Year 7 Monitoring and Closeout Report

Roses Creek
Burke County, NC

DMS Project ID No. 96309

Construction Completed: May 2016
UAS Data Collected: March 3, 2022
Vegetation Data Collected: September 28, 29 and October 24, 2022
Submitted: February 2023

Prepared for:
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I HEREBY CERTIFY THAT THE DOCUMENT CONTAINED HEREIN, ROSES CREEK YEAR 7 MONITORING REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

SIGNED AND DATED THIS 17 DAY OF February 2023.

Vickie Miller

Vickie Miller, PWS, AICP

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1.0 PROJECT SUMMARY

The following report summarizes the vegetation establishment and stream stability for Year 7 monitoring for the Roses Creek Site (hereafter referred to as the "Site") in Burke County, North Carolina.

1.1 Goals and Objectives

Primary goals for the Site, as detailed in the Roses Creek Stream Mitigation Site Mitigation Plan (ICA Engineering 2015) include:

1. Reducing water quality stressors and providing/enhancing flood attenuation.
2. Restoring and enhancing aquatic, semi-aquatic and riparian habitat.
3. Restoring and enhancing habitat connectivity with adjacent natural habitats.

The following objectives accomplish the goals listed above:

1. Reducing water quality stressors and providing/enhancing flood attenuation through:
    a. Restoring the existing degraded, straightened and incised/entrenched streams as primarily a Priority 1 restoration where bankfull and larger flows can access the floodplain allowing nutrients, sedimentation, trash and debris from upstream runoff to settle from floodwaters to the extent practical. Restoring a stable dimension, pattern, and profile will ensure the channel will transport and attenuate watershed flows and sediment loads without aggrading or degrading.
    b. Restore channel banks by relocating the channel, excavating bankfull benches, placing in-stream structures to reduce shearing forces on outside meander bends, and planting native vegetative species to provide soil stability, thus reducing stream bank stressors.
    c. Reducing point source (i.e. cattle and equipment crossings) and non-point source (i.e. stormwater runoff through pastures) pollution associated with on-site agricultural operations (hay production and cattle) by exclusionary fencing from the stream and riparian buffer and by eliminating all stream crossings from the easement.
    d. Plant a vegetative buffer on stream banks and adjacent floodplains to treat nutrient enriched surface runoff from adjacent pastureland associated with on-site agricultural operations.
    e. Restoring riparian buffers adjacent to the streams that are currently maintained for hay production that will attenuate floodwaters, in turn reducing stressors from upstream impacts.
2. Restoring and enhancing aquatic, semi-aquatic and riparian habitat through:
    a. Restoration of a sinuous gravel bed channel that promotes a stable bed form and accommodates benthic macroinvertebrate and fish propagation. Additionally, woody materials such as log structures, overhanging planted vegetation and toe wood/brush toe in submerged water will provide a diversity of shading, bed form and foraging opportunities for aquatic organisms.
    b. Restoring native vegetation to the stream channel banks and the adjacent riparian corridor, that is currently grass dominated, will diversify flora and create a protected habitat corridor, which will provide an abundance of available foraging and cover habitat for a multitude of amphibians, reptiles, mammals and birds.

3. Restoring and enhancing habitat connectivity with adjacent natural habitats through:
    a. Planting the riparian buffer with native vegetation.
    b. Protection of the restored community will ensure a protected wildlife corridor between the Site and the upstream and downstream mature riparian buffers and upland habitats.
    c. Converting approximately 15 acres from existing agricultural land to riparian buffer protected by permanent conservation easement.

1.2 Success Criteria

Monitoring of restoration efforts will be performed until success criteria are fulfilled. Monitoring includes stream channel/hydraulics and vegetation. In general, the restoration success criteria, and required remediation actions, are based on the Stream Mitigation Guidelines (USACE et al. 2003) and the Ecosystem Enhancement Program Monitoring Requirements and Performance Standards for stream and/or Wetland Mitigation (NCEEP 2011). Project success criteria are further detailed in the Baseline Monitoring Document & As-Built Baseline Report (HDR|ICA 2016).

1.3 Background Summary

The North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) contracted HDR|ICA to restore 4,746 linear feet of Roses Creek and three of its unnamed tributaries within the Site to assist in fulfilling stream mitigation needs in the watershed. The Site is located approximately 12 miles northwest of downtown Morganton in Burke County, NC. The Site contains Roses Creek and three unnamed headwater tributaries of Roses Creek (UT 1, UT 2 and UT 3). The Site is located within the 03050101060030 14-digit Hydrologic Unit, which is also a DMS Targeted Hydrologic Unit for Cataloging Unit 03050101 of the Catawba River Basin. Roses Creek is classified as a Water Supply Watershed (WS-III), as it is part of the headwaters that feed Lake Rhodhiss. The Site was formerly comprised of one property owned by Robert B. Sisk and Martha M. Sisk (PIN # 1767479652) (known as the Sisk Farm) and was recently (2019/2020) subdivided between four owners and six parcels. The three additional owners are Annette Sisk and Samuel Ray Jr. (PIN# 1767470935), Robert M. Sisk and Sarah Turner (PINs # 1767476489, 1767464764 and 1767573144) and Bruce A. Sisk (PIN# 1767579505). Additional information concerning project history is presented in Table 2.

1.4 Vegetation

Planted stem performance across the entirety of the Site is meeting or exceeding (by over 10%) Year 7 criteria average of 210 stems per acre. When only taking planted stems into account, 17 of the 17 plots are meeting Year 7 criteria of 210 stems per acre. When considering natural recruits, all vegetation plots far exceed the Year 7 criteria. Individual plot densities ranged between 243 to 486 stems per acre with an average stem density across monitored plots of 343 stems per acre. Three additional transects were performed along UT 1, UT 2 and Roses Creek to illustrate vegetation density in other areas of the conservation easement. All three transects (1-3) are exceeding the Year 7 criteria of 210 stems per acre with 486, 243 and 809 stems per acre, respectively. Planted vegetation height is averaging 10.3 feet across all plots with plot averages ranging from 4.7 to 13.5 feet;

however, plots 4, 11 and 15 fall short of the average 8-foot height criteria for Year 7 plots. Table 8 illustrates Year 7 tree height in the permanent vegetation plots.

Stem density calculations including natural recruits were made based on the 2016 Monitoring Guidance which dictates no single species may account for over 50% of the required number of stems within any vegetation plot. Plots 1, 10, 11, 12, 14, 15, 16 and 17 have greater than 50% of one single species within the vegetation plots. Plot 1 has 20 common persimmon (*Diospyros virginiana*) natural recruits, and plots 10-17 (excluding 13) have many river birch (*Betula nigra*) natural recruit seedling and saplings. The river birch natural recruits are located throughout the floodplain along Roses Creek from station 26+00 and downstream to the end of the project. However, planted stems are surviving and providing some diversity.

Chinese privet (*Ligustrum sinese*), Japanese honeysuckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), and mimosa (*Albizia julibrissin*) have been observed in the past years and recently downstream of station 14+75 along the UT 1 floodplain. As part of the invasives management plan for 2022, invasive species were chemically treated on both sides of UT 1 floodplain, at the confluence at UT1 with Roses Creek, Roses Creek a few hundred feet downstream on both banks and along the fence line of Sisk Farm Road adjacent to UT 2 on April 5, and 29, 2022. On April 5, a combination of basal bark application (20% Garlon 4 in Bark Oil Blue) and foliar spray with 3% glyphosate was applied in the invasive areas along UT 1, Roses Creek and the roadside adjacent to UT 2. On April 29 the foliar spray and cut stem application to privet and a large mimosa along UT 1 was performed. A final treatment for these identified invasives areas is scheduled for UT 2 in the spring of 2023 for the Japanese honeysuckle. The Current Conditions Plan View depicts this invasive populations of honeysuckle between Sisk Farm Road and UT 2.

The cattle waste encroachment area outside the conservation easement at approximately station 41+50 of Roses Creek is running into the forested and herbaceous riparian buffer between the pasture area and the stream since it is the low spot in the landscape. The landowner is not willing to remove his cattle from this area of the pasture as it provides a shady spot for cattle and the landowner noted he has limited pasture. HDR believes the wide forested and herbaceous buffer (over 50 feet) inside the easement is processing the excess cattle waste. Another area has been called out on the CCPV as "Fence undermining area" and is located at approximately station 40+00 adjacent to an ephemeral pool. The landowner has added wood and concrete blocks to shore up the bottom fence openings to prevent cattle from passing under or breaching the easement fence. There is no evidence of livestock entering into the easement in 2022.

Rutherford Power was hired to relocate utility poles and associated utility easement completely out of the Site at the upper reach of UT 1. The utility pole right of way clearing and relocation of poles was completed in October 2022. All utility easements have been relocated outside the Site.

1.5 Stream Stability

Roses Creek and its tributaries have remained in stable, functioning condition over the past monitoring year. Cross section geometry along Roses Creek has experienced minor fluctuations over the past two monitoring years. Cross Section 4 has made small but notable improvements toward better stabilization when compared to year 5 changes due to beaver activity. In Year 5, increased depth and bankfull area were noted with a beaver dam being the likely cause. In Year 7, both the

depth and bankfull area are trending back down. As seen in the Cross Section 4 photo, the typical riffle characteristics appear just below the monumented cross section location. This indicates that the riffle has migrated just downstream and the area under the tape for Cross Section 4 more closely resembles a glide facet.

In Year 5 monitoring, deposition was seen in UT 1, 2, and 3. These conditions have improved for UT 1 and 2 based on Year 7 cross section values. UT 3 however continues a depositional trend. As noted in previous year monitoring, the likely cause is increased vegetation establishment and narrowing of the bankfull area. Each tributary maintains a single thread channel throughout the Site as seen from the aerial drone photography.

Cross section geometry along Roses Creek has experienced minor fluctuations over the past two monitoring years. Cross Section 4 has increased in depth and bankfull area due to a beaver dam that was constructed immediately upstream of the cross section causing a scour hole to form through the cross section. The beaver dam was discovered in February 2020 and removed the following month. Another beaver dam was discovered in 2021 and was removed in the summer of 2021. As sediment is transported through the system it is possible that this hole will fill in over time. Stream banks remain stable through this reach following removal of the beaver dam.

Adaptive management in the form of supplemental tree planting in 2016/2017 and stream channel repairs in 2018/2019 assisted to increase tree density and stabilize stream banks and channels. Appendix H has been added to the report to show the locations and tree species that were planted in 2017. Appendix I shows the location of repairs along the UTs and the mainstem of Roses Creek that were completed in October 2018 and early 2019.

It should be noted the Site had met Success Criteria of two bankfull events by Year 3 of monitoring. All four crest gauges on the Site have been damaged by insects, making the gauge measurements unreadable since 2019. Crest gauge records for Years 1 – 4 are provided in Appendix E.

Beaver activity was noted in late summer of 2022 in the downstream portions of Roses Creek. Two beaver dams were located at stations 29+25 and 32+50 along Roses Creek and created some backwater effects upstream of these locations. In late fall of 2022, four beavers were trapped by APHIS and the dams were removed by hand raking and minimal chainsaw work. HDR will visually assess and photo document these areas for stability in late 2022/early 2023 ahead of the agency meeting.

Based on water level data obtained using Hobo U20 pressure transducers installed in the bottom of each tributary, UT 2 has indicated constant flow throughout the past monitoring year. It is thought that UT 1 and UT 3 also experienced constant flow throughout the early parts of the past monitoring year; however, due to equipment failure data was not recorded for the entire months of January and February for all UTs. New Hobo U20 pressure transducers were installed in early March 2022 on all three UTs due to malfunction and low battery status of equipment. It is worth noting, UT 1 exhibited 176 days with flow and 24 consecutive flow days and UT 3 exhibited 204 days with flow and 102 consecutive flow days. Water level data is provided in Appendix E as well.

Pebble counts were conducted on Roses Creek riffle cross sections as well as riffle cross sections for UT 1, 2, and 3 in March 2022. Results show a D50 of 21mm for Cross Section 1, a D50 of 46mm for

Cross Section 4, and D50 of 28mm for Cross Section 5. D50 for the tributaries showed results of sandy and silty particle sizes.

1.6 Monitoring Year 7 Summary

The Site has met the final geomorphic, vegetation and hydrologic success criteria. Roses Creek, UT 1, UT 2 and UT 3 remain stable and functioning as designed and based on the stream survey data gathered in MY 7 and prior years. Some aggradation is occurring in UT 3 due to the flat nature of the surrounding landscape: however, the channel continues to flow the majority of the year and is functioning as a single thread perennial stream. Visual assessments reveal little signs of instability for all streams and past instabilities have been repaired or have naturally stabilized. As stated in Section 1.4, planted stem density is averaging 343 stems per acre across the Site and is far exceeding the Year 7 criteria of 210 stems per acre.

Tables and figures within the appendices of the various performance metrics and monitoring elements support the findings of meeting success criteria. A narrative background on the project can be found in the Mitigation Plan documents available on DMS's website.

2.0 METHODOLOGY

Year 7 monitoring surveys were completed using a GNSS VRS Rover. Each cross section was marked with a rebar monument at their beginning and ending points. The rebar has been located vertically and horizontally in NAD 83-State Plane. Surveying these monuments throughout the Site ensured proper orientation. The survey data was imported into MicroStation for verification. The Ohio Department of Natural Resources' "The Reference Reach Spreadsheet Version 4.3L" were used to analyze cross section data (Mecklenburg 2006). Tables and figures were created using Microsoft Excel.

Vegetation monitoring was completed using CVS level II methods, for 20, 100 square meter vegetation plots (Lee et al. 2006). Seventeen permanent vegetation plots were monitored and three additional transects (50 m long by 2 m wide) were added along UT 1, UT 2 and Roses Creek. The taxonomic standard for vegetation used for this document was Flora of the Southern and Mid-Atlantic States (Weakley 2011).

3.0 REFERENCES

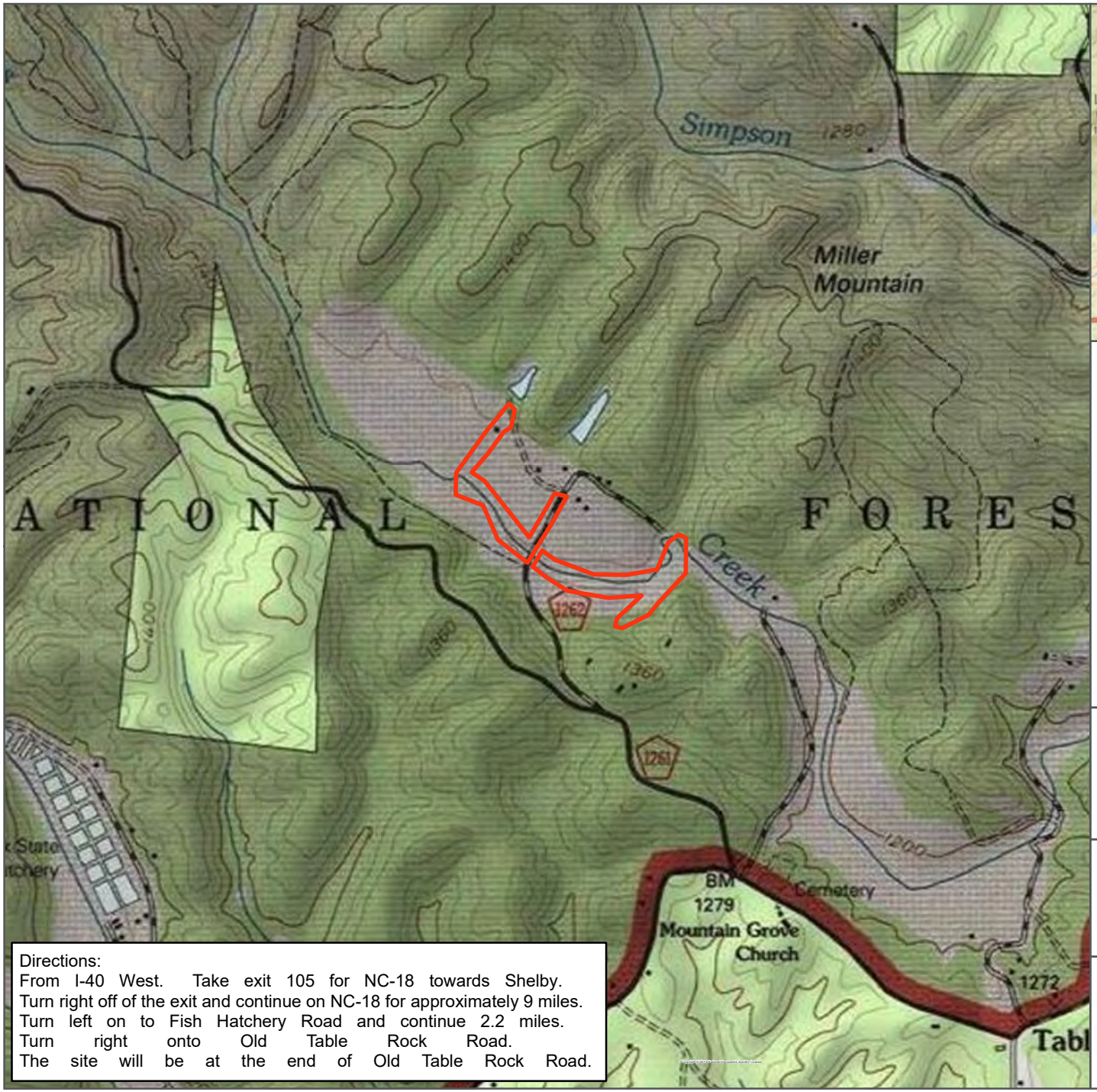
Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm).

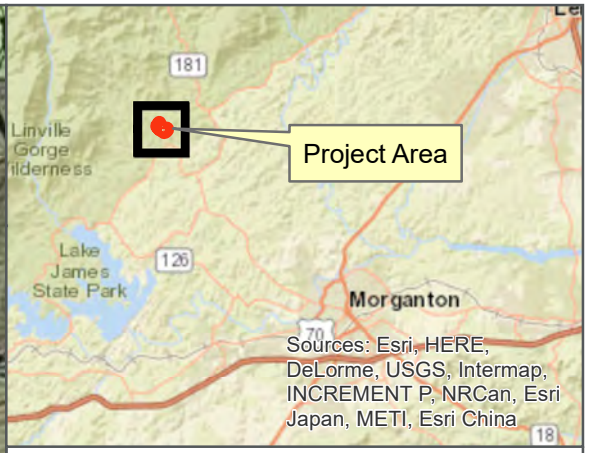
Mecklenburg, Dan. 2006. The Reference Reach Spreadsheet Version 4.3L. 2006. Ohio Department of Natural Resources. Division of Soil and Water. (http://www.dnr.state.oh.us/tabid/9188/default.aspx)

Weakley, Alan S. 2011. Flora of the Southern and Mid-Atlantic States (online). Available: http://www.herbarium.unc.edu/FloraArchives/WeakleyFlora_2011-May-nav.pdf [May 15, 2011]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

APPENDICES

Appendix A. Project Vicinity Map and Background Tables





Legend

Project Easement

The subject project site is an environmental restoration site of the NCDEQ Divison of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, monitoring, and stewardship of the restoration site is permitted within the terms and timeframes of their defined, pre-approved roles. Any intended site visitation or activity by any person outside of these previously sanctioned activities/roles requires prior coordination with DMS.

ROSES CREEK STREAM MITIGATION SITE

VICINITY MAP
BURKE COUNTY, NC

N

0 1,000 2,000 4,000 Feet

FIGURE 1

PATH: Z:\ROSES_CREEK\5.0_PROJECT_DEVELOPMENT\5.2_WORK_IN_PROGRESS\DOCS\MONITORING\YEAR 1\APPENDIX A_VICINITY MAP AND BACKGROUND TABLES\VICINITY MAP.MXD - USER: ADIGERON - DATE: 11/13/2017

Map Produced 12/2/2016

Table 1. Project Components and Mitigation Credits

Roses Creek, Burke County DMS Project No. 96309									
Credit Summary									
	Stream SMU		Riparian Wetland WMU		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,009.600								
Project Components									
Project Component or Reach ID	Stationing/ Location		Existing Footage/ Acreage	Approach (PI, PII, etc.)	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio	SMU	
Roses Creek	10+00-41+81		3,643	PI	Restoration	3,181	1:1	3,121*	
Roses Creek	41+81-42+19		38	-	EII	38	2.5:1	15	
UT 1	10+00-12+54; 16+11-16+46		267	PI	Restoration	289	1:1	289	
UT 1	12+54-16+11; 16+46-19+30		641	-	EII	641	2.5:1	256	
UT 2	10+00-17+07		610	PI	Restoration	707	1:1	707	
UT 3	10+00-16+21		558	PI	Restoration	621	1:1	621	
Total	NA		5,757	PI	Restoration /EII	5,477	1-2.5:1	5,009.600	

* Stream Mitigation Units decreased by 60 to account for break in easement at the stream crossing on Sisk Farm Road

Component Summation						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	4,798					
Enhancement II	679					

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	September 2015	September 2015
Final Design – Construction Plans	September 2015	March 2016
Construction	February 25, 2016	May 18, 2016
Temporary S&E Mix Applied to Entire Project Area	---	May 18, 2016
Permanent Seed Mix Applied to Entire Project Area	---	May 18, 2016
Bare Root, Containerized, and B&B plantings for Entire Project Area	---	May 27, 2016
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	May 2016	July 2016
Year 1 Monitoring	November 2016	January 2017
Stream Morphology	November 2016	--
Vegetation	August 2016	--
Supplemental Planting	---	February 2017
Year 2 Monitoring	August 2017	November 2017
Stream Morphology	June 2017	--
Vegetation	August 2017	--
Supplemental Planting	---	February 2018
Year 3 Monitoring	August 2018	November 2018
Stream Morphology	March 2018	--
Vegetation	August 2018	--
Structural Repairs	--	October 2018
Year 4 Monitoring	November 2019	December 2019
Stream Morphology	--	--
Vegetation	--	--
Dam Removal	--	September 2019
Invasive Species Management	January 2019	September 2019
Year 5 Monitoring		
Stream Morphology	February 2020	January 2021
Vegetation	August 2020	January 2021
Invasive Species Management		April and Aug. 2020
Dam Removal		March 2020
Year 6 Monitoring		
Stream Morphology	September 2021	
Vegetation	September 2021	
Dam Removal		August 2021
Year 7 Monitoring		
Stream Morphology	March 2, 3, 2022	
Vegetation	Sept. 28/29, Oct. 24, 2022	
Invasives Species Management		April 5, 29 2022 (Spring 2023)
Dam Removal /Beavers trapped		Oct. 11 (traps checked – Oct. 13, 14, 17, 19, 25,26 and 27) & Nov. 9, 2022 (raked 2 dams)

Table 3. Project Contacts Table

Designer Primary project design POC	ICA Engineering 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Vickie Miller (919) 232-6600
Construction Contractor Construction Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Structural Repair Contractor Structural Repair Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Planting Contractor Planting Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Lloyd Glover (919) 639-6132
Supplemental Planting Contractor Supplemental Planting Contractor POC	River Works, Inc. 114 W Main Street, Suite 106 Clayton, NC 27520 Bill Wright (919) 590-5193
Seeding Contractor Seeding Contractor POC	Land Mechanic Designs, Inc. 126 Circle G Lane Willow Spring, NC 27607 Lloyd Glover (919) 639-6132
Seed Mix Sources	Green Resources – Triangle Office
Nursery Stock Suppliers	1) Dykes and Son Nursery, McMinnville, TN 2) Foggy Mountain Nursery (live stakes)
Monitoring Performers	HDR|ICA Engineering Inc. 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Vickie Miller (919) 232-6600
Stream Monitoring POC	HDR|ICA Engineering Inc. 555 Fayetteville Street, Suite 900 Raleigh, North Carolina 27601 Wyatt Yelverton (919) 232-6623
Vegetation Monitoring POC	HDR|ICA Engineering Inc. 555 Fayetteville Street, Suite 400 Raleigh, North Carolina 27601 Jessica Tisdale (919) 232-6654

Table 4. Project Information

Project Information				
Project Name		Roses Creek Stream Mitigation Site		
County		Burke		
Project Area (acres)		17.3		
Project Coordinates (latitude and longitude)		35.850953, -81.819541		
Project Watershed Summary Information				
Physiographic Province		Piedmont / Mountain		
River Basin		Catawba		
USGS Hydrologic Unit 8-digit	03050101	USGS Hydrologic Unit 14-digit	03050101060030	
NCDWQ Sub-basin		03-08-31		
Project Drainage Area (acres)		Roses: 3,309, UT 1: 35, UT 2: 47, UT 3: 10		
Project Drainage Area Percentage of Impervious Area		<1%		
CGIA Land Use Classification		Agricultural/Pasture		
Ecoregion		Northern Inner Piedmont		
Geological Unit		Zabg: Alligator Back Formation; Gneiss		
Reach Summary Information				
Parameters	**Roses Creek**	**UT 1**	**UT 2**	**UT 3**
Length of reach (linear feet)	3,681 existing	900 existing	610 existing	558 existing
Valley Classification	VIII	VIII	VIII	VIII
Drainage Area (acres)	3,309	35	47	13
NCDWQ Stream Identification Score	56	30	33.5	34
NCDWQ Water Quality Classification	WS-III; Tr	WS-III; Tr	WS-III; Tr	WS-III; Tr
Morphological Description (stream type)	E4, B4, and F4	B5, F5	B5	B5, G5
Evolutionary Trend	Simon's Stages: Premodified » Constructed » Degradation and Widening	Could maintain a B type channel in majority of reach Or F » B	G » B/E	G » B

Regulatory Considerations (cont.)			
Coastal Zone Management (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	CLOMR/LOMR
Essential Fisheries Habitat	No	N/A	N/A

Appendix B. Visual Assessment Data

Table 5: Visual Stream Morphology Stability Assessment (3/4, 5/25 and 10/24/22)
Reach ID: Roses Creek
Assessed Length: 3,121 FT

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	17	17			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	18	18			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	18	18			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	17	17			100%
		2. Thalweg centering at downstream of meander (Glide)	17	17			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100.0%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	19	19			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	19	19			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	19	19			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	19	19			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	19	19			100%

Table 5a: Visual Stream Morphology Stability Assessment (3/4, 5/25, 10/24/22)
Reach ID: UT1
Assessed Length: 234 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			1	10	96%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	2	2			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	2	2			100%
	4.Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	3	3			100%
		2. Thalweg centering at downstream of meander (Glide)	3	3			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	12	12			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	12	12			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	12	12			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	12	12			100%

Table 5b: Visual Stream Morphology Stability Assessment (3/4, 5/25, 10/24/22)
Reach ID: UT2
Assessed Length: 707 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	22	22			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	21	21			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	21	21			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	22	22			100%
		2. Thalweg centering at downstream of meander (Glide)	22	22			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	21	21			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	21	21			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	21	21			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	21	21			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	21	21			100%

Table 5c: Visual Stream Morphology Stability Assessment (3/4, 5/25, 10/24/22)
Reach ID: UT3
Assessed Length: 620 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	13	13			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	12	12			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	13	13			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	13	13			100%
		2. Thalweg centering at downstream of meander (Glide)	13	13			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100.0%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	14	14			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	14	14			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	14	14			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	14	14			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	14	14			100%

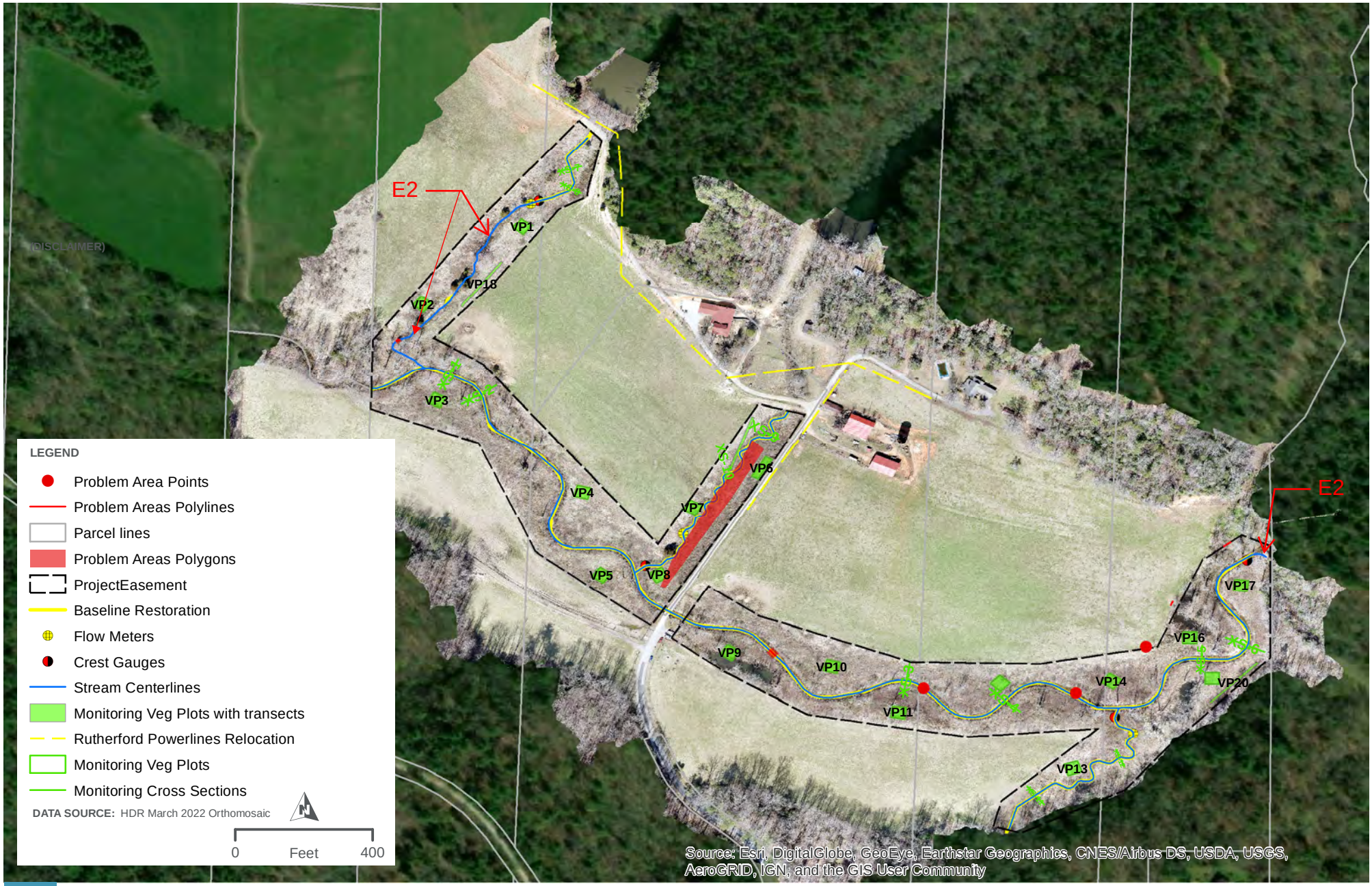
Table 6. Vegetation Condition Assessment (9/28 and 9/29/22)

Planted Acreage **15.81**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.05 Acres	Pink polygons filled with green x's	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 Acres	Blue cross hatch pattern	0	0.0	0.0%
			Total			
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.1 Acres	Pattern and color.	0	0	0%
			Cumulative Total			

Easement Acreage **17.33**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Green grass pattern.	1	0.4	2%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	None	N/A	N/A	N/A	N/A



ROSES CREEK FEATURES

DMS PRJ #96309

CLOSEOUT MY 7

PATH: \\CLTSMAIN\GIS_DATA\GIS\PROJECTS\4629_NCDENR\00000000_DMS_ECORESTORATION\ROSESCREEK\7.2_WIP\MAP_DOCS\MXD\WORKING\ROSESCREEK_2023_GEOREFERENCEPDF.MXD - USER: JTISDALE - DATE: 2/20/2023

DMS PROJECT #: 96309

CONTRACT: ROSES CREEK

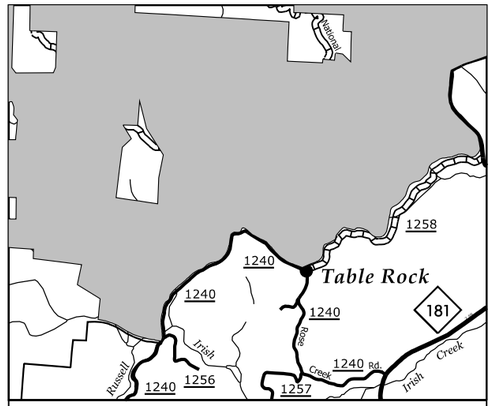
STATE		SHEET NO.
N.C.	ROSES CREEK	1

CURRENT CONDITIONS PLAN VIEW (CCPV)
ROSES CREEK

LOCATION: BURKE COUNTY, NORTH CAROLINA

LAT: 35°51' 01" N ***LONG: –81°49' 11" W***

TYPE OF WORK: CCPV PLANS – YEAR 7



VICINITY MAP

YEAR 7 CONDITIONS

BANK/BED CONDITION

- MINOR EROSION
- BEAVERDAM

VEGETATION PROBLEM AREAS

- INVASIVE POPULATION

MY 7– VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- PROPERTY LINE
- GRAVEL ROAD
- SOIL ROAD
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- CONSERVATION EASEMENT
- REMOVED POWERLINE
- EXISTING POWERLINE
- RELOCATED EXISTING POWERLINE
- FENCE
- XS-1 — CROSS–SECTION LOCATION
- FM — FLOW METER
- CREST GAUGE
- WLB — EXISTING WETLANDS
- BRUSH TOE
- ROCK L–VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- ROCK /LOG CROSS VANE
- FLOODPLAIN INTERCEPTOR
- VEGETATION TRANSECTS
- 5' x 10' VEG PLOT
- 10' x 10' VEG PLOT
- PHOTO POINT AND DIRECTION

GRAPHIC SCALES

50 25 0 50 100
PLANS

10 5 0 10 20
PROFILE (HORIZONTAL)

20 10 0 20 40
PROFILE (VERTICAL)

DESIGN DATA

ROSES CREEK			UT 1			UT 2			UT 3		
DESIGN STREAM TYPE	=	C4	DESIGN STREAM TYPE	=	C5	DESIGN STREAM TYPE	=	C5	DESIGN STREAM TYPE	=	C5
BANKFULL AREA (FT^2) CROSS–SECTIONED	=	66.4	BANKFULL AREA (FT^2) CROSS–SECTIONED	=	2.1	BANKFULL AREA (FT^2) CROSS–SECTIONED	=	2.1	BANKFULL AREA (FT^2) CROSS–SECTIONED	=	2.6
BANKFULL WIDTH (FT)	=	30.5	BANKFULL WIDTH (FT)	=	5.0	BANKFULL WIDTH (FT)	=	5.0	BANKFULL WIDTH (FT)	=	5.5
MAX DEPTH (FT)	=	2.72	MAX DEPTH (FT)	=	0.58	MAX DEPTH (FT)	=	0.58	MAX DEPTH (FT)	=	0.63
WIDTH /DEPTH RATIO	=	14.0	WIDTH /DEPTH RATIO	=	13.0	WIDTH /DEPTH RATIO	=	13.0	WIDTH /DEPTH RATIO	=	13.1
DRAINAGE AREA (MI^2)	=	5.17	DRAINAGE AREA (MI^2)	=	0.06	DRAINAGE AREA (MI^2)	=	0.07	DRAINAGE AREA (MI^2)	=	0.02
BANKFULL SLOPE(FT/FT)	=	0.0062	BANKFULL SLOPE(FT/FT)	=	0.0021	BANKFULL SLOPE(FT/FT)	=	0.0021	BANKFULL SLOPE(FT/FT)	=	0.0021

PROJECT LENGTH

		PROPOSED DESIGN STREAM LENGTH		ASBUILT STREAM LENGTH	
ROSES CREEK	=	3,219.20	FT	3,222.56	FT
UT 1	=	930.38	FT	950.69	FT
UT 2	=	707.59	FT	710.07	FT
UT 3	=	621.03	FT	627.80	FT

VICKIE MILLER
PROJECT MANAGER

Prepared in the Office of:

HDR ICA
ICA Engineering, Inc.
555 Fayetteville Street, Suite 900
Raleigh, NC 27601
NC License No: F–0258

2/7/2023
...\Year 7\RosesCrk_psh_01.dgn
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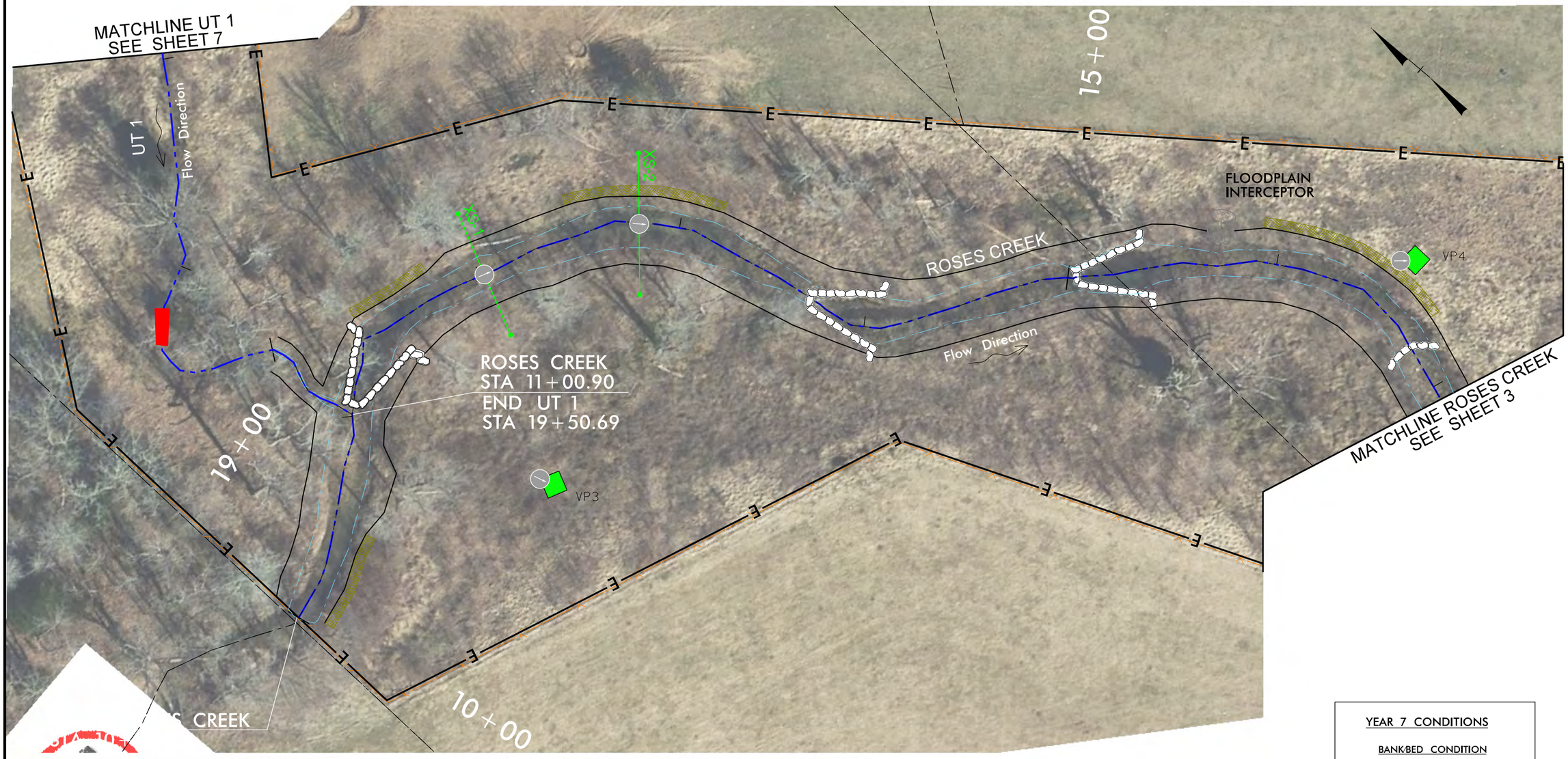
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 7



LEGEND

- ASBUILT ALIGNMENTS & STATIONING (15+00)
- PROPERTY LINE
- GRAVEL ROAD
- SOIL ROAD
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- CONSERVATION EASEMENT
- REMOVED POWERLINE
- EXISTING POWERLINE
- RELOCATED EXISTING POWERLINE
- FENCE
- CROSS-SECTION LOCATION (XS-1)
- FLOW METER (FM)
- CREST GAUGE
- EXISTING WETLANDS (WLB)
- BRUSH TOE
- ROCK L-VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- ROCK /LOG CROSS VANE
- FLOODPLAIN INTERCEPTOR
- VEGETATION TRANSECTS
- 5' x 10' VEG PLOT
- 10' x 10' VEG PLOT
- PHOTO POINT AND DIRECTION

YEAR 7 CONDITIONS

BANK/BED CONDITION
- MINOR EROSION
- BEAVERDAM

VEGETATION PROBLEM AREAS
- INVASIVE POPULATION

MY 7– VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

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NC License No: F-0258

ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE 50 25 0 25 PLANS

DATE: 02-07-23

CCPV YEAR 7

SHEET 2

EEP# 96309

2/7/2023
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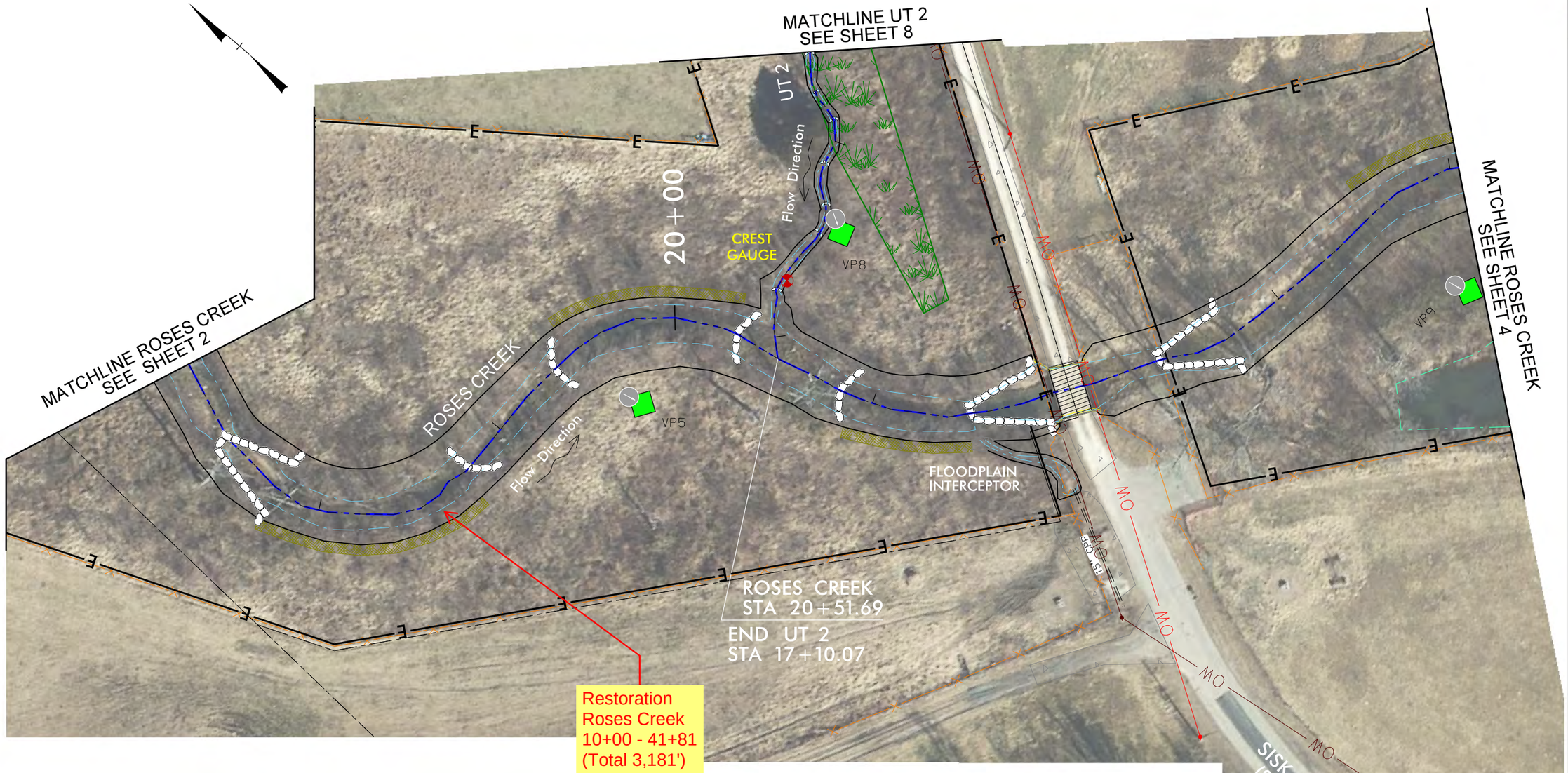
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 7



LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- PROPERTY LINE
- GRAVEL ROAD
- SOIL ROAD
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- REMOVED POWERLINE
- EXISTING POWERLINE
- RELOCATED EXISTING POWERLINE
- FENCE
- XS-1 — CROSS-SECTION LOCATION
- FM — FLOW METER
- CREST GAUGE
- WLB — EXISTING WETLANDS
- BRUSH TOE
- ROCK L-VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- ROCK /LOG CROSS VANE
- FLOODPLAIN INTERCEPTOR
- VEGETATION TRANSECTS
- 5' x 10' VEG PLOT
- 10' x 10' VEG PLOT
- PHOTO POINT AND DIRECTION

YEAR 7 CONDITIONS

BANK/BED CONDITION
- MINOR EROSION
- BEAVERDAM

VEGETATION PROBLEM AREAS
- INVASIVE POPULATION

MY 7– VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

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ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 02-07-23

CCPV
YEAR 7

SHEET
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EEP# 96309

2/7/2023
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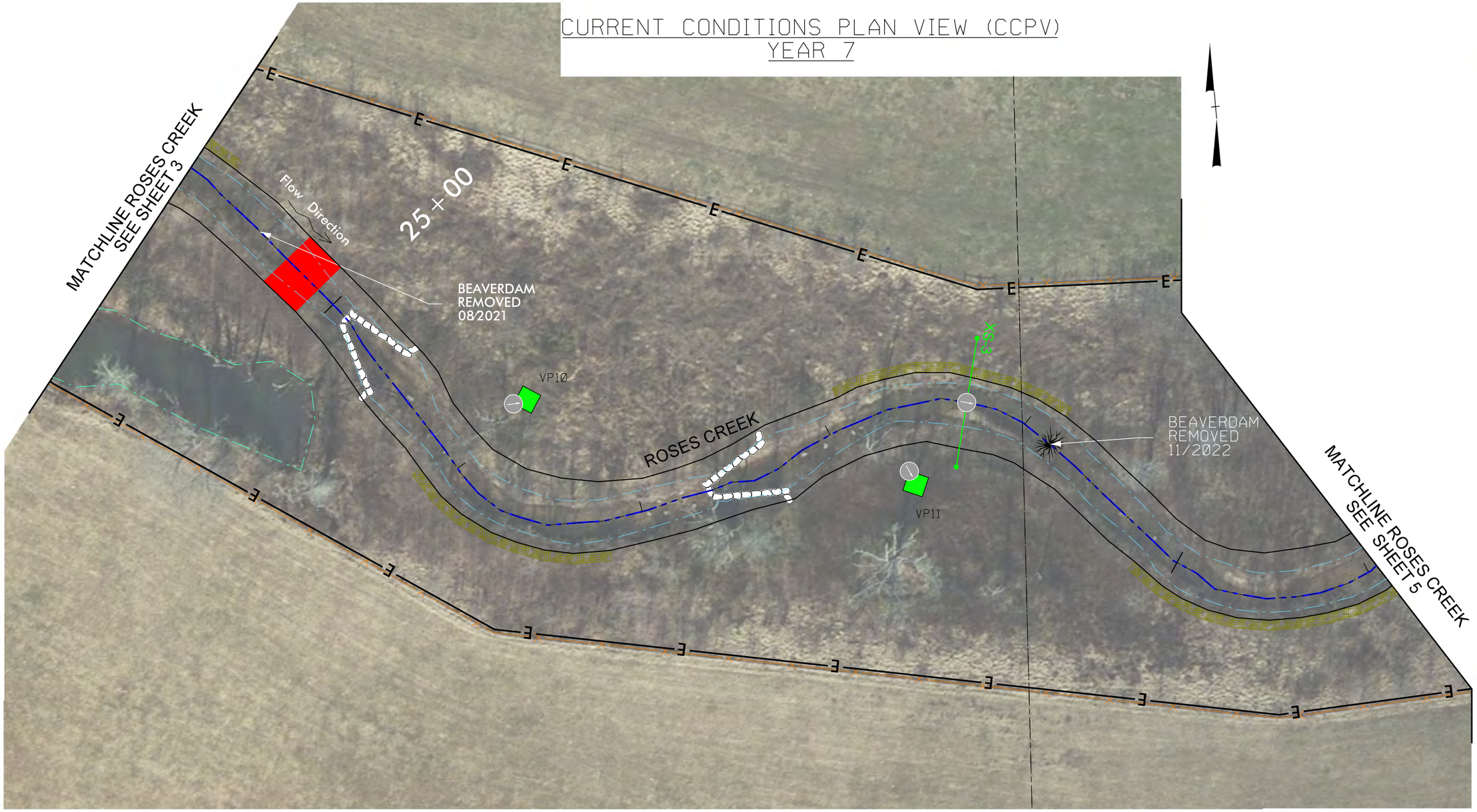
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 7



LEGEND

- ASBUILT ALIGNMENTS & STATIONING (15+00)
- PROPERTY LINE
- GRAVEL ROAD
- SOIL ROAD
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- CONSERVATION EASEMENT (E)
- REMOVED POWERLINE
- EXISTING POWERLINE
- RELOCATED EXISTING POWERLINE
- FENCE
- CROSS-SECTION LOCATION (XS-1)
- FLOW METER (FM)
- CREST GAUGE
- EXISTING WETLANDS (WLB)
- BRUSH TOE
- ROCK L-VANE
- ROCK CROSS VANE
- ROCK STEP STRUCTURE w/ BOULDERS
- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- ROCK /LOG CROSS VANE
- FLOODPLAIN INTERCEPTOR
- VEGETATION TRANSECTS
- 5' x 10' VEG PLOT
- 10' x 10' VEG PLOT
- PHOTO POINT AND DIRECTION

YEAR 7 CONDITIONS

BANK/BED CONDITION
- MINOR EROSION
- BEAVERDAM

VEGETATION PROBLEM AREAS
- INVASIVE POPULATION

MY 7- VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

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ROSES CREEK
STREAM RESTORATION PROJECT
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 0 25
PLANS

DATE: 02-07-23

CCPV
YEAR 7

SHEET
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EEP# 96309

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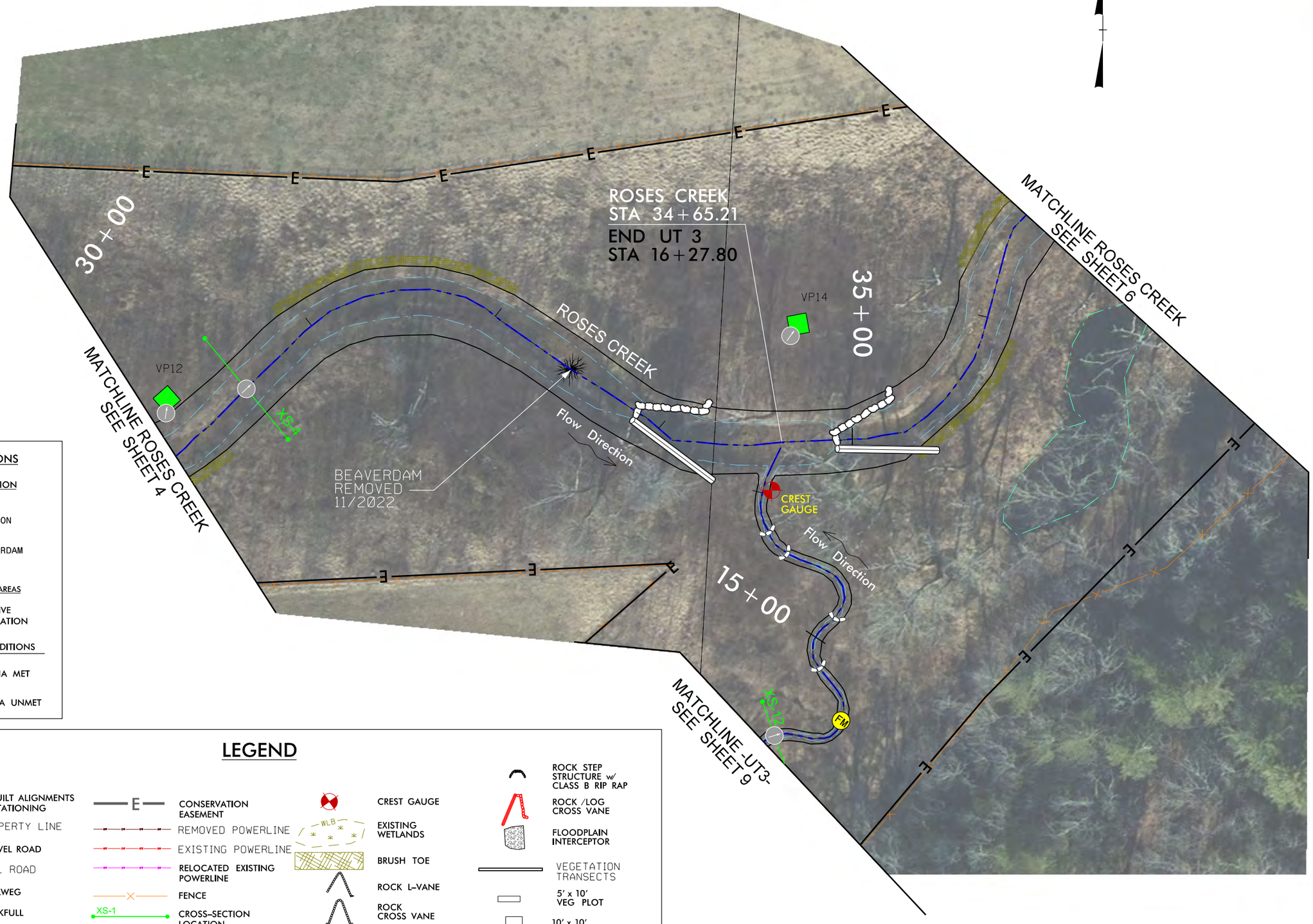
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 7



YEAR 7 CONDITIONS

BANK/BED CONDITION

- MINOR EROSION
- BEAVERDAM

VEGETATION PROBLEM AREAS

- INVASIVE POPULATION

MY 7– VEGETATION PLOT CONDITIONS

- CRITERIA MET
- CRITERIA UNMET

LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- PROPERTY LINE
- GRAVEL ROAD
- SOIL ROAD
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- REMOVED POWERLINE
- EXISTING POWERLINE
- RELOCATED EXISTING POWERLINE
- FENCE
- XS-1 — CROSS-SECTION LOCATION
- FM — FLOW METER
- CREST GAUGE
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- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
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- 5' x 10' VEG PLOT
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- PHOTO POINT AND DIRECTION

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ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 0 25 25
PLANS

DATE: 02-07-23

CCPV
YEAR 7

SHEET
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EEP# 96309

2/7/2023
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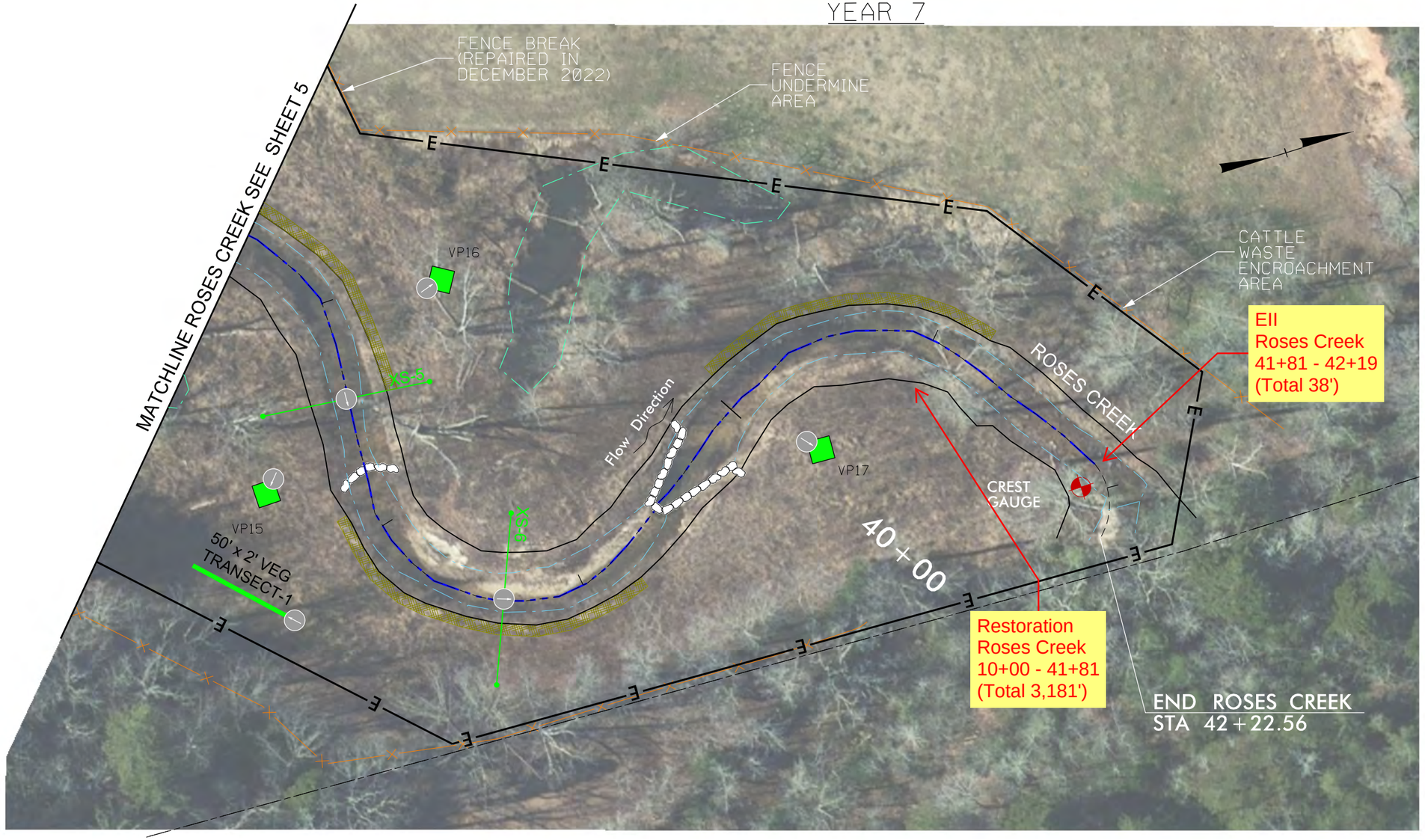
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 7



LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- PROPERTY LINE
- GRAVEL ROAD
- SOIL ROAD
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- REMOVED POWERLINE
- EXISTING POWERLINE
- RELOCATED EXISTING POWERLINE
- FENCE
- XS-1 — CROSS-SECTION LOCATION
- FM — FLOW METER
- CREST GAUGE
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- 5' x 10' VEG PLOT
- 10' x 10' VEG PLOT
- PHOTO POINT AND DIRECTION

YEAR 7 CONDITIONS

BANK/BED CONDITION
- MINOR EROSION
- BEAVERDAM

VEGETATION PROBLEM AREAS
- INVASIVE POPULATION

MY 7– VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

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ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE 50 25 0 25
PLANS

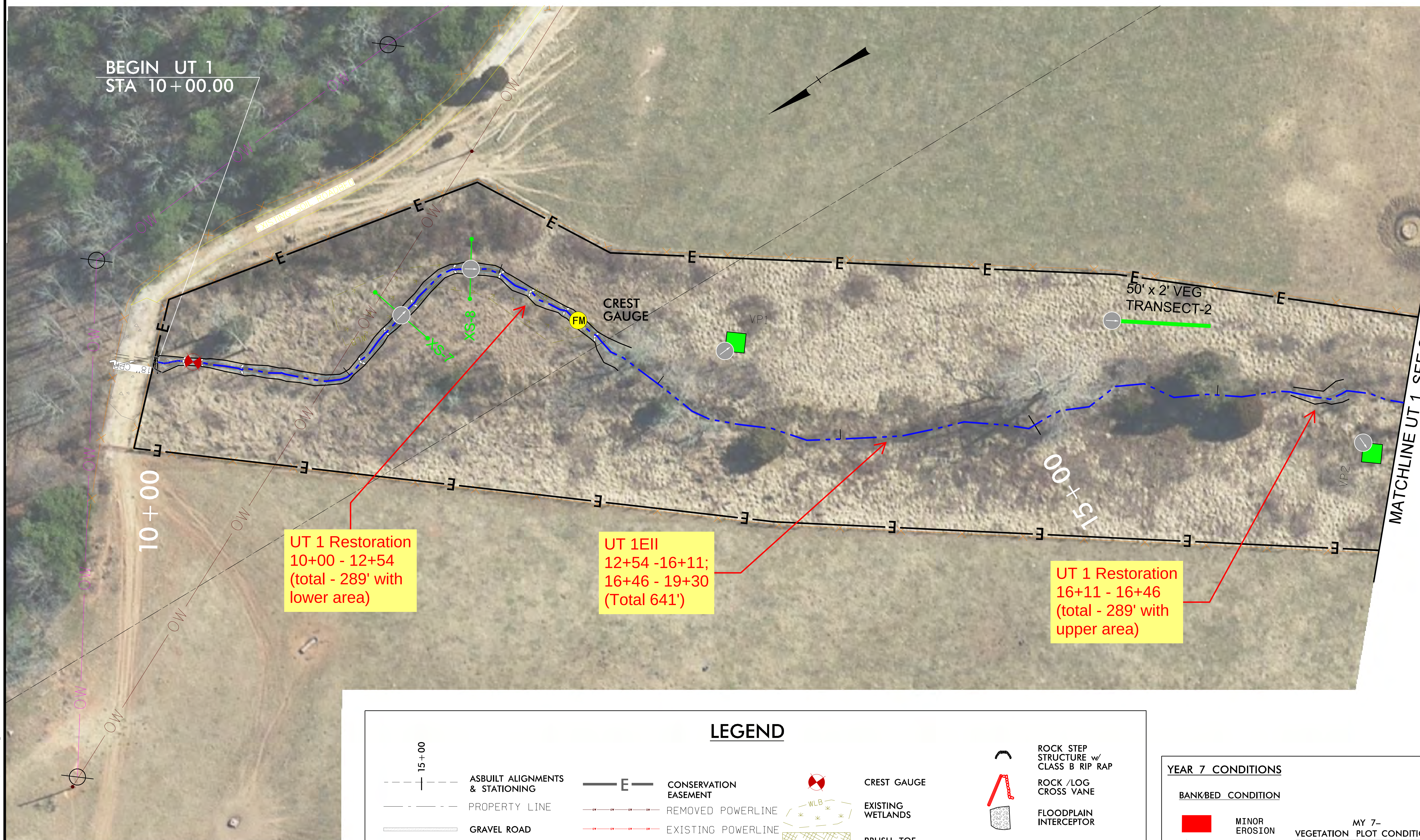
DATE: 02-07-23

CCPV YEAR 7

SHEET 6

EEP# 96309

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 7



LEGEND

15+00	ASBUILT ALIGNMENTS & STATIONING
	PROPERTY LINE
	GRAVEL ROAD
	SOIL ROAD
	THALWEG
	BANKFULL
	EPHEMERAL POOL
E	CONSERVATION EASEMENT
	REMOVED POWERLINE
	EXISTING POWERLINE
	RELOCATED EXISTING POWERLINE
	FENCE
XS-1	CROSS-SECTION LOCATION
FM	FLOW METER
	CREST GAUGE
WLB	EXISTING WETLANDS
	BRUSH TOE
	ROCK L-VANE
	ROCK CROSS VANE
	ROCK STEP STRUCTURE w/ BOULDERS
	ROCK STEP STRUCTURE w/ CLASS B RIP RAP
	ROCK /LOG CROSS VANE
	FLOODPLAIN INTERCEPTOR
	VEGETATION TRANSECTS
	5' x 10' VEG PLOT
	10' x 10' VEG PLOT
	PHOTO POINT AND DIRECTION

YEAR 7 CONDITIONS

BANK/BED CONDITION

	MINOR EROSION
	BEAVERDAM

VEGETATION PROBLEM AREAS

	INVASIVE POPULATION

MY 7– VEGETATION PLOT CONDITIONS

	CRITERIA MET
	CRITERIA UNMET

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ICA | HDR

STREAM RESTORATION PROJECT
ROSES CREEK
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 02-07-23
CCPV
YEAR 7

EEP# 96309

2/7/2023
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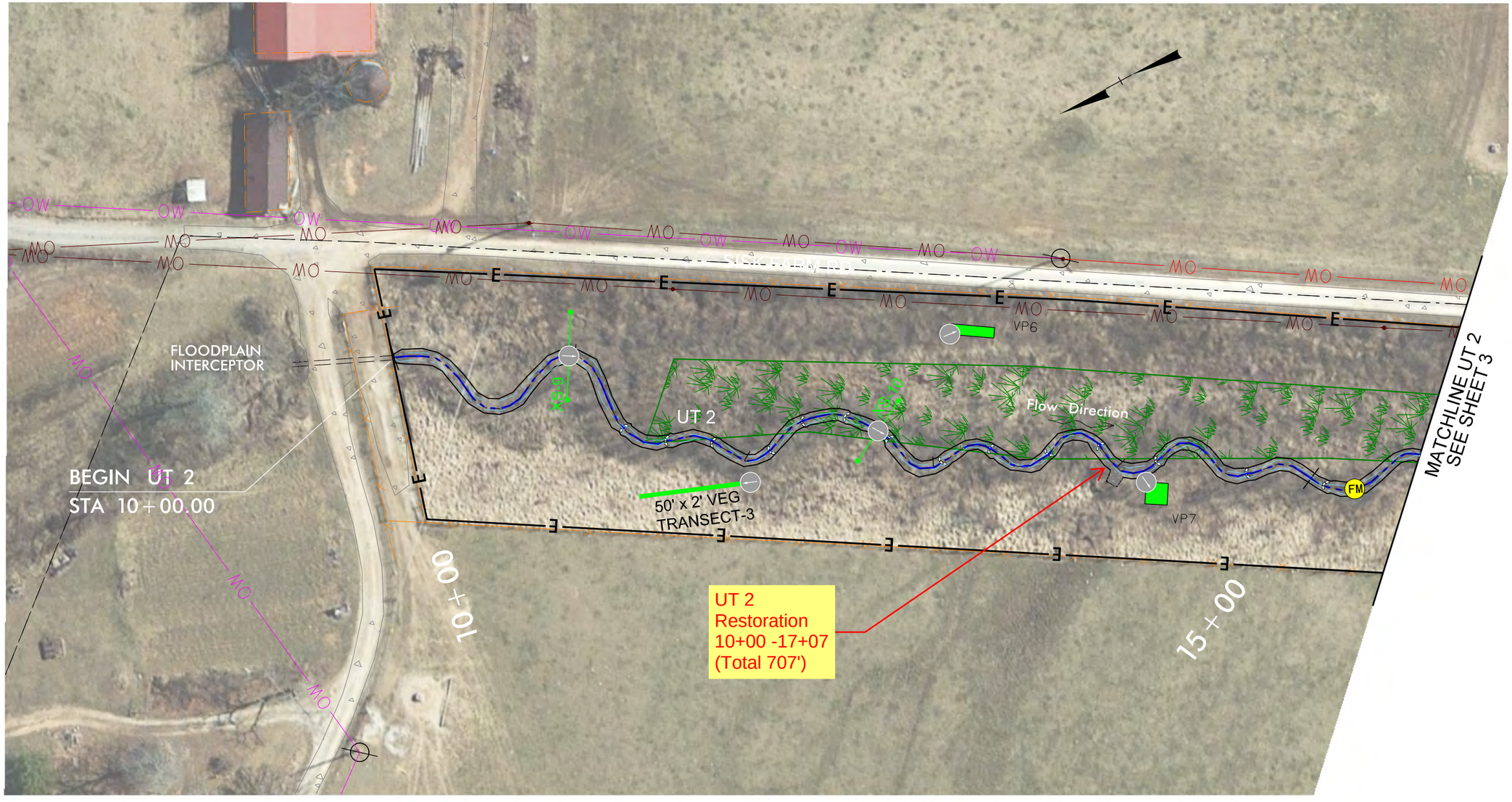
CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 7



LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- PROPERTY LINE
- GRAVEL ROAD
- SOIL ROAD
- THALWEG
- BANKFULL
- EPHEMERAL POOL
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- EXISTING POWERLINE
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- 5' x 10' VEG PLOT
- 10' x 10' VEG PLOT
- PHOTO POINT AND DIRECTION

YEAR 7 CONDITIONS

BANK/BED CONDITION
- MINOR EROSION
- BEAVERDAM

VEGETATION PROBLEM AREAS
- INVASIVE POPULATION

MY 7– VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

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Suite 900
Raleigh, NC 27601
NC License No: F-0258

ROSES CREEK
STREAM RESTORATION PROJECT
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE 50 25 0 25 PLANS

DATE: 02-07-23

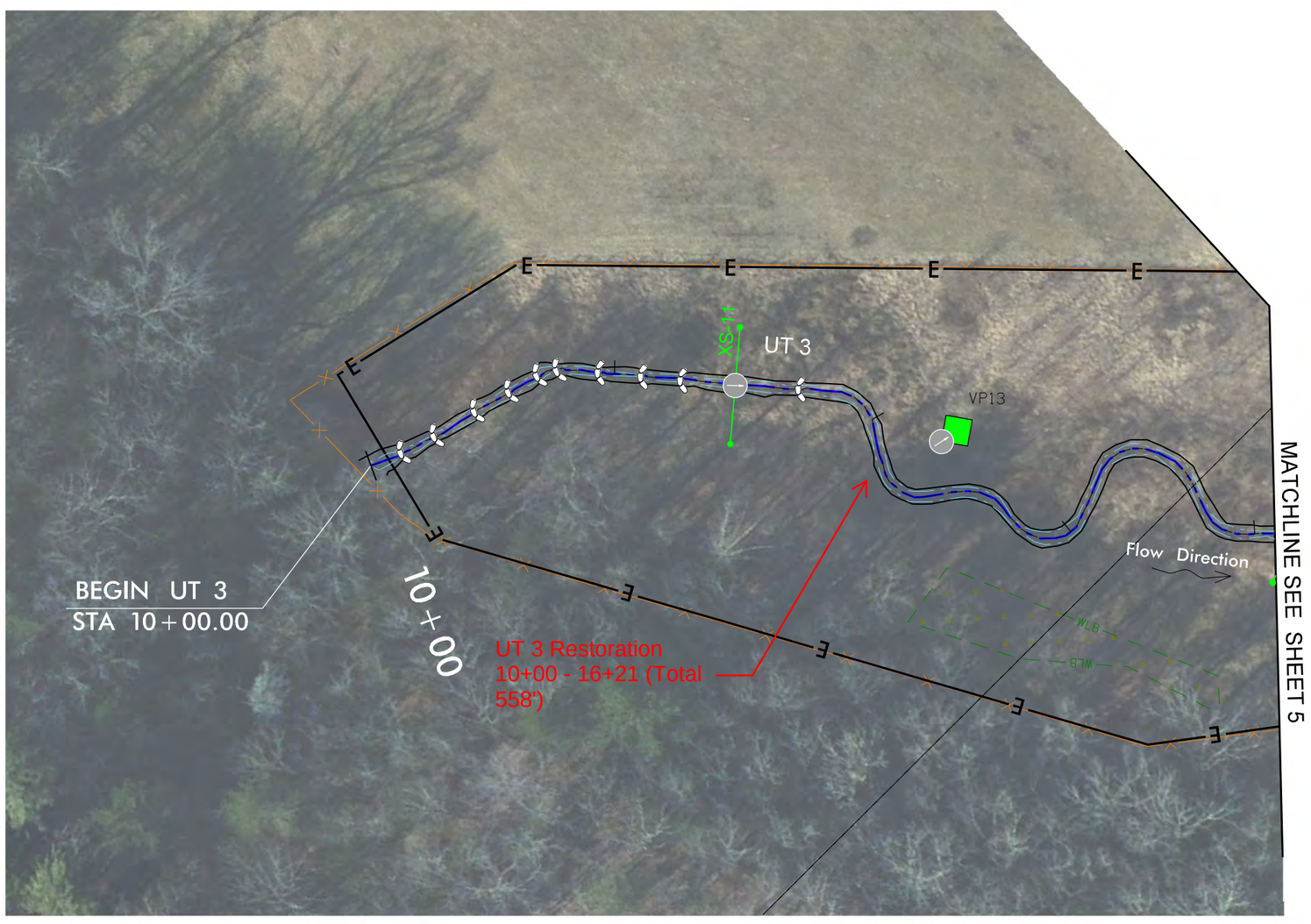
CCPV YEAR 7

SHEET 8

EEP# 96309

2/7/2023

CURRENT CONDITIONS PLAN VIEW (CCPV)
YEAR 7



LEGEND

- 15+00 — ASBUILT ALIGNMENTS & STATIONING
- PROPERTY LINE
- GRAVEL ROAD
- SOIL ROAD
- THALWEG
- BANKFULL
- EPHEMERAL POOL
- E — CONSERVATION EASEMENT
- REMOVED POWERLINE
- EXISTING POWERLINE
- RELOCATED EXISTING POWERLINE
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- XS-1 — CROSS-SECTION LOCATION
- FM — FLOW METER
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- ROCK STEP STRUCTURE w/ CLASS B RIP RAP
- ROCK /LOG CROSS VANE
- FLOODPLAIN INTERCEPTOR
- VEGETATION TRANSECTS
- 5' x 10' VEG PLOT
- 10' x 10' VEG PLOT
- PHOTO POINT AND DIRECTION

YEAR 7 CONDITIONS

BANK/BED CONDITION
- MINOR EROSION
- BEAVERDAM

VEGETATION PROBLEM AREAS
- INVASIVE POPULATION

MY 7- VEGETATION PLOT CONDITIONS
- CRITERIA MET
- CRITERIA UNMET

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ROSES CREEK RESTORATION PROJECT
STREAM
BURKE COUNTY, NORTH CAROLINA

GRAPHIC SCALE 50 25 0 25 PLANS

DATE: 02-07-23

CCPV YEAR 7

SHEET 9

EEP# 96309

Figures 3.1 - 3.34. Vegetation Plot and Site Photos

3.1 Vegetation Plot 1

3.2 Vegetation Plot 2

3.3 Vegetation Plot 3

3.4 Vegetation Plot 4

3.5 Vegetation Plot 5

3.6 Vegetation Plot 6

3.7 Vegetation Plot 7

3.8 Vegetation Plot 8

3.9 Vegetation Plot 9

3.10 Vegetation Plot 10

3.11 Vegetation Plot 11

3.12 Vegetation Plot 12

3.13 Vegetation Plot 13

3.14 Vegetation Plot 14

3.15 Vegetation Plot 15

3.16 Vegetation Plot 16

3.17 Vegetation Plot 17

3.18 Upper beaver dam station 29+25

3.19 Lower beaver dam station 32+50

3.20 Invasive treatment results at UT1

3.21 Mimosa tree removal at UT1

3.22 Invasive treatment results at UT2

3.23 Upper reach UT1, downstream March 2022

3.24 Upper reach UT2, downstream March 2022

3.25 UT 3, view upstream December 2022

3.26 Fence opening nearby by Roses Creek Station 36+50

3.27 Fence repair nearby Roses Creek Station 36+50, December 2022

3.28 UT 1 Powerline relocation October 2022

3.29 UT1 upper reach aerial (March 3, 2022)

3.30 UT1 lower reach aerial (March 3, 2022)

3.31 Pond above UT1 aerial (March 3, 2022)

3.32 UT2 drone aerial (March 3, 2022)

3.33 UT3 drone aerial, view 1 (March 3, 2022)

3.34 UT3 drone aerial, view 2 (March 3, 2022)

Appendix C. Vegetation Plot Data

EEP Project Code 96309. Project Name: Roses Creek

Table 7a: Vegetation Plot Mitigation Success Summary

			Current Plot Data (MY7 2022)																																
			WFW-0001			WFW-0002			WFW-0003			WFW-0004			WFW-0005			WFW-0006			WFW-0007			WFW-0008			WFW-0009			WFW-0010			WFW-0011		
Scientific Name	**Common Name**	**Species Type**	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree									2			5																						
Aesculus glabra	buckeye	Tree																											1						
Alnus incana	gray alder	Tree																											5						
Alnus serrulata	hazel alder	Shrub																						2	2	2									
Asimina triloba	pawpaw	Tree																																	
Betula nigra	river birch	Tree	1	1	1	4	4	4	1	1	3				1	1	1			2			2	1	1	4			16			20	1	1	315
Carya	hickory	Tree																																	
Carya glabra	pignut hickory	Tree																									2	2	3				1	1	1
Cephalanthus occidentalis	common buttonbush	Shrub																																	
Cornus alternifolia	alternateleaf dogwood	Tree																																	
Cornus amomum	silky dogwood	Shrub			5	1	1	4	1	1	4			5	1	1	1	4	4	6	2	2	2	4	4	7			1	1	1	2			
Cornus florida	flowering dogwood	Tree																																	
Diospyros virginiana	common persimmon	Tree			20																														
Fraxinus nigra	black ash	Tree																																	
Fraxinus pennsylvanica	green ash	Tree				1	1	2	1	1	1	3	3	3	3	3	3	2	2	2	4	4	6	1	1	4	2	2	2	3	3	7	2	2	2
Juniperus virginiana	eastern red cedar	Tree												1																					
Lindera benzoin	northern spicebush	Shrub																																	
Liquidambar styraciflua	sweetgum	Tree									3			10			7																		
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	1	4	4	4						8				1	1	1							1	1	1	1	1	1
Nyssa sylvatica	blackgum	Tree																														1			
Platanus occidentalis	American sycamore	Tree	2	2	2			2	1	1	2	7	7	13	5	5	5				3	3	4	4	4	4	3	3	3	3	3	3	3	3	3
Populus heterophylla	swamp cottonwood	Tree																																	
Prunus serotina	black cherry	Tree																		1			1												
Prunus serotina var. serotina	black cherry	Tree																																	
Quercus alba	white oak	Tree						1						1																					
Quercus michauxii	swamp chestnut oak	Tree																																	
Quercus nigra	water oak	Tree																					1												
Quercus pagoda	cherrybark oak	Tree																			1	1	1												
Quercus phellos	willow oak	Tree																																	
Quercus rubra	northern red oak	Tree																																	
Rhus copallinum	flameleaf sumac	shrub			6																														
Robinia pseudoacacia	black locust	Tree																																	
Rosa multiflora	multiflora rose	Exotic																																	
Salix nigra	black willow	Tree																								18			1			1			1
Tilia americana	Basswood	Tree																																	
Ulmus americana	American elm	Tree																																	
Ulmus rubra	slippery elm	Tree	2	2	2			1			3	1	1	1						1															
		Stem count	6	6	37	7	7	15	8	8	22	11	11	39	10	10	25	6	6	12	11	11	18	12	12	39	7	7	32	8	8	35	8	8	323
		size (ares)	1			1			1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	4	4	7	4	4	7	5	5	8	3	3	8	4	4	6	2	2	5	5	5	8	5	5	6	3	3	8	4	4	7	5	5	6
		Stems per ACRE	243	243	1497	283	283	607	324	324	890	445	445	1578	405	405	1012	243	243	486	445	445	728	486	486	1578	283	283	1295	324	324	1416	324	324	13071

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%
- Volunteers included

EEP Project Code 96309. Project Name: Roses Creek

Table 7b: Vegetation Plot Mitigation Success Summary

			Current Plot Data (MY7 2022)																																							
			WFW-0012			WFW-0013			WFW-0014			WFW-0015			WFW-0016			WFW-0017			Transect-1			Transect-2			Transect-3			MY7 (2022)			MY5 (2020)			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	red maple	Tree																													6														
Aesculus glabra	buckeye	Tree																													1														
Alnus incana	gray alder	Tree																													5					1								
Alnus serrulata	hazel alder	Shrub																								5					2	2	2	3	3	6	2	2	21	2	2	12			
Asimina triloba	pawpaw	Tree																																		1								
Betula nigra	river birch	Tree	1	1	151	1	1	4			250			200			60	1	1	103						2	1	1	51	12	12	1138	12	12	586	13	13	384	8	8	151	19	19	19	26	26	26
Carya	hickory	Tree						1													1	1	1								1			3											
Carya glabra	pignut hickory	Tree						1																					3	3	5				1	1	3	2	2	2						
Cephalanthus occidentalis	common buttonbush	Shrub																														2	2	5							4	4	4	5	5	5
Cornus alternifolia	alternateleaf dogwood	Tree																																							1	1	1	2	2	2
Cornus amomum	silky dogwood	Shrub	2	2	2	1	1	1				1	1	1	2	2	1	2	2	2							1	1	1	23	23	43	19	19	33	28	28	38	26	26	26	35	35	35	54	54	54
Cornus florida	flowering dogwood	Tree													1	1	1												1	1	1				1	1	1	1	1	1						
Diospyros virginiana	common persimmon	Tree																													20			27			20			22					
Fraxinus nigra	black ash	Tree																																				2	2	2	9	9	9	9	9	9
Fraxinus pennsylvanica	green ash	Tree	3	3	3	6	6	7	1	1	1	5	5	5			1	2	2	4	3	3	3	1	1	1	7	7	7	41	41	52	36	36	50	40	40	52	35	35	38	56	56	56	74	74	74
Juniperus virginiana	eastern red cedar	Tree																													1														
Lindera benzoin	northern spicebush	Shrub						5																							5						3	1	1	2						
Liquidambar styraciflua	sweetgum	Tree												1													1	1	1			21			9			2			3					
Liriodendron tulipifera	tuliptree	Tree							1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	4	4	4	15	15	23	14	14	18	15	15	17	6	6	11	11	11	11	12	12	12
Nyssa sylvatica	blackgum	Tree																													1			3											
Platanus occidentalis	American sycamore	Tree	1	1	4	4	4	4	5	5	5	1	1	3				2	2	2	5	5	5	4	4	4	6	6	6	44	44	59	42	42	62	40	40	83	31	31	42	49	49	49	59	59	59
Populus heterophylla	swamp cottonwood	Tree													3	3	3													3	3				3	3	3	3	3	3						
Prunus serotina	black cherry	Tree																												1	1	3	1	1	1	1	1	1	1	1	1						
Prunus serotina var. serotina	black cherry	Tree																																1											
Quercus alba	white oak	Tree									1																				3														
Quercus michauxii	swamp chestnut oak	Tree																																							2	2	2	2	2	2
Quercus nigra	water oak	Tree																													1	1	1	1	1	1	1	1	1				1	1	1	1	1	1
Quercus pagoda	cherrybark oak	Tree																													1	1	1	1	1	1	1	1	1						
Quercus phellos	willow oak	Tree																																							47	47	47	68	68	68
Quercus rubra	northern red oak	Tree																			1	1	1									2	2	3	2	2	3								
Rhus copallinum	flameleaf sumac	shrub																													6			2			1								
Robinia pseudoacacia	black locust	Tree																																1											
Rosa multiflora	multiflora rose	Exotic																																3											
Salix nigra	black willow	Tree			6						42				1	1	13									6				1	1	82			3	1	1	19	1	1	4	4	4	4	7	7	7
Tilia americana	Basswood	Tree															1														1														
Ulmus americana	American elm	Tree																																							4	4	4	7	7	7
Ulmus rubra	slippery elm	Tree																													3	3	8	2	2	2									
		Stem count	7	7	166	12	12	23	7	7	300	8	8	211	8	8	80	8	8	113	12	12	12	6	6	19	20	20	70	144	144	1490	135	135	819	149	149	651	119	119	320	242	242	242	326	326	326
		size (ares)	1			1			1			1			1			1			1			1			1			17			17			17			17			17					
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.42			0.42			0.42			0.42			0.42					
		Species count	4	4	5	4	4	7	3	3	6	4	4	6	5	5	7	5	5	6	5	5	5	3	3	6	6	6	6	12	12	26	12	12	22	14	14	18	13	13	15	13	13	13	13	13	13
		Stems per ACRE	283	283	6718	486	486	931	283	283	12141	324	324	8539	324	324	3237	324	324	4573	486	486	486	243	243	769	809	809	2833	343	343	3547	321	321	1950	355	355	1550	283	283	762	576	576	576	776	776	776

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

EEP Project Code 96309. Project Name: Roses Creek

Table 7c. Stems Per Plot Across All Years

Stems per plot across all years																				
	MY1 (2016)				MY2 (2017)				MY3 (2018)				MY5 (2020)				MY7 (2022)			
Plot	**Planted Stems**	**Planted Stems/ac**	**Total Stems**	**Total Stems/ac**	**Planted Stems**	**Planted Stems/ac**	**Total Stems**	**Total Stems/ac**	**Planted Stems**	**Planted Stems/ac**	**Total Stems**	**Total Stems/ac**	**Planted Stems**	**Planted Stems/ac**	**Total Stems**	**Total Stems/ac**	**Planted Stems**	**Planted Stems/ac**	**Total Stems**	**Total Stems/ac**
1	13	526	13	526	0	0	20	809	9	364	30	1214	6	243	42	1700	6	243	37	1497
2	11	445	11	445	1	40	2	81	7	283	7	283	6	243	11	445	7	283	15	607
3	12	486	12	486	7	283	8	324	8	324	8	324	10	405	20	809	8	324	22	890
4	17	688	17	688	12	486	14	567	11	445	14	567	11	445	17	688	11	445	38	1538
5	14	567	14	567	9	364	15	607	10	405	17	688	10	405	18	728	10	405	25	1012
6	20	809	20	809	7	283	7	283	8	324	17	688	8	324	16	647	6	243	12	486
7	13	526	13	526	6	243	8	324	11	445	17	688	11	445	18	728	11	445	18	728
8	19	769	19	769	11	445	11	445	12	486	27	1093	12	486	19	769	12	486	39	1578
9	17	688	17	688	7	283	38	1538	9	364	48	1942	7	283	15	607	9	364	34	1376
10	11	445	11	445	3	121	4	162	9	364	31	1255	8	324	19	769	8	324	35	1416
11	18	728	68	2752	11	445	31	1255	10	405	29	1174	6	243	107	4330	9	364	326	13193
12	12	486	12	486	5	202	27	1093	7	283	54	2185	5	202	109	4411	7	283	161	6515
13	13	526	13	526	13	526	15	607	13	526	17	688	13	526	21	850	12	486	23	931
14	15	607	15	607	3	121	25	1012	7	283	33	1335	7	283	109	4411	7	283	300	12141
15	12	486	32	1295	8	324	30	1214	7	283	31	1255	4	162	107	4330	11	445	214	8660
16	14	567	14	567	9	364	36	1457	9	364	29	1174	3	121	107	4330	8	324	80	3237
17	12	486	12	486	7	283	29	1174	8	324	29	1174	8	324	64	2590	8	324	113	4573
AVG	**14**	**578.5**	**18.4**	**745.1**	**7.0**	**283.3**	**18.8**	**761.8**	**9.1**	**369.0**	**25.8**	**1042.7**	**7.9**	**321.4**	**48.2**	**1949.6**	**8.8**	**357.1**	**87.8**	**3551.7**

EEP Project Code 96309. Project Name: Roses Creek

Table 7d. Tree Height by Vegetation Plot

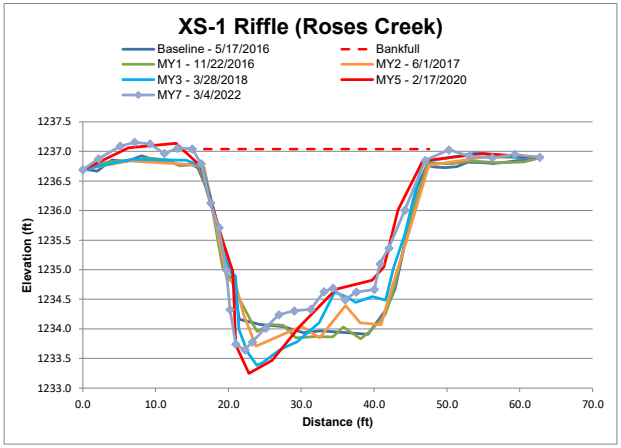
	Planted Tree/Shrub Height (cm)																
Plot Trees/Shrubs	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 6**	**Plot 7**	**Plot 8**	**Plot 9**	**Plot 10**	**Plot 11**	**Plot 12**	**Plot 13**	**Plot 14**	**Plot 15**	**Plot 16**	**Plot 17**
1	206	290	380	190	210	190	310	400	400	400	530	400	190	320	190	480	350
2	340	230	240	93	300	220	680	350	460	280	300	400	380	610	110	290	560
3	240	190	270	100	500	140	390	330	230	400	230	350	180	450	160	200	260
4	400	320	310	170	460	270	580	300	400	100	210	400	360	500	160	360	460
5	330	230	370	190	440	280	280	480	46	330	380	350	650	300	160		180
6	580	300	500	300	380	190	330	400	270	240	30	250	260	230	80		330
7		390	170	170	640		370	500	400	400	90	350	380	250	150		260
8			560	150	400		160	340		400			570				300
9				150	450		230	280					150				
10				105	340		350	500					160				
11				20			390	490					420				
12								360					700				
13																	
14																	
15																	
16																	
17																	
18																	
19																	
Av. height by plot (cm)	349.3	278.6	350.0	148.9	412.0	215.0	370.0	394.2	315.1	318.8	252.9	357.1	366.7	380.0	144.3	332.5	337.5
Av. height by plot (ft)	11.5	9.1	11.5	4.9	13.5	7.05	12.1	12.9	10.3	10.5	8.3	11.7	12.0	12.5	4.7	10.9	11.1
Av. height across plots (ft)	10.3																

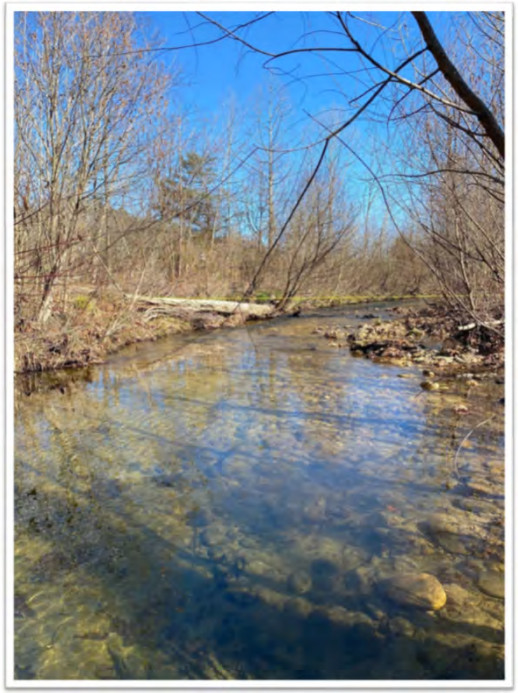
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Appendix D. Stream Survey Data

Figures 4.1 – 4.12. Cross Section Plots

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 1 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/3/2022
Field Crew	TC, WY



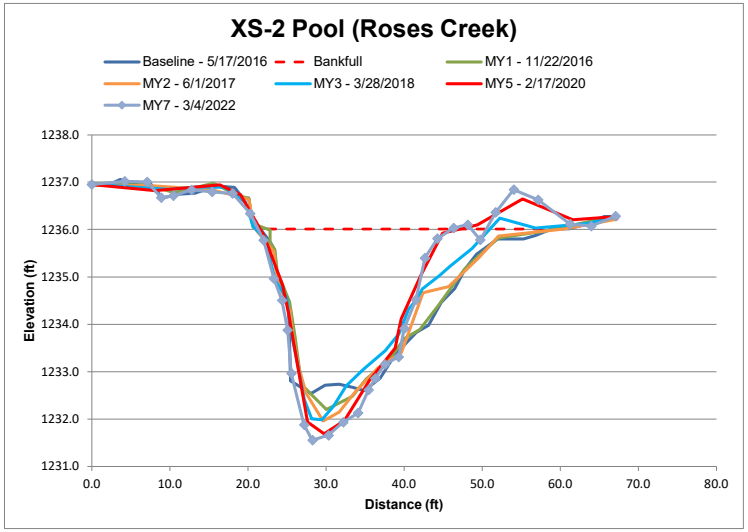


	Cross Section 1 (Riffle)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7****
Bankfull Width (ft)	33.80	31.10	30.73	29.98	29.94	30.76
Floodprone Width (ft)	508.32	508.32	508.32	508.32	508.32	508.32
Bankfull Mean Depth (ft)	2.00	2.20	2.19	2.18	2.02	2.21
Bankfull Max Depth (ft)	2.81	2.89	3.01	3.35	3.47	3.40
Bankfull Cross Sectional Area (ft^2)	67.70	68.28	67.22	65.27	60.43	68.06
Bankfull Width/Depth Ratio	16.90	14.14	14.03	13.75	14.82	13.90
Bankfull Entrenchment Ratio	15.04	16.35	16.54	16.96	16.98	16.53
Low Bank Height (ft)	---	---	---	3.44	3.6	3.15
Bank Height Ratio*	1.00	1.00	1.00	1.00	>1	0.93

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

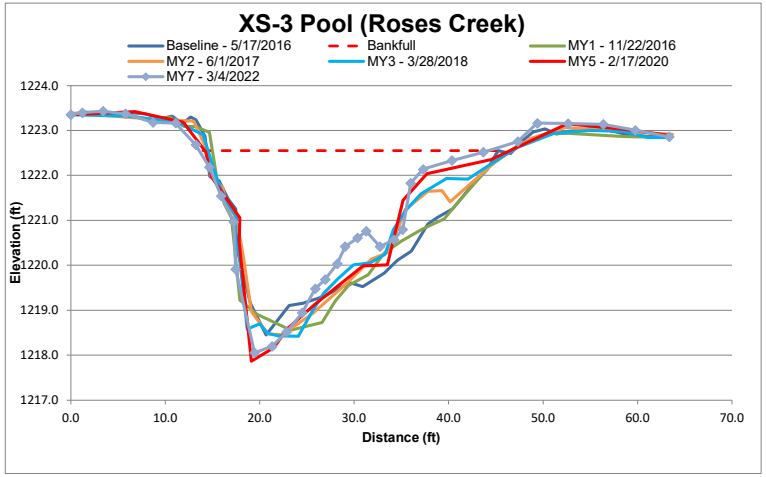
**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 2 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/3/2022
Field Crew	TC, WY



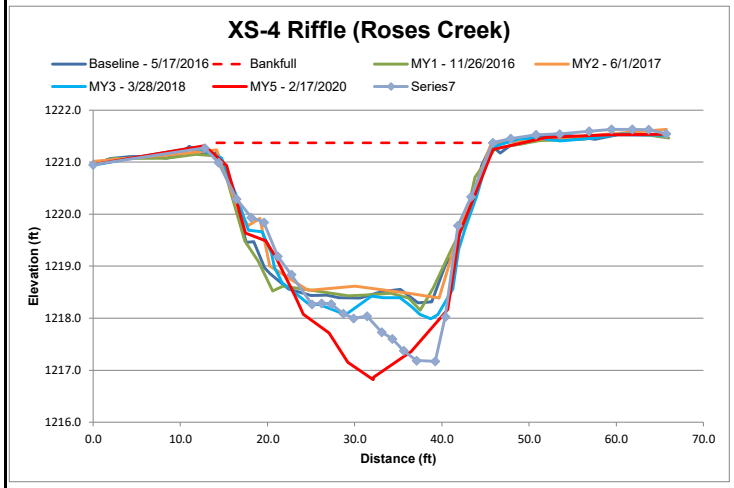
	Cross Section 2 (Pool)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Width (ft)	38.53	37.04	39.49	30.03	25.64	24.84
Floodprone Width (ft)						
Bankfull Mean Depth (ft)	1.73	1.75	1.65	1.96	2.24	2.52
Bankfull Max Depth (ft)	3.47	3.80	4.05	4.02	4.32	4.45
Bankfull Cross Sectional Area (ft^2)	66.48	64.97	65.02	58.79	57.56	62.53
Bankfull Width/Depth Ratio						
Bankfull Entrenchment Ratio						
Low Bank Height (ft)						
Bank Height Ratio						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 3 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/3/2022
Field Crew	TC, WY



	Cross Section 3 (Pool)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Width (ft)	32.44	31.58	32.26	32.20	32.28	30.61
Floodprone Width (ft)						
Bankfull Mean Depth (ft)	2.19	2.32	2.07	2.03	2.00	1.95
Bankfull Max Depth (ft)	4.10	3.99	4.09	4.13	4.68	4.49
Bankfull Cross Sectional Area (ft^2)	71.10	73.39	66.76	65.48	64.54	59.61
Bankfull Width/Depth Ratio						
Bankfull Entrenchment Ratio						
Low Bank Height (ft)						
Bank Height Ratio						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 4 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/3/2022
Field Crew	TC, WY

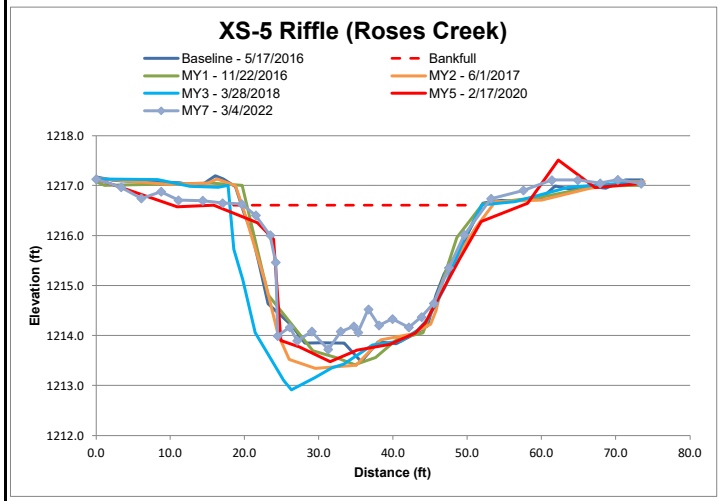


	Cross Section 4 (Riffle)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7****
Bankfull Width (ft)	31.11	31.66	31.03	32.35	32.12	33.04
Floodprone Width (ft)	696.00	696.00	696.00	696.00	696.00	696.00
Bankfull Mean Depth (ft)	2.19	2.16	2.08	2.12	2.63	2.47
Bankfull Max Depth (ft)	2.89	3.03	2.80	3.20	4.37	4.20
Bankfull Cross Sectional Area (ft^2)	68.21	68.41	64.61	71.47	84.41	81.58
Bankfull Width/Depth Ratio	14.21	14.66	14.92	14.64	12.21	13.38
Bankfull Entrenchment Ratio	22.37	21.98	22.43	21.51	21.67	21.07
Low Bank Height (ft)	---	---	---	3.38	4.42	4.10
Bank Height Ratio*	1.00	1.00	1.00	1.05	1.15	0.97

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 5 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/3/2022
Field Crew	TC, WY

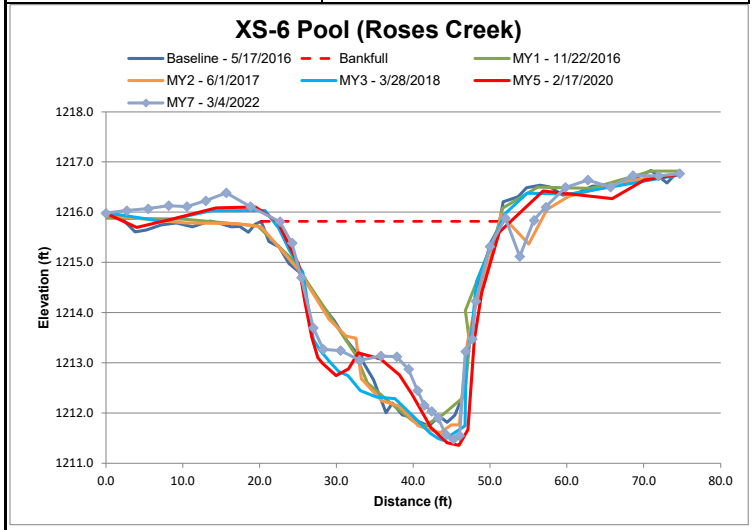


	Cross Section 5 (Riffle)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7****
Bankfull Width (ft)	32.56	32.99	34.06	36.04	30.66	32.81
Floodprone Width (ft)	563.60	563.60	563.60	563.60	563.60	563.60
Bankfull Mean Depth (ft)	2.13	2.25	2.22	2.37	1.90	1.82
Bankfull Max Depth (ft)	3.16	3.23	3.29	3.73	2.80	2.89
Bankfull Cross Sectional Area (ft^2)	69.41	74.12	75.52	85.30	58.11	59.80
Bankfull Width/Depth Ratio	15.29	14.66	15.34	15.21	16.14	18.00
Bankfull Entrenchment Ratio	17.31	17.08	16.55	15.64	18.38	17.18
Low Bank Height (ft)	---	---	---	3.69	2.80	2.89
Bank Height Ratio*	1.00	1.00	1.00	<1	<1	1.00

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

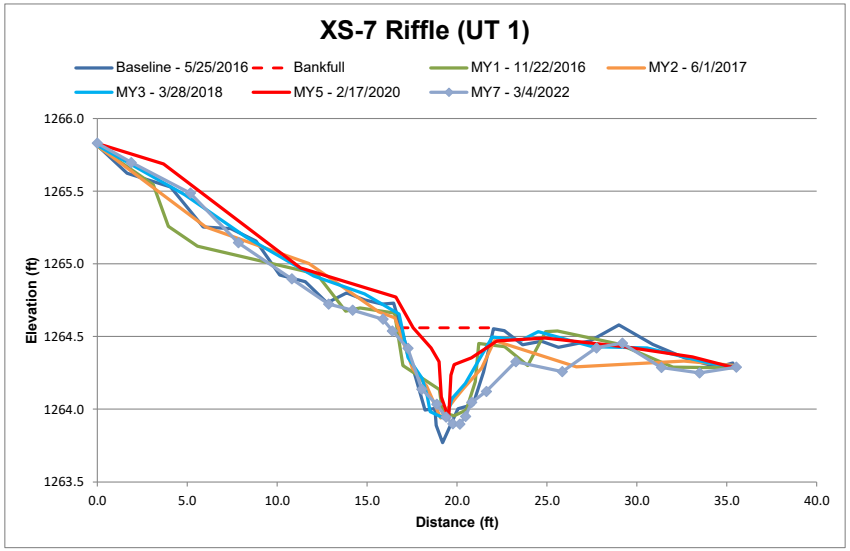
**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 6 (Roses Creek)
Drainage Area (Acres)	3,309
Date	3/3/2022
Field Crew	TC, WY



	Cross Section 6 (Pool)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Width (ft)	31.02	31.30	30.99	29.70	29.46	32.76
Floodprone Width (ft)						
Bankfull Mean Depth (ft)	2.37	2.23	2.32	2.69	2.56	2.18
Bankfull Max Depth (ft)	4.07	3.98	4.11	4.36	4.37	4.34
Bankfull Cross Sectional Area (ft^2)	73.63	69.77	71.83	80.01	75.54	71.40
Bankfull Width/Depth Ratio						
Bankfull Entrenchment Ratio						
Low Bank Height (ft)						
Bank Height Ratio						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 7 (UT 1)
Drainage Area (Acres)	38.40
Date	3/3/2022
Field Crew	TC, WY

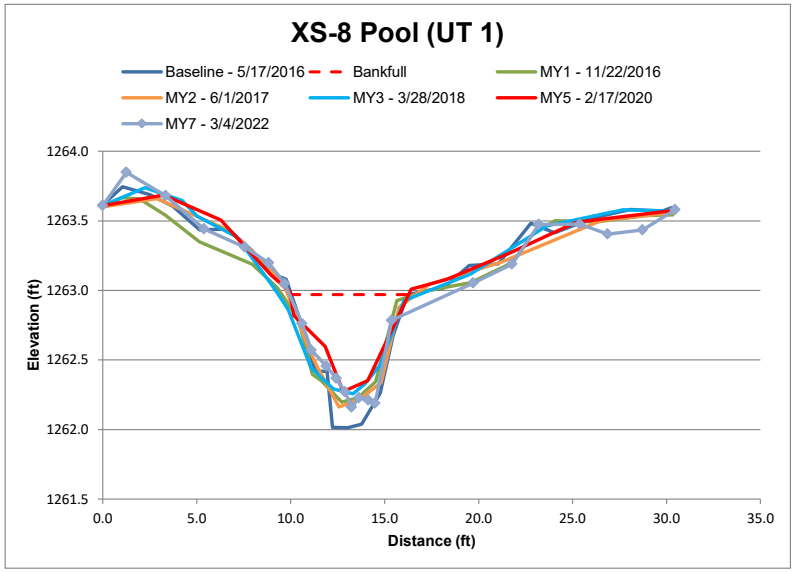


	Cross Section 7 (Riffle)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7****
Bankfull Width (ft)	5.12	4.46	5.31	5.01	4.66	5.23
Floodprone Width (ft)	91.80	91.80	91.80	91.80	91.80	91.80
Bankfull Mean Depth (ft)	0.45	0.41	0.35	0.36	0.21	0.48
Bankfull Max Depth (ft)	0.78	0.59	0.61	0.62	0.62	0.66
Bankfull Cross Sectional Area (ft^2)	2.30	1.82	1.86	1.78	0.96	2.52
Bankfull Width/Depth Ratio	11.38	10.88	15.17	13.92	22.19	10.86
Bankfull Entrenchment Ratio	17.93	20.58	17.29	18.32	19.70	17.55
Low Bank Height (ft)	---	---	---	0.57	0.53	0.43
Bank Height Ratio*	1.00	1.00	1.00	<1	<1	0.65

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

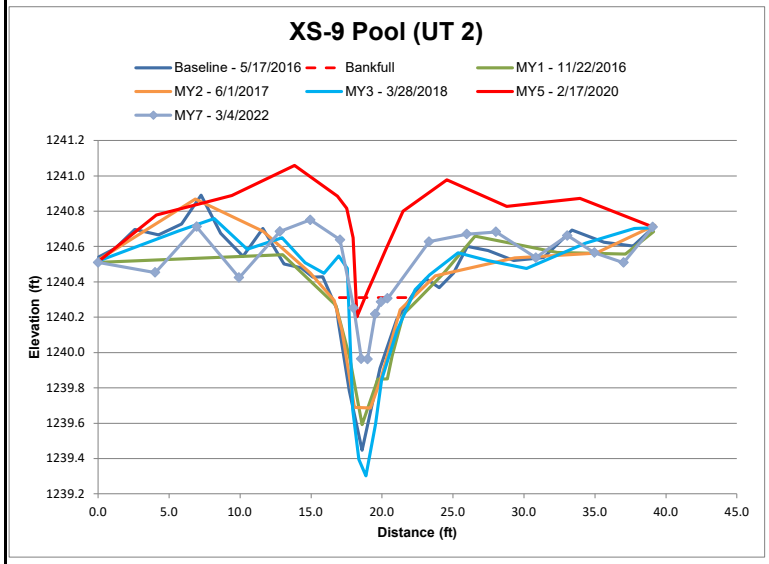
**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 8 (UT 1)
Drainage Area (Acres)	38.40
Date	3/3/2022
Field Crew	TC, WY



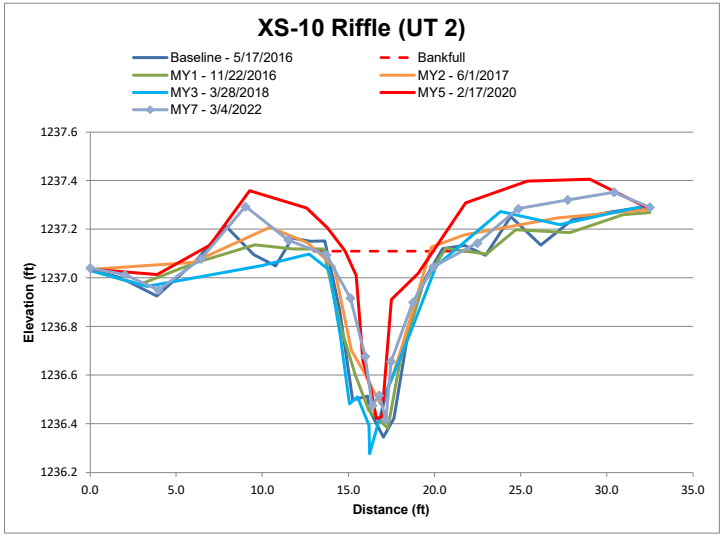
	Cross Section 8 (Pool)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Width (ft)	6.24	7.07	6.80	7.49	6.30	8.45
Floodprone Width (ft)						
Bankfull Mean Depth (ft)	0.58	0.44	0.47	0.42	0.40	0.37
Bankfull Max Depth (ft)	0.96	0.77	0.81	0.71	0.70	0.81
Bankfull Cross Sectional Area (ft^2)	3.64	3.10	3.23	3.12	2.50	3.11
Bankfull Width/Depth Ratio						
Bankfull Entrenchment Ratio						
Low Bank Height (ft)						
Bank Height Ratio						

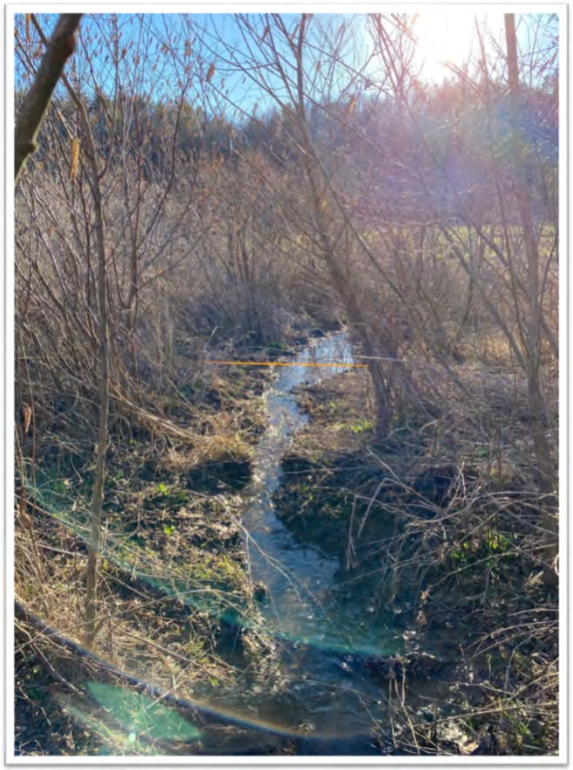
River Basin	Catawba
Watershed	03050101060030
XS ID	XS 9 (UT 2)
Drainage Area (Acres)	44.80
Date	3/3/2022
Field Crew	TC, WY



	Cross Section 9 (Pool)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Width (ft)	5.56	6.43	5.69	5.53	2.37	2.57
Floodprone Width (ft)						
Bankfull Mean Depth (ft)	0.37	0.31	0.33	0.49	0.53	0.16
Bankfull Max Depth (ft)	0.86	0.72	0.63	1.12	0.73	0.35
Bankfull Cross Sectional Area (ft^2)	2.07	1.97	1.90	2.73	1.26	0.41
Bankfull Width/Depth Ratio						
Bankfull Entrenchment Ratio						
Low Bank Height (ft)						
Bank Height Ratio						

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 10 (UT 2)
Drainage Area (Acres)	44.80
Date	3/3/2022
Field Crew	TC, WY



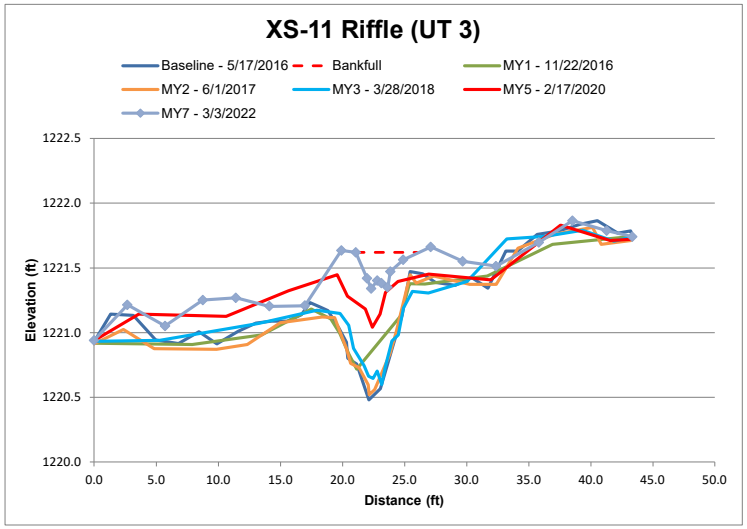


	Cross Section 10 (Riffle)					
Dimension and substrate*	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7****
Bankfull Width (ft)	6.70	7.10	6.79	7.38	5.32	4.81
Floodprone Width (ft)	93.36	93.36	93.36	93.36	93.36	93.36
Bankfull Mean Depth (ft)	0.42	0.38	0.32	0.39	0.25	0.36
Bankfull Max Depth (ft)	0.77	0.74	0.64	0.84	0.70	0.69
Bankfull Cross Sectional Area (ft^2)	2.79	2.69	2.17	2.88	1.35	1.74
Bankfull Width/Depth Ratio	16.75	18.68	21.22	18.92	21.28	13.28
Bankfull Entrenchment Ratio	13.93	13.14	13.75	12.65	17.55	19.41
Low Bank Height (ft)	---	---	---	0.83	0.87	0.63
Bank Height Ratio*	1.00	1.00	1.01	1.00	>1	0.91

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

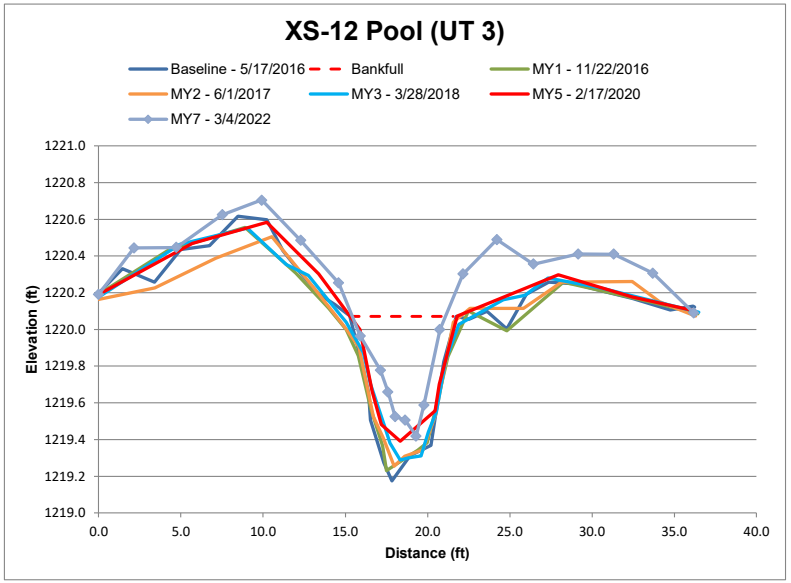
River Basin	Catawba
Watershed	03050101060030
XS ID	XS 11 (UT 3)
Drainage Area (Acres)	12.80
Date	3/3/2022
Field Crew	TC, WY



	Cross Section 11 (Riffle)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7****
Bankfull Width (ft)	6.00	7.28	5.38	6.73	7.22	5.11
Floodprone Width (ft)	175.41	175.41	175.41	175.41	175.41	175.4
Bankfull Mean Depth (ft)	0.36	0.21	0.37	0.24	0.3	0.13
Bankfull Max Depth (ft)	0.69	0.46	0.65	0.57	0.76	0.57
Bankfull Cross Sectional Area (ft^2)	2.19	1.51	2.01	1.62	2.18	0.69
Bankfull Width/Depth Ratio	16.67	34.67	14.54	28.04	24.07	106.7
Bankfull Entrenchment Ratio	29.24	24.09	32.60	26.06	24.3	34.34
Low Bank Height (ft)	---	---	---	0.50	0.85	0.58
Bank Height Ratio*	1.00	1.00	1.00	<1	1.12	1.03

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.
**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

River Basin	Catawba
Watershed	03050101060030
XS ID	XS 12 (UT 3)
Drainage Area (Acres)	12.80
Date	3/3/2022
Field Crew	TC, WY



	Cross Section 12 (Pool)					
Dimension and substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Width (ft)	6.39	7.93	7.52	7.99	6.50	5.65
Floodprone Width (ft)						
Bankfull Mean Depth (ft)	0.56	0.46	0.45	0.40	0.43	0.34
Bankfull Max Depth (ft)	0.90	0.84	0.82	0.78	0.68	0.65
Bankfull Cross Sectional Area (ft^2)	3.55	3.61	3.40	3.23	2.78	1.93
Bankfull Width/Depth Ratio						
Bankfull Entrenchment Ratio						
Low Bank Height (ft)						
Bank Height Ratio						

Table 8. Baseline Stream Data Summary
Roses Creek Mitigation Site
Roses Creek: 3,200 Lf.

Parameter	Regional Curve		Pre-Existing Condition	Reference - Roses Creek Upstream	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Eq. Mountains	Eq. Piedmont	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	35.00	26.20	41.10	30.50	30.50	31.02	31.98	31.11	33.80	1.58	3.00
Floodprone Width (ft)			78.90	250.00	480.00	394.24	524.76	508.32	671.72	139.47	3.00
Bankfull Mean Depth (ft)	1.80	2.60	1.67	1.88	2.18	2.00	2.19	2.19	2.37	0.19	3.00
Bankfull Max Depth (ft)			2.92	2.71	2.72	2.81	3.26	2.89	4.07	0.71	3.00
Bankfull Cross Sectional Area (ft^2)	66.00	66.10	68.83	57.40	66.40	67.70	69.85	68.21	73.63	3.29	3.00
Width/Depth Ratio			24.60	16.20	14.00	13.09	14.73	14.21	16.90	1.96	3.00
Entrenchment Ratio			1.92	8.20	15.70	12.67	16.45	15.04	21.65	4.65	3.00
Bank Height Ratio			1.80	1.00	1.00	1.00	1.00	1.00	1.00	0.00	3.00
d50 (mm)			61.30	61.30	61.30						
Profile											
Riffle Length (ft)						37.17	64.41	58.40	106.19	18.18	23.00
Riffle Slope (ft/ft)			0.01	0.02	0.03	0.01	0.02	0.02	0.05	0.01	23.00
Pool Length (ft)						17.36	53.01	54.24	93.29	20.18	26.00
Pool Max depth (ft)			4.13	4.70	4.36	3.31	4.50	4.43	6.20	0.80	26.00
Pool Spacing (ft)			37.00 - 171.00	76.9 - 227.9	2.0 - 7.5	86.78	130.47	130.18	210.45	35.20	25.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			73.00 - 152.00	30.0 - 195.0	61.0 - 195.2						
Radius of Curvature (ft)			28 - 168	30.0 - 178.0	61.0 - 91.5						
Rc: Bankfull Width (ft/ft)			0.7 - 4.1	1.0 - 5.8	2.0 - 3.0						
Meander Wavelength (ft)			200 - 375	60 - 344	61.0 - 344.0						
Meander Width Ratio			1.78 - 3.70	1.0 - 6.4	2.0 - 6.4						
Substrate, bed and transport parameters											
Ri% / P%						35% / 65%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^p / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankful											
Unit Stream Power (transport capacity) lbs/ft.s			3.83		3.83	3.83					
Additional Reach Parameters											
Drainage Area (SM)			5.17	4.66	5.17						
Impervious cover estimate (%)											
Rosgen Classification			B4	C4	C4	C4					
Bankfull Velocity (fps)				5.10	4.80						
Bankfull Discharge (cfs)			300.00	295.00	300.00						
Valley length (ft)			2894.00		2894.00	2894.00					
Channel Thalweg length (ft)			3425.00		3219.00	3219.00					
Sinuosity (ft)			1.18	1.11	1.11	1.11					
Water Surface Slope (Channel) (ft/ft)			0.0099	0.0192	0.0062	0.0059					
BF slope (ft/ft)					0.0062	0.0059					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 8a. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 1 to Roses Creek: 234 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Eq. Mountains	Eq. Piedmont	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	6.70	5.30	6.00	4.40	5.00	5.12	5.12	5.12	5.12	0.00	1.00
Floodprone Width (ft)			8.40	27.50	60.00	91.80	91.80	91.80	91.80	0.00	1.00
Bankfull Mean Depth (ft)	0.50	0.70	0.23	0.51	0.38	0.45	0.45	0.45	0.45	0.00	1.00
Bankfull Max Depth (ft)			0.36	1.00	0.58	0.78	0.78	0.78	0.78	0.00	1.00
Bankfull Cross Sectional Area (ft^2)	3.20	3.30	1.39	2.30	2.10	2.30	2.30	2.30	2.30	0.00	1.00
Width/Depth Ratio			26.20	12.80	13.00	11.38	11.38	11.38	11.38	0.00	1.00
Entrenchment Ratio			1.40	6.28	12.00	17.93	17.93	17.93	17.93	0.00	1.00
Bank Height Ratio			6.11	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
d50 (mm)											
Profile											
Riffle Length (ft)						7.20	10.60	9.60	17.00	2.91	12.00
Riffle Slope (ft/ft)			0.0260	0.0033 - 0.0284	0.0021 - 0.0029	0.0201	0.0265	0.0213	0.0799	0.0210	12.00
Pool Length (ft)						3.60	11.89	9.80	37.39	9.23	11.00
Pool Max depth (ft)			Channelized	1.98	0.77	0.49	0.73	0.77	0.96	0.19	11.00
Pool Spacing (ft)			Channelized	10.10 - 41.0	10.0 - 30.0	18.40	24.04	20.90	45.59	8.03	10.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	10.00 - 30.00						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.00 - 15.00						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.40 - 3.00						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	20.0 - 55.0						
Meander Width Ratio			Channelized	2.74 - 4.11	2.00 - 6.00						
Substrate, bed and transport parameters											
Ri% / P%						49% / 51%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^p / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankfull											
Unit Stream Power (transport capacity) lbs/ft.s			0.07		0.07	0.07					
Additional Reach Parameters											
Drainage Area (SM)			0.06	0.07	0.06						
Impervious cover estimate (%)											
Rosgen Classification			F5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.10						
Bankfull Discharge (cfs)			2.4	3.00	2.40						
Valley length (ft)			199.00		199.00	199.00					
Channel Thalweg length (ft)			199.00		234.00	234.00					
Sinuosity (ft)			1.00	1.16	1.18	1.18					
Water Surface Slope (Channel) (ft/ft)			0.0260	0.0033 - 0.0284	0.0021	0.0027					
BF slope (ft/ft)					0.0021	0.0027					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 8b. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 2 to Roses Creek: 707 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Mountains Eq.	Piedmont Eq.	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	7.10	5.60	4.40	4.40	5.00	6.70	6.70	6.70	6.70	0.00	1.00
Floodprone Width (ft)			8.10	27.50	60.00	32.45	32.45	32.45	32.45	0.00	1.00
Bankfull Mean Depth (ft)	0.50	0.80	0.95	0.51	0.38	0.42	0.42	0.42	0.42	0.00	1.00
Bankfull Max Depth (ft)			1.39	1.00	0.58	0.77	0.77	0.77	0.77	0.00	1.00
Bankfull Cross Sectional Area (ft^2)	3.50	3.70	4.16	2.30	2.10	2.79	2.79	2.79	2.79	0.00	1.00
Width/Depth Ratio			4.60	12.80	13.00	15.95	15.95	15.95	15.95	0.00	1.00
Entrenchment Ratio			1.84	6.28	12.00	4.84	4.84	4.84	4.84	0.00	1.00
Bank Height Ratio			1.70	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
d50 (mm)											
Profile											
Riffle Length (ft)						4.27	13.94	13.33	31.46	6.12	23.00
Riffle Slope (ft/ft)			0.0260	0.0033 - 0.0284	0.0021 - 0.0030	0.0020	0.0025	0.0025	0.0038	0.0006	23.00
Pool Length (ft)						3.73	10.18	8.00	27.19	5.71	24.00
Pool Max depth (ft)			Channelized	1.98	0.77	0.53	0.96	0.92	1.59	0.24	24.00
Pool Spacing (ft)			Channelized	10.10 - 41.00	10.0 - 30.00	7.46	25.57	22.39	57.59	11.77	23.00
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	13.70 - 30.00						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.00 - 16.00						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.40 - 3.20						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	20.00 - 75.50						
Meander Width Ratio			Channelized	2.74 - 4.11	2.70 - 6.00						
Substrate, bed and transport parameters											
Ri% / P%						58% / 42%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ df^{sp} / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankful											
Unit Stream Power (transport capacity) lbs/ft.s			0.89		0.06	0.06					
Additional Reach Parameters											
Drainage Area (SM)			0.07	0.07	0.07						
Impervious cover estimate (%)											
Rosgen Classification			G5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.10						
Bankfull Discharge (cfs)			2.40	3.00	2.40						
Valley length (ft)			575.00		575.00	575.00					
Channel Thalweg length (ft)			575.00		707.00	707.00					
Sinuosity (ft)			1.00	1.16	1.99	1.23					
Water Surface Slope (Channel) (ft/ft)			0.0260	0.0033 - 0.0284	0.0021	0.0023					
BF slope (ft/ft)					0.0021	0.0023					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 8c. Baseline Stream Data Summary
Roses Creek Mitigation Site
UT 3 to Roses Creek: 620 LF

Parameter	Regional Curve		Pre-Existing Condition	Reference - UT West Branch Rocky River	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Mountains Eq.	Piedmont Eq.	Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	4.50	3.50	5.00	4.40	5.50	6.00	6.00	6.00	6.00	0.00	1
Floodprone Width (ft)			44.13	27.50	70.00	175.41	175.41	175.41	175.41	0.00	1
Bankfull Mean Depth (ft)	0.30	0.30	0.26	0.51	0.42	0.36	0.36	0.36	0.36	0.00	1
Bankfull Max Depth (ft)			1.70	1.00	0.63	0.69	0.69	0.69	0.69	0.00	1
Bankfull Cross Sectional Area (ft^2)	1.50	1.60	2.40	2.30	2.60	2.19	2.19	2.19	2.19	0.00	1
Width/Depth Ratio			12.23	12.80	13.10	16.67	16.67	16.67	16.67	0.00	1
Entrenchment Ratio			9.52	6.28	12.70	29.24	29.24	29.24	29.24	0.00	1
Bank Height Ratio			3.33	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1
d50 (mm)											
Profile											
Riffle Length (ft)						4.0	13.7	11.1	46.1	9.2	20
Riffle Slope (ft/ft)			0.0295	0.0033 - 0.0284	0.0029 - 0.0045	0.0025	0.0030	0.0030	0.0035	0.0004	20
Pool Length (ft)						3.2	12.1	8.1	34.6	9.0	20
Pool Max depth (ft)			Channelized	1.98	0.84	0.76	1.49	1.29	2.61	0.61	20
Pool Spacing (ft)			Channelized	10.10 - 41.00	12.7 - 51.70	10.3	25.0	25.8	45.3	9.4	19
Pool Cross Sectional Area (ft^2)											
Pattern											
Channel Beltwidth (ft)			Channelized	12.00 - 18.00	15.10 - 49.50						
Radius of Curvature (ft)			Channelized	10.00 - 14.00	12.70 - 17.60						
Rc: Bankfull Width (ft/ft)			Channelized	2.30 - 3.20	2.30 - 3.20						
Meander Wavelength (ft)			Channelized	45.00 - 66.00	15.10 - 83.10						
Meander Width Ratio			Channelized	2.74 - 4.11	2.70 - 9.00						
Substrate, bed and transport parameters											
Ri% / P%						53% / 47%					
SC% / Sa% / G% / C% / B% / Be%											
d16 / d35 / d50 / d84 / d95/ di^{sp} / di^{sp} (mm)											
Reach Shear Stress (competency) lb/ft^2											
Max part size (mm) mobilized at bankful											
Unit Stream Power (transport capacity) lbs/ft.s			0.09		0.08	0.08					
Additional Reach Parameters											
Drainage Area (SM)			0.02	0.07	0.02						
Impervious cover estimate (%)											
Rosgen Classification			B5	C5	C5	C5					
Bankfull Velocity (fps)				1.30	1.00						
Bankfull Discharge (cfs)			2.6	3.0	2.6						
Valley length (ft)			422		422	422					
Channel Thalweg length (ft)			422		620	620					
Sinuosity (ft)			1.00	1.16	1.47	1.47					
Water Surface Slope (Channel) (ft/ft)			0.0268	0.0033 - 0.0284	0.0025	0.0037					
BF slope (ft/ft)					0.0025	0.0037					
Bankfull Floodplain Area (acres)											
Proportion over wide (%)											
Entrenchment Class (ER Range)											
Incision Class (BHR Range)											
BEHI VL% / L% / M% / H% / VH% / E%											
Channel Stability or Habitat Metric											
Biological or Other											

Table 9. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
Roses Creek Mitigation Site
Roses Creek: 3,200 LF

	Cross Section 1 (Riffle)								Cross Section 2 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7**	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	33.80	31.10	30.73	29.98		29.94		30.76	38.53	37.04	39.49	30.03		25.64		24.84
Floodprone Width (ft)	508.32	508.32	508.32	508.32		508.32		508.32								
Bankfull Mean Depth (ft)	2.00	2.20	2.19	2.18		2.02		2.21	1.73	1.75	1.65	1.96		2.24		2.52
Bankfull Max Depth (ft)	2.81	2.89	3.01	3.35		3.47		3.40	3.47	3.80	4.05	4.02		4.32		4.45
Bankfull Cross Sectional Area (ft^2)	67.70	68.28	67.22	65.27		60.43		68.06	66.48	64.97	65.02	58.79		57.56		62.53
Bankfull Width/Depth Ratio	16.90	14.14	14.03	13.75		14.82		13.90								
Bankfull Entrenchment Ratio	15.04	16.35	16.54	16.96		16.98		16.53								
Low Bank Height (ft)				3.44		3.60		3.15								
Bank Height Ratio*	1.00	1.00	1.00	1.00		>1		0.93								
	Cross Section 3 (Pool)								**Cross Section 4 (Riffle)**							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7**
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	32.44	31.58	32.26	32.20		32.28		30.61	31.11	31.66	31.03	32.35		32.12		33.04
Floodprone Width (ft)									696.00	696.00	696.00	696.00		696.00		696.00
Bankfull Mean Depth (ft)	2.19	2.32	2.07	2.03		2.00		1.95	2.19	2.16	2.08	2.12		2.63		2.47
Bankfull Max Depth (ft)	4.10	3.99	4.09	4.13		4.68		4.49	2.89	3.03	2.80	3.20		4.37		4.20
Bankfull Cross Sectional Area (ft^2)	71.10	73.39	66.76	65.48		64.54		59.61	68.21	68.41	64.61	71.47		84.41		81.58
Bankfull Width/Depth Ratio									14.21	14.66	14.92	14.64		12.21		13.38
Bankfull Entrenchment Ratio									22.37	21.98	22.43	21.51		21.67		21.07
Low Bank Height (ft)												3.38		4.42		4.10
Bank Height Ratio*									1.00	1.00	1.00	1.06		1.15		0.97
	Cross Section 5 (Riffle)								**Cross Section 6 (Pool)**							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7**	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	32.56	32.99	34.06	36.04		30.66		32.81	31.02	31.30	30.99	29.70		29.46		32.76
Floodprone Width (ft)	563.60	563.60	563.60	563.60		563.60		563.60								
Bankfull Mean Depth (ft)	2.13	2.25	2.22	2.37		1.90		1.82	2.37	2.23	2.32	2.69		2.56		2.18
Bankfull Max Depth (ft)	3.16	3.23	3.29	3.73		2.80		2.89	4.07	3.98	4.11	4.36		4.37		4.34
Bankfull Cross Sectional Area (ft^2)	69.41	74.12	75.52	85.30		58.11		59.80	73.63	69.77	71.83	80.01		75.54		71.40
Bankfull Width/Depth Ratio	15.29	14.66	15.34	15.21		16.14		18.00								
Bankfull Entrenchment Ratio	17.31	17.08	16.55	15.64		18.38		17.18								
Low Bank Height (ft)				3.69		2.80		2.89								
Bank Height Ratio*	1.00	1.00	1.00	<1		<1		1.00								

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

Table 9a. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
Roses Creek Mitigation Site
UT 1 Roses Creek: 234 LF

	Cross Section 7 (Riffle)								Cross Section 8 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7**	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	5.12	4.46	5.31	5.01		5.38		5.23	6.24	7.07	6.80	7.49		6.30		8.45
Floodprone Width (ft)	91.80	91.80	91.80	91.80		91.80		91.80								
Bankfull Mean Depth (ft)	0.45	0.41	0.35	0.36		0.26		0.48	0.58	0.44	0.47	0.42		0.40		0.37
Bankfull Max Depth (ft)	0.78	0.59	0.61	0.62		0.74		0.66	0.96	0.77	0.81	0.71		0.70		0.81
Bankfull Cross Sectional Area (ft^2)	2.30	1.82	1.86	1.78		1.40		2.52	3.64	3.10	3.23	3.12		2.50		3.11
Bankfull Width/Depth Ratio	11.38	10.88	15.17	13.92		20.69		10.86								
Bankfull Entrenchment Ratio	17.93	20.58	17.29	18.32		17.05		17.55								
Low Bank Height (ft)				0.57		0.79		0.43								
Bank Height Ratio*	1.00	1.00	1.00	<1		<1		0.65								

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.
**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

Table 9b. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
Roses Creek Mitigation Site
UT2 Roses Creek: 707 LF

	Cross Section 9 (Pool)								Cross Section 10 (Riffle)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7**
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	5.56	6.43	5.69	5.53		2.37		2.57	6.70	7.10	6.79	7.38		5.18		4.81
Floodprone Width (ft)									93.36	93.36	93.36	93.36		93.36		93.36
Bankfull Mean Depth (ft)	0.37	0.31	0.33	0.49		0.53		0.16	0.42	0.38	0.32	0.39		0.24		0.36
Bankfull Max Depth (ft)	0.86	0.72	0.63	1.12		0.73		0.35	0.77	0.74	0.64	0.84		0.66		0.69
Bankfull Cross Sectional Area (ft^2)	2.07	1.97	1.90	2.73		1.26		0.41	2.79	2.69	2.17	2.88		1.23		1.74
Bankfull Width/Depth Ratio									16.75	18.68	21.22	18.92		21.58		13.28
Bankfull Entrenchment Ratio									13.93	13.14	13.75	12.65		18.03		19.41
Low Bank Height (ft)												0.83		0.69		0.63
Bank Height Ratio*									1.00	1.00	1.01	1.00		>1		0.91

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

Table 9c. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
Roses Creek Mitigation Site
UT3 Roses Creek: 620 LF

	Cross Section 11 (Riffle)								Cross Section 12 (Pool)							
Dimension	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7**	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Based on fixed baseline bankfull elevation																
Bankfull Width (ft)	6.00	7.28	5.38	6.73		7.22		5.11	6.39	7.93	7.52	7.99		6.50		5.65
Floodprone Width (ft)	175.41	175.41	175.41	175.41		175.41		175.41								
Bankfull Mean Depth (ft)	0.36	0.21	0.37	0.24		0.30		0.13	0.56	0.46	0.45	0.40		0.43		0.34
Bankfull Max Depth (ft)	0.69	0.46	0.65	0.57		0.76		0.57	0.90	0.84	0.82	0.78		0.68		0.65
Bankfull Cross Sectional Area (ft^2)	2.19	1.51	2.01	1.62		2.18		0.69	3.55	3.61	3.40	3.23		2.78		1.93
Bankfull Width/Depth Ratio	16.67	34.67	14.54	28.04		24.07		106.70								
Bankfull Entrenchment Ratio	29.24	24.09	32.60	26.06		24.30		34.34								
Low Bank Height (ft)				0.5		0.85		0.58								
Bank Height Ratio*	1.00	1.00	1.00	<1		1.12		1.03								

* Base - MY2 calculated by holding bankfull elevation constant. MY3 data calculated by fitting as-built bankfull cross section area to monitoring year channel.

**Updated bankfull elevation used in MY7. Also updated method used for bank height ratio (BHR) in MY7.

Appendix E. Hydrologic Data

Table 10. Verification of Bankfull Events

Date	Crest Gauge Info		Gauge Reading (ft)	Gauge Elevation (ft)	Crest Elevation (ft)	Bankfull Elevation (ft)	Height above Bankfull (ft)	Photo
	Site	Sta.						
10/5/2016	1	Roses Creek Lower	0.00	1212.11	N/A	1213.93	N/A	5.1
10/5/2016	2	UT 1	0.00	1267.45	N/A	1267.95	N/A	5.2
10/5/2016	3	UT 2	0.35	1227.81	1228.16	1228.19	N/A	5.3
10/5/2016	4	UT 3	0.25	1216.94	1217.19	1217.36	N/A	5.4
11/22/2016	1	Roses Creek Lower	0.00	1212.11	N/A	1213.93	N/A	5.5
11/22/2016	2	UT 1	0.00	1267.45	N/A	1267.95	N/A	5.6
11/22/2016	3	UT 2	0.00	1227.81	N/A	1228.19	N/A	5.7
11/22/2016	4	UT 3	0.35	1216.94	1217.29	1217.36	N/A	5.8
6/2/2017	1	Roses Creek Lower	1.89	1212.11	1214.00	1213.93	0.07	5.9
6/2/2017	2	UT 1	0.80	1267.45	1268.25	1267.95	0.30	5.10
6/2/2017	3	UT 2	1.50	1227.81	1229.31	1228.19	1.12	5.11
6/2/2017	4	UT 3	1.80	1216.94	1218.74	1217.36	1.38	5.12
8/15/2017	1	Roses Creek Lower	0.50	1212.11	1212.61	1213.93	N/A	5.13
8/15/2017	2	UT 1	0.38	1267.45	1267.83	1267.95	N/A	5.14
8/15/2017	3	UT 2	0.85	1227.81	1228.66	1228.19	0.47	5.15
8/15/2017	4	UT 3	1.64	1216.94	1218.58	1217.36	1.22	5.16
3/28/2018	1	Roses Creek Lower	2.83	1212.11	1214.94	1213.93	1.01	5.17
3/28/2018	2	UT 1	0.38	1267.45	1267.83	1267.95	N/A	5.18
3/28/2018	3	UT 2	2.50	1227.81	1230.31	1228.19	2.12	5.19
3/28/2018	4	UT 3	1.38	1216.94	1218.32	1217.36	0.96	5.20
8/6/2018	1	Roses Creek Lower	3.75	1212.11	1215.86	1213.93	1.93	5.21
8/6/2018	2	UT 1	1.13	1267.45	1268.58	1267.95	0.63	5.22
8/6/2018	3	UT 2	2.54	1227.81	1230.35	1228.19	2.16	5.23
8/6/2018	4	UT 3	2.92	1216.94	1219.86	1217.36	2.50	5.24
1/29/2019	1	Roses Creek Lower	2.68	1212.11	1214.79	1213.93	0.86	5.25
1/29/2019	2	UT 1	0.67	1267.45	1268.12	1267.95	0.17	5.26
1/29/2019	3	UT 2	3.83	1227.81	1231.64	1228.19	3.45	5.27
1/29/2019	4	UT 3	3.75	1216.94	1220.69	1217.36	3.33	5.28
All four crest gauges were damaged by insects and have been unreadable since 2020.								

Figure 5.1 – 5.3 Tributary Water Level Gauge Meter Data

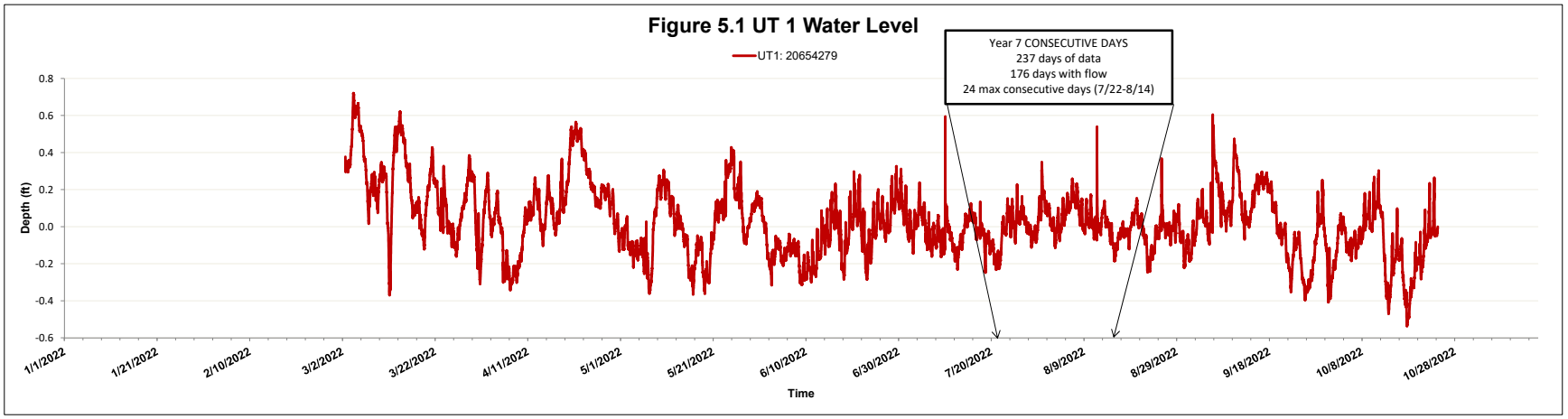
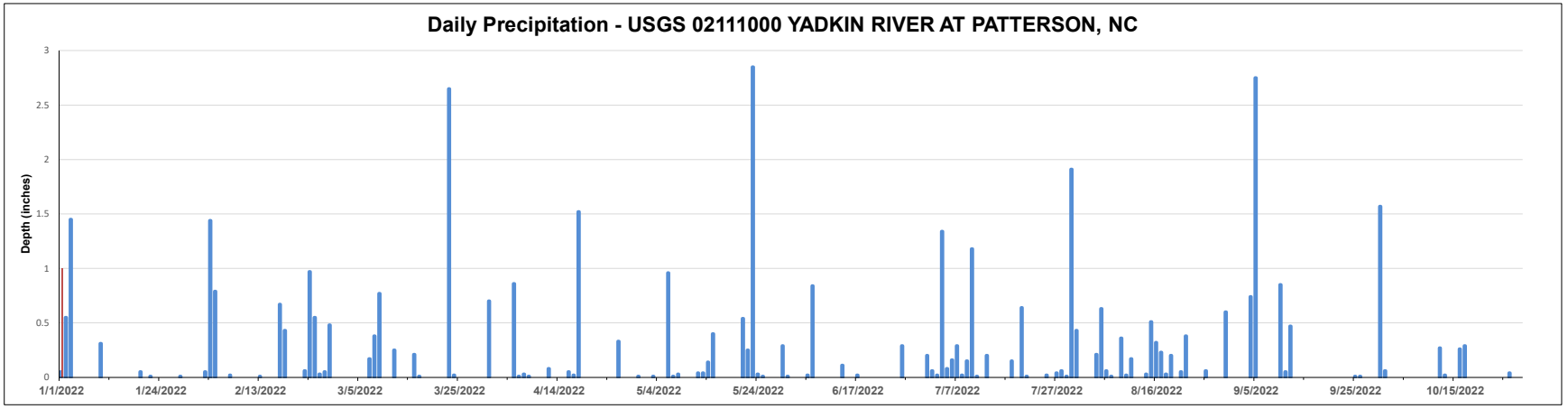


Figure 5.1 UT 1 Water Level
UT1: 20654279
Year 7 CONSECUTIVE DAYS
237 days of data
176 days with flow
24 max consecutive days (7/22-8/14)
Depth (ft)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1/1/2022
1/21/2022
2/10/2022
3/2/2022
3/22/2022
4/11/2022
5/1/2022
5/21/2022
6/10/2022
6/30/2022
7/20/2022
8/9/2022
8/29/2022
9/18/2022
10/8/2022
10/28/2022
Time


Daily Precipitation - USGS 02111000 YADKIN RIVER AT PATTERSON, NC
Depth (inches)
3
2.5
2
1.5
1
0.5
0
1/1/2022
1/24/2022
2/13/2022
3/5/2022
3/25/2022
4/14/2022
5/4/2022
5/24/2022
6/17/2022
7/7/2022
7/27/2022
8/16/2022
9/5/2022
9/25/2022
10/15/2022

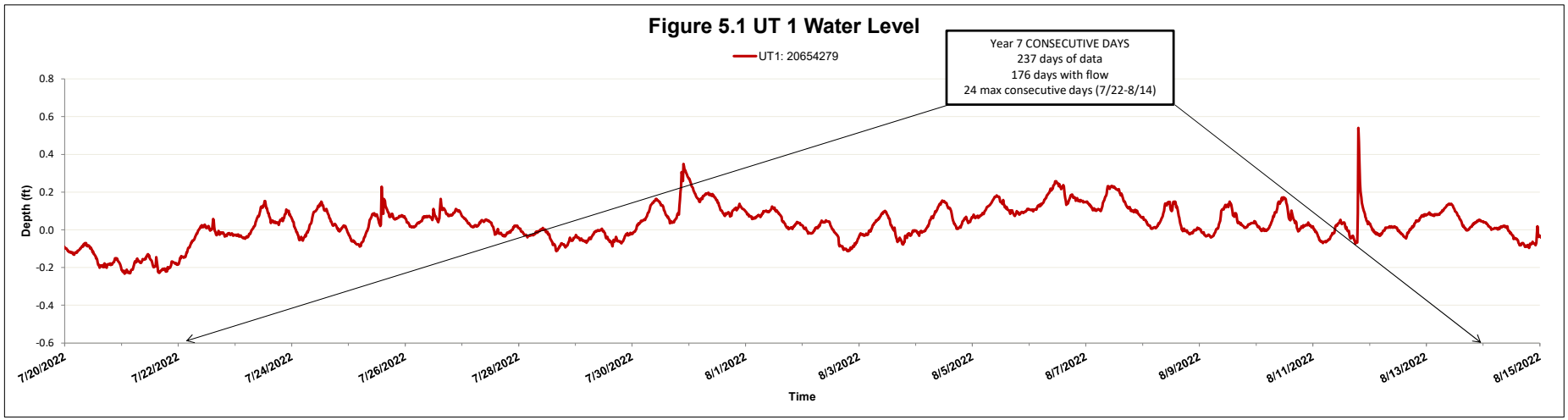


Figure 5.1 UT 1 Water Level
UT1: 20654279
Year 7 CONSECUTIVE DAYS
237 days of data
176 days with flow
24 max consecutive days (7/22-8/14)
Depth (ft)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
7/20/2022
7/22/2022
7/24/2022
7/26/2022
7/28/2022
7/30/2022
8/1/2022
8/3/2022
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8/7/2022
8/9/2022
8/11/2022
8/13/2022
8/15/2022
Time

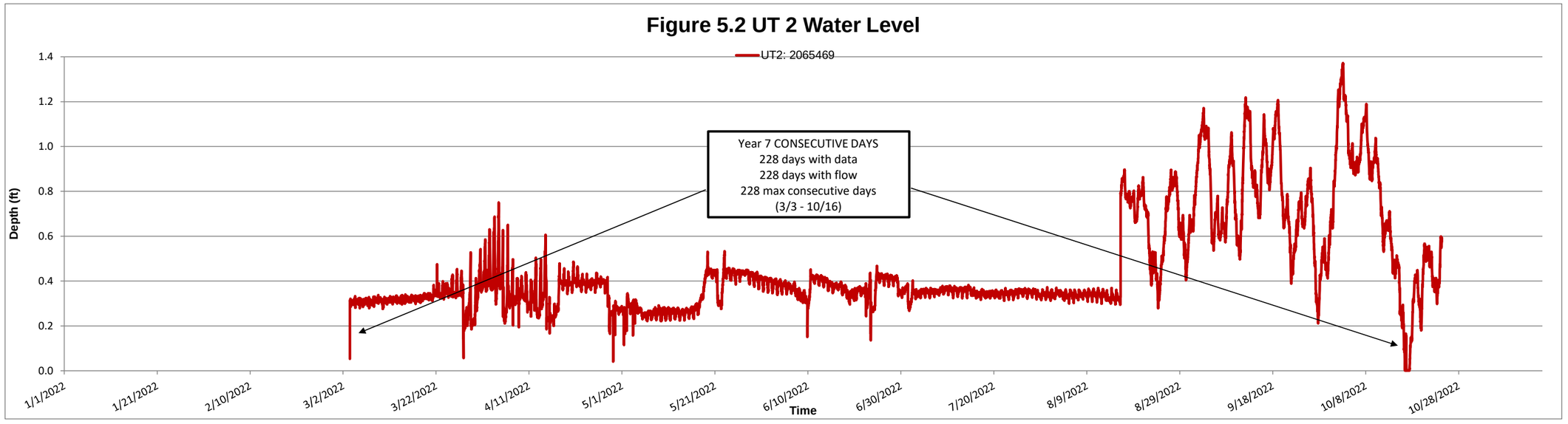
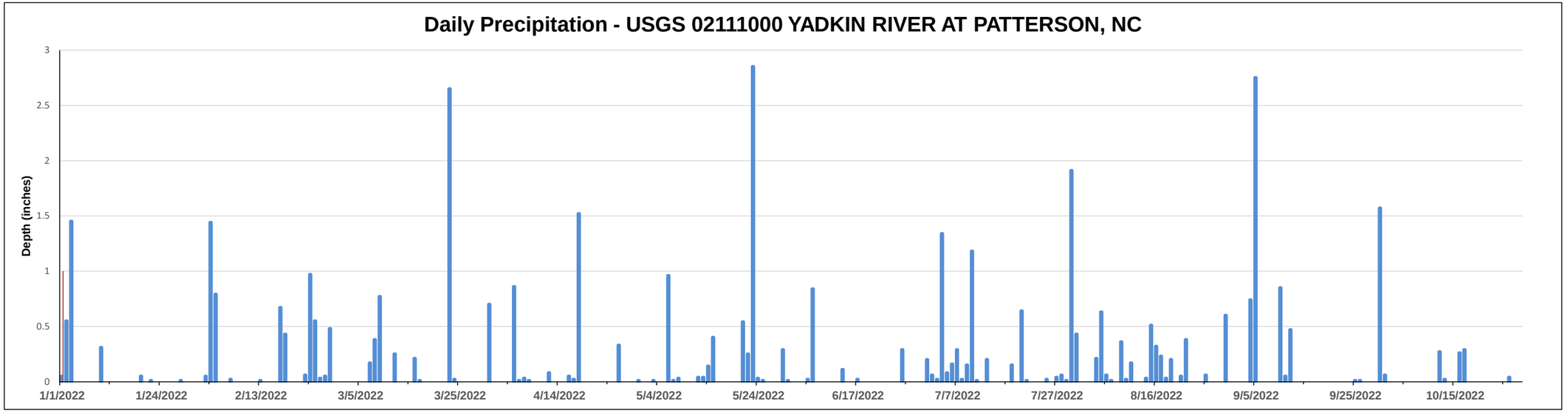


Figure 5.2 UT 2 Water Level
UT2: 2065469
Year 7 CONSECUTIVE DAYS
228 days with data
228 days with flow
228 max consecutive days
(3/3 - 10/16)
Depth (ft)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/2022
1/21/2022
2/10/2022
3/2/2022
3/22/2022
4/11/2022
5/1/2022
5/21/2022
6/10/2022
6/30/2022
7/20/2022
8/9/2022
8/29/2022
9/18/2022
10/8/2022
10/28/2022
Time


Daily Precipitation - USGS 02111000 YADKIN RIVER AT PATTERSON, NC
Depth (inches)
3
2.5
2
1.5
1
0.5
0
1/1/2022
1/24/2022
2/13/2022
3/5/2022
3/25/2022
4/14/2022
5/4/2022
5/24/2022
6/17/2022
7/7/2022
7/27/2022
8/16/2022
9/5/2022
9/25/2022
10/15/2022

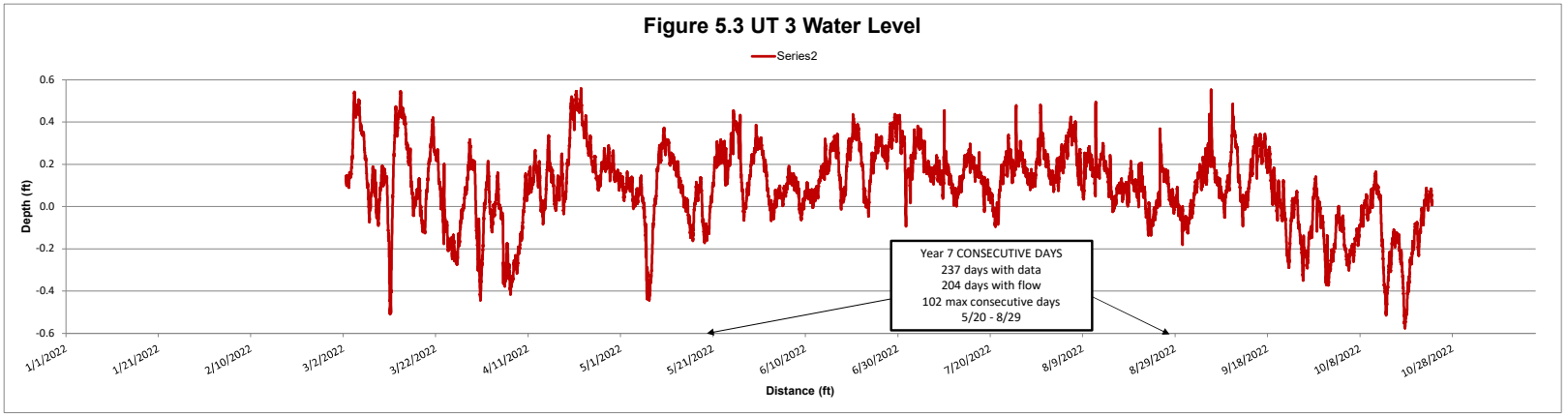
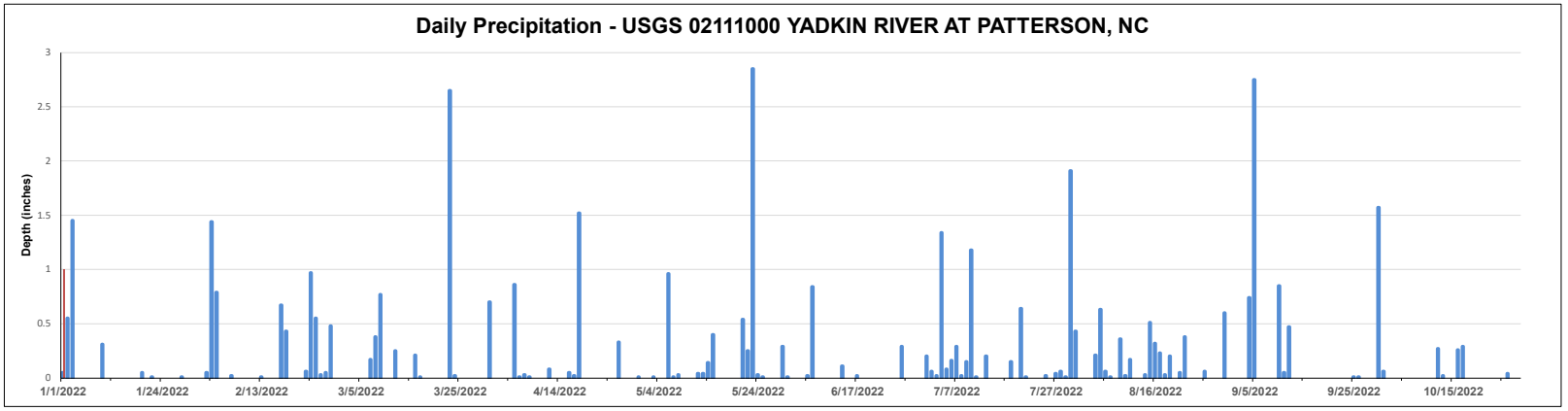


Figure 5.3 UT 3 Water Level
Series2
Depth (ft)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
Year 7 CONSECUTIVE DAYS
237 days with data
204 days with flow
102 max consecutive days
5/20 - 8/29
1/1/2022
1/21/2022
2/10/2022
3/2/2022
3/22/2022
4/11/2022
5/1/2022
5/21/2022
6/10/2022
6/30/2022
7/20/2022
8/9/2022
8/29/2022
9/18/2022
10/8/2022
10/28/2022
Distance (ft)


Daily Precipitation - USGS 02111000 YADKIN RIVER AT PATTERSON, NC
Depth (inches)
3
2.5
2
1.5
1
0.5
0
1/1/2022
1/24/2022
2/13/2022
3/5/2022
3/25/2022
4/14/2022
5/4/2022
5/24/2022
6/17/2022
7/7/2022
7/27/2022
8/16/2022
9/5/2022
9/25/2022
10/15/2022

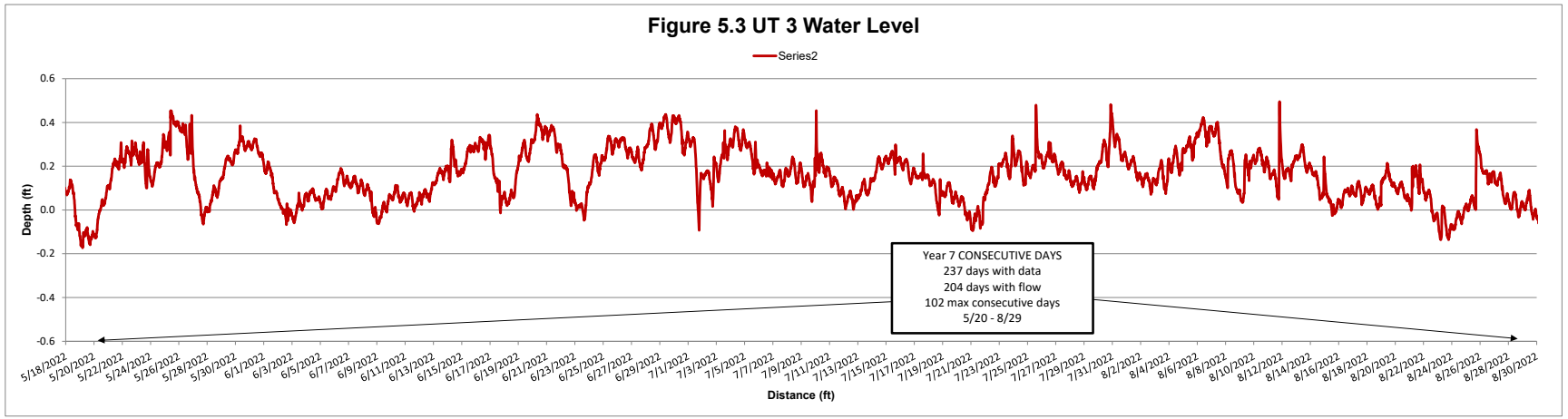


Figure 5.3 UT 3 Water Level
Series2
Depth (ft)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
Year 7 CONSECUTIVE DAYS
237 days with data
204 days with flow
102 max consecutive days
5/20 - 8/29
Distance (ft)

Table 11. Tributary Surface Water Summary

Tributary	Dates	Number of Consecutive Days with Flow
UT 1	6/25/2016 - 7/27/2016	32
UT 1	2/25/2017 - 5/6/2017	70
UT 1	6/1/2017 - 8/14/2017	74
UT 1	1/12/2018 – 3/1/2018	48
UT 1	5/15/2018 – 8/6/2018	83
UT 1	2/17/2020 – 4/26/2020	69
UT 1	4/27/2020 – 8/10/2020	105
UT 1	3/2/2022- 10/28/2022	24 (176*, 237#)
UT 2	6/9/2016 - 1/22/2017	228
UT 2	1/23/2017 - 5/11/2017	108
UT 2	6/1/2017 – 7/26/2017	55
UT 2	8/30/2017 – 10/3/2017	34
UT 2	11/18/2017 – 3/20/2018	122
UT 2	4/19/2018 – 8/6/2018	109
UT 2	1/1/2020 – 2/7/2020	37
UT 2	2/7/2020 – 4/9/2020	62
UT 2	4/29/2020-8/10/2020	103
UT 2	3/2/2022-10/28/2022	236 (236*, 236#)
UT 3	2/15/2017 – 5/11/2017	85
UT 3	6/1/2017 – 7/23/2017	52
UT 3	12/14/2017 – 3/1/2018	77
UT 3	4/27/2018 – 7/22/2018	86
UT 3	2/14/2020 – 8/10/2020	169
UT 3	3/2/2022-10/28/2022	102 (204*, 237#)
*days with flow, #days of data		

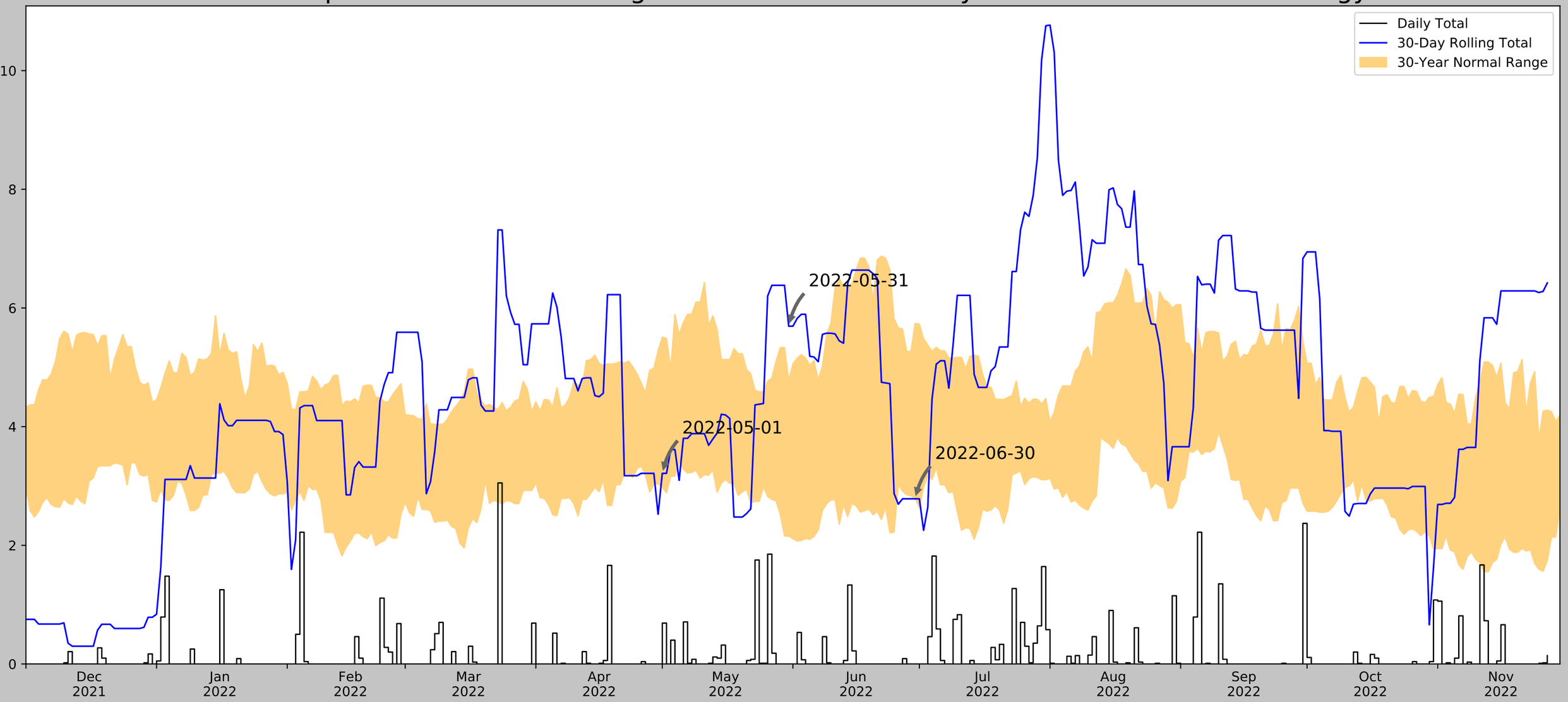
Appendix F. IRT DMS Meeting Minutes (2022)

Roses Creek
96309
2021 – MY6
HDR
PM: Tsomides

2022: The IRT noted persistent issues on the site including braided channels, beaver dams and cattle encroachment. Based on the provider discussions with the landowner, all fencing on the site has been repaired and no livestock encroachment currently exists. Two cattle "wasting areas" located outside of the conservation easement were discussed. HDR reiterated that no livestock are currently in the conservation easement. HDR will work with the landowner to potentially determine a solution prior to project closeout. A beaver dam was removed in MY6(2021) and no additional beaver issues have been observed on the site. All vegetation plots are currently meeting the success criteria. No random vegetation plots are currently being collected on the site. The IRT recommended 2 random vegetation plots/ transects be conducted in MY7(2022) to confirm vegetative success. An overhead utility line that ran parallel to UT2 was moved during MY6(2021) but a line remains transecting the top of UT1; HDR is still in the process of working with the utility to move the line. UT1 low gauge data could not be collected during MY6(2021) but photos of the flow have been collected. IRT asked about the culvert and upstream pond on UT1; HDR believes the culvert is not clogged. IRT asked that all flow gauge data should be summarized in MY7(2022) for each flow gauge on the site (consecutive days of flow and total days of flow). Invasives on the site were discussed and treatment should be completed through project closeout. A potential "headcut" on UT1 was discussed. HDR does not believe the feature is a headcut and does not plan to repair the area. UT3 was discussed and some of the stream credits are "at risk". Portions of the reach are braided w/ wetland features observed. DMS (Harry) and HDR (Jessica) do not feel that the credits at risk on the site exceed the requested MY6(2021) credit release request; however, the IRT wants to HOLD all outstanding credit (15%) until after MY7(2022) during the final credit release in 2023. **NO CREDIT RELEASE IN 2022.**

Appendix G. USACE Antecedent Precipitation vs. Normal Range

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	35.850953, -81.819541
Observation Date	2022-06-30
Elevation (ft)	1232.79
Drought Index (PDSI)	Incipient drought
WebWIMP H_2O Balance	Dry Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2022-06-30	2.787402	5.740945	2.783465	Dry	1	3	3
2022-05-31	2.155512	4.772441	5.692914	Wet	3	2	6
2022-05-01	2.973622	5.509055	3.212599	Normal	2	1	2
Result							Normal Conditions - 11

Figure and tables made by the
Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days (Normal)	Days (Antecedent)
BRIDGEWATER HYDRO	35.7428, -81.8361	1100.066	7.53	132.724	4.388	11217	90
GLEN ALPINE 2.6 W	35.7323, -81.8248	1232.94	8.203	0.15	3.693	1	0
GLEN ALPINE 0.7 WSW	35.7266, -81.7902	1262.139	8.748	29.349	4.193	131	0
MARION 4.7 NE	35.7344, -81.9537	1232.94	11.017	0.15	4.96	1	0
MORGANTON	35.7297, -81.6728	1180.118	11.74	52.672	5.901	3	0

Appendix H. 2017 Re-planting Zones

Easement Boundary
Restoration
Enhancement II

Vegetation Plot- Criteria Met

No
Yes

Replant Zone

A- 1.8 ac
B- 0.9 ac
C- 0.6 ac
D- 1.4 ac
E- 2.1 ac
F- 0.9 ac

UT 1
UT 2
UT 3
Roses Creek

1.8 ac
1 ac
0.9 ac
0.6 ac
1.4 ac
2.1 ac

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

Roses Creek Replanting Map- 2017

Roses Creek Stream Mitigation Site
Burke County, North Carolina

0 325 650 975 1,300 Feet

HDR | ICA

N E S W

NC

Figure 7.1

Table 13. Planting List for Zone A Through Zone C

Zone A- UT 1	1.8 AC	9 x 9 spacing (542 stems/ac)	
Common Name	**Scientific Name**	**% Composition**	**# Planted**
Sycamore	*Platanus occidentalis*	15	146
River Birch	*Betula nigra*	15	146
Green Ash	*Fraxinus pennsylvanica*	15	146
Tulip Tree	*Liriodendron tulipifera*	15	146
White Oak	*Quercus alba*	12	117
Northern Red Oak	*Quercus rubra*	12	117
American Elm	*Ulnus american*	6	59
Willow Oak	*Quercus phellos*	5	49
Silky Dogwood	*Cornus amomum*	5	49
		TOTAL	975
Zone B- Roses	**0.9 AC**	**10 x 10 spacing (436 stems/ac)**	
Common Name	**Scientific Name**	**% Composition**	**# Planted**
Sycamore	*Platanus occidentalis*	15	59
River Birch	*Betula nigra*	15	59
Green Ash	*Fraxinus pennsylvanica*	15	59
Tulip Tree	*Liriodendron tulipifera*	15	59
White Oak	*Quercus alba*	12	48
Northern Red Oak	*Quercus rubra*	12	48
American Elm	*Ulnus american*	6	24
Willow Oak	*Quercus phellos*	5	20
Silky Dogwood	*Cornus amomum*	5	20
		TOTAL	396
Zone C- Roses	**.6 AC**	**9 x 9 spacing (542 stems/ac)**	
Common Name	**Scientific Name**	**% Composition**	**# Planted**
Sycamore	*Platanus occidentalis*	15	49
River Birch	*Betula nigra*	15	49
Green Ash	*Fraxinus pennsylvanica*	15	49
Tulip Tree	*Liriodendron tulipifera*	15	49
White Oak	*Quercus alba*	12	39
Northern Red Oak	*Quercus rubra*	12	39
American Elm	*Ulnus american*	6	20
Willow Oak	*Quercus phellos*	5	17
Silky Dogwood	*Cornus amomum*	5	17
		TOTAL	328

Table 13a. Planting List for Zone D Through Zone F

Zone D- Roses	**1.4 AC**	**10 x 10 spacing (436 stems/ac)**	
Common Name	**Scientific Name**	**% Composition**	**# Planted**
Sycamore	*Platanus occidentalis*	15	92
River Birch	*Betula nigra*	15	92
Green Ash	*Fraxinus pennsylvanica*	15	92
Tulip Tree	*Liriodendron tulipifera*	15	92
White Oak	*Quercus alba*	12	74
Northern Red Oak	*Quercus rubra*	12	74
American Elm	*Ulnus american*	6	37
Willow Oak	*Quercus phellos*	5	31
Silky Dogwood	*Cornus amomum*	5	31
		TOTAL	615
Zone E- Roses	**2.1 AC**	**13 x 13 spacing (260 stems/ac)**	
Common Name	**Scientific Name**	**% Composition**	**# Planted**
Sycamore	*Platanus occidentalis*	15	82
River Birch	*Betula nigra*	15	82
Green Ash	*Fraxinus pennsylvanica*	15	82
Tulip Tree	*Liriodendron tulipifera*	15	82
White Oak	*Quercus alba*	12	65
Northern Red Oak	*Quercus rubra*	12	65
American Elm	*Ulnus american*	6	33
Willow Oak	*Quercus phellos*	5	28
Silky Dogwood	*Cornus amomum*	5	28
		TOTAL	547
Zone F- UT 2	**0.9 AC**	**9 x 9 spacing (542 stems/AC)**	
Common Name	**Scientific Name**	**% Composition**	**# Planted**
River Birch	*Betula nigra*	20	97
Green Ash	*Fraxinus pennsylvanica*	20	97
Sycamore	*Platanus occidentalis*	20	97
Button Bush	*Quercus alba*	15	73
Tag Alder	*Alnus serrulata*	15	73
Silky Dogwood	*Cornus amomum*	10	49
		TOTAL	486

Appendix I. 2018 Adaptive Management Repairs

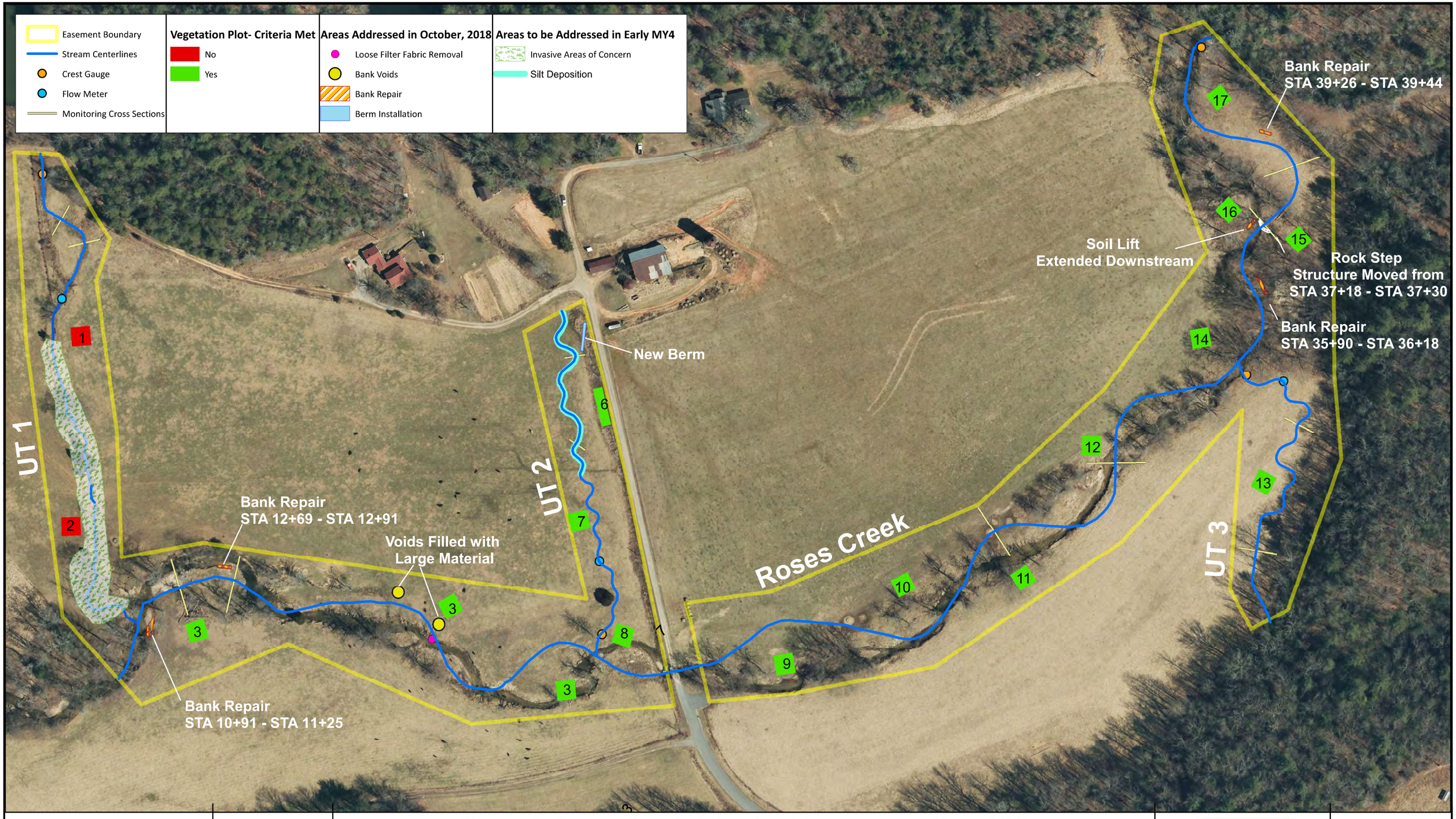


Figure 7. Roses Creek Adaptive Management Map- MY3

Roses Creek Stream Mitigation Site
Burke County, North Carolina

0 325 650 975 1,300 Feet