Year 1 Monitoring Report for Stream Restoration of Thompsons Fork and Unnamed Tributary

McDowell County, NC
SCO # D06030-A

Prepared for:
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Submitted: December 2009

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I. EXECUTIVE SUMMARY

The Thompsons Fork stream restoration project is located near the City of Marion, in Nebo Township, McDowell County, North Carolina. Pre-restoration land use was primarily agricultural, resulting in impaired, channelized, eroding, incised and entrenched stream channels. The project reaches include the restoration of 2,727 linear feet of the Thompsons Fork mainstem and 1,948 linear feet of an unnamed tributary (UT); also included is 390 linear feet of enhancement and 356 linear feet of preservation along UT. Restoration of the project streams, completed during May 2008, provided the desired habitat and stability features required to improve and enhance the ecologic health of the streams for the long-term. The following report documents the Year 1 Annual Monitoring for this project.

Vegetative monitoring was completed in September 2009 following the Carolina Vegetation Survey methodology. Stem counts completed at ten (10) vegetation plots show an average density of 704 stems per acre for the site. This density exceeds the success criteria of 320 stems/acre after three years of monitoring. All individual plots had stem densities meeting the minimum requirement. Additionally, a large number of recruit stems were found in each plot. A few vegetative problem areas of low concern were noted in the project area, included scattered populations of problematic species and sparse vegetative cover. The problematic species have been proactively managed by herbicide treatment, with follow-up treatment planned for the spring; no maintenance is required for the areas of sparse vegetation at this time.

Monitoring of the streams identified some problem areas along the project reaches. A single area of erosion has resulted in bank scour along the outside of a meander bend on the mainstem of Thompsons Fork. Narrow bars of wetland vegetation forming along the stream banks of the mainstem were noted under the aggradation feature category for future monitoring. Minor aggradation is also occurring in a few pools associated with log sills along the unnamed tributary to Thompsons Fork. None of the problem areas warrant maintenance at this time.

The visual stream stability assessment revealed that the majority of in-stream structures are functioning as designed and built on the Thompsons Fork mainstem and unnamed tributary. Bedform features are evolving along the restored reaches compared to as-built conditions, as shown on the long-term longitudinal profiles. Dimensional measurements of the monumented cross-sections remain stable when compared to as-built conditions. The comparison of the As-Built and Year 1 long-term stream monitoring profile data show stability with minimal change from as-built conditions. Constructed riffles are stable, with median particle distributions ranging from coarse to very coarse gravel. The substrate in the pools also remained stable, with median particle distributions of very fine silt/clay material. Based on the crest gage network installed on the project reaches, one bankfull event was recorded along each reach since construction was completed.

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

Thompsons Fork Mainstem

Parameter	Pre-Restoration	As-built	Year 1
Length	**2,530 ft**	**2,727 ft**	**2,727 ft**
Bankfull Width	**20.9 ft**	**37.7 ft**	**36.3 ft**
Bankfull Max Depth	**5.1 ft**	**2.5 ft**	**2.4 ft**
Width/Depth Ratio	**7.7**	**27.1**	**28.7**
Entrenchment Ratio	**1.5**	**3.0**	**3.0**
Bank Height Ratio	**2.4**	**1.0**	**1.0**
Sinuosity	**1.12**	**1.19**	**1.19**

Unnamed Tributary to Thompsons Fork

Parameter	Pre-Restoration	As-built	Year 1
Length	**1,598 ft**	**1,948 ft**	**1,948 ft**
Bankfull Width	**13.1 ft**	**14.0 ft**	**15.4 ft**
Bankfull Max Depth	**1.1 ft**	**1.7 ft**	**1.6 ft**
Width/Depth Ratio	**16.0**	**17.4**	**18.1**
Entrenchment Ratio	**3.4**	**6.0**	**5.6**
Bank Height Ratio	**1.6**	**1.0**	**1.0**
Sinuosity	**1.09**	**1.36**	**1.36**

II. PROJECT BACKGROUND

A. Location and Setting

The project is located near the intersection of Watson Road and South Creek Road on the north side of Interstate 40, approximately 7 miles east of the City of Marion, in Nebo Township, McDowell County, North Carolina as shown on **Figure 1**. The stream channels included in this project are the Thompsons Fork mainstem and one unnamed tributary stream designated UT.

The directions to the project site are as follows:

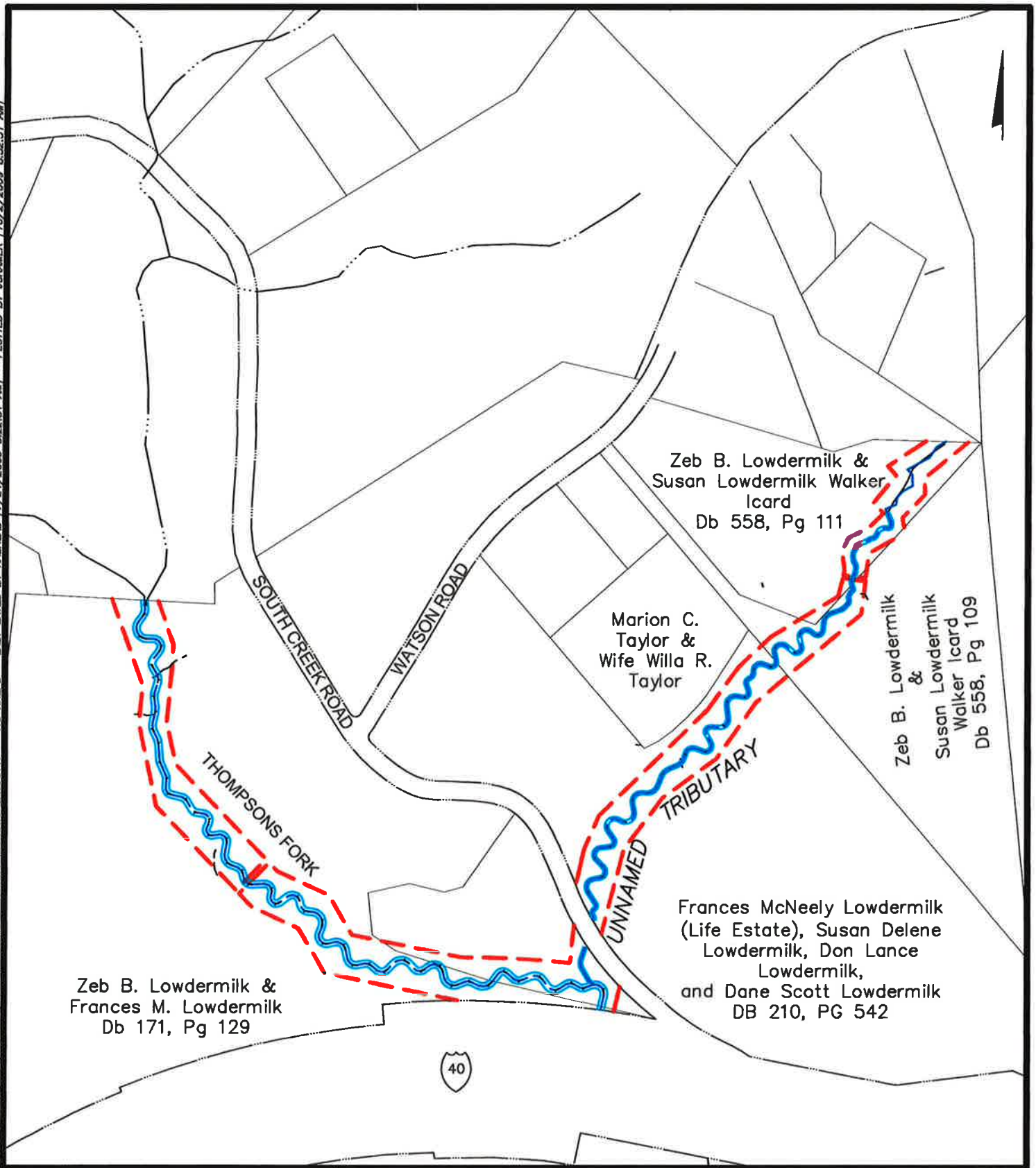
> Exit I-40 at Exit 94 and travel north on Dysartsville Road for 0.6 mile. Turn left and travel west onto US-70 for 3.2 miles, then turn left onto Watson Road. Travel 1.1 miles south on Watson Road to the intersection of South Creek Road. Zeb Lowdermilk's residence (1394 South Creek Road, Nebo, NC 28761) is located on the right (south) side of South Creek Road at the intersection of Watson Road. The project spans four tracts of land: (Tract 1) owned by Zeb B. Lowdermilk and wife Francis M. Lowdermilk (deceased); (Tract 2) owned by Francis McNeely Lowdermilk (Life Estate), Susan Delene Lowdermilk, Don Lance Lowdermilk, and Dane Scott Lowdermilk; and (Tracts 3 and 4) owned by Zeb B. Lowdermilk and daughter Susan Lowdermilk Walker Icard.

B. Project Structure, Mitigation Type, Approach and Objectives

Pre-restoration land use surrounding the project streams was predominantly agricultural, including pasture/hayland with wooded and cleared hillsides. Pre-restoration land use surrounding the Thompsons Fork restoration reach was active cattle pasture land. The pre-existing riparian corridor was absent to extremely narrow (5 to 10 feet wide) along the Thompsons Fork mainstem, widening for only a short distance near the downstream limits of the mainstem project reach. Streambanks were denuded and extremely unstable, with vertical to undercut banks up to 15 feet in height from the former farm stream crossing to the bottom of the mainstem reach.

A hayland meadow was present along the UT right bank. Along the UT left bank the riparian corridor consists of mature hardwood forested hill slope. Along the 356 linear feet of UT preservation reach, beginning at the granite outcrop spring from which the perennial UT emerges, the stream exists in a mature mixed hardwood and evergreen forest with diversified herbaceous, shrub, mid-story and canopy species present. Typical species observed along the streams and adjacent forested areas include *Alnus rugosa* (tag alder), *Platanus occidentalis* (Eastern sycamore), *Abies* species (fir), *Pinus taeda* (loblolly pine), *Pinus elliottii* (slash pine), *Ostrya virginiana* (Eastern hophornbeam), *Diospyros virginiana* (persimmon), *Kalmia latifolia* (mountain laurel), *Cornus amomum* (silky dogwood), *Ilex opaca* (American holly), and the invasive species *Ligustrum sinense* (Chinese privet) and *Lonicera japonica* (Japanese honeysuckle).

Prior to restoration, a combination of historical and recent anthropogenic factors and practices impacted the channel along the impaired mainstem reach, resulting in its unstable Rosgen G4 stream type. The deeply incised and entrenched condition of the channel prior to restoration was attributed to management of the riparian corridor for hay production, cattle intrusion resulting in



\\CMHDATA01\PROJECT01\20061398\20061398ENV\DWG\EXHIBITS\YEAR 1-FIGURE 1-VICINITY MAP.DWG<LAYOUT1> - NO XREFS - LAST SAVED BY RASHEAD [7/24/2009 9:22:31 AM] - PLOTTED BY JCRAMER [10/2/2009 8:52:51 AM]

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MCDOWELL COUNTY, NORTH CAROLINA
THOMPSON FORK RESTORATION
FIGURE 1: SITE VICINITY MAP
N.C. ECOSYSTEM ENHANCEMENT PROGRAM

Date: July, 2009

Not To Scale

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streambank hoof shear and vegetative denuding from grazing and browsing, combined with the erosive nature of the discharge of "sediment hungry" water from the 30-inch reinforced concrete pipe outfall from Muddy Creek Flood Control Dam Number 8. Additionally, a shift in stream base level occurred during the construction of Interstate 40 (I-40), when the invert of the culvert carrying Thompsons Fork under I-40 was set 12 to 15 feet below the pre-disturbance invert of the streambed, triggering channel incision, head cutting, floodplain abandonment, and lowering of the water table. The Thompsons Fork mainstem unstable bank height ratio, entrenchment ratio, channel slope (0.0039 ft/ft) greater than valley slope (0.0031 ft/ft) and poorly defined bedform features showed the instability of the deeply incised, unstable, degrading stream channel disconnected from its floodplain. Mid-channel, lateral, and transverse sand and gravel bars were present at locations throughout the mainstem reach, demonstrating the stream lacked stable pattern, profile, dimension, capacity and competency to entrain the high sediment load. 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, steep, denuded streambanks, resulting in accelerated erosion rates. Utilizing the near-bank stress method algorithm, it was estimated 2,076 cubic yards per year (or 2,700 tons per year) of sediment was being eroded from the streambanks along the mainstem.

The UT channel was a classic Rosgen Type I valley confined, A1-A2 stream type transitioning to a Type II colluvial valley, B3 stream type at the point where the stream emerges from its mixed deciduous hardwood and evergreen forested corridor into an open meadow at the top of the impaired reach. The forested reach segment has some bedrock control, in-stream boulders with negligible instream woody debris accumulation. The indigenous, well established, healthy riparian vegetative communities in the channel and in the overbank regions provide extremely stable channel conditions for the forested reach, and are preserved within the conservation easement recorded for the project. Agricultural land use adjacent to the stream corridor together with aggressive vegetative management resulted in steep to undercut streambanks, accelerated streambank erosion and channel incision along the Enhancement Level II and Priority Level I Restoration reaches. The unstable streambanks were contributing large volumes of suspended sediment and bedload material to the larger Thompsons Fork mainstem. It was estimated 291 cubic yards per year (or 378 tons per year) of sediment was being eroded from streambanks along the UT under existing conditions.

The mitigation goals and objectives for the project streams are related to restoring stable physical and biological function of the project streams beyond pre-restoration (impaired) conditions. Pre-restoration conditions consisted of impaired, channelized, eroding, incised and entrenched stream channels. The specific mitigation goals for the project are listed below.

- Provide stable stream channels with features inherent of ecologically diverse environments, including appropriate stream-bed features, such as pools and riffles, and a riparian corridor with diverse and native vegetation. Utilize reference reach information as the foundation of the restoration design.
- Provide stream channels with the appropriate geometry and slope to convey bankfull flows while entraining bedload and suspended sediment readily available to the streams.
- Provide a connection between the bankfull channel and the floodprone area, and stable channel geometry and protective cover to prevent erosion.
- Provide a minimization of future land use impacts to the streams and a perpetual stream corridor protection via livestock exclusion fencing and restrictive conservation easement conveyances to the State of North Carolina.

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

Thompsons Fork Mainstem:

- Reversed the effects of channelization through a combination of Priority I and Priority II restoration techniques. The restoration has changed the average width/depth ratio from 7.7 to 28.7.
- Restored a natural and stable sinuosity to the stream channel, increasing the sinuosity of the channel from 1.1 to 1.2, and providing a more stable relationship between the valley and bankfull slopes (the bankfull slope was higher than the valley slope in the pre-restoration condition and is now less than the valley slope with the completed restoration).
- Stabilized eroding streambanks by providing an appropriately sized channel with stable channel bank slopes with a combination of embedded stone, natural fabrics and hearty vegetation as protective cover. The average Bank Height Ratio has been changed from 2.36 to 1.0.
- Provided a re-connection between the restored stream channel and the adjacent floodprone area by both raising the stream bed and excavating the adjacent floodplain. The completed restoration changed the average entrenchment ratio from 1.53 to 3.0.
- Created instream aquatic habitat features such as deep pools supported by riffles, including rock cross vanes with deep pools to transition the channel thalweg from the restored reach to the downstream existing channel.
- Re-vegetated the riparian corridor with indigenous trees and shrubs and preservation of existing riparian corridors where possible.

Unnamed Tributary (UT):

- Reversed the effects of channelization through a combination of Priority I and Priority II restoration techniques, as well as Enhancement Level I activities and Preservation of a short reach at the upstream end of the project. The average width/depth ratio of the restored stream channel is 18.1. In the restoration reach, stable pattern, profile and dimension were all restored to the stream channel. In the enhancement reach, a stable profile was provided and dimension of the stream channel was modified accordingly. The preservation reach is in a stable and heavily wooded corridor that will be protected by the conservation easement for the project.
- Restored a natural and stable sinuosity to the stream channel, increasing the sinuosity of the channel from 1.1 to more than 1.3, and providing a more stable relationship between the valley and bankfull slopes (the bankfull and valley slopes were nearly identical in the pre-restoration condition and is substantially less than the valley slope with the completed restoration).
- Stabilized eroding streambanks by providing an appropriately sized channel with stable channel bank slopes. The average Bank Height Ratio has been changed from 1.63 to 1.0.

- Provided a re-connection between the restored stream channel and the adjacent floodprone area by both raising the stream bed and excavating the adjacent floodplain. The completed restoration changed the average entrenchment ratio from 3.4 to 5.6.
- Created instream aquatic habitat features such as pools supported a combination of riffles and step-log structures.
- Re-vegetated the riparian corridor with indigenous trees and shrubs and preservation of existing riparian corridors where possible.

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

Table I. Project Structure Table Thompsons Fork Stream Restoration / EEP Project No. D06030-A	
Project Segment/Reach ID	**Linear Footage or Acreage**
Thompsons Fork Mainstem	2,727 ft
Unnamed Tributary (UT)	2,694 ft
TOTAL	**5,421 ft**

Table II. Project Mitigation Objectives Table Thompsons Fork Stream Restoration / EEP Project No. D06030-A					
Project Segment/ Reach ID	**Mitigation Type**	**Linear Footage or Acreage**	**Mitigation Ratio**	**Mitigation Units**	**Comment**
Thompsons Fork Mainstem	Priority Level 1 Restoration	2,727 ft	1.0	2,727 ft	Restore dimension, pattern, and profile
UT	Preservation	356 ft	5.0	71 ft	Preserved within the conservation easement
UT	Enhancement Level 1	390 ft	1.5	260 ft	Restore profile and dimension, step-pool bank stabilization
UT	Priority Level 2 Restoration	1,948 ft	1.0	1,948 ft	Restore dimension, pattern, and profile
TOTAL		**5,421 ft**		**5,006 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 Thompsons Fork Stream Restoration / EEP Project No. D06030-A			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration plan	Apr 2007	Aug 2006	Jun 2007
Final Design - 90%[1]	--	--	--
Construction	Jan 2008	N/A	May 2008
Temporary S&E applied to entire project area[2]	Jan 2008	N/A	May 2008
Permanent plantings	Mar 2008	N/A	Apr 2008
Mitigation plan/As-built	May 2008	Jun 2008	Oct 2008
Year 1 monitoring	2009	Sep 2009 (vegetation) Jul 2009 (geomorphology)	Dec 2009
Year 2 monitoring	2010		
Year 3 monitoring	2011		
Year 4 monitoring	2012		
Year 5 monitoring	2013		

[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.

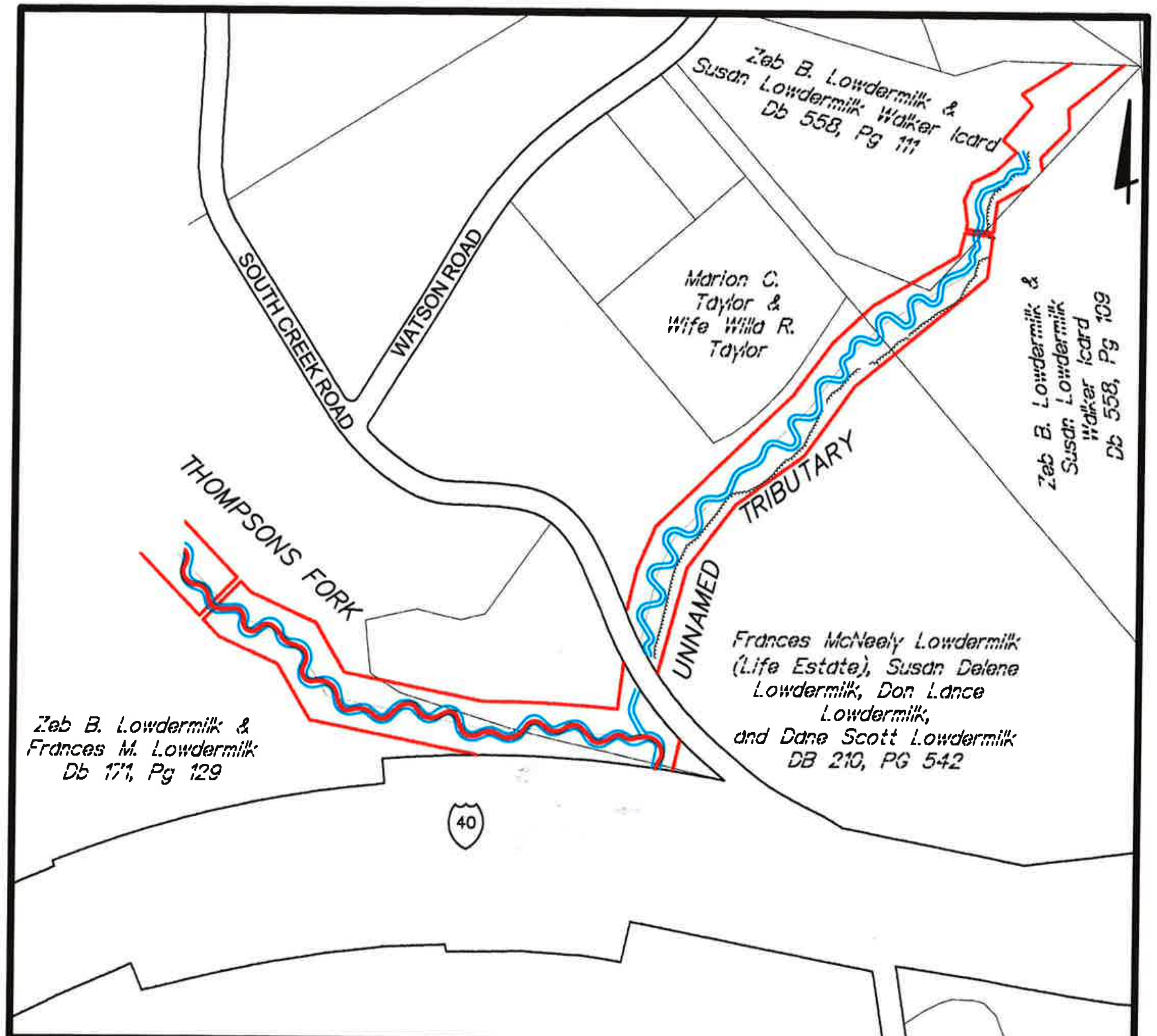
Table IV. Project Contact Table Thompsons Fork Stream Restoration / EEP Project No. D06030-A	
Designer	Evans, Mechwart, Hambleton & Tilton, Inc. 5500 New Albany Road, Columbus, OH 43054
Construction Contractor	South Mountain Forestry 6624 Roper Hollow, Morganton, NC 28655
Monitoring Performers	Evans, Mechwart, Hambleton & Tilton, Inc. 5500 New Albany Road, Columbus, OH 43054
Stream Monitoring POC	Warren E. Knotts, EMH&T
Vegetation Monitoring POC	Holly M. Blunck, EMH&T

Table V. Project Background Table Thompsons Fork Stream Restoration / EEP Project No. D06030-A	
Project County	McDowell
Drainage Area	Mainstem-7.57 sq mi UT-0.163 sq mi
Drainage Impervious Cover Estimate	2.36%
Stream Order	Mainstem-3rd UT-1st
Physiographic Region	Blue Ridge Mountains/Southern Inner Piedmont
Ecoregion	Eastern Blue Ridge Foothills
Rosgen Classification of As-built	Mainstem-C4 UT- C3b
Dominant Soil Types	Colvard loam, Evard-Cowee complex, Iotla sandy loam
Reference Site ID	Thompsons Fork Mainstem, Brindle Creek
USGS HUC for Project and Reference	03050101
NCDWQ Sub-basin for Project and Reference	03050101040010
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	50%

D. Monitoring Plan View

The monitoring plan view is included as Figure 2.

MCDOWELL COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
THOMPSONS FORK AND UNNAMED TRIBUTARY
2008



LOCATION MAP
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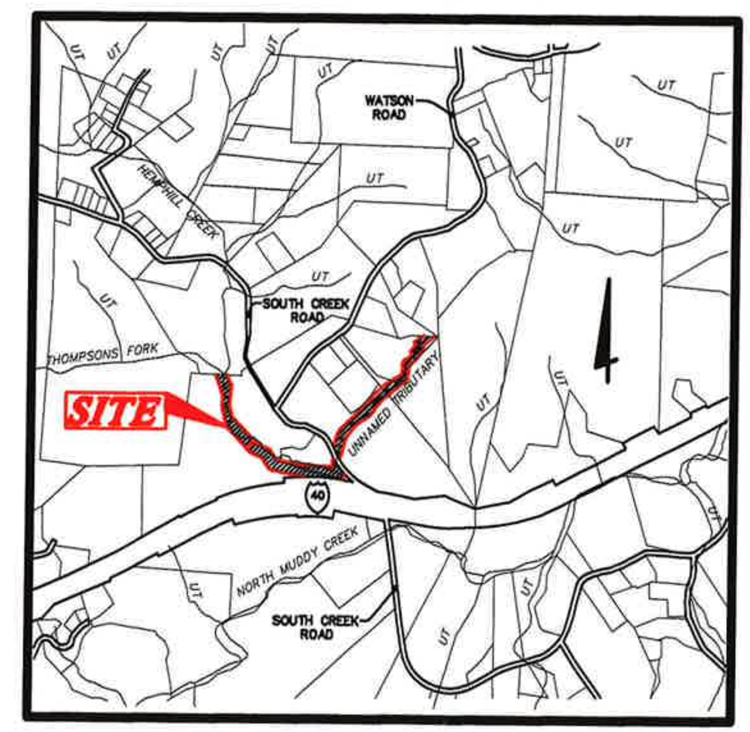

VICINITY MAP
Not To Scale

MCDOWELL COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
THOMPSONS FORK
AND UNNAMED TRIBUTARY

Date	Job No.
October, 2009	2009-0328
Scale: Hor: 1" = 40' Ver: 1" = 5'	Sheet 1/8

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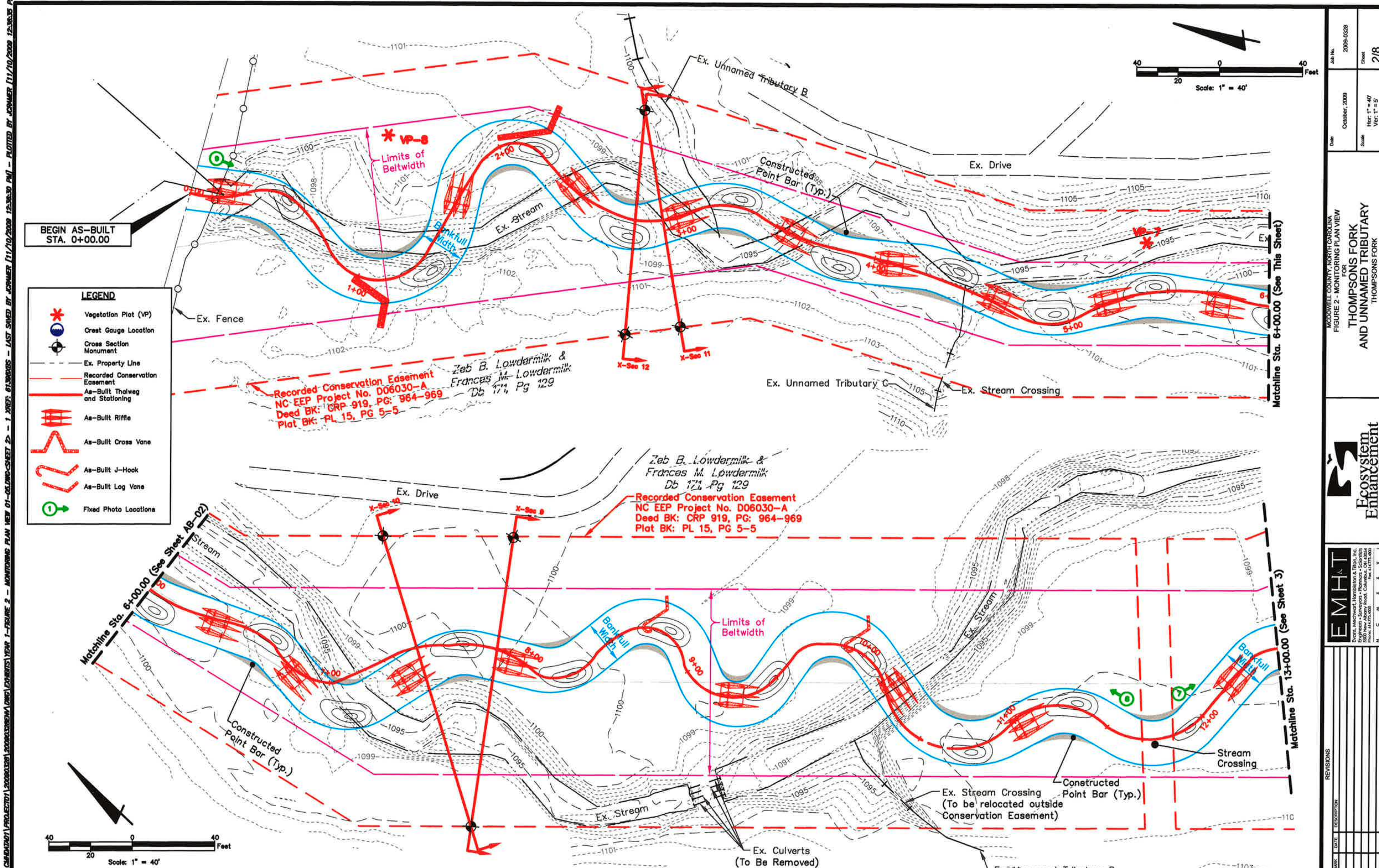
Evans, Mechwart, Hambleton & Tilton, Inc.
Engineers • Surveyors • Planners • Scientists
5500 New Albany Road, Columbus, OH 43054
Phone: 614.775.4500 Fax: 614.775.4800

MARK	DATE	DESCRIPTION

REVISIONS


BEGIN AS-BUILT
STA. 0+00.00
LEGEND
Vegetation Plot (VP)
Crest Gauge Location
Cross Section Monument
Ex. Property Line
Recorded Conservation Easement
As-Built Thalweg and Stationing
As-Built Riffle
As-Built Cross Vane
As-Built J-Hook
As-Built Log Vane
Fixed Photo Locations
VP-8
VP-7
Limits of Beltwidth
Bankfull Width
Ex. Stream
Ex. Fence
Ex. Unnamed Tributary B
Ex. Unnamed Tributary C
Ex. Stream Crossing
Ex. Drive
Constructed Point Bar (Typ.)
X-Sec 12
X-Sec 11
X-Sec 10
X-Sec 9
Recorded Conservation Easement
NC EEP Project No. D06030-A
Deed BK: CRP 919, PG: 964-969
Plat BK: PL 15, PG 5-5
Zeb B. Lowdermilk &
Frances M. Lowdermilk
Db 171, Pg 129
Matchline Sta. 6+00.00 (See This Sheet)
Matchline Sta. 6+00.00 (See Sheet AB-02)
Matchline Sta. 13+00.00 (See Sheet 3)
Stream Crossing
Ex. Stream Crossing
(To be relocated outside
Conservation Easement)
Ex. Culverts
(To Be Removed)
Scale: 1" = 40'
Feet
MCDOWELL COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
THOMPSONS FORK
AND UNNAMED TRIBUTARY
THOMPSONS FORK
Job No. 2009-0328
Date October, 2009
Scale Hor: 1" = 40' Ver: 1" = 5'
Sheet 2/8
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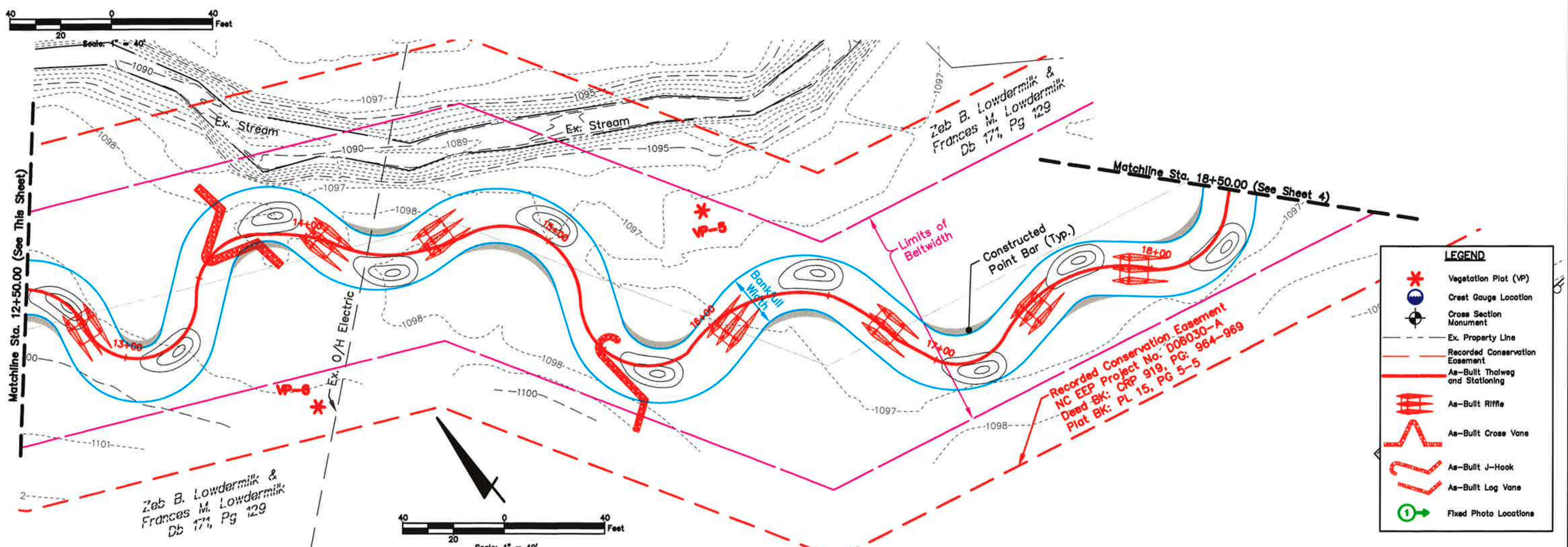

MCDOWELL COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
THOMPSONS FORK
AND UNNAMED TRIBUTARY
THOMPSONS FORK

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Scale	Hor: 1" = 40' Ver: 1" = 5'	Sheet	3/8

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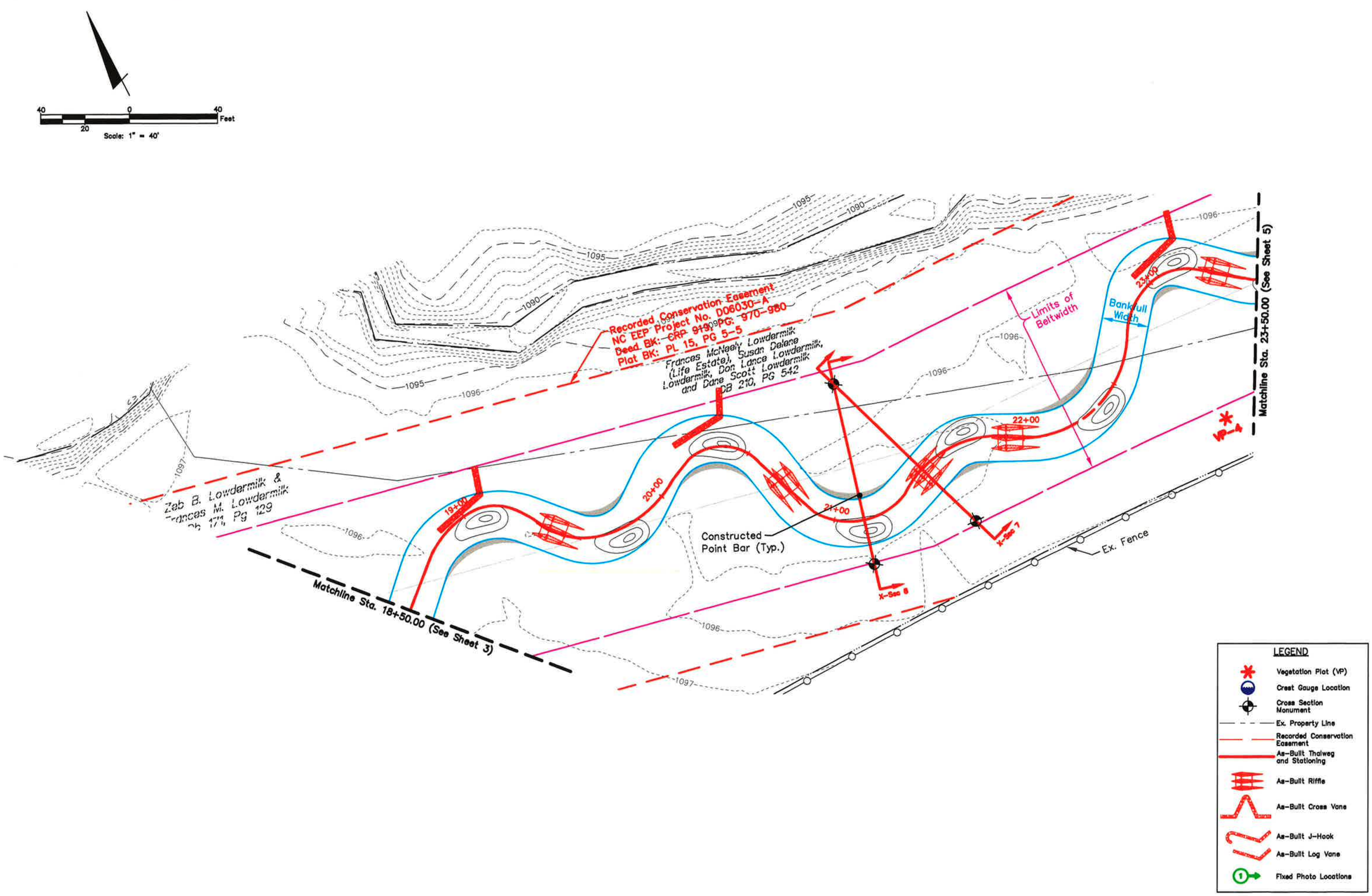
\\CMHDATA01\PROJECT01\20061388\20061388EMA\DWG\EXHIBITS\YEAR 1-FIGURE 2 - MONITORING PLAN VIEW 01-06.DWG<SHEET 3> - 1 XREF: 61388SDS - LAST SAVED BY GTHOMAS [9/14/2009 8:58:43 AM] - PLOTTED BY GTHOMAS [9/14/2009 9:17:48 AM]



MCDOWELL COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
THOMPSONS FORK
AND UNNAMED TRIBUTARY
THOMPSONS FORK

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Date	Job No.
October, 2009	2009-0328
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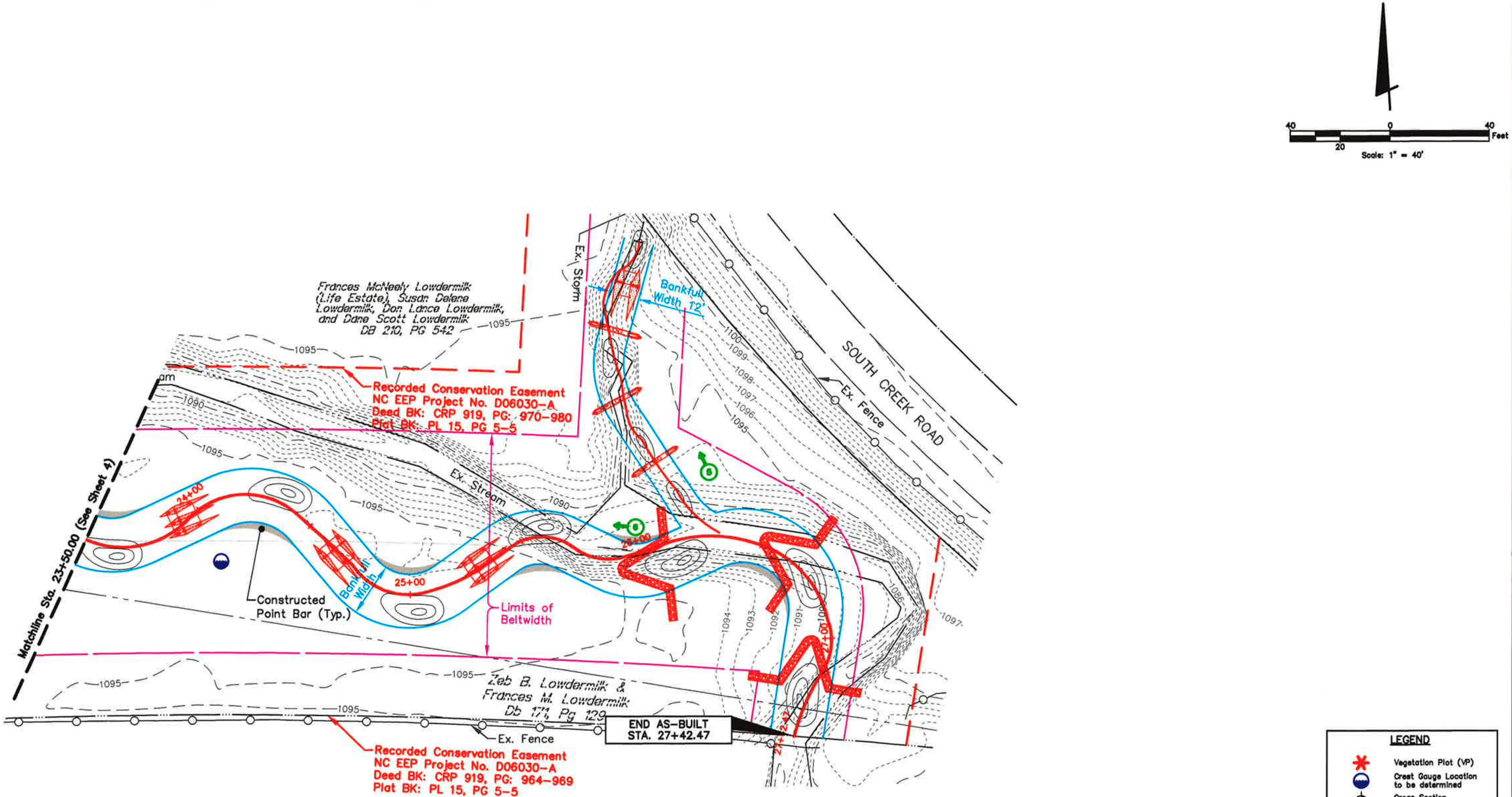

LEGEND

- Vegetation Plot (VP)
- Crest Gauge Location to be determined
- Cross Section Monument
- Ex. Property Line
- Recorded Conservation Easement
- As-Built Thalweg and Stationing
- As-Built Riffle
- As-Built Cross Vane
- As-Built J-Hook
- As-Built Log Vane
- Fixed Photo Locations

EMHT

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MCDOWELL COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
THOMPSONS FORK AND UNNAMED TRIBUTARY THOMPSONS FORK

Job No.	Date	Scale	Sheet
2009-0328	October, 2009	Hor: 1" = 40' Ver: 1" = 5'	5/8

REVISIONS

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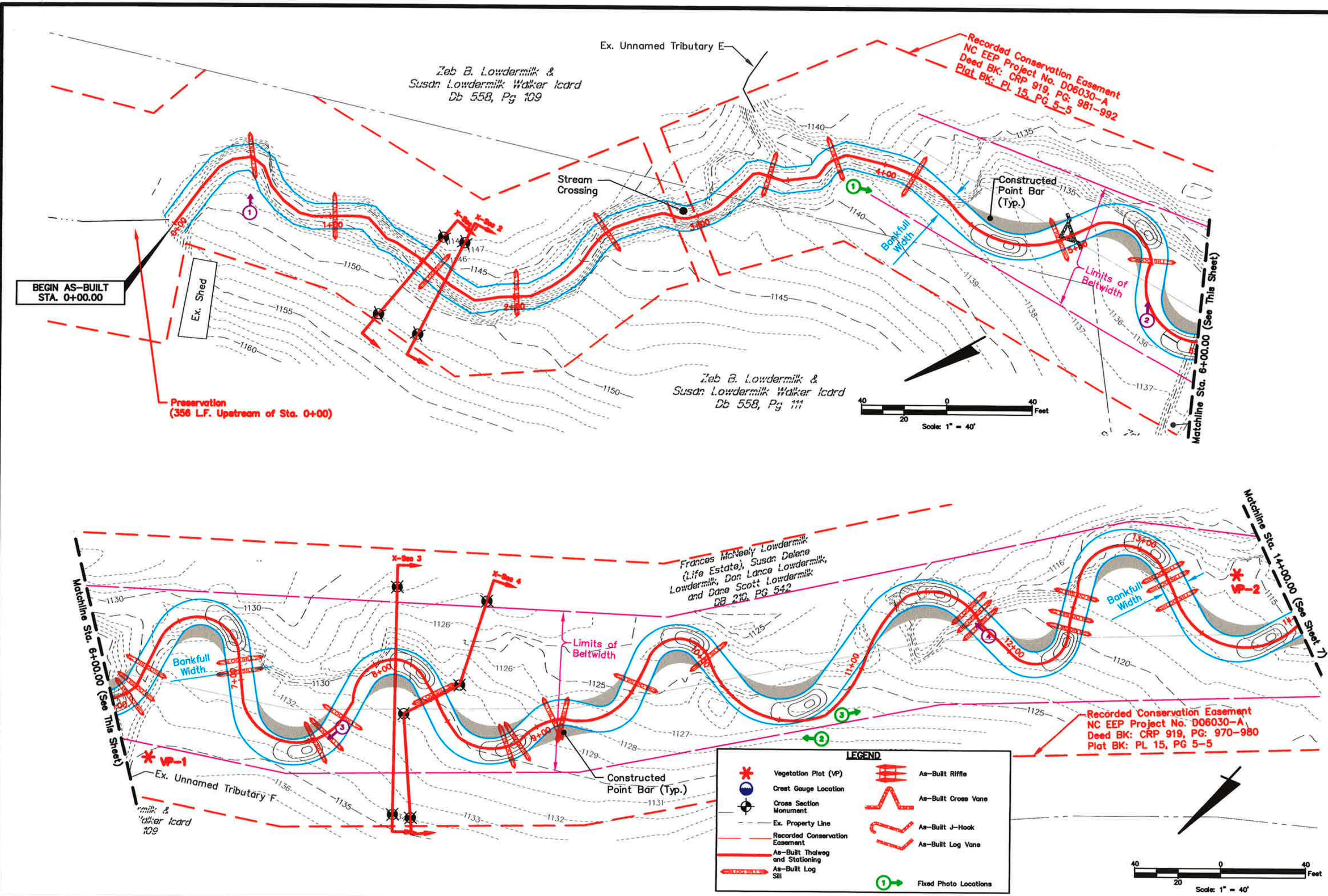

MCDOWELL COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
THOMPSONS FORK
AND UNNAMED TRIBUTARY
UNNAMED TRIBUTARY

Ecosystem Enhancement Program

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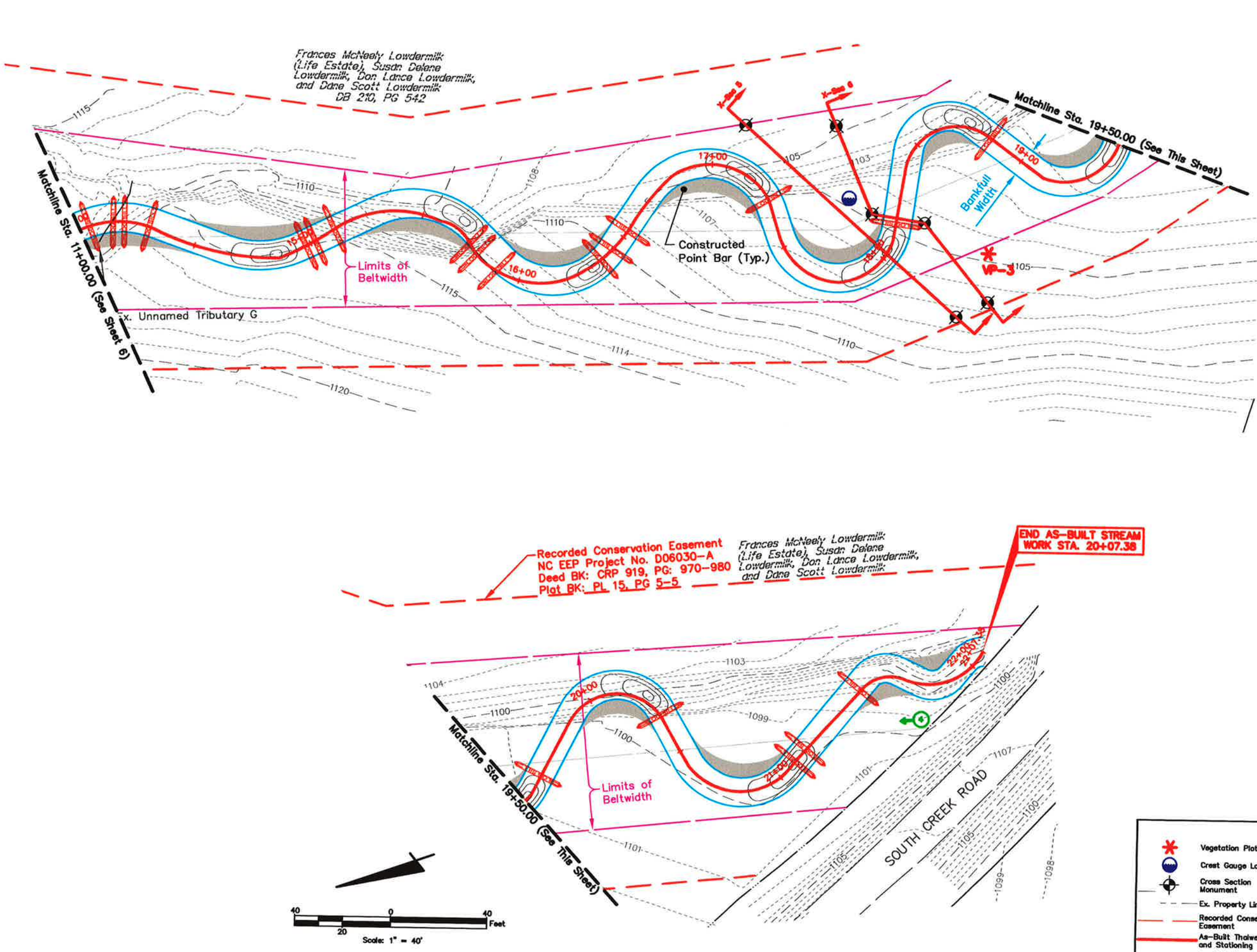

Job No. 2009-0328
Sheet 7/8
Date October, 2009
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MCDOWELL COUNTY, NORTH CAROLINA
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UNNAMED TRIBUTARY

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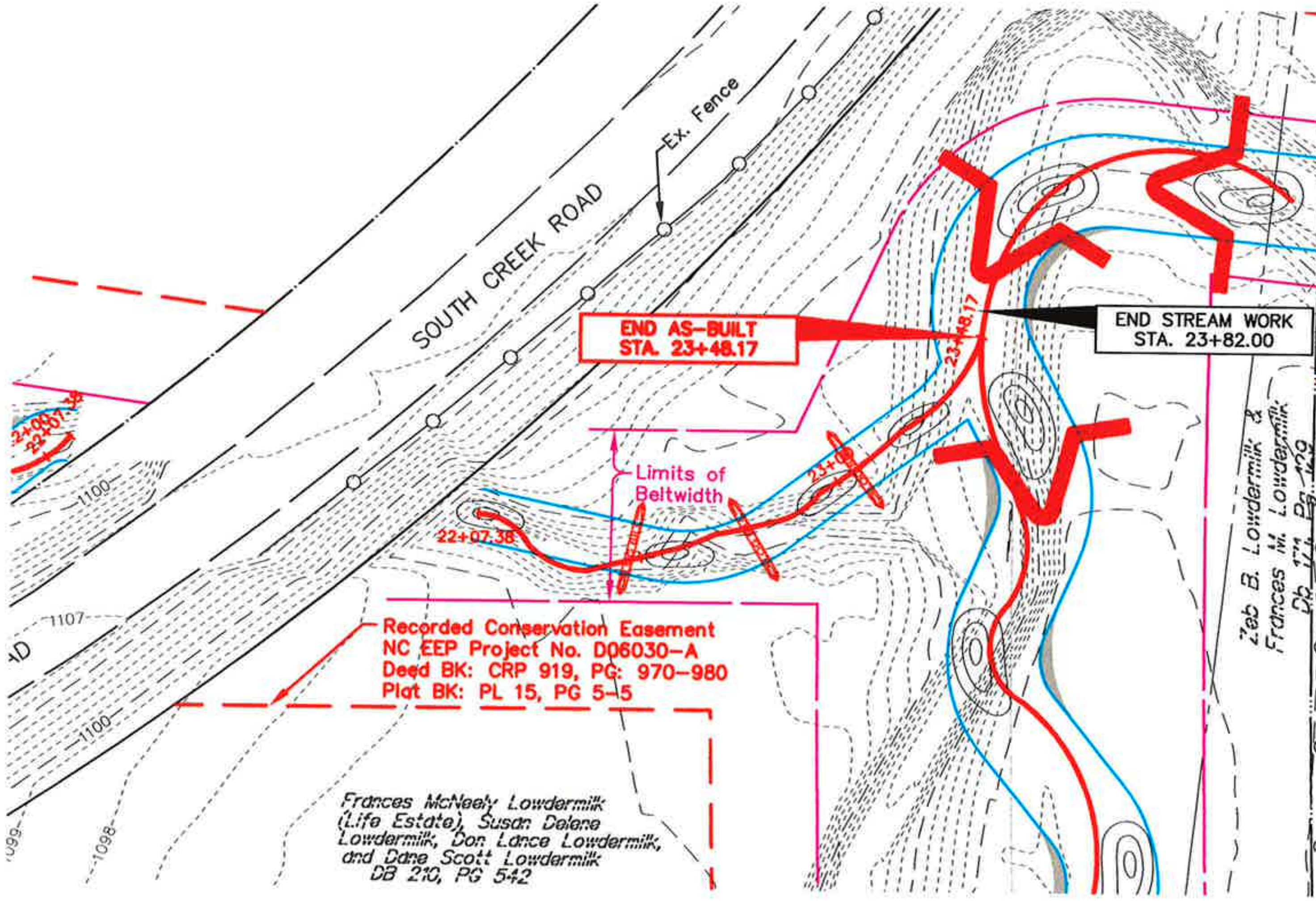
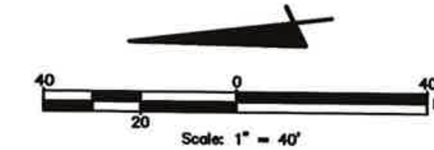


Recorded Conservation Easement
NC EEP Project No. D06030-A
Deed BK: CRP 919, PG: 964-969
Plat BK: PL 15, PG 5-5



LEGEND

Vegetation Plot (VP)	As-Built Riffle
Crest Gauge Location	As-Built Cross Vane
Cross Section Monument	As-Built J-Hook
Ex. Property Line	As-Built Log Vane
Recorded Conservation Easement	As-Built Photo Locations of Typical Structures
As-Built Thalweg and Stationing	Fixed Photo Locations
As-Built Log Sill	

MCDOWELL COUNTY, NORTH CAROLINA
FIGURE 2 - MONITORING PLAN VIEW
FOR
THOMPSONS FORK
AND UNNAMED TRIBUTARY
UNNAMED TRIBUTARY

Date: October, 2009
Job No.: 2009-0328
Scale: Hor: 1" = 40' Ver: 1" = 5'
Sheet: 8/8

Ecosystem Enhancement Program

EMH&T
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REVISIONS
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III. PROJECT CONDITION AND MONITORING RESULTS

A. Vegetation Assessment

1. Soil Data

Soil information was obtained from the NRCS Soil Survey of McDowell County, North Carolina (USDA NRCS, September, 1995). The soils along the mainstem of Thompsons Fork and its associated Unnamed Tributary 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.

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

Table VI. Preliminary Soil Data
Thompsons Fork Stream Restoration / EEP Project No. D06030-A

Series	Max. Depth (in.)	% Clay on Surface	K[1]	T[2]	% Organic Matter
Colvard loam (CoA)	60	8-18	0.15	4	1-2
Evard-Cowee complex (EwE)	30	7-25	0.28	2-5	1-5
Iotla sandy loam (IoA)	60	12-18	0.15	5	2-5

[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
Thompsons Fork Stream Restoration / EEP Project No. D06030-A

Feature/Issue	Station # / Range	Probable Cause	Photo #
Invasive Population	UT: See Plan View	Native Vine: encroachment from adjacent woodland	VPA 1
	UT: See Plan View	Sericea lespedeza: encroachment from pasture	VPA 2
Bare Floodplain	UT: See Plan View	Unknown: could be poor, rocky soil	VPA 3

The most notable vegetation problem area was occurring on the left bank of the unnamed tributary. A species of vine had spread into the riparian corridor from the adjacent wooded hillside, with the most dense concentration located in the area of Vegetation Plot 2. The species is a member of the pea family, likely *Amphicarpaea bracteata* (hog peanut), which is native to North Carolina. However, this vine was strangling the woody vegetation in and around the monitoring plot, where approximately 80% of the planted woody stems were suffering from vine

strangulation. Without control of the vine, tree mortality could be high in this area, jeopardizing the minimum stem count criteria. Because of this, the presence of the vine within the project corridor was considered a problem area of high priority, and management with herbicide treatments were conducted in the fall of 2009, with follow-up planned for the spring of 2010, to try and control the spread of this vine within the project corridor.

Several areas along the unnamed tributary were noted to have low overall herbaceous cover along the riparian corridor on the right bank. These areas are patchy and scattered throughout the corridor, with none of the areas showing banks that are completely bare. However, due to the threat by invasive species in the same areas along the tributary, particularly Sericea lespedeza, the sparse vegetation is noted as an area of concern. If the herbaceous cover does not increase, the open patches will provide an avenue for colonization and spread of the invasive species. The coverage of herbaceous vegetation and the spread of Sericea lespedeza along the right bank of the tributary are considered areas of low concern at this time, and will therefore be watched during future years of monitoring. In addition, proactive management in the form of herbicide treatments were conducted on the lespedeza throughout the fall, with follow-up planned for the spring, to limit the impact of this species on the vegetative success of the project.

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. Thompsons Fork Stream Restoration / EEP Project No. D06030-A											
	Plots								Year 0 Totals	Year 1 Totals	Survival %
Species	1	2	3	4	5	6	7	8			
Shrubs											
Alnus serrulata	3	3	3	3	8	7	9	6	42	42	100
Aronia arbutifolia	2			2		1		1	6	6	100
Ilex verticillata						2			2	2	100
Salix exigua					5	2			7	7	100
Sambucus canadensis					1				1	1	100
Trees											
Diospyros virginiana				1					1	1	100
Fraxinus pennsylvanica	9	20	15	9	4	2			59	59	100
Platanus occidentalis				2		5	1	4	12	12	100
Quercus palustris		1	1	1	1	1		1	6	6	100
Salix nigra					1	1		1	3	3	100
Year 1 Totals	14	24	19	18	20	21	10	13	139	139	100
Live Stem Density	567	972	770	729	810	851	405	527			
Average Live Stem Density	704										

Table VIIIb. Stem counts for each species arranged by plot - all stems. Thompsons Fork Stream Restoration / EEP Project No. D06030-A								
	Plots							
Species	1	2	3	4	5	6	7	8
Shrubs								
Alnus serrulata	4	3	3	6	8	7	9	6
Aronia arbutifolia	2			2		1		1
Aronia melanocarpa					4	1		
Ilex verticillata						2		
Salix exigua					5	2		
Sambucus canadensis	1		2	2	3	1	2	
Trees								
Betula sp.								46
Diospyros virginiana				1				
Fraxinus pennsylvanica	9	20	15	9	4	2		
Juglans nigra		1					1	
Platanus occidentalis				2		5	1	4
Quercus palustris		1	1	1	1	1		1
Salix nigra					1	1		1
Year 1 Totals	16	25	21	23	26	23	13	59
Live Stem Density	648	1013	851	932	1053	932	527	2390
Average Live Stem Density	1043							

The average stem density of planted species for the site exceeds the minimum criteria of 320 stems per acre after three years. Each individual plot also has a stem density above the minimum. In addition, a number of recruit stems have been found in all plots. The recruit stems increase the total stem density across the site by nearly 50%.

5. Vegetation Plot Photos

Vegetation plot photos are provided in Appendix A.

B. Stream Assessment

1. Hydrologic Criteria

Two crest-stage stream gages were installed on the project reaches, each of which is located at the bankfull stage at a riffle cross-section, one along the unnamed tributary and one along the Thompsons Fork Mainstem. The locations of the crest-stage stream gages are shown on the monitoring plan view (Figure 2). Bankfull events were recorded during Year 1, as documented in Table IX.

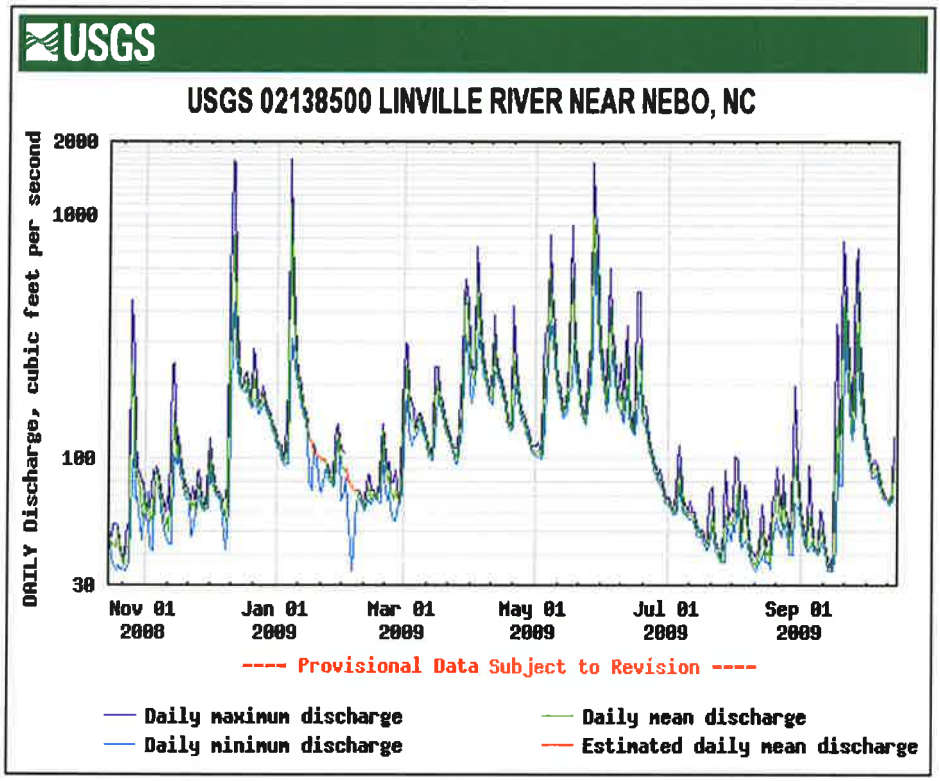
Table IX. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo #
9/21/09	1/6/09-1/8/09*	Crest gage at XS-6 on UT	BF 1
9/21/09	1/6/09-1/8/09*	Crest gage at XS-7 on Mainstem	BF 2

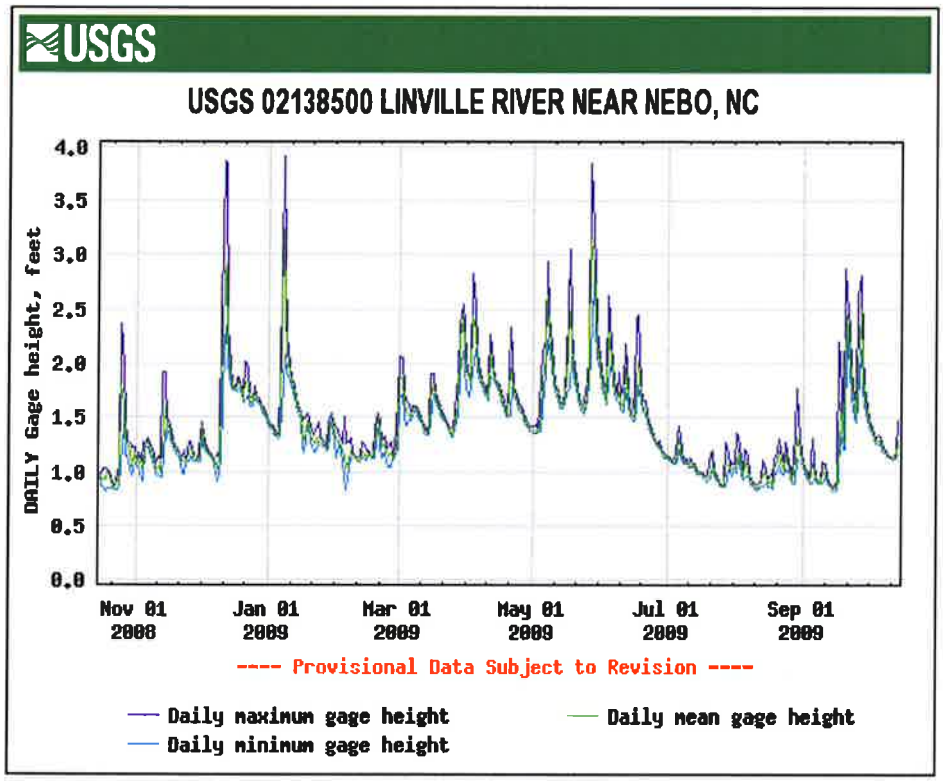
*Date is approximate; based on a review of recorded rainfall data

In September 2009, the crest gage on the unnamed tributary registered a bankfull event at a height of 3.5" above the bottom of the crest gage. The crest gage on the mainstem of Thompsons Fork also documented a bankfull event, at a height of 5.75" above the bottom of the crest gage. These crest gages are set at or above the bankfull elevation of each stream channel. Photographs of the crest gages are shown in Appendix B.

The most likely date for the bankfull event was after the rain events that occurred on January 6 and January 7. On these dates, rainfall as recorded in Rutherford, NC totaled 1.91 inches, with 1.03" on January 6 and 0.88" on January 7. As this was the largest precipitation event of significance since the completion of the as-built documentation, this is likely the bankfull event recorded by both crest gages. This corresponds to a high discharge event on January 8, as recorded at USGS Gage 02138500 Linville River at Nebo, NC, which lies approximately 15 miles west of Morganton and 5 miles east of Marion, NC. Other large precipitation events occurred on December 10-11, 2008, with a total precipitation of 1.73" over the two days, and May 24-26, 2009, with a total precipitation of 1.32" over the three day period. 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 Year 1 is included in Table X.

Table X. Stream Problem Areas Thompsons Fork Stream Restoration / EEP Project No. D06030-A			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Bank Scour	9+80 Mainstem	Scour at outside meander bend	SPA 1
Other	Scattered areas along Mainstem and UT; See SPA Plan View	Low flows allow wetland vegetation to colonize the stream channel, which could contribute to sedimentation	SPA 2,3

One small area of bank scour was noted along the outside bank of a meander along the Thompsons Fork Mainstem. The scour is isolated to a small area, and given the robust vegetation of the riparian corridor, this area is expected to remain isolated. This problem area is considered low concern at this time, as the scour area itself will likely become vegetated, providing natural bank stabilization without the need for mechanical intervention.

There are scattered areas throughout the project reaches that are developing wetland vegetation within the stream channel, particularly along the unnamed tributary. While the wetland vegetation is beneficial for water quality, there is the potential that the vegetation will decrease flows, particularly during times of low flow, thereby allowing sediment to drop into the channel. This type of problem tends to exacerbate itself, as continuing sedimentation allows for further colonization and growth of wetland plants. These areas are therefore included in the problem area table as low concern areas that will be watched in future years to ensure the channel remains viable as a stream, and does not aggrade into a linear wetland type feature.

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 17 and September 18, 2009. These photographs are provided in Appendix B.

6. Stability Assessment Table

The visual stream assessment was performed to determine the percentage of stream features that remain in a state of stability after the first 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
Thompsons Fork Stream Restoration / EEP Project No. D06030-A
Segment/Reach: Mainstem

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

Table XIa. Categorical Stream Feature Visual Stability Assessment
Thompsons Fork Stream Restoration / EEP Project No. D06030-A
Segment/Reach: UT

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles[1]	100%	100%				
B. Pools[2]	100%	96%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Vanes / J Hooks etc.[4]	N/A	N/A				
G. Wads and Boulders[4]	N/A	N/A				
H. Log Sills[3]	100%	95%				

[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 log sills 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 Thompsons Fork mainstem and unnamed tributary. One meander along the mainstem reach has a minor amount of scouring around an outside bend. The only other category on the mainstem reach that includes features performing in a state unlike that of the as-built include areas of wetland formation. It appears that narrow bars forming along the stream banks are becoming vegetated with wetland species. Wetland plants are excellent for

water quality, but these areas have been noted under the aggradation feature category for future monitoring.

Minor aggradation is also occurring in a few locations along the unnamed tributary to Thompsons Fork. Sedimentation has occurred in a few of the pools located near the log sills installed for grade control, thus decreasing the maximum pool depth. All pools and associated log sills are still present and functional throughout the stream channel, including those with noted sedimentation.

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 As-Built and Year 1 is the same as the data provided from the As-Built survey, as pattern has not changed based on the Year 1 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 as-built conditions. The comparison of the As-Built and Year 1 long-term stream monitoring profile data show stability with minimal change from as-built conditions, after consideration of a software anomaly that resulted in a shift in the locations of profile features in Year 1 versus Year 0. RiverMorph uses the shortest straight line distance between the consecutive survey points to create the stationing for the profile. The Year 1 survey represents a larger number of collected survey points which will lead to a higher cumulative length of stream profile, particularly affected by the number of points collected around each meander bend. The lengthening of the stream profile in Year 1 also affects the locations of each pool and riffle with respect to the Year 0 profile. In fact, the pool and riffle features remain in the same locations shown on the as-built mitigation plan, with only slight adjustments. As such, we have evaluated stability from the standpoint of comparing features between the Year 0 and Year 1 profiles with the understanding of the 'shift' in these features between the profiles.

For the unnamed tributary, riffle lengths and slopes are stable. While the median pool to pool spacing is stable, the maximum pool spacing has decreased in Year 1. The same trend is true for the mainstem profile data, where the median values are stable, but the maximum values have decreased. This is a result of the shorter length of profile analyzed for the Year 1 monitoring, since only a portion of each stream was surveyed, as compared to the entire length of both reaches surveyed for the as-built documentation.

The substrate of the constructed riffles on the unnamed tributary has stabilized, with a median particle size of coarse gravel as compared to a median particle distribution of fine to very coarse gravel reported for the as-built condition. On the Thompsons Fork mainstem, there was a minor shift to a more stable median distribution of coarse to very coarse gravel as compared to the as-built distribution of fine to medium gravel. The pool substrate remains stable as well, with median particle sizes consisting of very fine particles in the silt/clay category, based on the Year 1 substrate analysis. Remedial maintenance work on the restored reaches is not warranted at this time.

XII: Baseline Geomorphologic and Hydraulic Summary

Thompsons Fork & Unnamed Tributary Mitigation Plan / EEP Project No. D06030-A

Station/Reach: Thompsons Fork Mainstem Priority I Restoration Reach - Station 0+00.00 to 18+06.42 (1,806.42 l.f.)

Parameter	Thompsons Fork Reference Reach			Pre-Existing Condition**			Design			As-Built Riffle XSs 7, 9, 10 & 11			Year 1 Riffle XSs 7, 9, 10 & 11		
Dimension	Min	Max	Mean	Min	Max	Mean	Min	Max	Med.	Min	Max	Med.	Min	Max	Med.
Drainage Area (mi^2)			5.57			7.57			7.57			7.57			7.57
BF Width (ft)			15.38			20.90			21.50	34.52	39.81	37.74	35.30	38.95	36.32
Floodprone Width (ft)			18.89			32.00	39.0	100.0	90.0	89.89	143.71	113.53	86.87	146.66	109.57
BF Cross Sectional Area (ft^2)			23.80			56.50			52.00	48.51	59.39	52.85	39.38	54.16	47.43
BF Mean Depth (ft)			1.55			2.70			2.40	1.30	1.60	1.40	1.09	1.39	1.32
BF Max Depth (ft)			2.09			5.05			3.00	2.16	2.88	2.52	2.14	2.59	2.38
Width/Depth (ft)			9.92			7.74			8.96	23.21	30.16	27.07	25.40	33.00	28.68
Entrenchment Ratio			1.23			1.53	1.81	4.65	4.19	2.30	4.16	3.00	2.31	4.15	3.00
Bank Height Ratio			1.18			2.36			1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wetted Perimeter (ft)			18.50			24.77			26.30	34.91	40.28	38.84	35.70	39.27	36.73
Hydraulic Radius (ft)			12.50			2.28			1.98	1.28	1.57	1.38	1.08	1.38	1.31
BF Discharge (cfs)			64.8			285.0			285.0	149.5	149.5	149.5	149.5	149.5	149.5
BF Mean Velocity (ft/sec)			2.72			5.04			4.77	2.52	3.08	2.83	2.76	3.80	3.15
Pattern															
*Channel Beltwidth (ft)	16.30	56.00	36.40				39.00	100.00	90.00	40.00	90.00	90.00	40.00	90.00	90.00
*Radius of Curvature (ft)	9.70	48.90	25.40				18.70	48.90	28.30	18.70	48.90	27.70	18.70	48.90	27.70
*Meander Wavelength (ft)	49.50	119.40	104.30				89.20	119.90	110.40	84.17	119.85	110.35	84.17	119.85	110.35
*Meander Width Ratio	1.06	3.64	2.37				4.15	5.58	5.13	1.04	2.34	2.34	1.13	2.48	2.31
Profile															
Riffle Length (ft)	15.0	21.6	18.3				14.3	39.4	21.8	8.6	30.6	17.2	7.2	19.6	14.7
Riffle Slope (ft/ft)	0.0099	0.0127	0.0113				0.0099	0.0127	0.0113	0.0051	0.0571	0.0166	0.00599	0.03391	0.01832
Pool Length (ft)	17.0	32.1	24.3				28.6	105.0	42.6	21.5	82.9	39.3	18.2	60.3	32.4
Pool Spacing (ft)	73.1	77.1	75.1				42.6	83.2	61.5	25.0	145.0	63.8	31.4	113.7	55.6
Substrate															
D50 (mm)			29.4			13.7			13.7	5.7	10.6	9.1	23.8	32.7	29.1
D84 (mm)			50.1			26.2			26.2	35.9	66.3	43.4	60.8	87.1	73.9
Additional Reach Parameters															
Valley Length (ft)			188.00			2261			2295			2295			2295
Channel Length (ft)			140.00			2530			2799			2742			2742
Sinuosity			1.34			1.12			1.22			1.19			1.19
Valley Slope (ft/ft)			0.0031			0.0044			0.0031			0.0036			0.0036
Bankfull Slope (ft/ft)			0.0024			0.0039			0.0024			0.0030			0.0030
Rosgen Classification			E4			G4			E4			C4			C4
*Habitat Index															
*Macrobenthos															

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

**Insufficient field indicators to estimate pattern and bedform features under impaired G4 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 mean value.

Year 1 Monitoring data were quantitatively and qualitatively evaluated using RiverMorph v 4.3.0.

Table XII: Baseline Geomorphologic and Hydraulic Summary

Thompsons Fork & Unnamed Tributary Mitigation Plan / EEP Project No. D06030-A

Station/Reach: UT Priority Level I Restoration Reach - Station 4+00.00 to 16+37.32 (1,237.32 l.f.)

Parameter	Brindle Creek Reference Reach			Pre-Existing Condition			Design			As-Built XS-4 & XS-6			Year 1 XS-4 & XS-6		
Dimension	Min	Max	Mean	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area (mi^2)			1.16			0.16			0.16			0.16			0.16
BF Width (ft)			24.02			13.10			12.00	13.94	14.08	14.01	14.03	16.67	15.35
Floodprone Width (ft)			232.00			44.80	45.00	85.00	71.50	78.48	88.08	83.28	74.03	97.32	85.68
BF Cross Sectional Area (ft^2)			30.77			10.70			11.50	11.17	11.37	11.27	11.15	14.89	13.02
BF Mean Depth (ft)			1.28			0.82			0.96	0.80	0.81	0.81	0.80	0.89	0.85
BF Max Depth (ft)			1.72			1.12			1.20	1.64	1.76	1.70	1.56	1.62	1.59
Width/Depth (ft)			18.77			15.98			12.50	17.38	17.42	17.40	17.54	18.73	18.14
Entrenchment Ratio			9.66			3.42	3.75	7.08	5.96	5.63	6.26	5.95	5.28	5.84	5.56
Bank Height Ratio			1.00			1.63			1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wetted Perimeter (ft)			26.58			14.74			13.92	14.41	14.56	14.49	14.39	17.02	15.71
Hydraulic Radius (ft)			1.16			0.73			0.83	0.77	0.78	0.78	0.78	0.87	0.83
BF Discharge (cfs)			98.2			54.9			54.9	54.9	54.9	54.9	54.9	54.9	54.9
BF Mean Velocity (ft/sec)			3.19			5.13			4.77	4.83	4.91	4.87	3.69	4.92	4.22
Pattern															
*Channel Beltwidth (ft)	44.17	46.50	45.22				45.00	85.00	71.50	44.00	75.41	73.33	44.00	75.41	73.33
*Radius of Curvature (ft)	12.97	24.44	17.67				14.40	40.90	22.60	10.39	40.91	22.57	10.39	40.91	22.57
*Meander Wavelength (ft)	88.23	115.70	104.80				64.20	124.00	100.00	64.19	124.91	99.37	64.19	124.91	99.37
*Meander Width Ratio	1.84	1.94	1.88				3.75	7.08	5.96	3.14	5.38	5.23	3.14	4.78	4.52
Profile															
Riffle Length (ft)	19.0	31.0	25.7				22.60	46.60	36.40	6.08	55.10	23.40	7.57	43.62	25.79
Riffle Slope (ft/ft)	0.0125	0.0362	0.0211				0.0603	0.1215	0.0578	0.0350	0.0940	0.0595	0.0400	0.0957	0.0633
Pool Length (ft)	11.0	31.6	17.4				18.40	43.00	27.60	8.19	48.20	24.71	6.28	52.80	21.02
Pool Spacing (ft)	67.6	77.5	71.4				63.40	112.00	78.40	20.94	159.00	65.21	14.18	99.67	59.44
Substrate															
D50 (mm)			38.5			37.5			37.5	7.7	37.5	16.0	18.9	20.0	19.4
D84 (mm)			60.2			73.4			73.4	68.2	73.7	71.8	53.9	71.5	62.7
Additional Reach Parameters															
Valley Length (ft)			294.00			1485			1437			1437			1437
Channel Length (ft)			353.00			1617			1966			1948			1948
Sinuosity			1.2			1.09			1.37			1.36			1.36
Valley Slope (ft/ft)			0.0106			0.0353			0.0353			0.0353			0.0350
Bankfull Slope (ft/ft)			0.0115			0.0324			0.0258			0.0243			0.0244
Rosgen Classification			C4			C3b			C3b			C3b			C3b
*Habitat Index															
*Macrobenthos															

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

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 median value.

Year 1 Monitoring data were quantitatively and qualitatively evaluated using RiverMorph v 4.3.0.

IV. METHODOLOGY

Vegetation monitoring was conducted in September 2009 using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee, M.T., Peet, RK., Roberts, S.R., Wentworth, T.R. 2006). Stream monitoring was conducted in July 2009 to provide adequate time between the as-built survey (completed in June 2008) and the Year 1 monitoring survey. Subsequent stream monitoring will occur in the summer of Years 2 through 5 to provide a full year between surveys. Vegetation monitoring will continue to be conducted in the fall of each subsequent year of monitoring, providing a full year between vegetative surveys.

APPENDIX A

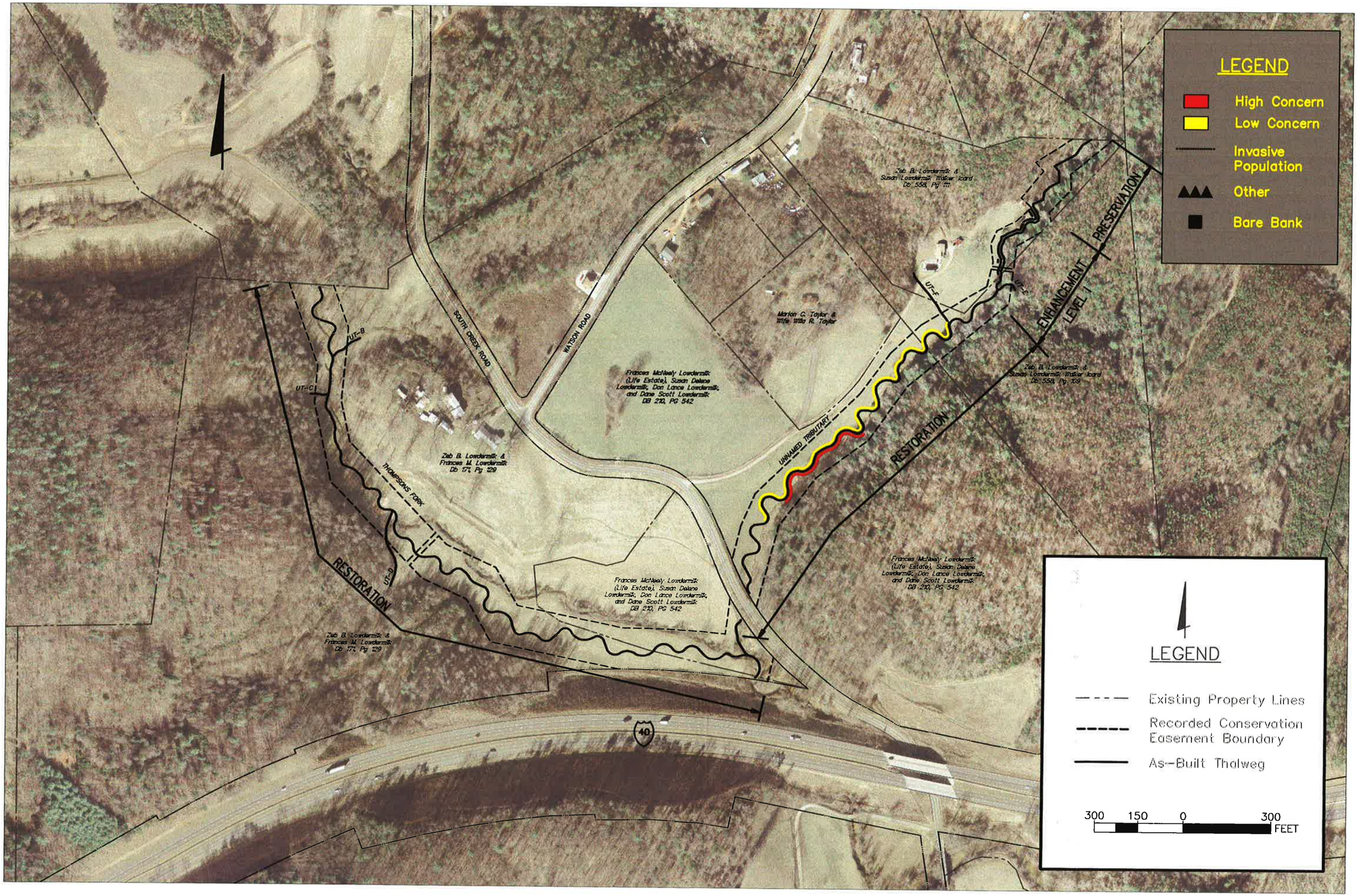
Vegetation Raw Data

1. Vegetation Problem Area Photos
2. Vegetation Problem Area Plan View
3. Vegetation Monitoring Plot Photos
4. Vegetation Data Tables

VPA 1
View of the dominance by a vine in Vegetation Plot 2, considered a problem area of high concern. The planted woody vegetation is facing strangulation by the vine in this area.
(EMH&T, Inc. 9/18/09)

VPA 2
Overview of the patchy spread of Sericea lespedeza along UT1, considered a problem area of low concern.
(EMH&T, Inc. 9/18/09)

VPA 3
View of the patchy vegetation along the right bank of UT1. This is only considered a problem due to the threat of spread by Sericea lespedeza in the same area of the project.
(EMH&T, Inc. 9/18/09)



MCDOWELL COUNTY, NORTH CAROLINA

THOMPSONS FORK AND UNNAMED TRIBUTARY

APPENDIX A

VEGETATION PROBLEM AREA PLAN VIEW

Job No.	Sheet
2006-1398	1/1
Date: October, 2008	Scale: 1" = 300'

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

Vegetation Plot 1
Monitoring Year 1
(EMH&T, Inc. 9/18/09)

Vegetation Plot 2
Monitoring Year 1
(EMH&T, Inc. 9/18/09)

Vegetation Plot 3
Monitoring Year 1
(EMH&T, Inc. 9/18/09)

Vegetation Plot 4
Monitoring Year 1
(EMH&T, Inc. 9/18/09)

Vegetation Plot 5
Monitoring Year 1
(EMH&T, Inc. 9/18/09)

Vegetation Plot 6
Monitoring Year 1
(EMH&T, Inc. 9/18/09)

Vegetation Plot 7
Monitoring Year 1
(EMH&T, Inc. 9/18/09)

Vegetation Plot 8
Monitoring Year 1
(EMH&T, Inc. 9/18/09)

Table 1. Vegetation Metadata	
Report Prepared By	Holly Blunck
Date Prepared	9/22/2009 11:43
database name	cvs-eep-entrytool-v2.2.6.mdb
database location	Q:\ENVIRONMENTAL\Monitoring\EEP Vegetation Database
computer name	26WYM41
file size	61800448
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	D06030A
project Name	Thompsons Fork
Description	Stream restoration of Thompsons Fork mainstem and tributary.
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	8

Table 2. Vegetation Vigor by Species								
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**	**Unknown**
	Alnus serrulata	40	2					
	Aronia arbutifolia	2	4					
	Diospyros virginiana		1					
	Fraxinus pennsylvanica	5	30	17	7			
	Ilex verticillata	1	1					
	Quercus palustris	4	2					
	Salix nigra	2	1					
	Sambucus canadensis		1					
	Platanus occidentalis	6	5	1				
	Salix exigua	7						
TOT:	**10**	**67**	**47**	**18**	**7**			

Table 3. Vegetation Damage by Species				
	Species	All Damage Categories	(no damage)	Vine Strangulation
	Alnus serrulata	42	38	4
	Aronia arbutifolia	6	6	
	Diospyros virginiana	1	1	
	Fraxinus pennsylvanica	59	41	18
	Ilex verticillata	2	2	
	Platanus occidentalis	12	12	
	Quercus palustris	6	6	
	Salix exigua	7	7	
	Salix nigra	3	3	
	Sambucus canadensis	1	1	
TOT:	**10**	**139**	**117**	**22**

Table 4. Vegetation Damage by Plot				
	plot	All Damage Categories	(no damage)	Vine Strangulation
	D06030A-01-0001-year:1	14	14	
	D06030A-01-0002-year:1	24	5	19
	D06030A-01-0003-year:1	19	19	
	D06030A-01-0004-year:1	18	18	
	D06030A-01-0005-year:1	20	20	
	D06030A-01-0006-year:1	21	21	
	D06030A-01-0007-year:1	10	7	3
	D06030A-01-0008-year:1	13	13	
TOT:	**8**	**139**	**117**	**22**

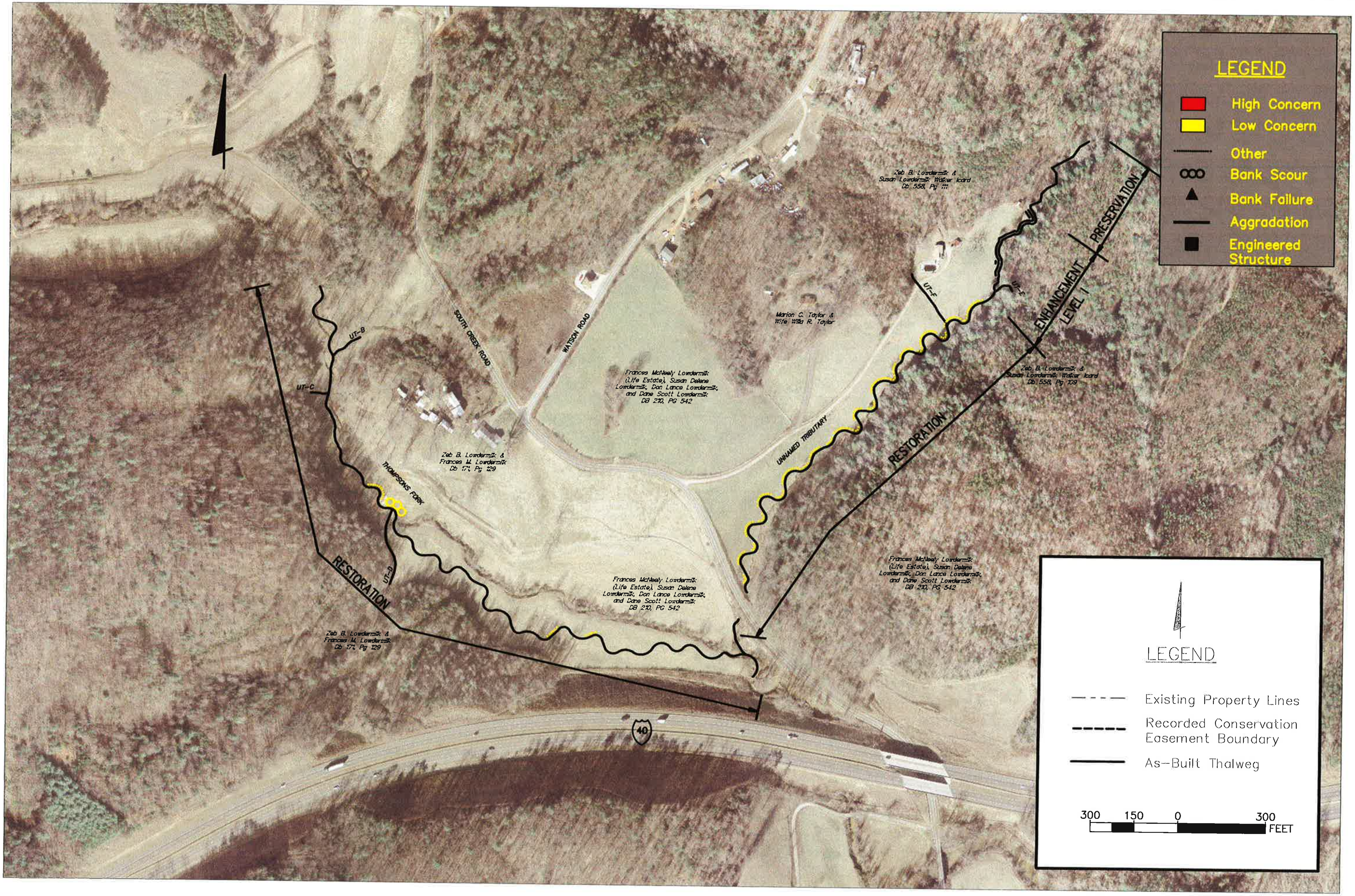
Table 5. Stem Count by Plot and Species - Planted Stems												
	Species	Total Planted Stems	# plots	avg# stems	plot D06030A-01-0001-year:1	plot D06030A-01-0002-year:1	plot D06030A-01-0003-year:1	plot D06030A-01-0004-year:1	plot D06030A-01-0005-year:1	plot D06030A-01-0006-year:1	plot D06030A-01-0007-year:1	plot D06030A-01-0008-year:1
	Alnus serrulata	42	8	5.25	3	3	3	3	8	7	9	6
	Aronia arbutifolia	6	4	1.5	2			2		1		1
	Diospyros virginiana	1	1	1				1				
	Fraxinus pennsylvanica	59	6	9.83	9	20	15	9	4	2		
	Ilex verticillata	2	1	2						2		
	Platanus occidentalis	12	4	3				2		5	1	4
	Quercus palustris	6	6	1		1	1	1	1	1		1
	Salix exigua	7	2	3.5					5	2		
	Salix nigra	3	3	1					1	1		1
	Sambucus canadensis	1	1	1					1			
TOT:	**10**	**139**	**10**		**14**	**24**	**19**	**18**	**20**	**21**	**10**	**13**

Table 6. Stem Count by Plot and Species - All Stems												
	Species	Total Stems	# plots	avg# stems	D06030A-01-0001-year:1	D06030A-01-0002-year:1	D06030A-01-0003-year:1	D06030A-01-0004-year:1	D06030A-01-0005-year:1	D06030A-01-0006-year:1	D06030A-01-0007-year:1	D06030A-01-0008-year:1
	Alnus serrulata	46	8	5.75	4	3	3	6	8	7	9	6
	Aronia arbutifolia	6	4	1.5	2			2		1		1
	Aronia melanocarpa	5	2	2.5					4	1		
	Diospyros virginiana	1	1	1				1				
	Fraxinus pennsylvanica	59	6	9.83	9	20	15	9	4	2		
	Ilex verticillata	2	1	2						2		
	Juglans nigra	2	2	1		1					1	
	Quercus palustris	6	6	1		1	1	1	1	1		1
	Salix nigra	3	3	1					1	1		1
	Sambucus canadensis	11	6	1.83	1		2	2	3	1	2	
	Betula	46	1	46								46
	Platanus occidentalis	12	4	3				2		5	1	4
	Salix exigua	7	2	3.5					5	2		
TOT:	**13**	**206**	**13**		**16**	**25**	**21**	**23**	**26**	**23**	**13**	**59**

APPENDIX B

Geomorphologic Raw Data

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



MCDOWELL COUNTY, NORTH CAROLINA

THOMPSONS FORK AND UNNAMED TRIBUTARY

APPENDIX B

STREAM PROBLEM AREA PLAN VIEW

Date	Job No.
October, 2008	2006-1398
Scale	Sheet
1" = 300'	1/1

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

SPA 1
Minor bank slumping along the left bank of Thomspons Fork near station 9+80.
(EMH&T, Inc. 9/18/09)

SPA 2
Wetland vegetation forming within the stream channel on UT1. There are several wetland areas found along this stream.
(EMH&T, Inc. 9/18/09)

SPA 3
Wetland vegetation forming within the stream channel on Thompsons Fork near station 8+75, causing a narrowing of the channel.
(EMH&T, Inc. 9/18/09)

Fixed Station 1
Overview of valley along UT1 near the upstream terminus of the project, approximately Station 4+00, facing downstream.
(EMH&T, Inc. 9/18/09)

Fixed Station 2
Overview of valley along UT1 near the midpoint of the project, approximately Station 10+75, facing upstream.
(EMH&T, Inc. 9/18/09)

Fixed Station 3
Overview of valley along UT1 near the midpoint of the project, approximately Station 10+75, facing downstream.
(EMH&T, Inc. 7/18/09)

Fixed Station 4
Overview of valley along UT1 near the downstream terminus of the project, just north of South Creek Road, facing upstream.
(EMH&T, Inc. 9/18/09)

Fixed Station 5
Overview of valley along UT1 at the downstream terminus of the project, facing upstream.
(EMH&T, Inc. 9/17/09)

Fixed Station 6
Overview of valley along the mainstem near the downstream terminus of the project, facing upstream.
(EMH&T, Inc. 9/17/09)

Fixed Station 7
Overview of valley along the mainstem near the midpoint of the project, approximately Station 12+00, facing downstream.
(EMH&T, Inc. 9/17/09)

Fixed Station 8
Overview of valley along the mainstem near the midpoint of the project, approximately Station 11+50, facing upstream.
(EMH&T, Inc. 9/17/09)

Fixed Station 9
Overview of valley along the mainstem near the upstream terminus of the project, facing downstream.
(EMH&T, Inc. 9/18/09)

Table B1. Visual Morphological Stability Assessment
Thompsons Fork Stream Restoration / EEP Project No. D06030-A
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?	42	42	0	100	
	2. Armor stable (e.g. no displacement)?	42	42	0	100	
	3. Facet grade appears stable?	42	42	0	100	
	4. Minimal evidence of embedding/fining?	42	42	0	100	
	5. Length appropriate?	42	42	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	42	42	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	42	42	0	100	
	3. Length appropriate?	42	42	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	42	42	0	100	
	2. Downstream of meander (glide/inflection) centering?	42	42	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	41	42	1	98	
	2. Of those eroding, # w/concomitant point bar formation?	42	42	0	100	
	3. Apparent Rc within spec?	42	42	0	100	
	4. Sufficient floodplain access and relief?	42	42	0	100	**99%**
E. Bed General	1. Geveral channel bed aggradation areas (bar formation)	N/A	N/A	3/25 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?	10	10	0	100	
	2. Height appropriate?	10	10	0	100	
	3. Angle and geometry appear appropriate?	10	10	0	100	
	4. Free of piping or other structural failures?	10	10	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
Thompsons Fork Stream Restoration / EEP Project No. D06030-A
Segment/Reach: UT

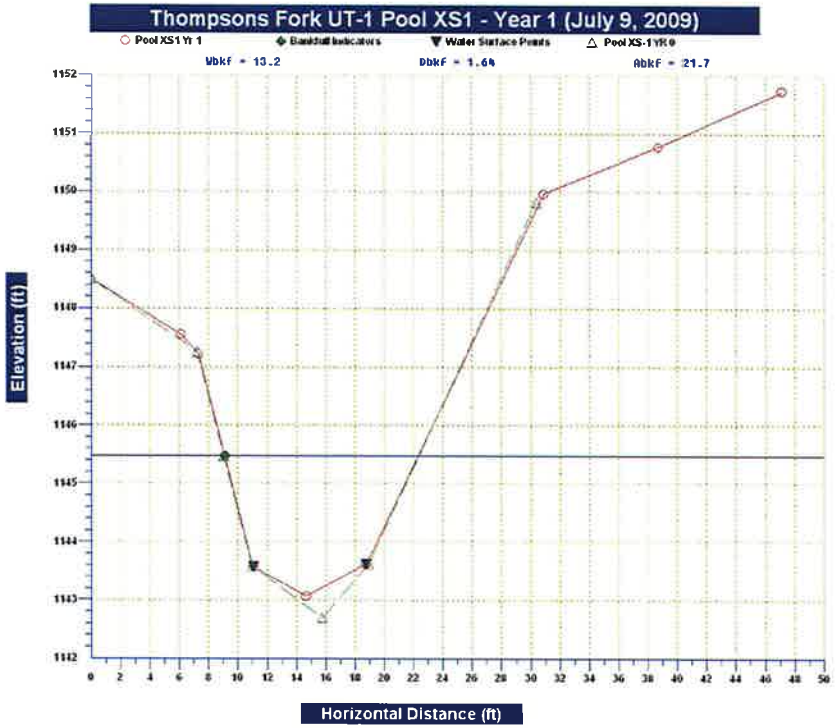
Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	35	35	0	100	
	2. Armor stable (e.g. no displacement)?	35	35	0	100	
	3. Facet grade appears stable?	35	35	0	100	
	4. Minimal evidence of embedding/fining?	35	35	0	100	
	5. Length appropriate?	35	35	0	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	35	35	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	31	35	4	89	
	3. Length appropriate?	35	35	0	100	**96%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	38	38	0	100	
	2. Downstream of meander (glide/inflection) centering?	38	38	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	38	38	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	38	38	0	100	
	3. Apparent Rc within spec?	38	38	0	100	
	4. Sufficient floodplain access and relief?	38	38	0	100	**100%**
E. Bed General	1. Geveral channel bed aggradation areas (bar formation)	N/A	N/A	0/0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/0 feet	100	**100%**
F. Vanes	1. Free of back or arm scour?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	**N/A**
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	**N/A**
H. Log Sills	1. Maintaining grade control?	58	58	0	100	
	2. Minimal evidence of sedimentation in adjacent pool?	51	58	7	89	**95%**

Summary Data
All dimensions in feet.

Bankfull Area	21.66 ft^2
Bankfull Width	13.2 ft
Mean Depth	1.64 ft
Maximum Depth	2.41 ft
Width/Depth Ratio	8.05
Entrenchment Ratio	1.74

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	UT-1
DATE	7/9/09
CROSS SECTION:	1
FEATURE:	Pool

Cross-section photo – looking upstream

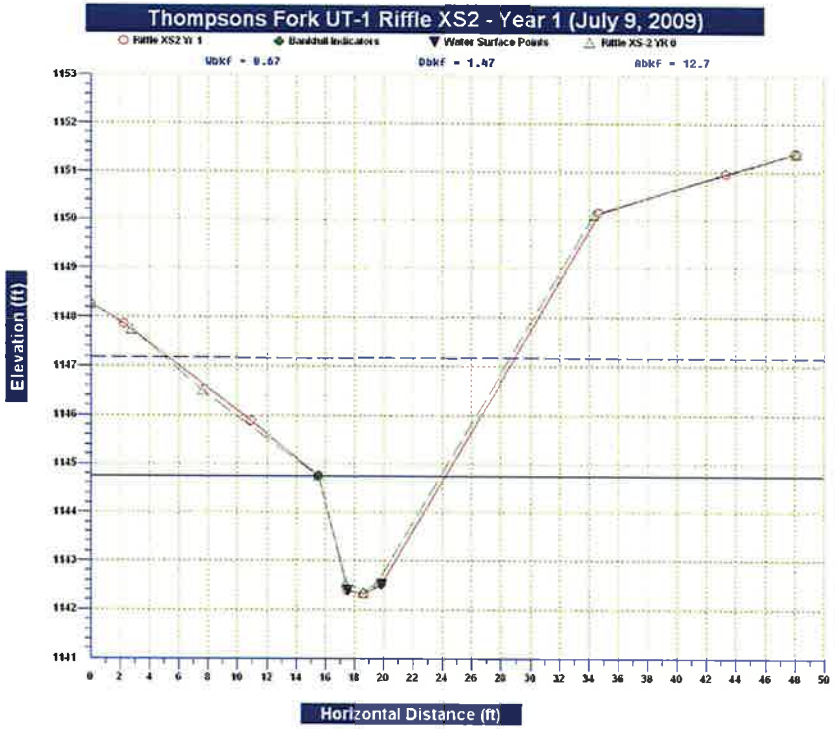


Summary Data
All dimensions in feet.

Bankfull Area	12.71 ft^2
Bankfull Width	8.67 ft
Mean Depth	1.47 ft
Maximum Depth	2.43 ft
Width/Depth Ratio	5.9
Entrenchment Ratio	2.73
Classification	E

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	UT-1
DATE	7/9/09
CROSS SECTION:	2
FEATURE:	Riffle

Cross-section photo – looking upstream

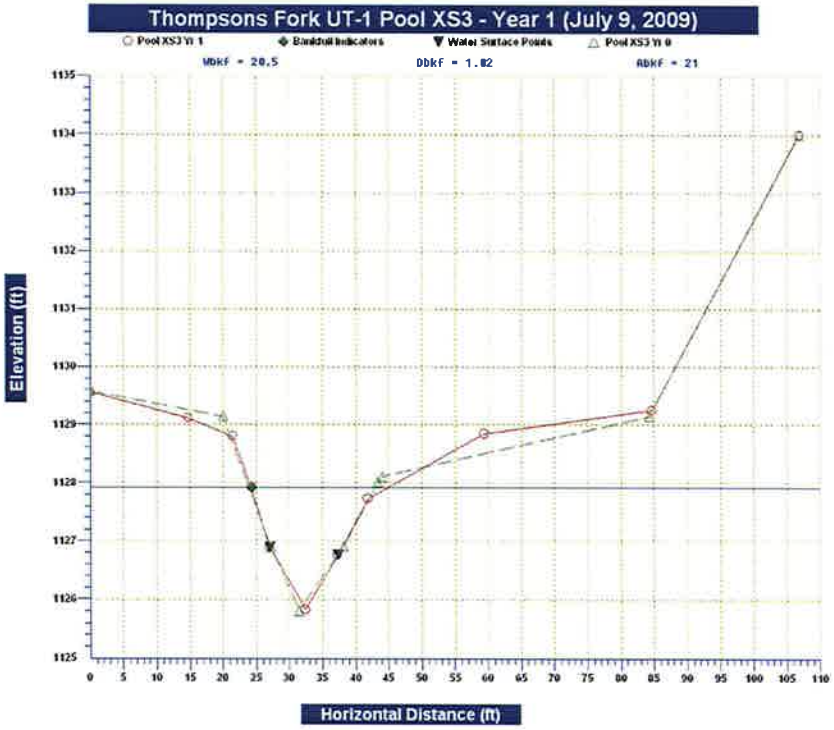


Summary Data
All dimensions in feet.

Bankfull Area	21.02 ft^2
Bankfull Width	20.53 ft
Mean Depth	1.02 ft
Maximum Depth	2.09 ft
Width/Depth Ratio	20.13
Entrenchment Ratio	4.3

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	UT-1
DATE	7/9/09
CROSS SECTION:	3
FEATURE:	Pool

Cross-section photo – looking upstream



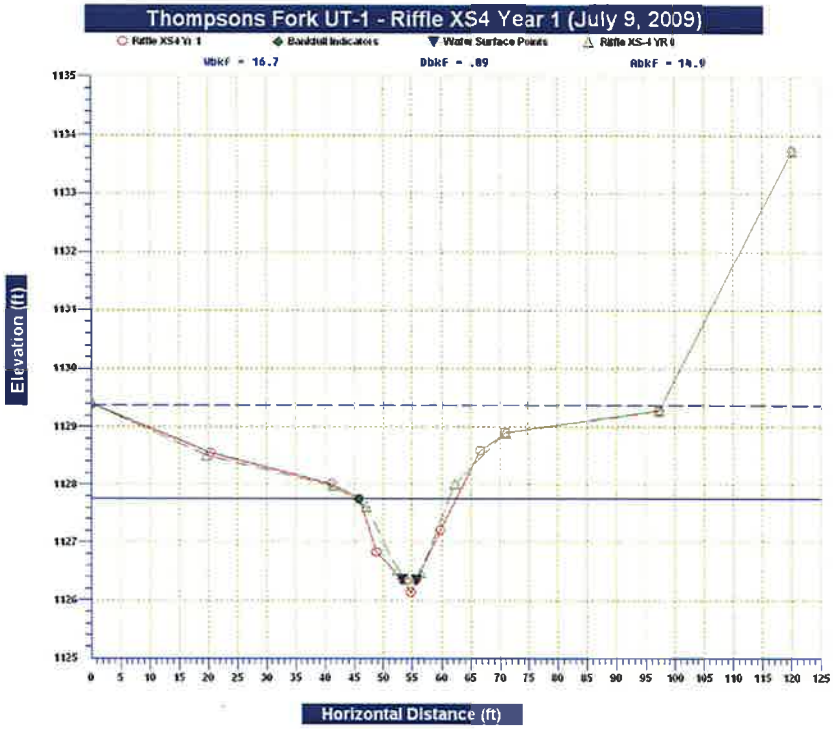
Summary Data
All dimensions in feet.

Bankfull Area	14.89 ft^2
Bankfull Width	16.67 ft
Mean Depth	0.89 ft
Maximum Depth	1.62 ft
Width/Depth Ratio	18.73
Entrenchment Ratio	5.84
Classification	C

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	UT-1
DATE	7/9/09
CROSS SECTION:	4
FEATURE:	Riffle

Ecosystem Enhancement

Cross-section photo – looking upstream



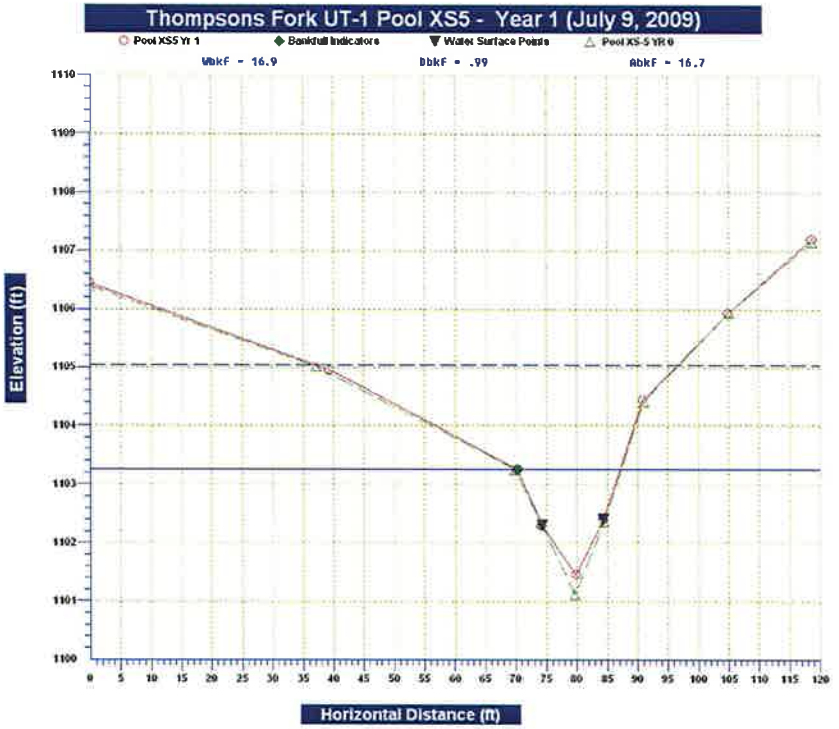
EMH&T

Summary Data
All dimensions in feet.

Bankfull Area	16.74 ft^2
Bankfull Width	16.88 ft
Mean Depth	0.99 ft
Maximum Depth	1.8 ft
Width/Depth Ratio	17.05
Entrenchment Ratio	3.55

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	UT-1
DATE	7/9/09
CROSS SECTION:	5
FEATURE:	Pool

Cross-section photo – looking upstream

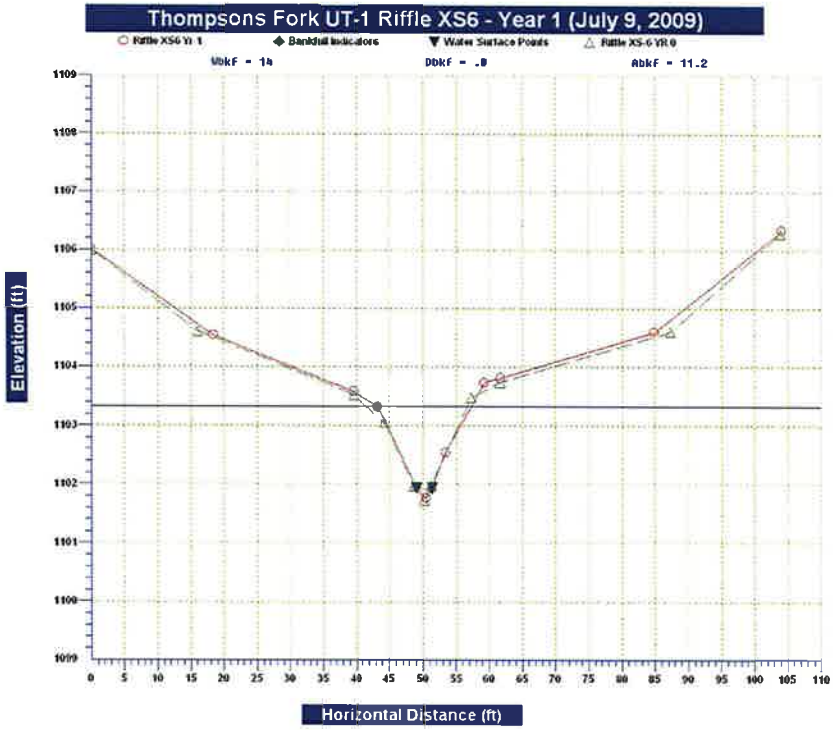


Summary Data
All dimensions in feet.

Bankfull Area	11.15 ft^2
Bankfull Width	14.03 ft
Mean Depth	0.8 ft
Maximum Depth	1.56 ft
Width/Depth Ratio	17.54
Entrenchment Ratio	5.28
Classification	C

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	UT-1
DATE	7/9/09
CROSS SECTION:	6
FEATURE:	Riffle

Cross-section photo – looking upstream

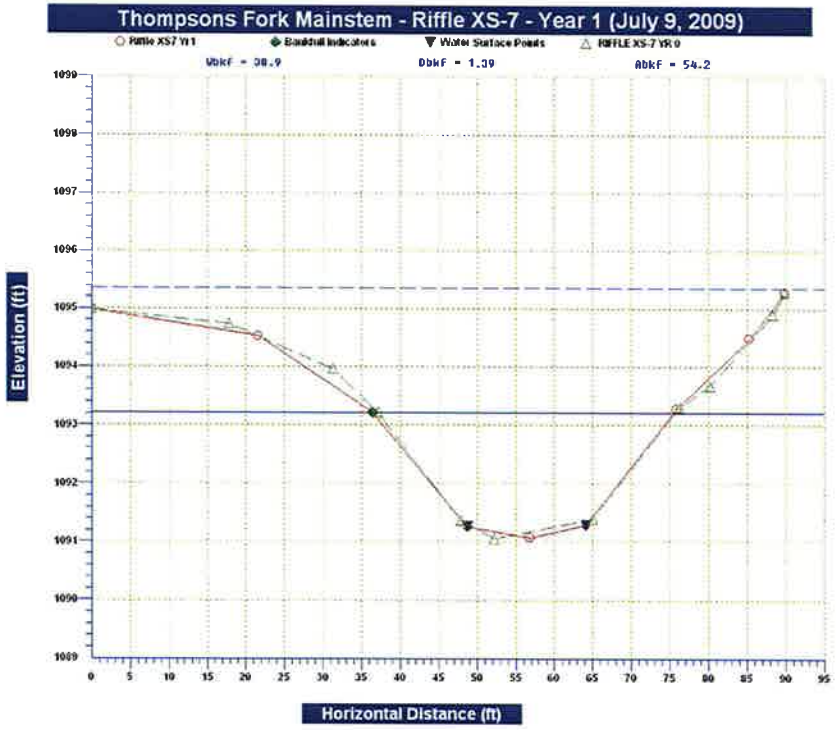


Summary Data
All dimensions in feet.

Bankfull Area	54.16 ft^2
Bankfull Width	38.95 ft
Mean Depth	1.39 ft
Maximum Depth	2.14 ft
Width/Depth Ratio	28.02
Entrenchment Ratio	2.31
Classification	C

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	7/9/09
CROSS SECTION:	7
FEATURE:	Riffle

Cross-section photo – looking upstream

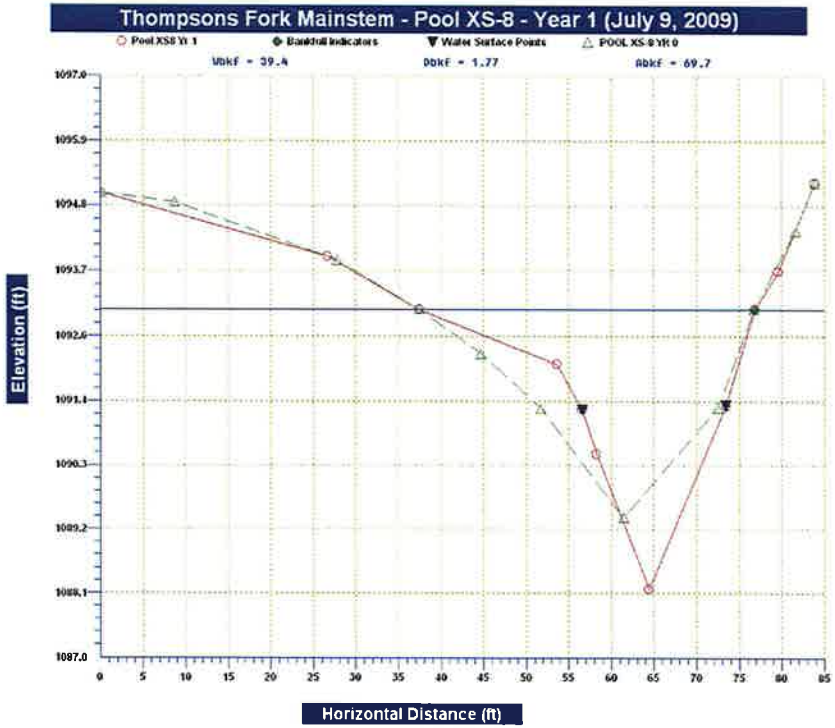


Summary Data
All dimensions in feet.

Bankfull Area	69.72 ft^2
Bankfull Width	39.37 ft
Mean Depth	1.77 ft
Maximum Depth	4.84 ft
Width/Depth Ratio	22.24
Entrenchment Ratio	2.13

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	7/9/09
CROSS SECTION:	8
FEATURE:	Pool

Cross-section photo – looking upstream

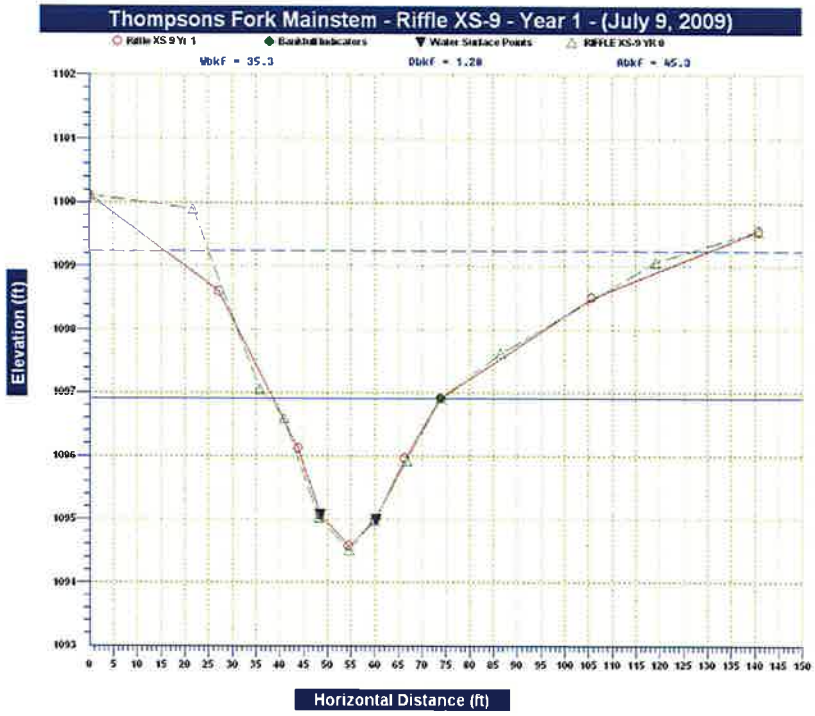


Summary Data
All dimensions in feet.

Bankfull Area	45.27 ft^2
Bankfull Width	35.31 ft
Mean Depth	1.28 ft
Maximum Depth	2.34 ft
Width/Depth Ratio	27.59
Entrenchment Ratio	3.25
Classification	C

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	7/9/09
CROSS SECTION:	9
FEATURE:	Riffle

Cross-section photo – looking upstream

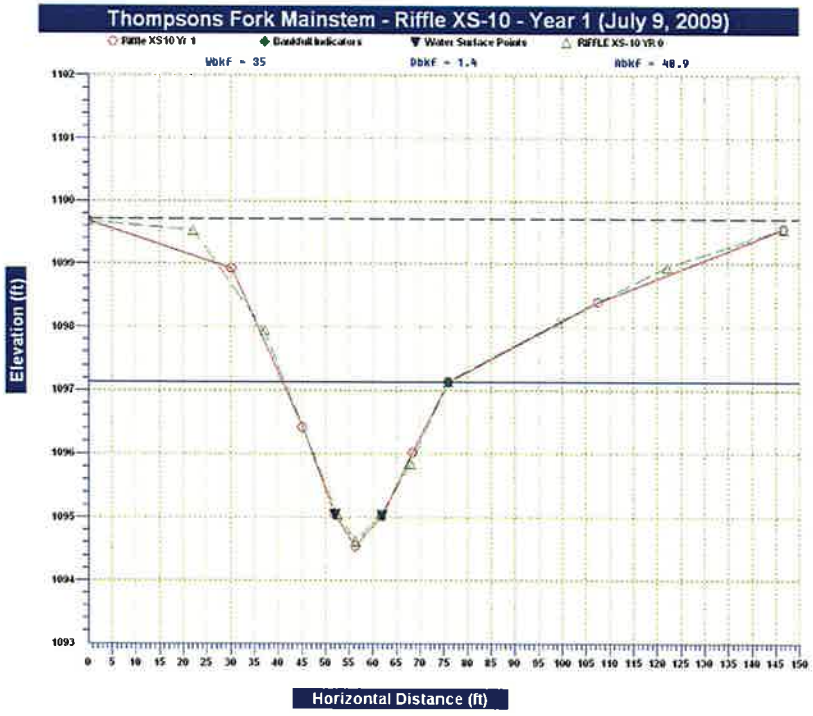


Summary Data
All dimensions in feet.

Bankfull Area	48.93 ft^2
Bankfull Width	35.01 ft
Mean Depth	1.4 ft
Maximum Depth	2.59 ft
Width/Depth Ratio	25.01
Entrenchment Ratio	4.19
Classification	C

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	7/9/09
CROSS SECTION:	10
FEATURE:	Riffle

Cross-section photo – looking downstream

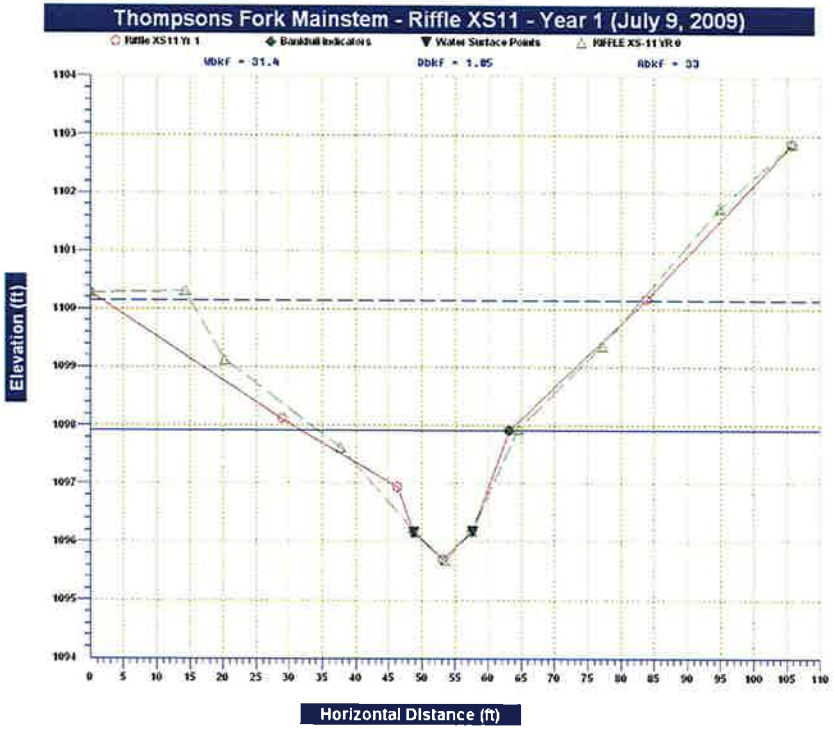


Summary Data
All dimensions in feet.

Bankfull Area	32.98 ft^2
Bankfull Width	31.42 ft
Mean Depth	1.05 ft
Maximum Depth	2.23 ft
Width/Depth Ratio	29.92
Entrenchment Ratio	2.61
Classification	C

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	7/9/09
CROSS SECTION:	11
FEATURE:	Riffle

Cross-section photo – looking upstream

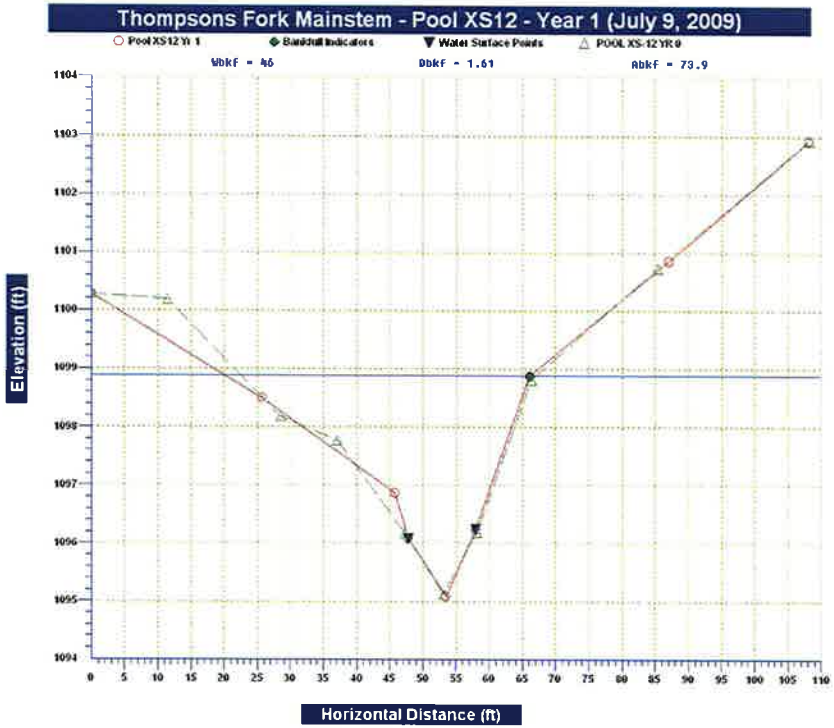


Summary Data
All dimensions in feet.

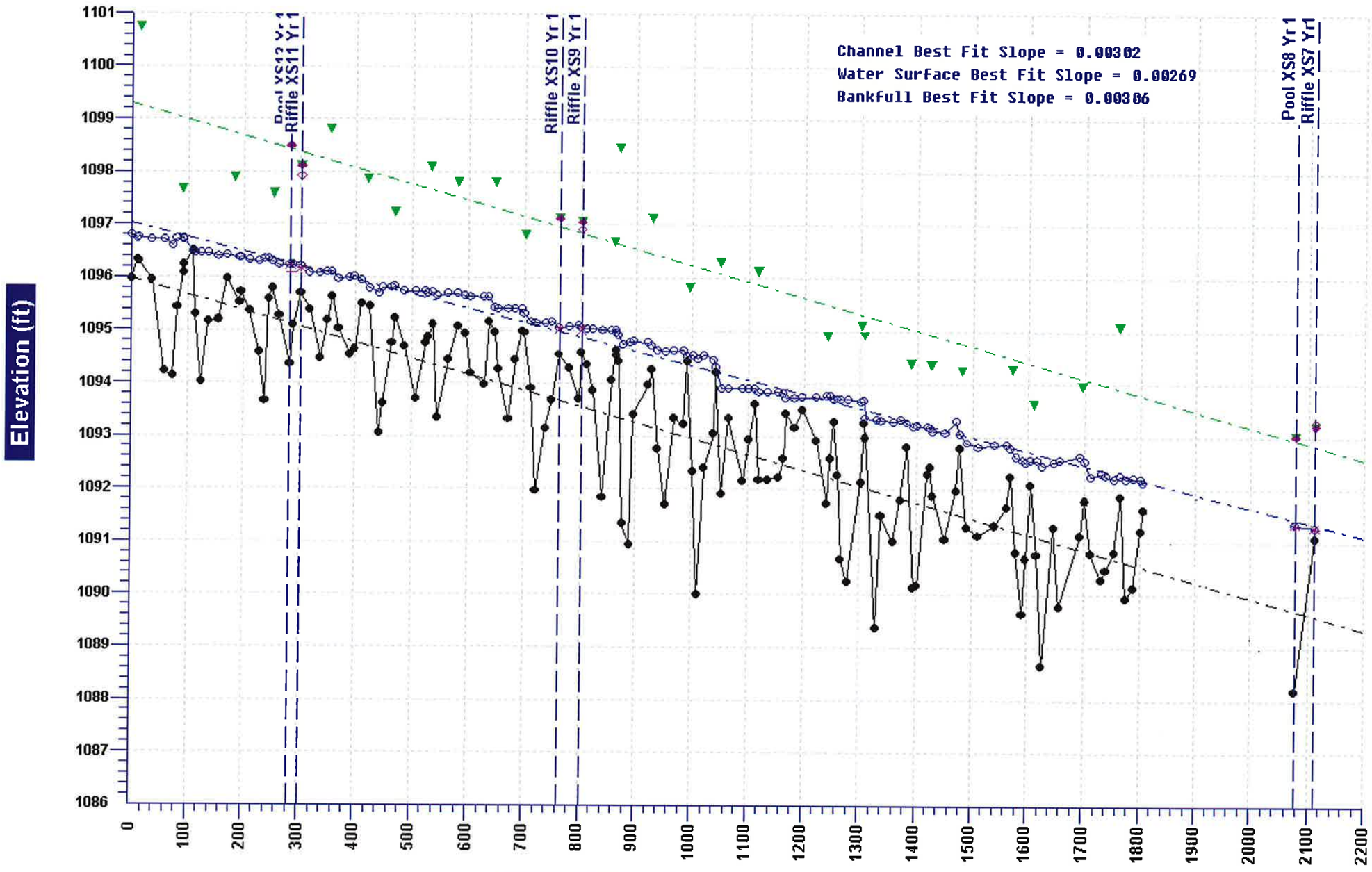
Bankfull Area	73.87 ft^2
Bankfull Width	45.96 ft
Mean Depth	1.61 ft
Maximum Depth	3.8 ft
Width/Depth Ratio	28.55
Entrenchment Ratio	2.3

PROJECT	Thompsons Fork
	D06030-A
	1-YEAR
TASK	Cross-Section
REACH	Mainstem
DATE	7/9/09
CROSS SECTION:	12
FEATURE:	Pool

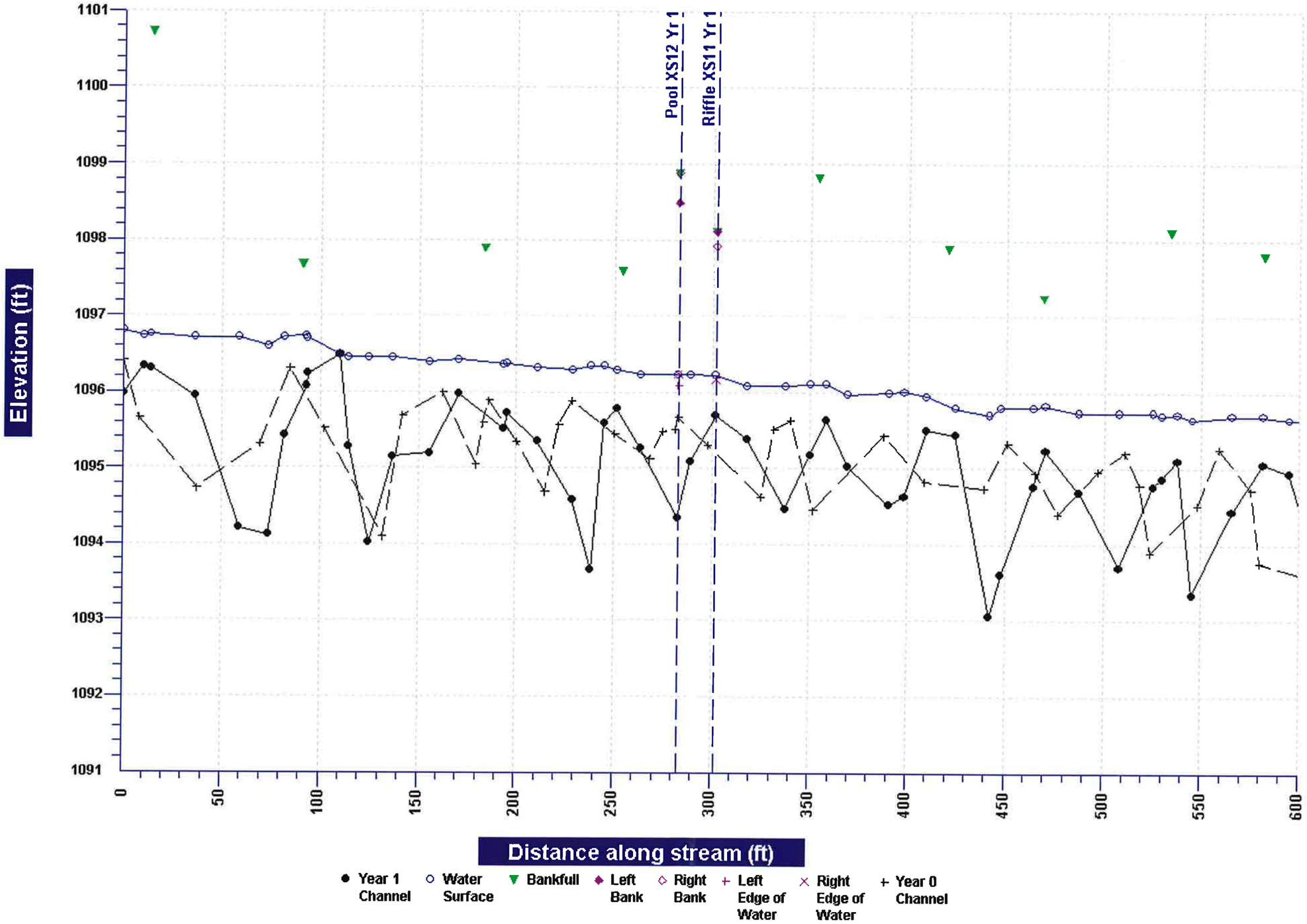
Cross-section photo – looking downstream



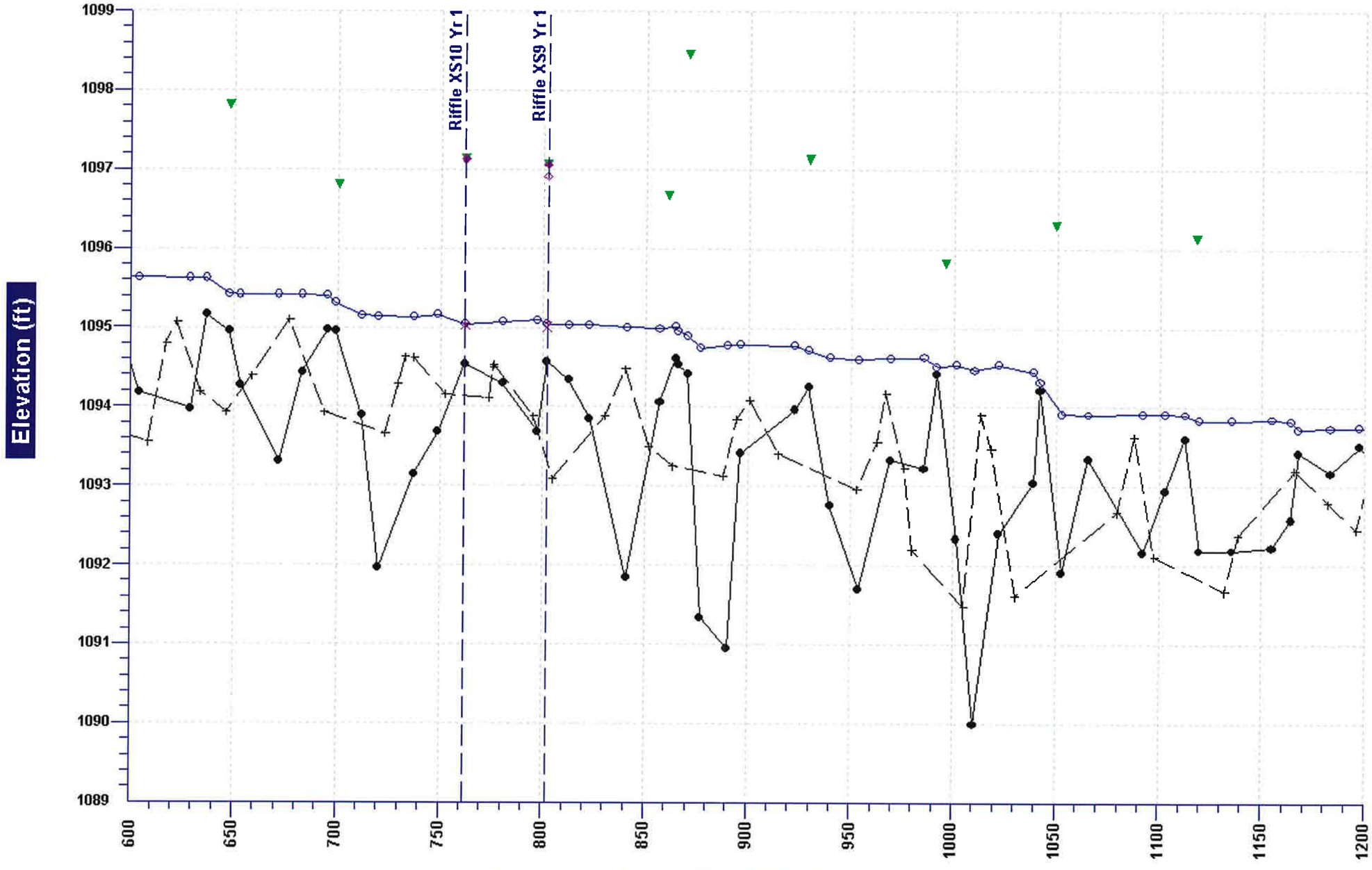
Thompsons Fork Mainstem Longitudinal Profile - Year 1 (July 9, 2009)



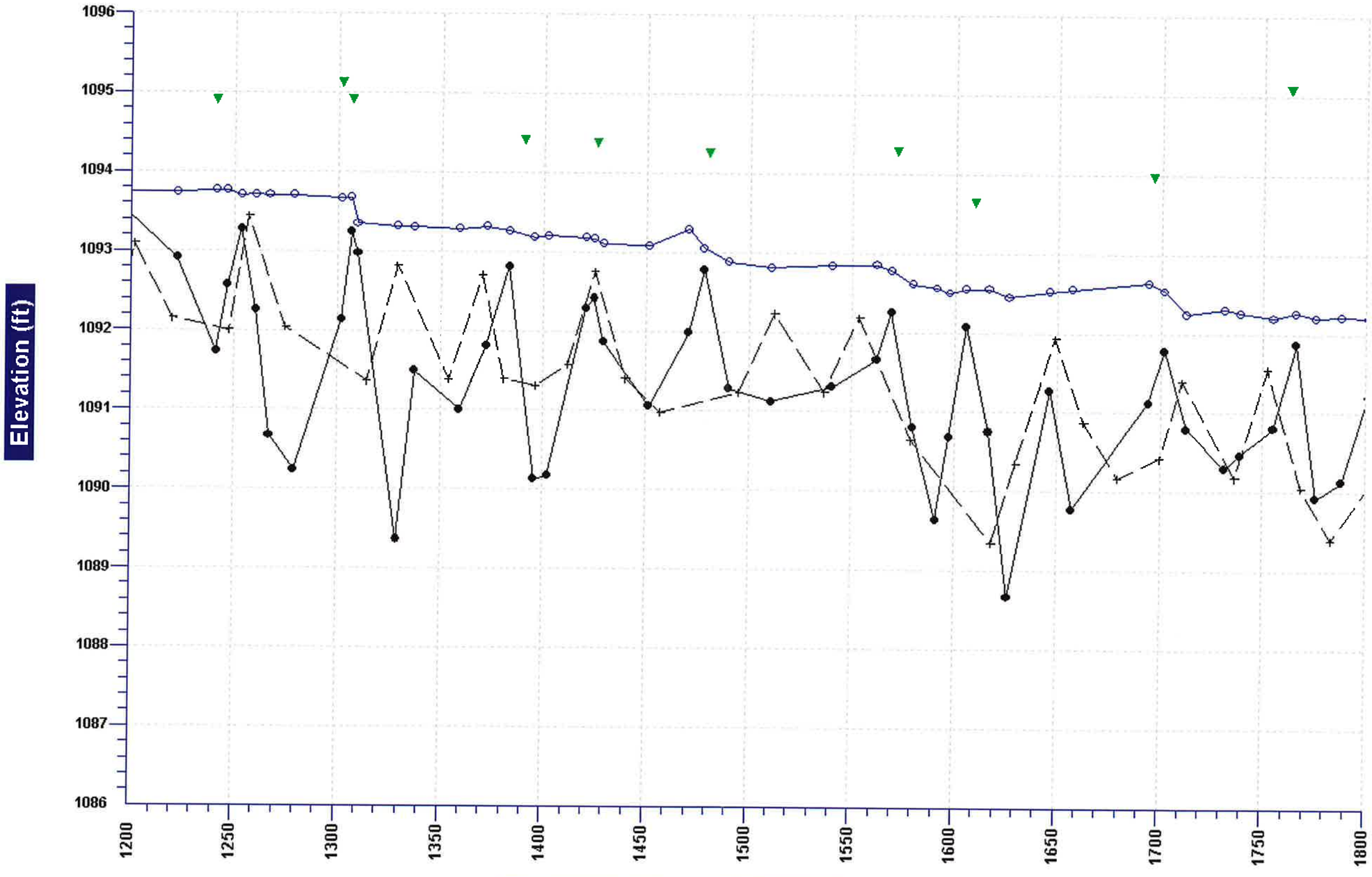
Thompsons Fork Mainstem Longitudinal Profile - Year 1 (July 9, 2009)



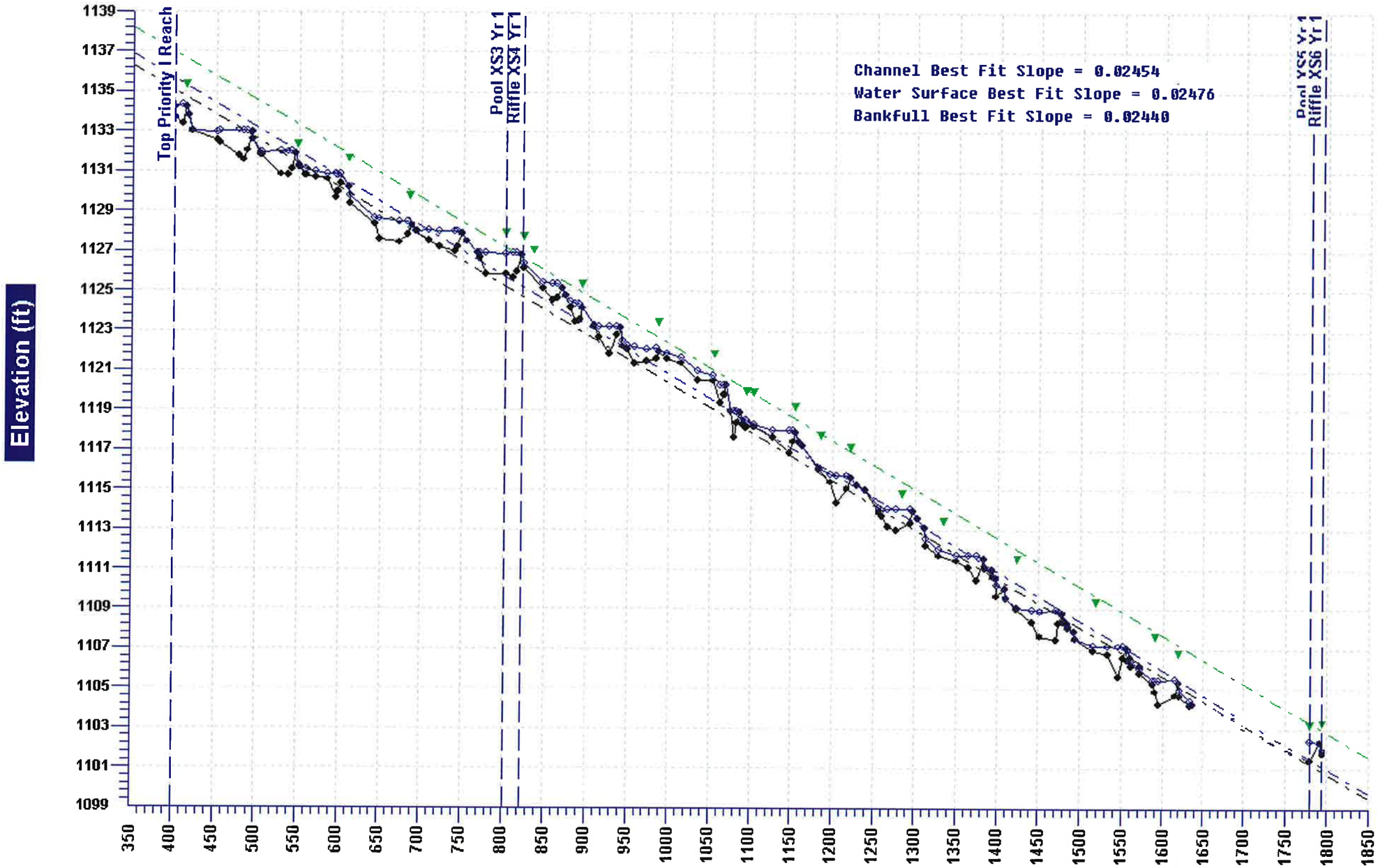
Thompsons Fork Mainstem Longitudinal Profile - Year 1 (July 9, 2009)



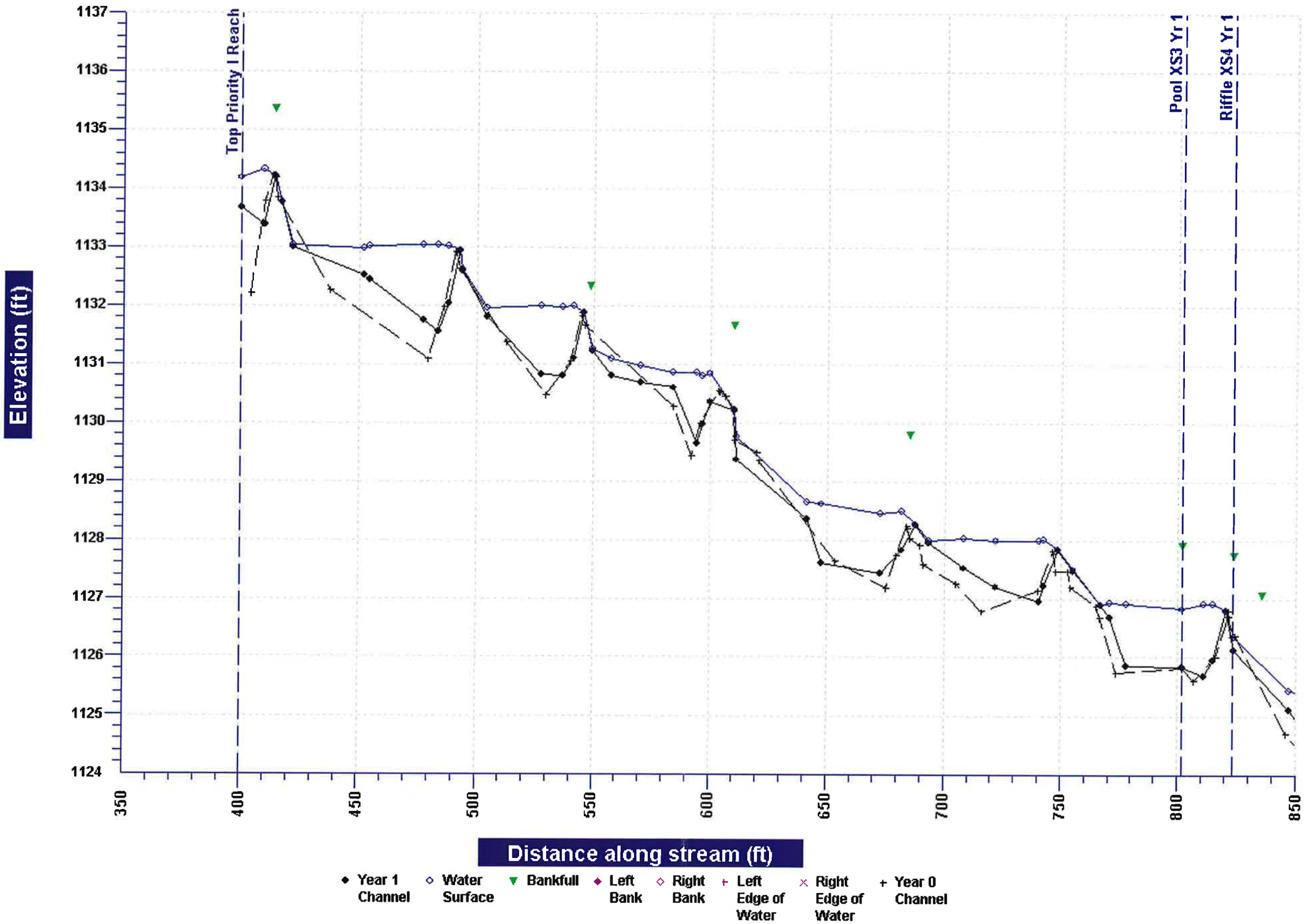
Thompsons Fork Mainstem Longitudinal Profile - Year 1 (July 9, 2009)



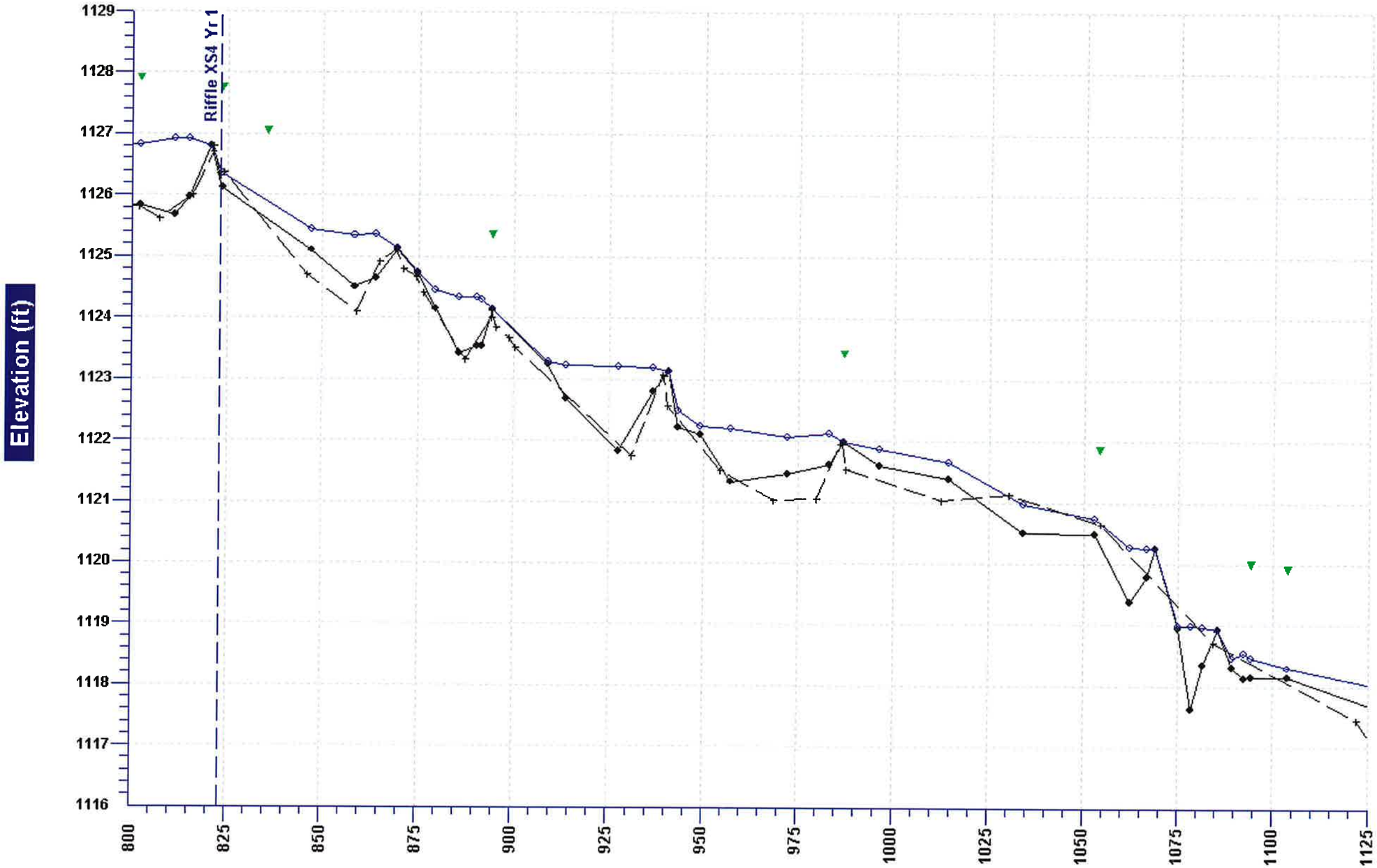
Thompsons Fork - UT1 - Priority Level 1 Profile - Year 1 (July 9, 2009)



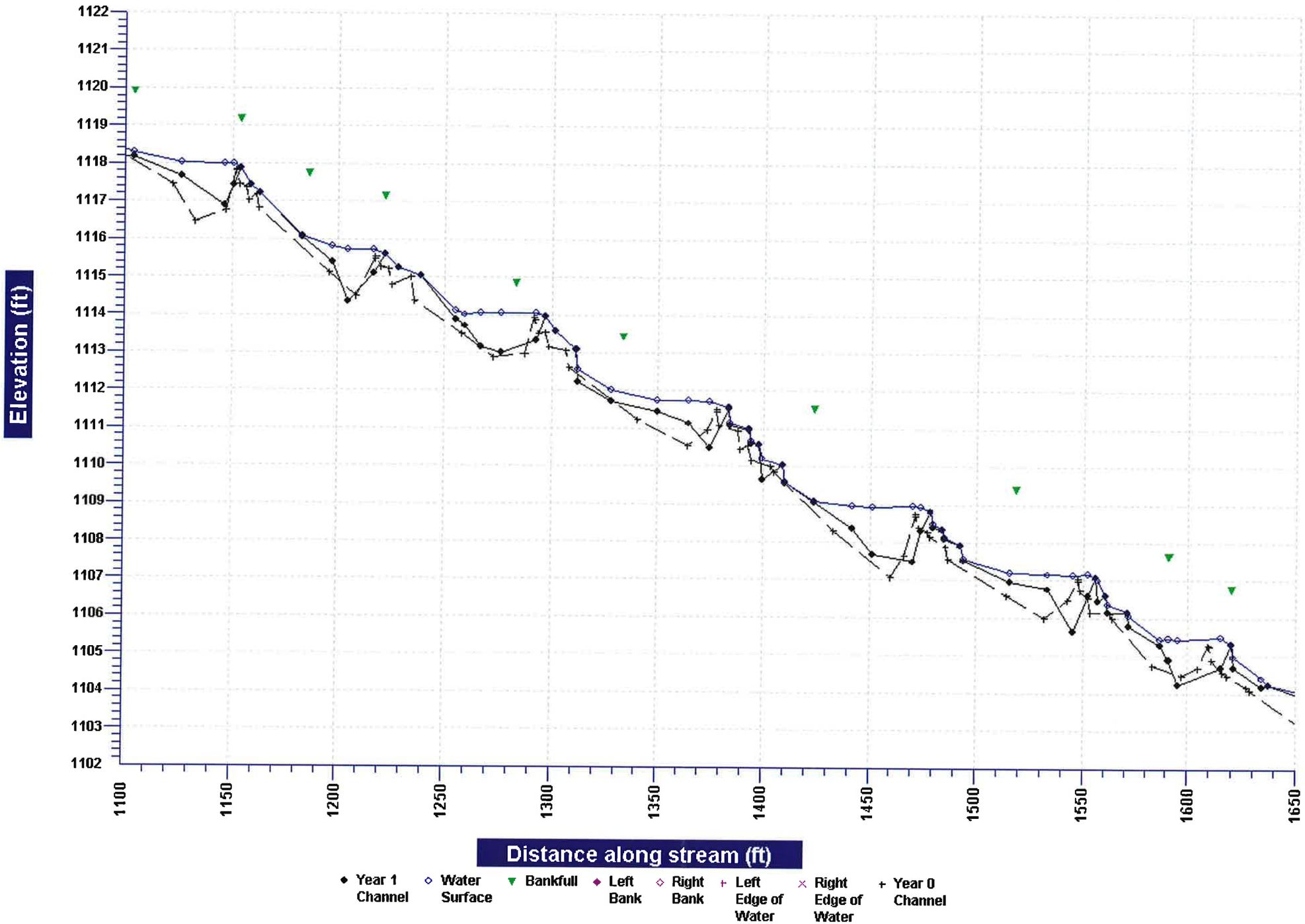
Thompsons Fork - UT1 - Priority Level 1 Profile - Year 1 (July 9, 2009)



Thompsons Fork - UT1 - Priority Level 1 Profile - Year 1 (July 9, 2009)

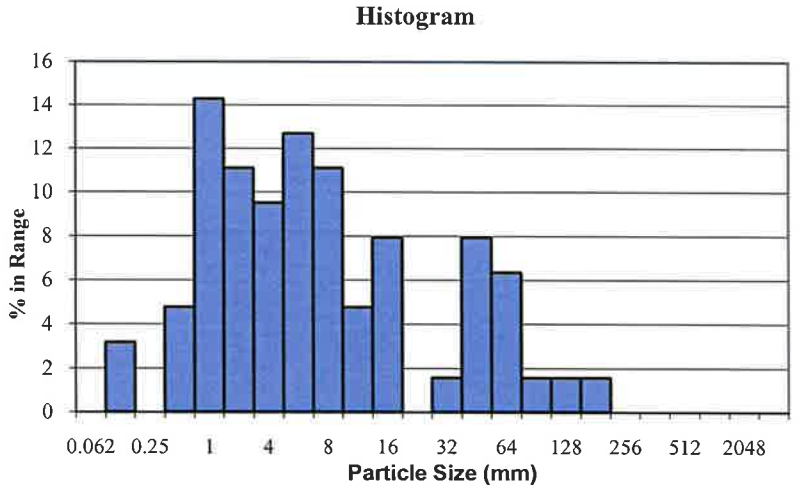


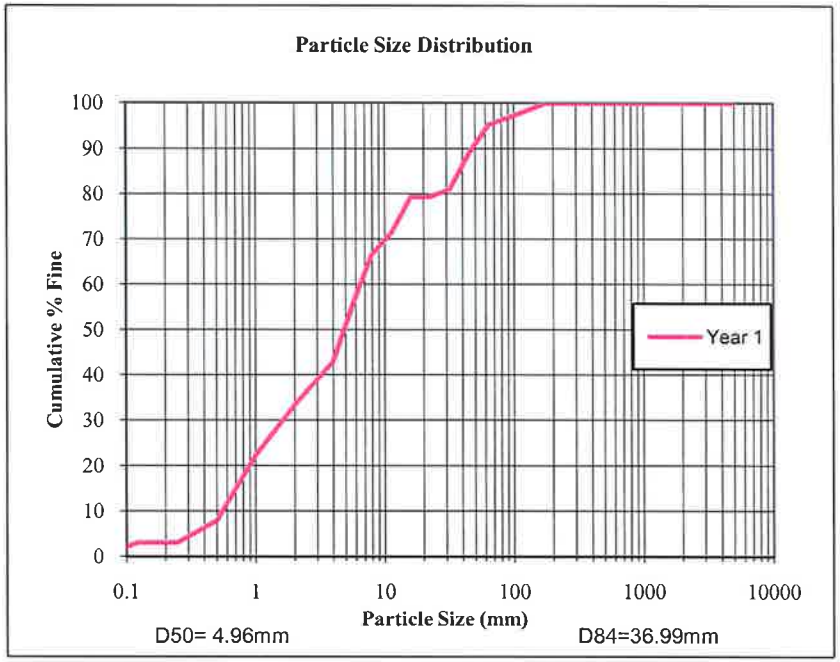
Thompsons Fork - UT1 - Priority Level 1 Profile - Year 1 (July 9, 2009)



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	2	3	3
Fine Sand	0.125-0.25	0	0	3
Medium Sand	0.25-0.5	3	5	8
Coarse Sand	0.5-1.0	9	14	22
Very Coarse Sand	1.0-2.0	7	11	33
Very Fine Gravel	2.0-4.0	6	10	43
Fine Gravel	4.0-5.7	8	13	56
Fine Gravel	5.7-8.0	7	11	67
Medium Gravel	8.0-11.3	3	5	71
Medium Gravel	11.3-16.0	5	8	79
Coarse Gravel	16.0-22.6	0	0	79
Coarse Gravel	22.6-32	1	2	81
Very Coarse Gravel	32-45	5	8	89
Very Coarse Gravel	45-64	4	6	95
Small Cobble	64-90	1	2	97
Small Cobble	90-128	1	2	98
Large Cobble	128-180	1	2	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	

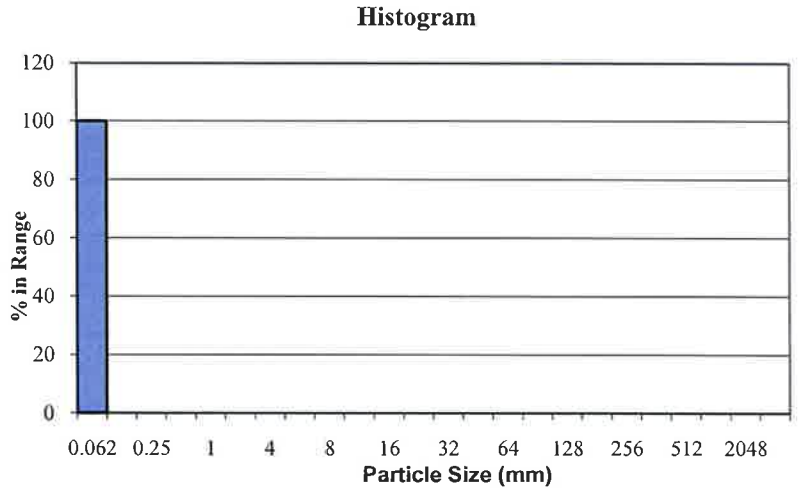
Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	1
Date	7/9/09	**Sta No.**	1+60

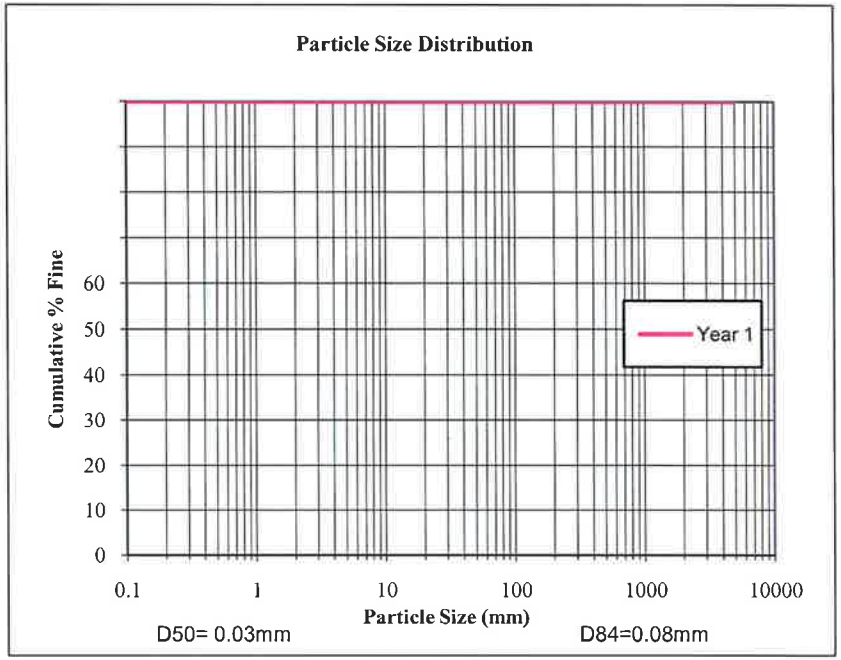




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	60	100	100
Very Fine Sand	0.062-0.125	0	0	100
Fine Sand	0.125-0.25	0	0	100
Medium Sand	0.25-0.5	0	0	100
Coarse Sand	0.5-1.0	0	0	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0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

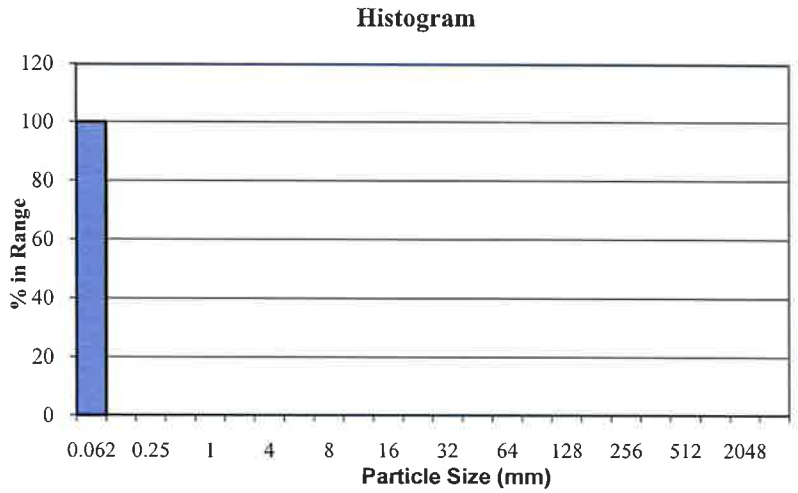
Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	2
Date	7/9/09	**Sta No.**	1+74

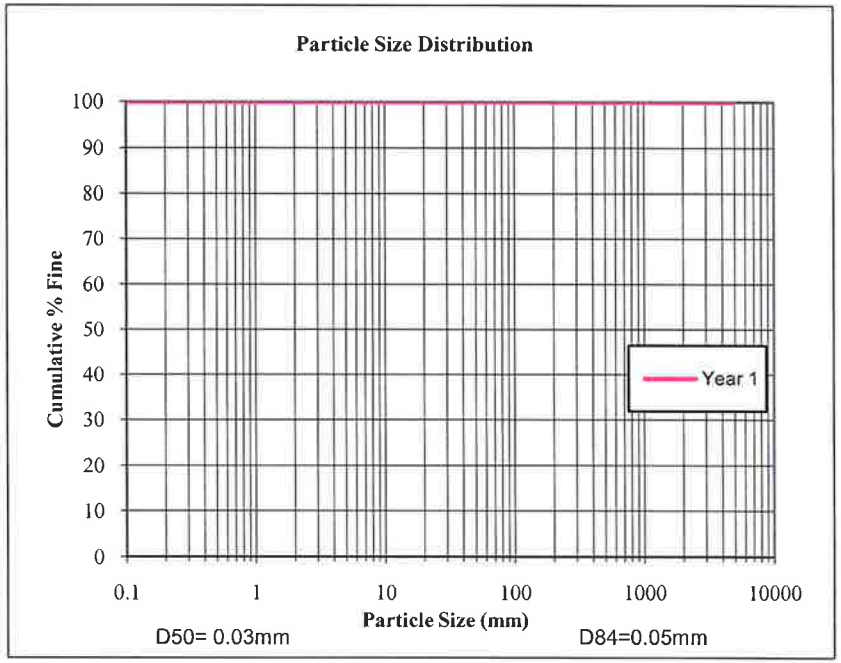




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	60	100	100
Very Fine Sand	0.062-0.125	0	0	100
Fine Sand	0.125-0.25	0	0	100
Medium Sand	0.25-0.5	0	0	100
Coarse Sand	0.5-1.0	0	0	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0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

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	3
Date	7/9/09	**Sta No.**	8+09

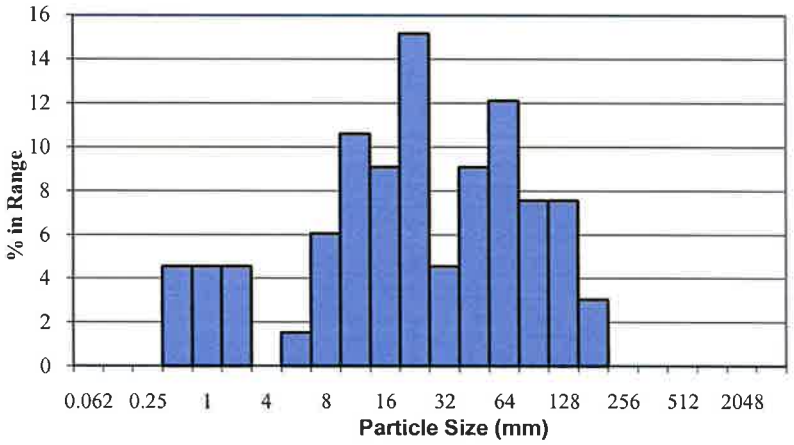




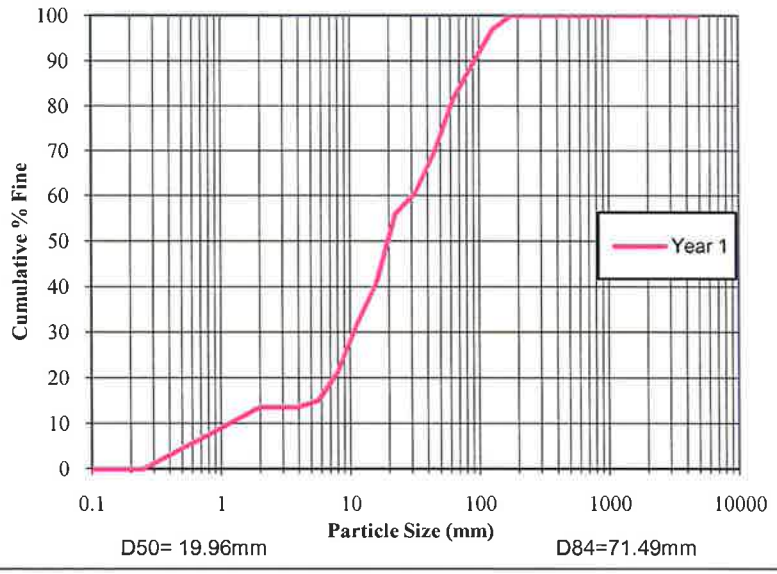
Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	3	5	5
Coarse Sand	0.5-1.0	3	5	9
Very Coarse Sand	1.0-2.0	3	5	14
Very Fine Gravel	2.0-4.0	0	0	14
Fine Gravel	4.0-5.7	1	2	15
Fine Gravel	5.7-8.0	4	6	21
Medium Gravel	8.0-11.3	7	11	32
Medium Gravel	11.3-16.0	6	9	41
Coarse Gravel	16.0-22.6	10	15	56
Coarse Gravel	22.6-32	3	5	61
Very Coarse Gravel	32-45	6	9	70
Very Coarse Gravel	45-64	8	12	82
Small Cobble	64-90	5	8	89
Small Cobble	90-128	5	8	97
Large Cobble	128-180	2	3	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		66	100	

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	4
Date	7/9/09	**Sta No.**	8+31

Histogram

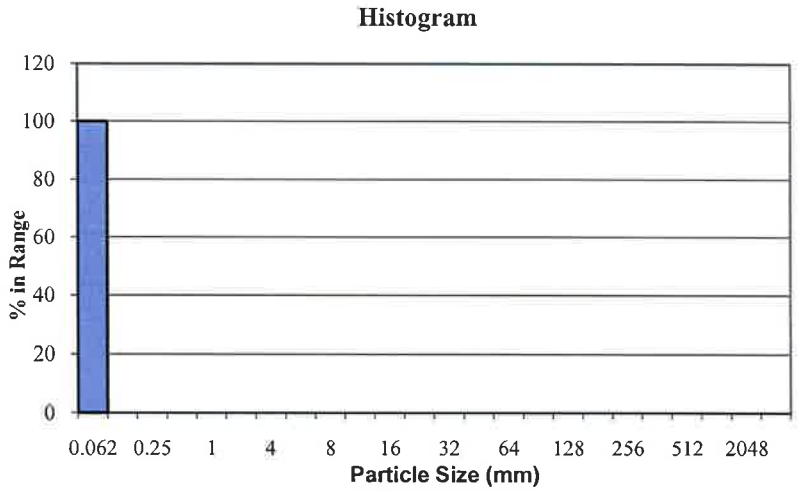


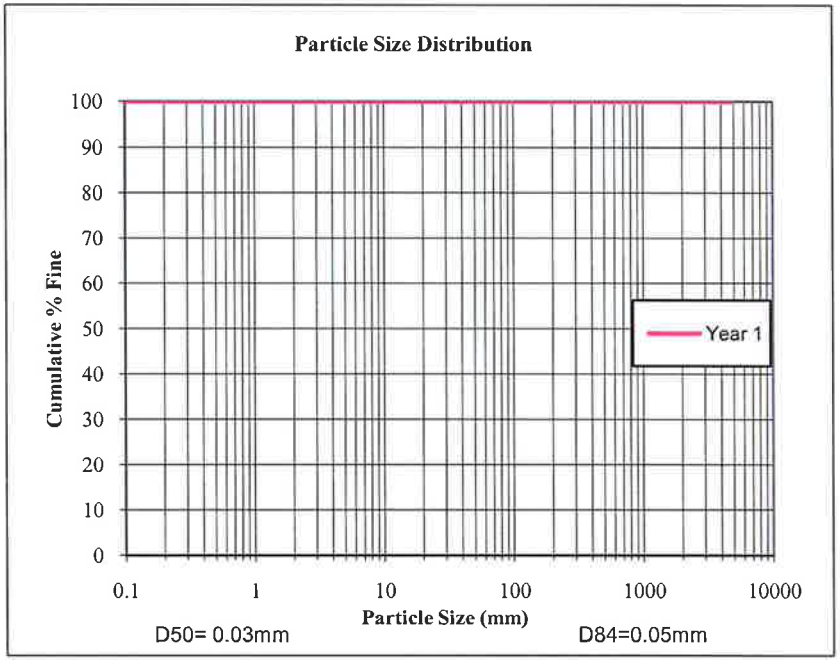
Particle Size Distribution



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

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	5
Date	7/9/09	**Sta No.**	17+79

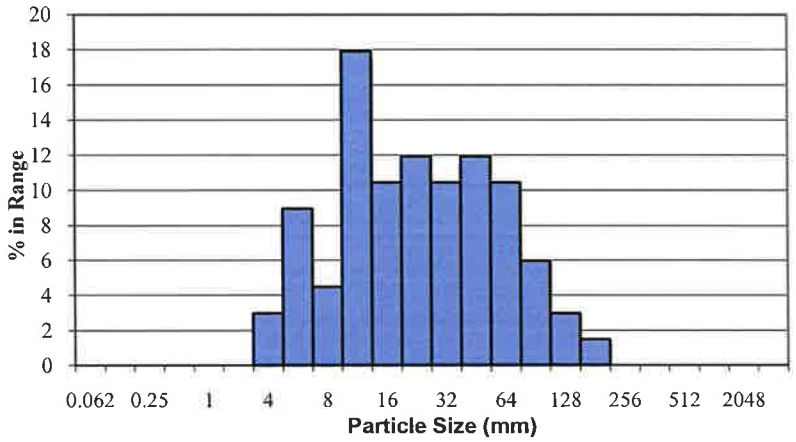


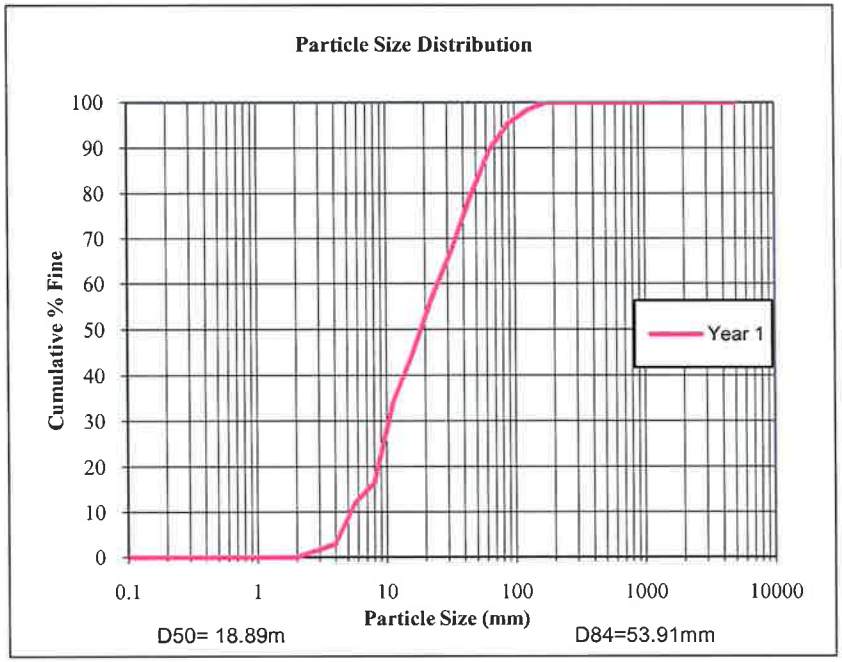


Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	0	0	0
Coarse Sand	0.5-1.0	0	0	0
Very Coarse Sand	1.0-2.0	0	0	0
Very Fine Gravel	2.0-4.0	2	3	3
Fine Gravel	4.0-5.7	6	9	12
Fine Gravel	5.7-8.0	3	4	16
Medium Gravel	8.0-11.3	12	18	34
Medium Gravel	11.3-16.0	7	10	45
Coarse Gravel	16.0-22.6	8	12	57
Coarse Gravel	22.6-32	7	10	67
Very Coarse Gravel	32-45	8	12	79
Very Coarse Gravel	45-64	7	10	90
Small Cobble	64-90	4	6	96
Small Cobble	90-128	2	3	99
Large Cobble	128-180	1	1	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		67	100	

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	6
Date	7/9/09	**Sta No.**	17+94

Histogram

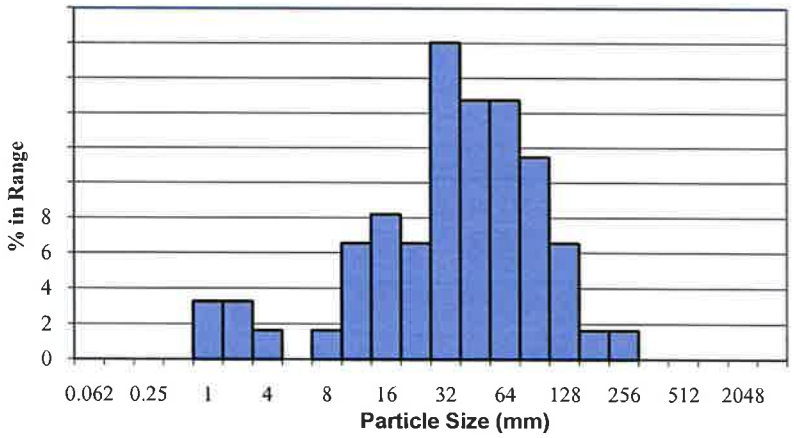


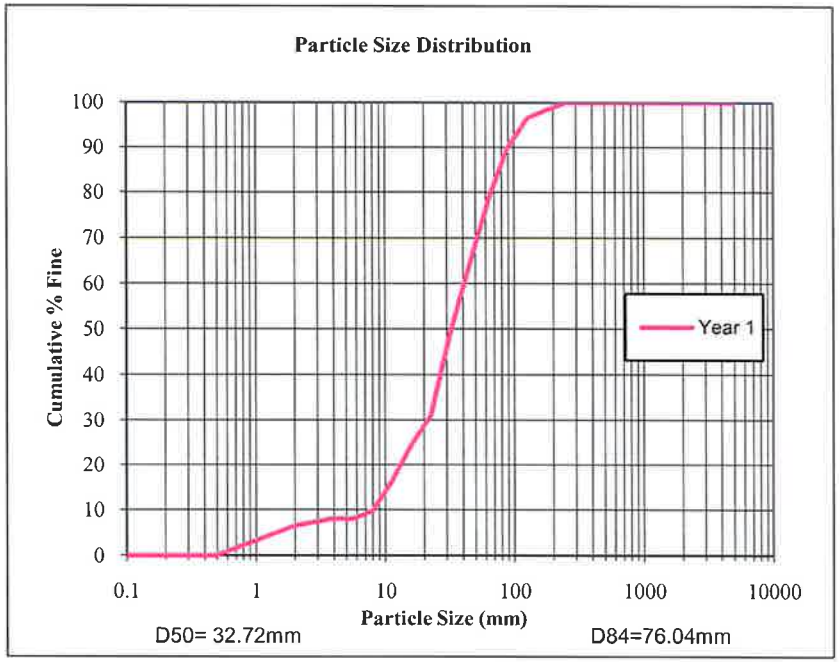


Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	0	0	0
Coarse Sand	0.5-1.0	2	3	3
Very Coarse Sand	1.0-2.0	2	3	7
Very Fine Gravel	2.0-4.0	1	2	8
Fine Gravel	4.0-5.7	0	0	8
Fine Gravel	5.7-8.0	1	2	10
Medium Gravel	8.0-11.3	4	7	16
Medium Gravel	11.3-16.0	5	8	25
Coarse Gravel	16.0-22.6	4	7	31
Coarse Gravel	22.6-32	11	18	49
Very Coarse Gravel	32-45	9	15	64
Very Coarse Gravel	45-64	9	15	79
Small Cobble	64-90	7	11	90
Small Cobble	90-128	4	7	97
Large Cobble	128-180	1	2	98
Large Cobble	180-256	1	2	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		61	100	

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	7
Date	7/9/09	**Sta No.**	21+11

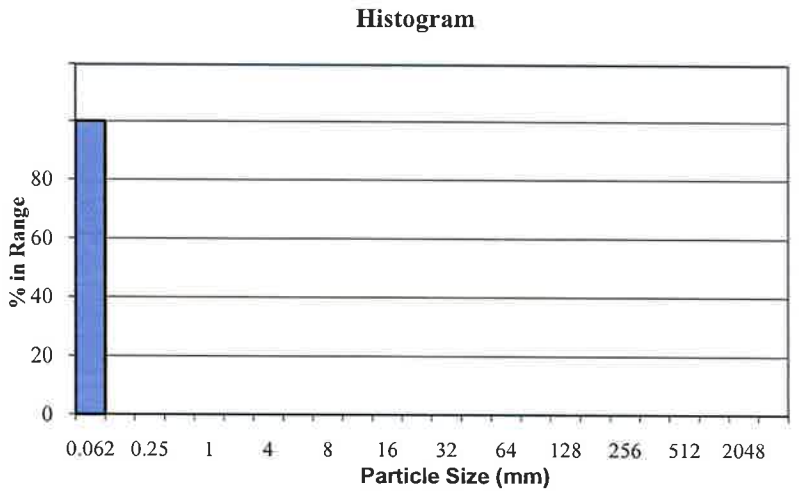
Histogram

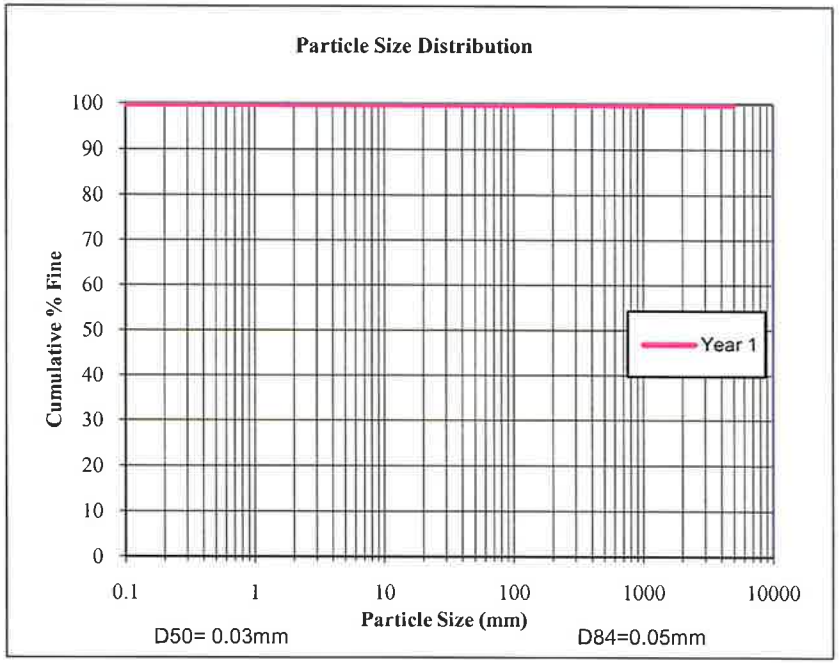




Pebble Count – Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	60	100	100
Very Fine Sand	0.062-0.125	0	0	100
Fine Sand	0.125-0.25	0	0	100
Medium Sand	0.25-0.5	0	0	100
Coarse Sand	0.5-1.0	0	0	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0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

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	8
Date	7/9/09	**Sta No.**	20+77

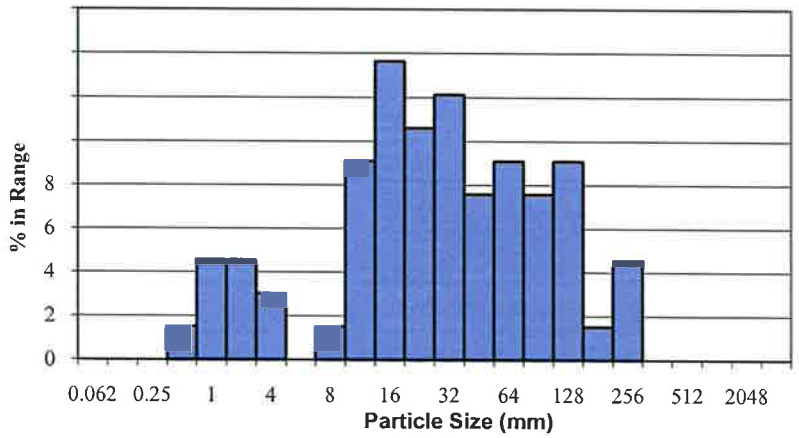


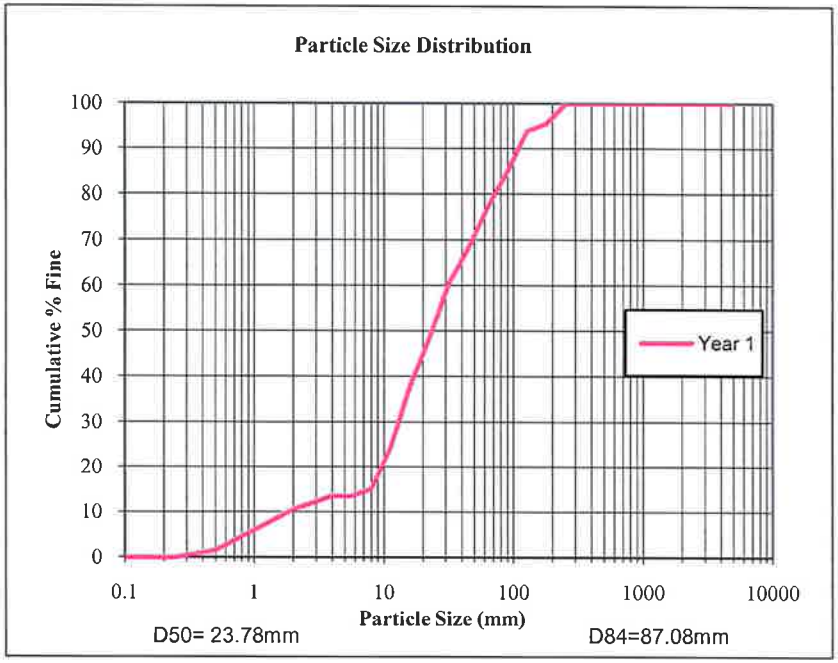


Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	1	2	2
Coarse Sand	0.5-1.0	3	5	6
Very Coarse Sand	1.0-2.0	3	5	11
Very Fine Gravel	2.0-4.0	2	3	14
Fine Gravel	4.0-5.7	0	0	14
Fine Gravel	5.7-8.0	1	2	15
Medium Gravel	8.0-11.3	6	9	24
Medium Gravel	11.3-16.0	9	14	38
Coarse Gravel	16.0-22.6	7	11	48
Coarse Gravel	22.6-32	8	12	61
Very Coarse Gravel	32-45	5	8	68
Very Coarse Gravel	45-64	6	9	77
Small Cobble	64-90	5	8	85
Small Cobble	90-128	6	9	94
Large Cobble	128-180	1	2	95
Large Cobble	180-256	3	5	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		66	100	

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	9
Date	7/9/09	**Sta No.**	7+76

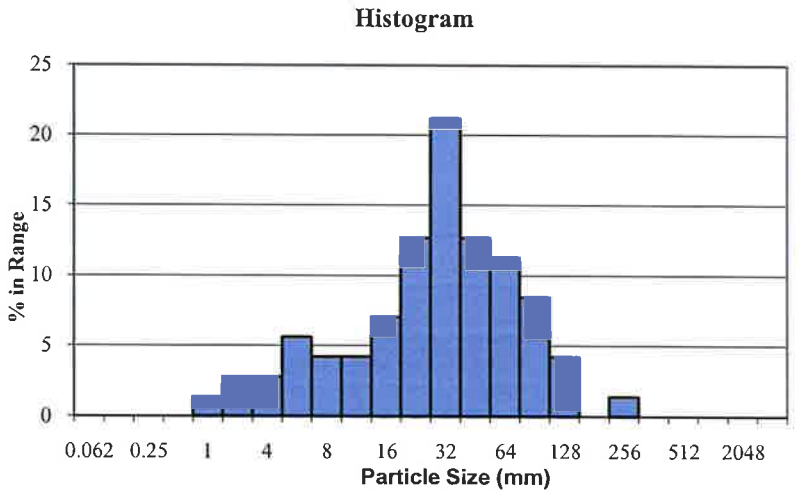
Histogram

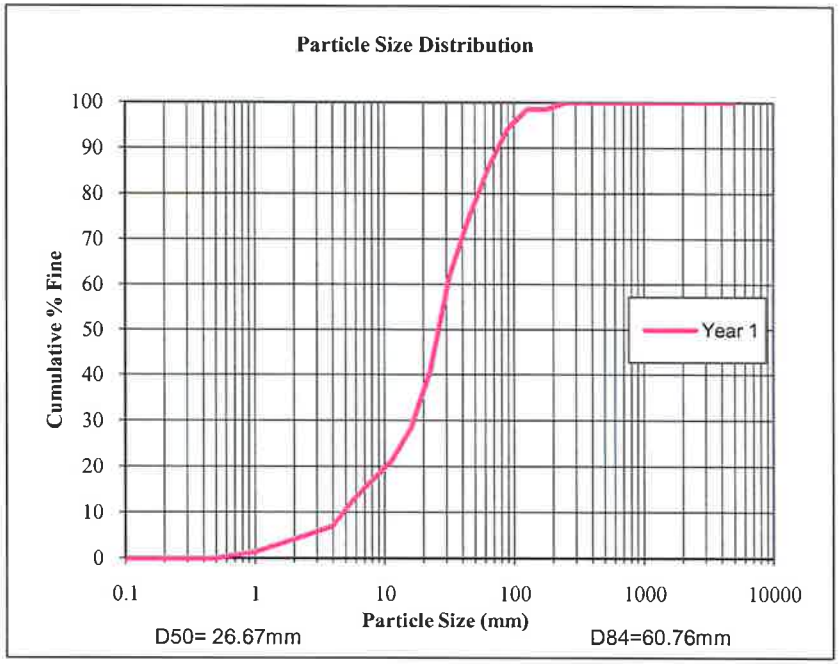




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	0	0	0
Coarse Sand	0.5-1.0	1	1	1
Very Coarse Sand	1.0-2.0	2	3	4
Very Fine Gravel	2.0-4.0	2	3	7
Fine Gravel	4.0-5.7	4	6	13
Fine Gravel	5.7-8.0	3	4	17
Medium Gravel	8.0-11.3	3	4	21
Medium Gravel	11.3-16.0	5	7	28
Coarse Gravel	16.0-22.6	9	13	41
Coarse Gravel	22.6-32	15	21	62
Very Coarse Gravel	32-45	9	13	75
Very Coarse Gravel	45-64	8	11	86
Small Cobble	64-90	6	8	94
Small Cobble	90-128	3	4	99
Large Cobble	128-180	0	0	99
Large Cobble	180-256	1	1	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		71	100	

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	10
Date	7/9/09	**Sta No.**	7+37

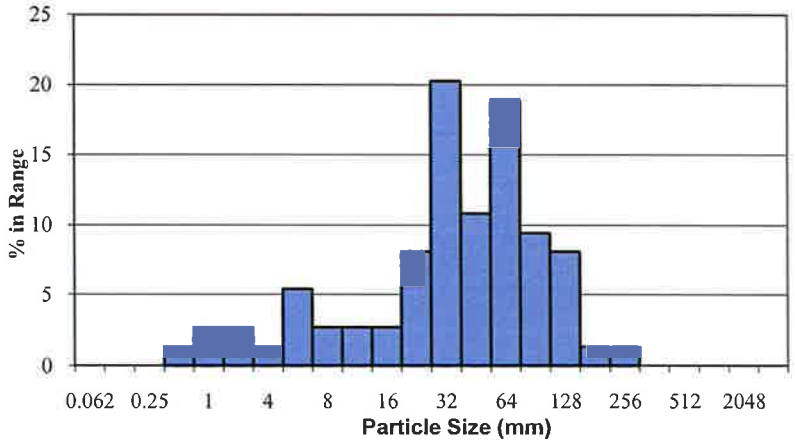


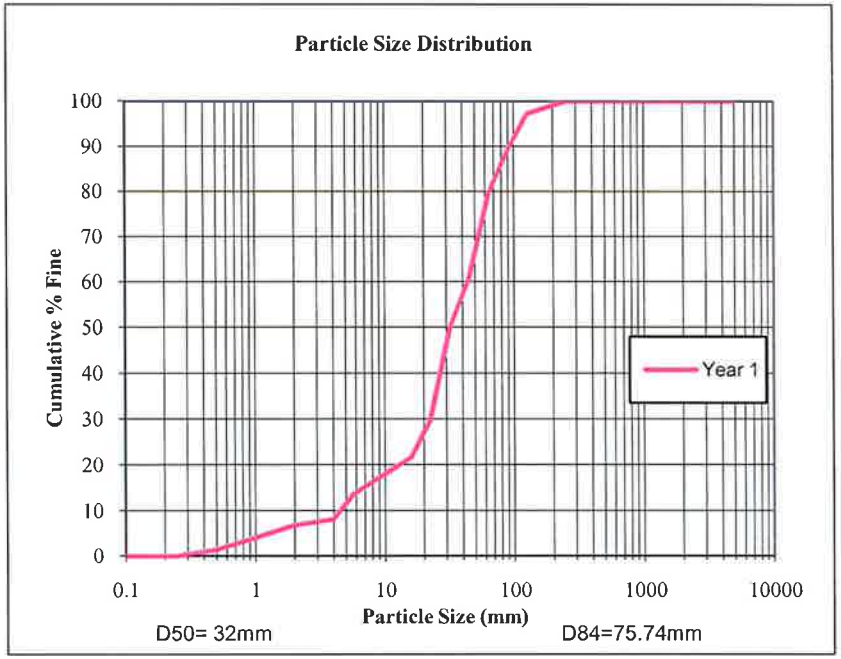


Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	0	0	0
Medium Sand	0.25-0.5	1	1	1
Coarse Sand	0.5-1.0	2	3	4
Very Coarse Sand	1.0-2.0	2	3	7
Very Fine Gravel	2.0-4.0	1	1	8
Fine Gravel	4.0-5.7	4	5	14
Fine Gravel	5.7-8.0	2	3	16
Medium Gravel	8.0-11.3	2	3	19
Medium Gravel	11.3-16.0	2	3	22
Coarse Gravel	16.0-22.6	6	8	30
Coarse Gravel	22.6-32	15	20	50
Very Coarse Gravel	32-45	8	11	61
Very Coarse Gravel	45-64	14	19	80
Small Cobble	64-90	7	9	89
Small Cobble	90-128	6	8	97
Large Cobble	128-180	1	1	99
Large Cobble	180-256	1	1	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		74	100	

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	11
Date	7/9/09	**Sta No.**	2+81

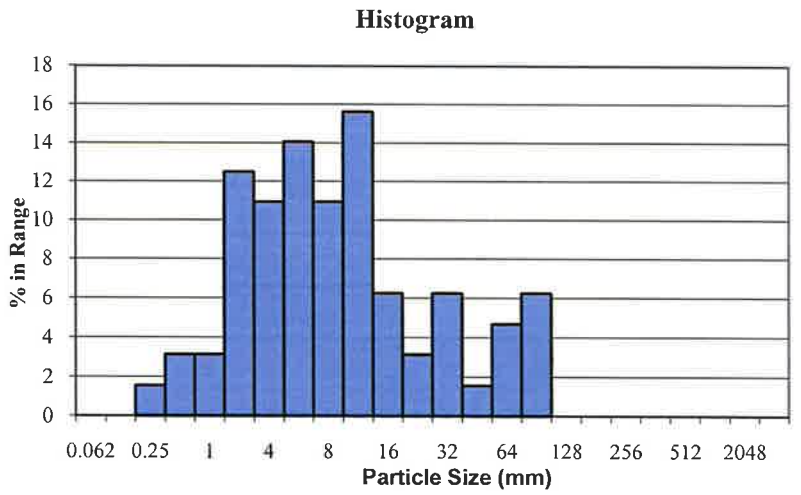
Histogram

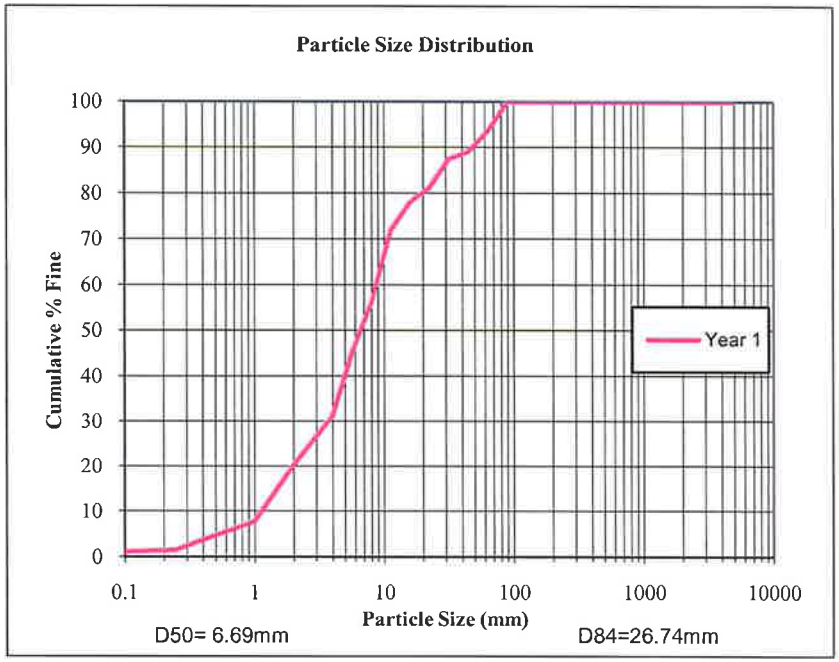




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	0	0	0
Very Fine Sand	0.062-0.125	0	0	0
Fine Sand	0.125-0.25	1	2	2
Medium Sand	0.25-0.5	2	3	5
Coarse Sand	0.5-1.0	2	3	8
Very Coarse Sand	1.0-2.0	8	13	20
Very Fine Gravel	2.0-4.0	7	11	31
Fine Gravel	4.0-5.7	9	14	45
Fine Gravel	5.7-8.0	7	11	56
Medium Gravel	8.0-11.3	10	16	72
Medium Gravel	11.3-16.0	4	6	78
Coarse Gravel	16.0-22.6	2	3	81
Coarse Gravel	22.6-32	4	6	88
Very Coarse Gravel	32-45	1	2	89
Very Coarse Gravel	45-64	3	5	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		64	100	

Thompsons Fork Stream Restoration EEP Project No. D06030-A			
Reach	UT	**X Sec**	12
Date	7/9/09	**Sta No.**	2+68





BF 1
Crest Gage at XS-6 on UT.
(EMH&T, Inc. 9/21/09)

BF 2
Crest Gage at XS-7 on Mainstem.
(EMH&T, Inc. 9/21/09)