Year 5 Monitoring Report for Stream Restoration of Bailey Fork

Burke County, NC
SCO # D04006-02

Prepared for:
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Submitted: February 2011

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Table of Contents

List of Tables

List of Appendices

I. EXECUTIVE SUMMARY

The Bailey Fork stream restoration project is located near Morganton in Burke County, North Carolina. Prior to restoration, the streambanks were denuded, actively eroding, and had nearly vertical profiles. Vegetative cover was minimal along the stream. The project goal for the restoration, completed during early 2006, was to modify the dimension, pattern, and profile of the existing stream channels to stable and self-maintaining conditions by utilizing natural channel design techniques and procedures. Elements of the restoration design included improved bedform features, enhanced aquatic habitat diversity, establishment of riffle-pool sequences, in-stream grade control structures, rootwad bank stabilization, and establishment of a native forested riparian plant community. The following report documents the Year 5 Annual Monitoring for the project.

Monitoring of the vegetation was completed in September 2010 following the Carolina Vegetation Survey methodology. Stem counts completed in 10 vegetation plots show an average density of 571 stems per acre for the site, which exceeds the success criteria of 320 stems per acre after three years and the allowable 10% mortality for 288 stems/acre after 4 years and 260 stems/acre after 5 years. In year 5, all vegetation plots have stem densities above the minimum. Additionally, a substantial number of recruit stems have been found in all plots. The recruit stems increase the total stem density across the site by 62% and help all plots to surpass the minimum criteria.

A few vegetative problem areas noted to be of low concern in 2009 were removed from the problem area table in 2010. These included scattered populations of problematic species ((*Pueraria montana*) - kudzu) as well as an established population of one invasive species (*Sericea lespedeza*). The problematic species have been proactively managed by herbicide treatment and woody vegetation survival is high. The section along UT2 which was noted to have sparse vegetation along the stream banks in 2009, had been re-colonized by stabilizing vegetation in 2010.

This monitoring year, several features have been removed from the stream problem areas tables of previous monitoring years, as project reaches have remained stable through the monitoring period, and show overall evidence the reaches are maintaining profile equilibrium. In Year 5, several features have been removed from the stream problem areas tables of previous monitoring years. The majority of these areas were structures that have been embedded throughout the monitoring period or they are areas of bank scour that were repaired in the summer of 2009. It is important to note that the stream channels remain stable in these areas in 2010. Once the channel has remained stable throughout two consecutive years of monitoring, the structures are no longer considered problem areas and are removed from the table. Only one new scour area was observed on Lower Bailey Fork in 2010. The left bank near this station is heavily vegetated and appears stable. It is therefore predicted that this minimal scour area will not worsen, over time.

The 2010 visual stream stability assessment revealed that the majority of stream features are functioning as designed and built on the project reaches. The structures previously identified as problematic were vanes/J-hooks, each of which has become embedded in sand size sediment. However, the channel is stable at each location where aggradation has covered a structure. In past years, a few meanders were found in a limited state of erosion, and a few point bars had formed within the project reaches. The pools and riffles that were noted to be performing in a state unlike

that of the as-built conditions were the result of aggradation along the corresponding reaches. The depositional trends are considered a natural component of the sand-dominated watershed.

Dimensional measurements of the monumented cross-sections remain stable when compared to as-built conditions. The comparison of the yearly long-term stream monitoring profile data show stability with minor changes from as-built conditions that are suspected to be due to aggradation. The substrate of the constructed riffles and pools remain stable, with median particle sizes ranging from fine gravel to very coarse gravel for riffles, and medium sand, for pools. Based on the crest gage network installed on the project reaches, three bankfull events have been recorded since construction was completed.

The following tables summarize the geomorphological changes along the restoration reaches for each stream. The values in the tables are the median values for each parameter.

Upper Bailey Fork

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**1,383.0 ft**	**1,543.0 ft**	**1,543.0 ft**	**1,543.0 ft**	**1,543.0 ft**	**1,543.0 ft**	**1,543.0 ft**
Bankfull Width	**23.2 ft**	**33.0 ft**	**30.0 ft**	**32.8 ft**	**32.8 ft**	**33.7 ft**	**31.3 ft**
Bankfull Mean Depth	**3.1 ft**	**2.3 ft**	**3.0 ft**	**2.6 ft**	**2.6 ft**	**2.6 ft**	**2.7 ft**
Bankfull Max Depth	**4.8 ft**	**4.7 ft**	**4.8 ft**	**4.4 ft**	**4.5 ft**	**4.5 ft**	**4.9 ft**
Width/Depth Ratio	**7.6**	**14.3**	**10.1**	**12.9**	**12.8**	**13.2**	**11.7**
Entrenchment Ratio	**9.0**	**3.2**	**3.5**	**3.2**	**3.2**	**3.2**	**3.4**
Bank Height Ratio	**2.0**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	**1.0**
Sinuosity	**1.1**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**

Lower Bailey Fork

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**1,125.3 ft**	**1,170.4 ft**	**1,170.4 ft**	**1,170.4 ft**	**1,170.4 ft**	**1,170.4 ft**	**1,170.4 ft**
Bankfull Width	**28.7 ft**	**31.5 ft**	**32.4 ft**	**32.7 ft**	**32.9 ft**	**31.8 ft**	**32.9 ft**
Bankfull Mean Depth	**2.3 ft**	**2.6 ft**	**2.5 ft**	**2.5 ft**	**2.6 ft**	**2.4 ft**	**2.7 ft**
Bankfull Max Depth	**4.8 ft**	**4.3 ft**	**4.4 ft**	**4.3 ft**	**4.3 ft**	**4.1 ft**	**4.7 ft**
Width/Depth Ratio	**7.8**	**12.1**	**12.8**	**12.9**	**12.8**	**13.3**	**12.3**
Entrenchment Ratio	**7.9**	**3.4**	**3.2**	**3.2**	**3.2**	**3.3**	**3.2**
Bank Height Ratio	**2.0**	**1.1**	**1.1**	**1.0**	**1.0**	**1.0**	**1.0**
Sinuosity	**1.2**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**

Unnamed Tributary 1

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**1,648.1 ft**	**1,758.1 ft**	**1,758.1 ft**	**1,758.1 ft**	**1,758.1 ft**	**1,758.1 ft**	**1,758.1 ft**
Bankfull Width	**23.2 ft**	**22.0 ft**	**16.1 ft**	**15.5 ft**	**15.5 ft**	**15.7 ft**	**16.4 ft**
Bankfull Mean Depth	**3.1 ft**	**1.2 ft**	**0.9 ft**	**0.9 ft**	**0.9 ft**	**0.9 ft**	**1.0 ft**
Bankfull Max Depth	**4.8 ft**	**2.4 ft**	**1.8 ft**	**1.9 ft**	**1.8 ft**	**1.9 ft**	**2.1 ft**
Width/Depth Ratio	**7.8**	**22.7**	**18.5**	**16.5**	**17.1**	**18.5**	**17.0**
Entrenchment Ratio	**7.9**	**3.3**	**4.3**	**4.3**	**4.5**	**4.5**	**4.3**
Bank Height Ratio	**2.1**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**
Sinuosity	**1.3**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**

Unnamed Tributary 2

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**898.9 ft**	**1,271.0 ft**	**1,271.0 ft**	**1,271.0 ft**	**1,271.0 ft**	**1,271.0 ft**	**1,271.0 ft**
Bankfull Width	**8.2 ft**	**18.6 ft**	**17.0 ft**	**13.4 ft**	**12.3 ft**	**13.1 ft**	**14.0 ft**
Bankfull Mean Depth	**2.4 ft**	**1.0 ft**	**0.9 ft**	**0.8 ft**	**0.7 ft**	**0.7 ft**	**0.8 ft**
Bankfull Max Depth	**3.5 ft**	**1.9 ft**	**1.6 ft**	**1.3 ft**	**1.2 ft**	**1.4 ft**	**1.6 ft**
Width/Depth Ratio	**3.4**	**18.6**	**18.7**	**16.7**	**16.8**	**17.9**	**18.2**
Entrenchment Ratio	**9.9**	**3.6**	**4.0**	**5.0**	**4.8**	**4.5**	**4.8**
Bank Height Ratio	**1.6**	**1.0**	**1.0**	**1.1**	**1.0**	**1.0**	**1.0**
Sinuosity	**1.1**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**

II. PROJECT BACKGROUND

A. Location and Setting

The project site is located approximately 2 miles southwest of Morganton, Burke County, North Carolina. The site is located 1.7 miles southwest of the I-40/US 64 interchange, as shown in Figure 1. The stream channels included in this project are the mainstem of Bailey Fork, and two unnamed tributaries to Bailey Fork, designated as UT1 and UT2. The project reach along the mainstem includes a portion upstream of Propst Road (hereafter referred to as Upper) and a portion downstream of that road (hereafter referred to as Lower).

The directions to the project site are as follows:

> From I-40, take US 64 south to Propst Road (SR 1112) and turn right. The project site is located on the north and south sides of Propst Road approximately 1,800 feet from the Propst Road and US 64 intersection.

B. Project Structure, Mitigation Type, Approach and Objectives

The primary, pre-existing land use within the immediate project site was agricultural. Based on photographic interpretation, the site had been historically utilized for agricultural row crop production and hayland. It is very likely the project site had been farmed since the Civil War era. The site was degraded by past land management practices including mechanical land clearing, straightening and dredging the stream channels. The project site was most recently utilized to produce hay for livestock feed. The stream banks were denuded, actively eroding, with vertical to undercut streambanks. Vegetative cover was minimal along the stream corridor, resulting in streambank erosion and lateral channel migration. The channels were deeply incised and laterally confined. Prior to restoration, the floodplain was functioning as an abandoned terrace perched above the bankfull elevation.

The project restoration goal was to restore channel dimension, pattern, and profile to stable and self-maintaining conditions utilizing natural channel design techniques and procedures. Physical restoration and water quality improvements were accomplished by meeting the restoration goals and objectives below:

- Design channels with the appropriate cross-sectional dimension, pattern, and longitudinal profile based on reference reach boundary conditions.
- Improve and create bedform and aquatic habitat features (riffles, runs, pools, and glides)
- Integrate, in conjunction with the stream restoration, a nested floodplain (bankfull bench) connected to the bankfull channel elevation (Priority Level II restoration) or raise the bed elevation of the stream reconnecting the bankfull elevation to the existing floodplain elevation (Priority Level I restoration).
- Restore channel and streambank stability by integrating in-stream grade control structures, root wads, and native revetment while also creating stable and functional aquatic and terrestrial habitat.
- Establish a native forested riparian plant community within a minimum 30-feet buffer, measured horizontally from the left and right top of bank. Eradicate exotic vegetation and protect the riparian corridor with a perpetual conservation easement.
- Provide aesthetic and educational opportunities.

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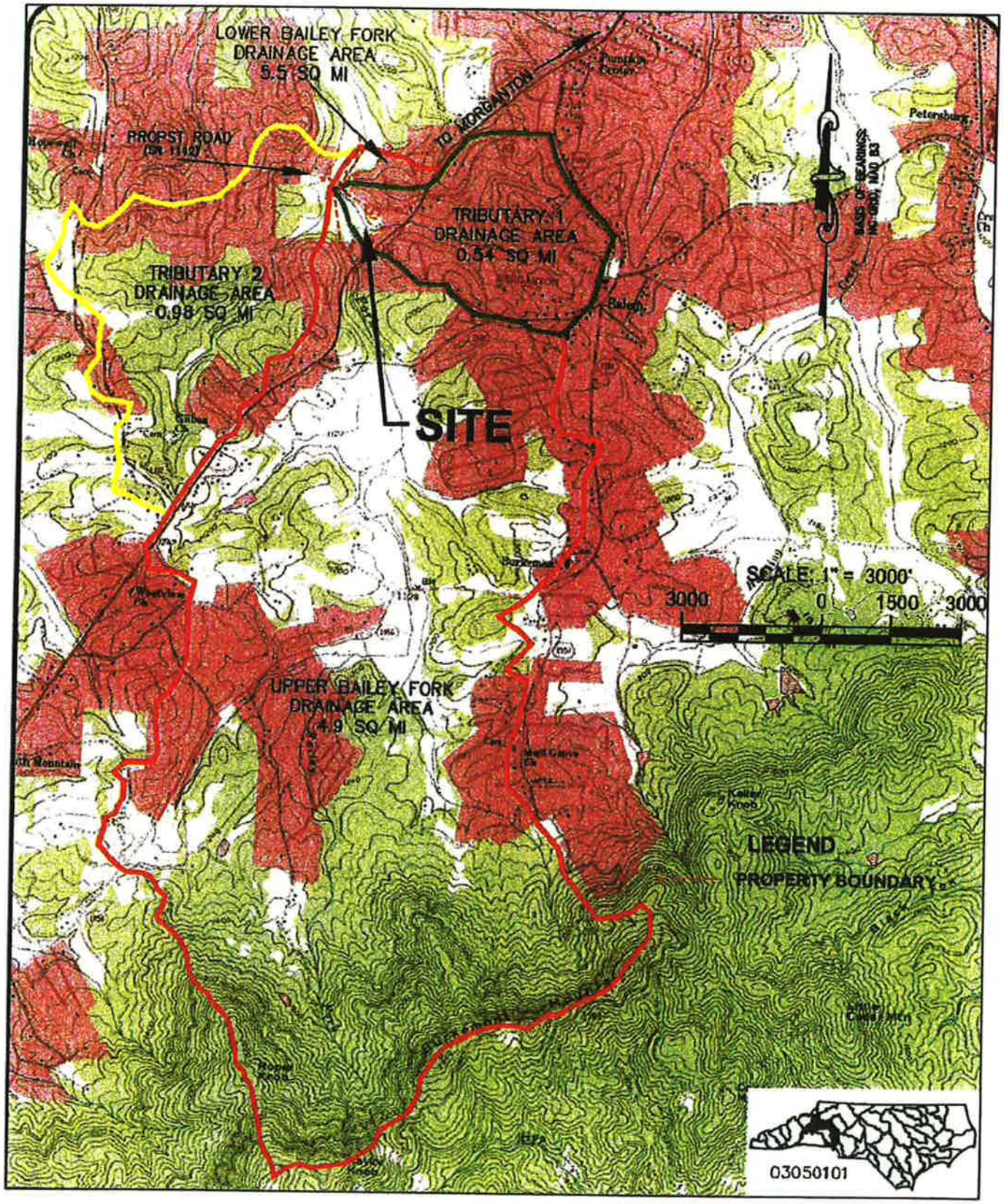
BURKE COUNTY, NORTH CAROLINA

BAILEY FORK STREAM RESTORATION

FIGURE 1: SITE VICINITY MAP

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date:	Job No.	Scale:
December, 2006	2006-1626	1" = 3000'



Restoration of the streams has met the objective of the project along both the mainstem of Thompsons Fork and the UT, providing the desired habitat and stability features required to improve and enhance the ecologic health of the streams for the long-term. Specifically, the completed restoration project has accomplished the items listed below.

Upper Bailey Fork:

- Reversed the effects of channelization using Priority Level II restoration techniques. The restoration has increased the median width/depth ratios from 7.6 to 11.7 after construction completion and 5 years of monitoring.
- Restored natural stream pattern, profile and dimension throughout the 1,543 l.f. stream reach, increasing channel sinuosity from 1.1 to 1.4, while creating a more stable relationship between the valley and bankfull slopes (the bankfull slope was greater than the valley slope under pre-existing conditions; the bankfull slope is now less than the valley slope).
- Stabilized eroding streambanks by providing an appropriately sized channel with stable streambank slopes using a combination of embedded stone, natural fabrics and aggressive native streamside and riparian revetment. The average Bank Height Ratio has been decreased from 1.95 (deeply incised) to 1.00 (stable) in Year 5.
- Provided a re-connection between the restored stream channel and a nested floodplain (bankfull bench) connected to the bankfull channel elevation (Priority Level II restoration). The completed restoration changed the average entrenchment ratio to 3.37, and restored the pre-existing unstable, incised and entrenched G4/F4 stream channel to a stable C4 stream type (Rosgen, 1994).
- Created instream aquatic habitat features including deep pools, rootwad streamside fish cover and streambank stabilization, constructed riffles, rock cross vanes and J-Hook vanes with deep pools and native streamside revetment to enhance outer meander bend stability, shade the pools, provide fish cover and lower water temperature to transition the channel thalweg of the restored stream to meet the culvert invert elevations at the three – 7.5 ft x 10.8 ft oval corrugated metal pipes (CMP) on the south side of Propst Road.
- Revegetated the stream banks and riparian corridor with indigenous trees, shrubs, herbaceous ground cover and preserved the riparian corridors within a perpetual conservation easement.

Lower Bailey Fork:

- Reversed the effects of channelization using Priority Level II restoration techniques. The restoration has increased the median width/depth ratios from 7.8 to 12.3 after construction completion and 5 years of monitoring.
- Restored natural stream pattern, profile and dimension throughout the 1,170 l.f. stream reach, increasing channel sinuosity from 1.2 to 1.3, while creating a more stable relationship between the valley and bankfull slopes (again, the bankfull slope was greater than the valley slope under pre-existing conditions; the bankfull slope is now less than the valley slope).
- Stabilized eroding streambanks by constructing an appropriately sized channel with stable streambank slopes using a combination of embedded stone, natural fabrics and aggressive native streamside and riparian revetment. The average Bank Height Ratio has been decreased from 1.95 (deeply incised) to 1.00 (stable).
- Provided a re-connection between the restored stream channel and a nested floodplain (bankfull bench) connected to the bankfull channel elevation (Priority

Level II restoration). The completed restoration changed the average entrenchment ratio to 3.19, and restored the pre-existing unstable, incised and entrenched G4/F4 stream channel to a stable C4 stream type.

- Created instream aquatic habitat features including deep pools, rootwad streamside fish cover and streambank stabilization, constructed riffles, single arm log vanes, rock cross vanes and J-Hook vanes with deep scour pools and native streamside revetment to enhance outer meander bend stability, shade the pools, provide fish cover and lower water temperature.
- Revegetated the stream banks and riparian corridor with indigenous trees, shrubs, herbaceous ground cover and preserved the riparian corridors within a perpetual conservation easement.

Unnamed Tributary (UT1):

- Reversed the effects of channelization utilizing natural channel design restoration techniques. The average width/depth ratio of the restored stream channel was increased from 7.8 to 17.0 after construction completion and five years of monitoring.
- Restored natural stream pattern, profile and dimension throughout the 1,758 l.f. stream reach, increasing channel sinuosity from 1.3 to 1.4, and providing a more stable relationship between the valley and bankfull slopes (the bankfull and valley slopes were essentially parallel under pre-existing condition. The bankfull slope is now less than the valley slope).
- Stabilized eroding streambanks by providing an appropriately sized channel with stable streambank slopes. The average Bank Height Ratio has been changed from 2.10 (extremely incised) to 1.00 (stable).
- Raised the streambed elevation reconnecting the bankfull elevation to the existing floodplain elevation (Priority Level I restoration).
- The completed restoration changed the average entrenchment ratio to 4.26.
- Created instream aquatic habitat features including deep pools, rootwad streamside fish cover and streambank stabilization, constructed riffles, rock sills, step cross vanes and J-Hook vanes with deep scour pools and native streamside revetment to enhance outer meander bend stability, shade the pools, provide fish cover and lower water temperature.
- Revegetated the stream banks and riparian corridor with indigenous trees, shrubs, herbaceous ground cover and preserved the riparian corridors within a perpetual conservation easement.

Unnamed Tributary (UT2):

- Reversed the effects of channelization utilizing natural channel design restoration techniques. The average width/depth ratio of the restored stream channel was increased from 3.42 to 18.2 after construction completion and five years of monitoring.
- Restored natural stream pattern, profile and dimension throughout the 1,271 l.f. stream reach, increasing channel sinuosity from 1.1 to 1.5, and providing a more stable relationship between the valley and bankfull slopes (the bankfull slope was greater than the valley slope under pre-existing conditions; the bankfull slope is now less than the valley slope).

- Stabilized eroding streambanks by providing an appropriately sized channel with stable streambank slopes. The average Bank Height Ratio is 1.00 (stable) post-restoration and after 5 years of monitoring.
- Raised the streambed elevation reconnecting the bankfull elevation to the existing floodplain elevation (Priority Level I restoration).
- The completed restoration changed the average entrenchment ratio to 4.75.
- Created instream aquatic habitat features including deep pools, streambank stabilization, constructed riffles, rock sills, log sills, rock cross vanes and J-Hook vanes with deep scour pools and native streamside revetment to enhance outer meander bend stability, shade the pools, provide fish cover and lower water temperature.
- Revegetated the stream banks and riparian corridor with indigenous trees, shrubs, herbaceous ground cover and preserved the riparian corridors within a perpetual conservation easement.

Information on the project structure and objectives is included in Tables I and II.

Table I. Project Structure Table
Bailey Fork Stream Restoration / EEP Project No. D04006-02

Project Segment/Reach ID	Linear Footage or Acreage
Upper	1,543.0 lf
Lower	1,170.4 lf
UT1	1,758.1 lf
UT2	1,271.0 lf
TOTAL	**5,742.5 lf**

Table II. Project Mitigation Objectives Table
Bailey Fork Stream Restoration / EEP Project No. D04006-02

Project Segment/ Reach ID	Mitigation Type	Approach	Linear Footage or Acreage	Comment
Upper	Restoration	Priority 2	1,543.0 lf	Restore dimension, pattern, and profile
Lower	Restoration	Priority 2	1,170.4 lf	Restore dimension, pattern, and profile
UT1	Restoration	Priority 1	1,758.1 lf	Restore dimension, pattern, and profile
UT2	Restoration	Priority 1	1,271.0 lf	Restore dimension, pattern, and profile
TOTAL			**5,742.5 lf**	

C. Project History and Background

Project activity and reporting history are provided in Table III. The project contact information is provided in Table IV. The project background history is provided in Table V.

Table III. Project Activity and Reporting History Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration plan	Jan 2005	Oct 2004	Mar 2005
Final Design - 90%[1]	N/A	N/A	N/A
Construction	Aug 2005	N/A	Sep 2005
Temporary S&E applied to entire project area[2]	Feb 2005	N/A	Feb 2005
Permanent plantings	Mar 2006	N/A	Mar 2006
Mitigation plan/As-built	Dec 2005	May 2006	Aug 2006
Year 1 monitoring	2006	Sep 2006 (vegetation) Apr 2007 (geomorphology)	May 2007
Remedial Stream Maintenance*	Aug 2007	N/A	Aug 2007
Year 2 monitoring	2007	Sep 2007 (vegetation) Oct 2007 (geomorphology)	Jan 2008
Year 3 monitoring	2008	Sep 2008 (vegetation) Oct 2008 (geomorphology) Spring 2008 (planting)	Nov 2008
Year 4 monitoring	2009	Sep 2009 (vegetation) Sep 2009 (geomorphology) Spring 2009 (planting)	Dec 2009
Year 5 monitoring	2010	Sep 2010 (vegetation) Sep 2010 (geomorphology)	Feb 2011

[1]Full-delivery project; 90% submittal not provided.
[2]Erosion and sediment control applied incrementally throughout the course of the project.
N/A: Data collection is not an applicable task to these project activities.
*Remedial Maintenance involved efforts to repair the degraded reaches of the channel along Upper and Lower Bailey Fork, improving channel bank stability by creating a more stable bank slope, as shown on the August 2007 maintenance plan sheet.

Table IV. Project Contact Table Bailey Fork Stream Restoration / EEP Project No. D04006-02	
Designer	Natural Systems Engineering* 3719 Benson Drive , Raleigh, NC 27609
Construction Contractor	Natural Systems Engineering* 3719 Benson Drive , Raleigh, NC 27609
Monitoring Performers	EMH&T, Inc. 5500 New Albany Road, Columbus, OH 43054
Stream Monitoring POC	Jud M. Hines, EMH&T
Vegetation Monitoring POC	Megan Wolf, EMH&T
*Contact:	Jim Halley at The John R. McAdams Company, Inc 2905 Meridian Parkway, Durham, NC 27713

* Jim Halley authored the restoration plan for this project.

Table V. Project Background Table* Bailey Fork Stream Restoration / EEP Project No. D04006-02	
Project County	Burke
Drainage Area-Upper	4.9 sq mi
Drainage Area-Lower	5.5 sq mi
Drainage Area-UT1	0.55 sq mi
Drainage Area-UT2	0.98 sq mi
Drainage Impervious Cover Estimate	10%
Stream Order	2nd
Physiographic Region	Inner Piedmont
Ecoregion	Northern Inner Piedmont
Rosgen Classification of As-built	E/C type
Dominant Soil Types	Colvard sandy loam
Reference Site ID	Sal's Branch, Whites Creek, S. Muddy Birchfield, S. Muddy Tributary 4
USGS HUC for Project and Reference	03050101
NCDWQ Sub-basin for Project and Reference	03-08-31
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
Reason for 303d listing or stressor	N/A
% of project easement fenced	20%

*Data for Table V was derived from information from reports produced by Natural Systems Engineering.

D. Monitoring Plan View

The monitoring plan view is included as Figure 2. The information shown in Figure 2 is derived entirely from the As-Built stream plan provided with the approved Mitigation Plan report. In-stream structures shown on the plan view have been verified by the stream restoration designer/contractor based on field reconnaissance. The monitoring plan view also depicts the locations of each monumented cross-section, vegetation plot, crest gage and photo point that are part of the five year monitoring effort for this project.

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BURKE COUNTY, NORTH CAROLINA

BAILEY FORK STREAM RESTORATION

FIGURE 2A – INDEX MAP

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date: January, 2011

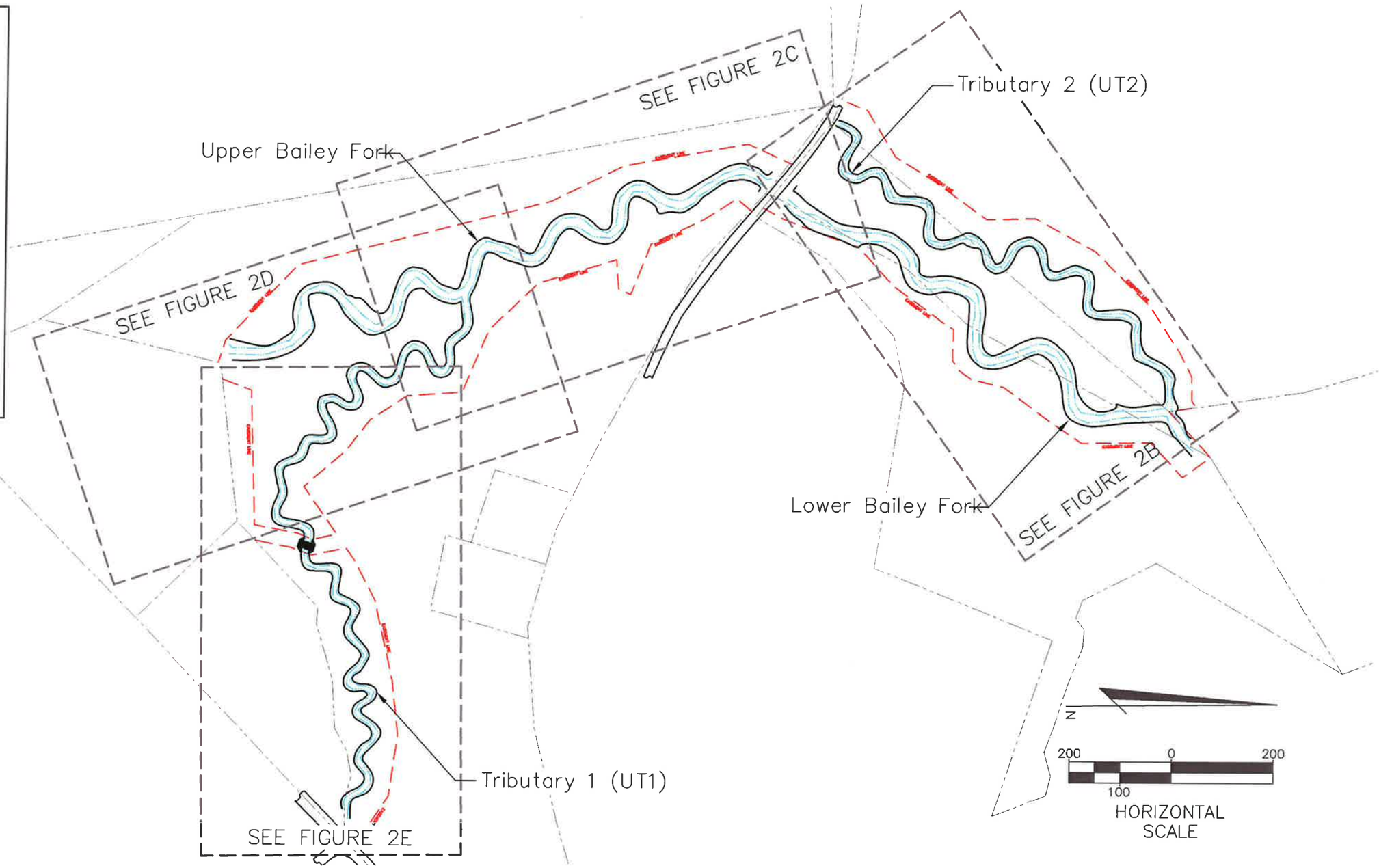
Scale: 1" = 60'

Job No: 2006–1626

LEGEND

- Root Wad
- Step–Cross Vane
- "J" Hook
- Rock Channel Sill
- Log Channel Sill
- Riffle

Base map and structure locations are shown per the as–built plan completed by Natural Systems Engineering in Nov. 2007.



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BURKE COUNTY, NORTH CAROLINA

BAILEY FORK STREAM RESTORATION

FIGURE 2B

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date: January, 2011

Scale: 1" = 60'

Job No: 2006-1626

LEGEND

- Vegetation Plot
- Photo Point
- Cross Section
- Crest Gauge

N/F
DAVID STROUP & WF
DB. 225 PG. 58

N/F
CHARLES TALBERT
DB. 1322 PG. 157
PB. 4 PG. 29

EASEMENT LINE

NEW FENCE LINE

VP-7

VP-8

VP-9

VP-10

XSEC 9

XSEC 10

XSEC 11

XSEC 12

PHOTO POINT 9 (PHOTO #9)

PHOTO POINT 10 (PHOTO #10)

PHOTO POINT 11 (PHOTO #11)

PHOTO POINT 12 (PHOTO #12)

PHOTO POINT 13 (PHOTO #13)

CG3

CG4

N

60 0 60
30
HORIZONTAL SCALE

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BURKE COUNTY, NORTH CAROLINA

BAILEY FORK STREAM RESTORATION

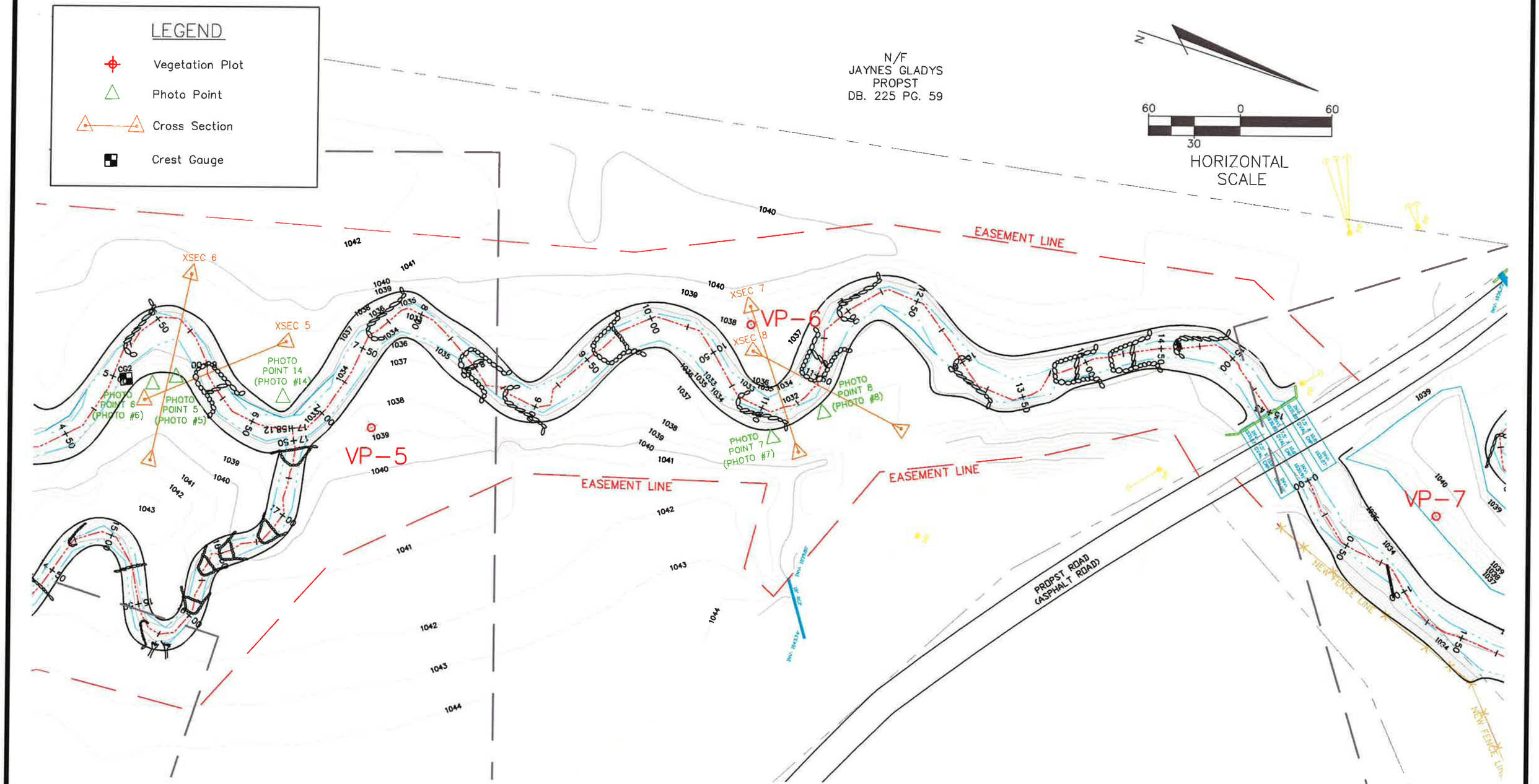
FIGURE 2C

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date: January, 2011

Scale: 1" = 60'

Job No: 2006-1626



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BAILEY FORK STREAM RESTORATION

FIGURE 2D

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date: January, 2011

Scale: 1" = 60'

Job No: 2006-1623

LEGEND

- Vegetation Plot
- Photo Point
- Cross Section
- Crest Gauge

N/F
CHARLIE DUVAL
DB. 841 PG. 1650

EASEMENT LINE

EASEMENT LINE

VP-2

VP-3

VP-4

VP-5

XSEC 6

XSEC 5

XSEC 4

XSEC 3

PHOTO POINT 6 (PHOTO #6)

PHOTO POINT 5 (PHOTO #5)

PHOTO POINT 14 (PHOTO #14)

PHOTO POINT 4 (PHOTO #4)

PHOTO POINT 3 (PHOTO #3)

CG2

N

60 0 60
30

HORIZONTAL SCALE

PERMANENT BENCHMARK
ELEVATION 1045.53 FT.

EMH&T
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BURKE COUNTY, NORTH CAROLINA

BAILEY FORK STREAM RESTORATION

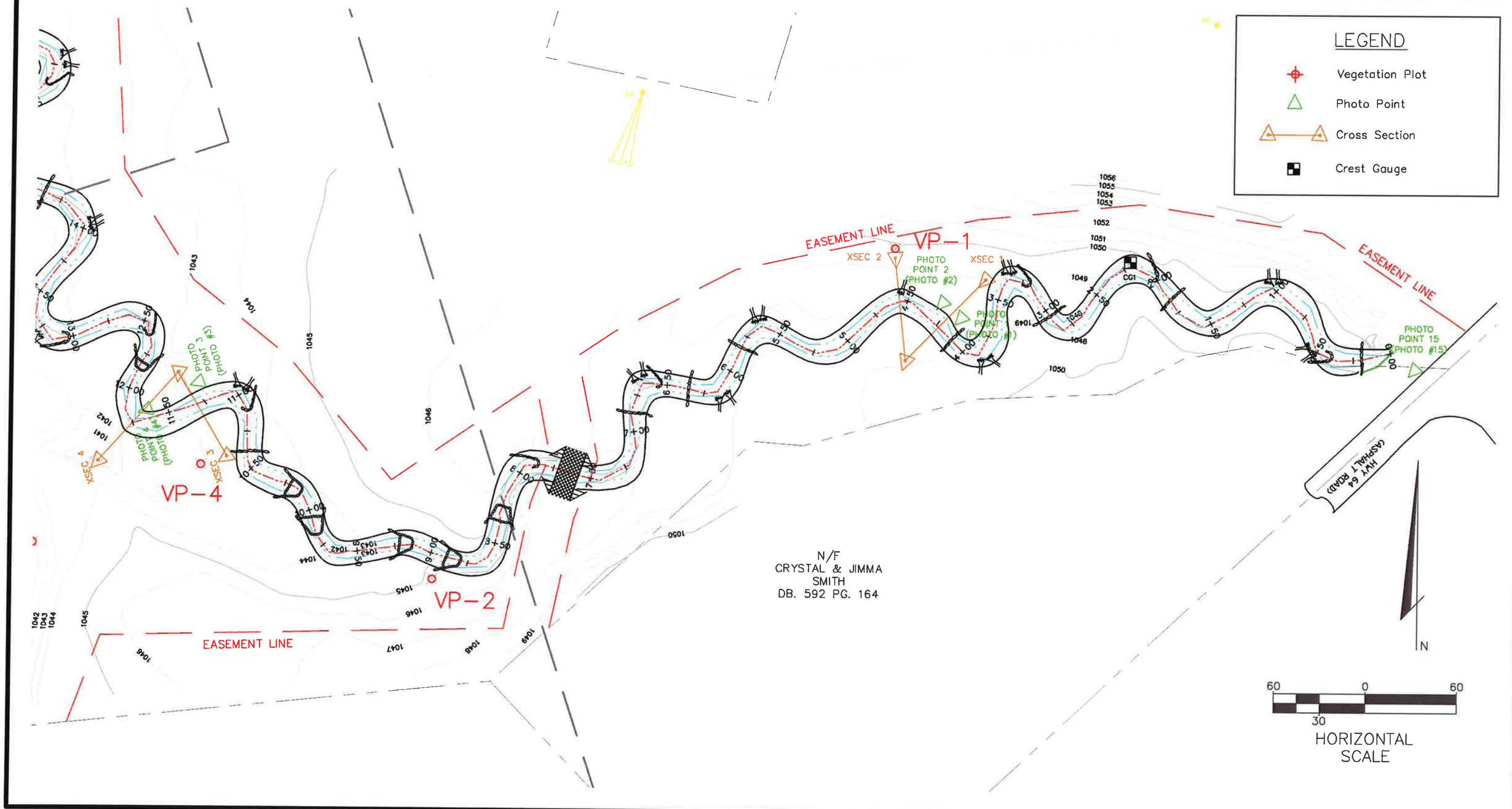
FIGURE 2E

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date: January, 2011

Scale: 1" = 60'

Job No: 2006-1626



III. PROJECT CONDITION AND MONITORING RESULTS

A. Vegetation Assessment

1. Soil Data

Soils present in the riparian area adjacent to Bailey Fork are characteristic of those found in alluvial landforms within the Northern Inner Piedmont ecoregion of North Carolina. Colvard sandy loam soils are mapped within the floodplain and immediately adjacent to the stream channels on the project site. Colvard soils are formed in loamy alluvial deposits, and are nearly level, very deep, and well-drained or moderately well-drained.

Other soils within the project's vicinity include Fairview sandy clay loam and Unison fine sandy loam, which are mapped on adjacent slopes and terraces. No hydric soils were mapped within the project corridor.

Data on the soils series found within and near the project site is summarized in Table VI.

Table VI. Preliminary Soil Data*
Bailey Fork Stream Restoration / EEP Project No. D04006-02

Series	Max. Depth (in.)	% Clay on Surface	K[1]	T[2]	% Organic Matter
Colvard sandy loam	60+	8-18	0.24	5	1-2
Fairview sandy clay loam	60+	20-35	0.24	5	0.5-1
Unison fine sandy loam	60+	12-20	0.24	5	0.5-1

*Data for Table VI was derived from information from reports produced by Natural Systems Engineering.
[1]Erosion Factor K indicates the susceptibility of a soil to sheet and rill erosion, ranging from 0.05 to 0.69.
[2]Erosion Factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity, measured in tons per acre per year.

2. Vegetative Problem Areas

Vegetative Problem Areas are defined as areas either lacking vegetation or containing populations of exotic vegetation. Each problem area identified during each year of monitoring is summarized in Table VII. Since no vegetation problem areas of concern were noted in during Year 5 vegetation monitoring, vegetation problem area photos have not been included in Appendix A.

Table VII. Vegetative Problem Areas Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo #**
NA	NA	NA	NA

The oldest vegetative problem on this project is the spread of the non-native species *Sericea lespedeza.* This species is a common component of pasture mixes and as this project is adjacent to pasture lands, it likely spread into the project area from the surrounding landscape. This species is present throughout the project corridor. Management for this species in 2010 included the continuation of herbicide treatments, begun in the fall of 2008. Spraying has enhanced the survival of planted woody species throughout the project reaches. Since this species has been actively managed by herbicide treatment for three years, and all plot counts are meeting performance standards, *Sericea lespedeza* has been taken off of the stream problem area table (Table VII).

A very minor population of kudzu (*Pueraria montana*) was identified near Vegetation Plot #5 in 2009. At the time of the Year 5 vegetation monitoring, the population of this species remained too small to have an impact on the desired vegetation. In 2009 and 2010, the population was treated with herbicide to control the spread of this invasive species. Because of the factors listed above, the population of kudzu is not included in the table of vegetation problem areas.

An additional, yet temporary, problem area noted in Year 4 included a section along UT2 with sparse vegetation along the stream banks. The vegetation along the left bank was damaged or destroyed by an unknown source. In Year 5, vegetation coverage and root density have significantly increased in this area and the banks are not denuded. This is therefore an area of no concern with no management necessary.

3. Vegetation Problem Area Plan View

Since no vegetation problem areas of concern were noted during Year 5 vegetation monitoring, the vegetation problem area plan view map is not included in Appendix A.

4. Stem Counts

A summary of the stem count data for each species arranged by plot is shown in Table VIII. Table VIIIa provides the survival information for planted species, while Table VIIIb provides the total stem count for the plots, including all planted and recruit stems. This data was compiled from the information collected on each plot using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0.* Additional data tables generated using the CVS-EEP format are included in Appendix A. All vegetation plots are labeled as VP in Figure 2.

Table VIIIa. Stem counts for each species arranged by plot - planted stems.
Bailey Fork Stream Restoration / EEP Project No. D04006-02

Species	Plots										Year 1 Totals	Year 2 Totals	Year 3 Totals	Year 4 Totals	Year 5 Totals	Survival %
	1	2	3	4	5	6	7	8	9	10						
Shrubs																
Alnus serrulata			3								1	1	1	3	3	300
Cephalanthus occidentalis											3	3	0	0	0	0
Cornus amomum	1	1		6	2	4	1	3	5	2	9	9	16	17	25	278
Rosa palustris	2										2	2	2	2	2	100
Salix exigua						1					2	2	2	2	1	50
Trees																
Betula nigra			4								0	0	0	4	4	NA
Fraxinus pennsylvanica	3				5	1			2		0	0	1	5	11	NA
Liriodendron tulipifera	1			2		4	3				15	4	8	10	10	67
*Malus*sp.	1										0	0	1	1	1	NA
Nyssa sylvatica	1										0	0	1	1	1	NA
Platanus occidentalis	4	1	8	4			4			10	35	30	31	32	31	89
Quercus alba				2							0	0	0	2	2	NA
Quercus michauxii						1			2		0	0	0	3	3	NA
Quercus pagoda	1	8			1		3	8	4	1	31	28	23	26	26	84
Quercus phellos		4	4	4			1	2		2	9	5	8	19	17	189
Salix nigra			1			2		1			1	0	0	1	4	400
Sambucus canadensis		1			2	2		1	2		0	0	0	0	8	NA
Totals	14	14	20	18	8	13	12	14	13	15	106	84	94	126	141	133
Live Stem Density	567	567	810	729	324	527	486	567	527	608						
Average Live Stem Density	571															

Table VIIIa. Stem counts for each species arranged by plot - all stems. Bailey Fork Stream Restoration / EEP Project No. D04006-02																
	Plots										Year 1	Year 2	Year 3	Year 4	Year 5	Survival
Species	1	2	3	4	5	6	7	8	9	10	Totals	Totals	Totals	Totals	Totals	%
Shrubs																
Alnus serrulata			3								1	1	1	3	3	300
Cephalanthus occidentalis											3	3	0	0	0	0
Cornus amomum	1	1		6	4	4	3	6	5	2	9	9	16	17	32	356
Rosa palustris	2										2	2	2	2	2	100
Salix exigua						1					2	2	2	2	1	50
Trees																
Acer negundo							7			2	0	0	0	0	9	NA
Acer rubrum		1	33				4			2	0	0	0	0	40	NA
Betula nigra			12								0	0	0	4	12	NA
Cercis canadensis								1			0	0	0	0	1	NA
Fraxinus pennsylvanica	3				5	1			2		0	0	1	5	11	NA
Liriodendron tulipifera	2		15	2		4	3				15	4	8	10	26	173
*Malus*sp.	1										0	0	1	1	1	NA
Nyssa sylvatica	1										0	0	1	1	1	NA
Platanus occidentalis	6	1	8	4			4			11	35	30	31	32	34	97
Taxodium distichum							2				0	0	0	0	2	NA
Quercus alba				2							0	0	0	2	2	NA
Quercus michauxii						1			2		0	0	0	3	3	NA
Quercus pagoda	1	8			1		3	8	4	1	31	28	23	26	26	84
Quercus phellos		4	4	4			1	3		3	9	5	8	19	19	211
Salix nigra			1			2		1			1	0	0	1	4	400
Sambucus canadensis		1			2	2	1	1	2		0	0	0	0	9	NA
Totals	17	15	76	18	10	13	27	19	13	21	106	84	94	126	229	216
Live Stem Density	689	608	3078	729	405	527	1094	770	527	851						
Average Live Stem Density	927															

At 571 stems/acre, average stem density of planted species for the site in 2010 exceeds the 5 year minimum criteria of 260 stems per acre. No plot has a stem density below the minimum. In addition, a substantial number of recruit stems have been found in all plots. The recruit stems increase the total stem density across the site by 62%.

Remedial tree plantings have been conducted throughout the monitoring period. These were intended to bring deficient areas of the site back into compliance with the 320 stems per acre minimum. In the spring of 2009, the following species were planted across the project site:

Scientific name	Common Name
Aronia arbutifolia	Red chokeberry
Alnus incana	Speckled alder
Ilex verticillata	Winterberry
Cornus amomum	Silky dogwood
Platanus occidentalis	Sycamore
Liriodendron tulipifera	Tulip poplar
Quercus bicolor	Swamp white oak
Quercus velutina	Black oak

The remedial plantings have resulted in a net gain of woody stems for the entire site, as exhibited in the yearly total presented in Table VIIIa, and the achievement of the minimum performance standard.

5. Vegetation Plot Photos

Vegetation plot photos are provided in Appendix A.

B. Stream Assessment

1. Hydrologic Criteria

A network of four crest-stage stream gages was installed on the project site, one on each of the stream reaches. The locations of the crest-stage stream gages are shown on the monitoring plan view (Figure 2). One bankfull event was documented for the site, prior to the beginning of the 5-year monitoring period, as reported in the Mitigation As-Built Report. Additional events were recorded in monitoring Years 2-5, and listed in Table IX. Photographs of the crest gages are shown in Appendix B.

Table IX. Verification of Bankfull Events

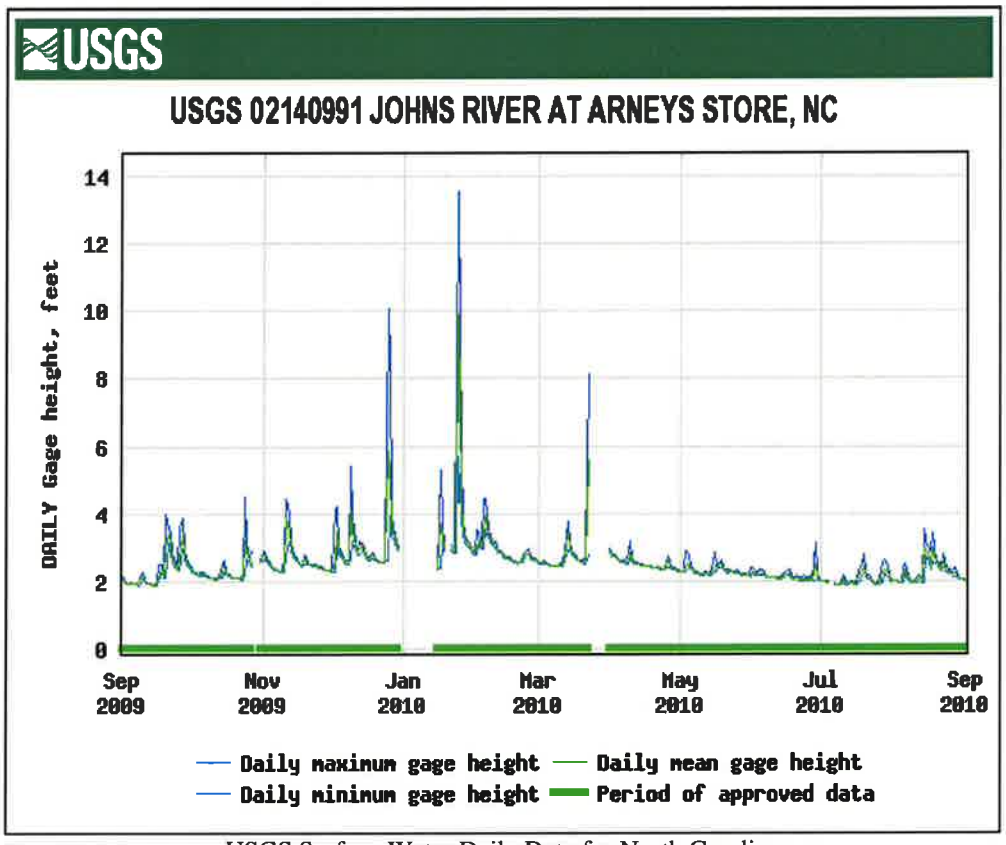
Date of Data Collection	Date of Occurrence	Method	Photo #
10/31/05	10/7/05-10/8/05	Photographs; Stream Gage Data	In Mitigation Plan
7/19/07	Unknown	Crest Gage 1 on UT1	BF 1
10/17/07	9/14/07-9/15/07*	Crest Gage 4 on Lower Bailey	BF 2
9/21/09	8/27/08*	Crest Gage 1 on UT1 Crest Gage 2 on Upper Bailey Crest Gage 3 on UT2 Crest Gage 4 on Lower Bailey	BF 3,4,5,6
9/28/10	1/25/10*	Crest Gage 4 on Lower Bailey	BF 7

*Date is approximate; based on a review of recorded rainfall and crest gage data

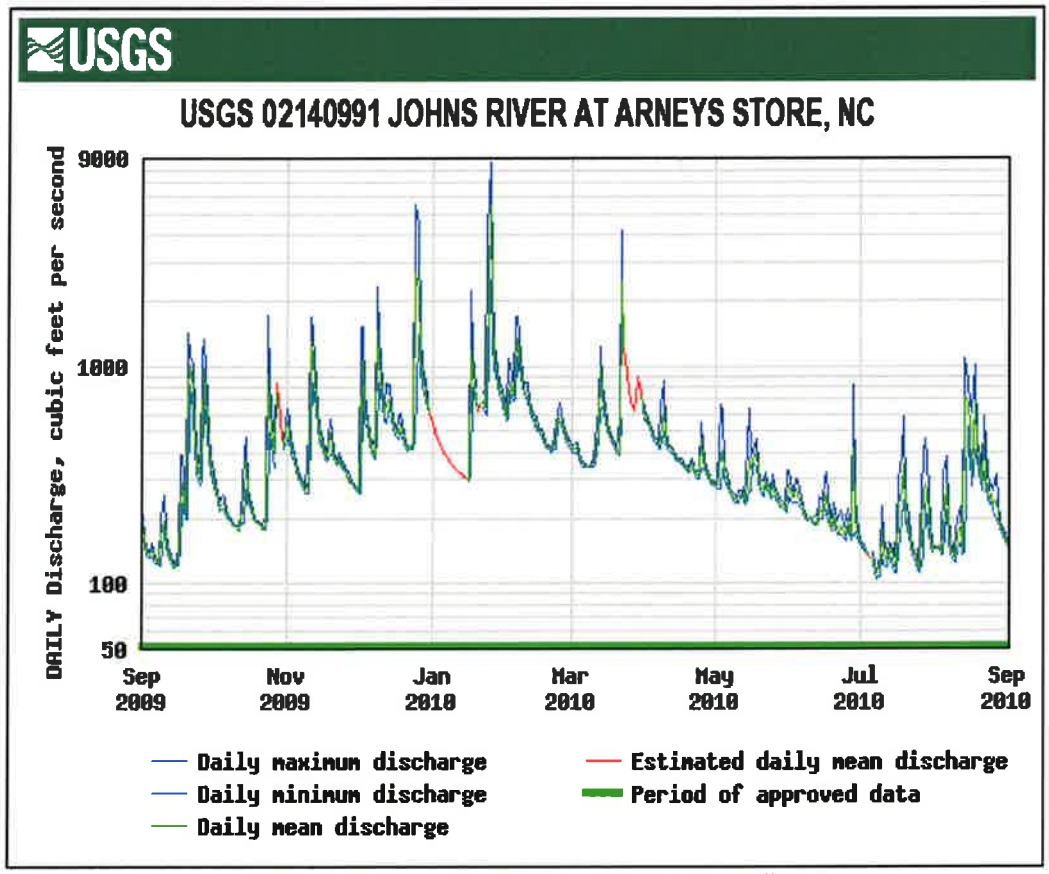
In September 2010, the crest gage on Lower Bailey Fork registered a bankfull event at a level of 3'6" above the bottom of the crest gage. The crest gages on the unnamed tributaries to Bailey Fork and Upper Bailey Fork could have also had bankfull flows during Lower Bailey Fork's

bankfull event. However, cork at these crest gages did not adhere to the wooden laths. During the summer reading, fire ants were observed to be carrying the cork away from the gages. Because of this, no bankfull events were recorded on these crest gages in 2010. All crest gages are set at or above the bankfull elevation of each stream channel.

The probable date for the most recently documented bankfull event was after the precipitation event that occurred on January 25, 2010. As this was the largest precipitation event of significance since the previous documentation in September 2009, this is likely the bankfull event recorded by the series of crest gages. This corresponds to a high discharge event on January 25 as recorded at USGS Gage 02140991along the Johns River at Arneys Store in Morganton, NC, which lies approximately 15 miles north of the project site. Other large precipitation events occurred on December 25 through December 26, 2009 and March 22, 2010. The discharge and gage height recorded at the Arneys Store station are shown on the hydrographs below.



USGS Surface-Water Daily Data for North Carolina
http://waterdata.usgs.gov/nc/nwis/dv?



USGS Surface-Water Daily Data for North Carolina
http://waterdata.usgs.gov/nc/nwis/dv?

The documentation provided by the onsite crest gage network in Year 4 provided the second monitoring year with a bankfull discharge event. No additional bankfull events were required to be documented for this project for the remainder of the monitoring period. The observance of the Year 5 bankfull event was included for documentation purposes.

2. Stream Problem Areas

A summary of the areas of concern identified during the visual assessment of the stream for each year of monitoring is included in Tables Xa through Xe.

Table Xa. Stream Problem Areas – Year 1 Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Aggradation	4+00 - 4+25 Upper	Lateral bar; bank material moving	SPA 1 (Year 1 Report)
	1+50 - 2+00 Upper	Lateral bar; bank material moving	
Bank failure	9+00 Lower	Rootwad causing reverse circulation leading to downstream bank scour and undercutting	SPA 2 (Year 1 Report)
	8+00 Lower	Large boulder fell out of bank; bank undercutting	
	11+50 Upper	Bank armor has fallen, undercutting	
Bank scour	11+80 - 12+50 Upper	Coir matting has fallen, bank erosion; deposition downstream	SPA 3 (Year 1 Report)
	10+25 Upper	Rootwad causing reverse circulation leading to downstream bank scour and undercutting	
	3+50 Upper	Channel is over widened, bank is slumping	
Stressed/failing structure	5+60 UT2	Embedded rock sill; channel is stable	SPA 4 (Year 1 Report)
	2+50 UT2	Embedded cross-vane; channel is stable	
	1+25 UT2	Embedded J-hook; channel is stable	
	14+75 Upper	Partially embedded J-hook; channel is stable	
	13+00 Upper	Embedded J-hook; channel is stable	
	10+60 UT1	Embedded rock sill ; channel is stable	
	3+25 UT1	Partially embedded J-hook; channel is stable	
	0+50 UT1	Embedded J-hook; channel is stable	
	0+25 UT1	Embedded rock sill ; channel is stable	
Other	7+00 UT1	Sinkhole adjacent to channel; piping water	SPA 5 (Year 1 Report)

Table Xb. Stream Problem Areas – Year 2 Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Aggradation	1+50 - 2+00 Upper	Point bar; vegetated and stable	SPA 1, SPA 2 (Year 2 Report)
	1+75 Lower	Mid-channel bar	
Bank scour	3+50 Upper	Channel overwidened, left bank is slumping, W/D too high resulting in aggradation.	SPA 3, SPA 4 (Year 2 Report)
Stressed/failing structure	5+60 UT2	Embedded rock sill; channel is stable	SPA 5, SPA 6 (Year 2 Report)
	2+50 UT2	Embedded cross-vane; channel is stable	
	1+25 UT2	Embedded J-hook; channel is stable	
	14+75 Upper	Partially embedded J-hook; channel is stable	
	13+00 Upper	Embedded J-hook; channel is stable	
	2+50 Upper	Embedded J-hook; channel is stable	
	12+00 UT1	Embedded rock sill; channel is stable	
	10+60 UT1	Embedded rock sill ; channel is stable	
	3+25 UT1	Partially embedded J-hook; channel is stable	
	2+00 UT1	Embedded J-hook; channel is stable	
	0+50 UT1	Embedded J-hook; channel is stable	
Other	7+00 UT1	Sinkhole adjacent to channel; has improved since the previous year due to floodplain deposition	

Table Xc. Stream Problem Areas – Year 3 Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Aggradation	1+50 - 2+00 Upper	Point bar; vegetated and stable	SPA 1, 2 (Year 3 Report)
	1+75 Lower	Mid-channel bar; vegetated and stable	
	6+30 UT1	Embedded rock sill; channel is stable	
	8+00 UT1	Embedded J-hook; channel is stable	
Bank scour	3+50 Upper	Slumping on left bank; heavily vegetated, channel is stable	SPA 3, 4, 5 (Year 3 Report)

Table Xd. Stream Problem Areas – Year 4 Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Aggradation	2+00 Lower	Bar forming along left bank; likely the remnants of the mid-channel bar formerly at station 1+75; vegetated and stable	SPA 1, 2, 3 (Year 4 report)
	1+80 UT1	Embedded rock sill; channel is stable	
	2+95 UT1	Embedded rock sill; channel is stable	
	4+15 UT1	Embedded rock sill; channel is stable	
	8+00 UT1	Embedded J-hook; channel is stable	
	13+80 UT1	Bar forming along right bank; vegetated and stable	
Bank scour	5+50 Upper	Scour on right bank upstream of J-hook on left bank	SPA 4, 5 (Year 4 report)
	8+80 – 9+00 Lower	Slumping on right bank underneath erosion matting	

Table Xd. Stream Problem Areas – Year 5 Bailey Fork Stream Restoration / EEP Project No. D04006-02			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Bank scour	8+00 Lower	Scour on left bank upstream of J-hook on left bank	SPA 1

In Year 5, several features have been removed from the stream problem areas tables of previous monitoring years. The majority of these areas were structures that have been embedded throughout the monitoring period or they are areas of bank scour that were repaired in the summer of 2009. It is important to note that the stream channels remain stable in these areas in 2010. Once the channel has remained stable throughout two consecutive years of monitoring, the structures are no longer considered problem areas and are removed from the table.

The only feature that had remained on the Year 4 table from previous monitoring years was the J-hook at station 8+00 on UT1. When Year 5 observations are considered, the channel has remained stable in this area for three consecutive years. Therefore, it has been removed from **Table Xd.** in 2010.

The other category of potential problem areas that remained in Year 4 was limited to two isolated areas of minimal bank scour (one scour area on Lower Bailey Fork and the other on Upper Bailey Fork). These scour areas were removed from Table Xd. in Year 5 because they have since been repaired, are densely vegetated and remain stable. Only one new scour area was observed on Lower Bailey Fork in 2010. The scour hole is located at station 8+00 on Lower Bailey Fork. The scour hole although tall, remains localized to a small area along the left bank of Lower Bailey Fork. The left bank near this station is heavily vegetated and appears stable and is located immediately upstream of a grade control feature. It is therefore predicted that this minimal scour area will not become more than a localized issue and will re-stabilize, over time. Accordingly, maintenance work is not warranted and the scour area is mapped in Appendix B as a stream problem area of low concern.

3. Stream Problem Areas Plan View

The location of each structural problem area is shown on the stream problem area plan view included in Appendix B. Each problem area is color coded with yellow for areas of low concern (areas to be watched) or red for high concern (areas where maintenance is warranted).

4. Stream Problem Areas Photos

Photographs of the stream problem areas noted in Table Xd are included in Appendix B.

5. Fixed Station Photos

Photographs were taken at each established photograph station on September 18, 2010. These photographs are provided in Appendix B.

6. Stability Assessment Table

The visual stream assessment was performed to determine the percentage of stream features remaining in a state of stability after the first year of monitoring. A summary of the visual assessment for each reach is included in Table XIa through Table XId. This summary was compiled from the more comprehensive Table B1, included in Appendix B. Each of the structures shown on the as-built plans were assessed during monitoring and reported in the tables.

Table XIa. Categorical Stream Feature Visual Stability Assessment Bailey Fork Stream Restoration / EEP Project No. D04006-02 Segment/Reach: Upper						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	87%	87%	87%	87%	87%
B. Pools[2]	100%	88%	88%	84%	100%	100%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	91%	98%	98%	100%	100%
E. Bed General	100%	98%	98%	98%	100%	98%
F. Vanes / J Hooks etc.[3]	100%	97%	96%	96%	96%	97%
G. Wads and Boulders[4]	N/A	N/A	N/A	N/A	N/A	N/A

Table XIb. Categorical Stream Feature Visual Stability Assessment Bailey Fork Stream Restoration / EEP Project No. D04006-02 Segment/Reach: Lower						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	100%	100%	100%	98%	98%
B. Pools[2]	100%	100%	100%	100%	100%	100%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	91%	100%	100%	96%	100%
E. Bed General	100%	100%	99%	99%	98%	97%
F. Vanes / J Hooks etc.[3]	100%	100%	100%	100%	100%	100%
G. Wads and Boulders[4]	N/A	N/A	N/A	N/A	N/A	N/A

Table XIc. Categorical Stream Feature Visual Stability Assessment Bailey Fork Stream Restoration / EEP Project No. D04006-02 Segment/Reach: UT1						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	93%	92%	92%	90%	90%
B. Pools[2]	100%	89%	87%	86%	86%	86%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	100%	100%	100%	100%	100%
E. Bed General	100%	100%	100%	98%	99%	98%
F. Vanes / J Hooks etc.[3]	100%	97%	97%	95%	94%	94%
G. Wads and Boulders[3]	100%	100%	100%	100%	100%	100%

Table XId. Categorical Stream Feature Visual Stability Assessment Bailey Fork Stream Restoration / EEP Project No. D04006-02 Segment/Reach: UT2						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	100%	89%	100%	100%	100%
B. Pools[2]	100%	96%	86%	93%	90%	90%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	100%	100%	100%	98%	100%
E. Bed General	100%	100%	100%	100%	100%	100%
F. Vanes / J Hooks etc.[3]	100%	95%	95%	95%	95%	95%
G. Wads and Boulders[4]	N/A	N/A	N/A	N/A	N/A	N/A

[1]Riffles are assessed using the longitudinal profile. A riffle is determined to be stable based on a comparison of location and elevation with respect to the as-built profile.
[2]Pools are assessed using the longitudinal profile. A pool is determined to be stable based on a comparison of location and elevation with respect to the as-built profile and a consideration of appropriate depth.
[3]Physical structures such as vanes, J-hooks, and root wads are assessed using the as-built plan sheets to define the location of such features. A structure is considered stable if the feature remains functional in the same location as shown in the as-built plan.
[4]Those features not included in the stream restoration were labeled N/A. This includes structures such as rootwads and boulders.

The visual stream stability assessment revealed that the majority of in-stream structures are functioning as designed and built on the project reaches. The structures identified as problematic on Upper Bailey Fork and Tributaries UT1 and UT2 were vanes/J-hooks, each of which has become embedded in sand size sediment. However, the channel is stable at each location where aggradation has covered a structure. The percentage of embedded features has remained relatively similar throughout the monitoring years. Meanders along the stream were found to have better stability in Year 5. A few point bars have also formed within Upper and Lower Bailey Fork, resulting in the percentages for the Bed General category in the preceding tables.

As a result of the streambank maintenance that occurred along upper and lower Bailey Fork in Year 2 during August 2007 and in Year 4 during the summer of 2009, each meander that was in an unstable state during Year 1 and Year 4 monitoring was repaired and has remained stable in Year 5.

All of the stream reaches were noted to have either pools or riffles that were not performing as intended based on the as-built conditions. On both the Upper and Lower reaches of Upper Bailey Fork, pool depths appear to have increased over the Year 4 conditions; all of these are now considered stable and of adequate depth. Although the stability percentage for riffle features on Upper Bailey Fork is comparatively low, the stream channel is both stable and functional, with no apparent detrimental effect.

A limited number of pools and riffles along reaches UT1 and UT2 have been impacted by aggradation along these reaches. As on Upper Bailey Fork, some of the riffles along UT1 have become slightly embedded. Several pools along this reach have also become filled with fine sediments, resulting in shallower pools. As mentioned previously, sand is a dominant substrate in the watershed. As such, a high sediment supply is readily available for the project reaches, and

the depositional trends seen in the project reaches is anticipated as a natural component of the system, rather than a concern with the physical structure of the project. It should be noted, however, that generalized channel aggradation along UT1 and UT2 has decreased, overall, since Year 4. Comparison of the monumented cross sections and the longitudinal profiles of UT1 and UT2 demonstrate this observation. Furthermore, the consistency demonstrated in Tables XIb. and XIc. implies that the stream channels have achieved a state of equilibrium in Year 5.

7. Quantitative Measures

Graphic interpretations of cross-sections, profiles and pebble counts are provided in Appendix B. A summary of the baseline morphology for the site is included in Table XII for comparison with the monitoring data shown in the tables in the appendices. Geomorphic data in Table XII, except for Year 1 through Year 5 monitoring data, was provided by Natural Systems Engineering. Year 0 data presented in cross-sections and profiles, contained in Appendix B, were also provided by Natural Systems Engineering.

Data provided for Table XIII. *Morphology and Hydraulic Monitoring Summary*, reflects all years of stream monitoring. The table depicts basic morphological and dimensional measurements for each monumented cross section of the project. Table XIII makes it easy to compare these dimensional values from year to year, thus illuminating trends in channel evolution.
The stream pattern data provided for Year 1 through Year 5 is the same as the data provided from the As-Built survey, as pattern has not changed based on the yearly stream surveys and visual field assessments.

Bedform features continue to evolve along the restored reaches as shown on the long-term longitudinal profiles. Dimensional measurements of the monumented cross-sections remain stable when compared to as-built conditions. The comparison of the As-Built through Year 4, and the Year 5 long-term stream monitoring profile data show stability with minor changes from as-built conditions. Riffle lengths and slopes are generally stable, although a few have decreased slightly due to aggradation. Pool lengths are also generally stable, except for a slight decrease on UT1, which is also suspected to be due to aggradation. Pool to pool spacings are representative of reference reach conditions and were generally stable except for minor increases due to slight shifts in the locations of the maximum pools depths or the loss of a pool due to aggradation.

The constructed riffles remain stable, with a median particle size ranging from fine gravel to very coarse gravel. The pools substrate remained stable, with median particle sizes within the medium sand category, based on Year 5 substrate analysis.

Table XII. Baseline Geomorphic and Hydraulic Summary

Bailey Fork Stream Restoration / EEP Project No. D04006-02

Station/Reach: Upper {Long-Term Monitoring Profile Station 0+00 to 8+00 (800 feet)}

Parameter	Regional Curve Data			Reference Reach			Pre-Existing Condition			Design			As-Built XSs 5 & 8			Year 1 Sta. 0+00 - 8+00			Year 2 Sta. 0+00 - 8+00			Year 3 Sta. 0+00 - 8+00			Year 4 Sta. 0+00 - 8+00			Year 5 Sta. 0+00 - 8+00		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			4.90	0.14	1.70	0.92			4.90			4.90			4.90			4.90			4.90			4.90			4.90			4.90
BF Width (ft)			25.10	7.35	10.80	9.08	19.90	26.47	23.19			28.00	28.20	37.70	32.95	29.07	30.94	30.01	28.89	36.63	32.76	28.77	36.74	32.76	28.96	38.50	33.73	27.84	34.67	31.26
Floodprone Width (ft)				43.00	150.00	96.50	180.00	180.00	180.00			280.00	100.00	109.00	104.50	99.20	109.50	104.35	99.84	109.52	104.68	99.72	109.00	104.36	100.50	110.50	105.50	99.71	109.38	104.55
BF Cross Sectional Area (ft^2)			63.62	9.10	20.70	14.90	67.37	71.69	69.53			65.00	71.70	81.80	76.75	77.68	102.22	89.95	77.14	89.37	83.26	76.82	90.98	83.90	75.00	97.40	86.20	79.47	88.19	83.83
BF Mean Depth (ft)			2.53	1.30	2.10	1.70	2.71	3.38	3.05			2.30	2.30	2.30	2.30	2.67	3.30	2.99	2.44	2.67	2.56	2.48	2.67	2.58	2.53	2.59	2.56	2.54	2.85	2.70
BF Max Depth (ft)				1.80	2.80	2.30	4.55	4.96	4.76			4.20	4.10	5.20	4.65	4.14	5.39	4.77	4.25	4.63	4.44	4.22	4.68	4.45	4.26	4.79	4.53	4.69	5.12	4.91
Width/Depth (ft)			9.92	5.65	5.14	5.40	7.34	7.83	7.59			12.20	12.26	16.39	14.33	9.38	10.89	10.14	10.82	15.01	12.92	10.78	14.81	12.80	11.18	15.22	13.20	9.77	13.65	11.71
Entrenchment Ratio				5.85	13.89	9.87	9.05	9.04	9.04			10.00	3.55	2.89	3.22	3.41	3.54	3.48	2.99	3.46	3.23	2.97	3.47	3.22	2.87	3.47	3.17	3.16	3.58	3.37
Bank Height Ratio				0.70	1.00	0.85	1.80	2.10	1.95			1.00	1.00	1.10	1.05	1.00	1.10	1.05	1.10	1.15	1.13	1.05	1.12	1.09	1.00	1.00	1.00	1.00	1.00	1.00
Wetted Perimeter (ft)			30.16	9.95	15.00	12.48	25.32	33.23	29.28			32.60	32.80	42.30	37.55	30.60	34.41	32.51	30.42	37.94	34.18	30.29	38.07	34.18	30.60	39.85	35.23	30.07	36.53	33.30
Hydraulic Radius (ft)			2.11	0.91	1.38	1.15	2.66	2.16	2.41			1.99	1.93	2.19	2.06	2.54	2.97	2.76	2.36	2.54	2.45	2.39	2.54	2.47	2.44	2.45	2.45	2.41	2.64	2.53
Pattern																														
*Channel Beltwidth (ft)				20.00	50.00	35.00	75.00	105.00	90.00	70.00	153.00	111.50	70.00	153.00	111.50	70.00	153.00	111.50	70.00	153.00	111.50	70.00	153.00	111.50	70.00	153.00	111.50	70.00	153.00	111.50
*Radius of Curvature (ft)				10.00	21.00	15.50	18.00	30.00	24.00	42.00	84.00	63.00	42.00	84.00	63.00	42.00	84.00	63.00	42.00	84.00	63.00	42.00	84.00	63.00	42.00	84.00	63.00	42.00	84.00	63.00
*Meander Wavelength (ft)				35.00	50.00	42.50	60.00	96.00	78.00	70.00	154.00	112.00	70.00	154.00	112.00	70.00	154.00	112.00	70.00	154.00	112.00	70.00	154.00	112.00	70.00	154.00	112.00	70.00	154.00	112.00
*Meander Width Ratio				2.00	21.80	11.90	3.20	3.60	3.40	2.50	5.50	4.00	2.50	5.50	4.00	2.41	4.95	3.72	2.42	4.18	3.40	2.43	4.16	3.40	2.42	3.97	3.31	2.51	4.41	3.57
Profile																														
Riffle Length (ft)				3.00	26.40	14.70	15.00	67.80	41.40	23.80	68.00	45.90	23.80	68.00	45.90	5.60	24.00	12.70	13.40	23.75	17.77	10.67	43.75	20.36	9.34	38.38	19.71	12.34	31.32	21.95
Riffle Slope (ft/ft)				0.0068	0.0700	0.0384	0.0086	0.0860	0.0473	0.0020	0.0035	0.0028	0.0020	0.0035	0.0028	0.0120	0.0456	0.0238	0.0045	0.0260	0.0173	0.0066	0.0247	0.0134	0.0023	0.0242	0.0078	0.0088	0.0402	0.0256
Pool Length (ft)				5.50	41.30	23.40	80.00	100.00	90.00	45.00	96.00	70.50	45.00	96.00	70.50	27.90	72.20	51.20	28.23	80.25	53.58	24.12	71.34	44.25	26.97	67.43	42.82	24.68	75.93	47.88
Pool Spacing (ft)				16.00	70.00	43.00	81.00	211.00	146.00	95.00	224.00	159.50	95.00	224.00	159.50	56.00	167.00	98.20	49.12	109.70	75.59	34.26	101.86	68.19	30.08	89.22	58.94	31.32	102.51	66.28
Additional Reach Parameters																														
**d50 (mm)				20.0	29.0	24.5	6.0	24.0	15.0				6.9	19.6	13.3			113.4			87.4			32.0			64.0			11.9
**d84 (mm)				38.0	76.0	57.0	7.0	50.0	28.5			55.0	121.0	154.0	137.5			178.3			115.0			139.3			119.8			95.1
Additional Reach Parameters																														
Valley Length (ft)				209	295	252.00			1108			1108			1108			1108			1108			1108			1108			1108
Channel Length (ft)				406	479	442.50			1383.0			1410.4			1543.0			1543.0			1543.0			1543.0			1543.0			1543.0
Sinuosity				1.9	1.6	1.8			1.1			1.3			1.4			1.4			1.4			1.4			1.4			1.4
Water Surface Slope (ft/ft)				0.0044	0.0219	0.0132			0.0024			0.0025			0.0027			0.0019			0.0019			0.0020			0.0029			0.0029
BF Slope (ft/ft)				0.0044	0.0219	0.0132			0.0035			0.0033			0.0020			0.0017			0.0024			0.0020			0.0014			0.0031
Rosgen Classification			E	E4	E4	E4			E-F-G			E4/C4			C4			E4			C4			C4			C4			C4
*Habitat Index																														
*Macrobenthos																														

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria

Note: Blank fields = Historic project documentation necessary to provide these data were unavailable at the time of this report submission.

**Year 3 D50 and D84 are composite values from XS-5 & XS-7. This distribution best represents reach subtrate composition. Riffle XS-5 D50 and D84 subtrate composition (i.e., 110 mm & 164 mm) uncharacteristically classifies UBF as a large cobble, C3 stream type.

Note: Where only one measurement was taken, that value is posted in the "Med" column.

Table XII. Baseline Geomorphic and Hydraulic Summary

Bailey Fork Stream Restoration / EEP Project No. D04006-02

Station/Reach: Lower {Long-Term Monitoring Profile Station 0+00 to 8+00 (800 feet)}

Parameter	Regional Curve Data			Reference Reach			Pre-Existing Condition			Design			As-Built XS 12			Year 1 Sta 0+00 - 8+00			Year 2 Sta 0+00 - 8+00			Year 3 Sta 0+00 - 8+00			Year 4 Sta 0+00 - 8+00			Year 5 Sta 0+00 - 8+00		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			5.50	0.14	1.70	0.92			5.50			5.50			5.50			5.50			5.50			5.50			5.50			5.50
BF Width (ft)			26.02	7.35	10.80	9.08	19.90	37.42	28.66			30.00			31.50			32.36			32.71			32.89			31.76			32.92
Floodprone Width (ft)				43.00	150.00	96.50	70.00	143.33	70.00			250.00			106.00			104.21			104.81			104.22			105.00			105.00
BF Cross Sectional Area (ft^2)			67.85	9.10	20.70	14.90	78.11	95.26	86.69			75.00			81.40			81.42			83.19			85.00			75.58			88.19
BF Mean Depth (ft)			2.61	1.30	2.10	1.70	1.60	3.00	2.30			2.50			2.60			2.52			2.54			2.58			2.38			2.68
BF Max Depth (ft)				1.80	2.80	2.30	4.55	4.96	4.76			4.50			4.30			4.35			4.28			4.31			4.07			4.69
Width/Depth (ft)			9.97	5.65	5.14	5.40	5.88	9.77	7.83			12.00			12.12			12.84			12.88			12.75			13.34			12.28
Entrenchment Ratio				5.85	13.89	9.87	6.80	9.04	7.92			8.33			3.37			3.22			3.18			3.17			3.30			3.19
Bank Height Ratio				0.70	1.00	0.85	1.80	2.10	1.95			1.00			1.05			1.05			1.01			1.00			1.00			1.00
Wetted Perimeter (ft)			31.24	9.95	15.00	12.48	23.10	43.42	33.26			35.00			36.70			34.27			34.44			34.65			33.20			35.80
Hydraulic Radius (ft)			2.17	0.91	1.38	1.15	3.38	2.19	2.79			2.14			2.22			2.38			2.42			2.45			2.28			2.46
Pattern																														
*Channel Beltwidth (ft)				20.00	50.00	35.00	75.00	105.00	90.00	98.00	120.00	109.00	98.00	120.00	109.00	98.00	120.00	109.00	98.00	120.00	109.00	98.00	120.00	109.00	98.00	120.00	109.00	98.00	120.00	109.00
*Radius of Curvature (ft)				10.00	21.00	15.50	18.00	30.00	24.00	45.00	90.00	67.50	45.00	90.00	67.50	45.00	90.00	67.50	45.00	90.00	67.50	45.00	90.00	67.50	45.00	90.00	67.50	45.00	90.00	67.50
*Meander Wavelength (ft)				35.00	50.00	42.50	60.00	96.00	78.00	200.00	220.00	210.00	200.00	220.00	210.00	200.00	220.00	210.00	200.00	220.00	210.00	200.00	220.00	210.00	200.00	220.00	210.00	200.00	220.00	210.00
*Meander Width Ratio				2.00	21.80	11.90	3.20	3.60	3.40	3.27	4.00	3.63	3.11	3.81	3.46	3.03	3.71	3.37	3.00	3.67	3.33	2.98	3.65	3.31	3.09	3.78	3.43	2.98	3.65	3.31
Profile																														
Riffle Length (ft)				3.00	26.40	14.70	34.80	69.50	52.15	14.00	40.00	27.00	30.00	55.00	42.50	6.90	15.80	11.35	7.15	18.89	13.13	6.39	37.27	14.69	7.45	34.76	17.63	9.40	33.40	17.60
Riffle Slope (ft/ft)				0.0068	0.0700	0.0384	0.0070	0.0235	0.0153	0.0025	0.0070	0.0048	0.0013	0.0029	0.0021	0.0095	0.0447	0.0271	0.0021	0.0434	0.0196	0.0055	0.0426	0.0122	0.0024	0.0271	0.0114	0.0039	0.0598	0.0272
Pool Length (ft)				5.50	41.30	23.40	27.20	60.00	43.60	20.00	45.00	32.50	50.00	100.00	75.00	27.70	54.10	40.90	14.85	52.77	29.93	14.39	37.52	26.48	16.14	42.21	26.62	17.80	65.80	40.10
Pool Spacing (ft)				16.00	70.00	43.00	110.00	110.00	110.00	50.00	85.00	67.50	110.00	140.00	125.00	50.60	141.60	113.28	24.71	114.76	48.61	24.67	117.79	52.01	31.03	144.00	62.07	28.20	121.10	61.70
Substrate																														
**d50 (mm)				20.0	29.0	24.5	6.0	24.0	15.0				6.9	19.6	13.3			46.1			41.8			58.6			58.2			50.7
**d84 (mm)				38.0	76.0	57.0	7.0	50.0	28.5			80.0	121.0	154.0	137.5			96.7			86.5			153.4			128.6			160.0
Additional Reach Parameters																														
Valley Length (ft)				209	295	252.00			920			920			920			920			920			920			920			920
Channel Length (ft)				406	479	442.50			1125.3			1174.1			1170.4			1170.4			1170.4			1170.4			1170.4			1170.4
Sinuosity				1.9	1.6	1.8			1.2			1.3			1.3			1.3			1.3			1.3			1.3			1.3
Water Surface Slope (ft/ft)				0.0044	0.0219	0.0132			0.0049			0.0025			0.0028			0.0018			0.0019			0.0017			0.0031			0.0026
BF Slope (ft/ft)				0.0044	0.0219	0.0132			0.0075			0.0033			0.0030			0.0018			0.0016			0.0015			0.0039			0.0036
Rosgen Classification			E	E4	E4	E4			G4/F4			E4/C4			C4			C4			C4			C4			C4			C4
*Habitat Index																														
*Macrobenthos																														

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria.

Note: Blank fields = Historic project documentation necessary to provide these data were unavailable at the time of this report submission.

**Years 1 through 4 data was derived using three riffle cross-sections out of the six total cross-sections from which pebble count data was collected. For this reach, XS 12 was the only riffle cross-section for which data was collected.

Note: Where only one measurement was taken, that value is posted in the "Med" column.

Table XII. Baseline Geomorphic and Hydraulic Summary

Bailey Fork Stream Restoration / EEP Project No. D04006-02

Station/Reach: UT1 {Long-Term Monitoring Profile Station 0+00 to 8+00 (800 feet)}

Parameter	Regional Curve Data			Reference Reach			Pre-Existing Condition			Design			As-Built XSs 1 & 3			Year 1 Sta. 0+00 - 8+00			Year 2 Sta. 0+00 - 8+00			Year 3 Sta. 0+00 - 8+00			Year 4 Sta. 0+00 - 8+00			Year 5 Sta. 0+00 - 8+00		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			0.54	0.14	1.70	0.92			0.54			0.54			0.54			0.54			0.54			0.54			0.54			0.54
BF Width (ft)			10.93	7.35	10.80	9.08	19.90	26.47	23.19			14.00	16.60	27.40	22.00	14.43	17.76	16.10	14.69	16.26	15.48	15.32	15.75	15.54	14.97	16.45	15.71	15.40	17.35	16.38
Floodprone Width (ft)				43.00	150.00	96.50	180.00	180.00	180.00	65.00	120.00	92.50	64.40	74.00	69.20	63.78	72.92	68.35	58.45	74.45	66.45	64.00	74.45	69.23	64.14	74.50	69.32	63.87	74.54	69.21
BF Cross Sectional Area (ft^2)			14.30	9.10	20.70	14.90	67.37	71.69	69.53			17.50	15.40	27.40	21.40	12.60	15.45	14.03	13.03	16.08	14.56	12.99	15.15	14.07	10.88	16.42	13.65	14.97	16.72	15.85
BF Mean Depth (ft)			1.30	1.30	2.10	1.70	2.71	3.38	3.05			1.30	0.56	1.73	1.15	0.87	0.87	0.87	0.89	0.99	0.94	0.85	0.96	0.91	0.73	1.00	0.87	0.96	0.97	0.97
BF Max Depth (ft)				1.80	2.80	2.30	4.55	4.96	4.76			1.80	1.80	3.00	2.40	1.66	1.98	1.82	1.66	2.03	1.85	1.70	1.98	1.84	1.64	2.08	1.86	1.91	2.26	2.09
Width/Depth (ft)			8.41	5.65	5.14	5.40	5.88	9.77	7.83			10.77	15.84	29.64	22.74	16.59	20.41	18.50	16.42	16.51	16.47	16.41	18.02	17.08	16.45	20.51	18.48	15.88	18.07	16.98
Entrenchment Ratio				5.85	13.89	9.87	6.80	9.04	7.92			6.61	2.70	3.88	3.29	3.59	5.05	4.32	3.59	5.07	4.33	4.06	4.86	4.46	4.06	4.98	4.52	3.68	4.84	4.26
Bank Height Ratio				0.70	1.00	0.85	2.05	2.15	2.10			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.03	1.00	1.02	1.01	1.00	1.00	1.00	1.00	1.00	1.00
Wetted Perimeter (ft)			13.53	9.95	15.00	12.48	25.32	33.23	29.28			16.60	17.72	30.86	24.29	15.20	19.06	17.13	15.45	17.34	16.40	15.97	16.67	16.32	15.70	17.01	16.36	16.60	18.37	17.49
Hydraulic Radius (ft)			1.06	0.91	1.38	1.15	2.66	2.16	2.41			1.05	0.87	0.89	0.88	0.81	0.83	0.82	0.84	0.93	0.89	0.81	0.91	0.86	0.69	0.97	0.83	0.90	0.91	0.91
Pattern																														
*Channel Beltwidth (ft)				20.00	50.00	35.00	30.00	40.00	35.00	30.00	80.00	55.00	30.00	80.00	55.00	30.00	80.00	55.00	30.00	80.00	55.00	30.00	80.00	55.00	30.00	80.00	55.00	30.00	80.00	55.00
*Radius of Curvature (ft)				10.00	21.00	15.50	9.00	18.00	13.50	15.00	35.00	25.00	15.00	35.00	25.00	15.00	35.00	25.00	15.00	35.00	25.00	15.00	35.00	25.00	15.00	35.00	25.00	15.00	35.00	25.00
*Meander Wavelength (ft)				35.00	50.00	42.50	48.00	60.00	54.00	55.00	100.00	77.50	55.00	100.00	77.50	55.00	100.00	77.50	55.00	100.00	77.50	55.00	100.00	77.50	55.00	100.00	77.50	55.00	100.00	77.50
*Meander Width Ratio				2.00	21.80	11.90	2.80	3.70	3.25	2.10	5.70	3.90	2.10	5.70	3.90	2.08	4.50	3.42	2.04	4.92	3.55	1.96	5.08	3.54	2.00	4.86	3.50	1.95	4.61	3.36
Profile																														
Riffle Length (ft)				3.00	26.40	14.70	34.80	69.50	52.15	14.00	40.00	27.00	4.00	37.00	14.22	4.70	28.60	15.70	5.02	26.34	14.17	9.28	25.32	18.00	6.61	19.84	9.89	4.80	33.10	14.20
Riffle Slope (ft/ft)				0.0068	0.0700	0.0384	0.0070	0.0235	0.0153	0.0025	0.0070	0.0048	0.0010	0.1830	0.0020	0.0046	0.0645	0.0254	0.0097	0.0559	0.0259	0.0151	0.0646	0.0376	0.0030	0.0790	0.0199	0.0035	0.0402	0.0210
Pool Length (ft)				5.50	41.30	23.40	27.20	60.00	43.60	20.00	45.00	32.50	3.00	37.00	20.00	8.40	56.90	30.80	7.44	54.86	27.36	10.67	44.74	23.21	8.03	30.13	15.94	7.40	60.70	24.70
Pool Spacing (ft)				16.00	70.00	43.00	110.00	110.00	110.00	50.00	85.00	67.50	22.00	88.00	50.00	39.77	120.50	64.00	27.83	81.86	55.23	17.11	106.45	55.93	12.49	100.87	34.63	15.70	124.30	47.30
Substrate																														
**d50 (mm)				20.0	29.0	24.5	6.0	24.0	15.0				16.7	22.4	19.6															
**d84 (mm)				38.0	76.0	57.0	7.0	50.0	28.5			65.0	31.0	50.0	40.5															
Additional Reach Parameters																														
Valley Length (ft)				209	295	252.00			1225			1225			1225			1225			1225			1225			1225			1225
Channel Length (ft)				406	479	442.50			1648.1			1707.3			1758.1			1758.1			1758.1			1758.1			1758.1			1758.1
Sinuosity				1.9	1.6	1.8			1.3			1.4			1.4			1.4			1.4			1.4			1.4			1.4
Water Surface Slope (ft/ft)				0.0044	0.0219	0.0132			0.0024			0.0025			0.0071			0.0047			0.0050			0.0069			0.0075			0.0074
BF Slope (ft/ft)				0.0044	0.0219	0.0132			0.0035			0.0033			0.0064			0.0046			0.0049			0.0069			0.0070			0.0075
Rosgen Classification			E	E4	E4	E4			G4/F4			E4/C4			C4			C4			C4			C4			C4			C4
*Habitat Index																														
*Macrobenthos																														

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria

Note: Blank fields = Historic project documentation necessary to provide these data were unavailable at the time of this report submission.

**Years 1 through 4 data were derived using three riffle cross-sections out of the six total cross-sections where pebble count data are collected per the site mitigation plan.. No data is reported, as only substrate samples at pool cross-sections were collected.

Note: Where only one measurement was taken, that value is posted in the "Med" column.

Table XII. Baseline Geomorphic and Hydraulic Summary

Bailey Fork Stream Restoration / EEP Project No. D04006-02

Station/Reach: UT2 {Long-Term Monitoring Profile Station 0+00 to 6+00 (600 feet)}

Parameter	Regional Curve Data			Reference Reach			Pre-Existing Condition			Design			As-Built XS-10			Year 1 Sta. 0+00 - 6+00			Year 2 Sta. 0+00 - 6+00			Year 3 Sta. 0+00 - 6+00			Year 4 Sta. 0+00 - 6+00			Year 5 Sta. 0+00 - 6+00		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			0.98	0.14	1.70	0.92			0.98			0.98			0.98			0.98			0.98			0.98			0.98			0.98
BF Width (ft)			13.59	7.35	10.80	9.08			8.20			16.00			18.60			16.97			13.36			12.25			13.07			14.00
Floodprone Width (ft)				43.00	150.00	96.50	12.00	150.00	81.00	60.00	180.00	120.00			67.00			67.00			67.15			58.18			66.50			66.54
BF Cross Sectional Area (ft^2)			21.14	9.10	20.70	14.90			20.10			23.00			18.70			15.43			10.63			8.88			9.49			10.80
BF Mean Depth (ft)			1.55	1.30	2.10	1.70			2.40			1.40			1.00			0.91			0.80			0.73			0.73			0.77
BF Max Depth (ft)				1.80	2.80	2.30			3.50			2.00			1.90			1.55			1.28			1.20			1.39			1.59
Width/Depth (ft)			8.77	5.65	5.14	5.40			3.42			8.00			18.60			18.65			16.70			16.78			17.90			18.18
Entrenchment Ratio				5.85	13.89	9.87			9.88			7.50			3.60			3.95			5.03			4.75			5.09			4.75
Bank Height Ratio				0.70	1.00	0.85			1.60			1.00			1.00			1.00			1.14			1.03			1.00			1.00
Wetted Perimeter (ft)			16.69	9.95	15.00	12.48			13.00			18.80			20.60			17.41			13.98			12.68			13.38			14.60
Hydraulic Radius (ft)			1.27	0.91	1.38	1.15			1.55			1.22			0.91			0.89			0.76			0.70			0.71			0.74
Pattern																														
*Channel Beltwidth (ft)				20.00	50.00	35.00	30.00	33.00	31.50	34.00	91.20	62.60	34.00	91.20	62.60	34.00	91.20	62.60	34.00	91.20	62.60	34.00	91.20	62.60	34.00	91.20	62.60	34.00	91.20	62.60
*Radius of Curvature (ft)				10.00	21.00	15.50	15.00	18.00	16.50	24.00	40.00	32.00	24.00	40.00	32.00	24.00	40.00	32.00	24.00	40.00	32.00	24.00	40.00	32.00	24.00	40.00	32.00	24.00	40.00	32.00
*Meander Wavelength (ft)				35.00	50.00	42.50	66.00	78.00	72.00	56.00	104.00	80.00	56.00	104.00	80.00	56.00	104.00	80.00	56.00	104.00	80.00	56.00	104.00	80.00	56.00	104.00	80.00	56.00	104.00	80.00
*Meander Width Ratio				2.00	21.80	11.90	3.70	4.00	3.85	2.10	5.70	3.90	2.10	5.70	3.90	2.10	5.70	3.90	2.54	6.83	4.69	2.78	7.44	5.11	2.60	6.98	4.79	2.43	6.51	4.47
Profile																														
Riffle Length (ft)				3.00	26.40	14.70	16.00	24.00	20.00	16.00	44.80	30.40	16.00	44.80	30.40	3.60	13.10	8.90	7.71	22.58	14.81	3.78	31.26	14.13	8.85	23.15	14.36	8.60	45.50	21.20
Riffle Slope (ft/ft)				0.0068	0.0700	0.0384	0.0072	0.0650	0.0361	0.0020	0.0045	0.0033	0.0020	0.0045	0.0033	0.0080	0.0616	0.0259	0.0062	0.0108	0.0082	0.0048	0.0185	0.0087	0.0014	0.0177	0.0069	0.0025	0.0282	0.0087
Pool Length (ft)				5.50	41.30	23.40				22.40	48.00	35.20	22.40	48.00	35.20	12.50	53.10	29.00	14.10	48.32	31.78	12.38	47.41	24.26	15.39	47.70	25.52	14.50	54.00	29.60
Pool Spacing (ft)				16.00	70.00	43.00				55.00	85.00	70.00	55.00	85.00	70.00	37.20	80.10	63.70	37.56	102.04	61.42	21.13	79.53	49.71	30.78	110.02	58.12	11.50	110.10	50.10
Substrate																														
**d50 (mm)				20.0	29.0	24.5	6.0	24.0	15.0						2.0			45.0			38.5			4.9			4.4			5.7
**d84 (mm)				38.0	76.0	57.0	7.0	50.0	28.5			48.0			62.0			173.5			107.7			50.9			70.1			71.0
Additional Reach Parameters																														
Valley Length (ft)				209	295	252.00			860			860			860			860			860			860			860			860
Channel Length (ft)				406	479	442.50			898.9			1181.6			1271.0			1271.0			1271.0			1271.0			1271.0			1271.0
Sinuosity				1.9	1.6	1.8			1.1			1.4			1.5			1.5			1.5			1.5			1.5			1.5
Water Surface Slope (ft/ft)				0.0044	0.0219	0.0132			0.0024			0.0025			0.0051			0.0024			0.0030			0.0029			0.0055			0.0054
BF Slope (ft/ft)				0.0044	0.0219	0.0132			0.0035			0.0033			0.0047			0.0026			0.0028			0.0029			0.0050			0.0055
Rosgen Classification			E	E4	E4	E4			G4/F4			E4/C4			C4			C4			C4			C4			C4			C4
*Habitat Index																														
*Macrobenthos																														

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria

Note: Blank fields = Historic project documentation necessary to provide these data were unavailable at the time of this report submission.

**Years 1 through 4 data were derived using three riffle cross-sections out of the six total cross-sections where pebble count data are collected per the site mitigation plan. For this reach, XS-10 was the only riffle cross-section where data were collected.

Note: Where only one measurement was taken, that value is posted in the "Med" column.

Table XIII: Morphology and Hydraulic Monitoring Summary
Bailey Fork and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-02
Reach: Bailey Fork UT-1

Parameter	Cross Section (Riffle 1)						Cross Section (Pool 2)						Cross Section (Riffle 3)						Cross Section (Pool 4)					
Dimension	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**
BF Width (ft)	35.37	14.43	14.69	15.32	14.97	15.4	19.7	14.81	24.25	25.01	23.92	20.98	25.38	17.76	16.26	15.75	16.45	17.35	15.5	11.54	13.07	24.73	21.51	23.42
Floodprone Width (ft)	74	72.92	74.45	74.45	74.5	74.54	68	67.71	53.33	68	56.83	54.05	64.4	63.78	58.45	64	64.14	63.87	78	78.42	78	78	77.92	78.46
BF Cross Sectional Area (ft²)	19.98	12.6	13.03	12.99	10.88	14.97	18.18	10.35	18.62	19.23	16.92	16.45	29.11	15.45	16.08	15.15	16.42	16.72	20.18	9.13	9.17	13.96	11.01	11.64
BF Mean Depth (ft)	0.56	0.87	0.89	0.85	0.73	0.97	0.92	0.7	0.77	0.77	0.71	0.78	1.15	0.87	0.99	0.96	1	0.96	1.3	0.79	0.7	0.56	0.51	0.50
BF Max Depth (ft)	1.91	1.66	1.66	1.7	1.64	1.91	2.31	1.95	1.92	2.47	1.55	2.12	3.67	1.98	2.03	1.98	2.08	2.26	2.65	1.73	1.64	1.97	1.53	2.12
Width/Depth Ratio	63.16	16.59	16.51	18.02	20.51	15.88	21.41	21.16	31.49	32.48	33.69	26.9	22.07	20.41	16.42	16.41	16.45	18.07	11.92	14.61	18.67	44.16	42.18	46.84
Entrenchment Ratio	2.09	5.05	5.07	4.86	4.98	4.84	3.45	4.57	2.2	2.72	2.38	2.58	2.54	3.59	3.59	4.06	3.9	3.68	5.03	6.8	5.97	3.15	3.62	3.35
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	35.99	15.2	15.45	15.97	15.7	16.6	20.56	15.58	24.75	25.96	24.25	21.88	28.85	19.06	17.34	16.66	17.01	18.37	17.12	12.26	13.68	25.41	21.9	21.90
Hydraulic Radius (ft)	0.55	0.83	0.84	0.81	0.69	0.9	0.88	0.66	0.75	0.74	0.7	0.75	1.01	0.81	0.93	0.91	0.97	0.91	1.18	0.74	0.67	0.55	0.5	0.50
Substrate																								
D50 (mm)	*	*	*	*	*	*	0.63	0.22	0.21	0.24	0.33	0.36	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)	**	**	**	**	**	**	1	0.45	0.45	1	0.52	0.81	**	**	**	**	**	**	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
Bailey Fork and Unnamed Tributaries Stream Restoration/ EEP Project No. D04006-02
Reach: Bailey Fork Mainstem (Upper)

Parameter	Cross Section (Riffle 5)						Cross Section (Pool 6)						Cross Section (Pool 7)						Cross Section (Riffle 8)					
Dimension	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**
BF Width (ft)	28.81	29.07	28.89	28.77	28.96	27.84	42.67	45.53	46.78	47	44.99	43.28	23.62	19.67	19.61	19.63	19.81	19.35	37.45	30.94	36.63	36.74	38.5	34.67
Floodprone Width (ft)	100	99.2	99.84	99.72	100.5	99.71	124	124.05	123.79	124.03	124.29	124.07	100	100.1	100	100	100	100.40	109	109	109	109	110.5	109.38
BF Cross Sectional Area (ft²)	72.81	77.68	77.14	76.82	75	79.47	112.06	107.45	104.83	99.89	92.13	86.01	49.26	47.85	46.71	47.56	40.24	40.75	86.65	102.22	89.37	90.98	97.4	88.19
BF Mean Depth (ft)	2.53	2.67	2.67	2.67	2.59	2.85	2.63	2.36	2.24	2.13	2.05	1.99	2.09	2.43	2.38	2.42	2.03	2.11	2.31	3.3	2.44	2.48	2.53	2.54
BF Max Depth (ft)	4.06	4.14	4.25	4.22	4.26	4.69	5.37	5.83	4.18	4.44	5.19	4.81	3.87	3.61	3.64	3.69	3.74	3.72	5.19	5.39	4.63	4.68	4.79	5.12
Width/Depth Ratio	11.36	10.89	10.82	10.78	11.18	9.77	16.22	19.29	20.88	22.07	21.95	21.75	11.3	8.09	8.24	8.11	9.76	9.17	16.21	9.38	15.01	14.81	15.22	13.65
Entrenchment Ratio	3.47	3.41	3.46	3.47	3.47	3.58	2.91	2.72	2.65	2.64	2.76	2.87	4.23	5.09	5.1	5.09	5.05	5.17	2.91	3.52	2.98	2.97	2.87	3.16
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	30.27	30.6	30.42	30.29	30.6	30.07	45.21	49.13	47.71	48.02	46.43	44.68	26.24	21.64	21.8	21.84	21.36	21.48	40.31	34.41	37.94	38.07	39.85	36.53
Hydraulic Radius (ft)	2.41	2.54	2.54	2.54	2.45	2.64	2.48	2.19	2.2	2.08	1.98	1.93	1.88	2.21	2.14	2.18	1.88	1.90	2.15	2.97	2.36	2.39	2.44	2.41
Substrate																								
D50 (mm)	20.18	113.38	87.4	110.12	64	11.9	0.88	*	*	*	*	*	0.28	0.38	0.58	0.54	0.23	0.45	6.85	*	*	*	*	*
D84 (mm)	122.31	178.27	114.97	163.8	119.77	95.1	3.1	**	**	**	**	**	1.15	6.54	0.87	0.94	0.53	0.95	156.52	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
Bailey Fork and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-02
Reach: Bailey Fork UT-2 and Mainstem (Lower)

Parameter	UT 2 - Cross Section (Pool 9)						UT 2 - Cross Section (Riffle 10)						Lower - Cross Section (Pool 11)						Lower - Cross Section (Riffle 12)					
Dimension	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**
BF Width (ft)	21.19	12.6	11.71	11.95	7.1	7.65	18.75	16.97	13.36	12.25	13.07	14	33.39	33.78	32.84	51.94	35.91	36.33	32.12	32.36	32.71	32.89	31.76	32.92
Floodprone Width (ft)	74	74.23	74.01	74.18	31.82	72.75	67	67	67.15	58.18	66.5	66.54	110	109.9	101.2	120	93.89	109.49	106	104.21	106	104.22	105	105
BF Cross Sectional Area (ft²)	21.06	12.23	10.05	9.75	3.15	7.95	19.16	15.43	10.63	8.88	9.49	10.8	84.5	92.87	84.76	108.26	88.89	93.91	82.05	81.41	83.19	85	75.58	88.19
BF Mean Depth (ft)	0.99	0.97	0.86	0.82	0.44	1.04	1.02	0.91	0.8	0.73	0.73	0.77	2.53	2.75	2.58	2.08	2.48	2.58	2.55	2.52	2.54	2.58	2.38	2.68
BF Max Depth (ft)	1.79	1.81	1.56	1.48	0.79	1.56	1.94	1.55	1.28	1.2	1.39	1.59	4.7	5.86	5.3	5.6	4.53	5.15	4.32	4.35	4.28	4.31	4.07	4.69
Width/Depth Ratio	21.4	12.99	13.62	14.57	16.14	7.36	18.38	18.65	16.7	16.78	17.9	18.18	13.2	12.28	12.73	24.97	14.48	14.08	12.6	12.84	12.88	12.75	13.34	12.28
Entrenchment Ratio	3.49	5.89	6.32	6.21	4.48	9.51	3.57	3.95	5.03	4.75	5.09	4.75	3.29	3.25	3.08	2.31	2.61	3.01	3.3	3.22	3.24	3.17	3.3	3.19
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	21.78	13.41	12.38	12.38	7.29	8.69	19.41	17.41	13.98	12.68	13.38	14.6	35.78	37.27	36.22	55.56	39.05	39.36	33.84	34.27	34.44	34.65	33.2	35.8
Hydraulic Radius (ft)	0.97	0.91	0.81	0.79	0.43	0.91	0.99	0.89	0.76	0.7	0.71	0.74	2.36	2.49	2.34	1.95	2.28	2.39	2.42	2.38	2.42	2.45	2.28	2.46
Substrate																								
D50 (mm)	0.41	*	*	*	*	*	2.33	45	38.5	4.85	4.43	5.7	0.3	0.31	0.3	1.42	0.42	0.41	22.6	46.09	41.75	58.57	58.16	50.7
D84 (mm)	0.76	**	**	**	**	**	62.36	173.5	107.71	50.89	70.06	71.01	1.8	0.49	0.47	3.08	1.26	1.15	118.22	97.6	86.53	153.41	128.6	160.02

* D50 pebble information was not calculated ** D84 pebble information was not calculated

IV. METHODOLOGY

Year 1 vegetation monitoring was conducted in September 2006 using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee, M.T., Peet, RK., Roberts, S.R., Wentworth, T.R. 2006). Year 5 vegetation monitoring was conducted in September 2010 using the same protocol as used in Years 1 through 4. Year 1 stream monitoring was conducted in April 2007 to provide adequate time between the as-built survey (completed in August 2006) and the Year 1 monitoring survey. Stream monitoring for Year 2 occurred in the fall of 2007, to provide six months between the Year 1 and Year 2 surveys. Year 3, 4, and 5 monitoring occurred in the fall of 2008, 2009, and 2010 respectively, to provide a full year between surveys.

APPENDIX A

Vegetation Raw Data

1. Vegetation Monitoring Plot Photos
2. Vegetation Data Tables

Vegetation Plot 1
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

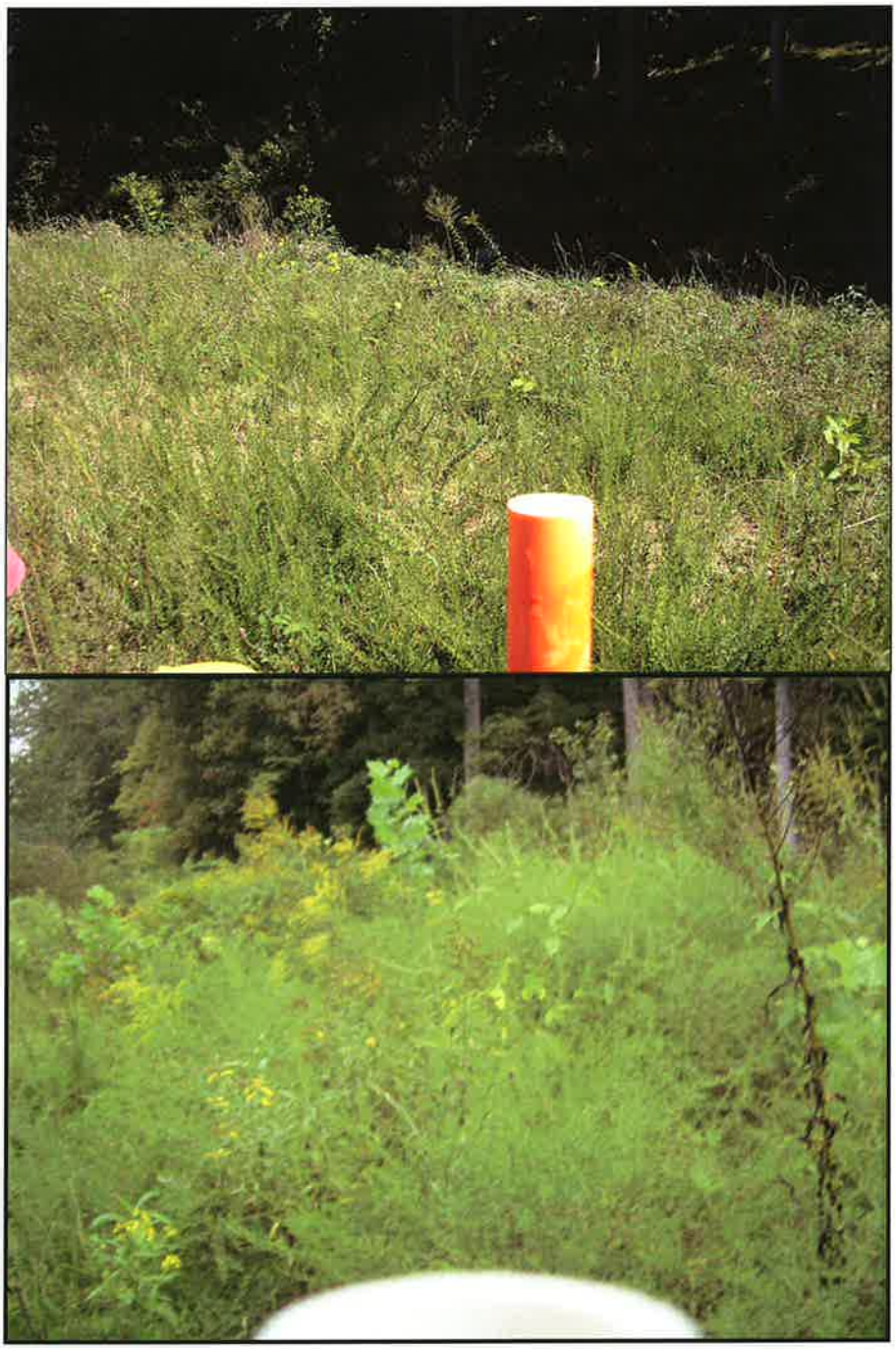
Vegetation Plot 2
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

Vegetation Plot 3
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

Vegetation Plot 4
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

Vegetation Plot 5
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

Vegetation Plot 6
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)



Vegetation Plot 7
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

Vegetation Plot 8
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

Vegetation Plot 9
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

Vegetation Plot 10
Top Photo – Monitoring Year 1 (EMH&T, Inc. 9/20/06)
Bottom Photo - Monitoring Year 5 (EMH&T, Inc. 9/18/10)

Table 1. Vegetation Metadata	
Date Prepared	1/22/2011 11:27
Prepared by	Megan Wolf
database name	cvs-eep-entrytool-v2.2.6_Backup.mdb
database location	Q:\ENVIRONMENTAL\Monitoring\EEP Vegetation Database
computer name	JT7PV31
file size	53219328
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.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	D040062
project Name	Bailey Fork
Description	Restoration of Bailey Fork and unnamed tributaries
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	10

Table 2. Vegetation Vigor by Species								
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**	**Unknown**
	Alnus serrulata	2	1				1	
	Betula nigra	3		1				
	Cornus amomum	13	8	2	2			
	Cornus kousa		1					
	Fraxinus pennsylvanica	4	3	4			1	
	Nyssa sylvatica	1						
	Quercus alba	2						
	Quercus michauxii	3						
	Quercus pagoda	18	6	2			1	
	Quercus phellos	11	2	3	1		2	
	Rosa palustris	2						
	Salix nigra	2	2					
	Sambucus canadensis			5	3			
	Liriodendron tulipifera	9	1					
	Platanus occidentalis	21	10				3	
	Malus	1						
	Salix		2					
	Salix exigua		1					
TOT:	**18**	**92**	**37**	**17**	**6**		**8**	

Table 3. Vegetation Damage by Species							
	Species	All Damage Categories	(no damage)	Insects	Site Too Dry	Unknown	(other damage)
	Alnus serrulata	4	4				
	Betula nigra	4	4				
	Cornus amomum	25	21	1		3	
	Cornus kousa	1	1				
	Fraxinus pennsylvanica	12	10			2	
	Liriodendron tulipifera	10	10				
	Malus	1	1				
	Nyssa sylvatica	1	1				
	Platanus occidentalis	34	34				
	Quercus alba	2	2				
	Quercus michauxii	3	3				
	Quercus pagoda	28	27				1
	Quercus phellos	19	14		1	2	2
	Rosa palustris	2	2				
	Salix	2	2				
	Salix exigua	1	1				
	Salix nigra	4	4				
	Sambucus canadensis	8	2			6	
TOT:	**18**	**161**	**143**	**1**	**1**	**13**	**3**

Table 4. Vegetation Damage by Plot							
	plot	All Damage Categorie	(no damage)	Insects	Site Too Dry	Unknown	(other damage)
	D040062-01-0001-year:5	15	15				
	D040062-01-0002-year:5	16	13			3	
	D040062-01-0003-year:5	21	19		1		1
	D040062-01-0004-year:5	19	17	1		1	
	D040062-01-0005-year:5	12	6			6	
	D040062-01-0006-year:5	18	18				
	D040062-01-0007-year:5	14	13				1
	D040062-01-0008-year:5	16	15			1	
	D040062-01-0009-year:5	15	12			2	1
	D040062-01-0010-year:5	15	15				
TOT:	**10**	**161**	**143**	**1**	**1**	**13**	**3**

Table 5. Stem Count by Plot and Species - Planted Stems														
	Species	Total Planted Stems	# plots	avg# stems	plot D040062-01-0001-year:5	plot D040062-01-0002-year:5	plot D040062-01-0003-year:5	plot D040062-01-0004-year:5	plot D040062-01-0005-year:5	plot D040062-01-0006-year:5	plot D040062-01-0007-year:5	plot D040062-01-0008-year:5	plot D040062-01-0009-year:5	plot D040062-01-0010-year:5
	Alnus serrulata	3	1	3			3							
	Betula nigra	4	1	4			4							
	Cornus amomum	25	9	2.78	1	1		6	2	4	1	3	5	2
	Cornus kousa	1	1	1					1					
	Fraxinus pennsylvanica	11	4	2.75	3				5	1			2	
	Liriodendron tulipifera	10	4	2.5	1			2		4	3			
	Malus	1	1	1	1									
	Nyssa sylvatica	1	1	1	1									
	Platanus occidentalis	31	6	5.17	4	1	8	4			4			10
	Quercus alba	2	1	2				2						
	Quercus michauxii	3	2	1.5						1			2	
	Quercus pagoda	26	7	3.71	1	8			1		3	8	4	1
	Quercus phellos	17	6	2.83		4	4	4			1	2		2
	Rosa palustris	2	1	2	2									
	Salix	2	1	2						2				
	Salix exigua	1	1	1						1				
	Salix nigra	4	3	1.33			1			2		1		
	Sambucus canadensis	8	5	1.6		1			2	2		1	2	
TOT:	**18**	**152**	**18**		**14**	**15**	**20**	**18**	**11**	**17**	**12**	**15**	**15**	**15**

Table 6. Stem Count by Plot and Species - All Stems														
	Species	Total Stems	# plots	avg# stems	D040062-01-0001-year:5	D040062-01-0002-year:5	D040062-01-0003-year:5	D040062-01-0004-year:5	D040062-01-0005-year:5	D040062-01-0006-year:5	D040062-01-0007-year:5	D040062-01-0008-year:5	D040062-01-0009-year:5	D040062-01-0010-year:5
	Alnus serrulata	3	1	3			3							
	Betula nigra	12	1	12			12							
	Cornus amomum	32	9	3.56	1	1		6	4	4	3	6	5	2
	Cornus kousa	1	1	1					1					
	Fraxinus pennsylvanica	11	4	2.75	3				5	1			2	
	Liquidambar styraciflua	3	2	1.5			1				2			
	Nyssa sylvatica	1	1	1	1									
	Quercus alba	2	1	2				2						
	Quercus michauxii	3	2	1.5						1			2	
	Quercus pagoda	26	7	3.71	1	8			1		3	8	4	1
	Quercus phellos	19	6	3.17		4	4	4			1	3		3
	Rosa palustris	2	1	2	2									
	Salix nigra	4	3	1.33			1			2		1		
	Sambucus canadensis	9	6	1.5		1			2	2	1	1	2	
	Cercis canadensis	1	1	1								1		
	Liriodendron tulipifera	26	5	5.2	2		15	2		4	3			
	Taxodium distichum	2	1	2							2			
	Platanus occidentalis	34	6	5.67	6	1	8	4			4			11
	Malus	1	1	1	1									
	Salix	2	1	2						2				
	Salix exigua	1	1	1						1				
	Acer negundo	9	2	4.5							7			2
	Acer rubrum	40	4	10		1	33				4			2
TOT:	**23**	**244**	**23**		**17**	**16**	**77**	**18**	**13**	**17**	**30**	**20**	**15**	**21**

APPENDIX B

Geomorphologic Raw Data

1. Fixed Station Photos
2. Table B1. Qualitative Visual Stability Assessment
3. Cross Section Plots
4. Longitudinal Plots
5. Pebble Count Plots
6. Bankfull Event Photos
7. Stream Problem Areas Plan View
8. Stream Problem Area Photos

Fixed Station 1 (Photo Point 13)
Overview of the valley at the confluence of Lower Bailey Fork and UT2, near the downstream terminus of the project, facing upstream along the mainstem.
Year 5 – top photo (EMH&T, Inc. 9/18/10)
Year 2 – bottom photo (EMH&T, Inc. 10/22/07)

Fixed Station 2 (Photo Point 14)
Overview of valley at confluence of Upper Bailey Fork and UT1, facing upstream.
Year 5 – top photo (EMH&T, Inc. 9/18/10)
Year 2 – bottom photo (EMH&T, Inc. 10/22/07)

Fixed Station 3 (Photo Point 15)
Overview of valley along UT1 near the upstream terminus of the project, facing downstream.
Year 5 – top photo (EMH&T, Inc. 9/18/10)
Year 2 – bottom photo (EMH&T, Inc. 10/22/07)

Table B1. Visual Morphological Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: Upper

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	1. Present?	13	15	2	87	
	2. Armor stable (e.g. no displacement)?	13	15	2	87	
	3. Facet grade appears stable?	13	15	2	87	
	4. Minimal evidence of embedding/fining?	13	15	2	87	
	5. Length appropriate?	13	15	2	87	**87%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	16	16	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	16	16	0	100	
	3. Length appropriate?	16	16	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	11	11	0	100	
	2. Downstream of meander (glide/inflection) centering?	11	11	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	11	11	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	11	11	0	100	
	3. Apparent Rc within spec?	11	11	0	100	
	4. Sufficient floodplain access and relief?	11	11	0	100	**100%**
E. Bed General	1. Geveral channel bed aggradation areas (bar formation)	N/A	N/A	1/20 feet	95	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**98%**
F. Vanes	1. Free of back or arm scour?	16	16	0	100	
	2. Height appropriate?	16	16	0	100	
	3. Angle and geometry appear appropriate?	16	16	0	100	
	4. Free of piping or other structural failures?	16	16	0	100	
	5. Structure buried under aggraded material?	14	16	2	87	**97%**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: Lower

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	1. Present?	9	9	0	100	
	2. Armor stable (e.g. no displacement)?	8	9	1	89	
	3. Facet grade appears stable?	9	9	0	100	
	4. Minimal evidence of embedding/fining?	9	9	0	100	
	5. Length appropriate?	9	9	0	100	**98%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	10	10	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	10	10	0	100	
	3. Length appropriate?	10	10	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	6	6	0	100	
	2. Downstream of meander (glide/inflection) centering?	6	6	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	6	6	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	6	6	0	100	
	3. Apparent Rc within spec?	6	6	0	100	
	4. Sufficient floodplain access and relief?	6	6	0	100	**100%**
E. Bed General	1. Geveral channel bed aggradation areas (bar formation)	N/A	N/A	2/ 50 feet	96	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**97%**
F. Vanes	1. Free of back or arm scour?	9	9	0	100	
	2. Height appropriate?	9	9	0	100	
	3. Angle and geometry appear appropriate?	9	9	0	100	
	4. Free of piping or other structural failures?	9	9	0	100	
	5. Structure buried under aggraded material?	9	9	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: UT1

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	1. Present?	33	35	2	94	
	2. Armor stable (e.g. no displacement)?	33	35	2	94	
	3. Facet grade appears stable?	33	35	2	94	
	4. Minimal evidence of embedding/fining?	26	35	9	72	
	5. Length appropriate?	33	35	2	94	**90%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	33	35	2	94	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	25	35	10	71	
	3. Length appropriate?	33	35	2	94	**86%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	28	28	0	100	
	2. Downstream of meander (glide/inflection) centering?	28	28	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	28	28	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	28	28	0	100	
	3. Apparent Rc within spec?	28	28	0	100	
	4. Sufficient floodplain access and relief?	28	28	0	100	**100%**
E. Bed General	1. Geveral channel bed aggradation areas (bar formation)	N/A	N/A	1/ 20 feet	95	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**98%**
F. Vanes	1. Free of back or arm scour?	31	31	0	100	
	2. Height appropriate?	31	31	0	100	
	3. Angle and geometry appear appropriate?	31	31	0	100	
	4. Free of piping or other structural failures?	31	31	0	100	
	5. Structure buried under aggraded material?	22	31	9	71	**94%**
G. Wads/ Boulders	1. Free of scour?	12	12	0	100	
	2. Footing stable?	12	12	0	100	**100%**

Table B1. Visual Morphological Stability Assessment
Bailey Fork Stream Restoration / EEP Project No. D04006-02
Segment/Reach: UT2

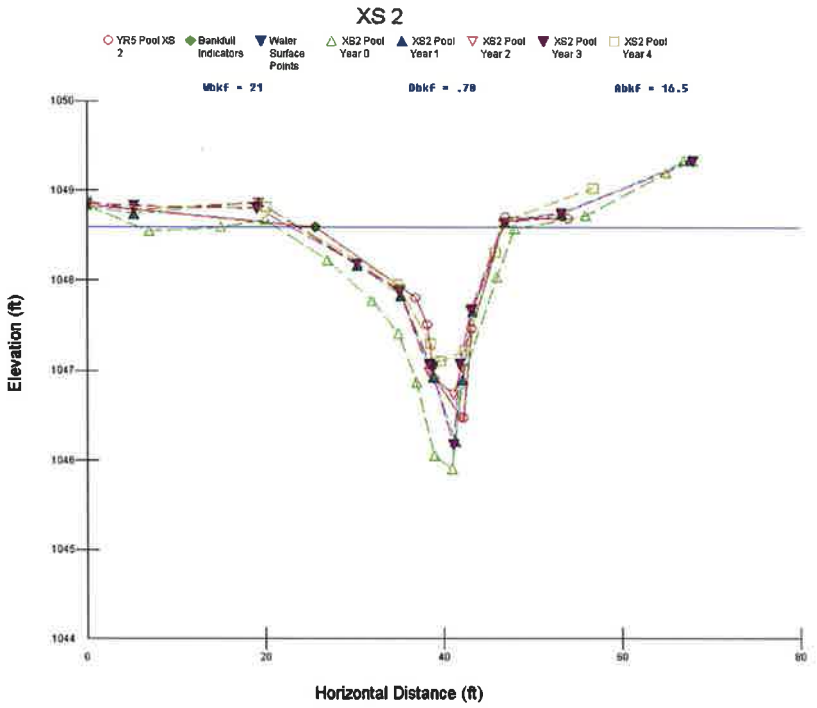
Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	19	19	0	100	
	2. Armor stable (e.g. no displacement)?	19	19	0	100	
	3. Facet grade appears stable?	19	19	0	100	
	4. Minimal evidence of embedding/fining?	19	19	0	100	
	5. Length appropriate?	19	19	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	18	19	1	95	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	15	19	4	79	
	3. Length appropriate?	18	19	1	95	**90%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	15	15	0	100	
	2. Downstream of meander (glide/inflection) centering?	15	15	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	14	15	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	15	15	0	100	
	3. Apparent Rc within spec?	15	15	0	100	
	4. Sufficient floodplain access and relief?	15	15	0	100	**100%**
E. Bed General	1. Geveral channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes	1. Free of back or arm scour?	11	11	0	100	
	2. Height appropriate?	11	11	0	100	
	3. Angle and geometry appear appropriate?	11	11	0	100	
	4. Free of piping or other structural failures?	11	11	0	100	
	5. Structure buried under aggraded material?	8	11	3	73	**95%**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Summary Data

Bankfull Area	14.97 ft^2
Bankfull Width	15.4 ft
Mean Depth	0.97 ft
Maximum Depth	1.91 ft
Width/Depth Ratio	15.88
Entrenchment Ratio	4.84
Classification	C

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	UT1
DATE	9/28/10
CROSS SECTION:	1
FEATURE:	Riffle

Cross-section photo – looking downstream



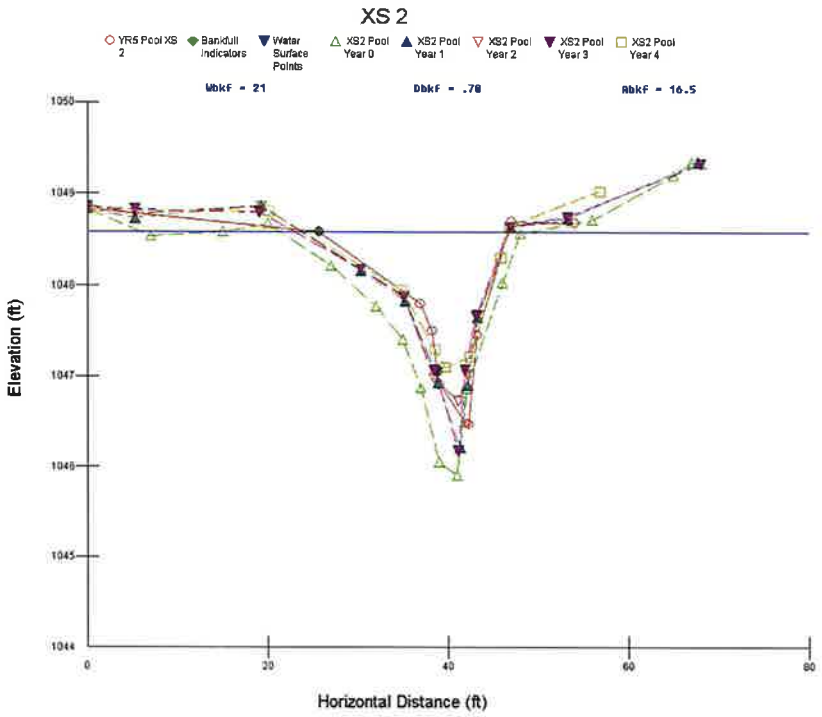
EMH&T

Summary Data

Bankfull Area	16.45 ft^2
Bankfull Width	20.98 ft
Mean Depth	0.78 ft
Maximum Depth	2.12 ft
Width/Depth Ratio	26.9
Entrenchment Ratio	2.58

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	UT1
DATE	9/28/10
CROSS SECTION:	2
FEATURE:	Pool

Cross-section photo – looking downstream

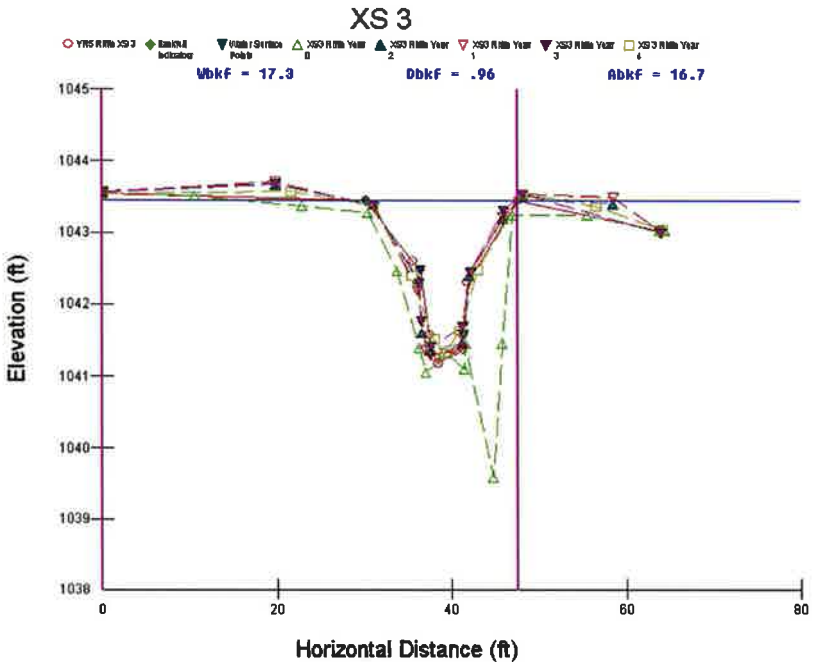


Summary Data

Bankfull Area	16.72 ft^2
Bankfull Width	17.35 ft
Mean Depth	0.96 ft
Maximum Depth	2.26 ft
Width/Depth Ratio	18.07
Entrenchment Ratio	3.68
Classification	C

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	UT1
DATE	9/28/10
CROSS SECTION:	3
FEATURE:	Riffle

Cross-section photo – looking downstream
Channel is obscured by vegetation.



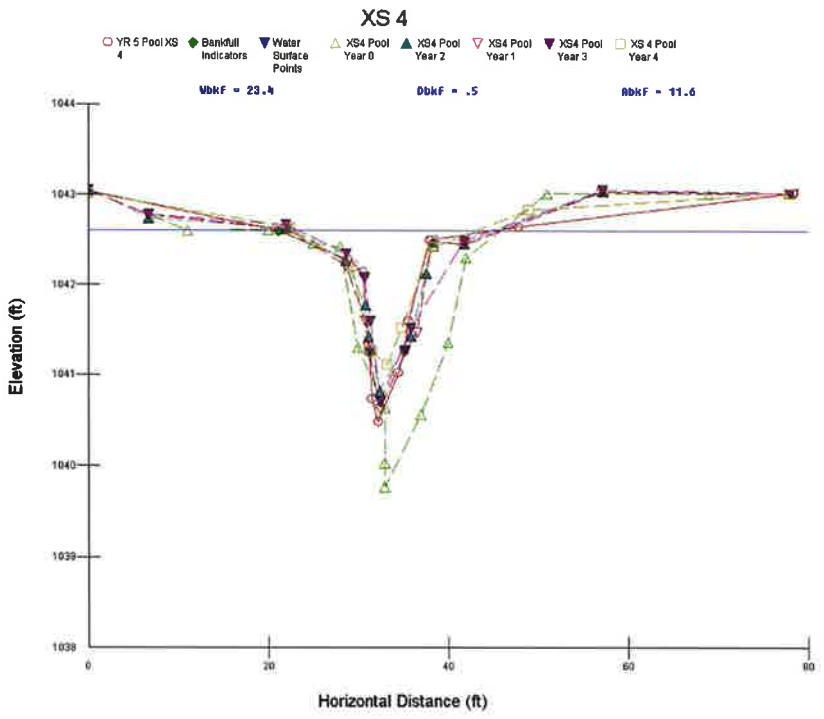
EMH&T

Summary Data

Bankfull Area	11.64 ft^2
Bankfull Width	23.42 ft
Mean Depth	0.5 ft
Maximum Depth	2.12 ft
Width/Depth Ratio	46.84
Entrenchment Ratio	3.35

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	UT1
DATE	9/28/10
CROSS SECTION:	4
FEATURE:	Pool

Cross-section photo – looking downstream

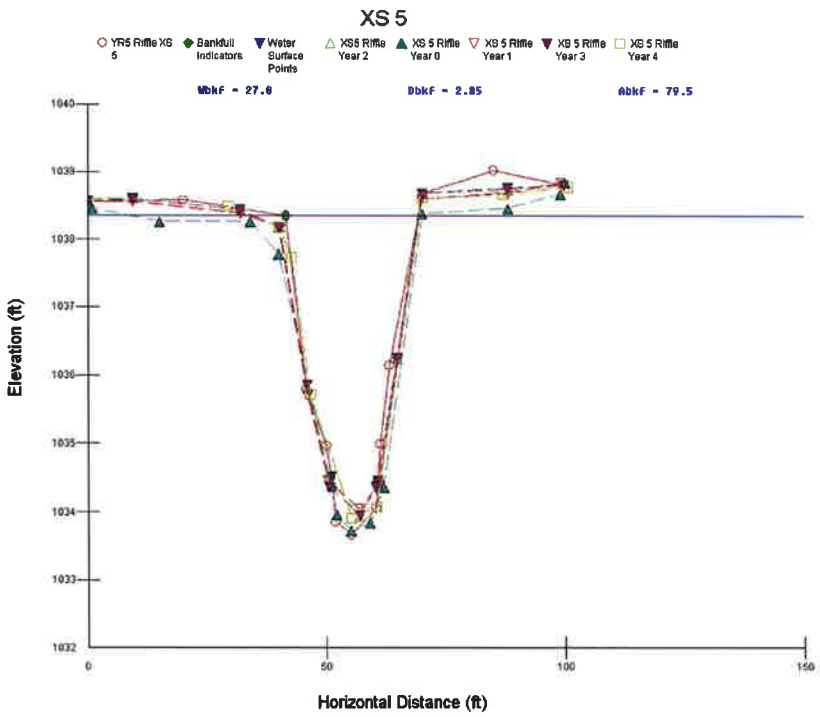


Summary Data

Bankfull Area	79.47 ft^2
Bankfull Width	27.84 ft
Mean Depth	2.85 ft
Maximum Depth	4.69 ft
Width/Depth Ratio	9.77
Entrenchment Ratio	3.58
Classification	C

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	Upper
DATE	9/28/10
CROSS SECTION:	5
FEATURE:	Riffle

Cross-section photo – looking downstream



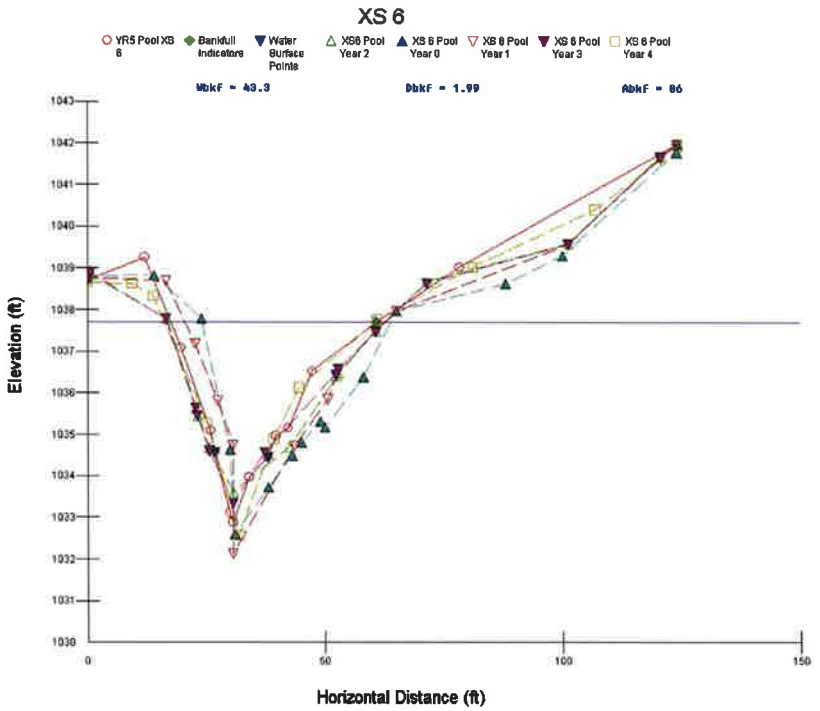
EMH&T

Summary Data

Bankfull Area	86.01 ft^2
Bankfull Width	43.28 ft
Mean Depth	1.99 ft
Maximum Depth	4.81 ft
Width/Depth Ratio	21.75
Entrenchment Ratio	2.87

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	Upper
DATE	9/28/10
CROSS SECTION:	6
FEATURE:	Pool

Cross-section photo – looking left to right bank

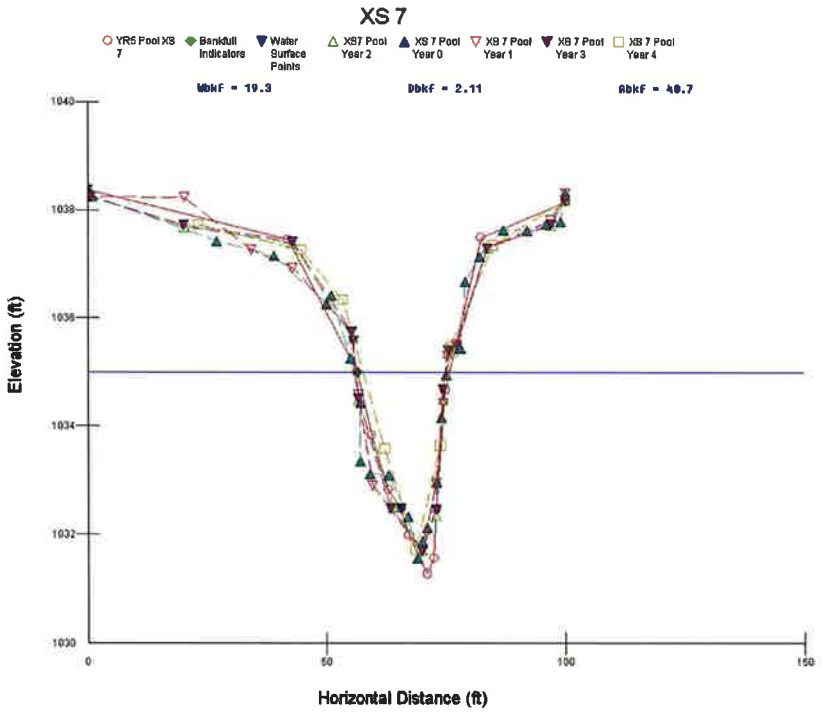


Summary Data

Bankfull Area	40.75 ft^2
Bankfull Width	19.35 ft
Mean Depth	2.11 ft
Maximum Depth	3.72 ft
Width/Depth Ratio	9.17
Entrenchment Ratio	5.17

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	Upper
DATE	9/28/10
CROSS SECTION:	7
FEATURE:	Pool

Cross-section photo – looking downstream

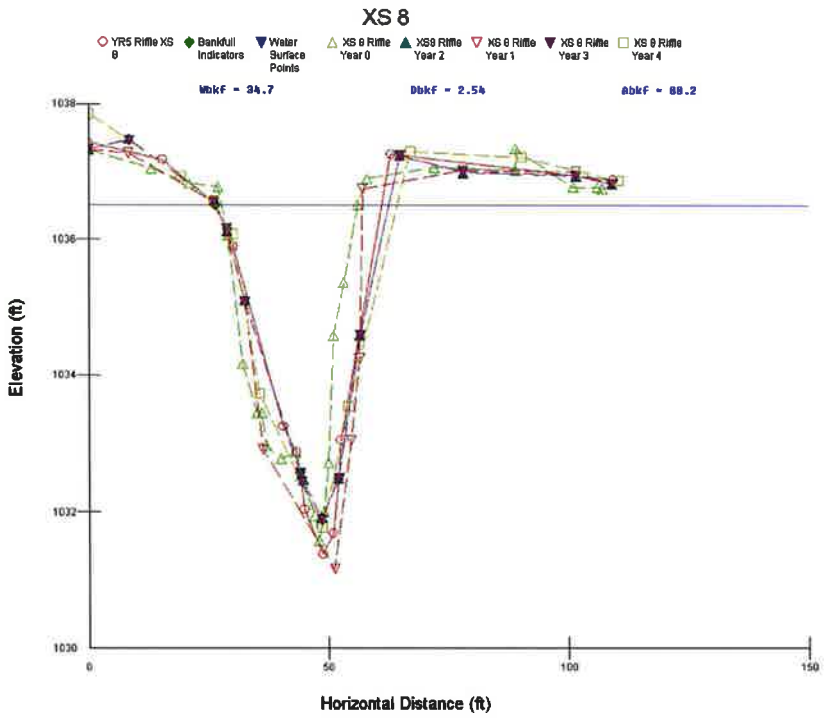


Summary Data

Bankfull Area	88.19 ft^2
Bankfull Width	34.67 ft
Mean Depth	2.54 ft
Maximum Depth	5.12 ft
Width/Depth Ratio	13.65
Entrenchment Ratio	3.16
Classification	C

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	Upper
DATE	9/28/10
CROSS SECTION:	8
FEATURE:	Riffle

Cross-section photo – looking downstream

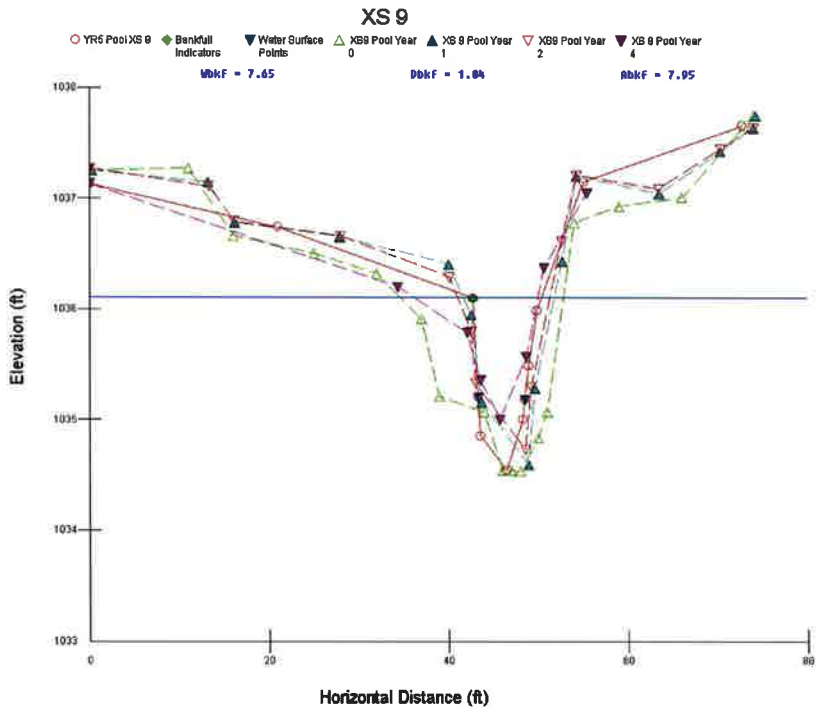


Summary Data

Bankfull Area	7.95 ft^2
Bankfull Width	7.65 ft
Mean Depth	1.04 ft
Maximum Depth	1.56 ft
Width/Depth Ratio	7.36
Entrenchment Ratio	9.51

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	UT2
DATE	9/28/10
CROSS SECTION:	9
FEATURE:	Pool

Cross-section photo – looking downstream

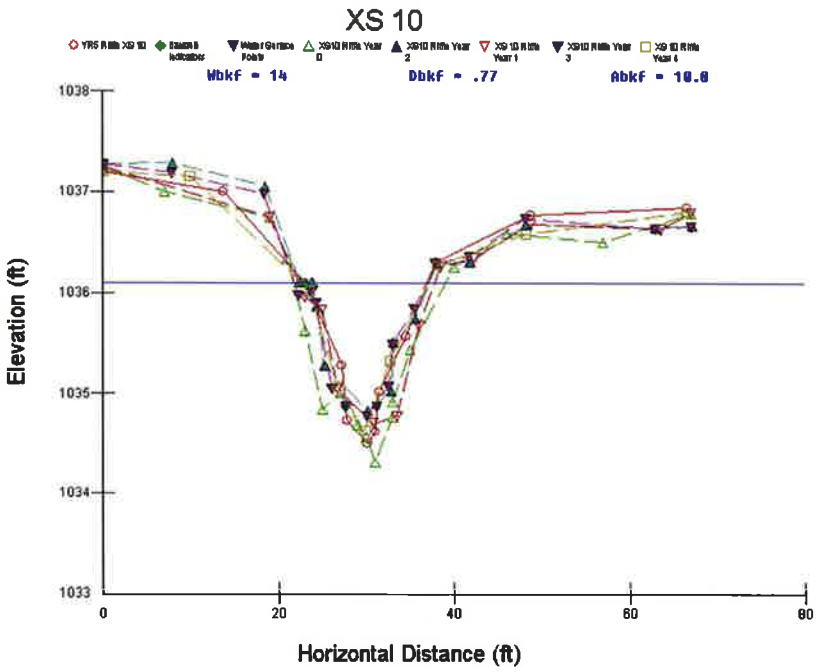


Summary Data

Bankfull Area	10.8 ft^2
Bankfull Width	14.0 ft
Mean Depth	0.77 ft
Maximum Depth	1.59 ft
Width/Depth Ratio	18.18
Entrenchment Ratio	4.75
Classification	C

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	UT2
DATE	9/28/10
CROSS SECTION:	10
FEATURE:	Riffle

Cross-section photo – looking downstream

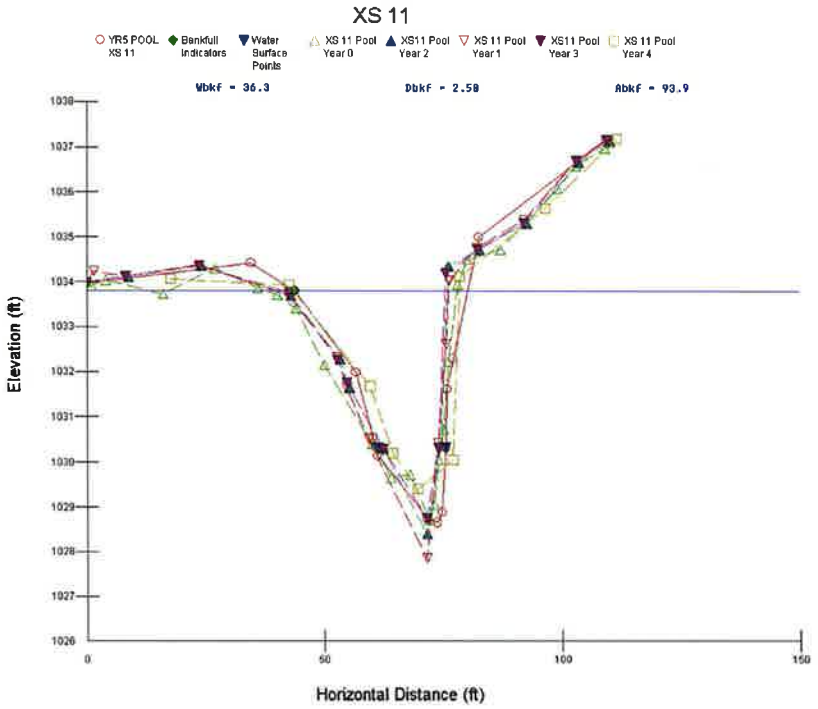


Summary Data

Bankfull Area	93.91 ft^2
Bankfull Width	36.33 ft
Mean Depth	2.58 ft
Maximum Depth	5.15 ft
Width/Depth Ratio	14.08
Entrenchment Ratio	3.01

PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	Lower
DATE	9/28/10
CROSS SECTION:	11
FEATURE:	Pool

Cross-section photo – channel partially obscured by vegetation

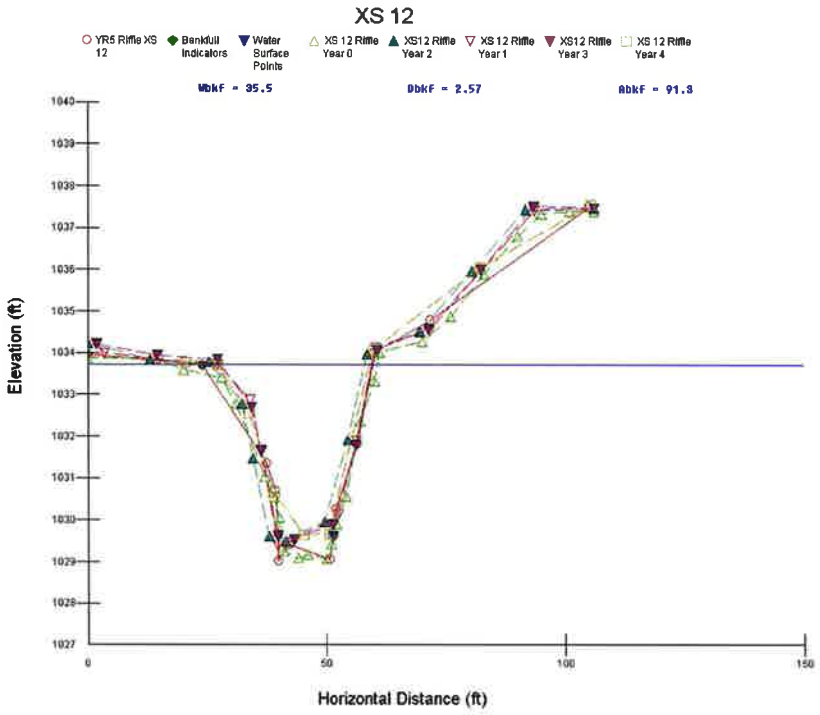


Summary Data

Bankfull Area	88.19 ft^2
Bankfull Width	32.92 ft
Mean Depth	2.68 ft
Maximum Depth	4.69 ft
Width/Depth Ratio	12.28
Entrenchment Ratio	3.19
Classification	C

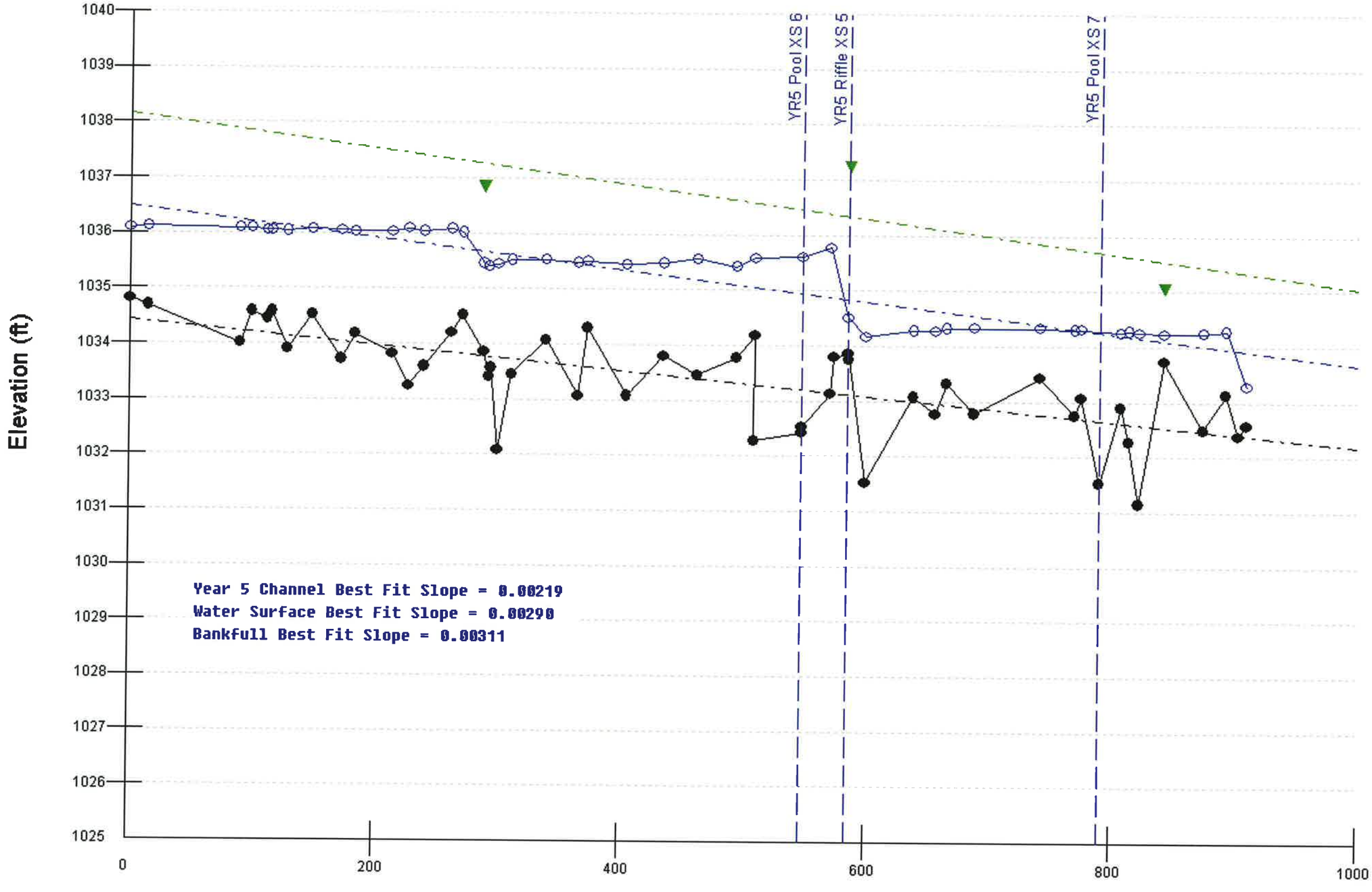
PROJECT	Bailey Fork
	D04006-2
	5-YEAR
TASK	Cross-Section
REACH	Lower
DATE	9/28/10
CROSS SECTION:	12
FEATURE:	Riffle

Cross-section photo – looking right to left bank

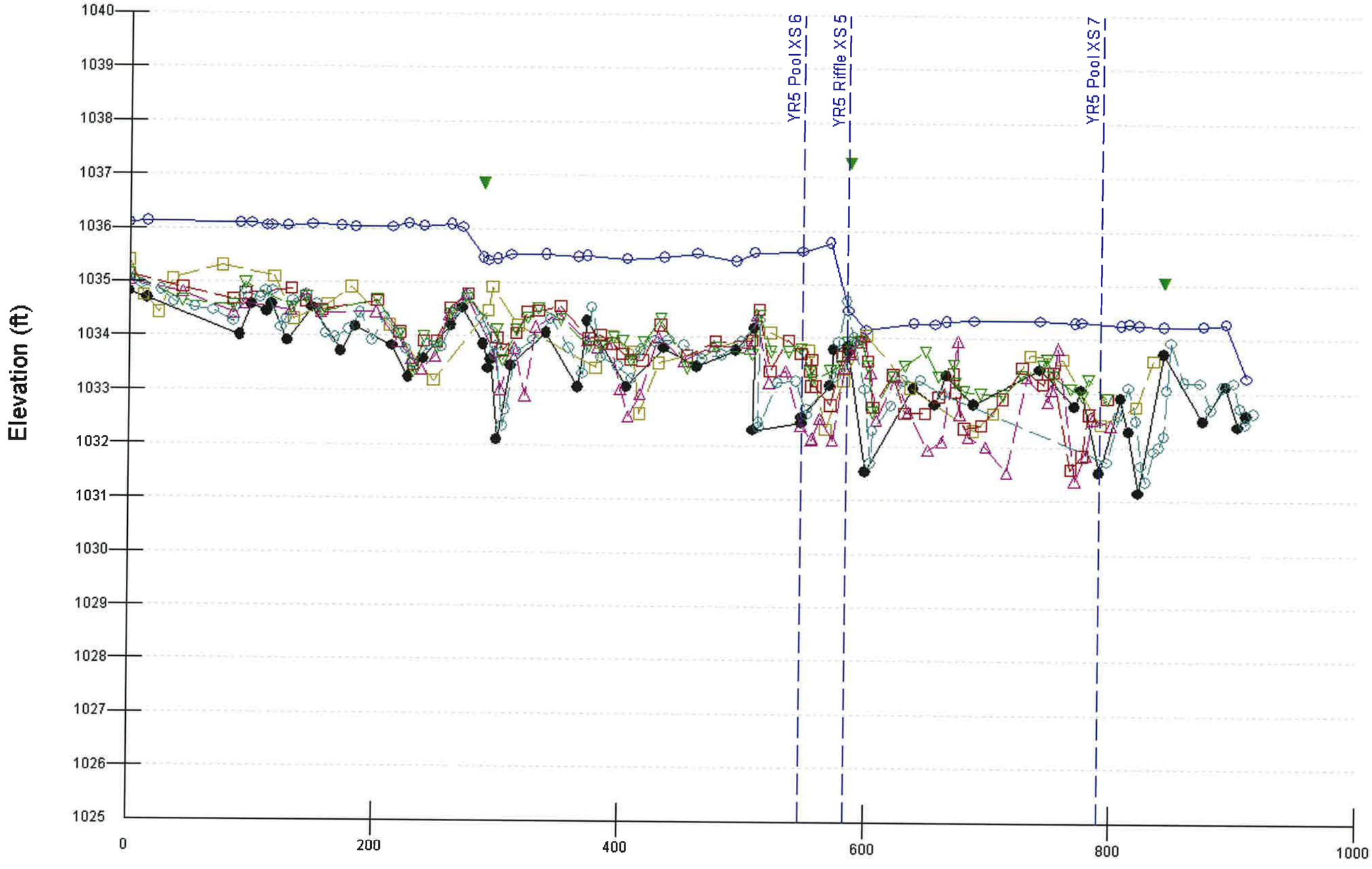


EMH&T

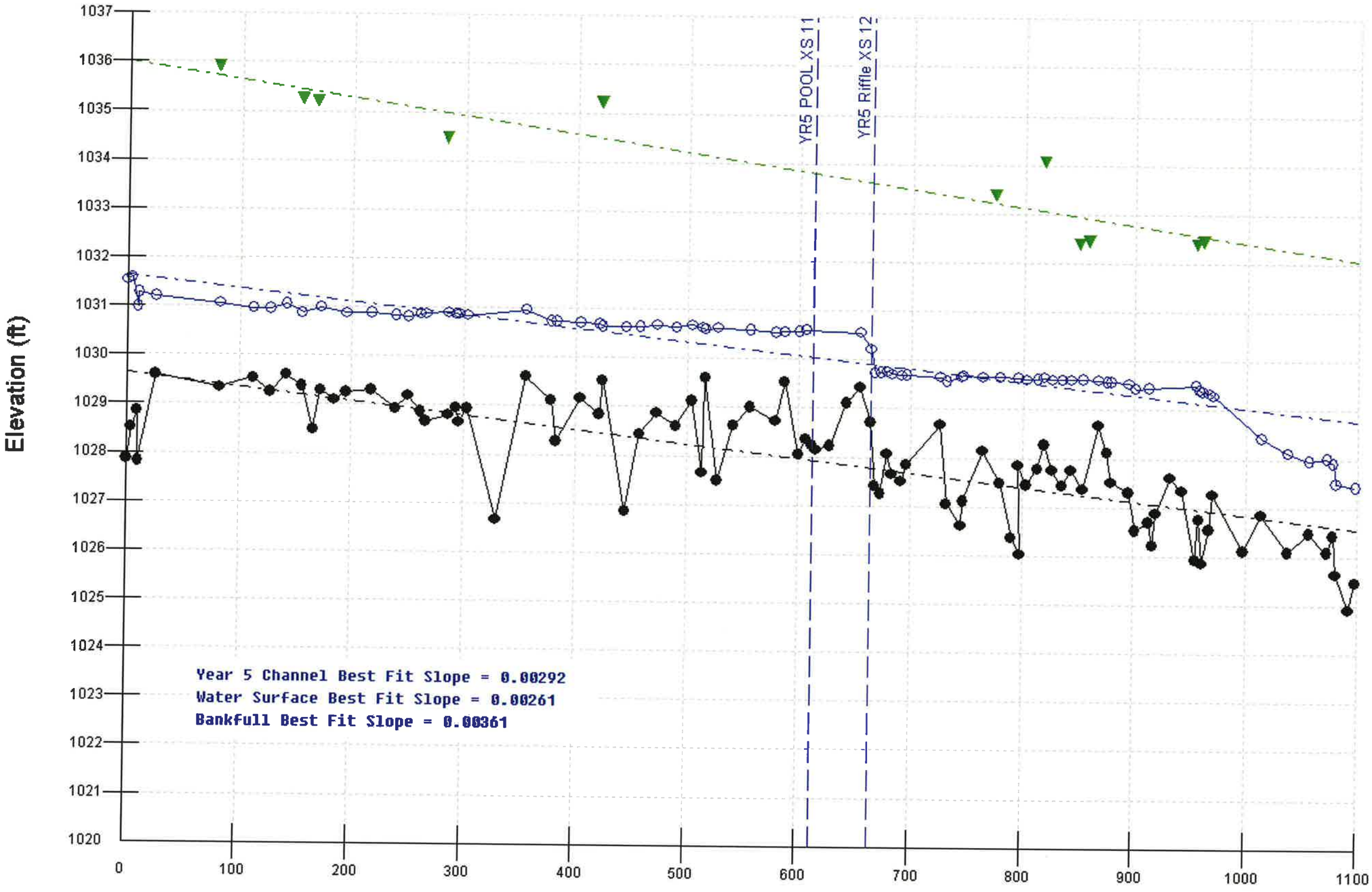
Upper Bailey - Year 5



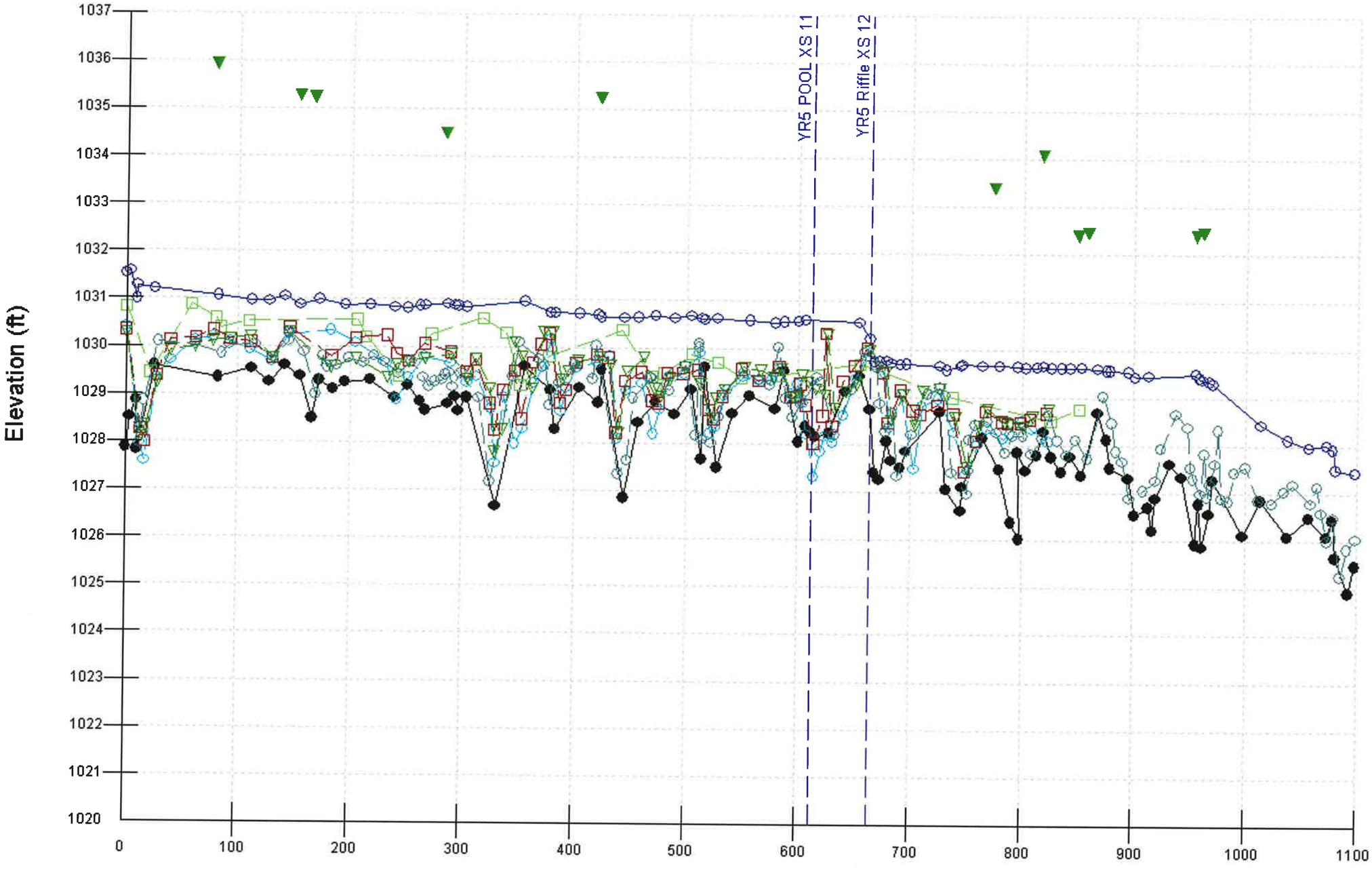
Upper Bailey - Year 5



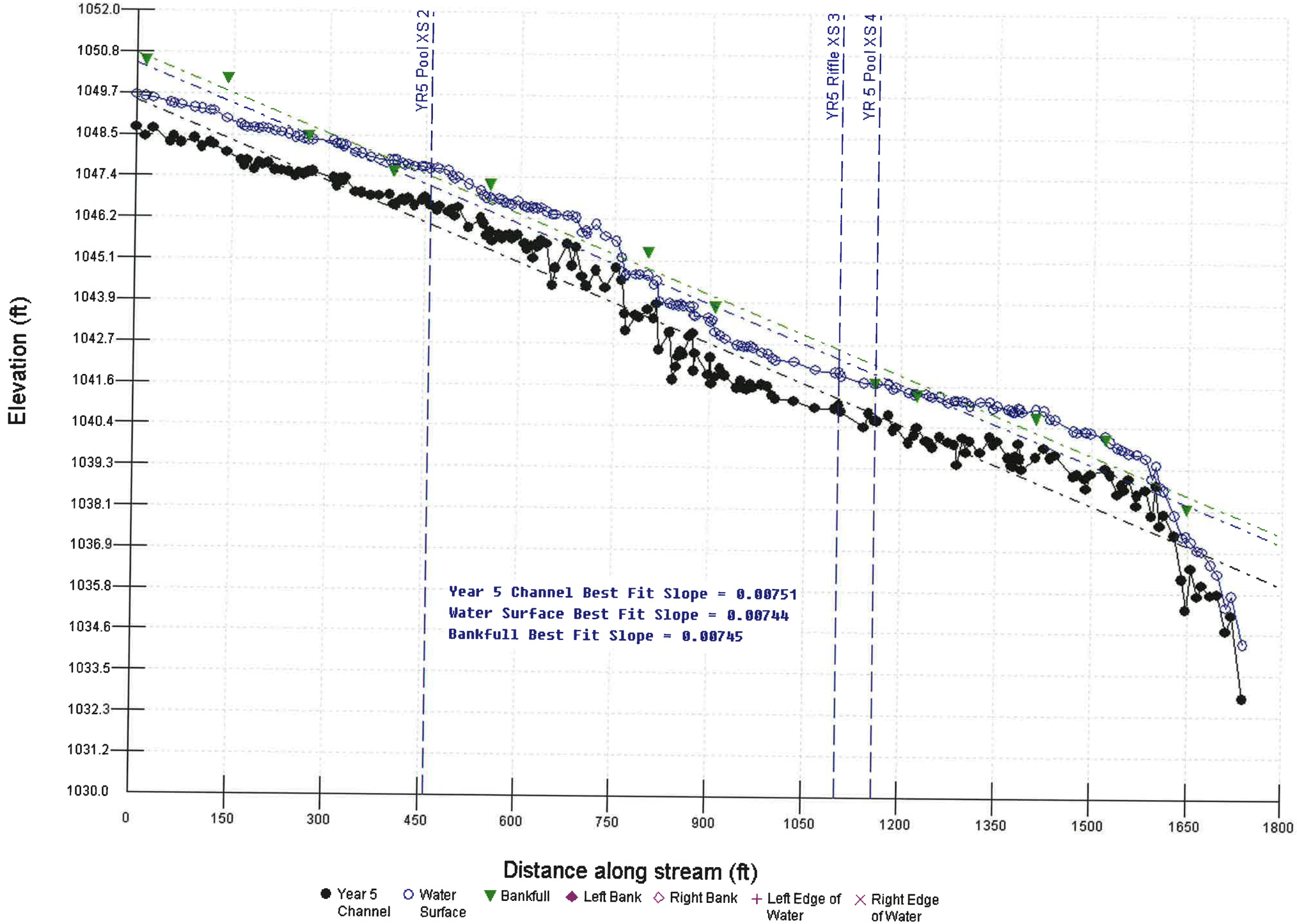
Lower Bailey Fork - Year 5



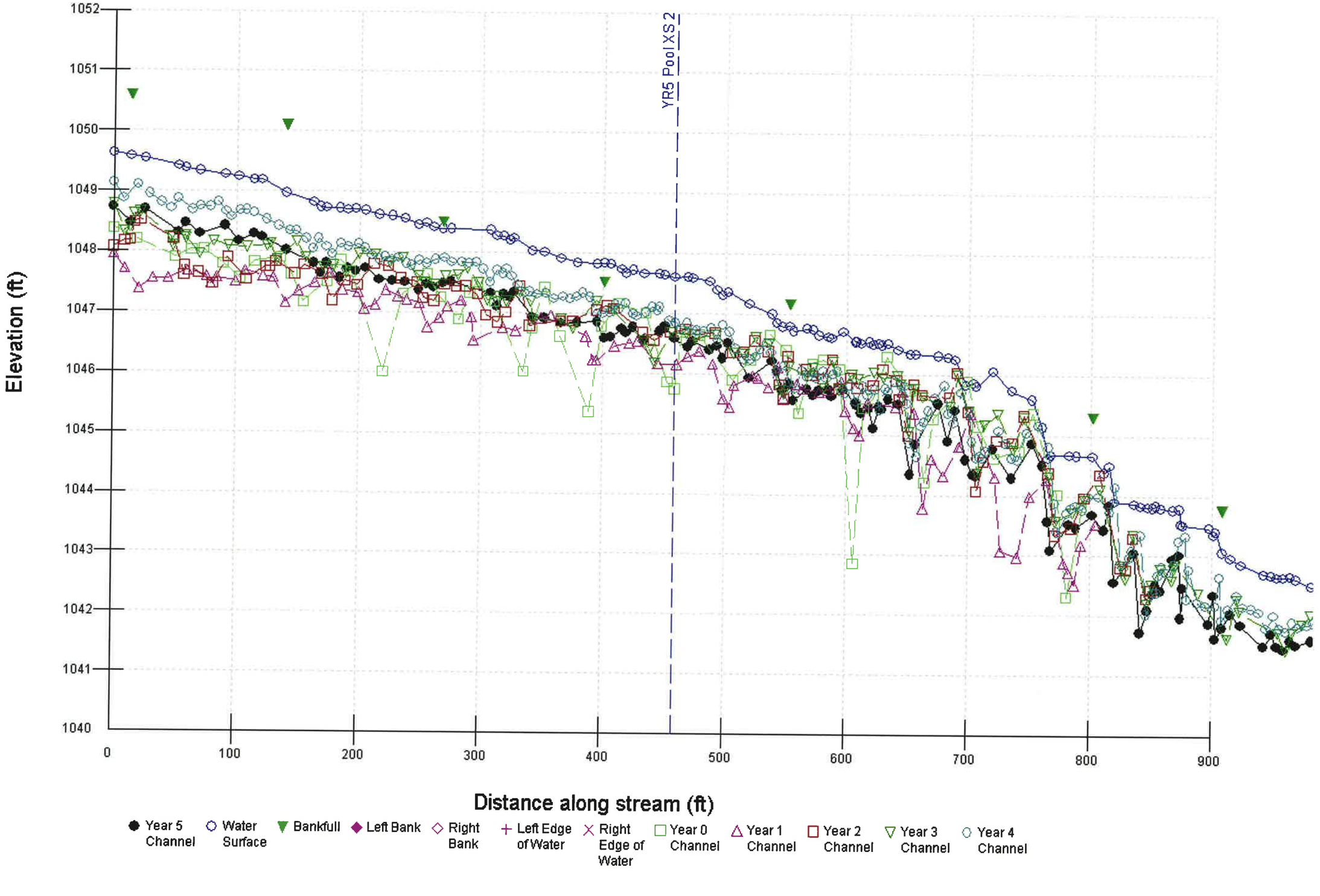
Lower Bailey Fork - Year 5



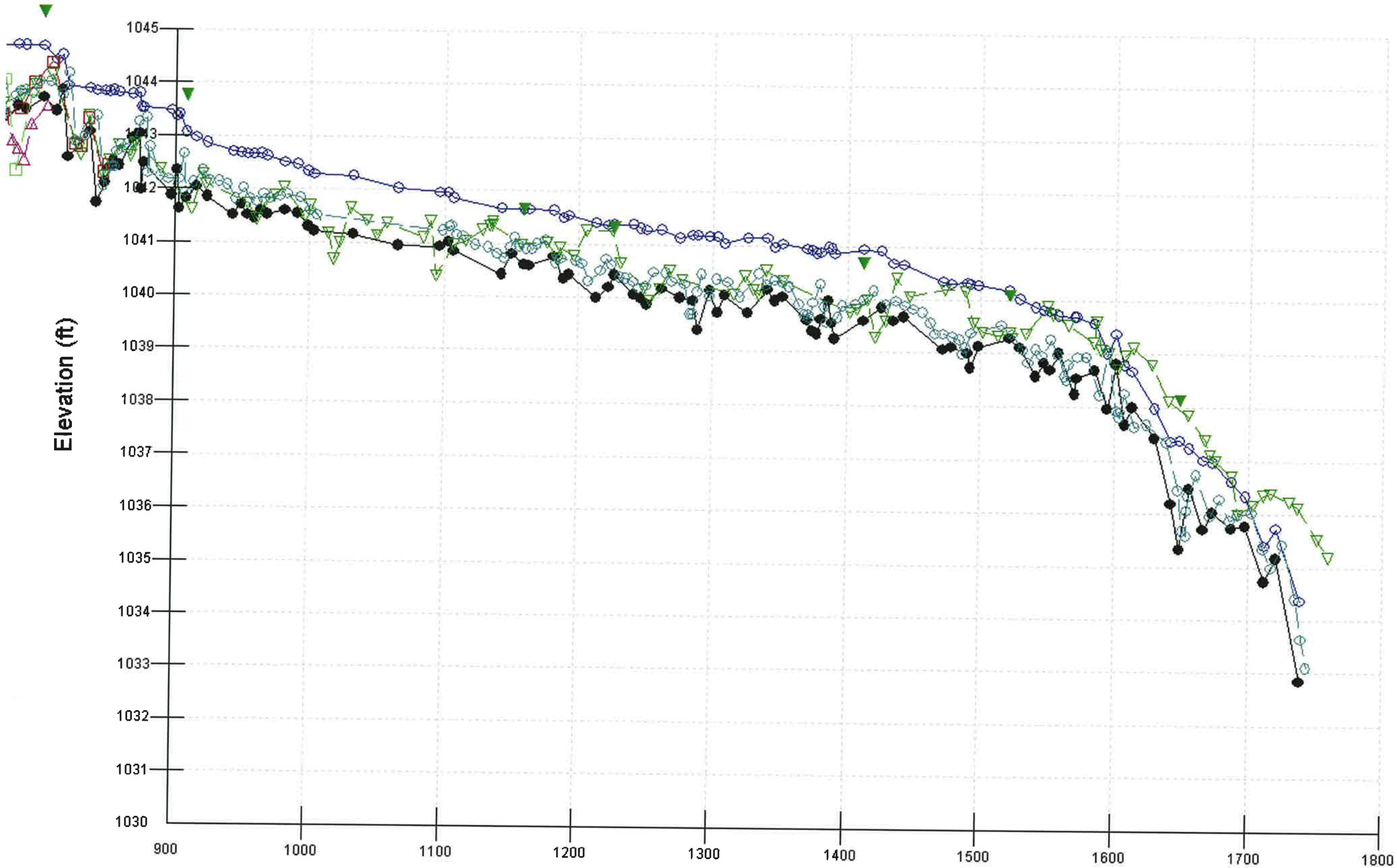
UT1- Year 5


Elevation (ft)
1052.0
1050.8
1049.7
1048.5
1047.4
1046.2
1045.1
1043.9
1042.7
1041.6
1040.4
1039.3
1038.1
1036.9
1035.8
1034.6
1033.5
1032.3
1031.2
1030.0
YR5 Pool XS 2
YR5 Riffle XS 3
YR 5 Pool XS 4
Year 5 Channel Best Fit Slope = 0.00751
Water Surface Best Fit Slope = 0.00744
Bankfull Best Fit Slope = 0.00745
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
Distance along stream (ft)
Year 5 Channel
Water Surface
Bankfull
Left Bank
Right Bank
Left Edge of Water
Right Edge of Water

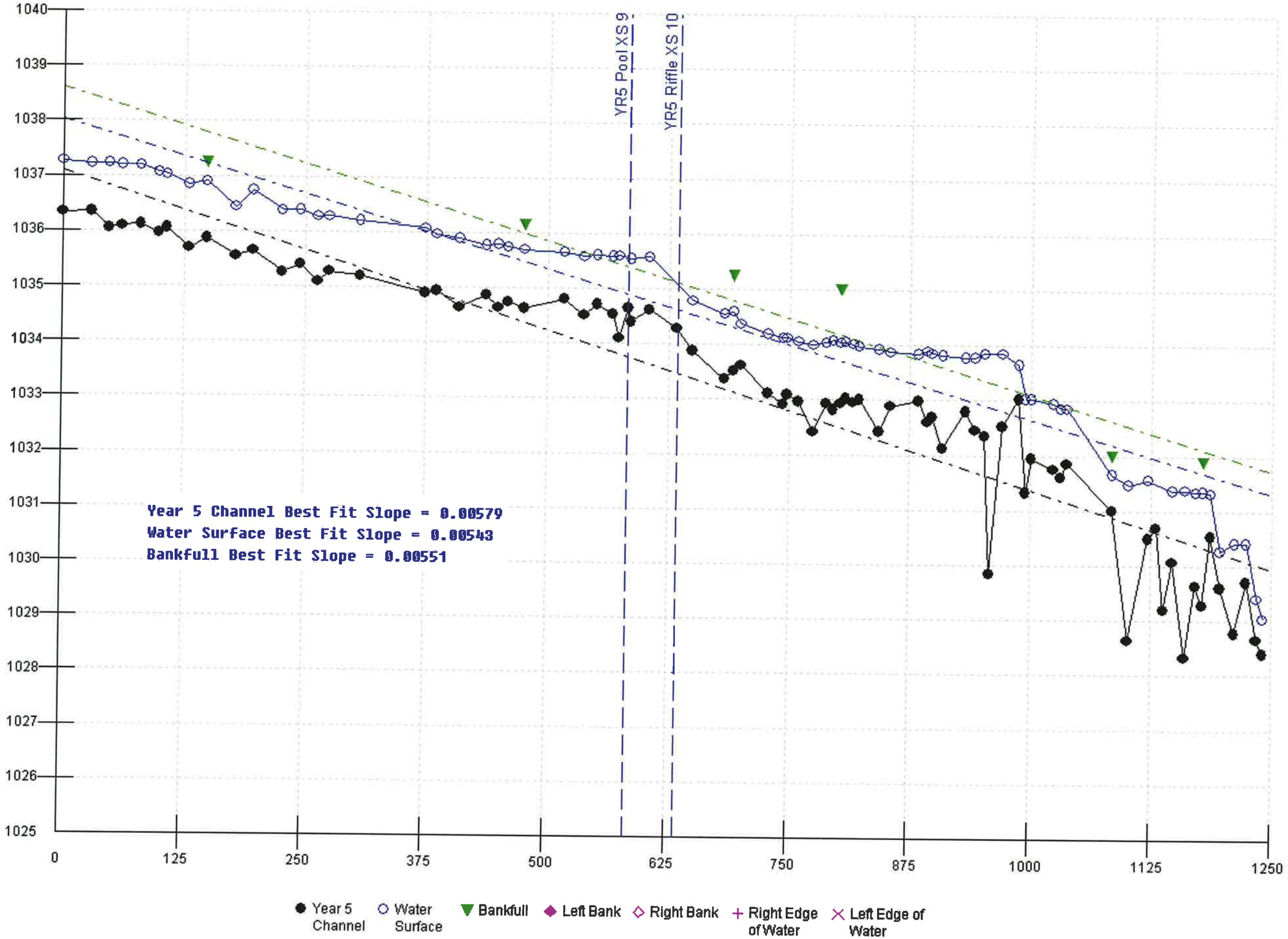
UT1- Year 5


YR5 Pool XS 2
Elevation (ft)
1052
1051
1050
1049
1048
1047
1046
1045
1044
1043
1042
1041
1040
0
100
200
300
400
500
600
700
800
900
Distance along stream (ft)
Year 5 Channel
Water Surface
Bankfull
Left Bank
Right Bank
Left Edge of Water
Right Edge of Water
Year 0 Channel
Year 1 Channel
Year 2 Channel
Year 3 Channel
Year 4 Channel

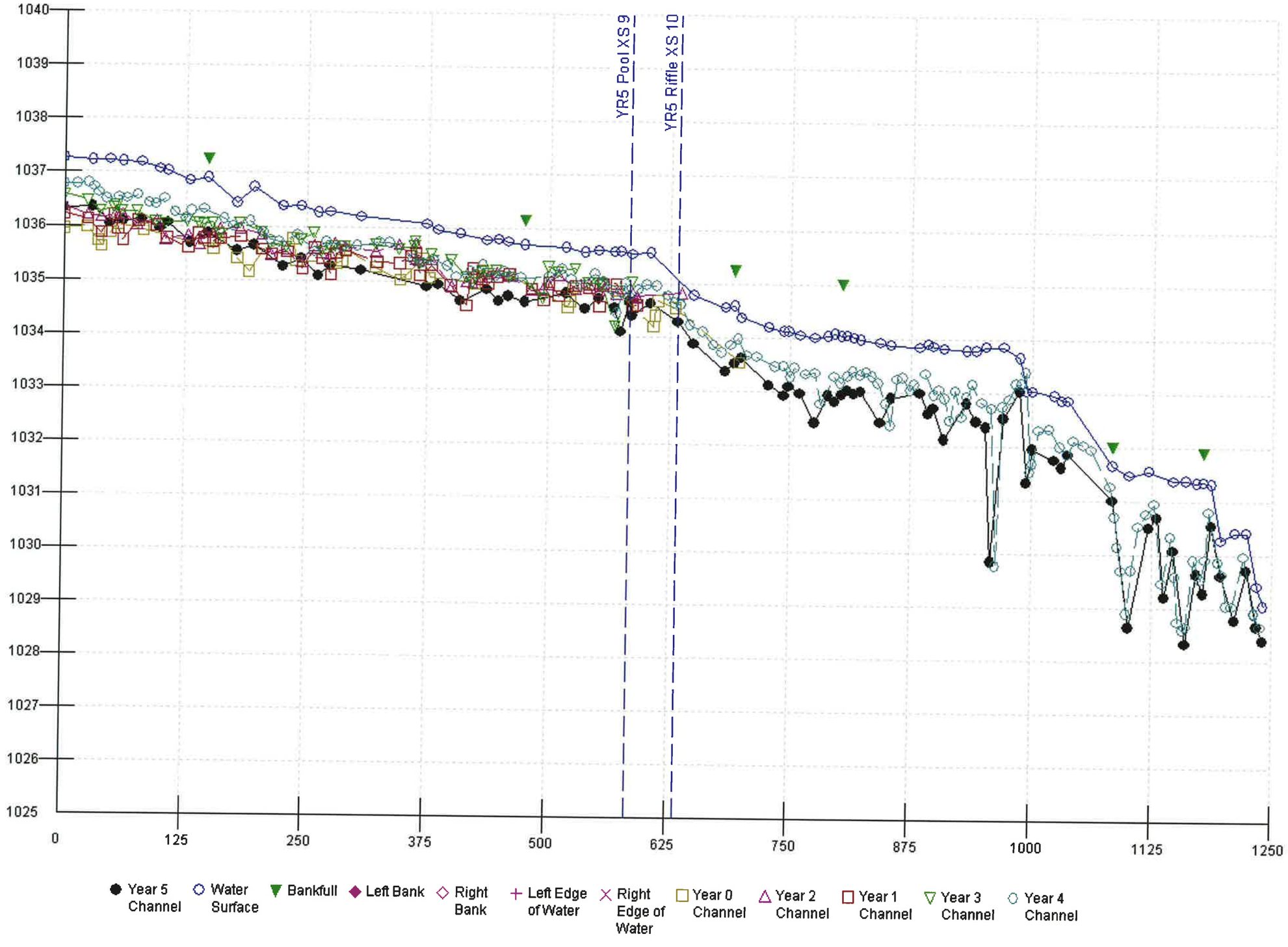
UT1- Year 5


Elevation (ft)
1045
1044
1043
1042
1041
1040
1039
1038
1037
1036
1035
1034
1033
1032
1031
1030
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
Distance along stream (ft)
Year 5 Channel
Water Surface
Bankfull
Left Bank
Right Bank
Left Edge of Water
Right Edge of Water
Year 0 Channel
Year 1 Channel
Year 2 Channel
Year 3 Channel
Year 4 Channel

UT2 - Year 5


YR5 Pool XS 9
YR5 Riffle XS 10
Year 5 Channel Best Fit Slope = 0.00579
Water Surface Best Fit Slope = 0.00543
Bankfull Best Fit Slope = 0.00551
1040
1039
1038
1037
1036
1035
1034
1033
1032
1031
1030
1029
1028
1027
1026
1025
0
125
250
375
500
625
750
875
1000
1125
1250
Year 5 Channel
Water Surface
Bankfull
Left Bank
Right Bank
Right Edge of Water
Left Edge of Water

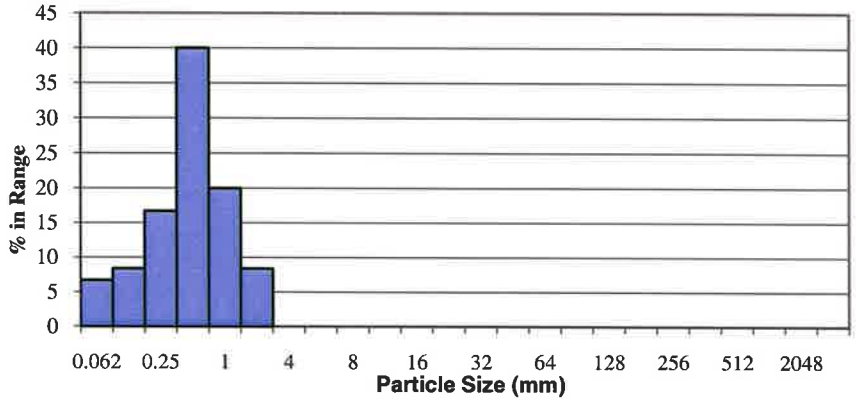
UT2 - Year 5

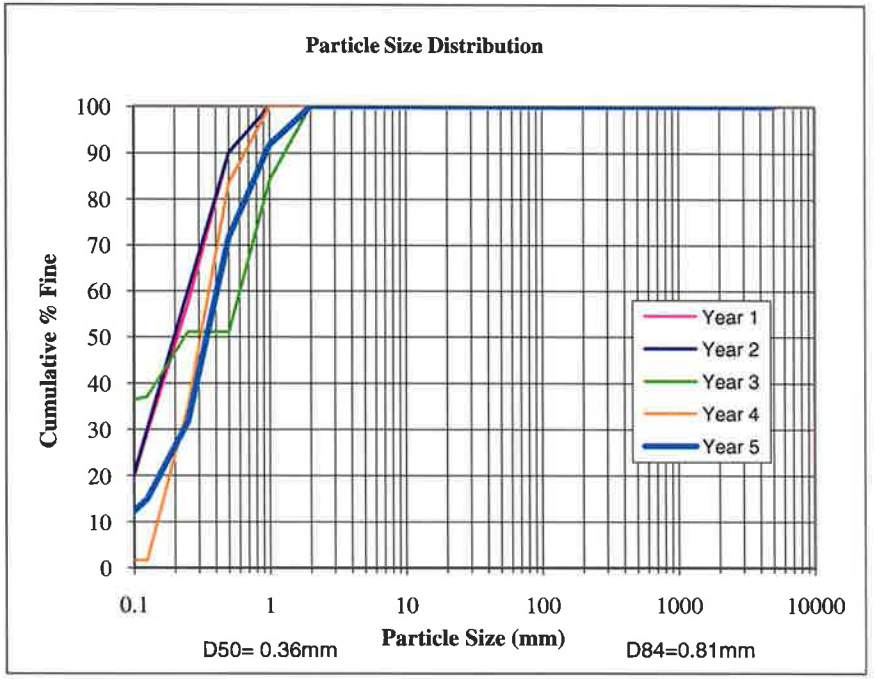

YR5 Pool XS 9
YR5 Riffle XS 10
1040
1039
1038
1037
1036
1035
1034
1033
1032
1031
1030
1029
1028
1027
1026
1025
0
125
250
375
500
625
750
875
1000
1125
1250
Year 5 Channel
Water Surface
Bankfull
Left Bank
Right Bank
Left Edge of Water
Right Edge of Water
Year 0 Channel
Year 2 Channel
Year 1 Channel
Year 3 Channel
Year 4 Channel

Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	4	7	7
Very Fine Sand	0.062-0.125	5	8	15
Fine Sand	0.125-0.25	10	17	32
Medium Sand	0.25-0.5	24	40	72
Coarse Sand	0.5-1.0	12	20	92
Very Coarse Sand	1.0-2.0	5	8	100
Very Fine Gravel	2.0-4.0	0	0	100
Fine Gravel	4.0-5.7	0	0	100
Fine Gravel	5.7-8.0	0	0	100
Medium Gravel	8.0-11.3	0	0	100
Medium Gravel	11.3-16.0	0	0	100
Coarse Gravel	16.0-22.6	0	0	100
Coarse Gravel	22.6-32	0	0	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		60	100	

Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	UT1	**X Sec**	2
Date	9/28/2010	**Sta No.**	4+50

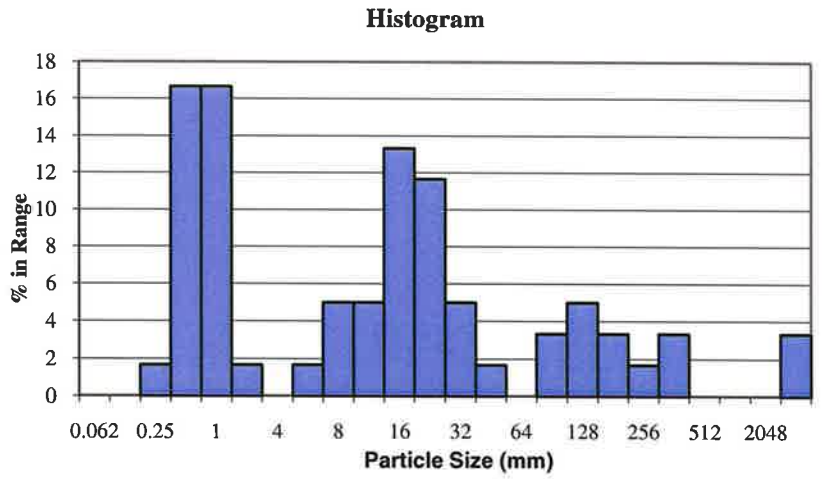
Histogram

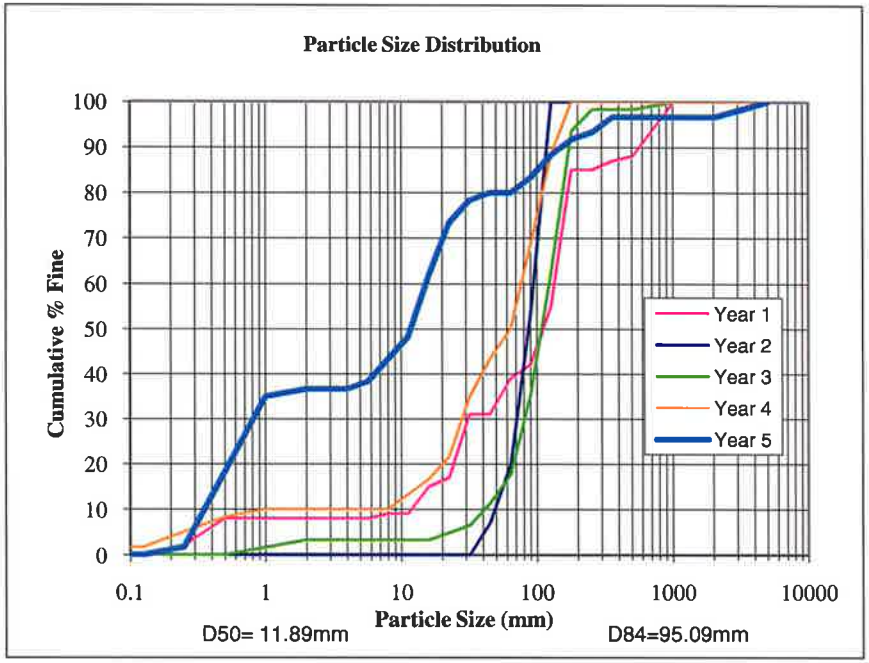




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	1	2	2
Medium Sand	0.25-0.5	10	17	18
Coarse Sand	0.5-1.0	10	17	35
Very Coarse Sand	1.0-2.0	1	2	37
Very Fine Gravel	2.0-4.0	0	0	37
Fine Gravel	4.0-5.7	1	2	38
Fine Gravel	5.7-8.0	3	5	43
Medium Gravel	8.0-11.3	3	5	48
Medium Gravel	11.3-16.0	8	13	62
Coarse Gravel	16.0-22.6	7	12	73
Coarse Gravel	22.6-32	3	5	78
Very Coarse Gravel	32-45	1	2	80
Very Coarse Gravel	45-64	0	0	80
Small Cobble	64-90	2	3	83
Small Cobble	90-128	3	5	88
Large Cobble	128-180	2	3	92
Large Cobble	180-256	1	2	93
Small Boulder	256-362	2	3	97
Small Boulder	362-512	0	0	97
Medium Boulder	512-1024	0	0	97
Large Boulder	1024-2048	0	0	97
Bedrock	<2048	2	3	100
Totals		60	100	

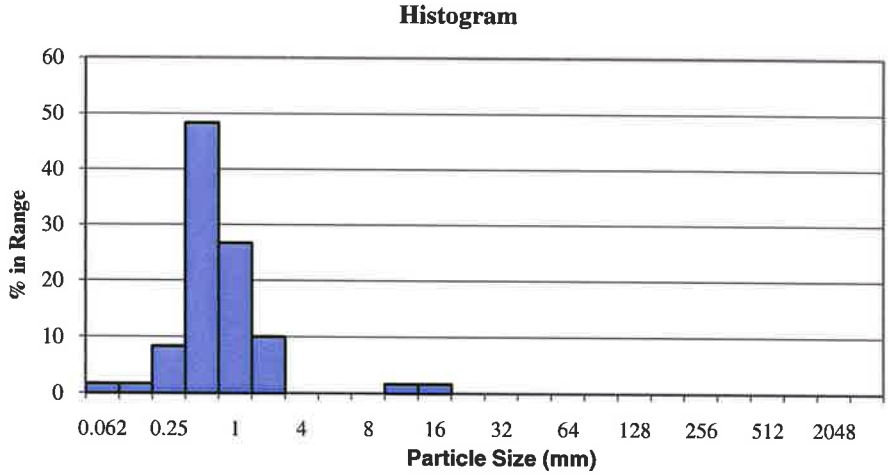
Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	Upper	**X Sec**	5
Date	9/28/2010	**Sta No.**	6+00

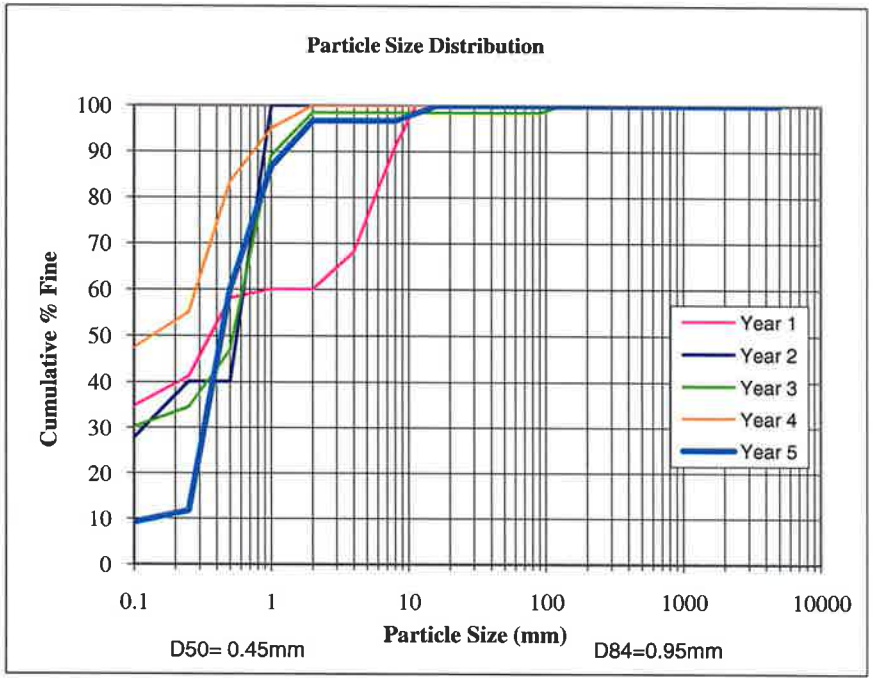




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	1	2	2
Very Fine Sand	0.062-0.125	1	2	3
Fine Sand	0.125-0.25	5	8	12
Medium Sand	0.25-0.5	29	48	60
Coarse Sand	0.5-1.0	16	27	87
Very Coarse Sand	1.0-2.0	6	10	97
Very Fine Gravel	2.0-4.0	0	0	97
Fine Gravel	4.0-5.7	0	0	97
Fine Gravel	5.7-8.0	0	0	97
Medium Gravel	8.0-11.3	1	2	98
Medium Gravel	11.3-16.0	1	2	100
Coarse Gravel	16.0-22.6	0	0	100
Coarse Gravel	22.6-32	0	0	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		60	100	

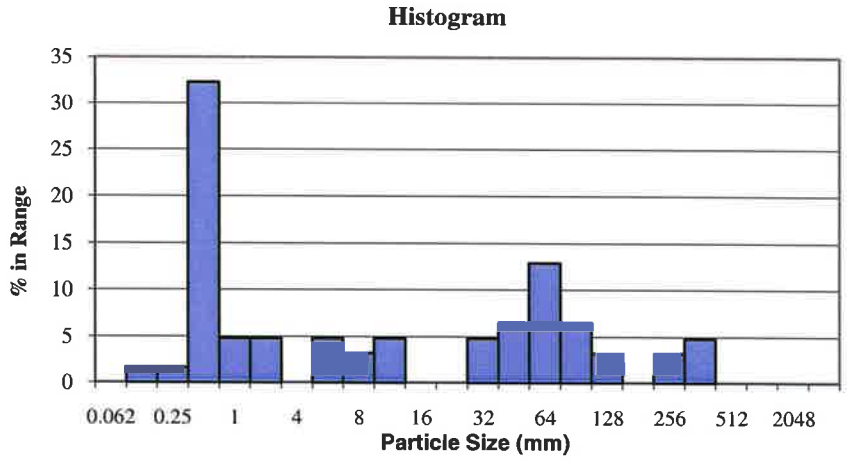
Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	Upper	**X Sec**	7
Date	9/28/2010	**Sta No.**	11+00

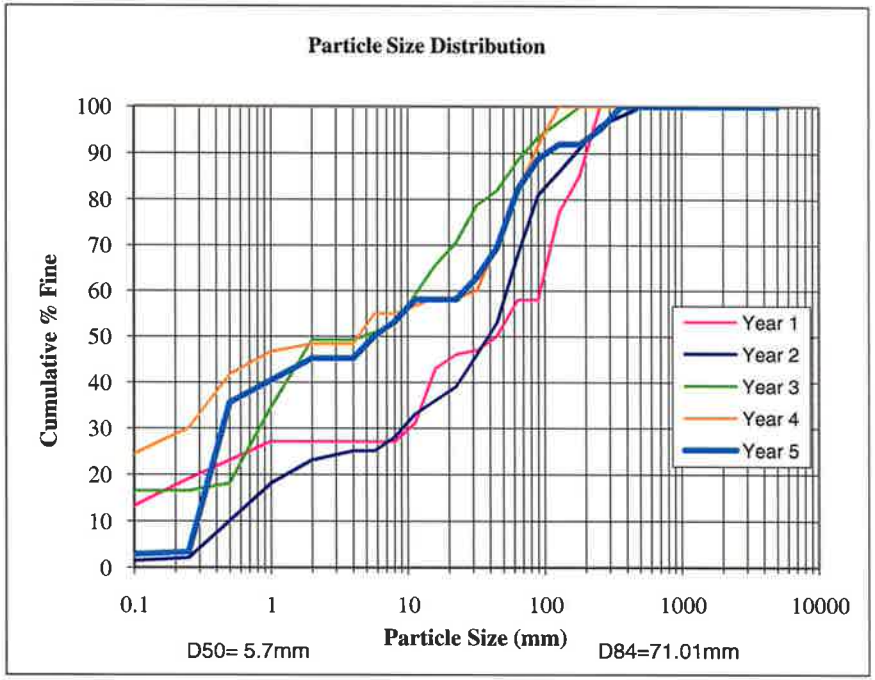




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	1	2	2
Fine Sand	0.125-0.25	1	2	3
Medium Sand	0.25-0.5	20	32	35
Coarse Sand	0.5-1.0	3	5	40
Very Coarse Sand	1.0-2.0	3	5	45
Very Fine Gravel	2.0-4.0	0	0	45
Fine Gravel	4.0-5.7	3	5	50
Fine Gravel	5.7-8.0	2	3	53
Medium Gravel	8.0-11.3	3	5	58
Medium Gravel	11.3-16.0	0	0	58
Coarse Gravel	16.0-22.6	0	0	58
Coarse Gravel	22.6-32	3	5	63
Very Coarse Gravel	32-45	4	6	69
Very Coarse Gravel	45-64	8	13	82
Small Cobble	64-90	4	6	89
Small Cobble	90-128	2	3	92
Large Cobble	128-180	0	0	92
Large Cobble	180-256	2	3	95
Small Boulder	256-362	3	5	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		62	100	

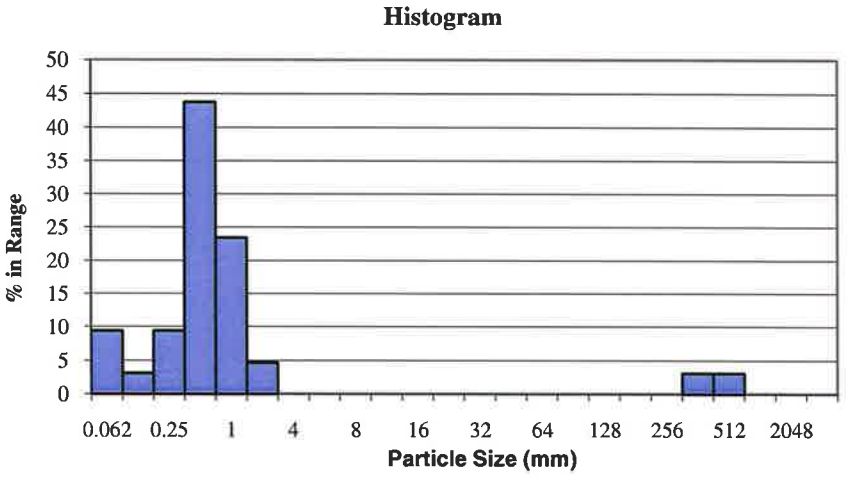
Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	UT2	**X Sec**	10
Date	9/28/2010	**Sta No.**	6+50

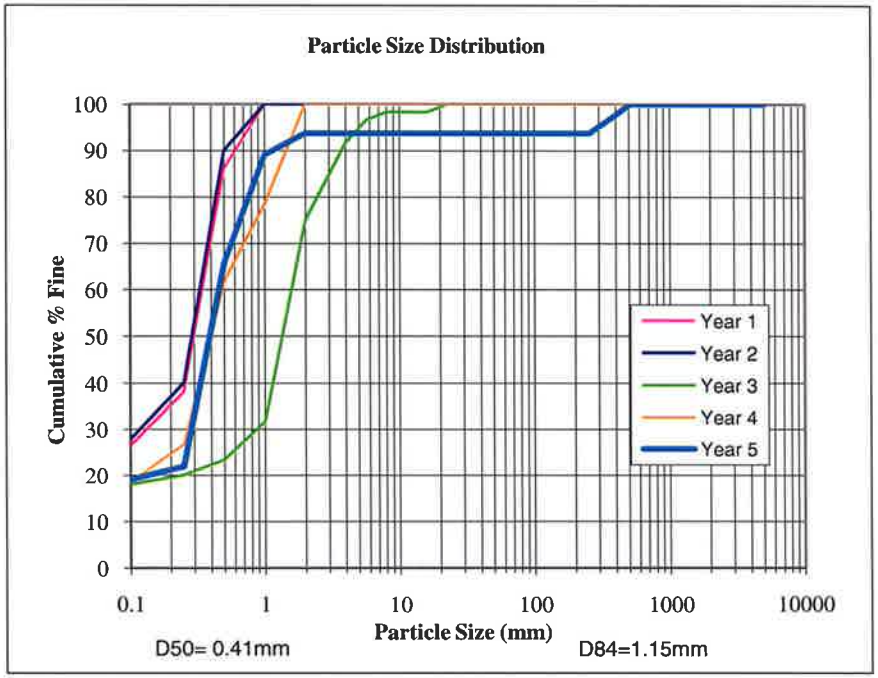




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	6	9	9
Very Fine Sand	0.062-0.125	2	3	13
Fine Sand	0.125-0.25	6	9	22
Medium Sand	0.25-0.5	28	44	66
Coarse Sand	0.5-1.0	15	23	89
Very Coarse Sand	1.0-2.0	3	5	94
Very Fine Gravel	2.0-4.0	0	0	94
Fine Gravel	4.0-5.7	0	0	94
Fine Gravel	5.7-8.0	0	0	94
Medium Gravel	8.0-11.3	0	0	94
Medium Gravel	11.3-16.0	0	0	94
Coarse Gravel	16.0-22.6	0	0	94
Coarse Gravel	22.6-32	0	0	94
Very Coarse Gravel	32-45	0	0	94
Very Coarse Gravel	45-64	0	0	94
Small Cobble	64-90	0	0	94
Small Cobble	90-128	0	0	94
Large Cobble	128-180	0	0	94
Large Cobble	180-256	0	0	94
Small Boulder	256-362	2	3	97
Small Boulder	362-512	2	3	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		64	100	

Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	Lower	**X Sec**	11
Date	9/28/2010	**Sta No.**	6+00

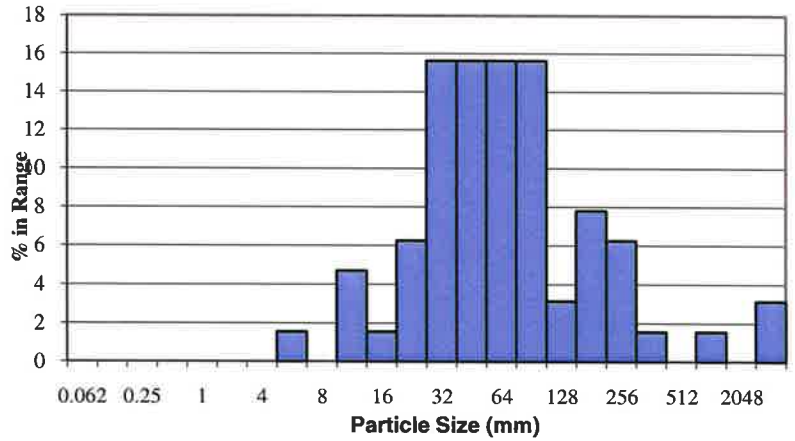


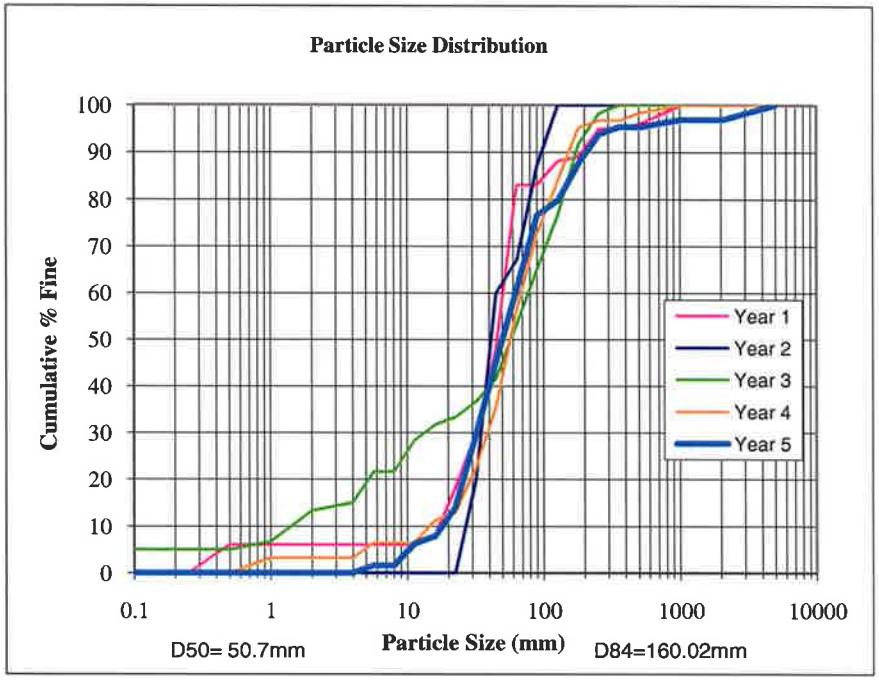


Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	0	0	0
Coarse Sand	0.5-1.0	0	0	0
Very Coarse Sand	1.0-2.0	0	0	0
Very Fine Gravel	2.0-4.0	0	0	0
Fine Gravel	4.0-5.7	1	2	2
Fine Gravel	5.7-8.0	0	0	2
Medium Gravel	8.0-11.3	3	5	6
Medium Gravel	11.3-16.0	1	2	8
Coarse Gravel	16.0-22.6	4	6	14
Coarse Gravel	22.6-32	10	16	30
Very Coarse Gravel	32-45	10	16	45
Very Coarse Gravel	45-64	10	16	61
Small Cobble	64-90	10	16	77
Small Cobble	90-128	2	3	80
Large Cobble	128-180	5	8	88
Large Cobble	180-256	4	6	94
Small Boulder	256-362	1	2	95
Small Boulder	362-512	0	0	95
Medium Boulder	512-1024	1	2	97
Large Boulder	1024-2048	0	0	97
Bedrock	<2048	2	3	100
Totals		64	100	

Bailey Fork Stream Restoration EEP Project No. D04006-02			
Reach	Lower	**X Sec**	12
Date	9/28/2010	**Sta No.**	6+50

Histogram





BF 1
Crest Gage 1 on UT1.
(EMH&T, Inc. 7/19/07)

BF 2
Crest Gage 4 on Lower Bailey.
(EMH&T, Inc. 10/17/07)

BF 3
Crest Gage 1 on UT1.
(EMH&T, Inc. 9/21/09)

BF 4
Crest Gage 2 on Upper Bailey.
(EMH&T, Inc. 9/21/09)

BF 5
Crest Gage 3 on UT2.
(EMH&T, Inc. 9/21/09)

BF 6
Crest Gage 4 on Lower Bailey.
(EMH&T, Inc. 9/21/09)

BF 7
Crest Gage 4 on Lower Bailey.
(EMH&T, Inc. 09/28/10)

EMH&T
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BURKE COUNTY, NORTH CAROLINA

BAILEY FORK

MONITORING

APPENDIX B

STREAM PROBLEM AREA PLAN VIEW – YEAR 4

Date: January, 2011

Scale: 1" = 200'

Job No: 2006-1626

SPA 1
Scour hole on the right bank of Upper Bailey Fork near station 5+00.
(EMH&T, Inc. 9/18/10)