Monitoring Year 1 FINAL Monitoring Report

Stewarts Creek Tributaries Stream Restoration Project

Surry County, North Carolina

Yadkin River Basin, Hydrologic Unit Code (HUC) 03040101

Data Collection Period:
September 2020 – November 2020

Submission Date:
December 2020

NCDEQ Contract No. 7183
DMS ID No. 100023
RFP#16-006993
USACE Action ID No. SAW-2017-01508
DWR ID No. 20171043

Prepared For:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Prepared By:

Ecosystem Planning and Restoration
1150 SE Maynard Road, Suite 140
Cary, NC 27511

Mitigation Project Name	**Stewarts Creek Tributaries**	**USACE Action ID**	**2017-01508**
DMS ID	**100023**	**DWR Permit**	**2017-1043**
River Basin	**Yadkin**	**Date Project Instituted**	**5/22/2017**
Cataloging Unit	**03040101**	**Stream/Wet. Service Area**	**Yadkin 03040101**
County	**Surry**	**Date Printed**	**10/12/2020**

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Signature of Official Approving Credit Release

1 - For NCDMS, no credits are released during the first milestone

2 - For NCDMS projects, the initial credit release milestone occurs when the as-built report (baseline monitoring report) has been approved by the NCIRT and posted to the NCDMS Portal, provided the following criteria have been met:

1) Approved of Final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan.
4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met.

Credit Release Milestone	**Cool Stream Credits**						
Project Credits	**Scheduled Releases %**	**Estimated Scheduled Release #**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	3,194.760	3,194.760	0.000	3,194.760	2020	10/12/2020
3 - Year 1 Monitoring	10.00%	1,064.920				2021	
4 - Year 2 Monitoring	10.00%	1,064.920				2022	
5 - Year 3 Monitoring	10.00%	1,064.920				2023	
6 - Year 4 Monitoring	5.00%	532.460				2024	
7 - Year 5 Monitoring	10.00%	1,064.920				2025	
8 - Year 6 Monitoring	5.00%	532.460				2026	
9 - Year 7 Monitoring	10.00%	1,064.920				2027	
Stream Bankfull Standard	10.00%	1,064.920				2022	
			Totals		3,194.760		

Total Gross Credits	10,649.200
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	3,194.760
Total Percentage Released	30.00%
Remaining Unreleased Credits	7,454.440

Notes

Contingencies (if any)

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Project Quantities

Mitigation Type	Restoration Type	Physical Quantity
Cool Stream	Restoration	9,498.000
Cool Stream	Enhancement II	1,573.000

Debits

							Cool Stream Restoration Credits
Beginning Balance (mitigation credits)							**10,649.200**
Released Credits							**3,194.760**
Unrealized Credits							**0.000**
Converted Credits							**0.000**
Owning Program	**Req. Id**	**TIP #**	**Project Name**	**USACE Permit #**	**DWR Permit #**	**DCM Permit #**	
Remaining Balance (Released credits)							**3,194.760**
Remaining Balance (Unreleased credits)							**7,454.440**
Total Remaining Balance (Released and Unreleased credits)							**10,649.200**

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Mr. Paul Wiesner
NCDEQ – Division of Mitigation Services
5 Ravencroft Dr., Suite 102
Asheville, NC 28801

December 18, 2020

RE: Response to Draft MY1 Monitoring Report (MY0) Comments dated December 4, 2020
Stewarts Creek Stream Restoration Project
Yadkin River Basin – CU# 03040101 – Surry County, North Carolina
NCDMS Project # 100023, Contract # 7183

Dear Mr. Wiesner,

Ecosystem Planning and Restoration (EPR) has reviewed the comments on the Draft MY1 Monitoring Report provided December 4, 2020. The comments have been addressed as described below and the Final MY1 Report and electronic deliverables have been revised in response to this review.

- *Cover Sheet: Please place the USACE # and DWR # on separate lines.*
  - **Updated.**

- *Table 1. Project Mitigation Quantities and Credits & Table 3. Project Attribute Table: The thermal regime for the project streams is "cool". Please update the tables and MY1 report accordingly.*
  - **Updated all accounts to say Cool instead of Warm.**

- *Table 1: The table footnote is incorrect. The minor rounding error for Moores Fork R1 was in the IRT approved mitigation plan. The IRT approved mitigation plan reported 629 SMUs but the actual credits are 629.2 SMUs (1,573 @2.5:1 = 629.2 SMUs). This was corrected in the MY0 asset table but the final MY0 report footnote was incorrect. Please update the footnote in the MY1 table accordingly.*
  - **Footnote updated to reflect IRT approved Mitigation Plan as the source of the miscalculation.**

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- *Table 2: The project success criteria also includes a monitoring year 3 interim success criteria of 320 stems/acre. Please update the performance criteria and cumulative monitoring results in the table and MY1 report accordingly.*
    - **Table updated to include Year 3 interim vegetation success criteria.**

- *Section 2.1.3 Channel Stability: In the report text, please elaborate on the repairs completed during MY1 and the project storm damage that occurred during Hurricane Zeta on 10/29/20. This section notes, "The need for additional repairs for the banks are currently being evaluated." Please elaborate; does EPR anticipate conducting stream repairs in MY2 or will EPR watch the areas during MY2 to determine if repairs are warranted?*
    - **A more extensive narrative was added to this section.**

- *Section 2.1.4 Stream Hydrology: In the report text, please review and provide additional discussion regarding the numerous bankfull events reported. Does EPR have any concerns with 11 bankfull events reported on UT3 Reach 2 (gauge SG-4)?*
    - **These numerous bankfull events on UT3 Reach 2 are likely influenced by the low top of bank depths allowing flood flows to easily access the floodplain in addition to the excessively wet year. This reach is performing as intended and show no signs of instability; therefore, the number of bankfull events is not concerning.**

- *Section 2.2.1 Vegetation Monitoring Data: In the report text, please describe how the areas of encroachment will be resolved with the landowner/ corn farmer. Will any additional conservation easement posts and/ or signage be installed to alleviate future encroachment? Easement encroachment in agricultural fields (easement scalloping) should be eliminated in MY2. Failure to eliminate conservation easement encroachment has led to additional required monitoring on other DMS sites.*
    - **Brief discussion of how encroachment will be resolved included in report.**

- *CCPV Maps: The MY3 interim success criteria for the project is 320 stems/acre. Please show any vegetation plots that do not meet the interim success criteria as "red" on the CCPV Maps.*
    - **Updated.**

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- *Table 6 & Table 7: The MY3 interim success criteria for the project is 320 stems/acre. Please show any vegetation plots (stems/ acres cells) that do not meet the MY3 interim success criteria as red/ orange on the tables.*
    - **Table 6 and 7 have been updated.**

- *Digital Support File Comments: Please submit the random vegetation plot features as polygons rather than lines.*
    - **The vegetation plots have been updated to be polygons rather than line features.**

If you have any questions regarding the Draft MY1 Monitoring Report, please contact me at 919-388-0787 or via email at ebennett@eprusa.net.

Sincerely,

Erin M Bennett

Erin M. Bennett, PE

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1.0 PROJECT SUMMARY

Ecosystem Planning and Restoration, PLLC (EPR) implemented the Stewarts Creek Tributaries Stream Restoration Project (Project; Site) for the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS) to provide 10,649.2 stream mitigation credits (SMCs) in the Yadkin River Basin, Hydrologic Unit Code (HUC) 03040101. The Stewarts Creek Tributaries Stream Restoration Project was contracted via NCDEQ-DMS RFP #16-006993. As approved by the North Carolina Interagency Review Team (NCIRT), all projects contracted under the 16-006993 RFP have a cool or warm water thermal regime service type. Penalties will not be assessed for using these project mitigation credits to satisfy cool or warm water thermal regime requirements. The Project restored 9,498 linear feet and enhanced 1,573 linear feet of three Unnamed Tributaries (UTs) to Stewarts Creek and Moores Fork within a 30-acre conservation easement (Figures 1). Mitigation assests are listed in Table 1.

The Site is located in NCDEQ Division of Water Resources (NCDWR) Sub-basin 03-07-03 and DMS Targeted Local Watershed 03040101100010. The Site was historically utilized for agricultural and cattle practices. As such, wetlands and streams in the Project area were adversely impacted by direct cattle access, farming activities, and stream channelization. The Site is situated on historic pastureland in a WS-IV Watershed that is 49% agricultural land, 37% forest, 11% residential, and 1% impervious. Prior to construction activities, all Project streams were incised, the UTs were straightened and had adjacent row crops, and Moores Fork suffered from cattle damage. Pre-construction, or pre-existing, Site conditions are provided in Table 3 and the Summary Tables in Appendix C. Photos and a more detailed description of Site conditions before restoration are available in the Mitigation Plan (Final version submitted May 2019).

1.1 Goals and Objectives

The Project goals were established based on an assessment of Site conditions and restoration potential with careful consideration of the stressors identified in the Upper Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) Report (NCEEP, 2009) and Yadkin Pee-Dee Basinwide Water Quality Plan (NCDWQ, 2008). These goals and objectives are presented in Table 2.

Site construction was completed in May 2020 and the as-built survey was completed in June 2020. Planting and baseline vegetation data collection occurred in May – June 2020. A detailed timeline of the Project activity and reporting history is provided in Appendix E.

1.2 Performance Criteria

Project success criteria were established in accordance with the *NCDEQ DMS Mitigation Plan Template* (ver. 06/2017), and *US Army Corps of Engineers – Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District* (October 24, 2016). The monitoring plan for the Site will

follow the same guidance as the *NCDED DMS Annual Monitoring Report Format, Data, and Content Requirement* (October 2020). Table 2 details the USACE success criteria that evaluate whether Project goals have been met throughout the monitoring period. For more detailed success criteria refer to the Final Mitigation Plan or the As-built Baseline Monitoring Report (Final version submitted October 2020).

Table 1. Project Mitigation Quantities and Credits

Project Component (reach ID, etc.)	Original Mitigation Plan ft/ac	As-built ft/ac	Original Mitigation Thermal Regime Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
UT1	2,742	2,742	Cool	R	1.0	2,742	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
UT2	1,009	1,009	Cool	R	1.0	1,009	
UT3 R1	944	944	Cool	R	1.0	944	
UT3 R2	2,421	2,421	Cool	R	1.0	2,421	
Moores Fork R1	1,573	1,573	Cool	E2	2.5	629.2*	Habitat Structures, Benching, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Moores Fork R2	1,998	1,998	Cool	R	1.0	1,998	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Moores Fork R3	384	384	Cool	R	1.0	384	
Net Change In Credit From Buffers	-	-	-	-	-	522	Wilmington District Stream Buffer Credit Calculator (Updated 1/19/2018)
					Total Assets Summary:		**10,649.2 SMUs**

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)
		Riverine	Non-Riverine	
Restoration	9,498			
Enhancement				
Enhancement I				
Enhancement II	1,573			
Rehabilitation				
Preservation				
High Quality Pres				

Overall Assets Summary

Asset Category	Overall Credits
Stream	**10,649.2**

*Moores Fork R1 mitigation credits were miscalculated in the IRT approved Mitigation Plan and have been updated.

Table 2. Summary: Goals, Performance, and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reduce sediment inputs and stream turbidity;	▪ Reduce the amount of land in active livestock pasture. ▪ Install fencing to exclude livestock from Project buffers and streams. ▪ Increase distance between active farming operations and receiving waters. ▪ Restore and protect riparian buffers to filter runoff. ▪ Stabilize eroding streambanks and concentrated runoff areas.	▪ Excluding livestock from all streams and buffers. The exclusion of livestock will remove a direct source of nutrients, fecal coliform, and sediment from the system. ▪ Restoring the Project streams to stable, functioning condition. Appropriate channel dimensions and in-stream log and wood structures will ensure channel stability and improve aquatic habitats. ▪ Restoring natural riparian vegetation. Restored riparian buffers will provide a source of woody debris and detritus for aquatic organisms, restore diverse aquatic and terrestrial habitats appropriate for the ecoregion and landscape setting, and provide shade, reduce water temperatures, and increase dissolved oxygen concentrations.	▪ Recordation and protection of a conservation easement meeting DMS guidelines ▪ Visual inspection of fence installed to exclude cattle from the stream and riparian buffer, demonstrating no encroachment. ▪ Vegetation success criteria of 320 stems/acre in Year 3, 260 native stems/acre in Year 5, and 210 native stems/acre in Year 7. ▪ Visual documentation of installed watering system and regular checks on its operation during annual monitoring. ▪ Visual inspection of BMP's to ensure proper function during monitoring period. ▪ Geomorphic cross sections indicate stable sections over the monitoring period. ▪ Bank height ratio (BHR) cannot exceed 1.2 for all measured cross sections on a given reach. ▪ Entrenchment ratio (ER) must be 2.2 or above for all measured riffle cross sections for C/E stream	<u>Permanent Vegetation Plots</u> 11 permanent vegetation plots, 0.02 acre in size (minimum), surveyed during As-built, Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Data collection includes species, height, planted vs. volunteer, and age.	At the end of Monitoring Year 1, the 11 permanent riparian vegetation plots had an average stem density of 496.9 stems/acre and have met the success criteria of 320 native stems/acre in MY3.
Reduce nutrient inputs	▪ Reduce the amount of land in active livestock pasture and row crop agriculture. ▪ Install fencing to exclude livestock from Project buffers and streams. ▪ Increase buffer widths between active farming operations and receiving waters. ▪ Restore and protect riparian buffers to filter runoff. ▪ Promote higher water table conditions, and thus denitrification, along restored headwaters.				
Reduce Fecal Coliform Inputs	▪ Reduce the amount of land in active livestock pasture. ▪ Exclude livestock from Project streams and buffers. ▪ Increase buffer width between active farming operations and receiving waters. ▪ Restore and protect riparian buffers to filter runoff.			<u>Annual Random Vegetation Plots</u> 11 randomly selected vegetation plots, 0.02 acre in size (minimum), surveyed during As-built, Years 1, 2, 3, 5, and 7 between July 1st and leaf drop. Data collection includes species and height.	The 11 randomly selected vegetation plots had an average stem density of 423.2 native stems/acre, which meets the success criteria for MY3.
Restore / Enhance Degraded	▪ Restore riparian buffer vegetation to filter runoff and provide organic matter and shade.			<u>Stream Profile</u> Full longitudinal survey on all restored	A full longitudinal survey of the Project streams was conducted during As-

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Riparian Buffers	▪ Protect riparian buffers with permanent conservation easement.	▪ Conversion of row crops to forested buffer. ▪ Protecting all areas with conservation easement.	types and 1.4 or above for B stream types. ▪ Documentation of hydrophytic vegetation within vegetation monitoring plots. ▪ Documentation of four bankfull events in different years throughout the monitoring period. ▪ Documentation of 30 days of consecutive stream flow in all reaches each monitoring year	and enhanced stream channels. Data was collected during As-built survey only (unless otherwise required).	built monitoring. Little signs of instability or degradation were noted for the stream profile during MY1 monitoring, even with some isolated bank failure, so a new profile was not surveyed.
Implement Agricultural BMPs in Agricultural Watersheds	▪ Construct agricultural conveyance system to filter and reduce agricultural runoff into restored stream systems. ▪ Construct a critical area restoration BMP by removing and decommissioning a heavily eroding forest road and cattle use area.			<u>Cross Sections</u> Cross sections are surveyed during Years 1,2,3,5, and 7. 26 total cross sections, 17 cross sections on the UTs and 9 cross sections on Moores Fork.	The Year 1 monitoring cross section surveys indicate that the Project streams are geomorphically stable and restored channel dimensions have not changed significantly during Monitoring Year 1. Cross sections were taken before Hurricane Zeta.
Reduce Urban/ Suburban Stormwater Runoff	▪ Restore riparian buffers along headwater streams that drain suburban areas. ▪ Protect riparian buffers with permanent conservation easement.			<u>Visual Assessment</u> Conducted yearly on all restored stream channels and in-stream structures.	Stream photo points and visual assessment indicate that all restored channels and in-stream structures are in good condition, except the few areas of bank failure on Moores Fork, and performing as intended. Photo points on Moores Fork were taken after Hurricane Zeta to show damage.
				<u>Additional Cross Sections</u> Only surveyed if instability is documented during monitoring.	No instability was documented during MY1 monitoring cross section survey, so no additional cross sections were surveyed

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reduce Stream Channel and Streambank Instability	▪ Restore degraded stream channels by establishing appropriate dimension, pattern and profile. ▪ Install in-stream structures to provide stream channel and streambank stability. ▪ Restore and protect riparian buffer to provide bank protection and stability. ▪ Install fencing to exclude livestock from Project streams and buffers.			<u>Stream Hydrology Monitoring</u> 5 pressure transducers and a rain gauge will record precipitation and streamflow data continuously through the monitoring period. Photos of high water indicators will be taken yearly.	Flow gauge data from MY1 indicate that the UTs met the established success criteria of 30 days or more of consecutive flow throughout the year. In addition, 0 – 11 bankfull events were recorded for the UTs.

Table 3. Project Attribute Table

Project Background Information				
Project Name		Stewarts Creek Tributaries Stream Restoration Project		
County		Surry		
Project Area (acres)		30		
Project Coordinates (latitude and longitude)		latitude 36 deg 30' 55" N, longitude 80 deg 41' 41" W and latitude 36 deg 30' 37" N, longitude 80 deg 42' 01" W		
Planted Acreage (Acres of Woody Stems Planted)		30		
Project Watershed Summary Information				
Physiographic Province		Piedmont		
River Basin		Yadkin Pee-Dee		
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	3040101100010	
Project Drainage Area (Acres and Sq. Mi.)		3,001 acres/ 4.69 Sq.Mi. (Total)		
Project Stream Thermal Regime		Cool		
Project Drainage Area Percentage of Impervious Area		Average 1%		
CGIA Land Use Classification		Average 35% Agriculture 50% Forested/Scrubland 11% Residential		

Reach Summary Information				
Parameters	**Moores Fork**	**UT1**	**UT2**	**UT3**
Length of reach (linear feet)	3,955	2,742	1,009	3,365
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres and Square Miles)	4.4 Sq.Mi., 2816 Ac	0.11 Sq.Mi., 70 Ac	0.07 Sq.Mi., 45 Ac	0.11 Sq.Mi., 70 Ac
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV
Stream Classification (existing)	F4	G4 -> F4	Channelized E4	F4
Stream Classification (proposed)	C4	C4	C4	C4
Evolutionary trend (Simon)	V	IV	IV	IV
FEMA classification	AE	AE	AE	AE

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	SAW-2017-01508
Water of the United States - Section 401	Yes	Yes	DWR #17-1043
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	General Permit NCG010000 - ID # SURRY-2020-005
Endangered Species Act	No	Yes	Categorical Exclusion Document; Appendix 10 in Mitigation Plan
Historic Preservation Act	No	Yes	
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	CLOMR 19-04-3237R, Floodplain Development Permit PL201900063, and LOMR case number 21-04-0390P
Essential Fisheries Habitat	No	N/A	N/A

2.0 MONITORING DATA ASSESSMENT

This document reports the Monitoring Year 1 data and compares it to the baseline data to determine the success of the Stewarts Creek Stream Restoration Project based on the performance criteria stated above.

2.1 Stream Monitoring

Stream monitoring involved field collection to assess the hydrologic and geomorphic functions of UT1, UT2, UT3, and Moores Fork. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 2. These monitoring parameters follow USACE guidance, but will also allow for monitoring of other parameters to document Site performance related to the Project goals listed in Table 2. The locations of the established monitoring cross sections and any channel instability areas are shown in Figures 1B-1E (Current Condition Plan View (CCPV)). On October 29, 2020, a 3.2-inch rain event associated with Hurricane Zeta occurred at the Site and caused some streambank damage along Moores Fork. This damage is mentioned in Table 2, Table 4, and the Figures 1B-1E. The cross section data for Moores Fork and the UTs and UTs photo points were collected before Hurricane Zeta while the Moores Fork photo points where collected after Hurricane Zeta.

2.1.1 Stream Profile

A full longitudinal profile was surveyed for the entire length of the restored streams in May - June 2020 to document as-built conditions. This survey was tied to a permanent benchmark and includes thalweg, water surface, right bank, and left bank features. Profile measurements were taken at the head of each feature (e.g. riffle, pool) and at the max depth of pools. The longitudinal profile will not be surveyed during annual monitoring unless vertical channel instability has been observed during monitoring and remedial actions or repairs are needed.

2.1.2 Stream Dimension

Permanent cross sections were installed across the Site to monitor stream stability through dimension change. Of the 26 permanent cross sections installed, 9 were located on Moores Fork and 17 on the UTs with 12 permanent cross sections installed in riffles and 14 in pools. Each cross section was monumented using t-posts on both streambanks. The location and elevation of each pin was located and recorded to facilitate data comparison from year to year. Cross sections were surveyed using a Topcon RL-H5A Self Leveling Laser Level. Reported data includes measurements of Bankfull Elevation (based on as-built bankfull area), Bank Height Ratio (BHR) (based on as-built bankfull area), Thalweg Elevation, Top of Bank Elevation, Top of Bank Max Depth, Top of Bank Cross Sectional Area, and Entrenchment Ratio (ER) (Appendix C). BHR measurements were made by holding the bankfull area recorded in the Baseline As-built report constant and adjusting the bankfull elevation. Reference photos were and will be taken of both streambanks every year to provide a visual assessment of any changes that may occur.

The Year 1 monitoring cross section surveys indicate that the Project streams are geomorphically stable and restored channel dimensions have not changed significantly during

Monitoring Year 1. Stream cross sections showed only minor fluctuations compared to the as-built condition and all restored streams meet the success criteria for restored stream channels as established in the Mitigation Plan and shown in Table 2. The cross section plots, photos, and data summary are included in Appendix C.

2.1.3 Channel Stability

Channel stability is assessed on an annual basis using photographs to visually document the condition of the restored Project streams. Photographs are taken from the same location in the same direction each year. 38 photo points were established during baseline monitoring and are shown in the CCPV (Figures 1B-1E). Visual assessments of channel stability were also made regularly throughout Monitoring Year 1.

Stream photo points and visual assessment indicate that all restored channels and in-stream structures are in good condition and performing as intended. During Monitoring Year 1, repairs, including bank sloping, installation of soil lifts, and rootwad revetments, were completed. Subsequent to these repairs, Hurricane Zeta caused some additional damage in a localized area at the transition between Moores Fork Reach 1 and 2. The location of streambank damage is shown in the CCPV (Figures 1B-1E). Photos of these areas are also included in the Monitoring Year 1 Photolog (Appendix A). The need for additional repairs for the banks will be evaluated during Monitoring Year 2. Minor floodplain rilling along the floodplain for UT1 that was noted after construction has stabilized and now these areas have stabilized and are covered with dense herbaceous vegetation.

2.1.4 Stream Hydrology

Five pressure transducers were installed along the UTs to document stream flow and the occurrence of bankfull events within the monitoring period. The locations of these gauges are shown in the CCPV (Figures 1B–1E). All gauges were installed at the downstream end of pools. The constructed bankfull elevation at each gauge was located and recorded, as well as the elevation of the downstream controlling grade. These elevations will be compared with the gauge readings to determine and document whether the stream is flowing and if a bankfull event has occurred. Photos will be taken of flood indicators, such as debris lines and sediment deposition on the floodplain, whenever it is apparent that a bankfull event has occurred.

A tipping bucket rain gauge was also installed at an adjacent EPR mitigation site to accurately document rainfall at the Site. The rainfall data can be compared to the flow gauge data to verify that high flows at the Site are correlated with rainfall events. The monitoring gauges were downloaded regularly throughout Monitoring Year 1 and rainfall data is presented in the flow gauge plots in Appendix D.

Flow gauge data from MY1 indicate that all three Project streams met the established success criteria of 30 days or more of consecutive flow throughout the year. According to the gauge for UT1 (SG-1), the stream had consistent flow throughout the year and the gauge documented 5 bankfull events. SG-2, located downstream on UT1, documented consistent flow throughout

the year and 2 bankfull events. SG-3, located on UT3 Reach 1, documented consistent flow throughout the year and 4 bankfull events. SG-4, located on UT3 Reach 2, documented consistent flow throughout the year and 11 bankfull events. SG-5, located on UT2, documented consistent flow throughout the year and no bankfull events. The date and timing of these bankfull events correlated with significant rainfall events recorded by the tipping bucket rain gauge. The numerous bankfull events are likely due to these reaches having low top of banks depths and allowing flood flows to easily access the floodplain along with an abnormally wet year. The UT reaches are performing as intended and show no signs of instability.

2.2 Riparian Vegetation Monitoring

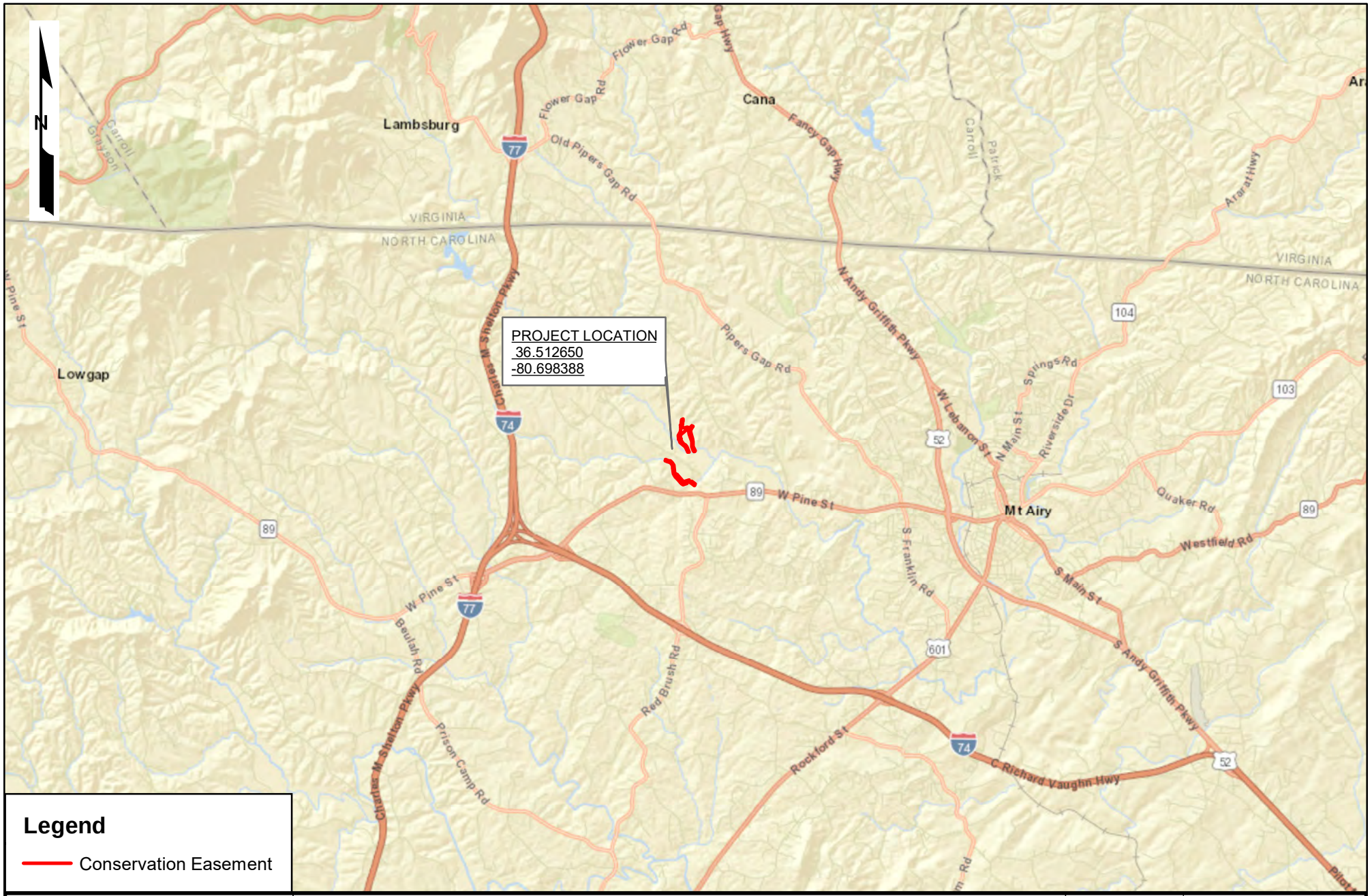
Riparian vegetation monitoring evaluates the growth and development of planted and volunteer vegetation across the Site. Monitored parameters, methods, schedule/frequency, and extent are summarized in Table 2. These monitoring parameters follow USACE guidance, but will also allow for monitoring of other parameters to document Site performance related to the Project goals listed in Table 2. The vegetation data for Moores Fork and the UTs was collected after Hurricane Zeta.

2.2.1 Vegetation Monitoring Data

11 permanent vegetation monitoring plots were monitored across the Site. The corners of the permanent vegetation plots were marked using steel t-posts and the location of each plot was surveyed during the as-built survey. The individual trees within each permanent plot were flagged and identified to facilitate repeat monitoring each year. In addition to the 11 permanent plots, 11 randomly placed vegetation plots are established each year and the location of these plots is recorded using a GPS. All vegetation plots for MY1 are shown in the CCPV (Figure 1B – 1E). Annual vegetation data is compiled and summarized using the DMS Vegetation Data Entry Tool.

Year 1 vegetation monitoring occurred in November 2020, before leaf drop, and more than 180 days after planting. Planted stem counts for each plot ranged from 5-16 trees per plot (202 - 648 trees per acre). The average density of planted stems from all 22 vegetation plots (permanent and random) was 11.43 trees per plot (462 trees per acre). Therefore, the vegetation plot data indicates that planted trees on the Site are meeting the interim success criteria for Monitoring Year 3.

No vegetation problem areas were noted in MY1 vegetation plots. Riparian herbaceous vegetation that was established after construction appears to be flourishing throughout the Site. There are areas of corn encroachment (0.2 acres) in the easement at the UTs shown in the CCPV (Figures 1B–1E). These areas and any other potential bare areas have been addressed through additional posts and signage made clear to the landowners and will be replanted in Winter of 2020/2021. Additionally, no invasive species vegetation were noted within the conservation easement.



STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

VICINITY MAP

DMS PROJECT ID# 100023

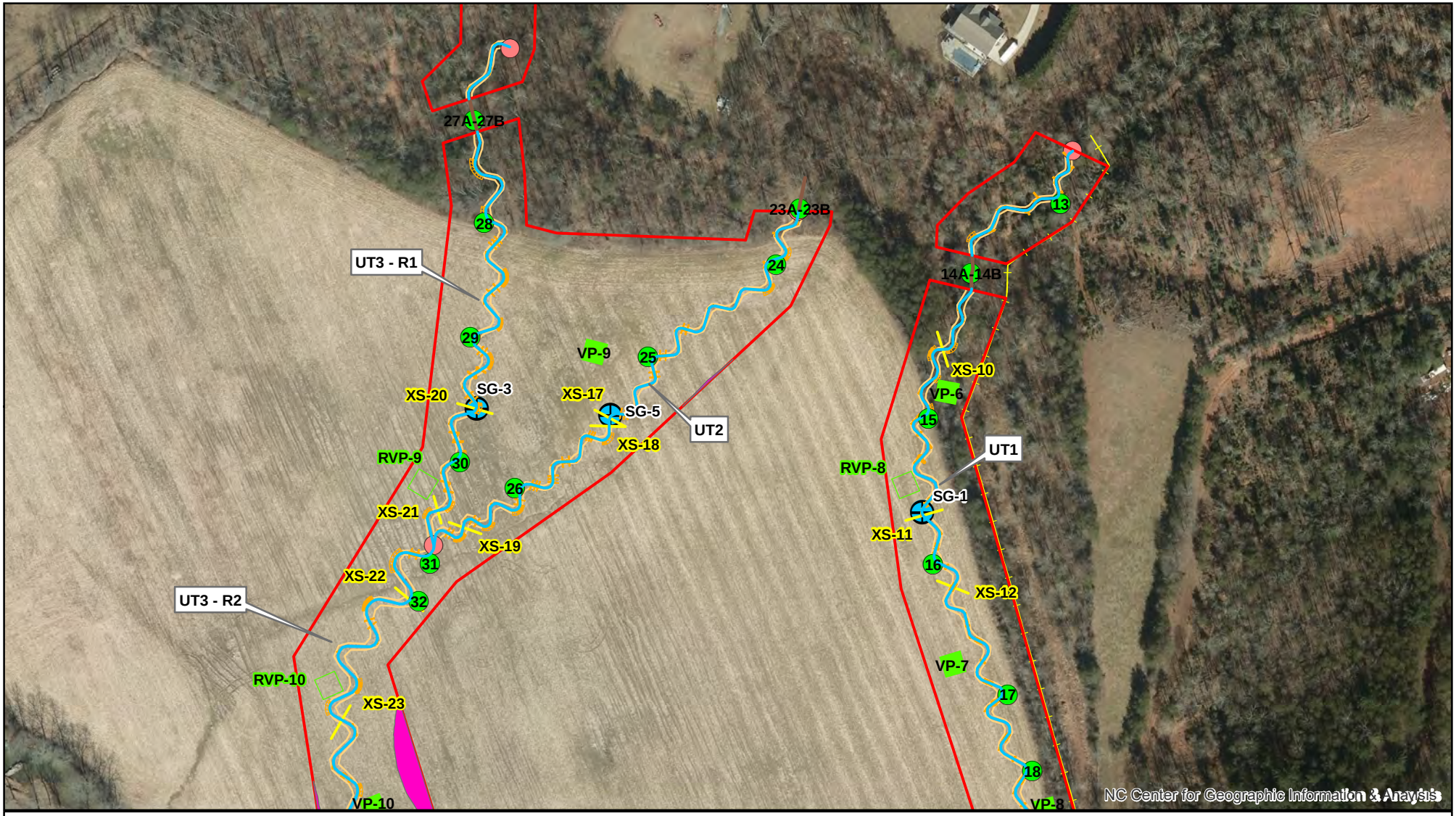
NOVEMBER 2020

FIGURE 1A

SURRY COUNTY, NC

Mitigation Services

ECOSYSTEM PLANNING & RESTORATION



Streams - Enhancement
Streams - Restoration
Conservation Easement
No Credit

Random Vegetation Plot
Yes
No

Fixed Vegetation Plot
Yes
No
Corn Encroachment

Structures
Top of Bank
Photo Points
Stream Gauges

Cross Sections
Reach Breaks
Fence

NC OneMap Orthoimagery (2018)

0 100 200 Feet
1 inch = 207 feet

N

STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

CURRENT CONDITION PLAN VIEW: ASSET MAP MY1: 2020

SURRY COUNTY, NC

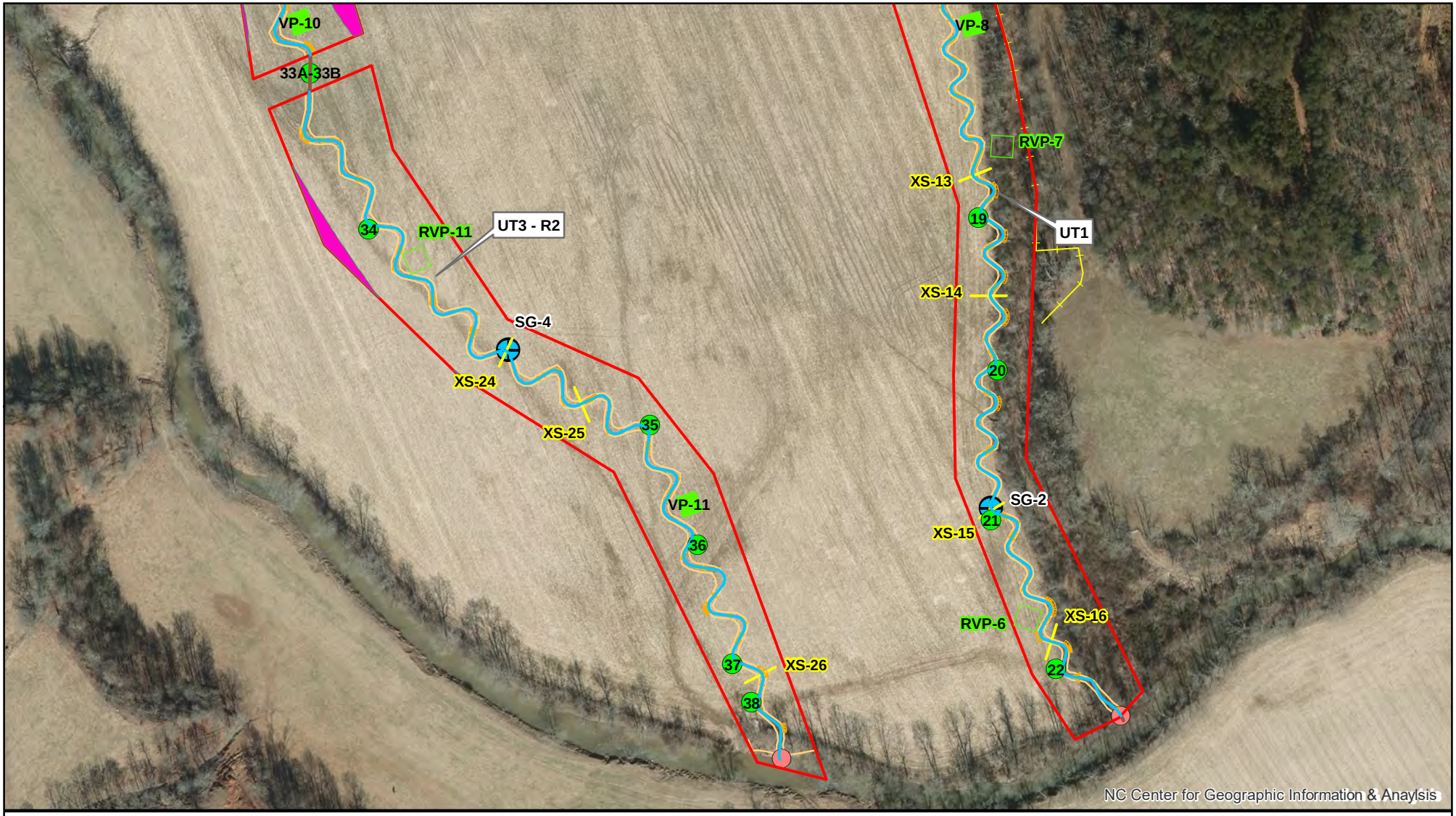
DMS PROJECT ID# 100023

DECEMBER 2020

FIGURE 1B

Mitigation Services ENVIRONMENTAL QUALITY

ECOSYSTEM PLANNING & RESTORATION



Streams - Enhancement
Streams - Restoration
Conservation Easement
No Credit

Random Vegetation Plot
Yes
No

Fixed Vegetation Plot
Yes
No
Corn Encroachment

Structures
Top of Bank
Photo Points
Stream Gauges

Cross Sections
Reach Breaks
Fence

NC OneMap Orthoimagery (2018)

0 100 200 Feet
1 inch = 207 feet

N

STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

CURRENT CONDITION PLAN VIEW: ASSET MAP MY1: 2020

SURRY COUNTY, NC

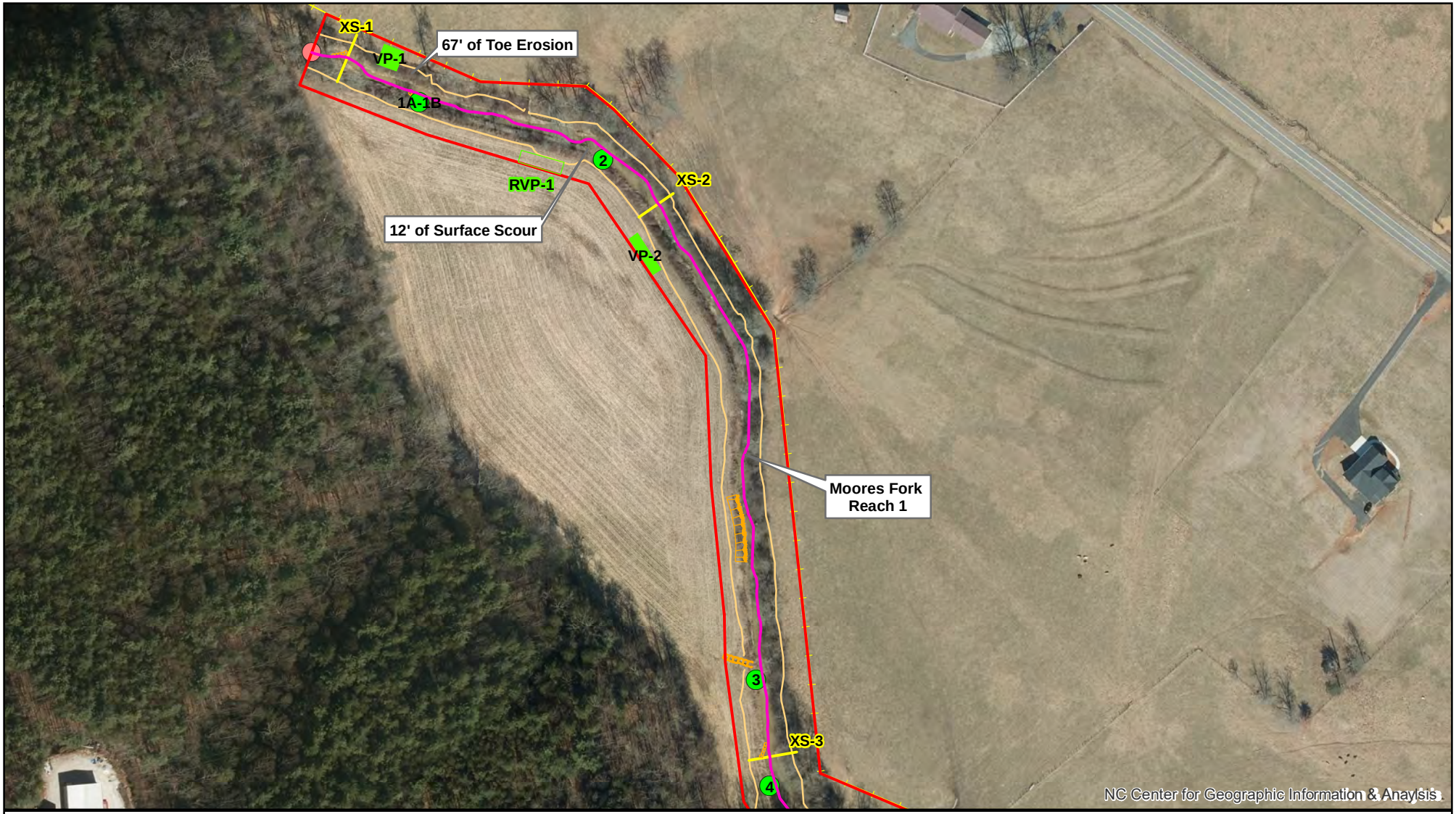
DMS PROJECT ID# 100023

DECEMBER 2020

FIGURE 1C

Mitigation Services ENVIRONMENTAL QUALITY

ECOSYSTEM PLANNING & RESTORATION



Streams - Enhancement
Streams - Restoration
Conservation Easement
No Credit

Random Vegetation Plot
Yes
No

Fixed Vegetation Plot
Yes
No
Corn Encroachment

Structures
Top of Bank
Photo Points
Stream Gauges

Cross Sections
Reach Breaks
Fence

NC OneMap Orthoimagery (2018)

0 100 200 Feet
1 inch = 207 feet

N

STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

CURRENT CONDITION PLAN VIEW: ASSET MAP MY1: 2020

DMS PROJECT ID# 100023

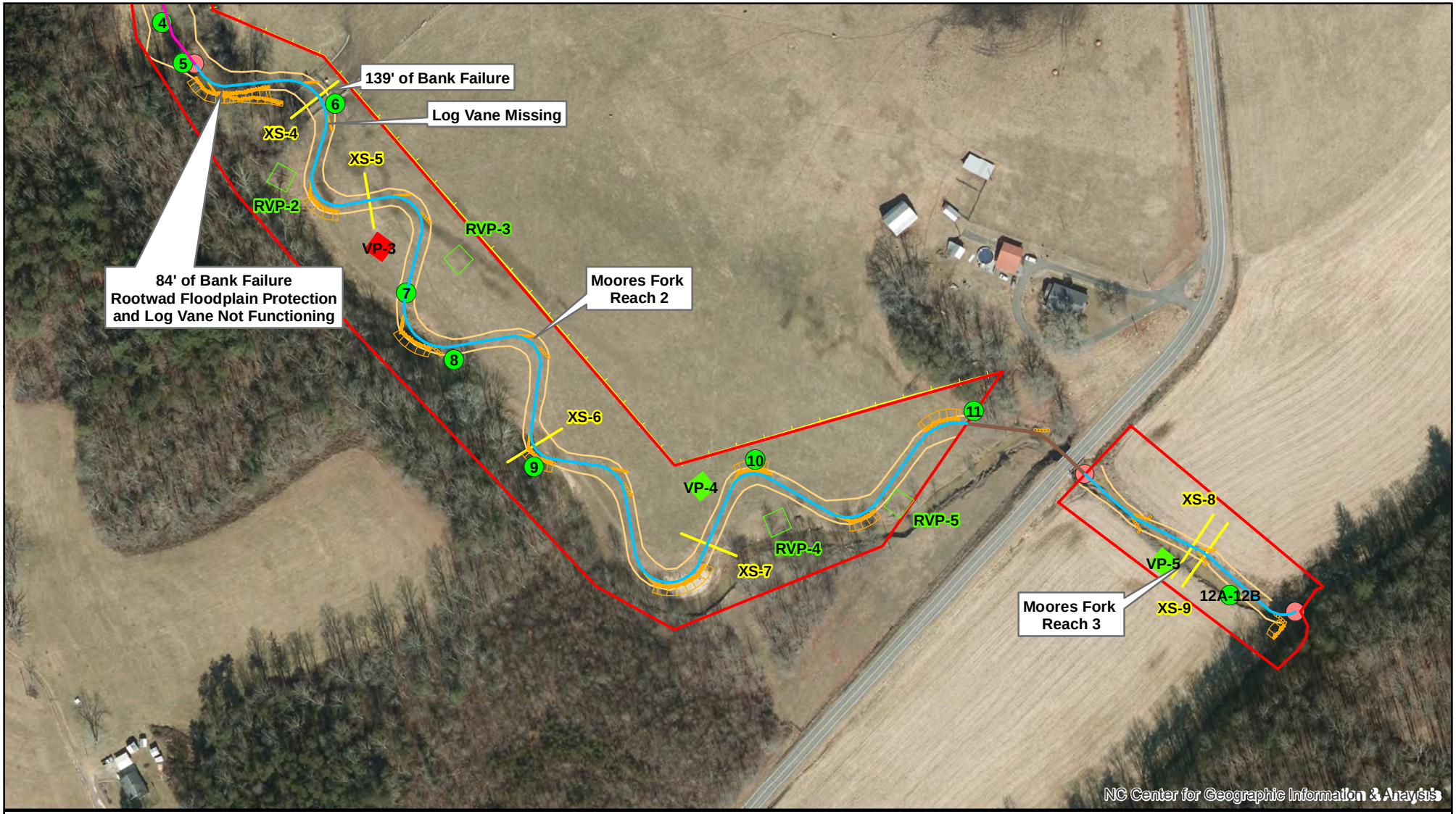
DECEMBER 2020

FIGURE 1D

SURRY COUNTY, NC

Mitigation Services ENVIRONMENTAL QUALITY

ECOSYSTEM PLANNING & RESTORATION



Streams - Enhancement
Streams - Restoration
Conservation Easement
No Credit

Random Vegetation Plot
Yes
No

Fixed Vegetation Plot
Yes
No
Corn Encroachment

Structures
Top of Bank
Photo Points
Stream Gauges

Cross Sections
Reach Breaks
Fence

NC OneMap Orthoimagery (2018)

0 100 200 Feet
1 inch = 207 feet

N

STEWARTS CREEK TRIBUTARIES STREAM RESTORATION PROJECT

CURRENT CONDITION PLAN VIEW: ASSET MAP MY1: 2020

DMS PROJECT ID# 100023

DECEMBER 2020

FIGURE 1E

SURRY COUNTY, NC

NC Mitigation Services ENVIRONMENTAL QUALITY

EPR ECOSYSTEM PLANNING & RESTORATION

3.0 REFERENCES

North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). DMS Vegetation Data Entry Tool, October 2020. https://ncdms.shinyapps.io/Veg_Table_Tool/

North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). DMS Cross Section Tool V.1.0 2020. https://ncdms.shinyapps.io/XS_APP/

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North Carolina Ecosystem Enhancement Program. 2009. Upper Yadkin Pee-Dee River Basin Restoration Priorities.

North Carolina Division of Water Quality. 2008. Yadkin Pee-Dee Basinwide Water Quality Plan.

U.S. Army Corps of Engineers. 2016. Wilmington District Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District.

Appendix A: Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Table 5. Vegetation Condition Assessment Table

Monitoring Year 1 Photo Log

Monitoring Year 1 Vegetation Photo Log

Table 4a. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**UT1**
Assessed Stream Length (ft)	**2800**
Assessed Bank Length (ft)	**5600**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	55	55		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	61	61		100%

Table 4b. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID	**UT2**
Assessed Stream Length (ft)	**1060**
Assessed Bank Length (ft)	**2120**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	22	22		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	25	25		100%

Table 4c. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID **UT3 - Reach 1**
Assessed Stream Length (ft) **994**
Assessed Bank Length (ft) **1988**

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	19	19		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	20	20		100%

Table 4d. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID UT3 - Reach 2
Assessed Stream Length (ft) 2486
Assessed Bank Length (ft) 4972

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	25	25		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	31	31		100%

Table 4e. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID Moores Fork - Reach 1
Assessed Stream Length (ft) 3145
Assessed Bank Length (ft) 6290

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			12	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			67	99%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	79	99%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	3	3		100%

Table 4f. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID Moores Fork - Reach 2
Assessed Stream Length (ft) 4389
Assessed Bank Length (ft) 8778

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			223	97%
				Totals	223	97%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	7	7		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	30	33		91%

Table 4g. Visual Stream Morphology Stability Assessment Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Reach ID Moores Fork - Reach 3
Assessed Stream Length (ft) 772
Assessed Bank Length (ft) 1544

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	Surface Scour/Bare Bank	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	6	6		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	2	2		100%

Table 5. Vegetation Condition Assessment Table
Stewarts Creek Tributaries Mitigation Project (DMS No.100023)

Planted Acreage **24.2**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.1 acres	0.00	0.0%
		Total	0.00	0.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.25 acres	0.00	0.0%
		Cumulative Total	0.00	0.0%

Easement Acreage **30**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.1 acres	0.00	0.0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	None	0.2	0.7%

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

Photo Point 1A – Moores Fork Reach 1, Sta. 11+81
Facing Upstream (11/3/2020)

Photo Point 1B – Moores Fork Reach 1, Sta. 11+81
Facing Downstream (11/3/2020)

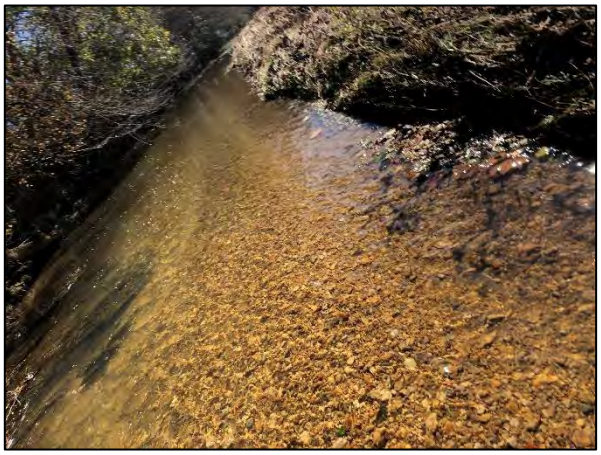


Photo Point 2 – Moores Fork Reach 1, Sta. 14+79
Facing Downstream (11/3/2020)

Photo Point 3 – Moores Fork Reach 1, Sta. 23+37
Facing Downstream (11/3/2020)

Photo Point 4 – Moores Fork Reach 1, Sta. 24+96
Facing Upstream (11/3/2020)

Photo Point 5 – Moores Fork Reach 2, Sta. 25+61
Facing Downstream (11/3/2020)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

Photo Point 6 – Moores Fork Reach 2, Sta. 27+97
Facing Downstream (11/3/2020)

Photo Point 7 – Moores Fork Reach 2, Sta. 32+21
Facing Upstream (11/3/2020)

Photo Point 8 – Moores Fork Reach 2, Sta. 33+48
Facing Upstream (11/3/2020)

Photo Point 9 – Moores Fork Reach 2, Sta. 36+47
Facing Upstream (11/3/2020)

Photo Point 10 – Moores Fork Reach 2, Sta. 41+77
Facing Upstream (11/3/2020)

Photo Point 11A – Moores Fork Reach 2, Sta. 45+79
Facing Upstream (11/3/2020)

ECOSYSTEM PLANNING & RESTORATION

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

Photo Point 11B – Moores Fork Reach 2, Sta. 45+79
Facing Downstream (11/3/2020)

Photo Point 12A – Moores Fork Reach 3, Sta. 50+54
Facing Upstream (11/3/2020)

Photo Point 12B – Moores Fork Reach 3, Sta. 50+54
Facing Downstream (11/3/2020)

Photo Point 13 – UT1, Sta. 10+84
Facing Upstream (10/22/2020)

Photo Point 14A – UT1, Sta. 12+91
Facing Upstream (10/22/2020)

Photo Point 14B – UT1, Sta. 12+91
Facing Downstream (10/22/2020)

ECOSYSTEM PLANNING & RESTORATION

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

Photo Point 15 – UT1, Sta. 15+52
Facing Upstream (10/22/2020)

Photo Point 16 – UT1, Sta. 18+34
Facing Upstream (10/22/2020)

Photo Point 17 – UT1, Sta. 21+12
Facing Upstream (10/22/2020)

Photo Point 18 – UT1, Sta. 22+81
Facing Upstream (10/22/2020)

Photo Point 19 – UT1, Sta. 27+39
Facing Upstream (10/22/2020)

Photo Point 20 – UT1, Sta. 30+35
Facing Upstream (10/22/2020)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

Photo Point 21 – UT1, Sta. 33+42
Facing Upstream (10/22/2020)

Photo Point 22 – UT1, Sta. 36+73
Facing Downstream (10/22/2020)

Photo Point 23A – UT2, Sta. 10+47
Facing Upstream (10/22/2020)

Photo Point 23B – UT2, Sta. 10+47
Facing Downstream (10/22/2020)

Photo Point 24 – UT2, Sta. 11+57
Facing Upstream (10/22/2020)

Photo Point 25 – UT2, Sta. 14+65
Facing Upstream (10/22/2020)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

Photo Point 26 – UT2, Sta. 18+32
Facing Upstream (10/22/2020)

Photo Point 27A – UT3 Reach 1, Sta. 11+51
Facing Upstream (10/22/2020)

Photo Point 27B – UT3 Reach 1, Sta. 11+51
Facing Downstream (10/22/2020)

Photo Point 28 – UT3 Reach 1, Sta. 13+35
Facing Upstream (10/22/2020)

Photo Point 29 – UT3 Reach 1, Sta. 15+88
Facing Upstream (10/22/2020)

Photo Point 30 – UT3 Reach 1, Sta. 18+28
Facing Upstream (10/22/2020)

ECOSYSTEM PLANNING & RESTORATION

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

Photo Point 31 – UT3 Reach 2, Sta. 20+10
Facing Upstream (10/22/2020)

Photo Point 32 – UT3 Reach 2, Sta. 21+27
Facing Upstream (10/22/2020)

Photo Point 33A – UT3 Reach 2, Sta. 27+44
Facing Upstream (10/22/2020)

Photo Point 33B – UT3 Reach 2, Sta. 27+44
Facing Downstream (10/22/2020)

Photo Point 34 – UT3 Reach 2, Sta. 30+47
Facing Upstream (10/22/2020)

Photo Point 35 – UT3 Reach 2, Sta. 37+79
Facing Upstream (10/22/2020)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

Photo Point 36 – UT3 Reach 2, Sta. 40+06
Facing Upstream (10/22/2020)

Photo Point 37 – UT3 Reach 2, Sta. 42+81
Facing Upstream (10/22/2020)

Photo Point 33A – UT3 Reach 2, Sta. 27+44
Facing Upstream (10/22/2020)

UT1 Culvert Opening
Facing Upstream (09/22/2020)

UT2 Culvert Opening
Facing Upstream (09/22/2020)

UT3 Reach 1 Culvert Opening
Facing Culvert Downstream (09/22/2020)

ECOSYSTEM PLANNING & RESTORATION

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Photo Log

UT3 Reach 2 Culvert Opening
Facing Upstream (09/22/2020)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Vegetation Photo Log

Veg Plot 1 – E Corner (11/3/2020)

Veg Plot 2 – NW Corner (11/3/2020)

Veg Plot 3 – N Corner (11/3/2020)

Veg Plot 4 – S Corner (11/3/2020)

Veg Plot 5 – S Corner (11/3/2020)

Veg Plot 6 –SE Corner (11/3/2020)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Vegetation Photo Log

Veg Plot 7 – SE Corner (11/3/2020)

Veg Plot 8 – SW Corner (11/3/2020)

Veg Plot 9 – SE Corner (11/3/2020)

Veg Plot 10 – N Corner (11/3/2020)

Veg Plot 11 – SW Corner (11/3/2020)

Random Veg Plot 1 –NW Corner (11/3/2020)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Vegetation Photo Log

Random Veg Plot 2 – W Corner (11/3/2020)

Random Veg Plot 3 – W Corner (11/3/2020)

Random Veg Plot 4 – NE Corner (11/3/2020)

Random Veg Plot 5 – N Corner (11/3/2020)

Random Veg Plot 6 – N Corner (11/3/2020)

Random Veg Plot 7 –NW Corner (11/3/2020)

Stewarts Creek Tributaries Stream Restoration Project
Monitoring Year 1 - Vegetation Photo Log

Random Veg Plot 8 – SW Corner (11/3/2020)

Random Veg Plot 9 – W Corner (11/3/2020)

Random Veg Plot 10 – N Corner (11/3/2020)

Random Veg Plot 11 – N Corner (11/3/2020)

Appendix B: Vegetation Plot Data

Table 6. Vegetation Plot Data

Table 7. Vegetation Performance Standards Summary Table

Table 6. Vegetation Plot Data
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Planted Acreage	24.2
Date of Initial Plant	2020-03-31
Date of Current Survey	2020-11-03
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW	4	4	1	1	2	2	6	6	2	2	2	2
	Carya glabra	pignut hickory	Tree	FACU	2	2										
	Carya tomentosa	mockernut hickory	Tree		3	3							1	1		
	Cornus amomum	silky dogwood	Shrub	FACW									1	1		
	Diospyros virginiana	common persimmon	Tree	FAC	1	1			1	1	1	1				
	Fraxinus pennsylvanica	green ash	Tree	FACW									1	1		
	Ilex opaca	American holly	Tree	FACU												
	Juniperus virginiana	eastern redcedar	Tree	FACU									4	4		
	Liriodendron tulipifera	tuliptree	Tree	FACU			1	1			1	1	1	1	2	2
	Platanus occidentalis	American sycamore	Tree	FACW			3	3			1	1	2	2	2	2
	Quercus alba	white oak	Tree	FACU	1	1										
	Quercus nigra	water oak	Tree	FAC	2	2			1	1	1	1			5	5
	Quercus phellos	willow oak	Tree	FAC	1	1	2	2							2	2
	Quercus rubra	northern red oak	Tree	FACU	1	1										
	Salix nigra	black willow	Tree	OBL			2	2			1	1	2	2		
	Ulmus americana	American elm	Tree	FACW	1	1			1	1	5	5			1	1
Sum	Performance Standard				16	16	9	9	5	5	16	16	14	14	14	14
Post Mitigation Plan Species	*Acer rubrum*	*red maple*	*Tree*	*FAC*					*2*	*2*						
Sum	Proposed Standard				16	16	9	9	5	5	16	16	14	14	14	14
Mitigation Plan Performance Standard	Current Year Stem Count					16		9		5		16		14		14
	Stems/Acre					648		364		202		648		567		567
	Species Count					9		5		4		7		8		6
	Dominant Species Composition (%)					25		33		29		38		29		36
	Average Plot Height					2		1		2		2		2		1
	% Invasives					0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					16		9		5		16		14		14
	Stems/Acre					648		364		202		648		567		567
	Species Count					9		5		4		7		8		6
	Dominant Species Composition (%)					25		33		29		38		29		36
	Average Plot Height					2		1		2		2		2		1
	% Invasives					0		0		0		0		0		0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

ECOSYSTEM PLANNING & RESTORATION

Table 6. Vegetation Plot Data (cont.)
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 F		Veg Plot 11 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW	2	2	1	1	5	5	5	5	1	1	4	4
	Carya glabra	pignut hickory	Tree	FACU												
	Carya tomentosa	mockernut hickory	Tree													
	Cornus amomum	silky dogwood	Shrub	FACW												
	Diospyros virginiana	common persimmon	Tree	FAC			1	1								
	Fraxinus pennsylvanica	green ash	Tree	FACW											1	1
	Ilex opaca	American holly	Tree	FACU			1	1								
	Juniperus virginiana	eastern redcedar	Tree	FACU												
	Liriodendron tulipifera	tuliptree	Tree	FACU	2	2	4	4					1	1	3	3
	Platanus occidentalis	American sycamore	Tree	FACW	2	2	1	1	5	5	1	1	3	3	3	3
	Quercus alba	white oak	Tree	FACU												
	Quercus nigra	water oak	Tree	FAC	5	5									1	1
	Quercus phellos	willow oak	Tree	FAC	2	2	1	1	4	4	1	1	2	2	1	1
	Quercus rubra	northern red oak	Tree	FACU												
	Salix nigra	black willow	Tree	OBL											2	2
	Ulmus americana	American elm	Tree	FACW	1	1	1	1			5	5	2	2	1	1
Sum	Performance Standard				14	14	10	10	14	14	12	12	9	9	16	16
Post Mitigation Plan Species	*Acer rubrum*	*red maple*	*Tree*	*FAC*												
Sum	Proposed Standard				14	14	10	10	14	14	12	12	9	9	16	16
Mitigation Plan Performance Standard	Current Year Stem Count					14		10		14		12		9		16
	Stems/Acre					567		405		567		486		364		648
	Species Count					6		7		3		4		5		8
	Dominant Species Composition (%)					36		40		36		42		33		25
	Average Plot Height					1		2		1		2		1		2
	% Invasives					0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					14		10		14		12		9		16
	Stems/Acre					567		405		567		486		364		648
	Species Count					6		7		3		4		5		8
	Dominant Species Composition (%)					36		40		36		42		33		25
	Average Plot Height					1		2		1		2		1		2
	% Invasives					0		0		0		0		0		0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6. Vegetation Plot Data (cont.)
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 12 R Total	Veg Plot 13 R Total	Veg Plot 14 R Total	Veg Plot 15 R Total	Veg Plot 16 R Total	Veg Plot 17 R Total	Veg Plot 18 R Total	Veg Plot 19 R Total	Veg Plot 20 R Total	Veg Plot 21 R Total	Veg Plot 22 R Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW	3	3	1	4	4	3	3	5	2	2	4
	Carya glabra	pignut hickory	Tree	FACU								1			
	Carya tomentosa	mockernut hickory	Tree												
	Cornus amomum	silky dogwood	Shrub	FACW											
	Diospyros virginiana	common persimmon	Tree	FAC					2			2			
	Fraxinus pennsylvanica	green ash	Tree	FACW	1		1		1		1			1	
	Ilex opaca	American holly	Tree	FACU											
	Juniperus virginiana	eastern redcedar	Tree	FACU											
	Liriodendron tulipifera	tuliptree	Tree	FACU	1			2				1		1	
	Platanus occidentalis	American sycamore	Tree	FACW	3	5	1	2	1	4	1		4	2	4
	Quercus alba	white oak	Tree	FACU								1			
	Quercus nigra	water oak	Tree	FAC		1	6				2	2	1	1	1
	Quercus phellos	willow oak	Tree	FAC	1	1			4	1	2	1			1
	Quercus rubra	northern red oak	Tree	FACU											
	Salix nigra	black willow	Tree	OBL	1	3		1			1		2		
	Ulmus americana	American elm	Tree	FACW										5	
Sum	Performance Standard				10	13	9	9	12	8	10	13	9	12	10
Post Mitigation Plan Species	*Acer rubrum*	*red maple*	*Tree*	*FAC*											
Sum	Proposed Standard				10	13	9	9	12	8	10	13	9	12	10
Mitigation Plan Performance Standard	Current Year Stem Count				10	13	9	9	12	8	10	13	9	12	10
	Stems/Acre				405	526	364	364	486	324	405	526	364	486	405
	Species Count				6	5	4	4	5	3	6	7	4	6	4
	Dominant Species Composition (%)				30	38	67	44	33	50	30	38	44	42	40
	Average Plot Height				2	2	2	2	2	1	2	1	2	2	2
	% Invasives				0	0	0	0	0	0	0	0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count				10	13	9	9	12	8	10	13	9	12	10
	Stems/Acre				405	526	364	364	486	324	405	526	364	486	405
	Species Count				6	5	4	4	5	3	6	7	4	6	4
	Dominant Species Composition (%)				30	38	67	44	33	50	30	38	44	42	40
	Average Plot Height				2	2	2	2	2	1	2	1	2	2	2
	% Invasives				0	0	0	0	0	0	0	0	0	0	0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 7. Vegetation Performance Standards Summary Table
Stewarts Creek Tributaries Stream Restoration Project (DMS No.100023)

Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	648		9	0	364		5	0	202		5	0
Monitoring Year 0	729		10	0	769		6	0	364		5	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	648		7	0	567		8	0	567		6	0
Monitoring Year 0	688		8	0	486		7	0	688		7	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	405		7	0	567		3	0	486		4	0
Monitoring Year 0	688		8	0	607		4	0	567		5	0
	Veg Plot 10 F				Veg Plot 11 F				Veg Plot Group 1 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	364		5	0	648		8	0	405		6	0
Monitoring Year 0	526		6	0	567		7	0				
	Veg Plot Group 2 R				Veg Plot Group 3 R				Veg Plot Group 4 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	526		5	0	364		4	0	364		4	0
Monitoring Year 0												
	Veg Plot Group 5 R				Veg Plot Group 6 R				Veg Plot Group 7 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	486		5	0	324		3	0	405		6	0
Monitoring Year 0												
	Veg Plot Group 8 R				Veg Plot Group 9 R				Veg Plot Group 10 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	526		7	0	364		4	0	486		6	0
Monitoring Year 0												
	Veg Plot Group 11 R											
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives								
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	405		4	0								
Monitoring Year 0												

*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

Appendix C: Stream Geomorphology Data

Cross Sections with Annual Overlays

Table 8. Baseline Stream Data Summary

Table 9. Cross Section Morphology Monitoring Summary

Cross Section Plot - MY1 - October 2020

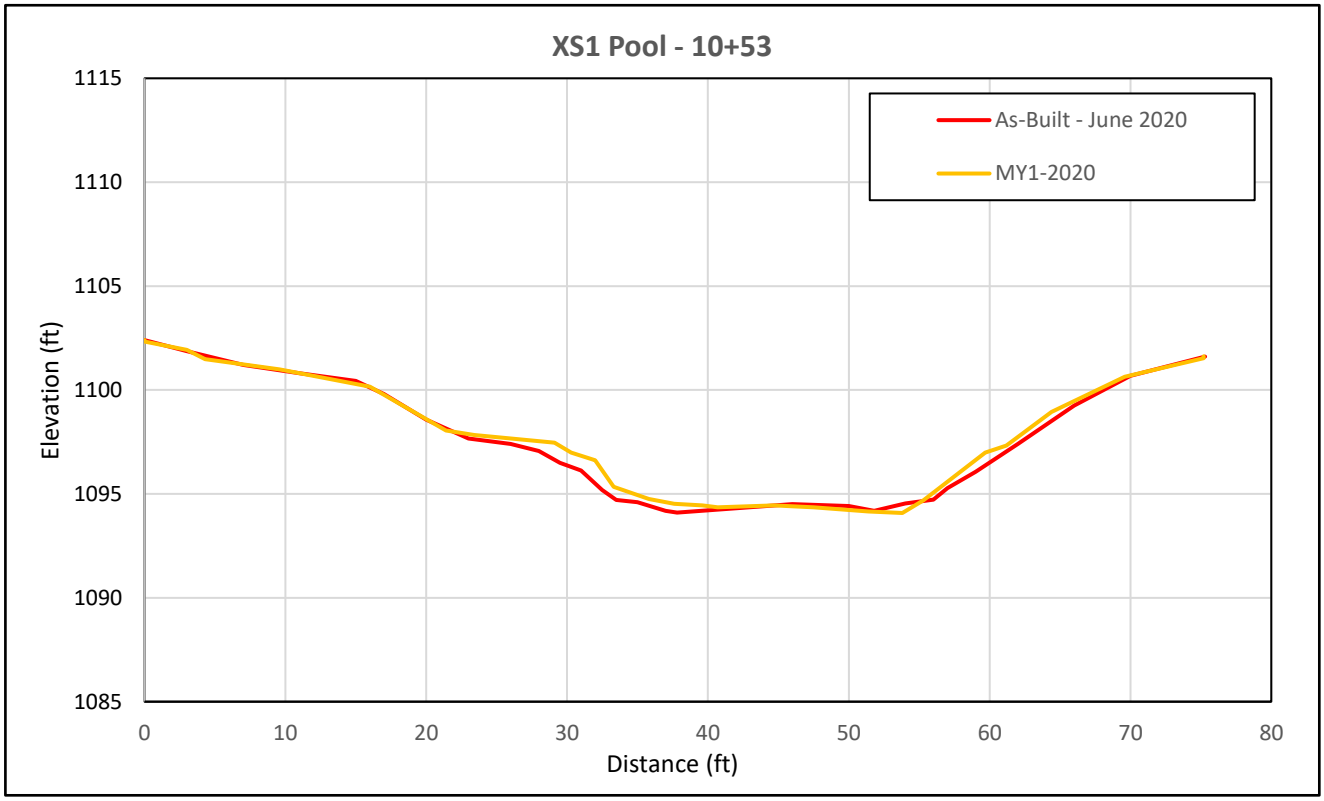
XS1 - Moores Fork Reach 1

Station 10+53 - Pool

XS1 looking upstream

XS1 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1097.06	1097.29					
Bank Height Ratio - Based on AB-Bankfull Area	1.20	1.05					
Thalweg Elevation	1094.10	1094.08					
LTOB Elevation	1097.67	1097.46					
LTOB Max Depth	3.57	3.38					
LTOB Cross Sectional Area	93.76	77.33					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

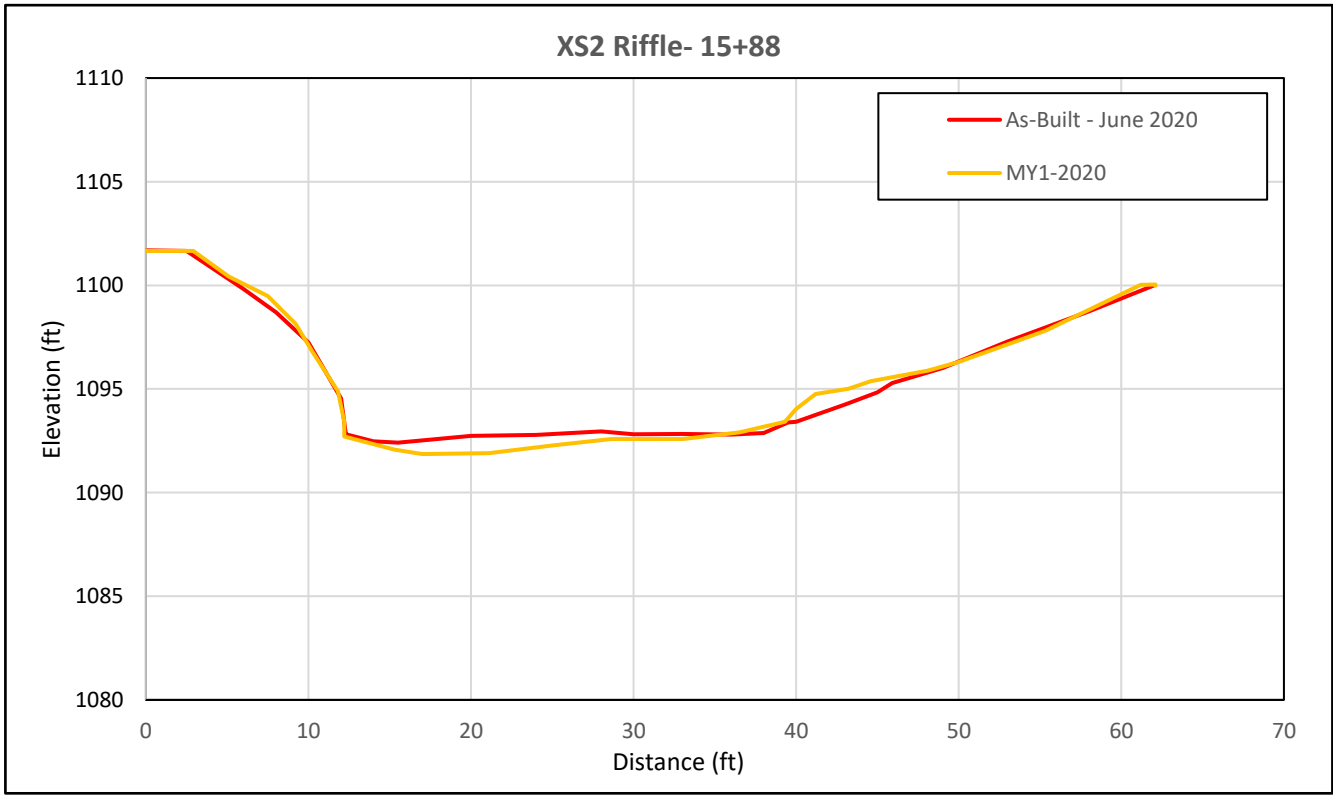
XS2 - Moores Fork Reach 1

Station 15+88 - Riffle

XS2 looking upstream

XS2 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1094.84	1094.64					
Bank Height Ratio - Based on AB-Bankfull Area	1.18	1.04					
Thalweg Elevation	1092.41	1091.86					
LTOB Elevation	1095.28	1094.76					
LTOB Max Depth	2.87	2.90					
LTOB Cross Sectional Area	75.98	65.20					
Entrenchment Ratio	1.29	1.54					



Cross Section Plot - MY1 - October 2020

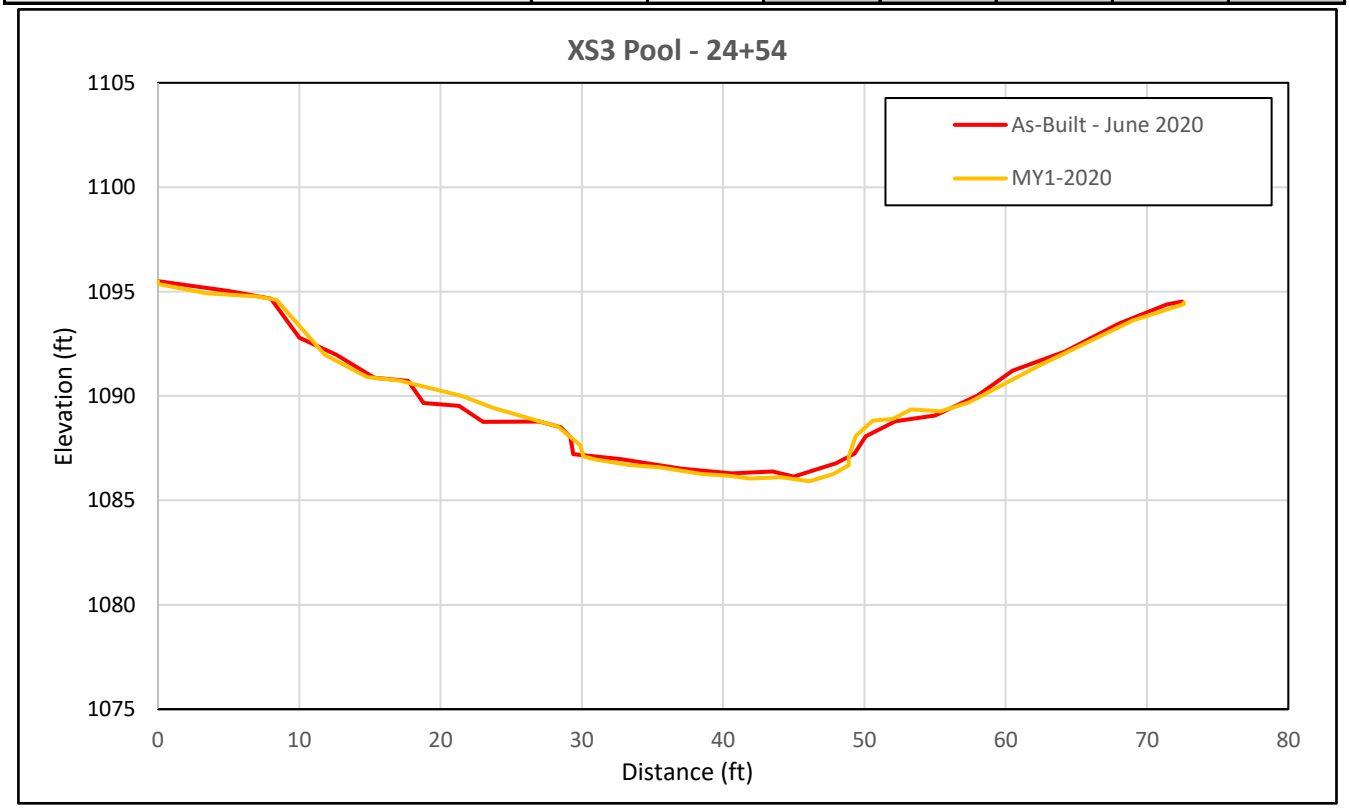
XS3 - Moores Fork Reach 1

Station 24+54 - Pool

XS3 looking upstream

XS3 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1088.77	1088.67					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.06					
Thalweg Elevation	1086.14	1085.92					
LTOB Elevation	1088.77	1088.82					
LTOB Max Depth	2.63	2.90					
LTOB Cross Sectional Area	45.04	48.74					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

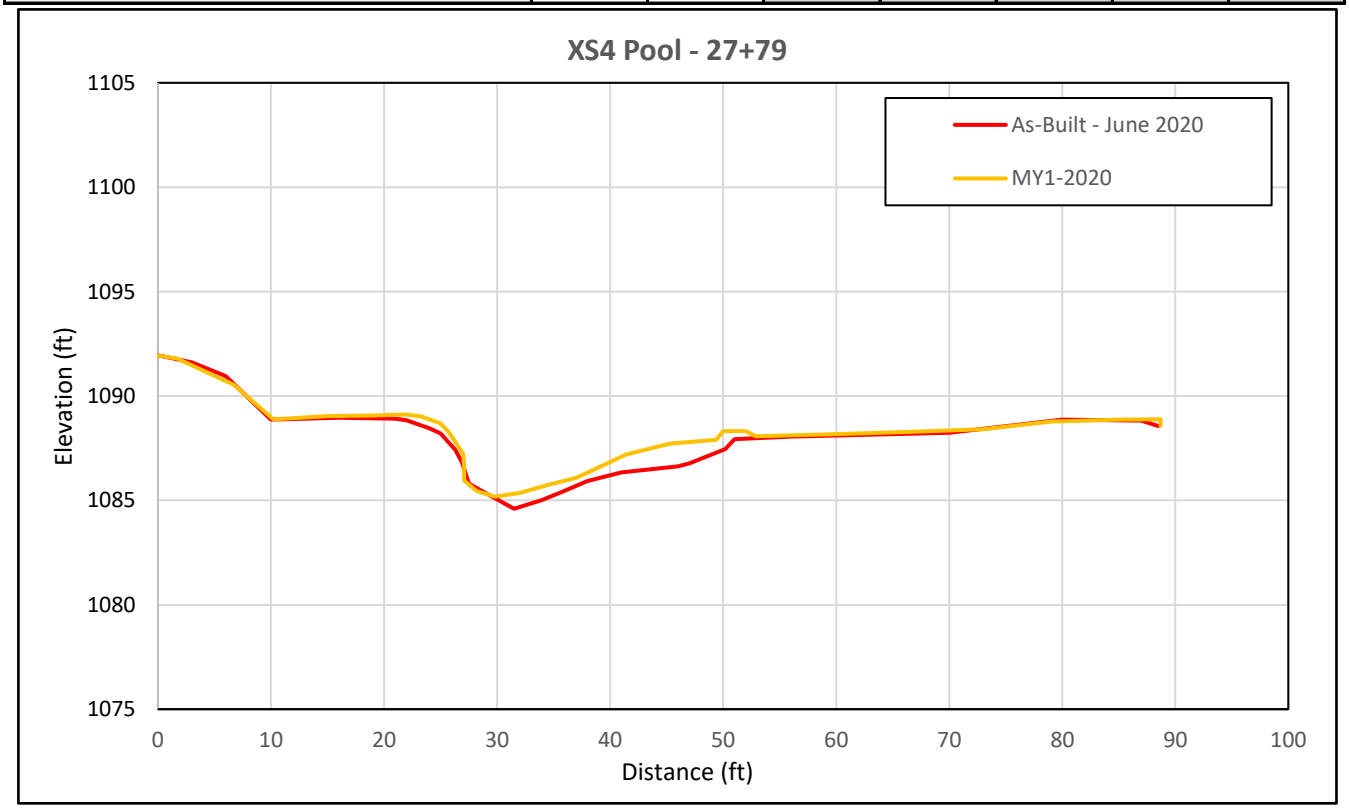
XS4 - Moores Fork Reach 2

Station 27+79 - Pool

XS4 looking upstream

XS4 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1087.94	1088.59					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.80					
Thalweg Elevation	1084.60	1085.18					
LTOB Elevation	1087.94	1087.91					
LTOB Max Depth	3.34	2.73					
LTOB Cross Sectional Area	47.12	31.39					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

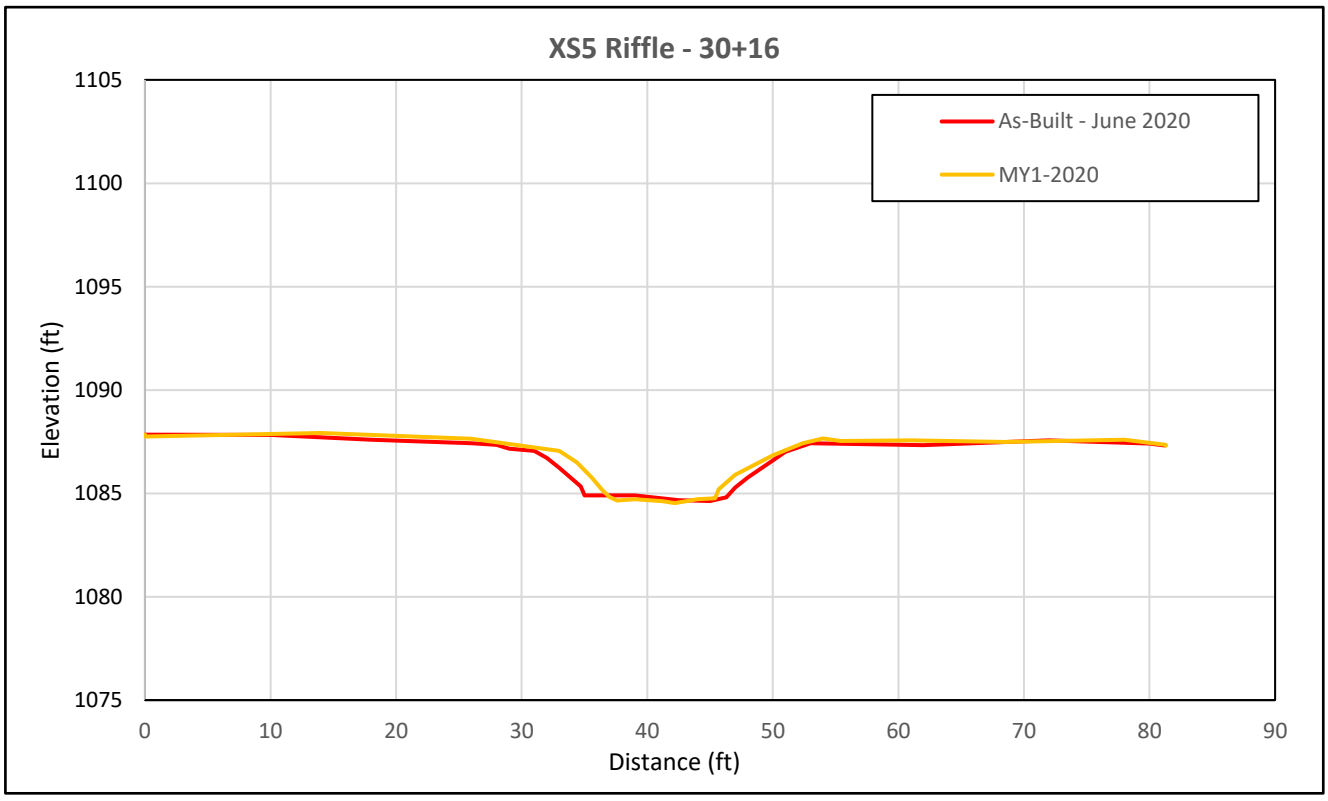
XS5 - Moores Fork Reach 2

Station 30+16 - Riffle

XS5 looking upstream

XS5 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1087.06	1087.32					
Bank Height Ratio - Based on AB-Bankfull Area	1.11	1.04					
Thalweg Elevation	1084.63	1084.53					
LTOB Elevation	1087.34	1087.43					
LTOB Max Depth	2.71	2.90					
LTOB Cross Sectional Area	40.53	36.65					
Entrenchment Ratio	>4.01	>4.55					



Cross Section Plot - MY1 - October 2020

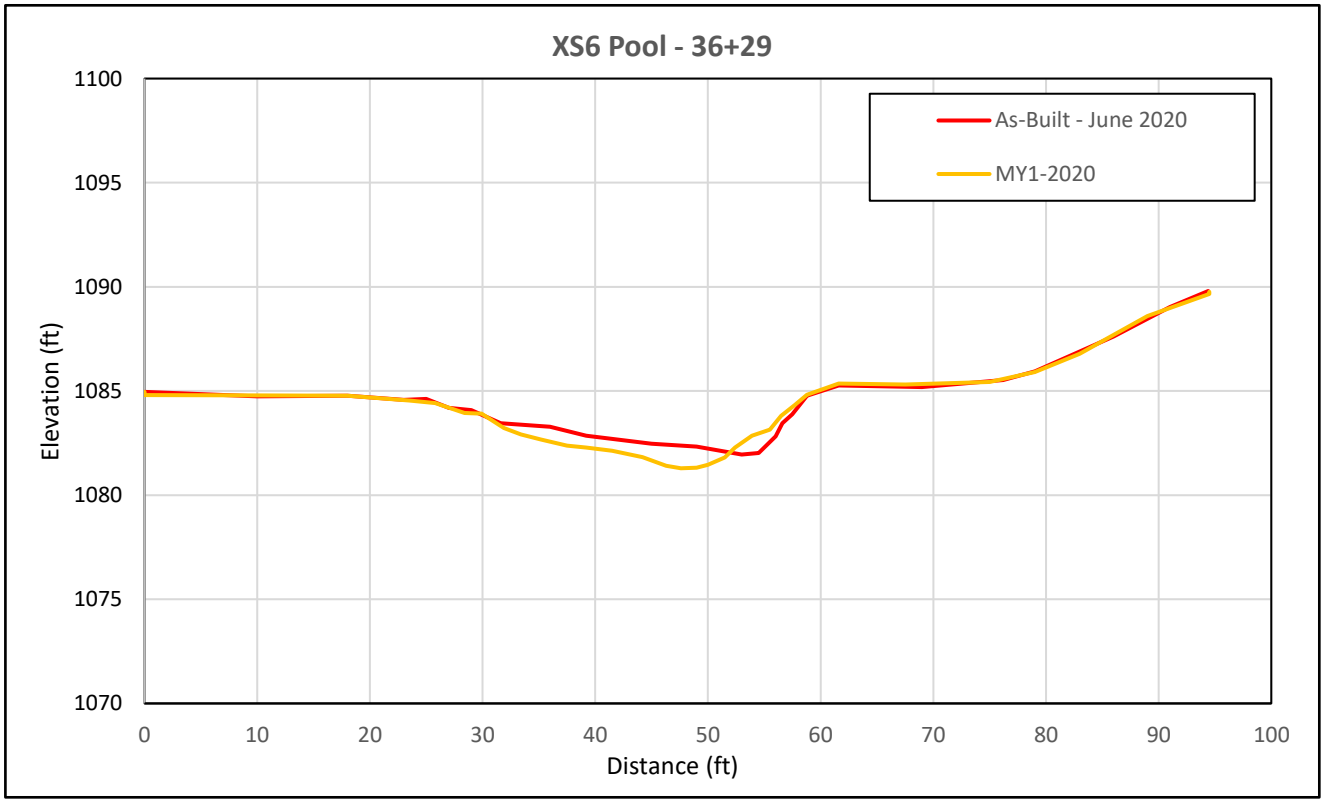
XS6 - Moores Fork Reach 2

Station 36+29 - Pool

XS6 looking upstream

XS6 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1084.62	1084.29					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.08					
Thalweg Elevation	1081.95	1081.29					
LTOB Elevation	1084.62	1084.54					
LTOB Max Depth	2.67	3.25					
LTOB Cross Sectional Area	53.58	61.60					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

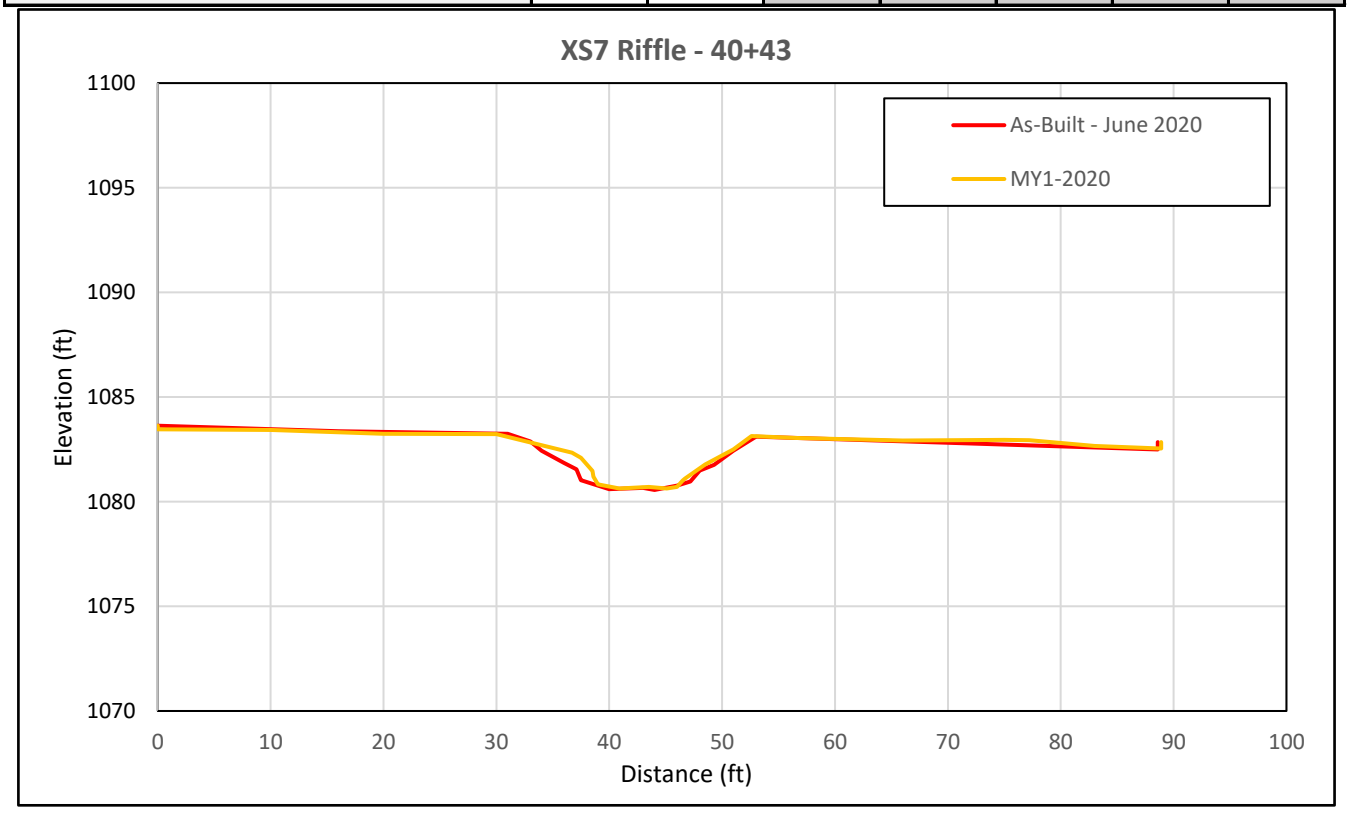
XS7 - Moores Fork Reach 2

Station 40+43 - Riffle

XS7 looking upstream

XS7 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1083.10	1083.29					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.94					
Thalweg Elevation	1080.56	1080.63					
LTOB Elevation	1083.10	1083.13					
LTOB Max Depth	2.54	2.50					
LTOB Cross Sectional Area	33.72	30.17					
Entrenchment Ratio	>4.14	>4.07					



Cross Section Plot - MY1 - October 2020

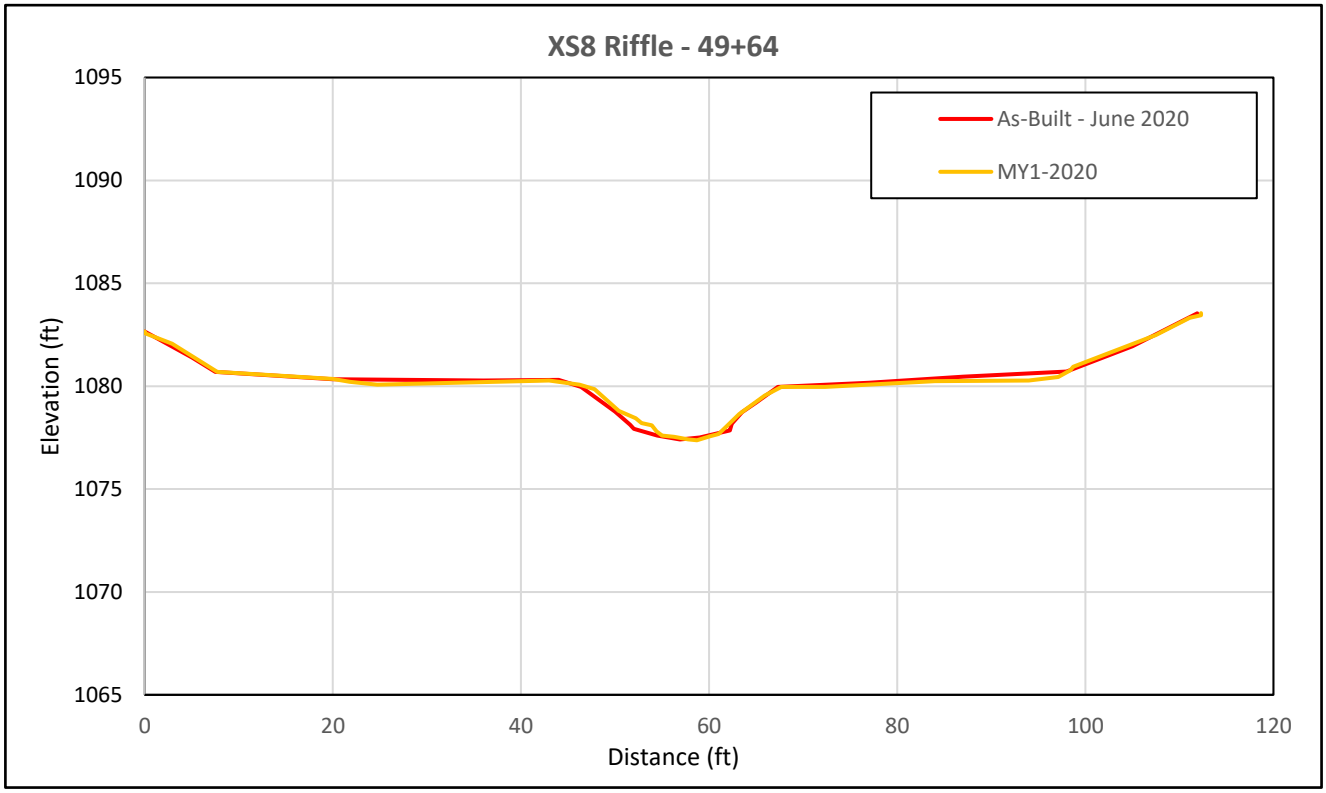
XS8 - Moores Fork Reach 3

Station 49+64 - Riffle

XS8 looking upstream

XS8 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1079.97	1080.11					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.95					
Thalweg Elevation	1077.41	1077.37					
LTOB Elevation	1079.97	1079.97					
LTOB Max Depth	2.56	2.60					
LTOB Cross Sectional Area	33.89	31.07					
Entrenchment Ratio	5.12	5.20					



Cross Section Plot - MY1 - October 2020

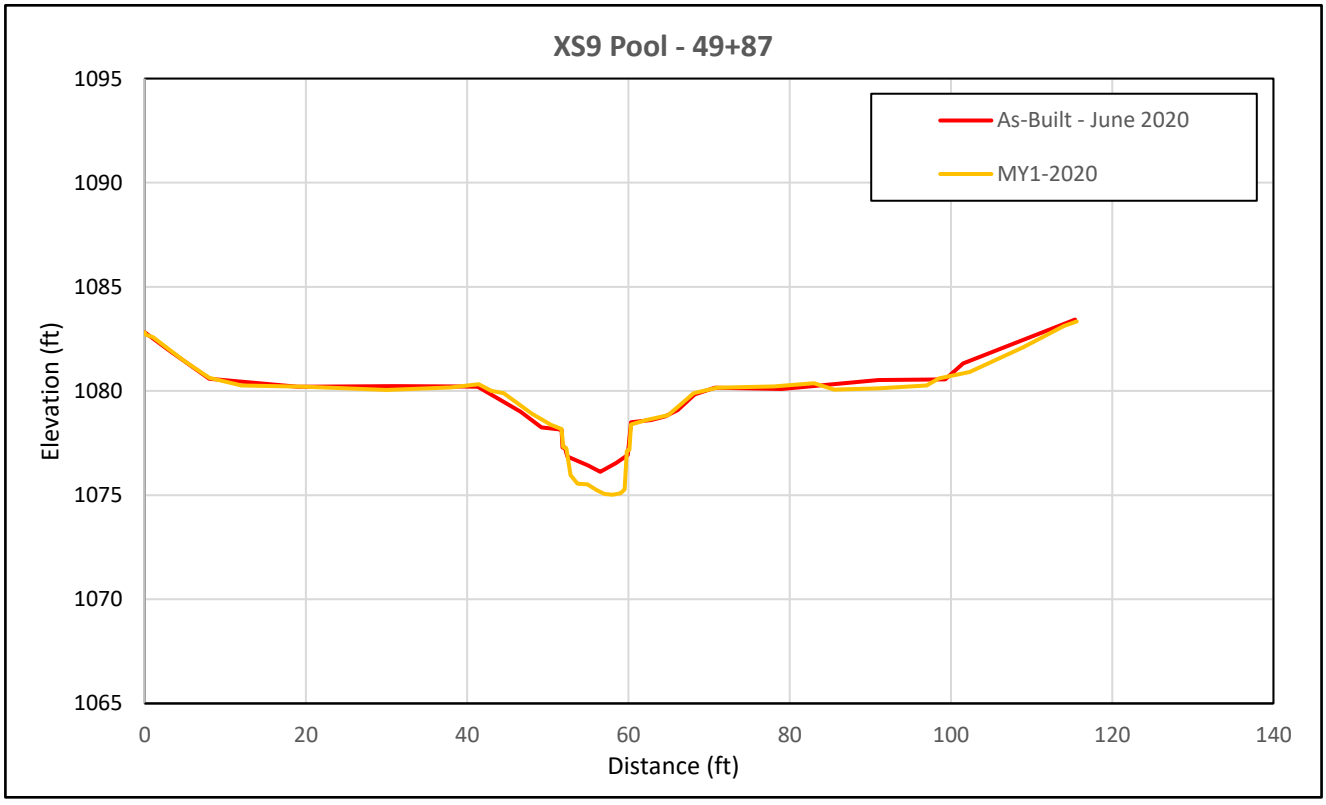
XS9 - Moores Fork Reach 3

Station 49+87 - Pool

XS9 looking upstream

XS9 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1080.16	1079.98					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.04					
Thalweg Elevation	1076.12	1075.02					
LTOB Elevation	1080.16	1080.16					
LTOB Max Depth	4.04	5.14					
LTOB Cross Sectional Area	52.58	57.57					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

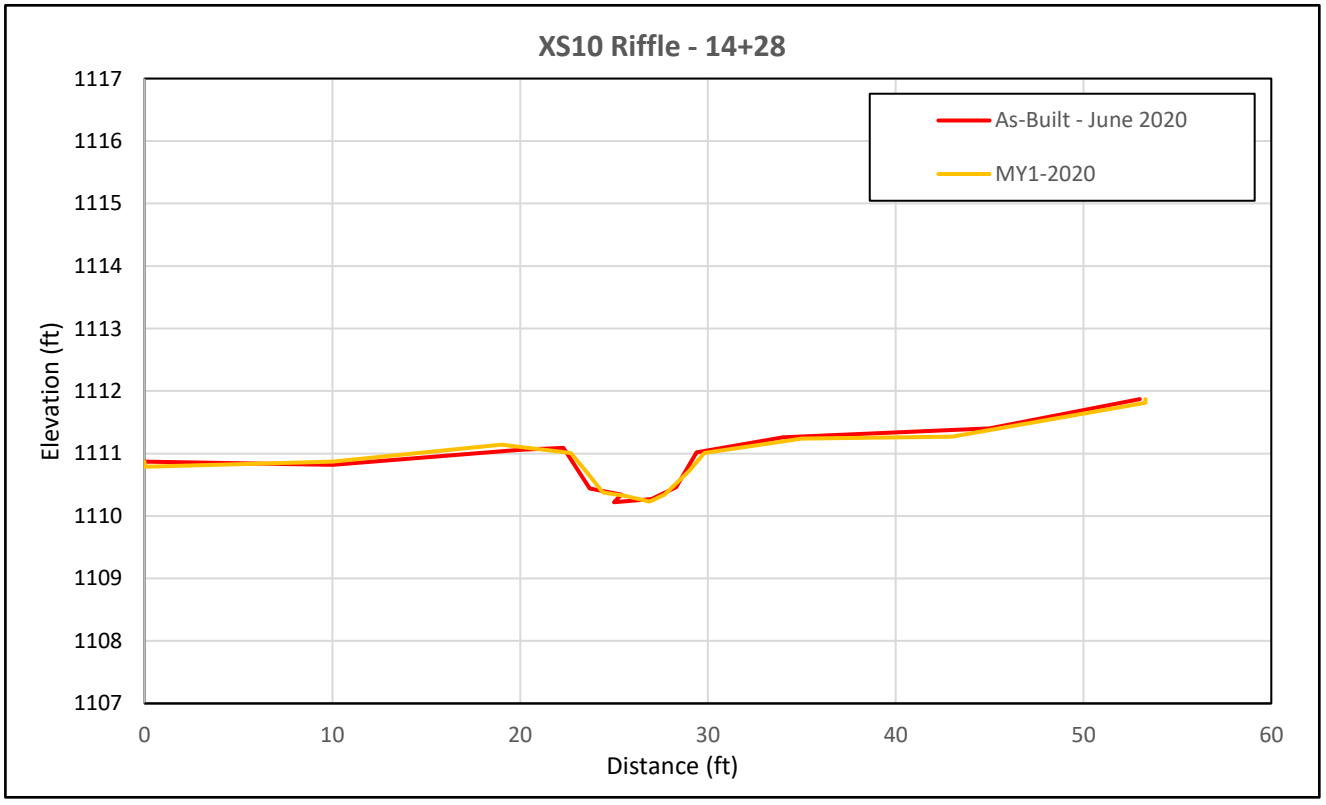
XS10 - UT1

Station 14+28 - Riffle

XS10 looking upstream

XS10 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1111.02	1111.05					
Bank Height Ratio - Based on AB-Bankfull Area	1.08	0.95					
Thalweg Elevation	1110.22	1110.23					
LTOB Elevation	1111.09	1111.01					
LTOB Max Depth	0.87	0.78					
LTOB Cross Sectional Area	4.40	3.60					
Entrenchment Ratio	7.50	7.45					



Cross Section Plot - MY1 - October 2020

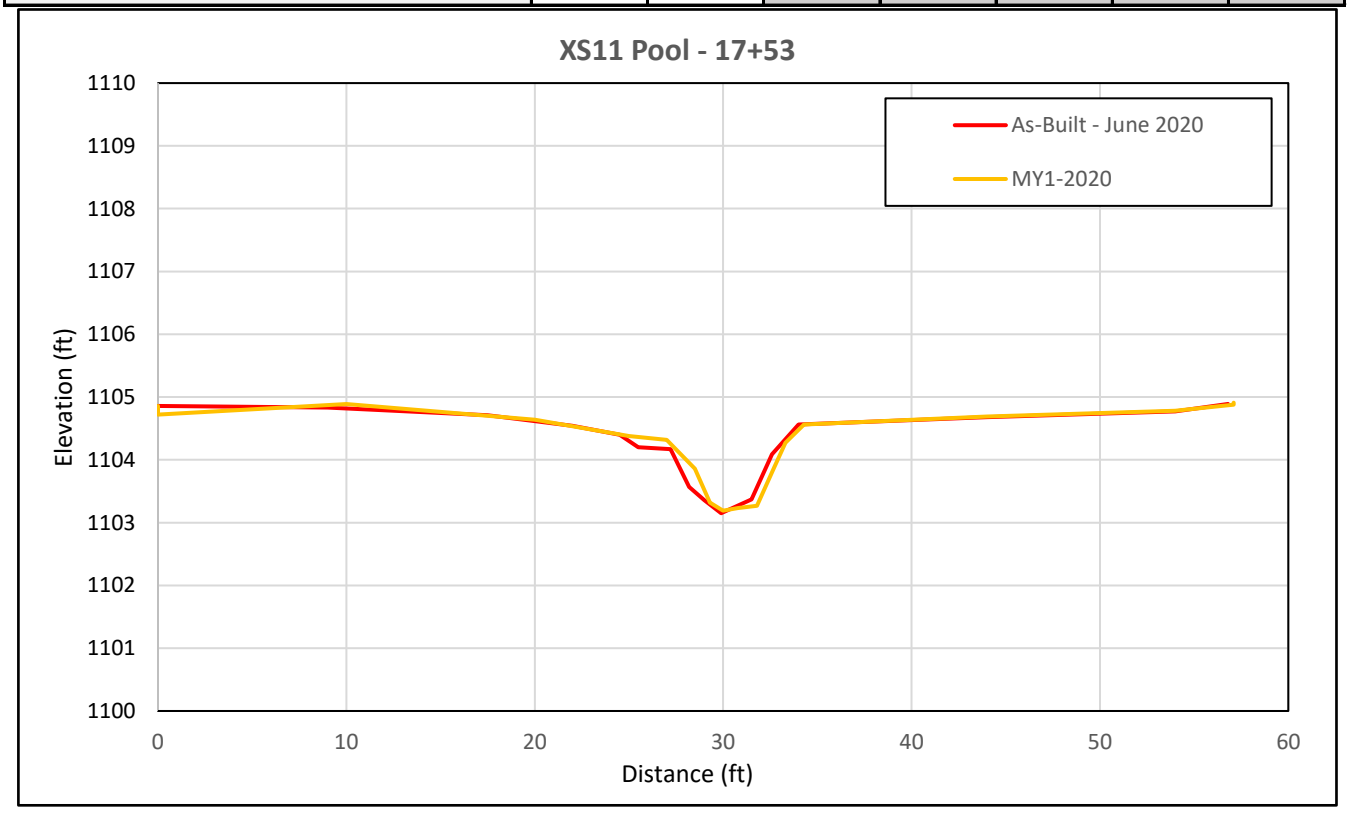
XS11 - UT1

Station 17+53 - Pool

XS11 looking upstream

XS11 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1104.40	1104.45					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.95					
Thalweg Elevation	1103.15	1103.19					
LTOB Elevation	1104.40	1104.38					
LTOB Max Depth	1.25	1.19					
LTOB Cross Sectional Area	5.48	4.92					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

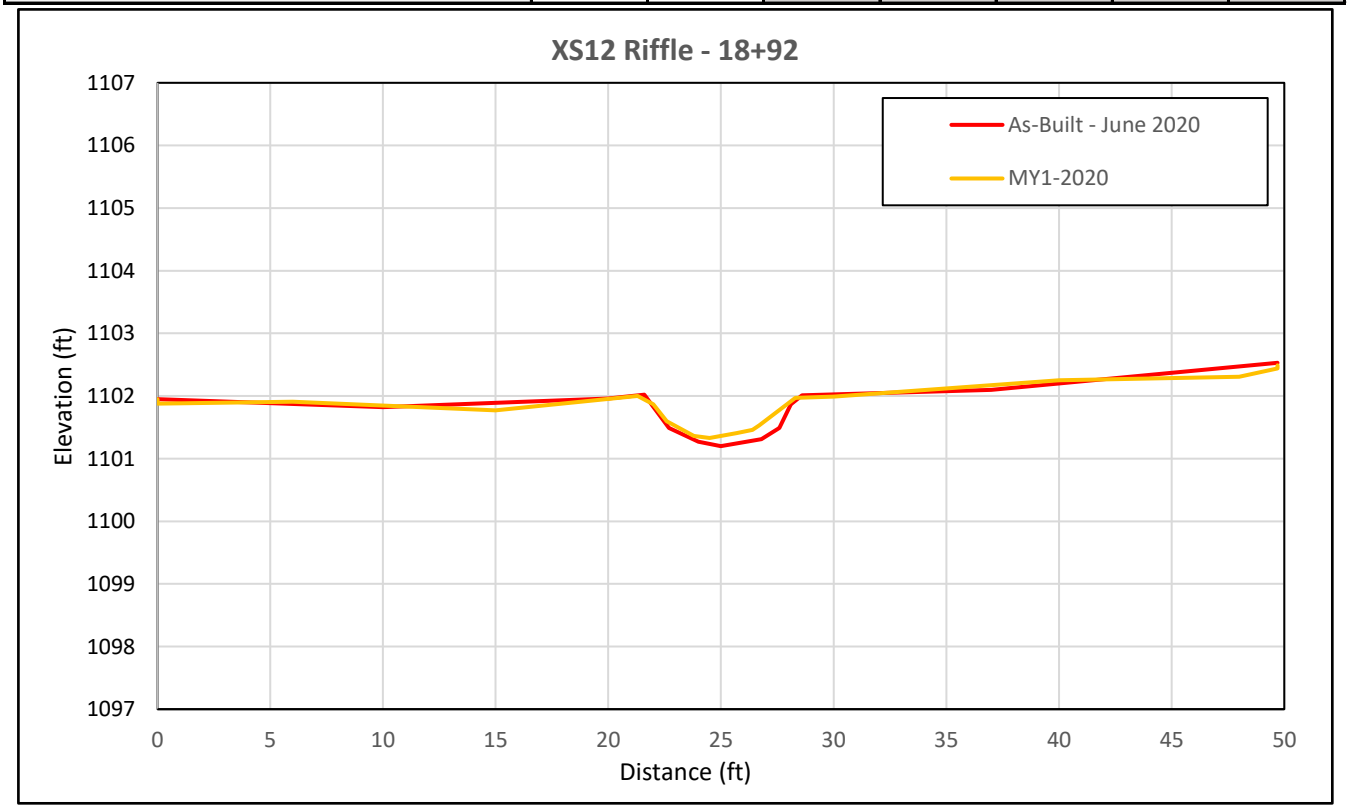
XS12 - UT1

Station 18+92 - Riffle

XS12 looking upstream

XS12 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1102.01	1102.14					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.79					
Thalweg Elevation	1101.20	1101.33					
LTOB Elevation	1102.01	1101.97					
LTOB Max Depth	0.81	0.64					
LTOB Cross Sectional Area	3.92	2.78					
Entrenchment Ratio	7.12	7.27					



Cross Section Plot - MY1 - October 2020

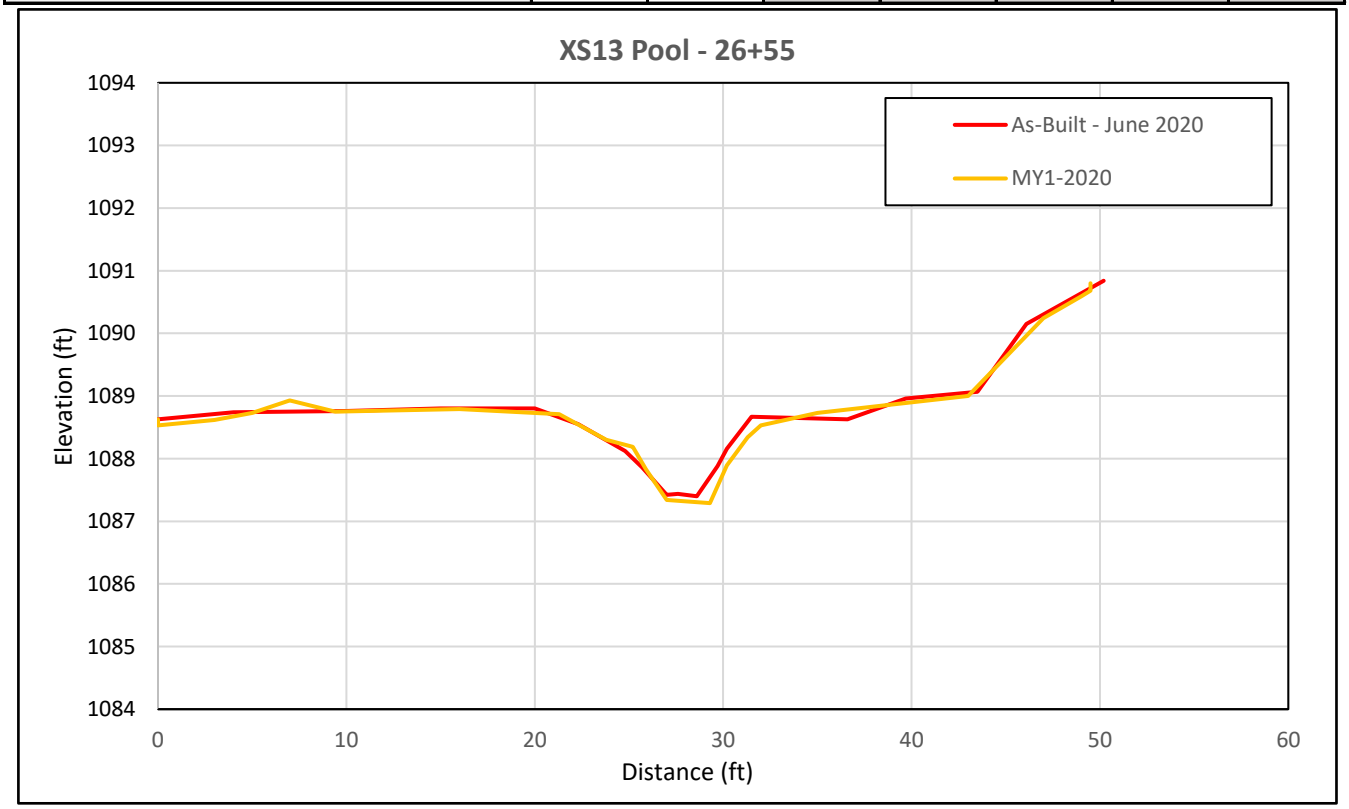
XS13 - UT1

Station 26+55 - Pool

XS13 looking upstream

XS13 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1088.55	1088.46					
Bank Height Ratio - Based on AB-Bankfull Area	1.10	1.23					
Thalweg Elevation	1087.40	1087.29					
LTOB Elevation	1088.67	1088.73					
LTOB Max Depth	1.27	1.44					
LTOB Cross Sectional Area	6.64	8.60					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

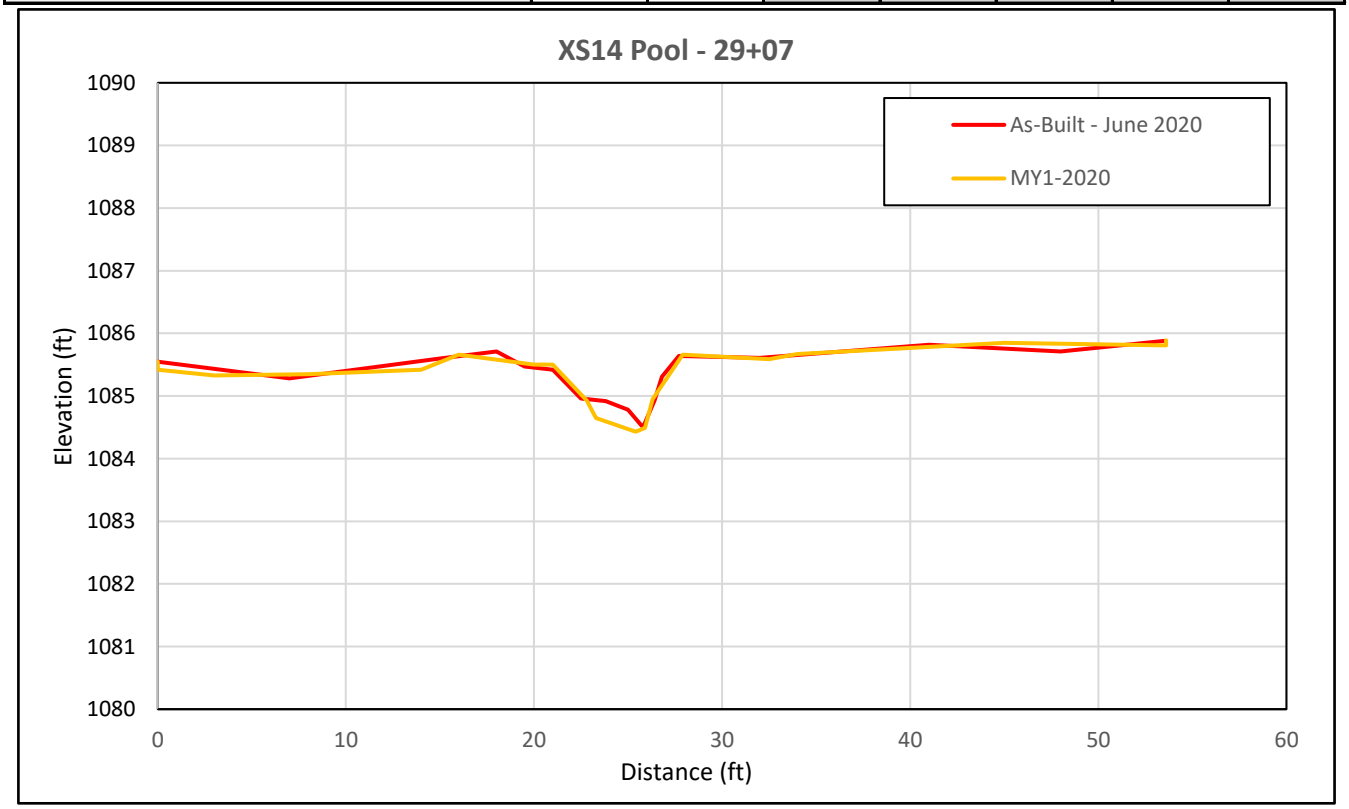
XS14 - UT1

Station 29+07 - Pool

XS14 looking upstream

XS14 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1085.64	1085.57					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.08					
Thalweg Elevation	1084.50	1084.43					
LTOB Elevation	1085.64	1085.66					
LTOB Max Depth	1.14	1.23					
LTOB Cross Sectional Area	4.63	5.61					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

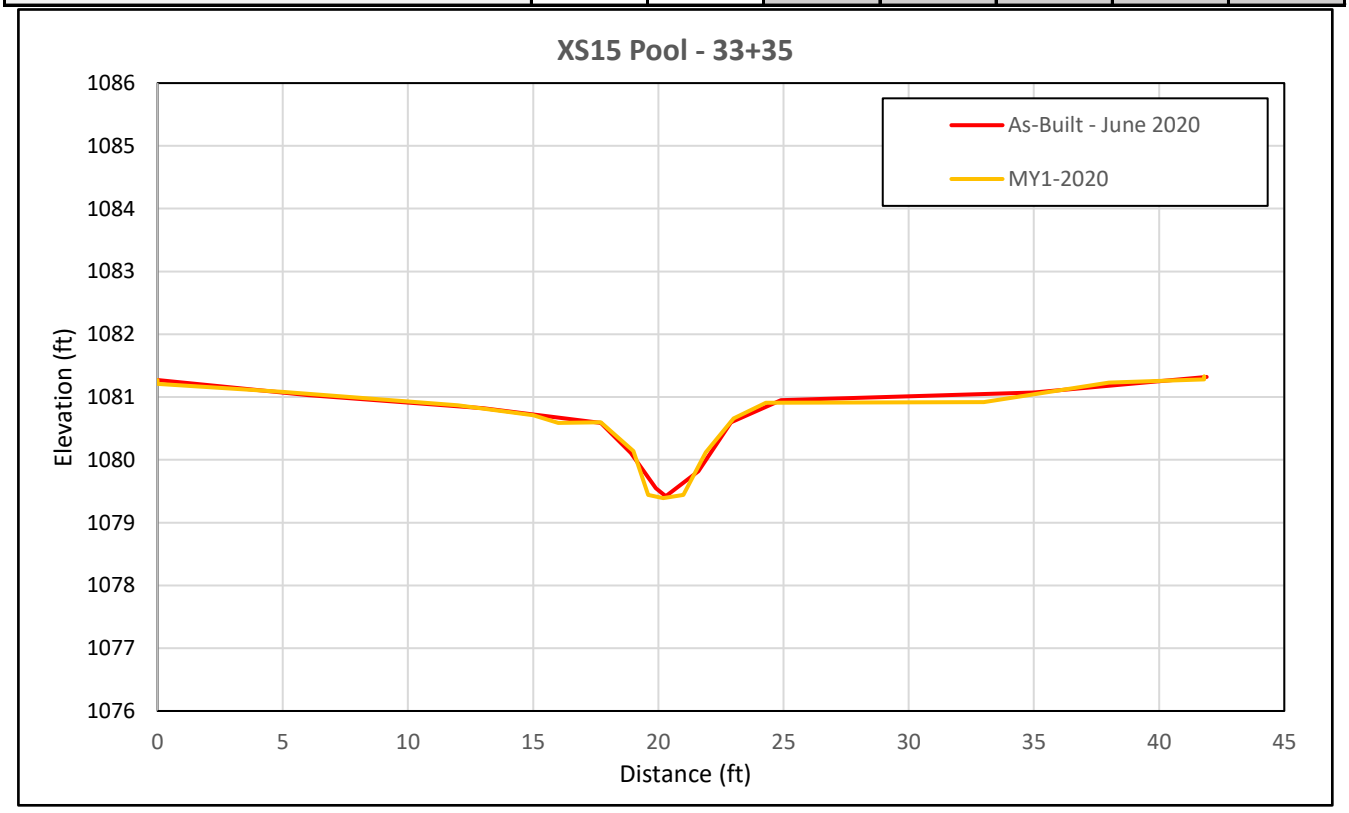
XS15 - UT1

Station 33+35 - Pool

XS15 looking upstream

XS15 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1080.95	1080.95					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.98					
Thalweg Elevation	1079.42	1079.39					
LTOB Elevation	1080.95	1080.91					
LTOB Max Depth	1.53	1.52					
LTOB Cross Sectional Area	6.90	6.40					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

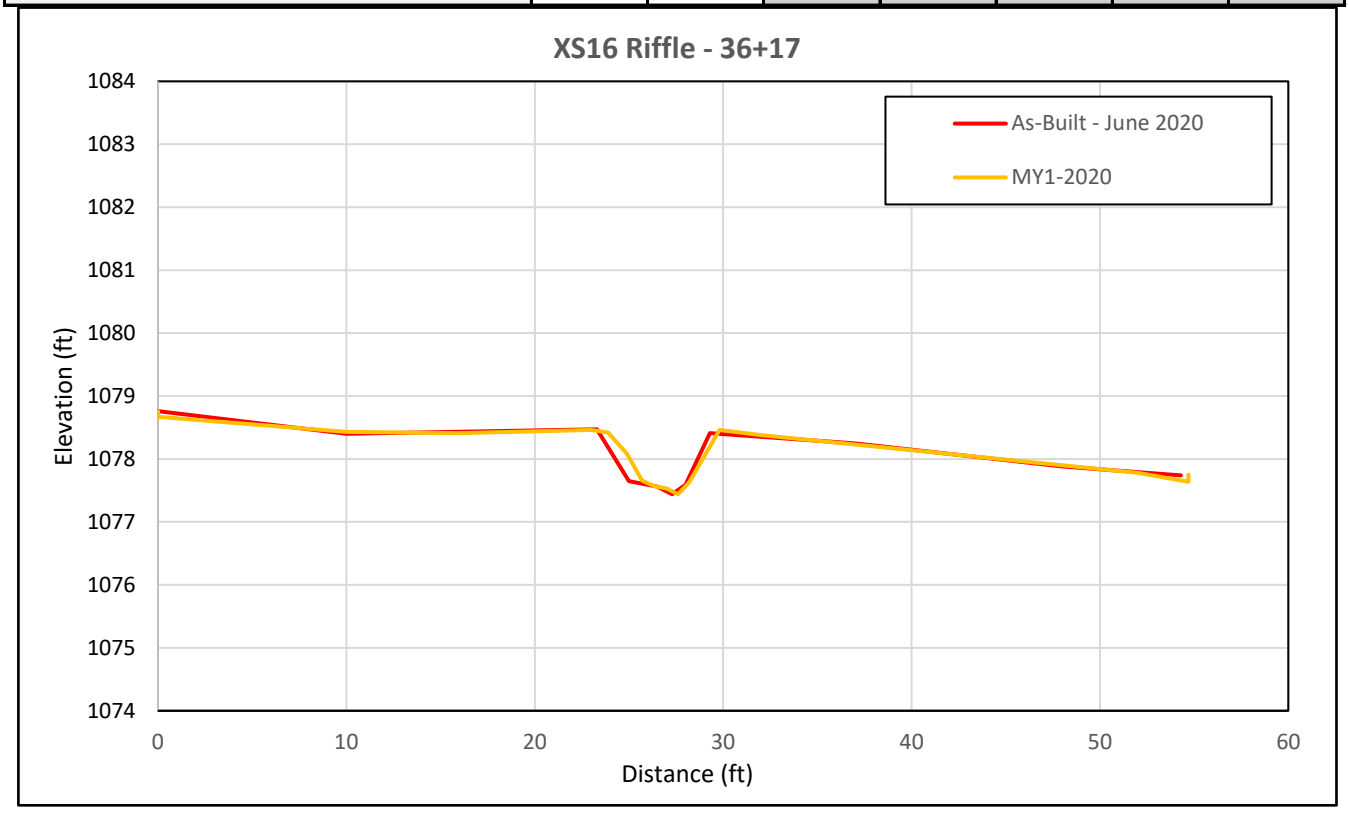
XS16 - UT1

Station 36+17 - Riffle

XS16 looking upstream

XS16 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1078.41	1078.47					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.99					
Thalweg Elevation	1077.44	1077.44					
LTOB Elevation	1078.41	1078.46					
LTOB Max Depth	0.97	1.02					
LTOB Cross Sectional Area	3.69	3.65					
Entrenchment Ratio	9.12	9.27					



Cross Section Plot - MY1 - October 2020

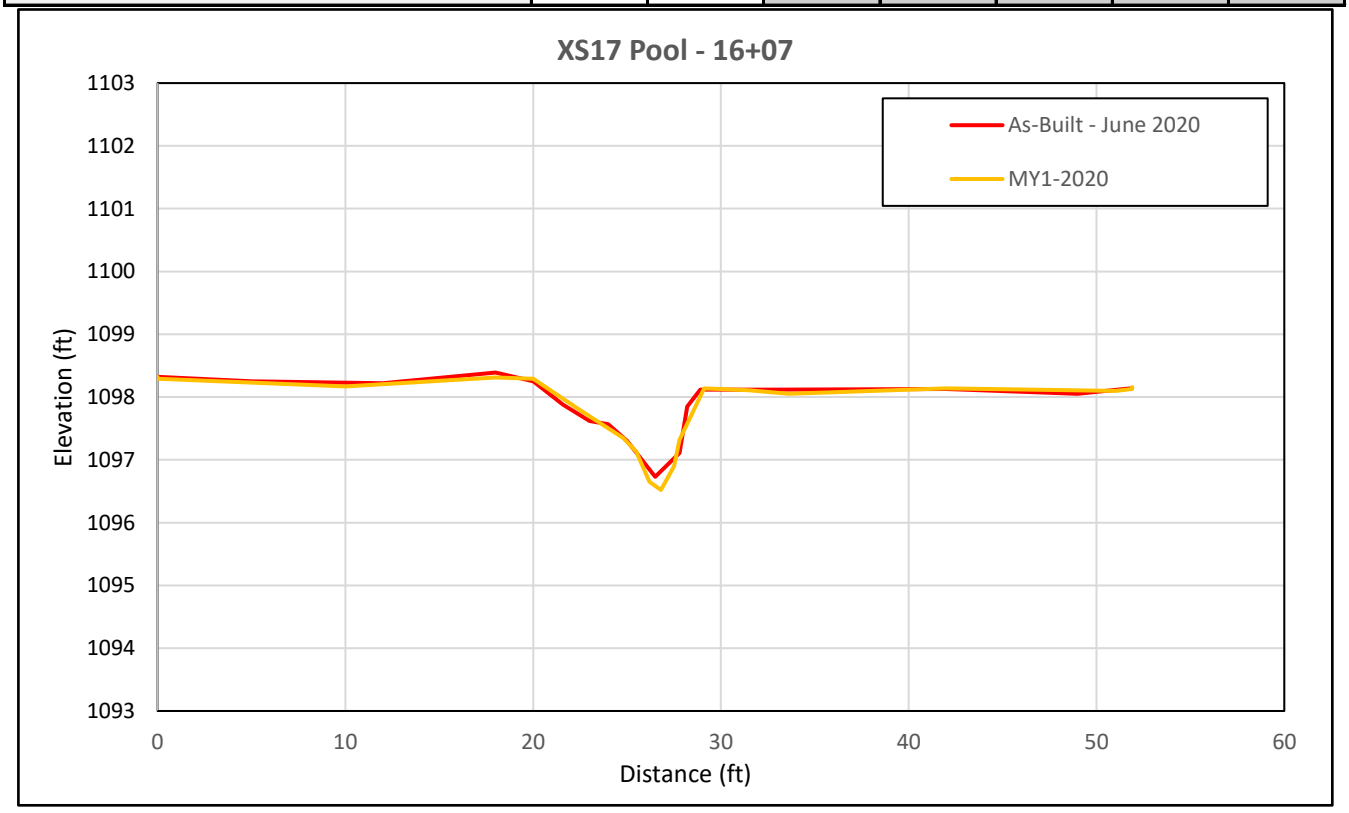
XS17 - UT2

Station 16+07 - Pool

XS17 looking upstream

XS17 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1098.12	1098.08					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.04					
Thalweg Elevation	1096.73	1096.52					
LTOB Elevation	1098.12	1098.14					
LTOB Max Depth	1.39	1.62					
LTOB Cross Sectional Area	5.42	5.90					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

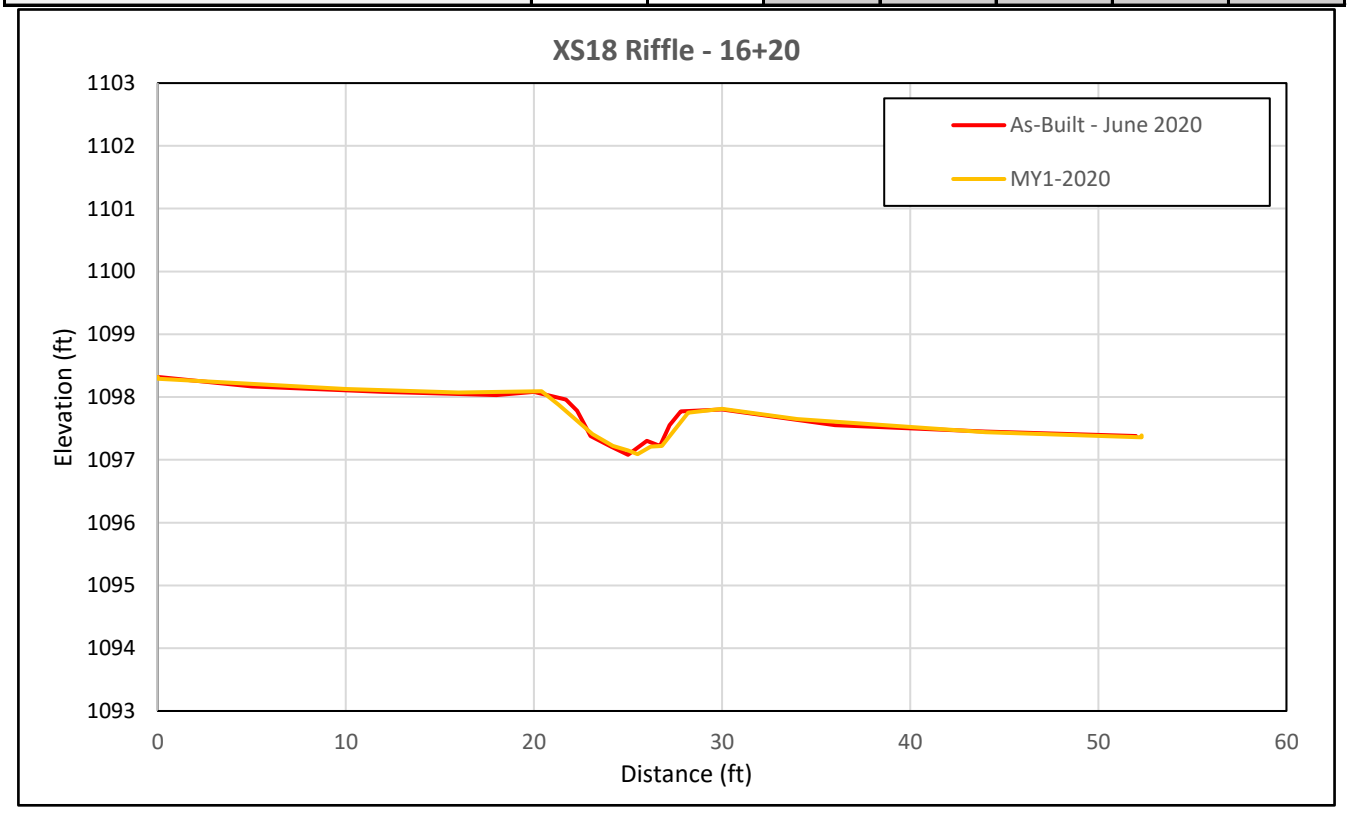
XS18 - UT2

Station 16+20 - Riffle

XS18 looking upstream

XS18 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1097.77	1097.72					
Bank Height Ratio - Based on AB-Bankfull Area	1.04	1.13					
Thalweg Elevation	1097.08	1097.09					
LTOB Elevation	1097.80	1097.81					
LTOB Max Depth	0.72	0.72					
LTOB Cross Sectional Area	2.61	3.02					
Entrenchment Ratio	9.48	8.17					



Cross Section Plot - MY1 - October 2020

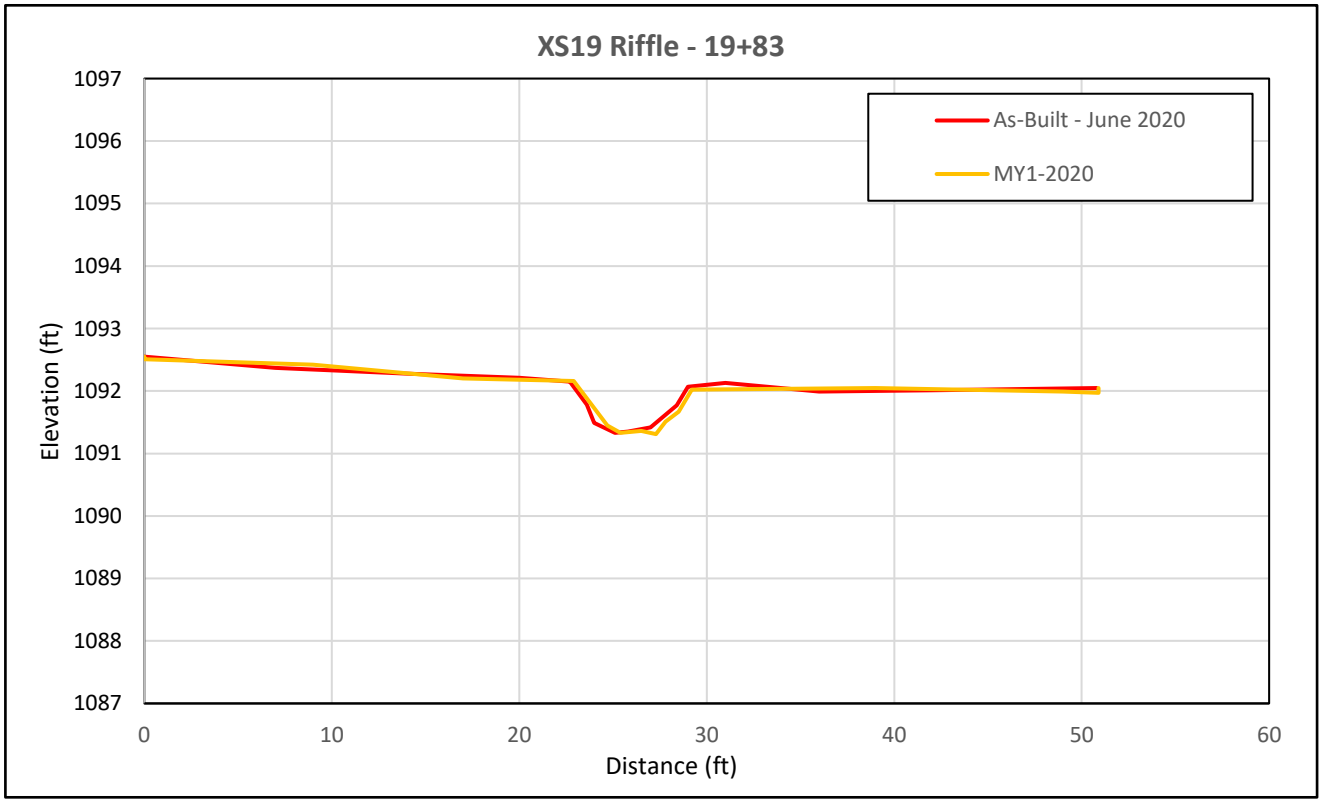
XS19 - UT2

Station 19+83 - Riffle

XS19 looking upstream

XS19 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1092.07	1092.04					
Bank Height Ratio - Based on AB-Bankfull Area	1.08	1.01					
Thalweg Elevation	1091.33	1091.31					
LTOB Elevation	1092.13	1092.05					
LTOB Max Depth	0.80	0.74					
LTOB Cross Sectional Area	3.52	3.20					
Entrenchment Ratio	8.32	8.56					



Cross Section Plot - MY1 - October 2020

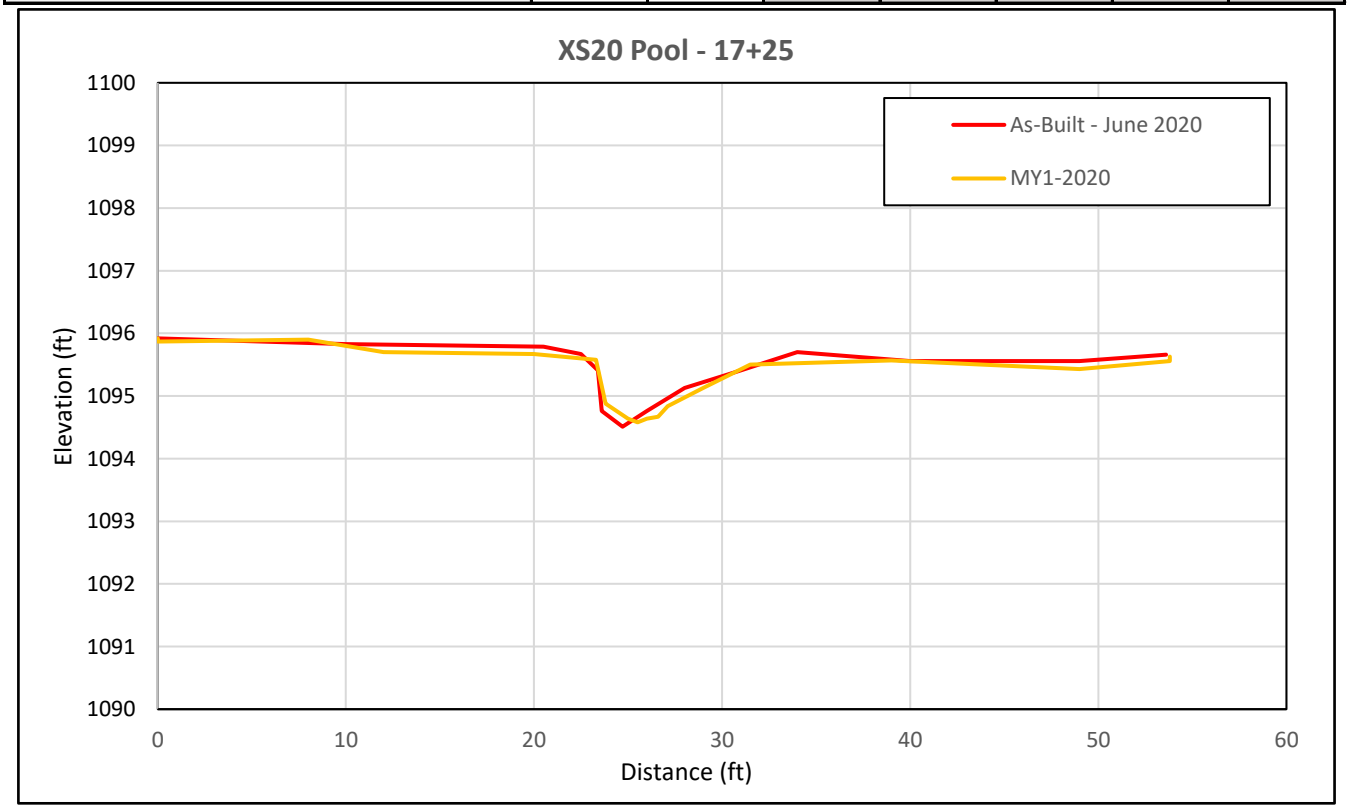
XS20 - UT3 Reach 1

Station 17+25 - Pool

XS20 looking upstream

XS20 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1095.67	1095.56					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.11					
Thalweg Elevation	1094.51	1094.58					
LTOB Elevation	1095.67	1095.67					
LTOB Max Depth	1.16	1.09					
LTOB Cross Sectional Area	5.72	9.02					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

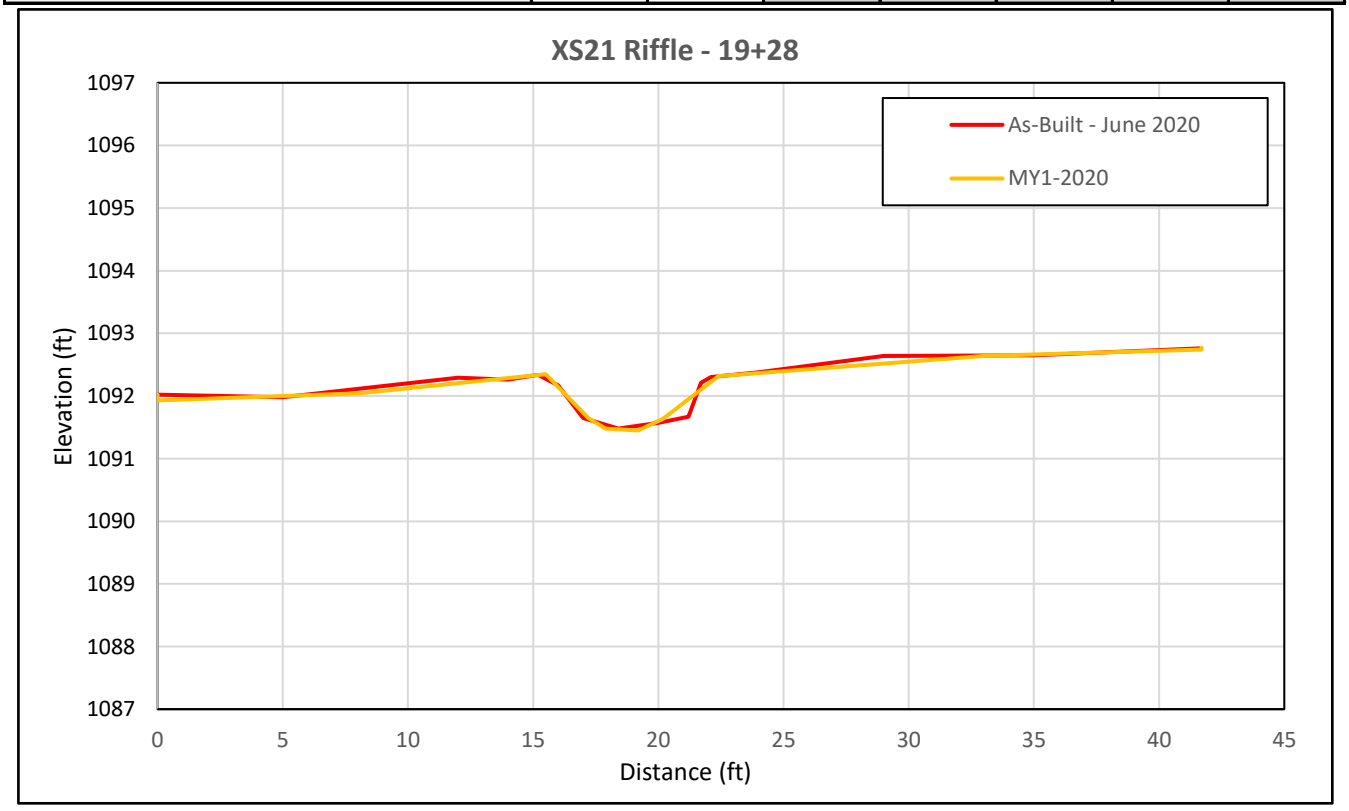
XS21 - UT3 Reach 1

Station 19+28 - Riffle

XS21 looking upstream

XS21 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1092.21	1092.24					
Bank Height Ratio - Based on AB-Bankfull Area	1.12	1.11					
Thalweg Elevation	1091.48	1091.45					
LTOB Elevation	1092.30	1092.32					
LTOB Max Depth	0.82	0.87					
LTOB Cross Sectional Area	3.71	3.71					
Entrenchment Ratio	7.06	6.11					



Cross Section Plot - MY1 - October 2020

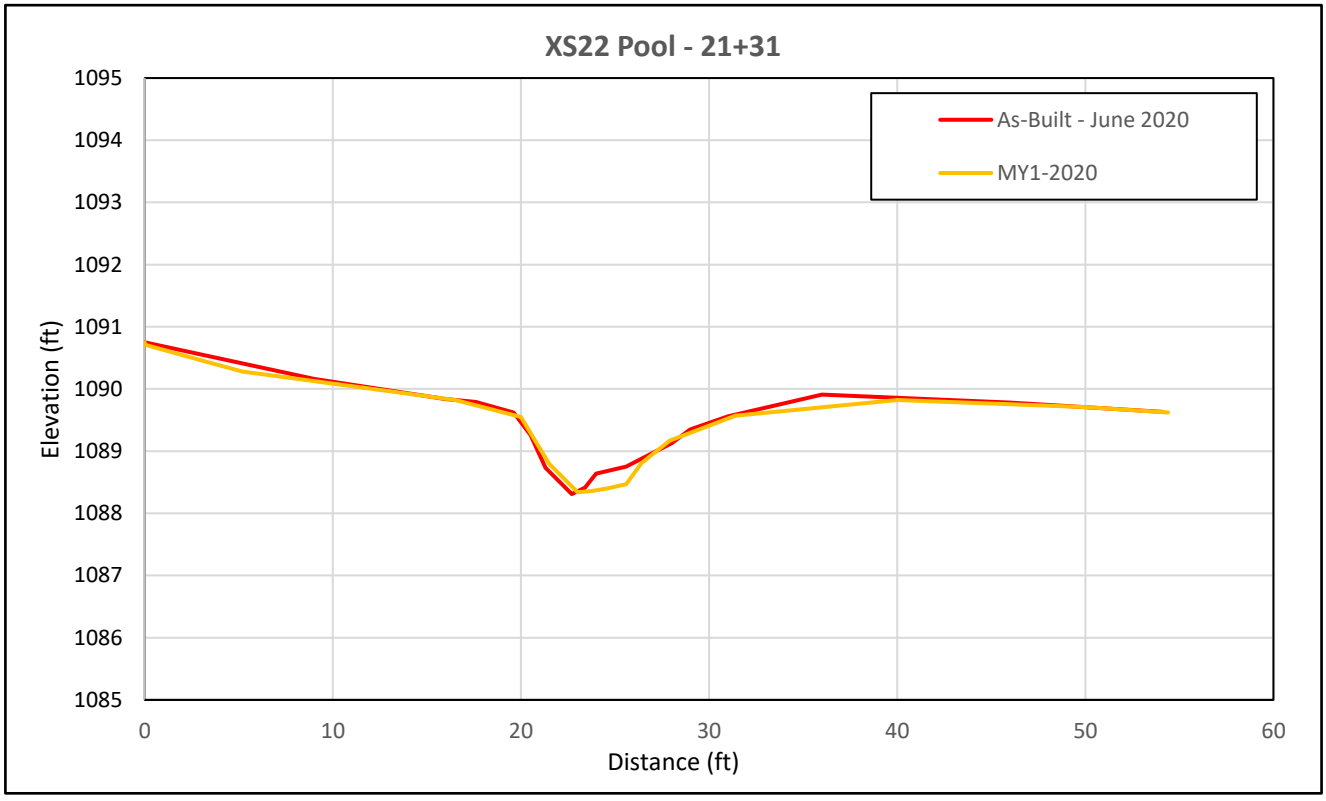
XS22 - UT3 Reach 2

Station 21+31 - Pool

XS22 looking upstream

XS22 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1089.56	1089.52					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.04					
Thalweg Elevation	1088.31	1088.34					
LTOB Elevation	1089.56	1089.57					
LTOB Max Depth	1.25	1.23					
LTOB Cross Sectional Area	6.88	7.47					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

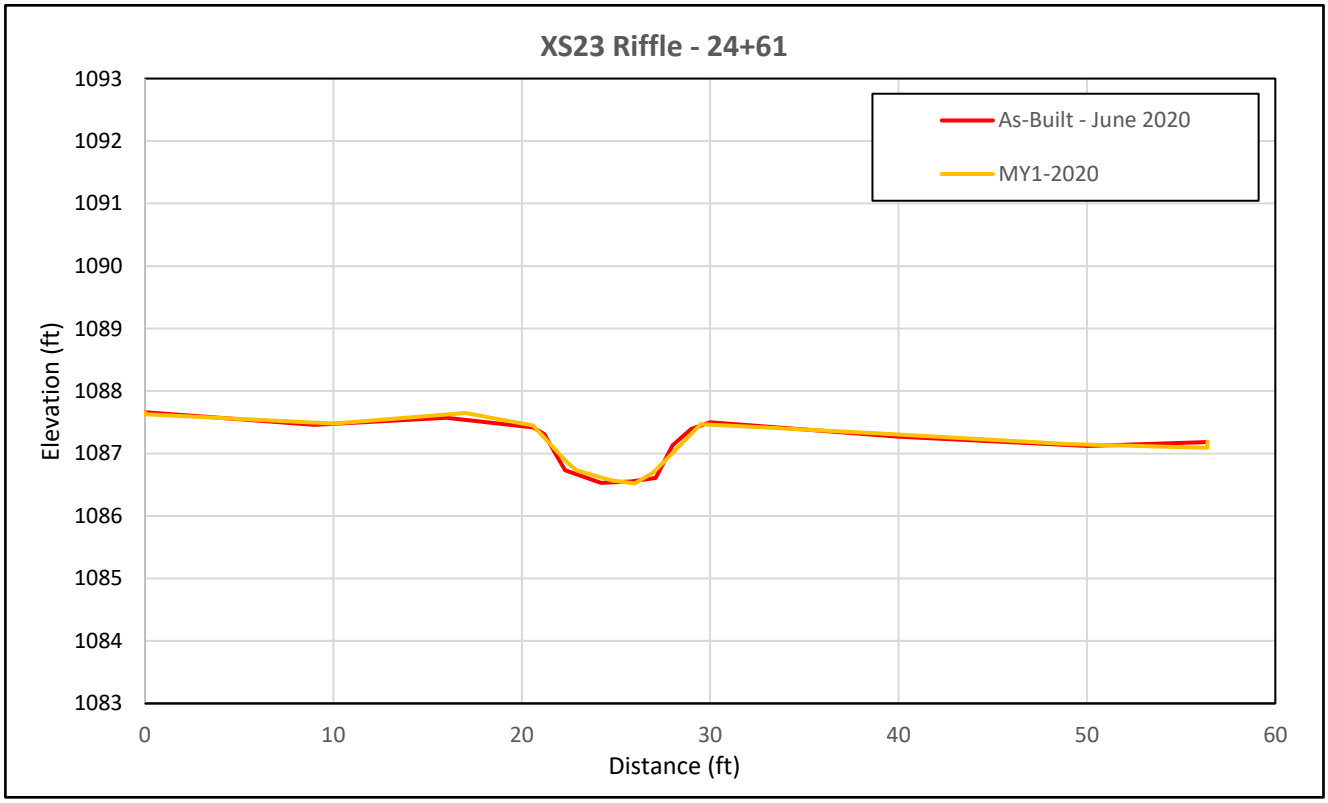
XS23- UT3 Reach 2

Station 24+61 - Riffle

XS23 looking upstream

XS23 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1087.39	1087.41					
Bank Height Ratio - Based on AB-Bankfull Area	1.13	1.06					
Thalweg Elevation	1086.53	1086.52					
LTOB Elevation	1087.50	1087.47					
LTOB Max Depth	0.97	0.95					
LTOB Cross Sectional Area	5.95	5.40					
Entrenchment Ratio	6.85	6.34					



Cross Section Plot - MY1 - October 2020

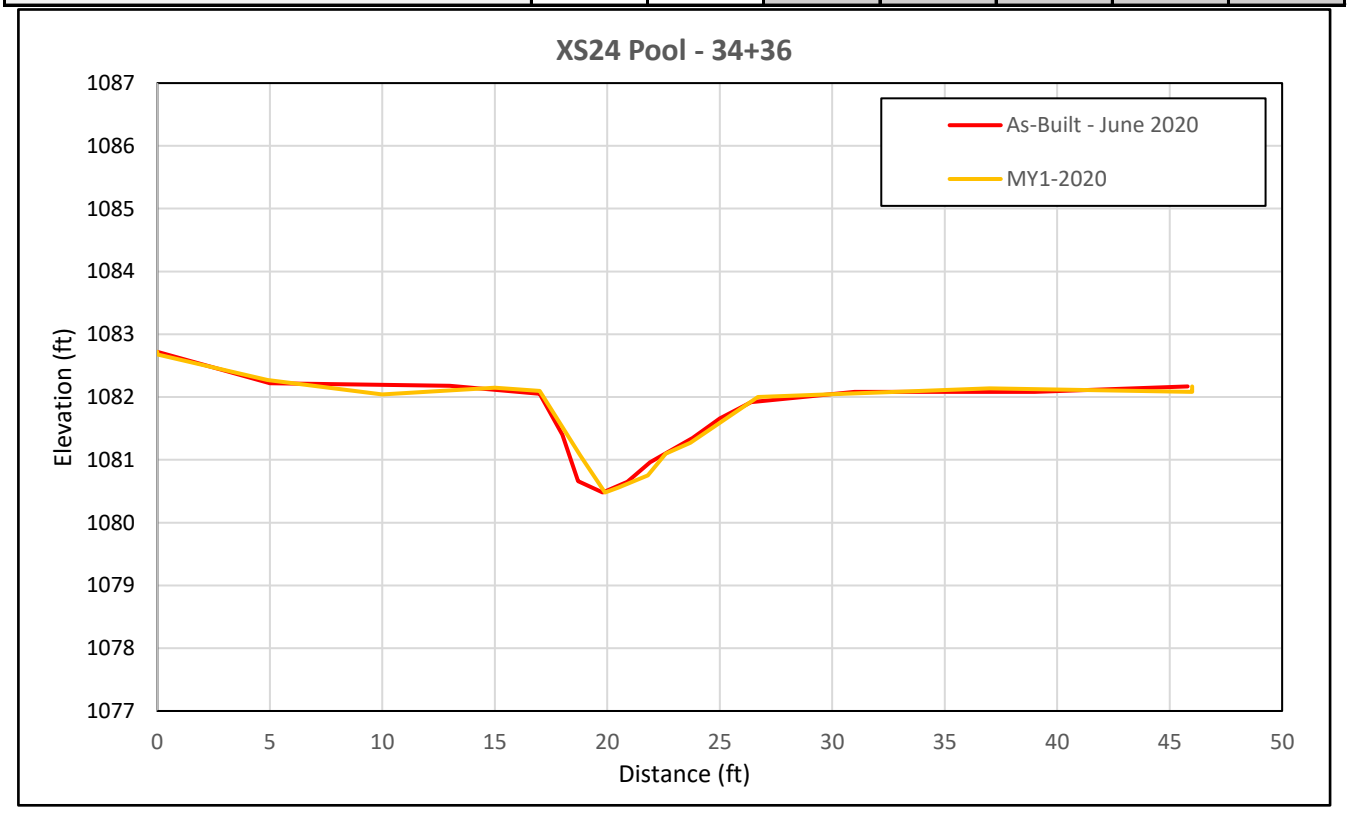
XS24 - UT3 Reach 2

Station 34+36 - Pool

XS24 looking upstream

XS24 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1081.92	1081.94					
Bank Height Ratio - Based on AB-Bankfull Area	1.11	1.04					
Thalweg Elevation	1080.48	1080.48					
LTOB Elevation	1082.08	1082.00					
LTOB Max Depth	1.60	1.52					
LTOB Cross Sectional Area	8.93	7.59					
Entrenchment Ratio	N/A	N/A					



Cross Section Plot - MY1 - October 2020

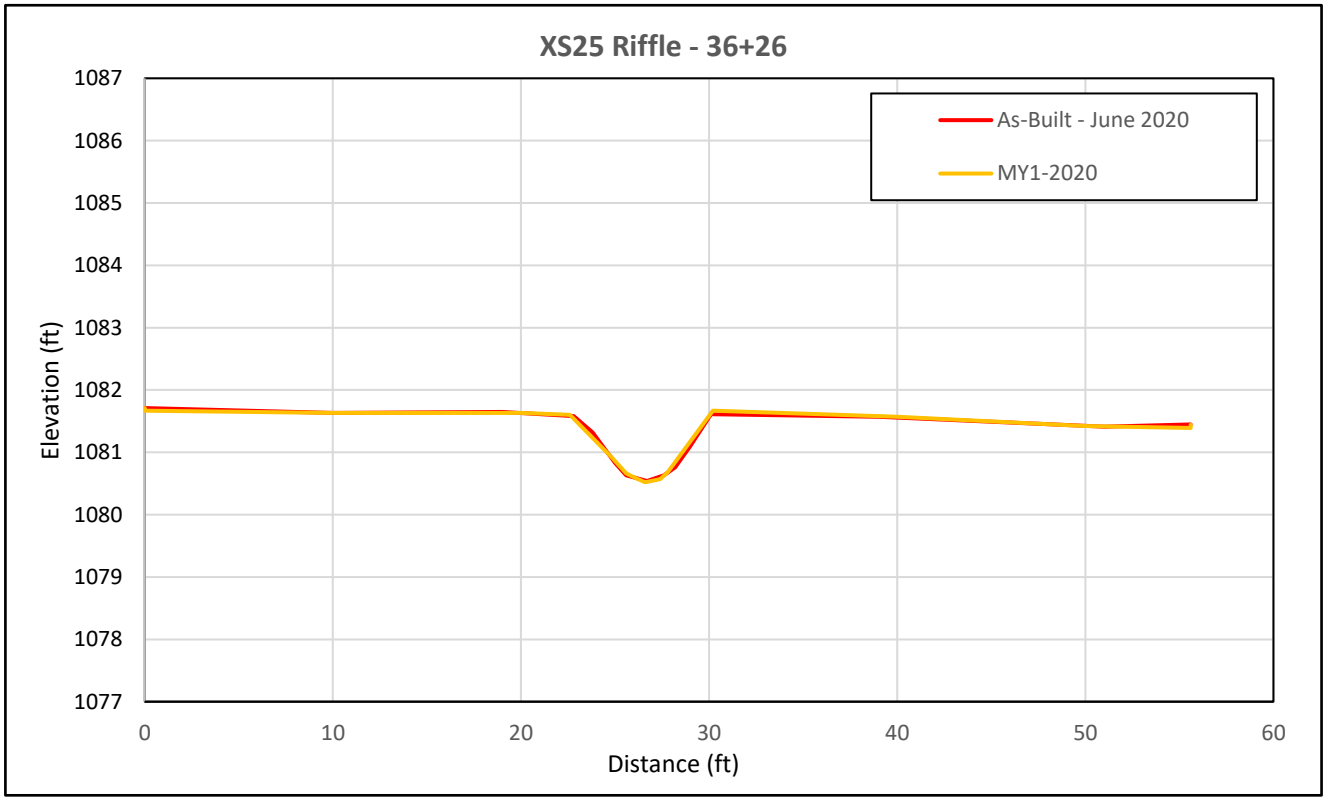
XS25 - UT3 Reach 2

Station 36+26 - Riffle

XS25 looking upstream

XS25 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1081.58	1081.59					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.01					
Thalweg Elevation	1080.54	1080.52					
LTOB Elevation	1081.58	1081.60					
LTOB Max Depth	1.04	1.08					
LTOB Cross Sectional Area	4.54	4.65					
Entrenchment Ratio	7.70	7.48					



Cross Section Plot - MY1 - October 2020

XS26 - UT3 Reach 2

Station 43+26 - Pool

XS26 looking upstream

XS26 looking downstream

	MY0	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation - Based on AB Bankfull Area	1077.31	1077.29					
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.01					
Thalweg Elevation	1075.90	1075.60					
LTOB Elevation	1077.31	1077.31					
LTOB Max Depth	1.41	1.71					
LTOB Cross Sectional Area	7.58	7.84					
Entrenchment Ratio	N/A	N/A					

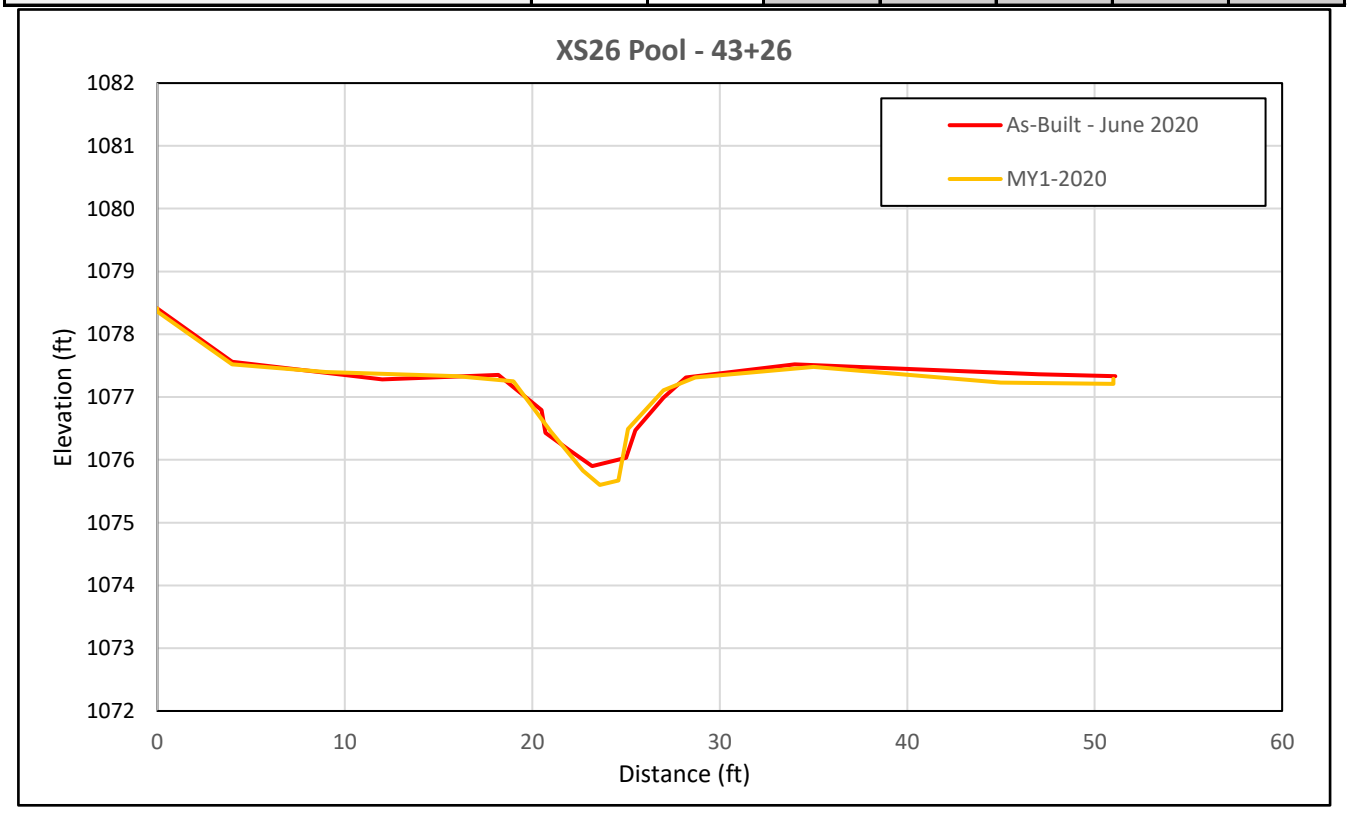


Table 8a. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - UT 1 (2742 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	4	7	4.6	4.3	5.0	5.1	5.7	0.6	4	5.6	6.1	-	6.6	-	-	5.6	6.1	6.6	6.0	6.6	7.0	7.0	-	3
Floodprone Width (ft)				5.7	7.3	7.0	9.7	1.9	4	13.4	18.9	-	24.4	-	-	13.4	18.9	24.4	49.7	52.1	52.2	54.3	-	3
Bankfull Mean Depth (ft)	0.5	0.8	0.7	0.5	0.5	0.5	0.6	0.1	4	0.4	0.6	-	0.7	-	-	0.4	0.5	0.7	0.6	0.6	0.6	0.6	-	3
[1]Bankfull Max Depth (ft)				0.7	0.7	0.7	0.8	0.1	4	1.2	1.3	-	1.4	-	-	0.6	0.7	0.8	0.8	0.9	0.8	1.0	-	3
Bankfull Cross Sectional Area (ft^2)	3.1	4.8	3.1	2.0	2.6	2.7	3.1	0.5	4	2.2	3.4	-	4.6	-	-	3.2	3.2	3.2	3.7	3.8	3.9	3.9	-	3
Width/Depth Ratio				8.5	10.0	9.7	12.0	1.5	4	10.0	12.0	-	14	-	-	10.0	12.0	14.0	9.6	11.6	12.5	12.6	-	3
Entrenchment Ratio				1.2	1.5	1.4	1.9	0.3	4	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	7.1	7.9	7.5	9.1	-	3
[1]Bank Height Ratio				5.6	8.4	7.7	12.5	3.1	4	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.0	1.0	1.0	1.1	-	3
Profile																								
Riffle Length (ft)				5.0	26.2	20.7	94.4	23.0	13	Total riffle length 60-70% of reach length						5.0	29.0	41.0	5.3	15.1	14.3	39.1	6.2	56
Riffle Slope (ft/ft)				0.012	0.044	0.038	0.084	0.025	13	-	-	-	-	-	-	0.009	0.024	0.075	0.008	0.037	0.034	0.086	0.019	56
Pool Length (ft)				5.8	11.3	9.5	22.0	4.6	13	Total pool length 30-40% of reach length						3.0	11.0	16.0	7.4	21.2	20.9	39.1	8.0	56
Pool Max depth (ft)				0.8	1.0	1.0	1.4	0.1	4	0.8	1.6	-	2.5	-	-	1.1	1.2	1.9	1.0	1.5	1.4	2.2	0.3	57
Pool Spacing (ft)				9.6	24.00	20.3	59.9	12.7	25	18	33.5	-	49	-	-	18.0	33.5	49.0	19.0	38.4	40.0	71.3	8.8	72
Pattern																								
Channel Beltwidth (ft)				6.2	16.9	16.5	34.1	7.5	18	18.3	27.5	-	36.6	-	-	18.3	27.5	36.6	12.7	28.4	30.4	37.0	6.5	67
Radius of Curvature (ft)				5.3	11.1	12.3	18.3	3.6	20	12.2	16.8	-	21.4	-	-	12.2	16.8	21.4	9.3	14.8	14.3	21.3	2.1	69
Rc:Bankfull width (ft/ft)				1.1	2.2	2.4	3.6	0.7	20	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	1.4	2.2	2.2	3.2	0.4	69
Meander Wavelength (ft)				24.3	45.7	41.8	79.0	14.2	18	42.7	58.0	-	73.2	-	-	30.5	51.9	73.2	35.7	60.0	61.4	73.4	8.9	71
Meander Width Ratio				4.8	9.1	8.3	15.7	14.2	18	3.0	4.5	-	6.0	-	-	3.0	4.5	6.0	1.9	4.3	4.6	5.6	1.5	67
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.66												0.56			0.65					
Max part size (mm) mobilized at bankfull				72												72			111					
Stream Power (transport capacity) lb/s				10												9			9					
Additional Reach Parameters																								
Rosgen Classification				G4->F4						C4						Cb4			C4					
Bankfull Velocity (fps)	1.0	10.8	5.8	3.2												2.5			2.1					
Bankfull Discharge (cfs)	4	40	18.1	8 to 16												8								
Valley length (ft)				1840						-						2158								
Channel Thalweg length (ft)				2373						-						2805			2805					
Sinuosity (ft)				1.29						1.2-1.4						1.3			1.3					
Water Surface Slope (Channel) (ft/ft)				0.021						-						0.018			0.018					
BF slope (ft/ft)				0.021						-						0.018			0.018					
[3]Bankfull Floodplain Area (acres)				0.310						-						0.9			0.9					
[4]% of Reach with Eroding Banks				80%						-														
Channel Stability or Habitat Metric				0.58						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8b. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - UT 2 (1009 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	4	7	3.8	2.5	3.5	3.5	4.5	-	2	4.7	5.1	-	5.5	-	-	4.7	5.1	5.5	5.5	5.8	5.8	6.1	-	2
Floodprone Width (ft)				6.5	9.3	9.3	12.0	-	2	11.2	15.8	-	20.4	-	-	11.2	15.8	20.4	50.8	51.4	51.4	52.0	-	2
Bankfull Mean Depth (ft)	0.5	0.8	0.6	0.5	0.7	0.7	0.9	-	2	0.3	0.5	-	0.6	-	-	0.3	0.4	0.6	0.4	0.5	0.5	0.5	-	2
[1]Bankfull Max Depth (ft)				0.7	0.9	0.9	1.0	-	2	1.1	1.8	-	2.4	-	-	0.5	0.6	0.7	0.7	0.7	0.7	0.7	-	2
Bankfull Cross Sectional Area (ft^2)	2	3	2.2	2.1	2.2	2.2	2.3	-	2	1.4	2.4	-	3.3	-	-	11.2	15.8	20.4	2.4	2.8	2.8	3.1	-	2
Width/Depth Ratio				2.8	6.2	6.2	9.5	-	2	10.0	12.0	-	14	-	-	10.0	12.0	14.0	12.0	12.2	12.2	12.5	-	2
Entrenchment Ratio				1.5	3.2	3.2	4.8	-	2	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	8.3	8.9	8.9	9.5	-	2
[1]Bank Height Ratio				4.0	7.5	7.5	10.9	-	2	1.0	1.0	-	1.0	-	-	1.0	1.0	1.1	1.0	1.1	1.1	1.1	-	2
Profile																								
Riffle Length (ft)				6.6	19.3	14.0	35.9	11.8	7	Total riffle length 60-70% of reach length						22.0	25.0	32.0	5.0	16.4	18.0	27.1	6.0	25
Riffle Slope (ft/ft)				0.015	0.027	0.023	0.047	0.011	7	-	-	-	-	-	-	0.011	0.027	0.045	0.02	0.045	0.043	0.083	0.017	25
Pool Length (ft)				7.1	10.6	8.5	20.3	4.7	8	Total pool length 30-40% of reach length						6.0	10.0	21.0	5.1	14.5	14.3	21.9	4.2	26
Pool Max depth (ft)				0.7	0.8	0.8	1.5	0.3	2	0.6	1.4	-	2.1	-	-	0.9	1.0	1.6	0.8	1.2	1.1	1.8	0.2	26
Pool Spacing (ft)				13.3	23.6	18.9	44.8	10.3	15	20.4	28.1	-	35.7	-	-	15.3	28.1	40.8	24.9	36.0	35.0	42.0	2.8	27
Pattern																								
Channel Beltwidth (ft)				4.8	7.9	7.3	12.3	2.2	15	15.3	23.0	-	30.6	-	-	15.3	23.0	30.6	23.2	27.2	27.5	32.6	2.5	27
Radius of Curvature (ft)				4.8	8.0	7.8	13.8	2.1	16	10.2	14.0	-	17.9	-	-	10.2	14.1	17.9	10.6	12.7	12.4	15.9	1.7	28
Rc:Bankfull width (ft/ft)				1.4	2.3	2.2	3.9	0.6	16	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	1.8	2.2	2.1	2.7	0.3	28
Meander Wavelength (ft)				13.6	37.4	37.0	68.3	18.7	15	35.7	48.5	-	61.2	-	-	25.5	43.4	61.2	40.4	54.4	52.9	92.0	9.2	28
Meander Width Ratio				3.9	10.7	10.6	19.5	18.7	15	3.0	4.5	-	6.0	-	-	3.0	4.5	6.0	4.0	4.7	4.7	5.6	1.5	27
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				1.1												0.5			0.62					
Max part size (mm) mobilized at bankfull				67												67			107					
Stream Power (transport capacity) lb/s				13												10			10					
Additional Reach Parameters																								
Rosgen Classification				Channelized E4						Cb						Cb4			Cb4					
Bankfull Velocity (fps)	1.0	10.8	5.9	3.7												3.6			2.9					
Bankfull Discharge (cfs)	4	40	13.0	8												8								
Valley length (ft)				374						-						1358								
Channel Thalweg length (ft)				397						-						1060			1060					
Sinuosity (ft)				1.06						1.2 to 1.4						1.34			1.3					
Water Surface Slope (Channel) (ft/ft)				0.026						-						0.022			0.0208					
BF slope (ft/ft)				0.026						-						0.022			0.0208					
[3]Bankfull Floodplain Area (acres)				0.1						-						0.5			0.5					
[4]% of Reach with Eroding Banks				70%						-														
Channel Stability or Habitat Metric				0.24						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8c. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - UT 3 R1 (994 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	4	7	4.6	4.1	4.9	4.9	5.8	-	3	4.7	5.1	-	5.5	-	-	5.6	6.1	6.6	5.9	5.9	5.9	5.9	-	1
Floodprone Width (ft)				5.8	11.4	7.6	20.7	-	3	11.2	15.8	-	20.4	-	-	13.4	18.9	24.4	41.6	41.6	41.6	41.6	-	1
Bankfull Mean Depth (ft)	0.5	0.8	0.7	0.4	0.6	0.7	0.7	-	3	0.3	0.5	-	0.6	-	-	0.4	0.5	0.7	0.5	0.5	0.5	0.5	-	1
[1]Bankfull Max Depth (ft)				0.6	1.0	1.0	1.4	-	3	1.1	1.8	-	2.4	-	-	0.6	0.7	0.8	0.7	0.7	0.7	0.7	-	1
Bankfull Cross Sectional Area (ft^2)	3.1	4.8	3.1	2.3	3.0	2.9	3.7	-	3	1.4	2.4	-	3.3	-	-	3.2	3.2	3.2	3.2	3.2	3.2	3.2	-	1
Width/Depth Ratio				5.9	9.0	6.6	14.4	-	3	10.0	12.0	-	14	-	-	10.0	12.0	14.0	11.1	11.1	11.1	11.1	-	1
Entrenchment Ratio				1.0	2.5	1.6	5.0	-	3	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	7.1	7.1	7.1	7.1	-	1
[1]Bank Height Ratio				2.7	4.2	4.0	5.8	-	3	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.1	1.1	1.1	1.1	-	1
Profile																								
Riffle Length (ft)				9.1	34.4	32.4	89.8	25.6	10	Total riffle length 60-70% of reach length						11.0	31.0	46.0	6.4	16.6	14.7	32.3	8.1	22
Riffle Slope (ft/ft)				0.001	0.029	0.030	0.051	0.015	10	-	-	-	-	-	-	0.016	0.027	0.064	0.020	0.047	0.044	0.089	0.018	22
Pool Length (ft)				7.7	17.9	16.3	29.8	7.5	10	Total pool length 30-40% of reach length						7.0	11.0	18.0	5.0	13.6	13.1	25.6	5.3	23
Pool Max depth (ft)				0.9	1.0	1.0	1.0	0.2	3	0.6	1.4	-	2.1	-	-	1.1	1.2	1.9	0.8	1.3	1.3	1.7	0.3	23
Pool Spacing (ft)				14.5	27.2	22.8	55.6	12.2	23	20.4	28.1	-	35.7	-	-	18.0	33.5	49.0	33.0	45.1	44.0	56.0	6.1	18
Pattern																								
Channel Beltwidth (ft)				6.0	12.8	8.7	37.0	8.6	21	15.3	23.0	-	30.6	-	-	18.3	27.5	36.6	16.4	31.0	32.4	39.3	5.5	20
Radius of Curvature (ft)				5.7	11.0	11.7	22.7	4.1	27	10.2	14.0	-	17.9	-	-	12.2	16.8	21.4	12.4	15.0	14.9	20.9	2.2	21
Rc:Bankfull width (ft/ft)				1.2	2.2	2.4	4.6	0.8	27	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	2.1	2.6	2.5	3.6	0.4	21
Meander Wavelength (ft)				16.7	34.9	31.7	68.3	14.7	23	35.7	48.5	-	61.2	-	-	30.5	51.9	73.2	57.6	73.3	70.0	117.0	14.3	20
Meander Width Ratio				3.4	7.1	6.4	13.8	14.7	23	3.0	4.5	-	6.0	-	-	3.0	4.5	6.0	2.8	5.3	5.5	6.7	2.3	20
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.58												0.62			0.69					
Max part size (mm) mobilized at bankfull				62												62			116					
Stream Power (transport capacity) lb/s				9												11			12					
Additional Reach Parameters																								
Rosgen Classification				F4						Cb						Cb4			Cb4					
Bankfull Velocity (fps)	1.0	10.8	4.2	3												2.8			2.9					
Bankfull Discharge (cfs)	4	40	13.0	9												9								
Valley length (ft)				1385						-						802								
Channel Thalweg length (ft)				1814						-						994			994					
Sinuosity (ft)				1.31						1.2 to 1.4						1.24			1.2					
Water Surface Slope (Channel) (ft/ft)				0.016						-						0.02			0.0209					
BF slope (ft/ft)				0.016						-						0.02			0.0209					
[3]Bankfull Floodplain Area (acres)				0.4						-						0.3			0.3					
[4]% of Reach with Eroding Banks				60%						-														
Channel Stability or Habitat Metric				0.55						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8d. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - UT 3 R2 (2421 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	5	9	5.7							4.7	5.1	-	5.5	-	-	6.8	7.3	7.8	7.2	7.7	7.7	8.2	-	2
Floodprone Width (ft)										11.2	15.8	-	20.4	-	-	16.1	22.6	29.2	55.6	56.0	56.0	56.3	-	2
Bankfull Mean Depth (ft)	0.8	1.2	0.9							0.3	0.5	-	0.6	-	-	0.5	0.6	0.8	0.6	0.6	0.6	0.6	-	2
[1]Bankfull Max Depth (ft)										1.1	1.8	-	2.4	-	-	0.7	0.8	0.9	0.9	1.0	1.0	1.0	-	2
Bankfull Cross Sectional Area (ft^2)	4	5	4.4							1.4	2.4	-	3.3	-	-	4.4	4.4	4.4	4.5	4.7	4.7	4.9	-	2
Width/Depth Ratio										10.0	12.0	-	14	-	-	10.0	12.0	14.0	11.5	12.7	12.7	13.9	-	2
Entrenchment Ratio										2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	6.9	7.3	7.3	7.7	-	2
[1]Bank Height Ratio										1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.0	1.1	1.1	1.1	-	2
Profile																								
Riffle Length (ft)										Total riffle length 60-70% of reach length						12.0	41.0	57.0	5.0	18.1	16.2	39.3	9.8	40
Riffle Slope (ft/ft)										-	-	-	-	-	-	0.004	0.01	0.018	0.004	0.022	0.018	0.063	0.016	40
Pool Length (ft)										Total pool length 30-40% of reach length						8.0	15.0	22.0	7.9	17.4	16.2	38.3	6.4	41
Pool Max depth (ft)										0.6	1.4	-	2.1	-	-	1.3	1.4	2.2	1.2	1.6	1.6	2.5	0.2	41
Pool Spacing (ft)										20.4	28.1	-	35.7	-	-	29.2	86.0	58.4	43.0	55.6	56.0	70.0	6.0	43
Pattern																								
Channel Beltwidth (ft)										15.3	23.0	-	30.6	-	-	25.6	42	58.4	26.5	42.1	42.1	56.6	6.9	43
Radius of Curvature (ft)										10.2	14.0	-	17.9	-	-	14.6	20.1	25.6	15.7	18.6	19.0	23.0	1.7	45
Rc:Bankfull width (ft/ft)										2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	2.0	2.4	2.5	3.0	0.3	45
Meander Wavelength (ft)										35.7	48.5	-	61.2	-	-	51.1	69.4	87.6	66.9	81.9	81.2	130.3	10.9	44
Meander Width Ratio										3.0	4.5	-	6.0	-	-	3.5	5.8	8.0	3.4	5.4	5.5	7.3	1.8	43
Transport parameters																								
Reach Shear Stress (competency) lb/f^2																0.25			0.24					
Max part size (mm) mobilized at bankfull																62			54					
Stream Power (transport capacity) lb/s																7			7					
Additional Reach Parameters																								
Rosgen Classification										C4						C4			C4					
Bankfull Velocity (fps)	2.3	22.5	5.9													3.9			3.6					
Bankfull Discharge (cfs)	9	90	25.8													17								
Valley length (ft)										-						1802								
Channel Thalweg length (ft)										-						2523			2523					
Sinuosity (ft)										1.2 to 1.4						1.4			1.4					
Water Surface Slope (Channel) (ft/ft)										-						0.0067			0.0063					
BF slope (ft/ft)										-						0.0067			0.0063					
[3]Bankfull Floodplain Area (acres)										-						0.9			0.9					
[4]% of Reach with Eroding Banks										-														
Channel Stability or Habitat Metric										-														
Biological or Other										-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8e. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - Moores Fork R1 (1573 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	20	30	22.5	30.7	30.7	30.7	30.7	-	1	21.9	23.9	-	25.9	-	-	21.9	23.9	25.9	33.2	33.2	33.2	33.2	-	1
Floodprone Width (ft)				35.0	35.0	35.0	35.0	-	1	52.6	74.1	-	95.6	-	-	52.6	74.1	95.6	43.0	43.0	43.0	43.0	-	1
Bankfull Mean Depth (ft)	1.8	3	2.4	1.7	1.7	1.7	1.7	-	1	1.6	2.1	-	2.6	-	-	1.6	2.1	2.6	1.8	1.8	1.8	1.8	-	1
[1]Bankfull Max Depth (ft)				2.7	2.7	2.7	2.7	-	1	1.2	1.3	-	1.4	-	-	2.3	3.0	3.8	2.4	2.4	2.4	2.4	-	1
Bankfull Cross Sectional Area (ft^2)	40	50	47.8	51.6	51.6	51.6	51.6	-	1	35.0	51.2	-	67.3	-	-	47.7	47.7	47.7	61.1	61.1	61.1	61.1	-	1
Width/Depth Ratio				18.2	18.2	18.2	18.2	-	1	10.0	12.0	-	14	-	-	10.0	12.0	14.0	18.1	18.1	18.1	18.1	-	1
Entrenchment Ratio				1.1	1.1	1.1	1.1	-	1	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	1.3	1.3	1.3	1.3	-	1
[1]Bank Height Ratio				3.2	3.2	3.2	3.2	-	1	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.2	1.2	1.2	1.2	-	1
Profile																								
Riffle Length (ft)				20.3	48.1	32.0	126.8	36.5	8	Total riffle length 60-70% of reach length						20.3	32.0	126.8	79	108.3	89	190	38.77	7
Riffle Slope (ft/ft)				0.002	0.013	0.013	0.025	0.007	8	-	-	-	-	-	-	0.002	0.013	0.025	0.002	0.005	0.004	0.009	0.002	7
Pool Length (ft)				30.9	61.8	55.4	98.0	20.8	8	Total pool length 30-40% of reach length						30.9	55.4	98.0	40	94.57	97	150	30.77	7
Pool Max depth (ft)				0.8	3.4	3.4	1.4	-	1	3.2	6.2	-	9.1	-	-	0.8	3.4	1.4	5.11	6.14	6.17	7.28	0.792	7
Pool Spacing (ft)				16.3	76.5	64.6	199.2	41.0	21	95.6	131.5	-	167.3	-	-	16.3	64.6	199.2	111	206.1	187.2	330.6	71.09	6
Pattern																								
Channel Beltwidth (ft)				31.2	37.9	35.5	85.1	8.1	44	83.7	137.4	-	191.2	-	-	31.2	35.5	85.1	31.2	37.9	35.5	85.1	8.1	44
Radius of Curvature (ft)				18.1	32.0	26.6	85.1	15.9	47	47.8	65.7	-	83.7	-	-	18.1	26.6	85.1	18.1	32.0	26.6	85.1	15.9	47
Rc:Bankfull width (ft/ft)				0.6	1.0	0.9	2.8	0.5	47	2.0	2.8	-	3.5	-	-	0.6	0.9	2.8	0.6	0.96	0.9	2.8	0.5	47
Meander Wavelength (ft)				14.8	76.4	52.6	281.1	66.0	45	167.3	227.1	-	286.8	-	-	14.8	52.6	281.1	14.8	76.4	52.6	281.1	66.0	45
Meander Width Ratio				0.5	2.5	1.7	9.2	2.1	45	3.5	5.8	-	8.0	-	-	0.5	1.7	9.2	0.5	2.3	1.7	9.2	2.0	45
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.4												0.46			0.26					
Max part size (mm) mobilized at bankfull				90												90			56					
Stream Power (transport capacity) lb/s				37												35			22					
Additional Reach Parameters																								
Rosgen Classification				F4						C4						C4			B4					
Bankfull Velocity (fps)	2.5	20.0	5.4	3.1												3.1			2.5					
Bankfull Discharge (cfs)	100	800	259.8	150												150								
Valley length (ft)				1470						-						1470								
Channel Thalweg length (ft)				1573						-						1573			1573					
Sinuosity (ft)				1.07						1.2 to 1.4						1.07			1.07					
Water Surface Slope (Channel) (ft/ft)				0.003						-						0.003			0.0023					
BF slope (ft/ft)				0.003						-						0.003			0.0023					
[3]Bankfull Floodplain Area (acres)				1.2						-						2.5			2.5					
[4]% of Reach with Eroding Banks				33%						-														
Channel Stability or Habitat Metric				0.20						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8f. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - Moores Fork R2 (1998 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	20	30	22.5	28.5	30.8	30.8	33.0	-	2	21.9	23.9	-	25.9	-	-	21.9	23.9	25.9	20.2	20.7	20.7	21.3	-	2
Floodprone Width (ft)				45.0	45.5	45.5	46.0	-	2	52.6	74.1	-	95.6	-	-	52.6	74.1	95.6	81.2	>88.6	>88.6	>88.6	-	2
Bankfull Mean Depth (ft)	1.8	3	2.4	1.4	1.6	1.6	1.7	-	2	1.6	2.1	-	2.6	-	-	1.6	2.1	2.6	1.6	1.6	1.6	1.7	-	2
[1]Bankfull Max Depth (ft)				2.1	2.3	2.3	2.5	-	2	1.2	1.3	-	1.4	-	-	2.3	3.0	3.8	2.4	2.5	2.5	2.5	-	2
Bankfull Cross Sectional Area (ft^2)	40	50	47.8	47.0	47.9	47.9	48.8	-	2	35.0	51.2	-	67.3	-	-	47.7	47.7	47.7	33.7	33.9	33.9	34.1	-	2
Width/Depth Ratio				16.6	19.9	19.9	23.2	-	2	10.0	12.0	-	14	-	-	10.0	12.0	14.0	12.0	12.7	12.7	13.4	-	2
Entrenchment Ratio				1.4	1.5	1.5	1.6	-	2	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	4.0	>4.14	>4.14	>4.14	-	2
[1]Bank Height Ratio				2.7	2.9	2.9	3.0	-	2	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.0	1.1	1.1	1.1	-	2
Profile																								
Riffle Length (ft)				15.3	66.6	53.7	179.0	50.1	9	Total riffle length 60-70% of reach length						29.0	121.0	167.0	73.6	113.0	118.1	169.4	28.7	13
Riffle Slope (ft/ft)				0.006	0.011	0.007	0.024	0.007	9	-	-	-	-	-	-	0.004	0.005	0.007	0.004	0.005	0.006	0.007	7.7E-04	13
Pool Length (ft)				15.3	71.2	71.6	147.0	38.6	9	Total pool length 30-40% of reach length						26.0	45.0	67.0	38.0	57.5	59.0	67.0	7.1	13
Pool Max depth (ft)				0.8	3.1	3.1	1.4	0.2	2	3.2	6.2	-	9.1	-	-	4.2	4.6	7.3	2.7	3.3	3.4	3.8	0.3	13
Pool Spacing (ft)				54.0	122.7	89.1	287.6	70.2	13	95.6	131.5	-	167.3	-	-	96.0	143.5	191.0	134.0	178.7	173.0	271.0	36.6	12
Pattern																								
Channel Beltwidth (ft)				47.4	85.9	75.3	174.1	40.2	9	83.7	137.4	-	191.2	-	-	83.7	137.5	191.2	83.7	126.2	126.7	176.7	24.8	10
Radius of Curvature (ft)				33.7	86.3	88.7	159.1	37.1	9	47.8	65.7	-	83.7	-	-	47.8	65.8	83.7	46.4	60.8	60.4	81.4	12.0	13
Rc:Bankfull width (ft/ft)				1.1	2.8	2.9	5.2	1.2	9	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	2.2	2.9	2.9	3.9	0.6	13
Meander Wavelength (ft)				214.5	296.9	303.9	414.1	75.2	9	167.3	227.1	-	286.8	-	-	167.3	138.1	286.8	188.0	246.7	243.5	304.0	33.2	10
Meander Width Ratio				7.0	9.7	9.9	13.5	2.4	9	3.5	5.8	-	8.0	-	-	3.5	5.8	8.0	4.0	6.1	6.1	8.5	1.6	10
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.4												0.46			0.39					
Max part size (mm) mobilized at bankfull				90												90			76					
Stream Power (transport capacity) lb/s				37												35			37					
Additional Reach Parameters																								
Rosgen Classification				F4						C4						C4			C4					
Bankfull Velocity (fps)	2.5	20.0	5.4	3.1												3.1			4.4					
Bankfull Discharge (cfs)	100	800	259.8	150												150								
Valley length (ft)				1808						-						1700								
Channel Thalweg length (ft)				2007						-						2176			2176					
Sinuosity (ft)				1.11						1.2 to 1.4						1.28			1.28					
Water Surface Slope (Channel) (ft/ft)				0.004						-						0.0037			0.0039					
BF slope (ft/ft)				0.004						-						0.0037			0.0039					
[3]Bankfull Floodplain Area (acres)				1.9						-						2.9			2.9					
[4]% of Reach with Eroding Banks				30%						-														
Channel Stability or Habitat Metric				0.26						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 8g. Baseline Stream Data Summary
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023) - Moores Fork R3 (384 feet)

Parameter	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only	LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)	20	30	22.5	22.8	22.8	22.8	22.8	-	1	21.9	23.9	-	25.9	-	-	21.9	23.9	25.9	20.9	20.9	20.9	20.9	-	1
Floodprone Width (ft)				144.4	144.4	144.4	144.4	-	1	52.6	74.1	-	95.6	-	-	52.6	74.1	95.6	106.9	106.9	106.9	106.9	-	1
Bankfull Mean Depth (ft)	1.8	3	2.4	2.3	2.3	2.3	2.3	-	1	1.6	2.1	-	2.6	-	-	1.6	2.1	2.6	1.6	1.6	1.6	1.6	-	1
[1]Bankfull Max Depth (ft)				3.2	3.2	3.2	3.2	-	1	1.2	1.3	-	1.4	-	-	2.3	3.0	3.8	2.6	2.6	2.6	2.6	-	1
Bankfull Cross Sectional Area (ft^2)	40	50	47.8	52.4	52.4	52.4	52.4	-	1	35.0	51.2	-	67.3	-	-	47.7	47.7	47.7	33.7	33.7	33.7	33.7	-	1
Width/Depth Ratio				9.9	9.9	9.9	9.9	-	1	10.0	12.0	-	14	-	-	10.0	12.0	14.0	13.0	13.0	13.0	13.0	-	1
Entrenchment Ratio				6.3	6.3	6.3	6.3	-	1	2.2	3.1	-	4.0	-	-	2.2	3.1	4.0	5.0	5.0	5.0	5.0	-	1
[1]Bank Height Ratio				1.4	1.4	1.4	1.4	-	1	1.0	1.0	-	1	-	-	1.0	1.05	1.1	1.0	1.0	1.0	1.0	-	1
Profile																								
Riffle Length (ft)				24.5	45.0	44.1	67.2	21.3	4	Total riffle length 60-70% of reach length						29.0	121.0	167.0	20.0	63.7	54.2	126.7	41.7	4
Riffle Slope (ft/ft)				0.003	0.009	0.008	0.016	0.006	4	-	-	-	-	-	-	0.004	0.005	0.007	0.004	0.006	0.005	0.011	0.003	4
Pool Length (ft)				16.4	41.4	33.6	92.0	30.0	5	Total pool length 30-40% of reach length						26.0	45.0	67.0	30	40	40	50	8.6	4
Pool Max depth (ft)				0.8	4.6	4.6	1.4	-	1	3.2	6.2	-	9.1	-	-	4.2	4.6	7.3	2.1	3.2	3.4	4.0	0.7	4
Pool Spacing (ft)				21.6	67.1	70.2	101.5	30.6	8	95.6	131.5	-	167.3	-	-	96.0	143.5	191.0	77.0	107.5	100.0	153.0	28.5	4
Pattern																								
Channel Beltwidth (ft)				23.2	30.8	28.1	53.7	8.9	10	83.7	137.4	-	191.2	-	-	83.7	137.5	191.2	63.9	63.9	63.9	63.9	-	1
Radius of Curvature (ft)				17.0	26.5	26.5	47.1	7.5	13	47.8	65.7	-	83.7	-	-	47.8	65.8	83.7	50.5	63.8	70.5	70.5	-	3
Rc:Bankfull width (ft/ft)				0.7	1.2	1.2	2.1	0.3	13	2.0	2.8	-	3.5	-	-	2.0	2.8	3.5	2.4	3.1	3.4	3.4	-	3
Meander Wavelength (ft)				18.0	82.0	84.2	139.5	36.6	12	167.3	227.1	-	286.8	-	-	167.3	138.1	286.8	241.0	241.0	241.0	241.0	-	1
Meander Width Ratio				0.8	3.6	3.7	6.1	1.6	12	3.5	5.8	-	8.0	-	-	3.5	5.8	8.0	3.1	3.1	3.1	3.1	-	1
Transport parameters																								
Reach Shear Stress (competency) lb/f^2				0.4												0.46			0.27					
Max part size (mm) mobilized at bankfull				90												90			58					
Stream Power (transport capacity) lb/s				37												35			25					
Additional Reach Parameters																								
Rosgen Classification				F4						C4						C4			C4					
Bankfull Velocity (fps)	2.5	20.0	5.4	3.1												3.1			4.5					
Bankfull Discharge (cfs)	100	800	259.8	150												150								
Valley length (ft)				373						-						373								
Channel Thalweg length (ft)				380						-						384			384					
Sinuosity (ft)				1.02						1.2 to 1.4						1.03			1.03					
Water Surface Slope (Channel) (ft/ft)				0.0076						-						0.0037			0.0027					
BF slope (ft/ft)				0.0076						-						0.0037			0.0027					
[3]Bankfull Floodplain Area (acres)				1.2						-						0.6			0.6					
[4]% of Reach with Eroding Banks				25%						-														
Channel Stability or Habitat Metric				0.14						-														
Biological or Other				-						-														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9. Monitoring Data - Cross-Section Morphology Data Table
Stewarts Creek Mitigation Project (DMS No. 100023)

	Moores Fork Reach 1																				Moores Fork Reach 2						
	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1097.06	1097.29						1094.84	1094.64						1088.77	1088.67						1087.94	1088.59					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.20	1.05						1.18	1.04						1.00	1.06						1.00	0.80					
Thalweg Elevation	1094.10	1094.08						1092.41	1091.86						1086.14	1085.92						1084.60	1085.18					
LTOB[2] Elevation	1097.67	1097.46						1095.28	1094.76						1088.77	1088.82						1087.94	1087.91					
LTOB[2] Max Depth (ft)	3.57	3.38						2.87	2.90						2.63	2.90						3.34	2.73					
LTOB[2] Cross Sectional Area (ft^2)	93.76	77.33						75.98	65.20						45.04	48.74						47.12	31.39					

	Moores Fork Reach 2																				Moores Fork Reach 3						
	Cross Section 5 (Riffle)							Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+								MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1087.06	1087.32						1084.62	1084.29						1083.10	1083.29						1079.97	1080.11					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.11	1.04						1.00	1.08						1.00	0.94						1.00	0.95					
Thalweg Elevation	1084.63	1084.53						1081.95	1081.29						1080.56	1080.63						1077.41	1077.37					
LTOB[2] Elevation	1087.34	1087.43						1084.62	1084.54						1083.10	1083.13						1079.97	1079.97					
LTOB[2] Max Depth (ft)	2.71	2.9						2.67	3.25						2.54	2.50						2.56	2.60					
LTOB[2] Cross Sectional Area (ft^2)	40.53	36.65						53.58	61.60						33.72	30.17						33.89	31.07					

	Moores Fork Reach 3							UT1																			
	Cross Section 9 (Pool)							Cross Section 10 (Riffle)							Cross Section 11 (Pool)							Cross Section 12 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1080.16	1079.98						1111.02	1111.05						1104.40	1104.45						1102.01	1102.14					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.04						1.08	0.95						1.00	0.95						1.00	0.79					
Thalweg Elevation	1076.12	1075.02						1110.22	1110.23						1103.15	1103.19						1101.20	1101.33					
LTOB[2] Elevation	1080.16	1080.16						1111.09	1111.01						1104.40	1104.38						1102.01	1101.97					
LTOB[2] Max Depth (ft)	4.04	5.14						0.87	0.78						1.25	1.19						0.81	0.64					
LTOB[2] Cross Sectional Area (ft^2)	52.58	57.57						4.40	3.60						5.48	4.92						3.92	2.78					

	UT1																										
	Cross Section 13 (Pool)							Cross Section 14 (Pool)							Cross Section 15 (Pool)							Cross Section 16 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1088.55	1088.46						1085.64	1085.57						1080.95	1080.95						1078.41	1078.47					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.10	1.23						1.00	1.08						1.00	0.98						1.00	0.99					
Thalweg Elevation	1087.40	1087.29						1084.50	1084.43						1079.42	1079.39						1077.44	1077.44					
LTOB[2] Elevation	1088.67	1088.73						1085.64	1085.66						1080.95	1080.91						1078.41	1078.46					
LTOB[2] Max Depth (ft)	1.27	1.44						1.14	1.23						1.53	1.52						0.97	1.02					
LTOB[2] Cross Sectional Area (ft^2)	6.64	8.60						4.63	5.61						6.90	6.40						3.69	3.65					

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.
2 - LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Table 9. Monitoring Data - Cross-Section Morphology Data Table
Stewarts Creek Mitigation Project (DMS No. 100023)

	UT2																			UT3 Reach 1							
	Cross Section 17 (Pool)							Cross Section 18 (Riffle)							Cross Section 19 (Riffle)							Cross Section 20 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1098.12	1098.08						1097.77	1097.72						1092.07	1092.04						1095.67	1095.56					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.04						1.04	1.13						1.08	1.01						1.00	1.11					
Thalweg Elevation	1096.73	1096.52						1097.08	1097.09						1091.33	1091.31						1094.51	1094.58					
LTOB[2] Elevation	1098.12	1098.14						1097.80	1097.81						1092.13	1092.05						1095.67	1095.67					
LTOB[2] Max Depth (ft)	1.39	1.62						0.72	0.72						0.80	0.74						1.16	1.09					
LTOB[2] Cross Sectional Area (ft^2)	5.42	5.90						2.61	3.02						3.52	3.20						5.72	9.02					

	UT3 Reach 1							UT3 Reach 2																			
	Cross Section 21 (Riffle)							Cross Section 22 (Pool)							Cross Section 23 (Riffle)							Cross Section 24 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1092.21	1092.24						1089.56	1089.52						1087.39	1087.41						1081.92	1081.94					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.12	1.11						1.00	1.04						1.13	1.06						1.11	1.04					
Thalweg Elevation	1091.48	1091.45						1088.31	1088.34						1086.53	1086.52						1080.48	1080.48					
LTOB[2] Elevation	1092.3	1092.32						1089.56	1089.57						1087.50	1087.47						1082.08	1082.00					
LTOB[2] Max Depth (ft)	0.82	0.87						1.25	1.23						0.97	0.95						1.60	1.52					
LTOB[2] Cross Sectional Area (ft^2)	3.71	3.71						6.88	7.47						5.95	5.40						8.93	7.59					

	UT3 Reach 2													
	Cross Section 25 (Riffle)							Cross Section 26 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1081.58	1081.59						1077.31	1077.29					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.01						1.00	1.01					
Thalweg Elevation	1080.54	1080.52						1075.90	1075.60					
LTOB[2] Elevation	1081.58	1081.60						1077.31	1077.31					
LTOB[2] Max Depth (ft)	1.04	1.08						1.41	1.71					
LTOB[2] Cross Sectional Area (ft^2)	4.54	4.65						7.58	7.84					

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.
2 - LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Appendix D: Hydrologic Data

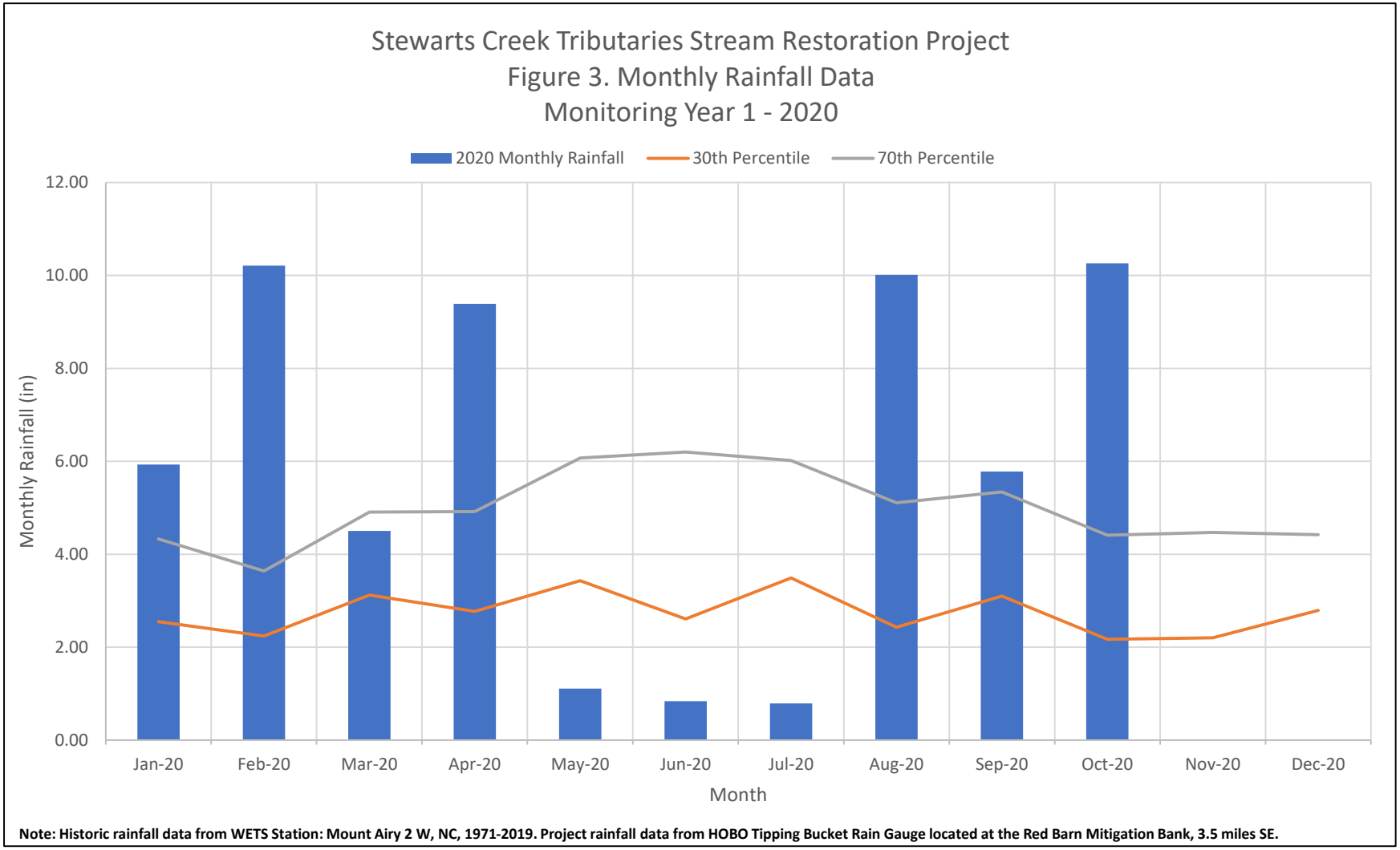
Table 10. Verification of Bankfull Events

Figure 3. Monthly Rainfall Summary Data

Precipitation and Water Level Hydrographs

Table 10. Bankfull Event Verification
Stewarts Creek Tributaries Stream Restoration Project (DMS No. 100023)

Overbank Events							
Gage ID	**MY1 (2020)**	**MY2 (2021)**	**MY3 (2022)**	**MY4 (2023)**	**MY5 (2025)**	**MY6 (2026)**	**MY7 (2027)**
UT1 - SCTSG1	5 separate events: 4/30/2020 5/27/2020-5/28/2020 8/15/2020 10/11/2020 10/29/2020	-	-	-	-	-	-
UT1 - SCTSG2	2 separate events: 4/30/2020 10/29/2020	-	-	-	-	-	-
UT3 Reach 1 - SCTSG3	4 separate events: 7/29/2020-8/1/2020 8/5/2020-8/6/2020 10/13/2020-10/15/2020 10/29/2020	-	-	-	-	-	-
UT3 Reach 2 - SCTSG4	11 separate events: 4/30/2020 5/23/2020 5/27/2020-5/28/2020 7/10/2020 8/3/2020 8/5/2020 8/15/2020 9/11/2020 9/29/2020 10/11/2020 10/29/2020	-	-	-	-	-	-
UT2 - SCTSG5	No bankfull events	-	-	-	-	-	-

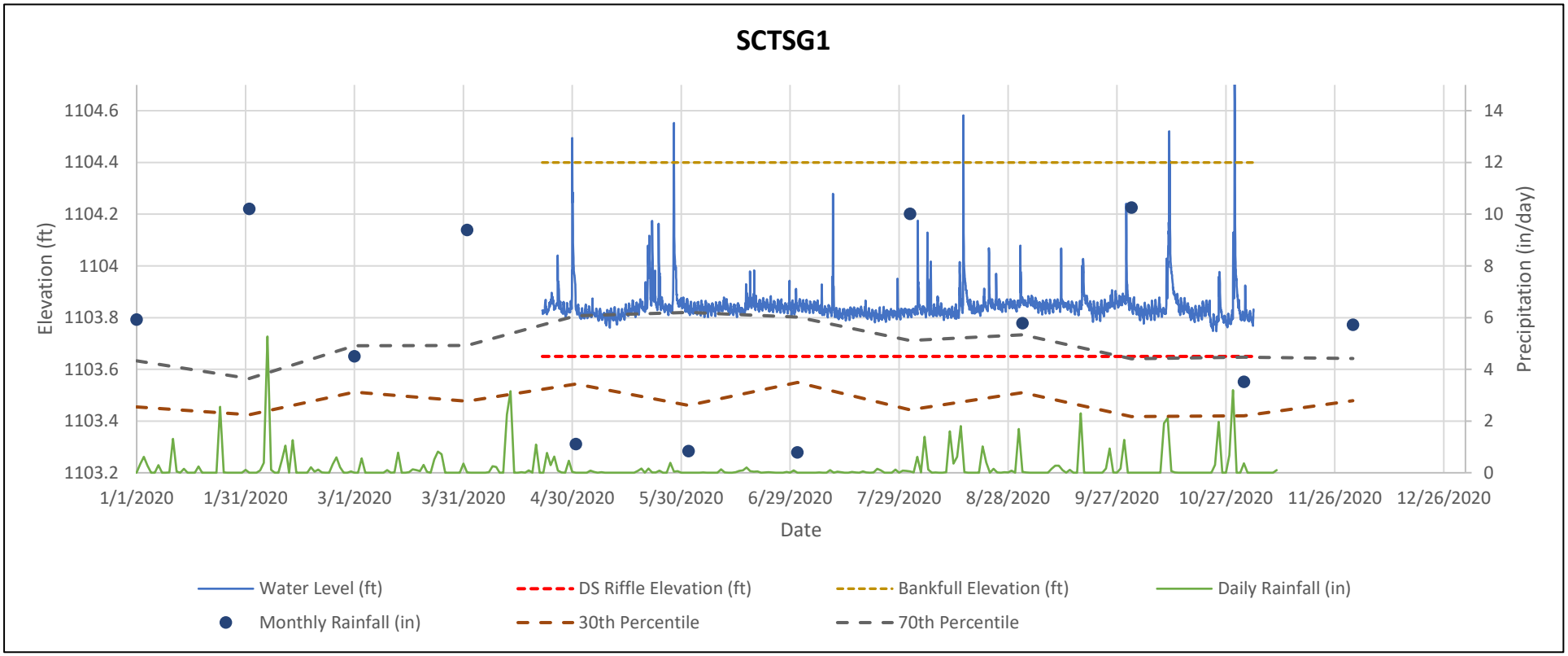


Note: Historic rainfall data from WETS Station: Mount Airy 2 W, NC, 1971-2019. Project rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Rainfall Summary							
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Annual Precip Total	58.82	-	-	-	-	-	-
WETS 30th Percentile	43.95	-	-	-	-	-	-
WETS 70th Percentile	52.86	-	-	-	-	-	-
Normal	Y	-	-	-	-	-	-

*Note: 2020 rainfall data does not include data from November or December because the gauge was last downloaded in October during MY1 monitoring.

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

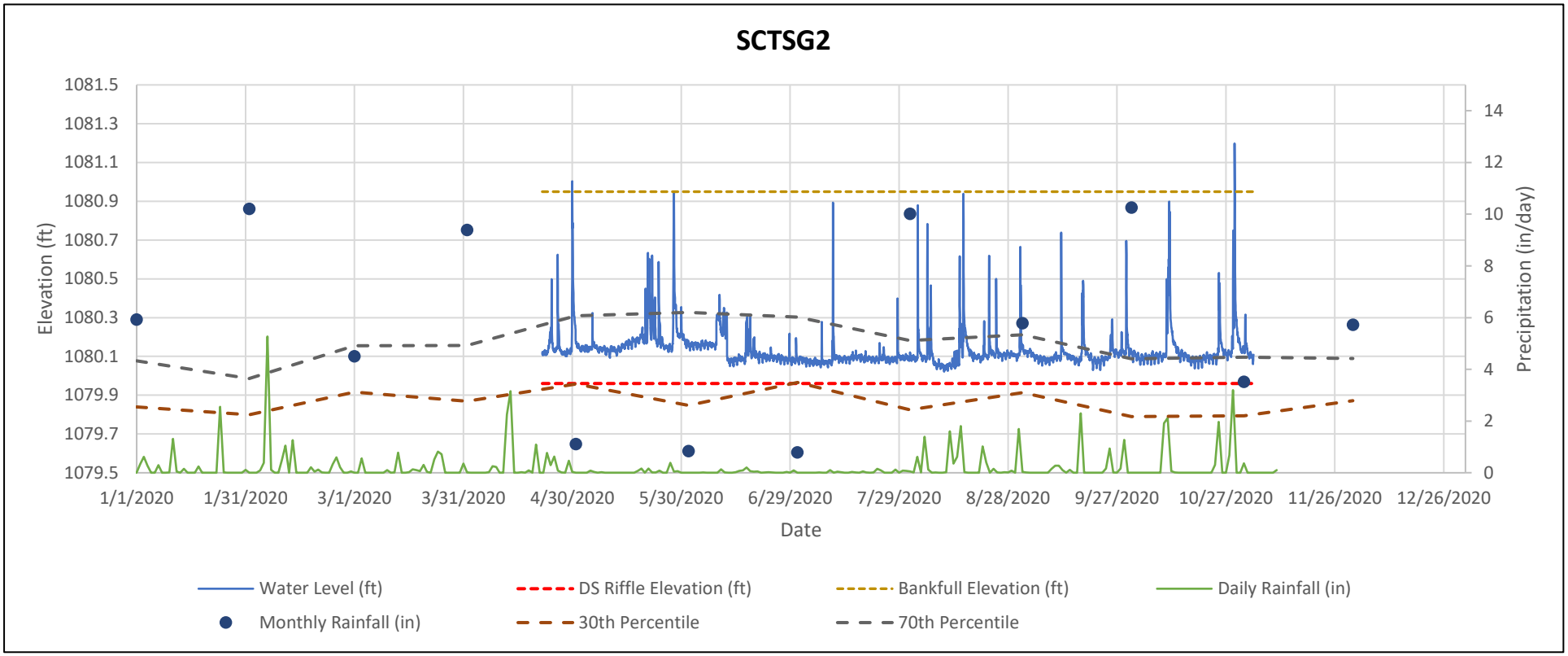


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20727103
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG1
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1103.23
Controlling Grade Elevation (ft)	1103.65
Bankfull Elevation (ft)	1104.4
Most Consecutive Days of Flow	167
Total Days of Flow	196
Max High Water Level Above Bankfull (ft)	0.35
Bankfull Events	6
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

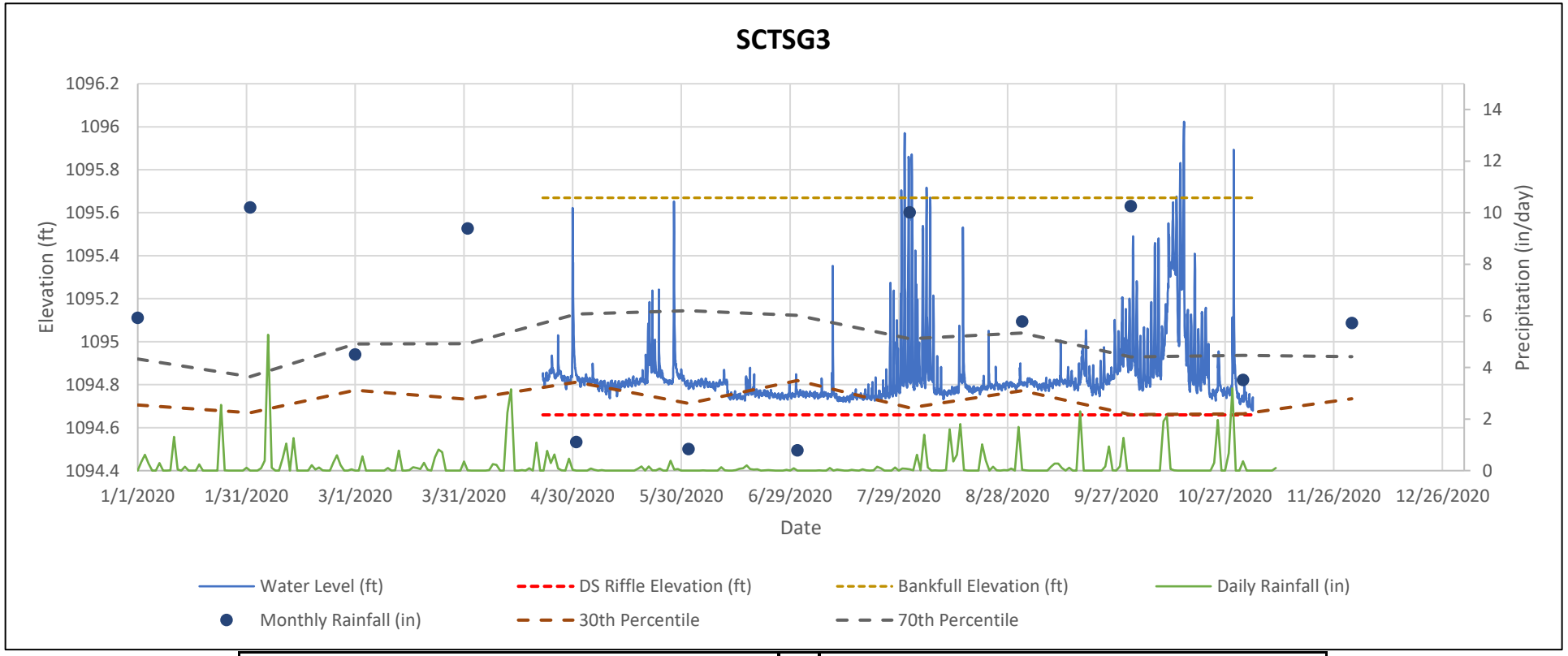


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT1
Date Installed	4/21/2020
Serial Number	20234981
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG2
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1079.65
Controlling Grade Elevation (ft)	1079.96
Bankfull Elevation (ft)	1080.95
Most Consecutive Days of Flow	167
Total Days of Flow	196
Max High Water Level Above Bankfull (ft)	0.25
Bankfull Events	2
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

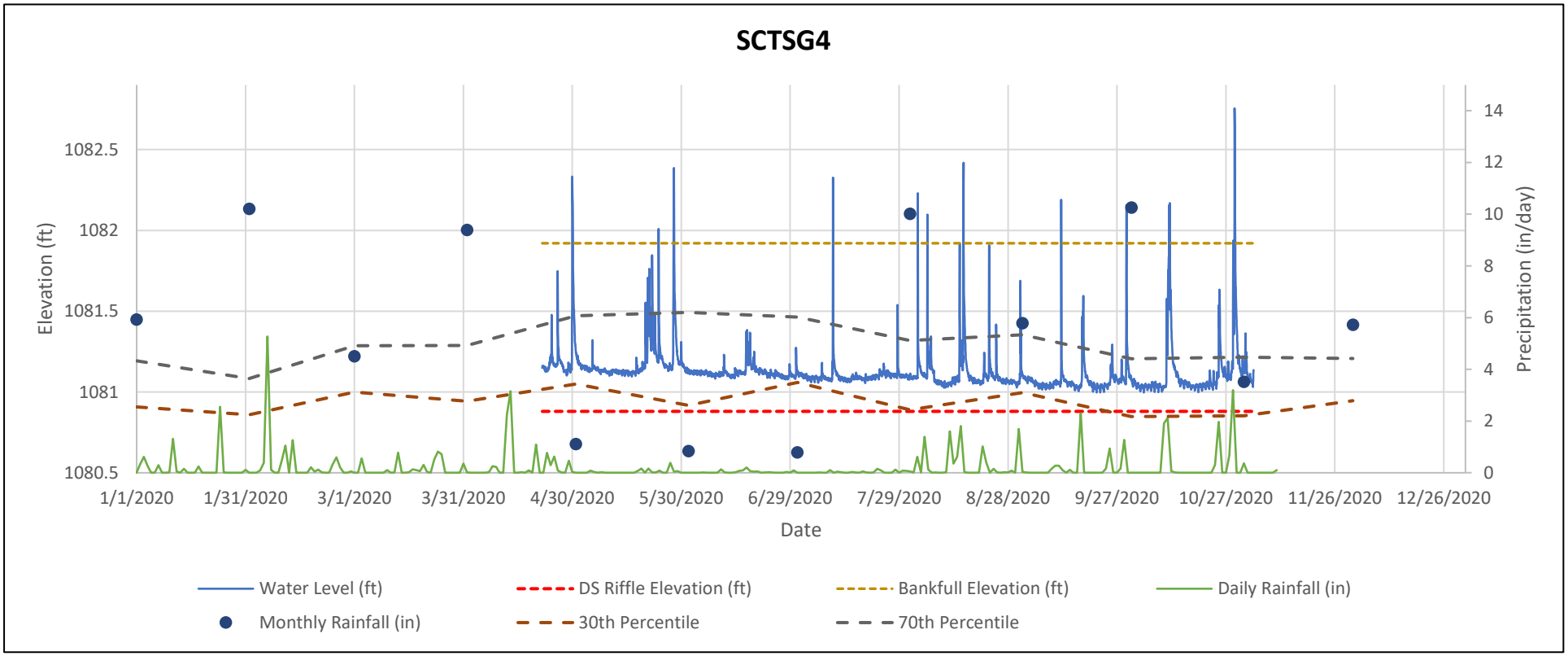


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 1
Date Installed	4/21/2020
Serial Number	20234982
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG3
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1094.68
Controlling Grade Elevation (ft)	1094.66
Bankfull Elevation (ft)	1095.67
Most Consecutive Days of Flow	167
Total Days of Flow	197
Max High Water Level Above Bankfull (ft)	0.35
Bankfull Events	10
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data

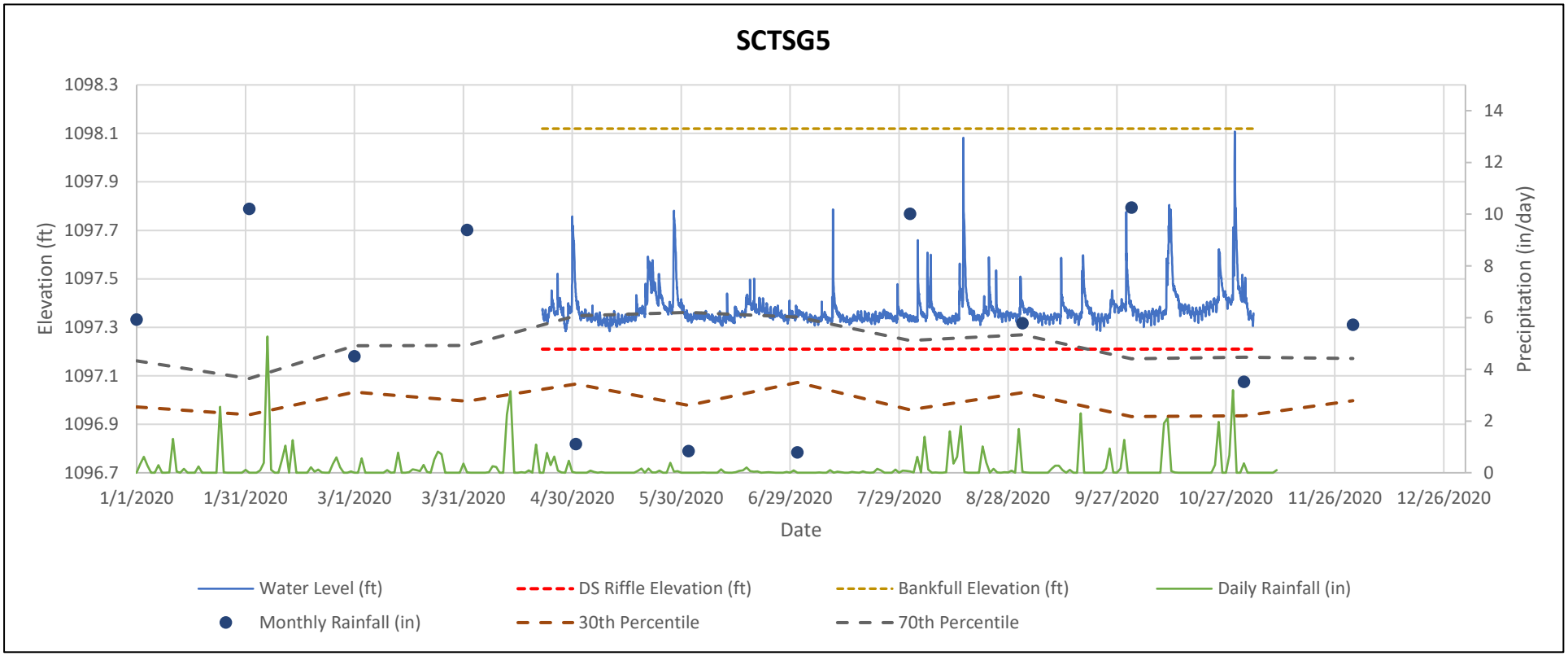


Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT3 Reach 2
Date Installed	4/21/2020
Serial Number	20234980
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Bank, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG4
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1080.63
Controlling Grade Elevation (ft)	1080.88
Bankfull Elevation (ft)	1081.92
Most Consecutive Days of Flow	167
Total Days of Flow	196
Max High Water Level Above Bankfull (ft)	0.84
Bankfull Events	13
Meets Success Criteria	Yes

Stewarts Creek Tributaries Stream Restoration Project
Year 1 (2020) Streamflow Data



Site Info	
Stream	Stewarts Creek Tributaries Stream Restoration Project
Reach	UT2
Date Installed	4/21/2020
Serial Number	20727118
Reach Type	Perennial

-Rainfall data from HOBO Tipping Bucket Rain Gauge located at the Red Barn Mitigation Site, 3.5 miles SE.

Year 1 (2020) Streamflow Data	
Gauge ID	SCTSG5
Start Date	4/21/2020
End Date	12/31/2020
Flow Criteria (Days)	30
Recordings Per Day	24
Logger Elevation (ft)	1096.96
Controlling Grade Elevation (ft)	1097.21
Bankfull Elevation (ft)	1098.12
Most Consecutive Days of Flow	167
Total Days of Flow	196
Max High Water Level Above Bankfull (ft)	-0.01
Bankfull Events	0
Meets Success Criteria	Yes

Appendix E: Project Timeline and Contact Information

Table 11. Project Activity and Reporting History

Table 12. Project Contacts Table

Table 11. Project Activity and Reporting History
Stewarts Creek Tributaries Stream Restoration Project (NCDMS Project No. 100023)

Elapsed Time Since grading complete: **0 yrs 8 months**
Elapsed Time Since planting complete: **0 yrs 9 months**
Number of reporting Years: **1**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution Date	NA	May-17
404 permit date	NA	Jul-19
Final Mitigation Plan	2017 to 2019	May-19
Final Design – Construction Plans	2017 to 2019	Sep-19
Site Earthwork	NA	May-20
As-Built Survey Performed	May - June 2020	Jun-20
Bare root plantings	NA	Mar-20
As-built monitoring report (Year 0 Monitoring – baseline)	Jun-20	Oct-20
Year 1 Monitoring	2020	Nov-20
Year 2 Monitoring	2021	Nov-21
Year 3 Monitoring	2022	Nov-22
Year 4 Monitoring	2023	Nov-23
Year 5 Monitoring	2024	Nov-24
Year 6 Monitoring	2025	Nov-25
Year 7 Monitoring	2026	Nov-26

Table 12. Project Contacts Table
Stewarts Creek Tributaries Stream Restoration Project (NCDMS Project No. 100023)

Designer Primary project design POC	Ecosystem Planning and Restoration, PLLC 1150 SE Maynard Road, Suite 140 Cary, NC 27511 Kevin Tweedy, PE (919) 388-0787
Construction Contractor Construction contractor POC	Resource Environmental Solutions, LLC (Formally Carolina Environmental Contracting, Inc.) 150 Pine Ridge Rd, Mt Airy, NC 27030 Wayne Taylor
Survey Contractor Survey contractor POC	Turner Land Surveying, PLLC PO Box 148, Swannanoa, NC 28778 Lissa Turner (919) 827-0745
Planting Contractor Planting contractor POC	Bruton Natural Systems, Inc. Charlie Bruton
Seeding Contractor Contractor point of contact	Resource Environmental Solutions, LLC (Formally Carolina Environmental Contracting, Inc.) 150 Pine Ridge Rd, Mt Airy, NC 27030 Wayne Taylor
Seed Mix Sources	Green Resource
Nursery Stock Suppliers	Dykes & Son Nursery (931) 668-8833
Monitoring Performers	Ecosystem Planning and Restoration, PLLC
Stream Monitoring POC	Erin Bennett, EPR (919) 388-0787
Vegetation Monitoring POC	Tom Barrett, EPR (919) 388-0787

Appendix F: Response to North Carolina Interagency Review Team (NCIRT)

Ecosystem Planning and Restoration, LLC
1150 SE Maynard Road, Suite 140
Raleigh, NC 27511

Phone: (919) 388-0787
www.eprusa.net

October 11, 2020

RE: Response to IRT Comments dated November 6, 2020
Stewarts Creek Stream Restoration Project
Yadkin River Basin – CU# 03040101 – Surry County, North Carolina
NCDMS Project # 100023, Contract # 7183

Dear Ms. Browning,

Ecosystem Planning and Restoration (EPR) has reviewed the comments provided by the North Carolina Interagency Review Team (NCIRT) on November 6, 2020. The comments have been addressed as described below.

Erin Davis, DWR

Based on record drawing sheets 20-25, there were several pools designed along Moores Fork that do not appear as part of the as-built profile line. Can you please provide context for what is shown in the profiles.

The profiles in the record drawings were created by building a 3-d surface from the topographic as-built survey and then "cutting" a profile along the <u>design</u> alignment, not the as-built thalweg. See approximate station 27+75 as an example. The design alignment does not coincide with the deepest part of the as-built pool. The as-built survey follows the as-built stream thalweg which has some natural variations and fluctuations in response to storm events, sediment regime, and in-stream structure response, and does not always follow the design alignment. This can lead to discrepancies or shifts in profile lengths and stationing when compared to the design. To ensure that as-built lengths match mitigation plan lengths, the design alignment is used. As-built pools, based on the surveyed thalweg, can be seen in both the plan view as-built contours in the record drawings, and the MY0 longitudinal profiles and cross sections. Based on our observations and the data collected to date, the pools are maintaining appropriately.

The photo log shows groundcover establishing better in some area than others, which is a general concern for Priority 2 restoration areas. Please note if any reseeding or soil treatments were completed during the growing season in the MY1 report.

The area in question has been flooded several times, resulting in varying ground cover conditions. We will likely need to reseed and replant some areas during the coming

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Raleigh, NC 27511

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winter/spring. More detail will be provided in the MY1 report as the Year 1 data are finalized and assessed.

DWR liked the inclusion of drone photos on the cover page. Having these images supplement the fixed photo points in as-built reports gives additional perspective and is helpful for our review.

We will do our best to implement drone photography for every monitoring year.

Kim Browning, USACE

It's noted that structures were added as a result of lack of sod mats on site and the reported benefit is additional woody debris in the system. Is this also why so many constructed riffles were added? Or was this a result of the two overbank events during construction?

When EPR realized there was a lack of sod mats on site to install to reduce the stress in bends, we ran a stress analysis using a 2D RAS model. With that analysis, we determined areas of high stress and placed all additional structures according to those stresses and professional judgement. The two overbank events during construction did not cause us to add additional structures.

The photos and drone photos were helpful. In future reports please add photos of the culvert openings.

We will do our best to implement every monitoring year.

If you have any questions regarding the responses, please contact me at 919-388-0787 or via email at ebennett@eprusa.net.

Sincerely,

Erin M Bennett

Erin M. Bennett, PE