



MONITORING YEAR 4 ANNUAL REPORT FINAL

December 2023

CATFISH POND MITIGATION SITE

Durham County, NC
Neuse River Basin
HUC 03020201

DMS Project No. 100039
NCDEQ Contract No. 007424
NCDWR Project No. 2018-0196 v1
USACE Action ID No. 2018-00424

Data Collection Dates: January - October 2023

PREPARED FOR:



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

PREPARED BY:



312 West Millbrook Road, Suite 225
Raleigh, NC 27609

Jason Lorch

jlorch@wildlandseng.com

Phone: 919.851.9986

CATFISH POND MITIGATION SITE
Monitoring Year 4 Annual Report

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Section 1: PROJECT OVERVIEW

The Catfish Pond Mitigation Site (Site) is in Durham County, approximately 12 miles north of the City of Durham and approximately 3 miles east of the Orange/Durham County border. The project watershed consists primarily of agricultural and forested land. The streams drain to Mountain Creek, which flows into Little River, the Eno River, and then Falls Lake. A 20.73-acre conservation easement has been placed on the Site. Table 3 presents more information related to the project attributes.

1.1 Project Quantities and Credits

Mitigation work within the Site included restoration and enhancement II of perennial and intermittent stream channels (Figures 1-1b). Table 1 below shows stream credits by reach and credit totals expected by project closeout.

Table 1: Project Quantities and Credits

PROJECT MITIGATION QUANTITIES							
Project Segment	Mitigation Plan Footage	As-Built Footage	Mitigation Category	Restoration Level	Mitigation Ratio (X:1)	Credits	Comments
Stream							
Catfish Creek Reach 1	115	115	Warm	EII	2.5	46.000	Invasive Control, Conservation Easement
Catfish Creek Reach 2	323	323	Warm	EII	2.5	129.200	Invasive Control, Grade Control Structures, Planted Buffer, Livestock Exclusion
Catfish Creek Reach 3	473	474	Warm	EII	2.5	189.200	Invasive Control, Grade Control Structures, Planted Buffer, Livestock Exclusion
Catfish Creek Reach 4	374	373	Warm	R	1.0	374.000	Full Channel Restoration, Planted Buffer, Livestock Exclusion
	72	72	N/A	N/A	0.0	0.000	Culvert Crossing
Catfish Creek Reach 5	460	460	Warm	EII	2.5	184.000	Grade Control Structures, Planted Buffer, Livestock Exclusion, Conservation Easement
Catfish Creek Reach 6	454*	444	Warm	R	1.0	454.000	Full Channel Restoration, Planted Buffer, Livestock Exclusion, Farm Pond Drained
Catfish Creek Reach 7	1,071*	1,087	Warm	EII	2.5	428.400	Invasive Control, Grade Control Structures, Planted Buffer, Livestock Exclusion

*Due to a stationing error in the Mitigation Plan, linear feet and associated credits were overestimated on Catfish Creek Reach 6 and underestimated on Reach 7 for a net overage of 10.6 credits. Stream credits were calculated using Mitigation Plan footage because the 10.6 credits represent only 0.28% of the total stream credits.

PROJECT MITIGATION QUANTITIES							
Project Segment	Mitigation Plan Footage	As-Built Footage	Mitigation Category	Restoration Level	Mitigation Ratio (X:1)	Credits	Comments
Stream							
UT1 Reach 1	263	263	Warm	EII	2.5	105.200	Invasive Control, Planted Buffer, Livestock Exclusion
	42	42	N/A	N/A	0.0	0.000	Culvert Crossing
	717	711	Warm	EII	2.5	286.800	Invasive Control, Planted Buffer, Livestock Exclusion
UT1 Reach 2	515	520	Warm	R	1.0	515.000	Full Channel Restoration, Planted Buffer, Livestock Exclusion
	60	61	N/A	N/A	0.0	0.000	Culvert Crossing
UT1 Reach 3	149	149	Warm	R	1.0	149.000	Full Channel Restoration, Planted Buffer, Livestock Exclusion
UT1 Reach 4	446	446	Warm	EII	2.5	178.400	Invasive Control, Planted Buffer, Livestock Exclusion
UT2	412	412	Warm	EII	2.5	164.800	Invasive Control, Grade Control Structures, Livestock Exclusion
Mountain Tributary	1,362	1,362	Warm	EII	2.5	544.800	Invasive Control, Grade Control Structures, Planted Buffer, Livestock Exclusion
Total:						3,748.800	

Blue = Restoration Orange = Enhancement II

Restoration Level	Stream		
	Warm	Cool	Cold
Restoration	1,492.000		
Enhancement I	--		
Enhancement II	2,256.800		
Preservation	--		
Totals	3,748.800		
Total Stream Credit[^]	3,748.800		

[^]Credits were adjusted at As-Built to include changes in stream alignment on Catfish Creek Reach 6 due to bedrock in the floodplain.

1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits. Table 2 below describes the project goals and objectives along with the expected outcomes to water quality and ecological processes.

Additionally, performance criteria for project objectives and a summary of the related monitoring data results for Monitoring Year 4 (MY4) are included.

Table 2: Goals, Performance Criteria, and Functional Improvements

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Exclude livestock from streams.	Install fencing around conservation easements adjacent to cattle pastures or remove livestock.	Reduction in sediment, nutrient, and fecal coliform bacteria inputs through livestock exclusion. Contribution to protection of or improvement of Water Supply Waterbody.	Exclusion fencing is installed and maintained. Livestock remain excluded from the project area.	Visually inspect the perimeter, as well as interior, of the Site to ensure there are no signs of livestock entering the Site.	No livestock access to the conservation easement has occurred.
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels for bankfull dimensions and depth relative to the existing floodplain. Remove existing berms to re-connect channel with adjacent wetlands.	Raise water table and hydrate riparian wetlands. Allow more frequent flood flows to disperse on the floodplain. Support geomorphology and higher-level functions.	Four bankfull events in separate years within monitoring period.	Crest gauge and/or pressure transducer recording flow elevations.	Bankfull events were documented on both Catfish Creek and UT1.
Improve the stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Significantly reduce sediment inputs from bank erosion. Reduce shear stress on channel boundary. Support all stream functions above hydrology.	Entrenchment ratio over 2.2 and bank height ratios below 1.2 with visual assessments showing stability.	Cross-section data will be collected during MY1, MY2, MY3, MY5, and MY7 and visual inspections will be performed annually.	Visual observations indicate streams are stable and functioning well.
Improve in-stream habitat.	Install habitat features such as constructed riffles, cover/lunker logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Increase and diversify available habitats for macroinvertebrates, fish, and amphibians leading to colonization and increase in biodiversity over time. Add complexity including LWD to streams.	There is no performance standard for this metric.	N/A	N/A
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zone and plant appropriate species on streambank.	Reduce sediment inputs from bank erosion and runoff. Increase nutrient cycling and storage in floodplain. Provide riparian habitat. Add a source of LWD and organic material to stream. Support all stream functions.	210 planted stems per acre at MY7. Interim survival rate of 320 planted stems per acre at MY3 and 260 at MY5. Trees in each plot must average 7 ft at MY5 and 10 ft at MY7.	One hundred square meter vegetation plots are placed on 2% of the planted area of the Site. Data will be collected during MY1, MY2, MY3, MY5, and MY7 and visual inspections will be performed annually.	Visual observations indicate planted trees are thriving and on track to meet MY5 performance standards.

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Permanently protect the project Site from harmful uses.	Establish conservation easements on the Site.	Protect site from encroachment on the riparian corridor and direct impact to streams and wetlands. Support all stream functions.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.	No easement encroachments have occurred.

1.3 Project Attributes

The Site area has been used for livestock grazing or maintained as managed herbaceous cover since at least 1940. Cattle were continually rotated through all fields with access to the project streams. Based on aerial photos from 1940 to 2012, there was an increase in agricultural activity between 1955 and 1972, but on-site streams have existed in their approximate locations with very little change to riparian buffer extents since 1972.

Catfish Pond was constructed sometime between 1940 and 1955, and extensive logging and farm road construction along the Site streams were prevalent during this period. Aerial photographs from 1972 show UT1 in a cleared condition. This imagery, in addition to the lack of sinuosity on UT1, suggests that the channel was straightened for agricultural purposes prior to 1972. UT1 showed no signs of riparian buffer growth until 2005, when an aerial photo shows a visible narrow corridor of trees. Catfish Creek, UT2, and Mountain Tributary do not show signs of channel manipulation.

Table 3 below presents additional information on pre-restoration conditions. Project Activity and Reporting History, as well as the Project Contact Table are included in Appendix E.

Table 3: Project Attributes

PROJECT INFORMATION			
Project Name	Catfish Pond Mitigation Site	County	Durham County
Project Area (acres)	20.73	Project Coordinates	36° 9' 48.03" N, 78° 54' 37.66" W
PROJECT WATERSHED SUMMARY INFORMATION			
Physiographic Province	Carolina Slate Belt of Piedmont	River Basin	Neuse River
USGS HUC 8-digit	03020201	USGS HUC 14-digit	03020201020040
DWR Sub-basin	03-04-01	Land Use Classification	45.6% forested, 54.2% cultivated, 0.2% wetland
Project Drainage Area (acres)	227 (Catfish Creek - 197, Mountain Tributary - 30)	Percentage of Impervious Area	0.0%



RESTORATION TRIBUTARY SUMMARY INFORMATION				
Parameters	Catfish Creek		UT1	
	Reach 4	Reach 6	Reach 2	Reach 3
Pre-project length (feet)	369	466	430	154
Post-project (feet)	373	444	520	149
Valley confinement	Unconfined	Moderately Confined		
Drainage area (acres)	56	70	105	107
Perennial, Intermittent, Ephemeral	Perennial			
DWR Water Quality Classification	WS-II/HQW/NSW			
Dominant Stream Classification (existing)	Incised E6	N/A	C6	E4b
Dominant Stream Classification (proposed)	C4	B4a	C4	B4a
Dominant Evolutionary class (Simon) if applicable	Stage IV	N/A	Stage V	Stage IV
REGULATORY CONSIDERATIONS				
Parameters	Applicable?	Resolved?	Supporting Documentation	
Water of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 4134.	
Water of the United States - Section 401	Yes	Yes		
Endangered Species Act	Yes	Yes	Categorical Exclusion in Mitigation Plan (Wildlands, 2019)	
Historic Preservation Act	Yes	Yes		
Coastal Zone Management Act (CZMA or CAMA)	N/A	N/A	N/A	
Essential Fisheries Habitat	N/A	N/A	N/A	

Section 2: MONITORING YEAR 4 DATA ASSESSMENT

Annual monitoring and site visits were conducted during MY4 to assess the condition of the project. The vegetation and stream success criteria for the Site follow the approved performance standards presented in the Mitigation Plan (Wildlands, 2019). Performance criteria for vegetation, stream, and hydrologic assessment are located in Section 1.2 Table 2: Goals, Performance Criteria, and Functional Improvements. Methodology for annual monitoring is presented in the Baseline Monitoring Document and As-Built Baseline Report (Wildlands, 2020).

2.1 Vegetative Assessment

Detailed vegetation inventory and analysis is not required during MY4. Visual assessment indicated that vegetation is performing adequately to attain interim success criteria of 260 planted stems per acre at the end of MY5 and terminal success criteria of 210 planted stems per acre averaging ten feet in height at the end of MY7. Volunteer tree species continue to become established adding to stem density and species diversity. Herbaceous vegetation is dense and providing streambank stabilization as well as wildlife habitat.

2.2 Vegetation Areas of Concern and Management

While planted trees are growing well, herbaceous vegetation is dense. In May 2023, another round of herbicide ring sprays was applied around the base of trees, targeting the area around trees waist high or less in height. Soil amendments were also added to the base of these stems to give them an advantage in competing for resources, therefore helping them grow above herbaceous vegetation. Soil amendments consisted of a mix of nutrients and lime to help neutralize soil, making it easier for roots to absorb those nutrients.

In March 2023, invasive and aggressively growing species were treated using various approaches along Catfish Creek. Isolated resprouts of Chinese Privet (*Ligustrum sinense*) were treated through a cut stump herbicide application or hand pulled. Sporadic patches of multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), and competing blackberry (*Rubus spp.*) were treated with a foliar spray of triclopyr. Wildlands will continue to monitor for invasive species and additional treatments will be applied as necessary.

2.3 Stream Assessment

Detailed morphological survey and analysis is not required during MY4. Visual monitoring indicated that the stream channel is performing as designed. No deposition or erosion exceeding approximate natural levels, or indicators of channel instability, were observed. The area on UT1 Reach 3 around cross-section 7 that was repaired in July 2021 (MY2) appears to be stable and functioning well. See Appendix A for stream photographs and visual assessment data.

2.4 Stream Areas of Concern and Management

In light of the difficulties documenting bankfull events on Catfish Creek, it was suggested at the June 2022 Interagency Review Team (IRT) site walk that the focus for Catfish Creek be on optimizing high frequency of streamflow. Streamflow has been documented throughout the year using both pressure transducers and trail cameras. Streamflow has been strong and continuous for much of the year. Wildlands will continue to monitor for both flow and bankfull events but does not believe stream flow is a cause for concern. See Section 2.5 below for more detailed information.



2.5 Hydrology Assessment

By the end of MY7, four or more bankfull events must have occurred in separate years within the restoration reaches. A bankfull event was recorded on Catfish Creek Reach 6 and on UT1 Reach 2 on July 9, 2023. The bankfull event on Catfish Creek Reach 6 was documented by the trail camera at the lower end of the reach (see Bankfull Event Visual Observations in Appendix D). The bankfull event on UT1 Reach 2 was recorded by the pressure transducer installed on the reach.

None of the pressure transducers on Catfish Creek have recorded a bankfull event in MY4 so far. They did record a significant spike in flow on July 9, 2023 when the bankfull event was recorded on UT1 and the Catfish Creek trail camera. We believe they are functioning correctly, but the pressure transducers are set to read every 30 minutes at the 00- and 30-minute marks. The trail camera on Catfish Creek Reach 6 happened to be taking quick videos every 30 minutes around the 15- and 45-minute marks. The bankfull was recorded at around the 45-minute mark. While it is possible Catfish Creek did not reach bankfull at the location of the Catfish Creek Reach 6 pressure transducer, we believe that the crest of bankfull flow at that location did not last long enough for the pressure transducer to take a reading while it was out of bank.

As mentioned in the MY2 Report, Wildlands installed two additional crest gauges on Catfish Creek Reach 4 in the hopes of determining if bankfull events were occurring in other locations along the stream (see Figure 1a for locations). In September 2022, they were re-installed to function both as flow and crest gauges to turn the focus toward stream flow as discussed at the June 2022 IRT site walk. Catfish Creek Reach 4 gauge B shows 165 consecutive and 199 total days of flow and Catfish Creek Reach 4 gauge C shows 161 consecutive and 197 total days of flow, out of 285 total days of monitoring for 2023. As in the previous year, neither gauge recorded a bankfull event. Because of the bedrock on Reach 6, it is almost impossible to install flow gauges. However, stream flow is documented in the trail cam video linked below.

Trail cameras installed during MY3 to monitor flow on Catfish Creek Reach 4 and Reach 6 were adjusted in winter 2022/2023. Both cameras face upstream and show timelapse of stream flow during daylight hours (See Figure 1a for location). Streams show consistent flow throughout winter and spring, with gradually decreasing flow in late summer. As mentioned above, the trail camera at the downstream end of Catfish Creek Reach 6 also recorded a bankfull event on 7/9/2023 around 1:45pm. The Catfish Creek Reach 4 timelapse does not add useful information beyond what can be seen in the Catfish Creek Reach 6 timelapse. Video processing is time intensive, so the Reach 4 video files were not processed completely and are not included here. The Catfish Creek Reach 6 timelapse video recording flow from January 1 to October 13, 2023 has been uploaded to YouTube: https://youtu.be/2_qw7OjiQI.

Hydrology on Catfish Creek will continue to be monitored via pressure transducers, where possible, and trail camera, if necessary, to confirm flow and document bankfull events. The Catfish Creek Reach 4 trail camera and the Catfish Creek Reach 4 gauge C transducer will be removed because neither seem to provide additional useful information. The Catfish Creek Reach 4 gauge B pressure transducer will suffice to record both flow and possible bankfull events on Reach 4. The original crest gauge on Catfish Creek Reach 6 and the trail camera will remain as they are.

Refer to Appendix D for hydrology data.

2.6 Wetland Assessment

As requested by the North Carolina Division of Water Resources (NCDWR), four groundwater wells with pressure transducers were installed and monitored within the existing wetlands zones (one along Catfish Creek Reach 4 and three along UT1 Reach 2). The purpose of these gauges was to assess



potential effects to wetland hydrology from the construction of the restored stream channels. The monitoring results are not tied to performance standards.

Groundwater gauges monitoring existing wetlands have consistently shown wetlands are functioning well in the 3-4 years post stream restoration. Since the existing wetlands are not for credit, and have consistently shown wetland hydroperiods, groundwater gauges were removed on May 17, 2023 with approval from the IRT (June 2022 IRT site walk and April 2023 Credit Release Meeting). The data for the first 78 days of the MY4 growing season, before gauge removal, has been included in Appendix D. The measured hydroperiods for those 78 days were 14.5% (37 days) and 30.5% (78 days) of the growing season.

2.7 Monitoring Year 4 Summary

Visual assessment indicated that all stream reaches within the Site are geomorphically stable and functioning as designed. Vegetation is well established along the stream banks and desirable volunteer tree species continue to add to stem density and species diversity. Survival and growth of planted trees appear to be on track to surpass MY5 interim success criteria. Sporadic resprouts of invasive vegetation were treated and herbicide ring sprays were applied around smaller trees in Monitoring Year 4. Wildlands will continue to monitor and treat as necessary. Bankfull events were recorded on both tributaries, and the flow gauges on Catfish Creek showed baseflow for 165 consecutive days and a total of 199 days out of the 285 days monitored. Groundwater gauges have shown existing, not for credit, wetlands are functioning well post stream restoration and were removed with permission. No easement encroachment or stream crossing issues have been identified in MY4. Overall, the Site is on track to meet MY7 success criteria.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. All raw data supporting the tables and figures in the appendices are available from DMS upon request.



Section 3: REFERENCES

- Breeding, R. 2010. Neuse River Basin Restoration Priorities 2010. NCEEP, NC
- Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E. 2003. Stream Restoration A Natural Channel Design Handbook.
- Harrelson, C.C., Rawlins, C.L., Potyondy, J.P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique*. Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.
- Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.
- Rosgen, D.L. 1996. Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology Books.
- Rosgen, D.L. 1997. A Geomorphological Approach to Restoration of Incised Rivers. Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision. Center For Computational Hydroscience and Bioengineering, Oxford Campus, University of Mississippi, Pages 12-22.
- North Carolina Division of Water Resources (DWR). 2015. Neuse 01 CU Update. River Basin Restoration Priorities Transition Approach.
- North Carolina Interagency Review Team (NCIRT). 2016. Wilmington District Stream and Wetland Compensatory Mitigation Update. Accessed at: <https://saw-reg.usace.army.mil/PN/2016/Wilmington-District-Mitigation-Update.pdf>
- United States Army Corps of Engineers. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.
- United States Geological Survey. 1998. North Carolina Geology.
- Wildlands Engineering, Inc. (2019). Catfish Pond Mitigation Project Mitigation Plan. DMS, Raleigh, NC.
- Wildlands Engineering, Inc. (2020). Catfish Pond Mitigation Project Baseline Monitoring Report. DMS, Raleigh, NC.



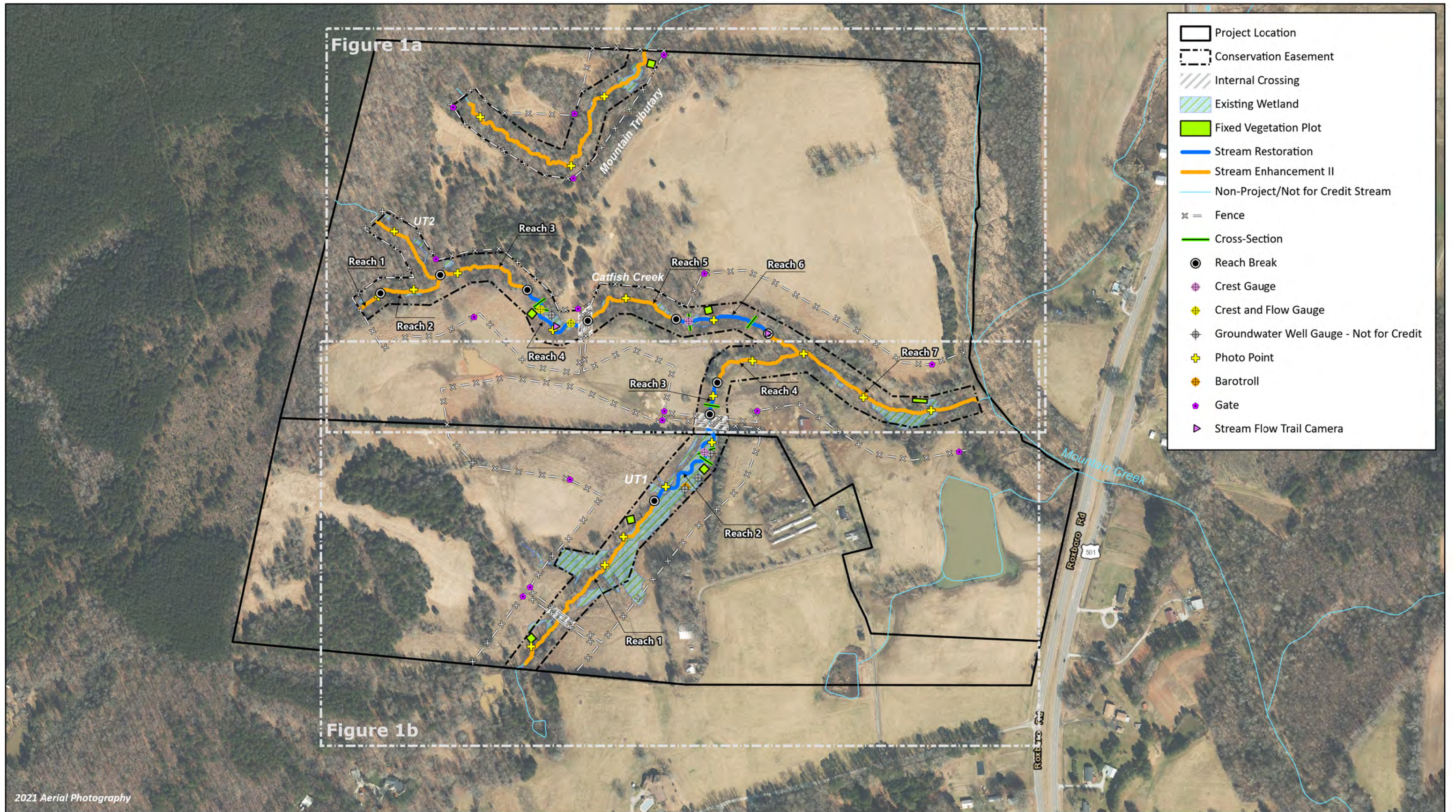


Figure 1. Current Condition Plan View
 Catfish Pond Mitigation Site
 DMS Project No. 100039
 Monitoring Year 4 – 2023
 Durham County, NC

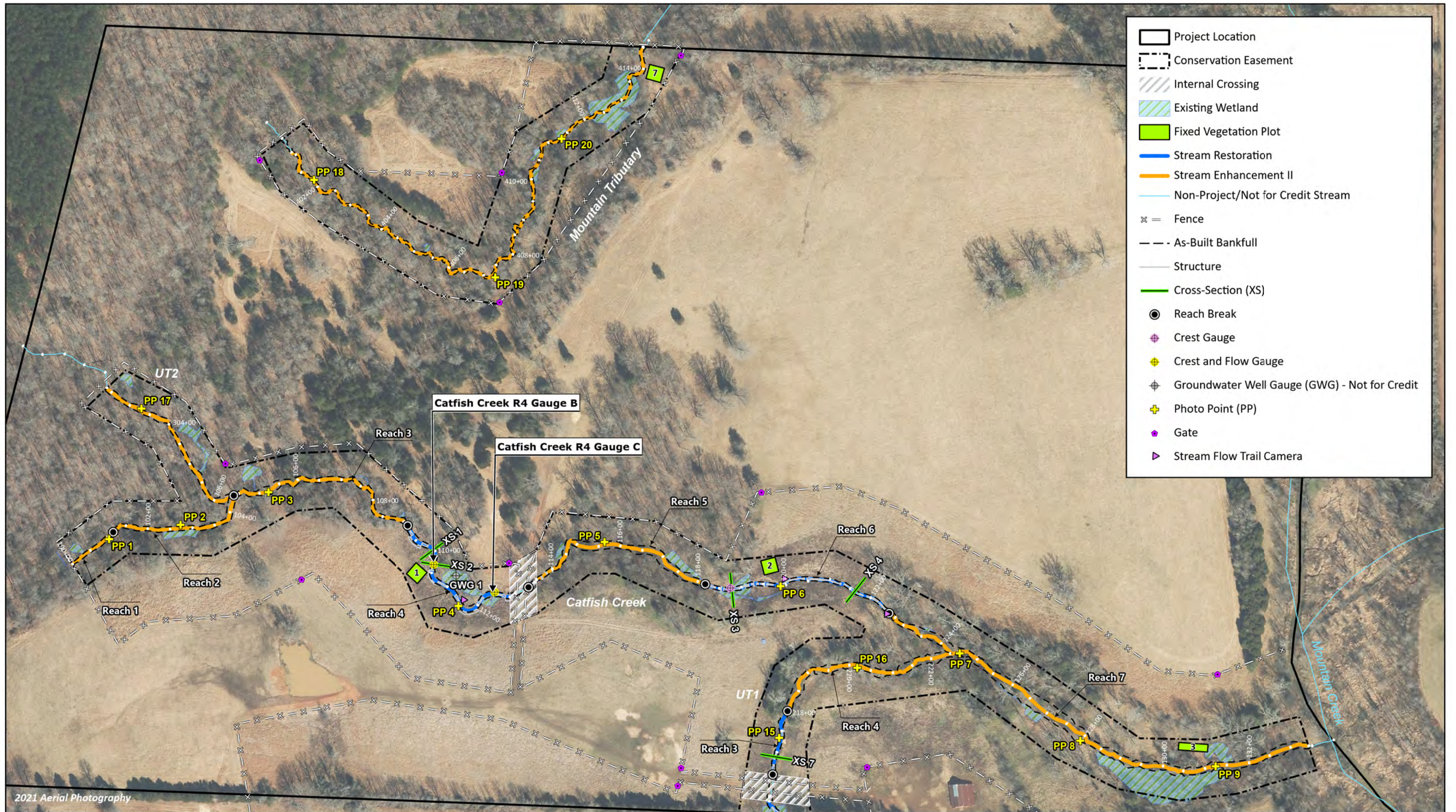


Figure 1a. Current Condition Plan View
 Catfish Pond Mitigation Site
 DMS Project No. 100039
 Monitoring Year 4 – 2023
 Durham County, NC



Figure 1b. Current Condition Plan View
 Catfish Pond Mitigation Site
 DMS Project No. 100039
 Monitoring Year 4 – 2023
 Durham County, NC

APPENDIX A. Visual Assessment Data

Table 4. Visual Stream Morphology Stability Assessment Table

Catfish Pond Mitigation Site
 DMS Project No. 100039
 Monitoring Year 4 - 2023

Catfish Creek Reach 4

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	373
					Assessed Bank Length	746
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 <u>NOT</u> 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
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	25	25		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	58	58		100%

Visual assessment was completed October 13, 2023.

Catfish Creek Reach 6

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	444
					Assessed Bank Length	888
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 <u>NOT</u> 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
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	4	4		100%

Visual assessment was completed October 13, 2023.

Table 4. Visual Stream Morphology Stability Assessment Table

Catfish Pond Mitigation Site
 DMS Project No. 100039
 Monitoring Year 4 - 2023

UT1 Reach 2

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	520
					Assessed Bank Length	1,040
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 <u>NOT</u> 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
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	22	22		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	30	30		100%

Visual assessment was completed October 13, 2023.

UT1 Reach 3

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	149
					Assessed Bank Length	298
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 <u>NOT</u> 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
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	14	14		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	7	7		100%

Visual assessment was completed October 13, 2023.

Table 5. Vegetation Condition Assessment Table

Catfish Pond Mitigation Site
 DMS Project No. 100039
 Monitoring Year 4 - 2023

Planted Acreage 8.00

Vegetation Category	Definitions	Mapping Threshold (ac)	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10	0	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.10	0	0%
Total			0.00	0%
Areas of Poor Growth Rates	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25	0	0%
Cumulative Total			0.00	0%

Visual assessment was completed October 13, 2023.

Easement Acreage 20.73

Vegetation Category	Definitions	Mapping Threshold (ac)	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	0.10	0	0%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0 Encroachments Noted / 0 ac	

Visual assessment was completed October 13, 2023.

STREAM PHOTOGRAPHS



PHOTO POINT 1 Catfish Creek R1 – upstream (03/14/2023)



PHOTO POINT 1 Catfish Creek R1 – downstream (03/14/2023)



PHOTO POINT 2 Catfish Creek R2 – upstream (03/14/2023)



PHOTO POINT 2 Catfish Creek R2 – downstream (03/14/2023)



PHOTO POINT 3 Catfish Creek R3 – upstream (03/14/2023)



PHOTO POINT 3 Catfish Creek R3 – downstream (03/14/2023)





PHOTO POINT 4 Catfish Creek R4 – upstream (03/14/2023)



PHOTO POINT 4 Catfish Creek R4 – downstream (03/14/2023)



PHOTO POINT 5 Catfish Creek R5 – upstream (03/14/2023)



PHOTO POINT 5 Catfish Creek R5 – downstream (03/14/2023)



PHOTO POINT 6 Catfish Creek R6 – upstream (03/14/2023)



PHOTO POINT 6 Catfish Creek R6 – downstream (03/14/2023)





PHOTO POINT 7 Catfish Creek R7 – upstream (03/14/2023)



PHOTO POINT 7 Catfish Creek R7 – downstream (03/14/2023)



PHOTO POINT 8 Catfish Creek R7 – upstream (03/14/2023)



PHOTO POINT 8 Catfish Creek R7 – downstream (03/14/2023)



PHOTO POINT 9 Catfish Creek R7 – upstream (03/14/2023)



PHOTO POINT 9 Catfish Creek R7 – downstream (03/14/2023)





PHOTO POINT 10 UT1 R1 – upstream (03/14/2023)



PHOTO POINT 10 UT1 R1 – downstream (03/14/2023)



PHOTO POINT 11 UT1 R1 – upstream (03/14/2023)



PHOTO POINT 11 UT1 R1 – downstream (03/14/2023)



PHOTO POINT 12 UT1 R1 – upstream (03/14/2023)



PHOTO POINT 12 UT1 R1 – downstream (03/14/2023)





PHOTO POINT 13 UT1 R2 – upstream (03/14/2023)



PHOTO POINT 13 UT1 R2 – downstream (03/14/2023)



PHOTO POINT 14 UT1 R2 – upstream (03/14/2023)



PHOTO POINT 14 UT1 R2 – downstream (03/14/2023)



PHOTO POINT 15 UT1 R3 – upstream (03/14/2023)



PHOTO POINT 15 UT1 R3 – downstream (03/14/2023)





PHOTO POINT 16 UT1 R4 – upstream (03/14/2023)



PHOTO POINT 16 UT1 R4 – downstream (03/14/2023)



PHOTO POINT 17 UT2 – upstream (03/14/2023)



PHOTO POINT 17 UT2 – downstream (03/14/2023)



PHOTO POINT 18 Mountain Trib – upstream (03/14/2023)



PHOTO POINT 18 Mountain Trib – downstream (03/14/2023)





PHOTO POINT 19 Mountain Trib – upstream (03/14/2023)



PHOTO POINT 19 Mountain Trib – downstream (03/14/2023)



PHOTO POINT 20 Mountain Trib – upstream (03/14/2023)



PHOTO POINT 20 Mountain Trib – downstream (03/14/2023)



CULVERT CROSSING PHOTOGRAPHS



Catfish Creek R4 – Looking Upstream (03/14/2023)



Catfish Creek R4 – Looking Downstream (03/14/2023)



UT1 R1 – Looking Upstream (03/14/2023)



UT1 R1 – Looking Downstream (03/14/2023)



UT1 R2 – Looking Upstream (03/14/2023)



UT1 R2 – Looking Downstream (03/14/2023)



APPENDIX B. Vegetation Plot Data

Vegetation inventory and analysis not required during MY4.

APPENDIX C. Stream Geomorphology Data

Morphological survey and analysis not required during MY4.

APPENDIX D. Hydrology Data

Table 10. Bankfull Events

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 4 - 2023

Reach	MY1 (2020)	MY2 (2021)	MY3 (2022)	MY4 (2023)*	MY5 (2024)	MY6 (2025)	MY7 (2026)
Catfish Creek Reach 6	10/11/2020	N/A	N/A	7/9/2023^			
UT1 Reach 2	12/14/2020	1/3/2021 2/15/2021 4/9/2021	5/23-24/2022	7/9/2023			

*Data was collected 1/1/2023 to 10/13/2023. Data from the remainder of MY4 will be updated in MY5.

^Bankfull documented visually on trail camera. A screenshot from the Catfish Creek Reach 6 video is included in Appendix D.

Table 11. Rainfall Summary

Catfish Pond Mitigation Site
DMS Project No. 100039
Monitoring Year 4 - 2023

	MY1 (2020)	MY2 (2021)	MY3 (2022)	MY4 (2023)	MY5 (2024)	MY6 (2025)	MY7 (2026)
Annual Precipitation Total	60.41 in	40.55 in	46.15 in	36.56 in*			
30 Year Average Precip WETS 30th Percentile	42.80 in	43.74 in	43.01 in	43.57 in			
30 Year Average Precip WETS 70th Percentile	50.25 in	51.35 in	50.84 in	51.23 in			
Annual Precipitation Compared to Normal	High	Low	Normal	*			

Annual Precipitation Source: **Butner Beef Cattle Laboratory (BAHA)** Station, Durham County, NC, State Climate Office (Approximately 5.5 miles from Site)

30 Year Average Precipitation Source: **Roxboro 7 ESE** Station, Person County, NC, AgACIS (Approximately 14 miles from Site)

*Annual precipitation was collected 1/1/2023 to 10/13/2023. Data from the remainder of MY4 will be updated in MY5.

**BANKFULL EVENT
VISUAL OBSERVATION**



Catfish Creek Reach 6: Bankfull event recorded on Catfish 4 trail camera (07/09/2023)



Table 12. Groundwater Gauge Summary

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 4 - 2023

Gauge	Max. Consecutive Hydroperiod (Percentage)						
	MY1 (2020)	MY2 (2021)	MY3 (2022)	MY4 (2023)*	MY5 (2024)	MY6 (2025)	MY7 (2026)
1	14 Days (5.3%)	49 Days (19.1%)	45 Days (17.6%)	37 Days (14.5%)			
2	100 Days (37.6%)	80 Days (31.3%)	59 Days (23.0%)	78 Days (30.5%)			
3	109 Days (41.0%)	87 Days (34.0%)	71 Days (27.7%)	78 Days (30.5%)			
4	59 Days (22.2%)	80 Days (31.3%)	36 Days (14.1%)	78 Days (30.5%)			

Performance Standard: **None**

Growing Season: **3/1/2023 to 11/11/2023 (255 Days)**

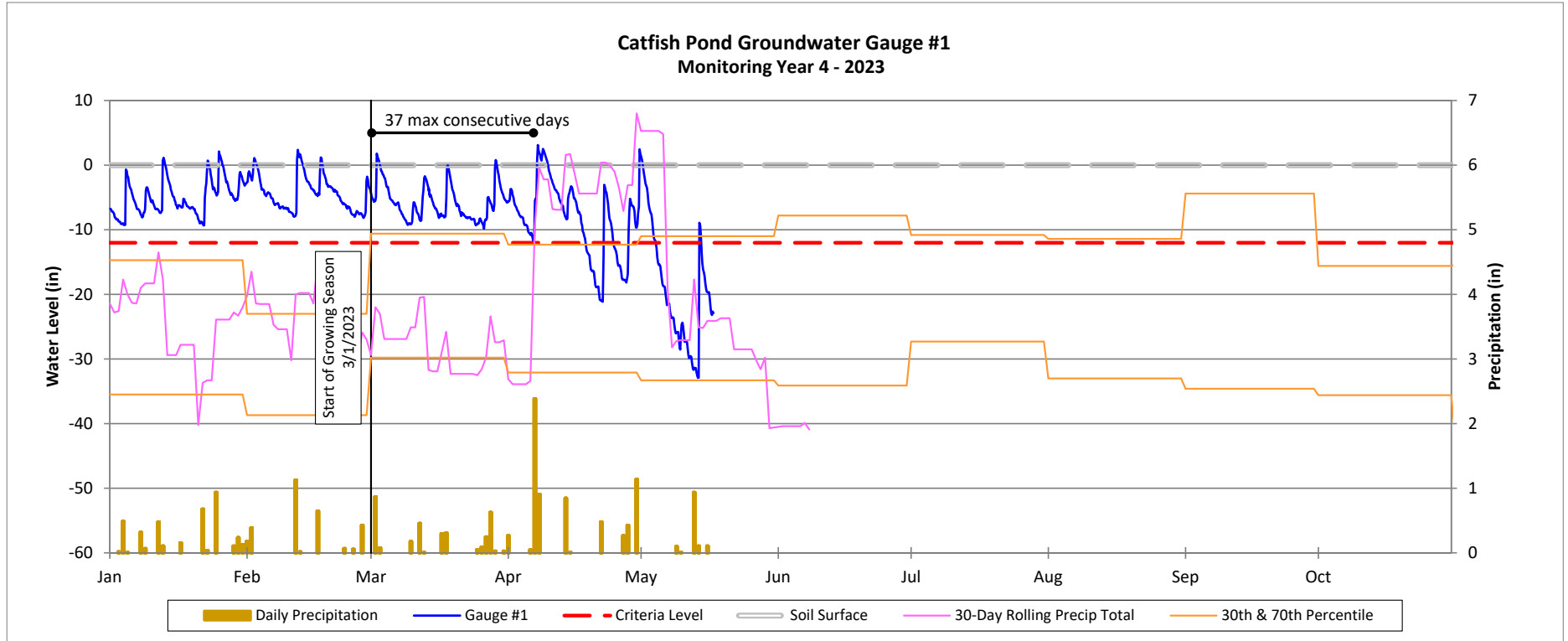
*Reflects the data collected from 3/1/2023 to 05/17/2023 (78 days). Groundwater gauges were removed on May 17, 2023.

Groundwater Gauge Plot

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 4 - 2023

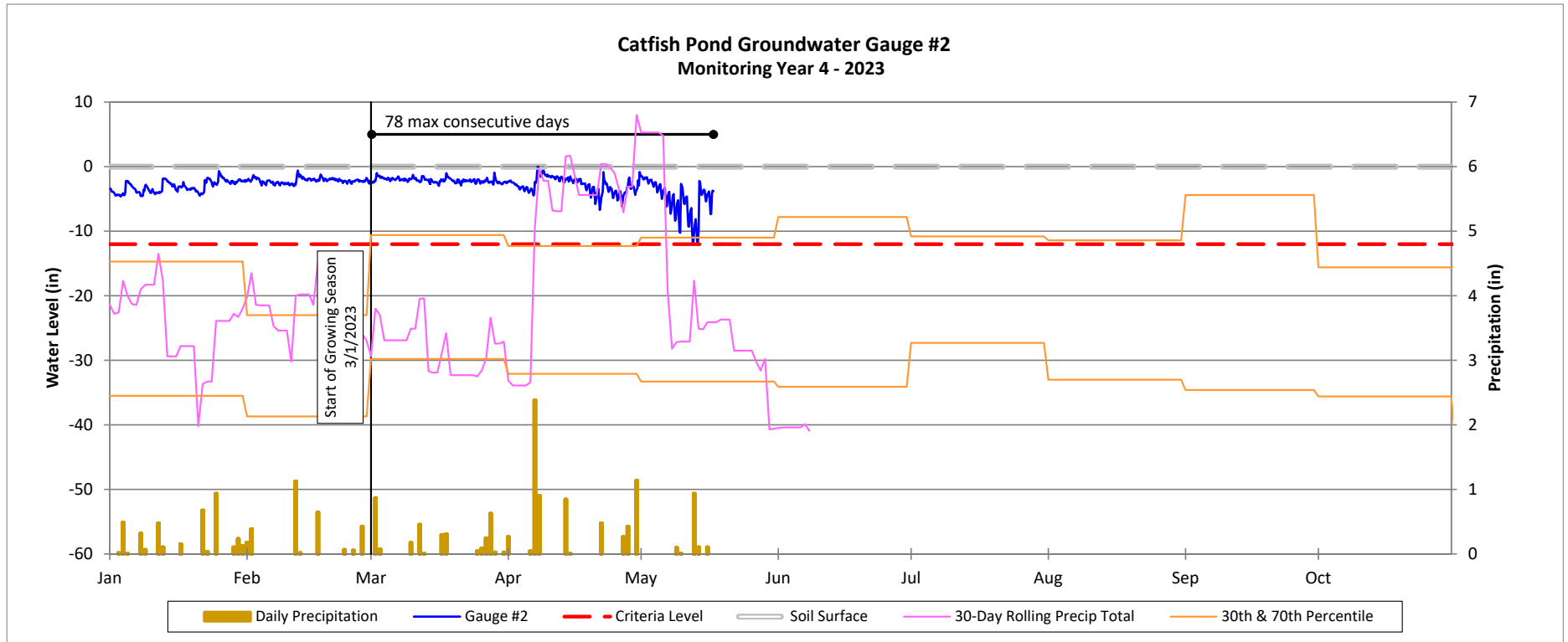


Groundwater Gauge Plot

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 4 - 2023

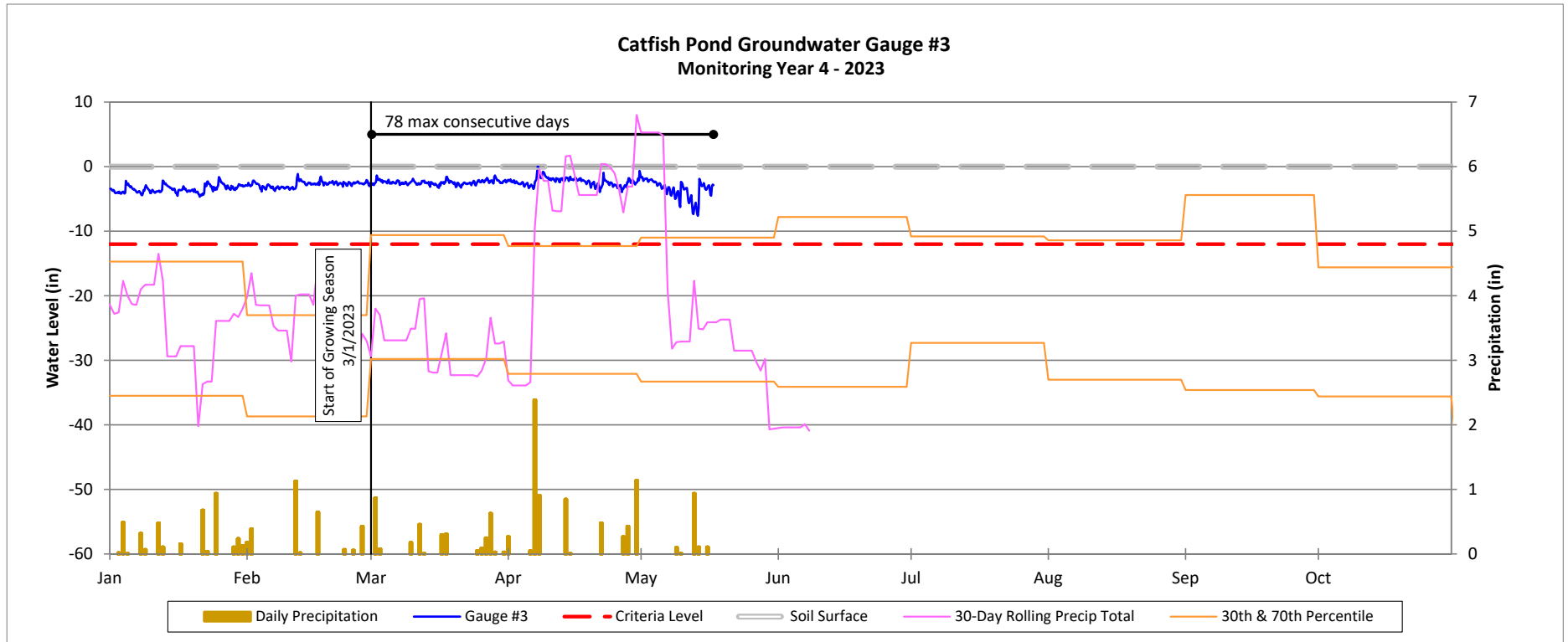


Groundwater Gauge Plot

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 4 - 2023

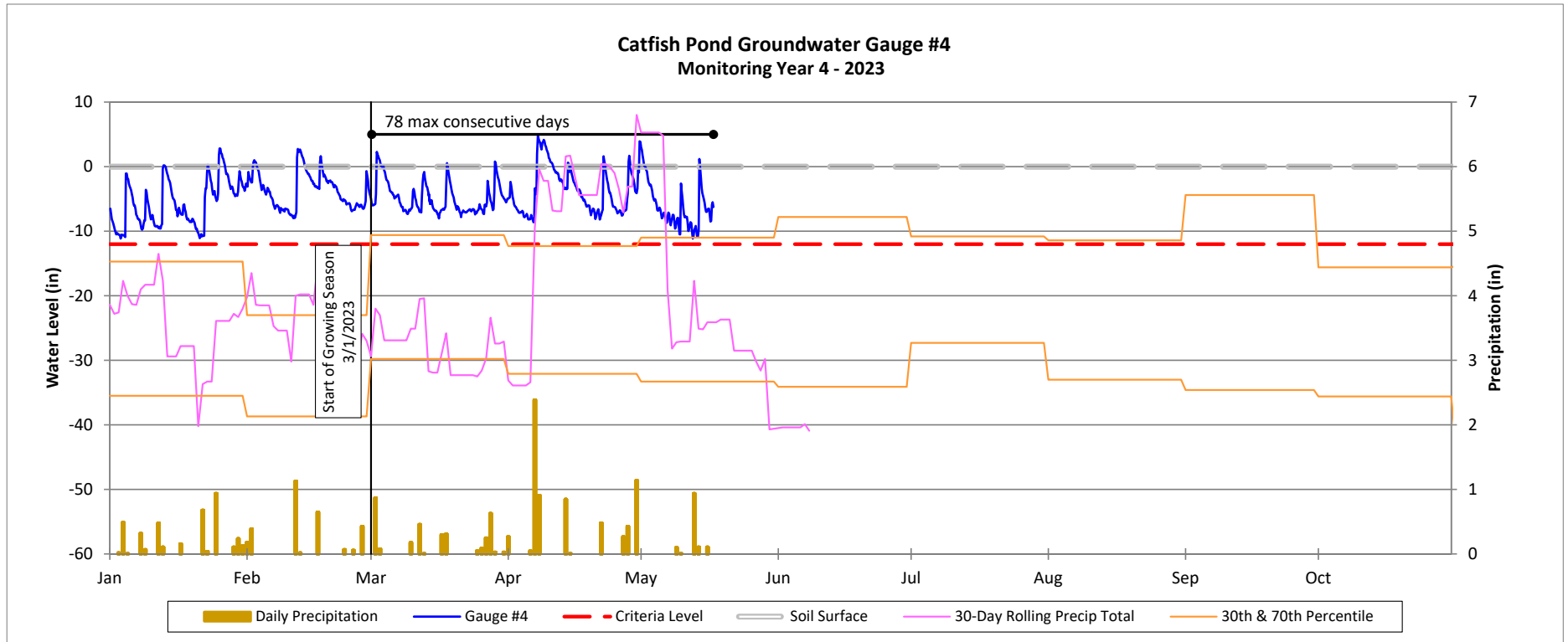


Groundwater Gauge Plot

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 4 - 2023



APPENDIX E. Project Timeline and Contact Info

Table 13. Project Activity and Reporting History

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 4 - 2023

Activity or Deliverable		Data Collection Complete	Completion or Scheduled Delivery
Project Instituted		NA	January 2018
Mitigation Plan Approved		July 2019	July 2019
Construction (Grading) Completed		February-March 2020	March 2020
Planting Completed		NA	March 2020
As-Built Survey Completed		March-April 2020	April 2020
Baseline Monitoring Document (Year 0)	Stream Survey	March-April 2020	June 2020
	Vegetation Survey	March 2020	
Year 1 Monitoring	Competitive Vegetation Treatment ¹		April-May 2020
	Invasive Vegetation Treatment		May & September 2020
	Stream Survey	October 2020	December 2020
	Vegetation Survey	October 2020	
Year 2 Monitoring	Stream channel repairs on UT1 Reach 3		July 2021
	Invasive Vegetation Treatment		September 2021
	Stream Survey	April & October 2021	December 2021
	Vegetation Survey	September 2021	
Year 3 Monitoring	Competitive Vegetation Treatment ¹ with Soil Amendments		April 2022
	Invasive Vegetation Treatment		May 2022
	In-stream Vegetation Treatment		June 2022
	Stream Survey	April 2022	December 2022
Vegetation Survey	September 2022		
Year 4 Monitoring	Invasive Vegetation Treatment		March 2023
	Competitive Vegetation Treatment ¹ with Soil Amendments		May 2023
	Visual Assessments Completed		October 2023
Year 5 Monitoring	Stream Survey	2024	December 2024
	Vegetation Survey	2024	
Year 6 Monitoring			December 2025
Year 7 Monitoring	Stream Survey	2026	December 2026
	Vegetation Survey	2026	

¹Herbicide ring sprays around the base of planted stems.

Table 14. Project Contact Table

Catfish Pond Mitigation Site

DMS Project No. 100039

Monitoring Year 4 - 2023

Designer Daniel Johnson, PE	Wildlands Engineering, Inc. 497 Bramson Ct, Suite 104 Mt. Pleasant, SC 29464 843.277.6221
Construction Contractor	Main Stream Earthwork, Inc. 631 Camp Dan Valley Rd Reidsville, NC 27320
Monitoring Performers Monitoring, POC	Wildlands Engineering, Inc. Jason Lorch 919.851.9986