Cane Creek (EEP #69)
Stream Restoration Site

2010 Annual Monitoring Report (Year 4 of 5)

Alamance County, North Carolina
EEP Project No. 69
Design Firm: Stantec Consulting Services, Inc.

April 2011

Prepared for:

NCDENR / Ecosystem Enhancement Program

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APPENDICES

1.0 Executive Summary

The Cane Creek (EEP #69) stream restoration project comprises 2,271 linear feet of stream restoration with 6.42 acres of buffer restoration. The project is in Alamance County north of Siler City, north of Old Dam Road (SR 2370), and west of Snow Camp Road (SR 1004). The project site is located in the Cape Fear River basin (HUC 03030002050050); this HUC has been identified as a Targeted Local Watershed (TLW) in EEP's Cape Fear River Basin Restoration Priorities 2009. Site construction and plantings were completed in March of 2006. The goals and objectives for Cane Creek (EEP #69) stream restoration are:

Goals:

- Improving water quality
- Reducing erosion and sedimentation
- Reducing nutrient loads from entering the stream through a filtration buffer
- Increasing the stream's access to its floodplain

Objectives:

- Improving aquatic habitat with the use of natural material stabilization structures and a riparian buffer
- Excluding cattle from the stream
- Providing wildlife habitat through the creation of a riparian zone

There are five vegetation plots, with only Plot 4 having identifiable planted stems with are live stakes. Four of the vegetation monitoring plots were added after the first monitoring year, therefore to err on the side of caution, stems, planted or not, were identified as natural stems. The plots were monitored using the CVS-EEP vegetation monitoring protocol, which was implemented for monitoring year (MY) -02, MY-03, and MY-04, and which will continue to be used for the remainder of the monitoring period. Vegetation Plot 1 was removed this monitoring year due to a proposed crossing which will traverse the plot. Supplemental plantings for areas with low woody stem densities will be conducted in 2011. A replacement Vegetation Plot 1 will be established for MY-05. Including Plots 2-5, there are 1,991 stems/acre; this included live stakes, planted stems, and natural/volunteer stems. All vegetation plots contain stem counts above the success criteria. The success criterion for planted woody species is 320 stems/acre after MY-03. A mortality rate of 10 percent will be allowed after MY-04 (288 stems/acre), with another 10 percent allowed after MY-05 (260 stems/acre). Natural woody stems are quantified on separate data sheets. An accurate number of planted stems/acre could not be determined since the planted stems could not be distinguished from natural stems.

The vegetation problem areas are mainly composed of a few bare benches with low stem densities, easement encroachment by beavers, and invasive exotics. Beavers encroached into the upper reach and built three dams: a large one at station 13+00 and two smaller ones at stations 13+75 and 22+50. Beaver trapping was conducted by Animal and Plant Health Inspection Service (APHIS) in August of 2010.

Invasive exotics throughout the conservation easement that are a threat to native vegetation include tree of heaven (*Alianthus altisimma*), princess tree (*Paulownia tomentosa*), and multiflora rose (*Rosa multiflora*). Other invasive exotics infrequently observed that did not seem to be an imminent threat include tall fescue (*Schedonurus arundinaceus*), Japanese honeysuckle (*Lonicera japonica*), and Chinese privet (*Ligustrum sinense*). According to the EEP Invasives of Concern/Interest List, tree of heaven, princess tree, mulitflora rose, Chinese privet, asnd Japanese honeysuckle are all classified as "High Concern" species and fescue as a "Low/Moderate Concern" species. For additional information relating to vegetation, see Appendix C.

The UT to Cane Creek Restoration project shows little change from MY-03 to MY-04. When field work was conducted, the channel was mainly dry and overgrown with vegetation in some segments of the channel. Vegetation is well established on the banks and floodplain throughout the reach. The stream banks are stable and the instream structures are functioning as intended. A comparison of the longitudinal profile between MY-03 and MY-04 shows little change in the portion of the stream that is downstream of the crossing at 19+10. However, the profile upstream of the stream crossing indicates that some of the pools are aggrading slightly due to the impoundment caused by recent and remnant beaver dams. Aggradation (occurring in approximately 13% of the project length) and the formation of mid-channel bars (present in MY-02) are still an issue throughout most of the project. This soils deposition is being held in place by vegetation, including willows and cattails, in some areas of the channel. The mid-channel; bars are preventing the flow from centering in the channel.

Several location along the stream reach have obstruction causing backwater conditions; the stream crossing at station 19+10 and the remnant beaver dams at stations 13+75 (removed August 2010) and 15+50 (remnant soils). The stream crossing at station 32+50, and the remnant beaver dam at station 20+50 were not causing backwater conditions at the time of our survey due to the dry conditions.

A comparison of the cross sections between MY-03 and MY-04 shows little change. Cross Section 2 shows slight bank erosion due to local disturbance caused by a dislodged tree on the bank. The stream banks in general are in good condition and the vegetation is well established at the permanent cross section locations. For MY-04, the bankfull data calculations were based on the baseline bankfull elevations. This elevation has varied in previous monitoring years. Pebble counts at riffle Cross Sections 1 and 3 show a trend towards a finer substrate due to the impoundment caused by the beaver dams. The pebble count at the riffle on Cross Section 5 continues a trend toward coarser substrate.

Summary information/data related to the occurrence of items such as beaver or encroachment, and statistics related to performance of various project and monitoring elements, can be found in the tables and figures in the report appendices. Narrative background and supporting

information formally found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices are available for EEP upon request.

2.0 Methodology

Methodologies follow EEP monitoring report template Version 1.3 (1/15/10) and guidelines (Lee et al 2008). Photos were taken with a digital camera. A Trimble Geo XT handheld unit with sub-meter accuracy was used to collect groundwater gauge locations, vegetation monitoring plot origins, and problem area locations. Cross sectional and longitudinal surveys were conducted using Total Station survey equipment. Data were entered into AutoCAD Civel3D to obtain dimensions of the cross sections and parameters applicable to the longitudinal profile. Reports were then generated to display summaries of the stream survey.

2.1 Vegetation Methodologies

Level II of the EEP/CVS protocol, version 4.2, was used to collect data for MY-04, which includes natural stems. Since Plots 2, 3, and 5 were established in MY-02, all stems recorded in these plots were classified as natural stems. Vegetation Plot 1 was omitted this year due to an additional stream crossing that will traverse the plot. Data collected for these plots are in Appendix C.

2.2 Stream Methodologies

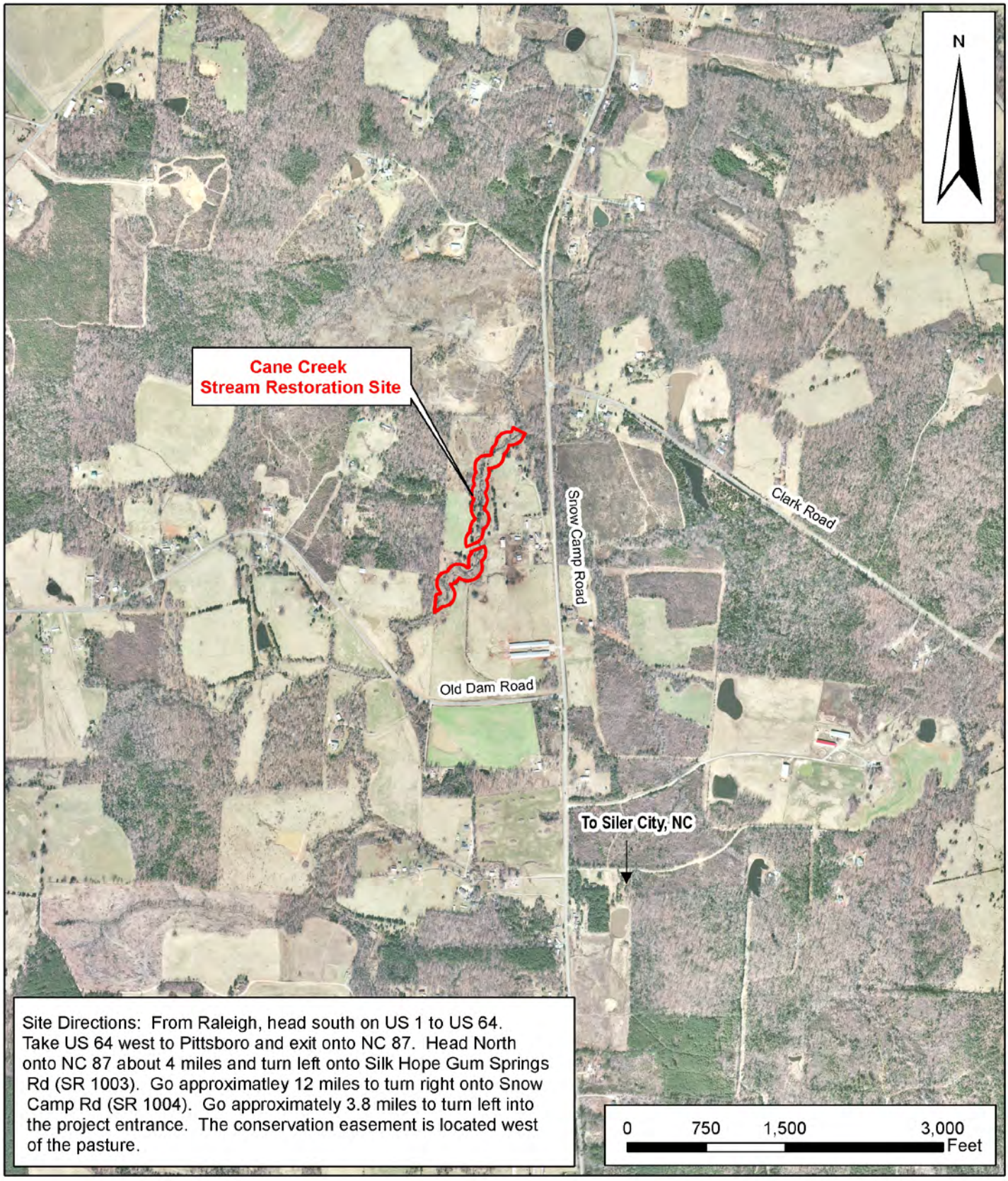
Stream profile and cross sections were surveyed using Total Station equipment and methods. The survey data were plotted using AutoCAD Civel3D. The longitudinal profile was generated using the MY-02 alignment. Wolman's Method was used to determine particle size distribution. Cross sectional data were extracted based on a linear alignment between the end pins.

3.0 References

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm)

Weakley, A.S. 2007. Flora of the Carolinas, Virginia, Georgia, and surrounding areas. Working draft of January 2007. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina. 1015pp.

Appendix A. Project Vicinity Map and Background Tables



Site Directions: From Raleigh, head south on US 1 to US 64. Take US 64 west to Pittsboro and exit onto NC 87. Head North onto NC 87 about 4 miles and turn left onto Silk Hope Gum Springs Rd (SR 1003). Go approximatley 12 miles to turn right onto Snow Camp Rd (SR 1004). Go approximately 3.8 miles to turn left into the project entrance. The conservation easement is located west of the pasture.

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Cane Creek Stream Restoration Site

Site Location Map

Alamance County, North Carolina

EEP Project No. 69

2005 Aerial Orthophotographic Maps
Source: Alamance County, NC

Date:
November 2010

Ecosystem Enhancement Program

Figure
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Table 1a and b. Project Components and Summations

Table 1a. Project Components Cane Creek / EEP #69									
Project Component or Reach ID	**Existing Feet/ Acres**	**Restoration Level**	**Approach**	**Footage or Acreage**	**Stationing**	**Mitigation Ratio**	**Mitigation Units**	**BMP Elements[1]**	**Comment**
Reach 1	2,260*	R	P2	2,260 lf	10+11-32+88	1:1	2,260*	CF=5730	Instream structure and vegetated buffer

*This length exclude the 17' wide crossing;
CF = Cattle Fencing

Table 1b. Component Summations Cane Creek / EEP #69							
		Riparian Wetland (ac)		**Non-**			
Restoration Level	**Stream (lf)**	**Riverine**	**Non-Riverine**	**Riparian (ac)**	**Upland (ac)**	**Buffer (ac)**	**BMP**
Restoration	2,260	-	-	-	-	-	-
Enhancement	-	-	-	-	-	-	-
Enhancement I	-	-	-	-	-	-	-
Enhancement II	-	-	-	-	-	-	-
Creation	-	-	-	-	-	-	-
Preservation	-	-	-	-	-	-	-
HQ Preservation	-	-	-	-	-	-	-
Totals (feet/acres)	2,260	0	0	0	0	0	1
MU Totals	2,260	0	0	0	0	0	

Table 2. Project Activity and Reporting History

Table 2. Project Activity and Reporting History Cane Creek / EEP #69		
Elapsed Time Since Grading Complete:	4 years 8 months	
Elapsed Time Since Planting Complete:	4 years 7 months	
Number of Reporting Years[1]:	4	
Activity or Deliverable	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	N/A	April 2003
Final Design – Construction Plan	N/A	October 2005
Construction	N/A	March 2006
Containerized, bare root, and B&B plantings for Reach/Segments 1&2	N/A	March 2006
Mitigation Plan / As-Built (Year 0 Monitoring – baseline)	May 2006	June 2006
Year 1 Monitoring	February 2007	March 2007
Year 2 Monitoring	October 2008	January 2009
Year 3 Monitoring	September 2009	December 2009

1 = Number of reports produced excluding the baseline

Table 3. Project Contacts Table

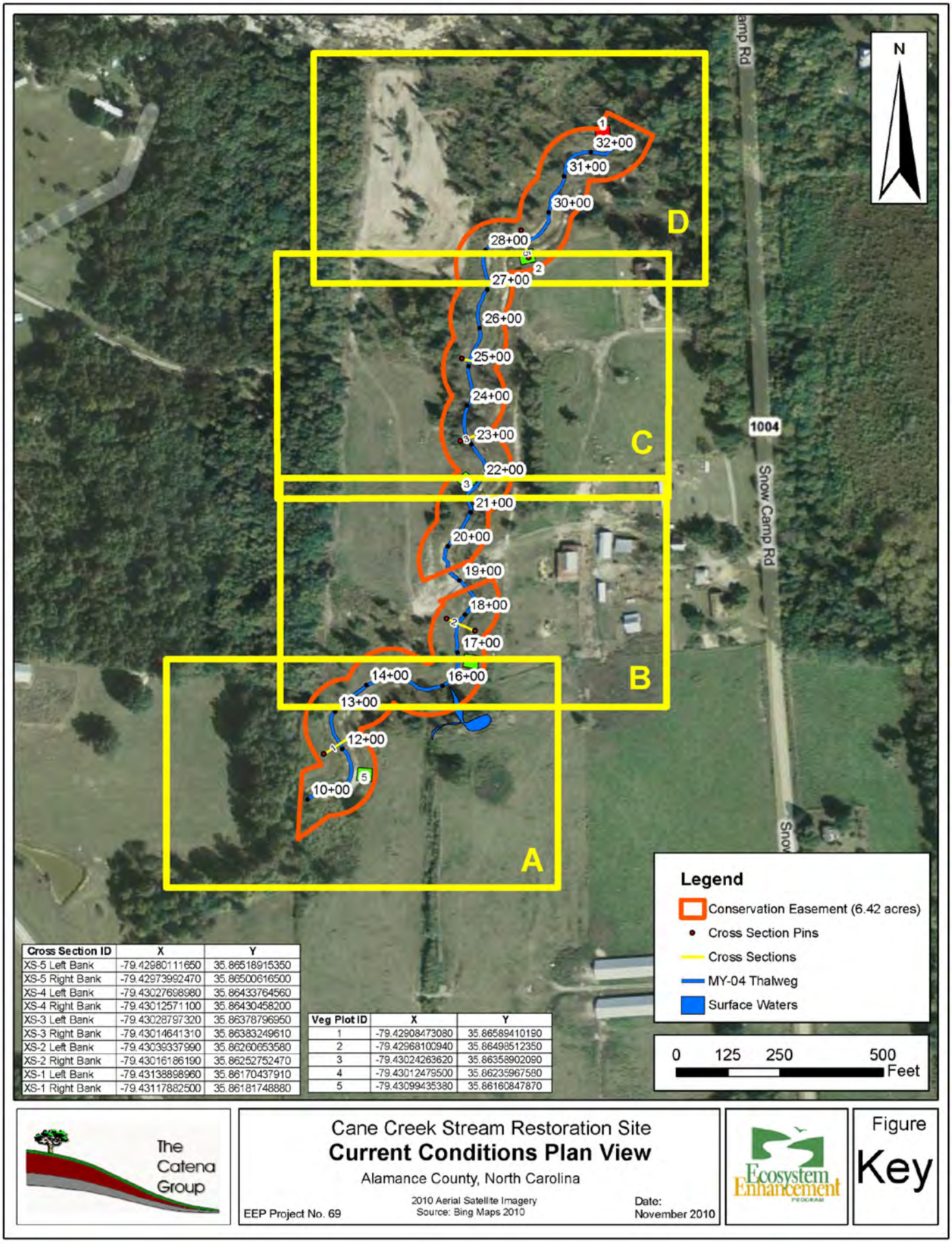
Table 3. Project Contact Table Cane Creek / EEP #69	
Designer **Primary Project Design POC**	Stantec Consulting Services Inc 801 Jones Franklin Road, Suite 300 Raleigh, North Carolina 27606 David Bidelspach - (919) 851-6866
Construction Contractor **Construction Contractor POC**	Shamrock Environmental Corp. 6101 Corporate Park Drive Browns Summit, North Carolina 27699 Bill Wright - (800) 881-1098
Survey Contractor **Survey Contractor POC**	Mulkey Engineers and Consultants P.O. Box 33127 Raleigh, North Carolina 27636 Derek F. Batts – (919) 851-1912
Planting Contractor **Planting Contractor POC**	Seal Brothers Contracting, LLC P.O.Box 86 Dobson, North Carolina 27017 Brian Seal – (336) 786-2263
Seeding Contractor **Seeding Contractor POC**	Seal Brothers Contracting, LLC P.O.Box 86 Dobson, North Carolina 27017 Brian Seal – (336) 786-2263
Seed Mix Sources	Shamrock Environmental Corp. 6101 Corporate Park Drive Browns Summit, North Carolina 27699
Nursery Stock Suppliers	Hills Nursery Co., Inc. (931) 668-4364
Monitoring Performers	The Catena Group (TCG) 410-B Millstone Drive Hillsborough, North Carolina 27678
Stream Monitoring POC	Ward Consulting Engineers 8368 Six Forks Road, Suite 104 Raleigh, NC 27613-5083
Vegetation Monitoring POC	The Catena Group (TCG) 410-B Millstone Drive Hillsborough, North Carolina 27678
Wetland Monitoring POC	N/A

Table 4. Cane Creek /EE P #69 Project Attribute Table

Project County	Alamance
Physiographic Region	Piedmont
Ecoregion	Carolina Slate Belt
Project River Basin	Cape Fear
USGS HUC for Project (14 digit)	0303002050050
NCDWQ Sub-basin for Project	Cane Creek
Within extent of EEP Watershed Plan?	Watershed Restoration Plan for the Cape Fear River Basin 2001
WRC Hab Class (Warm, Cool, Cold)	Warm water
% of Project easement fenced or demarcated	100% fenced beyond the 50 ft easement buffer
Beaver activity observed during the design phase?	U
Restoration Component Attribute Table	
Reach 1	
Drainage Area (acres)	2,003
Stream Order	3rd
Restored Length (feet)	2,271
Perennial or Intermittent	Perennial
Watershed Type (Rural, Urban, Developing, etc.)	Rural
Watershed LULC Distribution:	
Residential	5%*
Ag – Row Crop	10%*
Ag – Livestock	50%*
Forested	35%*
Watershed Impervious cover (%)	<5%*
NCDWQ AU/Index Number	22
NCDWQ Classification	C, NSW
303d listed?	No
Upstream of a 303d listed segment	No
Reasons for 303d listing or stressor	N/A
Total acreage of easement	6.42
Total vegetated acreage within the easement	6.42
Total planted acreage as part of the restoration	6.42
Rosgen classification of pre-existing	C4
Rosgen classification of As-built	C
Valley Type	VIII
Valley Slope	0.0034 ft/ft
Valley side slope range	0.07-0.135 ft/ft
Valley toe slope range	0.02-0.03 ft/ft
Cowardin classification	R3UB1
Trout waters designation	No
Species of concern, endangered, etc.	No
Dominant soil series and Characteristics	
Series	Herndon
Depth	Unknown
Clay %	Unknown
K	Unknown
T	Unknown

* These values are approximations from cursory analysis

Appendix B. Visual Assessment Data



Cross Section ID	X	Y
XS-5 Left Bank	-79.42980111650	35.86518915350
XS-5 Right Bank	-79.42973992470	35.86500616500
XS-4 Left Bank	-79.43027698980	35.86433764560
XS-4 Right Bank	-79.43012571100	35.86430458200
XS-3 Left Bank	-79.43028797320	35.86378796950
XS-3 Right Bank	-79.43014641310	35.86383249610
XS-2 Left Bank	-79.43039337990	35.86260653580
XS-2 Right Bank	-79.43016186190	35.86252752470
XS-1 Left Bank	-79.43138898960	35.86170437910
XS-1 Right Bank	-79.43117882500	35.86181748880

Veg Plot ID	X	Y
1	-79.42908473080	35.86589410190
2	-79.42968100940	35.86498512350
3	-79.43024263620	35.86358902090
4	-79.43012479500	35.86235967580
5	-79.43099435380	35.86160847870

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Cane Creek Stream Restoration Site
Current Conditions Plan View
Alamance County, North Carolina

EEP Project No. 69

2010 Aerial Satellite Imagery
Source: Bing Maps 2010

Date:
November 2010

Ecosystem Enhancement Program

Figure
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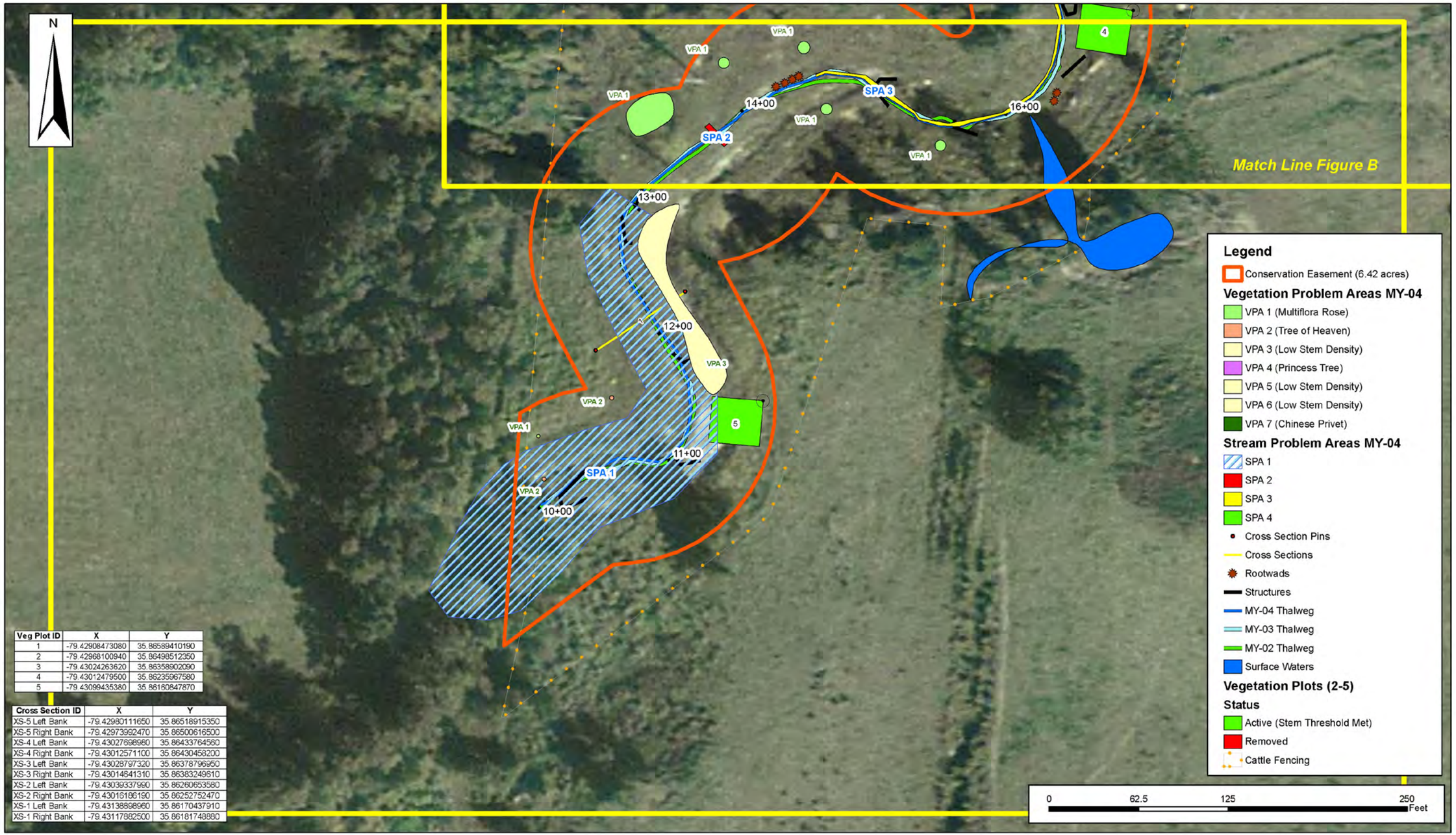

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Cane Creek Stream Restoration Site
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Alamance County, North Carolina

2010 Aerial Satellite Imagery
Source: Bing Maps 2010

EEP Project No. 69

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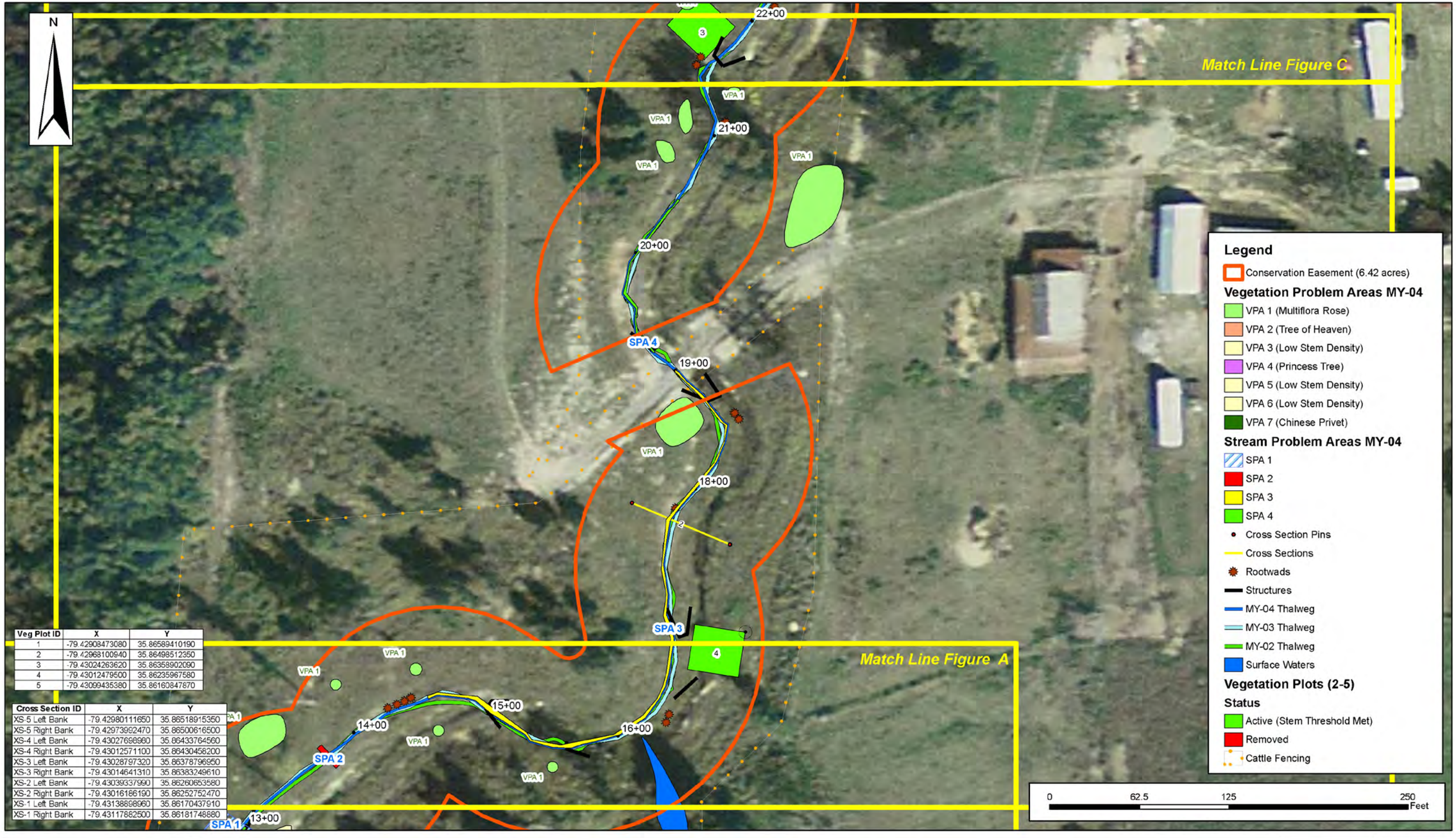
Figure
A



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Current Conditions Plan View

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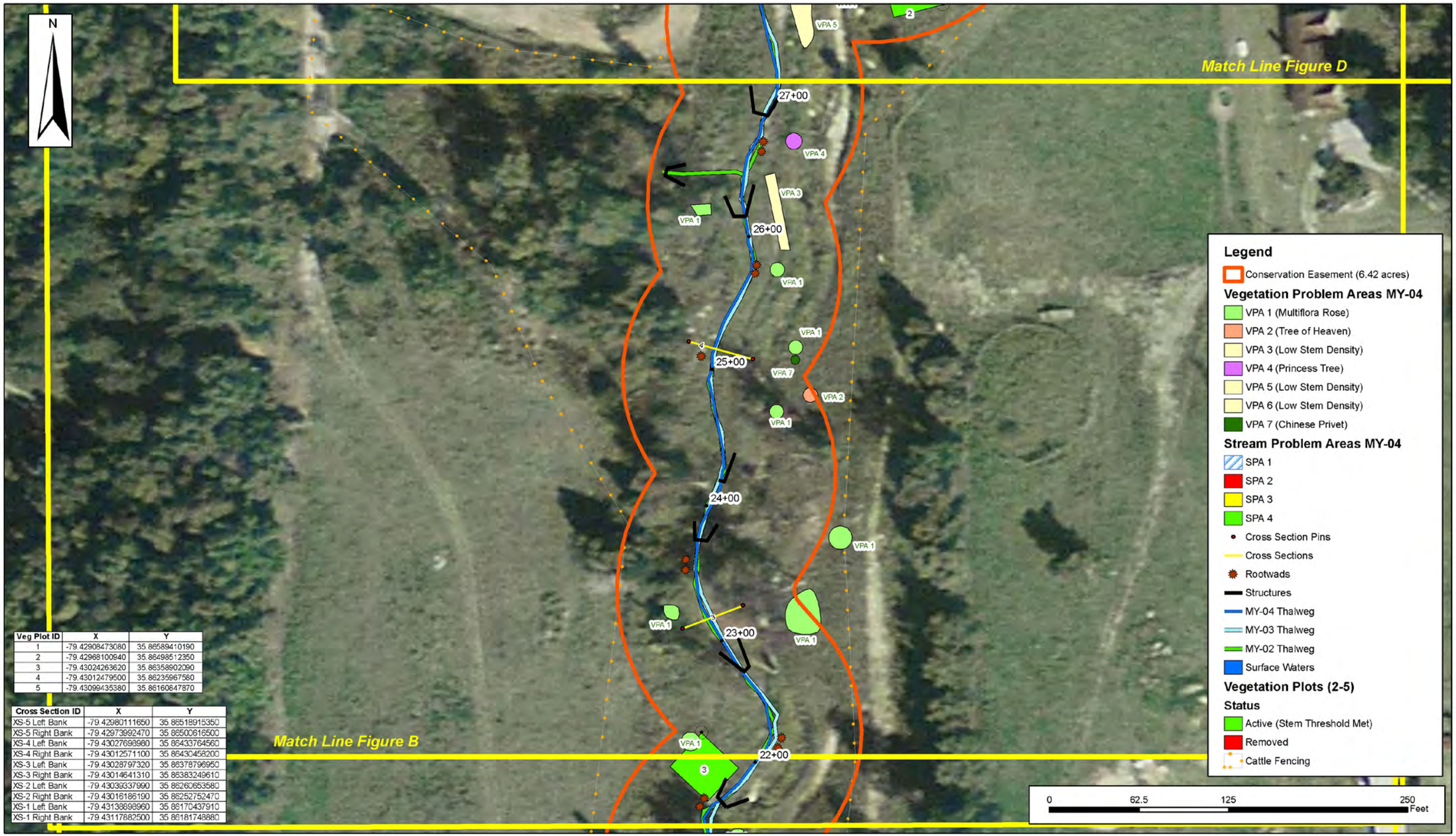
Figure
B



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EEP Project No. 69

Cane Creek Stream Restoration Site
Current Conditions Plan View

Alamance County, North Carolina

2010 Aerial Satellite Imagery
Source: Bing Maps 2010

Date:
November 2010

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Figure
C

Veg Plot ID	X	Y
1	-79.42906473080	35.86569410190
2	-79.42968100940	35.86498512350
3	-79.43024263620	35.86358902090
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Cane Creek Stream Restoration Site
Current Conditions Plan View

Alamance County, North Carolina

2010 Aerial Satellite Imagery
Source: Bing Maps 2010

EEP Project No. 69

Date:
November 2010

Ecosystem Enhancement Program

Figure
D

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID Main Channel
Assessed Length 2232

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			10	285	87%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	21	22			95%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	24	23			104%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	24	23			104%			
	4 **Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	20	23			87%			
		2. Thalweg centering at downstream of meander (Glide)	21	23			91%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			2	35	99%			99%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	2	35	99%	0	0	99%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	21	32			66%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	22	22			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	22	22			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	22	32			69%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	13	13			100%			

Table 6 Vegetation Condition Assessment

Planted Acreage[1] 6.42

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	See CCPV Legend	4	0.08	1.2%
			Cumulative Total	4	0.08	1.2%

Easement Acreage[2] 14

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	See CCPV Legend	25	1.34	20.9%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

UT to Cane Creek MY-04 Photo Points

Photo 1. Looking downstream at XS-1

Photo 2. Looking downstream at XS-2

Photo 3. Looking downstream at XS-3

Photo 4. Looking downstream at XS-4

Photo 5. Looking downstream at XS-5

MY-04 (2010) Vegetation Plot Photos

Photo 6. Plot 2 (Sept 6, 2008)

Photo 7. Plot 3 (Sept 6, 2008)

Photo 8. Plot 4 (Sept 6, 2008)

Photo 9. Plot 5 (Sept 6, 2008)

Photo 10. Plot 2 (Sept 3, 2010)

Photo 11. Plot 3 (Sept 3, 2010)

Photo 12. Plot 4 (Sept 3, 2010)

Photo 13. Plot 5 (Sept 3, 2010)

Appendix C. Vegetation Assessment Data

Table 7. Vegetation Plot Mitigation Success Summary Table

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
01	Plot Removed	100%*
02	N/A	
03	N/A	
04	Yes	
05	N/A	

* Tract mean met for Plot 04, the only plot with confirmed planted stems

Table 8. CVS Vegetation Metadata Table

Report Prepared By	The Catena Group
Date Prepared	11/5/2010 0:00
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
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	69
project Name	UT to Cane Creek
Description	2232 lf of stream restoration
River Basin	Cape Fear
length(ft)	2232 lf
stream-to-edge width (ft)	12
area (sq m)	6.42 acres easement
Required Plots (calculated)	5
Sampled Plots	4*

* Plot 01 was removed from the data set. A replacement plot is scoped to be established in the winter of 2010-11

Table 9. CVS Stem Count Total and Planted by Plot and Species

EEP Project Code 69. Project Name: UT to Cane Creek

			Current Plot Data (MY4 2010)												Annual Means								
			E69-01-VP2			E69-01-VP3			E69-01-VP4			E69-01-VP5			MY4 (2010)			MY3 (2009)			MY2 (2008)		
Scientific Name	Common Name	Species Type	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T	P-LS	P-all	T
Acer negundo	boxelder	Tree																					17
Acer negundo var. negundo	boxelder	Tree									1						1						
Acer rubrum	red maple	Tree																					62
Acer rubrum var. rubrum	red maple	Tree			1			4			8			4			17						
Baccharis halimifolia	eastern baccharis	Shrub Tree						1			1						2						1
Carpinus caroliniana	American hornbeam	Shrub Tree																					14
Cornus amomum	silky dogwood	Shrub									5						5						3
Fraxinus pennsylvanica	green ash	Tree			3						13			4			20						17
Juniperus virginiana	eastern redcedar	Tree																					10
Juniperus virginiana var. virginiana	eastern redcedar	Tree			1			14			1			4			20						
Ligustrum sinense	Chinese privet	Shrub Tree						1			1						2						3
Liquidambar styraciflua	sweetgum	Tree						7			28			10			45						35
Prunus serotina	black cherry	Shrub Tree																					1
Quercus	oak	Shrub Tree			1												1						
Quercus lyrata	overcup oak	Tree						1						1			2						4
Quercus michauxii	swamp chestnut oak	Tree			1												1						4
Rhus copallinum	flameleaf sumac	Shrub Tree																					1
Rhus copallinum var. copallinum	flameleaf sumac	Shrub Tree			1			1									2						
Rosa multiflora	multiflora rose	Shrub Vine						23									23						9
Salix nigra	black willow	Tree						1		5	5					5	6		11	11		13	15
Salix sericea	silky willow	Shrub Tree								2	2					2	2		2	2		2	2
Sambucus canadensis	Common Elderberry	Shrub Tree									7						7						8
Ulmus	elm	Tree																					59
Ulmus alata	winged elm	Tree			1			1			2			23			27						
Ulmus rubra	slippery elm	Tree									63						63						
		Stem count	0	0	9	0	0	54	0	7	137	0	0	46	0	7	246	0	13	13	0	15	265
		size (ares)	1			1			1			1			4			5			5		
		size (ACRES)	0.02			0.02			0.02			0.02			0.10			0.12			0.12		
		Species count	0	0	7	0	0	10	0	2	13	0	0	6	0	2	18	0	2	2	0	2	18
		Stems per ACRE	0	0	364.2	0	0	2185	0	283.3	5544	0	0	1862	0	70.82	2489	0	105.2	105.2	0	121.4	2145

Appendix D. Stream Survey Data

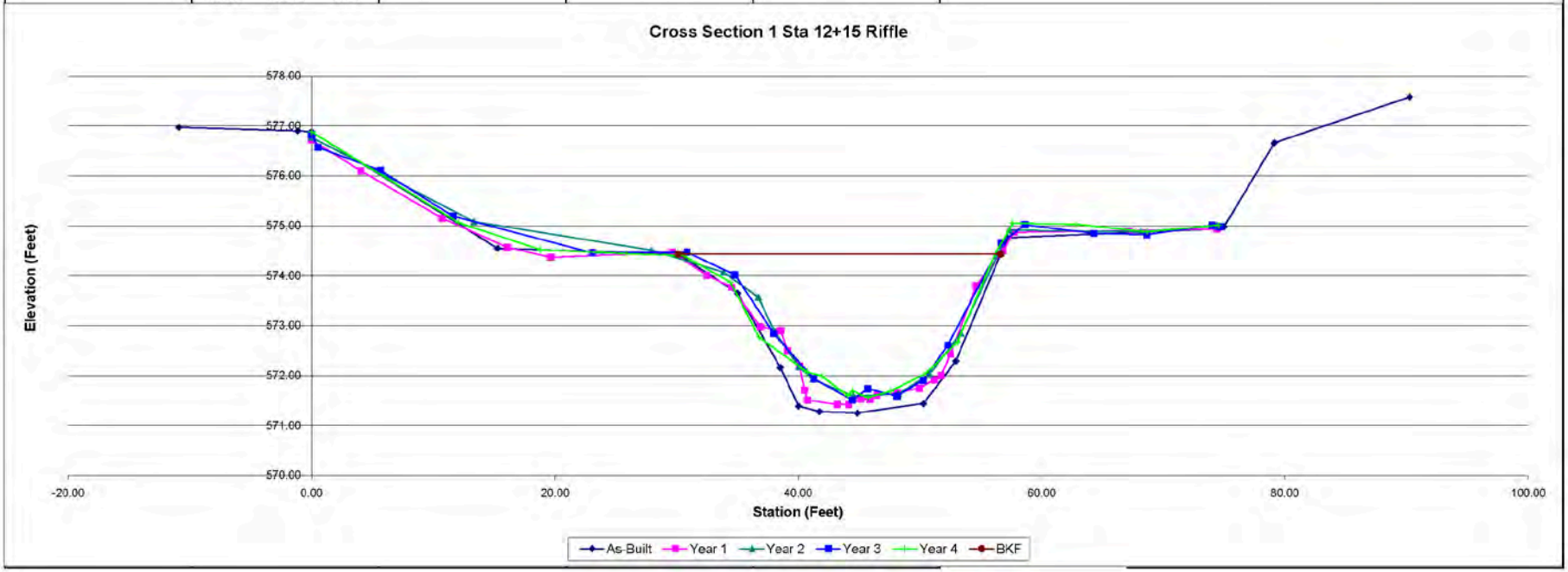
Project:	UT to Cane Creek
Cross Section:	Cross Section 1
Feature	Riffle
Station:	12+15
Date:	9/10/10
Crew:	BW, SV, ZP

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	51.0	48.0	46.8	44.2	46.5	
W (BKF)	26.6	27.2	28.3	25.5	29.1	
Max d	3.2	3.1	2.9	3.0	2.9	
Mean d	1.9	1.8	1.7	1.7	1.6	
W/D	13.9	15.4	17.1	14.7	18.2	

MY00-2006			MY01-2007			MY02-2008			MY03-2009			MY04-2010		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
-10.92	576.97		0.00	576.72	LPIN	0.00	576.77	LPIN	0.00	576.83	LPIN	0.00	576.88	LPIN
-1.10	576.90		4.05	576.10		13.34	575.08		0.52	576.57		12.09	575.06	
0.00	576.88	LPIN	10.73	575.15		27.96	574.51		5.63	576.11		18.81	574.52	
15.28	574.55		16.08	574.57		33.85	574.07	)BL Bankfu	11.62	575.19		25.84	574.44	
30.15	574.43	TOBL BKF	19.66	574.37		36.71	573.57		23.08	574.46		30.59	574.40	TOBL BKF
35.01	573.65		29.66	574.47	TOBL BKF	38.01	572.90		30.85	574.47	BKF TOBL	34.42	573.87	
38.54	572.16		32.50	574.01		40.05	572.18	TOE L	34.79	574.02		36.78	572.77	
40.04	571.39		34.52	573.77		41.18	571.93		37.99	572.84		40.74	572.07	TOE L
41.75	571.28		36.89	572.98		44.51	571.59	TW	41.27	571.94	TOE	41.94	571.99	
44.88	571.25	TW	38.55	572.90		48.21	571.63		44.44	571.51		44.05	571.60	
50.31	571.44		39.11	572.50		50.80	572.03	TOE R	45.73	571.74	TW	44.48	571.69	
52.95	572.29		40.11	572.19		53.37	572.85		48.11	571.59		45.72	571.56	TW
56.76	574.50	BKF	40.53	571.71		57.35	574.91	)BR Bankfu	50.29	571.91	TOE	47.60	571.69	
57.20	574.76	TOBR	40.77	571.51		68.18	574.88		52.30	572.61		50.54	572.05	TOE R
74.47	574.94	RPIN	43.19	571.42	TW	74.41	575.00	RPIN	56.71	574.66	BKF	53.11	572.68	
75.02	574.98		44.13	571.42					58.62	575.02	TOBR	56.17	574.43	BKF
79.14	576.66		45.14	571.53					64.28	574.85		57.64	575.05	TOBR
90.27	577.58		45.90	571.52					68.65	574.82		62.87	575.03	
			46.48	571.61					74.01	575.01		68.57	574.88	
			48.17	571.66					74.65	574.98	RPIN	74.54	575.01	RPIN
			49.96	571.75										
			51.19	571.92										
			51.73	572.00										
			52.52	572.43										
			54.63	573.80										
			56.82	574.50	BKF									
			57.72	574.87	TOBR									
			67.16	574.90										
			74.43	574.94	RPIN									

Photo of XS-1, looking in the downstream direction



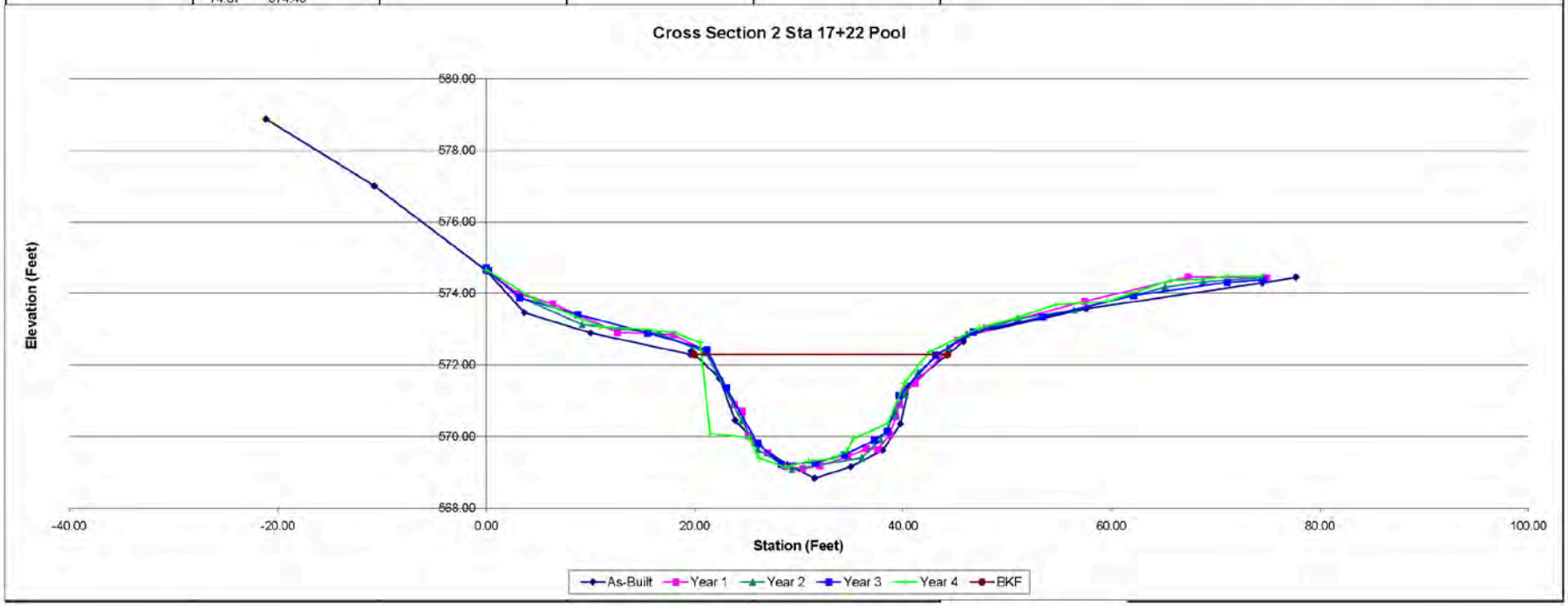
Project:	UT to Cane Creek
Cross Section:	Cross Section 2
Feature	Pool
Station:	17+22
Date:	9/10/10
Crew:	BW, SV, ZP

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	56.5	53.6	56.7	55.1	44.6	
W (BKF)	26.2	24.2	26.2	27.2	21.7	
Max d	3.7	3.6	3.5	3.4	3.1	
Mean d	2.2	2.2	2.2	2.0	2.1	
W/D	12.1	11.0	12.1	13.5	10.5	

MY00-2006			MY01-2007			MY02-2008			MY03-2009			MY04-2010		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
-21.13	578.87		0.00	574.64	LPIN	0.00	574.65	LPIN	0.00	574.70	LPIN	0.00	574.66	LPIN
-10.73	577.00		3.09	573.99		3.22	573.90		0.18	574.63		4.69	573.83	
0.00	574.64	LPIN	6.41	573.71		9.20	573.13		3.22	573.88		10.87	573.08	
3.67	573.46		12.60	572.91		16.59	572.88	BKF	8.83	573.41		15.59	572.99	
10.03	572.89		17.96	572.84	TOBL	21.10	572.34	TOBL	15.50	572.89		18.13	572.89	
19.65	572.29	TOBL BKF	20.99	572.40	BKF	24.52	570.44		21.17	572.43	BKF TOBL	20.52	572.63	TOBL BKF
19.69	572.38		23.83	570.89		26.06	569.63	TOE L	23.03	571.37		20.51	572.64	
22.42	571.62		24.59	570.70		29.32	569.07	TW	26.02	569.82	TOE	21.50	570.08	TOE L
23.88	570.45		25.18	570.02		36.04	569.40		28.32	569.23		25.21	569.96	
26.16	569.75		26.99	569.54		37.83	569.91		31.56	569.26	TW	26.19	569.40	
28.86	569.21		28.65	569.17		39.18	570.61	TOE R	34.38	569.49		28.67	569.14	TW
31.52	568.83	TW	30.36	569.09	TW	40.13	571.17		37.26	569.89		30.96	569.31	
34.98	569.15		32.03	569.18		41.41	571.79		38.49	570.14	TOE	33.37	569.39	
38.04	569.61		34.71	569.43		44.30	572.49		39.61	571.14		34.61	569.60	
39.76	570.35		36.48	569.66		46.09	572.86	TOBR BKF	43.17	572.27		35.27	569.94	
40.57	571.41		37.57	569.63		51.04	573.29		46.74	572.92	BKF TOBR	38.57	570.37	TOE R
45.80	572.65	BKF	38.73	570.05		56.40	573.53		53.46	573.34		40.15	571.50	
46.13	572.83	TOBR	39.33	570.56		65.12	574.17		62.11	573.94		42.53	572.36	TOBR
57.57	573.57		39.66	570.89		68.78	574.32		71.10	574.31		47.29	573.03	
74.48	574.29	RPIN	40.24	571.31		74.38	574.43	RPIN	74.56	574.38	RPIN	50.89	573.31	
77.73	574.45		41.17	571.49								54.59	573.68	
			45.23	572.69	TOBR BKF							59.61	573.77	
			47.96	573.03								65.72	574.37	
			57.43	573.78								68.18	574.38	
			67.39	574.46								71.13	574.48	
			74.66	574.43	RPIN							74.42	574.48	RPIN
			74.87	574.43										

Photo of XS-2, looking in the downstream direction



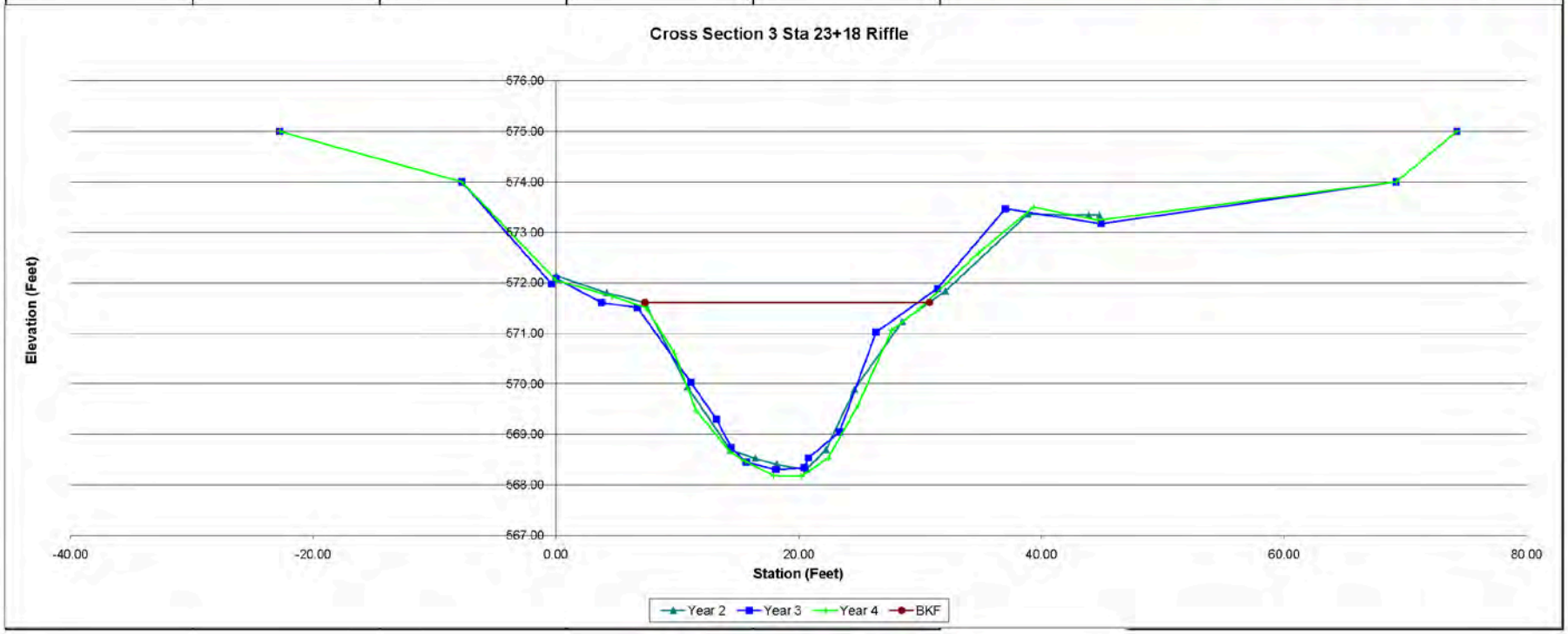
Project:	UT to Cane Creek
Cross Section:	Cross Section 3
Feature	Riffle
Station:	23+18
Date:	9/10/10
Crew:	BW, SV, ZP

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	NA	NA	45.8	42.1	47.6	
W (BKF)	NA	NA	23.5	22.5	23.5	
Max d	NA	NA	3.3	3.2	3.4	
Mean d	NA	NA	2.0	1.9	2.0	
W/D	NA	NA	12.0	12.0	11.6	

MY00-2006			MY01-2007			MY02-2008			MY03-2009			MY04-2010		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
						0.00	572.14	LPIN	-22.76	575.00		-22.76	575.00	
						4.17	571.80		-7.76	574.00		-7.76	574.00	
						7.33	571.61	BL Bankfu	-0.37	571.98		0.00	572.05	LPIN
						10.83	569.94		0.00	572.09	LPIN	4.70	571.73	
						14.38	568.69	TOE L	3.76	571.61		7.43	571.51	TOBL BKF
						16.43	568.52		6.73	571.51	BKF TOBL	9.76	570.61	
						18.17	568.40		11.12	570.03		11.55	569.47	
						20.65	568.30	TW	13.23	569.30		14.37	568.65	TOE L
						22.24	568.69	TOE R	14.45	568.74	TOE	15.58	568.47	
						24.60	569.89		15.68	568.45		17.94	568.18	TW
						28.54	571.23	BR Bankfu	18.11	568.30	TW	20.22	568.17	
						32.08	571.83		20.48	568.34		22.45	568.53	TOE R
						38.89	573.36		20.82	568.53	TOE	24.90	569.58	
						43.91	573.34		23.38	569.05		27.67	571.06	TOBR
						44.78	573.34	RPIN	26.39	571.02	BKF TOBR	29.99	571.49	BKF
									31.44	571.89		34.82	572.59	
									37.04	573.47		39.37	573.50	
									44.91	573.17	RPIN	44.64	573.24	RPIN
									69.24	574.00		69.24	574.00	
									74.24	575.00		74.24	575.00	

Photo of XS-3 looking in the downstream direction



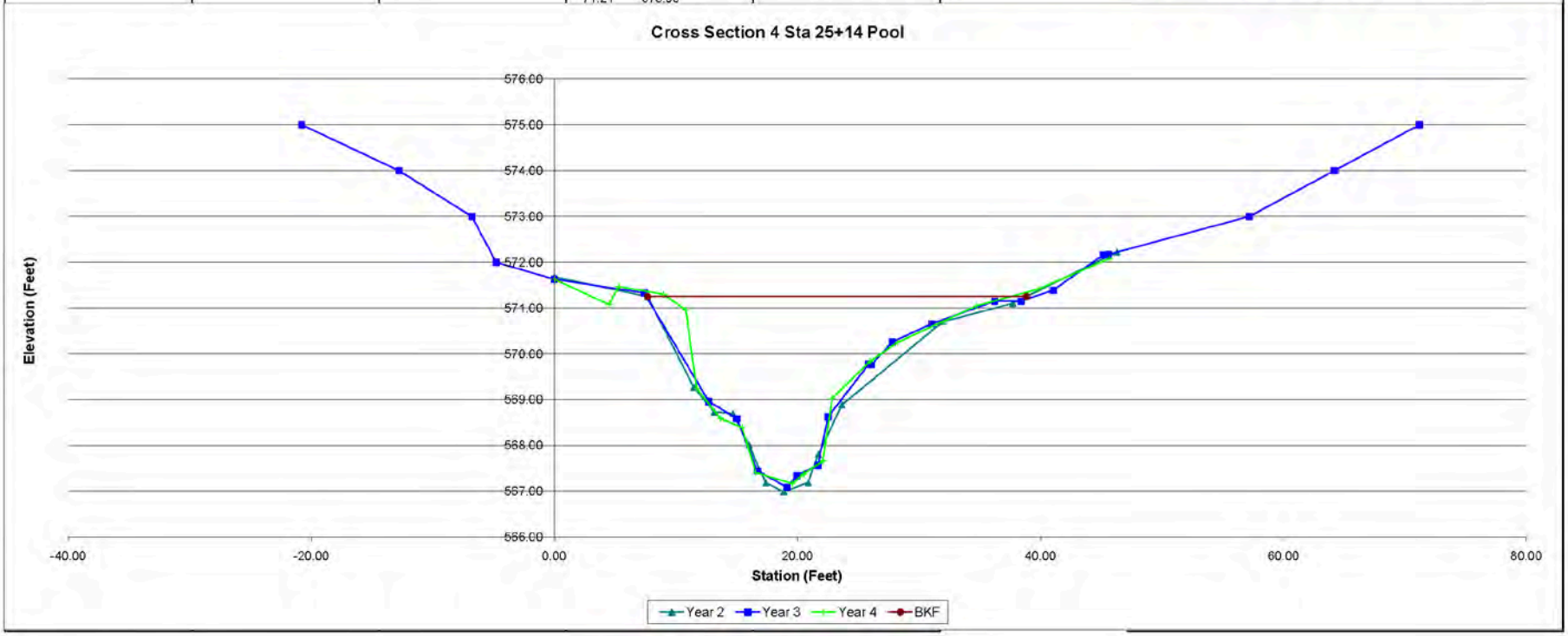
Project:	UT to Cane Creek
Cross Section:	Cross Section 4
Feature	Pool
Station:	25+14
Date:	9/10/10
Crew:	BW, SV, ZP

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	NA	NA	57.8	55.8	52.0	
W (BKF)	NA	NA	31.2	33.0	28.3	
Max d	NA	NA	4.3	4.2	4.1	
Mean d	NA	NA	1.9	1.7	1.8	
W/D	NA	NA	16.9	19.5	15.4	

MY00-2006			MY01-2007			MY02-2008			MY03-2009			MY04-2010		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
						0.00	571.68	LPIN	-20.79	575.00		0.00	571.63	LPIN
						7.67	571.25	TOBL BKF	-12.79	574.00		4.51	571.08	
						11.49	569.27		-6.79	573.00		5.31	571.47	
						13.17	568.73		-4.79	572.00		8.98	571.30	BKF
						14.70	568.70		0.00	571.63	LPIN	10.82	570.96	TOBL
						16.02	568.01	TOE L	7.40	571.33	BKF TOBL	11.73	569.25	
						17.40	567.19		12.73	568.96		13.69	568.59	
						18.88	566.99	TW	15.03	568.59		15.46	568.39	
						20.90	567.19		16.73	567.45	TOE L	16.59	567.41	TOE L
						21.74	567.81	TOE R	19.16	567.09	TW	19.58	567.17	TW
						23.67	568.89		19.97	567.34		20.53	567.38	
						31.96	570.70	TOBR BKF	21.71	567.57	TOE R	22.12	567.66	TOE R
						37.73	571.10		22.54	568.83		22.87	569.03	
						46.31	572.22	RPIN	25.90	569.78		26.02	569.84	
									26.09	569.76		28.25	570.25	TOBR
									27.83	570.26	BKF TOBR	34.77	571.05	
									31.07	570.66		39.81	571.41	
									36.26	571.15		45.69	572.08	RPIN
									38.41	571.15				
									41.06	571.39				
									45.18	572.16				
									45.61	572.17	RPIN			
									57.21	573.00				
									64.21	574.00				
									71.21	575.00				

Photo of XS-4, looking in the downstream direction



Project:	UT to Cane Creek
Cross Section:	Cross Section 5
Feature	Riffle
Station:	28+99
Date:	9/10/10
Crew:	BW, SV, ZP

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	NA	NA	43.4	39.3	39.0	
W (BKF)	NA	NA	26.3	25.7	22.7	
Max d	NA	NA	2.8	2.9	2.8	
Mean d	NA	NA	1.7	1.5	1.7	
W/D	NA	NA	15.9	16.8	13.2	

MY00-2006			MY01-2007			MY02-2008			MY03-2009			MY04-2010		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
						0.00	572.65	LPIN	0.00	572.65	LPIN	0.00	572.65	LPIN
						0.06	572.51		1.04	572.50		7.27	571.17	
						1.69	572.29		16.11	569.73		9.77	570.11	
						5.43	571.38		16.15	569.73		11.87	569.50	
						9.81	570.09		21.93	569.48	BKF TOBL	14.48	569.87	
						14.67	569.73		25.47	568.20		17.93	569.76	
						21.59	569.53	TOBL BKF	27.40	567.34	TOE L	22.45	569.51	TOBL BKF
						25.79	567.85		29.83	567.06		25.93	567.99	
						28.31	567.03	TOE L	31.96	566.98	TW	27.58	567.40	TOE L
						31.14	566.89	TW	33.82	566.95		29.60	567.08	
						36.50	567.29	TOE R	36.45	567.31	TOE R	31.94	566.89	TW
						39.34	568.79		40.40	569.33		34.26	567.06	
						42.38	570.21	TOBR BKF	41.99	570.14	BKF TOBR	36.59	567.25	TOE R
						52.52	570.85		47.36	570.59		38.24	568.22	
						59.00	572.50		53.36	570.89		41.91	570.00	TOBR BKF
						65.28	574.68		56.53	571.71		46.08	570.57	
						69.17	575.21	RPIN	63.29	574.20		52.40	570.74	
									66.24	574.96		55.36	571.22	
									68.53	575.13		59.40	572.68	
									68.93	575.23	RPIN	62.24	573.76	
												67.16	575.03	
												69.42	575.18	RPIN

Photo of XS-5, looking in the downstream direction

UT to Cane Creek
Longitudinal Profile
Main Channel: Station 10+00-32+90

Cross Section 1 Sta. 12+15 Riffle
Cross Section 2 Sta. 17+75 Pool
Stream Crossing Sta. 19+04-19+21
Cross Section 3 Sta. 23+18 Riffle
Cross Section 4 Sta. 25+15 Pool
Cross Section 5 Sta. 28+99 Riffle

Beaver Dam Opened 8/2010
Remnant Beaver Dam
Remnant Beaver Dam
Stream Crossing

Elevation (feet)
578
576
574
572
570
568
566
564

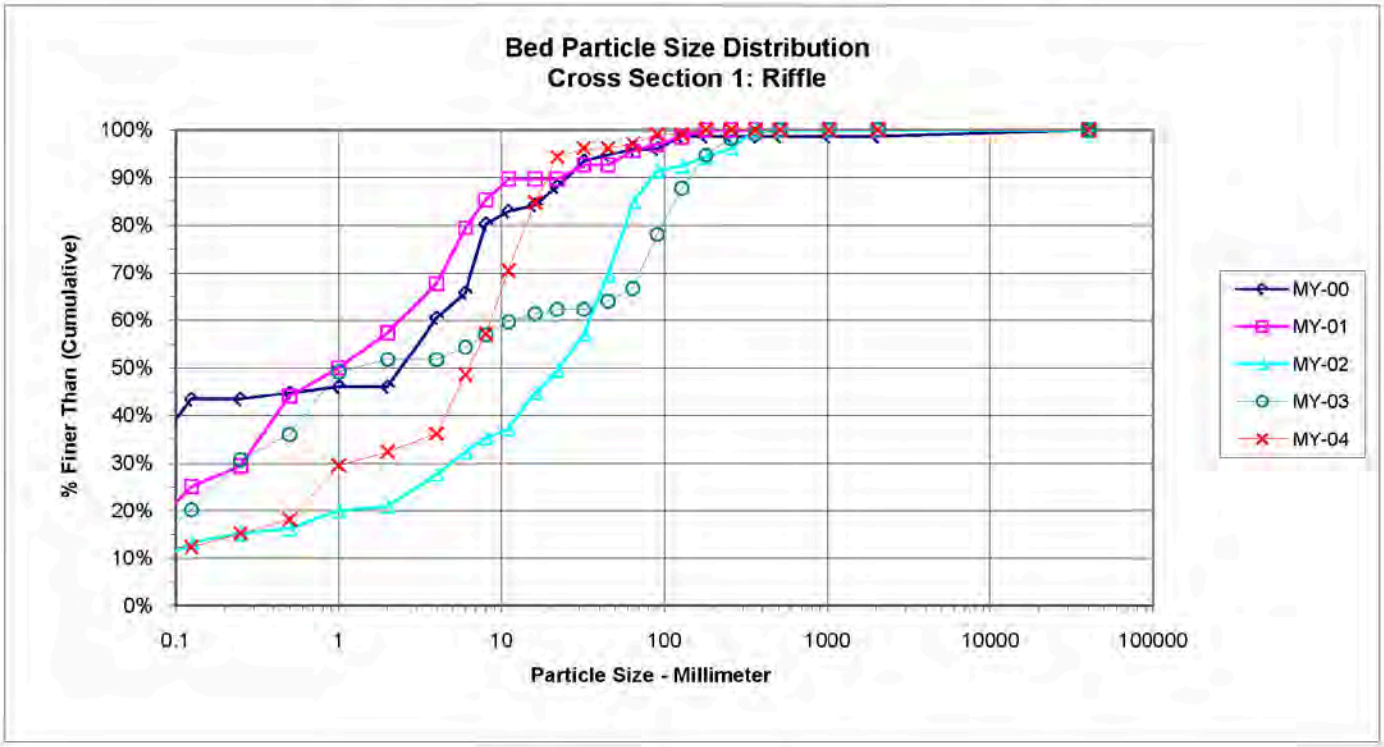
10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00 31+00 32+00 33+00

Station (feet)

TW MY-00 TW MY-01 TW MY-02 TW MY-03 BKF MY-01 BKF MY-02 BKF MY-03 WS MY-03 TW MY-04 WS MY-04 BKF MY-04

PEBBLE COUNT								
Project:	UT to Cane Creek, Project # 69					**Date:**	9/10/2010	
Location:	Cross Section #1							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	13	0	13	12%	12%
	Very Fine	.062 - .125	S	0	0	0	0%	12%
	Fine	.125 - .25	A	3	0	3	3%	15%
	Medium	.25 - .50	N	3	0	3	3%	18%
	Coarse	.50 - 1.0	D	12	0	12	11%	30%
.04 - .08	Very Coarse	1.0 - 2.0	S	3	0	3	3%	32%
.08 - .16	Very Fine	2.0 - 4.0		4	0	4	4%	36%
.16 - .22	Fine	4.0 - 5.7	G	13	0	13	12%	49%
.22 - .31	Fine	5.7 - 8.0	R	9	0	9	9%	57%
.31 - .44	Medium	8.0 - 11.3	A	14	0	14	13%	70%
.44 - .63	Medium	11.3 - 16.0	V	15	0	15	14%	85%
.63 - .89	Coarse	16.0 - 22.6	E	10	0	10	10%	94%
.89 - 1.26	Coarse	22.6 - 32.0	L	2	0	2	2%	96%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	0	0	0	0%	96%
1.77 - 2.5	Very Coarse	45.0 - 64.0		1	0	1	1%	97%
2.5 - 3.5	Small	64 - 90	C	2	0	2	2%	99%
3.5 - 5.0	Small	90 - 128	O	0	0	0	0%	99%
5.0 - 7.1	Large	128 - 180	B	1	0	1	1%	100%
7.1 - 10.1	Large	180 - 256	L	0	0	0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0	0	0	0%	100%
14.3 - 20	Small	362 - 512	L	0	0	0	0%	100%
20 - 40	Medium	512 - 1024	D	0	0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0	0	0	0%	100%
	Bedrock		BDRK	0	0	0	0%	100%
			Totals	**105**	**0**	**105**	**100%**	**100%**

d16	d35	d50	d84	d95
Silt/Clay	0.0	0.0	0.0	0.0



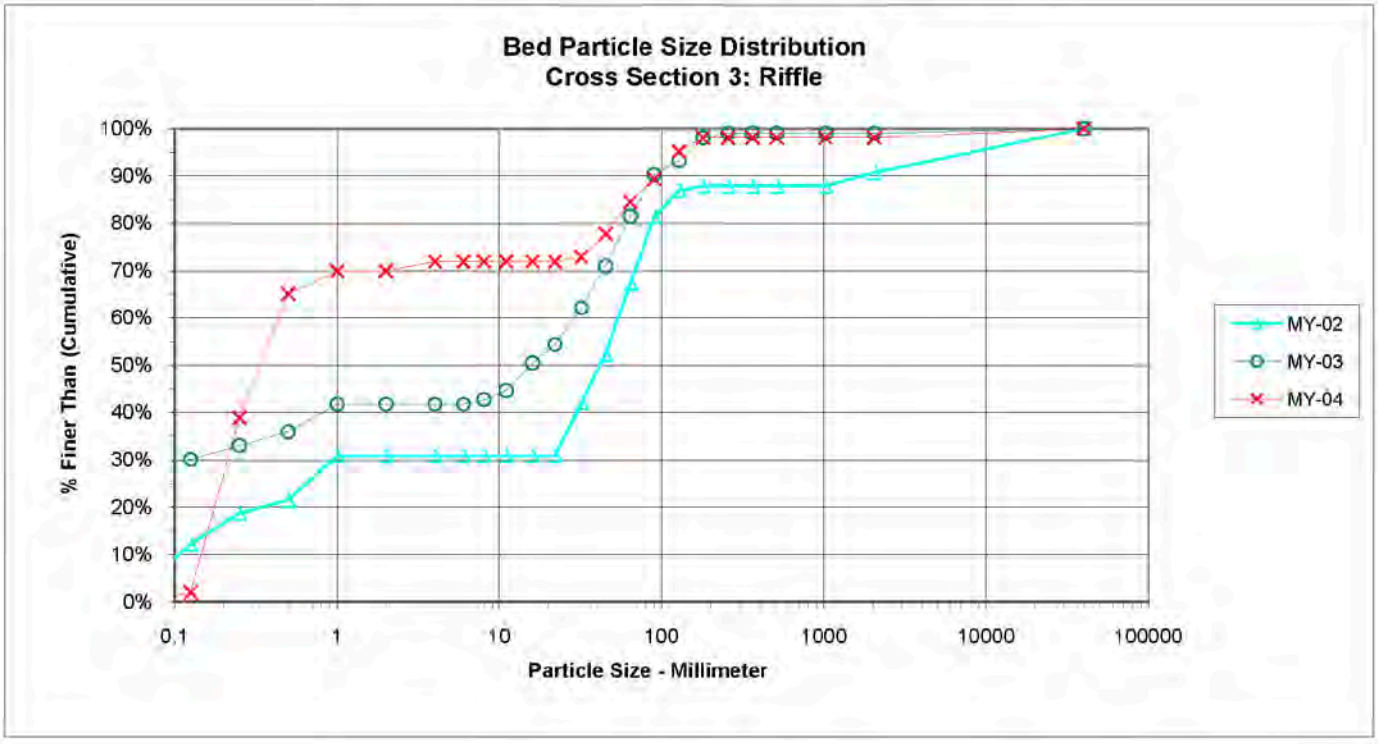
PEBBLE COUNT

Project: UT to Cane Creek, Project # 69 **Date:** 9/10/2010

Location: Cross Section #3

				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	0	0	0	0%	0%
	Very Fine	.062 - .125	S	2	0	2	2%	2%
	Fine	.125 - .25	A	38	0	38	37%	39%
	Medium	.25 - .50	N	27	0	27	26%	65%
	Coarse	.50 - 1.0	D	5	0	5	5%	70%
.04 -.08	Very Coarse	1.0 - 2.0	S	0	0	0	0%	70%
.08 - .16	Very Fine	2.0 - 4.0		2	0	2	2%	72%
.16 - .22	Fine	4.0 - 5.7	G	0	0	0	0%	72%
.22 - .31	Fine	5.7 - 8.0	R	0	0	0	0%	72%
.31 - .44	Medium	8.0 - 11.3	A	0	0	0	0%	72%
.44 - .63	Medium	11.3 - 16.0	V	0	0	0	0%	72%
.63 - .89	Coarse	16.0 - 22.6	E	0	0	0	0%	72%
.89 - 1.26	Coarse	22.6 - 32.0	L	1	0	1	1%	73%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	5	0	5	5%	78%
1.77 - 2.5	Very Coarse	45.0 - 64.0		7	0	7	7%	84%
2.5 - 3.5	Small	64 - 90	C	5	0	5	5%	89%
3.5 - 5.0	Small	90 - 128	O	6	0	6	6%	95%
5.0 - 7.1	Large	128 - 180	B	3	0	3	3%	98%
7.1 - 10.1	Large	180 - 256	L	0	0	0	0%	98%
10.1 - 14.3	Small	256 - 362	B	0	0	0	0%	98%
14.3 - 20	Small	362 - 512	L	0	0	0	0%	98%
20 - 40	Medium	512 - 1024	D	0	0	0	0%	98%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0	0	0	0%	98%
	Bedrock		BDRK	2	0	2	2%	100%
			Totals	**103**	**0**	**103**	**100%**	**100%**

d16	d35	d50	d84	d95
Silt/Clay	0.0	0.0	0.0	0.0



PEBBLE COUNT								
Project:	UT to Cane Creek, Project # 69					**Date:**	9/10/2010	
Location:	Cross Section #5							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	0	0	0	0%	0%
	Very Fine	.062 - .125	S	0	0	0	0%	0%
	Fine	.125 - .25	A	4	0	4	4%	4%
	Medium	.25 - .50	N	2	0	2	2%	6%
	Coarse	.50 - 1.0	D	11	0	11	10%	16%
.04 - .08	Very Coarse	1.0 - 2.0	S	0	0	0	0%	16%
.08 - .16	Very Fine	2.0 - 4.0		1	0	1	1%	17%
.16 - .22	Fine	4.0 - 5.7	G	1	0	1	1%	18%
.22 - .31	Fine	5.7 - 8.0	R	4	0	4	4%	22%
.31 - .44	Medium	8.0 - 11.3	A	2	0	2	2%	24%
.44 - .63	Medium	11.3 - 16.0	V	6	0	6	6%	30%
.63 - .89	Coarse	16.0 - 22.6	E	6	0	6	6%	35%
.89 - 1.26	Coarse	22.6 - 32.0	L	19	0	19	18%	53%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	12	0	12	11%	65%
1.77 - 2.5	Very Coarse	45.0 - 64.0		20	0	20	19%	84%
2.5 - 3.5	Small	64 - 90	C	11	0	11	10%	94%
3.5 - 5.0	Small	90 - 128	O	4	0	4	4%	98%
5.0 - 7.1	Large	128 - 180	B	1	0	1	1%	99%
7.1 - 10.1	Large	180 - 256	L	1	0	1	1%	100%
10.1 - 14.3	Small	256 - 362	B	0	0	0	0%	100%
14.3 - 20	Small	362 - 512	L	0	0	0	0%	100%
20 - 40	Medium	512 - 1024	D	0	0	0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0	0	0	0%	100%
	Bedrock		BDRK	0	0	0	0%	100%
			Totals	**105**	**0**	**105**	**100%**	**100%**

d16	d35	d50	d84	d95
Silt/Clay	0.0	0.0	0.0	0.0

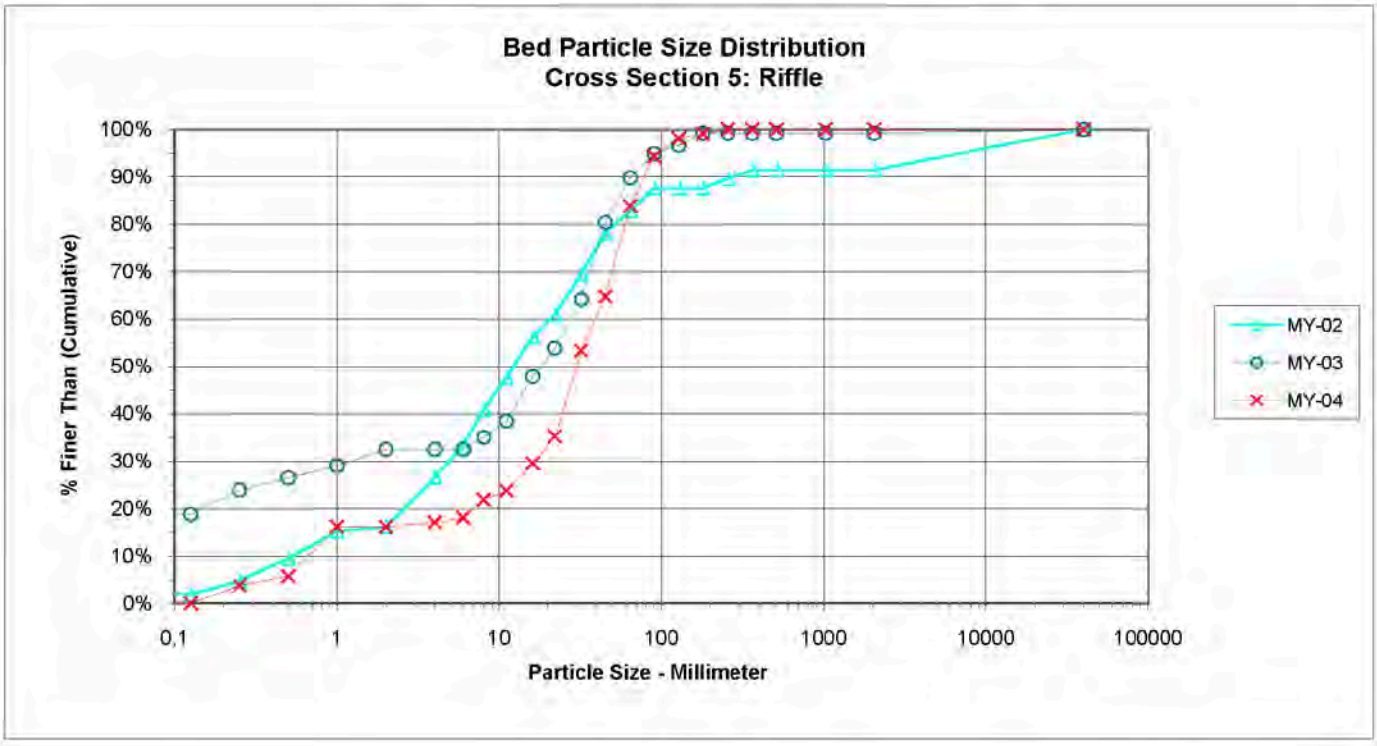


Table 10a. Baseline Stream Data Summary
UT to Cane Creek Stream Mitigation Site/Project No. 69 Main Channel (2232 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)							44.5						14.3					24				26.6			
Floodprone Width (ft)							88						47					72				72			
Bankfull Mean Depth (ft)							1						1.5					2				2.2			
[1]Bankfull Max Depth (ft)													2.2					3.2							
Bankfull Cross Sectional Area (ft^2)							46.5						21.4					47.7				51			
Width/Depth Ratio							43						10					12				13.9			
Entrenchment Ratio							2						3.3					3				2.7			
[1]Bank Height Ratio							0.8											1				1			
Profile																									
Riffle Length (ft)																				48		54	60		
Riffle Slope (ft/ft)							0.016											0.003		0.002		0.032	0.004		
Pool Length (ft)																				31		43	79		
Pool Max depth (ft)													2.5					5							
Pool Spacing (ft)							355				9			49				82		77		100	160		
Pattern																									
Channel Beltwidth (ft)							63						80					105				110			
Radius of Curvature (ft)							24				9.3			29			48	60	72	44		64	83		
Rc:Bankfull width (ft/ft)											0.7			3			2		3						
Meander Wavelength (ft)							218				32			92			53	123	192	48		127	205		
Meander Width Ratio							14						5.6					4.38				4.14			

Transport parameters				
Reach Shear Stress (competency) lb/f^2	0.54		0.26	
Max part size (mm) mobilized at bankful	55		55	
Stream Power (transport capacity) W/m^2				
Additional Reach Parameters				
Rosgen Classification	C4	C4b	C4	C4
Bankfull Velocity (fps)	4.3		4.2	
Bankfull Discharge (cfs)	202			
Valley length (ft)	1960			
Channel Thalweg length (ft)	2301	397	2232	2232
Sinuosity (ft)	1.17	1.2	1.14	1.14
Water Surface Slope (Channel) (ft/ft)	0.0056		0.0023	0.0029
BF slope (ft/ft)	0.0056		0.0023	0.0032
[3]Bankfull Floodplain Area (acres)				
[4]% of Reach with Eroding Banks				
Channel Stability or Habitat Metric				
Biological or Other				

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
UT to Cane Creek Stream Mitigation Site/Project No. 69 Main Channel (2232 feet)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																												
[1]SC% / Sa% / G% / C% / B% / Be%																												
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)			18																									
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10			100																					2.3	11			
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																												

Shaded cells indicate that these will typically not be filled in

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary. The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions. ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtuion distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
UT to Cane Creek Stream Mitigation Site/Project No. 69 Main Channel (2232 feet)

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	574.45	574.43	574.49	574.47	574.43			572.60	572.29	572.62	572.68	572.29			NA	NA	571.61	571.51	571.61			NA	NA	571.25	571.33	571.25			NA	NA	569.72	569.81	569.72		
Bankfull Width (ft)	26.6	27.2	28.31	25.451	29.142			26.2	24.2	26.167	27.244	21.691			NA	NA	23.452	22.504	23.488			NA	NA	31.209	32.998	28.319			NA	NA	26.315	25.667	22.679		
Floodprone Width (ft)	72	72	72	72	72			72	72	72	72	72			NA	NA	95.4	95.4	95.4			NA	NA	92	92	92			NA	NA	59.101	59.1	59.1		
Bankfull Mean Depth (ft)	1.9	1.8	1.65	1.7358	1.5973			2.2	2.2	2.1664	2.0231	2.0584			NA	NA	1.9524	1.8702	2.0248			NA	NA	1.8512	1.69	1.8376			NA	NA	1.6502	1.5316	1.7189		
Bankfull Max Depth (ft)	3.2	3.1	2.9	2.96	2.87			3.7	3.6	3.55	3.445	3.15			NA	NA	3.31	3.21	3.39			NA	NA	4.26	4.24	4.08			NA	NA	2.83	2.86	2.83		
Bankfull Cross Sectional Area (ft^2)	51	48	46.77	44.177	46.549			56.5	53.6	56.689	55.119	44.648			NA	NA	45.787	42.088	47.557			NA	NA	57.773	55.766	52.039			NA	NA	43.424	39.312	38.985		
Bankfull Width/Depth Ratio	13.9	15.4	17.14	14.663	18.245			12.1	11	12.079	13.466	10.538			NA	NA	12.012	12.033	11.6			NA	NA	16.859	19.525	15.411			NA	NA	15.947	16.759	13.194		
Bankfull Entrenchment Ratio		2.65	2.54	2.8289	2.4706				2.97	2.7515	2.6428	3.3194			NA	NA	4.0679	4.0615	4.0617			NA	NA	2.9479	2.7881	3.2487			NA	NA	2.2459	0	2.6059		
Bankfull Bank Height Ratio		1	0.86	0.9223	0.9895				1	1.0676	0.9202	1.0222			NA	NA	0.8852	0.8474	0.8496			NA	NA	0.8709	0.7476	0.7549			NA	NA	0.9329	0.8741	0.9258		
Cross Sectional Area between end pins (ft^2)	151.1	131.77	130.6	128.29	138.79			160.07	146.86	151.17	148.68	149.87			NA	NA	88.887	85.31	86.947			NA	NA	87.254	79.74	75.709			NA	NA	258.52	250.16	253.7		
d50 (mm)	N/A	2.36	22.6	1.3	6.3			N/A	N/A	N/A	N/A	N/A			NA	N/A	42	15.6	0.4			NA	N/A	N/A	N/A	N/A			NA	N/A	12.4	18.1	30.2		

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
UT to Cane Creek Stream Mitigation Site/Project No. 69 Main Channel (2232 feet)

Parameter	Baseline (2006)						MY-1 (2007)						MY-2 (2008)						MY- 3 (2009)						MY- 4 (2010)						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	26.6	26.60	26.6	26.6	-	1	27.2	27.20	27.2	27.2	-	1	23.45	26.03	26.31	28.31	2.442	3	22.5	24.54	25.45	25.67	1.767	3	22.68	25.10	23.49	29.14	3.521	3						
Floodprone Width (ft)	72	72	72	72	-	1	72	72	72	72	-	1	59.1	75.5	72	95.4	18.4	3	59.1	75.5	72	95.4	18.4	3	59.1	75.5	72	95.4	18.4	3						
Bankfull Mean Depth (ft)	1.9	1.90	1.9	1.9	-	1	1.8	1.80	1.8	1.8	-	1	1.65	1.75	1.65	1.952	0.175	3	1.532	1.71	1.736	1.87	0.171	3	1.597	1.78	1.719	2.025	0.22	3						
[1]Bankfull Max Depth (ft)	3.2	3.2	3.2	3.2	-	1	3.1	3.1	3.1	3.1	-	1	2.83	3.0133	2.9	3.31	0.259	3	2.86	3.01	2.96	3.21	0.18	3	2.83	3.03	2.87	3.39	0.312	3						
Bankfull Cross Sectional Area (ft^2)	51	51.00	51	51	-	1	48	48.00	48	48	-	1	43.42	45.33	45.79	46.77	1.72	3	39.31	41.86	42.09	44.18	2.441	3	38.98	44.36	46.55	47.56	4.685	3						
Width/Depth Ratio	13.9	13.90	13.9	13.9	-	1	15.4	15.40	15.4	15.4	-	1	12.01	15.03	15.95	17.14	2.683	3	12.03	14.48	14.66	16.76	2.368	3	11.6	14.35	13.19	18.24	3.469	3						
Entrenchment Ratio	-	-	-	-	-	0	2.65	2.65	2.65	2.65	-	1	2.246	2.95	2.54	4.068	0.978	3	0	2.30	2.829	4.061	2.082	3	2.471	3.05	2.606	4.062	0.882	3						
[1]Bank Height Ratio	-	-	-	-	-	0	1	1	1	1	-	1	0.86	0.89	0.885	0.933	0.037	3	0.847	0.88	0.874	0.922	0.038	3	0.85	0.92	0.926	0.99	0.07	3						
Profile																																				
Riffle Length (ft)							55	-	49	43	-	-	8.8	26.5	17	73.1	18.91	22	2.41	28.89	22.93	94.05	23.18	28	5.86	29.25	24.14	56.19	16.64	21						
Riffle Slope (ft/ft)							0.004	-	0.006	0.008	-	-	0.002	0.020	0.020	0.052	0.015	20	0.002	0.019	0.012	0.077	0.019	22	0.001	0.018	0.011	0.082	0.023	14						
Pool Length (ft)							24	-	57	89	-	-	17	69.05	58.5	132	35.17	22	18.99	49.3	36.21	147.1	30.49	29	16.98	63.57	43.58	155.5	40.1	23						
Pool Max depth (ft)								-			-	-	-	-	-	-	-	-	3.15	3.83	3.79	4.5	0.36	29	2.33	3.31	3.28	4.62	0.58	23						
Pool Spacing (ft)							55	-	129	257	-	-	34	102.52	105	212	41.84	21	20.99	78.47	65.28	176.9	40.27	28	35	97.92	93.25	201.8	41.89	22						
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification							C4						C4						C4						C4											
Channel Thalweg length (ft)							2232						2288						2288						2285											
Sinuosity (ft)							1.14						1.17						1.17						1.17											
Water Surface Slope (Channel) (ft/ft)							0.003						0.0026						0.0031						N/A											
BF slope (ft/ft)							0.003						0.0026						0.003						0.0028											
[3]Ri% / Ru% / P% / G% / S%													26%	-	68%	-	-		36%	-	64%	-	-		28%	-	66%	-	-							
[3]SC% / Sa% / G% / C% / B% / Be%													4%	19%	56%	13%	3%	6%	19%	23%	37%	19%	1%	1%	4%	35%	49%	11%	0%	1%						
[3]d16 / d35 / d50 / d84 / d95 /													0.816	13.33	25.69	80.51	69.5		0.108	2.95	11.69	79.01	141.9		0.493	8.45	12.28	47.63	83.31							
[2]% of Reach with Eroding Banks	N/A						5%						2%						0%						1%											
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Appendix E. Hydrologic Data

Table 12. Verification of Bankfull Events

Verification of Bankfull Events Cane Creek / EEP #69			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo#**
Late 2005/Early 2006	Late 2005/Early 2006	Visual during construction	N/A
October 26, 2008	September 7, 2008	Wrack lines	None
July 24, 2009	June 6, 2009	Crest gauge	N/A
June 23, 2010	May 17, 2010	Visual observation	N/A