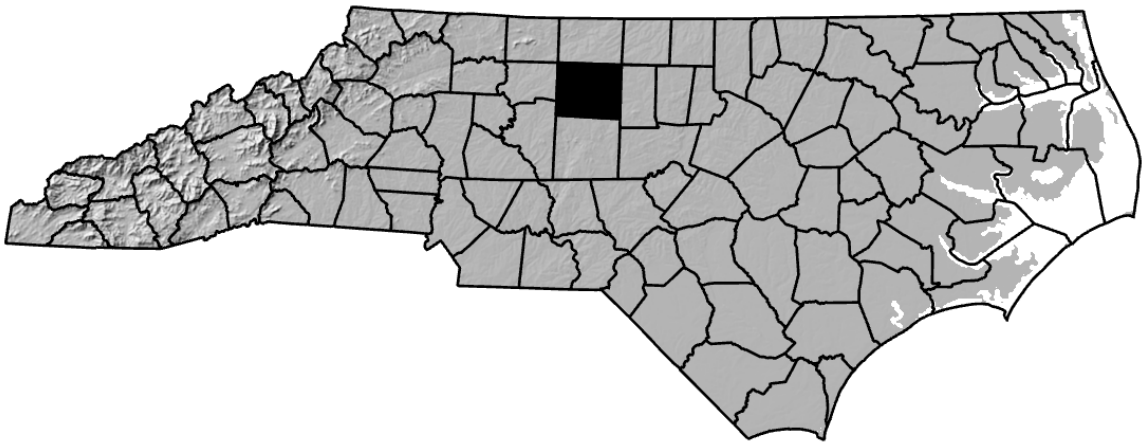
ANNUAL REPORT FOR 2023



U-2579BA Smith Creek
Forsyth County
TIP No. U-2579BA&B
USACE Action ID: SAW-2008-03183
DWR Project #: 20140090 v7

Prepared By:
Environmental Analysis Unit & Roadside Environmental Unit
North Carolina Department of Transportation
December 2023

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SUMMARY

The following report summarizes the stream monitoring activities that have occurred during 2023 at Smith Creek adjacent to the US 421 widening project in Forsyth County. The site was constructed during 2022 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-2579BA and was planted in January 2023. This report provides the monitoring results for the first formal year of monitoring of the required 5 years. (Year 2023). The Year 2023 monitoring period is the first of five scheduled years of monitoring (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring at Smtih Creek, the stream site remains stable at this time. The stream bank buffer is well vegetated for the first year of monitoring with an average density of 442 trees per acre surviving.

NCDOT will continue stream monitoring at the U-2579BA Smith Creek mitigation site in 2024.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during 2023 at the U-2579BA Smith Creek mitigation site. The site is located adjacent to US 421 east of the Winston-Salem Northern Beltway (see Figure 1). The site was constructed to provide mitigation for stream impacts associated with construction of TIP number U-2579BA. The site is includes of a reach of Smith Creek and an UT to Smith Creek adjacent to the newly widened roadway project.

The mitigation project includes 2,471 linear feet of stream relocation including 2,127 linear feet of Smith Creek and 344 linear feet for the Unnamed Tributary to Smith Creek. Construction was completed in November 2022 by NCDOT. The stream relocation involved the installation of rock cross vanes, constructed rock and roll riffles, construction of a new stream channel and construction of the floodplain through the relocated reach 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 2023 at the U-2579BA Smith Creek mitigation site. Hydrologic monitoring was not required for this site.

1.3 Project History

November 2022	Stream Relocation Construction Completed
January 2023	Planted Live Stakes and Bareroot Seedlings
January 2023	As-Built Survey Completed
August 2023	Vegetation Monitoring (Year 1)
November 2023	Stream Channel Monitoring (Year 1)

1.4 Debit Ledger

The entire U-2579BA Smith Creek stream mitigation site was used for the U-2579BA project to compensate for unavoidable stream impacts.

Figure 1: Project Vicinity Map

U-2579BA Smith Creek Fishponds Site - Stream Relocation

Forsyth County, NC

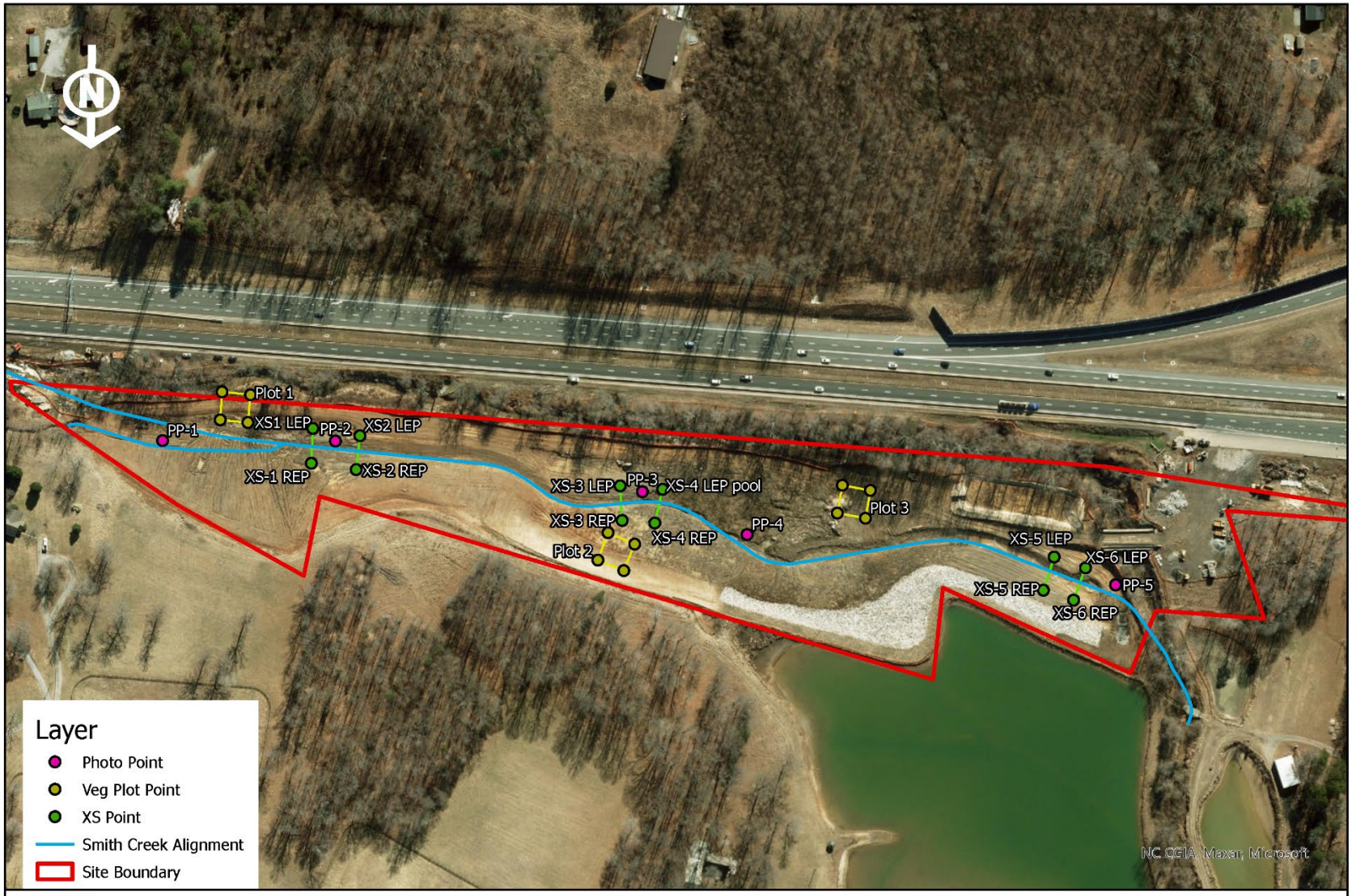


Figure 2: Site Monitoring Features

U-2579BA Smith Creek Fishponds Site - Stream Relocation
Forsyth County, NC

0 100 200
US Feet

2.0 STREAM ASSESSMENT

2.1 Success Criteria

Stream Assessment Success Criteria

The stream relocation 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 six (6) different locations along the relocated stream (three riffles and three 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 cover a cumulative total of approximately 2,471 linear feet of channel (2,127' for Smith Creek and 344' for the unnamed tributary). 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. If success criteria is not being met, remedial measures will be coordinated with resource agencies. The monitoring shall be conducted annually for a minimum of five (5) years after final planting. The monitoring results shall be submitted to resource agencies in a final report within sixty (60) days after completing monitoring. After 5 years, the NCDOT shall contact resource agencies to schedule a site visit to "close out" the mitigation site if the site has met success criteria. If success is not met, NCDOT will make necessary adjustments to the site or pay mitigation fees to cover the impacts.

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 three (3) 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 ft^2. 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.

Appropriate measures will be taken to control nuisance vegetation during the monitoring period if it affects the success of the planted vegetation.

2.2 Stream Description

2.2.1 Post-Construction Conditions

The mitigation project covers approximately 2,471 linear feet of stream relocation (2,127' for Smith Creek and 344' for the unnamed tributary). Construction was completed in November 2022 by NCDOT. The stream relocation involved the installation of rock cross vanes, constructed riffles, construction of a new stream channel and construction of the floodplain through the relocated reach 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 Smith Creek restoration site was to build a C5 stream type as identified in Rosgen's Applied River Morphology. A total of six cross sections (three riffles and three pools) were surveyed. For this report, only the riffle cross sections were used in the comparison of channel morphology in Table 1.

2.3 Results of the Stream Assessment

Table 1.0 Abbreviated Morphological Summary

Table 1. Abbreviated Morphological Summary for Riffles								
U-2579BA Smith Creek Fishponds Site - Cross Sections 1,3,5								
Variable	**Proposed**	**As-Built Avg.**	**As-Built Range**	**XS-1**	**XS-3**	**XS-5**	**MY1 Avg.**	**MY1 Range**
Drainage Area (mi^2)	**3.61**							
Floodprone Width (ft)	**258.8**	**49.8**	**34.8-60.0**	**38.0**	**50.2**	**60.0**	**49.4**	**38.0-60.0**
Bankfull Width (ft)	**28.8**	**21.0**	**18.8-22.5**	**19.4**	**20.0**	**22.0**	**20.5**	**19.4-22.0**
Entrenchment Ratio	**9.0**	**2.3**	**1.9-2.7**	**2.0**	**2.5**	**2.7**	**2.4**	**2.0-2.7**
Bankfull Mean Depth (ft)	**1.6**	**1.1**	**0.8-1.4**	**1.2**	**0.8**	**1.5**	**1.2**	**0.8-1.5**
Maximum Bankfull Depth (ft)	**2.3**	**1.7**	**1.3-2.2**	**1.7**	**1.1**	**2.2**	**1.7**	**1.1-2.2**
Width/Depth Ratio	**17.7**	**19.7**	**15.9-26.0**	**15.9**	**25.4**	**14.5**	**18.6**	**14.5-25.4**
Bankfull Cross Sectional Area (ft2)	**46.8**	**23.6**	**18.3-31.9**	**23.6**	**15.9**	**33.6**	**24.4**	**15.9-33.6**

*Drainage Area, Floodprone Width, and Slope are averaged values only.
*Riffle values are used for classification purposes.

2.3.1 Site Data

The assessment included the survey of 6 cross sections and the longitudinal profile of U-2579BA Smith Creek main channel and unnamed tributary to Smith Creek. The length of the surveyed profile along the main channel was approximately 2100 linear feet. The length of the surveyed profile along the UT was approximately 369 linear feet. Six cross sections were established during the 2022 as-built survey following site completion. 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 Figure 2.

- Cross Section #1: Station 15+32 linear feet, mid-point rock and roll riffle
- Cross Section #2: Station 15+15 linear feet, mid-point pool
- Cross Section #3: Station 20+91 linear feet, mid-point riffle
- Cross Section #4: Station 21+71 linear feet, mid-point pool
- Cross Section #5: Station 28+87 linear feet, mid-point rock and roll riffle
- Cross Section #6: Station 29+31 linear feet, mid-point pool

Based on visual assessment and comparisons of the as-built, MY1 (2023), the riffle cross sections are all stable and within expected thresholds for a C5 type stream. Sediment level in the pools is fluctuating as the stream is actively conveying sediment through the system. Pebble counts were not required per the permit conditions and therefore were not completed. The longitudinal profile survey was conducted from Sta. 09+25 through 30+25, stopping at the approximate limits of DOT ROW.

There was evidence of at least one bankfull event having occurred during the 2023 monitoring year by presence of matted vegetation and wrack lines. NCDOT will continue stream monitoring in 2024.

3.0 VEGETATION MONITORING: SMITH CREEK (YEAR 1)

3.1 Description of Species

The following tree species were planted on the stream bank:

Salix nigra, Black Willow

Sambucus canadensis, Elderberry

Cornus amomum, Silky Dogwood

The following tree species were planted in the buffer area:

Betula nigra, River Birch

Cornus amomum, Silky Dogwood

Platanus occidentalis, Sycamore

Liriodendron tulipifera, Yellow Poplar

Quercus lyrata, Overcup Oak

Quercus phellos, Willow Oak

Quercus michauxii, Swamp Chestnut Oak

Fraxinus pennsylvanica, Green Ash

3.2 Results of Vegetation Monitoring

Plot #	River Birch	Silky Dogwood	Sycamore	Yellow Poplar	Overcup Oak	Willow Oak	Swamp Chestnut Oak	Green Ash	Total (Year 1)	Total (at planting)	Density (Trees/Acre)
1		16				8	10		34	44	525
2	5		10	6	7				28	54	353
3	1	3		1	1	2	20	1	29	44	448
Year 1 Average Density (Trees/Acre)											**442**

Site Notes: Black willow and silky dogwood live stakes were noted surviving throughout the stream project. Other species noted onsite included *Scirpus* sp., jewelweed, alder, lespedeza, sweetgum, tear-thumb and various grasses. A wrack line was observed along the channel indicating a bankfull event had recently occurred.

3.3 Conclusions

There are a total of three vegetation monitoring plots established throughout the buffer area. The 2023 vegetation monitoring of the site revealed an average tree density of 442 trees per acre. This average is above the minimum success criteria of 320 trees per acre for Year 1. Due to the lower tree density average for Year 1, NCDOT will complete supplemental planting during the 2023/2024 planting window.

4.0 Overall Conclusions and Recommendations

The U-2579BA Smith Creek site has met the required stream and vegetation monitoring protocols for the first formal year of monitoring. Based on comparing the monitoring data to the as-built, the stream channel remains stable at this time. The stream bank buffer is well vegetated for the first year of monitoring with an average density of 442 trees per acre surviving.

NCDOT will continue stream and vegetation monitoring at the U-2579BA Smith Creek mitigation site in 2024.

5.0 References

On-Site Stream Mitigation Plan for U-2579BA NC 68 Connector from SR 2011 to the Haw River; Guilford County, NC, T.I.P. Number U-2579BA, WBS No's: 34429.1.1, 34429.2.2, 34429.2.3, June 25, 2013.

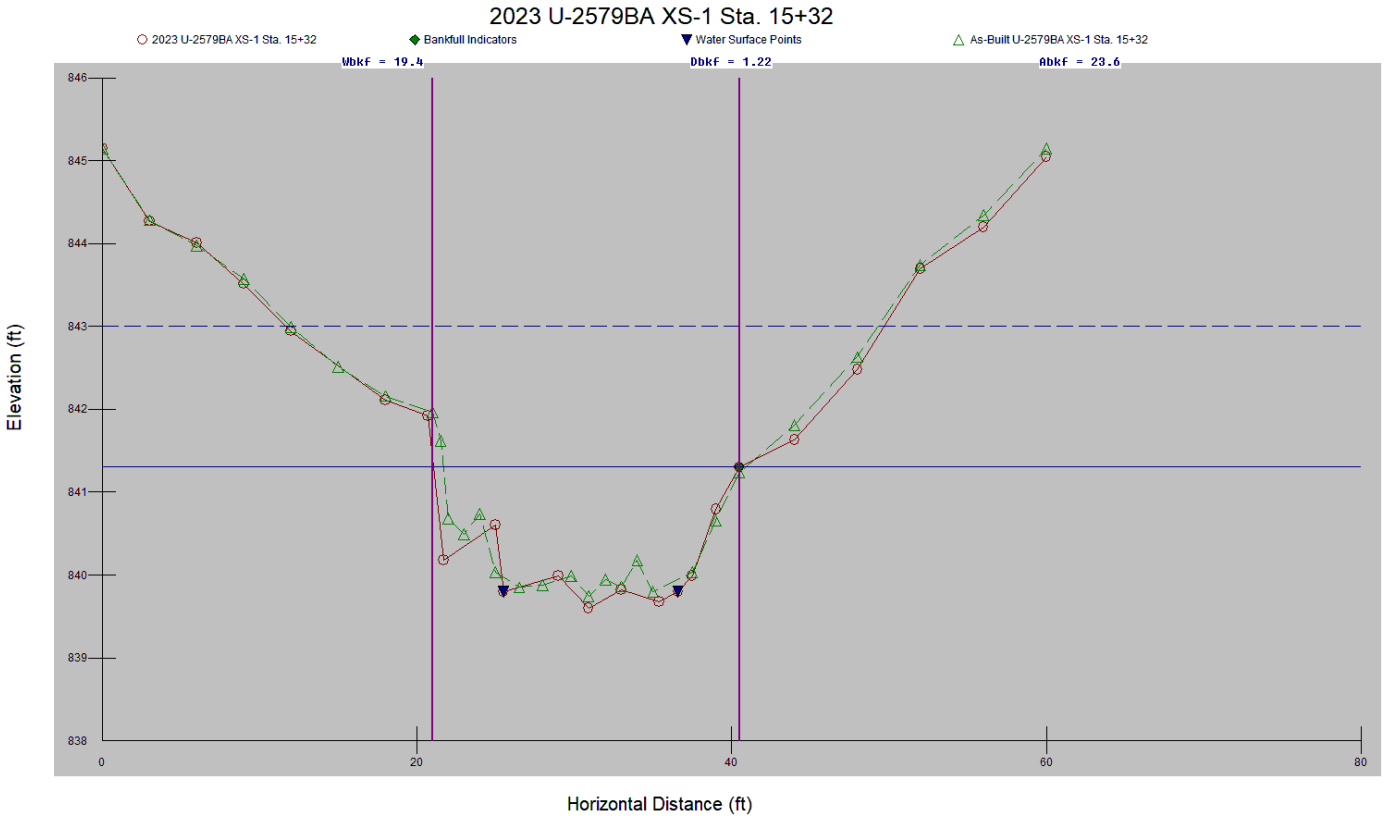
As-Built Report/Record Drawings for U-2579BA Smith Creek Mitigation Site, Forsyth County, NC, September 28, 2016.

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

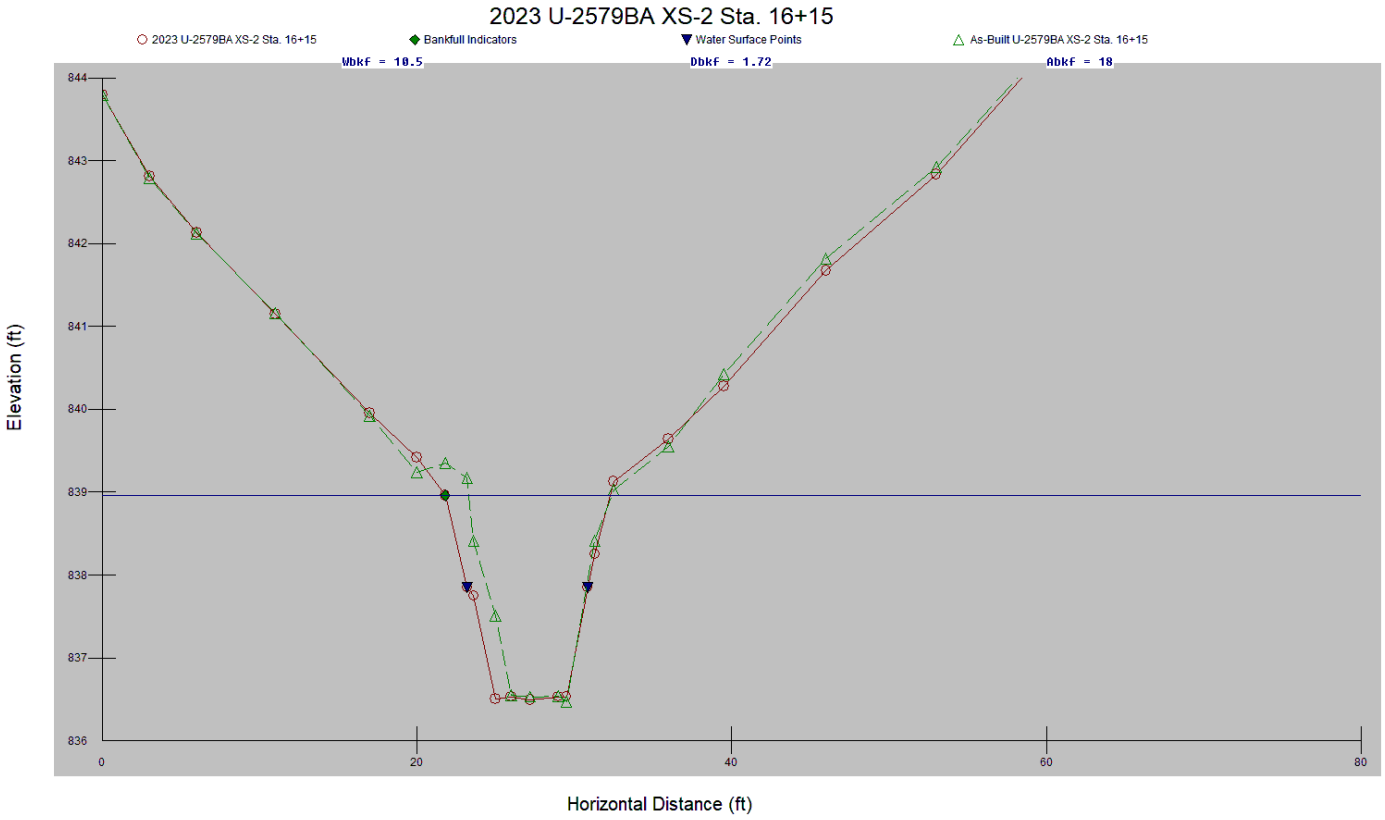
US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

APPENDIX A

CROSS SECTION COMPARISONS
&
LONGITUDINAL PROFILE

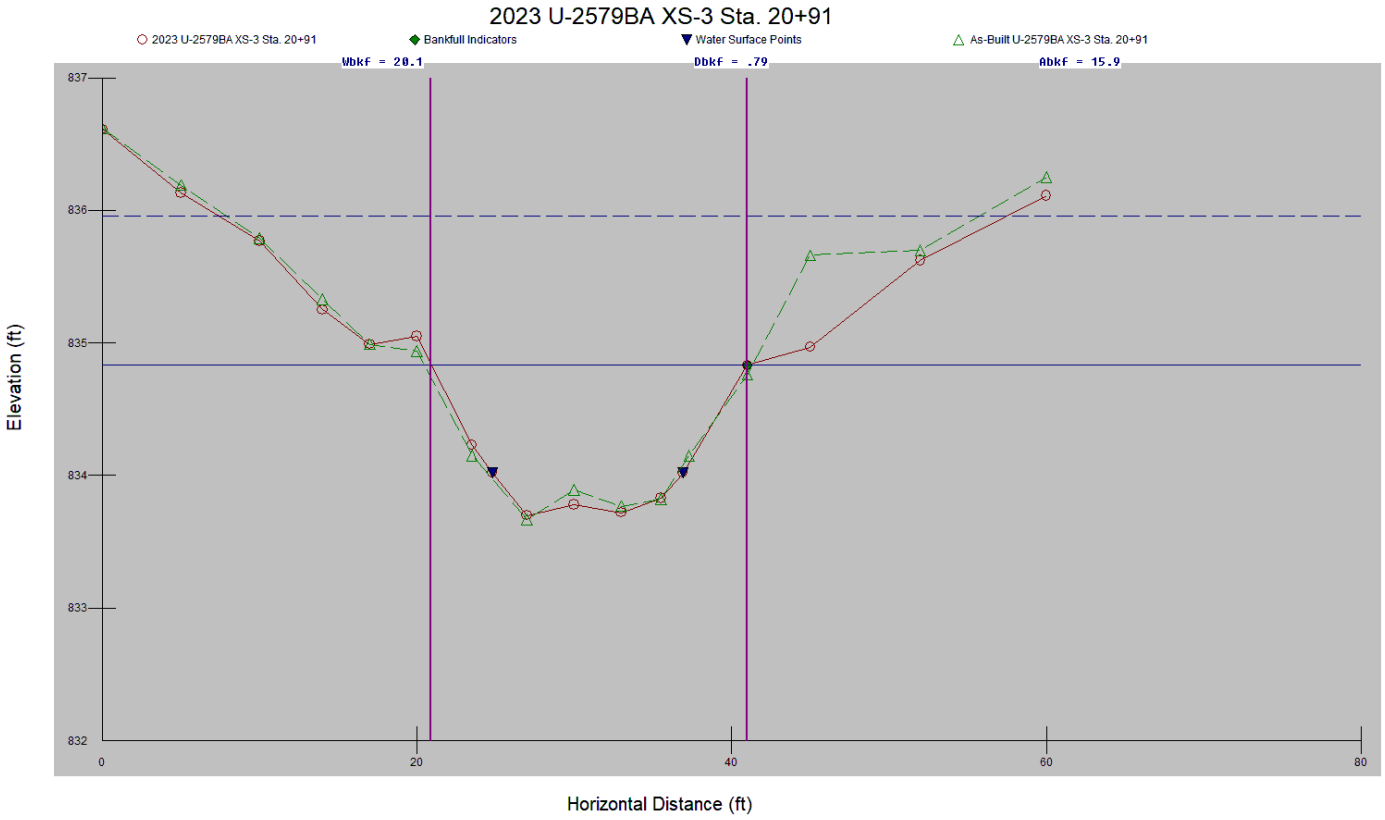


U-2579BA Smith Creek (Fishponds): Cross-Section #1 (Riffle) Abbreviated Morphological Summary						
Variable	**As-built**	**MY1 (2023)**	**MY2 (2024)**	**MY3 (2025)**	**MY4 (2026)**	**MY5 (2027)**
Width of the Floodprone Area (ft)	**34.83**	**38.0**				
Bankfull Width (ft)	**18.8**	**19.4**				
Entrenchment Ratio	**1.85**	**2.0**				
Bankfull Mean Depth (ft)	**1.09**	**1.2**				
Maximum Bankfull Depth (ft)	**1.5**	**1.7**				
Width/Depth Ratio	**17.25**	**15.9**				
Bankfull Cross Sectional Area (ft_2)	**20.53**	**23.6**				

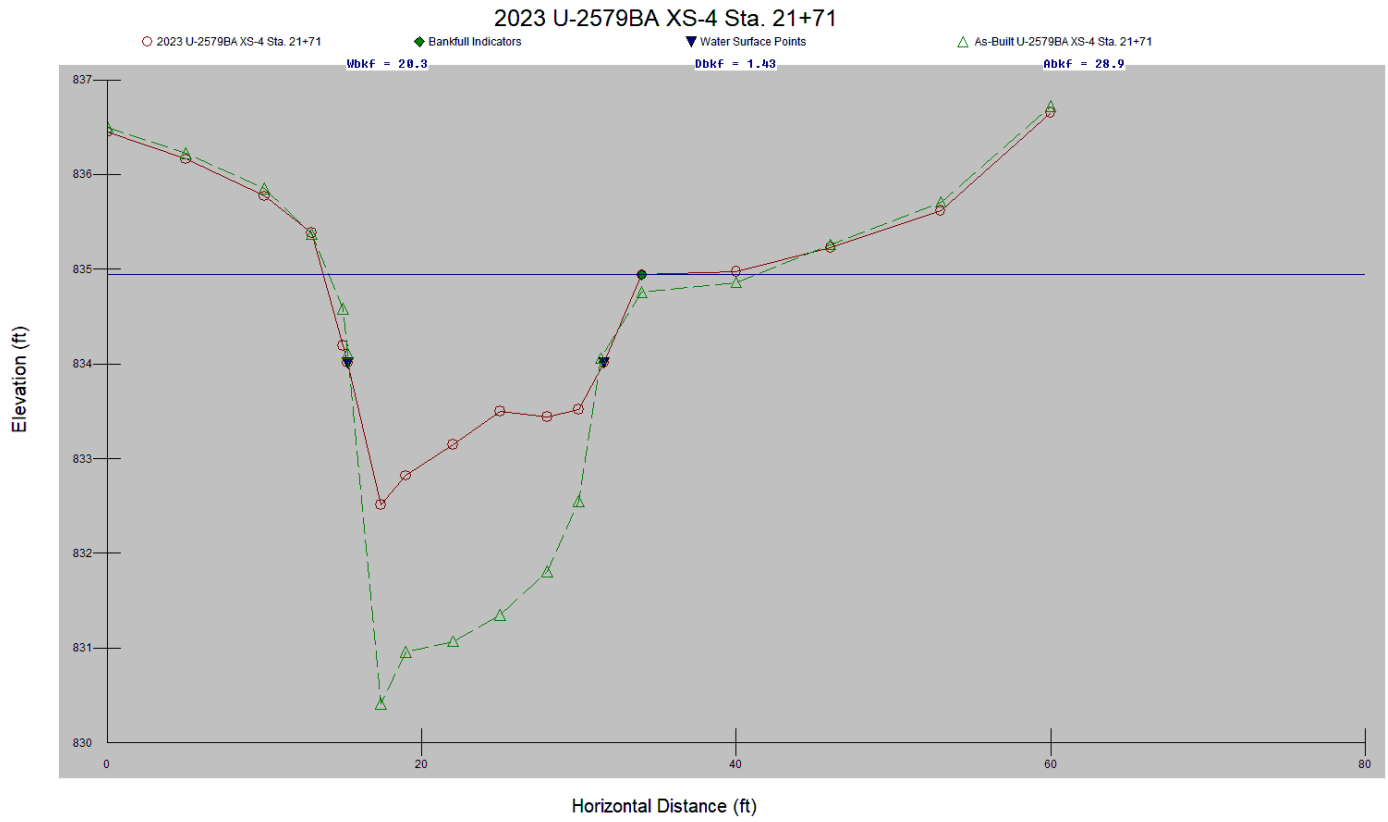


U-2579BA Smith Creek (Fishponds): Cross-Section #2 (Pool) Abbreviated Morphological Summary						
Variable	**As-Built**	**MY1 (2023)**	**MY2 (2024)**	**MY3 (2025)**	**MY4 (2026)**	**MY5 (2027)**
Bankfull Width (ft)	**15.1**	**10.5**				
Bankfull Mean Depth (ft)	**1.3**	**1.7**				
Maximum Bankfull Depth (ft)	**2.9**	**2.5**				
Bankfull Cross Sectional Area (ft_2)	**19.1**	**18.0**				

*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

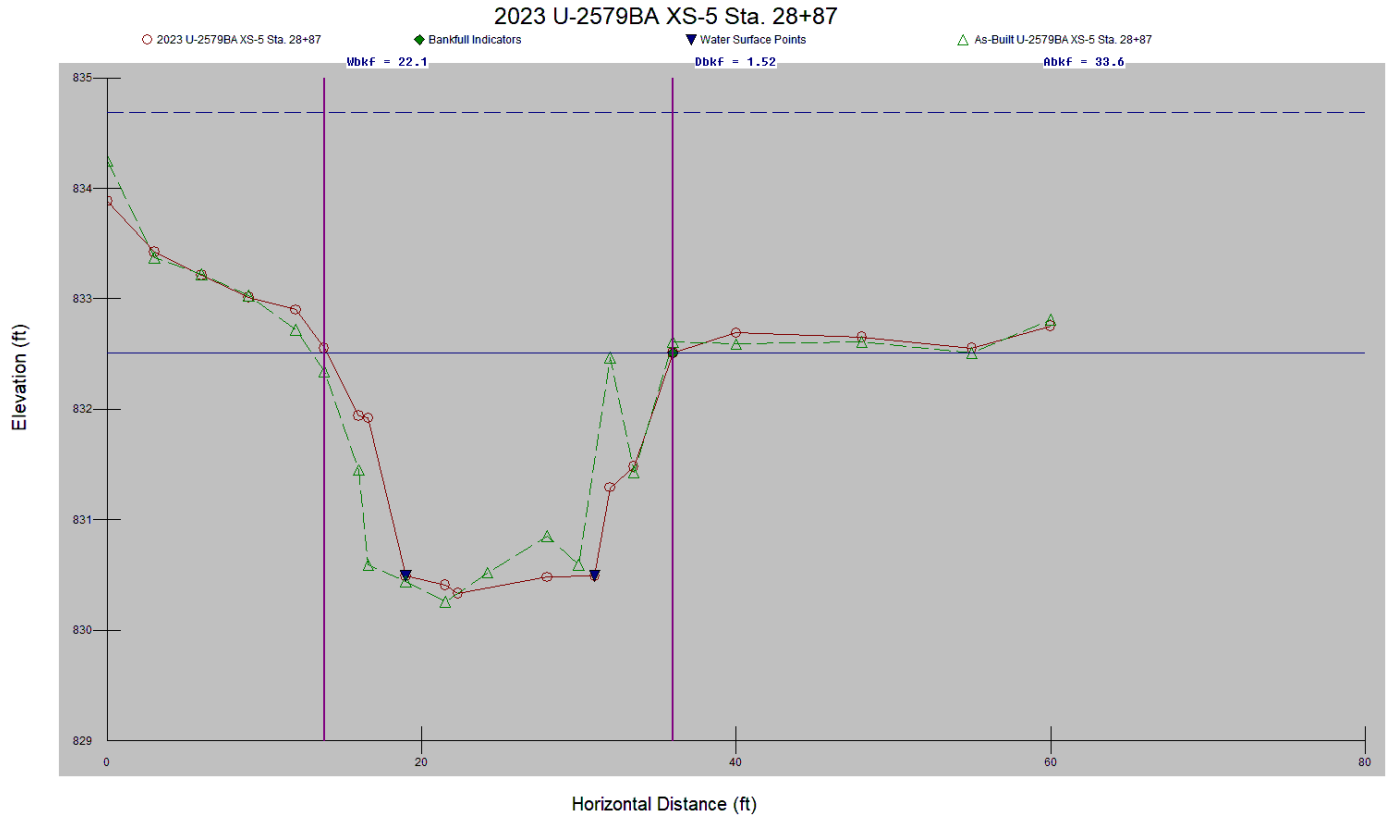


U-2579BA Smith Creek (Fishponds): Cross-Section #3 (Riffle) Abbreviated Morphological Summary						
Variable	**As-built**	**MY1 (2023)**	**MY2 (2024)**	**MY3 (2025)**	**MY4 (2026)**	**MY5 (2027)**
Width of the Floodprone Area (ft)	**54.65**	**50.2**				
Bankfull Width (ft)	**21.8**	**20.0**				
Entrenchment Ratio	**2.51**	**2.5**				
Bankfull Mean Depth (ft)	**0.84**	**0.8**				
Maximum Bankfull Depth (ft)	**1.27**	**1.1**				
Width/Depth Ratio	**25.95**	**25.4**				
Bankfull Cross Sectional Area (ft_2)	**18.25**	**15.9**				

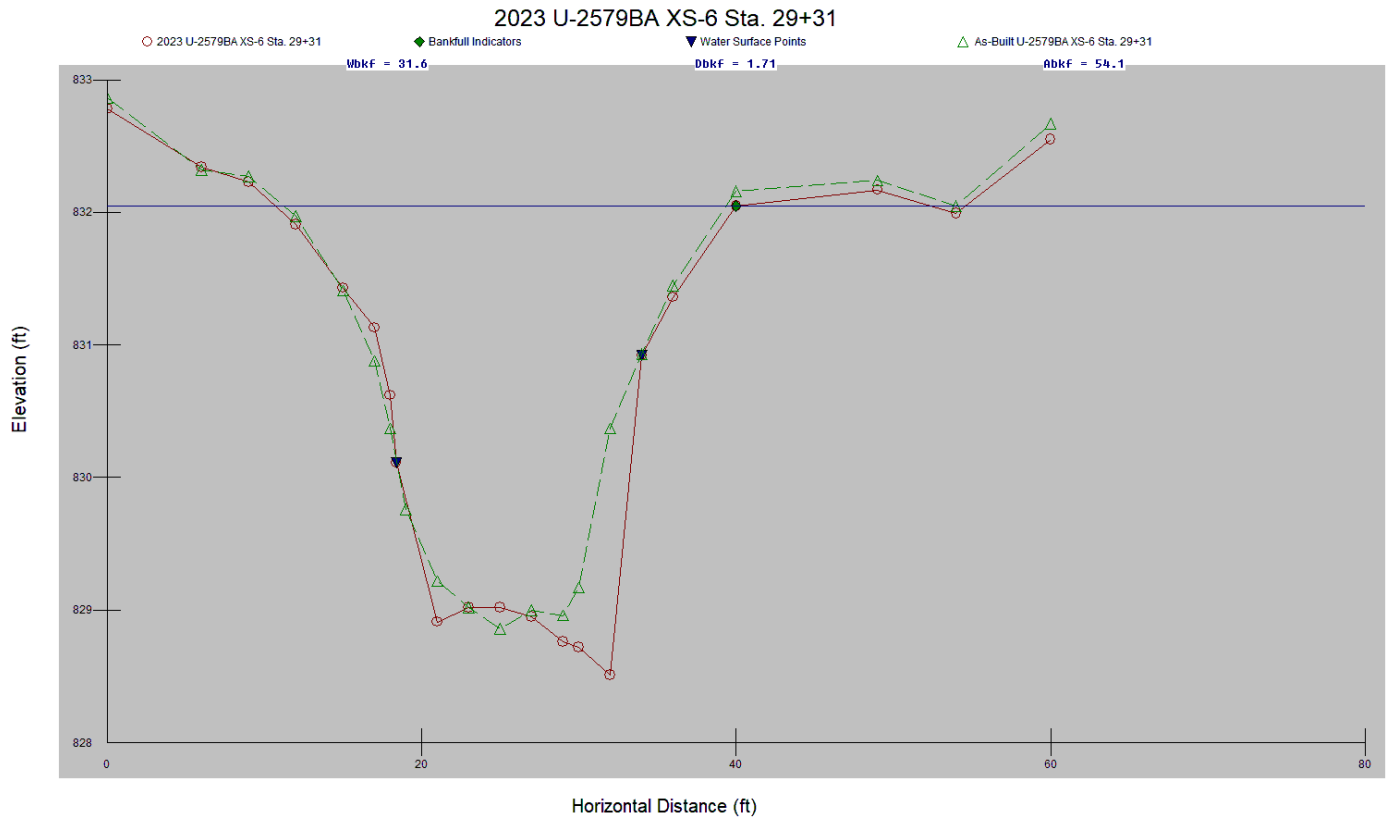


U-2579BA Smith Creek (Fishponds): Cross-Section #4 (Pool) Abbreviated Morphological Summary						
Variable	**As-Built**	**MY1 (2023)**	**MY2 (2024)**	**MY3 (2025)**	**MY4 (2026)**	**MY5 (2027)**
Bankfull Width (ft)	**19.5**	**20.3**				
Bankfull Mean Depth (ft)	**2.7**	**1.4**				
Maximum Bankfull Depth (ft)	**4.4**	**2.4**				
Bankfull Cross Sectional Area (ft_2)	**51.5**	**29.0**				

*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



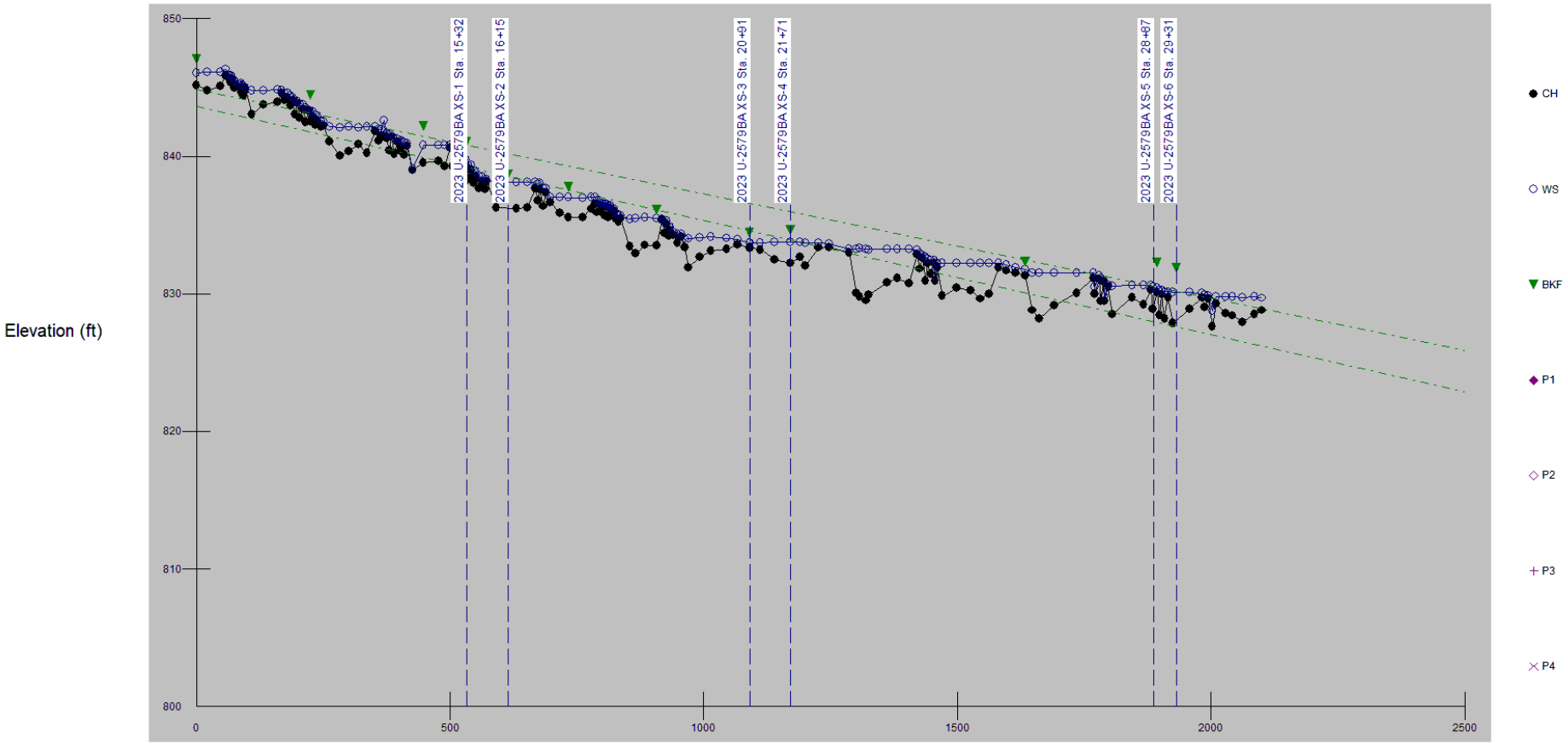
U-2579BA Smith Creek (Fishponds): Cross-Section #5 (Riffle) Abbreviated Morphological Summary						
Variable	**As-built**	**MY1 (2023)**	**MY2 (2024)**	**MY3 (2025)**	**MY4 (2026)**	**MY5 (2027)**
Width of the Floodprone Area (ft)	**60**	**60.0**				
Bankfull Width (ft)	**22.52**	**22.0**				
Entrenchment Ratio	**2.66**	**2.7**				
Bankfull Mean Depth (ft)	**1.42**	**1.5**				
Maximum Bankfull Depth (ft)	**2.21**	**2.2**				
Width/Depth Ratio	**15.86**	**14.5**				
Bankfull Cross Sectional Area (ft_2)	**31.87**	**33.6**				



U-2579BA Smith Creek (Fishponds): Cross-Section #6 (Pool) Abbreviated Morphological Summary						
Variable	**As-Built**	**MY1 (2023)**	**MY2 (2024)**	**MY3 (2025)**	**MY4 (2026)**	**MY5 (2027)**
Bankfull Width (ft)	**33.9**	**31.6**				
Bankfull Mean Depth (ft)	**1.6**	**1.7**				
Maximum Bankfull Depth (ft)	**3.3**	**3.5**				
Bankfull Cross Sectional Area (ft_2)	**52.4**	**18.5**				

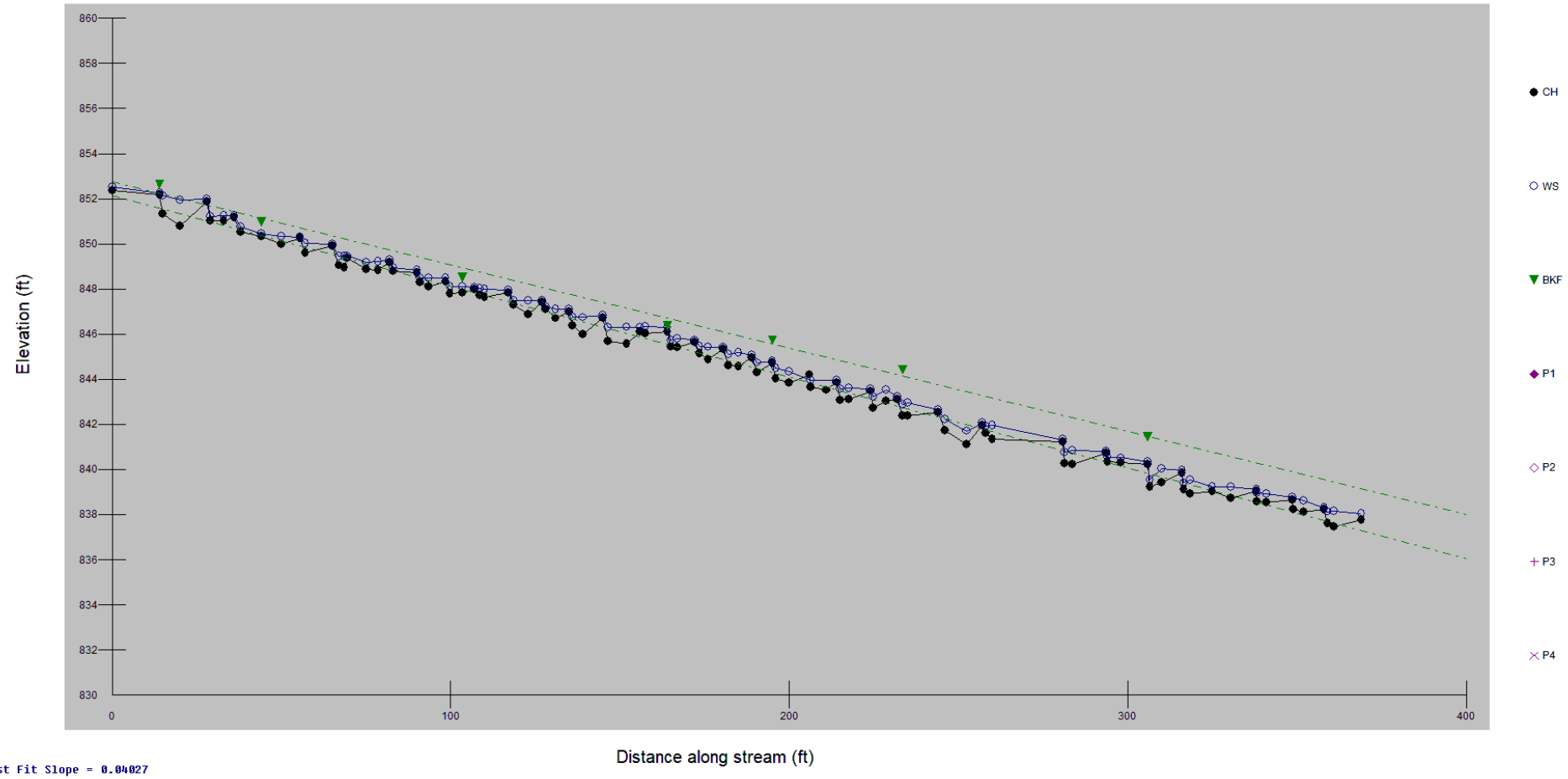
*According to the Rosgen Classification of Natural Rivers Floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features

Longitudinal Profile 2023 - U-2579BA (Fishponds)



CH Best Fit Slope = 0.00829
BKF Best Fit Slope = 0.00758

2023 U-2579BA Longitudinal Profile - UT1



CH Best Fit Slope = 0.04027
BKF Best Fit Slope = 0.03684

APPENDIX B

SITE PHOTOGRAPHS

Photo Point #1 UT1 Upstream

Photo Point #1 UT1 Downstream

Photo Point #1 Main Channel Upstream

Photo Point #1 Main Channel Downstream

Photo Point #2 Upstream

Photo Point #2 Downstream

November 2023

Photo Point #3 Upstream

Photo Point #3 Downstream

Photo Point #4 Upstream

Photo Point #4 Downstream

Photo Point #5 Upstream

Photo Point #5 Downstream

November 2023

Overview of Main Channel end with Pump Basin

November 2023

Photo Point #1 (Upstream)

Photo Point #1 (Downstream)

Photo Point #2 (Upstream)

Photo Point #2 (Downstream)

Photo Point #3 (Upstream)

Photo Point #3 (Downstream)

August 2023

Photo Point #4 (Upstream)

Photo Point #4 (Downstream)

Photo Point #5 (Upstream)

Photo Point #5 (Downstream)

Wrack line upstream of PP#4

Wrack line at PP#5

August 2023

Vegetation Plot #1

Vegetation Plot #2


Vegetation Plot #3

August 2023