

ANNUAL REPORT FOR 2020



**UT to Fourth Creek
Iredell County
TIP No. I-3819A
USACE Action ID: 2005-31626
NCDWR Project #: 11-1044**



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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2020 at the UT to Fourth Creek Mitigation Site in Iredell County. The site was planted during April 2016 by the North Carolina Department of Transportation (NCDOT). The site was purchased and designated as stream mitigation for impacts associated with Transportation Improvement Program (TIP) number I-3819A which included improvements to the Interchange at I-40 and I-77 in Statesville. This report provides the monitoring results for the fourth formal year of monitoring (2020). The Year 2020 monitoring period is the fourth 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.

During the 2019 NCDOT annual monitoring report meeting, the resource agencies and NCDOT discussed the potential impacts to the UT to Fourth Creek mitigation site that might occur during construction of the I-3819B project. Permitting for I-3819B has now been completed and updated maps of the impacts to the site are now included in Appendix C. Through avoidance and minimization during the permitting phase of I-3819B, impacts to the stream footage were reduced from 210 linear feet to 61 linear feet of permanent stream impacts and 10 linear feet of temporary stream impacts with buffer impacts being reduced from a projected 5.99 acres to 2.40 acres at the site. Due to the reduction of buffer impacts in the planted area, NCDOT resumed vegetation monitoring on Plot #2 and Plot #3 in 2020.

Based on the overall conclusions of monitoring, the site has met the required monitoring protocols for the fourth formal year of monitoring. Based on the comparison of the monitoring data to the as-built, there is some aggradation in the downstream end of the reach, however the stream channel remains stable throughout the majority of the site at this time. The stream banks are heavily vegetated for the fourth year of monitoring however the buffer area around vegetation plots 2 and 3 have shown poor tree survival. A supplemental planting of 2.2 acres in this area is planned for 2021.

NCDOT will continue stream and vegetation monitoring at the UT to Fourth Creek Mitigation Site in 2021.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2020 at the UT to Fourth Creek Mitigation Site. The site is situated directly North-East of the I-40 and I-77 interchange (see Figure 1). The site was constructed to provide mitigation for stream impacts associated with construction of TIP number I-3819A. The site is composed of one reach of an Unnamed Tributary (UT) to Fourth Creek.

The mitigation project includes 2,294 linear feet of stream enhancement and 6.37 acres of stream buffer in the north-east quadrant of the I-40/I-77 interchange. The site was established with cattle fenced out in February 2016 by NCDOT. Stream enhancement involved restricting livestock access by fencing along the boundary of the site, live staking banks, and planting of bareroot seedlings in the buffer. A supplemental planting of the site occurred in April 2018.

1.2 Purpose

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

1.3 Project History

January 2016	Reforestation Completed
September 2016	As-Built Survey Completed
September 2016	Vegetation Monitoring (Year 1)
December 2016	Stream Channel Monitoring (Year 1)
March 2018	Mowed and Sprayed Southwest Buffer
April 2018	Supplemental Buffer Planting
July 2018	Vegetation Monitoring (Year 2)
December 2018	Stream Channel Monitoring (Year 2)
August 2019	Vegetation Monitoring (Year 3)
September 2019	Stream Channel Monitoring (Year 3)
August 2020	Vegetation Monitoring (Year 4)
October 2020	Stream Channel Monitoring (Year 4)

1.4 Debit Ledger

The entire UT to Fourth Creek stream mitigation site was used at a 2:1 ratio for the I-3819A project to compensate for unavoidable stream impacts.

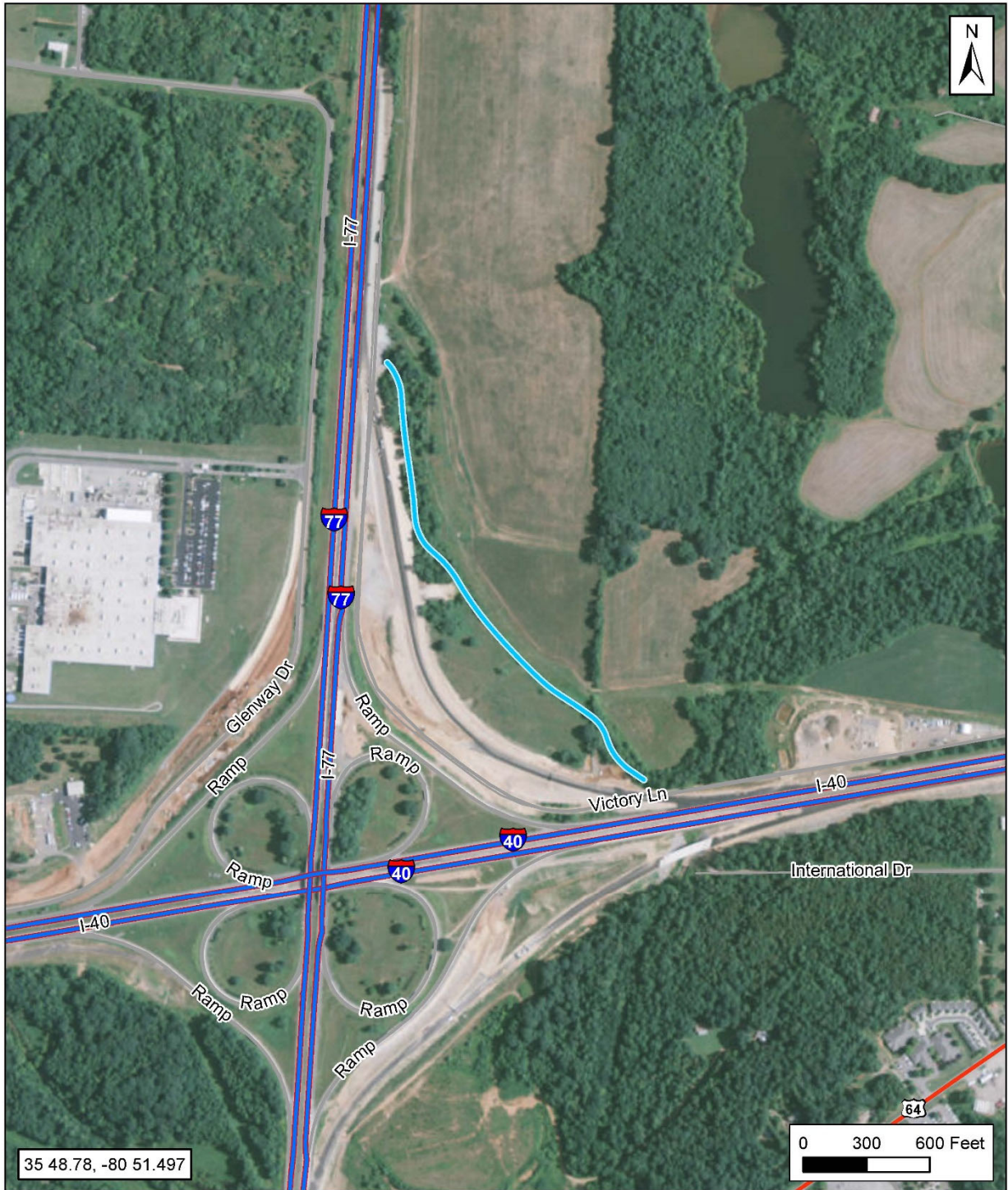


Figure 1: Project Vicinity Map
 I-3819A Stream Mitigation
 Interchange at I-40 and I-77 in Statesville
 Iredell County, SC

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 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. A longitudinal profile survey shall not be conducted. The entire length of the stream enhancement will be investigated for channel stability. 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 four staked survival plots. Plots 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 2,294 linear feet of stream enhancement in the north-east quadrant of the I-40/I-77 interchange. The site was established, and cattle fenced out in February 2016 by NCDOT. Stream enhancement involved restricting livestock access by fencing along the boundary of the site, live staking banks, and planting of bareroot seedlings in the buffer.

2.2.2 Monitoring Conditions

The objective of the UT to Fourth Creek mitigation site was to improve water quality, habitat, and hydrology by removing degrading factors and protecting the system from further impacts. For this report, only the riffle cross sections were used in the comparison of channel morphology in Table 1.

Table 1. Abbreviated Morphological Summary
UT to Fourth Creek Cross Sections #1 and #3

Variable	As-built		Monitoring Year 1 - 2016		Monitoring Year 2 - 2018		Monitoring Year 3 - 2019		Monitoring Year 4 – 2020		Monitoring Year 5 – 2021	
	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)	--	--					--	--				
Bankfull Width (ft)	6.57	3.17	5.36	3.46	6	6.14	5.77	4.46	5.87	4.86		
Bankfull Mean Depth (ft)	1.07	0.62	1.14	0.68	1.35	0.33	1.21	0.91	1.53	0.73		
Width/Depth Ratio	6.14	5.11	4.7	5.09	4.44	18.61	4.77	4.9	3.84	6.66		
Bankfull Cross Sectional Area (ft ²)	7.01	1.96	6.1	2.35	8.11	2.04	6.96	4.05	8.96	3.57		
Maximum Bankfull Depth (ft)	1.45	0.83	1.49	0.91	1.98	0.75	1.56	1.27	2.14	1.04		
Floodprone Area (ft)	16.45	23.72	16.44	29.31	19.37	25.76	15.35	37.06	20.29	37.57		
Entrenchment Ratio	2.5	7.49	3.07	8.48	3.23	4.2	2.66	8.31	3.46	7.73		

*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 along the UT to Fourth Creek mitigation site established by NCDOT. The four cross sections were established during the 2016 as-built survey/monitoring. Cross sections were established at locations where they would represent the various channel dimensions that exist along the existing alignment so that they could be monitored for stability. The locations of the cross sections are presented below and shown in Appendix C.

- ◆ Cross Section #1: UT to Fourth Creek (most upstream), midpoint of riffle
- ◆ Cross Section #2: UT to Fourth Creek, midpoint of pool
- ◆ Cross Section #3: UT to Fourth Creek, midpoint of riffle
- ◆ Cross Section #4: UT to Fourth Creek (most downstream), midpoint of pool

Based on visual assessment and comparisons of the as-built plans to MY4 monitoring data, the channel and all four cross sections appear stable at time of survey. Graphs of the cross sections are presented in Appendix A. Cross section's #3 and #4 continue to show some aggradation of both the channel and floodplain due to flattening of the valley slope and deposition of sediment from upstream. Photo points at the vegetation plots presented in Appendix B show steady growth of herbaceous and woody vegetation. Pebble counts were not required per the permit conditions and therefore were not completed. All other monitoring activities will continue to be completed by NCDOT throughout the five-year monitoring period.

3.0 VEGETATION: UT TO FOURTH CREEK MITIGATION SITE (YEAR 4 MONITORING)

3.1 Success Criteria

Mitigation Plan: Success for vegetation monitoring within the riparian buffer is based on the survival of at least 260 stems of five year old trees at year five. Vegetation monitoring will consist of counts of planted stems within a minimum of four 50 x 50 foot plots established within the riparian buffer area.

3.2 Description of Species

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

Cephalanthus occidentalis, Buttonbush

Cornus amomum, Silky Dogwood

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

Liriodendron tulipifera, Yellow Poplar

Platanus occidentalis, American Sycamore

Quercus rubra, Northern Red Oak

Quercus alba, White Oak

Juglans nigra, Black Walnut

Betula nigra, River Birch

3.3 Results of Vegetation Monitoring

Plot #	Yellow Poplar	Sycamore	Northern Red Oak	White Oak	Black Walnut	River Birch	Total (Year 4)	Total (at planting)	Density (Trees/Acre)
1	2	25			5	2	34	34	680
2	1	8	1		3		13	47	188
3							0	50	0
4		31		2		4	37	40	629
Year 4 Average Density (Trees/Acre)									374
Year 3 Average Density (Trees/Acre)									655
Year 2 Average Density (Trees/Acre)									655
Year 1 Average Density (Trees/Acre)									162

Site Notes: Buttonbush and silky dogwood live stakes that were planted along the streambank and noted during the monitoring evaluation were surviving. Other vegetation noted onsite included briars, goldenrod, pokeberry, black willow, elderberry, soft rush, *Scirpus* sp., jewelweed, tearthumb, fescue, red maple and various grasses.

3.4 Conclusions

All vegetation monitoring plots were monitored in Year 4. Vegetation Plots 2 and 3 are now included in the Year 4 monitoring evaluation. Once the I-3819B permit drawings were finalized, it was determined that this portion of the buffer would not be impacted and should be included in future monitoring reports. There are a total of 4 vegetation monitoring plots established throughout the buffer enhancement area. The 2020 vegetation monitoring of the site revealed an average tree density of 374 trees per acre. This average is above the minimum success criteria of 260 trees per acre for Year 4 but, Plots 2 and 3 are showing very low tree survival.

The April 2018 supplemental buffer planting did not include the area surrounding Plots 2 and 3, per the low stem count in 2020. NCDOT proposes to complete a supplemental planting of 2.2 acres in 2021 (see attached Supplemental Planting Map) to increase the survival rates within this area and continue vegetation monitoring in 2021.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

The UT to Fourth Creek Mitigation Site has met the required monitoring protocols for the fourth formal year of monitoring. Based on comparisons of the as-built plans to the MY4 monitoring data and visual assessment, the channel and all four cross sections appear stable with only some minor localized bank erosion occurring. The stream buffer planting is meeting the required planting vegetation success criteria of 260 trees per acre by achieving an average tree density of 374 trees per acre. While this meets success criteria, vegetation plots 2 and 3 have shown poor tree survival. A supplemental planting of 2.2 acres is planned for 2021.

NCDOT will continue stream and vegetation monitoring at the UT to Fourth Creek Mitigation Site in 2021.

5.0 REFERENCES

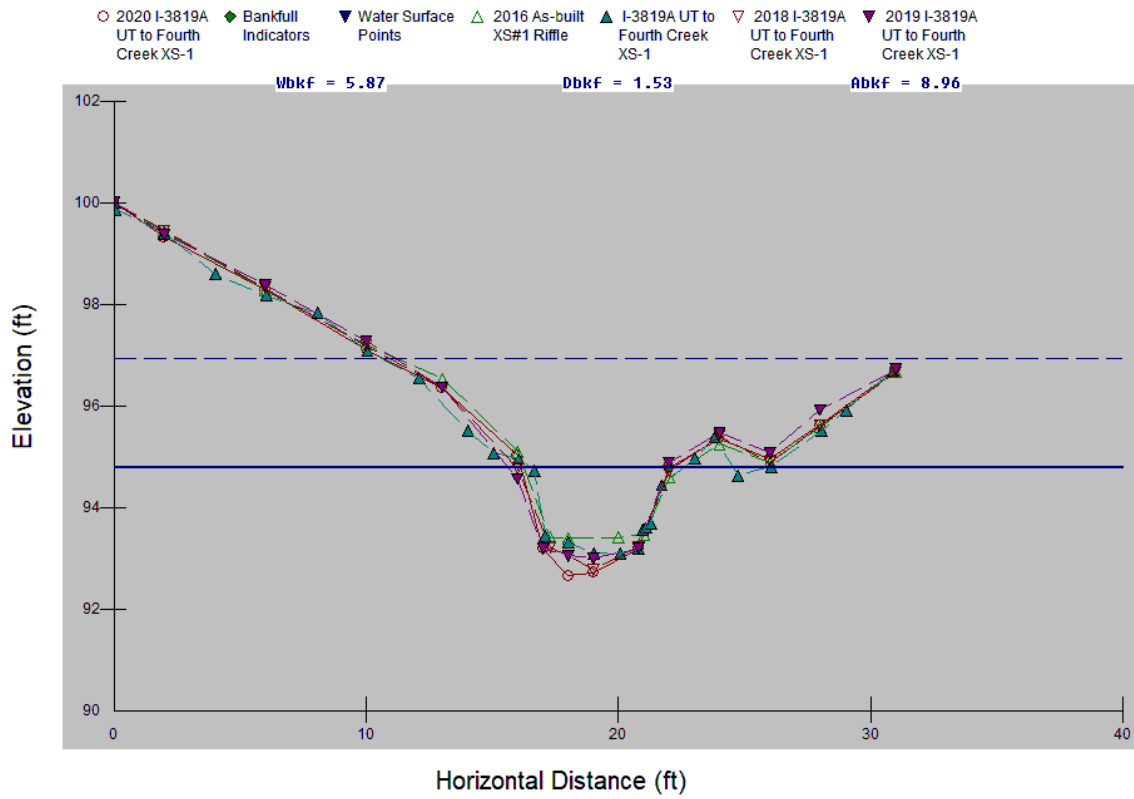
On-Site Stream Mitigation Plan, Interchange at I-40 and I-77 in Statesville; Iredell County, NC, T.I.P. Number I-3819A, WBS No: 34192.1.2, February 15, 2012.

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.

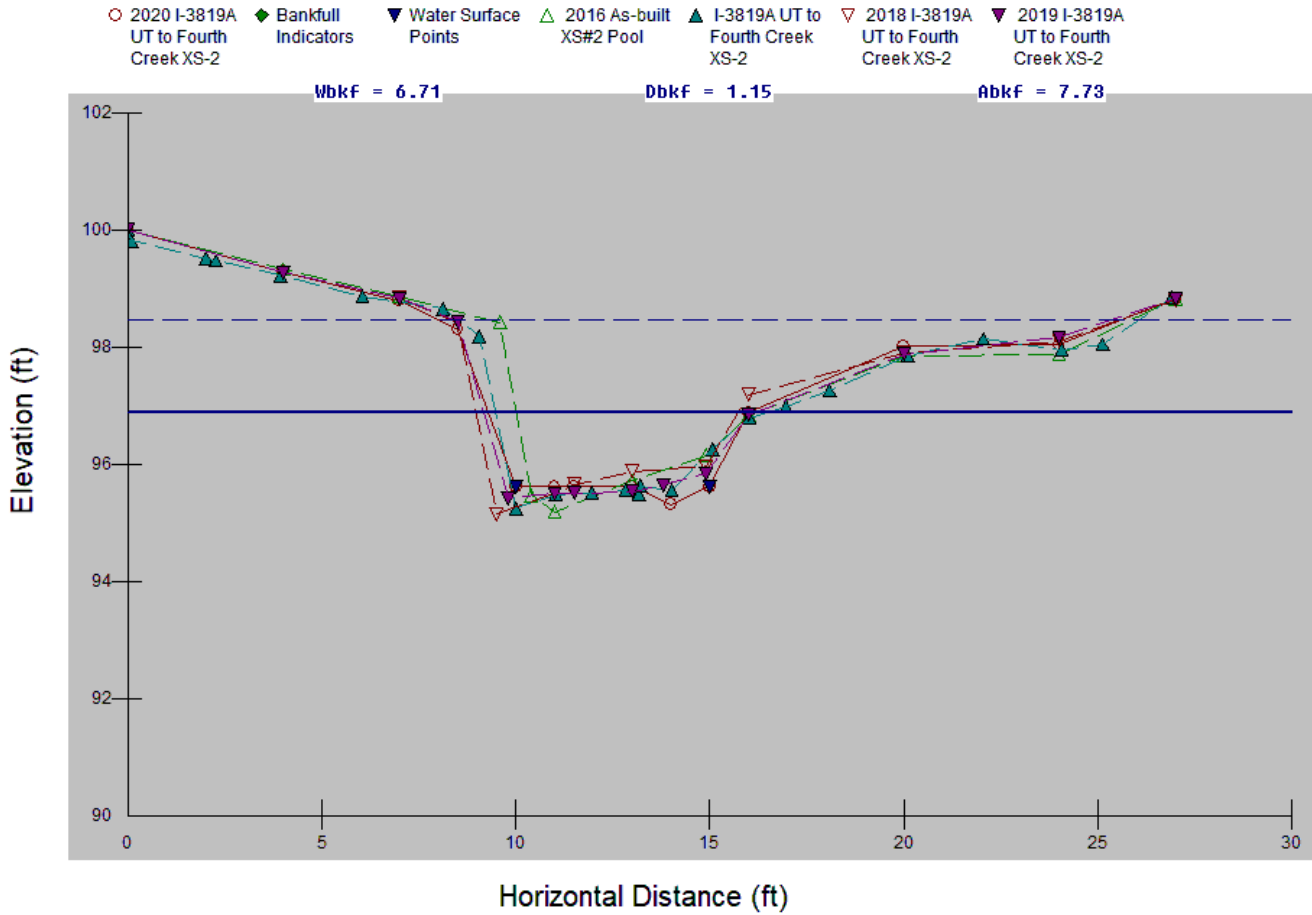
APPENDIX A
CROSS SECTION COMPARISONS

2020 I-3819A UT to Fourth Creek XS-1



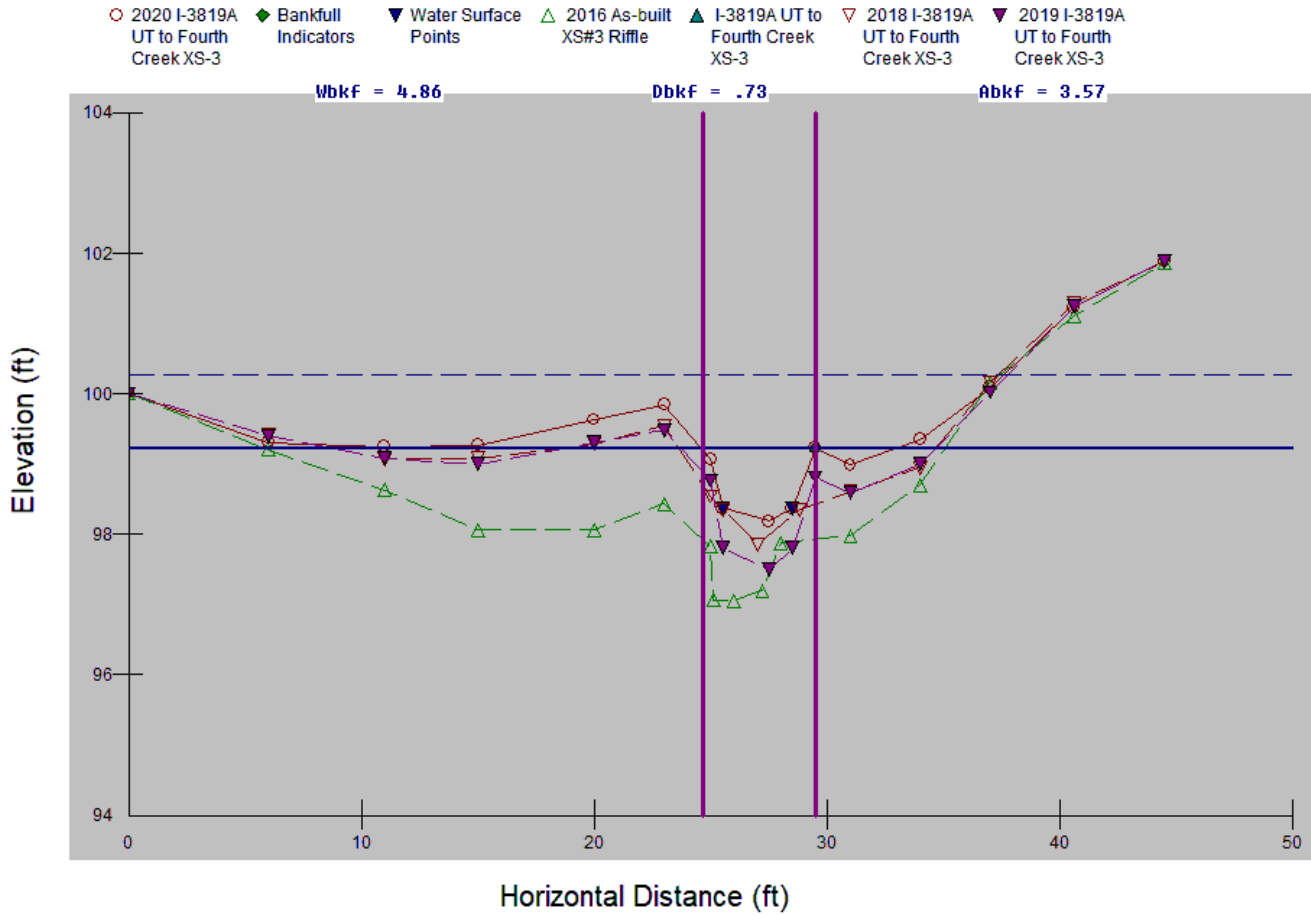
Cross-Section #1 (Riffle) Abbreviated Morphological Summary					
	2016	2018	2019	2020	2021
Bankfull Width (ft.)	5.36	6.0	5.77	5.87	
Bankfull Mean Depth (ft.)	1.14	1.35	1.21	1.53	
Width/Depth Ratio	4.7	4.44	4.77	3.84	
Bankfull Cross Sectional Area (ft ²)	6.1	8.11	6.96	8.96	
Maximum Bankfull Depth (ft.)	1.49	1.98	1.56	2.14	
Width of the Floodprone Area (ft.)	16.44	19.37	15.35	20.29	
Entrenchment Ratio	3.07	3.23	2.66	3.46	

2020 I-3819A UT to Fourth Creek XS-2



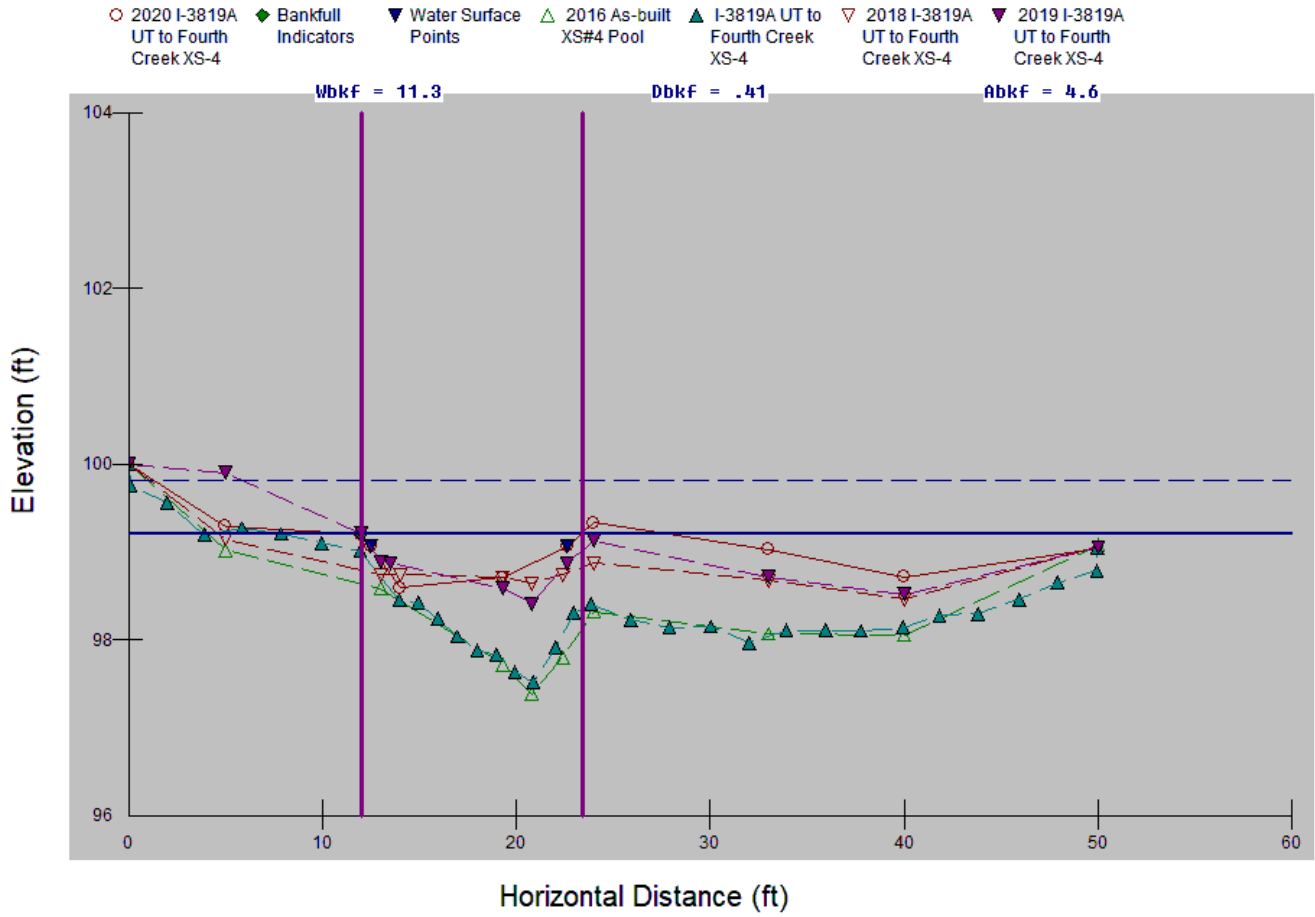
Cross-Section #2 (Pool) Abbreviated Morphological Summary					
	2016	2018	2019	2020	2021
Bankfull Cross Sectional Area (ft ²)	12.08	9.48	7.51	7.73	
Bankfull Mean Depth (ft.)	1.30	1.33	1.1	1.15	
Maximum Bankfull Depth (ft.)	2.45	2.04	1.42	1.57	
Bankfull Width (ft.)	7.53	7.12	6.81	6.71	

2020 I-3819A UT to Fourth Creek XS-3



Cross-Section #3 (Riffle) Abbreviated Morphological Summary					
	2016	2018	2019	2020	2021
Bankfull Width (ft.)	3.46	6.14	4.46	4.86	
Bankfull Mean Depth (ft.)	0.68	0.33	0.91	0.73	
Width/Depth Ratio	5.09	18.61	4.9	6.66	
Bankfull Cross Sectional Area (ft²)	2.35	2.04	4.05	3.57	
Maximum Bankfull Depth (ft.)	0.91	0.75	1.27	1.04	
Width of the Floodprone Area (ft.)	29.31	25.76	37.06	37.57	
Entrenchment Ratio	8.48	4.20	8.31	7.73	

2020 I-3819A UT to Fourth Creek XS-4



Cross-Section #4 (Pool) Abbreviated Morphological Summary					
	2016	2018	2019	2020	2021
Bankfull Cross Sectional Area (ft ²)	3.93	1.75	4.58	4.6	
Bankfull Mean Depth (ft.)	0.45	0.13	0.39	0.41	
Maximum Bankfull Depth (ft.)	0.90	0.41	0.72	0.61	
Bankfull Width (ft.)	8.82	13.6	11.75	11.33	

APPENDIX B
SITE PHOTOGRAPHS

I-3819A UT to Fourth Creek

Photo Point 1 Upstream-XS 1



Photo Point 1 Downstream-XS 1



Photo Point 2 Upstream-XS 2



Photo Point 2 Downstream-XS 2



Photo Point 3 Upstream



Photo Point 3 Downstream



Photo Point 4 Upstream



Photo Point 4 Downstream



I-3819A UT to Fourth Creek

Photo Point 5 Upstream



Photo Point 5 Downstream



Photo Point 6 Upstream-XS 3



Photo Point 6 Downstream-XS 3



Photo Point 7 Upstream-XS 4



Photo Point 7 Downstream-XS 4



UT to Fourth Creek



Vegetation Plot #1



Vegetation Plot #2



Vegetation Plot #3



Vegetation Plot #4



Streambank Vegetation



Streambank Vegetation

APPENDIX C

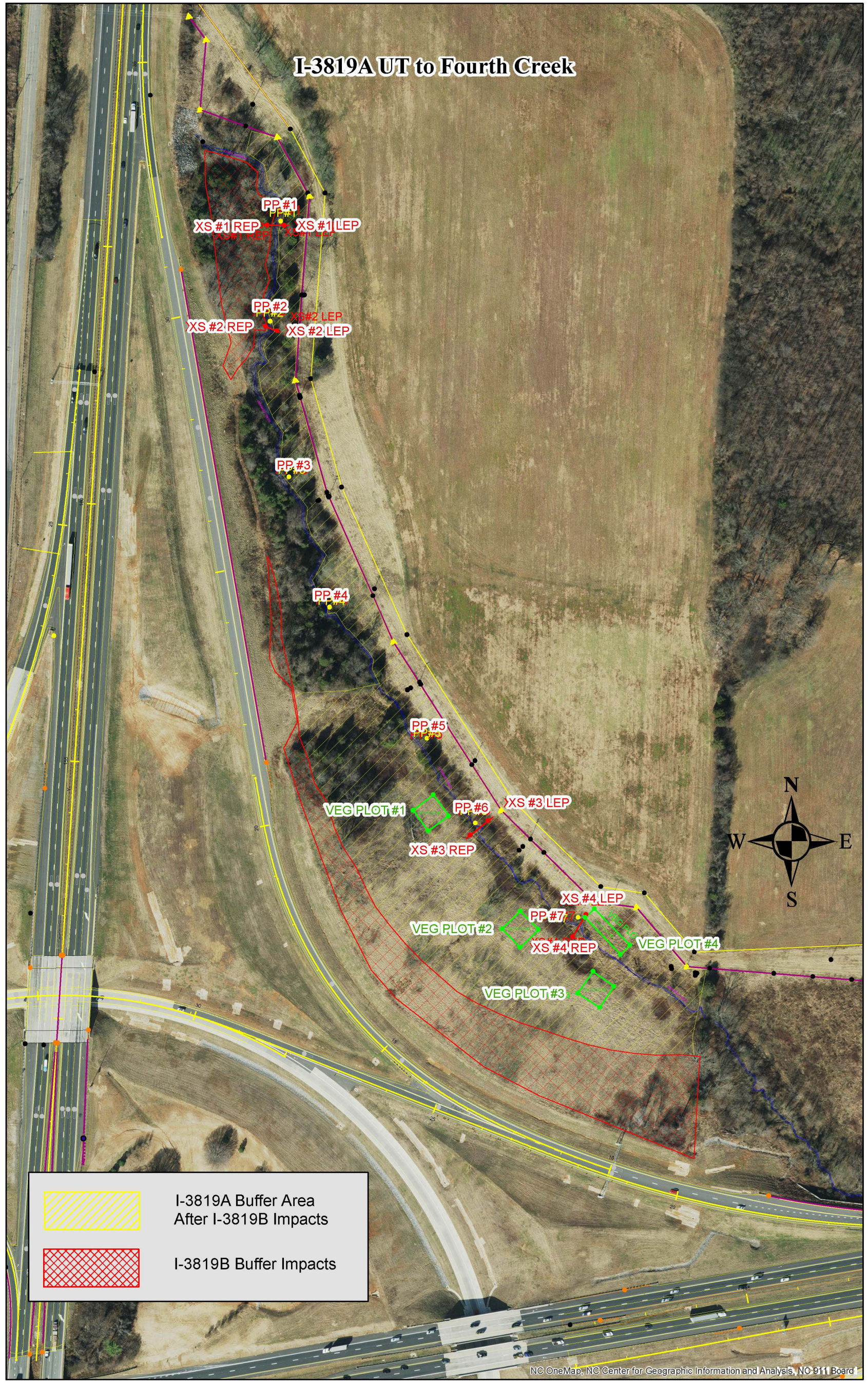
CROSS SECTION, VEGETATION PLOT & PHOTO POINT LOCATIONS (AS-BUILT PLANS)





NC Center for Geographic Information & Analysis

	<p>Supplemental Planting Map I-3819A UT to Fourth Creek Mitigation Site Iredell County, North Carolina</p>	
<p>0 600 1,200 2,400 Feet</p>		

I-3819A UT to Fourth Creek



	I-3819A Buffer Area After I-3819B Impacts
	I-3819B Buffer Impacts