefferson Club Road crosses the stream via this 14' x 7.5 box culvert.

M12-US: View from Meander 12 looking upstream through the culvert. Note how the channel has narrowed and vegetated in the Year 1 photograph.

M12-DS: View from Meander 12 looking downstream.



M13-US: View from Meander 13 looking upstream.

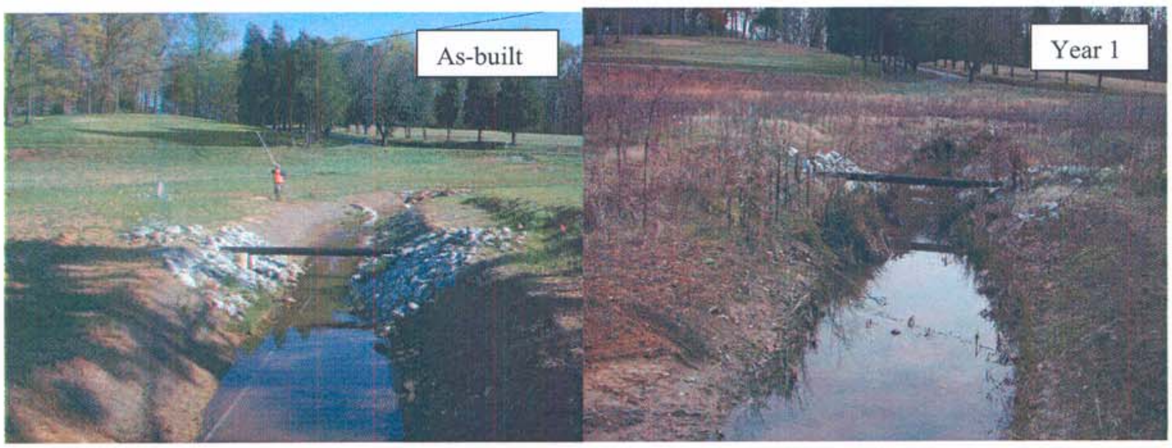
M13-DS: View from Meander 13 looking downstream.

M14-US: View from Meander 14 looking upstream.

M14-DS: View from Meander 14 looking downstream. Note stone step-pool outfall to connecting roadway drainage to stream channel.

M15-US: View from Meander 15 looking upstream.

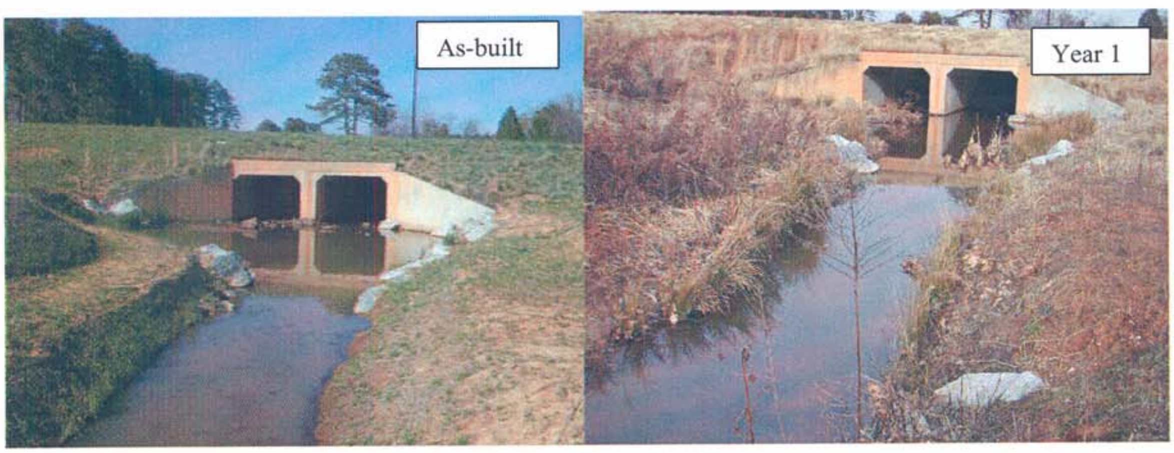
M15-DS: View from Meander 15 looking downstream. Note this cross-vane was moved upstream into the meander to avoid a gas line during construction. In effect, the upper portion of the cross vane has been covered up by the point bar.



M16-US: View from Meander 16 looking upstream. The aerial sewer line was re-routed to make it perpendicular to the stream.

M16-DS: View from Meander 16 looking downstream. Cross-vane is drowned out due to backwater from the off-site lake downstream.

M17-US: View from Meander 17 looking upstream.



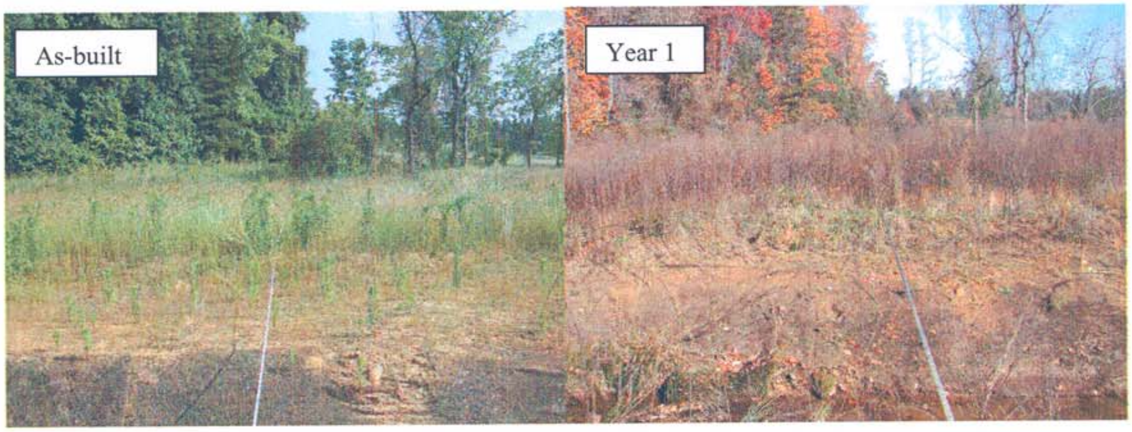
M17-DS: View from Meander 17 looking downstream towards the double 10' x 8' box culvert. Cross-vane is drowned out.

APPENDIX D
VEGETATION PHOTO LOG

Vegetation Photo Log

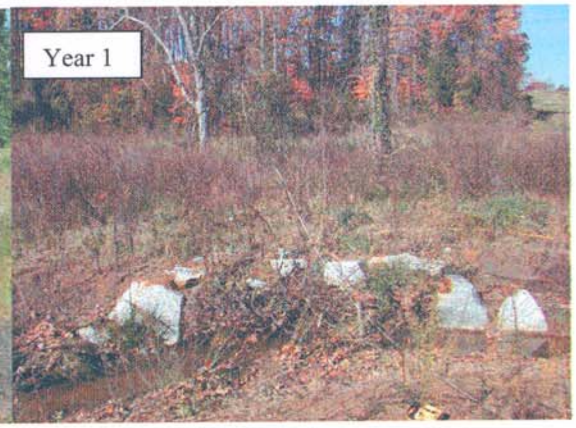
Jefferson Pilot Stream Restoration –Year 1

Guilford County, North Carolina

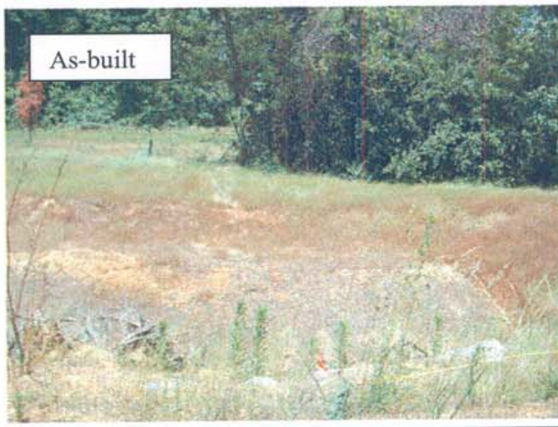


Transect 1 (BT1-L) – Left bank. Shows build-out bench above coir matting with thin herbaceous vegetation

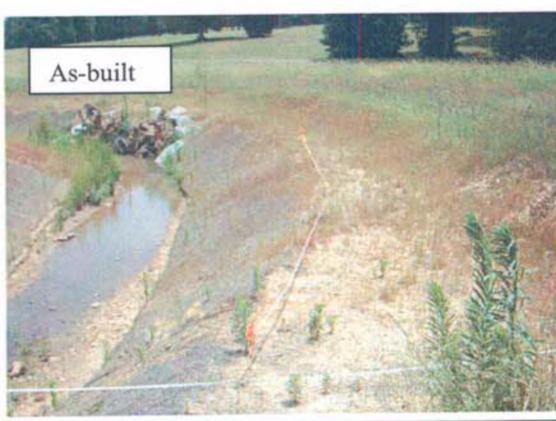
Transect 2 (BT2-L) – Left bank. Shows belt transect tape crossing a root wad. Tape for build-out bench plot is in the foreground.



Transect 3 (BT3-L) – Left Bank. Shows herbaceous vegetation.



Transect 4 (BT4-L)– Left bank. Looking at area disturbed by construction of new structure.



Transect 5 (BT5-D)– View of right build-out bench looking downstream. Note development of sedges and rushes on point bar above structure.

Transect 7 (BT7-L)– Left bank below bridge. Shows significant elevation change between build-out bench and buffer elevation.

Transect 8 (BT8-D)– Right build-out bench looking downstream. Shows relatively dense herbaceous vegetation.

Transect 9 (BT9-R) – View of right bank, build-out bench and buffer.

Photo Log

Jefferson Pilot Stream Restoration
Guilford County, North Carolina

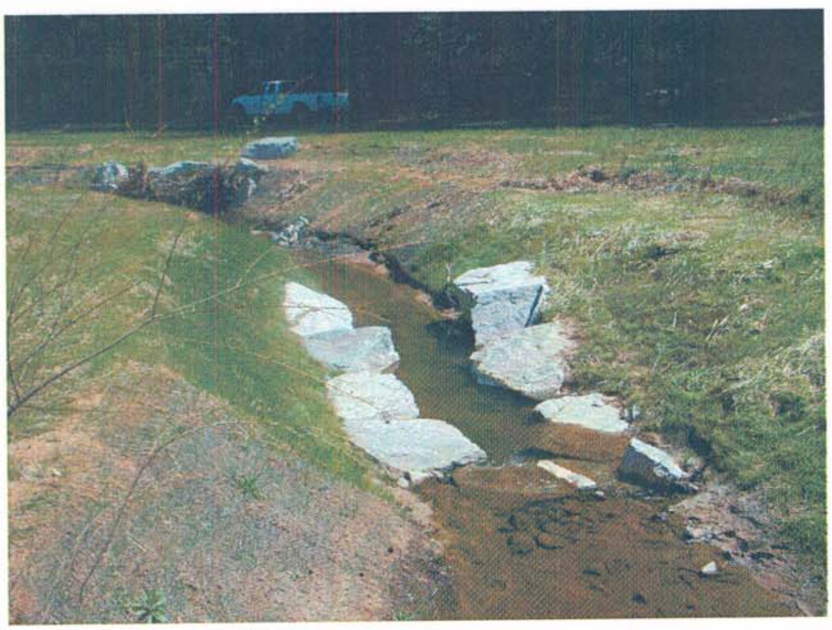
M1-US: Meander 1, looking in the upstream direction. Fenceline represents the beginning of the project and longitudinal profile.

M1-DS: View from Meander 1, looking downstream towards M2.

M2-US: View from Meander 2 looking in the upstream direction towards M1.

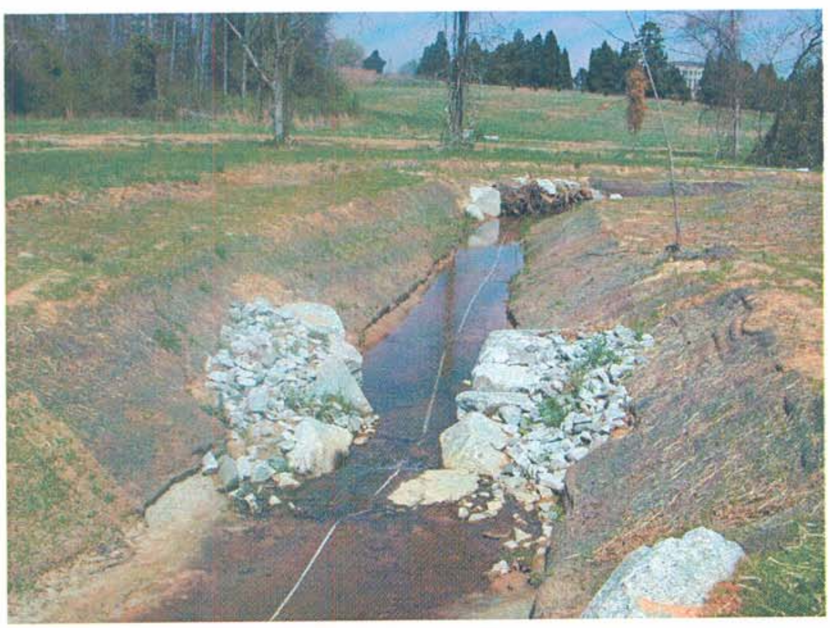
M2-DS: View from Meander 2, looking downstream at M3.

M3-US: View from Meander 3 looking upstream.



M3-DS: View from Meander 3 looking downstream towards a cross vane that was installed after the main construction period due to concerns with the grade downstream.

M4-US: View from Meander 4 looking upstream at Meander 3.

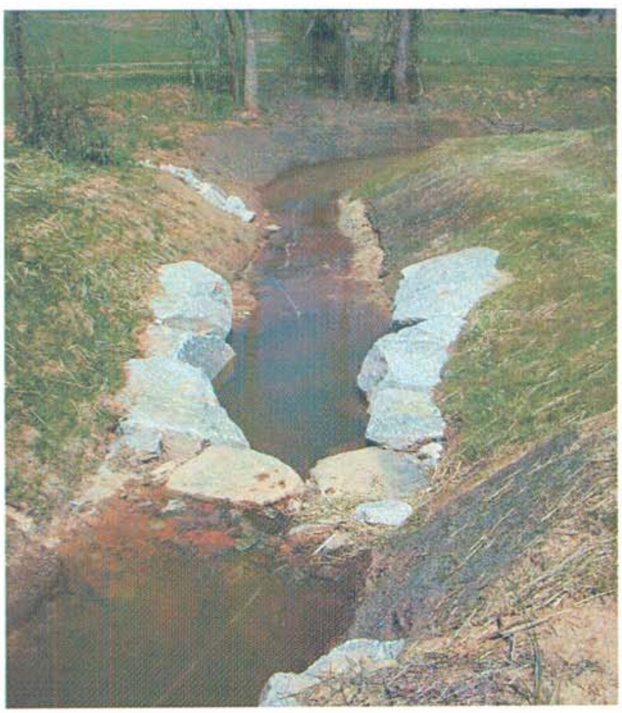


M4-DS: View from Meander 4 looking downstream towards Meander 5.

M5-US: View from Meander 5 looking upstream towards Meander 4.

M5-DS: View from Meander 5 looking downstream towards Meander 6. Note the cross rock and the boulder adjacent to it on the right have settled since construction and are below the water surface.

M6-US: View from Meander 6 looking upstream towards Meander 5. Note rip-rap was installed at the end of construction due to bed downcutting.



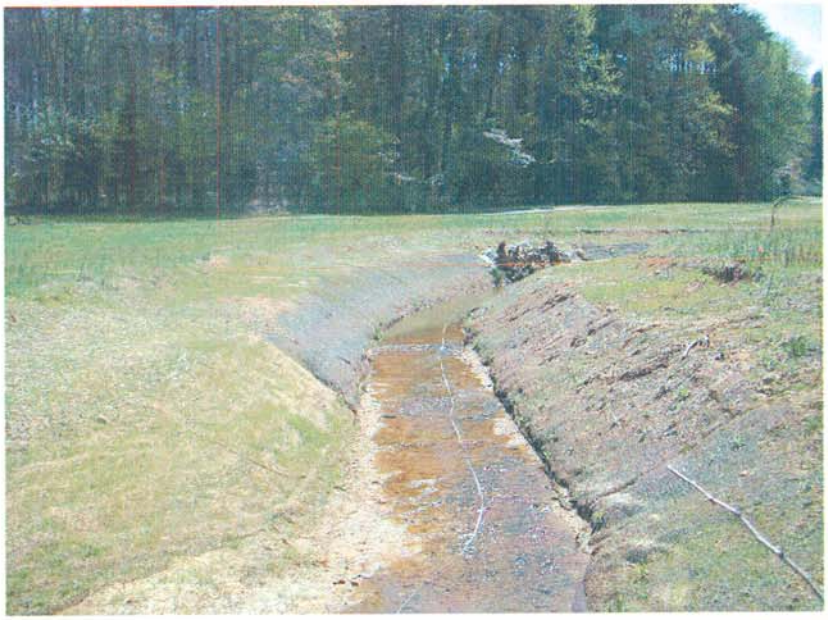
M6-DS: View from Meander 6 looking downstream. Note newly constructed cross-vane due to upstream degradation since the initial construction. Water is short cutting between the cross boulders on the right side.

M7-US: View from Meander 7 looking upstream.

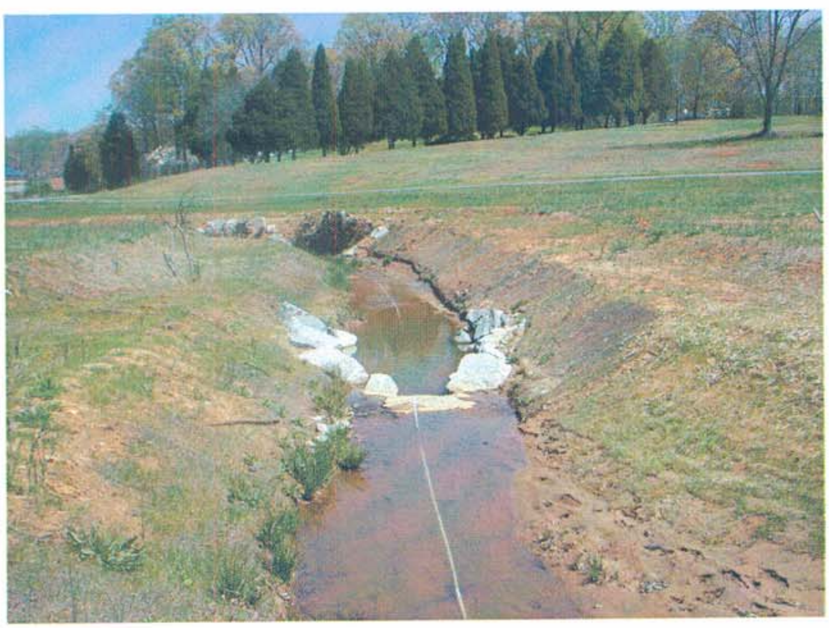
M7-DS: View from Meander 7 looking downstream.

M8-US: View from Meander 8 looking upstream. Note the yellow fiberglass tape is pulled across the pool cross section in the foreground.

M8-DS: View from Meander 8 looking downstream towards Meander 9. Meander 9 does not have rootwads since the existing trees were salvaged.

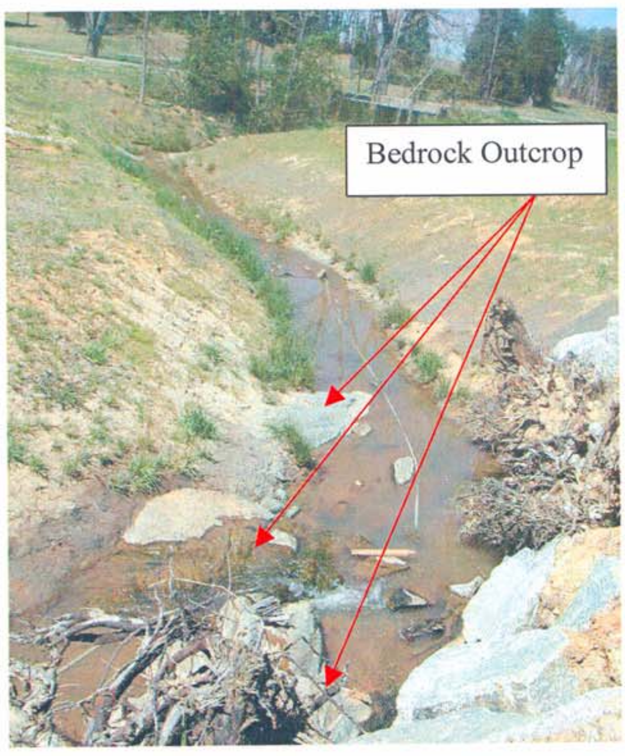


M9-US: View from Meander 9 looking upstream. Note the fiberglass tape is pulled across a riffle cross section near the center of the picture.



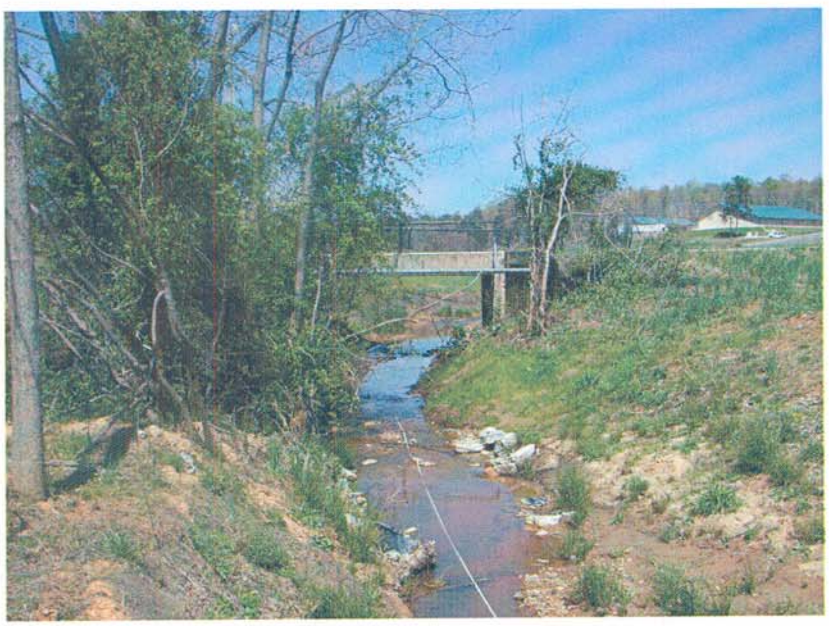
M9-DS: View from Meander 9 looking downstream. Note the point bar formation in the lower right corner of picture.

M10-US: View from Meander 10 looking upstream.



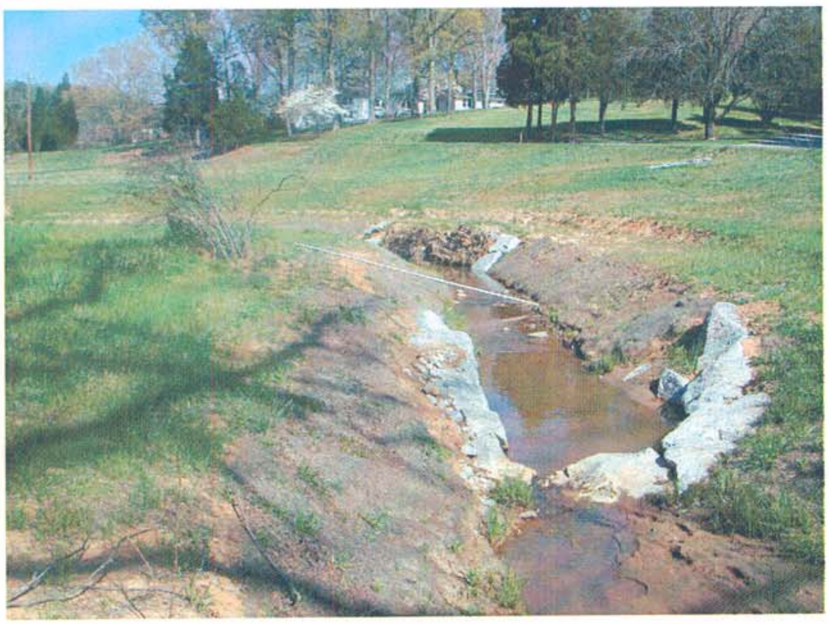
M10-DS: View from Meander 10 looking downstream. Note the bedrock in the bed of the channel exposed during construction.

M11-US: View from Meander 11 looking upstream.



M11-DS: View from Meander 11 looking downstream. Jefferson Club Road crosses the stream via this 14' x 7.5 box culvert.

M12-US: View from Meander 12 looking upstream through the culvert.

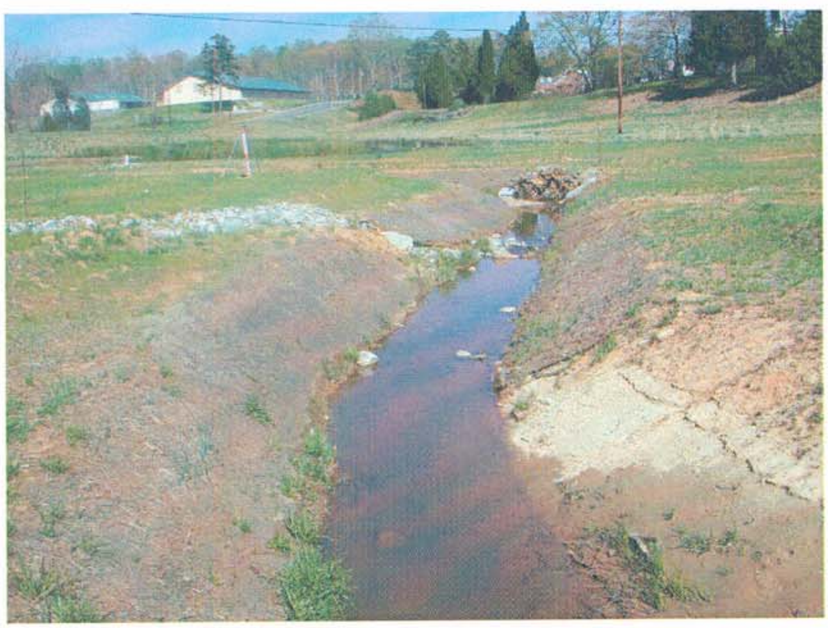


M12-DS: View from Meander 12 looking downstream.

M13-US: View from Meander 13 looking upstream.

M13-DS: View from Meander 13 looking downstream.

M14-US: View from Meander 14 looking upstream.



M14-DS: View from Meander 14 looking downstream. Note stone step-pool outfall to connect roadway drainage to stream.

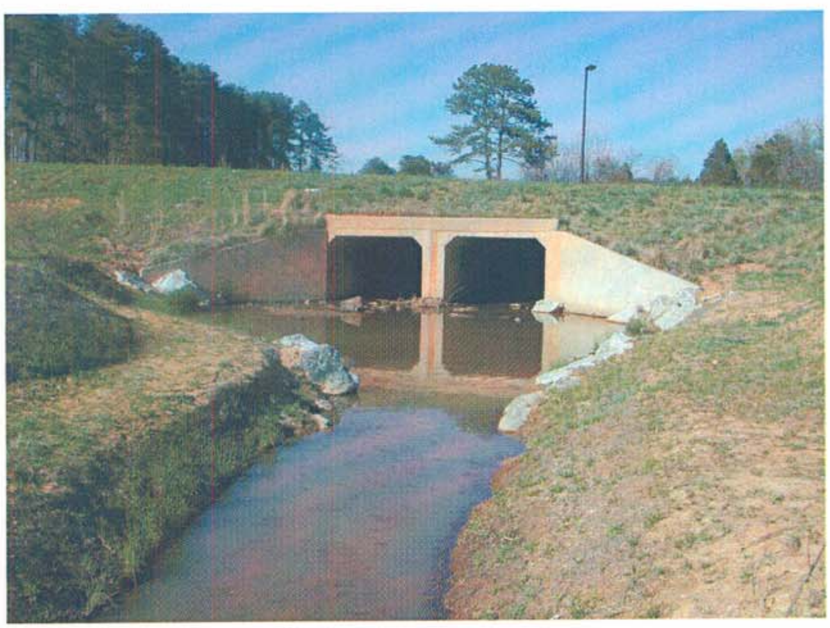
M15-US: View from Meander 15 looking upstream.

M15-DS: View from Meander 15 looking downstream. Note this cross-vane was moved upstream into the meander to avoid a gas line during construction. In effect, the upper portion of the cross vane has been covered up by the point bar since the cross vane slowed the water on the inside meander.

M16-US: View from Meander 16 looking upstream. The aerial sewer line was re-routed to make it perpendicular to the stream.

M16-DS: View from Meander 16 looking downstream. Cross-vane is drowned out due to backwater from the off-site lake downstream.

M17-US: View from Meander 17 looking upstream.



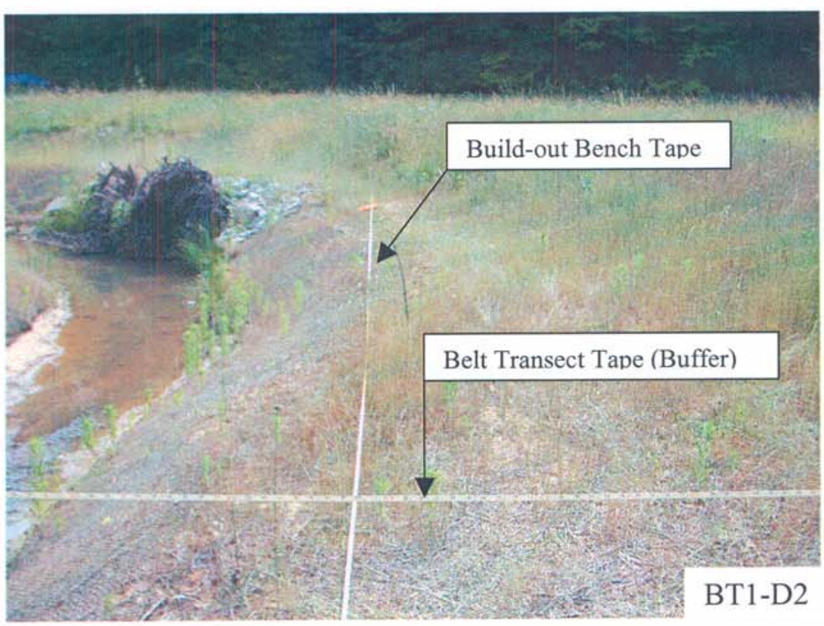
M17-DS: View from Meander 17 looking downstream towards the double 10' x 8' box culvert. Cross-vane is drowned out.

Vegetation Photo Log

Jefferson Pilot Stream Restoration –As-Built
Guilford County, North Carolina
June 6, 2002

BT1-L

Transect 1 – Left bank. Shows build-out bench above coir matting with thin herbaceous vegetation



BT1-D2

Transect 1 – Right build-out bench looking downstream. Shows the right side build-out bench vegetation. Transect tape in foreground, suspended above bench

Transect 2 – Left bank. Shows belt transect tape crossing a root wad. Tape for build-out bench plot is in the foreground.

Transect 3 – View of right build-out bench looking downstream. Shows herbaceous vegetation on build-out bench and transplant above structure in background.

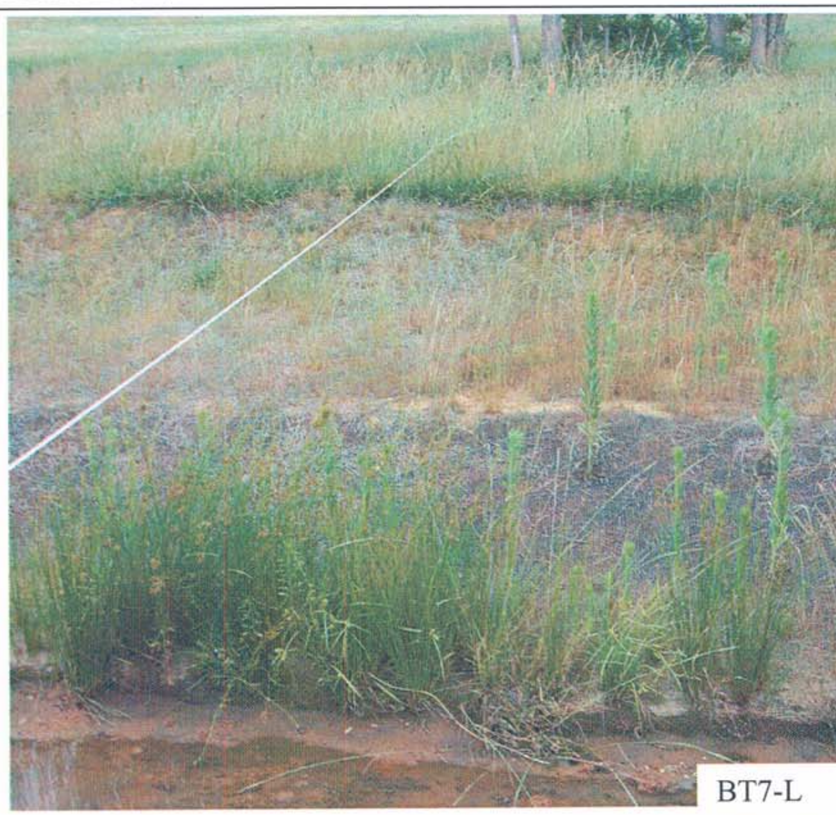

BT4-D

Transect 4 – Right build-out bench looking downstream, facing area of new structure.


BT4-L

Transect 4 – Left bank. Looking at area disturbed by construction of new structure.

Transect 5 – View of right build-out bench looking downstream, showing tape setup for bench plot. Note development of sedges and rushes along edge of stream on point bar above structure.



Transect 7 – Left bank in lower section below bridge. Shows significant elevation change between build-out bench and buffer elevation.

Transect 8 – Right build-out bench looking downstream. Shows relatively dense herbaceous vegetation, primarily Italian ryegrass.

Transect 9 – View of right bank, build-out bench and buffer.