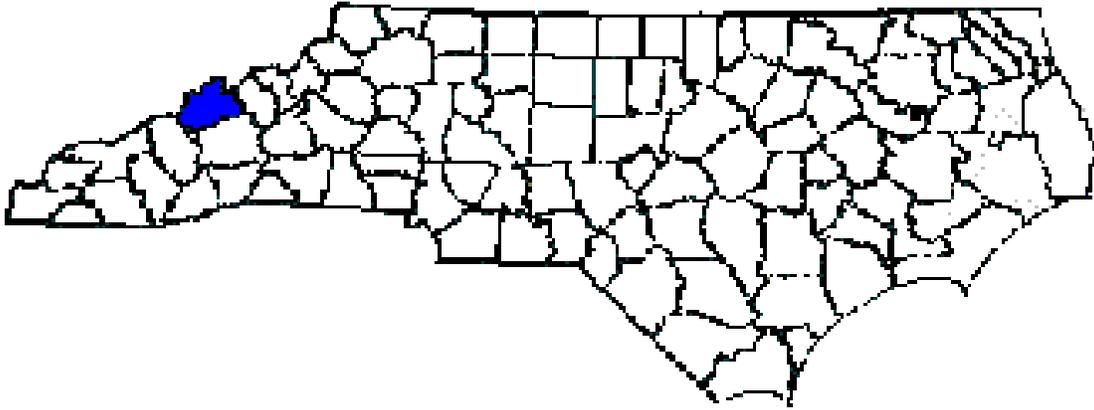


# ANNUAL REPORT FOR 2014



**Holland Creek Site M Mitigation Site  
Madison County  
TIP No. R-2518A  
COE Action ID: SAW-2007-2197-357/300  
DWQ #: 20071134**



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## **SUMMARY**

The following report summarizes the stream monitoring activities that have occurred during the Year 2014 at the Holland Creek Site M Mitigation Site in Madison County. The North Carolina Department of Transportation (NCDOT) completed this project and water was turned in December 2008. This report provides the monitoring results for the fifth formal year of monitoring (Year 2014). The Year 2014 monitoring period was the fifth of five scheduled years of monitoring on the Holland Creek Site M Mitigation Site (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring at the Holland Creek Site M, it has met the required monitoring protocols for the fifth formal year of monitoring on the stream but has not met for third formal year of monitoring on the planted vegetation. The northeast side of the buffer is lacking planted vegetation due to herbaceous competition. NCDOT sprayed the northeast side of the buffer and plans to replant the buffer in 2015. It was agreed by the Regulatory Agencies and NCDOT during the March 25, 2014 Annual Monitoring Meeting that the longitudinal profile could be discontinued for the remainder of the five year monitoring period due to heavy vegetation within the channel. In lieu of doing the longitudinal profile, visual inspection of the channel stability throughout the reach and photo documentation at the permanent photo point locations would be completed. All other monitoring activities will continue to be completed throughout the five year monitoring period. The channel throughout the stream restoration site is stable at this time. NCDOT proposes to discontinue stream monitoring and will continue vegetation monitoring in 2015.

## 1.0 INTRODUCTION

### 1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2014 at the Holland Creek Site M Mitigation Site. Site M is located on US 19 in Madison County at Sta. 81+80 to 82+20 Lt. and Sta. 81+30 Rt. –L- (Figure 1). The Holland Creek Site M was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number R-2518A in Madison County.

The mitigation site provided approximately 276 linear feet of stream restoration. Construction was completed and water was turned in December 2008 by the NCDOT. Stream restoration involved installing several in-stream cross vane structures and planting the riparian buffer zone.

### 1.2 Purpose

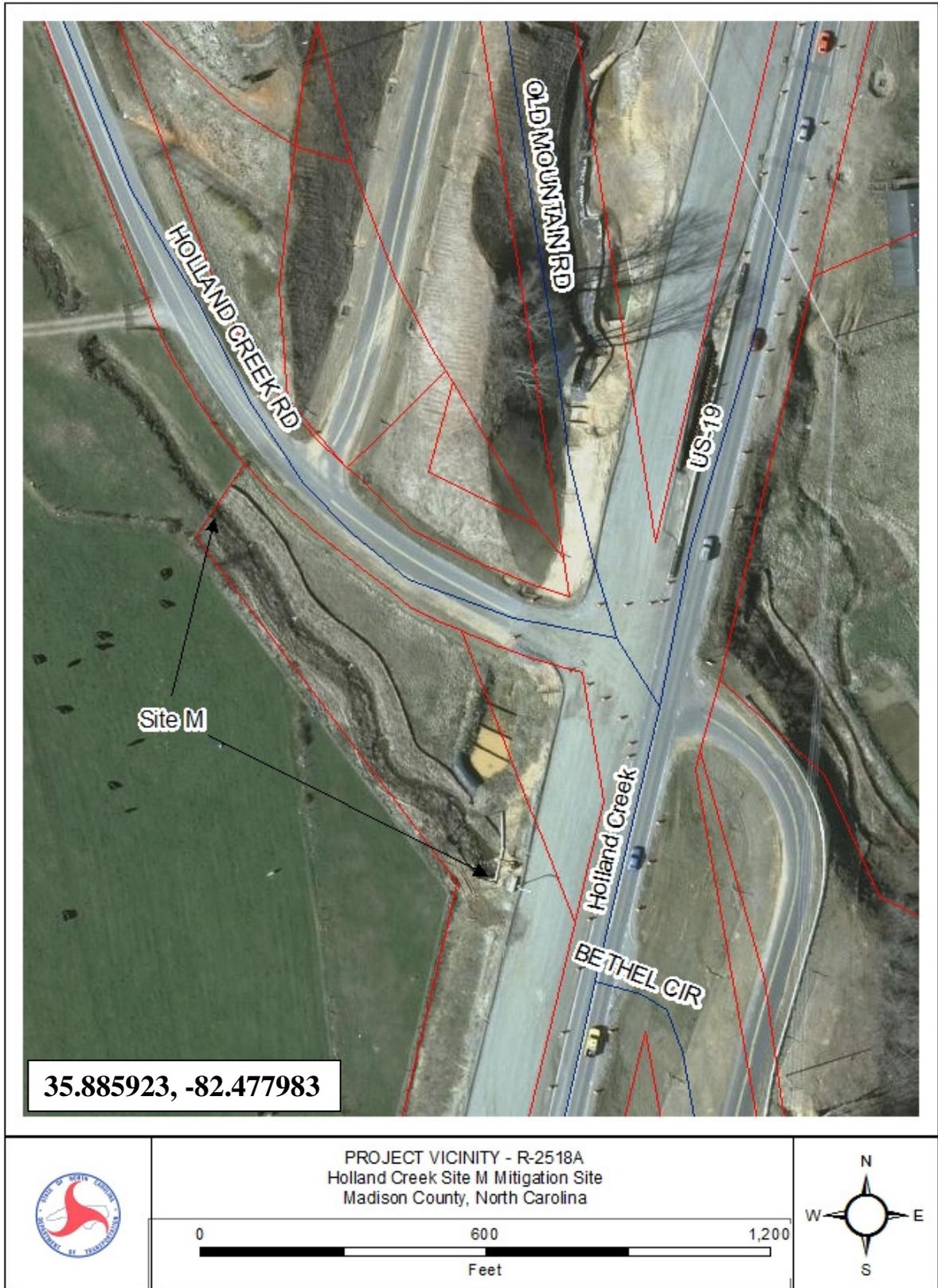
In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2014 at the Holland Creek Site M Mitigation Site. Hydrologic monitoring was not required for this site.

### 1.3 Project History

December 2008	Construction Completed
December 2008	Water Turned Into Stream
March 2009	Site Planted (Type I only)
October 2009	As-Built Survey Completed
November 2010	Stream Channel Monitoring (Year 1)
November 2011	Stream Channel Monitoring (Year 2)
March 2012	Site Planted (Type I and II)
September 2012	Vegetation Monitoring (Year 1)
November 2012	Stream Channel Monitoring (Year 3)
February 2013	Supplemental Buffer Planting
March 2013	Bankfull Monitoring Gauge Installed
August 2013	Vegetation Monitoring (Year 2)
November 2013	Stream Channel Monitoring (Year 4)
May 2014	Herbicide Application
June 2014	Herbicide Application
July 2014	Vegetation Monitoring (Year 3)
November 2014	Stream Channel Monitoring (Year 5)

### 1.4 Debit Ledger

The entire Holland Creek Site M stream mitigation site was used for the R-2518A project to compensate for unavoidable stream impacts.



**Figure 1. Vicinity Map**

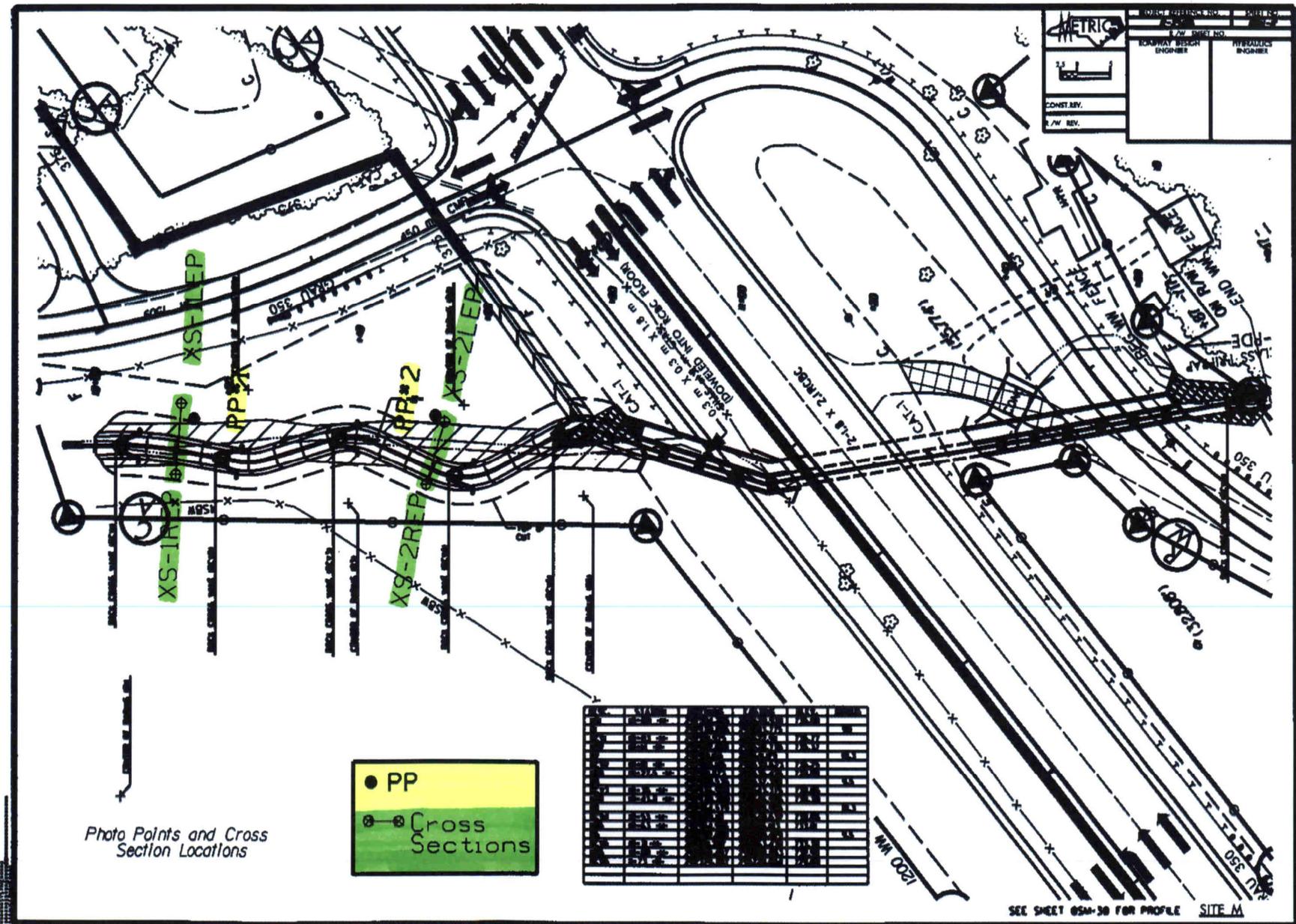
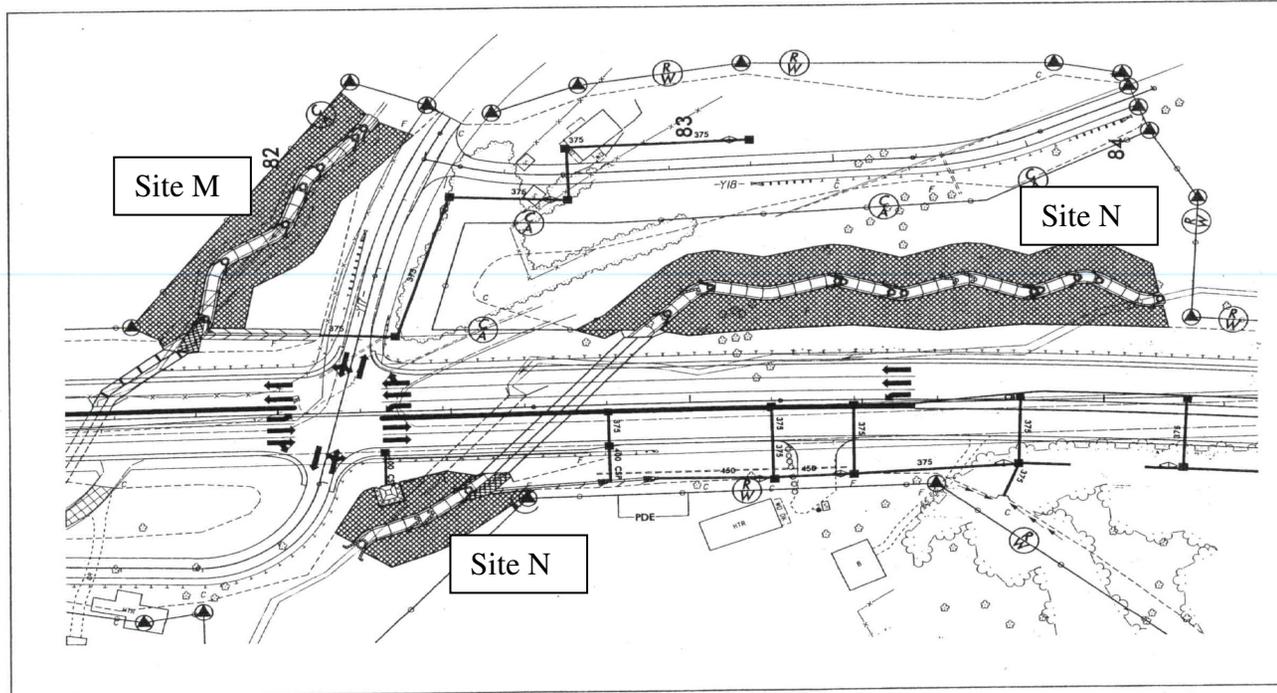


Figure 2. Site M Map



PROJECT REFERENCE NO. R 2516A	SHEET NO. EC-82/CONST.25
R/W SHEET NO. ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

### 0.4 HECTARE STREAMBANK REFORESTATION



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

Figure 3. Site M Reforestation Map

## **2.0 STREAM ASSESSMENT**

### **2.1 Success Criteria**

The permittee shall monitor the restoration and enhancement mitigation sites following the Level 1 protocols outlined in the "Stream Mitigation Guidelines," dated April 2003 with the following exceptions:

1. Pebble counts shall not be conducted.
2. Two cross sections shall be conducted for streams less than 500 linear feet and five (5) cross sections shall be conducted for streams greater than 500 linear feet.
3. Riparian success shall be by visual inspection of plant survival. Photos will be taken and comments noted on plant survival.

The permittee shall monitor the preservation sites by visual inspection. Photos will be taken and comments noted on plant survival. The monitoring shall be conducted annually for a minimum of five (5) years after final planting. The monitoring results shall be submitted to DWQ in a final report within sixty (60) days after completing monitoring. After 5 years the NCDOT shall contact the DWQ to schedule a site visit to "close out" the mitigation site.

### **2.2 Stream Description**

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

The restoration/relocation of the Holland Creek Site M Mitigation Site involved installing several in-stream cross vane structures and planting the riparian buffer zone.

#### ***2.2.2 Monitoring Conditions***

The objective of the Holland Creek Site M stream restoration was to restore a B4c stream as identified in Rosgen's Applied River Morphology. A total of two cross sections (one in a riffle and one in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented below in Table 1 (Site M).

**Table 1. Abbreviated Morphological Summary (Holland Creek Site M)**

Variable	Proposed	Cross-Section #1 (Riffle)				
		2010	2011	2012	2013	2014
Drainage Area (mi <sup>2</sup> )	1.3	1.3	1.3	1.3	1.3	1.3
Bankfull Cross Sectional Area (ft <sup>2</sup> )	14.02	13.82	9.46	10.61	10.3	9.11
Maximum Bankfull Depth (ft.)	1.3 – 1.6	1.59	1.27	1.84	1.54	1.63
Width of the Floodprone Area (ft.)	22	21.42	18.84	23.17	20.75	21.3
Bankfull Mean Depth (ft.)	1.08	1.04	0.77	0.82	0.8	0.74
Width/Depth Ratio	12	12.73	16.03	15.73	16.11	16.61
Entrenchment Ratio	1.7	1.62	1.53	1.8	1.61	1.73
Bankfull Width (ft.)	13.0	13.24	12.34	12.9	12.89	12.29

\* Riffle values are used for classification purposes, pool values are shown in Appendix A.

## 2.3 Results of the Stream Assessment

### 2.3.1 Site Data

The assessment included the survey of two cross sections and the longitudinal profile of the Holland Creek Site M established by NCDOT after construction. The length of the profile along the Holland Creek Site M was approximately 300 linear feet. Two cross sections were established during the as-built monitoring year. 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.

Holland Creek Site M Cross-Sections:

- ◆ Cross-Section #1: Holland Creek Site M, Station 62+00, midpoint of riffle
- ◆ Cross-Section #2: Holland Creek Site M, Station 198+50, midpoint of pool

Based on comparisons of the As-Built to the monitoring data, all of the 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. A mid-channel bar has developed at the surface water gauge as depicted in the Cross Section #2 graph. This area remains stable at this time.

It was agreed by the Regulatory Agencies and NCDOT during the March 25, 2014 Annual Monitoring Meeting that the longitudinal profile could be discontinued for the remainder of the five year monitoring period due to heavy vegetation within the channel. In lieu of doing the longitudinal profile, visual inspection of the channel stability throughout the reach and photo documentation at the permanent photo point locations would be completed. All other monitoring activities will continue to be completed throughout the five year monitoring period. Pebble counts were not required per the permit conditions and therefore were not completed. Four bankfull events were documented at Site M during the 2014 monitoring year.

### **3.0 VEGETATION: HOLLAND CREEK SITE M**

#### **3.1 Description of Species**

The following tree 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*, Yellow Poplar

*Platanus occidentalis*, Sycamore

*Fraxinus pennsylvanica*, Green Ash

*Quercus alba*, White Oak

#### **3.2 Results of Vegetation Monitoring**

**Streambank & Buffer Vegetation:** The streambank reforestation was completed in March 2012. NCDOT completed a supplemental planting of the buffer on February 11, 2013 due to a limited number of trees noted surviving during the 2012 monitoring evaluation. The Year 3 vegetation monitoring evaluation noted: Type I: Black Willow, Silky Dogwood and Type II: Sycamore, Green Ash, and Tulip Poplar were surviving but still at a low threshold along the northeast buffer. NCDOT completed two herbicide applications to control the crown vetch that was out-competing the bare root seedlings.

#### **3.3 Conclusions**

NCDOT plans to replant the buffer in 2015. NCDOT will continue to monitor the planted vegetation in 2015.

### **4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS**

The Holland Creek Site M Mitigation Site has met the required monitoring protocols for the fifth formal year of monitoring on the stream but is not meeting for the third formal year of monitoring on the planted vegetation. NCDOT plans to replant the buffer in 2015. The channel throughout the stream restoration site is stable. NCDOT proposes to discontinue stream monitoring but will continue vegetation monitoring in 2015.

## 5.0 REFERENCES

Stream Mitigation Plan, US Highway 19, R-2518A On-Site Mitigation  
Madison County, North Carolina, August 2006.

Design Plans for R-2518A, US 19 from I-26 to 0.8 KM east of the Yancey Co.  
Line, Stream Mitigation (Preservation, Enhancement, and Restoration),  
HSMM.

North Carolina Department of Transportation (NCDOT), April 29, 2008. 404 and  
401 Individual Permits for R-2518A and R-2518B (ACOE Permit No. 2007-  
2197-357/300 and DWQ Project No. 20071134, Individual Certification No.  
3706).

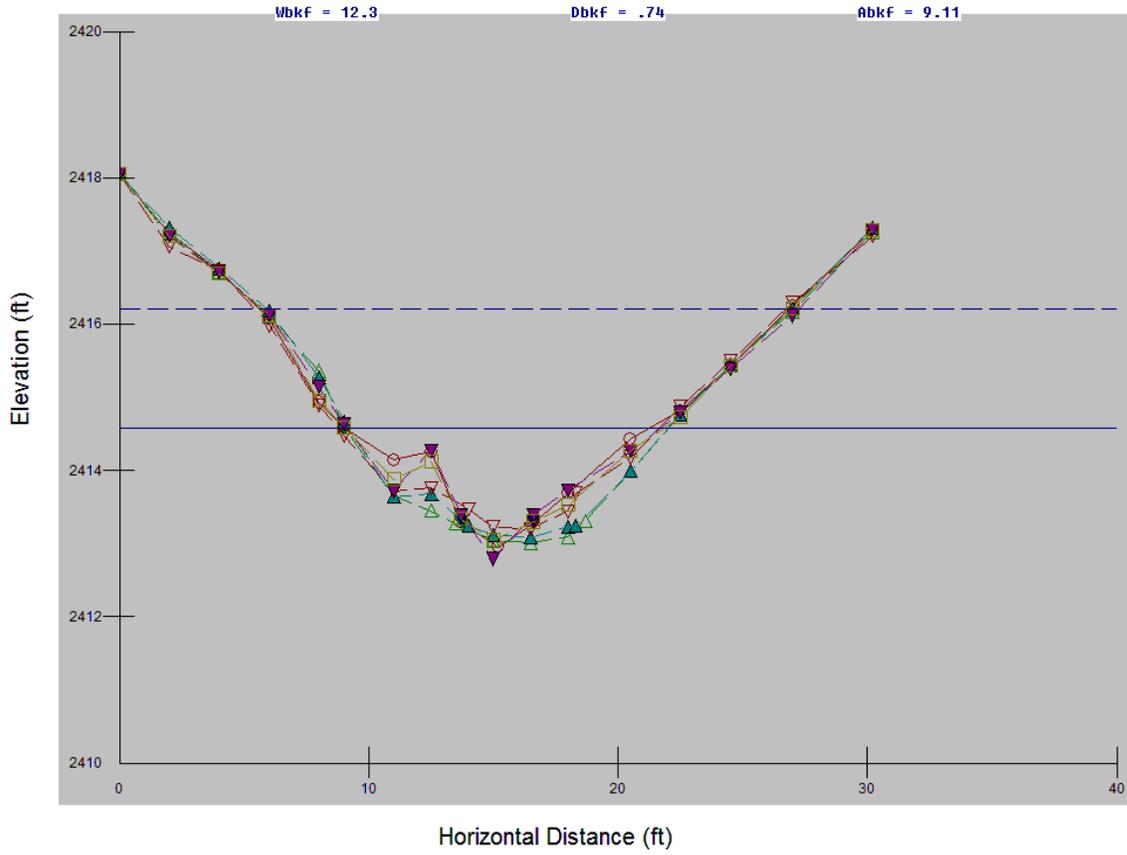
Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa  
Springs, Colorado.

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 SECTIONS**

### R-2518A Site M XS#1 @ STA 62+00

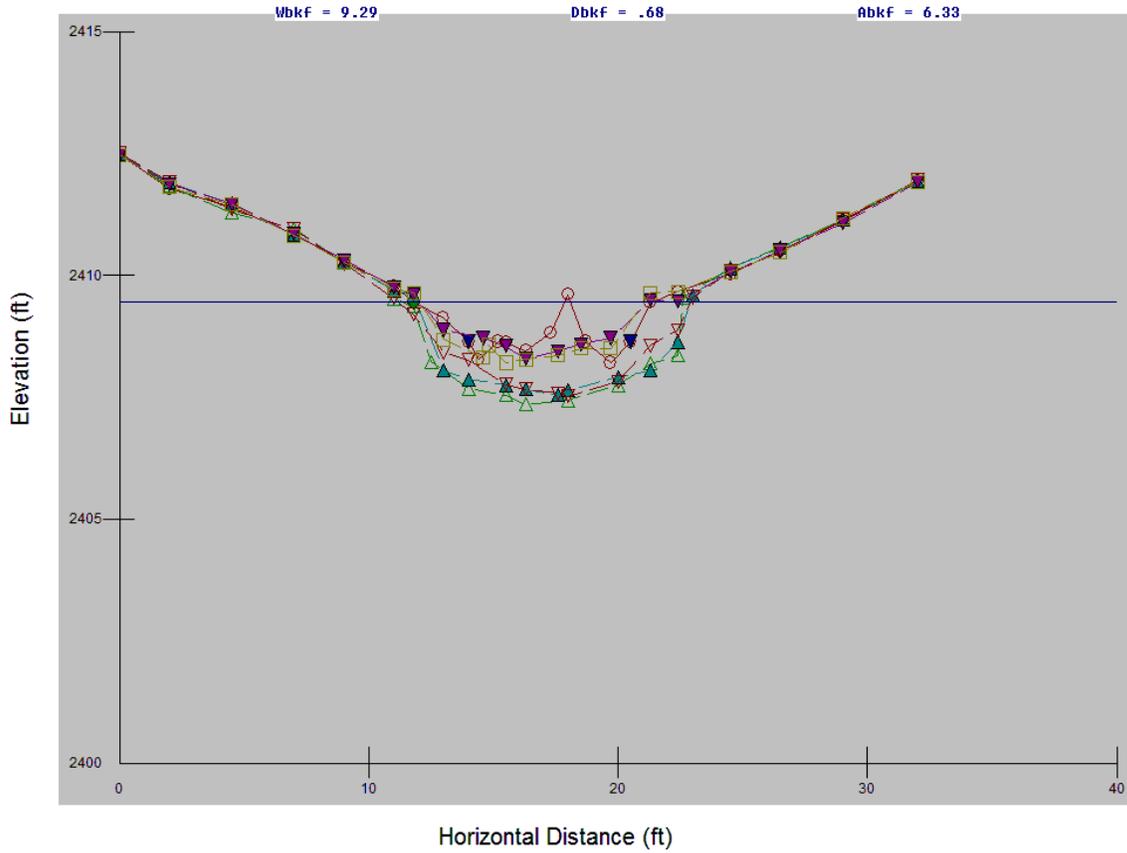
- 2014 - R-2518A Site M XS#1 @ STA 62+00
- ◆ Bankfull Indicators
- ▼ Water Surface Points
- △ 2009 As-Built R-2518A Site M XS-1 @ Sta. 62+00
- ▲ 2010 R-2518A Site M XS-1 @ Sta. 62+00
- ▽ 2011 R-2518A Site M XS-1 @ Sta. 62+00
- ▼ 2012 R-2518A Site M XS-1 @ Sta. 62+00
- 2013 - R-2518A Site M XS#1 @ STA 62+00



<b>Site M: Cross-Section #1 (Riffle) Abbreviated Morphological Summary</b>					
	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<b>Bankfull Cross Sectional Area (ft<sup>2</sup>)</b>	13.82	9.46	10.61	10.3	9.11
<b>Maximum Bankfull Depth (ft.)</b>	1.59	1.27	1.84	1.54	1.63
<b>Width of the Floodprone Area (ft.)</b>	21.42	18.84	23.17	20.75	21.3
<b>Bankfull Mean Depth (ft.)</b>	1.04	0.77	0.82	0.80	0.74
<b>Width/Depth Ratio</b>	12.73	16.03	15.73	16.11	16.61
<b>Entrenchment Ratio</b>	1.62	1.53	1.8	1.61	1.73
<b>Bankfull Width (ft.)</b>	13.24	12.34	12.9	12.89	12.29

### R-2518A Site M XS#2 @ STA 198+50

- 2014 - R-2518A Site M XS#2 @ STA 198+50
- ◆ Bankfull Indicators
- ▼ Water Surface Points
- △ 2009 As-Built R-2518A Site M XS-2 @ Sta. 198+50
- ▲ 2010 R-2518A Site M XS-2 @ Sta. 198+50
- ▽ 2011 R-2518A Site M XS-2 @ Sta. 198+50
- ▼ 2012 R-2518A Site M XS-2 @ Sta. 198+50
- 2013 - R-2518A Site M XS#2 @ STA 198+50



Site M: Cross-Section #2 (Pool) Abbreviated Morphological Summary					
	2010	2011	2012	2013	2014
Bankfull Cross Sectional Area (ft <sup>2</sup> )	17.46	15.98	8.24	9.73	6.33
Maximum Bankfull Depth (ft.)	2.04	2.03	1.31	1.43	1.24
Bankfull Mean Depth (ft.)	1.56	1.33	0.74	1.02	0.68
Bankfull Width (ft.)	11.2	12.06	11.09	9.5	9.29

\*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**

# Holland Creek Site M



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)



Mid channel bar has developed @ surface water gauge  
November 2014

# Holland Creek Site M



Vegetation Overview Photo

July 2014