Beaver Creek Stream Restoration
2008 Final Monitoring Report

Construction Completed January 2003 - 5 Years Elapsed (MY5)
Third Year of Measurement - Measurement Suspended in MY3 and MY4 Due to Repair

Ecosystem Enhancement Program Project Number 00028

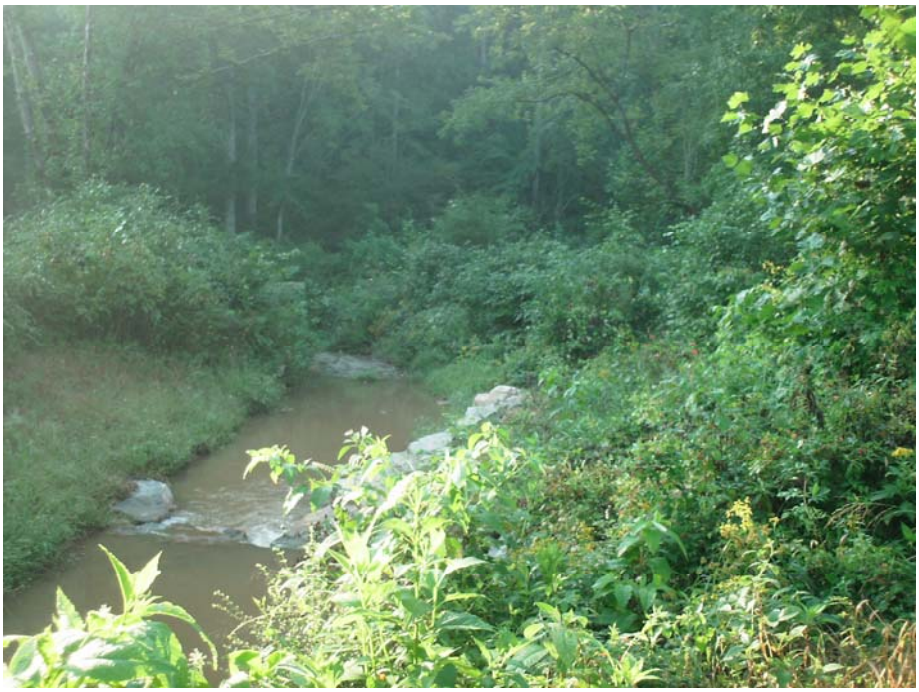
Submitted to: NCDENR-Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

Project Designed by: Earth Tech of North Carolina
701 Corporate Center Drive, Suite 475
Raleigh, NC 27606

Submitted: February 12, 2009

Beaver Creek Stream Restoration
2008 Final Monitoring Report
Monitoring Year Five

Ecosystem Enhancement Program Project Number 00028



Prepared by: URS Corporation – North Carolina
1600 Perimeter Park Drive, Suite 400
Morrisville, NC 27560

Project Manager: Kathleen McKeithan
kathleen_mckeithan@urscorp.com
919-461-1597

February 12, 2009

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1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Beaver Creek site consists of 4,670 linear feet of stream restoration. A tributary to the Fisher River, Beaver Creek is located on agricultural land approximately 3.6 miles southeast of the Town of Dobson in Surry County, North Carolina. The watershed area for the site is 5.9 square miles, and the property is fully contained within the property of five landowners.

The Surry County Soil and Water Conservation District (SCSWCD) staff identified Beaver Creek as a potential restoration site after landowners complained of active erosion and flooding adjacent to the stream. Beaver Creek had areas of significant, active bank erosion throughout the proposed project limits. There is evidence of historic straightening as well as thinning and removal of riparian vegetation, both of which resulted in stream degradation. The degradation included a deeply incised channel that accelerated the erosion process and forced the channel to contain larger than bankfull storm events. One of the three tributaries, within the project limits, had also been straightened.

The restoration site is located entirely within undeveloped land. There are no utilities within the project limits. The Priority I restoration involved converting the 4,670 linear feet of impaired channel into a sinuous channel that meanders for a total 4,266 linear feet. Rock and log 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.

Per the 2003 As-Built Report, prepared by Earth Tech (Earth Tech 2003), the objectives of the Beaver Creek Stream Restoration Project included the following: Restore 4,670 linear feet of Beaver Creek (as measured along the thalweg); Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load; Improve water quality and reduce further property loss by stabilizing eroding stream banks; Reconnect the stream to its floodplain or establish a new floodplain at a lower elevation; Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris and establish a riparian buffer; and Provide aesthetic value, wildlife habitat, and bank stability through the creation or enhancement of a riparian zone.

The Beaver Creek site was constructed in the summer of 2002. Repair work was conducted at the site in the spring of 2004. The site was then monitored in 2004, Monitoring Year (MY) 1 by NC State University (NCSU 2005) and in 2005 (MY2) by EcoLogic Associates (Ecologic 2006). A second round of repair work was scheduled for 2005. The site was not monitored in 2006 (MY3) or 2007 (MY4), pending additional repairs and maintenance. Repairs were completed at the site in the summer of 2008. Additional planting and transplants took place in December, 2008.

The 2008 monitoring event signifies MY5, as well as the baseline data for the site post-repairs. In general, it appears as if the recent repairs have helped stabilize the site. Rock and log vane repairs have improved the stability of the system and are successfully directing flow away from problem erosion areas. Woody survival at the site is poor in some areas, but much of this is due to disturbance from the recent construction activities. Several haul roads and staging and

stockpiling areas were placed along the channel, thus destroying any planted woody vegetation. The site was re-planted in December/January of 2008 and 2009. Transplants from areas with strong vegetation survival were also used to supplement areas with poor survival.

2.0 PROJECT BACKGROUND

2.1 PROJECT OBJECTIVES

The project objectives stated in the 2003 As-Built Report, prepared by Earth Tech are to:

1. Restore 4,670 linear feet of Beaver Creek (as measured along the thalweg).
2. Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load.
3. Improve water quality and reduce further property loss by stabilizing eroding stream banks.
4. Reconnect the stream to its floodplain or establish a new floodplain at a lower elevation.
5. Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris, and establish a riparian buffer.
6. Provide aesthetic value, wildlife habitat, and bank stability through the creation or enhancement of a riparian zone.

2.2 PROJECT STRUCTURE, MITIGATION TYPE, AND APPROACH

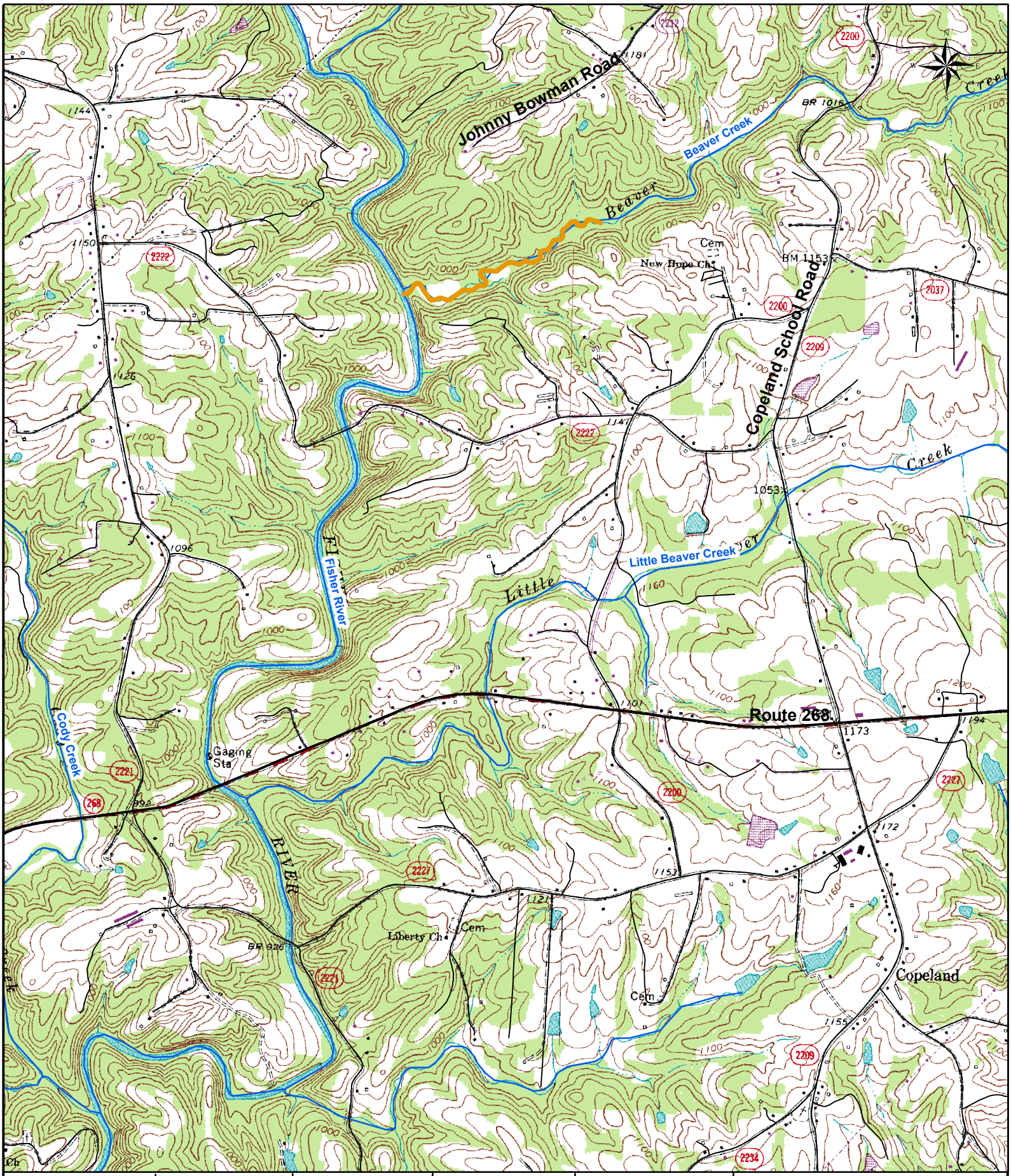
The Beaver Creek site was suggested by the SCSWD after landowners complained of active erosion and flooding adjacent to the channel. The stream had been subject to historic straightening and removal of riparian vegetation. The channel was incised and was accelerating erosion by forcing the channel to contain larger than bankful storm events.

The Priority I restoration involved converting the impaired channel into a sinuous channel that meanders for a total of 4,266 feet as measured along the thalweg. Rock and log 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.

2.3 LOCATION AND SETTING

The Beaver Creek site is located on agricultural land approximately 3.6 miles southeast of the Town of Dobson in Surry County, North Carolina (Figure 1). The watershed area for the site is 5.9 square miles, and the property is fully contained within the property of five landowners.

To travel to the site from I-40, take exit 206 to US-421 north. Follow US-421 to exit 257, US-601. Follow US-601 north to Dobson, NC. At the second Dobson exit (NC-1100), turn right at the top of the ramp onto Turkey Ford Road (SR 1100). Follow Turkey Ford Road for 3.7 miles and turn right onto Copeland School Road (SR 2220). Follow for two miles and turn right onto Simpson Mill Road (SR 2210). Follow Simpson Mill Road for 0.7 miles and turn right onto Hamlin Ford Road (SR 2222). The entrance to the site is a driveway to the right after the mobile home park.



Prepared By:
URS Corporation - North Carolina
1600 Perimeter Park Drive
Suite 400
Morrisville, NC 27560
Phone: 919-461-1100
Fax: 919-461-1415

URS

Prepared For:
NC Ecosystem
Enhancement Program

Ecosystem Enhancement PROGRAM

Project:
Beaver Creek
Stream Restoration
Surry County, NC

Monitoring Year:
5 (2008)

Project Number:
00344

Date:
February 2009

Legend
Project Reach

Figure 1
Project Vicinity

0 0.25 0.5
Miles

2.4 PROJECT HISTORY AND BACKGROUND

SCSWCD staff identified Beaver Creek as a potential restoration site after landowners complained of active erosion and flooding adjacent to the stream. The stream was actively eroding along a tight meander located on the property owned by Mr. Mike Jones. The extensive erosion created a meander with a sharp radius where, during storm events, water was overtopping the bank and flooding the adjacent landowner, Mr. Wayne Draughn.

Besides the above stated problem area, Beaver Creek had other areas of significant active bank erosion throughout the proposed project limits. There is evidence of historic straightening that resulted in stream degradation. Thinning and removal of riparian vegetation also contributed to the stream degradation. The degradation included a deeply incised channel that accelerated the erosion process and forced the channel to contain larger than bankfull storm events. One of the three tributaries, within the project limits, had also been straightened.

The Priority I restoration involved converting the 4,670 linear foot impaired channel into a sinuous channel that meanders for a total 4,266 linear feet. Rock and log 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.

The Beaver Creek Stream Restoration project was designed by Earth Tech and construction was completed in the summer of 2002. The Mitigation and As-Built Plan were completed in February 2003. The estimated restoration length is 4,266 linear feet.

Repair work was conducted at the site in the spring of 2004. The site was then monitored in 2004 (MY1) by NC State University and in 2005 (MY2) by EcoLogic Associates. Both monitoring reports state that the project was not performing as designed. The 2005 (MY2) report states that "Serious damage and deterioration of the restoration started in 2003 and continues to the present day." A second round of repair work was scheduled for 2005. The site was not monitored in 2006 (MY3) or 2007 (MY4), pending additional repairs and maintenance. Repairs were completed at the site in the summer of 2008. Additional planting and transplants will take place in December, 2008.

The 2008 monitoring event signifies MY5, as well as the baseline data for the site post-repairs. In general, the site has been improved drastically by the recent repairs. The 2008 (MY5) monitoring event roughly follows the cross sections and vegetation plots established by EcoLogic in 2005. EcoLogic followed protocol similar to that presently required by North Carolina Ecosystem Enhancement Program (NCEEP). EcoLogic used the As-Built cross section locations, but had to establish all of the vegetation plots. No vegetation monitoring plots had been established at the time of the As-Built survey.

Table I: Project Mitigation Structure and Objectives Table

Beaver Creek EEP Project Number 00028						
Project Segment or Reach	**Existing Feet**	**Mitigation Type**	**Approach**	**Linear Footage**	**Stationing**	**Comment**
Beaver Creek	4,670	R	PI	4,266	10+00 to 52+13	

R = Restoration
EI = Enhancement
EII = Enhancement II
S = Stabilization

PI = Priority I
PII = Priority II
PIII = Priority III
SS = Stream Bank Stabilization

Table II: Project Activity and Reporting History

Beaver Creek EEP Project Number 00028			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	2001	Unknown	2001
Mitigation Plan	2001	Unknown	2001
Construction	Fall 2002	Unknown	Fall 2002
Temporary S&E mix applied to project area	Fall 2002	Unknown	Fall 2002
As-Built Report	Fall 2002	Unknown	February 2003
Permanent seed mix applied to reach	Fall 2002	Unknown	Fall 2002
Structural maintenance (bank and structure)	Spring 2004	Unknown	Spring 2004
Supplemental planting of bare root and containers	Spring 2004	Unknown	Spring 2004
Year 1 Monitoring	Fall 2003	Unknown	September 2004
Year 2 Monitoring	August 2005	Unknown	September 2005
Year 3 Monitoring*	August 2006	N/A	N/A
Year 4 Monitoring*	August 2007	N/A	N/A
Structural maintenance (bank and structure)	Summer 2008	Unknown	Summer 2008
Year 5 Monitoring	August 2008	September 2008	October 2008
Supplemental planting of bare root and containers	December 2008	Unknown	

*Data were not collected in 2006 and 2007 (MY3 and MY4). The project was put on hold due to pending repair activities.

Table III: Project Contact Table

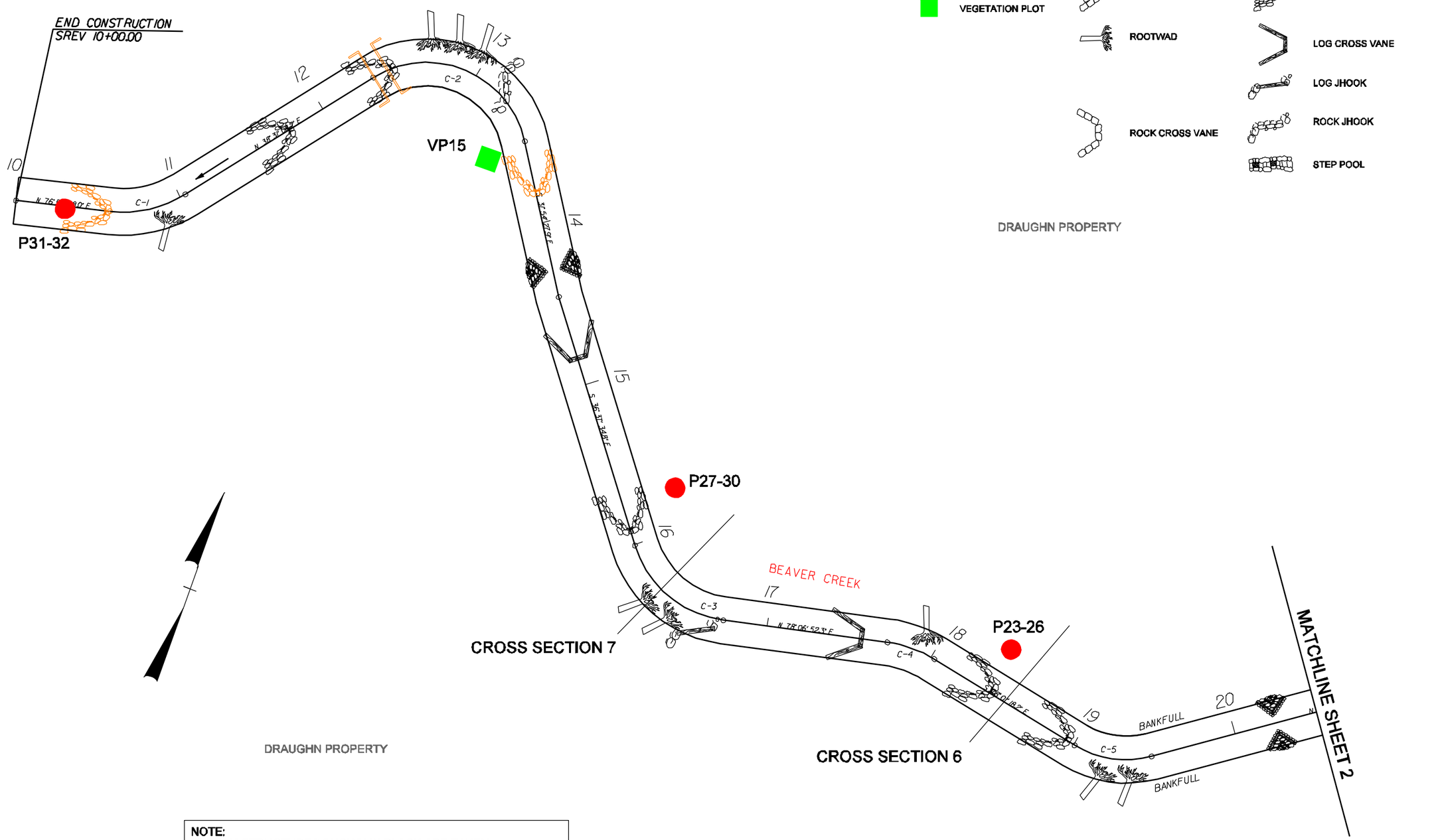
Beaver Creek EEP Project Number 00028	
Activity or Report	**Actual Completion or Delivery**
Designer Primary project design POC	Earth Tech of North Carolina 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 Bill Jenkins 919-854-6200
Construction Contractor Construction contractor POC	West Contracting PO Box 310 Marble, NC 28905 Maurice West Jr. 828-837-2280
Planting Contractor Planting contractor POC	Carolina Environmental PO Box 1905 Mount Airy, NC 27030 Joanne Cheatham 336-320-3849
Seeding Contractor Seeding contractor POC	Carolina Environmental PO Box 1905 Mount Airy, NC 27030 Joanne Cheatham 336-320-3849
2004 Monitoring Performers Monitoring POC	Biological & Agricultural Engineering North Carolina State University Campus Box 7625 Raleigh, NC 27695 Dan Clinton 919-515-6771
2005 Monitoring Performers Monitoring POC	EcoLogic Associates, P.C. 4321-A South Elm-Eugene Street Greensboro, NC 27406 Kyle Hoover, Moni Bates 336-355-1108
2006 Monitoring Performers	No monitoring conducted
2007 Monitoring Performers	No monitoring conducted
2008 Monitoring Performers Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 919-461-1597 Kathleen McKeithan

Table IV: Project Background Table

Beaver Creek EEP Project Number 00028	
Project County	Surry County
Drainage Area	5.9 square miles
Drainage impervious cover estimate (%)	Estimated at < 5%
Stream Order	3rd order
Physiographic Region	Piedmont/Foothills
Ecoregion	Northern Inner Piedmont (45e)
Rosgen Classification of As-Built	E
Dominant soil types	N/A
Reference site ID	N/A
USGS HUC for Project and Reference	03040101
NCDWQ Sub-basin for Project and Reference	12-63-12
NCDWQ classification for Project and Reference	C
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	N/A
% of project easement fenced	0% - No cattle

2.5 MONITORING PLAN VIEW

See Figure 2 for Monitoring Plan View.



NOTE:
STREAM STRUCTURES SHOWN IN BLACK ARE TAKEN FROM AS-BUILT PLANS DEVELOPED BY EARTH TECH IN 2003. STREAM STRUCTURES SHOWN IN ORANGE WERE DEPICTED AS REPAIRED AND/OR ALTERED DURING REPAIR ACTIVITIES IN 2008 ACCORDING TO BAKER ENGINEERING AS-BUILT PLANS 2008.

REVISIONS

NO.	DATE

Prepared by
URS
URS Corporation – North Carolina
1600 Perimeter Park Drive
Morrisville, North Carolina 27560
TELEPHONE (919) 461-1100 FAX (919) 461-1415

PROJECT: BEAVER CREEK STREAM RESTORATION 2008 MONITORING REPORT

TITLE: MONITORING PLAN VIEW

CLIENT: NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

FIGURE 2

DATE: FEB 2009

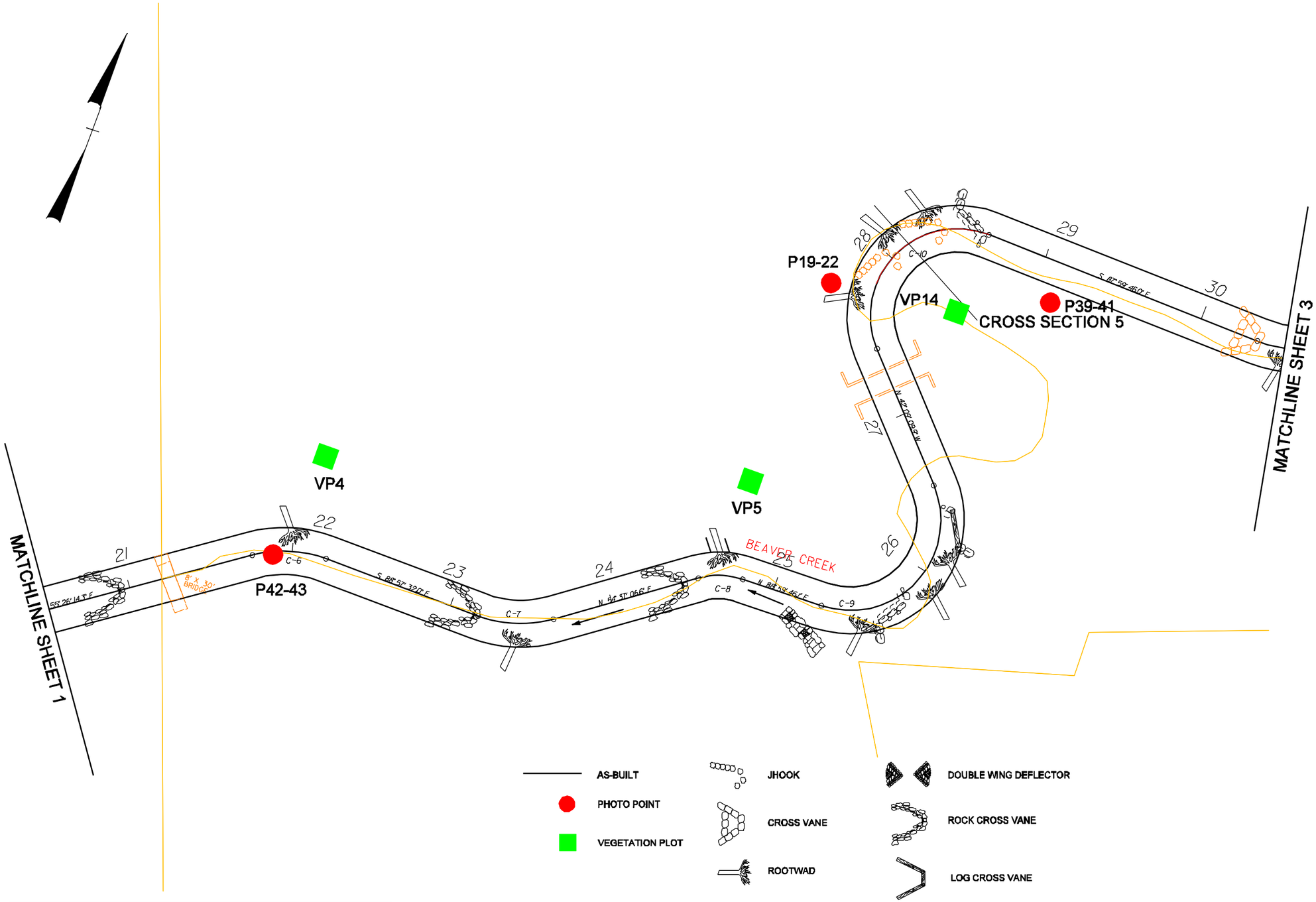
TECHNICIAN: EHJ

CHECKED BY: KM

MONITORING YEAR 5

EEP PROJECT NO. 28

SHEET NO. 1



AS-BUILT

PHOTO POINT

VEGETATION PLOT

JHOOK

CROSS VANE

ROOTWAD

ROCK CROSS VANE

DOUBLE WING DEFLECTOR

ROCK CROSS VANE

LOG CROSS VANE

LOG JHOOK

ROCK JHOOK

STEP POOL

30 15 0 30 60

1" = 60'

NOTE:
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URS Corporation – North Carolina
1600 Perimeter Park Drive
Morrisville, North Carolina 27560
TELEPHONE (919) 461-1100 FAX (919) 461-1415

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TECHNICIAN: EHJ

CHECKED BY: KM

MONITORING YEAR 5

EEP PROJECT NO. 28

SHEET NO. 2

AS-BUILT

PHOTO POINT

VEGETATION PLOT

JHOOK

CROSS VANE

ROOTWAD

ROCK CROSS VANE

DOUBLE WING DEFLECTOR

ROCK CROSS VANE

LOG CROSS VANE

LOG JHOOK

ROCK JHOOK

STEP POOL

JONES PROPERTY

MATCHLINE SHEET 2

MATCHLINE SHEET 4

P36-38

P33-35

BEAVER CREEK

BANKFULL

BANKFULL

POT STA 13+89.48

31 32 33 34 35 36 37 38 39

C-11 C-12 C-13 C-14 C-15

N 60° 22' 13.9" E

N 52° 37' 52.3" E

S 79° 16' 50.2" E

N 64° 30' 01.8" E

S 66° 43' 16.2" E

N 59° 49' 45.7" E

10+00

11+00

MEDLEY PROPERTY

HUDSON PROPERTY

FILLED EXISTING CHANNEL

NOTE:
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30 15 0 30 60

1" = 60'

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Prepared by
URS
URS Corporation - North Carolina
1600 Perimeter Park Drive
Morrisville, North Carolina 27560
TELEPHONE (919) 461-1100 FAX (919) 461-1415

PROJECT: BEAVER CREEK STREAM RESTORATION 2008 MONITORING REPORT

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Ecosystem Enhancement

DATE: FEB 2009

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MONITORING YEAR 5

EEP PROJECT NO. 28

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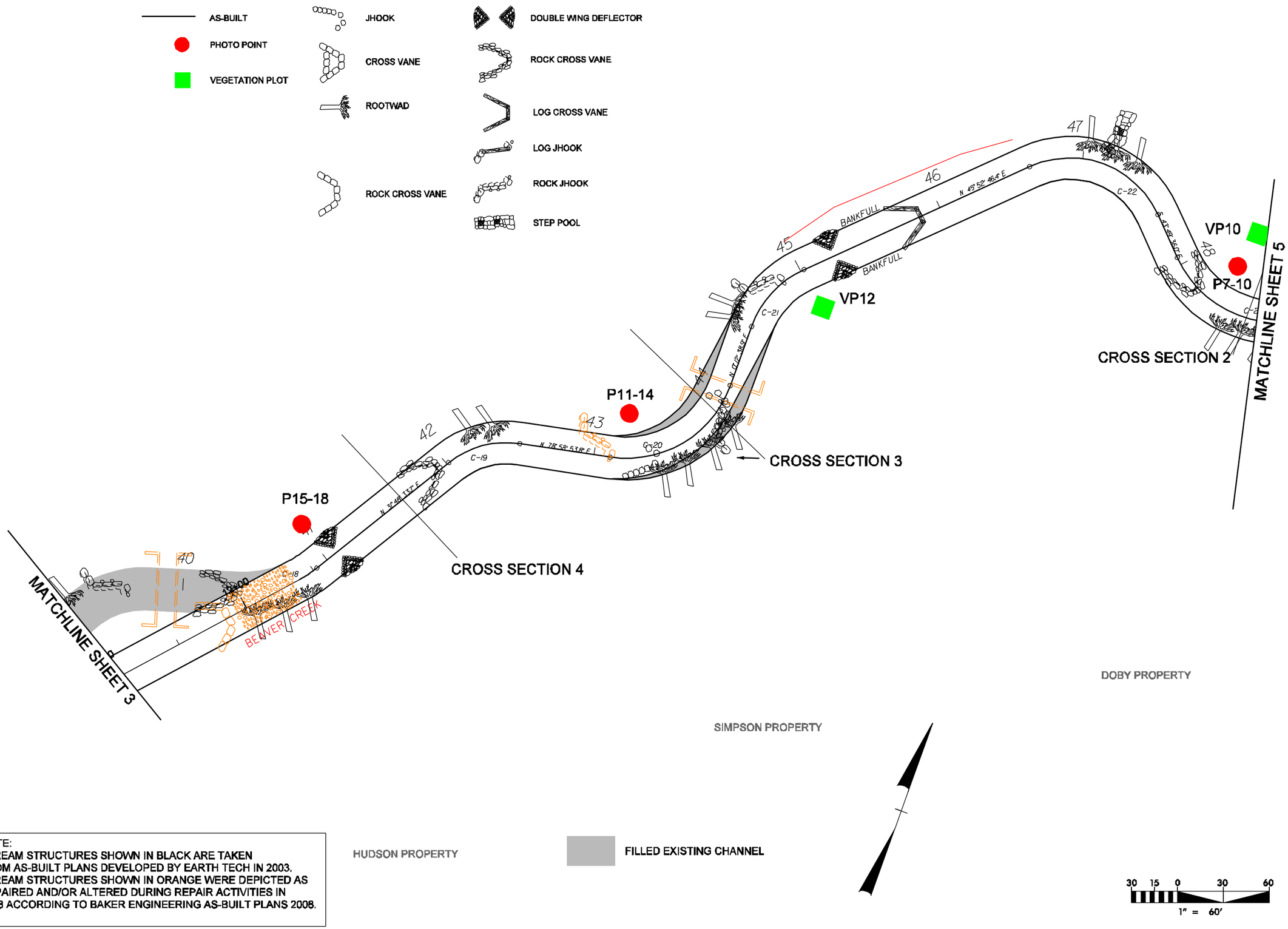

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URS
URS Corporation – North Carolina
1600 Perimeter Park Drive
Morrisville, North Carolina 27560
TELEPHONE (919) 461-1100 FAX (919) 461-1415

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DATE: FEB 2009

TECHNICIAN: EHJ

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MONITORING YEAR 5

EEP PROJECT NO. 28

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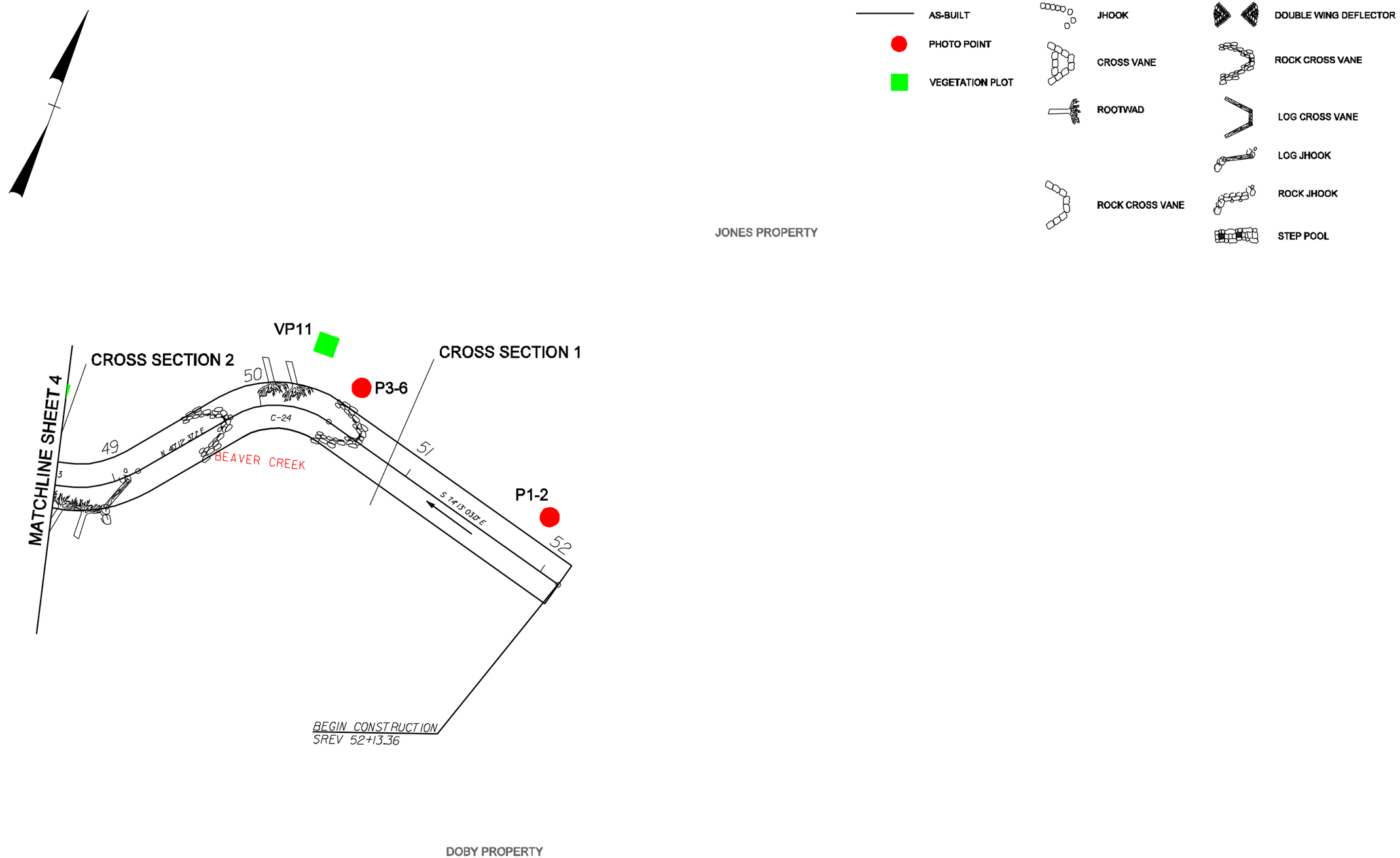

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30 15 0 30 60
1" = 60'

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URS Corporation - North Carolina
1600 Perimeter Park Drive
Morrisville, North Carolina 27560
TELEPHONE (919) 461-1100 FAX (919) 461-1415

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CHECKED BY: KM

MONITORING YEAR 5

EEP PROJECT NO. 28

SHEET NO. 5

3.0 PROJECT CONDITION AND MONITORING RESULTS

3.1 VEGETATION ASSESSMENT

Vegetation monitoring plot stem counts and photos are located in Appendices A-I and A-IV.

3.1.1 VEGETATION PROBLEM AREAS

Vegetative problem areas include poor woody survival, bare floodplains, and the presence of kudzu (*Puereria montana*). These areas are concentrated mainly in those portions of the project disturbed during recent construction activities. These areas were re-planted in the winter of 2008-2009. The kudzu is concentrated in the upstream reach of the site. Vegetative Problem Area Photos are located in Appendix A-II.

3.1.2 VEGETATION CURRENT CONDITION PLAN VIEW

See Appendix A-III for the Vegetation Current Condition Plan View.

3.2 STREAM ASSESSMENT

3.2.1 PROCEDURAL ITEMS

3.2.1.1 Morphometric Criteria

Dimension and profile were sampled per the 2003 Stream Mitigation Guidelines (USACE 2003) as follows:

Dimension: Seven permanent cross sections were surveyed. Due to recent disturbance caused by repair activities, several cross section bank pins were re-established. URS re-established cross section bank pins as close as possible to the locations surveyed by EcoLogic in 2005. Both pins were found at cross section one. The right bank was re-established at cross sections two, three, six, and seven. No pins were found for cross sections four or five; URS re-established both banks at cross sections four and five. The survey includes points measured at all breaks in slope including top of bank, bankfull, and thalweg.

Profile: A total of 3,672 linear feet of longitudinal profile was surveyed. Survey points include the top of bank, the beginning of each stream feature such as riffle or pool, and the maximum pool depth.

3.2.1.2 Hydrologic Criteria

No crest gages are installed at this site to document bankfull events. Therefore, potential occurrence was extrapolated based on US Geological Survey (USGS) stream gage discharge data for the Fisher River near Copeland, NC (02113000). The gage is located within one mile of the site in the same watershed and has a drainage area of 128 square miles. An estimate of the number of bankfull events between August 2007 and August 2008 was made by comparing the stream discharges from the USGS data in cubic feet per second (cfs) against the bankfull discharge estimated from the drainage area on the Rural Piedmont NC Regional Curve. According to the regional curve, a bankfull event occurs on a stream with a 128 square mile drainage area when the discharge nears 2,900 cfs. Based on this primary surrogate USGS data, an estimated two bankfull events occurred between August 2007 and August 2008 (USGS 2008).

Table V: Verification of Bankfull Events

Beaver Creek EEP Project Number 00028		
Date of Data Collection	**Date of Occurrence**	**Method**
September 19, 2008	October 2007	Proximal USGS Gage Resource
September 19, 2008	April 2008	Proximal USGS Gage Resource

Figure 3: USGS Stream Gage Discharge Data

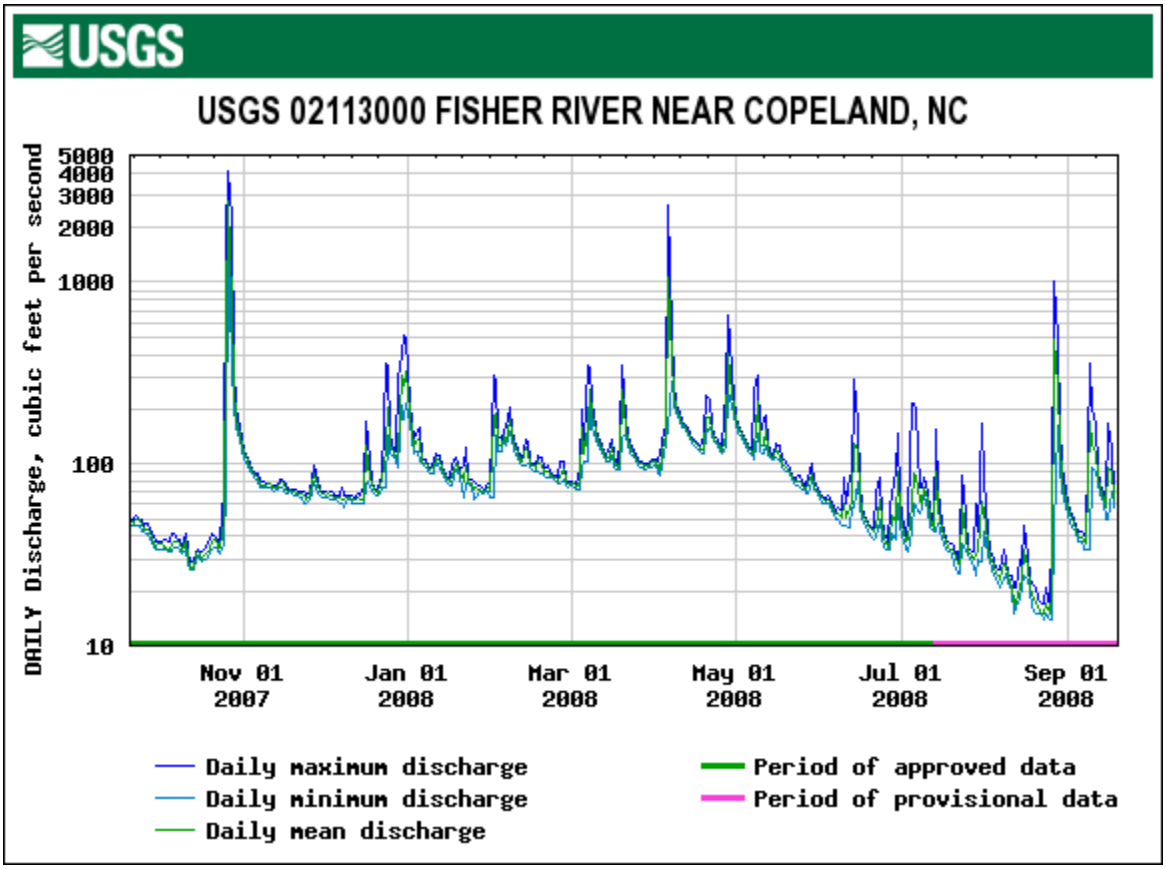

Table VI: BEHI and Sediment Export Estimates

Beaver Creek EEP Project Number 00028															
Time Point	**Segment/ Reach**	**Linear Footage**	**Extreme**		**Very High**		**High**		**Moderate**		**Low**		**Very Low**		**Sediment Export**
			ft	%	ft	%	ft	%	ft	%	ft	%	ft	%	Ton/y
MY5	Beaver	3,672									3,672	100			56

3.2.2 STREAM PROBLEM AREAS

There were a total of four stream problem areas. The recent repairs focused on many of the problem areas identified in the 2005 Monitoring Report prepared by EcoLogic. The new and replaced structures have also allowed eroding banks to re-stabilize and re-vegetate. Bare bank areas remain, but are improving. Three vane structures were found to have failed due to shifting boulders, channel downcutting, and scouring behind vane arms.

3.2.3 FIXED PHOTO STATION PHOTOS

Stream Photo Station Photos are located in Appendix B-IV.

3.2.4 STABILITY ASSESSMENT

Table VII: Categorical Stream Feature Visual Stability Assessment (% Functioning)

Beaver Creek EEP Project Number 00028						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03***	**MY-04***	**MY-05**
A. Riffle	100	--	88	--	--	99
B. Pool	100	--	87	--	--	100
C. Thalweg	100	--	100	--	--	100
D. Meanders	100	--	100	--	--	94
E. Bed General	100	--	100	--	--	99
F. Bank Condition	100	--	100	--	--	99
G. Vanes / J Hooks	100	--	100	--	--	96
H. Wads and Boulders	100	--	38	--	--	100

*Data were not collected in 2006 and 2007 (MY3 and MY4). The project was put on hold due to pending repair activities.

3.2.5 QUANTITATIVE MEASURES TABLES (MORPHOLOGY AND HYDROLOGY)

Table VIII: Baseline Morphology and Hydraulic Summary

Beaver Creek EEP Project Number 00028																		
Parameter*	**Regional Curve Interval**			**Pre-Existing Condition**			**Project Reference Stream (Big Branch)**			**Project Reference Stream (Basin Creek)**			**Design**			**As-built**		
Dimension	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
BF Width (ft)	15	50	28	27	37.5	30.6	20.0	21.5	20.8	29.5	36.9	33.2	--	--	28	21.9	33.6	--
Floodprone Width (ft)	--	--	--	--	--	230	--	--	130	--	--	329	--	--	230	--	--	313
BF Cross Sectional Area (ft^2)	40	150	75	53.3	89.7	70.6	40.9	42.8	41.9	64.9	71.9	68.4	--	--	70.0	55.1	104.6	--
BF Mean Depth (ft)	1.7	4.0	2.8	1.8	2.8	2.3	--	--	2.0	1.9	2.2	2.1	--	--	2.5	2.6	3.1	--
BF Max Depth (ft)	--	--	--	2.5	3.3	3.1	2.5	2.7	2.6	3.0	3.2	3.1	--	--	4.2	4.3	5.2	--
Width/Depth Ratio	--	--	--	9.5	16.0	13.6	9.8	10.8	10.3	13.4	19.4	16.4	--	--	11.2	9.8	10.8	--
Entrenchment Ratio	--	--	--	--	--	7.5	--	--	65	--	--	8.9	--	--	7.5	9.4	12	--
Bank Height Ratio	--	--	--	1.6	2.4	2.0	--	--	1.0	--	--	1.0	--	--	1.0	--	--	--
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pattern																		
Channel Beltwidth (ft)	--	--	--	34	256	107	31	44	37	59	75	64.7	43	208	99	43	208	87
Radius of Curvature (ft)	--	--	--	16.0	285	99	42	63	55	40.1	69.3	51.2	45	76	65.5	45	76	65
Meander Wavelength (ft)	--	--	--	116	802	338	185	260	222			350	192	485	305	192	485	275
Meander Width Ratio	--	--	--	1.1	8.4	3.5	1.5	2.1	1.8	1.7	2.3	1.9	1.5	7.4	3.5	--	--	--

* USGS gage data are unavailable for this project and are not included in the table.

Table VIII: Baseline Morphology and Hydraulic Summary (cont.)

Beaver Creek EEP Project Number 00028																		
Parameter*	**Regional Curve Interval**			**Pre-Existing Condition**			**Project Reference Stream (Big Branch)**			**Project Reference Stream (Basin Creek)**			**Design**			**As-built**		
Dimension	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Profile																		
Riffle Length (ft)	--	--	--	--	--	--	23.4	78.0	58.5	--	--	--	--	--	--	--	--	--
Riffle Slope (ft/ft)	--	--	--	--	--	--	0.015	0.019	0.017	0.018	0.02	0.021	0.004	0.032	0.010	--	--	--
Pool Length (ft)	--	--	--	--	--	--	23.6	32.0	26.9	--	--	--	--	--	--	--	--	--
Pool Spacing (ft)	--	--	--	80	440	215	98	180	139	271	334	305	94	321	159	--	--	--
Substrate																		
d50 (mm)	--	--	--	--	--	4.7	--	--	--	--	--	58	--	--	--	--	--	--
d84 (mm)	--	--	--	--	--	90	--	--	--	--	--	180	--	--	--	--	--	--
Additional Reach Parameters																		
Valley Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3314
Channel Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4220
Sinuosity	--	--	--	--	--	1.35	--	--	1.1	--	--		--	--	1.22	--	--	1.3
Water Surface Slope (ft/ft)	--	--	--	--	--	0.005	--	--	0.009	--	--	0.014	--	--	0.005	--	--	0.5%
BF Slope (ft/ft)	--	--	--	--	--	0.006	--	--	0.009	--	--		--	--	0.006	--	--	
Rosgen Classification	--	--	--	--	--	C4, G4, F4	--	--	E4	--	--	C4	--	--	E4	--	--	E5

* USGS gage data are unavailable for this project and are not included in the table.

Table IX: Morphology and Hydraulic Monitoring Summary

Beaver Creek EEP Project Number 00028																				
Parameter	Cross Section 1 Riffle					Cross Section 2 Pool					Cross Section 3 Pool					Cross Section 4 Riffle				
Dimension	**MY1**	**MY2**	**MY3***	**MY4***	**MY5**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5**
BF Width (ft)	29.1	19.3	--	--	22.5	29.1	25.6	--	--	35.3	24.6	21.2	--	--	34.1	32.9	19.1	--	--	20.2
Floodprone Width (ft)	315	33.9	--	--	>50	--	62.1	--	--	>70	--	39.2	--	--	>70	315	31.2	--	--	>60
BF Cross Sectional Area (ft^2)	86.8	32.14	--	--	48.4	110.6	71.7	--	--	110.0	78.2	48.8	--	--	83.7	108	38.9	--	--	78.6
BF Mean Depth	2.7	1.67	--	--	2.2	3.8	2.79	--	--	3.1	3.2	2.3	--	--	2.5	3.3	2.04	--	--	3.9
BF Max Depth	4.5	2.19	--	--	3.0	5.8	4.8	--	--	5.0	5.2	3.3	--	--	4.3	6.7	2.84	--	--	4.9
Width/Depth Ratio	11.8	11.6	--	--	10.4	--	9.2	--	--	11.3	--	9.23	--	--	13.9	10	9.33	--	--	5.2
Entrenchment Ratio	10.8	1.7	--	--	>2.2	--	2.4	--	--	>2.0	--	1.85	--	--	>2.1	9.6	1.64	--	--	>3.0
Bank Height Ratio	--	--	--	--	1.0	--	--	--	--	1.0	--	--	--	--	1.0	--	--	--	--	1.0
Wetted Perimeter (ft)	--	20.62	--	--	23.9	--	28.9	--	--	37.6	--	23.2	--	--	36.0	--	20.84	--	--	25.0
Hydraulic radius (ft)	--	1.56	--	--	2.0	--	2.5	--	--	2.9	--	2.11	--	--	2.3	--	1.87	--	--	3.1
Substrate																				
d50 (mm)	1.13	3.2	--	--	40	0.36	0.69	--	--	6.4	0.44	1.56	--	--	1.5	0.55	1.96	--	--	.062
d84 (mm)	45.32	32	--	--	120	27.88	1	--	--	39	21.7	16	--	--	6	22.02	52.6	--	--	9.1

*Data were not collected in 2006 and 2007 (MY3 and MY4). The project was put on hold due to pending repair activities.

Table IX: Morphology and Hydraulic Monitoring Summary (cont.)

Beaver Creek EEP Project Number 00028															
Parameter	Cross Section 5 Pool					Cross Section 6 Riffle					Cross Section 7 Pool				
Dimension	**MY1**	**MY2**	**MY3***	**MY4***	**MY5**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5**
BF Width (ft)	48	34	--	--	38.1	34.6	33.2	--	--	31.6	38.2	20.77	--	--	21.8
Floodprone Width (ft)	--	50.7	--	--	>60	315	43.1	--	--	>60	--	45.3	--	--	>60
BF Cross Sectional Area (ft^2)	125.8	88.8	--	--	101.6	93.6	78.2	--	--	90.2	95.2	47	--	--	71.1
BF Mean Depth	2.6	2.6	--	--	2.7	2.7	2.35	--	--	2.9	2.5	2.28	--	--	3.3
BF Max Depth	5.7	4.5	--	--	5.0	4.8	4.32	--	--	4.5	5.8	3.88	--	--	4.7
Width/Depth Ratio	--	13.13	--	--	14.3	12.8	14.11	--	--	11.1	--	9.12	--	--	6.7
Entrenchment Ratio	--	1.49	--	--	>1.6	9.1	1.3	--	--	>1.9	--	2.18	--	--	>2.8
Bank Height Ratio	--	--	--	--	1.0	--	--	--	--	1.0	--	--	--	--	1.0
Wetted Perimeter (ft)	--	35.7	--	--	39.9	--	36	--	--	34.4	--	22.64	--	--	24.9
Hydraulic radius (ft)	--	2.5	--	--	2.5	--	2.17	--	--	2.6	--	2.09	--	--	2.8
Substrate															
d50 (mm)	5.25	1.38	--	--	.062	0.36	11.03	--	--	1.1	0.36	0.61	--	--	.91
d84 (mm)	38.5	16	--	--	1.5	27.88	32	--	--	5.2	27.88	1.39	--	--	5.1

*Data were not collected in 2006 and 2007 (MY3 and MY4). The project was put on hold due to pending repair activities.

Table IX: Morphology and Hydraulic Monitoring Summary (cont.)

Beaver Creek EEP Project Number 00028															
Parameter	**MY1**			**MY2**			**MY3***			**MY4***			**MY5**		
Pattern	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**
Channel Beltwidth (ft)	39	192	80	40	240	90	--	--	--	--	--	--	20	200	80
Radius of Curvature (ft)	42	170	90	50	100	70	--	--	--	--	--	--	42	100	60
Meander Wavelength (ft)	182	481	267	225	435	262	--	--	--	--	--	--	230	570	380
Meander Width Ratio	--	--	--	11.6	22.5	13.5	--	--	--	--	--	--	9.8	29.7	17.8
Profile															
Riffle Length (ft)	--	--	--	5.2	53.3	21.1	--	--	--	--	--	--	25	50.8	35.7
Riffle Slope (ft/ft)	--	--	--	0.0053	0.069	0.029	--	--	--	--	--	--	0.0083	0.026	0.016
Pool Length (ft)	--	--	--	33.9	195	89	--	--	--	--	--	--	57.8	187.8	95.1
Pool Spacing (ft)	--	--	--	17.5	219	84	--	--	--	--	--	--	16.3	384.8	127.7
Additional Reach Parameters															
Valley Length (ft)	--	3314	--	--	3314	--	--	--	--	--	--	--	--	3314	--
Channel Length (ft)	--	4198	--	--	4360	--	--	--	--	--	--	--	--	4210	--
Sinuosity	--	1.3	--	--	1.3	--	--	--	--	--	--	--	--	1.3	--
Water Surface Slope (ft/ft)	--	0.55	--	--	0.005	--	--	--	--	--	--	--	--	0.005	--
BF Slope (ft/ft)	--	0.54	--	--	0.005	--	--	--	--	--	--	--	--	0.005	--
Rosgen Classification	--	E5	--	--	B5	--	--	--	--	--	--	--	--	B5	--

*Data were not collected in 2006 and 2007 (MY3 and MY4). The project was put on hold due to pending repair activities.

4.0 METHODOLOGY SECTION

All monitoring methodologies follow the most current templates and guidelines provided by EEP (EEP 2006). Photographs were taken at high resolution using a Sealife EcoShot 6.0 megapixel digital camera. GPS locations were collected in 2005 (MY2) on both banks of each cross section and on all four corners of each vegetation plot. GPS locations were taken in 2008 (MY5) of the southwest corner of each vegetation plot inventoried during 2008 monitoring. GPS location information was collected using a Trimble Geo XT handheld mapping grade GPS unit. Stream and vegetation problem areas were noted in the field on 2008 As-Built Plan Sheets provided by Baker Engineering (Baker 2008). Permanent photo station photographs were taken from locations marked in the Year One Monitoring Report, prepared by EcoLogic Associates. URS included four additional photo station locations (11 photos) during the 2008 monitoring event.

4.1 STREAM METHODOLOGY

The methods used to generate the data in this report are standard fluvial geomorphology techniques as described in *Applied River Morphology* (Rosgen 1996) and related publications from US Forest Service and the interagency Stream Mitigation Guidelines (USACE 2003). URS' field morphology survey was conducted using a Nikon Total Station and the data were analyzed and displayed using the Reference Reach Spreadsheet, Version 4.1T (Mecklenburg 2006). Modified Wolman pebble counts were conducted within the feature of each cross section. Photographs were taken from both banks at each cross section. A photo was taken from the left bank towards the right bank and from the right bank towards the left bank.

4.2 VEGETATION METHODOLOGY

Vegetation plots were not established for the As-Built survey by Earth Tech due to storm damage that occurred prior to vegetation monitoring. Four circular vegetation monitoring plots were established by NC State University during 2004 (MY1). Fourteen new vegetation plots were established during 2005 (MY2) by EcoLogic. EcoLogic established 14 10-meter by 10-meter vegetation plots, per EEP's current protocol at that time.

According to the 2006, Version 4.0 CVS-EEP Protocol for Recording Vegetation (Lee *et al* 2006), the Beaver Creek Stream Restoration Project requires the monitoring of six vegetation plots. The new CVS-EEP Protocol for Recording Vegetation was used to inventory a total of seven vegetation plots. Five of EcoLogic's plots were inventoried (VP11, VP10, VP12, VP4, and VP15) during 2008. Two new plots (VP16 and VP17) were to be established by URS in 2008 after re-planting occurred in areas newly planted following the 2008 repairs. However, this will be accomplished during 2009 monitoring once contract issues have been resolved.

URS' vegetation monitoring methods followed the 2006, Version 4.0 CVS-EEP Protocol for Recording Vegetation (http://cvs.bio.unc.edu/methods.htm). Vegetation plot photographs were collected at the southwest corner of each vegetation plot. Vegetation monitoring plots were re-marked in the field by replacing all old flagging with new flagging. Each vegetation plot was marked by Ecologic in 2005 with a four-foot PVC pipe at the upstream, outside corner. The remaining three corners were marked with steel conduit. URS moved the PVC to the southwest corner (origin of the plot) and placed orange flagging at the southwest corner of each vegetation plot. Blue flagging was placed at the remaining three corners. Planted stems were flagged in white. Volunteer/natural regeneration stems were inventoried but not flagged. Monitoring taxonomy follows 'Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas' (Weakley 2007). Stem height was measured with a folding one-meter rule. Diameter at breast height and decimeter height were measured with calipers. The X,Y coordinates relative to the southwest

corner (origin) of each stem in the plot were recorded, as was the bearing of the x axis from the southwest corner. The results of the stem counts are located in Appendix A-I. Photographs of the monitoring plots are located in Appendix A-IV.

5.0 REFERENCES

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Appendices

Appendix A: Vegetation Raw Data

Appendix A-I: Vegetation Survey Data Tables

Table A1: Vegetation Metadata

Report Prepared By	Susan Shelingoski
Date Prepared	9/22/2008 12:47
database name	cvs-eep-entrytool-v2.2.5.mdb
database location	C:\Documents and Settings\susan_shelingoski\Desktop
computer name	RDUXPL160
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	28
project Name	Beaver Creek
Description	Stream Restoration
River Basin	Yadkin-Pee Dee
length(ft)	4,199
stream-to-edge width (ft)	20
area (sq m)	9.6 acres
Required Plots (calculated)	6
Sampled Plots	5

Table A2: Vegetation Vigor by Species

	Species	4	3	2	1	0	Missing	Unknown
	Alnus serrulata	6						
	Betula nigra	13		1				
	Fraxinus pennsylvanica	6	2					
	Juglans nigra	1						
	Nyssa sylvatica	1						
	Quercus falcata	2						
	Quercus michauxii	9	1					
	Quercus phellos	3						
	Quercus velutina	1	1					
	Rhus glabra	6	1					
	Salix nigra	10						
	Carpinus caroliniana	2						
	Cercis canadensis	4						
	Prunus serotina	2						
TOT:	**14**	**66**	**5**	**1**				

Table A3: Vegetation Damage by Species

	Species	All Damage Categories	(no damage)	Insects
	Alnus serrulata	6	6	
	Betula nigra	14	14	
	Carpinus caroliniana	2	2	
	Cercis canadensis	4	4	
	Fraxinus pennsylvanica	8	8	
	Juglans nigra	1	1	
	Nyssa sylvatica	1	1	
	Prunus serotina	2	2	
	Quercus falcata	2	2	
	Quercus michauxii	10	10	
	Quercus phellos	3	3	
	Quercus velutina	2	2	
	Rhus glabra	7	6	1
	Salix nigra	10	10	
TOT:	**14**	**72**	**71**	**1**

Table A4: Vegetation Damage by Plot

	plot	All Damage Categories	(no damage)	Insects
	00028-01-0004-year:5	13	13	
	00028-01-0010-year:5	26	26	
	00028-01-0011-year:5	25	24	1
	00028-01-0012-year:5	8	8	
TOT:	**4**	**72**	**71**	**1**

Table A5: Stem Count by Plot and Species

	Species	Total Planted Stems	# plots	avg# stems	plot 00028-01-0004-year:5	plot 00028-01-0010-year:5	plot 00028-01-0011-year:5	plot 00028-01-0012-year:5
	Alnus serrulata	6	1	6			6	
	Betula nigra	14	3	4.67		12	1	1
	Carpinus caroliniana	2	1	2	2			
	Cercis canadensis	4	3	1.33	1	2	1	
	Fraxinus pennsylvanica	8	4	2	1	2	4	1
	Juglans nigra	1	1	1		1		
	Nyssa sylvatica	1	1	1			1	
	Prunus serotina	2	1	2		2		
	Quercus falcata	2	1	2			2	
	Quercus michauxii	10	3	3.33	1		5	4
	Quercus phellos	3	3	1		1	1	1
	Quercus velutina	2	2	1	1			1
	Rhus glabra	7	2	3.5		6	1	
	Salix nigra	10	2	5	7		3	
TOT:	**14**	**72**	**14**		**13**	**26**	**25**	**8**

Table A6: Vegetation Problem Areas

Beaver Creek EEP Project Number 00028				
Feature #	**Feature/Issue**	**Station # / Range**	**Probable Cause**	**Photo #**
VPA1	Exotic population	3+00	Kudzu	VPA1
VPA2	Exotic population	5+00	Kudzu	VPA2
VPA3	No woody survival	8+00 to 13+00	Maintenance and repairs	VPA3
VPA4	No woody survival	15+00 to 19+00	Maintenance and repairs	VPA4
VPA5	No woody survival	25+00 to 26+00	Maintenance and repairs	VPA5
VPA6	Bare floodplain	25+00 to 25+50	Maintenance and repairs	VPA6
VPA7	Bare banks	37+00 to 37+25	Bank erosion	VPA7

VPA8	No woody survival	39+50 to 40+00	Maintenance and repairs	VPA8

Appendix A-II: Vegetation Problem Area Photos

VPA1 facing left bank

VPA2 facing right bank

VPA3 facing right bank

VPA4 facing upstream

VPA5 facing upstream

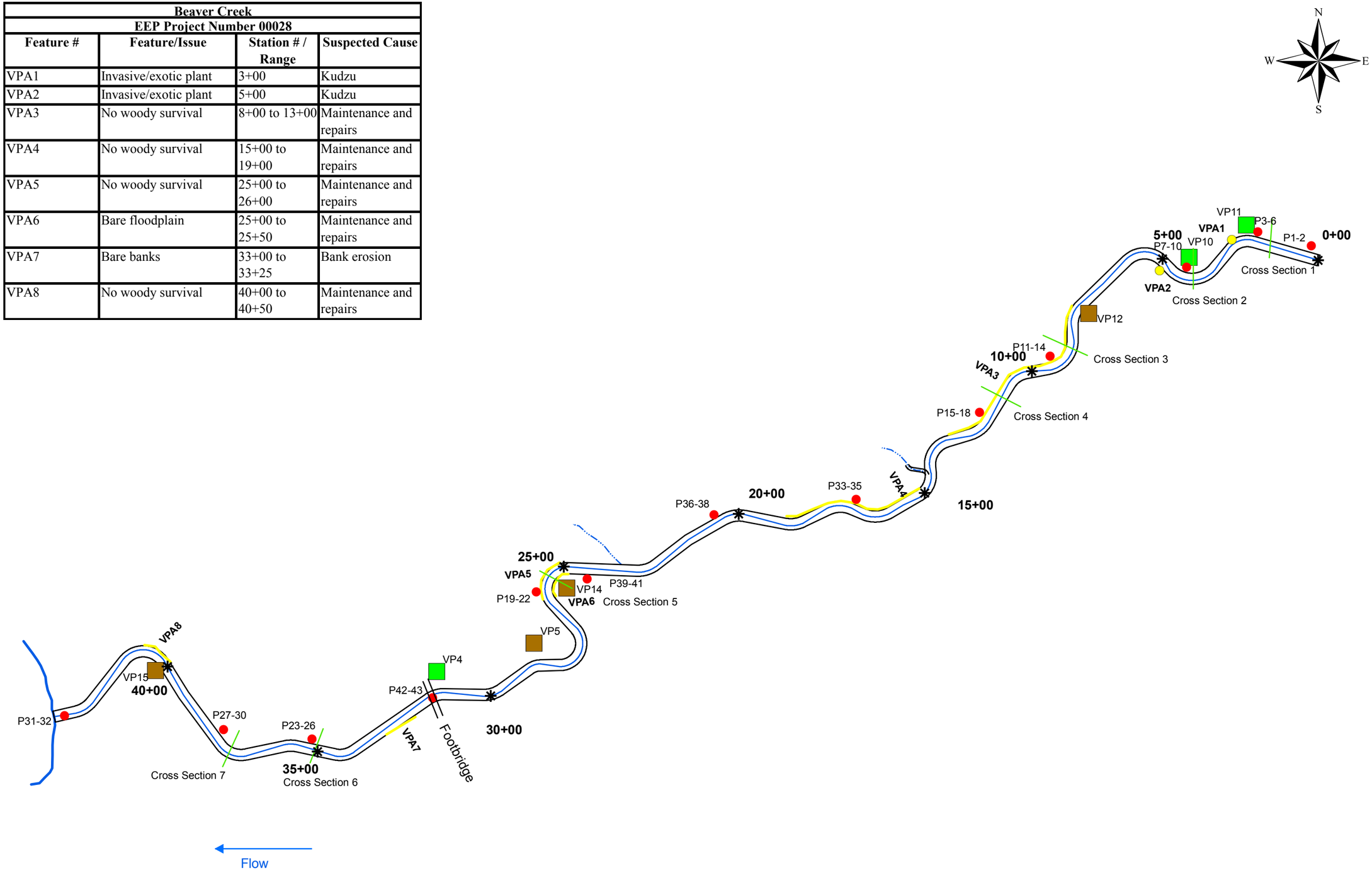
VPA6 facing upstream

VPA7 facing upstream

VPA8 facing downstream

Appendix A-III: Vegetation Current Condition Plan View

Beaver Creek EEP Project Number 00028			
Feature #	**Feature/Issue**	**Station # / Range**	**Suspected Cause**
VPA1	Invasive/exotic plant	3+00	Kudzu
VPA2	Invasive/exotic plant	5+00	Kudzu
VPA3	No woody survival	8+00 to 13+00	Maintenance and repairs
VPA4	No woody survival	15+00 to 19+00	Maintenance and repairs
VPA5	No woody survival	25+00 to 26+00	Maintenance and repairs
VPA6	Bare floodplain	25+00 to 25+50	Maintenance and repairs
VPA7	Bare banks	33+00 to 33+25	Bank erosion
VPA8	No woody survival	40+00 to 40+50	Maintenance and repairs



Prepared By:
URS Corporation - North Carolina
1600 Perimeter Park Drive
Suite 400
Morrisville, NC 27560
Phone: 919-461-1100
Fax: 919-461-1415

Prepared For:
NC Ecosystem
Enhancement Program

Project:
Beaver Creek
Stream Restoration
Surry County, NC

Monitoring Year:
5 (2008)

Project Number:
28

Date:
February 2009

Legend
- Problem Area Concern
- Problem Area Concern
- Stations
- Cross Section
- As-Built Streambank
- As-Built Centerline
- Vegetation Plot Meeting Success Criteria
- Vegetation Plot Not Meeting Success Criteria
- Photo Point

Vegetation
Current Condition
Plan View

Appendix A-IV: Vegetation Monitoring Plot Photos

VP4

VP10

VP11

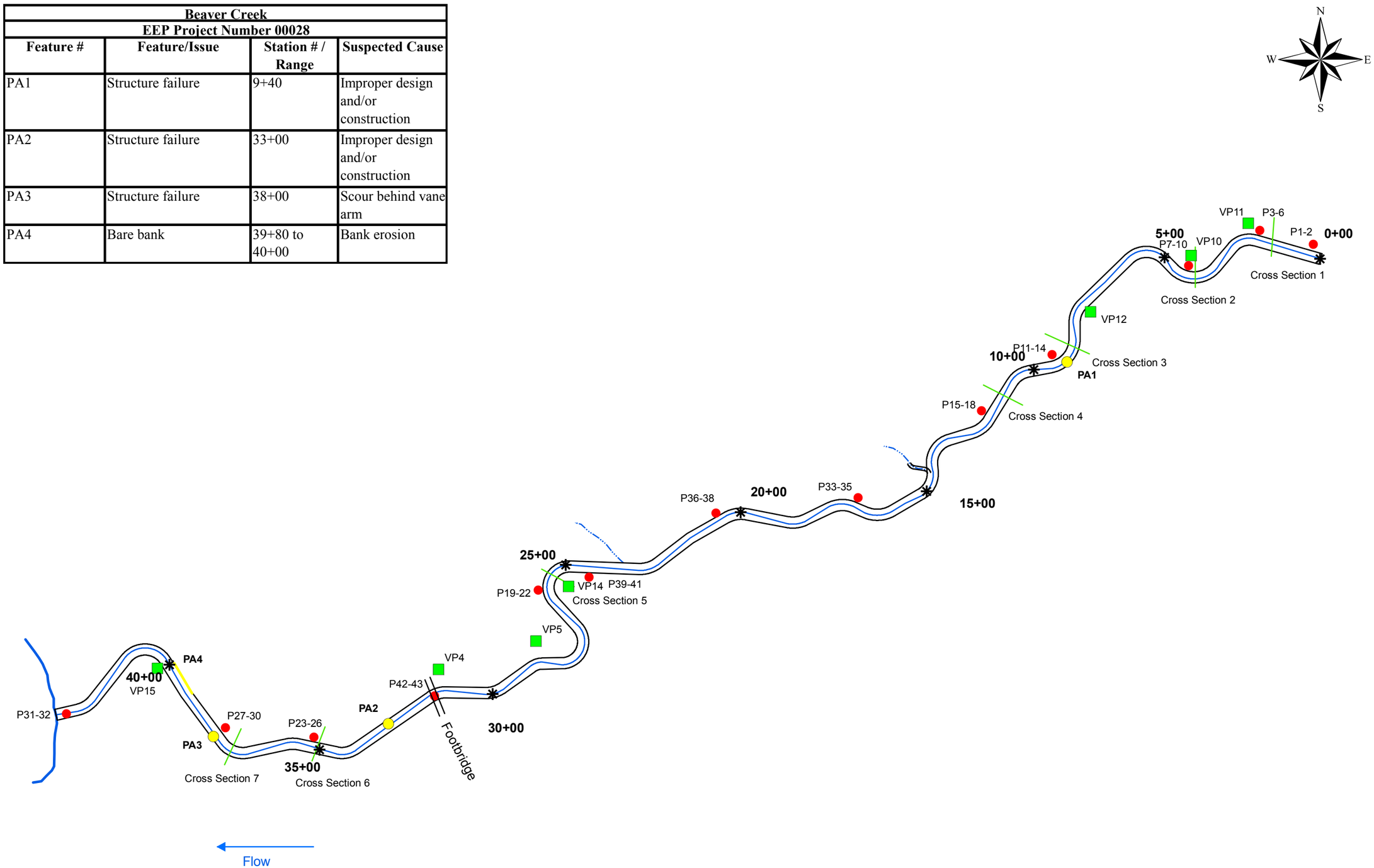
VP12

VP15

Appendix B: Geomorphic Raw Data

Appendix B-I: Stream Current Condition Plan View

Beaver Creek			
EEP Project Number 00028			
Feature #	**Feature/Issue**	**Station # / Range**	**Suspected Cause**
PA1	Structure failure	9+40	Improper design and/or construction
PA2	Structure failure	33+00	Improper design and/or construction
PA3	Structure failure	38+00	Scour behind vane arm
PA4	Bare bank	39+80 to 40+00	Bank erosion



Prepared By:
URS Corporation - North Carolina
1600 Perimeter Park Drive
Suite 400
Morrisville, NC 27560
Phone: 919-461-1100
Fax: 919-461-1415

URS

Prepared For:
NC Ecosystem
Enhancement Program

Ecosystem Enhancement PROGRAM

Project:
Beaver Creek
Stream Restoration
Surry County, NC

Monitoring Year:
5 (2008)

Project Number:
28

Date:
February 2009

Legend
- Problem Area Concern
- Problem Area Concern
- Stations
- Cross Section
- As-Built Streambank
- As-Built Centerline
- Vegetation Plot
- Photo Point

Stream
Current Condition
Plan View

Appendix B-II: Stream Problem Areas Data Table

Table B1: Stream Problem Areas

Beaver Creek EEP Project Number 00028				
Feature #	**Feature/Issue**	**Station # / Range**	**Probable Cause**	**Photo #**
PA1	Structure failure	9+40	Improper design and/or construction	PA1
PA2	Structure failure	33+00	Improper design and/or construction	PA2
PA3	Structure failure	38+00	Scour behind vane arm	PA3
PA4	Bare bank	39+80 to 40+00	Bank erosion	PA4

Appendix B-III: Representative Stream Problem Area Photos

PA1 facing upstream

PA2 facing right bank

PA3 facing left bank

PA4 facing right bank

Appendix B-IV: Stream Photo Station Photos

P1 facing upstream

P2 facing downstream

P3 facing upstream

P4 facing left bank

P5 facing downstream

P6 facing right bank floodplain

P7 facing upstream

P8 facing left bank

P9 facing downstream

P10 facing right bank floodplain

P11 facing upstream

P12 facing left bank

P13 facing downstream

P14 facing right bank floodplain

P15 facing upstream

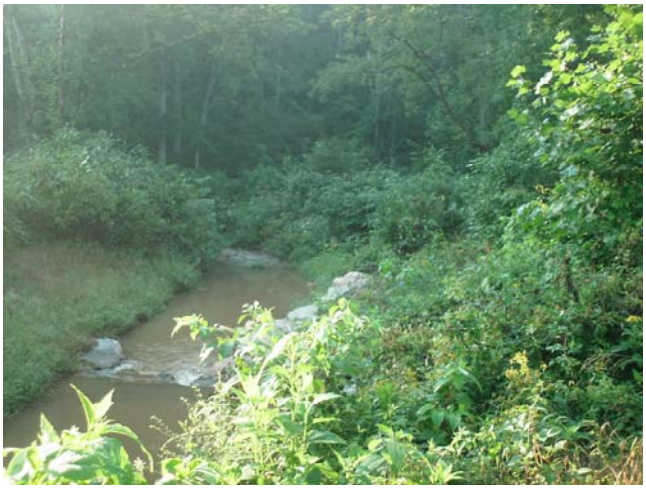
P16 facing left bank

P17 facing downstream

P18 facing right bank floodplain

P19 facing upstream

P20 facing left bank


P21 facing downstream

P22 facing right bank floodplain

P23 facing upstream

P24 facing left bank

P25 facing downstream

P26 facing right bank floodplain

P27 facing upstream

P28 facing left bank

P29 facing downstream

P30 facing right bank floodplain

P31 facing upstream

P32 facing downstream at Fisher River

P33 facing upstream

P34 facing left bank

P35 facing downstream

P36 facing upstream

P37 facing left bank

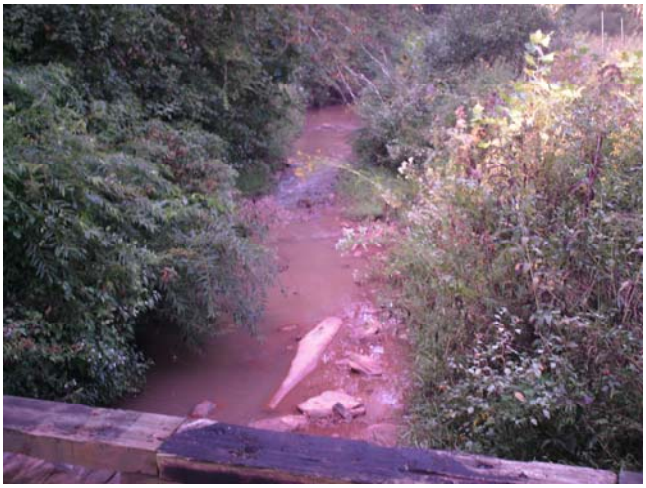
P38 facing downstream

P39 facing upstream

P40 facing left bank

P41 facing downstream

P42 facing upstream



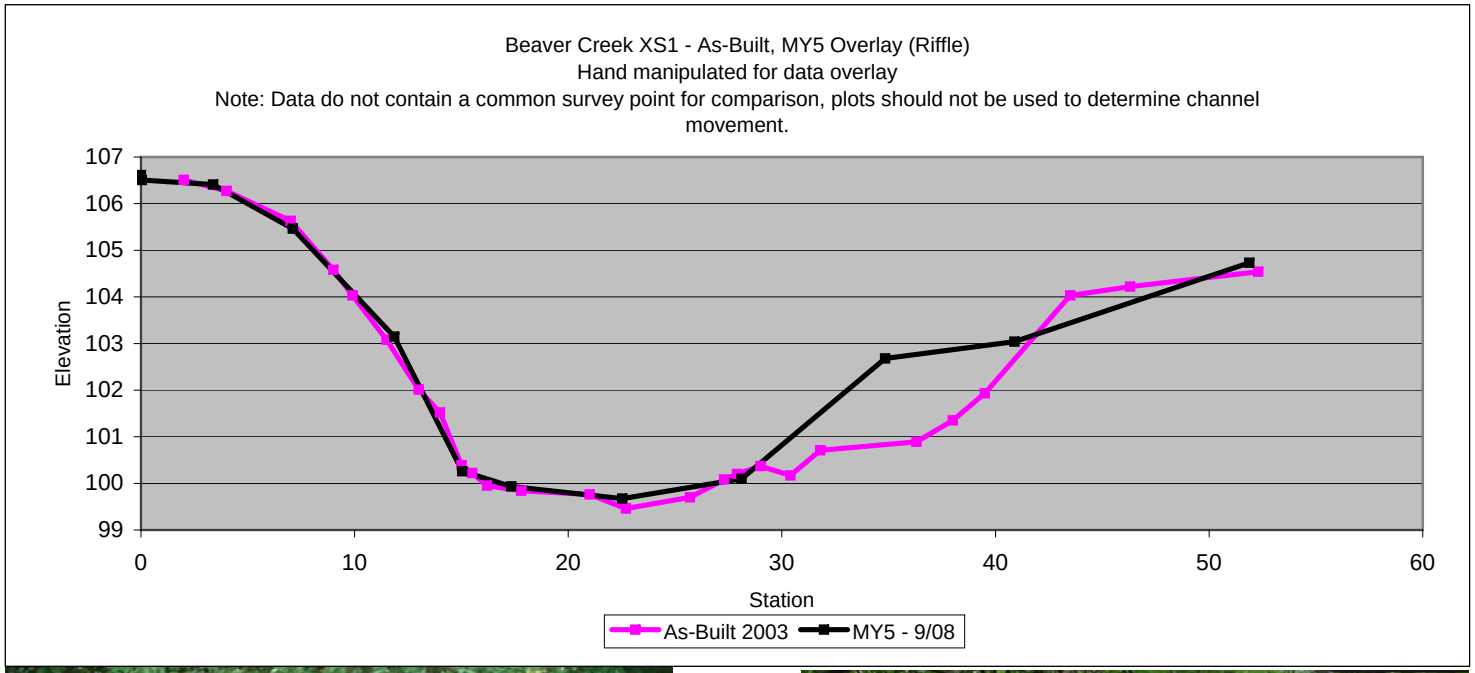
P43 facing downstream

Appendix B-V: Visual Morphological Stability Assessment Table

Table B2: Visual Morphological Stability Assessment

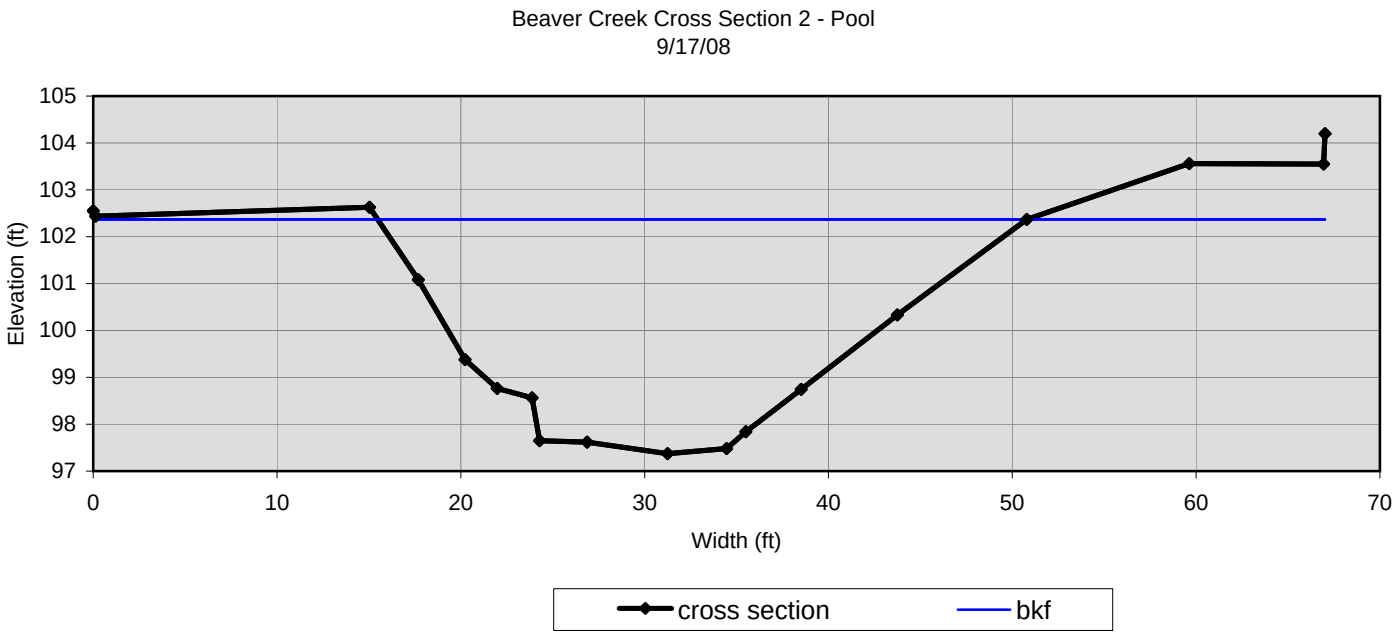
Beaver Creek EEP Project Number 00028						
Feature Category	Metric (per As-built and reference baselines)	(# stable) Number performing as Intended	Total Number per As-Built	Total number/feet in unstable state	% perform in stable condition	Feature perform. Mean or total
A. Riffles	Present?	20	20	N/A	100	
	Armor stable (no displacement)?	19	20	N/A	95	
	Facet grade appears stable?	20	20	N/A	100	
	Minimal evidence of embedding/fining?	20	20	N/A	100	
	Length appropriate?	20	20	N/A	100	
						99
B. Pools	Present (not subject to severe aggrad. or migration)?	40	40	N/A	100	
	Sufficiently deep (max pool D:mean Bkf >1.6)	40	40	N/A	100	
	Length appropriate?	40	40	N/A	100	
						100
C. Thalweg	Upstream of meander bend (run/inflection) centering?	22	22	N/A	100	
	Downstream of meander (glide/inflection) centering?	22	22	N/A	100	
						100
D. Meanders	Outer bend in state of limited/controlled erosion?	10	11	N/A	91	
	Of those eroding, # w/concomitant point bar formation?	0	0	N/A	n/a	
	Apparent Rc within spec?	11	11	N/A	100	
	Sufficient floodplain access and relief?	10	11	N/A	91	
				N/A		**94**
E. Bed General	General channel bed aggradation areas (bar formation)	3672	3672	0	100	
	Channel bed degradation–areas of increasing downcutting/headcutting?	3572	3672	5/100	97	
						99
F. Bank	Actively eroding, wasting, or slumping bank	3652	3672	2/20	99	
						99
G. Vanes	Free of back or arm scour?	33	36	N/A	92	
	Height appropriate?	36	36	N/A	100	
	Angle and geometry appear appropriate?	36	36	N/A	100	
	Free of piping or other structural failures?	33	36	N/A	92	
						96
H. Wads/ Boulders	Free of scour?	29	29	N/A	100	
	Footing stable?	29	29	N/A	100	
						100

Appendix B-VI: Cross Section Photos and Plots



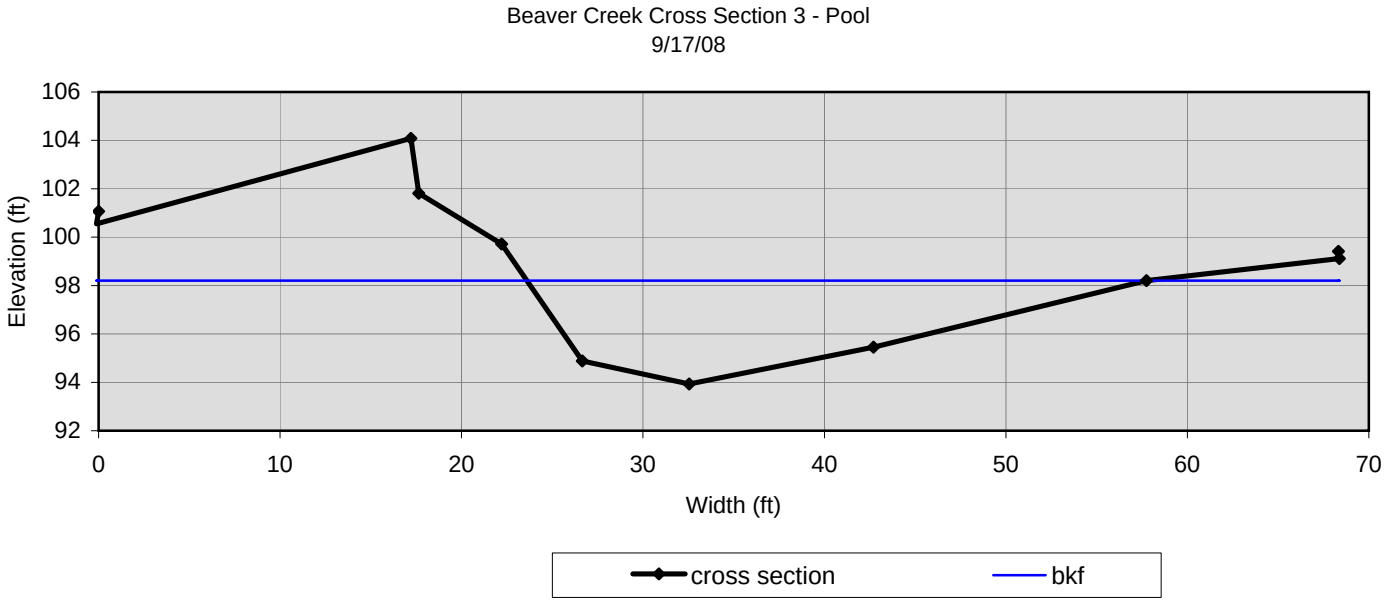
Facing Left Bank

Facing Right Bank



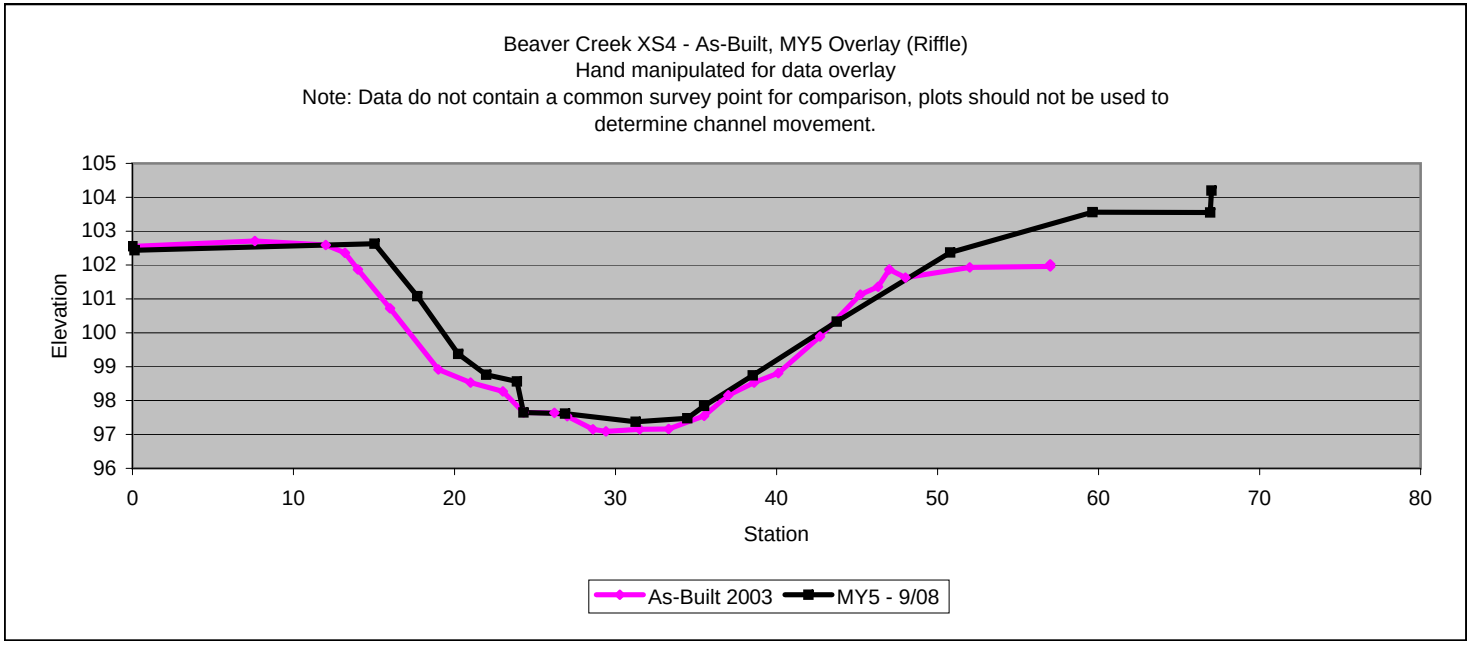
Facing Left Bank

Facing Right Bank



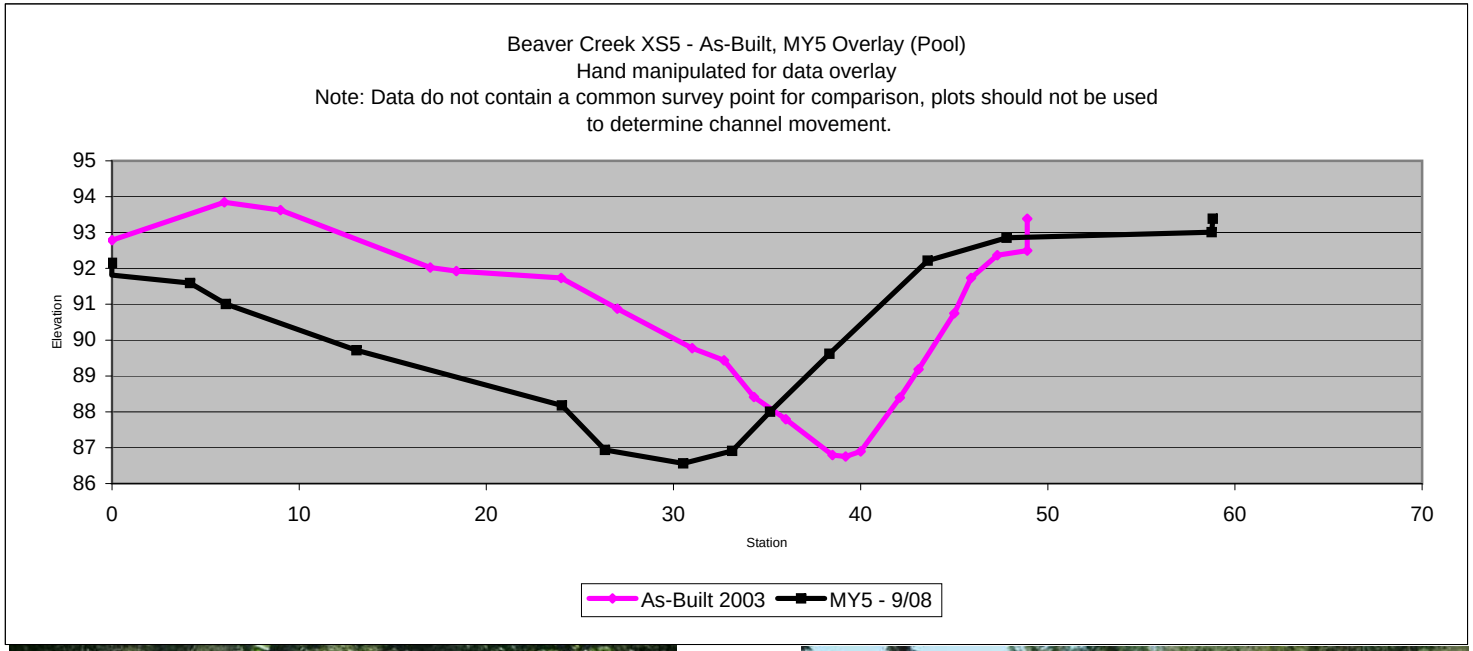
Facing Left Bank

Facing Right Bank



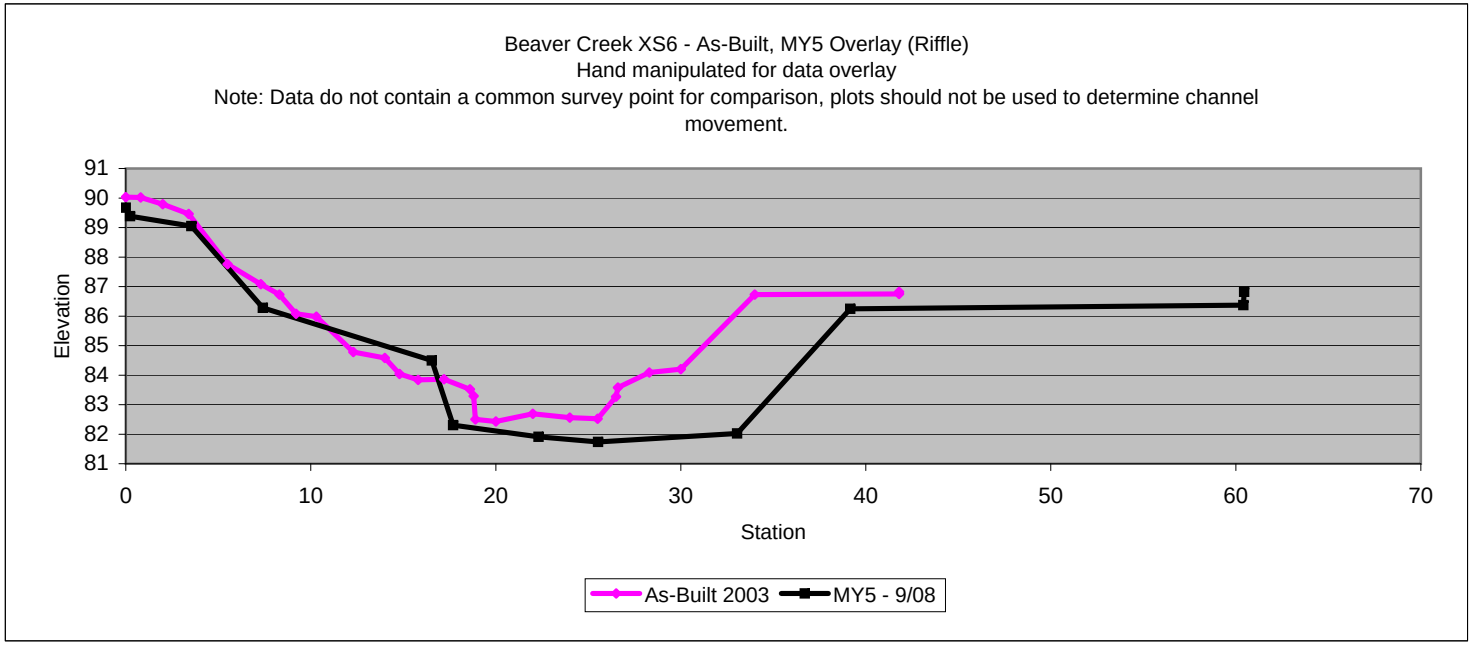
Facing Left Bank

Facing Right Bank



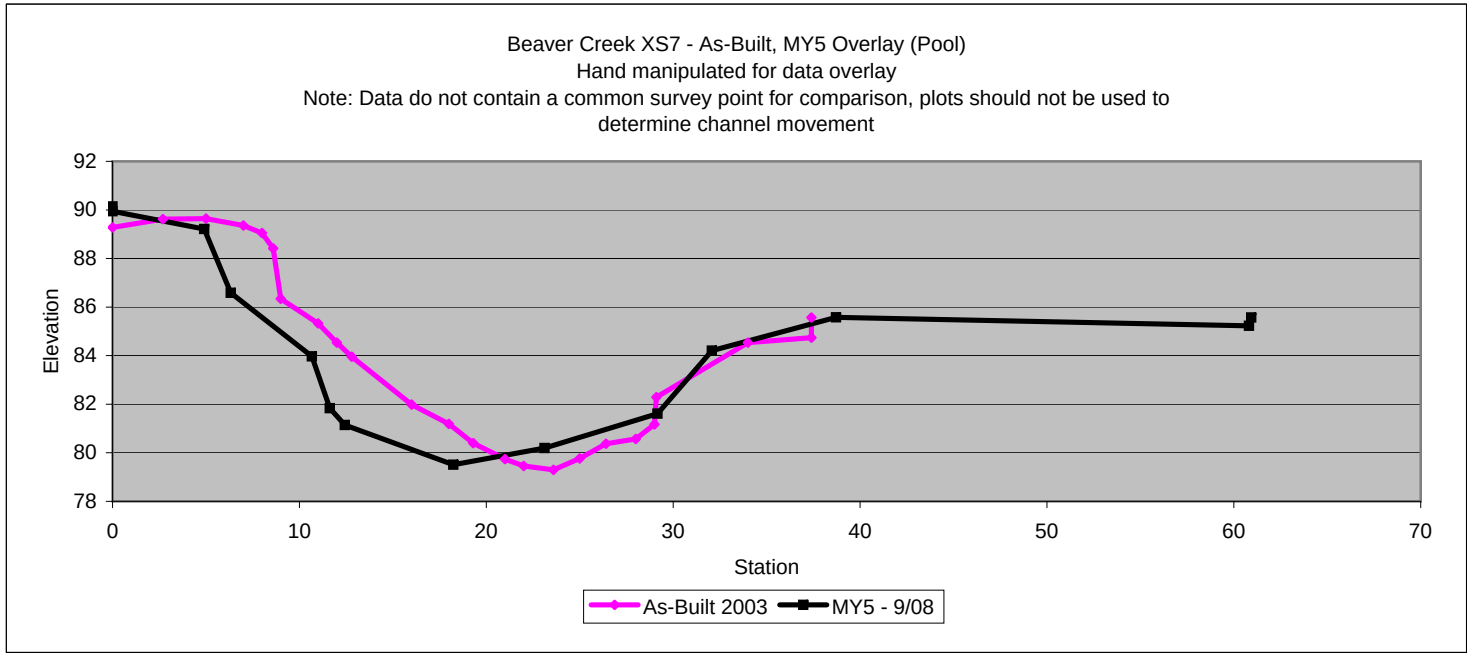
Facing Left Bank

Facing Right Bank



Facing Left Bank

Facing Right Bank

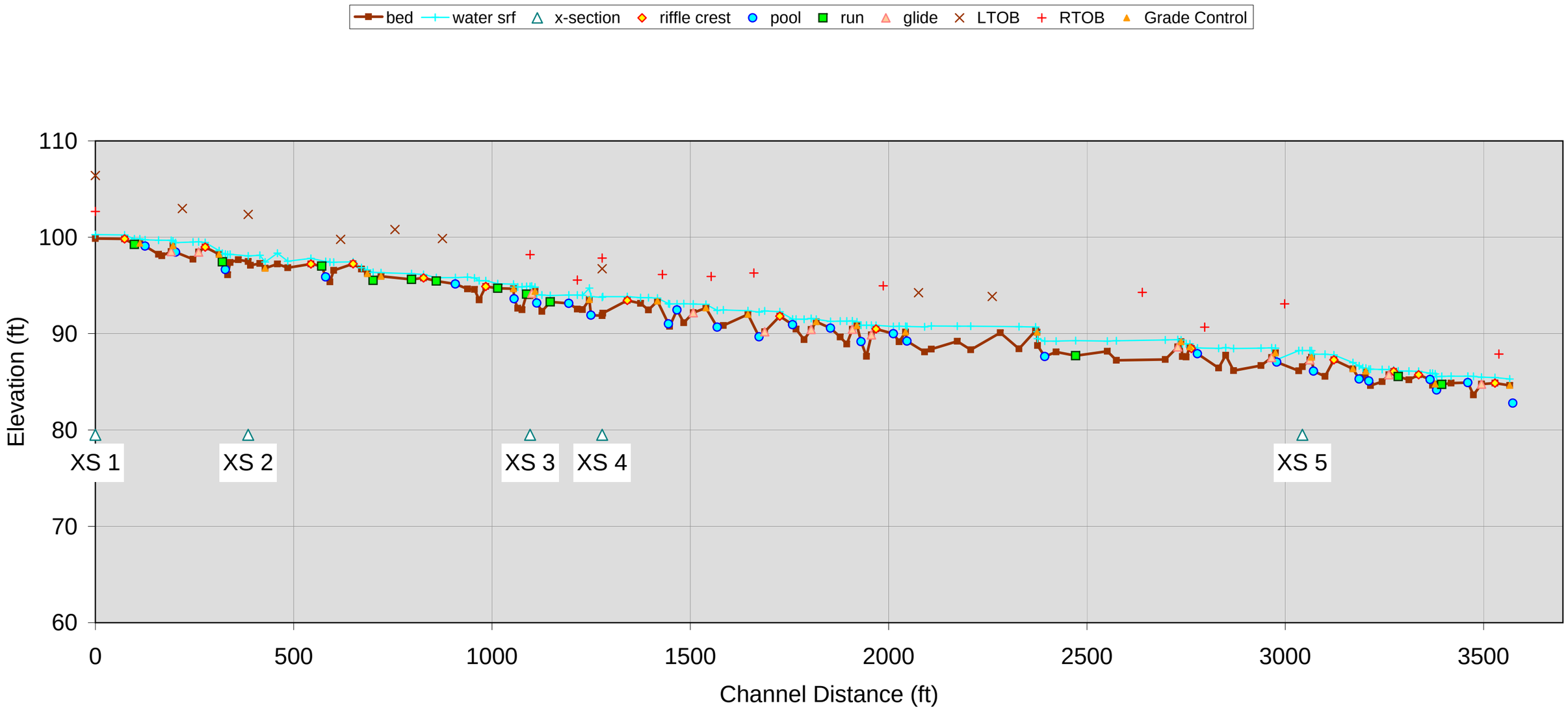


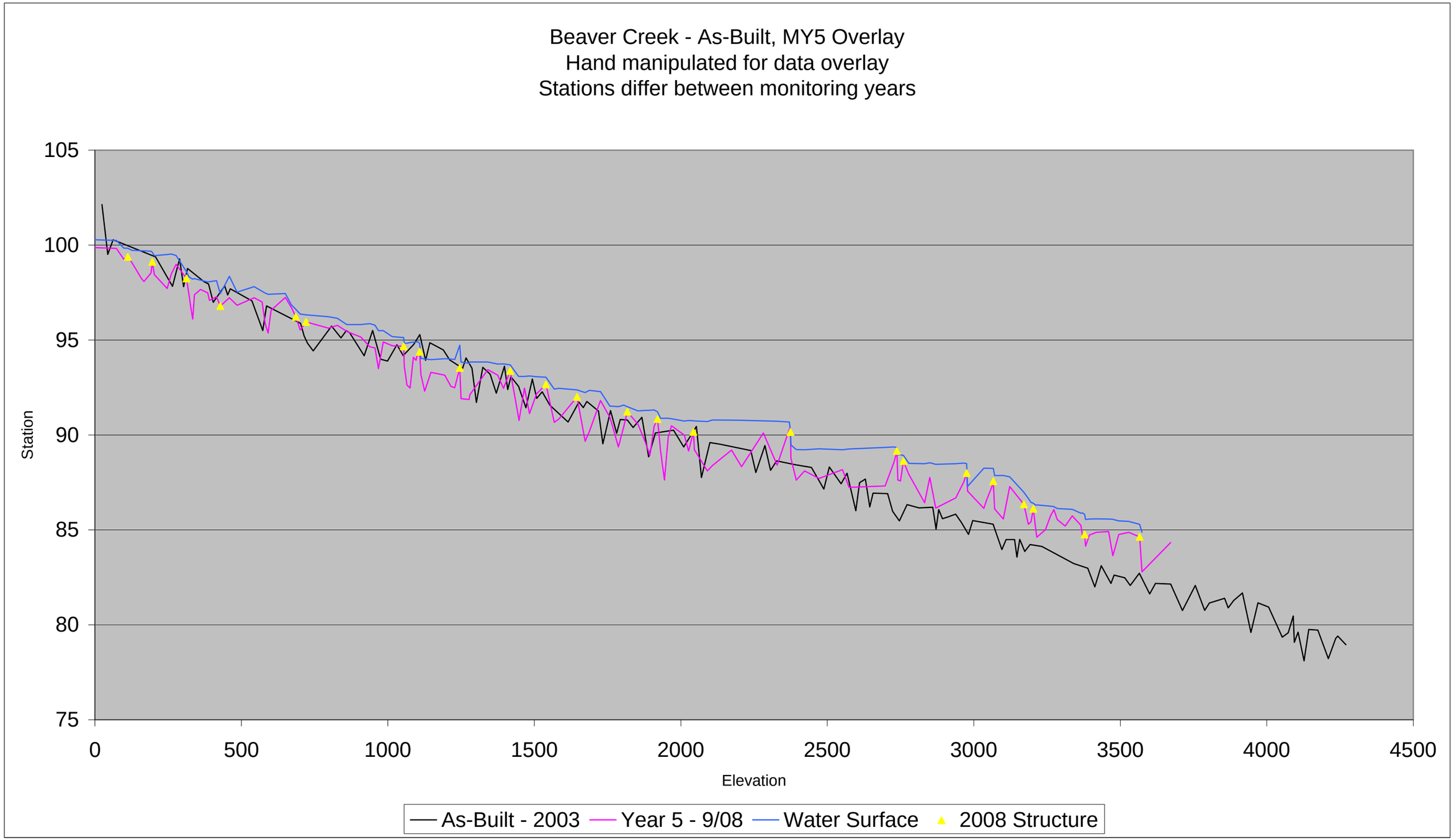
Facing Left Bank

Facing Right Bank

Appendix B-VII: Longitudinal Plot

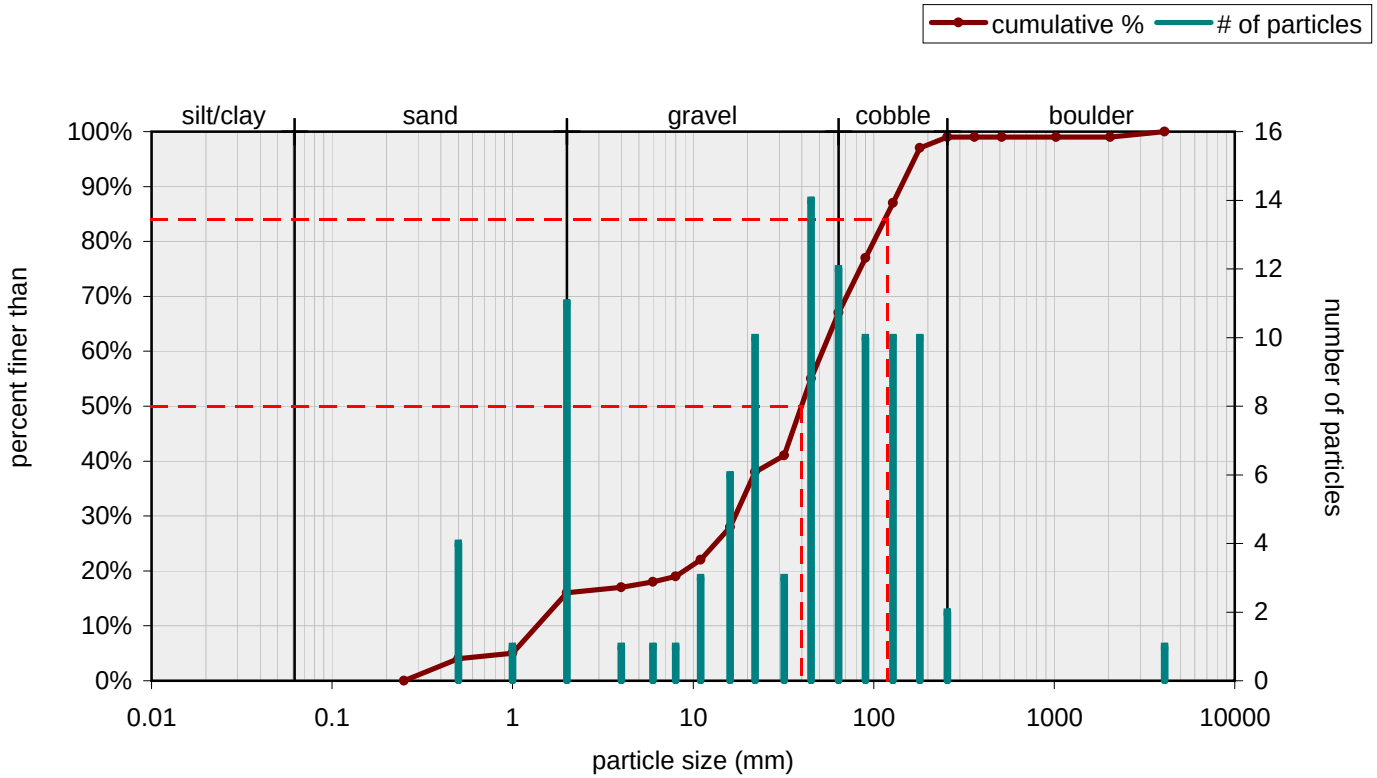
Beaver Creek Longitudinal Profile, 09/17/08 and 09/18/08




Beaver Creek - As-Built, MY5 Overlay
Hand manipulated for data overlay
Stations differ between monitoring years
105
100
95
90
85
80
75
Station
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Elevation
As-Built - 2003
Year 5 - 9/08
Water Surface
2008 Structure

Appendix B-VIII: Pebble Count Frequency Distribution Plots

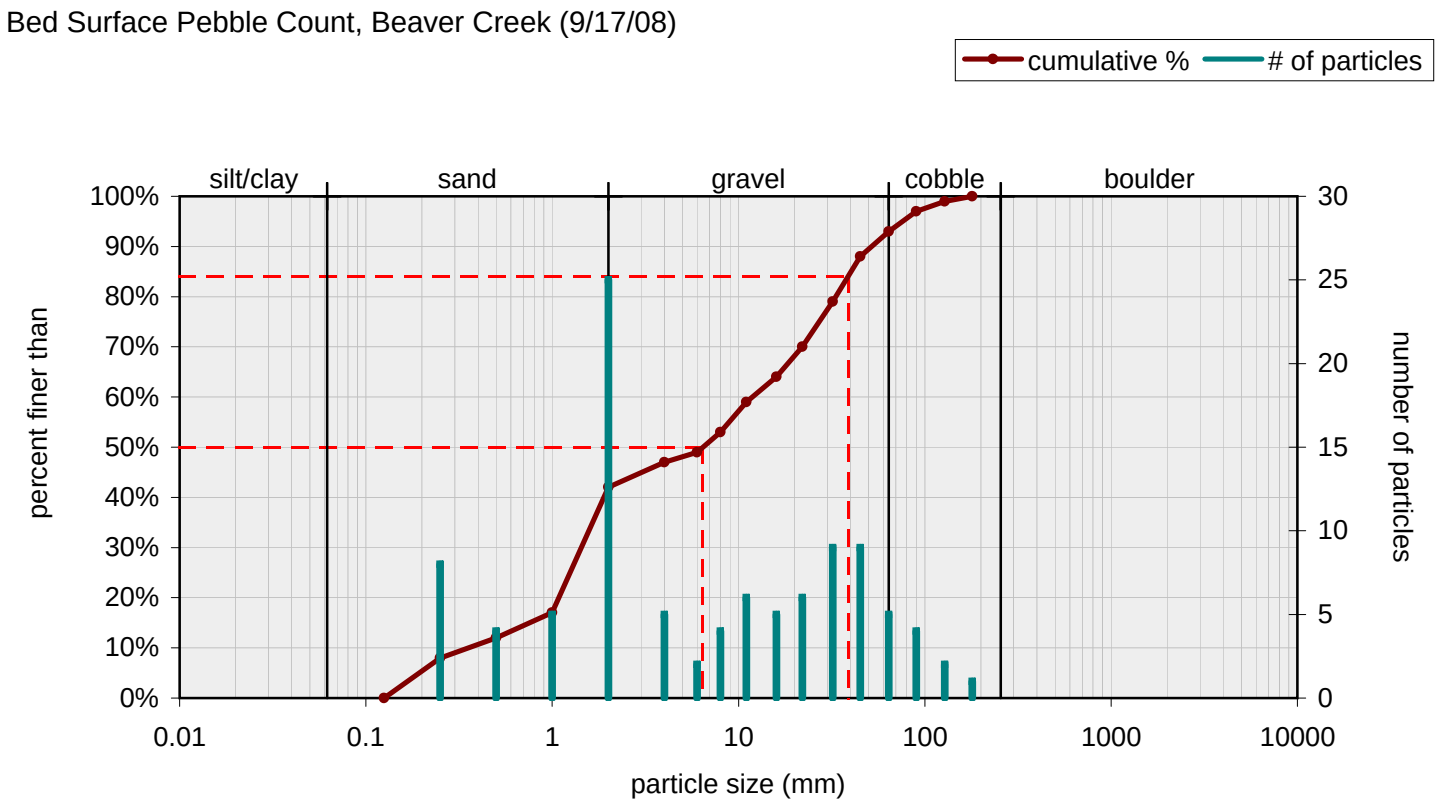
Riffle Surface Pebble Count, Beaver Creek (9/17/08)



Size (mm)	
D16	2
D35	20
D50	40
D65	60
D84	120
D95	170

Size Distribution	
mean	15.5
dispersion	11.5
skewness	-0.31

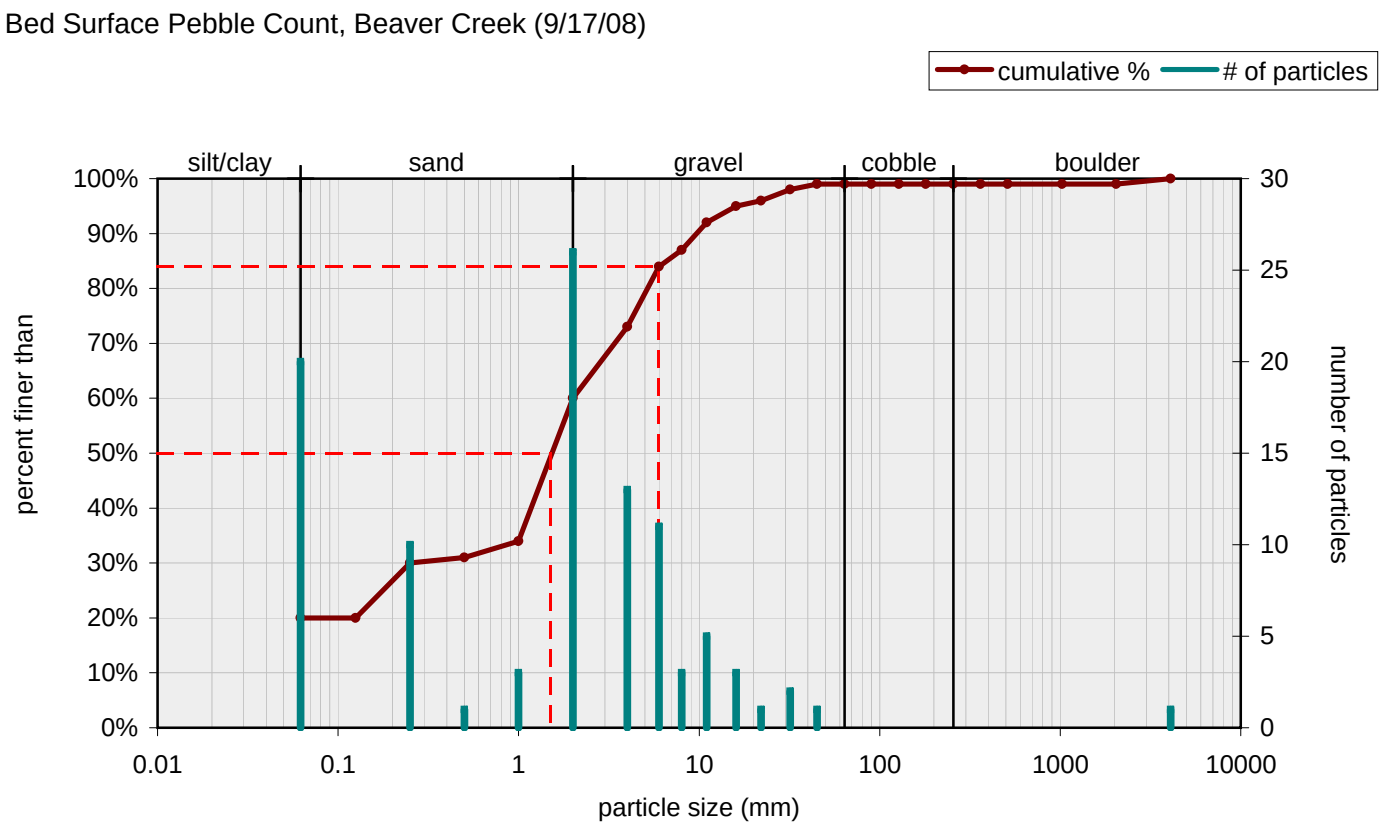
Type	
silt/clay	0%
sand	16%
gravel	51%
cobble	32%
boulder	1%



Size (mm)		
D16	0.87	3.4
D35	1.6	12
D50	6.4	17
D65	17	20
D84	39	29
D95	76	39

Size Distribution	
mean	5.8
dispersion	6.7
skewness	-0.03

Type	
silt/clay	0%
sand	42%
gravel	51%
cobble	7%
boulder	0%

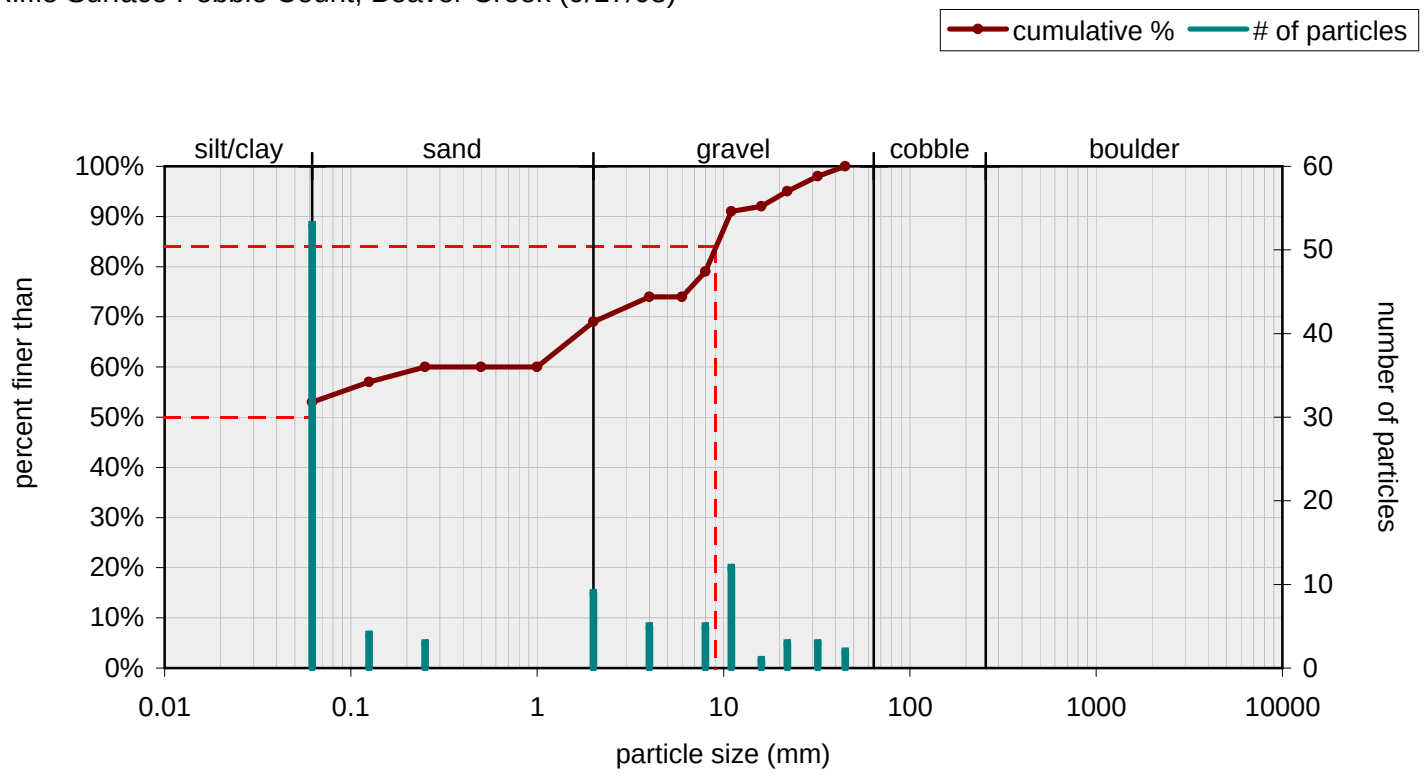


Size (mm)	
D16	0.062
D35	1
D50	1.5
D65	2.6
D84	6
D95	16

Size Distribution	
mean	0.6
dispersion	14.1
skewness	-0.28

Type	
silt/clay	20%
sand	40%
gravel	39%
cobble	0%
boulder	1%

Riffle Surface Pebble Count, Beaver Creek (9/17/08)

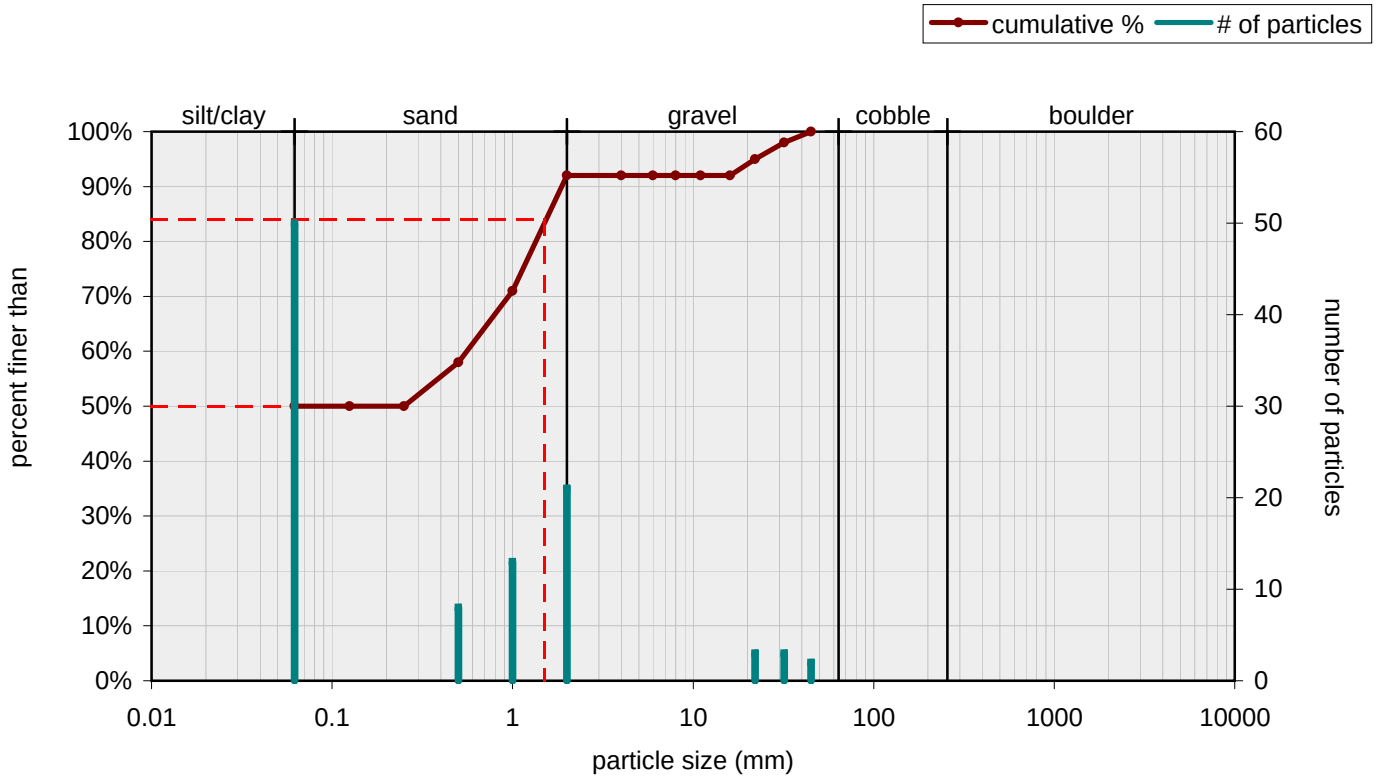


Size (mm)		
D16	0.062	3.4
D35	0.062	12
D50	0.062	17
D65	1.5	20
D84	9.1	29
D95	22	39

Size Distribution	
mean	0.8
dispersion	73.9
skewness	0.74

Type	
silt/clay	53%
sand	16%
gravel	31%
cobble	0%
boulder	0%

Bed Surface Pebble Count, Beaver Creek (9/18/08)

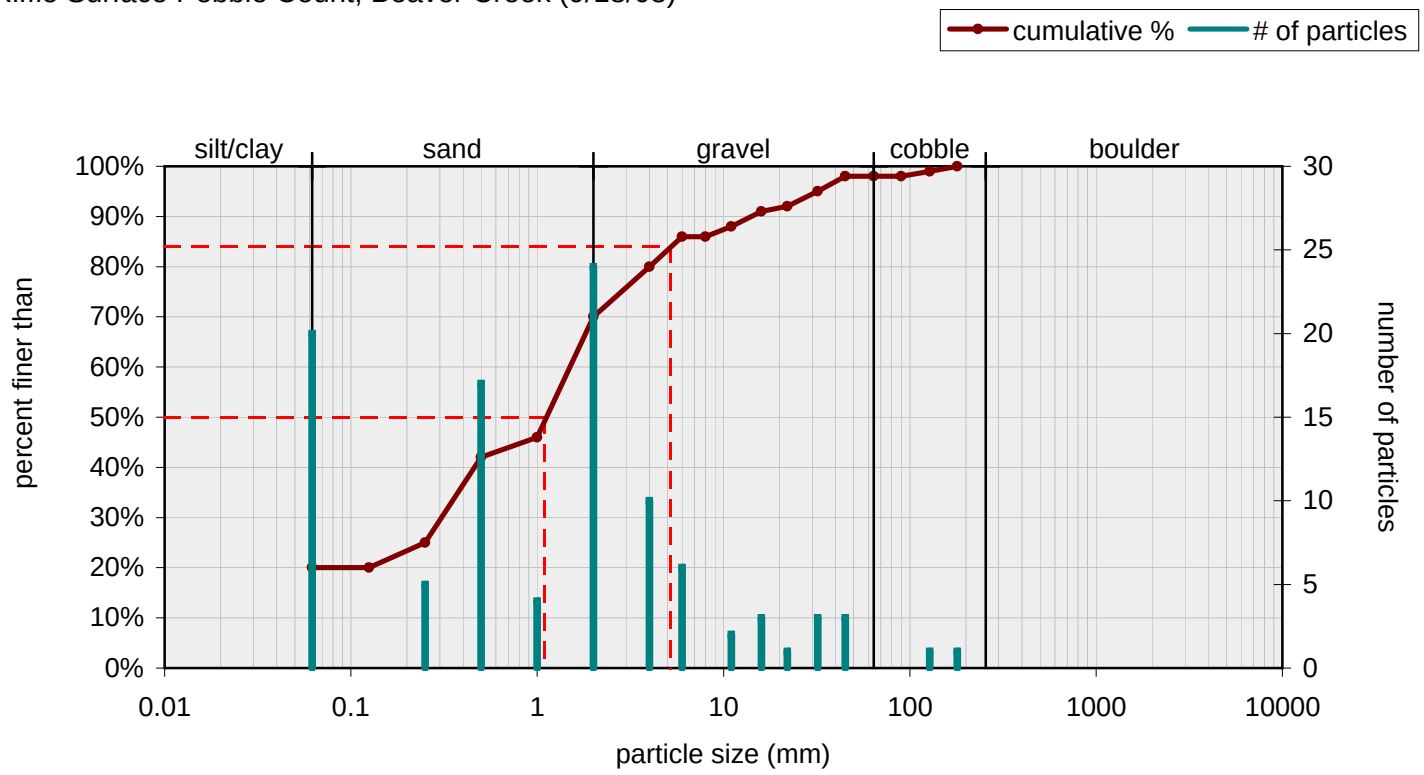


Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.73
D84	1.5
D95	22

Size Distribution	
mean	0.3
dispersion	12.6
skewness	0.59

Type	
silt/clay	50%
sand	42%
gravel	8%
cobble	0%
boulder	0%

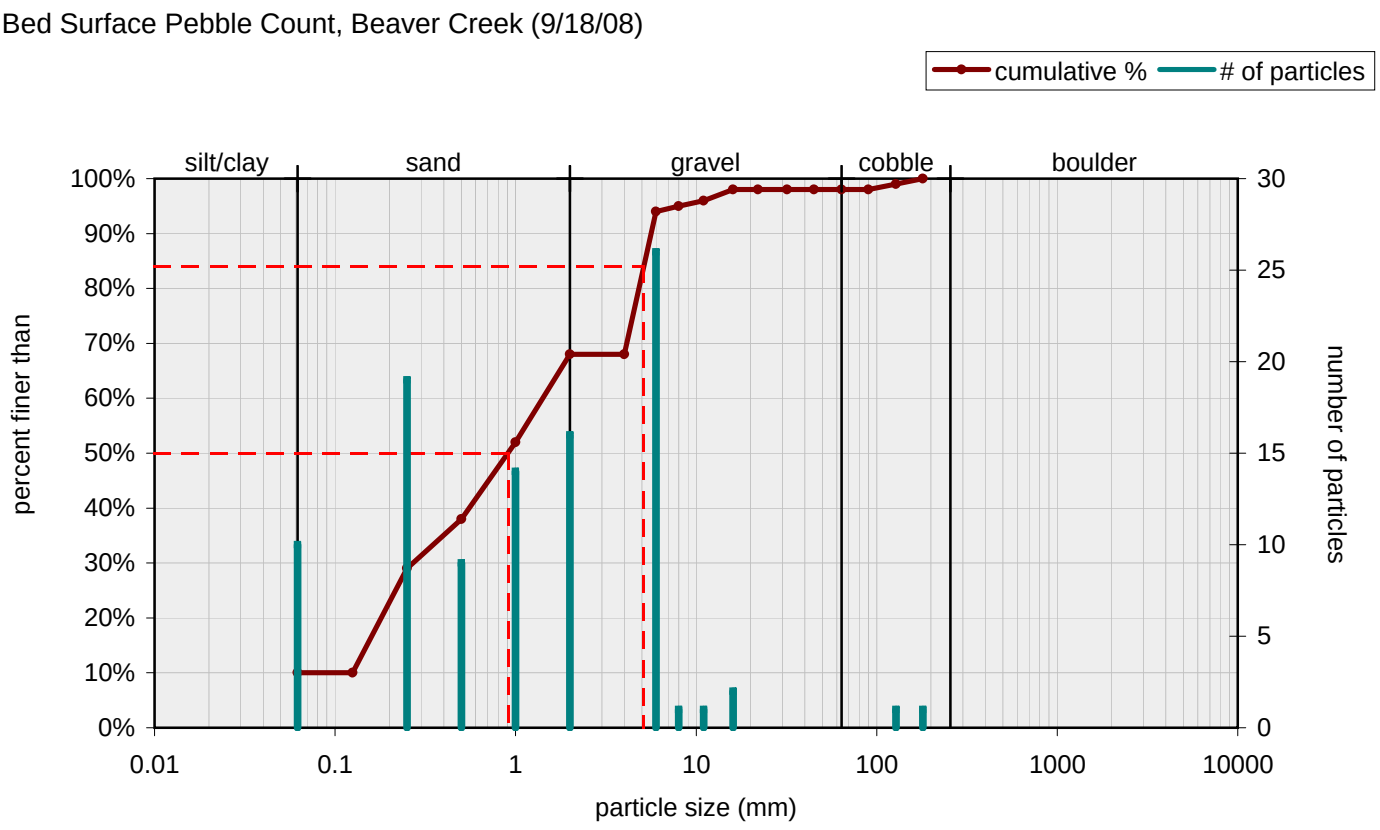
Riffle Surface Pebble Count, Beaver Creek (9/18/08)



Size (mm)		
D16	0.062	3.4
D35	0.38	12
D50	1.1	17
D65	1.7	20
D84	5.2	29
D95	32	39

Size Distribution	
mean	0.6
dispersion	11.2
skewness	-0.21

Type	
silt/clay	20%
sand	50%
gravel	28%
cobble	2%
boulder	0%



Size (mm)	
D16	0.16
D35	0.4
D50	0.91
D65	1.8
D84	5.1
D95	8

Size Distribution	
mean	0.9
dispersion	5.6
skewness	0.00

Type	
silt/clay	10%
sand	58%
gravel	30%
cobble	2%
boulder	0%