



MONITORING YEAR 3 ANNUAL REPORT FINAL

January 2024

SANDY BRANCH MITIGATION SITE

Chatham County, NC
Cape Fear River Basin
HUC 03030003
DMS Project No. 100060
NCDEQ Contract No. 7527
USACE Action ID No. SAW-2018-01167
NCDWR Project No. 2018-0786

Data Collection Period: January-November 2023
DMS RFP No. 16-007331

PREPARED FOR:



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



January 30, 2024

Jeremiah Dow

Eastern Regional Supervisor
North Carolina DEQ Division of Mitigation Services
217 West Jones Street, Raleigh, NC 27601

RE: DMS Comments on the MY3 Report
Sandy Branch, Project ID #100060, DMS Contract 7527

Dear Mr. Dow:

We have reviewed the comments on the MY3 Report for the above referenced project dated January 29, 2024 and have revised the report based on these comments. The revised documents are submitted with this letter. Below are responses to each of the comments. For your convenience, the comments are reprinted with responses in italics.

1. Section 2.2 states multiflora rose and privet were treated 'within the existing forested area along the lower portion of Sandy Branch Reach 2...' Were these scattered, individual sprouts or mappable treatment areas? Please add to CCPV if needed.

Response: These were scattered, individual sprouts outside of the mapping threshold. This has been clarified in the MY3 report text.

2. Table 5 – Please verify whether cattail treatment area exceeds the 0.1 acre threshold to be included on this table, and update the table if necessary.

Response: The sporadic cattail treatment areas include 0.10 acres and have been added to Table 5.

3. Recent scour on the outer bank in a meander was brought to DMS' attention at the 1/26/2024 site visit, located a short distance upstream of PP16. Please call out location on CCPV and discuss remedial actions taken, if any, in the MY4 report.

Response: The location of scour on the outside bank of a meander on Sandy Branch Reach 2 has been added to the CCPV, and text has been added to the report. Linear stream footage of the scour has been added to Table 4. Any remedial actions taken will be discussed in the MY4 report.

If you have any questions, please contact me by phone (919) 851-9986, or by email (jlorch@wildlandseng.com).



Sincerely,

A handwritten signature in black ink, appearing to read "Jason Lorch".

Jason Lorch, *Monitoring Coordinator*

SANDY BRANCH MITIGATION SITE
Monitoring Year 3 Annual Report

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Section 1: PROJECT OVERVIEW

The Sandy Branch Mitigation Site (Site) is located in Chatham County, approximately seven miles southeast of Siler City, NC in the Cape Fear River Basin 8-Digit Hydrologic Unit Code (HUC) 03030003. The Site involves re-establishing a stream and wetland complex utilizing stream restoration, wetland re-establishment, and wetland rehabilitation approaches. The Site is located within the DMS Targeted Local Watershed (TLW) for the Cape Fear River Basin HUC 03030003070050 (Bear Creek TLW) and the NC DWR Subbasin 03-06-12. The Sandy Branch Mitigation Site is one of the projects identified in the Upper Rocky River Local Watershed Plan as a priority for stream and wetland restoration.

1.1 Project Quantities and Credits

A conservation easement was recorded on 18.10 acres and was fenced prior to construction (Figure 1). Mitigation work within the Site included 3,286 linear feet of perennial stream channel restoration and 8.540 acres of wetland re-establishment and rehabilitation. The project is expected to provide 3,286.000 stream credits and 7.267 wetland credits at closeout.

Table 1. Project Mitigation Quantities and Credits

Project Components							
Project Segment	Mitigation Plan Footage/Acreage	As-Built Footage/Acreage	Mitigation Category	Restoration Level	Mitigation Ratio (X:1)	Credits	Comments
Stream							
Sandy Branch R1	861	849	Warm	R	1	861.000	Full Channel Restoration, Planted Buffer, Fencing Out Livestock
	40	40	Warm	N/A	N/A	N/A	External Crossing, Culvert
	110	104	Warm	R	1	110.000	Full Channel Restoration, Planted Buffer, Fencing Out Livestock
Sandy Branch R2	1,929	1,919	Warm	R	1	1,929.000	
UT1	131	125	Warm	R	1	131.000	
UT2	255	254	Warm	R	1	255.000	
Total:						3,286.000	
Wetland							
Re-establishment	N/A	4.721	Riparian	R	1.000	4.721	
Rehabilitation	3.819	3.819	Riparian	RE	1.500	2.546	
Total:						7.267	

Blue = Restoration

Project Credits		
Restoration Level	Stream - Warm	Riparian Wetland - Riverine
Restoration	3,286.000	
Re-establishment		4.721
Rehabilitation		2.546
Totals	3,286.000	7.267

1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits within the Cape Fear River Basin. While benefits such as habitat improvement and geomorphic stability are limited to the Site, reduced nutrient and sediment loading have further reaching effects. Table 2 below describes expected outcomes to water quality and ecological processes associated with the project goals and objectives. These goals were established and completed with careful consideration of goals and objectives described in the River Basin Restoration Priorities and to meet the DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed.

Table 2: Goals, Performance Criteria, and Functional Improvements

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Monitoring Results
Improve the stability of stream channels	Reconstruct stream channels that will maintain stable pattern and profile considering hydrologic and sediment inputs to the system, landscape setting, and the watershed conditions.	Reduce sediment inputs from bank erosion. Contribute to protection of, or improvement to, a Nutrient-Sensitive Water.	Entrenchment ratios remaining above 2.2 and bank height ratios remaining below 1.2, coarser material in riffles and finer material in pools, and progression towards stability shown in visual inspections.	Cross-section monitoring will be assessed during MY1, MY2, MY3, MY5, and MY7 and visual inspections will be assessed annually.	No deviations from design.
Reconnect channels with floodplains and riparian wetlands	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Reduce shear stress on channels, hydrate adjacent wetland areas, and filter pollutants from overbank flows.	Four bankfull events in separate years within monitoring period.	Crest gauges and/or pressure transducers recording flow elevations.	Five bankfull events were recorded during MY3.
Improve in-stream habitat	Install habitat features such as constructed riffles, lunger logs, and brush toe into restored streams. Add woody material to channel beds. Construct pools of varying depths.	Improve aquatic communities in project streams.	There is no required performance standard for this metric.	N/A	N/A

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Monitoring Results
Restore wetland hydrology, soils, and plant communities	Re-establish and rehabilitate riparian wetlands by raising stream beds and planting native wetland species.	Improve terrestrial habitat. Contribute to protection of, or improvement to, a Nutrient-Sensitive Water.	Free groundwater surface within 12 inches of the ground surface for 10% (27 days) of the growing season under normal precipitation conditions.	12 groundwater gauges equipped with pressure transducers are located in representative wetland areas and monitored annually. Two additional gauges were installed during MY2 per IRT request.	12 out of 14 groundwater gauges had groundwater within 12 inches of the ground surface for 10.0% (27 days) of the growing season consecutively.
Restore and enhance native floodplain vegetation	Plant native tree species in riparian zones where currently insufficient.	Reduce/control sediment inputs, reduce/manage nutrient inputs, provide canopy to shade streams and reduce thermal loadings, contribute to protection of, or improvement to, a Nutrient-Sensitive Water.	Survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7. Planted stems must average at least seven feet in height in each plot at the end of MY5 and 10 feet in height in each plot by the end of MY7.	One hundred square meter vegetation plots are placed on 2% of the planted area of the Site and monitored during MY1, MY2, MY3, MY5, and MY7.	All 13 vegetation plots have a planted stem density greater than 320 stems per acre.
Permanently protect the project site from harmful uses	Establish conservation easements and fence the Site.	Prevent development and agricultural uses that would damage the Site or reduce the benefits of the project.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.	No easement encroachments.

1.3 Project Attributes

The Site is located on a single parcel bounded by Elmer Moore Road on the northern edge and other agricultural parcels to the east, south, and west. Prior to restoration, the Site was an active livestock operation characterized by extensively grazed pasture, minimal riparian vegetation, and project streams functioning as the primary water source for livestock. The streams and riparian buffers onsite were in the same approximate configurations since before 1965, according to aerial photographs. In general, the area maintained its rural, agricultural character for more than 50 years with only minor changes in land use and land cover. Table 3 below and Table 8 in Appendix C present additional information on pre-restoration conditions.

Table 3. Project Attributes

Project Information				
Project Name	Sandy Branch Mitigation Site			
County	Chatham			
Project Area (acres)	18.10			
Project Coordinates (latitude and longitude decimal)	35°38'35"N 79°23'14"W			
Project Watershed Summary Information				
Physiographic Province	Piedmont			
River Basin	Cape Fear			
USGS Hydrologic Unit 8-digit	03030003			
DWR Sub-basin	03-06-12			
Project Drainage Area (acres)	463			
Project Drainage Area Percentage of Impervious Area	2%			
Land Use Classification	49% Cultivated Crops, 36% Forested, 13% Developed, 2% Other			
Reach Summary Information				
Parameters	Sandy Branch R1	Sandy Branch R2	UT1	UT2
Pre-project length (feet)	964	1,931	102	257
Post-project length (feet)	953	1,919	125	254
Valley confinement	Unconfined			
Drainage area (acres)	323	388-463	35	73
Perennial, Intermittent, Ephemeral	Perennial			
NCDWR Water Quality Classification	C, NSW			
Dominant Stream Classification (existing)	E4/F4	F4	E4/F4	F4
Dominant Stream Classification (proposed)	C4			
Dominant Evolutionary Classification (Simon)	Stage III: Degradation			
Wetland Summary Information				
Parameters	Re-establishment	Rehabilitation		
Pre-project area (acres)	N/A	3.819		
Post-project area (acres)	4.721	3.819		
Wetland Type (non-riparian, riparian)	Riparian	Riparian		
Mapped Soil Series	CmB - Cid-Lignum complex, 2-6% slopes			
Soil Hydric Status	Predominantly Non-Hydric			
Regulatory Considerations				
Regulation	Applicable?	Resolved?	Supporting Docs?	
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 4134. Categorical Exclusion in Mitigation Plan (Wildlands, 2019)	
Waters of the United States - Section 401	Yes	Yes		
Endangered Species Act	Yes	Yes		
Historic Preservation Act	Yes	Yes		
Coastal Zone Management Act (CZMA or CAMA)			N/A	
Essential Fisheries Habitat			N/A	

Section 2: MONITORING YEAR 3 DATA ASSESSMENT

Annual monitoring and site visits were conducted during MY3 to assess the condition of the project. The vegetation and stream success criteria for the Site follow the approved success criteria 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 MY0 Annual Report (Wildlands, 2021).

2.1 Vegetative Assessment

The MY3 vegetative survey was completed in August 2023. Vegetation monitoring resulted in an average planted stem density of 486 stems per acre, with individual plots ranging from 364 to 567 planted stems per acre. All 13 plots are well above the interim requirement of 320 stems per acre required at MY3 and are on track to meet the final success criteria required for MY7. Per IRT request, a random vegetation plot was conducted near groundwater well 12. Herbaceous vegetation growth is flourishing across the Site and is providing effective ground coverage to filter incoming runoff and nutrients. Refer to Appendix A for Vegetation Plot Photographs and the Vegetation Condition Assessment Table and Appendix B for Vegetation Plot Data.

2.2 Vegetation Areas of Concern and Management

To combat invasive species and encourage native vegetative growth, scattered individual sprouts of multiflora rose (*Rosa multiflora*) and Chinese privet (*Ligustrum sinense*) within the existing forested area along the lower portion of Sandy Branch Reach 2 were physically and chemically treated in February 2023, and again in August 2023. Smaller, sporadic populations of Chinese privet (*Ligustrum sinense*) along the upper portion of Sandy Branch Reach 1, above the crossing, were treated in October 2023. Isolated cattail (*Typha spp.*) populations (0.10 acres total) within wetlands along the upper portion of Sandy Branch Reach 2 were treated in September 2023. High density fescue was treated with sprays around planted stems and between as needed sitewide in April 2023 to help promote tree growth. Additional ring sprays and overseeding are planned for especially dense areas along the western side of Sandy Branch Reach 2 for spring 2024. Wildlands will continue to monitor and assess further treatment needs.

2.3 Stream Assessment

Morphological surveys for MY3 were conducted in March 2023. A vast majority of the streams within the Site are stable and functioning as designed. Cross-sections 7 and 8, located on riffles within UT1 and UT2 respectively, showed minor sediment deposition within the channel. Both UT1 and UT2 originate as non-project streams in areas with active livestock use. The upstream portions of UT1 and UT2, outside of the easement, are eroding and flushing sediment into the project streams. Both streams will be closely monitored but no management action will be taken at this time. All 8 cross-sections at the Site show little to no change in the bankfull areas and width-to-depth ratios, and bank height ratios are less than 1.2. Pebble count data is no longer required per the September 29, 2021, IRT Technical Work Group Meeting. The IRT reserves the right to request pebble count data and particle distributions if deemed necessary during the monitoring period. Refer to Appendix A for the Visual Stream Morphology Stability Assessment Table and Stream Photographs. Refer to Appendix C for Stream Geomorphology Data.



2.4 Stream Areas of Concern and Management

Scour was observed on the outside bank of a bend on the lower portion of Sandy Branch Reach 2. This area includes approximately 25 linear feet of streambank. This most likely occurred from a series of high flow events resulting from several large storms between December 2023-January 2024. Remedial action will be taken in MY4, and this area will continue to be monitored and documented. Refer to Appendix A for the Current Condition Plan View.

2.5 Hydrology Assessment

At the end of MY7, four or more bankfull events must have occurred in separate years within the restoration reaches of Sandy Branch. Multiple bankfull events were recorded on Sandy Branch Reach 2 during MY1, MY2, and MY3, resulting in partial attainment of the final stream hydrology assessment success criteria. Refer to Appendix D for hydrologic data.

2.6 Wetland Assessment

The performance criteria for wetland hydrology is groundwater within 12 inches of the ground surface for 10.0% (27 days) of the growing season consecutively. The growing season is set as March 1st through November 17th (261 days) and was approved by the IRT during the April 2023 Credit Release Meeting. Therefore, the soil temperature probe is no longer necessary and will be removed. Of the fourteen groundwater gauges on the Site, twelve met the success criteria during MY3. The twelve gauges that met were all well above the success criteria of 27 days, all meeting with 37-110 days consecutively. Although groundwater gauges 2 and 6 narrowly missed with a hydroperiod of 9.9% (26 days) and 8.8% (23 days), they were close to the 10% success criteria. Annual precipitation was lower than normal throughout MY3, especially in late February through March, which likely contributed to not meeting success criteria. Additionally, after construction of the stream channel, it is anticipated that the groundwater table will take some time to recharge. Overall, the data is trending positively, and it is expected that groundwater gauges 2 and 6 will continue to trend in a positive direction in subsequent monitoring years. Per the IRT's request, two additional groundwater gauges were installed in wetland re-establishment areas on April 28, 2022. After installation and a complete year of observation, groundwater gauges 13 and 14 have successfully met the criteria with a hydroperiod of 38.5% (101 days) and 27.5% (72 days) respectively. Refer to Figure 1 for the groundwater gauge locations and Appendix D for groundwater hydrology data and plots.

2.7 Monitoring Year 3 Summary

All vegetation plots are on track to exceed the MY3 interim requirement of 320 planted stems per acre. Vegetative cover has become well established and planted tree species are showing positive trends in both density and vigor. Herbaceous growth is flourishing across the Site and is providing effective ground coverage to filter incoming runoff and nutrients. The vast majority of project streams are stable and functioning as designed. One meander bend at the bottom of Sandy Branch Reach 2 had some recent scour, likely a result of several large storm events. Twelve of the fourteen groundwater gauges met success criteria in MY3. Groundwater gauges 2 and 6 missed success criteria by a narrow margin. Overall, data for the Site reflects a positive trend in groundwater and is expected to successfully recharge in subsequent years. Per IRT request, two additional groundwater gauges were installed in wetland re-establishment areas on April 28, 2022. After a complete year of observation, groundwater gauges 13 and 14 have successfully met performance criteria in MY3. Sandy Branch Reach 2 had multiple bankfull events in MY1, MY2, and MY3, resulting in partial attainment of the final stream hydrology assessment success criteria. The easement boundary has been walked and no signage issues were observed. The stream crossing is stable, and all fences are in good condition and keeping livestock out of the easement.



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

- Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0.
- North Carolina Department of Environmental Quality, Division of Mitigation Services (DMS). 2017. Annual Monitoring Report Format, Data Requirements, and Content Guidance June 2017.
- North Carolina Ecosystem Enhancement Program (EEP), 2009. Cape Fear River Basin Restoration Priorities.
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- North Carolina Interagency Review Team. 2016. Wilmington District Stream and Wetland Compensatory Mitigation Update.
- Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.
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- United States Army Corps of Engineers (USACE). 2003. *Stream Mitigation Guidelines*. USACE, NCDENR-DWQ, USEPA, NCWRC.
- Wildlands Engineering, Inc. (2019). *Sandy Branch Mitigation Project Mitigation Plan*. DMS, Raleigh, NC.



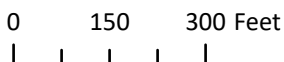
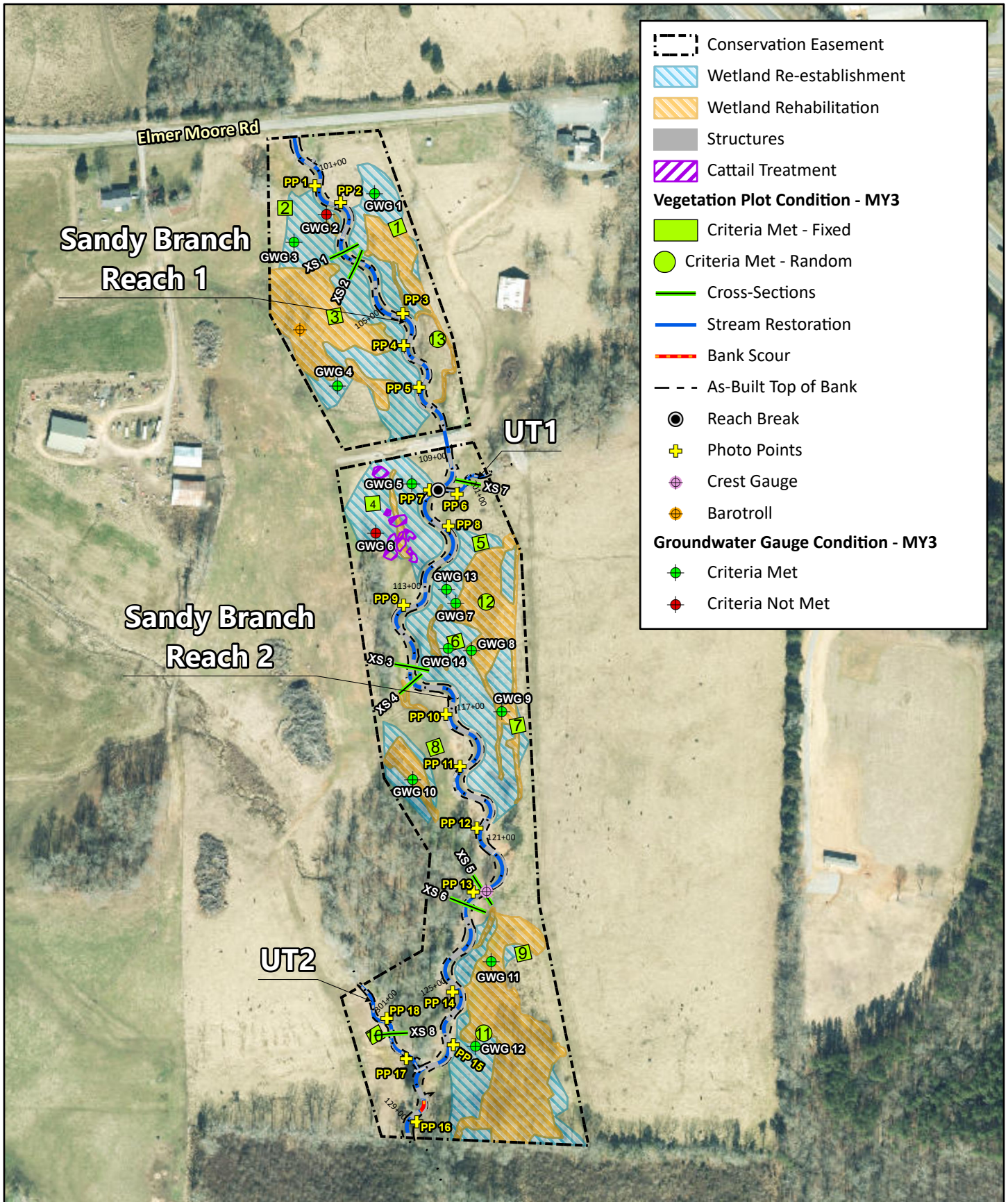


Figure 1. Current Condition Plan View
 Sandy Branch Mitigation Site
 DMS Project No. 100060
 Monitoring Year 3 - 2023

Chatham County, NC

APPENDIX A. VISUAL ASSESSMENT DATA

Table 4. Visual Stream Morphology Stability Assessment Table

Sandy Branch Mitigation Site
 DMS Project No. 100060
 Monitoring Year 3 - 2023

Sandy Branch Reach 1

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	953
					Assessed Bank Length	1,906
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.	13	13		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	8	8		100%

Visual Assessment was completed November 20, 2023.

Sandy Branch 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	1,919
					Assessed Bank Length	3,838
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.			25	99%
Totals:					25	99%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	24	24		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	14	14		100%

Visual Assessment was completed November 20, 2023.

Table 4. Visual Stream Morphology Stability Assessment Table

Sandy Branch Mitigation Site
 DMS Project No. 100060
 Monitoring Year 3 - 2023

UT1

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	125
					Assessed Bank Length	250
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	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	4	4		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	2	2		100%

Visual Assessment was completed November 20, 2023.

UT2

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	254
					Assessed Bank Length	508
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	100%
Structure	Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	6	6		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%.	1	1		100%

Visual Assessment was completed November 20, 2023.

Table 5. Vegetation Condition Assessment Table

Sandy Branch Mitigation Site
 DMS Project No. 100060
 Monitoring Year 3 - 2023

Planted Acreage 15.87

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 current MY stem count criteria.	0.10	0	0%
Total			0	0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10	0	0%
Cumulative Total			0.0	0%

Visual Assessment was completed November 20, 2023.

Easement Acreage 18.10

Vegetation Category	Definitions	Mapping Threshold (ac)	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. Invasive species included in summation above should be identified in report summary.	0.10	0.1*	1%
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 Encroachments Noted / 0 ac	

Visual Assessment was completed November 20, 2023.

*Small isolated populations of cattail (*Typha spp.*) treated during MY3.

STREAM PHOTOGRAPHS



PHOTO POINT 1 Sandy Branch R1 – upstream (02/15/2023)



PHOTO POINT 1 Sandy Branch R1 – downstream (02/15/2023)



PHOTO POINT 2 Sandy Branch R1 – upstream (02/15/2023)



PHOTO POINT 2 Sandy Branch R1 – downstream (02/15/2023)



PHOTO POINT 3 Sandy Branch R1 – upstream (02/15/2023)



PHOTO POINT 3 Sandy Branch R1 – downstream (02/15/2023)





PHOTO POINT 4 Sandy Branch R1 – upstream (02/15/2023)



PHOTO POINT 4 Sandy Branch R1 – downstream (02/15/2023)



PHOTO POINT 5 Sandy Branch R1 – upstream (02/15/2023)



PHOTO POINT 5 Sandy Branch R1 – downstream (02/15/2023)



PHOTO POINT 6 UT1 – upstream (02/15/2023)



PHOTO POINT 6 UT1 – downstream (02/15/2023)





PHOTO POINT 7 Sandy Branch R2 – upstream (02/15/2023)



PHOTO POINT 7 Sandy Branch R2 – downstream (02/15/2023)



PHOTO POINT 8 Sandy Branch R2 – upstream (02/15/2023)



PHOTO POINT 8 Sandy Branch R2 – downstream (02/15/2023)



PHOTO POINT 9 Sandy Branch R2 – upstream (02/15/2023)



PHOTO POINT 9 Sandy Branch R2 – downstream (02/15/2023)





PHOTO POINT 10 Sandy Branch R2 – upstream (03/14/2023)



PHOTO POINT 10 Sandy Branch R2 – downstream (03/14/2023)



PHOTO POINT 11 Sandy Branch R2 – upstream (02/15/2023)



PHOTO POINT 11 Sandy Branch R2 – downstream (02/15/2023)



PHOTO POINT 12 Sandy Branch R2 – upstream (02/15/2023)



PHOTO POINT 12 Sandy Branch R2 – downstream (02/15/2023)





PHOTO POINT 13 Sandy Branch R2 – upstream (02/15/2023)



PHOTO POINT 13 Sandy Branch R2 – downstream (02/15/2023)



PHOTO POINT 14 Sandy Branch R2 – upstream (02/15/2023)



PHOTO POINT 14 Sandy Branch R2 – downstream (02/15/2023)



PHOTO POINT 15 Sandy Branch R2 – upstream (02/15/2023)



PHOTO POINT 15 Sandy Branch R2 – downstream (02/15/2023)





PHOTO POINT 16 Sandy Branch R2 – upstream (03/14/2023)



PHOTO POINT 16 Sandy Branch R2 – downstream (03/14/2023)



PHOTO POINT 17 UT2 – upstream (02/15/2023)



PHOTO POINT 17 UT2 – downstream (02/15/2023)



PHOTO POINT 18 UT2 – upstream (03/14/2023)



PHOTO POINT 18 UT2 – downstream (03/14/2023)



CULVERT CROSSING PHOTOGRAPHS



Sandy Branch R1 – Looking Upstream (11/20/2023)



Sandy Branch R1 – Looking Downstream (11/20/2023)



VEGETATION PLOT PHOTOGRAPHS



FIXED VEG PLOT 1 (08/03/2023)



FIXED VEG PLOT 2 (08/03/2023)



FIXED VEG PLOT 3 (08/03/2023)



FIXED VEG PLOT 4 (08/03/2023)



FIXED VEG PLOT 5 (08/03/2023)



FIXED VEG PLOT 6 (08/03/2023)





FIXED VEG PLOT 7 (08/03/2023)



FIXED VEG PLOT 8 (08/03/2023)



FIXED VEG PLOT 9 (08/03/2023)



FIXED VEG PLOT 10 (08/03/2023)



RANDOM VEG PLOT 11 (08/03/2023)



RANDOM VEG PLOT 12 (08/03/2023)





RANDOM VEG PLOT 13 (08/03/2023)



GROUNDWATER GAUGE PHOTOGRAPHS



GROUNDWATER GAUGE 1 (11/20/2023)



GROUNDWATER GAUGE 2 (11/20/2023)



GROUNDWATER GAUGE 3 (11/20/2023)



GROUNDWATER GAUGE 4 (11/20/2023)

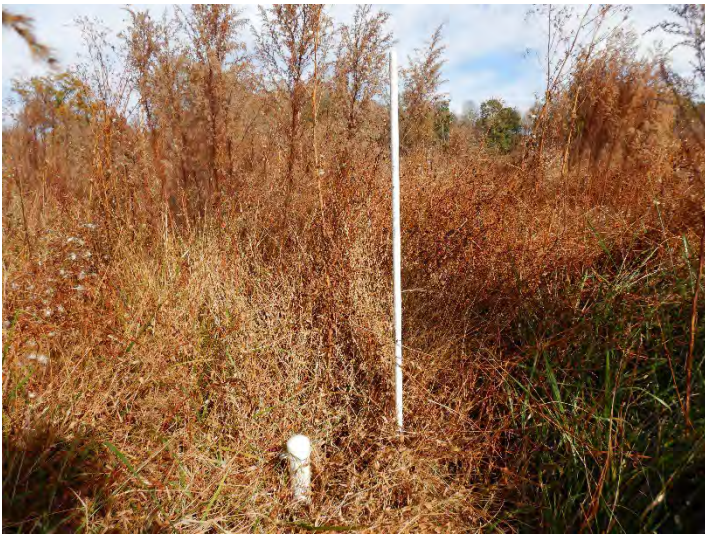


GROUNDWATER GAUGE 5 (12/1/2023)



GROUNDWATER GAUGE 6 (11/20/2023)





GROUNDWATER GAUGE 7 (11/20/2023)



GROUNDWATER GAUGE 8 (11/20/2023)



GROUNDWATER GAUGE 9 (11/20/2023)



GROUNDWATER GAUGE 10 (11/20/2023)



GROUNDWATER GAUGE 11 (11/20/2023)

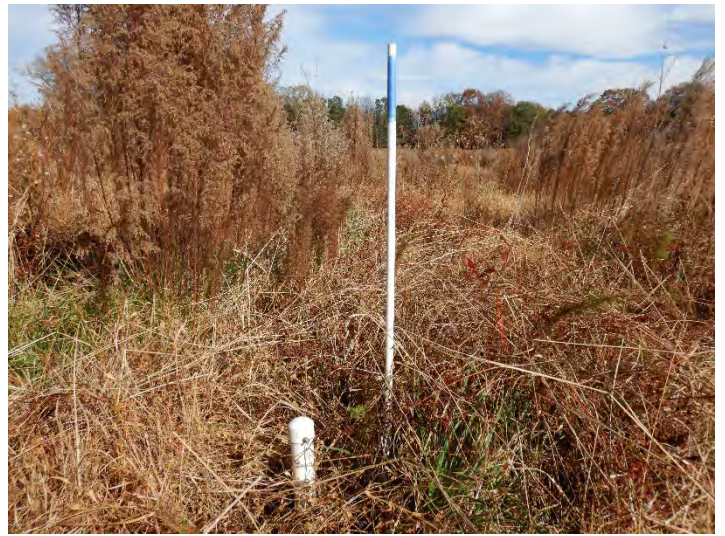


GROUNDWATER GAUGE 12 (11/20/2023)





GROUNDWATER GAUGE 13 (11/20/2023)



GROUNDWATER GAUGE 14 (11/20/2023)



APPENDIX B. VEGETATION PLOT DATA

Table 6. Vegetation Plot Data

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

Planted Acreage	15.87
Date of Initial Plant	2020-03-01
Date of Current Survey	2022-08-02
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/S hrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	<i>Acer negundo</i>	boxelder	Tree	FAC	1	1			1	1		
	<i>Betula nigra</i>	river birch	Tree	FACW	2	2	2	2	2	2	2	2
	<i>Diospyros virginiana</i>	common persimmon	Tree	FAC	1	1					2	2
	<i>Platanus occidentalis</i>	American sycamore	Tree	FACW	2	2	4	4	1	1	3	3
	<i>Quercus falcata</i>	southern red oak	Tree	FACU								
	<i>Quercus michauxii</i>	swamp chestnut oak	Tree	FACW	1	1	3	3	3	3		
	<i>Quercus nigra</i>	water oak	Tree	FAC			1	1				
	<i>Quercus pagoda</i>	cherrybark oak	Tree	FACW	2	2			1	1		
	<i>Quercus phellos</i>	willow oak	Tree	FACW	1	1	3	3	1	1		
	<i>Quercus shumardii</i>	Shumard's oak	Tree	FAC								
	<i>Salix nigra</i>	black willow	Tree	OBL	1	1			1	1	1	1
	<i>Ulmus rubra</i>	slippery elm	Tree	FAC			1	1			2	2
Sum	Performance Standard				11	11	14	14	10	10	10	10
Post Mitigation Plan Species	<i>Fraxinus pennsylvanica</i>	green ash	Tree	FACW								
Sum	Proposed Standard				11	11	14	14	10	10	10	10
Mitigation Plan Performance Standard	Current Year Stem Count					11		14		10		10
	Stems/Acre					445		567		405		405
	Species Count					8		6		7		5
	Dominant Species Composition (%)					18		29		30		30
	Average Plot Height (ft.)					5		7		5		3
	% Invasives					0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					11		14		10		10
	Stems/Acre					445		567		405		405
	Species Count					8		6		7		5
	Dominant Species Composition (%)					18		29		30		30
	Average Plot Height (ft.)					5		7		5		3
	% Invasives					0		0		0		0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.

2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded), species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).

3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6. Vegetation Plot Data

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

Planted Acreage	15.87
Date of Initial Plant	2020-03-01
Date of Current Survey	2022-08-02
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/S hrub	Indicator Status	Veg Plot 5 F		Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	<i>Acer negundo</i>	boxelder	Tree	FAC	1	1	1	1			1	1
	<i>Betula nigra</i>	river birch	Tree	FACW	1	1	4	4	2	2	3	3
	<i>Diospyros virginiana</i>	common persimmon	Tree	FAC			1	1				
	<i>Platanus occidentalis</i>	American sycamore	Tree	FACW	2	2	3	3	2	2	2	2
	<i>Quercus falcata</i>	southern red oak	Tree	FACU								
	<i>Quercus michauxii</i>	swamp chestnut oak	Tree	FACW	3	3	3	3	1	1	2	2
	<i>Quercus nigra</i>	water oak	Tree	FAC	1	1	2	2	2	2	1	1
	<i>Quercus pagoda</i>	cherrybark oak	Tree	FACW					1	1		
	<i>Quercus phellos</i>	willow oak	Tree	FACW	3	3			3	3	2	2
	<i>Quercus shumardii</i>	Shumard's oak	Tree	FAC								
	<i>Salix nigra</i>	black willow	Tree	OBL								
	<i>Ulmus rubra</i>	slippery elm	Tree	FAC					1	1	3	3
Sum	Performance Standard				11	11	14	14	12	12	14	14
Post Mitigation Plan Species	<i>Fraxinus pennsylvanica</i>	green ash	Tree	FACW								
Sum	Proposed Standard				11	11	14	14	12	12	14	14
Mitigation Plan Performance Standard	Current Year Stem Count					11		14		12		14
	Stems/Acre					445		567		486		567
	Species Count					6		6		7		7
	Dominant Species Composition (%)					27		29		25		21
	Average Plot Height (ft.)					4		4		5		4
	% Invasives					0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					11		14		12		14
	Stems/Acre					445		567		486		567
	Species Count					6		6		7		7
	Dominant Species Composition (%)					27		29		25		21
	Average Plot Height (ft.)					4		4		5		4
	% Invasives					0		0		0		0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.

2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded), species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).

3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6. Vegetation Plot Data

Sandy Branch Mitigation Site
 DMS Project No. 100060
Monitoring Year 3 - 2023

Planted Acreage	15.87
Date of Initial Plant	2020-03-01
Date of Current Survey	2022-08-02
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/S hrub	Indicator Status	Veg Plot 9 F		Veg Plot 10 F		Veg Plot 11 R	Veg Plot 12 R	Veg Plot 13 R
					Planted	Total	Planted	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	<i>Acer negundo</i>	boxelder	Tree	FAC	1	1	1	1	1		1
	<i>Betula nigra</i>	river birch	Tree	FACW	3	3	3	3	3	4	3
	<i>Diospyros virginiana</i>	common persimmon	Tree	FAC	2	2			2	1	1
	<i>Platanus occidentalis</i>	American sycamore	Tree	FACW	3	3	2	2		2	2
	<i>Quercus falcata</i>	southern red oak	Tree	FACU					1		
	<i>Quercus michauxii</i>	swamp chestnut oak	Tree	FACW	1	1	1	1	3	1	2
	<i>Quercus nigra</i>	water oak	Tree	FAC					1		
	<i>Quercus pagoda</i>	cherrybark oak	Tree	FACW	2	2					1
	<i>Quercus phellos</i>	willow oak	Tree	FACW			4	4			
	<i>Quercus shumardii</i>	Shumard's oak	Tree	FAC			1	1			
	<i>Salix nigra</i>	black willow	Tree	OBL				1	1		
	<i>Ulmus rubra</i>	slippery elm	Tree	FAC			2	2			1
Sum	Performance Standard				12	12	14	14	14	9	11
Post Mitigation Plan Species	<i>Fraxinus pennsylvanica</i>	green ash	Tree	FACW							1
Sum	Proposed Standard				12	12	14	14	14	9	12
Mitigation Plan Performance Standard	Current Year Stem Count					12		14	14	9	11
	Stems/Acre					486		567	567	364	445
	Species Count					6		7	8	5	7
	Dominant Species Composition (%)					25		29	21	44	27
	Average Plot Height (ft.)					4		3	4	5	5
	% Invasives					0		0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					12		14	14	9	12
	Stems/Acre					486		567	567	364	486
	Species Count					6		7	8	5	8
	Dominant Species Composition (%)					25		29	21	44	27
	Average Plot Height (ft.)					4		3	4	5	5
	% Invasives					0		0	0	0	0

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

Table 7. Vegetation Performance Standards Summary Table

Sandy Branch Mitigation Site

DMS Project No. 100060

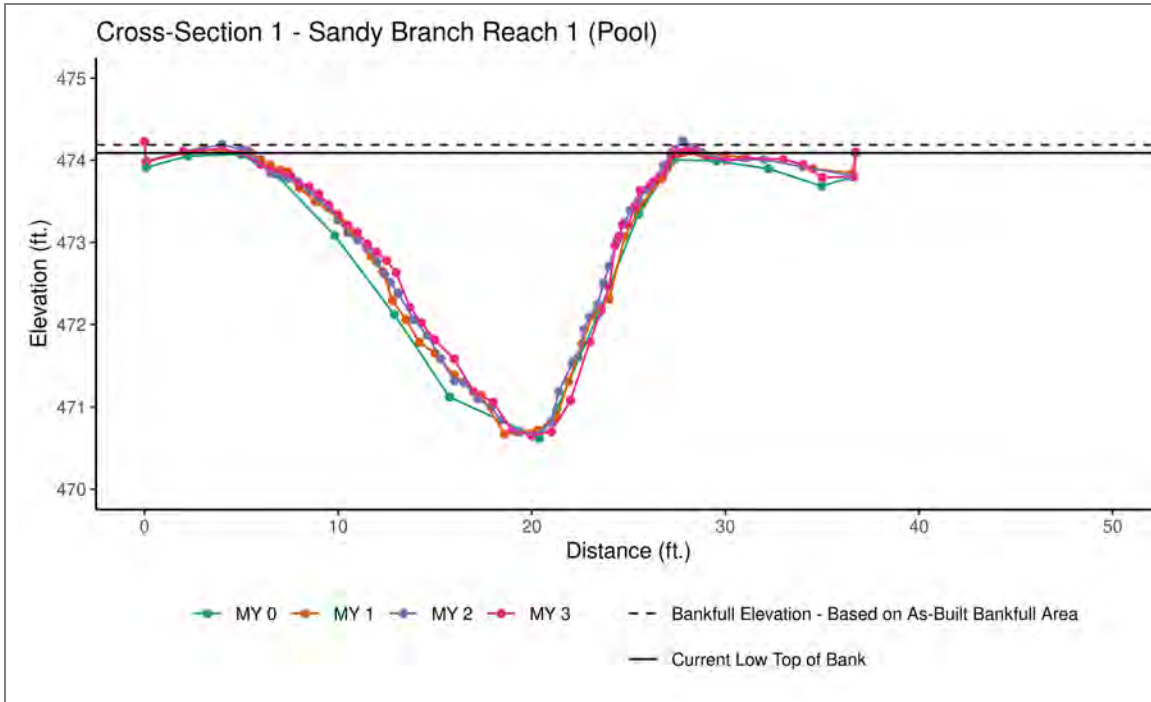
Monitoring Year 3 - 2023

	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	445	5	8	0	567	7	6	0	405	5	7	0
Monitoring Year 2	445	3	8	0	567	4	6	0	405	3	7	0
Monitoring Year 1	567	2	9	0	607	2	6	0	486	2	7	0
Monitoring Year 0	567	3	9	0	607	3	6	0	567	3	8	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	405	3	5	0	445	4	6	0	567	4	6	0
Monitoring Year 2	405	2	5	0	567	3	7	0	567	3	6	0
Monitoring Year 1	445	2	6	0	648	2	8	0	607	3	7	0
Monitoring Year 0	486	3	7	0	648	3	8	0	607	3	7	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	486	5	7	0	567	4	7	0	486	4	6	0
Monitoring Year 2	486	3	7	0	526	3	7	0	526	3	7	0
Monitoring Year 1	567	3	8	0	567	2	7	0	607	2	8	0
Monitoring Year 0	567	3	8	0	607	3	8	0	607	3	8	0
	Veg Plot 10 F				Veg Plot Group 11 R				Veg Plot Group 12 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	567	3	7	0	567	4	8	0	364	5	5	0
Monitoring Year 2	526	2	7	0	364	3	6	0	445	3	6	0
Monitoring Year 1	607	2	7	0	688	3	6	0	567	3	4	0
Monitoring Year 0	648	3	7	0	567	3	6	0	364	3	4	0
	Veg Plot Group 13 R											
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives								
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	445	5	7	0								
Monitoring Year 2	486	4	7	0								
Monitoring Year 1	688	2	7	0								
Monitoring Year 0	607	3	6	0								

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

APPENDIX C. STREAM GEOMORPHOLOGY DATA

Cross-Section Plots

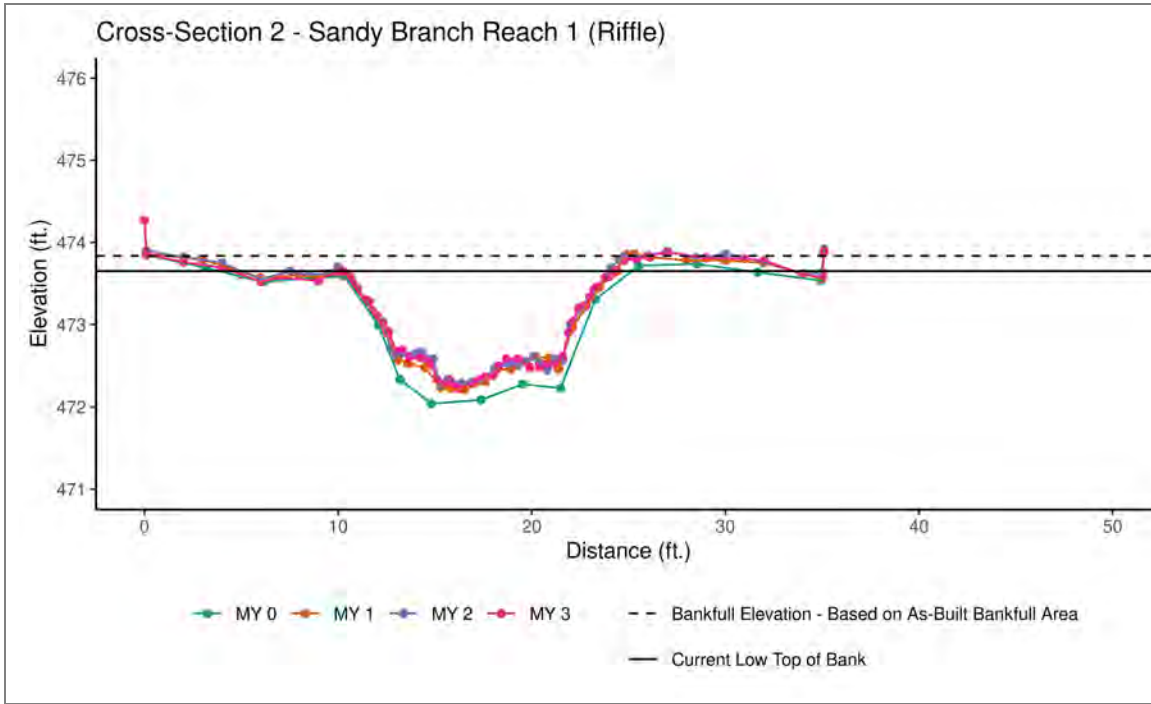


	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	N/A	N/A	N/A	N/A		
Bank Height Ratio - Based on AB-Bankfull Area	N/A	N/A	N/A	N/A		
Thalweg Elevation	470.62	470.67	470.65	470.65		
LTOB Elevation	474.01	474.09	474.12	474.09		
LTOB Max Depth	3.39	3.42	3.47	3.44		
LTOB Cross-Sectional Area	38.87	38.01	37.42	36.69		



Downstream (3/14/2023)



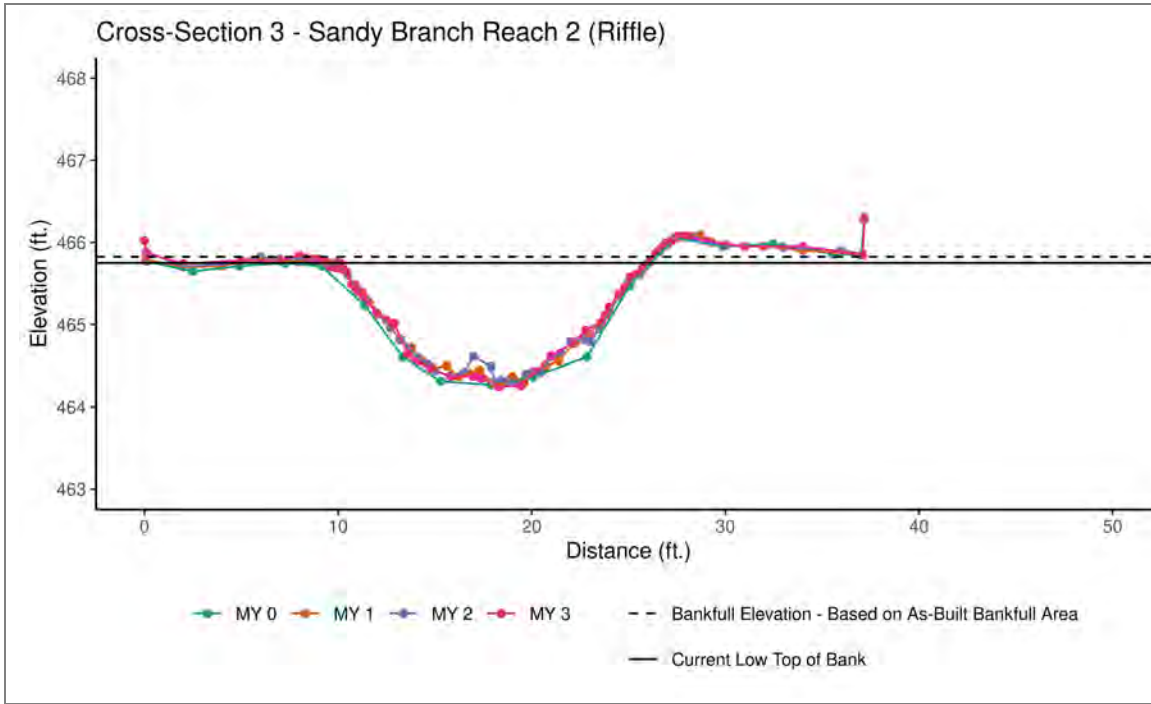


	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	473.58	473.79	473.84	473.83		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.91	0.86	0.88		
Thalweg Elevation	472.04	472.21	472.26	472.23		
LTOB Elevation	473.58	473.65	473.63	473.65		
LTOB Max Depth	1.54	1.44	1.37	1.42		
LTOB Cross-Sectional Area	14.96	12.88	12.00	12.36		



Downstream (3/14/2023)



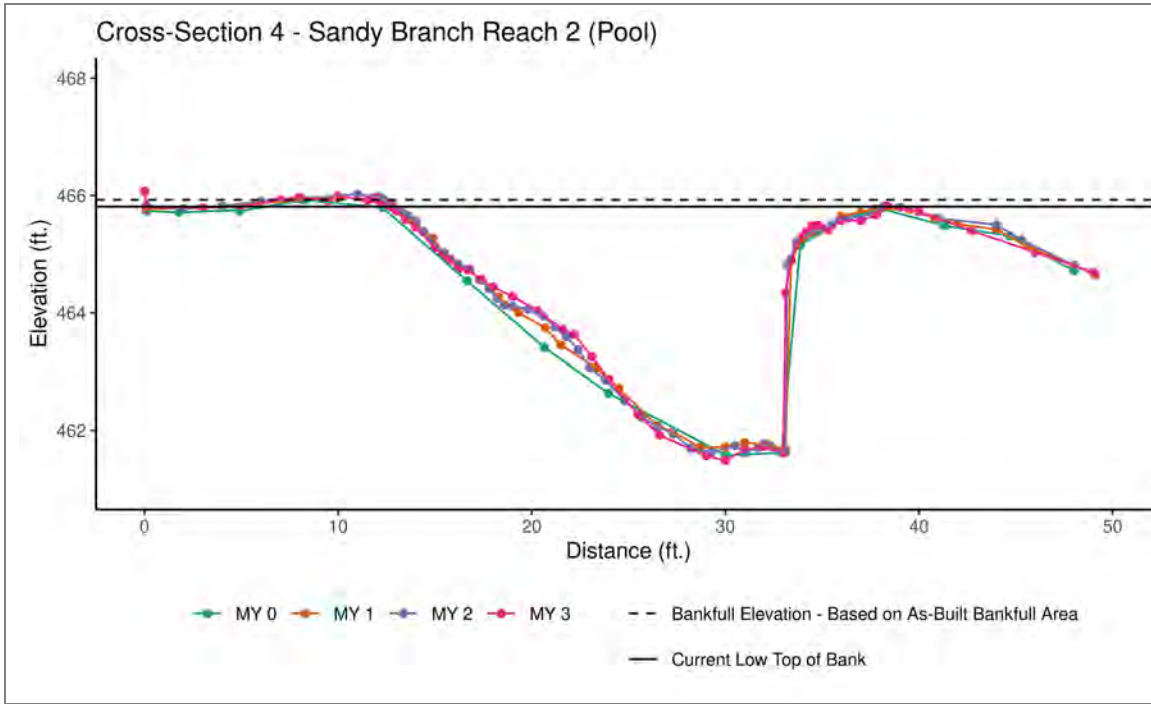


	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	465.71	465.83	465.83	465.82		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.96	0.95	0.95		
Thalweg Elevation	464.27	464.27	464.30	464.25		
LTOB Elevation	465.71	465.77	465.76	465.75		
LTOB Max Depth	1.44	1.50	1.46	1.50		
LTOB Cross-Sectional Area	16.25	15.33	15.06	15.08		



Downstream (3/14/2023)



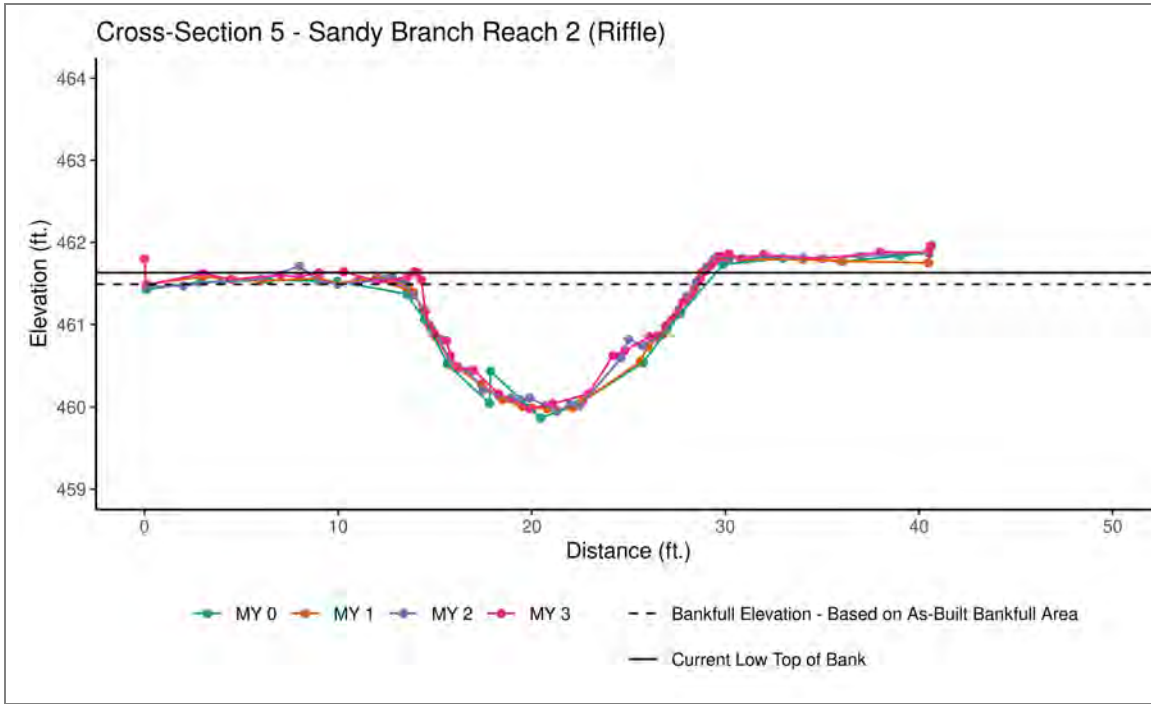


	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	N/A	N/A	N/A	N/A		
Bank Height Ratio - Based on AB-Bankfull Area	N/A	N/A	N/A	N/A		
Thalweg Elevation	461.58	461.68	461.62	461.49		
LTOB Elevation	465.78	465.77	465.82	465.81		
LTOB Max Depth	4.19	4.09	4.20	4.32		
LTOB Cross-Sectional Area	56.56	52.87	54.15	53.61		



Downstream (3/14/2023)



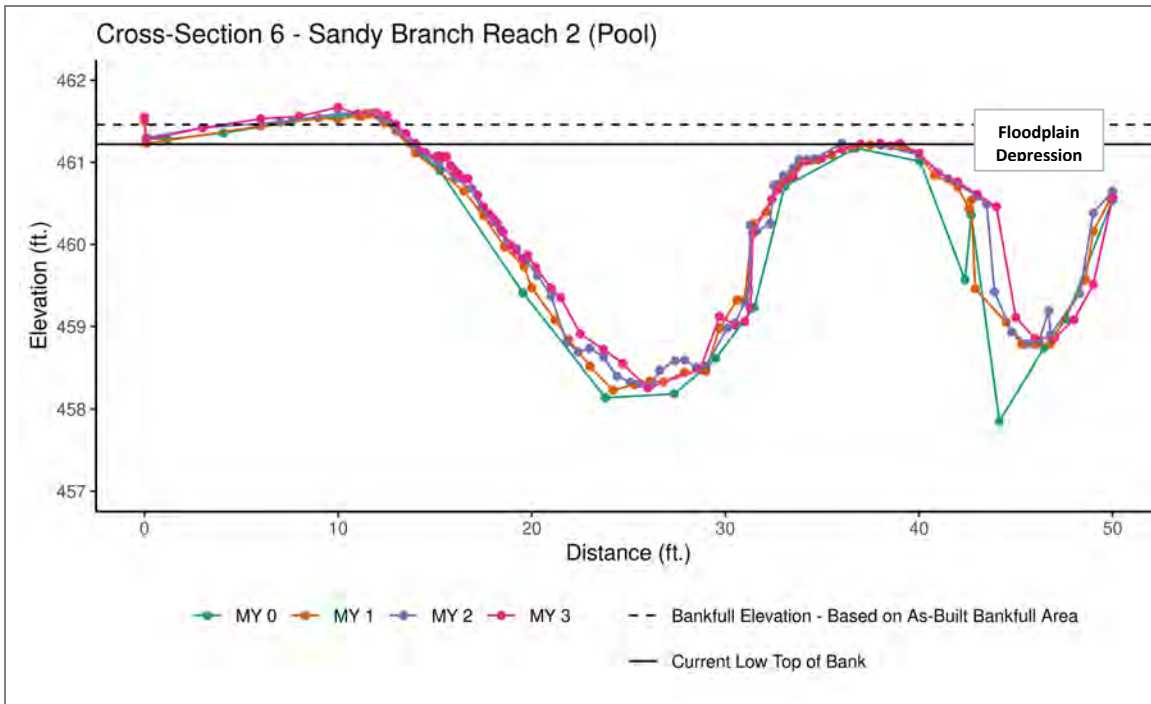


	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	461.37	461.40	461.45	461.49		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.08	1.09	1.09		
Thalweg Elevation	459.87	459.98	459.95	459.98		
LTOB Elevation	461.37	461.51	461.58	461.63		
LTOB Max Depth	1.50	1.53	1.63	1.65		
LTOB Cross-Sectional Area	13.91	15.57	15.87	15.96		



Downstream (3/14/2023)



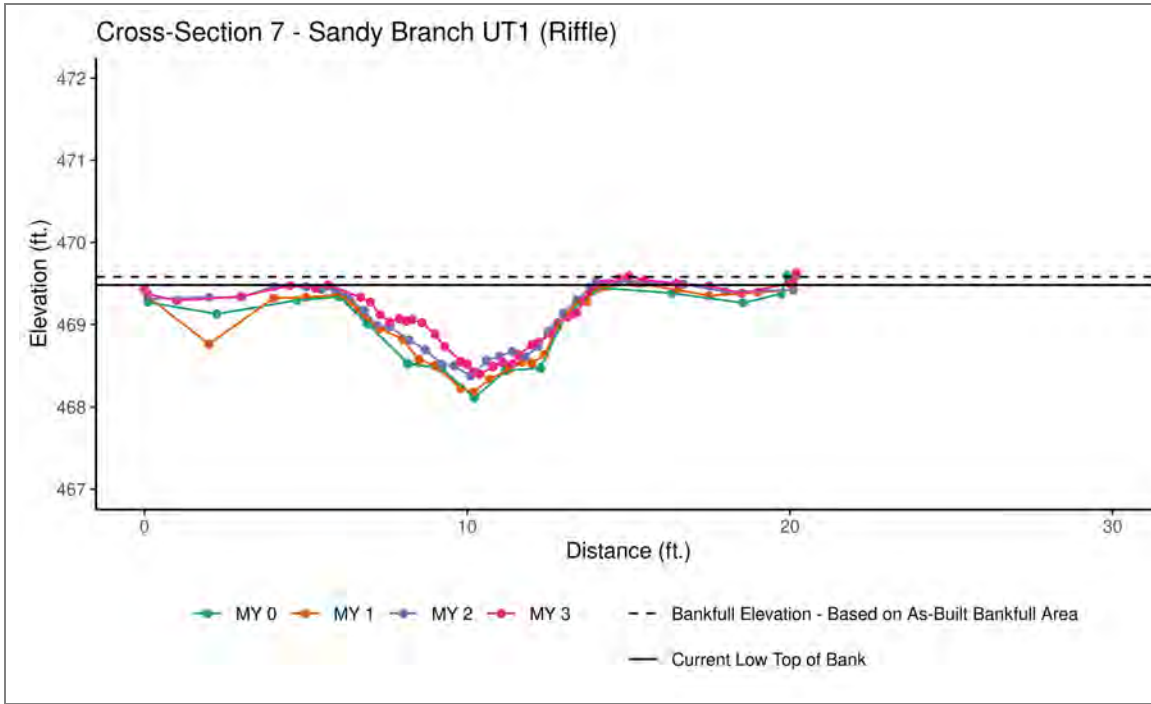


	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	N/A	N/A	N/A	N/A		
Bank Height Ratio - Based on AB-Bankfull Area	N/A	N/A	N/A	N/A		
Thalweg Elevation	458.14	458.23	458.30	458.26		
LTOB Elevation	461.17	461.18	461.23	461.22		
LTOB Max Depth	3.04	2.95	2.93	2.96		
LTOB Cross-Sectional Area	38.67	34.55	34.22	33.20		



Downstream (3/14/2023)



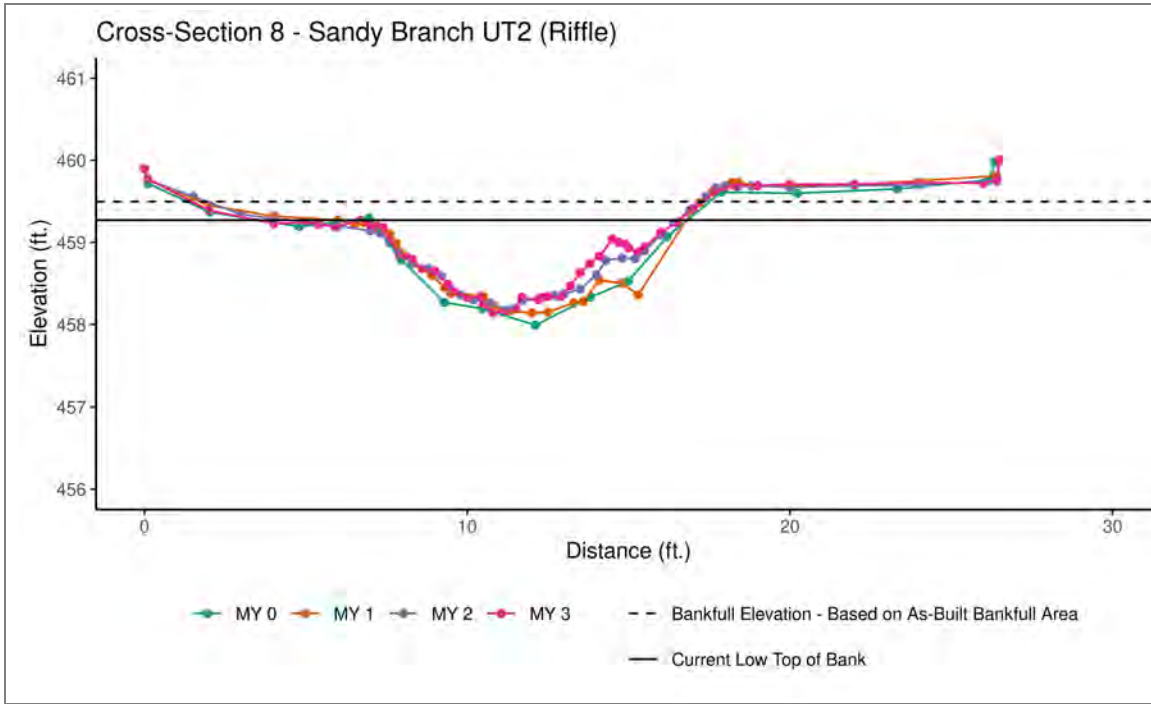


	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	469.34	469.39	469.51	469.57		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.96	0.92	0.93		
Thalweg Elevation	468.11	468.18	468.38	468.40		
LTOB Elevation	469.34	469.34	469.42	469.48		
LTOB Max Depth	1.22	1.16	1.04	1.08		
LTOB Cross-Sectional Area	5.25	4.86	4.54	4.53		



Downstream (3/14/2023)





	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	459.29	459.34	459.47	459.50		
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.92	0.74	0.83		
Thalweg Elevation	457.99	458.14	458.18	458.14		
LTOB Elevation	459.29	459.24	459.14	459.27		
LTOB Max Depth	1.30	1.10	0.96	1.13		
LTOB Cross-Sectional Area	8.12	7.14	5.07	5.89		



Downstream (3/14/2023)



Table 8. Baseline Stream Data Summary

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	Sandy Branch R1							
Riffle Only	Min	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	6.6		1	14.0		14.4		1
Floodprone Width (ft)	>60.0		1	>30.8		100.0		1
Bankfull Mean Depth (ft)	1.0		1	0.9		1.0		1
Bankfull Max Depth (ft)	1.6		1	1.3		1.5		1
Bankfull Cross Sectional Area (ft ²)	6.6		1	13.2		14.9		1
Width/Depth Ratio	6.5		1	14.8		13.9		1
Entrenchment Ratio	>9.1		1	>2.2		>6.9		1
Bank Height Ratio	1.0		1	1.0	1.2	1.0		1
Max part size (mm) mobilized at bankfull	87.0			88.0		82.7		
Rosgen Classification	E4/F4			C4		C4		
Bankfull Discharge (cfs)	22.0			44.0		50.9		
Sinuosity	1.10			1.16		1.16		
Water Surface Slope (ft/ft) ²	0.0100	0.0140	---	0.0017	0.0108	0.0074		
Other	---			---		---		
Parameter	Sandy Branch R2							
Riffle Only	Min	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	7.3	11.0	3	16.0		15.0	16.9	2
Floodprone Width (ft)	11.0	40.0	3	>35.2		70.0	80.0	2
Bankfull Mean Depth (fr)	1.2	1.6	3	1.1		0.9	1.0	2
Bankfull Max Depth (ft)	1.7	2.1	3	1.5		1.4	1.5	2
Bankfull Cross Sectional Area (ft ²)	9.1	14.0	3	17.5		14.0	16.3	2
Width/Depth Ratio	4.7	8.4	3	14.6		16.2	17.5	2
Entrenchment Ratio	1.5	3.7	3	>2.20		4.1	5.3	2
Bank Height Ratio	1.8	2.4	3	1.0	1.2	1.0	1.0	2
Max particle size (mm) mobilized at bankfull	---			---		68.3		
Rosgen Classification	F4			C4		C4		
Bankfull Discharge (cfs)	29.0	39.0	---	51.0	58.0	53.2	57.4	2
Sinuosity	1.20			1.27		1.27		
Water Surface Slope (ft/ft) ²	0.0041	0.0090	---	0.0044	0.0241	0.0060		
Other	---			---		---		

Table 8. Baseline Stream Data Summary

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

Parameter	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)			
	UT1								
Riffle Only	Min	Max	n	Min	Max	Min	Max	n	
Bankfull Width (ft)	3.3		1	7.0		7.7		1	
Floodprone Width (ft)	12.0		1	>15.4		55.0		1	
Bankfull Mean Depth (ft)	0.63		1	0.57		0.70		1	
Bankfull Max Depth (ft)	1.2		1	0.8		1.2		1	
Bankfull Cross Sectional Area (ft ²)	2.1		1	4.0		5.3		1	
Width/Depth Ratio	5.2		1	12.3		11.3		1	
Entrenchment Ratio	3.7		1	>2.2		7.1		1	
Bank Height Ratio	2.9		1	1.0	1.2	1.0			
Max part size (mm) mobilized at bankfull	---			---		62.6			
Rosgen Classification	E4/F4			C4		C4			
Bankfull Discharge (cfs)	7.7			9.0		13.2			
Sinuosity	1.10			1.14		1.14			
Water Surface Slope (ft/ft) ²	0.0270		---	0.0032	0.0198	0.0082			
Other	---			---		---			
Parameter	UT2								
Riffle Only	Min	Max	n	Min	Max	Min	Max	n	
Bankfull Width (ft)	2.9		1	9.0		9.9		1	
Floodprone Width (ft)	6.3		1	>19.8		80.0		1	
Bankfull Mean Depth (ft)	1.4		1	0.7		0.8		1	
Bankfull Max Depth (ft)	1.7		1	1.0		1.3		1	
Bankfull Cross Sectional Area (ft ²)	4.1		1	6.5		8.1		1	
Width/Depth Ratio	2.1		1	12.5		12.2		1	
Entrenchment Ratio	2.2		1	>2.2		8.1		1	
Bank Height Ratio	2.5		1	1.0	1.2	1.0			
Max particle size (mm) mobilized at bankfull	---			---		77.4			
Rosgen Classification	F4			C4		C4			
Bankfull Discharge (cfs)	15			16		27			
Sinuosity	1.10			1.09		1.09			
Water Surface Slope (ft/ft) ²	0.0084	0.0140	---	0.0036	0.0251	0.0081			
Other	---			---		---			

Table 9. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

Dimension	Sandy Branch Reach 1												Sandy Branch Reach 2											
	Cross-Section 1 (Pool)						Cross-Section 2 (Riffle)						Cross-Section 3 (Riffle)						Cross-Section 4 (Pool)					
	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	N/A	N/A	N/A	N/A			473.58	473.79	473.84	473.83			465.71	465.83	465.83	465.82			N/A	N/A	N/A	N/A		
Bank Height Ratio - Based on AB Bankfull ¹ Area	N/A	N/A	N/A	N/A			1.00	0.91	0.86	0.88			1.00	0.96	0.95	0.95			N/A	N/A	N/A	N/A		
Thalweg Elevation	470.62	470.67	470.65	470.65			472.04	472.21	472.26	472.23			464.27	464.27	464.30	464.25			461.58	461.68	461.62	461.49		
LTOB ² Elevation	474.01	474.09	474.12	474.09			473.58	473.65	473.63	473.65			465.71	465.77	465.76	465.75			465.78	465.77	465.82	465.81		
LTOB ² Max Depth (ft)	3.39	3.42	3.47	3.44			1.54	1.44	1.37	1.42			1.44	1.50	1.46	1.50			4.19	4.09	4.20	4.32		
LTOB ² Cross Sectional Area (ft ²)	38.87	38.01	37.42	36.69			14.96	12.88	12.00	12.36			16.25	15.33	15.06	15.08			56.56	52.87	54.15	53.61		
Dimension	Sandy Branch Reach 2												UT1				UT2							
	Cross-Section 5 (Riffle)						Cross-Section 6 (Pool)						Cross-Section 7 (Riffle)				Cross-Section 8 (Riffle)							
	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7	Base	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	461.37	461.40	461.45	461.49			N/A	N/A	N/A	N/A			469.34	469.39	469.51	469.57			459.29	459.34	459.47	459.50		
Bank Height Ratio - Based on AB Bankfull ¹ Area	1.00	1.08	1.09	1.09			N/A	N/A	N/A	N/A			1.00	0.96	0.92	0.93			1.00	0.92	0.74	0.83		
Thalweg Elevation	459.87	459.98	459.95	459.98			458.14	458.23	458.30	458.26			468.11	468.18	468.38	468.40			457.99	458.14	458.18	458.14		
LTOB ² Elevation	461.37	461.51	461.58	461.63			461.17	461.18	461.23	461.22			469.34	469.34	469.42	469.48			459.29	459.24	459.14	459.27		
LTOB ² Max Depth (ft)	1.50	1.53	1.63	1.65			3.04	2.95	2.93	2.96			1.22	1.16	1.04	1.08			1.30	1.10	0.96	1.13		
LTOB ² Cross Sectional Area (ft ²)	13.91	15.57	15.87	15.96			38.67	34.55	34.22	33.20			5.25	4.86	4.54	4.53			8.12	7.14	5.07	5.89		

¹Bank Height Ratio (BHR) takes the As-built bankfull area as the basis for adjusting each subsequent years bankfull elevation.

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

APPENDIX D. HYDROLOGY DATA

Table 10. Bankfull Events

Sandy Branch Mitigation Site
 DMS Project No. 100060
Monitoring Year 3 - 2023

Reach	MY1 (2021)	MY2 (2022)	MY3 (2023)	MY4 (2024)	MY5 (2025)	MY6 (2026)	MY7 (2027)
Sandy Branch Reach 2	2/4/2021 10/9/2021	1/3/2022 3/16/2022 11/27/2022	2/12/2023 4/7/2023 4/30/2023 7/5/2023 7/9/2023				

Table 11. Rainfall Summary

Sandy Branch Mitigation Site
 DMS Project No. 100060
Monitoring Year 3 - 2023

	MY1 (2021)	MY2 (2022)	MY3 (2023)	MY4 (2024)	MY5 (2025)	MY6 (2026)	MY7 (2027)
Annual Precip Total	47.37	42.49	32.39*				
WETS 30th Percentile	41.08	41.14	41.02				
WETS 70th Percentile	48.48	48.69	48.74				
Normal	Y	Y	*				

Annual Precipitation Source: **Siler City 7.2NE** Station, Chatham County, NC, AgACIS, approximately 11-mi. northwest.

30 Year Average Precipitation Source: **Siler City 2N** Station, Chatham County, NC, AgACIS, approximately 11-mi. northwest.

*Annual precipitation was collected 1/1/2023 to 11/20/2023. Data from the remainder of MY3 will be updated in MY4.

Table 12. Groundwater Gauge Summary

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

Gauge	Max. Consecutive Hydroperiod (Percentage)						
	MY1 (2021)	MY2 (2022)	MY3 (2023)	MY4 (2024)	MY5 (2025)	MY6 (2026)	MY7 (2027)
1	50 days (19.1%)	80 Days (30.5%)	101 Days (38.5%)				
2	20 days (7.6%)	25 Days (9.5%)	26 Days (9.9%)				
3	19 days (7.3%)	29 Days (11.1%)	27 Days (10.3%)				
4	51 days (19.5%)	82 Days (31.3%)	98 Days (37.4%)				
5	55 days (21%)	48 Days (18.3%)	70 Days (26.7%)				
6	20 days (7.6%)	31 Days (11.8%)	23 Days (8.8%)				
7	61 days (23.3%)	94 Days (35.9%)	110 Days (42.0%)				
8	62 days (23.7%)	82 Days (31.3%)	106 Days (40.5%)				
9	51 days (19.5%)	80 Days (30.5%)	64 Days (24.4%)				
10	37 days (14.1%)	43 Days (16.4%)	37 Days (14.1%)				
11	40 days (15.3%)	81 Days (30.9%)	101 Days (38.5%)				
12	51 days (19.5%)	56 Days (21.4%)	72 Days (27.5%)				
13	*	22 Days* (8.4%)	101 Days (38.5%)				
14	*	10 Days* (3.8%)	72 Days (27.5%)				

Performance Standard: **27 Days (10%)**

WETS Station (Daily Rainfall): **Siler City 7.2NE**

WETS Station (30th & 70th Percentile): **Siler City 2N, NC**

Growing Season: **3/1/2023 to 11/17/2023 (261 Days)**

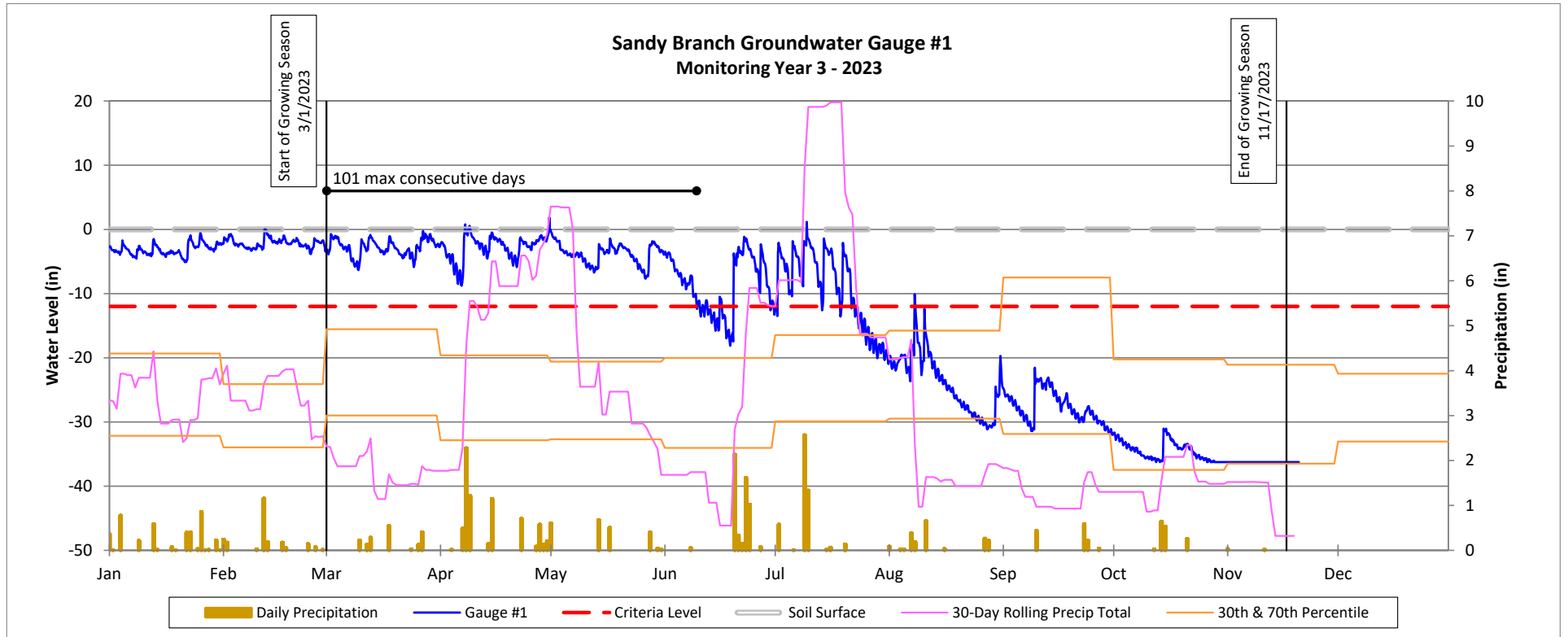
*GWGs 13 and 14 were installed on April 28, 2022 per IRT request.

Groundwater Gauge Plot

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

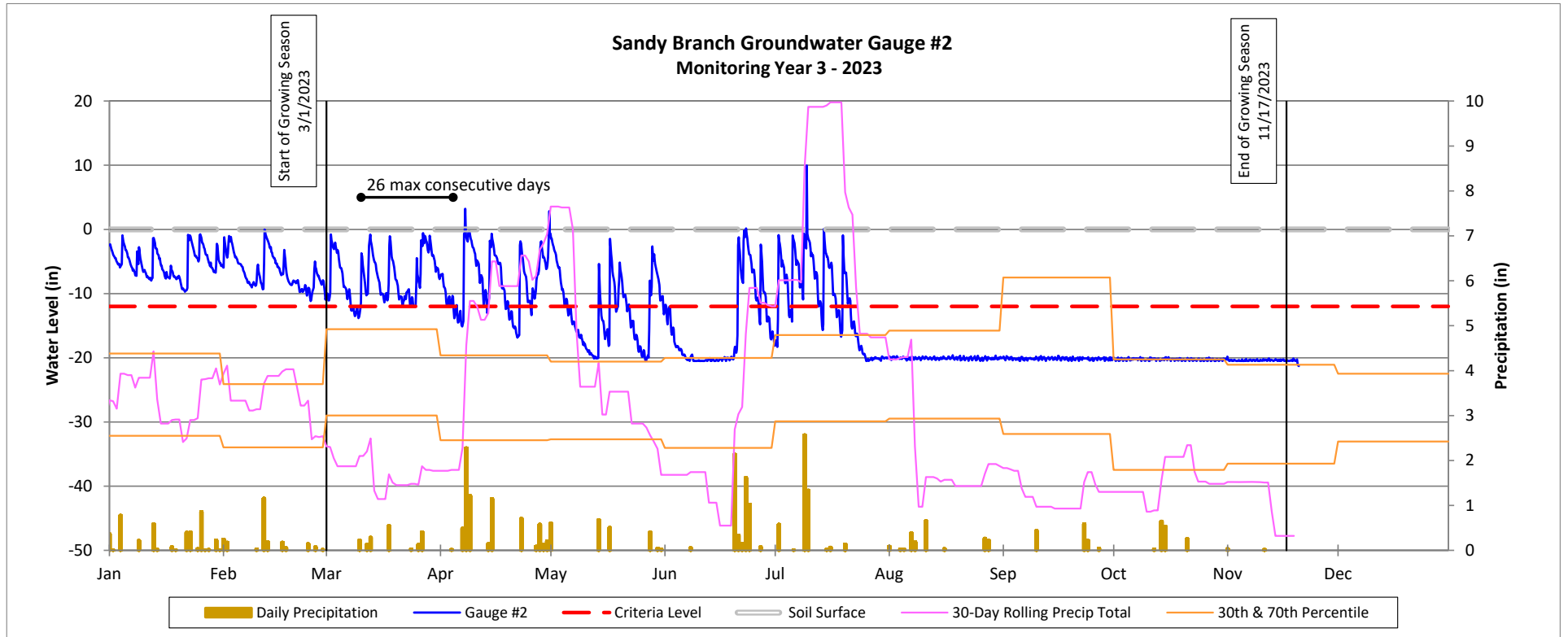


Groundwater Gauge Plot

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

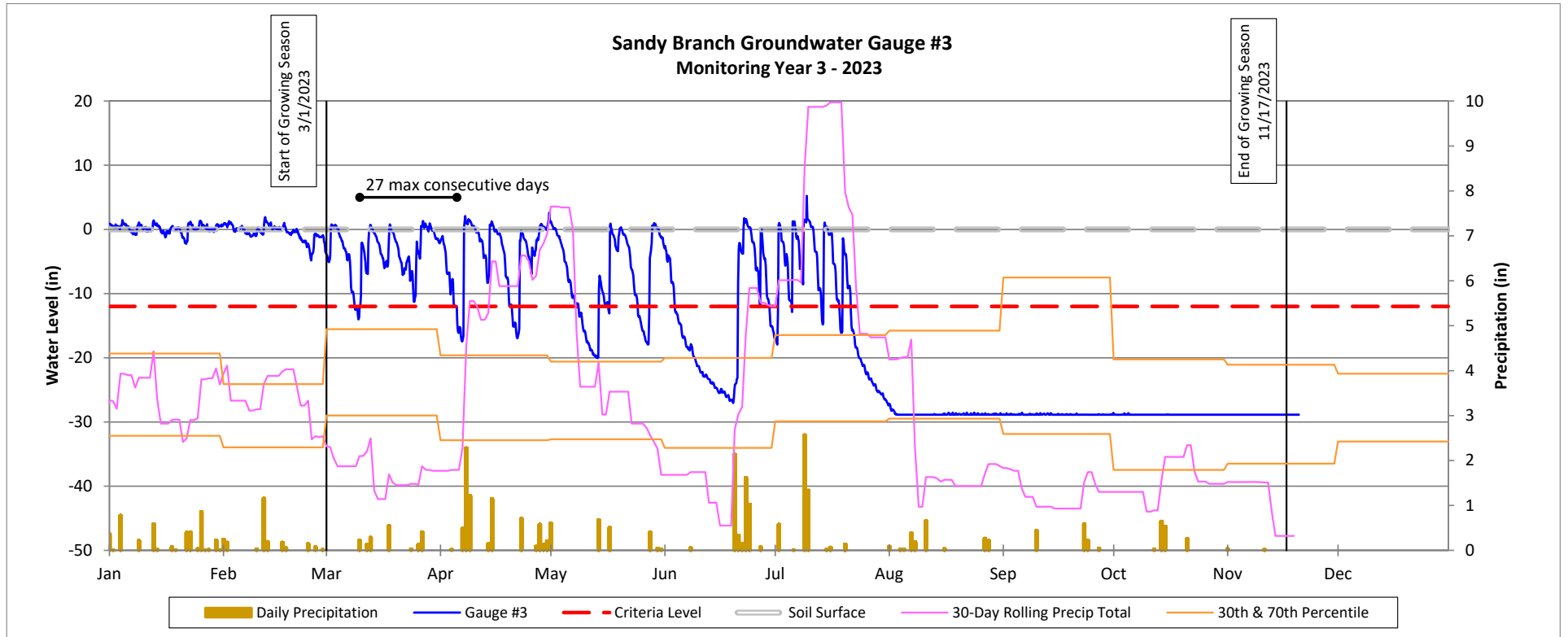


Groundwater Gauge Plot

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

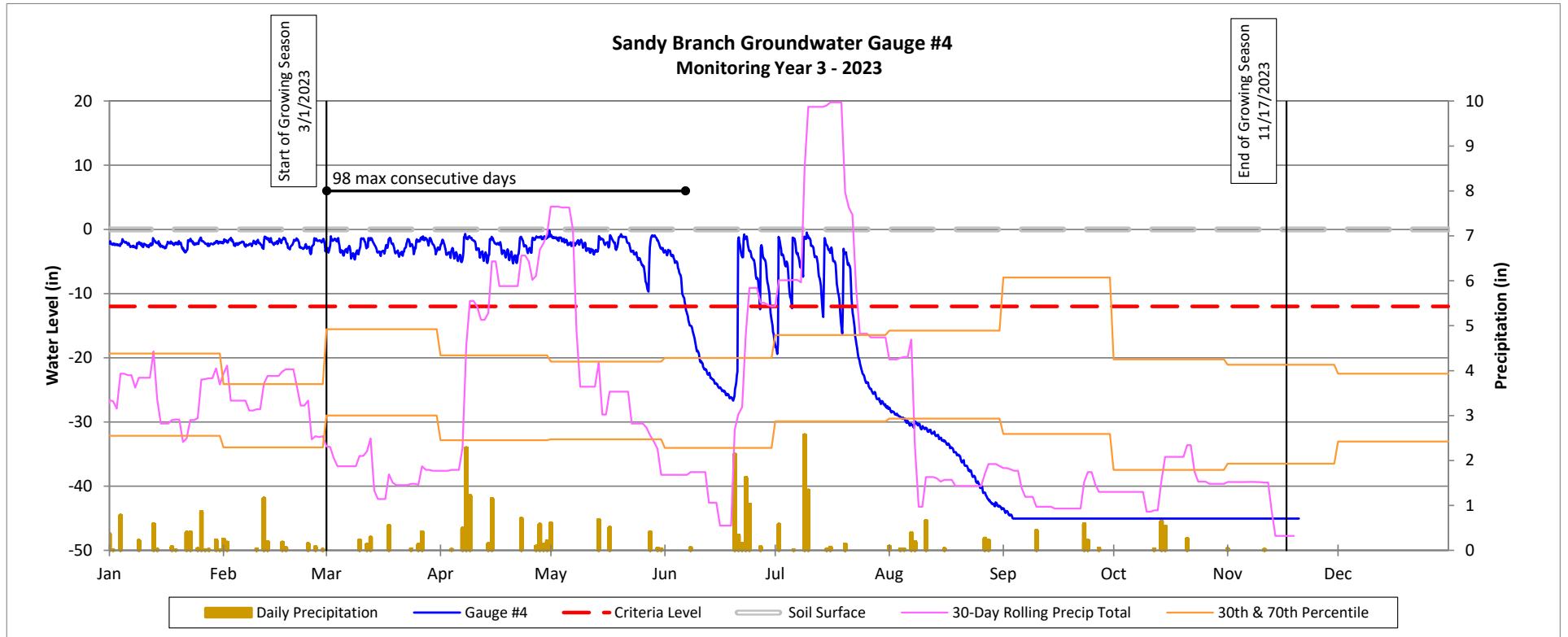


Groundwater Gauge Plot

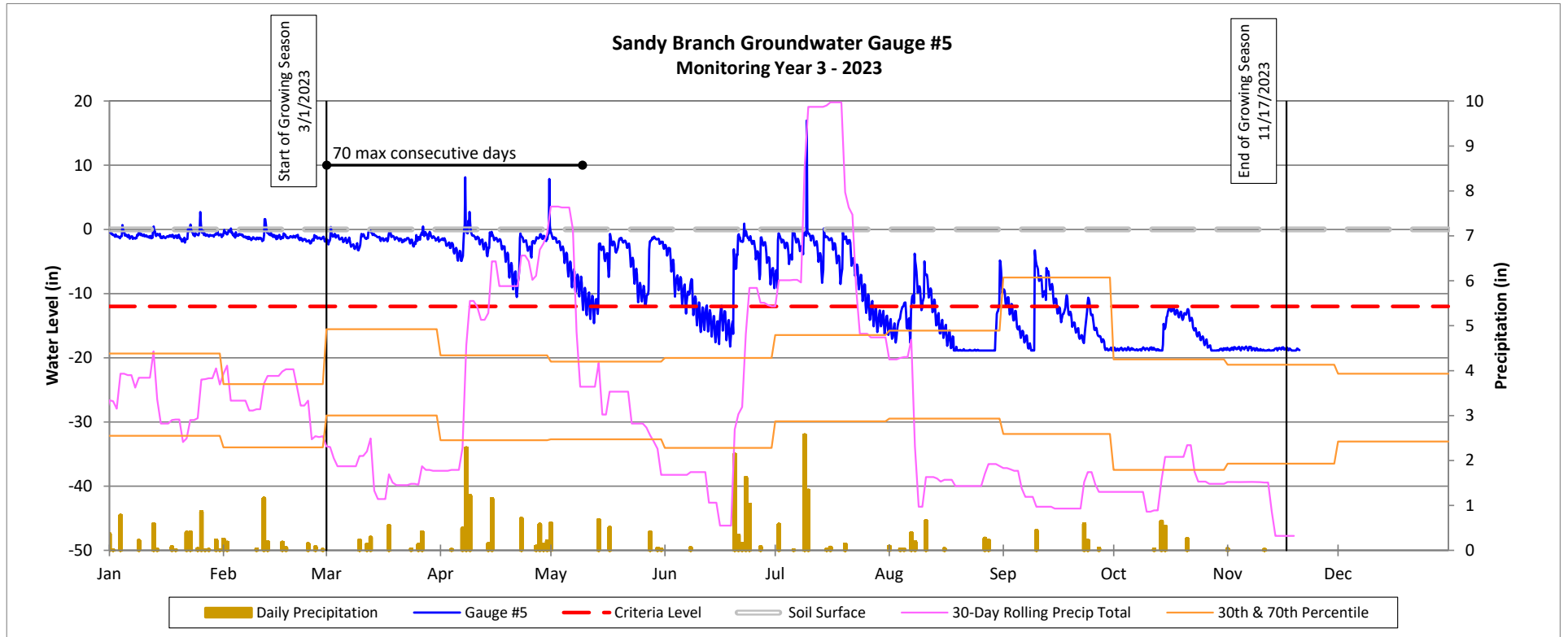
Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023



Groundwater Gauge Plot
Sandy Branch Mitigation Site
DMS Project No. 100060
Monitoring Year 3 - 2023

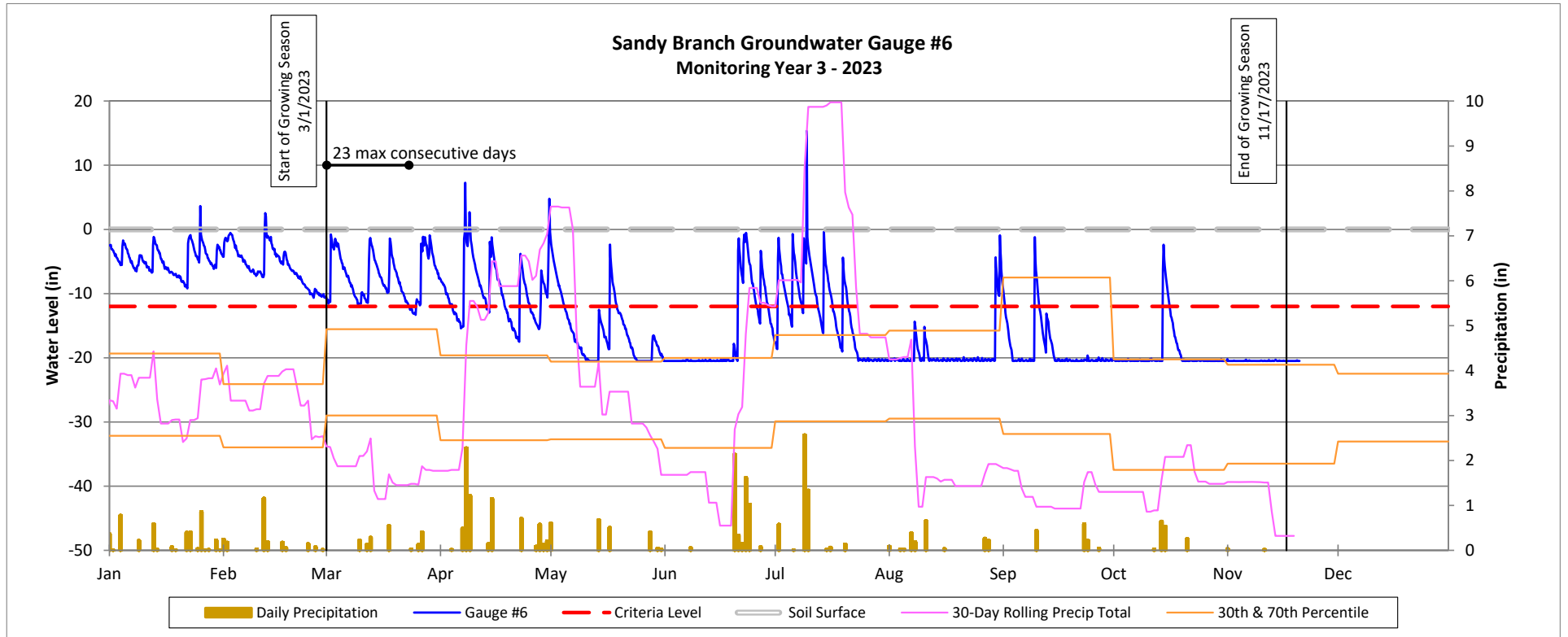


Groundwater Gauge Plot

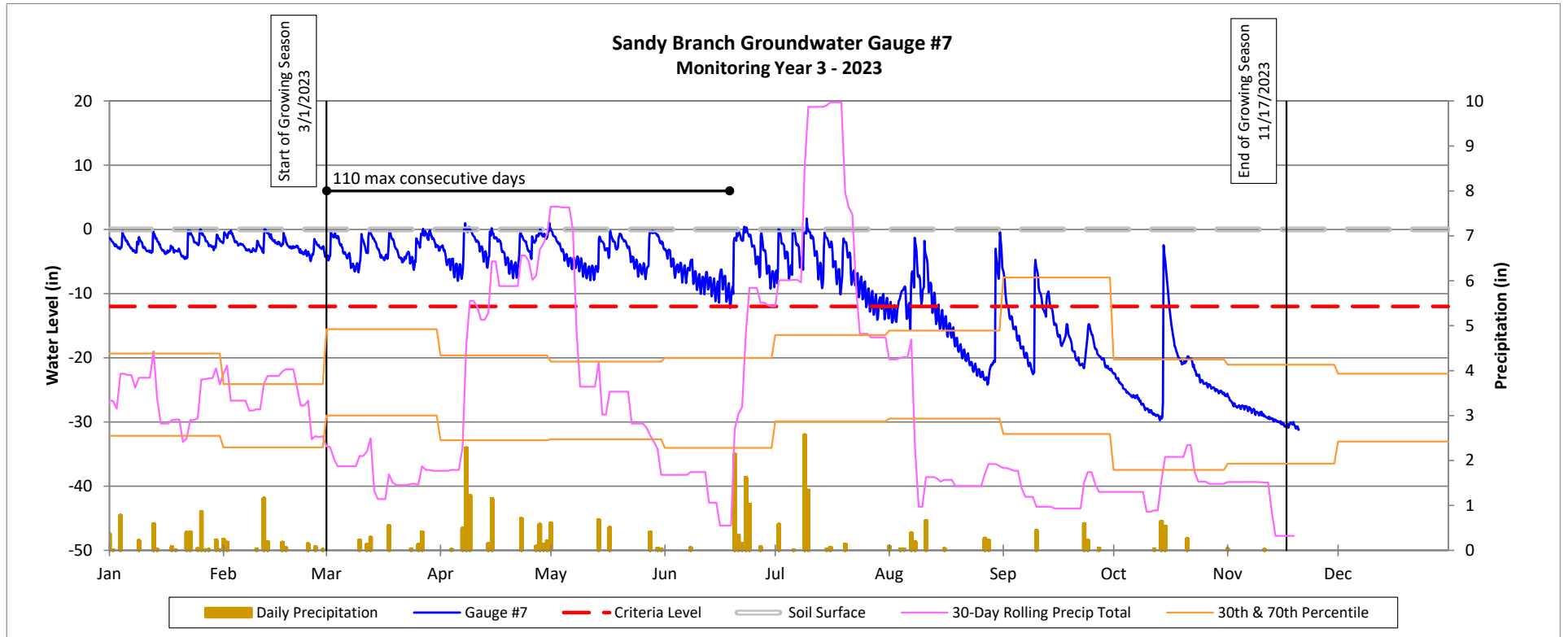
Sandy Branch Mitigation Site

DMS Project No. 100060

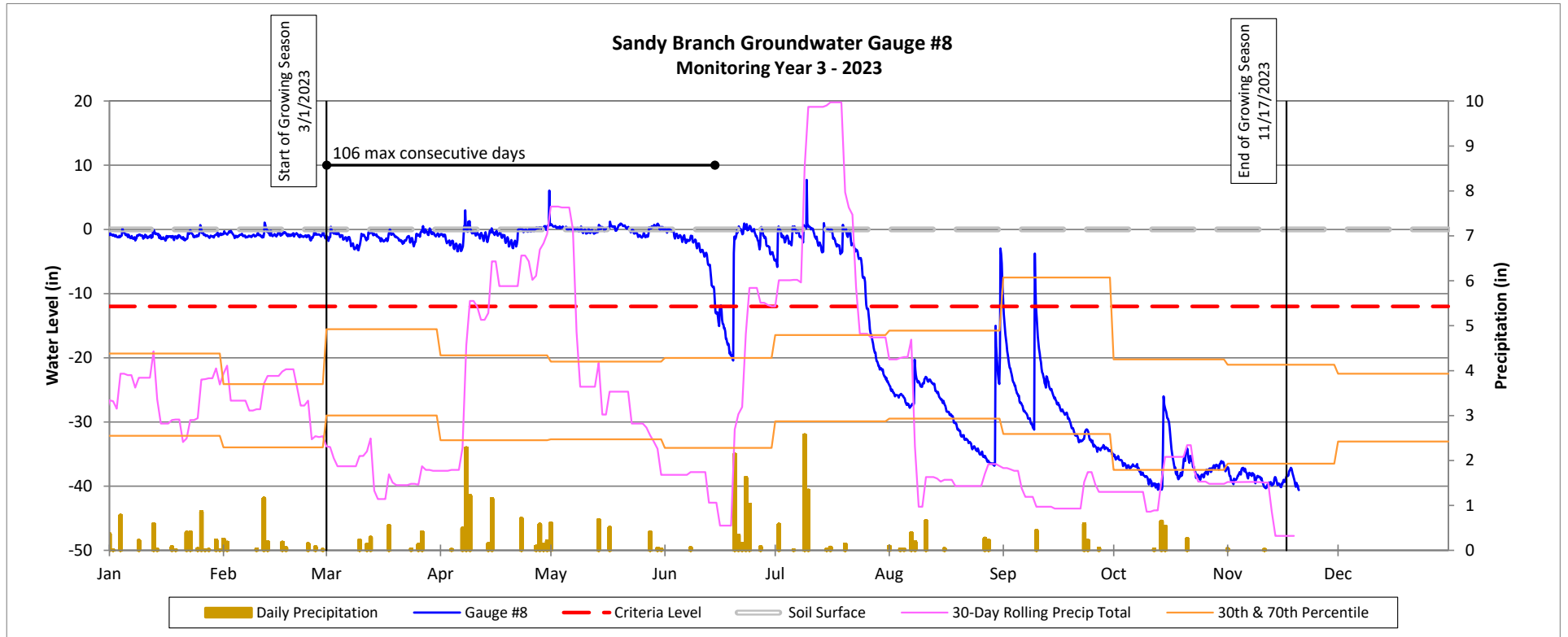
Monitoring Year 3 - 2023



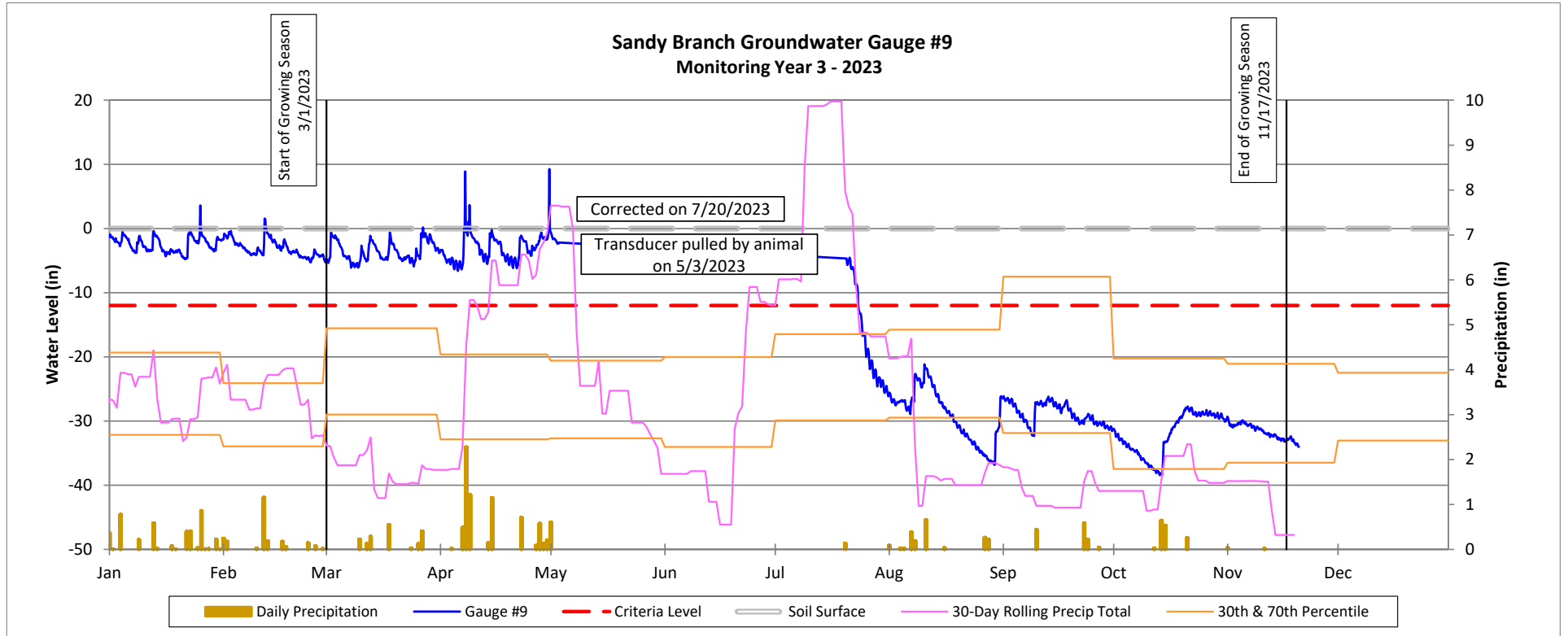
Groundwater Gauge Plot
Sandy Branch Mitigation Site
DMS Project No. 100060
Monitoring Year 3 - 2023



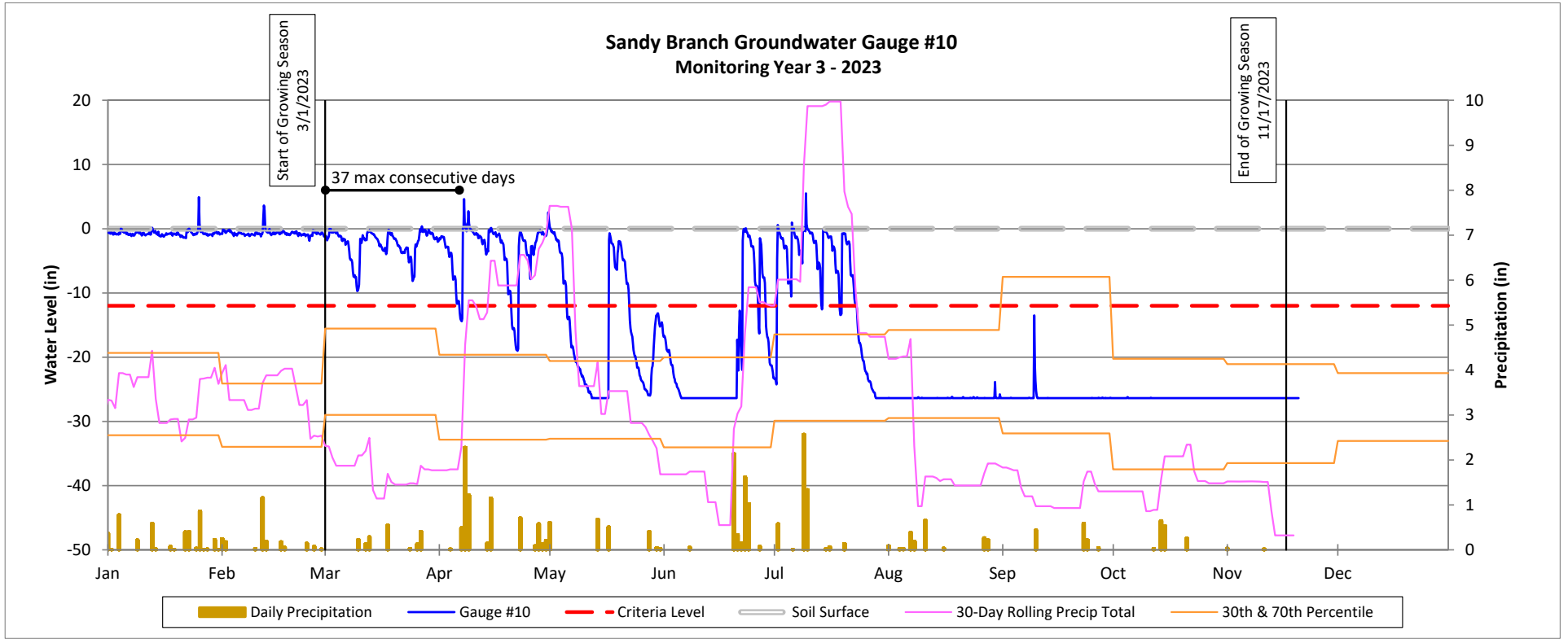
Groundwater Gauge Plot
Sandy Branch Mitigation Site
DMS Project No. 100060
Monitoring Year 3 - 2023



Groundwater Gauge Plot
 Sandy Branch Mitigation Site
 DMS Project No. 100060
Monitoring Year 3 - 2023



Groundwater Gauge Plot
Sandy Branch Mitigation Site
DMS Project No. 100060
Monitoring Year 3 - 2023

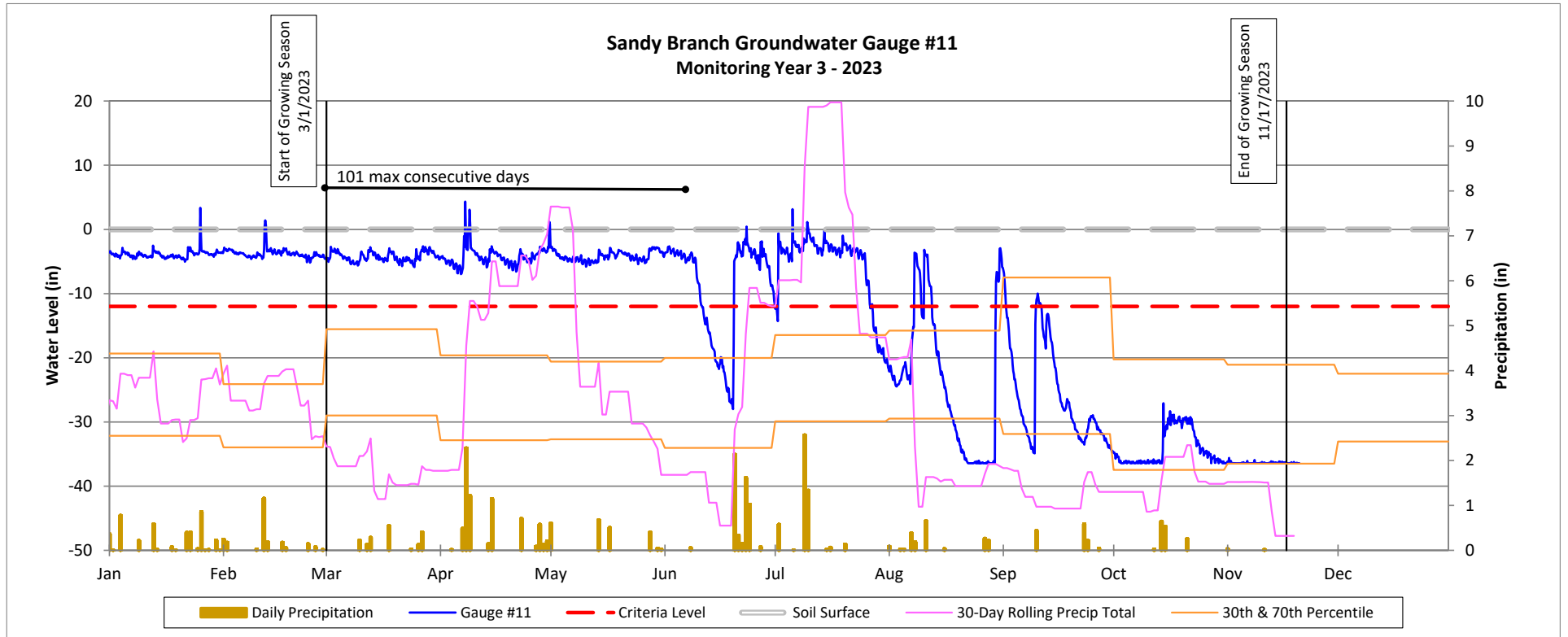


Groundwater Gauge Plot

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

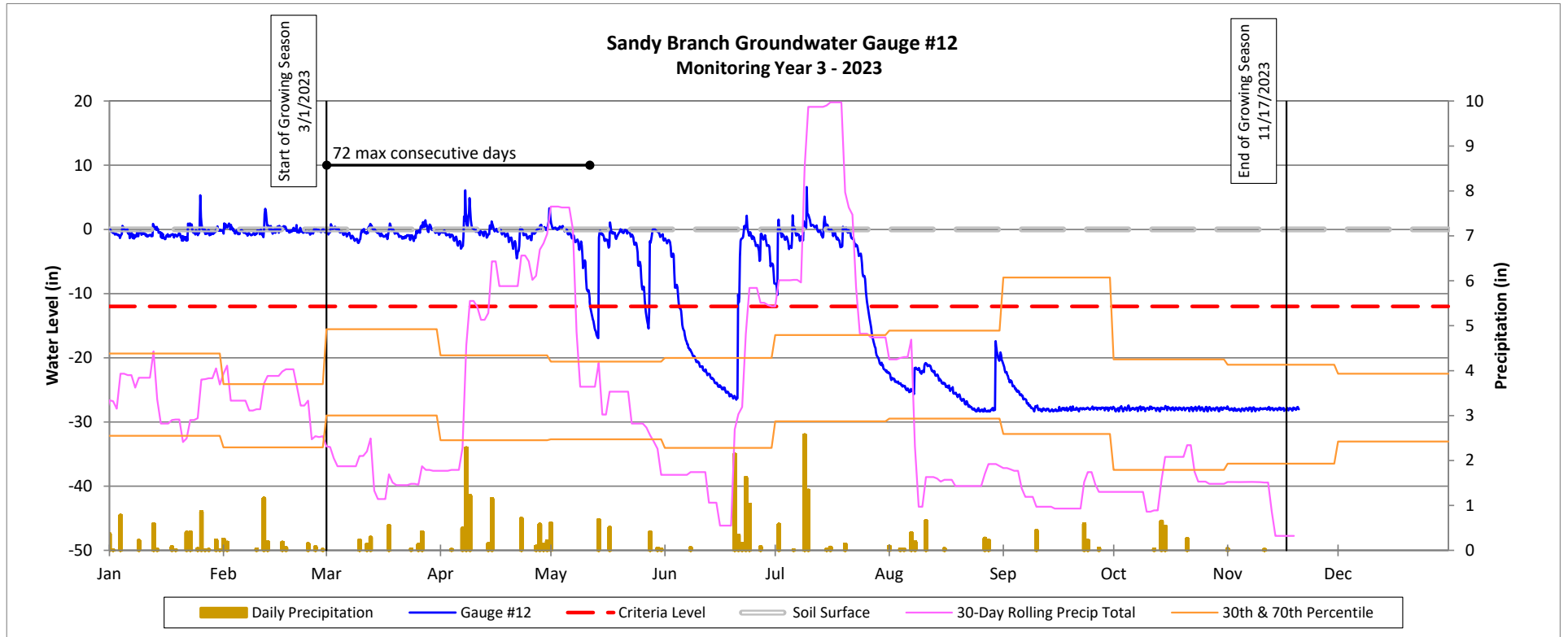


Groundwater Gauge Plot

Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023

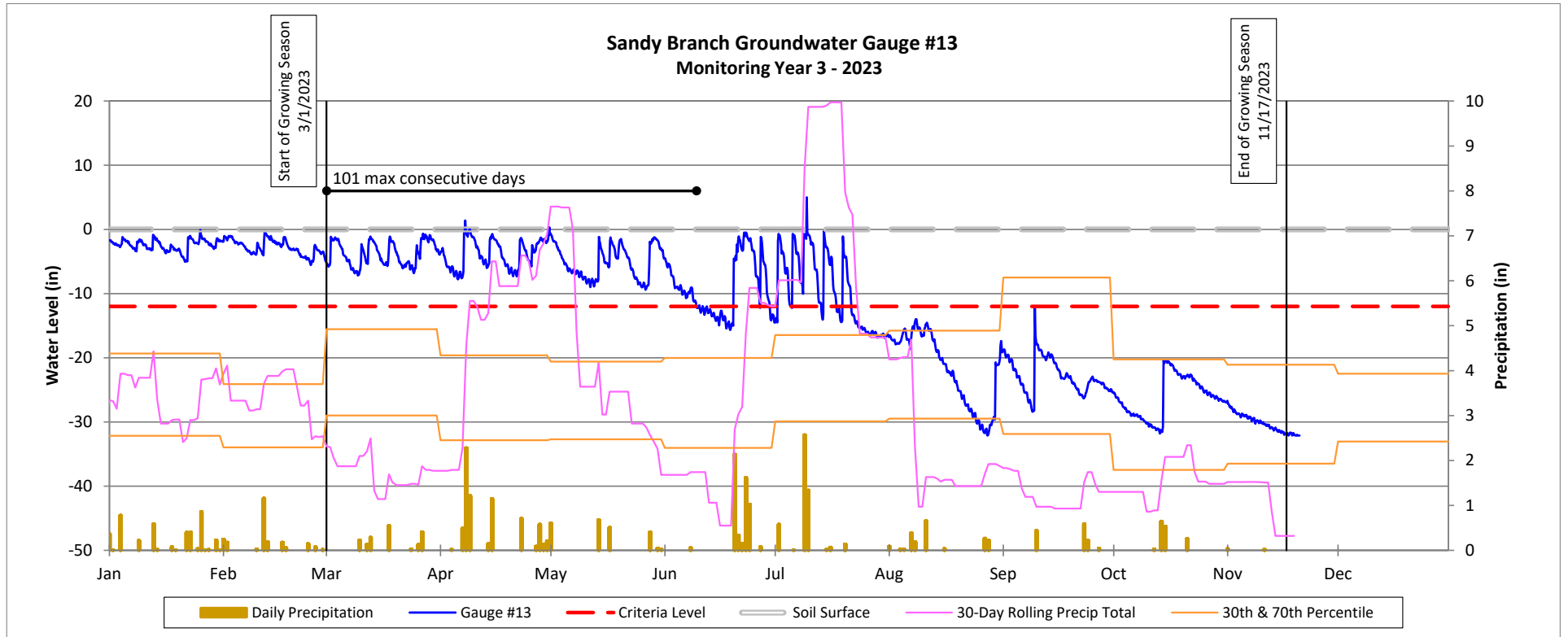


Groundwater Gauge Plot

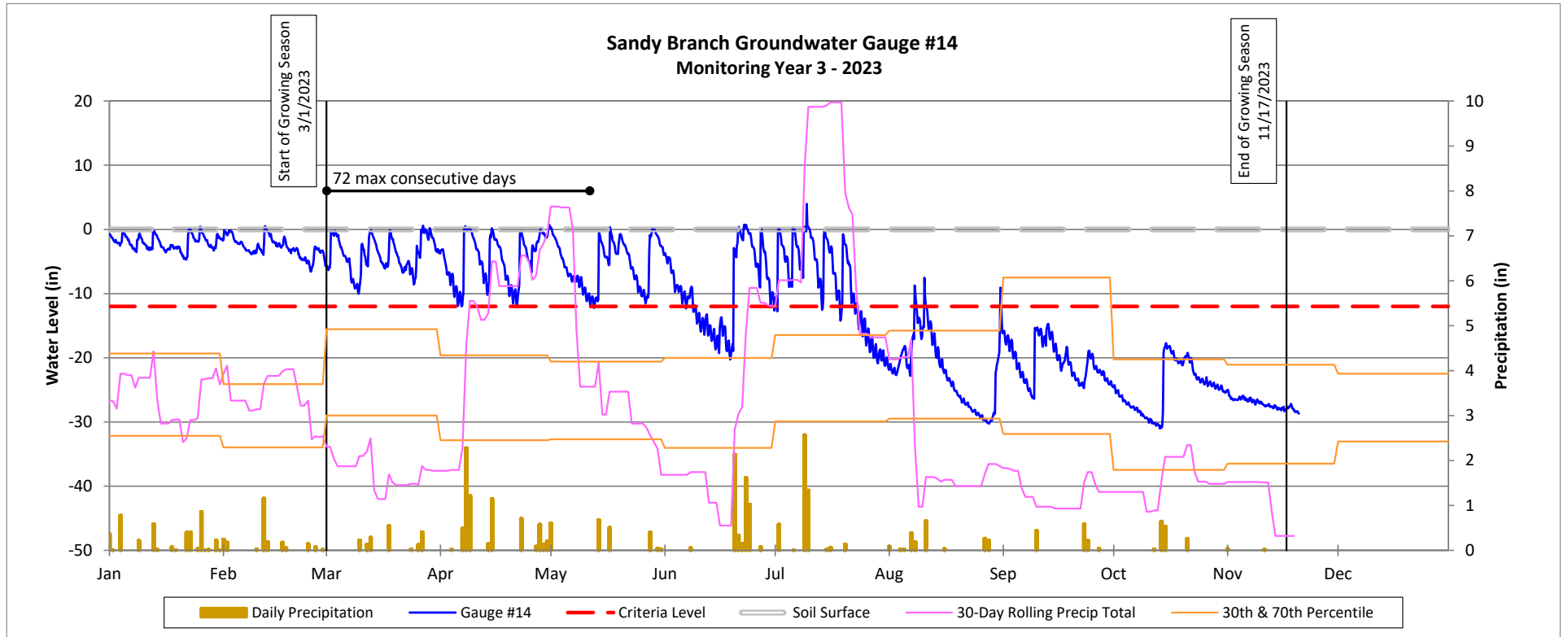
Sandy Branch Mitigation Site

DMS Project No. 100060

Monitoring Year 3 - 2023



Groundwater Gauge Plot
Sandy Branch Mitigation Site
DMS Project No. 100060
Monitoring Year 3 - 2023



APPENDIX E. PROJECT TIMELINE AND CONTACT INFO

Table 13. Project Activity and Reporting History

Sandy Branch Mitigation Site
 DMS Project No. 100060
Monitoring Year 3 - 2023

Activity or Deliverable		Data Collection Complete	Task Completion or Deliverable Submission
Project Instituted		September 2017	September 2017
Mitigation Plan Approved		December 2019	December 2019
Construction (Grading) Completed		September 2020	September 2020
Planting Completed		January 2021	January 2021
As-Built Survey Completed		September 2020	September 2020
Baseline Monitoring Document (Year 0)	Stream Survey	September 2020	April 2021
	Vegetation Survey	January 2021	
Year 1 Monitoring	Stream Survey	May 2021	December 2021
	Vegetation Survey	August 2021	
Year 2 Monitoring	Stream Survey	March 2022	December 2022
	Fescue Reduction	April 2022	
	Vegetation Survey	August 2022	
Year 3 Monitoring	Invasive Treatment	February and August 2023	December 2023
	Stream Survey	March 2023	
	Fescue Reduction	April 2023	
	Vegetation Survey	August 2023	
Year 4 Monitoring			December 2024
Year 5 Monitoring	Stream Survey	2025	December 2025
	Vegetation Survey	2025	
Year 6 Monitoring			December 2026
Year 7 Monitoring	Stream Survey	2027	December 2027
	Vegetation Survey	2027	

Table 14. Project Contact Table

Sandy Branch Mitigation Site
 DMS Project No. 100060
Monitoring Year 3 - 2023

Designer Greg Turner, PE	Wildlands Engineering, Inc. 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
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