# **Price Park Stream Restoration**

# **2003 Annual Monitoring Report**



- Delivered to: NCDENR/Ecosystem Enhancement Program 1619 Mail Service Center Raleigh, NC 27699-1619
- Prepared by: Biological & Agricultural Engineering Water Resources Research Institute North Carolina State University Campus Box 7625 Raleigh, NC 27695

March, 2004



### 2003 Price Park Stream Restoration Monitoring Abstract

An unnamed Tributary to Horsepen Creek, henceforth referred to as Price Park, was enhanced/restored through the North Carolina Ecosystem Enhancement Program (NCEEP). The goals and objectives of this project are as follows:

- 1.) Restore 1,776-linear feet of unnamed tributary to Horsepen Creek.
- 2.) Establish a riparian zone surrounding restored channel.

This is the 3<sup>rd</sup> year of the 5-year monitoring plan for Price Park Stream Restoration.

Project Name	Price Park - unnamed Tributary to Horsepen Creek
Designer's Name	Earth Tech of NC, Inc
	Raleigh, NC 27607
Contractor's Name	SEI, Inc
Project County	Guilford County
Directions to Project Site	Guildford College Road Exit off I-40. Follow north to New Garden Road. After passing Guilford College and Jefferson School, turn right at the light. Follow to the bottom of the hill where the creek crosses the road at Price Park. The project is upstream and downstream of the road crossing and is fully contained within the limits of Price Park.
Drainage Area	1.0 sq mi
USGS Hydro Unit	3030002
NCDWQ Subbasin	16-11-5-1
Project Length	1,776 linear feet
<b>Restoration Approach</b>	- Restore 1,464 linear feet of impaired stream into 1,776 linear using Priority I techniques
	- 50 foot riparian buffer throughout the project
Date of Completion	August 2001 with modifications, Feb. 2002 and planting completed March 2002
Monitoring Dates	4-2002, 12-2002

#### **Table 1A. Background Information**

#### **Results and Discussion**

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

#### Table 2A. Summary of Channel Conditions

DIMENSION		Price Park		Price Park			Price Park			Price Park		
	Cross-section #1			Cross-section #2			Cross-section #3			Cross-section #4		
	Riffle			Pool			Riffle			Riffle		
	As-built	Dec-02	2003	As-built	Dec-02	2003	As-built	Dec-02	2003	As-built	Dec-02	2003
Bankfull Cross-sectional Area	24.1	25.6	37.0	50.6	49.3	44.9	31.9	28.4	31.9	36.7	43.4	36.3
Bankfull Width	13.3	14.8	15.0	22.2	21.0	21.2	14.0	14.0	14.7	17.2	19.1	17.2
Bankfull Mean Depth	1.8	1.7	2.5	2.3	2.3	2.1	2.3	2.0	2.2	2.1	2.3	2.1
Bankfull Max Depth	3.5	3.6	4.3	4.9	4.8	4.8	3.6	3.4	3.6	3.2	3.6	3.7

PATTERN		Price Park			Price Park		Price Park			
		As-built			2002		2003			
	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	
Meander Wave Length	127	183	150	118	197	162	63	254	99	
Radius of Curvature	49	84	65	48	85	61	26	131	59	
Beltwidth	49	80	-	52	95	-	35	169	79	

PROFILE		Price Park		Price Park				
		As-built		2003				
	Minimum	Maximum	Median	Minimum	Maximum	Median		
Riffle Length	1	Not Reporte	d	9.46	59.45	46.735		
Riffle Slope	1	Not Reporte	d	0.56%	2.86%	1.42%		
Run Length	1	Not Reporte	d	29.4	87.3	41.8		
Run Slope	1	Not Reporte	d	-0.03%	0.69%	0.16%		
Pool Length	1	Not Reporte	d	22	62	38		
Pool to Pool Spacing	21	153	92	64.5	343	91.5		

SUBSTRATE	Price	Park	Price	Park	Price	Park	Price	Park	
	Cross-secti	on #1	Cross-secti	on #2	Cross-secti	on #3	Cross-section #4		
	Rit	ffle	Po	ool	Rit	ffle	Riffle		
	As-built	2003	As-built	2003	As-built	2003	As-built	2003	
D50	0.34	0.11	0.26	1.45	0.16	0.14	0.25	0.30	
D85	87.7	68.2	1.5	14.5	6.7	12.1	6.9	14.8	

VEGETATION	Quad 1 - JP		Quad 2 - JP		Quad 3 -JP		Quad 4 - JP		Quad 5 -JP	
	Observed	Planted*	Observed	Planted*	Observed	Planted*	Observed	Planted*	Observed	Planted*
Tree Stratum (stems/acre)	160	0	280	40	40	0	120	120	80	80
Shrub Stratum (% cover)	0.5	n/a	0.5	n/a	0.5	n/a	1	n/a	0	n/a
Herb Stratum (%cover)	7.5	n/a	97	n/a	17.5	n/a	87	n/a	70	n/a

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

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

- The lack of successful vegetation in the riparian buffer
  - Supplemental plantings are needed to meet minimum density.
  - Soil should be tested for fertility and amended as directed.
- Down-cutting near channel confluence
  - This area should be monitored to ensure the down-cutting does not continue up through the project.
  - Areas with bank erosion due to overland flow washing into the channel
    - These areas should be examined closely to see if a structure is necessary to provide a stable method of allowing the water to enter the channel or if vegetation will be adequate.
    - These areas should be monitored closely during upcoming site visits to monitor degradation.
- The lack of successful herbaceous cover along sections of the streambanks.
  - These areas should be reseeded.
  - It will be required to prepare a seedbed in order establish herbaceous cover.

#### Vegetation Overall

- Replanting trees to obtain mitigation requirements
  - The site could benefit from larger containerized trees both for bank stability and aesthetics.
- Stake only in areas where erosion is problematic
  - Live staking should also help in the establishment of herbaceous vegetation on the bare banks.
- Monitor invasive vegetation
  - Although invasive vegetation has not consumed this project site, there are numerous species that should be controlled now, most importantly kudzu and oriental bittersweet.

#### **Photos**

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

## **Price Park – Unnamed Tributary to Horsepen Creek**



**Typical Riffle.** 



Issue Photo 1 - Station 3+00. Bank scour below cross vane



**Typical Pool.** 



Issue Photo 2 - Station 3+60. Bank erosion behind rootwads.



Issue Photo 3 – Station 5+30 Unsecured matting and unvegetated bank.



Issue Photo 4 – Station 5+00 Erosion on bank below cross vane and washed away matting



Issue Photo 5 – Station 6+50 Unprotected bank



Issue Photo 7 – Station 7+40 Bank slump due to over-bank wash



Issue Photo 9– Station 13+70 Bank slump between root wads resulting from overland flow



Issue Photo 6 – Station 6+00 Cutting under cross vane



Issue Photo 8– Station 8+50 Bank slump due to over-bank wash



Issue Photo 10 – Station 14+10 Bank washout



Issue Photo11 – Station 13+50 Erosion near drainage channel



Issue Photo 12 – Station 13+60 Overland flow eroding channel bank

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#### **1.0 BACKGROUND INFORMATION**

The background information for this report is referenced from previous monitoring reports conducted by Earth Tech, Inc. The following was excerpted from 2001 Earth Tech As-Built monitoring report section 1.1:

This site is located on the west side of Greensboro off New Garden Road. The stream reach is located at the entrance to Price Park on land that is held by the City of Greensboro (Figure 1). The stream is situated in the Upper Cape Fear River Basin (8-digit hydrologic code: 03030002). Jefferson Elementary is located to the west, Price Park to the east, and Guilford College is located south of the site. Local residents use the area surrounding the stream for walking, biking, and other recreational activities.

The stream is the unnamed tributary to Horsepen Creek, henceforth referred to as the Jefferson Pilot stream. This stream drains into a private pond that backs up the lower portion of the channel. The pond elevation was raised after the restoration construction was completed. From a review of historical aerial photographs, this second order stream appears to have been straightened prior to 1937 for agricultural purposes. The drainage area is approximately 1.0 square mile (Figure 1).

Prior to the restoration, a narrow riparian corridor existed along much of the stream banks and the channel was deeply incised with active erosion and undercutting. Within this buffer, the vegetation was relatively weedy and scrubby with only approximately 10 trees with a basal diameter greater than 10 inches. Development pressures continue to increase the urbanization in the Jefferson Pilot watershed and adjacent watersheds.

The Priority I restoration involved converting the 1436 ft straightened channel into a sinuous channel that meanders for a total of 1646 ft as measured along the centerline or 1,776 along the thalweg (Appendix A). Cross-vanes and rootwads were incorporated for aquatic habitat enhancement and bed and bank stability. A 50-foot riparian buffer on either side of the stream was planted with native vegetation. In addition, an aerial sanitary sewer line was re-aligned to be perpendicular to the stream flow and a gas line was re-routed under the stream channel.

Table 1 contains a schedule of events for the construction of the Jefferson Pilot stream.

Construction Event	Date
Channel construction	June-August 2001
Additional structure construction	February 25-28, 2002
Temporary Seeding	July-August 2001
	February 2002 (limited to disturbed areas after construction of additional structures)

#### **Table 1. Schedule of Construction Events**

Permanent Seeding	August 2001
Planting of bare-root stock	February 18-19, 2002 & March 7, 2002
As-built Stream Survey	April 11, 2002
As-built Vegetation Survey	June 6, 2002

#### **1.1 Goals and Objective**

The goals and objectives of this project are as follows.

- 1.) Restore 1,776-linear feet of unnamed tributary to Horsepen Creek.
- 2.) Establish a riparian zone surrounding restored channel.

#### **1.2 Project Location**

The project is located in Greensboro, North Carolina. From Interstate I-40 exit on Guilford College road north. Follow Guildford College road for about 2 miles and near right onto New Garden road. Follow New Garden road for about 1 mile. Past Guildford College, turn right onto Jefferson Club road. The project is located at the bottom of the hill at the stream crossing. The culvert is located in the middle of the project.

#### **1.3 Project Description**

The restoration of 1,776 linear feet of the Unnamed Tributary to Horsepen Creek, hereafter referred to as Price Park, consists of re-meandering and re-connecting the existing channel to the floodplain. Riffle-pool bedform was constructed as well as a stable meander pattern developed from stable reference streams. Pools were maintained through the use of cross vane structures used to hold the bed elevation at the outlet of the pools. Rootwads were used to stabilize the outside of the meander bends. Vegetation was planted to establish a dense root mass along the stream banks and in the riparian zone.





#### Figure 3. Plan view of As-built conditions

(To be attached) showing all structures with station numbers showing vegetation permanent plots showing permanent cross-sections and benchmarks showing vegetation plots showing monitoring gauges

# **Figure 4. Plan view of 2003 overlain on As-built** (To be attached)

#### 2.0 YEAR 2003 RESULTS AND DISCUSSION

Year 2003 monitoring results are shown for Little Pine and Brush Creek Monitoring.

#### 2.1 Vegetation

The following describes the results of 2003 vegetation monitoring conducted at the Price Park Stream Restoration Site. Sampling and analysis methods used can be found in the appendix. Modifications to those methods are described below. Using the <u>Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects</u>, 5 vegetation monitoring plots were randomly located within the riparian buffer of the Price Park project. No reference area was studied; therefore no comparisons could be made to reference conditions.

#### 2.1.1 Results and Discussion

Vegetation within the riparian buffer of this unnamed tributary to Horsepen Creek is overall considered unsuccessful. The upper portion of the restoration site (above road culvert) was scantily vegetated with very few native species. Vegetation below the culvert was slightly denser as the area was more wetland-like and contained wetter herbaceous species such as *Juncus* spp. (rushes) and *Carex* spp. (sedges). The planted native herbaceous vegetation noted was *Helianthus* spp. (sunflowers) and *Panicum* spp. (switchgrass and deertongue). These occurred mainly on the floodplain. The banks were largely devoid of vegetation. Microstegium and Lespedeza were among many exotics located within these areas.

Live stakes were absent throughout the entire project. Planted trees and shrubs are doing poorly throughout the entire buffer, although a few sycamores (*Platanus occidentalis*) were growing well at a few locations. Volunteer species of *Cornus amonum* (silky dogwood), *Alnus serrulata* (tag alder), and *Sambucus canadensis* (elderberry) are scattered sparsely throughout. Tree mortality was apparently high when compared to the number of trees initially planted. Extrapolation from the five plots resulted in an overall average of approximately 48 planted trees per acre for this restoration site. If natural regeneration is included with planted trees, the number is increased to an average of approximately 136 trees per acre. Both of these estimates are based on a diverse mix of species as well. Natural regeneration obviously plays an important role in the restoration of this site; however, more trees are needed to meet mitigation requirements.

Invasive plant species on the site included *Lonicera japonica* (Japanese honeysuckle), *Pueraria lobata* (kudzu), *Lespedeza cuneata*, *Celastrus orbiculatus* (oriental bittersweet), *Microstegium vimineum*, and *Rosa multiflora* (multiflora rose). Kudzu and oriental bittersweet are of major concern due to their prolific spreading and choking tendencies. Kudzu was documented both upstream and downstream of the culvert in small patches. Bittersweet was heavy in adjacent mature trees above the culvert and will likely work its way into the buffer. Multiflora rose, honeysuckle, and lespedeza were scattered throughout and nowhere abundant.

#### 2.2 Morphology

Restored channel dimension, pattern, profile and substrate were examined during the 2003 monitoring.

#### 2.2.1 Results and Discussion

Channel profile along Price Park has maintained grade over the past year for the majority of the restored reach. Some down cutting has occurred from station 10+37 to 16+00. Above the culvert, riffles are not present. Below most of the cross vanes is a scour pool followed by a run feature. Four riffles were observed along the project. Bedrock continues to define channel grade as the project approaches the culvert.

Pools throughout the project are maintaining scour depth throughout the project. Pool length appears to be increasing but no previous data was collected to validate this observation. Pool to pool spacing has increased but this is likely the inclusion of cross vane scour pools in previous analysis. Impacts of the downstream pond on the profile remain on the lower 250 feet of the project. Backwater at low flow reaches to station 15+00, crating a long pool.

Channel cross-sections have remained mostly consistent since construction. There are areas of bank slumping as evident in cross-section #3. Most bank slumping appears to be the result of overland flow washing into the channel. Cross-section #1 continues to show signs of enlarging due to channel down cutting. Cross-section #2 (pool) is decreasing in area as a result of aggrading along the inside meander. Cross-section #4 have remained similar in area to as-built conditions.

Channel substrate has remained similar to as-built conditions throughout the reach. Cross-section #1 has decreased in coarseness (d50 of 0.34mm to 0.11mm) but appears to have stabilized. The pool cross-section (#2) has coarsened since construction showing there is a significant amount of scour through the meander. Cross-sections #3 and #4 have remained very similar to as-built conditions.

Channel pattern appears to have been maintained since construction. A few of the outside meander bends are experiencing slight migration through bank slumping but no excessive migration is evident and no shoot cut-offs are apparent.

Channel banks throughout the project vary in condition from stable and well vegetated to eroded with no vegetation. Eroded areas appear to be the result of upland and floodplain drainage into the channel and lack of stream bank vegetation. This is a particular problem in areas where the new channel approached the old channel that we filled in (station 5+00). Stormwater appears to be traveling down the floodplain in the location of the old channel and intersecting the new channel in two locations (stations 3+50 and 5+00). In these areas, herbaceous vegetation has not established and the channel bank is scouring from the top down. Stormwater is also draining from depressions on the floodplain and entering the channel in concentrated form at stations 7+40, 8+50, 13+50 through 13+70 and 14+10. Streambanks in these areas are eroded as well. Vegetation along some of the streambanks is sparse and needs supplemental planting to establish root mass on the banks.

#### **Table 2. Summary of Channel Conditions**

DIMENSION		Price Park		Price Park			Price Park			Price Park		
	Cross-section #1			Cross-section #2			Cross-section #3			Cross-section #4		
	Riffle			Pool			Riffle			Riffle		
	As-built	Dec-02	2003	As-built	Dec-02	2003	As-built	Dec-02	2003	As-built	Dec-02	2003
Bankfull Cross-sectional Area	24.1	25.6	37.0	50.6	49.3	44.9	31.9	28.4	31.9	36.7	43.4	36.3
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Bankfull Max Depth	3.5	3.6	4.3	4.9	4.8	4.8	3.6	3.4	3.6	3.2	3.6	3.7

PATTERN		Price Park			Price Park		Price Park			
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D85	87.7	68.2	1.5	14.5	6.7	12.1	6.9	14.8

VEGETATION	Quad	1 - JP	Quad	2 - JP	Quad	3 -JP	Quad	4 - JP	Quad	5 -JP
	Observed	Planted*								
Tree Stratum (stems/acre)	160	0	280	40	40	0	120	120	80	80
Shrub Stratum (% cover)	0.5	n/a	0.5	n/a	0.5	n/a	1	n/a	0	n/a
Herb Stratum (%cover)	7.5	n/a	97	n/a	17.5	n/a	87	n/a	70	n/a

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



▲ Right Bankfull ----- Water Surface — Long Pro 2003 Left Bankfull 



#### 2.3 Areas of Concern

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

- The lack of successful vegetation in the riparian buffer
  - Supplemental plantings are needed to meet minimum density.
  - Soil should be tested for fertility and amended as directed.
- Down-cutting near channel confluence
  - This area should be monitored to ensure the down-cutting does not continue up through the project.
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#### Vegetation Overall

- Replanting trees to obtain mitigation requirements
  - The site could benefit from larger containerized trees both for bank stability and aesthetics.
- Stake only in areas where erosion is problematic
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- Monitor invasive vegetation
  - Although invasive vegetation has not consumed this project site, there are numerous species that should be controlled now, most importantly kudzu and oriental bittersweet.

#### 2.4 Photo Log

#### **Price Park Photo Log**

#### Appendices

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

1	Project Name 1 Task 1	Price Park Longitudina	l Profile				Symbol Key	Thalweg		
	1 dSK 1	Longitudina	a i toine				TR I	Head of Rift	fle	
	Date						TP I	Head of Poo	d	
	Crew S	Shaffer, Bid	elspach, Clin	ton			TU I TM I	Head of Rur Max Pool	1	
	2003 Survey						1101	Max 1 001		
	TW Shot	TW	TW	ws	ws	LBKF	LBKF	RBKF	RBKF	
	number	Station	Elevation	Station	Elevation	Station	Elevation	Station	Elevation	Feature
	8.00	14.12	95.05			3.93	97.90	2.80	98.46	T
	7.00	14.33	93.75	16.66	95.32			18.28	97.77	Ť
	24.00	37.94	94.28	37.53	95.06	42.35	97.72	43.58	97.71	TP
	26.00	51.95	93.41	53.03	94.86	62.03	97.50	52.05	97.74	TU
	32.00	115.61	93.91	114.21	94.67	102.25	97.44	03.34	37.00	TP
	34.00	126.14	93.40	126.81	94.68	129.91	97.47	126.45	98.02	TM
	36.00	146.38	94.20	147.56	94.62	149.15	97.44	149.87	97.33	XV
	40.00	172.85	92.25	173.04	94.49	180.37	97.64			τυ
	42.00	190.87	93.39	190.29	94.50	182.18	97.57			TP
	44.00	208.05	93.16	210.31	94.50					TM
	46.00	226.13	94.10	225.19	94.52	217.74	97.34			T
	52.00	280.00	93.23	279.70	93.85	274.17	97.56			TP
	54.00	298.26	92.24	300.34	93.82			296.32	97.59	TM
	57.00	317.71	93.54	318.94	93.90	312.72	97.03	326.35	97.33	XV T
	61.00	350.88	91.49	352.20	92.85	355.59	96.99			Ť
	63.00	367.52	91.76	369.52	92.86			368.86	96.44	TP
	65.00 67.00	391.05	91.02	393.96	92.90	406.24	06.15	384.01	96.12	TM
	69.00	400.47	92.56	407.05	92.04	406.24	95.63	410.02	90.30	TP
	73.00	465.59	91.48	464.31	91.79	455.50	95.50			TP
	75.00	474.16	90.36	475.40	91.87	400.00	04.00			TM
	79.00 77.00	485.25 492.66	90.76 91.87	486.02 492.78	91.83 91.64	468.98	94.89			xv
	81.00	496.04	90.42	495.56	91.00					т
	83.00	507.05	89.75	507.67	90.97			507.25	94.74	T
	85.00 87.00	518.75 530.07	90.24 90.78	519.62 530 36	90.97	521.01	94.68			Ť
	89.00	540.63	90.56	539.82	90.71			543.22	93.92	TU
	91.00	554.38	89.63			560.37	93.84			TP
	93.00	578.00	89.10	578.04	90.70	582.32	93.44	504.22	02.75	TM
	97.00	601.82	90.48	601.58	90.72	606.15	93.84	394.23	93.75	T
	99.00	612.19	88.79	612.08	90.70					т
	101.00	626.20	89.99	664 27	00.22	637.63	93.64	630.16	93.39	T
	104.00	678.06	89.25	677.99	90.22	671.05	93.47	680.20	93.01	TP
	108.00	695.81	88.78	696.58	90.18					TM
	110.00	711.59	89.33	712.91	90.14	702.72	93.38	713.38	93.38	TG
	114.00	753.64	89.45 89.20	753.83	89.91	748.71	93.26	747.33	93.20	TP
	118.00	787.24	88.46							TM
	120.00	799.78	89.02	800.06	89.92			044.07	00.00	T
	122.00	820.26	89.64	813.76	89.88			814.37	92.93	T
	287.00	832.23	87.78			831.72	92.04			Ť
	126.00	840.19	89.26	840.11	89.62			839.62	93.14	T
	289.00	841.20	88.52 88.52	841.16	88.85	850.48	91.48	846.46	92.34	ти
	293.00	858.99	88.22							т
	294.00	861.57	87.36							Т
	295.00	866.98	87.69 87.83	874 07	88 79	875.86	91.61	876 69	92 77	т
	299.00	880.14	87.93	014.01	00.70	010.00	01.01	010.00	02.77	т т
	300.00	882.42	87.53							Т
	301.00	892.12	86.62	891.42	88.82			895.08	93.33	TM
	304.00	906.20	88.65	906.15	88.73	908.24	91.46			TBROCK
	306.00	912.31	87.17	912.39	87.58			915.41	92.33	TBROCK
	308.00	920.93	86.93	025.20	97 50					T
	311.00	924.00	86.84	920.30	07.59					Ť
	313.00	936.29	86.90							т
	314.00	953.62	86.11	953.56	87.36	950.23	90.61	005 0-	<i></i>	т
	316.00 318.00	964.07 988.21	86.32	988.46	87.40 87.41	972.19	90.58	965.92	91.22	÷
	320.00	994.26	87.16	994.20	87.37	994.39	90.81	1000.05	90.76	TBROCK
	322.00	1010.90	86.31	1011.26	86.66			1000 0	e · • -	TBROCK
	324.00 330.00	1027.32	85.76	1027.61	86.71	1063.03	91 22	1033.94	91.25	TC
	332.00	1108.90	85.80	1109.02	86.47	1109.04	90.00			TP
	334.00	1128.52	85.48	1134.29	86.43		aa 5-			TM
	335.00	1151.38	86.04	1150.83	86.40	1142.43	89.52	1143.75	89.91	т
	343.00	1205.71	85.46	1205.21	86.14	1197.46	88.76	1203.45	88.86	TP
	345.00	1218.65	83.79	1222.47	86.15	1229.38	88.75	1225.35	88.88	TM
	349.00	1275.00	84.79	1275.02	85.11	1263.02	88.73			TU
	353.00	1319.50	84.59	1318.92	85.00	1307.09	88.41	1317.02	88.41	TB
	355.00	1324.70	84.16	1325.78	85.03					т
	359.00	1384.62	83.98	1385.23	84.52	1393.70	87.75	1372.54	87.81	TU T
	363.00	1417.37	84.29	1417.19	84.55	1416.49	87.05	1418.41	87.46	TB
	365.00	1426.65	83.70	1427.41	84.14					TP
	367.00	1437.66	82.84	1440.81	84.12	1464.40	P7 07			TM
	369.00	1461.68	82.11	1464.49	84.06 84.09	1401.40	01.21	1468.53	87.12	Ť
	373.00	1472.96	83.72	1473.41	84.18	1478.93	87.25			TU
	377.00	1537.13	83.07	1537.18	84.10	1528.71	87.15	1517.79	87.25	TU
	380.00	1589.04	82.89	1587.87	84.10 84.12	1000.57	80.61	1581.15	86.89	TM
	384.00	1607.96	83.23	1611.73	84.14				55.55	xv
	385.00	1618.32	81.55			1612.92	86.28	1612.64	86.79	т
	386.00	1663.77	82.98 82.47	1651.30	84.12	1666.98	86.36	1652.05	86.53	÷
	388.00	1675.73	81.96		54.12		50.00	1678.44	86.71	т
	389.00	1701.10	82.83	1705.01	04.00	1700 40	05 70	1700 55	00.01	XV
	390.00	1766.02	83.47	1765.91	84.U9 84.17	1709.18	85.72	1706.55	d6.61	TCI

TW	TW	WS	BKF	
Station	Elevation	Elevation	Elevation	Feature
00+00.0	96.74	97.23		Fenceline
00+18.0	96.96	97.09	99.91	XVANE
00+22.0	96.01	96.80		XVANE-Max Pool
00+34.0	96.48	96.71	99.18	TR
00+60.0	95.19	96.59		TM
00+89.0	96.17	96.50	99.52	TR
01+44.0	95.47	96.57		TM
01+69.0	96.12	96.44	99.29	XVANE
01+73.0	94.50	96.44		XVANE-Max Pool
01+89.0	95.62	96.43	99.52	TR
02+25.0	95.14	96.39	00.00	IM
02+42.0	96.02	90.33	99.29	XVANE Max Bool
02+47.0	95.51	95.88	99.78	TP
03+08.0	94.24	95.75	55.70	тм
03+28.0	95.43	95.63	99.16	XVANE
03+42.0	93.87	95.03		XVANE-Max Pool
03+52.0	94.48	95.04	98.57	TR
04+06.0	93.16	95.00		тм
04+21.0	94.79	94.94	98.11	XVANE
04+30.0	93.28	94.61		XVANE-Max Pool
04+39.0	92.67	94.61	97.97	TR
04+86.0	92.06	93.86		TM
05+01.0	93.62	93.72	96.94	XVANE
05+13.0	91.03	92.87		XVANE-Max Pool
05+22.0	92.48	92.86	96.61	TR
05+68.0	91.26	92.54		TM
06+12.0	91.95	92.2	95.17	XVANE
06+20.0	90.39	92.22	05.40	XVANE-Max Pool
00+30.0	91.91	92.15	95.46	TM
07:46.0	90.40	92.02	04.24	TR
07+40.0	91.00	01.71	04.31	TM
08+25.0	91.30	91.71	94.92	XVANE
08+32.0	89.66	91.58	04.02	XVANE-Max Pool
08+61.0	91.16	91.5	94.15	TR
09+10.0	89.78	91.34		TM
09+24.0	91.23			Top Bedrock
09+35.0	89.54	90.26		Max Pool
09+70.0	89.89	90.15	93.5	TR
10+09.0	89.02	89.91		Top Bedrock
10+15.0	89.66	89.87	93.54	TM
10+36.0	88.68	89.51		TR
10+56.0	89.1	89.51		US Box Culvert
11+23.0	88.83	89.09		DS Box Culvert
11+65.0	88.55	88.98	92.15	XVANE
11+69.0	86.56	88.75		XVANE-Max Pool
11+88.0	88.3	88.64	91.81	IR
12+30.0	86.07	88.28		IM
12+57.0	87.94	00.13	91.1	XVANE May Deal
12+01.0	87.42	07.04	00.96	TD
12+74.0	96.62	07.02	80.00	TM
13+51.0	87.35	87.69	90.68	TR
13+82.0	87.04	87.36	90.48	Intermediate Point
14+12.0	85.79	86.95		Lateral Scour Pool
14+51.0	85.63	86.95		тм
14+64.0	85.82	86.72	89.65	XVANE
14+75.0	84.72	86.72		XVANE-Max Pool
14+92.0	86.17	86.69	89.76	TR
15+47.0	85.72	86.71		Aerial Sewer Line
15+95.0	85.18	86.66		тм
16+20.0	85.56	86.69	89.4	XVANE
16+31.0	84.18	86.66		XVANE-Max Pool
16+88.0	84.84	86.68		TM
17+09.0	85.31	86.67	89.17	XVANE
17+15.0	84.30	86.63		XVANE-Max Pool
17+76.0	85.46	86.67		DBL 10' x 8' Box Cul

TW	TW	ws	BKF	
Station	Elevation	Elevation	Elevation	Feature
00+00.0	96.39	96.86		Fenceline
00+18.0	96.83	96.83	99.55	XVANE
00+24.0	95.58	96.41		XVANE-Max Poo
00+35.0	96.40	96.51	98.85	TR
00+74.0	95.31	96.32		TM
00+94.0	96.18	96.32	98.90	TR
01+44.0	95.27	96.21		TM
01+69.0	95.86	96.11	98 90	XVANE
01+74.0	94.56	96.11		XVANE-Max Poo
01+92.0	95.76	96.11	99.30	TR
02+29.0	95.27	96.11		TM
02+46.0	95.85	96.06	99.01	XVANE
02+50.0	94,79	96.04		XVANE-Max Poo
02+77.0	95.64	96.01	99.37	TR
03+13.0	94.18	95.39		TM
03+31.0	95.25	95.32	98.89	XVANE
03+43.0	93.57	94.89		XVANE-Max Poo
03+51.0	94.45	94.86	98.31	TR
04+05.0	93.40	94.86		TM
04+18.0	94.58	94.86	97.83	XVANE
04+30.0	93.11	94.85		XVANE-Max Poo
04+38.0	92.54	94.82	97.73	TR
04+83.0	91.97	93.46		TM
05+02.0	93.54	93.37	96.51	XVANE
05+13.0	90.92	92.79		XVANE-Max Poo
05+20.0	92.38	92.78	96.45	TR
05+61.0	90.91	92.33		TM
06+14.0	91.85	92.09	94.88	XVANE
06+21.0	90.67	91.94		XVANE-Max Poo
06+40.0	91.75	91.94	95.19	TR
06+89.0	90.24	91.82		TM
07+46.0	91.69	91.81	94.98	TR
07+92.0	90.46	91.44		TM
08+24.0	91.12	91.41	94.24	XVANE
08+31.0	89.74	91.28		XVANE-Max Poo
08+54.0	91.13	91.29	94.00	TR
09+11.0	90.54	91.12		TM
09+32.0	89.27	90.02		TM
09+56.0	89.7	89.99	94.15	TR
10+04.0	89.16	89.68		Top Bedrock
10+24.0	88.81	89.27	93.41	TM
10+49.0	89.07	89.25		TR
10+86.0	88.66	89.04		US Box Culvert
11+04.0	88.41	88.93		DS Box Culvert
11+64.0	88.47	88.62	91.81	XVANE
11+69.0	86.53	88.46		XVANE-Max Poo
11+85.0	88.24	88.46	91.72	TR
12+30.0	86.11	88.09		IM
12+55.0	87.84	87.95	90.9	XVANE
12+59.0	86.71	87.66		XVANE-Max Poo
12+74.0	87.41	87.62	91.07	TR
13+24.0	86.85	87.39		IM
13+48.0	87.12	87.37	90.48	IK
13+82.0	86.87	87.36		Intermediate Poin
14+45.0	05.41	60.43		IM
14+64.0	86.00	86.47	89.52	AVANE May Dra
14+/1.0	65.20	00.47	00.00	AVANE-Max P00
14+96.0	86.20	86.43	89.62	IR Aorial Samar Linn
15+47.0	05.72	00.30		Aerial Sewer Line
16+98.0	85.23 85.40	86.35	90.19	1M
16+20.0	84.70	00.30	09.10	AVAINE May Door
10+30.0	64.70 85.52	00.35	90.11	AVANE-Max Poo
16+40.0	84.83	86.35	09.11	TM
17+10.0	85.26	86.35	88.94	XVANE
17+76.0	85.33	86.35	00.04	DBL 10' v 8' Boy
	F101-01-0	C 10 1 - 10 1		A DECK MARKED DOOR

Project Name	Price Park									
Cross Section	#1									
Feature	Riffle									
Date	9/30/03	;								
Crew	Shaffer, Bid	lelspach, Clin	ton		* Elevations adjusted up adjusted up 1.63					
	2001			2002			2003			
As-	Build Survey			2002 Survey	7	2	2003 Survey			
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes		
0.0	98.4	edge scrub v	0	98.55	LPIN GRD	0	98.3877			
23.6	98.9	LT BOB	12	98.72		2.81	98.25001			
25.6	97.8	Toe BOB	24	98.99	LT BOB	11.5	98.56661	LPIN GRD		
27.5	97.5		26	97.76	Toe BOB	23.67	98.89014	LT BOB		
34.0	97.2	LBKF	34.3	97.35	LBKF	26.91	97.71921			
38.6	95.1		37.5	96.03		28.56	97.51953			
39.4	94.0	LEW/WS	38.7	94.58		34.14	97.244	LBKF		
41.4	93.8	TW	38.9	94.32	LEW	37.32	94.89443			
43.0	94.1	REW	42.2	93.71	TW	38.96	94.22712			
43.7	95.3		44	93.8	REW	39.72	93.5669			
45.2	96.1		44.1	95.78		40.82	92.9152			
47.3	97.2	RBKF	44.8	96.01		41.35	92.9173			
49.0	98.1		47.4	97.35		42.14	93.23559			
54.8	98.5	Toe BOB	49.1	98.25	RBKF	42.62	93.53453	TW		
57.7	99.7	RT BOB	55.3	98.71	Toe BOB	43.21	93.08141			
59.7	100.1		56	98.99		43.7	93.5185			
74.0	100.6		59	100.17	RT BOB	44.38	93.45383			
100.0	100.6		73	100.67		45.51	94.24056			
124.0		edge g-way	86	100.67		46.3	95.96063			
		001	91.5	100.49		47.05	96.08462			
			100	100.67	RPIN GRD	49.14	97.90004	RBKF		
			124	101.4	edge g-way	52.56	98.24567			
						56.42	98.5006			
						58.72	99.86416			
						69.13	100.2514	RPIN GRD		
						81.89	100.5424			
						89.22	100.3363			
						101.78	100.3065			
						113.56	100.5393			
						122.79	100.8996			



Photo of Cross-Section #1 - Looking Downstream

	As-Built	2002	2003
Area	24.1	25.64	36.99
Width	13.3	14.8	15.0
Mean Depth	1.8	1.7	2.5
Max Depth	3.5	3.6	4.3



Project Name	Jefferson Pilot
Cross Section	#1
Feature	Riffle
Date	12/17/02
Crew	Pace, Patterson

			As-Built			Dec-02						
Description	Material	Size (mm)	Riffle	%	Cum %	Riffle	%	Cum %	Bank	Bed	%	Cum %
Silt/Clay	silt/clay	0.061	18	36.0%	36.0%	15	30.0%	30.0%	15	9	24.2%	24.2%
	very fine sand	0.062	0	0.0%	36.0%	3	6.0%	36.0%	24	1	25.3%	49.5%
	fine sand	0.125	3	6.0%	42.0%	3	6.0%	42.0%	1	2	3.0%	52.5%
Sand	medium sand	0.25	5	10.0%	52.0%	5	10.0%	52.0%		1	1.0%	53.5%
	course sand	0.50	0	0.0%	52.0%	2	4.0%	56.0%		2	2.0%	55.6%
	very course sand	1.0	1	2.0%	54.0%	5	10.0%	66.0%		4	4.0%	59.6%
	very fine gravel	2.0	0	0.0%	54.0%	2	4.0%	70.0%		3	3.0%	62.6%
G	fine gravel	4.0	0	0.0%	54.0%	2	4.0%	74.0%		0	0.0%	62.6%
r	fine gravel	5.7	0	0.0%	54.0%	1	2.0%	76.0%		7	7.1%	69.7%
я	medium gravel	8.0	0	0.0%	54.0%	2	4.0%	80.0%		8	8.1%	77.8%
v	medium gravel	11.3	1	2.0%	56.0%	1	2.0%	82.0%		2	2.0%	79.8%
•	course gravel	16.0	1	2.0%	58.0%	3	6.0%	88.0%		4	4.0%	83.8%
с 1	course gravel	22.6	3	6.0%	64.0%	1	2.0%	90.0%		4	4.0%	87.9%
1	very course gravel	32	0	0.0%	64.0%	1	2.0%	92.0%		4	4.0%	91.9%
	very course gravel	45	2	4.0%	68.0%	0	0.0%	92.0%		0	0.0%	91.9%
	small cobble	64	5	10.0%	78.0%	3	6.0%	98.0%		5	5.1%	97.0%
Cobble	medium cobble	90	9	18.0%	96.0%	1	2.0%	100.0%		2	2.0%	99.0%
Conne	large cobble	128	2	4.0%	100.0%	0	0.0%	100.0%		1	1.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	small boulder	256	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
Boulder	medium boulder	512	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
TOTAL	/ %of whole count		50	100.0%		50	100.0%		40	59	100.0%	

	d16	d35	d50	d85	d95
As-Built	0.06	0.06	0.34	87.67	107.22
Dec-02	0.06	0.09	0.34	15.53	65.75
2003	0.06	0.08	0.11	19.62	68.22



Project Name	Price Park								
Cross Section	#2								
Feature	Riffle								
Date	9/30/03	3							
Crew	Shaffer, Bid	lelspach, Clint	ion		* Elevations	ions adjusted up adjusted up 2.50			
	2001			2002		· ·	2003		
As-	Build Survey		2	002 Survey			2003 Survey		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation Notes		
0.0	96.9	LPIN	0	97	LPIN GRD	0	97.00 LPIN GRD	A REAL	
21.4	96.9		15	97.03		4.81	97.14	1 cm	
34.7	96.9	LT BOB	35.3	97.07	LT BOB	16.12	97.00		
38.5	95.6	Toe BOB	38.6	95.83	Toe BOB	26.54	96.98	A STATE	
44.8	95.2	LBKF	45	95.37	LBKF	35.97	97.04 LT BOB		
52.0	92.7		51.8	92.94	bench	38.34	95.72 Toe BOB	10	
54.5	92.4		54.2	93.11		44.55	95.40 LBKF		
56.3	91.8	LEW/WS	56	92.42		49.27	93.44		
57.1	91.4		56.8	91.17	LEW	53.1	93.27		
57.7	90.8		61	90.6	TW	54.65	93.09	Å	
59.2	90.4	TW @ rooty	61.8	91.04		56.06	92.04		
61.6	91.0		62.6	93.64		58.62	91.44	New York	
62.7	94.0		66	95.68	RBKF	58.67	91.44	100	
67.0	95.7	RBKF	71.3	96.16	Toe BOB	60.21	91.20		
71.0	96.0	Toe BOB	74	97.54	RT BOB	61.49	90.63 TW	1	
73.7	97.4	RT BOB	84	97.5		61.83	92.93	101	
80.0	97.5		92.7	97.33		62.24	94.44	de la	
87.3	97.5		100	97.49	RPIN GRD	64.43	95.12		
92.4	97.2					65.71	95.72 RBKF		
100	97.29					68.03	95.96 Toe BOB		
						71.17	96.29		
						73.74	97.50 RT BOB		
						80.58	97.62		
						90.67	97.48		
						99.55	97.47 RPIN GRD		



Photo of Cross-Section #2 - Looking Downstream

	As-Built	2002	2003
Area	50.6	49.28	44.90
Width	22.2	21.0	21.2
Mean Dept	2.3	2.3	2.1
Max Depth	4.9	4.8	4.8



Project Name	Jefferson Pilot
Cross Section	#2
Feature	Pool
Date	12/17/02
Crew	Pace, Patterson

		-	As-Duilt	-	-	Dec-02				-	-	
Description	Material	Size (mm)	Pool	%	Cum %	Pool	%	Cum %	Bank	Bed	%	Cum %
Silt/Clay	silt/clay	0.061	5	10.0%	10.0%	11	20.8%	20.8%	11	0	11.0%	11.0%
	very fine sand	0.062	6	12.0%	22.0%	8	15.1%	35.8%	13	0	13.0%	24.0%
	fine sand	0.125	8	16.0%	38.0%	11	20.8%	56.6%	9	0	9.0%	33.0%
Sand	medium sand	0.25	16	32.0%	70.0%	6	11.3%	67.9%	6	0	6.0%	39.0%
	course sand	0.50	5	10.0%	80.0%	1	1.9%	69.8%	7	0	7.0%	46.0%
	very course sand	1.0	2	4.0%	84.0%	2	3.8%	73.6%	4	1	5.0%	51.0%
	very fine gravel	2.0	2	4.0%	88.0%	3	5.7%	79.2%	1	0	1.0%	52.0%
G	fine gravel	4.0	1	2.0%	90.0%	3	5.7%	84.9%	0	2	2.0%	54.0%
r	fine gravel	5.7	2	4.0%	94.0%	1	1.9%	86.8%	2	11	13.0%	67.0%
-	medium gravel	8.0	1	2.0%	96.0%	2	3.8%	90.6%	1	6	7.0%	74.0%
a v	medium gravel	11.3	0	0.0%	96.0%	1	1.9%	92.5%	2	7	9.0%	83.0%
•	course gravel	16.0	0	0.0%	96.0%	2	3.8%	96.2%	1	6	7.0%	90.0%
e	course gravel	22.6	1	2.0%	98.0%	0	0.0%	96.2%	1	6	7.0%	97.0%
1	very course gravel	32	1	2.0%	100.0%	2	3.8%	100.0%		3	3.0%	100.0%
	very course gravel	45	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	small cobble	64	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
Cabbla	medium cobble	90	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
CODDIe	large cobble	128	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	small boulder	256	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
Boulder	medium boulder	512	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
TOTAL	/ %of whole count		50	100.0%		53	100.0%		58	42	100.0%	

	d16	d35	d50	d85	d95
As-Built	0.08	0.17	0.26	1.50	8.25
Dec-02	0.00	0.09	0.16	4.55	17.46
2003	0.07	0.25	1.35	14.46	25.01



Project Name	Price Park							
Cross Section	#3							
Feature	Riffle							
Date	9/30/03	;						
Crew	Shaffer, Bidelspach, Clinton				* Elevations	* Elevations adjusted up *adjusted up 2.51 feet		
ľ	2001			2002	-		2003	
As-	Build Survey			2002 Survey	y		2003 Survey	
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation Notes	
0.0	96.5	LPIN	0	96.62	LPIN GRD	0	96.65 LPIN GRD	
12.5	96.7		6	96.48		2.2	96.14	
24.0	96.2	LT BOB	12.5	96.93		10.05	96.91	
25.3	95.3		23.8	96.46	LT BOB	18.28	96.56	
32.0	95.1	LBKF	24.8	95.58	Toe BOB	23.93	96.35 LT BOB	
36.2	92.5		29.8	95.1	overland wa	24.66	95.38 Toe BOB	
37.0	91.9		30.3	94.91	overland wa	30.59	95.04	
37.6	91.7	LEW/WS	30.7	94.4	overland wa	30.7	95.04 LBKF	
39.3	91.5		31	94.18	overland wa	31.38	93.49	
41.0	91.5	TW	31.3	95.05		33.01	93.54	
42.4	91.7	REW	32	95.07	LBKF	34.05	93.26	
42.8	92.6		36.5	92.88		35.78	93.16	
46.0	94.9	RBKF	37	91.98	LEW	36.52	92.74	
48.0	95.2		40.1	91.65	TW	37.03	91.68	
52.0	95.2		42.2	91.81	REW	37.58	91.52	
55.0	96.4	RT BOB	42.8	92.95		37.64	91.70	
70.0	96.4		46	95.04	RBKF	39.23	91.40 TW	
100.0	96.5	RPIN	52	95.44	Toe BOB	39.75	91.61	
			55.4	96.67	RT BOB	40.22	91.48	
			72	96.56		41.54	91.74	
			100	96.73	RPIN GRD	41.75	91.75	
						41.96	92.91	
						42.8	93.20	
						45.42	95.04 RBKF	
						48.8	95.13 Toe BOB	
						51.69	95.43 RT BOB	
						54.21	96.65	
						72.15	96.52	
						87.47	96.52	
						99.76	96.71 RPIN GRD	



Photo of Cross-Section #3 - Looking Upstream

	As-Built	2002	2003
Area	31.9	28.41	31.86
Width	14.0	14.0	14.7
Mean Dept	2.3	2.0	2.2
Max Depth	3.6	3.4	3.6



Project Name	Jefferson Pilot
Cross Section	#3
Feature	Riffle
Date	12/17/02
Crew	Pace, Patterson

			As-Built	-		Dec-02					-	-
Description	Material	Size (mm)	Riffle	%	Cum %	Riffle	%	Cum %	Bank	Bed	%	Cum %
Silt/Clay	silt/clay	0.061	13	25.5%	25.5%	16	32.0%	32.0%	30	3	33.0%	33.0%
	very fine sand	0.062	8	15.7%	41.2%	4	8.0%	40.0%	6	2	8.0%	41.0%
	fine sand	0.125	6	11.8%	52.9%	4	8.0%	48.0%	11	8	19.0%	60.0%
Sand	medium sand	0.25	9	17.6%	70.6%	2	4.0%	52.0%		3	3.0%	63.0%
	course sand	0.50	1	2.0%	72.5%	4	8.0%	60.0%		3	3.0%	66.0%
	very course sand	1.0	1	2.0%	74.5%	2	4.0%	64.0%		3	3.0%	69.0%
	very fine gravel	2.0	0	0.0%	74.5%	2	4.0%	68.0%		2	2.0%	71.0%
G	fine gravel	4.0	2	3.9%	78.4%	5	10.0%	78.0%		0	0.0%	71.0%
r	fine gravel	5.7	3	5.9%	84.3%		0.0%	78.0%	1	3	4.0%	75.0%
-	medium gravel	8.0	3	5.9%	90.2%	9	18.0%	96.0%		3	3.0%	78.0%
a	medium gravel	11.3	1	2.0%	92.2%		0.0%	96.0%	1	9	10.0%	88.0%
v	course gravel	16.0	1	2.0%	94.1%	1	2.0%	98.0%	1	4	5.0%	93.0%
e 1	course gravel	22.6	2	3.9%	98.0%	1	2.0%	100.0%		5	5.0%	98.0%
1	very course gravel	32	1	2.0%	100.0%		0.0%	100.0%		1	1.0%	99.0%
	very course gravel	45	0	0.0%	100.0%		0.0%	100.0%		0	0.0%	99.0%
	small cobble	64	0	0.0%	100.0%		0.0%	100.0%		1	1.0%	100.0%
Cabbla	medium cobble	90	0	0.0%	100.0%		0.0%	100.0%			0.0%	100.0%
Conne	large cobble	128	0	0.0%	100.0%		0.0%	100.0%			0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%		0.0%	100.0%			0.0%	100.0%
	small boulder	256	0	0.0%	100.0%		0.0%	100.0%			0.0%	100.0%
	small boulder	362	0	0.0%	100.0%		0.0%	100.0%			0.0%	100.0%
Boulder	medium boulder	512	0	0.0%	100.0%		0.0%	100.0%			0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%		0.0%	100.0%			0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
TOTAL	/ %of whole count		51	100.0%		50	100.0%		50	50	100.0%	

	d16	d35	d50	d85	d95
As-Built	0.00	0.08	0.16	6.74	21.10
Dec-02	0.00	0.07	0.28	7.78	9.49
2003	0.00	0.07	0.14	12.05	22.50



Project Name	Price Park						
Cross Section	#4						
Feature	Riffle						
Date	9/30/03						
Crew	Shaffer, Bid	elspach, Clint	on		* Elevations	adjusted up	*adjusted by 2.43
	2001			2002			2003
As-E	Build Survey			2002 Survey	7	2	2003 Survey
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation Notes
0.0	91.8		0	91.83	LPIN GRD	0	91.87 LPIN GR
20.6	91.8		14	91.89		9.24	91.87
40.0	91.5		25	91.75		19.52	91.90
45.5	91.3	LT BOB	45.8	91.33	LT BOB	34.09	91.63
48.0	90.1		48.4	90.2	Toe BOB	45.58	91.36 LT BOB
54.0	89.4	LBKF	54.2	89.5	LBKF	47.77	90.34 Toe BOB
59.0	86.8		59.3	87.2		49.57	90.02
61.2	86.4	LEW/WS	60.4	86.67	LEW/WS	54.12	89.49 LBKF
65.0	86.2	TW	61.8	86.45		58.46	87.57
66.5	86.3	REW	63	85.9	TW	59.96	86.69
71.2	89.4	RBKF	65.2	85.91		60.86	86.49
76.5	89.7		66.4	86.64	REW	61.36	86.59
78.5	90.5	RT BOB	67.5	87.24		61.8	86.44
94.7	91.3		71.5	89.5	RBKF	63.07	86.09
100.0	91.0		76.3	89.81	Toe BOB	65.05	85.83 TW
			78.3	90.6	RT BOB	66.25	86.14
86.0		Sewerline C	84	91.08		66.99	86.84
			89	91.18		71.27	89.47 RBKF
			100	91.11	RPIN GRD	76.27	89.79 Toe BOB
						79.03	90.78 RT BOB
						90.66	91.26
						99.89	91.07 RPIN GR



Photo of Cross-Section #4 - Looking Upstream

	As-Built	2002	2003
Area	36.7	43.36	36.28
Width	17.2	19.1	17.2
Mean Dept	2.1	2.3	2.1
Max Depth	3.2	3.6	3.7



Project Name	Jefferson Pilot
Cross Section	#4
Feature	Riffle
Date	12/17/02
Crew	Pace, Patterson

As-Built Dec-02												
Description	Material	Size (mm)	Riffle - Bed	%	Cum %	Riffle - Bed	%	Cum %	Riffle - Bank	Riffle - Bed	%	Cum %
Silt/Clay	silt/clay	0.061	8	16.0%	16.0%	7	13.7%	13.7%	24	2	26.0%	26.0%
	very fine sand	0.062	4	8.0%	24.0%	7	13.7%	27.5%	16	0	16.0%	42.0%
	fine sand	0.125	12	24.0%	48.0%	4	7.8%	35.3%	4	1	5.0%	47.0%
Sand	medium sand	0.25	3	6.0%	54.0%	5	9.8%	45.1%	2	3	5.0%	52.0%
	course sand	0.50	0	0.0%	54.0%	1	2.0%	47.1%	2	4	6.0%	58.0%
	very course sand	1.0	4	8.0%	62.0%	2	3.9%	51.0%		1	1.0%	59.0%
	very fine gravel	2.0	4	8.0%	70.0%	5	9.8%	60.8%		2	2.0%	61.0%
G	fine gravel	4.0	3	6.0%	76.0%	2	3.9%	64.7%		3	3.0%	64.0%
r	fine gravel	5.7	4	8.0%	84.0%	5	9.8%	74.5%	1	3	4.0%	68.0%
-	medium gravel	8.0	4	8.0%	92.0%	3	5.9%	80.4%		3	3.0%	71.0%
u	medium gravel	11.3	1	2.0%	94.0%	2	3.9%	84.3%	1	10	11.0%	82.0%
•	course gravel	16.0	2	4.0%	98.0%	4	7.8%	92.2%		10	10.0%	92.0%
e 1	course gravel	22.6	1	2.0%	100.0%	0	0.0%	92.2%		6	6.0%	98.0%
1	very course gravel	32	0	0.0%	100.0%	3	5.9%	98.0%		1	1.0%	99.0%
	very course gravel	45	0	0.0%	100.0%	1	2.0%	100.0%		0	0.0%	99.0%
	small cobble	64	0	0.0%	100.0%	0	0.0%	100.0%		1	1.0%	100.0%
Cobble	medium cobble	90	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
CODDIC	large cobble	128	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	small boulder	256	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
Boulder	medium boulder	512	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0.0%	100.0%			0.0%	100.0%
TOTAL	/ %of whole count		50	100.0%		51	100.0%		50	50	100.0%	

	d16	d35	d50	d85	d95
As-Built	0.06	0.14	0.25	6.85	15.06
Dec-02	0.07	0.18	1.31	13.33	32.71
2003	0.00	0.08	0.30	14.78	23.30



Project Name	Jefferson Pilot
Task	Feature Slope and Length Calculations
Date	12/17/02
Crew	Bidelspach, Shaffer, Clinton

Data given is Head of Riffle and max pool, cannot calculate lengths or slope.

2003 Data Price Park

Run			Bed	Water		
	Station	Change	elevation	elevation	change	slope
	88.17		96.04	96.69		
	124.21	36.04	95.91	96.67	0.02289	0.06%
	183.04		95.61	96.49		
	220.31	37.27	95.16	96.50	-0.0096	-0.03%
	247.95		94.48	95.99		
	289.70	41.75	95.23	95.85	0.14056	0.34%
	350.14		93.97	94.90		
	379.52	29.38	93.76	94.86	0.03611	0.12%
	608.74		91.73	92.72		
	687.99	79.25	91.25	92.17	0.54327	0.69%
	1021.26		88.31	88.66		
	1108.58	87.32	87.51	88.38	0.28008	0.32%
	1285.02		86.79	87.11		
	1335.78	50.76	86.16	87.03	0.0795	0.16%

Price Park						
Riffle		Bed	Water			
Station	Change	elevation	elevation	change	slope	
540.36		92.78	92.98			
549.82	9.46	92.56	92.71	0.27065	2.86%	Riffle
722.91		91.33	92.14			
763.83	40.92	91.45	91.91	0.22756	0.56%	Riffle
1232.47		85.7912	88.15			
1285.02	52.55	1285.00	87.11	1.03993	1.98%	Riffle
1335.78		86.16	87.03			
1395.23	59.45	85.98	86.52	0.51031	0.86%	Riffle

Pool	length	p-p spacing					
47					min	max	median
88	41		Riffle	Length	9.5	59.5	46.7
124				Slope	0.56%	2.86%	1.42%
157	33	73	Run	Length	29.4	87.3	41.8
200				Slope	-0.03%	0.69%	0.16%
235	35	77	Pool	Length	22.0	62.0	38.0
289				Spacing	65	343	92
328	39	91					
379							
417	38	89.5					
474							
496	22	87					
549							
611	62	95					
687							
722	35	124.5					
783							
810	27	92					
1119							
1160	41	343					
1173							
1235	62	64.5					
1437							
1474	37	251.5					
1560							
1621	61	135					

PROFILE	Price Park			Price Park			
	A	s-built - 200	1	2003			
	Minimum Maximum Median			Minimum	Maximum	Median	
Riffle Length	]	Not Reported		9.46	59.45	46.735	
Riffle Slope	]	Not Reported		0.56%	2.86%	1.42%	
Run Length	]	Not Reported		29.4	87.3	41.8	
Run Slope	]	Not Reported		-0.03%	0.69%	0.16%	
Pool Length	]	Not Reported		22	62	38	
ool to Pool Spacing	51	150.3	63.7	64.5	343	91.5	

Task	Channel Pattern Measurements	
Date	9/30/03	
Crew	Pace, Patterson	

Jefferson Pilot						
Radius of	Meander	Channel				
Curvature	Wavelength	Beltwidth				
59.5		49-80				
64.5	127					
48.5	135					
59.5	139					
76.5	152					
68.5	150					
55.5	145					
72.5	174					
53.5	183					
69.5	166					
83.8						
64.0		52-95				
47.5	118					
61.0	170					
59.5	197					
53.5	179					
61.5	123					
84.5						
47.5	118.0	Min				
84.5	197.0	Max				
63.5	154.1	Avg				

## **Photo Reference Points**

Price Park 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.

2003



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 4.62



M5-DS: View from Meander 5 looking downstream towards Meander 6. 63



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. 64



M6-DS: View from Meander 6 looking downstream. 65





M7-US: View from Meander 7 looking upstream. 66



M7-DS: View from Meander 7 looking downstream.67



M8-US: View from Meander 8 looking upstream. 68



M8-DS: View from Meander 8 looking downstream towards Meander 9. 69



M9-US: View from Meander 9 looking upstream. 70





M9-DS: View from Meander 9 looking downstream. Note the point bar formation in the lower right corner of picture.71





M10-US: View from Meander 10 looking upstream. 72





M10-DS: View from Meander 10 looking downstream. Note the bedrock in the bed of the channel exposed during construction.73

Photo Log 7



M11-US: View from Meander 11 looking upstream. 74



M11-DS: View from Meander 11 looking downstream. Jefferson Club Road crosses the stream via this 14' x 7.5 box culvert. 75



M12-US: View from Meander 12 looking upstream through the culvert. Note how the channel has narrowed and vegetated in the Year 1 photograph.76



M12-DS: View from Meander 12 looking downstream. 77





M13-US: View from Meander 13 looking upstream. 79



M13-DS: View from Meander 13 looking downstream. 80





M14-US: View from Meander 14 looking upstream. 81

![](_page_40_Picture_3.jpeg)

M14-DS: View from Meander 14 looking downstream. Note stone step-pool outfall to connecting roadway drainage to stream channel.82

![](_page_40_Picture_5.jpeg)

M15-US: View from Meander 15 looking upstream. 83

![](_page_41_Picture_0.jpeg)

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.84

![](_page_41_Picture_2.jpeg)

M16-US: View from Meander 16 looking upstream. The aerial sewer line was rerouted to make it perpendicular to the stream.85

![](_page_41_Picture_4.jpeg)

M16-DS: View from Meander 16 looking downstream. Cross-vane is drowned out due to backwater from the off-site lake downstream. 86

![](_page_42_Picture_0.jpeg)

M17-US: View from Meander 17 looking upstream. 87

![](_page_42_Picture_2.jpeg)

![](_page_42_Picture_3.jpeg)

M17-DS: View from Meander 17 looking downstream towards the double 10' x 8' box culvert. Cross-vane is drowned out.88