Mary's Creek (EEP #241)
Restoration Site
2010 Annual Monitoring Report (Year 4)

Alamance County
EEP Project No. 241
Design Firm: Stantec Consulting Services, Inc.

March 2011

Prepared for:

NCDENR/ Ecosystem Enhancement Program
1619 Mail Service Center
Raleigh, NC 27699-1619

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TABLE OF CONTENTS

APPENDICES

I. Executive Summary

The Mary's Creek (EEP #241) stream restoration project consists of 2,082 linear feet of stream restoration with just over 7.3 acres of buffer restoration. The project is in Alamance County north of Siler City, north of Greensboro Chapel Hill Road (SR 1005) and east of Lindley Mill Road (SR 1003) (Figure 1). Site construction and plantings were completed in March of 2006. The goals and objectives for Mary's Creek (EEP #241) stream restoration are:

- Improving water quality
- Providing wildlife habitat through the creation of a riparian zone
- Improving aquatic habitat with the use of natural material stabilization structures and a riparian buffer
- Excluding cattle from the stream
- Reducing nutrient loads from entering the stream through a filtration buffer
- Increasing the streams access to its floodplain
- Reducing erosion and sedimentation

Level II of the CVS-EEP protocol was administered for Monitoring Year (MY)-04, which includes planted woody stems and natural woody stems. Three vegetation monitoring plots (1, 2, and 3) were added in MY-02 to the original two established during baseline data collection. Planted stems could not be distinguished from natural stems during the MY-02 vegetation data collection, therefore all stems were recorded as natural, except for three black willow livestakes located within Plot 4. Including all five monitoring plots, there are 2695stems/acre including natural and planted stems. The success criterion for planted woody species is 320 stems/acre after MY-03. A mortality rate of ten percent will be allowed after MY-04 (288 stems/acre), with another ten percent allowed after MY-05 (260 stems/acre). An accurate number of planted stems /acre could not be determined since the planted stems could not be distinguished from natural stems.

Invasive exotics and areas of low stem densities are the only notable vegetation problems areas for MY-04. Tree of heaven (*Ailanthus altissima*) and Chinese privet (*Ligustrum sinense*) have reached levels of concern as well two areas of low stem densities and are depicted in the Current Conditions Plan View (Appendix B). Other invasive exotics observed within the conservation easement include tall fescue (*Schedonurus arundinaceus*), Gill over the ground (*Glechoma hederacea*), Johnson grass (*Sorghum halapense*), Japanese honeysuckle (*Lonicera japonica*), Japanese stiltgrass (*Microstegium vimineum*), and multiflora rose (*Rosa multiflora*). According to the NC Native Plant Society, all of these species, with the exception of tall fescue, Johnson grass, and gill over the ground, are classified as "Rank 1", which is defined as exotic plant species that have invasive characteristics and spread readily into native plant communities, displacing native vegetation. Johnson grass and gill over the ground are classified as "Rank 2" which is exotic plant species that display some invasive characteristics, but do not appear to present as great a threat as Rank 1 species. Although these species have been given these ranks, the functionality of the project is not expected to be impaired significantly by these species. Tree of Heaven, Chinese privet, and multiflora rose are considered a

species of "High Concern" according to EEP's invasive plant ranking list. Tall fescue, Johnson grass, and Japanese stiltgrass are species of "Low/Moderate Concern". The conservation easement contains tall fescue that resided within the seedbank pre-construction and is still the dominant grass in the adjacent cattle fields. For additional information relating to vegetation, see Appendix C.

Overall, the banks are stable and well vegetated along all project stream reaches. The majority of the structures are also functioning properly with little evidence of needed repairs with the exception of the two end structures on Mary's Creek that were noted as degraded in MY-02. Previously reported problems with the structure at station 19+75 continues to exhibit signs of piping, but has not degraded further as compared to MY-03. The piping of the structure at 20+95 reported in MY-03 has appeared to have stabilized and is not exhibiting signs of degraded structural integrity. Rills were observed along the fence line of the stream crossing of Mary's Creek which is outside of the EEP conservation easement. However during a second site visit it was noted that the landowner had filled in the rills. The steep roadway slope at the crossing makes the crossing approach susceptible to erosion. Erosion has slowed on the upstream face of the crossing from previous monitoring year; this area will continue to be observed due to its lack of armoring.

Changes from MY-03 to MY-04 in the main channel are minimal. Riffle and pool stability and performance are comparable to MY-03. The riffle substrate has fined slightly placing the distribution closer to the MY-02 samples. The bedrock outcrop at station 24+50 is still causing minor backwater effects upstream more than 200 feet. The bed of the main channel remains stable with no significant aggradation or degradation. This is also reflected in a comparison of the cross sectional data between MY-03 and MY-04. The structures at stations 25+25 and 26+00 that exhibited problems in MY-02 and MY-03 have failed and boulders have dislodged and moved slightly downstream. These two structure failures are not causing stream integrity problems. The vane arms are still intact, and are successfully providing bank protection. The bedrock directly upstream is preventing any downcutting of the stream. The erosion at the upstream culvert crossing face has slowed and some additional vegetation growth was observed.

The tributary also exhibited minor changes from MY-03 to MY-04. The reach is stable and the banks and channel are heavily vegetated. Some of the structures are difficult to locate due to the heavy vegetation and sediment present in the reach, however no issues were observed. The greatest change since MY-03 is the presence of two obstructions, located at stations 12+80 and 13+90, consisting of accumulated washed debris in the channel. The obstructions are causing backwater effects that extend to the top of the reach. The particle size distribution for the tributary has transitioned to a finer particle bed material from MY-03 due to the backwater. The longitudinal profile and cross sections for MY-04 show no significant changes from the previous monitoring year.

Summary information/data related to the occurrences 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 formerly found in these reports can be found in the mitigation plan and restoration plan documents available on EEPs website. All raw

data supporting the tables and figures in the appendices is available from EEP upon request.

II. Methodology

Methodologies follow the current EEP monitoring report template, Version 1.3 1/15/10, and the version 4.2 of the CVS-EEP protocol for recording vegetation (Lee et al 2008). Photos were taken with a digital camera. A Trimble Geo XT handheld unit with sub-meter accuracy was used to locate stream and vegetation problem areas.

A. Vegetation Methodologies

Level II of the EEP/CVS protocol Version 4.2, which includes natural stems, was used to collect data for MY-04 for five vegetation monitoring plots. Data collected for these plots are in Appendix C.

B. Stream Methodologies

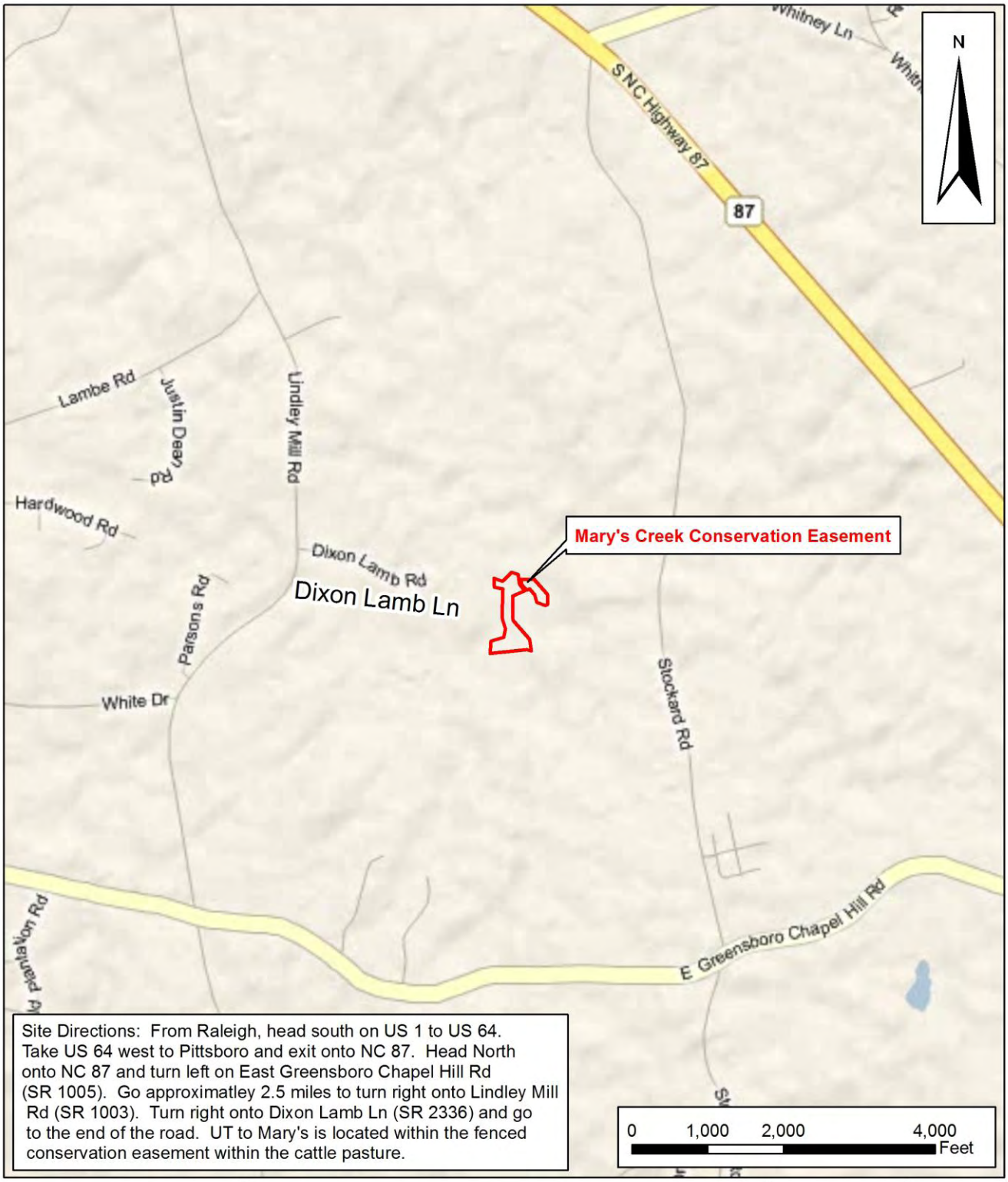
Stream profile and cross-sections were surveyed using total station equipment and methods. The survey data was plotted using AutoCAD Civil3D. The longitudinal profile was generated using the MY-02 alignment. Cross sectional data was extracted based on a linear alignment between the end pins. Pattern parameters were calculated by measuring the plotted dimensions of the MY-04 surveyed thalweg. Profile parameters were determined through analysis of a Microsoft Excel generated plot of the profile based on the aforementioned baseline alignment.

III. References

Lee, Michael T. Peet, Robert K. Roberts, Steven D., Wentworth, Thomas R. (2008). *CVS-EEP Protocol for Recording Vegetation Version 4.2.*

Weakley, Alan (2007). *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas*. http://www.herbarium.unc.edu/flora.htm.

Appendix A. Project Vicinity Map and Background Tables



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Mary's Creek Stream Restoration Site
Site Location Map
Alamance County, North Carolina
USGS 7.5-Minute Topographic Quadrangle Map
EEP Project No. 241
Date: March 2011

Ecosystem Enhancement Program

Figure 1

Table 1a and b. Project Components and Summations

Table 1.a. Project Components Mary's Creek (EEP #241)								
Project Component or Reach ID	**Existing Feet/Acres**	**Restoration Level**	**Approach**	**Footage or Acreage**	**Stationing**	**Buffer Acres**	**BMP Elements[1]**	**Comment**
Mary's Creek	1750	R	P2	1632 lf	10+00-26+31.8	6.1	CF=4505 lf	Instream Structure and Vegetated Buffers
UT to Mary's Creek	360	R	P2	450 lf	10+00 – 14+50	1.2		Instream Structure and Vegetated Buffers

1 = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; Grassed Swale = S; LS = Level Spreader; NI = Natural Infiltration Area; O = Other

CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing

Table 1b. Component Summations

Table 1.b. Component Summations Mary's Creek (EEP #241)							
Restoration Level	**Stream (lf)**	**Riparian Wetland (Ac)**		**Non-Riparian (Ac)**	**Upland (Ac)**	**Buffer (Ac)**	**BMP**
		Riverine	**Non-Riverine**				
Restoration	2082						
Enhancement							
Enhancement I							
Enhancement II							
Creation							
Preservation							
HQ Preservation							
		0	0				
Totals	**2082**	**0**		**0**	**0**	**0**	**Count**

Table 2. Project Activity and Reporting History

Mary's Creek (EEP #241)			
Activity or Reporting	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion Date**
Restoration Plan	N/A	-	April 2003
Final Design-90%	N/A	N/A	October 2005
Construction	N/A	N/A	March 2006
Temporary S&E mix applied to entire project area	N/A	N/A	March 2006
Permanent seed mix applied to entire project area	N/A	N/A	March 2006
Bare-Root and Livestake planting	N/A	N/A	March 2006
Mitigation Plan/As-built (Year 0 Monitoring-baseline)	N/A	May 2006	June 2006
Year 1 Monitoring	N/A	February 2007	March 2007
Year 2 Monitoring	N/A	July 2008	December 2008
Year 3 Monitoring	N/A	November 2009	March 2010
Year 4 Monitoring	N/A	January 2011	March 2011

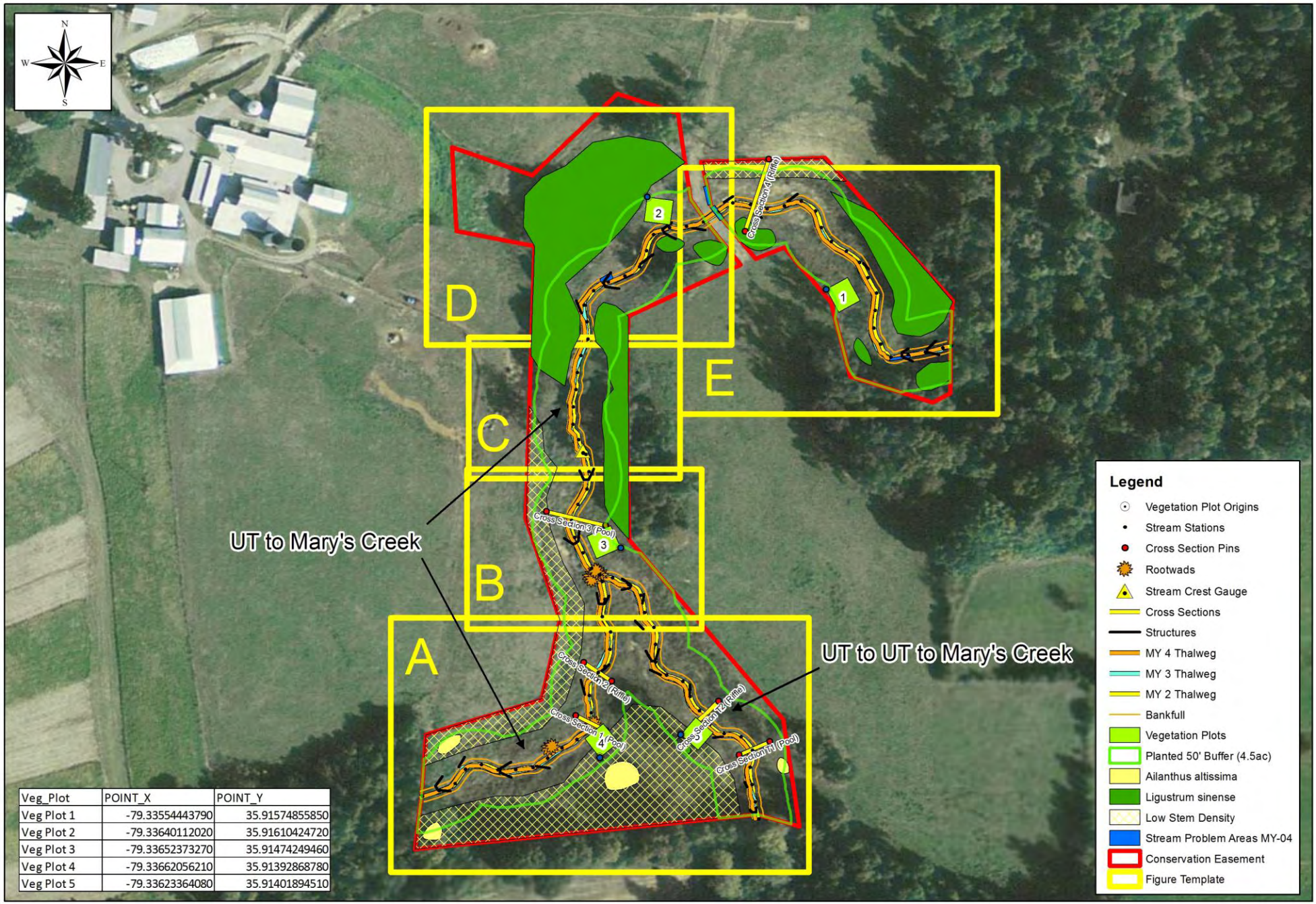
Table 3. Project Contact Table

Project Contact Table Mary's Creek (EEP #241)	
Designer	Stantec Consulting Services Inc 801 Jones Franklin Road, Suite 300 Raleigh, North Carolina 27606 David Bidelspach - (919) 851-6866
Construction Contractor	Shamrock Environmental Corp. 6101 Corporate Park Drive Browns Summit, North Carolina 27699 Bill Wright - (800) 881-1098
Planting Contractor POC	Seal Brothers Contracting, LLC P.O. Box 86 Dobson, North Carolina 27017 Brian Seal
Seeding Contractor POC	Shamrock Environmental Corp. 6101 Corporate Park Drive Browns Summit, North Carolina 27699 Bill Wright - (800) 881-1098
Seed Mix Sources	contact Shamrock Environmental Corp.
Nursery Stock Suppliers	Hills Nursery Co., Inc. (931) 668-4364
Monitoring Performers	
Stream Monitoring	Ward Consulting Engineers 8368 Six Forks Road, Suite 104 Raleigh, NC 27613-5083
Vegetation Monitoring	The Catena Group 410-B Millstone Dr. Hillsborough, NC 27278

Table 4. Project Attribute Table

Project County	Alamance	
Physiographic Region	Piedmont	
Ecoregion	Carolina Slate Belt	
River Basin	Cape Fear	
USGS HUC for Project (14 digit)	03030002050020	
NCDWQ Subbasin for the Project	Mary's 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?	Unknown	
Restoration Component Attribute Table	**Reach 1 (Main)**	**Reach 2 (Trib)**
Drainage Area	815acres	330 acres
Stream Order	3rd	1st
Restored Length	1632	450
Perennial or Intermittent	Perennial	Perennial
Watershed Type (Rural, Urban, Developing, etc.)	Rural	Rural
Watershed LUL Distribution:		
Residential	10%*	5%*
Ag – Row Crop	25%*	25%*
Ag – Livestock	20%*	35%*
Forested	45%*	35%*
Watershed Impervious cover (%)	<5%	<5%
NCDWQ AU/Index Number	16-26	16-26
NCDWQ Classification	C, NSW	C, NSW
303d listed?	Downstream of the site, Mary's Creek was listed on the 2002 list, but removed from the 2006 list	
Reasons for 303d listing or stressor	U	U
Total acreage of easement	7.3 acres	
Total Vegetated Acreage within Easement	7.3 acres	
Total Planted Acreage as Part of the Restoration	7.3 acres	
Rosgen Classification of Pre-Existing	C4/F4	C4
Rosgen Classification of As-built	C	C
Valley Type	VIII	VIII
Valley Slope	0.0096 ft/ft	0.0096ft/ft
Valley Side Slope Range	0.1076-0.3285 ft/ft	0.1076-0.3285 ft/ft
Valley Toe Slope Range	0.0111-0.0285ft/ft	0.0111-0.0285ft/ft
Cowardin Classification	Stream (R3UB1)	Stream (R3UB1)
Trout Waters designation	No	No
Species of Concern, Endangered, etc.	No	No
Dominant Soil Series Type		
Series	Herndon	Herndon
Depth	U	U
Clay %	U	U
K	U	U
T	U	U

Appendix B. Visual Assessment Data



Veg_Plot	POINT_X	POINT_Y
Veg Plot 1	-79.33554443790	35.91574855850
Veg Plot 2	-79.33640112020	35.91610424720
Veg Plot 3	-79.33652373270	35.91474249460
Veg Plot 4	-79.33662056210	35.91392868780
Veg Plot 5	-79.33623364080	35.91401894510

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Mary's Creek Stream Restoration Site

Consolidated Current Conditions Plan View

Bing Maps Satellite Imagery

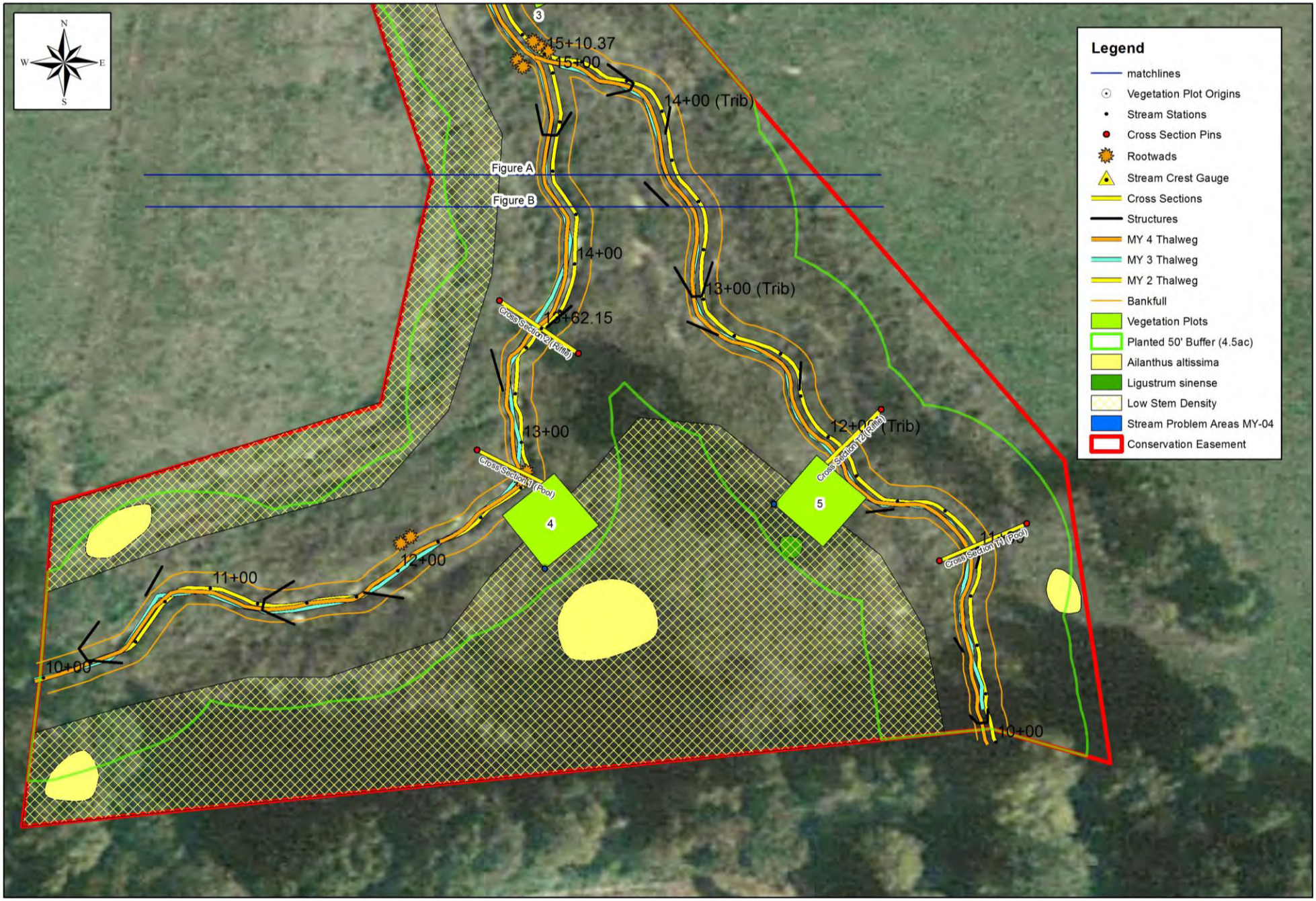
Alamance County, North Carolina

0 50 100 200 Feet

EEP Project No. 241

Date: March 2011

Figure Key



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Mary's Creek Stream Restoration Site

Consolidated Current Conditions Plan View

Bing Maps Satellite Imagery

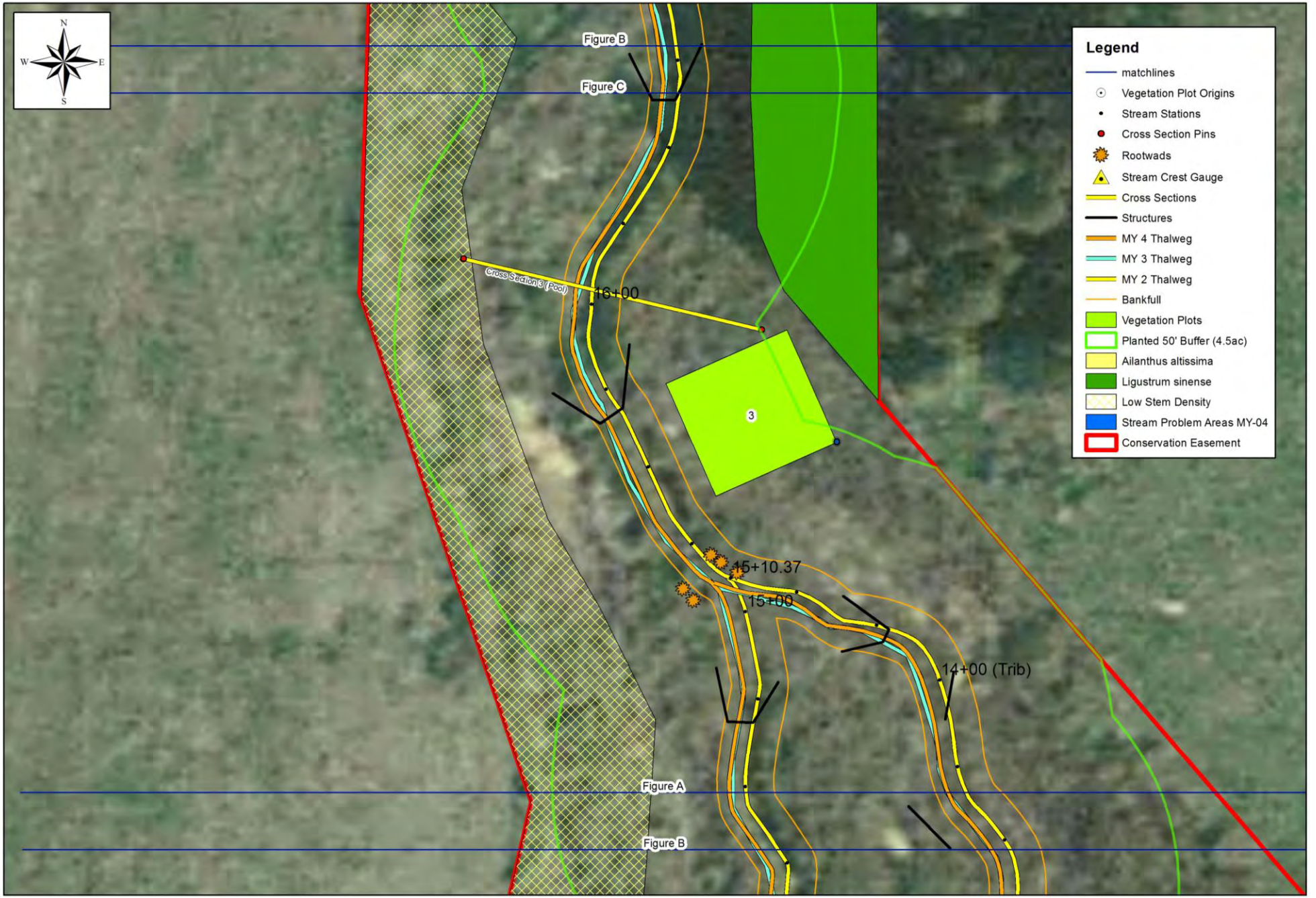
Alamance County, North Carolina

0 20 40 80 Feet

EEP Project No. 241

Date: March 2011

Figure A



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Mary's Creek Stream Restoration Site

Consolidated Current Conditions Plan View

Bing Maps Satellite Imagery

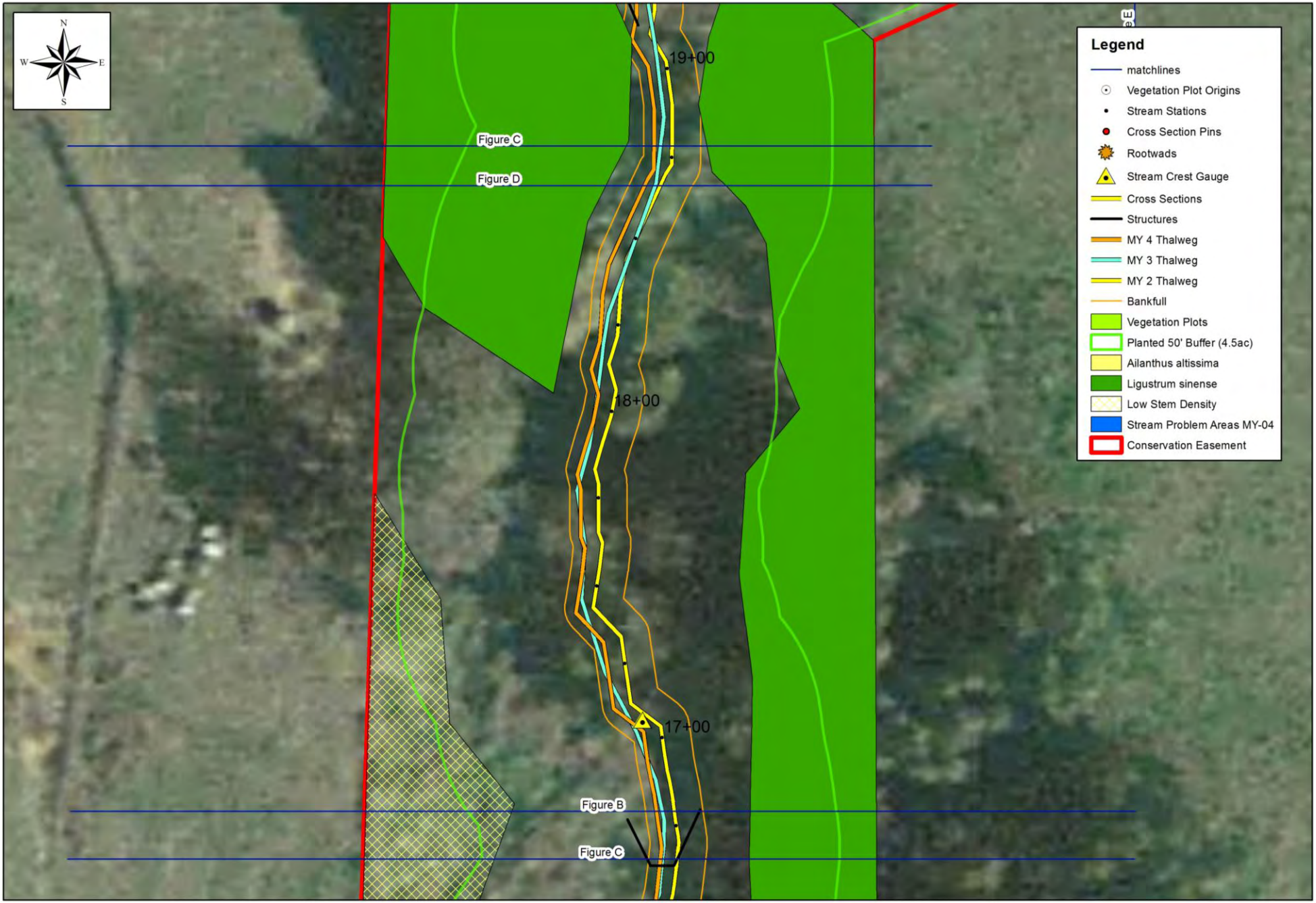
Alamance County, North Carolina

0 10 20 40 Feet

EEP Project No. 241

Date: March 2011

Figure B



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Mary's Creek Stream Restoration Site

Consolidated Current Conditions Plan View

Bing Maps Satellite Imagery

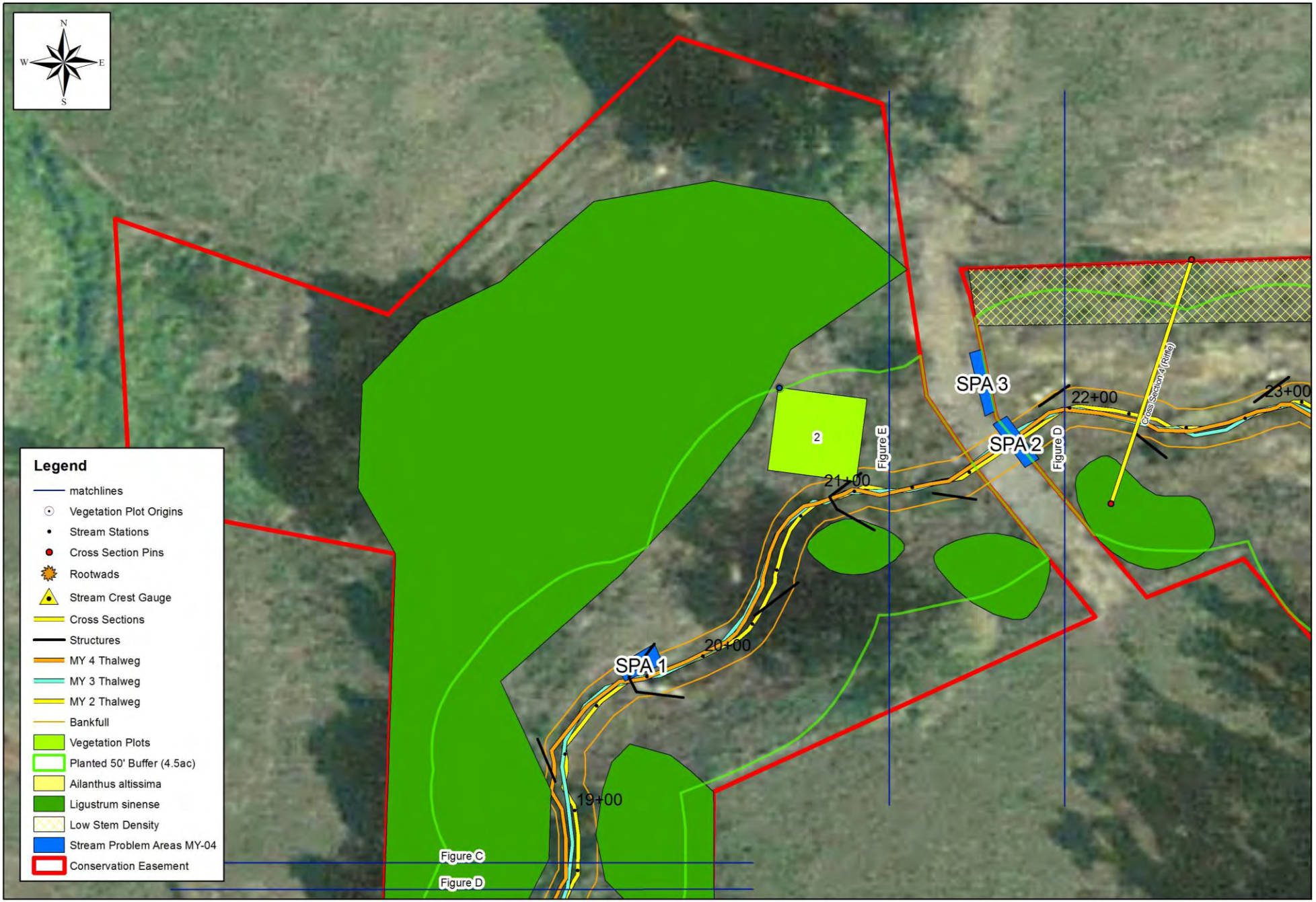
Alamance County, North Carolina

0 10 20 40 Feet

EEP Project No. 241

Date: March 2011

Figure C



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Mary's Creek Stream Restoration Site

Consolidated Current Conditions Plan View

Bing Maps Satellite Imagery

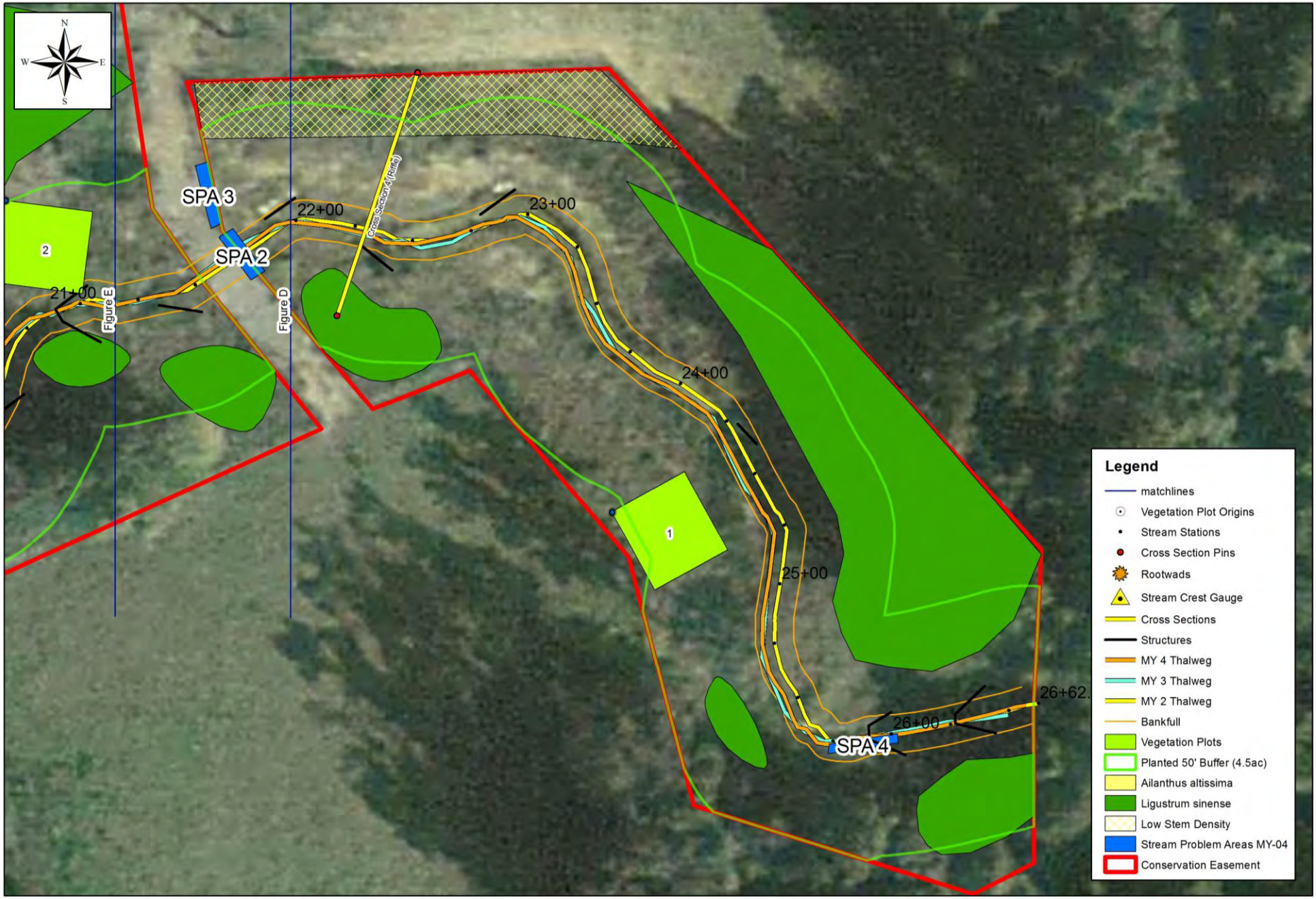
Alamance County, North Carolina

0 15 30 60 Feet

EEP Project No. 241

Date: March 2011

Figure D



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Ecosystem Enhancement Program

Mary's Creek Stream Restoration Site

Consolidated Current Conditions Plan View

Bing Maps Satellite Imagery

Alamance County, North Carolina

0 15 30 60 Feet

EEP Project No. 241

Date: March 2011

Figure E

Table 5. Visual Stream Morphology Stability Assessment Table

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Main Channel**
Assessed Length **1632**

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)			2	35	98%			
		2. Degradation - Evidence of downcutting					100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	21	23			91%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	21	21			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	21	21			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	20	21			95%			
		2. Thalweg centering at downstream of meander (Glide)	21	21			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	30	99%			99%
	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.			1	25	99%			99%
	3. Mass Wasting	Bank slumping, calving, or collapse					100%			100%
				Totals	2	55	98%	0	0	98%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	12	17			71%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	9	17			53%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	13	17			76%			
	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)	12	17			71%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	5	17			29%			

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Tributary**
Assessed Length **450**

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)					100%			
		2. Degradation - Evidence of downcutting					100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	5	10			50%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	4	11			36%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	4	11			36%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	4	11			36%			
		2. Thalweg centering at downstream of meander (Glide)	4	11			36%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion					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.					100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse					100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	4	5			80%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	5			40%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	5			80%			
	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)	4	5			80%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	1	5			20%			

Table 6. Vegetation Condition Assessment

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **4.56**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Low Stem Density Areas	Woody stem densities clearly below target levels based visual observation.	0.1 acres	yellow hatch	3	1.59	34.9%
			Total	3	1.59	34.9%

Easement Acreage[2] **7.3**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
2. Invasive Areas of Concern[4]	Areas of *Ailanthus altissima*.	1000 SF	Solid Yellow	4	0.08	1.1%
3. Invasive Areas of Concern[4]	Areas of *Ligustrum sinense.*	1000 SF	Solid Green	5	1.42	19.5%

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.

Stream Station Photos

Photo 1. XS-1-Downstream View

Photo 2. XS-2 Downstream View

Photo 3. XS-3 Downstream View

Photo 4. XS-4 Downstream View

Photo 5. XS-T1 Downstream View

Photo 6. XS-T2-Downstream View

Vegetation Monitoring Plot Photos

Photo 7. Vegetation Monitoring Plot 1

Photo 8. Vegetation Monitoring Plot 2

Photo 9. Vegetation Monitoring Plot 3

Photo 10. Vegetation Monitoring Plot 4

Photo 11. Vegetation Monitoring Plot 5

Appendix C. Vegetation Assessment Data

Table 7. Vegetation Plot Mitigation Success Summary Table

Mary's Creek (EEP #241)		
Veg Plot ID	**Veg Survival Threshold Met?**	**Tract Mean**
VP1	N/A	0%*
VP2	N/A	
VP3	N/A	
VP4	No	
VP5	N/A	

* Tract mean not met for Plot 4 (121 planted stems/acre), the only plot with confirmed planted stems.

Table 8**. Vegetation Metadata Table**

database name	cvs-eep-entrytool-v2.2.7.mdb
database location	11/5/2010 13:54
computer name	
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	241
project Name	Mary's Creek (EEP #241)
Description	2096 lf of stream restoration; no wetlands
River Basin	Cape Fear
length(ft)	2096
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	5

Table 9. Stem Count Total Planted by Plot and Species

EEP Project Code 241. Project Name: Mary's Creek

			Current Plot Data (MY4 2010)																Annual Means								
			E241-01-VP1			E241-01-VP2			E241-01-VP3			E241-01-VP4			E241-01-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	P-LS	P-all	T
Acer rubrum	red maple	Tree																								7
Acer rubrum var. rubrum	red maple	Tree												20			6			26						12
Alnus serrulata	hazel alder	Shrub Tree									1									1						1
Baccharis halimifolia	eastern baccharis	Shrub Tree															1			1						1
Carpinus caroliniana	American hornbeam	Shrub Tree																								10
Carpinus caroliniana var. caroliniana	Coastal American Hornbeam	Shrub Tree			7			1												8						
Celtis laevigata	sugarberry	Shrub Tree									1						1			2						3
Cornus amomum	silky dogwood	Shrub									2						4			6						3
Diospyros virginiana	common persimmon	Tree												1						1						2
Fraxinus pennsylvanica	green ash	Tree			55			22			10			4			3			94						202
Gleditsia triacanthos	honeylocust	Shrub Tree			1			1												2						
Hypericum	St. Johnswort	Shrub																								2
Juniperus virginiana var. virginiana	eastern redcedar	Tree						3			1			4			34			42						103
Ligustrum sinense	Chinese privet	Shrub Tree			7			15						1			23			46						132
Liquidambar styraciflua	sweetgum	Tree			11			1			6			18			23			59						61
Pinus taeda	loblolly pine	Tree			6						1						3			10						8
Platanus occidentalis var. occidentalis	Sycamore, Plane-tree	Tree									1									1						1
Prunus serotina	black cherry	Shrub Tree																								2
Prunus serotina var. serotina	black cherry	Shrub Tree						1									2			3						
Rosa multiflora	multiflora rose	Shrub Vine						1						1			6			8						8
Salix nigra	black willow	Tree									1	3	3	3			6	3	3	10	3	3	3	3	3	14
Sambucus canadensis	Common Elderberry	Shrub Tree			2						2			4						8						6
Ulmus	elm	Tree												1						1						
Ulmus alata	winged elm	Tree						1						1			1			3						5
Ulmus rubra	slippery elm	Tree			1															1						1
		Stem count	0	0	90	0	0	46	0	0	26	3	3	58	0	0	113	3	3	333	3	3	3	3	3	584
		size (ares)	1			1			1			1			1			5			5			5		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.12			0.12			0.12		
		Species count	0	0	8	0	0	9	0	0	10	1	1	11	0	0	13	1	1	21	1	1	1	1	1	21
		Stems per ACRE	0	0	3642	0	0	1862	0	0	1052	121.4	121.4	2347	0	0	4573	24.28	24.28	2695	24.28	24.28	24.28	24.28	24.28	4727

Appendix D. Stream Assessment Data

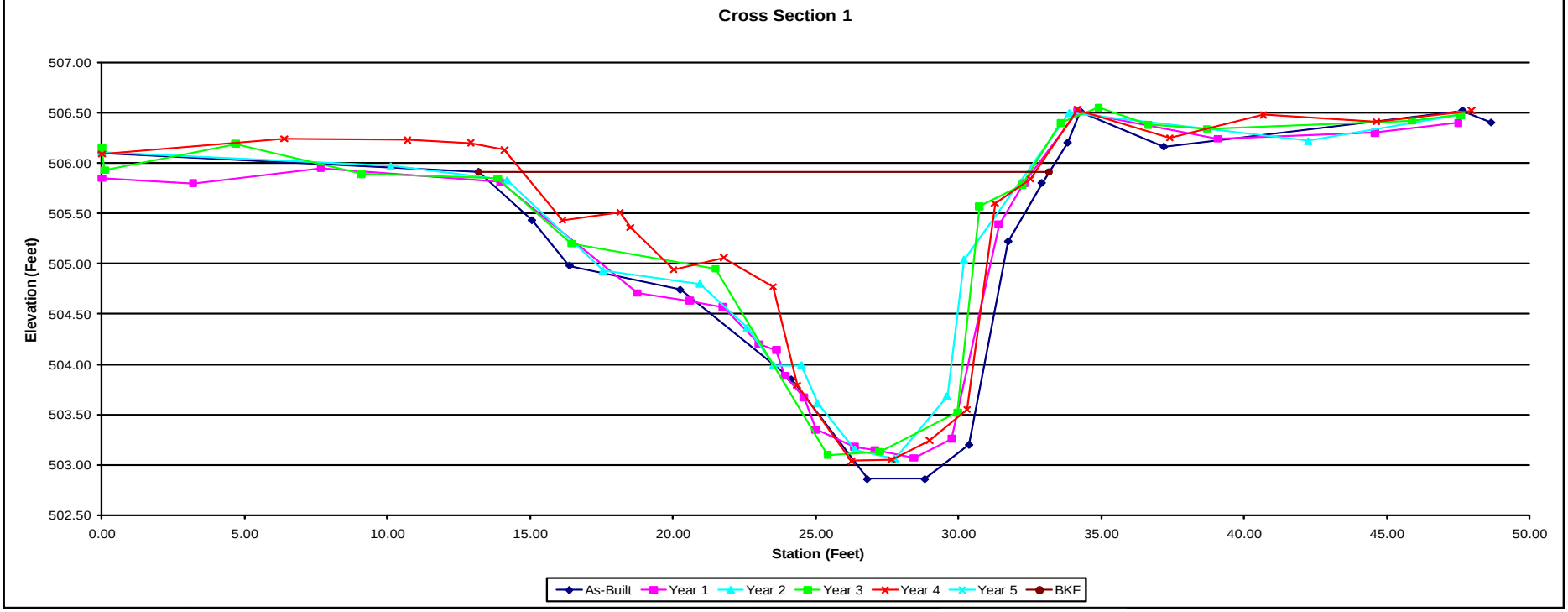
Project:	Mary's Creek
Cross Section:	Cross Section 1
Feature	Pool
Station:	12+83
Date:	12/30/10
Crew:	ZAP, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4
A (BKF)	30.4	27.3	24.5	22.9	24.0
W (BKF)	19.7	18.3	18.0	18.2	18.0
Max d	3.0	2.8	2.8	2.7	2.9
Mean d	1.5	1.5	1.4	1.3	1.3
W/D	12.8	12.3	13.2	14.5	13.4

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	506.10	LPIN	0.00	505.85	LPIN	0.00	506.11	LPIN	0.00	506.15	LPIN	0.00	506.09	LPIN
13.19	505.91	TOBL	3.19	505.80		10.12	505.97		0.10	505.93		6.38	506.24	
15.06	505.43		7.66	505.95		14.20	505.83	TOBL	4.68	506.19		10.70	506.23	
16.38	504.98		13.95	505.81	TOBL	17.56	504.93		9.09	505.89		12.92	506.20	TOBL
20.25	504.74		18.75	504.71		20.95	504.80		13.86	505.85	TOBL	14.09	506.13	
24.14	503.85		20.58	504.63		22.60	504.36		16.45	505.20		16.13	505.43	
26.80	502.86	TW	21.75	504.57		23.53	503.99		21.49	504.95		18.15	505.51	
28.82	502.86		23.01	504.20		24.51	503.99		25.42	503.10	TOEL	18.51	505.36	
30.37	503.20		23.62	504.14		25.07	503.61		27.25	503.13	TW	20.02	504.94	
31.74	505.22		23.93	503.89		26.38	503.15		29.97	503.52	TOER	21.77	505.06	
32.91	505.80		24.58	503.67		27.77	503.06	TW	30.73	505.57		23.50	504.77	
33.82	506.20		25.00	503.35		29.60	503.68		32.22	505.78		24.35	503.79	TOE L
34.27	506.51	TOBR	26.36	503.18		30.20	505.04		33.58	506.40		26.25	503.04	
37.19	506.16		27.06	503.15		33.89	506.50	TOBR	34.91	506.55	TOBR	27.66	503.05	TW
47.65	506.52	RPIN	28.44	503.07	TW	42.26	506.22		36.65	506.38		28.98	503.24	
48.65	506.40		29.76	503.26		47.61	506.48	RPIN	38.69	506.34		30.30	503.55	TOE R
			31.41	505.39					45.88	506.42		31.28	505.60	
			32.29	505.80					47.58	506.48	RPIN	32.52	505.84	
			34.16	506.51	TOBR							34.15	506.53	TOBR
			39.08	506.24								37.40	506.25	
			44.58	506.30								40.67	506.48	
			47.50	506.40	RPIN							44.63	506.41	
												47.96	506.52	RPIN

Photo of XS-1, looking in the downstream direction



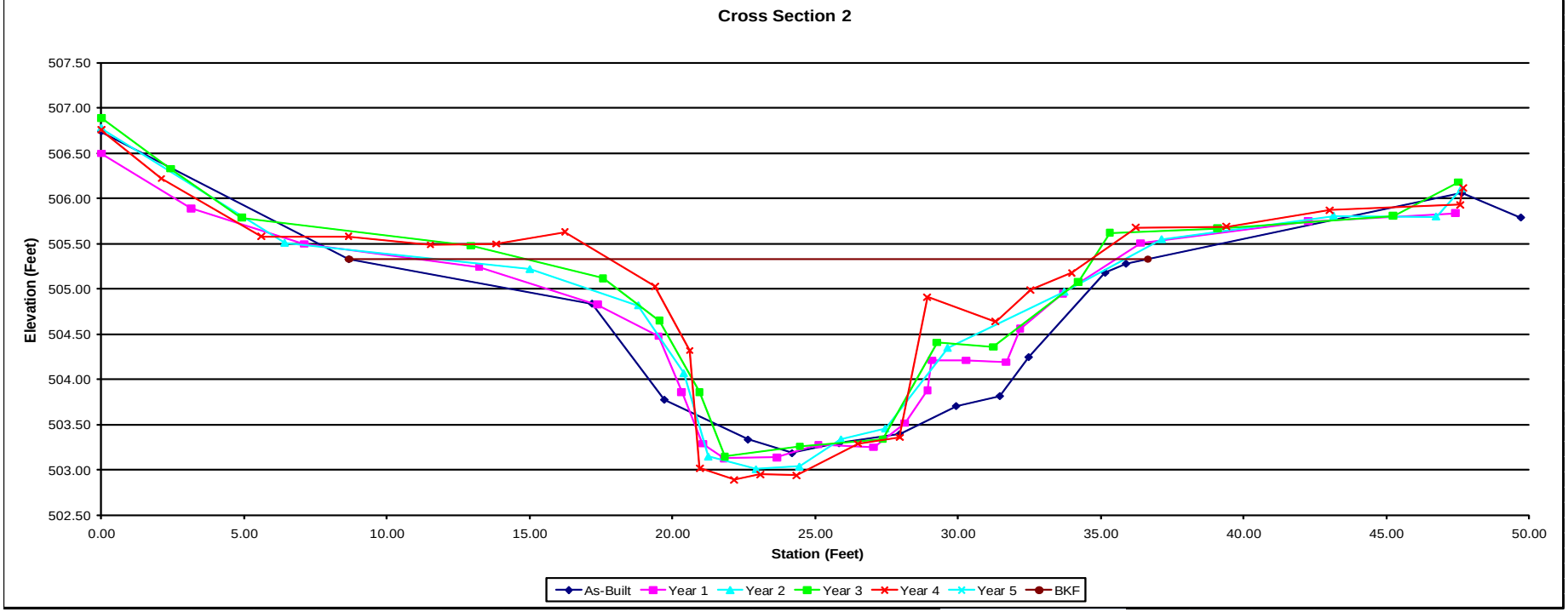
Project:	Mary's Creek
Cross Section:	Cross Section 2
Feature	Riffle
Station:	13+62
Date:	12/30/10
Crew:	ZAP, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4
A (BKF)	29.6	30.5	21.4	25.4	21.3
W (BKF)	28.0	29.3	20.2	22.1	16.8
Max d	2.1	2.4	2.2	2.3	2.4
Mean d	1.1	1.0	1.1	1.2	1.3
W/D	26.4	28.1	19.0	19.2	13.3

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	506.74	LPIN	0.00	506.50	LPIN	0.00	506.78	LPIN	0.00	506.89	LPIN	0.00	506.76	LPIN
8.67	505.33	TOBL	3.13	505.89		6.42	505.51		2.42	506.33		2.10	506.22	
17.19	504.84		7.09	505.50		15.01	505.22	TOBL	4.91	505.79		5.60	505.58	
19.72	503.78		13.23	505.24	TOBL	18.81	504.82		12.94	505.48	TOBL	8.65	505.58	
22.65	503.34		17.37	504.83		20.40	504.07		17.56	505.12		11.52	505.49	
24.19	503.19	TW	19.51	504.48		21.26	503.15		19.54	504.65		13.82	505.50	
25.84	503.30		20.32	503.86		22.93	503.01		20.94	503.86		16.23	505.63	TOBL
27.96	503.40		21.06	503.29		24.45	503.04	TW	21.83	503.15	TOEL	19.39	505.03	
29.94	503.71		21.80	503.13	TW	25.91	503.34		24.46	503.26	TW	20.60	504.32	
31.47	503.82		23.65	503.14		27.46	503.46		27.36	503.34	TOER	20.95	503.02	TOE L
32.48	504.25		25.11	503.28		29.64	504.35		29.26	504.41		22.16	502.89	
35.16	505.18	TOBR	27.04	503.25		33.73	504.97	TOBR	31.23	504.36		23.07	502.95	
35.89	505.28		28.14	503.52		37.14	505.55		34.21	505.08		24.35	502.94	TW
47.65	506.06	RPIN	28.93	503.88		43.16	505.81		35.31	505.62		26.50	503.29	
49.72	505.79		29.08	504.21		46.75	505.80		39.08	505.67	TOBR	27.95	503.36	TOE R
			30.28	504.21		47.64	506.11	RPIN	45.24	505.81		28.92	504.91	
			31.68	504.19					47.53	506.18	RPIN	31.31	504.64	
			32.18	504.56								32.54	504.99	
			33.68	504.95	TOBR							33.98	505.18	TOBR
			36.40	505.51								36.22	505.68	
			42.27	505.75								39.40	505.69	
			47.42	505.84	RPIN							43.02	505.87	
												47.58	505.93	
												47.68	506.12	RPIN

Photo of XS-2, looking in the downstream direction



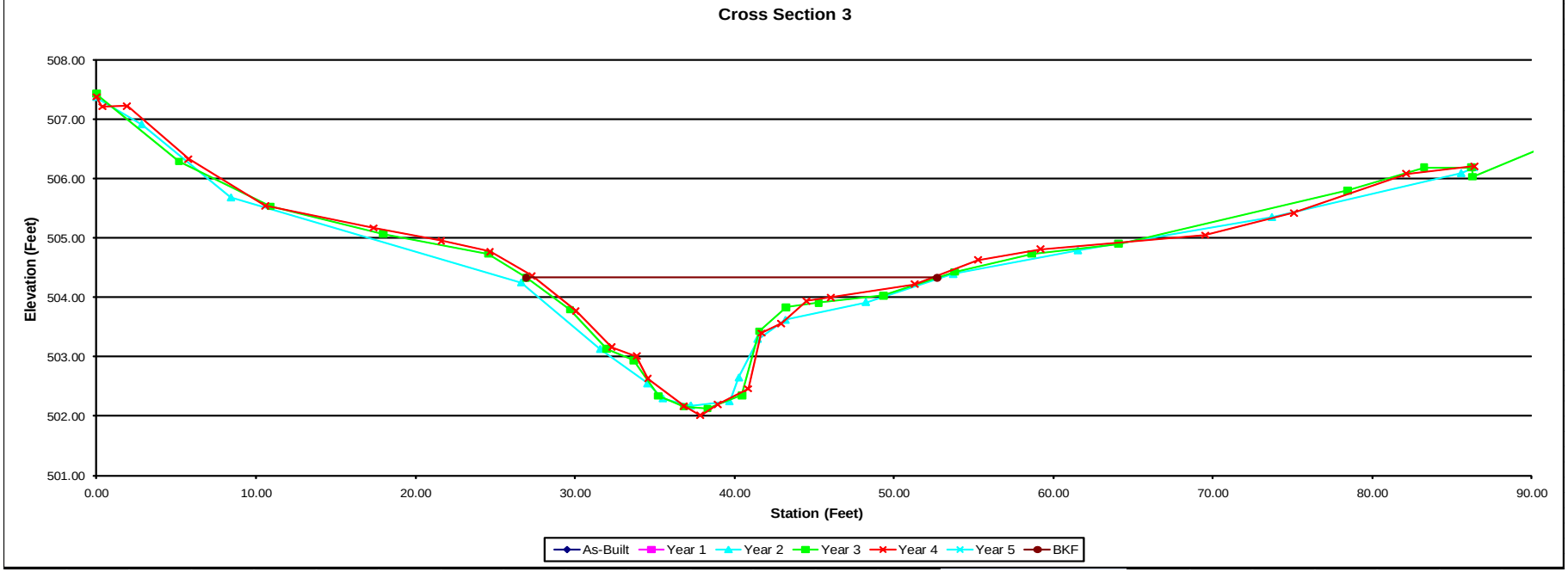
Project:	Mary's Creek
Cross Section:	Cross Section 3
Feature	Pool
Station:	16+04
Date:	12/30/10
Crew:	ZAP, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4
A (BKF)	NA	NA	23.6	25.6	23.7
W (BKF)	NA	NA	25.2	26.6	24.9
Max d	NA	NA	2.1	2.3	2.3
Mean d	NA	NA	0.9	1.0	0.9
W/D	NA	NA	27.0	27.7	26.2

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	507.37	LPIN	0.00	507.43	LPIN	0.00	507.38	LPIN
						2.84	506.91		5.16	506.29		0.35	507.21	
						8.44	505.68		10.92	505.53		1.91	507.22	
						26.65	504.25	TOBL	18.00	505.07		5.75	506.33	
						31.60	503.13		24.57	504.73		10.57	505.54	
						34.56	502.55		26.94	504.33	TOBL	17.37	505.17	
						35.53	502.30		29.70	503.79		21.61	504.95	
						37.28	502.18	TW	31.99	503.13		24.67	504.77	TOBL
						39.70	502.25		33.69	502.94		27.30	504.36	
						40.30	502.65		35.23	502.34	TOEL	30.05	503.77	
						41.47	503.30		36.84	502.16		32.33	503.16	
						43.22	503.62	TOBR	38.32	502.13	TW	33.88	503.01	
						48.26	503.92		40.47	502.35	TOER	34.58	502.63	TOE L
						53.74	504.39		41.55	503.43	TOBR	36.83	502.17	
						61.56	504.79		43.25	503.83	TOBR	37.86	502.01	TW
						73.73	505.35		45.29	503.91		38.97	502.20	
						85.60	506.09		49.35	504.03		40.86	502.46	TOE R
						86.38	506.19	RPIN	53.83	504.43		41.70	503.40	
									58.66	504.73		42.94	503.56	
									64.10	504.90		44.54	503.94	TOBR
									78.48	505.80		46.07	504.00	
									83.26	506.19		51.29	504.22	
									86.24	506.19	RPIN	55.28	504.63	
									86.29	506.03		59.19	504.81	
									95.00	507.00		69.53	505.05	
												75.09	505.42	
												82.14	506.08	
												86.42	506.21	RPIN

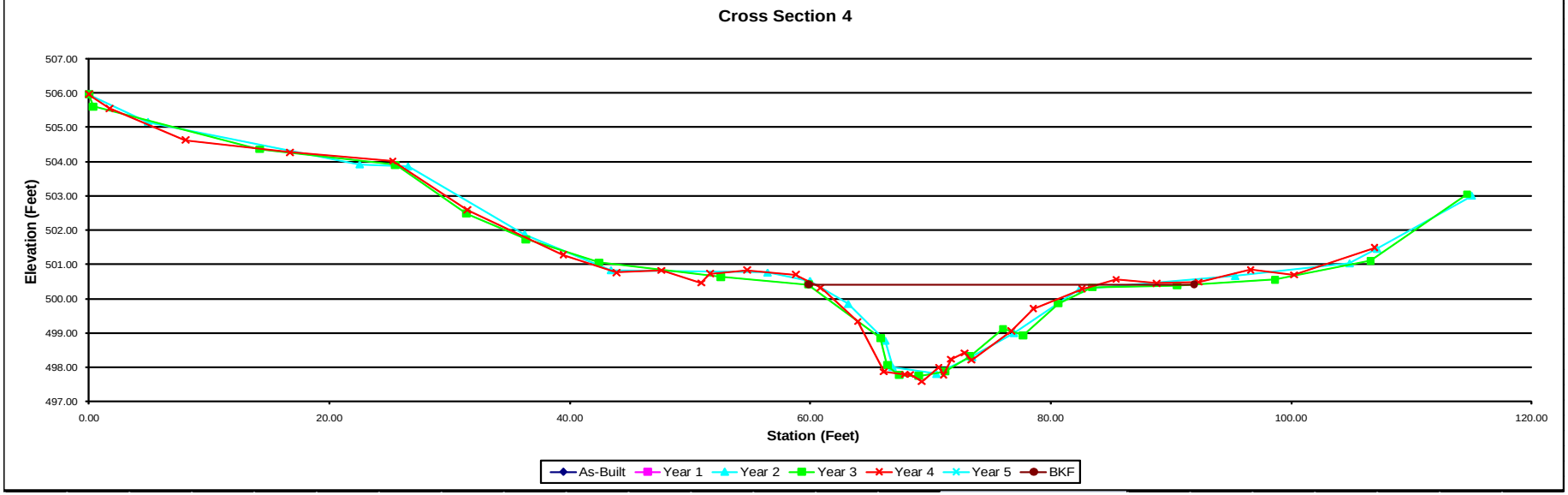
Photo of XS-3 looking in the downstream direction



Project:		Mary's Creek		Summary (bankfull)										
Cross Section:		Cross Section 4			MY0	MY1	MY2	MY3	MY4					
Feature		Riffle		A (BKF)	NA	NA	35.2	34.2	48.4					
Station:		22+30		W (BKF)	NA	NA	30.6	32.1	25.0					
Date:		12/30/10		Max d	NA	NA	2.7	2.7	2.9					
Crew:		ZAP, SV		Mean d	NA	NA	1.2	1.1	1.9					
				W/D	NA	NA	26.6	30.1	12.9					

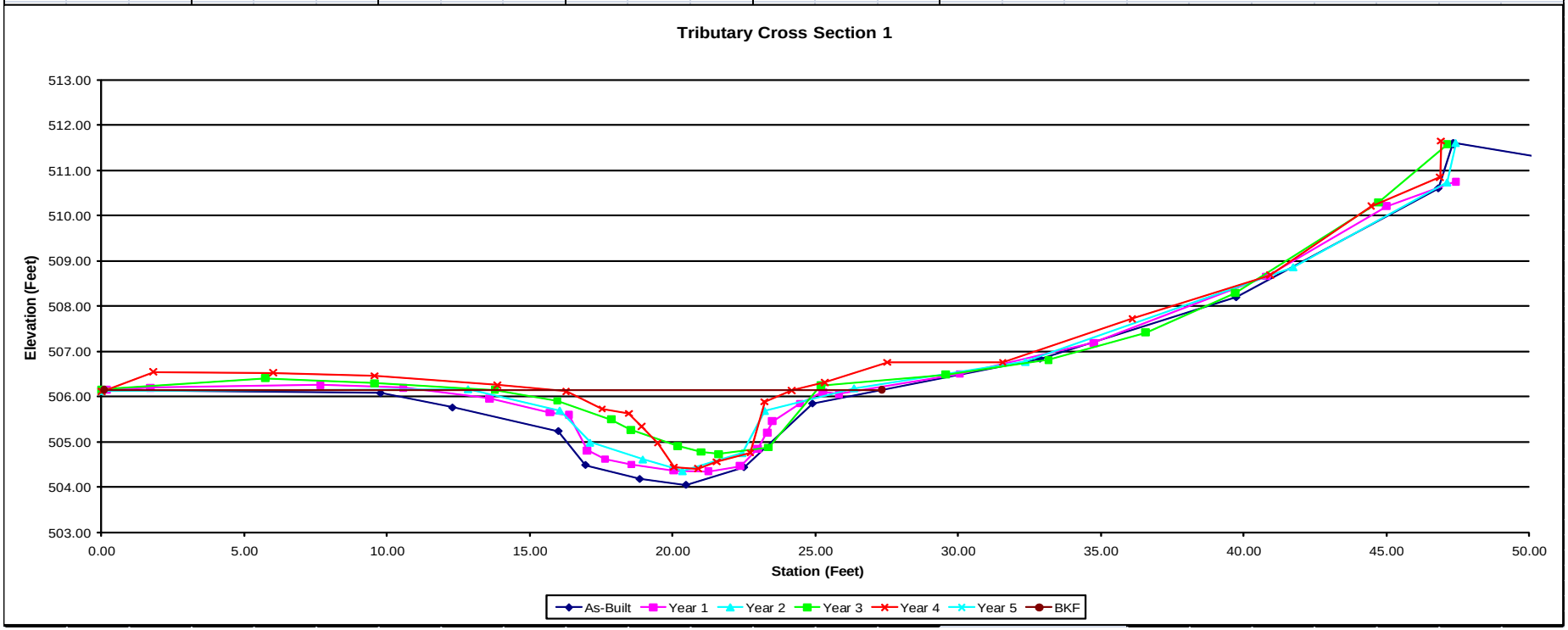
MY00-2006			MY01-2007			MY02-2008			MY03-2009			MY04-2010		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
						0.00	505.96	LPIN	0.00	505.96	LPIN	0.00	505.96	LPIN
						4.91	505.15		0.35	505.60		1.69	505.55	
						22.52	503.91		14.19	504.36		8.03	504.63	
						26.54	503.85		25.49	503.90		16.70	504.27	
						36.24	501.88		31.39	502.48		25.27	504.02	
						43.42	500.83		36.35	501.73		31.48	502.59	
						56.44	500.76		42.42	501.06		39.45	501.28	
						59.97	500.52	TOBL	52.55	500.63		43.87	500.76	
						63.15	499.85		59.84	500.41	TOBL	47.62	500.82	
						66.23	498.78		65.84	498.85		50.92	500.46	
						66.83	498.01		66.40	498.06	TOEL	51.66	500.73	
						70.49	497.81	TW	67.38	497.77		54.74	500.83	
						73.45	498.30		69.00	497.75	TW	58.79	500.70	
						76.93	499.00		71.18	497.88	TOER	60.84	500.32	TOBL
						82.39	500.28	TOBR	73.26	498.32		63.96	499.33	
						95.33	500.66		76.02	499.12		66.11	497.87	TOE L
						104.85	501.03		77.70	498.93		67.84	497.79	
						107.13	501.45	RPIN	80.62	499.86		68.32	497.79	
						115.00	503.00		83.44	500.33	TOBR	69.27	497.58	TW
									90.49	500.38		70.68	498.00	
									98.66	500.55		71.08	497.78	TOE R
									106.60	501.10	RPIN	71.70	498.23	
									114.63	503.05		72.81	498.42	
												73.42	498.21	
												76.71	499.05	
												78.54	499.71	
												82.61	500.28	TOBR
												85.45	500.56	
												88.78	500.45	
												92.31	500.48	
												96.62	500.84	
												100.22	500.69	
												106.94	501.49	RPIN

Photo of XS-4, looking in the downstream direction



Project:		Mary's Creek Tributary			Summary (bankfull)									
Cross Section:		Cross Section 1				MY0	MY1	MY2	MY3	MY4				
Feature		Pool			A (BKF)	17.2	13.0	11.3	9.4	7.4				
Station:		11+02			W (BKF)	15.1	14.7	13.4	12.8	8.7				
Date:		12/30/10			Max d	2.1	1.8	1.8	1.5	1.8				
Crew:		ZAP. SV			Mean d	1.1	0.9	0.8	0.7	0.9				
					W/D	13.3	16.5	15.8	17.2	10.2				
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
0.04	506.13	LPIN	0.18	506.15	LPIN	0.00	506.13	LPIN	0.00	506.16	LPIN	0.00	506.11	LPIN
0.09	506.15		1.71	506.20		12.84	506.17	TOBL	5.73	506.41		1.81	506.55	
9.78	506.08	TOBL	7.67	506.26		16.05	505.70		9.55	506.30		6.02	506.53	
12.30	505.76		10.57	506.20	TOBL	17.11	504.99		13.77	506.15	TOBL	9.57	506.46	
16.01	505.24		13.58	505.96		18.96	504.62		15.96	505.91		13.86	506.26	
16.96	504.49		15.70	505.65		20.35	504.36	TW	17.85	505.50		16.27	506.12	TOBL
18.86	504.18		16.37	505.60		22.44	504.76		18.53	505.27		17.53	505.73	
20.48	504.05	TW	17.01	504.81		23.23	505.69		20.17	504.91	TOEL	18.46	505.63	
22.51	504.44		17.63	504.62		26.36	506.19	TOBR	21.00	504.78	TW	18.91	505.35	
24.91	505.85	TOBR	18.55	504.50		32.36	506.77		21.62	504.73		19.48	504.98	TOE L
32.88	506.84		20.04	504.37		41.74	508.86		23.36	504.88	TOER	20.04	504.44	
39.75	508.20		21.25	504.35	TW	47.13	510.73		25.19	506.25	TOBR	20.89	504.41	TW
46.83	510.61	RPIN	22.37	504.47		47.43	511.60	RPIN	29.56	506.49		21.54	504.56	
47.34	511.61		22.98	504.85					33.17	506.81		22.72	504.76	TOE R
47.37	511.58		23.31	505.21					36.57	507.42		23.22	505.89	
47.37	511.61		23.49	505.46					39.70	508.29		24.18	506.14	
50.96	511.24		24.46	505.85					44.71	510.29		25.34	506.32	TOBR
			25.26	506.10	TOBR				47.13	511.58	RPIN	27.52	506.76	
			25.82	506.06								31.56	506.76	
			30.06	506.50								36.10	507.72	
			34.75	507.19								40.93	508.69	
			40.80	508.66								44.46	510.21	
			45.00	510.21								46.88	510.85	
			47.43	510.75	RPIN							46.91	511.65	RPIN

Photo of XS-T1, looking in the downstream direction
*Cross Section labeled XS-11 to differentiate between main channel XS-1



Project:	Mary's Creek Tributary
Cross Section:	Cross Section 2
Feature	Riffle
Station:	11+91
Date:	12/30/10
Crew:	ZAP. SV

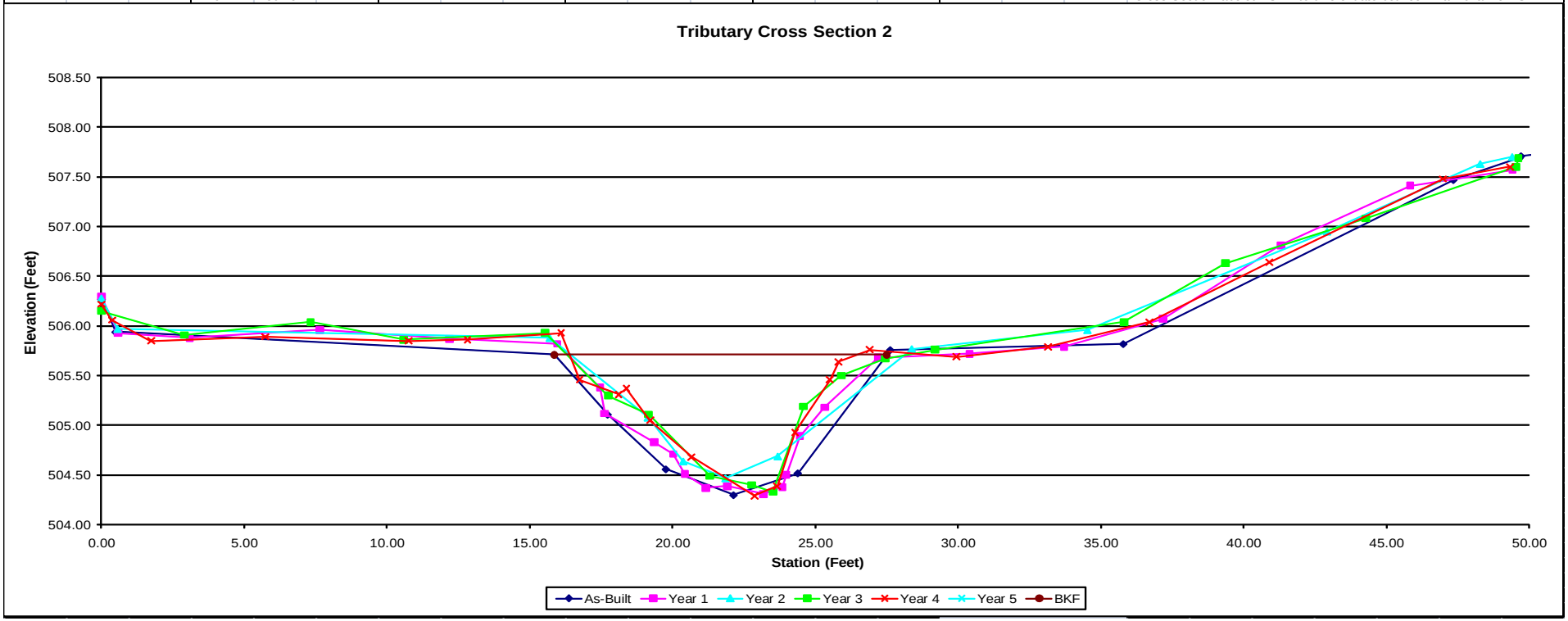
Summary (bankfull)

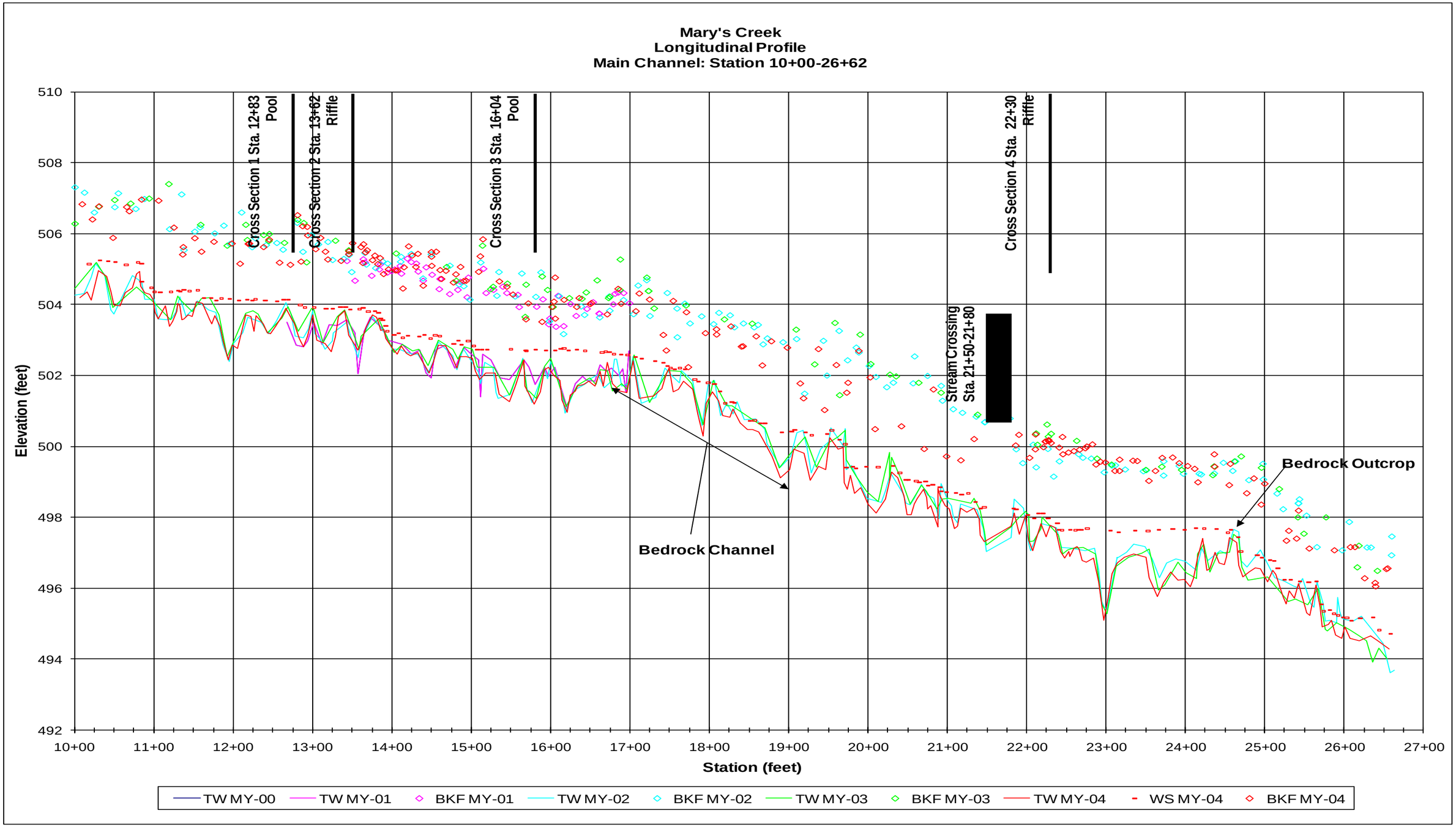
	MY0	MY1	MY2	MY3	MY4
A (BKF)	10.0	8.8	8.9	7.4	7.3
W (BKF)	11.8	11.2	12.2	12.0	10.1
Max d	1.4	1.4	1.3	1.4	1.4
Mean d	0.8	0.8	0.7	0.6	0.7
W/D	13.9	14.3	16.8	19.5	14.0

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	506.27	LPIN	0.00	506.30	LPIN	0.00	506.28	LPIN	0.00	506.15	LPIN	0.00	506.22	LPIN
0.01	506.27		0.59	505.93		0.57	505.97		2.90	505.91		0.37	506.06	
0.50	505.94		3.09	505.88		15.70	505.88	TOBL	7.32	506.04		1.74	505.85	
15.86	505.71	TOBL	7.64	505.96		19.13	505.08		10.59	505.86		5.74	505.89	
17.73	505.11		12.19	505.87		20.37	504.64		15.54	505.93	TOBL	10.75	505.85	
19.77	504.56		15.96	505.82	TOBL	21.85	504.47	TW	17.75	505.30		12.82	505.86	
22.14	504.30	TW	17.46	505.38		23.68	504.69		19.16	505.11		16.10	505.93	TOBL
24.39	504.52		17.62	505.12		28.37	505.77	TOBR	21.31	504.49	TOEL	16.75	505.46	
27.63	505.76	TOBR	19.36	504.83		34.52	505.96		22.77	504.40	TW	18.11	505.31	
35.79	505.82		20.02	504.71		42.91	506.95		23.52	504.33	TOER	18.38	505.37	
47.35	507.47		20.43	504.51		48.27	507.63		24.58	505.19		19.21	505.05	TOE L
49.66	507.69		21.17	504.37		49.39	507.70	RPIN	25.90	505.50	TOBR	20.66	504.68	
49.72	507.71	RPIN	21.91	504.39					27.44	505.67		22.87	504.29	TW
57.01	507.95		23.19	504.31	TW				29.19	505.76		23.66	504.39	
			23.85	504.38					35.80	506.04		24.29	504.93	TOE R
			23.97	504.50					39.35	506.63		25.51	505.46	
			24.46	504.89					44.27	507.08		25.81	505.64	
			25.33	505.18					49.54	507.60		26.91	505.76	TOBR
			27.19	505.68	TOBR				49.62	507.69	RPIN	29.95	505.69	
			30.40	505.72								33.15	505.79	
			33.71	505.79								36.70	506.04	
			37.17	506.07								40.89	506.64	
			41.30	506.81								46.98	507.48	
			45.83	507.41								49.32	507.60	RPIN
			49.41	507.57										

Photo of XS-T2, looking in the downstream direction

*Cross Section labeled XS-12 to differentiate between main channel XS-2




Mary's Creek
Longitudinal Profile
Main Channel: Station 10+00-26+62
Cross Section 1 Sta. 12+83 Pool
Cross Section 2 Sta. 13+62 Riffle
Cross Section 3 Sta. 16+04 Pool
Cross Section 4 Sta. 22+30 Riffle
Stream Crossing Sta. 21+50-21+80
Bedrock Channel
Bedrock Outcrop
Elevation (feet)
510
508
506
504
502
500
498
496
494
492
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
Station (feet)
TW MY-00
TW MY-01
BKF MY-01
TW MY-02
BKF MY-02
TW MY-03
BKF MY-03
TW MY-04
WS MY-04
BKF MY-04

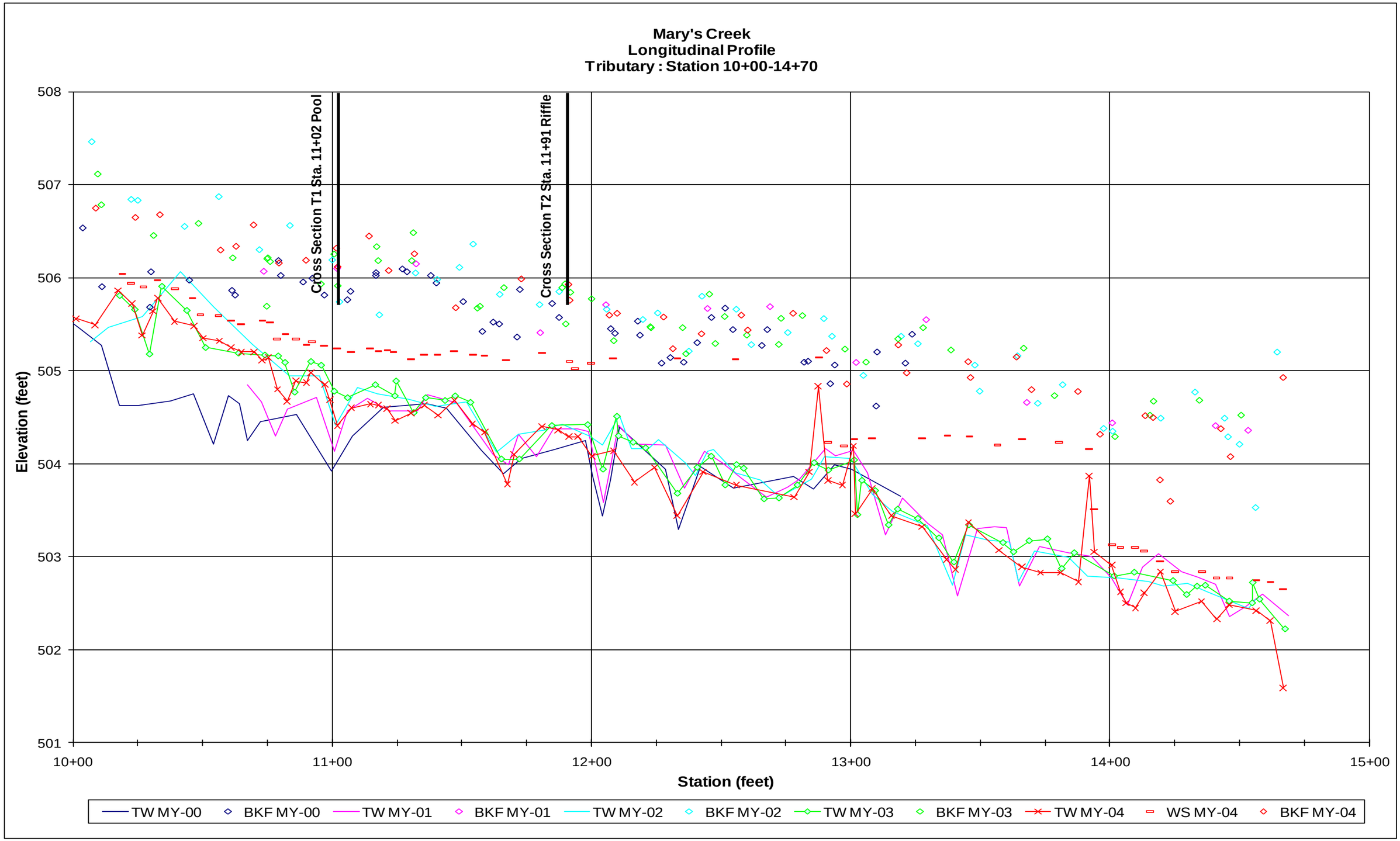

Mary's Creek
Longitudinal Profile
Tributary : Station 10+00-14+70
Cross Section T1 Sta. 11+02 Pool
Cross Section T2 Sta. 11+91 Riffle
Elevation (feet)
508
507
506
505
504
503
502
501
10+00
11+00
12+00
13+00
14+00
15+00
Station (feet)
TW MY-00
BKF MY-00
TW MY-01
BKF MY-01
TW MY-02
BKF MY-02
TW MY-03
BKF MY-03
TW MY-04
WS MY-04
BKF MY-04

Figure 7. Pebble Count Plots – Cross-Section 2 – Mary's Creek (EEP #241)

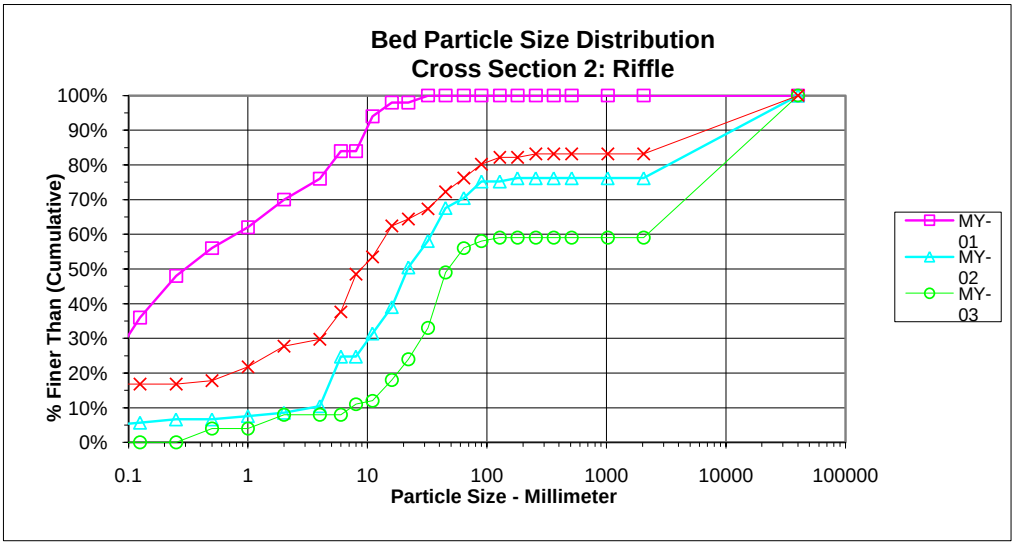


Figure 8. Pebble Count Plots – Cross-Section 4 – Mary's Creek (EEP #241)

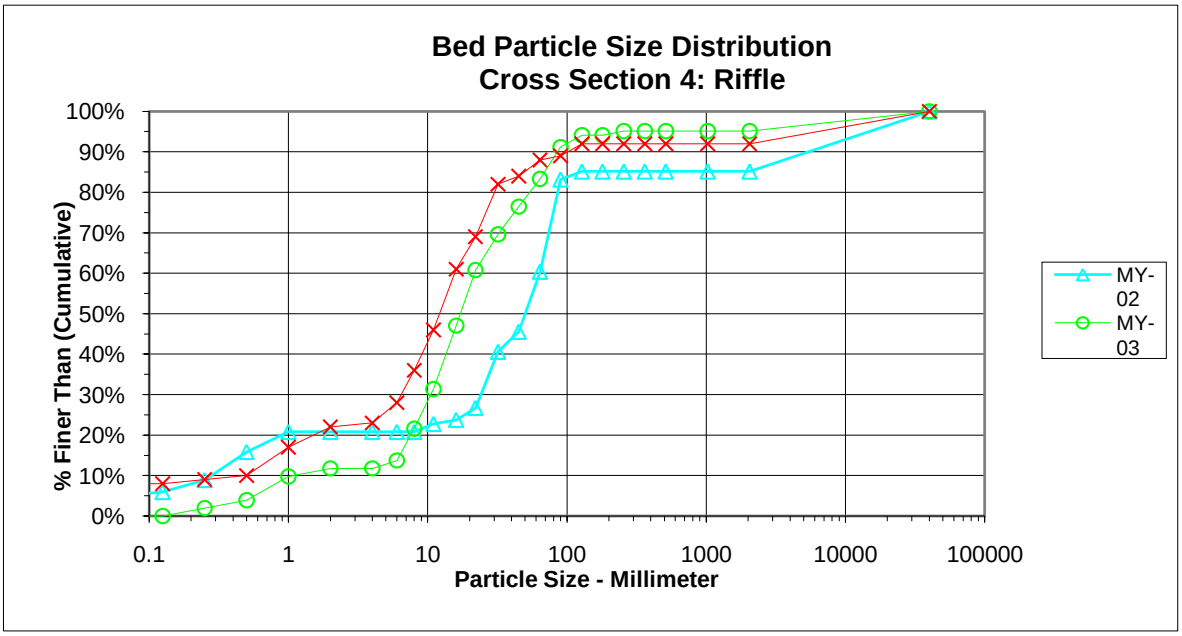


Figure 9. Pebble Count Plots – Cross-Section2 – Mary's Creek (EEP #241)

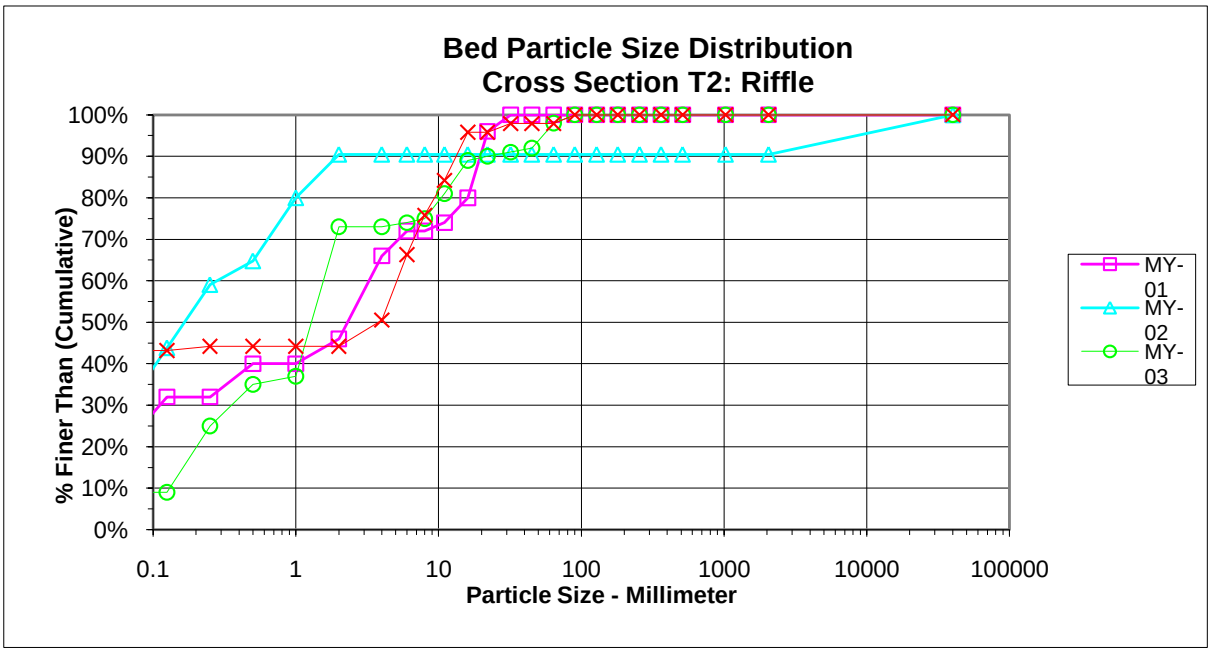


Table 10a. Baseline Stream Data Summary
Mary's Creek (241) - Main Channel (1632 feet)

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)							34.5											18				26.5			
Floodprone Width (ft)							37											54				54			
Bankfull Mean Depth (ft)							0.7											1.5				1.1			
[1]Bankfull Max Depth (ft)																									
Bankfull Cross Sectional Area (ft^2)							24.1											28				28.1			
Width/Depth Ratio							50											12				25			
Entrenchment Ratio							1.07											3				2			
[1]Bank Height Ratio							2.9											1				1			
Profile																									
Riffle Length (ft)																				17		45	31		
Riffle Slope (ft/ft)							0.023											0.005		0.004		0.01	0.007		
Pool Length (ft)																				20		34	27		
Pool Max depth (ft)																									
Pool Spacing (ft)					28			148										41		30		90	45		
Pattern																									
Channel Beltwidth (ft)							105										54	81	108	30		65	100		
Radius of Curvature (ft)																	36	45	54	40		59	78		
Rc:Bankfull width (ft/ft)																									
Meander Wavelength (ft)					330		585	840									54	99	144	68		100	133		
Meander Width Ratio							3										3	4.5	6	1.1		2.5	3.8		
Transport parameters																									
Reach Shear Stress (competency) lb/f^2																									
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							F4											C4				C4			
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)							1750											1632				1632			
Sinuosity (ft)							1.03											1.2				1.2			
Water Surface Slope (Channel) (ft/ft)							0.0057											0.0031				0.0033			
BF slope (ft/ft)							0.0057											0.0031				0.0034			
[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
Mary's Creek (241) - Tributary (450 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)																		12							
Floodprone Width (ft)																		36							
Bankfull Mean Depth (ft)																		1							
[1]Bankfull Max Depth (ft)																									
Bankfull Cross Sectional Area (ft^2)																		11							
Width/Depth Ratio																		12							
Entrenchment Ratio																		3							
[1]Bank Height Ratio																		1							
Profile																									
Riffle Length (ft)																				16		30	44		
Riffle Slope (ft/ft)																		0.008		0.005		0.007	0.01		
Pool Length (ft)																									
Pool Max depth (ft)																				14		28	41		
Pool Spacing (ft)																		28		45		56	67		
Pattern																									
Channel Beltwidth (ft)																	36	54	72	28			35		
Radius of Curvature (ft)																	24	30	36	38		46	54		
Rc:Bankfull width (ft/ft)																									
Meander Wavelength (ft)																	36	66	96	na		108	na		
Meander Width Ratio																	3	4.5	6	2.4			3		
Transport parameters																									
Reach Shear Stress (competency) lb/f^2																									
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification																		C4				C4			
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)																									
Valley length (ft)																									
Channel Thalweg length (ft)																		450				450			
Sinuosity (ft)																		1.2				1.2			
Water Surface Slope (Channel) (ft/ft)																		0.0044				0.0039			
BF slope (ft/ft)																		0.0044				0.0037			
[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 = P roportion 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 11a. Monitoring – Cross-Section Morphology Data Table

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections) Mary's Creek (241) - Main Channel (1632 feet)																										
	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Riffle)						
Based on fixed baseline bankfull elevation	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		505.9	505.8	505.2	505.9				505.3	505.2	505.5	505.3				NA	N/A	502.1	504.3				NA	500.5	500.4	500.5		
Bankfull Width (ft)		18.3	18	18.2	17.95				26.6	20.19	24.74	16.84				NA	25.22	26.63	24.92				NA	21.28	23.29	24.97		
Floodprone Width (ft)		54	54	54	54				54	54	54	54				NA	81.88	88.06	82				NA	81.77	84.45	82		
Bankfull Mean Depth (ft)		1.5	1.361	1.259	1.337				1	1.061	1.127	1.265				NA	0.935	0.961	0.95				NA	1.381	1.45	1.936		
Bankfull Max Depth (ft)		2.8	2.77	2.7	2.87				2.2	2.21	2.425	2.44				NA	2.055	2.25	2.32				NA	2.47	2.58	2.92		
Bankfull Cross Sectional Area (ft^2)		27.3	24.49	22.92	24				26.6	21.41	27.87	21.3				NA	23.57	25.59	23.66				NA	29.4	33.78	48.35		
Bankfull Width/Depth Ratio		12.3	13.22	14.46	13.43				26.6	19.04	21.96	13.32				NA	26.98	27.71	26.25				NA	15.4	16.06	12.9		
Bankfull Entrenchment Ratio		2.95	3.001	2.966	3.008				2	2.675	2.183	3.206				NA	3.247	3.307	3.29				NA	3.843	3.626	3.284		
Bankfull Bank Height Ratio		1	1	1	1.098				1	0.873	0.915	0.918				NA	0.701	0.978	0.832				NA	1	1	0.925		
Cross Sectional Area between end pins (ft^2)					35.79							61.85							173.9							282.2		
d50 (mm)		NA	NA	NA	NA				0.23	21.75	47.7	8.9				NA	N/A	NA	NA				NA	50.7	17.3	12.3		

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)Mary's Creek (241) - Tributary (450 feet)														
	Cross Section 1 (Pool)							Cross Section 2 (Riffle)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	506.2	506.2	506.2	506.2	506.2			506.7	505.8	505.9	505.9	505.7		
Bankfull Width (ft)	15.1	14.7	13.39	12.76	8.727			11.8	11.2	12.2	12.02	10.1		
Floodprone Width (ft)	36	36	36	36	36			36	36	36	36	36		
Bankfull Mean Depth (ft)	1.1	0.9	0.845	0.74	0.9			8	0.8	0.728	0.617	0.7		
Bankfull Max Depth (ft)	2.1	1.8	1.81	1.47	1.8			1.4	1.4	1.3	1.385	1.4		
Bankfull Cross Sectional Area (ft^2)	17.2	13	11.32	9.443	7.4			10	8.8	8.881	7.421	7.3		
Bankfull Width/Depth Ratio	13.3	16.5	15.85	17.24	10.2			13.9	14.3	16.76	19.47	14		
Bankfull Entrenchment Ratio		2.4	2.688	2.821	4.125				3.2	2.951	2.995	3.564		
Bankfull Bank Height Ratio		1	1	0.966	0.977				1	1	0.794	1.032		
Cross Sectional Area between end pins (ft^2)					103.2							54.08		
d50 (mm)	NA	NA	NA	NA	NA			NA	1.8	0.18	1.4	3.8		

Table 11b. Monitoring – Stream Reach Morphology Data Table

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Mary's Creek (241) - Main Channel (1632 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						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)			28						29.3				20.2		25.4	30.6			22.1		27.1	32.1			16.8		20.9	25								
Floodprone Width (ft)			54						54				54		68	82			54		68	82			54		68	82								
Bankfull Mean Depth (ft)			1.06						1.04				1.06		1.11	1.15			1.07		1.11	1.15			1.26		1.6	1.94								
[1]Bankfull Max Depth (ft)			2.14						2.37				2.21		2.46	2.71			2.33		2.5	2.66			2.44		2.68	2.92								
Bankfull Cross Sectional Area (ft^2)			29.6						30.5				21.4		28.3	35.2			25.4		29.8	34.2			21.3		34.8	48.4								
Width/Depth Ratio			26.4						28.1				19		22.8	26.6			19.2		24.6	30.1			12.9		13.1	13.3								
Entrenchment Ratio			1.93						1.85				2.67		2.68	2.68			2.45		2.5	2.56			3.21		3.24	3.28								
[1]Bank Height Ratio			0.93						0.77				0.87		0.89	0.91			0.95		0.96	0.97			0.92		0.92	0.92								
Profile																																				
Riffle Length (ft)							18		19.5	23			2.2		27	108			3.3		20.5	65.1			2.55	24.5	16.4	66.3	19	23						
Riffle Slope (ft/ft)							0.01		0.01	0.02			0		0.02	0.05			0.01		0.02	0.05			0	0.03	0.02	0.1	0.02	20						
Pool Length (ft)							22		31	67			7.7		41.6	98			15		30	89			14.6	39.8	33.8	93.4	21.6	25						
Pool Max depth (ft)																									1.88	2.82	2.69	4.42	0.61	25						
Pool Spacing (ft)							35		70	92			36		85	222			27		57	148			20.8	64.2	59.4	125	29.3	24						
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification									C4						C4						C4						C4									
Channel Thalweg length (ft)									1632						1662						1662						1662									
Sinuosity (ft)									1.2						1.09						1.09						1.11									
Water Surface Slope (Channel) (ft/ft)									0.0038						0.0062						0.0065						0.0063									
BF slope (ft/ft)									0.0034						0.0057						0.006						0.0063									
[3]Ri% / Ru% / P% / G% / S%													26%		43%				39%		55%				36%		61%									
[3]SC% / Sa% / G% / C% / B% / Be%													5%	10%	51%	15%	0%	19%	0%	10%	60%	7%	0%	23%	12%	12%	57%	5%	0%	12%						
[3]d16 / d35 / d50 / d84 / d95 /													2.64	20.7	36.2	53	Be		10.5	22.9	32.5	33.1	124		0.53	6.54	10.6	22.5	Be							
[2]% of Reach with Eroding Banks															2%						1%						2%									
Channel Stability or Habitat Metric																																				
Biological or Other																																				

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

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

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Mary's Creek (241) - Tributary (450 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						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)								11.2						12.2						12						10.1										
Floodprone Width (ft)								36						36						36						36										
Bankfull Mean Depth (ft)								0.8						0.73						0.62						0.72										
[1]Bankfull Max Depth (ft)								1.4						1.3						1.39						1.42										
Bankfull Cross Sectional Area (ft^2)								8.8						8.88						7.42						7.28										
Width/Depth Ratio								14.3						16.8						19.5						14										
Entrenchment Ratio								3.2						2.95						2.99						3.56										
[1]Bank Height Ratio								1						1						0.79						1.03										
Profile																																				
Riffle Length (ft)							17		29	34			3		21	42			3		10	38			2.43	16.1	11.7	42.8	12.4	11						
Riffle Slope (ft/ft)							0.01		0.01	0.02			0		0.02	0.03			0		0.01	0.03			0.01	0.03	0.02	0.08	0.02	10						
Pool Length (ft)							13		18	50			10		18	30			3		12	31			7.24	23.1	17.9	79	20.3	11						
Pool Max depth (ft)																									1.22	1.84	1.92	2.22	0.32	11						
Pool Spacing (ft)							32		65	74			26		44	67			12		26	56			19.4	41.4	38.8	68.7	16.7	10						
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)							450						469						469						469											
Sinuosity (ft)							1.2						1.11						1.11						1.15											
Water Surface Slope (Channel) (ft/ft)							0.0034						0.0076						0.0076						0.0073											
BF slope (ft/ft)							0.0037						0.0062						0.0052						0.003											
[3]Ri% / Ru% / P% / G% / S%													37%		28%				40%		53%				40%		57%									
[3]SC% / Sa% / G% / C% / B% / Be%													29%	61%	0%	0%	0%	10%	9%	64%	25%	2%	0%	0%	43%	1%	54%	2%	0%	0%						
[3]d16 / d35 / d50 / d84 / d95 /															0.18	1.38			SC	0.5	1.4	12.9	54.5		0.1	0.1	3.8	10.9	15.7							
[2]% of Reach with Eroding Banks															0%						0%						0%									
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. Stream Assessment Data

Table 12. Verification of Bankfull Events

Mary's Creek (EEP #241)			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo #**
Late 2005/Early 2006	Late 2005/Early 2006	Visual during construction	N/A
September 18, 2008	September 7, 2008	Wrack lines	N/A
July 24, 2009	Unsure (June 6, 2009)	Crest Gauge	N/A
June 15, 2010	May 17, 2010 (3.3" rain event)	Wrack lines/Crest Gauge	N/A