McCain Site
Stream Restoration Monitoring Report
EEP Project # 443
Monitoring Year – 01
2009

Submitted to:

NCDENR-EEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

December 2009

Design and Monitoring Firm

Landmark Center II, Suite 220
4601 Six Forks Road
Raleigh, NC 27609
Phone: (919) 278-2514
Fax: (919) 783-9266

Project Contact: Adam Spiller
Email: adam.spiller@kci.com
KCI Project No: 12053743E

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT 1

2.0 METHODOLOGY 2

3.0 REFERENCES 2

APPENDIX A – GENERAL FIGURES AND PLAN VIEW

Figure 1. Vicinity Map 4
Figure 2. Current Condition Plan View 5

APPENDIX B – GENERAL PROJECT TABLES

Table 1. Project Restoration Components 9
Table 2. Project Activity and Reporting History 9
Table 3. Project Contacts Table 9
Table 4. Project Attribute Table 10

APPENDIX C – VEGETATION ASSESSMENT DATA

Table 5. Vegetation Plot Mitigation Success Summary Table 12
Table 6. Vegetation Metadata Table 12
Table 7. Stem Count Total and Planted by Plot and Species 13
Vegetation Monitoring Plot Photos 14

APPENDIX D – STREAM ASSESSMENT DATA

Stream Station Photos 19
Table 8 Visual Morphological Stability Assessment 29
Table 9. Verification of Bankfull Events 32
Cross-Section Plots
Longitudinal Profile Plot
Pebble Count Plots.

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

In 2003, the North Carolina Department of Transportation identified the McCain Site as a potential stream restoration site. This site was transferred to the North Carolina Ecosystem Enhancement Program prior to the creation of the restoration plan. The McCain site is located in Randolph County, North Carolina. The 0.9 mi^2 watershed is located within the USGS 14-digit HUC 030401030500050 and the NCDWQ Sub-basin 03-07-09 of the Lower Yadkin River Basin. The project restored approximately 2,470 linear feet of channel on Unnamed Tributary to Back Creek. Project construction was completed in early 2009. The project goals and objectives are listed below.

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.
- Reduce land and riparian vegetation loss resulting from lateral erosion and bed degradation.
- Improve aquatic and terrestrial 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.

The riparian buffer was planted with native bare root trees and shrubs, and the stream banks were planted with four different species of live stakes. Seven vegetation monitoring plots were established following the EEP-Carolina Vegetation Survey (CVS) vegetation monitoring protocol during the baseline conditions survey. The first-year monitoring counted an average of 497 planted stems/acre and found adequate herbaceous cover throughout the conservation easement. The project buffer contained a large amount of ragweed (*Ambrosia* sp.), but this does not seem to be affecting plant survival. The first year of monitoring found the vegetation component of the project to be on track to meeting the success criteria.

The first year of monitoring found the stream to be functional and stable throughout most of the project. The surveyed cross-sections and longitudinal profile have not changed significantly from the as-built conditions over the course of the stream monitoring. The stream has experienced some bed degradation, specifically between Stations 13+30 to 14+05 and 15+85 to 16+20. All of the in-stream structures are functioning as designed problems and the stream is stable.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on the EEPs website. All raw data supporting the tables and figures in the appendices are available upon request.

2.0 METHODOLOGY

The Level 1 CVS-EEP protocol (http://cvs.bio.unc.edu/methods.htm) was used to collect vegetation data from the McCain Site.

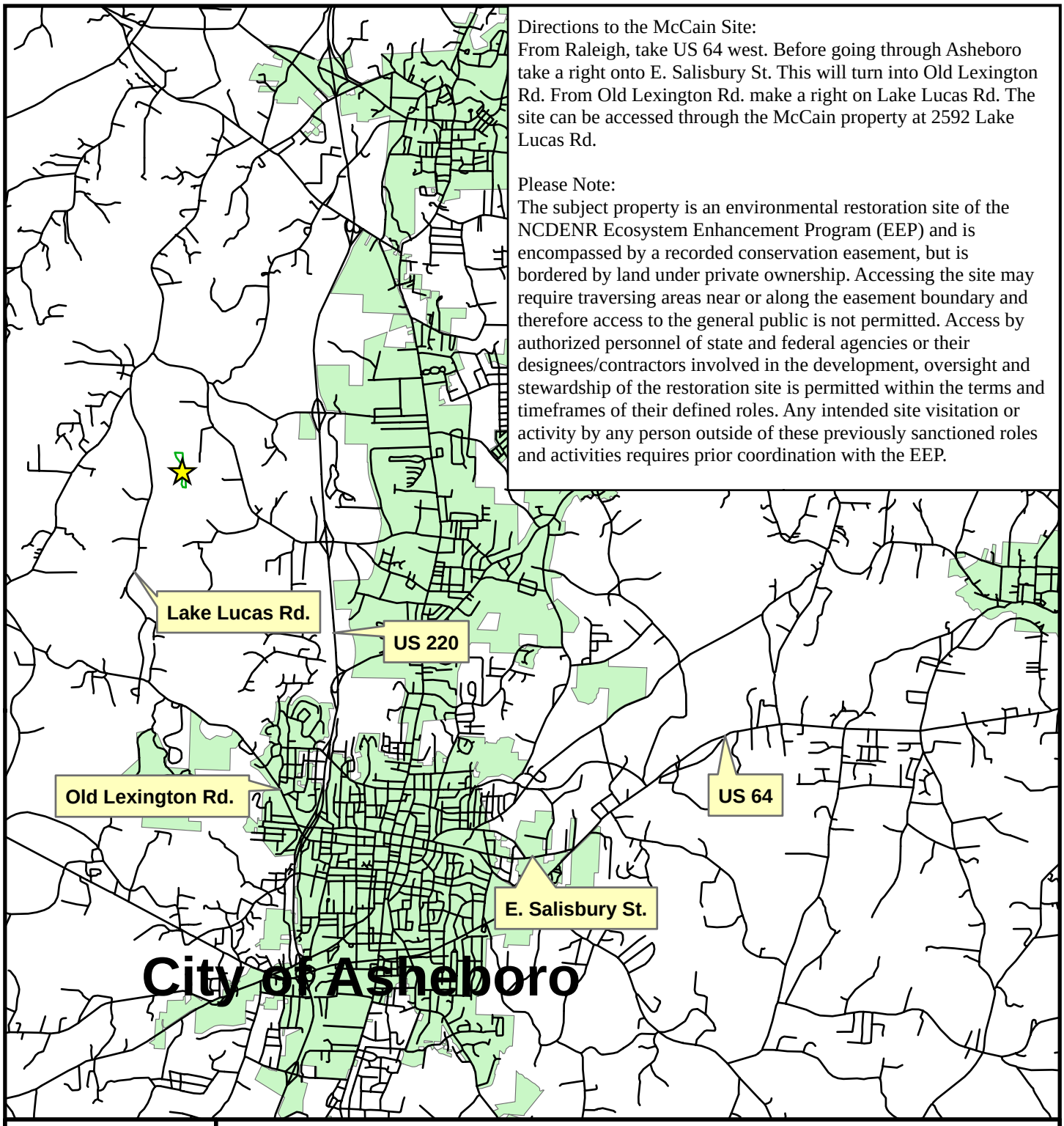
3.0 REFERENCES

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

Weakley, A. S. 2006. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas. (http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2006-Jan.pdf)

Appendix A

General Figures and Plan Views



Directions to the McCain Site:
From Raleigh, take US 64 west. Before going through Asheboro take a right onto E. Salisbury St. This will turn into Old Lexington Rd. From Old Lexington Rd. make a right on Lake Lucas Rd. The site can be accessed through the McCain property at 2592 Lake Lucas Rd.

Please Note:
The subject property is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access to the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with the EEP.

Figure 1. Vicinity Map

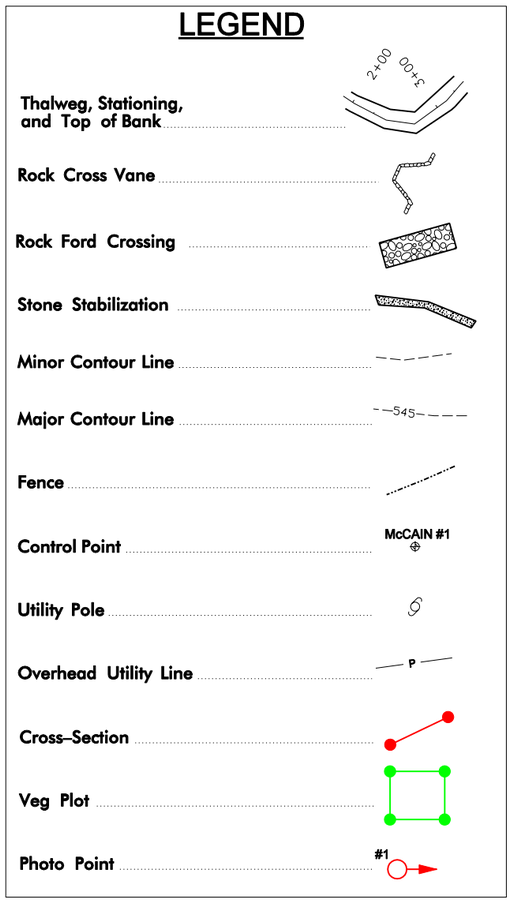
Ecosystem Enhancement Program

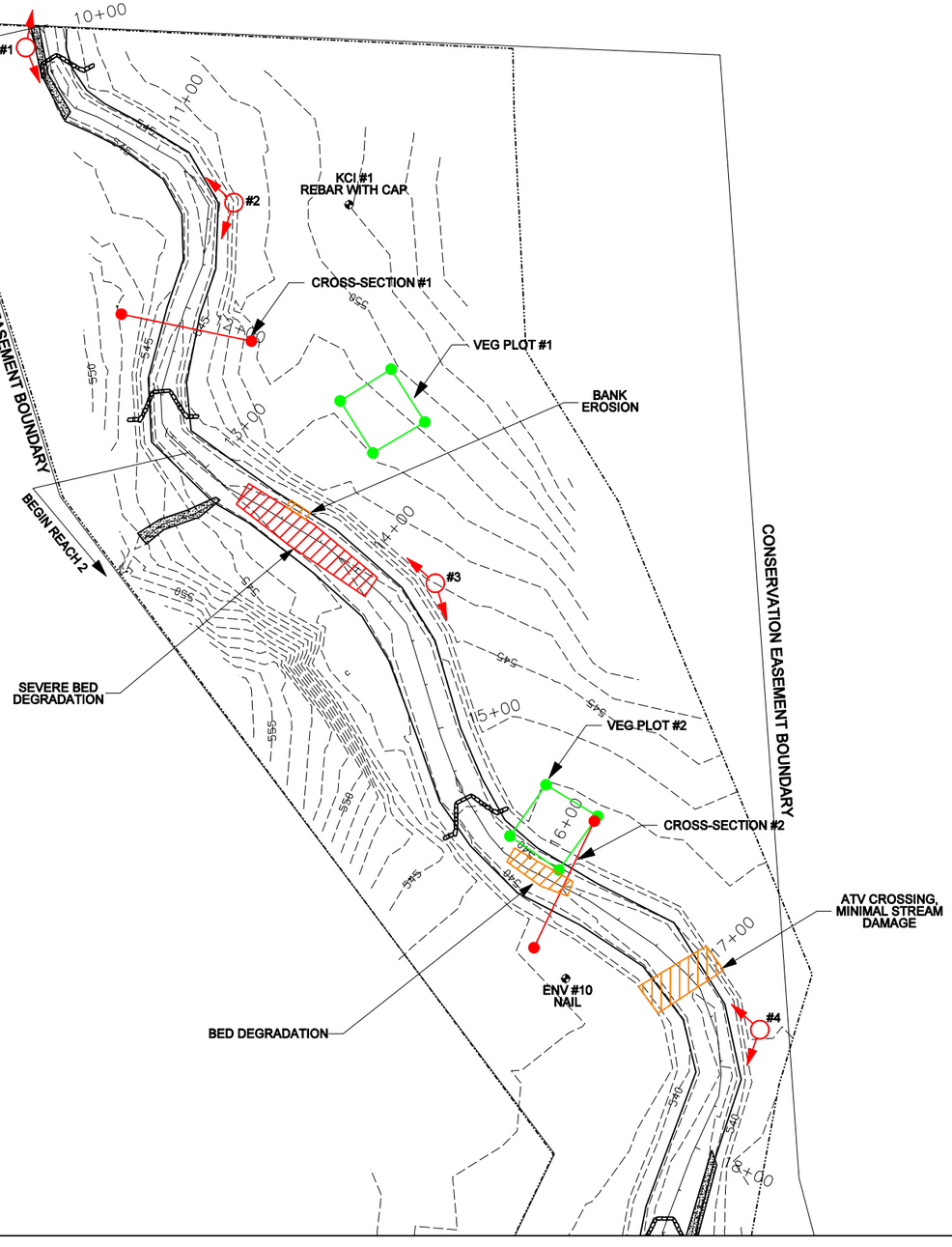
★ Project Site

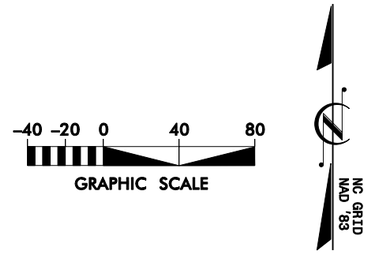
N
W E
S

1 inch equals 1.5 miles

3 1.5 0 3
Miles







MATCHLINE SEE SHEET 2

MATCHLINE SEE SHEET 2

SYM.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

Ecosystem Enhancement Program

KCI ENGINEERS • PLANNERS • SCIENTISTS
ASSOCIATES OF NC
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

McCAIN PROPERTY - UT TO BACK CREEK
STREAM RESTORATION PROJECT
EEP PROJECT #443, MY-01
SOPHIA, RANDOLPH COUNTY, NORTH CAROLINA
STATION 10+00 TO STATION 18+52

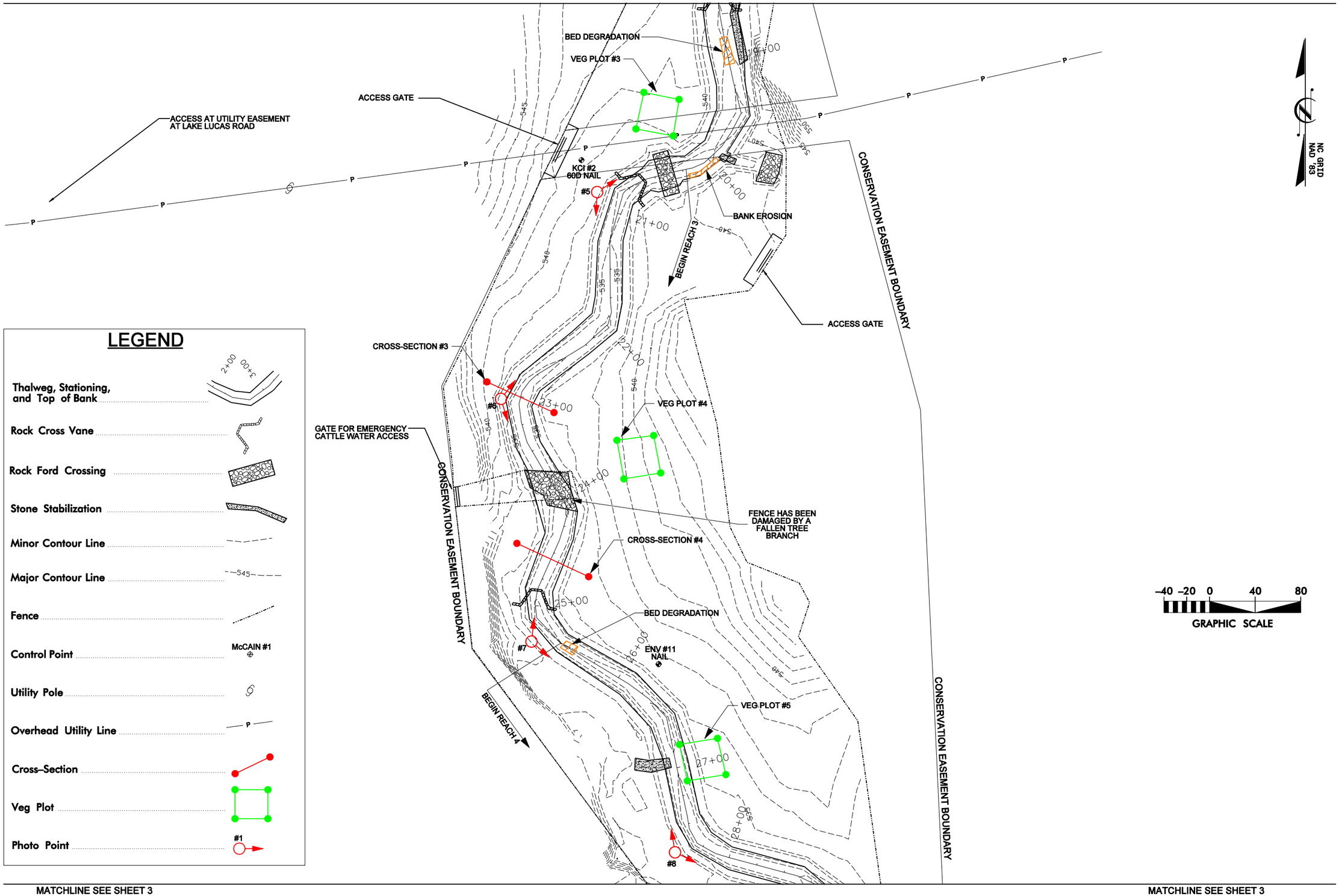
DATE: DECEMBER 2009
SCALE: 1" = 40'

CURRENT CONDITION PLAN VIEW

SHEET 1 OF 3

MATCHLINE SEE SHEET 1

MATCHLINE SEE SHEET 1



LEGEND

- Thalweg, Stationing, and Top of Bank
- Rock Cross Vane
- Rock Ford Crossing
- Stone Stabilization
- Minor Contour Line
- Major Contour Line
- Fence
- Control Point (McCAIN #1)
- Utility Pole
- Overhead Utility Line
- Cross–Section
- Veg Plot
- Photo Point (#1)

MATCHLINE SEE SHEET 3

MATCHLINE SEE SHEET 3

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

McCAIN PROPERTY - UT TO BACK CREEK STREAM RESTORATION PROJECT

EEP PROJECT #443, MY-01
SOPHIA, RANDOLPH COUNTY, NORTH CAROLINA
STATION 18+52 TO STATION 28+80

DATE: DECEMBER 2009
SCALE: 1" = 40'

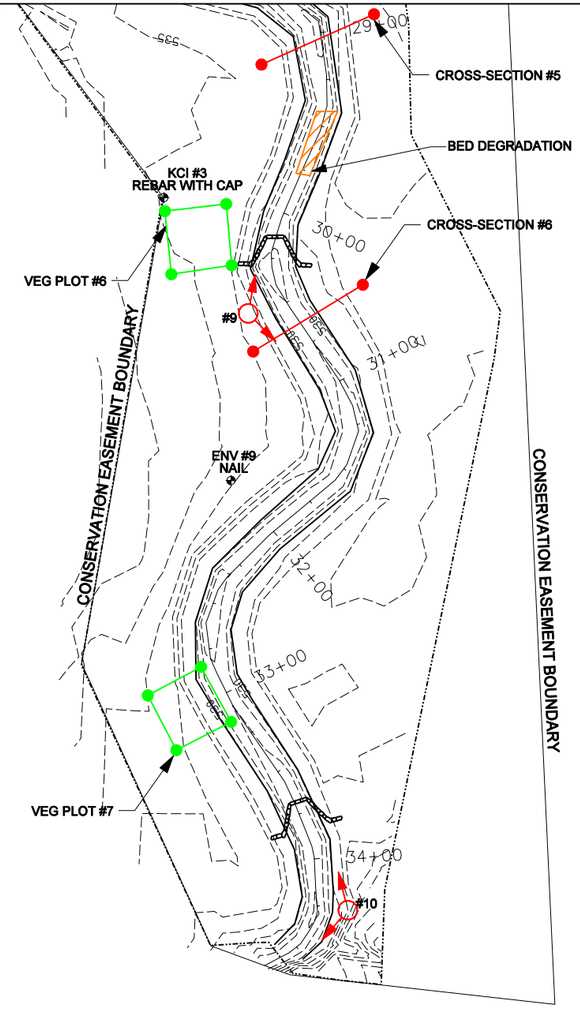
CURRENT CONDITION PLAN VIEW

MATCHLINE SEE SHEET 2

MATCHLINE SEE SHEET 2

LEGEND

- Thalweg, Stationing, and Top of Bank
- Rock Cross Vane
- Rock Ford Crossing
- Stone Stabilization
- Minor Contour Line
- Major Contour Line
- Fence
- Control Point (McCAIN #1)
- Utility Pole
- Overhead Utility Line (P)
- Cross–Section
- Veg Plot
- Photo Point (#1)



GRAPHIC SCALE: –40 –20 0 40 80

NC GRID NAD '83

CROSS-SECTION COORDINATES

		NORTHING	EASTING	ELEVATION
CROSS-SECTION 1	LB	734735.9381	1746381.8929	548.39
	RB	734750.6724	1746310.7986	548.15
CROSS-SECTION 2	LB	734473.5603	1746569.4449	543.01
	RB	734404.3635	1746536.4518	543.18
CROSS-SECTION 3	LB	733888.1215	1746462.6269	537.42
	RB	733914.9934	1746403.7981	539.76
CROSS-SECTION 4	LB	733744.2532	1746493.0029	536.98
	RB	733773.4611	1746430.0640	536.72
CROSS-SECTION 5	LB	733469.0412	1746732.3871	534.81
	RB	733442.4984	1746672.9621	536.24
CROSS-SECTION 6	LB	733326.2237	1746726.4775	534.05
	RB	733290.9942	1746668.5976	534.22

VEGETATION PLOT COORDINATES

	NORTHING	EASTING
VEGETATION PLOT #1	734720.5835	1746458.3211
	734703.2431	1746430.4921
	734674.8052	1746448.3808
	734691.7336	1746476.7933
VEGETATION PLOT #2	734493.4077	1746543.0044
	734476.2316	1746571.3042
	734446.8668	1746550.0446
	734465.3995	1746523.2910
VEGETATION PLOT #3	734162.6573	1746572.2892
	734168.8762	1746541.4157
	734136.8391	1746534.4487
	734130.7241	1746567.2099
VEGETATION PLOT #4	733829.9902	1746523.9181
	733863.9420	1746517.8217
	733868.0456	1746550.0363
	733835.2289	1746556.1683
VEGETATION PLOT #5	733565.1648	1746579.5309
	733597.1084	1746572.6516
	733602.5131	1746606.0003
	733570.6933	1746613.3063
VEGETATION PLOT #6	733365.1116	1746621.9527
	733331.7960	1746625.4098
	733336.5329	1746657.2544
	733368.8913	1746654.3806
VEGETATION PLOT #7	733124.4687	1746641.0621
	733095.4500	1746656.9404
	733080.5213	1746628.0131
	733109.4479	1746612.9452

NO.	DESCRIPTION	DATE	APPROVED
	REVISIONS		

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

McCAIN PROPERTY - UT TO BACK CREEK
STREAM RESTORATION PROJECT
EEP PROJECT #443, MY-01
SOPHIA, RANDOLPH COUNTY, NORTH CAROLINA
STATION 28+80 TO STATION 34+70

DATE: DECEMBER 2009
SCALE: 1" = 40'

CURRENT CONDITION PLAN VIEW

SHEET 3 OF 3

Appendix B

General Project Tables

Table 1. Project Restoration Components
Project Number and Name: 443 - McCain Site

Segment/ Reach ID	Existing Linear Feet	Type	Approach	Linear Feet	Stationing	Comment
Reach 1	490	R	P2	286	10+00 - 12+86	
Reach 2	515	R	P2	736	12+86 - 20+22	Project footage includes 53' of channel through easement exception.
Reach 3	1,440	R	P2	519	20+22 - 25+41	
Reach 4		R	P2	929	25+41 - 34+70	

R = Restoration P2 = Priority 2

Table 2. Project Activity and Reporting History
Project Number and Name: 443 - McCain Site

Activity or Report	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/segments1-4	N/A	Mar 09
Mitigation Plan / As-Built (Year 0 Monitoring - Baseline)	May 09	Jul 09
Year 1 Monitoring	Oct 09	Dec 09

Table 3. Project Contacts Table
Project Number and Name: 443 - McCain Site

Design Firm	KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266
Construction and Planting Contractor	Carolina Environmental Contracting, Inc. PO Box 1905 Mount Airy, NC 27030 Contact: Mr. Stephen James Phone: (336) 320-3849 Fax: (336) 320-3854
Nursery Stock Suppliers	Viginia Department of Forestry PO Box 160 Crimora, VA 24431 Phone: (504) 363-5732
Monitoring Performers	
MY-00, 01	KCI Associates of NC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Attribute Table Project Number and Name: 443 - McCain Site				
Project County	Randolph County			
Physiographic Region	Piedmont			
Ecoregion	Carolina Slate Belt			
Project River Basin	Yadkin			
USGS HUC for Project (14 digit)	03040103050050			
NCDWQ Sub-basin for Project	03-07-09			
Within extent of EEP Watershed Plan?	No			
WRC 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	Reach 3	Reach 4
Drainage Area	0.88 sq.mi.			
Stream Order	First	First	First	First
Restored length (feet)	286	736	519	929
Perennial or Intermittent	Perennial	Perennial	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	C4	C4
Valley Type	U	U	U	U
Valley Slope	0.0066	0.0066	0.0066	0.0066
Valley side slope range (e.g. 2-3%)	U	U	U	U
Valley toe slope range (e.g. 2-3%)	U	U	U	U
Trout waters designation	No			
Species of concern, endangered etc.? (Y/N)	No			
Dominant soil series and characteristics				
Series	Dogue Sandy Loam			
Depth Clay%	U	U	U	U
K	U	U	U	U
T	U	U	U	U

"N/A" is for items that do not apply.

"-" is for items that are unavailable.

"U" is for items that are unknown.

Appendix C

Vegetation Assessment Data

Table 5. Vegetation Plot Mitigation Success Summary Table
Project Number and Name: 443 - McCain Site

Vegetation Plot ID	Monitoring Year 01 Planted Stem Density (stems/acre)	Vegetation Survival Threshold Met?
1	283	Yes
2	850	Yes
3	728	Yes
4	405	Yes
5	486	Yes
6	283	Yes
7	445	Yes

Table 6. Vegetation Metadata Table
Project Number and Name: 443 – McCain Site

Report Prepared By	Brian Roberts
Date Prepared	11/12/2009 16:25
Database Name	KCI-2008-cvs-eep-entrytool-v2.2.7-MTL.mdb
Database Location	C:\Users\broberts\Desktop\KCI_2008-entrytool-v2.2.7

PROJECT SUMMARY----------

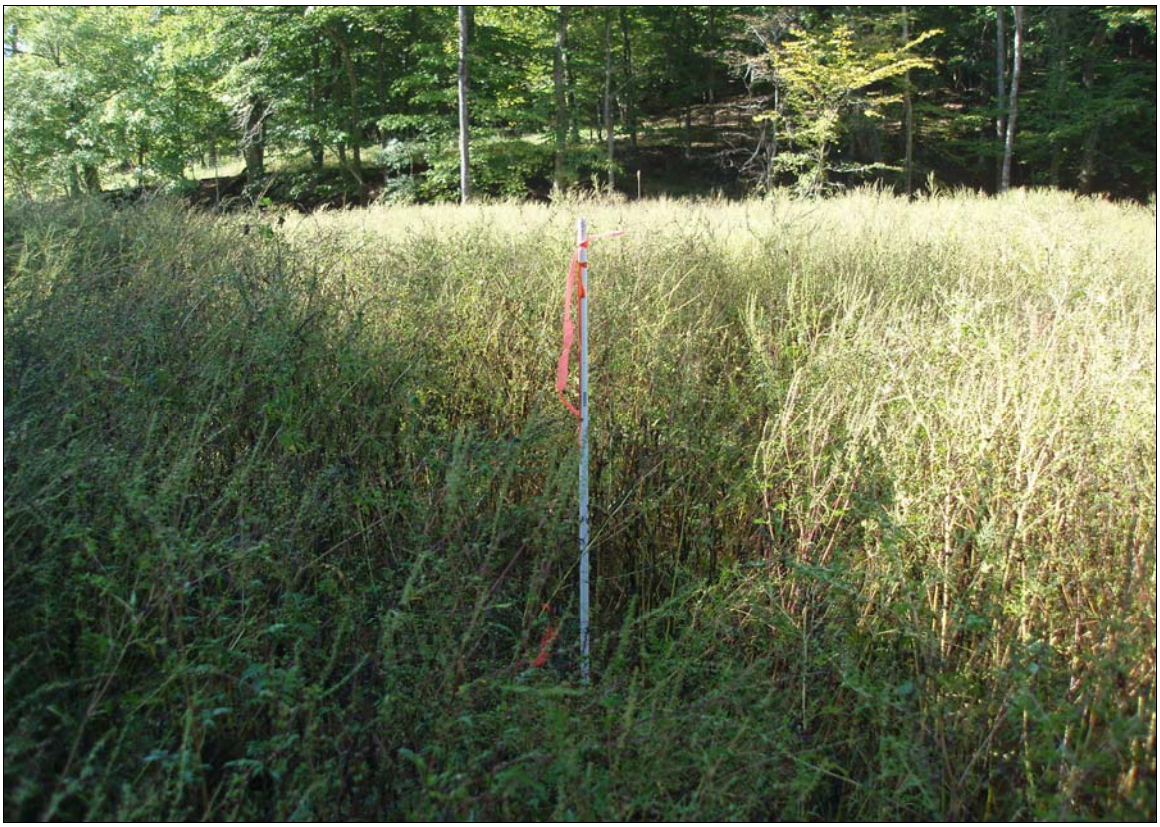
Project Code	Project Name	Description	Length (ft)	Stream-to-Edge Width (ft)	Area (sq m)	Required Plots (calculated)	Sampled Plots
443	McCain Site	Stream restoration site in Randolph Co., NC.	2,450	50	22,759	7	7

Table 7. Stem Count Total and Planted by Plot and Species
Project Number and Name: 443 – McCain Site

			Current Plot Data (MY1 2009)																					Annual Means					
			443-A-0001			443-A-0002			443-A-0003			443-A-0004			443-A-0005			443-A-0006			443-A-0007			MY1 (2009)			MY0 (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		2	2		4	4		1	1		19	19		20	20
Cornus amomum	silky dogwood	Shrub				8	8	8		1	1		1	1	3	3	3		2	2	4	5	5	15	20	20	21	26	26
Fraxinus pennsylvanica	green ash	Tree					2	2		1	1		1	1											4	4		4	4
Liriodendron tulipifera	tuliptree	Tree								3	3		2	2								1	1		6	6		6	6
Platanus occidentalis	American sycamore	Tree					1	1		5	5					1	1		1	1		1	1		9	9		9	9
Quercus	oak	Shrub Tree																										7	7
Quercus falcata	southern red oak	Tree								1	1		2	2											3	3		4	4
Quercus pagoda	cherrybark oak	Tree								1	1														1	1			
Quercus phellos	willow oak	Tree		5	5								1	1		1	1								7	7		2	2
Salix nigra	black willow	Tree				8	8	8							1	1	1							9	9	9	9	9	9
Salix sericea	silky willow	Shrub Tree				1	1	1							4	4	4				3	3	3	8	8	8	8	8	8
Sambucus	elderberry	Shrub Tree																									1	1	1
Unknown		unknown																									1	2	2
		Stem count	0	7	7	17	21	21	0	18	18	0	10	10	8	12	12	0	7	7	7	11	11	32	86	86	40	98	98
		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	6	6	3	6	6	0	3	3	2	5	5	3	10	10	5	12	12
		Stems per ACRE	0	283.3	283.3	688	849.8	849.8	0	728.4	728.4	0	404.7	404.7	323.7	485.6	485.6	0	283.3	283.3	283.3	445.2	445.2	185	497.2	497.2	231.2	566.6	566.6

P-LS - Planted Live Stakes Stems P-all - Planted Stems Total (with Live Stakes) T - Total (Planted Including Live Stakes and Volunteers)

Vegetation Monitoring Plot Photos



Vegetation Plot 1: 9/29/09 – MY-01

Vegetation Plot 2: 9/29/09 – MY-01

Vegetation Plot 3: 9/29/09 – MY-01

Vegetation Plot 4: 9/29/09 – MY-01

Vegetation Plot 5: 9/29/09 – MY-01

Vegetation Plot 6: 9/29/09 – MY-01

Vegetation Plot 7: 9/29/09 – MY-01

Vegetation Plot 7 Supplemental Photo: 9/29/09 – MY-01

Appendix D

Stream Assessment Data

Appendix D

Stream Assessment Data

Stream Station Photos

Photo Point 1u: View looking upstream towards the beginning of the project. 11/17/09 – MY-01

Photo Point 1d: View looking downstream near Station 10+00. 11/17/09 – MY-01

Photo Point 2u: View looking upstream taken near Station 11+50. 11/17/09 – MY-01

Photo Point 2d: View looking downstream taken near Station 11+50. 11/17/09 – MY-01

Photo Point 3u: View looking upstream near Station 14+30. 11/17/09 – MY-01

Photo Point 3d: View looking downstream near Station 14+30. 11/17/09 – MY-01

Photo Point 4u: View looking upstream near Station 17+35. 11/17/09 – MY-01

Photo Point 4d: View looking downstream near Station 17+35. 11/17/09 – MY-01

Photo Point 5u: View looking upstream near Station 21+00. 11/17/09 – MY-01

Photo Point 5d: View looking downstream near Station 21+00. 11/17/09 – MY-01

Photo Point 6u: View looking upstream near Station 23+00. 11/17/09 – MY-01

Photo Point 6d: View looking downstream near Station 23+00. 11/17/09 – MY-01

Photo Point 7u: View looking upstream near Station 25+25. 11/17/09 – MY-01

Photo Point 7d: View looking downstream near Station 25+25. 11/17/09 – MY-01

Photo Point 8u: View looking upstream near Station 27+75. 11/17/09 – MY-01

Photo Point 8d: View looking downstream near Station 27+75. 11/17/09 – MY-01

Photo Point 9u: View looking upstream near Station 30+30. 11/17/09 – MY-01

Photo Point 9d: View looking downstream near Station 30+30. 11/17/09 – MY-01

Photo Point 10u: View looking upstream near Station 34+25. 11/17/09 – MY-01

Photo Point 10d: View looking downstream towards the end of the project. 11/17/09 – MY-01

Table 8a. Qualitative Visual Stability Assessment
Project Number and Name: 443 – McCain Site
Segment/Reach: Reach 1

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	2	2		100%	
	2. Armor stable (e.g. no displacement)?	2	2		100%	
	3. Facet grade appears stable?	2	2		100%	**100%**
	4. Minimal evidence of embedding/fining?	2	2		100%	
	5. Length appropriate?	2	2		100%	
B. Pools	1. Present? (e.g. no severe aggradation)	3	3		100%	
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)	3	3		100%	**100%**
	3. Length appropriate?	3	3		100%	
C. Thalweg	1. Upstream of meander bend centering?	2	2		100%	**100%**
	2. Downstream of meander centering?	3	3		100%	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	3	3		100%	
	2. Of those eroding, # w/ concomitant point bar formation?					**100%**
	3. Apparent Rc within spec?	3	3			
	4. Sufficient floodplain access and relief?	3	3		100%	
E. Bed General	1.General channel bed aggradation areas (bar formation)			0/0	100%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?			0/0	100%	**100%**
F. Bank	1.Actively eroding, wasting, or slumping bank			0/0	100%	**100%**
G. Vanes	1. Free of back or arm scour?	2	2		100%	
	2. Height appropriate?	2	2		100%	**100%**
	3. Angle and geometry appear appropriate?	2	2		100%	
	4. Free of piping or other structural failures?	2	2		100%	

Table 8a. Qualitative Visual Stability Assessment
Project Number and Name: 443 – McCain Site
Segment/Reach: Reach 1

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	2	2		100%	
	2. Armor stable (e.g. no displacement)?	2	2		100%	
	3. Facet grade appears stable?	2	2		100%	**100%**
	4. Minimal evidence of embedding/fining?	2	2		100%	
	5. Length appropriate?	2	2		100%	
B. Pools	1. Present? (e.g. no severe aggradation)	3	3		100%	
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)	3	3		100%	**100%**
	3. Length appropriate?	3	3		100%	
C. Thalweg	1. Upstream of meander bend centering?	2	2		100%	**100%**
	2. Downstream of meander centering?	3	3		100%	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	3	3		100%	
	2. Of those eroding, # w/ concomitant point bar formation?					**100%**
	3. Apparent Rc within spec?	3	3			
	4. Sufficient floodplain access and relief?	3	3		100%	
E. Bed General	1.General channel bed aggradation areas (bar formation)			0/0	100%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?			0/0	100%	**100%**
F. Bank	1.Actively eroding, wasting, or slumping bank			0/0	100%	**100%**
G. Vanes	1. Free of back or arm scour?	2	2		100%	
	2. Height appropriate?	2	2		100%	**100%**
	3. Angle and geometry appear appropriate?	2	2		100%	
	4. Free of piping or other structural failures?	2	2		100%	

Table 8c. Qualitative Visual Stability Assessment
Project Number and Name: 443 – McCain Site
Segment/Reach: Reach 3

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	4	4		100%	
	2. Armor stable (e.g. no displacement)?	4	4		100%	
	3. Facet grade appears stable?	4	4		100%	**100%**
	4. Minimal evidence of embedding/fining?	4	4		100%	
	5. Length appropriate?	4	4		100%	
B. Pools	1. Present? (e.g. no severe aggradation)	5	5		100%	
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)	3	5		60%	**87%**
	3. Length appropriate?	5	5		100%	
C. Thalweg	1. Upstream of meander bend centering?	5	5		100%	**100%**
	2. Downstream of meander centering?	5	5		100%	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	5	5		100%	
	2. Of those eroding, # w/ concomitant point bar formation?				100%	**100%**
	3. Apparent Rc within spec?	5	5		100%	
	4. Sufficient floodplain access and relief?	5	5		100%	
E. Bed General	1.General channel bed aggradation areas (bar formation)			0/0	100%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?			0/0	100%	**100%**
F. Bank	1.Actively eroding, wasting, or slumping bank			0/0	100%	**100%**
G. Vanes	1. Free of back or arm scour?	2	2		100%	
	2. Height appropriate?	2	2		100%	**100%**
	3. Angle and geometry appear appropriate?	2	2		100%	
	4. Free of piping or other structural failures?	2	2		100%	

Table 8d. Qualitative Visual Stability Assessment
Project Number and Name: 443 – McCain Site
Segment/Reach: Reach 4

Feature Category	Metric (per As-built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	7	7		100%	**100%**
	2. Armor stable (e.g. no displacement)?	7	7		100%	
	3. Facet grade appears stable?	7	7		100%	
	4. Minimal evidence of embedding/fining?	7	7		100%	
	5. Length appropriate?	7	7		100%	
B. Pools	1. Present? (e.g. no severe aggradation)	7	7		100%	**95%**
	2. Sufficiently deep (Dmax pool:Mean Bkf > 1.6?)	6	7		86%	
	3. Length appropriate?	7	7		100%	
C. Thalweg	1. Upstream of meander bend centering?	7	7		100%	**100%**
	2. Downstream of meander centering?	8	8		100%	
D. Meanders	1. Outer bend in state of limited/controlled erosion?	7	7		100%	**100%**
	2. Of those eroding, # w/ concomitant point bar formation?				100%	
	3. Apparent Rc within spec?	7	7		100%	
	4. Sufficient floodplain access and relief?	7	7		100%	
E. Bed General	1.General channel bed aggradation areas (bar formation)			0/0	100%	**98%**
	2. Channel bed degradation - areas of increasing down cutting or head cutting?			2/35	96%	
F. Bank	1.Actively eroding, wasting, or slumping bank			0/0	100%	**100%**
G. Vanes	1. Free of back or arm scour?	2	2		100%	**100%**
	2. Height appropriate?	2	2		100%	
	3. Angle and geometry appear appropriate?	2	2		100%	
	4. Free of piping or other structural failures?	2	2		100%	

Table 9. Verification of Bankfull Events
Project Number and Name: 443 - McCain Site

Date of Data Collection	Date of Occurance	Method	Photo Number
11/17/2009	11/13/2009	Site visit to evaluate indicators of stage after storm events	N/A

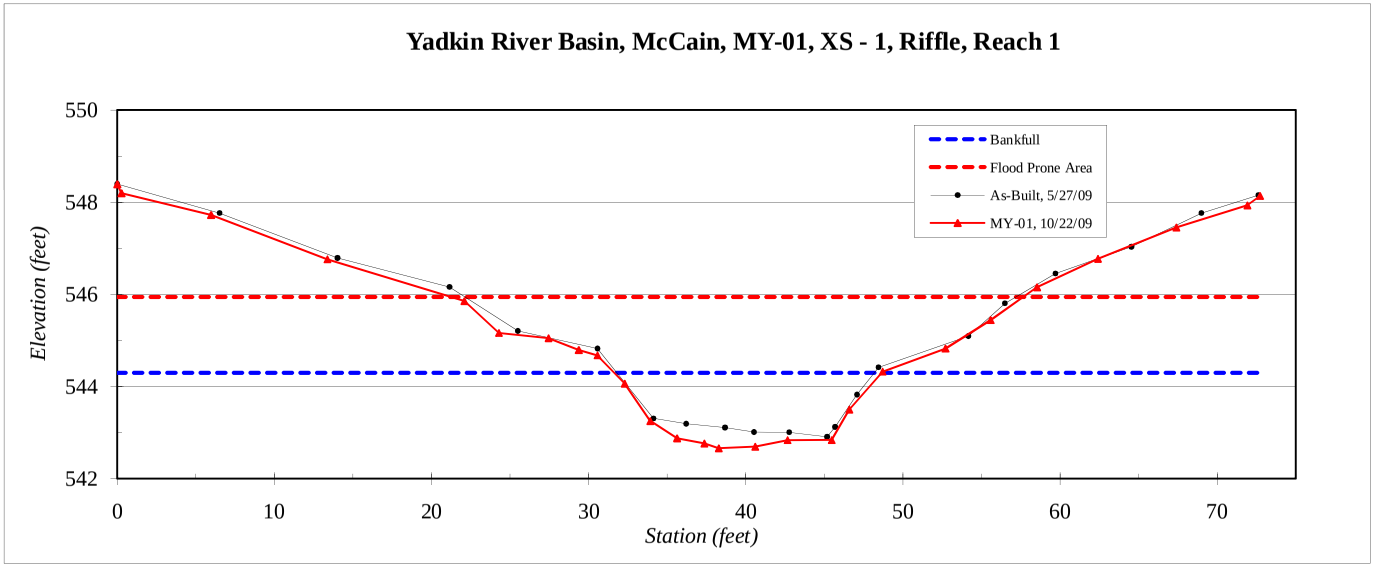
Cross-Section Plots

River Basin:	Yadkin
Watershed:	McCain, MY-01
XS ID	XS - 1, Riffle, Reach 1
Drainage Area (sq mi):	0.88
Date:	10/20/2009
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	548.39
0.3	548.19
6.0	547.72
13.4	546.76
22.1	545.85
24.3	545.16
27.4	545.05
29.4	544.79
30.6	544.68
32.3	544.06
33.9	543.25
35.6	542.88
37.4	542.76
38.3	542.66
40.6	542.70
42.6	542.84
45.5	542.84
46.6	543.50
48.7	544.32
52.7	544.82
55.6	545.44
58.5	546.15
62.4	546.77
67.4	547.45
71.9	547.93
72.7	548.13

SUMMARY DATA	
Bankfull Elevation:	544.3
Bankfull Cross-Sectional Area:	20.8
Bankfull Width:	17.2
Flood Prone Area Elevation:	545.9
Flood Prone Width:	37.0
Max Depth at Bankfull:	1.6
Mean Depth at Bankfull:	1.2
W / D Ratio:	14.2
Entrenchment Ratio:	2.2
Bank Height Ratio:	1.0

Stream Type	C4

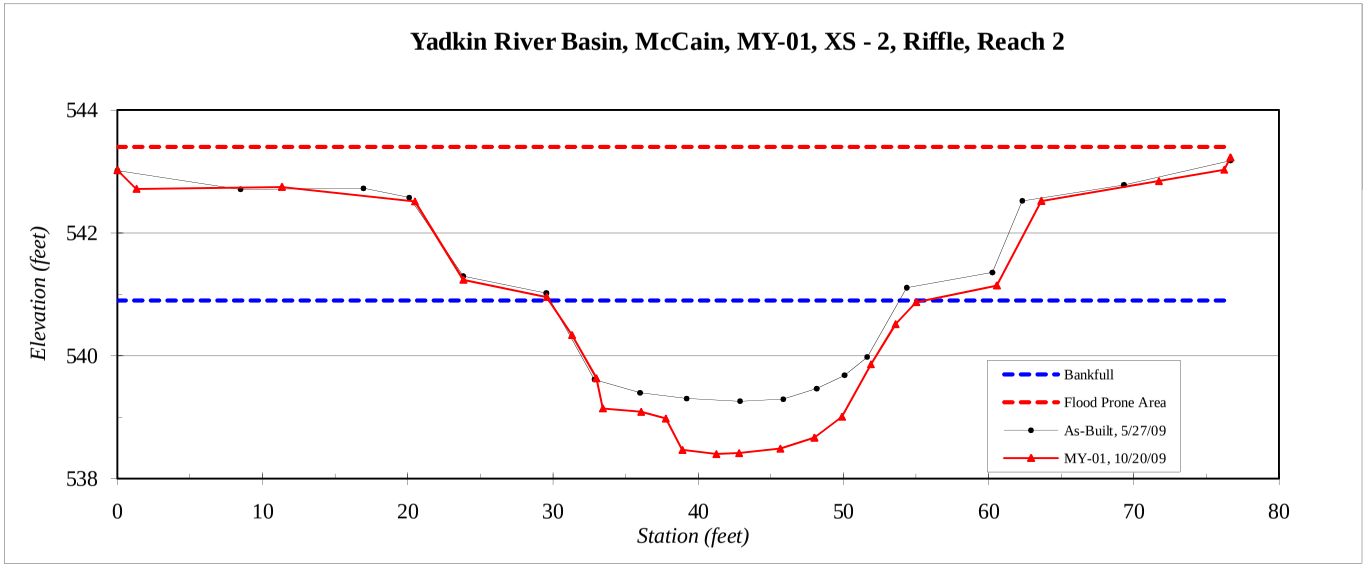


River Basin:	Yadkin
Watershed:	McCain, MY-01
XS ID	XS - 2, Riffle, Reach 2
Drainage Area (sq mi):	0.88
Date:	10/20/2009
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	543.02
1.3	542.72
11.3	542.75
20.5	542.51
23.8	541.24
29.6	540.96
31.3	540.34
33.0	539.64
33.4	539.14
36.1	539.09
37.8	538.98
38.9	538.47
41.3	538.40
42.8	538.42
45.7	538.49
48.0	538.67
49.9	539.01
51.9	539.86
53.6	540.51
55.0	540.87
60.6	541.14
63.6	542.52
71.7	542.84
76.2	543.03
76.7	543.23

SUMMARY DATA	
Bankfull Elevation:	540.9
Bankfull Cross-Sectional Area:	42.7
Bankfull Width:	25.2
Flood Prone Area Elevation:	543.4
Flood Prone Width:	>75
Max Depth at Bankfull:	2.5
Mean Depth at Bankfull:	1.7
W / D Ratio:	14.9
Entrenchment Ratio:	>3.0
Bank Height Ratio:	1.0

Stream Type	C4

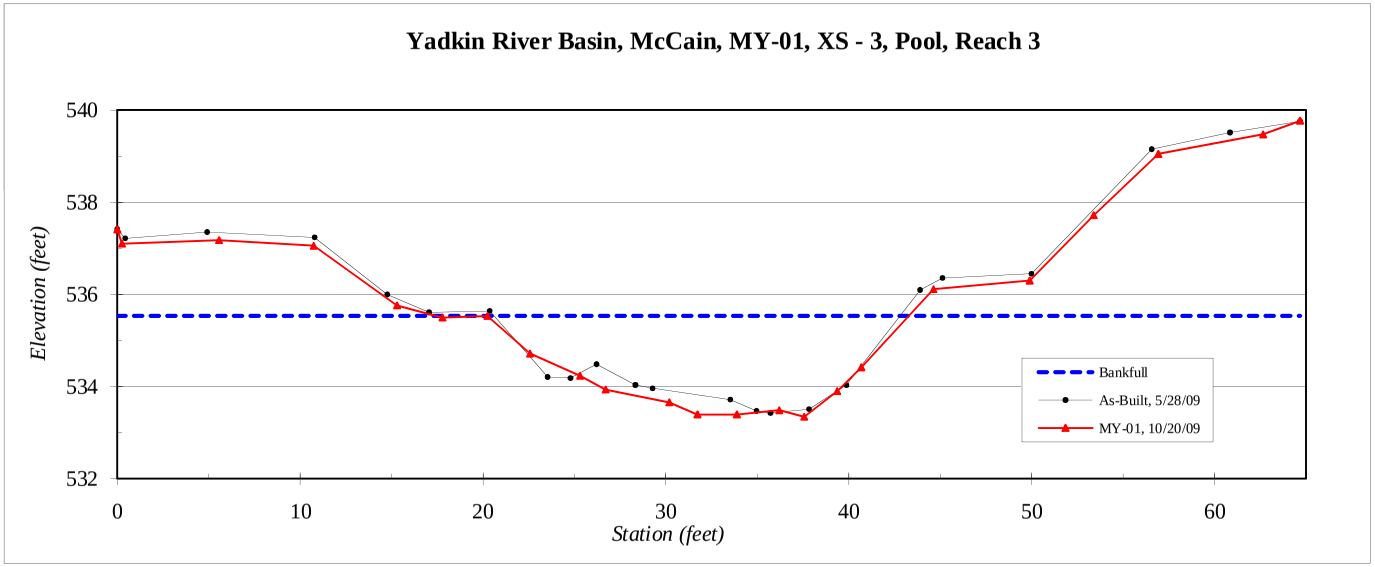


River Basin:	Yadkin
Watershed:	McCain, MY-01
XS ID	XS - 3, Pool, Reach 3
Drainage Area (sq mi):	0.88
Date:	10/20/2009
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	537.41
0.3	537.10
5.6	537.18
10.7	537.06
15.3	535.76
17.8	535.49
20.2	535.53
22.6	534.71
25.3	534.23
26.7	533.93
30.2	533.65
31.7	533.39
33.9	533.39
36.2	533.49
37.6	533.34
39.4	533.90
40.7	534.41
44.6	536.11
49.9	536.30
53.4	537.72
56.9	539.05
62.7	539.47
64.7	539.77

SUMMARY DATA	
Bankfull Elevation:	535.5
Bankfull Cross-Sectional Area:	34.1
Bankfull Width:	23.0
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.2
Mean Depth at Bankfull:	1.5
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C4

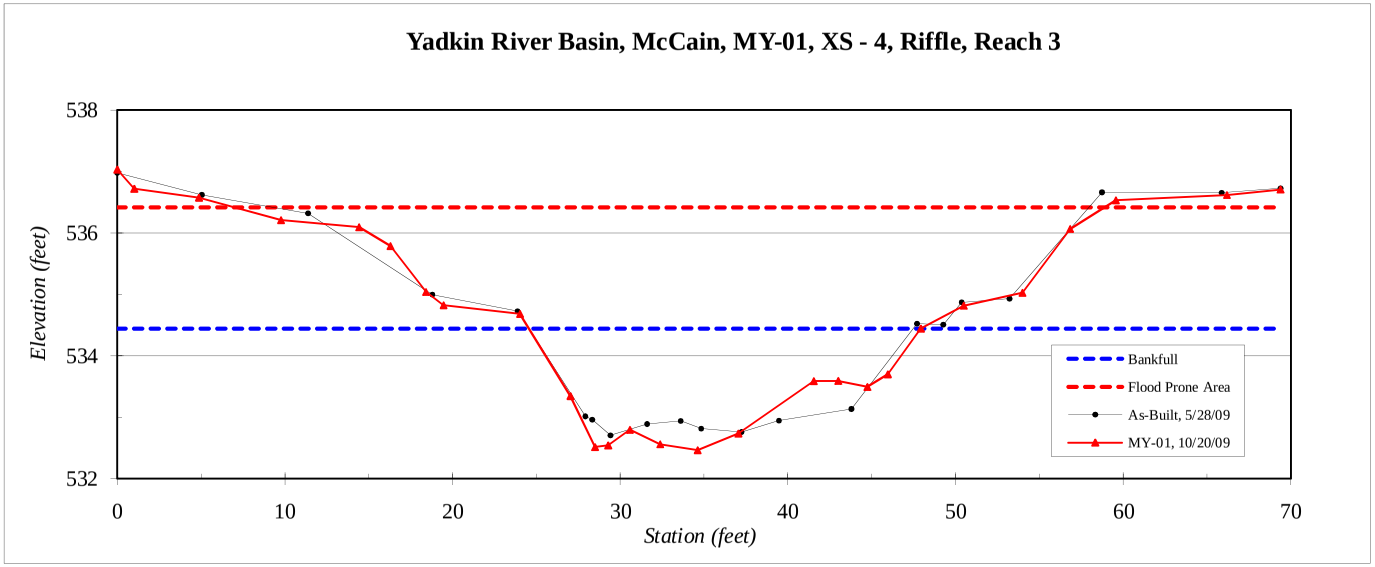


River Basin:	Yadkin
Watershed:	McCain, MY-01
XS ID	XS - 4, Riffle, Reach 3
Drainage Area (sq mi):	0.88
Date:	10/20/2009
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	537.03
1.0	536.72
4.9	536.57
9.8	536.21
14.4	536.09
16.3	535.79
18.4	535.04
19.5	534.82
24.0	534.68
27.0	533.34
28.5	532.52
29.3	532.54
30.6	532.80
32.4	532.56
34.6	532.46
37.0	532.74
41.5	533.59
43.0	533.59
44.7	533.49
46.0	533.70
47.9	534.44
50.5	534.82
54.0	535.03
56.8	536.06
59.6	536.53
66.2	536.62
69.4	536.70

SUMMARY DATA	
Bankfull Elevation:	534.4
Bankfull Cross-Sectional Area:	29.7
Bankfull Width:	23.4
Flood Prone Area Elevation:	536.4
Flood Prone Width:	52.0
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	1.3
W / D Ratio:	18.4
Entrenchment Ratio:	2.2
Bank Height Ratio:	1.0

Stream Type	C4

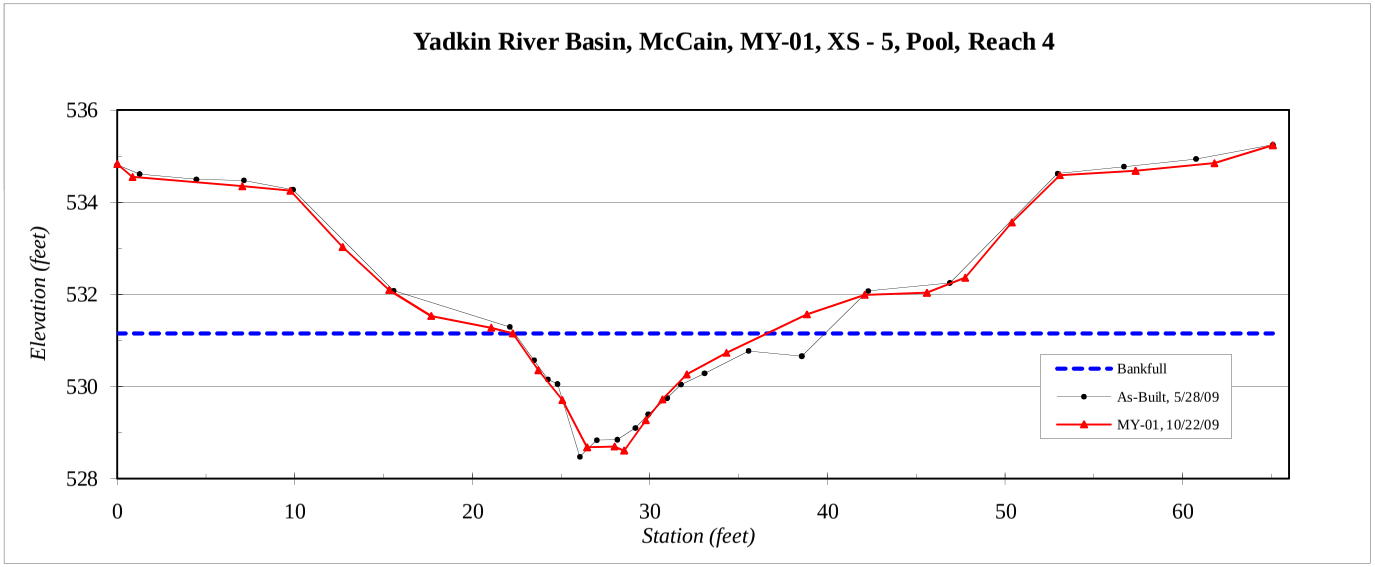


River Basin:	Yadkin
Watershed:	McCain, MY-01
XS ID	XS - 5, Pool, Reach 4
Drainage Area (sq mi):	0.88
Date:	10/22/2009
Field Crew:	B. Roberts, A. French

Station	Elevation
0.0	534.81
1.3	534.61
4.5	534.49
7.1	534.47
9.9	534.27
15.6	532.08
22.1	531.29
23.5	530.57
24.3	530.15
24.8	530.05
26.1	528.48
27.0	528.84
28.2	528.85
29.2	529.10
29.9	529.40
31.0	529.75
31.7	530.04
33.1	530.28
35.6	530.77
38.6	530.66
42.3	532.07
46.9	532.25
53.0	534.62
56.7	534.77
60.8	534.94
65.1	535.24

SUMMARY DATA	
Bankfull Elevation:	531.2
Bankfull Cross-Sectional Area:	17.8
Bankfull Width:	14.3
Flood Prone Area Elevation:	-
Flood Prone Width:	-
Max Depth at Bankfull:	2.5
Mean Depth at Bankfull:	1.2
W / D Ratio:	-
Entrenchment Ratio:	-
Bank Height Ratio:	-

Stream Type	C4

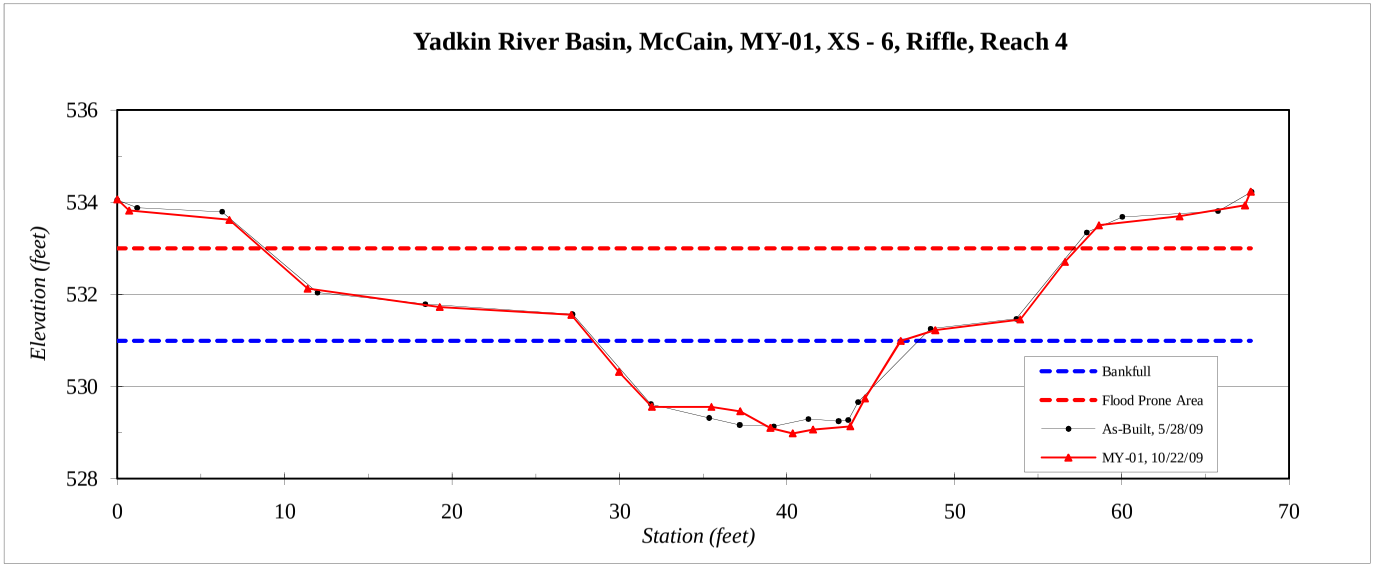


River Basin:	Yadkin
Watershed:	McCain, MY-01
XS ID	XS - 6, Riffle, Reach 4
Drainage Area (sq mi):	0.88
Date:	10/22/2009
Field Crew:	B. Roberts, A. French

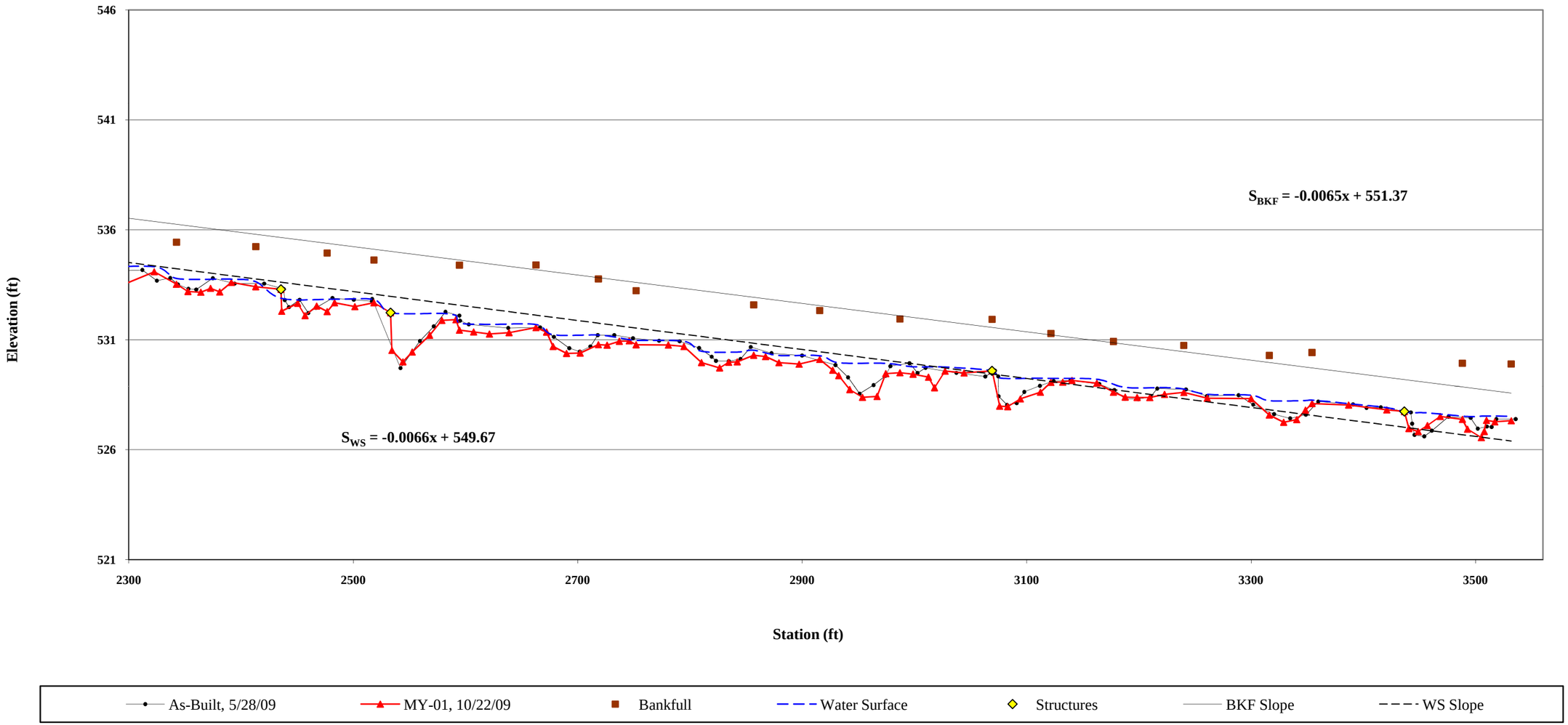
Station	Elevation
0.0	534.06
0.7	533.82
6.7	533.62
11.4	532.13
19.3	531.73
27.1	531.56
30.0	530.32
31.9	529.56
35.5	529.56
37.2	529.46
39.0	529.10
40.3	528.98
41.6	529.06
43.8	529.14
44.7	529.74
46.8	530.99
48.9	531.22
53.9	531.45
56.6	532.70
58.6	533.50
63.5	533.69
67.4	533.93
67.7	534.23

SUMMARY DATA	
Bankfull Elevation:	531.0
Bankfull Cross-Sectional Area:	25.2
Bankfull Width:	18.4
Flood Prone Area Elevation:	533.0
Flood Prone Width:	50.5
Max Depth at Bankfull:	2.0
Mean Depth at Bankfull:	1.4
W / D Ratio:	13.4
Entrenchment Ratio:	2.7
Bank Height Ratio:	1.0

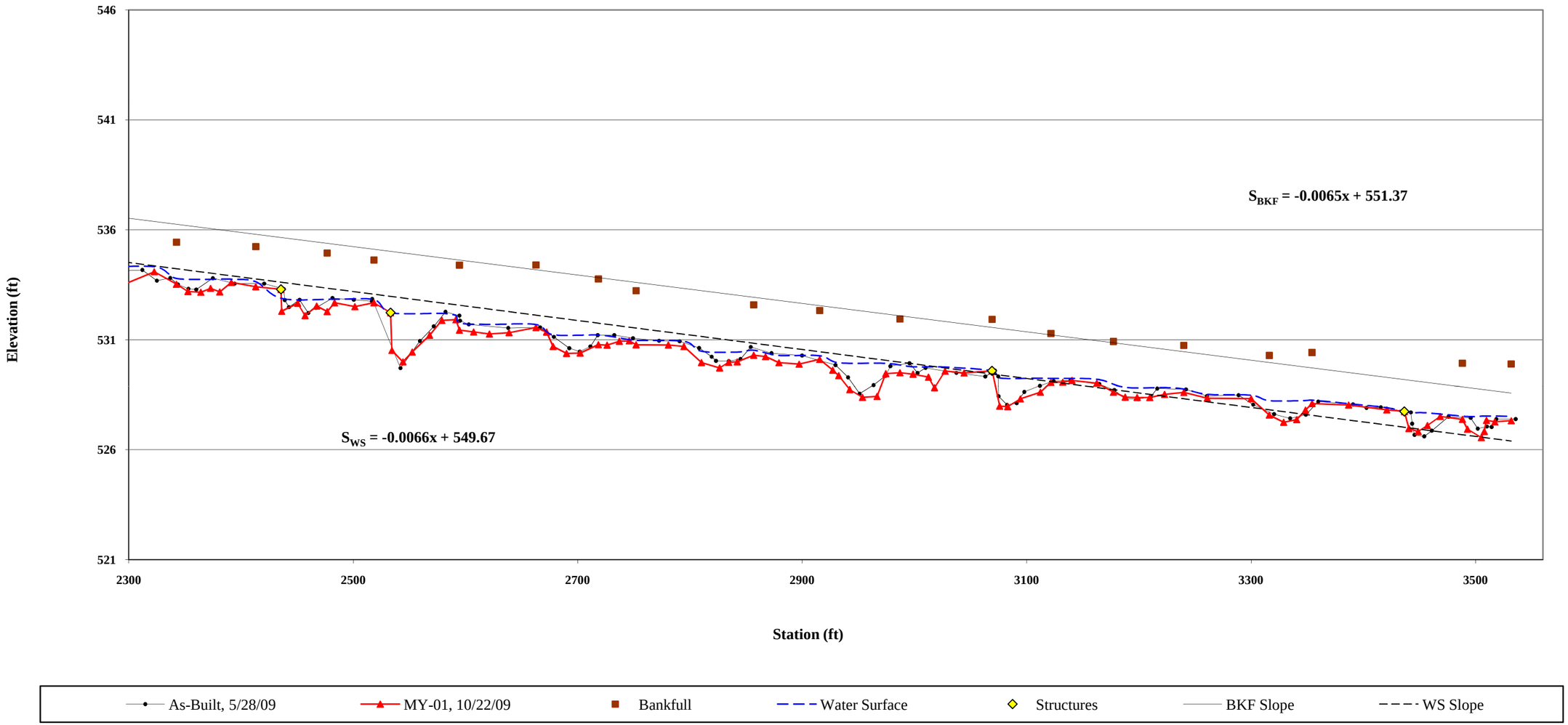
Stream Type	C4



Longitudinal Profile
McCain - Unnamed Tributary to Back Creek
EEP Project Number - 47
Station 23+00 - 35+50



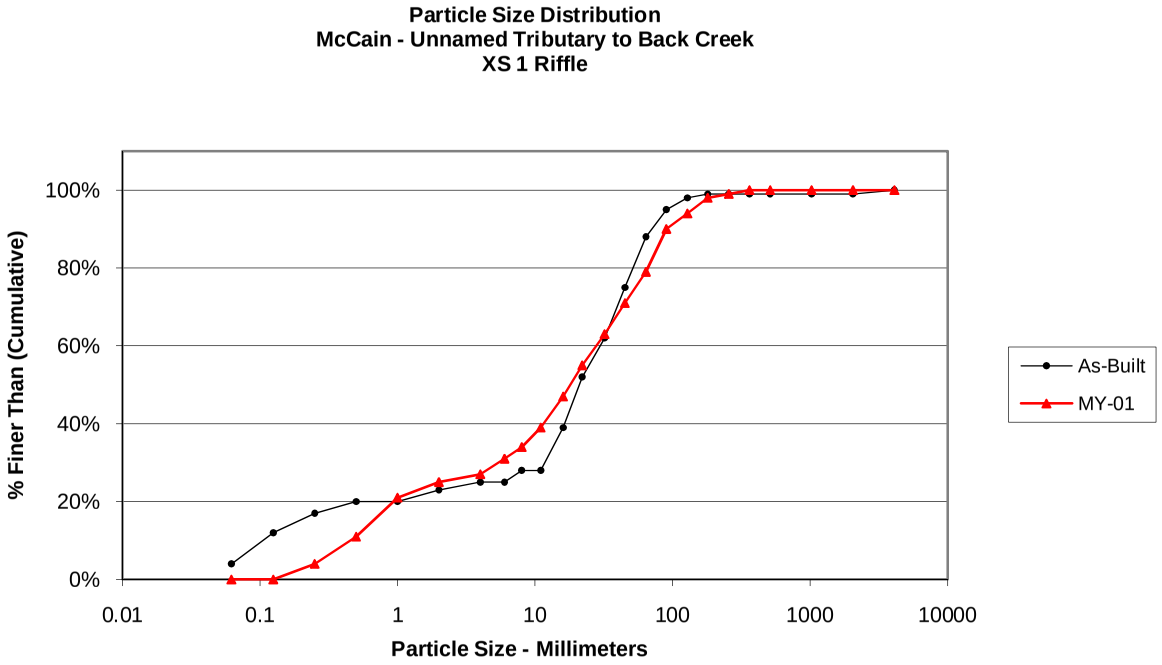
Longitudinal Profile
McCain - Unnamed Tributary to Back Creek
EEP Project Number - 47
Station 23+00 - 35+50



Pebble Count Plots

Cross-Section 1 Riffle - MY-01			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	4
Medium	.25 - .50	N	7
Coarse	.50 - 1	D	10
Very Coarse	1 - 2	S	4
Very Fine	2 - 4		2
Fine	4 - 5.7	G	4
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	5
Medium	11.3 - 16	V	8
Coarse	16 - 22.6	E	8
Coarse	22.6 - 32	L	8
Very Coarse	32 - 45	S	8
Very Coarse	45 - 64		8
Small	64 - 90	C	11
Small	90 - 128	O	4
Large	128 - 180	B	4
Large	180 - 256	L	1
Small	256 - 362	B	1
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



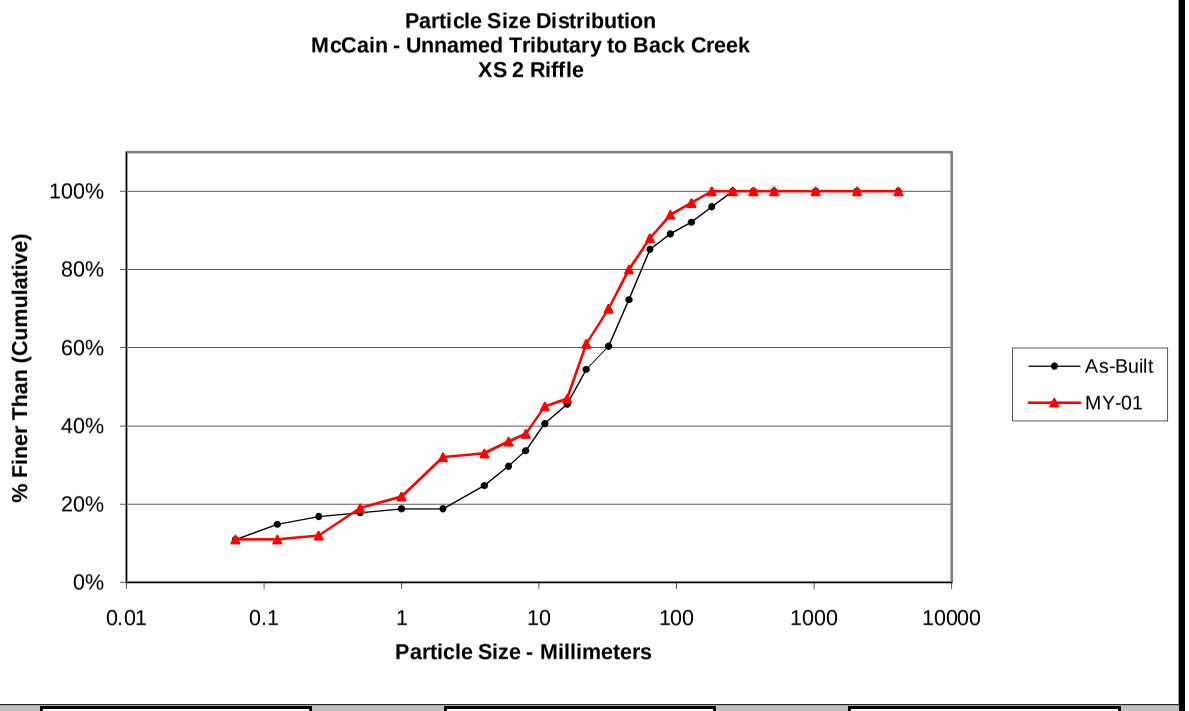
Size (mm)	
D16	0.71
D35	8.5
D50	18
D65	35
D84	75
D95	140

Size Distribution	
mean	7.3
dispersion	14.8
skewness	-0.28

Type	
silt/clay	0%
sand	25%
gravel	54%
cobble	20%
boulder	1%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 2 Riffle - MY-01			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	11
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	1
Medium	.25 - .50	N	7
Coarse	.50 - 1	D	3
Very Coarse	1 - 2	S	10
Very Fine	2 - 4		1
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	7
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	14
Coarse	22.6 - 32	L	9
Very Coarse	32 - 45	S	10
Very Coarse	45 - 64		8
Small	64 - 90	C	6
Small	90 - 128	O	3
Large	128 - 180	B	3
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



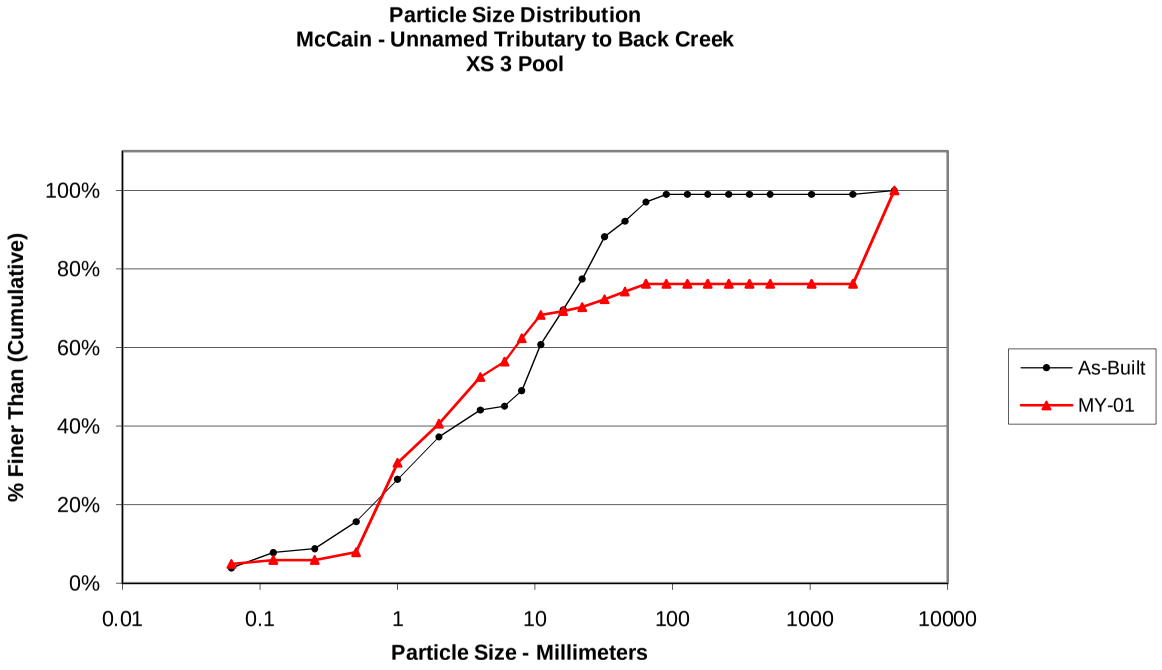
Size (mm)	
D16	0.37
D35	5.2
D50	17
D65	26
D84	54
D95	100

Size Distribution	
mean	4.5
dispersion	24.6
skewness	-0.39

Type	
silt/clay	11%
sand	21%
gravel	56%
cobble	12%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 3 Pool - MY-01			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	5
Very Fine	.062 - .125	S	1
Fine	.125 - .25	A	
Medium	.25 - .50	N	2
Coarse	.50 - 1	D	23
Very Coarse	1 - 2	S	10
Very Fine	2 - 4		12
Fine	4 - 5.7	G	4
Fine	5.7 - 8	R	6
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	1
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	2
Very Coarse	32 - 45	S	2
Very Coarse	45 - 64		2
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	24
		Total	101

Note:



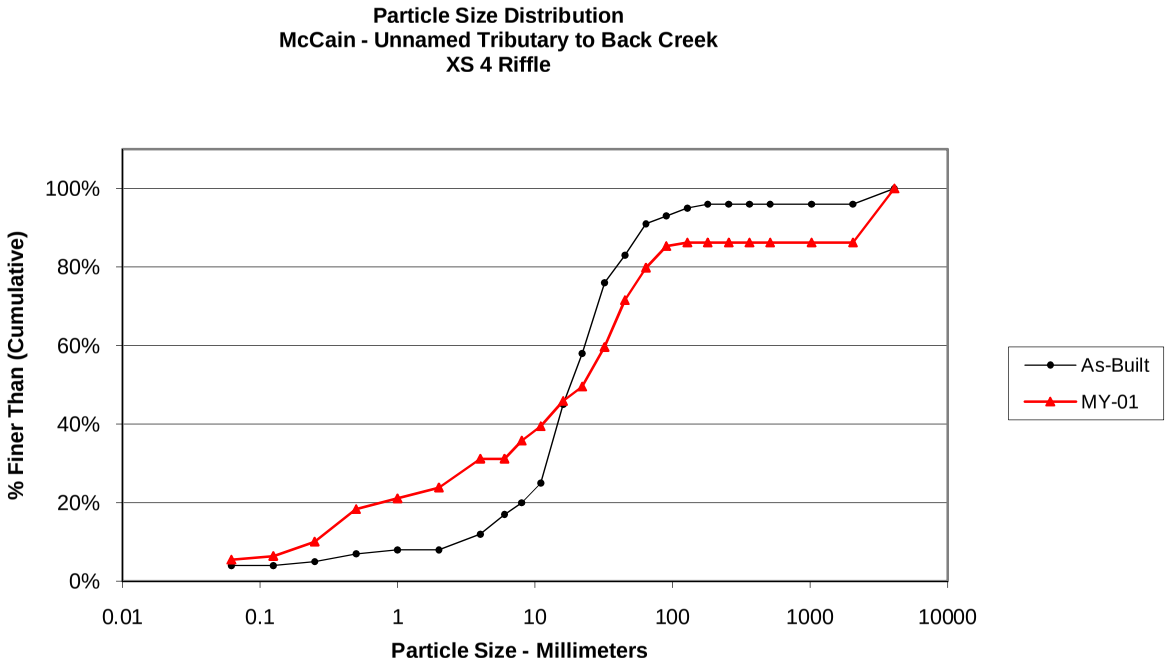
Size (mm)	
D16	0.57
D35	0.89
D50	1.7
D65	3.4
D84	8.7
D95	33

Size Distribution	
mean	2.2
dispersion	4.1
skewness	0.11

Type	
silt/clay	5%
sand	36%
gravel	36%
cobble	0%
boulder	0%
bedrock	24%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 4 Riffle - MY-01			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	6
Very Fine	.062 - .125	S	1
Fine	.125 - .25	A	4
Medium	.25 - .50	N	9
Coarse	.50 - 1	D	3
Very Coarse	1 - 2	S	3
Very Fine	2 - 4		8
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	5
Medium	8 - 11.3	A	4
Medium	11.3 - 16	V	7
Coarse	16 - 22.6	E	4
Coarse	22.6 - 32	L	11
Very Coarse	32 - 45	S	13
Very Coarse	45 - 64		9
Small	64 - 90	C	6
Small	90 - 128	O	1
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	15
		Total	109

Note:



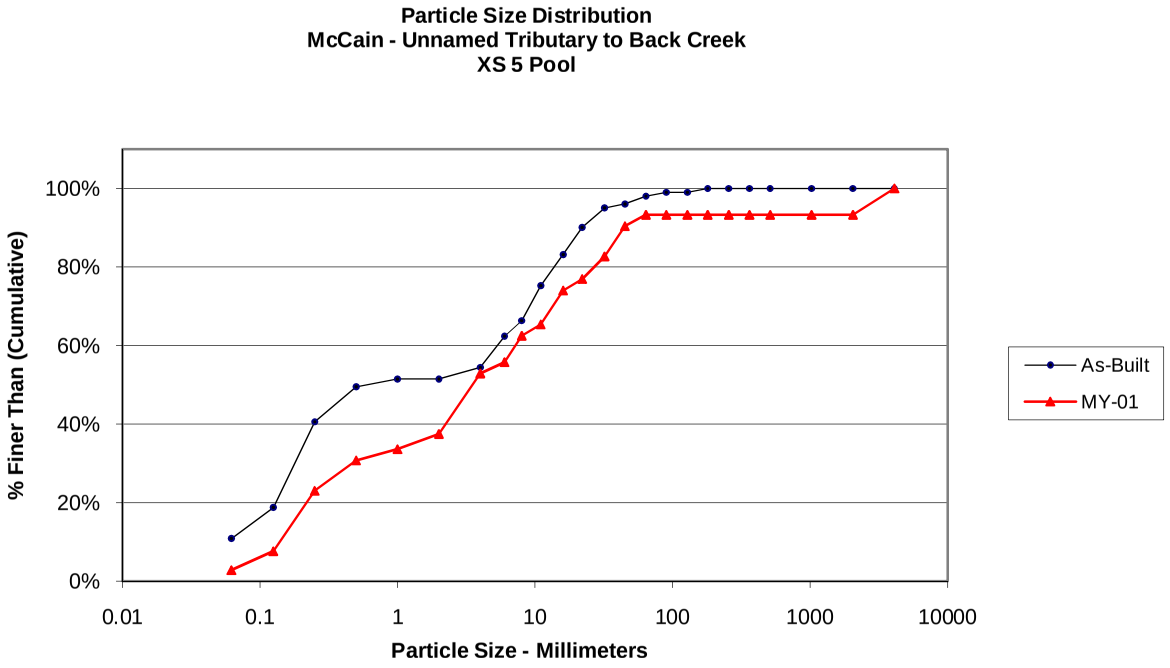
Size (mm)	
D16	0.34
D35	3.6
D50	14
D65	28
D84	47
D95	73

Size Distribution	
mean	4.0
dispersion	22.3
skewness	-0.37

Type	
silt/clay	6%
sand	18%
gravel	56%
cobble	6%
boulder	0%
bedrock	14%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 5 Pool - MY-01			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	3
Very Fine	.062 - .125	S	5
Fine	.125 - .25	A	16
Medium	.25 - .50	N	8
Coarse	.50 - 1	D	3
Very Coarse	1 - 2	S	4
Very Fine	2 - 4		16
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	7
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	3
Coarse	22.6 - 32	L	6
Very Coarse	32 - 45	S	8
Very Coarse	45 - 64		3
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	7
		Total	104

Note:



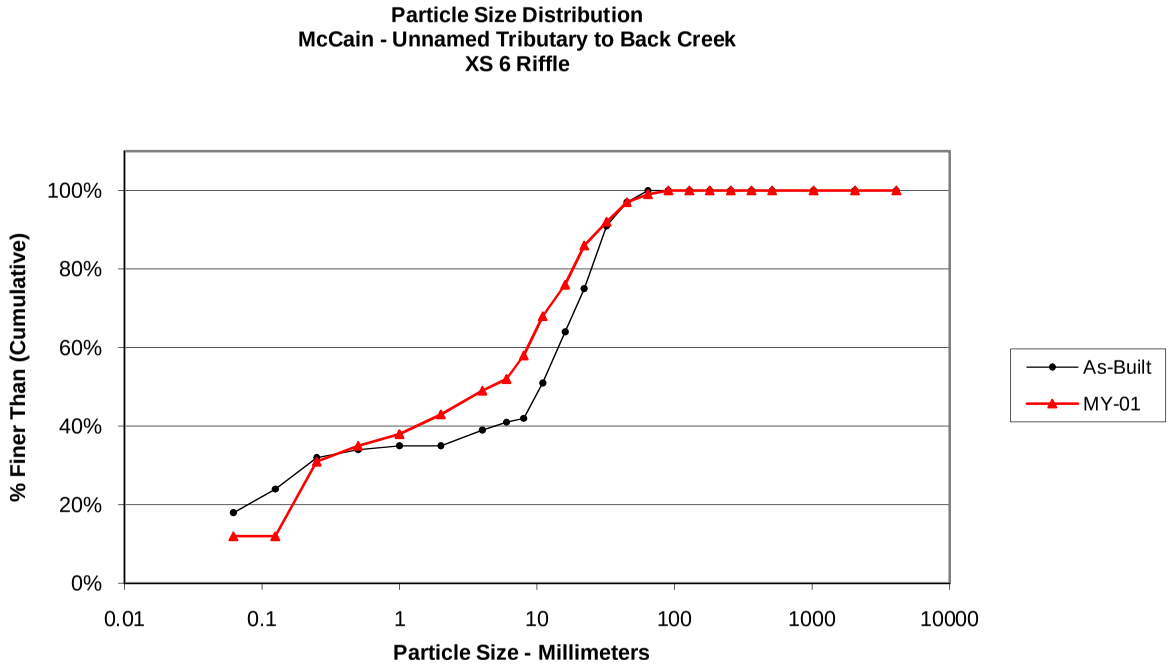
Size (mm)	
D16	0.17
D35	0.78
D50	3
D65	7.4
D84	24
D95	42

Size Distribution	
mean	2.0
dispersion	12.8
skewness	-0.12

Type	
silt/clay	3%
sand	35%
gravel	56%
cobble	0%
boulder	0%
bedrock	7%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 6 Riffle - MY-01			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	12
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	19
Medium	.25 - .50	N	4
Coarse	.50 - 1	D	3
Very Coarse	1 - 2	S	5
Very Fine	2 - 4		6
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	6
Medium	8 - 11.3	A	10
Medium	11.3 - 16	V	8
Coarse	16 - 22.6	E	10
Coarse	22.6 - 32	L	6
Very Coarse	32 - 45	S	5
Very Coarse	45 - 64		2
Small	64 - 90	C	1
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



Size (mm)	
D16	0.14
D35	0.5
D50	4.6
D65	10
D84	21
D95	39

Size Distribution	
mean	1.7
dispersion	18.7
skewness	-0.29

Type	
silt/clay	12%
sand	31%
gravel	56%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%