UT to Rush Fork Stream Mitigation Project
Year 1 (2022) Monitoring Report FINAL

DMS Project ID No. 100068, DEQ Contract No. 7535

RFP# 16-007335 (Issued 9/8/17)

USACE Action ID No. SAW-2018-01171, DWR# 2018-1034

Haywood County, North Carolina, French Broad River Basin: 06010106

MY1 Data Collection Period: October – November 2022

Submitted to/Prepared for:
NC Department of Environmental Quality
Division of Mitigation Services (DMS)
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Michael Baker
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Submission Date: January 2023

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January 26, 2023

Paul Wiesner, PM
NCDEQ, Division of Mitigation Services
Asheville Regional Office
2090 U.S. 70 Highway
Swannanoa, NC 28778-8211

Subject:
Response to DMS Comments (January 6, 2023) for DRAFT Monitoring Year 1 Report.
UT to Rush Fork Stream Mitigation Project, Haywood County
French Broad River Basin: 06010106
DMS Project #100068

Dear Mr. Wiesner,

Please find below our responses to the NC Division of Mitigation Services (DMS) review comments dated January 6, 2023, in reference to the Rush Fork Stream Mitigation Project's DRAFT Monitoring Year 1 Report. We have revised the Draft document in response to review comments as outlined below.

- Report Cover: Please include the RFP and RFP issuance date on the report cover: RFP 16-007335 (Issued 9/8/17).
  RESPONSE: Revision made as requested.

- Section 1.1 Project Description: This section notes; "*Michael Baker Engineering, Inc. (Michael Baker) restored approximately 2,843.58 linear feet and enhanced an additional 1,160.43 linear feet of stream along seven reaches of unnamed tributaries (UT) to Rush Fork creek.*" Please use the mitigation plan length totals consistently in this report text section. The project enhancement footage should be updated to 1,179.54 linear feet.
  RESPONSE: Revision made as requested.

- Section 1.4 Monitoring Results and Project Performance: The report text notes that all observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database Legacy system. In the report text, please also indicate the closest weather station's distance from the project site. Is it close enough to provide accurate rain data or is an on-site rain gauge warranted?
  RESPONSE: This language has been added to the report as requested. The nearest weather station (WAYN) is located 11.4 miles to the southwest of the project in Waynesville, NC on Test Farm Rd. Data from both the WAYN weather station and data from the Multi-Sensor Precipitation Estimate (MPE) system generated by the North Carolina Climate Office Weather

Station are adequate to characterize precipitation trends at the mitigation site as the MPE system is specific to site coordinates.

- Table 2: Recommend updating the "Number of Reporting Years" to 1 to be consistent with monitoring year 1. The IRT approved the project mitigation plan on April 19, 2021; please update this date accordingly. Please review all dates and the table and confirm their accuracy.
  RESPONSE: Revisions made as requested.

- Table 4: Please include the project stream's thermal regime in the revised table (COLD).
  RESPONSE: Revision made as requested.

- Table 5 & Table 6: Please include the assessment date at the top of each table. This was an IRT request at the 2022 credit release meeting.
  RESPONSE: Revision made as requested.

- Table 6: A "*" is located beside "Bare Areas"; however, there is no corresponding footnote. Please update the table accordingly.
  RESPONSE: The "*" has been removed.

- Appendix B - Project Photos: The IRT has requested photos of all project culvert inlets and outlets to confirm crossing stability and sufficient organism passage. In future monitoring years, please try to take late dormant season photos of the project crossings with minimal vegetation to demonstrate crossing stability and sufficient organism passage.
  RESPONSE: We agree that photos of culvert inlets and outlets in this report are difficult to see due to thick vegetation. MY1 photos of these culverts were taken in late November 2022. We plan to take photos of the site and culvert inlets and outlets early in the MY2 growing season before thick vegetation grows and obscures the view in stream and other photos.

- Table 11: Please review and confirm that the flow gauge data presented in the table and report is accurate. If RF2 was installed in March 2022, how can it have 368 days of cumulative flow? Please update the report as necessary.
  RESPONSE: This typo was corrected to 266 days of flow and revisions have been made as requested.

Digital Deliverable Comments:

- None

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As requested, Michael Baker has provided an electronic response letter addressing the DMS comments received and two (2) hardcopies of the FINAL report, and the updated e-submission digital files will be sent via secure ftp link. A full final electronic copy with electronic support files have been included on a USB drive. Please do not hesitate to contact me (Jason.york@mbakerintl.com 828-412-6101) should you have any questions regarding our response submittal.

Sincerely,

Jason York

Jason York
Environmental Scientist

Enclosure: Final MY1 Report UT to Rush Fork Stream Mitigation Project

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APPENDICES

1.0 PROJECT SUMMARY

1.1 Project Description

Michael Baker Engineering, Inc. (Michael Baker) restored approximately 2,843.58 linear feet and enhanced an additional 1,179.54 linear feet of stream along seven reaches of unnamed tributaries (UT) to Rush Fork creek. Additionally, 0.996 uncredited acres of adjacent riparian wetlands will be enhanced and protected within the conservation easement of the project. The project lies within the French Broad River Basin, Hydrologic Unit Code (HUC) 06010106-020010 (named the Pigeon River/Crabtree Creek Watershed), which is identified as a Targeted Local Watershed (TLW) in the NC Division of Mitigation Services' (DMS 2009) *French Broad River Basin Restoration Priorities* (RBRP) report. The project is located in the Blue Ridge Physiographic Region, within the Southern Crystalline and Mountains Level IV ecoregion. The project watershed drains into Rush Fork Creek, which flows for approximately 2.8 miles to its confluence with Crabtree Creek which continues for approximately 0.7 miles where it flows into the Pigeon River. These tributaries and streams are designated as Class C waters by the surface water classification system of the NC Division of Water Resources (DWR).

The UT to Rush Fork Stream Mitigation Project (project) is located on two adjacent parcels of an active cattle farm in Haywood County, North Carolina, halfway between the unincorporated communities of Crabtree and Fines Creek as shown on the Project Vicinity Map (Figure 1). The project site entrance is 5.9 miles down Route 209 from exit 24 off of I-40, on the right at 9503 Rush Fork Road. Coordinates for the approximate center of the project are 35.644607 N Latitude, -82.940170 W Longitude. Current agricultural use on the project site is predominantly livestock pasture; however, past use may have included row crops and apple production. These activities negatively impacted both water quality and streambank stability along the project stream reaches. The resulting observed stressors included streambank erosion, sedimentation, excess nutrient input, channel modification, and the loss of riparian buffers.

The project is being conducted as part of the DMS Full Delivery In-Lieu Fee Program and is anticipated to generate a total of 3,533.610 cold-water stream mitigation credits and the site will be protected by an 8.26-acre permanent conservation easement (Appendix B).

1.2 Goals and Objectives

The goals of this project are identified below:

- Reconnect stream reaches to their floodplains,
- Improve stream stability,
- Improve aquatic habitat,
- Reestablish forested riparian buffers, and
- Permanently protect the project in a conservation easement.

To accomplish these goals, the following objectives were identified:

- To restore appropriate bankfull dimensions, and/or raise channel beds, by utilizing either a Priority I Restoration approach or an Enhancement Level I approach.
- Stabilize eroding channel banks and arrest incision by utilizing an Enhancement Level II approach.

- To construct streams of appropriate dimensions, pattern, and profile in restored reaches, slope stream banks and provide bankfull benches on enhanced reaches and utilize bio-engineering to provide long-term stability.
- Construct the correct channel morphology along all stream channels, increasing the number and depth of pools utilizing structures including geo-lifts with brush toe, log vanes/weirs, root wads, and/or J-hooks.
- Establish riparian buffers at a 30-foot minimum width along all stream reaches, planted with native tree and shrub species.
- Establish a permanent conservation easement restricting land use in perpetuity. This will prevent site disturbance and allow the project to mature and stabilize.

1.3 Project Success Criteria

The success criteria and performance standards for the project will follow the NCDMS's templates As-Built Baseline Monitoring Report Format, Data Requirements, and Content Guidance (June 2017), and the Annual Monitoring Report Format, Data Requirements, and Content Guidance (June 2017), and as described in Section 7 of the approved Mitigation Plan. All specific monitoring activities will follow those outlined in detail in Section 8 of the approved Mitigation Plan and will be conducted for a period of 7 years unless otherwise noted.

1.4 Monitoring Results and Project Performance

The Year 1 monitoring survey data of the eighteen permanent cross-sections indicates that these stream sections are geomorphically stable and are within the lateral/vertical stability and in-stream structure performance categories. All reaches are stable and performing as designed and are rated at 100 percent for all the parameters evaluated (Table 5 in Appendix B). There were no Stream Problem Areas (SPAs) identified.

During Year 1 monitoring, the planted acreage performance categories were functioning. The planted stems endured abnormally dry conditions in February, May, June, and July and moderate drought conditions in October of their first year. The average density of total planted stems, based on data collected from the 6 permanent and 1 random monitoring plots for the Year 1 monitoring conducted in October and November 2022 was 393 stems per acre (Table 7 in Appendix C). Thus, the Year 1 vegetation data demonstrate that the Site is on track to meet the minimum success interim criteria of 320 trees per acre by the end of Year 3. No vegetation problem areas (VPAs) were identified as exceeding the reportable mapping threshold of 0.1 acres, although some small areas appear to have been impacted by wild hogs where rooting activity damaged some planted stems. Minor areas of poor growth will be supplemental planted and seeded where needed during MY2 at a rate of 200 stems per acre.

During Year 1 monitoring, no post-construction bankfull events were observed (see Table 10 in Appendix E) between the installation of gauges in March 2022 and MY1 monitoring in November 2022.

As the observed monthly rainfall data for the project presented in Figure 6 in Appendix E demonstrates, the past 12 months have varied on a monthly basis compared to historic average precipitation. In an annual comparison the site experienced similar average annual rainfall at 50.07 inches observed for the project and the county's 51.41 inches of rainfall. Reported observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database Legacy system. This system uses a Multi-Sensor Precipitation Estimate (MPE) to combine radar-based precipitation values with surface gauges to generate site specific data based on project coordinates. The closest weather station (WAYN) is located approximately 11.4 miles southwest of the project at the Mountain Research Station on Test Farm Rd. in Waynesville, NC.

Three automated flow gauges exceeded the minimum 30-day performance criteria during MY1. The three automated crest gauges did not record a bankfull event during MY1. Summary information/data related to the Site and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report Appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan available on the DMS website. Any raw data supporting the tables and figures in the Appendices is available from DMS upon request.

This report documents the successful completion of the Year 1 monitoring activities for the post-construction monitoring period.

1.5 Technical and Methodological Descriptions

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using a Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the As-built Survey. The survey data from the permanent project cross-sections were collected and classified using the Rosgen Stream Classification System to confirm design stream type (Rosgen 1994).

The six permanent vegetation-monitoring quadrants (plots) were installed across the site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.1 (Lee 2007) and the data collected from each was input into the DMS Veg Table Production Tool (2021).

All of the crest gauges and flow gauges are Van Essen brand Baro-Diver data loggers.

All observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database Legacy system.

The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photograph stations, and crest gauges, are shown on the CCPV map found in Appendix B.

IRT comments for MY0 and the October 27, 2022 *Response to IRT Comments (October 11, 2022) Notice for Initial Credit Release/ NCDMS UT to Rush Fork/ SAW-2018-01171/Haywood County* have been included in Appendix E.

1.6 References

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC. 2012.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.

North Carolina Division of Mitigation Services. 2020. *Annual Monitoring Report Format, Data Requirements, and Content Guidance October 2020.* NC Department of Environmental Quality. Raleigh, NC.

North Carolina Interagency Review Team (NCIRT). 2020. Guidance document "*Wilmington District Stream and Wetland Compensatory Mitigation Update".* October 24, 2016

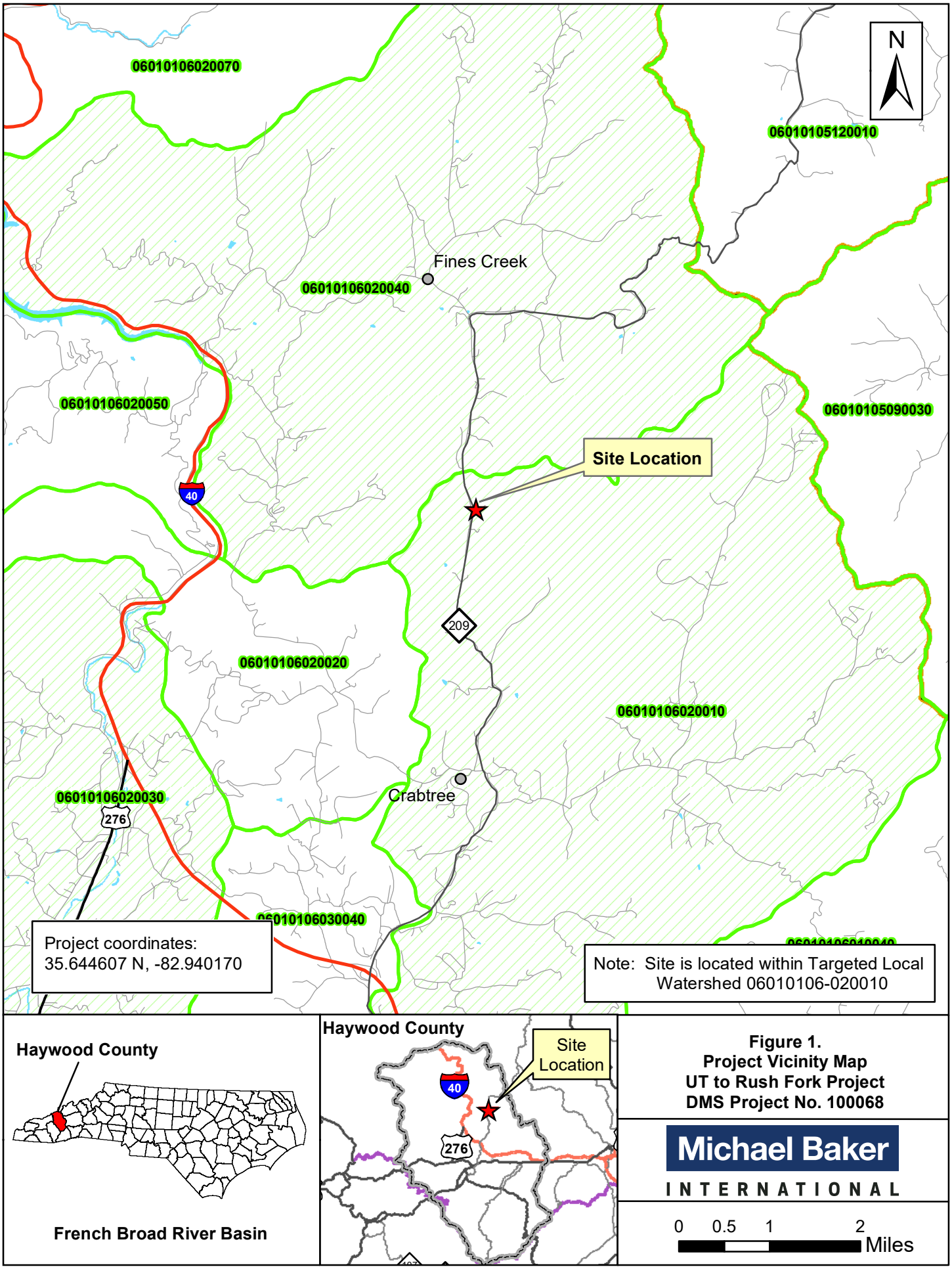
Rosgen, D.L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

Rosgen, D.L. 1996. Applied River Morphology. Wildlands Hydrology. Pagosa Springs, CO.

United States Army Corps of Engineers (USACE). 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

APPENDIX A

Background Tables and Figures


N
06010106020070
06010105120010
Fines Creek
06010106020040
06010106020050
06010105090030
Site Location
40
209
06010106020020
06010106020010
Crabtree
06010106020030
276
06010106030040
Project coordinates:
35.644607 N, -82.940170
Note: Site is located within Targeted Local Watershed 06010106-020010
Haywood County
French Broad River Basin
Haywood County
Site Location
40
276
Figure 1.
Project Vicinity Map
UT to Rush Fork Project
DMS Project No. 100068
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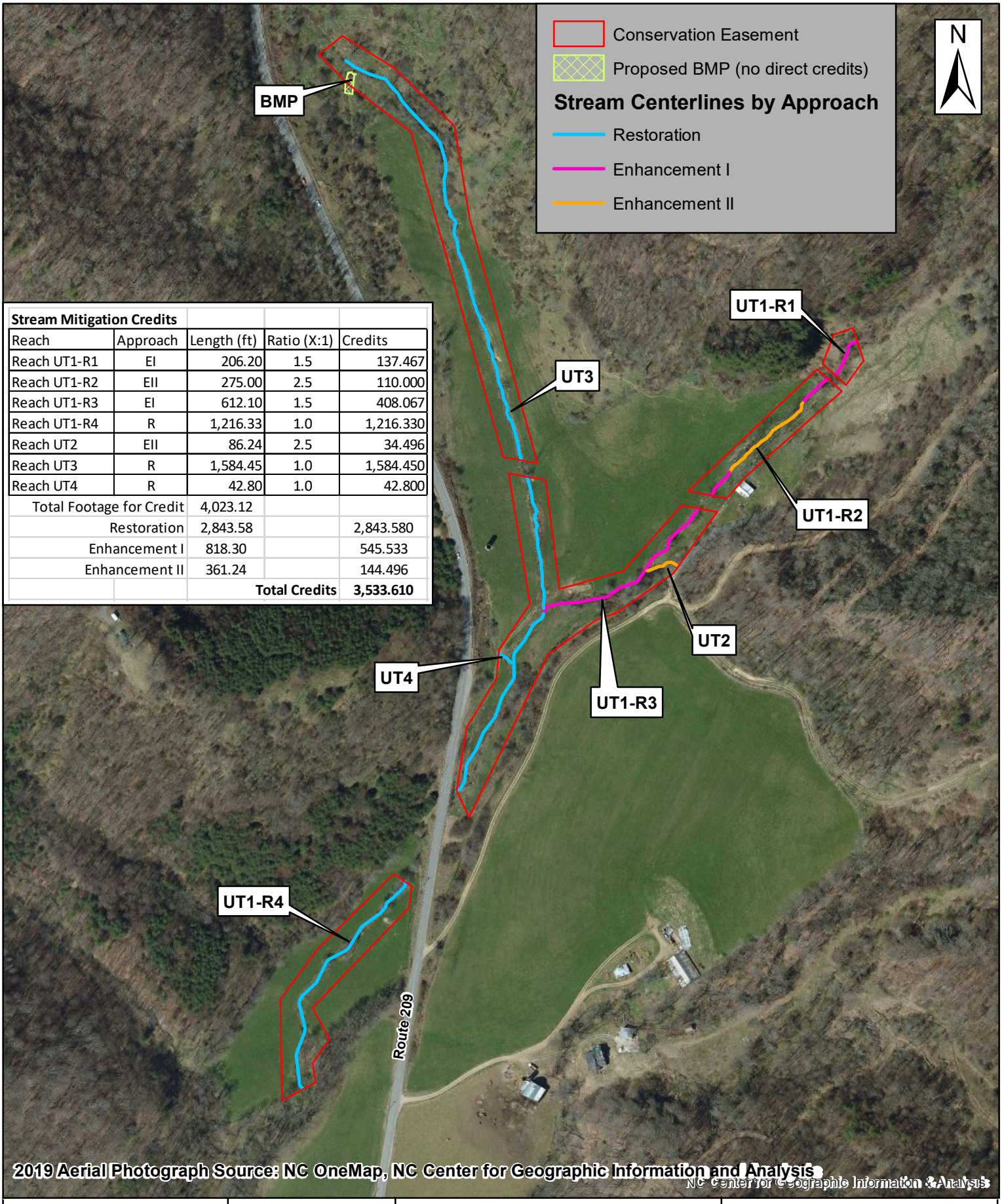
0 0.5 1 2
Miles



Stream Mitigation Credits				
Reach	Approach	Length (ft)	Ratio (X:1)	Credits
Reach UT1-R1	EI	206.20	1.5	137.467
Reach UT1-R2	EII	275.00	2.5	110.000
Reach UT1-R3	EI	612.10	1.5	408.067
Reach UT1-R4	R	1,216.33	1.0	1,216.330
Reach UT2	EII	86.24	2.5	34.496
Reach UT3	R	1,584.45	1.0	1,584.450
Reach UT4	R	42.80	1.0	42.800
Total Footage for Credit		4,023.12		
Restoration		2,843.58		2,843.580
Enhancement I		818.30		545.533
Enhancement II		361.24		144.496
			Total Credits	**3,533.610**

Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services
DMS Proj. No. 100068

0 125 250 500 Feet

Figure 2. Project Asset and Credit Map
UT to Rush Fork Project
Haywood County

Table 1. Project Mitigation Quantities and Credits

UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Project Segment	Original Mitigation Plan* Ft/Ac	As-Built Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits
Stream						
Reach UT1-R1	206.20	206.410	Cold	EI	1.5	137.467
Reach UT1-R2	275.00	275.000	Cold	EII	2.5	110.000
Reach UT1-R3	612.10	600.860	Cold	EI	1.5	408.067
Reach UT1-R4	1,216.33	1,224.370	Cold	R	1.0	1,216.330
Reach UT2	86.24	78.160	Cold	EII	2.5	34.496
Reach UT3	1,584.45	1,577.530	Cold	R	1.0	1,584.450
Reach UT4	42.80	41.900	Cold	R	1.0	42.800
					Total:	**3,533.610**
Wetland						
N/A	0.996	0.996	-	E	-	-
					Total:	**N/A**

Project Credits

Restoration Level	Stream			Riparian	Non-Rip	Coastal
	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	-	-	2,843.580	-	-	-
Re-establishment				-	-	-
Rehabilitation				-	-	-
Enhancement				-	-	-
Enhancement I	-	-	545.534			
Enhancement II	-	-	144.496			
Creation				-	-	-
Preservation	-	-	-	-	-	
Totals			**3,533.610**			

Table 2. Project Activity and Reporting History
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Grading Completed in	**Feb-22**
Elapsed Time Since grading complete:	**11 months**
All Planting Completed in	**Feb-22**
Elapsed Time Since planting complete:	**11 months**
Number of Reporting Years[1]:	**1**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution date	N/A	April 2018
404 permit date	N/A	April 2021
Mitigation Plan	N/A	April 2021
Final Design – Construction Plans	N/A	February 2022
Construction Grading Completed	N/A	February 2022
As-Built Survey	March 2022	August 2022
Livestake and Bareroot Planting Completed	February 2022	N/A
As-Built Stream Survey	March 2022	N/A
As-Built Vegetation Monitoring	March 2022	N/A
As-Built Baseline Monitoring Report (MY0)	March 2022	August 2022
Year 1 Monitoring		
Year 1 Stream Survey	November 2022	N/A
Year 1 Vegetation Monitoring	November 2022	N/A
Monitoring Year 1 Report (MY1)	December 2022	January 2023
Year 2 Monitoring (anticipated)	December 2023	December 2023
Year 3 Monitoring (anticipated)	December 2024	December 2024
Year 4 Monitoring (anticipated)	December 2025	December 2025
Year 5 Monitoring (anticipated)	December 2026	December 2026
Year 6 Monitoring (anticipoated)	December 2027	December 2027
Year 7 Monitoring (anticipated)	December 2028	December 2028

[1] = The number of monitoring reports excluding the as-built/baseline report

Table 3. Project Contacts
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Designer	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Katie McKeithan, Tel. 919-481-5703
Construction Contractor	
Baker Grading & Landscaping, Inc.	1000 Bat Cave Road, Old Fort, NC 28762 Contact: Charles Baker, Tel. 828-668-5060 x. 11
Survey Contractor	
Kee Mapping and Surveying	88 Central Avenue Asheville, NC 28801 Contact: Brad Kee, Tel. 828-575-9021
Planting Contractor	
Baker Grading & Landscaping, Inc.	1000 Bat Cave Road, Old Fort, NC 28762 Contact: Charles Baker, Tel. 828-668-5060 x. 11
Seeding Contractor	
Baker Grading & Landscaping, Inc.	1000 Bat Cave Road, Old Fort, NC 28762 Contact: Charles Baker, Tel. 828-668-5060 x. 11
Seed Mix Sources	
Roundstone Native Seed, LLC	9764 Raider Hollow Road, Upton, KY 42784 Telephone: 270-531-3034
Nursery Stock Suppliers	
Foggy Mountain Nursery (livestakes)	797 Helton Creek Road, Lansing, NC 28643 Telephone: 336-384-5323
Dykes and Son Nursery	825 Maude Etter Road, McMinnville, TN 37110 Telephone: 843-528-3204
Monitoring Performers	
Michael Baker Engineering, Inc.	797 Haywood Rd. Suite 201 Asheville, NC 28806
Stream Monitoring POC	Jason York, Tel. 828-380-0118
Vegetation Monitoring POC	Jason York, Tel. 828-380-0118

Table 4. Project Baseline Information and Attributes
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Table 4. Project Background Information			
Project Name	UT to Rush Fork Stream Mitigation Project		
County	Haywood County		
Project Area (acres)	8.26		
Project Coordinates (latitude and longitude)	35.644607 N, -82.940170 W		
Planted Acreage (Acres of Woody Stems Planted)	7.3		
Thermal Regime	COLD		
Project Watershed Summary Information			
Physiographic Province	Blue Ridge		
River Basin	French Broad		
USGS Hydrologic Unit 8-digit	6010106	USGS Hydrologic Unit 14-digit	06010106-020010
DWR Sub-basin	04-03-05		
Project Drainage Area (Acres and Square Miles)	308 acres/0.48 square miles (at downstream end of UT1)		
Project Drainage Area Percentage of Impervious Area	0.18% impervious area		
CGIA Land Use Classification	79,8% forested, 17.1% hay/pasture, and 2.9% developed (open space).		
Reach Summary Information			
Parameters	**UT1**	**UT2**	**UT3**	**UT4**
Length of reach (linear feet)	2,464	99	1,618	18
Valley confinement (Confined, moderately confined, unconfined)	Moderately Confined	Unconfined	Moderately Confined	Unconfined
Drainage area (Acres)	308	24	98	27
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Perennial	Intermittent
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	B4a	B	A to B4	B
Stream Classification (proposed)	B4a	B	A to B4	Cb
Evolutionary trend (Simon)	IV – Degradation and Widening	III – Degrading	IV – Degradation and Widening	III – Degrading
FEMA classification	Zone X	Zone X	Zone X	Zone X
Regulatory Considerations				
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**	
Water of the United States - Section 404	Yes	No	PCN	
Water of the United States - Section 401	Yes	No	PCN	
Endangered Species Act	Yes	Yes	Categorical Exclusion	
Historic Preservation Act	Yes	Yes	Categorical Exclusion	
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	No	N/A	N/A	
Essential Fisheries Habitat	No	N/A	N/A	
Notes:				
[1] Source: USGS National Land Cover Database (NLCD) for 2016				

APPENDIX B

Visual Assessment Data

Table 5. Visual Stream Morphology Stability Assessment - Assessed November 2022
UT to Rush Fork Stream Mitigation Project – NCDMS Project No. 100068

Reach ID: Reach UT1-R1
Assessed Length (LF): 206.41

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1.Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	10	10			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5) **(Plunge Pools)**	9	9			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrear riffle)	9	9			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			100%
		2. Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	10	10			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	10	10			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	10	10			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	10	10			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flow	10	10			100%

Reach ID: Reach UT1-R2 (EI)
Assessed Length (LF): 275.00

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1.Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	2	2			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5) **(Plunge Pools)**	2	2			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrear riffle)	2	2			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			100%
		2. Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	2	2			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	2	2			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	2	2			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flow	2	2			100%

Reach ID: Reach UT1-R3 (EII)
Assessed Length (LF): 600.86

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1.Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	20	20			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5) **(Plunge Pools)**	19	19			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrear riffle)	19	19			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			100%
		2. Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering 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 or around sills or arms	19	19			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	19	19			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flow	19	19			100%

Reach ID: Reach UT1-R4
Assessed Length (LF): 1,224.37

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1.Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	36	36			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5) **(Plunge Pools)**	36	36			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrear riffle)	36	36			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			100%
		2. Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	36	36			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	36	36			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	36	36			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	N/A	N/A			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flow	N/A	N/A			100%

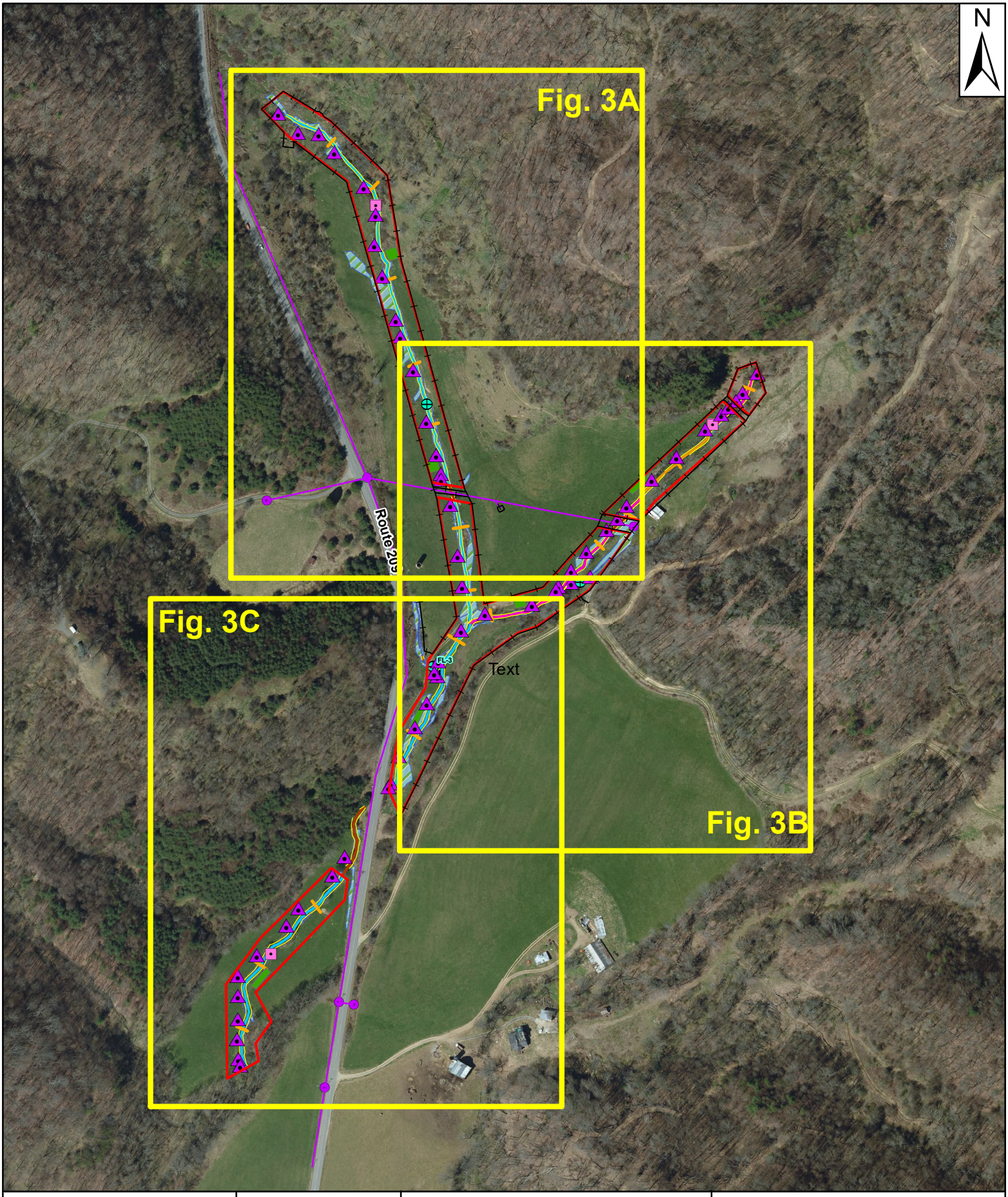
Table 5: Visible Stream Morphology Assessment. Reach ID: Reach UT2							
Assessed Length (LF): 78.16							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	1.Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1	0	0	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5) **(Plunge Pools)**	0	0	0	0	100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrear riffle)	N/A	N/A			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			100%
		2. Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	0	0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	0	0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	0	0			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	0	0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flov	0	0			100%

Reach ID: Reach UT3							
Assessed Length (LF): 1,577.53							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	1.Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	44	44	0	0	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5) **(Plunge Pools)**	43	43	0	0	100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrear riffle)	43	43			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			100%
		2. Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	43	43			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	43	43			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	43	43			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	43	43			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flov	43	43			100%

Reach ID: Reach UT4							
Assessed Length (LF): 41.90							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	1.Vertical Stability	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1	0	0	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5) **(Plunge Pools)**	0	0	0	0	100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrear riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			100%
		2. Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			100%
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	0	0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	0	0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	0	0			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	0	0			100%

Table 6. Vegetation Conditions Assessment - Assessed November 2022
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Planted Acreage: 7.3						
Vegetation Category	**Defintions**	**Mapping Threshold (acres)**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1 acres	N/A	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	N/A	0	0.00	0.0%
			Total			
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25 acres	N/A	0	0.00	0.0%
			Cumulative Total			
Easement Acreage: 8.26						
Vegetation Category	**Defintions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Points**	**Combined Acreage**	**% of Planted Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	N/A	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	577 ft²	N/A	0	0.00	0.0%

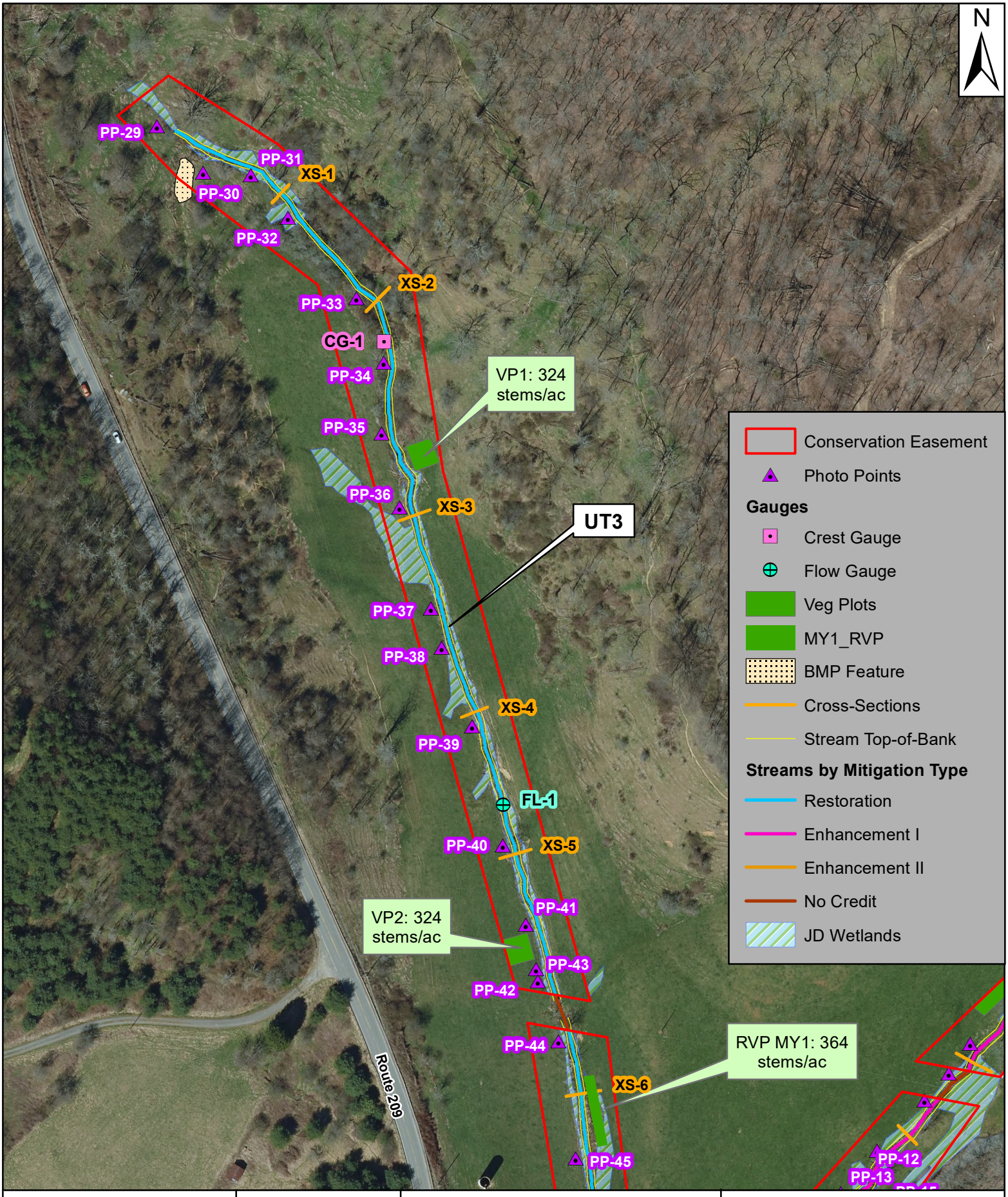


Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services
DMS Proj. No. 100068

0 250 500 Feet

Figure 3. Current Condition Plan View (CCPV) Overview MY1 UT to Rush Fork Project Haywood County

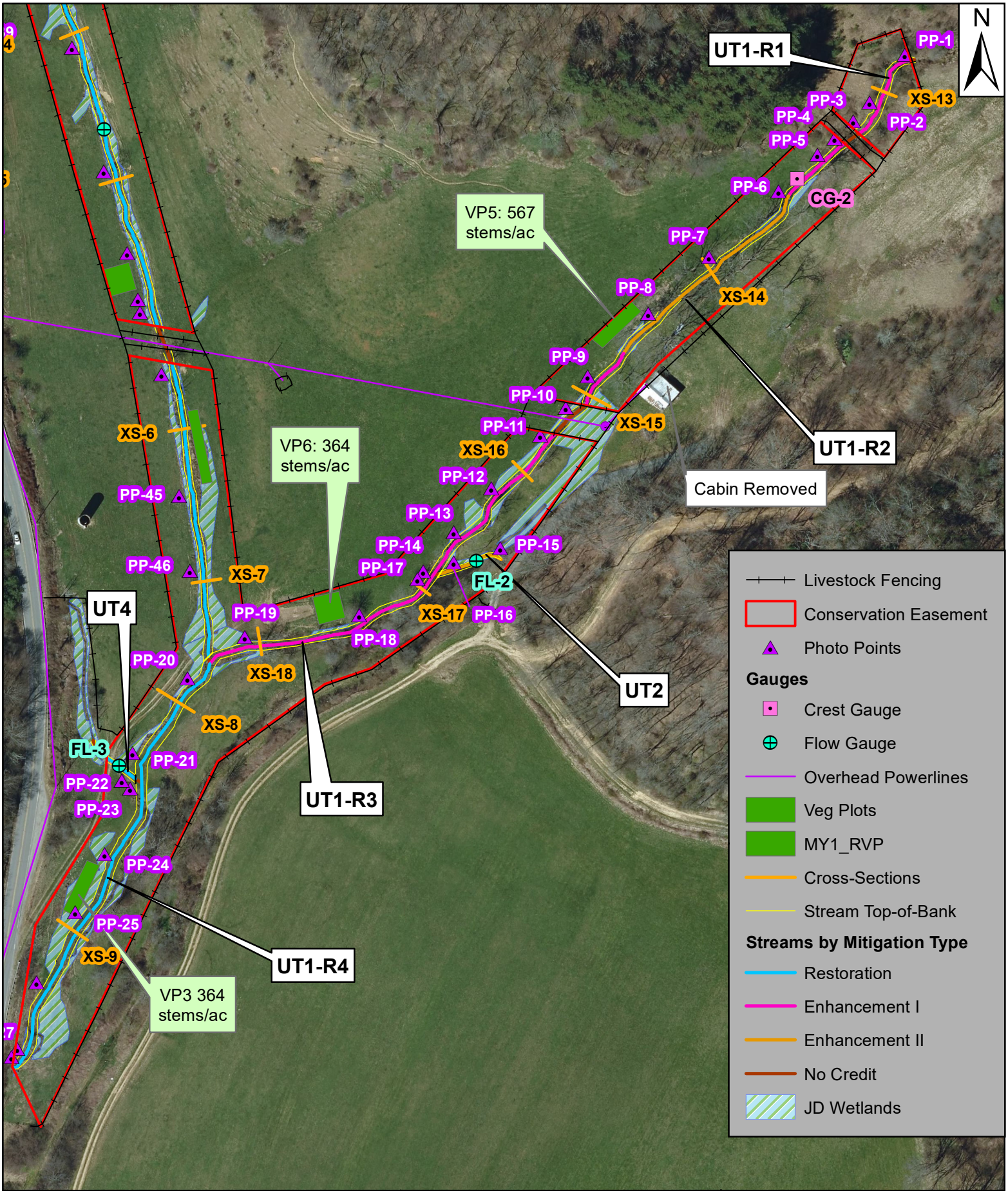


Michael Baker INTERNATIONAL

North Carolina Division of Mitigation Services
DMS Proj. No. 100068

0 125 250 Feet

Figure 3A. Current Condition Plan View (CCPV) MY1
UT to Rush Fork Project
Haywood County



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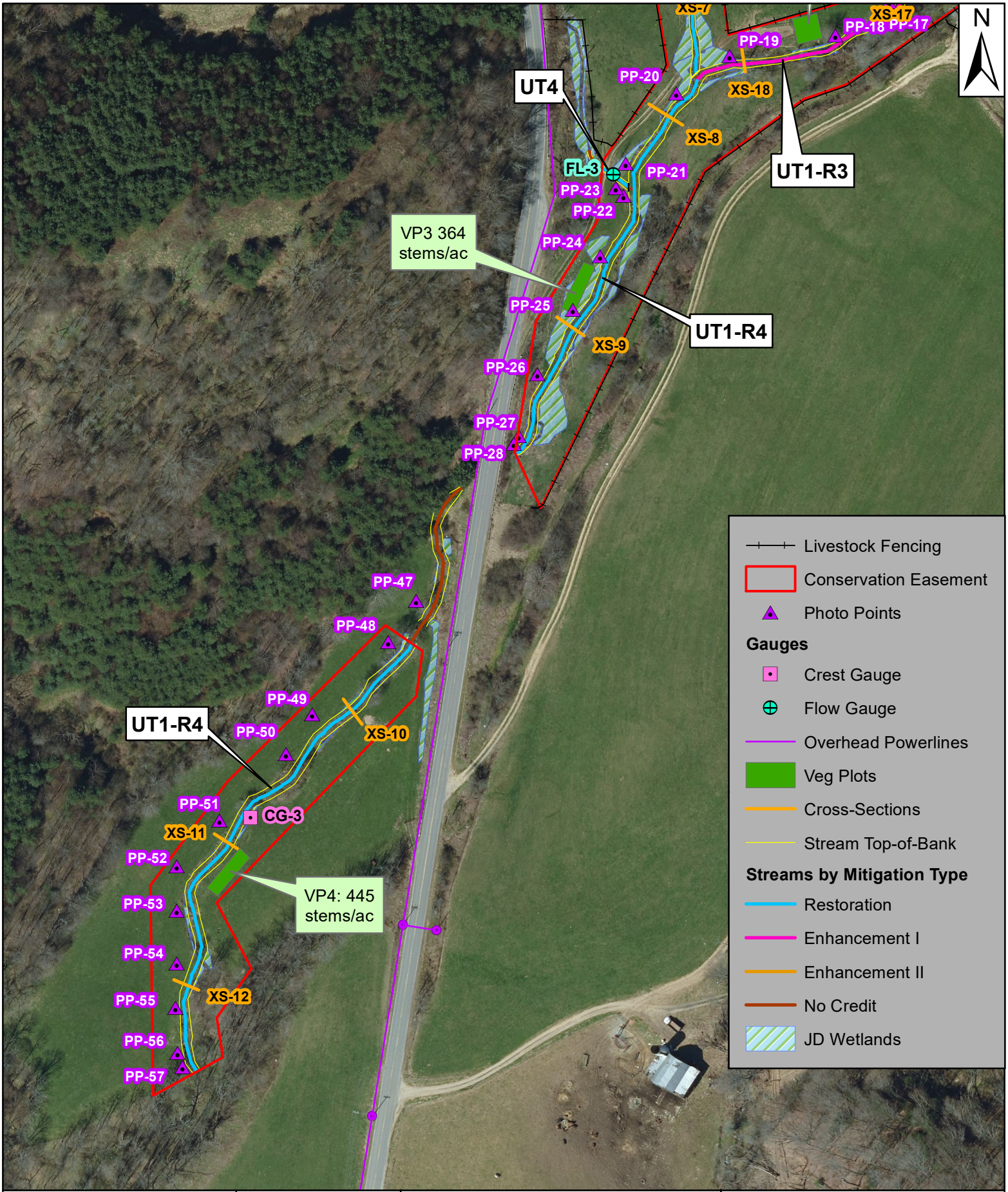
DMS Proj. No. 100068

0 125 250 Feet

Figure 3B. Current Condition Plan View (CCPV) MY1
UT to Rush Fork Project
Haywood County



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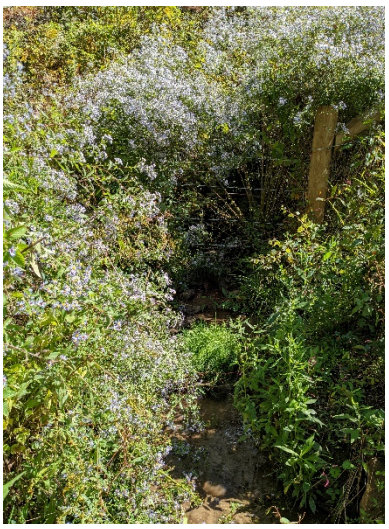
DMS Proj. No. 100068

0 125 250 Feet

Figure 3C. Current Condition Plan View (CCPV) MY1
UT to Rush Fork Project
Haywood County

MY1 Stream Station Photo-Points
NCDMS Project No. #100068

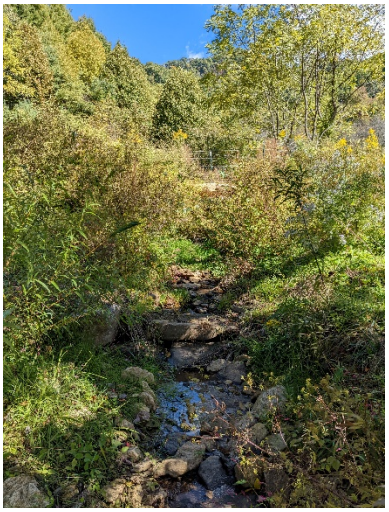


PP-1: UT1, R 1, Station 11+00. Upstream. October 4, 2022.

PP-2: UT1, R 1, Station 11+80. Upstream. October 4, 2022.

PP-3: UT1, R 1, Station 12+10 Culvert. Downstream. October 4, 2022.

PP-4: UT1, R 1, Station 12+33 Downstream. October 4, 2022.



PP-6: UT1, R 2, Station 13+25. Upstream. October 4, 2022.

PP-7: UT1, R 2, Station 14+60. Upstream. October 4, 2022.

MY1 Stream Station Photo-Points
NCDMS Project No. #100068

PP-7: UT1, R 2, Station 14+60.
Upstream. October 4, 2022.

PP-8: UT1, R 2, Station 15+50.
Upstream. October 4, 2022.

PP-9: UT1, R 3, Station 16+50.
Upstream. October 4, 2022.

PP-10: UT1, R 3, 16+80.
Upstream. October 4, 2022.

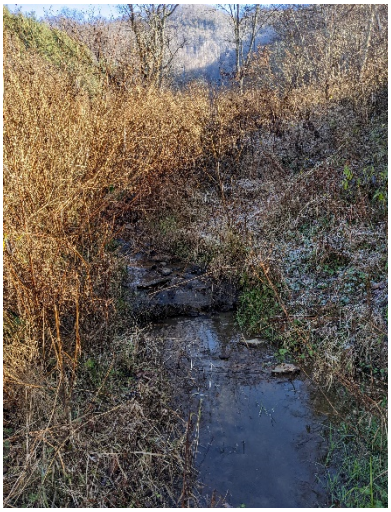
P-11: UT1, R 3, Station 17+35.
Upstream. October 4, 2022.

PP-12: UT1, R 3, Station 18+25.
Upstream. October 4, 2022.

PP-13: UT1, R 3, Station 18+90.
Upstream. October 4, 2022.

PP-14: UT1 R 3, Station 19+55.
Upstream. October 4, 2022.

PP-15: UT2, Station 10+15.
Upstream. October 4, 2022.



PP-16: UT2, Station 10+85.
Upstream. November 29, 2022

PP-17: UT1, R3, Station 19+70.
Upstream. November 29, 2022

PP-18: UT1, R 3, Station 20+60.
Upstream. November 29, 2022

PP-19: UT1, R 3, Station 22+00. Upstream. October 4, 2022

PP-20: UT1, R 4, Station 22+75. Upstream.

PP-21: UT1, R 4, Station 23+90. Upstream.

PP-22: UT1, R 4, Station 24+20. Upstream. November 9, 2022

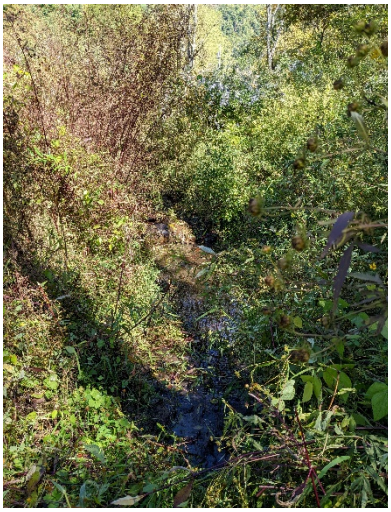
PP-23: UT4, Station 10+50. Upstream. November 9, 2022

PP-24: UT1, R 4, Station 25+25. Upstream. November 29, 2022

MY1 Stream Station Photo-Points
NCDMS Project No. #100068

PP-25: UT1, R 4, Station 26+00.
Upstream. November 29, 2022

PP-26: UT1, R 4, Station 27+00.
Upstream. November 29, 2022



PP-27: UT1, R 4, Station 27+75.
Upstream. October 4, 2022

PP-28: UT1, R 4, Station 27+90.
Downstream. November 29, 2022

PP-29: BMP at Top of UT3.
November 9, 2022.

PP-30: UT3, Station 10+00.
Upstream. November 9, 2022

MY1 Stream Station Photo-Points
NCDMS Project No. #100068

PP-31: UT3, Station 11+10.
Upstream. November 9, 2022

PP-32: UT3, Station 11+75.
Upstream. November 9, 2022

PP-33: UT3, Station 13+15.
Upstream. November 9, 2022

PP-34: UT3, Station 14+15.
Upstream. November 9, 2022

PP-35: UT3, Station 14+85.
Upstream. November 9, 2022

PP-36: UT3, Station 15+95.
Upstream. November 9, 2022

PP-37: UT3, Station 17+35.
Upstream. November 9, 2022

PP-38: UT3, Station 17+65.
Upstream. November 9, 2022

PP-39: UT3, Station 18+75.
Upstream. November 9, 2022

PP-40: UT3, Station 20+40.
Upstream. November 9, 2022

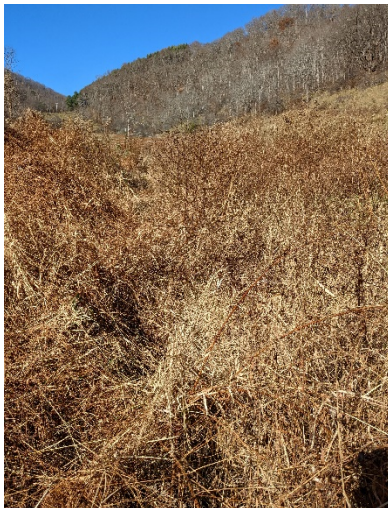
PP-41: UT3, Station 21+20.
Upstream. November 9, 2022

PP-42: UT3, Station 22+10.
Upstream. November 9, 2022

PP-43: UT3, Station 22+15. Downstream. November 9, 2022

PP-44: UT3, Station 23+15. Upstream. November 9, 2022

PP-45: UT3, Station 24+40. Upstream. November 9, 2022



PP-46: UT3, Station 25+35. Upstream. November 9, 2022

PP-47: UT3, Station 26+30. Upstream at confluence. November 9, 2022.

PP-48: UT1, R 4, Station 30+50. Downstream. November 29, 2022

PP-49: UT1, R 4, Station 31+20.
Upstream. November 29, 2022

PP-50: UT1, R 4, Station 32+50.
Upstream. November 29, 2022

PP-51: UT1, R 4, Station 33+10.
Upstream. November 29, 2022

PP-52: UT1, R 4, Station 34+30.
Upstream. November 29, 2022

PP-53: UT1, R 4, Station 35+00.
Upstream. November 29, 2022

PP-54: UT1, R 4, Station 35+60.
Upstream. November 29, 2022

PP-55: UT1, R 4, Station 36+15. Upstream. November 29, 2022

PP-56: UT1, R 4, Station 37+00. Upstream. November 29, 2022

PP-57: UT1, R 4, Station 37+50. Upstream. November 29, 2022

PP-58: UT1, R 4, Station 37+60. Downstream. End of Project. November 29, 2022

Monitoring Gauges and Overbank Photographs

Flow Gauge 1. UT3. (November 28, 2022)

Flow Gauge 2. UT2. (November 28, 2022)

Flow Gauge 3. UT4. (November 28, 2022)

Crest Gauge 1. UT3 (November 28, 2022)

Crest Gauge 2 UT1 R1. (November 28, 2022)

Crest Gauge 3 UT1 R4. (November 29, 2022)

APPENDIX C

Vegetation Plot Data

Table 7. Vegetation Plot Data
Ut to Rush Fork Mitigation Project - NCDMS Project No. 100068

Planted Acreage	7.3
Date of Initial Plant	2022-02-23
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	NA
Date of Current Survey	2022-11-09
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F		Veg Plot 2 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total
Species Included in Approved Mitigation Plan	Aesculus flava	yellow buckeye	Tree	FACU							1	1	1	1	1	1	
	Betula lenta	sweet birch	Tree	FACU			1	1			1	1	2	2	1	1	1
	Betula nigra	river birch	Tree	FACW	1	1	2	2	1	1	2	2	2	2	1	1	1
	Carpinus caroliniana	American hornbeam	Tree	FAC											1	1	
	Cephalanthus occidentalis	common buttonbush	Shrub	OBL					2	2							
	Cornus amomum	silky dogwood	Shrub	FACW			1	1	1	1	2	2					2
	Fraxinus americana	white ash	Tree	FACU	2	2	1	1					1	1			
	Fraxinus pennsylvanica	green ash	Tree	FACW	2	2											1
	Halesia carolina	Carolina silverbell	Tree	FAC					1	1					1	1	
	Ilex verticillata	common winterberry	Tree	FACW	1	1											
	Liriodendron tulipifera	tuliptree	Tree	FACU			1	1					3	3			
	Nyssa sylvatica	blackgum	Tree	FAC									1	1			
	Platanus occidentalis	American sycamore	Tree	FACW							3	3	1	1	2	2	3
	Quercus alba	white oak	Tree	FACU					2	2	1	1	2	2	2	2	
	Quercus falcata	southern red oak	Tree	FACU													1
	Quercus imbricaria	shingle oak	Tree	FAC	2	2	1	1	1	1							
	Sambucus canadensis	American black elderberry	Tree				1	1									
	Ulmus americana	American elm	Tree	FACW					1	1	1	1					
	Xanthorhiza simplicissima	yellowroot	Shrub	FACW									1	1			
Sum	Performance Standard				8	8	8	8	9	9	11	11	14	14	9	9	9
Mitigation Plan Performance Standard	Current Year Stem Count					8		8		9		11		14		9	9
	Stems/Acre					324		324		364		445		567		364	364
	Species Count					5		7		7		7		9		7	6
	Dominant Species Composition (%)					25		25		22		27		21		22	33
	Average Plot Height (ft.)					3		2		2		2		2		2	4
	% Invasives					0		0		0		0		0		0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					8		8		9		11		14		9	9
	Stems/Acre					324		324		364		445		567		364	364
	Species Count					5		7		7		7		9		7	6
	Dominant Species Composition (%)					25		25		22		27		21		22	33
	Average Plot Height (ft.)					3		2		2		2		2		2	4
	% Invasives					0		0		0		0		0		0	0

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

Table 7. Vegetation Plot Data
Ut to Rush Fork Mitigation Project - NCDMS Project No. 100068

Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	324		5	0	324		7	0	364		7	0
Monitoring Year 0	729		9	0	688		10	0	729		10	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	445		7	0	567		9	0	364		7	0
Monitoring Year 0	850		11	0	972		12	0	648		9	0
	Veg Plot Group 1 R											
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Overall Site Stem Density 393.142857							
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	364		6	0								
Monitoring Year 0	567		10	0								

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

APPENDIX D

Stream Geomorphology Data

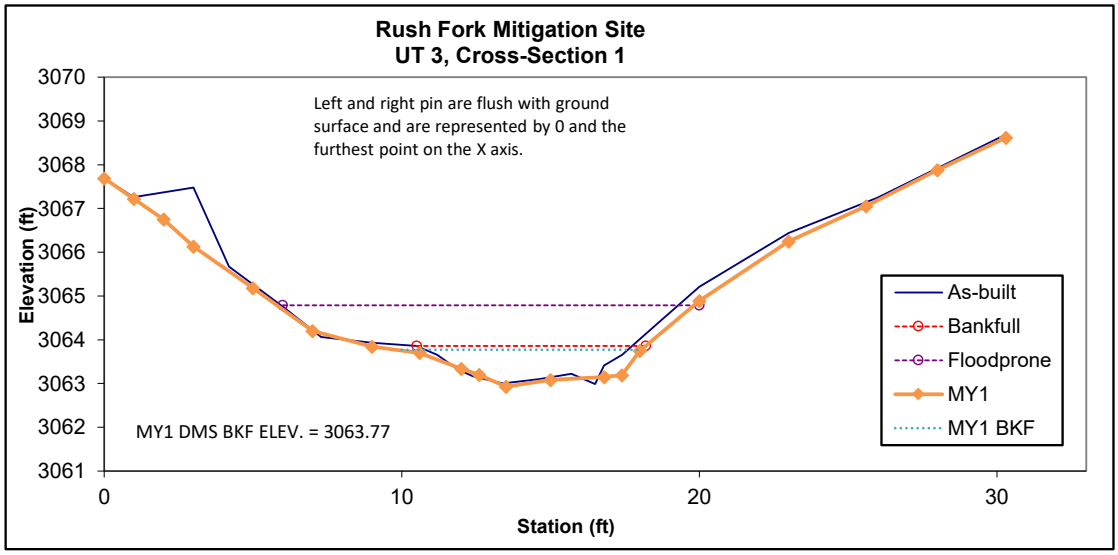
Permanent Cross-Section 1

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	4.96	9.19	0.5	0.9	17.0	1.1	1.6	3063.86	3063.86



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

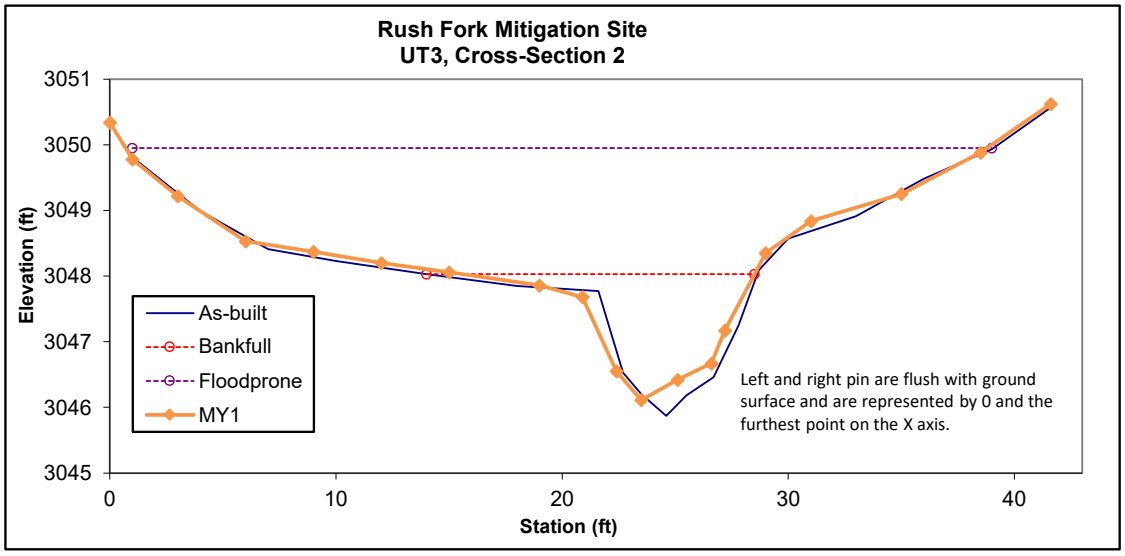
Permanent Cross-Section 2

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	C	10.36	13.51	0.77	1.92	17.55	--	--	3048.03	3048.03



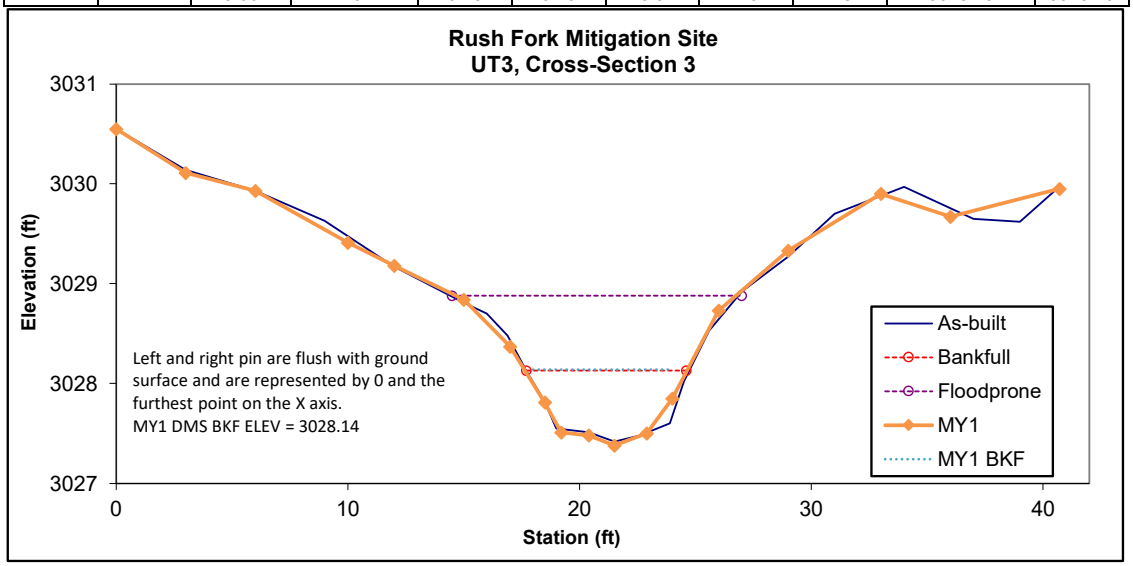
Permanent Cross-Section 3

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	3.66	7.64	0.48	0.75	15.92	1.0	1.8	3028.13	3028.13



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

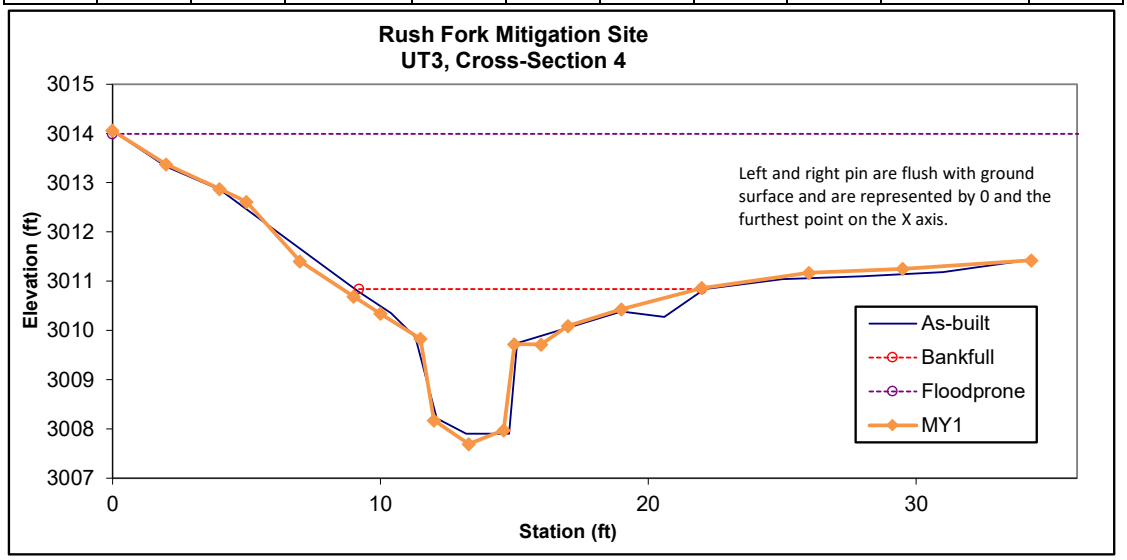
Permanent Cross-Section 4

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	E	14.74	13.42	1.1	3.15	12.2	--	--	3010.84	3010.84



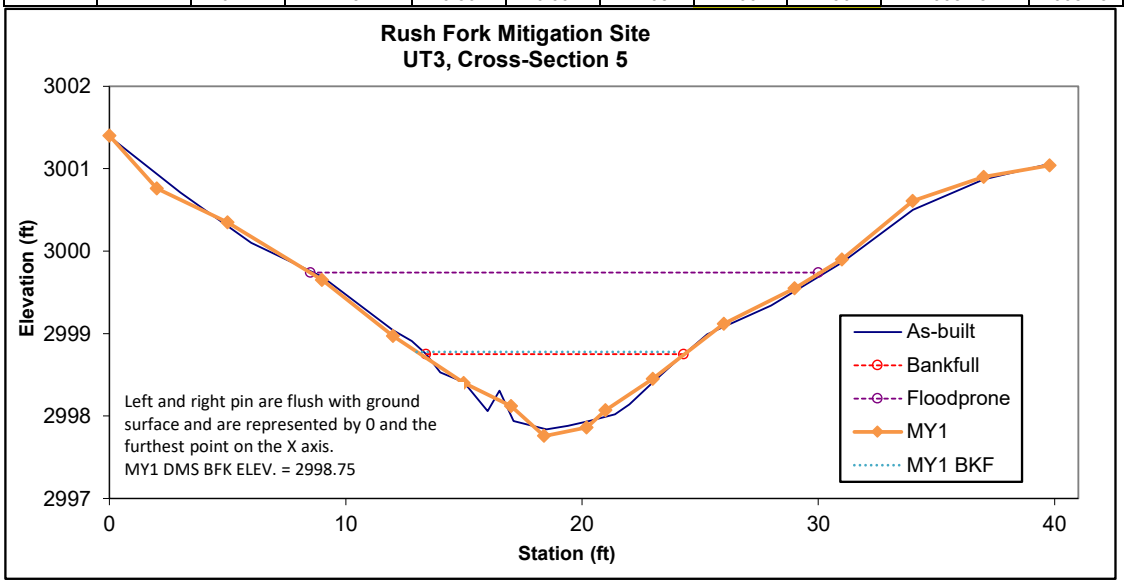
Permanent Cross-Section 5

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	6.14	12.34	0.50	0.99	24.68	1.00	1.90	2998.75	2998.75



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

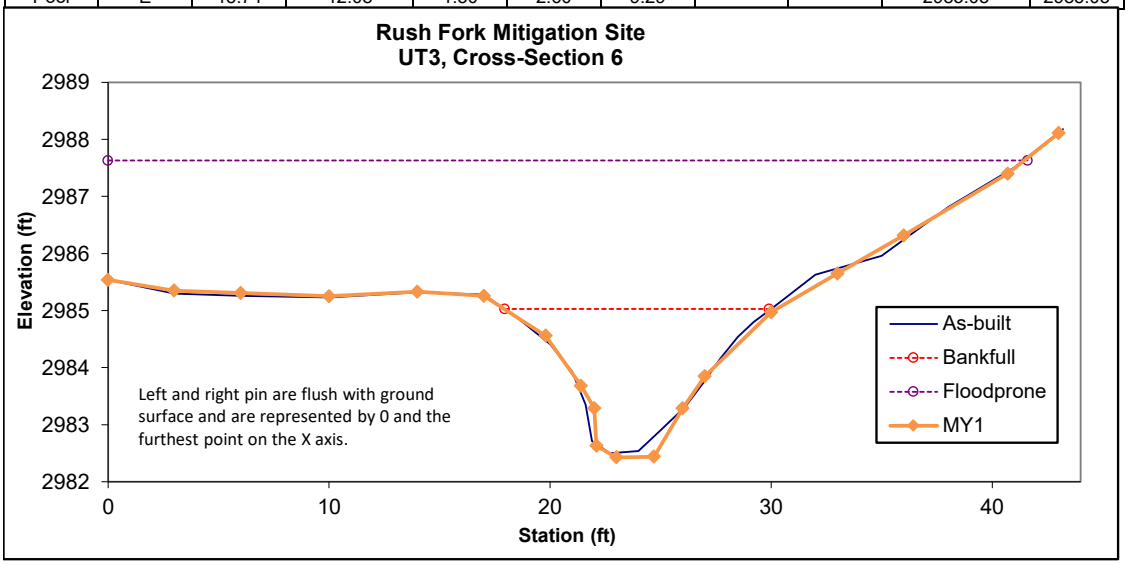
Permanent Cross-Section 6

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	E	15.74	12.08	1.30	2.60	9.29	--	--	2985.03	2985.03



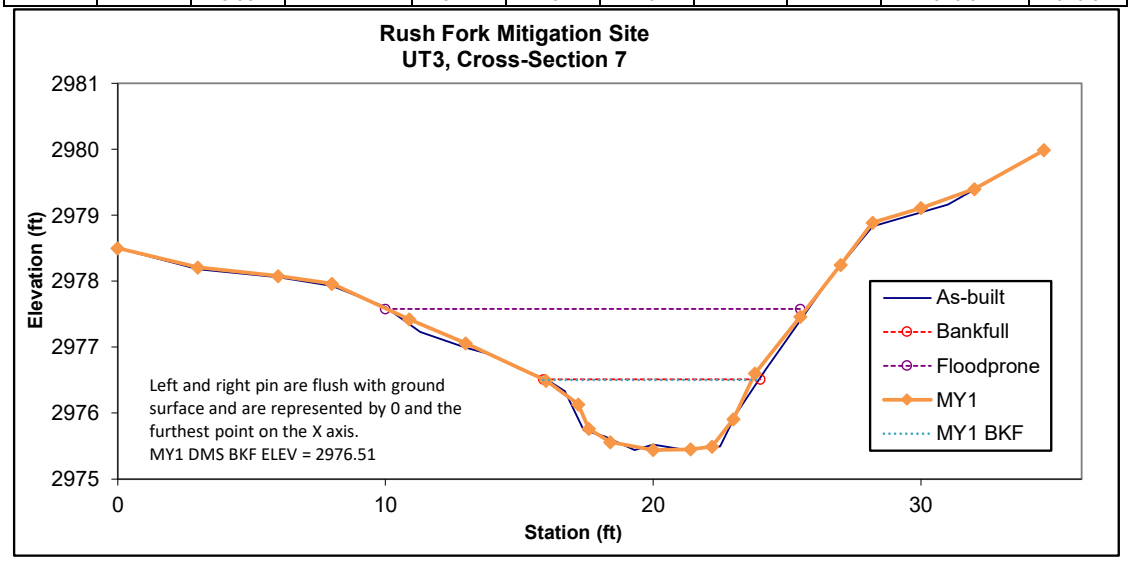
Permanent Cross-Section 7

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	5.93	7.7	0.77	1.07	10	1	2.1	2976.51	2976.51



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

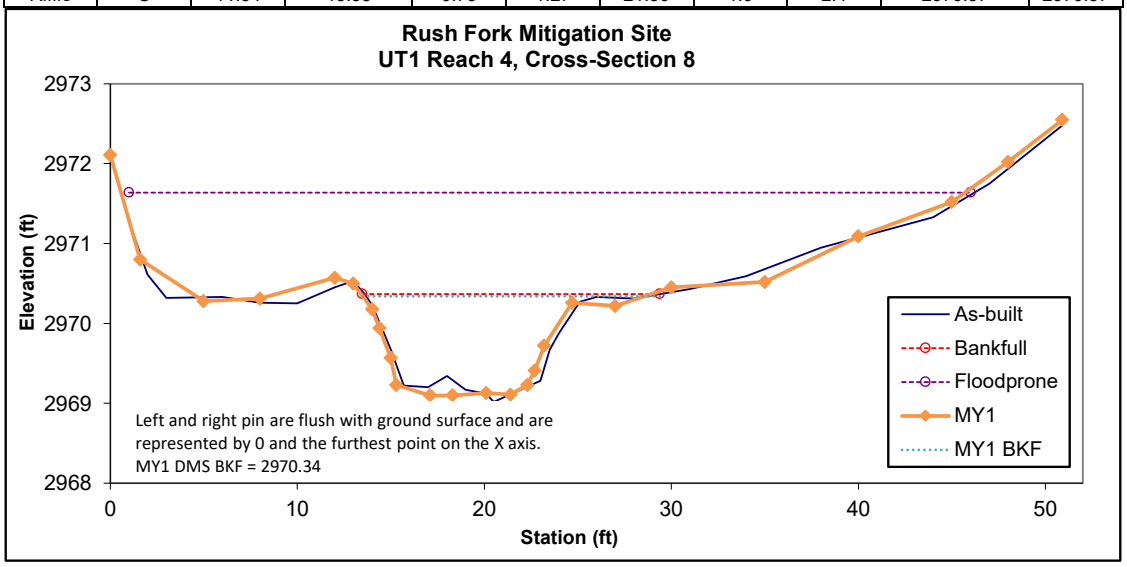
Permanent Cross-Section 8

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	11.34	15.55	0.73	1.27	21.30	1.0	2.4	2970.37	2970.37



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

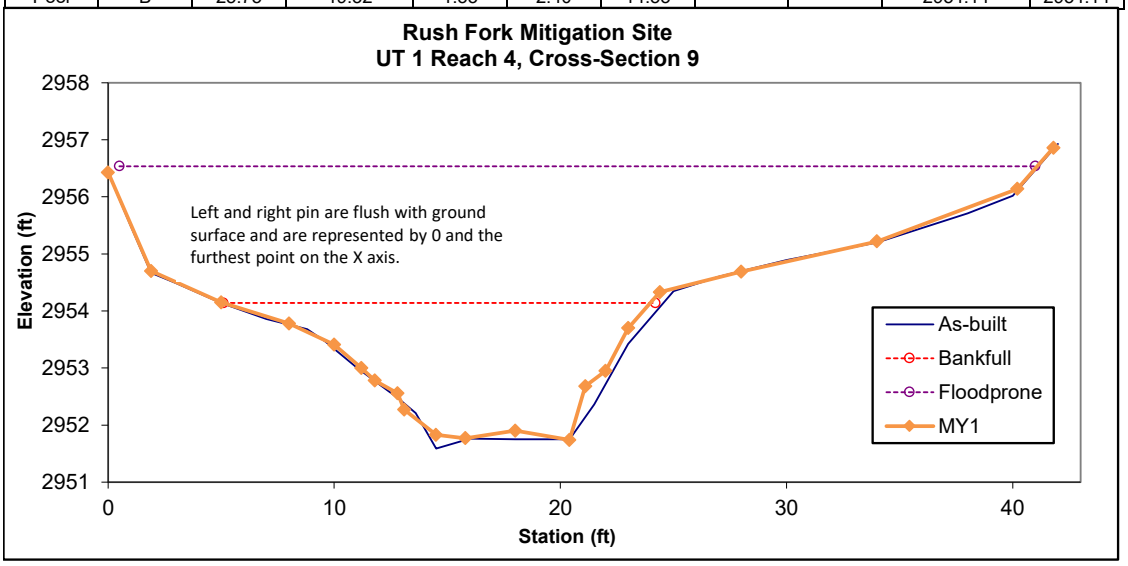
Permanent Cross-Section 9

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	B	25.75	19.32	1.33	2.40	14.53	--	--	2954.14	2954.14



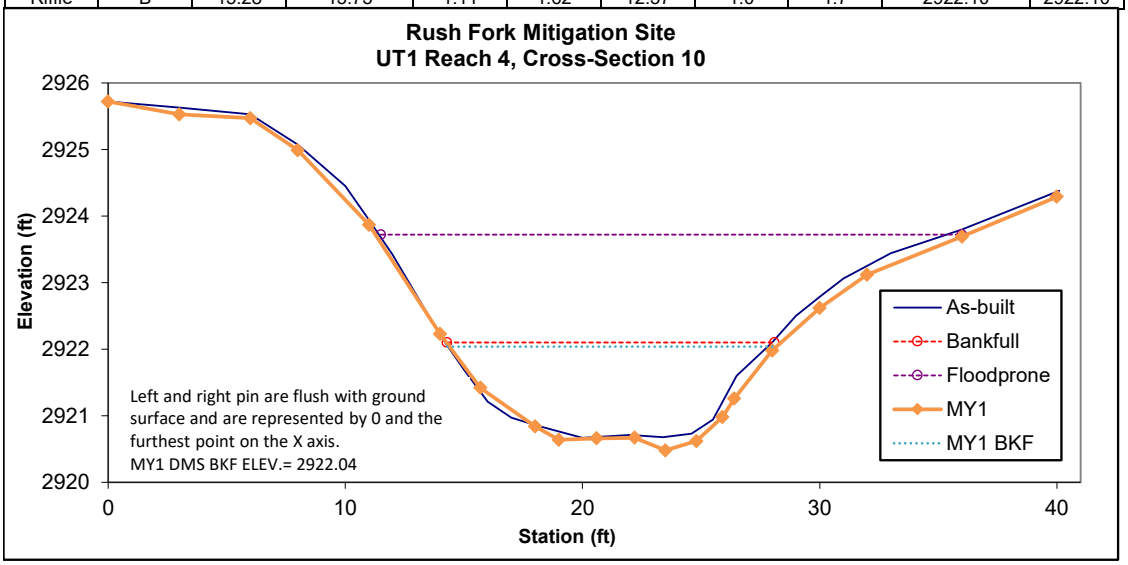
Permanent Cross-Section 10

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	15.28	13.73	1.11	1.62	12.37	1.0	1.7	2922.10	2922.10



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

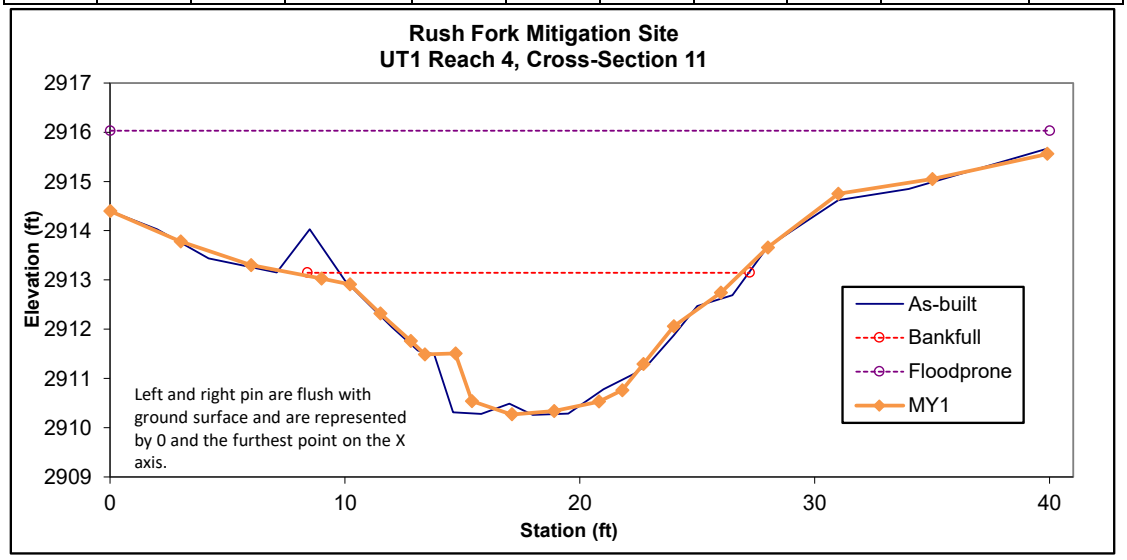
Permanent Cross-Section 11

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	E	30.05	20.89	1.44	2.88	14.51	--	--	2913.15	2913.15



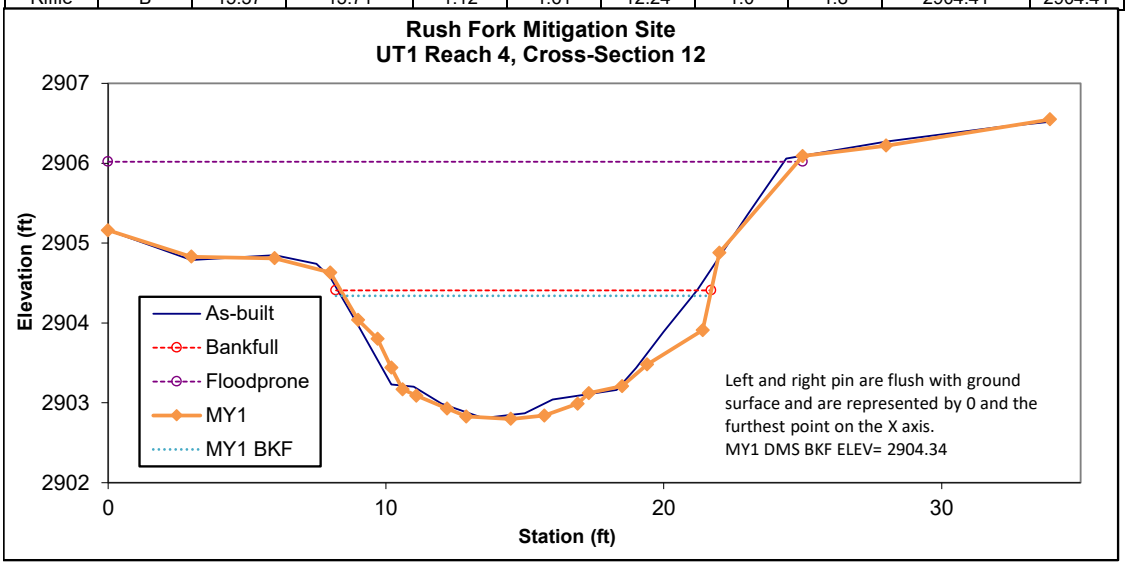
Permanent Cross-Section 12

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	15.37	13.71	1.12	1.61	12.24	1.0	1.8	2904.41	2904.41



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

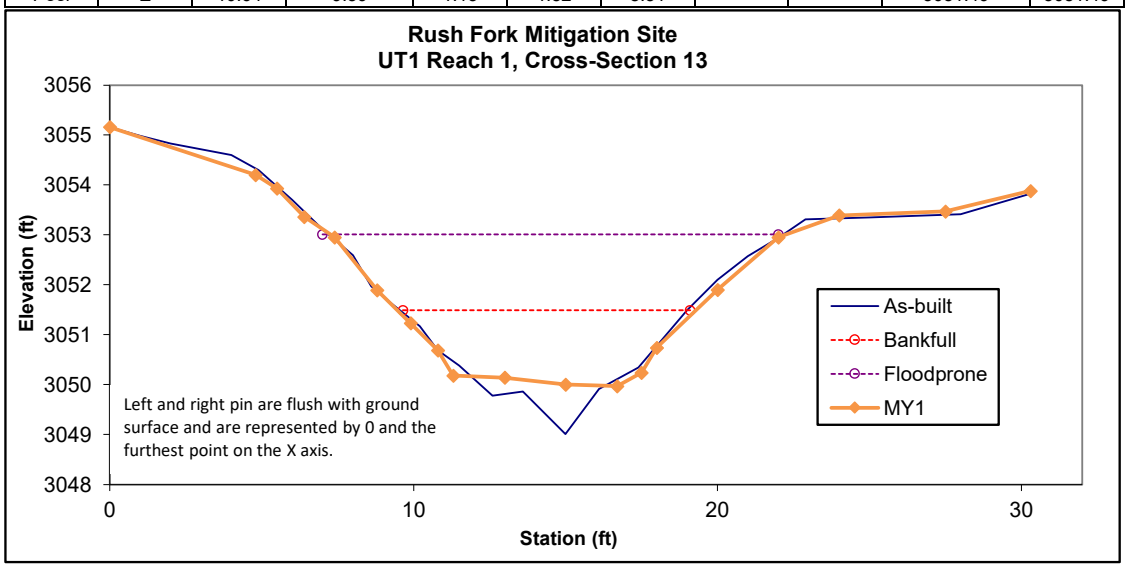
Permanent Cross-Section 13

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	E	10.64	9.39	1.13	1.52	8.31	--	--	3051.49	3051.49



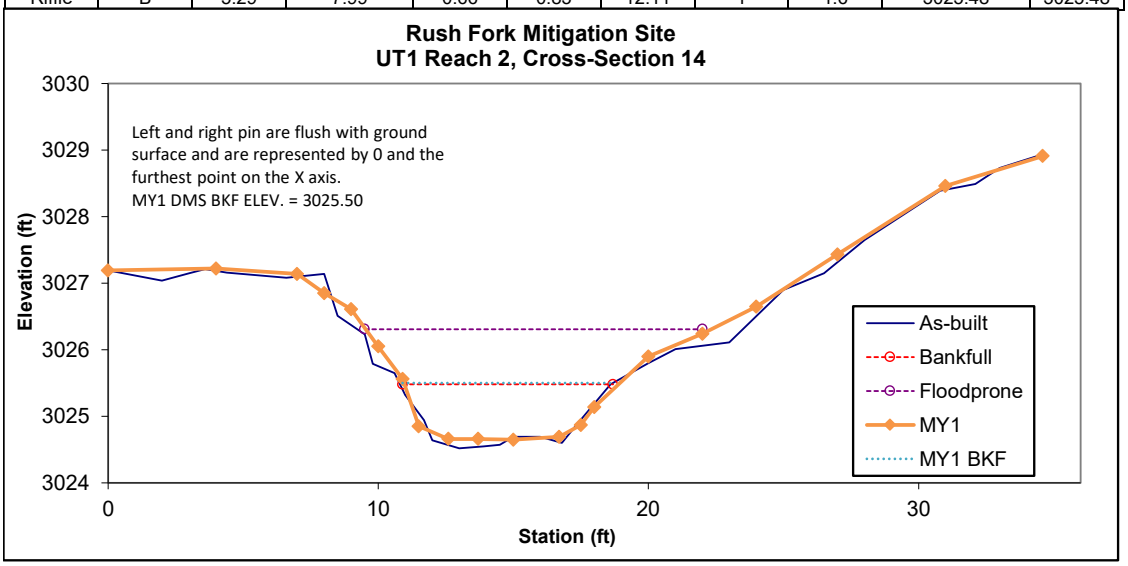
Permanent Cross-Section 14

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	5.29	7.99	0.66	0.83	12.11	1	1.6	3025.48	3025.48



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

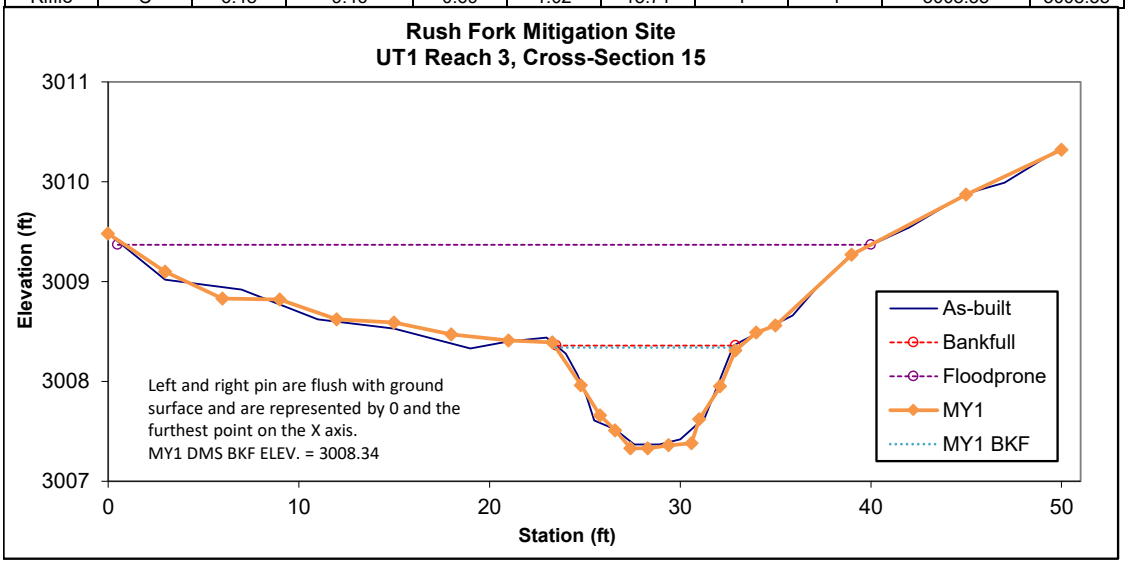
Permanent Cross-Section 15

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	6.48	9.46	0.69	1.02	13.71	1	4	3008.35	3008.35



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

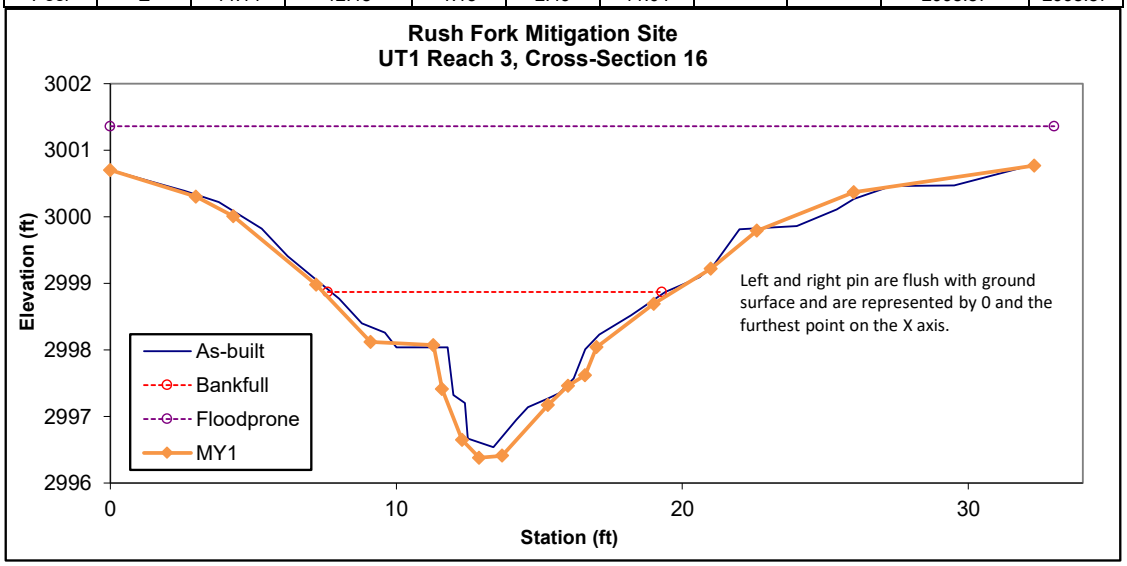
Permanent Cross-Section 16

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	E	14.14	12.48	1.13	2.49	11.04	--	--	2998.87	2998.87



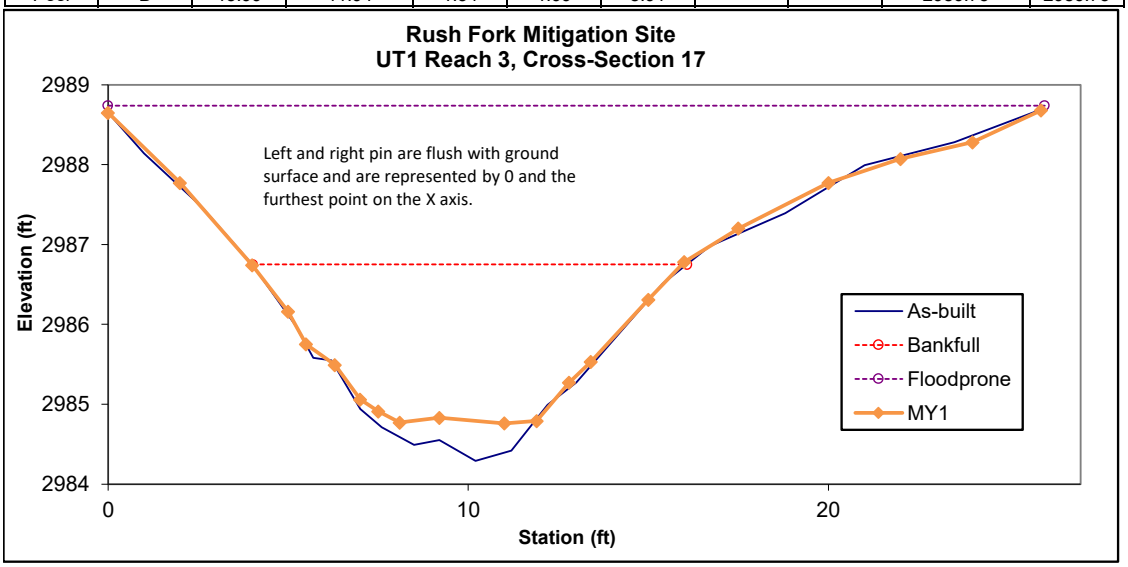
Permanent Cross-Section 17

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	B	15.99	11.94	1.34	1.99	8.91	--	--	2986.75	2986.75



Permanent Cross-Section 18

Year 1 Survey Collected: November 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	B	17.1	13.5	1.3	2.6	10.6	--	--	2976.03	2976.03

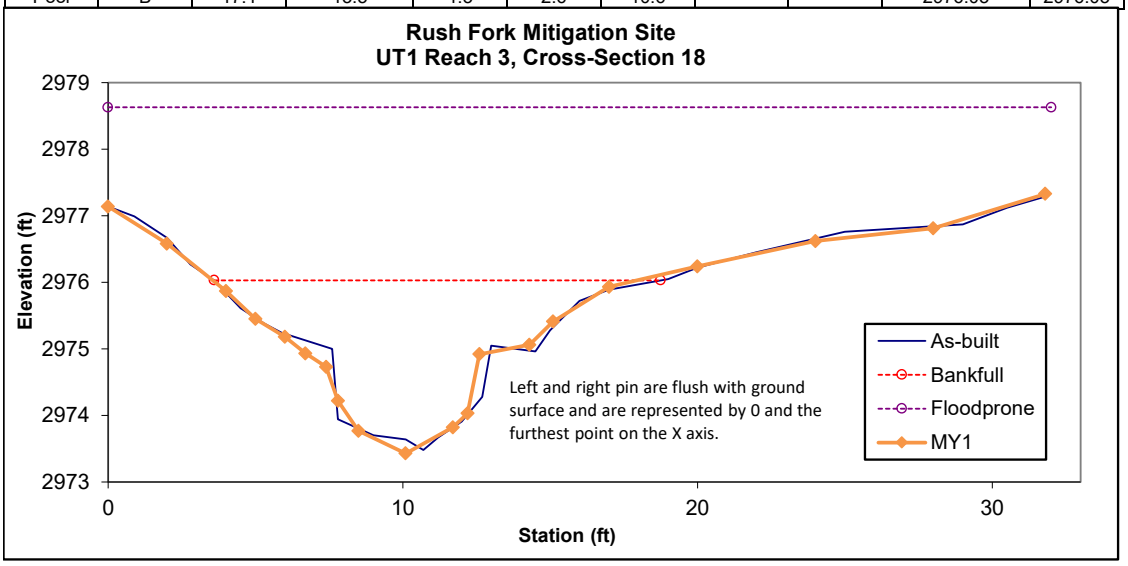


Table 8. Baseline Stream Data Summary

Rush Fork Stream Mitigation Project: DMS Project No ID. 100068

UT1 - Reach 1-3 (Enhancement)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	7.1000	9.65	-----	12.2000	9.90	11.39	-----	12.88	9.00	9.50	-----	10.00	7.79	9.28	9.28	10.76
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	15.09	27.03	15.09	38.96
BF Mean Depth (ft)	0.2700	0.58	-----	0.8900	0.55	0.86	-----	1.16	0.65	0.68	-----	0.70	0.59	0.65	0.65	0.70
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	0.80	0.90	-----	1.00	0.96	0.98	0.98	0.99
BF Cross-sectional Area (ft^2)	3.3300	4.85	-----	6.4	5.4	8.76	-----	12.1	5.9	6.45	-----	7.00	5.44	5.90	5.90	6.36
Width/Depth Ratio	7.9800	26.62	-----	45.2600	8.97	13.49	-----	18.00	13.80	14.05	-----	14.30	11.13	14.69	14.69	18.24
Entrenchment Ratio	1.1500	1.43	-----	1.7100	1.70	1.67	-----	1.63	1.40	-----	-----	2.20	1.94	2.78	2.78	3.62
Bank Height Ratio	1.0000	1.43	-----	1.8600	1.00	1.19	-----	1.38	1.10		-----	1.10	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.30	14.60	15.40	20.50
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-0.0950	-0.0680	-0.0630	-0.0400
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.00	9.50	10.00	14.00
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.00	42.10	35.00	240.00
Pool Max Depth (ft)	----	----	----	----	-----	-----	-----	-----	1.50	1.75	-----	2.00	2.33	2.46	2.47	2.55
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	168.14/256/80	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.21	-----	-----	0.15	0.32	-----	0.49	0.15	-----	-----	0.21	0.15	----	----	0.21
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	B4a	-----	-----		B4a - B4 - Ba	-----	-----	-----	B4a	-----	-----	----	B	----	----
BF Velocity (fps)	3.00	3.82	-----	4.64	3.42	5.11	-----	6.80	2.15	3.58	-----	5.00	----	----	----	----
BF Discharge (cfs)	10.00	19.75	-----	29.50	23.90	31.16	-----	38.41	12.60	14.95	-----	17.30	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	1,164	-----	-----	-----	-----	-----	-----	-----	1,093.30	-----	-----	----	1,082.27	----	----
Sinuosity	1.06	1.07	-----	1.07	1.02	1.08	-----	1.14	-----	1.05	-----	-----	----	----	----	----

Table 8. Baseline Stream Data Summary

Rush Fork Stream Mitigation Project: DMS Project No ID. 100068

UT1 - Reach 4 (Restoration)

Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	8.7300	11.07	-----	13.4000	9.90	11.39	-----	12.88	12.50	12.75	-----	13.00	12.93	14.21	13.36	15.90
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	21.96	30.86	24.30	46.32
BF Mean Depth (ft)	0.7300	1.01	-----	1.2800	0.55	0.86	-----	1.16	0.90	0.93	-----	0.95	0.69	0.71	0.87	1.11
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	1.20	1.25	-----	1.30	1.35	1.46	1.43	1.60
BF Cross-sectional Area (ft^2)	9.8600	10.48	-----	11.1	5.4	8.76	-----	12.1	11.3	11.70	-----	12.10	11.01	13.27	14.33	14.48
Width/Depth Ratio	6.8200	12.59	-----	18.3600	8.97	13.49	-----	18.00	12.00	15.00	-----	18.00	11.65	15.94	13.13	13.13
Entrenchment Ratio	1.4800	2.45	-----	3.4200	1.70	1.67	-----	1.63	1.40	1.80	-----	2.20	1.59	2.13	1.88	1.88
Bank Height Ratio	1.0000	1.31	-----	1.6200	1.00	1.19	-----	1.38	1.00	----	-----	1.62	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12.30	19.30	17.70	19.30
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	----	-0.5800	-0.0220	-0.0377	-0.0790
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	----	2.00	13.40	14.00	22.00
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	----	-----	-----	----	18.00	44.80	40.00	117.00
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.50	-----	-----	2.55	2.72	2.72	2.89
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	156/180/100.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.48	-----	-----	0.15	0.32	-----	0.49			-----		----	----		----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	B4	-----	-----		B4a - B4 - Ba	-----	-----	-----	B4	-----	-----	----	B4	----	----
BF Velocity (fps)	3.17	3.61	-----	4.04	3.42	5.11	-----	6.80	4.00	5.00	-----	6.00	----	----	----	----
BF Discharge (cfs)	31.24	38.03	-----	44.81	23.90	-----	-----	38.41	37.88	38.13	-----	38.37	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	1,300.00	-----	-----	-----	-----	-----	-----	-----	1,216.33	-----	-----	----	1,224.37	----	----
Sinuosity	1.08	1.11	-----	1.14	1.02	1.08	-----	1.14	1.10	1.15	-----	1.20	----	----	----	----

Table 8. Baseline Stream Data Summary

Rush Fork Stream Mitigation Project: DMS Project No ID. 100068

UT3 - Restoration

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	6.58	-----	-----	9.90	11.39	-----	12.88	7.50	8.00	-----	8.50	7.04	8.29	7.60	10.92
Floodprone Width (ft)	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11.96	15.37	14.41	20.71
BF Mean Depth (ft)	-----	0.82	-----	-----	0.55	0.86	-----	1.16	0.57	0.61	-----	0.65	0.52	0.61	0.58	0.77
BF Max Depth (ft)	-----		-----	-----	-----	-----	-----	-----	0.70	0.78	-----	0.85	0.71	0.89	0.89	1.07
BF Cross-sectional Area (ft^2)	-----	5.4	-----	-----	5.4	8.76	-----	12.1	4.6	5.30	-----	6.00	3.64	5.05	5.16	6.23
Width/Depth Ratio	-----	8.02	-----	-----	8.97	13.49	-----	18.00	-----	13.10	-----	-----	10.32	13.88	13.02	19.16
Entrenchment Ratio	-----	2.17	-----	-----	1.70	1.67	-----	1.63	1.40	1.80	-----	2.20	1.70	1.85	1.86	1.97
Bank Height Ratio	-----	1.83	-----	-----	1.00	1.19	-----	1.38	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	-----	N/A	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.20	18.70	16.90	37.20
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-0.1400	-0.0660	-0.0649	-0.0330
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.00	5.70	6.00	12.00
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.00	37.00	34.00	70.00
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	1.70	1.75	-----	1.80	2.16	2.54	2.53	2.94
Substrate and Transport Parameters																
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.15	-----	-----	0.15	0.32	-----	0.49	-----	0.15	-----	-----	----	0.15	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	Ba	-----	-----		B4a - B4 - Ba	-----	-----	-----	Ba	-----	-----	----	B4	----	----
BF Velocity (fps)	-----	3.48	-----	-----	3.42	5.11	-----	6.80	4.42	4.71	-----	5.00	----	----	----	----
BF Discharge (cfs)	-----	18.8	-----	-----	23.90	31.16	-----	38.41	19.00	24.50	-----	30.00	----	----	----	----
Valley Length	-----	1,541	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	1,618	-----	-----	-----	-----	-----	-----	-----	1,584.45	-----	-----	----	1,577.53	----	----
Sinuosity	-----	1.05	-----	-----	1.02	1.08	-----	1.14	-----	1.02	-----	-----	----	----	----	----

Table 9. Cross-Section Morphology Data Summary
UT to Rush Fork Restoration Project: DMS Project No ID. 100068

Stream Reach	UT3																												
	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (Riffle)							Cross-section X-4 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																													
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	3063.86	3063.77						3048.03	3048.03						3028.13	3028.14						3010.84	3010.84					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.1						1.00	1.00						1.00	1.00						1.00	1.00					
Thalweg Elevation	3062.99	3062.93						3045.87	3046.11						3027.42	3027.38						3007.90	3007.69					
LTOB[2] Elevation	3063.86	3063.86						3048.03	3048.03						3028.13	3028.13						3010.84	3010.84					
LTOB[2] Max Depth (ft)	0.87	0.90						2.16	1.92						0.71	0.75						2.94	3.15					
LTOB[2] Cross Sectional Area (ft²)	4.20	4.96						11.12	10.36						3.64	3.66						15.11	14.74					

Stream Reach	UT3														UT 1 Reach 4														
	Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)							Cross-section X-7 (Riffle)							Cross-section X-8 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																													
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2998.75	2998.78						2985.03	2985.03						2976.51	2976.50						2970.37	2970.34					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.00						1.00	1.00						1.00	1.00						1.00	1.00					
Thalweg Elevation	2997.84	2997.76						2982.50	2982.43						2975.44	2975.44						2969.02	2969.10					
LTOB[2] Elevation	2998.75	2998.75						2985.03	2985.03						2976.51	2976.51						2970.37	2970.37					
LTOB[2] Max Depth (ft)	0.91	0.99						2.53	2.60						1.07	1.07						1.35	1.27					
LTOB[2] Cross Sectional Area (ft²)	6.23	6.14						15.51	15.74						6.11	5.93						11.01	11.34					

Stream Reach	UT1 Reach 4																												
	Cross-section X-9 (Pool)							Cross-section X-10 (Riffle)							Cross-section X-11 (Pool)							Cross-section X-12 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																													
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2954.14	2954.14						2922.10	2922.01						2913.15	2913.15						2904.41	2904.34					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.00						1.00	1.00						1.00	1.00						1.00	1.00					
Thalweg Elevation	2951.59	2951.74						2920.67	2920.48						2910.26	2910.27						2902.81	2902.80					
LTOB[2] Elevation	2954.14	2954.14						2922.10	2922.10						2913.15	2913.15						2904.41	2904.41					
LTOB[2] Max Depth (ft)	2.55	2.40						1.43	1.62						2.89	2.88						1.60	1.61					
LTOB[2] Cross Sectional Area (ft²)	27.56	25.75						14.50	15.28						31.24	30.05						14.33	15.37					

Table 9. Cross-Section Morphology Data Summary
UT to Rush Fork Restoration Project: DMS Project No ID. 100068

Stream Reach	UT1 Reach 1							UT1 Reach 2							UT1 Reach 3														
	Cross-section X-13 (Pool)							Cross-section X-14 (Riffle)							Cross-section X-15 (Riffle)							Cross-section X-16 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																													
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	3051.49	3051.49						3025.48	3025.50						3008.35	3008.34						2998.87	2998.87					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.00						1.00	1.00						1.00	1.00						1.00	1.00					
Thalweg Elevation	3049.01	3049.97						3024.52	3024.65						3007.37	3007.33						2996.54	2996.38					
LTOB[2] Elevation	3051.49	3051.49						3025.48	3025.48						3008.35	3008.35						2998.87	2998.87					
LTOB[2] Max Depth (ft)	2.48	1.52						0.96	0.83						0.98	1.02						2.33	2.49					
LTOB[2] Cross Sectional Area (ft²)	12.13	10.64						5.44	5.29						6.36	6.48						12.06	14.14					

Stream Reach	UT1 Reach 3													
	Cross-section X-17 (Pool)							Cross-section X-18 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation														
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	2986.75	2986.75						2976.03	2976.03					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.00						1.00	1.00					
Thalweg Elevation	2984.29	2984.76						2973.48	2973.43					
LTOB[2] Elevation	2986.75	2986.75						2976.03	2976.03					
LTOB[2] Max Depth (ft)	2.46	1.99						2.55	2.60					
LTOB[2] Cross Sectional Area (ft²)	17.60	15.99						17.29	17.10					

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

1 - **Bank Height Ratio (BHR)** takes the As-built bankfull area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.

2 - **LTOB Area and Max depth** - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

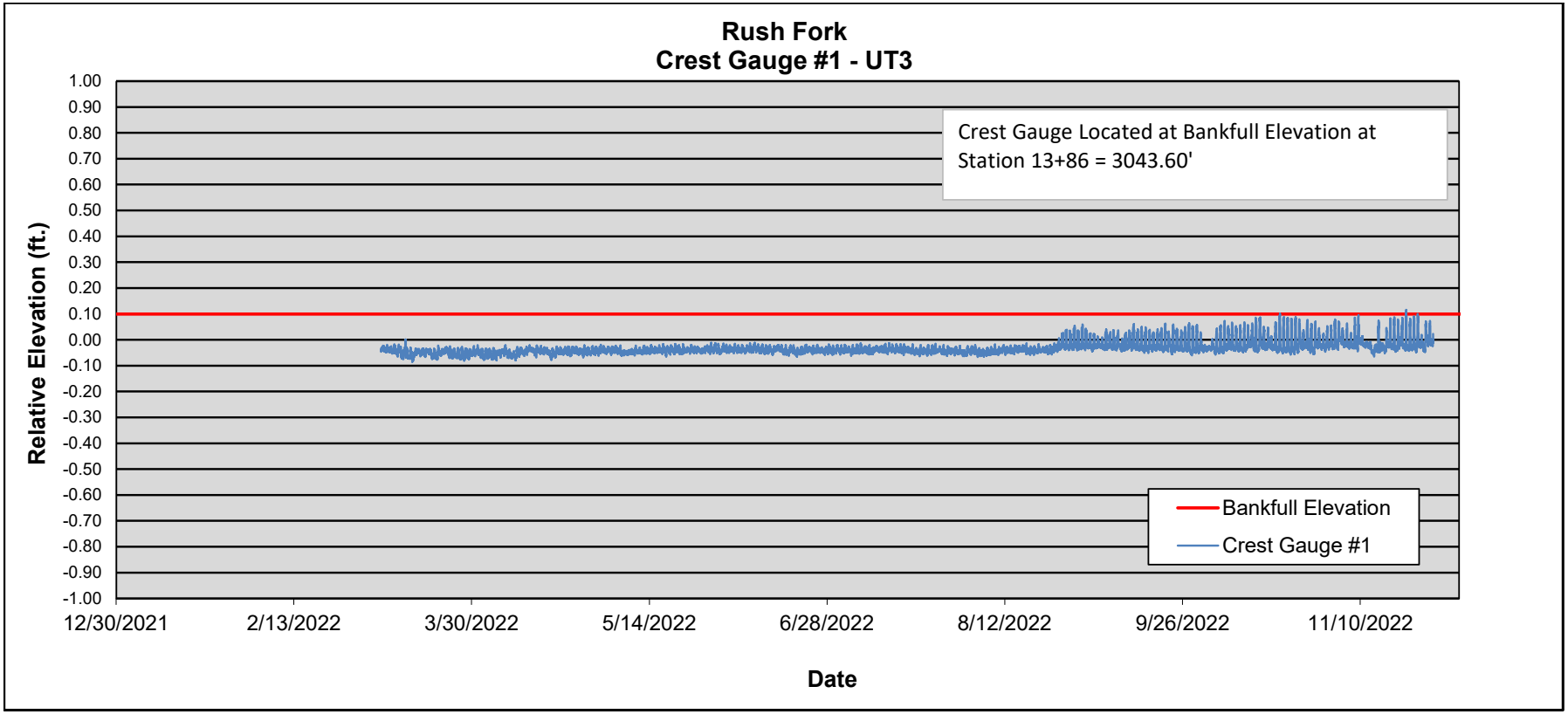
APPENDIX E

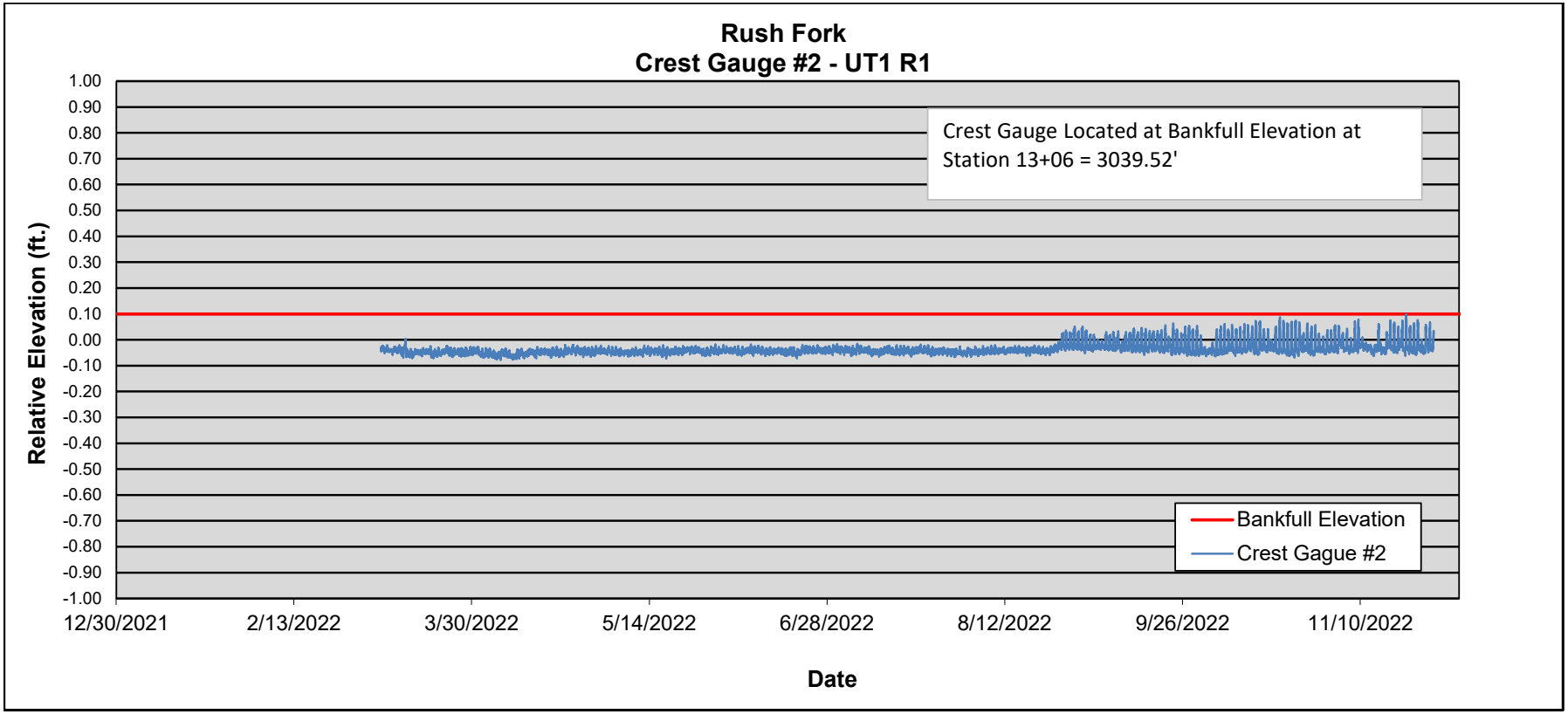
Hydrologic Data

Table 10. Verification of Bankfull Events
UT to Rush Fork Stream Mitigation Project - NCDMS Project No. 100068

Date of Data Collection	UT3 Crest Gauge #1	UT1 R1 Crest Gauge #2	UT1 R4 Crest Gauge #3	Date of Bankfull Event Occurrence	Method of Data Collection
Year 1 Monitoring (2022)					
11/29/2022	NA	NA	NA	NA	Continuous Stage Recorder

Note: Crest gauge readings were corroborated with associated spikes in the automated Continuous Stage Recorder (see graph in Appendix E) and/or with photographs (Appendix B).


Rush Fork
Crest Gauge #1 - UT3
Relative Elevation (ft.)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
12/30/2021
2/13/2022
3/30/2022
5/14/2022
6/28/2022
8/12/2022
9/26/2022
11/10/2022
Date
Crest Gauge Located at Bankfull Elevation at Station 13+86 = 3043.60'
Bankfull Elevation
Crest Gauge #1


Rush Fork
Crest Gauge #2 - UT1 R1
Relative Elevation (ft.)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
12/30/2021
2/13/2022
3/30/2022
5/14/2022
6/28/2022
8/12/2022
9/26/2022
11/10/2022
Date
Crest Gauge Located at Bankfull Elevation at Station 13+06 = 3039.52'
Bankfull Elevation
Crest Gague #2

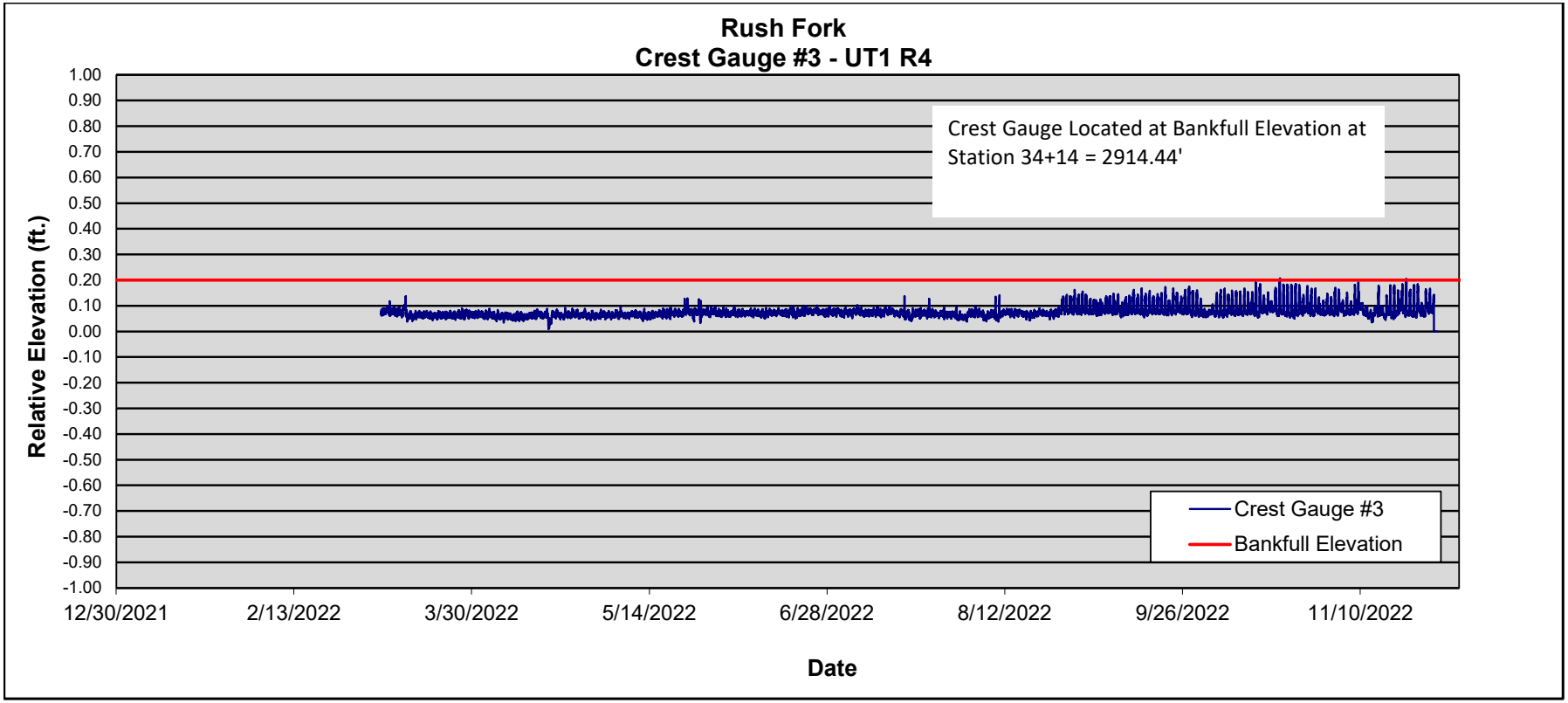
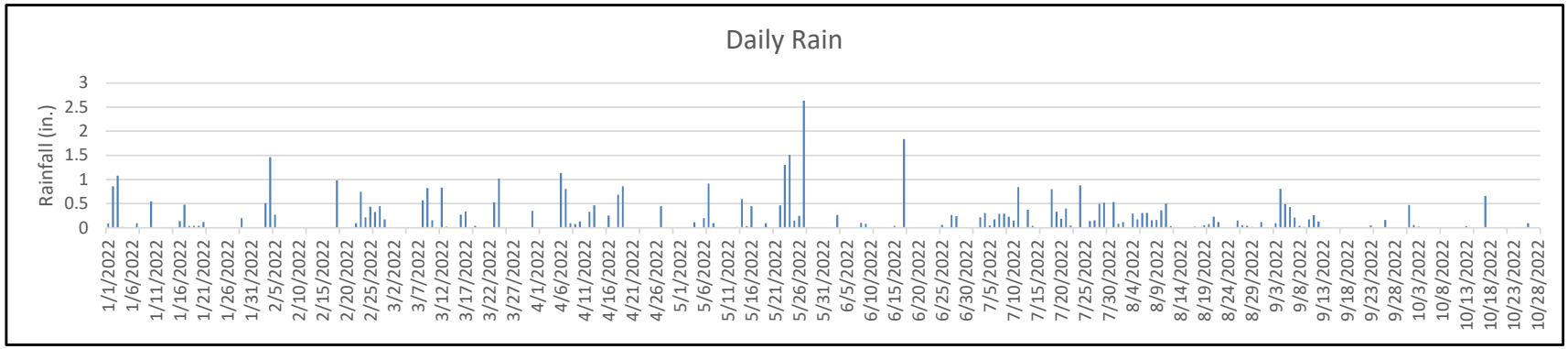
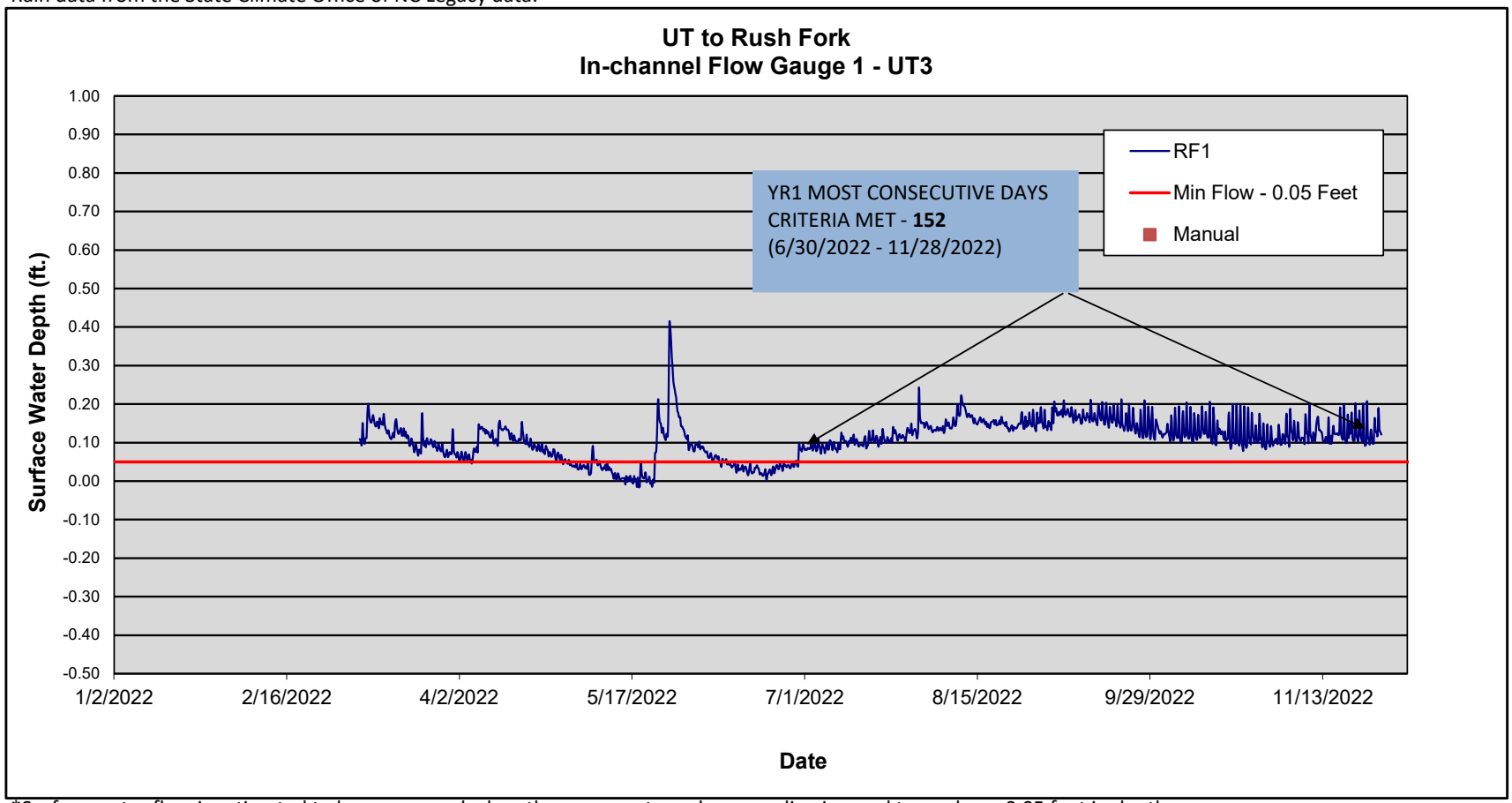

Rush Fork
Crest Gauge #3 - UT1 R4
Crest Gauge Located at Bankfull Elevation at Station 34+14 = 2914.44'
Relative Elevation (ft.)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
-0.60
-0.70
-0.80
-0.90
-1.00
12/30/2021
2/13/2022
3/30/2022
5/14/2022
6/28/2022
8/12/2022
9/26/2022
11/10/2022
Date
Crest Gauge #3
Bankfull Elevation

Figure 5 Flow Gauge Graphs

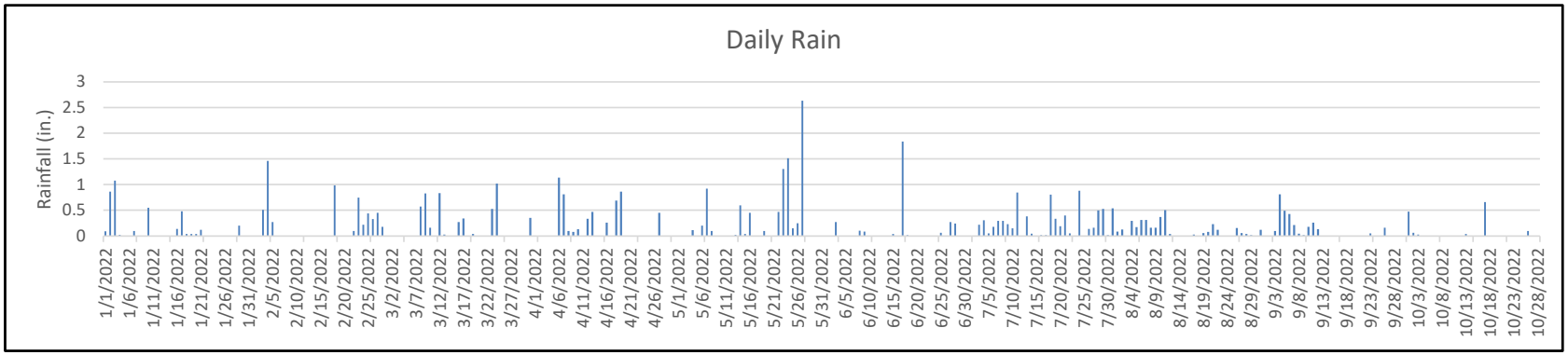


Rain data from the State Climate Office of NC Legacy data.

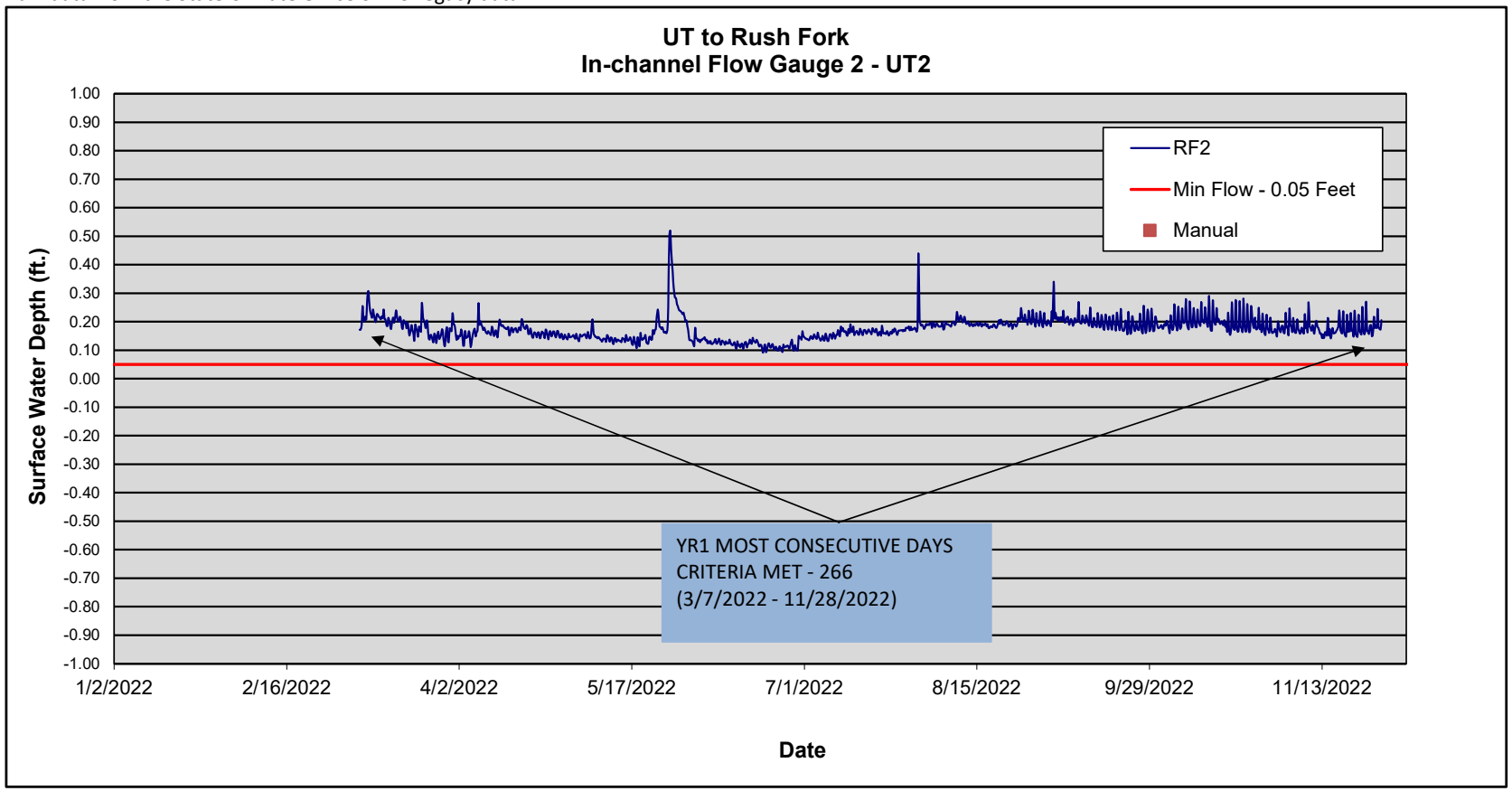


*Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 5 Flow Gauge Graphs

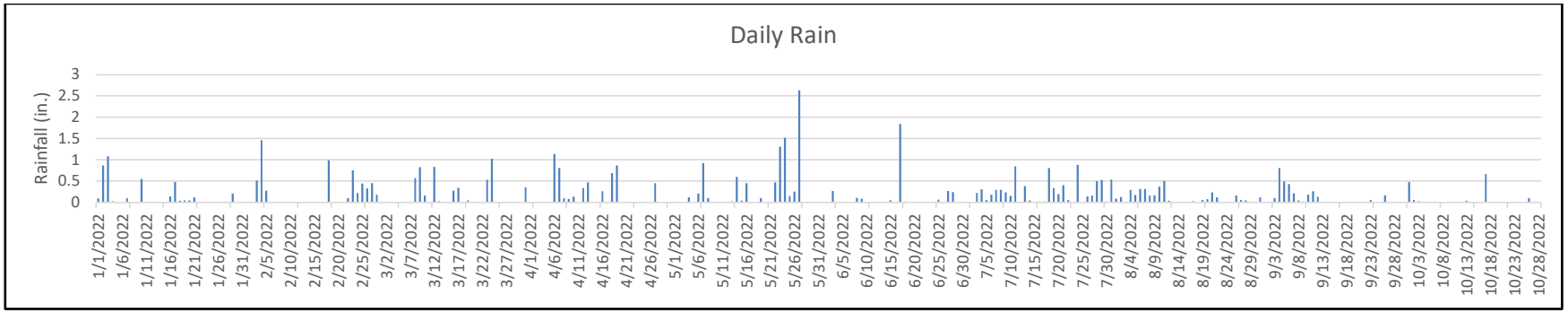


Rain data from the State Climate Office of NC Legacy data.

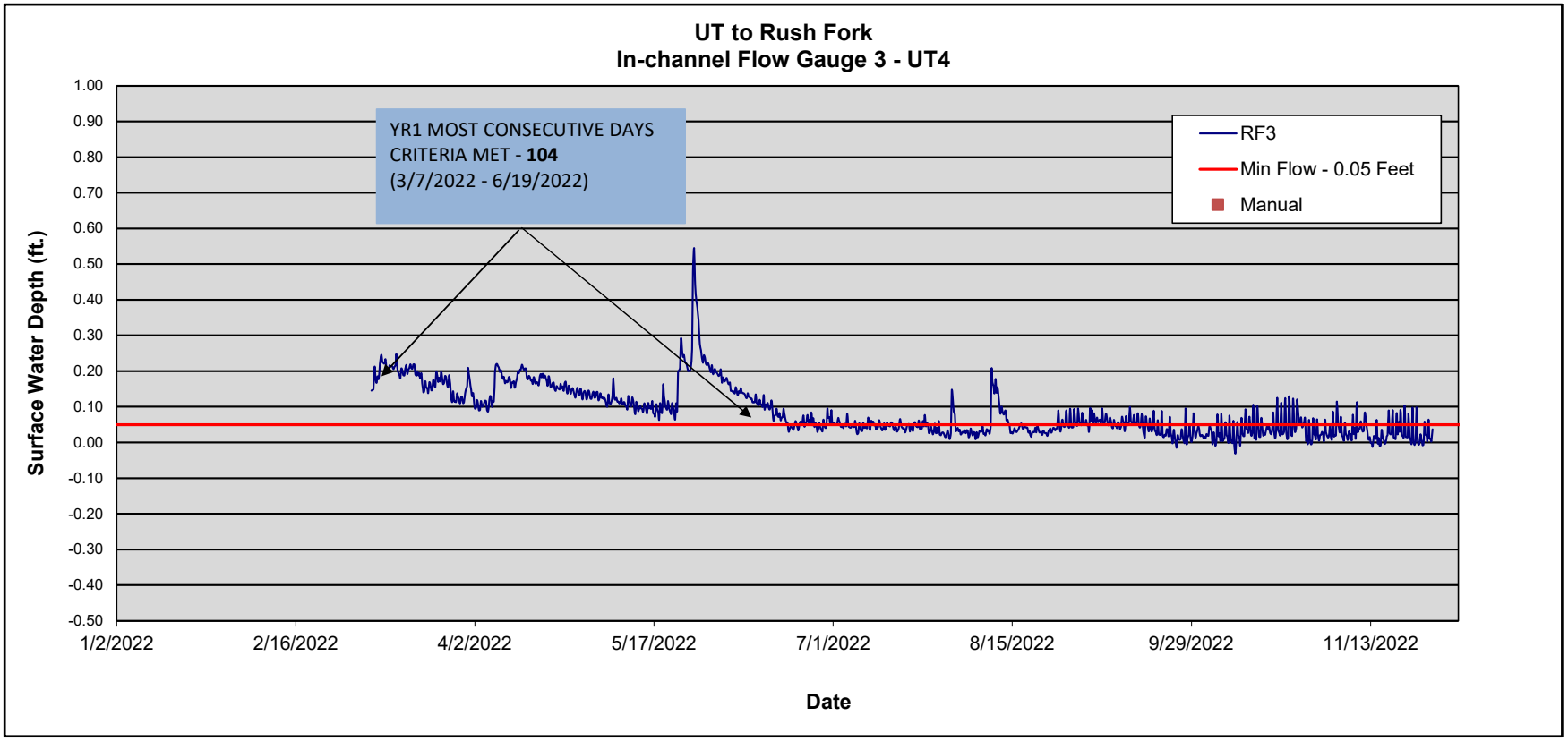


*Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 5 Flow Gauge Graphs



Rain data from the State Climate Office of NC Legacy data.



*Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 6. Observed Rainfall Versus Historic Averages

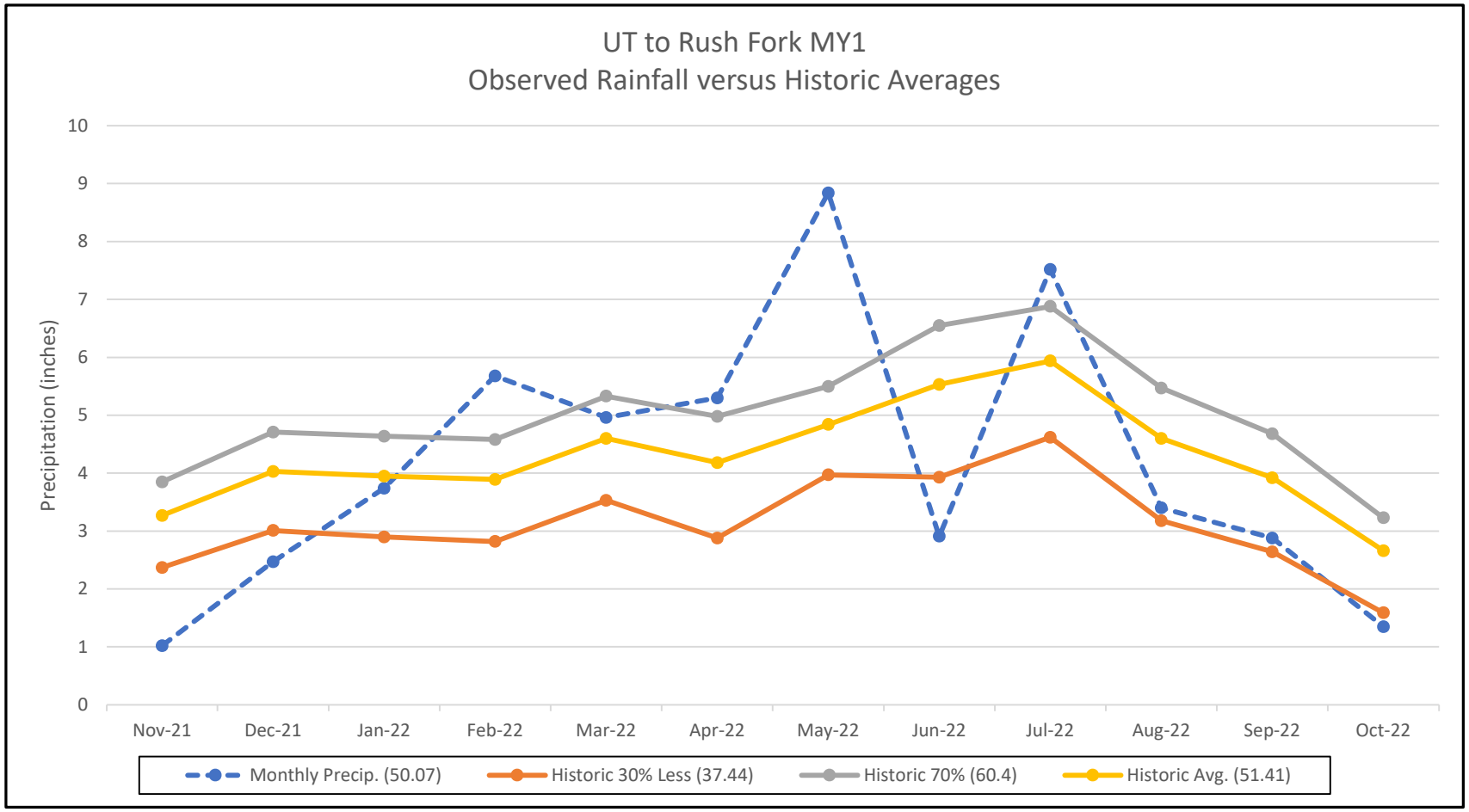


Table 11. All Years Flow Gauge Success
UT to Rush Fork Stream Restoration Project: DMS Project ID No. 100068

Flow Gauge ID	Most Consecutive Days Meeting Criteria[1]							Cumulative Days Meeting Criteria[2]						
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)
Flow Gauges (Installed March, 2022)														
RF1	152.0							219.0						
RF2	266.0							266.0						
RF3	104.0							116.0						

Notes:

[1]Indicates the number of consecutive days within the monitoring year where flow was measured.

[2]Indicates the number of cumulative days within the monitoring year where flow was measured.

Success criteria will include 30 days of consecutive baseflow for monitoring gauges during a normal rainfall year.

Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

APPENDIX F

IRT Comments

Michael Baker
INTERNATIONAL

We Make a Difference

October 27, 2022

Subject: Response to IRT Comments (October 11, 2022) for Notice of Initial Credit Release/ NCDMS UT to Rush Fork/ SAW-2018-01171/Haywood County

Please find below our responses to the IRT) review comments October 11, 2022 in reference to the Rush Fork Stream Mitigation Project's As-Built Baseline Monitoring Report.

The 15-Day As-Built/MY0 review for the UT to Rush Fork Mitigation Site (SAW-2018-01171) ended September 21, 2022. Per Section 332.8(o)(9) of the 2008 Mitigation Rule, this review followed the streamlined review process. All comments received from the NCIRT are incorporated in the email below. There were no objections to issuing the initial 30% credit release of 1,060.076 cold stream mitigation units. Please find attached the current signed ledger. No site visit is requested at this time.

Todd Bowers, USEPA:
Overall, the Site looks great, appears to be performing as intended, and is on track to meet stream and vegetation success criteria. All red-line deviations of the vegetation planting and site construction plans (structure mods, fencing gates and substitute species) were all minor in nature and noted.

The following items or highlights from the As-Built Condition Assessment were noted:

1. There appears to be a minor error in stream photos with Photo 47 differing from the location noted on Figure 3c.
   Response: This discrepancy has been noted and will be corrected in the MY1 Report.
2. Planted species substitutions are suitable with only a very minor reduction in site diversity.

Overall, I am very satisfied with the report and the work that Baker has completed at the site. Having not been able to visit this location, I really appreciated the detailed ground-level stream feature photos to illustrate the grading, planting, monitoring equipment and features implemented. I recommend the appropriate credit release (Milestone 2) for cold stream mitigation units for this monitoring milestone. I have no other substantial comments not requesting a site visit at this time.

Erin Davis, NCDWR:
1. DWR appreciated all of DMS' comments and Baker's responses.

2. Regarding the BMP partially located outside of the easement, DWR's preference would be to have the entire BMP within the easement, and we would support an easement modification request to capture the feature within the project area. However, we do acknowledge that the

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final mitigation plan figures do show the BMP extending beyond the easement line and are glad that the feature perimeter is fenced. If the situation remains as-is, we recommend clear CE boundary signage and early communication between Stewardship and landowner on long-term maintenance and fencing.

Response: Clear CE signage is posted on the perimeter fence surrounding the BMP. This will be discussed with Stewardship and the landowner.

3. Redline Sheet 4 appears to show the UT2 culvert pipe and riprap extending into the easement. I'm not sure if this is the same area DMS referenced in their comments. If not, please discuss a proposed resolution.

Response: This feature is the same area referenced by DMS in their comments. The boulder tail-wall which extended into the easement a few inches has been realigned so it is completely outside of the easement area.

4. Photo Point 23 – Please confirm the culvert upstream of UT4 was properly embedded as per the 401 water quality certification.

Response: The culvert upstream of UT4 is properly embedded per the 401 water quality certification.

5. DWR appreciated the planted species diversity and good report photos.

Dave McHenry, NCWRC:

Please provide some history on the culvert under NC 209 (UT 1 Sta 28+90) with the "plunge pool" detail. It was not backwatered, and not designed to, even though the culvert bisects the site. The grades were raised/set above the inverts on the culverts that were installed elsewhere. I realize the 100-200-foot reach below NC 209 is outside of the CE possibly because of concerns about possible chronic influence of the culvert and likely future road maintenance. And, the culvert is about 3%.

Response: The culvert referenced is an existing culvert under NC 209 and is outside of the conservation easement. There was a 1.5' drop at the end of this culvert. This culvert is approximately 200 feet upstream of the established conservation easement below NC 209. There was significant drop and instability over these 200 feet and while it generated no credit, we felt that it required stabilization. We installed 5 boulder structures and did restoration level work through this reach. This reach was not included in the easement due to the road and overhead utility right-of-way extending into the stream buffer zone. The easement began where there was no longer an overlap. Given that the NC 209 culvert is outside of our easement and is NCDOT's infrastructure, we did not want to take any action that could be interpreted as affecting its function, so backing water into the culvert was not considered. We did want to raise the water level to the pipe invert and eliminate the drop which likely blocked aquatic species passage. This was done by setting the downstream riffle elevation at 0.08 feet (< 1 inch) below the outlet of the culvert. We believe that this will allow passage of species into

the pipe; however, passage through the pipe is still doubtful due to high velocities over a long length of pipe. It is the responsibility of NCDOT to correct that issue.

Sincerely,

Jason York

Jason York
Environmental Scientist

From:	Isenhour, Kimberly T CIV USARMY CESAW (USA)
To:	Clemmons, Micky
Cc:	Davis, Erin B; Tugwell, Todd J CIV USARMY CESAW (US); Wilson, Travis W.; Bowers, Todd; Leslie, Andrea J; McHenry, David G; Haywood, Casey M CIV USARMY CEMVP (USA); Crumbley, Tyler A CIV USARMY CESAW (USA); Fennel, Tommy E CIV USARMY CESAW (USA); Wiesner, Paul; Harmon, Beth; Stanfill, Jim; McKeithan, Katie
Subject:	[External] Notice of Initial Credit Release/ NCDMS UT to Rush Fork/ SAW-2018-01171/ Haywood County
Date:	Friday, October 7, 2022 2:39:59 PM
Attachments:	UT to Rush Fork_100068_FB 06_STR_Initial Release KI.pdf

Good afternoon all,

The 15-Day As-Built/MY0 review for the UT to Rush Fork Mitigation Site (SAW-2018-01171) ended September 21, 2022. Per Section 332.8(o)(9) of the 2008 Mitigation Rule, this review followed the streamlined review process. All comments received from the NCIRT are incorporated in the email below. There were no objections to issuing the initial 30% credit release of 1,060.076 cold stream mitigation units. Please find attached the current signed ledger. No site visit is requested at this time.

Todd Bowers, USEPA:
Overall, the Site looks great, appears to be performing as intended, and is on track to meet stream and vegetation success criteria. All red-line deviations of the vegetation planting and site construction plans (structure mods, fencing gates and substitute species) were all minor in nature and noted.

The following items or highlights from the As-Built Condition Assessment were noted:

1. There appears to be a minor error in stream photos with Photo 47 differing from the location noted on Figure 3c.
2. Planted species substitutions are suitable with only a very minor reduction in site diversity.

Overall, I am very satisfied with the report and the work that Baker has completed at the site. Having not been able to visit this location, I really appreciated the detailed ground-level stream feature photos to illustrate the grading, planting, monitoring equipment and features implemented. I recommend the appropriate credit release (Milestone 2) for cold stream mitigation units for this monitoring milestone. I have no other substantial comments not requesting a site visit at this time.

Erin Davis, NCDWR:
1. DWR appreciated all of DMS' comments and Baker's responses.
2. Regarding the BMP partially located outside of the easement, DWR's preference would be to have the entire BMP within the easement, and we would support an easement modification request to capture the feature within the project area. However, we do acknowledge that the final mitigation plan figures do show the BMP extending beyond the easement line and are glad that the feature perimeter is fenced. If the situation remains as-is, we recommend clear CE boundary signage and early communication between Stewardship and landowner on long-term maintenance and fencing.
3. Redline Sheet 4 appears to show the UT2 culvert pipe and riprap extending into the

easement. I'm not sure if this is the same area DMS referenced in their comments. If not, please discuss a proposed resolution.

4. Photo Point 23 – Please confirm the culvert upstream of UT4 was properly embedded as per the 401 water quality certification.

5. DWR appreciated the planted species diversity and good report photos.

Dave McHenry, NCWRC:

Please provide some history on the culvert un NC 209 (UT 1 Sta 28+90) with the "plunge pool" detail. It was not backwatered, and not designed to, even though the culvert bisects the site. The grades were raised/set above the inverts on the culverts that were installed elsewhere. I realize the 100-200-foot reach below NC 209 is outside of the CE possibly because of concerns about possible chronic influence of the culvert and likely future road maintenance. And, the culvert is about 3%.

Thanks and have a good weekend,
Kim

Kim Isenhour
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers I 919.946.5107