MY1 FINAL MONITORING REPORT
Hornpipe Branch Tributaries Mitigation Project
Lenoir County
Neuse River Basin
CU 03020202

DMS Project # 100076
DMS Contract # 7605
Contracted RFP # 16-007401
USACE Action ID Number: SAW-2018-01762
DWR Project # 2018-1155

Calendar Year of Data Collection: 2021

Prepared for:
North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
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Environmental Quality

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November 29th, 2021

NC Department of Environmental Quality

Division of Mitigation Services

Attn: Lindsay Crocker

217 West Jones Street, Suite 3000-A

Raleigh, NC 27603

RE: WLS Responses to NCDEQ DMS Review Comments for Task 7 Draft Monitoring Report Year 1 for Hornpipe Branch Tributaries Mitigation Project, NCDEQ DMS Full-Delivery Project ID #100076, Contract #7605, Neuse River Basin, Cataloging Unit 03020202, Lenoir County, NC

Dear Ms. Crocker:
Water & Land Solutions, LLC (WLS) is pleased to present the Final Monitoring Report Year 1 for the Hornpipe Branch Tributaries Mitigation Project to the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS). The Final Monitoring Report Year 1 were developed by addressing NCDEQ DMS's review comments.

Under this cover, we are providing the Final Monitoring Report Year 1, and the required digital data for each (the .pdf copies of the entire updated reports and the updated digital data) via electronic delivery. We are providing our written responses to NCDEQ DMS's review comments on the Draft Monitoring Report Year 1 below. Each of the DMS review comments is copied below in **bold** text, followed by the appropriate response from WLS in regular text:

Digital Deliverables:

1. **DMS Comment: Please submit the veg transects as polygons rather than lines.** WLS Response: Veg transects are included in the e-data as polygons.

2. **DMS Comment: Please submit features characterizing the cork crest gauges and display these in the CCPV.**WLS Response: The cork crest gauge shapefile is included in the e-data.

3. **DMS Comment: Much of the surface water gauge data included in the Appendix D Hydrology workbook seems to only include the time. Please submit these data in a date-time format. Please also include the Bankfull Depth and Downstream Riffle elevations in the surface water gauge sheet.** Response: Surface water gauge data was updated to include the date and time. Bankfull depth and downstream riffle elevations are also included in the workbook.

4. **DMS Comment: Note that the symbology used for the Bankfull Depth and Downstream Riffle lines are switched between the FG and CG figures.** Response: Symbology on the graphs has been changed to be consistent on gauge figures.

Please contact me if you have any questions or comments.

Sincerely,

Water & Land Solutions, LLC

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1 Project Summary

1.1 Project Location and Description

The Hornpipe Branch Tributaries Mitigation Project ("Project") is a North Carolina Department of Environmental Quality (NCDEQ), Division of Mitigation Services (DMS) full-delivery stream mitigation project contracted with Water & Land Solutions, LLC (WLS) in response to RFP 16-007401. The Project will provide stream mitigation credits in the Neuse River Basin (Cataloging Unit 03020202). The Project is in Lenoir County, North Carolina, in the Community of Deep Run at coordinates 35.134242° North and -77.655045° West. The project site is in the Targeted Local Watershed 003020202050010 (Warm Water Thermal Regime).

The Project involved the restoration of five stream reaches (MS1, MS2, MS3, UT1, and UT2) and their riparian buffers. Proposed stream lengths total 1,239 linear feet of headwater streams and 3,912 linear feet of single-thread streams. The mitigation plan provides a detailed project summary and Table 1 provides a summary of project assets. Figure 1 illustrates the project mitigation components and Figure 2 illustrates the reference site location in proximity to the project.

Monitoring Year 1 (MY1) activities occurred in October 2021. This report presents the data for MY1. The Project meets the MY1 success criteria for stream hydrology, stream horizontal and vertical stability, streambed condition and stability, stream flow, and vegetation. Based on these results, the Project is on a trajectory to meet interim and final success criteria in Monitoring Year 2 (MY2). For more information on the chronology of the project history, activity, and contact information, refer to Appendix E.

1.2 Project Quantities and Credits

The Project mitigation components include Stream Restoration activities as summarized in Table 1 below.

Table 1. Hornpipe Branch Tributaries (ID-100076) Project Mitigation Quantities and Credits

Project Segment	Original Mitigation Plan Ft/Ac	As-Built Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits	Comments
Stream							
MS1	1,440	1,468	Warm	R	1.00000	1,440.000	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement
MS2	943	940	Warm	R	1.00000	943.000	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement
MS3	1,529	1,521	Warm	R	1.00000	1,529.000	Full Channel Restoration, Planted Buffer, Permanent Conservation Easement
UT1	677	677	Warm	R	1.00000	677.000	Headw ater Channel Restoration, Planted Buffer, Permanent Conservation Easement
UT2	562	562	Warm	R	1.00000	562.000	Headw ater Channel Restoration, Planted Buffer, Permanent Conservation Easement
					Total:	**5,151.000**	
Wetland							
					Total:	**0.000**	

Project Credits							
	Stream			Riparian	Non-Rip	Coastal	
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh	
Restoration	5,151.000	0.000	0.000	0.000	0.000	0.000	
Re-establishment				0.000	0.000	0.000	
Rehabilitation				0.000	0.000	0.000	
Enhancement				0.000	0.000	0.000	
Enhancement I	0.000	0.000	0.000				
Enhancement II	0.000	0.000	0.000				
Creation				0.000	0.000	0.000	
Preservation	0.000	0.000	0.000	0.000	0.000		
Totals	**5,151.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	

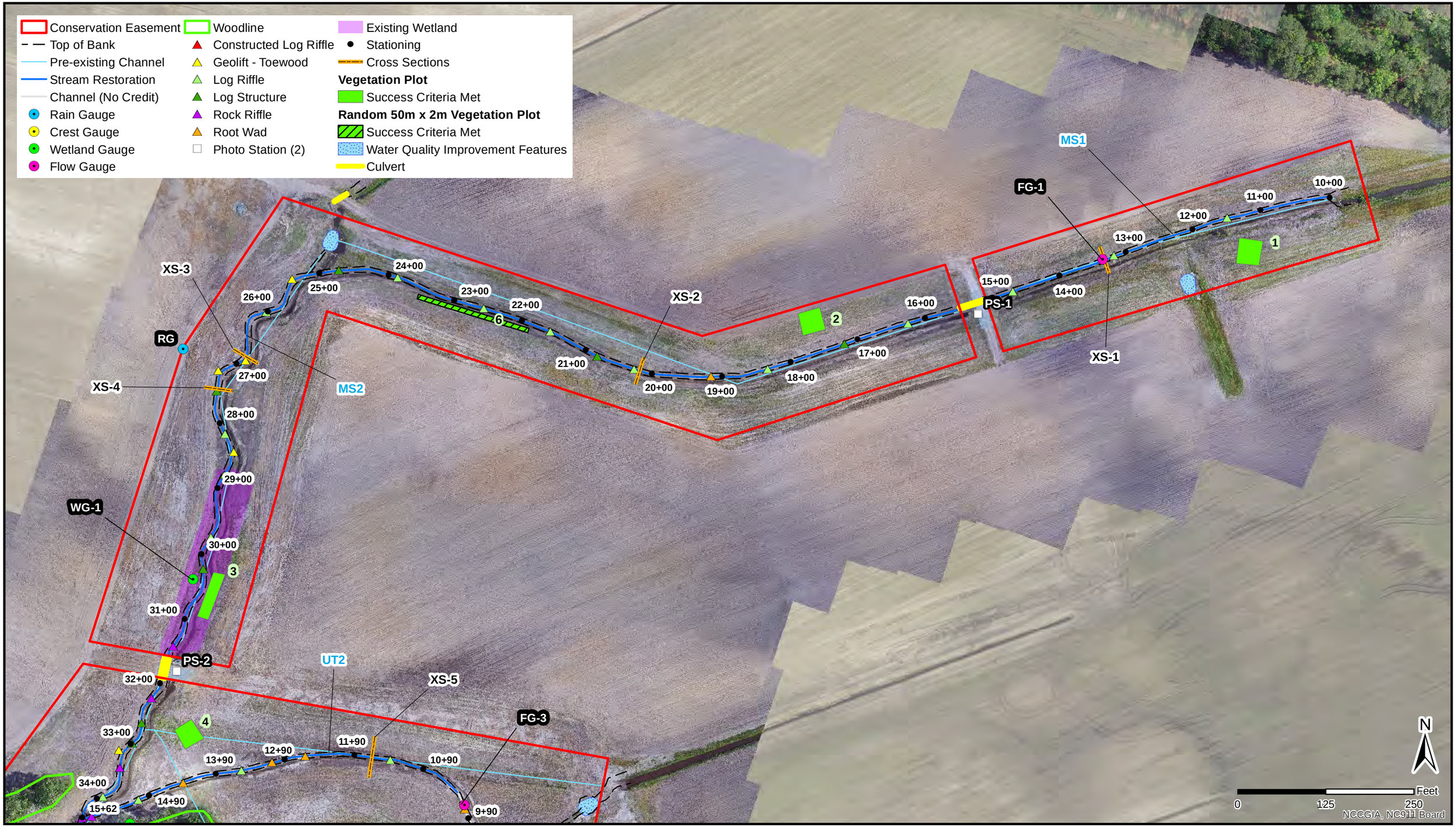
Total Stream Credit	**5,151.000**
Total Wetland Credit	**0.000**

Wetland Mitigation Category		Restoration Level	
CM	Coastal Marsh	HQP	High Quality Preservation
R	Riparian	P	Preservation
NR	Non-Riparian	E	Wetland Enhancement - Veg and Hydro
		EII	Stream Enhancement II
		EI	Stream Enhancement I
		C	Wetland Creation
		RH	Wetland Rehabilitation - Veg and Hydro
		REE	Wetland Re-establishment Veg and Hydro
		R	Restoration

1.3 Current Condition Plan View

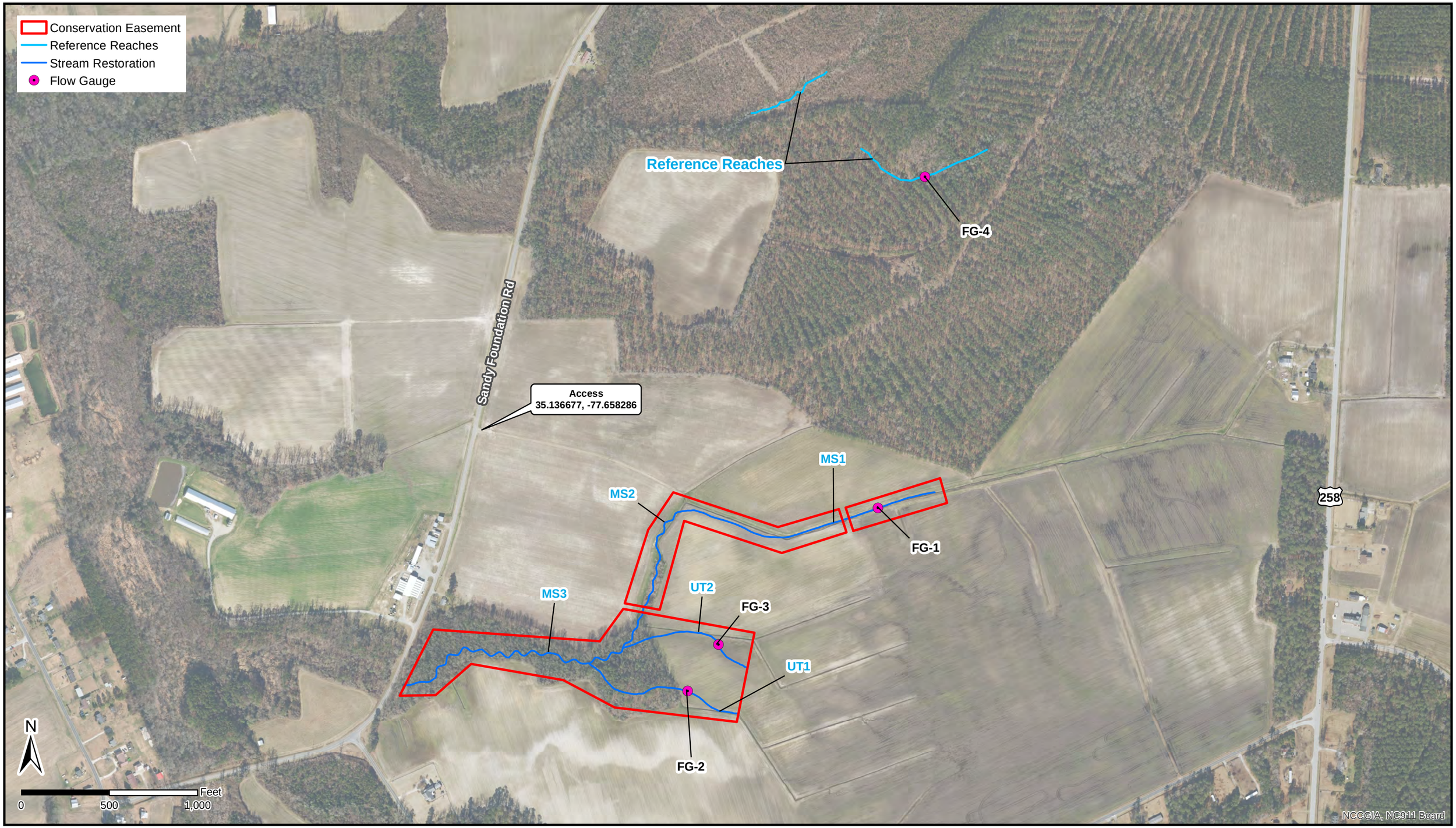
The following pages present the Current Condition Plan View (CCPV).

WATER & LAND™ SOLUTIONS	NC Mitigation Services ENVIRONMENTAL QUALITY	**Hornpipe Branch Tributaries Mitigation Project Lenoir County, North Carolina**	USACE Action ID Number: SAW-2018-01762 Data Collection Date: 10/19/2021 MY1	USACE Current Conditions Plan View Monitoring Year 1 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1a



WATER & LAND™ SOLUTIONS	NC Mitigation Services ENVIRONMENTAL QUALITY	**Hornpipe Branch Tributaries Mitigation Project Lenoir County, North Carolina**	USACE Action ID Number: SAW-2018-01762 Data Collection Date: 10/19/2021 MY1	USACE Current Conditions Plan View Monitoring Year 1 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1b

WATER & LAND™ SOLUTIONS	NC Mitigation Services Environmental Quality	**Hornpipe Branch Tributaries Mitigation Project Lenoir County, North Carolina**	USACE Action ID Number: SAW-2018-01762 Data Collection Date: 10/19/2021 MY1	USACE Current Conditions Plan View Monitoring Year 1 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1c



WATER & LAND™ SOLUTIONS		**Hornpipe Branch Tributaries Mitigation Project Lenoir County, North Carolina**	USACE Action ID Number: SAW-2018-01762 Data Collection Date: 10/19/2021 MY1	Reference Site Map NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 2

2 Goals, Performance Criteria, and Functional Improvements

2.1 Project Goals and Objectives

The Project will meet the goals and objectives described in the Hornpipe Branch Tributaries Final Approved Mitigation Plan and will address general restoration goals and opportunities outlined in the 2010 (amended 2018) Neuse River Basin Watershed Restoration Priorities (RBRP). More specifically, the functional goals and objectives outlined in the RBRP will be met:

- Reducing sediment and nutrient inputs to the Southwest Creek Watershed.
- Restoring and protecting streams, wetlands, riparian buffers and aquatic habitat.
- Implementing agricultural BMPs and stream restoration in nutrient sensitive watersheds.

To accomplish these project-specific goals, the following objectives will be measured to document overall project success:

- Restore stream and floodplain interaction and geomorphically stable conditions by reconnecting historic flow paths and promoting more natural flood processes;
- Improve and protect water quality by reducing streambank erosion, nutrient and sediment inputs;
- Restore and protect riparian buffer functions and habitat connectivity in perpetuity by recording a permanent conservation easement; and
- Incorporate water quality improvement features to reduce nonpoint source inputs to receiving waters.

Table 2: Summary: Goals, Performance and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Improve Stream Base Flow Duration	Improve and/or remove existing stream crossings and restore a more natural flow regime and aquatic passage.	Create a more natural and higher functioning headwater flow regime and provide aquatic passage; re-establish appropriate wetland hydroperiods and provide hydrologic storage	Maintain seasonal flow on intermittent stream for a minimum of 30 consecutive days during normal annual rainfall	3 Flow gauges (MS1, UT1, UT2)	2/3 met requirements - 2021
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Design BHRs to not exceed 1.2 and increase ERs no less than 2.2 for Rosgen 'C' and 'E' stream types and 1.4 for 'B' stream types.	Provide temporary water storage and reduce erosive forces (shear stress) in channel during larger flow events.	Minimum of four bankfull events in separate years. Wetland hydrology data is supplementary and is not tied to project success criteria.	Minimum of four bankfull events in separate years. Wetland hydrology data is supplemanetary. Wetlands are not tied to project success criteria.	2 recorded bankfull events - 2021
Improve stabilty of stream channels	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	Bank height ratios remain below 1.2 over the monitoring period. Visual assessments showing progression towards stability.	12 Cross section surveys	all cross sections BHR<1.2. - 2021
Establish Riparian Buffer Vegetation	Plant native species vegetation a minimum 50' wide from the top of the streambanks with a composition/density comparable to downstream reference condition.	Increase woody and herbaceous vegetation will provide channel stability and reduce streambank erosion, runoff rates and exotic species vegetation.	Within planted portions of the site, a minimum of 320 stems per acre must be present at year three; a minimum of 260 stems per acre must be present at year five with an average height of seven feet; and a minimum of 210 stems per acre and average ten foot tree heights must be present at year seven.	Tree data for 5 fixed veg plots and 2 random plots (species & height), visual assessment	7/7 veg plots met - 2021

2.2 Project Success Criteria

The success criteria for the Project will follow the approved performance standards and monitoring protocols from the final approved mitigation plan; which was developed in compliance with the USACE October 2016 Guidance, USACE Stream Mitigation Guidelines (April 2003 and October 2005), and 2008 Compensatory Mitigation Final Rule. Cross-section and vegetation plot data will be collected in Years 0, 1, 2, 3, 5, and 7. Stream hydrology data and visual monitoring will be reported annually. Specific success criteria components and evaluation methods are described below.

2.2.1 Single-Thread Streams

***Stream Hydrology*:** Four separate bankfull or over bank events must be documented within the seven-year monitoring period and the stream hydrology monitoring will continue until four bankfull events have been documented in separate years. Stream hydrology monitoring will be accomplished with pressure transducers installed in pools and correlating sensor depth to top of bank elevation. Recorded water depth above the top of bank elevation will document a bankfull event. The devices will record water depth hourly and will be inspected quarterly.

The stage recorders include an automatic pressure transducer (HOBO Water Level (13 ft) Logger) set in PVC piping in the channel. The elevation of the bed and top of bank at each stage recorder location will be recorded to be able to document presence of water in the channel and out of bank events. Visual observations (i.e. wrack or debris lines) and traditional cork crest gauges will also be used to document out of bank events.

Stream Profiles, Vertical Stability, and Floodplain Access: Stream profiles, as a measure of vertical stability and floodplain access will be evaluated by looking at Bank Height Ratios (BHR). In addition, observed bedforms should be consistent with those observed for channels of the design stream type(s). The BHR shall not exceed 1.2 along the restored Project stream reaches. This standard only applies to restored reaches of the channel where BHRs were corrected through design and construction. Vertical stability will be evaluated with visual assessment, cross sections and, if directed by the IRT, longitudinal profile.

Stream Horizontal Stability: Cross-sections will be used to evaluate horizontal stream stability on restored streams. There should be little change expected in as-built restoration cross-sections. If measurable changes do occur, they should be evaluated to determine if the changes represent a movement toward a more unstable condition (e.g., downcutting, erosion) or a movement towards increased stability (e.g., settling, vegetation establishment, deposition along the streambanks, decrease in width/depth ratio). Cross-sections shall be classified using the Rosgen Stream Classification method and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

Stream cross-section monitoring will be conducted using a Topcon Total Station. Three-dimensional coordinates associated with cross-section data will be collected in the field (NAD83 State Plane feet PIPS 3200). Morphological data will be collected at 12 cross-sections. Survey data will be imported into Microsoft Excel® and DMS Shiny App for data processing and analysis.

Reference photo transects will be taken at each permanent cross-section. Lateral photos should not indicate excessive erosion or continuing degradation of the streambanks. Photographs will be taken of both streambanks at each cross-section. A survey tape stretched between the permanent cross-section

monuments/pins will be centered in each of the streambank photographs. The water elevation will be shown in the lower edge of the frame, and as much of the streambank as possible will be included in each photo. Photographers will attempt to consistently maintain the same area in each photo over time.

Streambed Material Condition and Stability: Streambed material is expected to have minimal changes over time and any significant changes (e.g., aggradation, degradation, embeddedness) will be noted after streambank vegetation becomes established and a minimum of two bankfull flows or greater have been documented. If significant changes are observed within stable riffles and pools, additional sediment transport analyses may be required.

Jurisdictional Stream Flow: Monitoring of stream flow will be conducted to demonstrate that the restored stream systems classified as intermittent and/or ephemeral exhibit base flow for a minimum of 30 consecutive days throughout some portion of the year during a year with normal rainfall conditions. Stream flow monitoring will be accomplished with pressure transducers installed in pools and correlating sensor depth to the downstream top of riffle elevation (see appendix D for installation diagrams). If the pool water depth is at or above the top of riffle elevation, then the channel will be assumed to have surface flow. The devices will record water elevation twice per day and will be inspected quarterly to document surface hydrology and provide a basis for evaluating flow response to rainfall events.

2.2.2 Headwater Streams

Continuous Surface Flow: Continuous surface water flow within the valley or crenulation must be documented to occur every year for at least 30 consecutive days during the prescribed monitoring period. Additional monitoring maybe required if surface water flow cannot be documented due to abnormally dry conditions.

Channel Formation: During monitoring years 1 through 4, the preponderance of evidence must demonstrate a concentration of flow indicative of channel formation within the topographic low-point of the valley or crenulation as documented by the following indicators:

- Scour (indicating sediment transport by flowing water)
- Sediment deposition (accumulations of sediment and/or formation ripples)
- Sediment sorting (sediment sorting indicated by grain-size distribution with the primary path of flow)
- Multiple observed flow events (must be documented by gauge data and/or photographs)
- Destruction of terrestrial vegetation
- Presence of litter and debris
- Wracking (deposits of drift material indicating surface water flow)
- Vegetation matted down, bent, or absent (herbaceous or otherwise)
- Leaf litter disturbed or washed away

During monitoring years 5 through 7, the stream must successfully meet the requirements above and the preponderance of evidence must demonstrate the development of stream bed and banks as documented by the following indicators:

- Bed and banks (may include the formation of stream bed and banks, development of channel pattern such as meander bends and/or braiding at natural topographic breaks, woody debris, or plant root systems)

- Natural line impressed on the bank (visible high-water mark)
- Shelving (shelving of sediment depositions indicating transport)
- Water staining (staining of rooted vegetation)
- Change in plant community (transition to species adapted for flow or inundation for a long duration, including hydrophytes)
- Changes in character of soil (texture and/or chroma changes when compared to the soils abutting the primary path of flow).

2.2.3 Vegetation

Vegetation monitoring will occur in the fall each required monitoring year, prior to leaf drop. Plots will be monitored in years 1, 2, 3, 5, and 7. Vegetative success for the Project during the intermediate monitoring years will be based on the survival of at least 320, three-year-old planted trees per acre at the end of Year 3 of the monitoring period; and at least 260, five-year-old, planted trees per acre that must average seven feet in height at the end of Year 5 of the monitoring period. The final vegetative restoration success criteria will be achieving a density of no less than 210, seven-year-old planted stems per acre that must average ten feet in height in Year 7 of monitoring.

Vegetation success is being monitored at a total of five permanent vegetation plots and two random transects. Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data are processed using the NCDMS Shiny App. For each fixed plot the origin was marked with a PVC pole and the other three corners were marked with rebar. For each random transect the ends of the transect and each tree was marked with flagging tape. Tree species and height will be recorded for each planted stem and photos of each plot are to be taken from the origin each monitoring year.

2.2.4 Visual Assessment

WLS will conduct visual assessments in support of mitigation performance monitoring. Visual assessments of all stream reaches will be conducted twice per monitoring year with at least five months in between each site visit for each of the seven years of monitoring. Photographs will be used to visually document system performance and any areas of concern related to streambank and bed stability, condition of in-stream structures, channel migration, active headcuts, live stake mortality, invasive plant species or animal browsing, easement boundary encroachments, and general streambed conditions. Permanent photo points will be at the cross-sections and culvert crossings.

3 Project Attributes

3.1 Design Approach

3.1.1 Stream

The Project stream design approach included a combination of stream restoration activities. Priority Level I, II and III restoration approaches were incorporated with the design of a single-thread meandering channel and headwater stream valley, with parameters based on reference site comparisons, published empirical relationships, NC Coastal Plain Regional Curves, and hydrologic and hydraulic analyses. All non-vegetated areas within the conservation easement were planted with native vegetation and any areas of invasive species were removed and/or treated.

- **MS1 –** Priority Level II/III Restoration

- **MS2 –** Priority Level I/II Restoration
- **MS3 –** Priority Level I Restoration
- **UT1 and UT2 –** Headwater Restoration

3.2 Project Attributes

See Table 3 below for Project Attributes.

Table 3. Project Attribute Table					
Project Name	Hornpipe Branch Tributaries Mitigation Project				
County	Lenoir				
Project Area (acres)	23.43				
Project Coordinates (latitude and longitude decimal degrees)	35.134242°, -77.655045°				
Project Watershed Summary Information					
Physiographic Province	Coastal Plain				
River Basin	Neuse River				
USGS Hydrologic Unit 8-	3020202				
DWR Sub-basin	3/4/2005				
Project Drainage Area (acres)	331				
Project Drainage Area Percentage of Impervious Area	2.00%				
Land Use Classification	2.01.03, 2.01.01, 3.02 (78% cultivated crops, 16% evergreen/mixed forest)				
Reach Summary Information					
Parameters	**Reach MS1**	**Reach MS2**	**Reach MS3**	**Reach UT1**	**Reach UT2**
Pre-project length (feet)	1,493	774	1,548	498	644
Post-project (feet)	1,468	940	1,521	677	562
Valley confinement (Confined, moderately confined, unconfined)	unconfined	unconfined	unconfined	unconfined	unconfined
Drainage area (acres)	183	222	331	46	32
Perennial, Intermittent, Ephemeral	Intermittent	Perennial	Perennial	Intermittent	Ephemeral
NCDWR Water Quality Classification	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW
Dominant Stream Classification (existing)	N/A (channelized ditch)	N/A (channelized ditch)	F5	N/A (channelized ditch)	N/A (channelized ditch)
Dominant Stream Classification (proposed)	DA/E5	C5/E5	C5/E5	DA	DA
Dominant Evolutionary class (Simon) if applicable	IV	IV	III/IV	IV	IV
Regulatory Considerations					
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**		
Water of the United States - Section 404	Yes	Yes	404 Permit		
Water of the United States - Section 401	Yes	Yes	401 Permit		
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		
Essential Fisheries Habitat	No	N/A	Categorical Exclusion		

4 Monitoring Year 1 Assessment and Results

4.1 Morphological Assessment

Morphological data for MY1 was collected in October 2021. Refer to Appendices A and C for summary data tables, morphological plots, and stream photographs.

4.1.1 Stream Horizontal Pattern & Longitudinal Profile

The MY1 stream channel pattern and longitudinal profiles closely match the design parameters. The MY1 plan form geometry or pattern fell within acceptable ranges of the design parameters for all restored reaches. Minor channel adjustments in riffle slopes, pool depths and pattern do not present a stability concern or indicate a need for remedial action and will be assessed visually during the annual assessments.

4.1.2 Stream Horizontal Dimension

The MY1 channel dimensions generally match the design parameters and are within acceptable and stable ranges of tolerance. Two of the 12 cross-sections are located in headwater restoration reaches and the remaining 10 cross-sections are located in Priority I/II single-thread restoration channels. All ten of the PI/PII cross-sections show little change in the bankfull area and all bank height ratios are less than 1.2. It is expected that over time that some pools may accumulate fine sediment and organic matter, however, this is not an indicator of channel instability. Maximum riffle depths are also expected to fluctuate slightly throughout the monitoring period as the channels adjust.

4.2 Stream Hydrology

4.2.1 Stream Flow

Two of the three pressure transducers (flow gauges), installed in March 2021 on reaches MS1, UT1, and UT2, documented that the streams exhibited surface flow for a minimum of 30 consecutive days throughout the monitoring year (Appendix D). One additional flow gauge, FG-4, is located on a reference reach located 0.5 miles north of the project. FG-1 (MS-1) exhibited a maximum consecutive flow of 47 days between June 20, 2021 and August 5, 2021, with a cumulative total of 106 days of flow during MY1. FG-2 (UT-1) exhibited a maximum consecutive flow of 37 days between March 24, 2021 and April 29, 2021, with a cumulative total of 84 days of flow during MY1. FG-3 (UT-2) exhibited a maximum consecutive flow of 29 days between March 24, 2021 and April 21, 2021, with a cumulative total of 97 days of flow during MY1. FG-4 (Reference Reach) exhibited a maximum consecutive flow of 48 days between March 24, 2021 and May 10, 2021, with a cumulative total of 96 days of flow during MY1. Due to a malfunction with the data transfer shuttle, data from FG-1 and FG-2 was lost between August 5, 2021 and October 19, 2021. Both FG-1 and FG-2 were reset during MY1 activities on October 19, 2021. Additionally, to determine if rainfall amounts are normal for the given year, precipitation data was obtained from an onsite rain gauge.

4.2.2 Bankfull Events

During MY1, bankfull events were recorded on the pressure transducer crest gauge. CG-1 recorded 2 events with a maximum event of 0.488' above bankfull on April 1, 2021. The CG-1 pressure transducer malfunctioned on June 6, 2021 and was replaced during MY1 activities on October 19, 2021. Additionally, the cork crest gauge located adjacent to CG-1 recorded 2 bankfull events with a maximum event of 0.85' above bankfull. Associated data and photographs are located in Appendix D.

4.2.3 Headwater Stream Channel Formation

During MY1, streams UT1 and UT2 exhibited evidence indicative of channel formation within the topographic low-point of the valley (see table in appendix C).

4.2.4 Wetlands

Wetland mitigation credits are not contracted or proposed for this project. Two groundwater wells were installed in March 2021 in an existing jurisdictional wetland on MS-2 (GW-1) and adjacent to UT2 (GW-2) to monitor groundwater levels in the project. No performance standards for wetland hydrology success were proposed in the Mitigation Plan and therefore wetland mitigation monitoring is not included in the project. GW-1 had a consecutive hydroperiod of 12.00 percent and GW-2 had a consecutive hydroperiod of 11.56 percent of the growing season during MY1. Groundwater well locations are shown on the CCPVs, and the data is included in Appendix D.

4.2.5 Vegetation

Monitoring of the five permanent vegetation plots and two random transects was completed during the third week of October 2021. Vegetation data and photos can be found in Appendix B. The MY1 average planted density is 653 stems per acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre at the end of the third monitoring year. Each vegetation plot is meeting the interim measure requirements and has 364 - 850 stems per acre. Volunteer species were not noted during MY1 but are expected to establish in upcoming years.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project.

A significant population of privet (*Ligustrum sinense*) was located along MS3 and the wooded areas of UT1 and UT2 prior to construction. Construction activities included removing existing privet within the easement. Mechanical and herbicide treatments of privet along MS3 (~2.41 acres) were conducted during MY1 (see CCPV). Larger privet was cut and resprouts will be treated as needed. Smaller privet was foliar sprayed with 3% herbicide. Treatments are documented in the table below.

Invasive Species Treatment Table

Monitoring Year	Invasive Targeted	Invasive Treatment	Date Treatment Conducted	Herbicide Used
1	Privet	Foliar	5/5/2021	Rodeo (3%), Garlon 3A (3%)
	Privet	Foliar	5/19/2021	Rodeo (3%), Garlon 3A (3%)
	Privet	Foliar	6/1/2021	Garlon 3A (3%)

These areas will be closely monitored, and re-sprouts will be treated as needed to prevent further establishment. Any future treatments will be documented and included in subsequent monitoring reports.

Appendix A:
Visual Assessment Data

Visual Stream Morphology Stability Assessment Table
Vegetation Condition Assessment Table
Photos: Cross Section Photos
Photos: Stream Photo Points (Culvert Crossings)

Visual Stream Stability Assessment						
Reach		MS1, MS2, MS3, UT1, UT2				
Assessed Stream Length		5,168				
Assessed Bank Length		11,386.54				
Major Channel Category		**Metric**	**Number Stable, Performing as Intended**	**Total Number in As-built**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	62	62		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	20	20		100%

Visual Vegetation Assessment				
Planted Acreage	**17.7**			
Vegetation Category	**Definitions**	**Mapping Threshold**	**Combined Acreage**	**% of Planted Acreage**
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10acres	0.00	0.0%
		Total	0.00	0.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
	Cumulative Total		0.00	0.0%
Easement Acreage	**23.43**			
Vegetation Category	**Definitions**	**Mapping Threshold**	**Combined Acreage**	**% of Easement Acreage**
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.10 acres	2.41	10.3%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	0.00	

MS1, XS1, Upstream (MY-00)

MS1, XS1, Upstream (MY-01)

MS1, XS1, Downstream (MY-00)

MS1, XS1, Downstream (MY-01)

MS1, XS1, Left Bank (MY-00)

MS1, XS1, Left Bank (MY-01)

MS1, XS1, Right Bank (MY-00)

MS1, XS1, Right Bank (MY-01)

MS1, XS2, Upstream (MY-00)

MS1, XS2, Upstream (MY-01)

MS1, XS2, Downstream (MY-00)

MS1, XS2, Downstream (MY-01)

MS1, XS2, Left Bank (MY-00)

MS1, XS2, Left Bank (MY-01)

MS1, XS2, Right Bank (MY-00)

MS1, XS2, Right Bank (MY-01)

MS2, XS3, Upstream (MY-00)

MS2, XS3, Upstream (MY-01)

MS2, XS3, Downstream (MY-00)

MS2, XS3, Downstream (MY-01)

MS2, XS3, Left Bank (MY-00)

MS2, XS3, Left Bank (MY-01)

MS2, XS3, Right Bank (MY-00)

MS2, XS3, Right Bank (MY-01)

MS2, XS4, Upstream (MY-00)

MS2, XS4, Upstream (MY-01)

MS2, XS4, Downstream (MY-00)

MS2, XS4, Downstream (MY-01)

MS2, XS4, Left Bank (MY-00)

MS2, XS4, Left Bank (MY-01)

MS2, XS4, Right Bank (MY-00)

MS2, XS4, Right Bank (MY-01)

UT2, XS5, Upstream (MY-00)

UT2, XS5, Upstream (MY-01)

UT2, XS5, Downstream (MY-00)

UT2, XS5, Downstream (MY-01)

UT2, XS5, Left Bank (MY-00)

UT2, XS5, Left Bank (MY-01)

UT2, XS5, Right Bank (MY-00)

UT2, XS5, Right Bank (MY-01)

UT1, XS6, Upstream (MY-00)

UT1, XS6, Upstream (MY-01)

UT1, XS6, Downstream (MY-00)

UT1, XS6, Downstream (MY-01)

UT1, XS6, Left Bank (MY-00)

UT1, XS6, Left Bank (MY-01)

UT1, XS6, Right Bank (MY-00)

UT1, XS6, Right Bank (MY-01)

MS3, XS7, Upstream (MY-00)

MS3, XS7, Upstream (MY-01)

MS3, XS7, Downstream (MY-00)

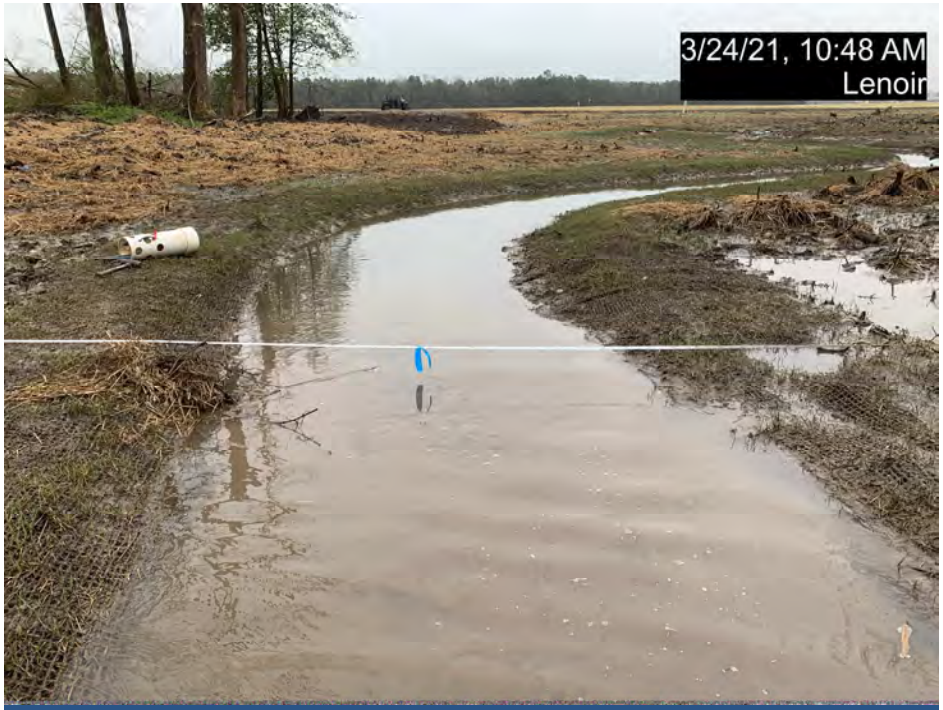
MS3, XS7, Downstream (MY-01)

MS3, XS7, Left Bank (MY-00)

MS3, XS7, Left Bank (MY-01)

MS3, XS7, Right Bank (MY-00)

MS3, XS7, Right Bank (MY-01)



MS3, XS8, Upstream (MY-00)

MS3, XS8, Upstream (MY-01)

MS3, XS8, Downstream (MY-00)

MS3, XS8, Downstream (MY-01)

MS3, XS8, Left Bank (MY-00)

MS3, XS8, Left Bank (MY-01)

MS3, XS8, Right Bank (MY-00)

MS3, XS8, Right Bank (MY-01)

MS3, XS9, Upstream (MY-00)

MS3, XS9, Upstream (MY-01)

MS3, XS9, Downstream (MY-00)

MS3, XS9, Downstream (MY-01)

MS3, XS9, Left Bank (MY-00)

MS3, XS9, Left Bank (MY-01)

MS3, XS9, Right Bank (MY-00)

MS3, XS9, Right Bank (MY-01)

MS3, XS10, Upstream (MY-00)

MS3, XS10, Upstream (MY-01)

MS3, XS10, Downstream (MY-00)

MS3, XS10, Downstream (MY-01)

MS3, XS10, Left Bank (MY-00)

MS3, XS10, Left Bank (MY-01)

MS3, XS10, Right Bank (MY-00)

MS3, XS10, Right Bank (MY-01)

MS3, XS11, Upstream (MY-00)

MS3, XS11, Upstream (MY-01)

MS3, XS11, Downstream (MY-00)

MS3, XS11, Downstream (MY-01)

MS3, XS11, Left Bank (MY-00)

MS3, XS11, Left Bank (MY-01)

MS3, XS11, Right Bank (MY-00)

MS3, XS11, Right Bank (MY-01)

MS3, XS12, Upstream (MY-00)

MS3, XS12, Upstream (MY-01)

MS3, XS12, Downstream (MY-00)

MS3, XS12, Downstream (MY-01)

MS3, XS12, Left Bank (MY-00)

MS3, XS12, Left Bank (MY-01)

MS3, XS12, Right Bank (MY-00)

MS3, XS12, Right Bank (MY-01)

PS-1 – MS1, Culvert Crossing, Upstream (MY-00)

PS-1 – MS1, Culvert Crossing, Upstream (MY-01)

PS-1 – MS1, Culvert Crossing, Downstream (MY-00)

PS-1 – MS1, Culvert Crossing, Downstream (MY-01)

PS-2 – MS2, Culvert Crossing, Upstream (MY-00)

PS-2 – MS2, Culvert Crossing, Upstream (MY-01)

PS-2 – MS2, Culvert Crossing, Downstream (MY-00)

PS-2 – MS2, Culvert Crossing, Downstream (MY-01)

Appendix B:
Vegetation Plot Data

Vegetation Performance Standards Summary Table
Vegetation Plot Counts and Densities Table
Photos: Vegetation Plot Photos
Red-line Planting List

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	688	1	7	0	607	2	8	0	850	1	8	0
Monitoring Year 0	688	1	7	0	607	1	8	0	850	1	8	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot Group 6 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	810	1	8	0	648	2	12	0	607	2	5	0
Monitoring Year 0	810	1	8	0	648	2	12	0				
	Veg Plot Group 7 R											
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives								
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	364	2	6	0								
Monitoring Year 0												

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

Stem Counts and Densities Table	
Planted Acreage	17.7
Date of Initial Plant	2021-03-31
Date(s) of Supplemental Plant(s)	#N/A
Date(s) Mowing	#N/A
Date of Current Survey	2021-10-19
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 R	Veg Plot 7 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW	1	1	1	1	3	3			1	1	3	1
	Carpinus caroliniana	American hornbeam	Tree	FAC			1	1	2	2	3	3	1	1		
	Fraxinus pennsylvanica	green ash	Tree	FACW			4	4					1	1	1	1
	Liriodendron tulipifera	tuliptree	Tree	FACU			4	4	5	5			1	1	2	2
	Nyssa biflora	swamp tupelo	Tree	OBL	1	1			1	1	1	1	1	1		
	Persea palustris	swamp bay	Shrub	FACW							2	2	2	2		
	Platanus occidentalis	American sycamore	Tree	FACW	5	5			1	1	3	3	4	4	4	1
	Quercus alba	white oak	Tree	FACU	2	2	1	1			3	3	1	1		1
	Quercus bicolor	swamp white oak	Tree	FACW	2	2	1	1	2	2	2	2	1	1		
	Quercus michauxii	swamp chestnut oak	Tree	FACW					1	1	5	5	1	1		3
	Quercus nigra	water oak	Tree	FAC	1	1	1	1					1	1		
	Quercus phellos	willow oak	Tree	FACW	5	5	2	2	6	6	1	1	1	1	5	
Sum	Performance Standard				17	17	15	15	21	21	20	20	16	16	15	9
Post Mitigation Plan Species	Ilex verticillata	common winterberry	Tree	FACW					1	1	1	1				1
Sum	Proposed Standard				17	17	15	15	22	22	21	21	16	16	15	10
Mitigation Plan Performance Standard	Current Year Stem Count					17		15		21		20		16	15	9
	Stems/Acre					688		607		850		810		648	607	364
	Species Count					7		8		8		8		12	5	6
	Dominant Species Composition (%)					29		27		27		24		25	33	30
	Average Plot Height					1		2		1		1		2	2	2
	% Invasives					0		0		0		0		0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					17		15		22		21		16	15	10
	Stems/Acre					688		607		891		850		648	607	405
	Species Count					7		8		9		9		12	5	7
	Dominant Species Composition (%)					29		27		27		24		25	33	30
	Average Plot Height					1		2		1		1		2	2	2
	% 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.

Hornpipe Mitigation Project Red-line Planting List				
Species	**Common Name**	**Stems**	**% Planted**	**Mitigation Plan %**
Fraxinus pennsylvanica	Green Ash	700	5.56%	3%
Betula nigra	River birch	1800	14.29%	10%
Quercus michauxii	Swamp chestnut oak	700	5.56%	8%
Quercus bicolor	Swamp white oak	700	5.56%	8%
Platanus occidentalis	American sycamore	1700	13.49%	10%
Quercus nigra	Water Oak	1500	11.90%	8%
Liriodendron tulipifera	Tulip Poplar	1400	11.11%	10%
Quercus phellos	Willow Oak	1700	13.49%	8%
Nyssa biflora	Swamp black gum	700	5.56%	8%
Quercus alba	White Oak	600	4.76%	6%
~~***Clethra alnifolia***~~	~~Sweet pepperbush~~	~~0~~	~~0.00%~~	3%
Carpinus caroliniana	Ironwood	700	5.56%	3%
Persea palustris	Red bay	200	1.59%	3%
Ilex verticillata	Winterberry	200	1.59%	0%
~~***Eubotrys racemosus***~~	~~Swamp doghobble~~	~~0~~	~~0.00%~~	3%
~~***Magnolia virginiana***~~	~~Sweetbay magnolia~~	~~0~~	~~0.00%~~	3%
~~***Cyrilla racimiflora***~~	~~Titi~~	~~0~~	~~0.00%~~	3%
~~***Itea virginica***~~	~~Sweetspire~~	~~0~~	~~0.00%~~	3%
Total		**12,600**	**100%**	

* changes from mitigation plan in red

Fixed Veg Plot 1 (MY-00)

Fixed Veg Plot 1 (MY-01)

Fixed Veg Plot 2 (MY-00)

Fixed Veg Plot 2 (MY-01)

Fixed Veg Plot 3 (MY-00)

Fixed Veg Plot 3 (MY-01)

Fixed Veg Plot 4 (MY-00)

Fixed Veg Plot 4 (MY-01)

Fixed Veg Plot 5 (MY-00)

Fixed Veg Plot 5 (MY-01)

Random Veg Plot 6, Facing East (MY-01)

Random Veg Plot 6, Facing West (MY-01)

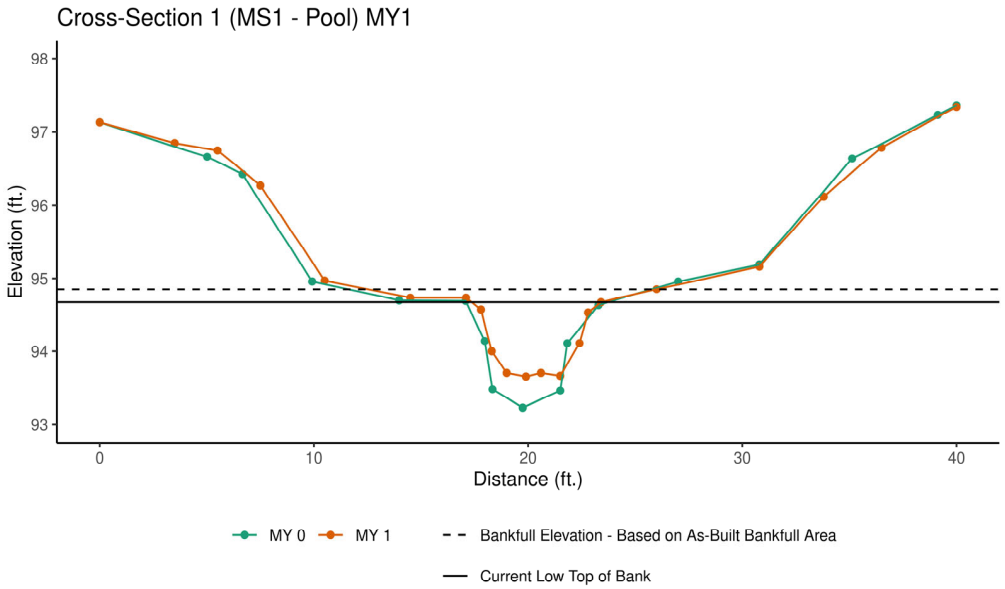
Random Veg Plot 7, Facing East (MY-01)

Random Veg Plot 7, Facing West (MY-01)

Appendix C:

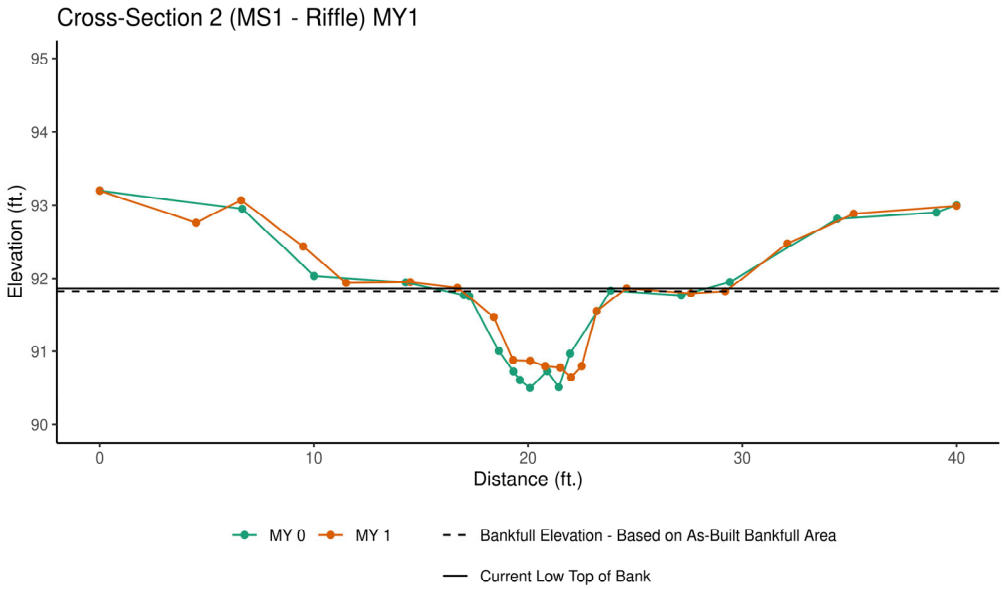
Stream Geomorphology Data

Cross-Sections with Annual Overlays
Baseline Stream Data Summary Tables
Cross-Section Morphology Data
Headwater Stream Channel Formation Table



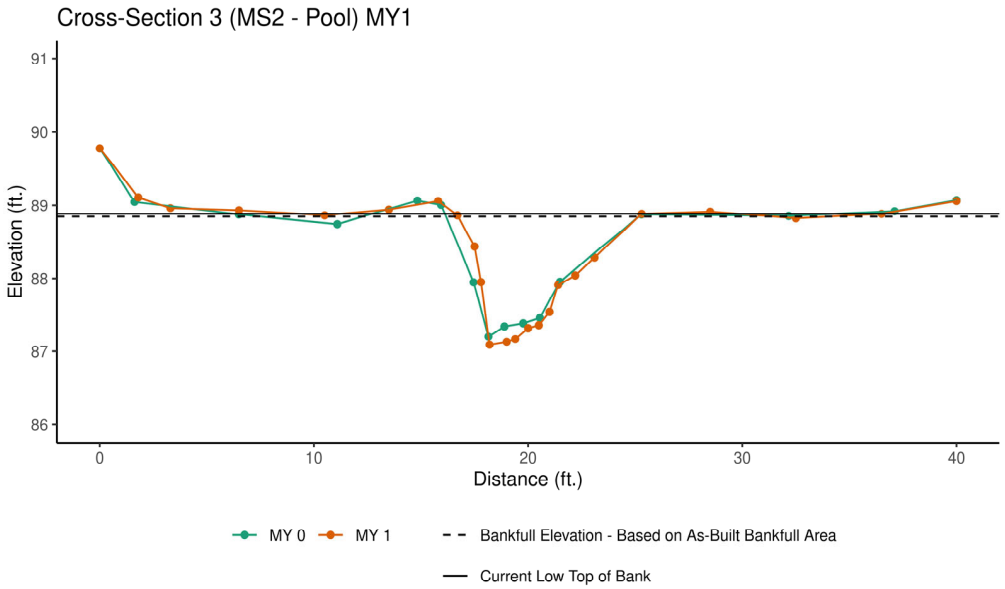
Distance	Elevation	Features
0	97.13	TLP
3.5	96.85	
5.5	96.75	
7.5	96.27	
10.5	94.97	
14.5	94.73	
17.1	94.73	TLB
17.8	94.57	
18.3	94	LEW
19	93.71	
19.9	93.66	THW
20.6	93.71	
21.5	93.67	
22.4	94.11	REW
22.8	94.53	
23.4	94.67	TRB, BKF
26	94.85	
30.8	95.16	
33.8	96.12	
36.5	96.79	
40	97.34	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	94.63	94.85						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.85						
Thalweg Elevation	93.23	93.66						
LTOB Elevation	94.63	94.67						
LTOB Max Depth	1.401	1.01						
LTOB Cross Sectional Area	5.20	4.13						



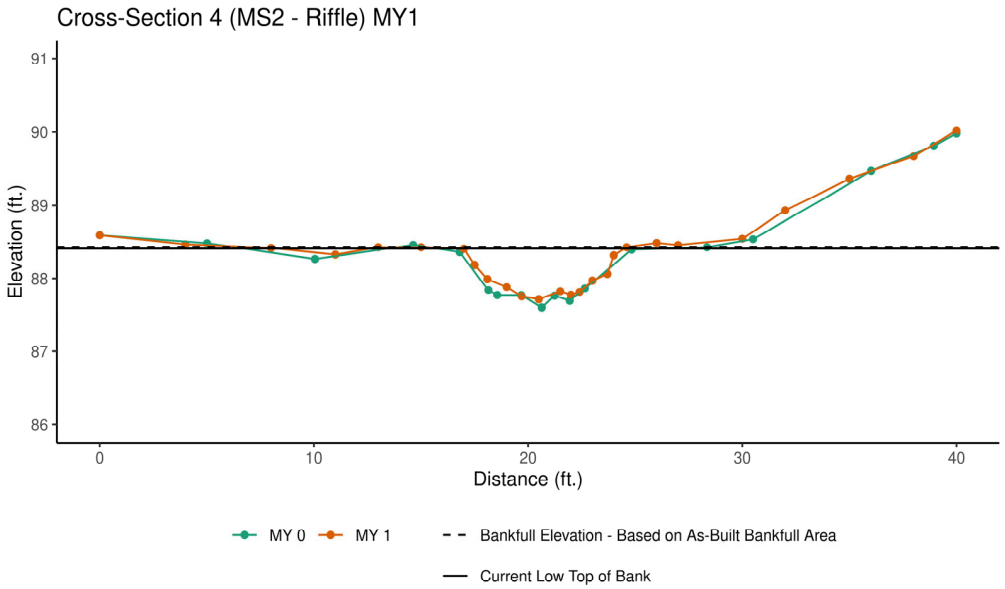
Distance	Elevation	Features
0	93.2	TLP
4.5	92.76	
6.6	93.07	
9.5	92.43	
11.5	91.94	
14.5	91.95	
16.7	91.87	TLB
18.4	91.47	
19.3	90.88	LEW
20.1	90.87	
20.8	90.8	
21.5	90.78	
22	90.65	THW
22.5	90.8	REW
23.2	91.55	
24.6	91.86	TRB, BKF
27.6	91.79	
29.2	91.82	
32.1	92.47	
35.2	92.88	
40	92.99	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	91.75	91.82						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	1.03						
Thalweg Elevation	90.51	90.65						
LTOB Elevation	91.75	91.86						
LTOB Max Depth	1.245	1.21						
LTOB Cross Sectional Area	4.72	5.03						



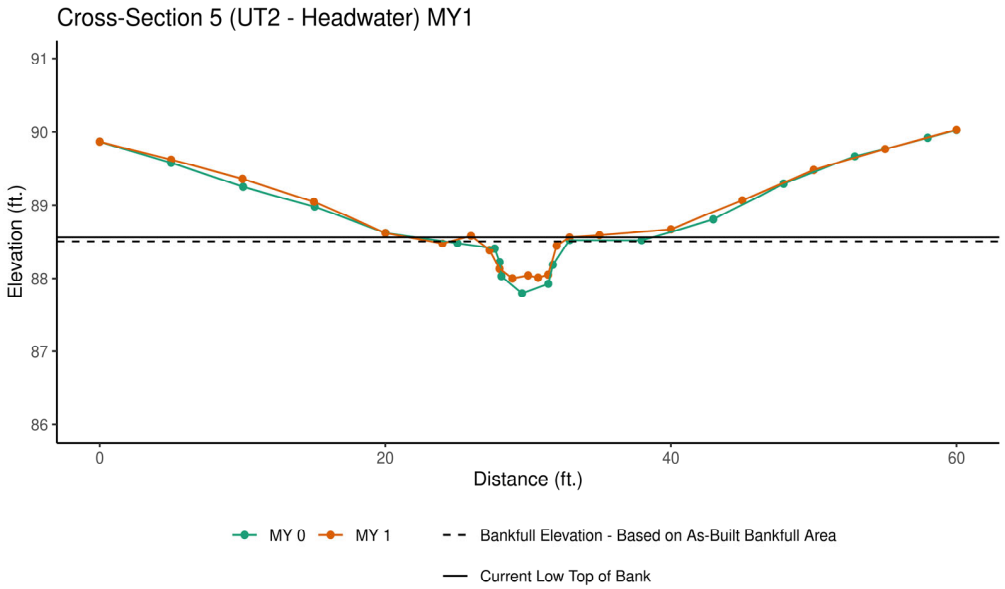
Distance	Elevation	Features
0	89.78	TLP
1.8	89.11	
3.3	88.96	
6.5	88.93	
10.5	88.86	
13.5	88.94	
15.8	89.06	TLB
16.7	88.86	
17.5	88.43	
17.8	87.95	LEW
18.2	87.09	THW
19	87.13	
19.4	87.17	
20	87.32	
20.5	87.36	
21	87.54	REW
21.4	87.91	
22.2	88.04	
23.1	88.28	
25.3	88.88	TRB, BKF
28.5	88.91	
32.5	88.82	
36.5	88.88	
40	89.06	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	88.87	88.84						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	1.02						
Thalweg Elevation	87.34	87.09						
LTOB Elevation	88.87	88.88						
LTOB Max Depth	1.529	1.79						
LTOB Cross Sectional Area	7.68	8.01						



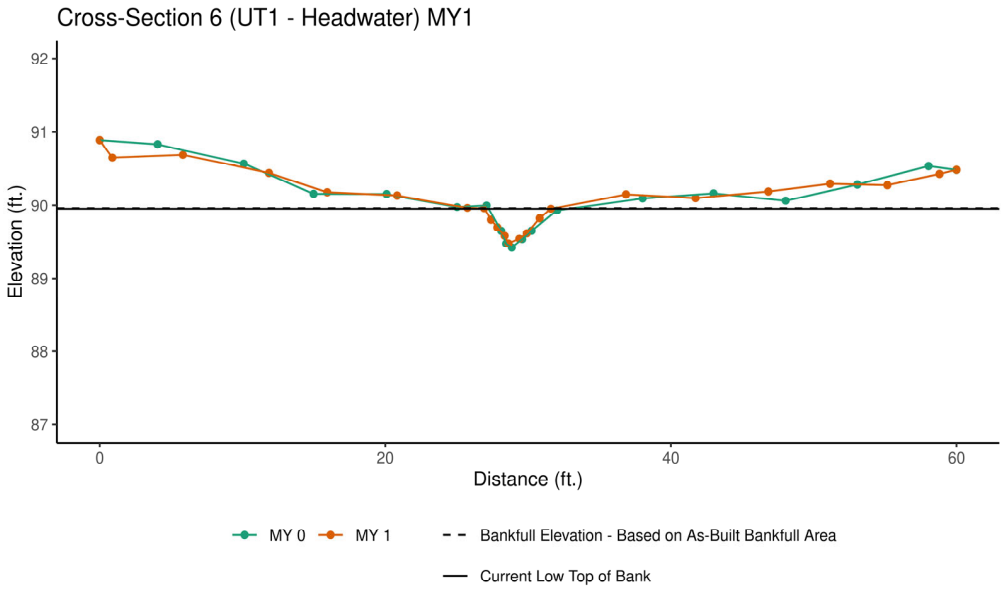
Distance	Elevation	Features
0	88.59	TLP
4	88.46	
8	88.41	
11	88.32	
13	88.42	
15	88.42	
17	88.4	TLB, BKF
17.5	88.18	
18.1	87.99	LEW
19	87.88	
19.7	87.75	
20.5	87.71	THW
21.5	87.82	
22	87.77	
22.4	87.81	REW
23	87.97	
23.7	88.06	
24	88.31	TRP
24.6	88.42	TRB
26	88.48	
27	88.45	
30	88.54	
32	88.93	
35	89.36	
38	89.67	
40	90.02	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	88.35	88.43						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.97						
Thalweg Elevation	87.60	87.71						
LTOB Elevation	88.35	88.40						
LTOB Max Depth	0.755	0.69						
LTOB Cross Sectional Area	3.64	3.45						



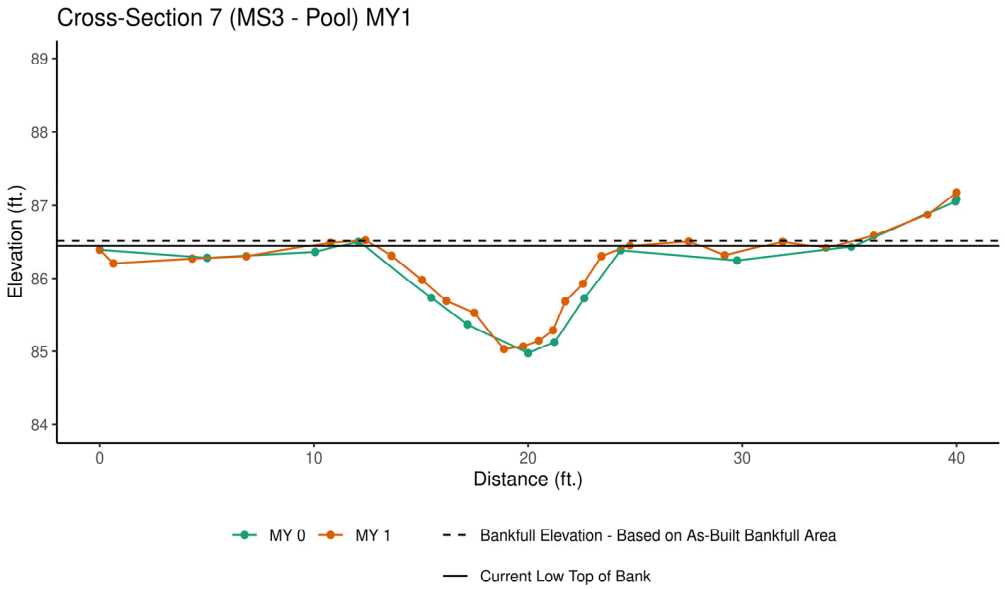
Distance	Elevation	Features
0	89.87	TLP
5	89.62	
10	89.36	
15	89.05	
20	88.62	
24	88.47	
26	88.58	TLB
27.3	88.38	
28	88.13	LEW
28.9	88	THW
30	88.04	
30.7	88.01	
31.4	88.05	REW
32	88.44	
32.9	88.56	TRB, BKF
35	88.59	
40	88.67	
45	89.07	
50	89.48	
55	89.77	
60	90.03	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	88.40	88.50						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	1.12						
Thalweg Elevation	87.79	88.00						
LTOB Elevation	88.40	88.56						
LTOB Max Depth	0.609	0.56						
LTOB Cross Sectional Area	1.96	2.35						



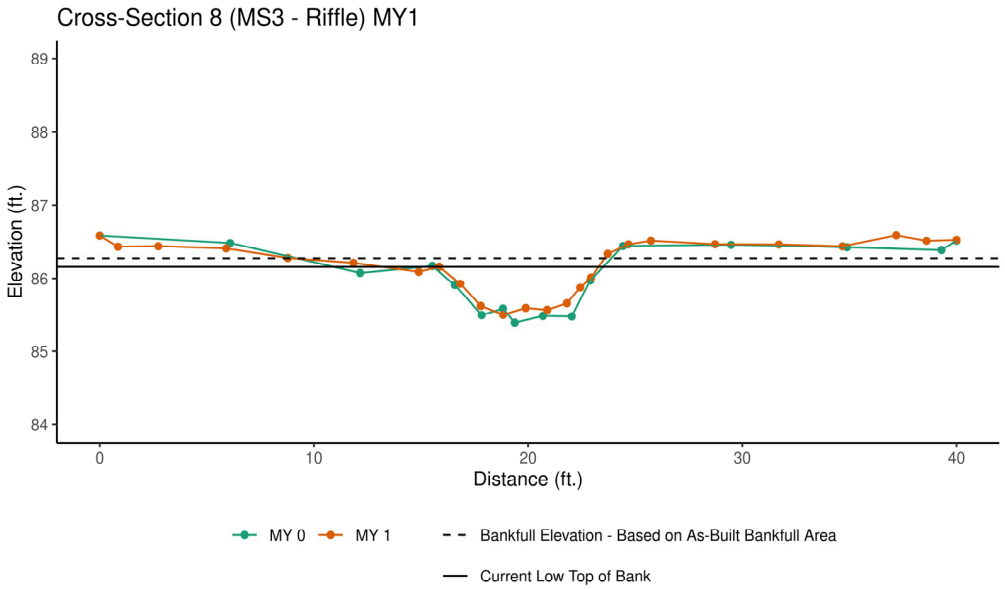
Distance	Elevation	Features
0	90.89	TLP
0.88475194	90.65	
5.82486335	90.689	
11.8538879	90.438	
15.932676	90.18	
20.8275342	90.136	
25.7481988	89.963	
26.9160936	89.957	LTB
27.4027752	89.8	
27.842477	89.697	
28.3571473	89.581	
28.6279852	89.473	THW
29.3815508	89.54	
29.9050639	89.615	
30.8099186	89.82	
31.5947969	89.95	TRB, BKF
36.854413	90.151	
41.7274006	90.101	
46.8237136	90.19	
51.1470209	90.295	
55.1589851	90.276	
58.8089019	90.425	
60	90.482	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	89.93	89.96						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.98						
Thalweg Elevation	89.42	89.47						
LTOB Elevation	89.93	89.95						
LTOB Max Depth	0.511	0.477						
LTOB Cross Sectional Area	1.23	1.19						



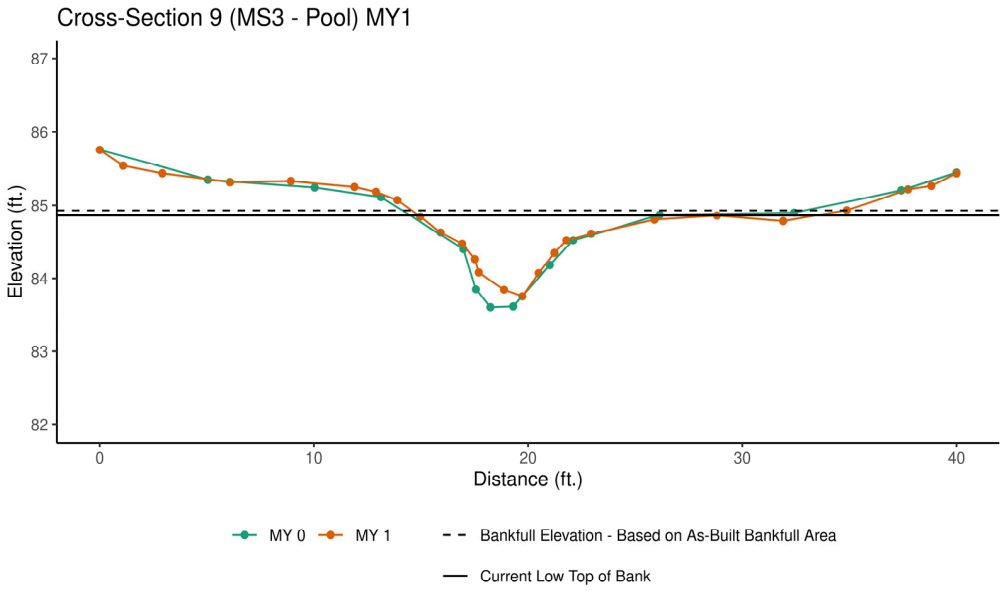
Distance	Elevation	Features
0	86.38	TLP
0.63704631	86.201	
4.32070573	86.264	
6.84446667	86.295	
10.7711787	86.486	
12.4014042	86.521	TLB
13.6229999	86.302	
15.0473251	85.98	
16.1860615	85.686	
17.4869471	85.527	
18.8728906	85.029	THW
19.7732533	85.067	
20.4954077	85.145	
21.1630427	85.291	
21.7324856	85.68	
22.5624148	85.927	
23.4251789	86.296	
24.75372	86.442	TRB BKF
27.4974548	86.504	
29.1731785	86.308	
31.8821915	86.499	
33.9057504	86.41	
36.1374842	86.585	
38.6459738	86.869	
40	87.176	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	86.37	86.51						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.95						
Thalweg Elevation	84.98	85.03						
LTOB Elevation	86.37	86.44						
LTOB Max Depth	1.398	1.413						
LTOB Cross Sectional Area	9.20	8.37						



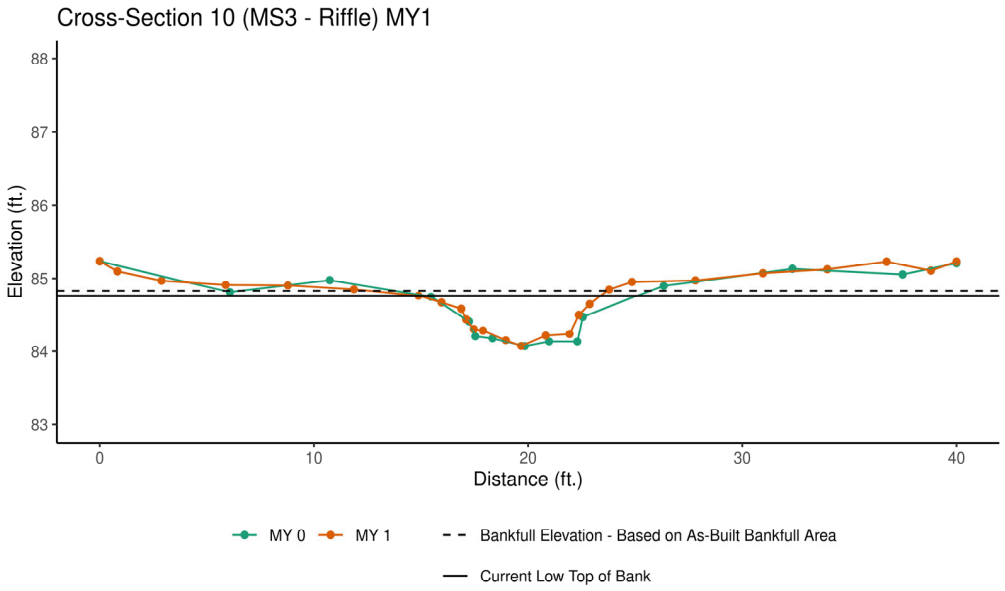
Distance	Elevation	Features
0	86.58	TLP
0.85408313	86.426	
2.73550909	86.433	
5.90362643	86.404	
8.78270391	86.274	
11.8482887	86.208	
14.8961174	86.09	
15.8505786	86.156	TLB, BKF
16.8347767	85.926	
17.7886176	85.62	
18.8312821	85.501	THW
19.8907521	85.592	
20.8920028	85.566	
21.8092984	85.656	
22.4333453	85.873	
22.9350603	86.011	
23.7155647	86.33	
24.6867042	86.459	TRB
25.7320799	86.51	
28.7279144	86.461	
31.7062292	86.458	
34.6766782	86.432	
37.1867578	86.585	
38.6012908	86.508	
40	86.521	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	86.17	86.27						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.85						
Thalweg Elevation	85.40	85.50						
LTOB Elevation	86.17	86.16						
LTOB Max Depth	0.773	0.655						
LTOB Cross Sectional Area	4.04	3.20						



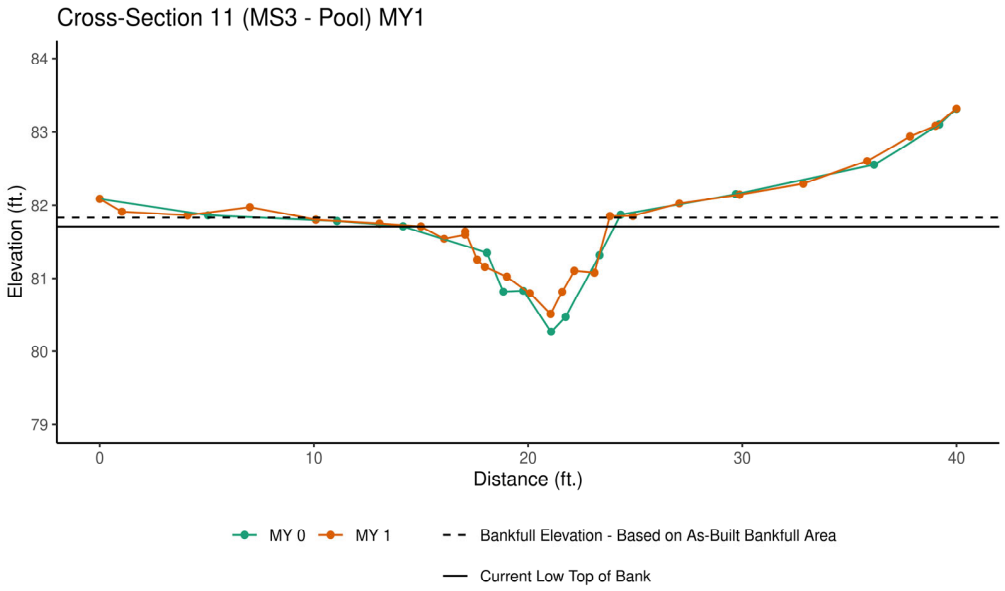
Distance	Elevation	Features
0	85.76	TLP
1.09327627	85.538	
2.92345361	85.434	
6.07983766	85.316	
8.92025493	85.33	
11.8896133	85.252	TLB
12.8970551	85.185	
13.8935721	85.073	
14.962764	84.843	
15.9139075	84.626	
16.9206124	84.469	
17.512024	84.258	
17.6971994	84.081	LEW
18.8744071	83.843	
19.7292013	83.75	THW
20.4910899	84.071	REW
21.2291509	84.344	
21.7872062	84.515	
22.9436749	84.609	
25.8971747	84.802	
28.8163024	84.857	TRB, BKF
31.9060575	84.782	
34.878878	84.931	
37.7389457	85.219	
38.8261674	85.266	
40	85.433	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	84.87	84.93						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.94						
Thalweg Elevation	83.60	83.75						
LTOB Elevation	84.87	84.86						
LTOB Max Depth	1.265	1.107						
LTOB Cross Sectional Area	6.09	5.12						



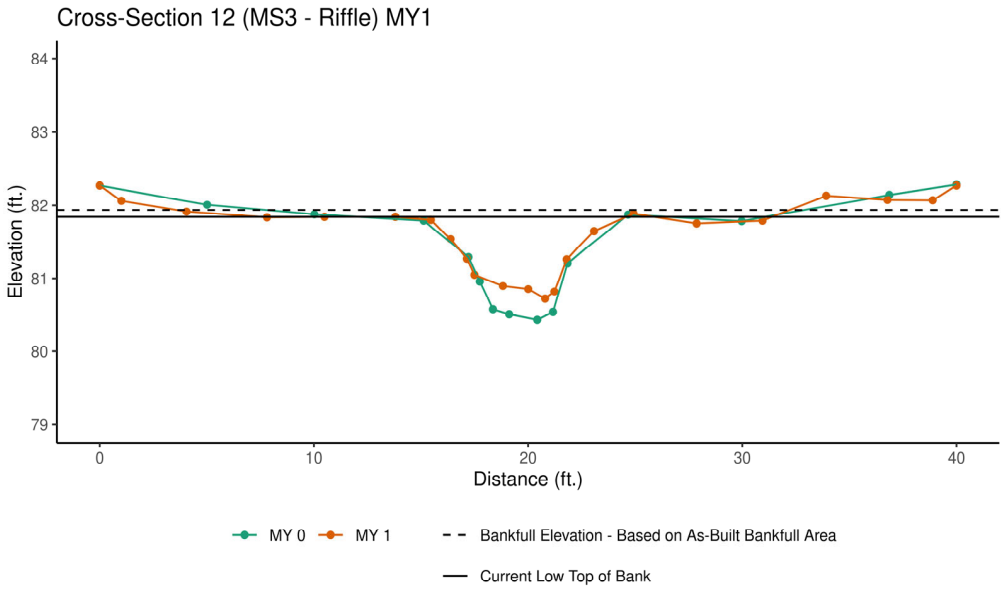
Distance	Elevation	Features
0	85.23	TLP
0.8274358	85.096	
2.8840156	84.969	
5.8792491	84.91	
8.78674029	84.904	
11.8671989	84.849	
14.8808736	84.758	TLB, BKF
15.9582288	84.665	
16.8811508	84.581	
17.1038505	84.44	
17.4652462	84.307	
17.8923194	84.288	
18.9577962	84.153	
19.6778308	84.072	THW
20.8209606	84.22	
21.9350179	84.241	
22.3672225	84.498	
22.8728007	84.643	
23.7841327	84.846	
24.8488589	84.952	TRB
27.8100901	84.973	
30.9650852	85.071	
33.9690205	85.124	
36.738611	85.224	
38.8065865	85.106	
40	85.225	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	84.74	84.83						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.91						
Thalweg Elevation	84.07	84.07						
LTOB Elevation	84.74	84.76						
LTOB Max Depth	0.674	0.686						
LTOB Cross Sectional Area	3.77	3.18						



Distance	Elevation	Features
0	82.09	TLP
1.03577797	81.909	
4.10097757	81.86	
7.00985192	81.973	
10.0886124	81.8	
13.0618783	81.748	
14.9962388	81.708	TLB, BKF
16.0795427	81.538	
17.0617596	81.639	
17.0597611	81.594	
17.6194364	81.251	
17.9807939	81.155	
19.0096393	81.022	
20.0801486	80.792	
21.0505195	80.512	THW
21.5900033	80.812	
22.1563339	81.102	
23.0971965	81.077	
23.8204535	81.849	TRB
24.8918282	81.852	
27.0602507	82.026	
29.8719271	82.148	
32.8466337	82.296	
35.8277632	82.601	
37.8297904	82.94	
39.019312	83.083	
40	83.318	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	81.71	81.83						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.91						
Thalweg Elevation	80.27	80.51						
LTOB Elevation	81.71	81.71						
LTOB Max Depth	1.437	1.196						
LTOB Cross Sectional Area	5.88	4.84						



Distance	Elevation	Features
0	82.27	TLP
1.00920018	82.063	
4.0535482	81.911	
7.80938211	81.832	
10.4935735	81.839	
13.8021073	81.839	TLB, BKF
15.4585015	81.797	
16.3809344	81.535	
17.1402329	81.265	
17.4958522	81.048	LEC
18.8235669	80.896	
20.00516	80.852	
20.7917496	80.718	THW
21.22528	80.817	REC
21.8006607	81.256	
23.0770473	81.645	
24.9221664	81.882	TRB
27.8683191	81.749	
30.9429957	81.787	
33.9144822	82.132	
36.7774936	82.076	
38.8880779	82.071	
40	82.27	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	81.79	81.93						
Bank Height Ratio - Based on As-Built Bankfull Area	1.00	0.92						
Thalweg Elevation	80.43	80.72						
LTOB Elevation	81.79	81.84						
LTOB Max Depth	1.354	1.121						
LTOB Cross Sectional Area	6.47	5.46						

Baseline Stream Data Summary Hornpipe, MS1											Hornpipe, MS2										Hornpipe, MS3									
Parameter	Pre-Existing Condition (3/14/2018)					Design		MY0 (3/24/2021)			Pre-Existing Condition (3/14/2018)					Design		MY0 (3/24/2021)			Pre-Existing Condition (3/14/2018)					Design		MY0 (3/24/2021)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)		4.2			1		6.9		6.4	1		4.5			1		7.5		7.9	1		8.4			1		8.4	8.0	9.5	3
Floodprone Width (ft)		9.0			1	15.0	30.0		34.5	1		8.7			1	29.0	47.0		33.9	1		8.8			1	19.0	30.0	40.0	40.0	3
Bankfull Mean Depth (ft)		0.9			1		0.5		0.7	1		1.0			1		0.6		0.5	1		0.7			1		0.6	0.4	0.7	3
Bankfull Max Depth (ft)		1.2			1		0.7		1.2	1		1.3			1		0.8		0.8	1		0.8			1		0.9	0.7	1.3	3
Bankfull Cross Sectional Area (ft^2)		3.8			1		3.7		4.7	1		4.4			1		4.3		3.6	1		5.5			1		5.4	3.8	6.5	3
Width/Depth Ratio		4.7			1		13.0		8.8	1		4.5			1		13.0		17.1	1		12.7			1		13.0	13.0	24.0	3
Entrenchment Ratio		2.1			1	2.2	4.3		5.4	1		2.0			1	3.9	6.3		4.3	1		1.1			1	2.3	3.6	4.2	5.0	3
Bank Height Ratio		2.6			1	1.0	1.1		1.0	1		2.2			1	1.0	1.1		1.0	1		4.8			1	1.0	1.1	1.0	1.0	3
Max part size (mm) mobilized at Bankfull	14.0					10.0		12.0			13.0					8.0		6.0			10.0					9.0		8.0		
Rosgen Classification	Channelized					DA/E5		E5			Channelized					E5/C5		C5			F5					E5/C5		C5		
Bankfull Discharge (cfs)	4.0					4.0		4.0			4.5					4.5		4.5			6.6					6.6		6.6		
Sinuosity (ft)	1.01					1.02		1.02			1.01					1.11		1.10			1.02					1.18		1.16		
Water Surface Slope (Channel) (ft/ft)	0.005					0.0049		0.0044			0.0041					0.0037		0.0033			0.004					0.0044		0.0042		
Other																														

Baseline Stream Data Summary Hornpipe, UT1 (HW)											Hornpipe, UT2 (HW)									
Parameter	Pre-Existing Condition (3/14/2018)					Design		MY0 (3/24/2021)			Pre-Existing Condition (3/14/2018)					Design		MY0 (3/24/2021)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)		4.3			1		4.4		4.7	1		2.7			1		4.4		4.8	1
Floodprone Width (ft)		6.9			1	15.0	30.0		44.5	1		4.4			1	15.0	30.0		30.5	1
Bankfull Mean Depth (ft)		0.4			1		0.3		0.3	1		0.4			1		0.3		0.4	1
Bankfull Max Depth (ft)		1.0			1		0.3		0.5	1		0.6			1		0.3		0.6	1
Bankfull Cross Sectional Area (ft^2)		1.6			1		1.2		1.2	1		1.1			1		1.2		2.0	1
Width/Depth Ratio		11.5			1		16.0		18.2	1		6.8			1		16.0		11.9	1
Entrenchment Ratio		1.6			1	3.4	6.8		9.4	1		1.6			1	3.4	6.8		6.3	1
Bank Height Ratio		3.3			1	1.0	1.1		1.0	1		4.7			1	1.0	1.1		1.0	1
Max part size (mm) mobilized at Bankfull	9.0					6.0		6.0			9.0					7.0		10.0		
Rosgen Classification	Channelized					DA		DA			Channelized					DA		DA		
Bankfull Discharge (cfs)	1.4					1.4		1.4			1.2					1.2		1.2		
Sinuosity (ft)	1.06					1.09		1.09			1.06					1.07		1.05		
Water Surface Slope (Channel) (ft/ft)	0.0065					0.0062		0.0063			0.0067					0.0065		0.0062		
Other																				

Monitoring Data - Cross-Section Morphology Monitoring Summary

Hornpipe Branch Tributaries/DMS:100076 Segment/Reach: MS1, MS2, MS3, UT1, UT2 (Data Collected 10/19/2021)

	Cross-Section 1 (Pool - MS1)							Cross-Section 2 (Riffle - MS1)							Cross-Section 3 (Pool - MS2)							Cross-Section 4 (Riffle - MS2)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	94.63	94.85						91.75	91.82						88.87	88.84						88.35	88.43					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.85						1.00	1.03						1.00	1.02						1.00	0.97					
Thalweg Elevation	93.23	93.66						90.51	90.65						87.34	87.09						87.60	87.71					
LTOB[2] Elevation	94.63	94.67						91.75	91.86						88.87	88.88						88.35	88.40					
LTOB[2] Max Depth (ft)	1.40	1.01						1.25	1.21						1.53	1.79						0.75	0.69					
LTOB2 Cross-Sectional Area (ft2)	5.20	4.13						4.72	5.03						7.68	8.01						3.64	3.45					

	Cross-Section 5 (Headwater - UT2)							Cross-Section 6 (Headwater UT1)							Cross-Section 7 (Pool - MS3)							Cross-Section 8 (Riffle - MS3)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	88.40	88.50						89.93	89.96						86.37	86.51						86.17	86.27					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.12						1.00	0.98						1.00	0.95						1.00	0.85					
Thalweg Elevation	87.79	88.00						89.42	89.47						84.98	85.03						85.40	85.50					
LTOB[2] Elevation	88.40	88.56						89.93	89.95						86.37	86.44						86.17	86.16					
LTOB[2] Max Depth (ft)	0.61	0.56						0.51	0.48						1.40	1.41						0.77	0.66					
LTOB2 Cross-Sectional Area (ft2)	1.96	2.35						1.23	1.19						9.20	8.37						4.04	3.20					

	Cross-Section 9 (Pool - MS3)							Cross-Section 10 (Riffle - MS3)							Cross-Section 11 (Pool - MS3)							Cross-Section 12 (Riffle - MS3)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	84.87	84.93						84.74	84.83						81.71	81.83						81.79	81.93					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.94						1.00	0.91						1.00	0.91						1.00	0.92					
Thalweg Elevation	83.60	83.75						84.07	84.07						80.27	80.51						80.43	80.72					
LTOB[2] Elevation	84.87	84.86						84.74	84.76						81.71	81.71						81.79	81.84					
LTOB[2] Max Depth (ft)	1.27	1.11						0.67	0.69						1.44	1.20						1.35	1.12					
LTOB2 Cross-Sectional Area (ft2)	6.09	5.12						3.77	3.18						5.88	4.84						6.47	5.46					

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

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

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

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

Evidence of Headwater Stream Formation Hornpipe Branch Tributaries Mitigation Project				
Channel Forming Indicators - UT1	**MY1**	**MY2**	**MY3**	**MY4**
Scour (indicating sediment transport by flowing water)	Yes			
Sediment deposition (accumulations of sediment and/or formation of ripples)	No			
Sediment sorting (sediment sorting indicated by grain-size distribution within primary flow path)	No			
Multiple observed flow events (must be documented by gauge data and/or photographs)	Yes			
Destruction of terrestrial vegetation	No			
Presence of litter and debris	No			
Wracking (deposits of drift material indicating surface water flow)	Yes			
Vegetation matted down, bent, or absent (herbaceous or otherwise)	No			
Leaf litter disturbed or washed away	No			
Channel Forming Indicators - UT2	**MY1**	**MY2**	**MY3**	**MY4**
Scour (indicating sediment transport by flowing water)	Yes			
Sediment deposition (accumulations of sediment and/or formation of ripples)	No			
Sediment sorting (sediment sorting indicated by grain-size distribution within primary flow path)	No			
Multiple observed flow events (must be documented by gauge data and/or photographs)	Yes			
Destruction of terrestrial vegetation	No			
Presence of litter and debris	No			
Wracking (deposits of drift material indicating surface water flow)	Yes			
Vegetation matted down, bent, or absent (herbaceous or otherwise)	No			
Leaf litter disturbed or washed away	No			

Appendix D:
Hydrologic Data

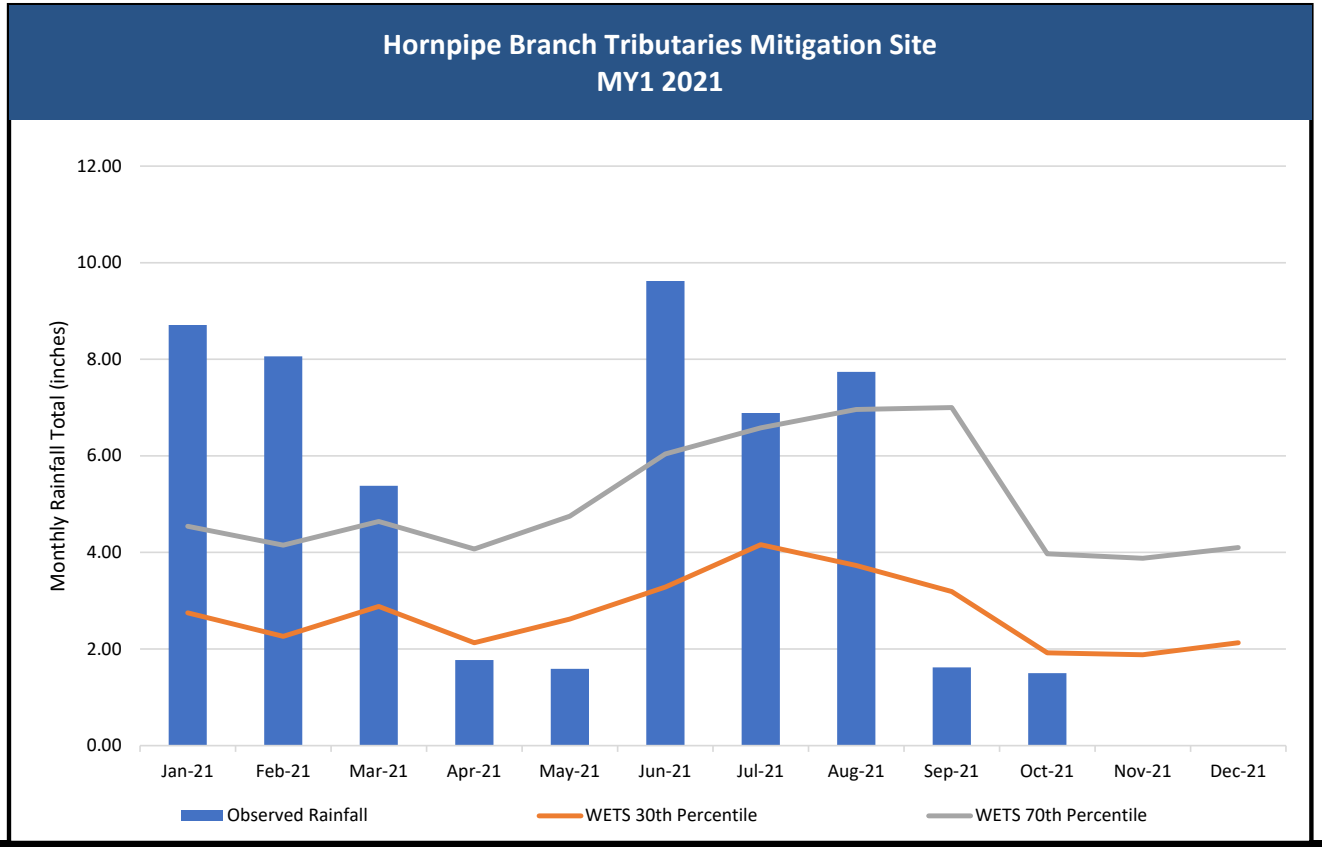
Verification of Bankfull Events
Monthly Rainfall Summary Data
Water Level Hydrographs
Flow Gauge and Crest Gauge Installation Diagrams
Wetland Hydrology Criteria Attainment Table and Graphs

Hornpipe Branch Tributaries Mitigation Project: Overbank Events (MY1) Crest Gauge CG-1 (MS3)					
	Date of Collection	**Date of Occurrence**	**Method**	**Notes**	**Measurement Above Bankfull (feet)**
MY1	4/7/2021	3/27/2021 - 3/28/2021	Pressure Transducer	Bankfull due to rainfall event	0.411
	4/7/2021	4/1/2021	Pressure Transducer	Bankfull due to rainfall event	0.488
	8/5/2021	unknown	Cork Gauge	Evidence of bankfull on traditional cork gauge	0.85
	10/19/2021	unknown	Cork Gauge	Evidence of bankfull on traditional cork gauge	0.45

8/5/2021

10/19/2021

*Data lost due to a pressure transducer malfunction from 6/6/2021 - 10/19/2021

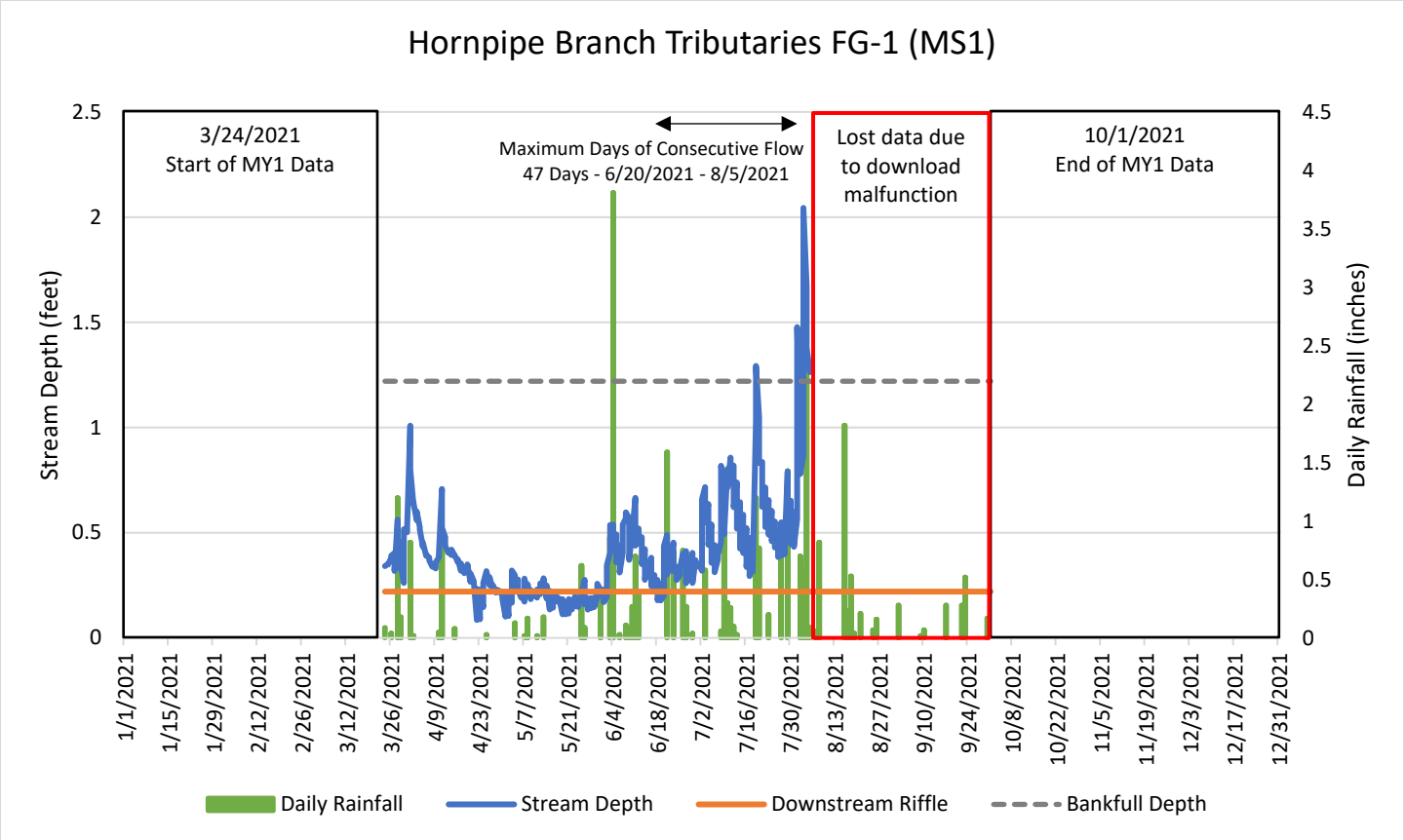


Hornpipe Branch Tributaries Mitigation Project Monthly Rainfall Summary												
	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
Observed Rainfall	8.71	8.06	5.38	1.77	1.59	9.62	6.89	7.74	1.62	1.50	**	**
WETS 30th Percentile	2.75	2.26	2.88	2.13	2.62	3.28	4.16	3.73	3.19	1.92	1.88	2.13
WETS 70th Percentile	4.54	4.15	4.64	4.07	4.75	6.04	6.58	6.96	7.00	3.97	3.88	4.10
Low/Normal/High	H	H	H	L	L	H	H	H	L	L	**	**

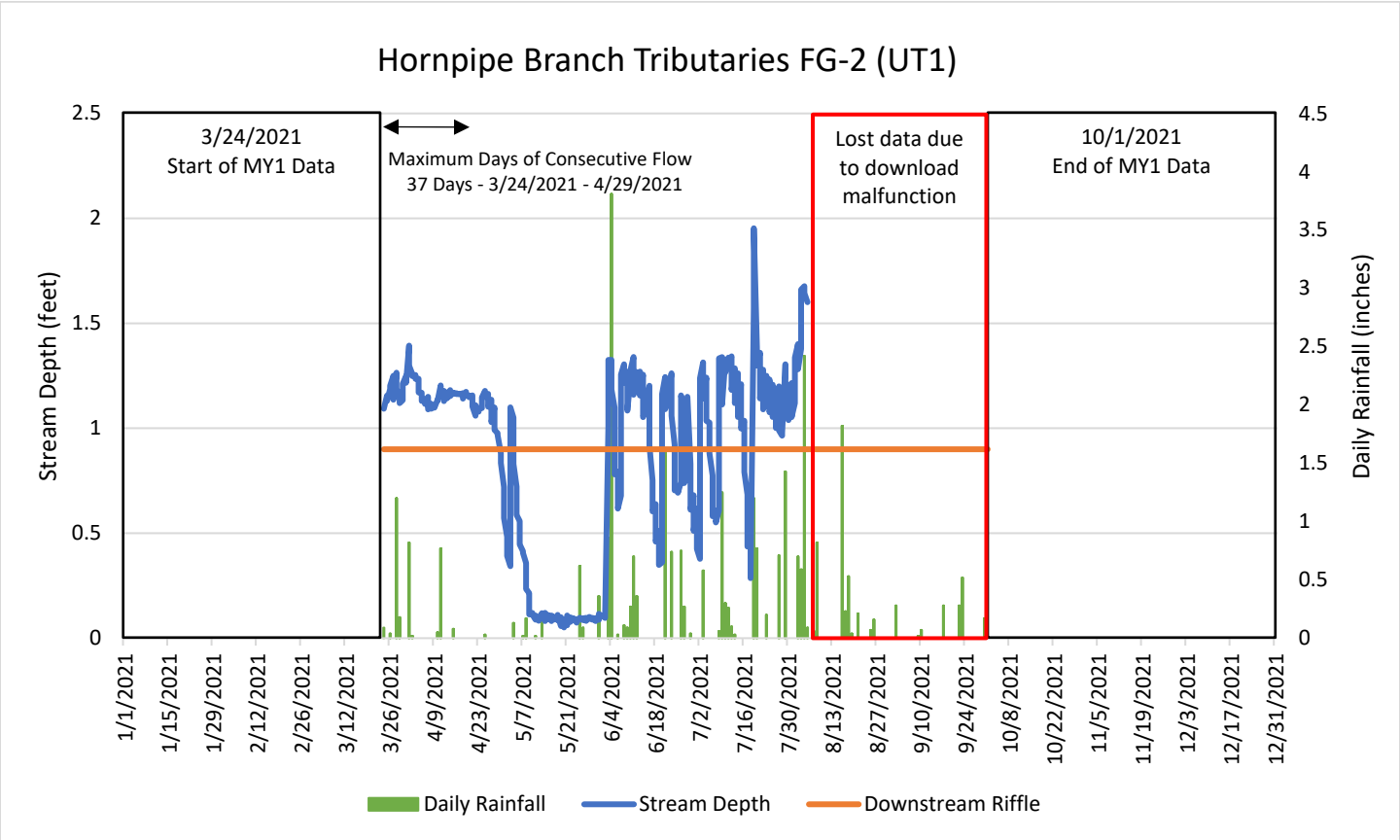
*30th and 70th Percentile data collected from data from WETS Station: KINSTON AG RESEARCH, NC

**Incomplete Month

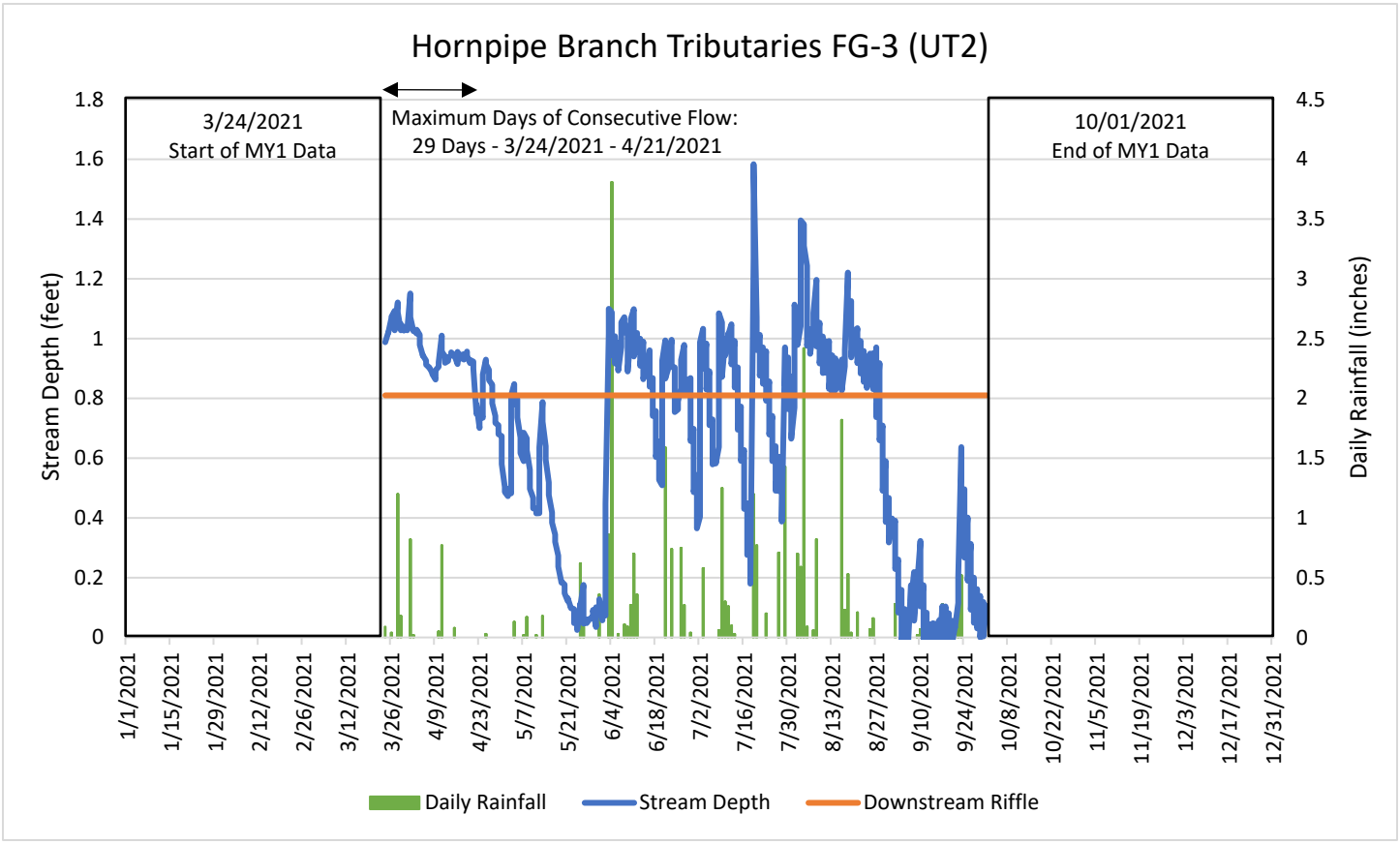
Flow Gauge Data – Hornpipe Branch Tributaries MY1



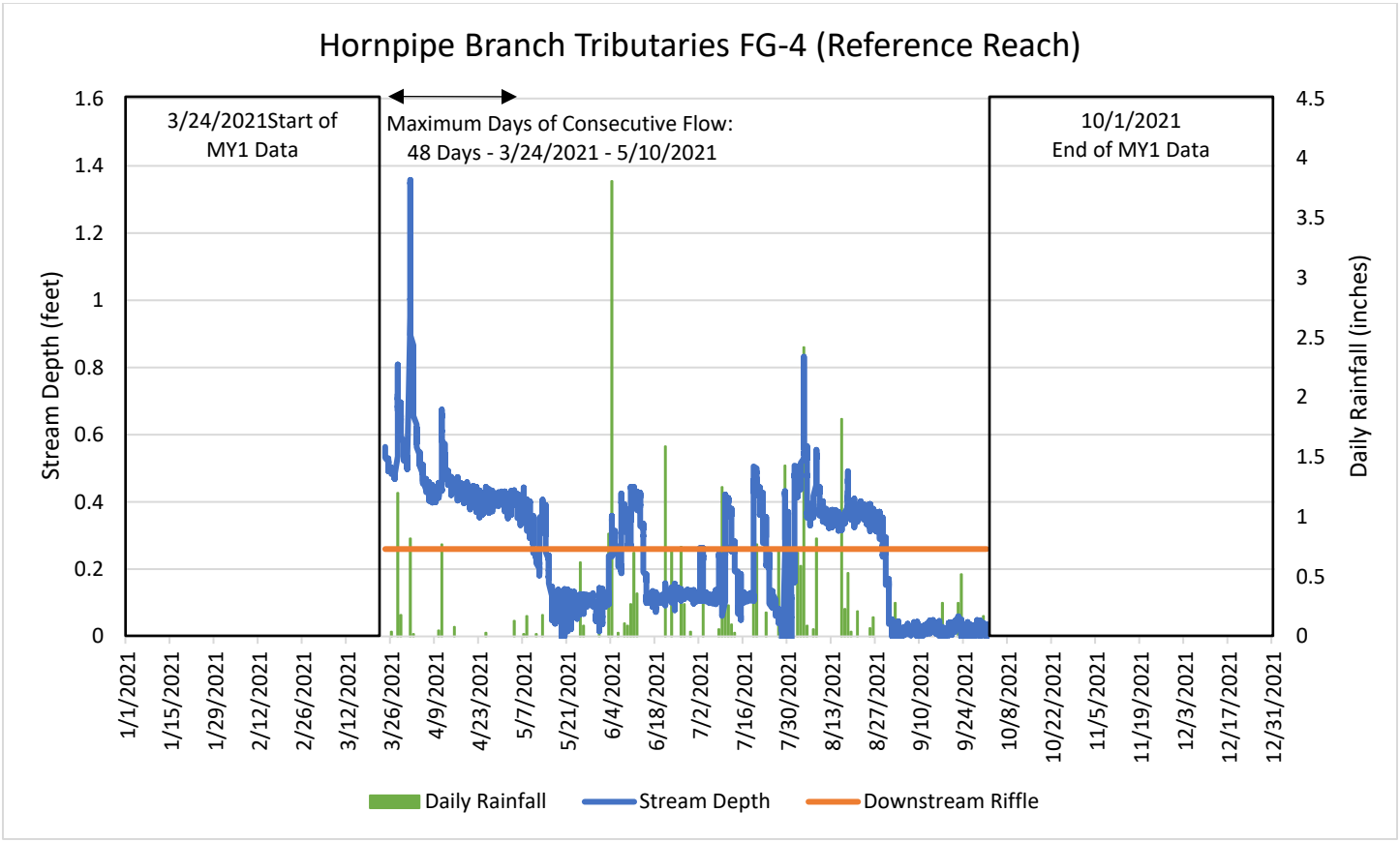
*106 days of cumulative flow in MY1, 29 days of no recorded flow in MY1



*84 days of cumulative flow in MY1, 51 days of no recorded flow in MY1

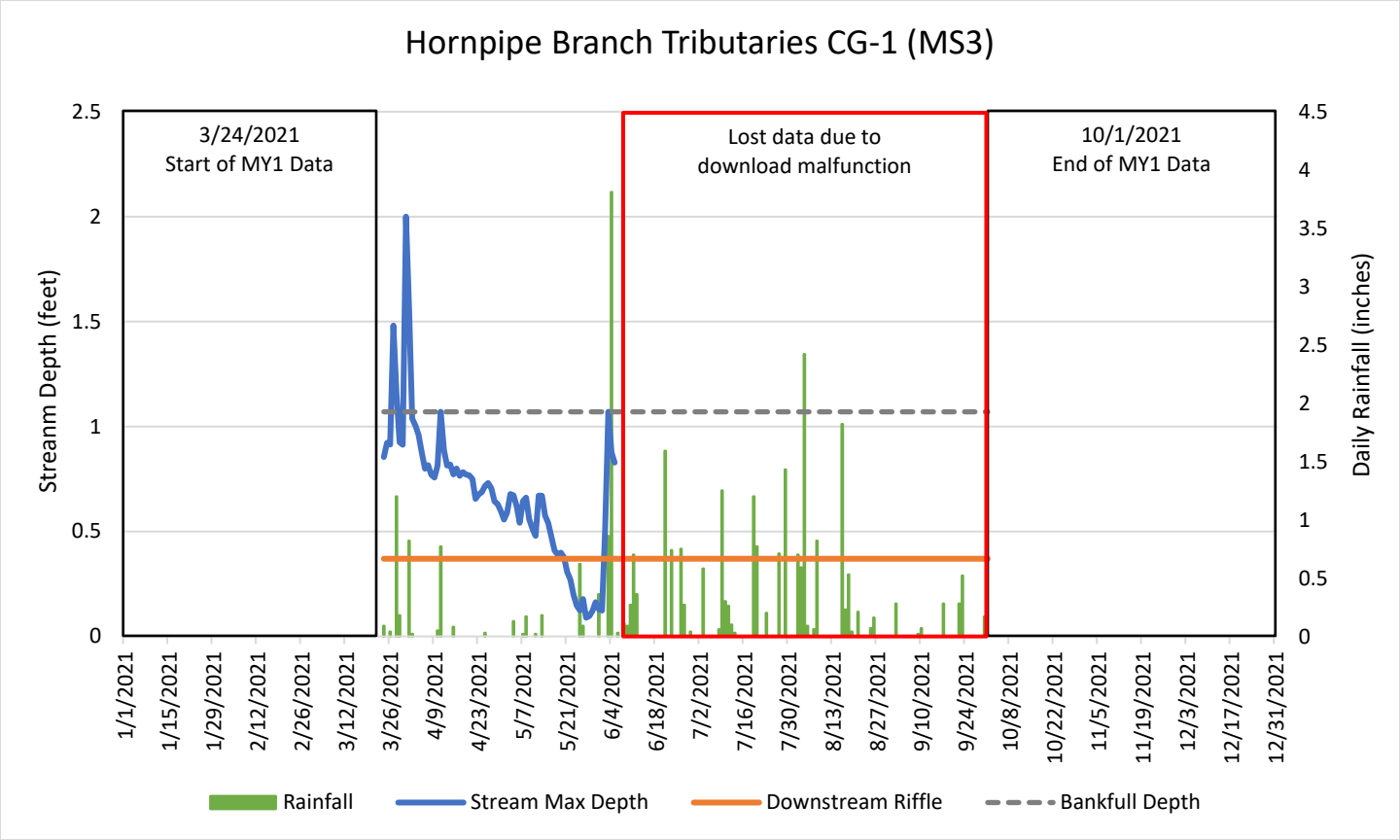


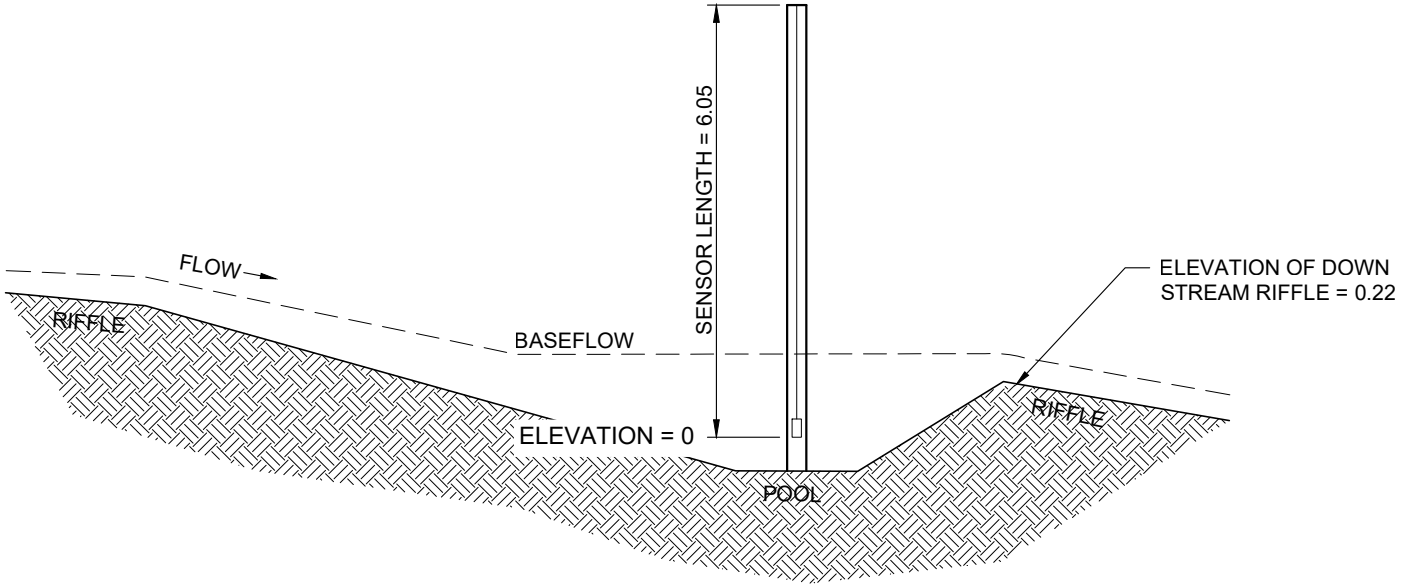
*97 days of cumulative flow in MY1, 95 days of no recorded flow in MY1



*96 days of cumulative flow in MY1, 96 days of no recorded flow in MY1

Crest Gauge Data – Hornpipe Branch Tributaries MY1

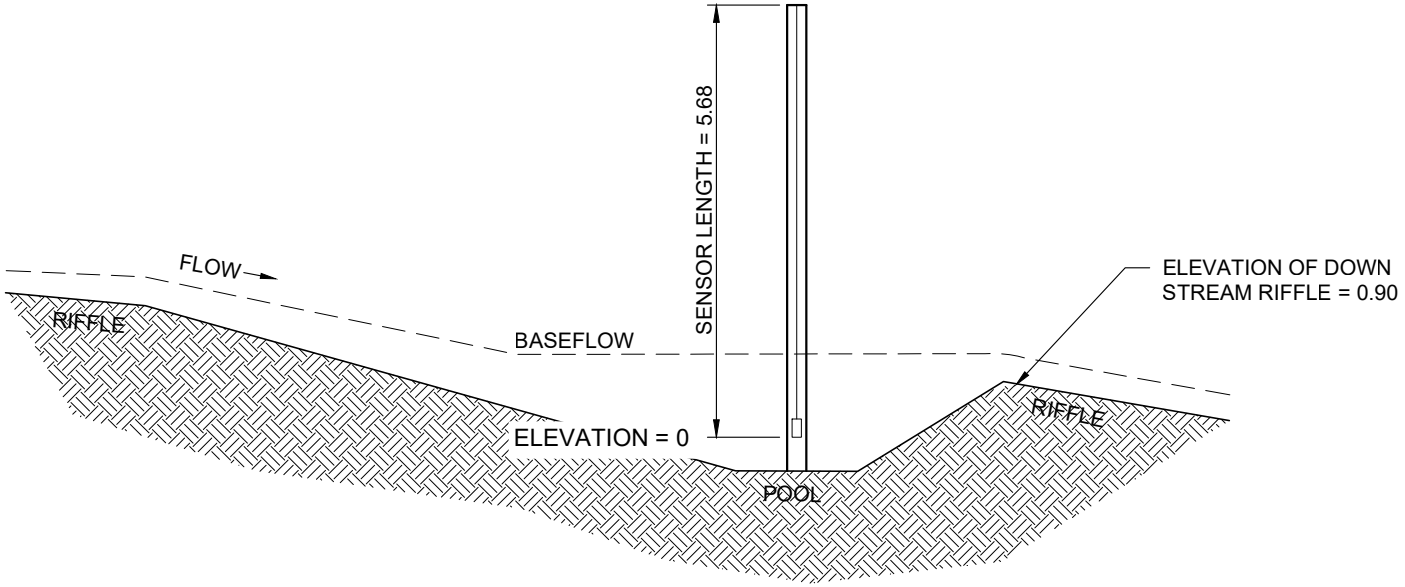




FLOW GAUGE #1 - MS1

Flow Depth = 0.22 feet

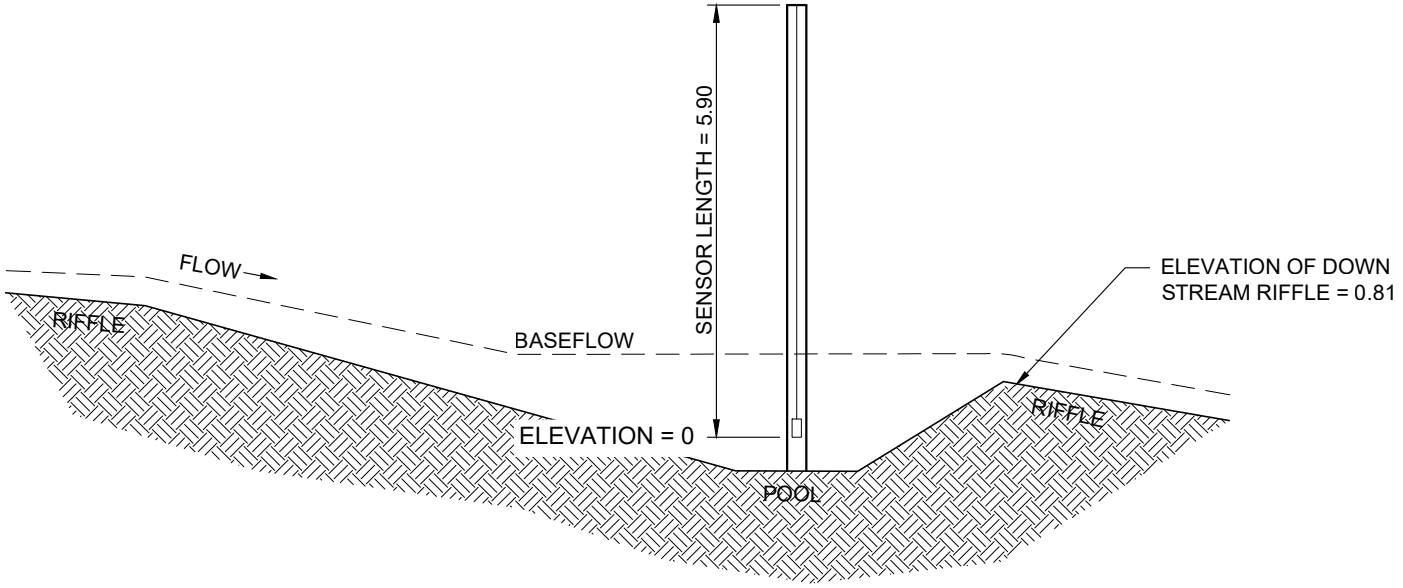
*All elevations relative to sensor depth



FLOW GAUGE #2 - UT1

Flow Depth = 0.90 feet

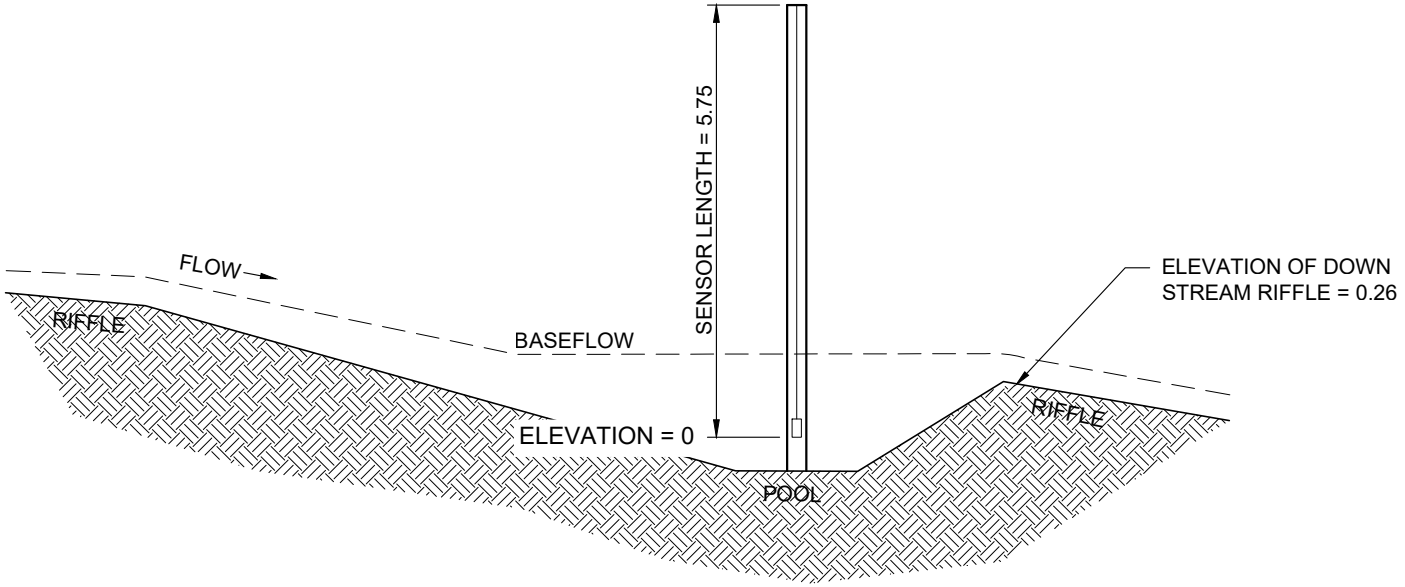
*All elevations relative to sensor depth



FLOW GAUGE #3 - UT2

Flow Depth = 0.81 feet

*All elevations relative to sensor depth

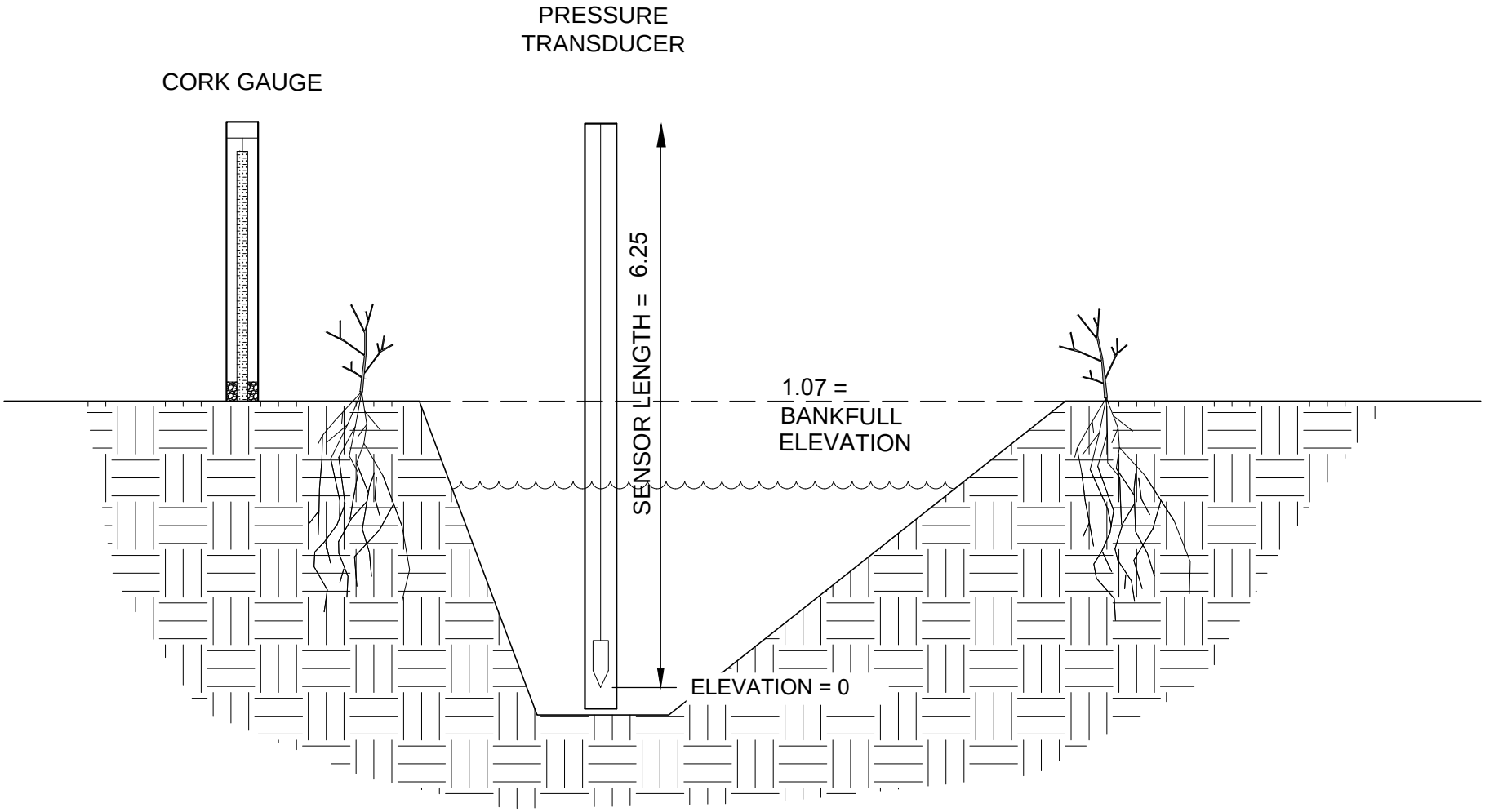


FLOW GAUGE #4 - Reference Reach

Flow Depth = 0.26 feet

*All elevations relative to sensor depth

CROSS SECTIONAL VIEW OF STREAM



Crest Gauge CG-1 (MS-3)

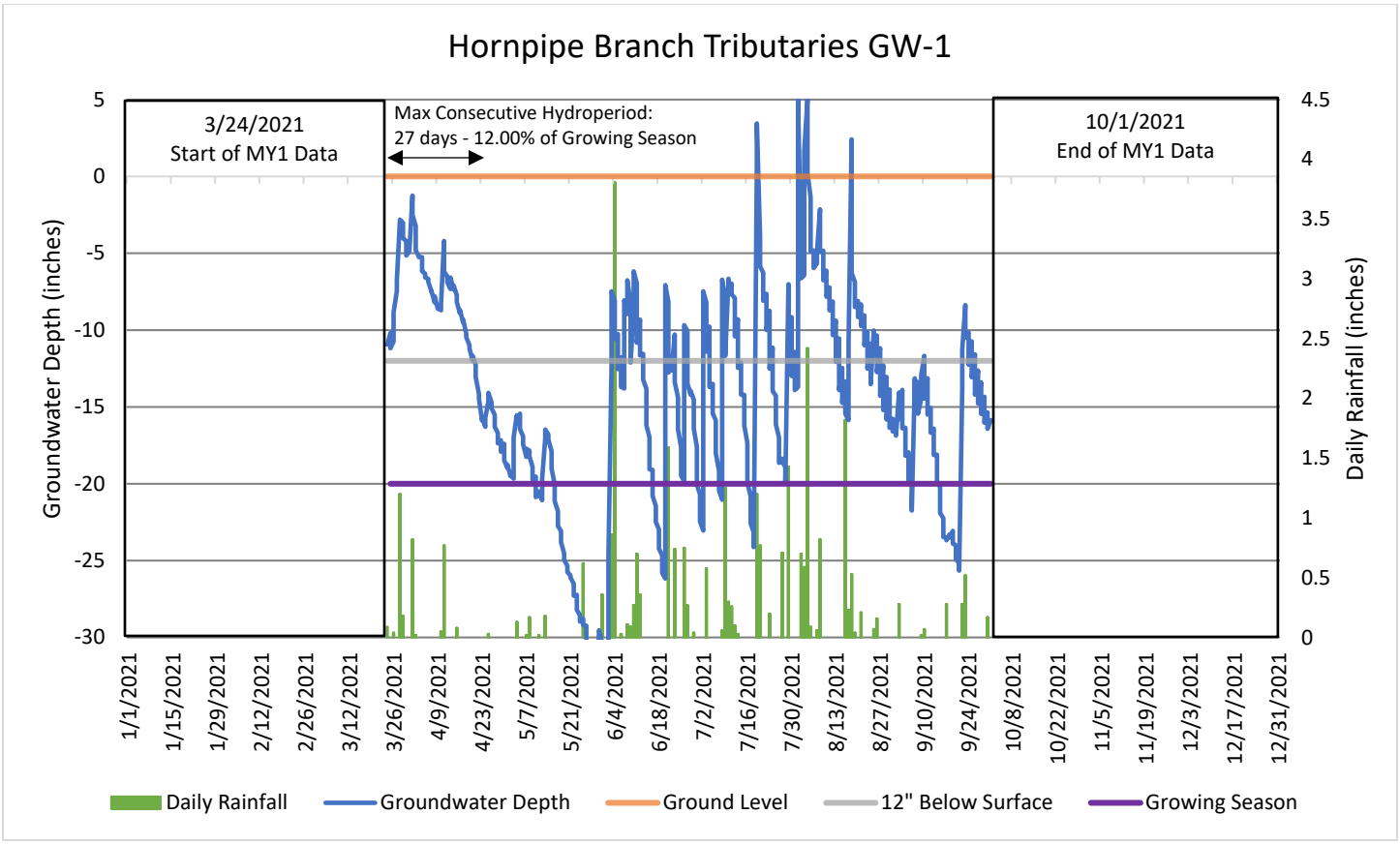
Bankfull Event Depth = 1.07 feet

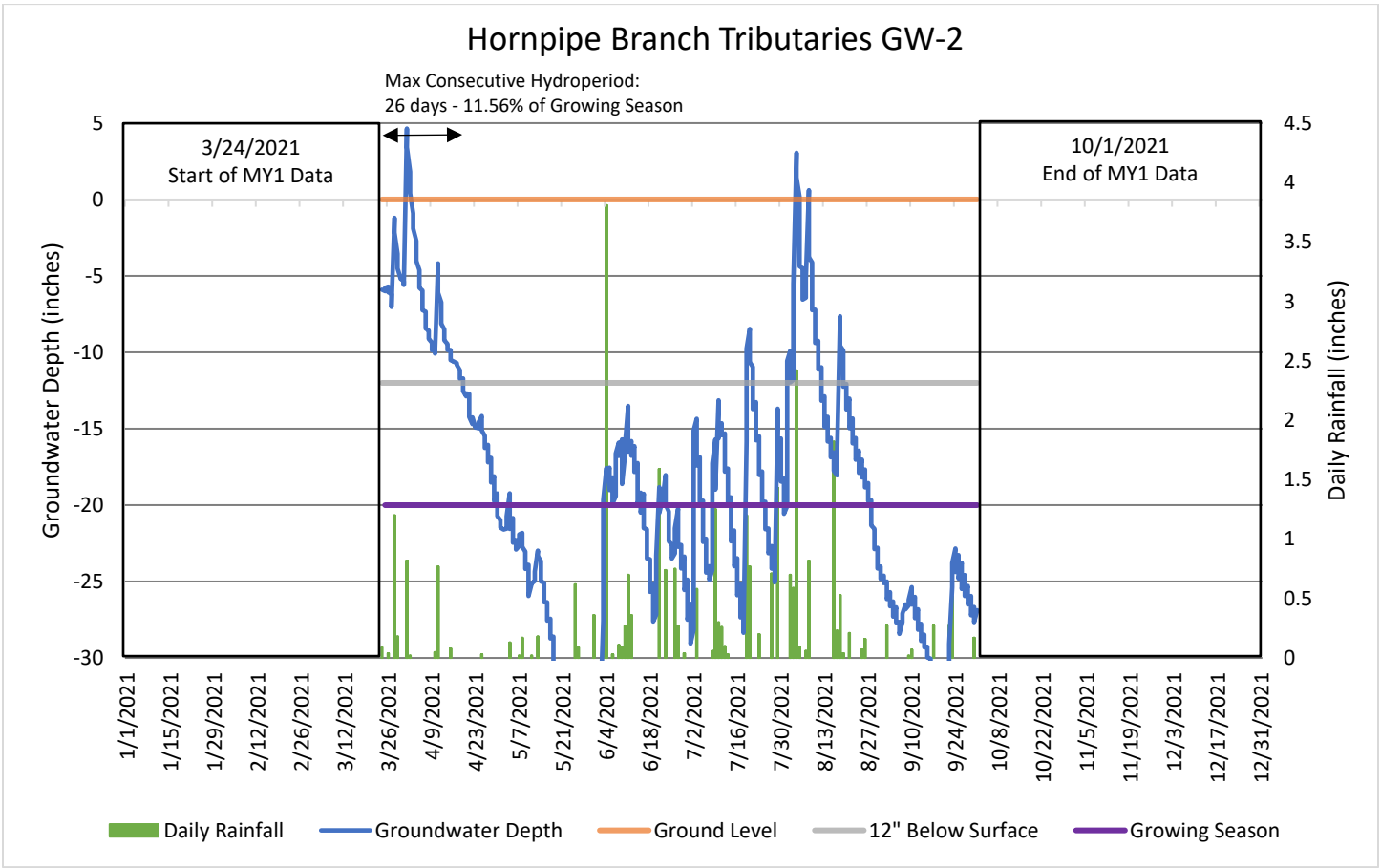
*All elevations relative to sensor depth

Hornpipe Branch Tributaries Wetland Hydrology Criteria Attainment Table									
	Performance Standard: N/A* WETS Station: Kinston Ag Research, Inc Growing Season: 3/26 to 11/7 (225 days) Max. Consecutive Hydroperiod (%)								
Monitoring Gauge	MY 1 2021	MY2 2022	MY 3 2023	MY 4 2024	MY 5 2025	MY 6 2026	MY 7 2027	MY 7+ 2028	Average
GW-1	12.00%								12.00%
GW-2	11.56%								11.56%

*No wetland mitigation credits were contracted or proposed for Hornpipe Branch Tributaries therefore no performance standards for wetland hydrology success are proposed.

Groundwater Gauge Data – Hornpipe Branch Tributaries MY1





Appendix E:

Project Timeline and Contact Info

Project Timeline and Contacts

Activity or Deliverable	Data Collection Complete	Task Completion or Deliverable Submission
Project Instituted	NA	6/14/2018
Mitigation Plan Approved	NA	7/6/2020
Construction (Grading) Completed	NA	3/26/2021
Planting Completed	NA	4/3/2021
As-built Survey Completed	NA	5/14/2021
MY-0 Baseline Report	4/29/2021	6/18/2021
MY1 Monitoring Reports	10/19/2021	11/29/2021
Remediation Items (e.g. beaver removal, supplements, repairs etc.)		
Encroachment		

Hornpipe Branch Tributaries	
Provider	7721 Six Forks Road, Suite 130
Water & Land Solutions, LLC	Raleigh, NC 27615
Mitigation Provider POC: Emily Dunnigan	(269) 908-6306
Designer	7721 Six Forks Road, Suite 130
Water & Land Solutions, LLC	Raleigh, NC 27615
Primary project design POC: Kayne Van Stell	(919) 818-8481
Construction Contractor	453 Silk Hope Liberty Road
Wright Contracting, LLC	Siler City, NC 27344
Primary contractor POC: Ben Johnson	(336) 402-8312

Appendix F: Correspondence

MY0 IRT Comments Memo
IRT As-Built Site Visit Meeting Minutes

WATER & LAND SOLUTIONS

WLS Memo

Hornpipe Branch Tributaries Mitigation Site, DMS Project #100076

USACE Action ID#: SAW-2018-01762

DWR Project #2018-1155

Subject: Hornpipe Branch Tributaries As-Built Baseline IRT Comments

Date Prepared: November 1st, 2021

This memo addresses the North Carolina Interagency Review Team (NCIRT) comments on the Hornpipe Branch Tributaries As-Built/MY0 report. These comments were provided via email by Kimberly Browning on July 16th, 2021. DMS directed WLS to address these comments in the MY1 report. WLS is providing our written responses to the NCIRT's review comments below. Each of the NCIRT review comments is copied below in bold text, followed by the appropriate response from WLS in regular text:

USACE Comments (Kim Browning)

1. **The IRT does have some concern that MS1 was constructed as full channel PII/PIII restoration through a headwater system. During the mitigation plan review, WLS stated that a shallow flow path will be constructed to form a small pilot channel similar to the adjacent reference sites described in Section 6.2.1. The pilot or primary channel will be approximately 2-4 ft wide and 0.3'-0.7' deep and not function as a ditch flowing through a wetland. Please confirm the depth of the pilot channel.** Response: As described in the approved mitigation plan, Section 6.1.2, the upper portion of MS1 was constructed as a Priority Level II/III Restoration by gradually raising the bed elevation and excavating a floodplain bench before reconnecting the stream with its geomorphic floodplain (Priority Level I) near MS2. This reach was intentionally not constructed using the same HW valley approach as UT1 and UT2 given the confinement and larger catchment (DA = 183 ac). The PII restoration approach along MS1 was utilized to address an IRT concern (USACE/Kim Browning mitigation plan comment #11) that raising the ditch elevation to the same as the surrounding land would result in significant rehydration of the surrounding farm fields. Raising the channel profile elevation abruptly in this area would have caused a potential flood and groundwater impact to an existing farm road and adjacent property access. The representative as-built channel dimensions match the approved design parameters.

DWR Comments (Erin Davis)

1. **DWR is ok with the addition of winterberry to the approved planting plan species list.** Response: Thank you.

2. **The redline drawings appear to show absolutely no deviations in location or material/type of**

streambed/bank structures installed compared to the final mitigation design plans. Please confirm. Response: Correct/Confirmed no significant deviations were made to the stream alignment, bed material or in-stream structures.

3. **DWR appreciated the inclusion of the drone site photos. They provided an additional perspective that was helpful for this review.** Response: Thank you.

USACE Comments (Casey Haywood)

1. **Pg 4. Table 2 Summary: Goal- Establish riparian buffer vegetation: The objective/treatment states "Plant native species vegetation a minimum 30' wide from the top of the streambanks". The riparian buffer requirement for Lenoir County is a minimum of 50 feet. Additionally, under Performance Criteria- for projects located in the coastal plain and piedmont counties, trees in each plot must average 7 feet in height at year five and 10 feet in height at year seven. Please update.** Response: The table has been edited to reflect the Lenoir County requirements and appropriate performance criteria.

2. **Pg 7. Section 2.2.3 Vegetation: Update the narrative to "trees in each plot must average 7 feet in height at year five and 10 feet in height at year seven".** Response: The report has been updated to reflect the appropriate requirements.

3. **Pg 14. Appendix A: Visual Assessment Table- The assessed stream length is recorded as 5,690- this should match the as-built stream length 5,168.** Response: The assessed stream length has been changed to match the as-built length.

4. **Design sheets: Please verify that the centerline was used for crediting determination, not the thalweg, and UT1 & UT2 were calculated using valley length. It is unclear when looking at the design sheets.** Response: The design stream lengths and credits in the approved mitigation plan were determined using the proposed centerline for reaches MS1, MS2, MS3. Proposed stream credits for headwater reaches UT1 and UT2 were determined using valley lengths. The as-built survey represents the stream centerline and graded valley lengths.

5. **Please confirm that easement boundary markers have been installed.** Response: All easement markers were installed prior to planting in March of 2021.

WATER & LAND SOLUTIONS
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Meeting Minutes

Hornpipe Branch Tributaries Mitigation Site

Subject: NCIRT As-Built Site Meeting
Date Prepared: October 21, 2021
Meeting Date and Time: October 19, 2021 @ 10:00 am
Meeting Location: On Site (Lenoir County, NC)
Attendees: USACE: Kim Browning, Casey Haywood (NCIRT)
NCDEQ DWR: Erin Davis (NCIRT)
NCDMS: Lindsay Crocker
NCWRC: Travis Wilson, Maria Dunn (NCIRT)
WLS: Daniel Ingram, Catherine Manner, Emily Dunnigan

These meeting minutes document notes and discussion points from the North Carolina Interagency Review Team (NCIRT) As-Built Site Meeting for the Hornpipe Branch Tributaries Mitigation Project (Neuse River Basin, CU 03020202). The site is located in Lenoir County, near Deep Run, North Carolina. The meeting began at 10:00 am with a conversation about which reaches were designed as headwater streams and which were designed as single thread channels. After the short discussion, attendees toured the project site to review existing conditions. The project site review notes are presented below in the order they were discussed/visited.

MS1

- Group started by walking down MS1.
- Kim asked which reaches are headwater and which are single thread and if any were multithread. Daniel responded that UT1 & UT2 are headwater and the rest are single thread.
- Erin noted that MS1 has little to no sinuosity which is atypical of single thread systems. WLS responded MS1 was designed that way due to the deep ditch that existed within the natural valley and wanted to prevent flooding the farm fields. Kim asked what was done during construction on MS1 and if it was intermittent or perennial. Daniel responded that MS1 is intermittent, and that the bed was slightly raised, and structures were added.
- Kim asked if there was rock in the BMP on MS1. Catherine responded that there is some rock in the BMP.
- Kim asked how the veg was doing along the PII benches. Daniel responded that the veg is doing well due to uncompacted loamy soils and March planting. There are no areas of erosion.
- Erin asked if livestakes were used. Daniel responded that we did livestake with multiple species and some species are growing better than others.

- Erin asked if MS1 gets out of its banks. Catherine responded yes and noted some wrack lines present at as-built monitoring set up.
- Kim asked if Juncus plugs were used. Kim also expressed concern that shading will be important to prevent in-stream vegetation. Daniel responded that no juncus plugs were used and all of the herbaceous vegetation is volunteer or from the seed mix.
- Erin requested a crest gauge below the crossing on MS1 and additional visual monitoring of overbank events. WLS responded the MS1 flow gauge will be used to document out of bank events upstream of the culvert and WLS will document observations of out of bank events on MS2 with photographs.
- Kim noted structures along MS1 were not visible and to monitor to ensure that sediment is being flushed through the system.

MS2

- Erin noted some cattail and suggested treating it. Emily responded WLS will treat as needed.
- Kim asked if planting was done in zones based on wetness and if wetlands are creditable. Daniel responded no planting zones were utilized on site. Catherine responded that there are no wetland credits on site.
- Travis commented that a double culvert is not ideal for a stream this small due to channel over widening at the outlet of the pipe. He suggested a structure should be set just below the culvert. Daniel noted that a riffle was placed just below the culvert to help hold channel dimensions; and the project was constructed according to the approved design.

UT2

- Travis asked if WLS could provide data for the cumulative days of flow on all reaches. Daniel responded that WLS will provide that data in future monitoring years.

MS3

- Casey and Kim asked if MS3 was classified as perennial. Emily responded yes.
- Kim expressed concern that no water was flowing on MS3. Daniel noted that water was present in all pools and no in-channel vegetation was present; both indicating flow during the preponderance of the year.
- Kim requested flow data for MS3. Daniel responded that the crest gauge will be used to provide flow data.
- Kim noted that a constructed riffle near station 44+00 seemed high. WLS will monitor.

General Comments/Summary

- Kim expressed concern for flow and credits on UT1 & UT2. She asked for photo documentation and flow data on UT1 & UT2.
- Kim asked for a random vegetation plot to be done on the floodplain bench of MS1/MS2.

- Kim also stated that the IRT might request an additional cross-section and photos below the culvert on MS1 in future years if aggradation is noted at the current cross-sections. No additional cross-sections are requested at this time.
- Travis asked for additional flow documentation for UT1 & UT2. He recommended setting up cameras that take a photo per day (camera company camlockbox.com) Erin recommended video and photo points. WLS will look into camera rigs for potential future use, but for Year 1 will continue to use ad hoc photo and video documentation.
- Erin requested documentation on MS1 below the culvert of overbank events and to treat sporadic cattails.
- Meeting minutes will be provided to the IRT following the meeting and be included in the appendices of the MY1 report.

The above minutes represents Water & Land Solutions' interpretation and understanding of the meeting discussion and actions. If recipients of these minutes should find any information contained in these minutes to be in error, incomplete, please notify the author with appropriate corrections and/or additions within five business days to allow adequate time for correction and redistribution.