EMH&T
Engineers, Surveyors, Planners, Scientists

December 22, 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 Restoration of Silver Creek and Unnamed Tributaries
SCO# D05016-01

Dear Guy,

On behalf of Wetlands Resource Center, EMH&T Inc. is pleased to submit the Year 5 Monitoring Report for Silver Creek and Unnamed Tributaries (SCO# D05016-01). This report contains data from the vegetation monitoring, conducted in September 2011, and data from the stream monitoring, completed in September 2011. 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) 775-4507. We appreciate your willingness to work with us on this report.

Sincerely,

EVANS, MECHWART, HAMBLETON & TILTON, INC.

Megan F. Wolf
Environmental Scientist

Enclosure

Copies: Cal Miller, WRC

Year 5 Monitoring Report for Stream Restoration of Silver Creek and Unnamed Tributaries

Burke County, NC
SCO # D05016-01

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

Ecosystem Enhancement PROGRAM

Submitted: December 2011

Prepared by:

Wetlands Resource Center
3970 Bowen Road
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And

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I. EXECUTIVE SUMMARY

The Silver Creek stream restoration project is located near Morganton in Burke County, North Carolina. Prior to restoration, channelization and cattle intrusion resulted in vegetative denuding and bank destabilization due to hoof shear. The vertical to undercut unstable streambanks were contributing large volumes of suspended sediment and bedload material to the larger Silver Creek watershed. The project reach includes the restoration of 2,905 linear feet of the Silver Creek mainstem and 1,552 linear feet of an Unnamed Tributary (UT-A); also included is 166 linear feet of preservation along UT-B, UT-C and UTD. Restoration of the project streams, completed during April 2007, re-established geomorphologic features consistent with natural stream channel characteristics. Elements of the restoration included stable channel pattern, profile and dimension consistent with reference reach conditions quantified within the Silver Creek watershed, upstream from the project on Brindle Creek. In-stream structures were constructed to provide grade control, streambank stabilization and aquatic habitat features. Restoration reconnected project stream channels to functional floodplains with extensive riparian plantings. The following report documents the Year 5 Annual Monitoring for this project.

Vegetative monitoring was completed in September 2011 following the Carolina Vegetation Survey methodology. Stem counts completed at ten (10) vegetation plots show an average density of 397 stems per acre for the site. This is an improvement over the Year 4 average of 324 stems per acre for the site and reflects the remedial planting effort from the spring of 2011 (described later in this document). This density also far exceeds the required success criteria of 260 stems/acre after five years of monitoring. No plots have stem densities below the minimum in 2011. In addition to the planted woody species, a substantial number of recruit stems have been found in all plots. The recruit stems bring the site average to 608 and results in a 53% increase in the total stem density across the site.

To address the issue of low plant stem counts seen in 2010 on those plots affected by previous cattle intrusion, specific areas were targeted for replanting within the Silver Creek and UT-A riparian corridors. This planting effort also included the deficient sample plots and surrounding areas within the buffer. Supplemental planting occurred in the spring 2011. This Year 5 monitoring report discusses the details of this planting effort.

Year 5 monitoring of the streams identified a few problem areas along the project reaches. One vegetative problem area of low concern was noted for the mainstem. This included a small section along the riparian corridor that contained sparse vegetative cover. An additional vegetative problem area for the project in Year 5 occurred along UT-A. Japanese stiltgrass (*Microstegium vimineum*) was observed to be colonizing bare ground on the steep slopes of the riparian corridor, as well as the streambed. This issue is discussed in further detail in the vegetation problem areas section of this report. A minor area of aggradation was noted on the mainstem at its confluence with UT-C and is considered of low concern at this time. Minor areas of bank scour that were noted on UT-A in 2009 have been successfully stabilized using seeding efforts to establish ground cover.

The most substantial problem from 2009 occurred along UT-A due to accidental cattle access into both the channel and riparian corridor. The cattle intrusion resulted in damage to planted and native woody species and trampling of the herbaceous understory. These areas were reseeded in the fall of 2009. This reseeding has greatly increased ground cover in 2010 and 2011and has further stabilized the banks of the tributary. As stated above, tree and shrub species appropriate

for partial shade conditions were planted in the spring of 2011 in order to replace those woody species damaged by the cattle. The disturbance to the stream channel was limited to a reach approximately 400 feet long. Minor repairs to the bed and bank of the channel were also made in 2009.

The visual stream stability assessment revealed that the majority of stream features are functioning as designed and built on the Silver Creek mainstem. In 2009, some features along UT-A were not performing as intended. By the monitoring event of 2010, these features had been successfully returned to a functional state by way of minor repair. The features have remained stable in 2011. Since the majority of the feature malfunctions were associated with the cattle intrusion (which have successfully been excluded from the riparian corridor of the tributary), the channel features should continue to remain functional in perpetuity. The number and depth of pools along UT-A have remained stable when compared to Year 4. As described in a later section of this report, it is expected that these shallow pools will cyclically flush and aggrade during corresponding wet and dry seasons.

Dimensional measurements of the monumented cross-sections remain stable when compared to as-built conditions. However, 2009 cattle access to the riparian corridor of UT-A destroyed many of the original cross section monuments. New monuments were installed in 2010 during the Year 4 stream survey. New monuments were also established for a few cross sections along the Silver Creek mainstem. As a result, the overlay of several cross sections monuments on the Year 5 templates in Appendix B do not precisely line up. This is not a sign of instability, but rather a result of re-setting the monumentation at selected cross sections.

The comparison of the yearly long-term stream monitoring profile data show generalized stability with minimal changes from as-built conditions. However, as discussed in more detail in the stream stability section of this report, two pool cross sections on Silver Creek mainstem had notable aggradation in 2011. Also, while two pools on UT-A showed significant aggradation in Year 5, all of the stream issues that resulted from 2009 cattle access have been corrected and remain stable in Year 5 . The substrate of the constructed riffles remains stable, with median particle sizes ranging from coarse sand to very coarse gravel. D_{50} particle distributions have adjusted slightly from year to year but still remain stable after 5 years of monitoring. Based on the crest gage network installed on the project reaches, three bankfull events have occurred since construction was completed.

In addition to the monitoring protocol required by EEP, additional monitoring of Tributaries UT-B and UT-C has been required by the NC DWQ under the Section 401 permit issued for the project on May 25, 2007. Year 5 vegetation monitoring found that the average stem density for the combined tributaries far exceeds the minimum criteria of 320 stems per acre. Stream monitoring found no morphological stability problems along these tributaries. In the spring of 2011, however, aggradation was observed along UT-C. Aggradation on this tributary had formed a lateral bar at its confluence with Silver Creek mainstem. This issue on UT-C is explained in more detail later in this report. A picture of the resultant lateral bar on the Silver Creek mainstem is included in the Stream Problem Area Photos in Appendix A.

In December 2010, an agreement was reached between Wetlands Resource Center (WRC) and the EEP about improvements to the cattle crossing on UT-A. At that time, WRC agreed to work with the local NRCS office to provide offline watering for cattle. WRC also agreed to modify the

existing cattle access point of the stream into a cattle crossing (with no access to water for drinking). The cattle crossing was successfully constructed in the spring of 2011.

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

Silver Creek Mainstem

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**3,040 ft**	**2,905 ft**	**2,905 ft**	**2,905 ft**	**2,905 ft**	**2,905 ft**	**2,905 ft**
Bankfull Width	**60.9 ft**	**58.0 ft**	**57.5 ft**	**63.9 ft**	**55.0 ft**	**49.0 ft.**	**53.9 ft.**
Bankfull Mean Depth	**4.0 ft**	**1.6 ft**	**1.6 ft**	**1.4 ft**	**1.6 ft**	**1.5 ft.**	**1.5 ft.**
Bankfull Max Depth	**7.0 ft**	**3.3 ft**	**3.2 ft**	**3.4 ft**	**3.7 ft**	**3.8 ft.**	**4.0 ft.**
Width/Depth Ratio	**5.4***	**38.8**	**36.2**	**45.3**	**34.8**	**27.4**	**31.0**
Entrenchment Ratio	**0.7***	**1.7**	**1.7**	**1.8**	**1.9**	**2.1**	**2.1**
Bank Height Ratio	**3.9***	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**
Sinuosity	**1.46**	**1.40**	**1.40**	**1.40**	**1.40**	**1.4**	**1.4**

*These values represent the worst case scenario for each parameter

Unnamed Tributary A

Parameter	Pre-Restoration	As-built	Year 1	Year 2	Year 3	Year 4	Year 5
Length	**1,508 ft**	**1,552 ft**	**1,552 ft**	**1,552 ft**	**1,552 ft**	**1,552 ft**	**1,552 ft**
Bankfull Width	**13.7 ft**	**7.5 ft**	**7.1 ft**	**6.9 ft**	**8.5 ft**	**9.1 ft.**	**9.5 ft.**
Bankfull Mean Depth	**0.3 ft**	**0.5 ft**	**0.5 ft**	**0.5 ft**	**0.6 ft**	**0.4 ft.**	**0.6 ft.**
Bankfull Max Depth	**0.9 ft**	**0.9 ft**	**0.8 ft**	**1.0 ft**	**1.0 ft**	**0.9 ft.**	**0.9 ft.**
Width/Depth Ratio	**52.8**	**15.9**	**14.0**	**14.7**	**14.6**	**20.6**	**17.7**
Entrenchment Ratio	**0.9**	**1.9**	**1.7**	**2.1**	**1.6**	**1.5**	**1.6**
Bank Height Ratio	**1.9**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**
Sinuosity	**1.06**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**	**1.09**

II. PROJECT BACKGROUND

A. Location and Setting

The project is located approximately 3,000 feet east of Dysartsville Road and approximately 2,500 feet south of Patton Road, west of the City of Morganton, in Burke County, North Carolina, as shown on Figure 1. The stream channels included in this project are the Silver Creek mainstem and four unnamed tributary streams designated UT-A, UT-B, UT-C and UT-D.

The directions to the project site are as follows:

> From I-40, exit at Exit 94 and travel south along Dysartsville Road and turn left (east) onto Seven Springs Lane. The project spans properties owned separately by Mr. and Mrs. Frank Queen and Mr. (deceased) and Mrs. Richard Conway (Seven Springs Farms, Inc.).

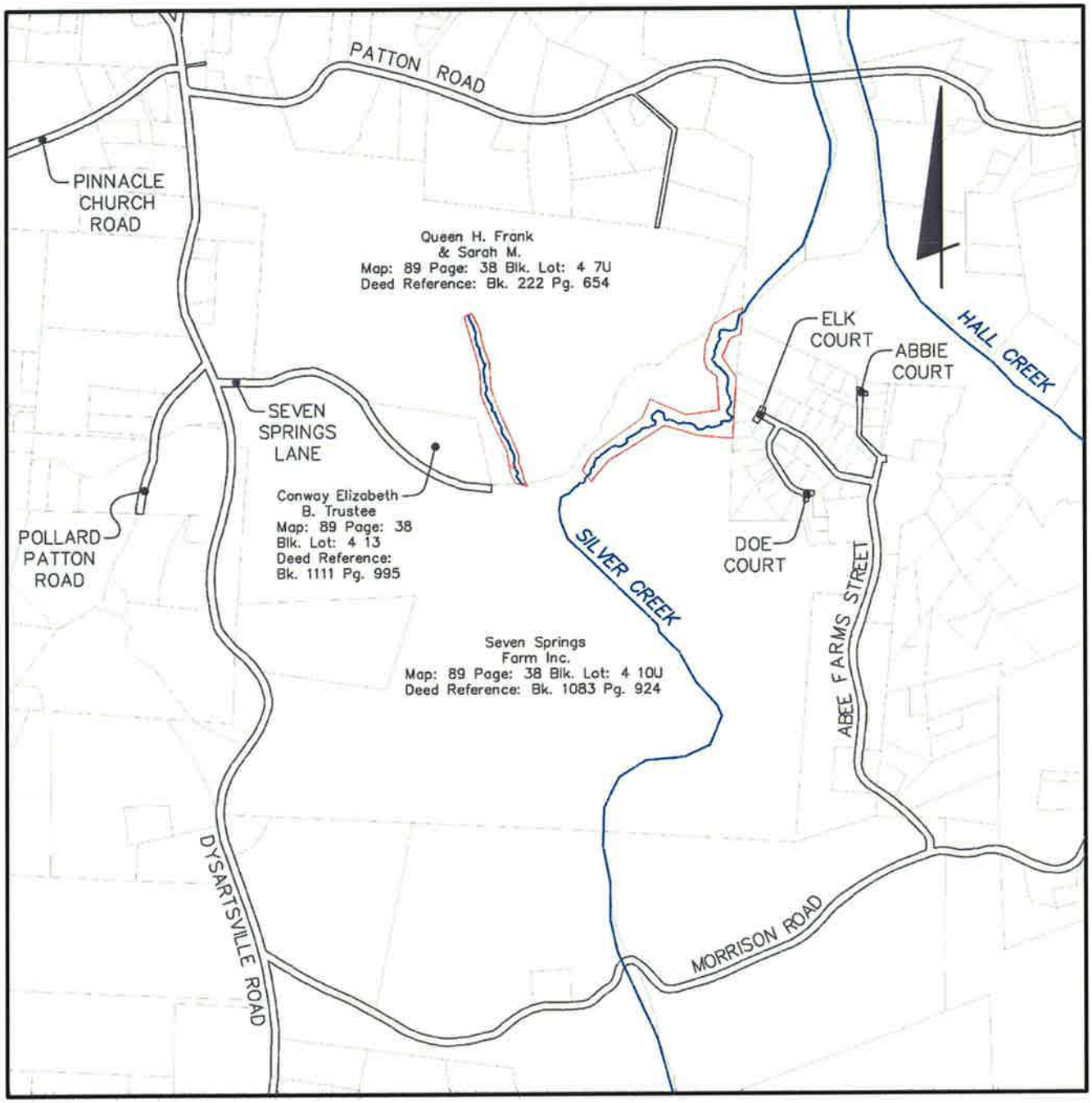
B. Project Structure, Mitigation Type, Approach and Objectives

The primary, pre-existing land use within the immediate project site was agricultural. Based on photographic interpretation, the site had been historically utilized for agricultural row crop production and hayland. It is likely the project site had been farmed since early colonial times. The site was degraded by past land management practices including mechanical land clearing, straightening and dredging the stream channels. Silver Creek was one of the first streams in North Carolina to be mined for precious metals and gem stones. The project site was most recently utilized to produce hay for livestock feed. The pre-existing riparian corridor along Silver Creek, including UT-B, UT-C and UT-D, varied from wide to denuded within the project area. The wide portion consisted of a mature forested corridor, while narrow and denuded areas were the result of a recent pine beetle infestation. Active pasture is located to the east and west of UT-A. A wooded corridor is present along the UT-A reach and has been maintained. Typical species observed along the streams and adjacent forested areas include *Pinus taeda* (loblolly pine), *Platanus occidentalis* (sycamore) and *Ilex opaca* (American holly).

Prior to restoration, agricultural land use and channel incision had altered the Silver Creek mainstem throughout the project reach, resulting in an unstable Rosgen F4 stream type. The incised nature of the channel was attributed to channelization and cattle intrusion, which resulted in vegetative denuding and bank destabilization due to hoof shear. The Silver Creek channel's unstable width to depth ratio, entrenchment ratio, relatively flat average profile slope and poorly defined active streambed resulted in a deeply incised channel disconnected from its floodplain. Mid-channel, lateral, and transverse sand and gravel bar deposits were observed at locations throughout the reach, demonstrating the stream lacked stable pattern, profile and dimension to entrain its bedload. The locations of these depositional features in the near bank region deflected flows from the center of the channel toward the incised vertical to undercut streambanks, accelerating streambank erosion. It is estimated that approximately 5,570 cubic yards per year (or 6,980 tons per year) of sediment was being eroded from the unstable streambanks along the impaired mainstem reach into the Silver Creek watershed prior to restoration.

The UT-A channel was a classic Type I valley confined, A1-A2 stream type transitioning to a Type II colluvial valley, B4 stream type in the lower third of the impaired reach. The upper two-

thirds of the reach exhibited some bedrock control, in-stream boulders together with flood placed woody debris from leaning or fallen trees along the unstable, steep to undercut streambanks. The



BURKE COUNTY, NORTH CAROLINA

SILVER CREEK RESTORATION

FIGURE 1: SITE VICINITY MAP

N.C. ECOSYSTEM ENHANCEMENT PROGRAM

EMH&T

Evans, Mechwart, Hambleton & Tilton, Inc.

Engineers • Surveyors • Planners • Scientists

Date: January, 2011

Not To Scale

Ecosystem Enhancement PROGRAM

impaired riparian vegetative communities were exacerbating streambank erosion rates and down-slope movement of colluvium. Cattle intrusion had adversely impacted the entire tributary as evidenced by vegetative denuding and bank failure attributed to hoof shear. Agricultural land use (pastureland) adjacent to the stream corridor and uncontrolled cattle access to the stream for watering and shade resulted in unstable, steep to undercut streambanks, and accelerated severe to extreme streambank erosion. The unstable streambanks were contributing large volumes of suspended sediment and bedload material to the larger Silver Creek watershed. It was estimated 290 cubic yards per year (or 375 tons per year) of sediment was being eroded from the unstable streambanks along UT-A prior to restoration.

The mitigation goals and objectives for the project streams were met by restoring physical and biological functions of the project reaches beyond pre-existing conditions. Pre-restoration conditions consisted of impaired, channelized, eroding and entrenched stream channels. The project restoration goal was to restore channel dimension, pattern, and profile to stable and self-maintaining conditions utilizing natural channel design methods and techniques. The mitigation goals and objectives were met by providing the attributes described below.

- Stable stream channels with features inherent of a diverse aquatic and riparian ecosystem.
- Integrated a Priority Level II restoration approach by excavating a floodplain and reconnecting the bankfull elevation to a stable floodprone area.
- Improved and created bedform and physical aquatic habitat features (riffles, runs, pools and glides).
- Minimization of existing land use impacts on the stream.
- Long-term protection of the stream corridors via a perpetual conservation easement conveyed to the State of North Carolina.

Restoration of the project streams re-established geomorphologic features consistent with reference reach conditions. Results achieved are listed below.

- Bankfull channels constructed with the appropriate geometries to convey bankfull flows and transport suspended sediment and bedload materials available to the streams.
- Stable channel pattern, profile and dimension consistent with natural streams in the region.
- Grade control and bank stabilization in-stream structures, such as cross vanes, J-hook vanes, rock vanes, dual-winged jetties, constructed riffles, step pools, root wad revetment, rock-toe channel protection or native revetment, that enhance environmental attributes of the stream channels while creating stable and functional aquatic habitat.
- Reconnection of project stream channels to functional floodplains.
- Extensive indigenous riparian plantings and exotic vegetation control that establishes a native forested plan community within the newly constructed and protected stream corridor.

Restoration of the streams has met the objective of the project along both the Silver Creek mainstem and UT-A, providing the desired habitat and stability features required to improve and enhance the ecologic health of the streams for the long-term. Specifically, the completed restoration project has accomplished the following items, considering both the pre-existing impaired condition and the channel conditions as verified as part of the Year 5 monitoring.

Silver Creek Mainstem:

- Reversed the effects of channel incision and entrenchment using a Priority Level II restoration approach. The restoration has increased the width/depth ratio from 5.36 (most impaired reach) to 31.0 (median value) after construction completion and five years of monitoring.
- Restored natural stream pattern, profile and dimension throughout the 2,959 l.f. mainstem reach, decreasing channel sinuosity from 1.46 to 1.40, while creating a stable relationship between valley, channel, water surface and bankfull slopes.
- Stabilized eroding streambanks by providing an appropriately sized channel with stable streambank slopes using a combination of embedded stone, natural fabrics and aggressive native streamside and riparian revetment. The average Bank Height Ratio has been decreased from 3.98 (deeply incised) to 1.00 (stable) in Year 5.
- Provided a re-connection between the restored stream bankfull elevation and floodprone area (Priority Level II restoration). The completed restoration changed the entrenchment ratio from a minimum value of 0.7 to an average value of 2.1, and restored the pre-existing unstable, incised and entrenched F4 stream channel to a stable B4c stream type (Rosgen, 1994).
- Created instream aquatic habitat features including deep pools, rootwad streamside fish cover and streambank stabilization, constructed riffles, rock cross vanes, J-Hook rock vanes, log vane – J-Hook – root wad combination structures with deep pools and native streamside revetment to enhance outer meander bend stability, shade the pools, provide fish cover and lower water temperature.
- Revegetated the streambanks and riparian corridor with indigenous canopy and mid-story trees, shrubs and herbaceous ground cover.
- Preserved the riparian corridor within a fenced, perpetual conservation easement conveyed to the State of North Carolina.

Unnamed Tributary A (UT-A):

- Reversed the effects of channelization utilizing Priority Level II natural channel design restoration techniques. The average width/depth ratio of the restored stream channel has been adjusted to a stable median value of 17.7.
- Restored natural stream pattern, profile and dimension throughout the 1,552 l.f. stream reach providing a more stable relationship between the Rosgen Type II Valley (Rosgen, 1994) slope and bankfull channel slopes.
- Stabilized vertical to undercut, eroding streambanks by constructing an appropriately sized channel with stable streambank slopes. The average Bank Height Ratio was decreased from 1.91 (deeply incised) to 1.00 (stable).
- Raised the streambed elevation by constructing appropriately spaced step-pools and riffle sequences, thereby decreasing near-bank shear stress.
- Restoration increased the average entrenchment ratio from 0.91 to 1.61, restoring the unstable, incised and entrenched A4 stream type to a stable B4 stream type (Rosgen, 1994).
- Created instream aquatic habitat features including step-pools, log sills, streambank slope stabilization, constructed riffles, rock sills and rock toe channel protection.
- Revegetated stabilized streambanks and the riparian corridor with indigenous canopy, mid-story, shrubs and herbaceous plant species, where deficient.
- Preserved the riparian corridor within a fenced, perpetual conservation easement conveyed to the State of North Carolina.

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

Table I. Project Structure Table Silver Creek Stream Restoration / EEP Project No. D05016-01	
Project Segment/Reach ID	**Linear Footage or Acreage**
Silver Creek Mainstem	2,905 ft
Unnamed Tributary A (UT-A)	1,552 ft
Unnamed Tributary B (UT-B)	66 ft
Unnamed Tributary C (UT-C)	48 ft
Unnamed Tributary D (UT-D)	52 ft
TOTAL	4,623 ft

Table II. Project Mitigation Objectives Table Silver Creek Stream Restoration / EEP Project No. D05016-01					
Project Segment/ Reach ID	**Mitigation Type**	**Linear Footage or Acreage**	**Mitigation Ratio**	**Mitigation Units**	**Comment**
Silver Creek Mainstem	Priority 2 Restoration	2,905 ft	1.0	2,905 ft	Restore dimension, pattern, and profile
UT-A	Priority 2 Restoration	1,552 ft	1.0	1,552 ft	Restore dimension, pattern, and profile
UT-B	Preservation	66 ft	5.0	13 ft	Preserved within the conservation easement
UT-C	Preservation	48 ft	5.0	10 ft	Preserved within the conservation easement
UT-D	Preservation	52 ft	5.0	10 ft	Preserved within the conservation easement
TOTAL		4,623 ft		4,490 ft	

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 Silver Creek Stream Restoration / EEP Project No. D05016-01			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration plan	Aug 2005	Feb 2006	May 2006
Final Design - 90%[1]	--	--	--
Construction	Feb 2006	N/A	Apr 2007
Temporary S&E applied to entire project area[2]	Feb 2006	N/A	Apr 2007
Permanent plantings	Apr 2006	N/A	Apr 2007
Mitigation plan/As-built	Jun 2006	May 2007	Sep 2007
Year 1 monitoring	2007	Sept 2007 (vegetation) Nov 2007 (geomorphology)	Jan 2008
Year 2 monitoring	2008	Sept 2008 (vegetation) Dec 2008 (geomorphology)	Dec 2008
Year 3 monitoring	2009	Sept 2009 (vegetation) Nov 2009 (geomorphology)	Dec 2009
Year 4 monitoring	2010	Sept 2010 (vegetation) Sept 2010 (geomorphology)	Feb 2011
Year 5 monitoring	2011	Sept 2011 (vegetation) Sept 2011 (geomorphology)	Dec 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 for these project activities.

Table IV. Project Contact Table Silver Creek Stream Restoration / EEP Project No. D05016-01	
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 Silver Creek Stream Restoration / EEP Project No. D05016-01	
Project County	Burke
Drainage Area[1]	Mainstem-8.26 sq mi UT-A-0.075 sq mi
Drainage Impervious Cover Estimate	5.5%
Stream Order[1]	Mainstem-3rd UT-A-1st
Physiographic Region	Blue Ridge Mountains/Southern Inner Piedmont
Ecoregion	Eastern Blue Ridge Foothills
Rosgen Classification of As-built[1]	Mainstem-B4c UT-A-B4a
Dominant Soil Types	Colvard sandy loam, Rhodhiss sandy loam
Reference Site ID	Brindle Creek
USGS HUC for Project and Reference	03050101
NCDWQ Sub-basin for Project and Reference	03050101050050
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	100%

[1]Data for UT-B, UT-C, and UTD are not reported as they are Preservation reaches.

In addition to the monitoring required by EEP protocol, monitoring has been required by the NC DWQ under the Section 401 permit issued for the project on May 25, 2007. The 401 permit conditions require monitoring data collection related to bank stability and success of vegetative plantings installed along UT-B and UT-C, which were impacted during restoration construction along Silver Creek. The additional monitoring data is summarized under the appropriate sections of this report.

D. Monitoring Plan View

The monitoring plan view is included as Figure 2.

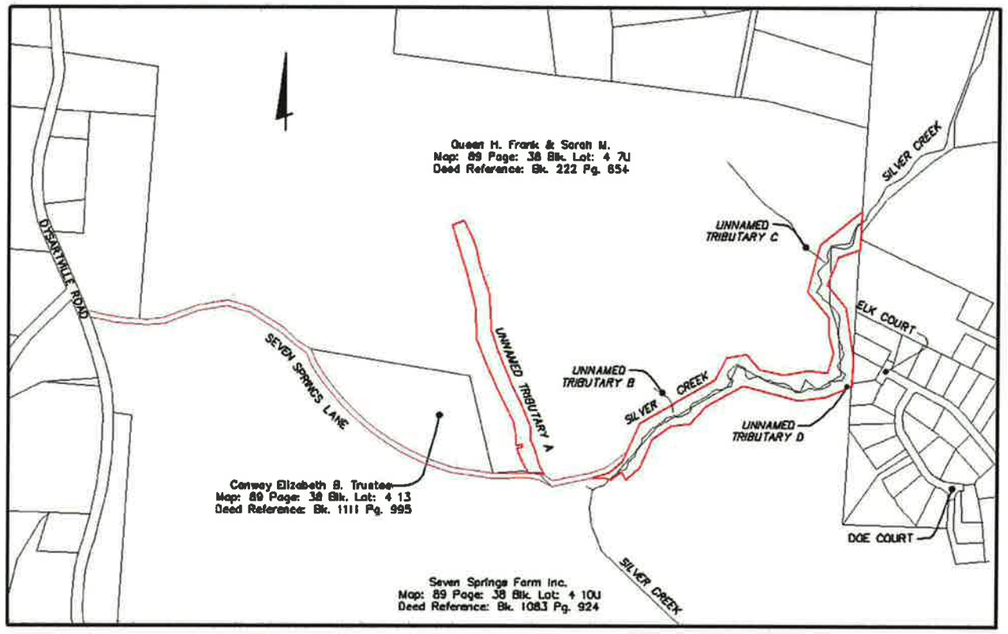
BURKE COUNTY, NORTH CAROLINA

FIGURE 2 - MONITORING PLAN VIEW

FOR

SILVER CREEK AND UNNAMED TRIBUTARY

2011



LOCATION MAP
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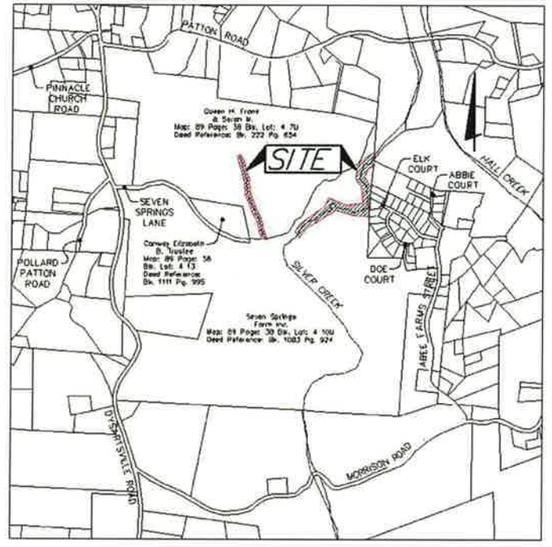


VICINITY MAP
Not To Scale

BURKE COUNTY, NORTH CAROLINA
FIGURE 2 – MONITORING PLAN VIEW
FOR
SILVER CREEK AND UNNAMED TRIBUTARY
SILVER CREEK

Date	Job No
December, 2011	2007-1898
Scale	Sheet
As Noted	1/6

Ecosystem Enhancement Program

EMH&T
Engineering, Surveying & Environmental Services
5500 New Albany Road, Columbus, OH 43054
Phone: 614.775.4500

BEGIN AS-BUILT STA. 0+00.00

BEGIN STREAM WORK STA. 0+00.00

Queen H. Frank & Sarah M.
Map: 89 Page: 38 Blk. Lot: 4 7U
Deed Reference: Bk. 222 Pg. 654

Seven Springs Farm Inc.
Map: 89 Page: 38 Blk. Lot: 4 10U
Deed Reference: Bk. 1083 Pg. 924

EEP Ingress/Egress Easement along Seven Springs Lane

EX. SOIL ROAD (DO NOT DISTURB)

Recorded Conservation Easement NC EEP Project No. D05016-1 Plat Bk. 31, Pg. 249

Recorded Conservation Easement NC EEP Project No. D04006-5 Plat Bk. 27, Pgs. 119-120

X-Sec 1 Riffle

X-Sec 2 Pool

VP-1

VP-2

VP-3

Ex. Low Water Crossing

Stream Bank Reinforcement

Bankfull Width (30')

Prop. Thalweg

Ex. Thalweg

Limits of Beltwidth

Matchline Sta. 5+00.00 (See This Sheet)

Matchline Sta. 10+00.00 (See Sheet 03)

Unnamed Tributary B (UT-B)

Constructed Point Bar (Typ.)

Prop. Bank Fill (Typ.)

LEGEND

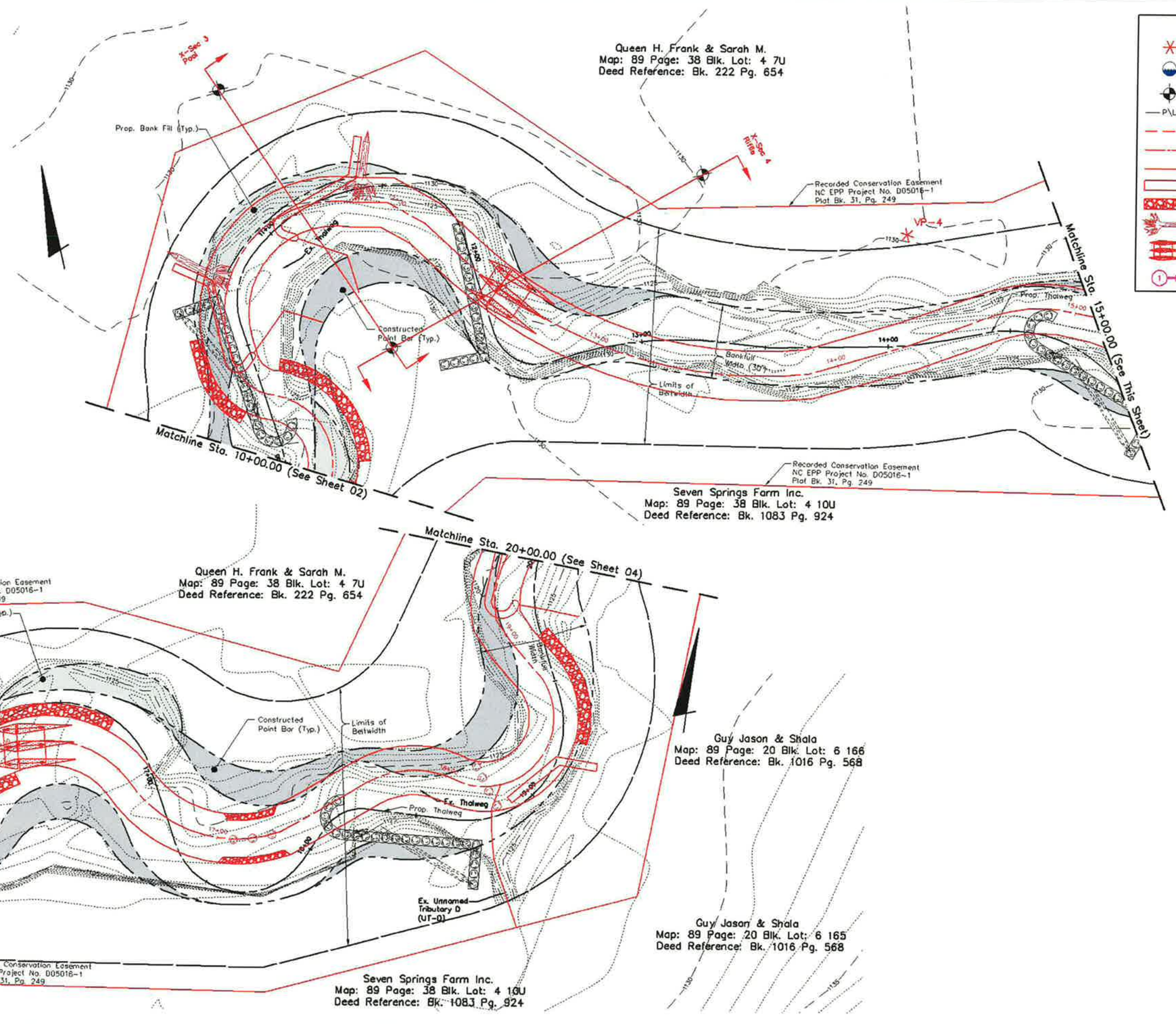
- Vegetation Plot (VP)
- Crest Gauge
- Cross Section Monument
- P\L — Ex. Property Line
- Recorded Conservation Easement
- As-Built Thalweg and Stationing
- As-Built Channel
- As-Built Structure
- As-Built Bank Stabilization
- As-Built Root Wad
- As-Built Riffle
- Photo Direction and Location

Job No. 2007-189B
Sheet 2/6
Date December, 2011
Scale Hor: 1" = 40'
Ver: 1" = 4'

BURKE COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
SILVER CREEK AND UNNAMED TRIBUTARY
SILVER CREEK
PLAN & PROFILE

Ecosystem Enhancement Program

EMH&T
Environmental, Water Resources & Transportation
Planning • Surveying • Engineering • Scientists
5500 New Albany Road, Columbus, OH 43054
(614) 775-4500 www.emht.com



BURKE COUNTY, NORTH CAROLINA
FIGURE 2 – MONITORING PLAN VIEW
FOR
SILVER CREEK AND UNNAMED TRIBUTARY
SILVER CREEK
PLAN & PROFILE

Job No.	Sheet
20071898	3/6
Date: December, 2011	Scale: Hor: 1" = 40' Ver: 1" = 4'

Ecosystem Enhancement Program

EMH&T
Environmental, Hydrologic & Transportation Engineers • Surveyors • Planners • Scientists
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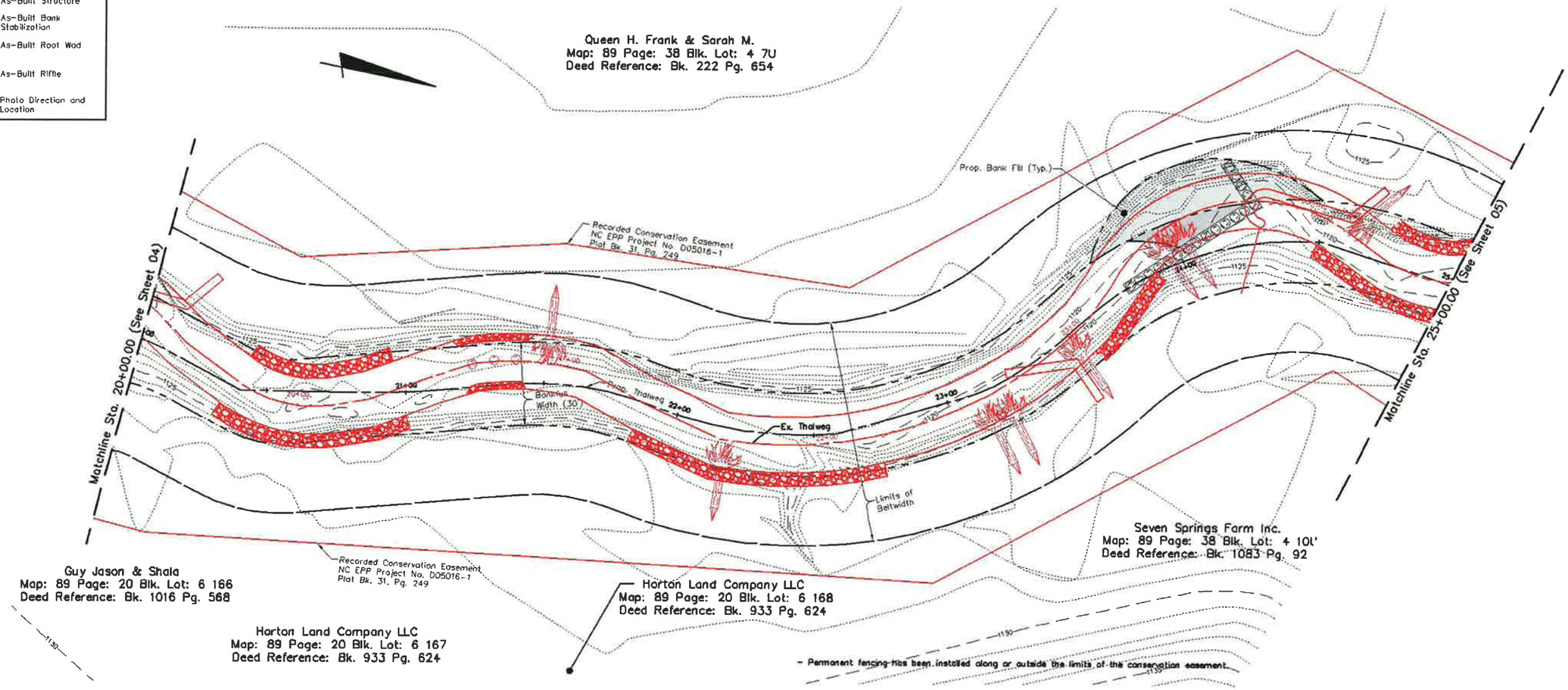
LEGEND

- Vegetation Plot (VP)
- Crest Gauge
- Cross Section Monument
- P\L — Ex. Property Line
- Recorded Conservation Easement
- As-Built Thalweg and Stationing
- As-Built Channel
- As-Built Structure
- As-Built Bank Stabilization
- As-Built Root Wad
- As-Built Riffle
- 1 → Photo Direction and Location



BURKE COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
SILVER CREEK AND UNNAMED TRIBUTARY
SILVER CREEK
PLAN & PROFILE

Job No	Sheet
2007-1898	4/6
Date: December, 2011	
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Ecosystem Enhancement Program

EMH&T

REVISIONS

LEGEND

- Vegetation Plot (VP)
- Crest Gauge
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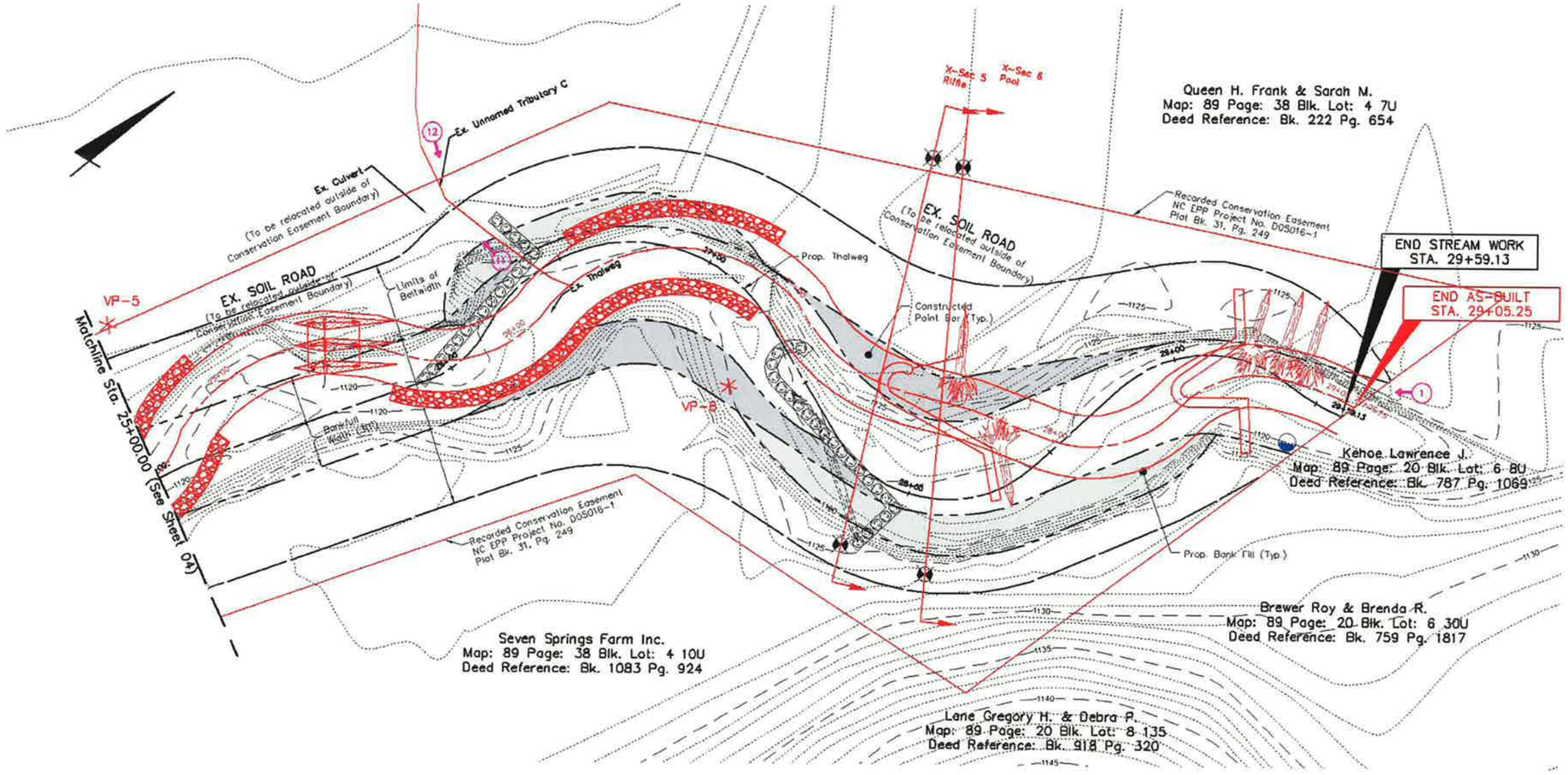

Job No. 2007-1898
Date December, 2011
Scale Hor. 1" = 40'
Ver. 1" = 4'
Sheet 5/6

BURKE COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
CREEK AND UNNAMED TRIBUTARY
SILVER CREEK
PLAN & PROFILE

Ecosystem Enhancement Program

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BEGIN AS-BUILT STA. 0+00.00

BEGIN STREAM WORK STA. 0+00.00

Queen H. Frank & Sarah M.
Map: 89 Page: 38 Blk. Lot: 4 7U
Deed Reference: Bk. 222 Pg. 654

Recorded Conservation Easement NC EEP Project No. D05016-1 Plat Bk. 31, Pg. 249

Unnamed Tributary To Silver Creek

Ex. Thalweg

X-Sec. 1 Riffle

Regrade Channel Banks & Reinforce w/Heavy Fabric and Live Branch Plantings

Ex. Log Vane (Do Not Disturb)

VP-1

VP-2

Matchline Sta. 5+00.00 (See This Sheet)

Permanent fencing has been installed along or outside the limits of the conservation easement.

Matchline Sta. 5+00.00 (See This Sheet)

Queen H. Frank & Sarah M.
Map: 89 Page: 38 Blk. Lot: 4 7U
Deed Reference: Bk. 222 Pg. 654

Ex. Log Vane (Do Not Disturb)

Recorded Conservation Easement NC EEP Project No. D05016-1 Plat Bk. 31, Pg. 249

X-Sec. 2 Pool

Unnamed Tributary To Silver Creek

Step Pools

Proposed Bankfull Width (8')

Ex. Thalweg

Ex. Overhead Electric

Prop. Thalweg

Build Bankfull Channel w/Log Vanes

Matchline Sta. 10+00.00 (See This Sheet)

Matchline Sta. 10+00.00 (See This Sheet)

Recorded Conservation Easement NC EEP Project No. D05016-1 Plat Bk. 31, Pg. 249

X-Sec. 4 Riffle

X-Sec. 3 Pool

VP-3

Unnamed Tributary To Silver Creek

Ex. Thalweg

Reinforce Bank w/Heavy Fabric and Live Branch Plantings

Regrade Channel Banks and Reinforce Bank w/Heavy Fabric and Live Branch Plantings

Proposed Bankfull Width (8')

Excavate Floodprone Bench

Recorded Conservation Easement NC EEP Project No. D05016-1 Plat Bk. 31, Pg. 249

VP-4

Prop. Thalweg

Bank Reinforcement w/Point Bar

Riffle

Prop. Thalweg

Ex. Culvert

Seven Springs Farm Inc.
Map: 89 Page: 38 Blk. Lot: 4 10U
Deed Reference: Bk. 1083 Pg. 924

END AS-BUILT STA. 15+66.60

END STREAM WORK STA. 15+32.71

EX. SOIL ROAD

Recorded Conservation Easement NC EEP Project No. D04006-5 Plat Bk. 27, Pgs. 119-120

EEP Ingress/Egress Easement along Seven Springs Lane

LEGEND

- Vegetation Plot (VP)
- Crest Gauge
- Cross Section Monument
- P\L — Ex. Property Line
- Recorded Conservation Easement
- As-Built Thalweg and Stationing
- As-Built Channel
- As-Built Structure
- As-Built Bank Stabilization
- As-Built Root Wad
- As-Built Riffle
- Photo Direction and Location

BURKE COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
UNNAMED TRIBUTARY TO SILVER CREEK
UT-A
PLAN & PROFILE

Job No.	2007-189B
Date	December, 2011
Scale	Hor: 1" = 40' Ver: 1" = 4'
Sheet	6/6

Ecosystem Enhancement Program

EMH&T

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\\CMHDATA01\Projects01\2007189B\2007189Benn\Dwg\Exhibits\Year 5 Figure 2 - Monitoring Plan View.dwg<Sheet 6> - No Xrefs - No Images - SavedBy: JCRAMER (6/14/2011 8:13:42 AM) - PlottedBy: JCRAMER (6/14/2011 8:15:32 AM)

III. PROJECT CONDITION AND MONITORING RESULTS

A. Vegetation Assessment

1. Soil Data

Soil information was obtained from the NRCS Soil Survey of Burke County, North Carolina (USDA NRCS, January 3, 2006). The soils along the mainstem of Silver Creek include the Colvard Series consisting of loamy sediments ranging from 40 to 60 inches or more in thickness over deposits of sandy, loamy gravelly to cobbly sediments. Rock fragments range from 0 to 15 percent to a depth of 40 inches, and from 0 to 80 percent below 40 inches. Flakes of mica range from a few to common.

The Rhodhiss Series is present along UT-A and is residuum from the underlying felsic crystalline bedrock. The Rhodhiss sandy to sandy-clay loam is found on 25 to 40 percent hillside slopes with a depth to bedrock greater than 60 inches. The depth to the top of the argillaceous (clayey) horizon ranges from 2 to 20 inches. The depth to the base of the argillaceous horizon is 20 to 60 inches or more. The pedon contains 0 to 20 percent mica flakes throughout, with mica content ranging up to 35 percent below a depth of 40 inches when the C horizon is present.

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

Table VI. Preliminary Soil Data
Silver Creek Stream Restoration / EEP Project No. D05016-01

Series	Max. Depth (in.)	% Clay on Surface	K[1]	T[2]	% Organic Matter
Colvard sandy loam (CvA)	60+	8-18	0.24	5	1-2
Rhodhiss sandy loam (RhD)	60+	5-20	0.24	5	0.5-2

[1]Erosion Factor K indicates the susceptibility of a soil to sheet and rill erosion, ranging from 0.05 to 0.69.
[2]Erosion Factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity, measured in tons per acre per year.

2. Vegetative Problem Areas

Vegetative Problem Areas are defined as areas either lacking vegetation or containing populations of exotic vegetation. Each problem area identified during each year of monitoring is summarized in Table VII. Photographs of the vegetative problem areas are shown in Appendix A.

Table VII. Vegetative Problem Areas Silver Creek Stream Restoration / EEP Project No. D05016-1			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo #**
Bare Floodplain	Mainstem: 12+00-16+50	Sparse vegetation along riparian corridor; likely due to poor soil	VPA 1
Invasive Population	UT-A: 2+40-14+40	Bare, disturbed, and moist soil along UT-A has provided appropriate growing conditions for Japanese Stiltgrass (*Microstegium vimineum*)	VPA 2

There are a few areas with a population of sericea lespedeza along the Silver Creek mainstem. This species is a common component of pasture mixes, and as this project is adjacent to pasture lands, it likely spread into the project area from the surrounding landscape. Because this species is limited to isolated patches of small plants, it does not appear to be impacting the survival of woody stems and is therefore considered a problem of low concern at this time. Proactive management in the form of herbicide treatments was conducted throughout the spring of 2010 in order to limit the impact of this species on the vegetative success of the project.

A few areas along the Silver Creek mainstem were noted to have low overall herbaceous cover along the riparian corridor. These areas are patchy and scattered throughout the corridor, with none of the areas showing banks that are completely bare. Along the majority of the riparian corridor, vegetation cover has increased since Year 4 monitoring, as is depicted in the fixed station photos (Appendix B). Because of extensive vegetation growth, all other areas along the riparian corridor have been removed from Table VII and the Vegetation Problem Area Plan view (Appendix A). Between stations 12+00 and 16+50, bare soil remains evident on both sides of the corridor. It is apparent that the density of vegetation in this area has increased since 2010 monitoring, however. It is fully expected that vegetation will continue to spread into this section in future years. Accordingly, this stretch of the mainstem remains on Table VII and is mapped on the Vegetation Problem Area Plan View as an area of low concern.

The soil along this project is a mix of sand and gravel, and as such, provides very dry conditions in which seed must germinate and grow. In 2009, fencing was placed across the stream near the upstream terminus of the project in order to prevent cattle access from the adjoining property. Now that the cattle have been excluded, it is expected the permanent ground cover growing in the corridor will spread to fill the bare areas.

Cattle had unintentional access to UT-A through the early part of September 2009 due to a fallen tree across the protective fencing. The cattle intrusion into the riparian corridor resulted in several areas of bare ground and sparse vegetation. These areas were reseeded in the fall of 2009 using a seed mix appropriate for shady, partial canopied woodland areas. As is observed in the fixed station photos in Appendix B, ground cover has significantly increased in Years 4 and 5. The increase in vegetation cover has further stabilized the banks along UT-A.

In Year 5, it was observed that Japanese stiltgrass had infiltrated the corridor along the majority of UT-A. Shade from the secondary growth canopy along UT-A allows soil on the floodplain to remain damp and periodic downpours provide an avenue for natural disturbance. These conditions are prime for Japanese stiltgrass because it prefers moist and disturbed soils. Although it is invasive, its spread along UT-A does not appear to be affecting the survival of planted species. It

is also providing a moderate amount of bank stabilization for many of the naturally steep banks of the tributary. Herbicide treatment has been recommended to help control the spread of this plant. Spraying is scheduled for the spring of 2012. The stiltgrass population along UT-A is mapped on the Vegetation Problem Area Plan View (Appendix A) as a problem area of low concern.

3. Vegetation Problem Area Plan View

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

4. 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 on Figure 2.

Table VIIIa. Stem counts for each species arranged by plot - planted stems.
Silver Creek Stream Restoration / EEP Project No. D05016-1

Species	Plots										Year 0 Totals	Year 1 Totals	Year 2 Totals	Year 3 Totals	Year 4 Totals	Year 5 Totals	Survival %
	1	2	3	4	5	6	7	8	9	10							
Shrubs																	
Alnus serrulata	3			1	1			1	2		5	5	7	9	8	8	100
Aronia arbutifolia								1			0	0	0	1	1	1	100
Aronia melanocarpa		2	5			2	6	2	3	1	8	8	4	7	10	21	210
Cornus amomum	2	2	4	4	2	3	1	2	3		31	25	20	24	22	23	105
Cornus sericea			3								0	0	0	0	0	3	NA
Trees																	
Acer rubrum							3				2	2	2	2	3	3	100
Acer saccharum	1				3	1					18	18	13	8	6	5	83
Fraxinus pennsylvanica		1					1	2	2	3	15	15	9	10	11	9	82
Liriodendron tulipifera				1	1	1				1	4	4	4	3	2	4	200
Platanus occidentalis	1	4									16	11	8	8	5	5	100
Quercus alba			1								3	3	3	4	1	1	100
Quercus coccinea				2			1		2	2	0	0	0	0	0	7	NA
Quercus michauxii	1	3									0	0	1	1	4	4	100
Quercus palustris	1										0	0	0	0	1	1	100
Quercus velutina											0	0	0	0	2	0	0
Salix nigra			2											3	3	2	67
Sambucus canadensis						1					0	0	0	1	1	1	100
Year 5 Totals	**9**	**12**	**15**	**8**	**7**	**8**	**12**	**8**	**12**	**7**	102	96	74	81	80	98	123
Live Stem Density	**365**	**486**	**608**	**324**	**284**	**324**	**486**	**324**	**486**	**284**							
Average Live Stem Density	**397**																

Table VIIIb. Stem counts for each species arranged by plot - all stems. Silver Creek Stream Restoration / EEP Project No. D05016-1										
	Plots									
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Shrubs										
Alnus serrulata	6			1	9			1	2	
Aronia melanocarpa		2	5		2	4	6	7	3	1
Cornus amomum	2	2	5	4	2	3	1	2	3	
Cornus sericea			3							
Trees										
Acer rubrum	3				1		4			
Acer saccharum	1				5	1				
Cercis canadensis							2			
Celtis occidentalis							1			
Fraxinus pennsylvanica		1					1	3	4	5
Juglans nigra								1		1
Liriodendron tulipifera	1	2		1	1	2				1
Platanus occidentalis	1	4		1						
Quercus alba			1							
Quercus coccinea				2			1		2	2
Quercus michauxii	1	3								
Quercus palustris	1			1						
Rhus typhina				1			6	1		1
Salix nigra			2							
Sambucus canadensis						1				
Year 5 Totals	**16**	**14**	**16**	**11**	**20**	**11**	**22**	**15**	**14**	**11**
Live Stem Density	**648**	**567**	**648**	**446**	**810**	**446**	**891**	**608**	**567**	**446**
Average Live Stem Density	**608**									

The average stem density for the site in Year 5 meets the minimum criteria of 260 stems per acre after five years. No vegetation plots fall below this threshold number. The woody stem deficit observed in 2010 occurred along the UT-A where, in 2009, cattle intrusion had killed several trees and severely damaged others. In previous years, seedling mortality had been an issue along the entire length of UT-A. While the woody plantings of 2010 were focused on areas of open canopy in the existing tree cover, the presence of large trees and the well-developed existing vegetative cover shaded the smaller seedlings and provided substantial competition for resources.

In Year 4, plots 4 and 5 along the mainstem exhibited good survivability when compared to 2009; however, both plots remained slightly under the woody stem count goal of 288 stems/acre. The

presence of dry sandy soil could also have partially explained the lower stem counts of Plots 4 & 5.To address the issue of low planted stem counts for those plots affected by cattle intrusion, shade competition and dry, sandy soils, specific areas were targeted for replanting within the Silver Creek and UT-A riparian corridors, in the spring of 2011. Areas to be planted included the deficient sample plots and surrounding areas within the buffer. All deficient portions of the riparian corridors were supplemented with additional native tree and shrub plantings. These supplemental plantings followed the specifications of the project proposed in the project Restoration Plan and Mitigation Plan documents. Consideration was given to using larger woody stock, such as three-gallon potted material versus bare root specimen in performing the remedial plantings. These larger saplings have a more developed root system than bare root stock and thus will be better able to compete with the existing vegetation.

Species more suitable for full or partial shade were included in the species mix to provide better survivability under the existing canopy of UT-A. A table describing the species and approximated quantities of vegetation installed in the spring of 2011 is included in Appendix A.

These additional trees brought the average live stem density to 398 stems per acre in Year 5; an increase over the average live stem density of 324 stems per acre in Year 4. In addition to the planted woody species, a substantial number of recruit stems have been found in all plots in Year 5. The recruit stems result in nearly a 53% increase in the total stem density across the site, and bring all plots into compliance with the Year 5 minimum criteria.

Section 401 Permit Monitoring

In addition to the vegetative monitoring plots on the Silver Creek Mainstem and UT-A, one vegetation monitoring plot each has been placed on both UT-B and UT-C, as required by the NC DWQ under the Section 401 permit. Monitoring for these plots includes simple stem counts by species, and does not follow the full methodology of the *CVS-EEP Protocol for Recording Vegetation, Version 4.0.* A summary of the stem count data for these plots is shown in Table VIIIc.

Table VIIIc. Stem counts for the additional plots on UT-B and UT-C							
Species	Plots UT-B	Plots UT-C	Year 1 Totals	Year 2 Totals	Year 3 Totals	Year 4 Totals	Year 5 Totals
Shrubs							
Aronia melanocarpa	4	0	0	1	3	3	4
Cephalanthus occidentalis	1	2	0	2	1	3	3
Cornus amomum	7	2	2	6	7	9	9
Illex verticallata	0	3	0	0	0	3	3
Trees							
Acer saccharum	2	5	7	8	2	7	7
Fraxinus pennsylvanica	0	0	6	1	0	0	0
Liriodendron tulipifera	2	1	2	4	2	3	3
Platanus occidentalis	1	0	0	1	1	1	1
Quercus alba	0	2	2	3	0	2	2
Salix nigra	0	1			0	1	1
Year 5 Totals	17	16	19	26	16	32	**33**
Live Stem Density	**689**	**648**					
Average Live Stem Density	**668**						

The average stem density for UT-B and UT-C far exceeds the minimum criteria of 260 stems per acre after five years. The few supplemental plantings added to the site in 2009 and 2011 successfully contributed to the large stem count total, and no further plantings are anticipated for these tributaries.

5. Vegetation Plot Photos

Vegetation plot photos, including photos for the additional plots on UT-B and UT-C, are provided in Appendix A.

B. Stream Assessment

1. Hydrologic Criteria

Two crest-stage stream gages were installed on the project reaches, one each for the Silver Creek Mainstem and UT-A. The locations of the crest-stage stream gages are shown on the monitoring plan view (Figure 2). Both crest gages are set at or above the bankfull elevation of each stream channel. Photographs of the crest gages are shown in Appendix B. No bankfull events were documented for this site during the first or second years of monitoring. Bankfull events were recorded during Years 3, 4 and 5, as documented in Table IX.

Table IX. Verification of Bankfull Events

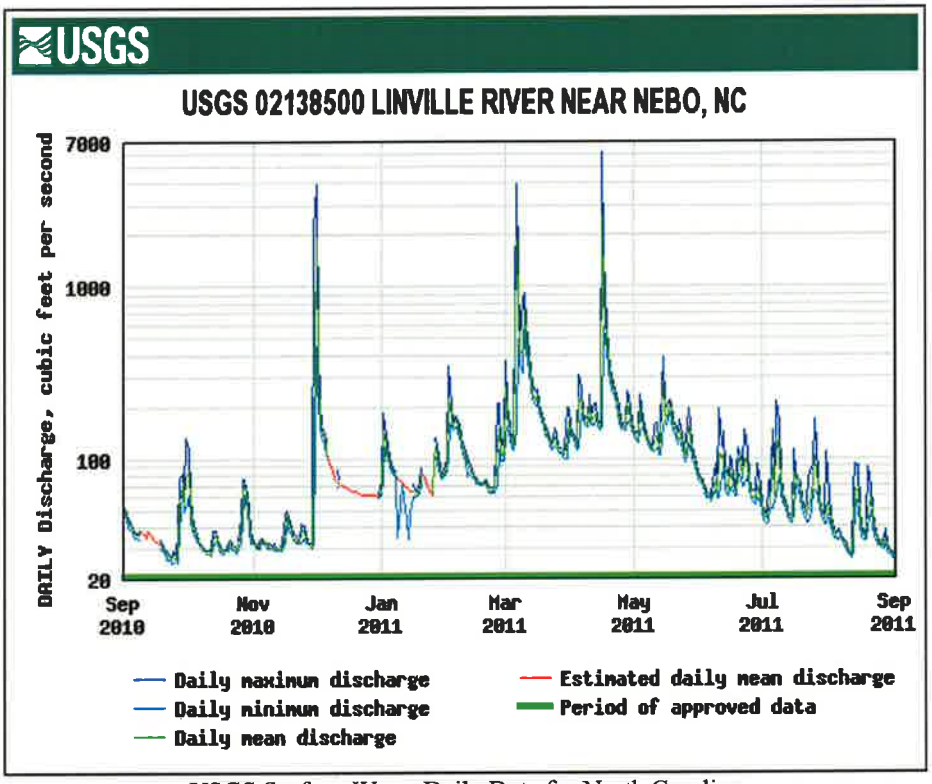
Date of Data Collection	Date of Occurrence	Method	Photo #
9/21/09	1/6/09-1/8/09*	Crest gage on UT-A	BF 1
9/21/09	1/6/09-1/8/09*	Crest gage on Mainstem	BF 2
5/12/10	1/24/10-1/25/10*	Crest gage on UT-A	BF 3
5/12/10	1/24/10-1/25/10*	Crest gage on Mainstem	BF 4
5/20/11	4/16/11-4/17/11*	Crest gage on Mainstem	BF 5

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

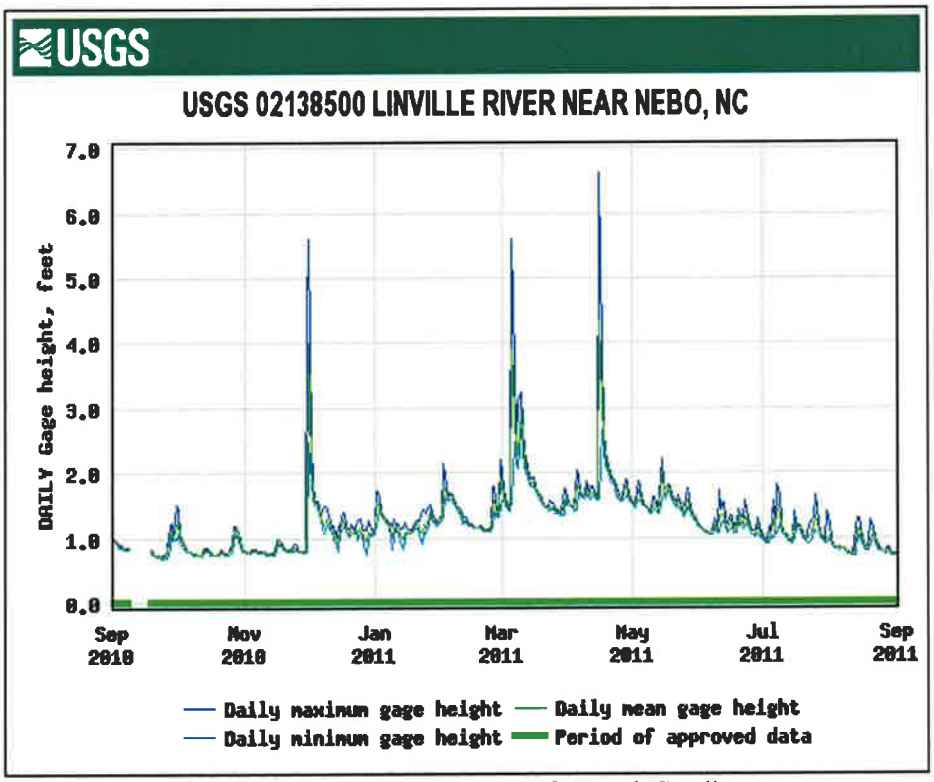
In May 2011, the crest gage on UT-A was inconclusive. Cork in the gage had been washed off of the wooden lathe inside the gage. Because of this, the level of Year 5 bankfull events could not be determined for this reach. The crest gage on the mainstem of Silver Creek documented a bankfull event at a height of 3.4 ft above the bottom of the crest gage. This observation highlights the fact that there was a signifcant flooding event for the Silver Creek mainstem between September 2010 and May 2011.

The most likely date for the bankfull event was after the rain events that occurred on April 16 and 17th, 2011. As this was the largest precipitation event of significance since the completion of the Year 4 monitoring documentation, this is likely the bankfull event recorded by the crest gage on the Silver Creek mainstem. These dates correspond to high discharge and gage height readings, as recorded at USGS Gage 02138500 at Nebo, NC, which lies approximately 15 miles west of Morganton and 5 miles east of Marion, NC. On these two days, maximum daily discharge was recorded to be 6,130 ft3/s (April 16th) and 1,150 ft3/s (April 17th). Maximum daily gage height was 6.61 ft. (April 16th) and 2.91 ft. (April 17th).

On two additional sets of dates, large-scale precipitation events occurred. These dates are November 30 - December 1, 2010 and March 6 - March 7th, 2011. The discharge and gage height recorded at the 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?

2. Stream Problem Areas

A summary of the areas of concern identified during the visual assessment of the stream for Years 1 through 4 is included in Tables Xa through Xc.

Table Xa. Stream Problem Areas – Year 1
Silver Creek Stream Restoration / EEP Project No. D05016-1

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Stressed/failing structure	5+75 UT-A	Natural log sill - concern for long-term stability	SPA 1
Other	11+00 - 13+00 UT-A	Nearly vertical banks - need to be stabilized with matting and vegetation	SPA 2

Table Xb. Stream Problem Areas – Year 2
Silver Creek Stream Restoration / EEP Project No. D05016-1

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Stressed/failing structure	5+75 UT-A	Natural log sill – removed due to concern for long-term stability; channel stabilized	SPA 1
Bank scour	2+50 UT-A	Bank scour/ sloughing on left bank	SPA 2
	3+55 UT-A	Bank scour/ sloughing on right bank	
	5+60 UT-A	Bank scour/ sloughing on left bank	
	10+50 UT-A	Bank scour/ sloughing	
Other	11+00 - 13+00 UT-A	Nearly vertical banks – have been reshaped, still in need of matting and revetment	SPA 3

Table Xc. Stream Problem Areas – Year 3
Silver Creek Stream Restoration / EEP Project No. D05016-1

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Aggradation	12+20 Mainstem	Mid-channel bar downstream of J-hook	SPA 1
	19+50 Mainstem	Mid-channel bar downstream of J-hook	
Bank scour	0+25 UT-A	Bank scour/ sloughing on right bank	SPA 2,3
	2+40 – 2+60 UT-A	Bank scour/ sloughing by log vane along left bank	
	3+55 UT-A	Bank scour/ sloughing on right bank	
	5+60 UT-A	Bank scour/ sloughing on left bank	
	8+50 UT-A	Vertical bank along the right bank	
	10+50 UT-A	Bank scour/ sloughing	
Other	11+00 - 13+00 UT-A	Nearly vertical banks – have been reshaped, damaged by cattle intrusion	SPA 4,5
	Throughout UT-A; most extensive from 11+00 to downstream project terminus	Cattle intrusion into stream channel and along stream banks	

Table Xd. Stream Problem Areas – Year 4 Silver Creek Stream Restoration / EEP Project No. D05016-1			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Aggradation	19+50 Mainstem	Mid-channel bar downstream of J-hook	SPA 1
Scour	28+ 50Mainstem	Bank scour hole- left bank	SPA 2

Table Xe. Stream Problem Areas – Year 5 Silver Creek Stream Restoration / EEP Project No. D05016-1			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Bank Scour	28+ 50: Mainstem	Water flow cutting into left bank	SPA 1
Aggradation	26+25-26+75 (left bank): Mainstem	Excessive sedimentation on UT-C	SPA 2,3,4
Bank Failure	19+50: Mainstem	Lack of stabilizing vegetation.	SPA 5

In Year 5, a small scour hole continues to be evident at station 28+50 on the mainstem. This left-bank scour is minor and appears to be well vegetated and stable. A new area of minimal bank failure was observed on the mainstem in 2011 (see Table Xe above). This issue is localized and does not appear to be expanding. It is expected that vegetation will colonize the newly exposed soil in this area and assist in stabilizing the bank. This erosion will be re-checked in the spring of 2012 in order to assess stability of the area. If need be, bank stabilization with be completed at that time. Areas of bank scour noted on UT-A in 2009 included a few small areas of minor bank erosion. These areas of scour were not observed during the 2010 or 2011 stream surveys. The bed and bank repairs along the tributary have further enhanced channel stability.

One small area of aggradation was noted along the Silver Creek Mainstem in 2011. A lateral bar has formed along the left bank at the confluence of UT-C and the mainstem of Silver Creek at station 26+50 (see Stream Problem Area Photos, Appendix B). The lateral bar is a result of excessive sediment loading on UT-C. In the spring of 2011a cattle access point was constructed on UT-C, outside of the conservation easement, in order to supplement watering of cattle. It is hypothesized that this access point was built as a direct response to the closure of the watering access point and eventual exclusion of cattle from UT-A (see Cattle Crossing Photos, Appendix C).

It is important to note that the watering point was removed in the fall of 2011 and base flow has returned to normal for UT-C. Sedimentation has decreased and it is expected that UT-C will cease its deposition of sand and silt into the mainstem. At the present time, the resultant lateral bar on Silver Creek is being considered a problem area of low concern as it does not appear to be affecting stream stability.

An additional area of concern which existed along UT-A in Year 4 concerned the steep slopes of the stream banks, also noted by EEP during the construction completion site visit. This is one of the areas impacted by the cattle intrusion of 2009. These banks had been re-graded to stable slope conditions. As is depicted in the fixed station photos in Appendix B, vegetation has begun to provide cover on the steep slopes. This has provided more stability and less threat of erosion.

As a result of the cattle intrusion inside the conservation easement of UT-A, the cattle also accessed the stream channel itself, causing hoof shear along the downstream portion of the restored channel. Minor repairs of the bed and bank of the channel were made in the late fall of 2009 and have successfully addressed and remedied the disturbance. One riffle was rebuilt to restore the designed grade. This riffle has remained stable in 2010 and 2011.

3. Stream Problem Areas Plan View

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

4. Stream Problem Areas Photos

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

5. Fixed Station Photos

Photographs were taken at each established photograph station on September 16, 2011. These photographs are provided in Appendix B. Photographs of UT-B and UT-C are also provided, as required by the NC DWQ under the Section 401 permit.

6. Stability Assessment Table

The visual stream assessment was performed to determine the percentage of stream features that remain in a state of stability after the fifth year of monitoring. The visual assessment for each reach is summarized in Table XIa and Table XIb. 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
Silver Creek Stream Restoration / EEP Project No. D05016-01
Segment/Reach: Mainstem

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles[1]	100%	100%	100%	100%	100%	100%
B. Pools[2]	100%	100%	100%	100%	100%	97%
C. Thalweg	100%	100%	100%	100%	100%	100%
D. Meanders	100%	100%	100%	100%	100%	100%
E. Bed General	100%	100%	100%	99%	99%	99%
F. Vanes / J Hooks etc. [3]	100%	100%	100%	100%	100%	100%
G. Wads and Boulders[4]	N/A	N/A	N/A	N/A	N/A	N/A

Table XIa. Categorical Stream Feature Visual Stability Assessment Silver Creek Stream Restoration / EEP Project No. D05016-01 Segment/Reach: Tributary A						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	100%	100%	96%	100%	100%
B. Pools[2]	100%	66%	100%	51%	100%	91%
C. Thalweg	100%	100%	100%	100%	51%	100%
D. Meanders	100%	100%	100%	79%	92%	96%
E. Bed General	100%	100%	100%	99%	99%	99%
F. Vanes / J Hooks etc. [3]	100%	98%	100%	98%	100%	100%
G. Wads and Boulders[4]	N/A	N/A	N/A	N/A	N/A	N/A

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

The visual stream stability assessment revealed that the majority of in-stream structures are functioning as designed and built on the Silver Creek mainstem. All meanders and pools are performing as intended. In Year 5, however, significant aggradation was observed at cross sections 2 and 5 (see cross section templates in Appendix B and Table XIa, above). The aggradation at cross section 2 is a direct result of the beaver dam which was built on the cross vane feature at this cross section in 2010. The dam was deconstructed in the fall of 2010, but has left the stream bed aggraded at cross section 2. There is no evidence of present or future instability issues at this cross section, however. Aggradation at cross section 5 is relatively minor and is not a sign of instability.

In Year 5, only minor erosion is occurring along a few meander bends along the UT-A. The growth of vegetation after seeding can be witnessed in the fixed station and cross section photographs in Appendix B. In 2011, all instream structures were functioning as designed on UT-A. Two constructed pools were observed to have aggraded over the past year (Appendix B). This aggradation is localized to these two pools and does not appear to be affecting channel stability for the tributary. In Year 3, there was a noticeable decrease in the number and depth of pools along UT-A. The depth of pools along the tributary have remained stable in Years 4 and 5. The pools were designed to be shallow, but due to this design, sediment tends to collect and essentially fill these pools during extended low-flow periods. It is expected that these shallow pools will cyclically flush and aggrade during corresponding wet and dry seasons.

Cattle Crossing Agreement (UT-A)

In December 2010, an agreement was reached between Wetlands Resource Center (WRC) and the EEP about improvements to the cattle crossing on UT-A. At that time, WRC agreed to work with the local NRCS office to provide offline watering for cattle. WRC also agreed to modify the

existing cattle access point of the stream into a cattle crossing (with no access to water for drinking). The cattle crossing was successfully constructed in the spring of 2011. The 2010 cattle crossing agreement letter, along with 2011 photos of the new crossing are included in Appendix C.

Section 401 Permit Monitoring

Monitoring is required by the NC DWQ under the Section 401 permit to ensure that stability is achieved along the restored portions of UT-B and UT-C. These streams were visually assessed for stability at the same time that the visual stream stability assessment was performed for the Silver Creek Mainstem and UT-A. UT-B appeared to be stable during the Year 5 assessment.

As described above, it appears that a new cattle watering point on UT-C (see Stream Problem Area Photos, Appendix B) had previously resulted in sedimentation along the tributary channel and excess sediment, in the form of sand and silt, being washed into the Silver Creek mainstem at the confluence of the 2 streams. This has created the formation of a lateral bar along the left bank of the mainstem at station 26+25 – 26+75. At the present time, this lateral bar on Silver Creek is being considered a problem area of low concern as it does not appear to be affecting stream stability. The cattle access point along UT-C has been removed and it is expected that this channel will again become stable. Photographic documentation of the preserved portions of Tributaries B and C is included with the Fixed Station Photographs in Appendix B.

7. Quantitative Measures

Graphic interpretations of cross-sections, profiles and substrate particle distributions are presented 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 stream pattern data provided for Years 1-5 is similar to the data provided from the As-Built survey, as pattern has not changed based on the Year 5 stream surveys and visual field assessment.

Bedform features continue to evolve along the restored reaches as shown on the long-term longitudinal profiles. Dimensional measurements of the monumented cross-sections remain stable when compared to previous years. Many of the cross sections on the mainstem show aggradation on the point bars and in the floodprone area. This is not a sign of instability, just the natural evolution of the stream over the years.

It should be noted that overall stream classification has remained the same for UT-A throughout all five years of monitoring. The stream was initially constructed as a B-type stream and remains that in Year 5. The Silver Creek mainstem was initially constructed as and continues to function as a B-channel. In Years 1-4, however, dimensional measurements re-classified it as a B-type channel. In Year 5 the stream is again a B-type channel consistent with years 1-4. The mainstem is adjusting slightly but still remains a very stable channel.

Riffle lengths, riffle slopes and pool to pool spacings are stable. The comparison of the As-Built, Years 1-4, and Year 5 long-term stream monitoring profile data show stability with minimal change from as-built conditions. The water surface and bankfull slopes are consistent throughout the 5 years of monitoring.

The constructed riffles remain stable, although some of the Year 5 particle distributions show larger substrate than previous years. The substrate in the mainstem of Silver Creek has increased in size slightly since Year 3 and remains stable in Years 4 and 5. Year 5 particle distribution along UT-A resulted in a B4 stream classification with medium gravel sized substrate. Year 3 resulted in a B5 classification (coarse sand) while all other years were a B4 classification. The change in the substrate size was minimal and could be a result of higher flows that cleaned out the aggradation that had occurred in previous years. It is assumed that fine particulates are settling during low flows, both in the pools, and to a smaller extent, in riffle features. The bankfull events in years 3 and 4 flushed these finer materials through the system. Pool depths for both reaches have remained stable. The small change in particle distributions is considered as a natural byproduct of the flow regime, rather than an indication of instability. Remedial maintenance work is not warranted or suggested.

Table XIIa. Baseline Geomorphic and Hydraulic Summary

Silver Creek Stream Restoration / EEP Project No. D05016-01

Station/Reach: Mainstem {Long-Term Monitoring Profile Station 0+00 to 20+71.94 (2071.94 linear feet)}

Parameter	Reference Reach			Pre-Existing Condition			Design			As-Built			Year 1 Sta. 0+00 - 18+71			Year 2 Sta. 0+00 - 20+72			Year 3 Sta. 0+00 - 20+72			Year 4 Sta. 0+00 - 20+72			Year 5 Sta. 0+00 - 20+72		
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
Drainage Area (mi^2)			1.16			8.26			8.26			8.26			8.26			8.26			8.26			8.26			8.26
BF Width (ft)			24.02	29.22	122.47	60.86			30.00	46.18	69.81	58.00	46.14	68.80	57.47	43.86	68.44	63.90	43.85	61.08	55.01	40.60	62.38	48.96	41.07	59.17	53.94
Floodprone Width (ft)			232.00	37.00	84.00	60.00	54.0	145.0	99.5	82.81	114.45	98.63	82.93	114.25	98.59	81.98	114.11	101.89	73.96	126.00	105.03	83.54	119.59	106.06	84.41	121.31	104.57
BF Cross Sectional Area (ft^2)			30.77	139.70	230.44	176.46			90.00	83.59	103.55	93.57	83.97	100.15	92.06	73.69	95.39	89.90	82.72	91.44	86.88	60.11	100.20	91.05	62.85	93.76	82.32
BF Mean Depth (ft)			1.28	1.88	5.45	3.95			1.59	1.29	1.81	1.55	1.46	1.82	1.64	1.39	1.68	1.41	1.50	1.89	1.58	1.46	2.05	1.48	1.39	1.74	1.53
BF Max Depth (ft)			1.72	6.57	7.62	7.04			3.00	2.80	3.75	3.28	2.81	3.48	3.15	3.08	4.15	3.35	3.54	4.21	3.73	3.62	4.59	3.83	3.56	4.30	4.03
Width/Depth (ft)			18.77	5.36	65.14	25.78			18.87	25.51	52.16	38.84	25.35	47.12	36.24	26.11	49.24	45.32	23.20	40.72	34.82	23.88	42.73	27.43	26.84	42.57	31.00
Entrenchment Ratio			9.66	0.69	1.91	1.29	1.80	4.83	3.32	1.59	1.79	1.69	1.66	1.80	1.73	1.60	1.87	1.79	1.69	2.06	1.91	1.92	2.17	2.06	1.94	2.06	2.05
Bank Height Ratio			1.00	3.89	4.07	3.98			1.00	1.00	1.02	1.01	1.00	1.00	1.00	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)			26.58	35.78	152.95	75.32			33.18	46.98	70.20	58.59	46.96	69.18	58.07	44.62	69.80	59.58	44.85	61.64	56.03	41.87	63.56	50.32	42.48	61.30	56.02
Hydraulic Radius (ft)			1.16	1.51	4.28	3.23			2.71	1.27	1.78	1.53	1.45	1.79	1.62	1.37	1.65	1.47	1.48	1.84	1.55	1.43	1.99	1.44	1.34	1.67	1.48
Pattern																											
*Channel Beltwidth (ft)	44.17	46.50	45.22	37	84	60	54.0	145.0	93.9	82.81	181.94	109.79	82.93	114.25	102.73	82.93	114.25	102.73	82.93	114.25	102.73	82.93	114.25	102.73	82.93	114.25	102.73
*Radius of Curvature (ft)	12.97	24.44	17.67				45.0	75.0	60.0	46.07	185.40	68.70	46.07	185.40	68.70	46.07	185.40	68.70	46.07	185.40	68.70	46.07	185.40	68.70	46.07	185.40	68.70
*Meander Wavelength (ft)	88.23	115.70	104.80				60.0	191.8	125.9	73.79	191.70	124.86	73.79	191.70	124.86	73.79	191.70	124.86	73.79	191.70	124.86	73.79	191.70	124.86	73.79	191.70	124.86
*Meander Width Ratio	1.84	1.94	1.88	0.61	1.38	0.99	1.80	4.83	3.13	1.79	2.61	1.89	1.66	1.80	1.79	1.57	1.89	1.61	1.87	1.89	1.87	2.04	1.83	2.10	2.02	1.93	1.90
Profile																											
Riffle Length (ft)	19.0	31.0	25.7	6.5	10.5	12.5			32.9	9.4	47.7	28.4	7.3	47.3	27.8	7.5	68.6	29.6	5.1	49.8	20.7	11.2	49.1	26.1	7.8	45.4	21.0
Riffle Slope (ft/ft)	0.0125	0.0362	0.0211	0.0045	0.0096	0.0069			0.0056	0.0039	0.1787	0.0242	0.0084	0.0318	0.0165	0.0080	0.0218	0.0131	0.0031	0.0242	0.0085	0.0009	0.0239	0.0100	0.0017	0.0203	0.0076
Pool Length (ft)	11.0	31.6	17.4	20.1	36.1	26.3			65.7	17.1	56.9	35.7	28.1	70.7	51.3	17.8	89.9	47.4	23.7	86.3	54.5	23.3	108.7	58.6	21.7	121.1	62.0
Pool Spacing (ft)	67.6	77.5	71.4	101.1	149.0	129.1			131.4	36.4	388.3	145.5	61.5	257.3	161.2	49.1	245.9	114.9	38.8	217.9	89.4	37.8	218.7	83.0	40.9	205.6	89.3
Substrate																											
d50 (mm)			38.5	12.9	38.5	26.6	12.9	38.5	25.7	15.5	26.9	21.2	7.7	16.5	12.1	9.8	21.4	18.9	6.0	16.7	7.4	5.7	38.5	22.1	13.7	59.2	31.1
d84 (mm)			60.2	20.6	60.2	52.3	20.6	60.2	40.4	21.2	30.4	25.8	10.9	21.3	16.1	15.3	29.8	27.6	11.4	38.4	25.4	72.9	88.3	80.6	30.9	1392.6	124.2
Additional Reach Parameters																											
Valley Length (ft)			294.00			2077			2077			2077			2077			2077			2077			2077			2077
Channel Length (ft)			353.00			3040			2959			2905			2905			2905			2905			2905			2905
Sinuosity			1.2			1.46			1.43			1.40			1.40			1.40			1.40			1.40			1.40
Water Surface Slope (ft/ft)			0.0106	0.0022	0.0030	0.0026			0.0025			0.0026			0.0028			0.0027			0.0029			0.0041			0.0029
BF Slope (ft/ft)			0.0115			**			0.0026			0.0027			0.0028			0.0027			0.0028			0.0030			0.0027
Rosgen Classification			C4			F4	B4c	C4	C4			B4c			B4c			B4c			B4c			B4c			B4c
*Habitat Index																											
*Macrobenthos																											

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

**Insufficient field indicators to estimate bankfull slope under impaired F4 channel conditions.

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

Where no min/max values are provided, only one value was measured or computed and is presented as the median value.

Table XIIb. Baseline Geomorphic and Hydraulic Summary

Silver Creek Stream Restoration / EEP Project No. D05016-01

Station/Reach: Tributary A {Long-Term Monitoring Profile Station 0+00 to 10+49.79 (1049.79 feet)}

Parameter	Reference Reach			Pre-Existing Condition			Design			As-Built			Year 1 Sta 0+00 - 10+43			Year 2 Sta 0+00 - 10+50			Year 3 Sta 0+00 - 10+50			Year 4 Sta 0+00 - 10+50			Year 5 Sta 0+00 - 10+50		
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
Drainage Area (mi^2)			1.16			0.08			0.08			0.08			0.08			0.08			0.08			0.08			0.08
BF Width (ft)			24.02			13.72			8.00	6.81	8.11	7.46	6.78	7.32	7.05	6.62	7.20	6.91	7.51	9.42	8.47	8.61	9.49	9.05	9.10	9.86	9.48
Floodprone Width (ft)			232.00	10.00	15.00	12.50	10.00	15.00	12.50	13.28	14.57	13.93	10.45	13.35	11.90	12.15	17.83	14.71	11.93	14.83	13.38	12.76	14.35	13.56	14.87	15.31	15.09
BF Cross Sectional Area (ft^2)			30.77			3.54			3.50	3.51	3.59	3.55	3.52	3.57	3.55	3.29	4.08	3.69	4.10	5.78	4.94	3.91	4.08	4.00	4.12	6.20	5.16
BF Mean Depth (ft)			1.28			0.26			0.50	0.43	0.53	0.48	0.48	0.53	0.51	0.50	0.57	0.54	0.55	0.61	0.58	0.43	0.45	0.44	0.45	0.64	0.55
BF Max Depth (ft)			1.72			0.90			1.00	0.81	1.01	0.91	0.63	1.01	0.82	1.00	1.02	1.01	0.98	0.99	0.99	0.84	0.85	0.85	0.88	0.96	0.92
Width/Depth (ft)			18.77			52.77			16.00	12.85	18.86	15.86	12.79	15.25	14.02	12.63	17.13	14.71	13.65	15.44	14.55	19.13	22.07	20.60	15.13	20.22	17.68
Entrenchment Ratio			9.66			0.91			1.56	1.80	1.95	1.88	1.43	1.97	1.70	1.84	2.48	2.13	1.58	1.59	1.59	1.48	1.51	1.50	1.54	1.68	1.61
Bank Height Ratio			1.00			1.91			1.00	1.00	1.00	1.00	1.00	1.00	1.00	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)			26.58			13.97			9.00	6.97	8.28	7.63	7.08	7.56	7.32	6.97	7.50	7.24	7.80	9.68	8.74	8.84	9.66	9.25	9.34	9.96	9.65
Hydraulic Radius (ft)			1.16			0.25			0.39	0.42	0.50	0.46	0.47	0.50	0.49	0.47	0.54	0.51	0.53	0.60	0.57	0.42	0.44	0.43	0.44	0.62	0.53
Pattern																											
*Channel Beltwidth (ft)	44.17	46.50	45.22							10.80	14.57	12.95	10.80	14.57	12.95	10.80	14.57	12.95	10.80	14.57	12.95	10.80	14.57	12.95	10.80	14.57	12.95
*Radius of Curvature (ft)	12.97	24.44	17.67							9.32	124.90	23.59	9.32	124.90	23.59	9.32	124.90	23.59	9.32	124.90	23.59	9.32	124.90	23.59	9.32	124.90	23.59
*Meander Wavelength (ft)	88.23	115.70	104.80							58.82	106.30	73.72	58.82	106.30	73.72	58.82	106.30	73.72	58.82	106.30	73.72	58.82	106.30	73.72	58.82	106.30	73.72
*Meander Width Ratio	1.84	1.94	1.88							1.45	1.95	1.74	1.59	1.99	1.84	1.63	2.02	1.87	1.44	1.55	1.53	1.25	1.54	1.43	1.19	1.48	1.37
Profile																											
Riffle Length (ft)	19.0	31.0	25.7							1.34	47.90	15.30	2.35	49.50	12.84	1.85	48.70	14.07	4.08	40.46	17.28	2.29	57.61	19.48	2.80	51.80	20.90
Riffle Slope (ft/ft)	0.0125	0.0362	0.0211							0.0344	0.6094	0.1389	0.0401	0.4593	0.1278	0.0373	0.5344	0.1334	No flow	No flow	No flow	0.0097	0.4165	0.1090	No Flow	No Flow	No Flow
Pool Length (ft)	11.0	31.6	17.4							6.07	22.79	12.43	6.59	24.21	13.81	6.30	23.50	13.10	5.27	18.25	11.77	6.24	23.35	13.65	6.40	25.70	12.60
Pool Spacing (ft)	67.6	77.5	71.4							10.19	143.20	55.63	10.92	150.25	38.78	10.60	146.70	47.20	15.92	149.41	63.19	16.17	142.15	60.50	18.00	144.00	56.00
Substrate																											
d50 (mm)			38.5							6.9	15.8	11.4	2.4	8.2	5.3	2.4	11.8	7.1	0.4	1.9	1.2	0.7	21.3	11.0	0.9	8.8	4.9
d84 (mm)			60.2							20.2	42.4	31.3	9.2	14.3	11.8	1.6	17.9	10.7	18.7	23.4	10.7	63.2	103.3	83.3	15.5	82.2	48.9
Additional Reach Parameters																											
Valley Length (ft)			294.00			1426			1426			1426			1426			1426			1426			1426			1426
Channel Length (ft)			353.00			1508			1533			1552			1552			1552			1552			1552			1552
Sinuosity			1.2			1.06			1.07			1.09			1.09			1.09			1.09			1.09			1.09
Water Surface Slope (ft/ft)			0.0106	0.0350	0.0500	0.0425	0.0350	0.0500	0.0425			0.0427			0.0385			0.0386			No flow			0.0399			No Flow
BF Slope (ft/ft)			0.0115			**	0.0375	0.0535	0.0455			0.0469			0.0367			0.0386			0.0389			0.0400			0.0425
Rosgen Classification			C4			A→B	A1/A2 → B4a					B4a			B4			B4			B5			B4			B4a
*Habitat Index																											
*Macrobenthos																											

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

**Insufficient field indicators to estimate bankfull slope under altered A→ B channel conditions.

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

Where no min/max values provided, only one value was measured or computed and is presented as the mean value.

Table XIIIa: Morphology and Hydraulic Monitoring Summary
Silver Creek and Unnamed Tributary Stream Restoration / EEP Project No. D05016-01
Reach: Silver Creek Mainstem

Parameter	Cross Section (Riffle 1)						Cross Section (Pool 2)						Cross Section (Pool 3)					
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)	48.18	45.41	43.86	43.85	40.6	41.07	42.09	42.89	43.13	41.46	42.14	39.37	51.22	50.34	47.2	49.07	48.57	37.69
Floodprone Width (ft)	82.77	82.18	81.98	73.96	83.54	84.41	84.36	81.48	86.54	76.6	74.81	72.5	181.93	133.73	176.79	125.6	121.7	115.74
BF Cross Sectional Area (ft²)	83.59	83.18	73.69	82.72	60.11	62.85	89.64	81.53	93.99	82.81	75.84	63.47	95.81	91.1	84.95	89.42	90.37	74.81
BF Mean Depth (ft)	1.81	1.83	1.68	1.89	1.48	1.53	2.13	1.9	2.18	2	1.8	1.61	1.87	1.81	1.8	1.8	1.86	1.98
BF Max Depth (ft)	3.41	3.48	3.35	4.21	3.83	4.03	4.84	4.02	5.41	5.03	4.31	3.62	5.39	4.54	5.33	5.83	5.56	5.6
Width/Depth Ratio	25.51	24.81	26.11	23.2	27.43	26.84	19.76	22.57	19.78	20.73	23.41	24.45	27.39	27.81	26.22	27.59	26.11	19.04
Entrenchment Ratio	1.79	1.81	1.87	1.69	2.06	2.06	2	1.9	2.01	1.85	1.78	1.84	3.55	2.66	3.75	2.53	2.51	3.07
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	46.98	46.27	44.62	44.85	41.87	42.48	43.43	43.85	44.8	43.12	43.35	43.03	52.85	51.51	48.95	51.81	51.19	41.31
Hydraulic Radius (ft)	1.78	1.8	1.65	1.84	1.44	1.48	2.06	1.86	2.1	1.92	1.75	1.47	1.81	1.77	1.74	1.73	1.77	1.81
Substrate																		
D50 (mm)	0.45	16.47	18.86	6.03		13.65	0.67	0.83	0.44	0.43		0.91	1.05	1.25	1.14	0.39	8.3	8.69
D84 (mm)	20.92	21.28	27.57	11.35		30.87	2.97	1.6	1.06	0.95		1126.07	3.4	1.76	1.73	0.98	17.98	19.7

Table XIIIa: Morphology and Hydraulic Monitoring Summary
Silver Creek and Unnamed Tributary Stream Restoration/ EEP Project No. D05016-01
Reach: Silver Creek Mainstem

Parameter	Cross Section (Riffle 4)						Cross Section (Riffle 5)						Cross Section (Pool 6)					
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)	69.81	68.8	63.9	61.08	62.38	59.17	67.28	67.15	68.44	55.01	48.96	53.94	74.69	72.28	72.24	69.54	75.67	62.95
Floodprone Width (ft)	114.36	113.68	114.11	126	119.59	121.31	106.92	111.01	109.57	105.03	106.06	104.57	112.73	112.79	134.97	142.87	119.4	119.28
BF Cross Sectional Area (ft²)	103.55	100.15	89.9	91.44	91.05	82.32	86.55	89.46	95.39	86.88	100.2	93.76	107.1	109.03	120.32	121.99	149.04	122.99
BF Mean Depth (ft)	1.48	1.46	1.41	1.5	1.46	1.39	1.29	1.33	1.39	1.58	2.05	1.74	1.43	1.51	1.67	1.75	1.97	1.95
BF Max Depth (ft)	2.8	2.81	3.08	3.54	3.62	3.56	3.75	4.04	4.15	3.73	4.59	4.3	3.87	3.91	4.48	4.8	4.96	6.06
Width/Depth Ratio	47.17	47.12	45.32	40.72	42.73	42.57	52.16	50.49	49.24	34.82	23.88	31	52.23	47.87	43.26	39.74	38.41	32.28
Entrenchment Ratio	1.64	1.65	1.79	2.06	1.92	2.05	1.59	1.65	1.6	1.91	2.17	1.94	1.51	1.56	1.87	2.05	1.58	1.89
Bank Height Ratio	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetted Perimeter (ft)	70.2	69.18	64.31	61.64	63.56	61.3	68.34	68.32	69.8	56.03	50.32	56.02	76.1	73.55	73.09	70.47	77.27	66.03
Hydraulic Radius (ft)	1.48	1.45	1.4	1.48	1.43	1.34	1.27	1.31	1.37	1.55	1.99	1.67	1.41	0.48	1.65	1.73	1.93	1.86
Substrate																		
D50 (mm)	4.25	7.76	9.75	16.66	38.5	31.06	2.51	13.65	21.4	7.24	5.7	59.24	3.01	2.5	1.83	0.59	4	1.88
D84 (mm)	26.9	10.93	15.33	38.39	88.27	124.2	15.47	19.85	29.8	25.42	72.91	1392.64	12.45	5.14	4.89	2.73	18.64	14.12

Table XIIIb: Morphology and Hydraulic Monitoring Summary
Silver Creek and Unnamed Tributarys Stream Restoration / EEP Project No. D05016-01
Reach: UT-A

Parameter	Cross Section (Riffle 1)						Cross Section (Pool 2)						Cross Section (Pool 3)						Cross Section (Riffle 4)					
Dimension	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**	**MY 0**	**MY 1**	**MY 2**	**MY 3**	**MY 4**	**MY 5**
BF Width (ft)	6.81	6.78	6.62	9.42	8.61	9.86	9.5	10.79	10.77	12.02	11.55	10	8.05	9.86	10.79	10.25	10.1	7.15	8.11	7.32	7.2	7.51	9.49	9.1
Floodprone Width (ft)	13.28	13.35	13.12	14.83	12.76	14.87	16.37	17.26	17.83	17.14	17.85	14.2	14.54	15.06	15.75	15.17	16.54	11.3	14.57	10.45	12.15	11.93	14.35	15.31
BF Cross Sectional Area (ft^2)	3.59	3.57	3.29	5.78	3.91	6.2	7.01	7.05	7.36	8.23	8.29	4.77	6.97	6.95	6.83	6.84	7.69	4.9	3.51	3.52	4.08	4.1	4.08	4.12
BF Mean Depth (ft)	0.53	0.53	0.5	0.61	0.45	0.64	0.74	0.65	0.68	0.68	0.72	0.48	0.87	0.71	0.63	0.67	0.76	0.69	0.43	0.48	0.57	0.55	0.43	0.45
BF Max Depth (ft)	1.01	1.01	1.02	0.98	0.84	0.96	1.37	1.02	1.08	1.01	1.32	0.84	1.64	1.02	1.1	0.99	1.33	1	0.81	0.68	1	0.99	0.85	0.88
Width/Depth Ratio	12.85	12.79	13.24	15.44	19.13	15.13	12.84	16.6	15.84	17.68	16.04	20.83	9.25	13.89	17.13	15.3	13.29	10.36	18.86	15.25	12.63	13.65	22.07	20.22
Entrenchment Ratio	1.95	1.97	1.98	1.58	1.48	1.54	1.72	1.6	1.66	1.43	1.55	1.42	1.81	1.53	1.46	1.48	1.64	1.58	1.8	1.43	1.69	1.59	1.51	1.68
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	1.00	1
Wetted Perimeter (ft)	7.12	7.08	6.97	9.68	8.84	9.96	9.91	11.13	11.11	12.3	11.92	10.16	8.7	10.2	11.04	10.53	10.48	7.61	8.28	7.56	7.5	7.8	9.66	9.34
Hydraulic Radius (ft)	0.5	0.5	0.47	0.6	0.44	0.62	0.71	0.63	0.66	0.67	0.69	0.47	0.8	0.68	0.62	0.65	0.73	0.64	0.42	0.47	0.54	0.53	0.42	0.44
Substrate																								
D50 (mm)	6.85	2.4	2.35	0.42	0.71	0.92	0.67	4	3.9	0.05	1.41	0.62	0.5	0.78	0.78	0.17	1	1.71	15.77	9.24	9.25	1.92	21.28	8.82
D84 (mm)	20.22	8.22	8	18.65	103.29	82.19	1.19	11.61	11.72	0.22	10.33	0.97	1.55	1.62	1.64	0.53	20.89	30.59	42.35	14.33	14.31	23.36	63.23	15.53

IV. METHODOLOGY

Year 1 vegetation monitoring was conducted in September 2007 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 2011 using the same protocol as used in Years 1, 2, 3 and 4. Year 1 stream monitoring was conducted in November 2007 to provide adequate time between the as-built survey (completed in May 2007) and the Year 1 monitoring survey. Stream monitoring for Years 2, 3 and 4 occurred in the fall of 2008, 2009 and 2010 respectively, providing a full year between monitoring events . Year 5 monitoring occurred in the fall of 2011 in order to provide a full year between surveys.

APPENDIX A

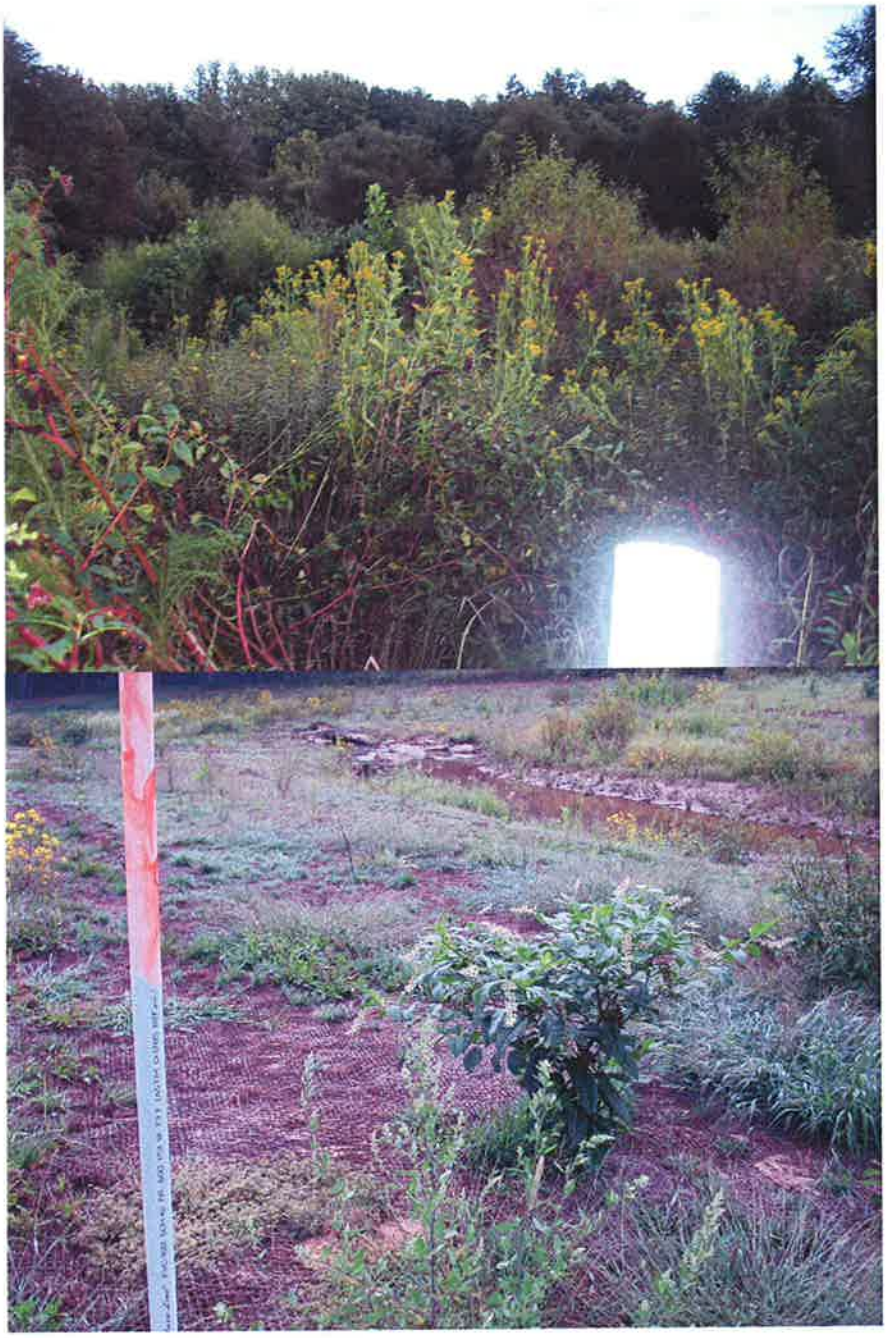
Vegetation Raw Data

1. Vegetation Monitoring Plot Photos
2. Vegetation Data Tables
3. Vegetation Problem Area Plan View
4. Vegetation Problem Area Photos
5. Vegetation Installed during 2011 Remedial Planting

Vegetation Plot 1 on Mainstem
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot 2 on Mainstem
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot 3 on Mainstem
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)



Vegetation Plot 4 on Mainstem
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot 5 on Mainstem
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot 6 on Mainstem
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot 1 on Tributary A
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot 2 on Tributary A
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot 3 on Tributary A
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot 4 on Tributary A
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Vegetation Plot on Tributary B

Year 5 – top photo – facing upstream on Trib. B (EMH&T, 9/16/11)

Year 1- bottom photo – facing downstream on Trib. B toward Silver Creek (EMH&T, 9/20/06)

Vegetation Plot on Tributary C
Year 5 – top photo (EMH&T, 9/16/11)
Year 1- bottom photo (EMH&T, 9/20/06)

Table 1. Vegetation Metadata	
Report Prepared By	Megan Wolf
Date Prepared	10/27/2011 15:04
database name	cvs-eep-entrytool-v2.2.6.mdb
database location	Q:\ENVIRONMENTAL\Monitoring\EEP Vegetation Database
computer name	HX1N941
file size	49823744
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	D0501601
project Name	Silver Creek
Description	Restoration of Silver Creek Mainstem and Unnamed Tributary A.
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	10

Table 2. Vegetation Vigor by Species							
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**
	Acer saccharum	3	2				5
	Alnus serrulata	7	1				1
	Aronia arbutifolia						1
	Aronia melanocarpa	16	3	1	1		
	Cornus amomum	20	2	1		1	3
	Fraxinus pennsylvanica	6	2	1			3
	Quercus alba	1					
	Quercus coccinea	4	3				
	Quercus michauxii	4					
	Quercus palustris			1			
	Salix nigra	2					1
	Sambucus canadensis			1			
	Cornus sericea	3					
	Liriodendron tulipifera	3	1				2
	Platanus occidentalis	3	1	1			3
	Acer rubrum	3					
TOT:	**16**	**75**	**15**	**6**	**1**	**1**	**19**

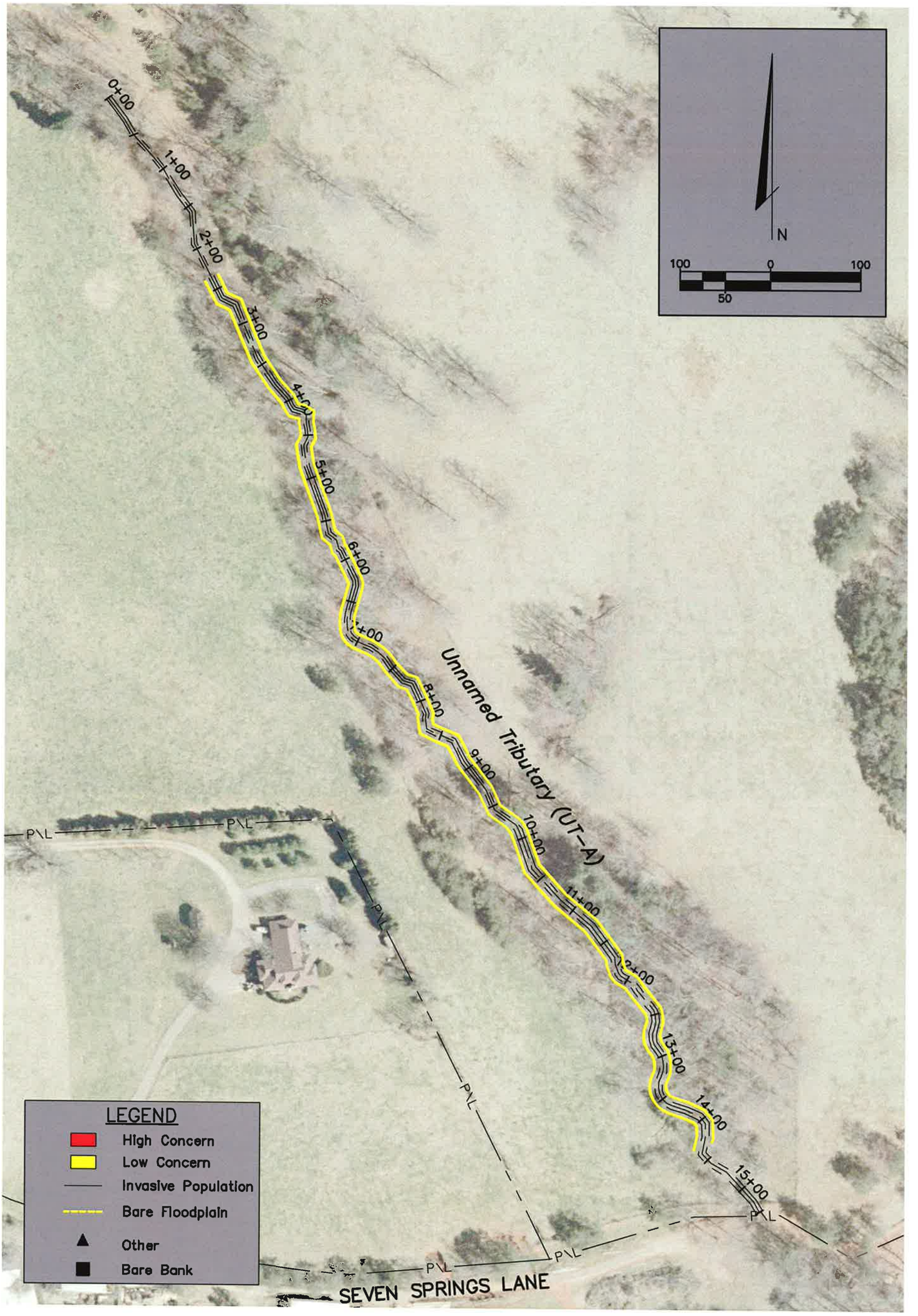
Table 3. Vegetation Damage by Species

	Species	All Damage Categories	(no damage)	Site Too Dry	Unknown
	Acer rubrum	3	3		
	Acer saccharum	10	10		
	Alnus serrulata	9	9		
	Aronia arbutifolia	1	1		
	Aronia melanocarpa	21	19	1	1
	Cornus amomum	27	26	1	
	Cornus sericea	3	3		
	Fraxinus pennsylvanica	13	13		
	Liriodendron tulipifera	6	6		
	Platanus occidentalis	8	7	1	
	Quercus alba	1	1		
	Quercus coccinea	7	7		
	Quercus michauxii	4	4		
	Quercus palustris	1		1	
	Salix nigra	3	3		
	Sambucus canadensis	1			1
TOT:	**16**	**118**	**112**	**4**	**2**

Table 4. Vegetation Damage by Plot					
	plot	All Damage Categorie	(no damage)	Site Too Dry	Unknown
	Silver Creek Mainstem Plot 1 (year 5)	11	8	3	
	Silver Creek Mainstem Plot 2 (year 5)	12	12		
	Silver Creek Mainstem Plot 3 (year 5)	17	16	1	
	Silver Creek Mainstem Plot 4 (year 5)	9	9		
	Silver Creek Mainstem Plot 5 (year 5)	13	13		
	Silver Creek Mainstem Plot 6 (year 5)	12	11		1
	UT-A Plot 1 (year 5)	12	12		
	UT-A Plot 2 (year 5)	8	7		1
	UT-A Plot 3 (year 5)	12	12		
	UT-A Plot 4 (year 5)	12	12		
TOT:	**10**	**118**	**112**	**4**	**2**

Table 5. Stem Count by Plot and Species														
	Species	Total Planted Stems	# plots	avg# stems	Silver Creek Mainstem Plot 1 (year 5)	Silver Creek Mainstem Plot 2 (year 5)	Silver Creek Mainstem Plot 3 (year 5)	Silver Creek Mainstem Plot 4 (year 5)	Silver Creek Mainstem Plot 5 (year 5)	Silver Creek Mainstem Plot 6 (year 5)	UT-A Plot 1 (year 5)	UT-A Plot 2 (year 5)	UT-A Plot 3 (year 5)	UT-A Plot 4 (year 5)
	Acer rubrum	3	1	3							3			
	Acer saccharum	5	3	1.67	1				3	1				
	Alnus serrulata	8	5	1.6	3			1	1			1	2	
	Aronia melanocarpa	21	7	3		2	5			2	6	2	3	1
	Cornus amomum	23	9	2.56	2	2	4	4	2	3	1	2	3	
	Cornus sericea	3	1	3			3							
	Fraxinus pennsylvanica	9	5	1.8		1					1	2	2	3
	Liriodendron tulipifera	4	4	1				1	1	1				1
	Platanus occidentalis	5	2	2.5	1	4								
	Quercus alba	1	1	1			1							
	Quercus coccinea	7	4	1.75				2			1		2	2
	Quercus michauxii	4	2	2	1	3								
	Quercus palustris	1	1	1	1									
	Salix nigra	2	1	2			2							
	Sambucus canadensis	1	1	1						1				
TOT:	**15**	**97**	**15**		**9**	**12**	**15**	**8**	**7**	**8**	**12**	**7**	**12**	**7**

Table 6. Stem Count by Plot and Species - All Stems														
	Species	Total Stems	# plots	avg# stems	Silver Creek Mainstem Plot 1 (year 5)	Silver Creek Mainstem Plot 2 (year 5)	Silver Creek Mainstem Plot 3 (year 5)	Silver Creek Mainstem Plot 4 (year 5)	Silver Creek Mainstem Plot 5 (year 5)	Silver Creek Mainstem Plot 6 (year 5)	UT-A Plot 1 (year 5)	UT-A Plot 2 (year 5)	UT-A Plot 3 (year 5)	UT-A Plot 4 (year 5)
	Acer saccharum	6	3	2	1				3	2				
	Alnus serrulata	19	5	3.8	6			1	9			1	2	
	Aronia melanocarpa	30	8	3.75		2	5		2	4	6	7	3	1
	Celtis occidentalis	1	1	1							1			
	Cornus amomum	24	9	2.67	2	2	5	4	2	3	1	2	3	
	Fraxinus pennsylvanica	14	5	2.8		1					1	3	4	5
	Quercus alba	1	1	1			1							
	Quercus coccinea	7	4	1.75				2			1		2	2
	Quercus michauxii	4	2	2	1	3								
	Quercus palustris	2	2	1	1			1						
	Rhus typhina	9	4	2.25				1			6	1		1
	Salix nigra	2	1	2			2							
	Sambucus canadensis	1	1	1						1				
	Cornus sericea	3	1	3			3							
	Liriodendron tulipifera	8	6	1.33	1	2		1	1	2				1
	Platanus occidentalis	6	3	2	1	4		1						
	Acer rubrum	8	3	2.67	3				1		4			
TOT:	**17**	**145**	**17**		**16**	**14**	**16**	**11**	**18**	**12**	**20**	**14**	**14**	**10**



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BURKE COUNTY, NORTH CAROLINA

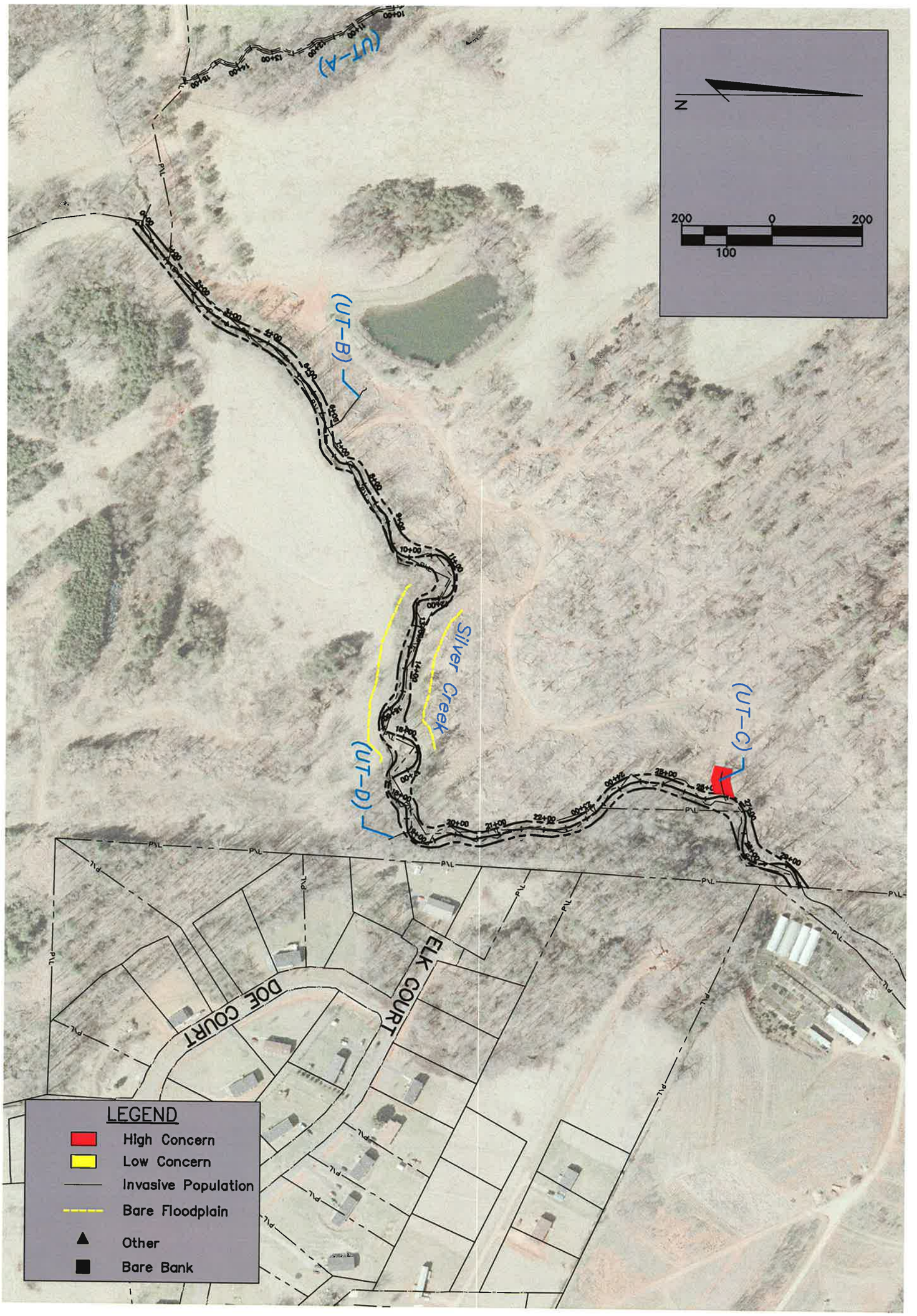
SILVER CREEK AND UNNAMED TRIBUTARY

MONITORING

APPENDIX A-2

VEGETATION PROBLEM AREA PLAN VIEW

Date:	December, 2011
Scale:	1" = 200'
Job No:	2007-1898
Sheet:	1/2



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BURKE COUNTY, NORTH CAROLINA

SILVER CREEK AND UNNAMED TRIBUTARY

MONITORING

APPENDIX A-1

VEGETATION PROBLEM AREA PLAN VIEW

Date:	December, 2011
Scale:	1" = 200'
Job No:	2007-1898
Sheet:	2/2

VPA 1
View of sparse vegetation in the floodplain along the mainstem at station 13+50.
(EMH&T, 9/16/11)

VPA 2
View of Japanese stiltgrass (*Microstegium vimineum*) infiltration along the Unnamed Tributary 1 (UT-1) at station 8+25. Photo direction faces downstream.
(EMH&T, 9/16/11)

Table 7. Vegetation Installed during 2011 Remedial Planting			
Species (scientific name)	Species (common name)	Quantity (approximate)	Material size
Cehphalanthus occidentalis	Buttonbush	500	bare root
Cornus amomum	Silky dogwood	500	bare root
Quercus coccinea	Scarlet oak	500	bare root
Sambucus canadensis	Elderberry	500	bare root
Ulmus americana	American elm	500	bare root

APPENDIX B

Geomorphologic Raw Data

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

Fixed Station 1
Overview of the Silver Creek Mainstem, facing upstream from the downstream project terminus.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/21/08)

Fixed Station 2
Overview of the Silver Creek Mainstem near Riffle #3, facing downstream.
Year 4 – top photo (EMH&T, September 2010)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 3
Overview of the Silver Creek Mainstem at Riffle #1, facing downstream.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 4
Overview of the Silver Creek Mainstem at Riffle #1, facing upstream.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 5
Overview of the Silver Creek Mainstem, facing downstream near station 2+60.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 6
Overview of UT-A, facing upstream near station 0+50.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 7
Overview of UT-A, facing upstream near station 8+00.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 8
Overview of UT-A, facing upstream near station 11+00.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 9
Overview of UT-B, facing upstream from the confluence of UT-B with Silver Creek.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 10
Overview of UT-B, facing downstream towards the confluence of UT-B with Silver Creek.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 11
Overview of UT-C, facing upstream from the confluence of UT-C with Silver Creek.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Fixed Station 12
Overview of UT-C, facing downstream towards the confluence of UT-C with Silver Creek.
Year 5 – top photo (EMH&T, 9/16/11)
Year 2- bottom photo (EMH&T, 8/8/08)

Table B1. Visual Morphological Stability Assessment
Silver Creek Stream Restoration / EEP Project No. D05016-1
Segment/Reach: Mainstem

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?	25	25	0	100	
	2. Armor stable (e.g. no displacement)?	25	25	0	100	
	3. Facet grade appears stable?	25	25	0	100	
	4. Minimal evidence of embedding/fining?	25	25	0	100	
	5. Length appropriate?	25	25	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	22	24	0	92	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	24	24	0	100	
	3. Length appropriate?	24	24	0	100	**97%**
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?	24	25	0	96	
	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	**99%**
E. Bed General	1. Geveral channel bed aggradation areas (bar formation)	N/A	N/A	1/ 10 feet	99	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**99%**
F. Vanes	1. Free of back or arm scour?	15	15	0	100	
	2. Height appropriate?	15	15	0	100	
	3. Angle and geometry appear appropriate?	15	15	0	100	
	4. Free of piping or other structural failures?	15	15	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
Silver Creek Stream Restoration / EEP Project No. D05016-1
Segment/Reach: Tributary A

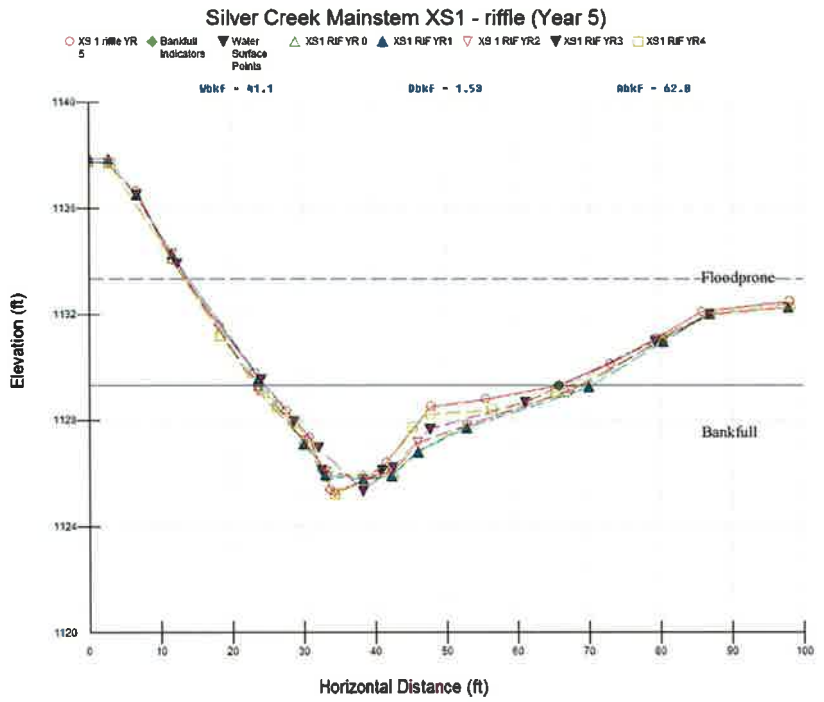
Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	25	25	0	100	
	2. Armor stable (e.g. no displacement)?	25	25	0	100	
	3. Facet grade appears stable?	25	25	0	100	
	4. Minimal evidence of embedding/fining?	25	25	0	100	
	5. Length appropriate?	25	25	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	13	15	0	87	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	13	15	0	87	
	3. Length appropriate?	15	15	0	100	**91%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	12	12	0	100	
	2. Downstream of meander (glide/inflection) centering?	12	12	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	12	12	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	12	12	0	100	
	3. Apparent Rc within spec?	12	12	0	100	
	4. Sufficient floodplain access and relief?	10	12	2	83	**96%**
E. Bed General	1. Geveral channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	1/ 5 feet	99	**99%**
F. Vanes	1. Free of back or arm scour?	17	17	0	100	
	2. Height appropriate?	17	17	0	100	
	3. Angle and geometry appear appropriate?	17	17	0	100	
	4. Free of piping or other structural failures?	17	17	0	100	**100%**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Summary Data

Bankfull Area (sq ft)	62.85
Bankfull Width (ft)	41.07
Mean Depth (ft)	1.53
Maximum Depth (ft)	4.03
Width/Depth Ratio	26.84
Entrenchment Ratio	2.06
Classification	B4

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	09/20/2011
CROSS SECTION:	1
FEATURE:	Riffle at Cross Vane # 1

Riffle Cross-Section 1, looking downstream

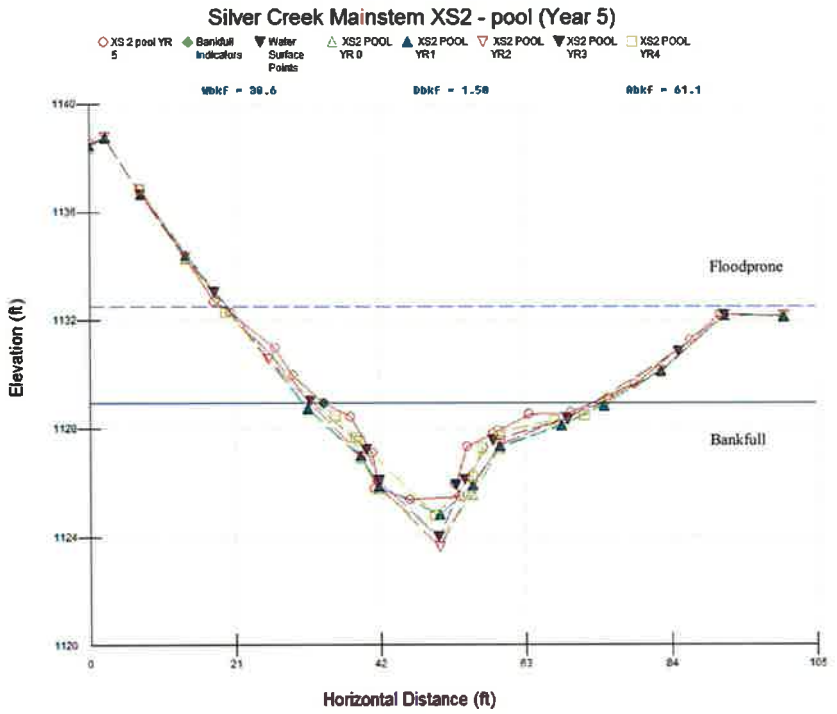


Summary Data

Bankfull Area (sq ft)	63.47
Bankfull Width (ft)	39.37
Mean Depth (ft)	1.61
Maximum Depth (ft)	3.62
Width/Depth Ratio	24.45
Entrenchment Ratio	1.84

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	09/20/2011
CROSS SECTION:	2
FEATURE:	Pool at Cross Vane # 1

Pool Cross-Section 2, looking upstream

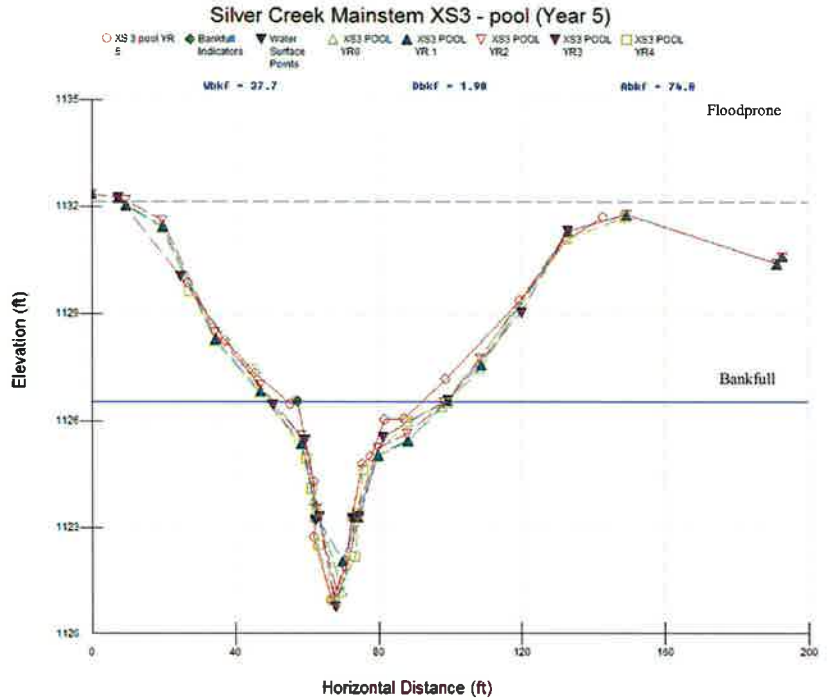


Summary Data

Bankfull Area (sq ft)	74.81
Bankfull Width (ft)	37.69
Mean Depth (ft)	1.98
Maximum Depth (ft)	5.6
Width/Depth Ratio	19.04
Entrenchment Ratio	3.07

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	09/20/2011
CROSS SECTION:	3
FEATURE:	Pool at J-Hook # 4

Pool Cross-Section 3, looking downstream

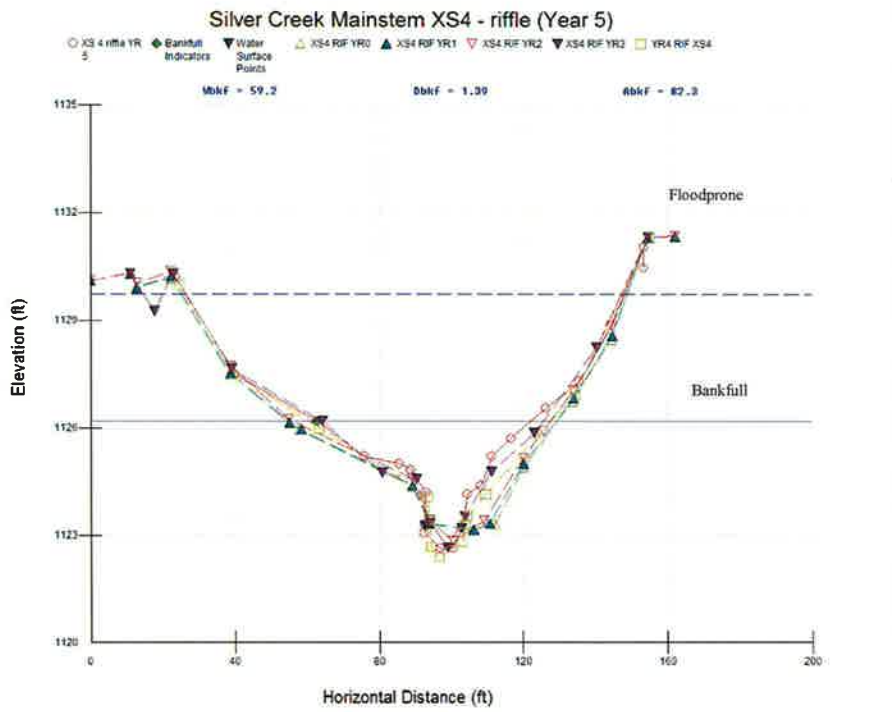


Summary Data

Bankfull Area (sq ft)	82.32
Bankfull Width (ft)	59.17
Mean Depth (ft)	1.39
Maximum Depth (ft)	3.56
Width/Depth Ratio	42.57
Entrenchment Ratio	2.05
Classification	B4

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	09/20/2011
CROSS SECTION:	4
FEATURE:	Riffle

Riffle Cross-Section 4, looking across channel, from left bank to right bank

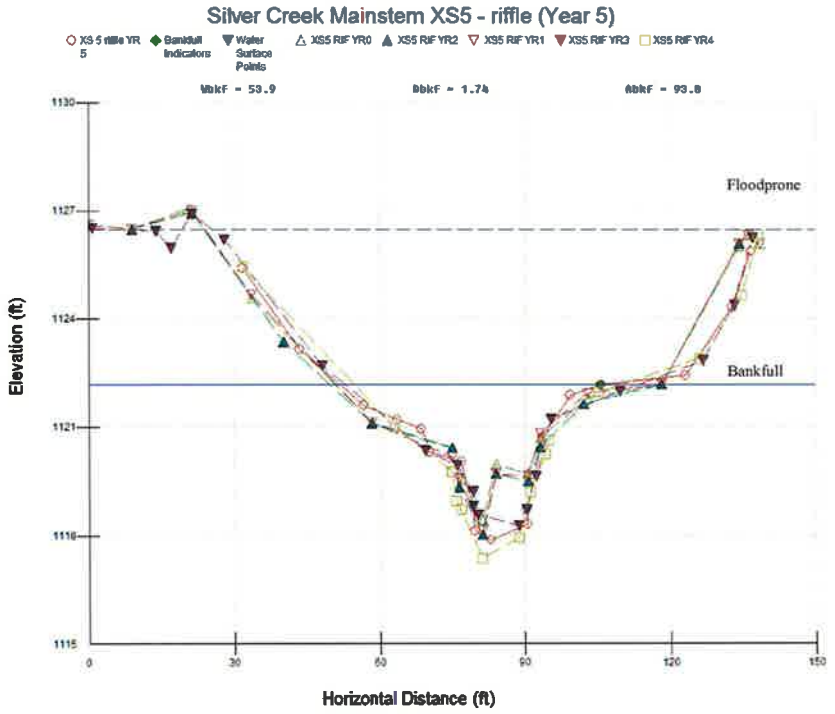


Summary Data

Bankfull Area (sq ft)	93.76
Bankfull Width (ft)	53.94
Mean Depth (ft)	1.74
Maximum Depth (ft)	4.3
Width/Depth Ratio	31.0
Entrenchment Ratio	1.94
Classification	B4

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	09/20/2011
CROSS SECTION:	5
FEATURE:	Riffle at J-Hook # 8

Riffle Cross-Section 5, looking downstream

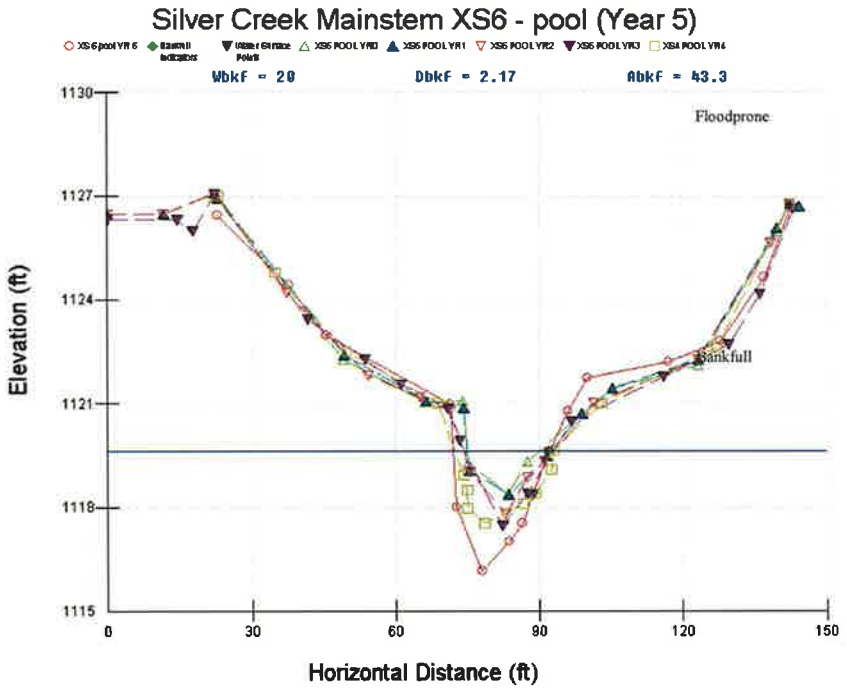


Summary Data

Bankfull Area (sq ft)	122.99
Bankfull Width (ft)	62.95
Mean Depth (ft)	1.95
Maximum Depth (ft)	6.06
Width/Depth Ratio	32.28
Entrenchment Ratio	1.89

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	09/20/2011
CROSS SECTION:	6
FEATURE:	Pool at J-Hook # 8

Pool Cross-Section 6, looking downstream



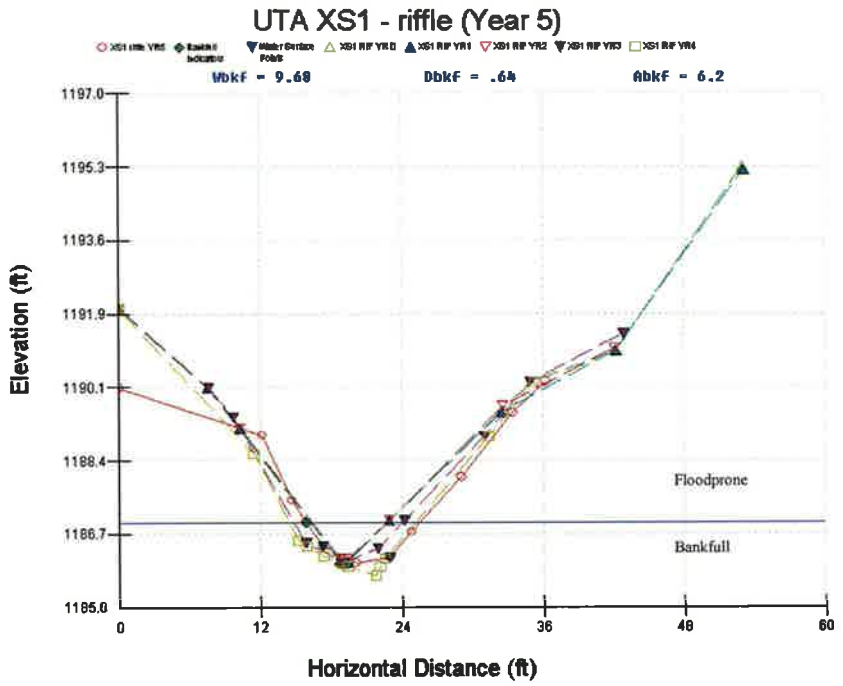
Summary Data

Bankfull Area (sq ft)	6.2
Bankfull Width (ft)	9.86
Mean Depth (ft)	0.64
Maximum Depth (ft)	0.96
Width/Depth Ratio	15.13
Entrenchment Ratio	1.54
Classification	B5

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	UT-A
DATE	09/20/2011
CROSS SECTION:	1
FEATURE:	Riffle

Ecosystem Enhancement

UTA Cross-Section 1, looking upstream



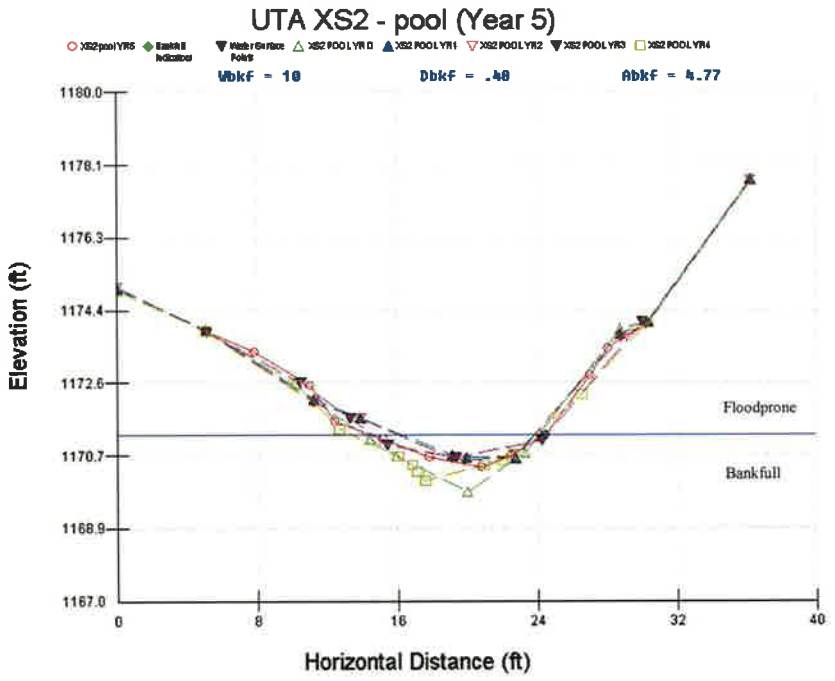
EMH&T

Summary Data

Bankfull Area (sq ft)	4.77
Bankfull Width (ft)	10.0
Mean Depth (ft)	0.48
Maximum Depth (ft)	0.84
Width/Depth Ratio	20.83
Entrenchment Ratio	1.42

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	UT-A
DATE	09/20/2011
CROSS SECTION:	2
FEATURE:	Pool

UTA Pool Cross-Section 2, looking across channel, from left to right bank

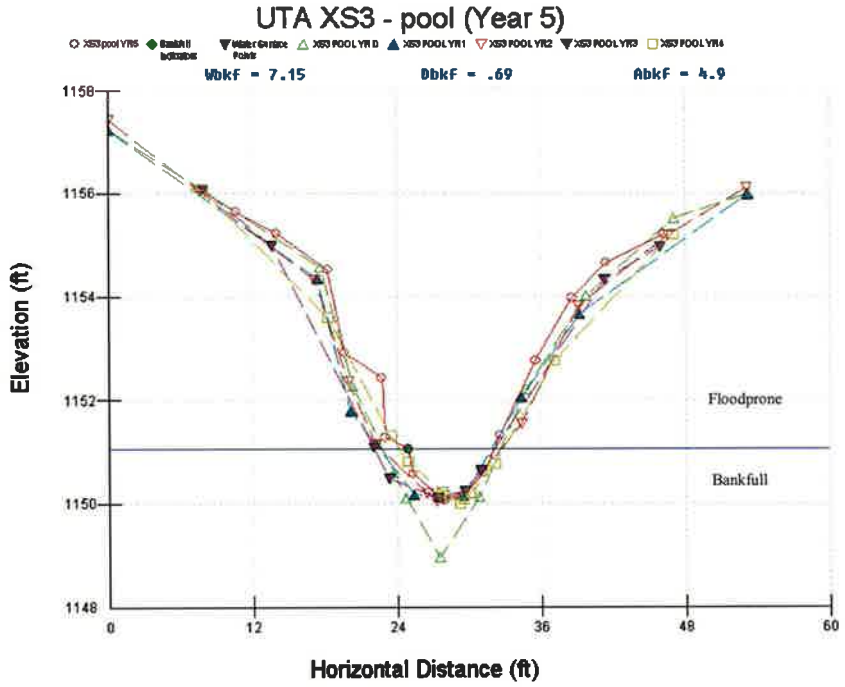


Summary Data

Bankfull Area (sq ft)	4.90
Bankfull Width (ft)	7.15
Mean Depth (ft)	0.69
Maximum Depth (ft)	1.00
Width/Depth Ratio	10.36
Entrenchment Ratio	1.58

PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	UT-A
DATE	09/20/2011
CROSS SECTION:	3
FEATURE:	Pool

UTA Pool Cross-Section 3, looking from right to left bank

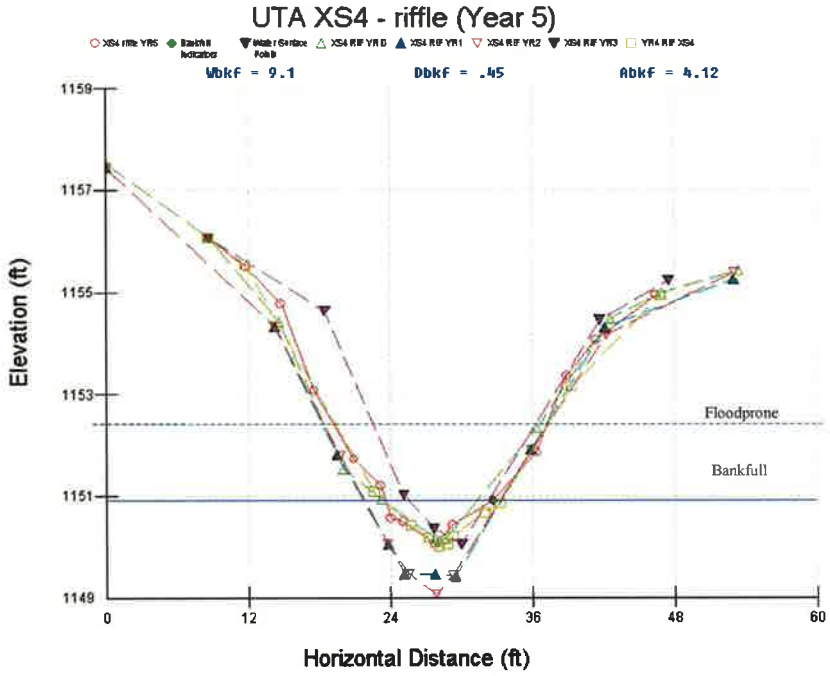


Summary Data

Bankfull Area (sq ft)	4.12
Bankfull Width (ft)	9.10
Mean Depth (ft)	0.45
Maximum Depth (ft)	0.88
Width/Depth Ratio	20.22
Entrenchment Ratio	1.68
Classification	B4

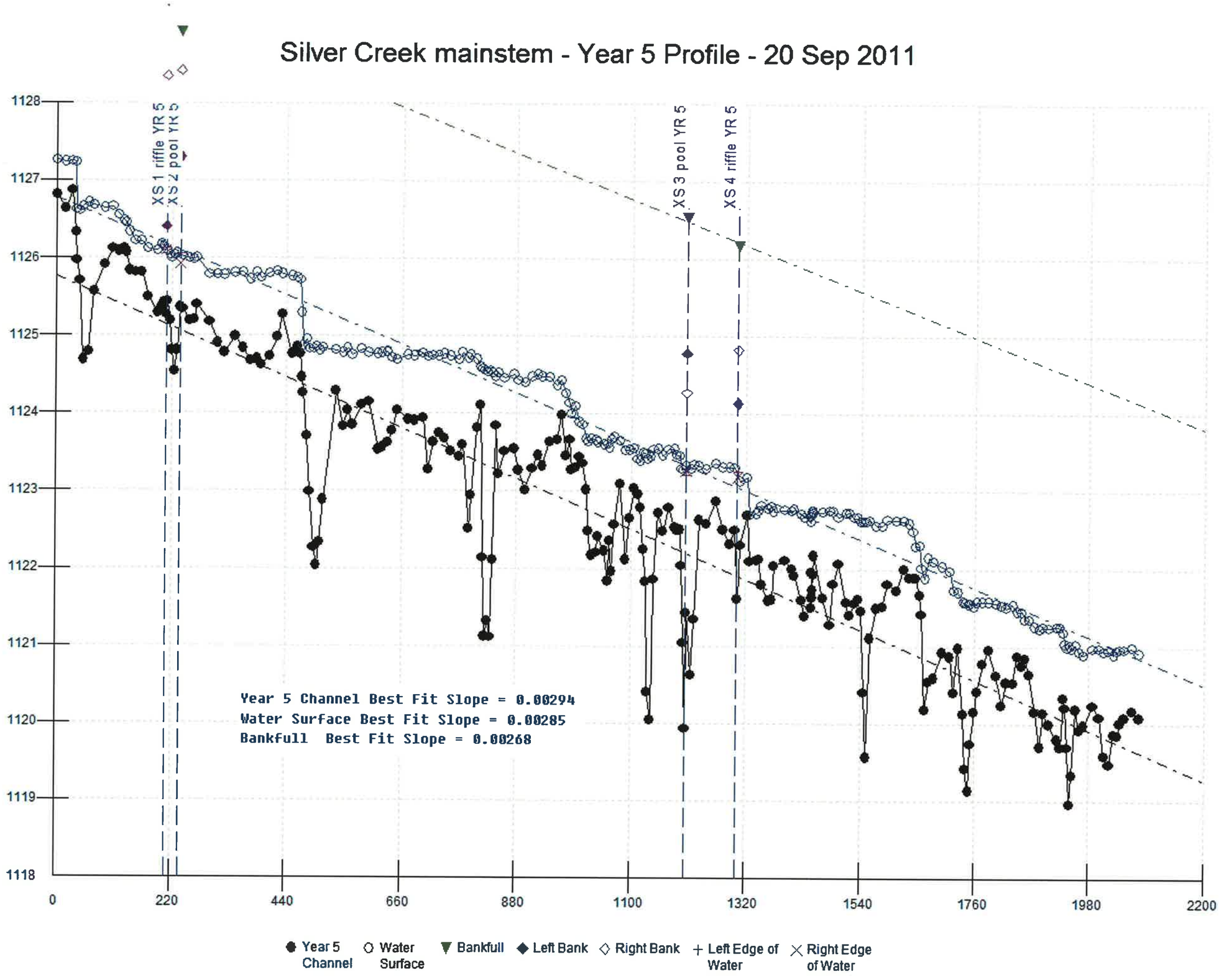
PROJECT	Silver Creek
	D05016-1
	5-YEAR
TASK	Cross-Section
REACH	UT-A
DATE	09/20/2011
CROSS SECTION:	4
FEATURE:	Riffle

UTA Riffle Cross-Section 4, looking downstream

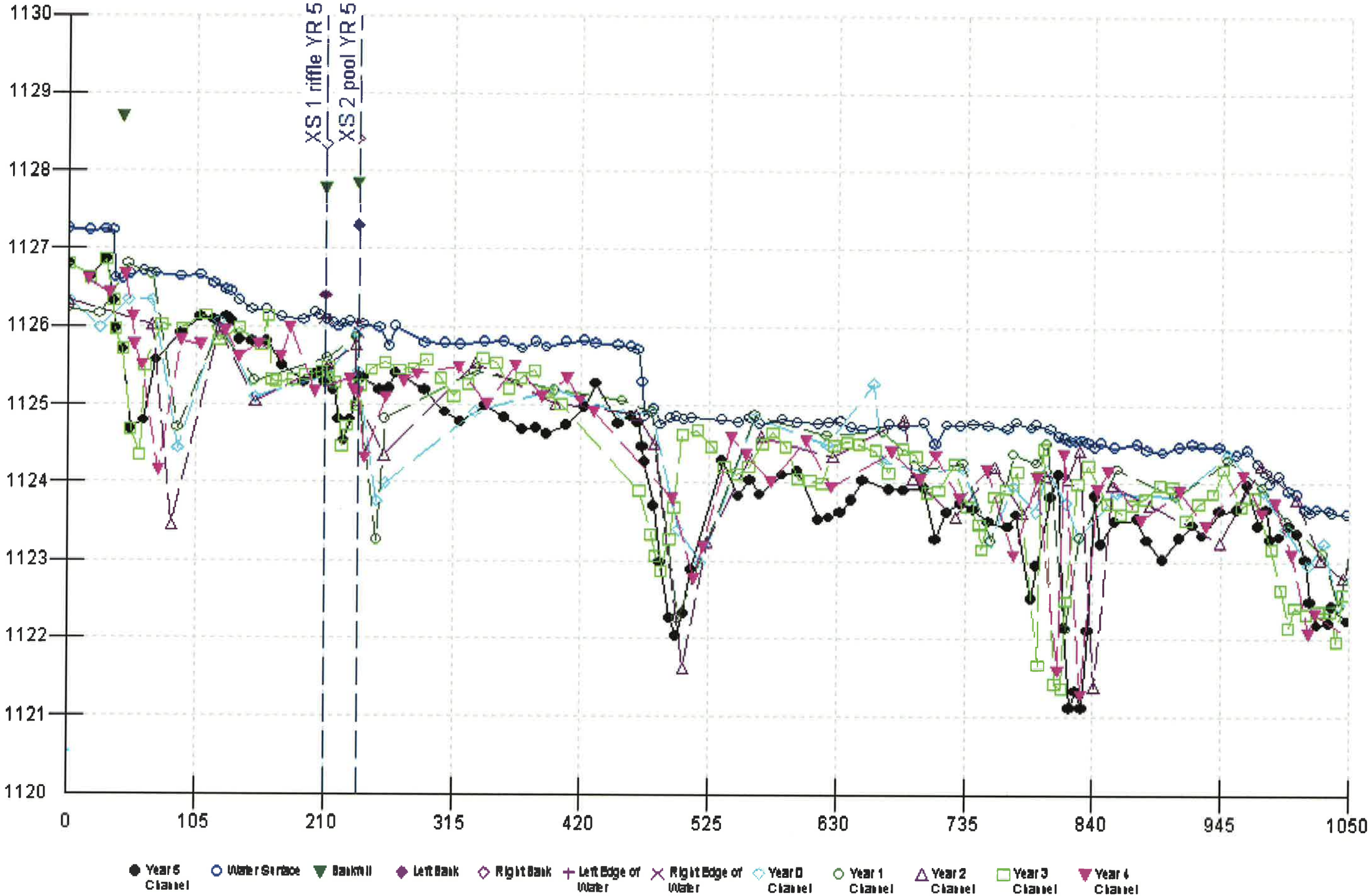


EMH&T

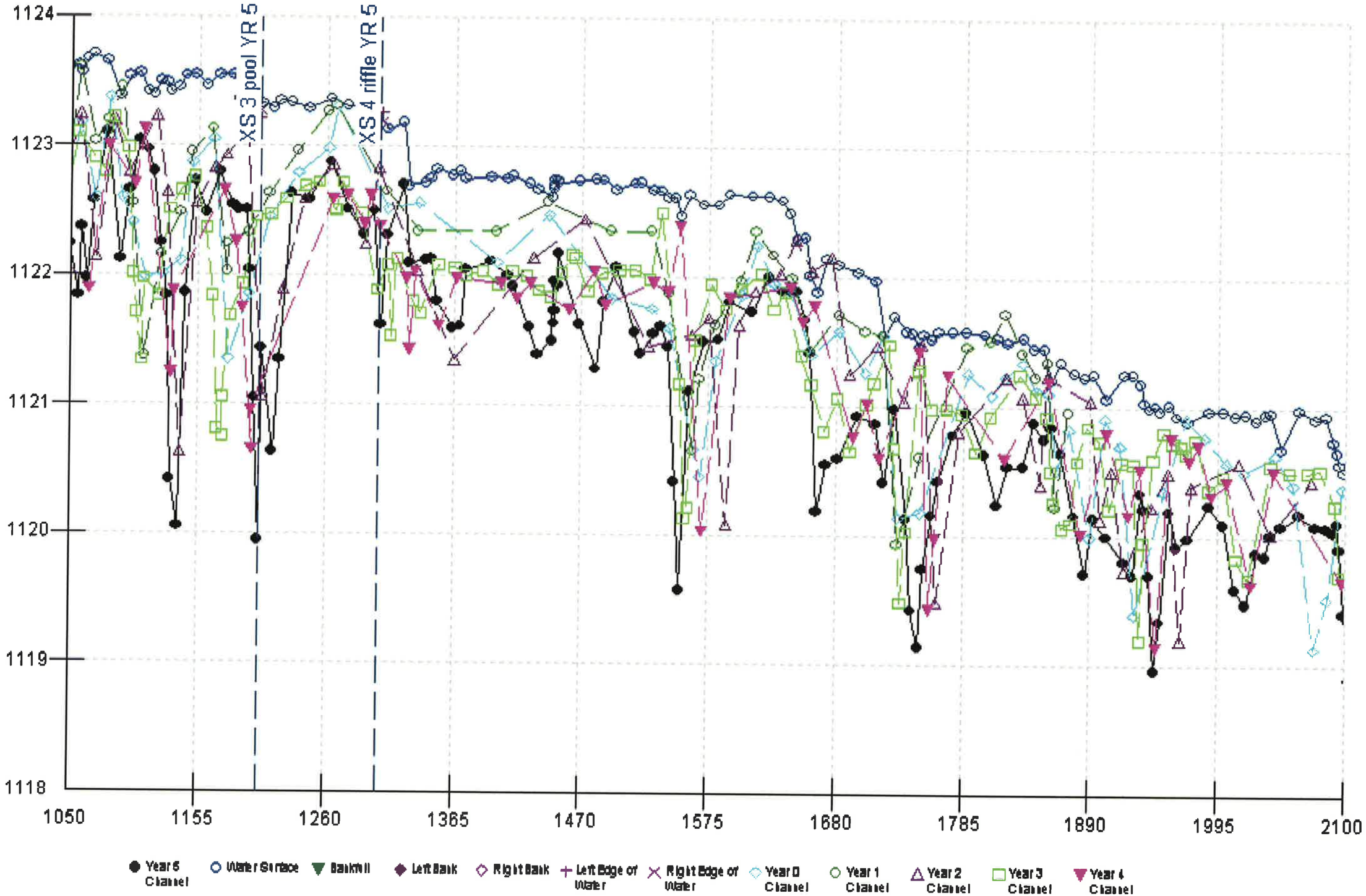
Silver Creek mainstem - Year 5 Profile - 20 Sep 2011



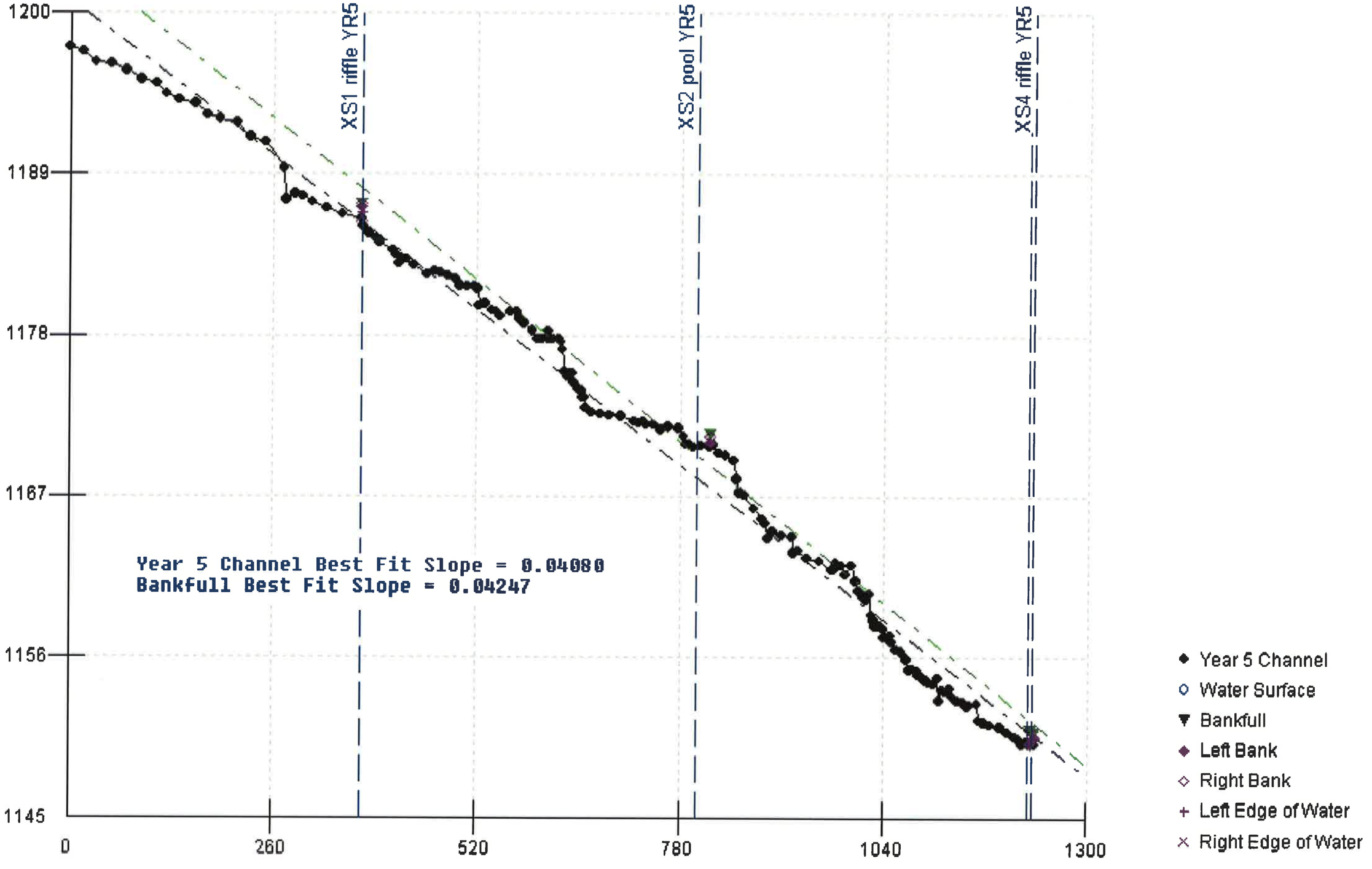
Silver Creek mainstem - Year 5 Profile - 20 Sep 2011



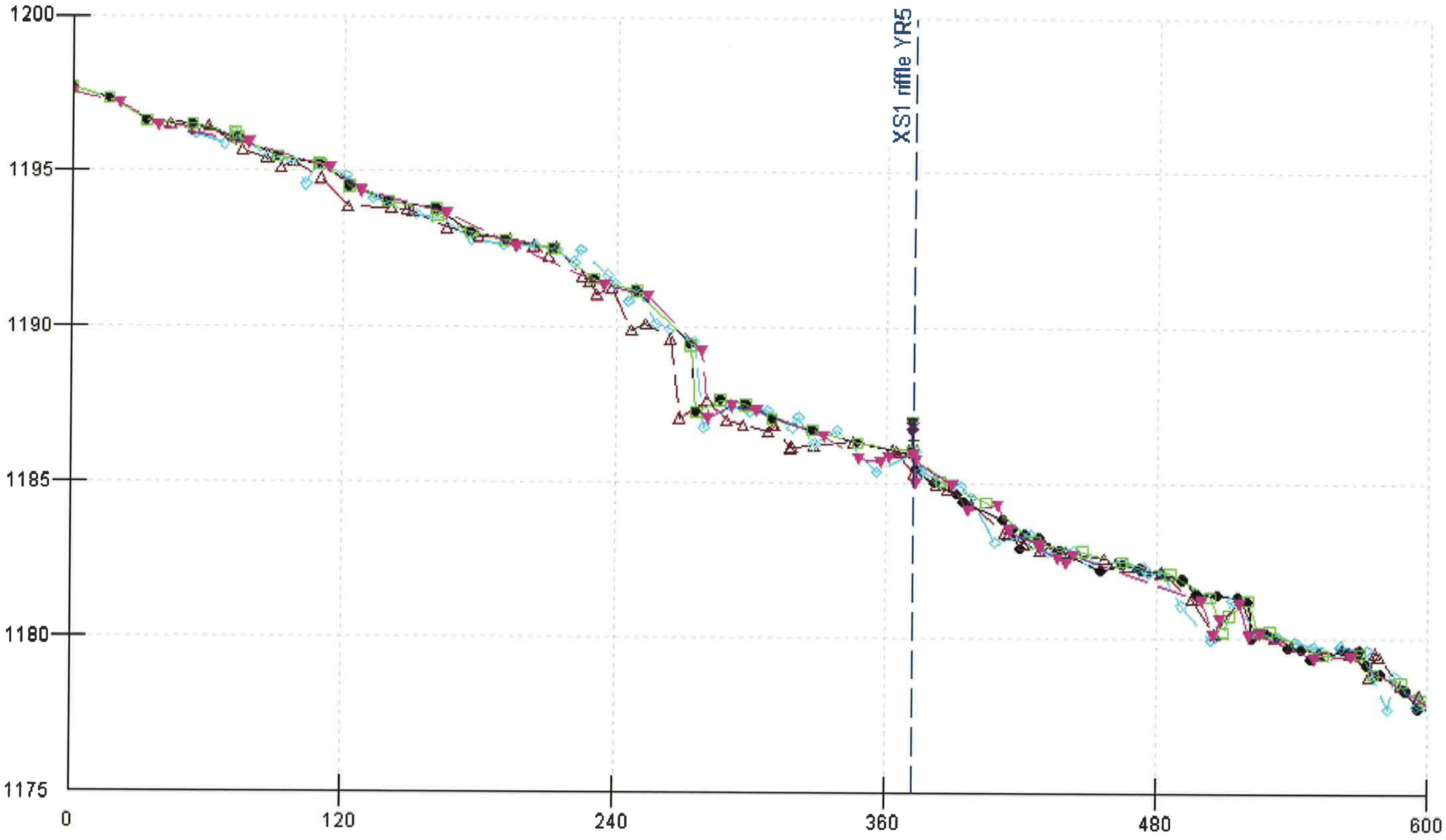
Silver Creek mainstem - Year 5 Profile - 20 Sep 2011



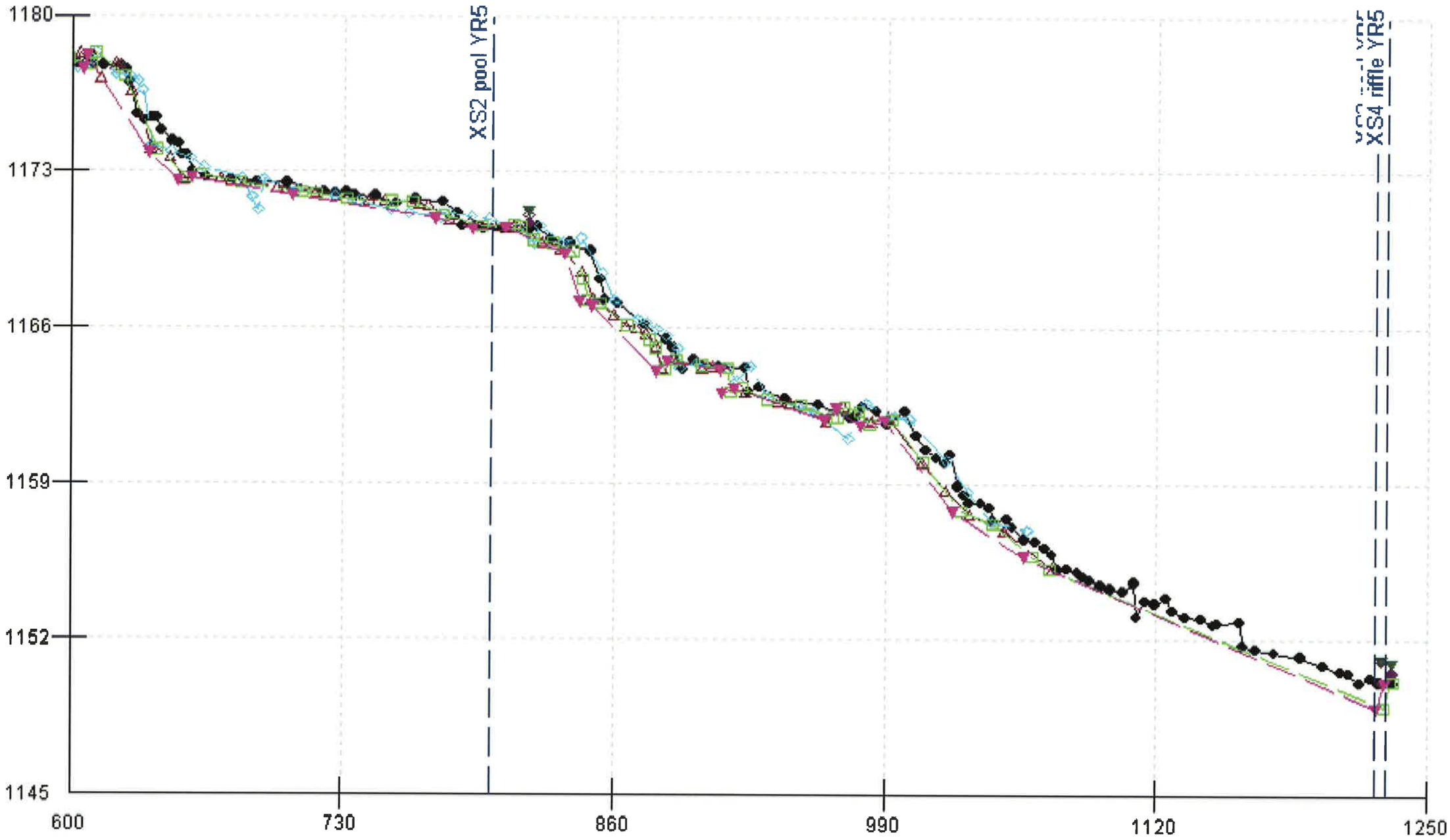
Silver Creek Unnamed Tributary A - Year 5 Profile - 20 Sep 2011



Silver Creek Unnamed Tributary A - Year 5 Profile - 20 Sep 2011

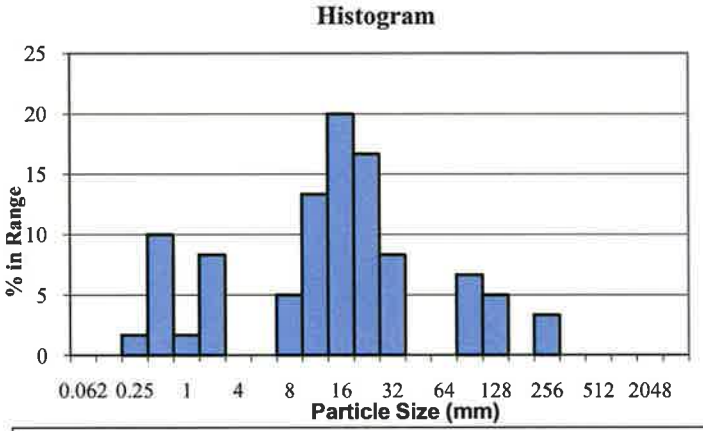


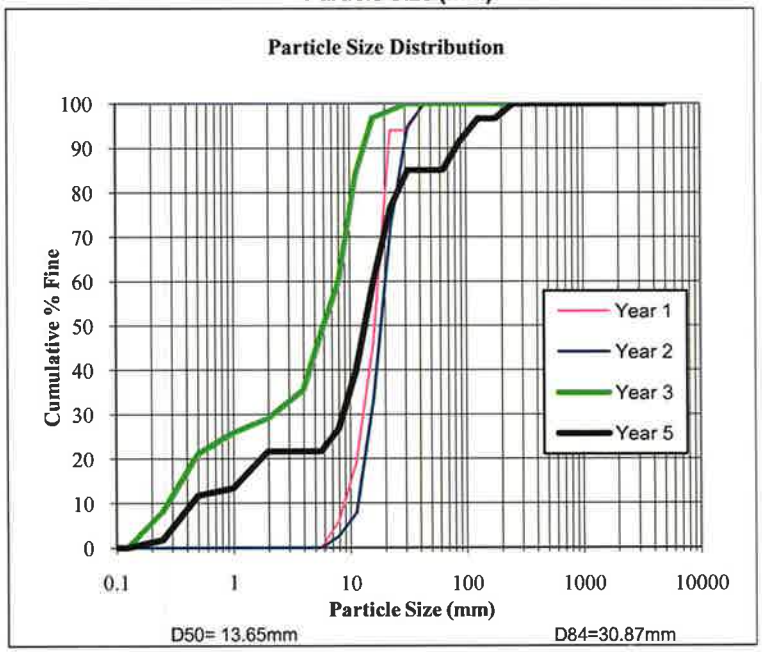
Silver Creek Unnamed Tributary A - Year 5 Profile - 20 Sep 2011



Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	1	2	2
Medium Sand	0.25-0.5	6	10	12
Coarse Sand	0.5-1.0	1	2	13
Very Coarse Sand	1.0-2.0	5	8	22
Very Fine Gravel	2.0-4.0	0	0	22
Fine Gravel	4.0-5.7	0	0	22
Fine Gravel	5.7-8.0	3	5	27
Medium Gravel	8.0-11.3	8	13	40
Medium Gravel	11.3-16.0	12	20	60
Coarse Gravel	16.0-22.6	10	17	77
Coarse Gravel	22.6-32	5	8	85
Very Coarse Gravel	32-45	0	0	85
Very Coarse Gravel	45-64	0	0	85
Small Cobble	64-90	4	7	92
Small Cobble	90-128	3	5	97
Large Cobble	128-180	0	0	97
Large Cobble	180-256	2	3	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	

Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	Mainstem	**X Sec**	1
Date	9/16/11	**Sta No.**	2+05

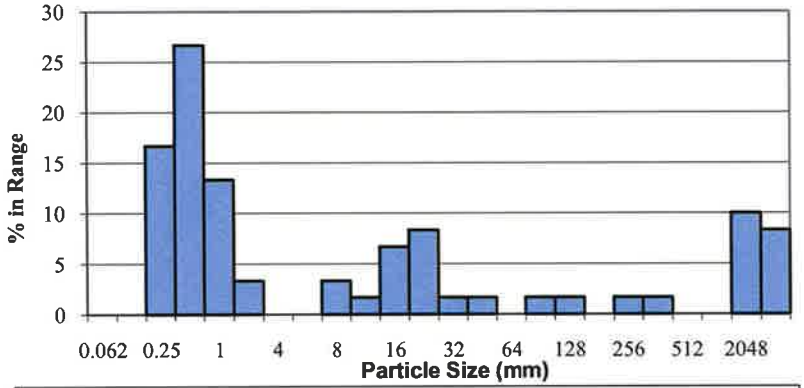


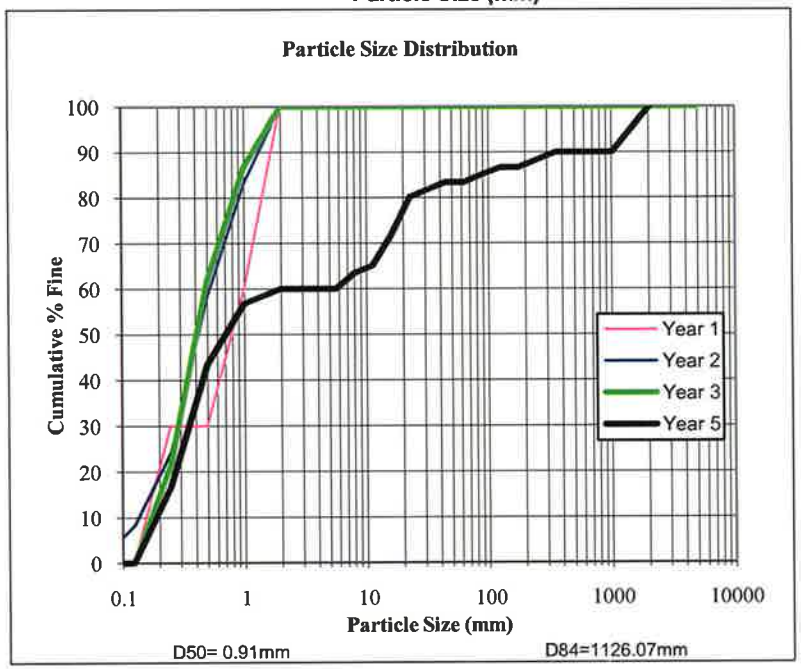


Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	10	17	17
Medium Sand	0.25-0.5	16	27	43
Coarse Sand	0.5-1.0	8	13	57
Very Coarse Sand	1.0-2.0	2	3	60
Very Fine Gravel	2.0-4.0	0	0	60
Fine Gravel	4.0-5.7	0	0	60
Fine Gravel	5.7-8.0	2	3	63
Medium Gravel	8.0-11.3	1	2	65
Medium Gravel	11.3-16.0	4	7	72
Coarse Gravel	16.0-22.6	5	8	80
Coarse Gravel	22.6-32	1	2	82
Very Coarse Gravel	32-45	1	2	83
Very Coarse Gravel	45-64	0	0	83
Small Cobble	64-90	1	2	85
Small Cobble	90-128	1	2	87
Large Cobble	128-180	0	0	87
Large Cobble	180-256	1	2	88
Small Boulder	256-362	1	2	90
Small Boulder	362-512	0	0	90
Medium Boulder	512-1024	0	0	90
Large Boulder	1024-2048	6	10	100
Bedrock	<2048	5	8	108
Totals		60	100	

Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	Mainstem	**X Sec**	2
Date	9/15/11	**Sta No.**	2+30

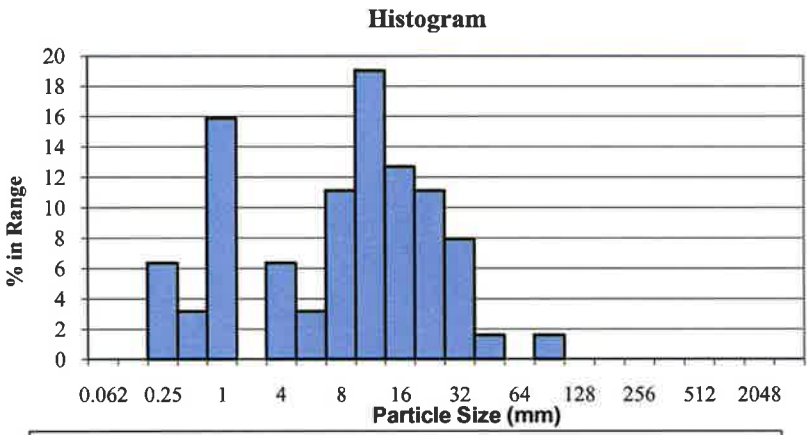
Histogram

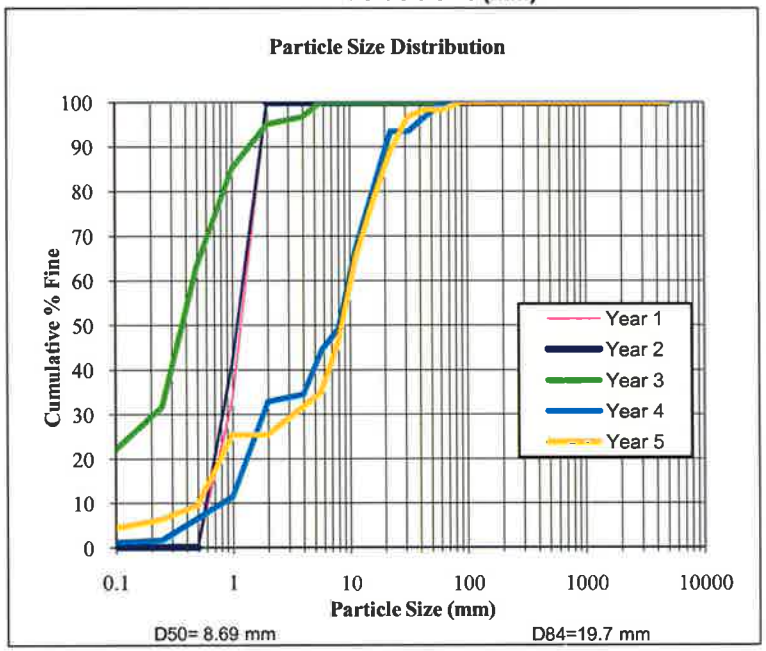




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	4	6	6
Medium Sand	0.25-0.5	2	3	10
Coarse Sand	0.5-1.0	10	16	25
Very Coarse Sand	1.0-2.0	0	0	25
Very Fine Gravel	2.0-4.0	4	6	32
Fine Gravel	4.0-5.7	2	3	35
Fine Gravel	5.7-8.0	7	11	46
Medium Gravel	8.0-11.3	12	19	65
Medium Gravel	11.3-16.0	8	13	78
Coarse Gravel	16.0-22.6	7	11	89
Coarse Gravel	22.6-32	5	8	97
Very Coarse Gravel	32-45	1	2	98
Very Coarse Gravel	45-64	0	0	98
Small Cobble	64-90	1	2	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		63	100	

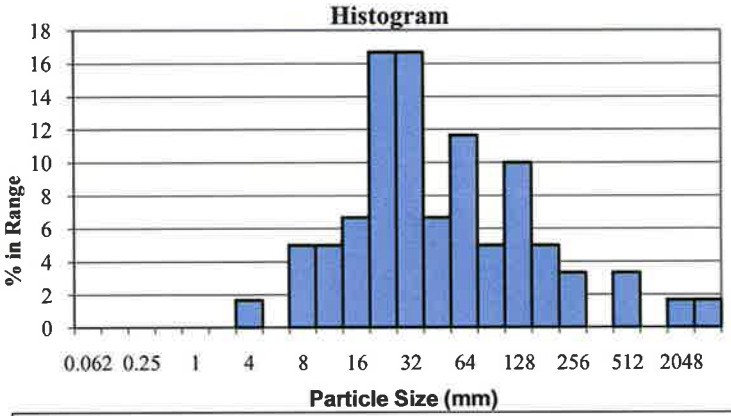
Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	Mainstem	**X Sec**	3
Date	9/15/11	**Sta No.**	11+18

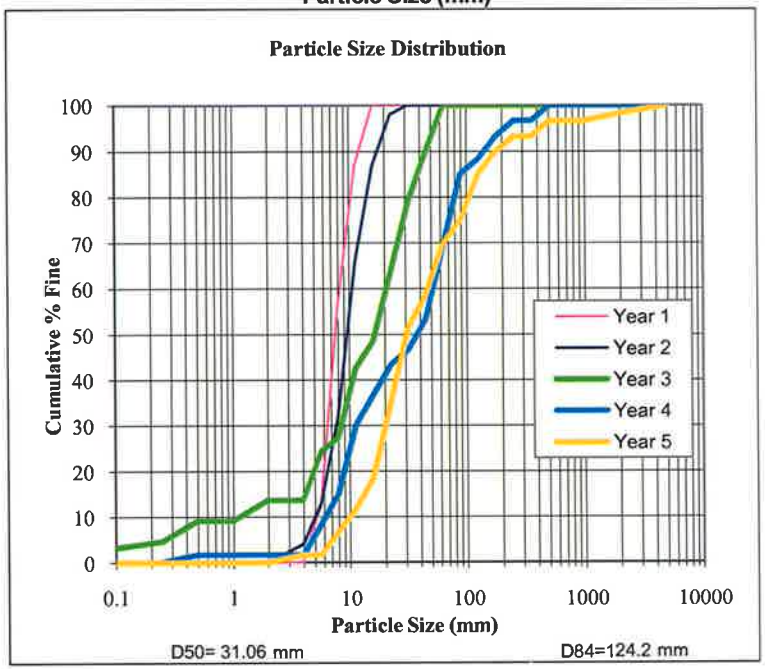




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	0	0	0
Coarse Sand	0.5-1.0	0	0	0
Very Coarse Sand	1.0-2.0	0	0	0
Very Fine Gravel	2.0-4.0	1	2	2
Fine Gravel	4.0-5.7	0	0	2
Fine Gravel	5.7-8.0	3	5	7
Medium Gravel	8.0-11.3	3	5	12
Medium Gravel	11.3-16.0	4	7	18
Coarse Gravel	16.0-22.6	10	17	35
Coarse Gravel	22.6-32	10	17	52
Very Coarse Gravel	32-45	4	7	58
Very Coarse Gravel	45-64	7	12	70
Small Cobble	64-90	3	5	75
Small Cobble	90-128	6	10	85
Large Cobble	128-180	3	5	90
Large Cobble	180-256	2	3	93
Small Boulder	256-362	0	0	93
Small Boulder	362-512	2	3	97
Medium Boulder	512-1024	0	0	97
Large Boulder	1024-2048	1	2	98
Bedrock	<2048	1	2	100
Totals		60	100	

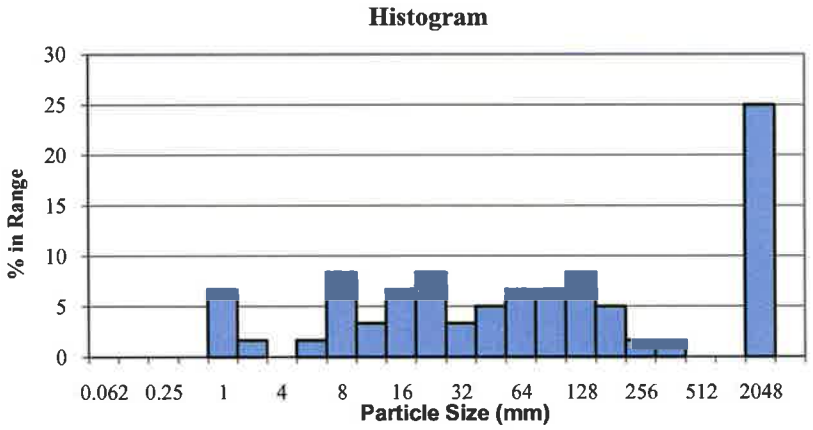
Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	Mainstem	**X Sec**	4
Date	9/30/10	**Sta No.**	12+25

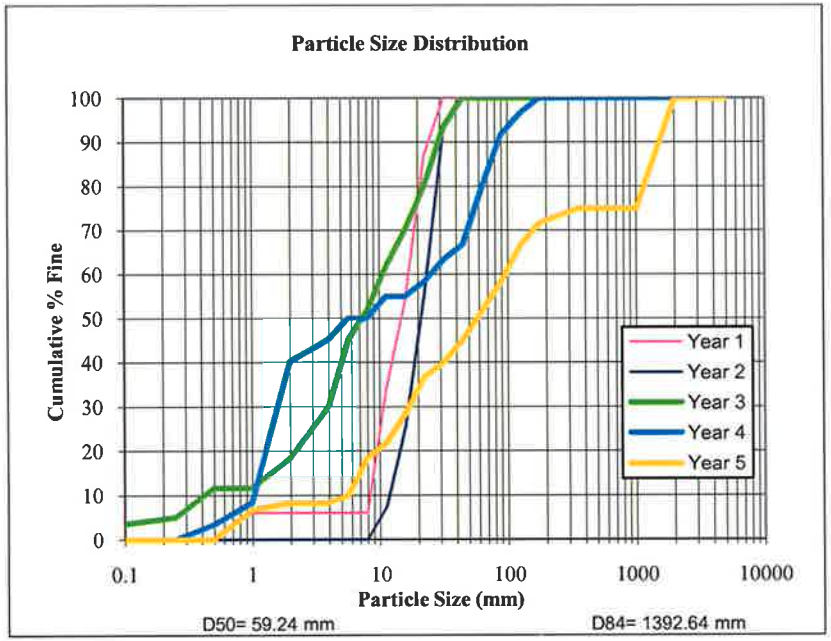




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	0	0	0
Coarse Sand	0.5-1.0	4	7	7
Very Coarse Sand	1.0-2.0	1	2	8
Very Fine Gravel	2.0-4.0	0	0	8
Fine Gravel	4.0-5.7	1	2	10
Fine Gravel	5.7-8.0	5	8	18
Medium Gravel	8.0-11.3	2	3	22
Medium Gravel	11.3-16.0	4	7	28
Coarse Gravel	16.0-22.6	5	8	37
Coarse Gravel	22.6-32	2	3	40
Very Coarse Gravel	32-45	3	5	45
Very Coarse Gravel	45-64	4	7	52
Small Cobble	64-90	4	7	58
Small Cobble	90-128	5	8	67
Large Cobble	128-180	3	5	72
Large Cobble	180-256	1	2	73
Small Boulder	256-362	1	2	75
Small Boulder	362-512	0	0	75
Medium Boulder	512-1024	0	0	75
Large Boulder	1024-2048	15	25	100
Bedrock	<2048	0	0	100
Totals		60	100	

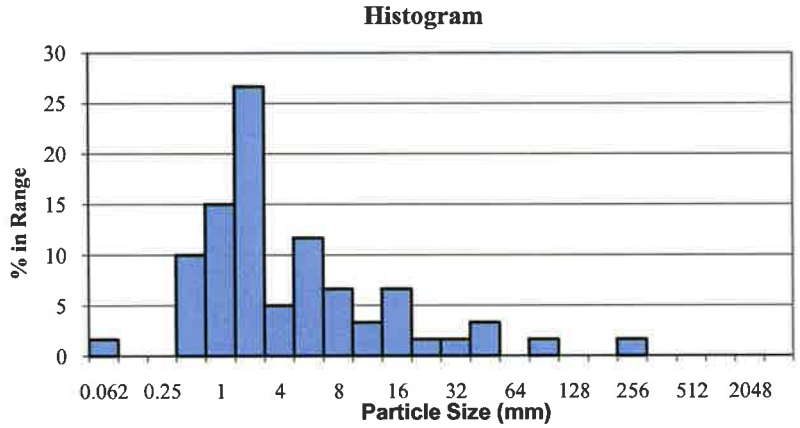
Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	Mainstem	**X Sec**	5
Date	9/15/11	**Sta No.**	27+62

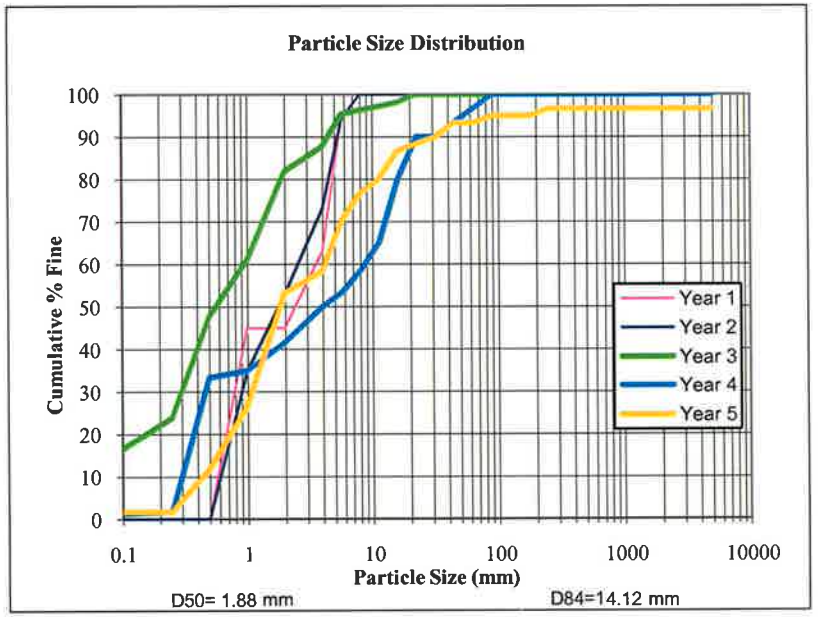




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	1	2	2
Very Fine Sand	0.062-0.125	0	0	2
Fine Sand	0.125-0.25	0	0	2
Medium Sand	0.25-0.5	6	10	12
Coarse Sand	0.5-1.0	9	15	27
Very Coarse Sand	1.0-2.0	16	27	53
Very Fine Gravel	2.0-4.0	3	5	58
Fine Gravel	4.0-5.7	7	12	70
Fine Gravel	5.7-8.0	4	7	77
Medium Gravel	8.0-11.3	2	3	80
Medium Gravel	11.3-16.0	4	7	87
Coarse Gravel	16.0-22.6	1	2	88
Coarse Gravel	22.6-32	1	2	90
Very Coarse Gravel	32-45	2	3	93
Very Coarse Gravel	45-64	0	0	93
Small Cobble	64-90	1	2	95
Small Cobble	90-128	0	0	95
Large Cobble	128-180	0	0	95
Large Cobble	180-256	1	2	97
Small Boulder	256-362	0	0	97
Small Boulder	362-512	0	0	97
Medium Boulder	512-1024	0	0	97
Large Boulder	1024-2048	0	0	97
Bedrock	<2048	2	0	97
Totals		60	97	

Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	Mainstem	**X Sec**	6
Date	9/15/11	**Sta No.**	27+75

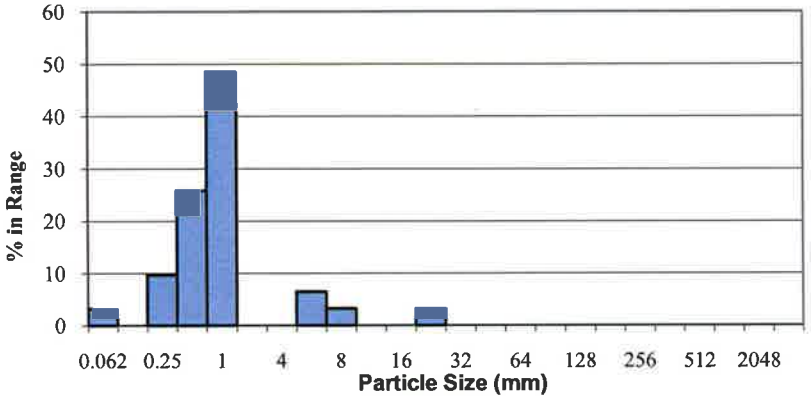


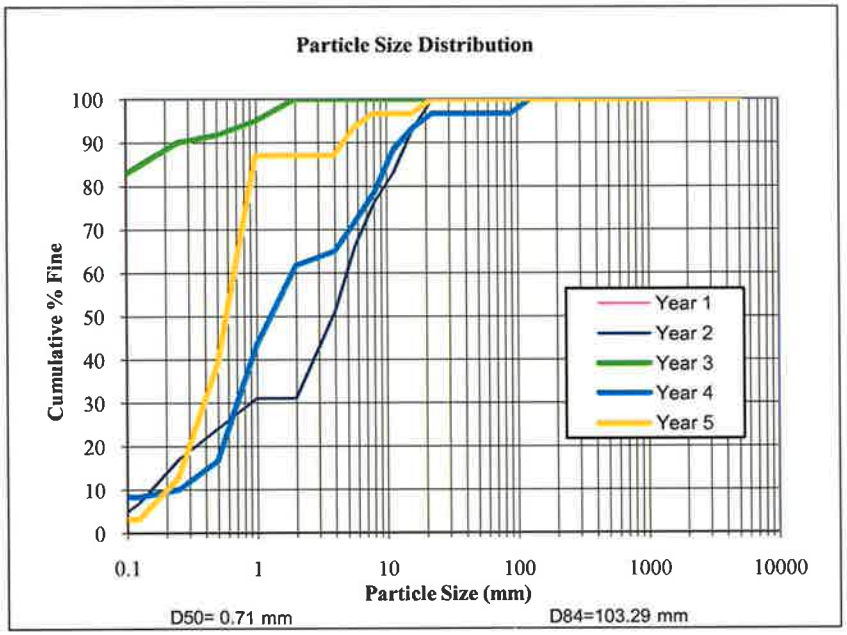


Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	2	3	3
Very Fine Sand	0.062-0.125	0	0	3
Fine Sand	0.125-0.25	6	10	13
Medium Sand	0.25-0.5	16	26	39
Coarse Sand	0.5-1.0	30	48	87
Very Coarse Sand	1.0-2.0	0	0	87
Very Fine Gravel	2.0-4.0	0	0	87
Fine Gravel	4.0-5.7	4	6	94
Fine Gravel	5.7-8.0	2	3	97
Medium Gravel	8.0-11.3	0	0	97
Medium Gravel	11.3-16.0	0	0	97
Coarse Gravel	16.0-22.6	2	3	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		62	100	

Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	UTA	**X Sec**	DS of 1
Date	9/15/11	**Sta No.**	3+45

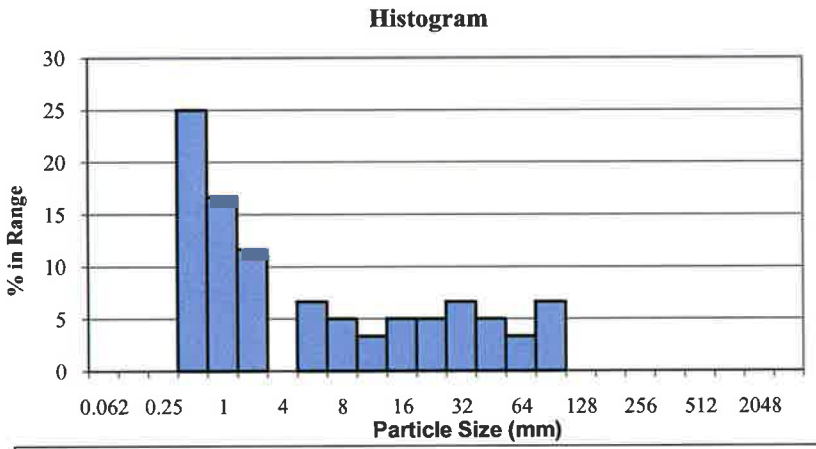
Histogram

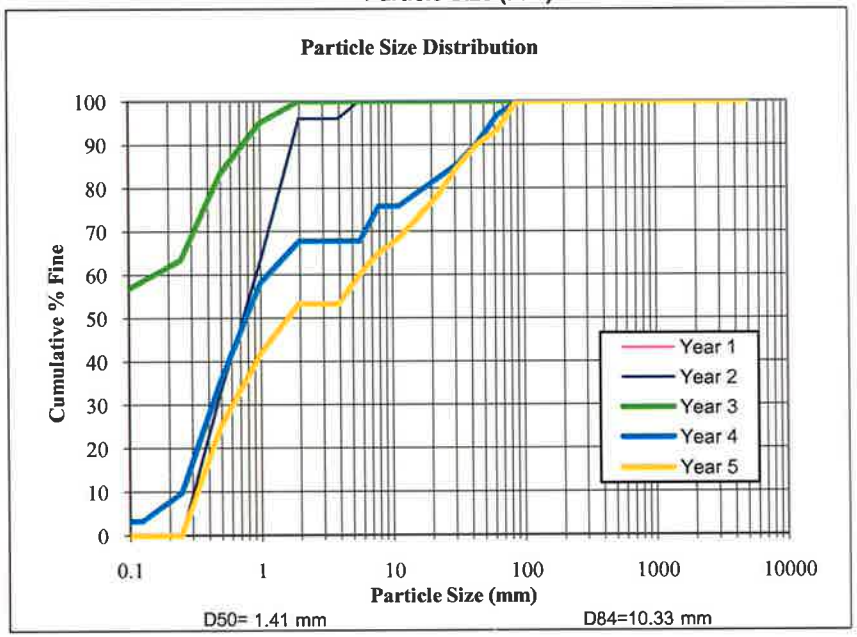




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	15	25	25
Coarse Sand	0.5-1.0	10	17	42
Very Coarse Sand	1.0-2.0	7	12	53
Very Fine Gravel	2.0-4.0	0	0	53
Fine Gravel	4.0-5.7	4	7	60
Fine Gravel	5.7-8.0	3	5	65
Medium Gravel	8.0-11.3	2	3	68
Medium Gravel	11.3-16.0	3	5	73
Coarse Gravel	16.0-22.6	3	5	78
Coarse Gravel	22.6-32	4	7	85
Very Coarse Gravel	32-45	3	5	90
Very Coarse Gravel	45-64	2	3	93
Small Cobble	64-90	4	7	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	

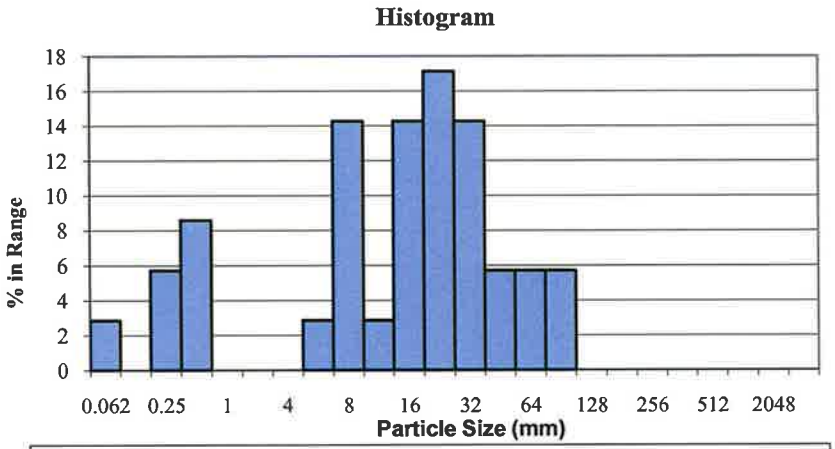
Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	UTA	**X Sec**	2
Date	9/15/11	**Sta No.**	7+80

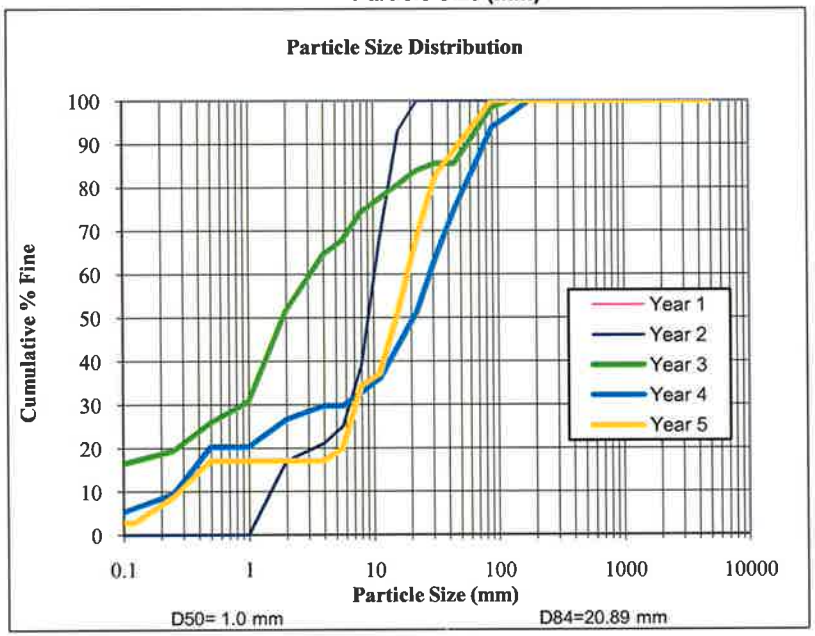




Pebble Count - Riffle				
Material	Particle Size (mm)	Count	% in Range	% Cumulative
Silt/Clay	<0.062	2	3	3
Very Fine Sand	0.062-0.125	0	0	3
Fine Sand	0.125-0.25	4	6	9
Medium Sand	0.25-0.5	6	9	17
Coarse Sand	0.5-1.0	0	0	17
Very Coarse Sand	1.0-2.0	0	0	17
Very Fine Gravel	2.0-4.0	0	0	17
Fine Gravel	4.0-5.7	2	3	20
Fine Gravel	5.7-8.0	10	14	34
Medium Gravel	8.0-11.3	2	3	37
Medium Gravel	11.3-16.0	10	14	51
Coarse Gravel	16.0-22.6	12	17	69
Coarse Gravel	22.6-32	10	14	83
Very Coarse Gravel	32-45	4	6	89
Very Coarse Gravel	45-64	4	6	94
Small Cobble	64-90	4	6	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		70	100	

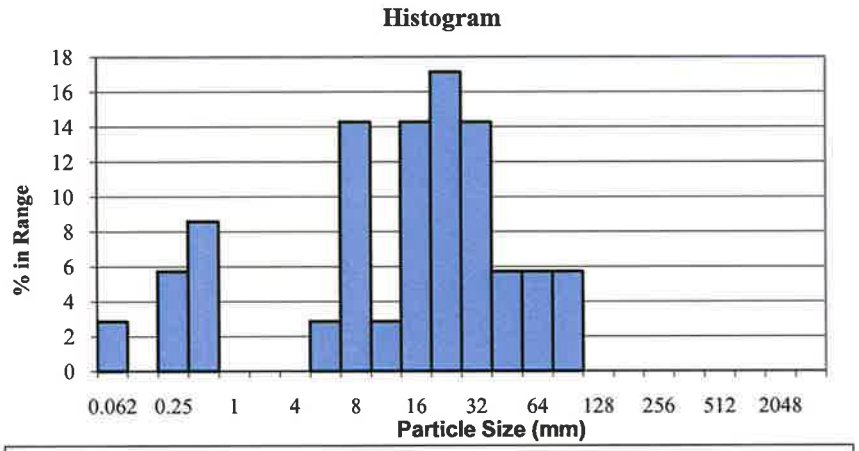
Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	UTA	X Sec	3
Date	9/15/11	Sta No.	11+80

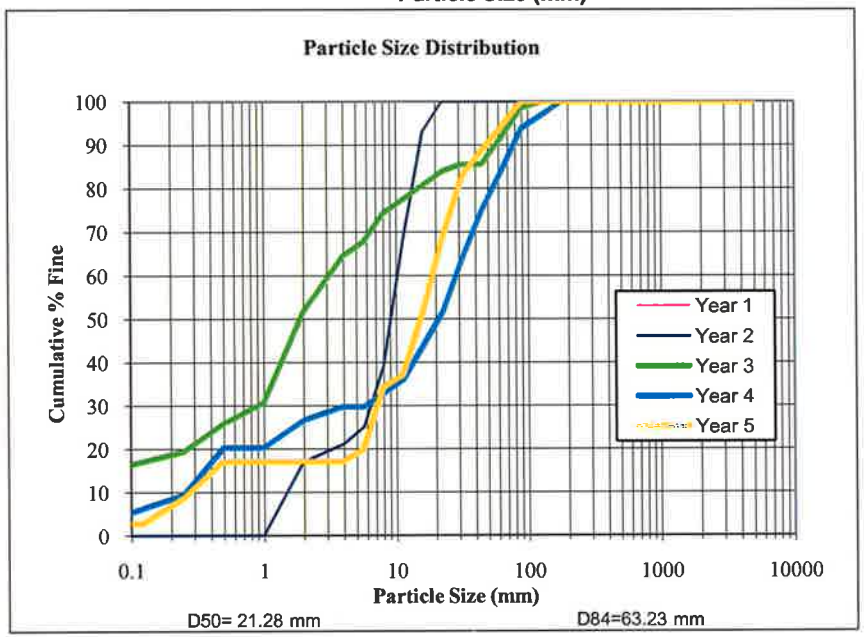




Pebble Count - Riffle				
Material	Particle Size (mm)	Count	% in Range	% Cumulative
Silt/Clay	<0.062	2	3	3
Very Fine Sand	0.062-0.125	0	0	3
Fine Sand	0.125-0.25	4	6	9
Medium Sand	0.25-0.5	6	9	17
Coarse Sand	0.5-1.0	0	0	17
Very Coarse Sand	1.0-2.0	0	0	17
Very Fine Gravel	2.0-4.0	0	0	17
Fine Gravel	4.0-5.7	2	3	20
Fine Gravel	5.7-8.0	10	14	34
Medium Gravel	8.0-11.3	2	3	37
Medium Gravel	11.3-16.0	10	14	51
Coarse Gravel	16.0-22.6	12	17	69
Coarse Gravel	22.6-32	10	14	83
Very Coarse Gravel	32-45	4	6	89
Very Coarse Gravel	45-64	4	6	94
Small Cobble	64-90	4	6	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		70	100	

Silver Creek Stream Restoration EEP Project No. D05016-1			
Reach	UTA	X Sec	DS of 4
Date	9/15/11	Sta No.	12+00





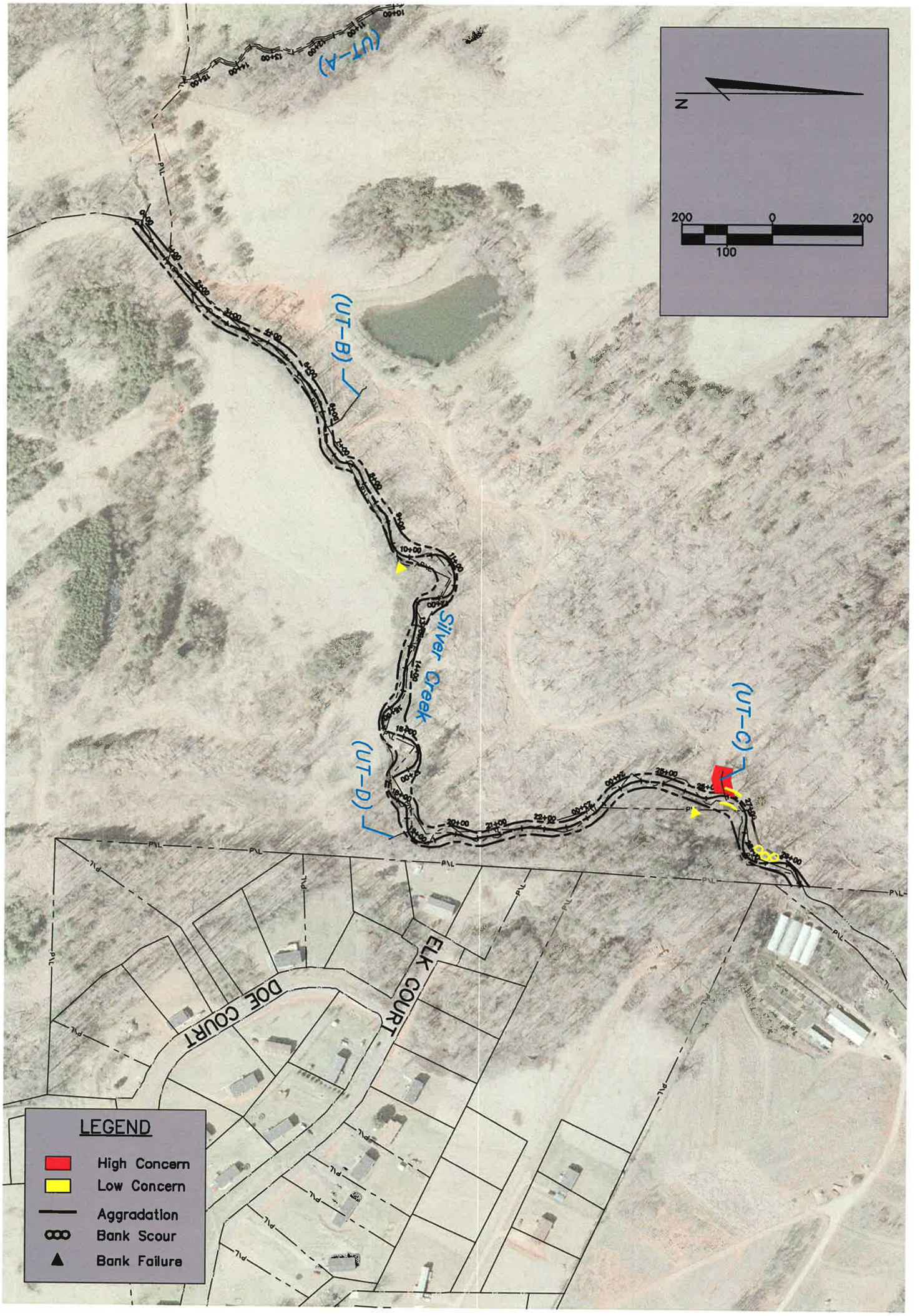
BF 1
Crest Gage on Silver Creek UT (Year 3).
(EMH&T, 9/21/09)

BF 2
Crest Gage on Silver Creek Mainstem (Year 3).
(EMH&T, 9/21/09)

BF 3
Crest Gage on Silver Creek UT (Year4).
(EMH&T, 5/12/10)

BF 4
Crest Gage on Silver Creek Mainstem (Year 4).
(EMH&T, 5/12/10)

BF 5
Crest Gage on Silver Creek Mainstem (Year 5).
(EMH&T, 5/20/11)



EMH&T
Evans, Mechwart, Hambleton & Tilton, Inc.
Engineers • Surveyors • Planners • Scientists
5500 New Albany Road, Columbus, OH 43054
Phone: 614.775.4500 Fax: 614.775.4800

BURKE COUNTY, NORTH CAROLINA

SILVER CREEK AND UNNAMED TRIBUTARY

MONITORING

APPENDIX B-1

STREAM PROBLEM AREA PLAN VIEW

Date:	December, 2011
Scale:	1" = 200'
Job No:	2007-1898
Sheet:	1/2

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BURKE COUNTY, NORTH CAROLINA

SILVER CREEK AND UNNAMED TRIBUTARY

MONITORING

APPENDIX B-2

STREAM PROBLEM AREA PLAN VIEW

Date:	December, 2011
Scale:	1" = 200'
Job No:	2007-1898
Sheet:	2/2

SPA 1
Area of scour on the right bank of Silver Creek near station 28+50.
(EMH&T, 9/16/11)

SPA 2
New cattle watering access point located immediately upstream of the upstream terminus of UT-C within project boundaries. Photo taken facing upstream on UT-C at the nexus of the cattle watering access point and the limit of the project boundary.
(EMH&T, 5/20/11)

SPA 3
New cattle watering access point located immediately upstream of the upstream terminus of UT-C within project boundaries. Photo taken facing downstream on UT-C at the nexus of the cattle watering access point and the limit of the project boundary (fence). The rerouting of the UT-C flow around the project fence can be seen in the above photograph.
(EMH&T, 5/20/11)

SPA 4
Sedimentation along the left bank of Silver Creek mainstem at station 26+25 (at the confluence of Silver Creek and Unnamed Tributary C (UT –C). This aggradation is being caused by excessive sediment loading on UT-C which has resulted from a new cattle watering access point located further upstream on the tributary.
(EMH&T, 9/16/11)

SPA 5
Bank failure and sloughing along the right bank at station 10+00 on the Silver Creek mainstem.
(EMH&T, 9/16/11)

APPENDIX C

UT-A Cattle Crossing Agreement Documentation

1.Cattle Crossing Agreement Letter

2. UT1 Cattle Crossing Photos (2011)

Wetlands Resource Center
3970 Bowen Road
Canal Winchester, Ohio 43110

December 10, 2010

Mr. Guy Pearce
NC EEP
1652 Mail Service Center
Raleigh, NC 27699-1652

Re: Silver Creek Stream Restoration

Dear Mr. Pearce:

Please allow this letter to confirm that Wetlands Resource Center is in the process of making the following improvements to the above referenced project.

- Provide offline watering for cattle. WRC will work with the local NRCS office to provide offline watering that meets their recommended specifications.
- The existing cattle watering/crossing located on the tributary stream will be modified so that it can only be utilized as a cattle crossing. After the modifications are complete the cattle will no longer have direct access to the stream.
- WRC will continue invasive species control and supplemental planting in the tributary stream corridor.

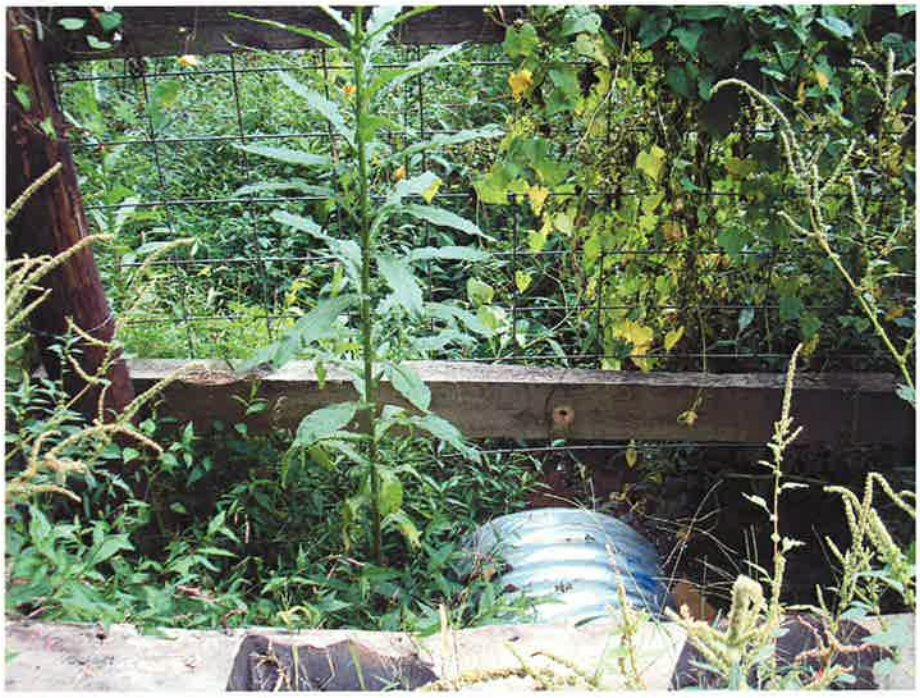
It is out belief that these improvements while not technically required as part of the project will provide additional benefits to the project.

If you have any questions or require any additional information please feel free to give me a call at (614) 864-7511.

Thank you,

Cal Miller
Managing Member

Cattle Crossing Photo - 1
UT1 as it enters culvert of newly constructed cattle crossing.
(EMH&T, 9/16/11)



Cattle Crossing Photo - 2
UT1 as it exits culvert of newly constructed cattle crossing.
(EMH&T, 9/16/11)