McCain Stream Restoration Project
Randolph County, North Carolina
EEP Project #443

MY-02 Monitoring Report - Final

Data Collected: October 18, 2010
Submitted: November 15, 2010

Prepared for:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Parker Lincoln Building
2728 Capital Boulevard, Suite 1H-103
Raleigh, NC 27606

McCain Stream Restoration
EEP Project #443
Sophia, North Carolina
Randolph County

MY-02 Monitoring Report - Final
Prepared By:

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TABLE OF CONTENTS

APPENDICES

I. Executive Summary

The McCain Stream Restoration Site restored a total of 2,470 linear feet of stream in the Lower Yadkin River Basin. The project site is situated in Randolph County in the Piedmont physiographic province of North Carolina and is in the Carolina Slate Belt ecoregion. The project stream is an Unnamed Tributary to Back Creek (UTBC). From the confluence with UTBC, Back Creek flows approximately one mile to Lake Lucas / Back Creek Reservoir. The McCain Stream Restoration site is located on a 71-acre parcel located approximately one mile southeast of the intersection of Lake Lucas Road (SR 1518) and Spero Road (SR1504) in Randolph County, North Carolina. The property is an active livestock farm, and is surrounded by a mix of hardwood forests, row crops, and other livestock operations. See Figure 1 Vicinity Map in Appendix A.

Project Goals:

- Restore a stable channel morphology that is capable of moving the flows and sediment provided by its watershed.
- Restore riparian buffer habitat and functions.
- Improve water quality to the receiving watershed by reducing bank erosion and bed degradation.
- Improve aquatic habitat.

Project Objectives:

- Build an appropriate C4 channel with stable channel dimensions.
- Plant a functional Bottomland Hardwood Forest community to create an effective riparian buffer.
- Exclude livestock from the riparian areas.

Seven vegetation monitoring plots (1-7) were monitored for MY-02. Of these seven plots, plots 1 and 6 are not meeting vegetation success criteria, resulting in 72% of the plots meeting the vegetation success criteria. 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). Currently the vegetation criteria are being met with 456 planted stems/acre. Bare banks, and areas of low stem densities, and invasive exotics are the only notable vegetation problem areas for MY-02. Invasive exotics within the conservation easement include tall fescue (*Schedonurus arundinaceus*), Japanese stiltgrass (*Microstegium vimineum*), and Chinese privet (*Ligustrum sinense*). Although these species have been given different ranks of severity, the functionality of the project is not expected to be impaired significantly. It is likely that all of these species were present in and adjacent to the conservation easement previous to construction. The fescue appears to be inhibiting some growth of planted stems and there is very few successional woody stems were observed in the fescue dominated areas. For additional information relating to vegetation, see Appendix C.

There are not any significant changes in the stream pattern, profile or dimension between the baseline and the present monitoring year MY-02. Bedform features are present in a majority of

the stream length providing vertical stability throughout the project site. In general, all pools are maintaining their depth with most of the very deep pools forming on the downstream side of structures. In Reach 1, the upper 286 linear feet stream segment, 100% of riffles and pools are stable and functioning as designed. The riffle pebble count in this reach exhibits slight fining, which may be contributing to a lower gradient. Reach 1, with a total length of 286 linear feet, exhibits total bank erosion of 21% of the overall reach length. The total bank erosion length of 58 feet is a relatively small length of the total project length but a high percentage of the short reach length. The bank erosion will be monitored next year to see if the bank problem areas tabilize in the future as vegetation continues to establish. The two structures in Reach 1 are functioning properly and are showing no signs of piping or integrity issues. In Reach 2, 94% and 88% of riffles and pools are functioning properly, respectively. Thalweg centering appears to be an issue on about 24% of the upstream side of pools (Run). This is mostly due to aggradation, which appears in about 8% of the overall reach length. The structures in Reach 2 are showing a functionality of 100% throughout the reach and exhibit no signs of piping or integrity issues. The banks of Reach 2 appear to be stable with only about 1% of the reach overall length exhibiting signs of erosion. The area of Cross Section 2 has increased 15%, which reflects a shallow pool formation in the cross section location. The pebble count in Cross Section 2 is coarsening showing good riffle function. Cross Section 3, a pool has a well developed point bar that is decreasing the pool cross sectional area. The substrate throughout Reach 2 is consistent with appropriate riffle and pool function.

Summary information/data related to the occurrence of items such as beaver encroachment and statistics related to performance of various project and monitoring elements can be found in the supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly Restoration Plan) documents available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

II. Methodology

Methodologies follow EEP monitoring report template Version 1.3 (1/15/2010) 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 vegetation monitoring plot origins, and problem area locations. Cross sectional and longitudinal surveys were conducted using total station survey equipment. Data was entered into AutoCAD Civil3D 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.

A. Vegetation Methodologies

Level I of the EEP/CVS protocol Version 4.2 was used to collect data for the seven representative vegetation monitoring plots within the conservation easement for MY-02. Data collected for these plots are in Appendix C.

B. Stream Methodologies

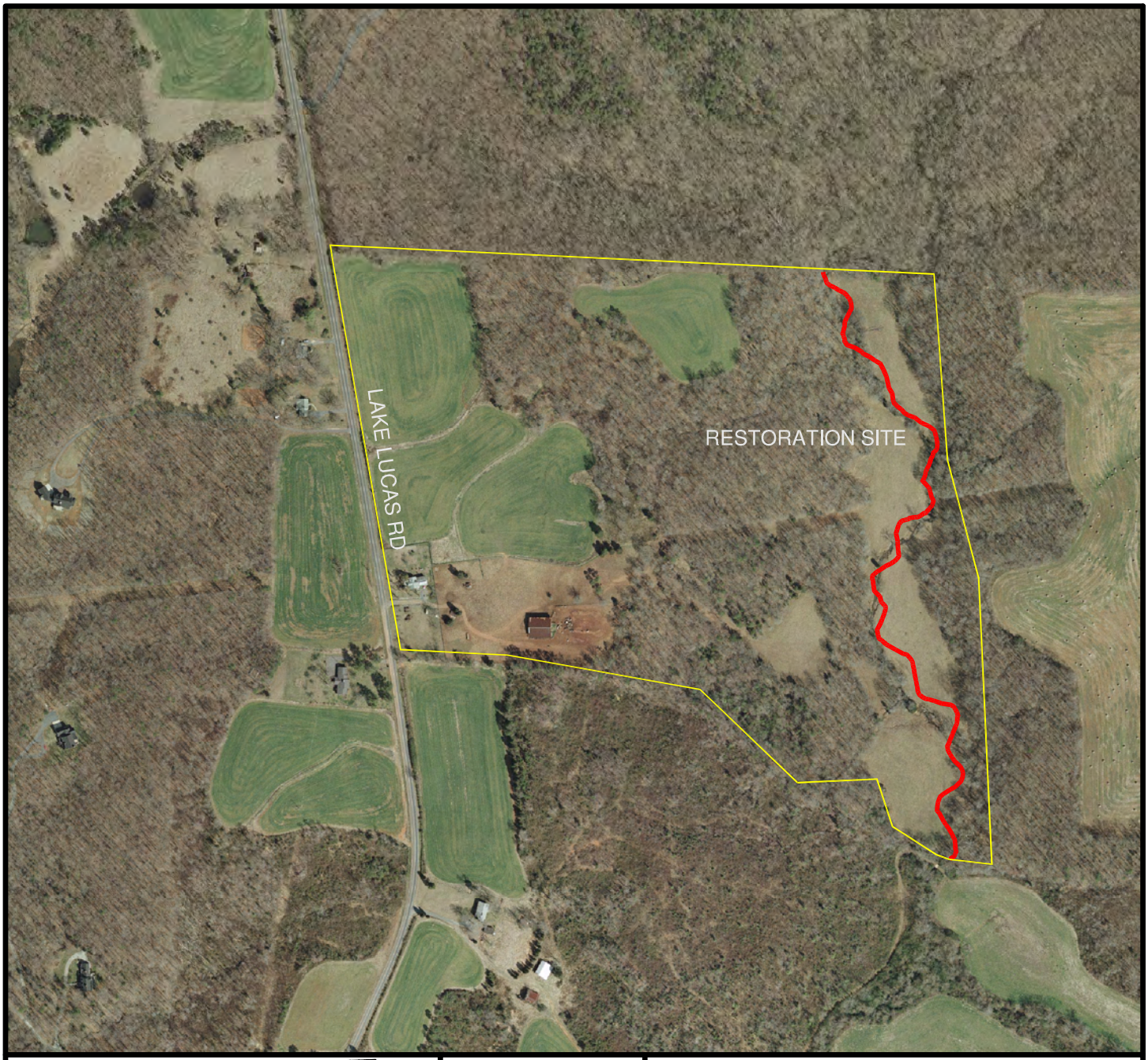
Stream profile and cross-sections were surveyed using total station equipment and methods. The survey data was plotted using AutoCAD Civil3D. The longitudinal profile was generated using the MY-00 alignment. Cross sectional data was extracted based on a linear alignment between the end pins.

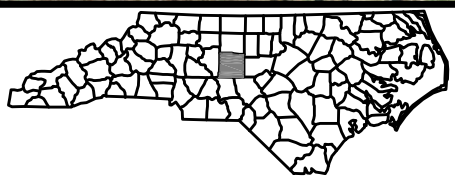
III. References

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





Ecosystem Enhancement PROGRAM

North Carolina – Ecosystem Enhancement Program

McCain Property Project Site
Randolph County, North Carolina
EEP ID #443

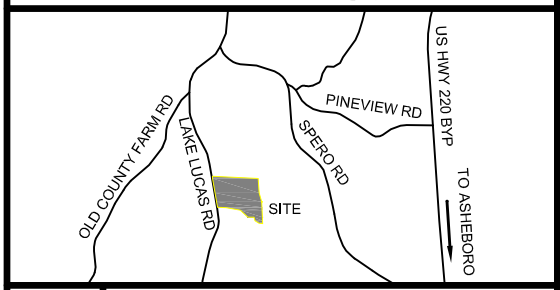


FIGURE 1
RESTORATION SITE
McCAIN PROPERTY
AERIAL VICINITY MAP

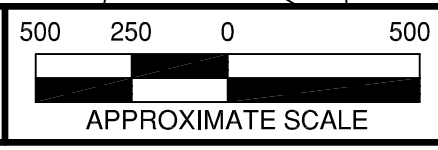


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Table 1a. Project Components

Table 1a. Project Components McCain Stream Restoration-Project No. 443									
Project Component or Reach ID	**Existing Feet/Acres**	**Restoration Level**	**Approach**	**Footage or Acreage**	**Stationing**	**Mitigation Ratio**	**Mitigation Units**	**BMP Elements[1]**	**Comment**
Reach I	490 lf	R	P2	286 lf	10+00 – 12+86	1	286		Stream was realigned and two cross vanes were installed
Reach II	1955 lf	R	P2	2184 lf	12+87 – 34+70	1	2131		Stream was realigned and six cross vanes were installed. A 53' length of channel through an easement exception has been excluded from the mitigation unit calculation.

1 = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area, O = Other, CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing

Table 1b. Component Summations

Table 1b. Component Summations **McCain Stream Restoration Site/Project No. 443**							
Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Riparian (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	2417	0	0	0	0		
Enhancement		0	0	0	0		
Enhancement I	0						
Enhancement II	0						
Creation		0	0	0	0		
Preservation	0	0	0	0	0		
HQ Preservation	0	0	0	0	0		
		0	0				
Totals (Feet/Acres)	**2417**	**0**		**0**	**0**	**0**	**0**
MU Totals	**2417**	**0**		**0**	**0**	**0**	**0**
	Non-Applicable						

Table 2. Project Activity and Reporting History

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McCain Stream Restoration Site/Project No. 443

Elapsed Time Since Grading Complete: 1 yr 10 months
Elapsed Time Since Planting Complete: 1 yr 10 Months
Number of Reporting Years[1]: 2

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	2003/2004	Jun-05
Final Design – Construction Plans	N/A	May-06
Construction	N/A	Mar-09
Temporary seed mix applied to entire project area	N/A	Mar-09
Permanent seed mix applied to reach/segments 1-4	N/A	Mar-09
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	May-09	Jul-09
Year 1 Monitoring	Oct-09	Dec-09
Year 2 Monitoring	Nov-10	Nov-10
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

1 = Equals the number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table

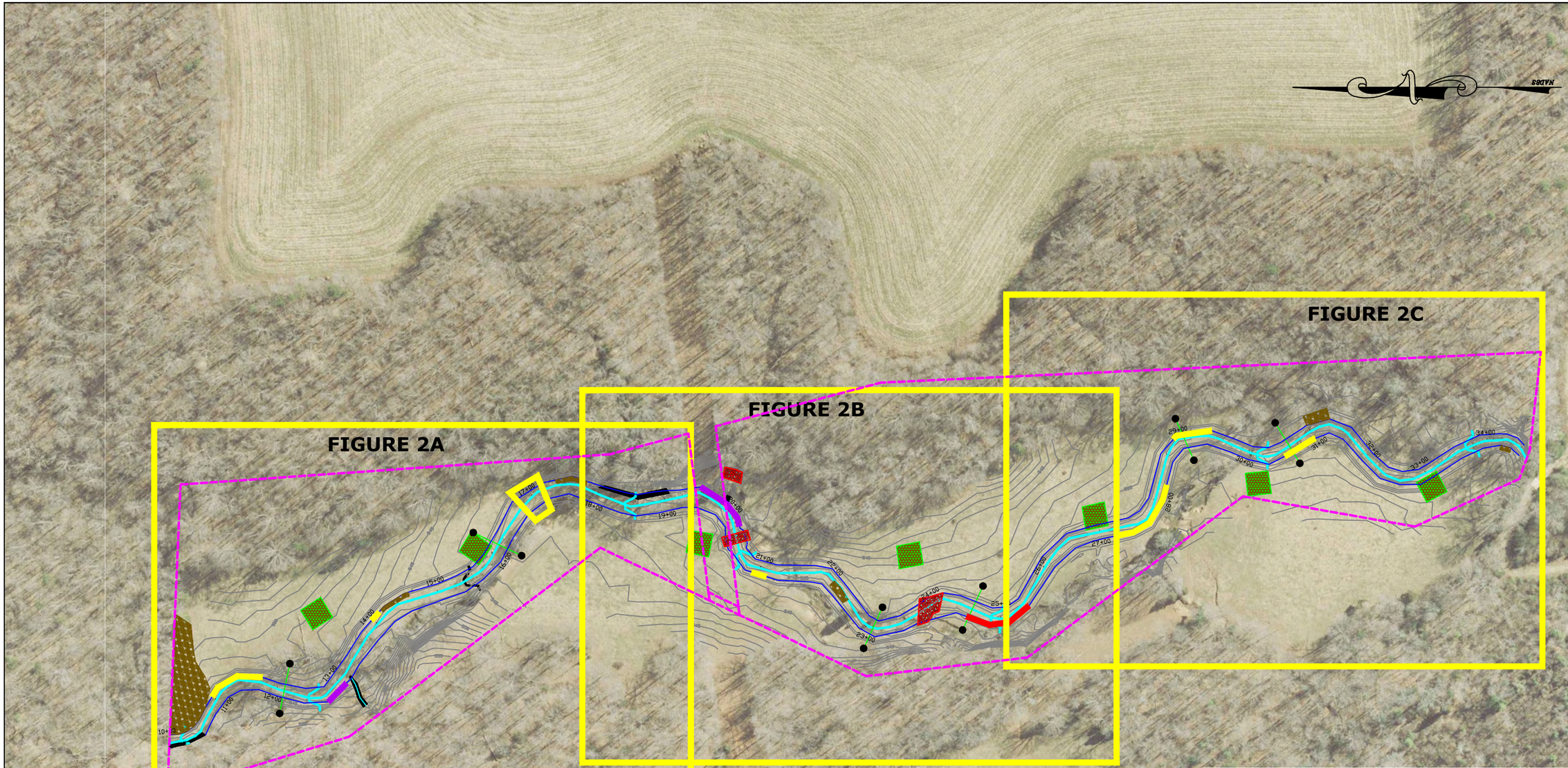
Table 3. Project Contacts Table McCain Stream Restoration Site/Project No. 443	
Designer Primary project design POC	KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Adam Spiller (919) 783-9214
Construction Contractor Construction contractor POC	Carolina Environmental Contracting, Inc. PO Box 1905 Mount Airy, NC 27030 Stephen James (336) 320-3849
Survey Contractor Survey contractor POC	
Planting Contractor Planting contractor POC	Carolina Environmental Contracting, Inc. PO Box 1905 Mount Airy, NC 27030 Stephen James (336) 320-3849
Seeding Contractor Contractor point of contact	
Seed Mix Sources	Company and Contact Phone
Nursery Stock Suppliers	Virginia Department of Forestry (504) 363-5732
Monitoring Performers	Ward Consulting Engineers, P.C. 8368 Six Forks Rd, Suite 104 Raleigh, NC 27615 Becky Ward (919) 870-0526
Stream Monitoring POC	Becky Ward (919) 870-0526
Vegetation Monitoring POC	Chris Sheats - The Catena Group - (919) 732-1300
Wetland Monitoring POC	Chris Sheats - The Catena Group - (919) 732-1300

Table 4. Project Attribute Table

Table 4. Project Attribute Table McCain Stream Restoration Site/Project No. 443		
Project County	Randolph County	
Physiographic Region	Piedmont	
Ecoregion	Carolina Slate Belt	
Project River Basin	Yadkin	
USGS HUC for Project (14 digit)	3040103050050	
NCDWQ Sub-basin for Project	03-07-09	
Within extent of EEP Watershed Plan?	No	
WRC Hab Class (Warm, Cool, Cold)	Warm	
% of project easement fenced or demarcated	100%	
Beaver activity observed during design phase?	No	
Restoration Component Attribute Table		
	Reach 1	Reach 2
Drainage area	0.88 sq mi.	0.88 sq mi.
Stream order	First	First
Restored length (feet)	286	2184
Perennial or Intermittent	Perennial	Perennial
Watershed type (Rural, Urban, Developing etc.)	Rural	
Watershed LULC Distribution (e.g.)		
Urban	4%	
Ag-Row Crop	16%	
Ag-Livestock	12%	
Forested	67%	
Water/Wetlands	<1%	
Watershed impervious cover (%)	2%	
NCDWQ AU/Index number	13-2-3-3 (UT Back Creek)	
NCDWQ classification	C	
303d listed?	No	
Upstream of a 303d listed segment?	No	
Reasons for 303d listing or stressor	N/A	
Total acreage of easement	12.9 Acres	
Total vegetated acreage within the easement	4.8 Acres	
Total planted acreage as part of the restoration	7.6 Acres	
Rosgen classification of pre-existing	B4c	C5/E5/C4
Rosgen classification of As-built	B4c	C4
Valley type	V	V
Valley slope	0.0066	
Valley side slope range (e.g. 2-3.%)	13.8% - 32.6%	
Valley toe slope range (e.g. 2-3.%)	2.52% - 6.15%	
Cowardin classification	N/A	N/A
Trout waters designation	No	
Species of concern, endangered etc.? (Y/N)	No	
Dominant soil series and characteristics		
Series	Dogue Sandy Loam	Dogue Sandy Loam
Depth	U	U
Clay%	U	U
K	U	U
T	U	U

Use N/A for items that may not apply. Use "-" for items that are unavailable and "U" for items that are unknown

Appendix B. Visual Assessment Data



Vegatation Plot Pin Coordinate Table (NAD83)

Vegatation Plot Number	Pin 1		Pin 2		Pin 3		Pin 4	
	Northing	Easting	Northing	Easting	Northing	Easting	Northing	Easting
1	734720.6	1746458.3	734703.2	1746430.5	734674.8	1746448.4	734691.7	1746476.8
2	734493.4	1746543.0	734476.2	1746571.3	734446.9	1746550.0	734465.4	1746523.3
3	734162.7	1746572.3	734168.9	1746541.4	734136.8	1746534.4	734130.7	1746567.2
4	733830.0	1746523.9	733863.9	1746517.8	733868.0	1746550.0	733835.2	1746556.2
5	733565.2	1746579.5	733597.1	1746572.7	733602.5	1746606.0	733570.7	1746613.3
6	733365.1	1746622.0	733331.8	1746625.4	733336.5	1746657.3	733368.9	1746654.4
7	733124.5	1746641.1	733095.5	1746656.9	733080.5	1746628.0	733109.4	1746612.9

Cross Section Pin Coordinate Table (NAD83)

Cross Section Number	Left Pin		Right Pin	
	Northing	Easting	Northing	Easting
1	734735.9	1746381.9	734750.7	1746310.8
2	734473.6	1745659.4	734404.4	1746536.5
3	733888.1	1746462.6	733915.0	1746403.8
4	733744.3	746493.0	733773.5	1746430.1
5	733469.0	1746732.4	733442.5	1746673.0
6	733326.2	1746726.5	733291.0	1746668.6

GRAPHIC SCALE

150 0 75 150 300 600

(IN FEET)

1 inch = 150 ft.

2007 Aerial Photo from Randolph County, NC GIS

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Ecosystem Enhancement Program

McCAIN PROPERTY (EEP #443)
CONSOLIDATED CURRENT CONDITIONS PLAN VIEW
RANDOLPH COUNTY, NORTH CAROLINA

DATE: 20 JULY 2010

REVISIONS:

PROJECT NAME: McCAIN PROPERTY

DWG NAME: CCPV

SCALE: 1" = 150'

SHEET NO.

FIGURE 2

Vegatation Plot Pin Coordinate Table (NAD83)

Vegatation Plot Number	Pin 1		Pin 2		Pin 3		Pin 4	
	Northing	Easting	Northing	Easting	Northing	Easting	Northing	Easting
1	734720.6	1746458.3	734703.2	1746430.5	734674.8	1746448.4	734691.7	1746476.8
2	734493.4	1746543.0	734476.2	1746571.3	734446.9	1746550.0	734465.4	1746523.3
3	734162.7	1746572.3	734168.9	1746541.4	734136.8	1746534.4	734130.7	1746567.2
4	733830.0	1746523.9	733863.9	1746517.8	733868.0	1746550.0	733835.2	1746556.2
5	733565.2	1746579.5	733597.1	1746572.7	733602.5	1746606.0	733570.7	1746613.3
6	733365.1	1746622.0	733331.8	1746625.4	733336.5	1746657.3	733368.9	1746654.4
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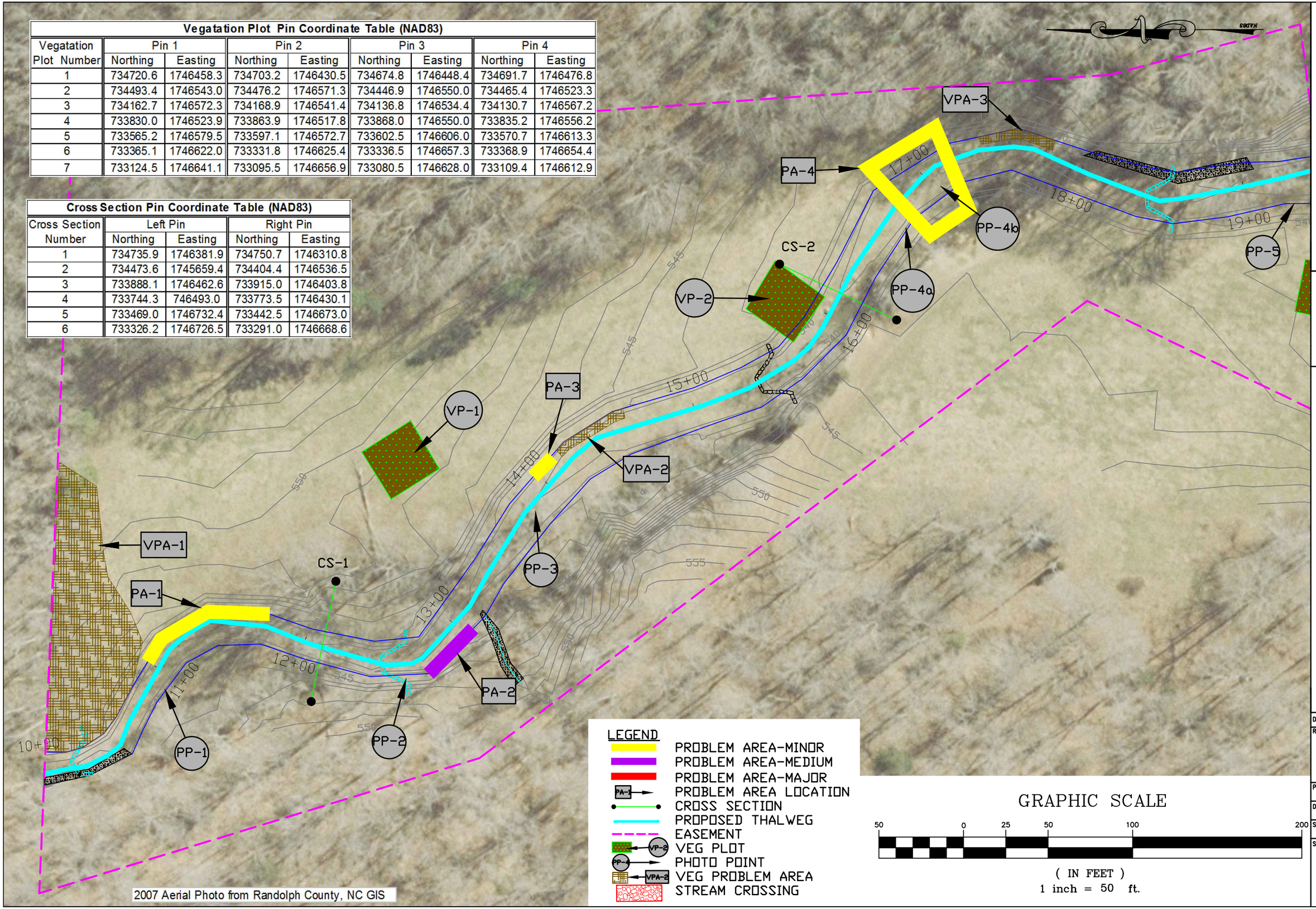

LEGEND

- PROBLEM AREA-MINOR
- PROBLEM AREA-MEDIUM
- PROBLEM AREA-MAJOR
- PA-1 PROBLEM AREA LOCATION
- CROSS SECTION
- PROPOSED THALWEG
- EASEMENT
- VP-2 VEG PLOT
- PP-4 PHOTO POINT
- VPA-2 VEG PROBLEM AREA
- STREAM CROSSING

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

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Ecosystem Enhancement Program

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RANDOLPH COUNTY, NORTH CAROLINA

DATE: 20 JULY 2010

REVISIONS:

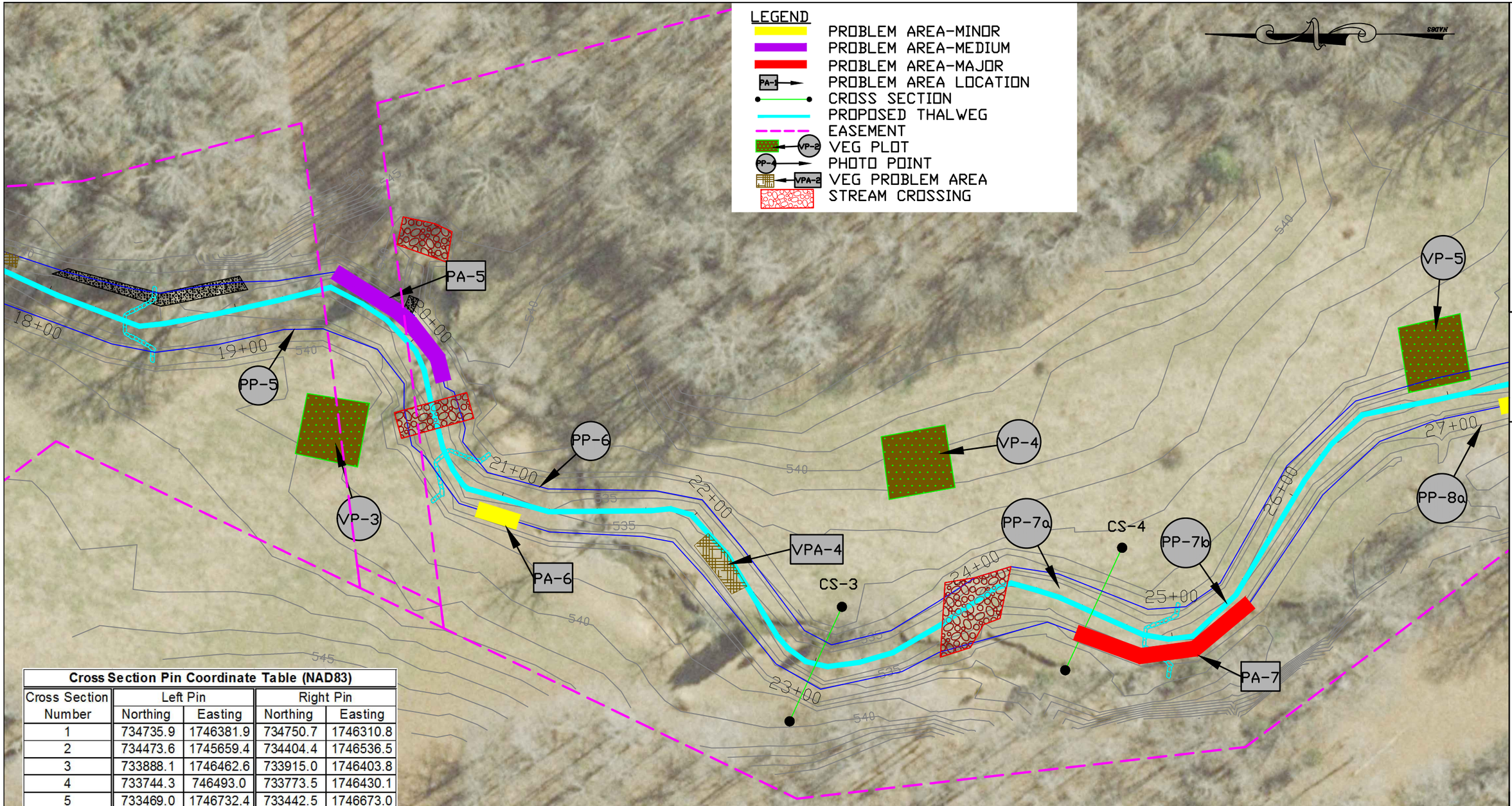
PROJECT NAME: McCAIN PROPERTY

DWG NAME: CCPV

SCALE: 1' = 50'

SHEET NO.

FIGURE 2A



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Vegatation Plot Number	Pin 1		Pin 2		Pin 3		Pin 4	
	Northing	Easting	Northing	Easting	Northing	Easting	Northing	Easting
1	734720.6	1746458.3	734703.2	1746430.5	734674.8	1746448.4	734691.7	1746476.8
2	734493.4	1746543.0	734476.2	1746571.3	734446.9	1746550.0	734465.4	1746523.3
3	734162.7	1746572.3	734168.9	1746541.4	734136.8	1746534.4	734130.7	1746567.2
4	733830.0	1746523.9	733863.9	1746517.8	733868.0	1746550.0	733835.2	1746556.2
5	733565.2	1746579.5	733597.1	1746572.7	733602.5	1746606.0	733570.7	1746613.3
6	733365.1	1746622.0	733331.8	1746625.4	733336.5	1746657.3	733368.9	1746654.4
7	733124.5	1746641.1	733095.5	1746656.9	733080.5	1746628.0	733109.4	1746612.9

2007 Aerial Photo from Randolph County, NC GIS

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)

1 inch = 50 ft.

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SCALE: 1" = 50'

SHEET NO.

FIGURE 2B

Vegatation Plot Pin Coordinate Table (NAD83)

Vegatation Plot Number	Pin 1		Pin 2		Pin 3		Pin 4	
	Northing	Easting	Northing	Easting	Northing	Easting	Northing	Easting
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3	734162.7	1746572.3	734168.9	1746541.4	734136.8	1746534.4	734130.7	1746567.2
4	733830.0	1746523.9	733863.9	1746517.8	733868.0	1746550.0	733835.2	1746556.2
5	733565.2	1746579.5	733597.1	1746572.7	733602.5	1746606.0	733570.7	1746613.3
6	733365.1	1746622.0	733331.8	1746625.4	733336.5	1746657.3	733368.9	1746654.4
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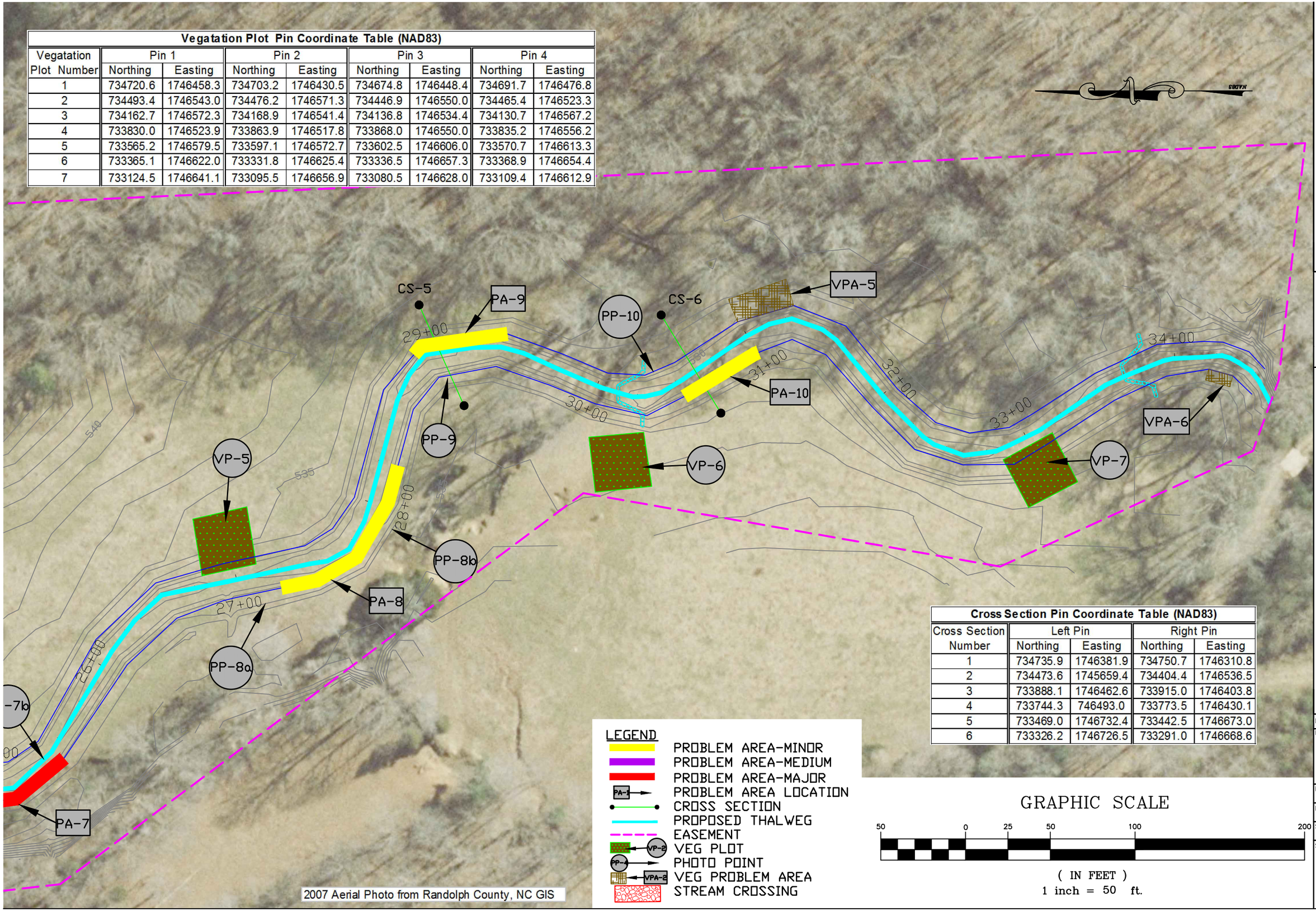

Cross Section Pin Coordinate Table (NAD83)

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5	733469.0	1746732.4	733442.5	1746673.0
6	733326.2	1746726.5	733291.0	1746668.6

LEGEND

- PROBLEM AREA-MINOR
- PROBLEM AREA-MEDIUM
- PROBLEM AREA-MAJOR
- PA-1 PROBLEM AREA LOCATION
- CROSS SECTION
- PROPOSED THALWEG
- EASEMENT
- VP-2 VEG PLOT
- PP-2 PHOTO POINT
- VPA-2 VEG PROBLEM AREA
- STREAM CROSSING

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)

1 inch = 50 ft.

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Ecosystem Enhancement Program

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REVISIONS:
PROJECT NAME: McCAIN PROPERTY
DWG NAME: CCPV
SCALE: 1' = 50'
SHEET NO.

FIGURE 2C

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Reach 1**
Assessed Length **286**

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)			1	10	97%			
		2. Degradation - Evidence of downcutting					100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	2	2			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	3	3			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	3	3			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	3	3			100%			
		2. Thalweg centering at downstream of meander (Glide)	2	2			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	120	79%			79%
	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	2	120	79%	0	0	79%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			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)	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Reach 2**
Assessed Length **2184**

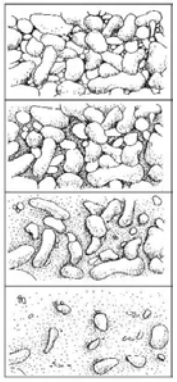
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing 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)			7	170	92%			
		2. Degradation - Evidence of downcutting					100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	16	17			94%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	16	17			94%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	15	17			88%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	13	17			76%			
		2. Thalweg centering at downstream of meander (Glide)	16	18			89%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			4	65	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.					100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse					100%			100%
				Totals	4	65	99%	0	0	99%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			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)	6	6			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	6	6			100%			

Criteria, Definitions and Thresholds for Visual Stream Morphology Assessments

Major Channel Category	Channel Sub-Category	Metric	Definitions	Cataloging Threshold	CCPV Depiction
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)	"Aggradation refers to at least moderate increases in reach stored sediment. It is NOT simply constituted by minor fining of riffles or filling of pools at or below baseflow elevations. An aggrading reach is often characterized by sand or gravel bar formation/growth with associated fining of reach substrate and smoothing of the reach long profile. Bars/aggraded areas significant enough to deflect flow against banks should be catalogued. Repeat channel photopoints are a key tool in assessing project aggradation. (See photo exhibit 1 below for range of example bar development/aggradation)	Catalog only if feature has most of the characteristics described to the left (cell E11) and is at least 15 feet in length or 20% of the riffle/run length, whichever is less.	NA
		2. Degradation - Number and size of evident downcuts within Riffle/Run units.	Where projects have regularly-spaced engineered grade control, degredation/downcutting is expected only in short, discreet lengths. "Indicators include perched sill structures, channel bed "steps" in clay-rich parent material, evidence of bed retreat at the bank toe (parent material may be exposed); mobilization of coarse riffle substrate in to pools downstream, and perhaps riffles with run morphology. Long-profile surveys should support an assessment of bed degradation where the visual assessment and survey overlap.	Catalog only if feature has most of the characteristics described to the left (cell E12) and is at least 15 feet in length or 20% of the riffle/run length, whichever is less.	Dark Red or Purple Color to be certain to distinguish from Mass Wasting Color Code
	2. Riffle Condition	1. Texture	Riffles should maintain a coarseness similar to the design distribution. Significant fining of the riffle surface indicates non-attainment for the riffle. Repeat pebble counts should support an assessment of riffle fining where overlap occurs (see exhibit graphic 2 below describing embedding for gravel-cobble systems).	NA	NA
	3. **Meander Pool Condition**	1. Depth Sufficient?	This metric is used to assess meander pools and also step-pools along a Rosgen B-type channel reaches. For stepped reaches the pools will be evaluated and tallied here and under the Habitat Sub-Category below. The max pool bankfull depth should be 1.6 times the mean bankfull depth (Max Pool Depth : Mean Bankfull Depth > 1.6). The mean bankfull depth from the As-built/baseline survey can be utilized to make this determination. Exhibit 3 provides residual pool depths using the 1.6 multiplier for a range of mean channel riffle depths that typify restoration projects.	NA	NA
		2. Length appropriate?	This metric will only be applied to meander pools. The meander pool length should be >30% of the ~ linear centerline distance between the tail of the upstream riffle and the head of the downstream rifle.	NA	NA
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)?	This metric is used to characterize flow paths along riffle-run-pool transitions. The thalweg is expected to be against the outer bank in the bend apex, but vectors oriented towards the outer bank too far above the bend apex may indicate the potential for increased bank erosion. Similarly, the pool-glide-riffle transition is also expected to demonstrate flow path centering (Metric 4.2 below). The current-year thalweg rendered on the CCPV figure can assist in this assessment.	NA	NA
		2. Thalweg centering at downstream of meander bend (Glide)?	See Metric 4.1 above	NA	NA
2. Bank	**1. Scoured/Eroding Bank**	In order to better assess continued bank erosion risk, tallied bank segments are also characterized with respect to the proximity and integrated extent of stabilizing vegetation. Continued erosion risk for a given bank instability object is essentially adjusted downwards by adjacent mature vegetation and/or stabilizing roots. One or more mature trees in close proximity (e.g. 10 feet or less) or obvious integration of root mass within the bank failure are characteristics that would prompt the tallying of a given bank object into the additional sub-category related to risk of further instability (columns J-L of the actual data table). Essentially, the vegetative elements of rooting density and depth (e.g. from a BEHI assessment) need to be considered here.	Banks with evident scour /erosion	<table><tr><th>Bank Height</th><th>Minimum Length</th></tr><tr><td>>6</td><td>6</td></tr><tr><td>3-6</td><td>8</td></tr><tr><td><3</td><td>10</td></tr></table> See Footnote/Exhibit 5 below also This table provides a guide for working thresholds for bank erosion cataloging/mapping based on bank height. For the bank height ranges above, the minimum length of bank to be mapped and tallied is specified. For example, where banks are <3 feet high, only map an unstable segment if it is ≥ 10 feet.[5]	Yellow.
	2. Undercut		Banks undercut/overhanging to the extent that mass wasting appears likely? Does NOT include undercuts that modest, appear sustainable/stable and are providing habitat.		Orange.
	3. Mass Wasting		Bank slumping/calving/collapse?		Red.
3. Structures	**1. Overall Integrity**	The assessment of engineered structure performance should include all structures that provide grade control, bank protection, or habitat functions. These include Vanes, J-hooks, and rootwads, etc.	Bulk of structure physically intact with no dislodged boulders or logs?		Using callouts or some other means to maintain legibility, annotate structure with red **"S"** if structural failure has occurred
	2. Grade Control		Bed grade control maintained across the sill structure? No evident loss of bed elevation immediately upstream of structure? Some piping alone will not constitute a loss of grade control.		Using callouts or some other means to maintain legibility, annotate structure with red **"G"** if structure has lost grade control
	2a. Piping		Catalog structures lacking any substantial flow underneath sills or around arms?		Using callouts or some other means to maintain legibility, annotate structure with red **"P"** if significant piping has occurred
	3. Bank Protection		See exhibit 4 below for determining structural sphere of influence. If the amount of bank that is deemed to be actively eroding within the structures sphere of influence exceeds 15% of the total bank footage within the structures sphere of influence, then the structure should be classified as not providing adequate bank protection in the data table.		Using callouts or some other means to maintain legibility, annotate structure with red **"B"** if structure has failed to provide bank protection
	4. Habitat		Are pools maintained @ ~ Max Pool Depth : Mean Bankfull Depth > 1.6? For rootwads, habitat provision means interacting with baseflow and providing cover.		Using callouts or some other means to maintain legibility, annotate structure with red **"H"** if structure is not providing habitat

Exhibit 1. Examples of bar features warranting concerning related to cataloging item 1.1.1 of the assessment

Exhibit 2. Graphic depicting embedding of riffles with fine material



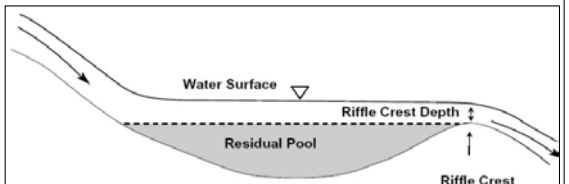
Progressing from top to bottom, the series of graphics to the left depicts the fining of interstial spaces between coarser particles. This describes increasing levels of embededness in riffles. The observer must have an understanding of the intended substrate distributions/texture of the bed for the projects riffles when assessing this. However, as a guideline for streams in the coarse gravel to cobble range, the 2nd panel from the top represents a visual guideline for the condition that would begin to elicit concern for this parameter, but still contains a good deal of coarse material. Progressing from that state to the conditions depicted in the the 3rd and 4th panel represents a visual que for significant emdedding.

From USEPA (EPA 841-B-97-003 - Nov 1997)

Exhibit 3. Residual Pool Depth Table - Relating 1.6 criterion for typical mean riffle depths to residual pool depths

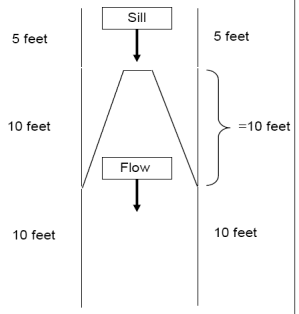
This residual pool table was provided in the event the tracking of bankfull at each pool feature to estimate a Dmax was inconvenient. Estimating the residual pool depth by measuring the max pool depth to water surface and subtracting the water depth at the riffle head may provide a more convenient way under certain circumstances to estimate in the field. For this reason the exhibit table provides a relationship between the 1.6 criterion applied to mean riffle depth for the site and the resulting residual pool depths.

Mean Riffle Depth D_{bkf}	Multiplier	Target Bankfull Pool Max	Residual Pool Depth
1.0	1.6	1.6	0.6
1.5	1.6	2.4	0.9
2.0	1.6	3.2	1.2
2.5	1.6	4.0	1.5
3.0	1.6	4.8	1.8
3.5	1.6	5.6	2.1
4.0	1.6	6.4	2.4
4.5	1.6	7.2	2.7
5.0	1.6	8.0	3.0



From: Hilton and Lisle, 1993

Exhibit 4. Extent of Structural Influence for Bank Protection



The drawing is a guideline for the extent of influence vane arms exert on stream banks. The bracketed segment (10ft) immediately adjacent to the vane arm is multiplied by 5 to determine the total length of bank influenced by a cross vane. This includes the bank length adjacent to each vane arm, 1 length (10 feet) below each van arm, and ½ length (5 feet) on each bank above the uppermost structural element (in this case the vane sill), yielding 50 feet in this example case. In this example a single arm vane or j-hook would only influence 25ft of bank.

If the amount of recent bank erosion observed within the extent of influence exceeds 15% then the structure is deemed not to be providing adequate bank protection. In the above examples this would amount to ~ 8 and 4 feet, respectively.

If in an earlier assessment the structure failed the 15% bank protection criteria but the erosion has subsequently stabilized, then the observer can use best professional judgment to determine if the structure is currently meeting the bank protection criteria.

5 = The above was developed because of the need to have a threshold given the large number of performers and to avoid spending time trying to catalog and map small objects that if excluded would have minimal overall impacts on the performance percentages. It is a guide that tries to strike a balance between the obvious need to have a threshold, yet provide confidence that the site conditions are accurately represented. For example, a scenario where 1 object nearly exceeding the threshold were to occur every 100 feet of bank height (which would be a high frequency and unlikely) with a bank height of 5 feet, would yield an error of ~3%. However, if the observer is encountering a truly high number of objects just below the threshold in the above table (e.g. > 1 per 100 feet of bank channel on average) and is concerned that the exclsuion of such objects is going to misrepresent the site conditions, then judgement should be applied and objects below the threshold may be cataloged. If a rare condition as described does occur and the thresholds are not utilized then a table footnote explaining this should be included.

Lastly, given the increase in overall area and the implications to stability, greater banks heights required smaller threshold minimums.

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **7.98**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of planted woody and herbaceous material.	0.1 acres	Brown Hatch	3	0.01	0.1%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Brown Hatch	8	1.34	16.8%
			Total	11	1.35	16.9%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	N/A	0	0.00	0.0%
			Cumulative Total	11	1.35	16.9%

Easement Acreage[2] **13.34 acres**

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	Brown Hatch	9	1.34	16.8%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Brown Hatch	9	1.34	16.8%

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

High Concern:				**Low/Moderate Concern:**	
Vines	**Genus/Species**	**Shrubs/Herbs**	**Genus/Species**	**Shrubs/Herbs**	**Genus/Species**
Kudzu	*Pueraria lobata*	Japanese Knotweed	Polygonum cuspidatum	Japanese Privet	Ligustrum Japonicum
Porcelain Berry	Ampelopsis brevipeduncu	Oriental Bittersweet	Celastrus orbiculatus	Glossy Privet	Ligustrum lucidum
Japanese Honeysuckle	Lonicera japonica	Multiflora Rose	Rosa multiflora	Fescue	Festuca spp.
Japanese Hops	Humulus japonicus	Russian olive	Elaeagnus angustifolia	English Ivy	Hedera helix
Wisterias	Wisteria spp.	Chinese Privet	Ligustrum sinense	Microstegium	Microstegium vimineum
Winter Creeper	Euonymus fortunei	Chinese Silvergrass	Miscanthus sinensis	Burning Bush	Euonymus alatus
Bush Killer (Watch List)	Cayratia japonica	Phragmites	Phragmites australis	Johnson Grass	Sorghum halepense
		Bamboos	Phyllostachys spp	Bush Honeysuckles	Lonicera, spp.
Trees		Sericea Lespedeza	Sericea Lespedeza	Periwinkles	Vinca minor
Tree of Heaven	Ailanthus altissima	Garlic Mustard (Watch List)	Alliaria petiolata	Morning Glories	Morning Glories
Mimosa	Albizia julibrissin	Cogon Grass (Watch List)	Imperata cylindrica	Bicolor Lespedeza (Watch List)	Lespedeza bicolor
Princess Tree	Paulownia tomentosa	Giant Reed (Watch List)	Arundo donax	Chinese Yams (Watch List)	Dioscorea oppositifolia
China Berry	Melia azedarach	Tropical Soda Apple (Watch List)	Solanum viarum	Air Potato (Watch List)	Dioscorea bulbifera
Callery Pear	Pyrus calleryana	Japanese Spirea (Watch List)	Spiraea japonica	Japanese Climbing Fern (Watch List)	Lygodium japonicum
White Mulberry	Morus alba	Japanese Barberry (Watch List)	Berberis thunbergii		
Tallow Tree (Watch List)	Triadica sebifera				

Stream Station Photos

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

Photo 6. Looking downstream at XS-6

Vegetation Monitoring Plots Photos

Photo 7. Vegetation Plot 1

Photo 8. Vegetation Plot 2

Photo 9. Vegetation Plot 3

Photo 10. Vegetation Plot 4

Photo 11. Vegetation Plot 5

Photo 12. Vegetation Plot 6

Photo 13. Vegetation Plot 7

Appendix C. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment		
Vegetation Plot ID	**Vegetation Survival Threshold Met?**	**Tract Mean**
VP 1	No	72%
VP 2	Yes	
VP 3	Yes	
VP 4	Yes	
VP 5	Yes	
VP 6	No	
VP 7	Yes	

Table 8. CVS Vegetation Plot Metadata McCain Stream Restoration Site/Project No. 443	
Report Prepared By	The Catena Group
database name	McCain Property.mdb
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.
PROJECT SUMMARY----------	
Project Code	443
project Name	McCain
Description	Stream restoration site located in the Yadkin River Basin
River Basin	
length(ft)	2450
stream-to-edge width (ft)	50
area (sq m)	22758.94
Required Plots (calculated)	7
Sampled Plots	7

EEP Project Code 443. Project Name: McCain

Table 9: Planted and Total Stem Counts

			Current Plot Data (MY2 2010)																						Annual Means					
			E443-A-0001			E443-A-0002			E443-A-0003			E443-A-0004			E443-A-0005			E443-A-0006			E443-A-0007			MY2 (2010)			MY1 (2009)		
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	P-LS	P-all	T
Betula nigra	river birch	Tree		2	2		1	1		6	6		3	3		1	1		4	4		1	1		18	18		19	19
Cornus amomum	silky dogwood	Shrub				8	8	8		1	1				3	3	3		1	1	4	5	5	15	18	18	15	20	20
Fraxinus pennsylvanica	green ash	Tree					2	2		1	1		1	1											4	4		4	4
Liriodendron tulipifera	tuliptree	Tree								3	3		1	1								1	1		5	5		6	6
Platanus occidentalis	American sycamore	Tree					1	1		5	5					1	1		1	1		1	1		9	9		9	9
Quercus falcata	southern red oak	Tree								1	1		2	2											3	3		3	3
Quercus pagoda	cherrybark oak	Tree								1	1														1	1		1	1
Quercus phellos	willow oak	Tree		4	4								1	1		1	1								6	6		7	7
Salix nigra	black willow	Tree				6	6	6							1	1	1							7	7	7	9	9	9
Salix sericea	silky willow	Shrub Tree				1	1	1							4	4	4				3	3	3	8	8	8	8	8	8
		Stem count	0	6	6	15	19	19	0	18	18	0	8	8	8	11	11	0	6	6	7	11	11	30	79	79	32	86	86
		size (ares)	1			1			1			1			1			1			1			7			7		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.17			0.17		
		Species count	0	2	2	3	6	6	0	7	7	0	5	5	3	6	6	0	3	3	2	5	5	3	10	10	3	10	10
		Stems per ACRE	0	242.8	242.8	607	768.9	768.9	0	728.4	728.4	0	323.7	323.7	323.7	445.2	445.2	0	242.8	242.8	283.3	445.2	445.2	173.4	456.7	456.7	185	497.2	497.2

Appendix D. Stream Survey Data

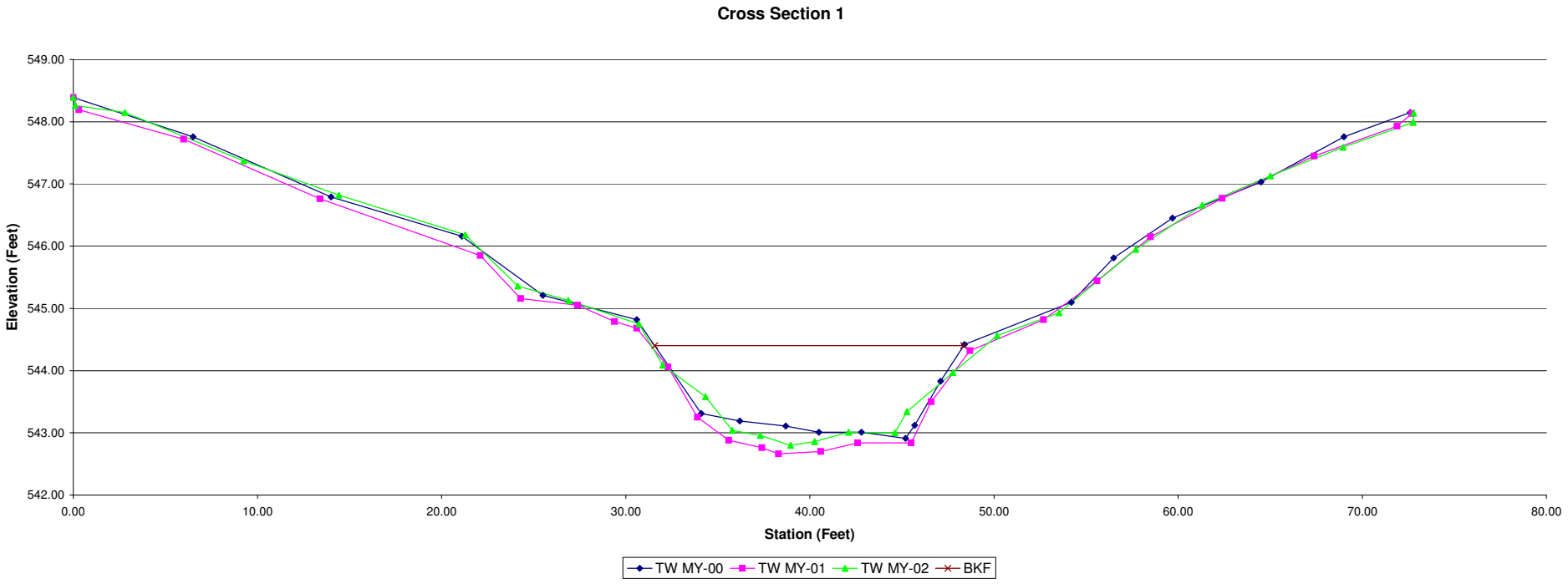
Project:	McCain Property
Cross Section:	Cross Section 1
Feature	Riffle Reach 1
Station:	12+11.30
Date:	10/18/10
Crew:	BW, ZAP, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	18.6	20.8	18.7			
W (BKF)	16.9	17.2	18.1			
Max d	1.5	1.6	1.6			
Mean d	1.1	1.2	1.0			
W/D	15.4	14.2	17.5			

MY00-2009			MY01-2009			MY02-2010			MY03-2011		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	548.39	LPIN	0.00	548.39	LPIN	0.00	548.39	LPIN			
6.50	547.76		0.30	548.19		0.10	548.26				
14.00	546.79		6.00	547.72		2.80	548.15				
21.10	546.16		13.40	546.76		9.25	547.37				
25.50	545.21		22.10	545.85		14.42	546.82				
30.60	544.82	TOBL	24.30	545.16		21.29	546.18				
34.10	543.31		27.40	545.05		24.14	545.36				
36.20	543.19		29.40	544.79		26.88	545.13				
38.70	543.11		30.60	544.68	TOBL	30.72	544.75	TOBL			
40.50	543.01		32.30	544.06		32.01	544.09				
42.80	543.01		33.90	543.25		34.33	543.58				
45.20	542.91	TW	35.60	542.88		35.79	543.04	TOE L			
45.70	543.12		37.40	542.76		37.32	542.96				
47.10	543.83		38.30	542.66	TW	38.96	542.80	TW			
48.40	544.42	TOBR	40.60	542.70		40.26	542.86				
54.20	545.10		42.60	542.84		42.10	543.01				
56.50	545.81		45.50	542.84		44.62	543.00	TOE R			
59.70	546.45		46.60	543.50		45.27	543.34				
64.50	547.03		48.70	544.32	TOBR	47.77	543.97				
69.00	547.76		52.70	544.82		50.16	544.56	TOBR			
72.60	548.15	RPIN	55.60	545.44		53.54	544.93				
			58.50	546.15		57.71	545.95				
			62.40	546.77		61.30	546.66				
			67.40	547.45		65.01	547.13				
			71.90	547.93		68.96	547.59				
			72.70	548.13	RPIN	72.76	547.99				
						72.79	548.14	RPIN			

Photo of XS-1, looking in the downstream direction



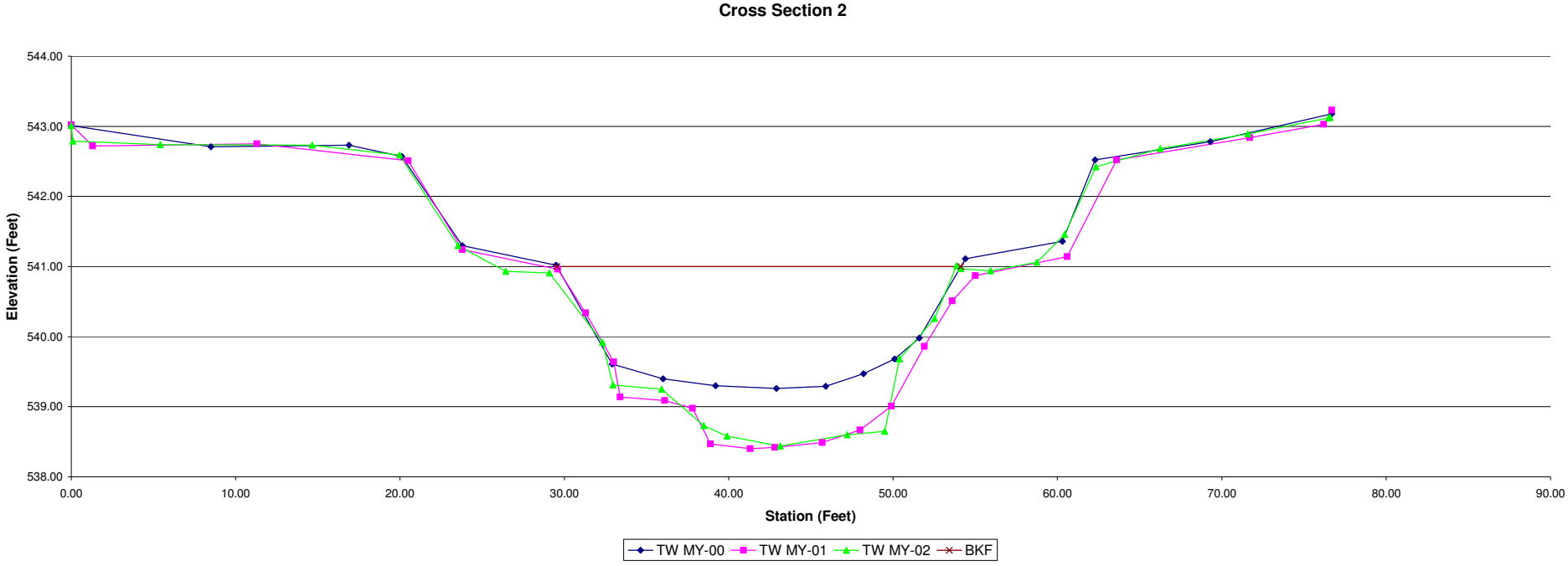
Project:	McCain Property
Cross Section:	Cross Section 2
Feature	Riffle Reach 2
Station:	16+25.07
Date:	10/18/10
Crew:	BW, ZAP, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	33.7	42.7	44.4			
W (BKF)	24.6	25.2	28.0			
Max d	1.8	2.5	2.6			
Mean d	1.4	1.7	1.6			
W/D	18.0	14.9	17.6			

MY00-2009			MY01-2009			MY02-2010			MY03-2011		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	543.01	LPIN	0.00	543.02	LPIN	0.00	543.01	LPIN			
8.50	542.71		1.30	542.72		0.10	542.79				
16.90	542.73		11.30	542.75		5.41	542.74				
20.10	542.57		20.50	542.51		14.66	542.73				
23.80	541.30		23.80	541.24		19.98	542.59				
29.50	541.02	TOBL	29.60	540.96	TOBL	23.53	541.30				
32.90	539.61		31.30	540.34		26.44	540.93				
36.00	539.40		33.00	539.64		29.09	540.91	TOBL			
39.20	539.30		33.40	539.14		32.32	539.92				
42.90	539.26	TW	36.10	539.09		32.96	539.31				
45.90	539.29		37.80	538.98		35.92	539.25				
48.20	539.47		38.90	538.47		38.49	538.73	TOE L			
50.10	539.68		41.30	538.40	TW	39.90	538.58				
51.60	539.98	TOBR	42.80	538.42		43.14	538.44	TW			
54.40	541.11		45.70	538.49		47.21	538.60				
60.30	541.36		48.00	538.67		49.50	538.65	TOE R			
62.30	542.52		49.90	539.01		50.39	539.68				
69.30	542.78		51.90	539.86		52.52	540.26				
76.70	543.18	RPIN	53.60	540.51		53.87	541.01				
			55.00	540.87	TOBR	54.13	540.97	TOBR			
			60.60	541.14		55.94	540.94				
			63.60	542.52		58.75	541.06				
			71.70	542.84		60.44	541.46				
			76.20	543.03		62.34	542.42				
			76.70	543.23	RPIN	66.25	542.68				
						71.59	542.89				
						76.49	543.12				
						76.58	543.13	RPIN			

Photo of XS-2, looking in the downstream direction



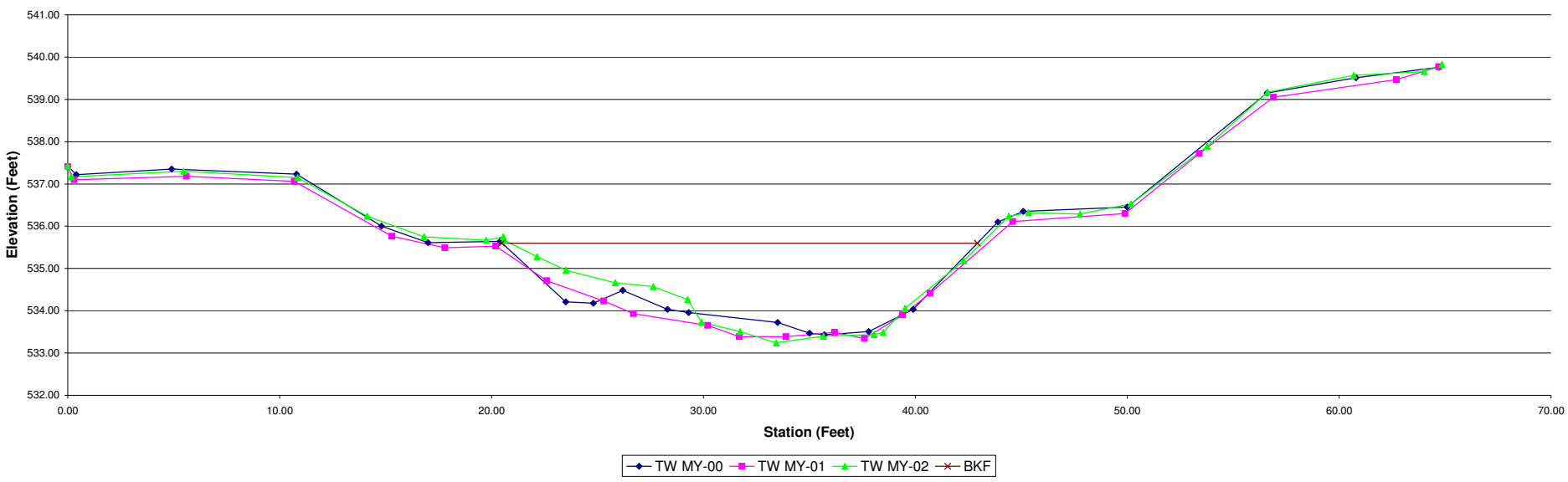
Project:	McCain Property
Cross Section:	Cross Section 3
Feature	Pool Reach 2
Station:	23+45.75
Date:	10/18/10
Crew:	BW, ZAP, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	33.6	34.1	30.8			
W (BKF)	22.6	23.0	22.3			
Max d	2.2	2.2	2.4			
Mean d	1.5	1.5	1.4			
W/D	-	-	-			

MY00-2009			MY01-2009			MY02-2010			MY03-2011		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	537.42	LPIN	0.00	537.41	LPIN	0.00	537.42	LPIN			
0.40	537.22		0.30	537.10		0.16	537.17				
4.90	537.35		5.60	537.18		5.47	537.30				
10.80	537.23		10.70	537.06		10.85	537.15				
14.80	536.00		15.30	535.76	TOBL	14.13	536.24				
17.00	535.61		17.80	535.49		16.82	535.75				
20.40	535.64	TOBL	20.20	535.53		19.75	535.67				
23.50	534.21		22.60	534.71		20.55	535.75				
24.80	534.18		25.30	534.23		20.59	535.67	TOBL			
26.20	534.48		26.70	533.93		22.15	535.28				
28.30	534.03		30.20	533.65		23.51	534.96				
29.30	533.96		31.70	533.39		25.84	534.66				
33.50	533.72		33.90	533.39		27.64	534.57				
35.00	533.47		36.20	533.49		29.25	534.26				
35.70	533.43	TW	37.60	533.34	TW	29.91	533.73	TOE L			
37.80	533.51		39.40	533.90		31.73	533.51				
39.90	534.03		40.70	534.41		33.44	533.24	TW			
43.90	536.10	TOBR	44.60	536.11	TOBR	35.66	533.40				
45.10	536.35		49.90	536.30		38.05	533.44				
50.00	536.45		53.40	537.72		38.48	533.49	TOE R			
56.60	539.15		56.90	539.05		39.52	534.06				
60.80	539.51		62.70	539.47		42.28	535.18				
64.70	539.76	RPIN	64.70	539.77	RPIN	44.41	536.24	TOBR			
						45.35	536.32				
						47.78	536.29				
						50.18	536.53				
						53.78	537.89				
						56.63	539.17				
						60.69	539.57				
						64.01	539.66				
						64.85	539.83	RPIN			

Photo of XS-3 looking in the downstream direction



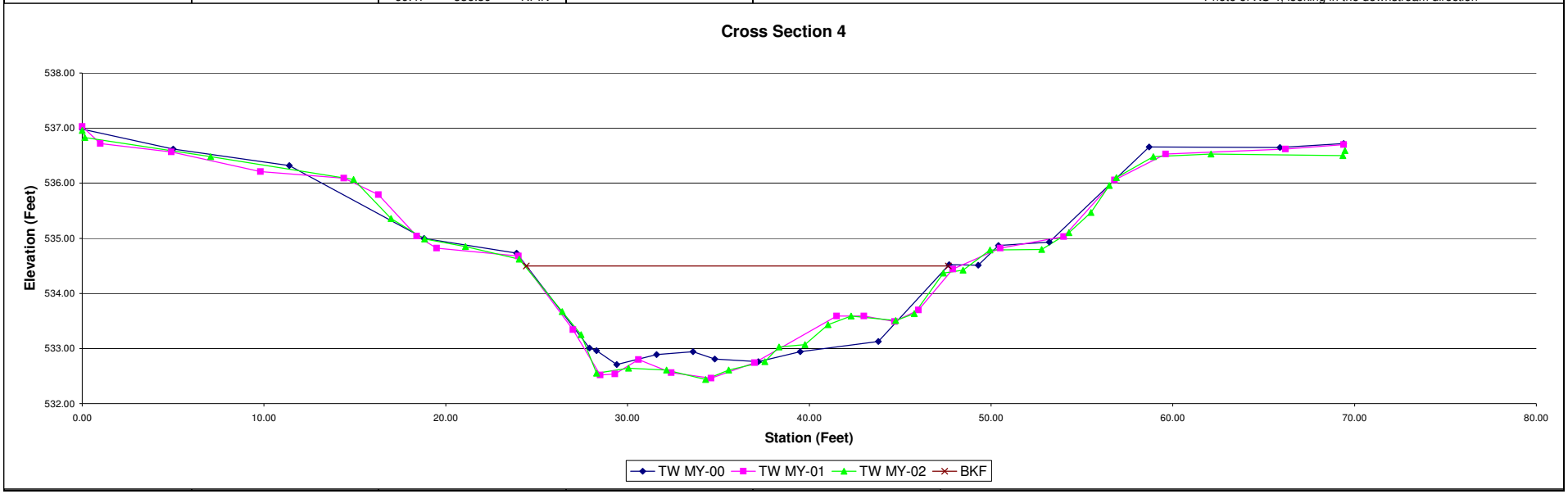
Project:	McCain Property
Cross Section:	Cross Section 4
Feature	Riffle Reach 2
Station:	25+05.32
Date:	10/18/10
Crew:	BW, ZAP, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	30.5	29.7	31.3			
W (BKF)	23.3	23.4	24.4			
Max d	1.8	2.0	2.1			
Mean d	1.3	1.3	1.3			
W/D	17.4	18.4	19.1			

MY00-2009			MY01-2009			MY02-2010			MY03-2011		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	536.98	LPIN	0.00	537.03	LPIN	0.00	536.96	LPIN			
5.00	536.62		1.00	536.72		0.14	536.83				
11.40	536.32		4.90	536.57		7.07	536.48				
18.80	535.00		9.80	536.21		14.93	536.07				
23.90	534.73	TOBL	14.40	536.09		16.99	535.36				
27.90	533.01		16.30	535.79		18.84	534.99				
28.30	532.96		18.40	535.04		21.09	534.85				
29.40	532.71	TW	19.50	534.82		24.04	534.62	TOBL			
31.60	532.89		24.00	534.68	TOBL	26.40	533.67				
33.60	532.94		27.00	533.34		27.45	533.25				
34.80	532.81		28.50	532.52		28.30	532.55	TOE L			
37.20	532.76		29.30	532.54		30.05	532.64				
39.50	532.94		30.60	532.80		32.15	532.61				
43.80	533.13		32.40	532.56		34.29	532.44	TW			
47.70	534.52		34.60	532.46	TW	35.57	532.61				
49.30	534.51	TOBR	37.00	532.74		37.56	532.76	TOE R			
50.40	534.87		41.50	533.59		38.34	533.03				
53.20	534.93		43.00	533.59		39.76	533.07				
58.70	536.66		44.70	533.49		41.03	533.43				
65.90	536.65		46.00	533.70		42.30	533.59				
69.40	536.72	RPIN	47.90	534.44	TOBR	44.75	533.51				
			50.50	534.82		45.77	533.63				
			54.00	535.03		47.37	534.37				
			56.80	536.06		48.46	534.42				
			59.60	536.53		49.95	534.79	TOBR			
			66.20	536.62		52.78	534.80				
			69.40	536.70	RPIN	54.29	535.10				
						55.49	535.47				
						56.50	535.96				
						56.90	536.10				
						58.93	536.48				
						62.10	536.53				
						69.35	536.50				
						69.47	536.59	RPIN			

Photo of XS-4, looking in the downstream direction



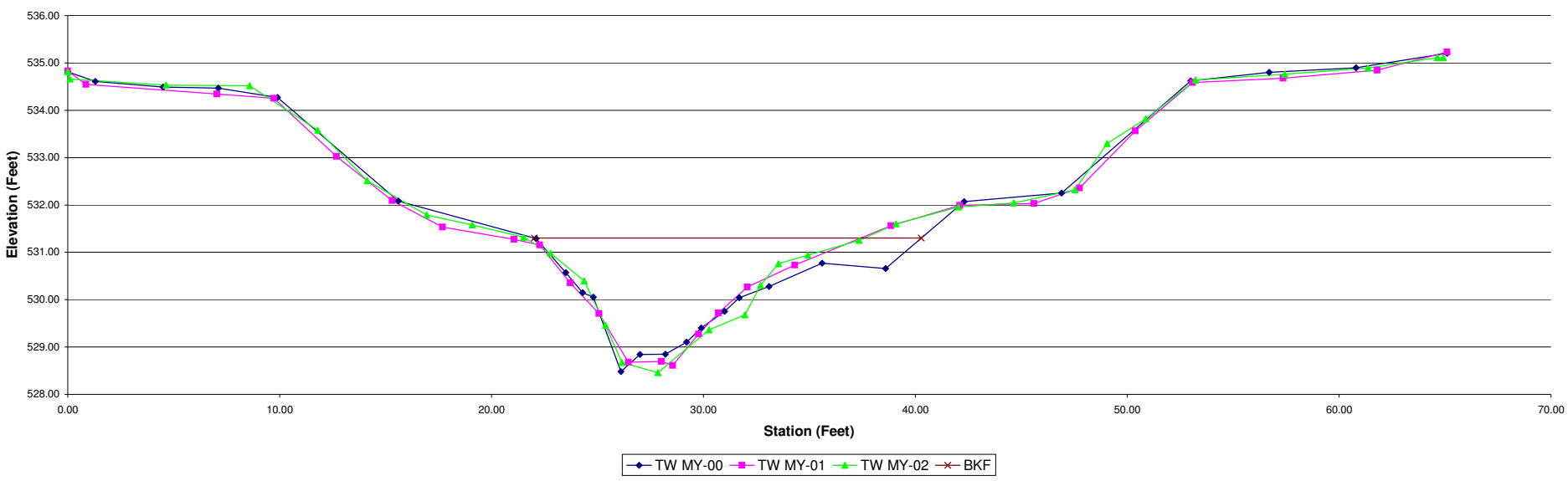
Project:	McCain Property
Cross Section:	Cross Section 5
Feature	Pool Reach 2
Station:	29+60.52
Date:	10/18/10
Crew:	BW, ZAP, SV

Summary (bankfull)

	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	22.2	17.8	20.5			
W (BKF)	18.1	14.3	16.0			
Max d	2.8	2.5	2.8			
Mean d	1.2	1.2	1.3			
W/D	-	-	-			

MY00-2009			MY01-2009			MY02-2010			MY03-2011		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	534.81	LPIN	0.00	534.83	LPIN	0.00	534.81	LPIN			
1.30	534.61		0.85	534.55		0.10	534.66				
4.50	534.49		7.04	534.34		4.64	534.53				
7.10	534.47		9.74	534.25		8.58	534.52				
9.90	534.27		12.69	533.03		11.79	533.58				
15.60	532.08		15.31	532.09		14.13	532.51				
22.10	531.29	TOBL	17.68	531.53		16.94	531.79				
23.50	530.57		21.06	531.28	TOBL	19.09	531.58				
24.30	530.15		22.28	531.15		21.52	531.32	TOBL			
24.80	530.05		23.71	530.35		22.78	530.98				
26.10	528.48	TW	25.07	529.71		24.38	530.40				
27.00	528.84		26.46	528.68		25.37	529.46	TOE L			
28.20	528.85		28.01	528.70		26.16	528.67				
29.20	529.10		28.55	528.61	TW	27.85	528.46	TW			
29.90	529.40		29.77	529.27		30.26	529.36				
31.00	529.75		30.71	529.72		31.96	529.68	TOE R			
31.70	530.04		32.08	530.26		32.69	530.30				
33.10	530.28		34.31	530.73		33.54	530.76	TOBR			
35.60	530.77		38.84	531.56	TOBR	34.93	530.94				
38.60	530.66		42.10	531.99		37.34	531.25				
42.30	532.07	TOBR	45.60	532.03		39.09	531.60				
46.90	532.25		47.75	532.36		42.04	531.96				
53.00	534.62		50.39	533.56		44.65	532.04				
56.70	534.80		53.09	534.59		47.54	532.32				
60.80	534.90		57.36	534.68		49.05	533.30				
65.10	535.20	RPIN	61.80	534.85		50.87	533.82				
			65.09	535.23	RPIN	53.22	534.64				
						57.43	534.76				
						61.37	534.89				
						64.64	535.11				
						64.92	535.11	RPIN			

Photo of XS-5, looking in the downstream direction



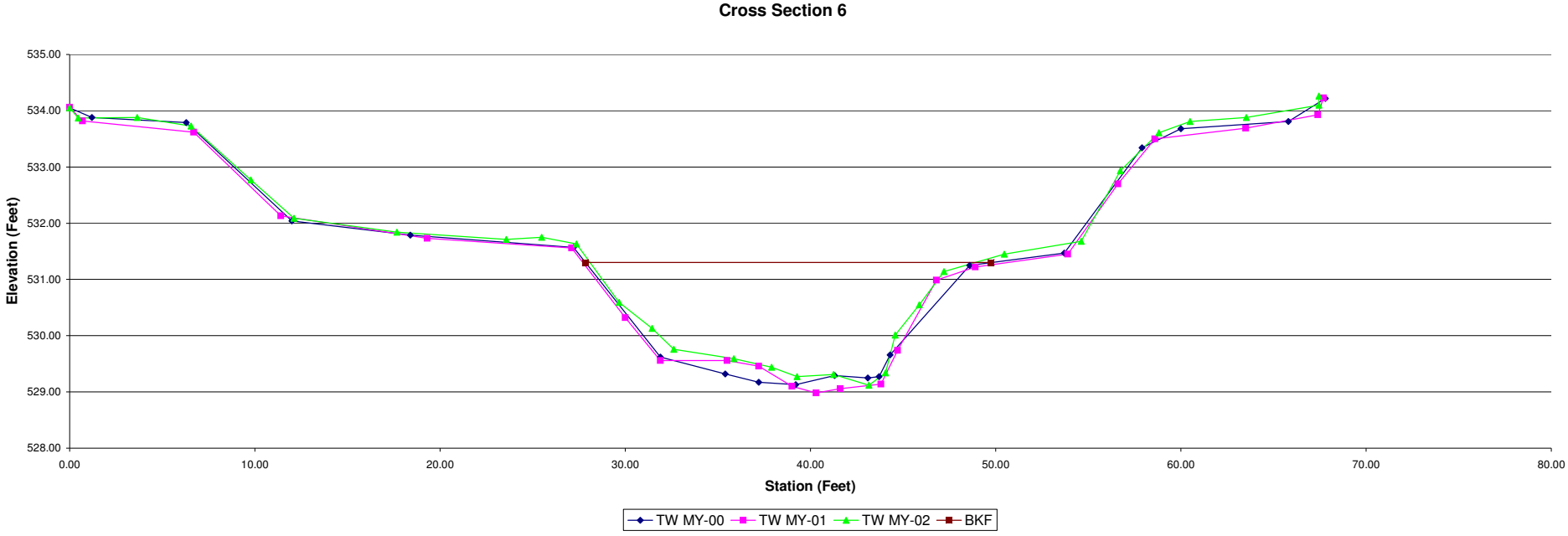
Project:	McCain Property
Cross Section:	Cross Section 6
Feature	Riffle Reach 2
Station:	31+23.66
Date:	10/18/10
Crew:	BW, ZAP, SV

Summary (bankfull)

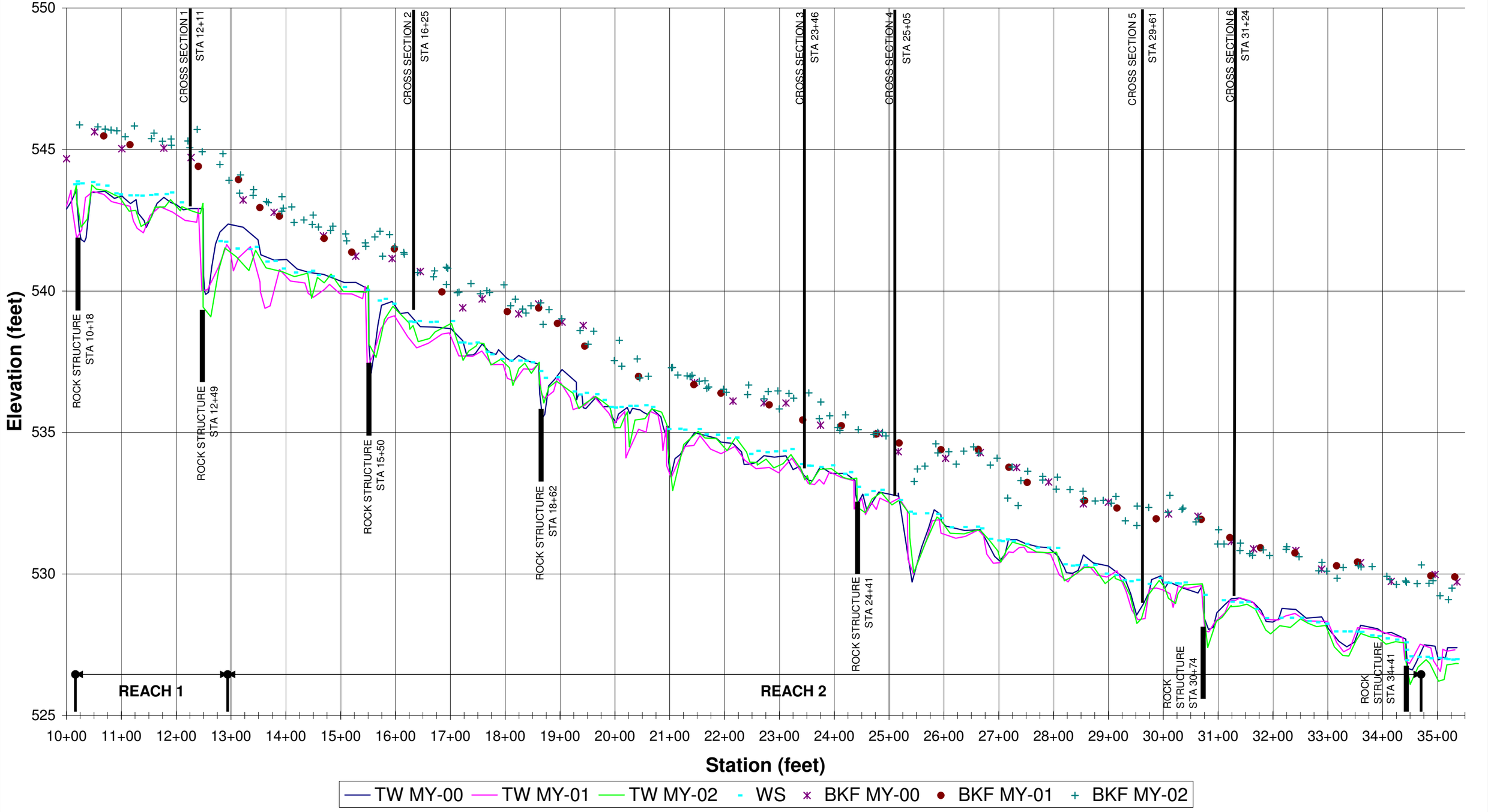
	MY0	MY1	MY2	MY3	MY4	MY5
A (BKF)	30.8	25.2	27.8			
W (BKF)	20.6	18.4	20.8			
Max d	2.1	2.0	2.2			
Mean d	1.5	1.4	1.3			
W/D	13.8	13.4	15.5			

MY00-2009			MY01-2009			MY02-2010			MY03-2011		
Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes	Station	Elevation	Notes
0.00	534.05	LPIN	0.00	534.06	LPIN	0.00	534.05	LPIN			
1.20	533.88		0.70	533.82		0.46	533.87				
6.30	533.79		6.70	533.62		3.65	533.88				
12.00	532.04		11.40	532.13		6.56	533.73				
18.40	531.79		19.30	531.73		9.79	532.77				
27.20	531.57	TOBL	27.10	531.56	TOBL	12.11	532.09				
31.90	529.62		30.00	530.32		17.67	531.84				
35.40	529.32		31.90	529.56		23.58	531.71				
37.20	529.17		35.50	529.56		25.48	531.75				
39.20	529.13	TW	37.20	529.46		27.37	531.63	TOBL			
41.30	529.29		39.00	529.10		29.66	530.59				
43.10	529.25		40.30	528.98	TW	31.44	530.13				
43.70	529.27		41.60	529.06		32.62	529.76				
44.30	529.66		43.80	529.14		35.86	529.59	TOE L			
48.60	531.25	TOB R	44.70	529.74		37.90	529.44				
53.70	531.47		46.80	530.99		39.28	529.27				
57.90	533.34		48.90	531.22	TOBR	41.25	529.31				
60.00	533.68		53.90	531.45		43.16	529.12	TW			
65.80	533.81		56.60	532.70		44.05	529.34	TOE R			
67.80	534.22	RPIN	58.60	533.50		44.57	530.01				
			63.50	533.69		45.87	530.55				
			67.40	533.93		47.21	531.14				
			67.70	534.23	RPIN	50.46	531.45	TOBR			
						54.62	531.68				
						56.73	532.93				
						58.82	533.61				
						60.49	533.81				
						63.53	533.88				
						67.45	534.10				
						67.46	534.26	RPIN			

Photo of XS-6, looking in the downstream direction

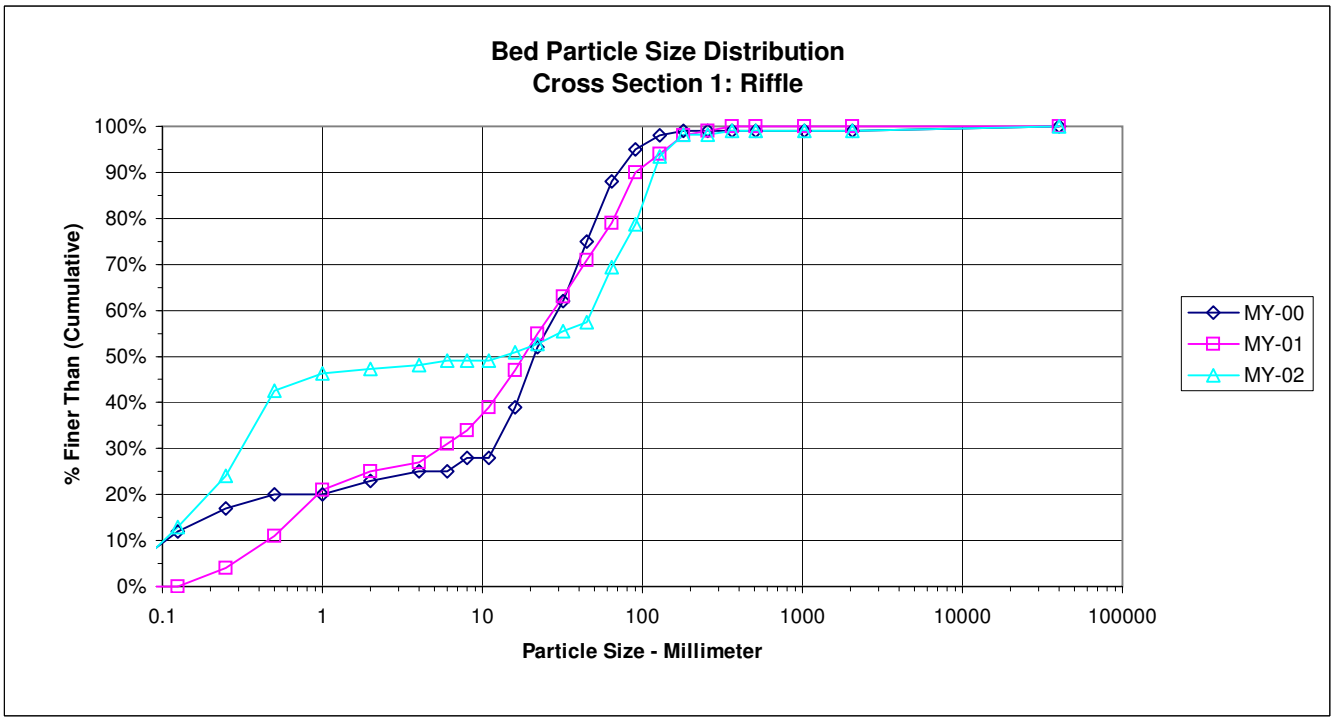


McCain Property
MY-02 Longitudinal Profile
Main Channel: Station 10+00-35+50



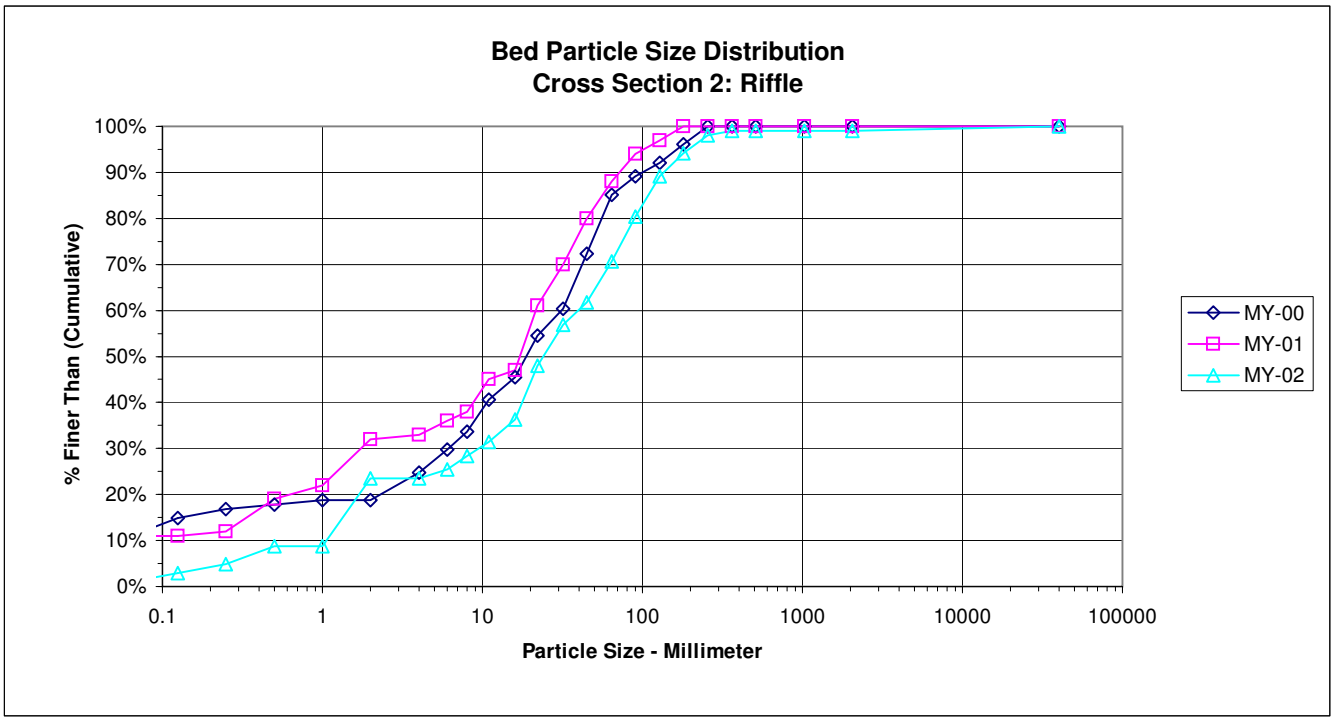
PEBBLE COUNT								
Project:	McCain Property					**Date:**	9/10/2010	
Location:	Cross Section #1							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	3		3	3%	3%
	Very Fine	.062 - .125	S	11		11	10%	13%
	Fine	.125 - .25	A	12		12	11%	24%
	Medium	.25 - .50	N	20		20	19%	43%
	Coarse	.50 - 1.0	D	4		4	4%	46%
.04 -.08	Very Coarse	1.0 - 2.0	S	1		1	1%	47%
.08 - .16	Very Fine	2.0 - 4.0		1		1	1%	48%
.16 - .22	Fine	4.0 - 5.7	G	1		1	1%	49%
.22 - .31	Fine	5.7 - 8.0	R	0		0	0%	49%
.31 - .44	Medium	8.0 - 11.3	A	0		0	0%	49%
.44 - .63	Medium	11.3 - 16.0	V	2		2	2%	51%
.63 - .89	Coarse	16.0 - 22.6	E	2		2	2%	53%
.89 - 1.26	Coarse	22.6 - 32.0	L	3		3	3%	56%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	2		2	2%	57%
1.77 - 2.5	Very Coarse	45.0 - 64.0		13		13	12%	69%
2.5 - 3.5	Small	64 - 90	C	10		10	9%	79%
3.5 - 5.0	Small	90 - 128	O	16		16	15%	94%
5.0 - 7.1	Large	128 - 180	B	5		5	5%	98%
7.1 - 10.1	Large	180 - 256	L	0		0	0%	98%
10.1 - 14.3	Small	256 - 362	B	1		1	1%	99%
14.3 - 20	Small	362 - 512	L	0		0	0%	99%
20 - 40	Medium	512 - 1024	D	0		0	0%	99%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0		0	0%	99%
	Bedrock		BDRK	1		1	1%	100%
			Totals	**108**	**0**	**108**	**100%**	**100%**

d16	d35	d50	d84	d95
0.2	0.4	13.5	103.6	144.6



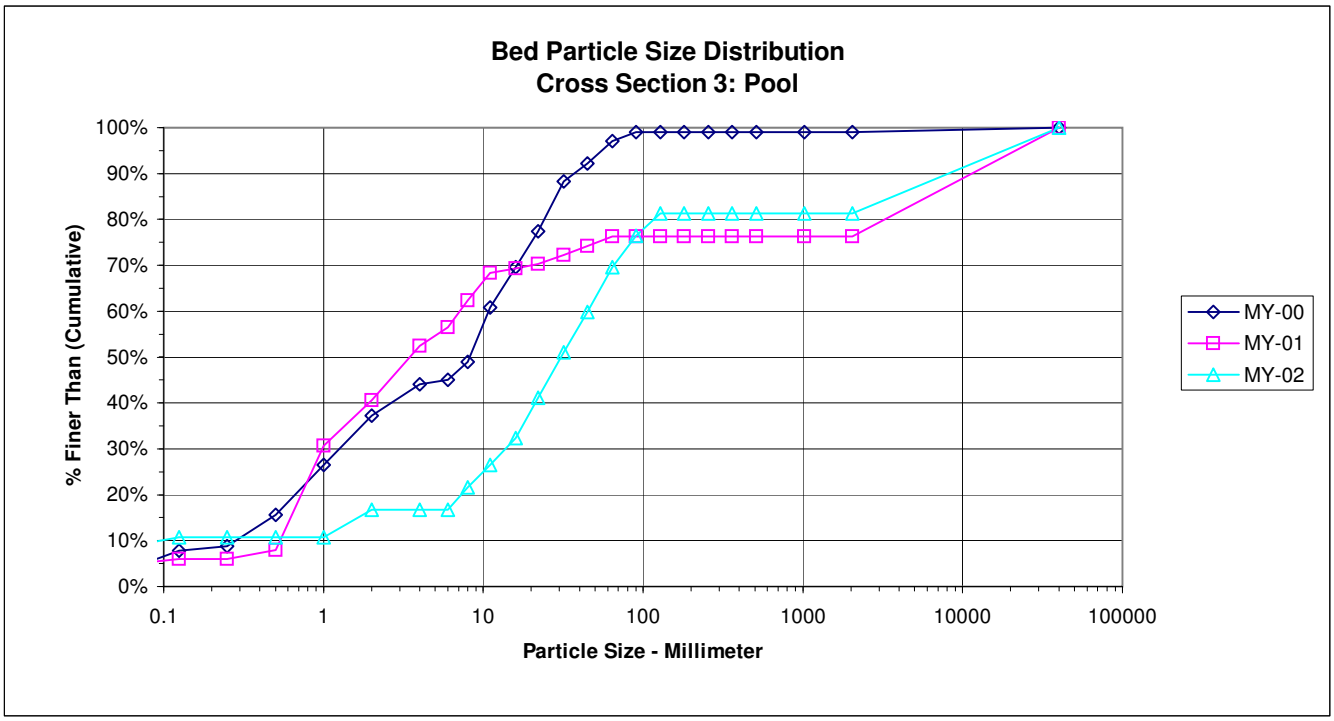
PEBBLE COUNT								
Project:	McCain Property					**Date:**	9/10/2010	
Location:	Cross Section #2							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	1	0	1	1%	1%
	Very Fine	.062 - .125	S	2	0	2	2%	3%
	Fine	.125 - .25	A	2	0	2	2%	5%
	Medium	.25 - .50	N	4	0	4	4%	9%
	Coarse	.50 - 1.0	D	0	0	0	0%	9%
.04 -.08	Very Coarse	1.0 - 2.0	S	15	0	15	15%	24%
.08 - .16	Very Fine	2.0 - 4.0		0	0	0	0%	24%
.16 - .22	Fine	4.0 - 5.7	G	2	0	2	2%	25%
.22 - .31	Fine	5.7 - 8.0	R	3	0	3	3%	28%
.31 - .44	Medium	8.0 - 11.3	A	3	0	3	3%	31%
.44 - .63	Medium	11.3 - 16.0	V	5	0	5	5%	36%
.63 - .89	Coarse	16.0 - 22.6	E	12	0	12	12%	48%
.89 - 1.26	Coarse	22.6 - 32.0	L	9	0	9	9%	57%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	5	0	5	5%	62%
1.77 - 2.5	Very Coarse	45.0 - 64.0		9	0	9	9%	71%
2.5 - 3.5	Small	64 - 90	C	10	0	10	10%	80%
3.5 - 5.0	Small	90 - 128	O	9	0	9	9%	89%
5.0 - 7.1	Large	128 - 180	B	5	0	5	5%	94%
7.1 - 10.1	Large	180 - 256	L	4	0	4	4%	98%
10.1 - 14.3	Small	256 - 362	B	1	0	1	1%	99%
14.3 - 20	Small	362 - 512	L	0	0	0	0%	99%
20 - 40	Medium	512 - 1024	D	0	0	0	0%	99%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0	0	0	0%	99%
	Bedrock		BDRK	1	0	1	1%	100%
			Totals	**102**	**0**	**102**	**100%**	**100%**

d16	d35	d50	d84	d95
1.5	14.7	24.2	105.5	197.1



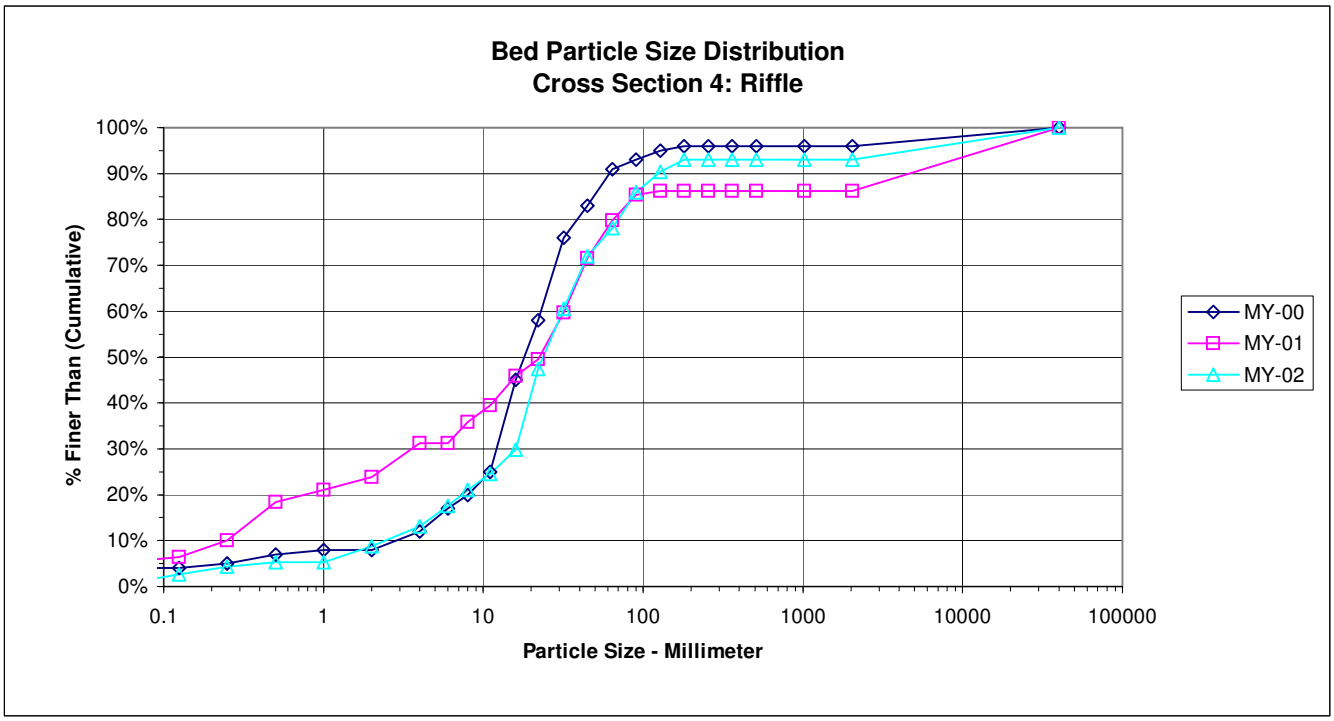
PEBBLE COUNT								
Project:	McCain Property					**Date:**	9/10/2010	
Location:	Cross Section #3							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C		9	9	9%	9%
	Very Fine	.062 - .125	S		2	2	2%	11%
	Fine	.125 - .25	A		0	0	0%	11%
	Medium	.25 - .50	N		0	0	0%	11%
	Coarse	.50 - 1.0	D		0	0	0%	11%
.04 -.08	Very Coarse	1.0 - 2.0	S		6	6	6%	17%
.08 - .16	Very Fine	2.0 - 4.0			0	0	0%	17%
.16 - .22	Fine	4.0 - 5.7	G		0	0	0%	17%
.22 - .31	Fine	5.7 - 8.0	R		5	5	5%	22%
.31 - .44	Medium	8.0 - 11.3	A		5	5	5%	26%
.44 - .63	Medium	11.3 - 16.0	V		6	6	6%	32%
.63 - .89	Coarse	16.0 - 22.6	E		9	9	9%	41%
.89 - 1.26	Coarse	22.6 - 32.0	L		10	10	10%	51%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S		9	9	9%	60%
1.77 - 2.5	Very Coarse	45.0 - 64.0			10	10	10%	70%
2.5 - 3.5	Small	64 - 90	C		7	7	7%	76%
3.5 - 5.0	Small	90 - 128	O		5	5	5%	81%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	81%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	81%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	81%
14.3 - 20	Small	362 - 512	L		0	0	0%	81%
20 - 40	Medium	512 - 1024	D		0	0	0%	81%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	81%
	Bedrock		BDRK		19	19	19%	100%
			Totals	**0**	**102**	**102**	**100%**	**100%**

d16	d35	d50	d84	d95
1.9	17.8	31.0	0.0	0.0



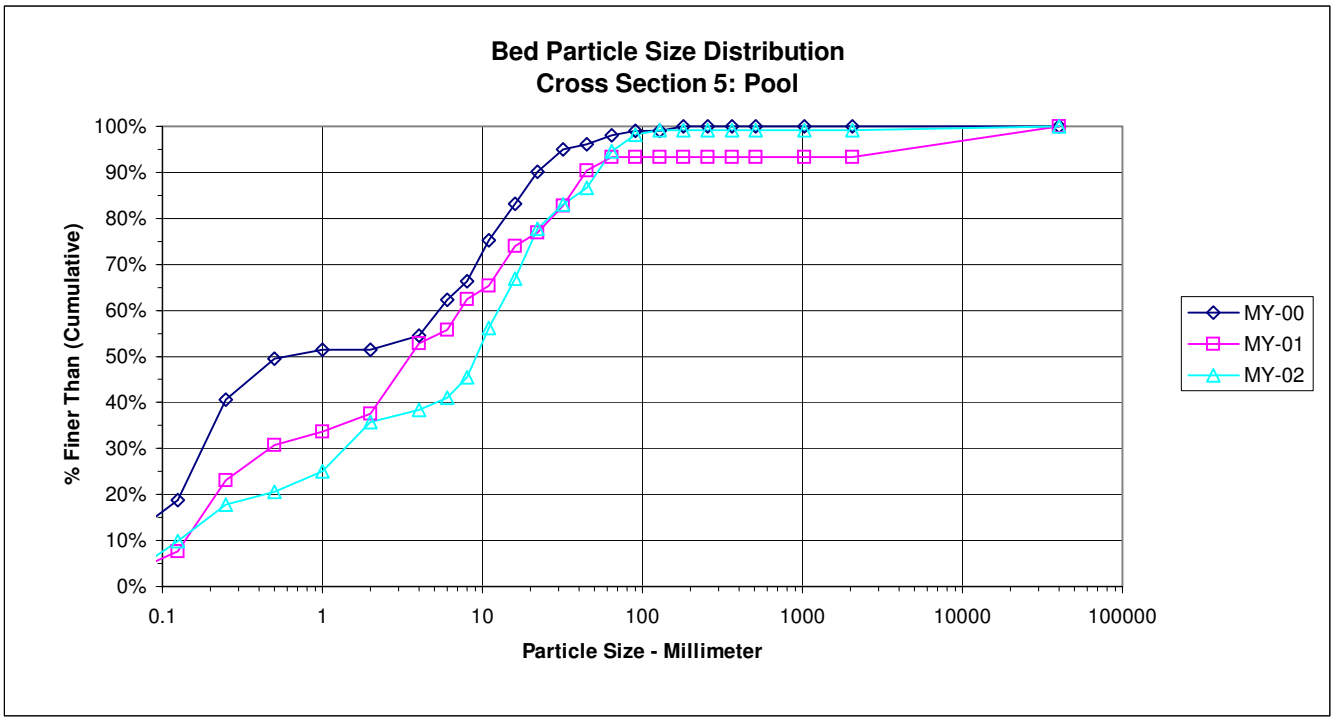
PEBBLE COUNT								
Project:	McCain Property					**Date:**	9/10/2010	
Location:	Cross Section #4							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	1		1	1%	1%
	Very Fine	.062 - .125	S	2		2	2%	3%
	Fine	.125 - .25	A	2		2	2%	4%
	Medium	.25 - .50	N	1		1	1%	5%
	Coarse	.50 - 1.0	D	0		0	0%	5%
.04 -.08	Very Coarse	1.0 - 2.0	S	4		4	4%	9%
.08 - .16	Very Fine	2.0 - 4.0		5		5	4%	13%
.16 - .22	Fine	4.0 - 5.7	G	5		5	4%	18%
.22 - .31	Fine	5.7 - 8.0	R	4		4	4%	21%
.31 - .44	Medium	8.0 - 11.3	A	4		4	4%	25%
.44 - .63	Medium	11.3 - 16.0	V	6		6	5%	30%
.63 - .89	Coarse	16.0 - 22.6	E	20		20	18%	47%
.89 - 1.26	Coarse	22.6 - 32.0	L	15		15	13%	61%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	13		13	11%	72%
1.77 - 2.5	Very Coarse	45.0 - 64.0		7		7	6%	78%
2.5 - 3.5	Small	64 - 90	C	9		9	8%	86%
3.5 - 5.0	Small	90 - 128	O	5		5	4%	90%
5.0 - 7.1	Large	128 - 180	B	3		3	3%	93%
7.1 - 10.1	Large	180 - 256	L	0		0	0%	93%
10.1 - 14.3	Small	256 - 362	B	0		0	0%	93%
14.3 - 20	Small	362 - 512	L	0		0	0%	93%
20 - 40	Medium	512 - 1024	D	0		0	0%	93%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0		0	0%	93%
	Bedrock		BDRK	8		8	7%	100%
			Totals	**114**	**0**	**114**	**100%**	**100%**

d16	d35	d50	d84	d95
5.3	17.8	24.0	83.5	0.0



PEBBLE COUNT								
Project:	McCain Property					**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		3	3	3%	3%
	Very Fine	.062 - .125	S		8	8	7%	10%
	Fine	.125 - .25	A		9	9	8%	18%
	Medium	.25 - .50	N		3	3	3%	21%
	Coarse	.50 - 1.0	D		5	5	4%	25%
.04 -.08	Very Coarse	1.0 - 2.0	S		12	12	11%	36%
.08 - .16	Very Fine	2.0 - 4.0			3	3	3%	38%
.16 - .22	Fine	4.0 - 5.7	G		3	3	3%	41%
.22 - .31	Fine	5.7 - 8.0	R		5	5	4%	46%
.31 - .44	Medium	8.0 - 11.3	A		12	12	11%	56%
.44 - .63	Medium	11.3 - 16.0	V		12	12	11%	67%
.63 - .89	Coarse	16.0 - 22.6	E		12	12	11%	78%
.89 - 1.26	Coarse	22.6 - 32.0	L		6	6	5%	83%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S		4	4	4%	87%
1.77 - 2.5	Very Coarse	45.0 - 64.0			9	9	8%	95%
2.5 - 3.5	Small	64 - 90	C		4	4	4%	98%
3.5 - 5.0	Small	90 - 128	O		1	1	1%	99%
5.0 - 7.1	Large	128 - 180	B		0	0	0%	99%
7.1 - 10.1	Large	180 - 256	L		0	0	0%	99%
10.1 - 14.3	Small	256 - 362	B		0	0	0%	99%
14.3 - 20	Small	362 - 512	L		0	0	0%	99%
20 - 40	Medium	512 - 1024	D		0	0	0%	99%
40 - 80	Lrg- Very Lrg	1024 - 2048	R		0	0	0%	99%
	Bedrock		BDRK		1	1	1%	100%
			Totals	**0**	**112**	**112**	**100%**	**100%**

d16	d35	d50	d84	d95
0.2	1.9	9.3	35.5	66.6



PEBBLE COUNT								
Project:	McCain Property					**Date:**	9/10/2010	
Location:	Cross Section #6							
				Particle Counts				
Inches	Particle	Millimeter		Riffles	Pools	Total No.	Item %	% Cumulative
	Silt/Clay	< 0.062	S/C	4		4	4%	4%
	Very Fine	.062 - .125	S	5		5	5%	9%
	Fine	.125 - .25	A	4		4	4%	13%
	Medium	.25 - .50	N	7		7	7%	20%
	Coarse	.50 - 1.0	D	1		1	1%	21%
.04 -.08	Very Coarse	1.0 - 2.0	S	6		6	6%	27%
.08 - .16	Very Fine	2.0 - 4.0		1		1	1%	28%
.16 - .22	Fine	4.0 - 5.7	G	2		2	2%	30%
.22 - .31	Fine	5.7 - 8.0	R	7		7	7%	37%
.31 - .44	Medium	8.0 - 11.3	A	4		4	4%	41%
.44 - .63	Medium	11.3 - 16.0	V	8		8	8%	49%
.63 - .89	Coarse	16.0 - 22.6	E	11		11	11%	59%
.89 - 1.26	Coarse	22.6 - 32.0	L	11		11	11%	70%
1.26 - 1.77	Very Coarse	32.0 - 45.0	S	17		17	17%	87%
1.77 - 2.5	Very Coarse	45.0 - 64.0		7		7	7%	94%
2.5 - 3.5	Small	64 - 90	C	5		5	5%	99%
3.5 - 5.0	Small	90 - 128	O	1		1	1%	100%
5.0 - 7.1	Large	128 - 180	B	0		0	0%	100%
7.1 - 10.1	Large	180 - 256	L	0		0	0%	100%
10.1 - 14.3	Small	256 - 362	B	0		0	0%	100%
14.3 - 20	Small	362 - 512	L	0		0	0%	100%
20 - 40	Medium	512 - 1024	D	0		0	0%	100%
40 - 80	Lrg- Very Lrg	1024 - 2048	R	0		0	0%	100%
	Bedrock		BDRK	0		0	0%	100%
			Totals	**101**	**0**	**101**	**100%**	**100%**

d16	d35	d50	d84	d95
0.4	7.5	16.8	42.6	68.9

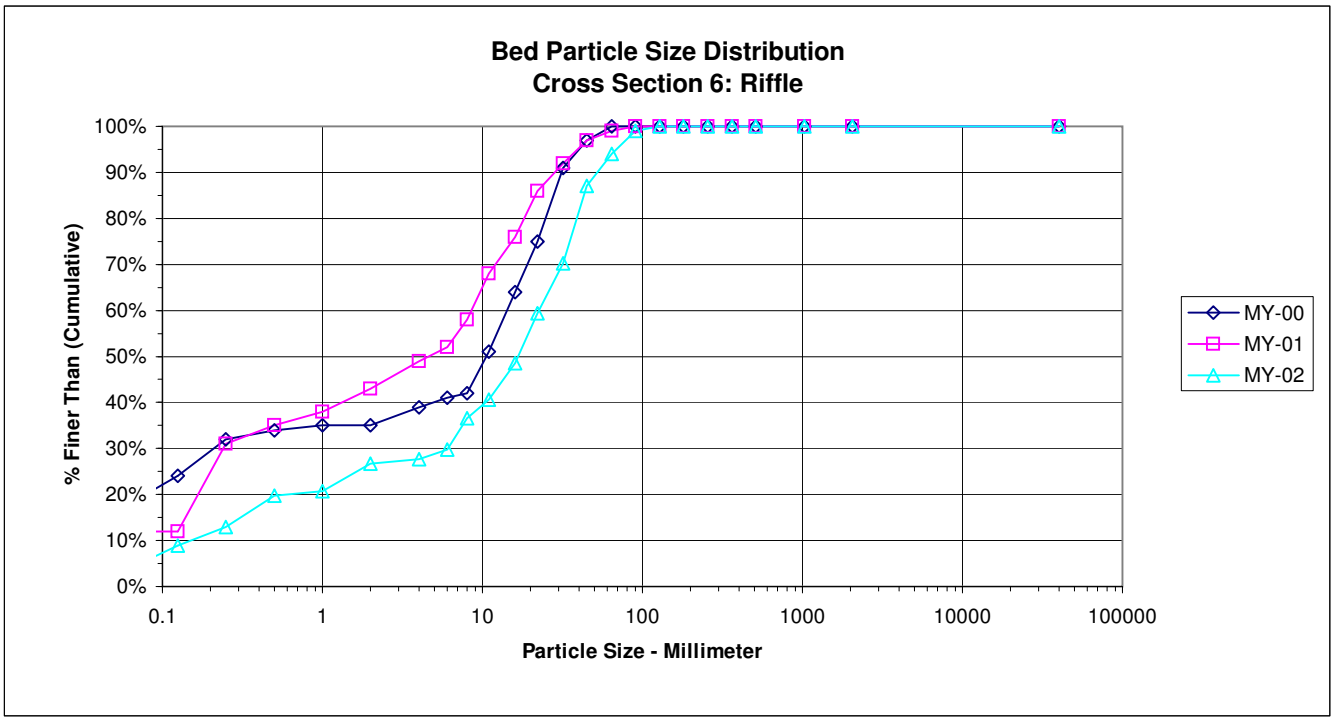


Table 10a. Baseline Stream Data Summary
McCain Stream Restoration Site/Project No. 443 - Reach: 1 (286 feet)

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)					14.6	18.7	25.9	29.3		4	10.4			27.1				18			16.9				
Floodprone Width (ft)					34	95	125	125		3	150			200							35				
Bankfull Mean Depth (ft)					1.1	1.4	1.4	1.7		4	0.8			1.5				1.4			1.1				
[1]Bankfull Max Depth (ft)					1.7	2.7	2.8	3.5		4	1.4			2				2			1.5				
Bankfull Cross Sectional Area (ft^2)					21.3	25.6	25.9	29.3		4	12.5			22.3				24.6			18.6				
Width/Depth Ratio					8.3	14	15	17.6		4	11.6			18.5				13.2			15.4				
Entrenchment Ratio					1.8	5.6	6.4	8.5		3	7.4			14.4							2.1				
[1]Bank Height Ratio					1	1.2	1.1	1.7		4	1			1				1			1				
Profile																									
Riffle Length (ft)											9			108				58		54	63	63	72	12	2
Riffle Slope (ft/ft)											0.01			0.076				0.007		0.005	0.006	0.006	0.007	0.002	2
Pool Length (ft)											28			108				38		16	21	22	25	4	3
Pool Max depth (ft)											1.8			3.1				3							
Pool Spacing (ft)											38			181				95		107	113	113	119	8	2
Pattern																									
Channel Beltwidth (ft)											75			135							78				
Radius of Curvature (ft)											14.5			26.8			30		35	35	38	38	40		2
Rc:Bankfull width (ft/ft)											1			1.6			1.7		1.9	2.1	2.2	2.2	2.4		
Meander Wavelength (ft)											70			148				190			204				1
Meander Width Ratio											3.6			13							4.6				
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2																									
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					B4c/E4/C4-5						B4c/C3/C4						B4c			B4c					
Bankfull Velocity (fps)																	3.9								
Bankfull Discharge (cfs)																									
Valley length (ft)					2155																				
Channel Thalweg length (ft)					2475												285			286					
Sinuosity (ft)					1.15						1.50-1.70						1.17			1.3					
Water Surface Slope (Channel) (ft/ft)											0.0070-0.0120						0.0067			0.0068					
BF slope (ft/ft)											0.0070-0.0120						0.0067			0.0065					
[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 10a. Baseline Stream Data Summary
McCain Stream Restoration Site/Project No. 443 - Reach: 2 (2184 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)					14.6	18.7	25.9	29.3		4	10.4			27.1			18	20	24	20.6	22.8	23.3	24.6	0.9	3
Floodprone Width (ft)					34	95	125	125		3	150			200						47	54	51	63	6.2	3
Bankfull Mean Depth (ft)					1.1	1.4	1.4	1.7		4	0.8			1.5			1	1.3	1.4	1.3	1.4	1.4	1.5	0.1	3
[1]Bankfull Max Depth (ft)					1.7	2.7	2.8	3.5		4	1.4			2			1.3	1.7	2	1.8	1.9	1.8	2.1	0.2	3
Bankfull Cross Sectional Area (ft^2)					21.3	25.6	25.9	29.3		4	12.5			22.3			25	25.5	26	30.8	31.89	31.2	33.7	1.3	3
Width/Depth Ratio					8.3	14	15	17.6		4	11.6			18.5			12.7	15.6	23	13.8	16.4	17.4	18	0.8	3
Entrenchment Ratio					1.8	5.6	6.4	8.5		3	7.4			14.4						2	2.3	2.5	2.5	0.1	3
[1]Bank Height Ratio					1	1.2	1.1	1.7		4	1			1				1		1	1	1	1	0	3
Profile																									
Riffle Length (ft)											9			108			59	67	88	20	68	76	97	23	13
Riffle Slope (ft/ft)											0.01			0.076			0.008	0.008	0.01	0.003	0.009	0.008	0.019	0.004	13
Pool Length (ft)											28			108			47	52	59	12	22	23	33	6	13
Pool Max depth (ft)											1.8			3.1			2.3	2.8	3.3	2.2	2.5		2.8		2
Pool Spacing (ft)											38			181			106	118	147	56	117	123	150	25	12
Pattern																									
Channel Beltwidth (ft)											75			135						20	66	62	97	24	10
Radius of Curvature (ft)											14.5			26.8			35		60	35	49	43	80	14	12
Rc:Bankfull width (ft/ft)											1			1.6			1.8		3.1	1.5	2.2	2.2	3.3		
Meander Wavelength (ft)											70			148			212	236	294	158	221	229	261	36	10
Meander Width Ratio											3.6			13						1.9	3.1	2.7	4.8		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2																									
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					B4c/E4/C4-5						B4c/C3/C4						B4c			B4c					
Bankfull Velocity (fps)																	3.9								
Bankfull Discharge (cfs)																									
Valley length (ft)					2155																				
Channel Thalweg length (ft)					2475												285			286					
Sinuosity (ft)					1.15						1.50-1.70						1.17			1.3					
Water Surface Slope (Channel) (ft/ft)											0.0070-0.0120						0.0067			0.0068					
BF slope (ft/ft)											0.0070-0.0120						0.0067			0.0065					
[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)
McCain Stream Restoration Site/Project No. 443 - Entire Stream (2470 lf)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%															56%		40%											
[1]SC% / Sa% / G% / C% / B% / Be%																												
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)																												
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																												
[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-construtions 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 meaningful comparisons.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

McCain Stream Restoration Site/Project No. 443

	Cross Section 1 (Reach 1-Riffle)							Cross Section 2 (Reach 2-Riffle)							Cross Section 3 (Reach 2-Pool)						
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+
Record elevation (datum) used	544.4	544.3	544.4					541	540.9	541					535.6	535.5	535.6				
Bankfull Width (ft)	16.9	17.2	18.11					24.6	25.2	27.87					22.6	23	22.25				
Floodprone Width (ft)	35	37	35					63	>75	63					-	-	-				
Bankfull Mean Depth (ft)	1.1	1.2	1.033					1.4	1.7	1.584					1.5	1.5	1.384				
Bankfull Max Depth (ft)	1.5	1.6	1.6					18	2.5	2.55					2.2	2.2	2.36				
Bankfull Cross Sectional Area (ft^2)	18.6	20.8	18.71					33.7	42.7	44.14					33.6	34.1	30.8				
Bankfull Width/Depth Ratio	15.4	14.2	17.52					18	14.9	17.59					-	-	-				
Bankfull Entrenchment Ratio	2.1	2.2	1.933					2.5	>3.0	2.261					-	-	-				
Bankfull Bank Height Ratio	1	1	1.1					1	1	0.969					-	-	-				
Cross Sectional Area between end pins (ft^2)	174.2	182	184.8					119	137	137.4					97	87	90				
d50 (mm)	21	18	13.5					19	17	24.2					8.1	1.7	31				
	Cross Section 4 (Reach 2-Riffle)							**Cross Section 5 (Reach 2-Pool)**							**Cross Section 6 (Reach 2-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+
Record elevation (datum) used	534.5	534.4	534.5					531.3	531.2	531.3					531.3	531	531.3				
Bankfull Width (ft)	23.3	23.4	23.99					18.1	14.3	16.46					20.6	18.4	20.79				
Floodprone Width (ft)	47	52	47					-	-	-					51	50.5	51				
Bankfull Mean Depth (ft)	1.3	1.3	1.234					1.2	1.2	1.282					1.5	1.4	1.339				
Bankfull Max Depth (ft)	1.8	2	1.99					2.8	2.5	2.88					2.1	2	2.18				
Bankfull Cross Sectional Area (ft^2)	31.2	29.7	29.61					22.2	17.8	21.1					30.8	25.2	27.84				
Bankfull Width/Depth Ratio	17.4	18.4	19.44					-	-	-					13.8	13.4	15.52				
Bankfull Entrenchment Ratio	2	2.2	1.959					-	-	-					2.5	2.7	2.453				
Bankfull Bank Height Ratio	1	1	1.095					-	-	-					1	1	1.069				
Cross Sectional Area between end pins (ft^2)	103	120	132.3					146	148	158.3					133	159	157.1				
d50 (mm)	17	14	24					0.6	3	9.3					11	4.6	16.8				

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."

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)		16.9						17.2						17.03																						
Floodprone Width (ft)		35						37						35																						
Bankfull Mean Depth (ft)		1.1						1.2						0.92																						
[1]Bankfull Max Depth (ft)		1.5						1.6						1.42																						
Bankfull Cross Sectional Area (ft^2)		18.6						20.8						15.67																						
Width/Depth Ratio		15.4						14.2						18.5																						
Entrenchment Ratio		2.1						2.2						2.056																						
[1]Bank Height Ratio		1						1						1.239																						
Profile																																				
Riffle Length (ft)	54.0	63.0	63.0	72.0	12.0	2		67.0					50.46	54.87	54.87	59.27	6.23	2																		
Riffle Slope (ft/ft)	0.005	0.006	0.006	0.007	0.002	2		0.007					0.002	0.005	0.005	0.009	0.005	2																		
Pool Length (ft)	16.0	21.0	22.0	25.0	4.0	3	25.0		30.0	31.0			93.02	96.96	96.96	100.9	5.57	2																		
Pool Max depth (ft)													3.72	4.82	4.82	5.91	1.55	2																		
Pool Spacing (ft)	107.0	113.0	113.0	119.0	8.0	2	112.0		125.0	194.0				127.1				1																		
Pattern																																				
Channel Beltwidth (ft)		78																																		
Radius of Curvature (ft)	35	38	38	40		2																														
Rc:Bankfull width (ft/ft)	2.1	2.2	2.2	2.4																																
Meander Wavelength (ft)		204																																		
Meander Width Ratio		4.6																																		
Additional Reach Parameters																																				
Rosgen Classification	B4c						C4						B4c																							
Channel Thalweg length (ft)	286						286						286																							
Sinuosity (ft)	1.3						1.3						1.3																							
Water Surface Slope (Channel) (ft/ft)	0.0068						0..65						0.0074																							
BF slope (ft/ft)	0.0065												0.0039																							
[3]Ri% / Ru% / P% / G% / S%													38%	10%	47%	10%																				
[3]SC% / Sa% / G% / C% / B% / Be%													4%	19%	65%	11%	0%	1%																		
[3]d16 / d35 / d50 / d84 / d95 /													0.2	14.2	21.1	58.2	90																			
[2]% of Reach with Eroding Banks							1%						21%																							
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

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)	20.6	22.8	23.3	24.6	0.9	3	18.4	22.33	23.4	25.2	3.523	3	20.79	23.08	23.99	24.44	1.992	3																		
Floodprone Width (ft)	47	54	51	63	6.2	3	51	55.33	52	63	6.658	3	47	53.67	51	63	8.327	3																		
Bankfull Mean Depth (ft)	1.3	1.4	1.4	1.5	0.1	3	1.3	1.467	1.4	1.7	0.208	3	1.281	1.425	1.339	1.655	0.201	3																		
[1]Bankfull Max Depth (ft)	1.8	1.9	1.8	2.1	0.2	3	2	2.167	2	2.5	0.289	3	2.06	2.197	2.18	2.35	0.146	3																		
Bankfull Cross Sectional Area (ft^2)	30.8	31.89	31.2	33.7	1.3	3	25.2	32.53	29.7	42.7	9.088	3	27.84	32.95	31.3	39.71	6.102	3																		
Width/Depth Ratio	13.8	16.4	17.4	18	0.8	3	13.4	15.57	14.9	18.4	2.566	3	14.5	16.37	15.52	19.09	2.41	3																		
Entrenchment Ratio	2	2.3	2.5	2.5	0.1	3	2.2	2.467	2.5	2.7	0.252	3	1.923	2.334	2.453	2.626	0.366	3																		
[1]Bank Height Ratio	1	1	1	1	0	3	1	1	1	1	0	3	1.051	1.059	1.058	1.069	0.009	3																		
Profile																																				
Riffle Length (ft)	20.0	68.0	76.0	97.0	23.0	13	16.0		37.6	86.8			13.0	65.8	69.2	112.0	29.3	17																		
Riffle Slope (ft/ft)	0.003	0.009	0.008	0.019	0.004	13	0.001		0.012	0.027			0.002	0.011	0.007	0.059	0.013	17																		
Pool Length (ft)	12.0	22.0	23.0	33.0	6.0	13	12.0		29.2	44.3			29.4	57.0	50.1	160.4	30.6	19																		
Pool Max depth (ft)	2.2	2.5		2.8		2							1.8	3.1	2.8	5.9	0.9	19																		
Pool Spacing (ft)	56.0	117.0	123.0	150.0	25.0	12	52.0		144.0	317.0			76.9	121.5	116.5	183.7	30.7	18																		
Pattern																																				
Channel Beltwidth (ft)	20	66	62	97	24	10																														
Radius of Curvature (ft)	35	49	43	80	14	12																														
Rc:Bankfull width (ft/ft)	1.5	2.2	2.2	3.3																																
Meander Wavelength (ft)	158	221	229	261	36	10																														
Meander Width Ratio	1.9	3.1	2.7	4.8																																
Additional Reach Parameters																																				
Rosgen Classification	C4						C4						C4																							
Channel Thalweg length (ft)	2182						2182						2182																							
Sinuosity (ft)	1.18						1.18						1.18																							
Water Surface Slope (Channel) (ft/ft)	0.0068						0.0067						0.0066																							
BF slope (ft/ft)	0.0065						0.0067						0.0068																							
[3]Ri% / Ru% / P% / G% / S%													54%	2%	32%	16%																				
[3]SC% / Sa% / G% / C% / B% / Be%													11%	10%	71%	7%	0%	1%																		
[3]d16 / d35 / d50 / d84 / d95 /													1.6	6.22	14.06	41.34	97.76																			
[2]% of Reach with Eroding Banks	0%												1%																							
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

Appendix E. Hydrologic Data

Table 12. Verification of Bankfull Events

Table 12. Verification of Bankfull Events Chapel Creek Stream Restoration-Project No. 77			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo #**
November 17, 2009	November 13, 2009	Site visit to evaluate indicators of stage after storm events	N/A
September 30, 2010	September 30, 2010	NWS COOP Station and site visit for confirmation	Photo 14

A stream crest gauge was installed on the site on November 1, 2010. The data for the rainfall event was collected from NWS Cooperative Observer Station Asheboro 2 W (310286) located in Asheboro, NC. The daily observed precipitation on September 30, 2010 shows rainfall of 3.81 inches over a 24 hour period which is greater than the bankfull storm event for the project location. Photo 14 shows the wrack line on the bank providing evidence of the bankfull event on the project site.

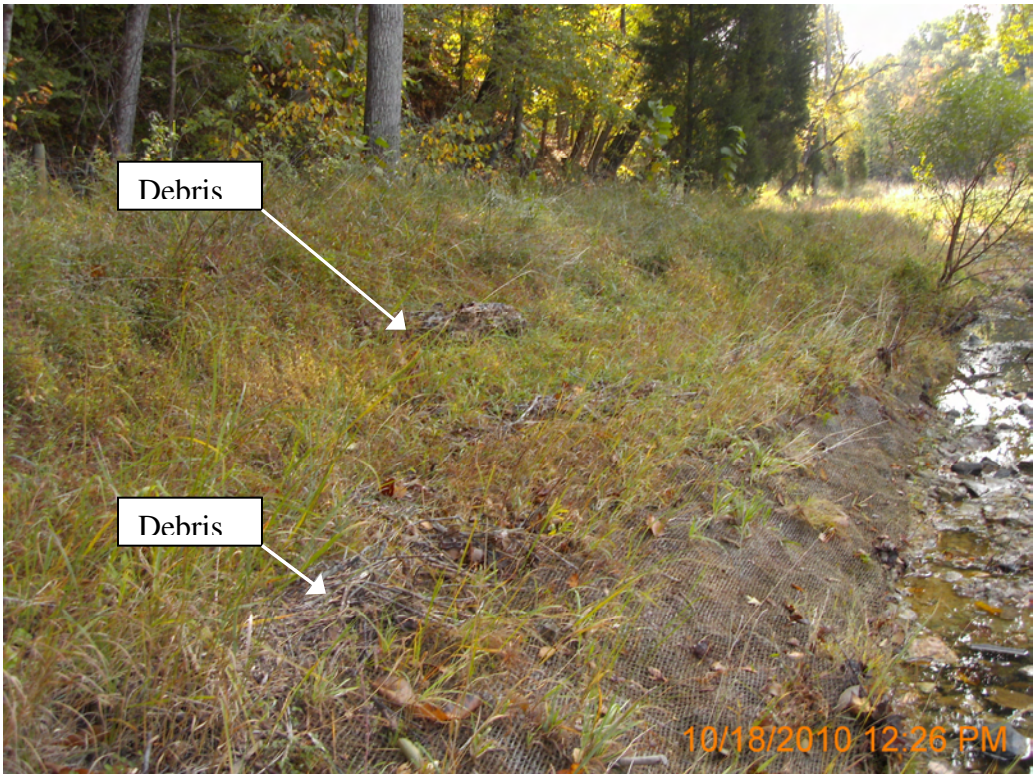


Photo 14. Wrack line

NOWData - NOAA Online Weather Data

ASHEBORO 2 W (310286)
Daily Almanac
Date: Sep 30, 2010

Daily Values	Observed	Normal	Record/Year	Prev Year
Max Temperature	76	76	90 in 1954	71
Min Temperature	63	56	38 in 1967+	50
Avg Temperature	69.5	66	80.0 in 1954+	60.5
Precipitation	3.81	0.13	3.81 in 2010	0.00
New Snowfall	-	-	0.0 in 2009+	0.0
Snow Depth	-	-	0 in 2009+	0
HDD (base 65)	0	2	13 in 1967+	4
CDD (base 65)	5	3	15 in 1954+	0

Month-To-Date	Observed	Normal	Record/Year	Prev Year
Avg Max Temperature	85.4	79.6	88.2 in 1933	78.3
Avg Min Temperature	63.3	61.1	54.9 in 1967	60.3
Avg Temperature	74.4	70.4	76.5 in 1933	69.3
Total Precipitation	6.63	4.22	14.16 in 1928	3.69
Total Snowfall	-	-	0.0 in 2009	0.0
Avg Snow Depth	-	-	0 in 2009	0
Total HDD	3	15	68 in 1928	14
Total CDD	293	175	355 in 1931	150

+ indicates record also occurred in previous years (last occurrence listed).

Official data and data for additional locations and years are available from the Regional Climate Centers and the National Climatic Data Center.

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.40	0.64	0.80	1.10	1.37	1.61	1.72	2.09	2.48	2.89	3.38	3.80	4.35	4.95	6.67	8.24	10.41	12.46
2	0.48	0.76	0.96	1.32	1.66	1.96	2.09	2.52	2.99	3.49	4.07	4.56	5.19	5.89	7.86	9.69	12.18	14.53
5	0.55	0.89	1.12	1.59	2.04	2.43	2.60	3.14	3.74	4.37	5.05	5.61	6.31	7.08	9.28	11.26	13.94	16.40
10	0.60	0.97	1.22	1.77	2.31	2.77	2.98	3.61	4.34	5.05	5.80	6.43	7.19	8.00	10.41	12.47	15.29	17.84
25	0.66	1.06	1.34	1.98	2.64	3.20	3.47	4.24	5.14	5.97	6.82	7.55	8.39	9.25	11.94	14.07	17.07	19.69
50	0.70	1.11	1.41	2.12	2.88	3.53	3.85	4.72	5.79	6.71	7.61	8.43	9.35	10.23	13.14	15.31	18.42	21.09
100	0.73	1.16	1.47	2.25	3.10	3.84	4.21	5.22	6.45	7.45	8.43	9.34	10.32	11.22	14.36	16.53	19.74	22.43
200	0.76	1.20	1.51	2.36	3.31	4.15	4.58	5.71	7.14	8.22	9.26	10.26	11.32	12.23	15.59	17.76	21.05	23.73
500	0.78	1.24	1.56	2.48	3.56	4.54	5.06	6.38	8.09	9.27	10.39	11.53	12.69	13.60	17.27	19.39	22.77	25.42
1000	0.80	1.26	1.58	2.56	3.74	4.83	5.42	6.90	8.85	10.10	11.28	12.52	13.77	14.67	18.58	20.65	24.08	26.69

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.