

OAKLEY CROSSROADS  
STREAM & BUFFER RESTORATION  
MONITORING REPORT (YEAR 2 OF 5)

Pitt County, North Carolina  
SCO Project Number 050659701  
EEP Project Number 273



Prepared for:  
North Carolina Ecosystem Enhancement Program  
1652 Mail Service Center  
Raleigh, NC 27699-1652



Status of Plan: Final  
Construction Completed: 2011  
Data Collected: 2012  
Submission Date: November 2012

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Prepared by:



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**Stantec**

Stantec Consulting Services, Inc.  
801 Jones Franklin Road, Suite 300  
Raleigh, NC 27606

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## 1.0 Executive Summary / Project Abstract

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The overall goal of the Oakley restoration project was to improve water quality and wildlife habitat by restoring a stable stream and riparian buffer system to the project site. The objectives of the project were to restore stream stability and improve aquatic habitat, restore riparian buffer along the stream channel, preserve riverine wetlands, establish a wildlife corridor, divert an unbuffered agricultural ditch system from the stream channel to an irrigation pond, and establish native vegetation within the permanent conservation easement. The project included 3,789 linear feet of stream restoration and 329 linear feet of stream enhancement. Priority II stream restoration involved restoring riffle/pool sequences, the installation of structures, and floodplain grading to improve floodplain connectivity and provide diverse instream habitat. Enhancement II stream restoration involved the planting of native hardwood trees and shrubs. Also, native riparian buffer planting took place on over 18 acres of the site, and an additional 1.37 acres of wetland was preserved. The project will result in 3,931 stream mitigation units (SMUs), 16.9 acres of buffer mitigation units (BMUs), and 0.27 acres of wetland mitigation units (WMUs).

The Monitoring Year 2 [MY2] stem counts within each of the nine (9) vegetative monitoring plots are included in Tables 7 and 9 in Appendix C. Located within the Tar-Pamlico River basin, this project was instituted prior to October 11, 2007 and is therefore eligible for riparian buffer restoration credit up to 200 feet from the top of bank of all perennial and intermittent waterways within the conservation easement area. As such, the vegetative monitoring plots have been assessed for the vegetation success criteria for both buffer (320 planted trees/acre) and streams (MY3 interim criteria of 320 woody stems/acre). All nine vegetative monitoring plots met the vegetation success criteria for riparian buffers. Of the five plots within the 50-foot stream buffer, all are currently meeting the vegetation success criteria for streams. Ecosystems Grading Solutions, Inc. planted an additional 5,000 bare roots and livestakes at the Oakley site on January 31, 2012.

Several large areas of *Murdannia keisak* (marsh dayflower), observed in 2011, have expanded in and along the banks of stream throughout Section 1 in 2012. Areas where *Murdannia keisak* was most abundant include: between Station 0+50 and 1+50, between Station 3+50 and 7+00, near Station 21+50, and near Station 28+50. Currently, these areas of *Murdannia keisak* do not pose a threat to native vegetation establishment or stream stability, but they will continue to be monitored during future field visits to document any changes. In addition, the streambanks on both left and right bank were observed to be bare below the Briley culvert, between Station 38+25 and 39+00. The rest of the site appears to have benefitted tremendously from the supplemental planting in 2012, as there were no additional bare areas observed on the project site. Overall the planted woody vegetation has become established and has excellent vigor.

Sections 1, 2, and 3 of the Oakley restoration project were observed to be in generally stable condition. The channel's profile and cross-section adjusted only minimally from baseline conditions. The channel has good connection to its floodplain. Evidence of bankfull overflow was observed during the stream and vegetation monitoring on October 4th and 10th, 2012. Evidence included the presence of wrack lines and cork above the bankfull line on the crest gauge. The dimension, pattern, and profile survey for MY2 conditions for Section 1 and Section 2 were analyzed, and the current shear stress and stream power are consistent with the design intent to reduce sediment transport.

An area of aggradation, noted in 2011, was again observed below the upstream culvert between Station 0+00 and 0+60. Additionally, one area of minor bed downcutting was observed between Station 35+00 and 37+00. The structures in this area are still providing grade control and will help the area reach an equilibrium. The areas of aggradation and bed downcutting do not currently threaten the stability of the stream. These areas will continue to be monitored during future field visits to document any changes. A few relict nutria burrows were also observed between Station 4+40 and 10+00, but the livestock are maintaining bank stability and these areas do not threaten the stability of the stream. *Callitriche heterophylla* (water starwort), a non-invasive species, was again observed in several areas along all three sections of the stream. This aquatic plant was also noted to be present in monitoring year 1 and prior to the construction of the restoration project. Neither the nutria nor the water starwort currently threatens the stability of the restored stream. These issues will continue to be monitored during future field visits to document any changes.

As per NCEEP's request the vegetative cover of brush mattresses along the entire stream length was also visually assessed. Several areas were observed where brush mattresses had less than the required 80% vegetative cover. These areas include brush mattresses located along the left bank on the meander bend near Station 28+00 and between Stations 36+00 and 36+50, a drastic improvement from 2011. Refer to Figure 2 in Appendix A for the location of these brush mattresses.

The wetland preservation areas were also visually assessed during the vegetation monitoring. No issues were observed in these areas and existing vegetation appears to be in good condition. These areas will continue to be monitored during future field visits.

Summary information, data, and statistics related to the 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 EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.



## **2.0 Methodology**

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Channel stability and vegetation survival were monitored on the project site. Post-restoration monitoring will be conducted for a minimum of five years or until the success criteria are met following the completion of construction to document project success. The Monitoring Year 2 survey was completed using survey grade GPS on October 10, 2012.

### **2.1 MORPHOLOGICAL PARAMETERS AND CHANNEL STABILITY**

#### **2.1.1 Dimension**

Dimensional characteristics were monitored at 7 permanent cross-sections (4 riffles, 3 pools) along Section 1 and Section 2. Survey data included points measured at all breaks in slope including top of bank, bankfull, inner berm, edge of water, and thalweg. Dimensional characteristics were compared to baseline conditions. All monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type. Stream channel stability and geomorphic monitoring for Section 3 was documented visually. Natural variability is expected, however the system should not experience trends toward excessive increasing bank erosion, channel degradation, or channel aggradation.

#### **2.1.1 Pattern and Profile**

The entire longitudinal profile of Section 1 and Section 2 was surveyed. Stationing from the as-built survey was used. The longitudinal profiles should show that the bedform features are remaining stable. The pools should remain deep with flat water surface slopes, and the riffles should remain steeper and shallower than the pools.

#### **2.1.2 Substrate**

Since the streams throughout the project site are dominated by sand-size particles, pebble count procedures would not show a significant change in bed material size or distribution over the monitoring period; therefore, as per NCEEP, bed material analyses were not undertaken for this project.

#### **2.1.1 Sediment Transport**

As mentioned previously, additional sediment transport evaluations will not be undertaken during the five-year monitoring period. However, the dimension, pattern, and profile survey for MY2 conditions for Section 1 and Section 2 were analyzed to determine whether the current sediment competency and capacity is consistent with the design.

## **2.2 VEGETATION**

The Carolina Vegetation Survey (CVS) Level 2 methodology was utilized to sample vegetation on October 4, 2012. Nine 100-square meter CVS plots have been established within the project area. In each plot, four plot corners have been permanently located with rebar. Volunteer plant species (Level 2) were recorded this year and will only be considered in vegetative success determinations for the stream portion of this project. As such, volunteer plant species will be recorded for subsequent monitoring years in

vegetation plots located within the 50 foot buffer of the restored stream. Refer to Figure 2 in Appendix A. In all vegetation plots species composition, density, and survival of the planted vegetation was monitored.

This project is generating both stream and riparian buffer mitigation assets. Vegetation success for these assets is measured in two ways. Stream mitigation units (SMUs) require 260 planted and volunteer native hardwood stems (trees and shrubs) per acre for a minimum of 5 years. Buffer mitigation units (BMUs) require 320 planted native hardwood stems (trees only) per acre for a minimum of 5 years. In accordance with North Carolina Division of Water Quality Administrative Code 15A NCAC 02B.0260 (TAR-PAMLICO RIVER BASIN, *Mitigation Program for Protection and Maintenance of Existing Riparian Buffers*) “[planted vegetation] shall include a minimum of at least two native hardwood tree species planted at a density to provide 320 trees per acre at maturity.” Also, for SMUs and BMUs, the buffer must be at least 50-feet wide on both sides of the channel.

The interim measure of vegetative success for SMUs for the site will be the survival of at least 320 3-year old stems per acre at the end of year three of the monitoring period and 280 4-year old stems per acre at the end of year four monitoring period. There are no interim measures of vegetative success for BMUs.

## **2.3 HYDROLOGY**

### **2.3.1 Wetland**

Neither wetland restoration or enhancement credit is being sought for this project. Existing jurisdictional wetlands as depicted in Figure 2 in Appendix A are being preserved. The wetland preservation areas are visually assessed during each monitoring year.

### **2.3.2 Stream**

One crest gauge has been installed onsite and is located near Cross-section 3. Each visit to the site included documentation of the highest stage for the monitoring interval and a reset of the device. Other indications of bankfull flow including the presence of wrack lines, sediment, or flooding were also monitored, and their presence was recorded and documented photographically. Refer to Figure 2 in Appendix A for the location of the crest gauge.

### 3.0References

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Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (<http://cvs.bio.unc.edu/methods.htm>)

NCDWQ. 2004. Tar-Pamlico River Basinwide Water Quality Plan. North Carolina Department of Environment and Natural Resources, Division of Water Quality. Raleigh, NC.

NCEEP. 2010. Procedural Guidance and Content Requirements for EEP Monitoring Reports. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 1.3, January 15, 2010.

NCEEP. 2008. Mitigation Plan Document – Format Data Requirements, and Content Guidelines. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 2.0, March 27, 2008.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

Schafale, M.P. and A.S. Weakley, 1990. Classification of the Natural Communities of North Carolina, Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, NCDEHNR, Raleigh, North Carolina.

United States Army Corps of Engineers – Wilmington District, North Carolina Division of Water Quality, United States Environmental Protection Agency – Region IV, Natural Resources Conservation Service, North Carolina Wildlife Resources Commission. 2003. Stream Mitigation Guidelines.

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## 4.0 Appendices

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Appendix A – Project Vicinity Map and Background Tables

Appendix B – Visual Assessment Data

Appendix C – Vegetation Plot Data

Appendix D – Stream Survey Data

Appendix E – Hydrologic Data

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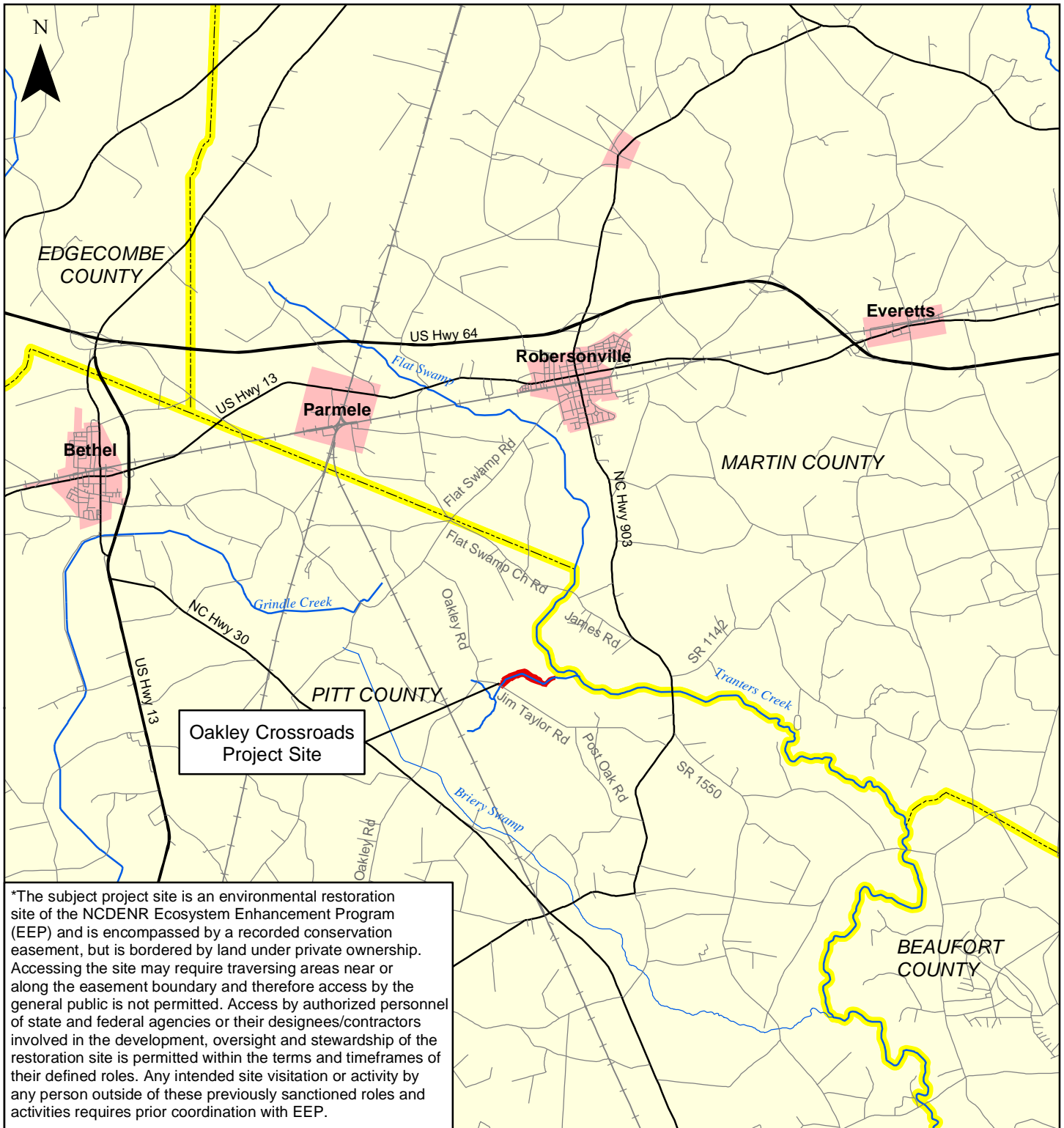
## **Appendix A. Project Vicinity Map and Background Tables**

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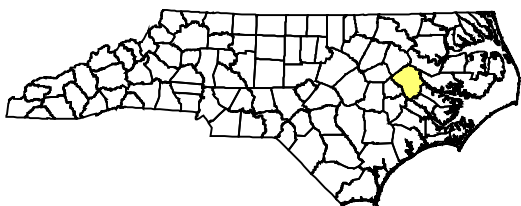
Figure 1	– Vicinity Map and Directions
Table 1a.b.	– Project Restoration Components
Table 2	– Project Activity and Reporting History
Table 3	– Project Contacts
Table 4	– Project Attribute

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\*The subject project site 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 by 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 EEP.



**Legend**

- Local Roads
- Major Roads
- Railroads
- Conservation Easement
- Streams
- Municipality
- County Boundary

**Figure 1. Project Vicinity Map**

Oakley Crossroads  
Stream & Buffer Restoration  
Pitt County, North Carolina

0 0.5 1 2 Miles



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**Table 1a. Project Components and Mitigation Credits**  
**Oakley Crossroads Stream and Buffer Restoration (EEP# 273)**

<b>Project Component or Reach ID</b>	<b>Existing Feet/Acres</b>	<b>Restoration Level</b>	<b>Approach</b>	<b>Footage or Acreage</b>	<b>Stationing/ Location</b>	<b>Mitigation Ratio</b>	<b>Mitigation Units</b>	<b>BMP Elements<sup>1</sup></b>	<b>Comment</b>
Section 1	2,950	R	PII	3,637	00+00 to 37+98.64	1:1	3,637		Ten foot width of ford crossing removed from total length. 152 LF of restored stream with <50' buffer separated into line item below. Total restoration footage 3,637 LF.
Section 1, <50 ft buffer	152	R	PII	152	~33+00 to ~37+00	1:1	152		152 LF of restored stream has <50' buffer on right bank. Mitigation ratio is likely to change once DWQ publishes reduced SMU calculation for areas with <50 ft of buffer.
Section 2	40	E	EII	40	~38+39 to ~38+79	1.5:1	26.7		Enhancement - log structures, brush mattresses and planting.
Section 3	289	E	EII	289	downstream of Section 2	2.5:1	115.6		Enhancement - planting only.
Riparian Buffer	n/a	R		735,728 sq ft	n/a	1:1	735,728		786,258 sq ft planted, 735,728 sq ft of which are eligible for mitigation credit. Area removed for areas with undiffuse flow, buffer width >200', or buffer width <50'.
Wetlands	1.37	P		1.37	n/a	5:1	0.27		

<b>Table 1b. Component Summations</b>							
<b>Oakley Crossroads Stream and Buffer Restoration (EEP #273)</b>							
Restoration	Stream	Riparian		Non-Ripar	Upland	Buffer	
Level	(lf)	Wetland (Ac)		(Ac)	(Ac)	(Ac)	BMP
		Riverine	Non-Riverine				
Restoration	3789					16.9	
Enhancement							
Enhancement I							
Enhancement II	329						
Creation							
Preservation		1.37					
HQ Preservation							
<b>Totals (Feet/Acres)</b>	<b>4118</b>	<b>1.37</b>				<b>16.9</b>	
<b>MU Totals</b>	<b>3,931.3</b>	<b>0.27</b>				<b>16.9</b>	

 Non-Applicable

<b>Table 2. Project Activity and Reporting History</b>		
<b>Oakley Crossroads Stream and Buffer Restoration (EEP# 273)</b>		
<b>Elapsed Time Since Grading Complete:</b>	<b>18 months</b>	
<b>Elapsed Time Since Original Planting Complete:</b>	<b>18 months</b>	
<b>Number of Reporting Years<sup>1</sup>:</b>	<b>2</b>	
	<b>Data Collection</b>	<b>Completion or</b>
<b>Activity or Deliverable</b>	<b>Complete</b>	<b>Delivery</b>
Mitigation Plan	n/a	August 2006
Final Design – Construction Plans	n/a	June 2010
Construction (Grading complete)	n/a	May 2011
Seeding	n/a	May 2011
Planting	n/a	May 2011
As-built (Year 0 Monitoring – baseline)	June 2011	July 2011
Year 1 Monitoring	September 2011	November 2011
Replanting (bareroots)	n/a	January 2012
Year 2 Monitoring	October 2012	November 2012
Year 3 Monitoring	n/a	n/a
Year 4 Monitoring	n/a	n/a
Year 5 Monitoring	n/a	n/a

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

<b>Table 3. Project Contacts Table</b>	
<b>Oakley Crossroads Stream and Buffer Restoration (EEP# 273)</b>	
<b>Designer</b>	Stantec Consulting Services, Inc.
	801 Jones Franklin Rd, Ste 300, Raleigh, NC 27606
Primary project design POC	Nathan Jean (970) 449-8615
<b>Construction Contractor</b>	Ecosystems Grading Solutions, Inc.
	6642 Roper Hollow Rd., Morganton, NC 28655
Construction contractor POC	Bobby Koone (828) 584-3018
<b>Survey Contractor</b>	Turner Land Surveying
	3201 Glenridge Dr., Raleigh, NC 27604
Survey contractor POC	Elizabeth and David Turner (919) 875-1378
<b>Planting Contractor</b>	Bruton Natural Systems, Inc.
	P.O. Box 1197, Remont, NC 27830
Planting contractor POC	Charlie Bruton (919) 242-6555
<b>Seeding Contractor</b>	Ecosystems Grading Solutions, Inc.
	6642 Roper Hollow Rd., Morganton, NC 28655
Contractor point of contact	Bobby Koone (828) 584-3018
<b>Seed Mix Sources</b>	Green Resources
<b>Nursery Stock Suppliers</b>	Southeastern Native Plant Nursery
	South Carolina Super Tree Nursery
	Natives
<b>Monitoring Performers</b>	Stantec Consulting Services, Inc.
	801 Jones Franklin Rd, Ste 300, Raleigh, NC 27606
Stream Monitoring POC	Tim Taylor (980) 297-7669
Vegetation Monitoring POC	Amber Coleman (919)865-7399
Wetland Monitoring POC	n/a

<b>Table 4. Project Baseline Information and Attributes</b>			
<b>Oakley Crossroads Stream and Buffer Restoration (EEP# 273)</b>			
<b>Project Information</b>			
Project County	Pitt		
Project Area (acres)	26.6		
Project Coordinates (latitude and longitude)	35.76692, -77.269077		
<b>Project Watershed Summary Information</b>			
Physiographic Region	Coastal Plain		
River Basin	Tar-Pamlico		
USGS HUC for Project (14 digit)	0302010309002		
NCDWQ Sub-basin for Project	03-03-06		
Project Drainage Area (sq mi)	1.71		
Project Drainage Area % Impervious	<1%		
CGIA Landuse Classification	Cropland and Pasture		
<b>Reach Summary Information</b>			
Reach name	Section 1	Section 2	Section 3
Length of reach (linear feet)	3,799	40	289
Valley classification	VIII	VIII	VIII
Drainage area (acres)	1,014.5	1,014.7	1,092.3
NCDWQ stream identification score	41	40.5	40.5
NCDWQ classification	n/a	n/a	n/a
Morphological description (stream type)	E5	F5	F5
Evolutionary trend	E5	C5	C5
Underlying mapped soils	Bladen	Pantego	Pantego
Drainage class	Poorly drained	Very poorly drained	Very poorly drained
Soil hydric status	Yes	Yes	Yes
Slope	0-2%	0-1%	0-1%
FEMA classification	Zone X	Zone X	Zone X
Native vegetation community	Riverine bottomland hardwood and mesic mixed hardwood forest		
Percent composition of exotic invasive vegetation	0%	0%	10%
<b>Wetland Summary Information</b>			
n/a - wetland preservation only			
<b>Regulatory Considerations</b>			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	USACE 404 permit
Waters of the United States - Section 401	Yes	Yes	NCDWQ 401 permit
Endangered Species Act	No	n/a	n/a
Historic Preservation Act	No	n/a	n/a
Coastal Zone Management Act (CZMA)/Coastal Aream Management Act (CAMA)	No	n/a	n/a
FEMA Floodplain Compliance	No	n/a	n/a

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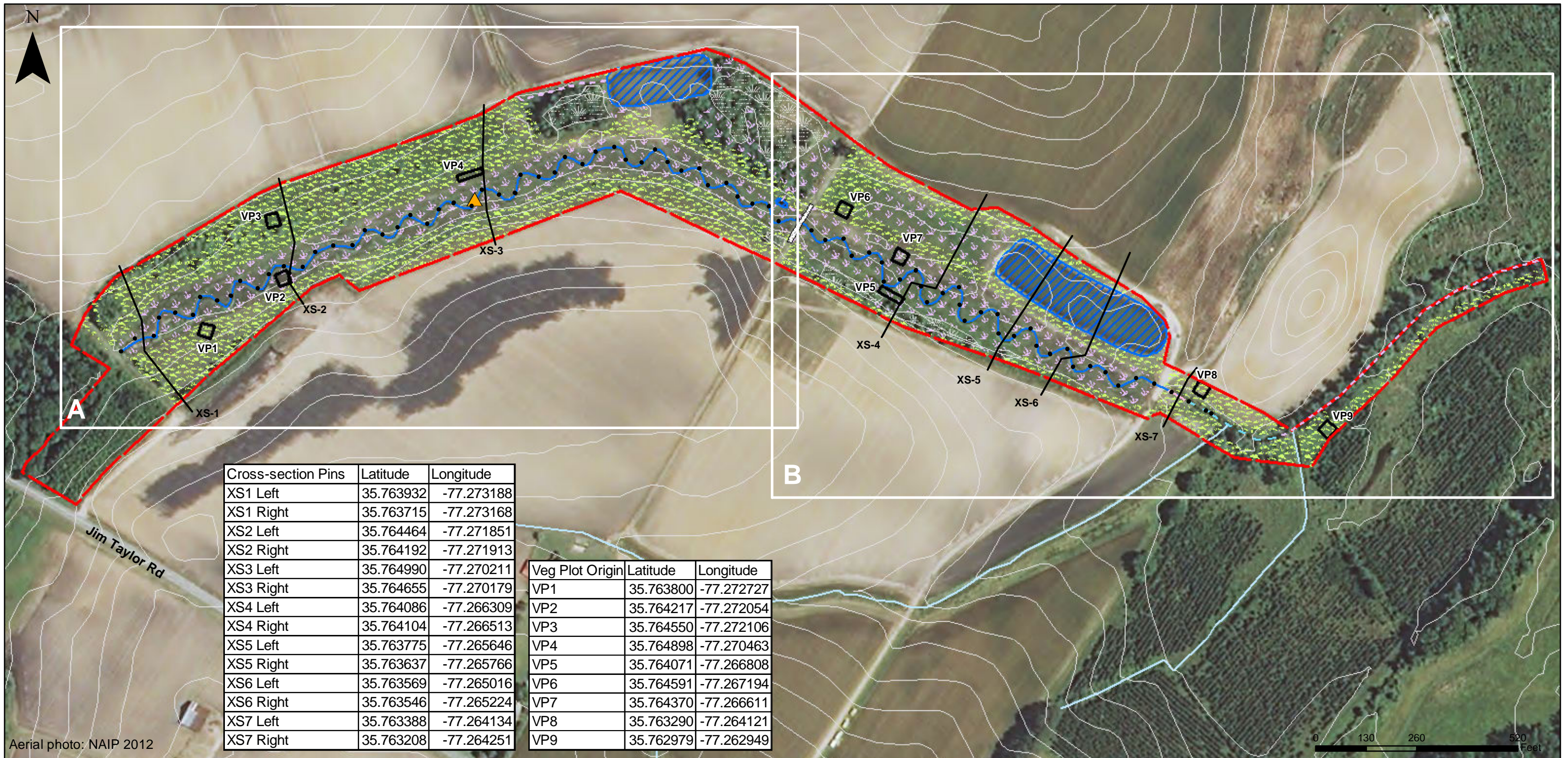


## **Appendix B. Visual Assessment**

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Figure 2	– Current Condition Plan View (3 Sheets)
Table 5	– Visual Stream Morphology Stability Assessment
Table 6	– Vegetation Condition Assessment
Photos	– Stream Stations (S1-S9)
Photos	– Vegetation Plots (V1-V19)









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**Figure 2. Current Condition Plan View MY2**

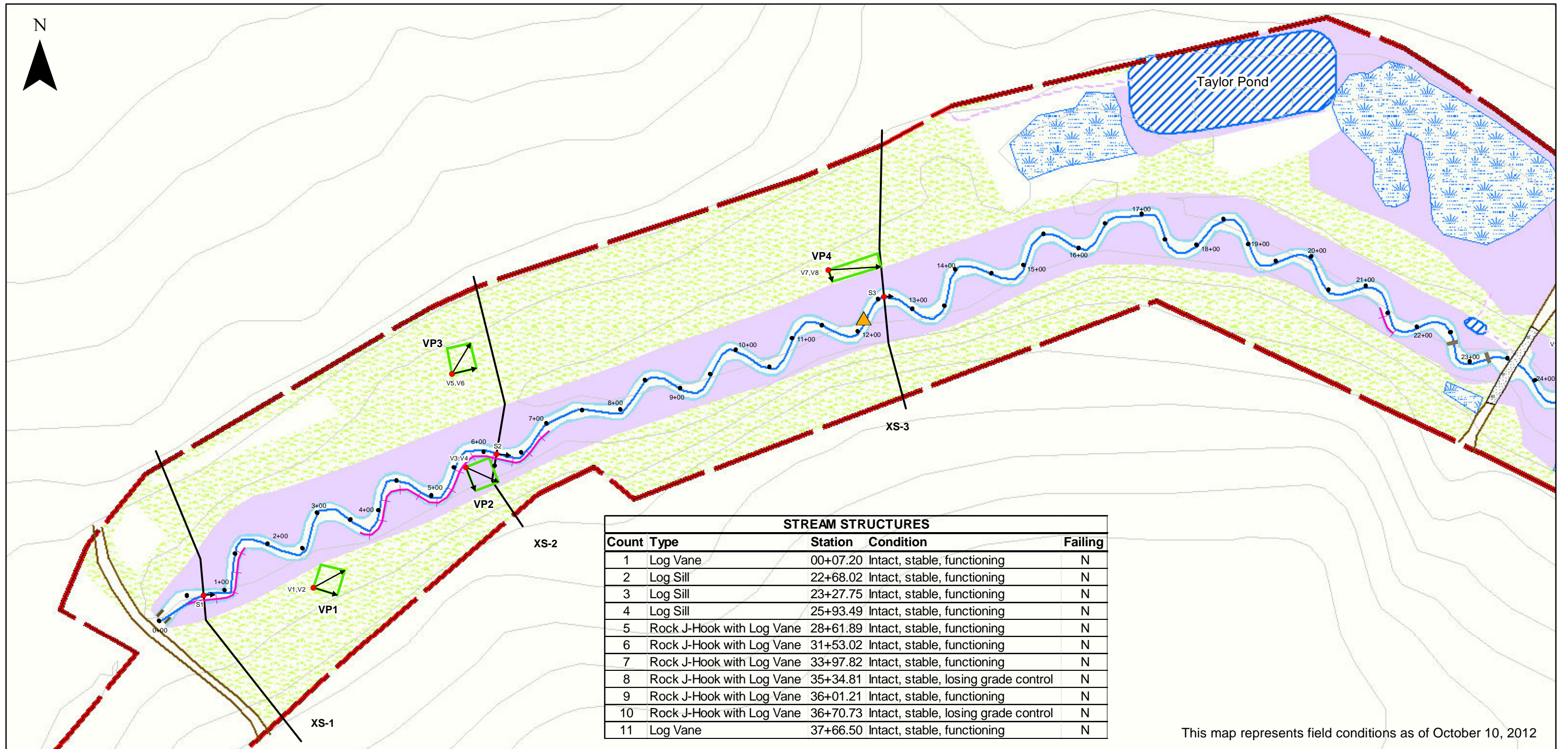
**Oakley Crossroads Stream and Buffer Restoration Project**  
**EEP #: 273**  
**Pitt County, North Carolina**  
**November 2012**

-  Crest gage
-  Vegetation monitoring plots (VP 1-9)
-  Stream cross-section surveys (XS 1-7)
-  Conservation easement
-  2' contours

-  Section 1 Stream Restoration Centerline MY1
-  Section 2 Stream Enhancement II
-  Section 3 Stream Enhancement II (planting only)
-  Other on-site hydrography
-  Non-buffered waterways
-  Ponds
-  Ford crossing
-  Wetland preservation

- Planting Zones**
-  Riverine Bottomland Hardwood Forest
-  Mesic Mixed Hardwood Forest

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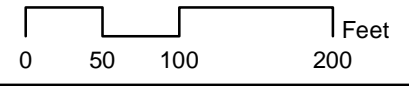
STREAM STRUCTURES				
Count	Type	Station	Condition	Failing
1	Log Vane	00+07.20	Intact, stable, functioning	N
2	Log Sill	22+68.02	Intact, stable, functioning	N
3	Log Sill	23+27.75	Intact, stable, functioning	N
4	Log Sill	25+93.49	Intact, stable, functioning	N
5	Rock J-Hook with Log Vane	28+61.89	Intact, stable, functioning	N
6	Rock J-Hook with Log Vane	31+53.02	Intact, stable, functioning	N
7	Rock J-Hook with Log Vane	33+97.82	Intact, stable, functioning	N
8	Rock J-Hook with Log Vane	35+34.81	Intact, stable, losing grade control	N
9	Rock J-Hook with Log Vane	36+01.21	Intact, stable, functioning	N
10	Rock J-Hook with Log Vane	36+70.73	Intact, stable, losing grade control	N
11	Log Vane	37+66.50	Intact, stable, functioning	N

This map represents field conditions as of October 10, 2012

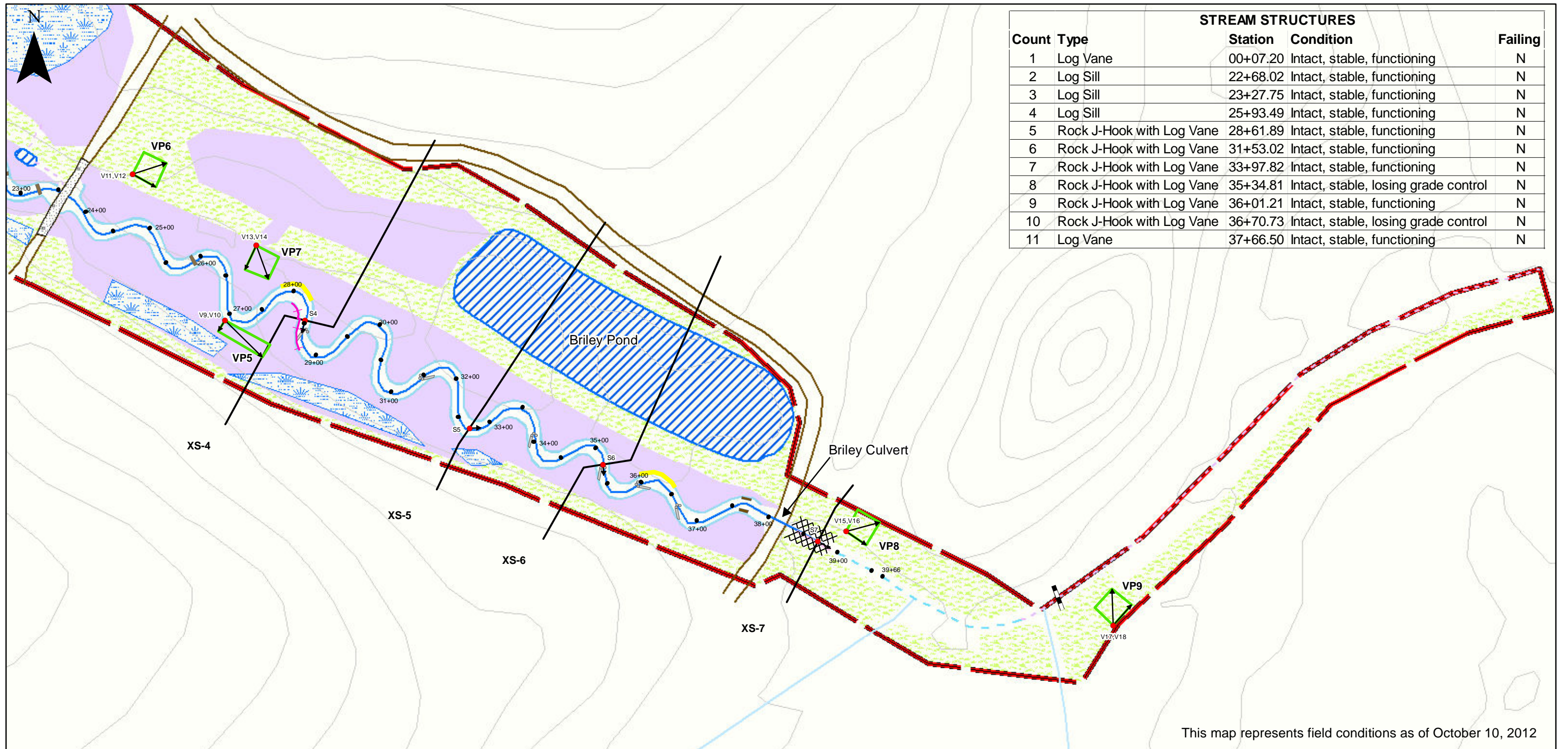
**Figure 2a. Current Condition Plan View MY2**

**Oakley Crossroads Stream and Buffer Restoration Project**  
**EEP #: 273**  
**Pitt County, North Carolina**  
**November 2012**

- Photo points (Veg=V, Stream=S)
- Stream cross-section surveys (XS 1-7)
- 2' contours
- Farm paths
- Ford crossing
- Conservation easement
- Vegetation Plot Success (VP 1-9)**
- Buffer=Yes, Stream=Yes or n/a
- Buffer=No, Stream=n/a
- Buffer=No, Stream=No
- Section 1 Stream Restoration Thalweg MY1
- Section 2 Stream Enhancement II
- Section 3 Stream Enhancement II (planting only)
- Other on-site hydrography
- Non-buffered waterways
- Ponds
- Wetland Preservation
- Crest gage
- Log Vane
- Log Sill
- Rock J-Hook with Log Vane
- Riverine Bottomland Hardwood Forest
- Mesic Mixed Hardwood Forest
- Livestakes
- Problem Areas**
- Brush Mattress <80% vegetative cover
- Beaver Dam
- Dead livestockes
- Murdannia keisak



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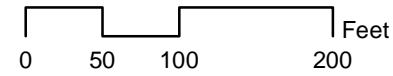
Count Type		STREAM STRUCTURES		
Count	Type	Station	Condition	Failing
1	Log Vane	00+07.20	Intact, stable, functioning	N
2	Log Sill	22+68.02	Intact, stable, functioning	N
3	Log Sill	23+27.75	Intact, stable, functioning	N
4	Log Sill	25+93.49	Intact, stable, functioning	N
5	Rock J-Hook with Log Vane	28+61.89	Intact, stable, functioning	N
6	Rock J-Hook with Log Vane	31+53.02	Intact, stable, functioning	N
7	Rock J-Hook with Log Vane	33+97.82	Intact, stable, functioning	N
8	Rock J-Hook with Log Vane	35+34.81	Intact, stable, losing grade control	N
9	Rock J-Hook with Log Vane	36+01.21	Intact, stable, functioning	N
10	Rock J-Hook with Log Vane	36+70.73	Intact, stable, losing grade control	N
11	Log Vane	37+66.50	Intact, stable, functioning	N

This map represents field conditions as of October 10, 2012

**Figure 2b. Current Condition Plan View MY2**

**Oakley Crossroads Stream and Buffer Restoration Project**  
**EEP #: 273**  
**Pitt County, North Carolina**  
**November 2012**

- Photo points (Veg=V, Stream=S)
- ∩ Stream cross-section surveys (XS 1-7)
- 2' contours
- Farm paths
- ▨ Ford crossing
- ▭ Conservation easement
- Vegetation Plot Success (VP 1-9)
- ▭ Buffer=Yes, Stream=Yes or n/a
- ▭ Buffer=No, Stream=n/a
- ▭ Buffer=No, Stream=No
- Section 1 Stream Restoration Thalweg MY1
- Section 2 Stream Enhancement II
- Section 3 Stream Enhancement II (planting only)
- Other on-site hydrography
- Non-buffered waterways
- ▨ Ponds
- ▨ Wetland Preservation
- ▲ Crest gage
- ▭ Log Vane
- ▭ Log Sill
- ▭ Rock J-Hook with Log Vane
- ▭ Planting Zones
- ▭ Riverine Bottomland Hardwood Forest
- ▭ Mesic Mixed Hardwood Forest
- ▭ Livestakes
- Problem Areas
- ▭ Brush Mattress <80% vegetative cover
- ▭ Beaver Dam
- ▭ Dead livestock
- ▭ Murdannia keisak



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Table 5  
 Reach ID  
 Assessed Length

**Visual Stream Morphology Stability Assessment**  
 Reach 1  
 3800

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 (Rifle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	N/A	56			100%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	56	56					
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		56	56			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	56	56			100%			
		2. Thalweg centering at downstream of meander (Glide)	56	56			100%			
	<b>Totals</b>									
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
<b>Totals</b>										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	11	11			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	9	11			82%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	11	11			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	11	11			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	11	11			100%			

**Table 6. Vegetation Condition Assessment**

**Oakley Crossroads Stream and Buffer Restoration (EEP# 273)**

<b>Planted acreage*</b>						
	18					
<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
1. Bare Areas	Very limited cover of woody material	0.1 acres	none	0	0	0.0%
2. Low Stem Density	Woody stem densities below target levels for stem count success criteria	0.1 acres	none	0	0	0.0%
				<b>Total</b>	<b>0</b>	<b>0.0%</b>
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	None	0	0	0.0%
				<b>Total</b>	<b>0</b>	<b>0.0%</b>
<b>Easement acreage</b>						
	26.6					
<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>CCPV Depiction</b>	<b>Number of Polygons</b>	<b>Combined Acreage</b>	<b>% of Easement Acreage</b>
4. Invasive areas of concern	<i>Murdannia keisak</i>	1000 SF	Magenta line with cross-hatches	4 line segments ~3' wide	0.039	0.1%
5. Encroachment areas		none	None	0	0	0.0%

\*Total planted acreage

## Stream Station Photos



**Photo Station S1** – Stream channel looking downstream at cross-section 1  
Station 00+72 - Priority 2 (10/10/12 Year 2)



**Photo Station S2** – Stream channel looking downstream at cross-section 2  
Station 06+17 – Priority 2 (10/10/12 Year 2)



**Photo Station S3** – Stream channel looking downstream at cross-section 3  
Station 12+59 – Priority 2 (10/10/2012 Year 2)



**Photo Station S4** – Stream channel looking downstream at cross-section 4  
Station 28+46 – Priority 2 (10/10/2012 Year 2)



**Photo Station S5** – Stream channel looking downstream at cross-section 5  
Station 32+71 – Priority 2 (10/10/2012 Year 2)



**Photo Station S6** – Stream channel looking downstream at cross-section 6  
Station 35+24 – Priority 2 (10/10/2012 Year 2)



**Photo Station S7** – Stream channel looking downstream at cross-section 7  
Station 38+71 – Enhancement 2 (10/10/2012 Year 2)



**Photo S8** – Evidence of bankfull overflow – wrackline (10/10/2012 Year 2)



**Photo S9** – Evidence of bankfull overflow – cork above bankfull line in crest gauge (10/4/2012 Year 2)

## Vegetation Plot Photos



**Photo Station V1** - Veg Plot 1 looking southeast (10/4/2012 Year 2)



**Photo Station V2** - Veg Plot 1 looking east (10/4/2012 Year 2)





**Photo Station V3 - Veg Plot 2 looking south (10/4/2012 Year 2)**



**Photo Station V4 - Veg Plot 2 looking southeast (10/4/2012 Year 2)**



**Photo Station V5 - Veg Plot 3 looking east (10/4/2012 Year 2)**



**Photo Station V6 - Veg Plot 3 looking northeast (10/4/2012 Year 2)**



**Photo Station V7 - Veg Plot 4 looking south (10/4/2012 Year 2)**



**Photo Station V8 - Veg Plot 4 looking southeast (10/4/2012 Year 2)**



**Photo Station V9 - Veg plot 5 looking south (10/4/2012 Year 2)**



**Photo Station V10 - Veg plot 5 looking southeast (10/4/2012 Year 2)**



**Photo Station V11 - Veg plot 6 looking east (10/4/2012 Year 2)**



**Photo Station V12 - Veg plot 6 looking northeast (10/4/2012 Year 2)**



**Photo Station V13 - Veg plot 7 looking south (10/4/2012 Year 2)**



**Photo Station V14 - Veg plot 7 looking southeast (10/4/2012 Year 2)**



**Photo Station V15 - Veg plot 8 looking east (10/4/2012 Year 2)**



**Photo Station V16 - Veg plot 8 looking northeast (10/4/2012 Year 2)**



**Photo Station V17** - Veg plot 9 looking northeast (10/4/2012 Year 2)



**Photo Station V18** - Veg plot 9 looking north (10/4/2012 Year 2)



## **Appendix C. Vegetation Plot Data**

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Table 7a,b.	– Vegetation Plot Mitigation Success Summary
Table 8	– CVS Vegetation Metadata
Table 9	– CVS Stem Count Total and Planted by Plot and Species

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**Table 7. Oakley Crossroads (G) (#273)**

Year 2 (04-Oct-2012)

Vegetation Plot Summary Information

Plot #	Riparian Buffer Stems <sup>1</sup>	Stream/Wetland Stems <sup>2</sup>	Live Stakes	Invasives	Volunteers <sup>3</sup>	Total <sup>4</sup>	Unknown Growth Form
0001	19	21	0	0	2	23	0
0002	16	16	0	0	124	140	0
0003	21	21	0	0	7	28	0
0004	19	20	0	0	5	25	0
0005	10	10	0	0	4	14	0
0006	18	18	0	0	21	39	0
0007	11	11	0	0	1	12	0
0008	17	17	0	0	0	17	0
0009	14	n/a	0	0	26	40	0

**Wetland/Stream Vegetation Totals**

(per acre)

Plot #	Stream/Wetland Stems <sup>2</sup>	Volunteers <sup>3</sup>	Total <sup>4</sup>	Success Criteria Met?
0001	850	81	931	Yes
0002	647	5018	5666	Yes
0003	850	283	1133	Yes
0004	809	202	1012	Yes
0005	405	162	567	Yes
0006	728	850	1578	Yes
0007	445	40	486	Yes
0008	688	0	688	Yes
0009	n/a	1052	1619	
Project Avg	678	854	1520	Yes

**Riparian Buffer Vegetation Totals**

(per acre)

Plot #	Riparian Buffer Stems <sup>1</sup>	Success Criteria Met?
0001	769	Yes
0002	647	Yes
0003	850	Yes
0004	769	Yes
0005	405	Yes
0006	728	Yes
0007	445	Yes
0008	688	Yes
0009	567	Yes
Project Avg	652	Yes

Stem Class characteristics

<sup>1</sup>Buffer Stems Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.

<sup>2</sup>Stream/

Wetland Stems Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines

<sup>3</sup>Volunteers Native woody stems. Not planted. No vines.

<sup>4</sup>Total Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

<b>Table 8 - CVS Metadata</b>	
<b>Oakley Crossroads Stream and Buffer Restoration - EEP #273</b>	
<b>Report Prepared By</b>	Amber Coleman
<b>Date Prepared</b>	10/10/2012 15:00
<b>database name</b>	STantec_Oakley_2012cvs-eeep-entrytool-v2.3.1.mdb
<b>database location</b>	U:\175613016\project\site_data\vegetation
<b>computer name</b>	COLEMANA-LT
<b>file size</b>	59727872
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj, total stems</b>	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.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>ALL Stems by Plot and spp</b>	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.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	273
<b>project Name</b>	Oakley Crossroads (G)
<b>Description</b>	Stream and Wetland Restoration
<b>River Basin</b>	Tar-Pamlico
<b>length(ft)</b>	
<b>stream-to-edge width (ft)</b>	
<b>area (sq m)</b>	
<b>Required Plots (calculated)</b>	
<b>Sampled Plots</b>	9

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

EEP Project Code 273. Project Name: Oakley Crossroads

Scientific Name	Common Name	Species Type	Current Plot Data (MY2 2012)																								Annual Means											
			E273-01-0001			E273-01-0002			E273-01-0003			E273-01-0004			E273-01-0005			E273-01-0006			E273-01-0007			E273-01-0008			E273-01-0009			MY2 (2012)			MY1 (2011)			MY0 (2011)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
<i>Acer rubrum</i> var. <i>rubrum</i>	red maple	Tree			1			108			7						2			21			1						7			147						
<i>Alnus serrulata</i>	hazel alder	Shrub						4																					4									
<i>Cornus amomum</i>	silky dogwood	Shrub																								2			2									
<i>Eubotrys racemosa</i>	swamp doghobble	Shrub																														1			1			1
<i>Fraxinus pennsylvanica</i>	green ash	Tree	4	4	4				4	4	4	5	5	5				4	4	4						5	5	5	5	22	22	22	13	13	13	13	13	13
<i>Liquidambar styraciflua</i>	sweetgum	Tree			1			11						5												16			33									
<i>Magnolia virginiana</i>	sweetbay	Tree	1	1	1							1	1	1				1	1	1										3	3	3	3	3	3	3	3	3
<i>Morella cerifera</i>	wax myrtle	shrub	2	2	2							1	1	1																3	3	3	3	3	3	3	3	3
<i>Nyssa biflora</i>	swamp tupelo	Tree				7	7	7													2	2	2							9	9	9	1	1	1	1	1	1
<i>Nyssa sylvatica</i>	blackgum	Tree	1	1	1				4	4	4	3	3	3	1	1	1	4	4	4										13	13	13	2	2	2	2	2	2
<i>Platanus occidentalis</i>	American sycamore	Tree	5	5	5				7	7	7	6	6	6				4	4	4	2	2	2				4	4	4	28	28	28	14	14	14	14	14	14
<i>Quercus</i>	oak	Tree																																				
<i>Quercus falcata</i>	southern red oak	Tree	8	8	8				4	4	4	4	4	4	1	1	1	3	3	3				5	5	5	5	5	5	30	30	30	10	10	10	12	12	12
<i>Quercus lyrata</i>	overcup oak	Tree				5	5	5							1	1	1	1	1	1										7	7	7	7	7	7	4	4	4
<i>Quercus michauxii</i>	swamp chestnut oak	Tree				2	2	2							3	3	3				1	1	1							6	6	6	7	7	7	9	9	9
<i>Quercus nigra</i>	water oak	Tree							2	2	2							1	1	1				11	11	11				14	14	14	13	13	13	7	7	7
<i>Quercus pagoda</i>	cherrybark oak	Tree				1	1	1													1	1	1	1	1	1				3	3	3	2	2	2			
<i>Quercus phellos</i>	willow oak	Tree				1	1	1							4	4	4				5	5	5							10	10	10	12	12	12	16	16	16
<i>Quercus rubra</i>	northern red oak	Tree																											1			1			1			
<i>Sambucus canadensis</i>	Common Elderberry	Shrub						1									2												3									
<i>Toxicodendron radicans</i>	eastern poison ivy	Vine																											1			1						
Unknown		Shrub or Tree																																		1	1	1
<b>Totals</b>			21	21	23	16	16	140	21	21	28	20	20	25	10	10	14	18	18	39	11	11	12	17	17	17	14	14	41	148	148	339	90	90	90	93	93	93
Stem count			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9	9	9	9	9	9	9	9
size (ares)			0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Species count			6	6	8	5	5	9	5	5	6	6	6	7	5	5	7	7	7	8	5	5	6	3	3	3	3	3	8	12	12	19	14	14	14	14	14	14
Stems per ACRE			849.8	849.8	930.8	647.5	647.5	5666	849.8	849.8	1133	809.4	809.4	1012	404.7	404.7	566.6	728.4	728.4	1578	445.2	445.2	485.6	688	688	688	566.6	566.6	1659	665.5	665.5	1524	404.7	404.7	404.7	418.2	418.2	418.2
<b>Riparian Buffer Success Criteria</b>			19	19	21	16	16	135	21	21	28	19	19	24	10	10	12	18	18	39	11	11	12	17	17	17	14	14	38	145	145	326	86	86	86	88	88	88
Stem count			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9	9	9	9	9	9	9	9
size (ACRES)			0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Species count			5	5	7	5	5	7	5	5	6	5	5	6	5	5	6	7	7	8	5	5	6	3	3	3	3	3	6	11	11	14	12	12	12	11	11	11
Stems per ACRE			768.9	768.9	849.8	647.5	647.5	5463	849.8	849.8	1133	768.9	768.9	971.2	404.7	404.7	485.6	728.4	728.4	1578	445.2	445.2	485.6	688	688	688	566.6	566.6	1538	652	652	1466	386.7	386.7	386.7	395.7	395.7	395.7

\*Bolted hardwood trees are counted toward riparian buffer success criteria.

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

PnoLS = Planted excluding livestakes

P-all = All planted stems including livestakes

T = All planted and natural recruit stems including livestakes

Total includes natural recruit stems

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## **Appendix D. Stream Survey Data**

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Figures 3a-j	– Cross-Sections with Annual Overlays
Figure 4	– Longitudinal Profiles with Annual Overlays
Table 10a,b.	– Baseline – Stream Data Summary
Table 11a.	– Monitoring – Cross-section Morphology Data
Table 11b.	– Monitoring – Stream Reach Morphology Data

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River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-1, Riffle, STA 0+72
Drainage Area(sq. mi.)	1.59
Date	10/10/2012
Field Crew	T. Taylor, A. Baldwin

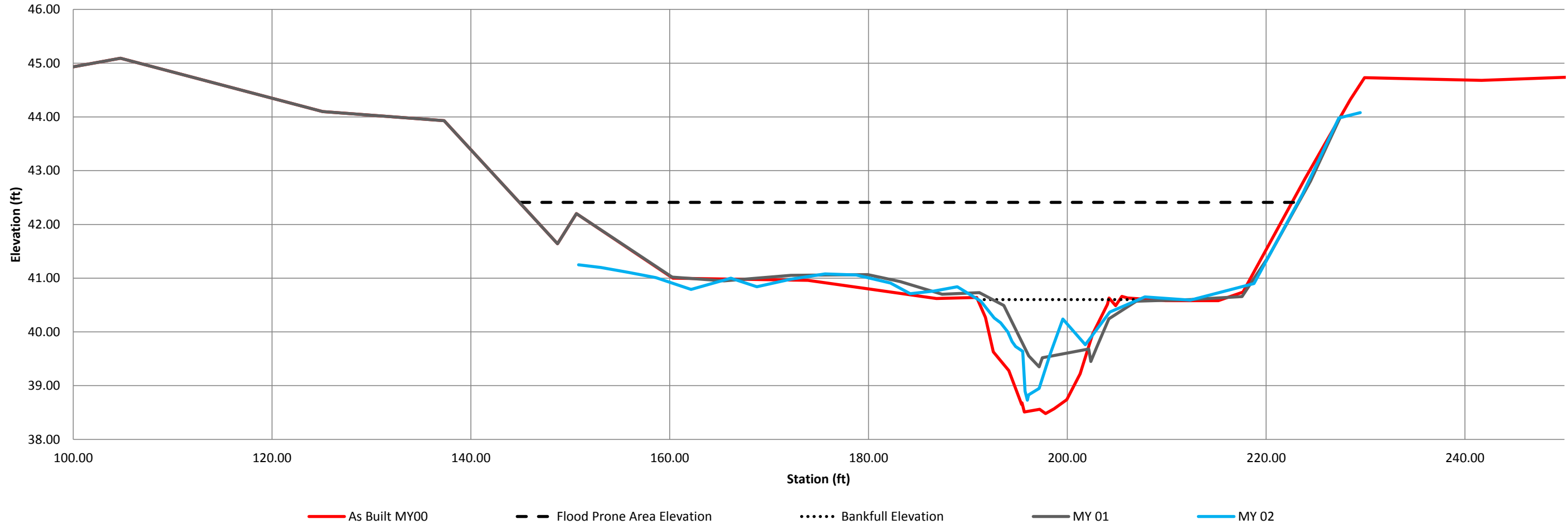
MY 00		MY 01		MY 02	
Station	Elevation	Station	Elevation	Station	Elevation
12.21	49.05	12.21	49.05	150.82	41.25
19.33	48.29	19.33	48.29	153.07	41.20
28.16	46.74	28.16	46.74	155.79	41.11
35.77	46.38	35.77	46.38	158.62	41.01
47.80	45.82	47.80	45.82	162.14	40.79
59.77	45.48	59.77	45.48	166.15	41.00
74.68	45.23	74.68	45.23	168.77	40.84
81.30	45.02	81.30	45.02	172.16	40.98
87.17	45.62	87.17	45.62	175.62	41.08
93.57	44.59	93.57	44.59	178.75	41.06
98.13	44.87	98.13	44.87	182.20	40.91
104.75	45.09	104.75	45.09	184.20	40.71
125.09	44.10	125.09	44.10	186.59	40.76
137.30	43.93	137.30	43.93	188.93	40.84
148.71	41.64	148.71	41.64	191.29	40.57
150.62	42.20	150.62	42.20	192.64	40.26
160.31	41.00	160.25	41.02	193.29	40.17
173.90	40.96	165.47	40.95	194.00	40.00
186.83	40.62	172.19	41.05	194.43	39.82
190.89	40.64	179.93	41.07	194.80	39.73
191.77	40.27	183.19	40.94	195.51	39.64
192.56	39.63	187.40	40.70	195.74	38.90

SUMMARY DATA	MY00	MY01	MY02
Bankfull Elevation	40.63	40.72	40.57
Bankfull Cross-Sectional Area	18.33	8.37	9.77
Bankfull Width	20.80	12.39	15.49
Flood Prone Area Elevation	42.78	41.63	42.41
Flood Prone Width	80.66	65.65	78.50
Max Depth at Bankfull	2.15	1.14	1.84
Mean Depth at Bankfull	0.88	0.68	0.63
W/D Ratio	23.64	18.22	24.59
Entrenchment Ratio	3.88	5.30	5.07
Bank Height Ratio	1.00	1.00	1.00
Stream Type	C	C	C



Sta. 0+75 Looking Downstream

**Oakley Crossroads - UT to Tranters Creek  
X-Section 1, Riffle, Station 0+72**



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River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-2, Riffle, STA 6+17
Drainage Area(sq. mi.)	1.59
Date	10/10/2012
Field Crew	T. Taylor, A. Baldwin

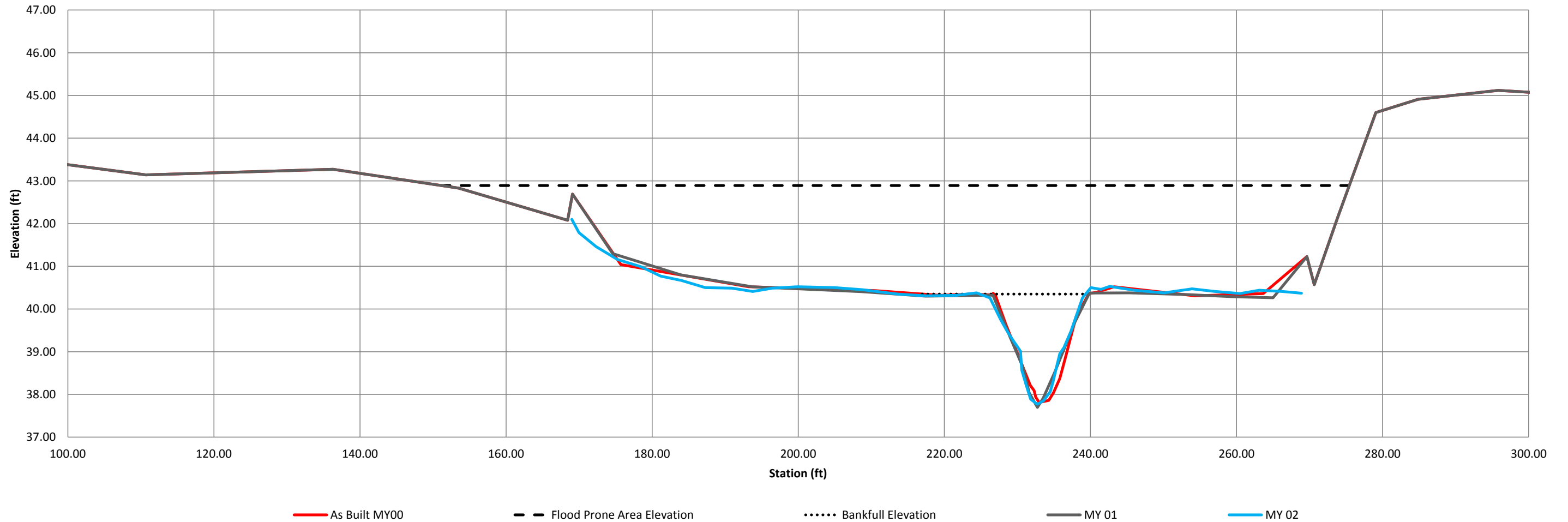
MY 00		MY 01		MY 02	
Station	Elevation	Station	Elevation	Station	Elevation
12.76	46.91	12.76	46.91	169.00	42.10
33.99	44.63	33.99	44.63	169.98	41.79
54.24	44.37	54.24	44.37	172.32	41.46
72.47	43.91	72.47	43.91	175.26	41.16
92.77	43.54	92.77	43.54	178.46	40.99
110.68	43.14	110.68	43.14	181.16	40.77
136.32	43.27	136.32	43.27	184.02	40.67
153.53	42.83	153.53	42.83	187.28	40.50
168.42	42.08	168.42	42.08	190.92	40.49
169.10	42.69	169.10	42.69	193.78	40.41
175.71	41.04	174.60	41.30	196.48	40.49
193.21	40.52	183.93	40.80	199.93	40.52
210.45	40.43	193.68	40.52	205.00	40.50
219.41	40.32	208.61	40.41	208.82	40.45
223.60	40.35	217.46	40.30	213.63	40.35
226.57	40.33	226.67	40.33	217.51	40.31
226.69	40.37	229.04	39.32	221.63	40.32
227.04	40.30	230.82	38.62	224.41	40.38
228.42	39.64	231.63	38.04	226.25	40.26
229.95	38.99	232.76	37.70	227.67	39.77
231.78	38.21	233.53	37.92	228.58	39.49
232.29	38.09	235.12	38.52	229.56	39.23
232.51	37.94	237.92	39.70	229.96	39.13

SUMARY DATA	MY00	MY01	MY02
Bankfull Elevation	40.35	40.38	40.38
Bankfull Cross-Sectional Area	18.16	17.88	18.17
Bankfull Width	16.60	13.16	15.09
Flood Prone Area Elevation	42.89	43.06	42.99
Flood Prone Width	124.27	124.27	124.27
Max Depth at Bankfull	2.54	2.68	2.61
Mean Depth at Bankfull	1.09	1.37	1.20
W/D Ratio	15.23	9.61	12.58
Entrenchment Ratio	7.49	9.44	8.24
Bank Height Ratio	1.00	1.00	1.00
Stream Type	C	C	C



Sta. 6+17 Looking Downstream

**Oakley Crossroads - UT to Tranters Creek  
X-Section 2, Riffle, Station 6+17**



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River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-3, Pool, STA 12+59
Drainage Area(sq. mi.)	1.59
Date	10/10/2012
Field Crew	T. Taylor, A. Baldwin

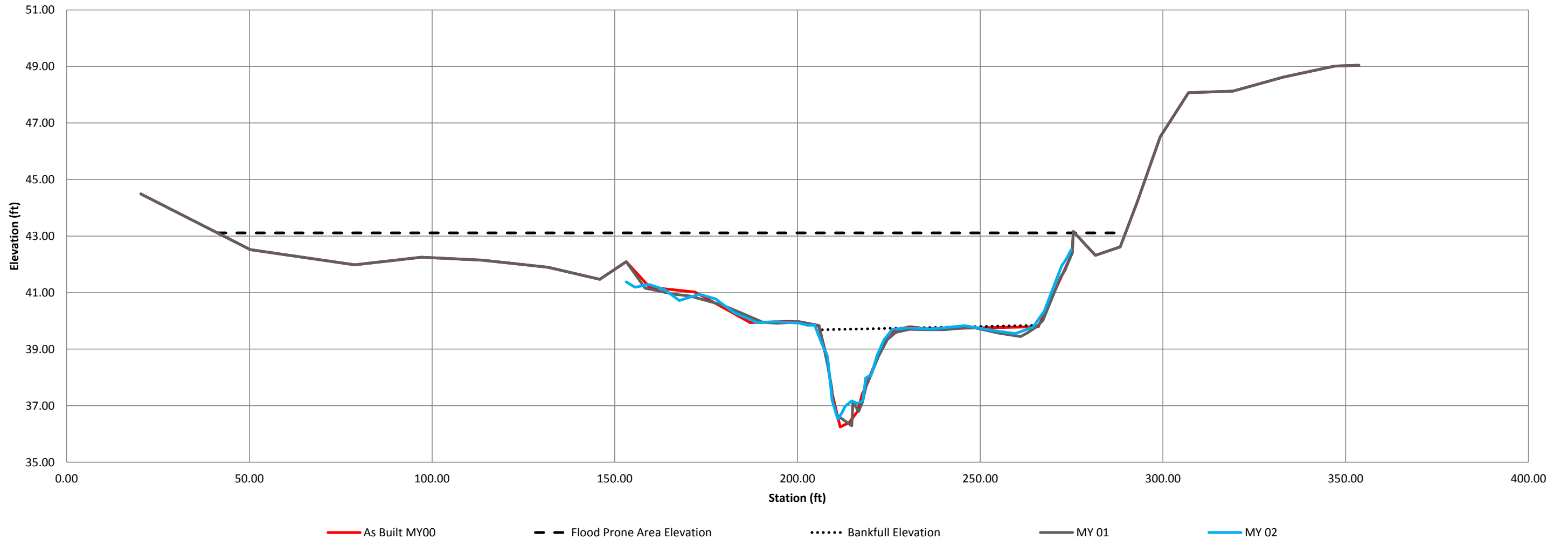
MY 00		MY 01		MY 02	
Station	Elevation	Station	Elevation	Station	Elevation
20.32	44.49	20.32	44.49	153.13	41.38
50.25	42.52	50.25	42.52	155.51	41.19
78.82	41.98	78.82	41.98	159.37	41.29
97.11	42.25	97.11	42.25	163.57	41.11
113.72	42.15	113.72	42.15	167.64	40.72
131.64	41.90	131.64	41.90	173.09	40.94
145.91	41.47	145.91	41.47	177.54	40.78
153.13	42.09	153.13	42.09	182.58	40.30
159.54	41.19	158.28	41.16	185.77	40.12
171.94	41.02	166.00	40.94	188.89	39.94
180.95	40.38	170.52	40.88	194.18	39.97
187.04	39.94	179.13	40.57	200.51	39.92
197.51	39.98	184.61	40.28	202.61	39.85
200.36	39.97	190.41	39.96	204.72	39.85
205.21	39.84	194.41	39.92	206.71	39.17
205.63	39.82	200.59	39.97	207.89	38.84
205.93	39.76	205.91	39.83	208.23	38.73
207.79	38.83	208.18	38.48	209.46	37.19
209.56	37.40	209.36	37.63	210.59	36.70
210.71	36.78	209.67	37.18	211.02	36.53
211.70	36.25	210.78	36.66	212.13	36.75
214.13	36.40	214.84	36.29	213.04	36.98

SUMMARY DATA	MY00	MY01	MY02
Bankfull Elevation	39.68	39.70	39.70
Bankfull Cross-Sectional Area	36.86	37.87	34.50
Bankfull Width	20.58	24.45	20.80
Flood Prone Area Elevation	43.11	43.11	42.87
Flood Prone Width	248.46	248.07	244.10
Max Depth at Bankfull	3.43	3.41	3.17
Mean Depth at Bankfull	1.79	1.55	1.66
W/D Ratio	11.50	15.77	12.53
Entrenchment Ratio	12.07	10.15	11.74
Bank Height Ratio	1.00	1.00	1.00
Stream Type	C	C	C



Sta. 12+59 Looking Downstream

**Oakley Crossroads - UT to Tranters Creek**  
**X-Section 3, Pool, Station 12+59**



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River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-4, Riffle, STA 28+46
Drainage Area(sq. mi.)	1.59
Date	10/10/2012
Field Crew	T. Taylor, A. Baldwin

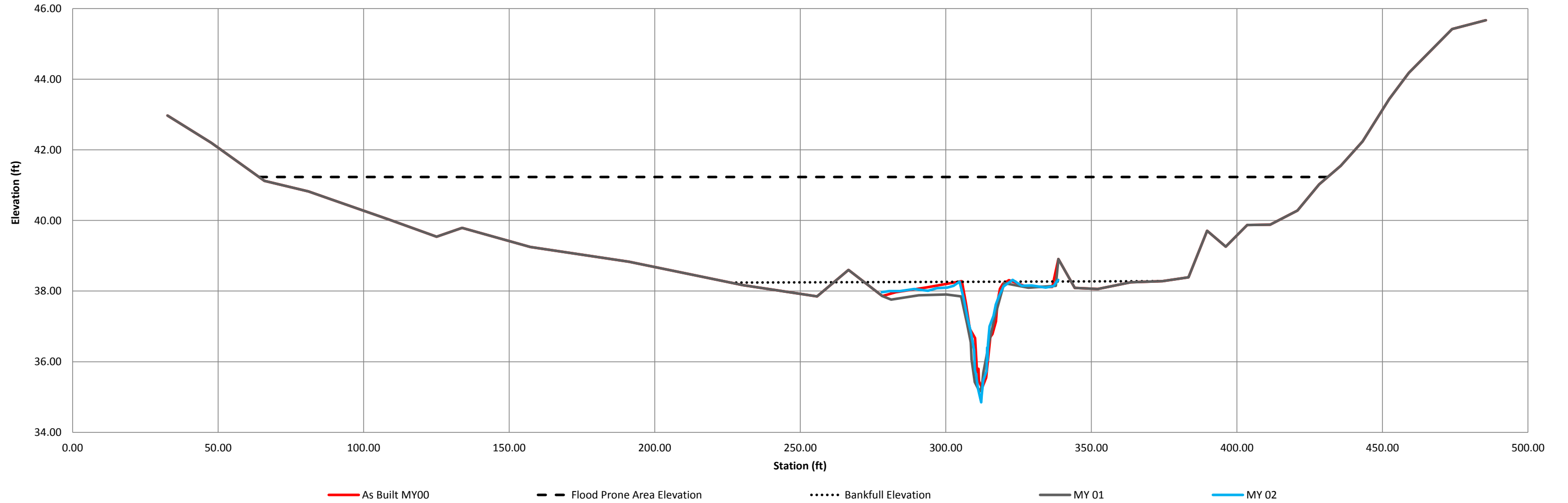
MY 00		MY 01		MY 02	
Station	Elevation	Station	Elevation	Station	Elevation
32.58	42.97	32.58	42.97	278.00	37.97
47.64	42.20	47.64	42.20	280.52	38.00
65.92	41.12	65.92	41.12	284.26	38.00
81.03	40.82	81.03	40.82	289.18	38.06
88.43	40.61	88.43	40.61	293.86	38.01
108.82	40.02	108.82	40.02	296.90	38.08
125.06	39.54	125.06	39.54	300.54	38.10
133.82	39.79	133.82	39.79	302.64	38.15
157.24	39.25	157.24	39.25	304.70	38.27
191.12	38.83	191.12	38.83	306.16	37.79
230.32	38.17	230.32	38.17	307.54	37.21
255.76	37.85	255.76	37.85	308.62	36.83
266.56	38.60	266.56	38.60	309.70	36.33
278.21	37.86	278.21	37.86	309.97	35.76
282.75	37.97	281.24	37.759	310.39	35.64
293.74	38.11	290.68	37.881	311.02	35.24
305.40	38.28	300.11	37.906	312.16	34.85
305.58	38.25	305.26	37.848	312.3	35.04
306.89	37.65	307.23	37.095	312.89	35.48
308.24	36.93	308.54	36.55	314.04	35.74
310.07	36.67	308.85	36.062	314.17	36.4

SUMMARY DATA	MY00	MY01	MY02
Bankfull Elevation	38.24	37.85	38.13
Bankfull Cross-Sectional Area	20.90	18.22	19.85
Bankfull Width	14.64	13.70	14.70
Flood Prone Area Elevation	41.23	40.54	41.41
Flood Prone Width	367.14	332.68	367.00
Max Depth at Bankfull	2.99	2.69	3.28
Mean Depth at Bankfull	1.43	1.33	1.35
W/D Ratio	10.24	10.30	10.89
Entrenchment Ratio	25.08	24.28	24.97
Bank Height Ratio	1.00	1.00	1.00
Stream Type	C	C	E



Sta. 28+46 Looking Downstream

**Oakley Crossroads - UT to Tranters Creek  
X-Section 4, Riffle, Station 28+46**



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River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-5, Pool, STA 32+71
Drainage Area(sq. mi.)	1.59
Date	9/1/2011
Field Crew	N. Jean, B.Mazzochi, A. Baldwin

MY 00		MY 01		MY 02	
Station	Elevation	Station	Elevation	Station	Elevation
26.15	42.13	26.15	42.13	281.30	37.19
36.87	42.19	36.87	42.19	285.24	37.29
68.22	41.81	68.22	41.81	289.79	37.33
85.37	36.59	85.37	36.59	294.67	37.29
90.80	34.92	90.80	34.92	299.78	37.32
176.23	35.02	176.23	35.02	303.71	37.27
177.81	35.70	177.81	35.70	306.55	37.23
185.44	38.11	185.44	38.11	307.36	37.17
195.27	40.20	195.27	40.20	308.48	37.03
205.06	39.95	205.06	39.95	309.01	36.82
214.85	39.11	214.85	39.11	310.26	36.76
229.47	38.00	229.47	38.00	311.69	36.37
245.21	37.39	245.21	37.39	312.62	36.04
262.60	37.51	262.60	37.51	314.52	35.78
281.47	38.01	281.47	38.01	315.69	35.60
288.37	37.49	289.99	37.262	316.15	35.54
288.85	37.44	300.08	37.334	316.61	35.68
299.46	37.54	308.08	37.1	317.26	34.62
304.38	37.33	313.02	36.025	317.96	34.15
306.65	37.44	317.31	35.866	318.95	33.71
307.72	37.34	317.44	34.823	320.06	33.763
308.44	37.26	319.38	33.992	320.8	33.461
308.86	36.08	321.18	33.670	321.82	33.814

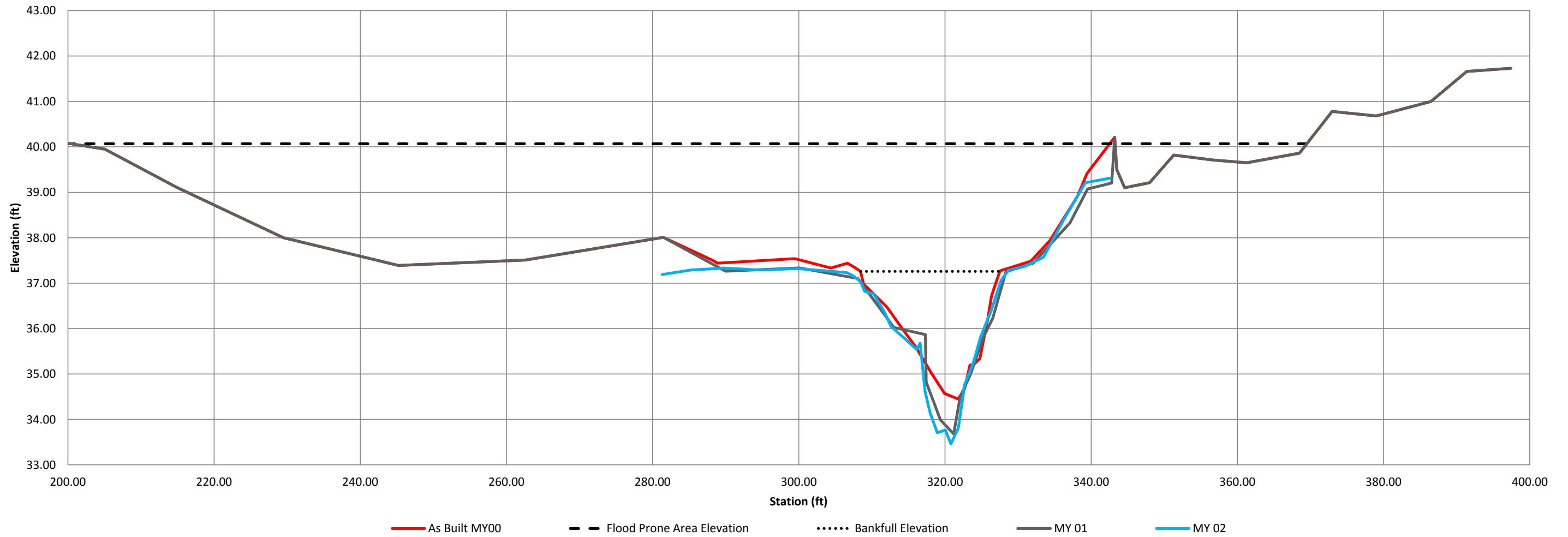
SUMARY DATA	MY00	MY01*	MY02
Bankfull Elevation	37.26	37.33	37.23
Bankfull Cross-Sectional Area	29.47	35.63	34.74
Bankfull Width	19.06	29.71	23.49
Flood Prone Area Elevation	40.07	40.98	41.00
Flood Prone Width	289.16	315.10	301.17
Max Depth at Bankfull	2.81	3.65	3.77
Mean Depth at Bankfull	1.55	1.20	1.48
W/D Ratio	12.30	24.76	15.87
Entrenchment Ratio	15.17	10.61	12.82
Bank Height Ratio	1.00	1.00	1.00
Stream Type	C	C	C

\*Floodprone width adjusted to not include adjacent farm pond.



Sta. 32+71 Looking Downstream

**Oakley Crossroads - UT to Tranters Creek  
X-Section 5 Pool, Station 32+71**



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River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-6, Riffle, STA 35+24
Drainage Area(sq. mi.)	1.59
Date	10/10/2012
Field Crew	T. Taylor, A. Baldwin

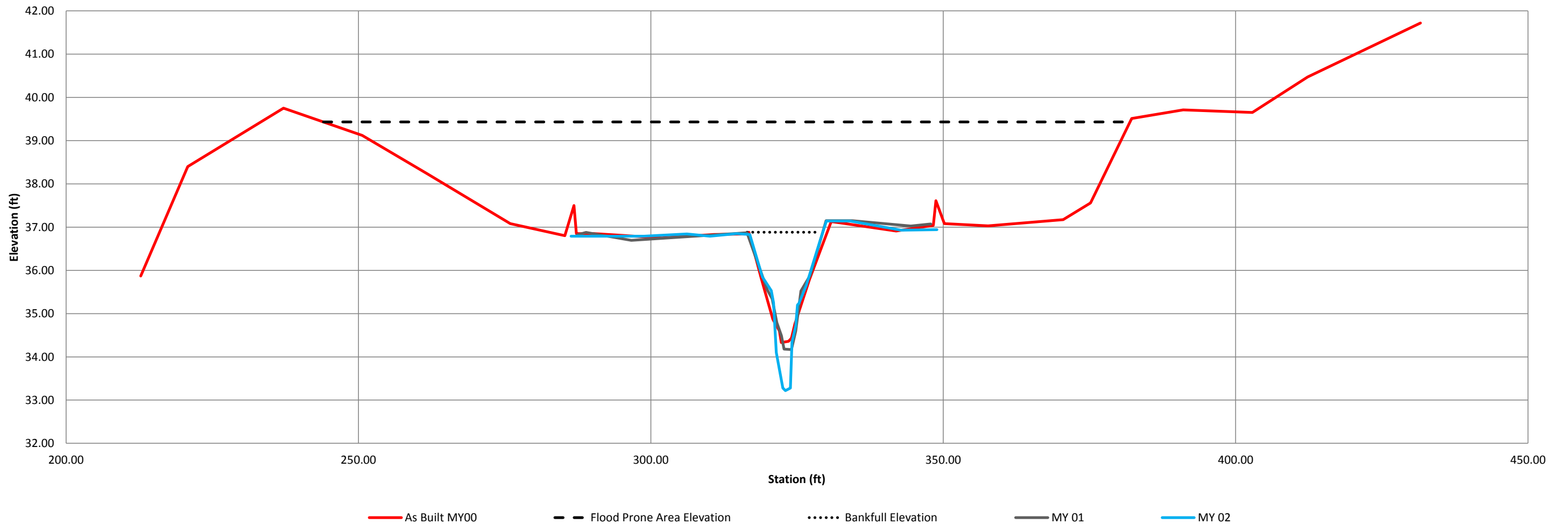
MY 00		MY 01		MY 02	
Station	Elevation	Station	Elevation	Station	Elevation
212.76	35.87	212.76	35.87	286.34	36.79
220.80	38.40	220.80	38.40	298.82	36.79
237.17	39.75	237.17	39.75	306.18	36.84
250.63	39.12	250.63	39.12	310.11	36.79
261.67	38.24	261.67	38.24	314.68	36.85
275.95	37.08	275.95	37.08	316.91	36.83
285.28	36.80	285.28	36.80	319.06	35.85
286.84	37.50	286.84	37.50	320.59	35.53
287.26	36.85	287.26	36.85	320.98	35.25
290.35	36.85	287.43	36.82	321.44	34.10
301.91	36.75	288.9	36.88	322.57	33.28
310.76	36.83	296.65	36.69	323.02	33.22
316.51	36.84	316.45	36.87	323.87	33.28
316.76	36.88	319.93	35.55	324.13	34.34
318.89	35.81	320.76	35.34	324.78	34.72
320.87	34.87	321.54	34.79	325.06	35.20
321.98	34.60	322.35	34.49	325.33	35.24
322.30	34.33	322.78	34.18	326.57	35.65
323.55	34.36	324.04	34.17	328.9	36.67
324.04	34.43	324.79	34.60	330.01	37.14
324.63	34.76	325.66	35.52	334.1	37.14
327.11	35.78	327.28	35.89	342.78	36.93
330.86	37.13	329.96	37.15	348.93	36.94

SUMMARY DATA	MY00	MY01	MY02
Bankfull Elevation	36.88	36.87	36.83
Bankfull Cross-Sectional Area	18.91	17.43	19.10
Bankfull Width	17.17	12.92	12.37
Flood Prone Area Elevation	39.43	39.57	40.44
Flood Prone Width	158.46	166.08	160.00
Max Depth at Bankfull	2.55	2.70	3.61
Mean Depth at Bankfull	1.10	1.35	1.54
W/D Ratio	15.61	9.59	8.03
Entrenchment Ratio	9.23	12.82	12.93
Bank Height Ratio	1.00	0.95	1.00
Stream Type	C	C	E



Sta. 35+24 Looking Downstream

**Oakley Crossroads - UT to Tranters Creek  
X-Section 6, Riffle, Station 35+24**



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River Basin	Tar-Pamlico River
Watershed	Tranters Creek
XS ID	XS-7, Riffle, STA 38+71
Drainage Area(sq. mi.)	1.59
Date	10/10/2012
Field Crew	T. Taylor, A. Baldwin

MY 00		MY 01		MY 02	
Station	Elevation	Station	Elevation	Station	Elevation
19.24	37.99	19.24	37.99	36.80	38.77
26.11	38.20	26.11	38.20	43.00	38.91
34.24	38.52	34.24	38.52	51.58	38.82
36.95	39.29	36.95	39.29	60.15	38.41
37.14	38.72	37.14	38.72	64.02	38.28
39.57	38.72	39.21	38.544	66.96	38.15
46.18	38.72	49.19	38.823	69.41	38.11
57.09	38.53	58.73	38.308	71.14	37.99
63.06	38.20	66.87	37.967	72.73	37.43
66.76	38.14	71.32	37.96	77.16	35.34
69.33	38.10	75.06	36.251	79.17	34.57
72.02	37.67	79.92	34.376	79.57	34.2
74.83	36.67	81.32	33.533	79.89	33.73
77.89	35.25	82.9	32.353	80.99	33.24
79.27	34.35	84.95	31.993	82.14	32.93
80.79	33.16	87.42	32.686	83.07	32.58
82.34	32.21	88.42	34.553	84.53	32.68
84.27	31.82	92.45	36.186	85.93	32.58
86.46	31.91	95.74	37.49	86.64	33.08
87.16	33.28	98.99	37.375	86.87	34.26
87.65	34.47	102.57	37.996	86.98	34.41
89.37	35.16	107.75	37.837	87.78	34.43

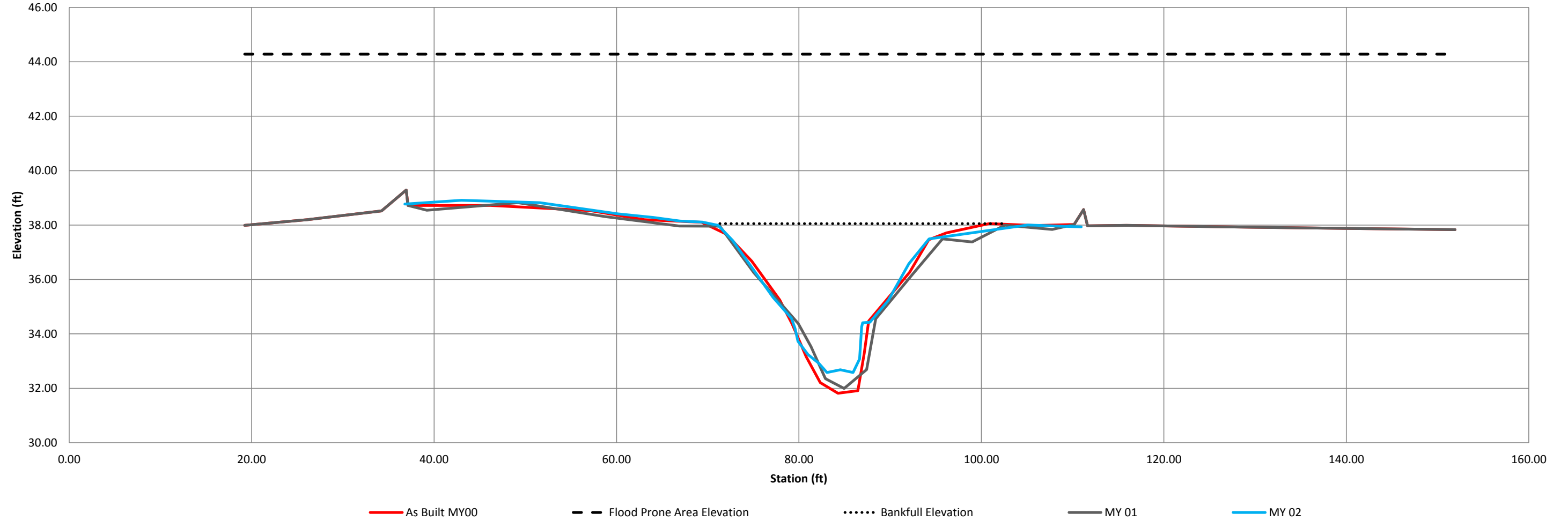
SUMMARY DATA	MY00*	MY01	MY02
Bankfull Elevation	38.05	38.00	38.00
Bankfull Cross-Sectional Area	75.91	77.93	71.24
Bankfull Width	31.46	36.52	34.07
Flood Prone Area Elevation	44.28	44.01	43.42
Flood Prone Width	132.69	132.69	>200
Max Depth at Bankfull	6.23	6.01	5.42
Mean Depth at Bankfull	2.41	2.13	2.09
W/D Ratio	13.05	17.15	16.30
Entrenchment Ratio	4.22	3.63	5.87
Bank Height Ratio	1.00	1.00	1.00
Stream Type	C	C	C

\* REVISED X-SEC DATA



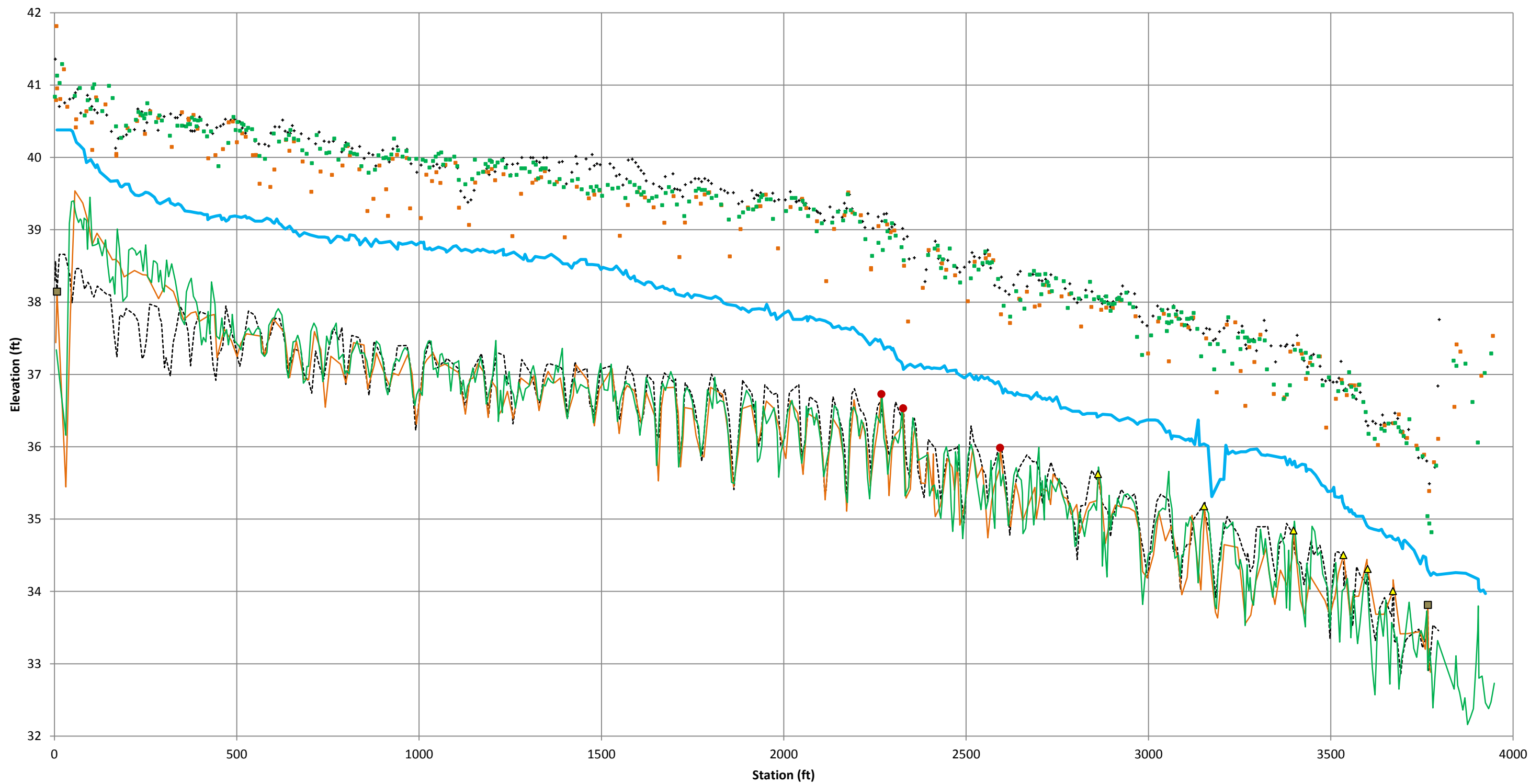
Sta. 38+71 Looking Downstream

**Oakley Crossroads - UT to Tranters Creek**  
**X-Section 7 Riffle, Station 38+71**



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Oakley Crossroads Stream and Buffer Restoration - Longitudinal Profile  
Station 0+00 to 38+79  
2012 Monitoring - Year 0, Year 01, Year 02



----- Year 0 Thalweg    ·    Year 0 RTOB    — Year 1 Thalweg    ■    Year 1 RTOB    — Year 2 Thalweg    ■    Year 2 RTOB    ●    Log Sill    ■    Log Vane    ▲    Rock J-Hook w/ Log Vane    — Year 3 Water

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**Table 10a. Baseline Stream Data Summary**  
**Oakley Crossroads Stream and Buffer Restoration / EEP Project No. 273 - Segment/Reach: Mainstem (3,950 feet)**

Parameter	Gauge <sup>2</sup>	Regional Curve			Pre-Existing Condition							Reference Reach(es) Data							Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Med	Max	Min	Mean	Med	Max	SD <sup>5</sup>	n		
<b>Dimension and Substrate - Riffle Only</b>																											
Bankfull Width (ft)					-	10.40	-	-	-	4	7.80	11.20	-	14.60	-	2	-	12.3	-	14.64	17.31	-	20.82	-	4		
Floodprone Width (ft)					-	15.00	-	-	-	4	120.00	126.50	-	133.00	-	2	-	240.0	-	80.66	182.63	-	367.14	-	4		
Bankfull Mean Depth (ft)					-	1.80	-	-	-	4	0.70	1.15	-	1.60	-	2	-	1.5	-	0.88	1.13	-	1.43	-	4		
<sup>1</sup> Bankfull Max Depth (ft)					-	2.70	-	-	-	4	1.60	1.85	-	2.10	-	2	-	2.4	-	2.15	2.56	-	2.99	-	4		
Bankfull Cross Sectional Area (ft <sup>2</sup> )					-	19.00	-	-	-	4	9.50	11.05	-	12.60	-	2	-	19.0	-	18.16	19.08	-	20.90	-	4		
Width/Depth Ratio					-	5.70	-	-	-	4	4.80	13.60	-	22.40	-	2	-	8.0	-	10.24	16.19	-	23.66	-	4		
Entrenchment Ratio					-	1.40	-	-	-	4	8.20	12.65	-	17.10	-	2	-	19.5	-	4.66	10.55	-	21.21	-	4		
<sup>1</sup> Bank Height Ratio					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<b>Profile</b>																											
Riffle Length (ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24.83	35.98	-	53.02	-	4		
Riffle Slope (ft/ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	0.003	-	0.006	-	4		
Pool Length (ft)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.47	33.67	-	44.45	-	2		
Pool Max depth (ft)					-	-	-	-	-	-	1.7	2.3	-	2.9	-	2	-	4	-	2.81	3.12	-	3.43	-	2		
Pool Spacing (ft)					-	-	-	-	-	-	5	27	35	67	-	4	43	52.5	62	43.4	64.26	-	94.03	-	2		
<b>Pattern</b>																											
Channel Beltwidth (ft)					-	-	-	-	-	-	45	72.5	-	100	-	2	62	74.0	86	38.56	55.94	-	86.18	-	48.00		
Radius of Curvature (ft)					-	-	-	-	-	-	8	12.8	14	21	-	4	22	27.0	31	19.24	27.81	-	36.28	-	56.00		
Rc:Bankfull width (ft/ft)					-	-	-	-	-	-	0.5	1.2	1.4	1.8	-	4	1.8	2.2	2.5	1.11	1.61	-	2.10	-	56.00		
Meander Wavelength (ft)					-	-	-	-	-	-	17	75	100	156	-	4	86	111	135	85.46	103.92	-	118.61	-	48.00		
Meander Width Ratio					-	-	-	-	-	-	5.8	6.3	-	6.8	-	2	5	6.0	7	2.23	3.23	-	4.98	-	48.00		
<b>Transport parameters</b>																											
Reach Shear Stress (competency) lb/ft <sup>2</sup>																											
Max part size (mm) mobilized at bankfull																											
Unit Stream Power (transport capacity) lbs/ft/s per unit width <sup>6</sup>																											

**Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)  
Oakley Crossroads Stream and Buffer Restoration / EEP Project No. 273 - Segment/Reach: Mainstem (3.950 feet)**

Parameter	Pre-Existing Condition						Reference Reach(es) Data						Design						As-built/Baseline					
<sup>1</sup> Ri% / Ru% / P% / G% / S%	-	0	-	0	0		-	-	-	-	-		-	-	-	-	-		52	-	48	-	-	
<sup>1</sup> SC% / Sa% / G% / C% / B% / Be%	0	33	67	0	0	0	0	100	0	0	0	0												
<sup>1</sup> d16 / d35 / d50 / d84 / d95 / d <sup>p</sup> / d <sup>sp</sup> (mm)	0.14	0.26	0.5	4.4	7.3	-	30	0.3	0.4	0.5	0.9	1.2	-	-										
<sup>2</sup> Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	-	-	-	-	-			-	-	-	-	-							-	-	-	-	-	
<sup>3</sup> 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, dsp = 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-construction 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)  
Oakley Crossroads Stream and Buffer Restoration / EEP Project No. 273 - Segment/Reach: Mainstem (3,950 feet)**

	Cross Section 1 (STA 0+72, Riffle)							Cross Section 2 (STA 6+17, Riffle)							Cross Section 3 (STA 12+59, Pool)							Cross Section 4 (STA 28+46, Riffle)							Cross Section 5 (STA 32+71, Pool)						
Based on fixed baseline bankfull elevation <sup>1</sup>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Record elevation (datum) used</b>		40.49	40.57						40.38	40.38						39.70	39.70						37.85	38.13						37.33	37.23				
Bankfull Width (ft)	20.82	12.39	15.49					16.60	13.16	15.09					20.58	24.38	20.80					14.64	13.70	14.70					19.06	29.71	23.49				
Floodprone Width (ft)	80.66	65.65	78.50					124.27	131.28	128.50					248.08	120.86	244.10					367.14	332.68	367.00					289.16	315.10	301.17				
Bankfull Mean Depth (ft)	0.88	0.68	0.63					1.09	1.37	1.20					1.79	1.55	1.66					1.43	1.33	1.35					1.55	1.20	1.48				
Bankfull Max Depth (ft)	2.15	1.14	1.84					2.54	2.68	2.61					3.43	3.41	3.17					2.99	2.69	3.28					2.81	3.65	3.77				
Bankfull Cross Sectional Area (ft <sup>2</sup> )	18.33	8.37	9.77					18.16	17.88	18.17					36.86	37.87	34.50					20.90	18.22	19.85					29.47	35.63	34.74				
Bankfull Width/Depth Ratio	23.66	18.22	24.59					15.23	9.61	12.58					11.50	15.73	12.53					10.24	10.30	10.89					12.30	24.76	15.87				
Bankfull Entrenchment Ratio	3.88	5.30	5.07					7.49	7.51	8.52					12.05	4.96	11.74					25.08	24.28	24.97					15.17	10.61	12.82				
Bankfull Bank Height Ratio	1.00	0.95	1.00					1.00	1.00	1.00					1.00	0.95	1.00					1.00	0.90	1.00					1.00	0.98	1.00				
Cross Sectional Area between end pins (ft <sup>2</sup> )																																			
d50 (mm)																																			
	Cross Section 6 (STA 35+24, Riffle)							Cross Section 7 (STA 38+71, Other)							Cross Section 8 (Riffle)							Cross Section 9 (Pool)							Cross Section 10 (Pool)						
Based on fixed baseline bankfull elevation <sup>1</sup>	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
<b>Record elevation (datum) used</b>		36.87	36.83						38.00	38.00																									
Bankfull Width (ft)	17.17	12.92	12.37					31.46	36.52	34.07																									
Floodprone Width (ft)	158.46	166.08	160.00					132.69	132.69	>200																									
Bankfull Mean Depth (ft)	1.10	1.35	1.54					2.41	2.13	2.09																									
Bankfull Max Depth (ft)	2.55	2.70	3.61					6.23	6.01	5.42																									
Bankfull Cross Sectional Area (ft <sup>2</sup> )	18.91	17.43	19.10					75.91	77.93	71.24																									
Bankfull Width/Depth Ratio	15.61	9.59	8.03					13.05	17.15	16.30																									
Bankfull Entrenchment Ratio	9.23	12.82	12.93					4.22	3.63	5.87																									
Bankfull Bank Height Ratio	1.00	0.95	1.00					1.00	1.00	1.00																									
Cross Sectional Area between end pins (ft <sup>2</sup> )																																			
d50 (mm)																																			

<sup>1</sup> = 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."

**Table 11b. Monitoring Data - Stream Reach Data Summary**  
**Oakley Crossroads Stream and Buffer Restoration / EEP Project No. 273 - Segment/Reach: Mainstem (3,950 feet)**

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n
Bankfull Width (ft)	14.6	17.31	-	20.82	-	4	12.4	12.8	12.9	13.16	0.39	4	12.4	14.4	14.9	15.49	1.399	4																		
Floodprone Width (ft)	80.7	182.63	-	367.14	-	4	65.7	118.7	124	166.1	50.4	4	78.5	183.5	144.3	367	126.9	4																		
Bankfull Mean Depth (ft)	0.9	1.13	-	1.43	-	4	0.7	1.1	1.35	1.37	0.39	4	0.6	1.2	1.275	1.54	0.392	4																		
<sup>1</sup> Bankfull Max Depth (ft)	2.2	2.56	-	2.99	-	4	1.1	2.2	2.68	2.703	0.9	4	1.8	2.8	2.945	3.61	0.783	4																		
Bankfull Cross Sectional Area (ft <sup>2</sup> )	18.2	19.08	-	20.9	-	4	8.4	8.4	17.4	17.88	5.37	4	9.8	16.7	18.64	19.85	4.686	4																		
Width/Depth Ratio	10.2	16.19	-	23.66	-	4	9.6	12.5	9.61	18.22	4.98	4	8.0	14.0	11.73	24.587	7.289	4																		
Entrenchment Ratio	4.7	10.55	-	21.21	-	4	5.3	9.2	9.44	12.82	3.77	4	5.1	12.9	10.73	24.966	8.682	4																		
<sup>1</sup> Bank Height Ratio	-	-	-	-	-	-	1	1	1	1	0	4	1	1	1	1	0	4																		
<b>Profile</b>																																				
Riffle Length (ft)	24.8	35.98	-	53.02	-	4	24.2	35.2	-	53.1	-	4	20.28	30.8	-	55.2		4																		
Riffle Slope (ft/ft)	0.002	0.003	-	0.006	-	4	0.002	0.003	-	0.006	-	4	0.002	0.004	-	0.006		4																		
Pool Length (ft)	20.47	33.67	-	44.45	-	2	21	32.54	-	45.21	-	2	26.76	38.88	-	51		2																		
Pool Max depth (ft)	2.81	3.12	-	3.43	-	2	3.41	3.53	-	3.65	-	2	3.17	3.47	-	3.77		2																		
Pool Spacing (ft)	43.4	64.26	-	94.03	-	2	42.1	65.2	-	95.2	-	2	28.72	64	-	106		33																		
<b>Pattern</b>																																				
Channel Beltwidth (ft)	38.6	55.94	-	86.18	-	48																														
Radius of Curvature (ft)	19.2	27.81	-	36.28	-	56																														
Rc:Bankfull width (ft/ft)	1.1	1.61	-	2.1	-	56																														
Meander Wavelength (ft)	85.5	103.92	-	118.61	-	48																														
Meander Width Ratio	2.2	3.23	-	4.98	-	48																														
<b>Additional Reach Parameters</b>																																				
Rosgen Classification	C4,E5						C4,E5						C4,E5																							
Channel Thalweg length (ft)													4064																							
Sinuosity (ft)	1.4						1.4						1.4																							
Water Surface Slope (Channel) (ft/ft)	0.00146						0.00145						0.00145																							
BF slope (ft/ft)	0.00144						0.00139						0.00137																							
<sup>3</sup> Ri% / Ru% / P% / G% / S%	52	-	48	-	-	-	52	-	48	-	-	-	52	-	48	-	-	-																		
<sup>3</sup> SC% / Sa% / G% / C% / B% / Be%																																				
<sup>3</sup> d16 / d35 / d50 / d84 / d95 /																																				
<sup>2</sup> % of Reach with Eroding Banks																																				
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**

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Table 12 – Verification of Bankfull Events

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<b>Table 12 - Verification of Bankfull Events</b>			
<b>Oakley Cross roads Stream and Buffer Restoration Project - EEP Project No. 273</b>			
<b>Date of Data Collection</b>	<b>Date of Occurrence</b>	<b>Method</b>	<b>Photo</b>
September 13, 2011	unknown	Visual observation of wrack lines	n/a
October 4, 2012	unknown	Crest gauge	S9
October 10, 2012	unknown	Visual observation of wrack lines	S8