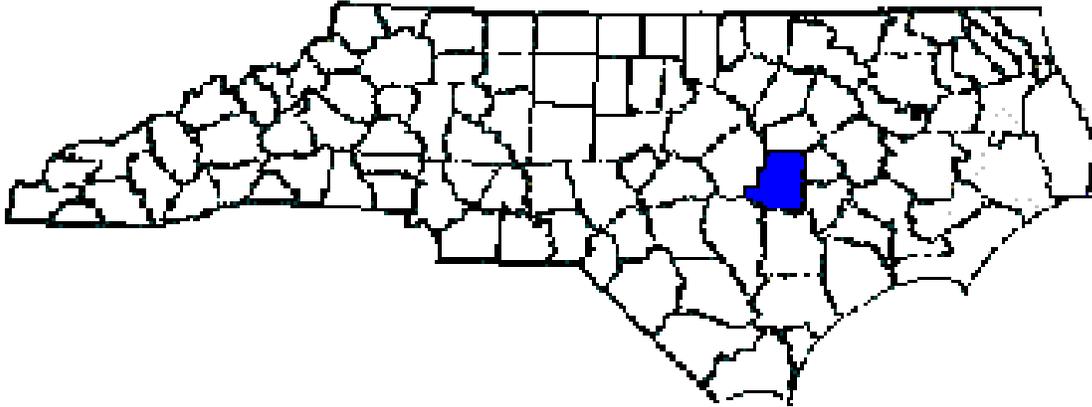


# ANNUAL REPORT FOR 2011



**Unnamed Tributary to Smith Mill Run  
Wayne County  
TIP No. R-2554BA – Permitted Site 4**



Prepared By:  
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North Carolina Department of Transportation  
November 2011

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## **SUMMARY**

The following report summarizes the stream monitoring activities that have occurred during 2011 at the UT to Smith Mill Run Mitigation Site in Wayne County. The site was constructed during 2009 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the second formal year of monitoring (Year 2011). The Year 2011 monitoring period is the second of five scheduled years for monitoring on UT to Smith Mill Run (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring along UT to Smith Mill Run, the site has met the required monitoring protocols for the second formal year of monitoring. Based on comparing the as-built data to the monitoring data, the channel is stable throughout the stream at this time. The streambank and buffer are meeting planted vegetation success criteria for the second year of monitoring.

NCDOT will continue stream monitoring at the UT to Smith Mill Run Mitigation Site for 2012.

## 1.0 INTRODUCTION

### 1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2011 at the UT to Smith Mill Run Mitigation Site. The site is located adjacent to US 70 (Goldsboro Bypass) just south of SR 1313 Belfast Road in Goldsboro, NC (Figure 1). UT to Smith Mill Run Mitigation Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2554BA in Wayne County.

The mitigation project covers approximately 1,082 linear feet of stream relocation. Construction was completed in January 2010 by the North Carolina Department of Transportation (NCDOT). Stream restoration involved the installation of rock cross vanes, rock vanes, construction of a new stream channel and construction of the floodplain to allow for overbank flooding. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

### 1.2 Purpose

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2011 at the UT to Smith Mill Run Mitigation Site. Hydrologic monitoring was not required for the site.

### 1.3 Project History

January 2010	Construction Completed
September 2010	Vegetation Monitoring (Year 1)
October 2010	Stream Channel Monitoring (Year 1)
January 2011	Replanted Site
August 2011	Vegetation Monitoring (Year 2)
November 2011	Stream Channel Monitoring (Year 2)

### 1.4 Debit Ledger

The entire UT to Smith Mill Run stream mitigation site was used for the R-2554BA project to compensate for unavoidable stream impacts.



## **2.0 STREAM ASSESSMENT**

### **2.1 Success Criteria**

The stream mitigation site shall be monitored annually for five years or until success criteria are satisfied. Monitoring protocols shall follow the Monitoring Level I outlined in the Stream Mitigation Guidelines, April 2003. NCDOT will evaluate the success of the stream relocation project based on guidance provided by the Stream Mitigation Guidelines disseminated by the United States Army Corps of Engineers-Wilmington District. The survey of channel dimension will consist of permanent cross sections placed at approximately six cross sections (three riffles and three pools). Annual photographs showing both banks and upstream and downstream views will be taken from permanent, mapped photo points. The survey of the longitudinal profile will represent distinct areas of the stream and will cover a cumulative total of 1,041 linear feet of channel. The entire restored length of stream will be investigated for channel stability and in-stream structure functionality. Any evidence of channel instability will be identified, mapped and photographed.

### **Vegetation Success**

For the onsite buffer mitigation sites, the permittee shall monitor the sites for five years. An annual report shall be submitted to the DWQ for a period of 5 years showing monitoring results, survival rate, success of tree and vegetation establishment, and that diffuse flow through the riparian buffer has been maintained. The first annual report shall be submitted within one year of the final planting. Failure to achieve a buffer density of 320 trees per acre after 5 years will require the annual report to provide appropriate remedial actions to be implemented and a schedule for implementation. Approval of the final annual report and a formal "close-out" of the mitigation site by the DWQ is required.

The success of vegetation plantings will be measured through stem counts. Permanent quadrants will be used to sample the riparian buffer. Survival of the live stakes will be determined by visual observation throughout the 5 year monitoring period.

Bareroot vegetation will be evaluated using 2 staked survival plots. Plots will be 50 ft. by 50 ft. or 100 ft. by 25 ft. and all flagged stems will be counted in those plots. Success will be defined as 320 stems per acre after 5 years. All vegetation monitoring will be conducted during the growing season.

### **2.2 Stream Description**

#### **2.2.1 Post-Construction Conditions**

The mitigation project covers approximately 1,082 linear feet of stream relocation. Construction was completed in January 2010 by the North Carolina Department of Transportation (NCDOT). Stream restoration involved the installation of rock cross vanes, rock vanes, construction of a new stream channel and construction of the floodplain to allow for overbank flooding. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

### **2.2.2 Monitoring Conditions**

The objective of the UT to Smith Mill Run Mitigation Site relocation was to build a C5 stream type as identified in the Rosgen's Applied River Morphology. A total of six cross sections (three in a riffle, three in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology in Table 1.

<b>Table 1. Abbreviated Morphological Summary (Upper and Lower Channel of the UT to Smith Mill Run)</b>							
<b>Variable</b>	<b>Proposed Upper Reach</b>	<b>Proposed Lower Reach</b>	<b>Cross Section #1 (Riffle)</b>	<b>Cross Section #3 (Riffle)</b>	<b>Cross Section #4 (Riffle)</b>	<b>Cross Section #6 (Riffle)</b>	<b>Min. - Max Values (Riffle Sections Only)</b>
			<b>2011</b>	<b>2011</b>	<b>2011</b>	<b>2011</b>	<b>2011</b>
Drainage Area (sq. mi)	<b>0.084</b>	<b>0.15</b>	0.084	0.084	0.15	0.15	0.15 - 0.084
Bankfull Width (ft)	<b>6.0</b>	<b>8.0</b>	9.87	8.83	10.26	9.92	8.83 – 10.26
Bankfull Mean Depth (ft)	<b>0.5</b>	<b>0.7</b>	0.34	0.37	0.43	0.72	0.34 – 0.72
Width/Depth Ratio	<b>12.0</b>	<b>11.4</b>	29.03	23.86	23.86	13.78	13.78 – 29.03
Bankfull Cross Sectional Area (ft <sup>2</sup> )	<b>3</b>	<b>5.6</b>	3.4	3.24	4.41	7.1	3.24 – 7.1
Maximum Bankfull Depth (ft)	<b>0.65</b>	<b>1.0</b>	0.57	0.77	1.06	1.36	0.57 – 1.36
Floodprone Area (ft)	<b>89-101</b>	<b>62-95</b>	40.46	55	26	41	26 – 55
Entrenchment Ratio	<b>14.8-16.8</b>	<b>7.9-11.9</b>	4.1	6.23	2.53	4.13	2.53 – 6.23

\*Drainage Area, Floodprone Width, and Slope are averaged values only.

\*Riffle values are used for classification purposes.

## **2.3 Results of the Stream Assessment**

### **2.3.1 Site Data**

The assessment included the survey of six cross sections and the longitudinal profile of UT to Smith Mill Run Mitigation Site established by the NCDOT after construction. The length of the profile along Smith Mill Run was approximately 1,041 linear feet (Main Channel: 900 lf. and Tributary: 141 lf.). Six cross sections were established during the as-built. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The location of the cross sections and longitudinal profile are shown in Appendix A.

- ◆ Cross Section #1. UT to Smith Mill Run, Station 166+00 linear feet, midpoint of riffle
- ◆ Cross Section #2. UT to Smith Mill Run, Station 251+00 linear feet, midpoint of pool
- ◆ Cross Section #3. UT to Smith Mill Run, Station 329+00 linear feet, midpoint of riffle
- ◆ Cross Section #4. UT to Smith Mill Run, Station 426+50 linear feet, midpoint of pool (main channel) and Station 64+00 linear feet, midpoint of riffle (tributary)
- ◆ Cross Section #5 UT to Smith Mill Run, Station 593+50 linear feet, midpoint of pool
- ◆ Cross Section #6 UT to Smith Mill Run, Station 805+00 linear feet, midpoint of riffle

Based on comparisons of the as-built to the monitoring data, all six cross sections appear stable with little or no active bank erosion. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment; however this information should remain similar in appearance. The longitudinal profile shows that the channel is stable for the 2011 monitoring evaluation.

## 2.4 Results of Stream and Buffer Vegetation

### 2.4.1 Description of Species

The following live stake species were planted on the streambank:

*Salix nigra*, Black Willow

*Cornus amomum*, Silky Dogwood

The following tree species were planted in the buffer area:

*Liriodendron tulipifera*, Tulip Poplar

*Platanus occidentalis*, American Sycamore

*Juglans nigra*, Black Walnut

*Betula nigra*, River Birch

*Fraxinus pennsylvanica*, Green Ash

### 2.4.2 Results of Vegetation Monitoring

**Buffer Vegetation:** One 50 ft. x 50 ft. vegetation plot and one 100 ft. x 25 ft. vegetation plot were set to determine the trees per acre in the buffer area.

**Table 2.** Vegetation Monitoring Results

Plot #	Tulip Poplar	American Sycamore	Black Walnut	River Birch	Green Ash	Total (Year 1)	Total (at planting)	Density (Trees/Acre)
1	4	5		1	2	12	40	204
2	8	14	1	15	2	40	40	680
Average Density (Trees/Acre)								442

**Site Notes:** The black willow and silky dogwood live stakes were surviving along sections of the streambank. Other vegetation noted included cattail, woolgrass, fennel, lespedeza, tear-thumb, soft rush, and various grasses.

### **2.4.3 Conclusions**

There were two vegetation monitoring plots established throughout the buffer area. The 2011 vegetation monitoring of the site revealed an average tree density of 442 trees per acre. This average is above the minimum success criteria of 320 trees per acre after year two monitoring. NCDOT is planning to supplementally plant the area around vegetation plot #1 due to the low density number by March 2012. NCDOT will continue to monitor the vegetation at the UT to Smith Mill Run Mitigation Site.

## **3.0 OVERALL CONCLUSIONS/RECOMMENDATIONS**

The UT to Smith Mill Run Mitigation Site has met the required monitoring protocols for the second formal year of monitoring. The channel and structures throughout the stream are stable at this time. The streambank and buffer are meeting planted vegetation success criteria for the second year of monitoring. NCDOT is planning to supplementally plant the area around vegetation plot #1 due to the low density number by March 2012.

NCDOT will continue stream monitoring at the UT to Smith Mill Run Mitigation Site for 2012.

## **4.0 REFERENCES**

Natural Channel Design for UT to Smith Mill Run (Permit Site 4); Wayne County, NC, Rev. October 10, 2007.

As-Built Report for Stream Restoration on R-2554BA Permit Site 4, Wayne County, NC, February 26, 2010.

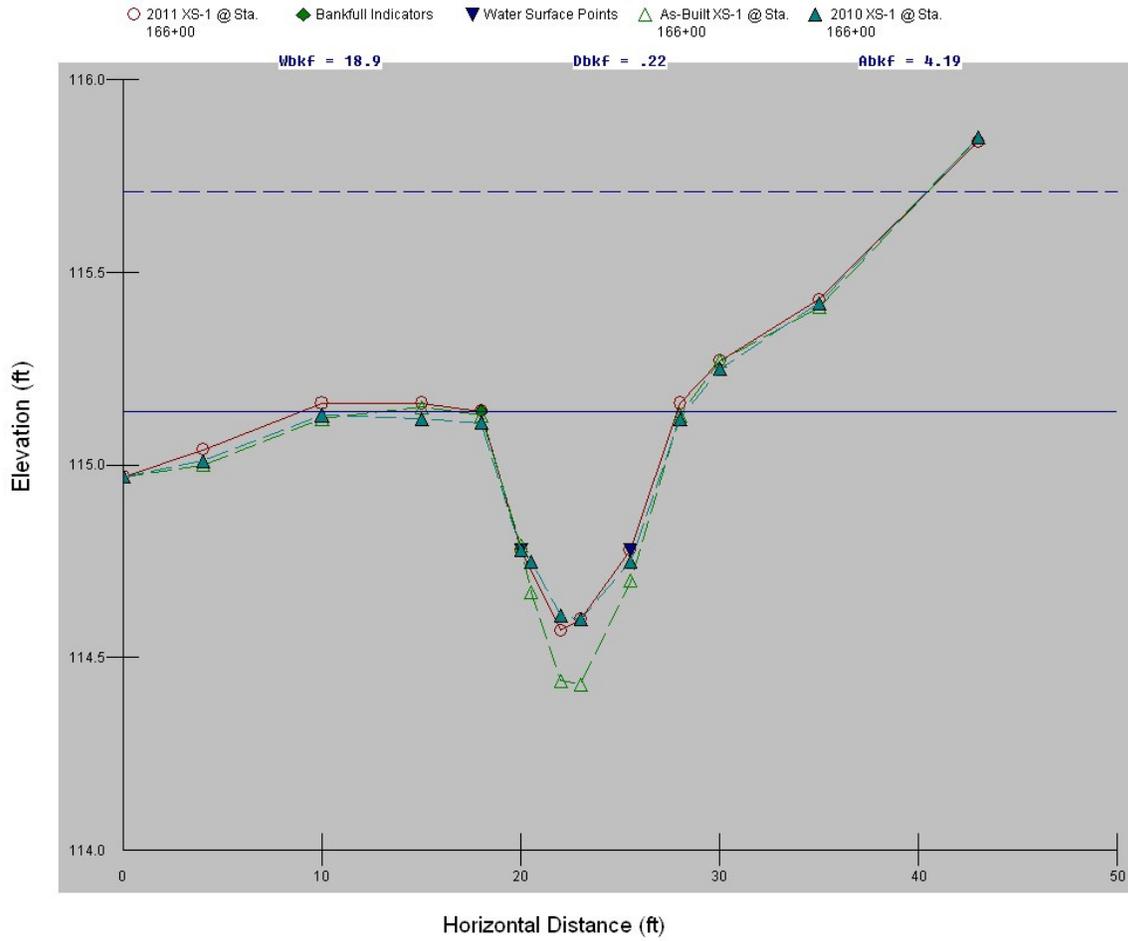
Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

**APPENDIX A**

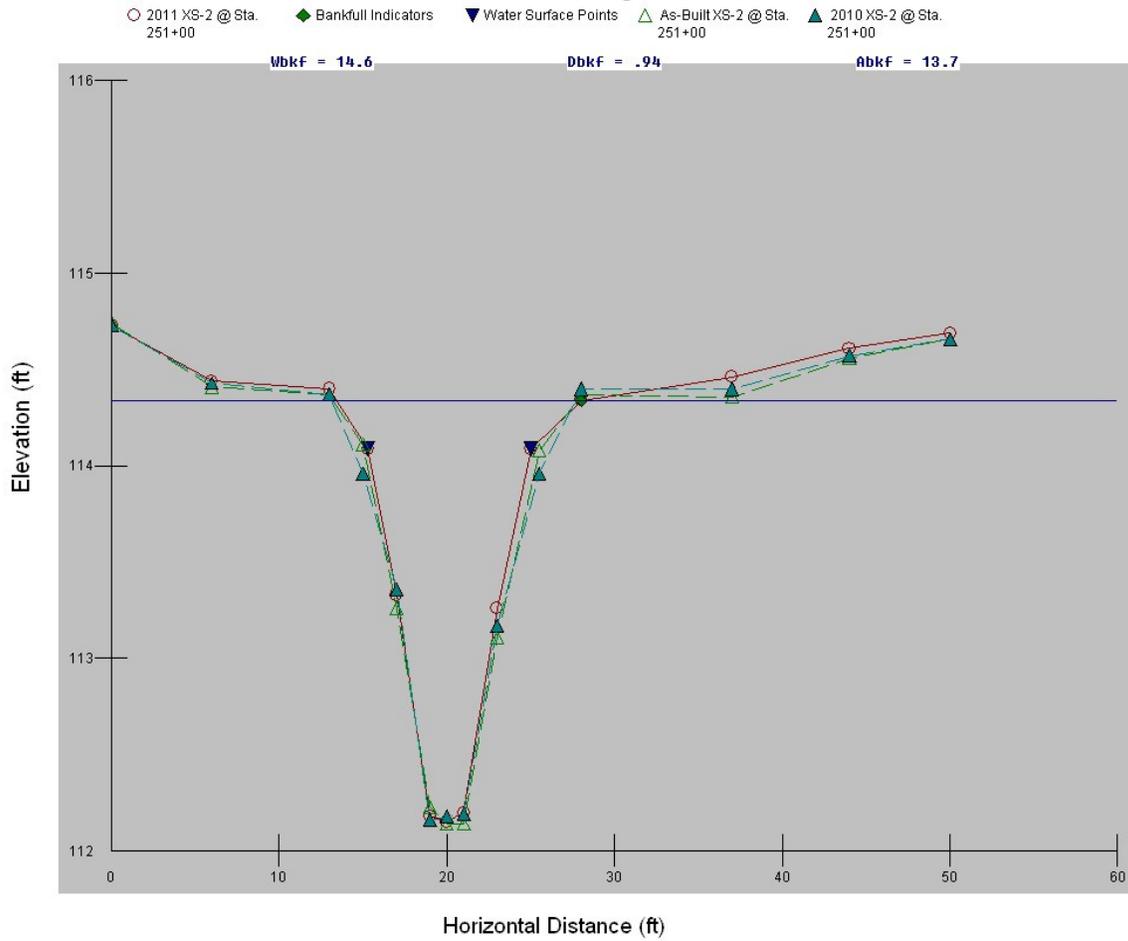
**CROSS SECTION COMPARISONS**  
**&**  
**LONGTITUDINAL PROFILE**

### R-2554BA Site 4 XS-1 @ Sta. 166+00



Cross-Section #1 (Riffle) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Width (ft)	9.93	9.87			
Bankfull Mean Depth (ft)	0.32	0.34			
Width/Depth Ratio	31.03	29.03			
Bankfull Cross Sectional Area (ft <sup>2</sup> )	3.18	3.4			
Maximum Bankfull Depth (ft)	0.51	0.57			
Width of the Floodprone Area (ft)	43	40.46			
Entrenchment Ratio	3.9	4.1			

### R-2554BA Site 4 XS-2 @ Sta. 251+00

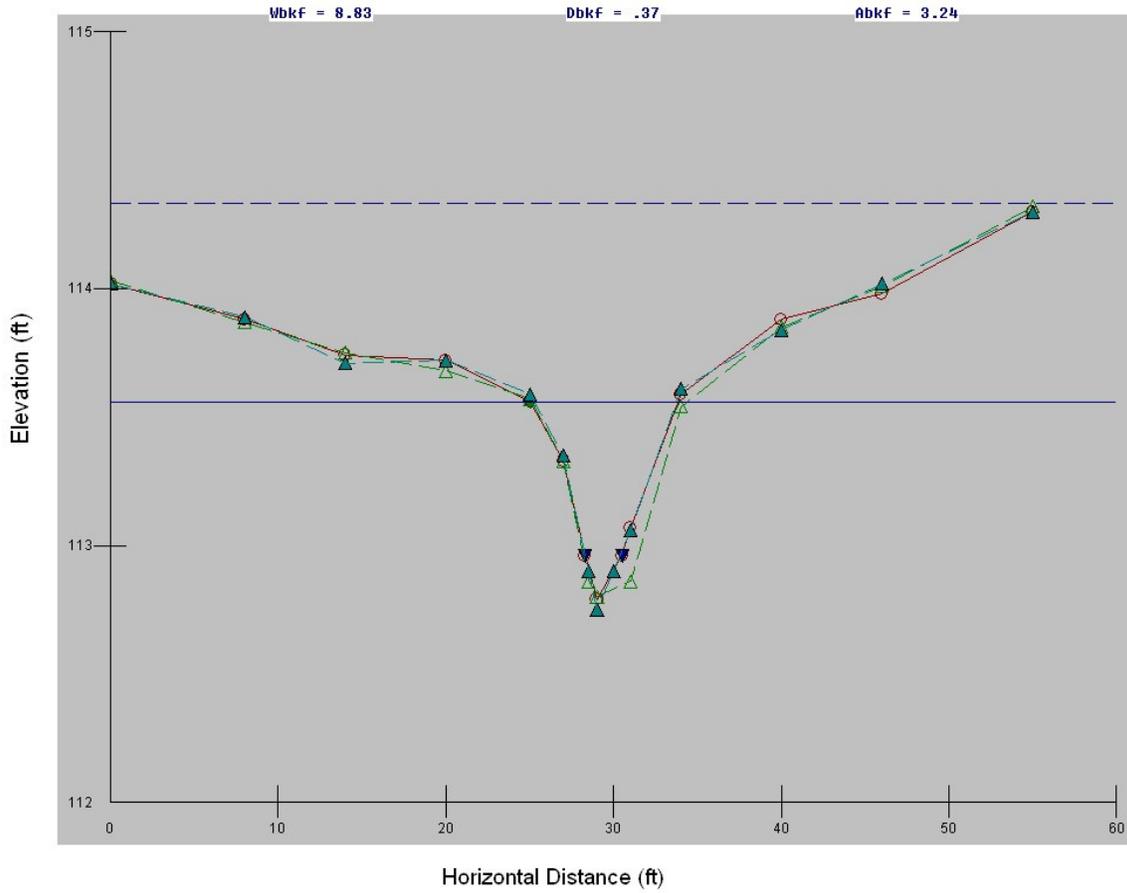


Cross-Section #2 (Pool) Abbreviated Morphological Summary*					
	2010	2011	2012	2013	2014
Bankfull Cross Sectional Area (ft <sup>2</sup> )	15.81	13.74			
Maximum Bankfull Depth (ft)	2.24	2.19			
Bankfull Mean Depth (ft)	0.85	0.94			
Bankfull Width (ft)	18.5	14.55			

\* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

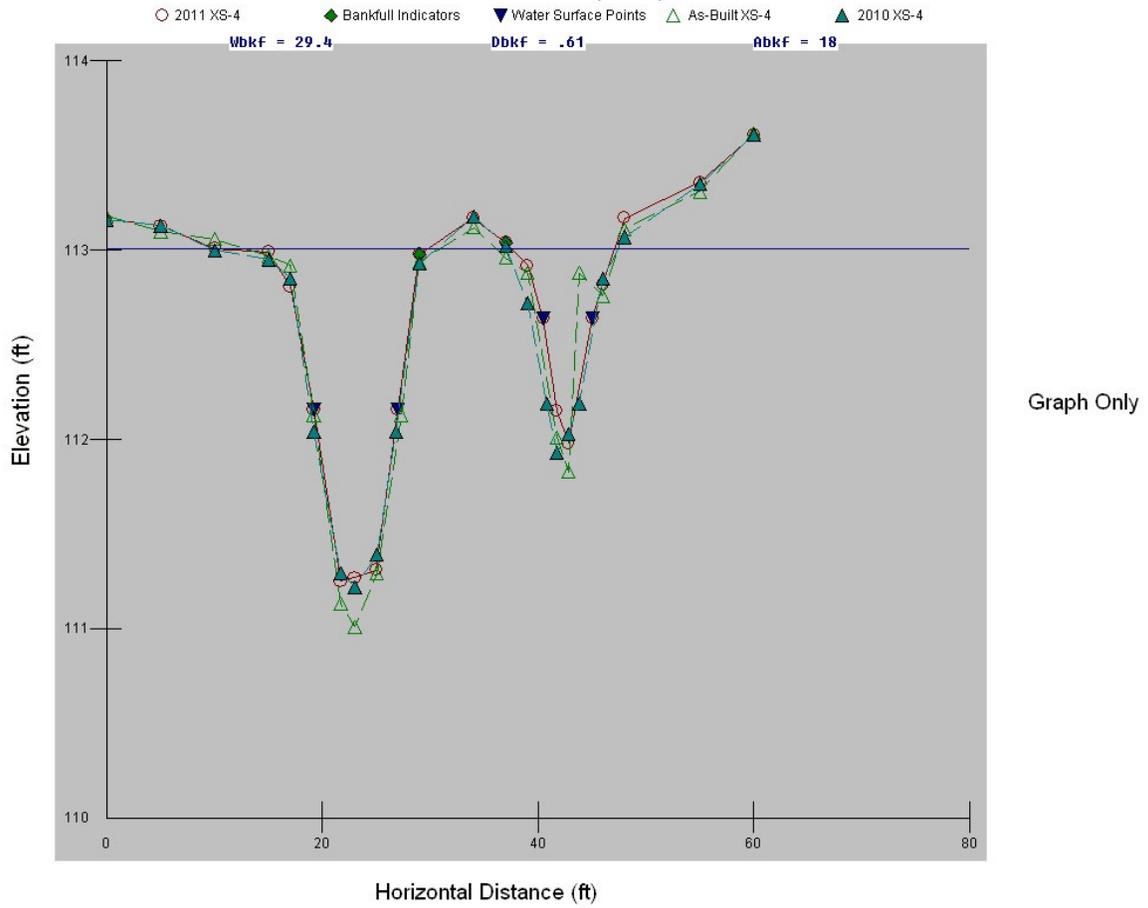
### R-2554BA Site 4 XS-3 @ Sta. 329+00

○ 2011 XS-3 @ Sta. 329+00    ◆ Bankfull Indicators    ▼ Water Surface Points    △ As-Built XS-3 @ Sta. 329+00    ▲ 2010 XS-3 @ Sta. 329+00

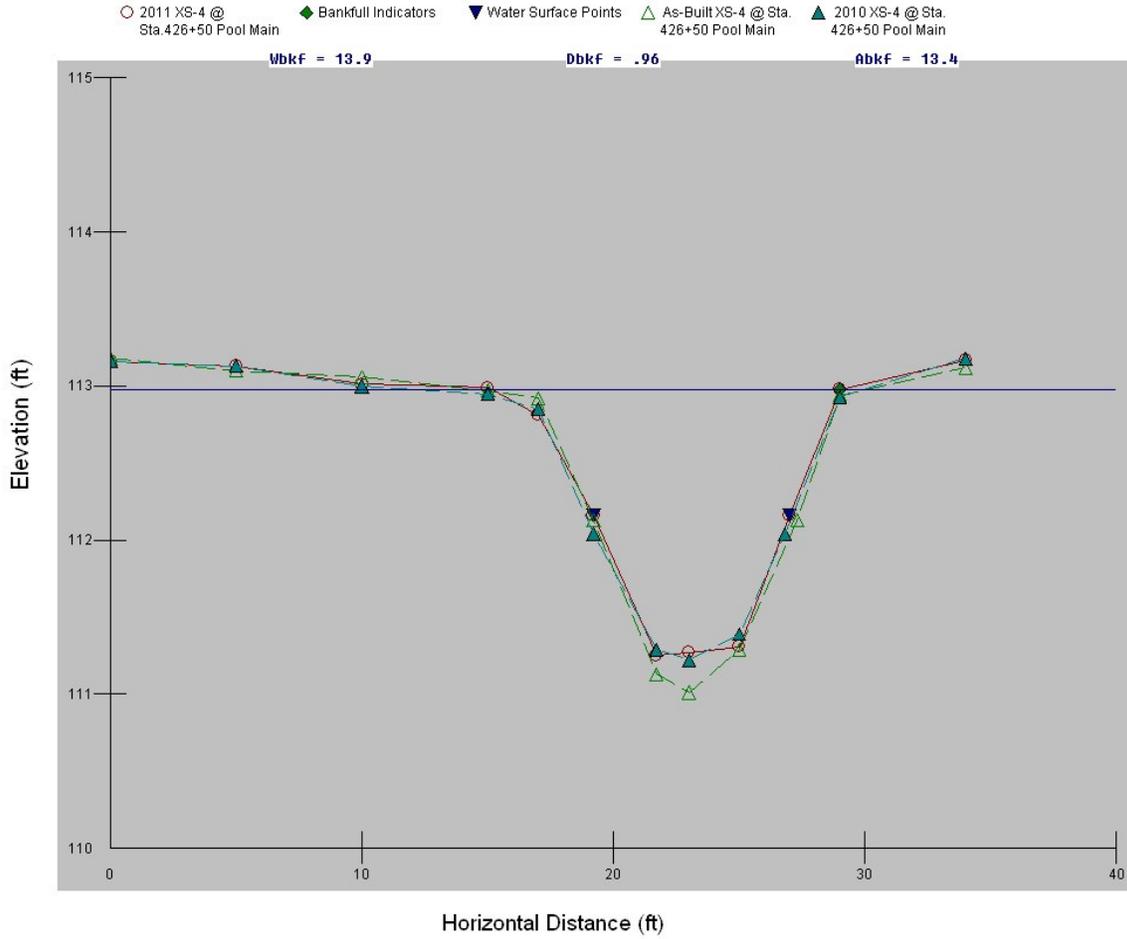


Cross-Section #3 (Riffle) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Width (ft)	8.89	8.83			
Bankfull Mean Depth (ft)	0.39	0.37			
Width/Depth Ratio	22.79	23.86			
Bankfull Cross Sectional Area (ft <sup>2</sup> )	3.46	3.24			
Maximum Bankfull Depth (ft)	0.84	0.77			
Width of the Floodprone Area (ft)	55	55			
Entrenchment Ratio	6.19	6.23			

R-2554BA Site 4 XS-4 Pool @ Sta. 426+50 (Main) and Riffle @ Sta. 64+00 (Trib.)



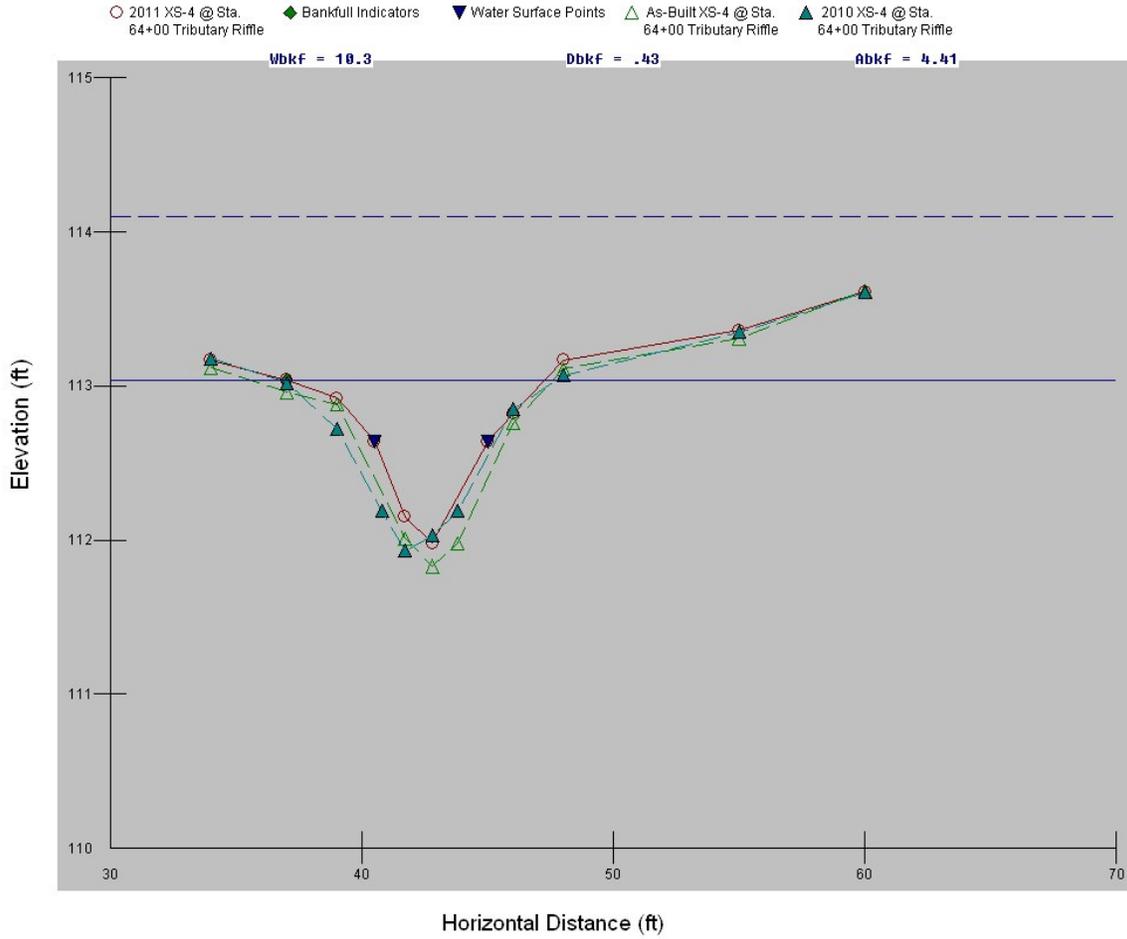
### R-2554BA Site 4 Pool XS-4 @ Sta.426+50 on the Main Channel



Cross-Section #4 (Main Pool) Abbreviated Morphological Summary*					
	2010	2011	2012	2013	2014
Bankfull Cross Sectional Area (ft <sup>2</sup> )	12.89	13.36			
Maximum Bankfull Depth (ft)	1.71	1.73			
Bankfull Mean Depth (ft)	0.95	0.96			
Bankfull Width (ft)	13.6	13.89			

\* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

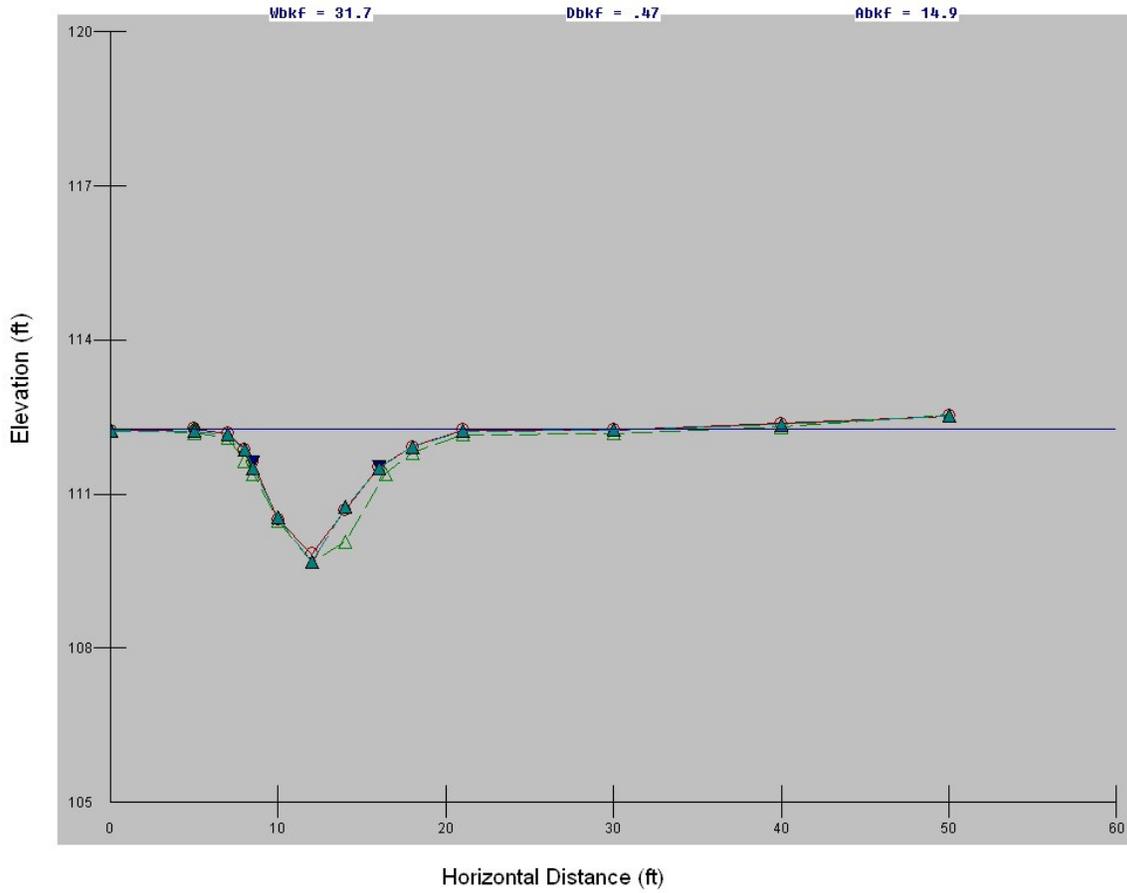
### R-2554BA Site 4 Riffle XS-4 @ Sta. 64+00 on the Tributary



Cross-Section #4 (Tributary Riffle) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Width (ft)	10.55	10.26			
Bankfull Mean Depth (ft)	0.52	0.43			
Width/Depth Ratio	20.29	23.86			
Bankfull Cross Sectional Area (ft <sup>2</sup> )	5.47	4.41			
Maximum Bankfull Depth (ft)	1.09	1.06			
Width of the Floodprone Area (ft)	26	26			
Entrenchment Ratio	2.47	2.53			

### R-2554BA Site 4 XS-5 @ Sta. 593+50

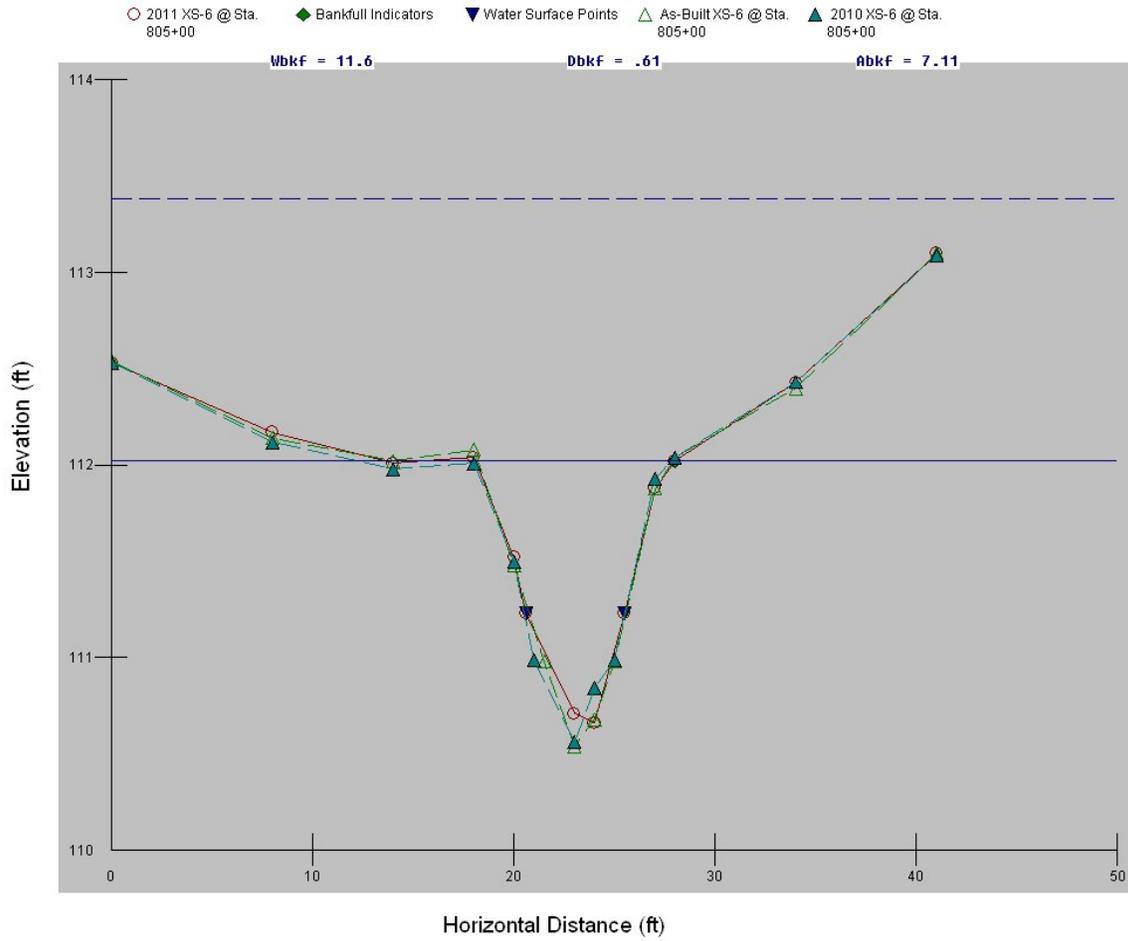
○ 2011 XS-5 @ Sta. 593+50    ◆ Bankfull Indicators    ▼ Water Surface Points    △ As-Built XS-5 @ Sta. 593+50    ▲ 2010 XS-5 @ Sta. 593+50



Cross-Section #5 (Pool) Abbreviated Morphological Summary*					
	2010	2011	2012	2013	2014
Bankfull Cross Sectional Area (ft <sup>2</sup> )	14.34	14.6			
Maximum Bankfull Depth (ft)	2.55	2.43			
Bankfull Mean Depth (ft)	0.9	0.91			
Bankfull Width (ft)	16	16			

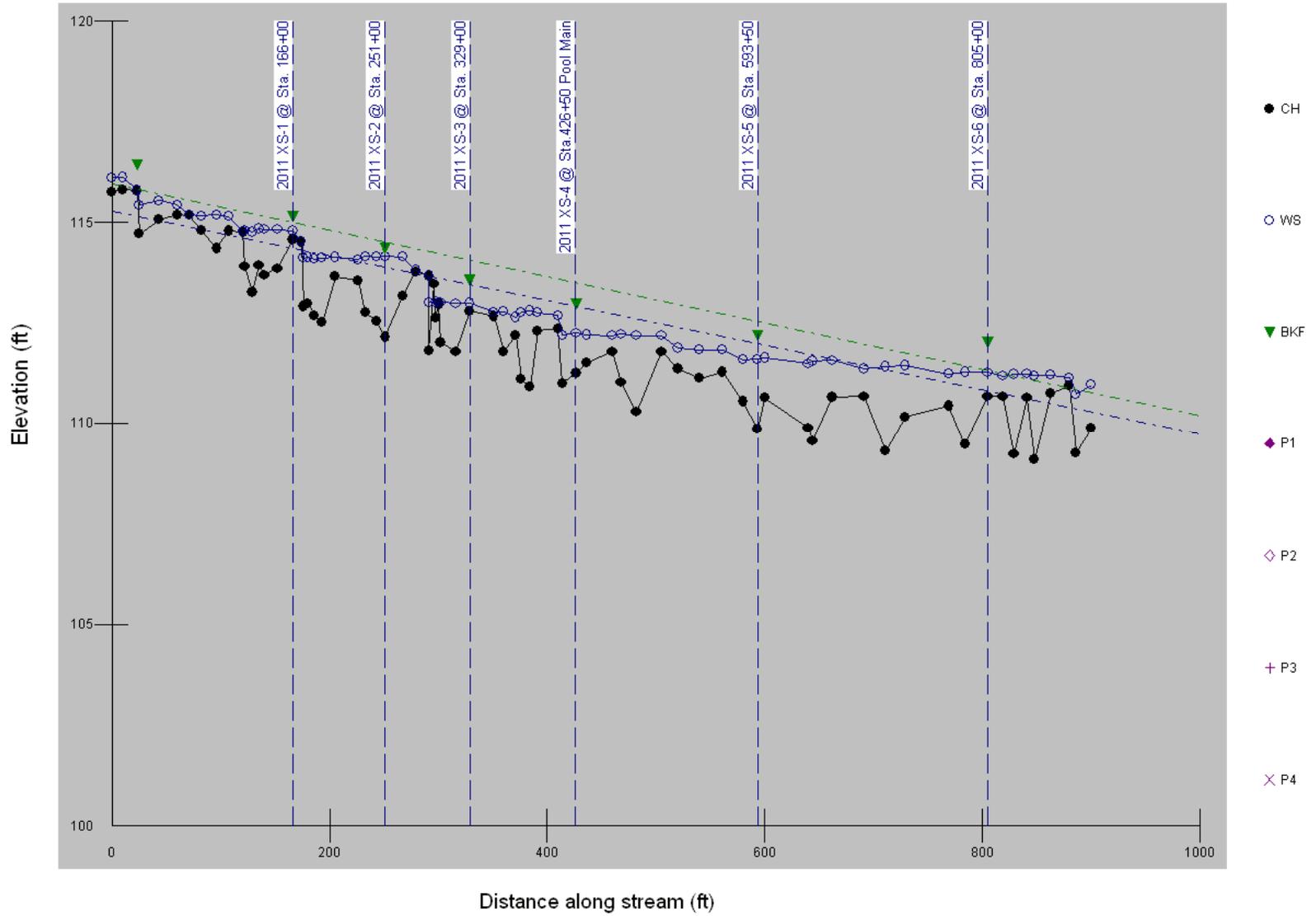
\* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.

### R-2554BA Site 4 XS-6 @ Sta. 805+00

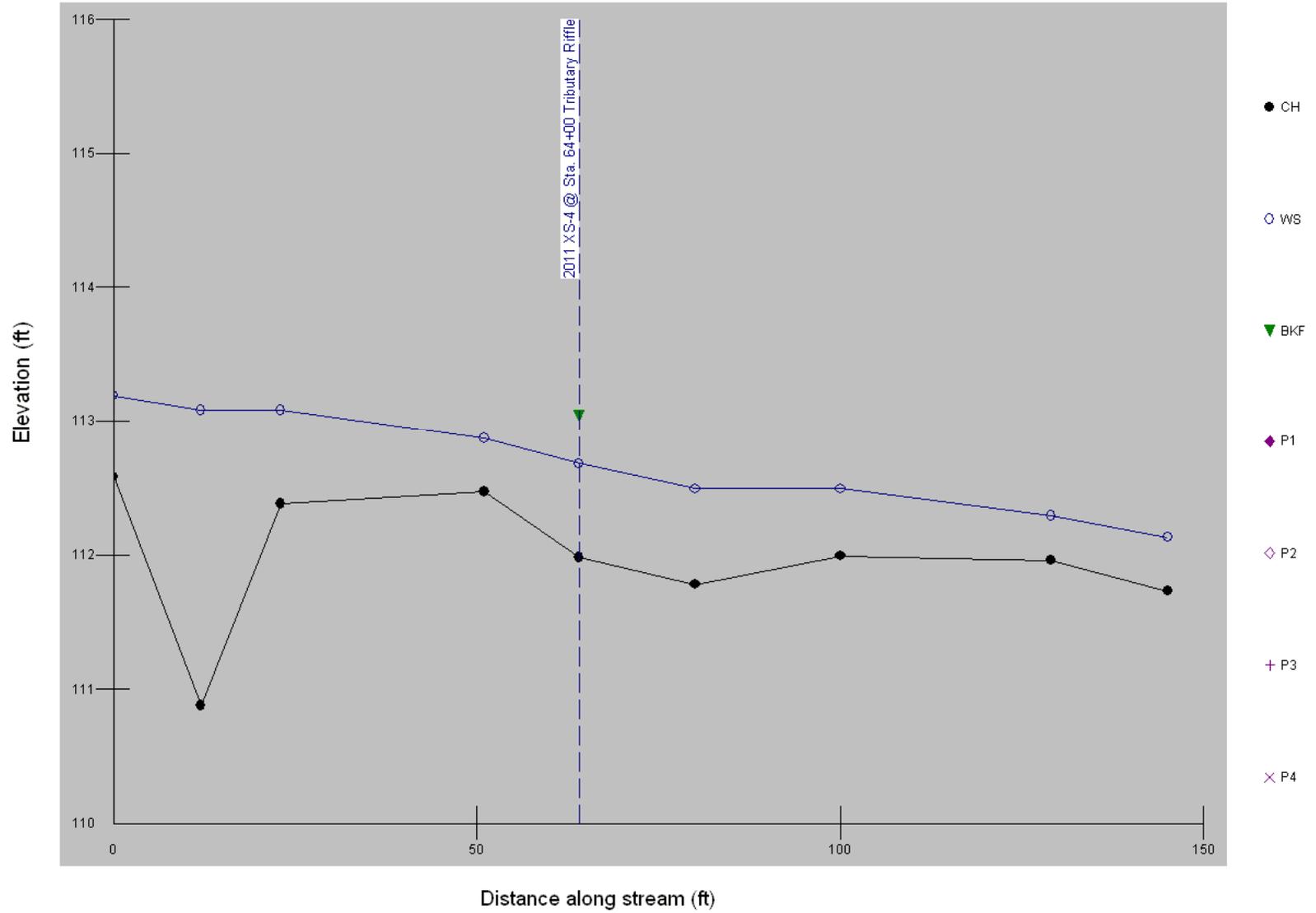


Cross-Section #6 (Riffle) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Width (ft)	9.73	9.92			
Bankfull Mean Depth (ft)	0.75	0.72			
Width/Depth Ratio	12.97	13.78			
Bankfull Cross Sectional Area (ft <sup>2</sup> )	7.28	7.1			
Maximum Bankfull Depth (ft)	1.45	1.36			
Width of the Floodprone Area (ft)	41	41			
Entrenchment Ratio	4.21	4.13			

UT to Smith Mill Run (Site 4) Longitudinal Profile of Main Channel



UT to Smith Mill Run (Site 4) Longitudinal Profile - Tributary



**APPENDIX B**

**SITE PHOTOGRAPHS, CROSS SECTION AND**

**PHOTO POINT LOCATIONS**

# UT to Smith Mill Run



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)



Photo Point #3 (Downstream)

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# UT to Smith Mill Run



Photo Point #4 (Upstream on Main Channel)



Photo Point #4 (Downstream on Main Channel)



Photo Point #4 (Upstream on Tributary)



Photo Point #5 (Upstream)



Photo Point #5 (Downstream)

November 2011

# UT to Smith Mill Run



Photo Point #6 (Upstream)



Photo Point #6 (Downstream)



Vegetation Plot #1



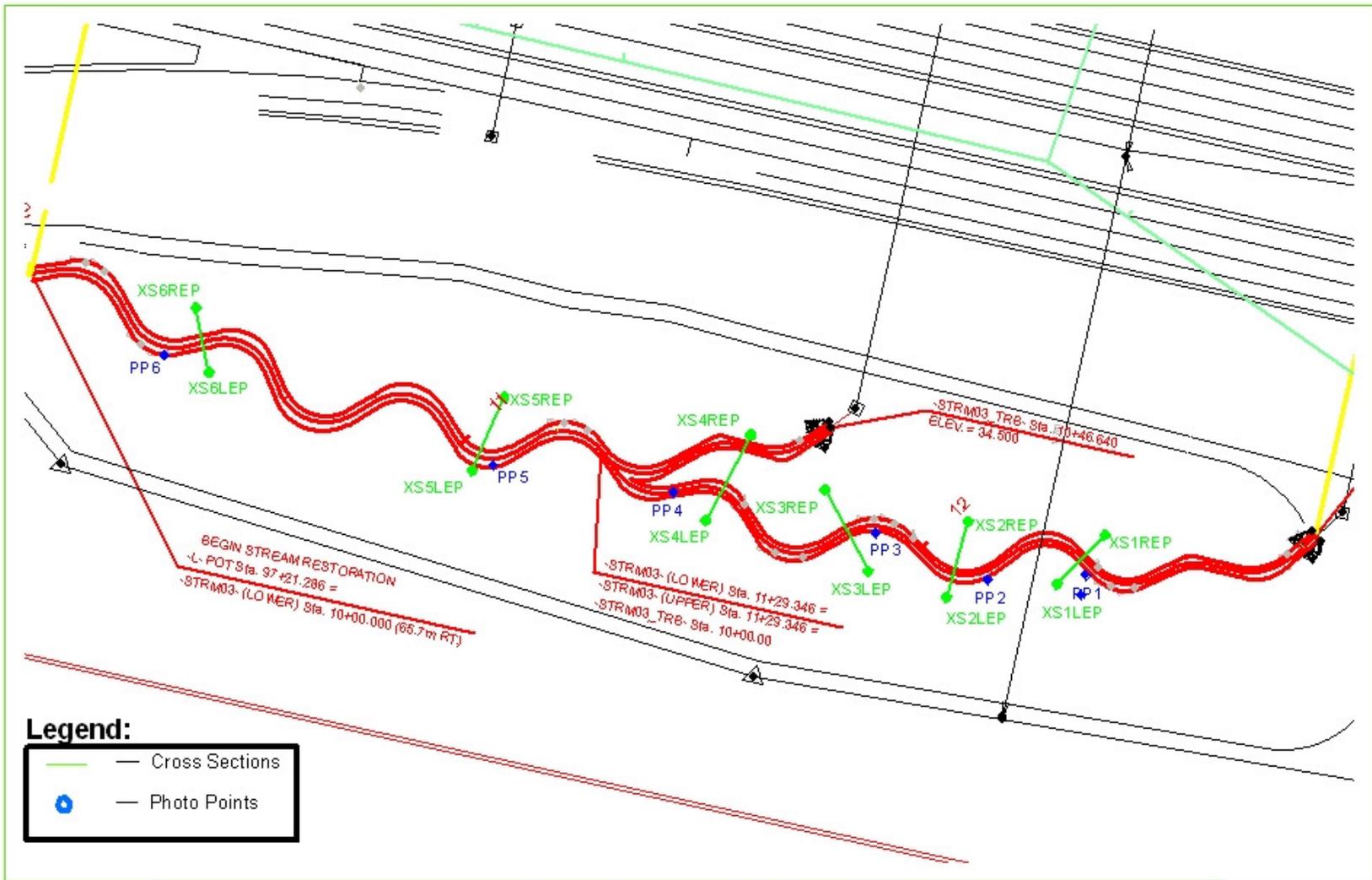
Vegetation Plot #2



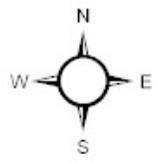
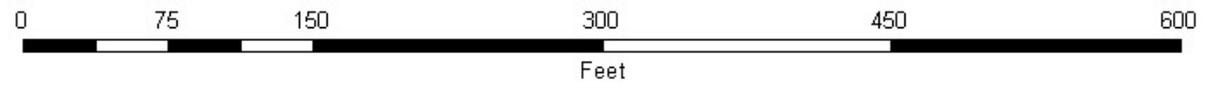
Overview Photo Looking Upstream  
November 2011

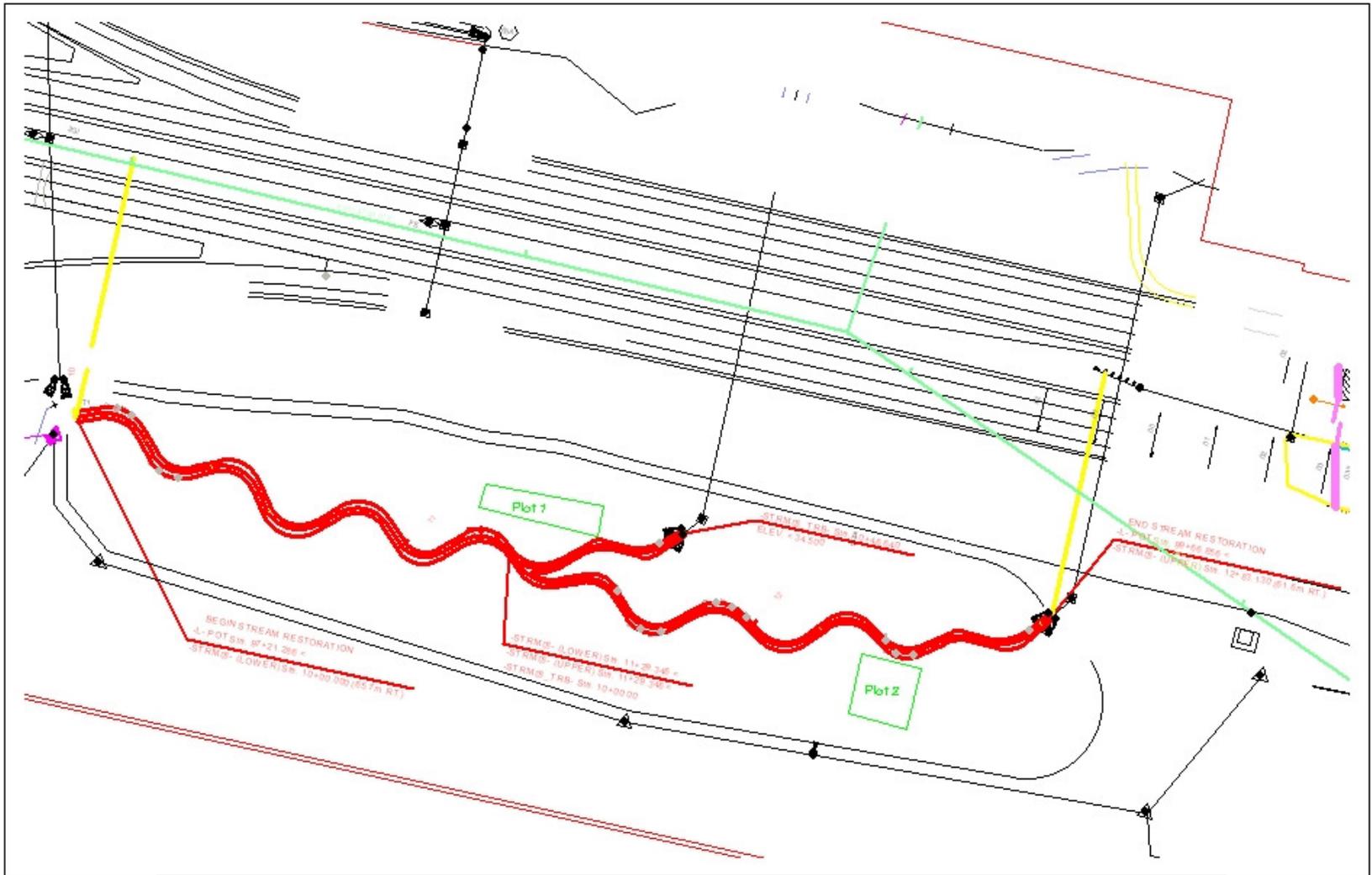


Overview Photo Looking Downstream



**Photo Point and Cross Section Locations  
R-2554BA UT to Smith Mill Run  
Wayne County, North Carolina**





**Vegetation Plot Locations  
R-2554BA UT to Smith Mill Run  
Wayne County, North Carolina**

