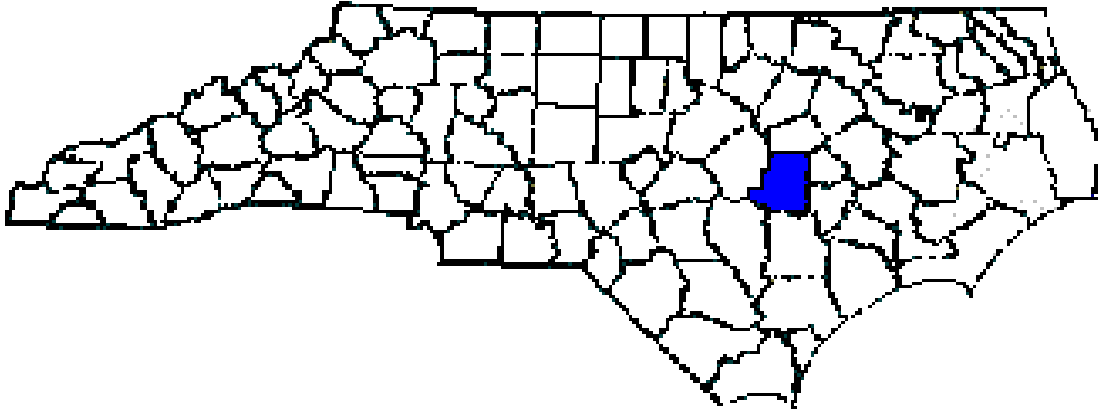


# ANNUAL REPORT FOR 2016



**Unnamed Tributary to Little River  
Wayne County  
TIP No. R-2554A – Site 7  
USACE Action ID: SAW-2008-00252  
NCDWR Project # 20080570**



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## **SUMMARY**

The following report summarizes the stream monitoring activities that have occurred during 2016 at the UT to Little River Mitigation Site in Wayne County. The site was constructed during 2013 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the fourth formal year of monitoring (Year 2016). The Year 2016 monitoring period is the fourth of five scheduled years for monitoring on UT to Little River (See Success Criteria Section 2.1).

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

NCDOT will continue stream and vegetation monitoring at the UT to Little River Mitigation Site for 2017.

## 1.0 INTRODUCTION

### 1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2016 at the UT to Little River Mitigation Site. The site is located along the US 70 Bypass which is currently under construction just west of Salem Church Road in Goldsboro, NC (Figure 1). The UT to Little River Mitigation Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2554A in Wayne County.

The mitigation project covers approximately 545 linear feet of stream relocation. Construction was completed in 2013 by 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

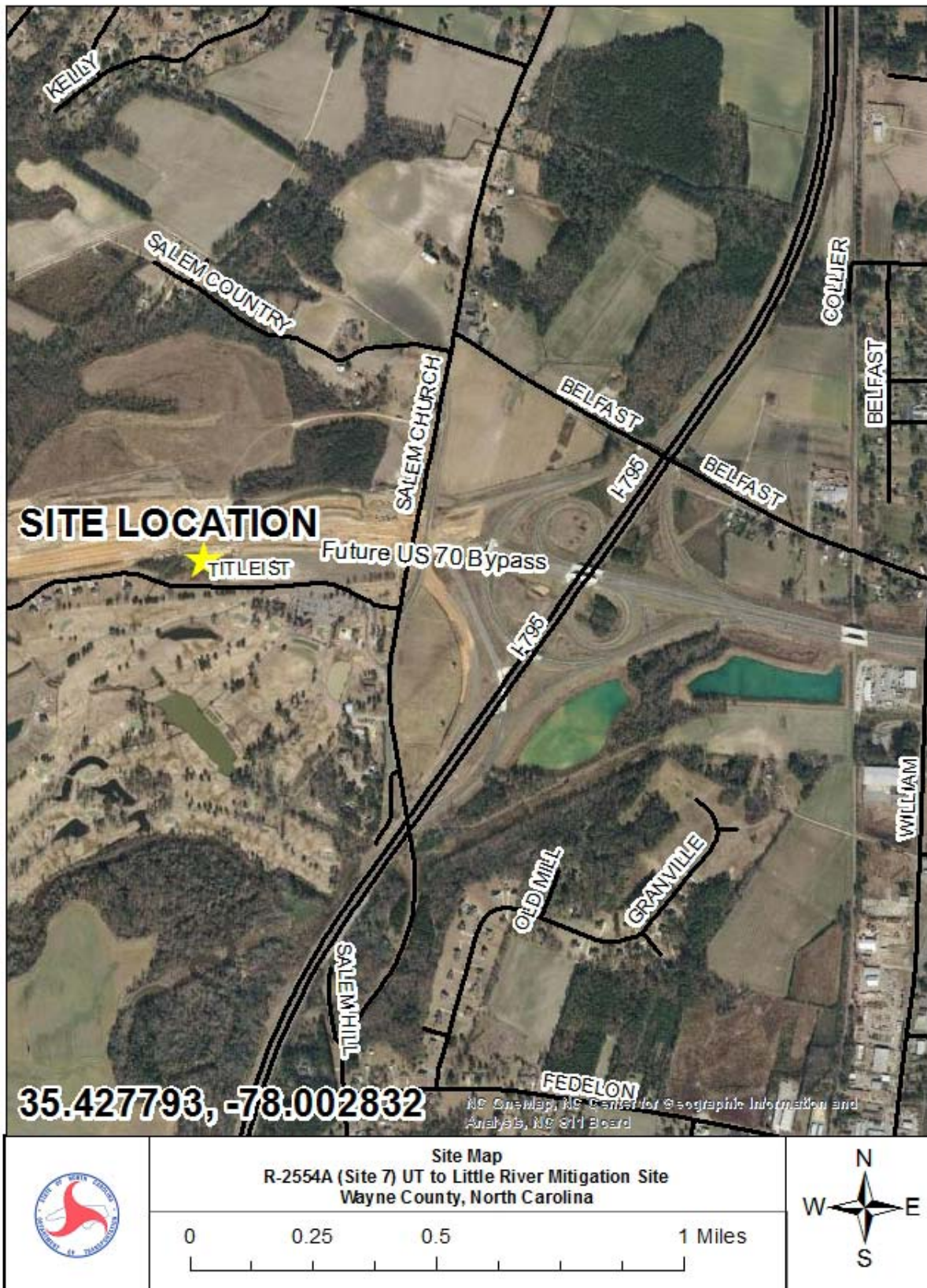
In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2016 at the UT to Little River Mitigation Site. Hydrologic monitoring was not required for the site.

### 1.3 Project History

February 2013	Water Turned Into Relocated Channel
April 2013	Streambank Reforestation Completed
May 2013	As-Built Survey Completed
August 2013	Stream Channel and Vegetation Monitoring (Year 1)
January 2014	Supplemental Planting
January 2014	Winter Stream Channel Photos (Year 2)
July 2014	Stream Channel and Vegetation Monitoring (Year 2)
October 2014	Longitudinal Profile (Year 2)
January 2015	Supplemental Live Staking
January 2015	Winter Stream Channel Photos (Year 3)
August 2015	Vegetation Monitoring (Year 3)
December 2015	Stream Channel Survey (Year 3)
June 2016	Vegetation Monitoring (Year 4)
December 2016	Stream Channel Survey (Year 4)

#### **1.4 Debit Ledger**

The entire UT to Little River Mitigation Site was used at a 1:1 ratio for the R-2554A project to compensate for unavoidable stream impacts.



**Figure 1. Site Location Map**

## **2.0 STREAM ASSESSMENT**

### **2.1 Success Criteria**

The stream mitigation site shall be monitored 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 four cross sections (two riffles and two 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 544 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 DWR 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 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 DWR 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. and flagged stems will be counted in these 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 545 linear feet of stream relocation. Construction was completed in 2013 by 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 Little River Mitigation Site relocation was to build a C5 stream type as identified in the Rosgen's Applied River Morphology. A total of four cross sections (two in a riffle, two 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 (UT to Little River - Site 7 Cross Sections #1 and #4)</b>				
<b>Variable</b>	<b>Proposed</b>	<b>Cross Section #1 (Riffle)</b>	<b>Cross Section #4 (Riffle)</b>	<b>Min. - Max Values (Riffle Sections Only)</b>
		<b>2016</b>	<b>2016</b>	<b>2016</b>
Drainage Area (sq. mi)	0.096	0.096	0.096	0.096
Bankfull Width (ft)	6.0	5.71	7.72	5.71 – 7.72
Bankfull Mean Depth (ft)	0.5	0.45	0.63	0.45 – 0.63
Width/Depth Ratio	12	12.69	12.25	12.25 – 12.69
Bankfull Cross Sectional Area (ft <sup>2</sup> )	6.8	2.59	4.84	2.59 – 4.84
Maximum Bankfull Depth (ft)	0.75	1	1.32	1 – 1.32
Floodprone Area (ft)	85 -115	40	40	40
Entrenchment Ratio	14 - 19	7	5.18	5.18 - 7

\*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 four cross sections and the longitudinal profile of UT to Little River Mitigation Site established by the NCDOT after construction. The length of the profile along UT to Little River was approximately 544 linear feet. Four 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 Howell Branch, Station 130+00 linear feet, midpoint of riffle
- ◆ Cross Section #2. UT to Howell Branch, Station 255+00 linear feet, midpoint of pool
- ◆ Cross Section #3. UT to Howell Branch, Station 369+00 linear feet, midpoint of pool
- ◆ Cross Section #4. UT to Howell Branch, Station 412+00 linear feet, midpoint of riffle

Based on comparisons of the as-built to 2016 monitoring data, all four 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 2016 longitudinal profile was not completed due to the thick planted vegetation along the streambank. Through visual observation and photos taken at the permanent photo point locations the channel bed remains stable at this time.

<b>Bankfull Events</b>	
<b>Date</b>	<b>Determined by</b>
10-23-14	Wrack Line
1-7-15	Wrack Line
12-1-16	Wrack Line

## 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

*Betula nigra*, River Birch

*Fraxinus pennsylvanica*, Green Ash

### 2.4.2 Results of Vegetation Monitoring

**Buffer Vegetation:** Two 50 ft. x 50 ft. vegetation plots were set to determine the trees per acre in the buffer area.

**Table 2.** Vegetation Monitoring Results

Plot #	Tulip Poplar	American Sycamore	River Birch	Green Ash	Total (Year 4)	Total (at planting)	Density (Trees/Acre)
1	2	15	8	9	34	40	578
2		6	18	6	30	33	618
<b>Year 4 Average Density (Tree/Acre)</b>							<b>598</b>
Year 3 Average Density (Trees/Acre)							638
Year 2 Average Density (Trees/Acre)							655
Year 1 Average Density (Trees/Acre)							533

**Site Notes:** The black willow and silky dogwood live stakes were surviving along the streambank. Some of the planted black willows along the streambank had fell or were leaning over due to Hurricane Matthew. Other vegetation noted included briars, soft rush, pine cattail, woolgrass, lespedeza, wax myrtle, sweetgum, and various grasses.

### **2.4.3 Conclusions**

There were two vegetation monitoring plots established throughout the buffer area. The 2016 vegetation monitoring of the site revealed an average tree density of 598 trees per acre. This average is well above the minimum success criteria of 320 trees per acre after the fourth year of monitoring. NCDOT will continue to monitor the vegetation at the UT to Little River Mitigation Site.

## **3.0 OVERALL CONCLUSIONS/RECOMMENDATIONS**

The UT to Little River Mitigation Site has met the required monitoring protocols for the fourth 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 fourth year of monitoring. NCDOT will continue stream and vegetation monitoring at the UT to Little River Mitigation Site.

## **4.0 REFERENCES**

Natural Channel Design for UT to Little River (Permit Site 7); Wayne County, NC, Rev. October 10, 2007.

As-Built Report for Stream Relocation on R-2554A Permit Site 7, Wayne County, NC, June 17, 2013.

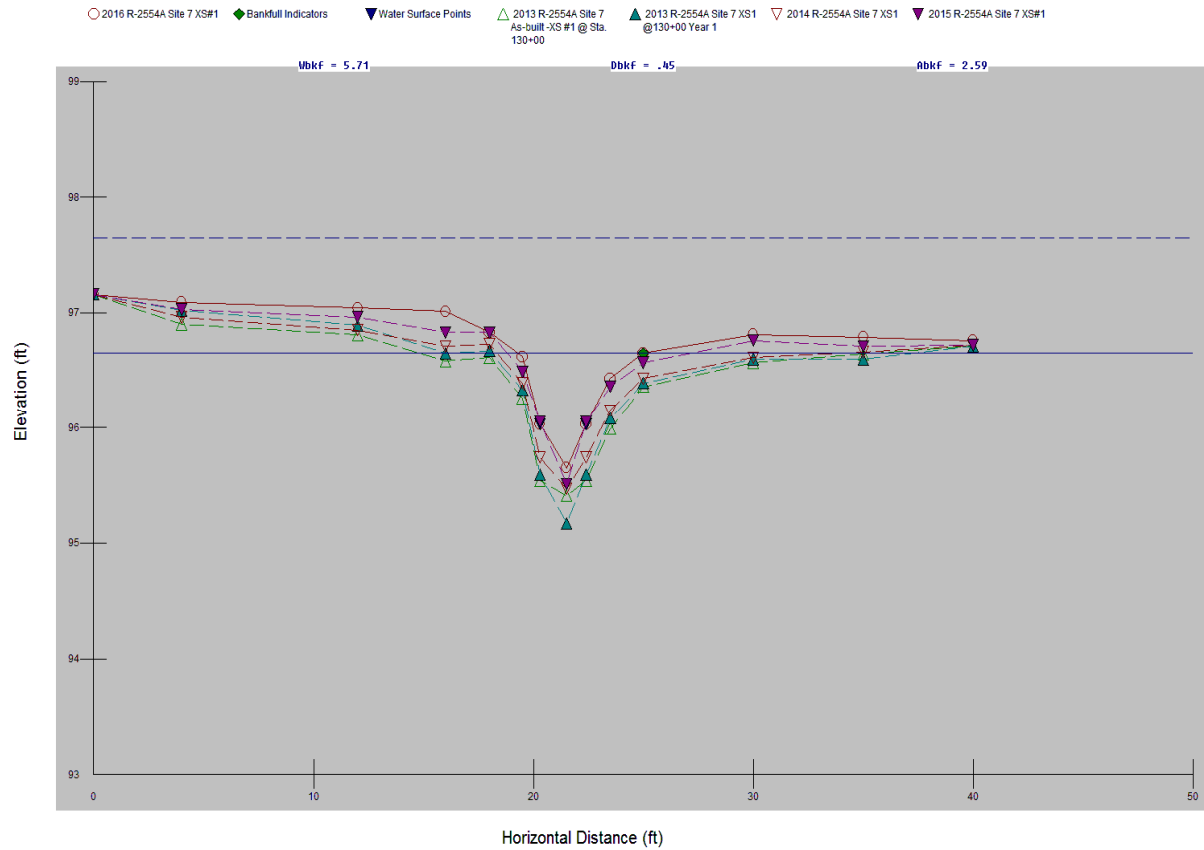
Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

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 Resources.

**APPENDIX A**

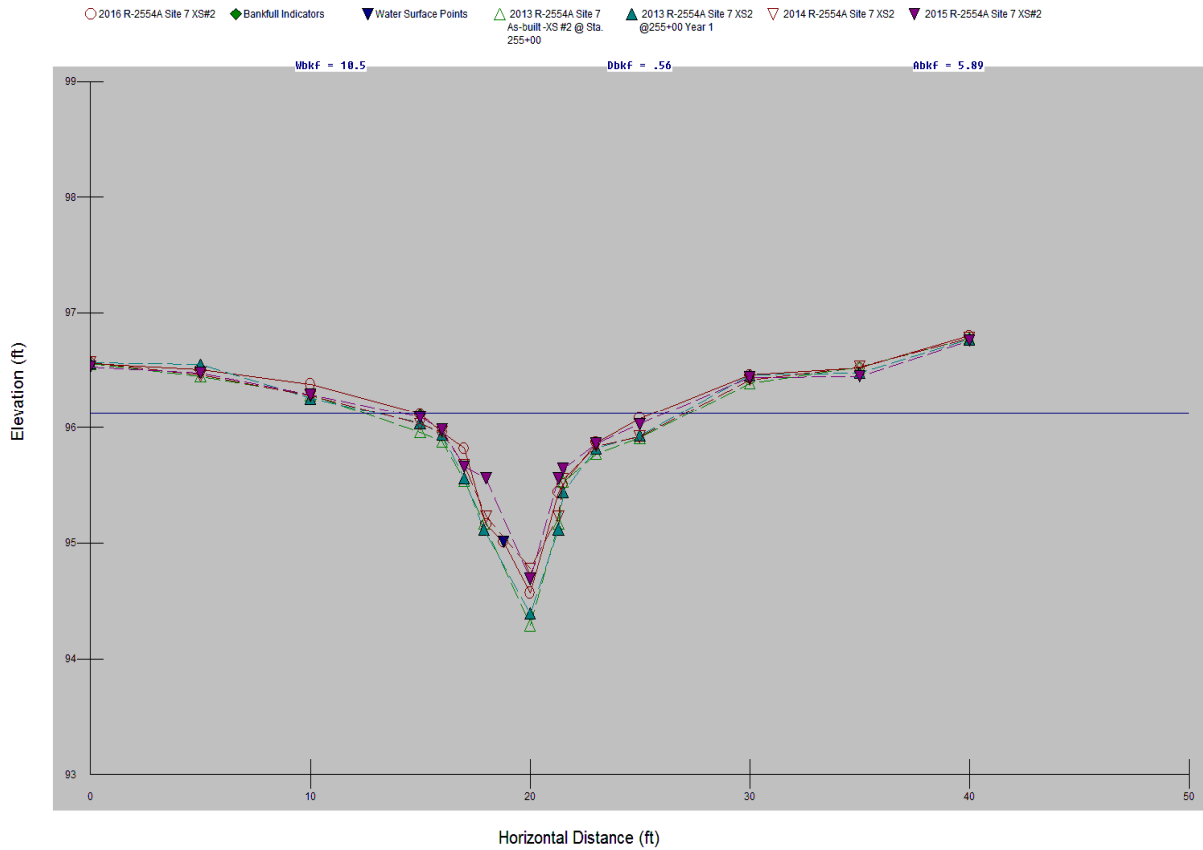
**CROSS SECTION COMPARISONS**

### R-2554A Site 7 XS#1



Cross-Section #1 (Riffle) Abbreviated Morphological Summary					
	2013	2014	2015	2016	2017
Bankfull Width (ft.)	5.76	5.68	5.85	5.71	
Bankfull Mean Depth (ft.)	0.58	0.49	0.42	0.45	
Width/Depth Ratio	9.93	11.59	13.93	12.69	
Bankfull Cross Sectional Area (ft <sup>2</sup> )	3.32	2.77	2.47	2.59	
Maximum Bankfull Depth (ft.)	1.22	0.96	1.06	1	
Width of the Floodprone Area (ft.)	40	40	40	40	
Entrenchment Ratio	6.94	7.05	6.83	7	

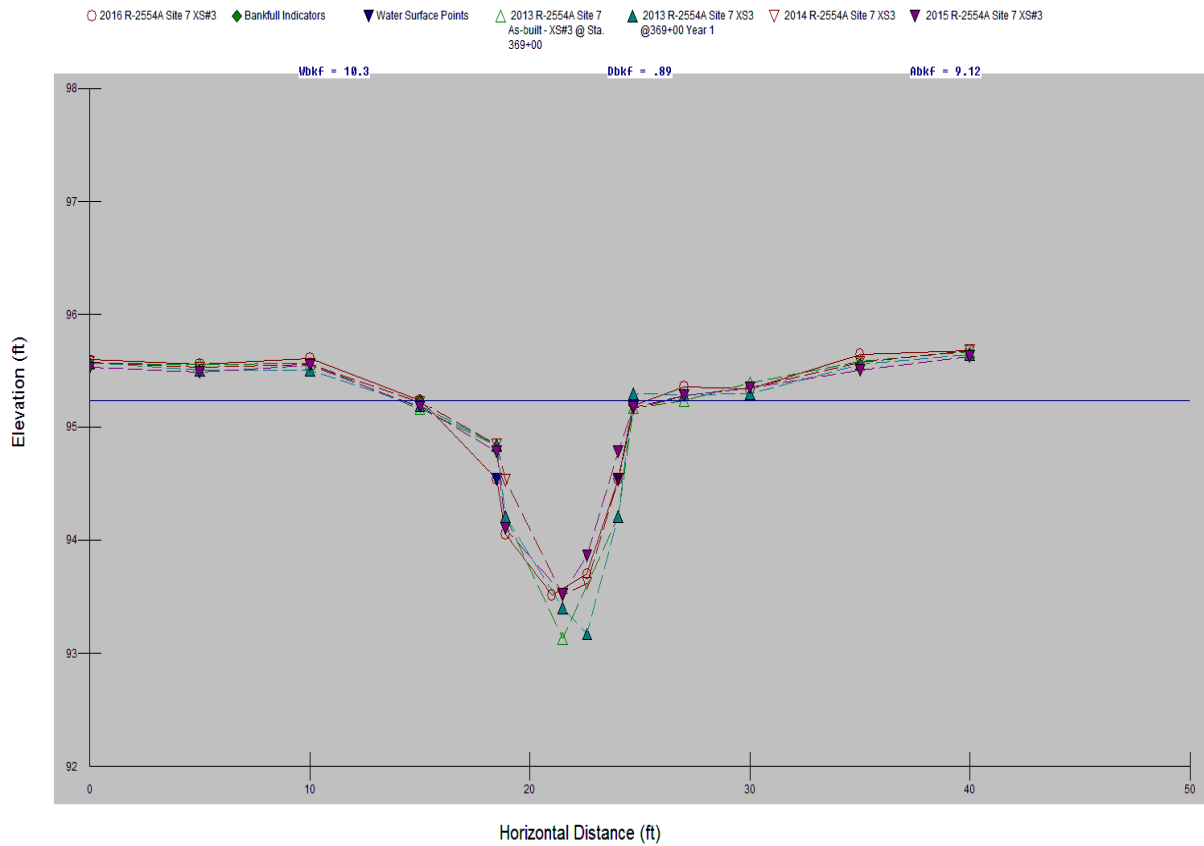
### R-2554A Site 7 XS#2



Cross-Section #2 (Pool) Abbreviated Morphological Summary*					
	2013	2014	2015	2016	2017
Bankfull Cross Sectional Area (ft <sup>2</sup> )	5.49	4.49	4.91	5.89	
Maximum Bankfull Depth (ft.)	1.55	1.18	1.4	1.55	
Bankfull Mean Depth (ft.)	0.6	0.48	0.46	0.56	
Bankfull Width (ft.)	9.09	9.4	10.73	10.53	

\* 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-2554A Site 7 XS#3



Cross-Section #3 (Pool) Abbreviated Morphological Summary*					
	2013	2014	2015	2016	2017
Bankfull Cross Sectional Area (ft <sup>2</sup> )	6.26	4.72	7.54	11.37	
Maximum Bankfull Depth (ft.)	1.67	1.33	1.66	1.73	
Bankfull Mean Depth (ft.)	1.06	0.81	0.78	0.97	
Bankfull Width (ft.)	5.9	5.84	9.7	11.69	

\* 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.





**APPENDIX B**

**SITE PHOTOGRAPHS, CROSS SECTION AND**

**PHOTO POINT LOCATIONS, AND**

**STREAMBANK REFORESTATION PLAN**



# UT to Little River



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)



Photo Point #3 (Downstream)

January 2016



# UT to Little River



Photo Point #4 (Upstream)



Photo Point #4 (Downstream)



Overview Photo

January 2016



# UT to Little River



Vegetation Plot #1



Vegetation Plot #2



Stormwater basin east of mitigation site



Stormwater outlet pipe into mitigation site



Overview Photo

June 2016



# UT to Little River



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Photo Point #3 (Upstream)



Photo Point #3 (Downstream)

December 2016



# UT to Little River



Photo Point #4 (Upstream)



Photo Point #4 (Downstream)



Stormwater basin east of mitigation site



Stormwater outlet pipe into mitigation site



Uprooted black willow along streambank from Hurricane Matthew

December 2016



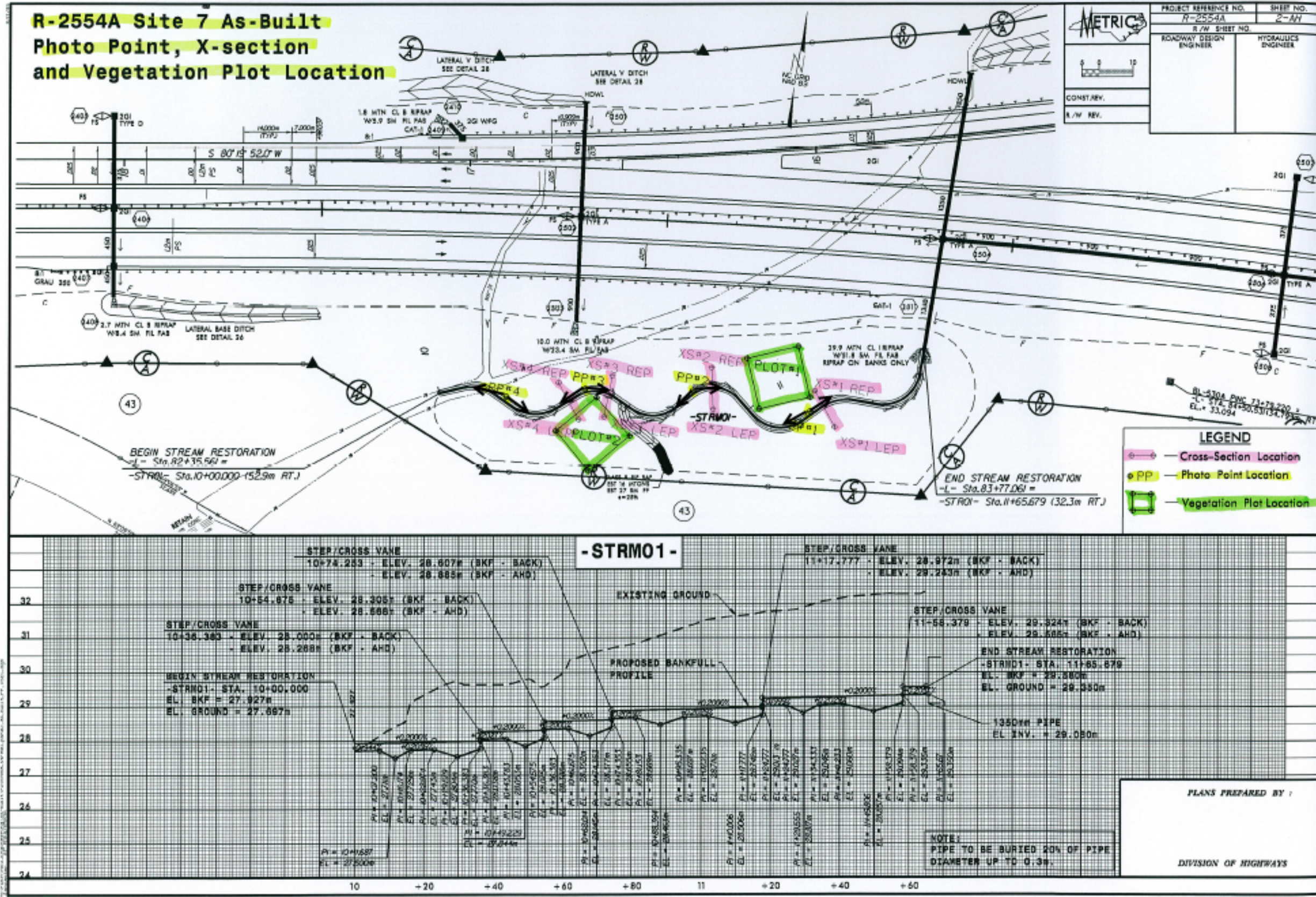


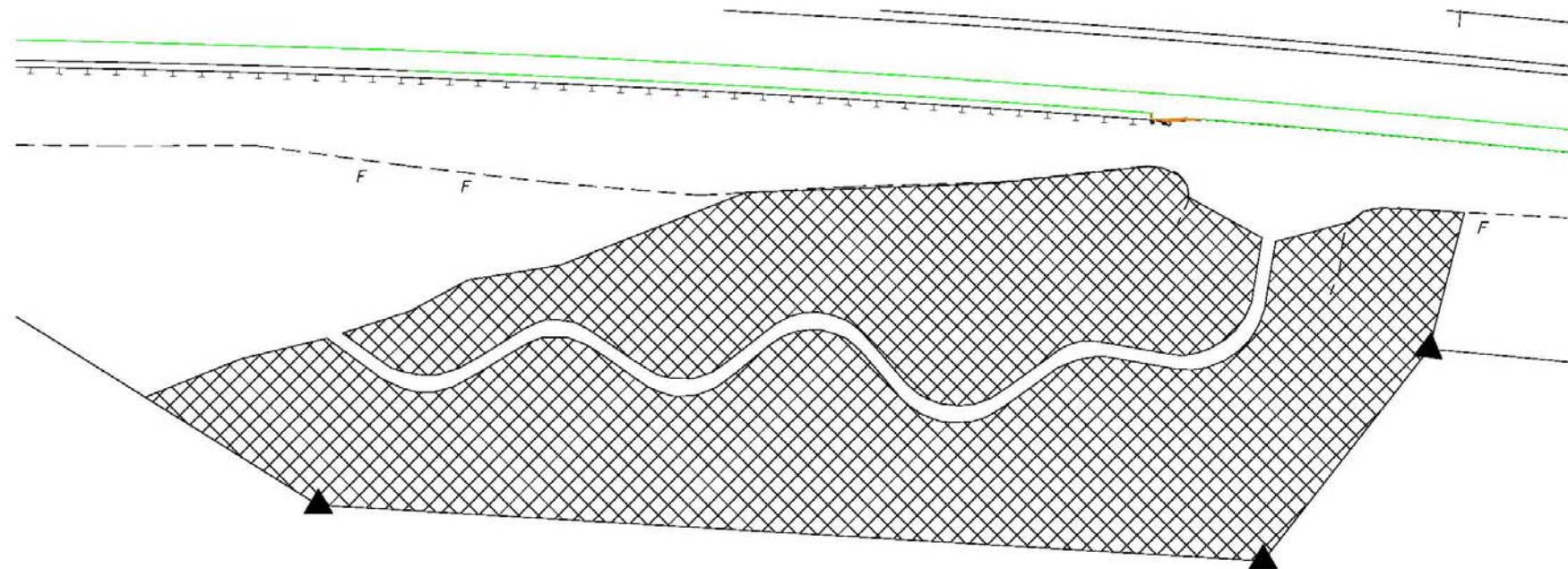
Photo Point, Cross Section, and Vegetation Plot Locations  
 R-2554A Site 7 UT to Little River  
 Wayne County, North Carolina



# 0.6 HECTARE STREAMBANK REFORESTATION



PROJECT REFERENCE NO. R-2554A	SHEET NO. EC-71/CONST-25
R/W SHEET NO. ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER



**SEE RF-2, RF-3 AND PROJECT SPECIAL PROVISIONS**

Streambank Reforestation Plan  
R-2554A Site 7 UT to Little River  
Wayne County, North Carolina