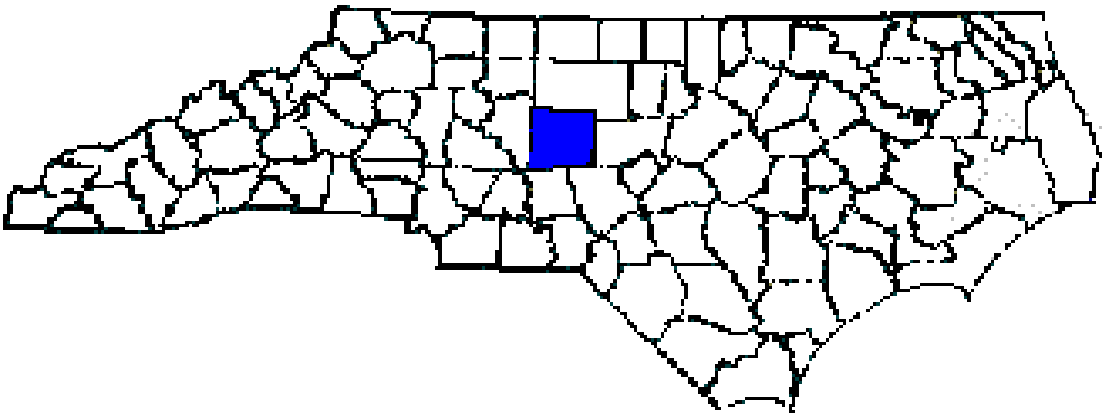
ANNUAL REPORT FOR 2012



UT to Muddy Creek Mitigation Site
Randolph County
TIP No. R-2606WM
COE Action ID: SAW-2004-00340
DWQ #: 2006-0331

Prepared By:
Natural Environment Section & Roadside Environmental Unit
North Carolina Department of Transportation
November 2012

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2012 at the UT to Muddy Creek Mitigation Site in Randolph County. The site was completed construction in November 2010 and planted in March 2011 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the second formal year of monitoring (Year 2012). The Year 2012 monitoring period is the second of five scheduled years for monitoring on UT to Muddy Creek Mitigation Site (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring along the UT to Muddy Creek, the site has met the required monitoring protocols for the second formal year of monitoring. Based on comparing the monitoring data to the as-built data, the channel is stable throughout the stream at this time. The streambank and buffer areas are vegetated for the second year of monitoring.

NCDOT will continue stream monitoring at the UT to Muddy Creek Mitigation Site for 2013.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2012 at the UT to Muddy Creek Mitigation Site. The site is located approximately 8 miles southeast of High Point. It is adjacent to US-311 Bypass (R-2606) and just south of Cedar Square Road and north of Spencer Road (Figure 1). The UT to Muddy Creek Mitigation Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2606 in Randolph County.

The mitigation project covers approximately 1,380 linear feet of stream restoration. Construction was completed in November 2010 and planted in March 2011 by NCDOT. Stream restoration involved the installation of rock cross vanes, rock a-vanes and 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 2012 at the UT to Muddy Creek Mitigation Site. Hydrologic monitoring was not required for the site.

1.3 Project History

November 2010	Construction Completed
March 2011	Planted Live Stakes and Bareroot Seedlings
July 2011	Vegetation Monitoring (Year 1)
October 2011	Stream Monitoring (Year 1)
September 2012	Vegetation Monitoring (Year 2)
October 2012	Stream Monitoring (Year 2)

1.4 Debit Ledger

The entire UT to Muddy Creek stream mitigation site was used for the R-2606 project to compensate for unavoidable stream impacts.

Figure 1. Vicinity Map

2.0 STREAM ASSESSMENT

2.1 Success Criteria

In accordance with the approved mitigation plan, NCDOT will evaluate the success of the stream restoration 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 seven cross sections (four 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 1,370 linear feet of channel (Main Channel: 1,275 lf. and Tributary: 95 lf). 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
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 4 staked survival plots. Plots will be 50 ft. by 50 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 1,380 linear feet of stream restoration. Construction was completed in November 2010 and planted in March 2011 by NCDOT. Stream restoration involved the installation of rock cross vanes, rock a-vane, and 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 Muddy Creek Mitigation Site was to restore a C5 stream type as identified in the Rosgen's Applied River Morphology. A total of seven cross sections (four in a riffle, three in a pool) were surveyed. For this report, Table 1 only included cross sections containing riffles in the comparison of channel morphology.

Table 1. Abbreviated Morphological Summary (UT to Muddy Creek Cross Sections #1, #3, #4, & #6)						
Variable	**As-Built**	**Cross Section #1 (Riffle) Main Channel**	**Cross Section #3 (Riffle) Main Channel**	**Cross Section #4 (Riffle) Tributary**	**Cross Section #6 (Riffle) Main Channel**	**Min. - Max Values (Riffle Sections Only)**
		2012	**2012**	**2012**	**2012**	**2012**
Drainage Area (sq. mi)	**0.4**	0.4	0.4	0.4	0.4	0.4
Bankfull Width (ft.)	**11.3**	12.75	14.76	7.39	13.79	7.39 – 14.76
Bankfull Mean Depth (ft.)	**0.7**	0.94	0.77	0.47	0.67	0.47 – 0.94
Width/Depth Ratio	**16.1**	13.56	19.17	15.72	20.58	13.56 – 20.58
Bankfull Cross Sectional Area (ft^2)	**8.0**	11.93	11.38	3.48	9.21	3.48 – 11.93
Maximum Bankfull Depth (ft.)	**1.0**	1.82	1.73	0.84	1.1	0.84 – 1.82
Floodprone Area (ft.)	**24.9 - 30.5**	34.21	47	23.11	39.49	23.11 - 47
Entrenchment Ratio	**2.2 – 2.7**	2.68	3.18	3.13	2.86	2.68 – 3.18

*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 seven cross sections and the longitudinal profile of UT to Muddy Creek established by the NCDOT after construction. The length of the profile along Muddy Creek Mitigation Site was approximately 1,370 linear feet (Main Channel: 1275 lf. and Tributary: 95 lf). Seven cross sections were established during the as-built survey. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The locations of the cross sections and longitudinal profile are shown in Appendix A.

- Cross Section #1. UT Muddy Creek, Station 166+00 linear feet, midpoint of riffle
- Cross Section #2. UT Muddy Creek, Station 297+00 linear feet, midpoint of pool
- Cross Section #3. UT Muddy Creek, Station 371+00 linear feet, midpoint of riffle
- Cross Section #4. UT Muddy Creek, Station 19+00 linear feet, midpoint of riffle (tributary)
- Cross Section #5. UT Muddy Creek, Station 713+00 linear feet, midpoint of pool
- Cross Section #6. UT Muddy Creek, Station 957+00 linear feet, midpoint of riffle
- Cross Section #7. UT Muddy Creek, Station 1160+00 linear feet, midpoint of pool

Based on comparisons of the monitoring data to the as-built data, all seven 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 showed that there is a slight headcut at Sta. 75+00 and water was piping under a crossvane at Sta. 88+00. Some minor bank scouring was noted on the left bank just downstream of Cross Section #5. A bankfull event has occurred since the last monitoring evaluation in 2011.

2.4 Results of Stream and Buffer Vegetation

2.4.1 Description of Species

The following live stake species were planted on the streambank:

Cephalanthus occidentalis, Buttonbush

Cornus amomum, Silky Dogwood

The following tree species were planted in the buffer area:

Platanus occidentalis, Sycamore

Quercus lyrata, Overcup Oak

Betula Nigra, River Birch

Liriodendron Tulipifera, Tulip Poplar

2.4.2 Results of Vegetation Monitoring

Table 2. Vegetation Monitoring Results: Four 50 ft. x 50 ft. vegetation plots were set to determine the trees per acre in the buffer area.

Plot #	Sycamore	Overcup Oak	River Birch	Tulip Poplar	Total (Year 2)	Total (at planting)	Density (Trees/Acre)
1	20	6	2	7	35	38	626
2	12	2	7		21	21	680
3	19	7	7	6	39	42	631
4	18	6	6	2	32	44	495
Average Density (Trees/Acre)							608

Site Notes: The buttonbush and silky dogwood live stakes are surviving along the streambank. Other vegetation noted included, horse-nettle, sweetgum, fennel, briars, goldenrod, *Juncus* sp., tear-thumb, baccharis, black willow, pokeberry, cattail, sumac, winged elm, and various grasses.

2.4.3 Conclusions

There were four vegetation monitoring plots established throughout the buffer area. The 2012 vegetation monitoring of the site revealed an average tree density of 608 trees per acre. This average is above the minimum success criteria of 320 trees per acre after year two monitoring.

3.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

The UT to Muddy Creek 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 area are vegetated for the second year of monitoring.

NCDOT will continue stream monitoring at the UT to Muddy Creek Mitigation Site for 2013.

4.0 REFERENCES

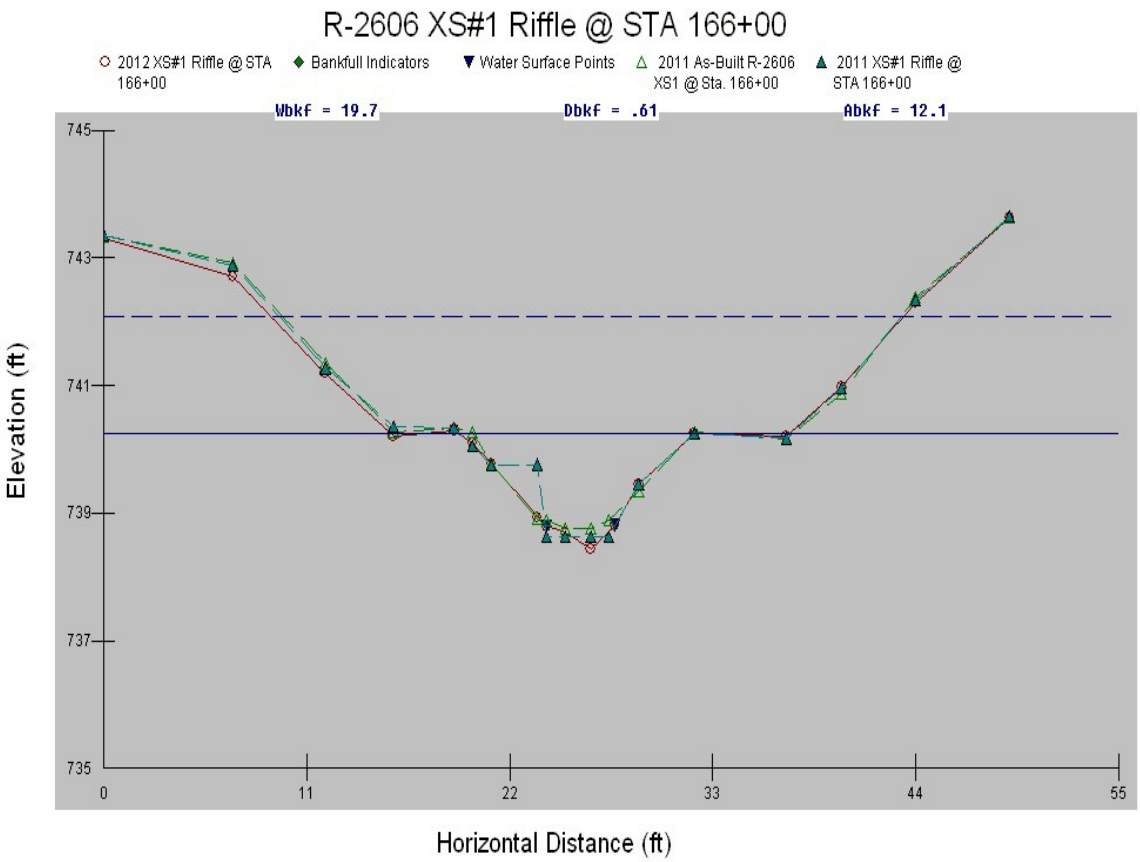
Stream and Wetland Mitigation Plan for UT to Muddy Creek (CF-16 Site) Randolph County, NC, August 2006

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

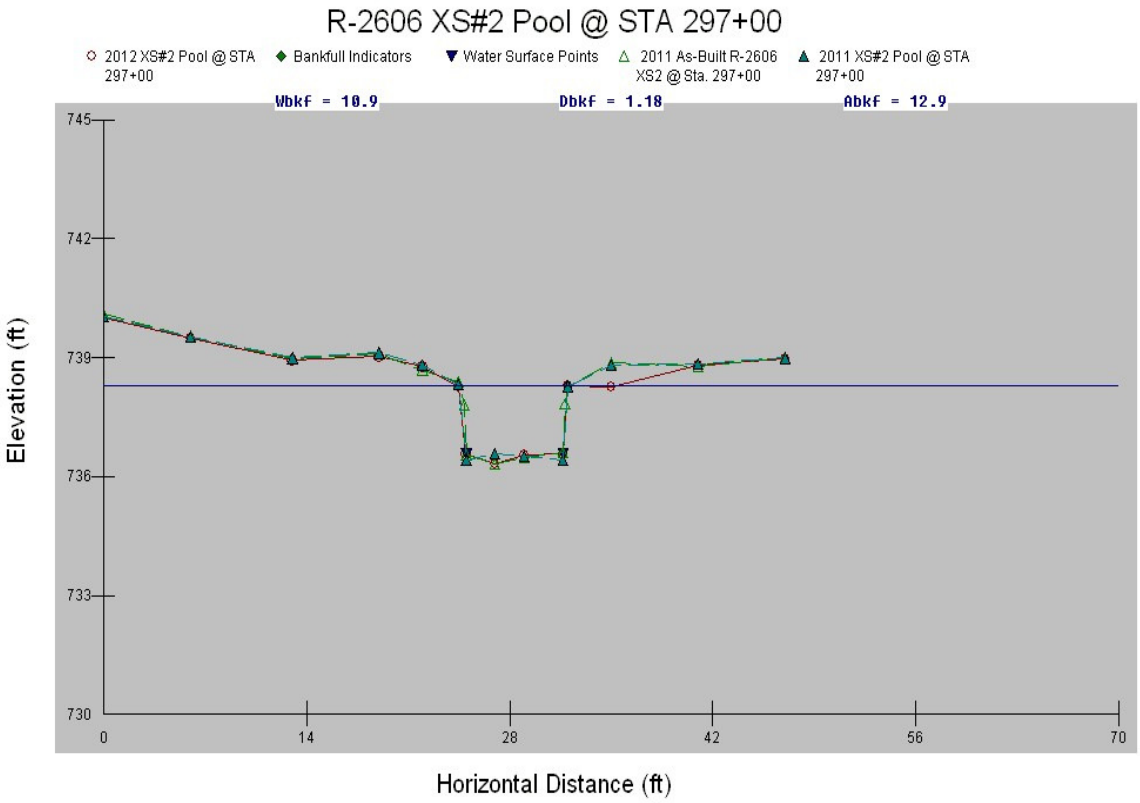
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

APPENDIX A

CROSS SECTION COMPARISONS
&
LONGTITUDINAL PROFILE

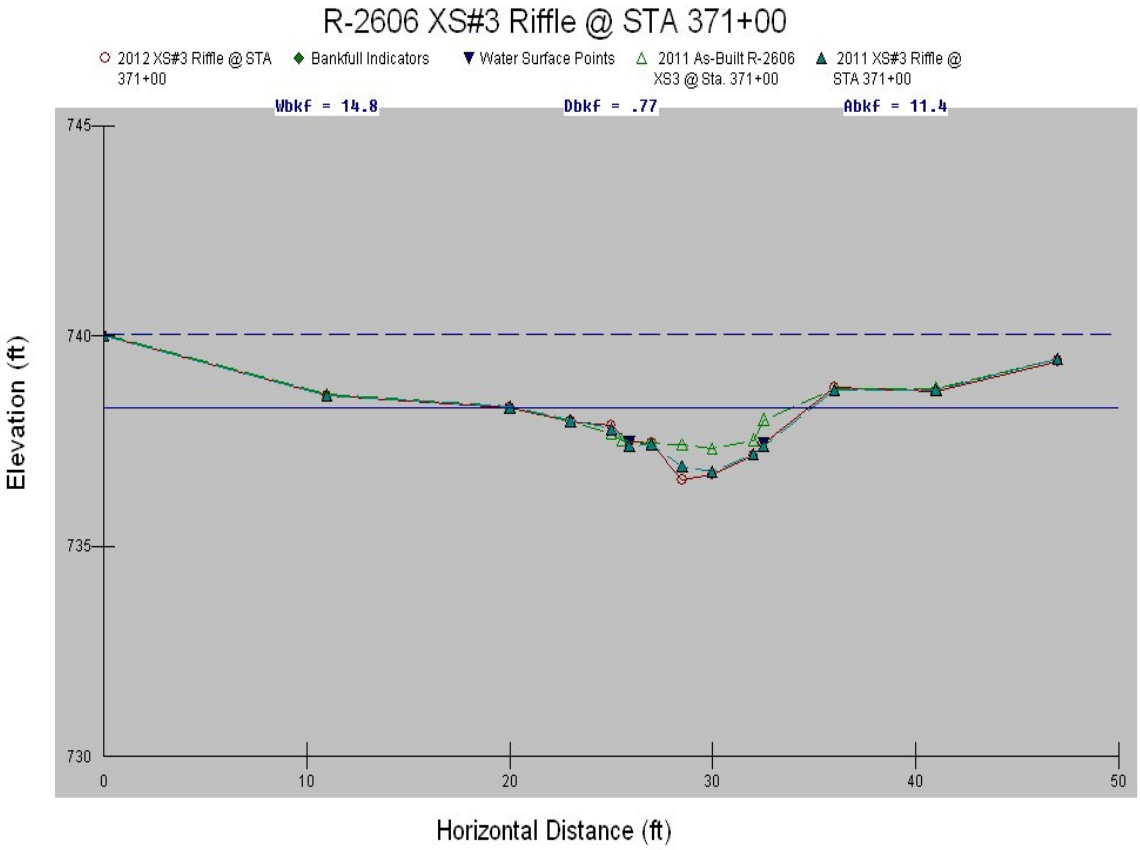


Cross-Section #1 (Riffle) Abbreviated Morphological Summary					
	2011	2012	2013	2014	2015
Bankfull Width (ft.)	12.71	12.75			
Bankfull Mean Depth (ft.)	0.85	0.94			
Width/Depth Ratio	14.95	13.56			
Bankfull Cross Sectional Area (ft^2)	10.84	11.93			
Maximum Bankfull Depth (ft.)	1.63	1.82			
Width of the Floodprone Area (ft.)	32.59	34.21			
Entrenchment Ratio	2.56	2.68			

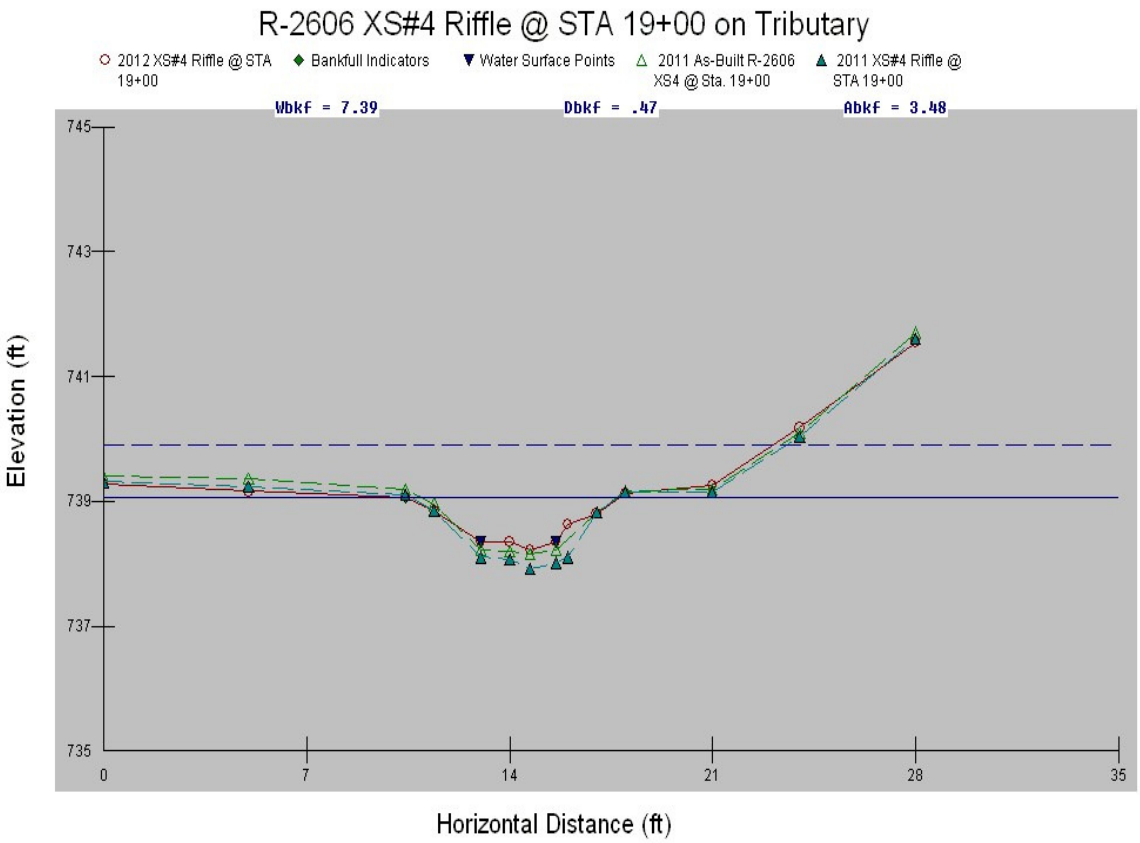


Cross-Section #2 (Pool) Abbreviated Morphological Summary*					
	2011	**2012**	**2013**	**2014**	**2015**
Bankfull Cross Sectional Area (ft^2)	**17.95**	**12.52**			
Maximum Bankfull Depth (ft.)	**2.39**	**1.98**			
Bankfull Mean Depth (ft.)	**1.38**	**1.15**			
Bankfull Width (ft.)	**13**	**10.93**			

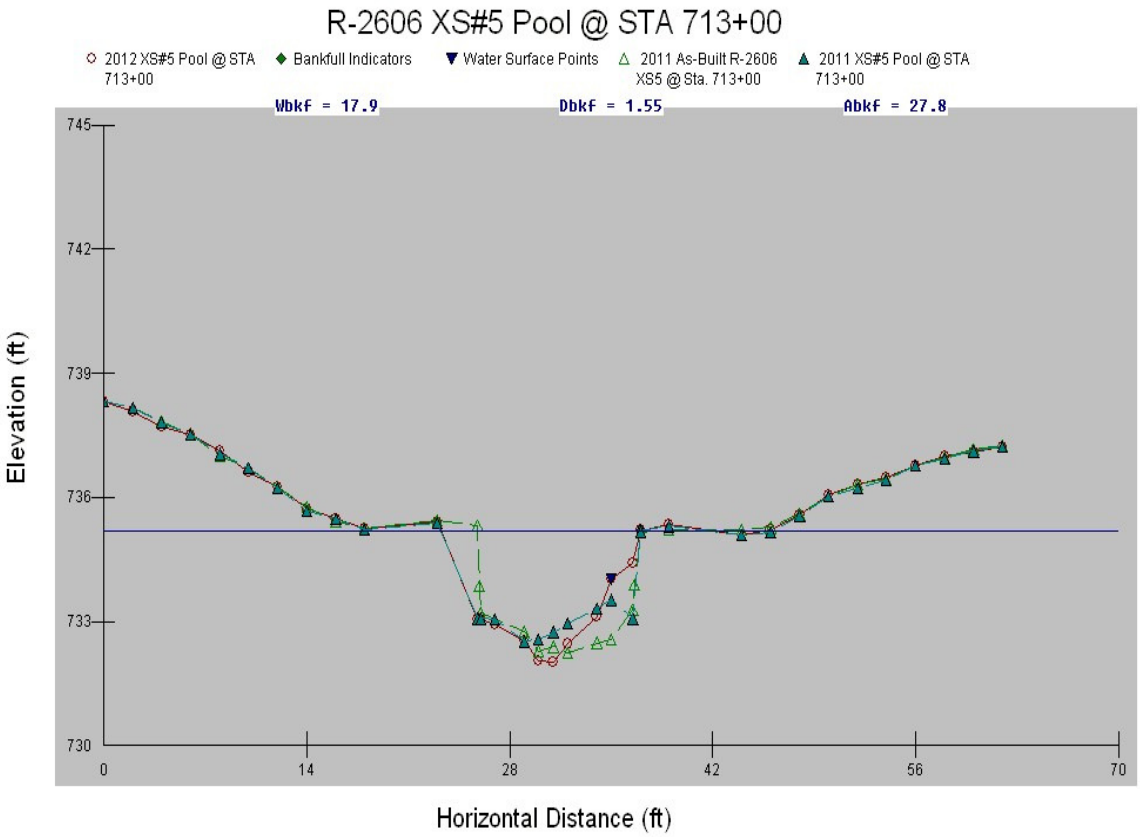
* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.



Cross-Section #3 (Riffle) Abbreviated Morphological Summary					
	2011	2012	2013	2014	2015
Bankfull Width (ft.)	14.94	14.76			
Bankfull Mean Depth (ft.)	0.75	0.77			
Width/Depth Ratio	19.92	19.17			
Bankfull Cross Sectional Area (ft^2)	11.18	11.38			
Maximum Bankfull Depth (ft.)	1.53	1.73			
Width of the Floodprone Area (ft.)	45.62	47			
Entrenchment Ratio	3.05	3.18			

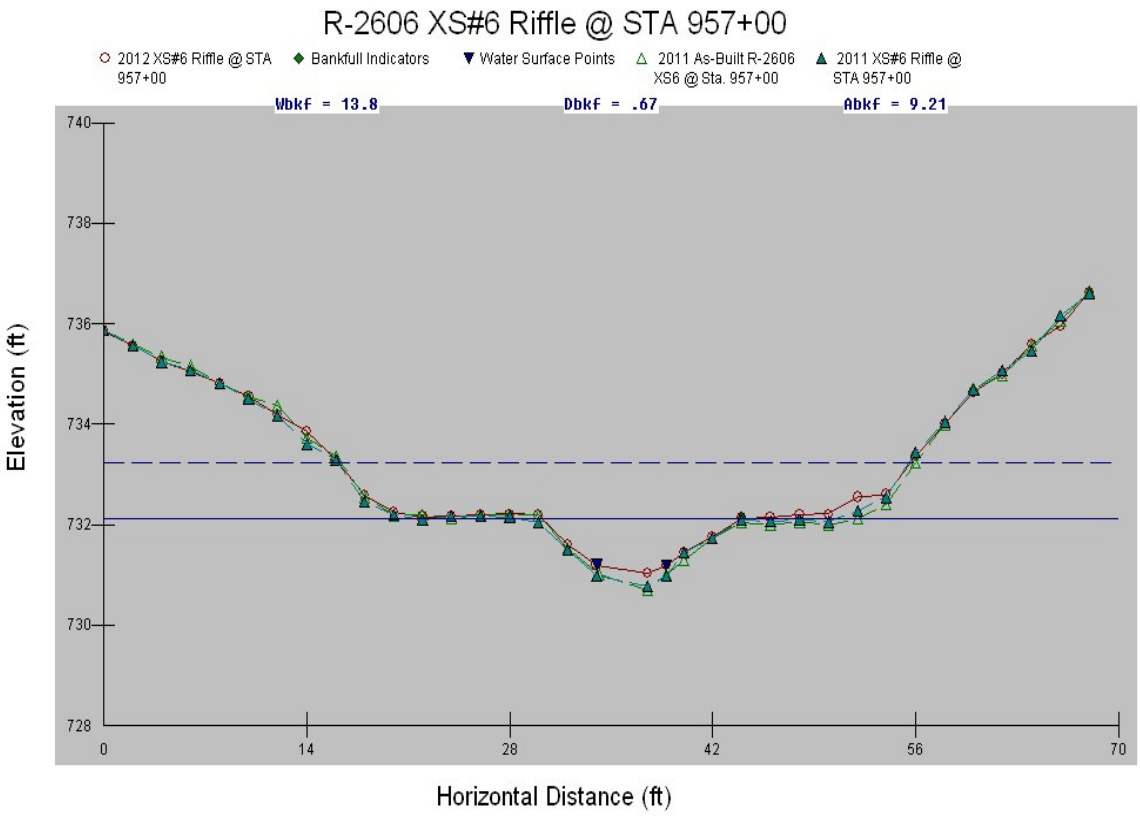


Cross-Section #4 (Riffle) Abbreviated Morphological Summary					
	2011	2012	2013	2014	2015
Bankfull Width (ft.)	8.95	7.39			
Bankfull Mean Depth (ft.)	0.61	0.47			
Width/Depth Ratio	14.67	15.72			
Bankfull Cross Sectional Area (ft^2)	5.42	3.48			
Maximum Bankfull Depth (ft.)	1.22	0.84			
Width of the Floodprone Area (ft.)	24.84	23.11			
Entrenchment Ratio	3.05	3.13			

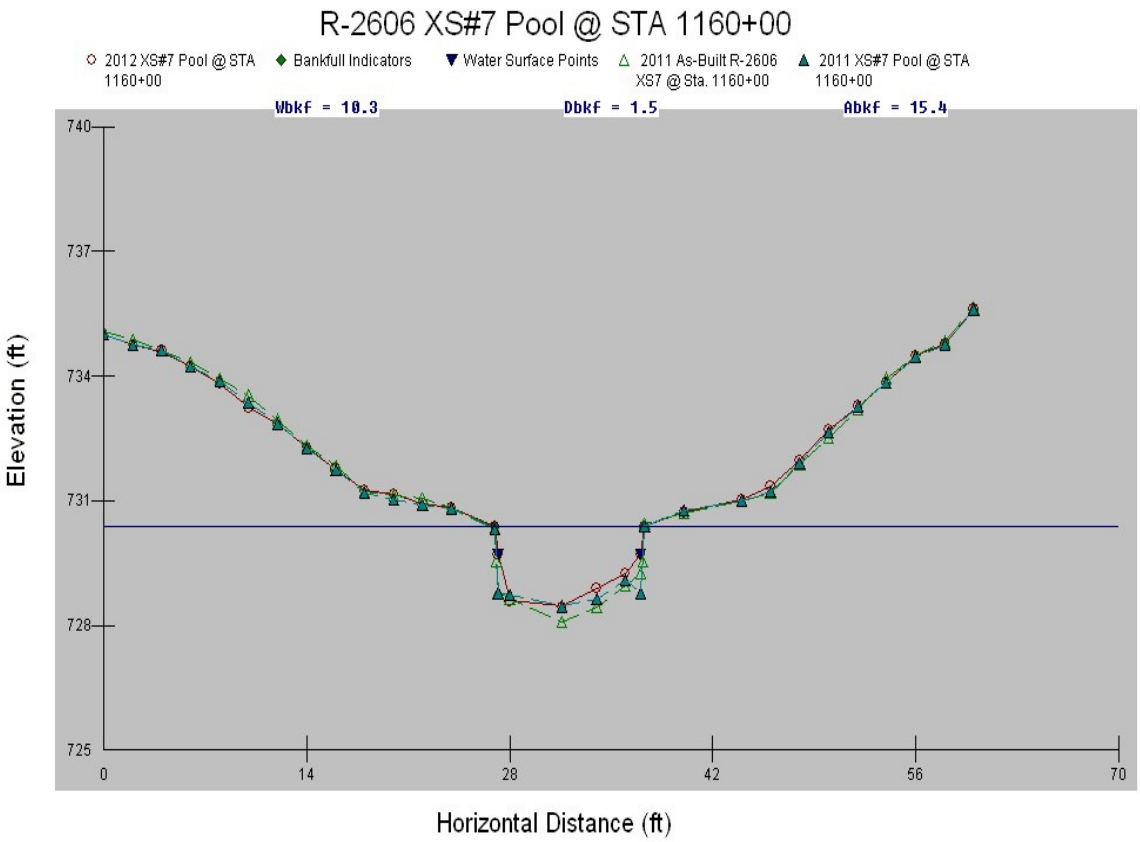


Cross-Section #5 (Pool) Abbreviated Morphological Summary*					
	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft^2)	**26.83**	**27.78**			
Maximum Bankfull Depth (ft.)	**2.65**	**3.19**			
Bankfull Mean Depth (ft.)	**1.5**	**1.55**			
Bankfull Width (ft.)	**17.9**	**17.87**			

* 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.



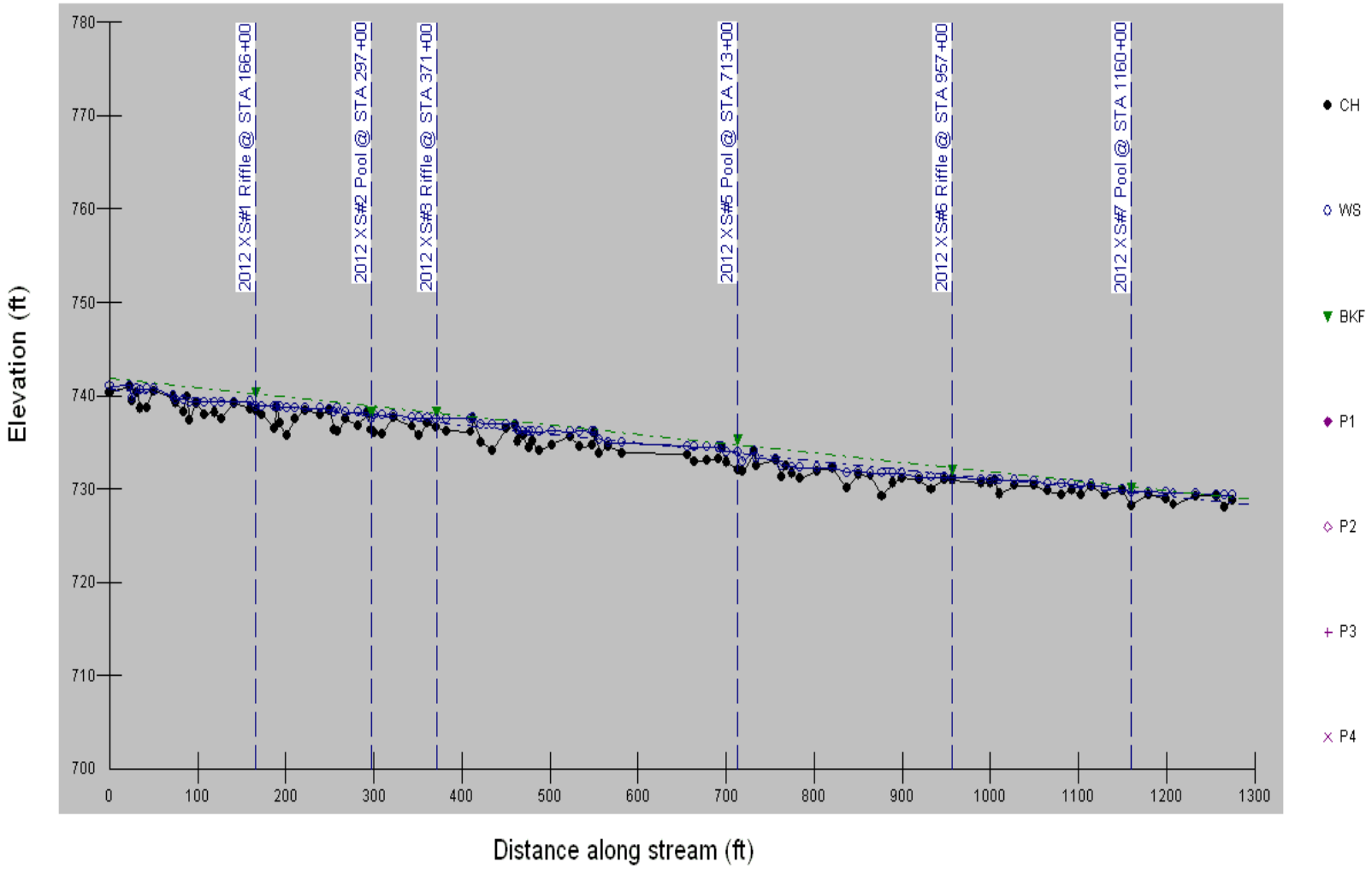
Cross-Section #6 (Riffle) Abbreviated Morphological Summary					
	2011	2012	2013	2014	2015
Bankfull Width (ft.)	15	13.79			
Bankfull Mean Depth (ft.)	0.71	0.67			
Width/Depth Ratio	21.13	20.58			
Bankfull Cross Sectional Area (ft^2)	10.72	9.21			
Maximum Bankfull Depth (ft.)	1.33	1.1			
Width of the Floodprone Area (ft.)	40.86	39.49			
Entrenchment Ratio	2.72	2.86			



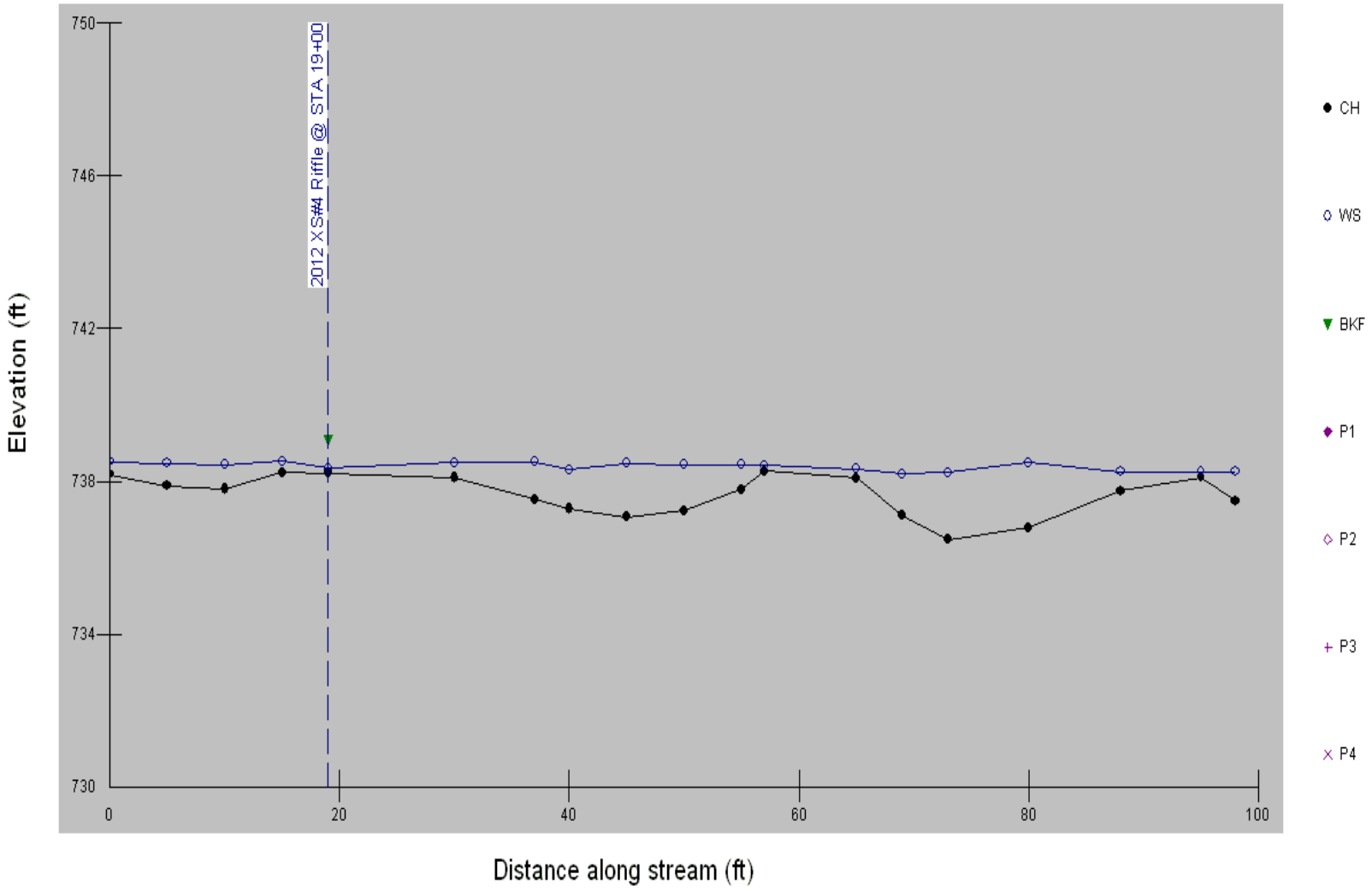
Cross-Section #7(Pool) Abbreviated Morphological Summary*					
	2011	2012	2013	2014	2015
Bankfull Cross Sectional Area (ft^2)	16.32	15.44			
Maximum Bankfull Depth (ft.)	1.85	1.92			
Bankfull Mean Depth (ft.)	1.59	1.5			
Bankfull Width (ft.)	10.3	10.3			

* 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.

2012 UT Muddy Creek Longitudinal Profile - Main Channel



2012 UT Muddy Creek Longitudinal Profile - Tributary



APPENDIX B

SITE PHOTOGRAPHS, CROSS SECTION, VEGETATION PLOT & PHOTO POINT LOCATIONS

UT to Muddy Creek

Photo Point #1 (Upstream) 10-23-12

Photo Point #1 (Downstream) 10-23-12

Photo Point #2 (Upstream) 10-23-12

Photo Point #2 (Downstream) 10-23-12

Photo Point #3 (Upstream) 10-23-12

Photo Point #3 (Downstream) 10-23-12

UT to Muddy Creek

Photo Point #4 (Upstream @ Tributary) 10-23-12

Photo Point #4 (Downstream @ Tributary) 10-23-12

Photo Point #5 (Upstream) 10-23-12

Photo Point #5 (Downstream) 10-23-12

Photo Point #6 (Upstream) 10-23-12

Photo Point #6 (Downstream) 10-23-12

UT to Muddy Creek

Photo Point #7 (Upstream) 10-23-12

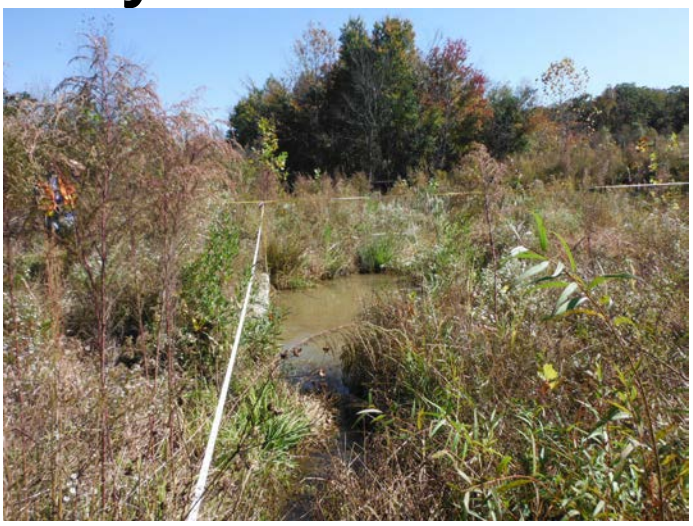


Photo Point #7 (Downstream) 10-23-12

Overview (Upstream) 9-13-12

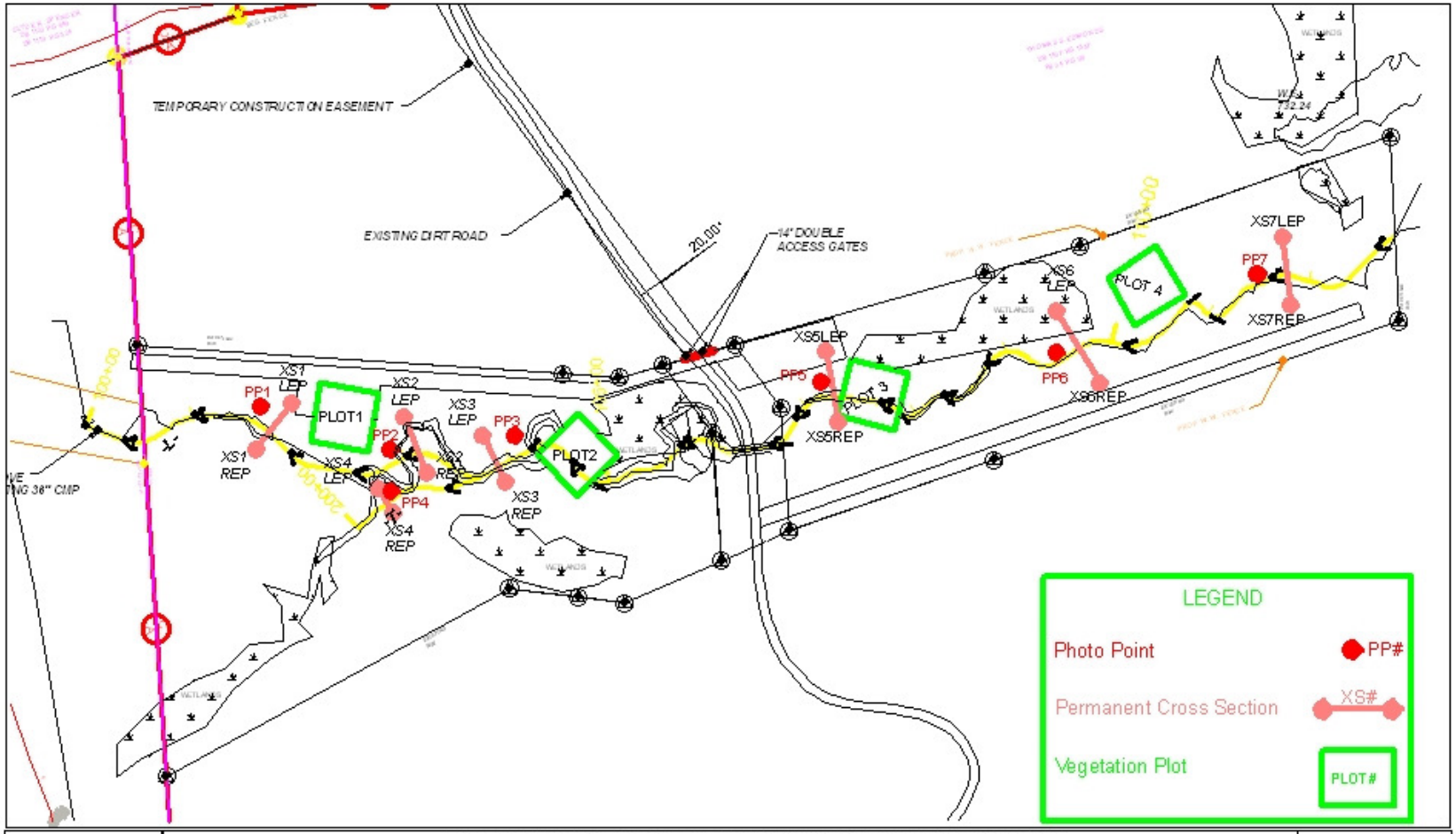
Overview (Downstream) 9-13-12

Overview (Upstream) 9-13-12

Overview (Downstream) 9-13-12

UT to Muddy Creek

Bank scouring on left bank just downstream of XS#5
10-23-12



Cross Section, Photo Point and Vegetation Plot Locations
R-2606WM UT to Muddy Creek
Randolph County, North Carolina

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