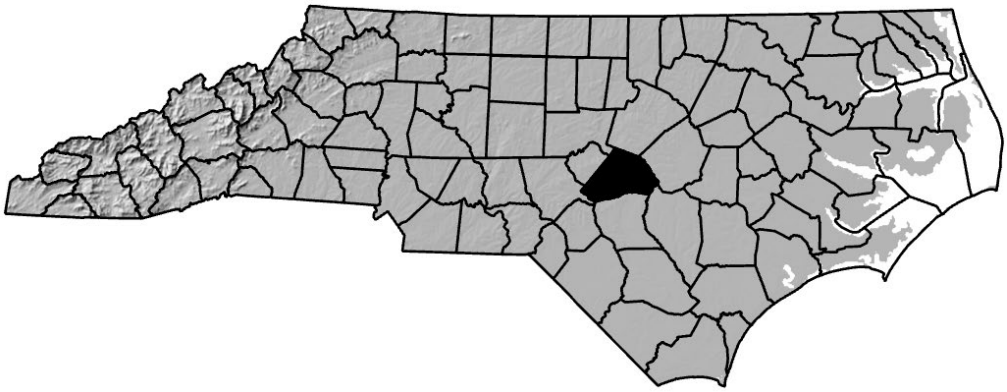
ANNUAL REPORT FOR 2024



B-4138WM UT to Cape Fear River
Harnett County
TIP No. B-4138WM
USACE Action ID: SAW-2003-00357
DWR Project #: 20091321

Prepared By:
Environmental Analysis Unit & Roadside Environmental Unit
North Carolina Department of Transportation
December 2024

TABLE OF CONTENTS

LIST OF FIGURES

TABLES

APPENDICES

SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2024 at the UT to Cape Fear River mitigation site in Harnett County. The site was originally constructed in 2013 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 B-4138WM. Due to significant stream instability the stream was redesigned, and remediation was completed at the site during the fall of 2019. This report provides the monitoring results for the fifth formal year of monitoring (Year 2024). The Year 2024 monitoring period is the fifth of five scheduled years of monitoring (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, the site has met the required monitoring protocols for the fifth year of monitoring. Based on comparing the monitoring data to the as-built, the stream channel remains stable throughout at this time. The stream bank is vegetated for the fourth year of monitoring.

There are a total of two vegetation monitoring plots established within the stream buffer area. The 2024 vegetation monitoring of the site revealed an average tree density of 558 trees per acre. This average is well above the minimum success criteria of 320 trees per acre for the fifth year of vegetation monitoring.

NCDOT proposes discontinuing stream monitoring at the UT to Cape Fear River site.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2024 at UT to Cape Fear River mitigation site. The site is situated directly adjacent to the southbound lanes of NC 210/401 (see Figure 1). The site was constructed to provide mitigation for stream impacts associated with construction of TIP number B-4138. The site is composed of one reach of a UT to Cape Fear River.

The mitigation project includes 606 linear feet of Priority II stream relocation. Construction was completed in fall of 2019 by NCDOT. Construction at the site involved the installation of rock cross vanes, rock sills, rock toe protection, constructed riffles, construction of a new stream channel, and construction of the floodplain through Priority II restoration to allow for overbank flooding. It also included the installation of coir fiber matting/roles along the stream banks. Live stakes were installed along the streambanks and bareroot seedlings within the buffer area in April 2021.

1.2 Purpose

For a mitigation site to be considered successful, it must meet the success criteria. This report details the monitoring in 2024 at UT to Cape Fear River. Hydrologic monitoring was not required.

1.3 Project History

June 2013	Initial Stream Construction Completed
June 2014	Stream Channel Monitoring (Year 1)
December 2019	Stream Remediation Completed
February 2020	As-Built Survey Completed
November 2020	Stream Channel Monitoring (Year 1 Restart)
April 2021	Streambank Reforestation Completed
August 2021	Vegetation Monitoring (Year 1)
November 2021	Stream Channel Monitoring (Year 2)
August 2022	Vegetation Monitoring (Year 2)
October 2022	Stream Channel Monitoring (Year 3)
June 2023	Vegetation Monitoring (Year 3)
October 2023	Stream Channel Monitoring (Year 4)
June 2024	Vegetation Monitoring (Year 4)
November 2024	Stream Channel Monitoring (Year 5)

1.4 Debit Ledger

The entire stream UT to Cape Fear River mitigation site was used for the B-4138WM project to compensate for unavoidable stream impacts.

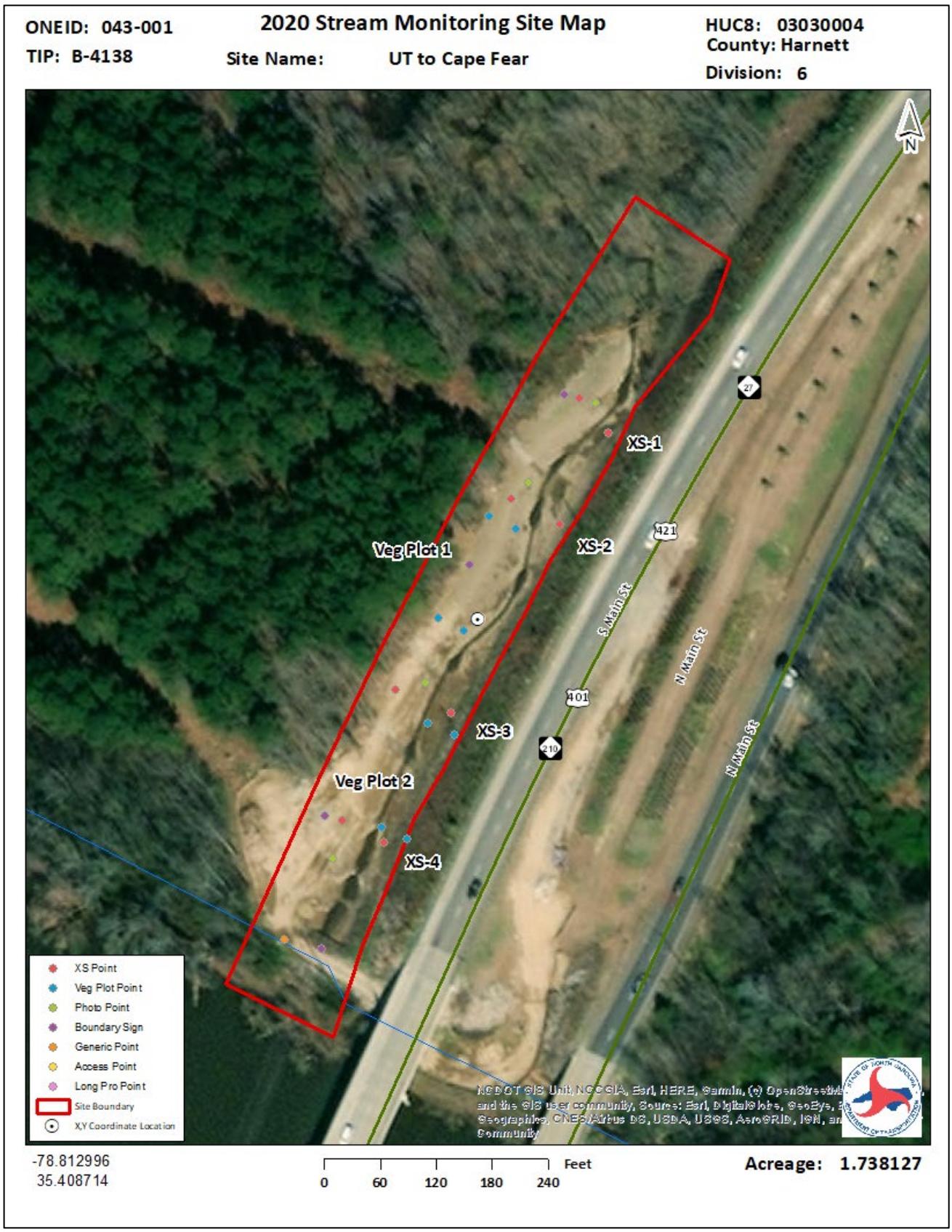


Figure 1-Vicinity Map

2.0 STREAM ASSESSMENT

2.1 Success Criteria

Mitigation Plan states: NCDOT shall monitor the restoration site by visual observation for channel and bank stability and by photo documentation for the survival and the density of the vegetation. NCDOT will monitor the site for a minimum of three years or until the site is deemed successful.

NCDWQ Permit states: The permittee shall visually monitor the vegetative plantings to assess and ensure complete stabilization of the mitigation stream segments. Riparian area success shall be determined by conducting stem counts to ensure a tree survival rate of 320 stems/acre. The monitoring shall be conducted annually for a minimum of 3 years after final planting. Photo documentation shall be utilized to document the success of the riparian vegetation and submitted to NCDWQ in a final report within sixty (60) days after completing monitoring. After 3 years the NCDOT shall contact NCDWQ to schedule a site visit to "close out" the mitigation site.

ACOE Permit states: In order to compensate for permanent impacts to 608 linear feet of stream, the permittee will perform on site mitigation consisting of approximately 608 linear feet of onsite stream restoration pursuant to the plan titled "UT to Cape Fear, Bridge No. 46 on US 401/NC 210, Stream Mitigation Plan, TIP B-4138" dated September 2009. Acceptance of this plan and mitigation proposal is predicted on compliance with the following conditions:

a. The restored channel will be allowed to stabilize for one growing season prior to the introduction of stream flow.

b. Monitoring shall continue for a minimum of five years unless the Corps determines in writing the monitoring may be discontinued.

c. Within 60 days following completion of all channel construction and planting efforts, the permittee will submit an as-built of the final site to the Corps.

d. Monitoring reports will be submitted to the Corps by January 31 of the year following each monitoring year.

2.2 Stream Description

2.2.1 Post-Construction Conditions

The mitigation project includes 606 linear feet of Priority II stream restoration. Construction was completed in December 2019 by NCDOT. Stream relocation at the site involved the installation of rock cross vanes, rock sills, rock toe protection, constructed riffles, construction of a new stream channel, and construction of the floodplain through Priority II restoration to allow for overbank flooding. It also included the installation of coir fiber matting/roles along the stream banks. Live stakes will be installed along the streambanks and bareroot seedlings within the buffer area during the dormant season between December 2020 and March 2021.

2.2.2 Monitoring Conditions

The objective of the UT to Cape Fear River relocation was to build a E4 stream type as identified in the Rosgen's Applied River Morphology. A total of four cross sections were surveyed. For this report, only the riffle cross sections were used in the comparison of channel morphology in Table 1.

Table 1. Abbreviated Morphological Summary
B-4138WM - Cross Sections #1 and #3

Variable	Proposed	As-Built		Monitoring Year 1 – 2020		Monitoring Year 2 – 2021		Monitoring Year 3 – 2022		Monitoring Year 4 – 2023		Monitoring Year 5 – 2024	
		Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)	Cross Section #1 (Riffle)	Cross Section #3 (Riffle)
Drainage Area (mi^2)	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66
Bankfull Width (ft)	10.5	10.00	8.5	8.00	8.2	7.23	9.28	7.3	9.4	7.26	9.46	7.5	9.53
Bankfull Mean Depth (ft)	0.7	0.54	0.61	0.55	0.61	0.45	0.76	0.51	0.67	0.48	0.67	0.68	0.75
Width/Depth Ratio	15.2	18.52	13.93	14.55	13.44	16.07	12.21	14.31	14.03	15.13	14.12	11.03	12.71
Bankfull Cross Sectional Area (ft^2)	7.5	5.42	5.23	4.39	5.00	3.24	7.07	3.74	6.26	3.5	6.3	5.13	7.11
Maximum Bankfull Depth (ft)	1.3	1.04	1.01	0.96	1.06	.90	1.27	0.93	1.19	0.92	1.28	1.27	1.39
Floodprone Area (ft)	36.0	34.89	39.84	34.79	40.88	33.11	45.0	34.56	44.91	34.45	45	37.52	45
Entrenchment Ratio	3.4	3.49	4.69	4.35	4.98	4.58	4.85	4.73	4.78	4.88	4.76	5	4.75

*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 4 cross sections and the longitudinal profile of UT to Cape Fear River established by the NCDOT after construction. Four cross sections were established during the 2020 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: UT to Cape Fear River, Station 10+89 linear feet, midpoint of riffle
- Cross Section #2: UT to Cape Fear River, Station 11+85 linear feet, midpoint of pool
- Cross Section #3: UT to Cape Fear River, Station 13+85 linear feet, midpoint of riffle
- Cross Section #4: UT to Cape Fear River, Station 15+09 linear feet, midpoint of pool

Based on visual assessment and comparisons of the as-built to the MY5 monitoring data, the channel and all four cross sections appear stable with little or no active bank erosion. Graphs of the cross sections are presented in Appendix A. Minor aggradation continues at XS1. NCDOT believes this is due to presence of aquatic vegetation in the upper half of the stream reach. A survey of the longitudinal profile was not required. However, the entire restored length of stream was investigated for channel stability and in-stream structure functionality. Photo points 1 through 4 presented in Appendix B show continued growth and vigor of herbaceous and woody vegetation. Based on field observations (sand deposits and wrack lines) a recent bankfull event had occurred at the site. Pebble counts were not required per the permit conditions and therefore were not completed.

Multiple bankfull events were recorded by the on-site stream gauge for the monitoring years prior to 2022 thus meeting the requirement for 2 overbank events during the 5-year monitoring period. As a result, NCDOT ceased to monitor stream hydrography at the B-4138 site in 2022.

3.0 VEGETATION: UT to CAPE FEAR RIVER

3.1 Description of Species

The following tree species were planted on the stream bank:

Salix nigra, Black Willow

Cephalanthus occidentalis, Buttonbush

The following tree species were planted in the buffer area:

Taxodium distichum, Baldcypress

Betula nigra, River Birch

Platanus occidentalis, Sycamore

Quercus nigra, Water Oak

3.2 Results of Vegetation Monitoring

Plot #	Baldcypress	River Birch	Sycamore	Water Oak	Total (Year 4)	Total (at planting)	Density (Trees/Acre)
1	13	12	8	5	38	45	574
2	9	18	3	5	35	44	541
Year 4 Average Density (Trees/Acre)							**558**
Year 3 Average Density (Trees/Acre)							535
Year 2 Average Density (Trees/Acre)							565
Year 1 Average Density (Trees/Acre)							581

Site Notes: Live stakes planted along the streambanks were surviving. Species from the planting list were noted as volunteering. Other species noted included soft rush, red maple, sweetgum, blackberry, lespedeza, *Scirpus* sp., baccharis, green ash, woolgrass, *Hibiscus* sp., briars, and various grasses. Some beaver activity was noted within Vegetation Plot #2. No beaver dams noted but a few seedlings were cut back. Wrack lines and staining of the leaves were noted within the floodplain indicating a bankfull event had occurred.

3.3 Conclusions

There are a total of 2 vegetation monitoring plots established throughout the buffer area. The 2024 vegetation monitoring of the site revealed an average tree density of 558 trees per acre. This average is well above the minimum success criteria of 320 trees per acre for Year 4.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

The UT to Cape Fear River 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 2024 vegetation monitoring of the site revealed an average tree density of 558 trees per acre. This average is well above the minimum success criteria of 320 trees per acre for year four.

NCDOT proposes to discontinue stream and vegetation monitoring at UT to Cape Fear River mitigation site.

5.0 REFERENCES

B-4138WM On-Site Stream Mitigation Plan; Harnett County, NC, Project No. 33490.1.1, September 2009

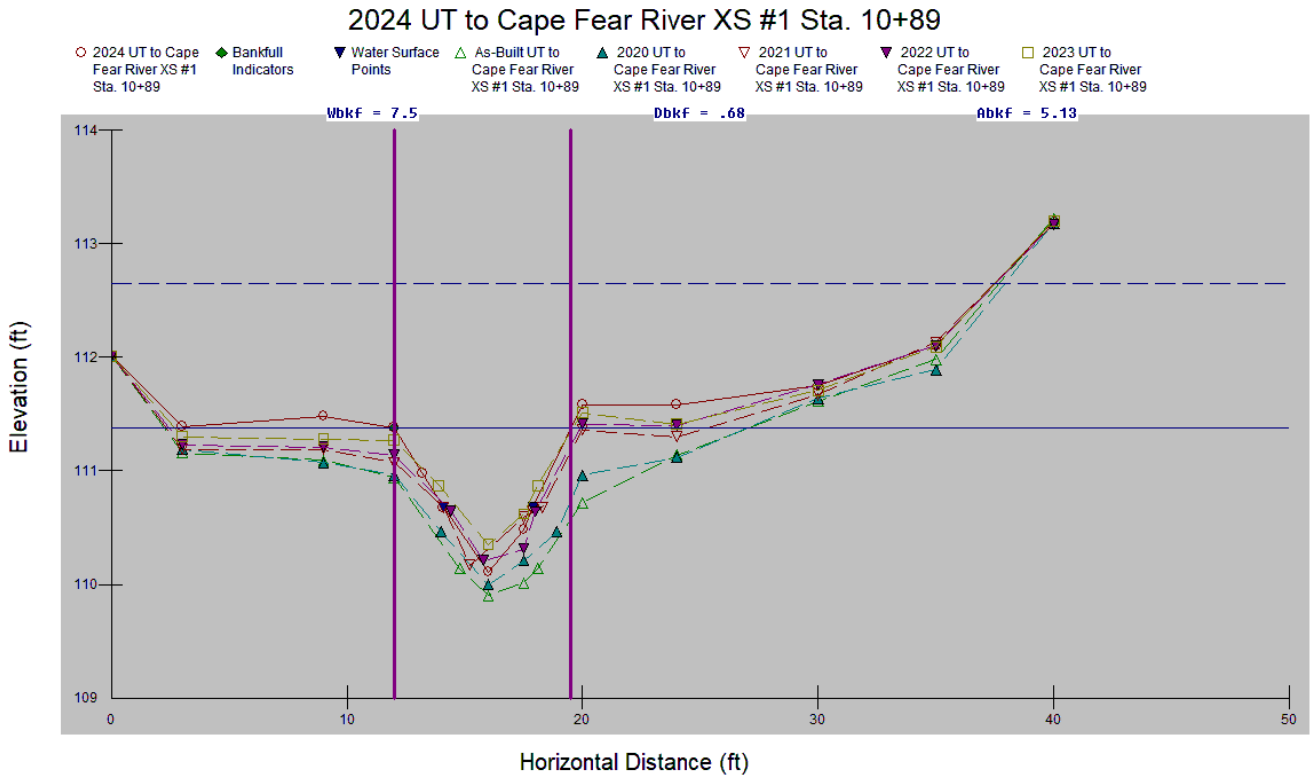
As-Built Report/Record Drawings for UT to Cape Fear River, Harnett County, NC, June 29,2020.

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

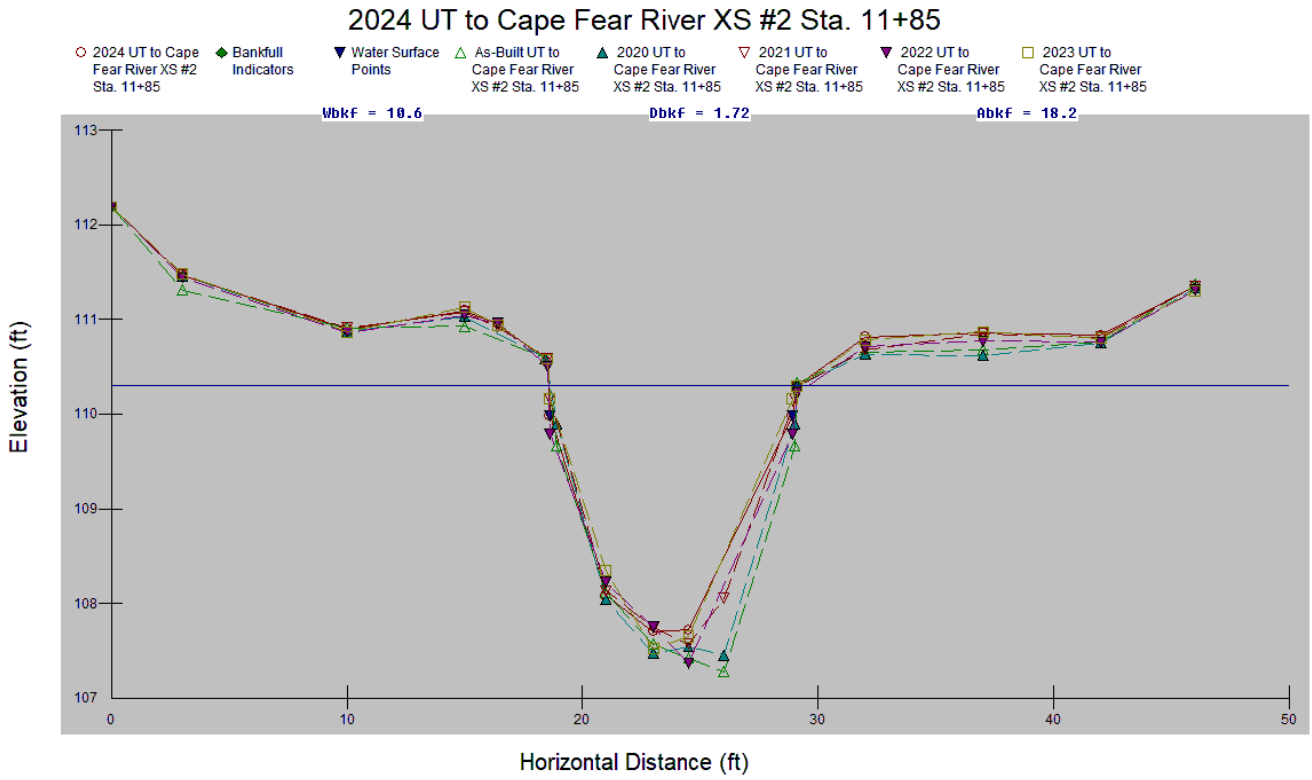
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

APPENDIX A

CROSS SECTION COMPARISONS
&
STREAM GAUGE DATA

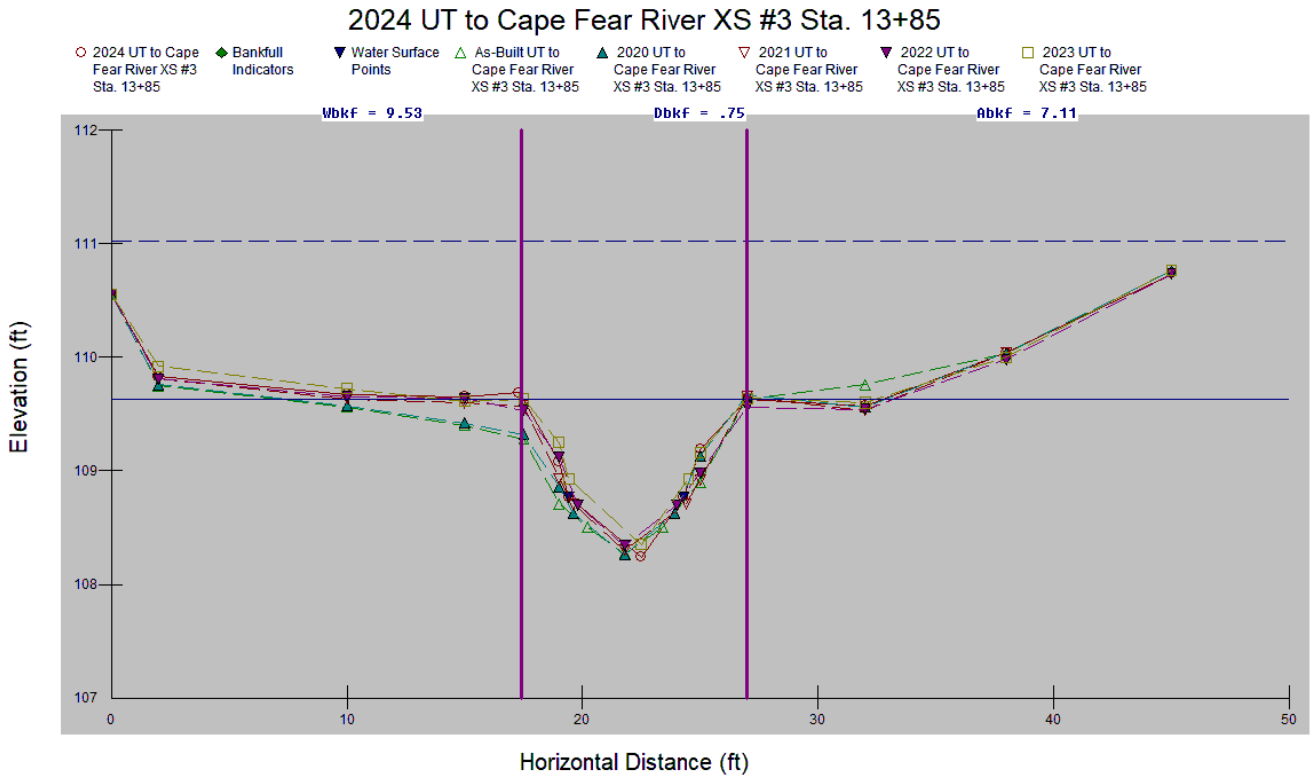


Cross-Section #1 (Riffle) Abbreviated Morphological Summary						
	As-built	2020	2021	2022	2023	2024
Bankfull Width (ft)	10.00	8.00	7.23	7.30	7.26	7.5
Bankfull Mean Depth (ft)	0.54	0.55	0.45	0.51	0.48	0.68
Width/Depth Ratio	18.52	14.55	16.07	14.31	15.13	11.03
Bankfull Cross Sectional Area (ft2)	5.42	4.39	3.24	3.74	3.5	5.13
Maximum Bankfull Depth (ft)	1.04	0.96	.90	0.93	0.92	1.27
Width of the Floodprone Area (ft)	34.89	34.79	33.11	34.56	34.45	37.52
Entrenchment Ratio	3.49	4.35	4.58	4.73	4.88	5

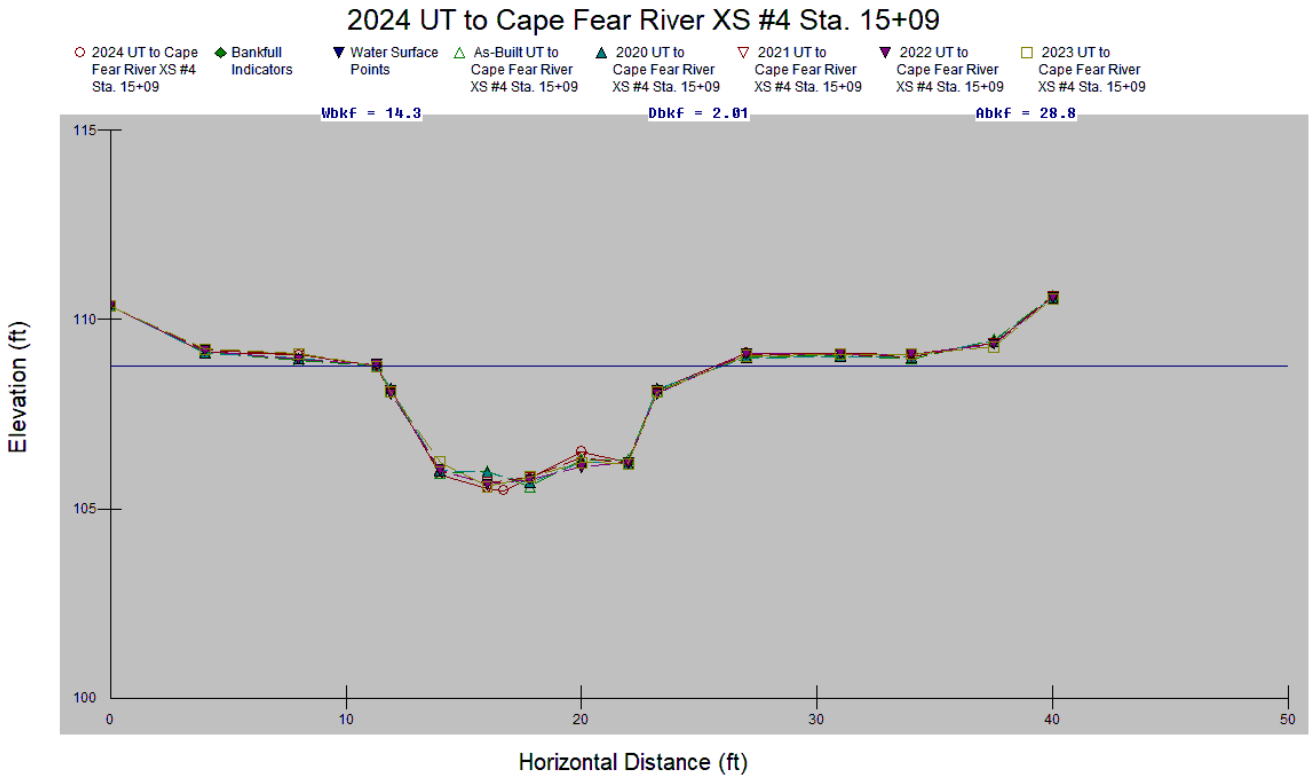


Cross-Section #2 (Pool) Abbreviated Morphological Summary						
	As-built	**2020**	**2021**	**2022**	**2023**	**2024**
Bankfull Width (ft)	**14.2**	**13.6**	**10.53**	**10.56**	**10.53**	**10.56**
Bankfull Mean Depth (ft)	**1.86**	**1.85**	**1.78**	**1.77**	**1.8**	**1.72**
Bankfull Cross Sectional Area (ft2)	**26.36**	**25.21**	**18.69**	**18.65**	**17.38**	**18.17**
Maximum Bankfull Depth (ft)	**3.37**	**3.18**	**2.72**	**2.85**	**2.77**	**2.6**

*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						
	As-built	2020	2021	2022	2023	2024
Bankfull Width (ft)	8.5	8.2	9.28	9.4	9.46	9.53
Bankfull Mean Depth (ft)	0.61	0.61	0.76	0.67	0.67	0.75
Width/Depth Ratio	13.93	13.44	12.21	14.03	14.12	12.71
Bankfull Cross Sectional Area (ft2)	5.23	5.00	7.07	6.26	6.3	7.11
Maximum Bankfull Depth (ft)	1.01	1.06	1.27	1.19	1.28	1.39
Width of the Floodprone Area (ft)	39.84	40.88	45	44.91	45	45
Entrenchment Ratio	4.69	4.98	4.85	4.78	4.76	4.75



Cross-Section #4 (Pool) Abbreviated Morphological Summary						
	As-built	**2020**	**2021**	**2022**	**2023**	**2024**
Bankfull Width (ft)	**14.67**	**14.63**	**14.52**	**14.66**	**14.55**	**14.32**
Bankfull Mean Depth (ft)	**1.96**	**1.95**	**1.99**	**2.06**	**1.97**	**2.01**
Bankfull Cross Sectional Area (ft2)	**28.74**	**28.48**	**28.86**	**30.15**	**28.63**	**28.77**
Maximum Bankfull Depth (ft)	**3.17**	**3.07**	**3.07**	**3.15**	**3.17**	**3.27**

*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

UT to Cape Fear 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)

UT to Cape Fear River

Photo Point #4 (Upstream)

Photo Point #4 (Downstream)

November 2024

UT to Cape Fear 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)

June 2024

UT to Cape Fear River

Photo Point #4 (Upstream)

Photo Point #4 (Downstream)

Overview Looking Upstream from Cape Fear River

June 2024

UT to Cape Fear River

Aerial Drone View Looking Downstream

November 2024

APPENDIX C

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

09/26/11

Kimley»Horn ©2016

NC LICENSE: #F-0102
P.O. BOX 33068
RALEIGH, NORTH CAROLINA 27636
PHONE: (919) 677-3000

PROJECT REFERENCE NO.	SHEET NO.
B-4138WM	OSM-4A

PROJECT ENGINEER

APPROVED BY:

DATE:

AS-BUILT PLAN SHEET

30 15 0 30 60

NAD 83/2011

CONTRACTOR TO INSTALL SAFETY FENCE ALONG CONSTRUCTION ENTRANCE, STAGING AND STOCKPOLE AREA, AND HAUL ROAD ADJACENT TO VEGETATED MEDIAN FOR THE PURPOSE OF PROTECTING EXISTING LANDSCAPING VEGETATION WITHIN THE MEDIAN.

CONTRACTOR TO INSTALL SAFETY FENCE ALONG CONSTRUCTION ENTRANCE, STAGING AND STOCKPOLE AREA, AND HAUL ROAD ADJACENT TO VEGETATED MEDIAN FOR THE PURPOSE OF PROTECTING EXISTING LANDSCAPING VEGETATION WITHIN THE MEDIAN.

PROPOSED TEMPORARY 20' WIDE GRAVEL CONSTRUCTION ENTRANCE

CONTRACTOR TO MODIFY EXTENT AND LAYOUT OF TEMPORARY CONSTRUCTION ENTRANCE AND STAGING AND STOCKPILE AREA TO MATCH EXISTING CONDITIONS AND MINIMIZE DISTURBANCE TO EXISTING VEGETATED MEDIAN.

PROPOSED TEMPORARY 15'-20' WIDE GRAVEL CONSTRUCTION ENTRANCE

ROCK CROSS VANE (RCV1)
ROCK CROSS VANE (RCV2)
ROCK CROSS VANE (RCV3)
ROCK CROSS VANE (RCV4)
ROCK CROSS VANE (RCV5)
ROCK CROSS VANE (RCV6)
ROCK CROSS VANE (RCV7)

STAGING AND STOCKPILE AREA

GPS CONTROL POINT
REBAR & CAP SET
N: 603,440.6336'
E: 2,055,688.6215'
EL: 138.027'
NC GRID NAD 83(2011)
COMBINED FACTOR: 0.99987487

HAUL ROAD

ALL EXISTING LOG CROSS VANES ARE TO BE REMOVED AND WASTED OFF SITE AND WILL BE REPLACED WITH ROCK CROSS VANES

GPS CONTROL POINT
REBAR & CAP SET
N: 603,833.6676'
E: 2,055,887.0069'
EL: 137.024'
NC GRID NAD 83(2011)

NC HIGHWAY 210 /401 SOUTHBOUND LANES

440.26' (GRID DIST.)

N 26°46'57" E

CONTRACTOR TO REMOVE THREE EXISTING ROCK CROSS VANES. ONLY RE-USE BOULDERS THAT ARE ANGULAR, WITH FLAT SIDES, THAT MEET THE BOULDER SIZE CRITERIA SPECIFIED IN THE ROCK CROSS VANE DETAIL.

SOUTHBOUND BRIDGE

SSMH RIM=134.28'
SSMH RIM=123.12'
SSMH RIM=119.12'
SSMH RIM=118.39'
SSMH RIM=117.20'
SSMH RIM=123.51'
STMH RIM=124.31' INV.=115.22'
STMH RIM=117.44' INV.=108.97' INV.=108.93'
DI TOP=116.78' INV.=109.25' INV.=109.13'
24" RCP INV.=108.58'

R/W
SS
FP
SIGN
GUARD RAIL
RIP RAP
WOODS

XS #1 LEP
XS #1 REP
XS #2 LEP
XS #2 REP
XS #3 LEP
XS #3 REP
XS #4 LEP
XS #4 REP
PP#1
PP#2
PP#3
PP#4

10+00
11+00
12+00
13+00
14+00
15+00
16+00

VEGETATION PLOT #1
VEGETATION PLOT #2

INV.=106.78'
INV.=106.80'
INV.=106.71'
INV.=106.88'
INV.=105.55'
INV.=105.51'
INV.=104.43'
INV.=106.39'
48" RCP
42" RCP

INSTALL FILTER FABRIC AND CLASS B STONE TO THE EXTENT NECESSARY TO ALLOW ACCESS

CAPE FEAR RIVER

EXISTING AERIAL 24" STEEL ENCASED SANITARY SEWER

BEGIN STREAM REPAIR STA. 10+00.00 TIE TO EXISTING GRADE. CONTRACTOR TO USE EXISTING STREAM ALIGNMENT FOR PROPOSED PROFILE AND GRADING.

CONTRACTOR TO REMOVE EXISTING BEAVER DAM

UT TO CAPE FEAR RIVER

END STREAM REPAIR STA. 16+05.82 TIE TO EXISTING 4-48" RCP

EXISTING SANITARY SEWER LINE
NOTE: PER THE PUBLIC WORKS DEPARTMENT OF HARNETT COUNTY, THERE IS NO DOCUMENTED EASEMENT FOR THIS SEWER LINE, AS IT IS ENTIRELY WITHIN THE BOUNDARY OF HARNETT COUNTY PROPERTY, OR NCDOT RIGHT-OF-WAY

CONTRACTOR TO STABILIZE EXISTING DRAINAGE SWALE WITH A WELL GRADED MIX OF CLASS A RIPRAP, CLASS B RIPRAP, AND NO.57 STONE. CONTRACTOR TO PROVIDE A STABLE TRANSITION TO THE STREAM CHANNEL.

PLACE COIR FIBER MATTING ALONG SIDES OF SWALE AS SHOWN IN THE "COIR FIBER MATTING DETAIL" AND THE "FLOODPLAIN INTERCEPTOR DETAIL"

EXISTING RIGHT OF WAY

TIE GRADING TO EXISTING TREE LINE

HARNETT COUNTY
D.B. 2147, PAGE 433
PIN # 0650-64-1818

CONTRACTOR TO STABILIZE EXISTING DRAINAGE SWALE WITH A WELL GRADED MIX OF CLASS A RIPRAP, CLASS B RIPRAP, AND NO.57 STONE. CONTRACTOR TO PROVIDE A STABLE TRANSITION TO THE STREAM CHANNEL.

PLACE COIR FIBER MATTING ALONG SIDES OF SWALE AS SHOWN IN THE "COIR FIBER MATTING DETAIL" AND THE "FLOODPLAIN INTERCEPTOR DETAIL"

BENCHMARK
BENCH TIE NAIL IN 12" HARDWOOD TREE
ELEV.=117.57'

ROCK SILL - SEE TABLE ON SHEET OSM-3A FOR STATION AND ELEVATION

EXISTING SANITARY SEWER LINE
SEE: D.B. 1792, PG. 553 & P.B. 2001, PG. 1312
NOTE: THESE DOCUMENTS REFER TO THE ORIGINAL LOCATION OF THIS LINE, PRIOR TO THE RELOCATION OF THE SOUTHBOUND LANES OF US 210/401