

FINAL
ANNUAL MONITORING REPORT
YEAR 3 (2014)
HAUSER CREEK STREAM RESTORATION SITE
DAVIE COUNTY, NORTH CAROLINA
(EEP Project No. 92471, Contract No. 004804)
Construction Completed August 2011



Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina



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Prepared by:
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603



October 2014

Table of Contents

1.0 EXECUTIVE SUMMARY	1
2.0 METHODOLOGY	2
2.1 Vegetation Assessment	2
2.2 Stream Assessment	2
3.0 REFERENCES	3

Appendices

APPENDIX A. PROJECT SITE LOCATION MAP AND BACKGROUND TABLES

- Figure 1. Site Location Map
- Table 1. Project Components and Mitigation Credits
- Table 2. Project Activity and Reporting History
- Table 3. Project Contacts Table
- Table 4. Project Baseline Information and Attributes

APPENDIX B. VISUAL ASSESSMENT DATA

- Figures 2 and 2A-2B. Current Conditions Plan View
- Table 5. Visual Stream Morphology Stability Assessment
- Table 6. Vegetation Condition Assessment
- Stream Fixed-Station Photographs
- Vegetation Monitoring Photographs

APPENDIX C. VEGETATION PLOT DATA

- Table 7. Vegetation Plot Criteria Attainment
- Table 8. CVS Vegetation Plot Metadata
- Table 9. Total and Planted Stems by Plot and Species

APPENDIX D. STREAM SURVEY DATA

- Cross-section Plots
- Longitudinal Profile Plots
- Substrate Plots
- Table 10. Baseline Stream Data Summary
- Table 11a - b. Monitoring Data

APPENDIX E. HYDROLOGY DATA

- Table 12. Verification of Bankfull Events

1.0 EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (NCEEP) has completed stream mitigation at the Hauser Creek Stream Restoration Site (hereafter referred to as the “Site”) located on the property of Alethea Segal in Davie County, North Carolina to assist in fulfilling stream mitigation goals in the area. The Site is located in United States Geological Survey (USGS) Hydrologic Unit 03040101160010 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-07-02) of the Yadkin Pee-Dee River Basin. The Site is not located in a Targeted Local Watershed. The Site drainage area is an approximately 2.64-square mile rural watershed at the Site outfall consisting primarily of forest and pasture land with low-density residential property. This report (compiled based on NCEEP’s *Procedural Guidance and Content Requirements for EEP Monitoring Reports* Version 1.4 dated 11/7/11) summarizes data for year 3 (2014) monitoring.

Restoration goals outlined in the approved *Hauser Creek Restoration Plan* [NCEEP 2008] include the following.

- Improve water quality with the construction of stable stream banks, removal of cattle access, and the establishment of a protective buffer.
- Control transport of sediment recruited by stream flows from cleared adjacent floodplains with the establishment of a forested buffer.
- Improve the stream function and habitat with the connection of the channelized and incised stream back to its floodplain.
- Restore long-term stability with the restoration of channel pattern, profile, and dimension.
- Improve in-stream habitat with the installation of root wads, constructed riffles, cross vanes, and single wing vanes to enhance pool depths.
- Improve buffer habitat by creating ephemeral pools within the old channel fill areas.

Project objectives outlined in the approved *Hauser Creek Restoration Plan* [NCEEP 2008] include the following.

- The restoration of 2525 linear feet of stream with Priority I Restoration in order to raise the stream elevation, reconnect the floodplain, restore pattern, and reestablish channel dimension.
- The enhancement of 93 linear feet of stream with Enhancement Level II activities which involve buffer restoration and bank stabilization.
- The preservation of 108 linear feet of stream by placing a conservation easement along the downstream reach of channel.
- Establish a riparian buffer with an average distance of 50 feet beyond each stream bank.

Prior to construction, the Site contained a degraded stream channel located within maintained pasture and floodplain fields with wooded uplands. Site streams were characterized by a narrow buffer, channels widths approximately two times what they should be, steep to moderate bank slopes, incision, and elevated bank-height ratios. Project construction was completed in August 2011. The Site will be protected by a permanent conservation easement held by the State of North Carolina.

Seven vegetation monitoring plots were monitored on July 3, 2014 for Year 3 (2014) monitoring. Vegetation success criteria dictate that an average density of 320 stems-per-acre must be surviving in the first three monitoring years. Subsequently, 288 stems-per-acre must be surviving in year 4 and 260 stems-per-acre in year 5. Stem counts will be based on an average of the evaluated vegetation plots. Based on the number of stems counted, average densities were measured at 526 planted stems-per-acre (excluding livestakes) surviving in Year 3 (2014). The dominant species identified at the Site were planted stems of sycamore (*Platanus occidentalis*) and green ash (*Fraxinus pennsylvanica*). All seven vegetation plots met success criteria based on planted stems alone.

Overall, vegetation on the Site is thriving. One small population of Japanese honeysuckle was observed near and in vegetation plot 1 (Figure 2A, Appendix B). This area will continue to be closely monitored during subsequent monitoring years to determine if remedial activities should occur.

Success criteria for stream restoration will be assessed using measurements of stream dimension, pattern, and profile; Site photographs; visual assessments; and vegetation sampling. Success is based on the stability of the stream.

Overall, the stream is functioning properly and as designed. Three areas of bank erosion were noted in Figures 2A-2B (Appendix B).

Map Label*	Station	Notes
SAC-1	22+50	Minor erosion and sloughing of approximately 20 feet along the right bank of an outer bend
SAC-2	18+75	Moderate erosion and sloughing of approximately 25 feet along the left bank of an outer bend as well as approximately 10 feet of the inner bend
SAC-3	12+00	Minor erosion and sloughing of approximately 15 feet along the right bank of an outer bend

*Map labels on Figures 2A-2B, Appendix B

Success criteria for stream restoration will include documentation of two bankfull channel events during the monitoring period. In the event that less than two bankfull events occur during the first five years, monitoring will continue until the second event is documented. In addition, bankfull events must occur during separate monitoring years. A crest gauge is located within the Site to assist with documentation of bankfull events (Figures 2 and 2A-2B, Appendix B). Two bankfull events were documented to date during the Year 3 (2014) monitoring season.

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 tables and figures within this report's appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents available on NCEEP's website. All raw data supporting the tables and figures in the appendices is available from NCEEP upon request.

2.0 METHODOLOGY

2.1 Vegetation Assessment

Seven vegetation plots were established and marked after construction with metal t-posts demarking the four corners of the plot. The plots are 10 meters square and are located randomly within the Site. These plots were surveyed on July 3, 2014 for the Year 3 (2014) monitoring season using the *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) (<http://cvs.bio.unc.edu/methods.htm>); results are included in Appendix C. The taxonomic standard for vegetation used for this document was *Flora of the Southern and Mid-Atlantic States* (Weakley 2012).

2.2 Stream Assessment

Annual stream monitoring was conducted in late March 2014 for the Year 3 (2014) monitoring season. Measurements were taken using a Topcon GTS 303 total station and Recon data collector. The raw total station file was processed using Carlson Survey Software into a Computer Aided Design (CAD) file. Coordinates were exported as a text/ASCII file to Microsoft Excel for processing and presentation of data. Pebble counts were completed using the modified Wolman method (Rosgen 1993). A crest gauge was installed in the lower portion of the Site to assist with documentation of overbank events.

Seven permanent cross-sections, five riffle and two pool, will be used to evaluate stream dimension; locations are depicted on Figures 2 and 2A-2B (Appendix B). Cross-sections are permanently monumented with metal t-posts at each end point. Cross-sections will be surveyed annually to provide a detailed measurement of the stream and banks including points on the adjacent floodplain, top of bank, bankfull, breaks in slope, edge of water, and thalweg. Data will be used to calculate width-depth ratios, entrenchment ratios, and bank height ratios for each cross-section. In addition, pebble counts were completed at cross-sections 3, 5, and 7, and photographs will be taken at each permanent cross-section annually.

One approximately 2500-linear foot monitoring reach (the entire Site stream reach) will be used to evaluate stream pattern and longitudinal profile (Figures 2 and 2A-2B, Appendix B). Measurement of channel pattern will include belt-width and meander length. Subsequently, data will be used to calculate meander-width ratios. Longitudinal profile measurements will include average water surface slopes and facet slopes and pool-to-pool spacing. In addition, visual stream morphology stability assessments will be completed in each of the monitoring reach annually to assess the channel bed, banks, and in-stream structures.

3.0 REFERENCES

- Ecosystem Enhancement Program (EEP). Unpublished. Procedural Guidance and Content Requirements for EEP Monitoring Projects, Version 1.4, dated 11/07/11. NC Department of Environment and Natural Resources. Available online at http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=2288101&name=DLFE-39268.pdf.
- Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2. (online). Available: <http://cvs.bio.unc.edu/methods.htm>.
- N.C. Ecosystem Enhancement Program. 2008. Ripshin Branch Stream & Wetland Restoration Plan - Ashe County, NC.
- Weakley, Alan S. 2012. Flora of the Southern and Mid-Atlantic States. Available online at: <http://www.herbarium.unc.edu/WeakleysFlora.pdf> [September 28, 2012]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.
- Weather Underground. 2013. Station at Winston Salem Airport, North Carolina. (online). Available: http://www.wunderground.com/history/airport/KINT/2013/6/3/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA [November 25, 2013]. Weather Underground.
- Weather Underground. 2014. Station at Winston Salem Airport, North Carolina. (online). Available: http://www.wunderground.com/history/airport/KINT/2013/8/3/CustomHistory.html?dayend=6&monthend=7&yearend=2014&req_city=NA&req_state=NA&req_statename=NA [July 7, 2014]. Weather Underground.

APPENDIX A

PROJECT SITE LOCATION MAP AND BACKGROUND TABLES

Figure 1. Site Location Map

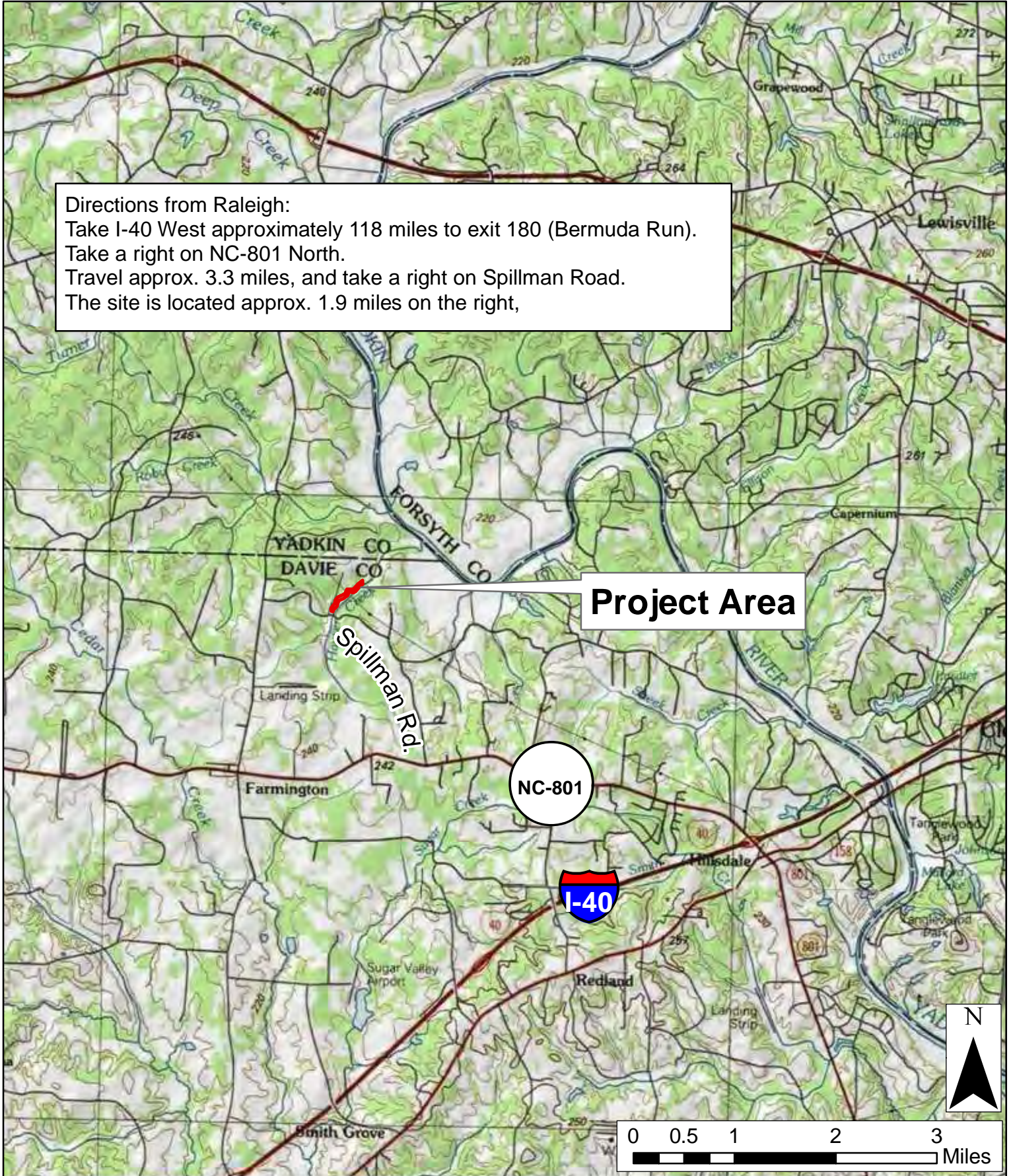
Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes

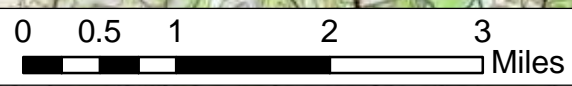
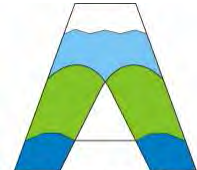
Directions from Raleigh:
 Take I-40 West approximately 118 miles to exit 180 (Bermuda Run).
 Take a right on NC-801 North.
 Travel approx. 3.3 miles, and take a right on Spillman Road.
 The site is located approx. 1.9 miles on the right,



Project Area

NC-801

I-40

Axiom Environmental
 218 Snow Avenue
 Raleigh, NC 27603
 (919) 215-1693

Axiom Environmental, Inc.

SITE LOCATION MAP
HAUSER CREEK
EPP PROJECT NUMBER 92471
Davie County, North Carolina

Dwn. by:
 KRJ

Date:
 October 2012

Project:
 12-004.11

FIGURE

1

**Table 1. Project Components and Mitigation Credits
Hauser Stream Restoration Site (EEP Project Number 92741)**

Mitigation Credits							
Type	Stream			Riparian Wetland		Buffer	
	Restoration	Restoration Equivalent		Restoration	Restoration Equivalent		
Totals	2387	22		--	--	--	
Projects Components							
Project Component/ Reach ID	Station Range	Existing Linear Footage/ Acreage	Priority Approach	Restoration/ Restoration Equivalent	Restoration Linear Footage/ Acreage	Mitigation Ratio	Comment
Reach 1	00+72 – 16+40	--	P1	Restoration	1568	1:1	Priority 1 Restoration
Reach 2	16+40 – 19+90	--	P1	Restoration	350	2:1	Half Credit Due to Location Within a Utilities Easement
Reach 3	19+90 – 26+31	641	P1	Restoration	607	1:1	34 ft is Outside of Easement in a Piped Crossing
Reach 4	26+31–27+39	108	Pres	Preservation	108	5:1	Preservation
Reach 5	--	93	E11	Enhancement (Level II)	93	2.5:1	Level 11 Enhancement.
Component Summation							
Restoration Level			Stream (linear footage)		Riparian Wetland (acres)		Buffer (square footage)
Restoration			2525*		--		--
Enhancement (Level II)			93		--		--
Preservation			108		--		--
Totals			2726		--		--
Mitigation Units			2409 SMUs		--		--

*34 linear feet is located outside of the easement in a piped crossing and is therefore not counted for mitigation credit; in addition, 350 linear feet is located within a utilities easement and therefore only receives half credit (2:1 mitigation ratio)

Table 2. Project Activity and Reporting History
Hauser Stream Restoration Site (EEP Project Number 92471)

Elapsed Time Since Grading Complete: 3 years 1 months

Elapsed Time Since Planting Complete: 2 years 9 months

Number of Reporting Years: 3

Activity or Deliverable	Data Collection Complete	Completion or Delivery
ERTR		April 2008
Restoration Plan		May 2008
No-rise Flood Study Approval		December 2009
Construction Plans / Erosion Control Plan		June 2010
Land Quality Approval		May 2011
Construction and Grading Begins		April 2011
Temporary S&E Mix Applied		April-August 2011
Permanent Seed Mix Applied		April-August 2011
Construction and Grading Ends		August 2011
Containerized Planting for Entire Reach		January 2012
As-Built Construction Drawings		March 2012
SCO Final Report		March 2012
Year 1 Monitoring (2012)	October 2012	December 2012
Year 2 Monitoring (2013)	October 2013	November 2013
Year 3 Monitoring (2014)	September 2014	September 2014
Year 4 Monitoring (2015)		
Year 5 Monitoring (2016)		

Table 3. Project Contacts Table
Hauser Stream Restoration Site (EEP Project Number 92471)

Designer	Ward Consulting Engineers, P.C. 8368 Six Forks Road Suite 104 Raleigh, NC 27615-5083 Becky Ward 919-870-0526
Construction, Planting, and Seeding Contractor	Carolina Environmental Contracting, Inc. Mt. Airy, North Carolina 336-320-3849
Surveyor	Turner Land Surveying PLLC 3201 Glenridge Drive Raleigh, NC 27604 Elizabeth Turner 919-875-1378
Seed Mix Source	Unknown
Baseline Data Collection	Not Applicable
Annual Monitoring Performer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

**Table 4. Project Baseline Information and Attributes
Hauser Stream Restoration Site (EEP Project Number 92471)**

Project Information	
Project Name	Hauser Stream Restoration Site
Project County	Davie County, North Carolina
Project Area	9.11 acres
Project Coordinates	836,322.303°N, 1,551,907.668°E
Project Watershed Summary Information	
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Project River Basin	Yadkin Pee-dee
USGS 8-digit HUC	03040101
USGS 14-digit HUC	03040101160010
NCDWQ Subbasin	03-07-02
Project Drainage Area	2.64 square miles
Project Drainage Area Impervious Surface	0.6%
Watershed Type	Rural
Reach Summary Information	
Parameters	Hauser Creek
Restored/Enhanced Length	2726 linear feet
Drainage Area	2.64 square miles
NCDWQ Index Number	12-86
NCDWQ Classification	WS-IV
Valley Type/Morphological Description	VIII/C4
Dominant Soil Series	Wehadkee, Chewacla
Drainage Class	Poorly Drained, Somewhat poorly drained
Soil Hydric Status	Hydric, Nonhydric may contain hydric Wehadkee inclusions
Slope	0.0025
FEMA Classification	Regulated Stream
Native Vegetation Community	Piedmont/Low Mountain Alluvial Forest
Percent Composition of Exotic Invasives	<5%
Regulatory Considerations	
Regulation	Applicable
Waters of the U.S. –Sections 404 and 401	Yes-Received Appropriate Permits
Endangered Species Act	Yes-No Effect
Historic Preservation Act	No
CZMA/CAMA	No
FEMA Floodplain Compliance	Yes-Received a No Rise Certification
Essential Fisheries Habitat	No

APPENDIX B

VISUAL ASSESSMENT DATA

Figures 2 and 2A-2B. Current Conditions Plan View

Table 5. Visual Stream Morphology Stability Assessment

Table 6. Vegetation Condition Assessment

Stream Fixed Station Photographs

Vegetation Monitoring Photographs



Prepared for:



Project:

HAUSER CREEK RESTORATION SITE

EEP Project Number 92471
Davie County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by:

KRJ/CLF

Date:

September 2014

Scale:

1 in = 180 ft

Project No.:

12-004.11

FIGURE

2

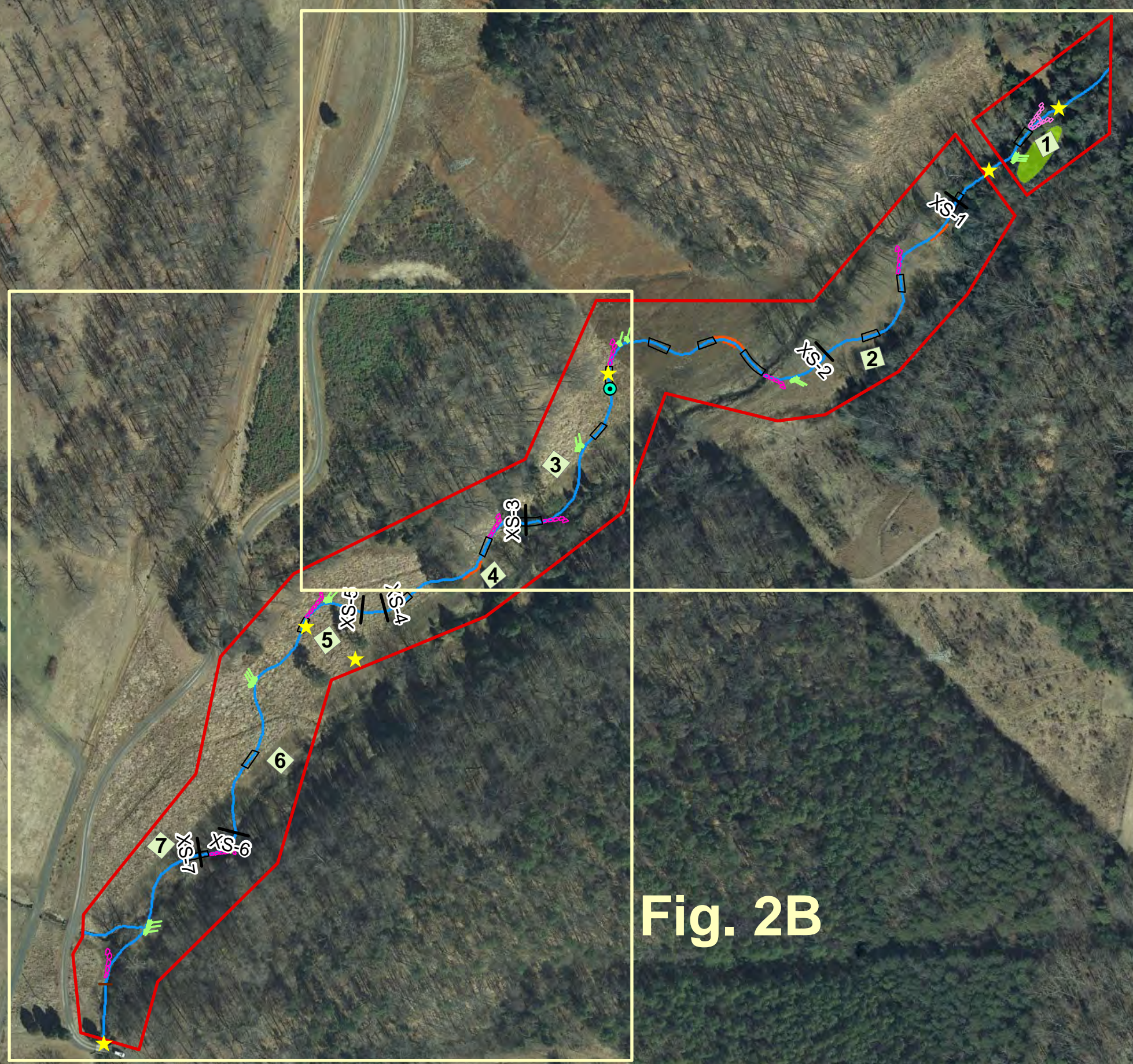


Fig. 2A

Fig. 2B

Legend

- Easement Boundary
- Stream

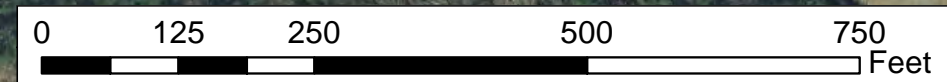
In-Stream Structures

- Constructed Riffle
- Cross Vane
- Log Structure
- Root Wad
- Single Arm Vane

Stream Areas of Concern














- Cross Sections

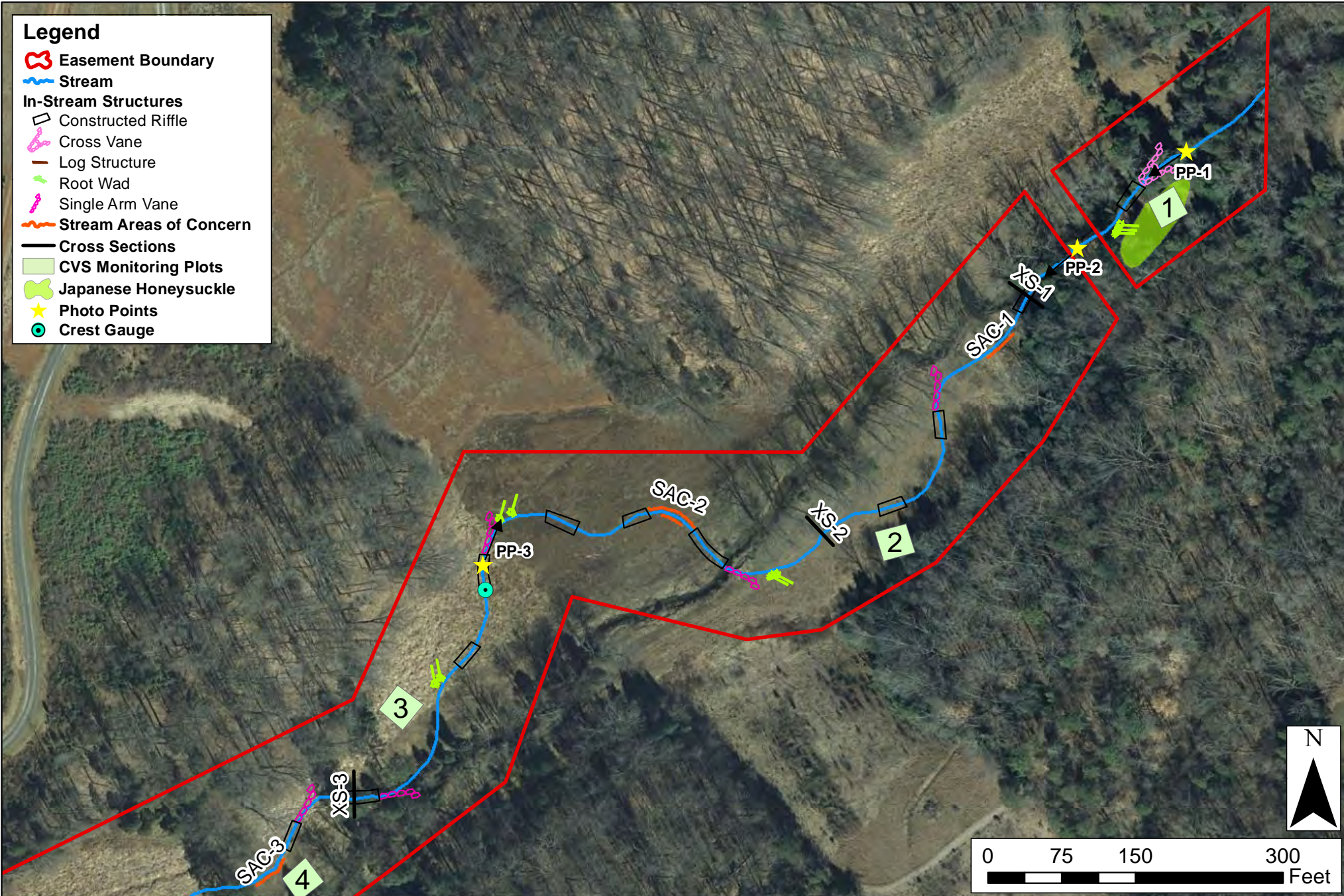
- CVS Monitoring Plots
- Japanese Honeysuckle
- Photo Points
- Crest Gauge



Spillman Road



- Legend**
-  Easement Boundary
 -  Stream
 - In-Stream Structures**
 -  Constructed Riffle
 -  Cross Vane
 -  Log Structure
 -  Root Wad
 -  Single Arm Vane
 -  Stream Areas of Concern
 -  Cross Sections
 -  CVS Monitoring Plots
 -  Japanese Honeysuckle
 -  Photo Points
 -  Crest Gauge

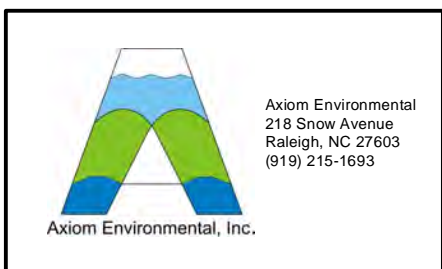
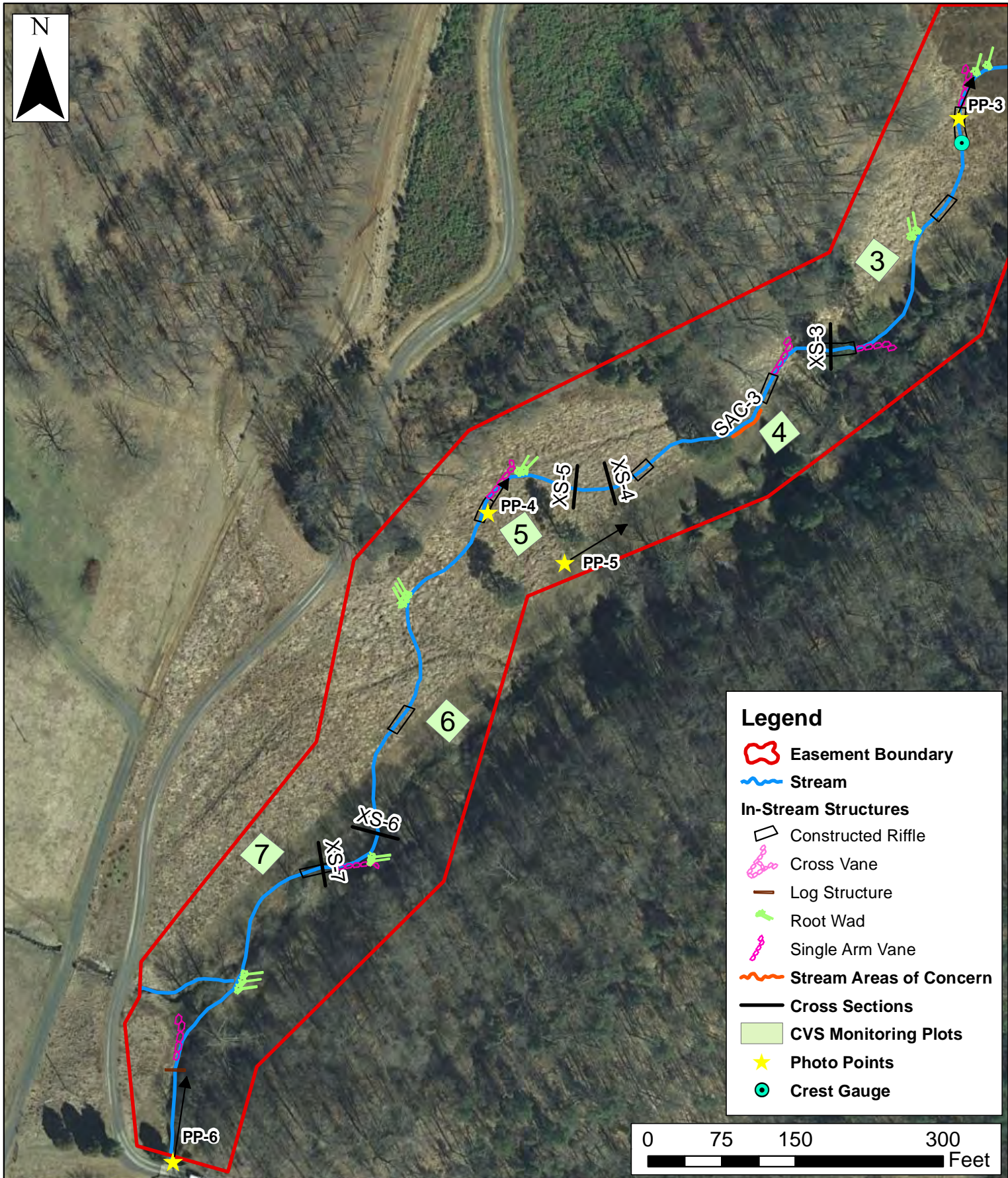


Axiom Environmental
 218 Snow Avenue
 Raleigh, NC 27603
 (919) 215-1693

**CURRENT CONDITIONS PLAN VIEW
 HAUSER CREEK
 EEP PROJECT NUMBER 92471
 Davie County, North Carolina**

Dwn. by.	KRJ/CLF
Date:	September 2014
Project:	12-004.11

FIGURE
2A



**CURRENT CONDITIONS PLAN VIEW
HAUSER CREEK
EEP PROJECT NUMBER 92471
Davie County, North Carolina**

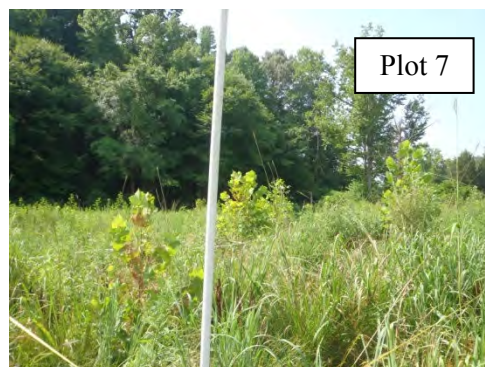
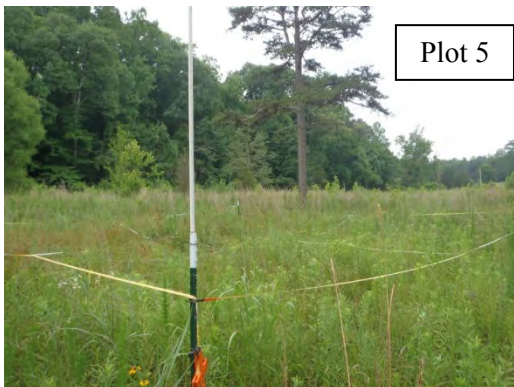
Dwn. by. KRJ/CLF
Date: September 2014
Project: 12-004.11

FIGURE
2B

**Hauser Creek
Stream Fixed Station Photographs
Taken September 22, 2014**



**Hauser Creek
Vegetation Monitoring Photographs
Taken July 3, 2014**



APPENDIX C
VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment

Table 8. CVS Vegetation Plot Metadata

Table 9. Total and Planted Stems by Plot and Species

**Table 7. Vegetation Plot Criteria Attainment
Hauser Restoration Site (EEP Project Number 92741)**

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	

**Table 8. CVS Vegetation Plot Metadata
Hauser Restoration Site (EEP Project Number 92741)**

Report Prepared By	Corri Faquin
Date Prepared	7/7/2014 9:06
database name	Axiom-EEP-2014-A-v2.3.1.mdb
database location	C:\Axiom\Business\CVS
computer name	CORRI-PC
file size	49324032
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY	
Project Code	92471
project Name	UT to Hauser Creek
Description	Stream Restoration
River Basin	Yadkin-Pee Dee
length(ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	7

APPENDIX D
STREAM SURVEY DATA

Cross-section Plots

Longitudinal Profile Plots

Substrate Plots

Tables 10a-b. Baseline Stream Data Summary

Tables 11a-b. Monitoring Data

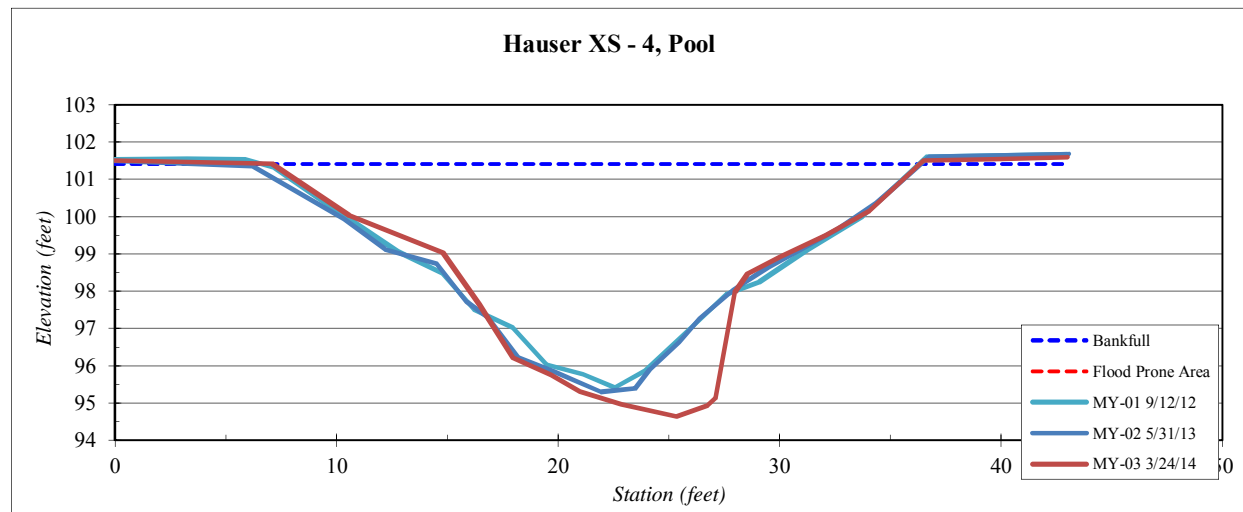
Site	Hauser Creek
Watershed:	Yadkin Pee Dee
XS ID	XS - 4, Pool
Feature	Pool
Date:	3/24/2014
Field Crew:	Perkinson, Jernigan



Station	Elevation
0.0	101.5
7.1	101.4
10.6	100.0
14.8	99.0
16.5	97.6
18.0	96.2
19.7	95.8
21.0	95.3
22.9	95.0
25.3	94.6
26.7	94.9
27.1	95.1
28.0	98.0
28.6	98.5
30.1	98.9
32.1	99.5
34.0	100.1
36.5	101.5
39.6	101.5
43.0	101.6

SUMMARY DATA	
Bankfull Elevation:	101.4
Bankfull Cross-Sectional Area:	98.1
Bankfull Width:	29.2
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	6.8
Mean Depth at Bankfull:	3.4
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

Stream Type	C/E
--------------------	-----



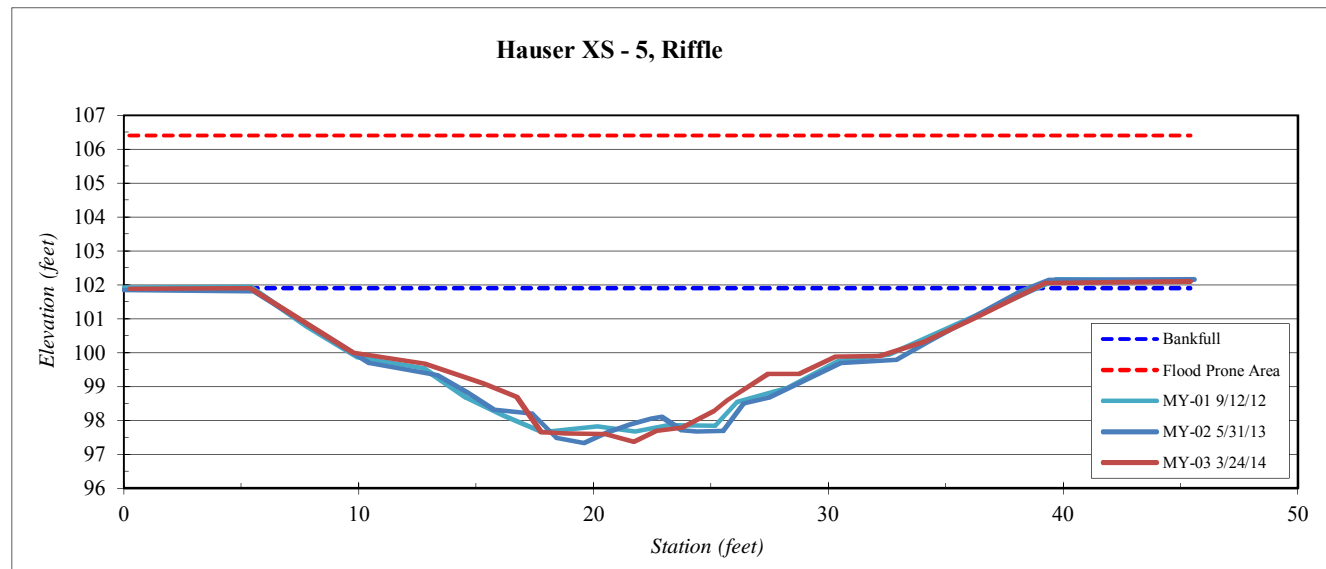
Site	Hauser Creek
Watershed:	Yadkin Pee Dee
XS ID	XS - 5, Riffle
Feature	Riffle
Date:	3/24/2014
Field Crew:	Perkinson, Jernigan



Station	Elevation
0.25	101.89
5.39	101.90
9.78	99.99
12.80	99.68
15.33	99.09
16.73	98.70
17.78	97.66
18.82	97.63
20.53	97.60
21.73	97.38
22.69	97.70
23.78	97.80
25.14	98.28
25.69	98.59
27.44	99.37
28.8	99.38
30.3	99.89
32.2	99.89
34.1	100.31
36.2	100.99
39.3	102.06
45.4	102.10

SUMMARY DATA	
Bankfull Elevation:	101.9
Bankfull Cross-Sectional Area:	80.8
Bankfull Width:	33.4
Flood Prone Area Elevation:	106.4
Flood Prone Width:	150.0
Max Depth at Bankfull:	4.5
Mean Depth at Bankfull:	2.4
W / D Ratio:	13.8
Entrenchment Ratio:	4.5
Bank Height Ratio:	1.0

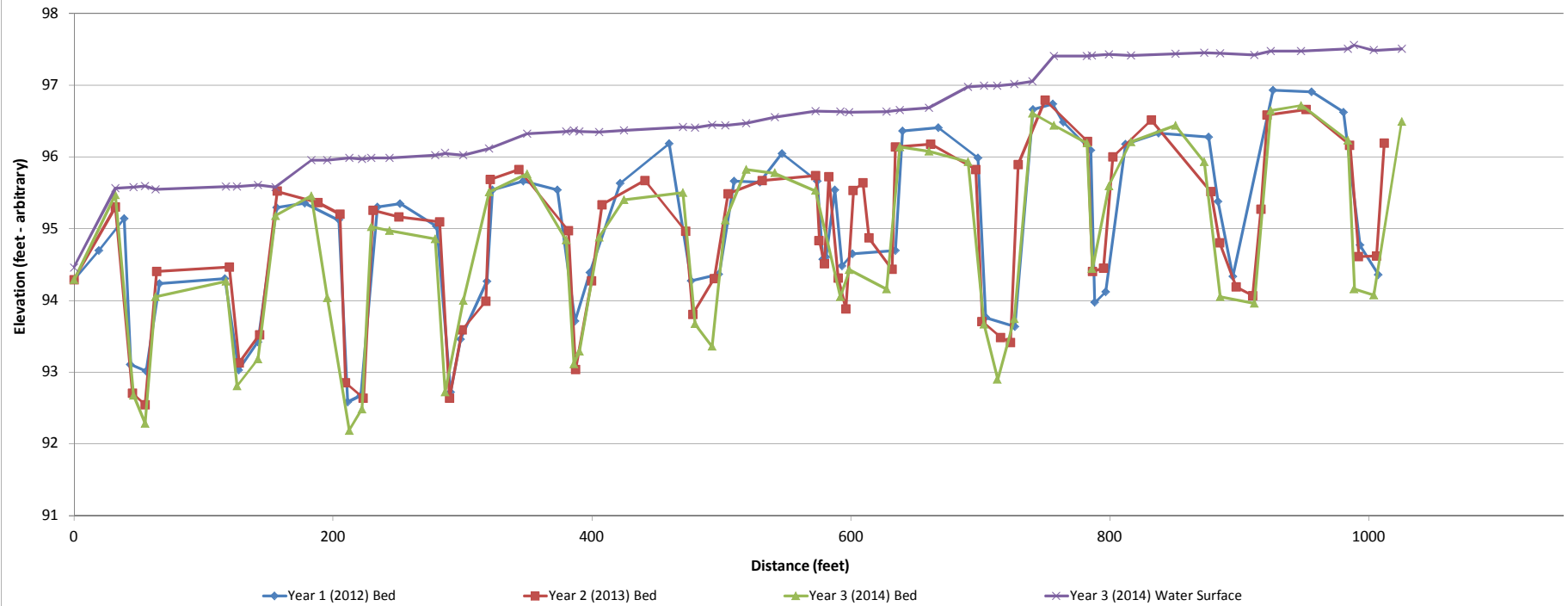
Stream Type	E
--------------------	---



Project Name	Hauser Creek - Year 3 (2014) Profile	Avg. Water Surface Slope	2012 0.0022	2013 0.0022	2014 0.0022	2015	
Reach	Main Reach (00+00 - 10+00)	Riffle Length	48	56	51		
Feature	Profile	Avg. Riffle Slope	0.0047	0.0039	0.0043		
Date	3/34/2014	Pool Length	16	18	21		
Crew	Perkinson, Dean, Jernigan	Avg. Pool Slope	0.0005	0.0004	0.0008		

2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation

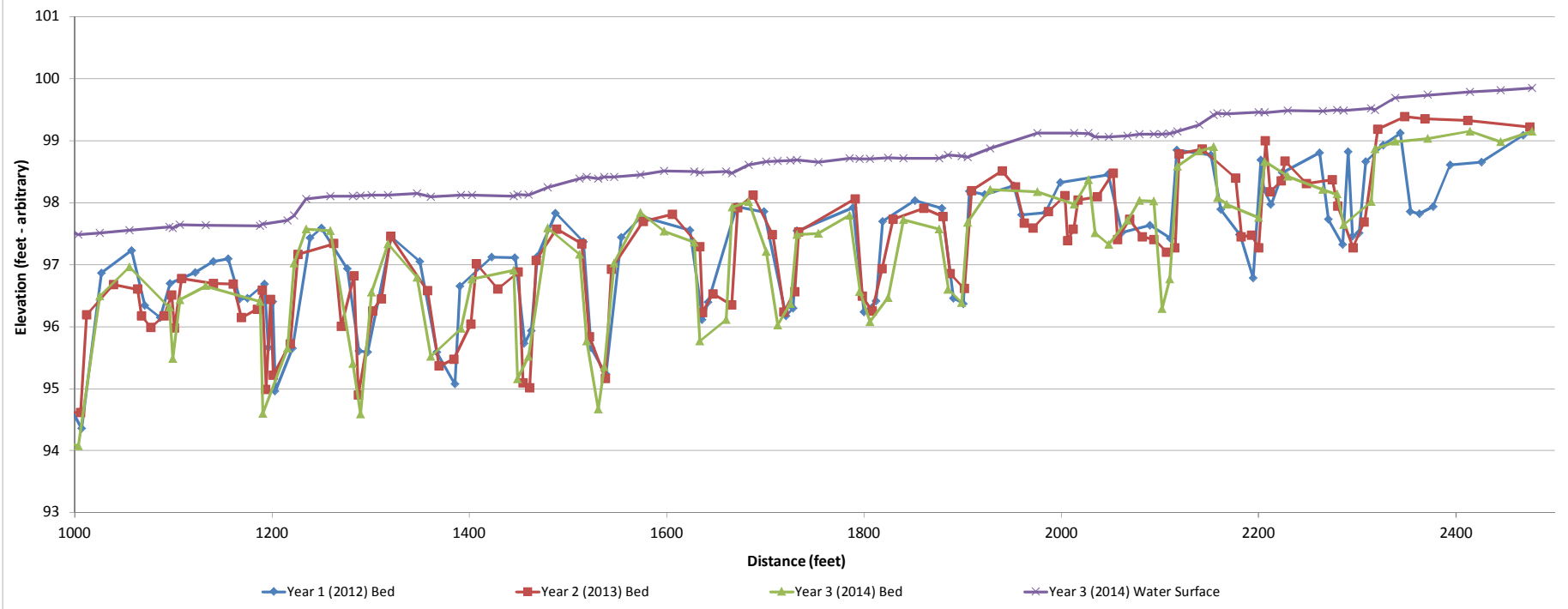
Hauser Creek Year 3 (2014) Profile - Reach 00+00 to 10+00



Project Name	Hauser Creek - Year 3 (2014) Profile	Avg. Water Surface Slope	2012 0.0022	2013 0.0022	2014 0.0022	2015	
Reach	Main Reach (10+00 - 22+50)	Riffle Length	48	56	51		
Feature	Profile	Avg. Riffle Slope	0.0047	0.0039	0.0043		
Date	3/34/2014	Pool Length	16	18	21		
Crew	Perkinson, Dean, Jernigan	Avg. Pool Slope	0.0005	0.0004	0.0008		

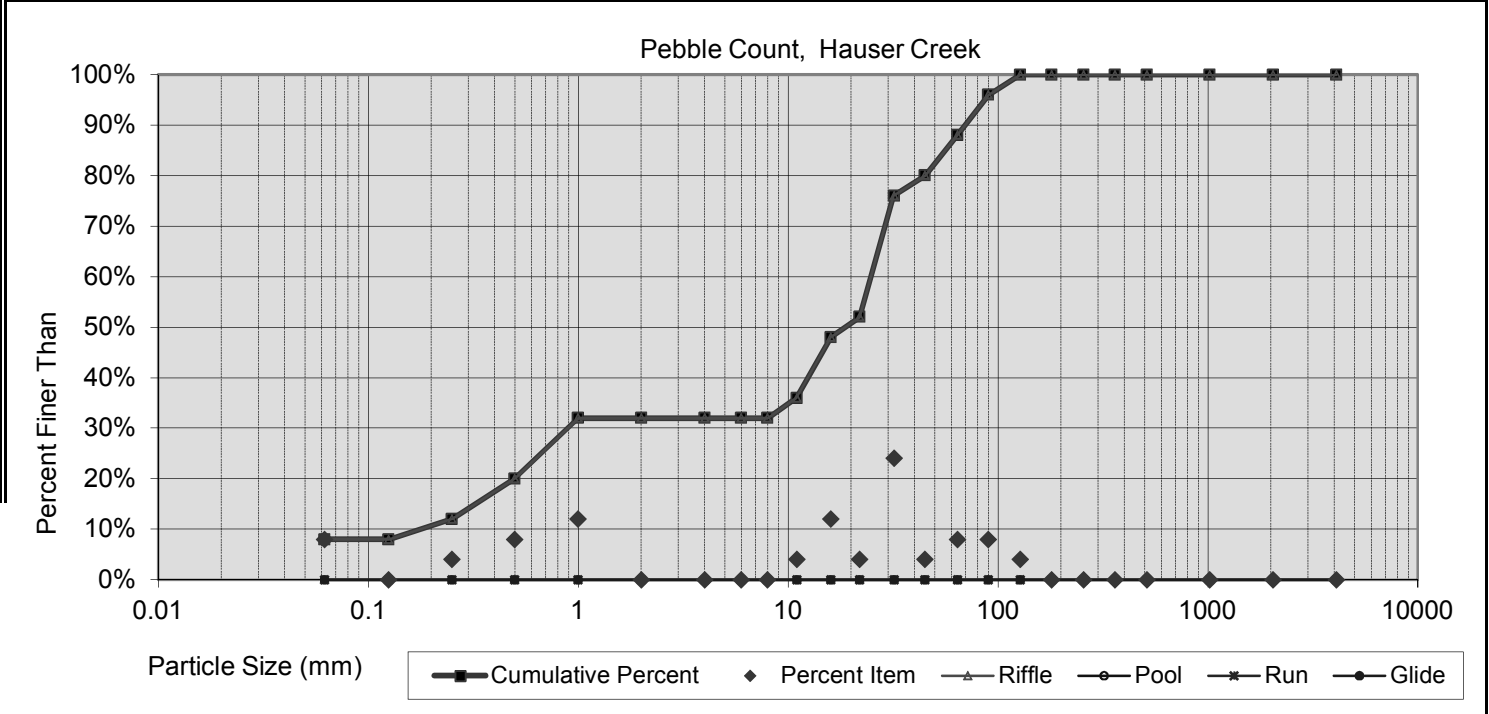
2012 Year 1 Monitoring \Survey			2013 Year 2 Monitoring \Survey			2014 Year 3 Monitoring \Survey			2015 Year 4 Monitoring \Survey		
Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation	Station	Bed Elevation	Water Elevation

Hauser Creek Year 3 (2014) Profile - Reach 10+00 to 22+50



Pebble Count,	
Hauser Creek	
Yadkin Pee Dee	

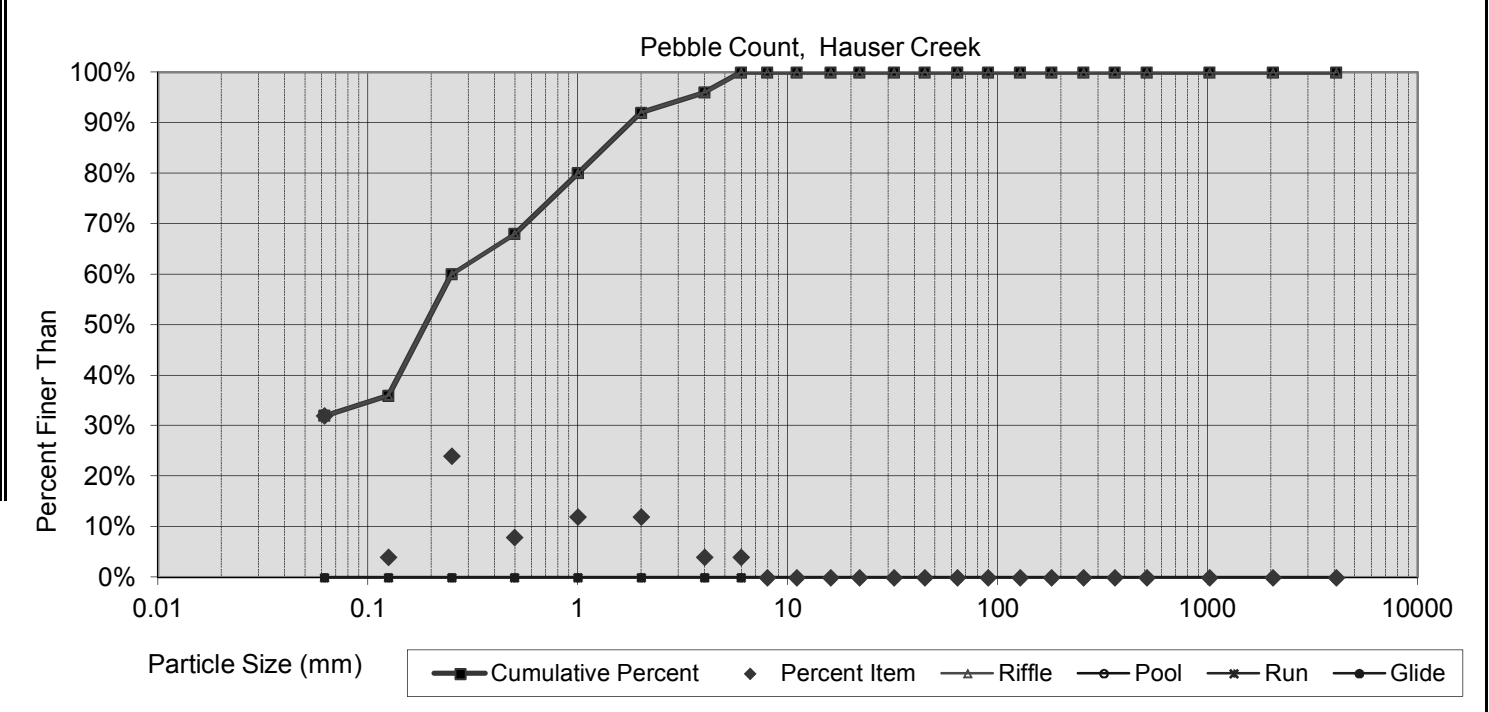
Note:	Cross Section 3



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.354	10.16	18.8	54	86	8%	24%	56%	12%	0%	0%

	Pebble Count,
	Hauser Creek
	Yadkin Pee Dee

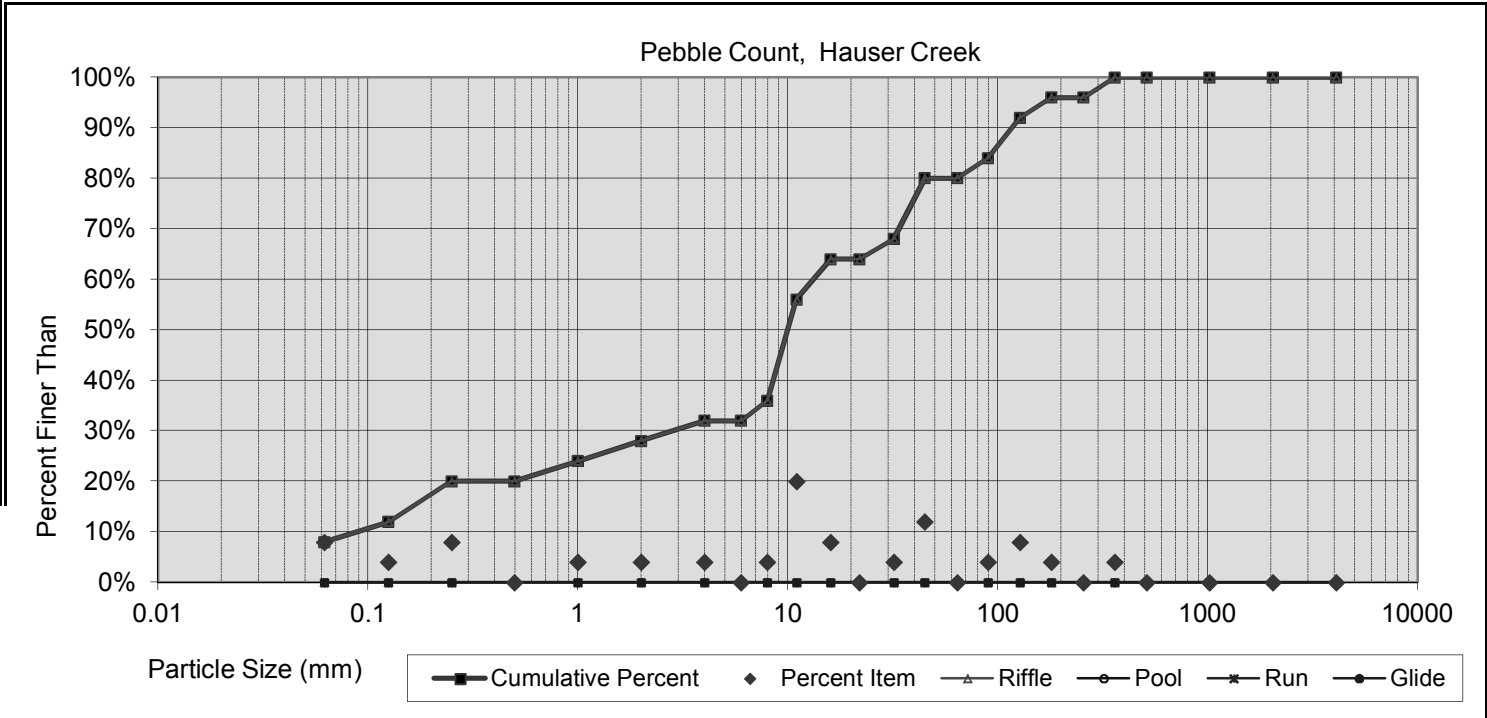
Note:	Cross Section 5



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
#N/A	0.10	0.2	1	3	32%	60%	8%	0%	0%	0%

	Pebble Count,
	Hauser Creek
	Yadkin Pee Dee

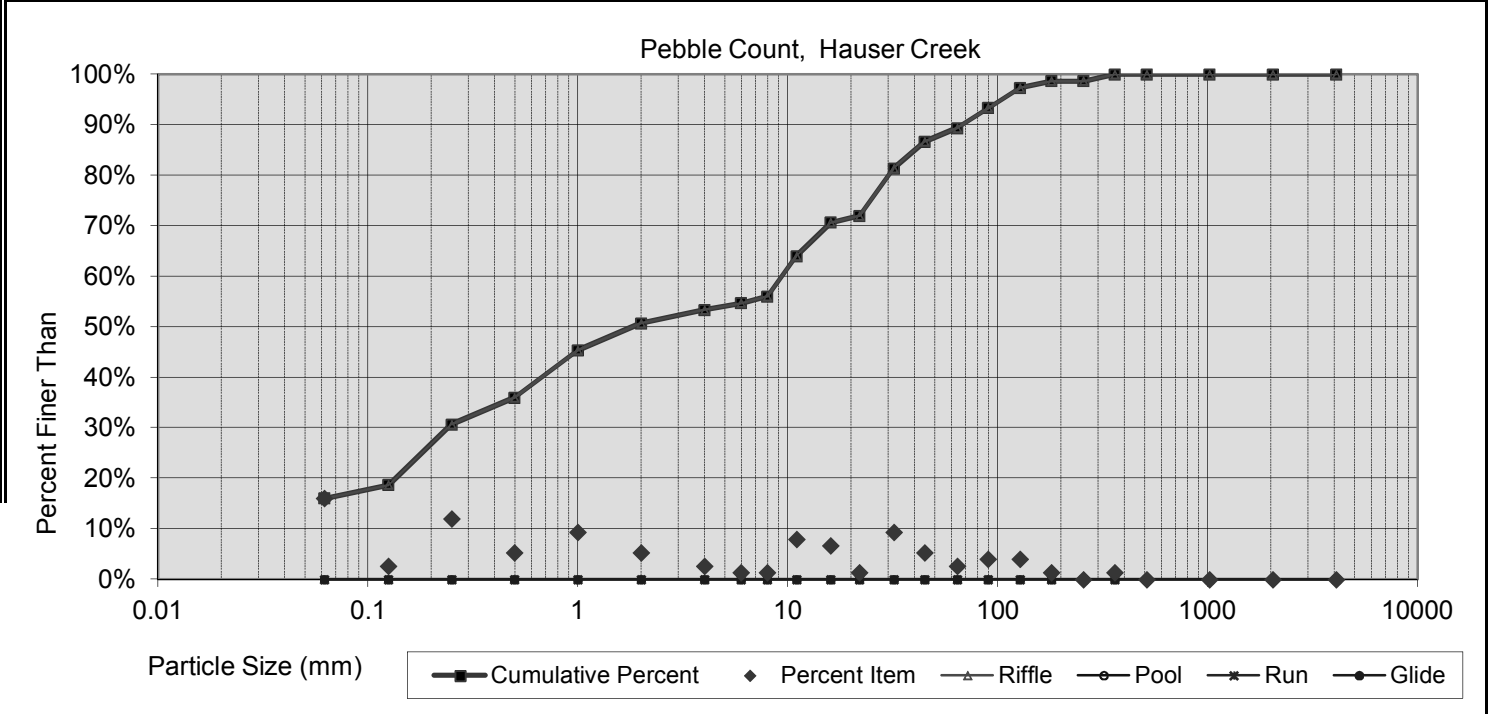
Note:	Cross Section 7



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
0.177	7.44	10.0	90	165	8%	20%	52%	16%	4%	0%

	Pebble Count,
	Hauser Creek
	Yadkin Pee Dee

Note:	Reach Total



Size percent less than (mm)					Percent by substrate type					
D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
#N/A	0.44	1.8	38	104	16%	35%	39%	9%	1%	0%

Table 10. Baseline Stream Data Summary
Hauser Stream Restoration Site-Project No. 92471

Parameter	Gauge ²	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design		
		LL	UL	Eq.	Min	Mean	Med	Max	SD ⁵	n	Min	Mean	Med	Max	SD ⁵	n	Min	Med	Max
Dimension and Substrate - Riffle Only																			
Bankfull Width (ft)	-	-	-	-	17.2		20.8	27.7			21.5		26.5	30.9				33	
Floodprone Width (ft)					176.8		275.2	333.4			306		415	530			210	268	330
Bankfull Mean Depth (ft)	-	-	-	-	2		2.6	3.1			1.6		2.2	3.4				2.5	
¹ Bankfull Max Depth (ft)	-				3.9		4.3	4.8			3.3		3.8	4.2			3.3	3.8	4.2
Bankfull Cross Sectional Area (ft ²)	-	-	-	-	38		54.7	71.2			43		60	80				83.2	
Width/Depth Ratio	-				5.5		8	10.8			7		12	19				13	
Entrenchment Ratio	-				10		13.5	19.3			8.3		16	22.4			6.4	8.1	10
¹ Bank Height Ratio	-				0.8		1.26	1.65			0.7		0.86	1.07			0.9	1	1.1
Profile																			
Riffle Length (ft)					----		----	----			----		----	----			----	----	----
Riffle Slope (ft/ft)					----		----	----			----		----	----			----	----	----
Pool Length (ft)					----		----	----			----		----	----			----	----	----
Pool Max depth (ft)					4.6		5.4	7.2			3.8		4.5	5.2			3.5	4	4.7
Pool Spacing (ft)					12.3		83.2	308			30		64	106			65	89	110
Pattern																			
Channel Beltwidth (ft)					35		46.6	56			26		30	36			43	61.5	107
Radius of Curvature (ft)					23		92.1	273			13		85	275			50	80	155
Rc:Bankfull width (ft/ft)					1.2		4.5	14.4			0.53		3.58	11.2			1.5	2.4	4.7
Meander Wavelength (ft)					55		118	245			60		90	160			128	164	194
Meander Width Ratio					2.9		5.8	12.9			1.1		1.3	1.6			1.3	1.9	3.3
Transport parameters																			
Reach Shear Stress (competency) lb/f ²							----						----					----	
Max part size (mm) mobilized at bankfull							----						----					----	
Stream Power (transport capacity) W/m ²							----						----					----	
Additional Reach Parameters																			
Rosgen Classification	----						C5/E5						C5/E5					C5	
Bankfull Velocity (fps)	----	----	----	----			5.24											5	
Bankfull Discharge (cfs)	----	----	----	----			416												
Valley length (ft)							2156						----						
Channel Thalweg length (ft)							2242						----					2463	
Sinuosity (ft)							1.04						1.1					1.17	
Water Surface Slope (Channel) (ft/ft)	-						0.0024						0.0028					0.0025	
BF slope (ft/ft)	-						----						----					----	
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 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

	Cross Section 1 (Riffle)						Cross Section 2 (Riffle)						Cross Section 3 (Riffle)						Cross Section 4 (Pool)					
Based on fixed baseline bankfull elevation¹	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	98.8	98.8	98.9				99.3	99.3	99.3				101.3	101.2	101.2				101.3	101.4	101.4			
Bankfull Width (ft)	29.2	29.0	29.2				27.6	26.8	27.4				32.4	31.3	31.2				28.9	30.0	29.2			
Floodprone Width (ft)	150.0	150.0	150.0				150.0	150.0	150.0				150.0	150.0	150.0				NA	NA	NA			
Bankfull Mean Depth (ft)	2.1	2.0	2.0				1.8	1.9	1.8				2.4	2.2	2.1				3.1	3.0	3.4			
Bankfull Max Depth (ft)	3.6	3.5	3.4				3.7	3.8	4.6				3.6	3.7	3.6				5.9	6.1	6.8			
Bankfull Cross Sectional Area (ft ²)	61.8	59.2	58.2				49.5	49.6	50.2				76.3	70.2	67.0				88.3	91.3	98.1			
Bankfull Width/Depth Ratio	13.8	14.2	14.7				15.4	14.5	15.0				13.8	14.0	14.5				NA	NA	NA			
Bankfull Entrenchment Ratio	5.1	5.2	5.1				5.4	5.6	5.5				4.6	4.8	4.8				NA	NA	NA			
Bankfull Bank Height Ratio	1.0	1.0	1.0				1.0	1.0	1.0				1.0	1.0	1.0				1.0	1.0	1.0			
Cross Sectional Area between end pins (ft ²)	----	----	----				----	----	----				----	----	----				----	----	----			
d50 (mm)	NA	NA	NA				NA	NA	NA				23.1	18.8	18.8				NA	NA	NA			
	Cross Section 5 (Riffle)						Cross Section 6 (Pool)						Cross Section 7 (Riffle)											
Based on fixed baseline bankfull elevation¹	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+						
Record elevation (datum) used	101.9	101.8	101.9				103.1	103.1	103.1				102.7	102.7	102.7									
Bankfull Width (ft)	33.6	32.6	33.4				39.7	41.5	41.1				33.0	31.3	31.0									
Floodprone Width (ft)	150.0	150.0	150.0				NA	NA	NA				150.0	150.0	150.0									
Bankfull Mean Depth (ft)	2.6	2.5	2.4				2.8	2.7	2.4				2.6	2.4	2.3									
Bankfull Max Depth (ft)	4.3	4.5	4.5				5.6	5.7	5.2				4.4	4.2	4.0									
Bankfull Cross Sectional Area (ft ²)	85.8	82.5	80.8				109.9	110.6	96.8				85.5	74.8	72.1									
Bankfull Width/Depth Ratio	13.2	12.9	13.8				NA	NA	NA				12.7	13.1	13.3									
Bankfull Entrenchment Ratio	4.5	4.6	4.5				NA	NA	NA				4.5	4.8	4.8									
Bankfull Bank Height Ratio	1.0	1.0	1.0				1.0	1.0	1.0				1.0	1.0	1.0									
Cross Sectional Area between end pins (ft ²)	----	----	----				----	----	----				----	----	----									
d50 (mm)	0.1	0.1	0.2				NA	NA	NA				22.0	11.0	10.0									

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

**Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Hauser Stream Restoration-Project No. 92471 (2463 feet)**

Parameter	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
Bankfull Width (ft)	27.6		32.4	33.6			26.8		31.3	32.6			27.4		31	33.4														
Floodprone Width (ft)			150						150						150															
Bankfull Mean Depth (ft)	1.8		2.4	2.6			1.9		2.2	2.5			1.8		2.1	2.4														
¹ Bankfull Max Depth (ft)	3.6		3.7	4.4			3.5		3.8	4.5			3.4		4	4.6														
Bankfull Cross Sectional Area (ft ²)	49.5		76.3	85.8			49.6		70.2	82.5			50.2		67	80.8														
Width/Depth Ratio	12.7		13.5	15.3			13		14.1	14.5			13.5		14.6	15.2														
Entrenchment Ratio	4.5		4.6	5.4			4.6		4.8	5.6			4.5		4.8	5.5														
¹ Bank Height Ratio			1						1						1															
Profile																														
Riffle Length (ft)	28	48	48	74	12.5	27	8	56	52	154	25	27	15	51	49	123	23	25												
Riffle Slope (ft/ft)	0.0%	0.5%	0.3%	2.8%	0.6%	25	0.0%	0.4%	0.2%	3.4%	0.7%	26	0.0%	0.4%	0.1%	3.5%	0.7%	25												
Pool Length (ft)	3	16	12	49	11	31	4	18	16	58	11	32	8	21	19	42	9	25												
Pool Max depth (ft)	5.6		5.8	5.9			5.7		5.9	6.1			5.2		6	6.8														
Pool Spacing (ft)	8	77	85	118	27	31	8	75	86	154	35	33	39	93	93	174	26	25												
Pattern																														
Channel Beltwidth (ft)																														
Radius of Curvature (ft)																														
Rc:Bankfull width (ft/ft)																														
Meander Wavelength (ft)																														
Meander Width Ratio																														
Additional Reach Parameters																														
Rosgen Classification			C4						C4						C4															
Channel Thalweg length (ft)			2468						2468						2468															
Sinuosity (ft)			1.17						1.17						1.17															
Water Surface Slope (Channel) (ft/ft)			0.0022						0.0022						0.0022															
BF slope (ft/ft)			----						----						----															
³ Ri% / Ru% / P% / G% / S%	52%	16%	20%	12%			29%	8%	11%	52%			55%	13%	22%	10%														
³ SC% / Sa% / G% / C% / B% / Be%	19%	28%	32%	21%	0%	0%	17%	31%	38%	13%	1%	0%	16%	35%	39%	9%	1%	0%												
³ d16 / d35 / d50 / d84 / d95 /	NA	0.26	6.9	73	130		NA	0.34	4	44	108		0.062	0.44	1.8	38	104													
² % of Reach with Eroding Banks			<5%						<5%						<5%															
Channel Stability or Habitat Metric			----						----						----															
Biological or Other			----						----						----															

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

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

APPENDIX E
HYDROLOGY DATA

Table 12. Verification of Bankfull Events

Table 12. Verification of Bankfull Events

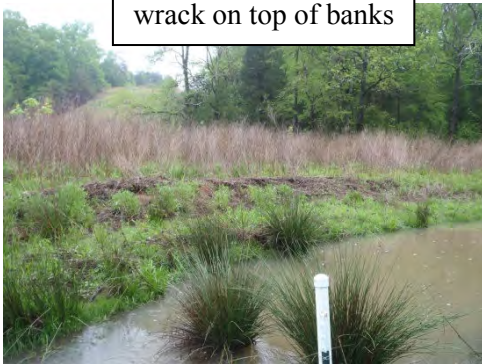
Hauser Creek Restoration Site (EEP Project Number 92741)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
June 3, 2013	December 26, 2012	Approximately 1.16 inches of rain documented to occur after two 0.5-inch events within the previous week at a nearby rain station*.	--
April 29, 2013	January 17, 2013	Approximately 4.6 inches of rain documented to occur from January 13-17, 2013 at a nearby rain station*.	--
April 29, 2013/ June 3, 2013	April 28, 2013	Approximately 1.25 inches of rain documented at a nearby rain station*, in addition to crest gauge observations and visual signs of overbank including wrack and sediment deposition adjacent to the channel, and receding water.	1-3
November 25, 2013	June 7, 2013	Approximately 2.76 inches of rain documented to occur between June 5-7, 2013 at a nearby rain station*.	--
November 25, 2013	July 27, 2013	Approximately 1.89 inches of rain documented to occur on July 27, 2013 at a nearby rain station*.	--
November 25, 2013	August 12, 2013	Approximately 2.60 inches of rain documented to occur between August 10-13, 2013 at a nearby rain station*.	--
July 7, 2014	November 26, 2013	Approximately 2.42 inches of rain documented to occur between November 26-27, 2013 at a nearby rain station**.	--
July 7, 2014	December 22, 2013	Approximately 2.47 inches of rain documented to occur between December 22-23, 2013 at a nearby rain station**.	--
July 7, 2014	January 11, 2014	Approximately 1.96 inches of rain documented to occur between January 10-11, 2014 at a nearby rain station**.	--
July 7, 2014	April 15, 2014	Approximately 2.33 inches of rain documented to occur between April 14-15, 2014 and one week after a 1.56-inch rainfall event at a nearby rain station**.	--

*Reported at the Winston Salem Airport (KINT) (Weatherunderground 2013)

**Reported at the Winston Salem Airport (KINT) (Weatherunderground 2014)

Bankfull Photo 1:
wrack on top of banks



Bankfull Photo 2:
sediment deposition



Bankfull Photo 3:
crest gauge

