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Engineers, Surveyors, Planners, Scientists

February 5, 2011

Mr. Guy Pearce
Full Delivery Supervisor
Ecosystem Enhancement Program
2728 Capital Blvd., Suite 1H 103
Raleigh, North Carolina 27604

Subject: Year 5 Monitoring Report for Stream Mitigation of South Muddy Creek Tributaries
SCO# D04006-01

Dear Guy,

On behalf of Wetlands Resource Center, EMH&T Inc. is pleased to submit the Year 5 Monitoring Report for the South Muddy Creek Tributaries (SCO# D04006-01). This report contains data from the vegetation monitoring, conducted in September 2010, and data from the stream monitoring, completed in September 2010. Three hard copies and one electronic copy of the document are being provided. Questions regarding this monitoring report may be directed to Cal Miller of Wetlands Resource Center at (614) 864-7511 or me at (614) 775-4506.

Sincerely,

EVANS, MECHWART, HAMBLETON & TILTON, INC.

Megan F. Wolf
Environmental Scientist

Enclosure

Copies: Cal Miller, WRC

Year 5 Monitoring Report for South Muddy Creek Tributaries (Queen Properties)

South Muddy Creek Tributaries
McDowell County, NC
SCO # D04006-01

Prepared for:
NCDENR – EEP
2728 Capital Blvd, Suite 1H 103
Raleigh NC 27604

Ecosystem Enhancement PROGRAM

Submitted: February 2010

Prepared by:

Wetlands Resource Center
3970 Bowen Road
Canal Winchester, Ohio 43110
Project Manager: Cal Miller
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And

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Columbus, Ohio 43054
Project Manager: Miles F. Hebert, P.E.
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Evans, Mechwart, Hambleton & Tilton, Inc.
Engineers, Surveyors, Planners, Scientists

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I. EXECUTIVE SUMMARY

The South Muddy Creek Tributaries restoration project is located near Dysartsville in McDowell County, North Carolina. The stream channels included in this project are designated as Tributaries A, A2, B and C. Prior to restoration, Tributaries A and A2 were drainage channels that had experienced modification in the form of ditching and vegetative management. Tributaries B and C were natural channels that were in a degraded condition attributed to head-cutting and streambank erosion exacerbated by cattle intrusion. The project consists of a combination of Priority 1 and Priority 2 Restoration and Enhancement Level 1. The project goal for the restoration plan, completed in 2005, was to re-establish geomorphologic features consistent with natural stream channel characteristics. Elements of the restoration design included grade control and bank stabilization using natural materials and native plantings, reconnection of the channels to functional floodplains, and the incorporation of instream habitat features including riffle/pool complexes to re-establish, sort and transport substrate materials. The following report documents the Year 5 Annual Monitoring for this project.

Vegetative monitoring was completed in September 2010 using the methodology of the Carolina Vegetation Survey. Year 5 stem counts completed in 30 vegetation plots showed an average density of 522 stems per acre for the site, which exceeds the success criteria of 260 stems/acre after 5 years. Two individual plots have stem densities below the minimum; planted stems have been added to these plots, increasing the stem count over the original monitoring period and bringing these plots to a stem count that meets the final Year 5 criteria. In addition, a substantial number of recruit stems have been found across the site. The recruit stems increase the total stem density across the site to 841 stems per acre.

A few vegetative problem areas of low concern were noted in the project area in previous monitoring years. These included scattered populations of rapidly-spreading species. The problematic species have been proactively managed by herbicide treatment and currently pose no threat to the survival of planted woody species throughout the project reaches.

Previous monitoring identified some problem areas along the tributaries of South Muddy Creek, including areas of bank scour and aggradation. Areas first noted as problems in a previous year of monitoring now have extensive vegetative development, which has increased streambank stability. Several areas of aggradation were noted in Year 5. Sand is the dominant streambed substrate in the project reaches, and as such, sediment deposition is attributed to high sediment supply readily available in the contribution watershed. It is noted that at all locations of aggradation, the channel and streambanks are stable. In 2009, one area of noted aggradation involved the upstream portion of Tributary A2. This section of the stream developed vegetation within the stream channel, which appeared to have decreased flows, thereby allowing additional sediment to drop into the channel. As was observed during the 2010 monitoring, the channel was returned to initial design conditions by removing fine sediment and in-stream vegetation in late 2009. Because of this, the tributary is better able to carry it's sediment load and maintains a stable morphology. As evidenced in the stream profile depicted in Appendix B., clearing of excessive sediment in Tributary A2 has created a generalized decrease in average stream bed profile elevations. The tributary has maintained stable dimensional characteristics throughout the final year of stream monitoring. A non-functional log sill on Tributary B, noted in the Year 4, was fixed prior to this Year 5 monitoring report. This fix has returned the grade control function of the structure.

The visual stream stability assessment revealed that the majority of stream features are functioning as designed and built on the project reaches. In Year 5, some log sills on Tributary B continue to be embedded in sand size sediment. However, the channel is stable at each location where aggradation has covered a structure. A few meanders were found in a limited state of erosion, none of which required maintenance. In addition, the meanders that had some level of erosion in previous years have continued to improve in 2010, due to the increased vegetative cover along the stream corridors. 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.

Year 5 dimensional measurements of the monumented cross-sections remain stable; generally within the range of values measured in previous years. Comparisons of the yearly long-term stream monitoring data show successive increases in channel-floodplain connectivity and increasingly stable channel dimensions throughout monitoring years 1-5. The comparison of the As-Built, Years 1-4, and Year 5 long-term stream monitoring profile data show natural evolution in the development of pool/riffle features as compared to as-built conditions. Median particle sizes of the stream channels ranged from very fine sand to very coarse sand. Median particle sized has therefore increased for the project, when compared to Year 4. Based on the crest gage network installed on the project reaches, the required two bankfull events have been recorded along each stream reach since construction was completed.

The following tables summarize the geomorphological changes along the restoration reaches for each stream.

Tributary A (Upper)

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**1,283 ft**	**1,609 ft**	**1,609 ft**	**1,609 ft**	**1,609 ft**	**1,609 ft**	**1,609 ft**
Bankfull Width	**6.6 ft**	**12.5 ft**	**16.3 ft**	**16.2 ft**	**15.3 ft**	**13.5 ft**	**10.5 ft**
Bankfull Mean Depth	**0.9 ft**	**0.9 ft**	**0.9 ft**	**0.9 ft**	**0.8 ft**	**0.6 ft**	**0.8 ft**
Bankfull Max Depth	**1.8 ft**	**1.5 ft**	**1.9 ft**	**1.9 ft**	**1.8 ft**	**1.6 ft**	**1.4 ft**
Width/Depth Ratio	**7.3**	**16.1**	**17.6**	**18.2**	**19.5**	**22.9**	**13.3**
Entrenchment Ratio	**1.4**	**4.1**	**3.2**	**3.2**	**3.7**	**4.1**	**4.1**
Bank Height Ratio	**3.6**	**1.1**	**1.1**	**1.0**	**1.0**	**1.0**	**1.0**
Sinuosity	**1.1**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**

Tributary A (Middle)

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**809 ft**	**1,094 ft**	**1,094 ft**	**1,094 ft**	**1,094 ft**	**1,094 ft**	**1,094 ft**
Bankfull Width	**6.6 ft**	**15.0 ft**	**14.6 ft**	**14.7 ft**	**14.6 ft**	**13.8 ft**	**14.5 ft**
Bankfull Mean Depth	**0.9 ft**	**0.8 ft**	**1.1 ft**	**1.1 ft**	**1.1 ft**	**1.0 ft**	**1.2 ft**
Bankfull Max Depth	**1.8 ft**	**1.5 ft**	**2.4 ft**	**2.1 ft**	**2.2 ft**	**2.3 ft**	**2.5 ft**
Width/Depth Ratio	**7.3**	**17.9**	**12.8**	**14.0**	**13.7**	**14.0**	**11.7**
Entrenchment Ratio	**1.4**	**4.0**	**4.6**	**4.2**	**4.2**	**4.8**	**4.6**
Bank Height Ratio	**3.6**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	**1.0**
Sinuosity	**1.0**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**

Tributary A (Lower)

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**5,179 ft**	**7,349 ft**	**7,349 ft**	**7,349 ft**	**7,349 ft**	**7,349 ft**	**7,349 ft**
Bankfull Width	**6.6 ft**	**22.1 ft**	**24.4 ft**	**25.3 ft**	**25.1 ft**	**26.0 ft**	**24.6 ft**
Bankfull Mean Depth	**0.7 ft**	**0.8 ft**	**0.9 ft**	**0.9 ft**	**0.9 ft**	**0.9 ft**	**0.9 ft**
Bankfull Max Depth	**1.4 ft**	**1.8 ft**	**1.9 ft**	**1.9 ft**	**1.9 ft**	**1.9 ft**	**2.0 ft**
Width/Depth Ratio	**8.9**	**23.5**	**29.0**	**28.6**	**27.7**	**31.4**	**31.0**
Entrenchment Ratio	**1.6**	**3.2**	**2.6**	**2.4**	**2.8**	**2.5**	**2.5**
Bank Height Ratio	**5.9**	**1.0**	**1.1**	**1.1**	**1.1**	**1.0**	**1.0**
Sinuosity	**1.0**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**

Tributary A2

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	322 ft	480 ft	480 ft	480 ft	480 ft	480 ft	480 ft
Bankfull Width	7.1 ft	17.9 ft	21.4 ft	21.7 ft	22.3 ft	21.3 ft	16.8 ft
Bankfull Mean Depth	0.6 ft	1.0 ft	0.8 ft	0.8 ft	0.7 ft	0.6 ft	1.0 ft
Bankfull Max Depth	1.1 ft	1.8 ft	1.6 ft	1.5 ft	1.3 ft	1.2 ft	1.9 ft
Width/Depth Ratio	11.8	17.7	26.1	27.2	30.2	36.6	16.7
Entrenchment Ratio	1.6	2.6	2.2	2.1	2.2	2.2	2.8
Bank Height Ratio	5.9	1.0	1.2	1.0	1.0	1.0	1.0
Sinuosity	1.1	1.4	1.4	1.4	1.4	1.4	1.4

Tributary B

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	1,279 ft	2,041 ft	2,041 ft	2,041 ft	2,041 ft	2,041 ft	2,041 ft
Bankfull Width	7.8 ft	24.9 ft	24.8 ft	27.0 ft	28.4 ft	27.5 ft	28.5 ft
Bankfull Mean Depth	0.6 ft	0.6 ft	0.8 ft	0.8 ft	0.8 ft	0.8 ft	0.8 ft
Bankfull Max Depth	1.2 ft	1.6 ft	1.9 ft	1.9 ft	1.8 ft	2.0 ft	2.1 ft
Width/Depth Ratio	12.6	41.3	32.0	31.1	38.6	33.8	37.8
Entrenchment Ratio	1.5	2.7	2.5	2.3	2.3	2.5	2.2
Bank Height Ratio	4.4	1.0	1.0	1.0	1.0	1.0	1.0
Sinuosity	1.1	1.6	1.6	1.6	1.6	1.6	1.6

Tributary C

Parameter	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	1,601 ft	1,601 ft	1,601 ft	1,601 ft	1,601 ft	1,601 ft
Bankfull Width	9.0 ft	9.4 ft	9.0 ft	9.4 ft	9.9 ft	9.8 ft
Bankfull Mean Depth	0.5 ft	0.5 ft	0.5 ft	0.5 ft	0.6 ft	0.6 ft
Bankfull Max Depth	0.7 ft	0.9 ft	0.8 ft	0.9 ft	0.9 ft	0.9 ft
Width/Depth Ratio	25.3	19.1	22.6	18.2	18.3	17.5
Entrenchment Ratio	2.5	2.5	2.7	2.7	1.9	2.4

II. PROJECT BACKGROUND

A. Location and Setting

The project is located in McDowell County, North Carolina, approximately two miles south of Interstate 40, between Marion and Morganton near the community of Dysartsville. The tributaries lie east of Muddy Creek Road, north of Pinnacle Church Road and west of Dysartsville Road, as shown on Figure 1. The stream channels included in the project are designated as Tributaries A, A2, B and C. Tributaries A, B and C confluence directly with South Muddy Creek. Tributary A2 confluences with Tributary A.

Directions to the project site are as follow:

> From Marion, follow Interstate 40 east to Dysartsville Road (Exit 94). Turn right onto Dysartsville Road to travel south for approximately 2 miles to Pinnacle Church Road. Follow Pinnacle Church Road to Muddy Creek Road, and turn right. The project site is on the east side of the road. This is private property; access to the stream corridor is limited to the dedicated ingress/egress included as part of the recorded Conservation Easement. Coordination with the property owner is encouraged prior to accessing the property.

B. Project Structure, Mitigation Type, Approach and Objectives

Pre-restoration land use surrounding the project tributaries consisted of agricultural croplands along Tributaries A and A2 and cattle pastureland along Tributaries B and C. The upper reaches of Tributaries A2, B and C were characterized by a mix of pastureland and limited wooded corridor. Tributaries A and A2 were drainage channels that had experienced modification in the form of ditching and vegetative management prior to restoration. Tributaries B and C are natural channels that, prior to restoration, were in a degraded condition attributed to head-cutting and streambank failure and erosion exacerbated by cattle intrusion and associated hoof shear. All of the tributary channels, prior to restoration, had narrow or denuded riparian corridors.

Tributaries A, A2 and B were surrounded by either cropland or pasture with no significant buffer prior to restoration. Tributaries B and C lacked cattle intrusion fencing that adversely impacted streambank stability. Tributary C was less degraded, prior to restoration, in that it had a significant wooded riparian corridor on the south (left) bank with well sorted and well graded bed materials. However, Tributary C was impacted by a significantly degraded riparian corridor on the north (right) bank, with numerous locations of streambank erosion and failure associated with cattle intrusion.

Restoration of the project streams re-established geomorphologic features consistent with natural stream channel characteristics. Results achieved are listed below.

- Bankfull channels constructed with the appropriate geometries to convey bankfull flows and transport suspended and bedload materials available to the streams.
- Stable channel patterns consistent with natural streams in the region.

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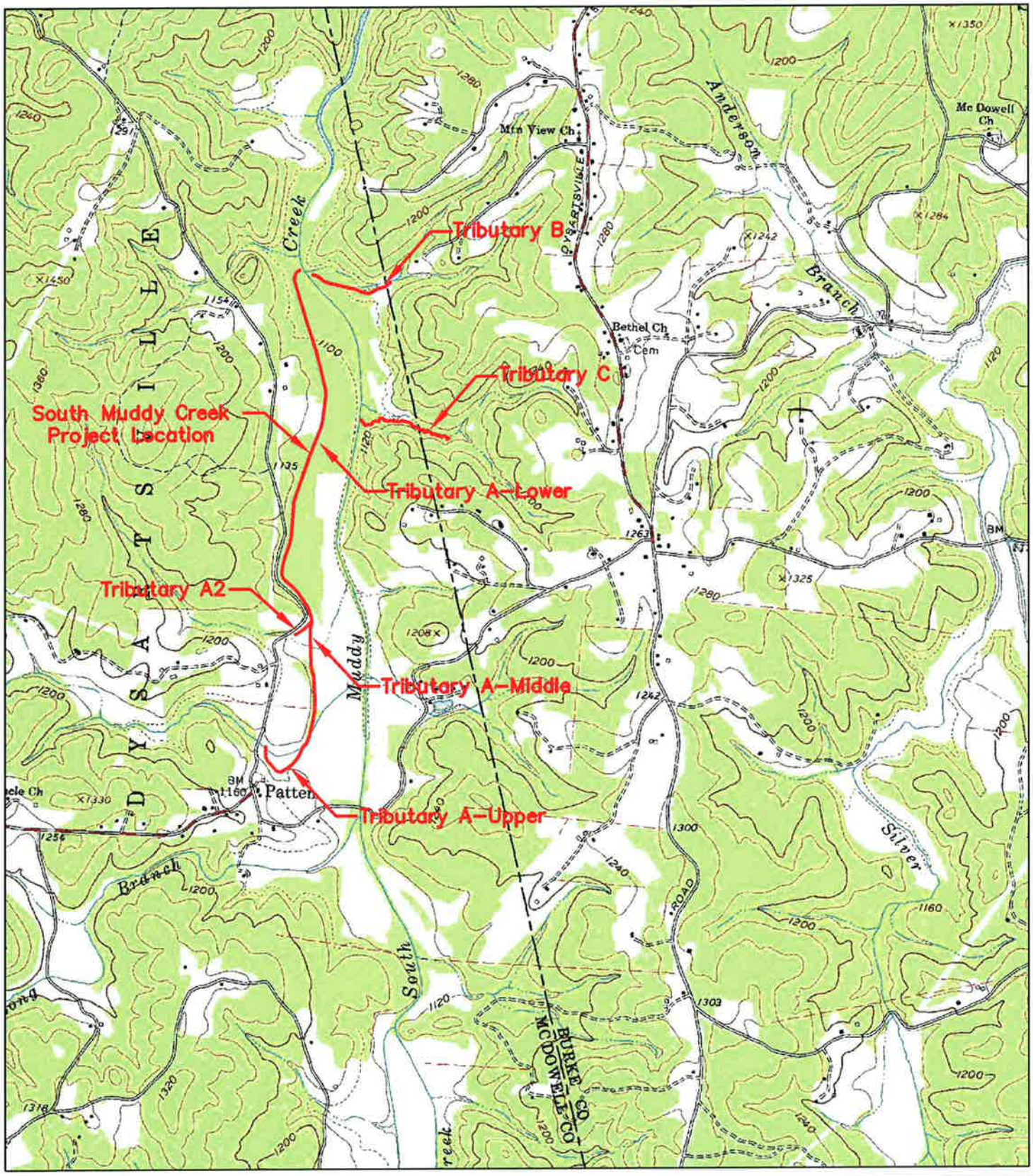
McDOWELL COUNTY, NORTH CAROLINA

SOUTH MUDDY CREEK TRIBUTARIES MONITORING

FIGURE 1

Date: January, 2011	Job No. 2004-2359	Scale: 1" = 2000'



- Grade control and bank stabilization features that enhance environmental attributes of the stream channels through the use of natural materials and native plantings.
- In-stream habitat features, including riffle/pool complexes to re-establish, sort and transport substrate materials available to the streams.
- Reconnection of project stream channels to functional floodplains.
- Extensive indigenous instream and riparian revetment.

Restoration of Tributaries A, A2 and B was accomplished through the modification of the existing pattern, profile and dimension of the tributary channels to a stable condition. The restored channels are on an alignment that is offset from the pre-existing stream channels. Post-construction, the existing tributary channels were abandoned and filled. Restoration along these reaches was either Priority 2, where the elevation of the floodplain was lowered through excavation to re-connect it to the restored stream channel, or a combination of Priority 2 and Priority 1, where the floodplain was lowered and the stream thalweg was raised above the existing channel profile.

The lower reach of Tributary A has a low gradient, which flattens to 0.0012 ft/ft. Due to a relatively flat profile gradient, a series of successive pool and riffle complexes was not proposed. Instead, the restored stream channel has constructed point bars on the inside of meander bends at pool locations and is transporting its bedload through the run/pool complexes as the bed form of the channel naturally evolves. The steeper gradient associated with the restored stream channels along Tributaries A2 and B allowed the construction of a sinuous channel with constructed riffle/pool sequences.

Enhancement Level I was implemented along one of the reaches on Tributary A by modifying the profile and dimension of the channel. Along this segment, improvements were constructed along the alignment of the existing stream channel. Enhancement Level I on Tributary C provides bank stabilization through cattle exclusion, with one hard-engineered, fenced and controlled cattle access point for watering, combined with continuous preservation of the riparian buffer zone via live stock exclusion fencing. Stabilization was accomplished by re-grading steep, undercut channel banks, and the use of jute matting and live plantings.

An important component of the restoration of Tributaries B and C is cattle exclusion. As mentioned previously, these channels are adjacent to pastureland, where cattle frequented the streams for shade and drinking water. Prior to restoration, the cattle accessed the streams at random locations and, in doing so, denuded and destabilized the pre-existing channel banks. The restoration of Tributary B includes fencing that permanently excludes cattle from the stream corridor. The fencing along Tributary C limits cattle access to a single point along the stream reinforced with stone underlain by non-woven geotextile to prevent degradation that would otherwise occur. All fencing has been placed at the outer edge of the perpetual conservation easement held by the State of North Carolina. Information regarding the project structure and objectives is included in Tables I and II that follows:

Table I. Project Structure Table South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01	
Project Reach/Segment ID	**Linear Footage**
A (upper)	1,609 l.f.
A (middle)	1,094 l.f.
A	1,052 l.f.
A (lower)	7,349 l.f.
A2	480 l.f.
B	2,041 l.f.
C	1,601 l.f.
TOTAL	**15,226 l.f.**

Table II. Project Mitigation Objectives Table South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01				
Project Segment/ Reach ID	**Mitigation Type**	**Approach**	**Linear Footage or Acreage**	**Comment**
A (upper)	Restoration	Priority 1&2	1,609 l.f.	Restore dimension, pattern, and profile
A	Enhancement	Level 1	1,052 l.f.	Restore dimension and profile
A (middle)	Restoration	Priority 1&2	1,094 l.f.	Restore dimension, pattern, and profile
A (lower)	Restoration	Priority 2	7,349 l.f.	Restore dimension, pattern, and profile
A2	Restoration	Priority 2	480 l.f.	Restore dimension, pattern, and profile
B	Restoration	Priority 2	2,041 l.f.	Restore dimension, pattern, and profile
C	Enhancement	Level 1	1,601 l.f.	Restore dimension and pattern
TOTAL			**15,226 l.f.**	

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 South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration plan	Aug 2005	Fall 2004	Mar 2005
Final Design - 90%[1]	N/A	N/A	N/A
Construction	Feb 2006	N/A	Apr 2006
Temporary S&E applied to entire project area[2]	Jul 2005	N/A	Apr 2006
Permanent plantings	Apr 2006	N/A	Apr 2006
Mitigation plan/As-built	Jun 2006	Nov 2006	Jan 2007
Year 1 monitoring	2006	Sep 2006 (vegetation) Apr 2007 (geomorphology)	Jun 2007
Year 2 monitoring	2007	Sep 2007 (vegetation) Oct 2007 (geomorphology)	Jan 2008
Year 3 monitoring	2008	Sep 2008 (vegetation) Oct 2008 (geomorphology)	Dec 2008
Year 4 monitoring	2009	Sep 2009 (vegetation) Sep 2009 (geomorphology)	Dec 2009
Year 5 monitoring	2010	Sep 2010 (vegetation) Sep 2010(geomorphology)	Feb 2011

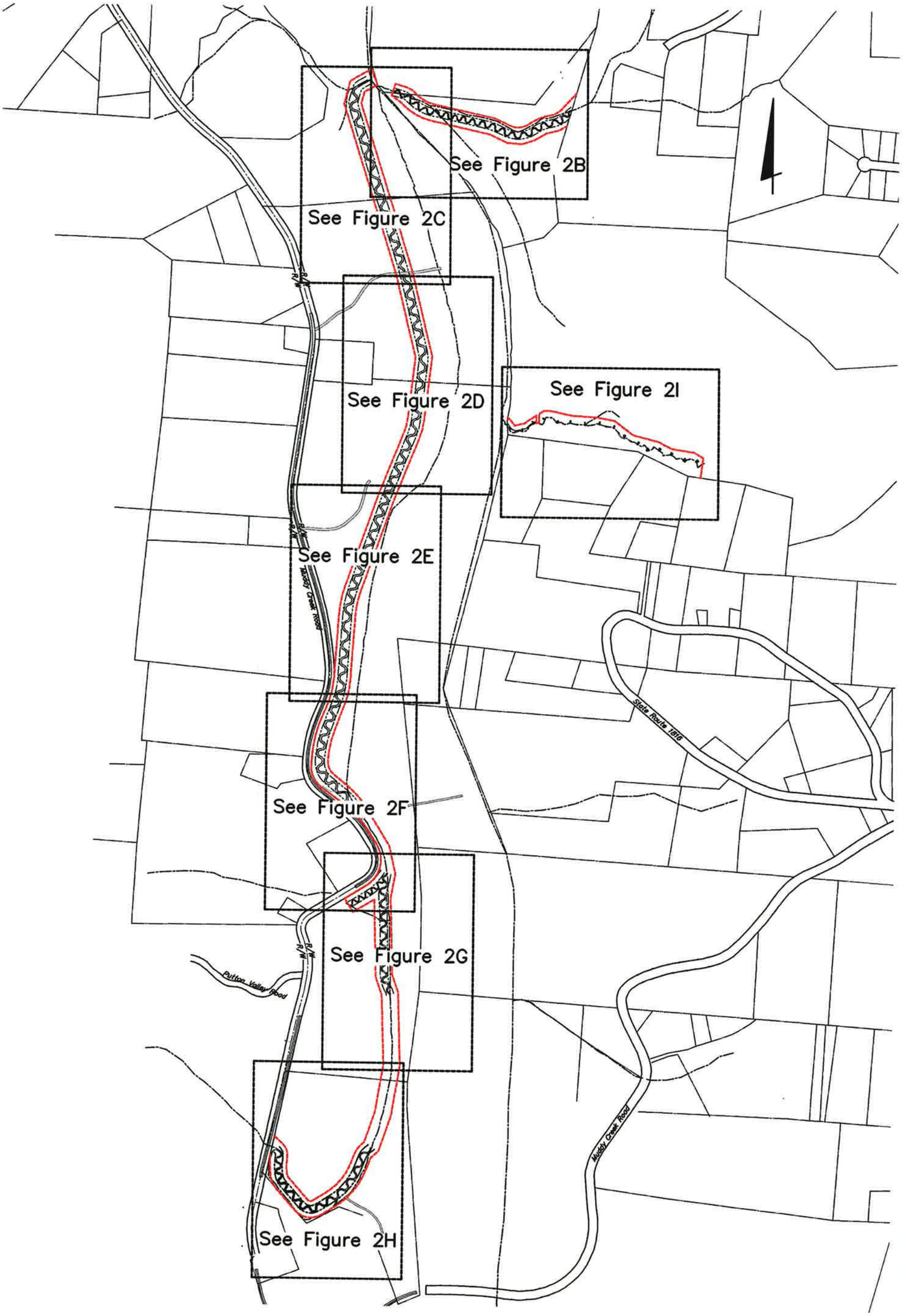
[1]Full-delivery project; 90% submittal not provided.
[2]Erosion and sediment control applied incrementally throughout the course of the project.
N/A: Data collection is not an applicable task to these project activities.

Table IV. Project Contact Table South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01	
Designer	Evans, Mechwart, Hambleton & Tilton, Inc. 5500 New Albany Road, Columbus, OH 43054
Construction Contractor	South Mountain Forestry 6624 Roper Hollow, Morganton, NC 28655
Monitoring Performers	Evans, Mechwart, Hambleton & Tilton, Inc. 5500 New Albany Road, Columbus, OH 43054
Stream Monitoring POC	Jud M. Hines, EMH&T
Vegetation Monitoring POC	Megan F. Wolf, EMH&T

Table V. Project Background Table South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01	
Project County	McDowell
Drainage Area- A (upper & middle)	1.38 sq mi
Drainage Area-A (lower)	2.03 sq mi
Drainage Area-A2	0.27 sq mi
Drainage Area-B	0.44 sq mi
Drainage Area-C	0.37 sq mi
Drainage Impervious Cover Estimate	2%-6%
Stream Order	Tributary A, B, C -2nd Tributaries A2 – 1st
Physiographic Region	Blue Ridge Mountains
Ecoregion	Eastern Blue Ridge Foothills
Rosgen Classification of As-built	C4/C5
Dominant Soil Types	Iotla sandy loam, Dillard loam
Reference Site ID	South Muddy Birchfield, South Muddy "Tributary 4"
USGS HUC for Project and Reference	3050101
NCDWQ Sub-basin for Project and Reference	03-08-30
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	24%

D. Monitoring Plan View

The monitoring plan view is included as Figure 2.



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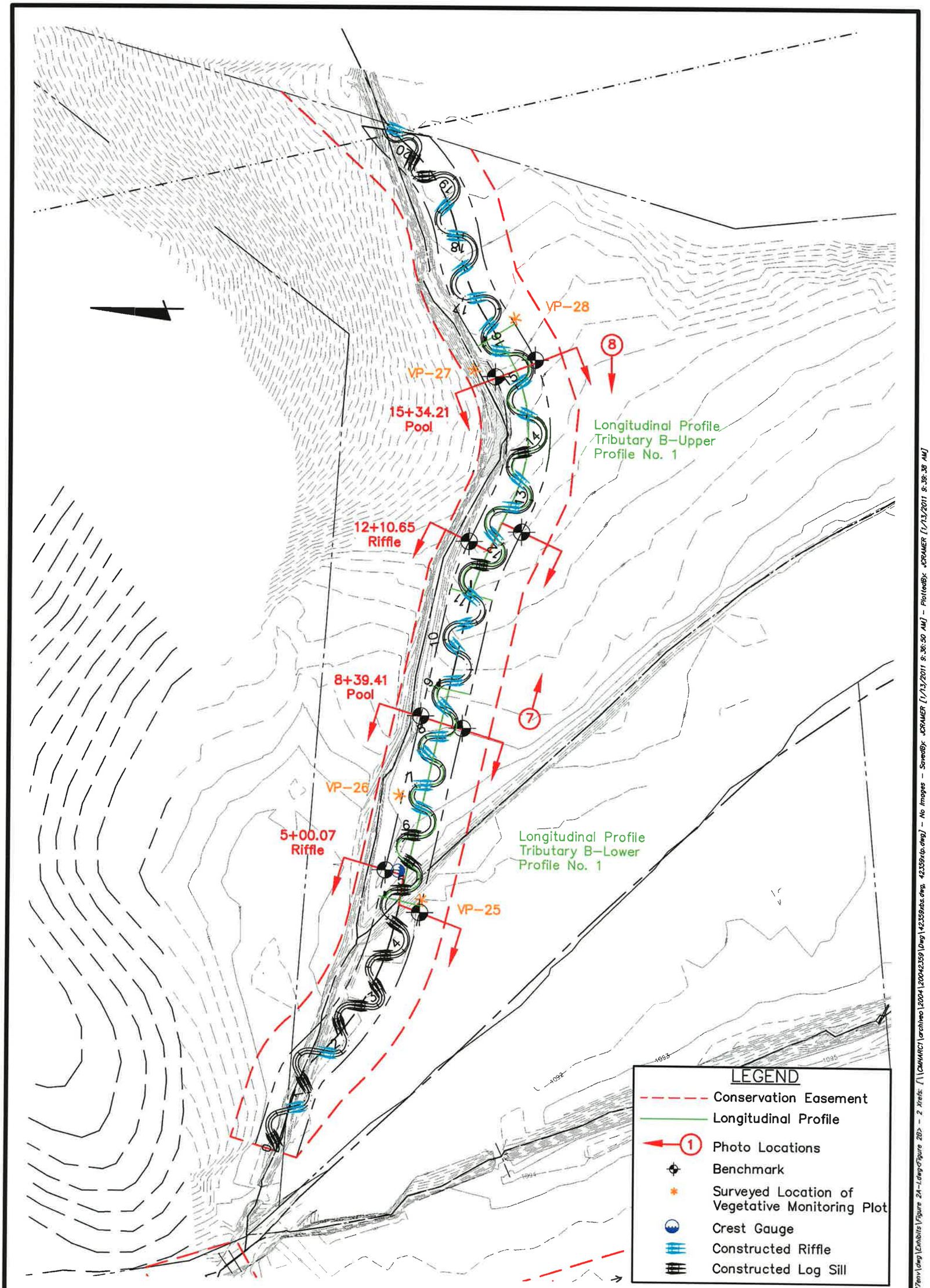
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 2A

INDEX MAP

Date:	January, 2011
Scale:	1" = 600'
Job No:	2006-1627



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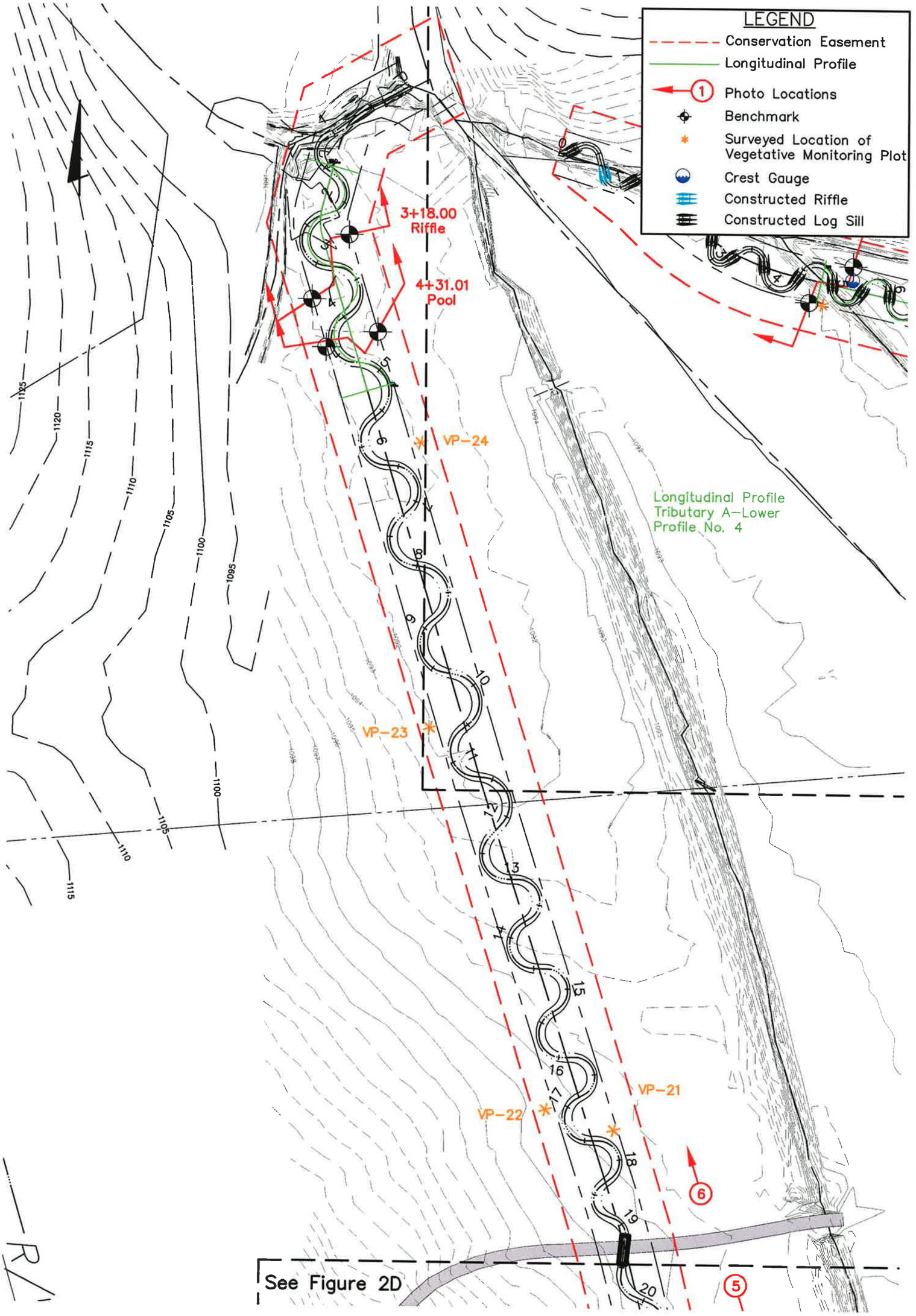
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 2B

TRIBUTARY B

Date:	January, 2011
Scale:	1" = 600'
Job No:	2006-1627



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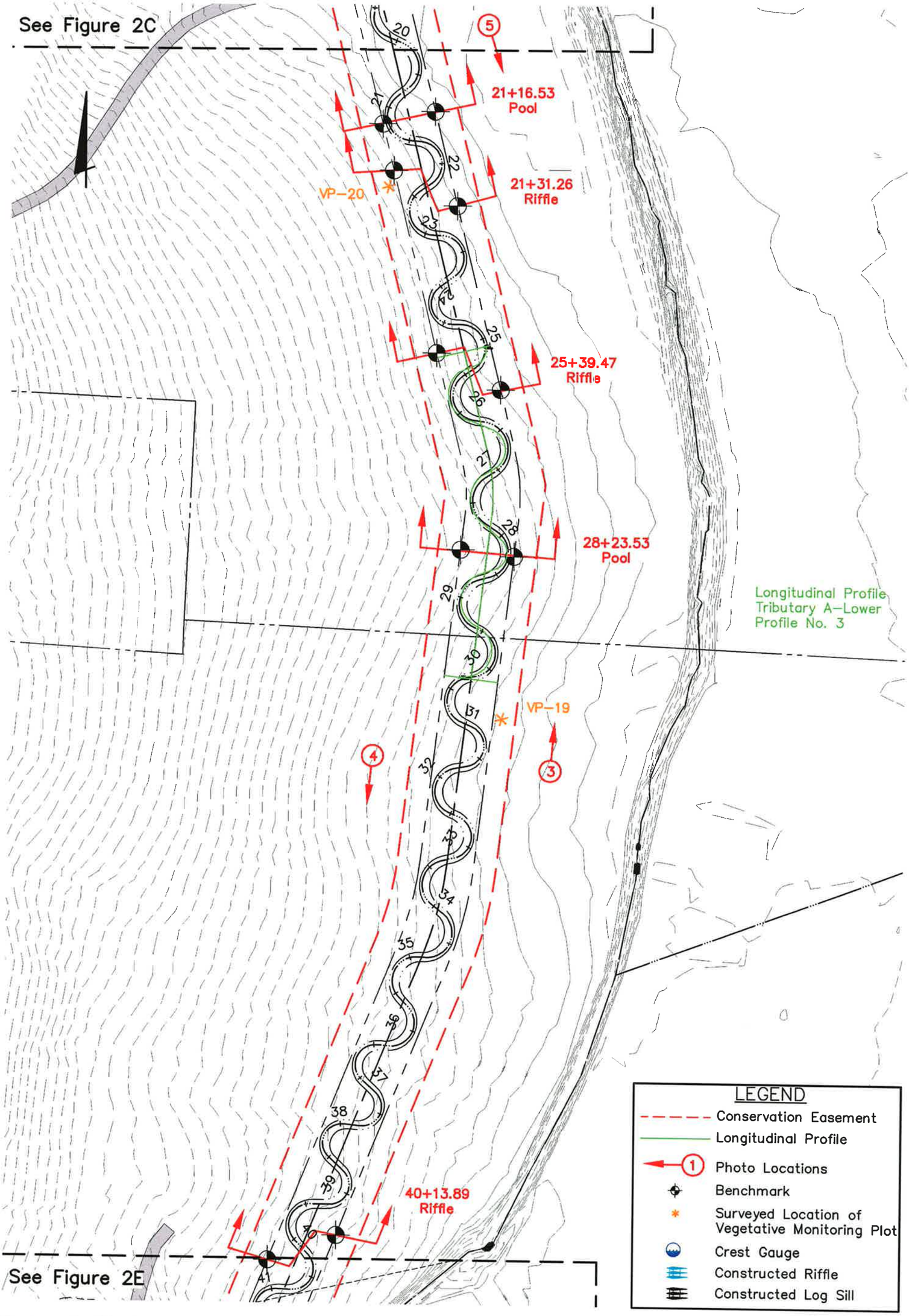
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 2C

TRIBUTARY A - LOWER

Date:	January, 2011
Scale:	1" = 100'
Job No:	2006-1627



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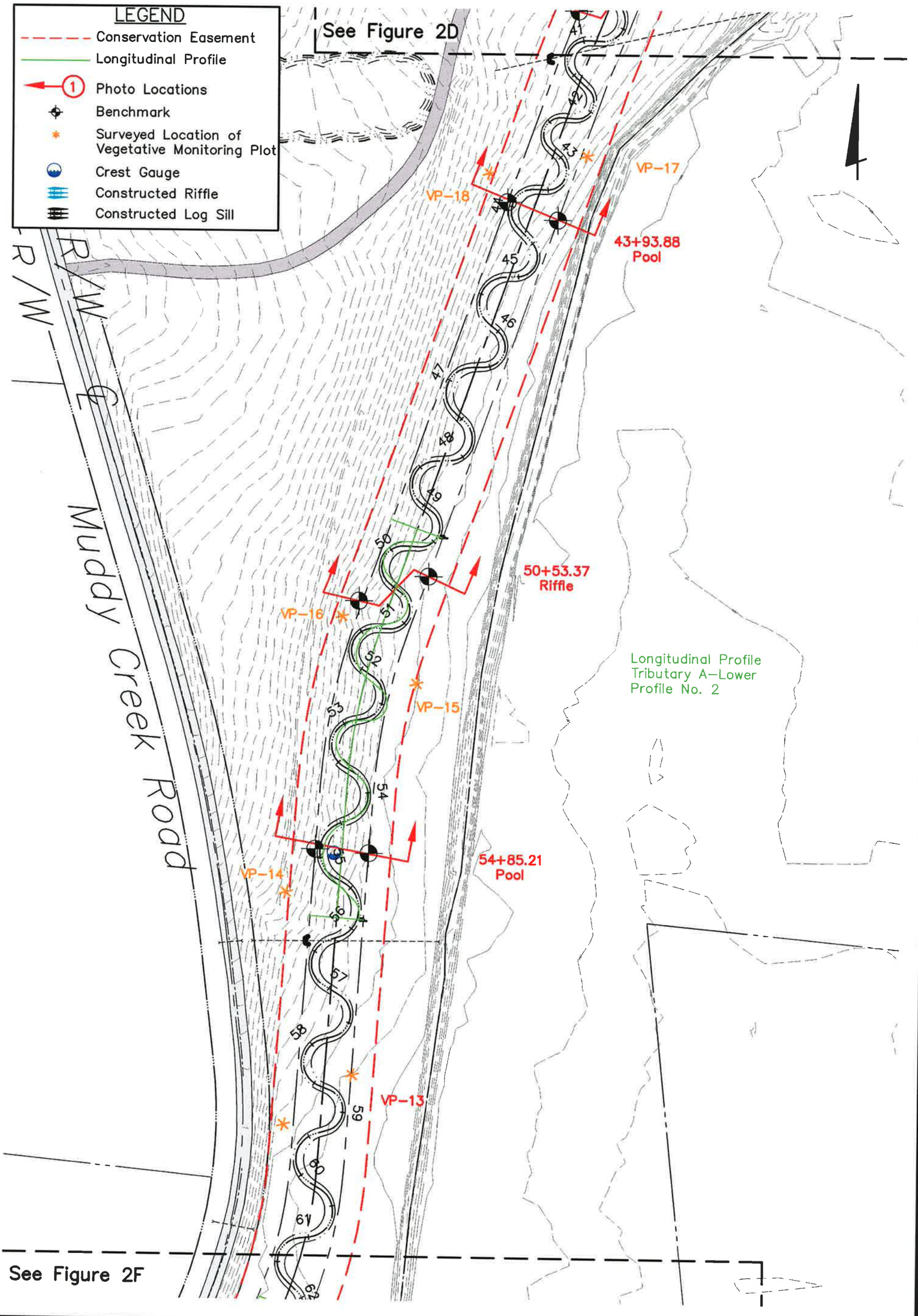
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 2D

TRIBUTARY A - LOWER

Date:	January, 2011
Scale:	1" = 100'
Job No:	2006-1627



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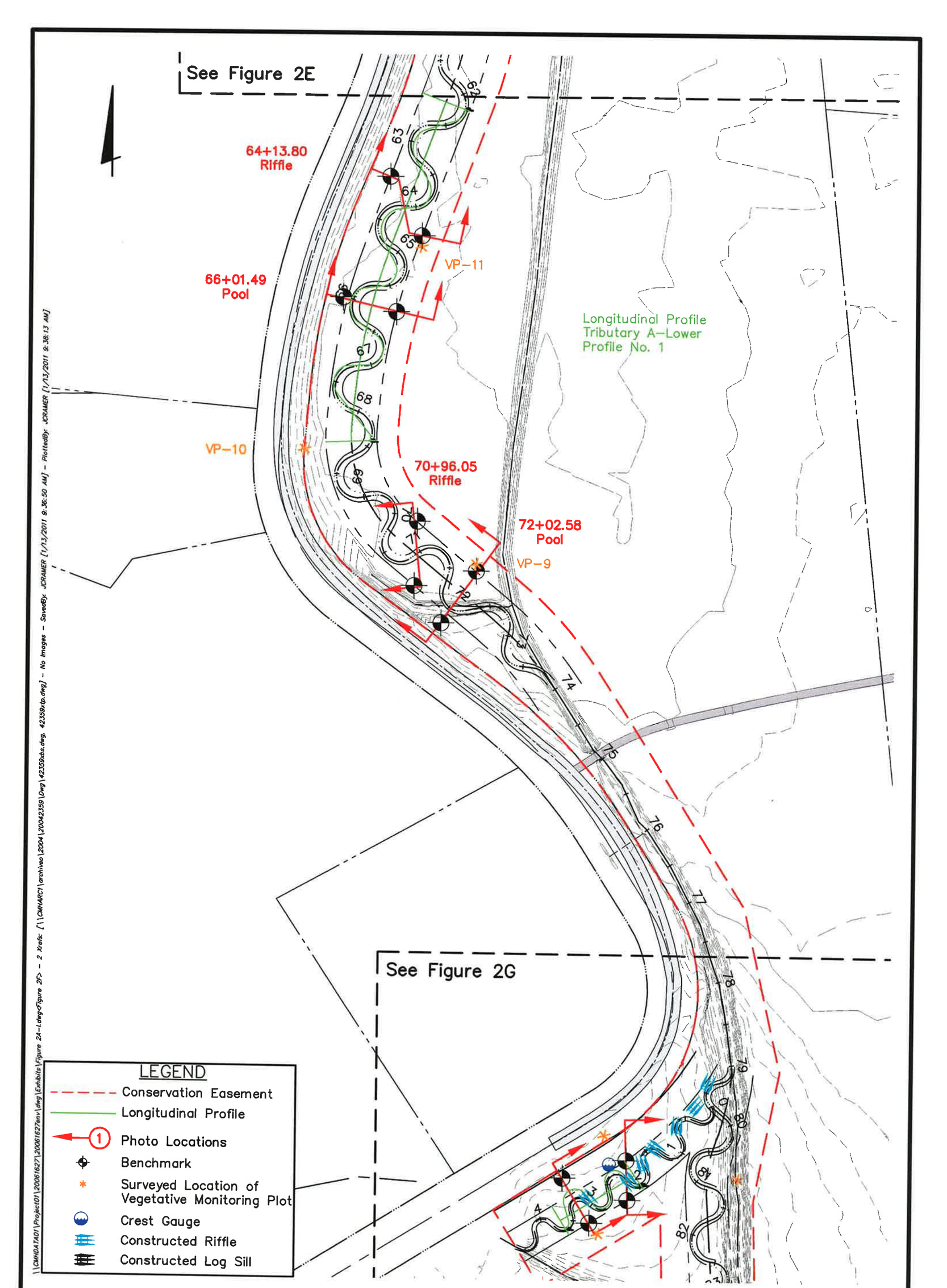
MONITORING

FIGURE 2E

TRIBUTARY A - LOWER

Date:	January, 2011
Scale:	1" = 100'
Job No:	2006-1627



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McDOWELL COUNTY, NORTH CAROLINA

SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

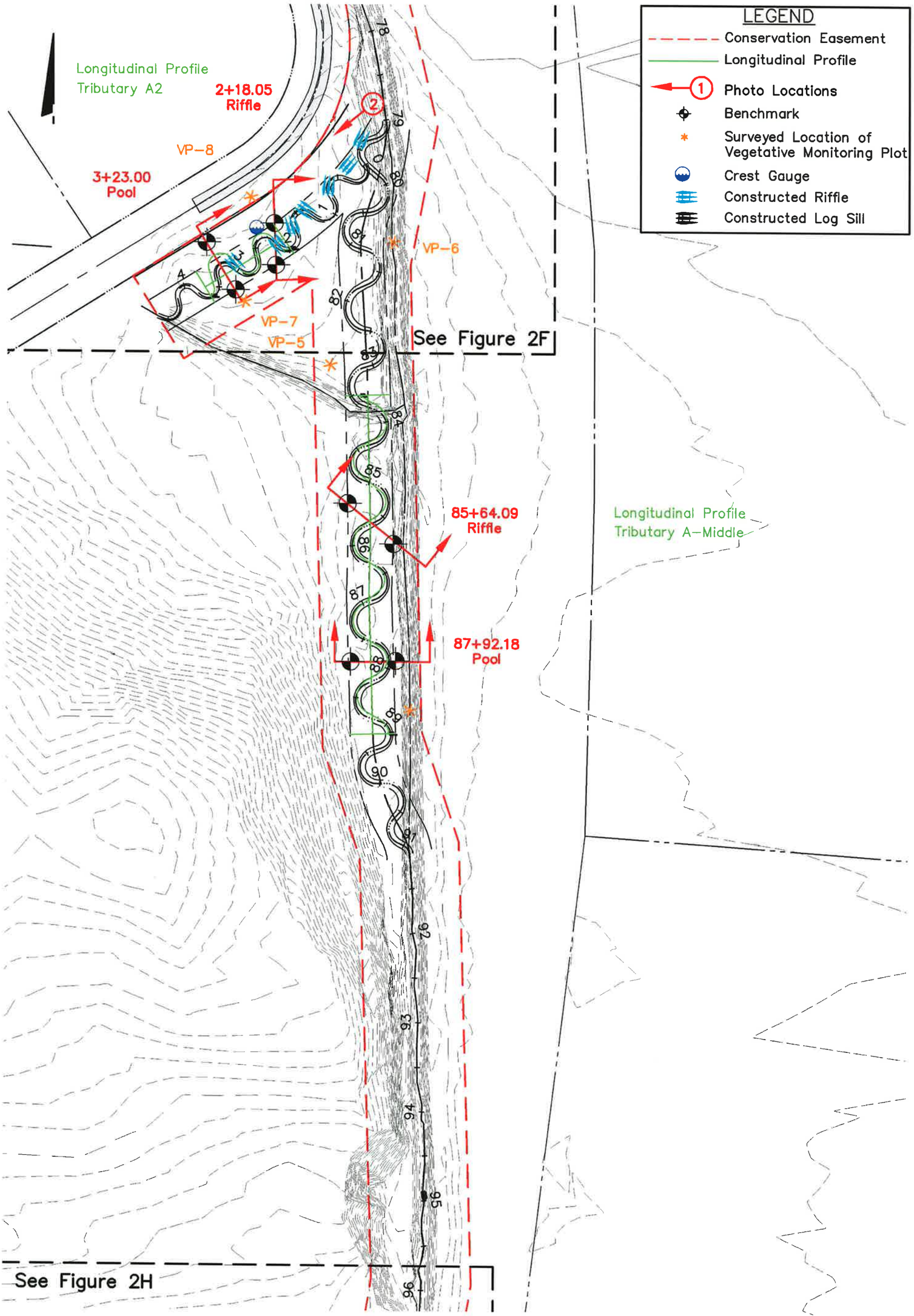
FIGURE 2F

TRIBUTARY A - LOWER

Date: January, 2011

Scale: 1" = 100'

Job No: 2006-1627



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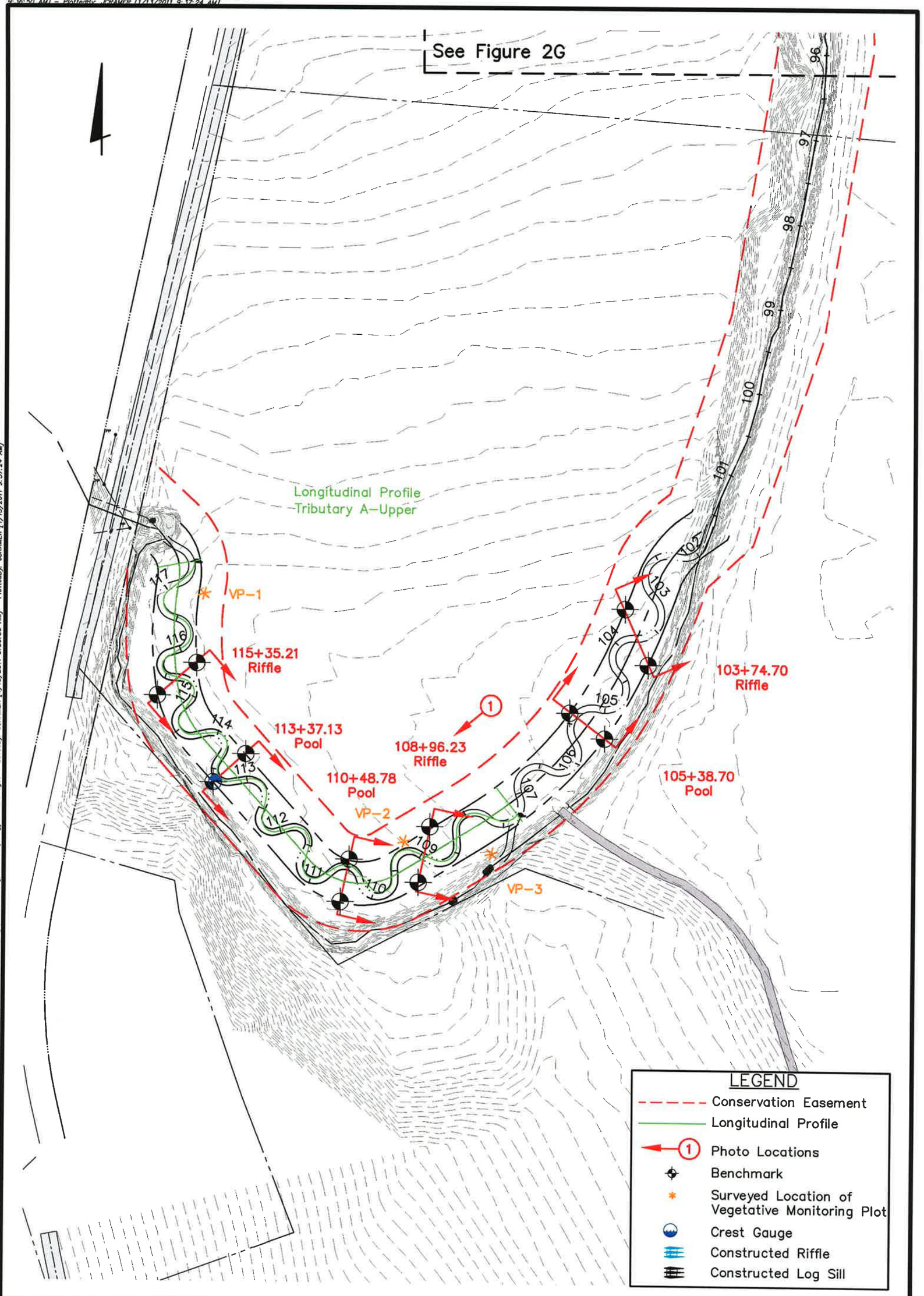
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 2G

TRIBUTARY A2 AND TRIBUTARY A - MIDDLE

Date:	January, 2011
Scale:	1" = 100'
Job No:	2006-1627



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SOUTH MUDDY CREEK TRIBUTARIES

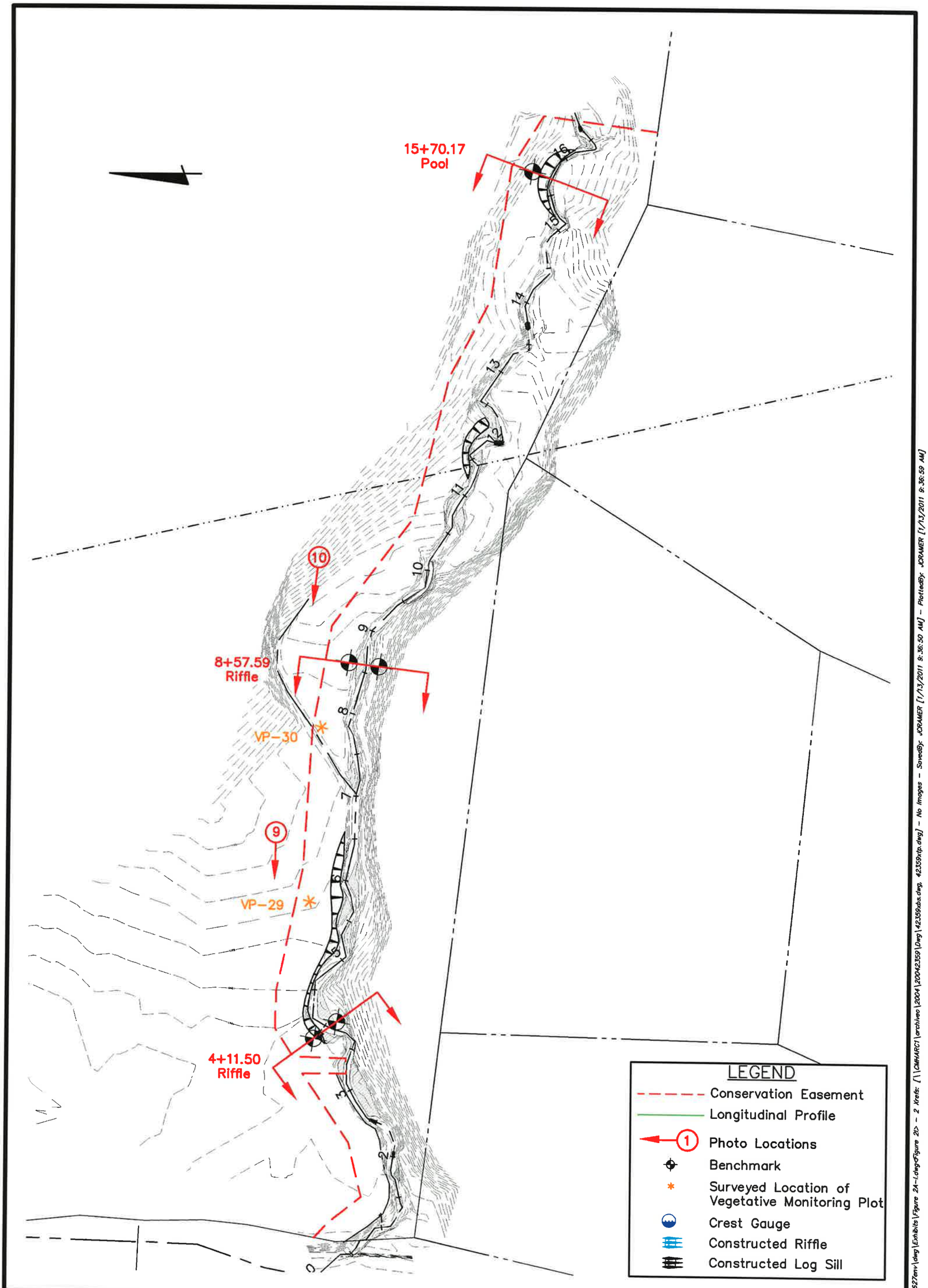
MONITORING

FIGURE 2H

TRIBUTARY A - UPPER

Date:	January, 2011
Scale:	1" = 100'
Job No:	2006-1627

\\CMHDATA01\Project01\2006\1627\2006162727env\dwg\Exhibits\Figure 2H - 2 Xrefs: [\\CMHARC1\archiveo\2004\20042359\Dwg\42359xbs.dwg, 42359xltp.dwg] - No Images - SavedBy: JCRAMER [1/13/2011 9:36:50 AM] - PlottedBy: JCRAMER [1/13/2011 9:37:24 AM]



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SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 2I
TRIBUTARY C

Date:	January, 2011
Scale:	1" = 100'
Job No:	2006-1627

III. PROJECT CONDITION AND MONITORING RESULTS

A. Vegetation Assessment

1. Soil Data

The project area is contained within the Iotla-Braddock-Rosman-Potomac soil association. This soil association typically consists of nearly level to very steep, somewhat poorly drained soils, which have a predominantly loamy, clayey or sandy subsoil formed in alluvium on floodplains and stream terraces (USDA, NRCS 1995).

The majority of Tributary A is mapped within Iotla sandy loam with 0-2% slopes, occasionally flooded. The upstream portion of the tributary flows through additional soil units including Elsinboro loam with 1-4% slopes, rarely flooded, Braddock clay loam with 6-15% slopes, eroded and Hayesville-Evard complex with 15-35% slopes. Tributary A2 is mapped in Iotla sandy loam. The portion of tributary B that is included in the restoration is mapped within Dillard loam, 1-4% slopes, rarely flooded. The portion of Tributary C that is included in the restoration is mapped within the Iotla sandy loam unit.

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

Table VI. Preliminary Soil Data
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Series	Max. Depth (in.)	% Clay on Surface	K[1]	T[2]	% Organic Matter
Braddock clay loam (BrC2)	80+	27-40	0.32	5	0-2
Dillard loam (DdB)	80+	10-15	0.32	5	4-8
Elsinboro loam (EsB)	60+	8-18	0.28	5	1-3
Hayesville-Evard complex (HeD)	60+	7-25	0.24-0.28	5	1-5
Iotla sandy loam (IoA)	60+	12-18	0.2	5	4-8

[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. All problem areas identified during each year of monitoring are summarized in Table VII. Since no vegetation problem areas of concern were observed in 2010, no photographs of the vegetative problem areas have been included in Appendix A.

Table VII. Vegetative Problem Areas South Muddy Creek Stream Restoration / EEP Project No. D04006-01			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo #**
NA	NA	NA	NA

Sericea lespedeza is a common component of pasture mixes and, as this project is adjacent to pasture lands, has likely spread into the project area from the surrounding landscape. This species has been present throughout the project corridor since Year 1 monitoring. Management for this species in 2009 included the continuation of herbicide treatments, begun in the fall of 2008. Further spraying has been conducted throughout Year 5, as it was deemed necessary to enhance survival of the planted species. Since this species has been actively managed by herbicide treatment, and the woody stem counts are meeting performance standards in Year 5, it has been taken off of the vegetation problem area table (Table VII.).

3. Vegetation Problem Area Plan View

Since no vegetation problem areas of concern were observed in 2010, the vegetative problem area plan view 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.

In Year 5, the average stem density of planted species for the site exceeds the 5 year minimum criteria with 528 stems/acre. All vegetation plots are meeting the Year 5 minimum criteria of 260 stems/acre. In addition, a substantial number of recruit stems have been found in most of the plots along all project reaches. In 2010, the recruit stems resulted in a 63% increase in the total stem density across the site.

Remedial plantings were first conducted in late April 2007. Approximately 2,000 trees were planted at this time, including 500 trees along Tributary C, and 1,500 trees along the other reaches. These additional trees brought the average live stem density to 323 stems per acre in Year 2, an increase over the average live stem density of 284 stems per acre in Year 1. An additional round of remedial tree plantings were conducted in 2008, bringing the planted density total to 336 stems per acre. A final round of remedial tree plantings was conducted throughout the 2009 monitoring period. This planting was intended to bring deficient areas of the site back into compliance with the 320 stems per acre minimum. The 2009 planting occurred on April 7. At that time, 1,000 stems of each of the following species were planted along the project streams:

Botanical Name	Common Name
Acer rubrum	Red maple
Alnus incana	Speckled alder
Aronia arbutifolia	Red chokeberry
Ilex verticillata	Winterberry
Platanus occidentalis	Sycamore
Quercus alba	White oak
Quercus velutina	Black oak

The remedial planting efforts have resulted in a net gain of woody stems for the entire site and the achievement of the minimum performance standard.

5. Vegetation Plot Photos

Vegetation plot photos are provided in Appendix A.

Table VIIIa. Stem counts for each species arranged by plot - planted stems.
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

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	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30						
Shrubs																																				
Alnus serrulata	3	2	2	1	4	4	1		1							4	1						1	1	2						0	16	21	28	27	100%
Aronia arbutifolia														1				2													0	0	0	0	3	100%
Aronia melanocarpa																								1							0	0	0	1	1	100%
Cephalanthus occidentalis										1																					0	1	7	2	1	100%
Cornus amomum	6	3	6		3	2	2	1	4	5	10	2		1	1	1	1	3	2	3	3	2	5	1	1	1	2		1		64	67	66	77	72	113%
Sambucus canadensis												3					1					1									5	5	0	5	5	100%
Trees																																				
Betula nigra																									1	2	1				0	0	8	7	4	100%
Crataegus sp.										1				2																	0	0	0	6	3	100%
Fraxinus pennsylvanica	5	2	5	1	1	5	1	2	4		4	5	10	2	7	2	13	2	4	4	1	3	1	4			3	3	1	2	29	68	63	96	97	334%
Juglans nigra																														1	0	0	0	1	1	100%
Liriodendron tulipifera				1						1		1		3	1	3	2	1	2	1	2			2							0	0	0	24	20	100%
Platanus occidentalis	1		3		1		1	3	5	2	5	2	1	4	1			1	1	5		2	1	2	2	3			5	4	19	19	20	52	55	289%
Prunus sp.																														1	0	0	0	1	1	100%
Prunus virginiana										1																					0	0	0	0	1	100%
Quercus alba			1		1				3				1	2	3	1	1		2		6		1	2							34	34	32	27	24	71%
Quercus michauxii			2	4							1				1	3		5			1		2		2		1	3	1		0	0	0	24	26	100%
Quercus phellos		2		3		3		2			1	3	7	1			2	1		2	1										10	12	13	28	28	280%
Quercus pagoda										1			1									1				4	1	1			13	11	11	12	9	69%
Quercus palustris					1																				1			2			0	0	0	0	4	100%
Salix nigra						2	3		1							1										1		1			0	6	8	12	9	100%
Unknown																															0	0	0	1	0	100%
Year 5 Totals	15	9	19	10	11	16	8	8	18	12	21	16	20	16	14	15	21	15	11	15	14	9	11	13	9	11	8	10	8	8	210	239	249	387	391	186%
Live Stem Density (stems per acre)	608	365	770	405	446	648	324	324	729	486	851	648	810	648	567	608	851	608	446	608	567	365	446	527	365	446	324	405	324	324						
per acre)	528																																			

Table VIIIb. Stem counts for each species arranged by plot - all stems.
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Species	Plots																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Shrubs																														
Alnus serrulata	4	2	3	1	6	4	1		1							6	1						1	1	2					
Aronia sp.																									1					
Aronia arbutifolia														1				2												
Aronia melanocarpa																								1						
Cephalanthus occidentalis										1																				
Cornus amomum	10	4	6	2	3	2	2	3	6	5	10	2		1	1	1	1	3	2	3	3	2	5	1	1	1	2		6	
Cornus sp.										1							2													
Rosa multiflora	1																													
Salix exigua																										1				
Sambucus canadensis									1	3		4					1		1			1						2		
Trees																														
Acer negundo																													1	3
Acer rubrum		1	1	1	15	98		1			2			5		3	1	2		1		3			2	7		1	1	
Acer saccharinum															1															
Betula nigra																									2	2	2			2
Crataegus sp.										1		1		2																
Fraxinus pennsylvanica	6	2	7	1	1	5	1	2	4		4	6	10	3	7	2	13	2	4	4	1	3	2	4			3	3	1	14
Juglans nigra																														1
Liquidambar styraciflua														2			1					1							1	
Liriodendron tulipifera				1						1		1		3	1	3	2	2	2	3	3			4						
Pinus sp.								2																						
Platanus occidentalis	1		3		1		1	3	6	2	5	2	1	4	1	1		1	1	5		2	1	2	2	3			6	8
Prunus sp.																														1
Prunus virginiana										1																				
Quercus sp.																												1		1
Quercus alba			1		1				3				1	2	3	1	1		2		6		1	2						
Quercus michauxii			2	4							1				1	3		10			2		2		2		1	3	1	
Quercus phellos		2		3		3		2			1	3	8	1			2	1	1	2	1									
Quercus pagoda										1			1									1				4	1	1		
Quercus rubra																											1			
Salix nigra						2	3		1							1										1		1		
Unknown																														
Year 4 Totals	22	11	23	13	27	114	8	13	22	16	23	19	21	24	15	21	25	23	13	18	16	13	12	15	12	19	10	12	17	30
Live Stem Density (stems per acre)	891	446	932	527	1094	4617	324	527	891	648	932	770	851	972	608	851	1013	932	527	729	648	527	486	608	486	770	405	486	689	1215
Average Live Stem Density (stems per acre)	846																													

B. Stream Assessment

1. Hydrologic Criteria

A network of six crest-stage stream gages was installed on each of the project reaches. The locations of the crest-stage stream gages are shown on the monitoring plan view (Figure 2). No bankfull events were documented for this site during the first year of monitoring. Bankfull events have been recorded during Years 2, 3,4, and 5 as documented in Table IX. Photographic documentation of the bankfull events is provided in Appendix B.

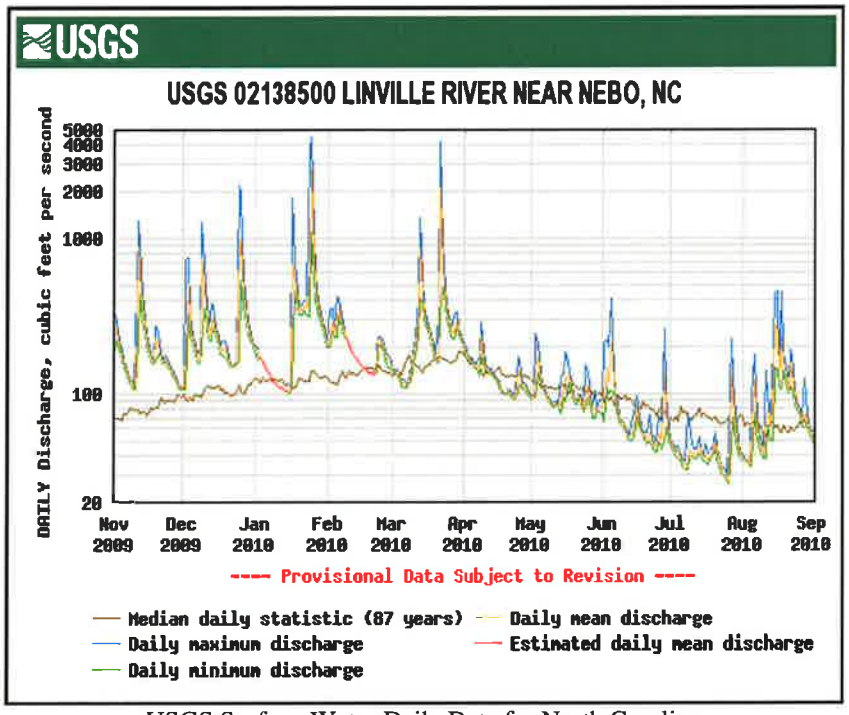
Table IX. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo #
7/18/07	Unknown	Crest gage at Station 5+00 on Tributary B	BF 1
7/18/07	Unknown (3 events)	Crest gage at Station 54+85 on Tributary A (Lower)	BF 2
10/19/07	9/14/07-9/15/07*	Crest gage at Station 113+37 on Tributary A (Upper)	BF 3
9/11/08	9/11/08	Photographed on-site	BF 4, 5, 6, 7
9/21/09	1/6/09-1/8/09*	Five crest gages across the site	BF 8, 9, 10, 11, 12
5/11/10	1/25/10-1/26/10 *and/or* 3/22/10*	*Crest gage at station 113+37 on Tributary A (Upper) * Crest Gage at station 54+85 on Tributary A (Lower) * Crest Gage on Tributary B * Crest Gage on Tributary A2	BF 13, 14, 15, 16

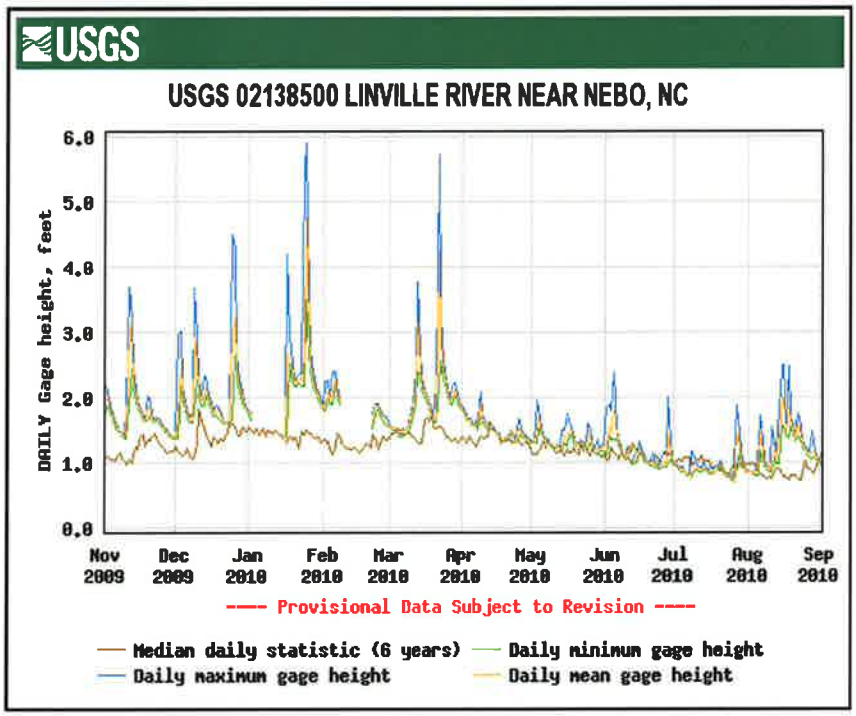
*Date is approximate; based on a review of recorded rainfall data

In May 2010, the crest gage at station 113+37 on Tributary A (Upper) registered a bankfull event at a level of 2' above the bottom of the crest gage. The crest gage at station 54+85 on Tributary A (Lower) registered a bankfull event at a level of 9.50" above the bottom of the crest gage. The crest gages on Tributaries B and A2 also documented a bankfull event, at heights of 3" and 6" above the bottom of the crest gages, respectively. These crest gages are set at or above the bankfull elevation of each stream channel.

The most likely date for the bankfull event was after the rain events that occurred on January 25 and January 26, and/or after the rain event that occurred on March 22, 2010. As these were the largest precipitation events of significance since the documentation of the bankfull event in September 2009, these are likely the bankfull event(s) recorded by the crest gages. These dates correspond to high discharge events, as well as high gage height observations, on January 25 and 26, and March 22, 2010; as recorded at USGS Gage 02138500 at Nebo, NC, which lies approximately 15 miles west of Morganton and 5 miles east of Marion, NC. Maximum daily discharge was 3,780 ft^3/s, 4,560 ft^3/s, and 4,200 ft^3/s for January 25, 26, and March 22, respectively. The discharge and gage height recorded at the above-mentioned Nebo 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 5 provided the fourth monitoring year with a bankfull discharge event, and the third monitoring year by which a bankfull event was documented by the crest gage network. This exceeds the total number of

bankfull events that are required to be documented for this project by the end of the fifth year of monitoring.

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
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Aggradation	4+50 (A2)	Large bar, 25 feet aggraded	SPA 1 (Year 1 Report)
	3+00 (A2)	Overwidened channel, 40 feet aggraded	
Bank failure	79+50 (A Middle)	Mat failed; scour hole, 5'	SPA 2, SPA 3 (Year 1 Report)
	12+10 (B)	Complete loss of riffle, bank failure.	
Bank scour	103+00 (A Upper)	Large hole, scour (15 feet)	SPA 4, SPA 5, SPA 6 (Year 1 Report)
	83+30 (A Middle)	Sloughing, coir log undercut and fallen into pool (15 feet)	
	82+70 (A Middle)	Sloughing, coir log undercut and fallen into pool (15 feet)	
	3+00 (A Lower)	Sloughing	
	19+70 (B)	Bank scour around log sill	
	18+50 (B)	Scour at outside meander bend; significant aggradation	
	16+00 (B)	Scour, matting loose and failing, bank slough	
	15+70 (C)	Bank scour/ sloughing	
	4+50 (C)	Bank scour/ sloughing	

Table Xb. Stream Problem Areas – Year 2
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Bank failure	12+10 (B)	Complete loss of riffle, bank recovering as a result of thick vegetation.	SPA 1 (Year 2 Report)
Bank scour	85+64 (A Middle)	Minor bank erosion	SPA 2 (Year 2 Report)
	15+70 (C)	Bank scour/ sloughing	
	4+50 (C)	Bank scour/ sloughing; heavily vegetated and stable	

Table Xc. Stream Problem Areas – Year 3 South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Bank failure	12+10 (B)	Complete loss of riffle; banks are heavily vegetated and stable	SPA 1,2 (Year 3 Report)
Bank scour	84+75 (A Middle)	Bank scour/sloughing approximately 20 feet from stream at top of slope	SPA 3,4 (Year 3 Report)
	85+64 (A Middle)	Minor bank erosion; heavily vegetated and stable	
	16+50 (B)	Bank scour/sloughing on left bank	
	15+25 to15+70 (C)	Bank scour/ sloughing	
	4+11 to 4+50 (C)	Bank scour/ sloughing	

Table Xd. Stream Problem Areas – Year 4 South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Aggradation	2+18 - 4+50 (A2)	Aggradation in channel is causing the stream to form wetland conditions. Structures are embedded in sediment.*	SPA 1 (Year 4 report)
	1+10, 6+00, 11+50, 13+80 (B)	Aggradation in channel is embedding log vanes under sediment.	
Bank failure	12+10 (B)	Complete loss of riffle; banks are heavily vegetated and stable	SPA 2 (Year 4 report)
Bank scour	83+30 (A Middle)	Sloughing on left bank: mid-channel bar forming downstream from this bank slump	SPA 3,4 (Year 4 report)
	84+75 (A Middle)	Bank scour/sloughing approximately 20 feet from stream at top of slope; heavily vegetated and stable	
	19+70 (B)	Bank scour around log sill; heavily vegetated and stable	
	16+50 (B)	Bank scour/sloughing on left bank; heavily vegetated and stable	
	15+25 to15+70 (C)	Bank scour/ sloughing; vegetated and stable	
	4+11 - 5+00 (C)	Bank scour/ sloughing	
Engineered structure	0+00 (B)	Water is flowing beneath the log sill	SPA 5 (Year 4 report)

*Area was repaired as part of monitoring/maintenance activities and will be revisited next monitoring period to verify stability.

Table Xe. Stream Problem Areas – Year 5 South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01			
Feature Issues	**Station Numbers**	**Suspected Cause**	**Stability Explanation**
Aggradation, Bank Failure, Bank Scour, Engineered Structure	Through project reaches	Varies based on type of issue	Feature issues remained stable from Year 4 (see text below).

Tributaries B and the Middle section of Tributary A each had some areas of very minor bank scour and/or bank erosion. The majority of those areas were first noted in a previous year, all of which have become heavily vegetated in Years 4 and 5, providing streambank stability. The riparian corridor is densely covered by herbaceous vegetation, which is expected to stabilize the sloughing banks in future years. Because of these reasons, the areas mentioned above have been taken off of Table Xe. A few areas of bank scour have been noted on Tributary C in previous years of monitoring and some of these areas have remained in Year 5. These locations were not identified as areas for enhancement in the Restoration Plan, and as such, no restoration activities have occurred along these banks. The state of these banks are remnants of an pre-existing condition, and are therefore, not considered problem areas in need of maintenance. Because of this, they are not included in Table Xe.

Four areas of aggradation were noted in Year 5. Three structures along Tributary B were noted to have been affected by aggradation. Sand is the dominant streambed substrate in the project reaches and, as such, sediment deposition over the noted structures is attributed to high sediment supply readily available in the contribution watershed. Because the issue for these structures arises from depositional trends, rather than a concern with the physical structure, these areas are listed in the table as aggradation issues, not failed structures. It is noted that at all locations where the structures are embedded, the channel and streambanks are stable. As previously mentioned, the other area of past aggradation involved the upstream portion on Tributary A2. Throughout 2009, this section of the stream was developing wetland vegetation within the stream channel, with heavy colonization by aquatic macrophytes. In late 2009, this area was repaired and returned to a more stable design condition. The Year 5 stream survey demonstrated that the repair on the Tributary has succeeded in decreasing aggradation along the upstream portion. Accordingly, this area of Tributary A2 has been taken off of the stream problem area table in Year 5.

In 2009, the most downstream of the constructed log sills was noted to be non-functional along Tributary B. The channel appeared to have downcut under the structure, allowing the water to flow under, rather than over the log sill as designed. This log sill was fixed in late 2009 and has returned the grade control function of the structure, according to Year 5 stream monitoring observances. This structure, therefore, is no longer considered a stream problem area. During the Year 5 stream survey in September 2010, it was noted that a beaver dam had been constructed on Tributary A (Lower) at station 0+00. Beavers had used the culvert between Tributary A and South Muddy Creek to construct the dam. At the time of survey, channel water level was noted to be at, or above, bankfull stage. The beaver dam increased water levels in the upstream direction for an estimated 1,000 feet along Tributary A (Lower). It should be noted that the dam was only a temporary problem area. It was deconstructed a week after the stream survey was completed, returning Tributary A (Lower) water levels to the appropriate elevation.

In summary, Table Xe. for Year 5 does not have any entries noting stream "problem areas" due to the fact that while minor areas of scour and aggradation were noted in Year 5, these areas were

localized and have remained stable throughout the monitoring period. Therefore, it is our belief that these areas represent natural channel processes rather than stream "problem areas".

3. Stream Problem Areas Plan View

Since no problem areas of concern were noted in 2010, the stream problem area plan view is not included in Appendix B.

4. Stream Problem Areas Photos

Since no problem areas of concern were noted in 2010, photographs of the stream problem areas are not included in Appendix B.

5. Fixed Station Photos

Photographs were taken at each established photograph station on September 16, 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 that remain in a stable state after the first year of monitoring. A summary of the assessment for each reach is included in Table XIa through Table XIf. This summary was compiled from the more comprehensive Table B1, included in Appendix B. Only those structures included in the as-built survey were assessed during monitoring and reported in the tables.

Table XIa. Categorical Stream Feature Visual Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A (Upper)

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles[1]	100%	100%	100%	100%	100%	100%
B. Pools[1]	100%	100%	100%	100%	99%	100%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	99%*	99%	100%	100%	100%
E. Bed General	100%	100%	100%	100%	100%	100%
F. Vanes / J Hooks etc.[2]	N/A	N/A	N/A	N/A	N/A	N/A
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A	N/A	N/A

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

Table XIc. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: A (Lower)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	100%	100%	100%	100%	100%
B. Pools[1]	100%	100%	100%	100%	100%	100%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	99%*	99%	100%	100%	99%
E. Bed General	100%	100%	100%	100%	100%	100%
F. Vanes / J Hooks etc.[2]	N/A	N/A	N/A	N/A	N/A	N/A
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A	N/A	N/A

Table XId. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: Tributary A2						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	97%*	100%	100%	89%**	94%
B. Pools[1]	100%	100%	100%	91%	71%**	76%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	100%	100%	100%	100%	100%
E. Bed General	100%	93%*	100%	100%	100%	100%
F. Vanes / J Hooks etc.[2]	N/A	N/A	N/A	N/A	N/A	N/A
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A	N/A	N/A

** Does not reflect repairs made to the upper end of the reach.

Table XIe. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: B						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	99%*	99%	99%	92%	94%
B. Pools[1]	100%	100%	100%	100%	97%	100%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	97%*	98%	100%	99%	99%
E. Bed General	100%	100%	100%	100%	100%	100%
F. Vanes / J Hooks etc.[2]	N/A	N/A	N/A	N/A	N/A	N/A
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A	N/A	N/A
H. Log Sills	100%	97%*	100%	100%	97%	97%

Table XIf. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: C						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	100%	100%	100%	100%	100%
B. Pools[1]	100%	100%	100%	100%	100%	100%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	99%*	98%	98%	96%	93%
E. Bed General	100%	100%	100%	100%	100%	100%
F. Vanes / J Hooks etc.[2]	N/A	N/A	N/A	N/A	N/A	N/A
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A	N/A	N/A

* The percentages for Year 1 were updated, using the percentages derived from Table B1 in Appendix B, using the Feature Performance Mean percentages located in the last column of Table B1. The Feature Performance Mean percentages were used for Year 2; therefore, the percentages are now comparable across the years.

[1]The tables were completed to include a percentage of stability for pool and riffle features using the definitions provided below for the stream reaches along Tributary A.

Riffle: A portion of the linear stream segment located between two consecutive meander bends.

Pool: A portion of the curvilinear stream segment located in each meander bend.

[2]Those features not included in the stream restoration were labeled N/A. This includes features such as vanes, J-hooks, rootwads and boulders.

The visual stream stability assessment revealed that the majority of in-stream features are functioning as designed and built on the project reaches. Some of the stream reaches included unstable meanders, where minor erosion occurring along the outer bends of meanders. However, the meanders that had been in a state of degradation in previous years have continued to improve in Year 5 due to increasing vegetative cover and associated root mass along the stream corridors. As the vegetation matures, the root mass is expanding in size, depth and density, enhancing streambank stability. As a result, the overall percentage of stability at meanders remained

comparable to Year 4 on most every reach, indicating a trend toward sustained channel stability over time. The percentage of stability declined slightly on Tributary C in 2010, due to a few meanders with limited states of erosion.

Aggradation is the cause for the percentages of instability noted under the riffle, pool and bed general categories along Tributaries A2 and B. When compared to Year 4, these Tributaries exhibit less aggradation and resultant embedded structures. This can also be seen when looking at the longitudinal profiles for these two reaches. What little aggradation was occurring in 2009 along Tributary A (upper, middle and lower) was observed to be reduced in 2010. As in Year 4, the majority of the unstable riffles along Tributary B are associated with embedded features (again as noted under the stream problem areas table). The number of unstable/embedded features along Tributary B has decreased from 2009 to 2010. Again in Year 5, on Tributary B, the majority of the installed log sills are functioning, with the exception of those noted to be under aggradation for the riffle feature category. As depicted in Table B1., the number of aggraded riffle features has decreased between Year 4 and Year 5 stream survey. In 2009, it was observed that the most downstream of the constructed log sills had lost its utility in maintaining grade control. As mentioned previously, this structure was fixed in late 2009 and has restored the grade control function for this structure.

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 minor depositional trends seen in these project reaches is anticipated as a natural component of the system, rather than a concern with the physical structure of the project.

In Year 5, aggradation is no longer considered to be a source of unstable pools and riffles on Tributary A2. The level of aggradation found along this reach has been much alleviated between 2009 and 2010 through adaptive management (remedial maintenance) in the form of sediment overload removal. Maintenance activities were completed to return the channel to initial design standards. As discussed previously, this section of the stream developed wetland vegetation into 2009, thereby allowing excessive sedimentation to occur. As a result of the cleaning of this channel in late 2009, the channel no longer continues the trend toward further colonization and growth of wetland plants. A few of the pools along this reach, which had become too shallow to function as pool features, and several of the embedded riffle features are now able to function as designed.

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 appendix. The data provided in Table XII for Years 1-5 reflects data from only the long-term monitoring reaches assessed along the Year 1 longitudinal profiles. The As-Built data documents the entire stream restoration project. 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 post-construction stream surveys and comprehensive visual field assessments along each of the project reaches.

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.

Bedform features continue to evolve along the restored reaches as shown on the long-term longitudinal profiles. As is exhibited in Table XIII, dimensional measurements of the monumented cross-sections remain stable, generally within the range of values measured in previous years. Some bankfull width measurements have decreased in Year 5, particularly along Upper A, A2 and B; tributaries noted in previous years to have general aggradation. When compared to Year 4, a few cross sections on Tributary B are also exhibiting slightly decreased bankfull depth measurements. However, comparisons of the yearly long-term stream monitoring data show successive increases in channel-floodplain connectivity and increasingly stable channel dimensions, interpreted from width/depth ratios, entrenchment ratios, bank height ratios, and channel geomorphologic parameters as shown on the long-term monitoring cross-sections.

The comparison of the As-Built, Years 1-4, and Year 5 long-term stream monitoring profile data show successive increases in the development of pool/riffle features as compared to as-built conditions. This was anticipated due to the sand-bed nature of the stream channels. Riffle lengths, pool lengths, and pool to pool spacings have steadily decreased from the as-built conditions, as pool and riffle features continue to develop in the appropriate positions along the reach, or have remained within the range found in previous years of monitoring. A few exceptions to these generalities occur on Tributaries A Lower (profile 2), A2 and B. On Tributary B, A2 and A Lower (profile 2), the riffle lengths have increased. On most reaches of Tributary A, the decreased pool length corresponded to a decreased riffle length due to the development of additional pool and riffle features, thus a decreased pool to pool spacing. The increased pool spacing, observed on Tributary A2 in 2009 has been reduced with the cleaning of excess sediment that occurred in late 2009. Aggradation along the upstream portion of this reach has been lessened by the channel clean-out and has restored functionality to the stream features.

Median particle sizes of the stream channels ranged from very fine sand to very coarse grained sand, following a trend of decreased median particle sizes from the as-built conditions, as fine particulates settle during low flows in the pools, and to a smaller extent, in riffle features. It should be noted that particle sized increased slightly from Year 4 to Year 5 stream monitoring. This is due to the fact that all stream reaches exhibited less aggradation and more functional flow in Year 5. This has allowed some of the smallest particles to be swept further downstream, therefore increasing 2010 median particle sizes. Remedial maintenance work on the restored reaches beyond that which was discussed under the problem area section of this report is not deemed necessary.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Upper Tributary A {Long-Term Monitoring Profile Station 0+00 to 9+71.47 (971.47 feet)}

Parameter	Reference Reach Data [1]						XS 114+61.61, -35.13																							
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Monitoring Year 1 [4]			Monitoring Year 2 [4]			Monitoring Year 3 [4]			Monitoring Year 4 [4]			Monitoring Year 5 [4]		
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]			1.3			0.14			1.38			1.38			1.38			1.38			1.38			1.38			1.38			1.38
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.55			7.60	11.00	14.00	12.50	12.42	20.22	16.32	12.21	20.20	16.21	12.33	18.34	15.34	12.99	13.93	13.46	9.24	12.68	10.49
Flood Prone Width (Wfpa) - ft.			100			43			9.12			50.00			50	38.82	65.6	52.21	39.19	51.52	45.36	51.83	57.62	54.73	52.36	58.38	55.37	40.27	51.47	51.45
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			5.91			10.44	8.86	12.24	10.55	11.69	18.64	15.17	11.19	17.78	14.49	8.08	16.49	12.29	6.73	10.08	8.41	7.13	8.33	8.26
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.90			1.15	0.63	1.11	0.87	0.92	0.94	0.93	0.88	0.91	0.90	0.66	0.9	0.78	0.48	0.78	0.63	0.56	0.89	0.79
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.78			1.80	1.28	1.66	1.47	1.52	2.3	1.91	1.52	2.23	1.88	1.72	1.96	1.84	1.48	1.61	1.55	1.27	1.67	1.39
Width/Depth Ratio			5.6			6.1			7.28			6.61	9.91	22.22	16.07	13.21	21.98	17.60	13.45	22.95	18.20	18.68	20.38	19.53	16.65	29.09	22.87	10.38	22.64	13.28
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.39			6.58	3.57	4.55	4.06	3.13	3.25	3.19	3.20	3.20	3.20	3.14	4.21	3.68	4.03	4.19	4.11	3.84	5.57	4.06
Bank Height Ratio			1.0			1.8			3.59			1.00			1.11	1.00	1.11	1.06	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wetted Perimeter - ft.			14.6			9.95			8.35			9.09	12.00	14.38	13.19	13.15	20.95	17.05	12.85	20.90	16.88	13.00	18.93	15.97	13.40	14.41	13.91	10.36	13.58	10.99
Hydraulic radius - ft.			1.42			0.91			0.71			1.15	0.62	1.02	0.82	0.89	0.89	0.89	0.85	0.87	0.86	0.62	0.87	0.75	0.47	0.75	0.61	0.53	0.80	0.76
Pattern																														
Belt Width (Wblt) - ft.						50				46.38	64.9		50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Radius of Curvature (Rc) - ft.						10						19.00	10.67	24.71	16.26	10.67	24.71	16.26	10.67	24.71	16.26	10.67	24.71	16.26	10.67	24.71	16.26	10.67	24.71	16.26
Meander Length (Lm) - ft.						50				76	106.4		60	107	78.5	60	107	78.5	60	107	78.5	60	107	78.5	60	107	78.5	60	107	78.5
Meander Width Ratio (Wblt/Wbkf)						6.8						6.58	3.57	4.55	4.00	2.47	4.03	3.25	2.48	4.10	3.29	2.73	4.06	3.39	3.59	3.85	3.72	3.94	5.41	4.68
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10							23.8	130.3	53.3	10.6	92.4	31.6	8.03	52.4	23.19	8.06	63.49	22.05	8.71	41.62	20.88	8.48	48.05	20.34
Riffle Slope (Srif) - ft./ft.			0.026			0.032							0.0026	0.0069	0.0048	0.0014	0.0078	0.0038	0.0054	0.0112	0.0078	0.0028	0.0428	0.0185	0.0023	0.0280	0.0108	0.0015	0.0055	0.0023
Pool Length (Lpool) - ft.			9			24							26.8	96.8	46.8	42.6	99.6	73.7	30.14	64.32	49.74	30.31	55.18	42.2	15.47	48.48	26.59	15.07	84.79	35.55
Pool-Pool Spacing (p-p) - ft.			40			27							85.3	159.9	128.7	88.8	142.2	104.5	49.78	111.68	69.1	24.31	88.64	55.87	20.63	63.95	39.42	30.15	147.91	64.38
Substrate [3]																														
d_{50} (mm)			20			26						20			3.4			3.4			7.0			0.6			0.3			0.2
d_{84} (mm)			38			76						38			12.5			12.5			16.3			16.0			0.5			0.9
Additional Reach Parameters [3]																														
Valley Length (ft)						295			2520			1049			1097			614.48			661.40			660.86			660.86			660.86
Channel Length (ft)			236			479			2644			1539			1609			903.29			972.26			971.47			971.47			971.47
Sinuosity						1.6			1.05			1.47			1.47			1.47			1.47			1.47			1.47			1.47
Water Surface Slope (Save)			0.006			0.022			0.0035			0.0030			0.0023			0.0025			0.0031			0.0028			0.0032			0.0031
Bankfull Slope (Sval)			NA			0.025						0.0044			0.0033			0.0029			0.0026			0.0031			0.0030			0.0030
Rosgen Classification			E4			E4			F/G			E4			C4			C4			C4			C5			C5			C5
Bankfull mean velocity (Vbkf)			4.73			6.59			4.40			1.98			1.96			1.36			1.29			1.52			2.22			2.26
Bankfull Discharge (Qbkf)			98			60			26.00			20.7			20.7			20.7			18.65			18.65			18.65			18.65

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes each riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Middle Tributary A {Long-Term Monitoring Profile Station 0+00 to 5+17.09 (517.09 feet)}

Parameter	Reference Reach Data [1]						XS 114+61.61, -35.13									Monitoring			Monitoring			Monitoring			Monitoring			Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]			Year 2 [4]			Year 3 [4]			Year 4 [4]			Year 5 [4]		
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]			1.3			0.14			1.38			1.38			1.38			1.38			1.38			1.38			1.38			1.38
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.55			8.00			15.00			14.63			14.68			14.55			13.76			14.54
Flood Prone Width (Wfpa) - ft.			100			43			9.12			50.00			60.00			67.33			61.33			61.37			66.43			67.05
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			5.91			12.00			12.61			16.62			15.35			15.48			13.54			18.04
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.90			1.00			0.84			1.14			1.05			1.06			0.98			1.24
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.78			2.00			1.50			2.38			2.11			2.24			2.26			2.47
Width/Depth Ratio			5.6			6.1			7.28			8.00			17.86			12.83			13.98			13.73			14.04			11.73
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.39			6.25			4.00			4.60			4.18			4.22			4.83			4.61
Bank Height Ratio			1.0			1.8			3.59			1.00			1.11			1.11			1.11			1.10			1.00			1.00
Wetted Perimeter - ft.			14.6			9.95			8.35			9.66			15.49			15.54			15.41			15.34			14.63			16.44
Hydraulic radius - ft.			1.42			0.91			0.71			1.24			0.81			1.07			1.00			1.01			0.93			1.10
Pattern																														
Belt Width (Wblt) - ft.						50				48.80	68.32				60.00			60.00			60.00			60.00			60.00			60.00
Radius of Curvature (Rc) - ft.						10						20.00	15.04	41.80	20.62	15.04	41.80	20.62	15.04	41.80	20.62	15.04	41.80	20.62	15.04	41.80	20.62	15.04	41.80	20.62
Meander Length (Lm) - ft.						50				80.00	112.00		75.00	91.00	85.00	75.00	91.00	85.00	75.00	91.00	85.00	75.00	91.00	85.00	75.00	91.00	85.00	75.00	91.00	85.00
Meander Width Ratio (Wblt/Wbkf)						6.8						6.25			4.00			4.10			4.09			4.12			4.36			4.13
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10							36.5	72.5	52.3	28.2	70.8	46.5	5.8	17.8	11.9	54.3	56.9	55.6	9.0	52.6	20.6	12.9	29.4	20.1
Riffle Slope (Srif) - ft./ft.			0.026			0.032							0.0012	0.0032	0.0026	0.0020	0.0053	0.0033	0.0092	0.0139	0.0109	0.0030	0.0033	0.0032	0.0028	0.0144	0.0078	0.0017	0.3500	0.0110
Pool Length (Lpool) - ft.			9			24							18.4	42.5	34.1	14.7	57.2	29.5	26.4	40.8	33.2	27.2	50.1	38.8	11.9	51.4	29.1	11.4	42.3	28.4
Pool-Pool Spacing (p-p) - ft.			40			27							49.8	83.6	66.5	64.5	87.6	78.3	42.5	133.0	78.9	44.1	97.6	70.6	22.0	96.7	43.8	13.4	110.5	43.6
Substrate [3]																														
d_{50} (mm)			20			26						20			0.23			0.23			<0.062			0.46			0.05			0.11
d_{84} (mm)			38			76						38			0.41			0.41			<0.062			1.19			0.24			0.77
Additional Reach Parameters [3]																														
Valley Length (ft)						295			816			816			816			375.72			375.93			376.35			376.35			376.35
Channel Length (ft)			236			479			824			1203			1094			503.47			503.75			504.31			504.31			504.31
Sinuosity						1.6			1.01			1.47			1.34			1.34			1.34			1.34			1.34			1.34
Water Surface Slope (Save)			0.006			0.022			0.0035			0.002			0.0017			0.0017			0.0018			0.0020			0.0022			0.0024
Bankfull Slope (Sval)			NA			0.025						0.003			0.0020			0.0011			0.0016			0.0019			0.0024			0.0028
Rosgen Classification			E4			E4			F/G			E4			C5			C5			C6			C5			C6			C5
Bankfull mean velocity (Vbkf)			4.73			6.59			4.40			1.71			1.63			1.23			1.34			1.32			1.51			1.14
Bankfull Discharge (Qbkf)			98			60			26.00			20.5			20.5			20.5			20.5			20.5			20.5			20.5

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes each riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Lower Tributary A {Long-Term Monitoring Profile No. 1 Station 0+00 to 5+80.47 (580.47 feet)}

Parameter	Reference Reach Data [1]						XS 1+66.16, -4.60									Monitoring			Monitoring			Monitoring			Monitoring			Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]			Year 2 [4]			Year 3 [4]			Year 4 [4]			Year 5 [4]		
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]			1.3			0.14			2.03			2.03			2.03			2.03			2.03			2.03			2.03			2.03
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.59			10.00	13.00	31.23	22.12			19.78			18.87			20.08			20.23			21.12
Flood Prone Width (Wfpa) - ft.			100			43			10.41			60.00	60.00	82.28	71.14			71.26			49.74			79.89			62.05			62.05
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			4.89			20.16	7.10	30.36	18.73			19.46			17.12			19.50			21.44			23.91
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.74			2.80	0.55	1.16	0.83			0.98			0.91			0.97			1.06			1.13
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.39				1.00	2.57	1.79			2.02			1.91			2.08			2.04			2.37
Width/Depth Ratio			5.6			6.1			8.91			4.00	14.79	32.20	23.50			20.18			20.74			20.70			19.08			18.69
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00	2.63	4.62	3.22			3.60			2.64			3.98			3.07			2.94
Bank Height Ratio			1.0			1.8			5.85			1.00	1.00	1.00	1.00			1.28			1.29			1.24			1.00			1.00
Wetted Perimeter - ft.			14.6			9.95			7.34			12.32	13.28	23.59	16.76			20.21			19.29			20.53			20.76			21.67
Hydraulic radius - ft.			1.42			0.91			0.67			1.64	0.53	1.12	0.81			0.96			0.89			0.95			1.03			1.10
Pattern																														
Belt Width (Wblt) - ft.						50				61.00	85.40				60.00			60.00			60.00			60.00			60.00			60.00
Radius of Curvature (Rc) - ft.						10						25.00	15.22	39.94	24.86	16.70	26.55	21.70	16.70	26.55	21.70	16.70	26.55	21.70	16.70	26.55	21.70	16.70	26.55	21.70
Meander Length (Lm) - ft.						50				100.00	140.00		90.00	145.00	107.00	90.00	145.00	107.00	90.00	145.00	107.00	90.00	145.00	107.00	90.00	145.00	107.00	90.00	145.00	107.00
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00	2.37	4.62	2.71			3.03			3.18			2.99			2.97			2.84
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10										27.90	41.90	32.20	10.30	34.35	22.45	30.07	46.37	35.59	10.81	34.46	20.75	9.58	26.48	20.76
Riffle Slope (Srif) - ft./ft.			0.026			0.032										0.0020	0.0072	0.0048	0.0035	0.0096	0.0057	0.0032	0.0063	0.0044	0.0013	0.0129	0.0051	0.0010	0.0050	0.0030
Pool Length (Lpool) - ft.			9			24										48.60	62.90	52.20	19.61	62.34	41.63	28.79	63.49	41.92	15.51	58.79	36.79	11.27	49.01	31.31
Pool-Pool Spacing (p-p) - ft.			40			27										51.50	88.70	72.30	59.63	87.76	73.55	30.32	100.11	72.24	35.14	85.15	64.72	24.79	70.98	49.39
Substrate [3]																														
d_{50} (mm)			20			26									0.13			0.13			0.21			0.16			0.04			0.13
d_{84} (mm)			38			76									0.29			0.29			0.25			0.37			0.17			1.30
Additional Reach Parameters [3]																														
Valley Length (ft)						295			5710			5164			5178			393.99			415.00			408.78			408.78			408.78
Channel Length (ft)			236			479			5948			7391			7349			559.46			589.30			580.47			580.47			580.47
Sinuosity						1.6			1.04			1.43			1.42			1.42			1.42			1.42			1.42			1.42
Water Surface Slope (Save)			0.006			0.022			0.0019			0.0014	0.0012	0.0012	0.0012			0.0010			0.0015			0.0016			0.0012			0.0013
Bankfull Slope (Sval)			NA			0.025						0.0020	0.0007	0.00099	0.00084			0.0012			0.0016			0.0012			0.0012			0.0012
Rosgen Classification			E4			E4			F/G			E			C5			C5			C5			C5			C6			C5
Bankfull mean velocity (Vbkf)			4.73			6.59			8.32			1.03			1.11			1.06			1.21			1.06			0.97			0.87
Bankfull Discharge (Qbkf)			98			60			40.7			20.70			20.70			20.7			20.7			20.7			20.7			20.7

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes each riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Lower Tributary A {Long-Term Monitoring Profile No. 2 Station 0+00 to 6+23.77 (623.77 feet)}

Parameter	Reference Reach Data [1]						XS 1+66.16, -4.60									Monitoring			Monitoring			Monitoring			Monitoring			Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]			Year 2 [4]			Year 3 [4]			Year 4 [4]			Year 5 [4]		
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]			1.3			0.14			2.03			2.03			2.03			2.03			2.03			2.03			2.03			2.03
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.59			10.00	13.00	31.23	22.12			17.21			20.89			21.59			21.13			21.07
Flood Prone Width (Wfpa) - ft.			100			43			10.41			60.00	60.00	82.28	71.14			31.25			38.54			39.52			35.97			34.01
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			4.89			20.16	7.10	30.36	18.73			8.87			15.80			15.78			9.93			9.27
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.74			2.80	0.55	1.16	0.83			0.52			0.76			0.73			0.47			0.44
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.39				1.00	2.57	1.79			1.17			1.34			1.37			0.94			0.88
Width/Depth Ratio			5.6			6.1			8.91			4.00	14.79	32.20	23.50			33.10			27.49			29.58			44.96			47.89
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00	2.63	4.62	3.22			1.82			1.84			1.83			1.70			1.61
Bank Height Ratio			1.0			1.8			5.85			1.00	1.00	1.00	1.00			1.28			1.00			1.00			1.00			1.00
Wetted Perimeter - ft.			14.6			9.95			7.34			12.32	13.28	23.59	16.76			17.46			21.12			21.82			21.21			21.14
Hydraulic radius - ft.			1.42			0.91			0.67			1.64	0.53	1.12	0.81			0.51			0.75			0.72			0.47			0.44
Pattern																														
Belt Width (Wblt) - ft.						50				61.00	85.40				60.00			60			60			60			60			60
Radius of Curvature (Rc) - ft.						10						25.00	15.22	39.94	24.86	15.22	39.94	23.19	15.22	39.94	23.19	15.22	39.94	23.19	15.22	39.94	23.19	15.22	39.94	23.19
Meander Length (Lm) - ft.						50				100.00	140.00		90.00	145.00	107.00	90	145	107	90	145	107	90	145	107	90	145	107	90	145	107
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00	2.37	4.62	2.71			3.49			2.87			2.78			2.84			2.85
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10										7.70	25.20	17.60	6.18	31.37	17.04	8.29	31.06	15.79	7.43	27.71	18.68	13.43	36.01	23.48
Riffle Slope (Srif) - ft./ft.			0.026			0.032										0.0056	0.0148	0.0098	0.0035	0.0194	0.0100	0.0035	0.0072	0.0056	0.0007	0.0113	0.0044	0.0015	0.0081	0.0048
Pool Length (Lpool) - ft.			9			24										39.90	86.90	60.30	27.07	37.05	33.37	30.05	43.45	38.11	14.19	52.71	30.62	16.48	75.06	32.69
Pool-Pool Spacing (p-p) - ft.			40			27										50.70	95.20	74.50	64.70	109.76	89.03	72.48	109.52	93.55	35.14	85.15	64.72	18.92	84.22	44.03
Substrate [3]																														
d_{50} (mm)			20			26									0.13			0.13			0.21			0.16			0.04			0.13
d_{84} (mm)			38			76									0.29			0.29			0.25			0.37			0.17			1.30
Additional Reach Parameters [3]																														
Valley Length (ft)						295			5710			5164			5178			431.18			406.11			417.60			417.60			417.60
Channel Length (ft)			236			479			5948			7391			7349			612.27			576.68			592.99			592.99			592.99
Sinuosity						1.6			1.04			1.43			1.42			1.42			1.42			1.42			1.42			1.42
Water Surface Slope (Save)			0.006			0.022			0.0019			0.0014	0.0012	0.0012	0.0012			0.0014			0.0015			0.0013			0.0014			0.0013
Bankfull Slope (Sval)			NA			0.025						0.0020	0.0007	0.0010	0.0008			0.0022			0.0017			0.0011			0.0039			0.0015
Rosgen Classification			E4			E4			F/G			E			C5			B5			B5			B5			B6			B5
Bankfull mean velocity (Vbkf)			4.73			6.59			8.32			1.03			1.11			2.33			1.31			1.31			2.08			2.23
Bankfull Discharge (Qbkf)			98			60			40.7			20.70			20.70			20.70			20.70			20.70			20.70			20.70

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes each riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Lower Tributary A {Long-Term Monitoring Profile No. 3 Station 0+00 to 5+36.67 (536.67 feet)}

Parameter	Reference Reach Data [1]						XS 1+66.16, -4.60									Monitoring			Monitoring			Monitoring			Monitoring			Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]			Year 2 [4]			Year 3 [4]			Year 4 [4]			Year 5 [4]		
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]			1.3			0.14			2.03			2.03			2.03			2.03			2.03			2.03			2.03			2.03
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.59			10.00	13.00	31.23	22.12			24.84			25.84			23.02			23.39			21.97
Flood Prone Width (Wfpa) - ft.			100			43			10.41			60.00	60.00	82.28	71.14			68.33			70.73			69.55			69.47			69.47
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			4.89			20.16	7.10	30.36	18.73			19.90			20.88			21.07			20.93			18.24
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.74			1.00	0.55	1.16	0.83			0.80			0.81			0.92			0.89			0.83
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.39			2.80	1.00	2.57	1.79			1.78			1.87			1.79			1.82			1.82
Width/Depth Ratio			5.6			6.1			8.91			4.00	14.79	32.20	23.50			31.05			31.90			25.02			26.28			26.47
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00	2.63	4.62	3.22			2.75			2.74			3.02			2.97			3.16
Bank Height Ratio			1.0			1.8			5.85			1.00	1.00	1.00	1.00			1.00			1.00			1.00			1.00			1.00
Wetted Perimeter - ft.			14.6			9.95			7.34			12.32	13.28	23.59	16.76			25.15			26.17			23.51			23.68			22.32
Hydraulic radius - ft.			1.42			0.91			0.67			1.64	0.53	1.12	0.81			0.79			0.80			0.90			0.88			0.82
Pattern																														
Belt Width (Wblt) - ft.						50				61.00	85.40	73.20			60.00			60.00			60.00			60.00			60.00			60.00
Radius of Curvature (Rc) - ft.						10						25.00	15.22	39.94	24.86	19.56	32.82	29.53	19.56	32.82	29.53	19.56	32.82	29.53	19.56	32.82	29.53	19.56	32.82	29.53
Meander Length (Lm) - ft.						50				100.00	140.00	120.00	90.00	145.00	107.00	90	145	107	90	145	107	90	145	107	90	145	107	90	145	107
Meander Width Ratio (Wblt/Wbkf)						6.8						0.14	2.37	4.62	2.71			2.42			2.32			2.61			2.57			2.73
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10										13.70	46.80	28.00	13.75	22.00	16.69	10.92	40.53	25.79	6.86	36.80	16.31	11.83	31.55	19.76
Riffle Slope (Srif) - ft./ft.			0.026			0.032										0.0016	0.0151	0.0064	0.0031	0.0055	0.0044	0.0019	0.0066	0.0034	0.0020	0.0135	0.0057	0.0040	0.0096	0.0051
Pool Length (Lpool) - ft.			9			24										20.90	55.90	38.20	14.80	46.90	29.02	27.13	44.12	33.90	19.34	38.05	28.79	18.59	50.14	28.58
Pool-Pool Spacing (p-p) - ft.			40			27										42.10	76.20	63.30	28.88	86.12	48.93	35.88	76.81	54.49	28.69	79.84	44.91	23.66	77.74	44.74
Substrate [3]																														
d_{50} (mm)			20			26									0.13			0.13			0.21			0.16			0.04			0.13
d_{84} (mm)			38			76									0.29			0.29			0.25			0.37			0.17			1.30
Additional Reach Parameters [3]																														
Valley Length (ft)						295			5710			5164			5178			359.28			358.82			377.94			377.94			377.94
Channel Length (ft)			236			479			5948			7391			7349			510.18			509.53			536.67			536.67			536.67
Sinuosity						1.6			1.04			1.43			1.42			1.42			1.42			1.42			1.42			1.42
Water Surface Slope (Save)			0.006			0.022			0.0019			0.0014	0.0012	0.0012	0.0012			0.0010			0.0007			0.0007			0.0011			0.0010
Bankfull Slope (Sval)			NA			0.025						0.0020	0.0007	0.0010	0.0008			0.0022			0.0016			0.0008			0.0008			0.0004
Rosgen Classification			E4			E4			F/G			E			C5			C5			C5			C5			C6			C5
Bankfull mean velocity (Vbkf)			4.73			6.59			8.32			1.03			1.11			1.04			0.99			0.98			1.94			2.23
Bankfull Discharge (Qbkf)			98			60			40.7			20.70			20.70			20.70			20.70			20.70			40.70			40.70

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries
[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C
[3] As-Built dimension data includes each riffle cross-sections in a described reach.
[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Lower Tributary A {Long-Term Monitoring Profile No. 4 Station 0+00 to 3+77.05 (377.05 feet)}

Parameter	Reference Reach Data [1]						XS 1+66.16, -4.60									Monitoring			Monitoring			Monitoring			Monitoring			Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]			Year 2 [4]			Year 3 [4]			Year 4 [4]			Year 5 [4]		
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]			1.3			0.14			2.03			2.03			2.03			2.03			2.03			2.03			2.03			2.03
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.59			10.00	13.00	31.23	22.12			35.85			35.63			35.61			39.25			34.30
Flood Prone Width (Wfpa) - ft.			100			43			10.41			60.00	60.00	83.00	71.50			83.00			82.94			82.90			82.82			82.65
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			4.89			20.16	7.10	30.36	18.73			40.43			37.04			35.45			43.45			38.46
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.74			2.80	0.55	1.16	0.83			1.13			1.04			1.00			1.11			1.12
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.39				1.00	2.57	1.79			2.78			2.62			2.46			2.94			2.99
Width/Depth Ratio			5.6			6.1			8.91			4.00	14.79	32.20	23.50			31.73			34.26			35.61			35.36			30.62
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00	2.63	4.62	3.23			2.32			2.33			2.33			2.11			2.41
Bank Height Ratio			1.0			1.8			5.85			1.00	1.00	1.00	1.00			1.00			1.00			1.00			1.00			1.00
Wetted Perimeter - ft.			14.6			9.95			7.34			12.32	13.28	29.74	16.76			36.37			36.22			36.07			39.87			35.23
Hydraulic radius - ft.			1.42			0.91			0.67			1.64	0.53	1.12	0.81			1.11			1.02			0.98			1.09			1.09
Pattern																														
Belt Width (Wblt) - ft.						50				61.00	85.40				60.00			60			60			60			60			60
Radius of Curvature (Rc) - ft.						10						25.00	15.22	39.94	24.86	24.54	33.26	30.15	24.54	33.26	30.15	24.54	33.26	30.15	24.54	33.26	30.15	24.54	33.26	30.15
Meander Length (Lm) - ft.						50				100.00	140.00		90.00	145.00	107.00	90	145	107	90	145	107	90	145	107	90	145	107	90	145	107
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00	2.37	4.62	2.71			1.67			1.68			1.68			1.53			1.75
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10										14.40	20.70	17.50	5.74	24.74	14.11	13.32	28.12	19.73	12.06	30.36	18.36	6.01	37.93	15.40
Riffle Slope (Srif) - ft./ft.			0.026			0.032										0.0044	0.0070	0.0057	0.0031	0.0075	0.0051	0.0059	0.0134	0.0100	0.0010	0.0302	0.0088	0.0110	0.0170	0.0330
Pool Length (Lpool) - ft.			9			24										38.70	80.30	58.50	27.75	48.75	40.43	29.62	47.00	40.94	15.39	46.58	25.04	15.02	30.80	21.31
Pool-Pool Spacing (p-p) - ft.			40			27										52.00	88.60	62.90	30.00	58.88	44.63	36.30	87.90	56.61	37.43	69.86	49.83	19.90	72.86	35.64
Substrate [3]																														
d_{50} (mm)			20			26									0.04			0.04			0.21			0.16			0.04			0.13
d_{84} (mm)			38			76									0.07			0.07			0.25			0.37			0.17			1.30
Additional Reach Parameters [3]																														
Valley Length (ft)						295			5710			5164			5178			267.21			255.23			265.53			265.53			265.53
Channel Length (ft)			236			479			5948			7391			7349			379.44			362.42			377.05			377.05			377.05
Sinuosity						1.6			1.04			1.43			1.42			1.42			1.42			1.42			1.42			1.42
Water Surface Slope (Save)			0.006			0.022			0.0019			0.0014	0.0012	0.0012	0.0012			0.0009			0.0015			0.0034			0.0029			0.0015
Bankfull Slope (Sval)			NA			0.025						0.0020	0.0007	0.0010	0.0008			0.0004			0.0012			0.0014			0.0014			0.0020
Rosgen Classification			E4			E4			F/G			E			C5			C5			C5			C5			B6			C5
Bankfull mean velocity (Vbkf)			4.73			6.59			8.32			1.03			1.11			0.51			0.56			0.58			0.48			0.54
Bankfull Discharge (Qbkf)			98			60			40.7			20.70			20.70			20.70			20.70			20.70			20.70			20.70

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries
[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C
[3] As-Built dimension data includes each riffle cross-sections in a described reach.
[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Tributary A2 {Long-Term Monitoring Profile Station 0+00 to 1+96.06 (196.06 feet)}

Parameter	Reference Reach Data [1]						XS 3+61.77, -216.17																							
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built [3]			Monitoring Year 1 [4]			Monitoring Year 2 [4]			Monitoring Year 3 [4]			Monitoring Year 4 [4]			Monitoring Year 5 [4]		
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]			1.3			0.14			0.27			0.27			0.27			0.27			0.27			0.27			0.27			0.27
Bankfull Width (Wbkf) - ft.			10.8			7.35			7.09			5.00			17.85			21.43			21.74			22.31			21.25			16.84
Flood Prone Width (Wfpa) - ft.			100			43			11.19			30.00			46.81			46.81			44.56			44.49			46.28			46.77
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			4.29			4.81			18.21			17.52			17.47			16.46			12.29			16.96
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.60			0.80			1.02			0.82			0.80			0.74			0.58			1.01
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.12			1.30			1.78			1.55			1.52			1.28			1.17			1.91
Width/Depth Ratio			5.6			6.1			11.82			3.85			17.65			26.13			27.17			30.15			36.64			16.67
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00			2.62			2.18			2.05			2.24			2.18			2.78
Bank Height Ratio			1.0			1.8			5.85			1.00			1.00			1.18			1.00			1.00			1.00			1.00
Wetted Perimeter - ft.			14.6			9.95			7.52			6.08			18.25			21.73			21.98			22.5			21.39			17.83
Hydraulic radius - ft.			1.42			0.91			0.57			0.79			1.00			0.81			0.79			0.73			0.57			0.95
Pattern																														
Belt Width (Wblt) - ft.						50				30.50	42.70	36.60			40.00			40.00			40.00			40.00			40.00			40.00
Radius of Curvature (Rc) - ft.						10						12.50	8.19	14.26	12.00	8.19	14.26	12.00	8.19	14.26	12.00	8.19	14.26	12.00	8.19	14.26	12.00	8.19	14.26	12.00
Meander Length (Lm) - ft.						50				50.00	70.00	60.00	47.00	57.00	51.00	47.00	57.00	51.00	47.00	57.00	51.00	47.00	57.00	51.00	47.00	57.00	51.00	47.00	57.00	51.00
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00			2.24			1.87			1.84			1.79			1.88			2.38
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10							8.30	11.20	9.80	2.56	24.20	14.60	16.80	47.82	29.75	23.62	40.40	32.01	15.87	39.29	24.91	15.02	30.00	20.11
Riffle Slope (Srif) - ft./ft.			0.026			0.032							0.0534	0.0718	0.0626	0.0255	0.1033	0.0523	0.0155	0.0328	0.0242	0.0134	0.0296	0.0215	0.0092	0.0181	0.0134	0.0010	0.0120	0.0060
Pool Length (Lpool) - ft.			9			24							31.90	47.10	39.50	12.60	30.30	24.30	20.72	26.29	23.75	37.42	38.46	37.94	24.46	34.60	28.79	36.20	42.70	39.30
Pool-Pool Spacing (p-p) - ft.			40			27							55.50	79.40	67.60	26.10	48.60	34.80	18.78	37.08	27.50	19.47	39.40	31.29	26.54	96.53	51.58	16.20	55.40	38.89
Substrate [3]																														
d_{50} (mm)			20			26						26																		
d_{84} (mm)			38			76						76																		
Additional Reach Parameters [3]																														
Valley Length (ft)						295			310			334			334			169.78			241.82			241.83			241.83			241.83
Channel Length (ft)			236			479			325			462			480			244.00			347.526			348.235			348.2352			348.2352
Sinuosity						1.6			1.05			1.38			1.44			1.44			1.44			1.44			1.44			1.44
Water Surface Slope (Save)			0.006			0.022			0.0156			0.0206			0.01025			0.0095			0.0069			0.0066			0.0081			0.0074
Bankfull Slope (Sval)			NA			0.025						0.0284			0.01035			0.0080			0.0063			0.0067			0.0200			0.0068
Rosgen Classification			E4			E4			F/G			E4			C4			C4			C4			C4			C4			C4
Bankfull mean velocity (Vbkf)			4.73			6.59			4.29			3.83			1.01			1.05			1.05			1.12			1.50			1.08
Bankfull Discharge (Qbkf)			98			60			18.4			18.4			18.4			18.4			18.4			18.4			18.4			18.4

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes each riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Tributary B {Upper Tributary B Long-Term Monitoring Profile Station 0+00 to 5+04.36 (504.36 feet)}

Parameter	Reference Reach Data [1]						XS 12+28.00, -35.88									Monitoring			Monitoring			Monitoring			Monitoring			Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]			Year 2 [4]			Year 3 [4]			Year 4 [4]			Year 5 [4]		
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]			1.3			0.14			0.44			0.44			0.44			0.44			0.44			0.44			0.44			0.44
Bankfull Width (Wbkf) - ft.			10.8			7.35			7.83			6.20	21.83	27.89	24.86			22.32			25.07			24.07			24.01			26.52
Flood Prone Width (Wfpa) - ft.			100			43			11.86			45.38	61.75	69.12	65.44			61.75			61.79			57.39			61.22			61.16
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			4.86			7.36	12.07	18.21	15.14			18.70			20.79			19.96			18.63			18.18
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.62			1.60	0.55	0.65	0.60			0.84			0.83			0.83			0.78			0.69
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.22				1.52	1.67	1.60			2.06			2.18			2.07			2.19			2.33
Width/Depth Ratio			5.6			6.1			12.63			3.88	39.69	42.91	41.30			26.57			20.79			29.00			30.78			38.43
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.51			7.32	2.48	2.83	2.66			2.77			2.47			2.38			2.55			2.31
Bank Height Ratio			1.0			1.8			4.40			1.00	1.00	1.00	1.00			1.00			1.00			1.00			1.00			1.00
Wetted Perimeter - ft.			14.6			9.95			8.22			7.53	22.49	28.15	25.32			23.65			26.62			25.20			24.97			27.92
Hydraulic radius - ft.			1.42			0.91			0.59			0.98	0.54	0.65	0.60			0.79			0.79			0.79			0.75			0.65
Pattern																														
Belt Width (Wblt) - ft.						50				45.38	52.95		50.00	50.00	50.00			50.00			50.00			50.00			50.00			50.00
Radius of Curvature (Rc) - ft.						10						15.50	10.20	19.38	14.05	12.95	19.38	16.79	12.95	19.38	16.79	12.95	19.38	16.79	12.95	19.38	16.79	12.95	19.38	16.79
Meander Length (Lm) - ft.						50				62.00	86.80		60.00	80.00	70.00	60.00	80.00	70.00	60.00	80.00	70.00	60.00	80.00	70.00	60.00	80.00	70.00	60.00	80.00	70.00
Meander Width Ratio (Wblt/Wbkf)						6.8						7.32	2.29	1.79	2.01			2.24			1.99			2.08			2.08			1.89
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10										13.10	15.60	14.40	13.06	18.82	15.31	12.49	20.90	16.32	7.43	31.44	16.77	6.57	23.94	16.85
Riffle Slope (Srif) - ft./ft.			0.026			0.032										0.0216	0.0754	0.0501	0.0160	0.0497	0.0396	0.0254	0.0577	0.0439	0.0058	0.0569	0.0262	0.0027	0.0660	0.0240
Pool Length (Lpool) - ft.			9			24										13.60	67.40	28.60	14.66	67.75	30.56	14.33	43.05	27.15	12.58	39.44	22.66	18.31	53.52	29.64
Pool-Pool Spacing (p-p) - ft.			40			27										56.80	128.20	79.70	27.81	86.46	58.15	28.70	75.08	53.49	21.72	66.88	39.62	15.96	97.64	40.37
Substrate [3]																														
d_{50} (mm)			20			26									55.06			55.1			0.19			0.16			0.23			0.28
d_{84} (mm)			38			76									83.88			83.9			0.23			0.23			88.27			0.49
Additional Reach Parameters [3]																														
Valley Length (ft)						295			1360			1302			1312			324.86			326.20			323.31			323.31			323.31
Channel Length (ft)			236			479			1455			2052			2041			506.78			508.87			504.36			504.36			504.36
Sinuosity						1.6			1.07			1.58			1.56			1.56			1.56			1.56			1.56			1.56
Water Surface Slope (Save)			0.006			0.022			0.0124			0.0123	0.0091	0.0099				0.0093			0.0090			0.0088			0.0086			0.0116
Bankfull Slope (Sval)			NA			0.025						0.0078	0.0089	0.0097				0.0093			0.0100			0.0083			0.0055			0.0118
Rosgen Classification			E4			E4			B			E	E4	C4	C4			E4			C5			C5			C5			C5
Bankfull mean velocity (Vbkf)			4.73			6.59			4.20			2.77			1.35			1.09			0.98			1.02			1.10			1.12
Bankfull Discharge (Qbkf)			98			60			20.4			20.4			20.4			20.4			20.4			20.4			20.4			20.4

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes each riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XII. Baseline Geomorphologic and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Tributary B {Lower Tributary B Long-Term Monitoring Profile Station 0+00 to 5+ 04.36 (504.36 feet)}

Parameter	Reference Reach Data [1]						XS 12+28.00, -35.88									Monitoring			Monitoring			Monitoring			Monitoring			Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]			Year 2 [4]			Year 3 [4]			Year 4 [4]			Year 5 [4]		
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]			1.3			0.14			0.44			0.44			0.44			0.44			0.44			0.44			0.44			0.44
Bankfull Width (Wbkf) - ft.			10.8			7.35			7.83			6.20	21.83	27.89	24.86			27.35			28.85			32.79			30.94			30.45
Flood Prone Width (Wfpa) - ft.			100			43			11.86			45.38	61.75	69.12	65.44			63.49			63.46			71.98			62.62			63.25
Bankfull Cross-Section Area (Abkf) - ft.[2]			20.7			9.1			4.86			7.36	12.07	18.21	15.14			19.93			19.68			22.41			25.98			25
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.62			1.00	0.55	0.65	0.60			0.73			0.69			0.68			0.84			0.82
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.22			1.60	1.52	1.67	1.60			1.69			1.69			1.58			1.87			1.79
Width/Depth Ratio			5.6			6.1			12.63			3.88	39.69	42.91	41.30			37.47			41.38			48.22			36.83			37.13
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.51			7.32	2.48	2.83	2.66			2.32			2.22			2.20			2.44			2.08
Bank Height Ratio			1.0			1.8			4.40			1.00	1.00	1.00	1.00			1.00			1.00			1.00			1.00			1.00
Wetted Perimeter - ft.			14.6			9.95			8.22			7.53	22.49	28.15	25.32			27.84			29.05			33.1			31.19			31.2
Hydraulic radius - ft.			1.42			0.91			0.59			0.98	0.54	0.65	0.60			0.72			0.68			0.68			0.83			0.8
Pattern																														
Belt Width (Wblt) - ft.						50				45.38	52.95		50.00	50.00	50.00			50.00			50.00			50.00			50.00			50.00
Radius of Curvature (Rc) - ft.						10						15.50	10.20	19.38	14.05	10.20	15.54	13.34	10.20	15.54	13.34	10.20	15.54	13.34	10.20	15.54	13.34	10.20	15.54	13.34
Meander Length (Lm) - ft.						50				62.00	86.80		60.00	80.00	70.00	60.00	80.00	70.00	60.00	80.00	70.00	60.00	80.00	70.00	60.00	80.00	70.00	60.00	80.00	70.00
Meander Width Ratio (Wblt/Wbkf)						6.8						7.32	2.29	1.79	2.01			1.83			1.73			1.52			1.62			1.64
Profile [3]																														
Riffle Length (Lrif) - ft.			16			10										1.30	12.30	6.50	9.00	12.39	10.17	9.13	20.10	13.03	7.05	20.26	13.65	9.58	26.34	18.08
Riffle Slope (Srif) - ft./ft.			0.026			0.032										0.0171	0.0934	0.0469	0.0275	0.0778	0.0444	0.0164	0.0405	0.0291	0.0050	0.0509	0.0170	0.0020	0.0087	0.0052
Pool Length (Lpool) - ft.			9			24										17.80	37.20	26.70	25.79	42.57	36.22	17.92	34.94	28.19	13.66	35.24	24.28	13.57	36.31	25.59
Pool-Pool Spacing (p-p) - ft.			40			27										41.60	60.80	47.70	20.06	47.07	34.09	39.31	56.52	45.78	25.11	54.18	47.07	15.16	51.08	33.24
Substrate [3]																														
d_{50} (mm)			20			26									55.06			55.06			0.19			0.16			0.23			0.28
d_{84} (mm)			38			76									83.88			83.88			0.23			0.23			88.27			0.49
Additional Reach Parameters [3]																														
Valley Length (ft)						295			1360			1302			1312			324.86			326.20			323.31			323.31			323.31
Channel Length (ft)			236			479			1455			2052			2041			506.78			508.87			504.36			504.36			504.36
Sinuosity						1.6			1.07			1.58			1.56			1.56			1.56			1.56			1.56			1.56
Water Surface Slope (Save)			0.006			0.022			0.0124			0.0123	0.0091	0.0099				0.0073			0.0067			0.0059			0.0052			0.0087
Bankfull Slope (Sval)			NA			0.025						0.0078	0.0089	0.0097				0.0069			0.0070			0.0059			0.0103			0.0084
Rosgen Classification			E4			E4			B			E	E4	C4	C4			C4			C5			C5			C5			C5
Bankfull mean velocity (Vbkf)			4.73			6.59			4.20			2.77			1.35			1.02			1.04			0.91			0.79			0.82
Bankfull Discharge (Qbkf)			98			60			20.4			20.4			20.4			20.4			20.4			20.4			20.4			20.4

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes each riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value;
where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A (Upper)

Parameter	Cross Section (Riffle 1) XS 115+35.21						Cross Section (Pool 2) XS 113+37.13						Cross Section (Pool 3) XS 110+48.78					
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**
BF Width (ft)	16.87	12.42	12.24	18.34	12.99	10.49	23.29	11.41	11.55	12.51	15.28	14.13	23.36	7.94	5.58	16.65	15.38	12.31
Floodprone Width (ft)	45.59	38.82	39.19	57.62	52.36	40.27	50	54.3	56.97	36.04	65.66	49.83	50.02	27.8	26.76	49.97	49.42	49.87
BF Cross Sectional Area (ft²)	17.25	11.69	11.19	16.49	10.08	8.33	28.22	9.69	10.89	11.37	11	12.42	26.86	4.46	3.64	13	11.78	8.03
BF Mean Depth (ft)	1.02	0.94	0.91	0.9	0.78	0.79	1.21	0.85	0.94	0.91	0.72	0.88	1.15	0.56	0.65	0.78	0.77	0.65
BF Max Depth (ft)	1.6	1.52	1.52	1.96	1.61	1.39	2.27	1.63	1.84	1.91	2.19	2.28	2.39	1.49	1.37	2.32	2.19	2.49
Width/Depth Ratio	16.54	13.21	13.45	20.38	16.65	13.28	19.25	13.42	12.29	13.75	21.22	16.06	20.31	14.18	8.58	21.35	19.97	18.49
Entrenchment Ratio	2.7	3.13	3.2	3.14	4.03	3.84	2.15	4.76	4.93	2.88	4.3	3.53	2.14	3.5	4.79	3	3.21	4.05
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	17.28	13.15	12.85	18.93	13.4	10.99	23.78	12.03	12.3	13.31	16.19	15.44	24.07	8.72	6.28	17.74	16.31	14.15
Hydraulic Radius (ft)	1	0.89	0.87	0.87	0.75	0.76	1.19	0.81	0.89	0.85	0.68	0.8	1.12	0.51	0.58	0.73	0.72	0.57
Substrate																		
D50 (mm)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A (Upper)

Parameter	Cross Section (Riffle 4) XS 108+96.23						Cross Section (Pool 5) XS 105+38.70						Cross Section (Riffle 6) XS103+74.70					
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**
BF Width (ft)	40.63	20.22	20.2	12.33	13.93	12.68	22.53	10.35	10.94	10.11	8..38	9.65	24.19	11.64	10.73	10.21	8.07	9.24
Floodprone Width (ft)	65.58	65.6	64.62	51.83	58.38	51.47	49.99	50	50.08	49.98	49.98	49.98	69.53	52.83	51.52	52.15	50.98	51.45
BF Cross Sectional Area (ft²)	37.22	18.64	17.78	8.08	6.73	7.13	20.23	6.32	7.55	6.33	5.4	8.18	24.32	9.49	9.08	8.61	7.02	8.26
BF Mean Depth (ft)	0.92	0.92	0.88	0.66	0.48	0.56	0.9	0.61	0.69	0.63	0.64	0.85	1.01	0.82	0.85	0.84	0.87	0.89
BF Max Depth (ft)	2.39	2.3	2.23	1.72	1.48	1.27	1.83	1.59	1.47	1.51	1.67	1.8	2.26	1.8	1.56	1.7	1.74	1.67
Width/Depth Ratio	44.16	21.98	22.95	18.68	29.02	22.64	25.03	16.67	15.86	16.05	13.09	11.35	23.95	14.2	21.62	12.15	9.28	10.38
Entrenchment Ratio	1.61	3.25	3.2	4.21	4.19	4.06	2.22	4.83	4.58	4.94	5.96	5.18	2.87	4.54	4.8	5.11	6.32	5.57
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	41.03	20.95	2.9	13	14.41	13.58	23.17	11.15	11.91	11.01	9.25	11.13	24.64	12.29	11.4	10.92	8.82	10.36
Hydraulic Radius (ft)	0.91	0.89	0.85	0.62	0.47	0.53	0.87	0.57	0.63	0.57	0.58	0.73	0.99	0.77	0.8	0.79	0.8	0.8
Substrate																		
D50 (mm)		3.43	6.98	0.64	0.28	0.21	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)		12.48	16.32	16	0.5	0.88	**	**	**	**	**	**	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A (Middle)

Parameter	Cross Section (Pool 7) XS 87+92.18						Cross Section (Riffle 8) XS 85+64.09					
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**
BF Width (ft)	23.38	16.43	13.36	16.49	17.48	14.68	36.65	14.63	14.68	14.55	13.76	14.54
Floodprone Width (ft)	50.01	57.22	57.37	57.93	50.05	52.18	67.33	67.33	61.33	61.37	66.43	67.05
BF Cross Sectional Area (ft²)	22.96	17.6	16.33	16.22	14.63	14.92	38.26	16.62	15.35	15.48	13.54	18.04
BF Mean Depth (ft)	0.98	1.07	1	0.98	0.84	1.02	1.04	1.14	1.05	1.06	0.98	1.24
BF Max Depth (ft)	2.02	1.83	1.88	1.9	1.85	1.78	2.76	2.38	2.11	2.24	2.26	2.47
Width/Depth Ratio	23.86	15.36	16.36	16.83	20.81	14.39	35.24	12.83	13.98	13.73	14.04	11.73
Entrenchment Ratio	2.14	3.48	3.51	3.51	2.86	3.55	1.84	4.6	4.18	4.22	4.83	4.61
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	23.77	17.02	17.3	17.13	17.9	15.62	37.42	15.54	15.41	15.34	14.63	16.44
Hydraulic Radius (ft)	0.97	1.03	0.94	0.95	0.82	0.96	1.02	1.07	1	1.01	0.93	1.1
Substrate												
D50 (mm)	*	0.23	0.03	0.46	0.05	0.11	*	*	*	*	*	*
D84 (mm)	**	0.41	0.05	1.19	0.24	0.77	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A (Lower)

Parameter	Cross Section (Pool 9) XS 72+02.58						Cross Section (Riffle 10) XS 70+96.05						Cross Section (Pool 11) XS 66+01.49					
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**
BF Width (ft)	18.13	16.41	9.97	25.13	23	20.59	14.26	15.64	15.22	22.84	21.78	23.03	24.11	12.09	12.84	24.9	13.77	23.64
Floodprone Width (ft)	64	57.84	56.85	71.77	74.54	72.78	49.85	56.93	51.61	76.29	76.99	76.29	63.05	36.13	35.32	67.74	36.61	67.74
BF Cross Sectional Area (ft²)	17.68	11.12	8.11	14.99	17.05	14.68	12.6	12.63	12.24	19.71	21.78	19.33	21.29	8.61	6.92	22.26	7.76	22.86
BF Mean Depth (ft)	0.98	0.68	0.81	0.6	0.74	0.71	0.88	0.81	0.8	0.86	1	0.84	0.88	0.71	0.54	0.89	0.56	0.97
BF Max Depth (ft)	1.91	1.84	1.78	1.86	2.25	1.91	1.65	1.88	1.79	2.25	2.32	1.9	1.72	1.34	1.23	1.88	1.19	2.3
Width/Depth Ratio	18.5	24.13	12.31	41.88	31.08	29	16.2	19.31	19.02	26.56	21.78	27.42	27.4	17.03	23.78	27.98	24.59	24.37
Entrenchment Ratio	3.53	3.53	5.7	2.86	3.24	3.54	3.49	3.64	3.39	3.34	3.53	3.31	2.62	2.99	2.75	2.72	2.66	2.87
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	18.66	17.86	11.11	26.29	24.1	21.21	14.69	16.36	15.68	23.37	22.77	23.39	24.4	12.51	13.11	25.25	13.99	24.34
Hydraulic Radius (ft)	0.95	0.62	0.73	0.57	0.71	0.69	0.86	0.77	0.78	0.84	0.96	0.83	0.87	0.69	0.53	0.88	0.55	0.94
Substrate																		
D50 (mm)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A (Lower)

Parameter	Cross Section (Riffle 12) XS 64+13.80						Cross Section (Pool 13) XS 54+85.21						Cross Section (Riffle 14) XS 50+53.37					
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**
BF Width (ft)	25.57	19.78	18.87	20.08	20.23	21.12	27.9	16.15	13.93	22.88	23.27	24.66	34.14	17.21	20.89	21.59	21.13	21.07
Floodprone Width (ft)	79.71	71.26	49.74	79.89	62.05	62.05	59.73	39.04	33.29	70	38.45	45.28	79.78	31.25	38.54	39.52	35.97	34.01
BF Cross Sectional Area (ft²)	33.47	19.46	17.12	19.5	21.44	23.91	46.27	13.56	9.67	28.27	32.51	28.45	47.31	8.87	15.8	15.78	9.93	9.27
BF Mean Depth (ft)	1.31	0.98	0.91	0.97	1.06	1.13	1.66	0.84	0.69	1.24	1.4	1.15	1.39	0.52	0.76	0.73	0.47	0.44
BF Max Depth (ft)	2.55	2.02	1.91	2.08	2.04	2.37	3.25	2.23	1.92	2.82	2.8	2.7	2.72	1.17	1.34	1.37	0.94	0.88
Width/Depth Ratio	19.52	20.18	20.74	20.7	19.08	18.69	16.81	19.23	20.19	18.45	16.62	21.44	24.56	33.1	27.49	29.58	44.96	47.89
Entrenchment Ratio	3.12	3.6	2.64	3.98	3.07	2.94	2.14	2.42	2.39	3.06	1.65	1.84	2.34	1.82	1.84	1.83	1.7	1.61
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	26.09	20.21	19.29	20.53	20.76	21.67	29.1	17.32	14.69	23.9	24.68	25.61	34.63	17.46	21.12	21.82	21.21	21.14
Hydraulic Radius (ft)	1.28	0.96	0.89	0.95	1.03	1.1	1.59	0.78	0.66	1.18	1.32	1.11	1.37	0.51	0.75	0.72	0.47	0.44
Substrate																		
D50 (mm)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A (Lower)

Parameter	Cross Section (Pool 15) XS 43+93.88						Cross Section (Riffle 16) XS 40+13.89						Cross Section (Pool 17) XS 28+23.53					
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**
BF Width (ft)	18.67	15.62	14.99	18.59	19.64	18.75	23.07	20.91	20.44	20.06	17.52	18.55	17.45	16.6	15.79	20.3	16.17	17.34
Floodprone Width (ft)	47.64	60.07	64.71	67.55	57.34	69.14	60.55	51.93	51.77	47.02	47.62	40.84	48.38	57.77	54.38	63.67	50.15	55.96
BF Cross Sectional Area (ft²)	20.64	17.4	16.56	20.21	21.15	21.16	29.35	22.09	20.36	18.57	15.69	14.71	16.45	14.12	12.72	19.38	16.8	15.87
BF Mean Depth (ft)	1.11	1.11	1.1	1.09	1.08	1.13	1.27	1.06	1	0.93	0.9	0.79	0.94	0.85	0.81	0.95	1.04	0.92
BF Max Depth (ft)	2.31	2.68	2.87	2.87	2.67	3.37	2.35	2.07	2.12	1.93	1.9	1.74	1.85	2.13	1.93	2.28	2.05	2.29
Width/Depth Ratio	16.82	14.07	13.63	17.06	18.19	16.59	18.17	19.73	20.44	21.57	19.47	23.48	18.56	19.53	19.49	21.37	15.55	18.85
Entrenchment Ratio	2.55	3.85	4.32	3.63	2.92	3.69	2.62	2.48	2.53	2.32	2.72	2.2	2.77	3.48	3.44	3.14	3.1	3.23
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	19.38	17.03	16.37	19.92	20.61	20.57	23.58	21.43	21.13	20.48	18	18.94	17.93	17.41	16.53	20.99	16.75	18.44
Hydraulic Radius (ft)	1.06	1.02	1.01	1.01	1.03	1.03	1.24	1.03	0.96	0.91	0.87	0.78	0.92	0.81	0.77	0.92	1	0.86
Substrate																		
D50 (mm)	*	*	*	*	*	*	*	0.13	0.06	0.16	0.04	0.13	*	*	*	*	*	*
D84 (mm)	**	**	**	**	**	**	**	0.29	0.21	0.37	0.17	1.3	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A (Lower)

Parameter	Cross Section (Riffle 18) XS 25+39.7						Cross Section (Riffle 19) XS 22+31.26						Cross Section (Pool 20) XS 21+16.53					
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**
BF Width (ft)	31.23	24.84	25.84	23.02	23.39	21.97	35.22	12.09	12.2	19.9	21.26	21.76	12.61	15.34	14.95	23.89	24.13	23.25
Floodprone Width (ft)	82.28	68.33	70.73	69.55	69.47	69.47	80.47	27.84	27.98	45.24	59.44	74.09	42.51	67.84	67.47	63.27	68.79	68.31
BF Cross Sectional Area (ft²)	30.36	19.9	20.88	21.07	20.93	18.24	46.76	5.67	5.34	14.16	18.06	21.69	12.43	18.13	16.59	28.17	31.25	30.84
BF Mean Depth (ft)	0.97	0.8	0.81	0.92	0.89	0.83	1.33	0.47	0.44	0.71	0.85	1	0.99	1.18	1.11	1.18	1.3	1.33
BF Max Depth (ft)	2.57	1.78	1.87	1.79	1.82	1.82	3.1	1.14	1.11	1.46	1.81	2.15	2.02	2.74	2.62	3.24	3.35	3.37
Width/Depth Ratio	32.2	31.05	31.9	25.02	26.28	26.47	26.48	25.72	27.73	28.03	25.01	21.76	12.74	13	13.47	20.25	18.56	17.48
Entrenchment Ratio	2.64	2.75	2.74	3.02	2.97	3.16	2.28	2.3	2.29	2.27	2.8	3.4	3.37	4.42	4.51	2.65	2.85	2.94
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	31.8	25.15	26.17	23.51	23.68	22.32	35.84	12.55	12.63	20.2	26.59	22.26	13.43	16.69	16.43	25.32	25.61	25.37
Hydraulic Radius (ft)	0.95	0.79	0.8	0.9	0.88	0.82	1.3	0.45	0.42	0.7	0.84	0.97	0.93	1.07	1.01	1.11	1.22	1.22
Substrate																		
D50 (mm)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A (Lower)

Parameter	Cross Section (Pool 21) XS 4+31.01						Cross Section (Riffle 22) XS 3+18.00					
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**
BF Width (ft)	22.77	25.28	25.5	25.64	25.04	25.98	29.25	35.85	35.63	35.61	39.25	34.3
Floodprone Width (ft)	59.9	71.3	67.58	66.53	47.36	68.24	82.99	83	82.94	82.9	82.82	82.65
BF Cross Sectional Area (ft²)	29.97	47.21	45.57	42.76	42.39	39.38	29.7	40.43	37.04	35.45	43.45	38.46
BF Mean Depth (ft)	1.32	1.87	1.79	1.67	1.69	1.52	1.02	1.13	1.04	1	1.11	1.12
BF Max Depth (ft)	2.59	3.75	3.6	3.39	3.44	3.2	2.51	2.78	2.62	2.46	2.94	2.99
Width/Depth Ratio	17.25	13.52	14.25	15.35	14.82	17.09	28.68	31.73	34.26	35.61	35.36	30.62
Entrenchment Ratio	2.63	2.82	2.65	2.59	1.89	2.63	2.84	2.32	2.33	2.33	2.11	2.41
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	23.52	26.82	26.94	26.84	26.38	27.13	29.74	36.37	36.22	36.07	39.87	35.23
Hydraulic Radius (ft)	1.27	1.76	1.69	1.59	1.61	1.45	1	1.11	1.02	0.98	1.09	1.09
Substrate												
D50 (mm)	*	0.04	0.03	0.04	0.06	0.08	*	*	*	*	*	*
D84 (mm)	**	0.07	0.05	0.28	0.21	0.4	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary B

Parameter	Cross Section (Pool 1) XS 15+34.21						Cross Section (Riffle 2) XS 12+10.65						Cross Section (Pool 3) XS 8+39.41						Cross Section (Riffle 4) XS 5+00.07					
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)	12.33	10.08	10.11	29.56	28.18	29.92	21.83	22.32	25.07	24.07	24.01	26.52	17.61	9.93	9.78	31.52	27.4	28	27.89	27.35	28.55	32.79	30.94	30.45
Floodprone Width (ft)	47.83	52.91	55.45	70	49.6	56.02	61.75	61.75	61.79	57.39	61.22	61.16	42.79	43.75	42.04	80	48.22	54.58	69.12	63.49	63.46	80	62.62	63.25
BF Cross Sectional Area (ft²)	10.68	9.41	9.64	26.75	22.35	24.85	12.07	18.7	20.79	19.96	18.63	18.18	1.1	5.57	5.2	20.11	16.33	18.03	18.21	19.93	19.68	22.41	25.98	25
BF Mean Depth (ft)	0.87	0.93	0.95	0.9	0.79	0.83	0.55	0.84	0.83	0.83	0.78	0.69	0.63	0.56	0.53	0.64	0.6	0.64	0.65	0.73	0.69	0.68	0.84	0.82
BF Max Depth (ft)	2.25	2.16	2.24	3.02	2.42	2.47	1.67	2.06	2.18	2.07	2.19	2.33	1.58	1.42	1.39	2.15	1.92	1.94	1.52	1.69	1.69	1.58	1.87	1.79
Width/Depth Ratio	14.17	10.84	10.64	32.84	35.67	36.05	39.69	26.57	30.2	29	30.78	38.43	27.95	17.73	18.45	49.25	45.67	43.75	42.91	37.47	41.38	48.22	36.83	37.13
Entrenchment Ratio	3.88	5.25	5.48	2.37	1.76	1.87	2.83	2.77	2.47	2.38	2.55	2.31	2.43	4.41	4.3	2.54	1.76	1.95	2.48	2.32	2.22	2.44	2.02	2.08
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)	13.76	11.36	11.5	30.97	29.38	31.14	22.49	23.65	26.22	25.2	24.97	27.92	18.15	10.56	10.46	32.21	28.72	28.72	28.15	27.84	29.05	33.1	31.19	31.2
Hydraulic Radius (ft)	0.78	0.83	0.84	0.86	0.76	0.8	0.54	0.79	0.79	0.79	0.75	0.65	0.61	0.53	0.5	0.62	0.57	0.63	0.65	0.72	0.68	0.68	0.83	0.8
Substrate																								
D50 (mm)	*	0.04	0.03	0.16	0.23	0.28	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)	**	0.18	0.05	0.4	0.47	0.49	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary A - 2

Parameter	Cross Section (Pool 1) XS 3+23.00						Cross Section (Riffle 2) XS 2+18.05					
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**
BF Width (ft)	18.04	8.47	8.5	16.87	16.54	15.99	17.85	21.43	21.74	22.31	21.25	16.84
Floodprone Width (ft)	60.66	32.05	30.16	57.6	52.35	58.35	46.81	46.81	44.56	44.49	46.28	46.77
BF Cross Sectional Area (ft^2)	19.02	12.64	5.16	12.05	9.74	11.6	18.21	17.52	17.47	16.46	12.29	16.96
BF Mean Depth (ft)	1.05	0.67	0.61	0.71	0.59	0.73	1.02	0.82	0.8	0.74	0.58	1.01
BF Max Depth (ft)	1.95	1.27	1.17	1.61	1.36	1.7	1.78	1.55	1.52	1.28	1.17	1.91
Width/Depth Ratio	17.18	12.64	13.93	23.76	28.03	21.9	17.5	26.13	27.17	30.15	36.64	16.67
Entrenchment Ratio	3.36	3.78	3.55	3.41	3.17	3.65	2.62	2.18	2.05	1.99	2.18	2.78
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	18.52	8.92	8.85	17.26	16.82	16.47	18.25	21.73	21.98	22.5	21.39	17.83
Hydraulic Radius (ft)	1.03	0.64	0.58	0.7	0.58	0.7	1	0.81	0.79	0.73	0.57	0.95
Substrate												
D50 (mm)	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)	**	**	**	**	**	**	**	**	**	**	**	**

Table XIII: Morphology and Hydraulic Monitoring Summary
South Muddy Creek and Unnamed Tributaries Stream Restoration / EEP Project No. D04006-01
Reach: South Muddy Creek Tributary C

Parameter	Cross Section (Pool 1) XS 15+70.17						Cross Section (Riffle 2) XS 8+57.59						Cross Section (Riffle 3) XS 4+11.50					
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**
BF Width (ft)	3.67	6.78	7.4	8.65	6.95	5.27	11.17	11.25	11.24	12.39	11.63	10.85	6.89	7.45	6.67	6.37	8.17	8.83
Floodprone Width (ft)	29.61	37.83	37.6	36.56	37.72	39.79	15.98	15.71	15.22	16.16	16.25	17.82	24.24	26.22	26.25	26.07	19.65	27.5
BF Cross Sectional Area (ft^2)	2.31	6.55	6.76	5.09	4.81	4.58	3.09	4.91	3.8	6.23	5.97	5.87	4.42	4.41	3.66	3.53	4.82	5.18
BF Mean Depth (ft)	0.63	0.97	0.91	0.59	0.69	0.87	0.28	0.44	0.34	0.5	0.51	0.54	0.64	0.59	0.55	0.55	0.59	0.59
BF Max Depth (ft)	0.89	1.42	1.24	0.88	0.96	1.18	0.53	0.79	0.61	0.75	0.76	0.75	0.91	0.91	1.04	1.02	1.07	1
Width/Depth Ratio	5.83	6.99	8.13	14.66	10.07	6.06	39.89	25.57	33.06	24.78	22.8	20.09	10.77	12.63	12.13	11.58	13.85	14.97
Entrenchment Ratio	8.08	5.58	5.08	4.23	5.42	7.54	1.43	1.4	1.35	1.31	1.4	1.64	3.52	3.52	3.94	4.09	2.4	3.11
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	4.28	7.95	8.51	9.37	7.57	6.18	11.47	11.4	11.33	12.57	12.87	11.07	7.49	7.97	7.09	6.75	8.48	9.32
Hydraulic Radius (ft)	0.54	0.82	0.79	0.54	0.64	0.74	0.27	0.43	0.34	0.5	0.46	0.53	0.59	0.55	0.52	0.52	0.57	0.56
Substrate																		
D50 (mm)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
D84 (mm)	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

* D50 pebble information was not calculated (pebble counts were not collected).
** D84 pebble information was not calculated (pebble counts were not collected).

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 (accepted in January 2007) and the Year 1 monitoring survey. Stream monitoring for Year 2 occurred in October 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, in order to provide a full year between surveys. This report documents the fifth year of both vegetation monitoring and stream survey.

APPENDIX A

Vegetation Raw Data

1. Vegetation Monitoring Plot Photos
2. Vegetation Data Tables

Vegetation Plot 1
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 2
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 3
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 4
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 5
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 6
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 7
Monitoring Year 5
(EMH&T, Inc. 9/16/09)

Vegetation Plot 8
Monitoring Year 5
(EMH&T, Inc. 9/16/09)

Vegetation Plot 9
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 10
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 11
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 12
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 13
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 14
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 15
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 16
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 17
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 18
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 19
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 20
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 21
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 22
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 23
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 24
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 25
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 26
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 27
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 28
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 29
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Vegetation Plot 30
Monitoring Year 5
(EMH&T, Inc. 9/16/10)

Table 1. Vegetation Metadata	
Report Prepared By	Megan Wolf
Date Prepared	1/19/2011 13:57
database name	cvs-eep-entrytool-v2.2.6_Backup.mdb
database location	Q:\ENVIRONMENTAL\Monitoring\EEP Vegetation Database
computer name	HX1N941
file size	52396032
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	D0400601
project Name	South Muddy Creek
Description	Restoration of tributaries A, A2, B and C of South Muddy Creek
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	30

Table 2. Vegetation Vigor by Species							
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**
	Alnus serrulata	19	6	1	1	2	3
	Aronia arbutifolia	1	2				
	Aronia melanocarpa	1					
	Betula nigra	4				2	2
	Cephalanthus occidentalis		1				1
	Cornus amomum	46	17	5	4	4	14
	Fraxinus pennsylvanica	53	31	5	5	1	11
	Juglans nigra	1					
	Quercus alba	16	8				3
	Quercus michauxii	13	10	3		1	1
	Quercus pagoda	7	2				4
	Quercus palustris	2	2				
	Quercus phellos	24	1		3	1	2
	Salix nigra	5	2	1	1		1
	Sambucus canadensis	4			1		1
	Liriodendron		1				
	Liriodendron tulipifera	12	5	1	1	2	3
	Platanus occidentalis	31	15	7	1	2	8
	Crataegus	2	1			1	2
	Prunus	1					
	Prunus virginiana	1					
	Uknown						1
TOT:	**22**	**243**	**104**	**23**	**17**	**16**	**57**

Table 3. Vegetation Damage by Species

	Species	All Damage Categories	(no damage)	Deer	Human Trampled	Site Too Wet	Unknown	Vine Strangulation	(other damage)
	Alnus serrulata	32	28	1			3		
	Aronia arbutifolia	3	3						
	Aronia melanocarpa	1	1						
	Betula nigra	8	6				2		
	Cephalanthus occidentalis	2	2						
	Cornus amomum	91	83		1	1	5	1	
	Crataegus	6	5					1	
	Fraxinus pennsylvanica	107	101				5		1
	Juglans nigra	1	1						
	Liriodendron	1	1						
	Liriodendron tulipifera	25	22				3		
	Platanus occidentalis	64	60				2		2
	Prunus	1	1						
	Prunus virginiana	1	1						
	Quercus alba	28	28						
	Quercus michauxii	29	25				4		
	Quercus pagoda	14	14						
	Quercus palustris	4	4						
	Quercus phellos	31	28				3		
	Salix nigra	12	12						
	Sambucus canadensis	6	5				1		
	Uknown	1	1						
TOT:	**22**	**468**	**432**	**1**	**1**	**1**	**28**	**2**	**3**

Table 4. Vegetation Damage by Plot									
	plot	All Damage Categories	(no damage)	Deer	Human Trampled	Site Too Wet	Unknown	Vine Strangulation	(other damage)
	D0400601-01-0001-year:5	15	13				2		
	D0400601-01-0002-year:5	11	10		1				
	D0400601-01-0003-year:5	24	22	1		1			
	D0400601-01-0004-year:5	15	15						
	D0400601-01-0005-year:5	14	14						
	D0400601-01-0006-year:5	19	16				3		
	D0400601-01-0007-year:5	11	11						
	D0400601-01-0008-year:5	13	10				3		
	D0400601-01-0009-year:5	21	21						
	D0400601-01-0010-year:5	20	20						
	D0400601-01-0011-year:5	25	25						
	D0400601-01-0012-year:5	21	19				1	1	
	D0400601-01-0013-year:5	21	20				1		
	D0400601-01-0014-year:5	17	16				1		
	D0400601-01-0015-year:5	17	17						
	D0400601-01-0016-year:5	17	15				2		
	D0400601-01-0017-year:5	23	23						
	D0400601-01-0018-year:5	18	17				1		
	D0400601-01-0019-year:5	13	11						2
	D0400601-01-0020-year:5	17	14				3		
	D0400601-01-0021-year:5	15	14				1		
	D0400601-01-0022-year:5	10	9				1		
	D0400601-01-0023-year:5	12	9				3		
	D0400601-01-0024-year:5	14	13				1		
	D0400601-01-0025-year:5	11	10				1		
	D0400601-01-0026-year:5	12	12						
	D0400601-01-0027-year:5	8	7				1		
	D0400601-01-0028-year:5	16	16						
	D0400601-01-0029-year:5	11	7				3	1	
	D0400601-01-0030-year:5	7	6						1
TOT:	**30**	**468**	**432**	**1**	**1**	**1**	**28**	**2**	**3**

Table 5. Stem Count by Plot and Species - Planted Stems

	Species	Total Planted Stems	# plots	avg# stems	plot D0400601-01-0001-year:5	plot D0400601-01-0002-year:5	plot D0400601-01-0003-year:5	plot D0400601-01-0004-year:5	plot D0400601-01-0005-year:5	plot D0400601-01-0006-year:5	plot D0400601-01-0007-year:5	plot D0400601-01-0008-year:5	plot D0400601-01-0009-year:5	plot D0400601-01-0010-year:5	plot D0400601-01-0011-year:5	plot D0400601-01-0012-year:5	plot D0400601-01-0013-year:5	plot D0400601-01-0014-year:5	plot D0400601-01-0015-year:5	plot D0400601-01-0016-year:5	plot D0400601-01-0017-year:5	plot D0400601-01-0018-year:5	plot D0400601-01-0019-year:5	plot D0400601-01-0020-year:5	plot D0400601-01-0021-year:5	plot D0400601-01-0022-year:5	plot D0400601-01-0023-year:5	plot D0400601-01-0024-year:5	plot D0400601-01-0025-year:5	plot D0400601-01-0026-year:5	plot D0400601-01-0027-year:5	plot D0400601-01-0028-year:5	plot D0400601-01-0029-year:5	plot D0400601-01-0030-year:5
	Alnus serrulata	27	13	2.08	3	2	2	1	4	4	1		1							4	1						1	1	2					
	Aronia arbutifolia	3	2	1.5														1				2												
	Aronia melanocarpa	1	1	1																								1						
	Betula nigra	4	3	1.33																									1	2	1			
	Cephalanthus occidentalis	1	1	1										1																				
	Cornus amomum	72	26	2.77	6	3	6		3	2	2	1	4	5	10	2		1	1	1	1	3	2	3	3	2	5	1	1	1	2		1	
	Crataegus	3	2	1.5										1				2																
	Fraxinus pennsylvanica	97	27	3.48	5	2	5	1	1	5	1	2	4		4	5	10	2	7	2	13	2	4	4	1	3	1	4			3	3	1	2
	Juglans nigra	1	1	1																														1
	Liriodendron tulipifera	19	12	1.58				1						1		1		3	1	3	2	1	2	1	2			2						
	Platanus occidentalis	55	22	2.45	1		3		1		1	3	5	2	5	2	1	4	1			1	1	5		2	1	2	2	3			5	4
	Prunus	1	1	1																														1
	Prunus virginiana	1	1	1										1																				
	Quercus alba	24	12	2			1		1				3				1	2	3	1	1		2		6		1	2						
	Quercus michauxii	26	12	2.17			2	4							1				1	3		5			1		2		2		1	3	1	
	Quercus pagoda	9	6	1.5										1			1									1				4	1	1		
	Quercus palustris	4	3	1.33					1																				1			2		
	Quercus phellos	28	12	2.33		2		3		3		2			1	3	7	1			2	1		2	1									
	Salix nigra	9	6	1.5						2	3		1							1										1		1		
	Sambucus canadensis	5	3	1.67												3					1					1								
TOT:	21	391	21		15	9	19	10	11	16	8	8	18	12	21	16	20	16	14	15	21	15	11	15	14	9	11	13	9	11	8	10	8	8

Table 6. Stem Count by Plot and Species - All Stems

	Species	Total Stems	# plots	avg# stems	D0400601-01-0001-year5	D0400601-01-0002-year5	D0400601-01-0003-year5	D0400601-01-0004-year5	D0400601-01-0005-year5	D0400601-01-0006-year5	D0400601-01-0007-year5	D0400601-01-0008-year5	D0400601-01-0009-year5	D0400601-01-0010-year5	D0400601-01-0011-year5	D0400601-01-0012-year5	D0400601-01-0013-year5	D0400601-01-0014-year5	D0400601-01-0015-year5	D0400601-01-0016-year5	D0400601-01-0017-year5	D0400601-01-0018-year5	D0400601-01-0019-year5	D0400601-01-0020-year5	D0400601-01-0021-year5	D0400601-01-0022-year5	D0400601-01-0023-year5	D0400601-01-0024-year5	D0400601-01-0025-year5	D0400601-01-0026-year5	D0400601-01-0027-year5	D0400601-01-0028-year5	D0400601-01-0029-year5	D0400601-01-0030-year5
	Acer saccharinum	1	1	1															1														
	Alnus serrulata	33	13	2.54	4	2	3	1	6	4	1		1							6	1						1	1	2					
	Aronia arbutifolia	3	2	1.5														1				2												
	Aronia melanocarpa	1	1	1																								1						
	Betula nigra	8	4	2																									2	2	2			2
	Cephalanthus occidentalis	1	1	1										1																				
	Cornus amomum	88	27	3.26	10	4	6	2	3	2	2	3	6	5	10	2		1	1	1	1	3	2	3	3	2	5	1	1	1	2		6	
	Fraxinus pennsylvanica	112	27	4.15	6	2	7	1	1	5	1	2	4		4	6	10	3	7	2	13	2	4	4	1	3	2	4			3	3	1	14
	Juglans nigra	1	1	1																														1
	Liquidambar styraciflua	5	4	1.25														2			1						1						1	
	Quercus alba	24	12	2			1		1				3				1	2	3	1	1		2		6		1	2						
	Quercus michauxii	32	12	2.67			2	4							1				1	3		10			2		2		2		1	3	1	
	Quercus pagoda	9	6	1.5										1			1									1				4	1	1		
	Quercus palustris	4	3	1.33					1																				1			2		
	Quercus phellos	30	13	2.31		2		3		3		2			1	3	8	1			2	1	1	2	1									
	Salix nigra	9	6	1.5						2	3		1							1										1		1		
	Sambucus canadensis	13	7	1.86									1	3		4					1		1			1						2		
	Cornus	3	2	1.5										1							2													
	Quercus	2	2	1																												1		1
	Quercus rubra	1	1	1																											1			
	Liriodendron tulipifera	25	12	2.08				1						1		1		3	1	3	2	2	2	3	3			4						
	Pinus	2	1	2								2																						
	Platanus occidentalis	61	23	2.65	1		3		1		1	3	6	2	5	2	1	4	1	1		1	1	5		2	1	2	2	3			6	8
	Aronia	1	1	1																									1					
	Crataegus	4	3	1.33										1		1		2																
	Prunus	1	1	1																														1
	Prunus virginiana	1	1	1										1																				
	Salix exigua	1	1	1																										1				
	Acer negundo	4	2	2																													1	3
	Acer rubrum	145	17	8.53		1	1	1	15	98		1			2			5		3	1	2		1		3			2	7		1	1	
TOT:	31	626	31		21	11	23	13	28	114	8	13	22	16	23	19	21	24	15	21	25	23	13	18	16	13	12	15	13	19	10	14	17	30

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

Fixed Station 1
Overview of Tributary A (upper), facing upstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. /19/06)

Fixed Station 2
Overview of valley along confluence of Tributary A2 with Tributary A, facing upstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)

Fixed Station 3
Overview of valley along Tributary A (lower) near station 31+50, facing downstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)

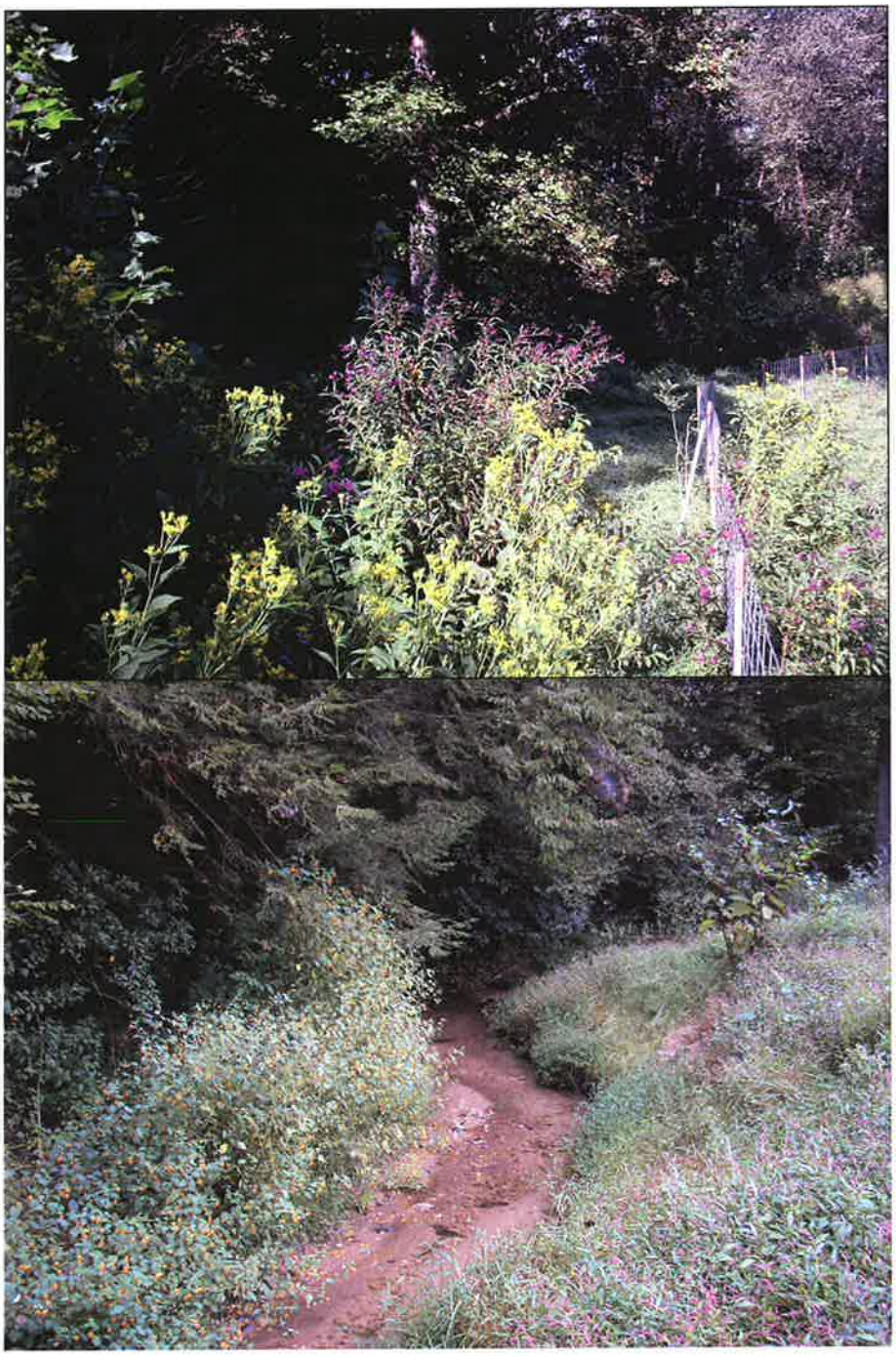
Fixed Station 4
Overview of valley along Tributary A (lower) near station 31+50, facing upstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)

Fixed Station 5
Overview of valley on Tributary A (lower) at large culvert, facing upstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)

Fixed Station 6
Overview of valley on Tributary A (lower) at large culvert, facing downstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)

Fixed Station 7
Overview of valley along Tributary B, facing upstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)

Fixed Station 8
Overview of valley along Tributary B, facing downstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)



Fixed Station 9
Overview of valley along Tributary C near station 6+50, facing downstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)

Fixed Station 10
Overview of valley along Tributary C near station 8+50, facing downstream.
Year 5 – top photo (EMH&T, Inc. 9/16/10)
Year 1- bottom photo (EMH&T, Inc. 9/19/06)

Table B1. Visual Morphological Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A (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?	24	24	0	100	
	2. Armor stable (e.g. no displacement)?	24	24	0	100	
	3. Facet grade appears stable?	24	24	0	100	
	4. Minimal evidence of embedding/fining?	24	24	0	100	
	5. Length appropriate?	24	24	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	25	25	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	25	25	0	100	
	3. Length appropriate?	25	25	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	25	25	0	100	
	2. Downstream of meander (glide/inflection) centering?	25	25	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	25	25	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	25	25	0	100	
	3. Apparent Rc within spec?	25	25	0	100	
	4. Sufficient floodplain access and relief?	25	25	0	100	**100%**
E. Bed General	1. General 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?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
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
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A (middle)

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?	18	18	0	100	
	2. Armor stable (e.g. no displacement)?	18	18	0	100	
	3. Facet grade appears stable?	18	18	0	100	
	4. Minimal evidence of embedding/fining?	18	18	0	100	
	5. Length appropriate?	18	18	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	19	19	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	19	19	0	100	
	3. Length appropriate?	19	19	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	19	19	0	100	
	2. Downstream of meander (glide/inflection) centering?	19	19	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	19	19	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	19	19	0	100	
	3. Apparent Rc within spec?	19	19	0	100	
	4. Sufficient floodplain access and relief?	19	19	0	100	**100%**
E. Bed General	1. General 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?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
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
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A (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?	93	93	0	100	
	2. Armor stable (e.g. no displacement)?	93	93	0	100	
	3. Facet grade appears stable?	93	93	0	100	
	4. Minimal evidence of embedding/fining?	93	93	0	100	
	5. Length appropriate?	93	93	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	95	95	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	95	95	0	100	
	3. Length appropriate?	95	95	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	95	95	0	100	
	2. Downstream of meander (glide/inflection) centering?	95	95	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	95	95	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	95	95	0	100	
	3. Apparent Rc within spec?	95	95	0	100	
	4. Sufficient floodplain access and relief?	92	95	3	97	**99%**
E. Bed General	1. General 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?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
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
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A2

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?	7	7	1	100	
	2. Armor stable (e.g. no displacement)?	7	7	0	100	
	3. Facet grade appears stable?	7	7	0	100	
	4. Minimal evidence of embedding/fining?	5	7	0	71	
	5. Length appropriate?	7	7	0	100	**94%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	5	7	0	71	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	5	7	0	71	
	3. Length appropriate?	6	7	0	86	**76%**
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. General 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?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
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
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: B

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?	22	23	1	96	
	2. Armor stable (e.g. no displacement)?	22	23	1	96	
	3. Facet grade appears stable?	22	23	1	96	
	4. Minimal evidence of embedding/fining?	20	23	3	87	
	5. Length appropriate?	22	23	1	96	**94%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	23	23	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	23	23	0	100	
	3. Length appropriate?	23	23	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	36	36	0	100	
	2. Downstream of meander (glide/inflection) centering?	36	36	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	35	36	1	97	
	2. Of those eroding, # w/concomitant point bar formation?	36	36	0	100	
	3. Apparent Rc within spec?	36	36	0	100	
	4. Sufficient floodplain access and relief?	36	36	0	100	**99%**
E. Bed General	1. General 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?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
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
H. Log Sills	1. Maintaining grade control?	14	14	0	100	
	2. Minimal evidence of sedimentation in adjacent pool?	13	14	1	93	**97%**

Table B1. Visual Morphological Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: C

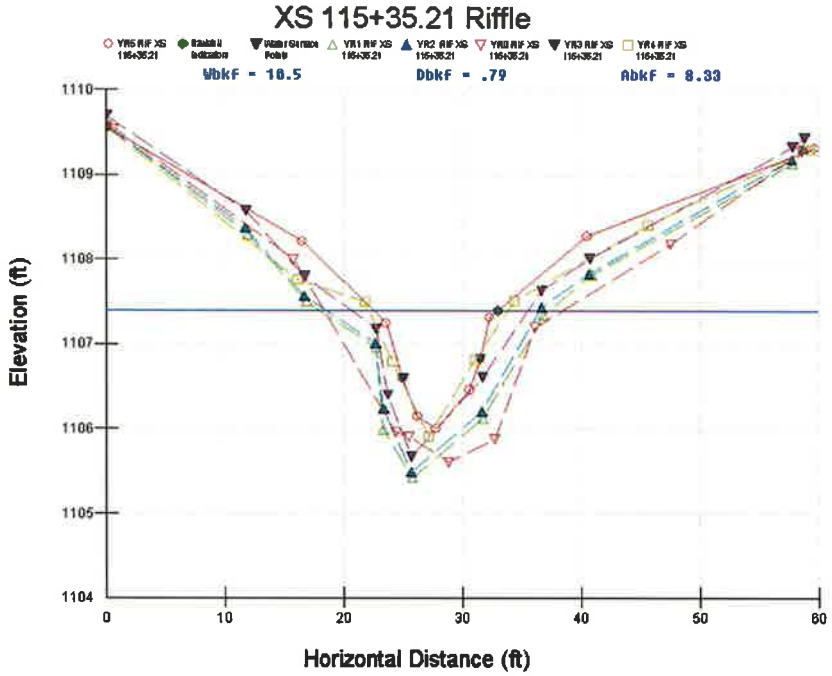
Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	33	33	0	100	
	2. Armor stable (e.g. no displacement)?	33	33	0	100	
	3. Facet grade appears stable?	33	33	0	100	
	4. Minimal evidence of embedding/fining?	33	33	0	100	
	5. Length appropriate?	33	33	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	34	34	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	34	34	0	100	
	3. Length appropriate?	34	34	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	19	19	0	100	
	2. Downstream of meander (glide/inflection) centering?	19	19	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	29	34	5	85	
	2. Of those eroding, # w/concomitant point bar formation?	32	34	2	94	
	3. Apparent Rc within spec?	34	34	0	100	
	4. Sufficient floodplain access and relief?	32	34	2	94	**93%**
E. Bed General	1. General 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?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
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	8.33 ft^2
Bankfull Width	10.49 ft
Mean Depth	0.79 ft
Maximum Depth	1.39 ft
Width/Depth Ratio	13.28
Entrenchment Ratio	3.84
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	Upper A
DATE	9/26/10
CROSS SECTION:	115+35
FEATURE:	Riffle

Cross-section photo – looking upstream

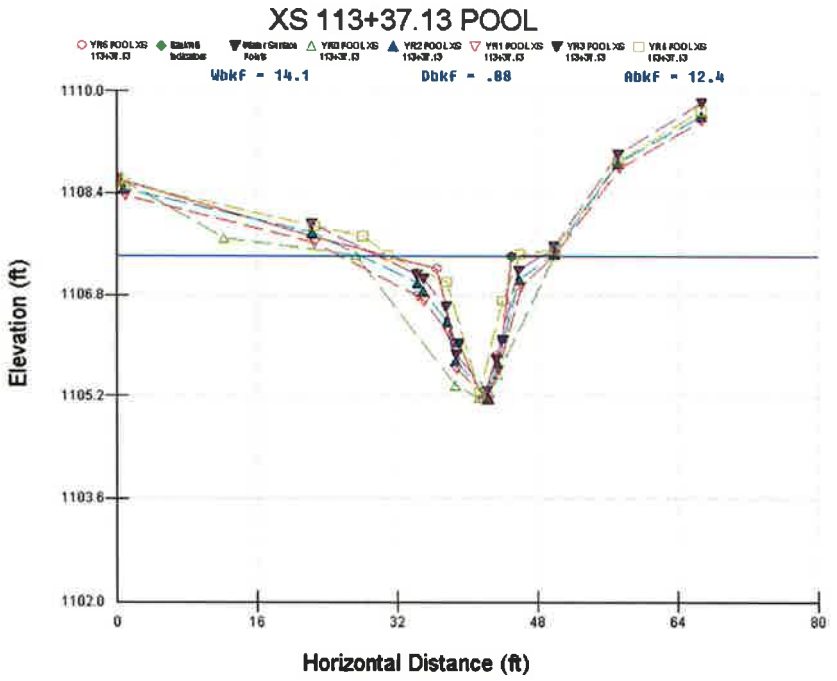


Summary Data

Bankfull Area	12.42 ft^2
Bankfull Width	14.13 ft
Mean Depth	0.88 ft
Maximum Depth	2.28 ft
Width/Depth Ratio	16.06
Entrenchment Ratio	3.53

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	09/26/10
CROSS SECTION:	113+37.13
FEATURE:	Pool

Cross-section photo – looking left to right bank Channel obscured by vegetation.

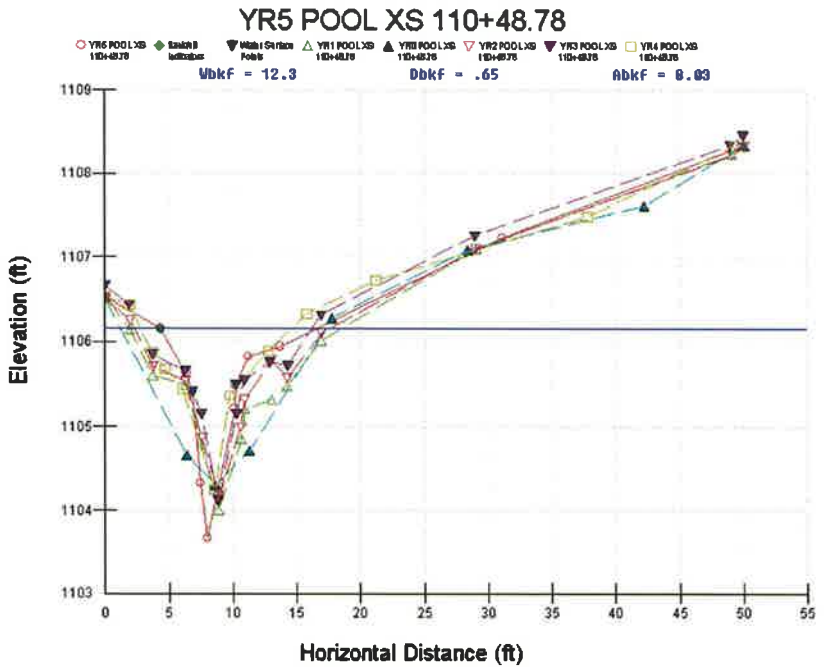


Summary Data

Bankfull Area	8.03 ft^2
Bankfull Width	12.31 ft
Mean Depth	0.65 ft
Maximum Depth	2.49 ft
Width/Depth Ratio	18.94
Entrenchment Ratio	4.05

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	9/26/10
CROSS SECTION:	110+48.78
FEATURE:	Pool

Cross-section photo – looking downstream

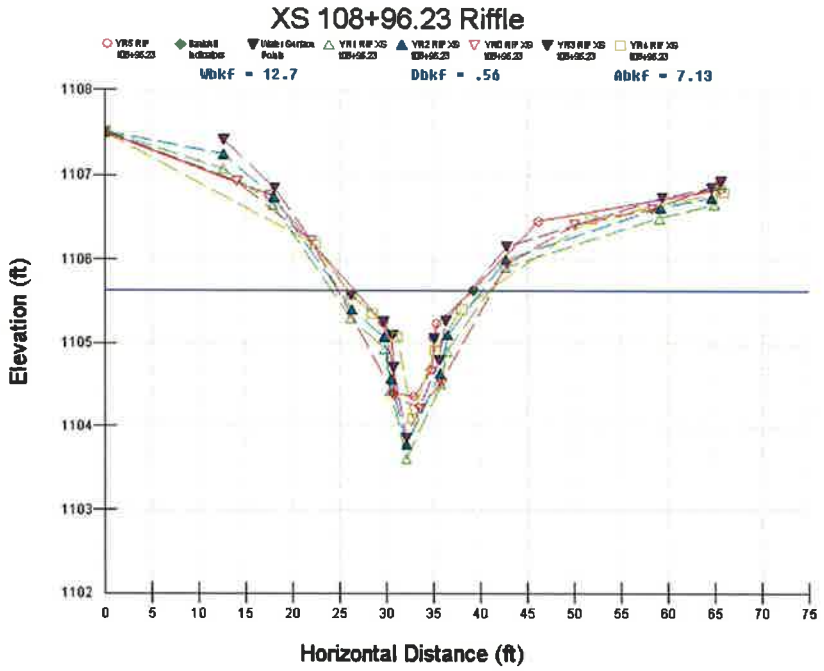


Summary Data

Bankfull Area	7.13 ft^2
Bankfull Width	12.68 ft
Mean Depth	0.56 ft
Maximum Depth	1.27 ft
Width/Depth Ratio	22.64
Entrenchment Ratio	4.06
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	9/26/10
CROSS SECTION:	108+96.23
FEATURE:	Riffle

Cross-section photo – looking downstream

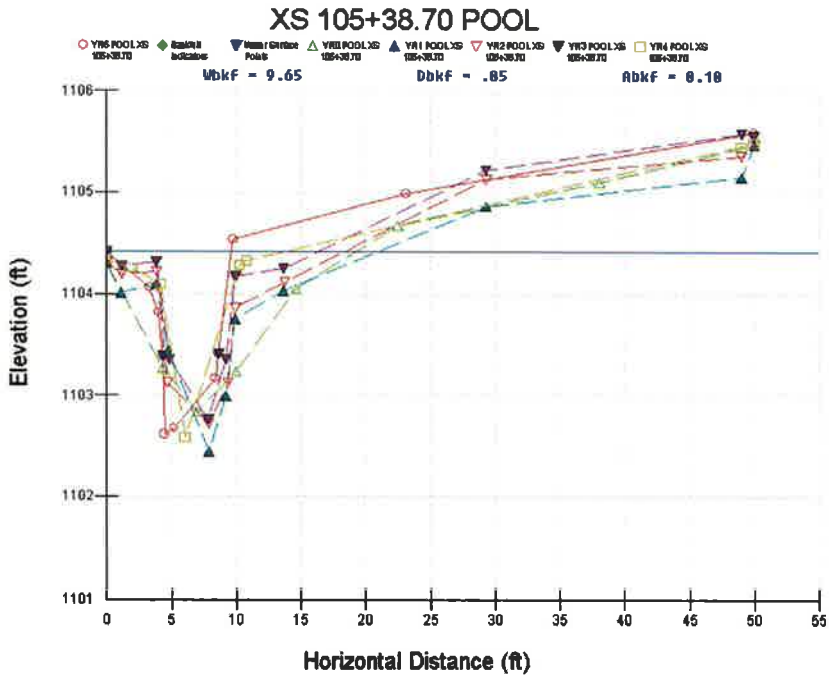


Summary Data

Bankfull Area	8.18 ft^2
Bankfull Width	9.65 ft
Mean Depth	0.85 ft
Maximum Depth	1.8 ft
Width/Depth Ratio	11.35
Entrenchment Ratio	5.18

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	9/26/10
CROSS SECTION:	105+38.70
FEATURE:	Pool

Cross-section photo – looking upstream

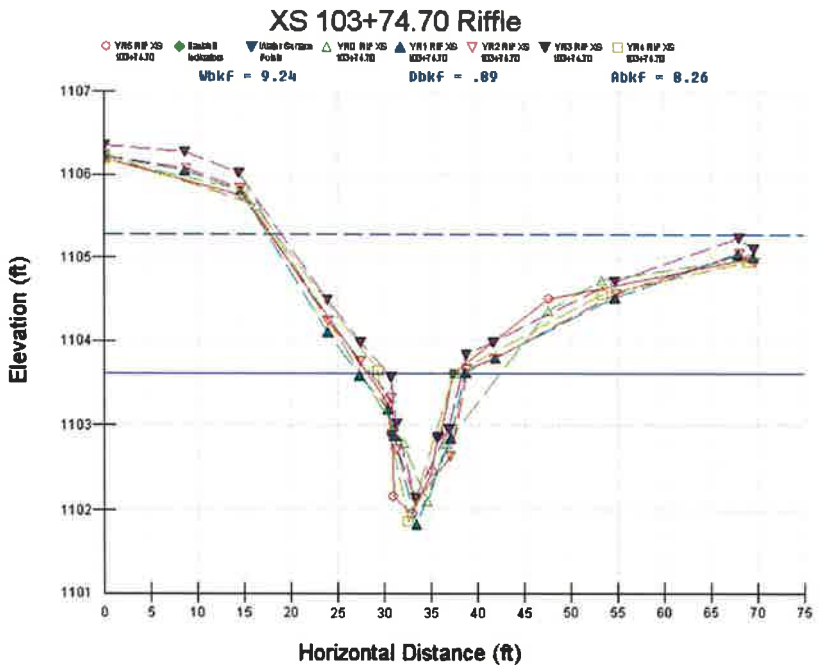


Summary Data

Bankfull Area	8.26 ft^2
Bankfull Width	9.24 ft
Mean Depth	0.89 ft
Maximum Depth	1.67 ft
Width/Depth Ratio	10.38
Entrenchment Ratio	5.57
Classification	E

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	9/26/10
CROSS SECTION:	103+74.70
FEATURE:	Riffle

Cross-section photo – looking upstream

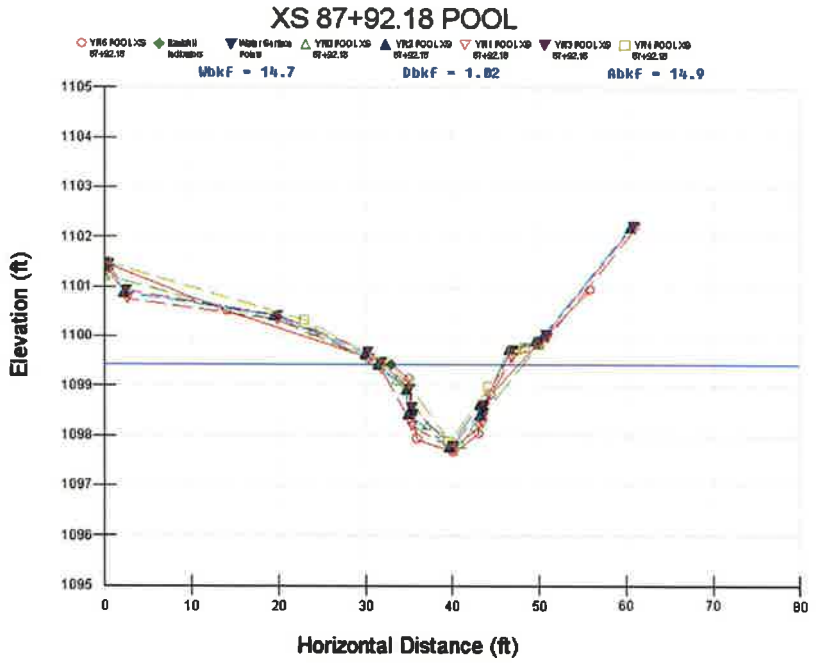


Summary Data

Bankfull Area	14.92 ft^2
Bankfull Width	14.68 ft
Mean Depth	1.02 ft
Maximum Depth	1.78 ft
Width/Depth Ratio	14.39
Entrenchment Ratio	3.55

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Middle
DATE	9/26/10
CROSS SECTION:	87+92.18
FEATURE:	Pool

Cross section photo – looking downstream

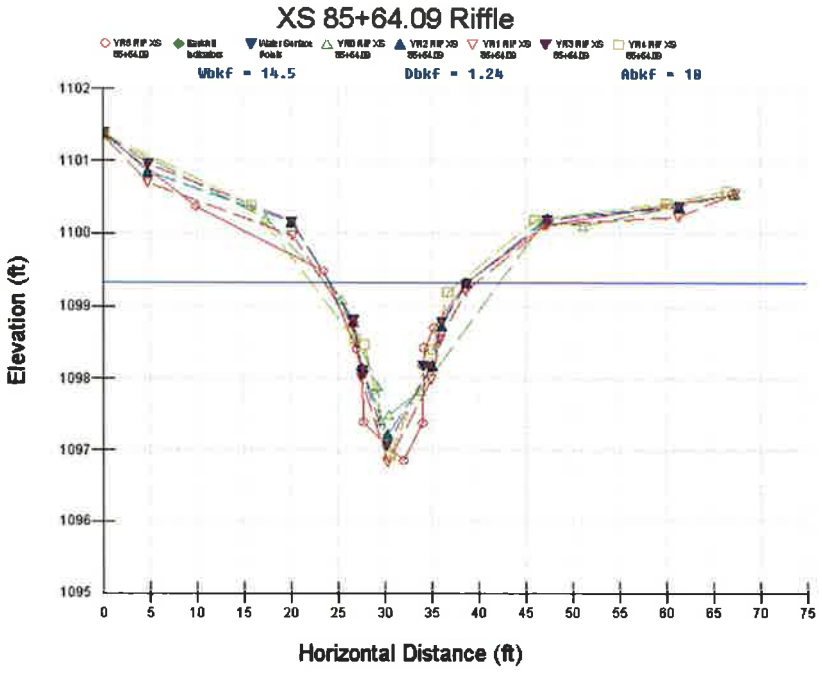


Summary Data

Bankfull Area	18.04 ft^2
Bankfull Width	14.54 ft
Mean Depth	1.24 ft
Maximum Depth	2.47 ft
Width/Depth Ratio	11.73
Entrenchment Ratio	4.61
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Middle
DATE	9/26/10
CROSS SECTION:	85+64.09
FEATURE:	Riffle

Cross section photo – looking downstream

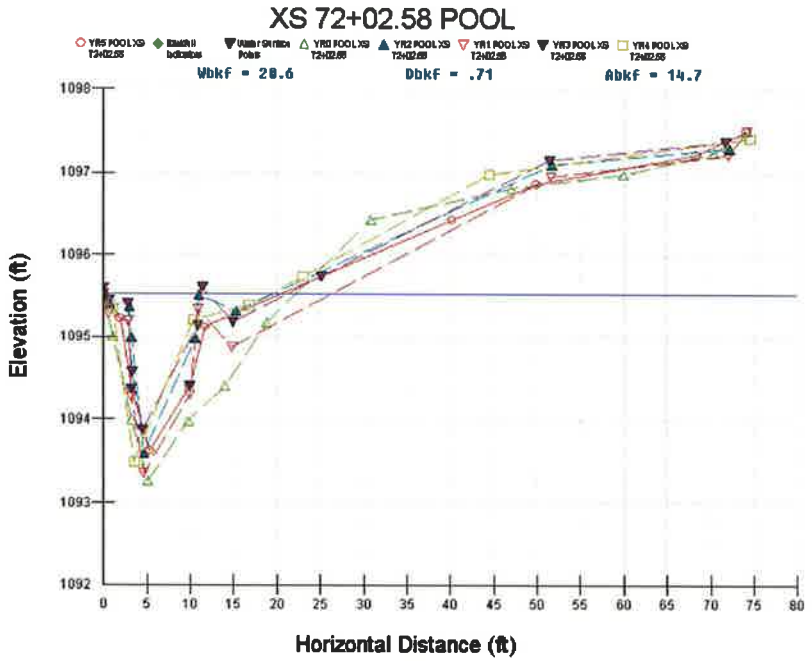


Summary Data

Bankfull Area	20.59 ft^2
Bankfull Width	14.68 ft
Mean Depth	0.71 ft
Maximum Depth	1.91 ft
Width/Depth Ratio	2.90
Entrenchment Ratio	3.54

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	72+02.58
FEATURE:	Pool

Cross section photo – looking downstream

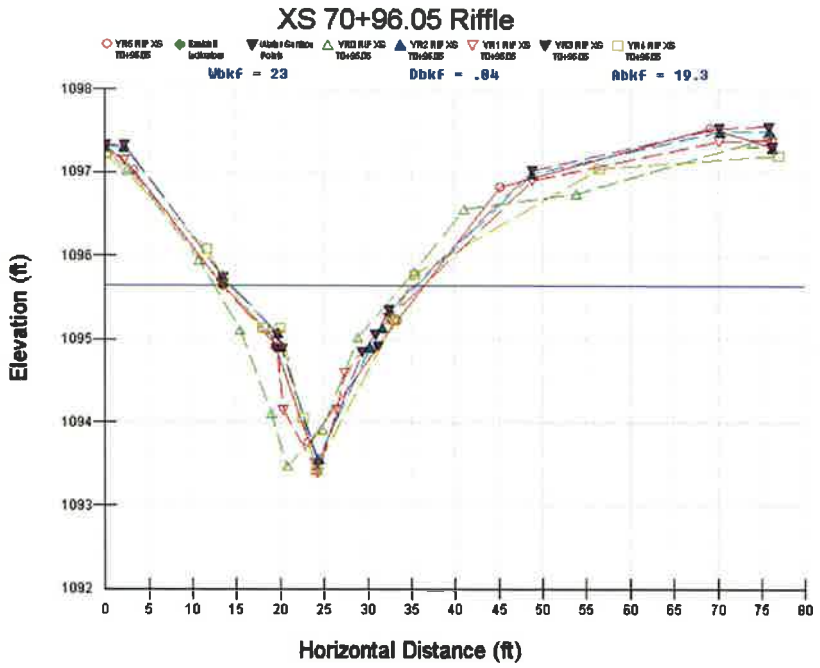


Summary Data

Bankfull Area	19.33 ft^2
Bankfull Width	23.0 ft
Mean Depth	0.84 ft
Maximum Depth	1.9 ft
Width/Depth Ratio	27.42
Entrenchment Ratio	3.31
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	70+96.05
FEATURE:	Riffle

Cross section photo – looking downstream

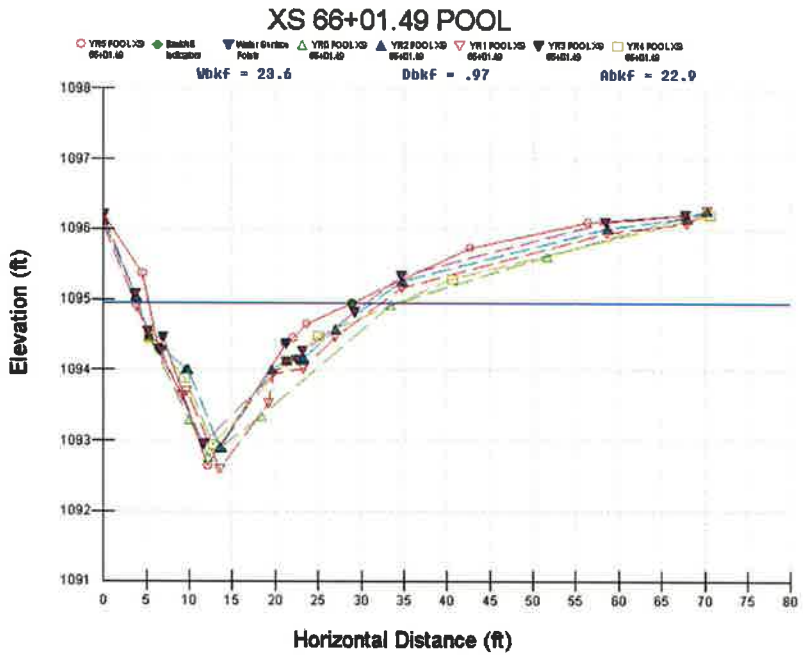


Summary Data

Bankfull Area	22.86 ft^2
Bankfull Width	23.64 ft
Mean Depth	0.97 ft
Maximum Depth	2.3 ft
Width/Depth Ratio	24.37
Entrenchment Ratio	2.87

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	66+01.49
FEATURE:	Pool

Cross section photo – looking downstream

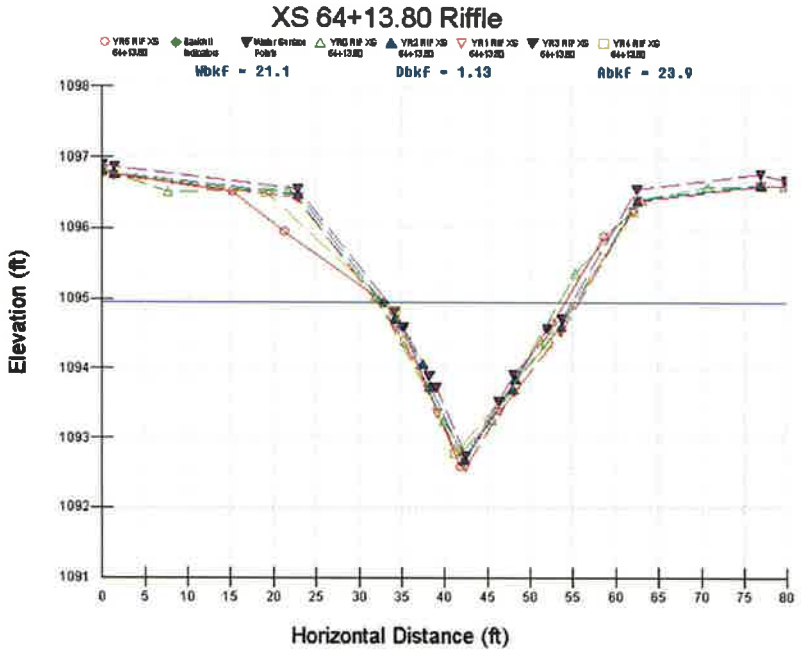


Summary Data

Bankfull Area	23.91 ft^2
Bankfull Width	21.12 ft
Mean Depth	1.13 ft
Maximum Depth	2.37 ft
Width/Depth Ratio	18.69
Entrenchment Ratio	2.94
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	64+13.80
FEATURE:	Riffle

Cross section photo – looking downstream

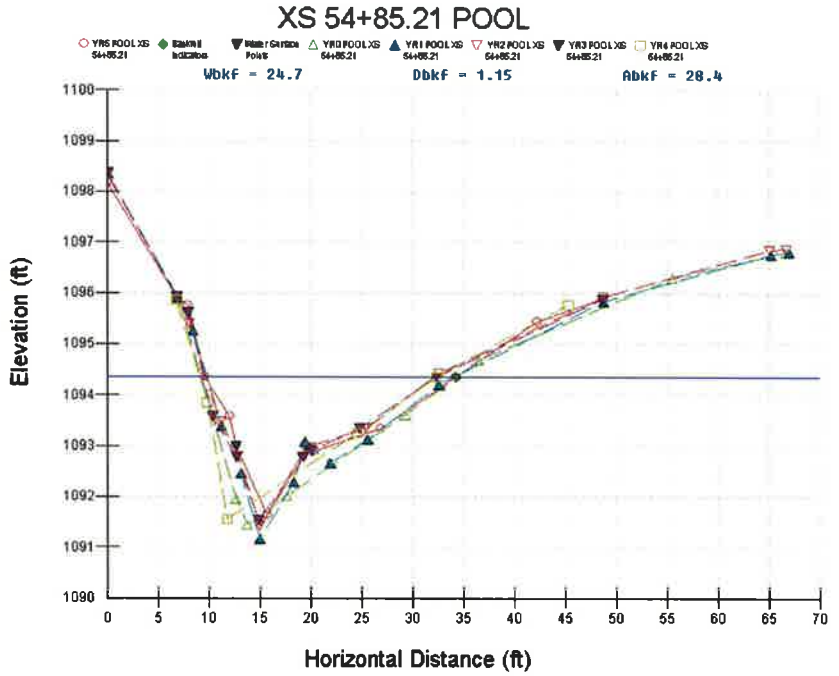


Summary Data

Bankfull Area	28.45 ft^2
Bankfull Width	24.66 ft
Mean Depth	1.15 ft
Maximum Depth	2.7 ft
Width/Depth Ratio	21.44
Entrenchment Ratio	1.84

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	54+85.21
FEATURE:	Pool

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

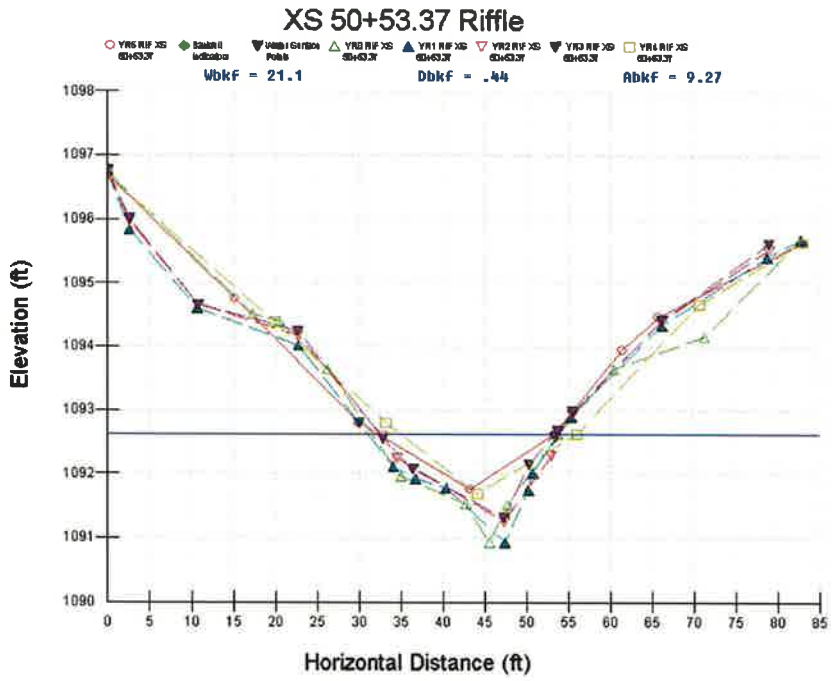


Summary Data

Bankfull Area	9.27 ft^2
Bankfull Width	21.07 ft
Mean Depth	0.44 ft
Maximum Depth	0.88 ft
Width/Depth Ratio	47.89
Entrenchment Ratio	1.61
Classification	B

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	50+53.37
FEATURE:	Riffle

Cross section photo – looking downstream

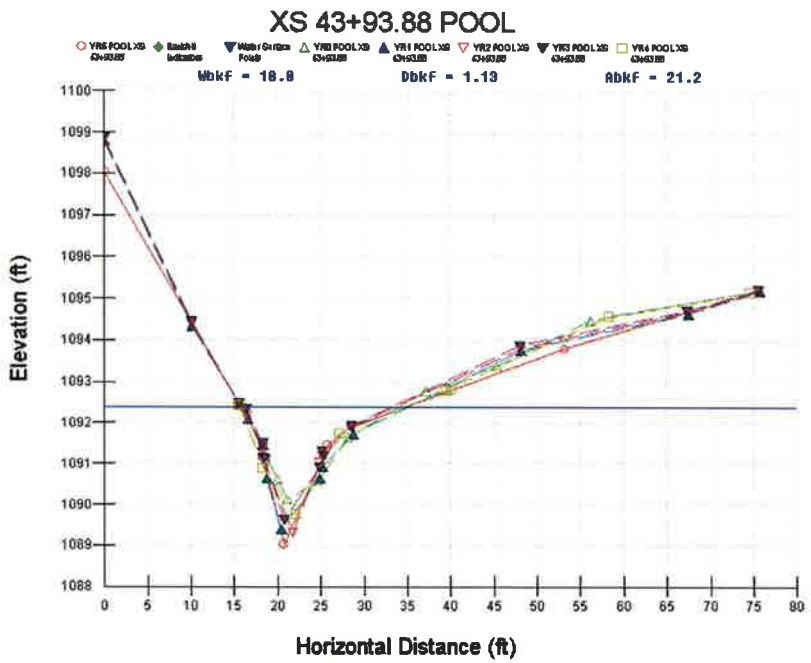


Summary Data

Bankfull Area	21.16 ft^2
Bankfull Width	18.75 ft
Mean Depth	1.13 ft
Maximum Depth	3.37 ft
Width/Depth Ratio	16.59
Entrenchment Ratio	3.69

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	43+93.88
FEATURE:	Pool

Cross section photo – looking downstream
Channel obscured by vegetation.

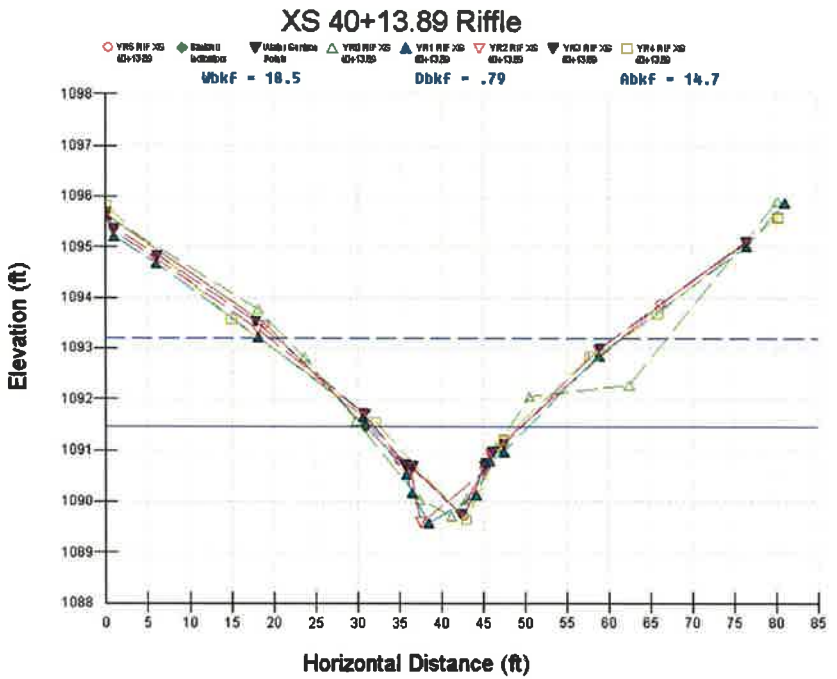


Summary Data

Bankfull Area	14.71 ft^2
Bankfull Width	18.55 ft
Mean Depth	0.79 ft
Maximum Depth	1.74 ft
Width/Depth Ratio	23.48
Entrenchment Ratio	2.2
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	40+13.89
FEATURE:	Riffle

Cross section photo – looking downstream
Channel obscured by vegetation.

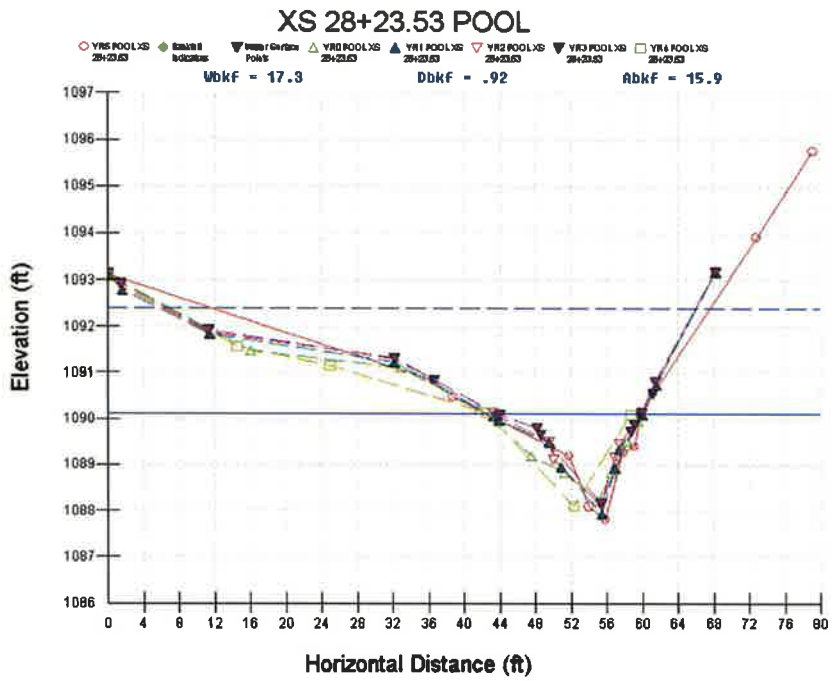


Summary Data

Bankfull Area	15.87 ft^2
Bankfull Width	17.34 ft
Mean Depth	0.92 ft
Maximum Depth	2.29 ft
Width/Depth Ratio	18.85
Entrenchment Ratio	3.23

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	28+23.53
FEATURE:	Pool

Cross section photo – looking downstream
Channel obscured by vegetation.

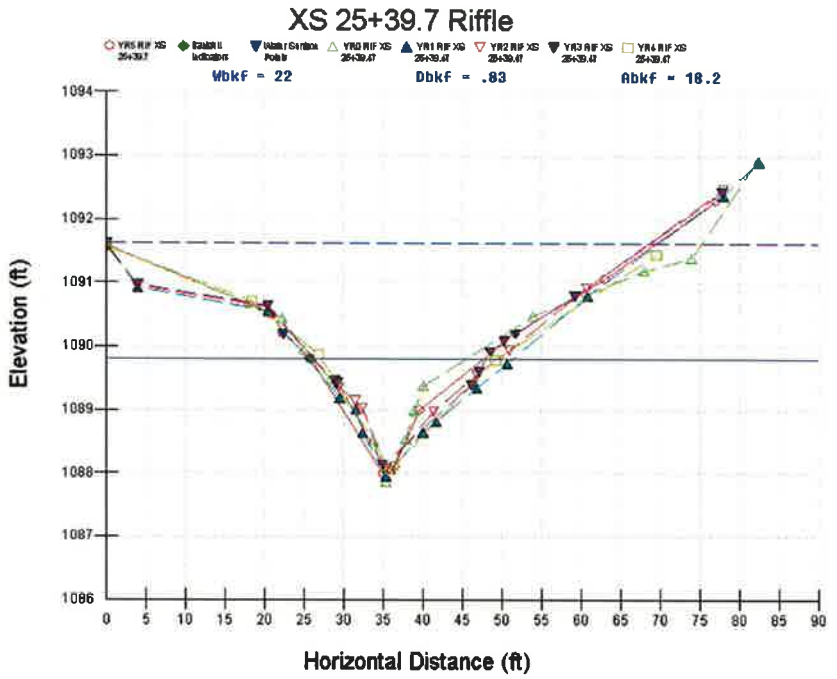


Summary Data

Bankfull Area	18.24 ft^2
Bankfull Width	21.97 ft
Mean Depth	.83 ft
Maximum Depth	1.82 ft
Width/Depth Ratio	26.47
Entrenchment Ratio	3.16
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	25+39.47
FEATURE:	Riffle

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



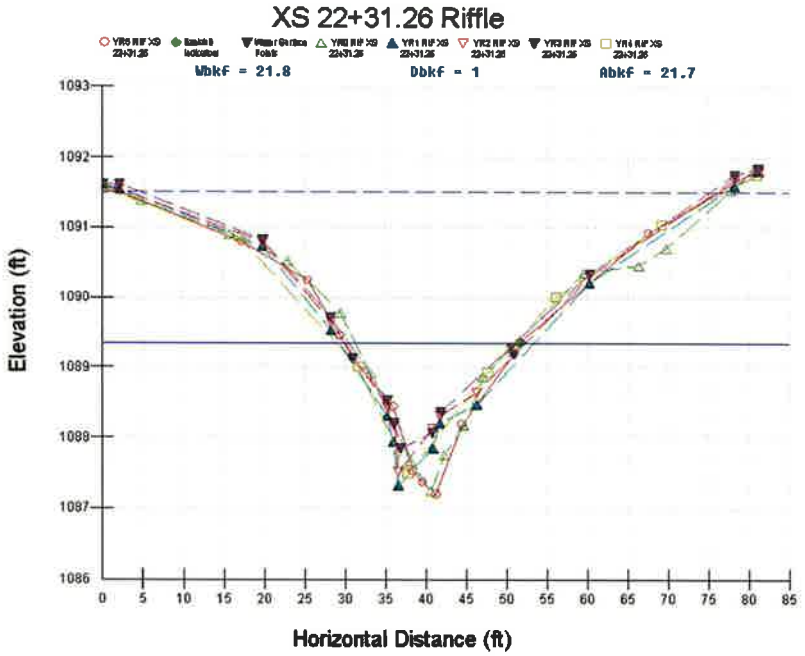
EMH&T

Summary Data

Bankfull Area	21.69 ft^2
Bankfull Width	21.76 ft
Mean Depth	1.0 ft
Maximum Depth	2.15 ft
Width/Depth Ratio	21.76
Entrenchment Ratio	3.4
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	22+31.26
FEATURE:	Riffle

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

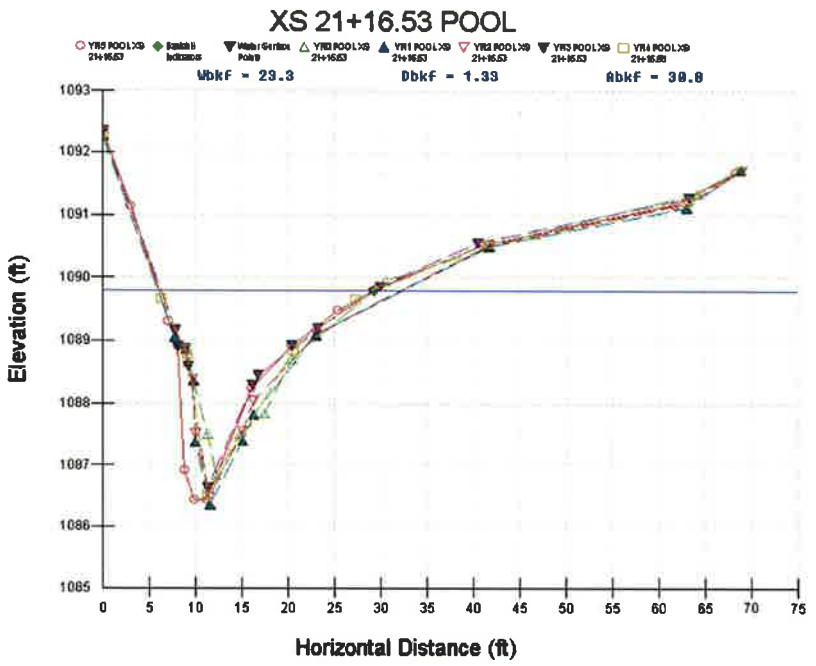


Summary Data

Bankfull Area	30.84 ft^2
Bankfull Width	23.25 ft
Mean Depth	1.33 ft
Maximum Depth	3.37 ft
Width/Depth Ratio	17.48
Entrenchment Ratio	2.94

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	21+16.53
FEATURE:	Pool

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

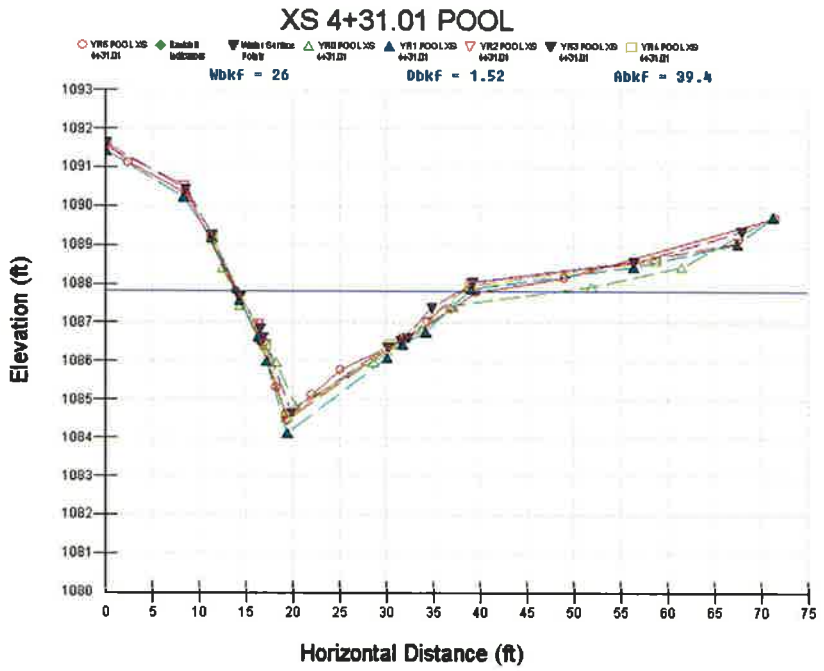


Summary Data

Bankfull Area	39.38 ft^2
Bankfull Width	25.99 ft
Mean Depth	1.52 ft
Maximum Depth	3.2 ft
Width/Depth Ratio	17.1
Entrenchment Ratio	2.64

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	4+31
FEATURE:	Pool

Cross section photo – looking downstream
Note high water level.

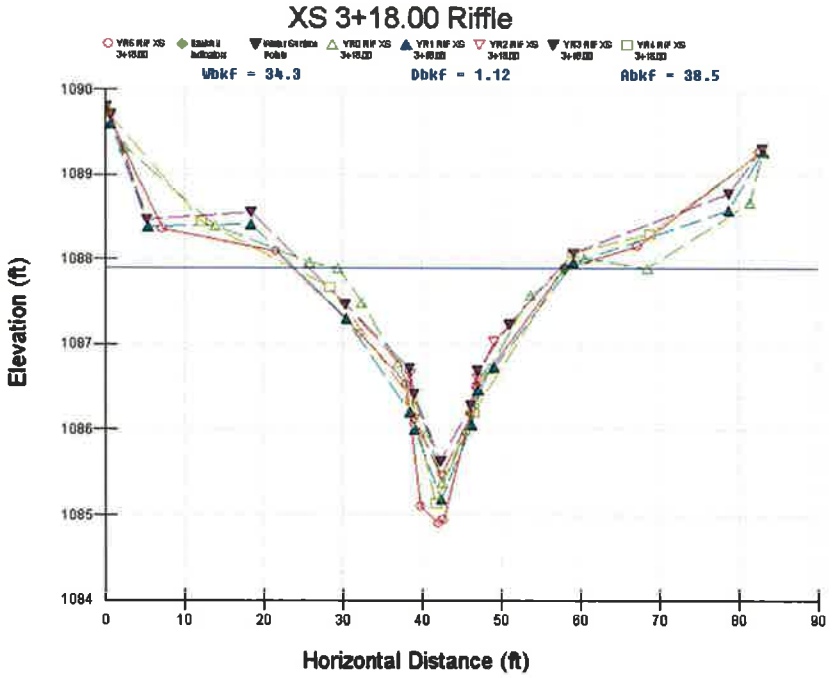


Summary Data

Bankfull Area	38.46 ft^2
Bankfull Width	34.3 ft
Mean Depth	1.12 ft
Maximum Depth	2.99 ft
Width/Depth Ratio	30.62
Entrenchment Ratio	2.41
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	9/26/10
CROSS SECTION:	3+18.00
FEATURE:	Riffle

Cross section photo – looking upstream
Note high water level.

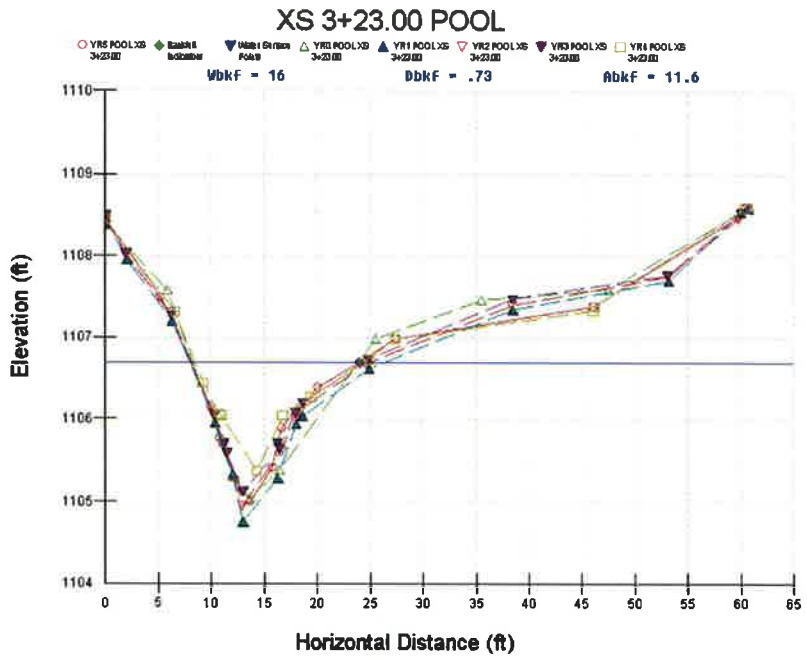


Summary Data

Bankfull Area	11.6 ft^2
Bankfull Width	15.99 ft
Mean Depth	0.73 ft
Maximum Depth	1.7 ft
Width/Depth Ratio	21.9
Entrenchment Ratio	3.65

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A2
DATE	9/26/10
CROSS SECTION:	3+23
FEATURE:	Pool

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

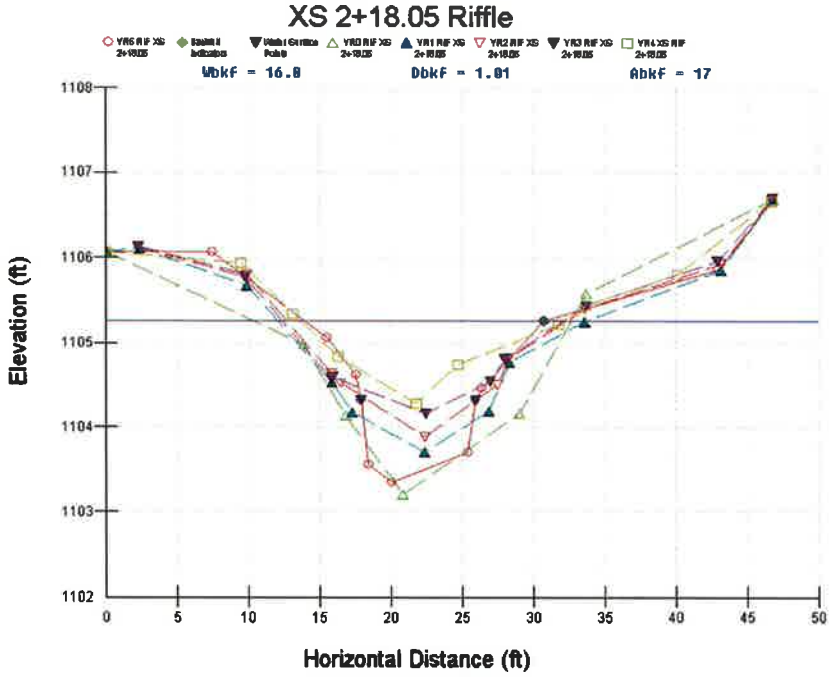


Summary Data

Bankfull Area	16.96 ft^2
Bankfull Width	16.84 ft
Mean Depth	1.01 ft
Maximum Depth	1.91 ft
Width/Depth Ratio	16.67
Entrenchment Ratio	2.78
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	A2
DATE	9/26/10
CROSS SECTION:	2+18
FEATURE:	Riffle

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

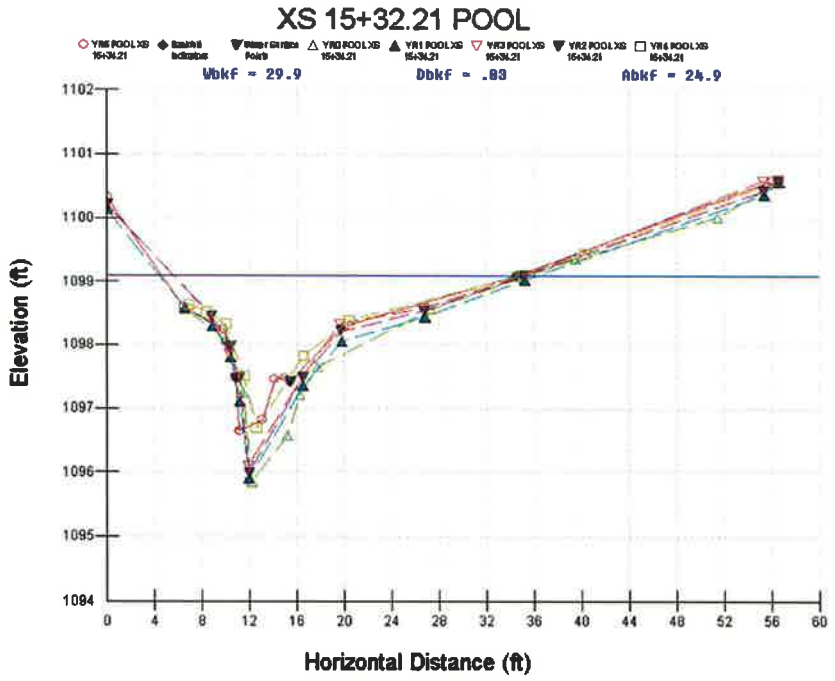


Summary Data

Bankfull Area	24.85 ft^2
Bankfull Width	29.92 ft
Mean Depth	0.83 ft
Maximum Depth	2.47 ft
Width/Depth Ratio	36.05
Entrenchment Ratio	1.87

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	B
DATE	9/26/10
CROSS SECTION:	15+34.21
FEATURE:	Pool

Cross-section photo – looking right to left bank.

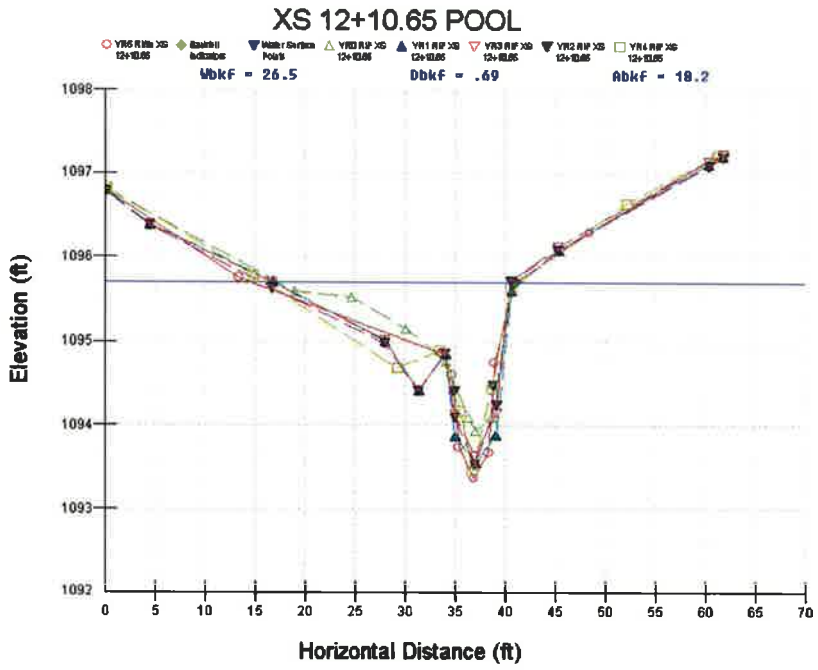


Summary Data

Bankfull Area	18.18 ft^2
Bankfull Width	26.52 ft
Mean Depth	0.69 ft
Maximum Depth	2.33 ft
Width/Depth Ratio	38.43
Entrenchment Ratio	2.31
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	B
DATE	9/26/10
CROSS SECTION:	12+10.65
FEATURE:	Riffle

Cross-section photo – looking downstream



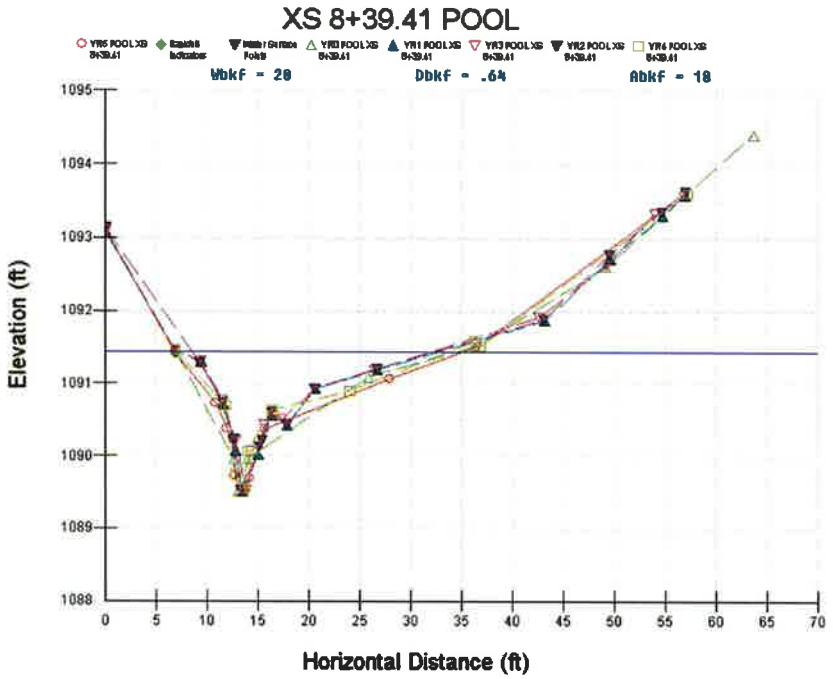
EMH&T

Summary Data

Bankfull Area	18.03 ft^2
Bankfull Width	28.0 ft
Mean Depth	0.64 ft
Maximum Depth	1.94 ft
Width/Depth Ratio	43.75
Entrenchment Ratio	1.95

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	B
DATE	9/26/10
CROSS SECTION:	8+39.41
FEATURE:	Pool

Cross-section photo – looking downstream.

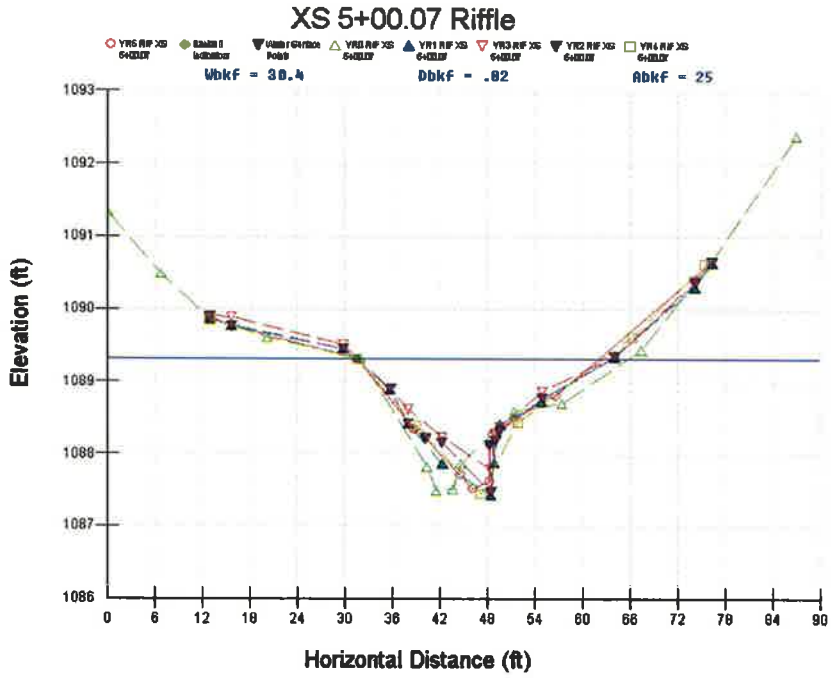


Summary Data

Bankfull Area	25.0 ft^2
Bankfull Width	30.45 ft
Mean Depth	0.82 ft
Maximum Depth	1.79 ft
Width/Depth Ratio	37.13
Entrenchment Ratio	2.08
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	B
DATE	9/29/10
CROSS SECTION:	5+00.07
FEATURE:	Riffle

Cross-section photo – looking left to right bank
Channel totally obscured by vegetation.



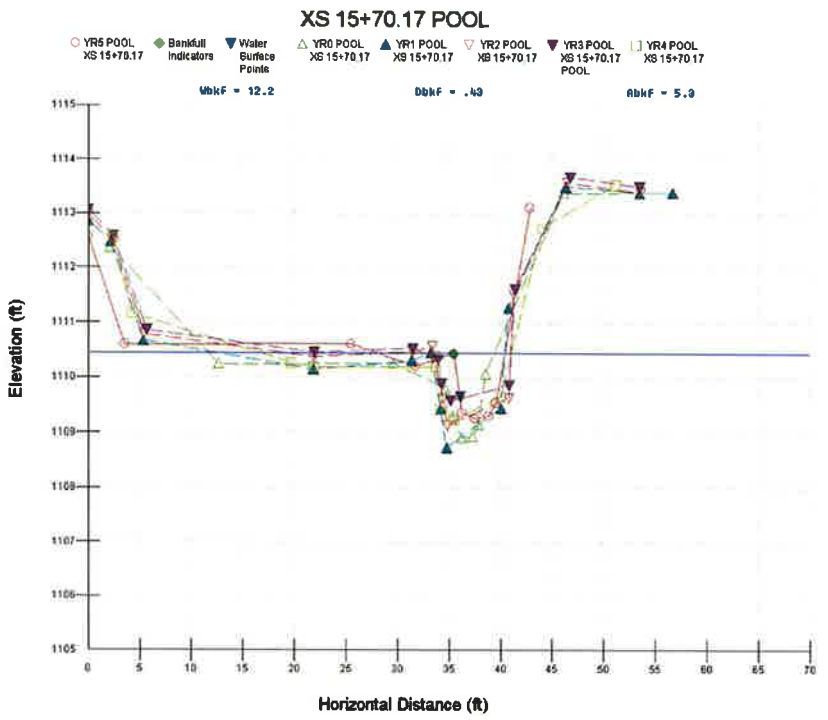
EMH&T

Summary Data

Bankfull Area	4.58 ft^2
Bankfull Width	5.27 ft
Mean Depth	0.87 ft
Maximum Depth	1.18 ft
Width/Depth Ratio	6.06
Entrenchment Ratio	7.54

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	C
DATE	9/26/10
CROSS SECTION:	15+70.17
FEATURE:	Pool

Cross-section photo – looking right bank to left bank

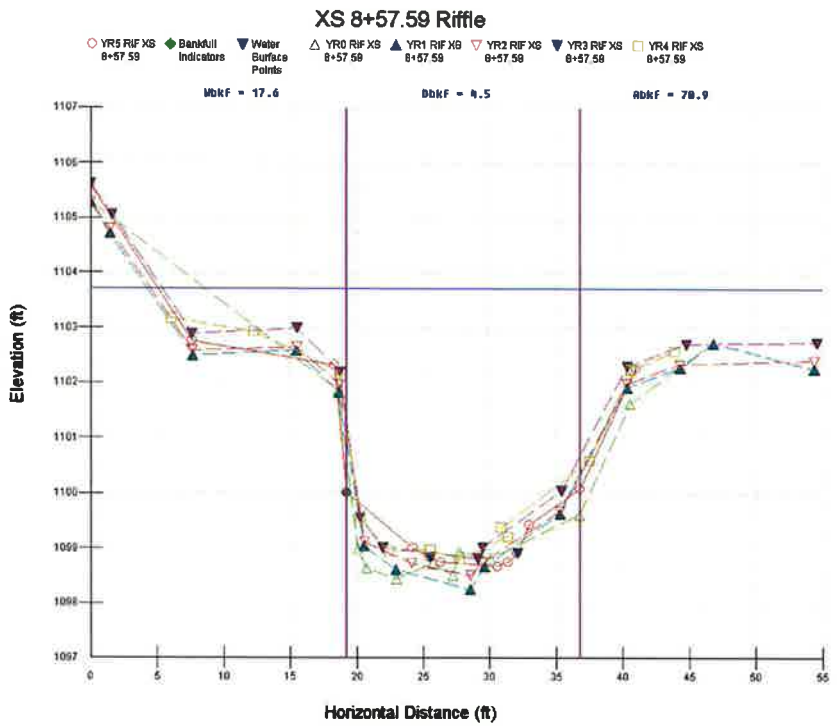


Summary Data

Bankfull Area	5.87 ft^2
Bankfull Width	10.85 ft
Mean Depth	0.54 ft
Maximum Depth	0.75 ft
Width/Depth Ratio	20.09
Entrenchment Ratio	1.64
Classification	B

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	C
DATE	9/26/10
CROSS SECTION:	8+57.59
FEATURE:	Riffle

Cross-section photo – looking downstream

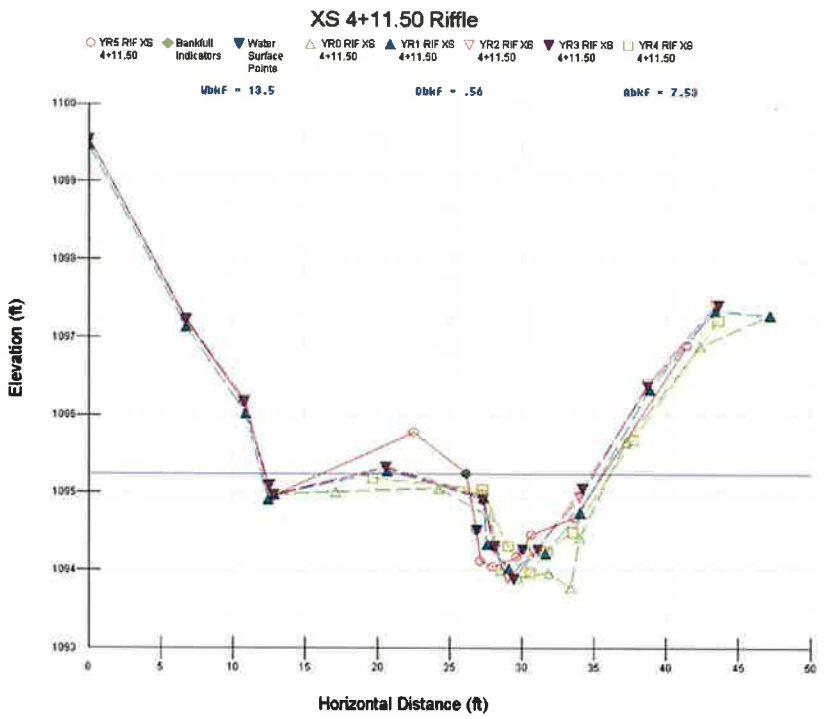


Summary Data

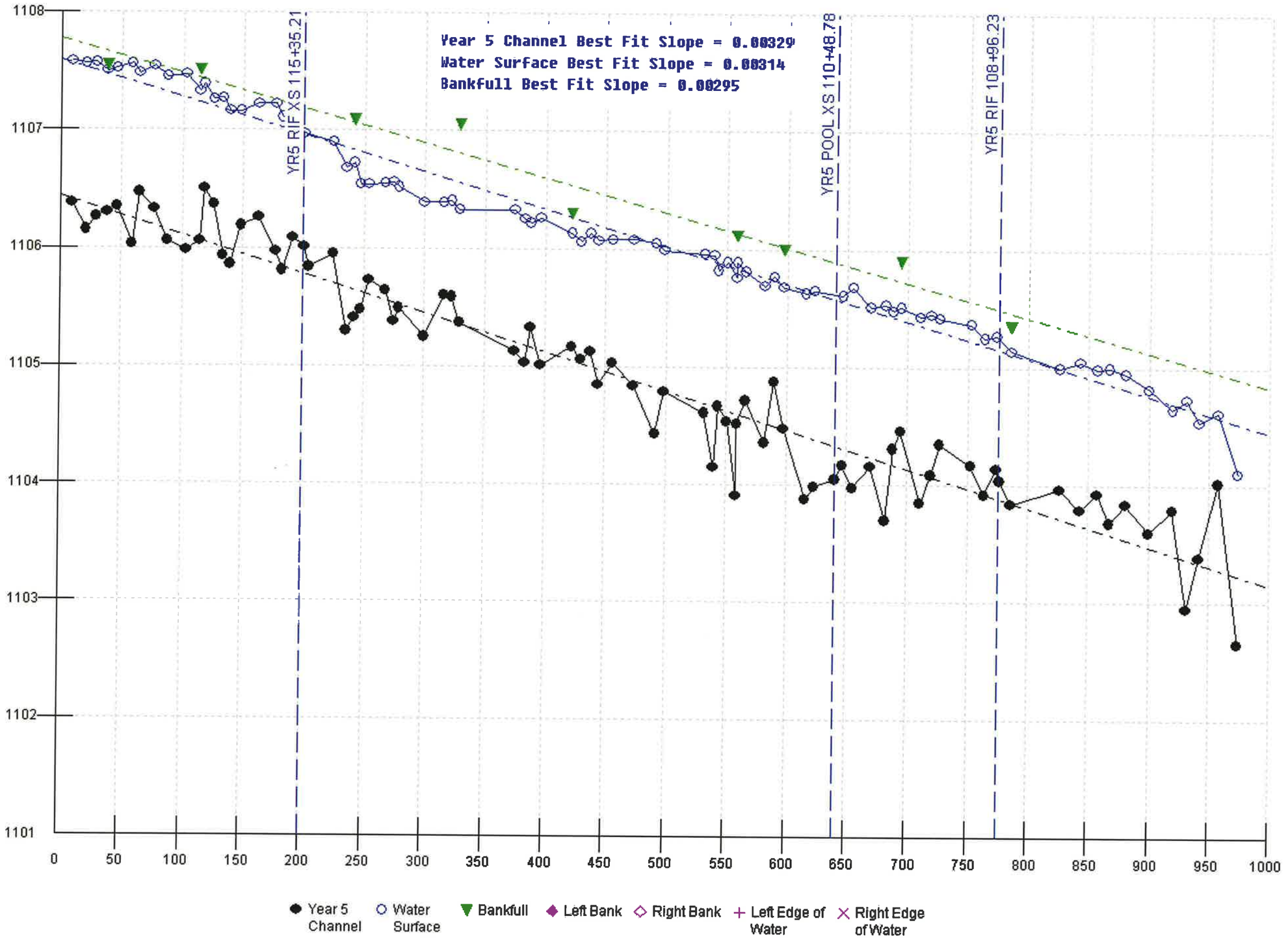
Bankfull Area	5.18 ft^2
Bankfull Width	8.83 ft
Mean Depth	0.59 ft
Maximum Depth	1.0 ft
Width/Depth Ratio	14.97
Entrenchment Ratio	3.11
Classification	C

PROJECT	South Muddy
	D04006-1
	5-YEAR
TASK	Cross-Section
REACH	C
DATE	9/26/10
CROSS SECTION:	4+11.50
FEATURE:	Riffle

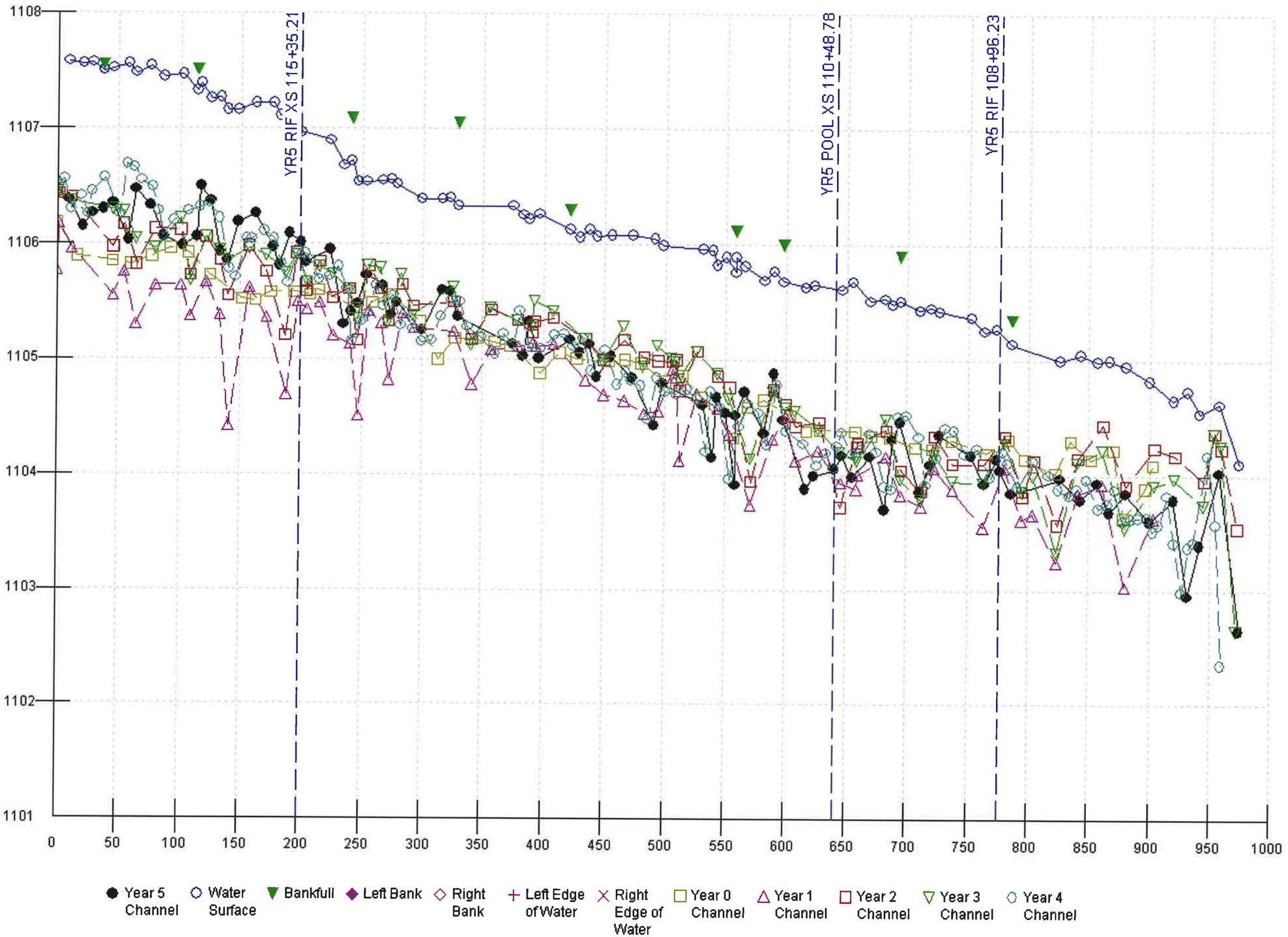
Cross-section photo – looking right to left bank



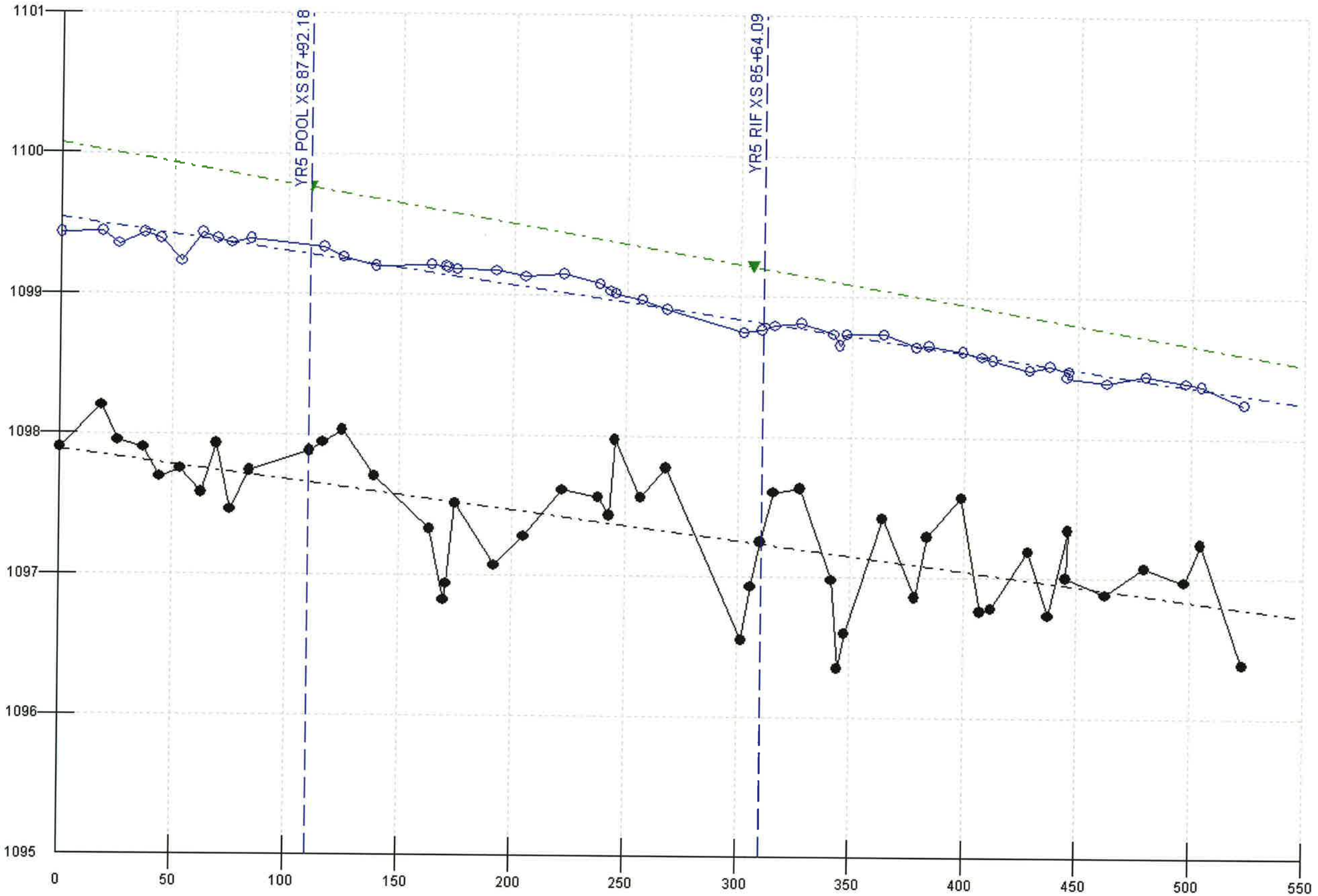
Upper Tributary A Year 5



Upper Tributary A Year 5



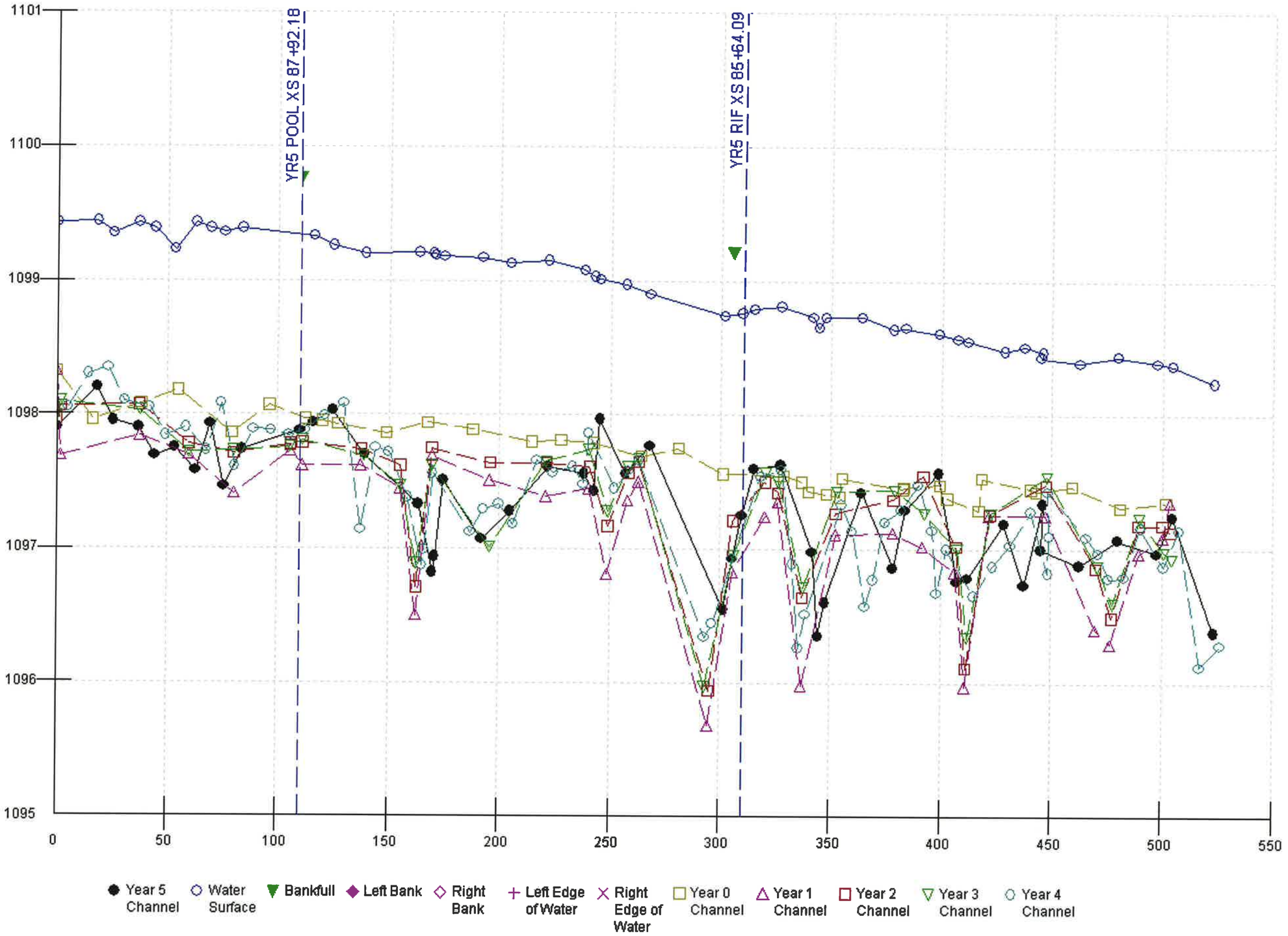
Middle Tributary A Year 5



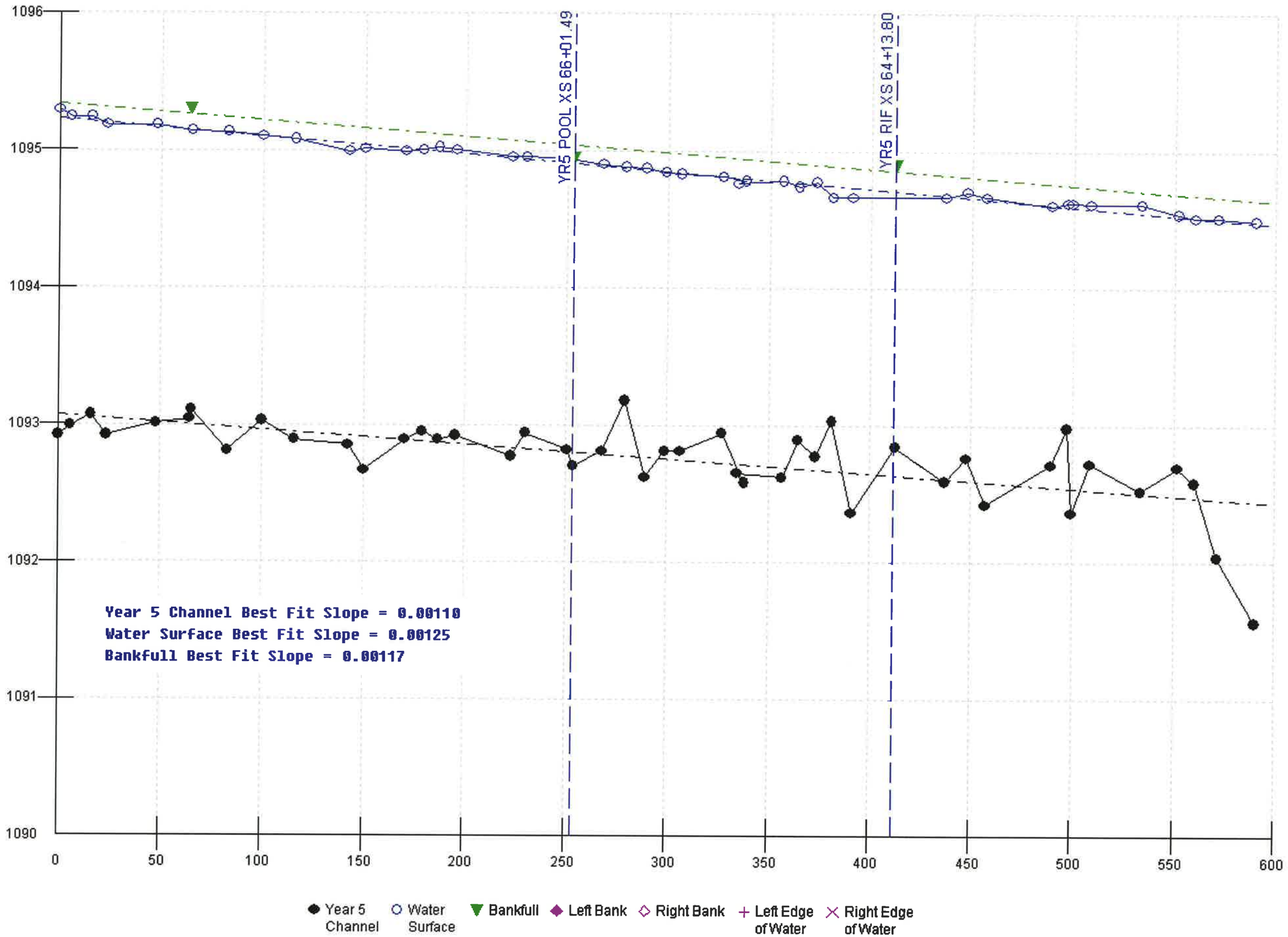
Year 5 Channel Best Fit Slope = 0.00212
Water Surface Best Fit Slope = 0.00235
Bankfull Best Fit Slope = 0.00281

● Year 5 Channel ○ Water Surface ▼ Bankfull ◆ Left Bank ◇ Right Bank + Left Edge of Water × Right Edge of Water

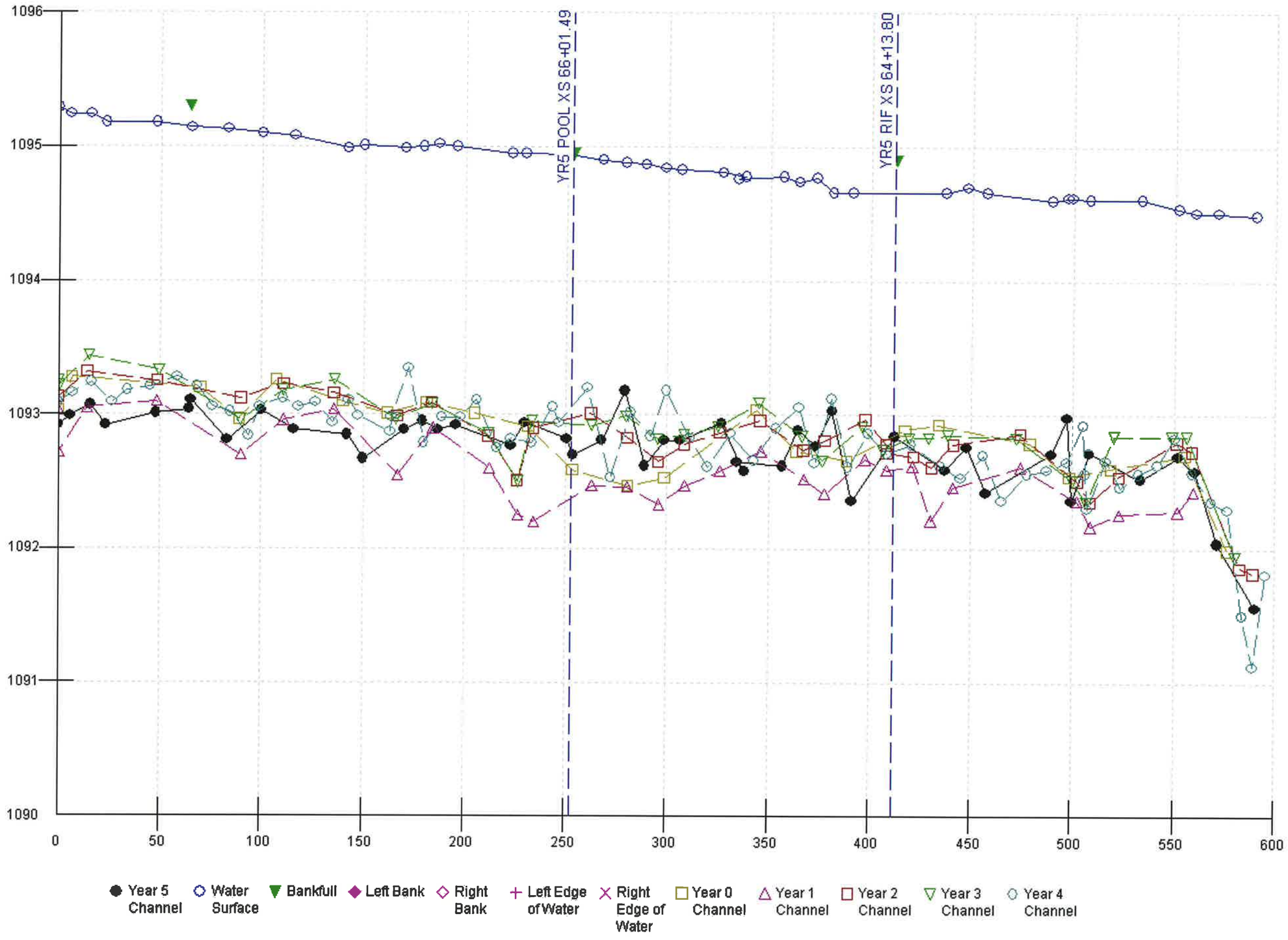
Middle Tributary A Year 5



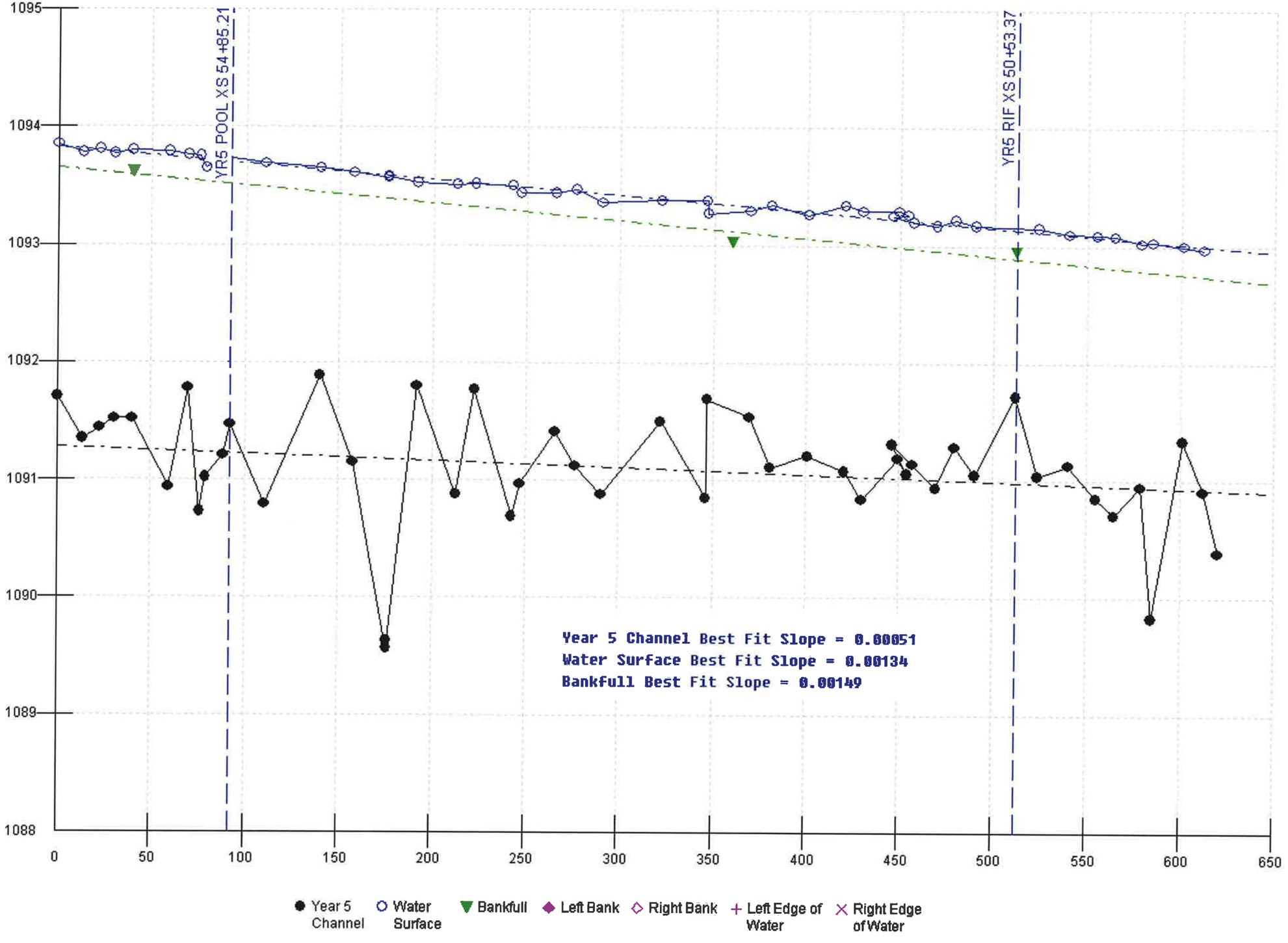
Lower Tributary A Year 5 - Profile 1



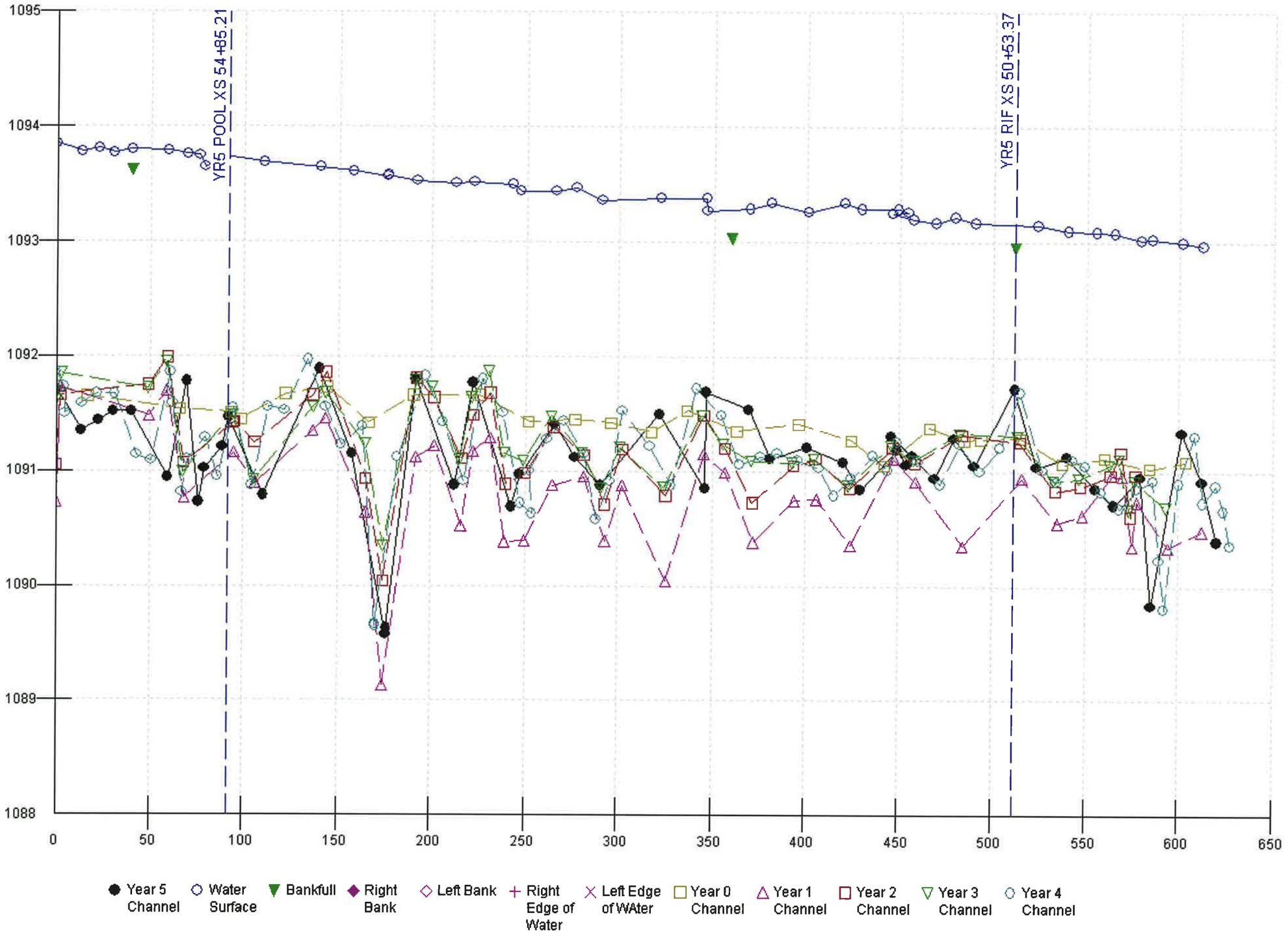
Lower Tributary A Year 5 - Profile 1



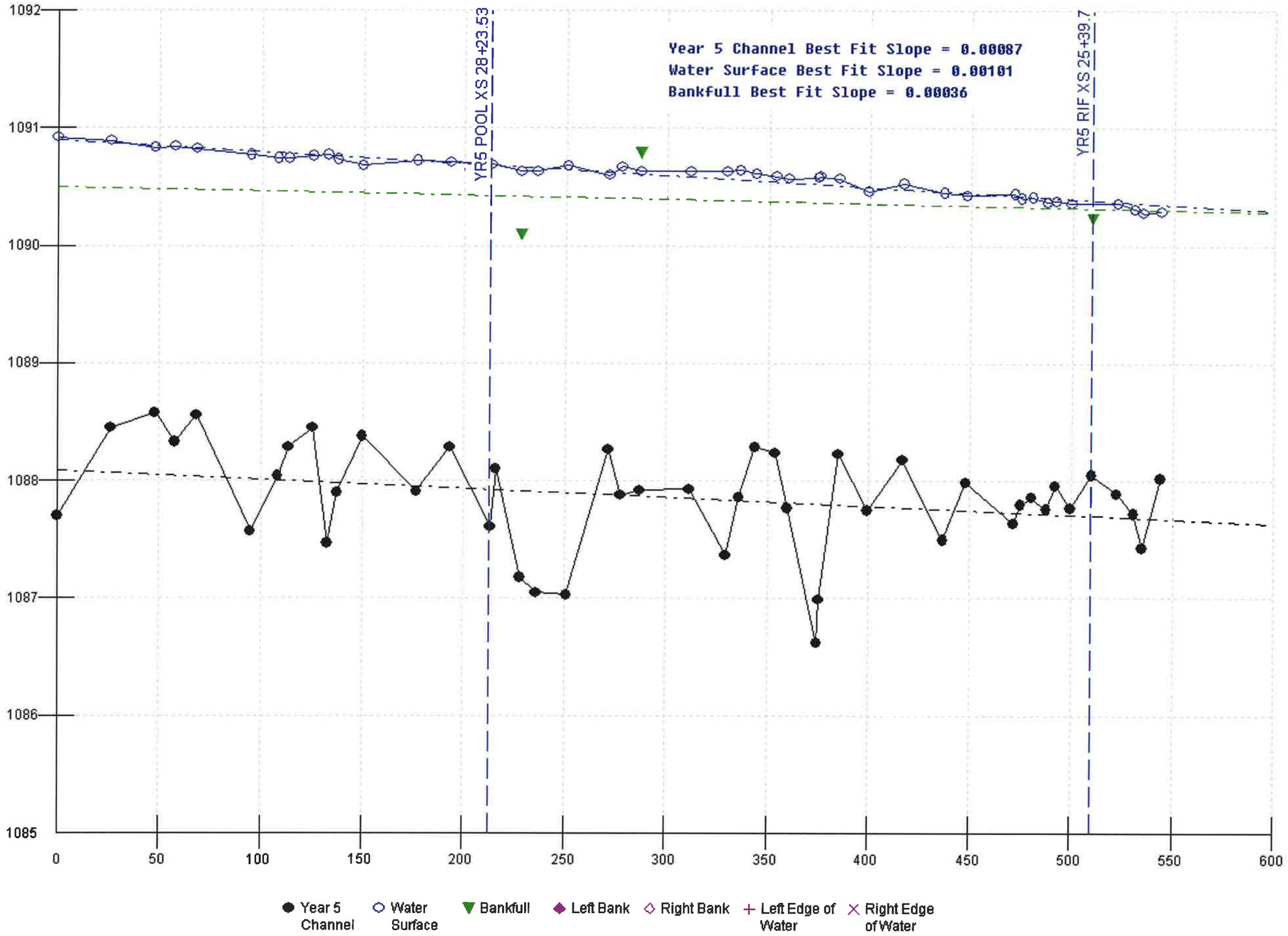
Lower Tributary A Year 5 - Profile 2



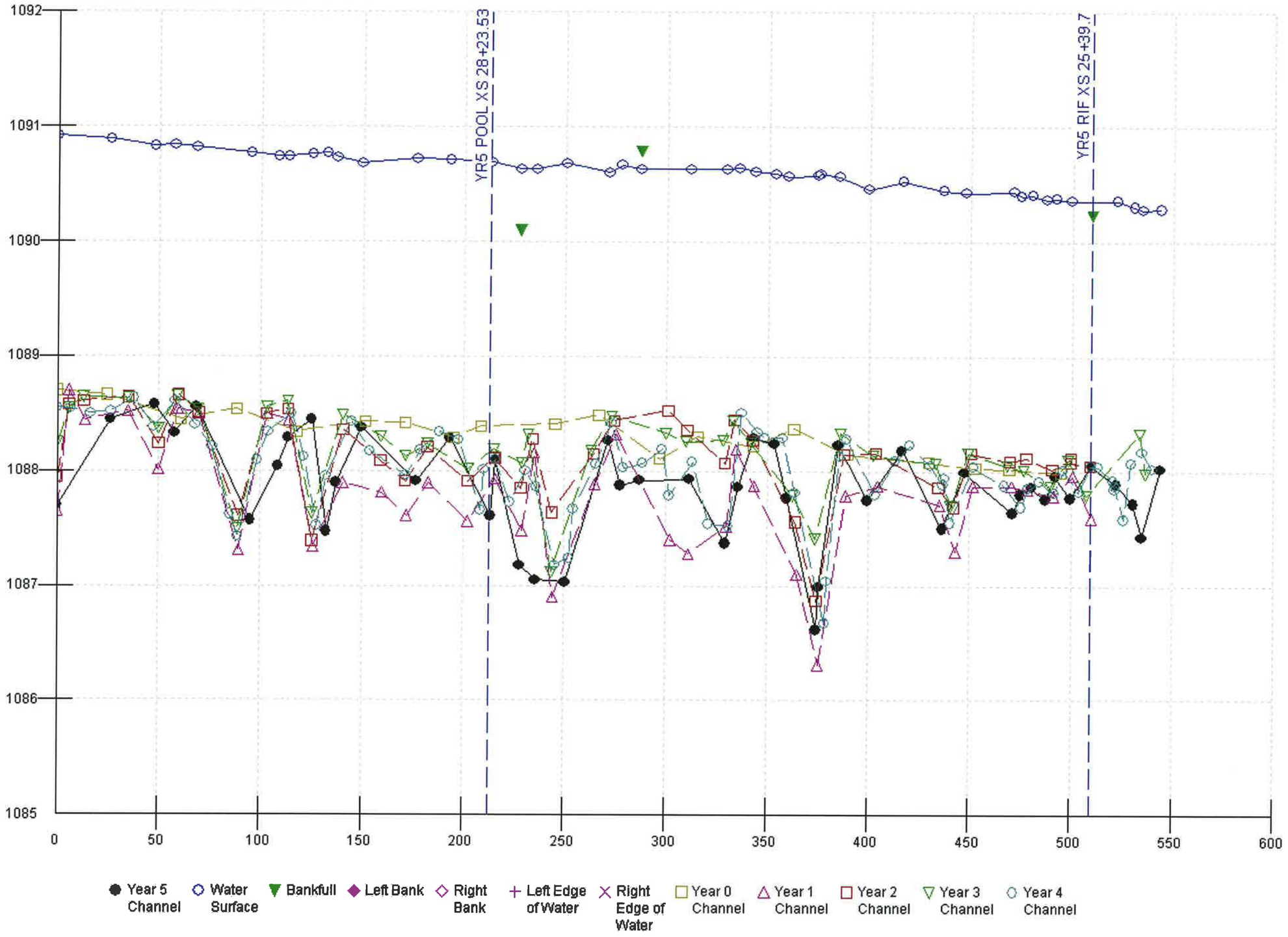
Lower Tributary A Year 5 - Profile 2



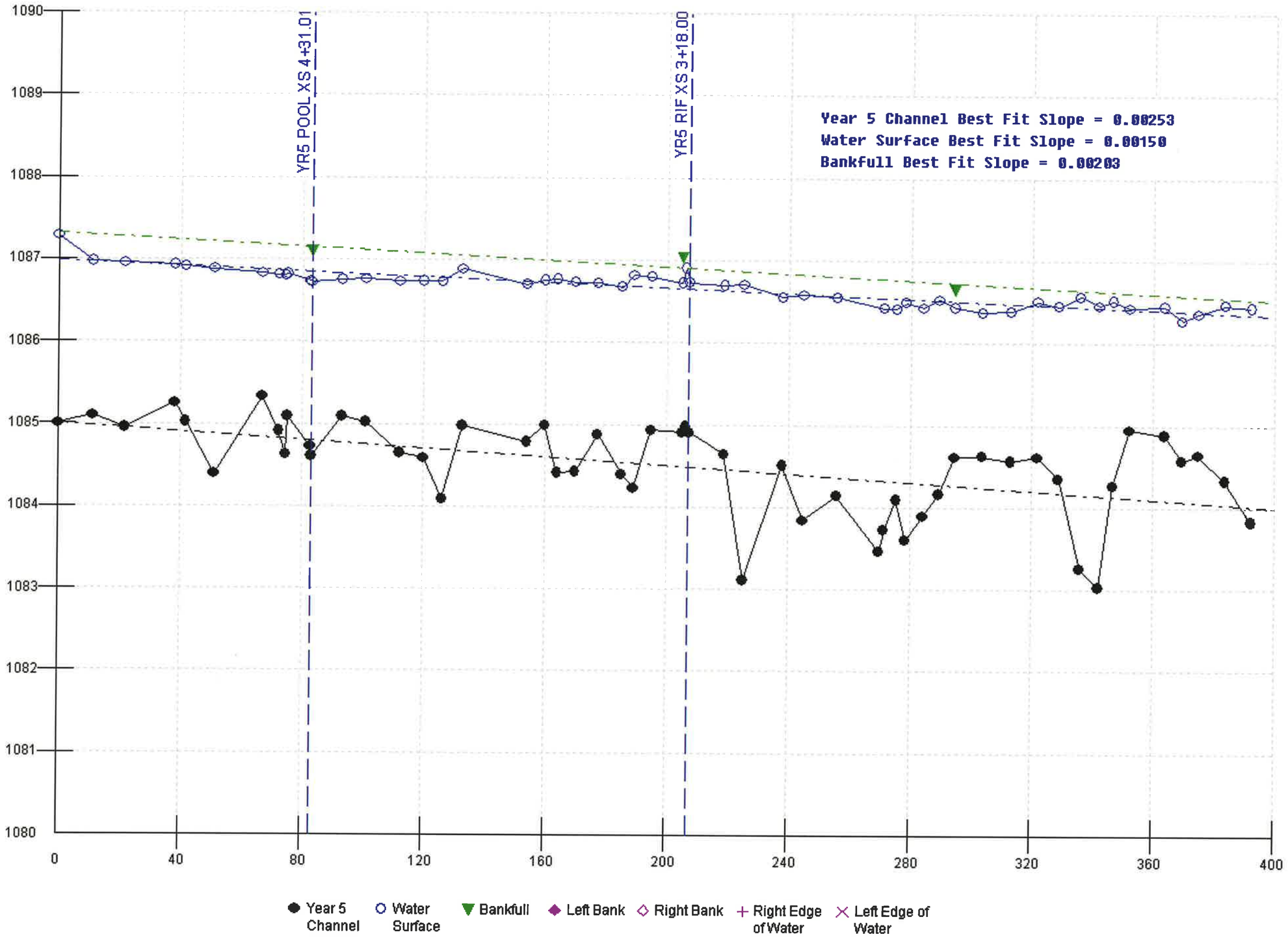
Lower Tributary A Year 5 - Profile 3



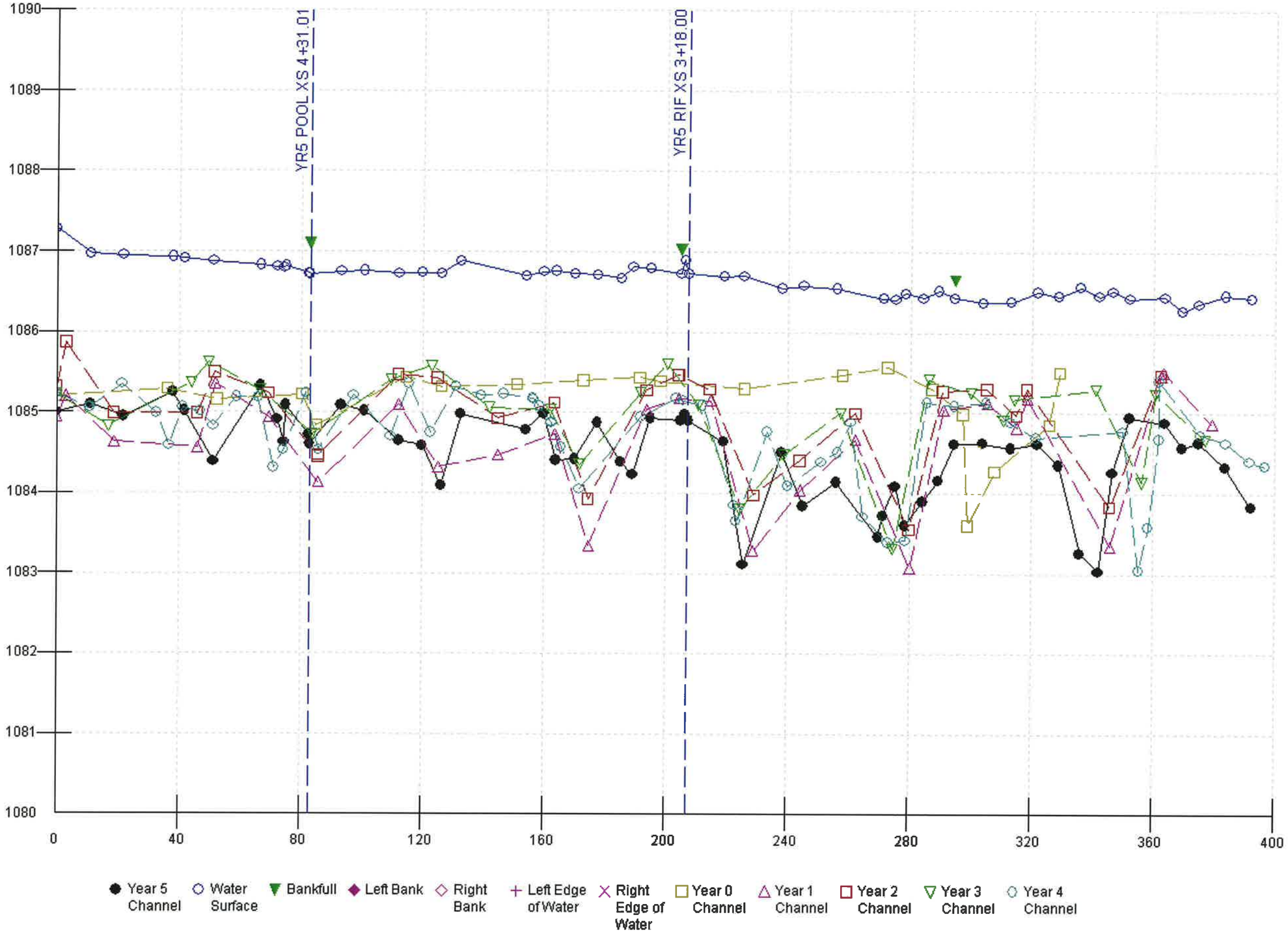
Lower Tributary A Year 5 - Profile 3



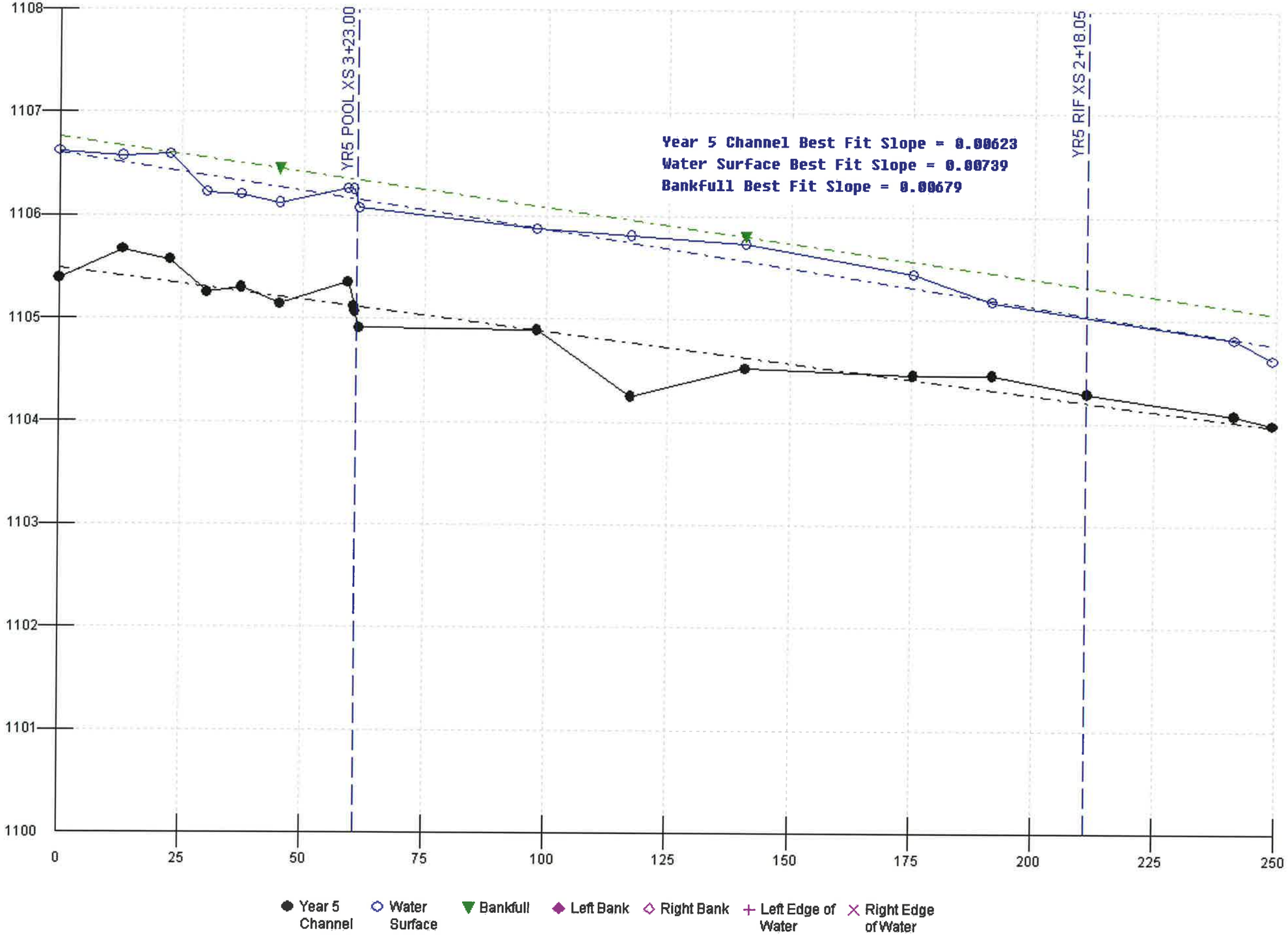
Lower Tributary A Year 5 - Profile 4



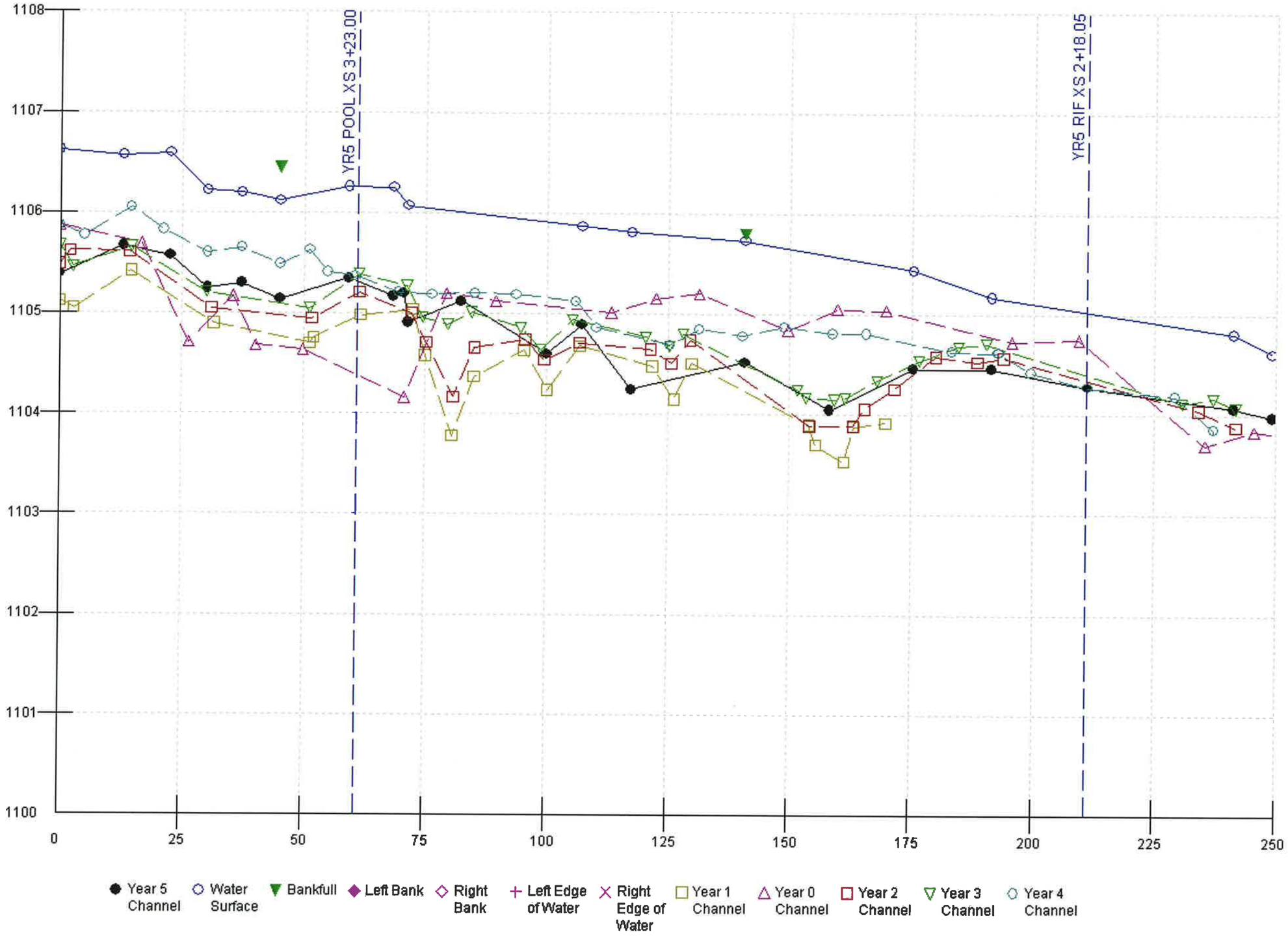
Lower Tributary A Year 5 - Profile 4



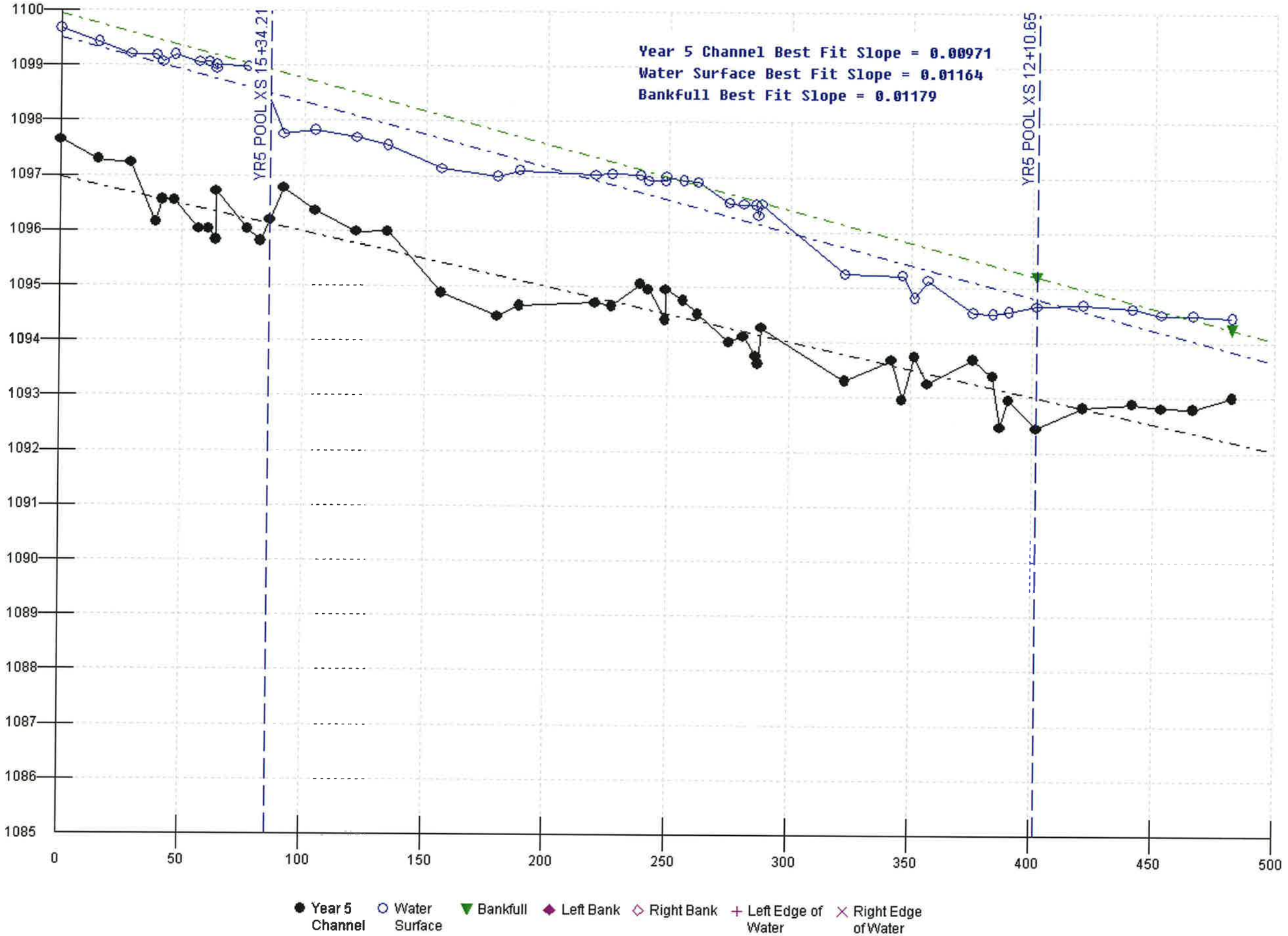
Tributary A2 Year 5



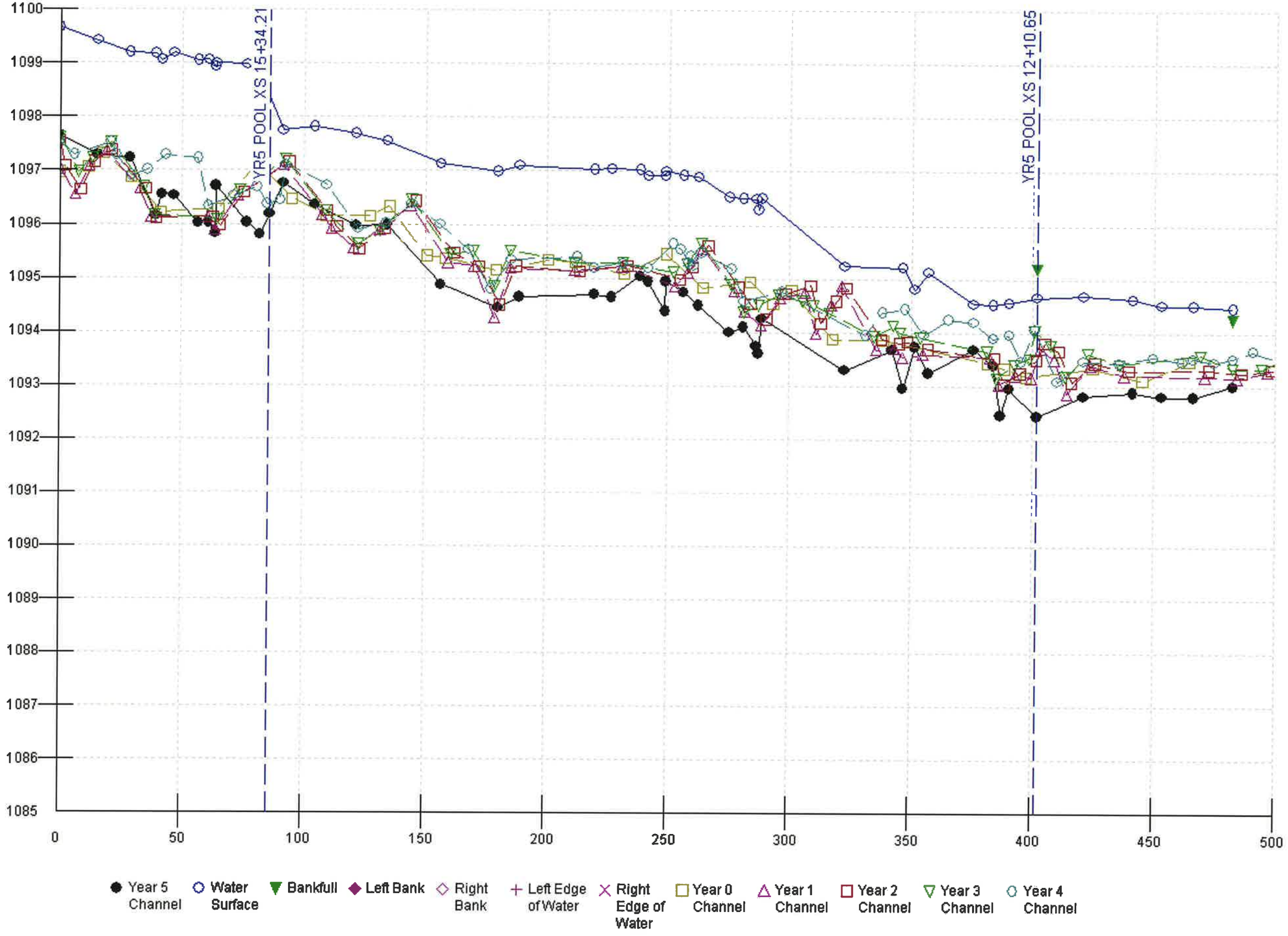
Tributary A2 Year 5



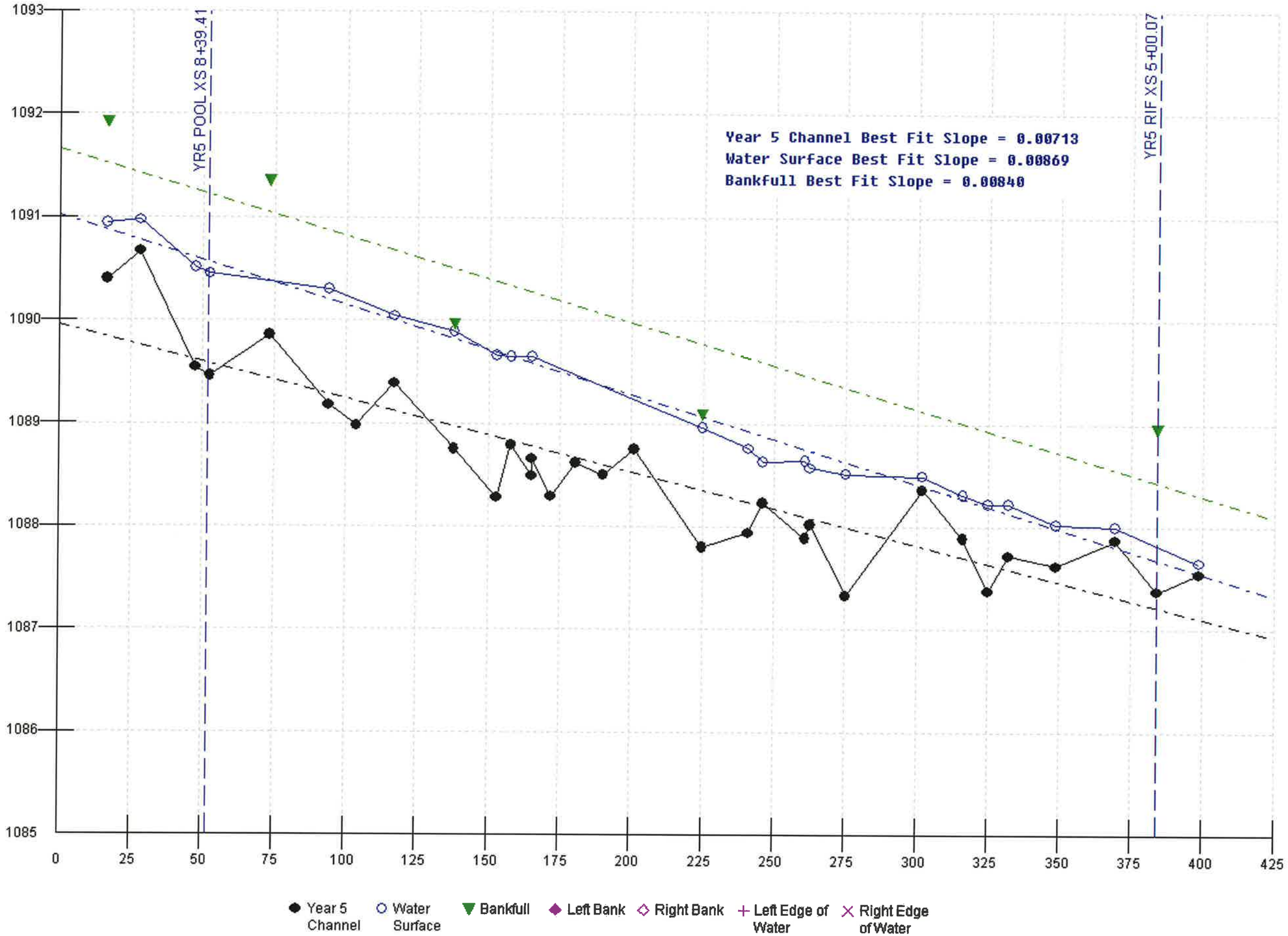
Upper Tributary B Year 5



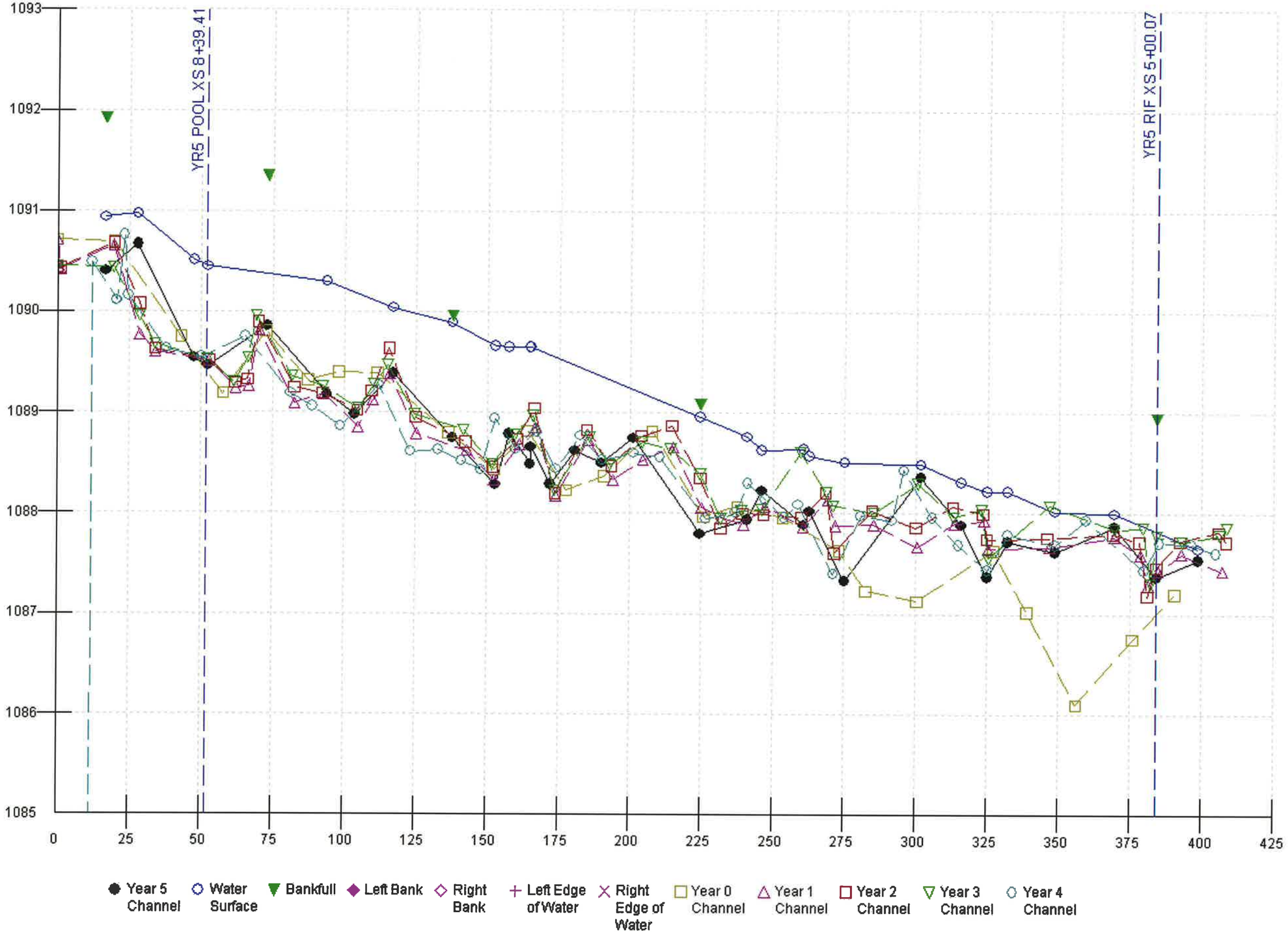
Upper Tributary B Year 5



Lower Tributary B Year 5

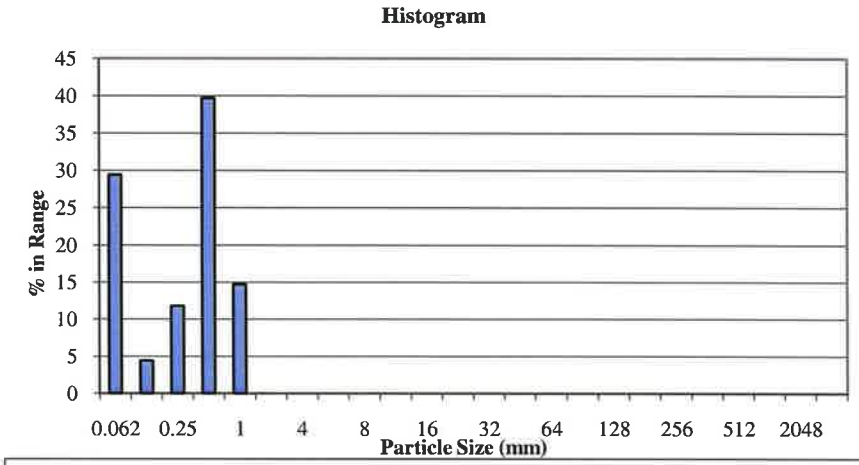


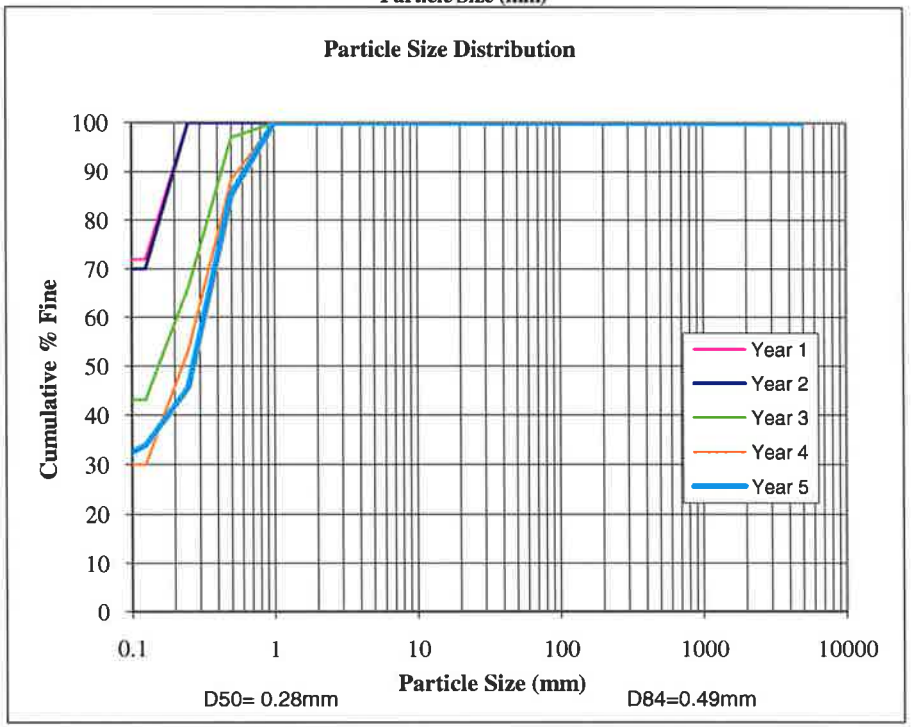
Lower Tributary B Year 5



Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	20	29	29
Very Fine Sand	0.062-0.125	3	4	34
Fine Sand	0.125-0.25	8	12	46
Medium Sand	0.25-0.5	27	40	85
Coarse Sand	0.5-1.0	10	15	100
Very Coarse Sand	1.0-2.0	0	0	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		68	100	

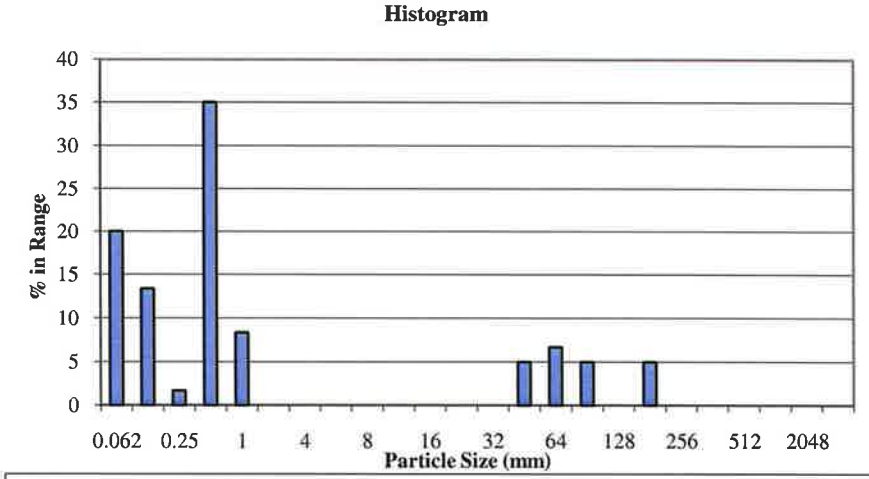
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	B	**X Sec**	N/A
Date	9/26/2010	**Sta No.**	15+34

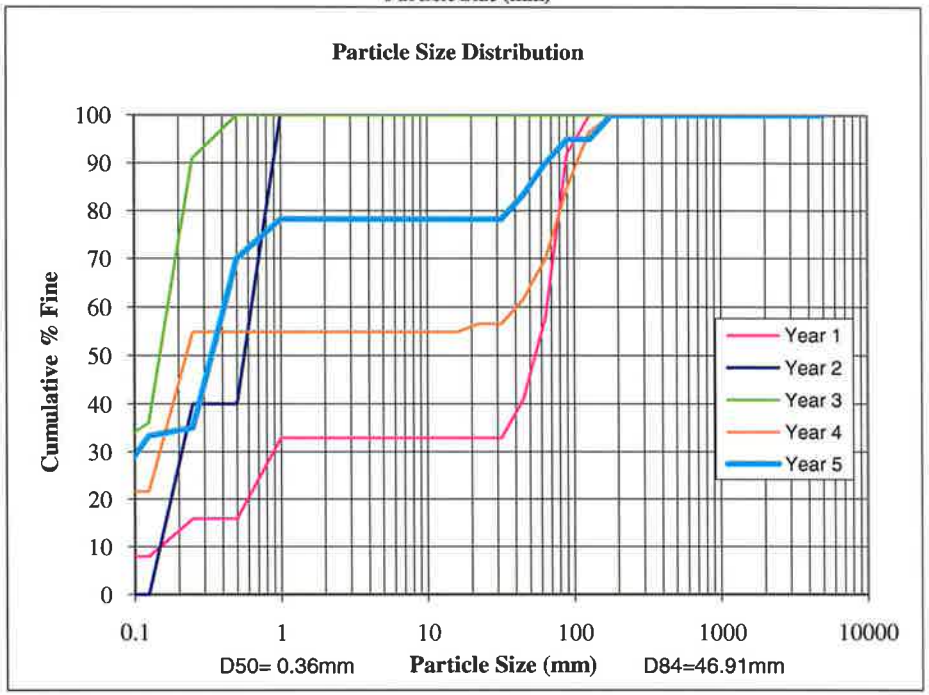




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	12	20	20
Very Fine Sand	0.062-0.125	8	13	33
Fine Sand	0.125-0.25	1	2	35
Medium Sand	0.25-0.5	21	35	70
Coarse Sand	0.5-1.0	5	8	78
Very Coarse Sand	1.0-2.0	0	0	78
Very Fine Gravel	2.0-4.0	0	0	78
Fine Gravel	4.0-5.7	0	0	78
Fine Gravel	5.7-8.0	0	0	78
Medium Gravel	8.0-11.3	0	0	78
Medium Gravel	11.3-16.0	0	0	78
Coarse Gravel	16.0-22.6	0	0	78
Coarse Gravel	22.6-32	0	0	78
Very Coarse Gravel	32-45	3	5	83
Very Coarse Gravel	45-64	4	7	90
Small Cobble	64-90	3	5	95
Small Cobble	90-128	0	0	95
Large Cobble	128-180	3	5	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	

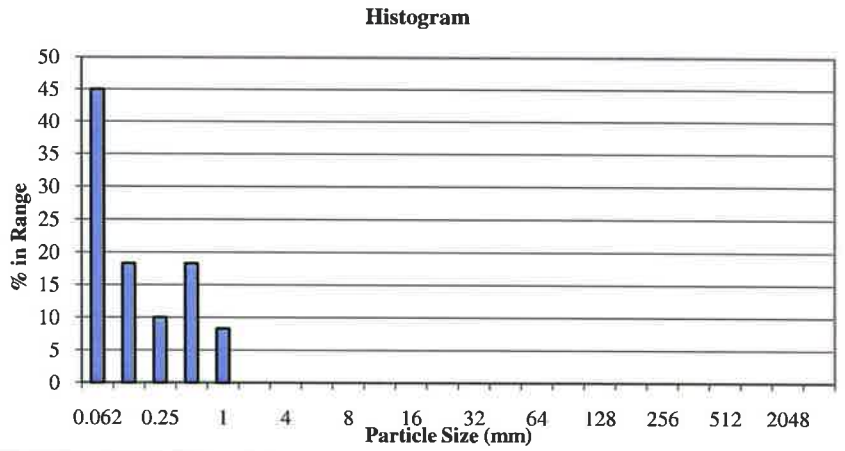
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	B	**X Sec**	N/A
Date	9/26/2010	**Sta No.**	2+25

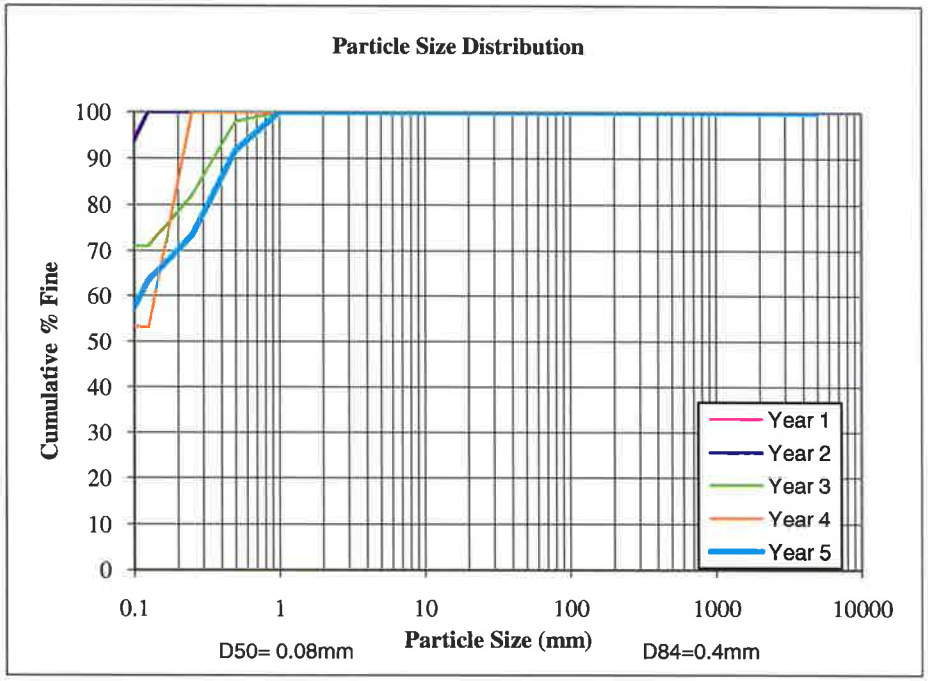




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	27	45	45
Very Fine Sand	0.062-0.125	11	18	63
Fine Sand	0.125-0.25	6	10	73
Medium Sand	0.25-0.5	11	18	92
Coarse Sand	0.5-1.0	5	8	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0	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	

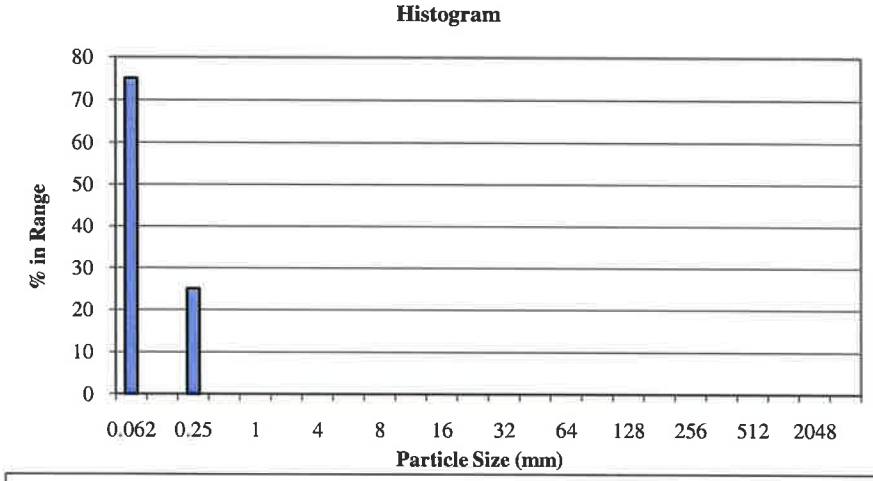
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	A (lower)	**X Sec**	N/A
Date	9/26/2010	**Sta No.**	4+31

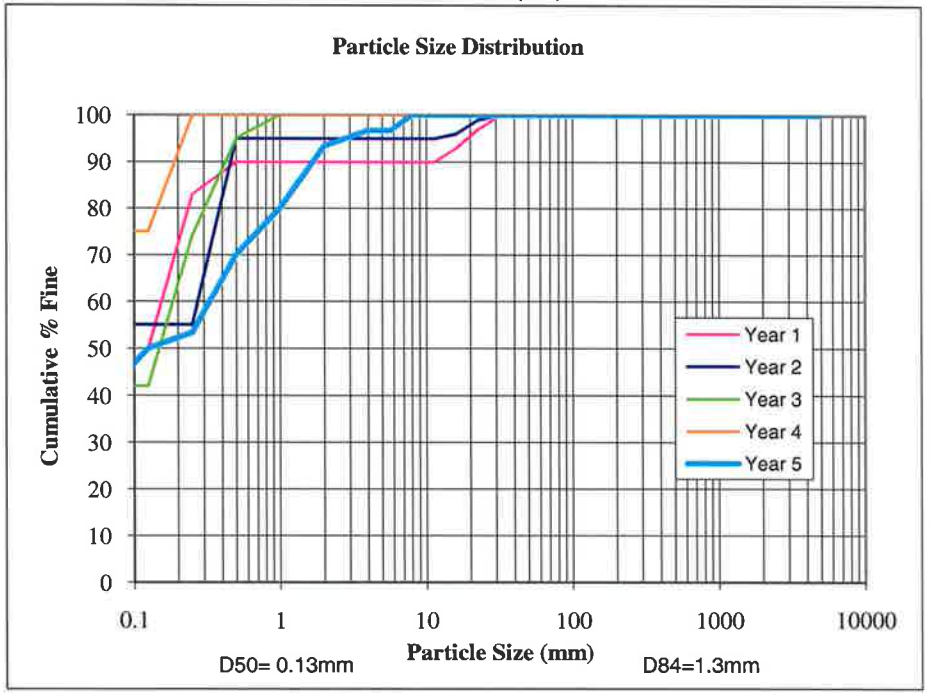




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	24	40	40
Very Fine Sand	0.062-0.125	6	10	50
Fine Sand	0.125-0.25	2	3	53
Medium Sand	0.25-0.5	10	17	70
Coarse Sand	0.5-1.0	6	10	80
Very Coarse Sand	1.0-2.0	8	13	93
Very Fine Gravel	2.0-4.0	2	3	97
Fine Gravel	4.0-5.7	0	0	97
Fine Gravel	5.7-8.0	2	3	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	

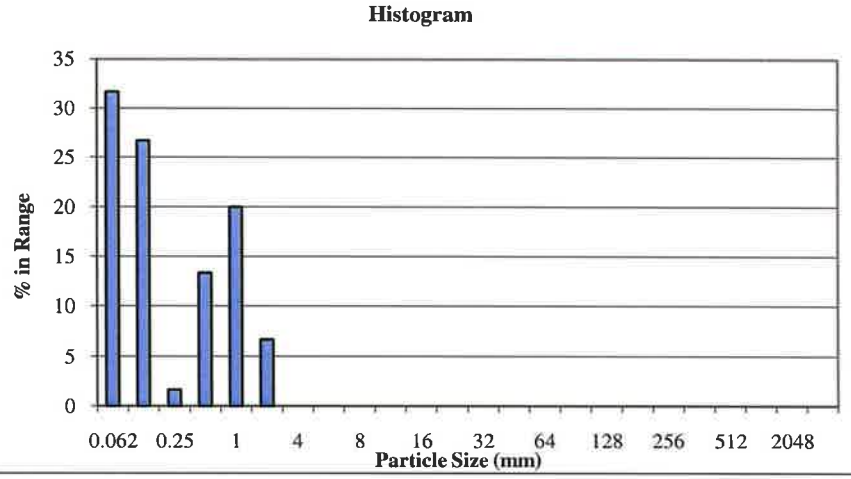
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	A (lower)	**X Sec**	N/A
Date	9/26/2010	**Sta No.**	40+13

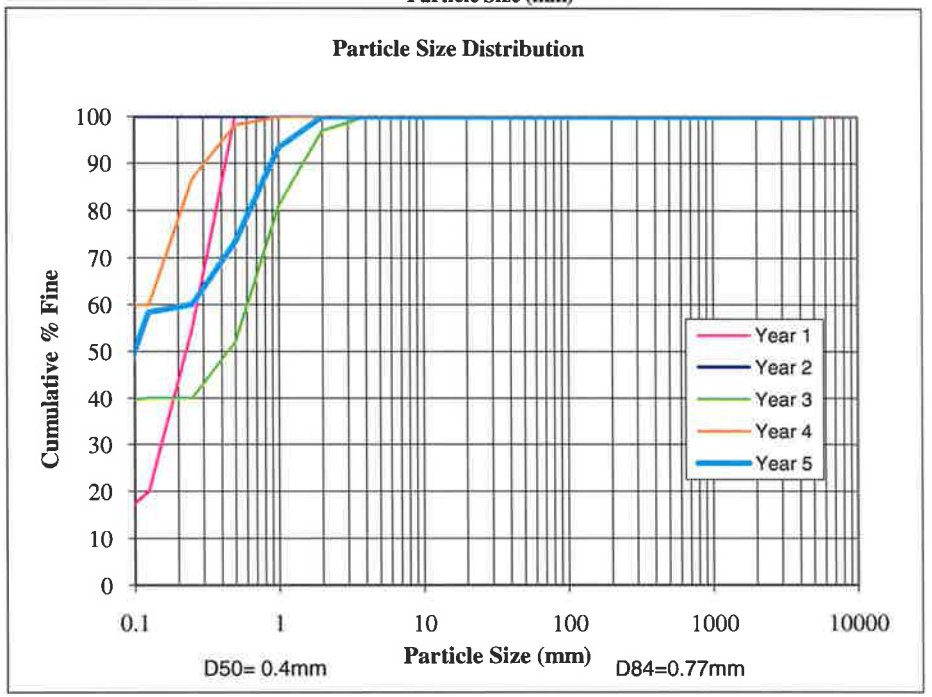




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	19	32	32
Very Fine Sand	0.062-0.125	16	27	58
Fine Sand	0.125-0.25	1	2	60
Medium Sand	0.25-0.5	8	13	73
Coarse Sand	0.5-1.0	12	20	93
Very Coarse Sand	1.0-2.0	4	7	100
Very Fine Gravel	2.0-4.0	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	

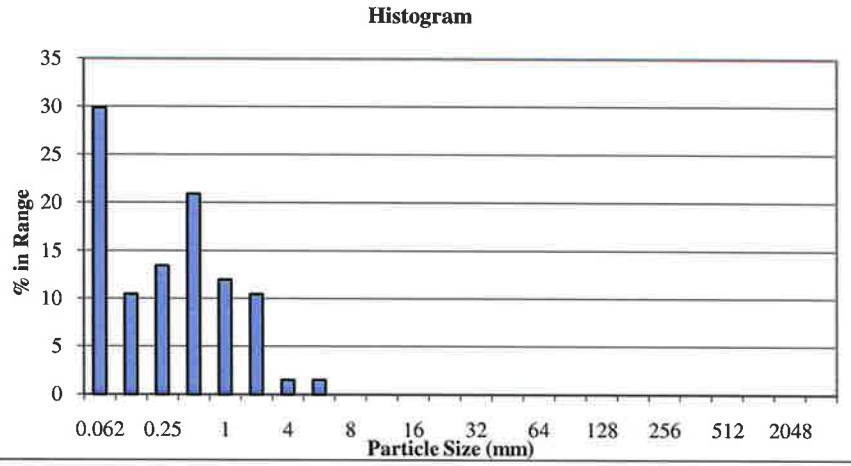
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	A (middle)	**X Sec**	N/A
Date	9/26/2010	**Sta No.**	87+92

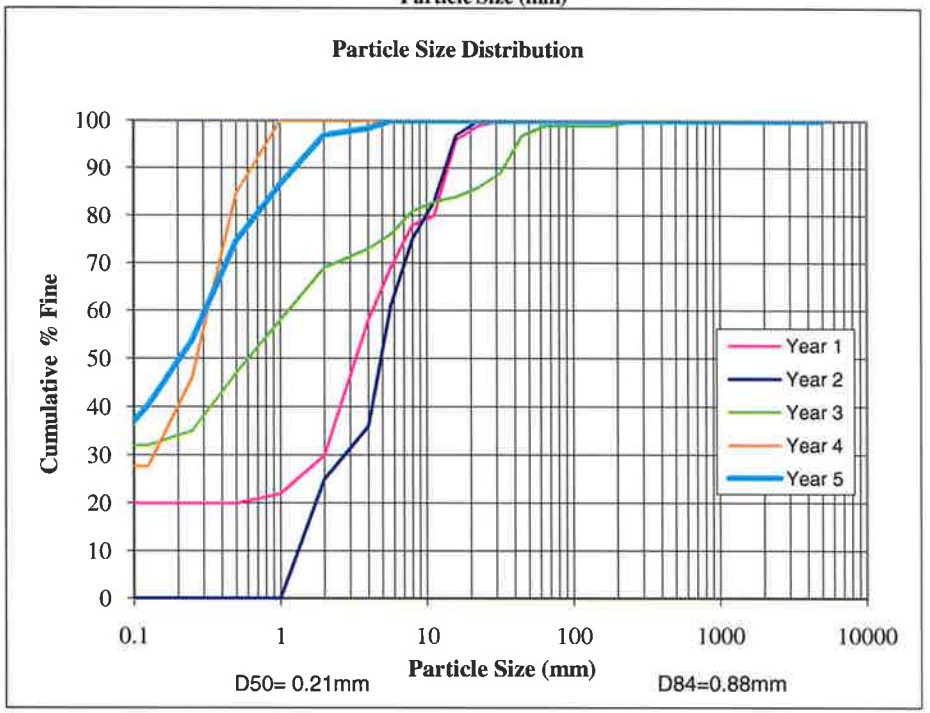




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	20	30	30
Very Fine Sand	0.062-0.125	7	10	40
Fine Sand	0.125-0.25	9	13	54
Medium Sand	0.25-0.5	14	21	75
Coarse Sand	0.5-1.0	8	12	87
Very Coarse Sand	1.0-2.0	7	10	97
Very Fine Gravel	2.0-4.0	1	1	99
Fine Gravel	4.0-5.7	1	1	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		67	100	

South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	A (upper)	**X Sec**	N/A
Date	9/26/2010	**Sta No.**	108+96





BF 1
Crest Gage at station 5+00 on Tributary B.
(EMH&T, Inc. 7/18/07)

BF 2
Crest Gage at station 54+85 on Tributary A (lower).
(EMH&T, Inc. 7/18/07)

BF 3
Crest Gage at station 113+37 on Tributary A (upper).
(EMH&T, Inc. 10/19/07)

BF 4
Bankfull event in progress on Tributary A (Lower) near station 3+18, looking upstream.
(EMH&T, Inc. 9/11/08)

BF 5
Bankfull event in progress on Tributary A (Lower) near station 3+18, looking across the channel.
(EMH&T, Inc. 9/11/08)

BF 6
Bankfull event in progress on Tributary A (Lower) near station 40+13, looking upstream.
(EMH&T, Inc. 9/11/08)

BF 7
Bankfull event in progress on Tributary A (Lower) near station 40+13, looking across the channel.
(EMH&T, Inc. 9/11/08)

BF 8
Crest Gage on Tributary A (upper).
(EMH&T, Inc. 9/21/09)

BF 9
Crest Gage on Tributary A (middle).
(EMH&T, Inc. 9/21/09)

BF 10
Crest Gage on Tributary A2.
(EMH&T, Inc. 9/21/09)

BF 11
Crest Gage on Tributary B.
(EMH&T, Inc. 9/21/09)

BF 12
Crest Gage on Tributary C.
(EMH&T, Inc. 9/21/09)

BF 13
Crest Gage at station 113+37 on Tributary A (upper).
(EMH&T, Inc. (documented, 5/11/10))

BF 14
Crest Gage at station 54+85 on Tributary A (lower).
(EMH&T, Inc. (documented, 5/11/10))

BF 15
Crest Gage on Tributary B.
(EMH&T, Inc. (documented, 5/11/10))

BF 16
Crest Gage on Tributary A2.
(EMH&T, Inc. (documented, 5/11/10))