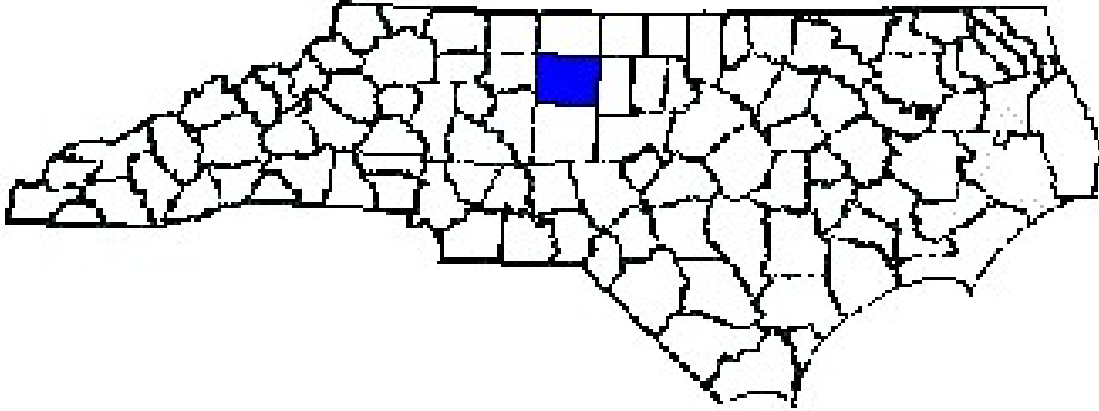


ANNUAL REPORT FOR 2020



U-2525B UT to North Buffalo Creek - Site #4
Guilford County
TIP No. U-2525B
USACE Action ID: SAW-2005-21386
DWR Project #: 20130918 v.8



Prepared By:
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December 2020

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2020 at UT to North Buffalo Creek Site #4 of Greensboro Eastern Loop project in Guilford County. The site was constructed during November 2015 by the North Carolina Department of Transportation (NCDOT). The site was designed as stream mitigation for impacts associated with the construction of Transportation Improvement Program (TIP) number U-2525B and was planted in February 2016. This report provides the monitoring results for the fifth formal year of monitoring (Year 2020). The Year 2020 monitoring period is the fifth of five scheduled years of monitoring on Site #4 (See Success Criteria Section 2.1). No hydrologic monitoring is required for this project; however, vegetation monitoring is required for five years.

Based on the overall conclusions of monitoring at Site #4, it has met the required monitoring protocols for the fifth formal year of monitoring. Based on comparing the monitoring data to the as-built data, the stream channel remains stable throughout the site. The stream bank is heavily vegetated for the fourth year of vegetation monitoring. The vegetation in the stream buffer area was planted in February 2016.

NCDOT proposes to cease future stream and vegetation monitoring at the U-2525B UT to North Buffalo Creek Site #4.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2020 at UT to North Buffalo Creek Site #4 of the Greensboro Eastern Loop project in Guilford County. The site is situated about 1,000 ft east of the intersection of Briarmeade Rd and McKnight Mill Rd flowing from north to south (see Figure 1). The site was constructed to provide mitigation for stream impacts associated with construction of TIP number U-2525B. The site is composed of one reach of a UT to North Buffalo Creek.

The mitigation project includes 386 linear feet of Priority II stream restoration. Construction was completed in November 2015 by NCDOT. Stream restoration involved the installation of rock cross vanes, log vanes, log cross vanes, constructed riffles, construction of a new stream channel, and construction of the floodplain through Priority II restoration reaches 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

For a mitigation site to be considered successful, it must meet the success criteria. This report details the monitoring in 2020 at the UT to North Buffalo Creek Site #4. Hydrologic monitoring was not required.

1.3 Project History

November 2015	Construction Completed
September 2016	As-Built Survey Completed
December 2016	Stream Channel Monitoring (Year 1)
February 2017	Planted Live Stakes and Bareroot Seedlings
July 2017	Vegetation Monitoring (Year 1)
November 2017	Stream Channel Monitoring (Year 2)
October 2017	Herbicide Application on Kudzu
June 2018	Onsite Agency Meeting & Vegetation Monitoring (Year 2)
November 2018	Stream Channel Monitoring (Year 3)
May 2019	Herbicide Application on Kudzu
June 2019	Vegetation Monitoring (Year 3)
November 2019	Stream Channel Monitoring (Year 4)
June 2020	Herbicide Application on Kudzu
June 2020	Vegetation Monitoring (Year 4)
November 2020	Stream Channel Monitoring (Year 5)

1.4 Debit Ledger

The entire UT to North Buffalo Creek Site #4 stream mitigation site was used for the U-2525B project to compensate for unavoidable stream impacts.



 **Figure 1: Project Vicinity Map**
 U-2525B UT to North Buffalo Site #4 Stream Mitigation
 Guilford County, SC

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 two cross sections (one riffle and one pool). 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 restoration and will cover a cumulative total of approximately 386 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. Pebble counts shall not be conducted. The monitoring shall be conducted annually for a minimum of five (5) years after final planting. The monitoring results shall be submitted to DWR in a final report within sixty (60) days after completing monitoring. After 5 years, the NCDOT shall contact the DWR to schedule a site visit to “close out” the mitigation site.

Vegetation Success

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

Bare root vegetation will be evaluated using one staked survival plot. The plot will be 50ft. by 50ft. If site conditions prevent a 50ft. by 50ft. plot, then the plot will have varying dimensions to encompass an area of 2,500 ft². All flagged stems will be counted in those plots. Success will be defined as 320 stems per acre after three years and 260 stems per acre after five 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 386 linear feet of Priority II stream restoration. Construction was completed in November 2015 by NCDOT.

Stream restoration involved the installation of rock cross vanes, log vanes, log cross vanes, constructed riffles, construction of a new stream channel, and construction of the floodplain through Priority II restoration reaches 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 U-2525B UT to North Buffalo Creek Site #4 restoration was to build a C5 stream type as identified in the Rosgen's Applied River Morphology. A total of two cross sections were surveyed. For this report, only the riffle cross section was used in the comparison of channel morphology in Table 1.

Table 1. Abbreviated Morphological Summary							
U-2525B - Site 4 Cross Section #2							
Variable	Proposed	As-built	Monitoring Year 1 2016	Monitoring Year 2 2017	Monitoring Year 3 2018	Monitoring Year 4 2019	Monitoring Year 5 2020
		Cross Section #2 (Riffle)	Cross Section #2 (Riffle)	Cross Section #2 (Riffle)	Cross Section #2 (Riffle)	Cross Section #2 (Riffle)	Cross Section #2 (Riffle)
Drainage Area (mi ²)	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Bankfull Width (ft)	12.7	11.4	11.1	11.9	12.2	10.15	8.91
Bankfull Mean Depth (ft)	0.9	0.81	0.84	0.89	1.02	1.00	1.15
Width/Depth Ratio	13.6	14.07	13.26	13.34	11.97	10.15	7.75
Bankfull Cross Sectional Area (ft ²)	11.9	9.23	9.37	10.57	12.47	10.15	10.24
Maximum Bankfull Depth (ft)	1.4	1.58	1.61	1.97	2.25	2.04	2.41
Floodprone Area (ft)	80	39	39	39	40	40	39
Entrenchment Ratio	6.3	3.43	3.52	3.3	3.27	3.94	4.38

*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 two cross sections and the longitudinal profile of UT to North Buffalo Creek Site #4 that was established by the NCDOT after construction. The length of the surveyed profile the reach of Site #4 was approximately 386 linear feet. Two cross sections were established during the 2016 as-built survey/monitoring. 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 profiles are shown in Appendix A.

- ◆ Cross Section #1: Site #4, Station 401+57 linear feet, midpoint of pool
- ◆ Cross Section #2: Site #4, Station 402+04 linear feet, midpoint of riffle

Based on visual assessment and comparisons of the as-built to the MY5 (2020) monitoring data, the channel and both cross sections appear stable with little or no active bank erosion. Graphs of the cross sections are presented in Appendix A. The 2020 longitudinal profile was not completed due to heavy 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. Photo points 1 and 2 presented in Appendix B show strong growth of herbaceous and woody vegetation. Based on field observations (sand deposits and wrack lines) at least one bankfull event has occurred during the 2020 monitoring year at Site #4. Pebble counts were not required per the permit conditions and therefore were not completed. The right end pin for XS #2 was reset during the 2019 monitoring year due to NCDOT being unable to locate the pin in the field. In 2020 the original right end pin was rediscovered and used in the stream survey. As a result, the 2019 data is not depicted in the XS-2 graph in Appendix A. All other monitoring activities will continue to be completed by NCDOT throughout the five-year monitoring period.

3.0 VEGETATION: UT TO NORTH BUFFALO CREEK – SITE #4 (YEAR 4 MONITORING)

3.1 Success Criteria

Mitigation Plan: All of the mitigation sites will be monitored according to the April 2003 Stream Mitigation Guidelines. The following components of the Level 1 monitoring will be performed each year of the 5-year monitoring period: reference photos, plant survival (identification of specific problem areas, estimated causes and proposed/required remedial action). Success for vegetation monitoring within the riparian buffer areas are based on the survival of at least 260 stems of five year old trees at year five.

3.2 Description of Species

The following live stake species were planted in the Streambank Area (Type I):

Salix nigra, Black Willow

Cornus amomum, Silky Dogwood

The following tree species were planted in the Buffer Area (Type II):

Liriodendron tulipifera, Tulip Poplar

Platanus occidentalis, American Sycamore

Prunus serotina, Black Cherry

Betula nigra, River Birch

Fraxinus pennsylvanica, Green Ash

3.3 Results of Vegetation Monitoring

Plot #	Tulip Poplar	Sycamore	Black Cherry	River Birch	Green Ash	Total (Year 4)	Total (at planting)	Density (Trees/Acre)
1		24		6	14	44	60	499
Year 4 Average Density (Trees/Acre)								499
Year 3 Average Density (Trees/Acre)								544
Year 2 Average Density (Trees/Acre)								601
Year 1 Average Density (Trees/Acre)								635

Site Notes: Black willow and silky dogwood live stakes that were planted along the streambank and noted during the monitoring evaluation were surviving. Other species noted onsite included elderberry, jewelweed, lespedeza, soft rush, alder, briars, blackberry, sweetgum, tear-thumb, cottonwood, and various grasses. Kudzu noted on the site was sprayed in June 2020.

3.4 Conclusions

There was one vegetation monitoring plot established in the buffer area. The 2020 vegetation monitoring of the site revealed an average tree density of 499 trees per acre. This average is above the minimum success criteria of 290 trees per acre for Year 4. NCDOT plans to continue vegetation monitoring in 2021.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

The UT to North Buffalo Creek Site #4 has met the required monitoring protocols for the fifth formal year of monitoring. Based on comparing the monitoring data to the as-built, the stream channel remains stable throughout at this time. The streambank and buffer plantings are meeting the planted vegetation success criteria for the fourth year of monitoring.

NCDOT proposes to discontinue stream monitoring but continue vegetation monitoring at the UT to North Buffalo Creek Site #4 in 2021.

5.0 REFERENCES

Mitigation Plan for Greensboro Eastern Loop; Guilford County, NC, T.I.P. Number U-2525B, WBS No's: 34821.1.1, August 12, 2013.

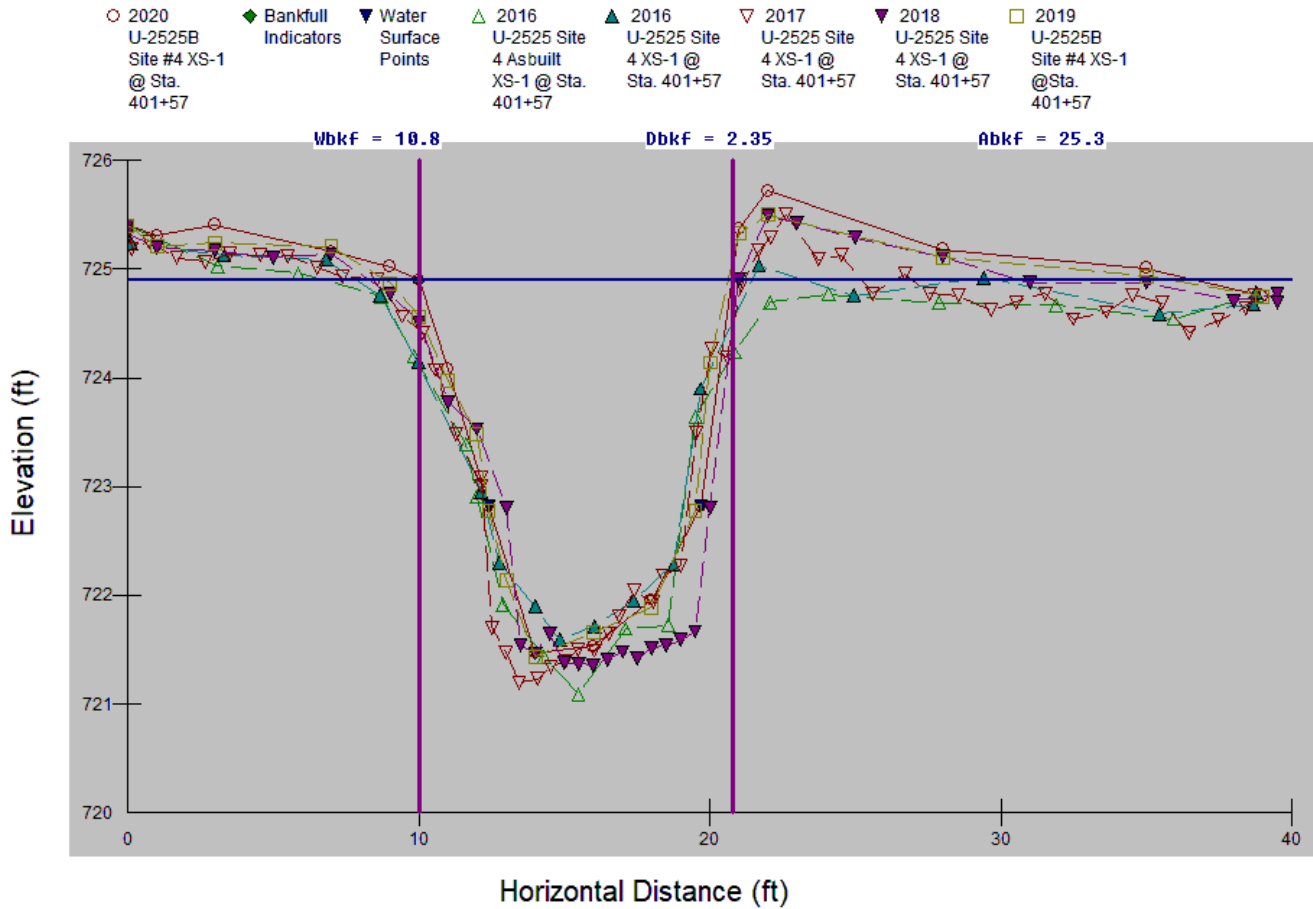
As-Built Report/Record Drawings for U-2525B Site #4 Mitigation Site, Guilford County, NC.

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

2020 U-2525B Site #4 XS-1 @ Sta. 401+57

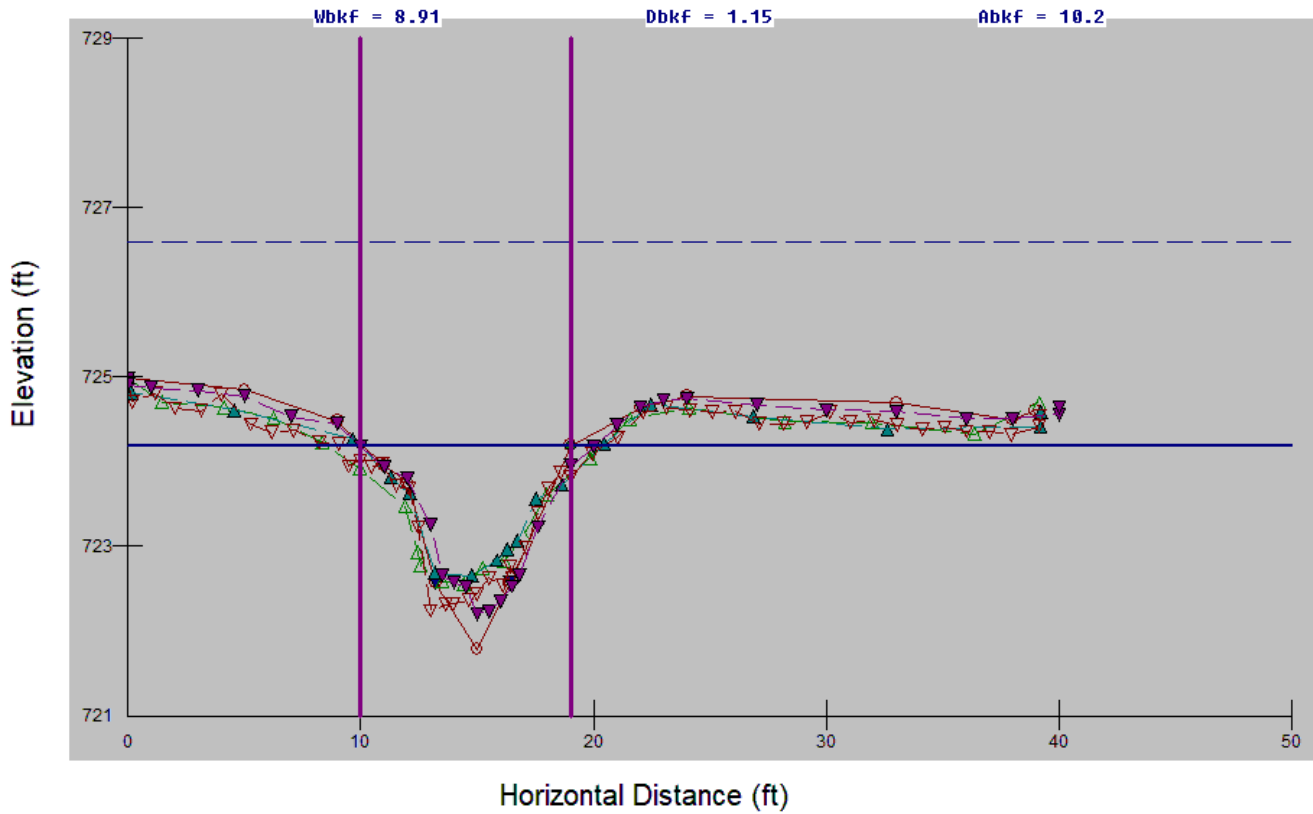


Site 4: Cross-Section #1 (Pool) Abbreviated Morphological Summary						
	As-built	2016	2017	2018	2019	2020
Bankfull Width (ft)	8.28	8.35	7.91	9.95	9.13	10.76
Bankfull Mean Depth (ft)	1.11	1.18	1.42	2.56	1.52	2.35
Bankfull Cross Sectional Area (ft²)	9.19	9.88	11.25	25.50	13.86	25.33
Maximum Bankfull Depth (ft)	1.72	1.77	1.89	4.24	2.59	3.43

*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

2020 U-2525B Site #4 XS-2 @ Sta. 402+04 (original)

○ 2020 U-2525B Site #4 XS-2 @ Sta. 402+04 (original)
 ◆ Bankfull Indicators
 ▼ Water Surface Points
 △ 2016 U-2525 Site 4 Asbuilt XS-2 @ Sta. 402+04
 ▲ 2016 U-2525 Site 4 XS-2 @ Sta. 402+04
 ▽ 2017 U-2525 Site 4 XS-2 @ Sta. 402+04
 ▼ 2018 U-2525 Site 4 XS-2 @ Sta. 402+04



Site 4: Cross-Section #2 (Riffle) Abbreviated Morphological Summary						
	As-built	2016	2017	2018	2019*	2020
Bankfull Width (ft)	11.4	11.1	11.9	12.2	10.15	8.91
Bankfull Mean Depth (ft)	0.81	0.84	0.89	1.02	1.00	1.15
Width/Depth Ratio	14.07	13.26	13.34	11.97	10.15	7.75
Bankfull Cross Sectional Area (ft²)	9.23	9.37	10.6	12.47	10.15	10.24
Maximum Bankfull Depth (ft)	1.58	1.61	1.97	2.25	2.04	2.41
Width of the Floodprone Area (ft)	39	39	39	40	40	39
Entrenchment Ratio	3.43	3.52	3.30	3.27	3.94	4.38

*2019 morphology data based off different right end pin location.

APPENDIX B

SITE PHOTOGRAPHS

U-2525B UT to North Buffalo Creek Site #4



Photo Point #1 (Upstream)



Photo Point #1 (Downstream)

U-2525B UT to North Buffalo Creek Site #4



Photo Point #2 (Upstream)



Photo Point #2 (Downstream)

U-2525B UT to North Buffalo Creek Site #4



Vegetation Plot #1



Overview looking upstream from culvert inlet at I-840.

June 2020

APPENDIX C

CROSS SECTION, VEGETATION PLOT & PHOTO POINT LOCATIONS (AS-BUILT PLANS)

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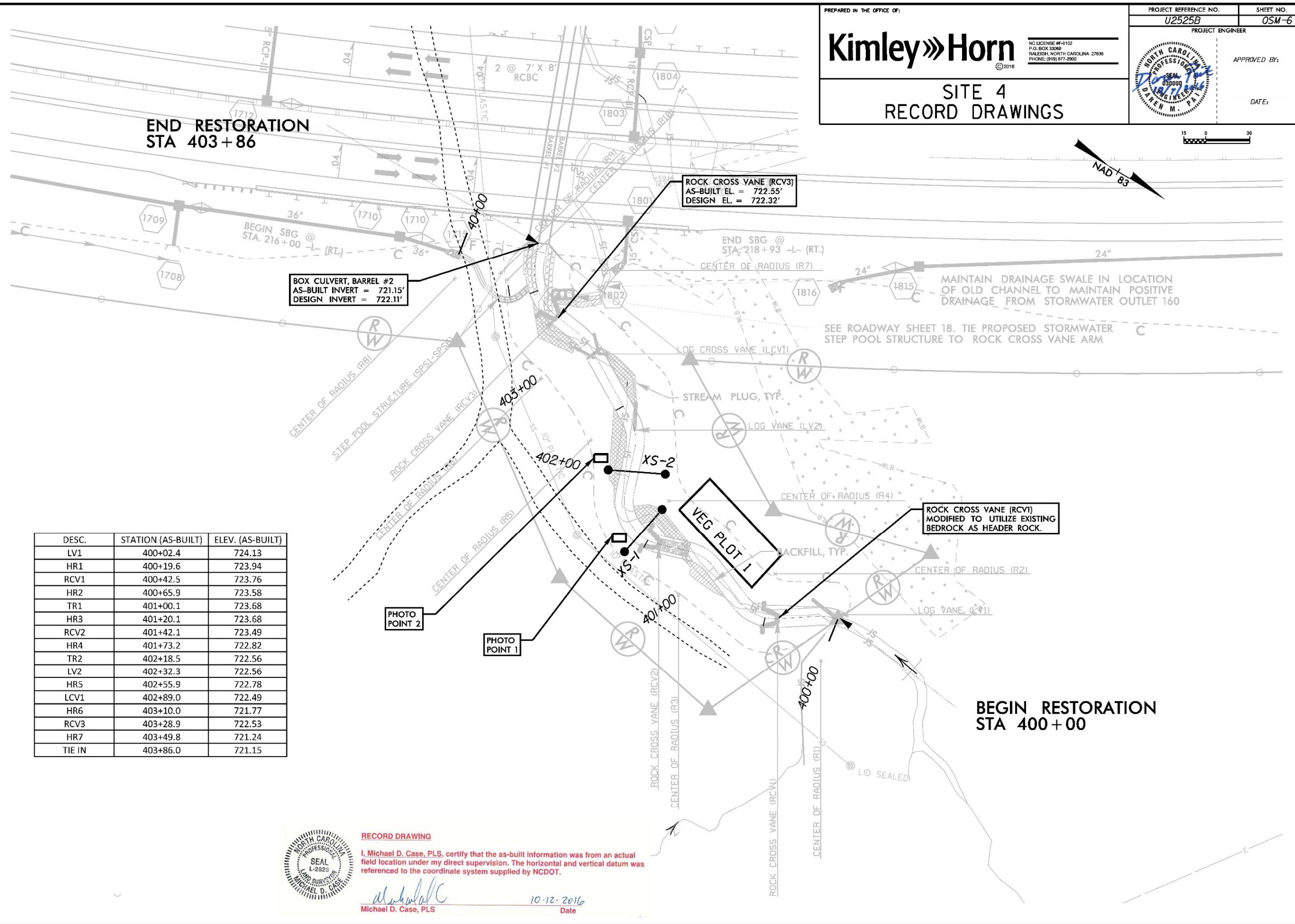
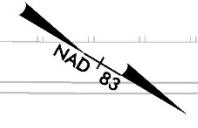
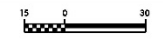
PROJECT REFERENCE NO.
U2525B

SHEET NO.
OSM-6



PROJECT ENGINEER
APPROVED BY:
DATE:

**SITE 4
RECORD DRAWINGS**



**END RESTORATION
STA 403+86**

MAINTAIN DRAINAGE SWALE IN LOCATION
OF OLD CHANNEL TO MAINTAIN POSITIVE
DRAINAGE FROM STORMWATER OUTLET 160

SEE ROADWAY SHEET 18. TIE PROPOSED STORMWATER
STEP POOL STRUCTURE TO ROCK CROSS VANE ARM

**BOX CULVERT, BARREL #2
AS-BUILT INVERT = 721.15'
DESIGN INVERT = 722.11'**

**ROCK CROSS VANE (RCV3)
AS-BUILT EL. = 722.55'
DESIGN EL. = 722.32'**

**ROCK CROSS VANE (RCV1)
MODIFIED TO UTILIZE EXISTING
BEDROCK AS HEADER ROCK.**

DESC.	STATION (AS-BUILT)	ELEV. (AS-BUILT)
LV1	400+02.4	724.13
HR1	400+19.6	723.94
RCV1	400+42.5	723.76
HR2	400+65.9	723.58
TR1	401+00.1	723.68
HR3	401+20.1	723.68
RCV2	401+42.1	723.49
HR4	401+73.2	722.82
TR2	402+18.5	722.56
LV2	402+32.3	722.56
HR5	402+55.9	722.78
LCV1	402+89.0	722.49
HR6	403+10.0	721.77
RCV3	403+28.9	722.53
HR7	403+49.8	721.24
TIE IN	403+86.0	721.15



RECORD DRAWING
I, Michael D. Case, PLS, certify that the as-built information was from an actual field location under my direct supervision. The horizontal and vertical datum was referenced to the coordinate system supplied by NCDOT.

Michael D. Case
Michael D. Case, PLS
Date: 10-12-2016